Geomage g-Space™ User Manual

USER MANUAL

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Introduction

1 Introduction

Geomage g-Space™ application designed as a full interpretation software, both geological and geophysical.

Subscribe to our channel and watch g-Space overview on YouTube

Geological Interpretation package
The first version released in November 2021 built of Seismic and Geological interpretation packages that includes all of required features needed for accurate, fast and convenient structural interpretation process.

View-only package:
- Loading 2D and 3D post-stack seismic data, including trace arithmetic
- Loading Well data, such as headers, markers, checkshots, las files, inclinometry
- Loading GIS shapefile and image data
- 2D displays in time domain

Common features:
- Support for Metric or Imperial measurement system
- Import/export Well data, such as headers, markers, checkshots, las files, inclinometry
- Advanced 2D and 3D views in time and depth domains
- Import GIS shapefiles and cultural data
- Import horizons, faults, grids
- CRS conversion
- Import geo-referenced image data
- Stratigraphy chart for markers, horizons and wells
- Map calculator and editor
- DEMO project based on Teapot Dome data

Seismic interpretation package:
- Loading 2D and 3D post-stack seismic data, including trace arithmetic
- Seismic mis-tie workflow
- Well-tie workflow
- Advanced arbitrary line creation and visualization by line or coordinates picking
- Horizon picking/import/export
- Fault picking/import/export, both in 2D or 3D views
- Seismic ghost view
- Flattening to horizon
- Mapping, including fault consideration
- Velocity model building and conversion by
  - checkshots

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  - checkshots+markers by zones
  - checkshots+markers+horizons by zones
- Pine chart / velocity model QC
- Depth conversion
- Spectral analysis - single and multi-zone

Geological interpretation package:
- Well arbitrary section
- Lithology/discrete log visualization
- Curve ghost view
- Flattening to marker/datum
- Well correlation / Markers picking
- Crossplot data analysis
- Well-log calculator
- Map interpolation by markers
- Mapping, including fault consideration
- Gross volume calculation
- Geobody creation

Reservoir interpretation package:
- 3D Static modeling using different algorithms
- 3D Gridding
- Well log propagation
- Volumetric / GRV calculation

Geophysical interpretation package:
- Import prestack gathers 2D/3D
- Gather conditioning (including RNMO, parabolic Radon etc.)
- Polynomial analysis of AVO
- Intercept and gradient
- Top/bottom muting of gathers
- Stacking of gathers
- Spectral decomposition
- Instantaneous attributes
- Band-pass filtering, AGC and gain (stacks and gathers)
- Advanced 3D prestack gathers view

Multi-user package:
- Multi-user management
- Multi-user interpretation QC tools
- Centralized project management
- PostgreSQL database
- Revision history

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- Monitored user access

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Installation

2 Installation

This paragraph gives the general information about:

System requirements 14 - the minimum requirement of the system for comfortable work
Installation steps 14 - guides through the installation process
Licensing 23 - guides through the licensing process and different license options
Software update 27 - explains how to get the latest g-Space version.

To download the latest version of g-Space please follow the link:
https://www.geomage.com/seismic-software/

2.1 Requirements

General assumptions for workstation are:

Operating system – 64-bit Only
- Windows: 7/8/10
- Linux and MacOS - please contact Geomage for updated status of release for those OS.

CPU
- 1 core minimum. Since g-Space designed to work in multi-thread mode in order to get better performance, it is advised to have as many CPU cores as possible to achieve best performance during calculation processes.

Disk
- SSD storage for seismic prestack data (recommended)
- HDD drive for the rest of the project data

RAM
- 4GB minimum
- the best practice is to have 2 times of loaded seismic data size

2.2 Installation steps

Installation steps for g-Space

Windows version

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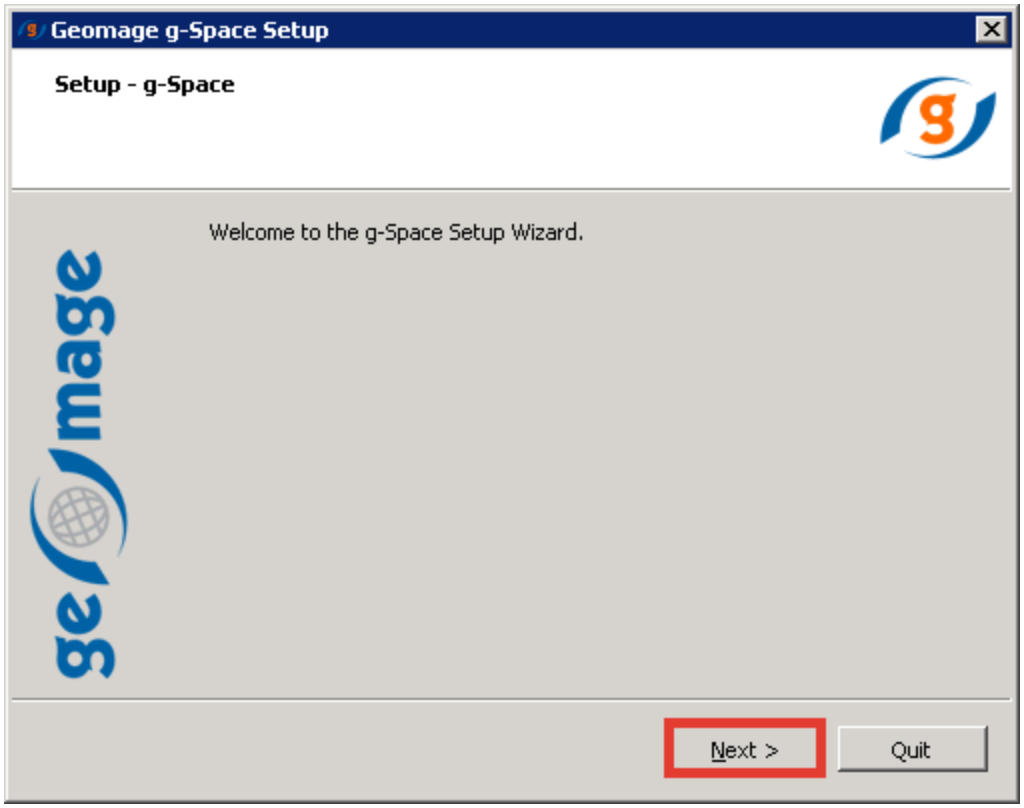
Geomage g-Space can be installed either from the company's web-site or directly from offline installation file.
If you have issues with internet access, please contact Geomage support at support@geomage.com and get instruction of how to get offline installation file.

Step 1
Make sure you're **logged in as an administrator** of the workstation and run the downloaded EXE file [GSpaceInstaller_Online_Win_xxxxx.exe] to start the installation. Click **Next**.



Step 2
Specify the installation directory for g-Space application and click **Next**.

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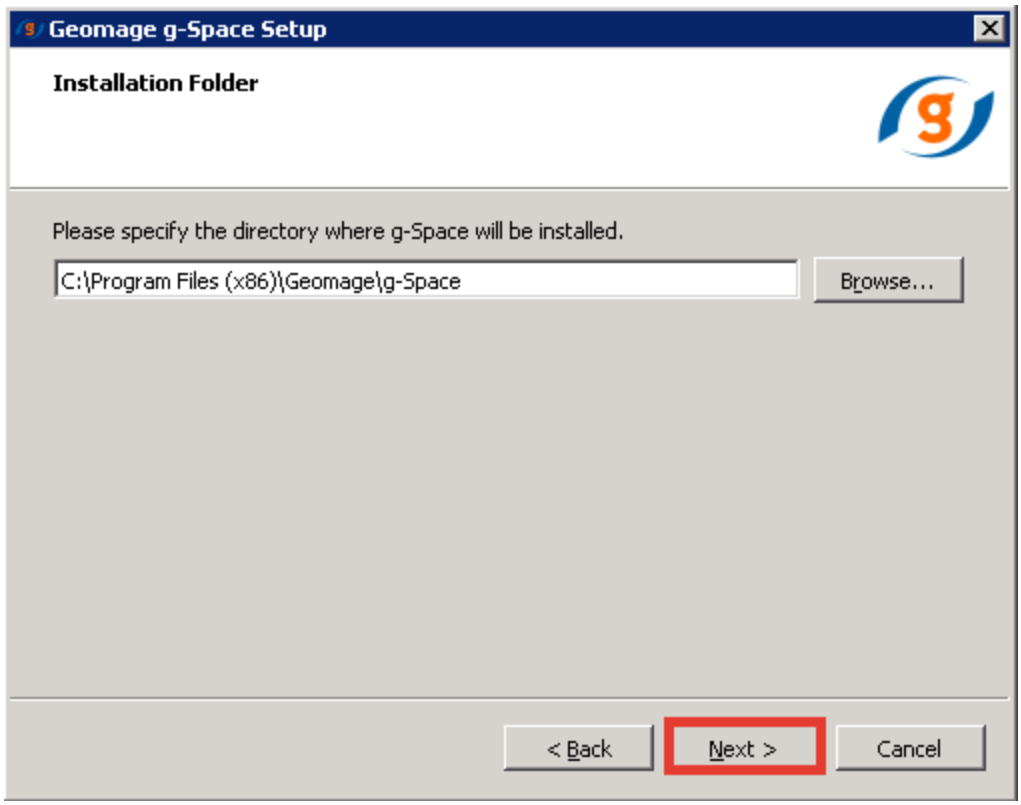

Step 3
Select the requested components for installation (by default all options are checked) and click "Next".

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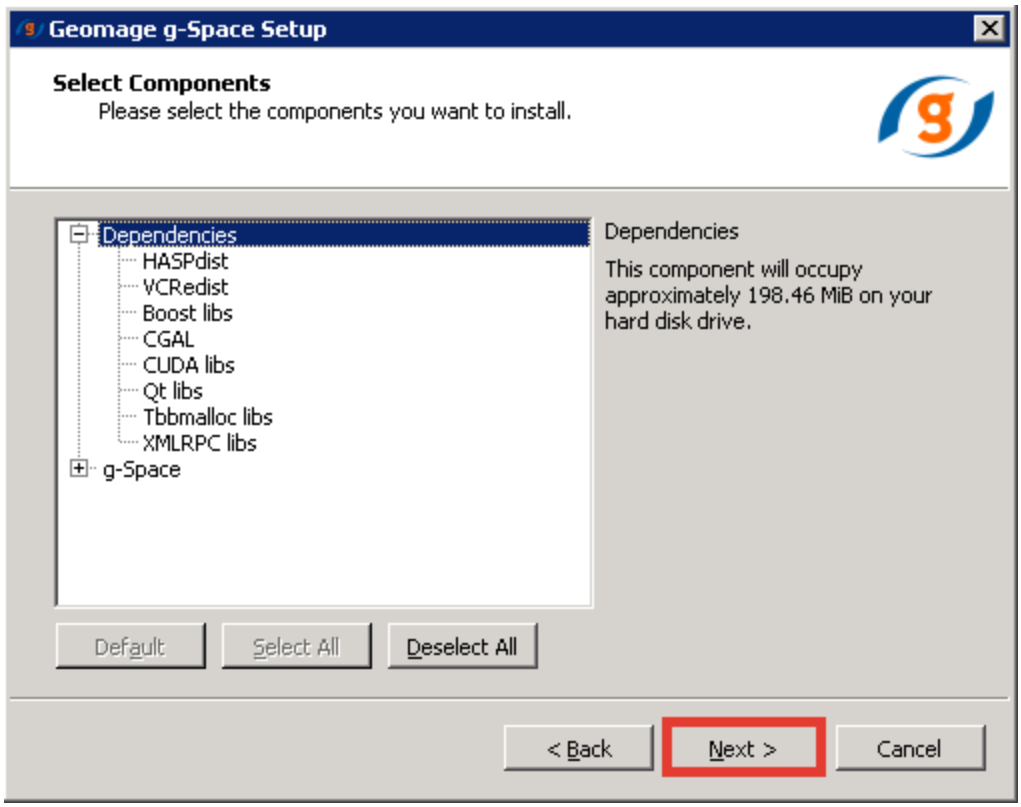

Step 4
Review the "License Agreement", check the box to accept and click Next.

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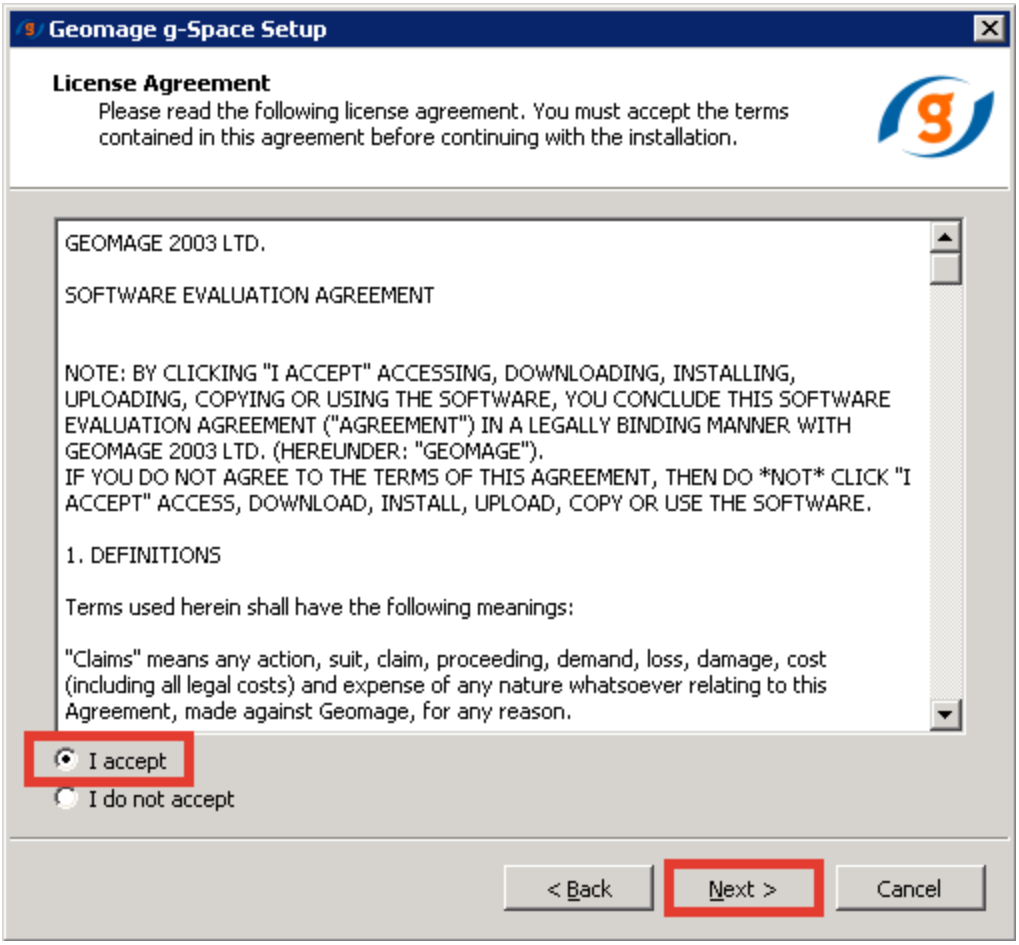

Step 5
Select the "Start Menu" for program's shortcuts and click **Next**.

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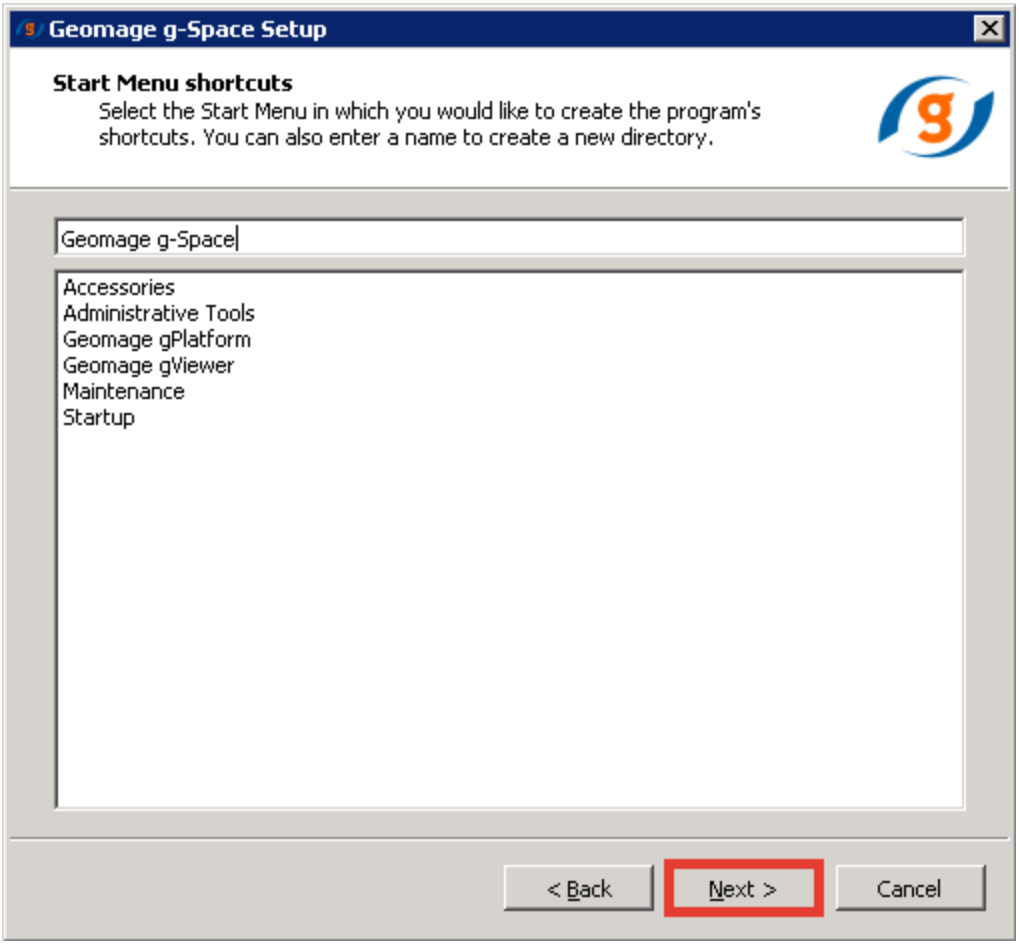

Step 6

g-Space is ready to be installed, click **Install** to begin the installation.

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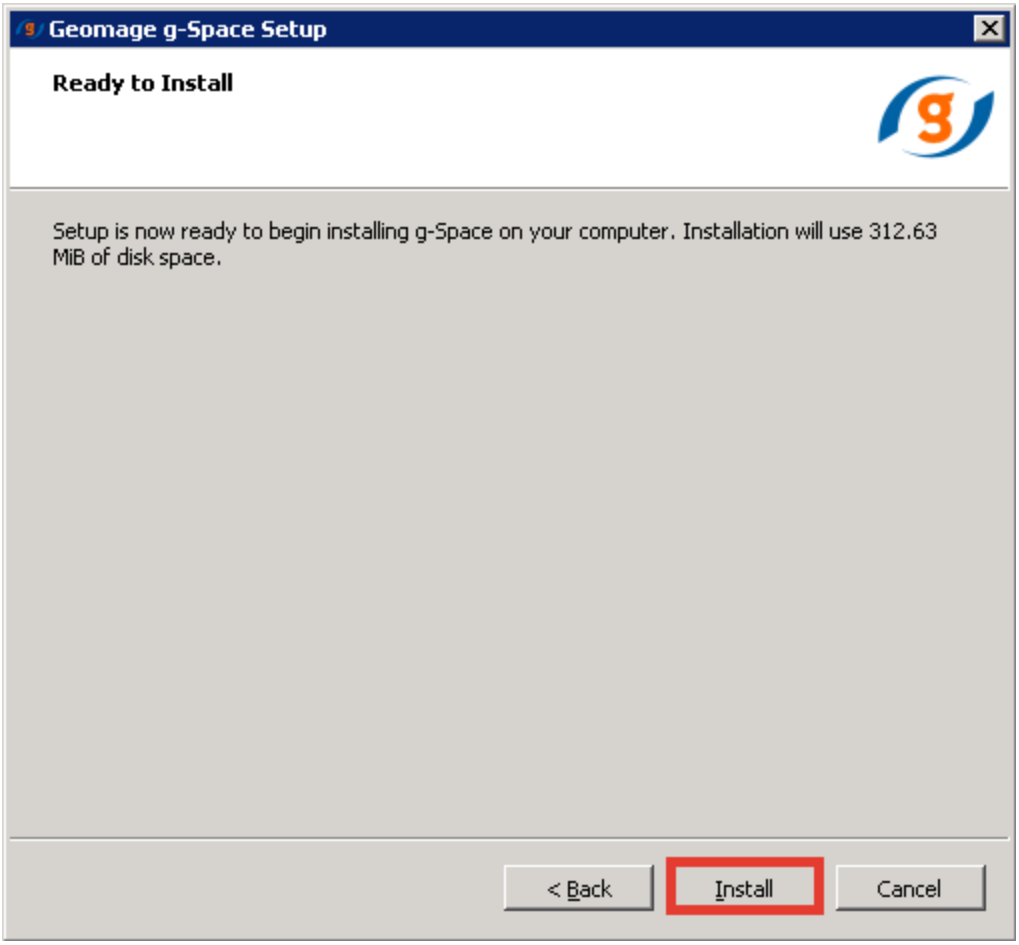

Step 7
It may take few seconds to finish the installation.

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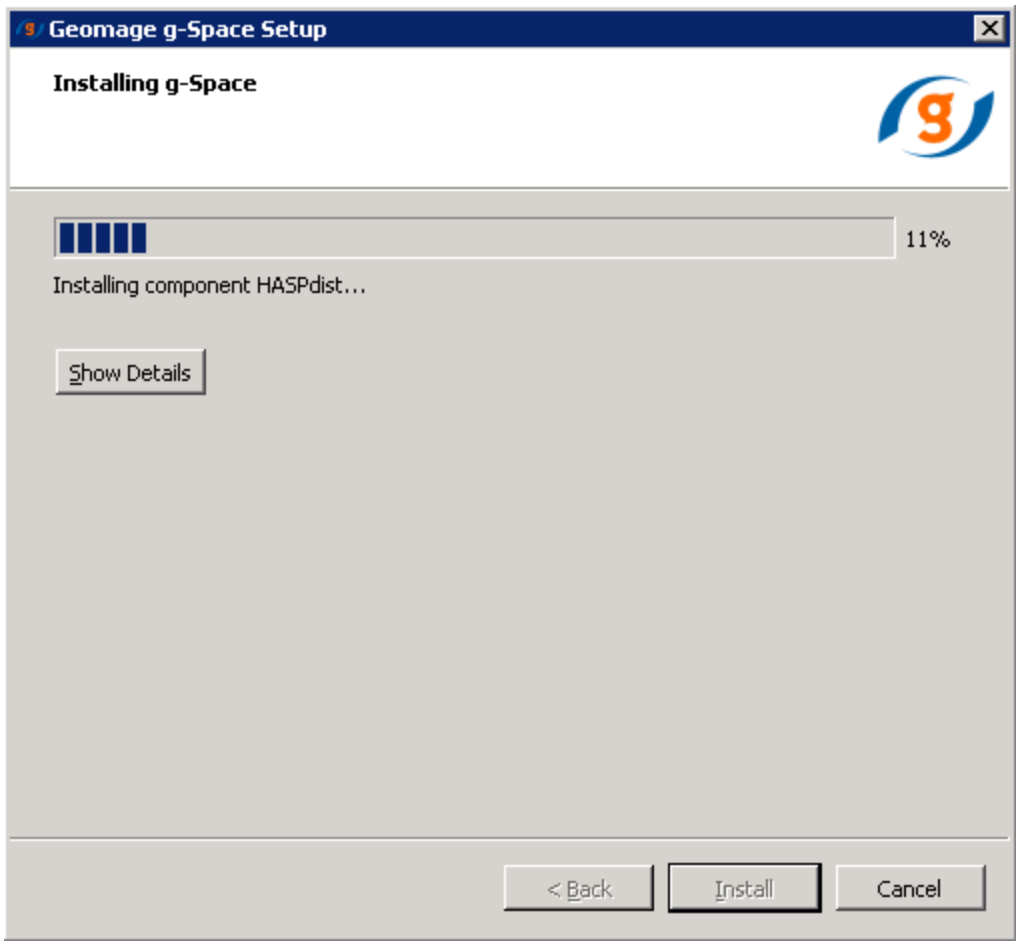

Step 8
Click "Finish" to complete the installation of g-Space. Uncheck **Run g-Space** if you want to run it later.

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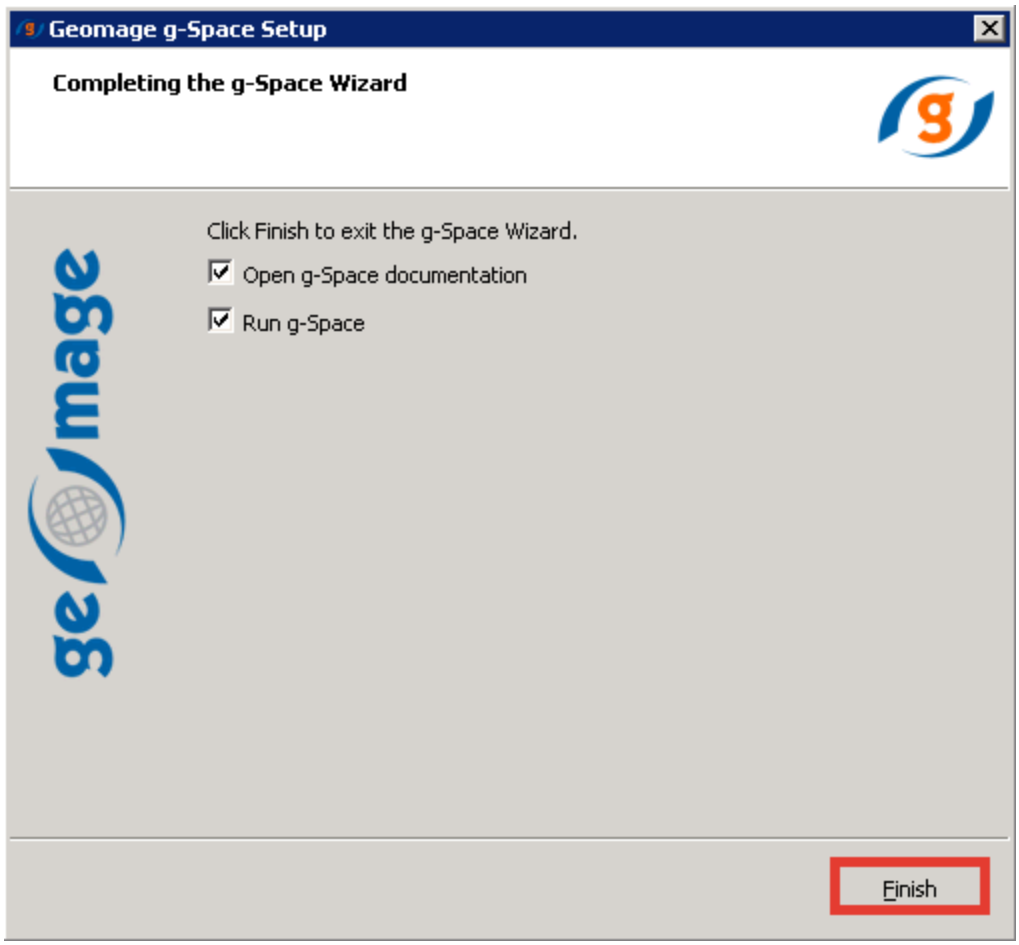
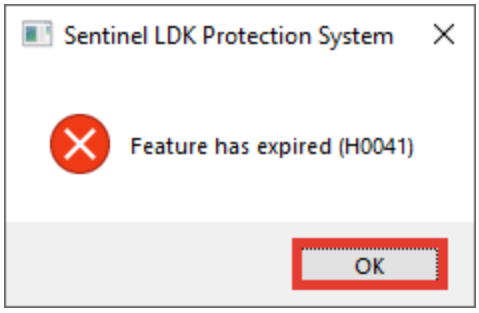


Once you have finished the installation process the message below may appear due to missing license file.



Press OK and follow the instructions in the licensing 23 section

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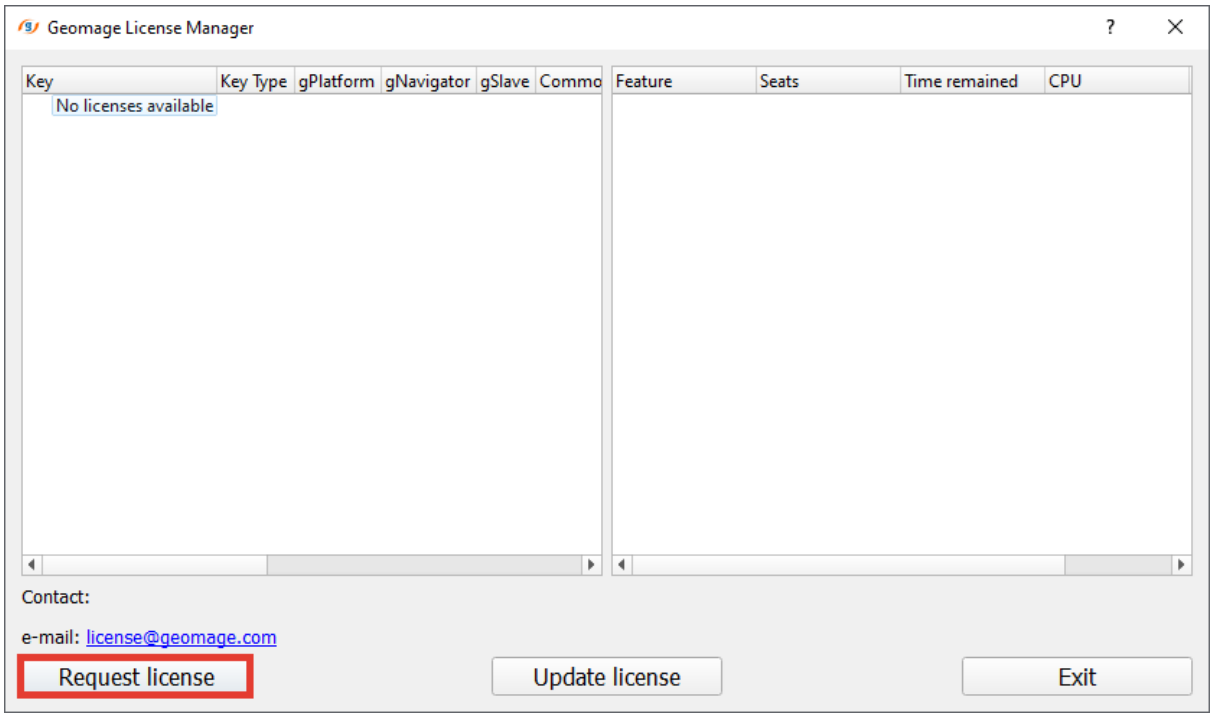
2.3 Licensing

To obtain a license for your product, please follow the steps below:

Step 1

- Launch g-Space using the start menu shortcut, or the shortcut installed on your desktop. This will launch Geomage Licence Manager.
- Click the "Request license" button in the Geomage License Manager.



Step 2

Once you have requested a license, the License manager will generate a License request code. You may choose two options:

***Option 1*:** Click "Send email" (1) to send the "License request code" to Geomage via your default email client.

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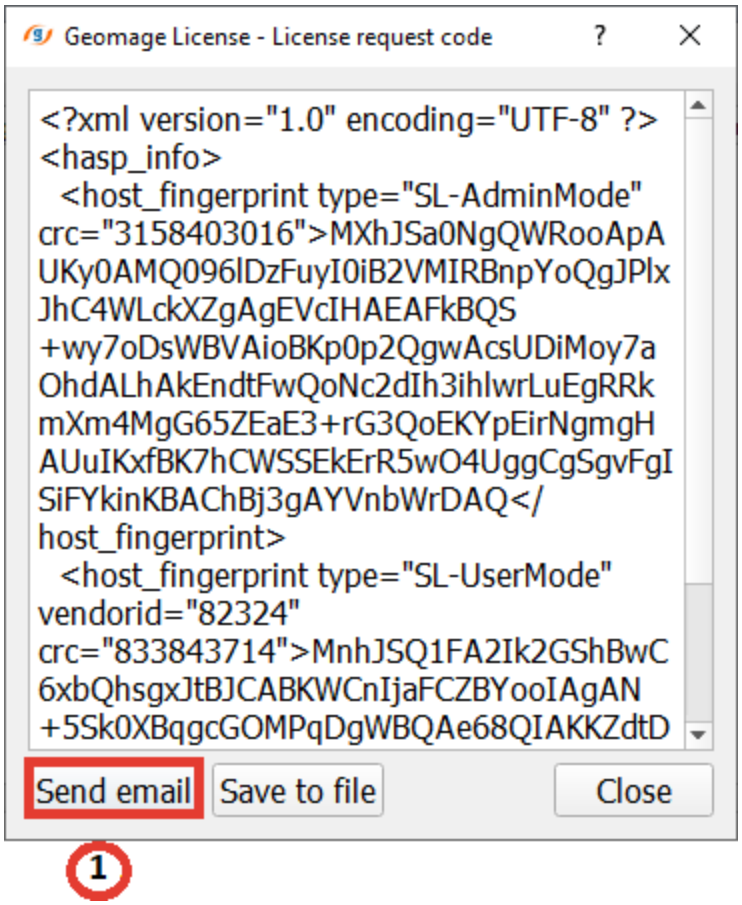

***Option 2*:** Copy the "License request code" (2) and send the entire string to **"license@geomage.com"** via a server or other email service.

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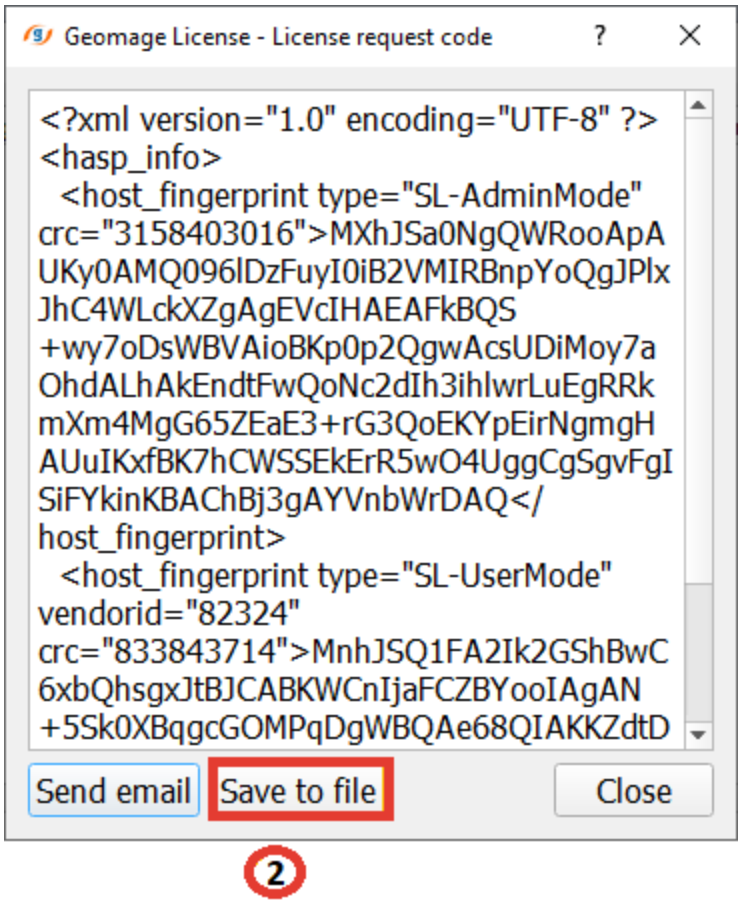

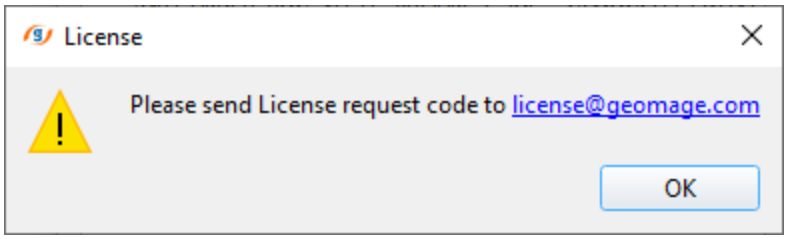

Geomage will then send you a license file via email.

Step 3

Once you have received your license, you must activate it.

1. Save the received file to a disk on your computer.
2. Go to the Geomage License manager and Click **Update license**.

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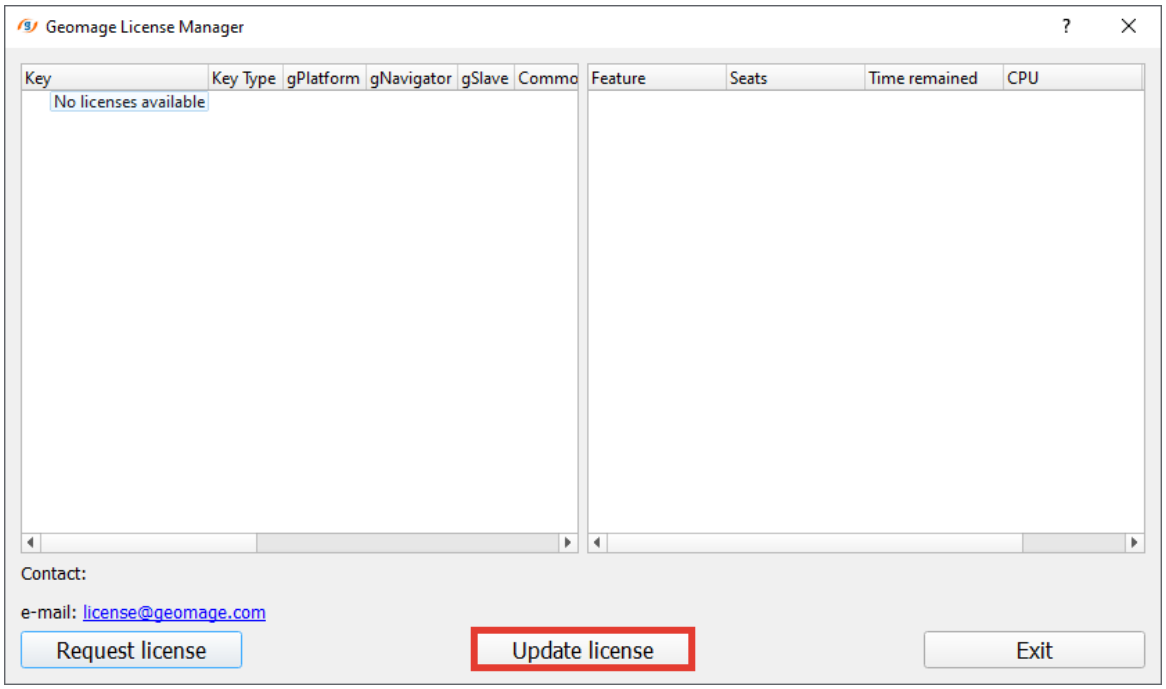
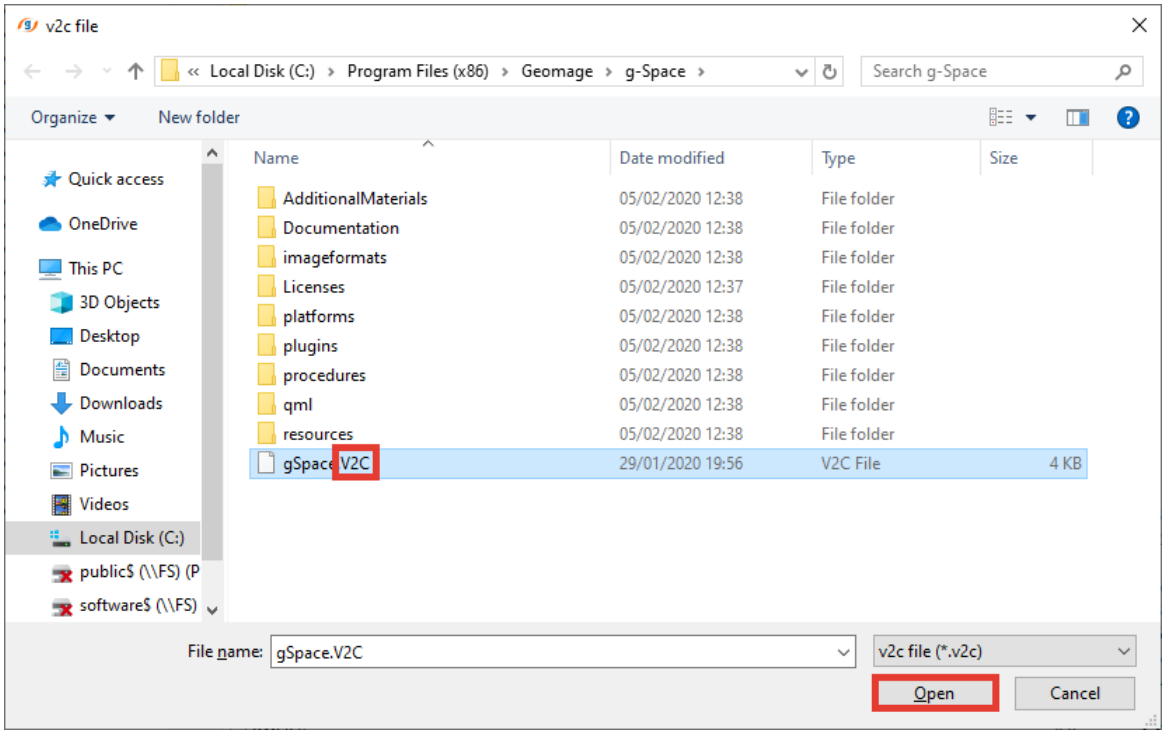


3. Chose the saved file (with suffix .V2C) and execute it by clicking "open".



Step 4

Click **OK** to complete the activation process.

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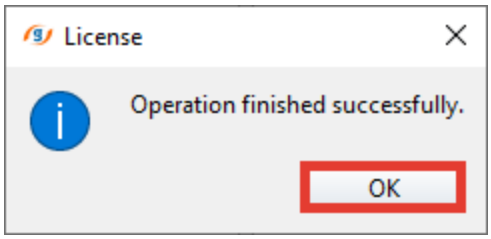
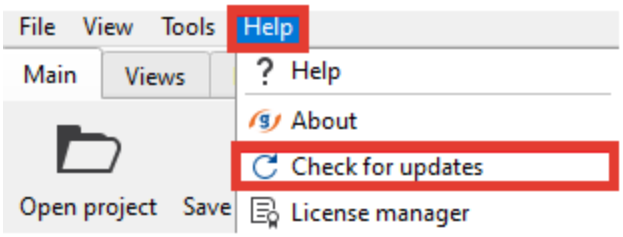


Step 5
Enjoy g-Space

2.4 Software update

On start of g-Space the application checks (on a daily basis) if a new version was uploaded to repository of Geomage. In case there is a newer version than installed an appropriate message will appear with suggestion to install the update.

In addtion, when needed, User can get the latest version of g-Space by clicking on Help menu and selecting **Check for updates** as shown on the image



That will initiate sequence of installing the product. Please proceed with **Update components** option.

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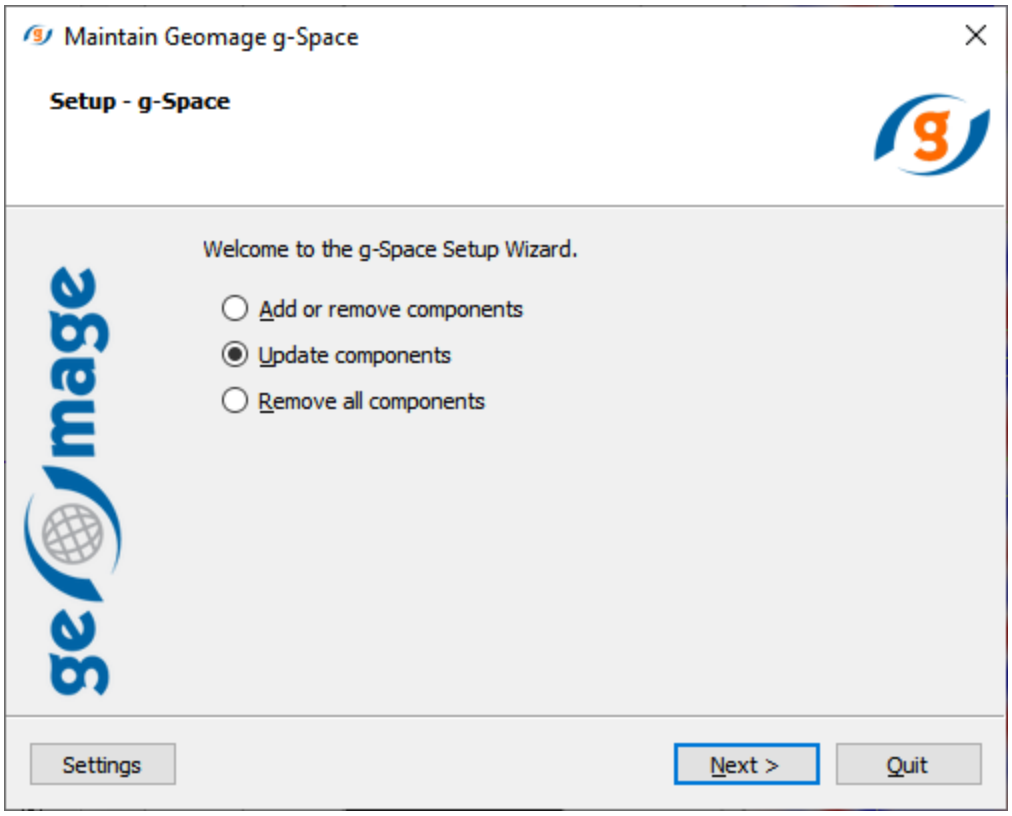

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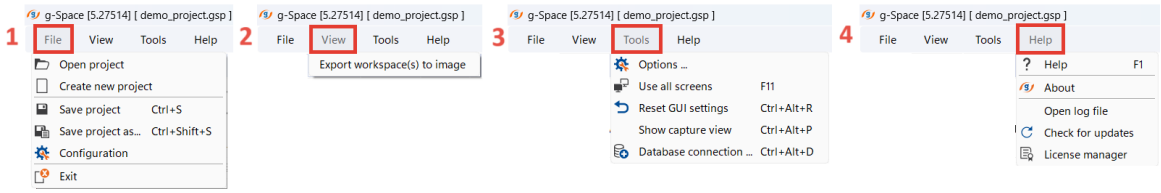
User Interface

3 User Interface

Let's start by getting acquainted with the program by exploring the interface.

Subscribe to our channel and watch g-Space interface overview on YouTube



The main menu of the g-Space software includes the following tabs:

1. **File** - This tab provides standard options for project management, such as:
   - **Open project:** Open a previously saved project.
   - **Create new project:** Create a new project.
   - **Save project:** Save the current project.
   - **Save project as...:** Save the current project under a new name or location.
   - **Configuration:** Set configuration settings for the software.
   - **Exit:** Close the application.

2. **View** - This tab contains options related to the display and export of the workspace:
   - **Export workspace(s) to image:** Export the current workspace(s) as an image file.

3. **Tools** - This tab provides tools for advanced settings and configurations:
   - **Options...:** Open the options menu for further configurations.
   - **Use all screens:** Toggle the use of multiple screens (shortcut: F11).
   - **Reset GUI settings:** Reset the graphical user interface settings to default (shortcut: Ctrl+Alt+R).
   - **Show capture view:** Display the capture view in the workspace (shortcut: Ctrl+Alt+P).
   - **Database connection:** Manage database connections (shortcut: Ctrl+Alt+D).

4. **Help** - This tab offers help and support options:
   - **Help:** Access the help documentation (shortcut: F1).
   - **About:** View information about the software version and credits.
   - **Open log file:** Open the log file to view recent actions and errors.
   - **Check for updates:** Check for available software updates.
   - **License manager:** Manage software licenses.

The g-Space workspace consists of several areas, each of which can be customized individually.

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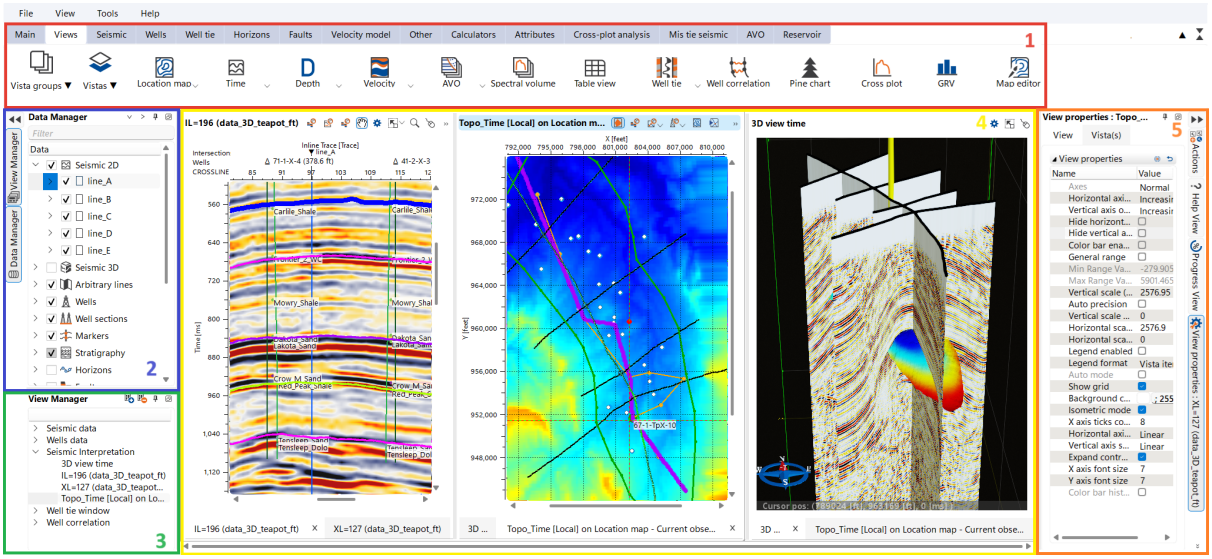

1. Ribbon Bar[33] is the topmost section of the interface, highlighted in the red box. Ribbon Bar is where you can access the main functionalities of the g-Space software. It is organized into several thematic tabs that group related tools and commands.

2. Data Manager[86] Panel is located on the left side of the interface, highlighted in the blue box. Data Manager is a panel used to control and organize the project's database. It displays a hierarchical view of all the data available within the project.

For data that can be visualized in the active window, the display icon will appear transparent. If the data cannot be visualized in the active window, the icon will be highlighted in gray.

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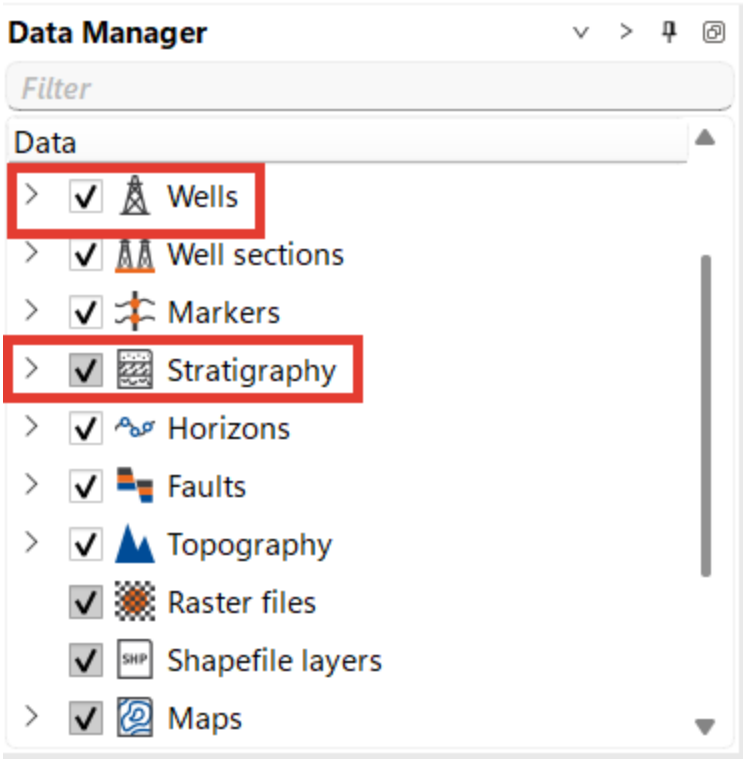

3. View Manager 90 Panel is located below the Data Manager on the left side, highlighted in the green box. View Manager is responsible for managing the Workspaces 114 and views within the g-Space application. Lists different workspaces and the views within them, such as Seismic data, Wells data, 3D view time, Well tie window, Well correlation, etc. Allows you to control the visibility, arrangement, and management of various views, enabling efficient handling of multiple data displays simultaneously.

4. Workspace Area. 114 The central area of the interface, highlighted in the yellow box. Workspace Area is where the main data visualizations and analysis take place. This area is used to display multiple Views 123 that are part of the ongoing workflow or project. Each view within the workspace can represent different types of data, such as seismic sections, well logs, map views, etc.

The cursor position can be synchronized on the map and section.

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The active window is highlighted in blue as in our Location map example and the Module Properties Panel is displayed for the active window.

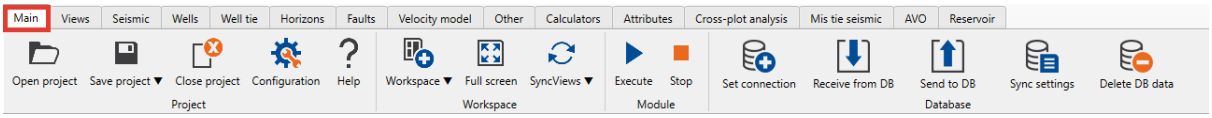
5. Module Properties Panel 91 is located on the right side of the interface, highlighted in the orange box. The Module Properties panel allows you to view and modify the properties and settings of the currently selected view or module. Includes adjustable settings such as axes properties, color settings, scaling, grid options, and other parameters specific to the active module. Also on the right side you can switch to other panels, such as

Progress view 112 that showing progress of the currently running process
Actions 108 panel contains processes that can be executed in the software

The g-Space interface is designed to be intuitive and flexible, enabling users to easily manage and analyze complex geophysical data. By familiarizing yourself with these components, you can efficiently navigate the software and optimize your workflows.

3.1 Ribbon bar

This chapter will guide through the existing bars available in g-Space and describe the functionality.



Main bar 34 - allows to perform the general actions with the project

Views bar 36 - allows to add different functional views 123 in workspace 114

Seismic bar 40 - allows to add/delete seismic datasets as well as perform functions with loaded seismic data

Wells bar 42 - allows to import/export/delete wells data as well as perform functions with wells

Petrophysics bar 46 - allows to run petrophysical calculations and interpretation tools, providing access to multiple calculators for processing and analysing well log data.

Well tie bar 62 - allows to setup and execute well-tie functionality

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Horizons bar 64 - allows to import/export/delete the horizons data

Faults bar 65 - allows to import/export/delete the faults data

Velocity model bar 66 - allows to customize your velocity model

Map interpolation bar 67 - allows to setup the mapping parameters

Attributes bar 68 - allows to calculate/generate attributes (as amplitude, envelope, instantaneous phase etc.) and spectral decomposition

Statistical analysis bar 72 - allows to generate and analyze the cross plots

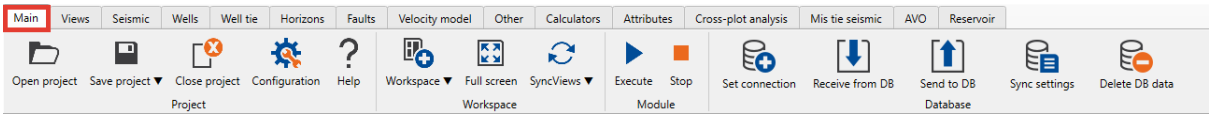
Mis tie seismic bar 78 - allows to check and fix the seismic intersections misties

AVO bar 80 - allows to perform AVO analysis

Reservoir bar 83 - allows to make gross rock volume calculation

3.1.1 Main bar

Main bar allows to perform the general actions with the project



Consists of 4 sections: Project, Workspace, Module, Database.

Project section:

Open project 235 - opens an existing project. Upon selection, g-Space will restart, and the project will be loaded

Save project 233 or create new project. On selection g-Space will save all setup and configuration of the project, including all data and views. For seismic data, only paths of seismic data are saved inside the project

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Close project - on selection, g-Space will unload open project and create an empty project

Configuration - allows to set global settings of the project

Help - opens the g-Space help system

Workspace section:

Workspace - when an arrow button clicked, allows switch between existing workspaces (graphical setups) or in case of clicking on the main button of the combobox allows to create a new empty workspace

Full screen - switch to Full screen mode that allows to put application in full-screen mode along all connected monitors. Shortcut key is F11

Synchronize views - allows to synchronize different views according to their axes. If synchronization selected all corresponding axes from different views will be scrolled and zoomed accordingly. The cursor position will also move synchronically on corresponding views. Views and/or specific axes can be selected/unselected to be synced in the settings dialog that appears when an arrow button of SyncViews clicked

Module section:

Run Execution process - This process re-initializes sync of all loaded data geometries and views according to current values of all properties of the application

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Stop process - interrupts Execution process and might put application state into unstable condition. It's advised to re-run Execution in such case

Database section:

Set connection - allows to set connection to the remote project

Receive from DB - allows to receive data from database

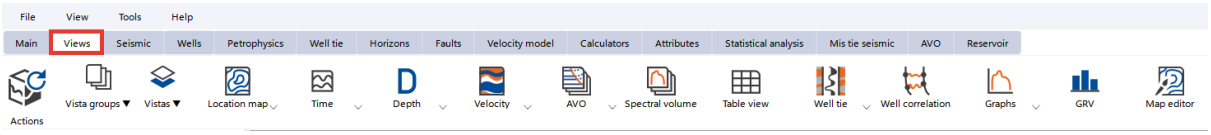
Send to DB - allows to send data to database

Sync settings - allows to set synchronization settings

Delete DB - allows to delete database

3.1.2 Views bar

Views bar allows to add different functional views into the current workspace.



Actions - Update 3D view

Vista groups - specific views which are not presented as buttons on the right

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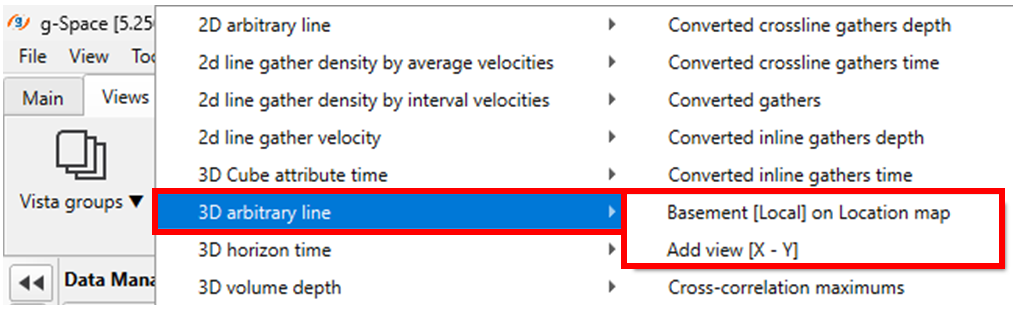
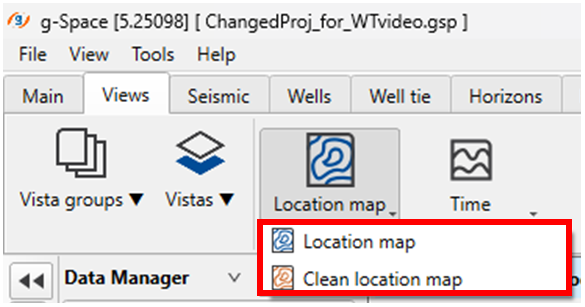
Vistas - contains all objects can be displayed. Each object has an option to be added to view of current workspace or in the new one:



Location map 124 - creates map view with ability to show and control loaded GIS-type data, such as seismic, well data geometry, polygons, arbitrary lines, maps, horizons, etc.

It has two options: create blank location map and create location map with objects added:



Time 130 - allows to add different seismic views in time domain (2D line, 3D inline, 3D crossline, 3D slice, Arbitary line, 3D view):

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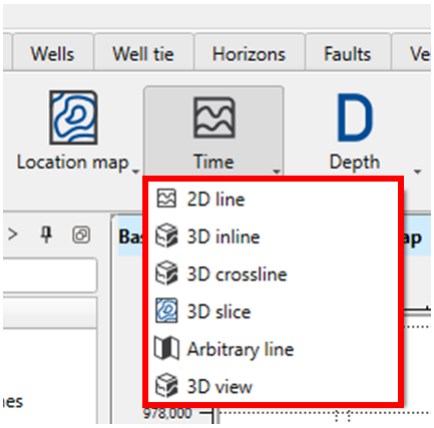
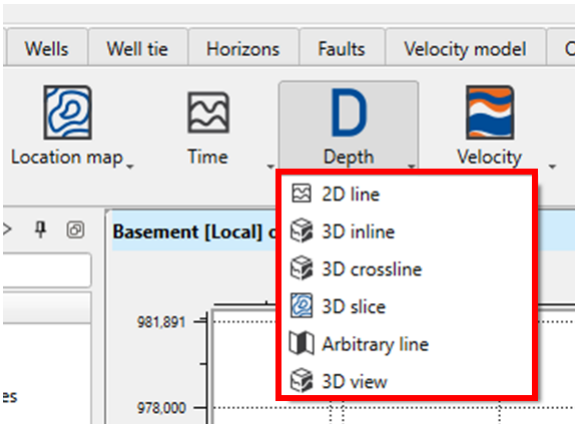


Depth - allows to add different seismic views in depth domain (2D line, 3D inline, 3D crossline, 3D slice, Arbitary line, 3D view):



Velocity - allows to add different velocity views in depth domain that were created by Velocity model building flows or loaded from external sources (2D line, 3D inline, 3D crossline, Arbitary line):

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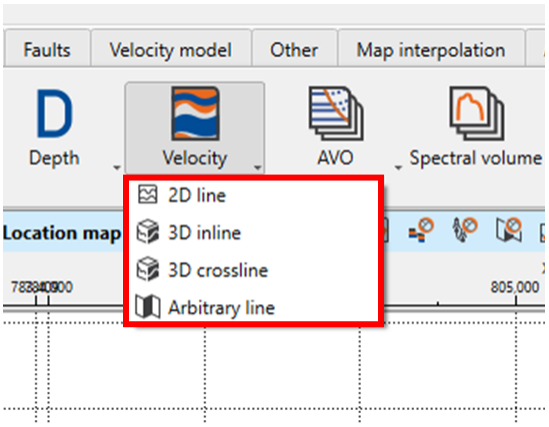
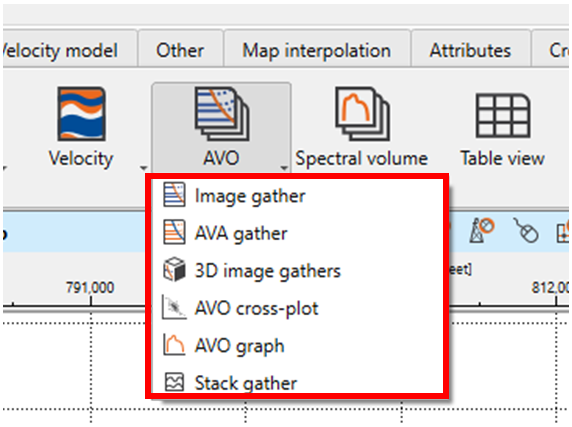


AVO - allows to add different views for AVO analysis (Image gather, AVA gather, 3D image gather, AVO cross-plot, AVO graph, Stack gather):



Spectral volume - creates view for spectral analysis

Table view - allows to create table view for review and edit different types of tabular format data

Well tie - contains two views. Well tie view allows to visualize, analyze and edit loaded checkshot, generate synthetic and perform seismic to well tie flow.

Cross-correlation view visualizes cross-correlation function between seismic and synthetic traces:

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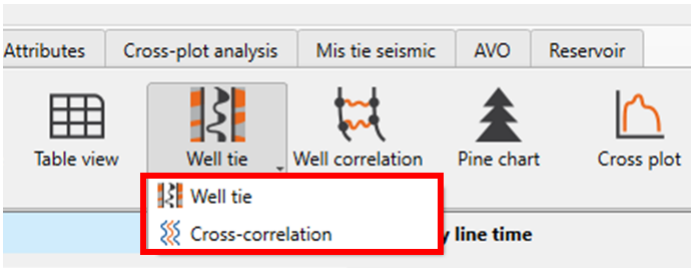
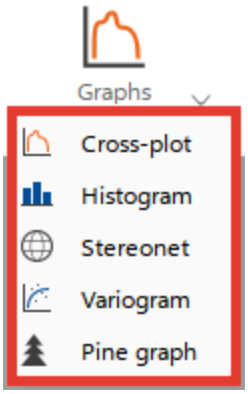


Well correlation 180 - creates a view for correlation and visualization of different types of well data such as continuous and/or discrete log data, point data, comment logs, etc.

Graphs 202 - creates views for statistical analysis data, consisting of Cross-plot 529, Histogram 532, Variogram 210, Stereonet 539, and Pine graph 208.



GRV 214 - creates a view with a graph for volumetric estimation

Map editor 214 - creates a view for map editing

3.1.3 Seismic bar

Seismic bar allows you to add/delete seismic data sets in the project

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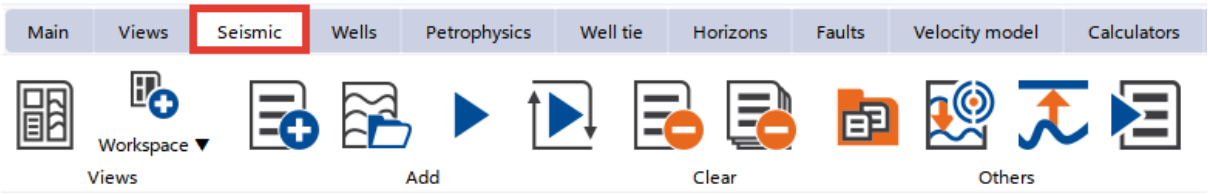

For information about the process of loading seismic data into the project, refer to chapter Import seismic 246

The view consists of 3 sections: Views, Add, Clear.

Views section:

Open predefined seismic data 118 workspace

Workspace 114: arrow button allows to switch between existing workspaces. Main button of the combobox allows to create a new empty workspace

Add section:

Add dataset - adding single dataset to the project. After adding data it still have to be reviewed and loaded into the project

Add and load dataset - adding and loading a single seismic dataset to the project. After adding data by that operation, it's ready to be used within the project. It assumes that all data is correct as loaded

Load dataset - loading a single seismic dataset that was previously added to the list of project's seismic. It assumes that all needed QC was already done

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Load all datasets - loading all seismic datasets that was previously added to the list of project's seismic or were changed during QC process. It assumes that all needed QC was already done on all seismic datasets

Clear section:

Clear dataset - remove a single selected seismic dataset from the project. The application does not deletes data from the disk

Clear all datasets - remove all seismic datasets from the project. The application does not deletes data from the disk

Others section:

Create seismic group

Propagate current shift on whole line

Calculate datum level

Import 3D attributes from ASCII. See more information in Import attributes 255

3.1.4 Wells bar

Wells bar allows to import/export/delete well data of the project

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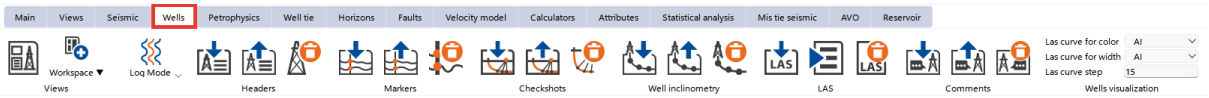

For more information about the formats supporting by g-Space please refer to chapter Well Data Formats 332

Consists of 8 sections: Views, Headers, Markers, Checkshots, Well inclinometry, LAS, Comments, Wells visualisation

Views section:

Open predefined wells data 121 workspace

Workspace 114 - arrow button allows to switch between existing workspaces. Main button of the combobox allows to create a new empty workspace

Headers section:

Import 257 / **Export** 308 / Clear Headers - operations on well headers information

Markers section:

Import 268 / **Export** 312 / Clear Markers - operations on well markers data

Checkshots section:

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Import 281 / Export 314 / Clear Checkshots - operations on time-depth relationship data within each well

Well inclinometry section:

Import 263 / Export 318 / Clear Well inclinometry - operations on well deviation information

LAS section:

Import 278 / Advanced Import / Clear LAS - operations on well log data

Comments section:

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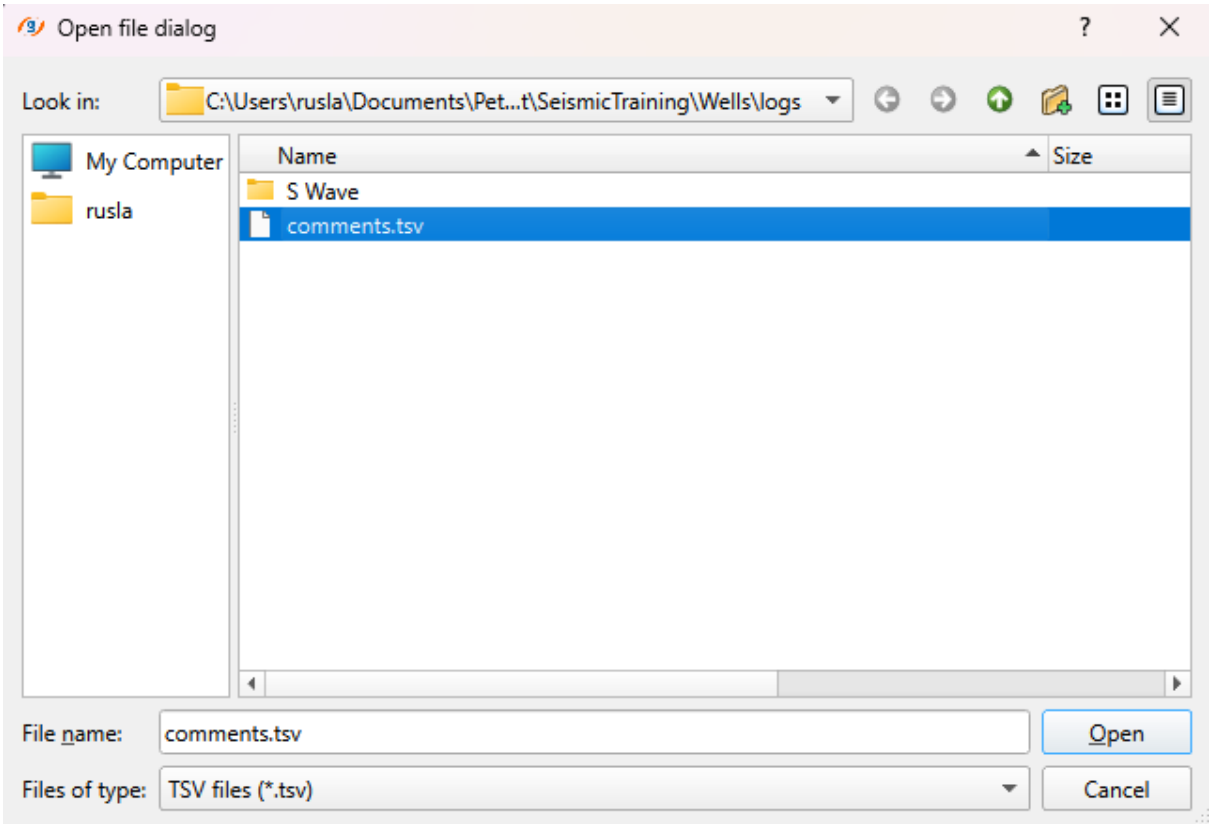
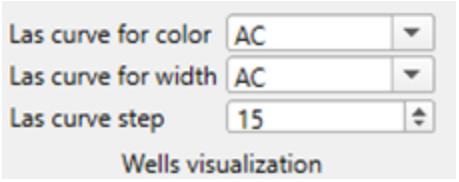


operations on well log data

Import 287 / **Export** 321 / Clear Comments block -

Wells visualisation section:



Settings for 3D visualization

It contains three options:

1. **Las curve for color**: A drop-down menu where the user can select a LAS curve color.

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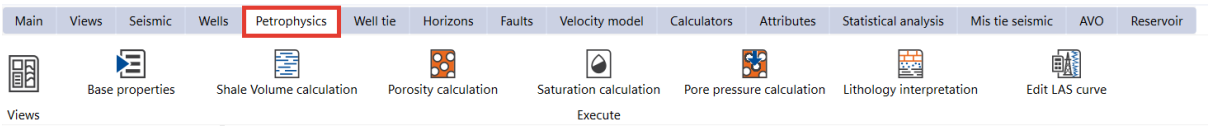
2. **Las curve for width**: A drop-down menu where the user can select a LAS to define the width of the Log curve in the 3D view.
3. **Las curve step**: A numeric input field set to 15, which specifies the step value for the log data used for visualization.

3.1.5 Petrophysics

The **Petrophysics bar** allows you to execute petrophysical calculations such as shale volume, porosity, saturation, pore pressure, and more using well log data available in the project.



For more information about input formats and methods used in each calculator, refer to the dedicated chapters for each calculation module.

The Bar consists of 2 sections: **Views, Execute.**

Views section:

Open predefined petrophysics calculation workspace.
The workspace includes the following views by default:

- Well log view 180
- Cross-plot view 206
- Well log histogram 203

Execute section:

This section includes calculators that operate on well log data. Each button opens a wizard or dialog for the selected operation.

Base properties – Opens the base property calculation wizard. This module allows estimation of hydrostatic pressure, temperature gradient, overburden stress, and effective stress using well depth and fluid parameters. Input parameters include fluid

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density, gravity constant, and depth range. The resulting curves can be saved as new well logs for further use in pore pressure or stress analysis.

Shale Volume calculation **Shale Volume calculation** – Opens the shale volume calculation module. Select the method (e.g., linear, Larionov) and input the gamma ray or other relevant logs.

Porosity calculation **Porosity calculation** – Opens the porosity calculation wizard. Supports various methods (density, sonic, neutron, or combined) and requires input of matrix and fluid properties.

Saturation calculation **Saturation calculation** – Opens the saturation wizard. Allows configuration of water saturation methods such as Archie or Simandoux, and includes parameter input for resistivity logs, cementation exponent, and formation water resistivity.

Pore pressure calculation **Pore pressure calculation** – Opens the pore pressure estimation module. Includes methods like Eaton's and Bowers', allowing you to define input logs (e.g., velocity, resistivity) and calibration parameters.

Lithology interpretation – Opens the lithology interpretation tool. This module enables defining lithotypes (e.g., sand, shale, limestone) based on log value ranges and logical rules. Users can set multiple lithotypes, assign weights to log

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parameters, define matching thresholds, and manage conflicts between overlapping definitions. The result is a lithology log representing the dominant lithotype per depth interval.

Edit LAS curve – Opens the LAS curve editing dialog. Provides options to modify existing well log curves using filters (moving average, median, bandpass), apply depth shifts, or perform mathematical operations with expressions. Includes a history panel for tracking applied modifications and undoing changes.
For more information refer to this topic: LAS editing 201

3.1.5.1 Base properties

The **Base properties** module provides a set of fundamental calculations commonly used in petrophysical and geomechanical analysis.
Each tab represents an individual calculator that generates a new log curve for the selected well or a batch of wells.
The module allows users to specify input parameters, define a calculation interval, and visualize the resulting curve before saving it to the project.

Hydrostatic Pressure

Calculates the hydrostatic pressure as a function of depth using the selected fluid density. The relationship is defined by:

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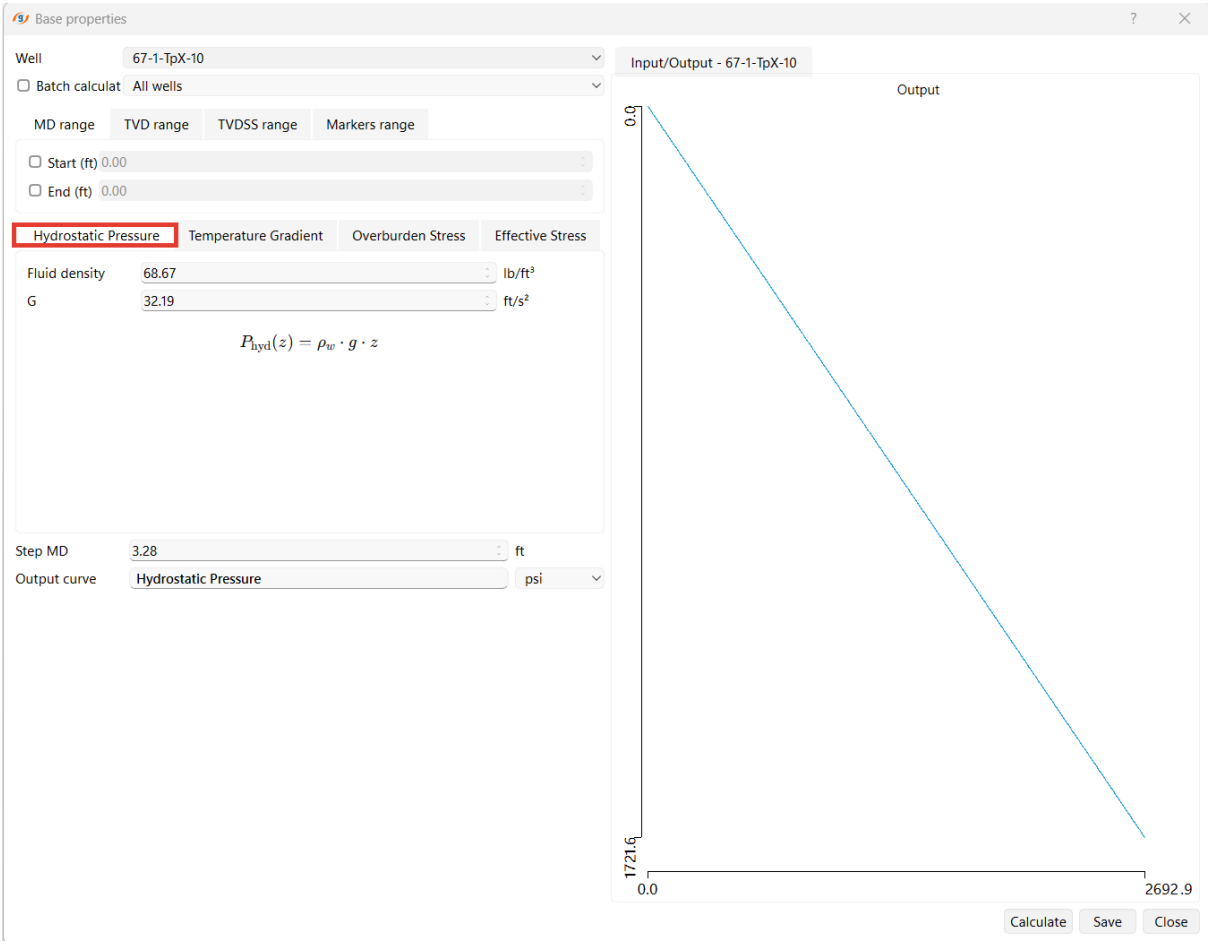

where

- *ρw* – fluid density,
- *g* – gravitational acceleration,
- *z* – depth.

Input parameters:

- Fluid density (kg/m³ or lb/ft³)
- Gravity constant (m/s² or ft/s²)
- Measured depth range and step

Output: Hydrostatic pressure curve (MPa or psi)

Temperature Gradient

Computes the temperature distribution with depth using a constant surface temperature and geothermal gradient.
The formula applied:

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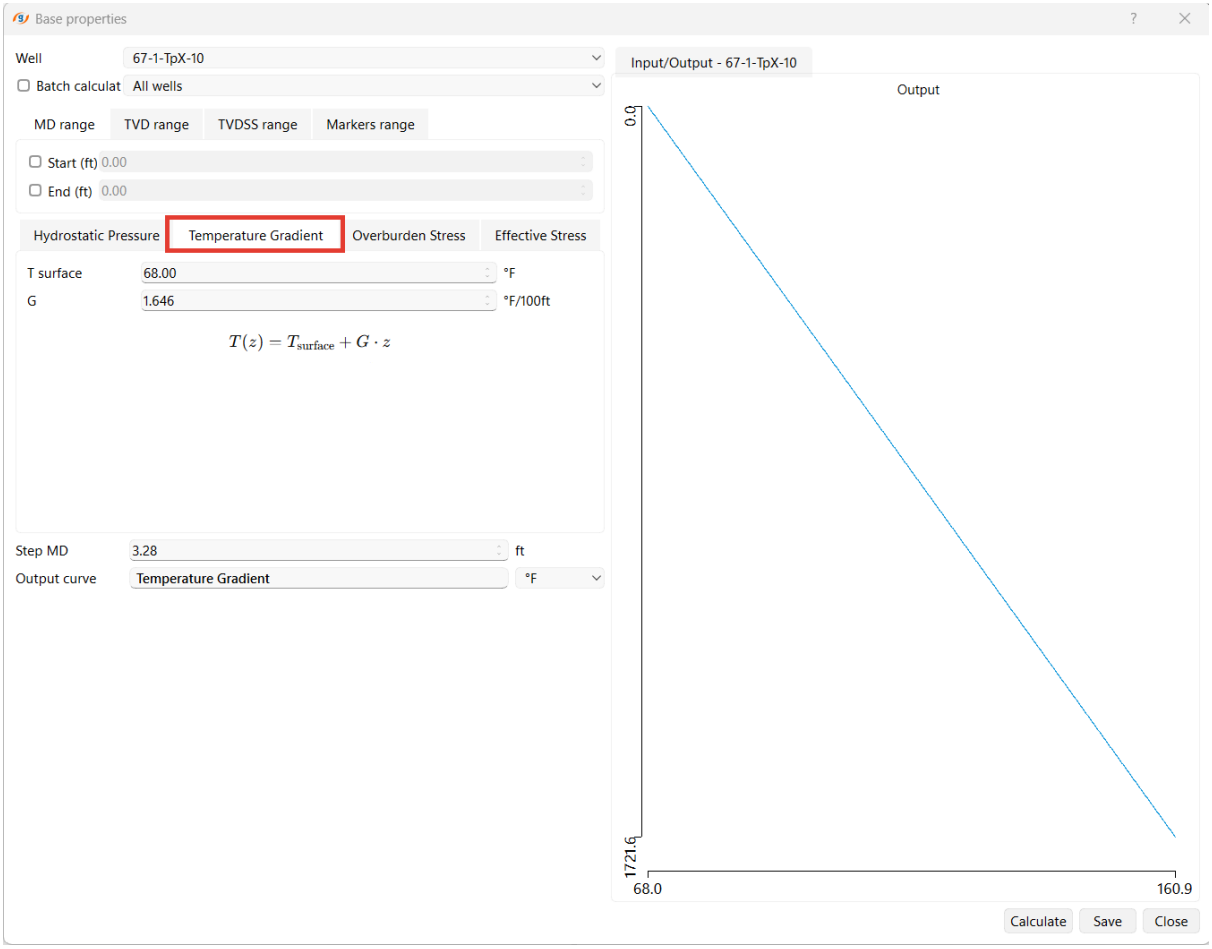

where

- *Tsurface* – surface temperature,
- *G* – geothermal gradient,
- *z* – depth.

Input parameters:

- Surface temperature (°C or °F)
- Temperature gradient (°C/100 m or °F/100 ft)
- Depth step

Output: Temperature Gradient curve

Overburden Stress

Estimates the vertical stress resulting from the weight of the overlying sediments.

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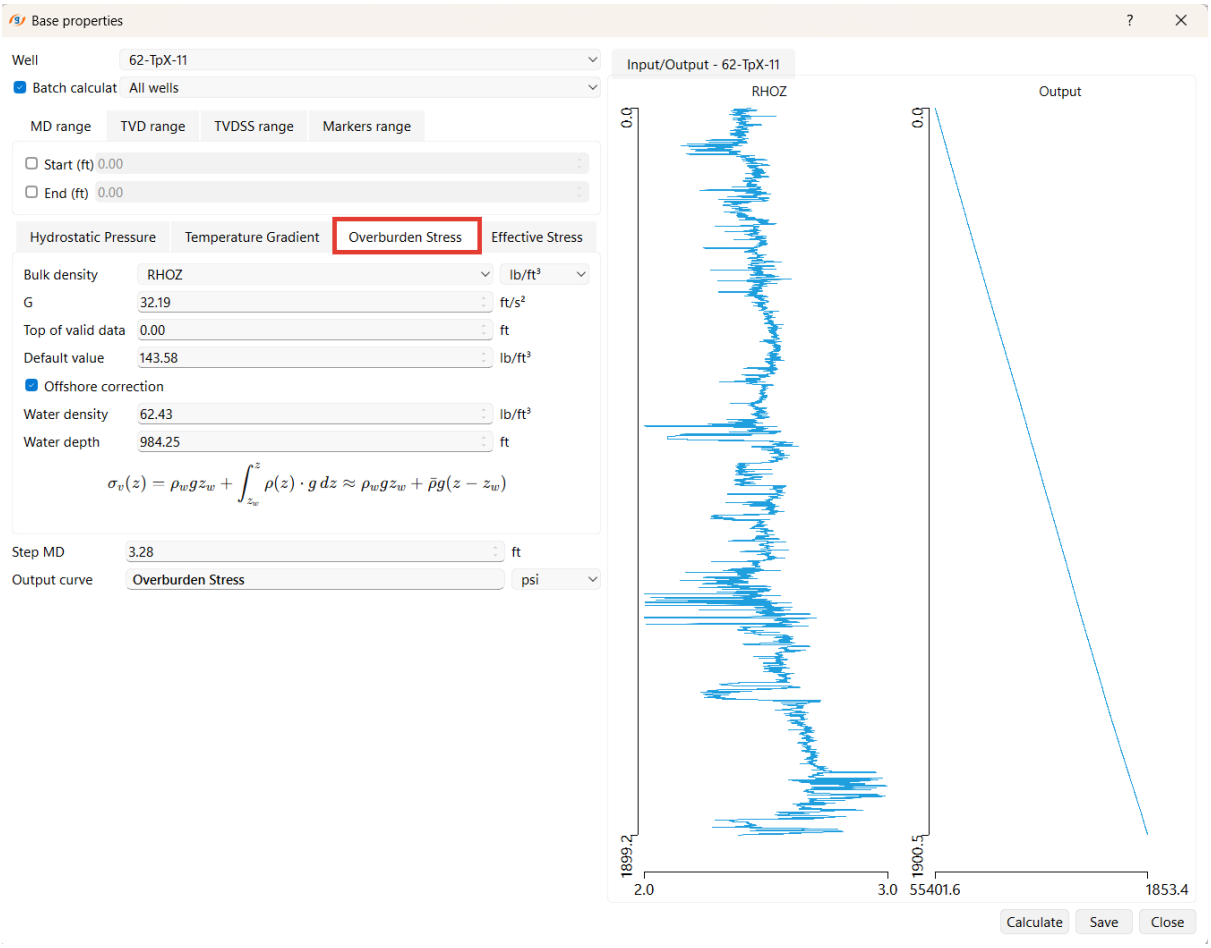
The calculation integrates the rock bulk density curve over depth:



where

- ρ – bulk density,
- g – gravitational acceleration.

Input parameters:

- Bulk density log
- Gravity constant
- Depth interval and step

Output: Overburden stress curve (MPa or psi)

Effective Stress

Determines the effective stress by subtracting pore pressure from total overburden stress:

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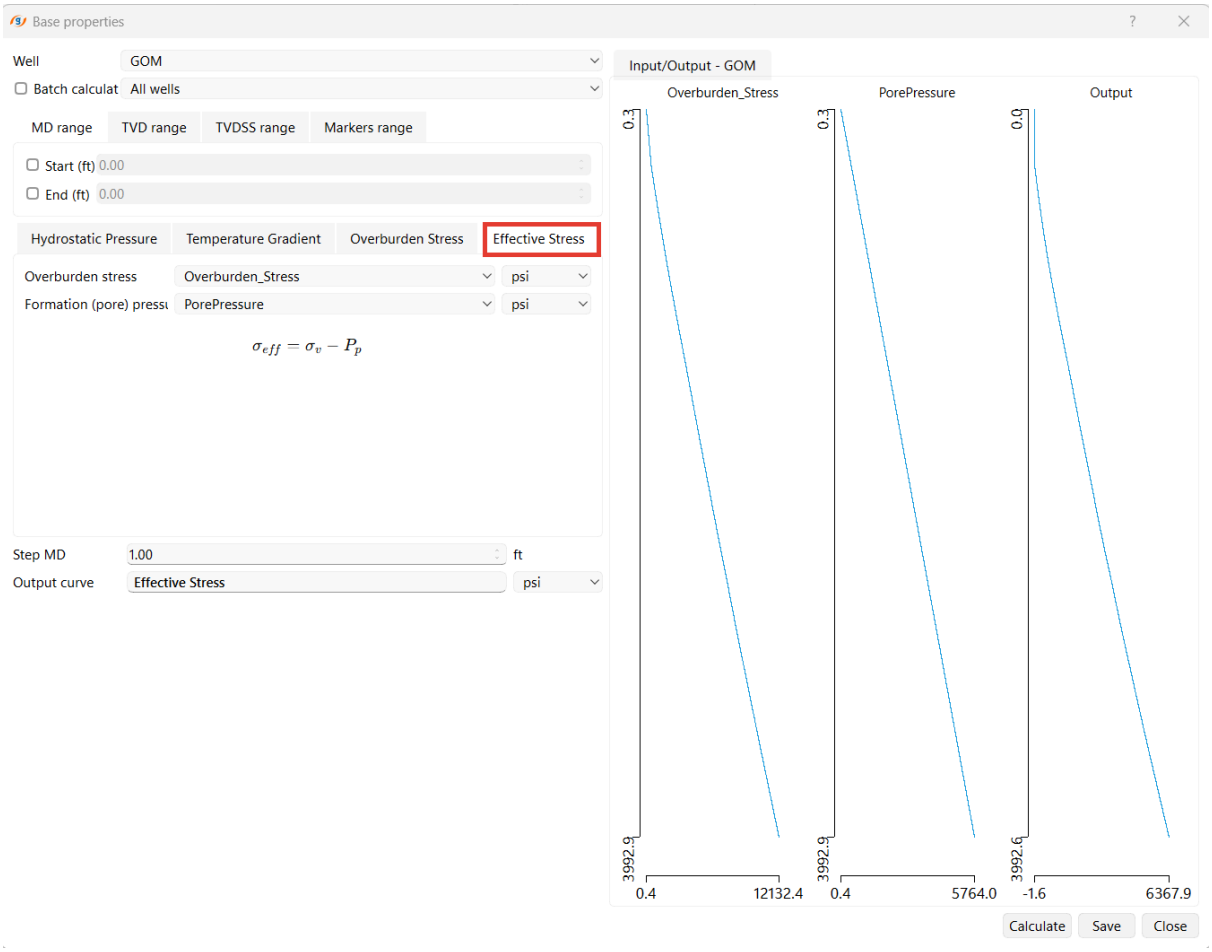

where

- σv – overburden stress,
- Pp – pore pressure.

Input parameters:

- Overburden stress curve
- Pore pressure curve

Output: Effective stress curve (MPa or psi)

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3.1.5.2 Shale Volume

The **Shale Volume** wizard estimates the fraction of shale within a formation based on well log data. It supports several industry-standard methods using **Gamma Ray (GR)** or **Spontaneous Potential (SP)** logs.

The output is a **Vshale (Vsh)** curve that represents the volumetric proportion of shale along the wellbore.

Input Parameters

- **Well selection:** Choose one well or activate **Batch calculation** to process all wells or a selected group from the Data Manager.
- **Depth filter:** Define the interval for calculation by using **MD range**, **TVD/TVDSS range**, or by selecting the depth between **markers**.
- **Curve selection:** Select the log to be used (Gamma Ray or SP).
- **Parameter limits:** Set clean and shale reference values for the chosen curve (manual or automatic).
- **Output curve:** Define the name for the resulting shale volume log.

Each method generates a **Vshale (Vsh)** log, displayed alongside the input curve for visual comparison.
Users can review results on the **Input/Output** panel, adjust parameters, **rename the output curve directly in the wizard**, and click **Save** to store it in the project.

Calculation Methods

1. Linear Index (GR)

This is the simplest approach assuming a linear relationship between Gamma Ray values and shale content.

Use:

- *Quick estimation for clean sand–shale sequences.*
- *Best applied when GR response is approximately linear with shale content.*

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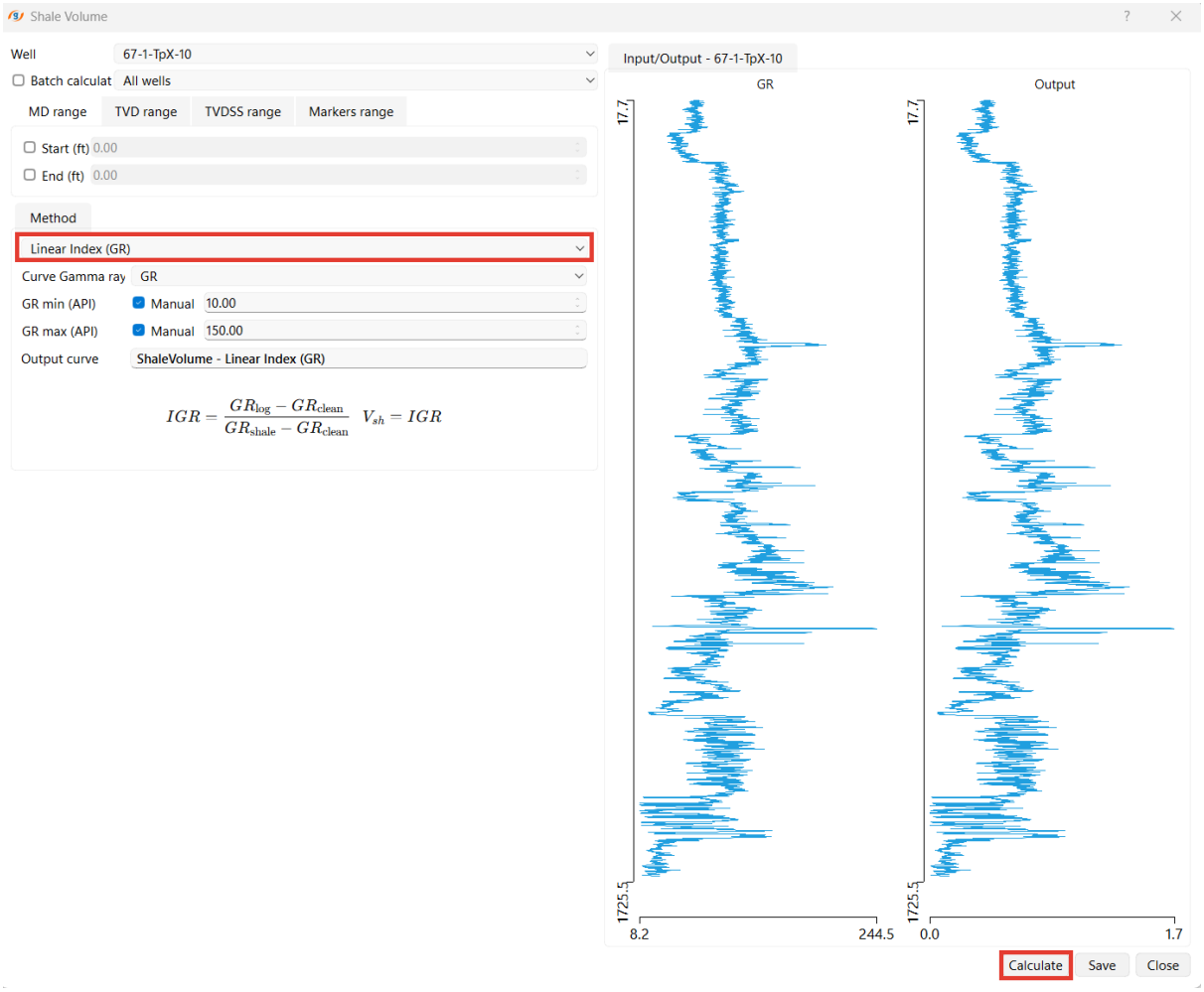

2. Steiber (GR)

Introduces a non-linear correction to better reflect compaction and radioactive mineral effects.

Use:

- Suitable for mixed lithologies and compacted formations.
- Reduces overestimation of shale content in clean sands.

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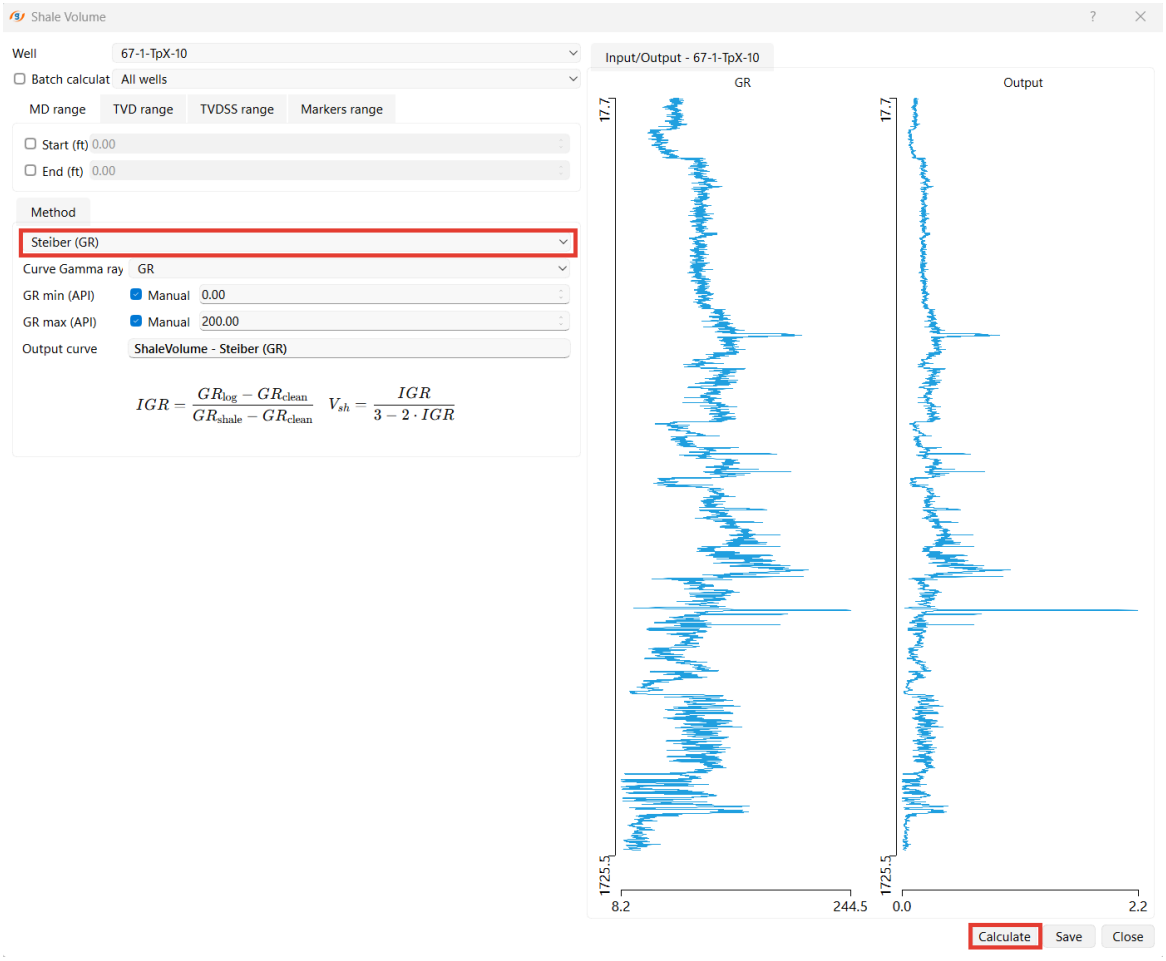

3. Clavier (GR)

An empirical formula that smooths the transition between clean and shaly intervals.

Use:

- *Appropriate for moderately shaly formations.*
- *Often applied to Tertiary clastic reservoirs.*

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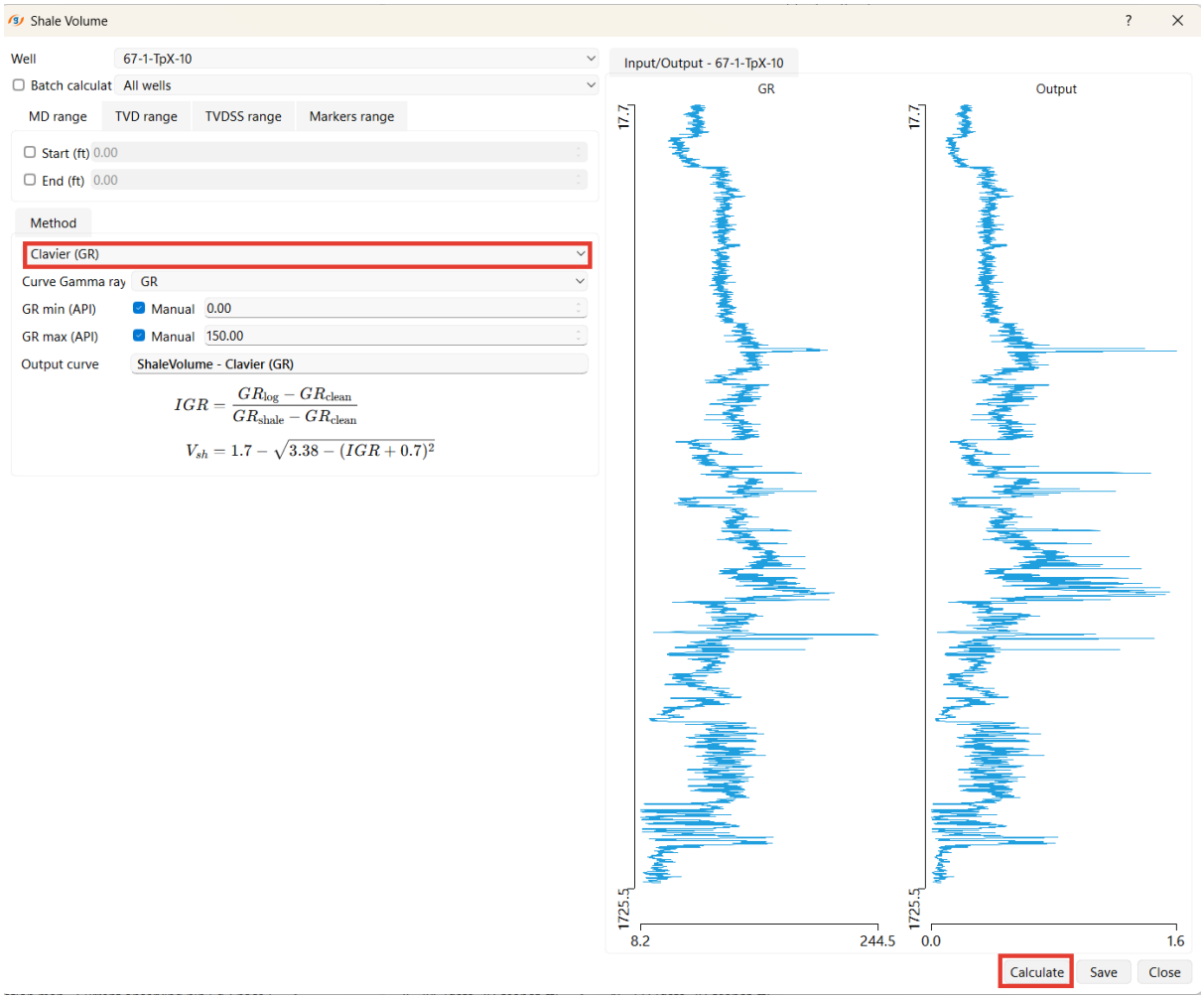

4. Larionov (Tertiary Rocks) (GR)

Developed by Larionov (1969) for young sedimentary sequences with low compaction.

Use:

- *Recommended for Tertiary rocks and soft sediments.*
- *Corrects for overestimated shale content in younger formations.*

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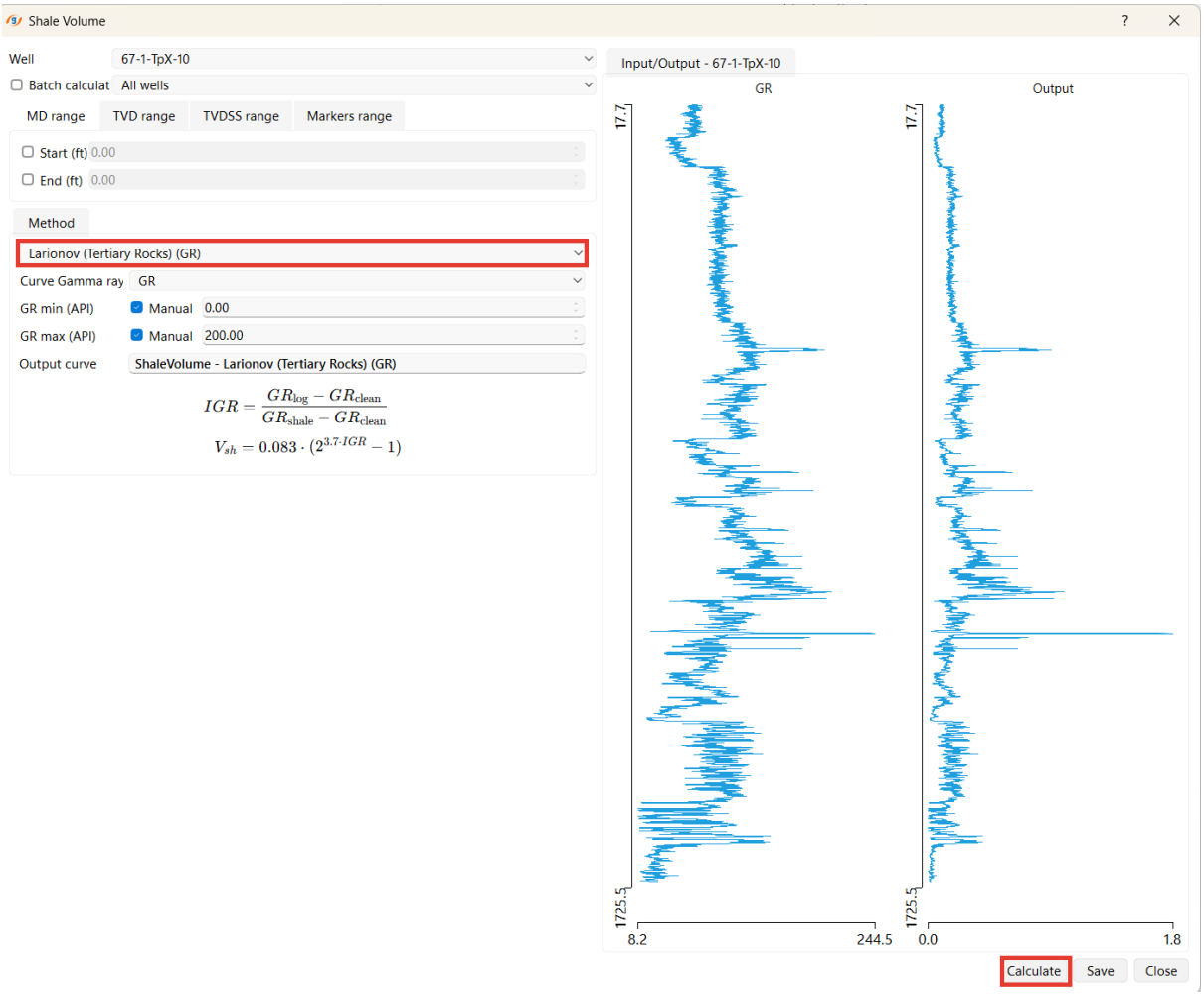

5. Larionov (Older Rocks) (GR)

Modified Larionov model for compacted and older formations (e.g., Paleozoic–Mesozoic).

Use:

- *Suitable for consolidated rocks and older stratigraphic units.*
- *Provides more realistic shale values in deep formations.*

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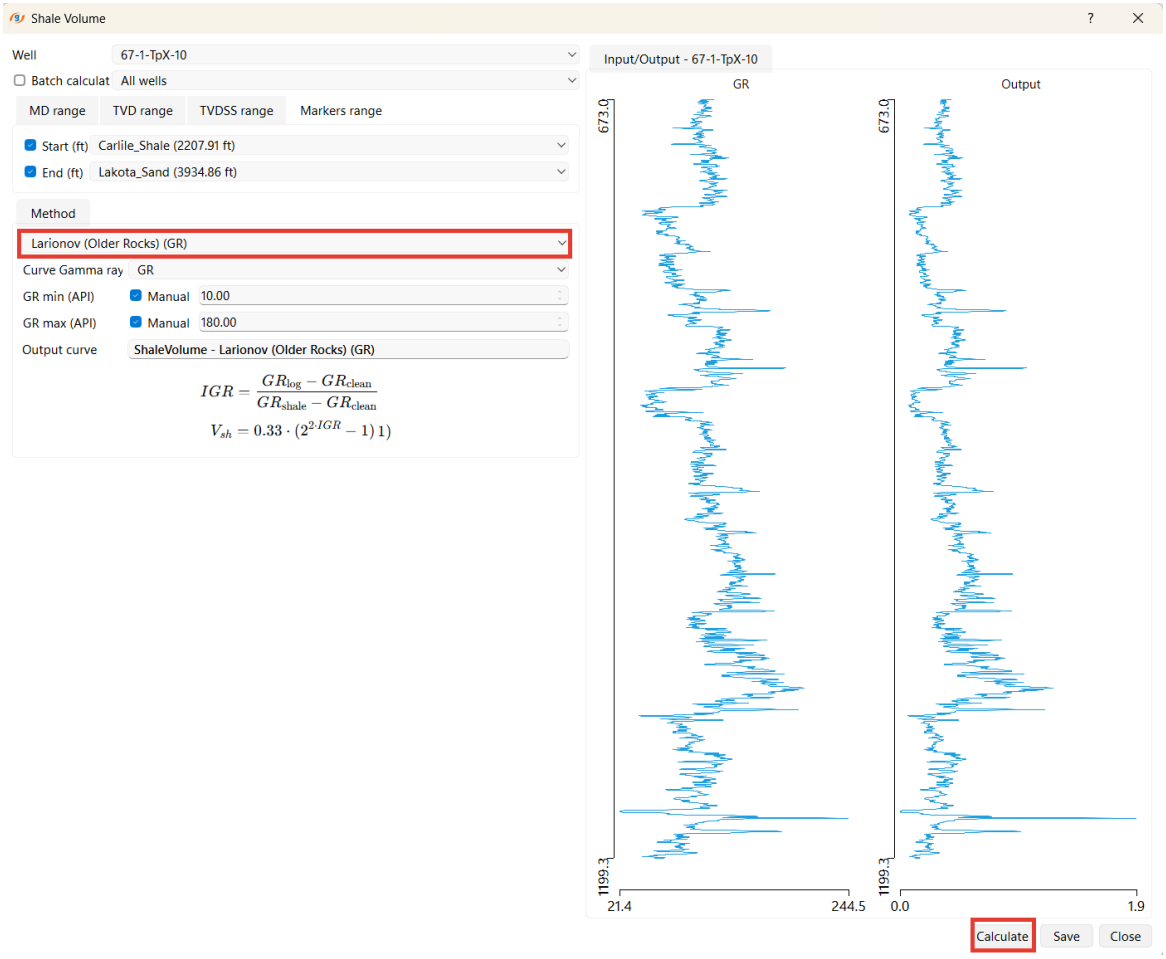

6. SP Baseline Method (SP)

Uses **Spontaneous Potential (SP)** log instead of GR for shale estimation.
The method compares the measured SP curve with reference clean and shale baselines.

Use:

- *Useful when GR data is unavailable or unreliable.*
- *Common in older wells with limited logging suites.*

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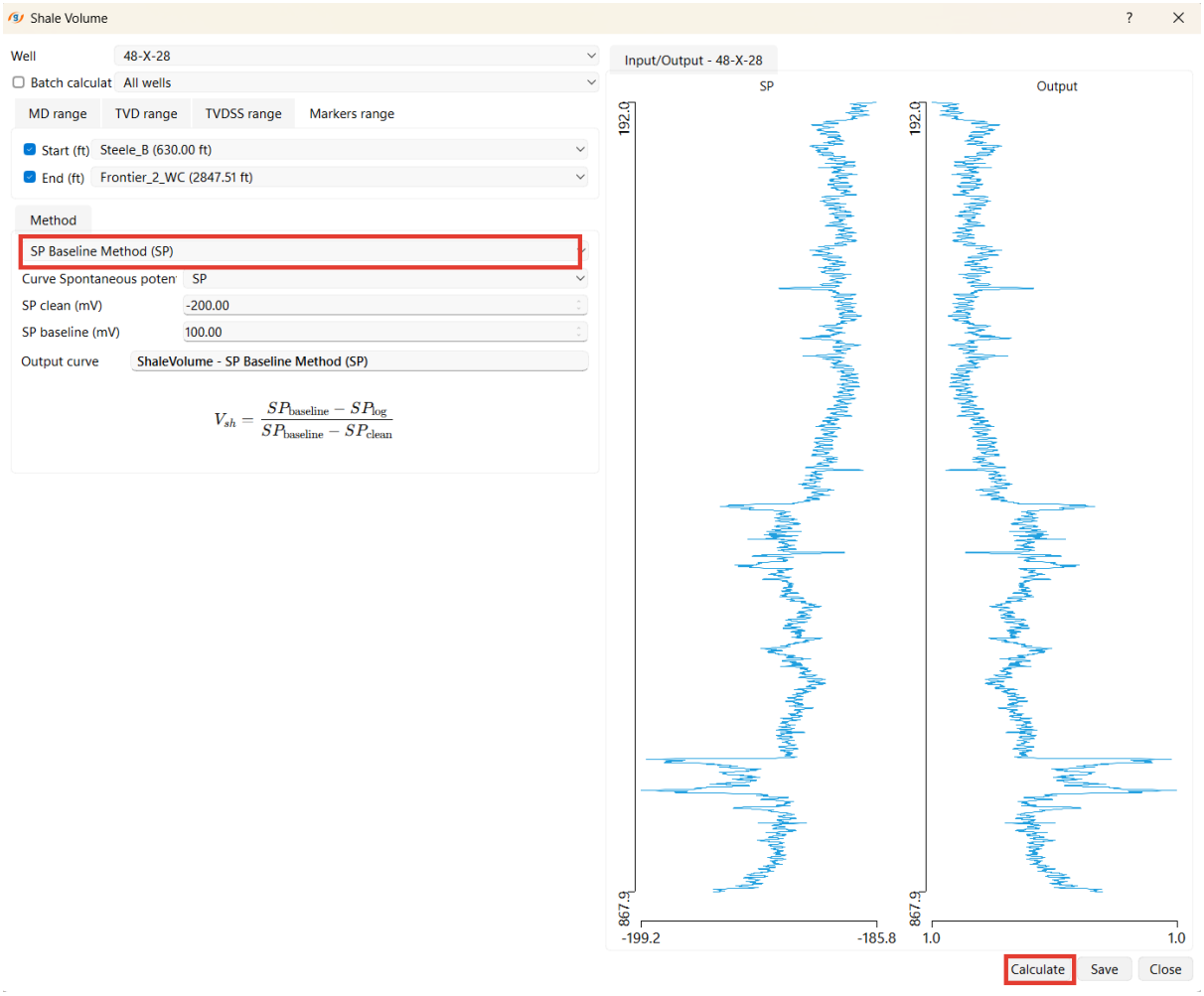

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3.1.5.3 Porosity

The **Porosity** wizard calculates total and effective porosity using available well logs such as density, neutron, or a combination of both.
The tool can be applied to a **single well** or in **batch mode**, allowing users to process all wells or selected wells from the **Data Manager**.

Input Parameters

- **Well selection:** Choose one well or enable **Batch calculation** to process multiple wells or a well group from the Data Manager.
- **Depth filter:** The calculation interval can be limited by **MD**, **TVD/TVDSS**, or **markers**.
- **Curve selection:** Choose the density, neutron, or shale volume logs depending on the selected method.
- **Material properties:** Specify matrix and fluid densities (and shale porosity if applicable).
- **Output curve:** Define the name of the resulting porosity log. The name can be **edited directly in the wizard** before saving.

Calculation Methods

Density Porosity – Total

Calculates porosity directly from the density log assuming a clean (shale-free) formation.

Use:

- For clean formations with minimal shale influence.
- Common for sandstone and carbonate reservoirs.

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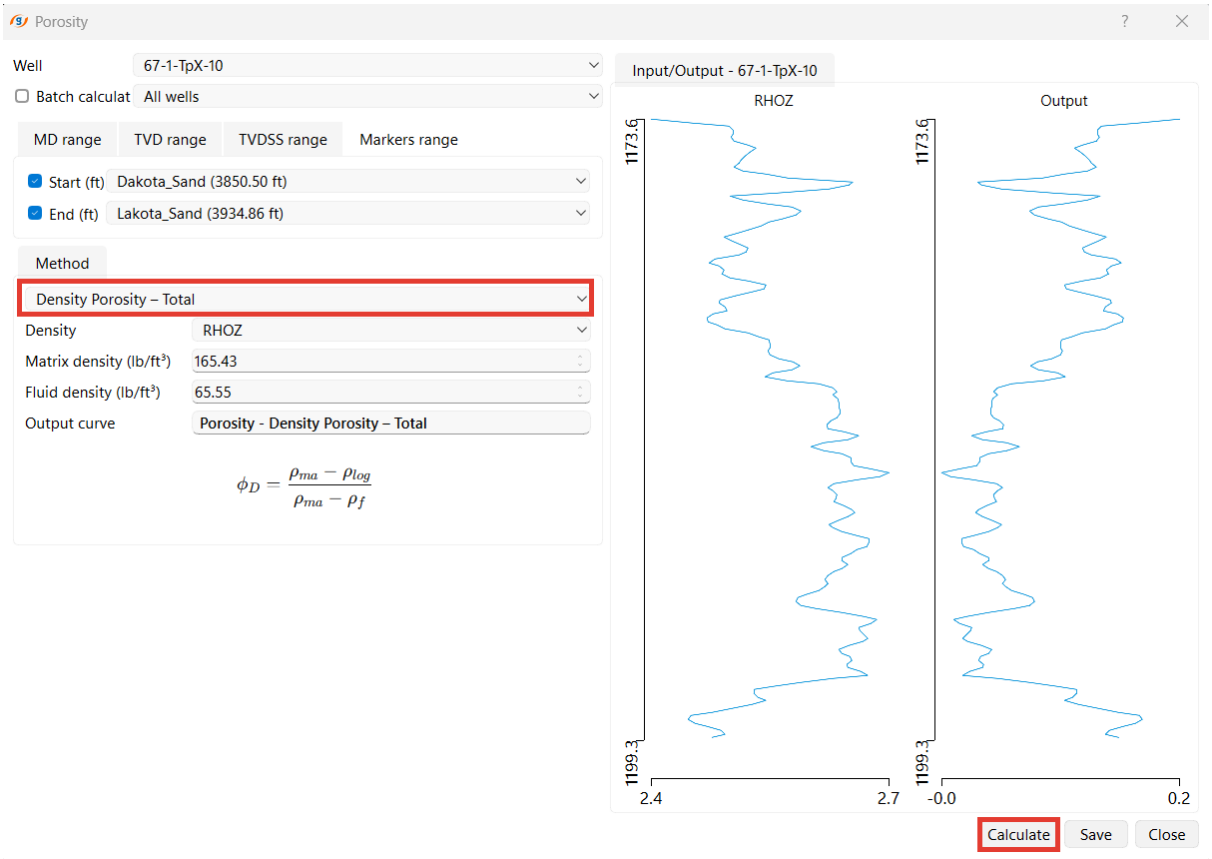

ρ_{ma} – matrix density,
ρ_f – fluid density,
ρ_{log} – measured formation density.

Density Porosity – Effective

Corrects the total porosity for shale content using a shale volume curve and shale porosity.

Use:

- Appropriate for shaly formations.
- Produces an effective porosity excluding bound water in shale.

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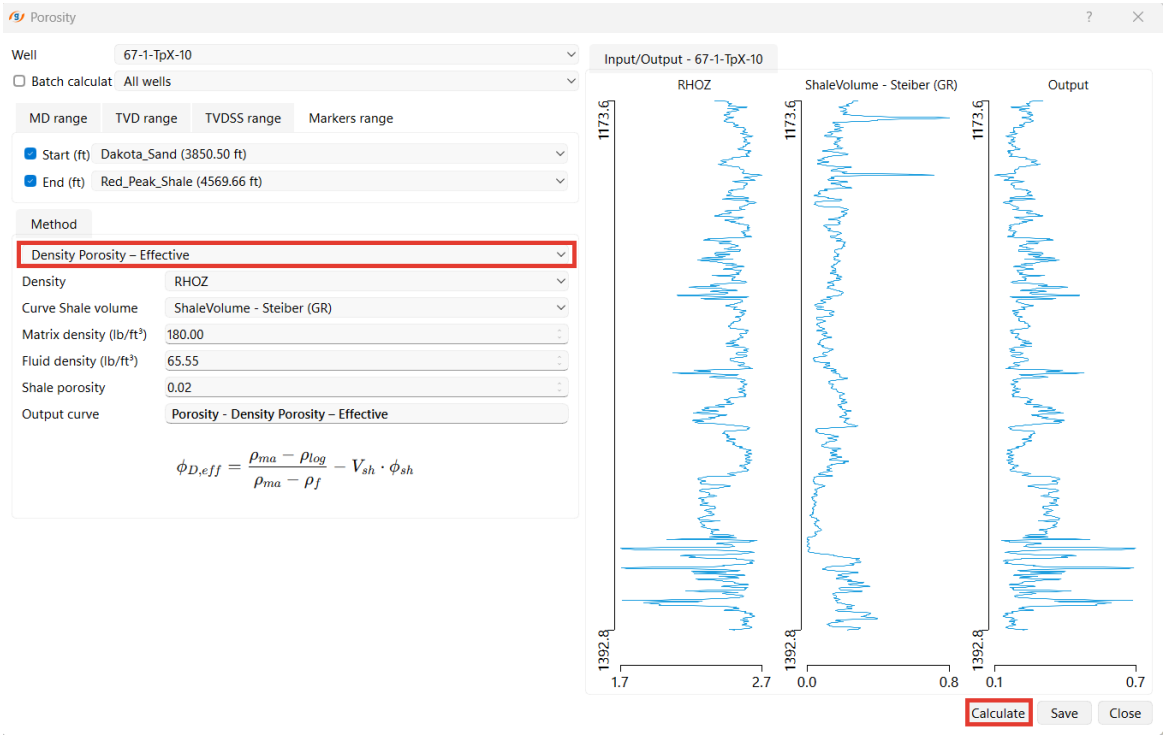


V_{sh} – shale volume,

ϕ_{sh} – shale porosity.

3.1.5.4 Saturation

Enter topic text here.

3.1.5.5 Pore pressure

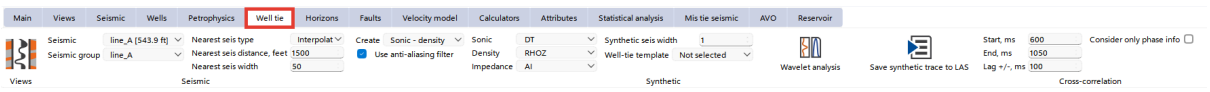
Enter topic text here.

3.1.5.6 Lithology

Enter topic text here.

3.1.6 Well tie bar

Well tie bar provides interface to perform seismic to well tie



For more information about well tie functionality please refer to Well tie view 172

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Consists of 3 sections: Seismic, Synthetic, Cross-correlation

In **Seismic** section it is possible to set seismic data for well tie.

Seismic	Choose the line which is near by to the well
Seismic group	Switch between different versions of loaded data
Nearest seis distance	Set searching distance of seismic data around the well
Nearest seis width	Set a number of traces in well tie view 172

In **Synthetic seismogram** section it is possible to set synthetic parameters:

Create	Set inputs: Sonic, Sonic - density, Impedance
Sonic, Density, Impedance	Drop down boxes allow you to choose the well logs
Synthetic seis width	Set a width in well tie view 172
Well-tie template	Stores all well-tie templates created in g-Space
Wavelet analysis	Settings for the wavelet used for well-tie

In **Cross-correlation** section it is possible to set cross-correlation window parameters:

Start	Set start of the analysis interval
End	Set end of the analysis interval
Lag	Set a width of plot in the cross-correlation view

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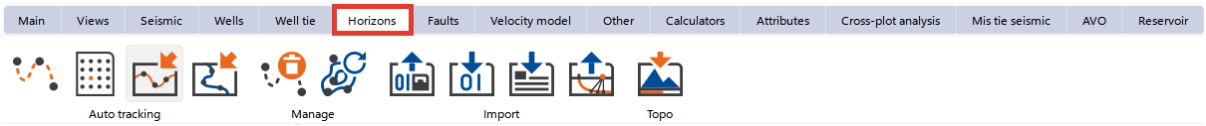
3.1.7 Horizons bar

Horizons bar allows you to import/export/delete or make other manipulations with horizons in the project



For more information about the formats supporting by g-Space please refer to chapter Horizon Data Formats 337

Full description about functionality of these buttons you can find here: Seismic picking 397

Consists of 4 sections: Auto tracking, Manage, Import, Topo

Auto tracking section:

Track horizon 2D

Track horizon 3D

Convert map to horizon by inline

Convert map to horizon by crossline

Manage section:

Clear horizons

Update horizon map

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Import section. For more information refer to this topics: Import 292 / Export 322 horizons**:**

Save horizon binary

Load horizon binary

Import horizon ASCII

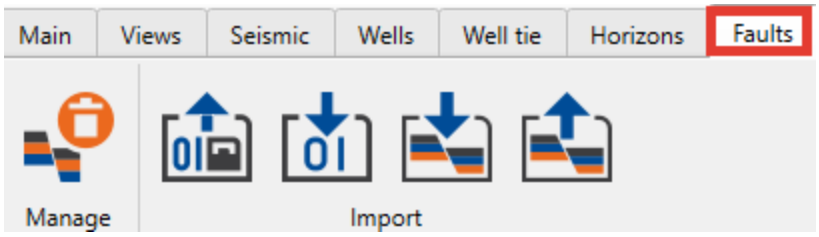
Export current horizon ASCII

Topo section. For more information refer to this topic: Import topography 298**:**

Load external topography

3.1.8 Faults bar

Faults bar allows you to import/export/delete the faults data in the project



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For more information about the fault formats supporting by g-Space please refer to chapter Fault Data Formats 339

Full description about functionality of the buttons refer to Import 294 / Export 325 faults

Clear faults

Export faults binary

Import faults binary

Import faults as charisma

Export faults as charisma

3.1.9 Velocity model bar

Velocity model bar allows you to customize your velocity model

For more information about the velocity models please refer to Velocity model 465

Open a velocity modeling wizard

Import depth velocity model

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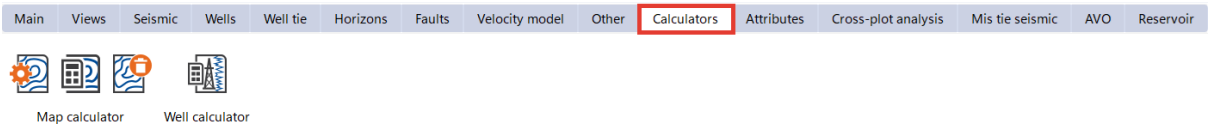
Update depth velocity by well-tie

Clear all well tied maps

Create Pine chart

3.1.10 Calculators bar

Calculators bar allows users to perform mathematical operations with maps and well data



Map Calculator: This tool allows users to perform mathematical operations on various types of maps, such as depth maps, velocity maps, and more, to create new calculated maps based on user-defined expressions.

Open map interpolation settings

Open map calculator

Clear all calculated maps

For more information about the map building please refer to Map creating 517

Well calculator: This tool is used to generate new well logs by applying mathematical expressions to existing logs. It enables the creation of customized well log data for further analysis.

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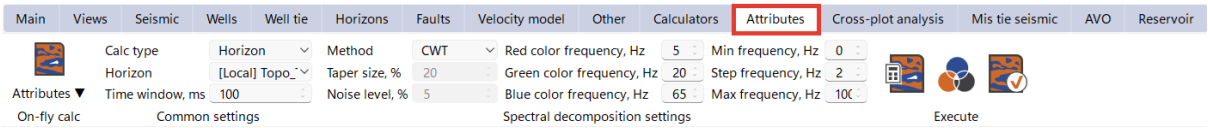
Open well log calculator

For more information about the well log operations please refer to Well log calculator 376

3.1.11 Attributes bar

Attributes bar allows you to generate/calculate the seismic attributes for further analysis during the seismic interpretation.



For more information about the attributes calculation please refer to chapters Seismic attributes 472 and Spectral decomposition 479

Consists of 4 sections: On-fly calc, Common settings, Spectral decomposition settings, Execute.

On-fly calc section:

Consists of one button which opens a context menu. In this menu you can select attributes for maps calculation or select an attribute to see it on the seismic section:

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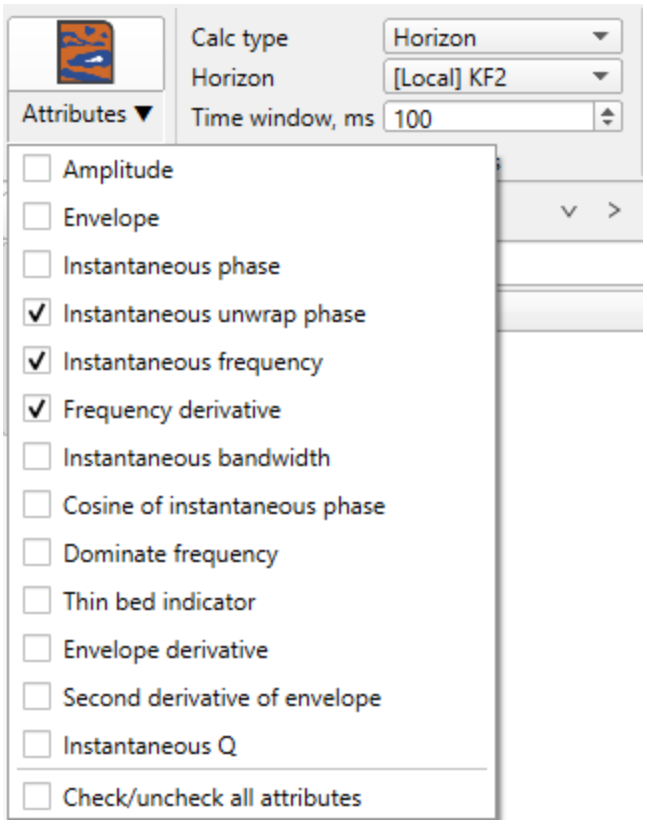
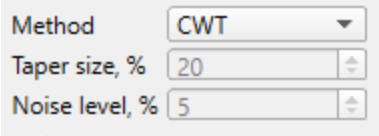


In **Common settings** section you can choose parameters of calculation**:**

Calc type	Choose type of calculation between horizon or whole seismic dataset
Horizon	Choose horizon for calculation
Time window, ms	Set time window of calculation

In **Spectral decomposition settings** section you can choose parameters for this attribute**:**



Set method of spectral decomposition calculations and set its parameters

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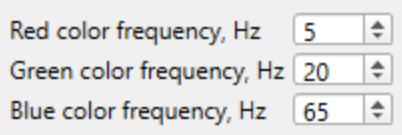
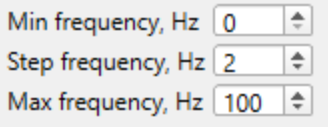


Set colors for each frequency



Set boundary parameters for calculations

Execute section:

Open the window for attributes calculation settings and start of calculation

Run spectral decomposition

Run QC for selected horizon picking. This icon is associated with spectral composition to QC and select the parameters from spectral decomposition from the selected horizon

The following list provides a detailed explanation of the seismic attributes available in g-Space. For each attribute, a brief theoretical background is given along with its practical application in seismic data analysis.

Amplitude: Represents the strength or intensity of the seismic signal at each reflection point. Amplitude variations are often related to changes in rock properties, fluid content, or lithology, making it a critical parameter for identifying potential reservoirs, stratigraphic boundaries, and geological features.

Envelope: The envelope is a smooth curve that outlines the peaks and troughs of a seismic wave. It's often used to detect changes in seismic reflectivity, which can be linked to stratigraphic features, faults, or lithological variations. The envelope highlights zones of high energy and can improve the interpretation of complex seismic events.

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Instantaneous Phase: The instantaneous phase attribute measures the phase angle of the seismic signal at any given point in time. This attribute is phase-independent, meaning it is not influenced by amplitude variations, making it useful for identifying continuous horizons and tracking lateral continuity in the subsurface.

Instantaneous Unwrap Phase: This is an unwrapped version of the instantaneous phase, where discontinuities in phase values are removed, providing a continuous phase profile. It helps in mapping stratigraphic layers more precisely, especially in areas where reflectors might be obscured by phase wrapping.

Instantaneous Frequency: This attribute calculates the frequency of the seismic signal at each point in time. It highlights changes in frequency that may correspond to subsurface geological variations such as layer thickness, rock types, and depositional environments. Instantaneous frequency is often used for high-resolution stratigraphic interpretation.

Frequency Derivative: The frequency derivative shows the rate of change of frequency over time. Rapid changes in frequency can indicate transitions between different rock types or depositional environments. It helps in identifying seismic features such as unconformities, thin beds, or channel boundaries.

Instantaneous Bandwidth: Instantaneous bandwidth represents the range of frequencies present at any point in the seismic signal. A higher bandwidth often indicates more complex geological structures, while a lower bandwidth can be associated with simpler, homogeneous layers. This attribute is useful for characterizing reservoir quality and seismic resolution.

Cosine of Instantaneous Phase: The cosine of the instantaneous phase converts phase information into a continuous waveform, emphasizing differences in phase between neighboring traces. This attribute is valuable for identifying faults, stratigraphic discontinuities, and other structural features that may be missed with traditional amplitude-based interpretation.

Dominant Frequency: Dominant frequency refers to the most prevalent frequency in the seismic signal. It can indicate the average thickness of the subsurface layers and is often related to depositional environments. A lower dominant frequency suggests thicker layers, while a higher frequency points to thinner beds or more rapid changes in geology.

Thin Bed Indicator: This attribute is designed to identify the presence of thin beds that are smaller than the resolution of the seismic wavelength. By analyzing amplitude and frequency variations, it highlights subtle features that might not be clearly visible in standard seismic attributes, helping to detect important stratigraphic details in thinly bedded reservoirs.

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Envelope Derivative: The envelope derivative measures the rate of change in the envelope of the seismic signal. It is useful for pinpointing areas where there is a significant transition in reflectivity, which may correspond to abrupt lithological changes, fault zones, or sharp depositional boundaries.

Second Derivative of Envelope: The second derivative of the envelope further enhances areas of rapid change in reflectivity. This attribute is particularly useful for detecting fine geological features that may be missed with other attributes, such as thin layers or subtle faults.

Instantaneous Q: Instantaneous Q represents the quality factor of the seismic wave, which measures the attenuation of the signal as it travels through the subsurface. High Q values suggest lower attenuation (indicating harder or more solid rock), while low Q values indicate higher attenuation (associated with softer rock or the presence of fluids). This attribute is often used to infer rock porosity or fluid content in reservoirs.

Coherence: Coherence measures the similarity of seismic traces across a specified window, helping to highlight discontinuities in the subsurface such as faults, fractures, or stratigraphic boundaries. It is a powerful tool for fault interpretation and for identifying subtle geological structures that may not be visible in standard amplitude data.

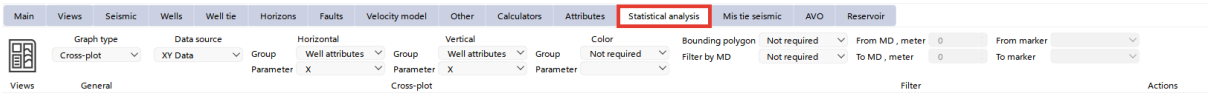
Similarity: Similarity compares seismic traces within a neighborhood and highlights differences in waveform shapes. This attribute is often used to identify features such as faults, channels, and stratigraphic boundaries, as well as variations in rock type or fluid content.

Chaos: The chaos attribute detects areas where the seismic signal appears disordered or non-coherent, often corresponding to zones with complex geological structures such as fault zones, fractured reservoirs, or highly heterogeneous formations. It can help interpret regions where seismic reflections are disrupted or unclear.

Seismic Relief: Seismic relief highlights the vertical variation in subsurface reflector depth, providing a clear representation of topography and structural variations. It is useful for identifying features such as anticlines, synclines, fault blocks, and other geological structures that involve significant elevation changes in the subsurface.

3.1.12 Statistical analysis bar

Statistical analysis view in g-Space is a powerful tool for analyzing and visualizing relationships between different attributes.



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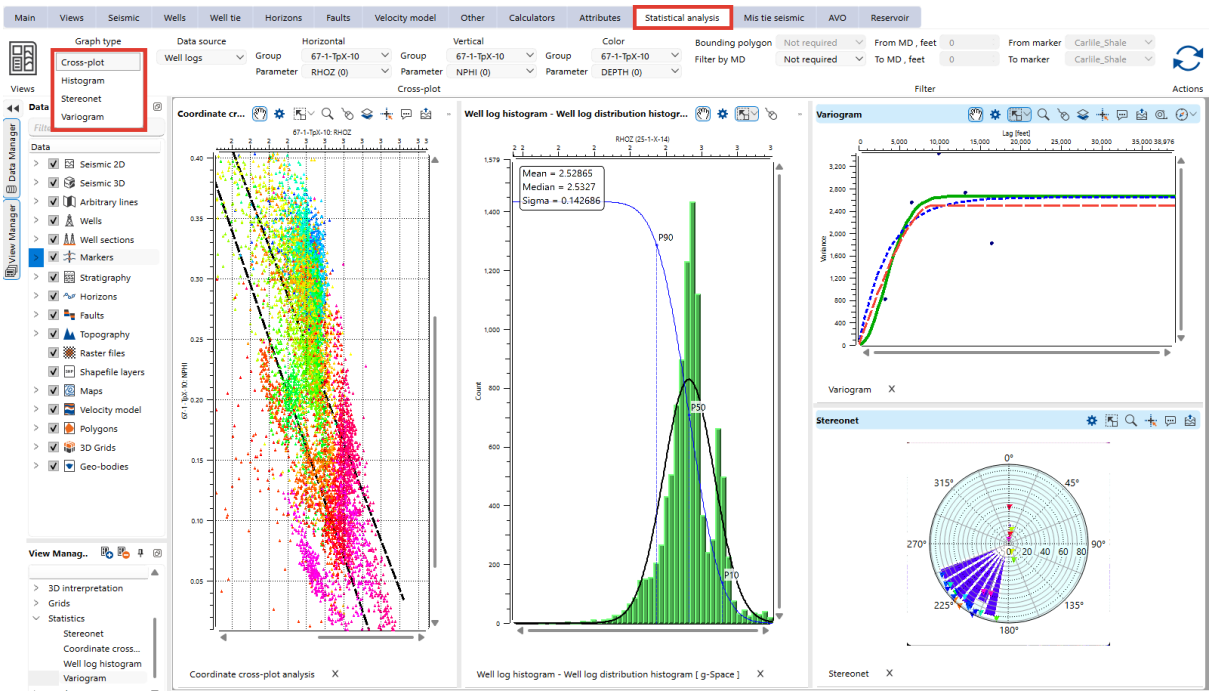
It provides three graph types:

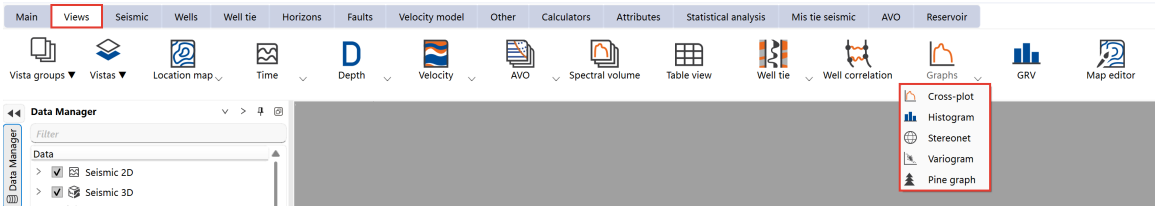
1. **Cross-plot**
2. **Histogram**
3. **Variogram**
4. **Stereonet View**
5. **Pine graph**

Each graph type serves a unique purpose in analyzing subsurface data and identifying trends, patterns, or distributions.



To access these Views:

1. Navigate to the Views Bar 36 in the Ribbon.
2. Select the **Graphs** option.
3. Open the desired graph type: Cross-plot 206, Histogram 203, Variogram 210, Stereonet 211 or Pine graph 208 View.



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In the **Statistical Analysis Bar** users can configure their plots.

Cross-Plot view is used to visualize the relationship between two selected attributes (X and Y axes). This is particularly useful for identifying correlations or patterns between the two variables.

Data Source: Choose the type of data to analyze (e.g., Well Logs or XY Data).

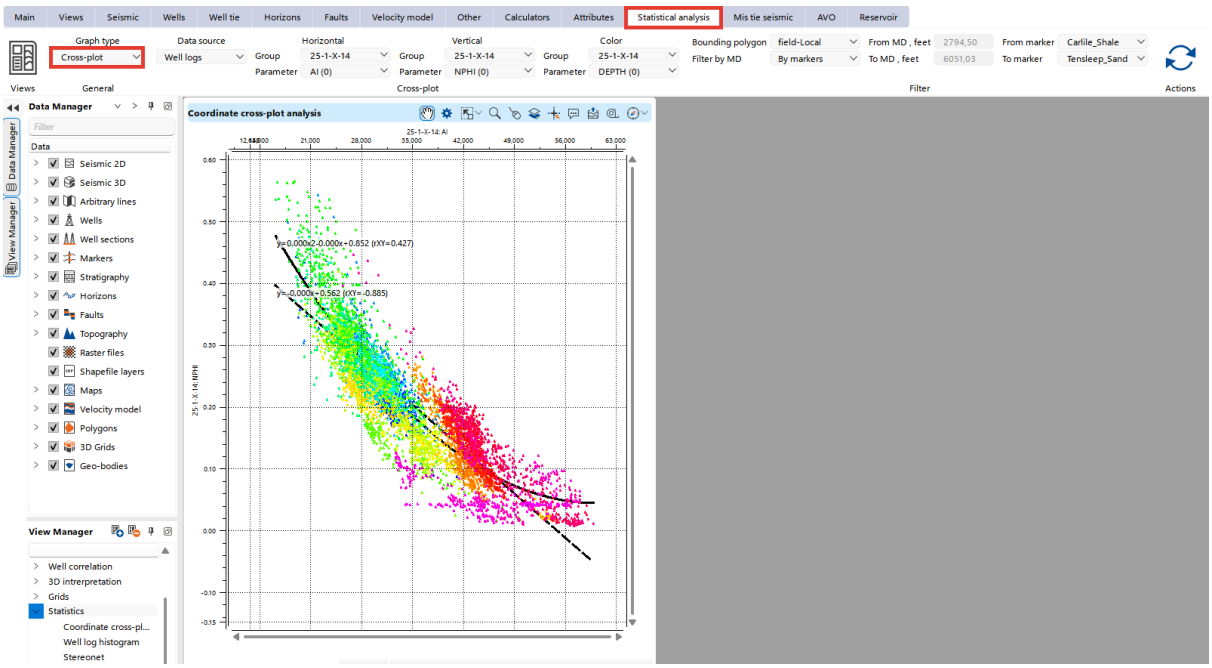
Horizontal Axis: Select the **Group** and corresponding **Parameter** for the X-axis.

Vertical Axis: Select the **Group** and corresponding **Parameter** for the Y-axis.

Color: Optionally assign a parameter for point coloring to enhance visualization.

Bounding Polygon: Limit points displayed on the cross-plot using a predefined polygon.

Filter by MD/Markers: For well data, filter points within specific measured depth (MD) ranges or between selected markers.



Histogram view provides a graphical representation of the distribution of an attribute, giving users insights into the frequency and range of data values.

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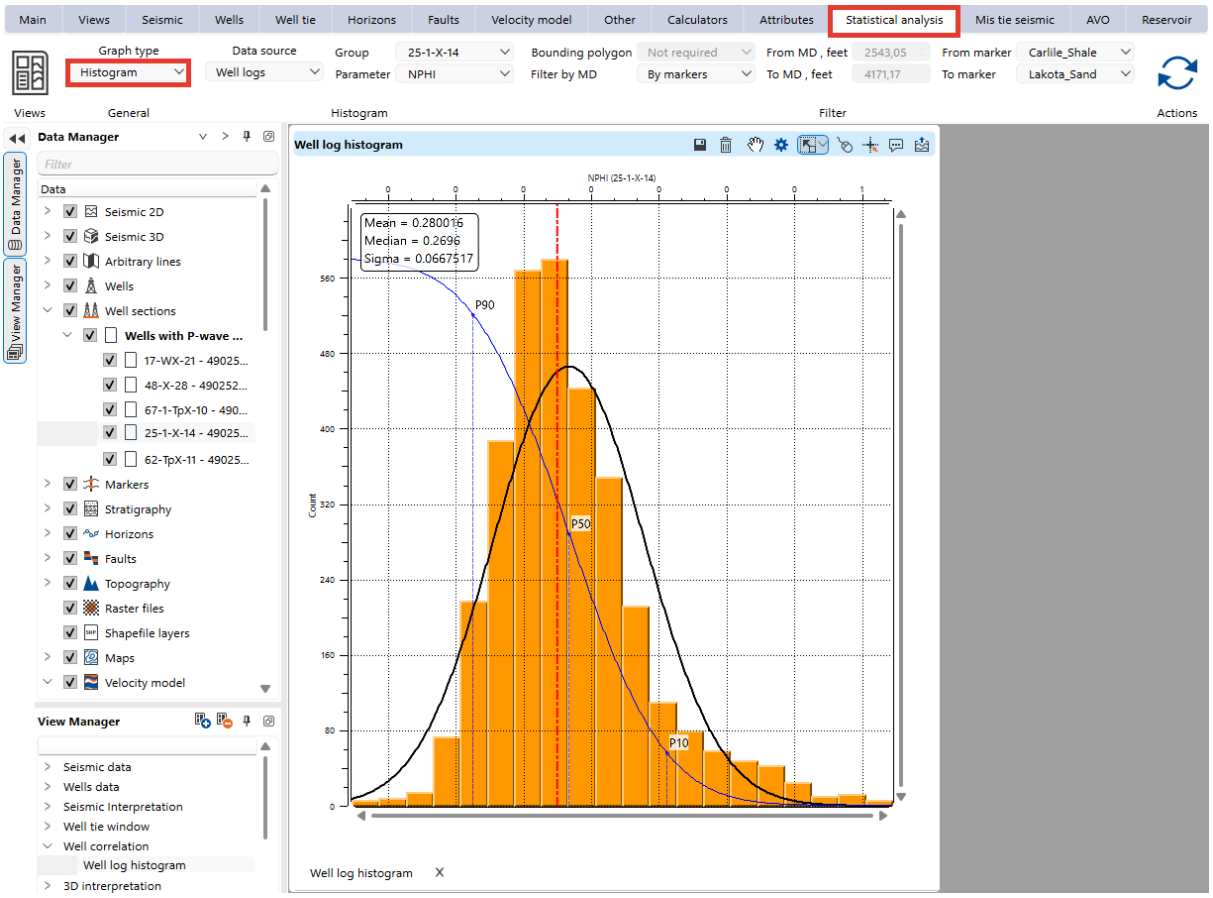
Data Source: Choose the type of data to analyze (e.g., Well Logs or XY Data).

Group: Select the well log group to be analyzed.

Parameter: Choose the parameter to visualize.

Bounding Polygon: Limit points displayed on the cross-plot using a predefined polygon.

Filter by MD/Markers: For well data, filter points within specific measured depth (MD) ranges or between selected markers.



The **Variogram View** in g-Space is a powerful tool for analyzing the spatial continuity and correlation of subsurface attributes. It helps users evaluate the variability of geological properties over different distances and directions.

Data Source: Choose the type of data to analyze (e.g., Well Logs, Well Attributes, Grid Maps, Horizons, Markers, Topography).

Data name: Choose the specific parameter to visualize spatial correlation.

Azimuth step, degree: Defines the angular interval for directional variogram calculations. A smaller step provides more detailed anisotropy analysis, while a larger step smooths directional variations.

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Lag step: Determines the spatial separation between data points used in the variogram calculation. A smaller lag step provides finer resolution, while a larger lag step captures broader trends.

Lag max: Specifies the maximum distance to be analyzed. It defines how far the variogram extends before reaching the sill (where spatial correlation becomes negligible).

Value extraction: Determines how values are sampled for variogram computation. Here are the **Value Extraction** options for the **Variogram View** in g-Space:

1. **Average** – Computes the mean value of the selected attribute within the defined lag step.
2. **RMS (Root Mean Square)** – Calculates the square root of the average of the squared values, emphasizing higher values in the dataset.
3. **Minimum** – Extracts the lowest value within the defined lag step.
4. **Maximum** – Extracts the highest value within the defined lag step.
5. **Dominant** – Selects the most frequently occurring value within the lag step.
6. **Median** – Determines the middle value of the dataset, reducing the influence of outliers.

Filter by Time/Horizons: Allows users to limit the variogram analysis to specific time intervals or geological horizons. This is useful for analyzing variations within a particular stratigraphic unit or time frame.

Bounding Polygon: Limit points used in the variogram calculation by defining a spatial boundary.

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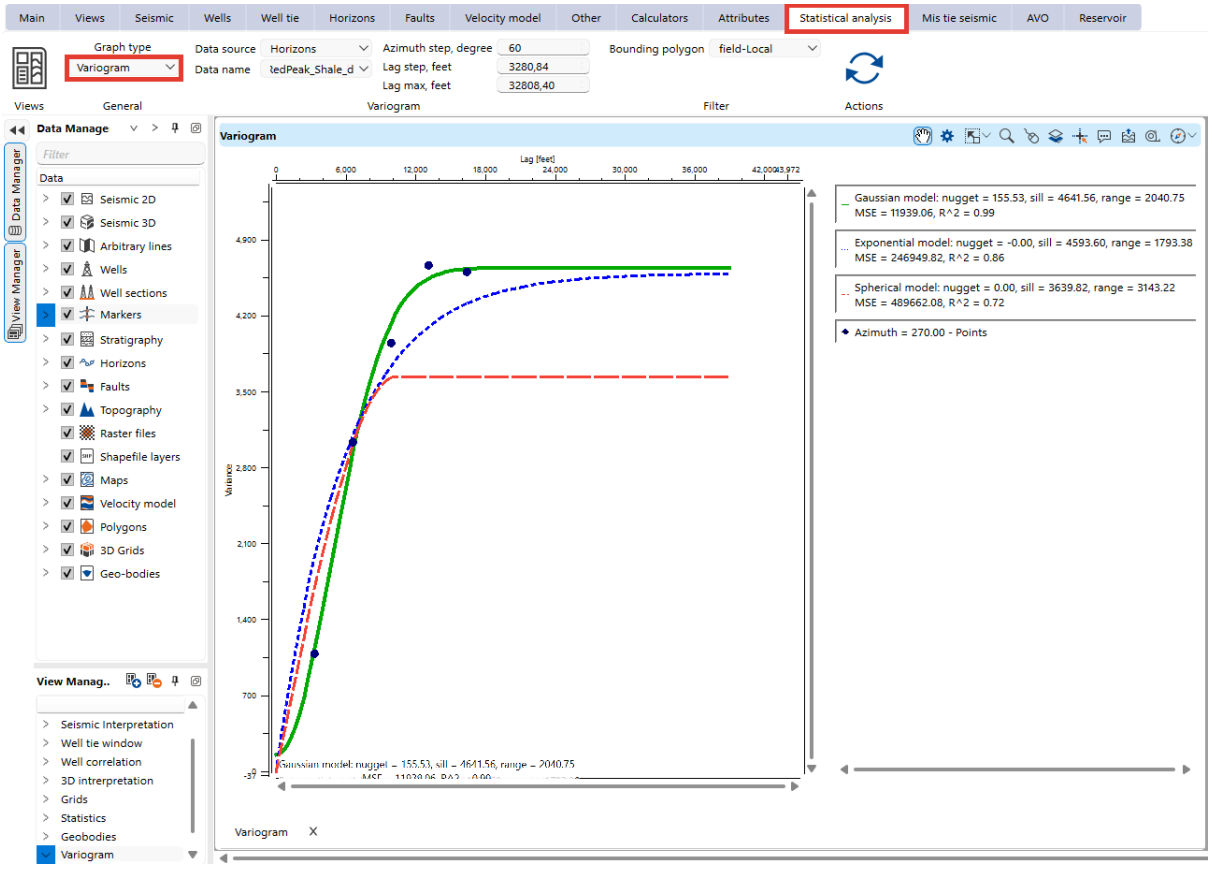

The **Stereonet** view is used to visualize the orientation of structural data, such as dip and azimuth, on a stereographic projection.

Well Name: Select the well to be analyzed.

Dip Angle: Choose the well log parameter for dip.

Azimuth: Select the well log parameter for azimuth.

Bounding Polygon: Limit points displayed on the cross-plot using a predefined polygon.

Filter by MD/Markers: For well data, filter points within specific measured depth (MD) ranges or between selected markers.

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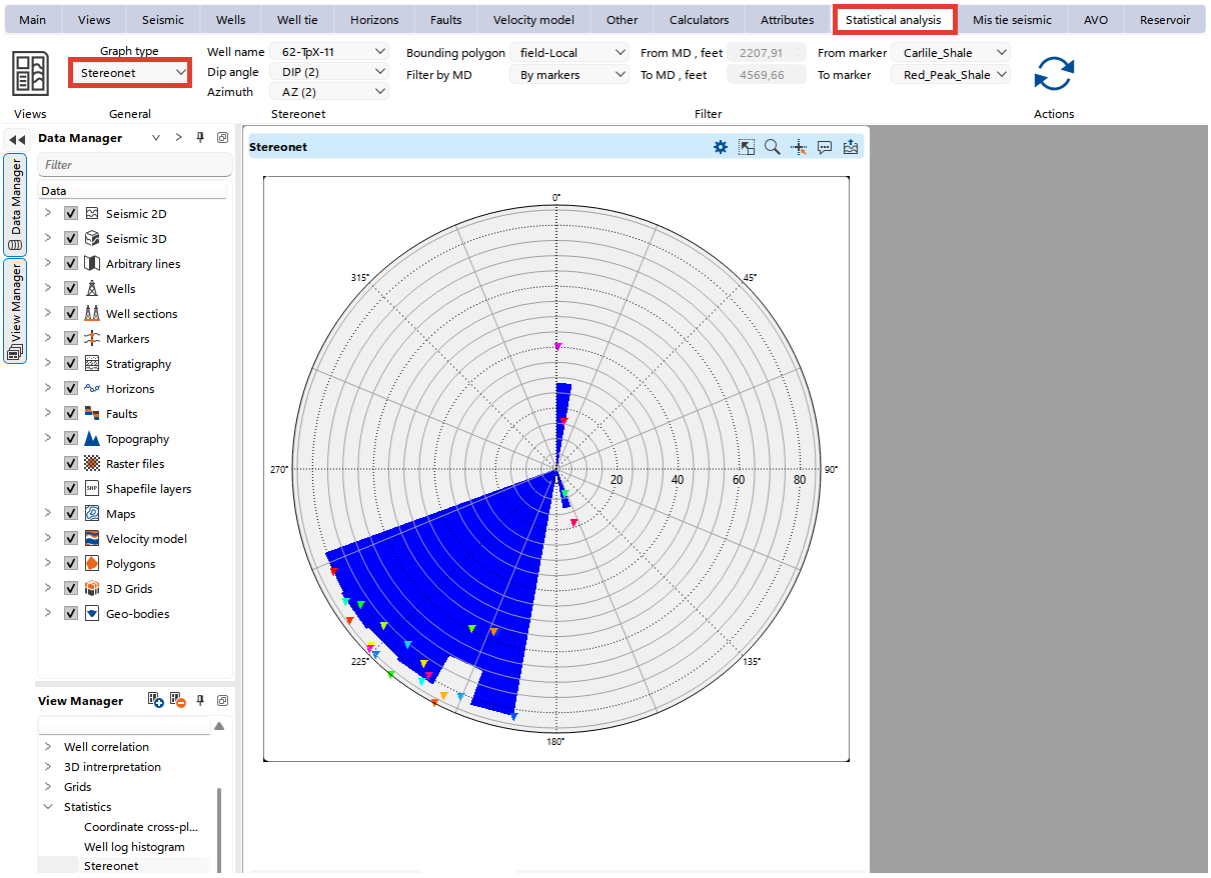
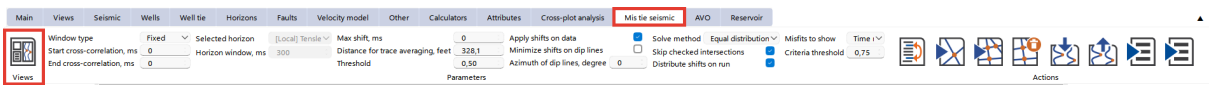


click **Update** to see updated results after changing settings.

For more information about the cross-plotting please refer to Statistical analysis 528

3.1.13 Mis tie seismic bar

Mis tie seismic bar allows you to find out and reduce the time difference or phase difference between two intersecting lines.



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For more information about miss ties please refer to Miss-tie correction 505

Consists of 3 sections: Views, Parameters, Actions

Views section:

Create mis-tie workspace for analysis line intersections

In the **Parameters** section it is possible to define the parameters of time and phase mis-ties calculation:

- **Window type:** choose fixed time window or time window around horizon
- **Start/End cross correlation:** choose start and end values for fixed time window
- **Selected horizon:** choose horizon using for center of time window
- **Horizon window:** choose time window around horizon
- **Max shift:** maximum shift that can be applied to seismic data
- **Cross-correlation aperture:** choose distance for averaging traces
- **Threshold:** choose threshold value for traces to be averaged
- **Apply shift on data:** apply existed shifts to seismic data in seismic visualization. When the box is unchecked seismic data visualized without any corrections
- **Minimize shifts on dips lines:** this option allows to reduce the shifts of lines located along the structure slope. Such lines may be more reliable because of better migration results
- **Azimuth of dip lines:** set azimuth of lines in which shifts will be reduced
- **Solve method:** choose math method for mis-ties minimization
- **Skip checked intersections:** option allows not to use checked intersections in automatic miss-ties calculation
- **Distribute shifts on run:** apply automatically calculated shifts to seismic data. When the box is unchecked mis-ties will be visualized on the location map only
- **Misfits to show:** choose phase of time type of miss-ties for visualization
- **Criteria threshold:** level of cross-correlation used in the automatic miss-ties calculation

In the **Actions** section it is possible to execute/generate the time and phase misties:

Set seismic group priority

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Run for current intersection

Run for all intersections

Clear all mis-tie corrections

Import cross points table from ASCII

Export cross points table to ASCII

Auto fit volumes

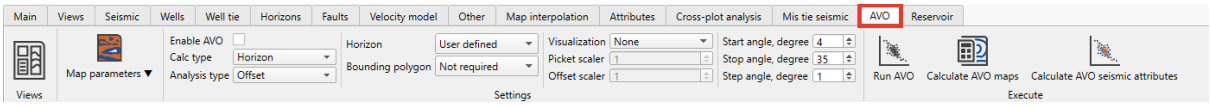
Calculate volume intersection

3.1.14 AVO bar

AVO (Amplitude Variation with Offset or Amplitude Versus Offset)

The AVO analysis allows users to measure rock properties and identify potential hydrocarbon reservoirs by analyzing how seismic reflection amplitudes change with the distance (or offset) between the source and receiver.

The user can measure the rock properties using AVO.



To start working with AVO, you need to create a dedicated workspace for AVO analysis. This workspace will allow you to manage and visualize the various aspects of AVO data. Once created, the AVO workspace will provide tools and views specifically designed for AVO analysis, such as cross-plot views and attribute maps.

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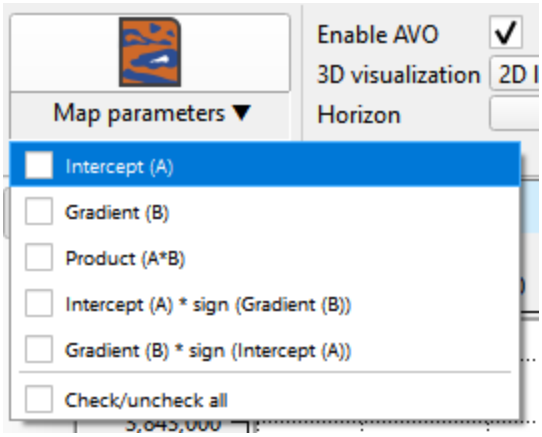
Create and open AVO analysis workspace

Map parameters.

The **Map Parameters** section for AVO analysis, as shown in the interface, allows the user to select and calculate specific attributes like the **Intercept (A)**, **Gradient (B)**, and their products.



Here's a description of the options in the "Map Parameters" menu:

1. **Intercept (A)** represents the amplitude at zero offset, essentially capturing the baseline reflection coefficient. It helps in identifying the type of lithology or fluid content in the subsurface.
2. **Gradient (B)** reflects the rate of change of amplitude with offset. The gradient provides additional details about the fluid content and type of rock present, particularly useful in detecting gas zones or differentiating between fluids.
3. **Product (A * B)** is a combination of the intercept and gradient, highlighting areas where both factors play a significant role together. It can be useful in enhancing certain anomalies within the seismic data.
4. **Intercept (A) * sign(Gradient (B))** applies a sign function to the gradient, combining it with the intercept to highlight changes in polarity and detect possible hydrocarbon indicators.
5. **Gradient (B) * sign(Intercept (A))**, similar to the previous option, but the sign function is applied to the intercept. This variation emphasizes areas where the

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intercept's polarity affects the gradient, which can be useful for identifying fluid contacts.

6. **Check/uncheck all** allows users to select or deselect all the parameters for processing at once.

Settings section:

- **Enable AVO:** This option must be checked to activate AVO processing within the workspace
- **Calc. type:** Choose calculation type between horizon or whole seismic. Perform AVO analysis along a selected horizon, focusing on specific geological layers. Apply AVO analysis across the entire seismic dataset, providing a broader view of the subsurface.
- **Analysis type:** Choose whether to use **Offsets** (the distance between the seismic source and receivers) or **Angles** (incident angles of seismic waves) for your calculations. This selection impacts how the AVO attributes are derived.
- **Horizon:** Select the horizon that you wish to analyze. This is particularly important when you are focusing on specific stratigraphic layers or intervals.
- **Bounding polygon:** If you need to limit the AVO analysis to a particular area, you can define a bounding polygon.
- **Visualization:** By default None. The user can select 2D line in case of 2D dataset, inline/cross line for 3D dataset
- **Start/stop/step angle:** This setting allows you to define the range and step of incident angles used in pre-stack data visualization. Adjusting these angles can help in analyzing different AVO responses across various offset ranges.

Execute section**:**

Run AVO cross plotting

Calculate AVO attributes maps

Calculate AVO attributes 3D volume or 2D sections

The AVO analysis in g-Space is a comprehensive toolset that enables detailed examination of seismic data to evaluate subsurface properties. By carefully configuring the settings and

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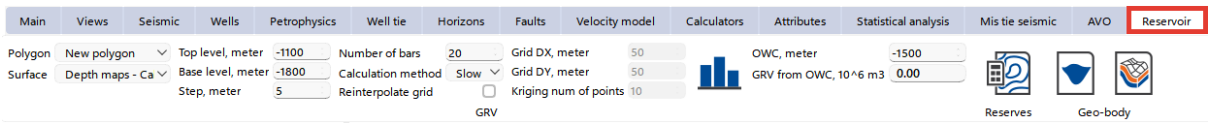
executing the appropriate analysis, users can gain valuable insights into reservoir characteristics and make informed decisions about exploration and development.

For further information about specific AVO functions and settings, please refer to AVO 491

3.1.15 Reservoir bar

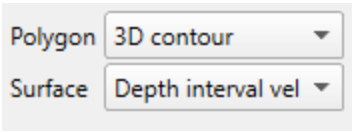
Reservoir bar allows you to perform volumetric calculations.



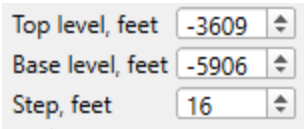
For more information about functions please refer to Volumetric calculations 563

Consists of 3 sections: GRV, HCIIP, Geo-body

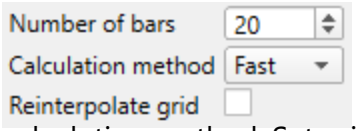
GRV section allows to calculate gross rock volume:



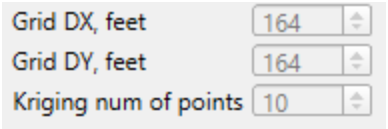
Choose polygon and structural map for calculations



Choose top and base of calculations. Choose step for each iteration



Choose number of points on histogram and calculation method. Set grid reconstruction if needed.



Set regridding parameters

Execute gross rock volume calculation

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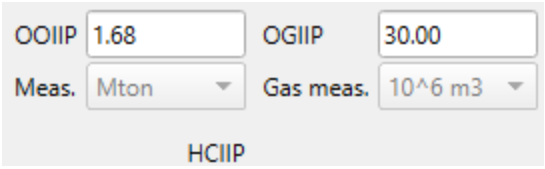
Set oil-water contact level and calculate GRV from OWC

HCIIP section allows to calculate oil and gas in place volume:

Open HCIIP calculator



Calculation results

Geo-body section allows to create 3D grid:

Create geo-body from gross rock volume

3.2 Panels

In this chapter you will get the general introduction to panels in g-Space

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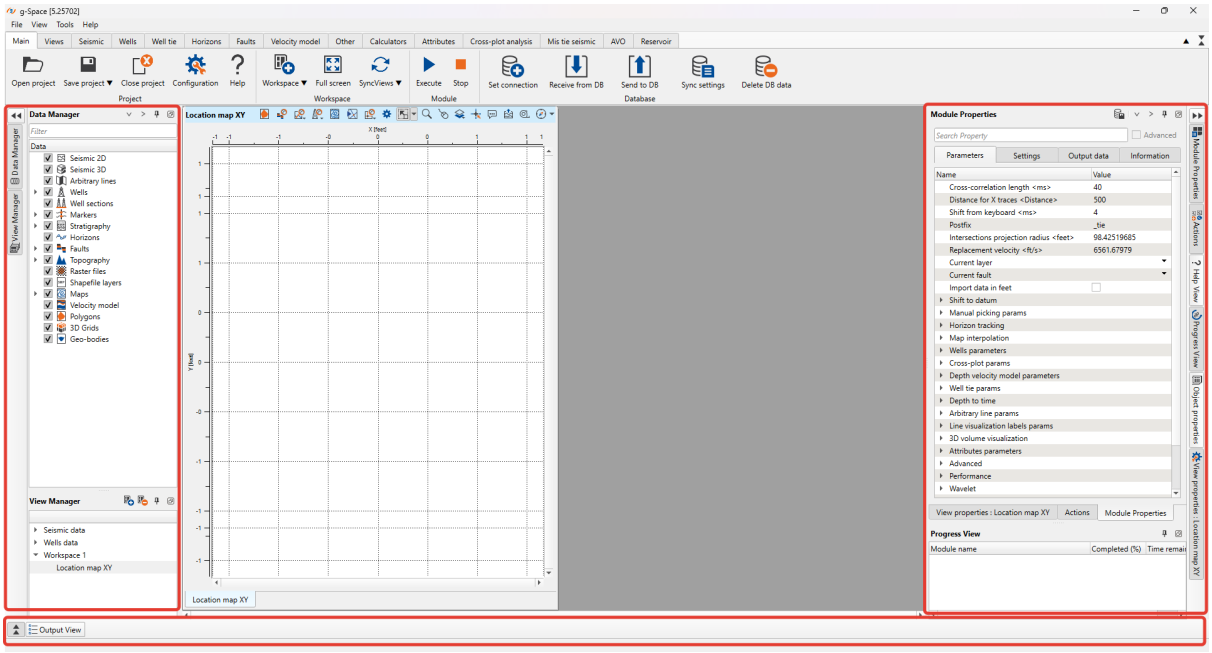

General information:

Panels are located in the left and right borders and on the bottom of the g-Space window and are combined into panels sets. By default, the View Manager 90 and Data Manager 86 are placed on the left and are used mostly for viewing and storing your data. On the right panels set you will find the Module Properties 91, View Properties 101, Progress View 112, Actions 108 and Object properties 113 which are used mostly for project settings and data manipulation. Output View 112 is located on the bottom.

Setting up the panels:

You can organize the panels according to your work habits. To do this drag them by holding left button mouse on the name of the panel.

To hide or extend panels you need to click on double arrows on the panels sets: , or

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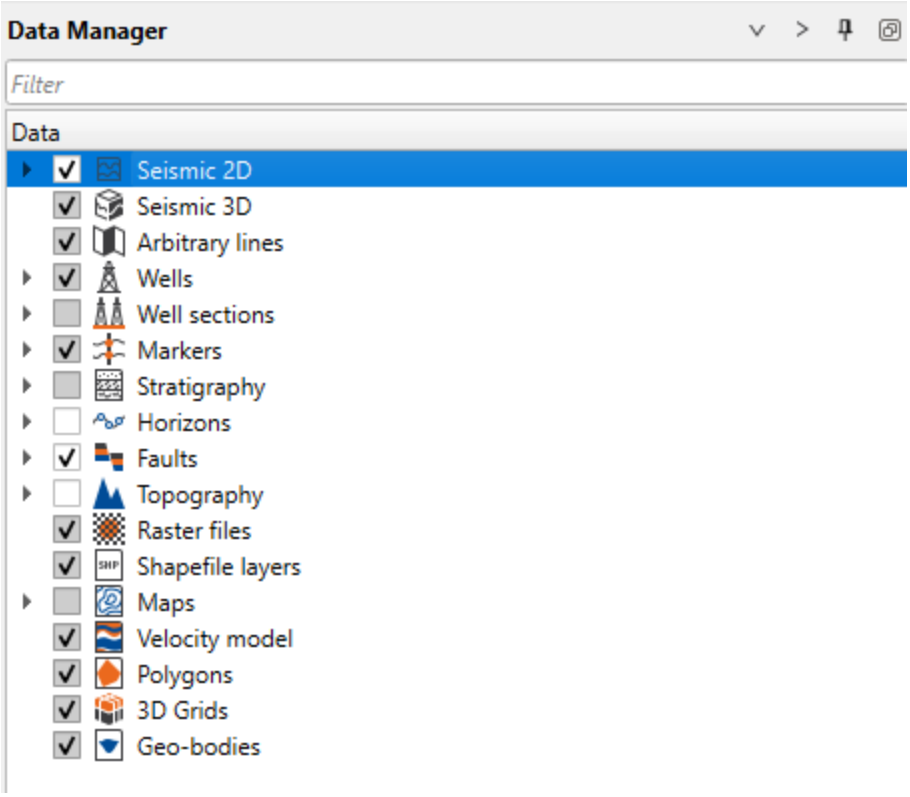
3.2.1 Data Manager

Data manager provides access to any data object from the project database and allows to control its creation, update, delete, visibility and operations



Data manager contains predefined categories for specific data types:

Seismic 2D - contains any type of 2D seismic data such as post-stack, pre-stack, velocity, attributes etc.
Right mouse button on the icon allows to:

- Add new line
- Convert ASCII data to lines
- Clear lines
- Export all lines to CPS-3 line file
- Export all time lines to depth
- Export all time lines with shifts
- Receive lines
- Commit lines
- Add folder

Seismic 3D - contains any type of seismic 3D data such as post-stack, pre-stack, velocity, attributes etc.

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Right mouse button on the icon allows to:
- Add new volume
- Convert ASCII data to volume
- Clear volumes
- Clear 3D visualization cache
- Receive volumes
- Commit volumes
- Add folder

Arbitrary lines - contains all seismic arbitrary lines created in g-Space
Right mouse button on the icon allows to:
- Add arbitrary line
- Clear arbitrary lines
- Add folder

Wells - contains any type of well data
Right mouse button on the icon allows to:
- Add LAS files
- Clear LAS files
- Add rasters
- Add checkshot
- Clear checkshot
- Create empty well
- Export well headers to file
- Import well headers from file
- Import well headers from IHS 297 fixed file
- Clear wells
- Receive wells
- Commit wells
- Add folder

Well sections - contains all well sections created in g-Space
Right mouse button on the icon allows to:
- Add well section
- Clear well sections
- Add folder

Markers - contains well marker data with other attributes
Right mouse button on the icon allows to:
- Add marker set
- Clear
- Receive markers
- Commit markers

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- Add folder

Stratigraphy - contains the stratigraphic data
Right mouse button on the icon allows to:
- Load from XML
- Load default
- Clear
- Add folder

Horizons - contains seismic picking
Right mouse button on the icon allows to:
- Add new horizon
- Clear horizons
- Create thickness map
- Receive horizons
- Commit horizons

Faults - contains fault picking
Right mouse button on the icon allows to:
- Add new fault
- Clear faults
- Set meshing mode to Sticks or Surfaces
- Export faults
- Receive faults
- Commit faults

Topography - contains internal (from seismic headers) and external (from other sources) topography
Right mouse button on the icon allows to:
- Add folder

Raster files - contains all image files loaded in g-Space
Right mouse button on the icon allows to:
- Add raster files
- Add folder

Shapefile layers - contains loaded shapes and cultural data
Right mouse button on the icon allows to:
- Add shape files
- Load cultural points from text file
- Load custom points from text file
- Add folder

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Maps - contains all grids loaded externally and generated by running velocity model.
Maps are separated by types:
- Depth interval velocity maps
- Depth maps
- Depth average velocity maps
- Erosion maps
- Well tie thickness maps
- Calculated maps
- Picked horizons thickness maps
- Horizon Vrms maps
- Depth average maps
- Time maps
- Attributes
- Gardner density by interval-V
- Gardner density by average-V
- Imported maps
- Spectral decomposition

Right mouse button on the icon allows to:
- Clear maps
- Add folder

Right mouse button on **type folder** allows to:
- Remove
- Load from text file
- Load from CPS-3 grid file
- Load from ZMap grid file

Velocity model - contains models created in g-Space
Right mouse button on the icon allows to:
- Add velocity model
- Import velocity model
- Clear
- Add folder

Polygons - contains polygons created in g-Space
Right mouse button on the icon allows to:
- Add polygon
- Import polygon from CPS-3 line file
- Clear
- Export all polygons to CPS-3 line file
- Export all polygons to shapefile
- Receive polygons

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- Commit polygons
- Add folder

3D Grids - contains 3D grids
Right mouse button on the icon allows to:
- Create new grid
- Clear
- Add folder

Geo-bodies - contains created geobodies
Right mouse button on the icon allows to:
- Load from file
- Clear
- Add folder

3.2.2 View Manager

View manager is a panel that allows to add, remove and manage different views 123 in numerous Workspaces 114 (equivalent to different desktops)

Selecting a specific view or workspace automatically switch the application to the selected workspace.

There are two predefined Workspaces 114 in the View Manager:
Seismic data 246 - this Workspace 114 has all views 123 required for importing 2D and 3D seismic into the project.
Wells data 256 - this Workspace 114 has all views 123 required for importing any well data to the project .

User cannot add, change or remove views from those predefined Workspaces.
User can change position and size of any view in those workspaces as well as graphical properties of any vista in those views.

User can change name of any workspace or view (except predefined) by either clicking F2 key or selecting Rename option from the context menu over desired view/workspace

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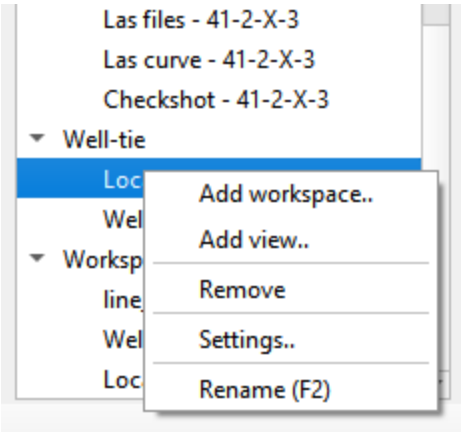

3.2.3 Module Properties

Module properties allows to setup all the process parameters implemented in g-Space

Module Properties has two states:

1. Process parameters - default state. Always active, except for seismic import

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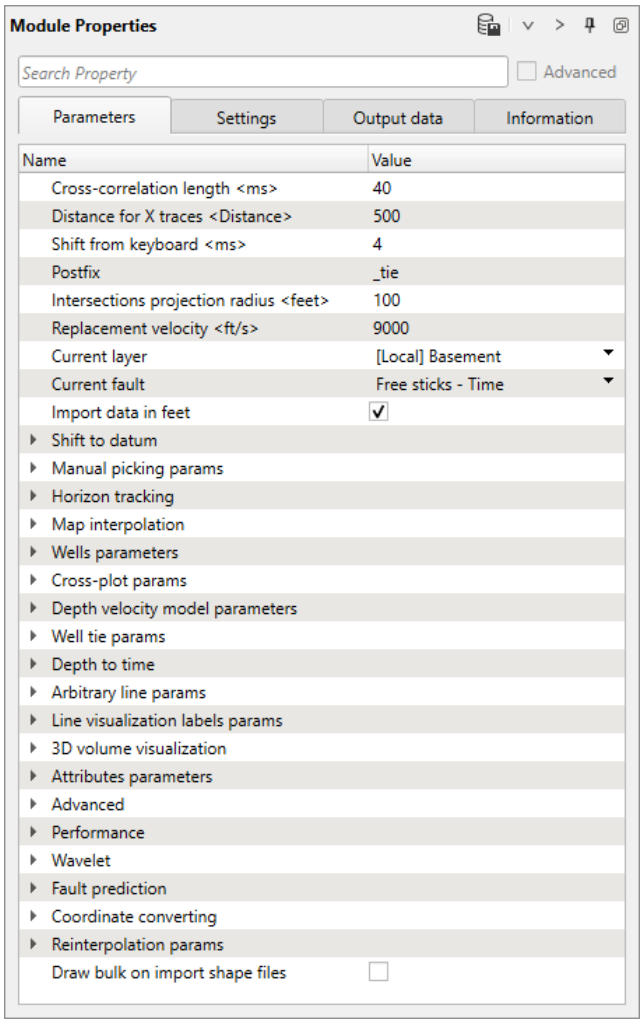

2. Import seismic parameters - launches during seismic import process where you can set the parameters for the import

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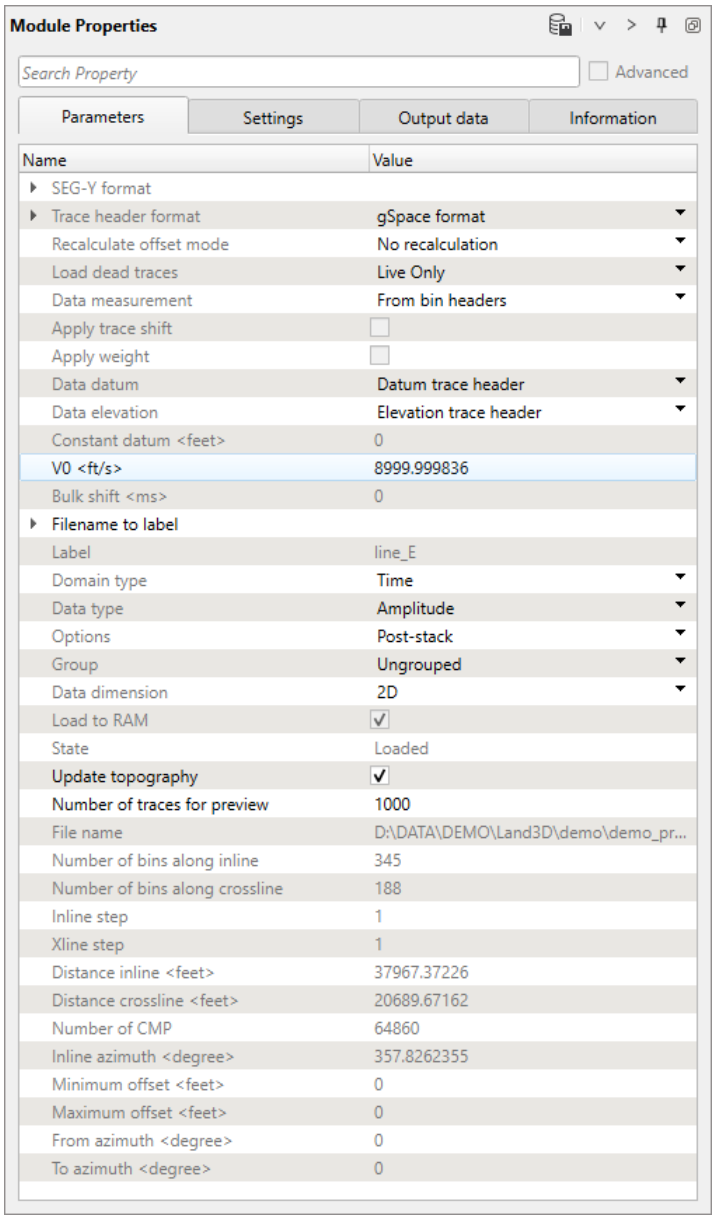

List of properties in default state:

Function Name	Explanation
Cross-correlation length <ms>	Sets the length of the cross-correlation window in milliseconds.
Distance for X traces <Distance>	Defines the distance used for cross-correlation across traces.
Shift from keyboard <ms>	Allows manual input of shift values in milliseconds via the keyboard.
Postfix	Adds a postfix to the cross-correlation results.

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Intersections projection radius <feet>	Sets the projection radius for intersections
Replacement velocity <ft/s>	Specifies the replacement velocity in m/ft per second
Current layer	Sets the selected horizon
Current fault	Sets the selected faul
Import measurement system	Sets the measurement system on import
Shift to datum	
Datum time <feet>	Sets the datum for data in time domain
Datum depth <feet>	Sets the datum for data in depth domain
Manual picking params	Opens parameters for manual picking settings
Pick mode	Sets the mode for picking (tracking, interpolation, etc.)
Automatic picking window <ms>	Defines the window for automatic picking in milliseconds
Pick type	Specifies the type of picking (e.g., peak, trough, zero-crossing)
Magnet type	Defines the magnet type for picking assistance
Energy picking threshold <%>	Sets the energy threshold for automatic picking in percentage
Horizon track on bin change	Enables horizon tracking on bin changes
Horizon Tracking	
Inline/cdp start autopick	Sets the starting inline/CDP for automatic picking
Crossline start autopick	Sets the starting crossline for automatic picking
Inline/cdp end autopick	Sets the ending inline/CDP for automatic picking
Crossline end autopick	Sets the ending crossline for automatic picking
Inline/cdp step autopick	Defines the step size for inlines/CDPs during automatic picking
Crossline step autopick	Defines the step size for crosslines during automatic picking
Follow IL XL continuity	Ensures continuity is followed along inlines and crosslines
By corr	Uses correlation for horizon tracking
Map Interpolation	
Interpolation type	Sets the type of interpolation used for map creation
Interpolation step X <feet>	Defines the interpolation step size in X direction
Interpolation step Y <feet>	Defines the interpolation step size in Y direction
Current topography step X <feet>	Defines the current topography step size in X direction
Current topography step Y <feet>	Defines the current topography step size in Y direction
Use faults for map creation	Includes faults in the map creation process
Use internal points for map creation	Uses internal points for map creation

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Fault clear radius <feet>	Sets the map clearing radius around faults
Kriging covariance	Defines the covariance for Kriging interpolation
Kriging range <feet>	Sets the range for Kriging interpolation
Kriging max points	Defines the maximum number of points for Kriging interpolation
Use polygons for map creation	Includes the bounding polygon in the map creation process
Polygons	Manages the polygon used for map creation
Wells Parameters	
Well projection radius <feet>	Sets the projection radius for wells
Well labels overlapping protection	Enables protection to prevent well labels from overlapping
Synthetic seis width <Trace>	Sets the width of synthetic seismic traces
Nearest seis type	Specifies the type of nearest seismic data used (distance or number of traces)
Nearest seis width <Trace>	Sets the width of the nearest seismic traces
Nearest seis distance <feet>	Defines the distance for the nearest seismic data
Selected seismic	Sets the currently selected seismic data
Selected seismic group	Sets the currently selected seismic group
Synthetic seismogram	
Create	Sets the data for a synthetic trace generation (sonic log, sonic - density, etc.)
Sonic	Sets the sonic log data for synthetic seismogram creation
Density	Sets the density log data for synthetic seismogram creation
Impedance	Sets the impedance log data for synthetic seismogram creation
Use anti-aliasing filter	Applies an anti-aliasing filter to the logs data
Update impedance on change checkshot	Updates impedance when checkshot data changes
Depth smooth <feet>	Sets smoothing step to depth data
Depth resample <feet>	Sets resampling step to depth data
Single well view template	Defines the template for single well view
Markers colors from stratigraphy	Uses stratigraphy to color well markers
Stratigraphy column	Specifies the stratigraphy column used for markers
LAS for Well color	Sets the LAS to color wellbores in 3D view
LAS for Well width	Sets the LAS for wellbores width in 3D view
LAS curve step	Defines the step size for LAS curves
Cross-plot Params	
Cross plot markers name	Sets the marker to cross-plot
Cross plot horizon name	Sets the horizon to cross-plot

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Depth Velocity Model Parameters	
Datum <feet>	Sets the datum level
Max depth <feet>	Defines the maximum depth for the model
Depth step <feet>	Sets the step size for depth
Bottom velocity <ft/s>	Defines the bottom velocity
Velocity for constant model <ft/s>	Sets the velocity for a constant model
Create depth velocity from VRMS params	
Smooth along horizons	Applies smoothing along horizons for velocity model creation
Smooth along horizons window <Traces>	Sets the window size for smoothing along horizons in traces
Create constant layer depth velocity params	
Number of supersamples	Defines the number of supersamples for constant layer depth velocity creation
Well Tie Params	
Bottom taper <ms>	Sets the bottom taper
Max radius to well <feet>	Defines the maximum radius to well
Propagation taper min <feet>	Sets the minimum taper for propagation
Propagation taper max <feet>	Sets the maximum taper for propagation
Max velocity <ft/s>	Defines the maximum velocity
Min velocity <ft/s>	Defines the minimum velocity
Gradient type	Sets the gradient type for well tie
Checkshot welltie	
Max marker deviation from well <feet>	Sets the maximum deviation for markers from the well
Interpolation type	Defines the interpolation type for checkshot welltie
Trend/Voronoi/triangulation smooth <feet>	Sets the smoothing type and range for trend, Voronoi, and triangulation.
Kriging covariance	Defines the covariance for Kriging in welltie
Kriging range	Sets the range for Kriging in welltie
Marker type interpolation	Specifies the interpolation type for markers
Regression coeff	Sets the regression coefficient for welltie
Extrapolate checkshot	Enables extrapolation of checkshot data
(Checkshot + marker + horizon) Calculate velocity by checkshots	Calculates velocity using checkshot, marker, and horizon data
(Checkshot + marker + horizon) Add marker horizons	Adds marker horizons to the checkshot and marker data
(Checkshot + marker + horizon) Vrms creation step	Sets the step size for Vrms creation from checkshot, marker, and horizon data

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Extrapolate deepest layer coeff	Sets the coefficient for extrapolating the deepest layer
Max distance to layer <feet>	Defines the maximum distance to the layer
Use wells and horizons inside polygon	Uses wells and horizons within a specified polygon for calculations
Use marker projection for detect velocity if marker not exist	Projects marker data to detect velocity if the marker is absent
Calculate velocity from topography	Computes velocity starting from topography level
Extrapolate check shot to 0	Extrapolates check shot data to zero
Depth to Time	
DT <ms>	Sets the depth to time conversion factor in milliseconds
Max time <ms>	Defines the maximum time for depth to time conversion
Arbitrary Line Params	
Create arbitrary line	Creates an arbitrary line
Arbitrary line step <feet>	Sets the step size for the arbitrary line
Arbitrary line max search distance <feet>	Defines the maximum search distance for the arbitrary line
Straighten on 3D view	Straightens the arbitrary line in the 3D view
Line Visualization Labels	
Show	
Trace header	
Show header name	
Precision	Sets the precision for line visualization labels.
Step <feet>	
3D Volume Visualization	
Step inline	Defines the step size for inlines in 3D volume visualization
Step crossline	Defines the step size for crosslines in 3D volume visualization
Step time <ms>	Sets the time step size in milliseconds for 3D volume visualization
Step depth <feet>	Sets the depth step size in feet for 3D volume visualization
Current inline	Sets the current inline being visualized
Current crossline	Sets the current crossline being visualized
Current time <ms>	Sets the current time for slice visualization
Current depth <feet>	Sets the current depth for slice visualization
Attributes Parameters	
Amplitude	Computes the amplitude attribute
Envelope	Computes the envelope attribute

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Instantaneous phase	Computes the instantaneous phase attribute
Instantaneous unwrap phase	Computes the unwrapped instantaneous phase attribute
Instantaneous frequency	Computes the instantaneous frequency attribute
Frequency derivative	Computes the frequency derivative attribute
Instantaneous bandwidth	Computes the instantaneous bandwidth attribute
Cosine of instantaneous phase	Computes the cosine of the instantaneous phase attribute
Dominate frequency	Computes the dominant frequency attribute
Thin bed indicator	Computes the thin bed indicator attribute
Envelope derivative	Computes the derivative of the envelope attribute
Second derivative of envelope	Computes the second derivative of the envelope attribute
Instantaneous Q	Computes the instantaneous Q attribute
Coherence	Computes the coherence attribute
Chaos	Computes the chaos attribute
Seismic relief	Computes the seismic relief attribute
Check/uncheck all attributes	Toggles the selection of all attributes for calculation
Selected horizon	Sets the horizon selected for attribute calculation
Time window <ms>	Sets the time window for attribute calculation
Calc type	Defines the type of calculation for attributes (map or the entire volume)
Advanced	
Merge stack line distance <feet>	Sets the distance for merging seismic volumes/lines into the single survey
Max distance picking projection <feet>	Defines the maximum distance for picking projection
Turn on undo	Enables the undo feature
Fill gaps in volume	Fills gaps in the volume data
Performance	
Show well names on location map	Displays well names on the location map
Show las curves on seismic views	Displays LAS curves on seismic views
Update horizon phase maps	Updates the horizon phase maps
Show cube slice on 3D view	Displays a slice of the cube in the 3D view
Update horizons 3D view	Updates horizons in the 3D view
Update volume 3D view	Updates the volume in the 3D view
Update maps and faults after adding stick	Updates maps and faults after adding a stick
Use only live traces for 30 data contouring	Uses only live traces to create the volume polygon
Show well table	Displays the well table
AVO real time update on polygons	Updates AVO data in real time on polygons

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Wavelet	
Convert to min phase	Converts the wavelet to minimum phase
Wavelet length <ms>	Sets the length of the wavelet
Wavelet Sample rate <ms>	Sets the sample rate of the wavelet
Ricker type	Specifies the type of Ricker wavelet
Dominant frequency <Hz>	Sets the dominant frequency of the wavelet
Detect time start <ms>	Defines the start time for wavelet detection
Detect time end <ms>	Defines the end time for wavelet detection
Fault Prediction	
Correlation time window <ms>	Sets the time window for cross correlation
Correlation bin window	Sets the bin window for cross correlation
Maximum shift <ms>	Defines the maximum shift allowed in fault prediction
Time stretch <%>	Specifies the time stretch percentage for fault prediction
Sigma for local faults	Sets the sigma value for local fault detection
Sigma for generalized faults	Sets the sigma value for generalized fault detection
Sigma for noise reduction	Sets the sigma value for noise reduction
Autopicking step	Defines the step size for autopicking
Coordinate Converting	
Use converting on import	Applies coordinate conversion on data import
Reinterpolation Params	
Do reinterpolation	Enables reinterpolation of data
Reinterpolation radius <feet>	Sets the radius for reinterpolation in feet
Number of taken bins	Defines the number of bins taken for reinterpolation
Draw bulk on import shape files	Draws bulk data on import of shape files

List of properties in the Seismic data workspace:

Function Name	Explanation
SEG-Y Format	
Data type	Specifies the type of data in the SEG-Y format (land, marine, etc.)
Text header size	Defines the size of the text header in the SEG-Y file
Binary header size	Defines the size of the binary header in the SEG-Y file
Endian	Specifies the byte order (endianness) of the data
EBCDIC	Indicates whether the text header is in EBCDIC format

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Data Sample format	Specifies the format of the data samples in the SEG-Y file (int, float, etc.)
Trace Header Format	Sets the trace header format from the list
Recalculate offset mode	Sets the mode for recalculating offsets in the trace headers
Load dead traces	Option to load or not dead traces from the SEG-Y file
Data measurement	Specifies the measurement units for the data
Apply trace shift	Applies a shift to trace data
Apply weight	Applies a weight factor to trace data
Data datum	Sets the datum level for the data (e.g. constant, floating)
Data elevation	Sets the topography level for the data
Constant datum <feet>	Specifies a constant datum level
VO <ft/s>	Specifies the replacement velocity (VO)
Bulk shift <ms>	Applies a bulk shift to the data
Filename to Label	
First char	Specifies the first character position used for labeling
Number of chars	Defines the number of characters used for labeling
Label	Displays the current label
Domain type	Specifies the domain of the data (time or depth)
Data type	Specifies the type of data (amplitude, velocity, etc.)
Options	Defines data type between pre-stack and post-stack
Group	Specifies the data group (e.g. PSTM, PSDM)
Data dimension	Defines the dimension of the data (2D or 3D)
Load to RAM	Option to load data into RAM
State	Displays the state of loading data into the project
Update topography	Updates the topography data after loading SEG-Y
Number of traces for preview	Specifies the number of traces to preview
File name	Displays the name of the file being processed
Number of bins along inline	Displays the number of bins along the inline direction
Number of bins along crossline	Displays the number of bins along the crossline direction
Inline step	Displays the step size for inlines
Xline step	Displays the step size for crosslines
Distance Inline <feet>	Displays the distance between inlines
Distance crossline <feet>	Displays the distance between crosslines
Number of CMP	Displays the number of common midpoints (CMP) in the data
Inline azimuth <degree>	Displays the azimuth angle for inlines
Minimum offset <feet>	Displays the minimum offset distance
Maximum offset <feet>	Displays the maximum offset distance
From azimuth <degree>	Displays the starting azimuth angle

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To azimuth <degree>	Displays the ending azimuth angle

3.2.4 View properties

View properties is a dynamic panel that displays the parameters for the active view or object.
The content of the window depends of the selected object.

By default View properties is located on the right.

To open the View properties panel open a panel bar or click the Settings button on the tool bar on the upper part of any View.

View properties is divided to two tabs:
View 102 - allows to set active view settings
Vista 104 - allows to set visibility, order and appearance of all vista items of the active view

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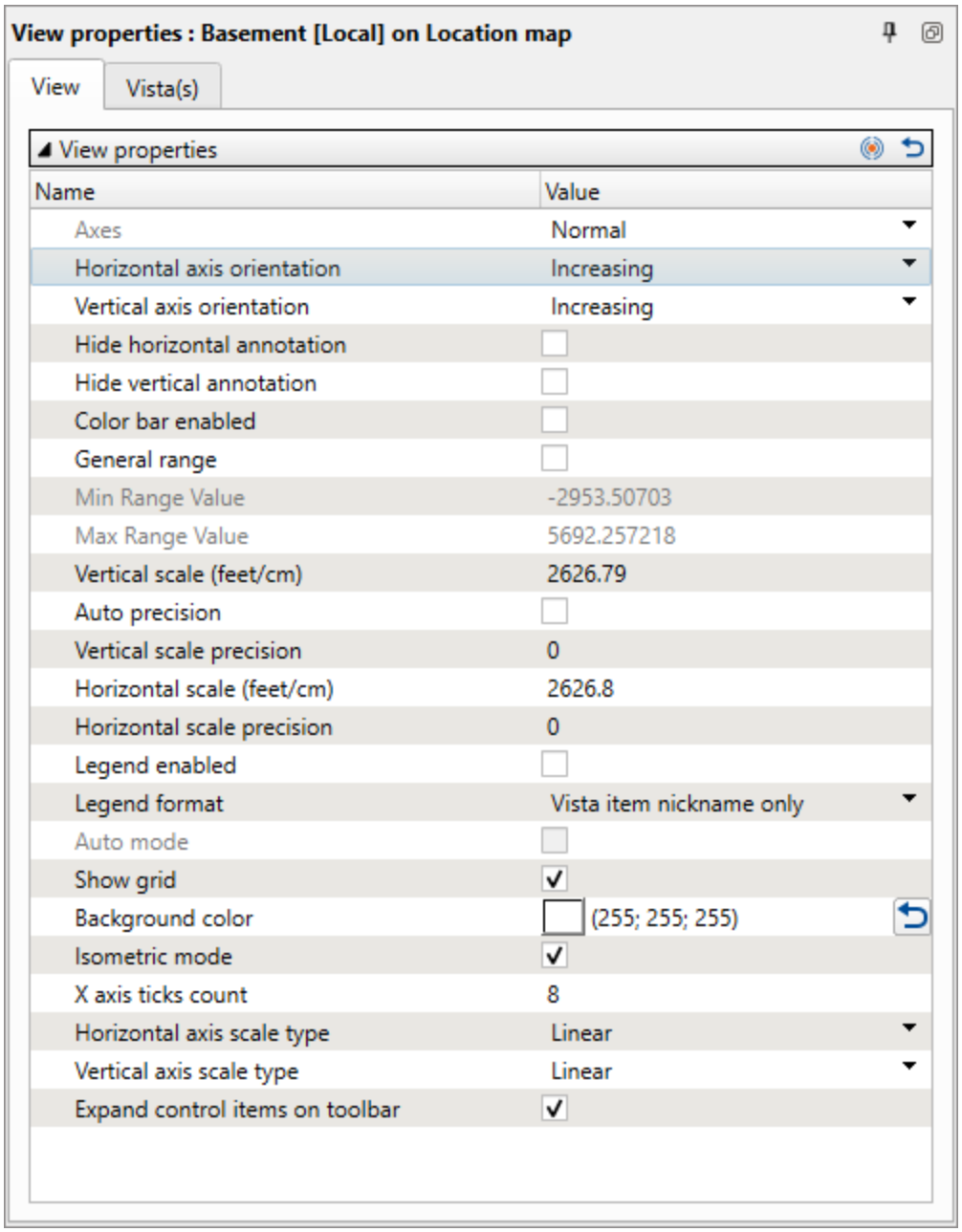

3.2.4.1 View

View tab - allows user to adjust views visual setting in g-Space. The settings list may vary depending on the active view type.

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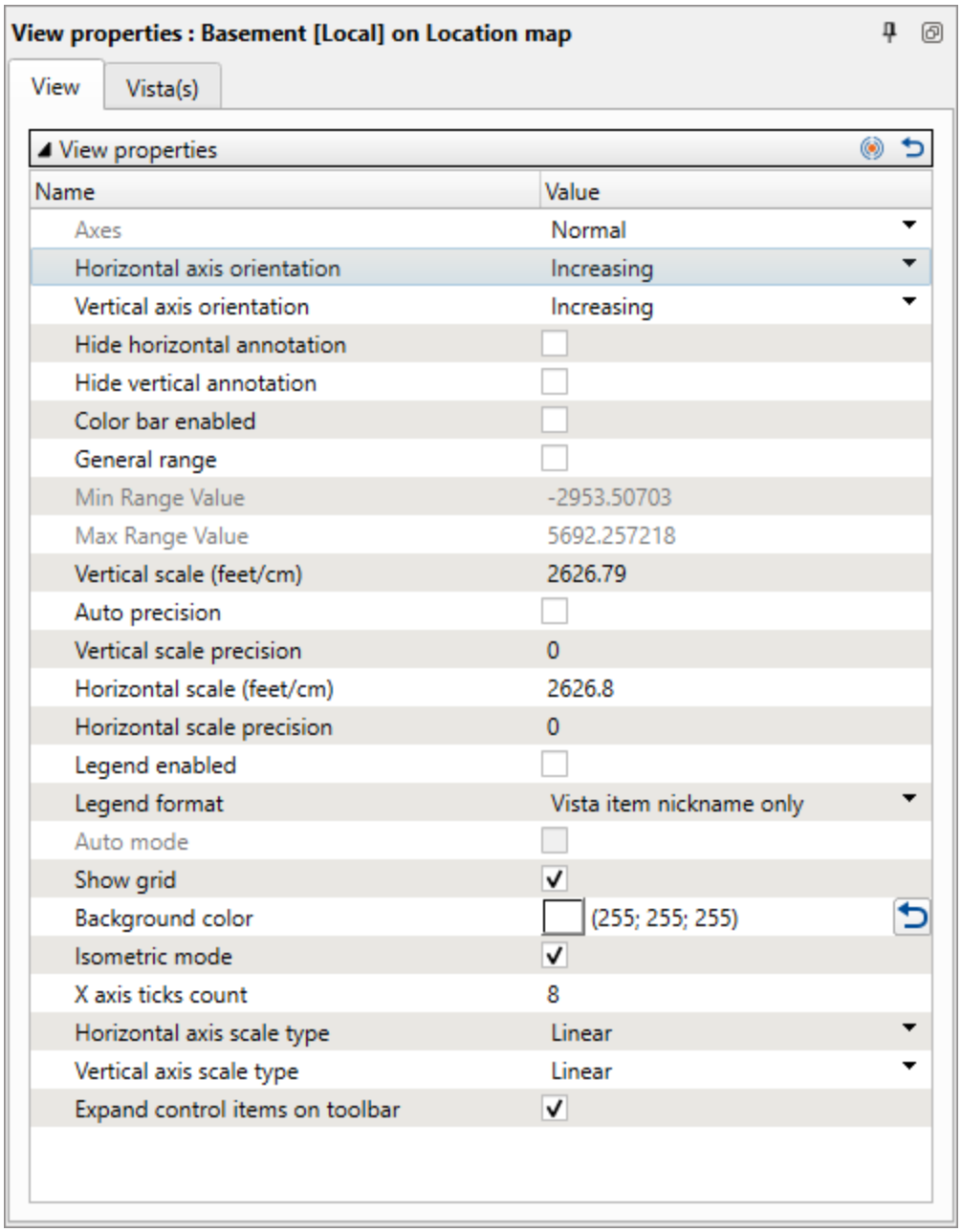

In the upper part you can reset properties to default parameters or propagate properties to other same type views

Here is the list of the settings you can make for the active view (it may not be complete and depends on the active view type)**:**

- Axes - default: Normal, but currently that property is disabled. Designed to change Horizontal and Vertical axes by rotating it 90 degrees.
- Horizontal/vertical axis orientation - flips orientation of horizontal/vertical axis
- Hide horizontal/vertical annotation - hide annotation from horizontal/vertical axis

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- Color bar enabled - when enabled adds color bar on right side of the view
- General range - when selected, the program will consider next 2 parameters for colorbar range of the pallete
- Min/Max Range Value - when enabled define minimum/maximum value of the palette for all Vistas on the view
- Vertical scale (feet/cm) - defines the actual vertical scale of the view
- Auto precision - when checked, application will define automatically the precision of vertical scale
- Vertical scale precision - when auto-precision not checked, this parameter defines precision for the vertical scale
- Horizontal scale (feet/cm) - defines the actual horizontal scale of the view
- Horizontal scale precision - when auto-precision not checked, this parameter defines precision for the horizontal scale
- Legend enabled - when enabled adds legend on the view
- Legend format - defines legend format
- Auto mode - default settings
- Show grid - shows grid on the view
- Background color - defines background color
- Isometric mode - when checked, vertical and horizontal scales will be the same
- X axis ticks count - number of ticks for horizontal axis
- Horizontal axis scale type - defines linear or log type for horizontal scale
- Vertical axis scale type - defines linear or log type for vertical scale
- Expand control items on toolbar - allows to show more icons in the upper part of the view
- Hide trace IDs - hides traces IDs on section views
- Trace Headers - allows to add additional information to section views from the segy headers

3.2.4.2 Vista

Vista tab - allows to set visibility, order and appearance of all vista items of the active view.
It divided for two sections: **Vista items** and **Vista item properties**

Vista items - allows you to turn on/off visibility of the objects on the view. This is dynamic part of the window and shows the items according to the active view

You can re-order the layers , turn on/off visibility of all objects and switch between working modes (Fault picks, Horizon picks, Loaded gathers time, Converted gathers time) on current view.

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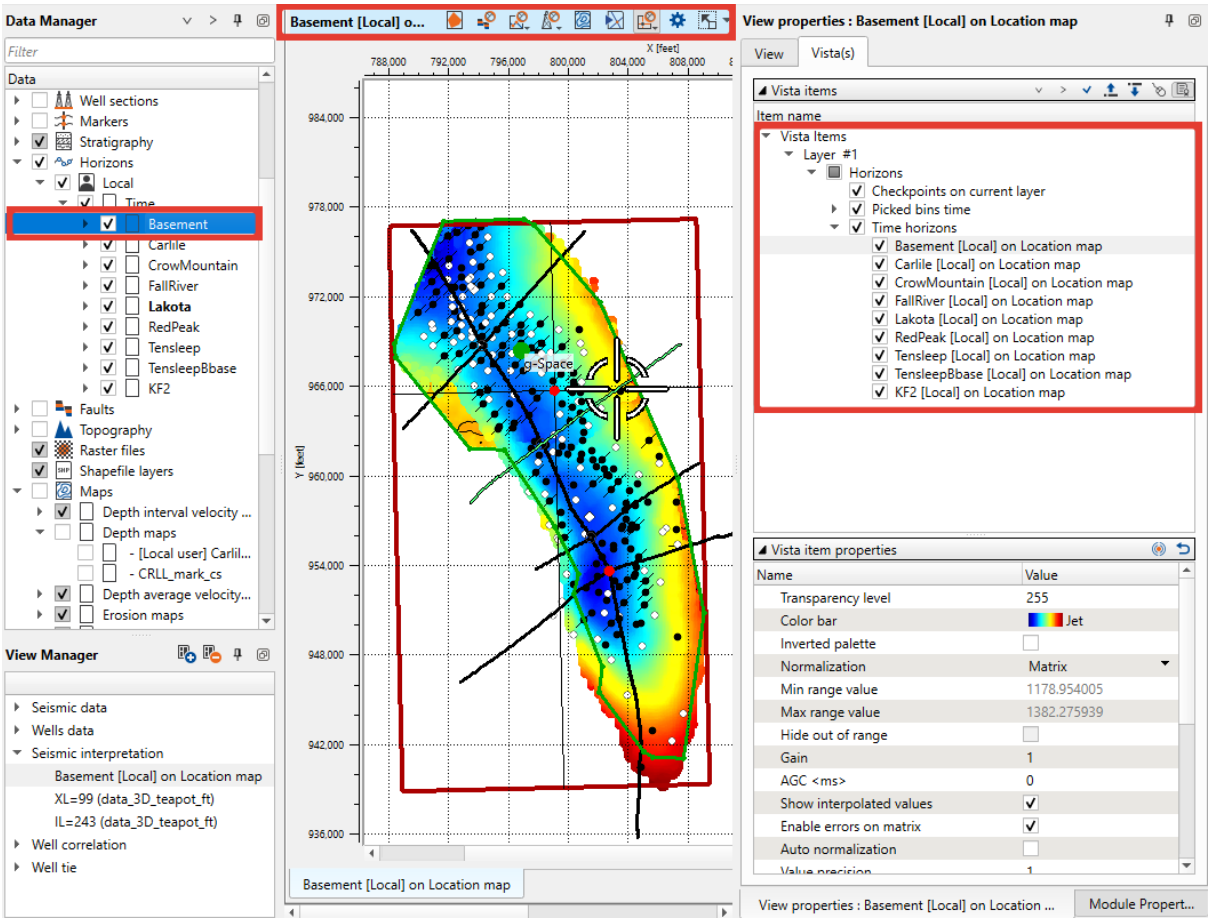
Additionally you can filter vista items by current object type in data manager (turned on by default). To do so here the general flow in few steps:

1. Open View properties panel (by opening the panel bar or using button)
2. Set active the button Filter by Data Manager
3. Click on the Data manager the object type you want to manage.

After that in the View properties you will get vista items for only the objects you selected in Data Manager:



Vista items properties section gives access to settings of selected object in the **Vista items** section.
The settings list may vary depending on the active item type

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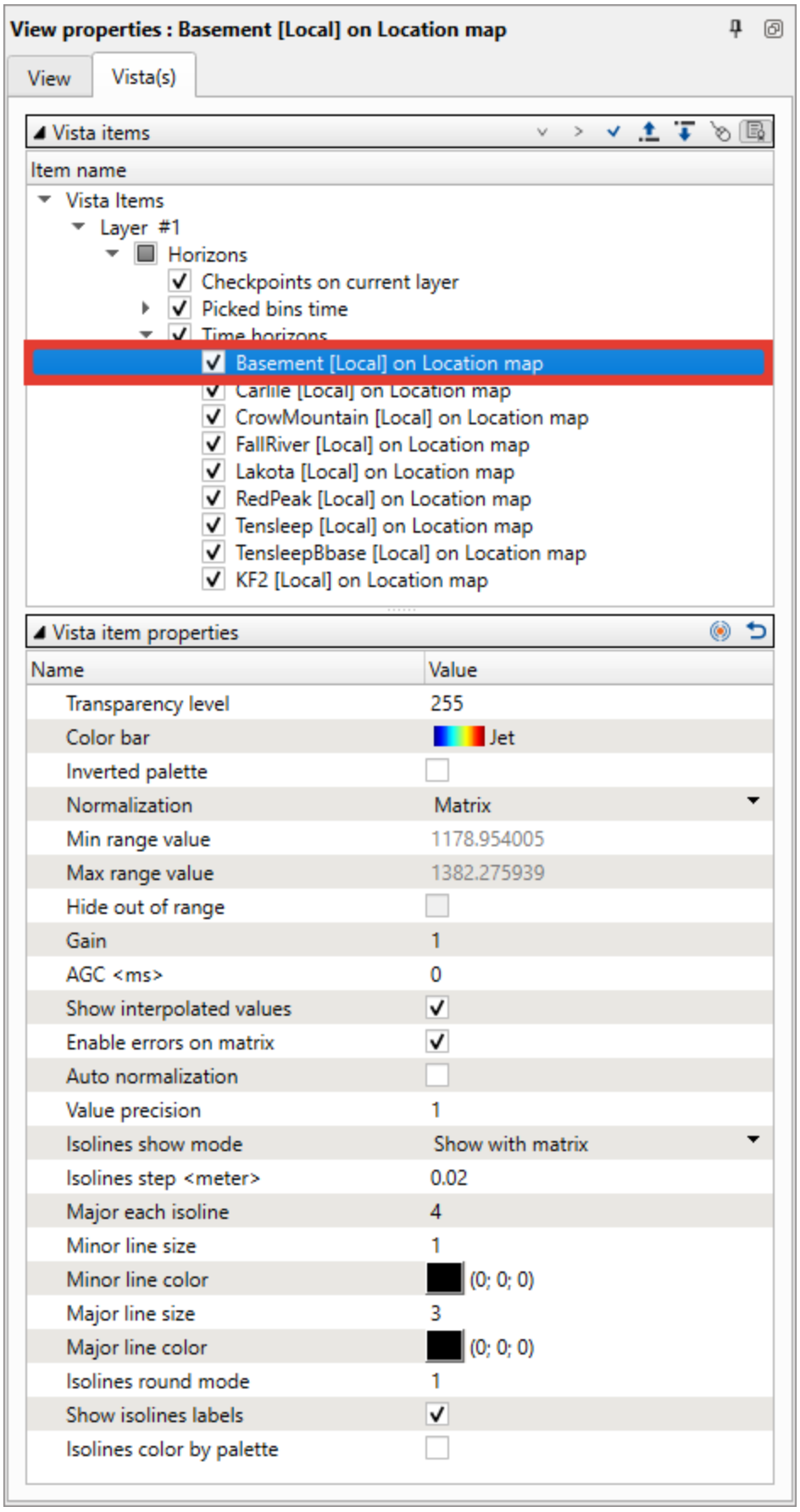

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Here is the list of the settings you can make for the active item (it may not be complete and depends on the active item type)**:**

- Transparency level - set the opacity level of the item
- Color bar - allows to select a color bar
- Inverted palette - inverts a color bar
- Normalization - allows to select the source for color range
- Min/max range value - allows to select the min/max range values for user defined normalization
- Hide out of range - hides values outside the selected range values
- Gain - allows to choose gain for the visualization
- AGC <ms> - allows to set AGC
- Show interpolated values
- Enable errors on matrix
- Auto normalization
- Value precision - set precision of the displayed data
- Isolines show mode - allow to turn on isolines
- Major each isoline - set the step of the bold isolines
- Minor line size - set thickness of minor isolines
- Minor line color - set color of minor isolines
- Major line size - set thickness of major isolines
- Major line color - set color of major isolines
- Isolines round mode - set isolines smoothing
- Show isolines labels - shows isolines values
- Isolines color by palette - set isolines color according the color bar
- Point type - set points style
- Point color - set points color
- Point color by palette - set points color according the color bar
- Point size - set points size
- Line color - set line color
- Line transparency - set opacity level for the line
- Connection type - set connection type for the points
- Line type - set line style (like solid, dashed, dotted etc.)
- Label position - set the label position
- Points label position - set the label position for the points
- Points rotation angle - set the points rotation
- Fill type - allow to fill the object
- Fill color - set the first filling color
- Fill color2 - set the second filling color

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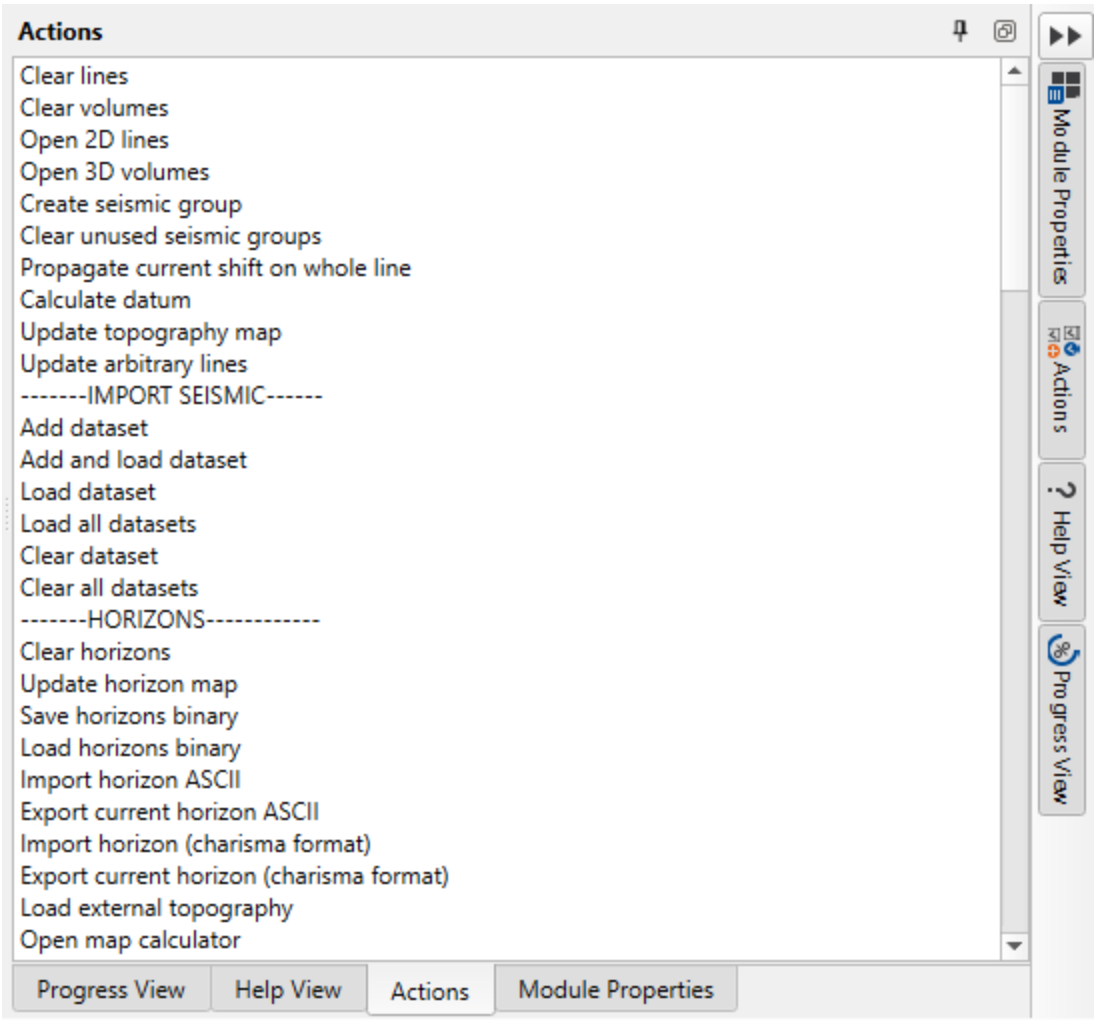
3.2.5 Actions

Actions panel allows to see all available processes that can be executed in g-Space



All these actions are mostly duplicated by another button, toolbar or tool, but some of them can still only be found in the Actions panel, especially new features.

Function Name	Explanation
SEISMIC DATA	
Clear lines	Removes all loaded 2D seismic lines from the project
Clear volumes	Removes all loaded 3D seismic volumes from the project
Open 2D lines	Navigate 2D seismic lines for loading into the project
Open 3D volumes	Navigate 3D seismic volumes for loading into the project

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Create seismic group	Creates a new group to organize multiple seismic datasets (for example PSTM, PostSTM etc.)
Clear unused seismic groups	Deletes seismic groups that are not currently in use
Propagate current shift on whole line	Applies the current time or depth shift across the entire seismic line
Calculate datum	Computes the reference level or datum for seismic data
Update topography map	Refreshes the topography map with the latest seismic data
Update arbitrary lines	Updates user-defined arbitrary seismic lines with the latest data
Create 3D geological model	Generates a 3D geological model
IMPORT SEISMIC	
Add dataset	Adds a new seismic dataset to the project without loading it
Add and load dataset	Adds and immediately loads a new seismic dataset to the project
Load dataset	Loads a previously added seismic dataset into the project
Load all datasets	Loads all available seismic datasets into the project
Clear dataset	Removes the selected dataset from the project
Clear all datasets	Removes all datasets from the project
HORIZONS	
Clear horizons	Removes all interpreted horizons from the project
Update horizon map	Refreshes the horizon map with the latest interpretations
Save horizons binary	Saves the interpreted horizons in a binary format
Load horizons binary	Loads horizons from a previously saved binary file
Import horizon ASCII	Imports horizon data from an ASCII file
Export current horizon ASCII	Exports the currently selected horizon to an ASCII file
Import horizon (charisma format)	Imports horizon data in Charisma format
Export current horizon (charisma format)	Exports the currently selected horizon to Charisma format
Load external topography	Loads an external topography file for use in interpretation
Open map calculator	Opens a tool to perform calculations on maps
Clear calculated maps	Removes all maps that were generated through calculations from the project
Import checkpoints ASCII	Imports checkpoints from an ASCII file
Export checkpoints ASCII	Exports checkpoints to an ASCII file
Create unconformity map	Generates an unconformities map
WELLS	
Clear wells	Removes all well data from the project
Import wells headers from text file	Imports well headers from a text file
Export wells headers to text file	Exports well headers to a text file

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Import wells inclinometry	Imports well inclination data
Export wells inclinometry	Exports well inclination data
Import wells trajectory	Imports well trajectory data
Clear wells inclinometry	Removes all well inclination data from the project
Import wells markers	Imports well marker data
Export wells markers to text file	Exports well markers to a text file
Export well-tied horizons-markers to text file	Exports the well markers and horizons for tied wells to a text file
Clear wells markers	Removes all well marker data from the project
Load LAS files	Loads well log data from LAS files
Clear LAS files	Removes all loaded LAS files from the project
Load check shots	Loads check shot data for wells
Clear check shots	Removes all check shot data from the project
Export all check shots	Exports all check shot data to a file
Export wells comments to text file	Exports well comments to a text file
Import wells comments from text file	Imports well comments from a text file
Clear all wells comments	Removes all well comments from the project
Wavelet analysis	Performs wavelet analysis on well data
Well log calculator	Opens a tool for performing calculations on well logs
Save synthetic trace to LAS	Saves synthetic seismic traces to an LAS file
VELOCITY MODEL	
Create depth velocity by well markers and time horizons	Generates a depth velocity model using well markers and time horizons
Create GRID depth velocity by well markers and time horizons	Creates a gridded depth velocity model using well markers and time horizons
Create depth velocity from checkshot	Generates a depth velocity model using check shot data
Create depth velocity from VRMS	Creates a depth velocity model using RMS velocity data
Create constant depth velocity	Generates a depth velocity model with a constant velocity
Create constant layer depth velocity	Generates a depth velocity model with constant velocities for different layers
Import depth velocity model	Imports a depth velocity model from a file
Update depth velocity by well the	Updates the depth velocity model using well data
Clear all well-tied maps	Removes all maps that are tied to well data from the project
Pine creation	Creates a pine tree - tool for the accuracy estimation of the velocity model
FAULTS	
Clear faults	Removes all faults from the project
Save faults binary	Saves fault data in a binary format
Load faults binary	Loads fault data from a binary file

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Import fault (charisma format)	Imports fault data in Charisma format
Export current fault (charisma format)	Exports the currently selected fault to Charisma format
HORIZON PICKING	
Convert map to horizon by crosslines	Converts a map to horizon data along crosslines
Convert map to horizon by inlines	Converts a map to horizon data along inlines
Track horizon by crosslines	Tracks a horizon along crosslines
Track horizon by inlines	Tracks a horizon along inlines
Track horizon	General tool for horizon tracking
Track horizon by whole 3D volume	Tracks a horizon across the entire 3D volume
Run QC for selected horizon picking	Performs quality control checks on the selected horizon picking
Update 3D view	Refreshes the 3D view to reflect the latest data and interpretations
Load picture files	Loads image files into the project
Clear pictures	Removes all loaded image files from the project
Load shape files	Loads shape files into the project
Clear shape files	Removes all loaded shape files from the project
Calculate gross rock volume	Computes the gross rock volume from the seismic data
Create geo-body from gross rock volume	Generates a geological body from the calculated gross rock volume
Calculate attributes	Computes various seismic attributes for analysis
Run spectral decomposition	Performs spectral decomposition on the seismic data
Import map from ASCII	Imports a map from an ASCII file
Update cross plot	Refreshes the cross plot with the latest data
Show object properties	Displays the properties of the selected object
Calculate HCIIP	Computes the Hydrocarbon Initially In Place (HCIIP)
Import 3D attribute data from ASCII	Imports 3D attribute data from an ASCII file
MAP INTERPOLATION	
Settings	Opens the settings for map interpolation
MIS TIE SEISMIC	
Set seismic groups priority	Sets the priority for different seismic groups
Run for current Intersection	Runs mis-tie corrections for the current intersection
Run for all Intersections	Runs mis-tie corrections for all intersections
Clear shifts or rotations	Removes all applied shifts or rotations from the seismic data
Import cross points table from ASCII	Imports a cross points table from an ASCII file
Export cross points table to ASCII	Exports the cross points table to an ASCII file
Auto fit volumes	Automatically fits the seismic volumes together

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Calculate volumes intersections	Computes the intersections of seismic volumes
PRE-STACK	
Run AVO	Runs Amplitude Versus Offset (AVO) analysis on pre-stack data
Calculate AVO maps	Generates AVO attribute maps from pre-stack data
Calculate AVO seismic attributes	Computes various AVO seismic attributes for analysis
Clear mute	Removes all mute information from the pre-stack data
Load mute	Loads mute information into the pre-stack data
Save mute	Saves mute information for the pre-stack data
DATABASE	
Set connection	Establishes a connection to the database
Clear references	Removes all references to database entries from the project
Sync settings	Opens synchronization settings with the database
Send to DB	Sends the current project data to the database
Receive from DB	Retrieves data from the database into the project
Delete DB data	Deletes selected data from the database

3.2.6 Output View

Output view provides information about the status of each executed process, including type of the process, benchmark, log and warnings

In case of data inconsistency during loading or incorrectly running process g-Space will show a warning massage and the user will see a description of the problem in the Output panel.

3.2.7 Progress View

Progress view panel provides information about the currently running process, its progress and the estimated time it will be completed

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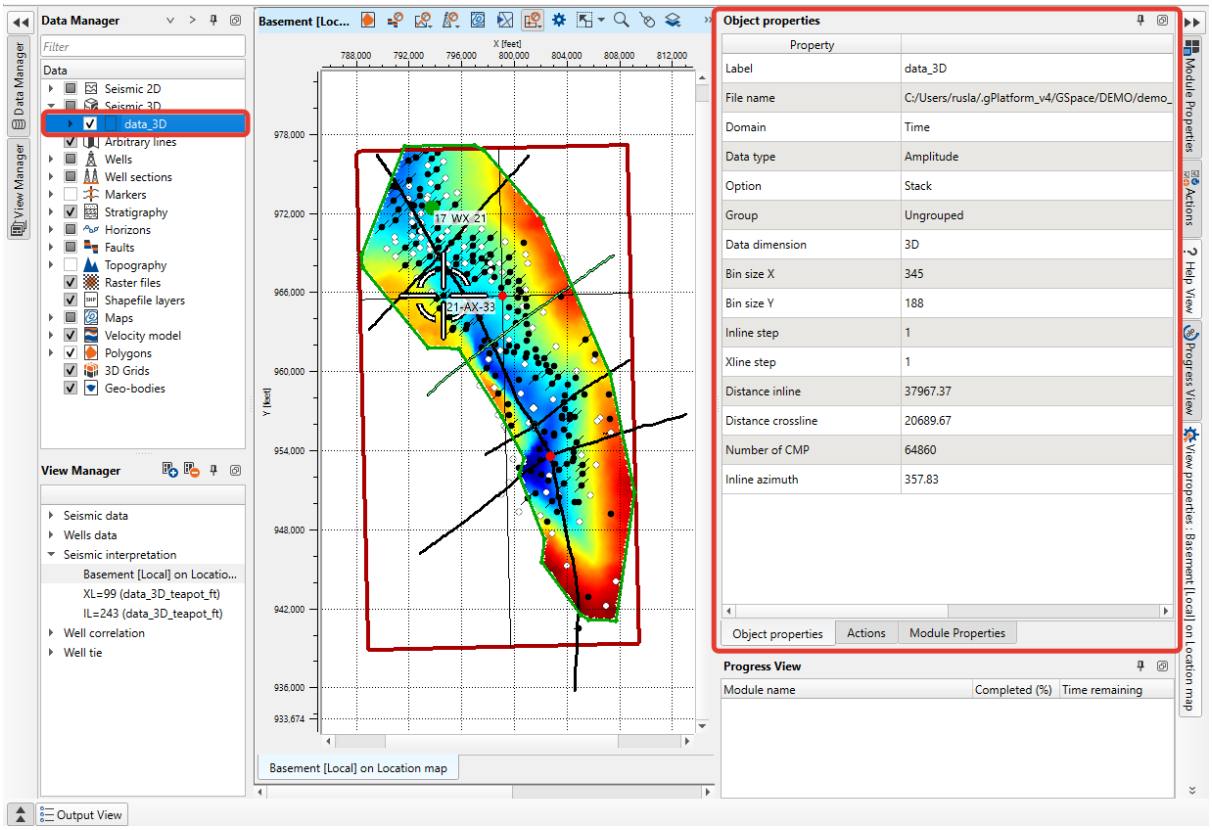
3.2.8 Object properties

Object properties provides general information about the selected in the Data Manager object



List of properties for seismic data:

Label
File name
Domain
Data type
Option
Group
Data dimension
Bin size X
Bin size Y
Inline step
Xline step

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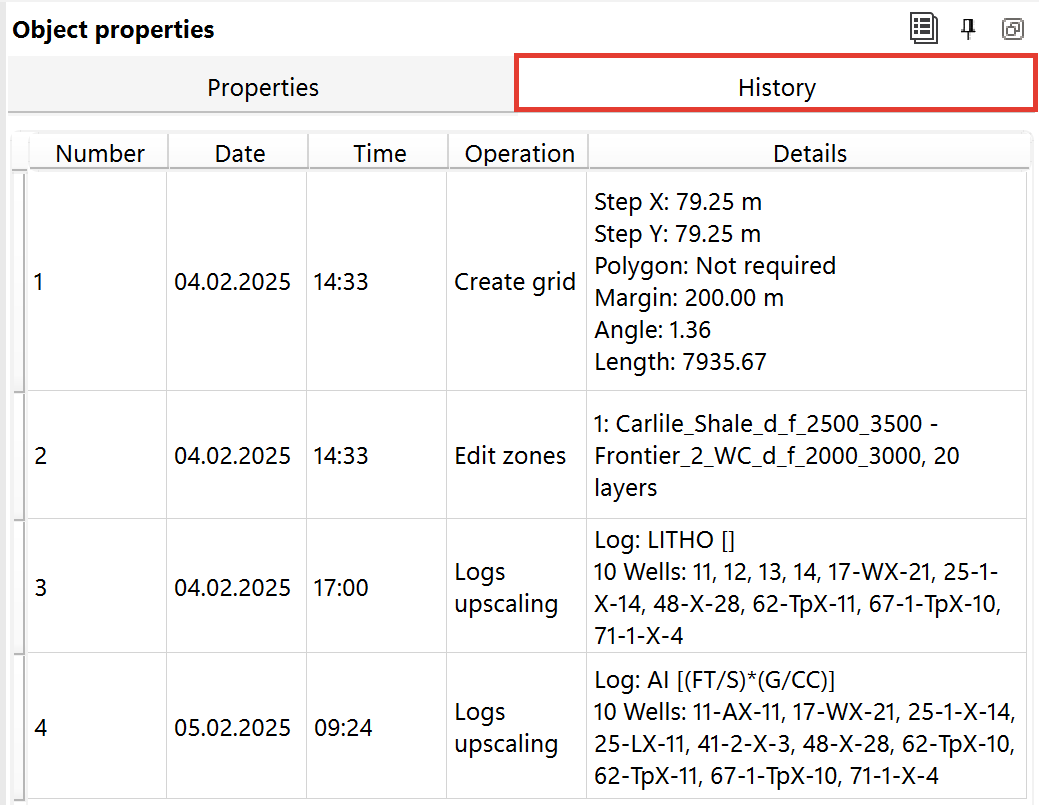
Distance inline
Distance crossline
Number of CMP
Inline azimuth

For 3D Grids, the **Object Properties** panel includes an additional **History** tab. This tab provides details about the grid creation process, including parameters such as step size, polygon, margin, angle, length, and zone edits. It also tracks log upscaling and the velocity model used for grid generation.



Number	Date	Time	Operation	Details
1	04.02.2025	14:33	Create grid	Step X: 79.25 m Step Y: 79.25 m Polygon: Not required Margin: 200.00 m Angle: 1.36 Length: 7935.67
2	04.02.2025	14:33	Edit zones	1: Carlile_Shale_d_f_2500_3500 - Frontier_2_WC_d_f_2000_3000, 20 layers
3	04.02.2025	17:00	Logs upscaling	Log: LITHO [] 10 Wells: 11, 12, 13, 14, 17-WX-21, 25-1-X-14, 48-X-28, 62-TpX-11, 67-1-TpX-10, 71-1-X-4
4	05.02.2025	09:24	Logs upscaling	Log: AI [(FT/S)*(G/CC)] 10 Wells: 11-AX-11, 17-WX-21, 25-1-X-14, 25-LX-11, 41-2-X-3, 48-X-28, 62-TpX-10, 62-TpX-11, 67-1-TpX-10, 71-1-X-4

3.3 Workspace

Workspace is a graphical setup of views that used to organize working process according to user's habits. User can add unlimited number of workspaces with unlimited number of Views 123 in each Workspace.

There are two predefined Workspaces where additional Views cannot be added:
- Seismic data workspace 118 - used to load and manage seismic data loaded into the project
- Wells data workspace 121 - used to load and manage well data loaded into the project

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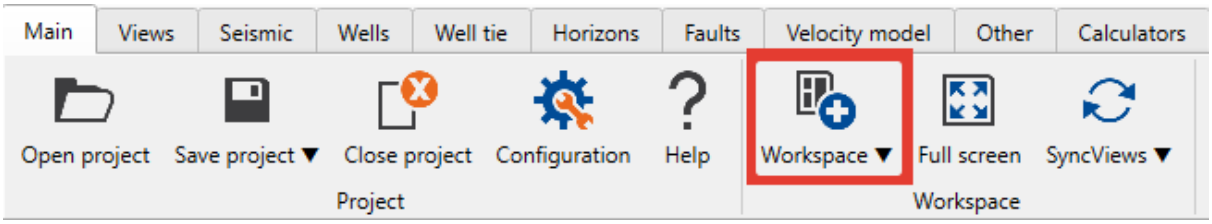
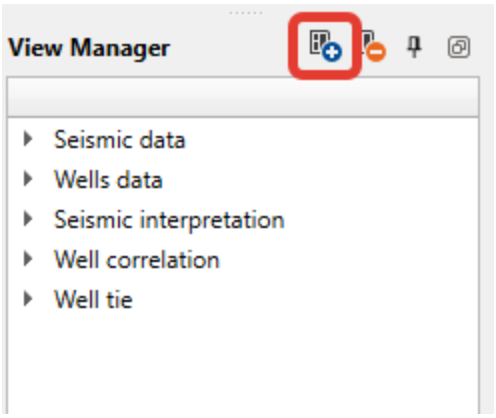
User still can arrange Views in those predefined Workspaces.

Creating new Workspace:
There are three options to add Workspace:

Option 1:
Go to Main bar 34 and click on Workspace button



Option 2:
On the upper part of View Manager 90 click on the button add Workspace



Option 3:
Right click mouse button on the View Manager and choose add Workspace

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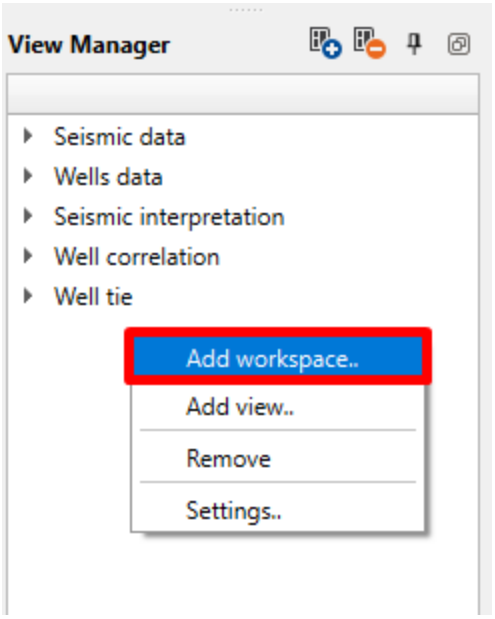
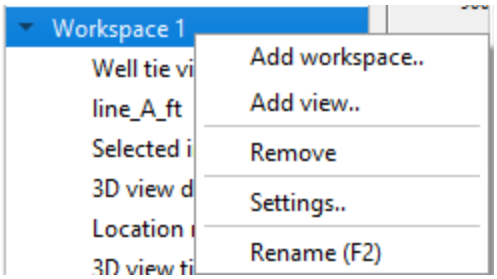


Operations with workspace:

By clicking right button mouse on the workspace you may choose different operations you want to do with it:



You can perform the following operations:

- Add workspace (another one)
- Add view in current workspace
- Remove workspace
- Settings - Lunch View properties 102 for active view in current workspace
- Rename workspace

To delete view from the workspace press right mouse button on this view and select delete:

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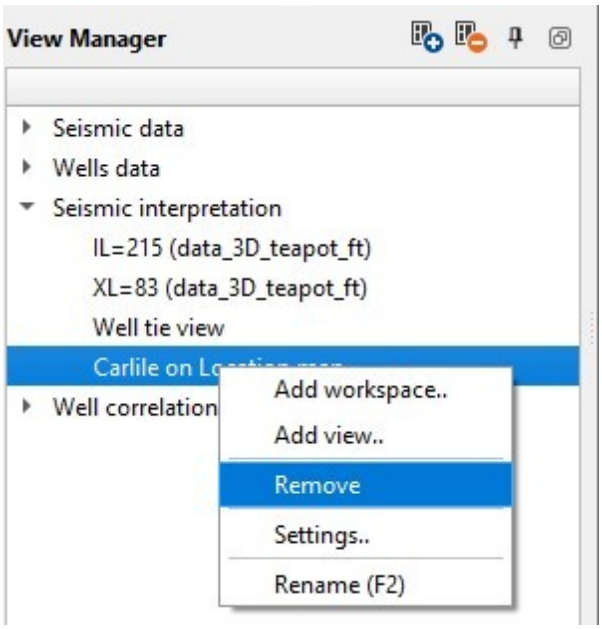

3.3.1 Views synchronization

g-Space supports views synchronization

Go to Ribbon 33 -> Main bar 34 and on button SyncViews press down arrow to launch synchronization settings

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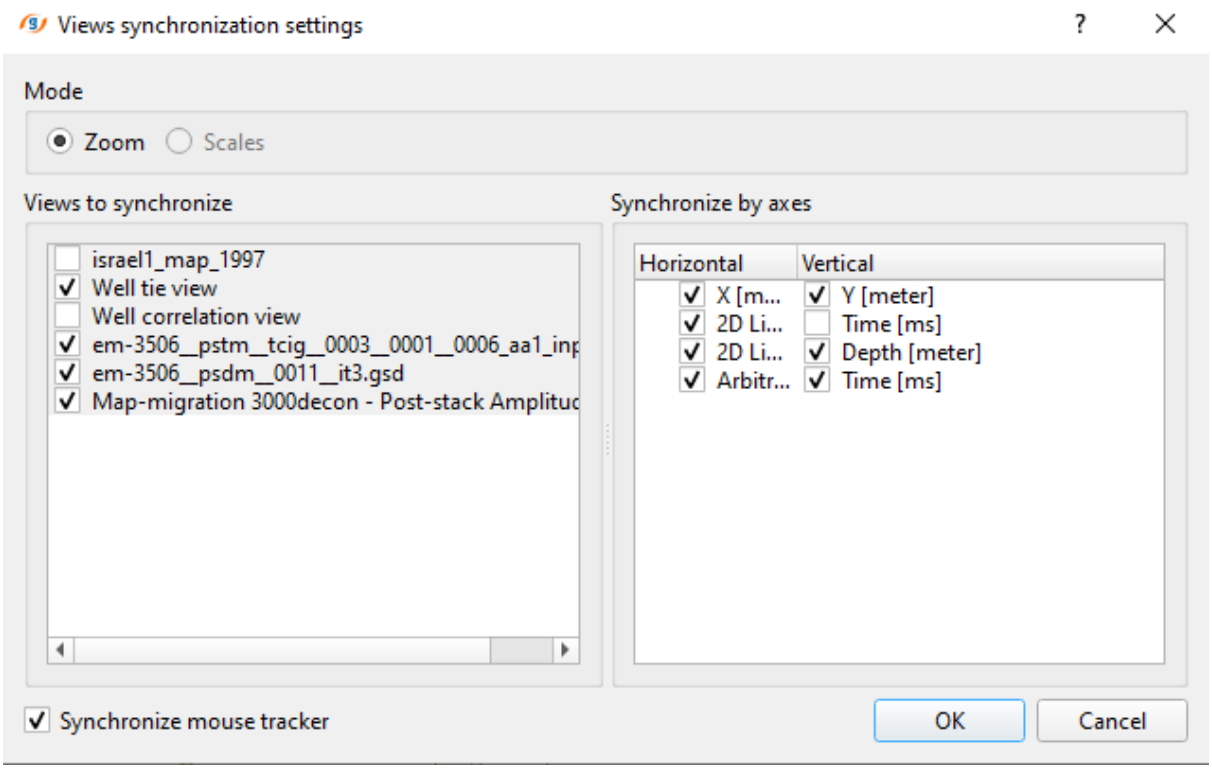
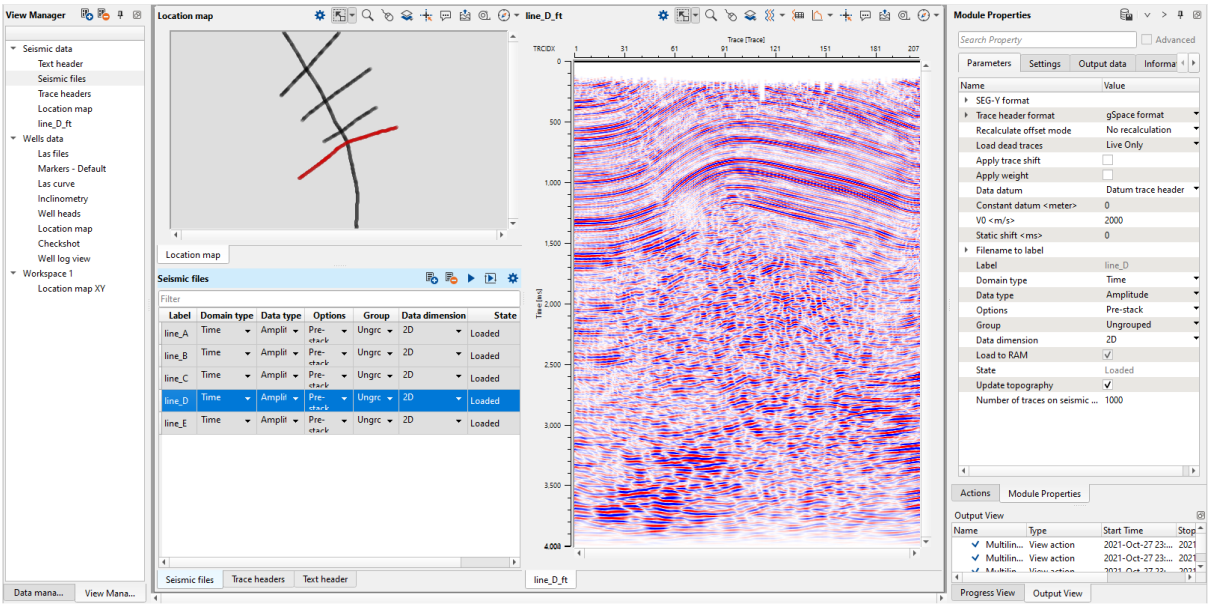


3.3.2 Seismic data workspace

Selection of Seismic data workspace in View manager activates corresponding workspace that include several views required for QC of the import process for seismic data.

For more information about seismic data loading please refer to import seismic 246



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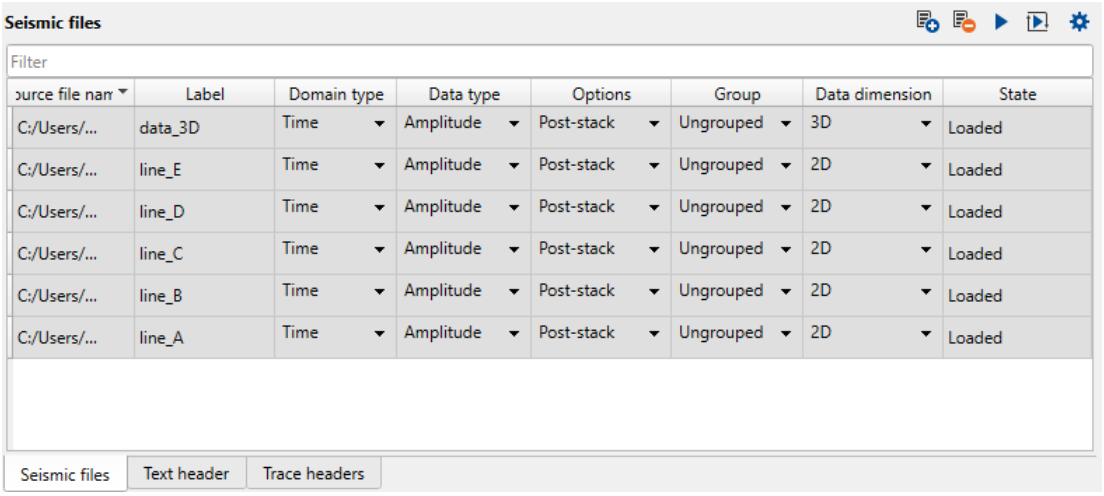
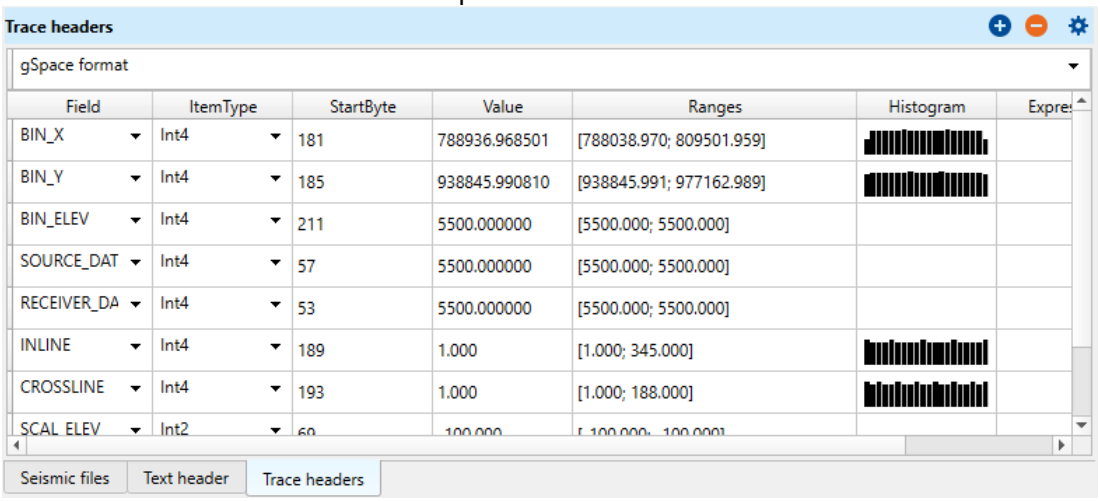
Workspace includes 2 views for settings:

- **Seismic files** view - contains all loaded sesimic files:



- **Trace headers** view - allows to set bins positions for loaded files:



And 3 views for visualization:

- **Location map** - map with loaded seismic files and topography

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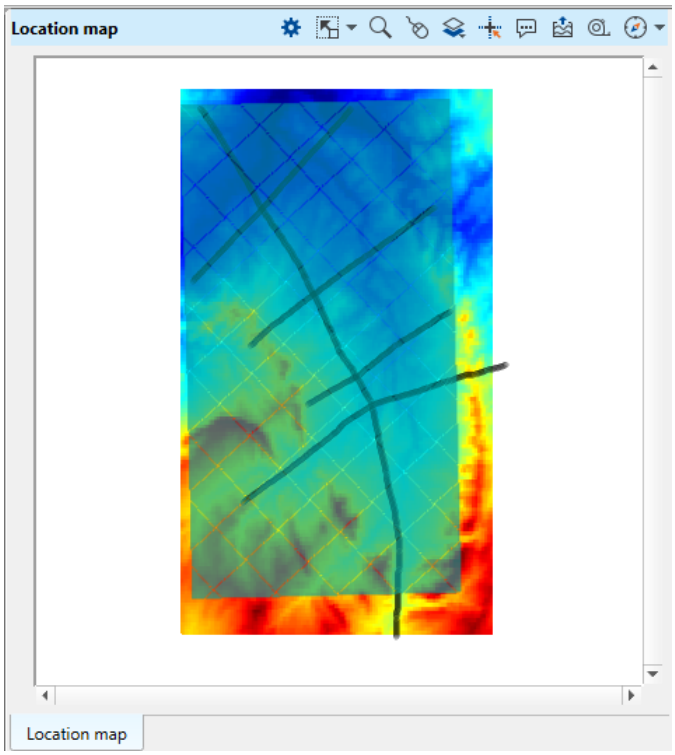
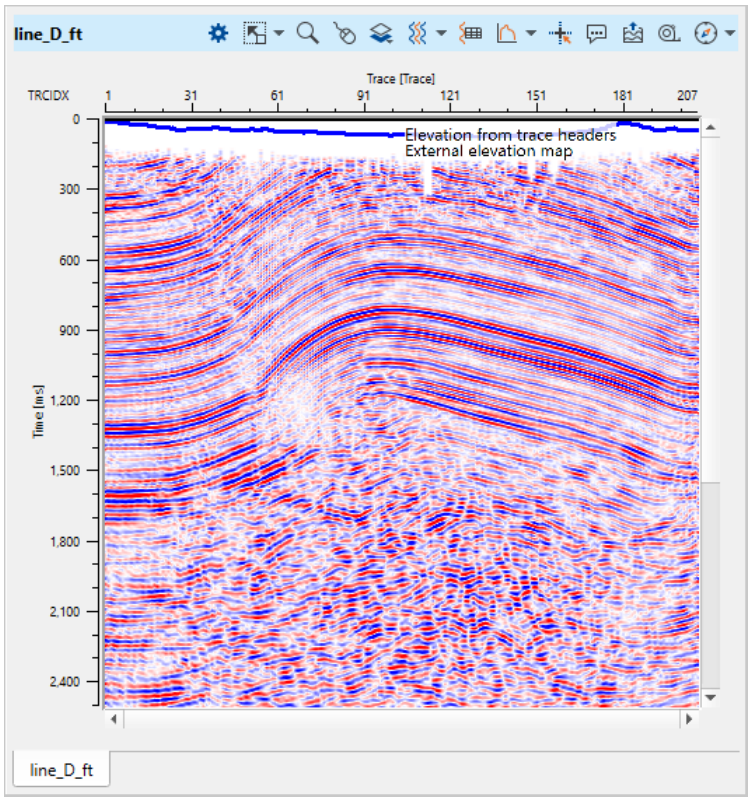


- **Section view** - traces visualization of the selected seismic file



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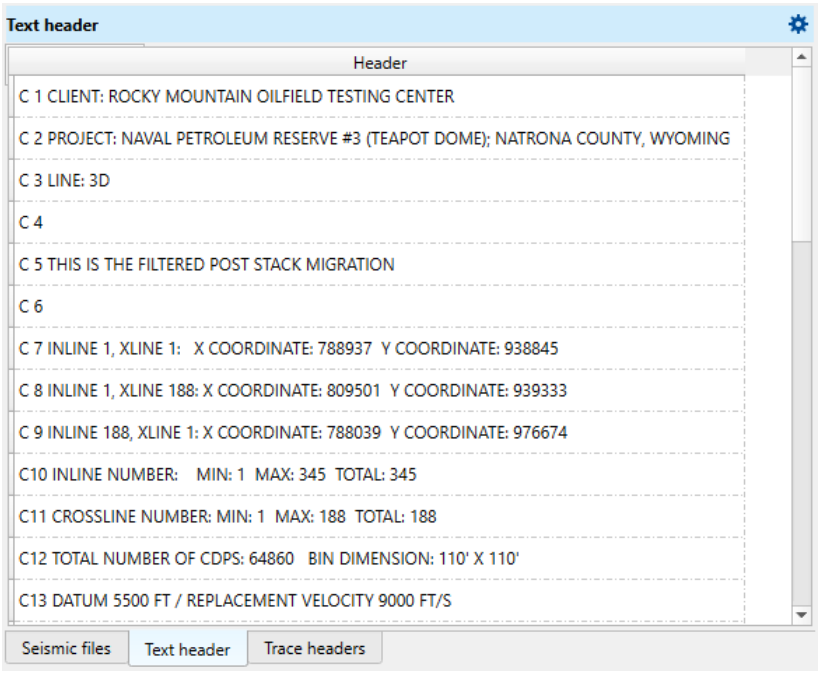
- **Text header** view - to view the seismic file text header



3.3.3 Wells data workspace

Selection of Wells data workspace View manager activates corresponding workspace that include several views required for QC of the import process for all types of well data.

For more information about well data importing please refer to Import wells 256

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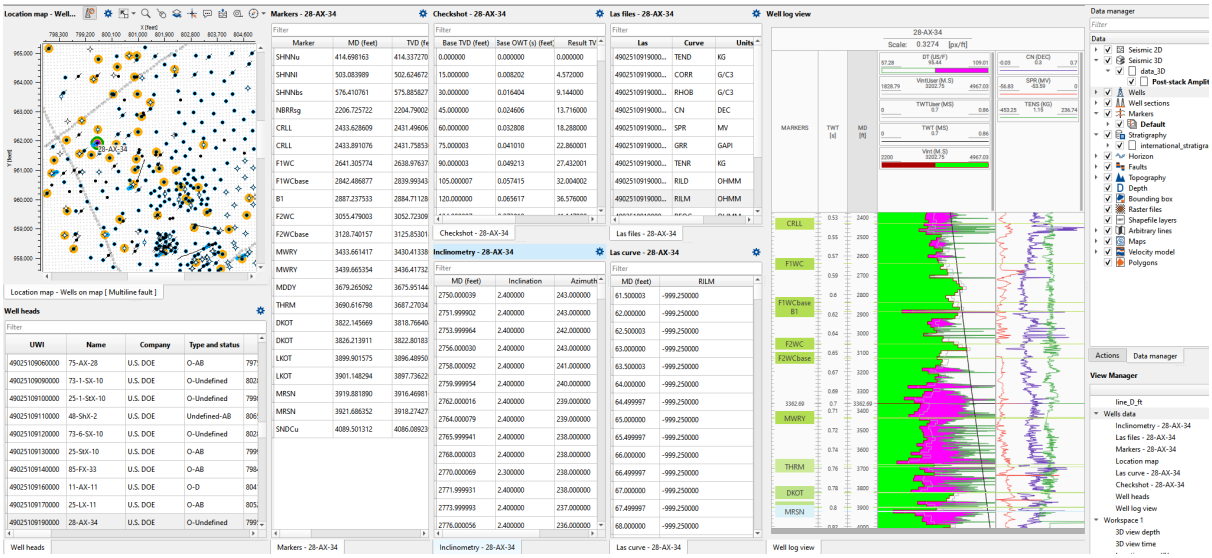

The predefined **workspace [Wells data]** includes following views:

Location map view - shows all wells that currently loaded into the project. That view reflects:

- type and status of the well - icon of the well according (description of codes for well status can be found in https://www.ogsrlibrary.com/definitions_well_status_oil_gas_ontario)
- existence of markers loaded into the well - blue circle
- existence of checkshot information - violet circle
- existence of well logs loaded from LAS files - orange circle
- existence of deviated inclinometry of the well - black line drawn from the well location

Well heads view - shows all wells header information loaded into the project

Markers view - shows all markers loaded for selected (current) well. The title of the view shows the name of the current well.

Checkshot view - shows all checkshot values for the selected (current) well. The title of the view shows the name of current well. User can double click on any value and edit it.

LAS files view - shows all well logs loaded for selected (current) well. The title of the view shows the name of the current well.
LAS curve view - shows all values of selected well log of selected (current) well. User can double click on any value and edit it.
Well log view - for visualization logs and markers.

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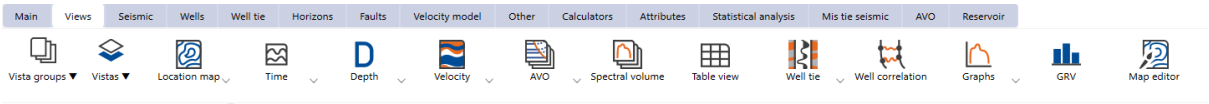
Inclinometry view - shows all inclinometry points for selected (current) well. The title of the view shows the name of current well.

3.4 Views

Views in g-Space are designed to help users visualize, quality control (QC), and manipulate various types of geological and geophysical data. Each view type offers a unique way to interact with your data, whether it's seismic, well logs, maps, or other geological models.

Vistas is a list of objects that can be visualized in any view. Within **Vista Groups**, you can find multiple objects available for visualization.



There are several key view types in g-Space, each tailored to specific data visualization and analysis needs:

- **Geo-View**: those views have two axes that can be zoomed, scrolled and synchronized (Horizontal <> Vertical):
  - Location map 124
  - All seismic section and image gather views used for visualization, interpretation, and conditioning of seismic data:
    - Time section: Distance <> Time
    - Depth section: Distance <> Depth
    - Velocity section: Distance <> Depth
    - AVO 158: Offset/Angle <> Time/Depth
  - Cross-plot 206: Horizontal <> Vertical
  - Pine Chart View 208
  - 3D view 133 - This is where the user can display both time and depth volumes in 3D view

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- **Well view** These views focus on well data, with a vertical axis that can be scrolled to navigate through different well depths.
  - Well correlation 180
  - Well-tie 172
- Table view 171 designed for the visualization and manipulation of tabular data, allowing for detailed analysis and editing of numerical datasets
- GRV (Gross Rock Volume) View 214 calculates and visualizes the Gross Rock Volume for reservoir characterization
- Map Editor View 214 creates, edits, and manages geological and geophysical maps for spatial analysis.

Customizing View Appearance

You can adjust the appearance of each view, as well as the visualization parameters for objects within the view, using the View Properties 101 panel. This panel provides a range of settings to tailor the display to your specific needs.

Most of the views operate similarly for zoom, scroll and selection of picking objects. For more information about mouse and keyboard controls and shortcuts refer to Controls and shortcuts 217

3.4.1 Location map

The **Location Map** is a window that allows users to display and manage loaded GIS-type data, including seismic, well data geometry, polygons, arbitrary lines, maps, horizons, and more.

The Location Map view consists of a map canvas with a coordinate frame and a functional panel at the top of the view.

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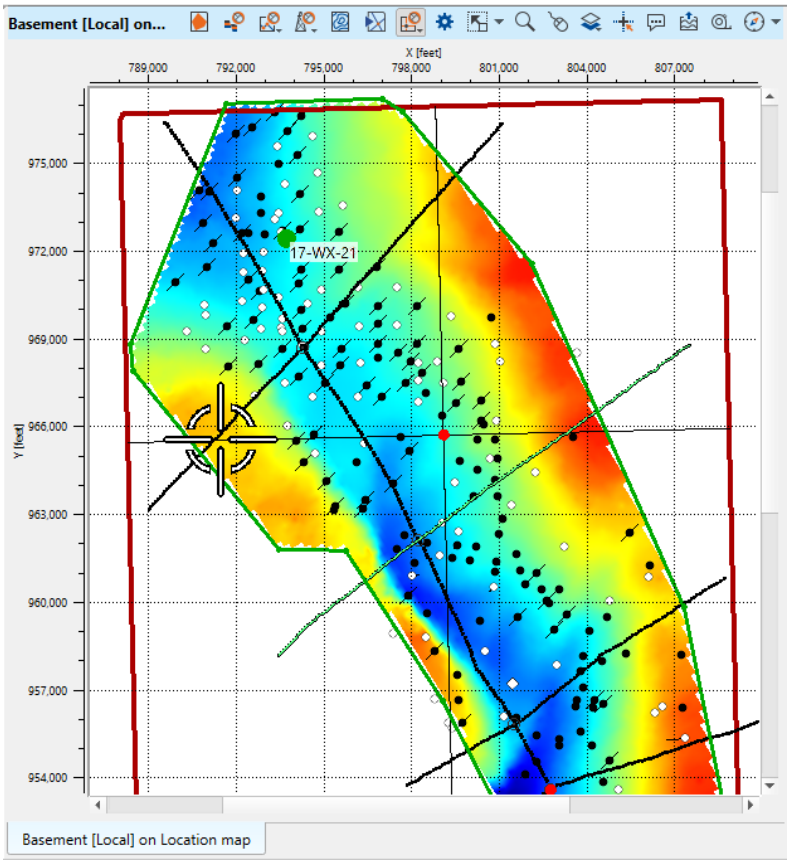
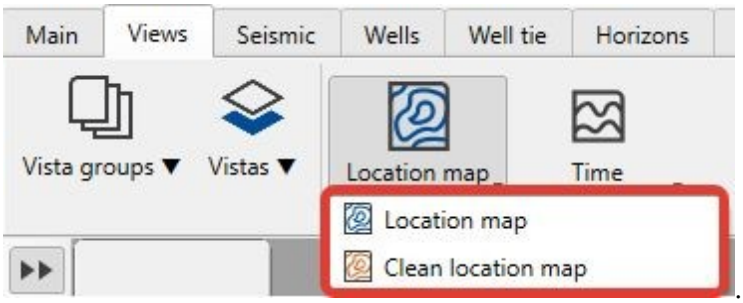


To create location map view go to the Views bar 36 in the Ribbon bar 33 and click on Location map button. It has two options: create blank location map and create location map with objects added:



The newly created view will appear in the View manager 90 in the active Workspase 114. User can place location map view by dragging it to any workspace except pre-defined once (Seismic data 118 and Well data 121).

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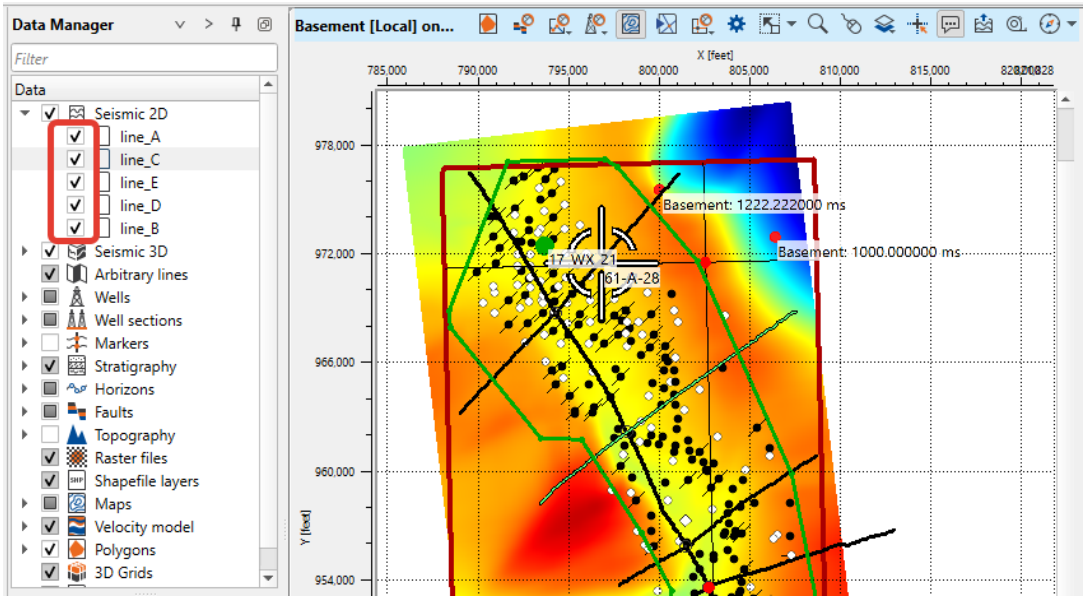
To define the object visibility style go to the View properties 101 by pressing ⚙ in the view functional panel or find it in the panel 84 sets.

On the **Location map view** user can visualize any object with coordinates. To visualize the object press its checkbox in the Data manager 86.



Functional panel allows user to perform the following actions:

- edit polygon
- edit fault
- edit 2D arbitrary line
- edit 3D arbitrary line
- current well on map
- edit well section

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edit checkpoints

select intersection

select 2D/3D/image bin

open View properties panel

adjust view area to all visible objects

adjust horizontal scale

adjust vertical scale

set/unset zoomable

set control item

add vista

enable mouse tracker

enable tool tip

export picture

ruler tool

show compass

show minimap

show scale bar

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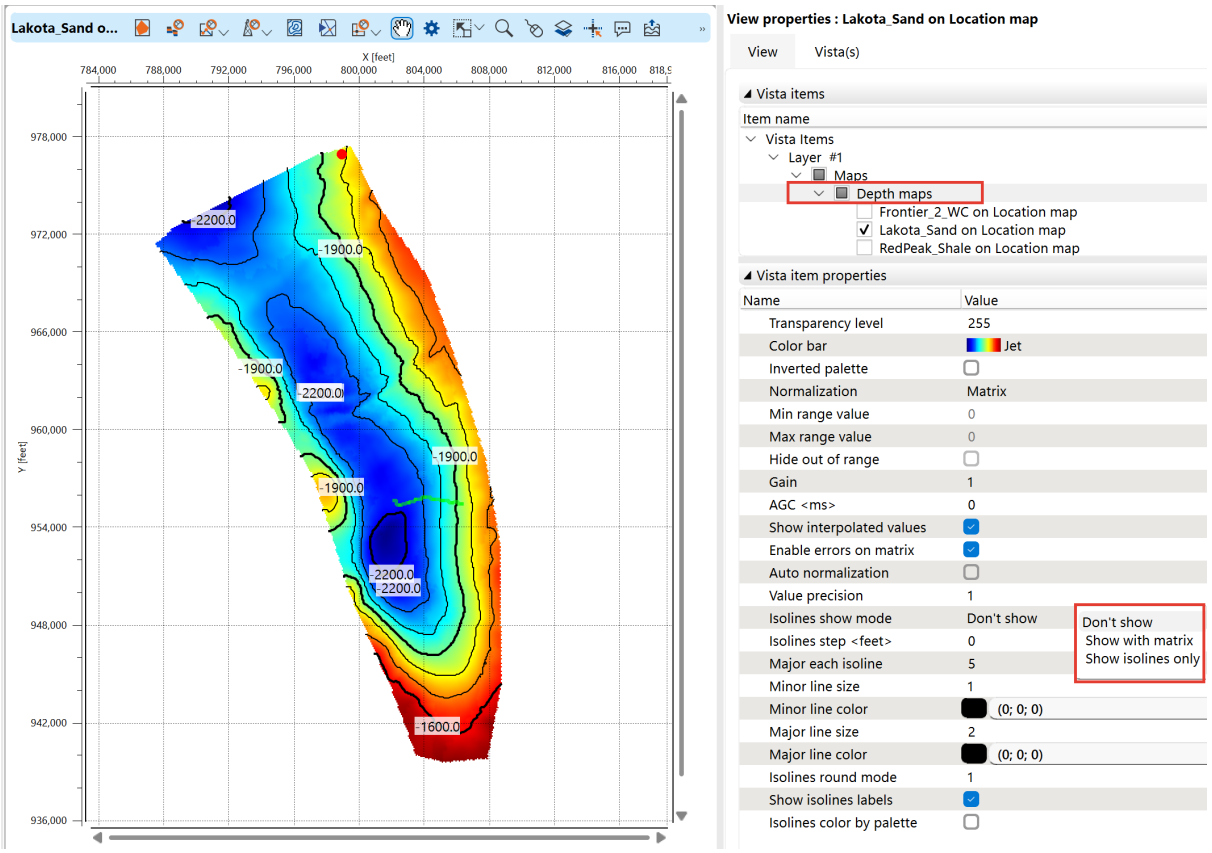
Vista Item Properties Overview



Transparency Level

- Adjusts the transparency of the displayed map.
- Range: 0 (fully opaque) to 255 (fully transparent).

Color Bar

- Defines the color scale applied to the map.

Inverted Palette

- Reverses the color gradient of the selected color bar.

Normalization

- Defines how data values are normalized for color mapping.
- Options include *Matrix* (based on grid values).

Min/Max Range Value

- Allows users to manually set the minimum and maximum values for the color scale.

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Hide Out of Range

- If enabled, values outside the defined range are hidden instead of clamped to min/max values.

Gain

- Adjusts the brightness of the map, affecting contrast between colors.

AGC (Automatic Gain Control)

- Affects amplitude scaling by normalizing the dynamic range.
- Measured in milliseconds.

Show Interpolated Values

- Enables the display of interpolated values in between original grid points.

Enable Errors on Matrix

- Highlights areas where the data matrix has inconsistencies or missing values.

Isoline Settings

Isolines Show Mode

- Controls the visibility of contour lines (isolines) on the map.
  - **Don't Show** – No isolines are displayed.
  - **Show with Matrix** – Isolines appear over the color-mapped grid.
  - **Show Isolines Only** – Displays isolines without the underlying color matrix.

Isolines Step (Units: Feet or Meters)

- Defines the interval between adjacent isolines.
- A smaller value increases the density of isolines.

Major Each Isoline

- Defines how frequently a thicker major isoline appears (e.g., every 5th isoline).

Minor Line Size & Color

- Adjusts the thickness and color of minor isolines.

Major Line Size & Color

- Adjusts the thickness and color of major isolines.

Isolines Round Mode

- Controls rounding behavior of isoline values.
- A higher round mode reduces precision but simplifies contour labels.

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Show Isolines Labels

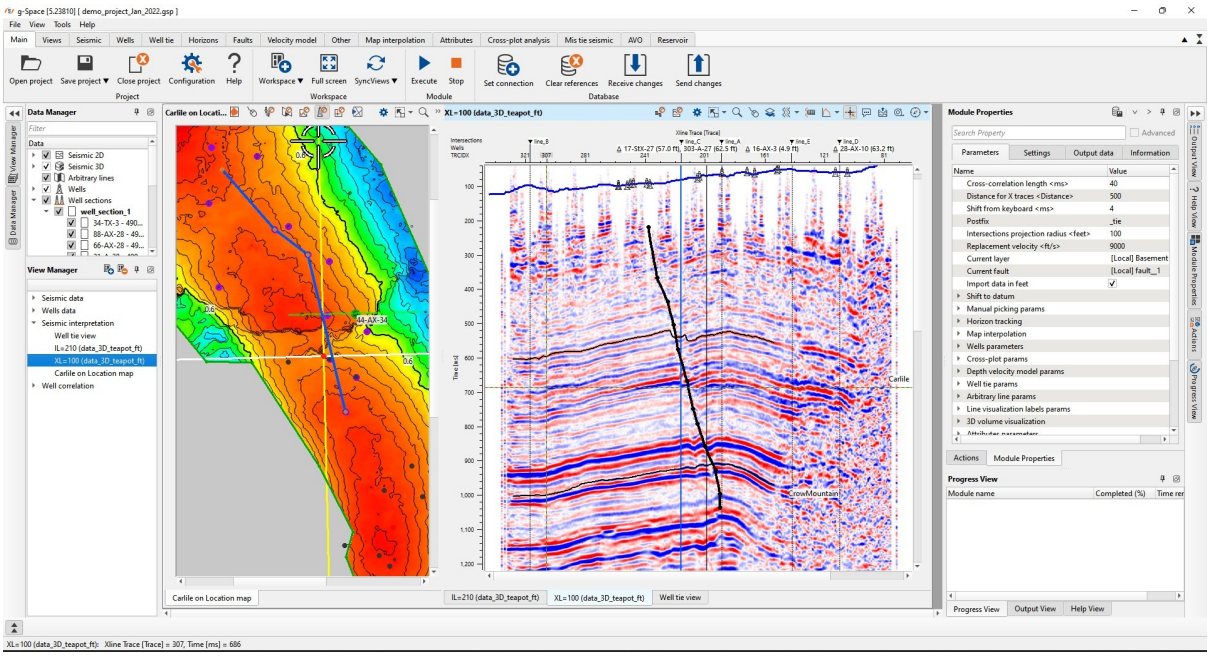
- Enables or disables numerical labels on isolines.

Isolines Color by Palette

- If enabled, isoline colors match the underlying color map instead of using a fixed color.

3.4.2 Seismic view

Seismic view is the set of section view windows where user can visualize seismic data and additional information such as grids, wells, markers, horizons, faults etc.



To create seismic section view go to the Views bar 36 on the Ribbon bar 33 and:

to create view in **time domain** open Time tab and choose between views: 2D line (for 2D data), 3D inline/crossline (for 3D data) or arbitrary line (for both 2D and 3D):

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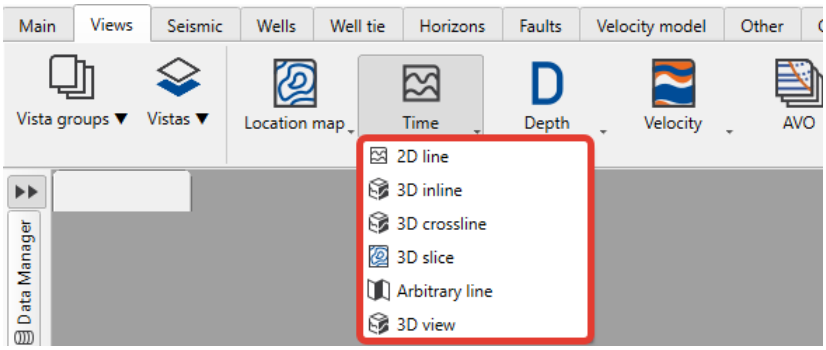
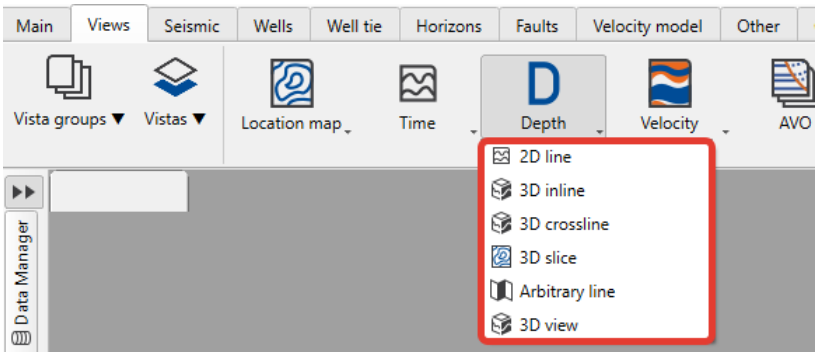
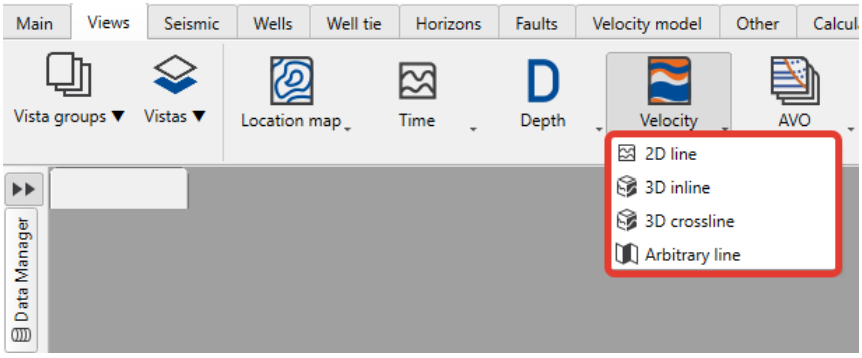


to create view in **depth domain** open Depth tab and choose between views: 2D line (for 2D data), 3D inline/crossline (for 3D data) or arbitrary line (for both 2D and 3D):



to create view for **velocity data** open Velocity tab and choose between views: 2D line (for 2D data), 3D inline/crossline (for 3D data) or arbitrary line (for both 2D and 3D):



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The newly created view will appear in the View manager 90 in the active Workspase 114. User can place Views by dragging them to any workspace except pre-defined once (Seismic data 118 and Well data 121).

To define the object visibility stile go to the View properties 101 by pressing in the view functional panel or find it in the panel 84 sets.

To visualize seismic data on the seismic section view make the loaded survey active by double click on it in the Data manager.

Additional information about seismic visualization you can find here 397.

Functional panel allows user to perform the following actions:

- faults picking
- horizons picking
- open View properties panel
- adjust view area to all visible objects
- adjust horizontal scale
- adjust vertical scale
- set/unset zoomable
- set control item
- add vista
- select traces
- trace data
- spectral analysis tool - multi selection

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spectral analysis tool - single selection

enable mouse tracker

enable tool tip

export picture

ruler tool

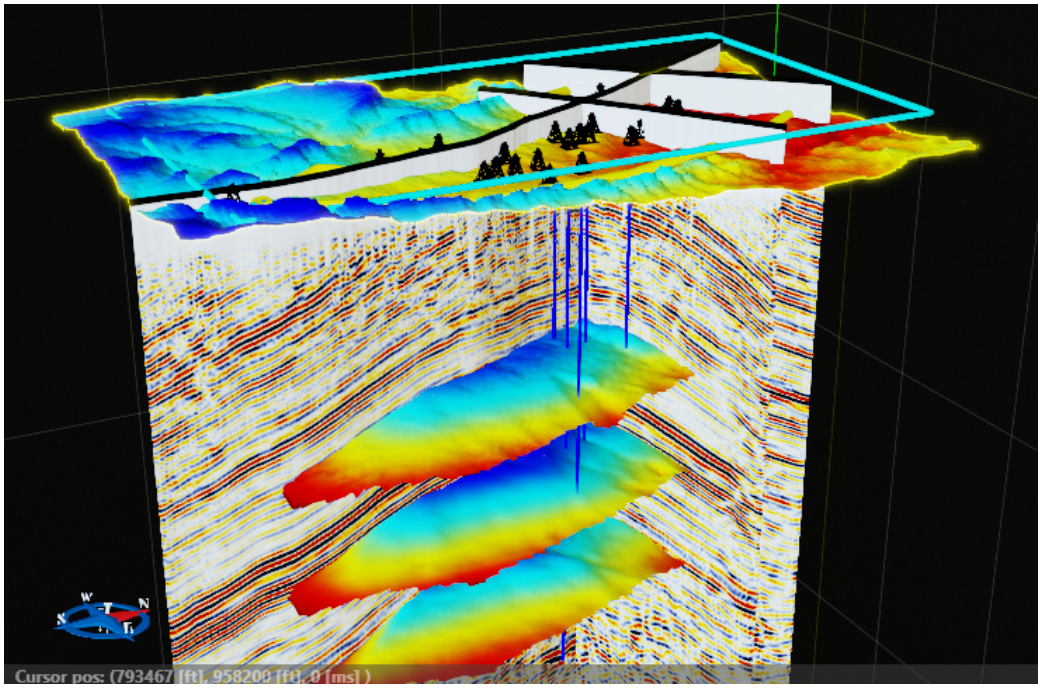
show compass

show minimap

show scale bar

3.4.3 3D view

3D View is a window that allows users to operate and visualize any geophysical and geological data, such as seismic volumes, well data, polygons, grids, horizons, maps and faults, in a 3D perspective.



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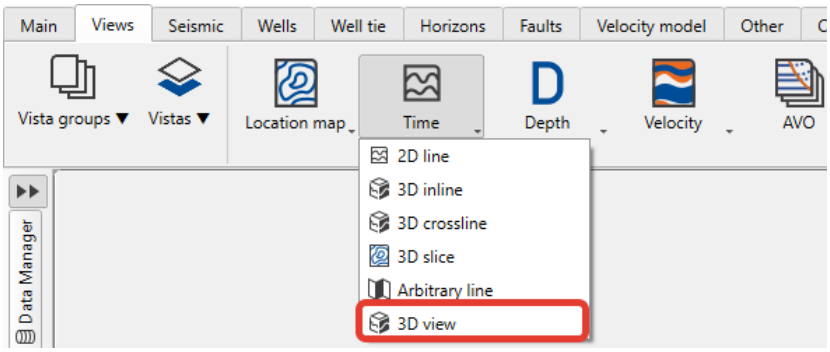
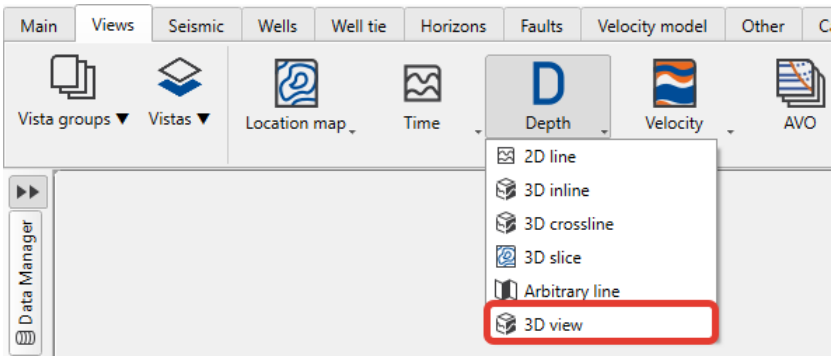
To create seismic section view go to the Views bar 36 on the Ribbon bar 33 and:

to create view in **time domain** open Time tab and select 3D view:



to create view in **depth domain** open Depth tab and choose between views: 2D line (for 2D data), 3D inline/crossline (for 3D data) or arbitrary line (for both 2D and 3D):



g-Space provides a clear distinction between **time and depth domains**, organizing **Horizons, Faults, and Maps** into dedicated folders for each.

For **3D visualization**, g-Space offers a feature that allows time-domain data to be displayed within the **3D depth view** using **the current velocity model**. This is especially useful during interpretation, as it enables reviewing results in time without requiring full data conversion to the depth domain.

In order to allow 3D view objects drawing, the user should adjust the **Performance** section found under Module properties 91 panel**.**

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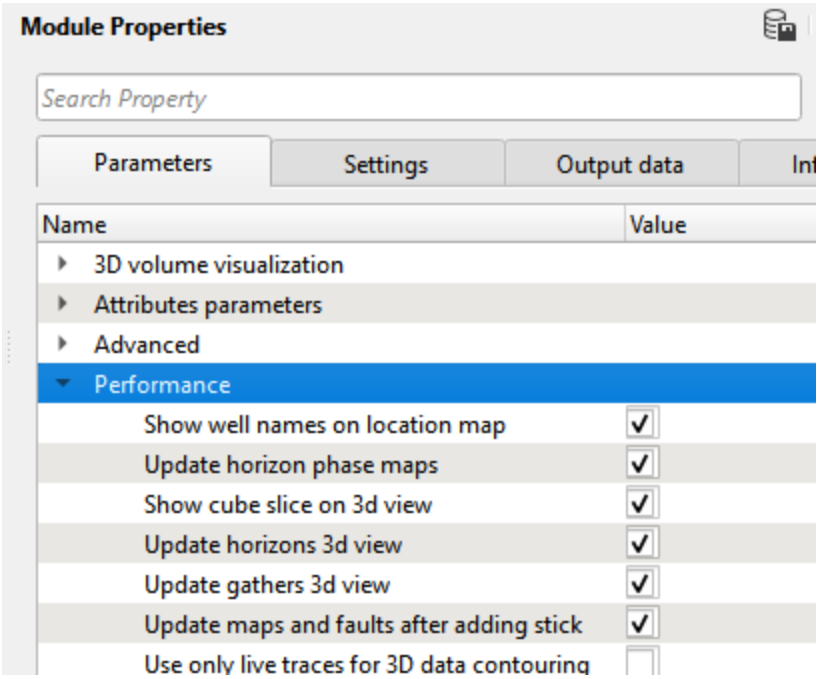
The main objective of these parameters is to optimize the performance of g-Space by unchecking them when the 3D view is not required. When more features are needed in the 3D view, the corresponding checkboxes should be selected.



Show well names on location map Displays all well names on the location map when checked.

Update horizon phase maps Automatically refreshes horizon phase maps based on changes in horizon data.

Show cube slice on 3d view Enables viewing a time/depth slice of the 3D volume when checked.

Update horizons 3d view Updates the 3D horizon view whenever changes are made to existing horizons (e.g., picking, adding new horizons).

Update gathers 3d view Updates the 3D gathers view when 2D lines are added or removed.

Update maps and faults after adding stick Automatically recreates the grid map of horizons and updates fault sticks when new fault sticks are added.

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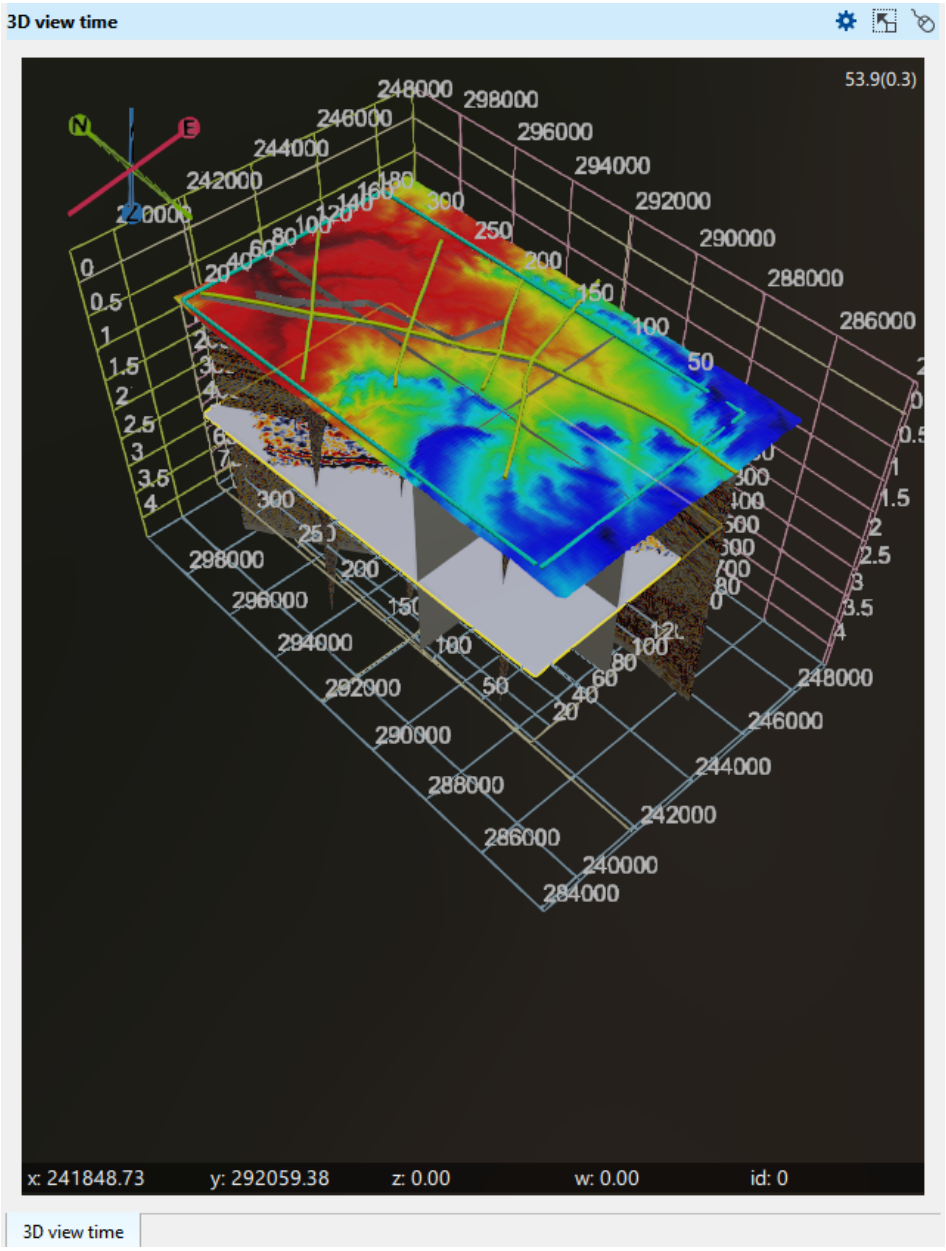
Use only live traces for 3D data contouring By default unchecked. When checked, only live traces are used for creating contour maps.

Displaying 3D volume

On the picture a few 2D lines, 3D volume, an arbitrary line, time slice, a topography map and wells are displayed on **Time 3D view**.



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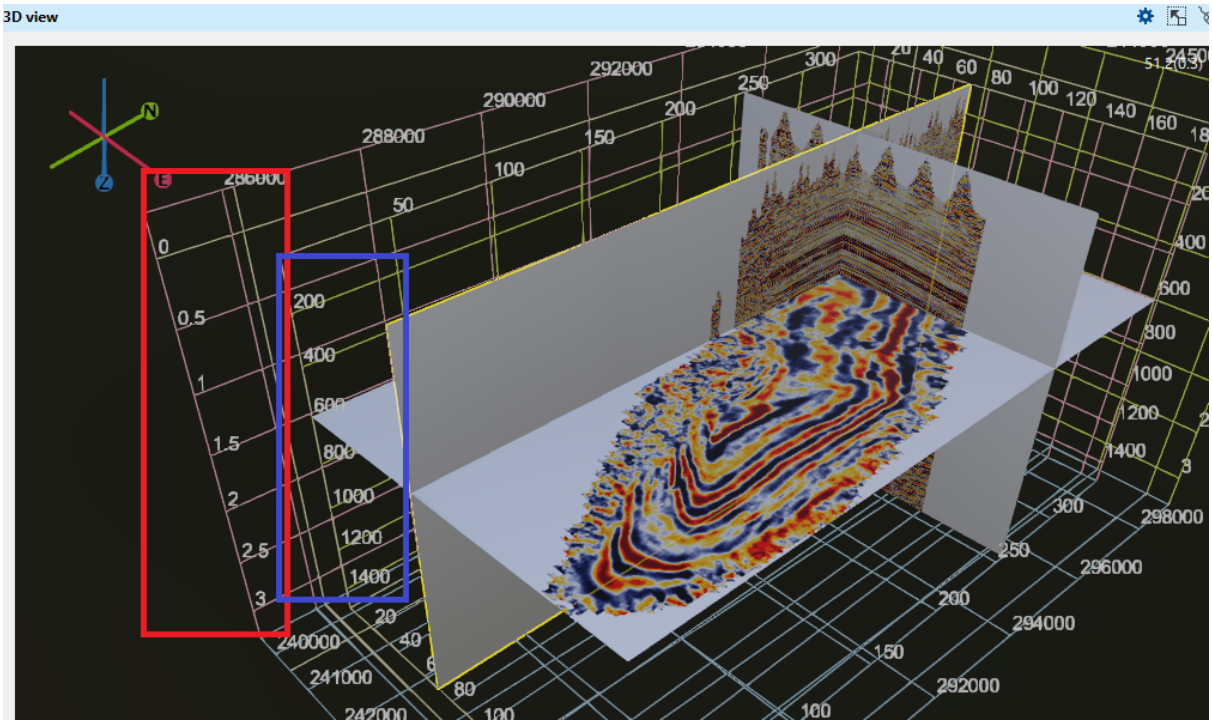
At the bottom of the display, the X, Y, and Z axes are shown, displaying the mouse position and its corresponding values. In the top right corner, the FPS (frames per second) value is displayed.

Vertical scale

In 3D view, two vertical scales exist. One is inside the volume and other is outside the volume. These two vertical scales shows us two different set of values.



The vertical scale of the inside grid (marked as blue rectangle) is showing the volume in **samples**. Like if we have 3000ms of record length and we have 4ms of sample interval, it will display like 200, 400 etc.

The vertical scale of the outside gird (marked as red rectangle) is showing the volume in **seconds**. If the record length is 3000ms then we can see it as 1s, 1.5s etc.

View appearance parameters and object visualization parameters can be set on the View properties panel as for other views.

Anyway a few settings related to 3D view only described below.

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View tab:

Well scale This property changes the thickness (size) of the displayed wells in the 3D view. By default it is 100. When the user changes it into 500 the thickness(size) increase.

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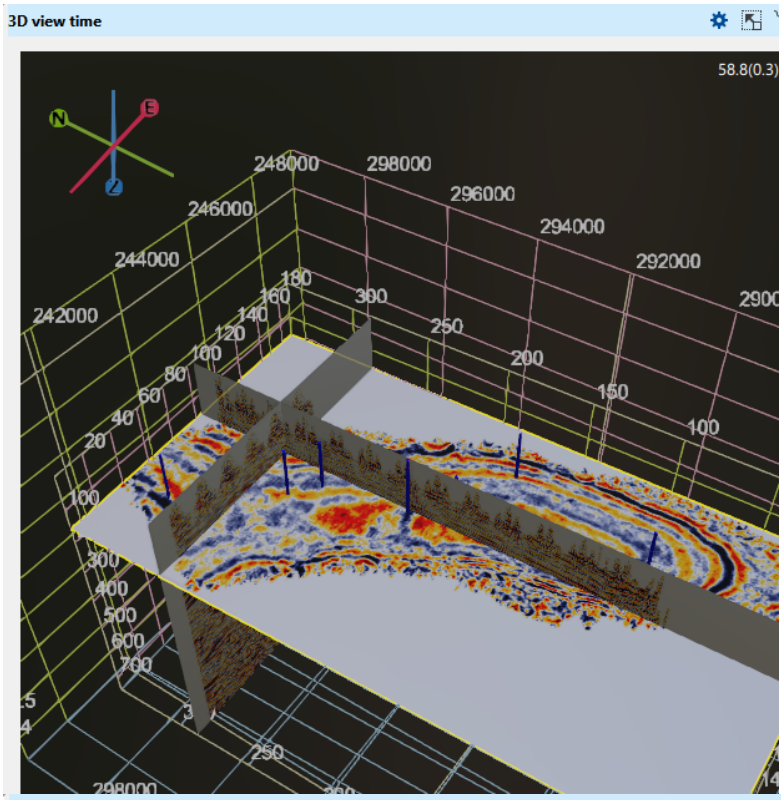

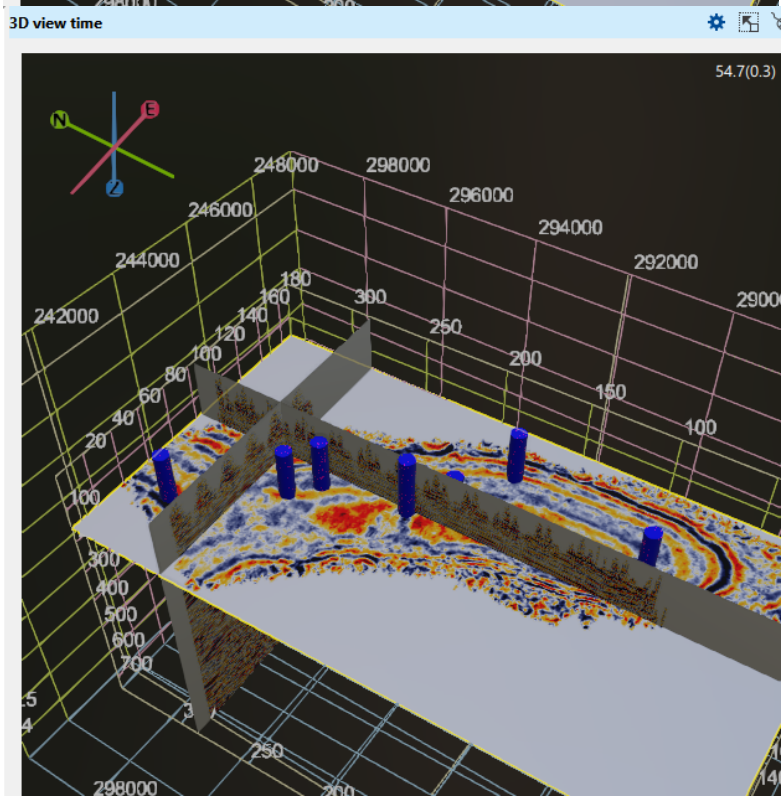

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Label size - The user can change the size of the X, Y, Inline, Crossline, Time/Depth slice labels. By default it is 1. Here we are changing it from 1 to 1.5. We can see the changes in the below image.

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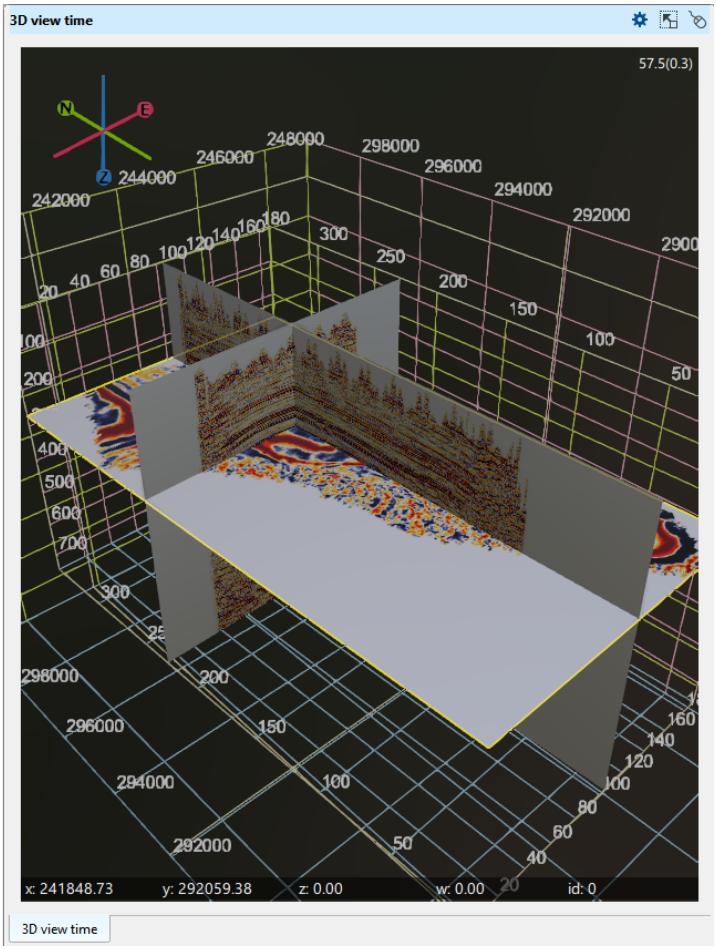
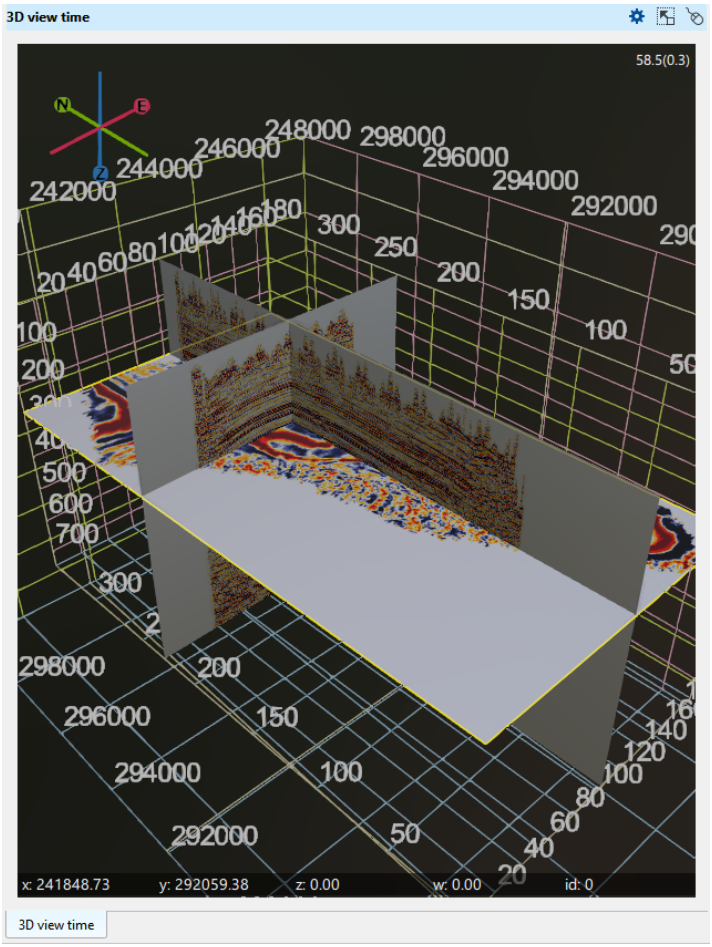


© 2026 Geomage 2003 LTD



Premitive thickness This parameter increases the display thickness of the 2D, 3D(Inline/crossline/time slice) and arbitrary line. In this instance, we have 1 as by default and changed that into 50 and we can able to see the thickness of the 2D lines as shown below.

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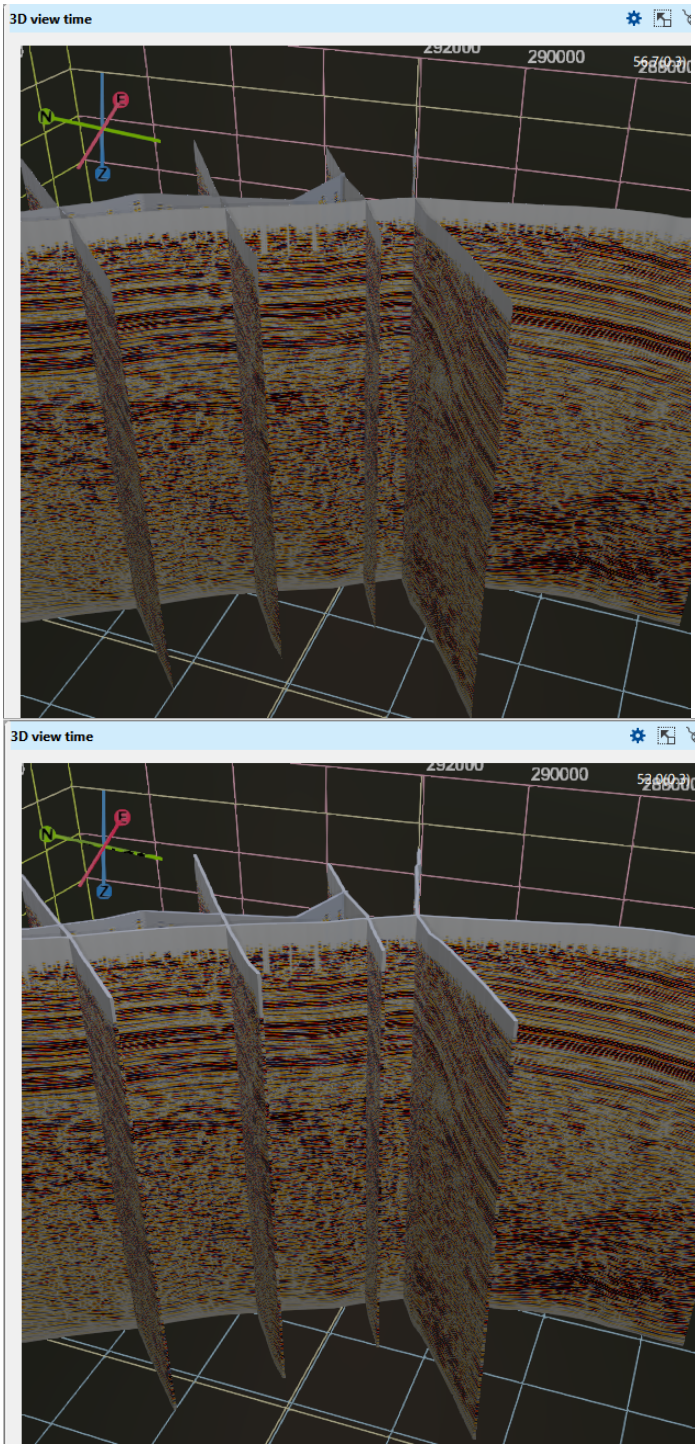

Points size It is a scalar for all 3D points like well markers, well rigs etc.

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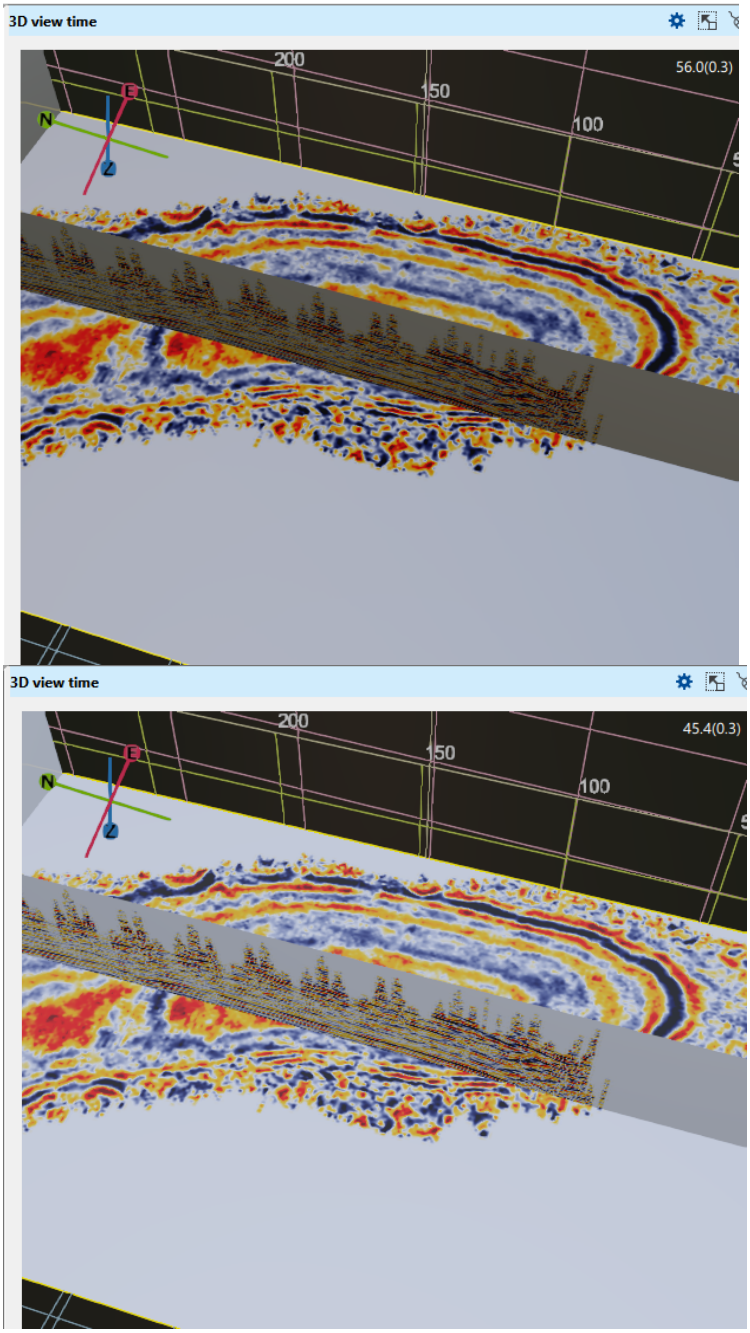
Metalness This parameter is similar to brightness/contrast. By default it is 1. If the user changes this to a lower value say 0.2, the contrast will increases as shown below.



Roughness This parameter is also similar to Metalness. The default value is 0.75. It can acts like brightness/contrast as shown below. We changed the default value from 0.75 to 0.1 and this is how it looks like.

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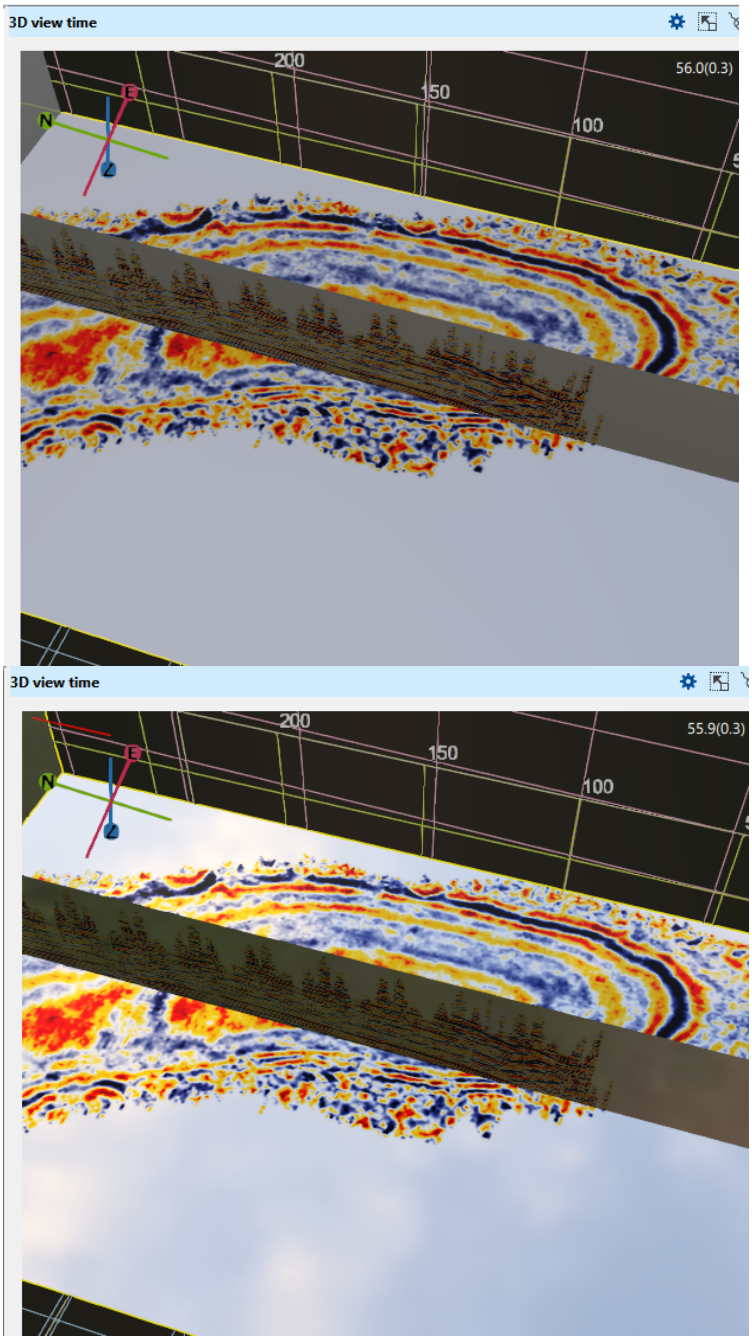

TTD Time To Depth adjusts the volume's size by either expanding or compressing it. The default TTD value is set to 2000. In the display, the left side shows the volume with a TTD of 2000, while the right side shows the same volume with a TTD of 1000. In the latter case, the vertical scale appears reduced (zoomed out/in), effectively altering the vertical axis's scalar value.

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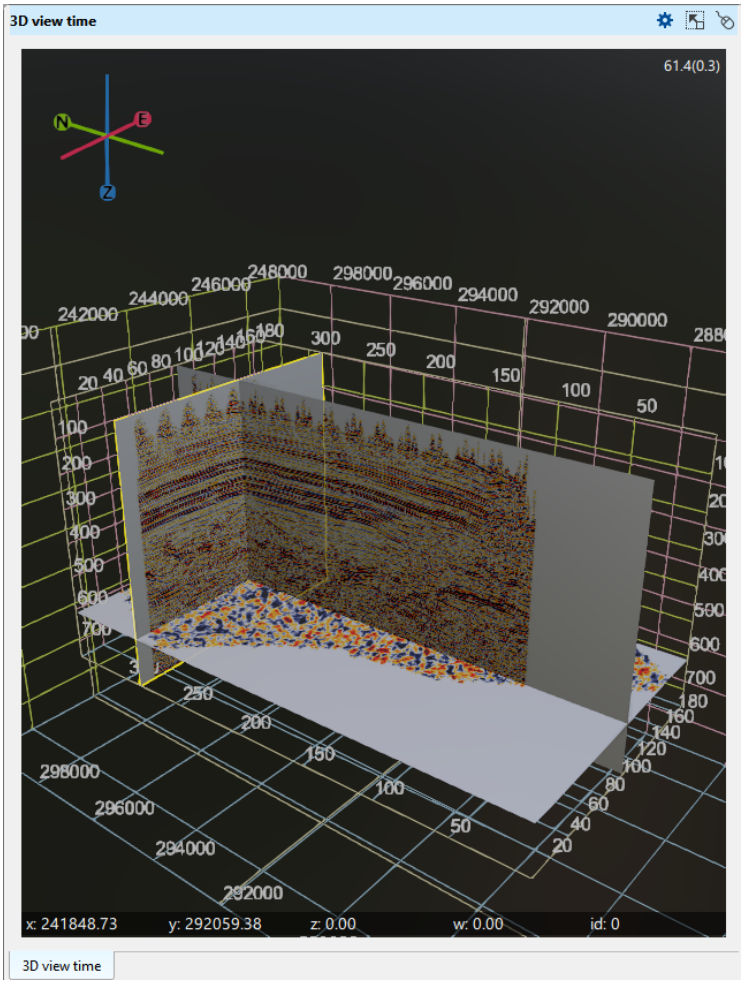
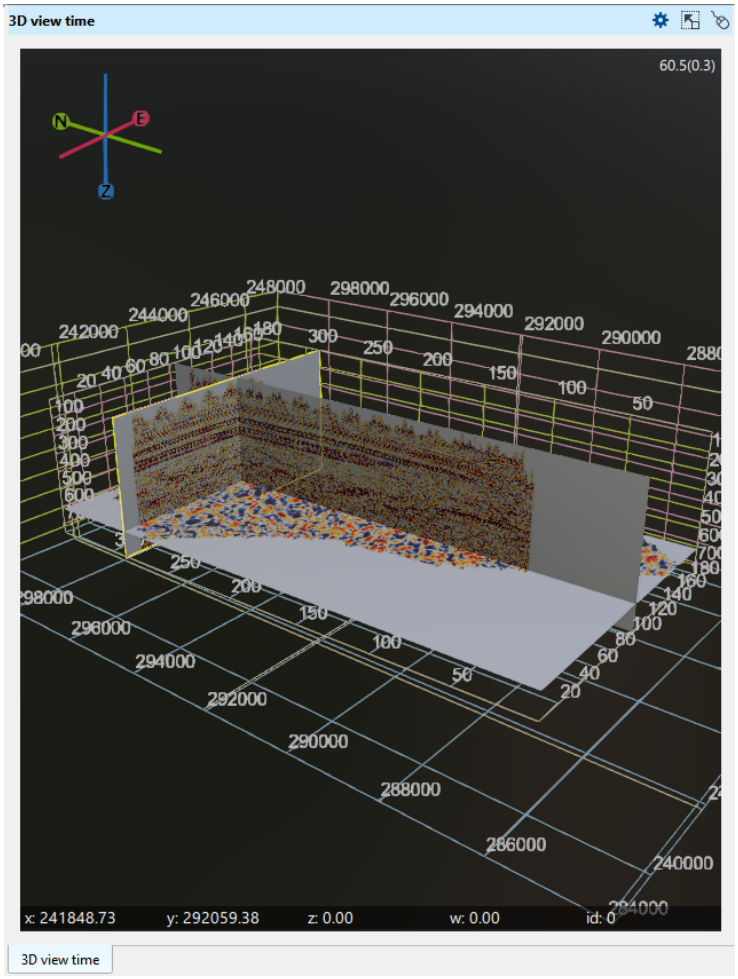


© 2026 Geomage 2003 LTD



Attribute multiplier This parameter is like adding gain to the selected display. By default it is 1. When we change it from 1 to 5, it looks like the below shown image.

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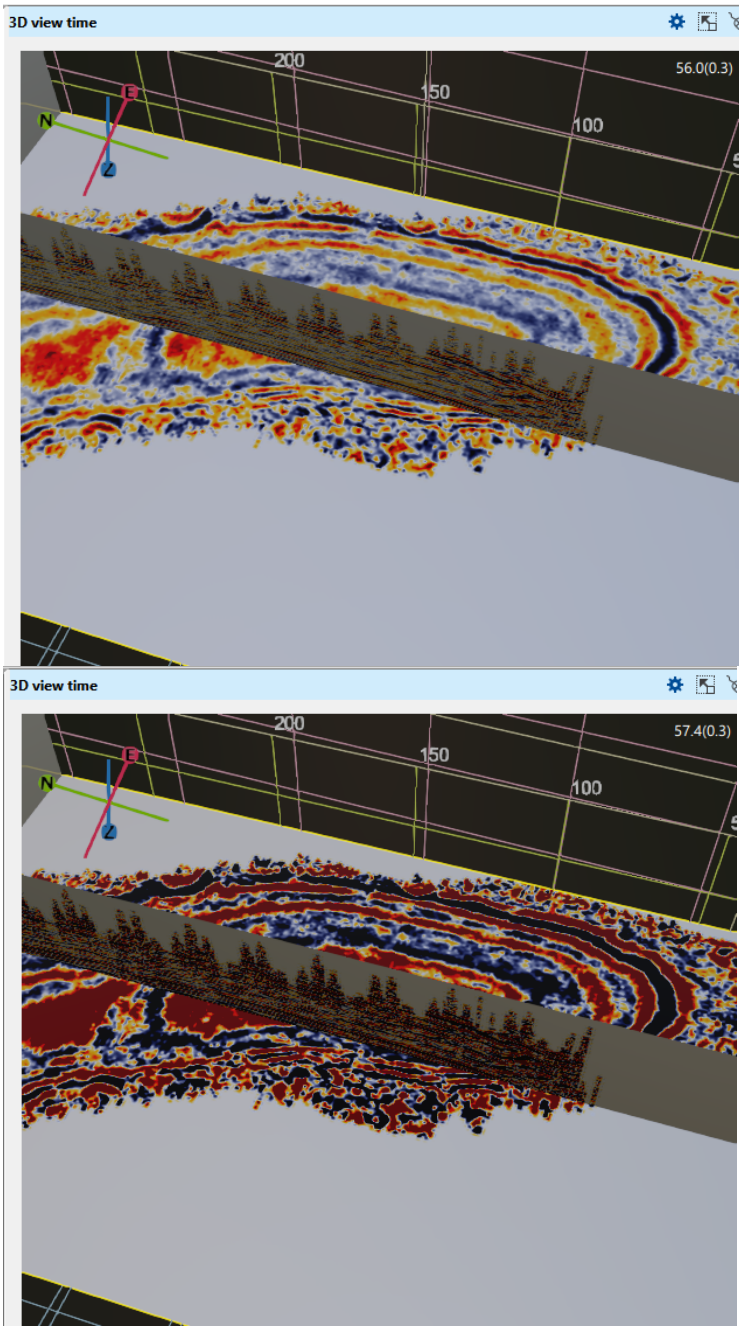

Perspective It is related to 3D projection. By default it is checked, if it is unchecked the object (in that case like a well marker) the one closer to the focus point is bigger than the one far way from the focus point.

AO AO stands for **Ambient Occulusion**.

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Surface value from Z If the horizons are having attributes (frequency, envelope etc) and the the surface value from Z is turned off, it will take the colorization from the actual attribute value. If the surface value from Z is checked, the colorization will take it from the Z value (time/depth)

IBL enabled **IBL** stands for **Image Based Lighting (IBL).** By default, it is checked(TRUE). It is also related to the display parameters. When this is disabled, the display looks very less in brightness.

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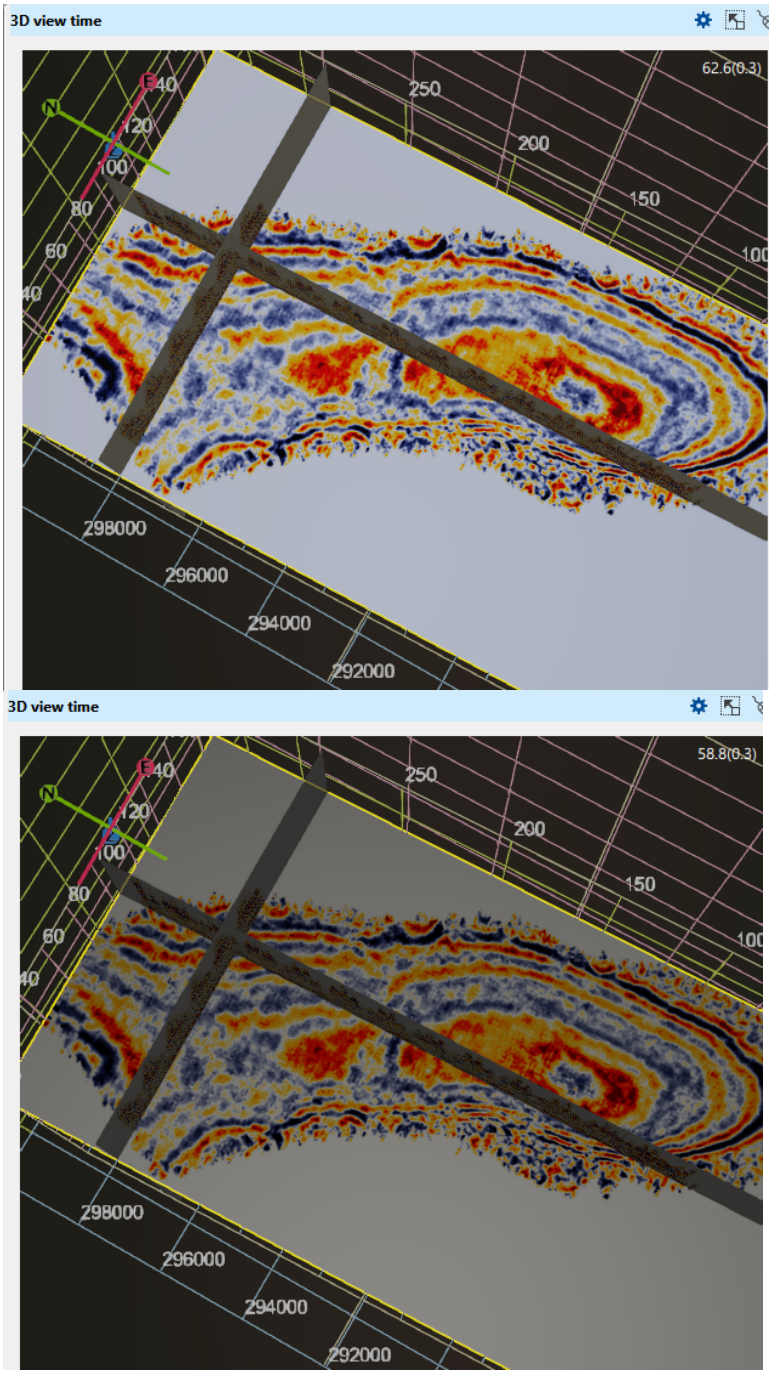

IBL multiplier This parameter is directly associated with the **IBL enabled** parameter. By default it is 1. If we change it into say 10, it exponentially increases the brightness.

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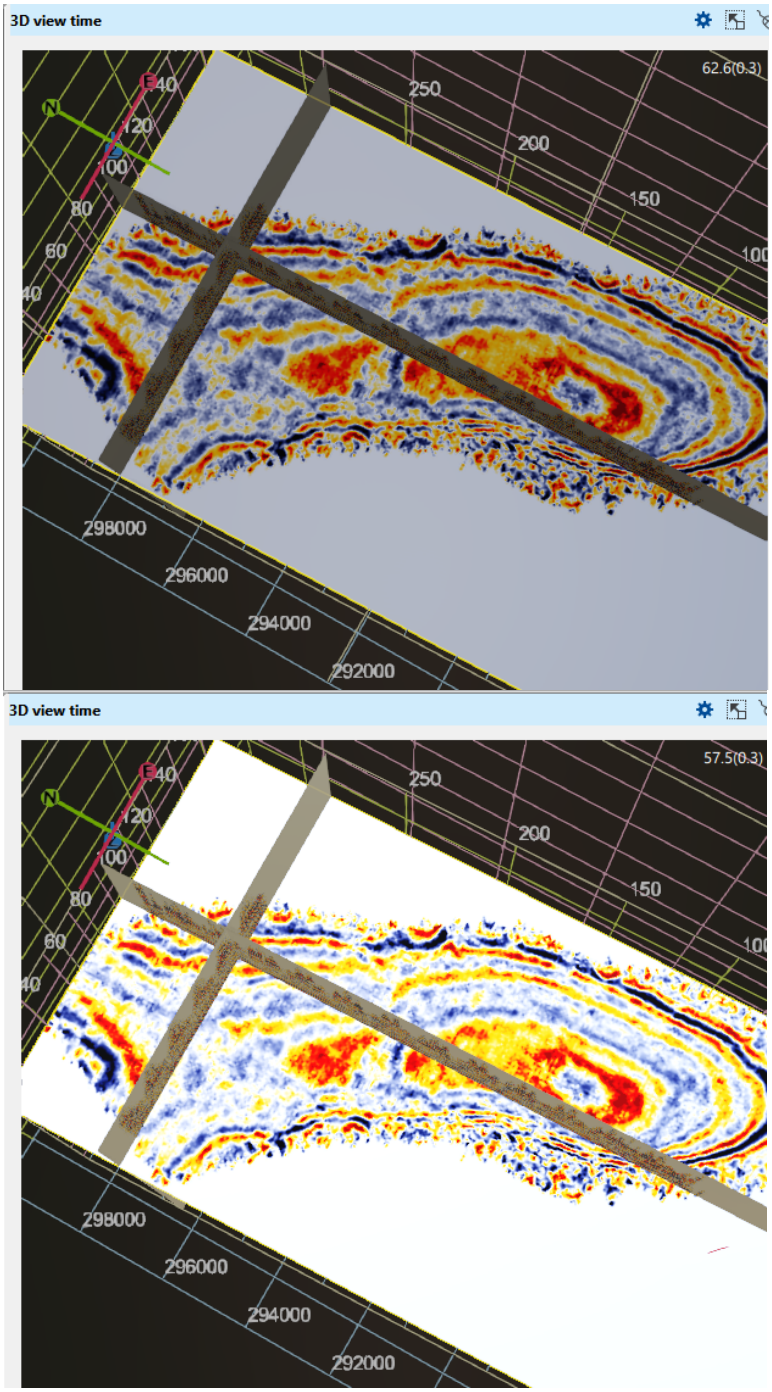

Vista(s) tab:

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AVO colored bins selected on AVO crossplot	displaying the calculated AVO parameters and
Loaded gathers window	displaying all the loaded 2D lines in the 3D view time
3D volume time	displaying all the loaded 3D volumes
3D Cube attribute time envelope, coherency	displaying any available attributes like frequency,
Surface seismic 2D geometry the line boundary	displaying the loaded 2D seismic lines geometry i.e.

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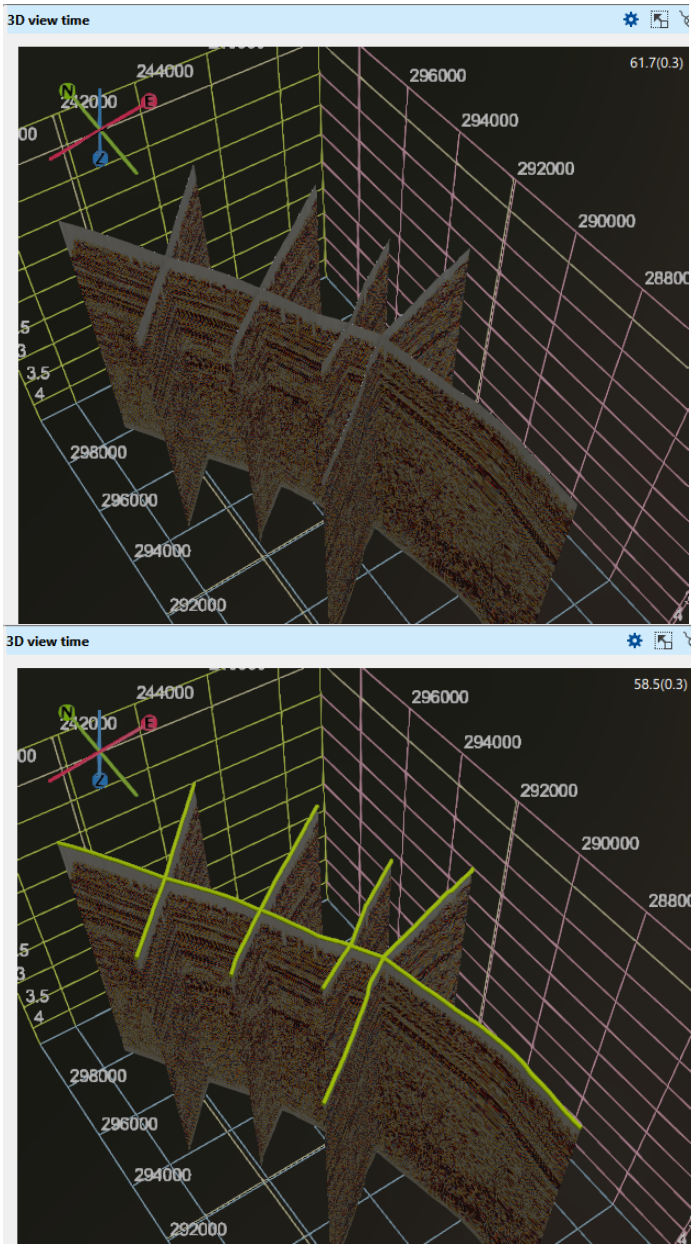

Surface seismic 3D geometry It will display the loaded 3D volume boundary like all the corner points.

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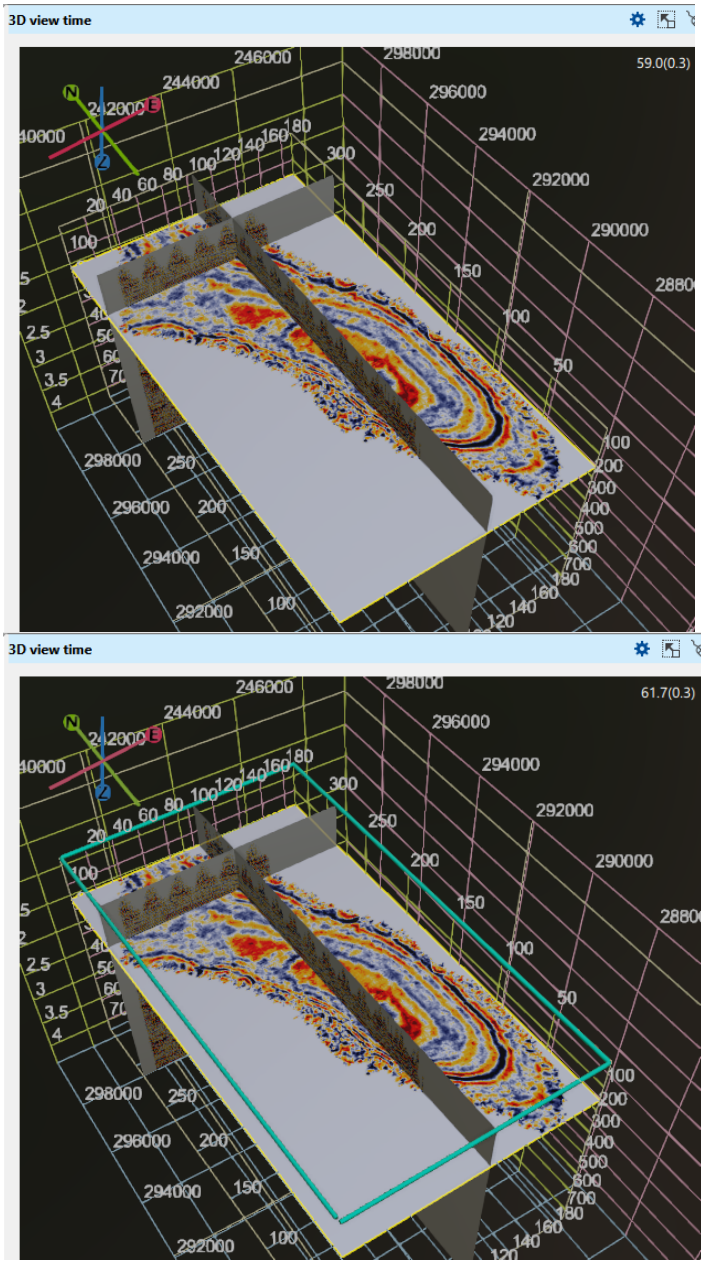

Arbitrary line 3D Displays an arbitrary line

Horizon 3D Topo Displays the topographical horizon

Fault picks This section displays the fault picks. By default, the Vista item properties are set to a size of 0.2. Users can adjust this value to view the fault picks in a larger size.

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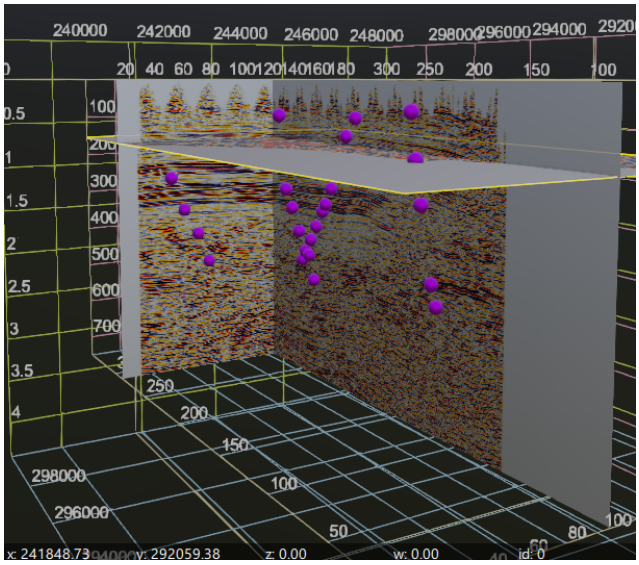

Fault sticks 3D This feature functions similarly to the Fault Picks Vista item but displays the fault points as a line or stick. It connects the fault points into a continuous line. When both Fault Picks and Fault Sticks are enabled, the display will show a combined view, as illustrated in the right image below.

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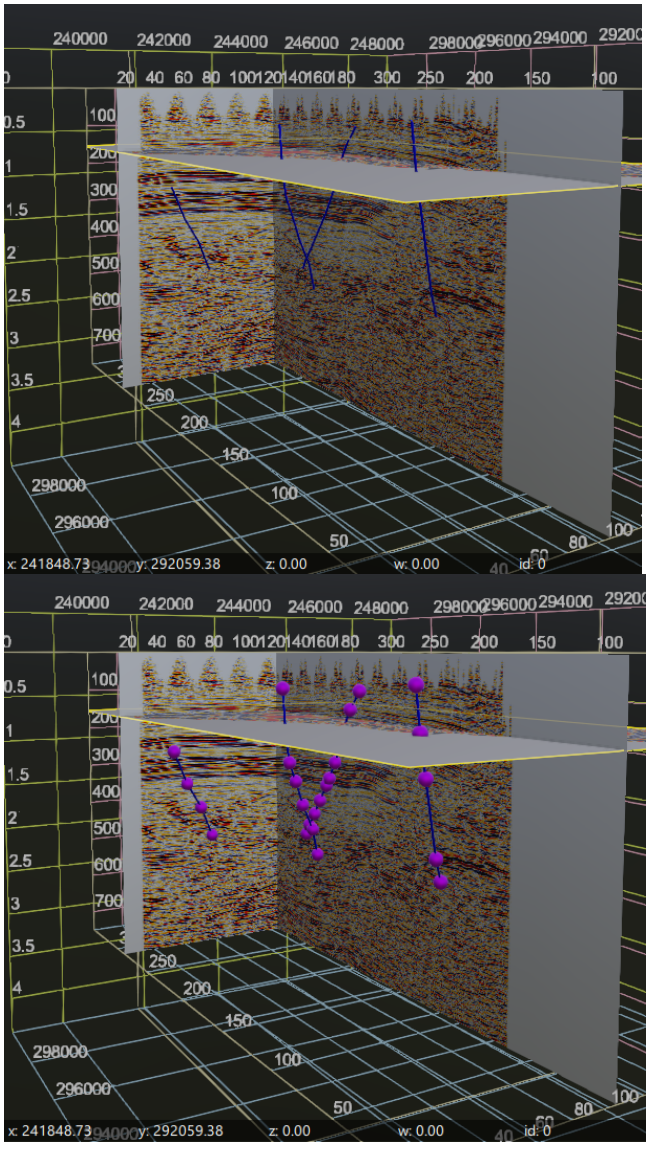

Fault 3D Shows a surface that connects all the sticks associated with the same fault, displaying all the picked or loaded faults in 3D view.

Wells 3D All the loaded wells are displayed here. To manage the visibility of the wells, expand the Wells 3D Vista item to check or uncheck them.

Well rig 3D Displays the well rig.

Markers 3D Displays all the well markers**.**

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Observing segment Whenever the user selects any bin on the location map, the corresponding position is displayed on the 3D view time window.

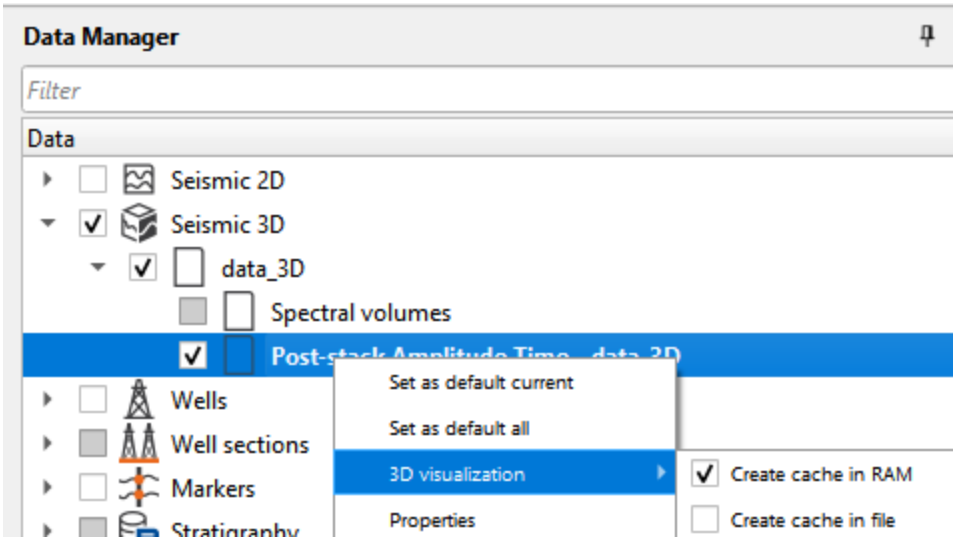
Polygon 3D Displays all the loaded polygons**.**

Polygon selection 3D Displays the current/selected or default polygon**.**

Handling the volume if the memory (RAM) is not enough

If the user is having enough memory for considerable volume size, they can use the option "**Create cache in RAM**". To do that, the user should go to **Data Manager** --> **Seismic 3D** --> **Post-stack Amplitude Time - data_3D** (whatever the name the user has given during the loading of the 3D volume) --> **Right click** --> **3D visualization** --> **Create cache in RAM**. This will use the on board memory to display the 3D volume.

In case the user doesn't have enough memory then they can select the option "**Create cache in file**". This will take little longer time to create cache file when compared to RAM option (depending on the size of the volume, hard disk type (HDD/SSD)). Once the process is completed, now it will access the file from the hard disk and display the 3D volume. The visualization of the 3D volume speed is as good as accessing from the RAM.



Hot keys

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To rotate the volume in any direction use **MB3** (Right mouse button). User can also able to do the rotation by holding **Ctrl+MB3** button.

To move the volume either up/down or left/right, use **Shift+MB3**(Right mouse button). This option won't rotate the volume. It will remain in it's original position during the movement of volume quite contrast to using **Ctrl+MB3** where it rotates the volume

To move any inline/xline, just click/select on that inline/xline with **MB1** and move wherever you want.

To move the time/depth slice, it's as same as the inline/xline. Simply hold **MB1** and move up/down.

The user can use the mouse wheel (**MB2** or middle mouse button) to zoom in/out the volume.

To add additional inlines, crosslines click L, to add additional slices for 3D volume click S.

3.4.4 AVO views

AVO views group is the set of views where user can visualize pre-stack seismic data and analyze it using graphs and cross-plots

AVO includes following windows:

Image gather 159

AVA gather 162

3D image gathers 163

AVO cross-plot 165

AVO graph 166

Stack gather 169

To create AVO section view go to the Views bar 36 on the Ribbon bar 33 and open AVO tab and choose the view that you prefer for data visualization

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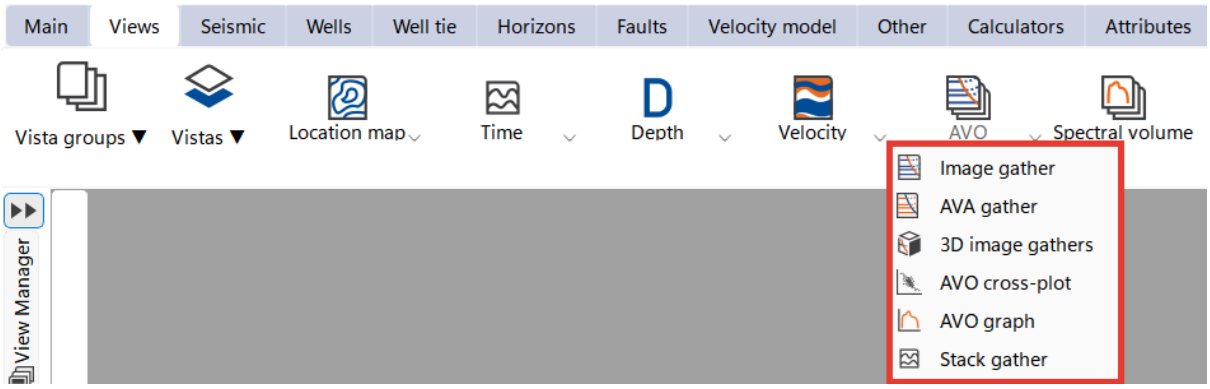

3.4.4.1 Image gather

This view displays seismic gathers, showing how amplitude varies with offset or angle for different traces. It is used to analyze AVO behavior across a range of offsets, helping to identify patterns and anomalies that may indicate changes in subsurface properties. The Image Gather View is essential for detailed AVO interpretation, allowing for the examination of amplitude variations before cross-plotting or other analyses.

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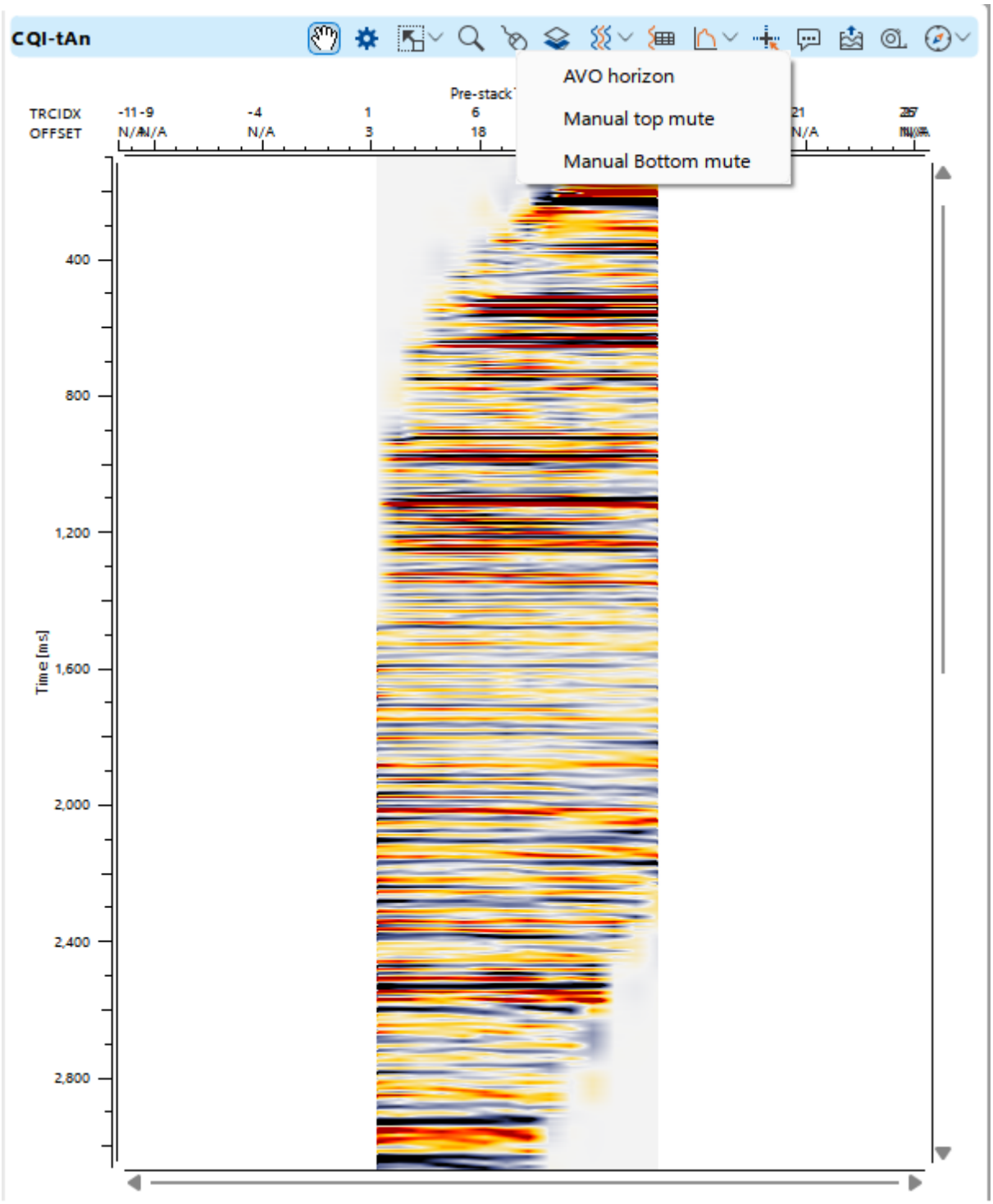

Functional panel allows user to perform the following actions:

open View properties panel

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adjust view area to all visible objects

set/unset zoomable

set control item from following options:

AVO horizon

Manual Top mute

Manual Bottom mute

add vista

select traces

trace header data

spectral analysis tool - multi selection

spectral analysis tool - single selection

enable mouse tracker

enable tool tip

export picture

ruler tool

show compass

show minimap

show scale bar

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3.4.4.2 AVA gather

This view displays amplitude versus angle (AVA) data across seismic gathers, allowing for the analysis of how amplitude changes with the angle of incidence. It is useful for identifying variations in subsurface properties, such as lithology or fluid content, by examining the angle-dependent behavior of seismic reflections. The AVA Gather View is crucial for detailed AVA interpretation before further analysis or cross-plotting

Functional panel allows user to perform the following actions:

open View properties panel

adjust view area to all visible objects

set/unset zoomable

set control item

add vista

select traces

trace header data

spectral analysis tool - multi selection

spectral analysis tool - single selection

enable mouse tracker

enable tool tip

export picture

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ruler tool

show compass

show minimap

 show scale bar

3.4.4.3 3D image gathers

3D image gathers is a window that allows users to operate and visualize any AVO/AVA data in a 3D perspective.

Structurally, the **3D Image Gathers** view shares many settings and functionalities with the general 3D View, providing a familiar interface for users. Key customization options include color scaling, amplitude thresholds, transparency adjustments, and the ability to filter by offset or angle ranges, allowing focused analysis of specific features within the dataset. This versatility supports the identification of amplitude anomalies across different offsets and angles, a fundamental aspect of AVO/AVA interpretation.

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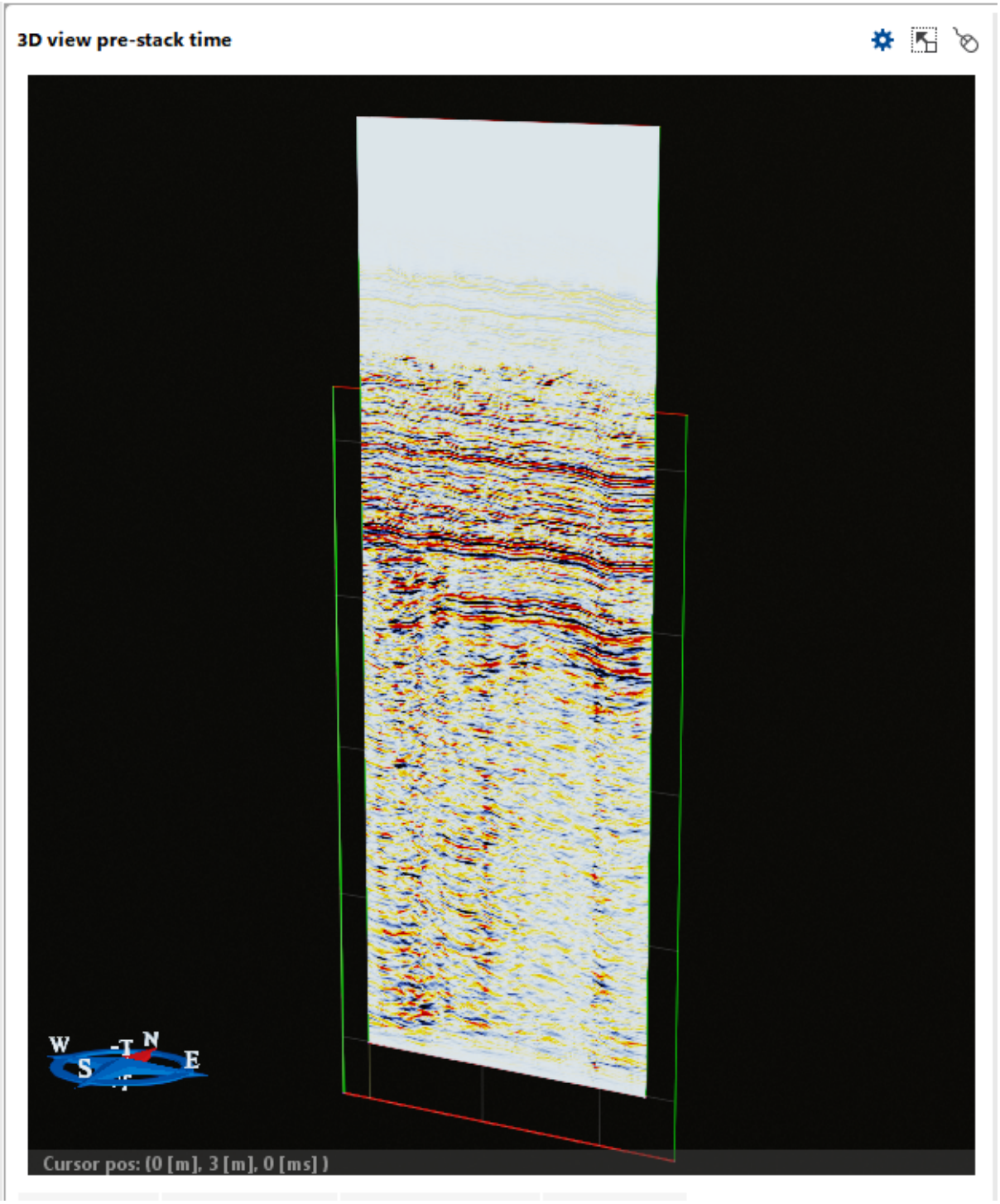

Integration with other views, such as Gather Conditioning 483, enables a comprehensive workflow for assessing and conditioning prestack data. By synchronizing data between views, users can streamline their AVO/AVA analysis, ensuring consistency and enhancing the overall understanding of geological features.

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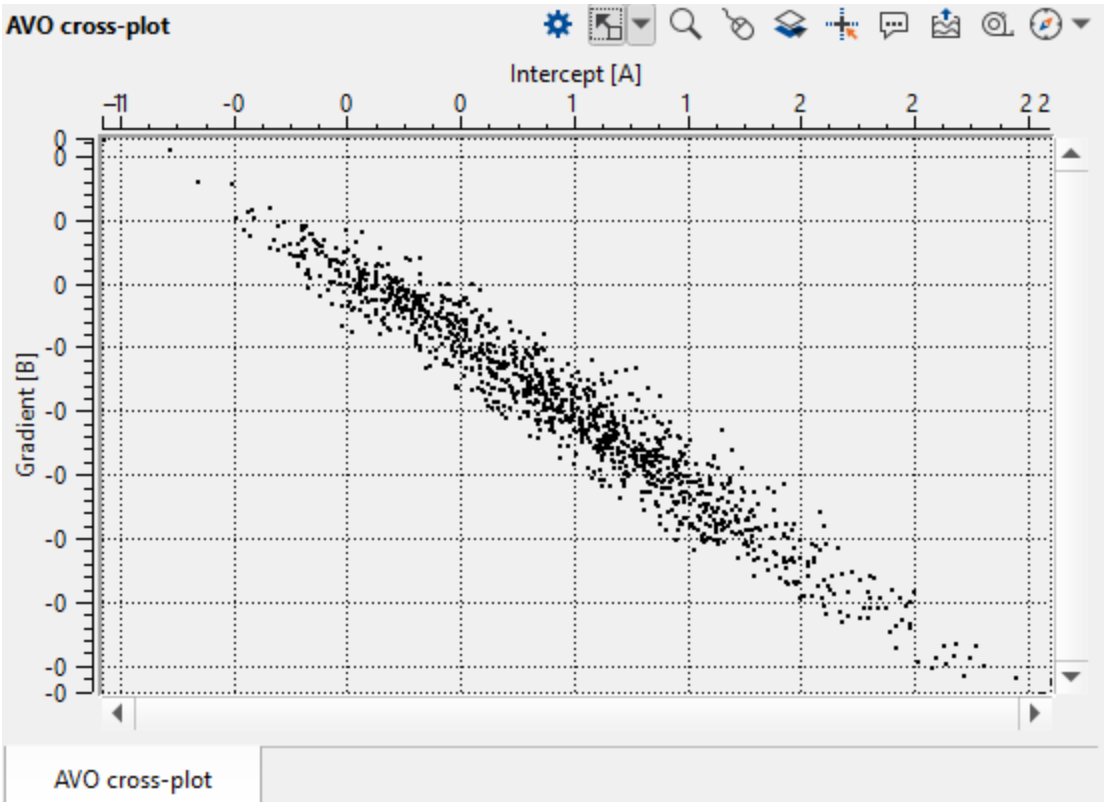
3.4.4.4 AVO cross-plot

This scatter plot visualizes AVO data with the x-axis representing the intercept (amplitude at zero offset) and the y-axis representing the gradient (rate of change of amplitude with offset). It is used to quantitatively compare AVO responses from different locations or horizons on a common scale, making it easier to identify data clusters that may indicate specific lithologies or fluid types.



The newly created view will appear in the View manager 90 in the active Workspase 114. User can place AVO cross-plot view by dragging it to any workspace except pre-defined once (Seismic data 118 and Well data 121).

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To define the object visibility stile go to the View properties 101 by pressing in the view functional panel or find it in the panel 84 sets.

Functional panel allows user to perform the following actions:

open View properties panel

adjust view area to all visible objects

set/unset zoomable

set control item

add vista

enable mouse tracker

enable tool tip

export picture

ruler tool

show compass

show minimap

show scale bar

3.4.4.5 AVO graph

This tool graphically represents Amplitude Versus Offset (AVO) data, displaying the relationship between reflection amplitude and offset for selected data points, helping to identify potential hydrocarbon indicators, lithology variations, or fluid content. Users can interactively adjust parameters, filter data points, and apply color-coding or clustering to enhance the analysis.

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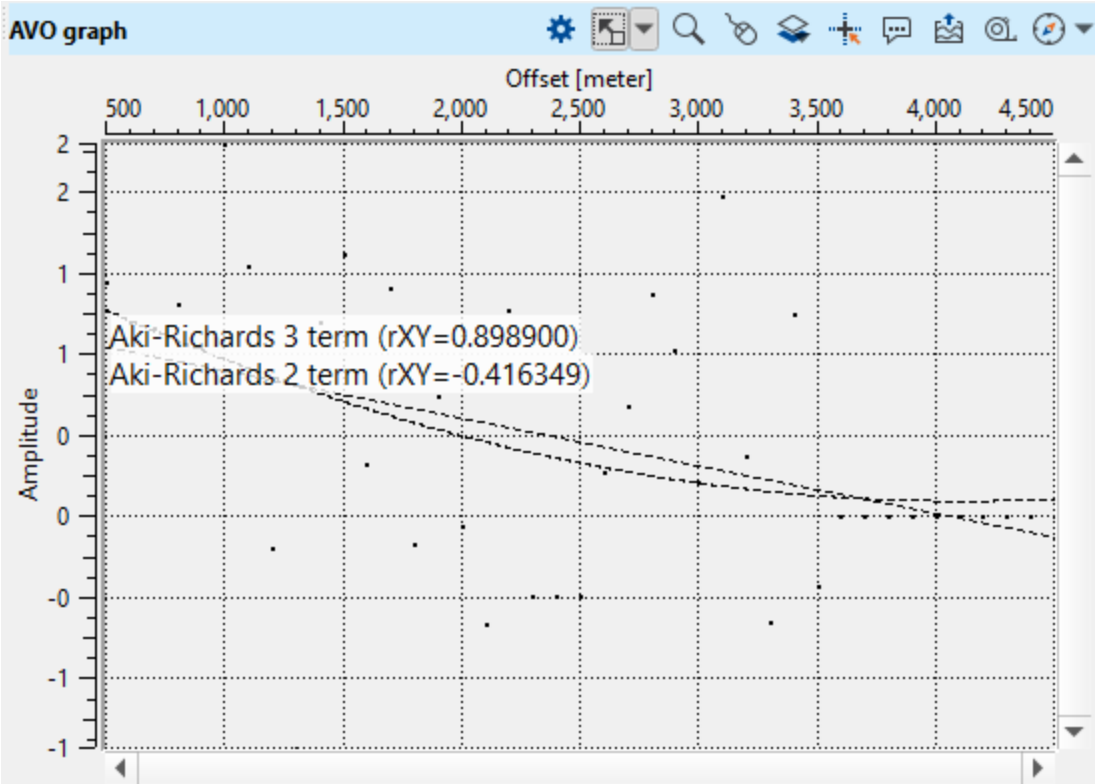

Aki-Richards Approximation Lines

Two approximation curves are overlaid on the data points to model the expected AVO response:

1. **Aki-Richards 2-Term Approximation**: This line uses the first two terms of the Aki-Richards equation, focusing on the intercept and gradient. It provides a simpler approximation that emphasizes the general trend of amplitude variation with offset.
   - **Correlation coefficient (rXY)**: The value displayed here (e.g., -0.416349) represents the correlation between the observed data points and the 2-term approximation, indicating how well this simpler model fits the data.
2. **Aki-Richards 3-Term Approximation**: This line incorporates an additional curvature term, offering a more detailed fit by considering higher-order effects significant at larger offsets.
   - **Correlation coefficient (rXY)**: This value (e.g., 0.898900) indicates the correlation between the observed data and the 3-term model, showing an improved fit with this additional term for higher accuracy in complex cases.

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Notes

- *Use the 2-term approximation to get a quick estimate of amplitude trends, especially when analyzing data with smaller offsets.*
- *Apply the 3-term approximation for datasets with a broader range of offsets or when high accuracy is required, as it captures more subtle effects related to rock properties and fluid content.*

The newly created view will appear in the View manager 90 in the active Workspase 114. User can place AVO graph view by dragging it to any workspace except pre-defined once (Seismic data 118 and Well data 121).

To define the object visibility stile go to the View properties 101 by pressing in the view functional panel or find it in the panel 84 sets.

Functional panel allows user to perform the following actions:

open View properties panel

adjust view area to all visible objects

set/unset zoomable

set control item

add vista

enable mouse tracker

enable tool tip

export picture

ruler tool

show compass

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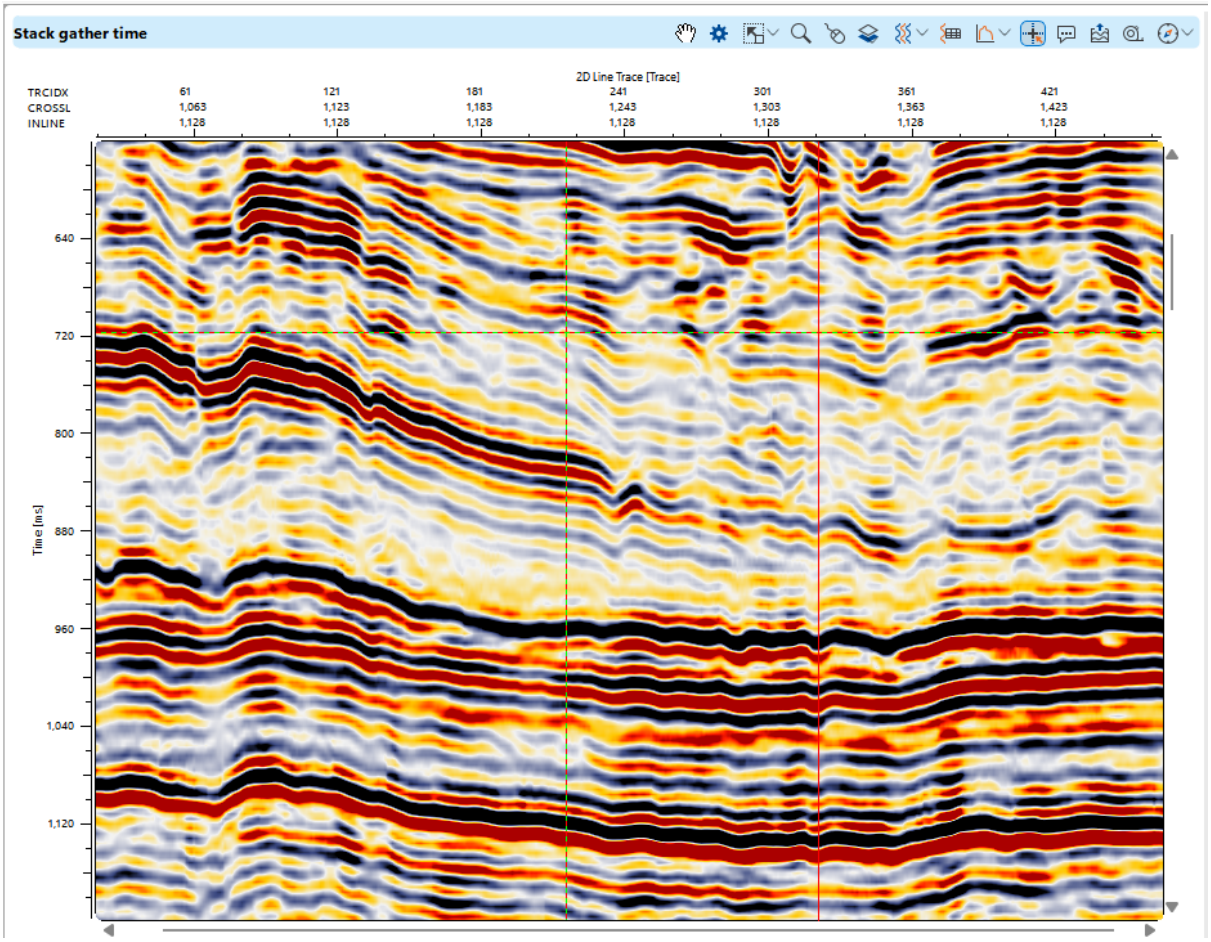
show minimap

show scale bar

3.4.4.6 Stack gather

This view presents stacked seismic data over time, combining multiple traces to enhance signal quality and reduce noise. It is used to analyze the summed seismic response at various time intervals, providing a clearer picture of subsurface structures and reflections. The Stack Gather Time View is essential for interpreting the overall seismic response and identifying key geological features.



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The newly created view will appear in the View manager 90 in the active Workspase 114. User can place Stack gather view by dragging it to any workspace except pre-defined once (Seismic data 118 and Well data 121).

To define the object visibility stile go to the View properties 101 by pressing in the view functional panel or find it in the panel 84 sets.

Functional panel allows user to perform the following actions:

open View properties panel

adjust view area to all visible objects

set/unset zoomable

set control item

add vista

select traces

trace header data

spectral analysis tool - multi selection

spectral analysis tool - single selection

enable mouse tracker

enable tool tip

export picture

ruler tool

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show compass

show minimap

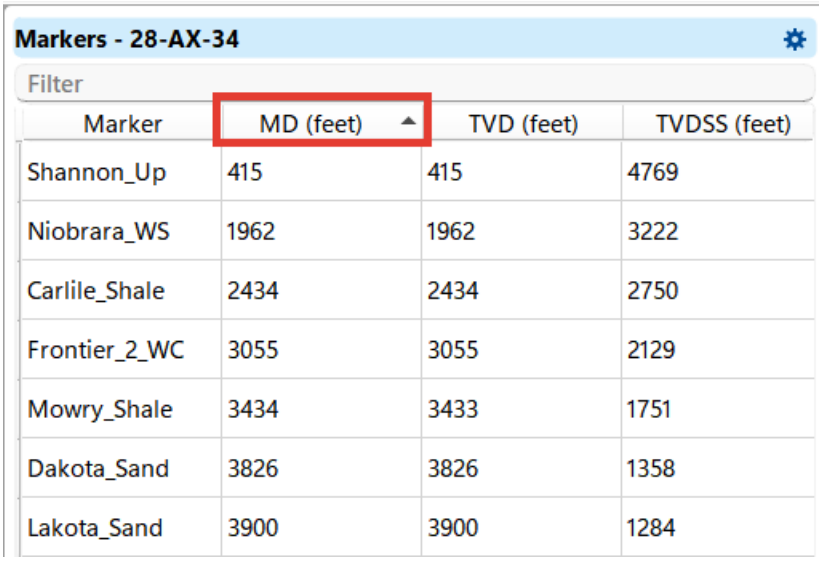
show scale bar

3.4.5 Table view

This window provides a convenient interface for reviewing and editing various types of data in a table format.

It is particularly useful for managing markers data, log data, seismic attributes, well logs, contacts data, fault data, grid reports and other subsurface information. This feature allows for efficient data updating, comparison, and quality control, making it an essential tool for ensuring the accuracy and consistency of the geo dataset.

Data can be easily sorted by values in descending/ascending or alphabetical order in each column by clicking on the column name, and you can also manually change the values in any cell by double-clicking on it.



Markers - 28-AX-34

Filter

Marker	MD (feet)	TVD (feet)	TVDSS (feet)
Shannon_Up	415	415	4769
Niobrara_WS	1962	1962	3222
Carlile_Shale	2434	2434	2750
Frontier_2_WC	3055	3055	2129
Mowry_Shale	3434	3433	1751
Dakota_Sand	3826	3826	1358
Lakota_Sand	3900	3900	1284

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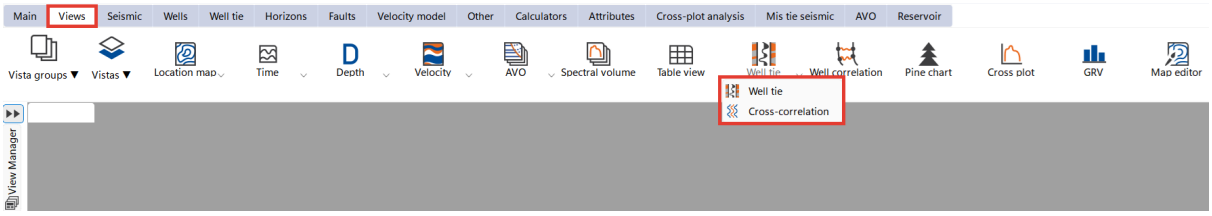
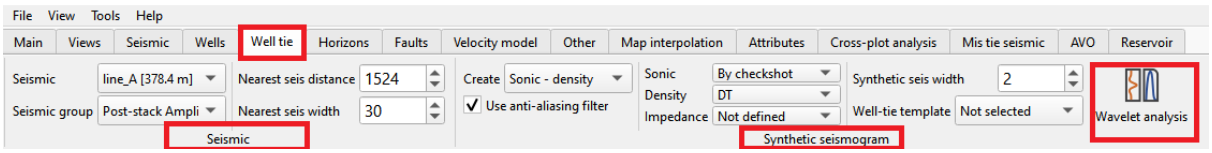
3.4.6 Well tie view

This view is designed for performing, analyzing, and visualizing the well tie process and its results. It consists of two windows: the first displays seismic and well data, while the second shows the cross-correlation function as a numerical outcome of the well tie analysis. This setup allows users to assess the alignment between seismic data and well logs effectively.



Well time view is a customizable window where users can independently display the data they need for their work, such as log data, time-depth curves, seismic traces, and synthetic traces.

To configure this window, users need to go to the Well Tie bar 62 in the Ribbon bar 33 and select the data required for visualization. The user should have seismic data, well information (check shots/sonic/density/Impedance) to perform the seismic to well tie.



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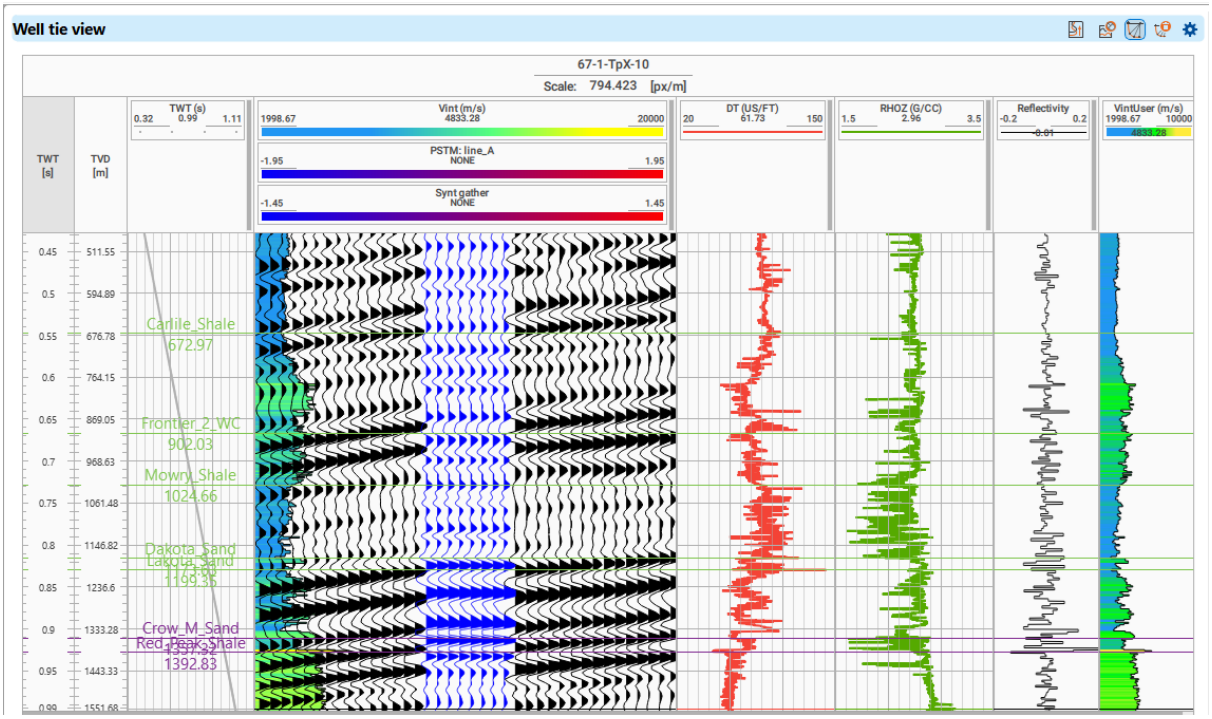

The newly created view will appear in the View manager 90 in the active Workspase 114.

For visualization settings, users can right-click to open the Settings window for the currently active track.

The orange locks with the letters S and Z indicate the scale settings, allowing you to enable or disable scrolling and zooming, respectively, with or without pressing the mouse wheel.

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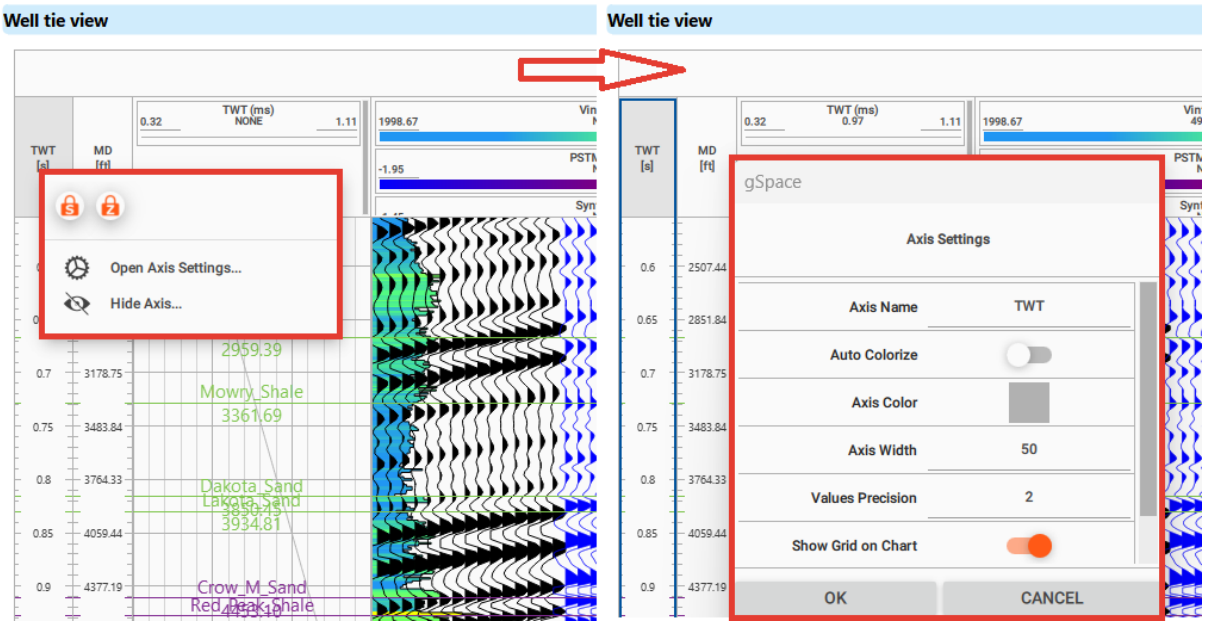

You can easily switch between the settings of each track without closing the settings window by simply clicking on the track you need.
The active track will be highlighted in blue.

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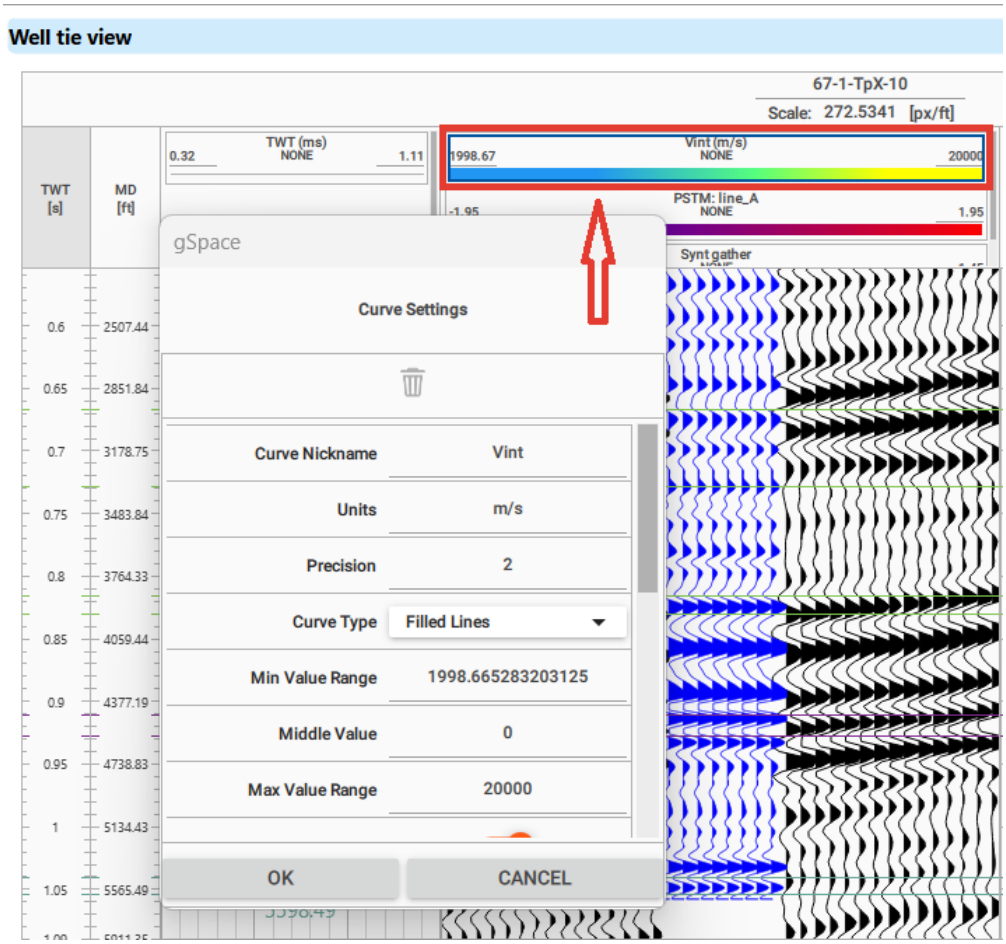

Clicking on the top field with the well name activates the **Global settings**, which include the following list provided below.

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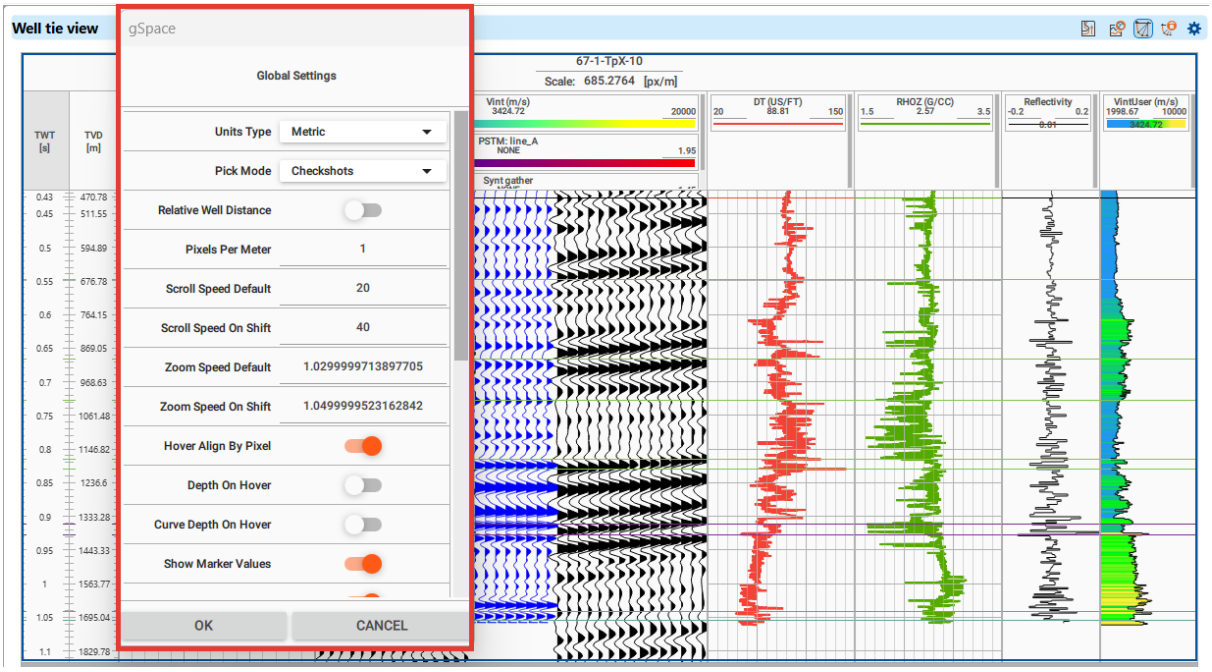

You can also access the **Global settings** by right-clicking on the field with the well name, where you will also find the following functionality:

Propagate Well Dimension Once it is activated, it will propagate the same settings across all the wells.

Fit Well to Content It will fit all the wells to the same. It is kind of Zoomed out.

Full size mode It will open a new window for print friendly image to print the well correlation.

Save Template The user can save the whole setup as a template. You can select a saved template from the Well tie bar 62 under Well Tie Template.

Add New Well This will allow the user to add any additional wells.

Remove Well As the name suggest, the user can remove any wells from the display.

Add New Track It will add an empty track

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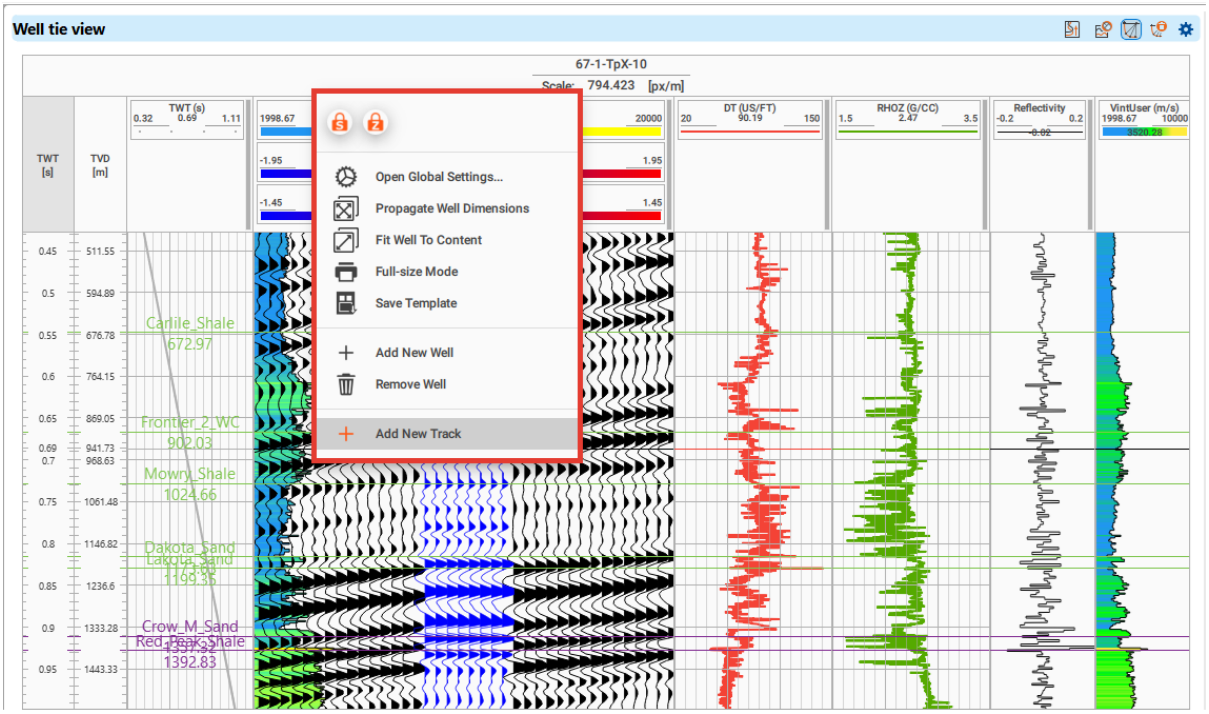

Global settings description

Unit Type The user choose either Metric or Imperial from the drop down menu.

Pick Mode The user choose either Checkshots or Markers

Relative Well Distance By default OFF. If turned ON, it will display the relative well distance

Scroll Speed Default Default scrolling speed settings

Scroll Speed on Shift Adjusts scrolling speed

Zoom Speed Default Default zooming speed settings

Zoom Speed on Shift Adjusts zooming speed

Depth on Hover Displays the MD when the cursor is hovered on the well log.

Curve Depth On Hover Displays the curved depth of the well log.

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Show Marker Values Displays marker depth values of the well log.

Show Marker Names It will show the marker names of the well log.

Marker Zoom on Hover Enables zooming into markers when the cursor hovers over them.

Propagate Curve data Enables the synchronization of curve data across multiple displays or sections, ensuring consistent updates to related curves when changes are made.

Marker Label Font Sets the font style and size for labels associated with markers.

Axis Font Sets the font style and size for labels associated with axis.

Default Brush Size Defines the default size of the brush tool used for marking or drawing on the display.

Frame Around Lithology Adds a frame around lithology displays.

Linear Velocity Defines the constant velocity used for converting time-based seismic data to depth or distance.

UI COLORS The User Interface (UI) to modify the color settings. When we click on it, it will expand. The user can change the foreground/back ground etc. To collapse it, just click on it one more time.

UI DIMENSIONS These settings are related to the Tracks/Horizons/Check shot height and width dimensions. The user can modify as per their choice.

AXIS SETTINGS Inside these settings, the user can ON/OFF the Markers/TWT/TVD etc.

MARKERS VISIBILITY All the loaded markers appear here. The user have the complete control to display which one needed to be displayed.

The **Cross-correlation view** is essential for evaluating the alignment between well log data and seismic data during the well-to-seismic tie process. It displays the cross-correlation function, which quantifies the similarity between the synthetic seismic trace (generated from well logs) and the actual seismic trace. By analyzing the cross-correlation values, users can adjust the time-depth relationship to achieve the best match, ensuring accurate ties between well data and seismic reflections.

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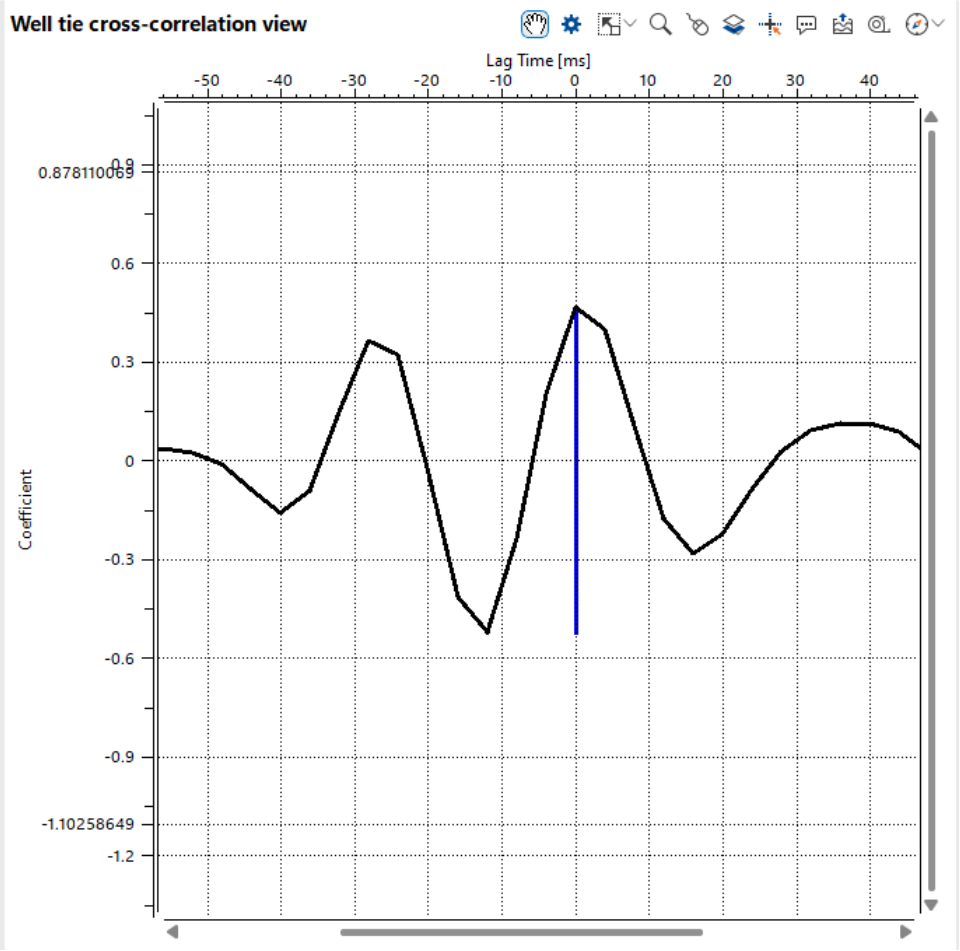

Functional panel allows user to perform the following actions:

- open View properties panel
- adjust view area to all visible objects
- set/unset zoomable
- set control item
- add vista
- enable mouse tracker

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enable tool tip

export picture

ruler tool

show compass

show minimap

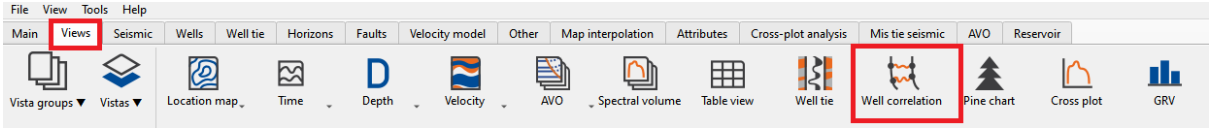
show scale bar

An example of a well-to-seismic tie, along with a detailed description of the required data, can be found in the Best Practice Flows - > Well Tie 379 section

3.4.7 Well correlation view

Well correlation - allows the user to create views where the user can visualize the different types of the well data such as log data (continuous and discrete), point data, comment logs etc. Well correlation view is designed to perform easy stratigraphic log correlation.

To create Well correlation view go to the Views bar 36 in the Ribbon bar 33 and click on **Well Correlation** option:



Below is an example display of a well correlation window.

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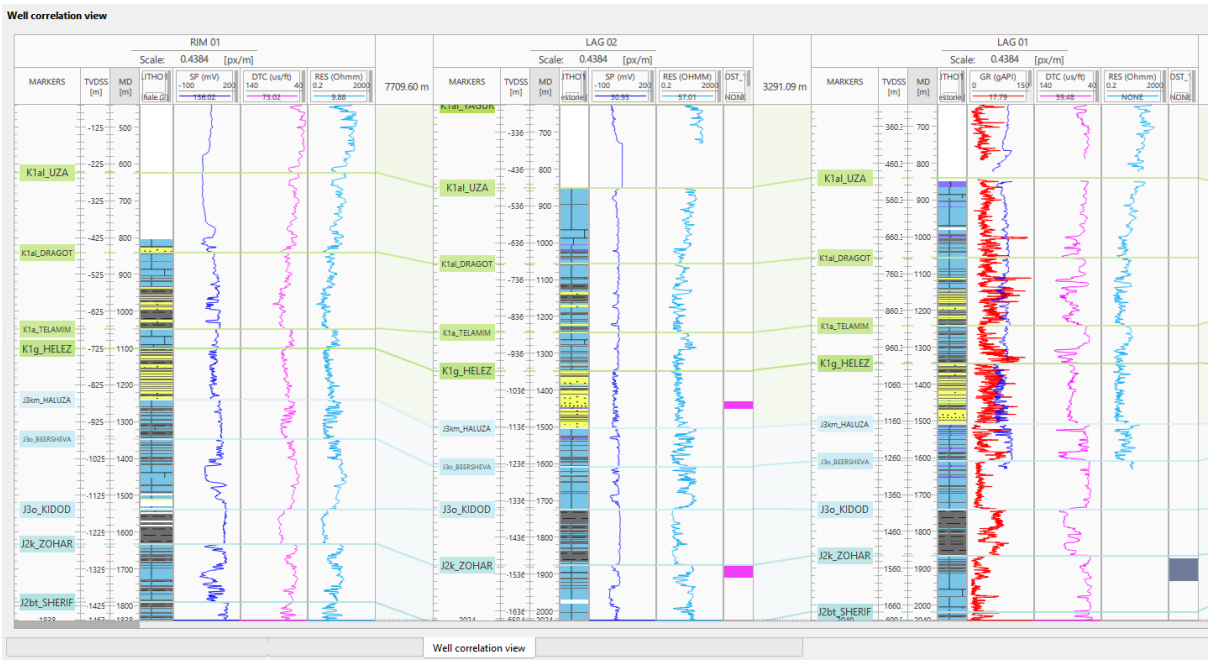

Adding Well sections:

To add a well section, navigate to the Data Manager. Right-click within the interface and select "Add Well Section" from the context menu. A new window will appear prompting you to provide a name for the well section. Enter the desired name and confirm your selection.

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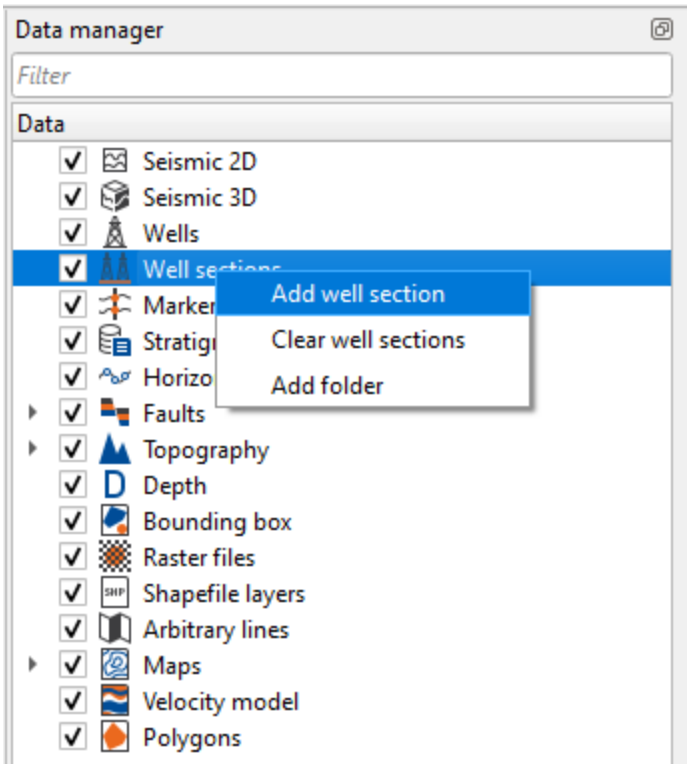
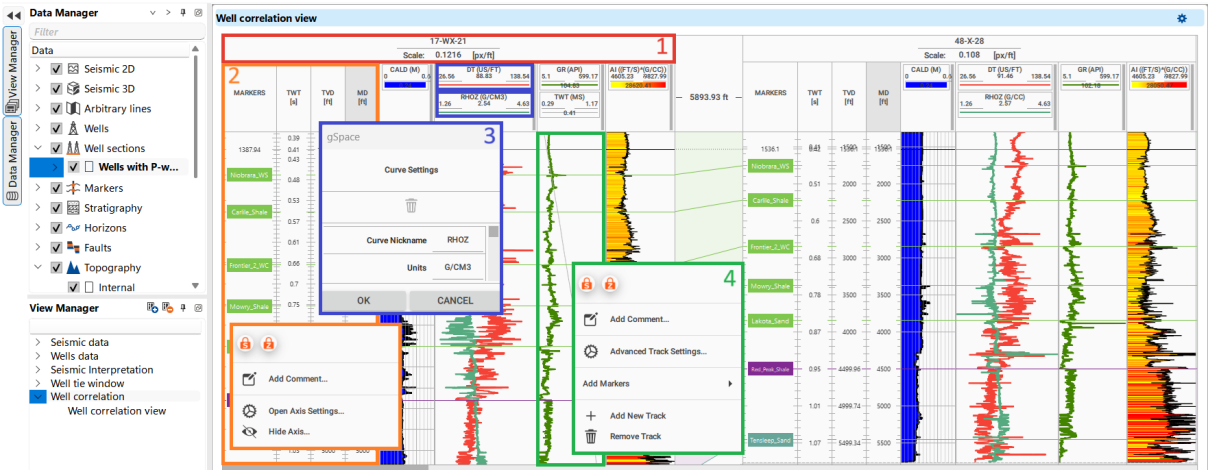


General settings:

In the following example, we are going to learn how to add/remove wells/tracks/horizons etc for any well inside the well correlation window.



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The user should be aware of several key functions related to well correlation within the software. The different tracks and displays are highlighted in the picture, and to access their settings, the user can right-click on each section.

Well Name Display (1 - Red): The area at the top of the window highlighted in red shows the well name. Right-clicking on this section allows access to global settings for the well.

A more detailed description of the global settings can be found below.

Axis Tracks and Settings (2 - Orange): The orange-highlighted areas indicate the axis tracks, which display depth, time, or other log data along the vertical axis.

By right-clicking on these tracks, users can access settings to adjust the scale or other visualization options specific to the axis.

The vertical axis can be zoomed in or out by placing the cursor within the axis track and adjusting the scale accordingly. In contrast, the horizontal axis can be scrolled from right to left and vice versa.

To set the priority scale, first, visualize the desired axis, then right-click to open its settings, and make it active.

The title of the active axis will turn gray, indicating it has been prioritized. By default, the priority axis is set to measured depth (MD), as shown in the figure where the MD field is highlighted in gray.

Curves Tracks and Settings (3 - Blue): The blue-highlighted sections show the individual curves or log tracks, such as GR (Gamma Ray), DT (Sonic), or AI (Acoustic Impedance).

Users can access the curve settings by right-clicking within this area, as shown in the inset labeled "3." Here, they can adjust parameters like curve nickname or units.

Tracks Displays and Settings (4 - Green): The green-highlighted areas indicate where users can manage the display of individual tracks. By right-clicking here, the user can add comments, access advanced track settings, add curves, as well as add new tracks and remove them.

To access Global Settings, the user should right-click inside the Well Name area (highlighted in red) as shown below.

Additional tools are also available.

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Open Global Settings It is where the user can add/remove any well markers/curves etc besides changing the overall look and feel of the display.

Propagate Well Dimension Once it is activated, it will propagate the same settings across all the wells.

Fit Well to Content It will fit all the wells to the same. It is kind of Zoomed out.

Full size mode It will open a new window for print friendly image to print the well correlation.

Save Template The user can save the whole setup as a template.

Add New Well This will allow the user to add any additional wells.

Remove Well As the name suggest, the user can remove any wells from the display.

Add New Track It will add an empty track

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Out of these all options, the most important one is **Open Global Settings**. We are going to learn about it in the following section.

Select **Open Global Settings** and a new pop-up window opens.

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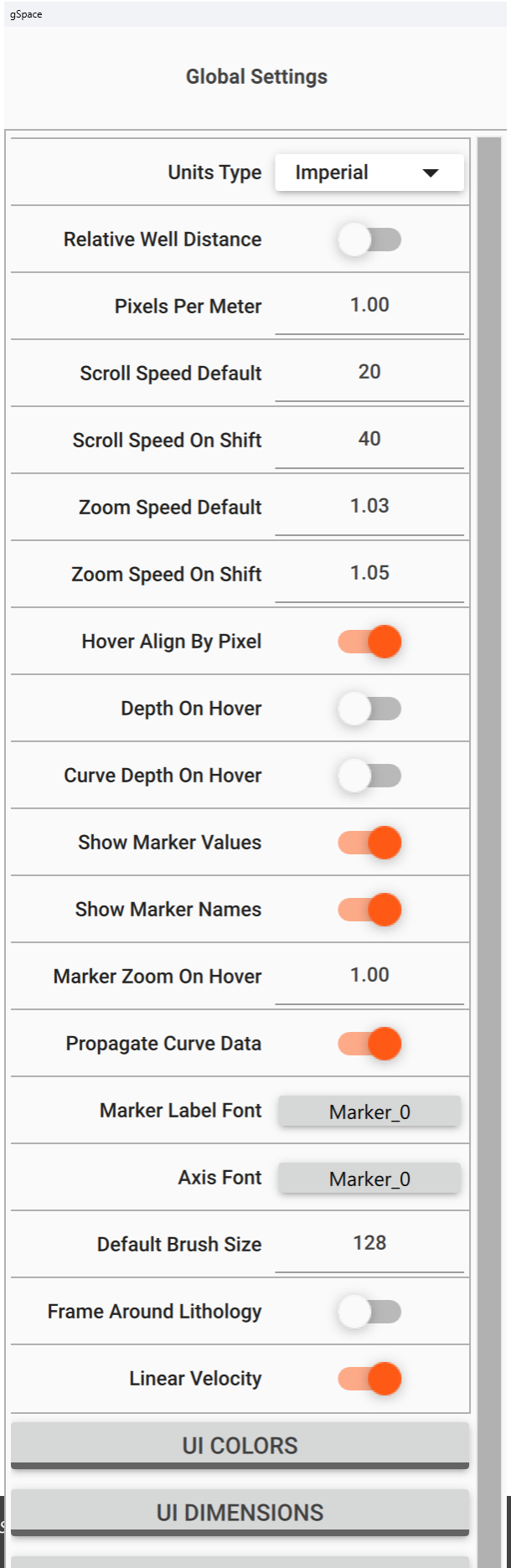

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Unit Type The user choose either Metric or Imperial from the drop down menu.

Relative Well Distance By default OFF. If turned ON, it will display the relative well distance

Depth on Hover It will display the MD when the cursor is hovered on the well log.

Curve Depth On Hover Displays the curved depth of the well log.

Show Marker Values Displays marker depth values of the well log.

Show Marker Names It will show the marker names of the well log.

Linear Velocity

UI COLORS This is nothing but User Interface (UI) to modify the color settings of the displays. When we click on it, it will expand.The user can change the foreground/back ground etc.To collapse it, just click on it one more time.

UI DIMENSIONS These settings are related to the Tracks/Horizons/Check shot height and width dimensions. The user can modify as per their choice.

AXIS SETTINGS Inside these settings, the user can ON/OFF the Markers/TWT/TVD etc.

HORIZON VISIBILITY All the loaded horizons appear here. The user have the complete control to display which horizons needed to be displayed.

There isn't a single, universally accepted international color palette for log curves, but certain conventions are commonly followed in the industry. Here are some typical color associations for log curves:

1. *Gamma Ray (GR): Green*
2. *Resistivity (ILD, LLD, etc.): Red*
3. *Density (RHOB): Brown*
4. *Neutron Porosity (NPHI): Blue*
5. *Sonic/Acoustic (DT): Black or Blue*
6. *SP (Spontaneous Potential): Black*

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7. *Porosity: Blue for neutron porosity, yellow for density porosity*
8. *Caliper: Blue or Purple*

Adding new track, well logs:

To add new track, **Right click** inside the **Well name** as shown below and select "**Add new track.** It will add an additional panel (Green rectangle) to the existing one as shown below.

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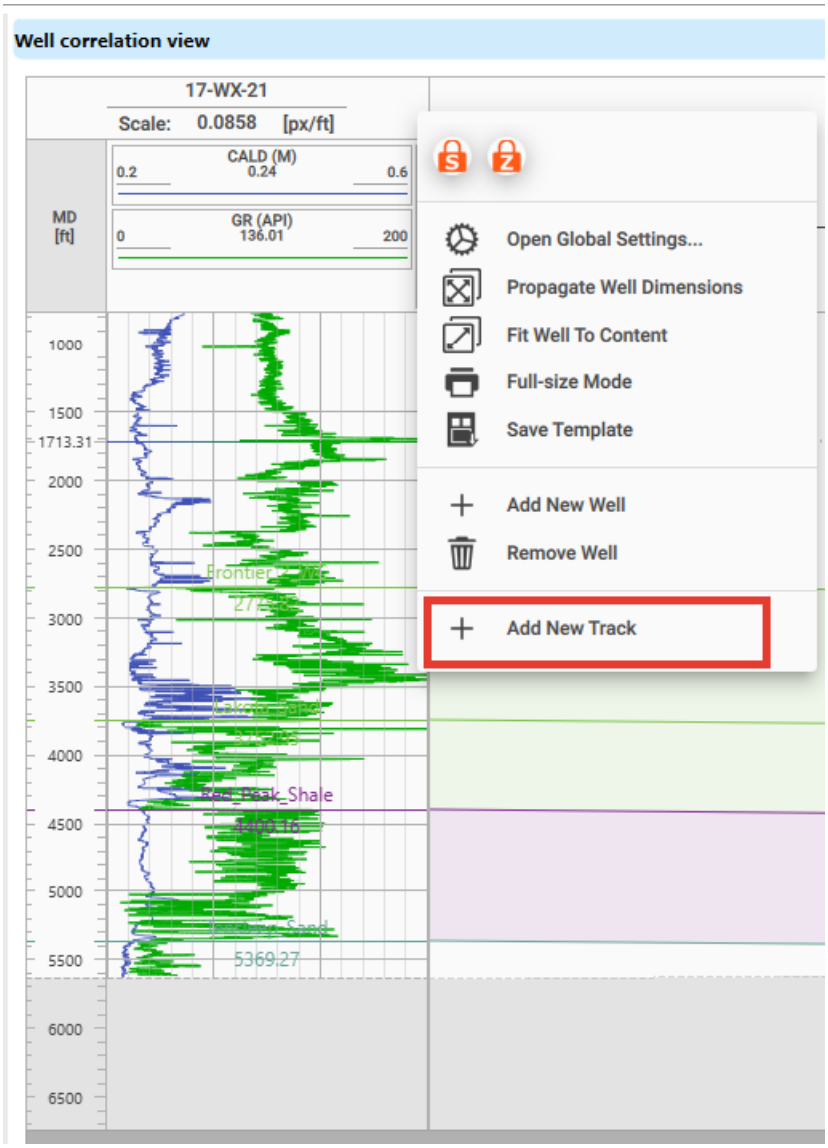

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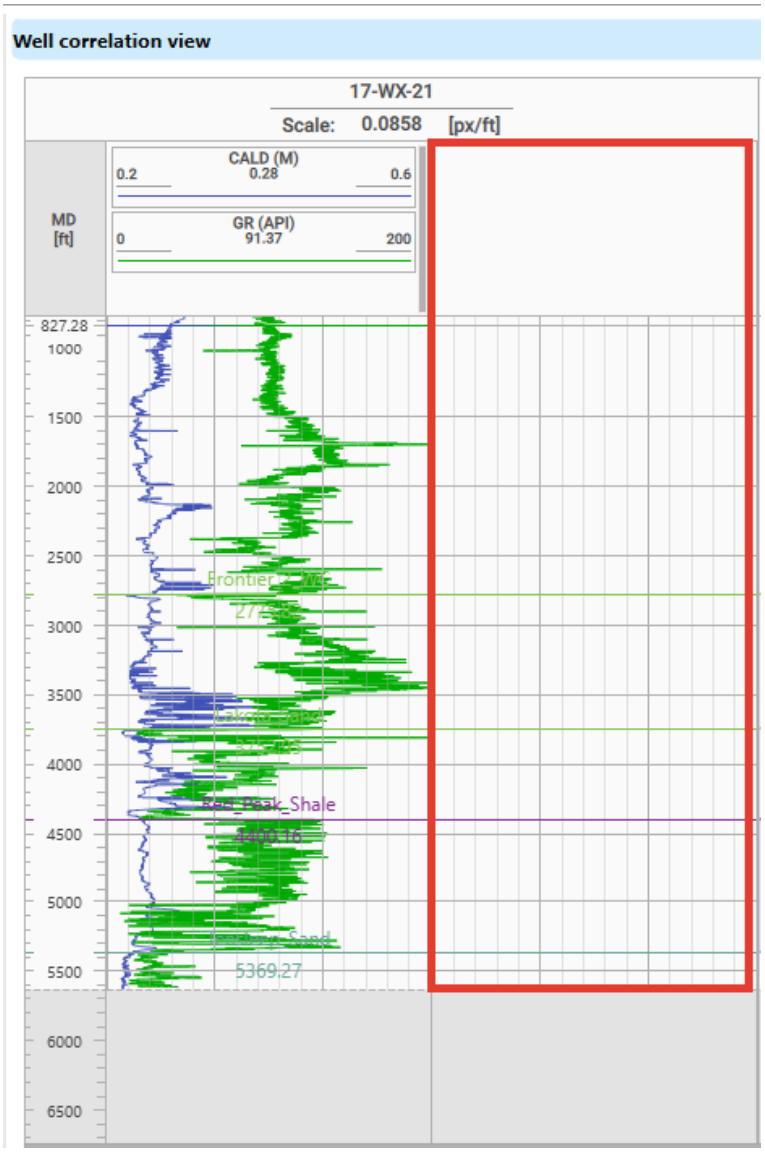

To add any well logs inside this, the user should **Right click** inside the **New Track window** and select **Advanced Track Settings**. It will open a new window as shown below.

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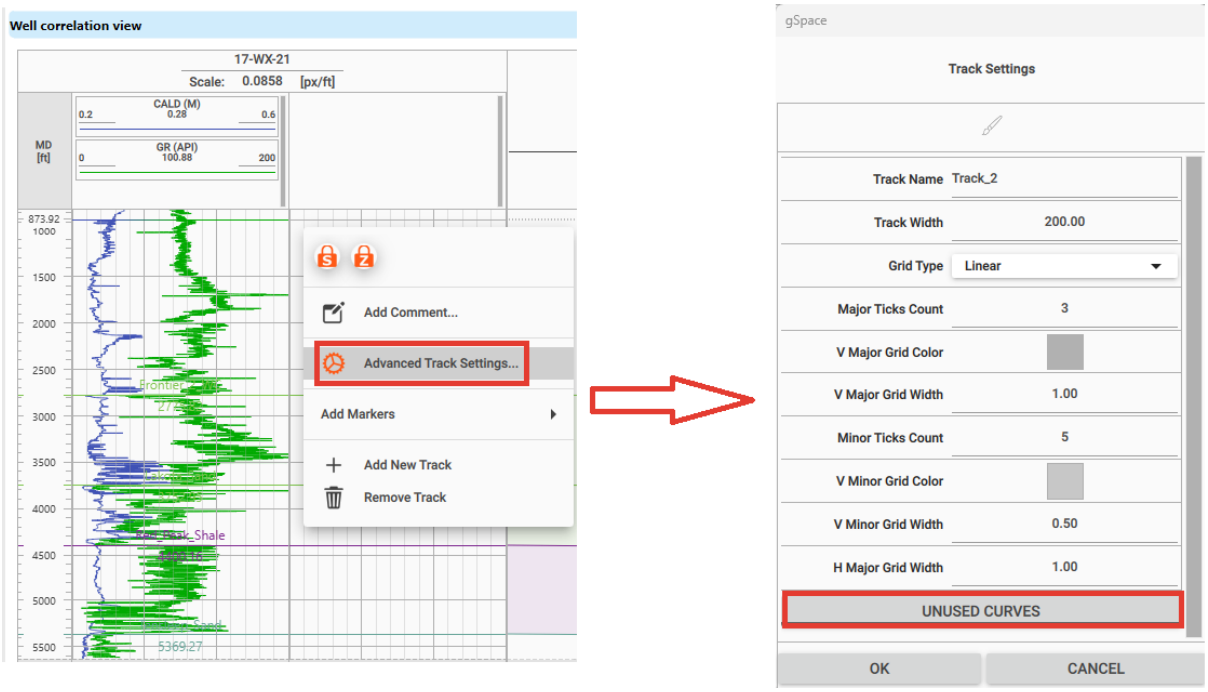

Click on **UNUSED CURVES.** It will display all the available well logs. By default they all are turned OFF.

Select the desired well logs and they will automatically added to the new track as shown below. As soon as they are added, they will disappear from the UNUSED CURVES list.

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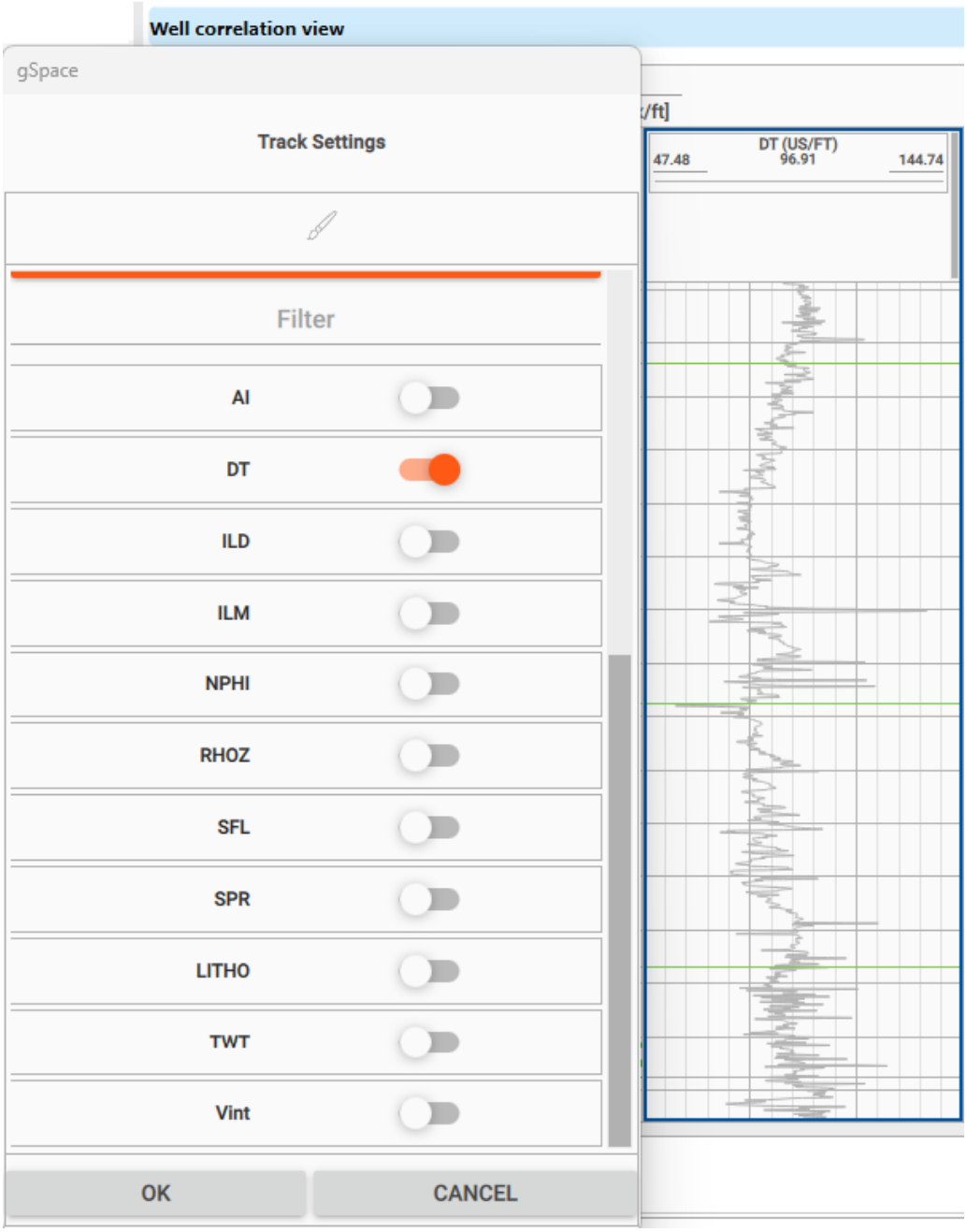

All these curves are added with default settings. To change the display settings of the individual curves, **Right click** inside the curve panel.

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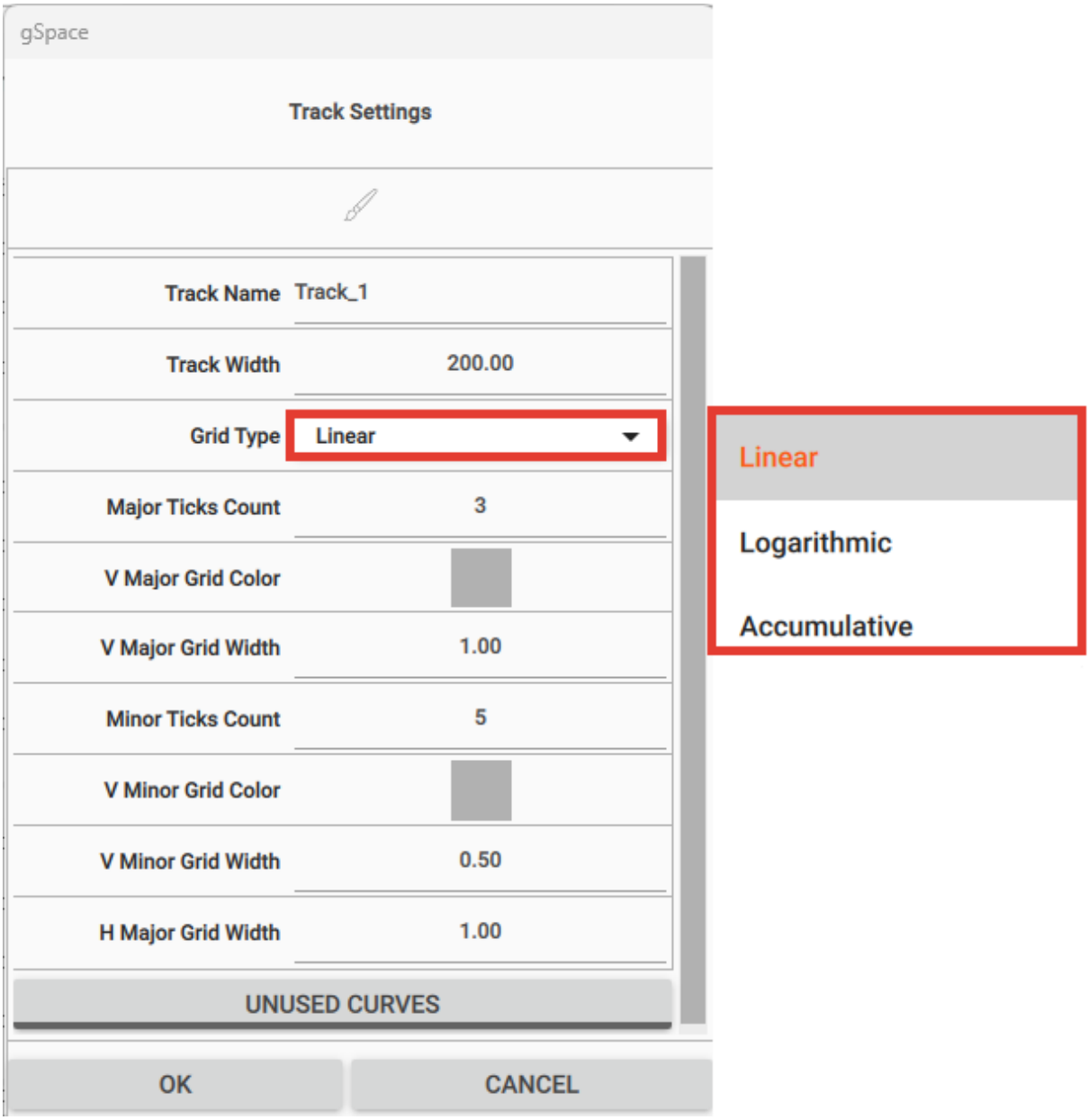
Track Settings

Each track within the Well Correlation view can be individually configured for optimal visualization of log data.

To access the **Track Settings**, right-click within the desired track area and select **Advanced Track Settings**.

A new settings window will appear, allowing the user to configure the track's properties.



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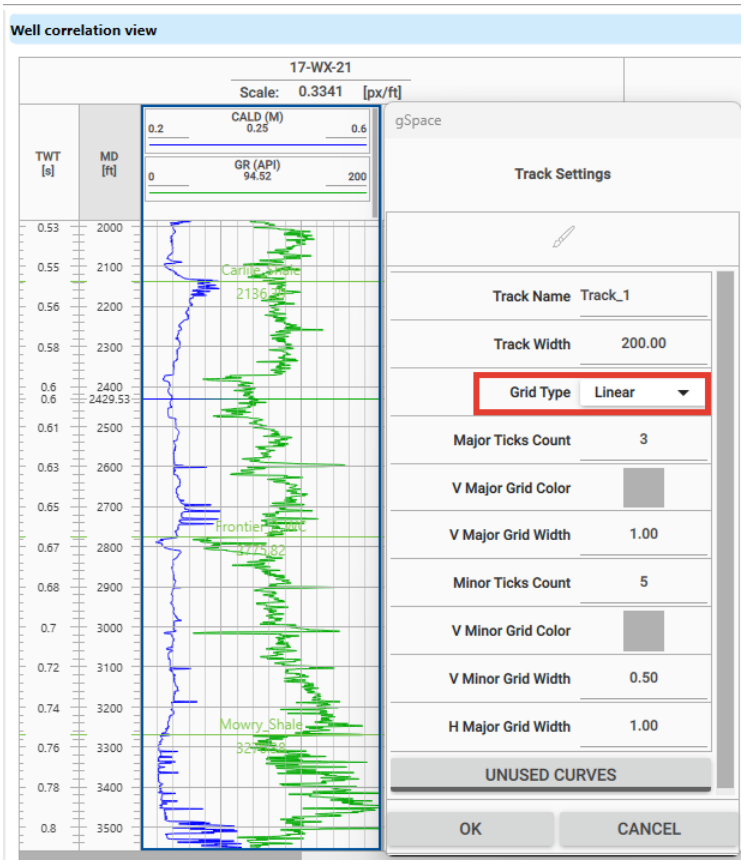
The following options are available:

- **Track Name**: Name of the track (e.g., GR, Density).
- **Track Width**: Controls the visual width of the track in pixels.
- **Grid Type**: Defines how the horizontal grid lines are displayed within the track. The options include:
  - **Linear** *(default)*: Standard linear scale, most commonly used for continuous log data.



  - **Logarithmic**: Useful for logs with values that span several orders of magnitude, such as **Resistivity** (ILD, LLD).

This type of curve benefits from logarithmic scaling to better distinguish low and high values in the same track.

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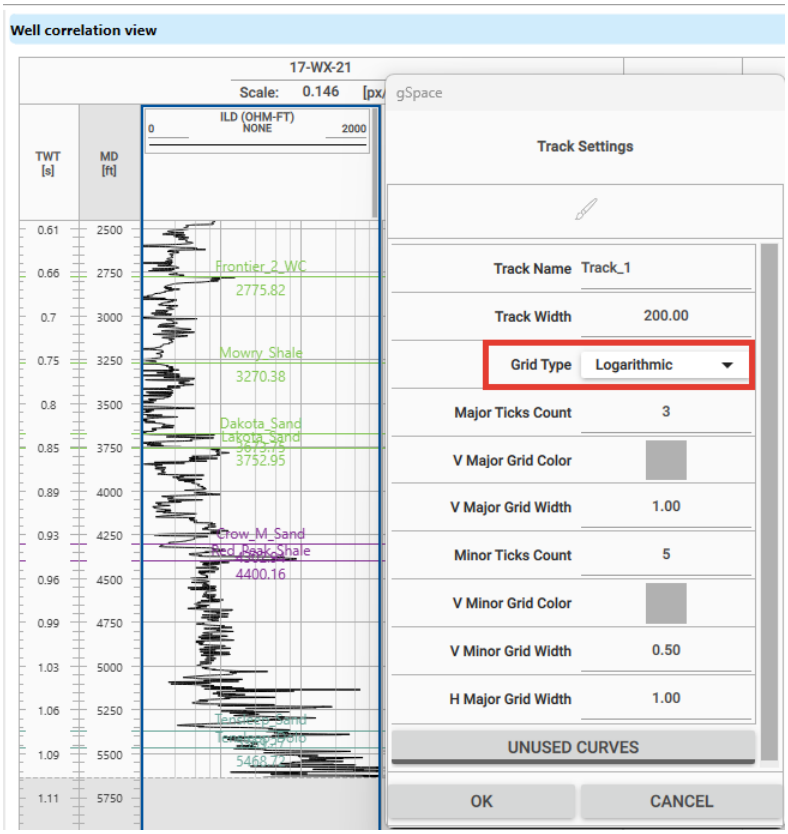

- **Accumulative**: Ideal for plotting **cumulative values**, such as **net pay**, **cumulative porosity**, or **total thickness** curves.

This setting allows the user to display running totals, which are especially useful in reservoir analysis and zone summation.

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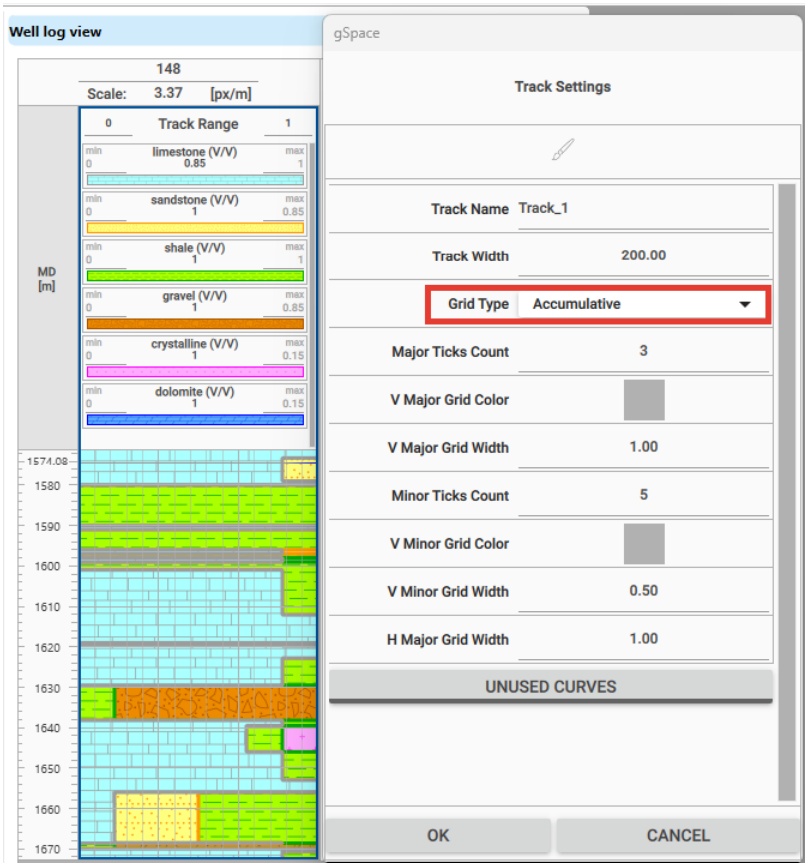

- **Major Ticks Count**: Number of major vertical grid divisions.
- **V Major Grid Color / Width**: Set the color and width for major vertical grid lines.
- **Minor Ticks Count**: Number of minor divisions between major grid lines.
- **V Minor Grid Color / Width**: Set the color and width for minor vertical grid lines.
- **H Major Grid Width**: Adjusts the thickness of horizontal major grid lines.

Curve Settings

To customize how individual well logs are displayed within a track, the user can right-click on the log curve and select **Curve Settings**.
This opens a window where various visual and functional options can be adjusted.

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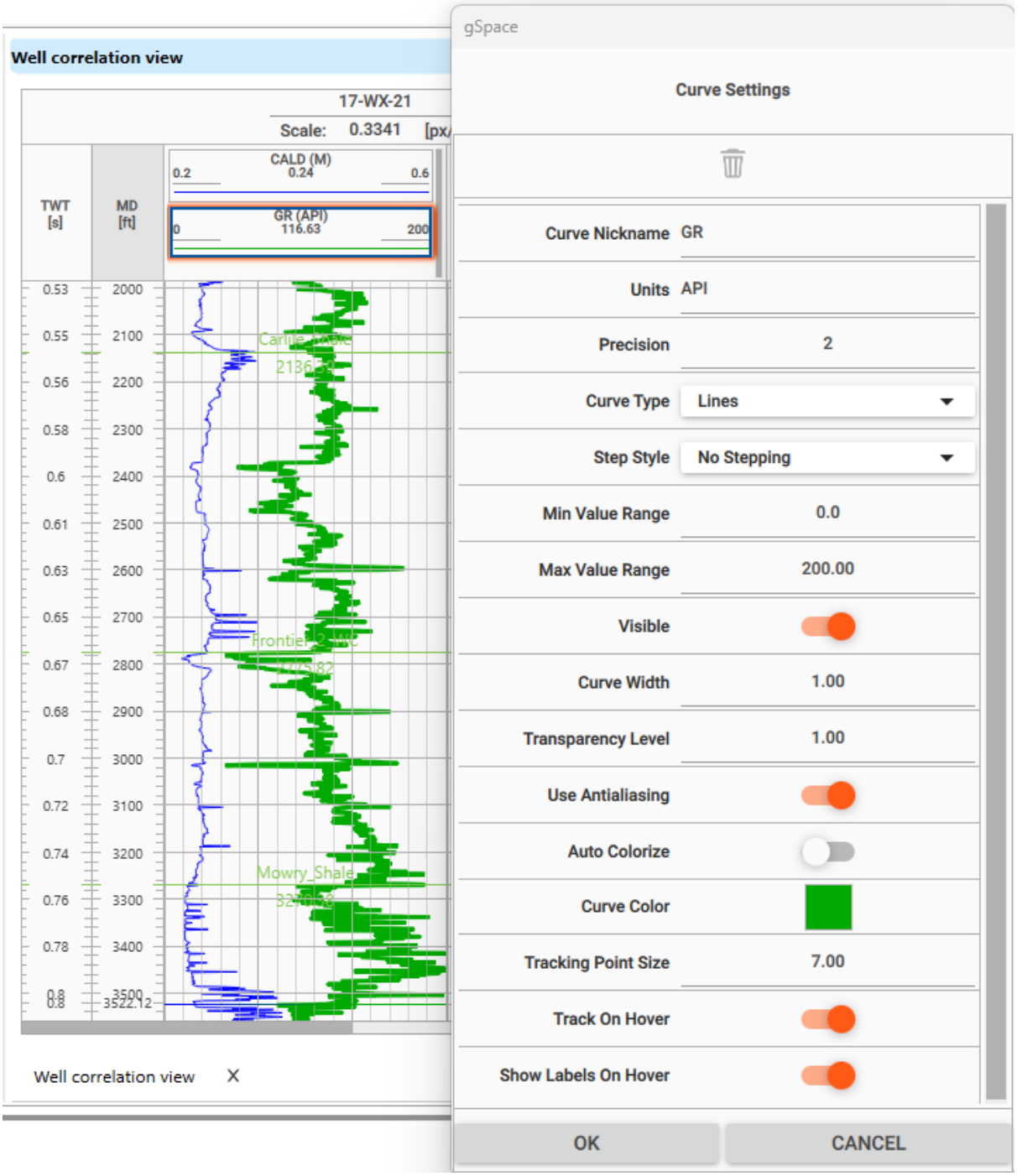

Key Options in Curve Settings:

- **Curve Nickname**: A user-friendly label displayed on the track (e.g., "GR" instead of "Gamma Ray").
- **Units**: Measurement units for the curve (e.g., "API", "Ω·m", "g/cc").
- **Precision**: Number of decimal places shown for the curve values.
- **Curve Type**: Defines the visual representation of the curve. Available options:

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- **Points**: Displays individual log values as discrete points.
- **Lines**: Connects data points with smooth lines. Suitable for most continuous log curves.
- **Filled Lines**: Similar to Lines, but fills the area under the curve—commonly used for porosity or saturation to visualize zone fill.
- **Lithology**: Displays lithology logs with symbolic or color-filled styles.
- **Image**: Allows logs to be visualized using imported raster log images (e.g., scanned logs or litho columns).

Notes

- *Lines and Filled Lines are best for continuous logs (e.g., GR, DT, Density).*
- *Points may suit sparse or point data (e.g., deviation surveys).*
- *Lithology is for categorical data (e.g., rock type).*
- *Image is ideal for historical or scanned well logs.*

- **Step Style** (Available only for "Lines" and "Filled Lines"): Defines how curve segments transition between depth values:
  - **No Stepping**: Default; lines are drawn directly between data points.
  - **Step Up**: Horizontal line at the top of each interval, then vertical drop.
  - **Step Center**: Horizontal line transitions midway between values.
  - **Step Down**: Horizontal line at the bottom of the interval, then vertical rise.

Notes

Step styles are helpful when displaying categorical or blocky data, such as lithology, saturation zones, or interpreted layers.

For example, Step Down might be used to show interval top values, while Step Up could reflect base markers.

- **Visible**: Toggle to show or hide the curve.
- **Curve Width**: Adjusts the thickness of the curve line.
- **Transparency Level**: Set the curve's transparency (useful for overlapping curves).
- **Use Antialiasing**: Enables smoother curve edges for better visual quality.
- **Auto Colorize**: Automatically assigns colors based on curve type or group.
- **Curve Color**: Manually set the color used to display the curve.

To remove any of these curves, the user can simply click on the Delete Curve icon. By default it is Grey in color. As the user hover the cursor, it will turn into Red.

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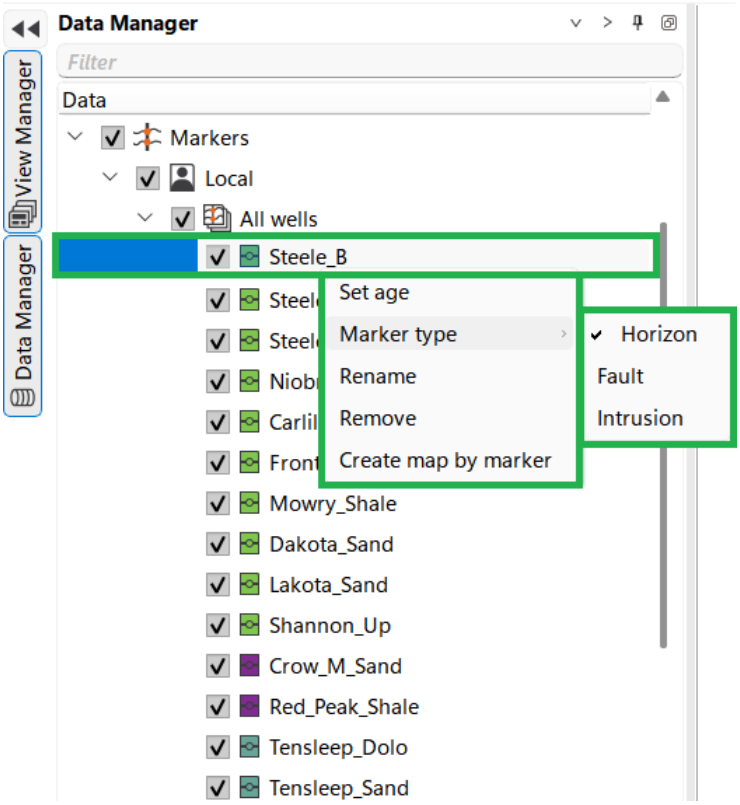
Managing Marker Sets in the Data Manager



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The Data Manager interface allows users to manage and customize marker sets for wells. The following functionalities are available:

1. **Marker Set Options (Left Panel):**
    - **Set Age:** Assign a specific geological age to the selected marker set.
    - **Marker Type:** Classify markers as either Horizon, Fault, or Intrusion. This helps in categorizing and visualizing different types of geological features.
    - **Rename:** Change the name of the selected marker set.
    - **Remove:** Delete the selected marker set from the project.
    - **Create Map by Marker:** Generate a map based on the selected marker, visualizing its distribution across the study area.

2. **New Marker Set Management (Bottom Left Panel):**

    - This panel allows the creation of a new marker set. Once created, the new marker set appears in the list, ready for further customization and data input.

3. **Marker Set Actions (Right Panel):**
    - **Set Default:** Designate the selected marker set as the default for the project.
    - **Rename:** Change the name of the selected marker set.
    - **Remove:** Delete the selected marker set.
    - **Duplicate:** Create a copy of the selected marker set, useful for making modifications without altering the original.
    - **Export/Import Markers Struct:** Export or import the structure of the markers for use in other projects or sessions.
    - **Export/Import Markers Ages**: Export or import the ages of the markers, ensuring consistency in geological timelines.
    - **Sort by Depth/Age:** Organize markers within the set either by their depth in the well or by their geological age.
    - **Commit:** Save changes made to the marker set.
    - **Set as Master:** Designate the selected marker set as the primary reference for correlation and mapping.
    - **Show Revisions:** View the history of changes made to the marker set.
    - **Add Group/Unconformity:** Add a new group or unconformity marker to the set, useful for defining significant geological boundaries.
    - **Add Marker:** Insert a new marker into the set.
    - **Child Build Order:** Adjust the build order of child markers within the set, either From top to down or From down to top. This controls the sequence in which markers are applied or visualized.

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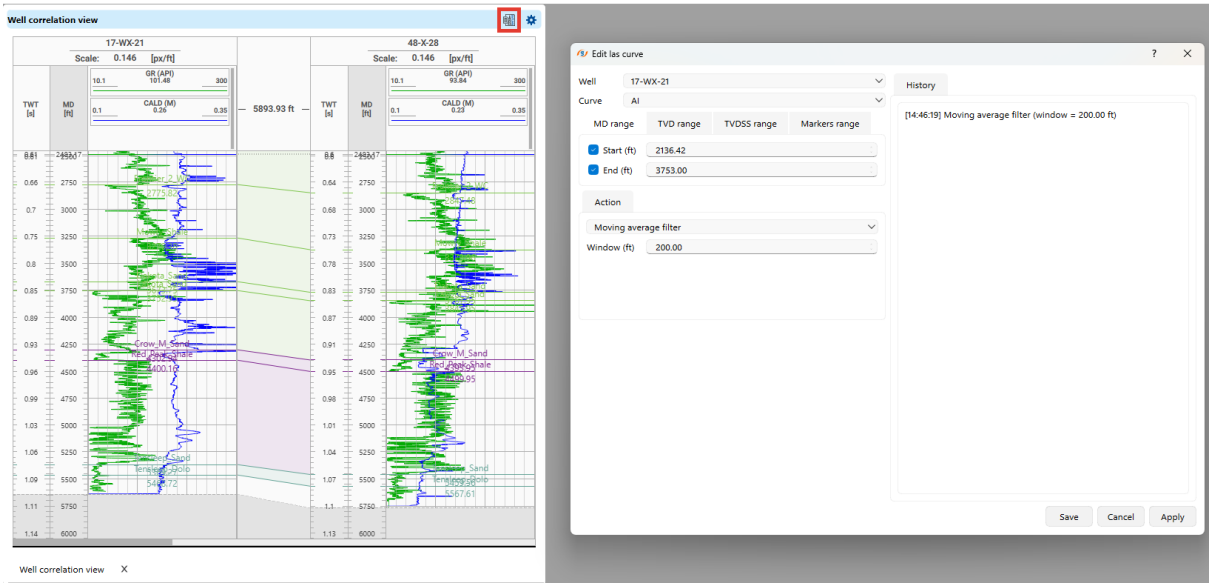
3.4.7.1 LAS editing

The **Edit LAS Curve** tool in the **Well Correlation View** allows users to apply basic processing and editing operations on individual log curves.

This is useful for cleaning, correcting, or customizing log data before interpretation or correlation.

To open the wizard click on a Top of the Well correlation view and choose **Edit LAS Curve**.



The wizard consists of the following key areas:

1. Well and Curve Selection

At the top, select the target **Well** and the **Curve** (log) you wish to edit using the dropdown menus.

2. Depth Range

Select the depth range over which the operation will be applied. Options include:

- **MD range**: Measured Depth
- **TVD range**: True Vertical Depth
- **TVDSS range**: the vertical depth measured below mean sea level
- **Markers range**: Use tops/markers to define interval

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Enable and set:

- **Start** and/or **End** depth values to limit the editing range (optional).

3. Action – Log Editing Options

In this section, choose one of the available operations from the **Action** dropdown menu:

- **Moving average filter**: Smooths the log by averaging values within a specified window. Enter the **window size** in feet.
- **Median filter**: Reduces noise by replacing each value with the median of its surrounding values within the defined window.
- **Bandpass filter**: Applies frequency-based filtering to isolate or remove specific ranges in the data.
- **Depth shift**: Shifts the entire curve vertically by a fixed amount. Useful for aligning logs when depth mismatches occur (e.g., from tool calibration errors).

4. History Panel

The **History** tab on the right keeps track of all applied changes, showing a list of previous actions for easy reference or rollback (currently empty in the screenshot).

5. Buttons

- **Apply**: Applies the selected action to the curve but keeps the wizard open.
- **Save**: Applies changes, name the new curve and closes the window.
- **Cancel**: Discards all unsaved changes and closes the window.

3.4.8 Graphs

The **Graphs** section in the Views bar 36 provides tools for visualizing and analyzing relationships within your data. It includes three main graph types:

1. Cross-Plot 206: Visualize the relationship between two selected attributes plotted on the X and Y axes. This is particularly useful for identifying trends, correlations, and patterns in the data.
2. Histogram 203: Display the frequency distribution of well log data. Use histograms to analyze data ranges, identify dominant values, and detect outliers in well attributes.
3. Variogram 210: Visualizes spatial continuity by plotting semivariance against lag distance, aiding geostatistical analysis.

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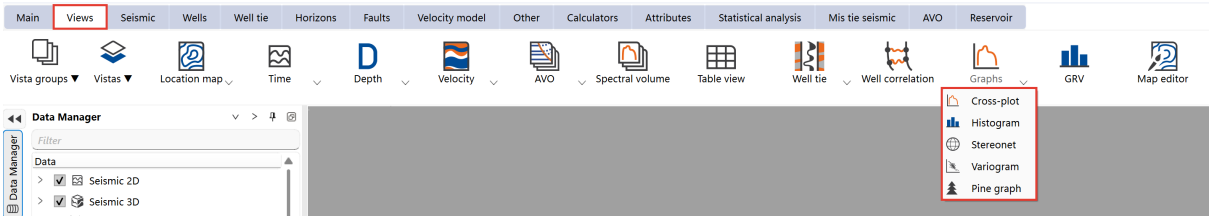
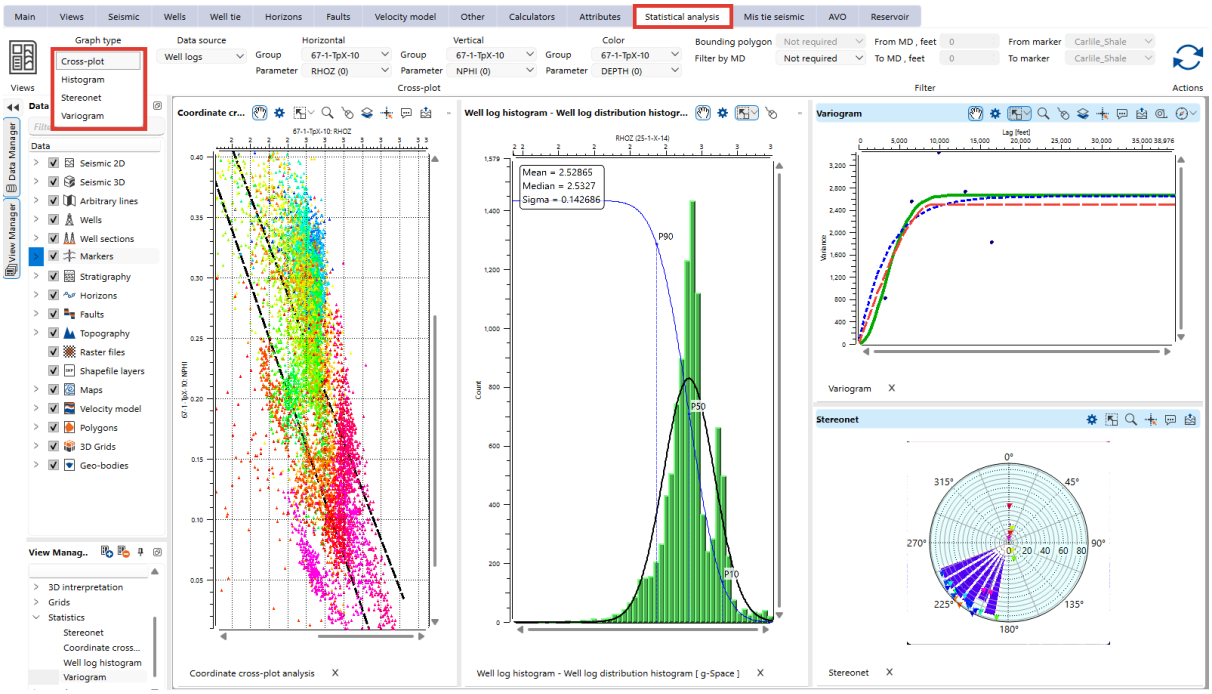
4. Stereonet 211: Plot structural orientations, such as dip and azimuth, on a stereographic projection. Stereonets are especially valuable for analyzing geological structures, such as faults, bedding planes, and stress orientations.



Configure the graph settings, such as data source, parameters, and filtering options in the Statistical analysis bar 72.



3.4.8.1 Histogram view

The Histogram view provides a graphical representation of the distribution of an attribute, giving users insights into the frequency and range of data values.

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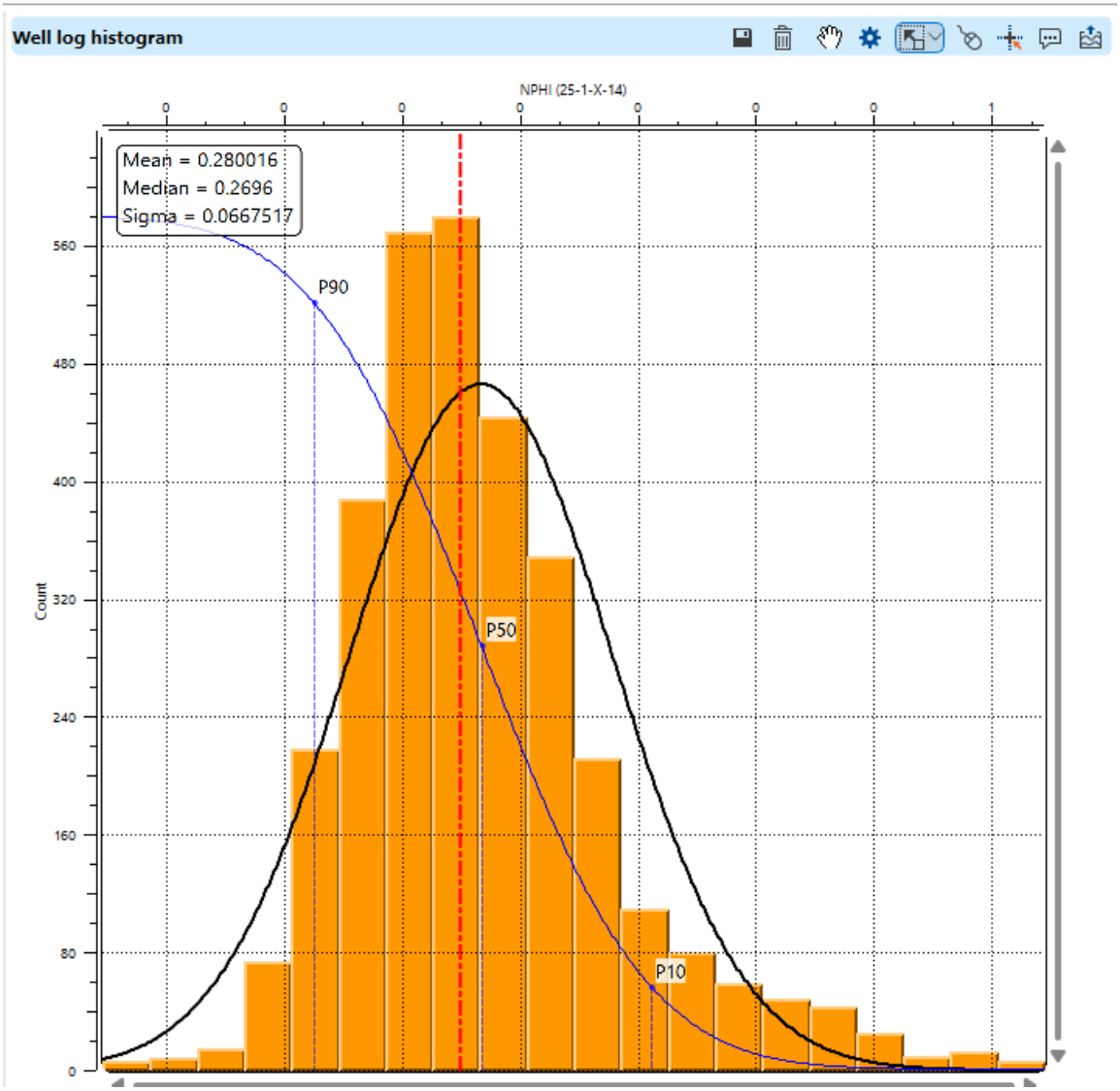
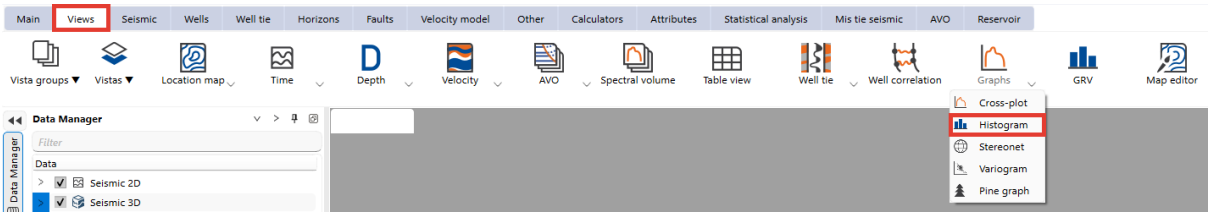


To create Histogram view go to the Views bar 36, navigate to **Graphs** and click on **Histogram** button:



To set what data to be analyzed set parameters in the Statistical analysis 72 bar:

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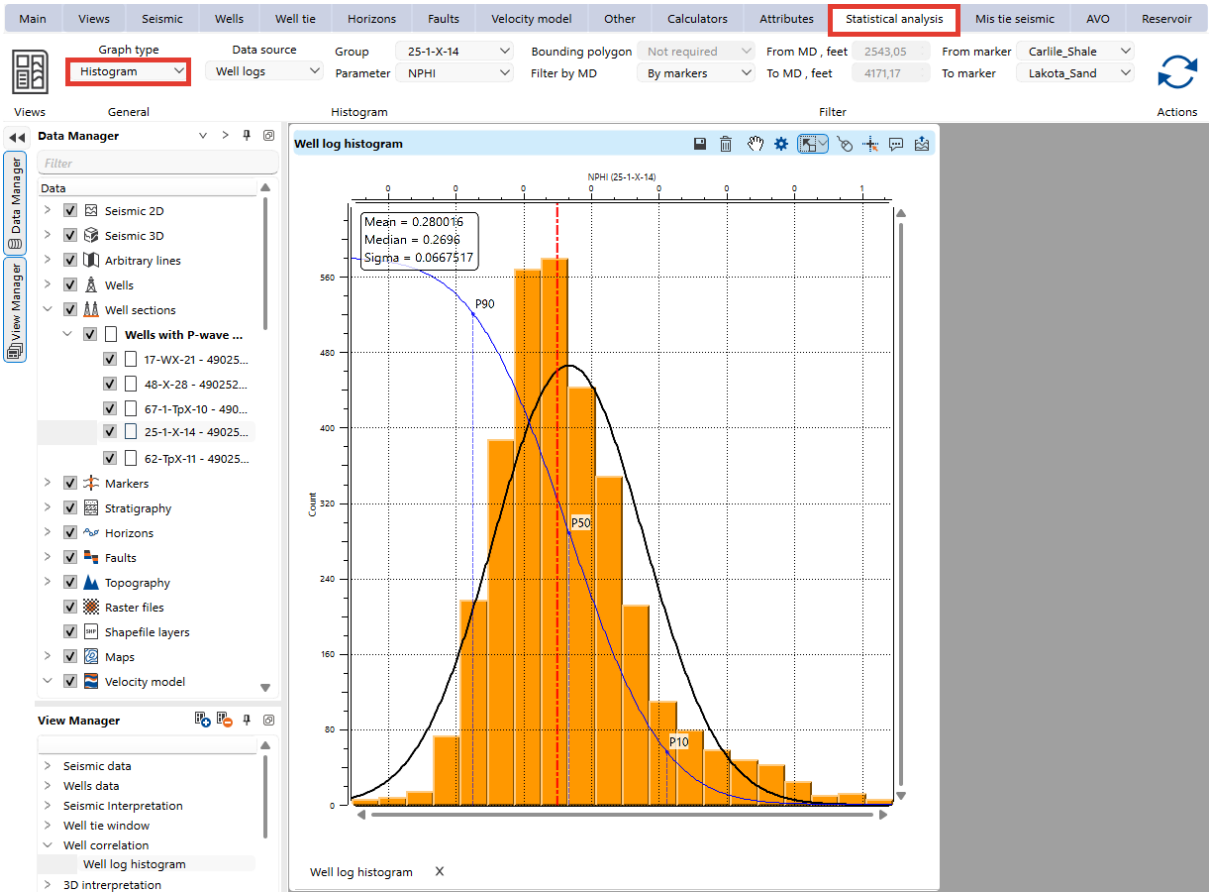

Functional panel allows user to perform the following actions:

- open View properties panel
- adjust view area to all visible objects
- set control item
- enable mouse tracker
- enable tool tip
- export picture

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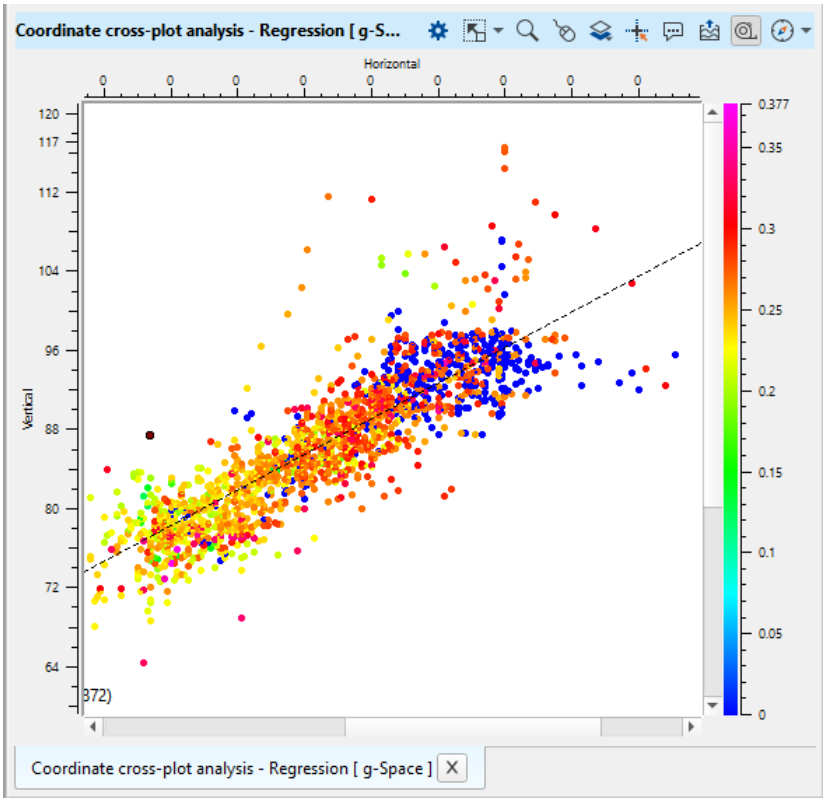
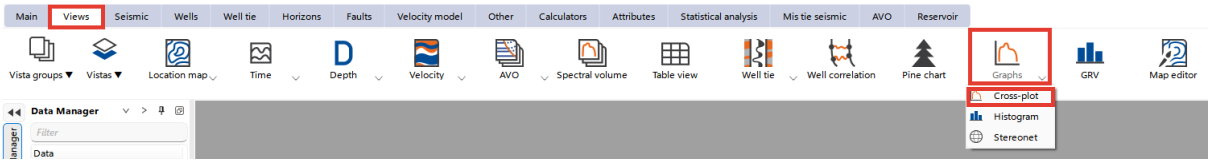
For more information about the Histogram analysis please refer to Statistical analysis 528

3.4.8.2 Cross plot view

Cross plot is a view which allows user to cross-plot different data types loaded in g-Space



To create cross plot view go to the Views bar 36, navigate to **Graphs** and click on **Cross plot** button:



To set what data to be analyzed set parameters in the Statistical analysis 72 bar:

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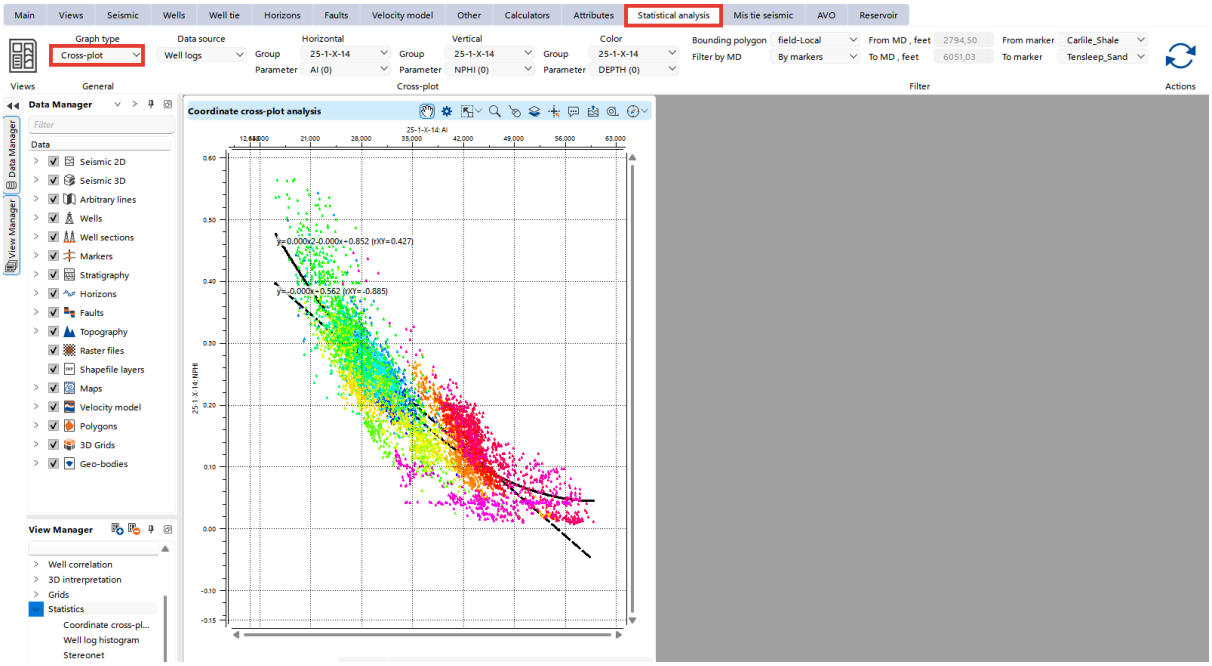

To define the object visibility stile go to the View properties 101 by pressing in the view functional panel or find it in the panel 84 sets.

For more information about the cross-plotting please refer to Statistical analysis 528

Functional panel allows user to perform the following actions:

- open View properties panel
- adjust view area to all visible objects
- adjust horizontal scale
- adjust vertical scale
- set/unset zoomable
- set control item
- add vista

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enable mouse tracker

enable tool tip

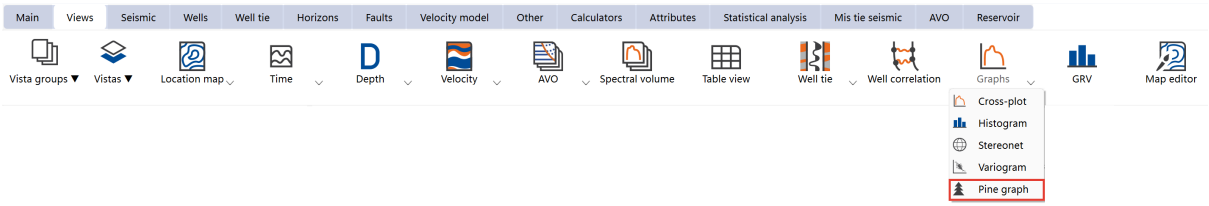
export picture

ruler tool

3.4.8.3 Pine graph view

Pine chart view is a quality control tool for velocity models. The Pine Chart View is a quality control tool designed specifically for evaluating and validating velocity models in geophysical analysis. This view provides a visual representation of velocity data across various depths or intervals, allowing users to assess the consistency and accuracy of the velocity model.

To create pine chart view go to the Views bar 36 in the Ribbon bar 33 and click on **Pine Chart** option:



The newly created view will appear in the View manager 90 in the active Workspase 114. User can place location map view by dragging it to any workspace except pre-defined once (Seismic data 118 and Well data 121).

Each point on this graph is a well marker. The x-axis shows the difference between velocity based depth and the actual marker depth. The y-axis shows the marker depth.

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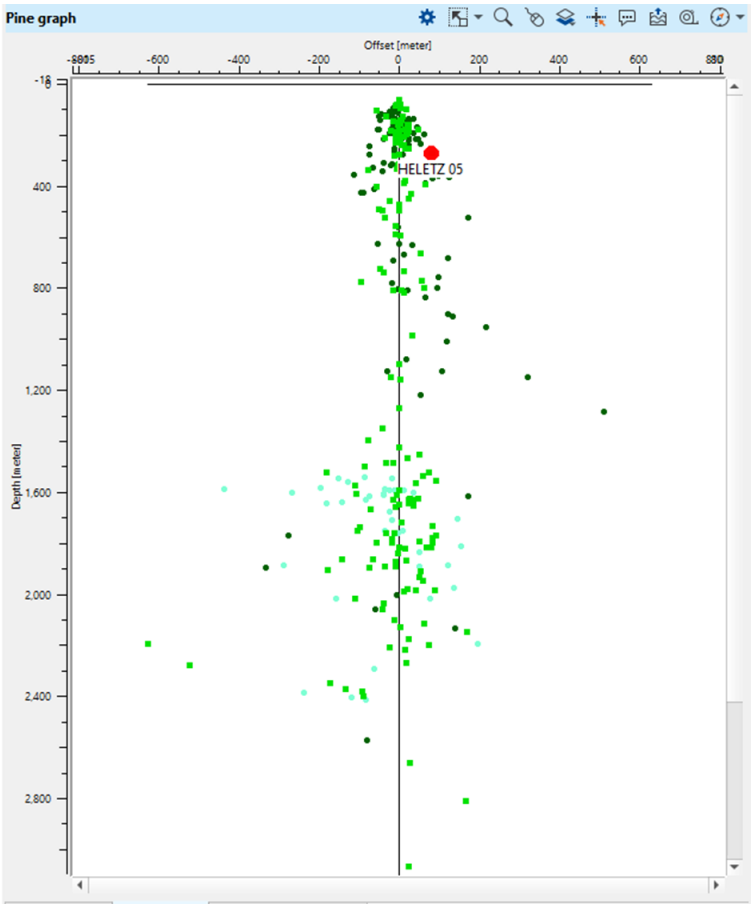

To define the object visibility stile go to the View properties 101 by pressing ⚙ in the view functional panel or find it in the panel 84 sets.

Functional panel allows user to perform the following actions:

- ⚙ open View properties panel
- adjust view area to all visible objects
- ↔ adjust horizontal scale
- ↕ adjust vertical scale

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set/unset zoomable

set control item

add vista

enable mouse tracker

enable tool tip

export picture

ruler tool

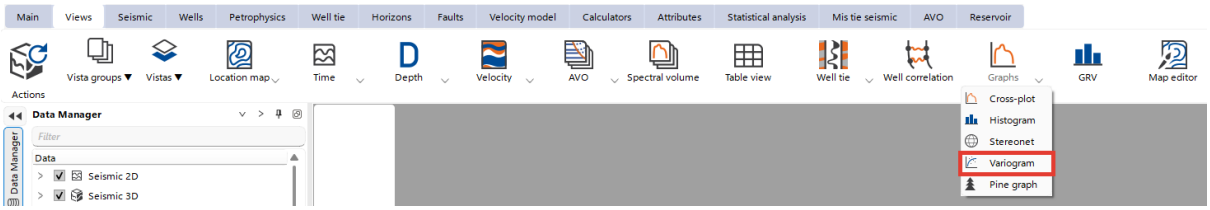
show compass

show minimap

show scale bar

3.4.8.4 Variogram view

To create Variogram view go to the Views bar 36, navigate to **Graphs** and click on **Variogram** button:



To start variogram analysis, navigate to to the Statistical Analysis 528 bar and select the **Variogram** option under the Graph type dropdown menu.

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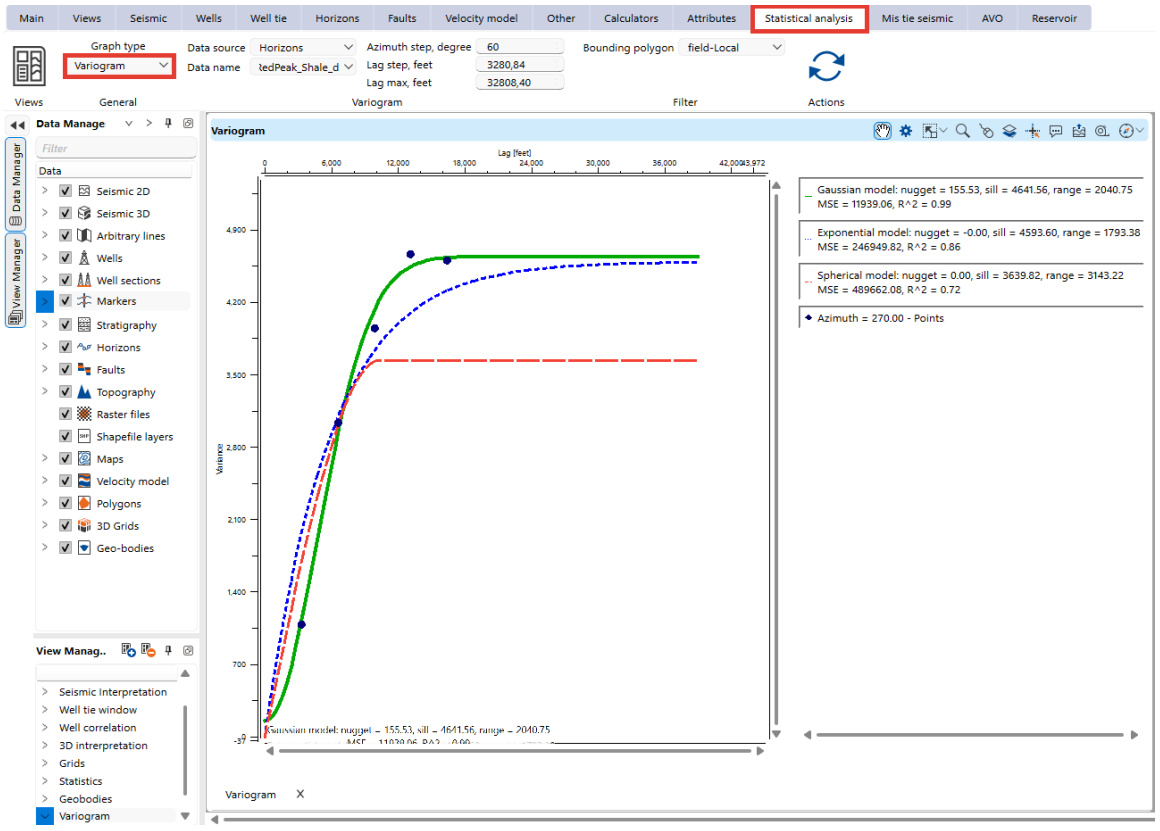

In the View Properties panel, users can adjust visual settings for better interpretation:

- Transparency levels
- Color schemes
- Line types and thickness
- Point size and shape

Users can also enable or disable specific models to focus on relevant data trends.

3.4.8.5 Stereonet view

The Stereonet View is a view that allows users to visualize and analyze orientation data, such as azimuths and dips, in g-Space.

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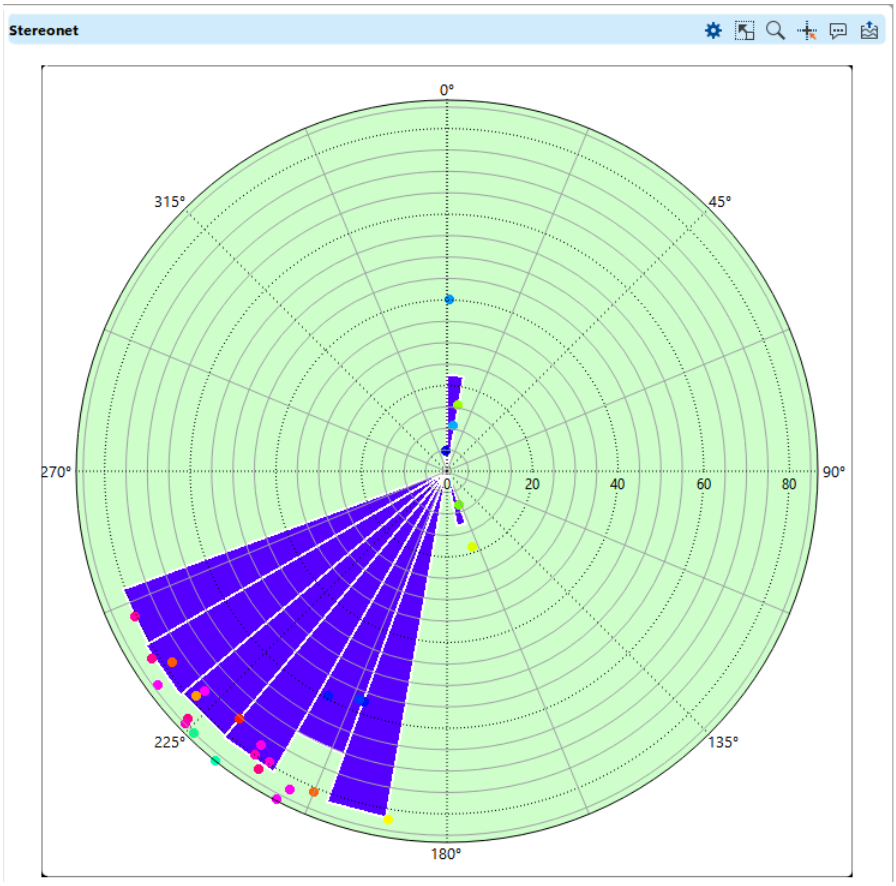
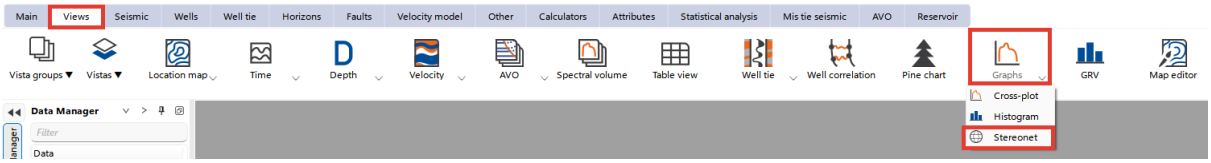


To create Stereonet view go to the Views bar 36, navigate to **Graphs** and click on **Stereonet** button:



To set what data to be analyzed set parameters in the Statistical analysis 72 bar:

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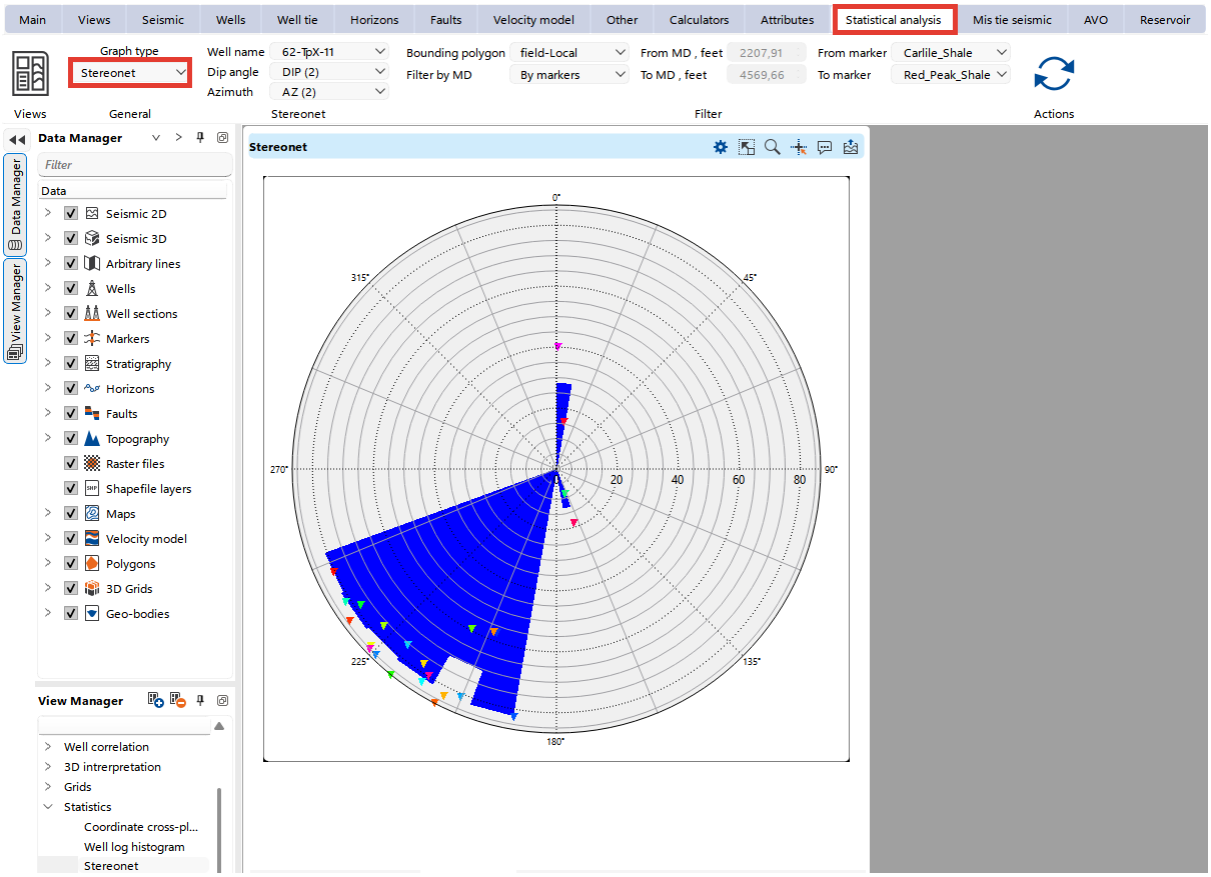

Functional panel allows user to perform the following actions:

- open View properties panel
- adjust view area to all visible objects
- set/unset zoomable
- enable mouse tracker
- enable tool tip
- export picture
- ruler tool

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3.4.9 GRV view

The **GRV View** in g-Space is a specialized graph used for visualizing and analyzing the distribution of Gross Rock Volume (GRV) within a reservoir or geological structure. This view plots GRV values (typically measured in cubic meters) along the X-axis against their associated probabilities on the Y-axis, helping to quantify the uncertainty and variability in the volume estimates.

3.4.10 Map editor

The **Map Editor View** in g-Space is a powerful tool for creating, editing, and analyzing contour maps and other spatial data visualizations. This view enables users to interactively modify and refine maps that represent various geological or geophysical properties.

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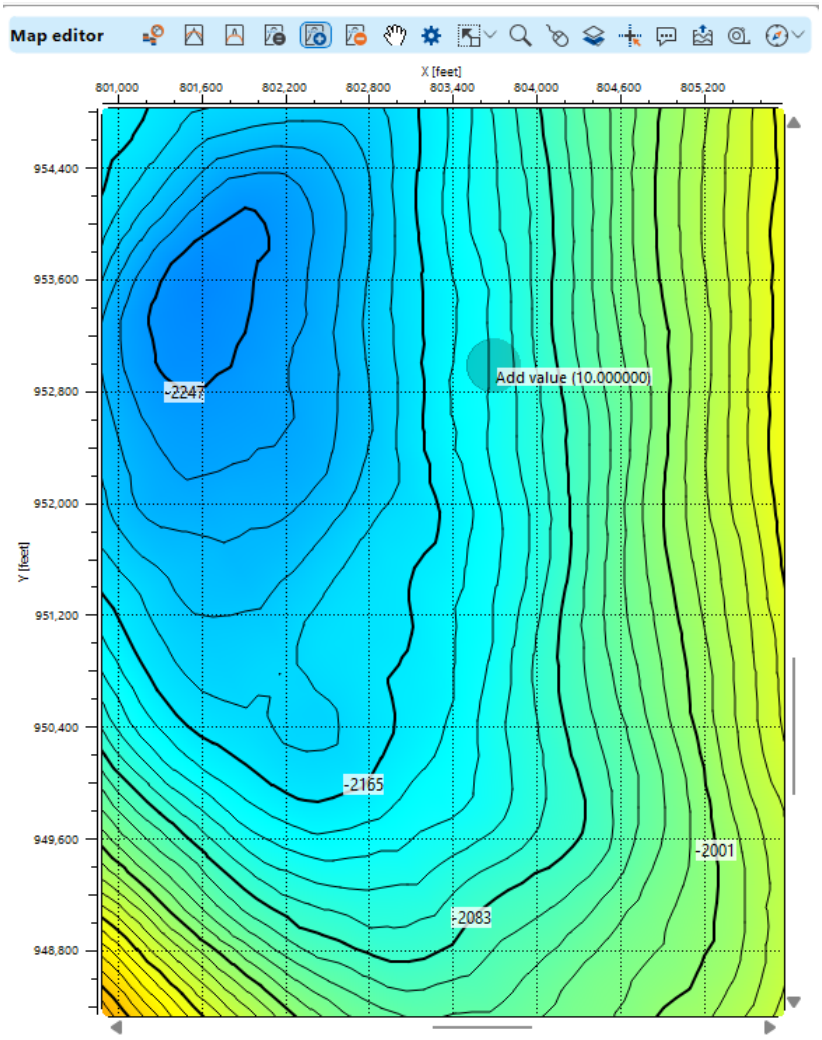
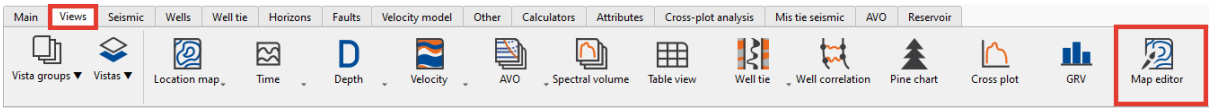


To open **Map editor** view go to the Views bar[36] in the Ribbon bar[33] and click on editor view button:



The newly created view will appear in the View manager[90] in the active Workspase[114]. User can place location map view by dragging it to any workspace except pre-defined once (Seismic data[118] and Well data[121]).

To define the object visibility stile go to the View properties[101] by pressing ⚙ in the view functional panel or find it in the panel[84] sets.

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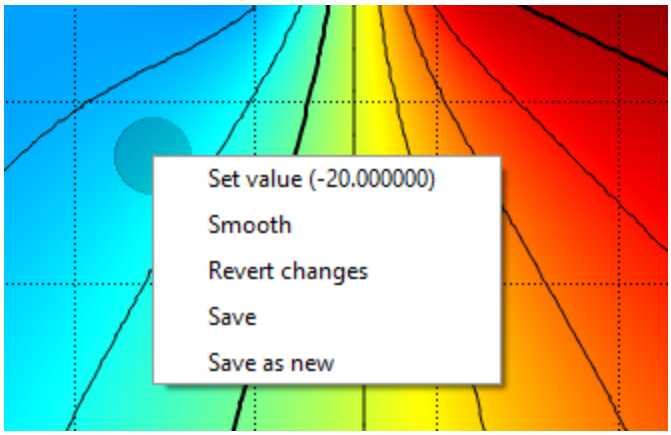
Important settings are located in the context menu (alt + RMB):



Here the user can:

- set value for the selected function
- smooth entire map
- revert all changes applied
- save edited map instead of original one
- save edited map as new one

Functional panel allows user to perform the following actions:

smooth

remove pick

set value

add value

subtract value

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open View properties panel

adjust view area to all visible objects

adjust horizontal scale

adjust vertical scale

set/unset zoomable

set control item

add vista

enable mouse tracker

enable tool tip

export picture

ruler tool

show compass

show minimap

 show scale bar

3.5 Controls and shortcuts

Mouse and keyboard controls

Buttons	Result	Applicable for:
Left click mouse	pick the active object	Geo-view, Well-view
Right click mouse on view	delete, remove the picked object	Geo-view, Well-view
Right click mouse on panel	launch additional functionality	Data manager, Workspace manager, Module properties
Double click	making the object active	On data manager

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Scroll button	zoom in/zoom out	Geo-view
Scroll button on axis	zoom in/zoom out the selected axis	Geo-view, Well-view
Pressing scroll button and moving mouse	dragging the view	Geo-view, Well-view
Alt + Right click mouse	launch additional functionality according to the active picking mode	Any of seismic view

In g-Space you can use shortcuts to make your routine work faster and convenient

Action	Shortcut	Description
Update horizon	m	Lunching the map interpolation algorithm on location map 124 view or both Time and Depth seismic views 130
flattening on marker	f	Align the well section along the marker on 'well correlation view'
Save project	Ctrl+S	Saving the project 233, creating new project 231
Save project as	Shift+Ctrl+S	Saving the project 233 to a different file
Full screen	F11	Switch the use of all monitors connected to workstation. Addition click will put application to prevision screen setup.
Reset GUI settings	Ctrl+Alt+R	Reset settings of the interface to g-Space default state.
Show capture view	Ctrl+Alt+P	
Help	F1	

3.6 Seismic data

Seismic data is the main display window where the user can able to visualize the entire dataset within a window. The entire dataset is loaded into the memory and display the full content of the data in the seismic data window. However if the user zoom in/out in any part of the **Seismic data** then that particular section of the display will be displayed on the screen.

Within the seismic data window, we have many option to visualize the data. For an example if the user wants to display the Offset plot on the top of the annotations, it can be

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done fairly easy. Before that we need to introduce various icons on the top of the seismic data window each got it's own significance.

1. Show properties

This will open up a pop-up window to change the display settings like placing annotations on the top, changing the color of the display from density to wiggle, applying AGC etc.

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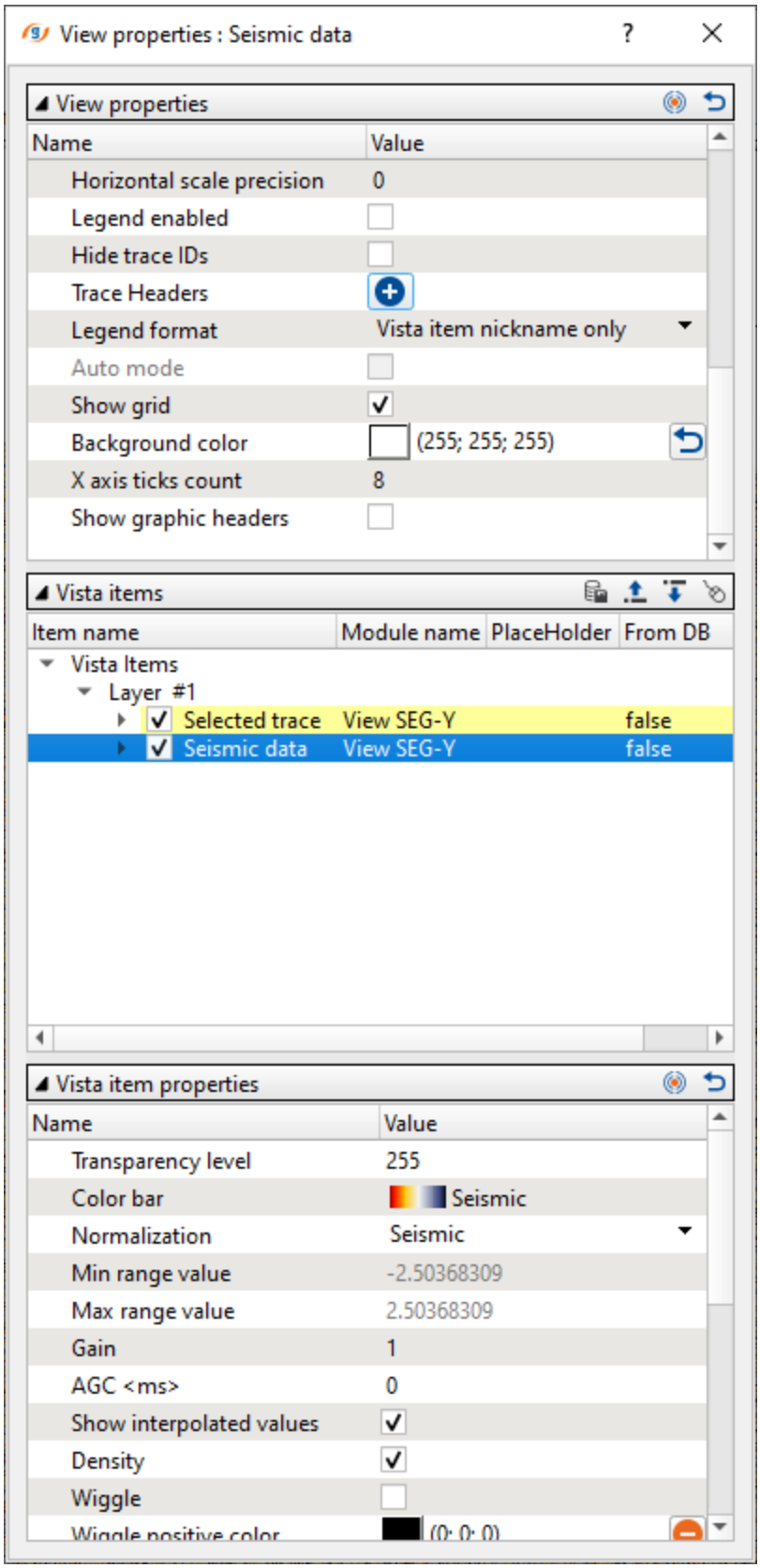

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Show properties is designed into 3 parts.

View properties predominantly takes care of Trace headers annotations , showing graphic headers etc.
Vista items deals with the main components of the data like seismic data, selected trace, selected shot gather etc
Vista item properties helps in adjusting the gain, AGC, change the color bar, applying Band pass filter etc.

2. Adjust to size **:**

This option adjust the display size into the original position. Zoom Out.

3. Set/Unset zoomable *:*

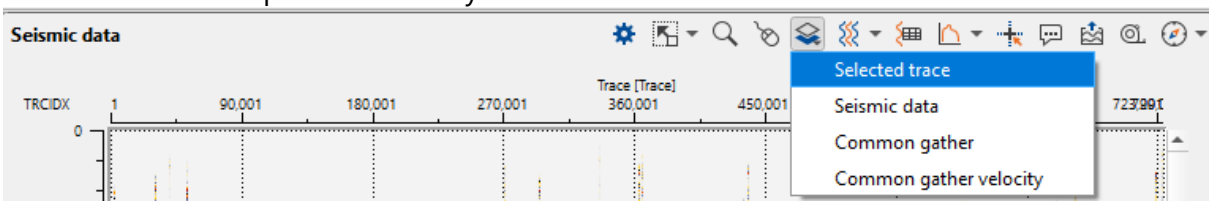
If the user wants to zoom a particular area, simply click on the icon to activate the zoom and draw a polygon on the seismic data to zoom that particular area. Please note that after the initial operation, the icon resets to zoom out position and the user needs to reselect the **set/unset zoomable** icon to zoom again.

4. Set control item *:*

This icon helps in selecting any particular item inside the seismic data window. For instance, if the user wants to select a trace then click on **Set control item** icon and it will give the options to choose. In this instance we have only one option i.e. select trace.

5. Add Vista *:*

This icon helps us to add any vista items like as shown below.



6. Select traces **:**

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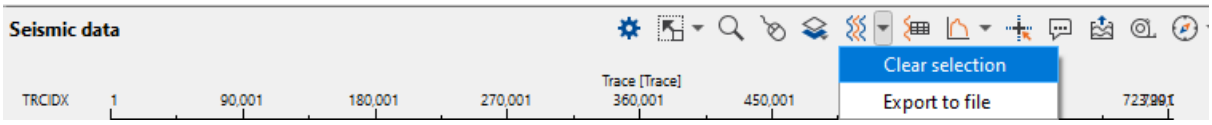
By selecting this icon, the user can able to select a trace. Besides this, we have an option to clear to Clear the selection and Export to file option if the user click on the downward triangle right next to the Select traces icon.

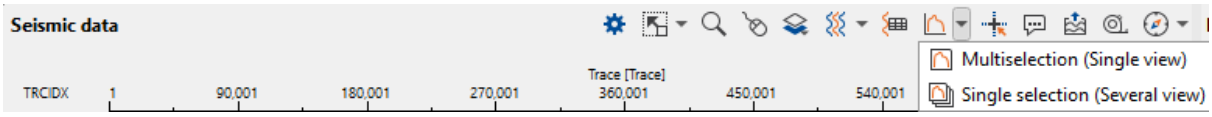


7. Trace headers table **:**

This option will work in tandem with the Select traces module. The trace headers information should be available in the Trace data window.

8. Spectral Analysis **:**

Within g-Viewer the user has the ability to analyze the amplitude and frequency of the seismic data via a spectral analysis. To perform this the user should go to either the Seismic data or the Common shot/receiver/bin tab.
Within the Spectral analysis icon, we have two options. **Multiple selection** (single view) and **Single selection** (Several view). By default, it will display the Single selection (several view).



Click on the **Spectral analysis** icon and it will generate the spectral analysis window as shown below. By default Single selection is selected and the corresponding spectrum is displayed. In the below image, we can see that the entire stack section is selected and the corresponding spectrum is displayed in a separate window.

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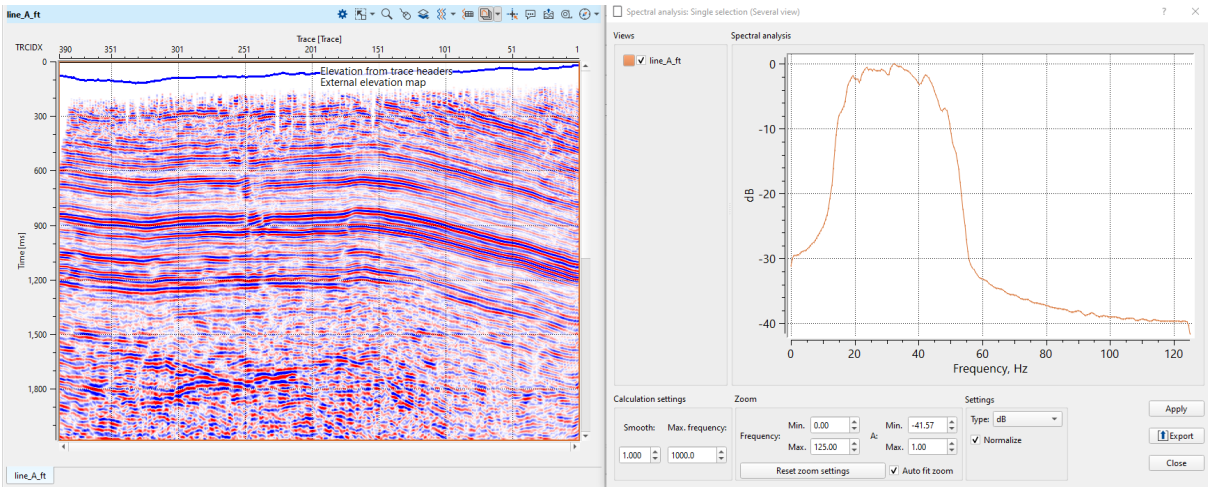
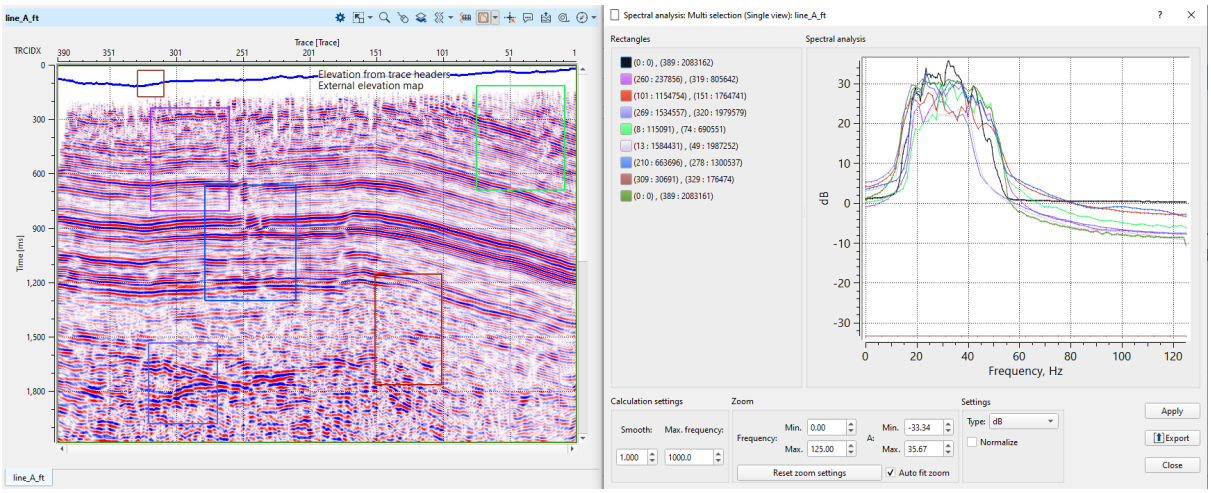


If the user wants to analyze different areas in a display then select the "**Multiple selection**" option and draw as many areas as desired to display the spectral analysis. To draw a polygon, simply hold and drag MB1 button at the desired location on the display window. Several window selections and their corresponding spectra are displayed below.



9. Set/unset mouse tracker **:**

When the user selects this option, it will show the dotted horizontal and vertical lines to show the mouse tracker as shown below.

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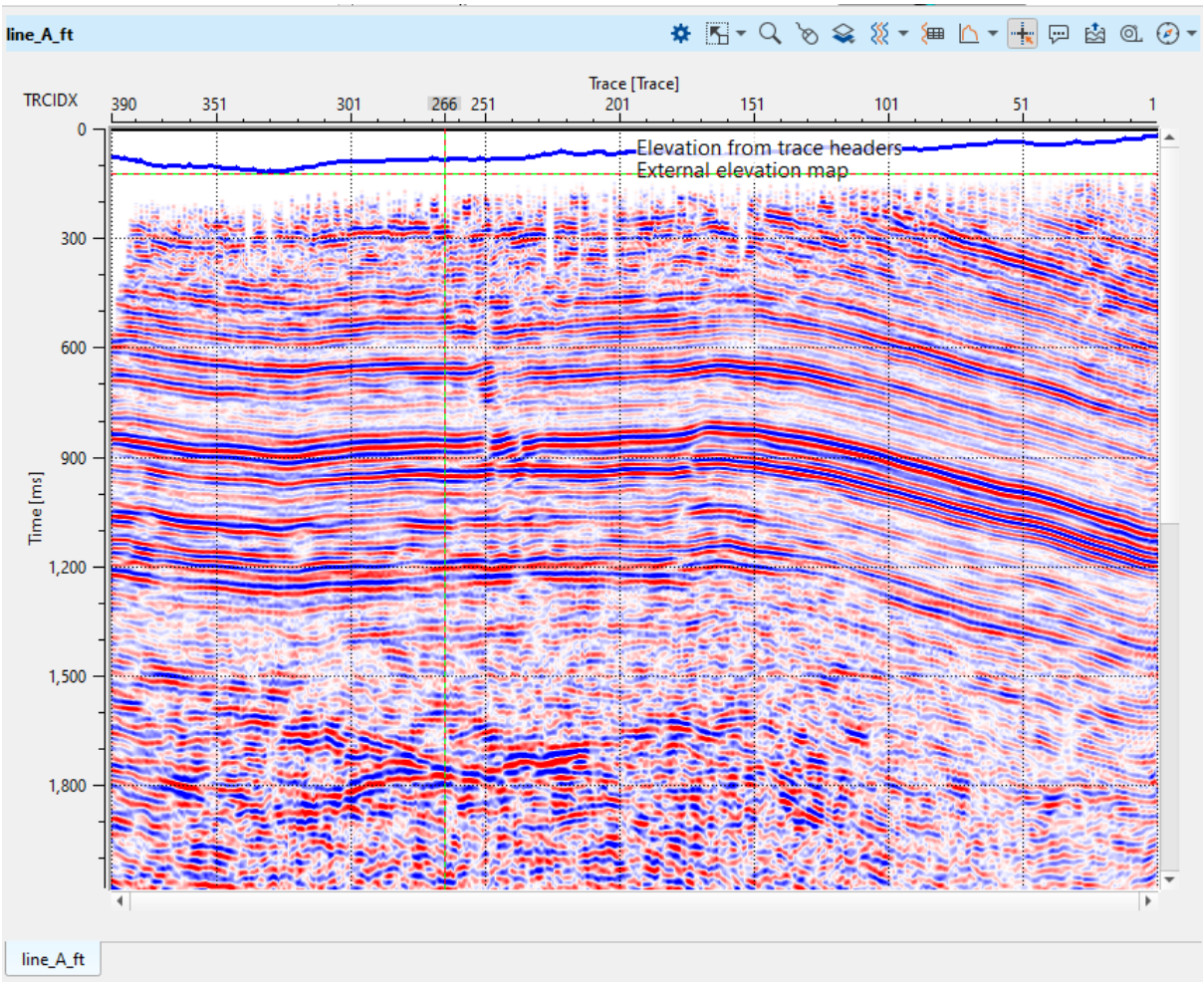

10. Tool tip :

Upon selecting this option, it will display the available information depending on the cursor position.

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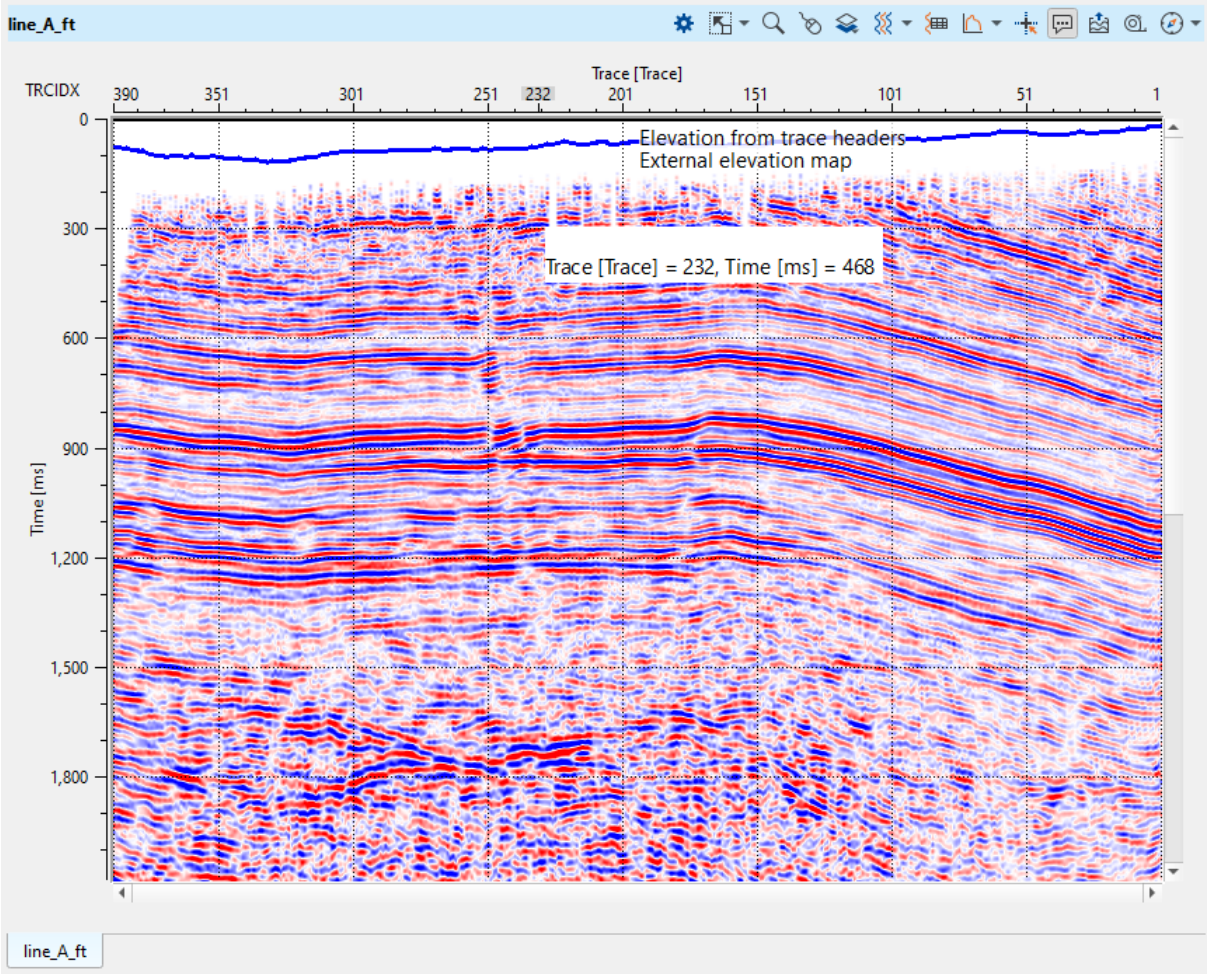

11. Export picture :

The user can able to import the images with different formats for future needs like power point presentations etc.

12. Ruler :

This is a very useful tool especially for **Prestack** data. For an example, we want to measure the velocity of an event. To achieve click on the Ruler icon and hold MB1(left mouse button) and draw a line. It will display the information as a tool tip as shown below. In case of post stack data, it isn't that informative.

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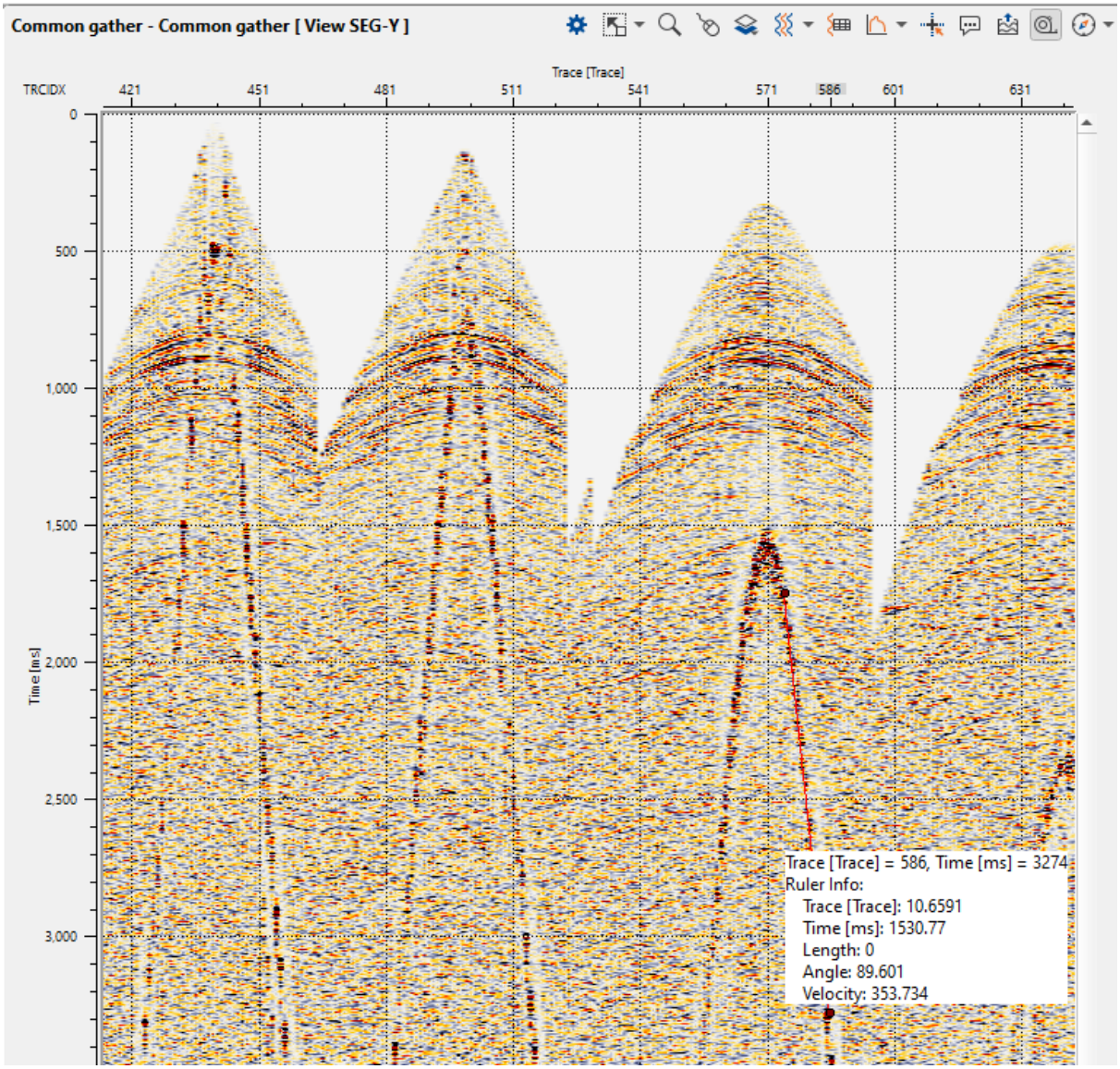

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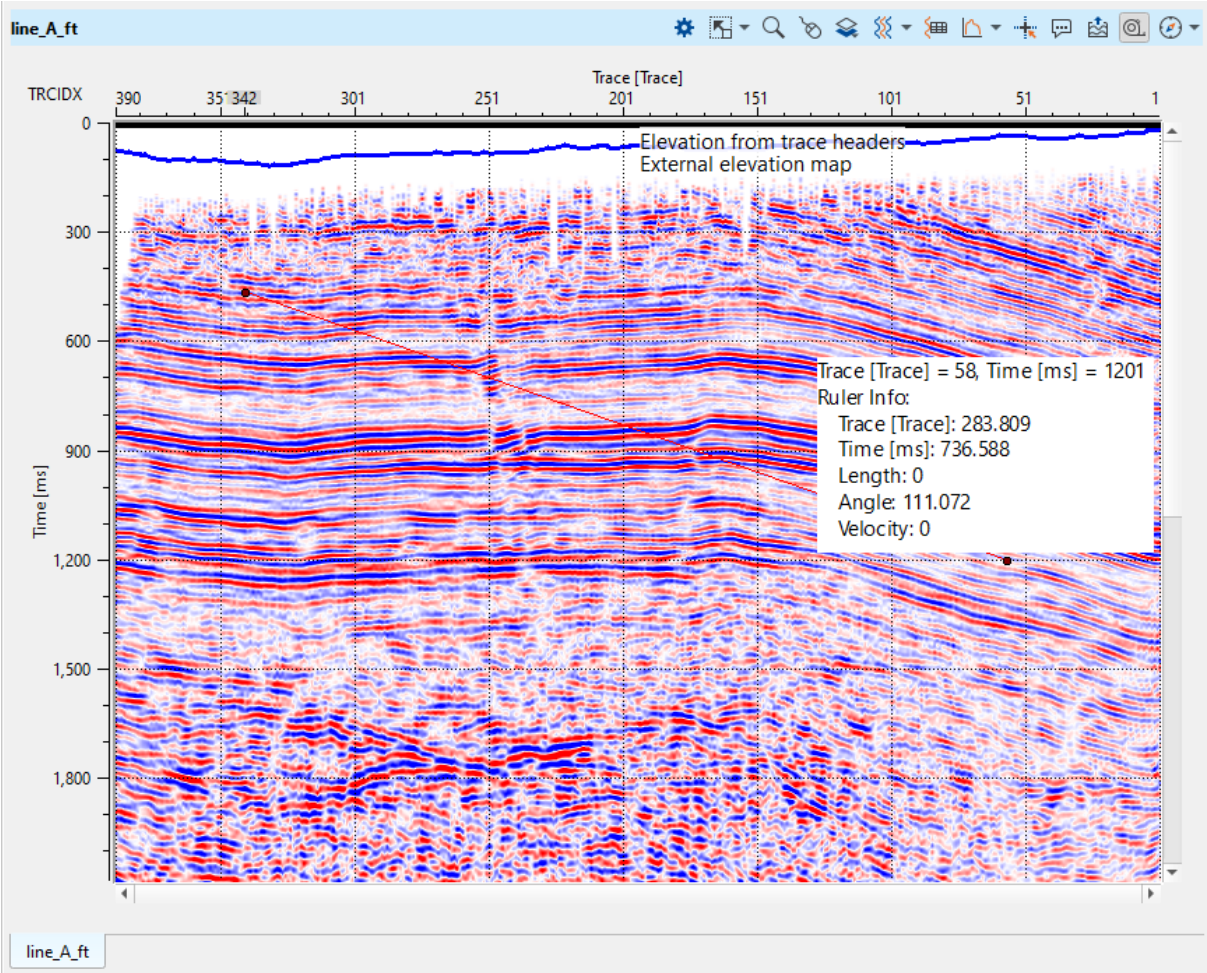
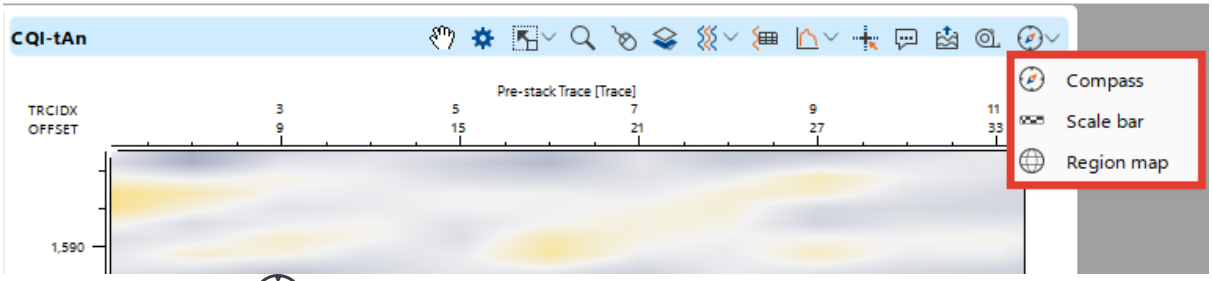


13. Miscellaneous

The *Miscellaneous* icon provides additional tools that enhance the seismic data interpretation experience. These tools add orientation, scale, and context to the data being visualized, especially in spatially complex environments. The main components include:



- Compass Displays an orientation guide within the seismic data window, helping users to maintain a clear sense of direction.

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- Scale bar Adds a scale reference to the display, allowing the user to visually gauge distances across the seismic section.

- Region map Shows a miniaturized map view of the region or data coverage area, providing spatial context for the seismic data being analyzed.

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Getting Started

4 Getting Started

This chapter will guide you through the essential steps of using g-Space software.

You'll find detailed instructions on installation 14 and licensing 23, as well as how to create 231, save 233, and load 235 projects. Whether you're starting a new project or working with an existing one, this section covers all the basics.

In addition, you'll learn how to configure your project settings 237, including selecting the appropriate measurement systems supported by g-Space.

We also provide an overview of the demo project 242 included with the software, which offers a hands-on opportunity to explore g-Space's capabilities with preloaded data.

g-Space is a powerful platform designed specifically for seismic interpretation and geomodeling, offering geoscientists advanced tools to analyze and interpret subsurface data with precision.

As the second software package in our product line, g-Space complements g-Platform™ — our leading solution for seismic processing and imaging. While g-Platform™ handles the initial stages of data acquisition and seismic processing, g-Space takes over to drive the workflow from seismic interpretation to comprehensive geological modeling.

In g-Space, seismic interpretation is at the core, with state-of-the-art algorithms and visualization techniques that allow users to accurately identify structural and stratigraphic features, evaluate reservoir quality, and understand properties distribution. The platform excels in integrating seismic data with well logs, stratigraphy, and other geological information, enabling the creation of detailed 3D geological models.

By the end of this chapter, you'll be equipped with the foundational knowledge to navigate g-Space, configure your projects, and begin leveraging its powerful tools for seismic interpretation and geomodeling, building upon the groundwork laid by g-Platform™.

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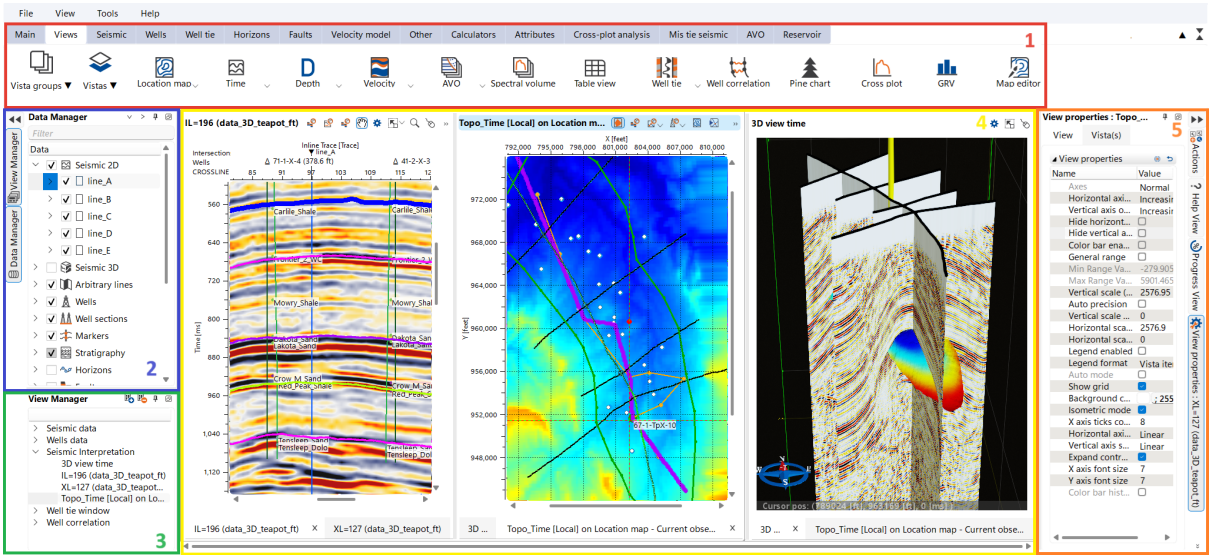

4.1 Creating a new project

To **create new project** follow next steps:

Step 1 Open g-Space

Step 2 In Menu bar click - **File** and then **Save project** or

in Ribbon bar 33 press **Save project** or just press **Ctrl+S** shortcut 217

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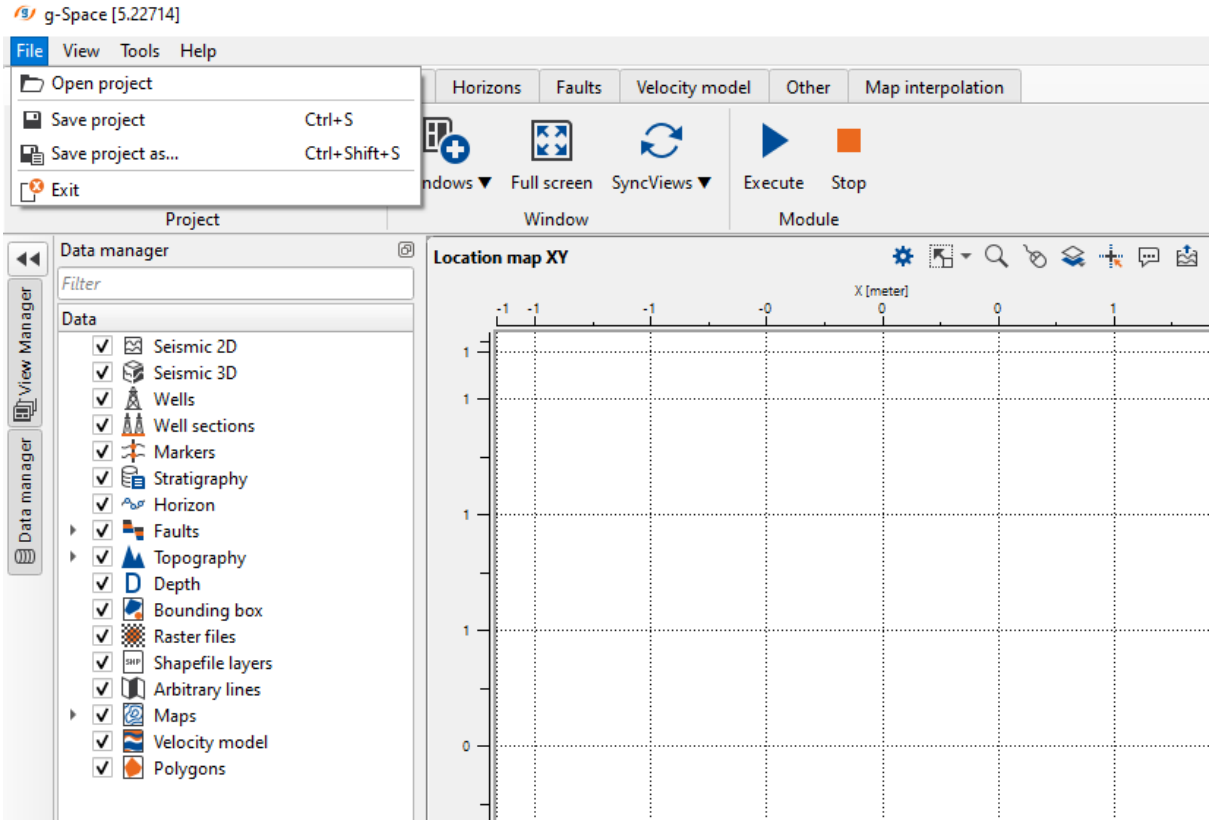

Step 3 In the appeared window **Save project** set the destination of the file directory and click **Save** button.

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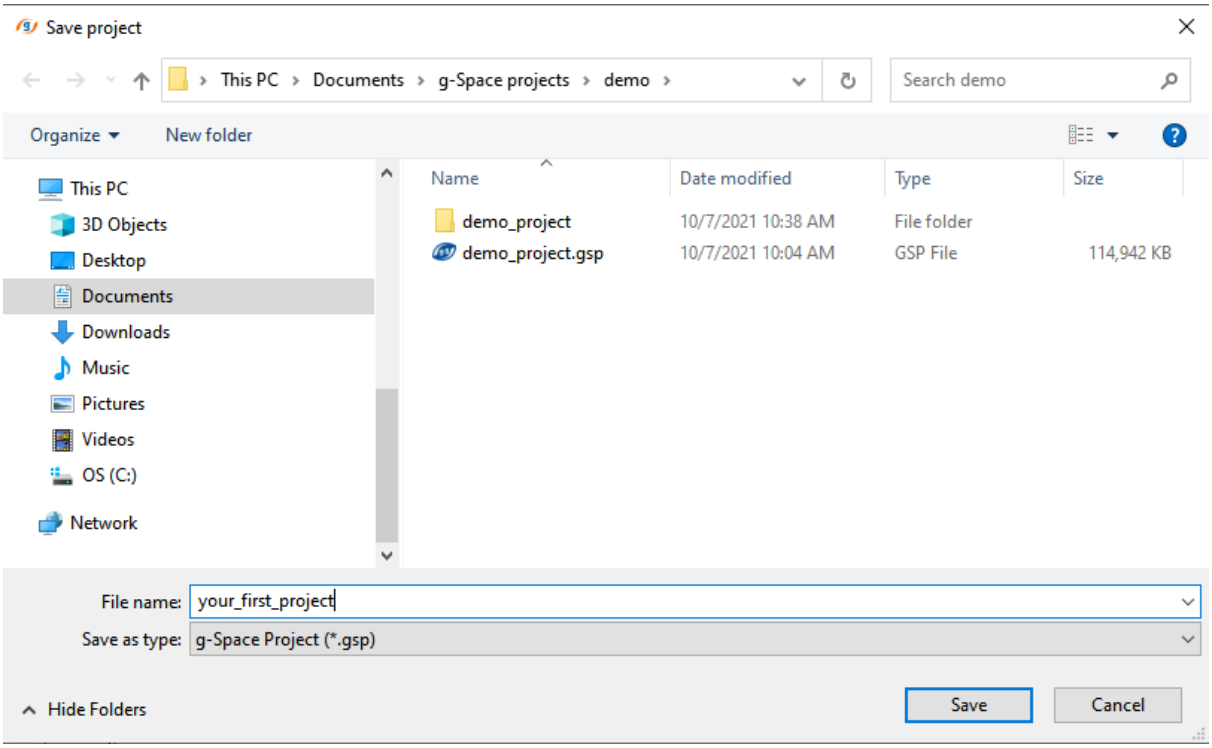

4.2 Saving the project

If you want to save changes to the existing project, use **option 1**.
If you prefer not to overwrite the current project and want to save it as a new file instead, use **option 2**.

Option 1.
In Menu bar click **File** and then **Save project** or

in Ribbon bar 33 press **Save project** or just press **Ctrl+S** shortcut 217

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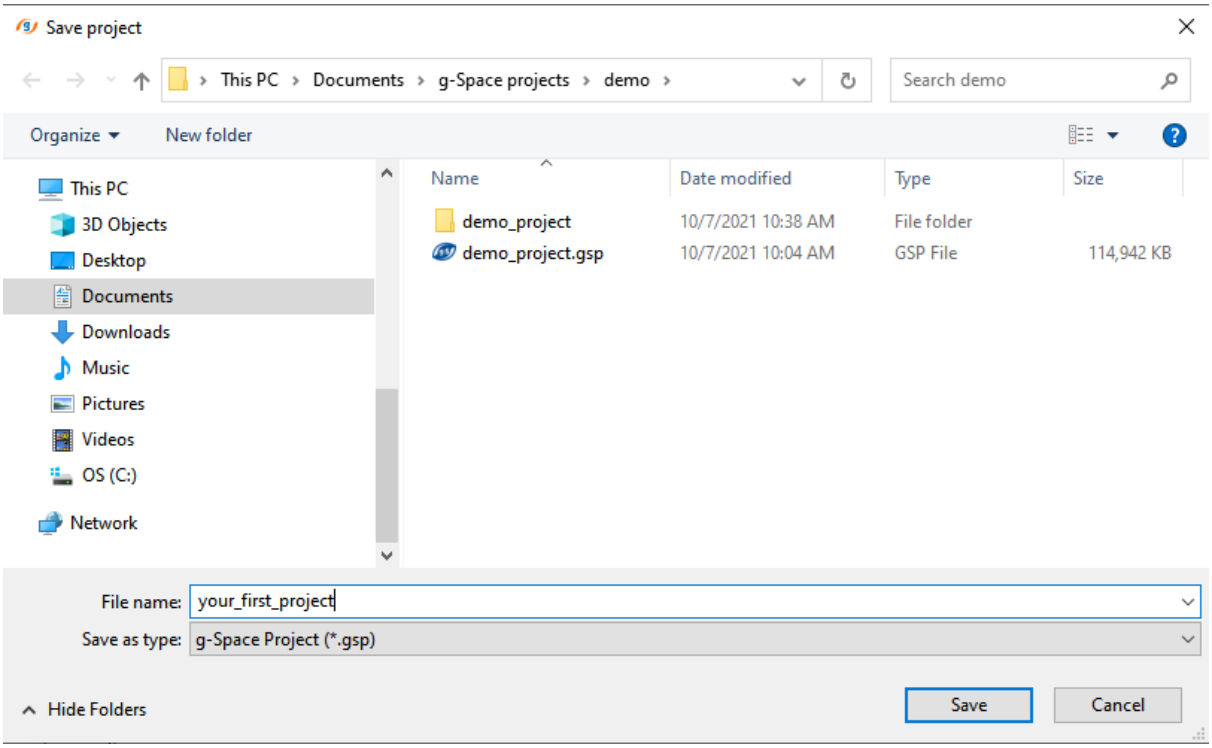

Option 2.
In Menu bar click **File** and then **Save project as** or just press **Shift+Ctrl+S** shortcut[217]

or in Ribbon bar[33] press on the arrow on the right bottom corner of the button **Save project** or just press **Shift+Ctrl+S** shortcut[217]

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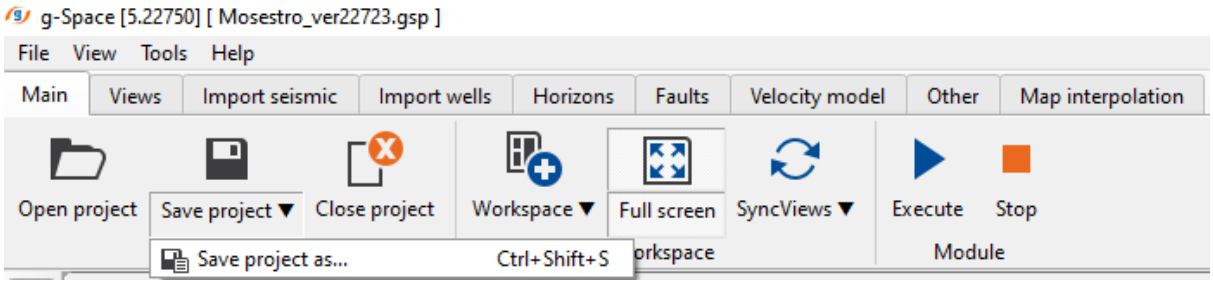

Depending on project size it may take from few seconds to few minutes to save the project.

4.3 Loading an existing project

g-Space project consists of two files with the following extensions:

***.gsp** - stores the data loaded in the project
***.gsp.gui** - stores visualization settings you made in the project

To load the existing project in Menu bar click **File** and then **Load project** or in Ribbon bar 33 press **Load project**

In appeared window locate the file with extension ***.gsp** and click **Open**

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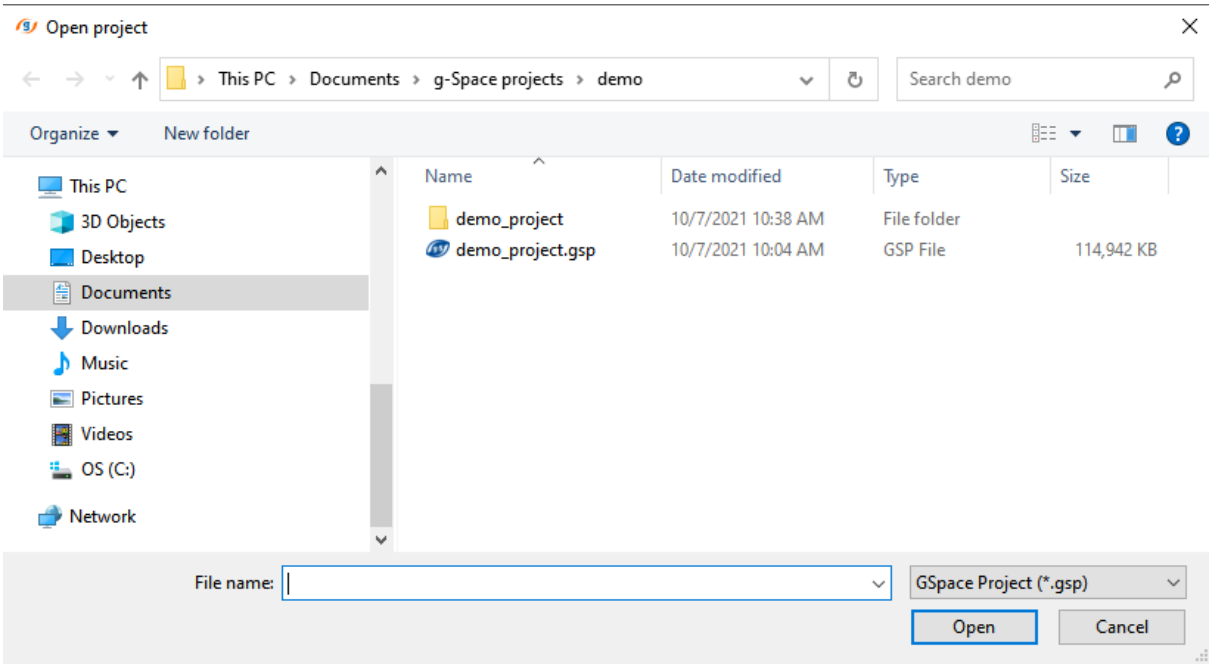

Depending on project size it may take from few seconds to few minutes to load the project.

4.4 Closing the project

If you don't want to close g-Space, but want to close the project there is an option for that:

In Ribbon bar 33 press **Close the project**. It will ask you if you want to save the changes you made and then will open clean unsaved g-Space project

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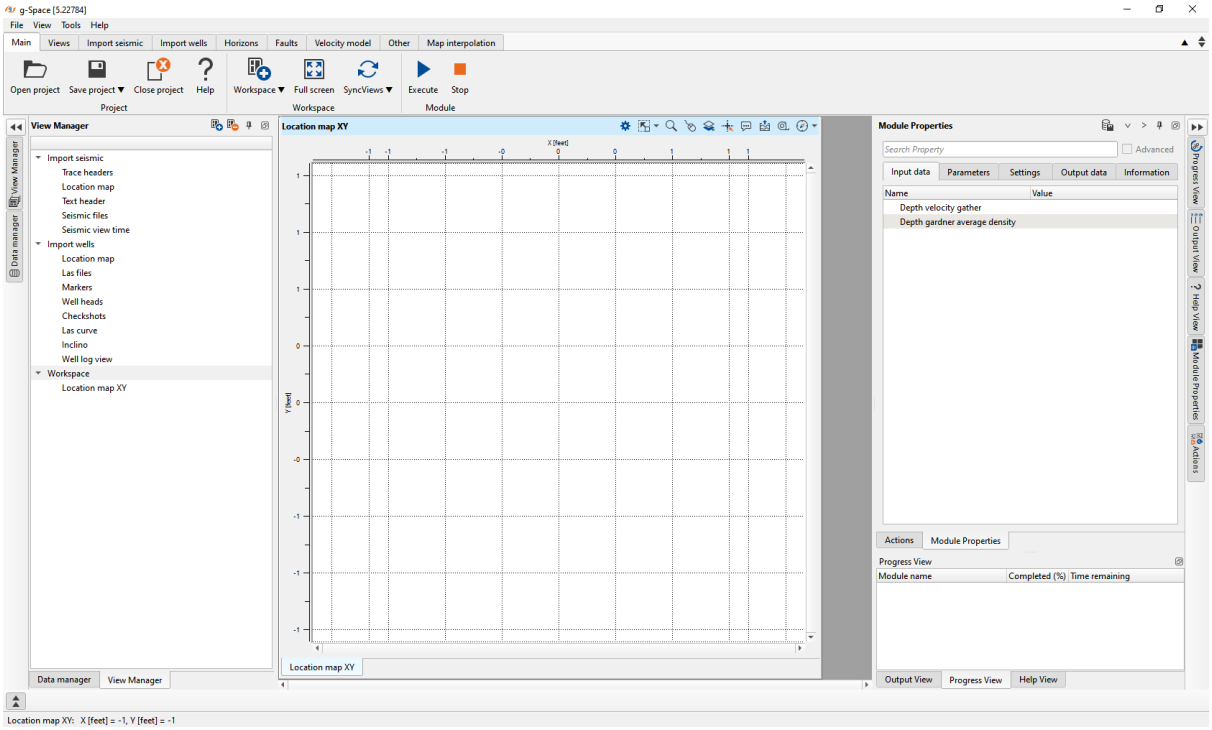
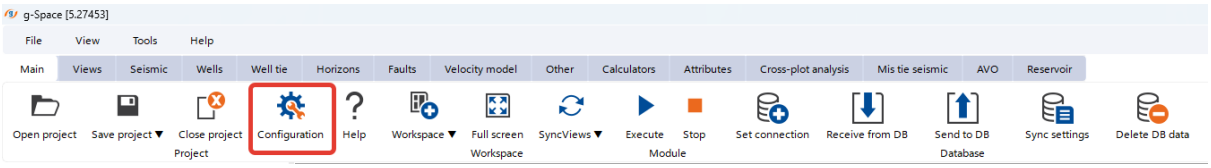


4.5 Project configuration

This chapter covers how to make a global settings for the project such as:

- Setting up datum 241
- Setting up coordinate and measurement system 238

The main project configuration you can find here on the Main tab:



After clicking on this icon you will be taken to the configuration menu:

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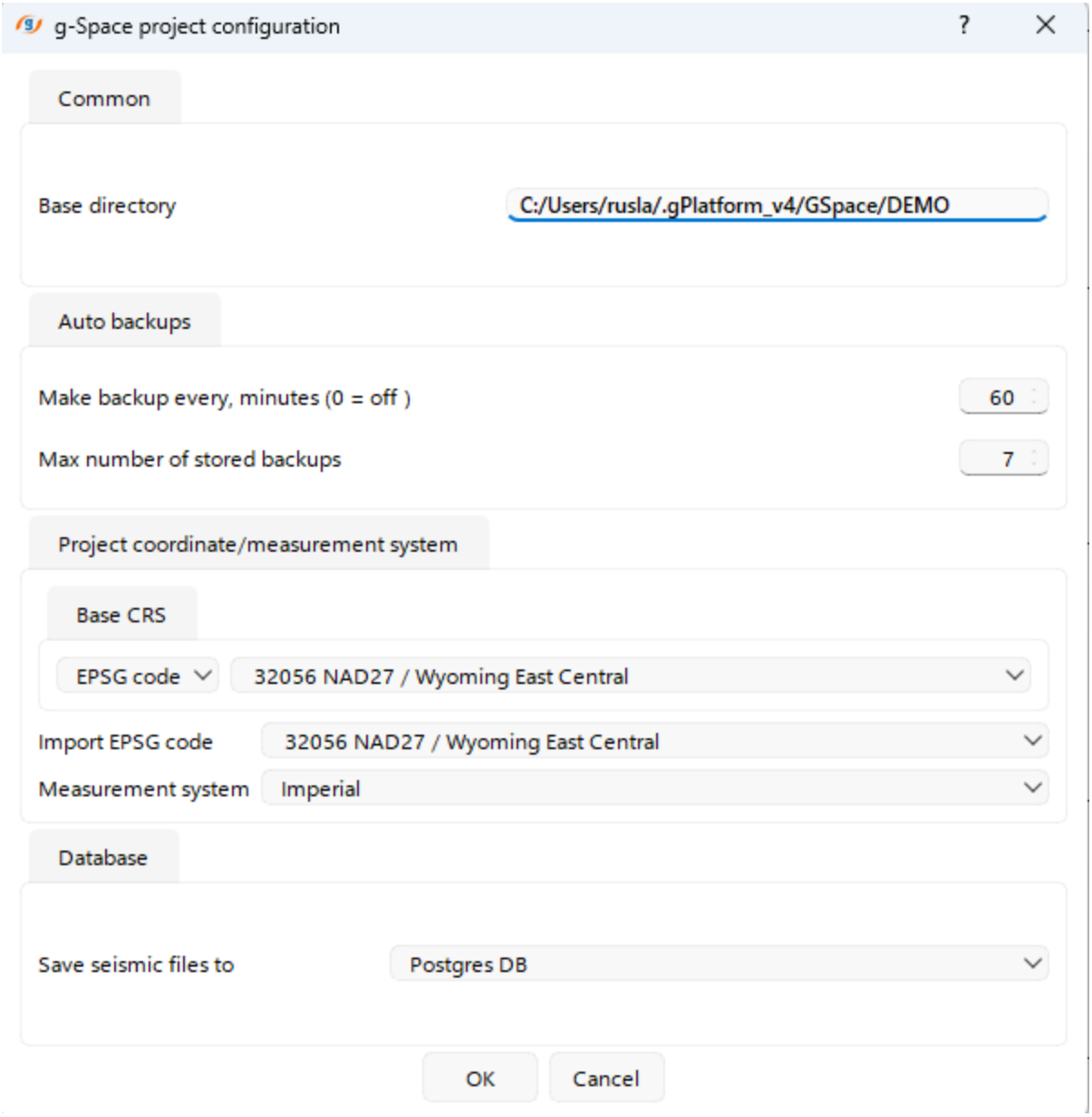

4.5.1 Coordinate and measurement system

To configure the project's Coordinate Reference System (CRS), open the Project configuration 237 menu.
In this menu, you can set the CRS and choose the measurement system:

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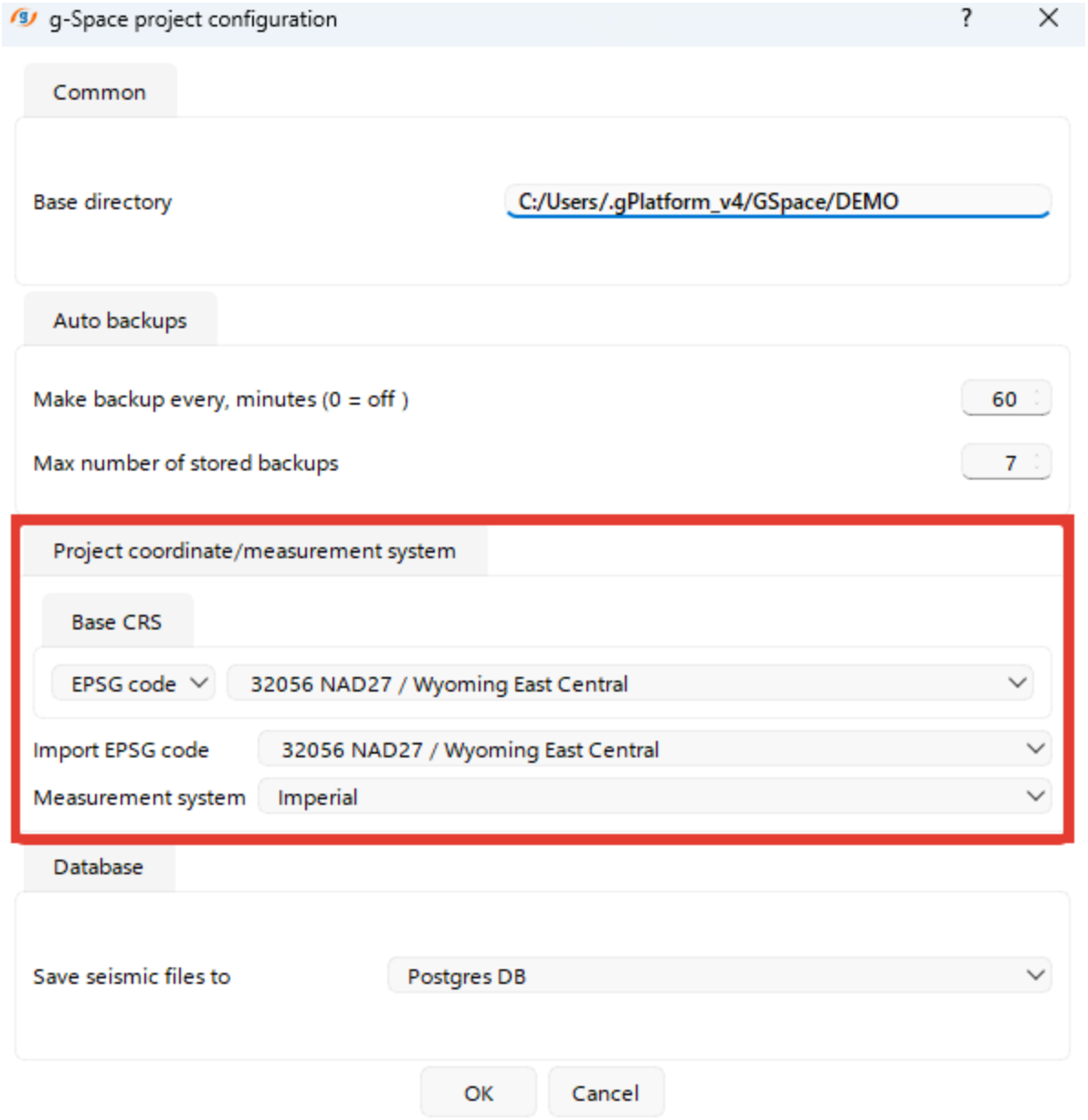

g-Space offers a vast selection of predefined CRS.
The easiest way to find the one that suits your project is by entering its EPSG code into the search field:

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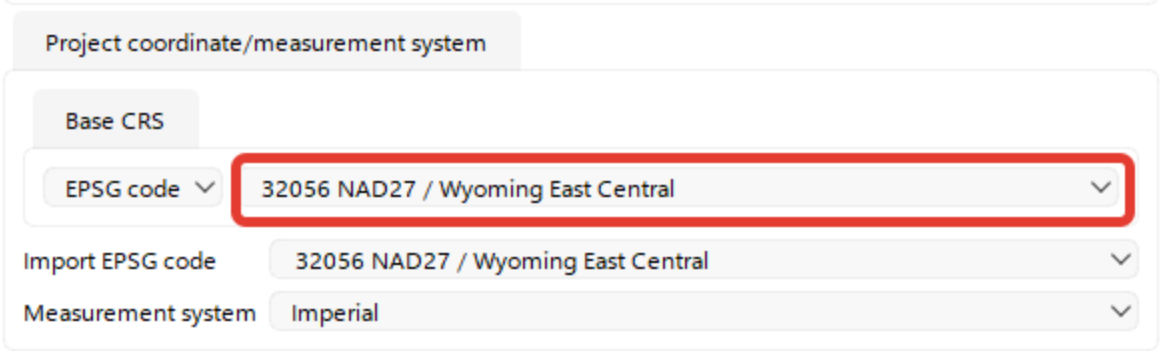
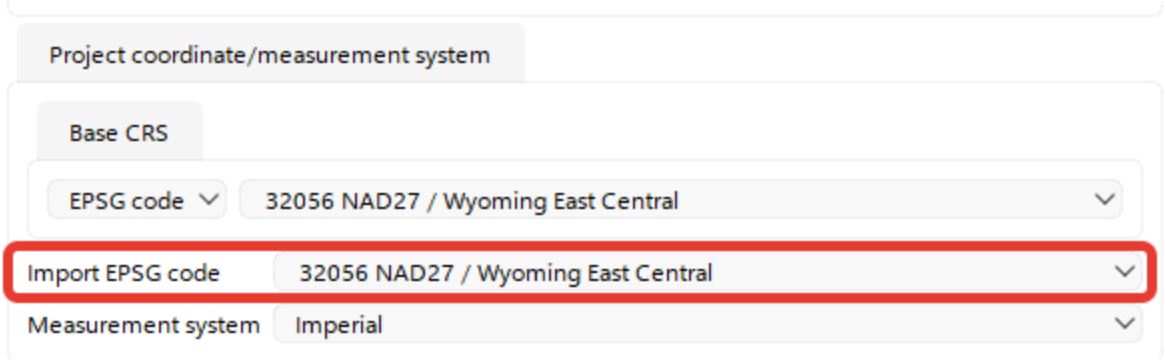


If the CRS of the imported data differs from the project's CRS, you can specify a different EPSG code for the import:



In this section, you can also choose the measurement system from three options: Imperial, Metric, or Field (coordinates in Metric and depth in Imperial):

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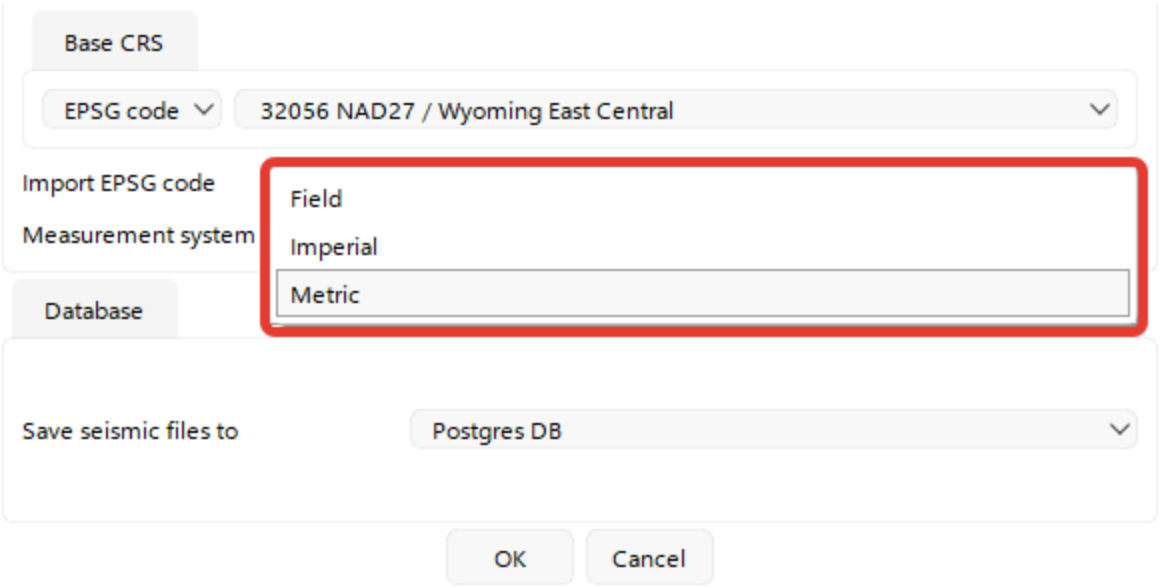

4.5.2 Datum configuration

To configure the datum, follow these steps:

- Go to Module properties 91 in **Parameters tab**
- Set the required parameters for **Replacement Velocity** and **Datum**
- Click the **Shift to Datum** checkbox

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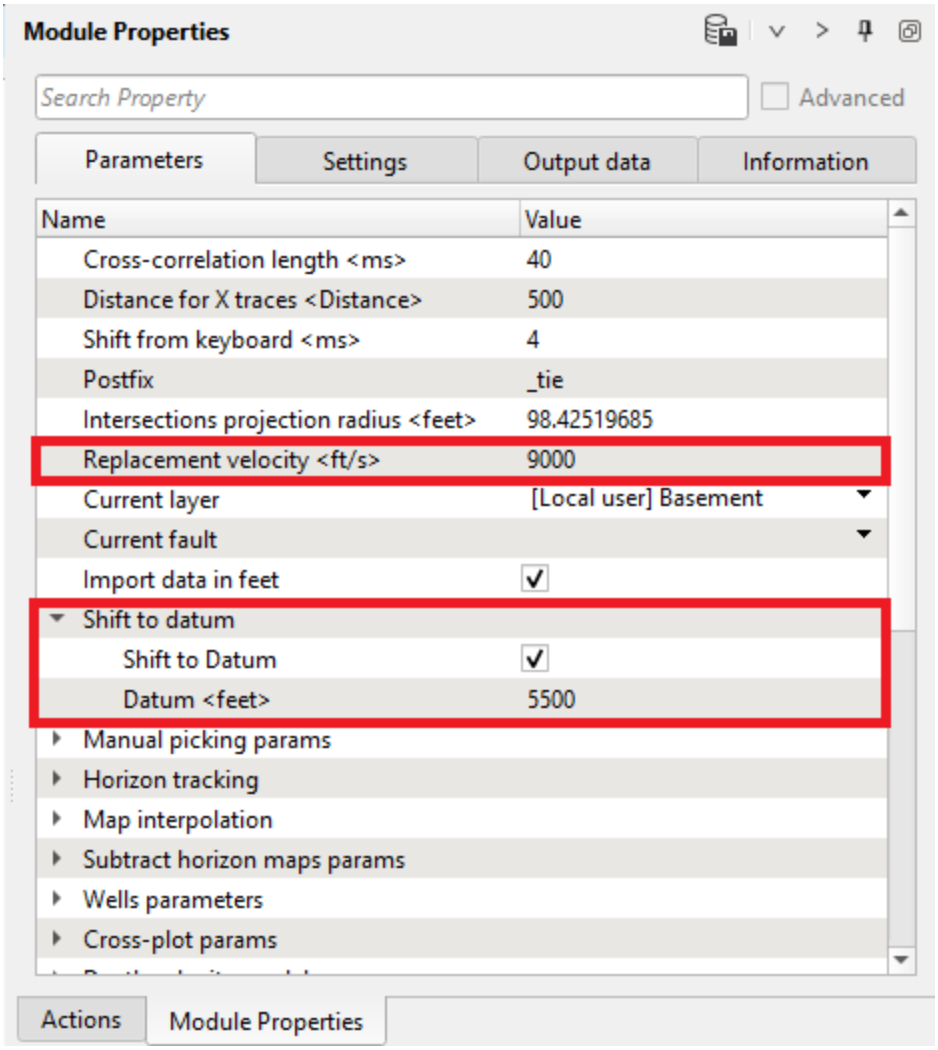

4.6 Demo project

The demo project is included in the installation package and is located in the user folder: *C:\Users\"USERNAME"\.gPlatform_v4\GSpace\DEMO*

This demo project is based on the open-source Teapot dome oil field dataset.

Teapot Dome, located in the Powder River Basin, Wyoming, is a geologically significant field known for its complex structural features and productive hydrocarbon reservoirs. The field primarily produces from the Cretaceous and Pennsylvanian formations, with key reservoirs including the Tensleep Sandstone and the Frontier Formation.

Dataset includes:

- 3D/2D seismic data

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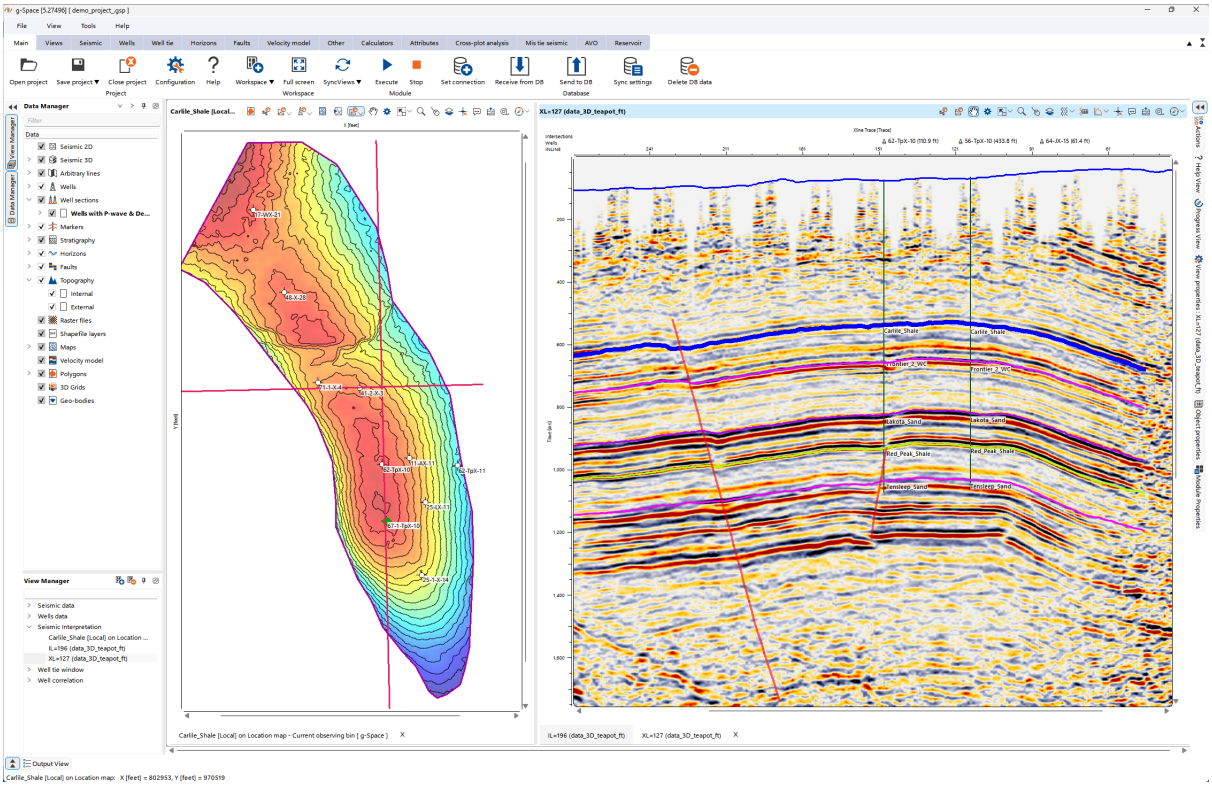
- Interpreted horizons
- Well data, including heads, inclinometry, logs, checkshots and markers

Please note that all data in the Demo Project is presented in the imperial system of units, with feet as the base unit of measurement. Project coordinate system is 32056 NAD27 / Wyoming East Central.

Several workspaces have been created in the demo project to help you familiarize yourself with the g-Space interface for different workflows, such as seismic interpretation, well correlation, and well tie.



4.7 Remote database

g-Space allows you to work with a remote database and offers a variety of tools for multi-user mode.

To set up a connection with the remote database, select "Set connection" in the main toolbar:

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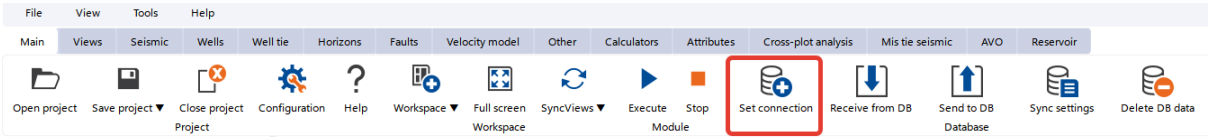
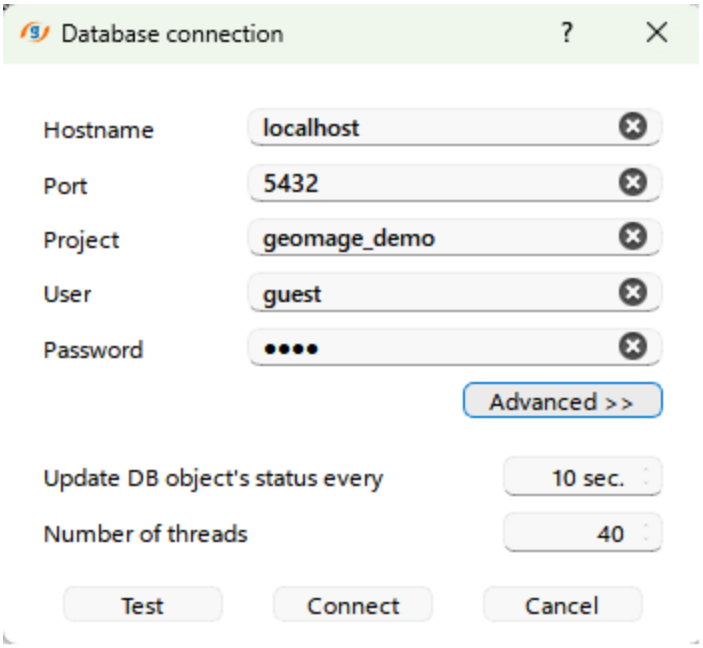


In the Database connection window, enter the connection settings and click the "Connect" button:



More information about working in multi-user mode you can find here: Multi-user mode 567
.

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Import data

5 Import data

This chapter will cover the ways how to integrate different types of data in g-Space.

g-Space supports the following types of data:
- Seismic 246 - SEGY 2D and 3D data
- Well data 256 - well headers 257, inclinometry 263, markers 268, well logs 278, checkshots 281, comment logs 287
- Seismic horizons 292
- Fault sticks 294
- Shape files 296
- Polygons 297
- Topography 298
- Geo-referenced images 299
- Grid data 302

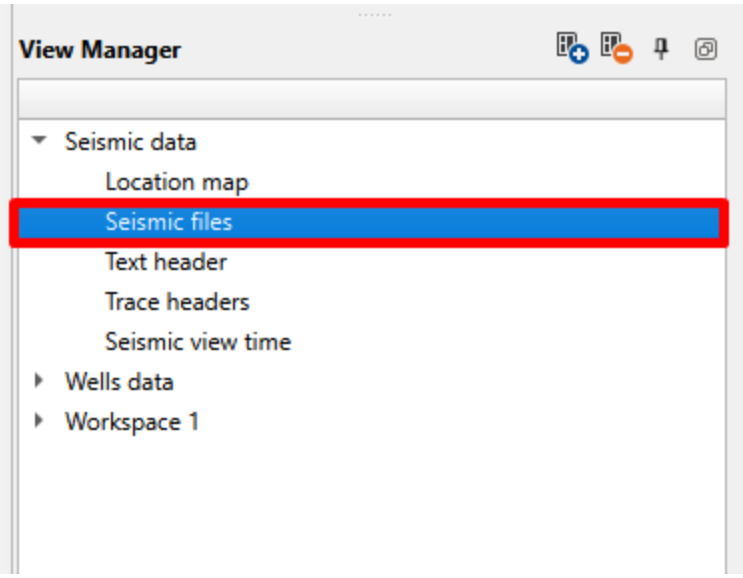
For more information about supporting formats please refer to chapter Formats 332

5.1 Import Seismic

Step 1

Go to the **seismic files** view of the seismic data 118 predefined workspace.

For this choose the **seismic files** view in the view manager 90:



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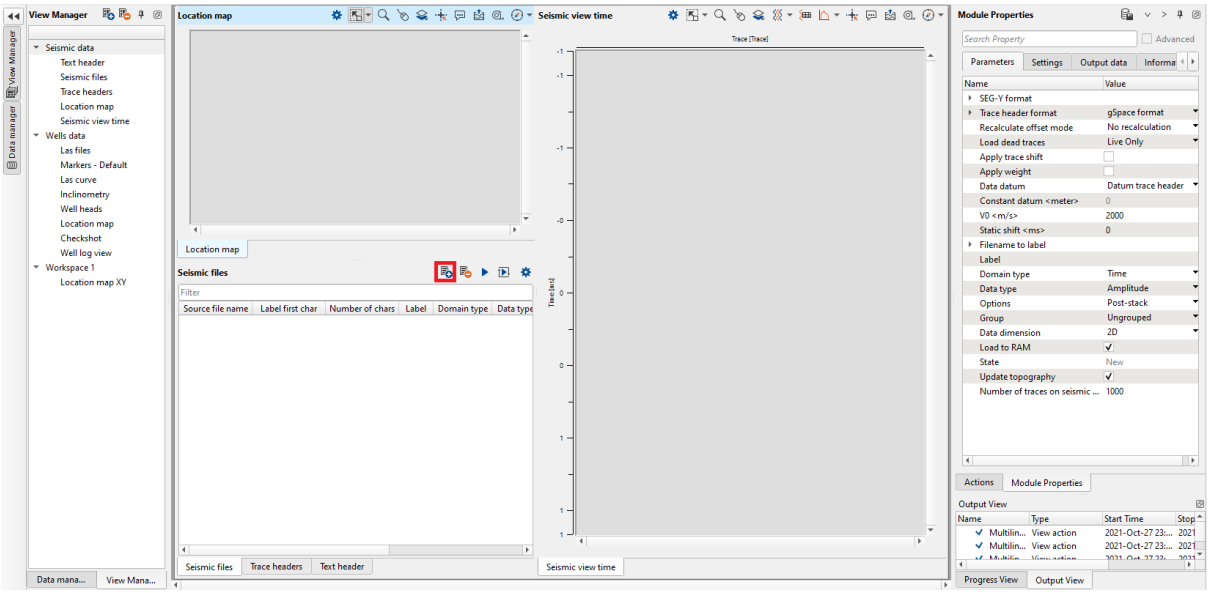
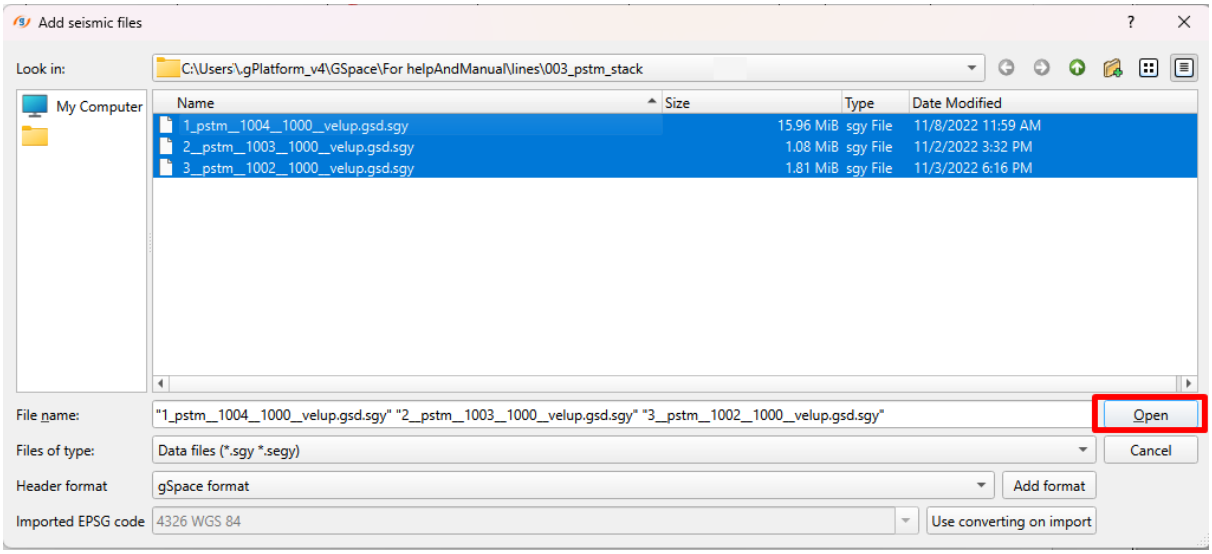
In the **seismic files** view press **Add files** button:



Locate seismic data and press Open:



Step 2: Data Preview and setting parameters

In the **seismic files** view set Domain (time/depth), Data type (amplitude/velocity/attribute), Options (Pre-/Post-stack), add to group (for example processing type), Data dimension (3D/2D).

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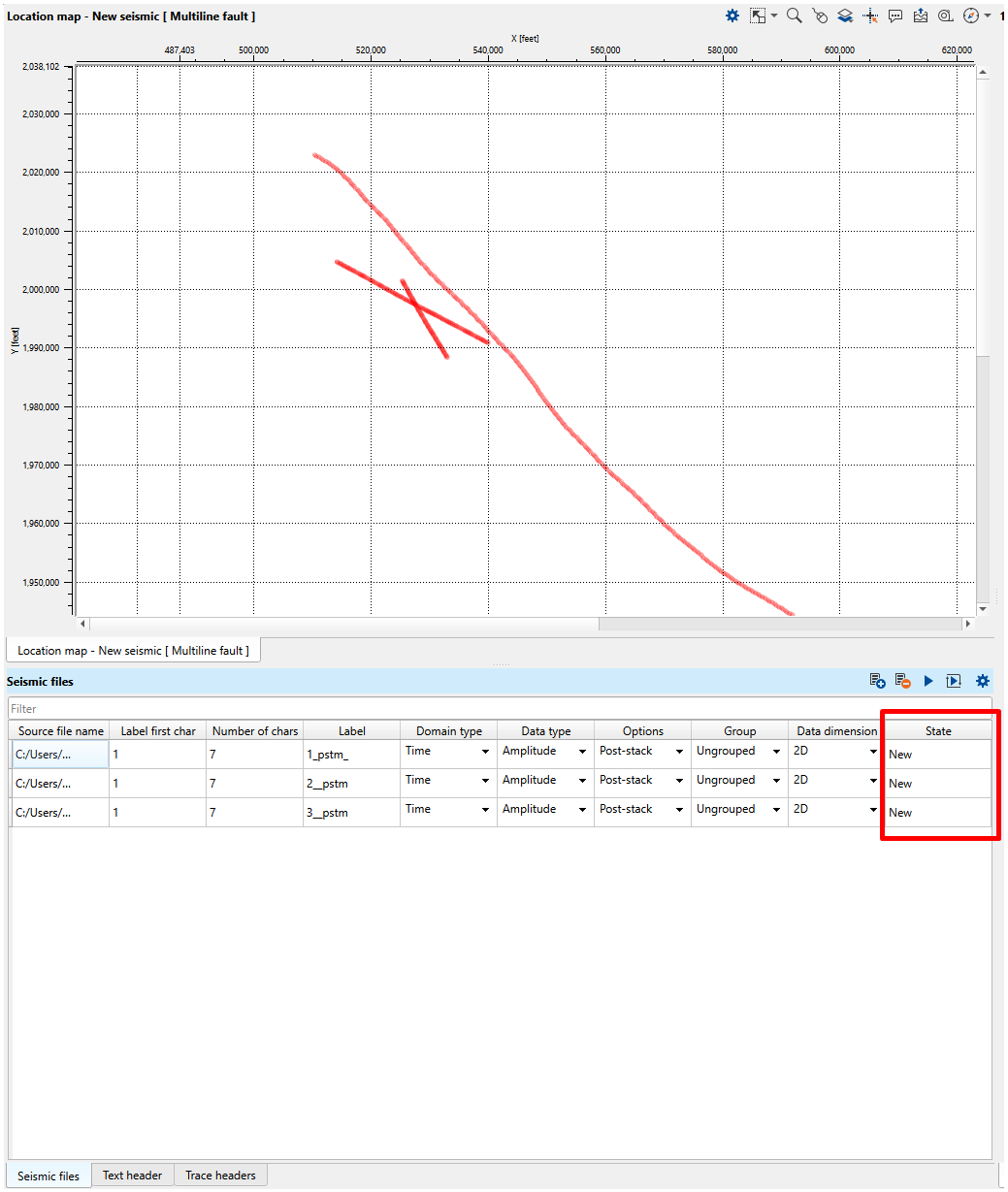
On the **location map** the loading lines or bins will appear in **RED** - it means they haven't been loaded yet. Also they marked as 'New' in the **State** column in the **seismic files** view (may not be displayed if the default header format differs from the actual seismic):



In case of 3D bins will appear in **RED**:

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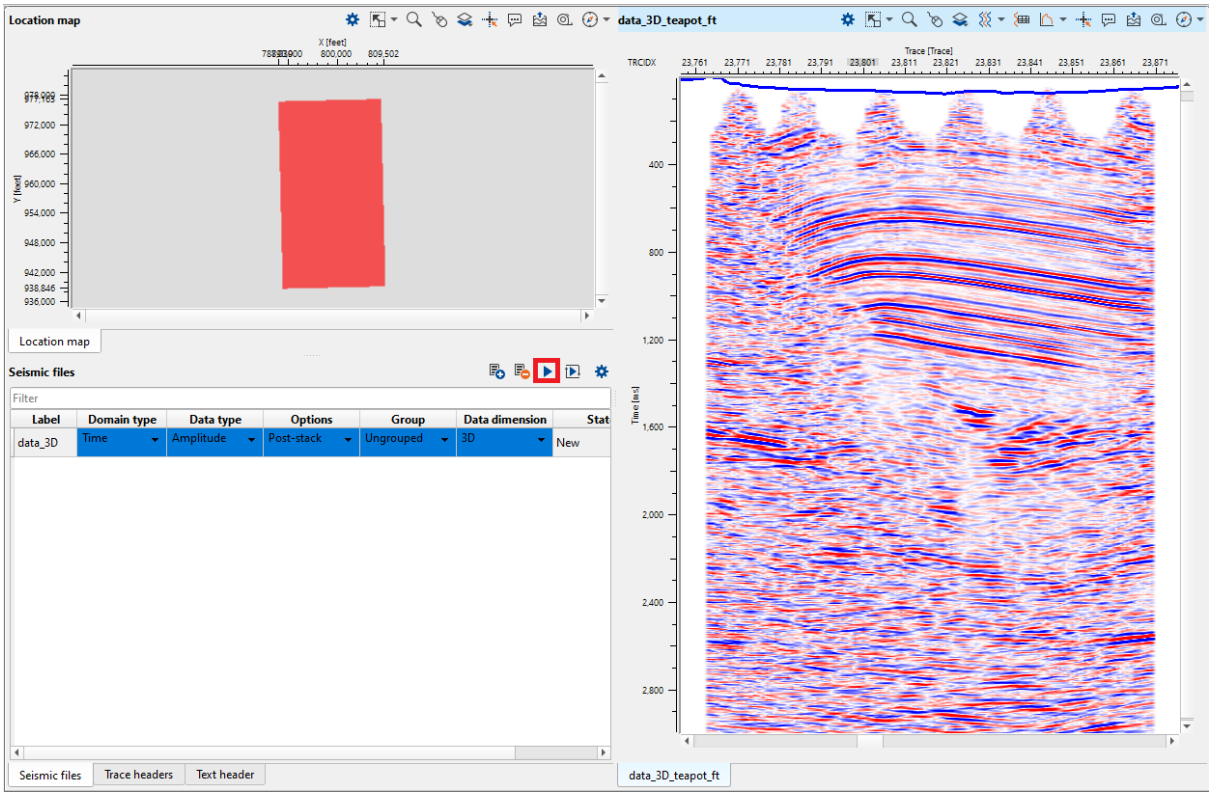
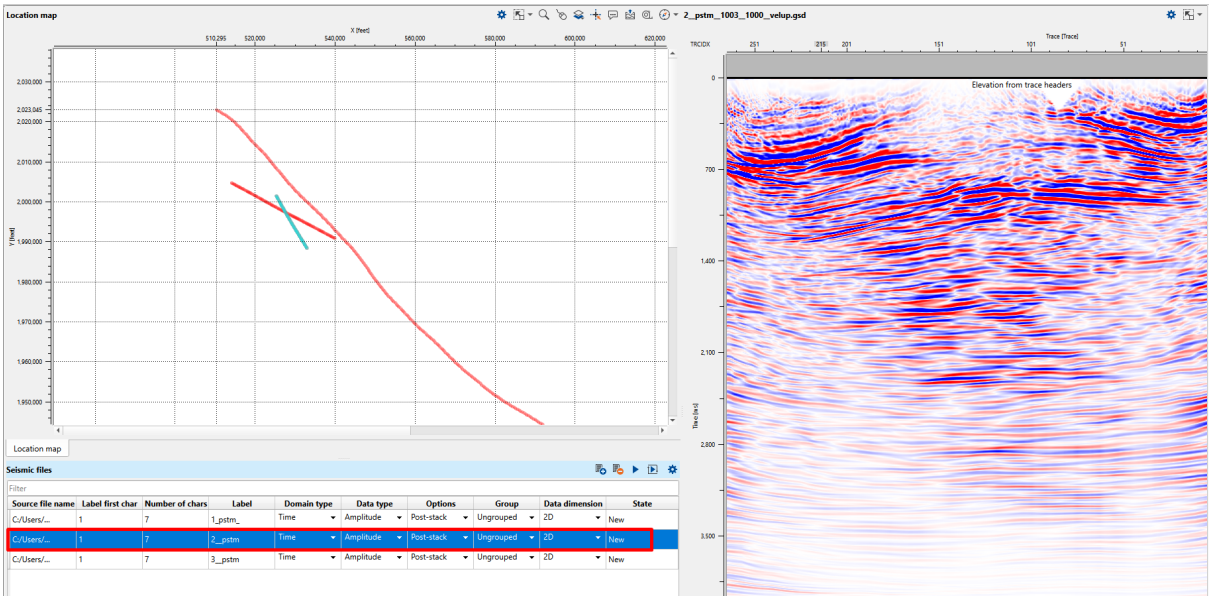


Choose specific file in the **seismic files** view to see the traces:



The text headers usually contain the main trace geometry information. In the **text header** view you can check which bytes contain it (X, Y and elevation in the case below):

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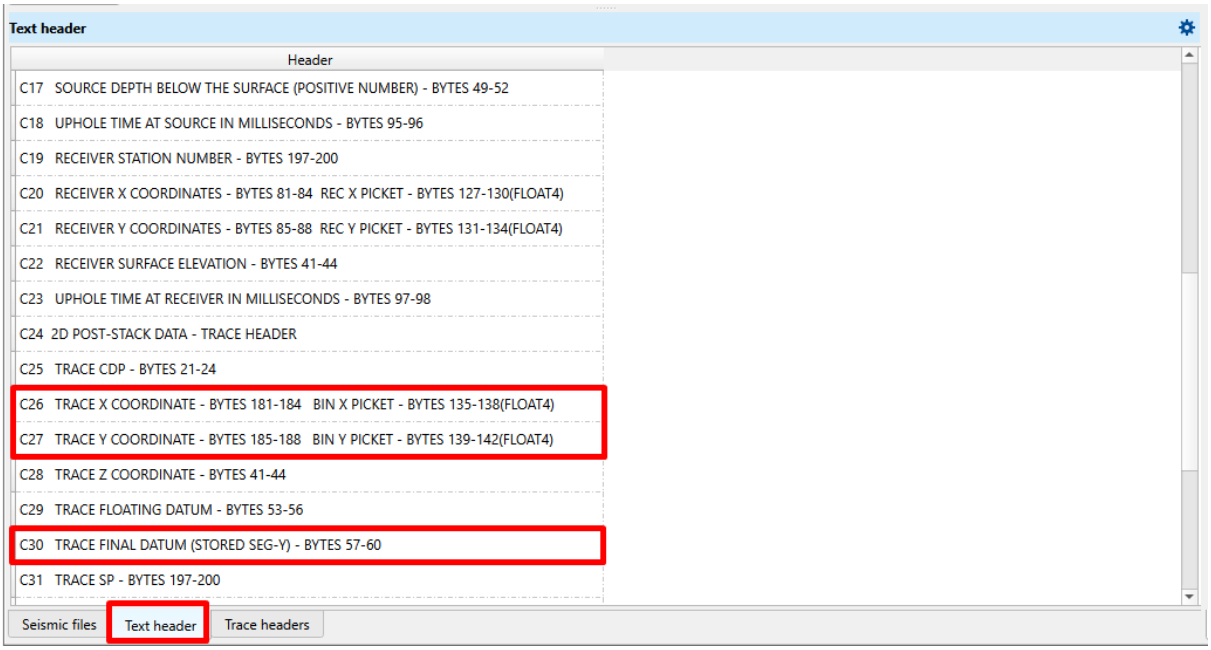
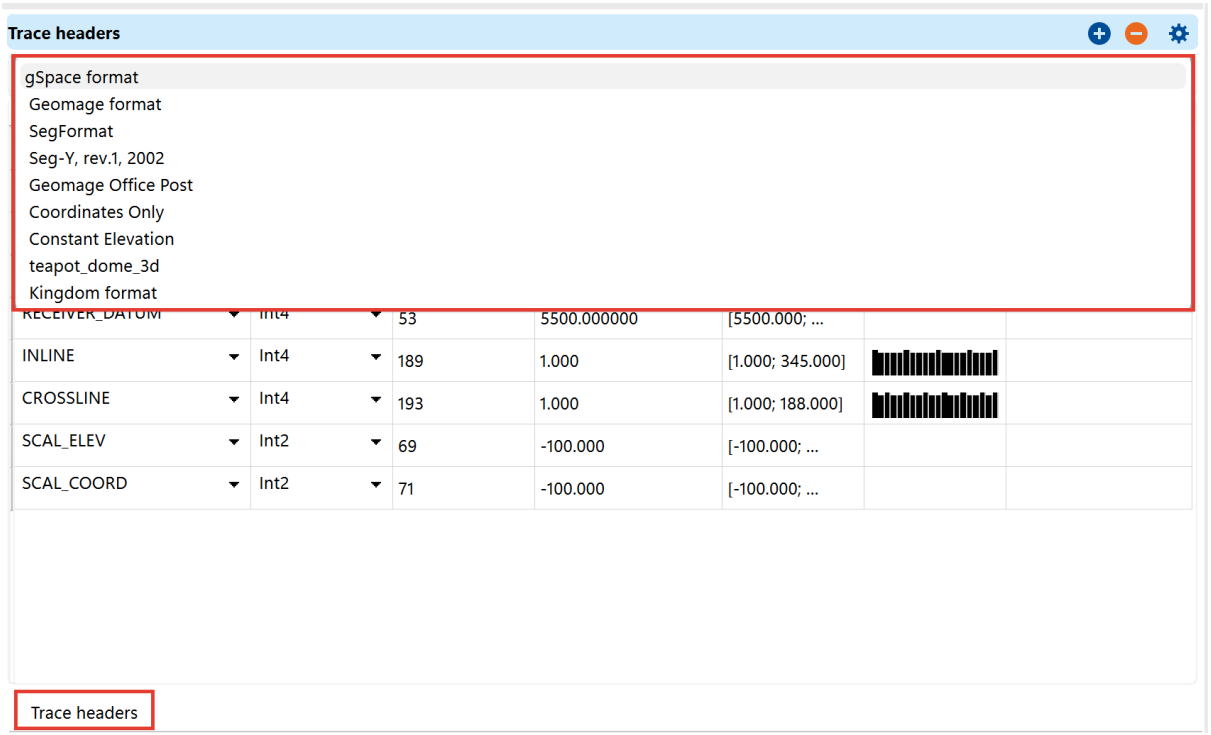


In the t**race headers** view choose one of the available trace header formats:



After that check that the bytes of the main fields are set correctly (trace X, Y and elevation and coordinates scale factors and other). To determine that you have your bytes set correctly the **Ranges** and **Histogram** columns can help you

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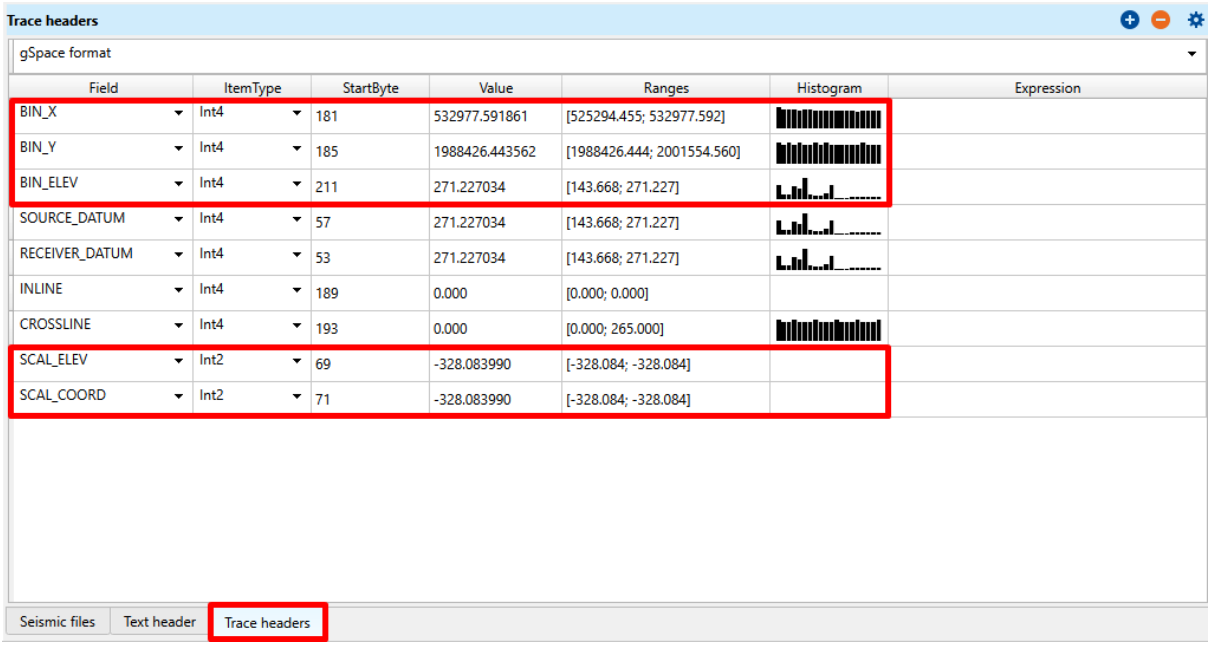
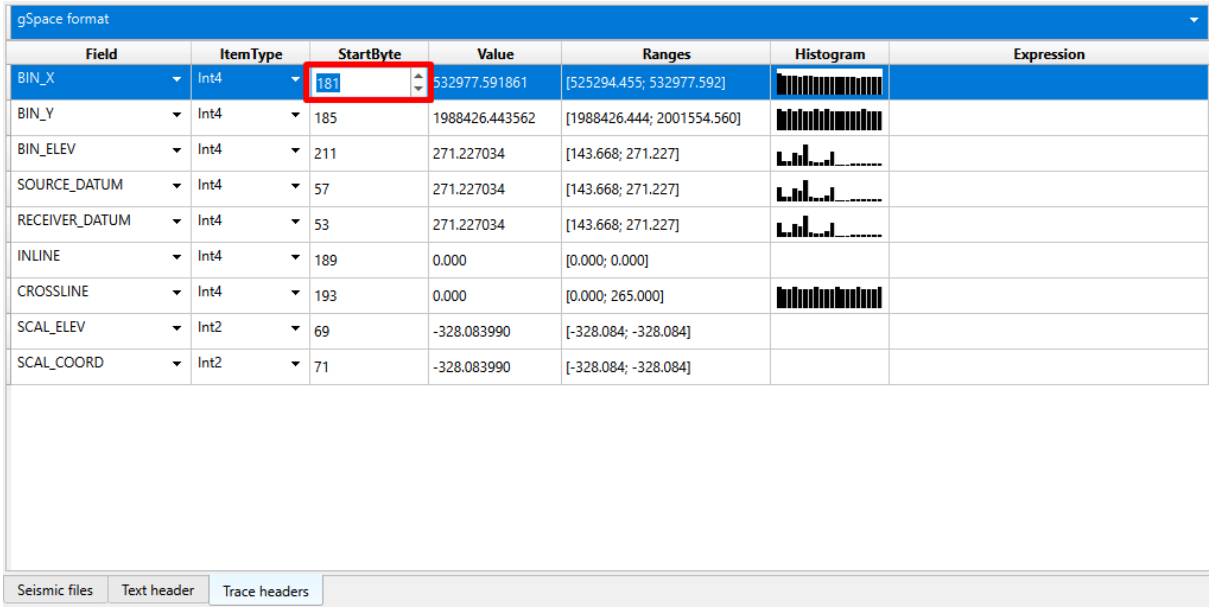


In case your seismic data in a different format than all available, select gSpace format and type **StartByte** value in any line according to your data:



After setting the new value, a window with a new format creation will appear:

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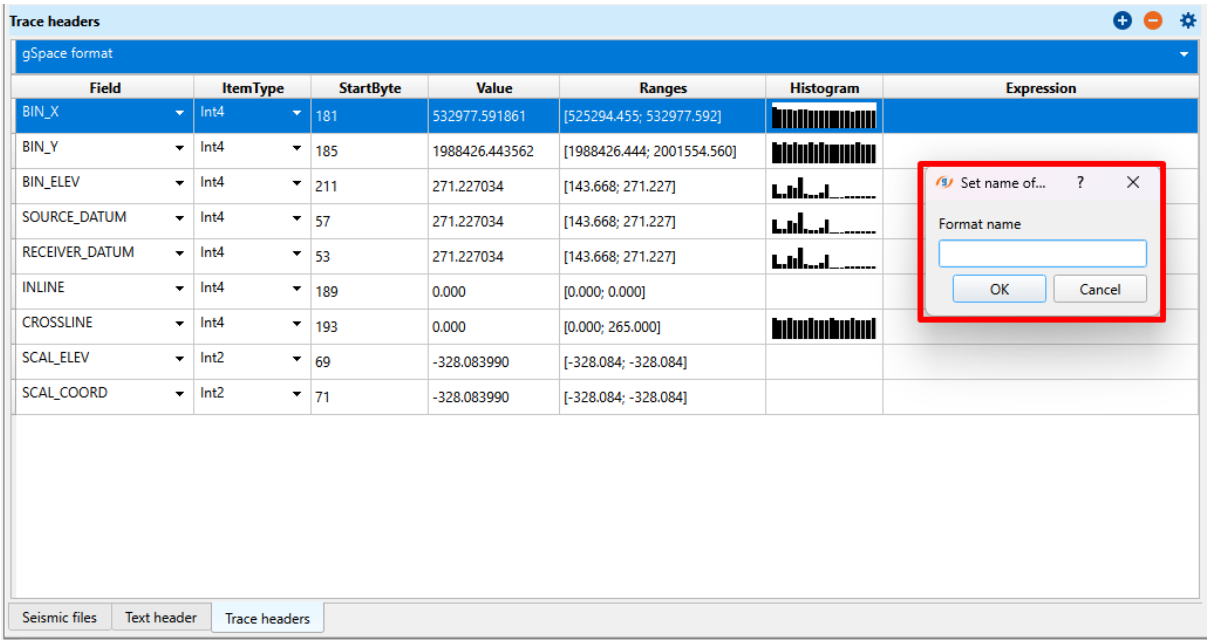

Type your format name and continue to change headers according to your data.

Once created, you can choose the new format later in other projects..

You have an option to use expression instead of trace headers. For this type an expression in the Expression column. To reference to the trace field use "data type (byte)". For example, the expression "int4(185)" returns the value read as a 4-byte integer from byte number 185. All available functions you can find here 342.

In Module properties 91 the additional loading parameters can be set such as Data Datum, Replacement velocity:

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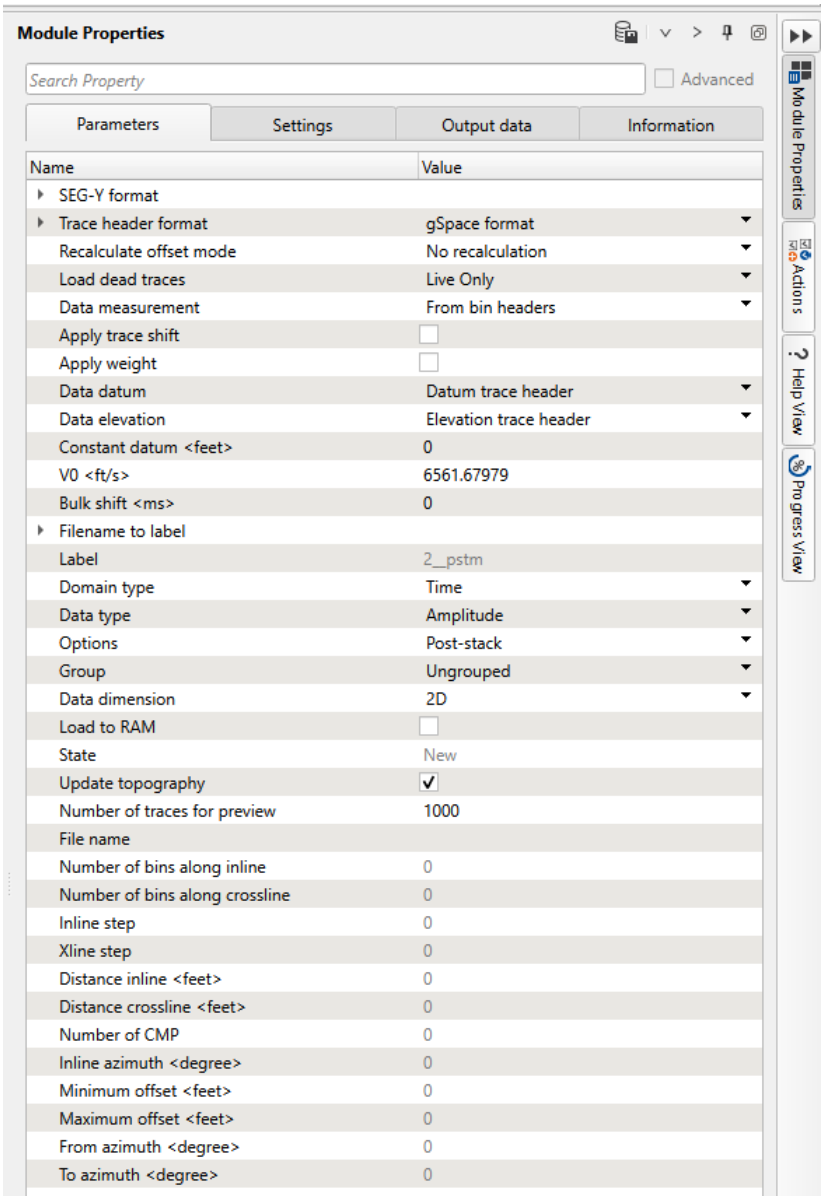

Note

g-Space uses topography information in some processes (such as velocity model creation). If you don't have topography information in your segy file you can set "Data elevation" parameter to "External topography" and it will be loaded from Geomage server.

Once all parameters are set press "Apply selected seismic" button or "Apply all seismic" button .

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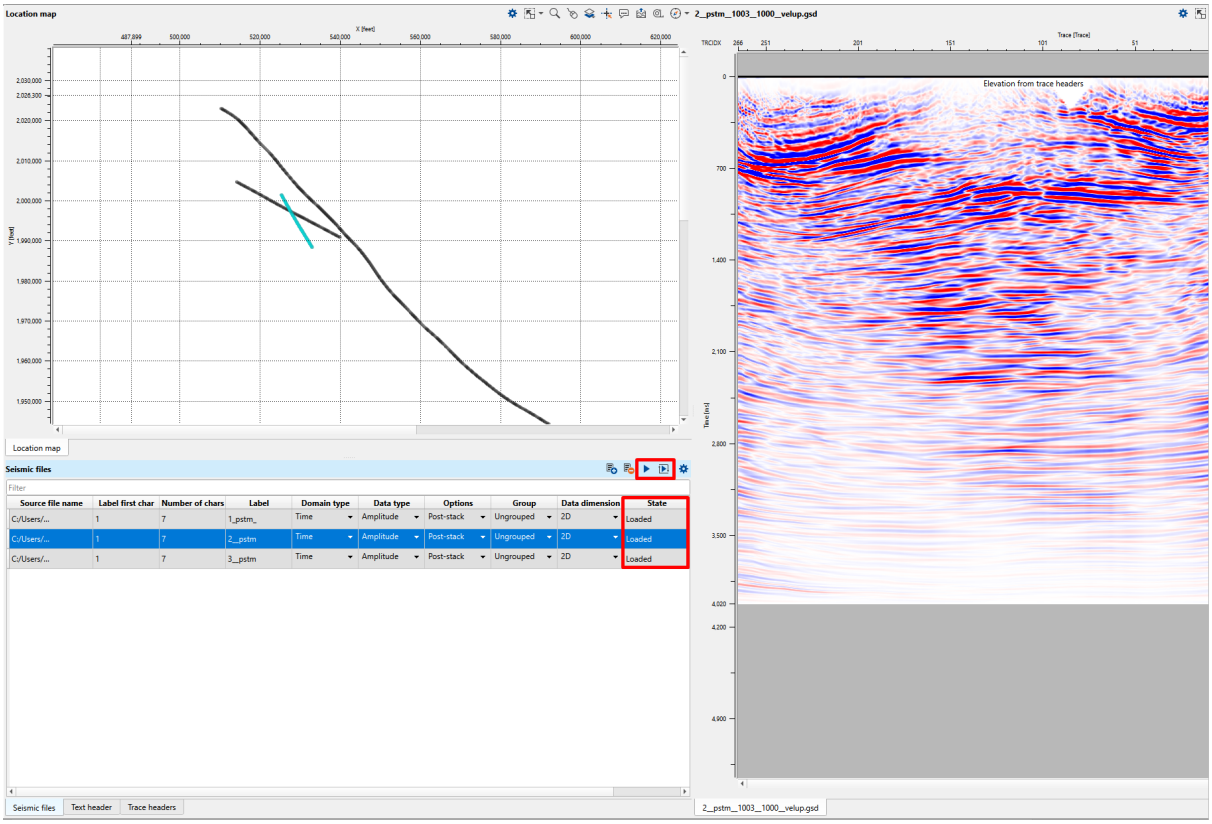
On the **location view** the loaded lines will appear in **Black** and **State** will change to "Loaded":



In case of 3D on **location view** the loaded volume will appear in **Dark red**:

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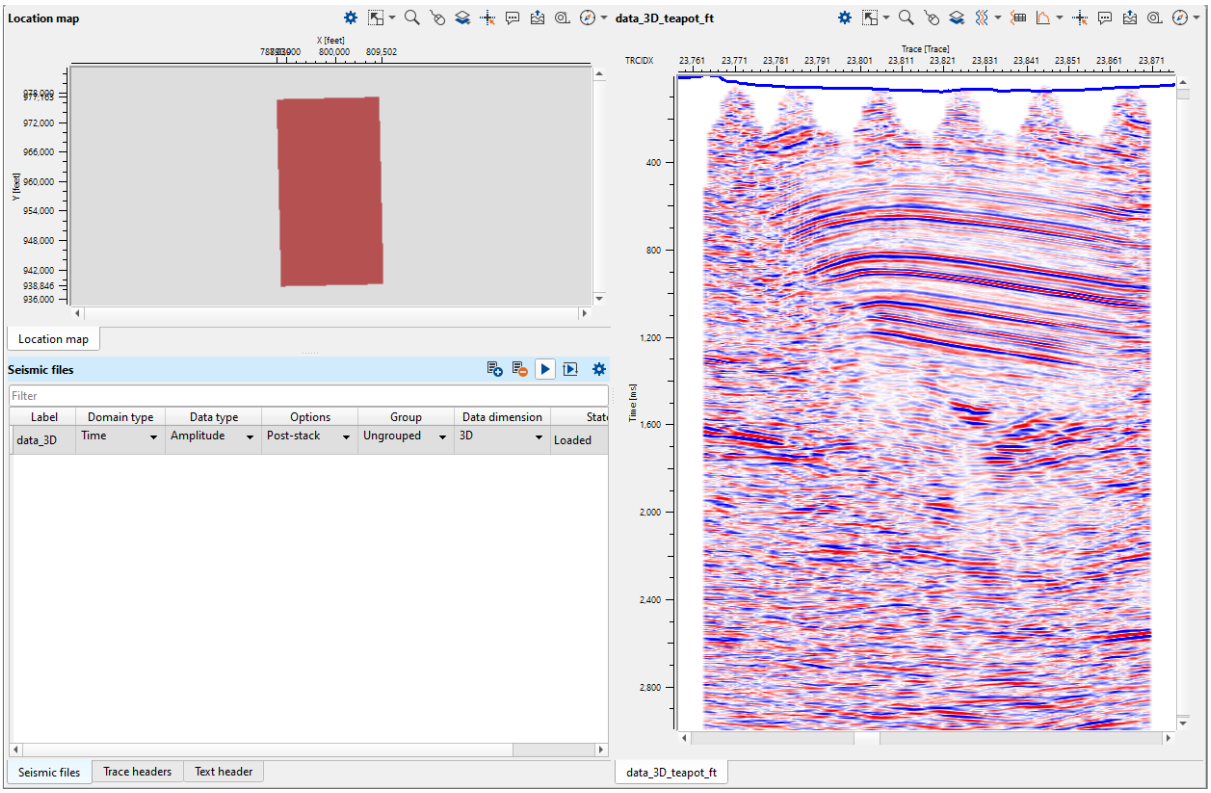
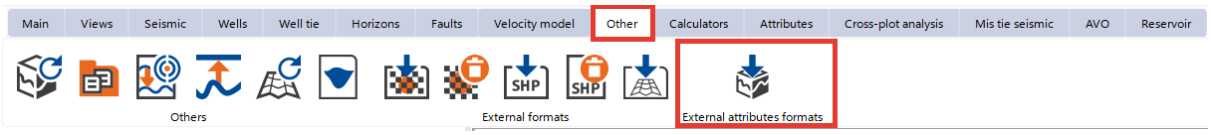


5.1.1 Import attributes

For Seismic attributes import navigate to the Other bar and click on **External attributes formats** section. This option allows you to load attribute data from an ASCII formatted file.



A window will open; select your file, ensure that the correct coordinate system and units of measurement are selected, and then upload the file.

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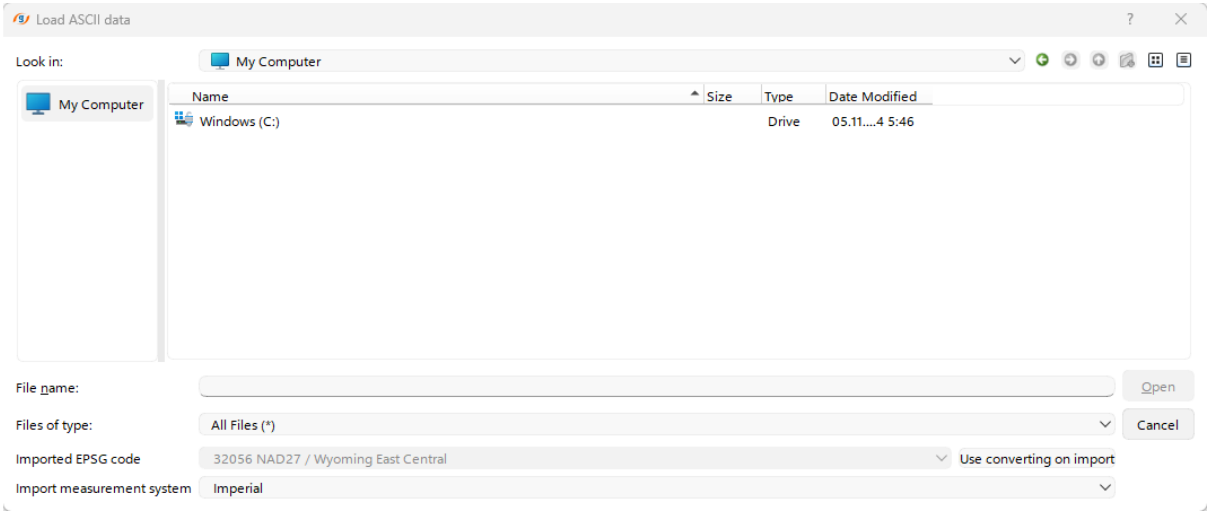

5.2 Import Wells

In this chapter we present how to load any Well-related data into g-Space project database

Selection of Wells data workspace 121 on View manager 90 activates corresponding workspace that include several views required for QC of the import process for all types of well data.

Here is the list of the data that is possible to import into g-Space

- Create well 256
- Import well headers 257
- Import inclinometry 263
- Import markers 268
- Import markers structure 277
- Import LAS files 278
- Import checkshots 281
- Import comment log 287

5.2.1 Create well

To create a new well go to Data manager 86 and press Right Click Mouse on the Wells icon. Choose **Create empty well**

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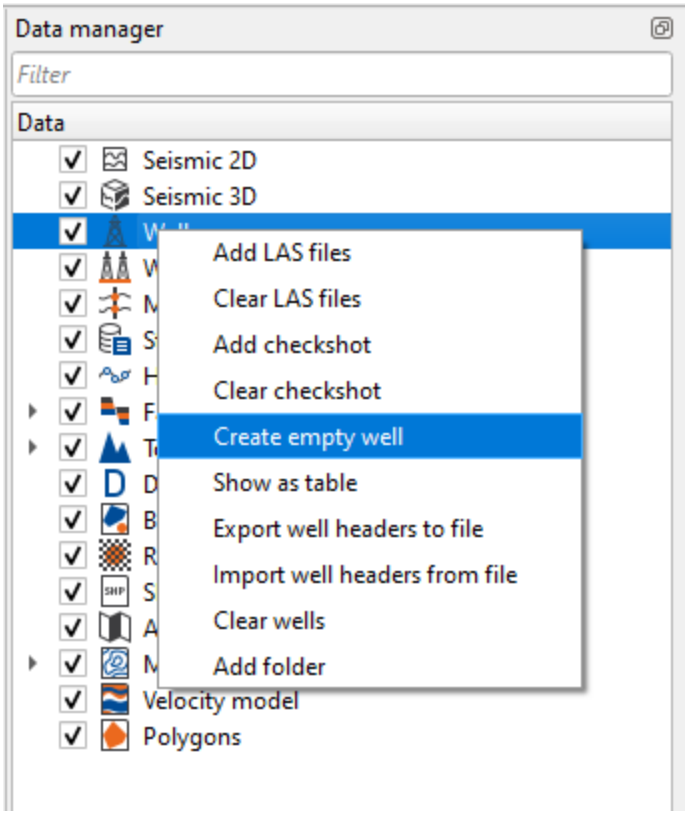
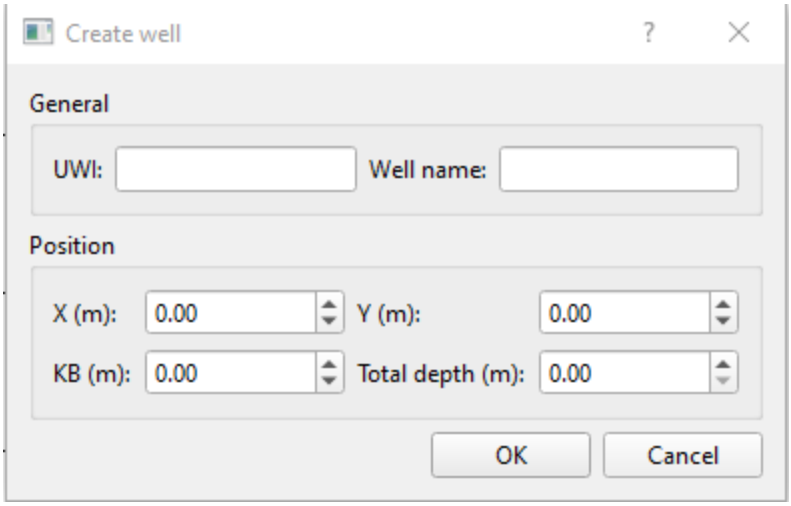


The following window will appear were the well information **must** be added: **UWI (unique well identifier), Well name, X, Y, KB (kelly bushing), Total depth**



5.2.2 Import well headers

Import well headers steps:

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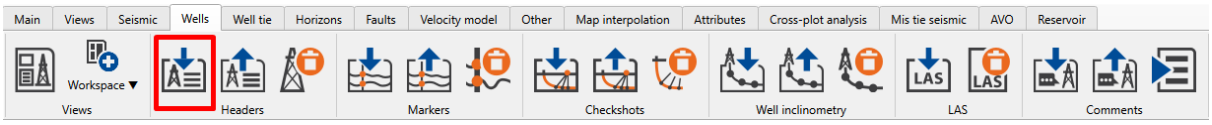
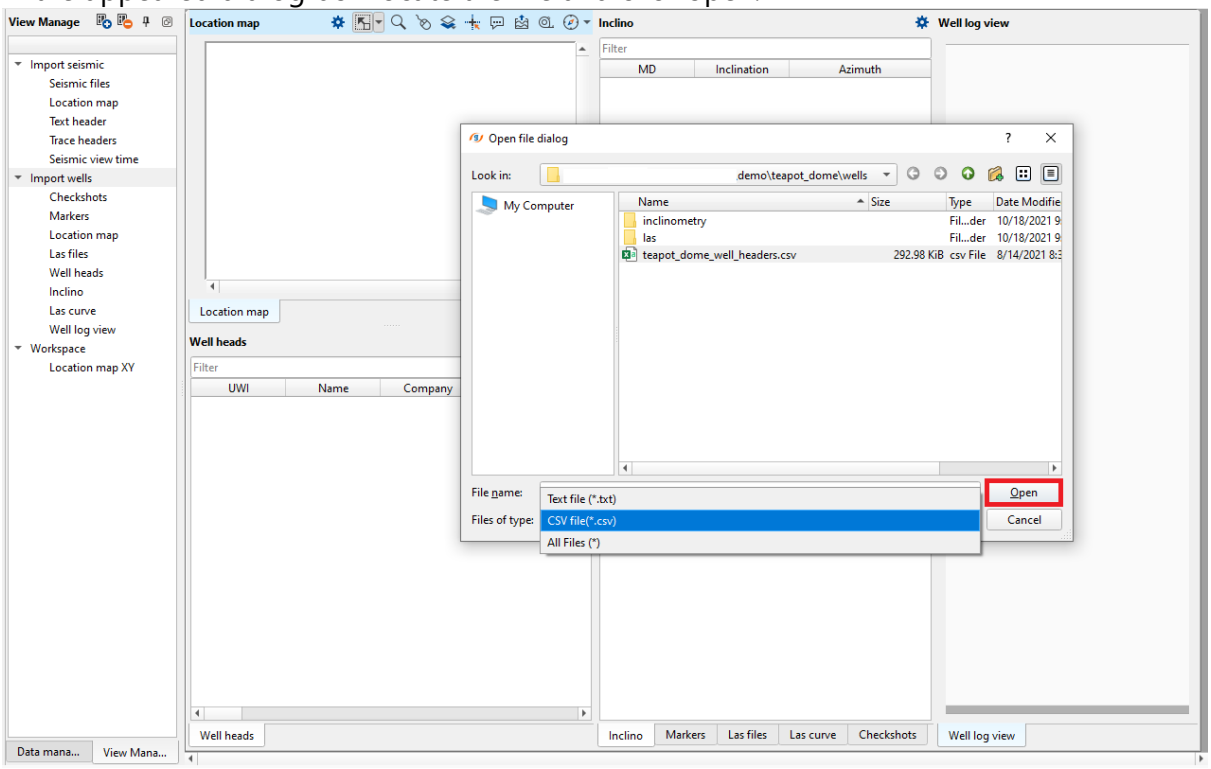
Step 1: Locating the file

Go to Ribbon 33 -> Wells bar 42 and click on Import well headers from text file



In the appeared dialog box locate the file and click open:



Step 2: Setting up reading parameters

g-Space will open file preview dialog were you can set the loading parameters such as: Separator type, Headers row, Start row, Date format.

In the **Original file** tab you will see how the file looks like and adjust loading parameters accordingly:

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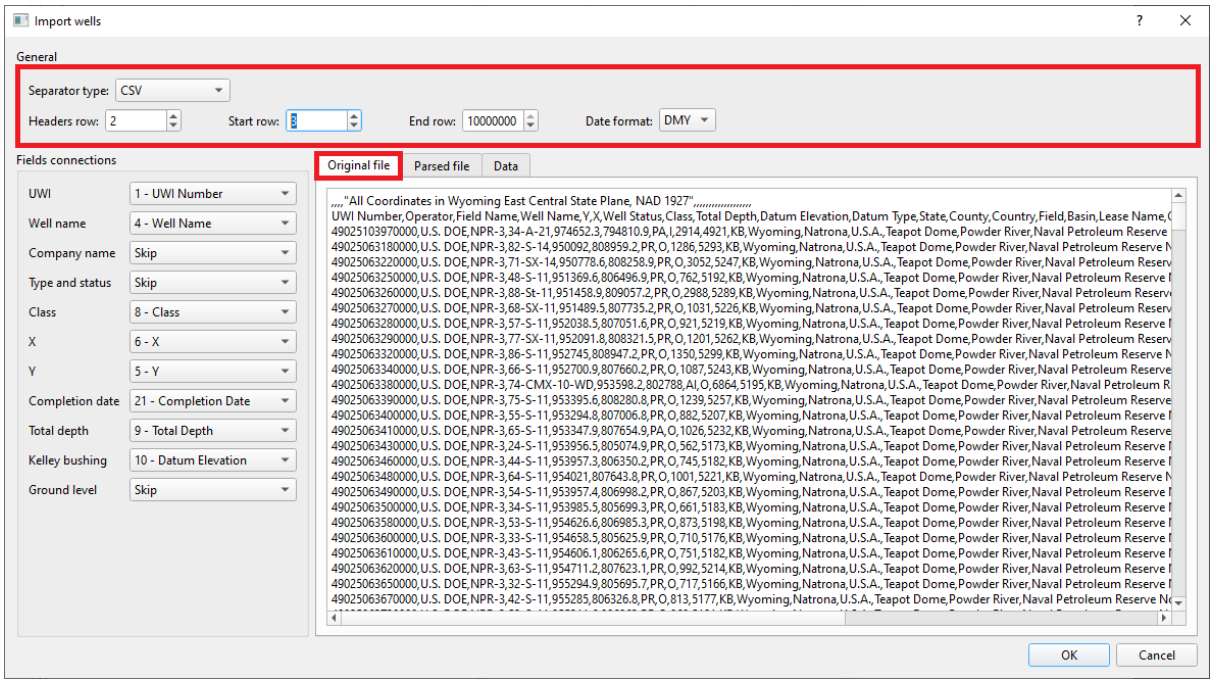
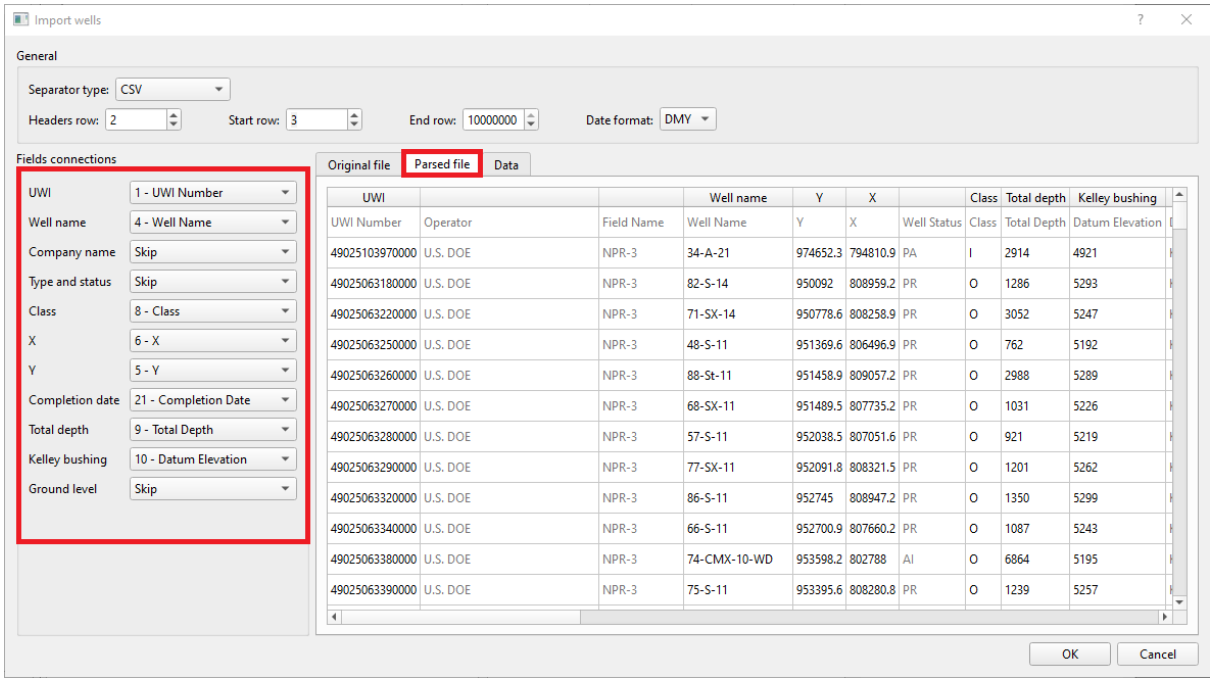


Step 3: Checking reading parameters

Click on Parsed file tab to check if you set reading parameters correctly and also you can decide which columns you want to add or skip:



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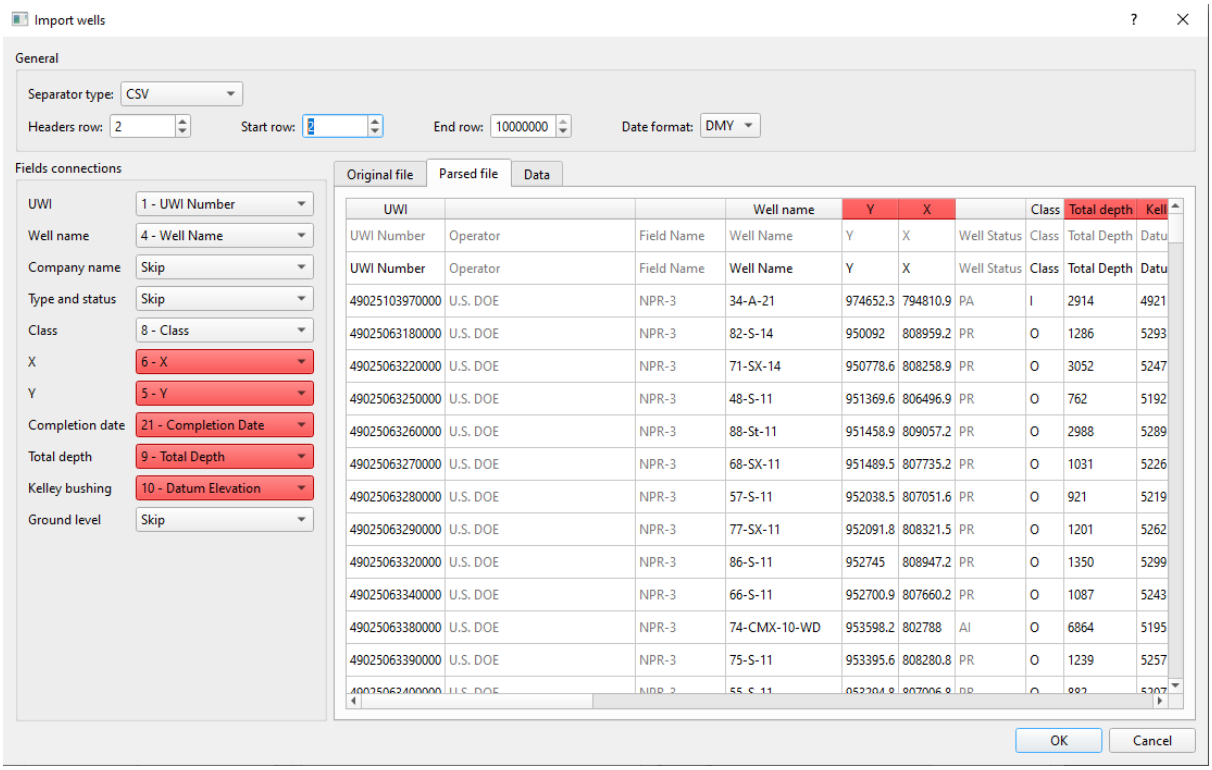
In the Field connections there are pre-set well attributes you may want to load. Also you can decide which of the columns you want to load or skip from drop-down box

Note

If some of the fields are colored RED, it means that data doesn't have required type or reading parameters were set incorrectly:



UWI			Well name	Y	X		Class	Total depth	Kell
UWI Number	Operator	Field Name	Well Name	Y	X	Well Status	Class	Total Depth	Datu
UWI Number	Operator	Field Name	Well Name	Y	X	Well Status	Class	Total Depth	Datu
49025103970000	U.S. DOE	NPR-3	34-A-21	974652.3	794810.9	PA	I	2914	4921
49025063180000	U.S. DOE	NPR-3	82-S-14	950092	808959.2	PR	O	1286	5293
49025063220000	U.S. DOE	NPR-3	71-SX-14	950778.6	808258.9	PR	O	3052	5247
49025063250000	U.S. DOE	NPR-3	48-S-11	951369.6	806496.9	PR	O	762	5192
49025063260000	U.S. DOE	NPR-3	88-St-11	951458.9	809057.2	PR	O	2988	5289
49025063270000	U.S. DOE	NPR-3	68-SX-11	951489.5	807735.2	PR	O	1031	5226
49025063280000	U.S. DOE	NPR-3	57-S-11	952038.5	807051.6	PR	O	921	5219
49025063290000	U.S. DOE	NPR-3	77-SX-11	952091.8	808321.5	PR	O	1201	5262
49025063320000	U.S. DOE	NPR-3	86-S-11	952745	808947.2	PR	O	1350	5299
49025063340000	U.S. DOE	NPR-3	66-S-11	952700.9	807660.2	PR	O	1087	5243
49025063380000	U.S. DOE	NPR-3	74-CMX-10-WD	953598.2	802788	AI	O	6864	5195
49025063390000	U.S. DOE	NPR-3	75-S-11	953395.6	808280.8	PR	O	1239	5257

Step 4: Adding columns (Optional)

If you want to add columns which is not in the field click on the column, then Right Click Mouse on the column and choose the (Addotional) column check box. There is an option to Rename columns:

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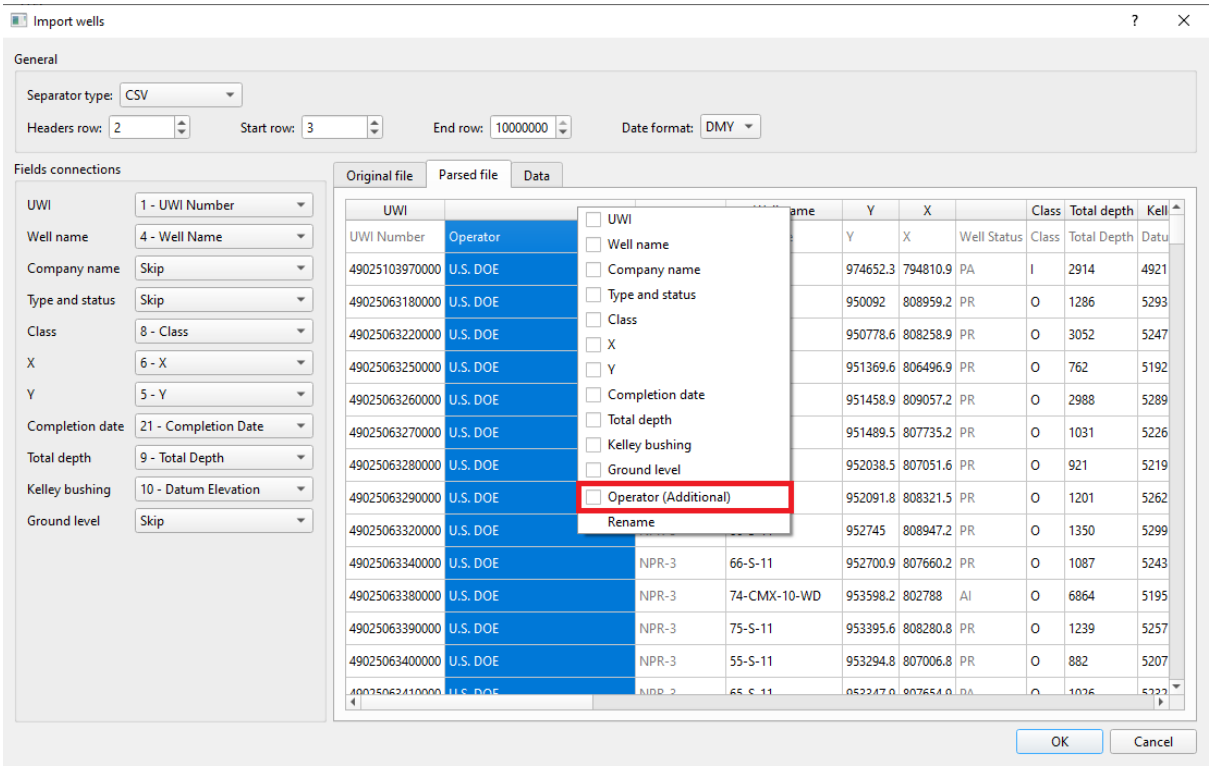

Note

To load well headers in g-Space you need to provide three necessary parameters: ***Kelley bushing (KB), X, Y.*** *The rest of the attributes are optional.*

Step 5. Checking the loading settings

In Data tab you can see if all settings were done correctly and all necessary columns were included. After that click OK:

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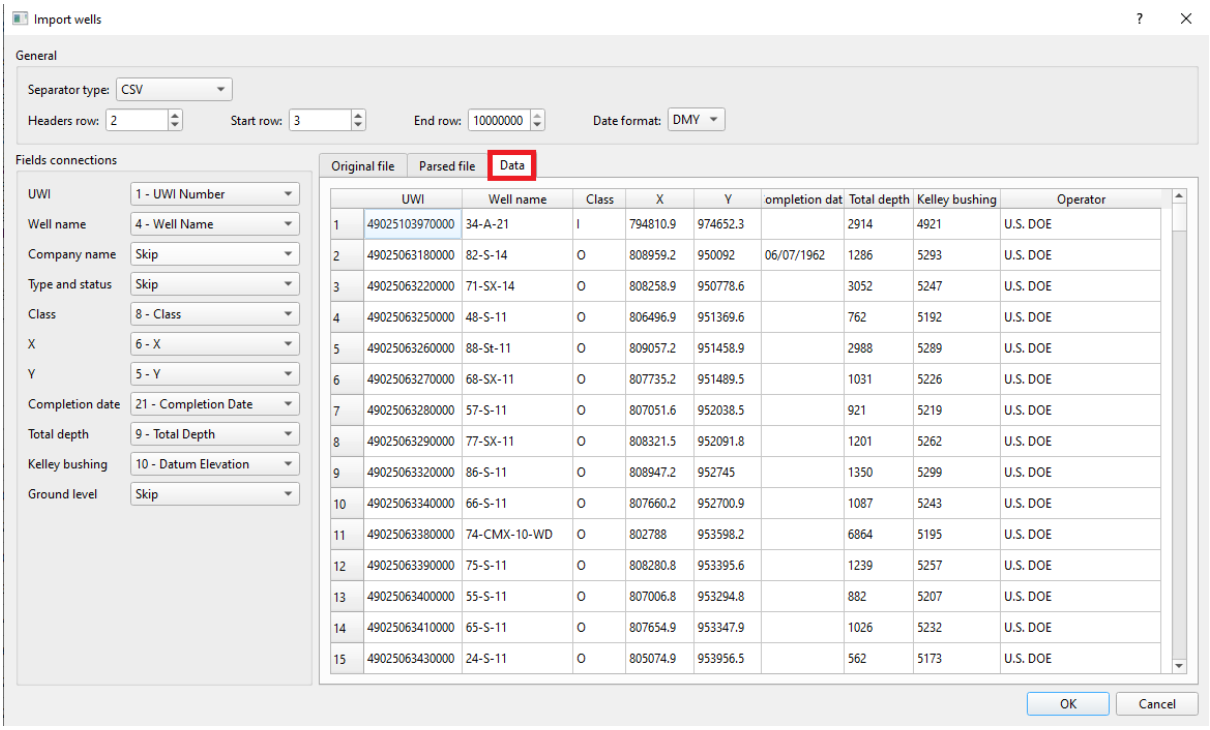
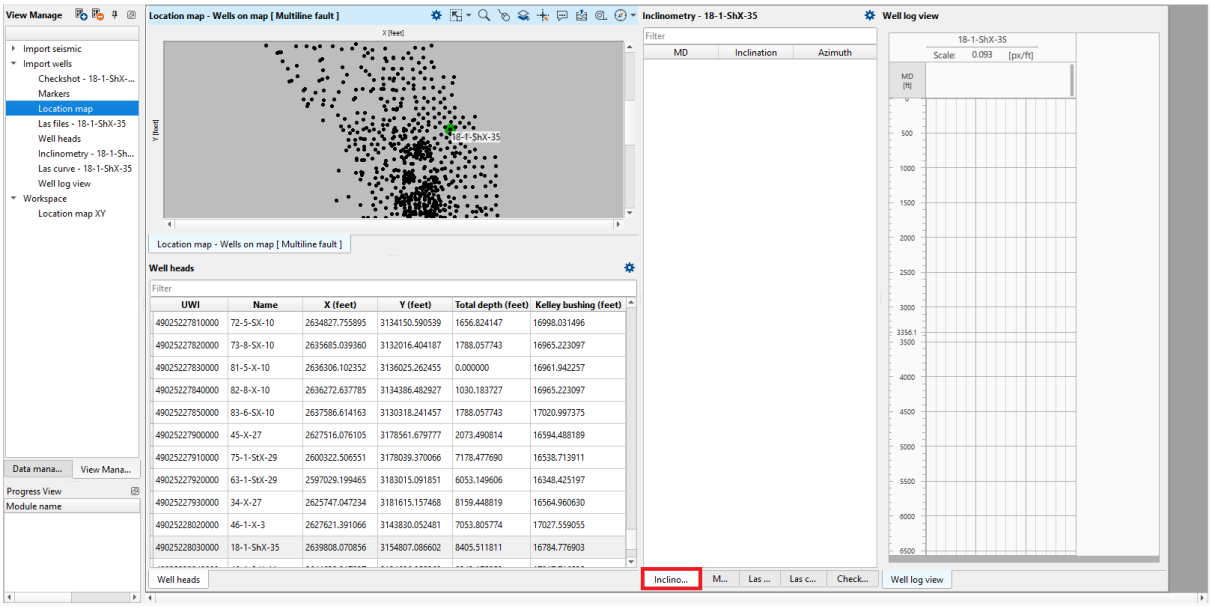


Step 6: Controlling loaded data

To check the loaded well headers data, click on well in map view - all loaded information will appear in the list of the wells on table below:



For more information about checkshot format please refer to Well Data Formats 332

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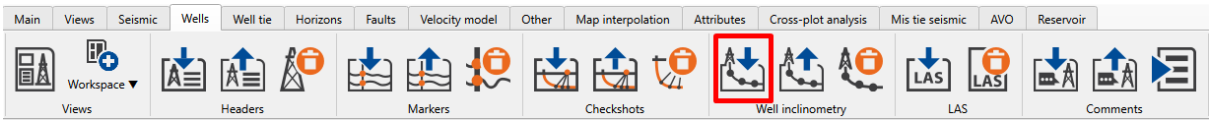
5.2.3 Import inclinometry

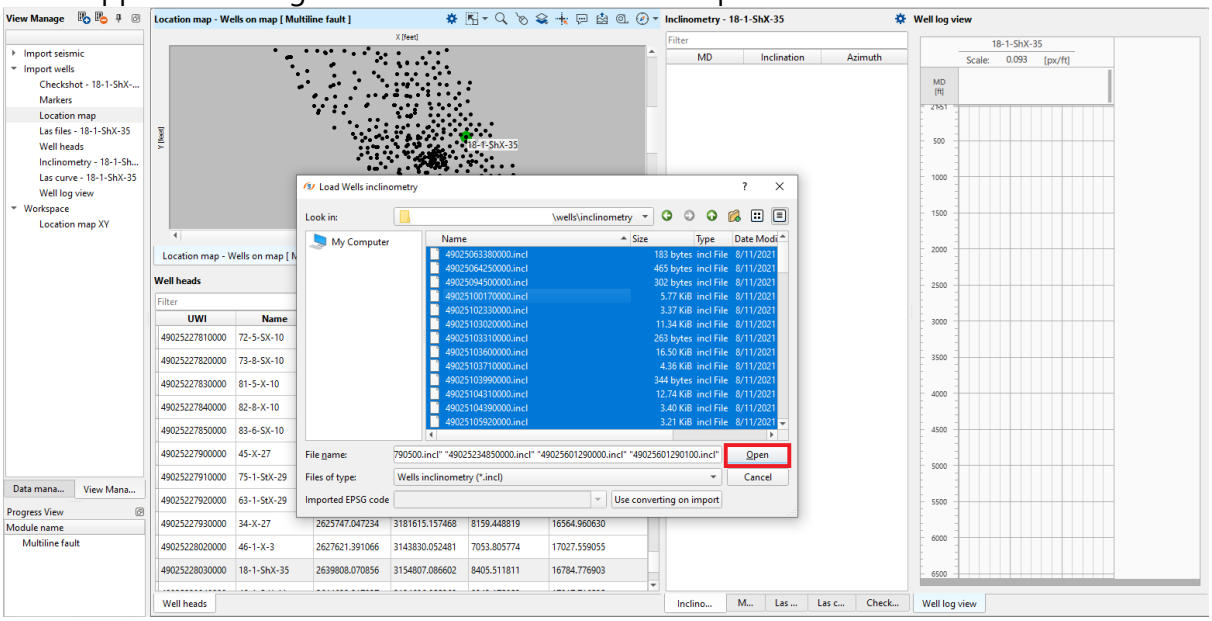
Import well deviation steps:

Step 1: Locating the file

Go to Ribbon 33 -> Wells bar 42 and click on Import wells inclinometry



In the appeared dialog box locate the files and click open:



Step 2: Setting up reading parameters

g-Space will open file preview dialog were you can set the loading parameters such as: Separator type, Headers row, Start row, End row.

In the **Original file** tab you will see how files looks like and adjust loading parameters accordingly

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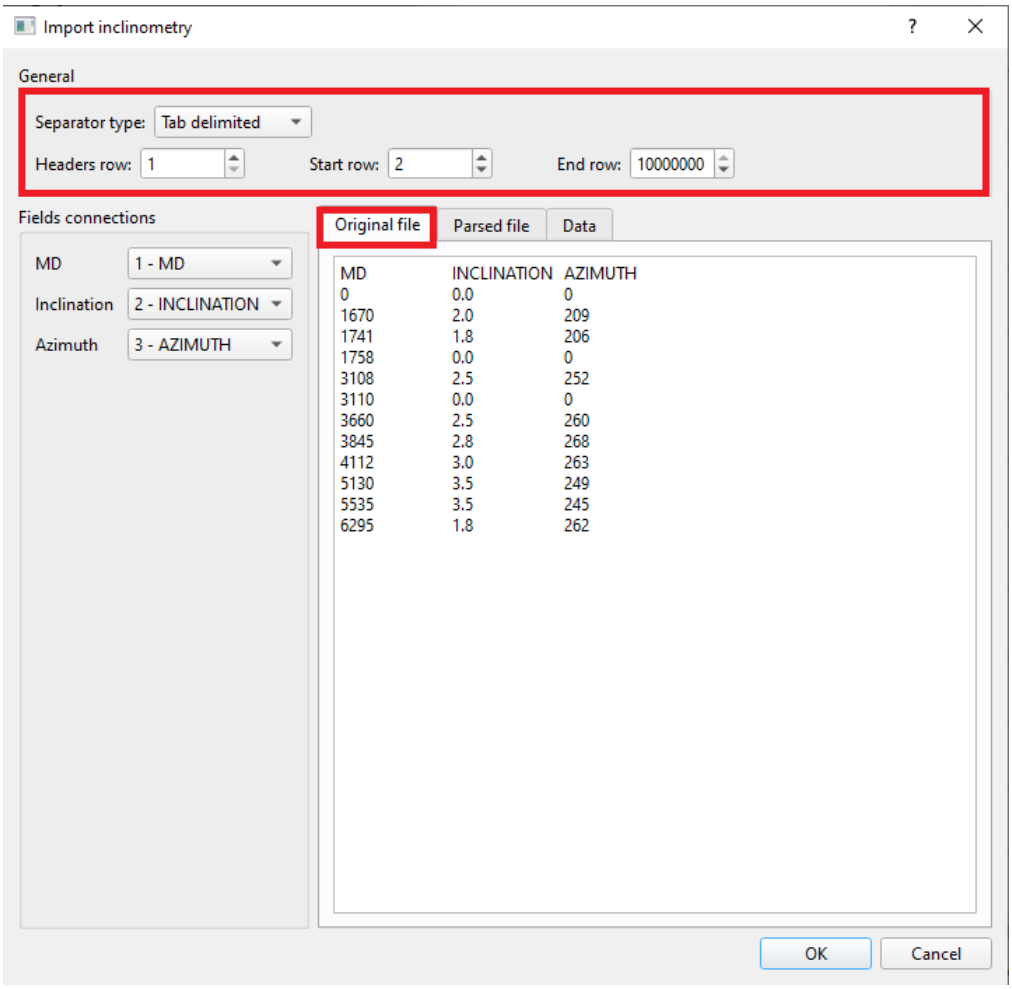

Step 3: Checking reading parameters

Click on **Parsed file tab** to check if you set reading parameters correctly and also you can decide which columns you want to add or skip

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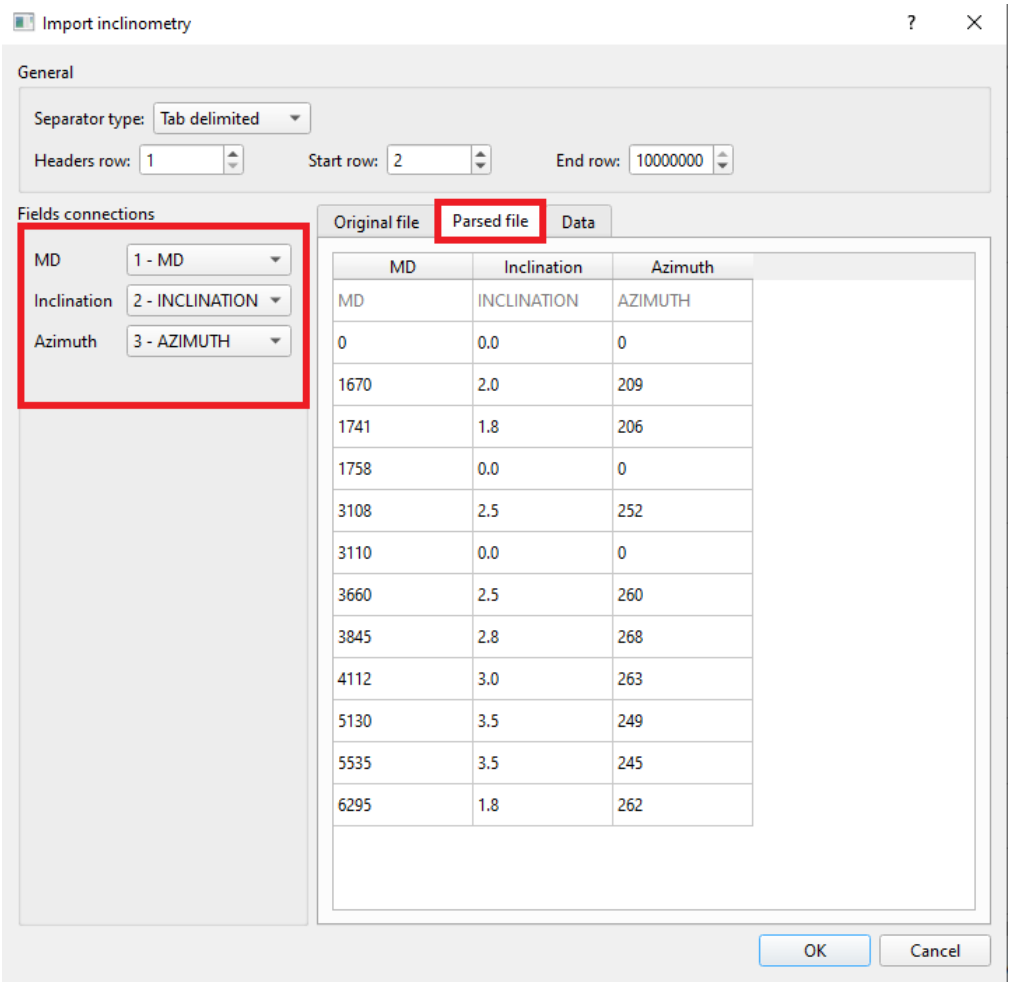

In the **Field connections** check the deviation parameters. If you have files with additional information you can chose skip unnecessary columns from drop-down box

Note

If some of the fields are colored RED, it means that data doesn't have required type or reading parameters were set incorrectly

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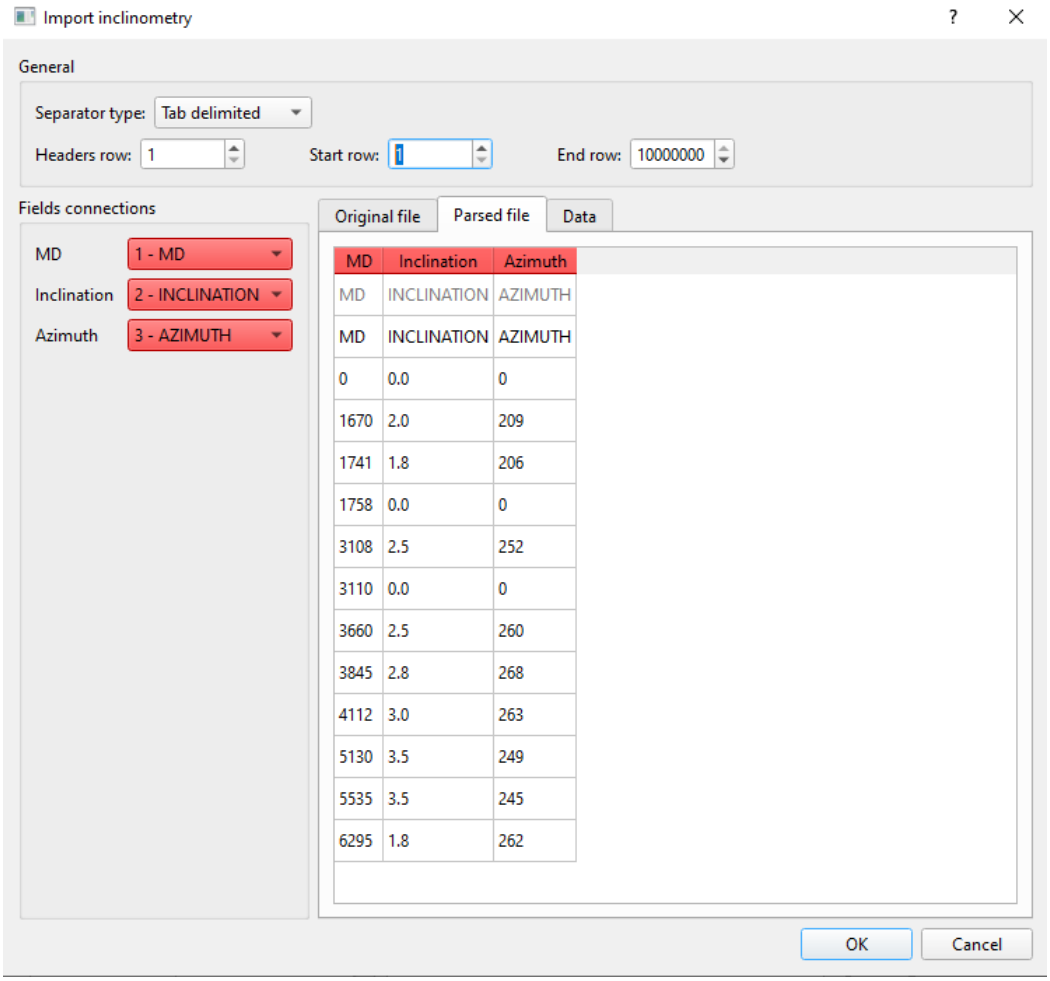

For more information about deviation format supporting by g-Space refer to Well Data Formats 332

Step 4. Checking the loading settings

In Data tab you can see if all settings were done correctly and all necessary columns were included. After that click OK

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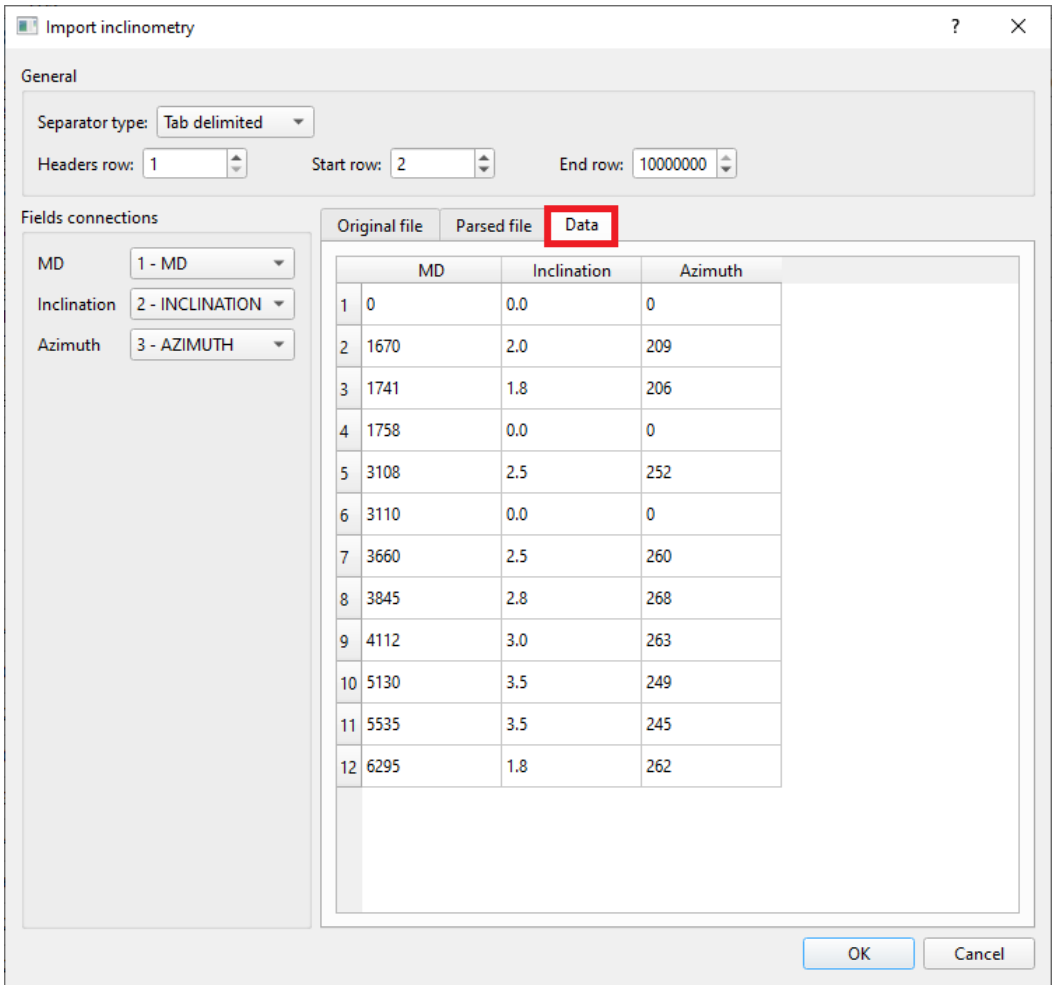

	MD	Inclination	Azimuth
1	0	0.0	0
2	1670	2.0	209
3	1741	1.8	206
4	1758	0.0	0
5	3108	2.5	252
6	3110	0.0	0
7	3660	2.5	260
8	3845	2.8	268
9	4112	3.0	263
10	5130	3.5	249
11	5535	3.5	245
12	6295	1.8	262

Step 5: Controlling loaded data

To check the data click on map view or in table below map - all loaded information will appear in the table **Inclinometry**

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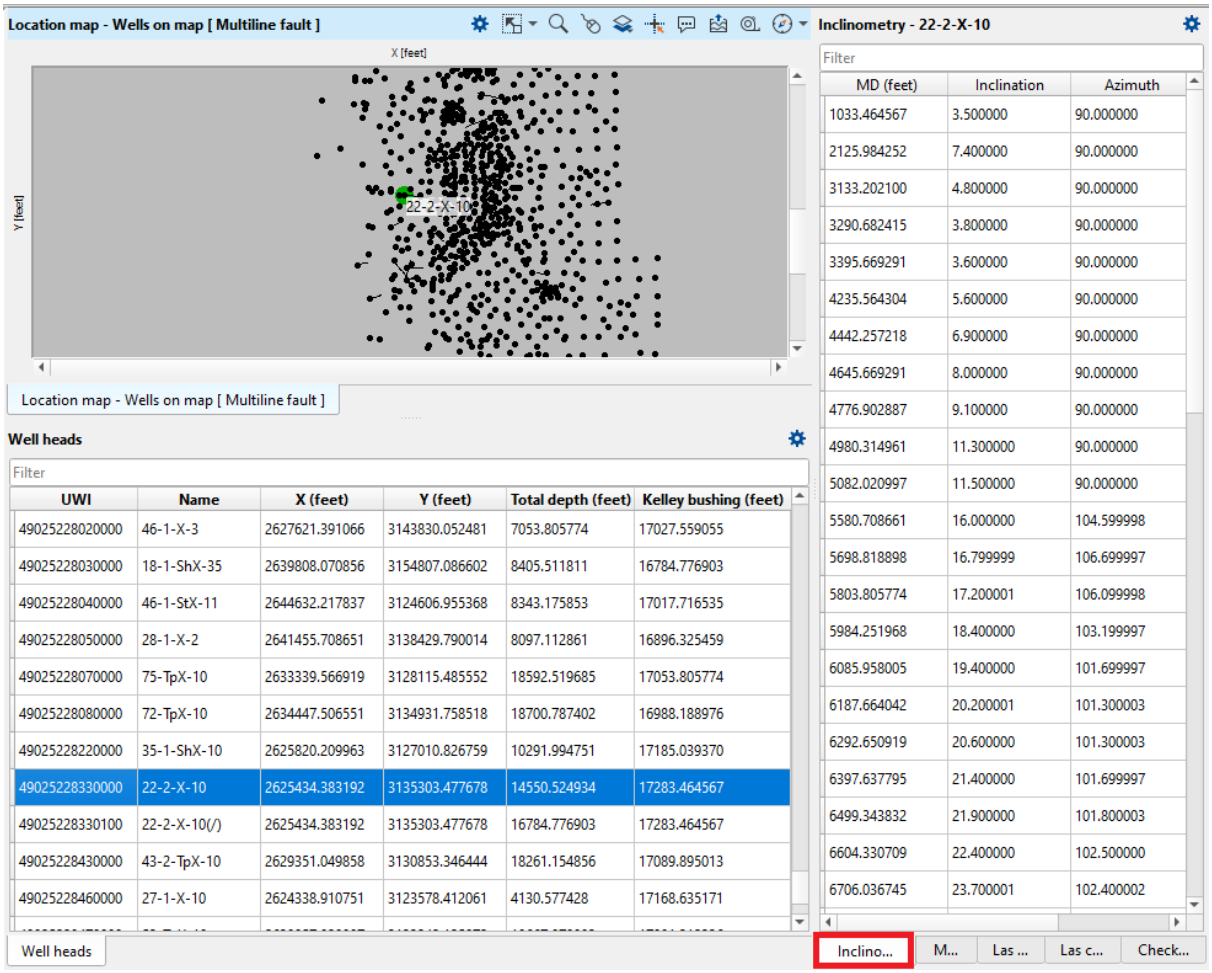


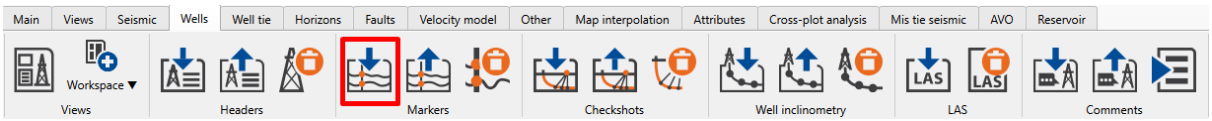
For more information about checkshot format please refer to Well Data Formats 332

5.2.4 Import markers

Import markers steps:

Step 1: Locating the file

Go to Ribbon 33 -> Wells bar 42 and click on Import markers



There are two options to load markers:

Option 1. Import well markers from MD format

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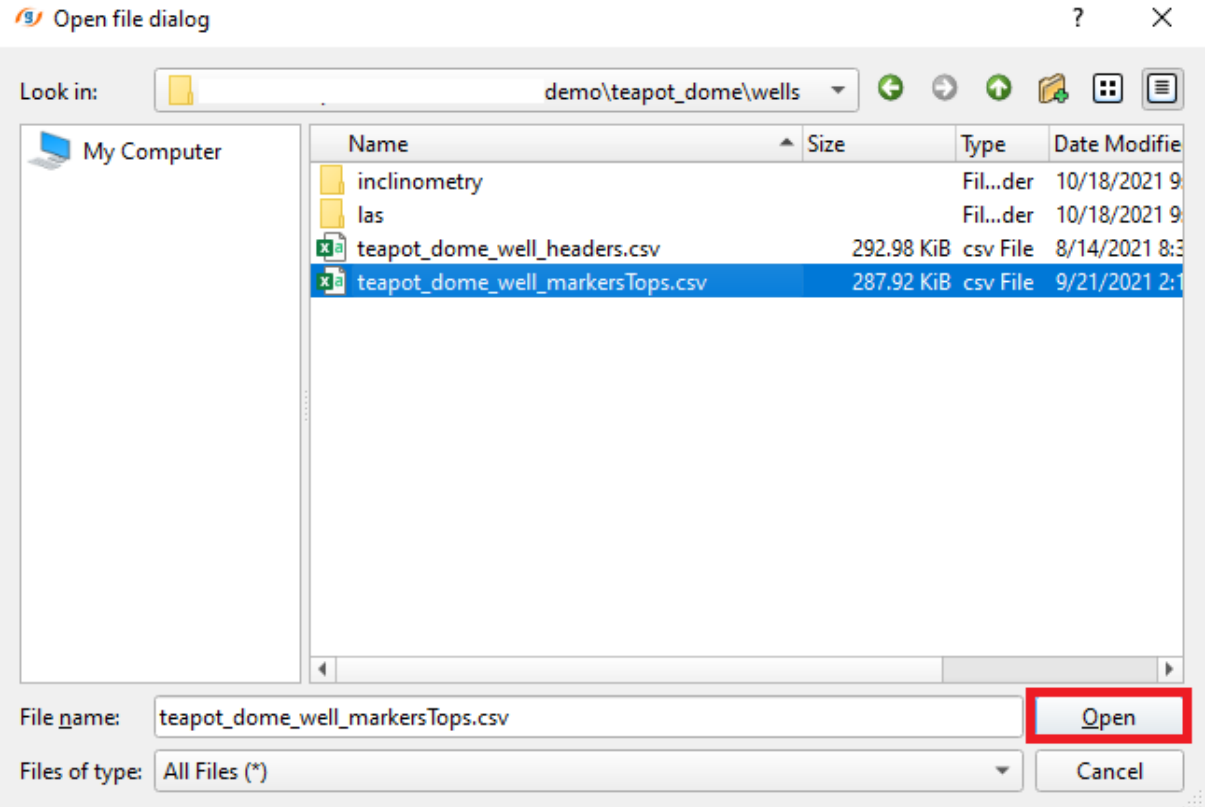
- MD, UWI

Option 2. Import well markers from XY format
- X, Y, Z, UWI

g-Space will launch Import wells workspace with pre-set Views where you can load and visually check loaded data.

In the appeared dialog box locate the file and click open



Step 2: Setting up reading parameters

g-Space will open file preview dialog were you can set the loading parameters such as: Separator type, Headers row, Start row, End row.

In **Original file** tab you will see how files looks like and adjust loading parameters accordingly.

If you have chosen option 1 - loading with parameters **MD, UWI** the following file preview dialog will appear

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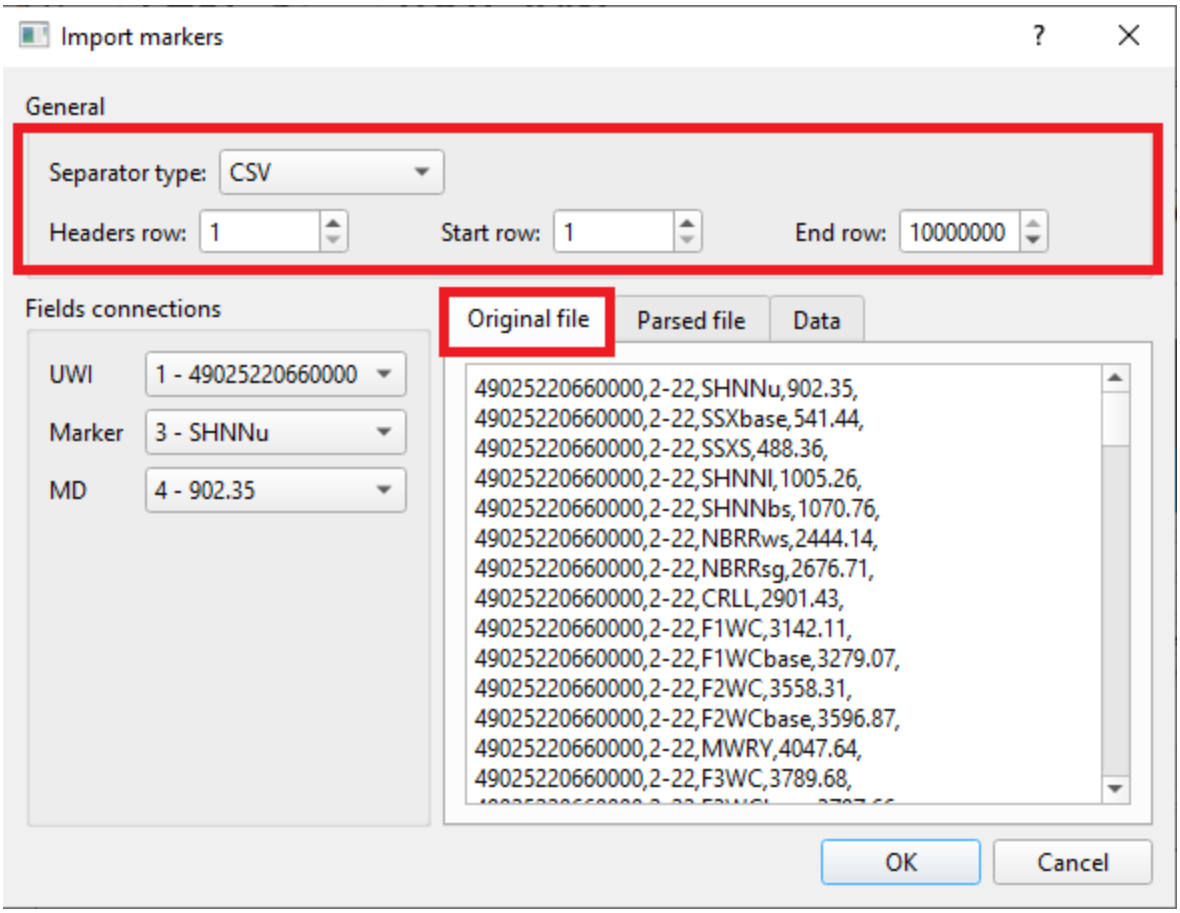

Or if you've chosen option 2 - loading with parameters **X, Y, Z, UWI** the following file preview dialog will appear

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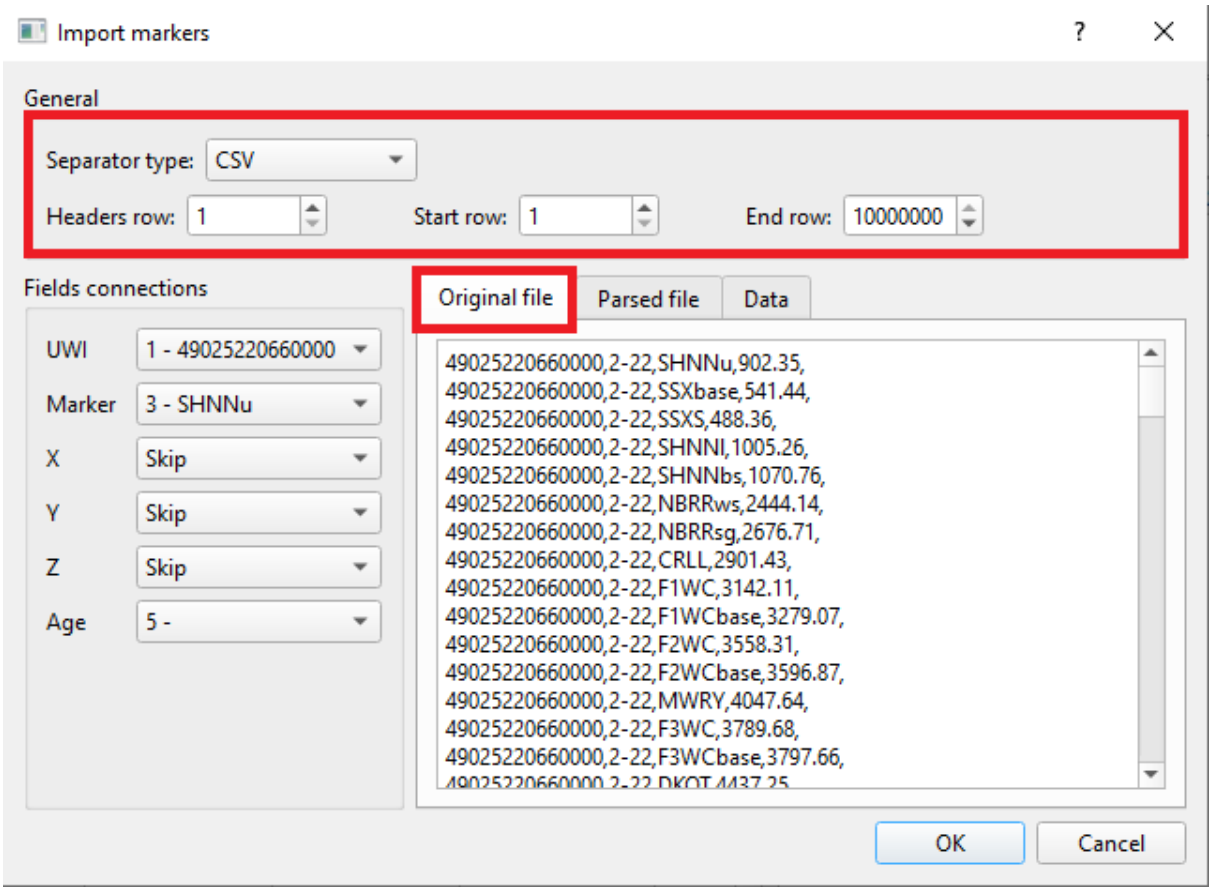

Step 3: Checking reading parameters

Click on **Parsed file** tab to check if you set reading parameters correctly and also you can decide which columns you want to add or skip

Option 1:

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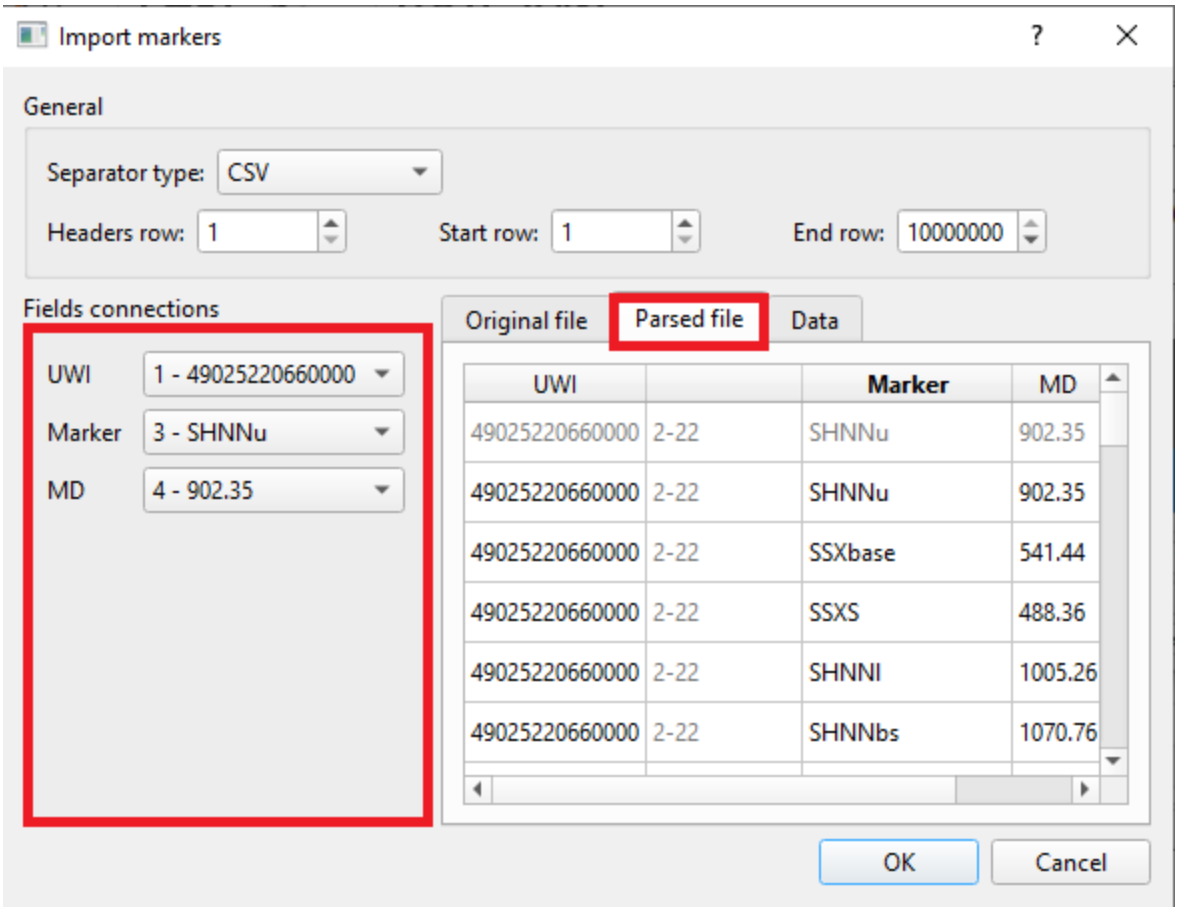

Option 2:

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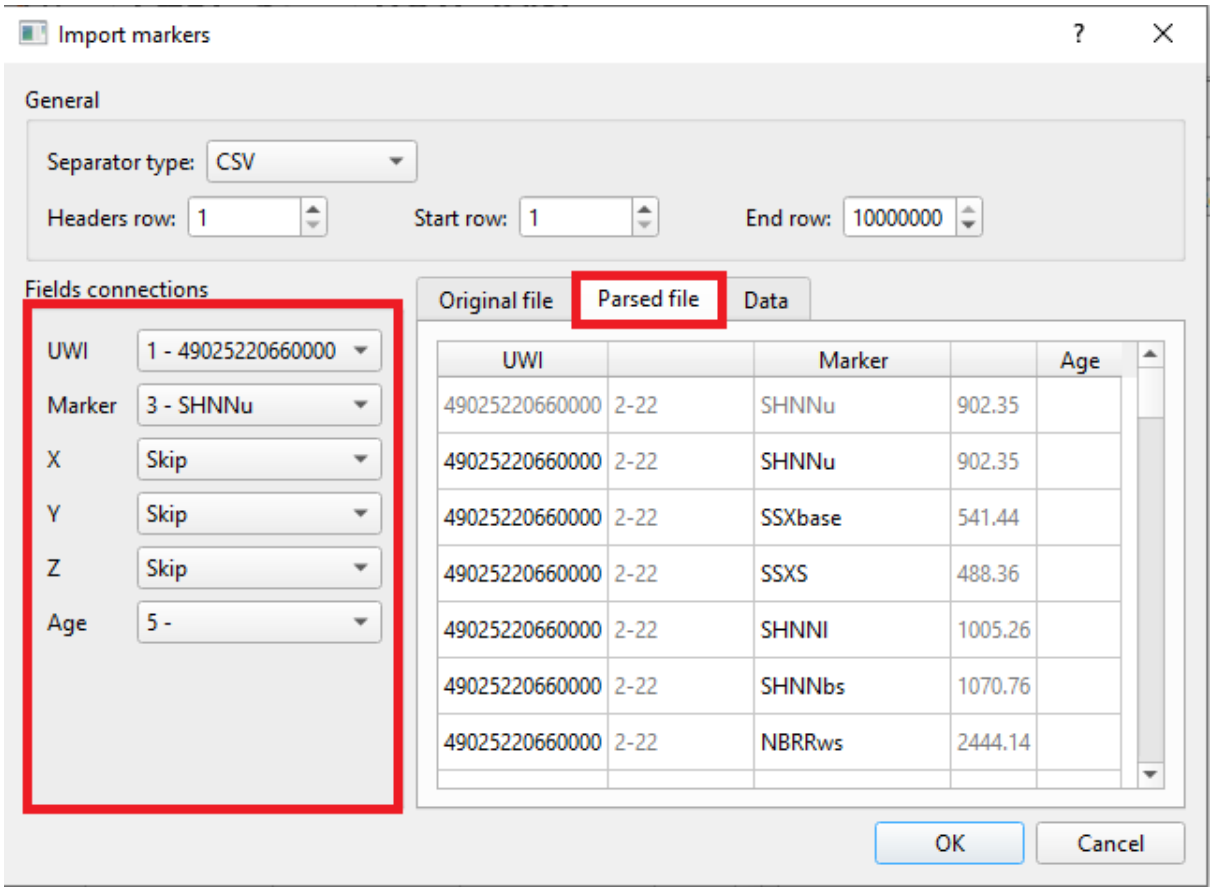

In the **Field connections** check the markers parameters. If you have files with additional information you can chose skip unnecessary columns from drop-down box

Note

If some of the fields are colored RED, it means that data doesn't have required type or reading parameters were set incorrectly

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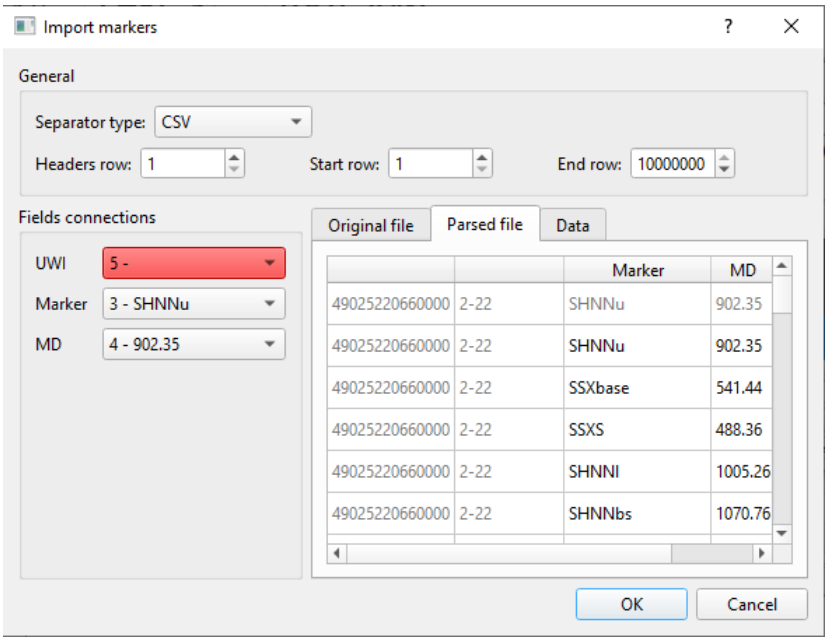

For more information about markers format supporting by g-Space refer to Well Data Formats 332

Step 4. Checking the loading settings

In Data tab you can see if all settings were done correctly and all necessary columns were included. After that click OK.

Option 1:

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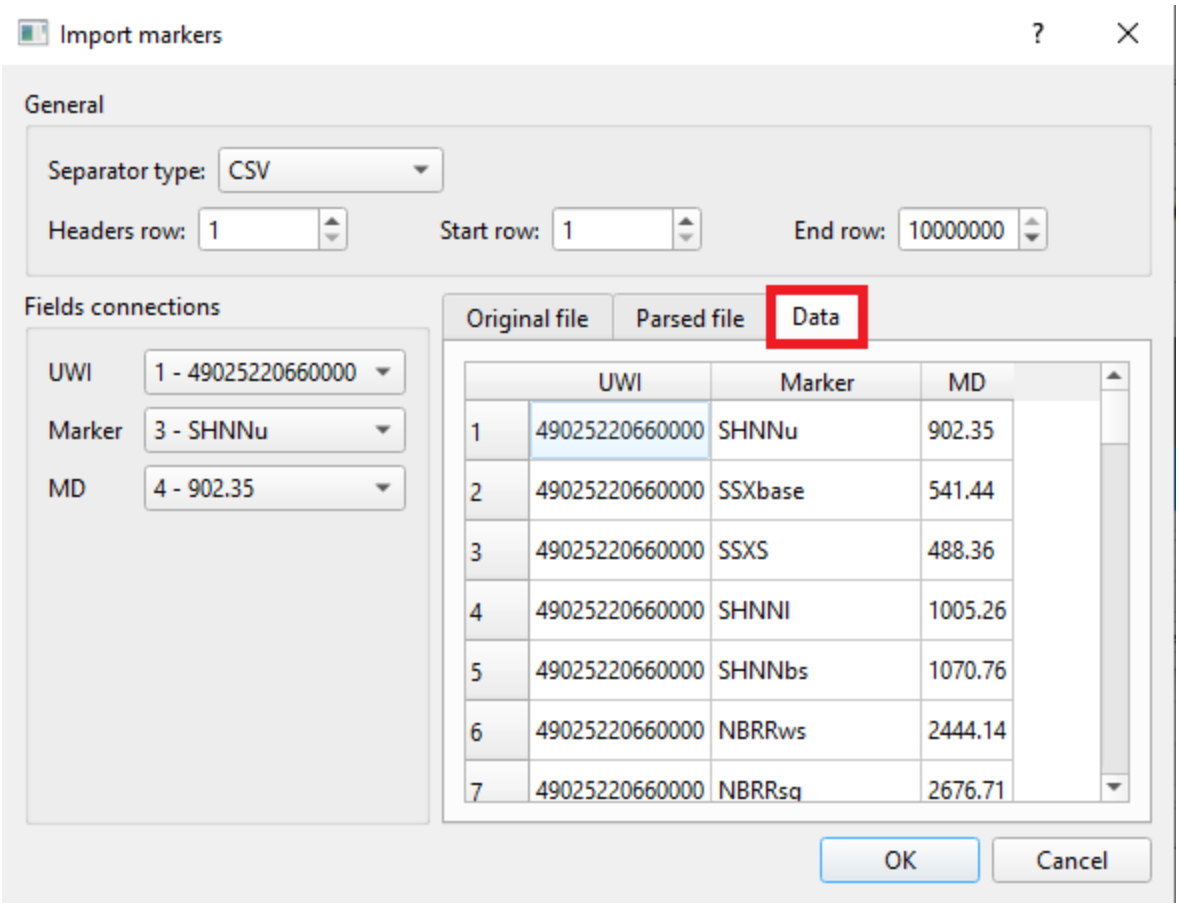
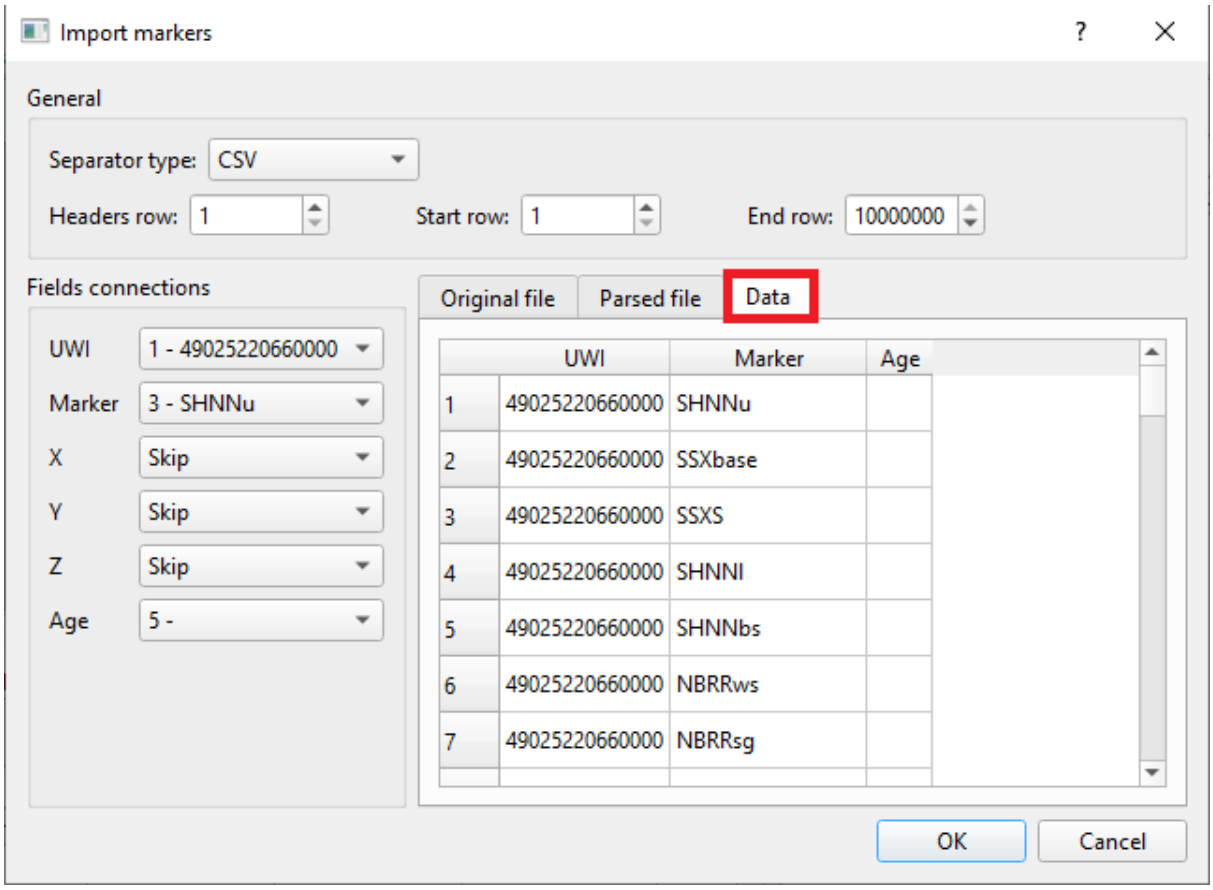


Option 2:

© 2026 Geomage 2003 LTD



Step 5: Controlling loaded data

To check the data click on map view or in table below map - all loaded information will appear in the table **Markers** and you can check them on **well log preview**

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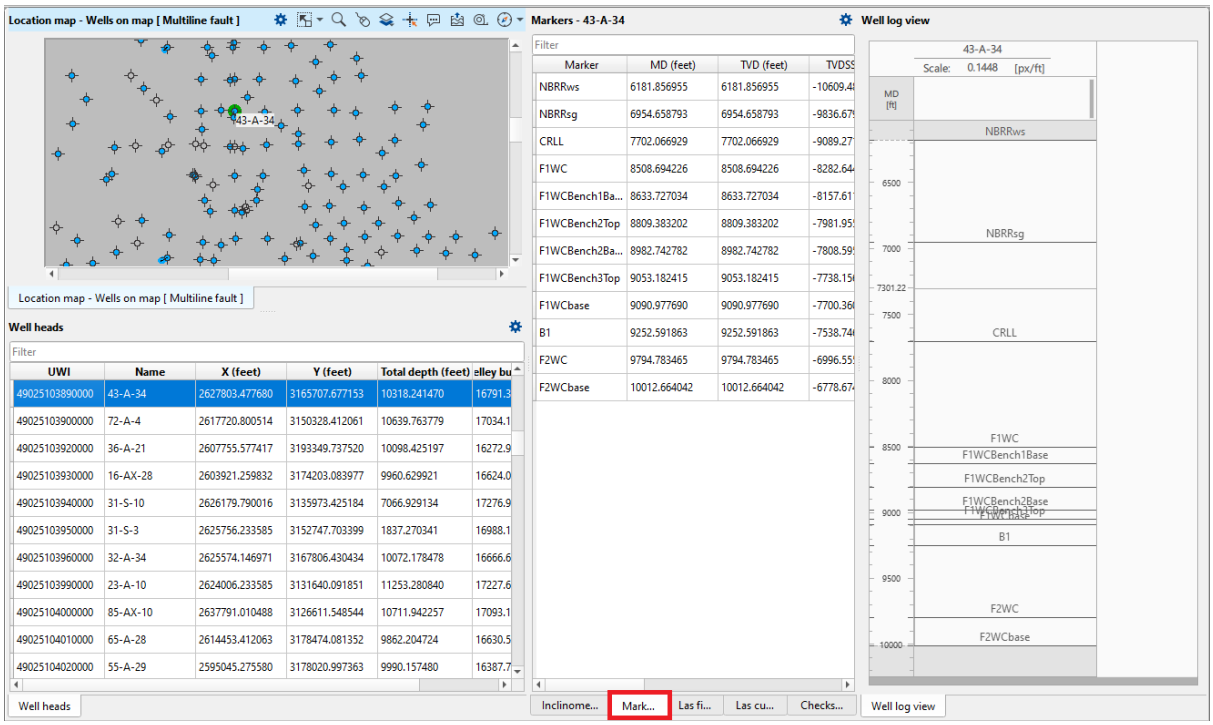
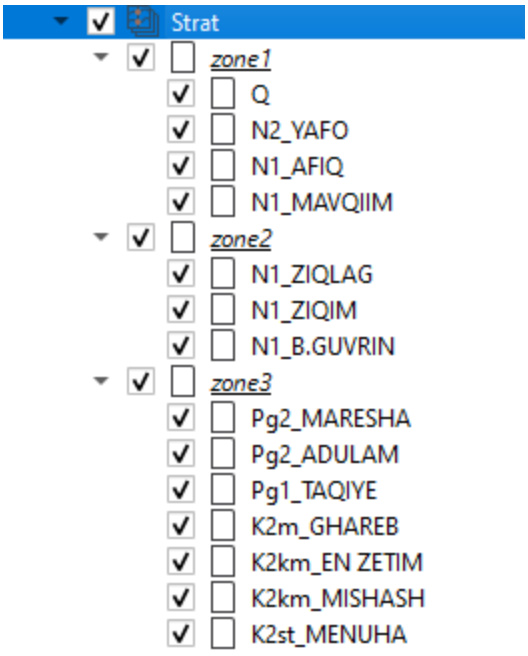


For more information about checkshot format please refer to Well Data Formats 332

5.2.5 Import markers structure

Sometimes you need to organize you markers with different levels of hierarchy. In g-Space it is possible using marker groups:



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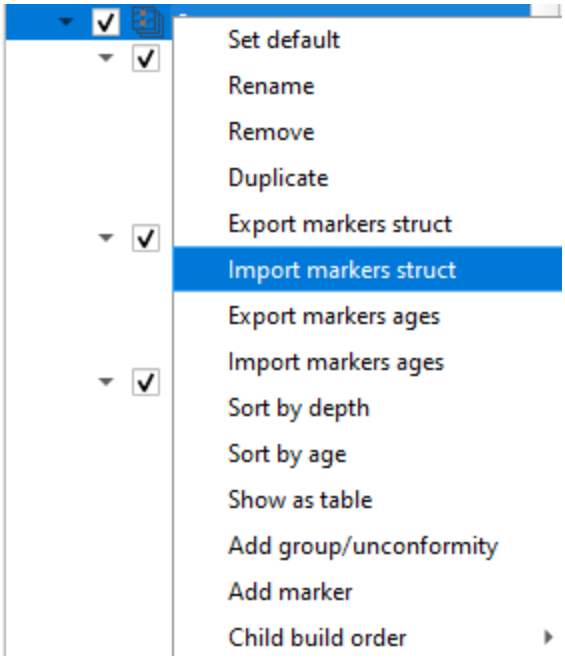
To import markers structure press Right Click Mouse on Markers set icon in Data Manager 86 and choose **Import markers struct**:



Locate the file with markers structure and it will apply automatically.

For more information about checkshot format please refer to Well Data Formats 332

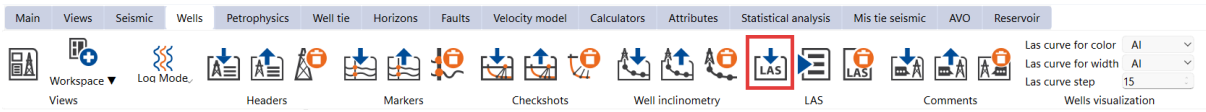
5.2.6 Import LAS files

There are two ways to load LAS files in g-Space: a **simple method** and an **advanced wizard**.

Option 1: Simple method

Step 1: Locate the file

Go to Ribbon 33 -> Wells bar 42 and click on Load LAS files button



In the appeared dialog box locate the files and click open

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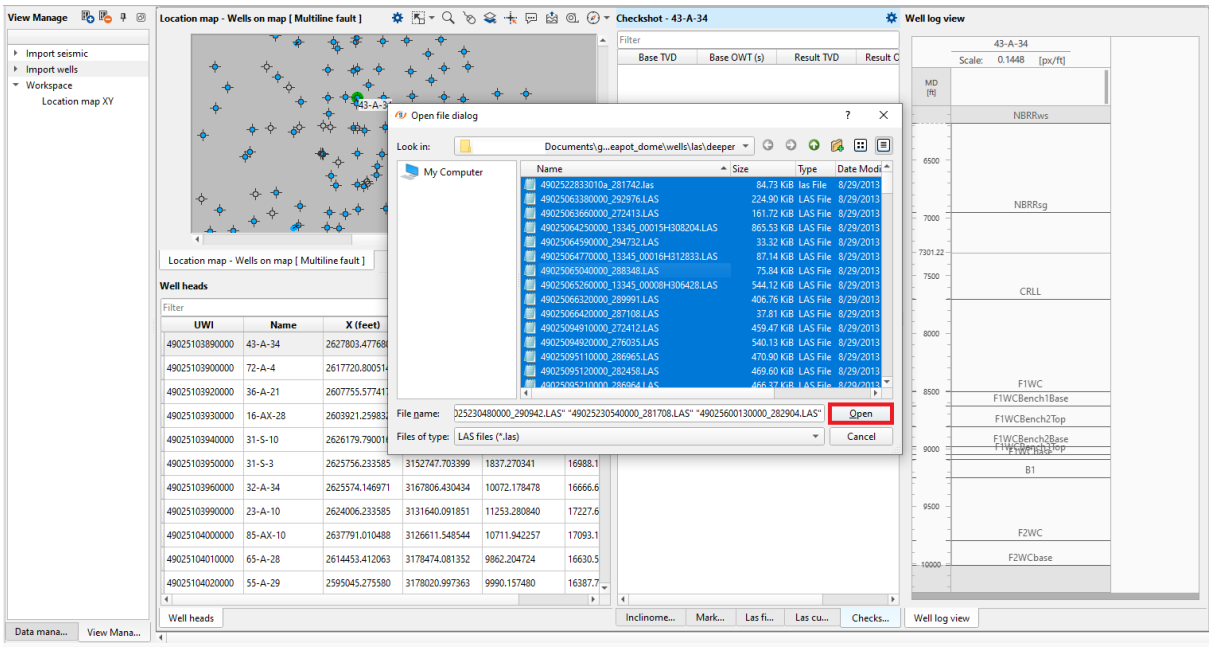
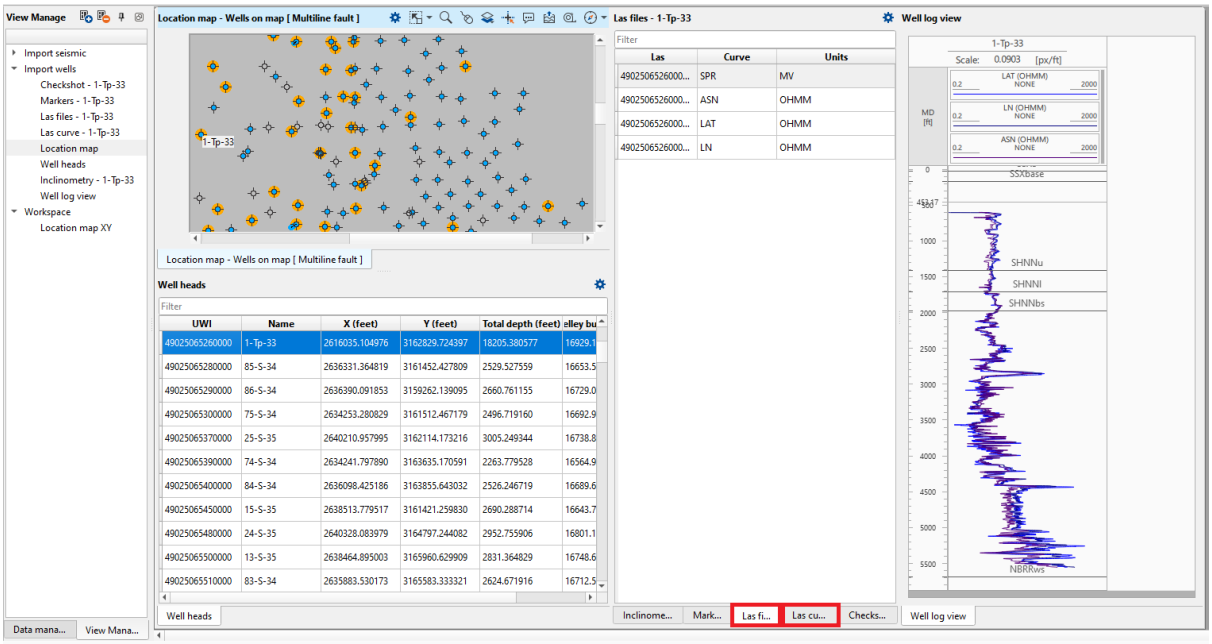


Step 2: Control loaded data

To check Well log data you have just loaded click on map view or in table below map. All loaded information will appear in table **LAS files** where you can find list of loaded curves. In the table **Las curve** you can check the log values. Also you can see the **log preview**



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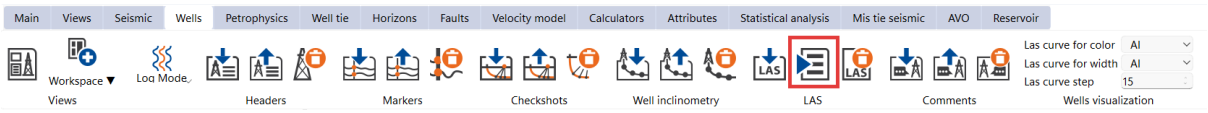
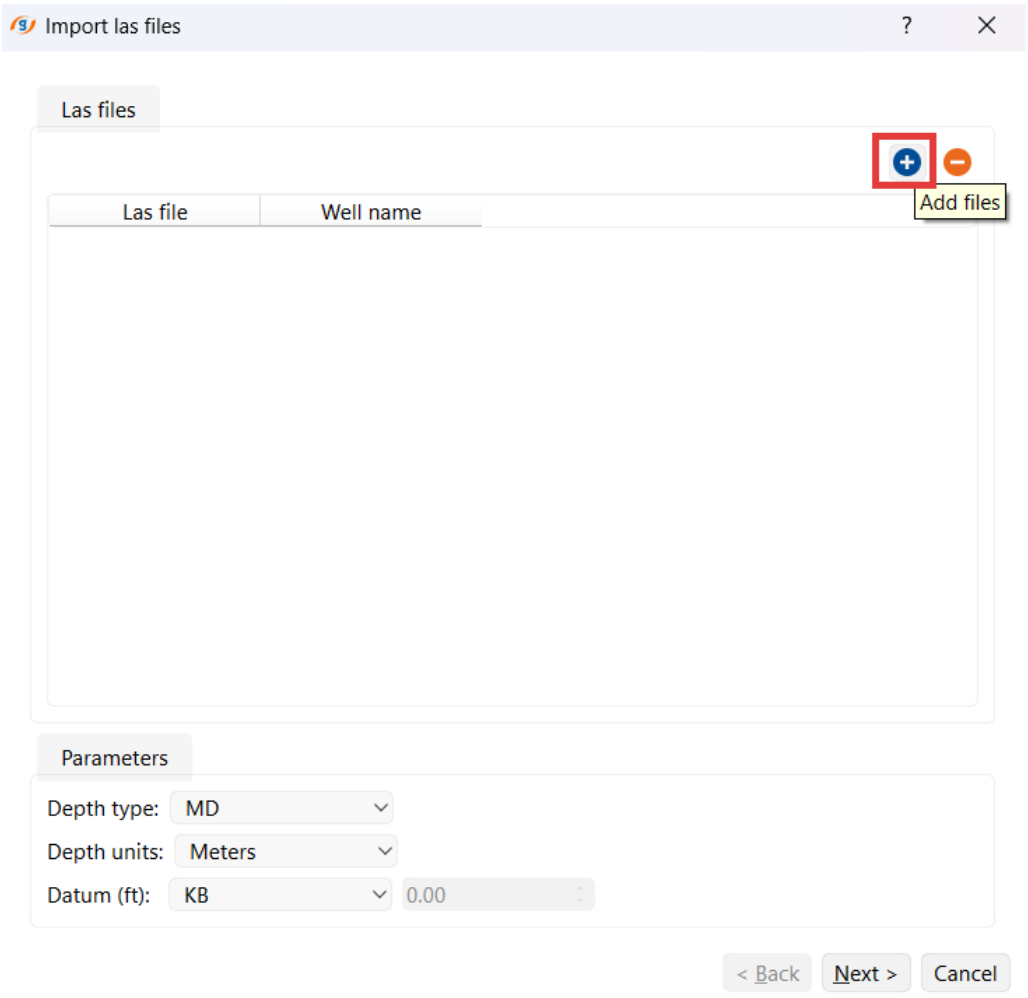
Option 2: Advanced method (Wizard)
The advanced LAS Import Wizard gives you more control over the loading process.



In the **Import LAS files** dialog, click the **+** button to add one or multiple LAS files. Once selected, press **Next**.



In the wizard window, you will see a table with all available curves from the selected LAS file.

Each curve is listed with:

- **Curve name** (short code, e.g., GR, DT, NPHI).

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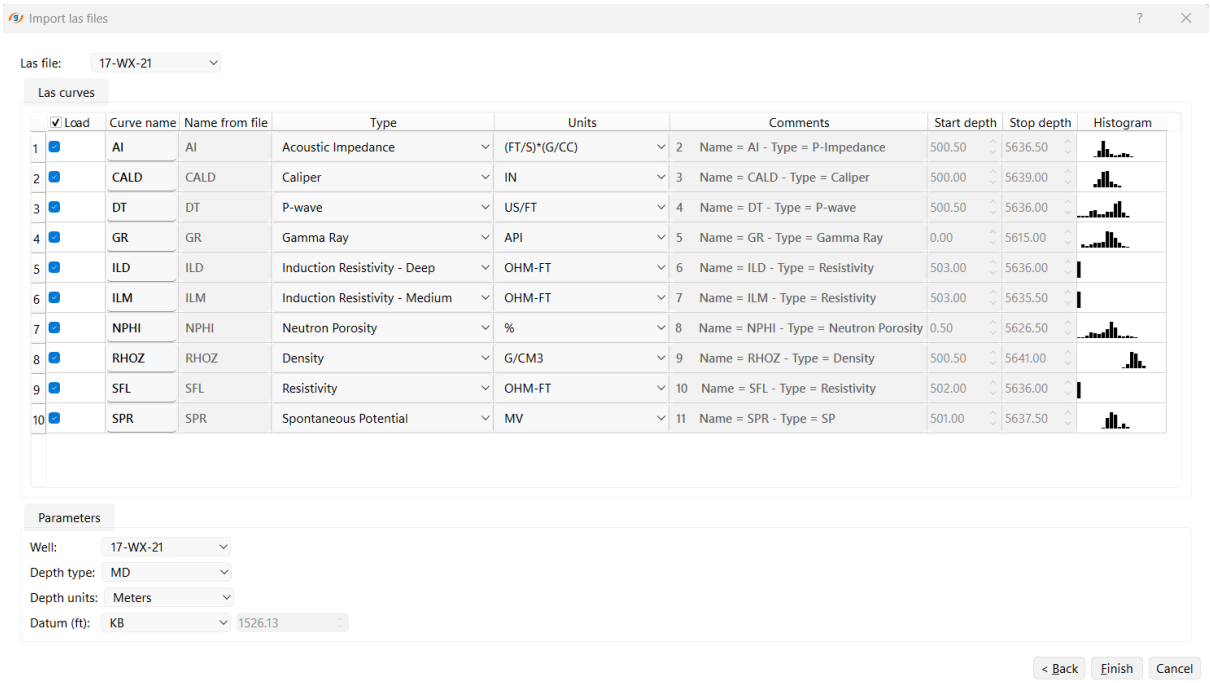
- **Name from file** (original name as stored in the LAS).
- **Type** (curve type: Gamma Ray, Density, Resistivity, etc.).
- **Units**.
- **Comments**.
- **Start depth / Stop depth**.
- **Histogram preview** of curve distribution.

  Curve name, Type and Units can be changed manually, you can choose the options from the list or type it.

At the bottom, you can set well-specific parameters:

- **Well** (well name).
- **Depth type** (MD, TVD, etc.).
- **Depth units** (Meters, Feet).
- **Datum** (e.g., KB).



For more information about formats please refer to Well Data Formats 332

5.2.7 Import checkshots

Note

Currently g-Space supports import checkshot data from KB datum.

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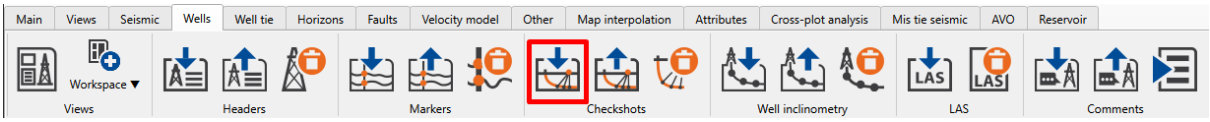
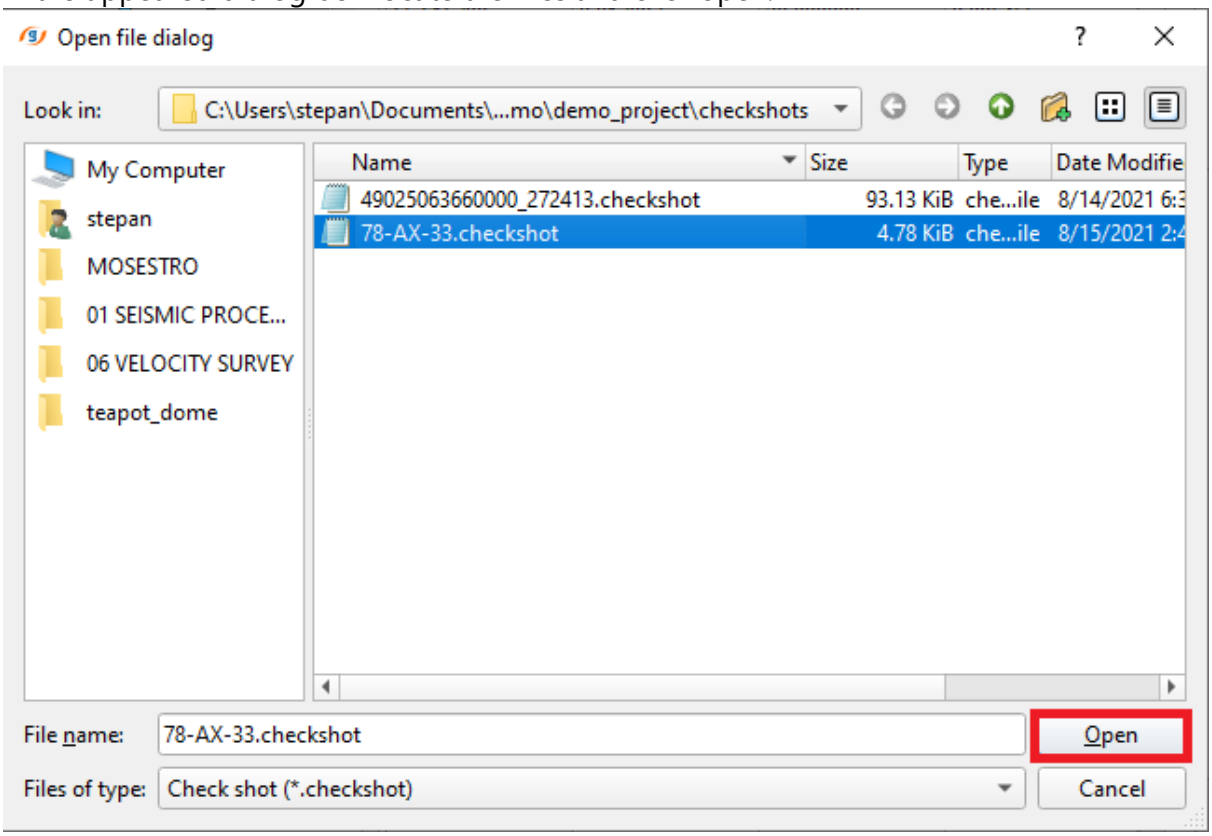
Import checkshots steps:

Step 1: Locating the file

To load checkhots go to Ribbon 33 -> Wells bar 42 and click on Load checkshots button



In the appeared dialog box locate the files and click open:



Step 2: Setting up reading parameters

g-Space will open file preview dialog were you can set the loading parameters such as: Separator type, Headers row, Start row, End row.

In the **Original file** tab you will see how files looks like and adjust loading parameters accordingly. Also set the import parameters

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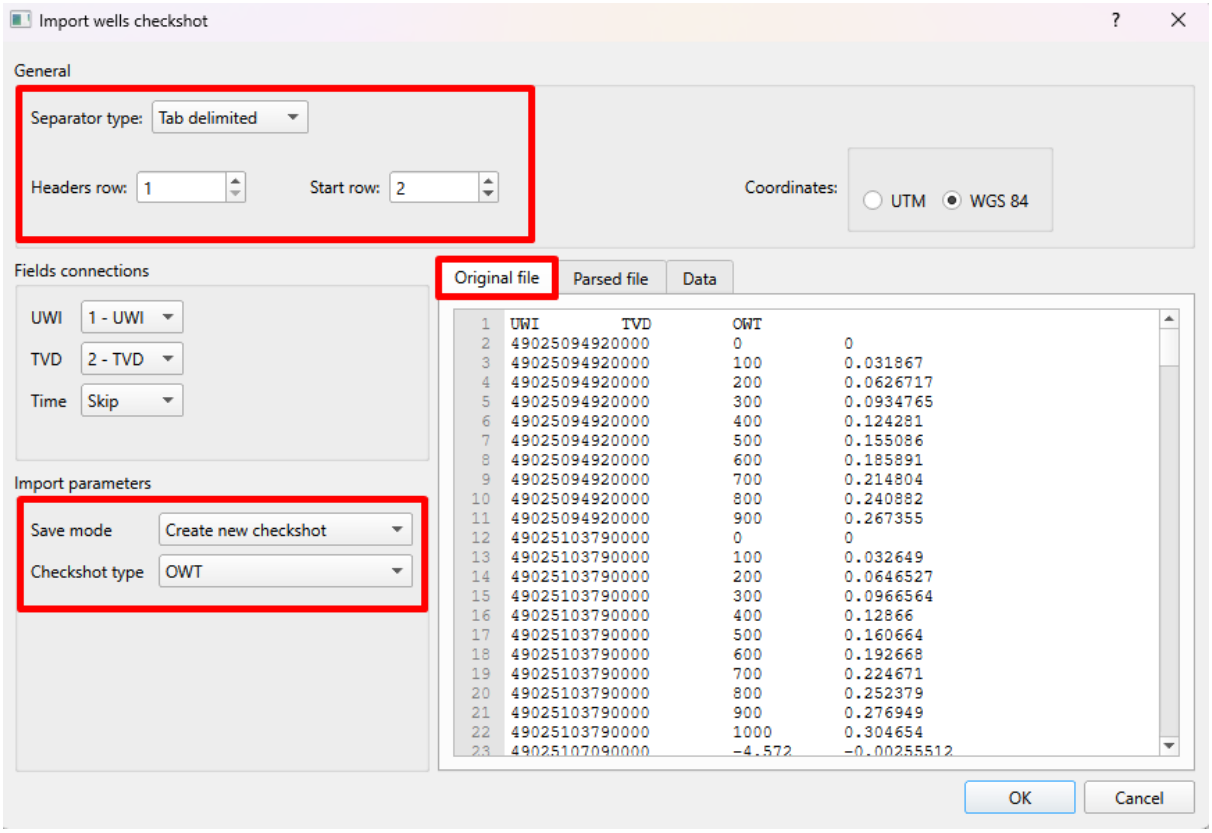

Step 3: Checking reading parameters

Click on the **Parsed file** tab to check if you set reading parameters correctly and also you can decide which columns you want to add or skip

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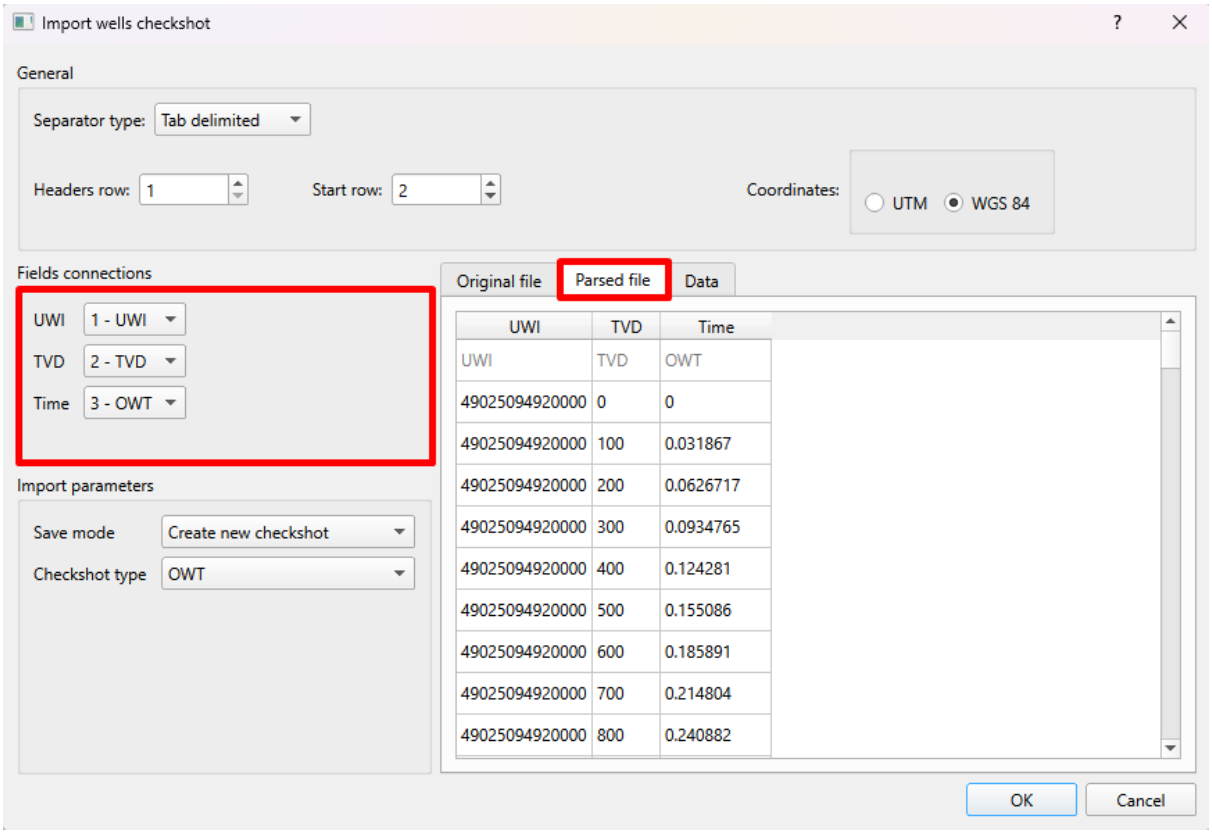

In the **Field connections** check the parameters. If you have files with additional information you can choose skip unnecessary columns from drop-down box.

Note

If some of the fields are colored RED, it means that data doesn't have required type or reading parameters were set incorrectly

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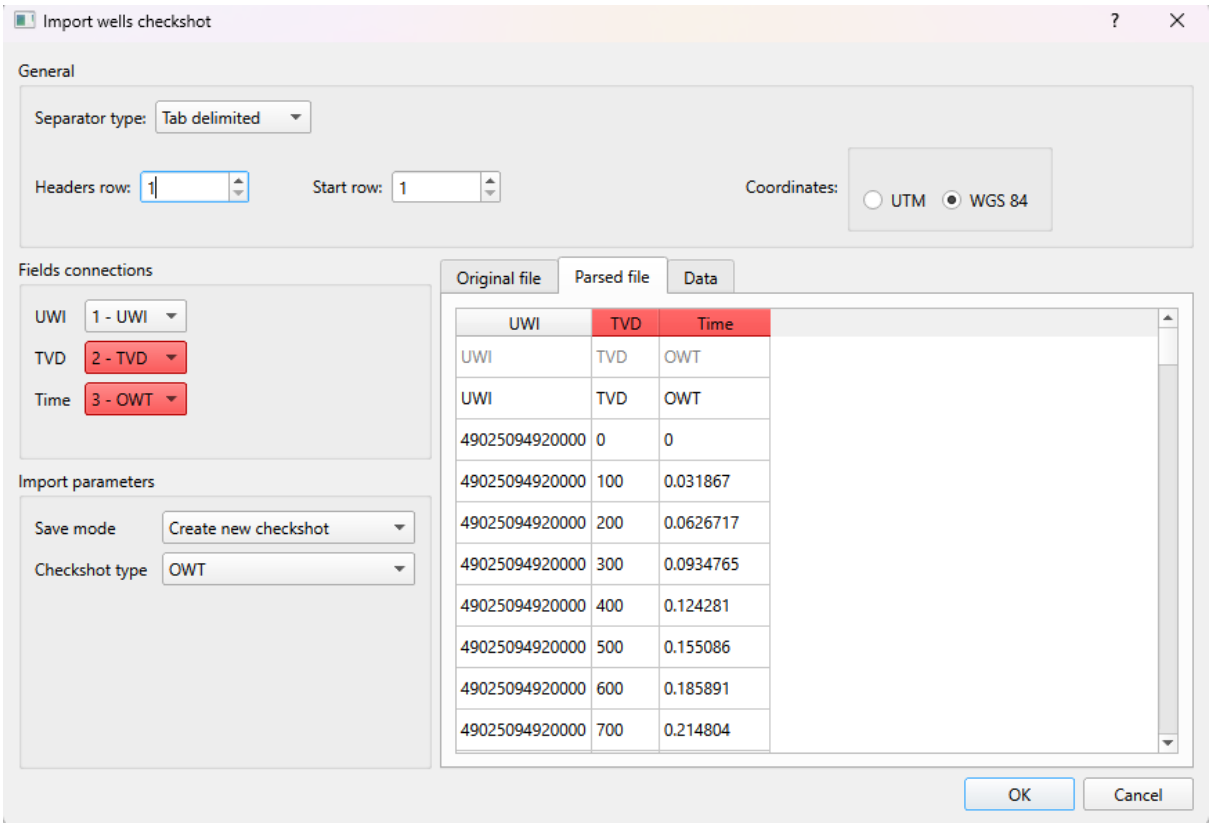

Step 4. Checking the loading settings

In Data tab you can see if all settings were done correctly and all necessary columns were included. After that click OK

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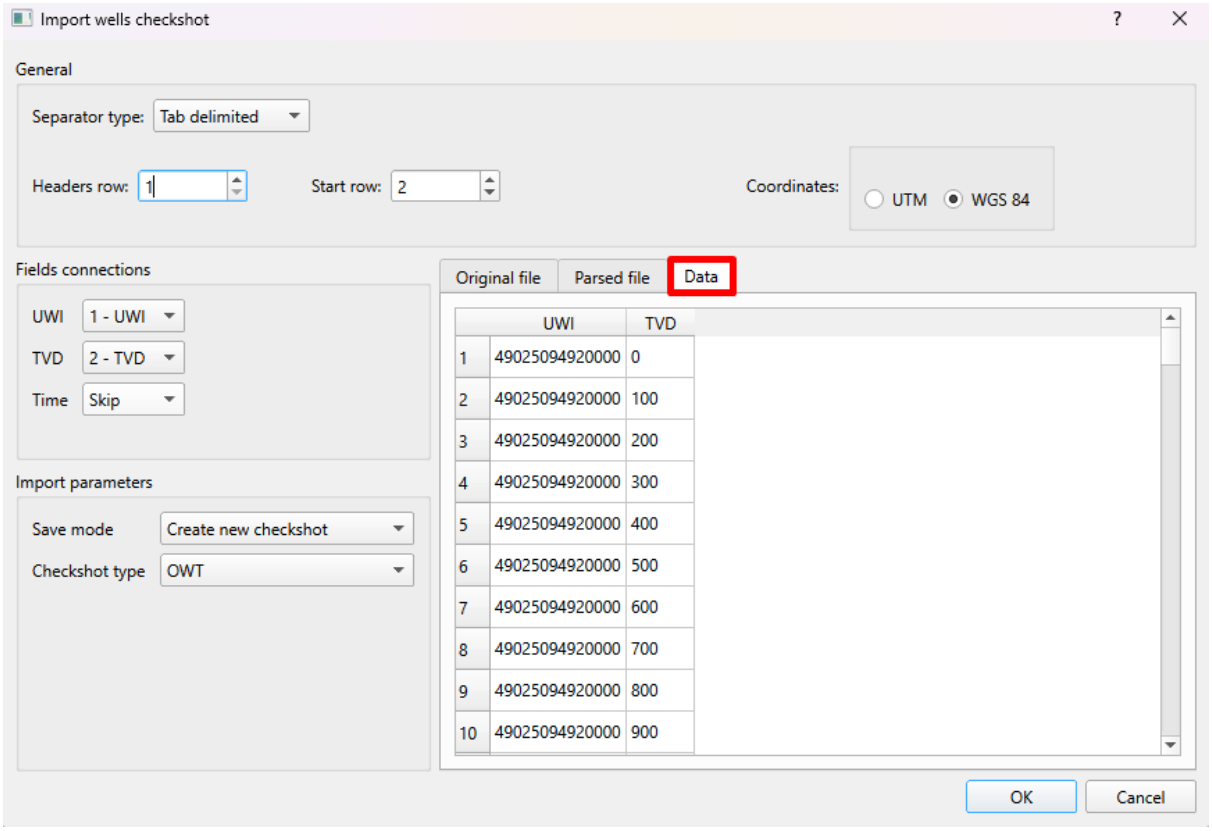

You can evaluate loaded data by clicking on map view or in table below map. All loaded information will appear in table **Checkshot** where you can check the values. Also you can see the data in **log preview** to the right

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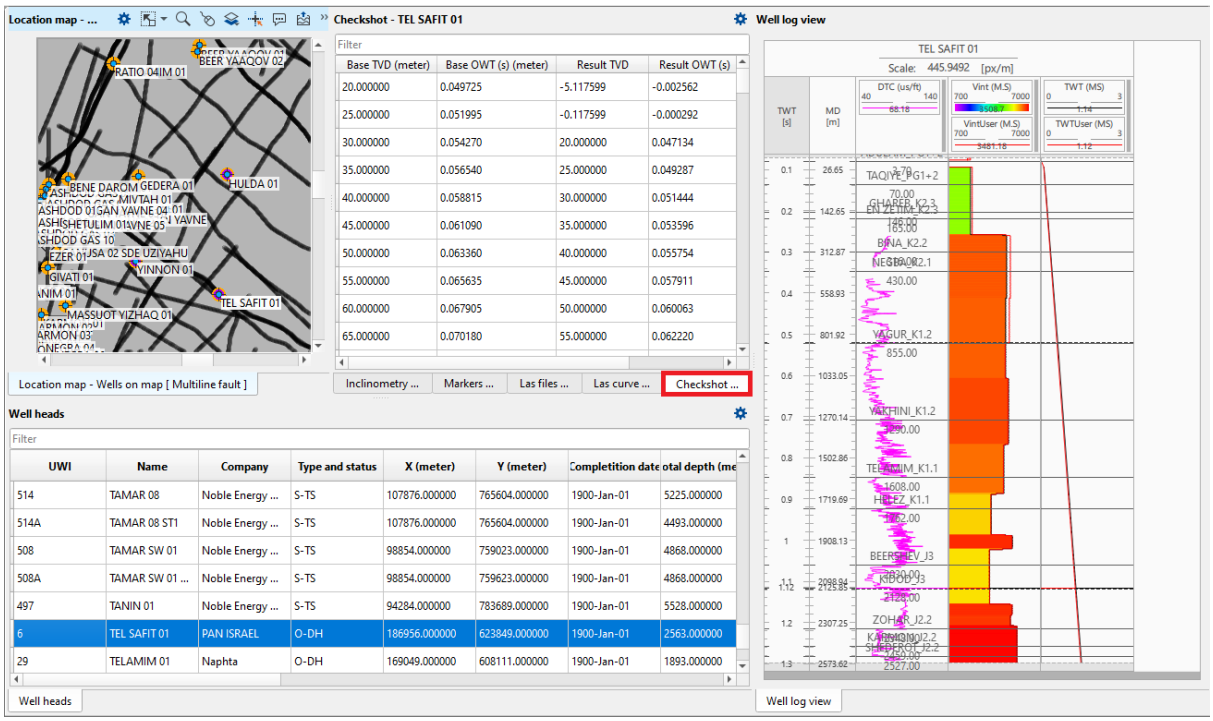


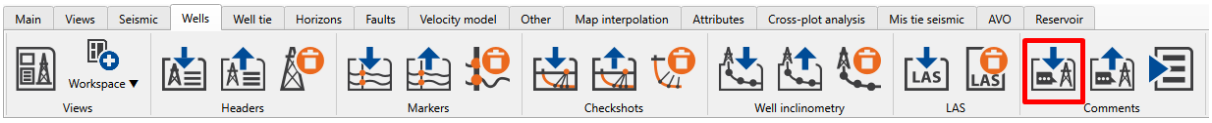
For more information about checkshot format please refer to Well Data Formats 332

5.2.8 Import comment log

Import comments steps:

Step 1: Locating the file

To load comments go to Ribbon 33 -> Wells bar 42 and click on Import well comments from text file button



In appeared open file dialog locate comments file and click open

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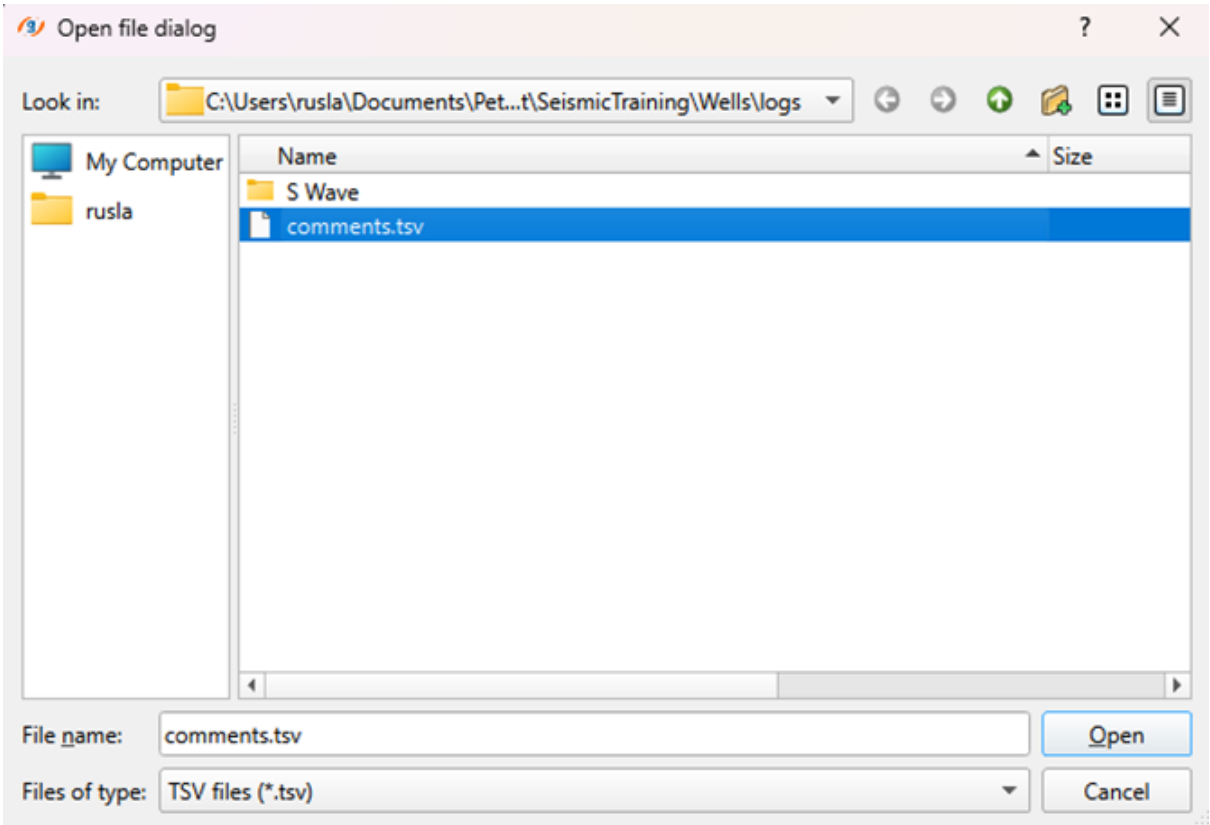

Step 2: Setting up reading parameters

g-Space will open file preview dialog were you can set the loading parameters such as: Separator type, Headers row, Start row, End row.

In the **Original file** tab you will see how files looks like and adjust loading parameters accordingly

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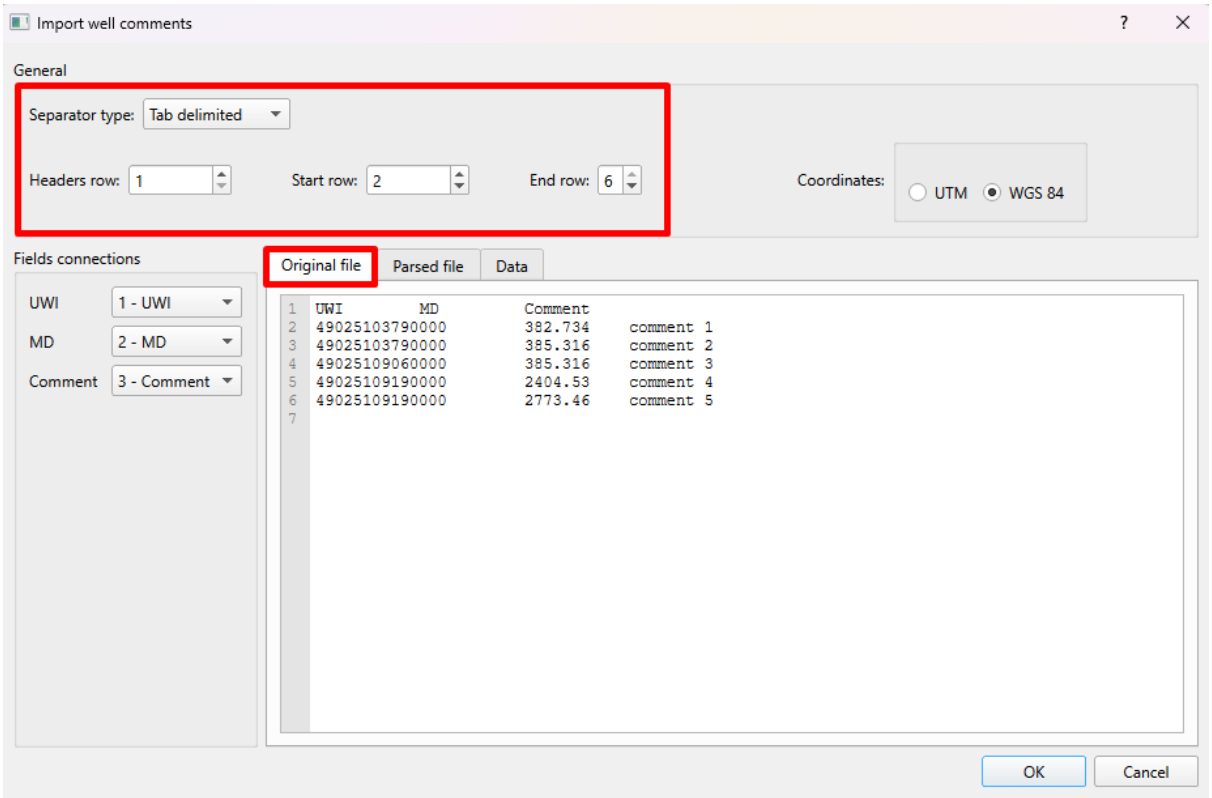

Step 3: Checking reading parameters

Click on **Parsed file tab** to check if you set reading parameters correctly and also you can decide which columns you want to add or skip

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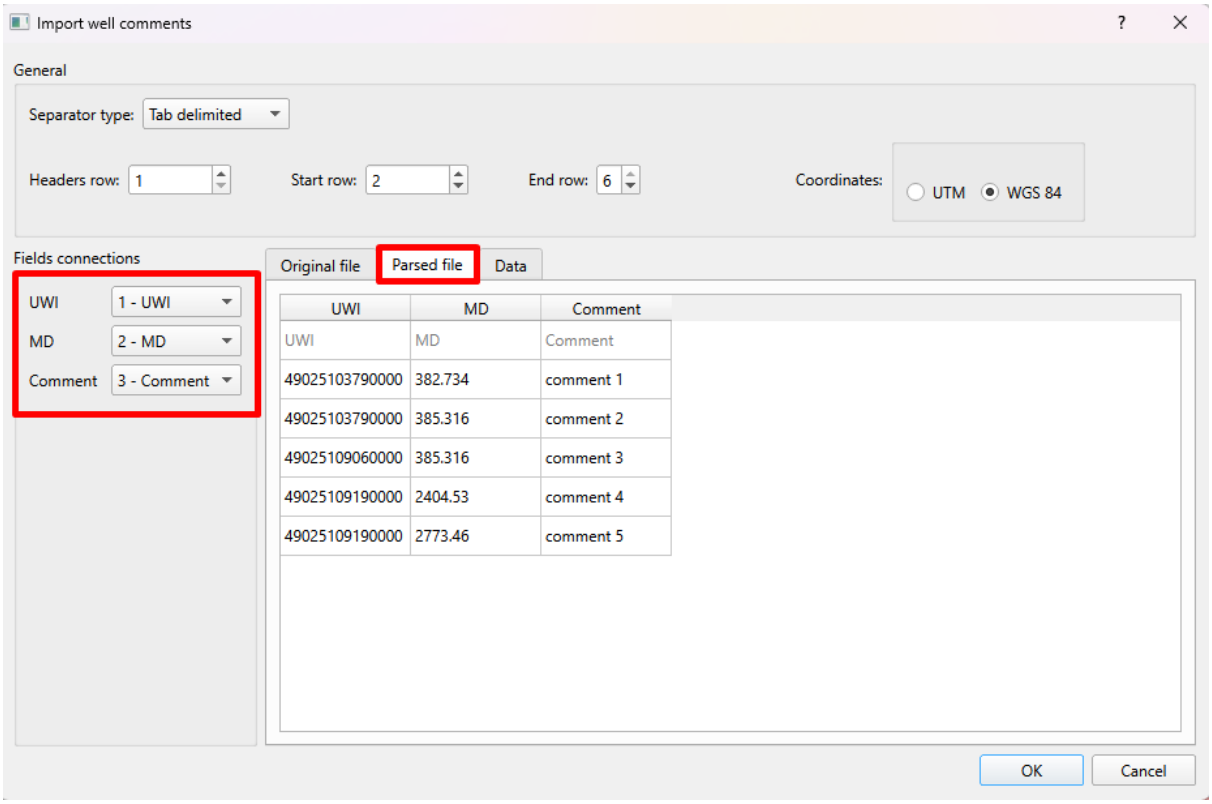

In the **Field connections** check the parameters. If you have files with additional information you can choose skip unnecessary columns from drop-down box.

Note

If some of the fields are colored RED, it means that data doesn't have required type or reading parameters were set incorrectly

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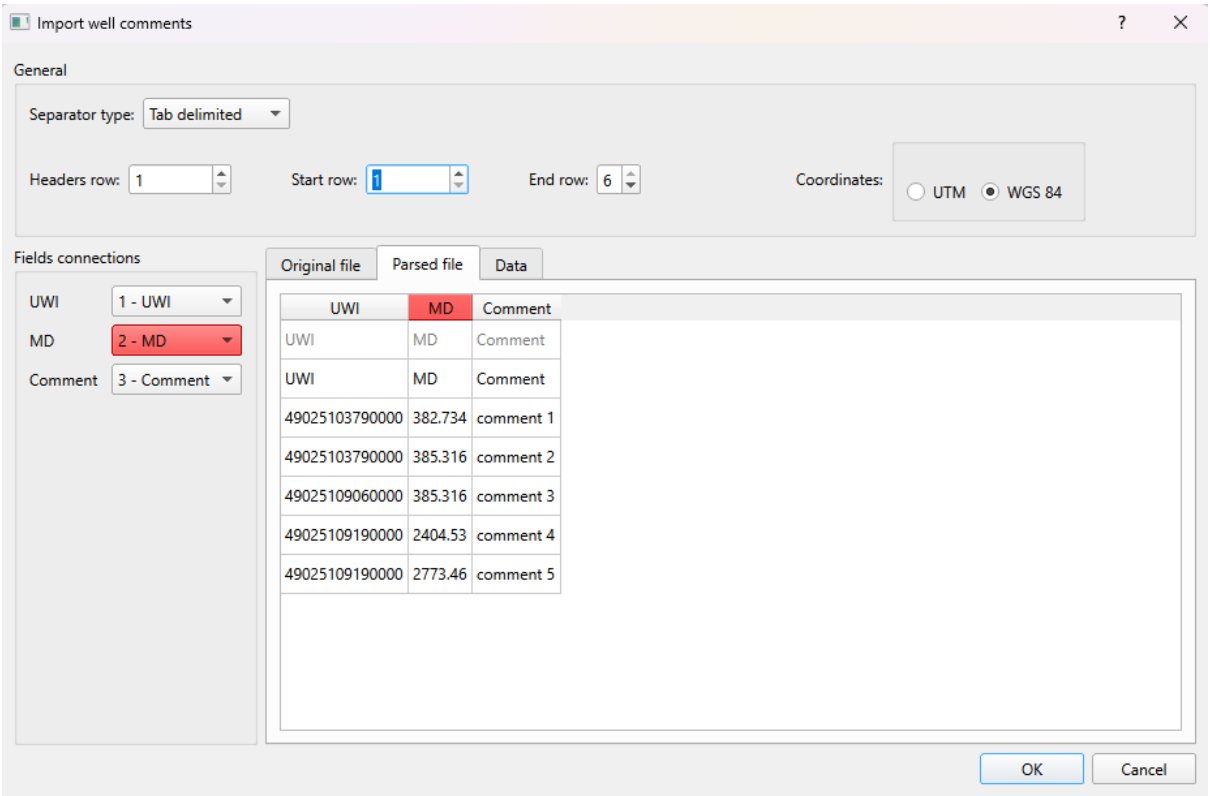

Step 4. Checking the loading settings

In Data tab you can see if all settings were done correctly and all necessary columns were included. After that click OK

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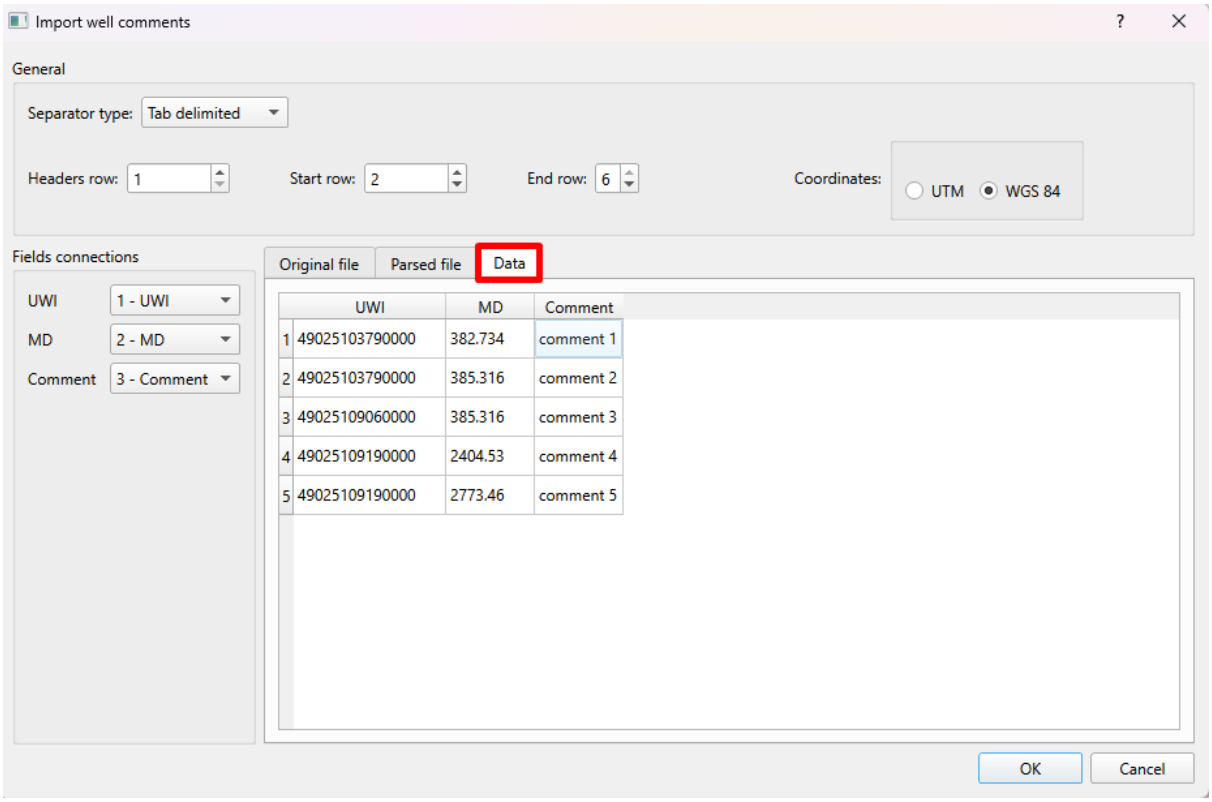
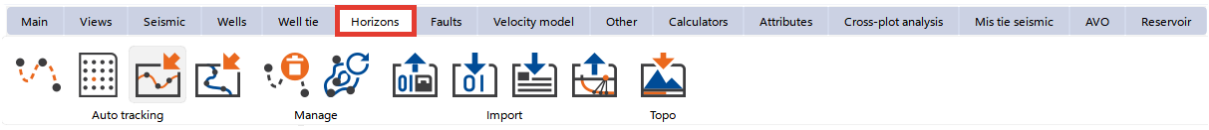


For more information about comment log format please refer to Well Data Formats 332

5.3 Import Horizons

g-Space supports several options importing horizons:

Navigate to the Horizons 64 bar



Option 1: Press load horizons binary button, locate file and press OK. g-Space will load binary horizons

IMPORTANT NOTE: Binary format contains a full copy of horizons exported from g-Space and it will overwrite all existing horizons

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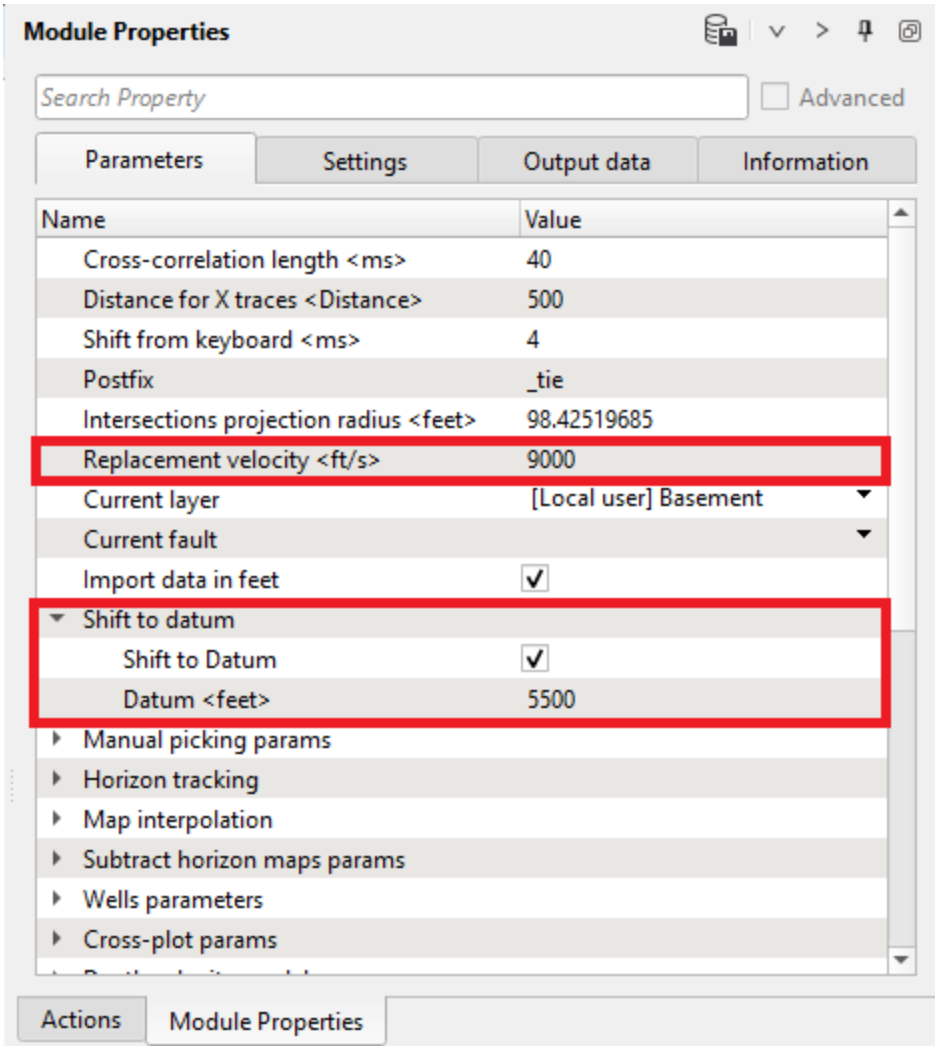
Option 2: Press Import horizons ASCII button, locate file and press OK.

For more information about horizon format please refer to chapter Horizon Data Format 337

Before importing horizons make sure that the project **datum** and **replacement velocity** are the same for importing horizons otherwise in must be changed. To do this go to Module Properties 91 panel --> Parameters tab



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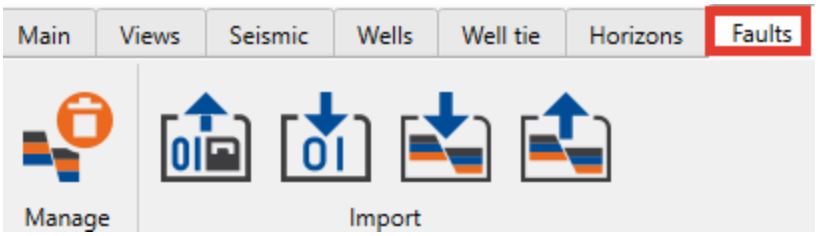
5.4 Import Faults

g-Space supports several options importing faults:

Navigate to the Faults bar



Option 1: Press load faults binary button, locate file and press OK. g-Space will load binary faults

IMPORTANT NOTE: Binary format contains a full copy of faults exported from g-Space and it will overwrite all existing faults

Option 2: Press Import faults Charisma format and locate file

Adjust the import settings as needed:

- **Imported EPSG Code**: Displays the coordinate system of the imported data.
- **Import Measurement System**: Allows selecting between Metric and other units.
- **Use Converting on Import**: Enables automatic conversion of coordinate or measurement systems.
- **Is Depth Fault**: If checked, the imported fault is treated as a depth-based fault and will be stored in Depth subfolder in the Faults folder in the **Data manager**.

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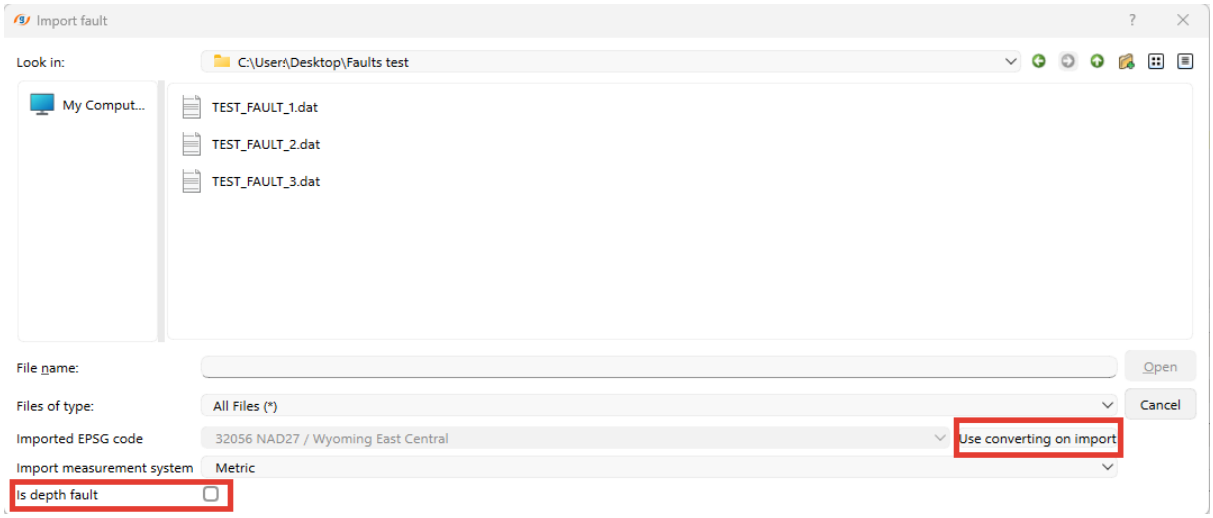

For more information about fault formats supported by g-Space refer to Fault Data Formats 339

Before importing faults make sure that the project **datum** and **replacement velocity** are the same for importing faults otherwise in must be changed. To do this go to Module Properties 91 panel --> Parameters tab

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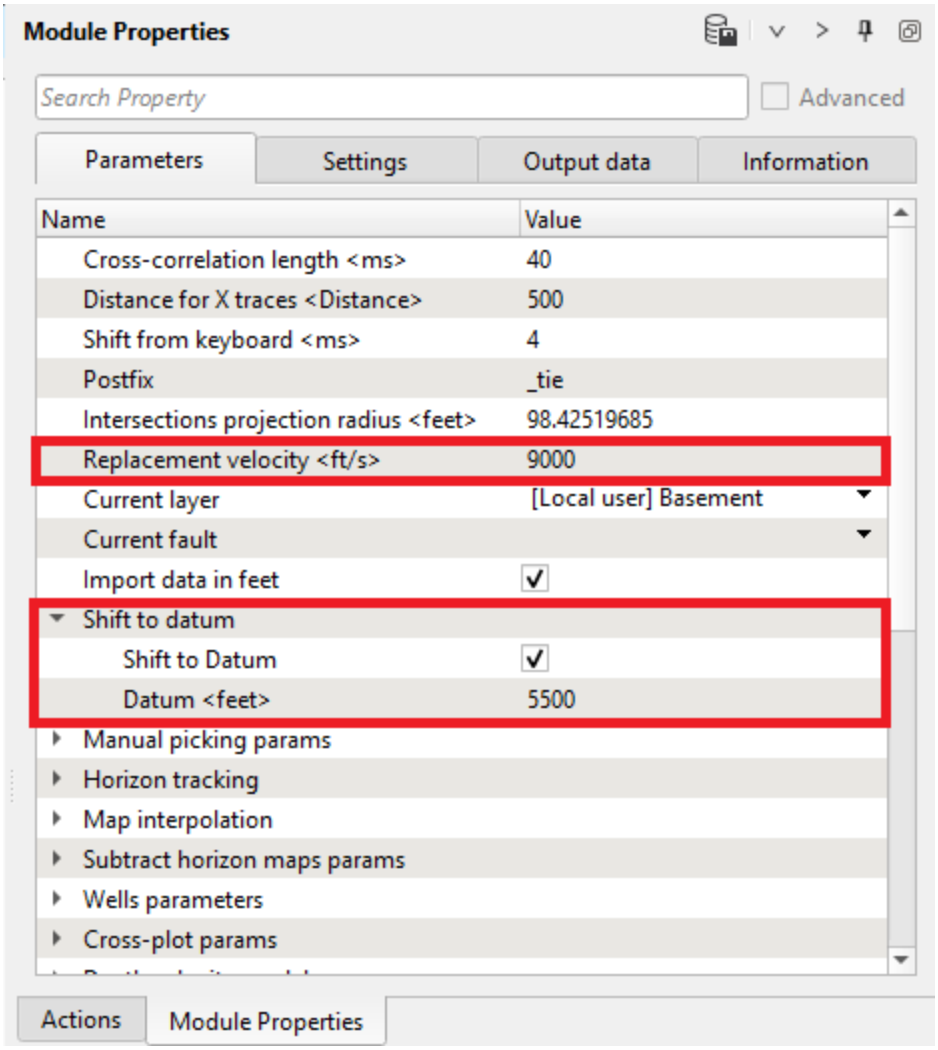
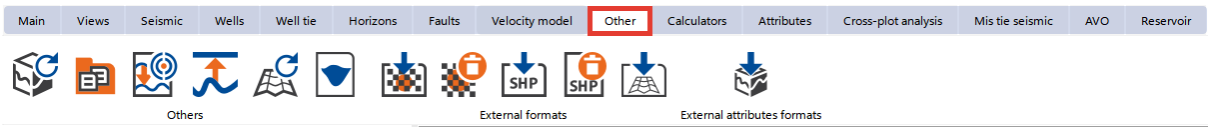


5.5 Import Shapefile

There are two ways to import shapefile into the project

Option 1: Navigate to the Other bar:



press **Load shapefile** button

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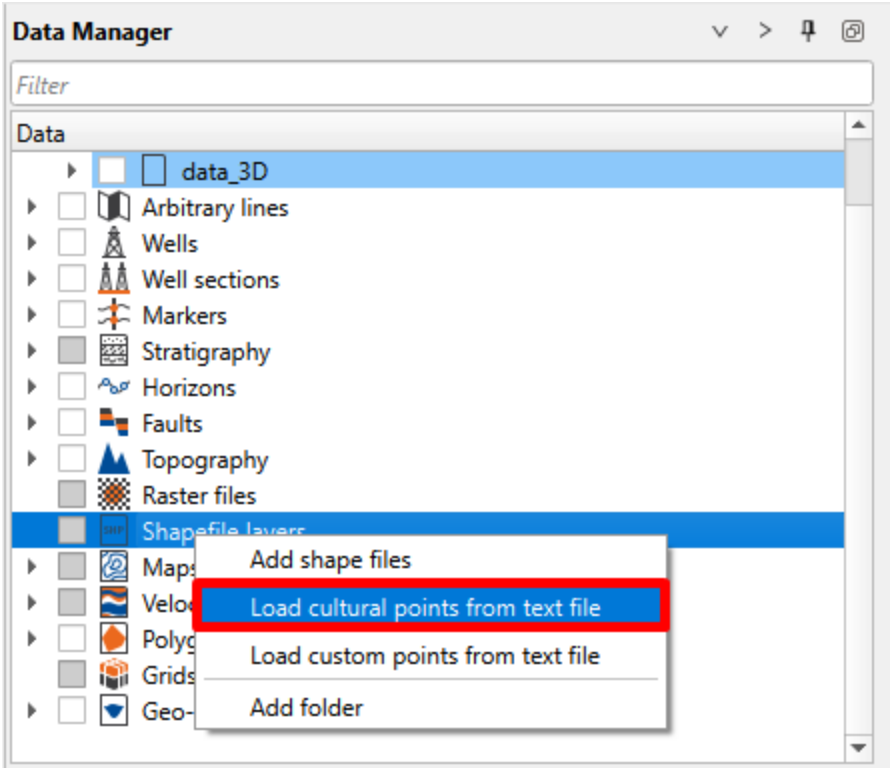
Option 2: On **Shapefile layers** icon in Data manager 86 press right mouse button and choose **Add shape files** option



Also you can import point attribute data by choosing Load cultural points from text file.

For more information about shapefiles format refer to GIS Data Formats 341

5.6 Import polygons

To import polygons to g-Space go to Data manager 86 on **Polygons** icon press right mouse button and choose **Import polygon from CPS-3 line file**

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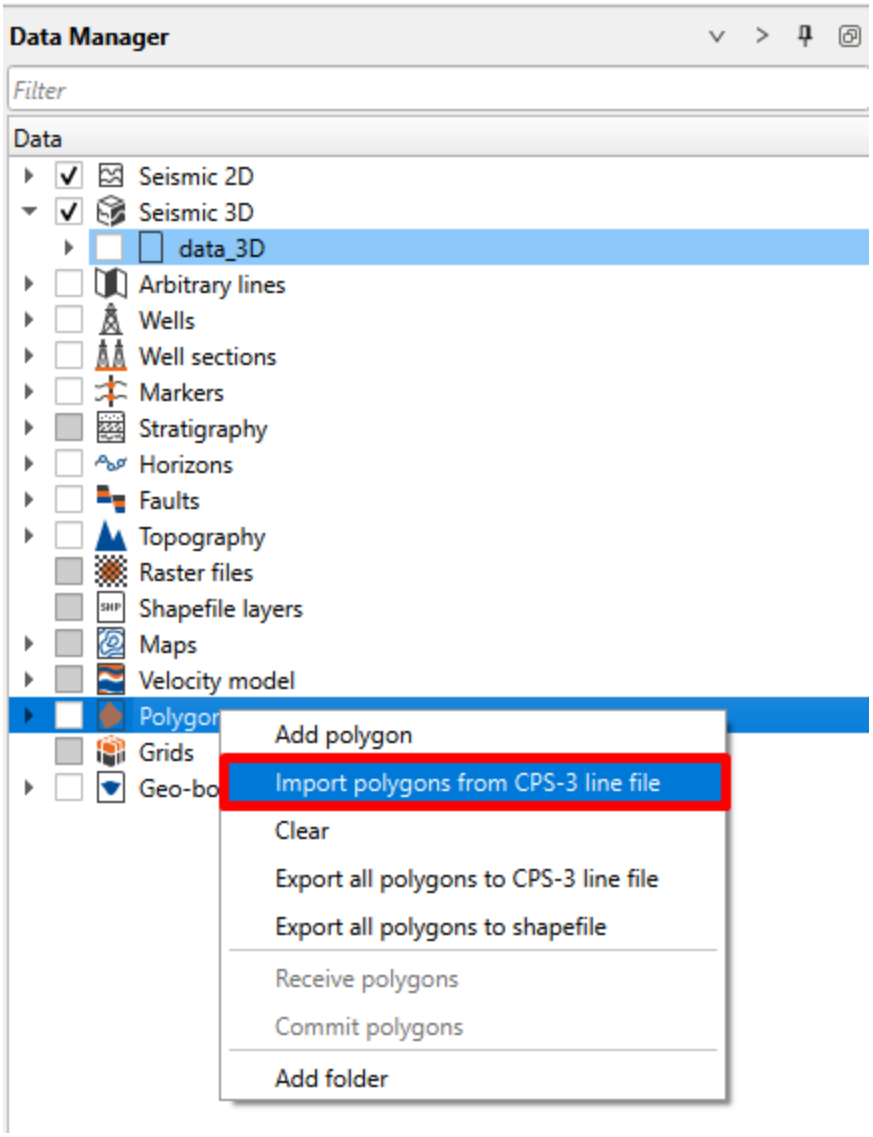
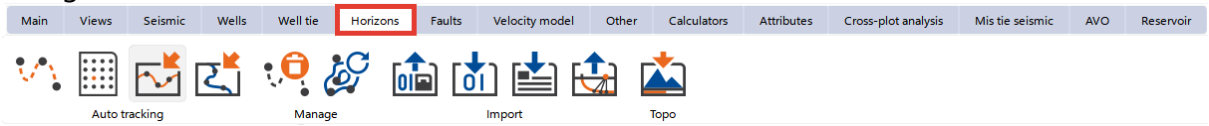


For more information about polygon formats supported by g-Space refer to GIS Data Formats 341

5.7 Import topography

Navigate to the Horizons bar 64:



press **Load external topography** button

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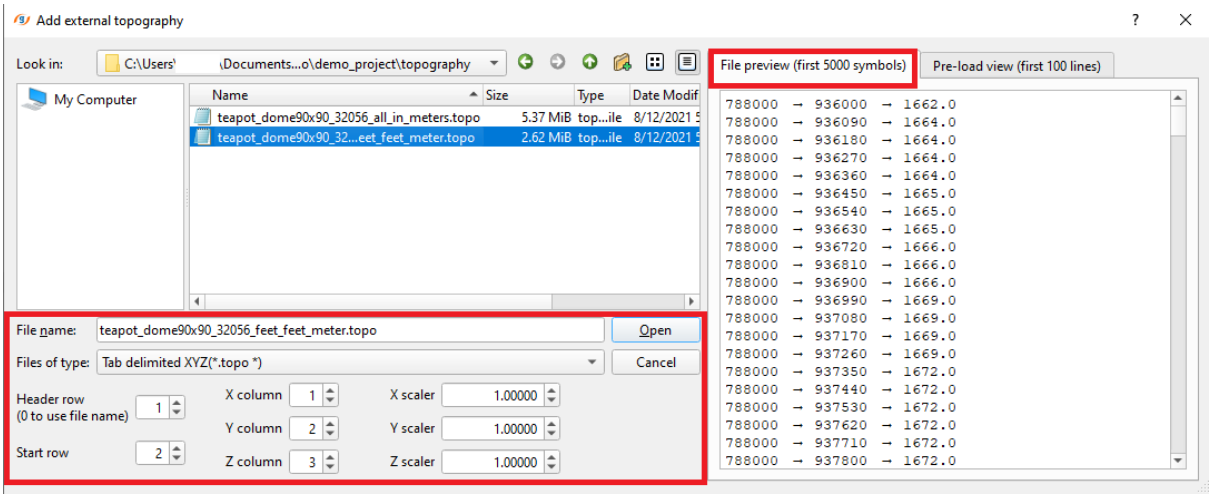
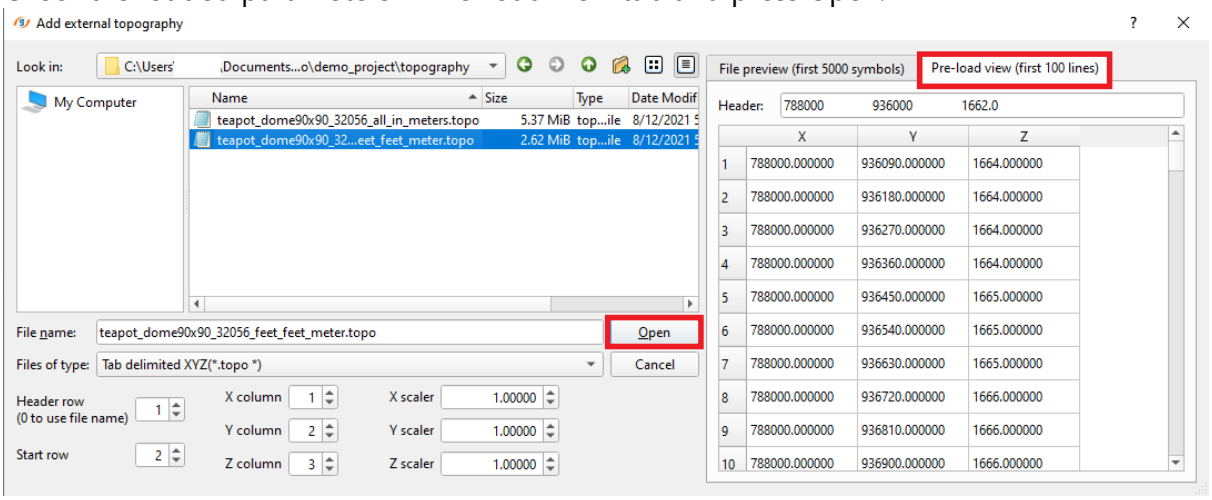
In the appeared **preview file** dialog chose file, set the loading parameters:

- File type
- Headers row
- X,Y,Z columns and scale ratio



Check the loaded parameters in Pre-load view tab and press Open:



For more information about external topography formats supported by g-Space refer to Grid Data Formats 338

5.8 Import images

There are two ways to import image file into the project

Option 1: Navigate to the Other bar

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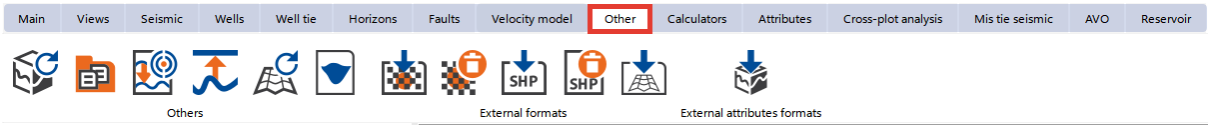
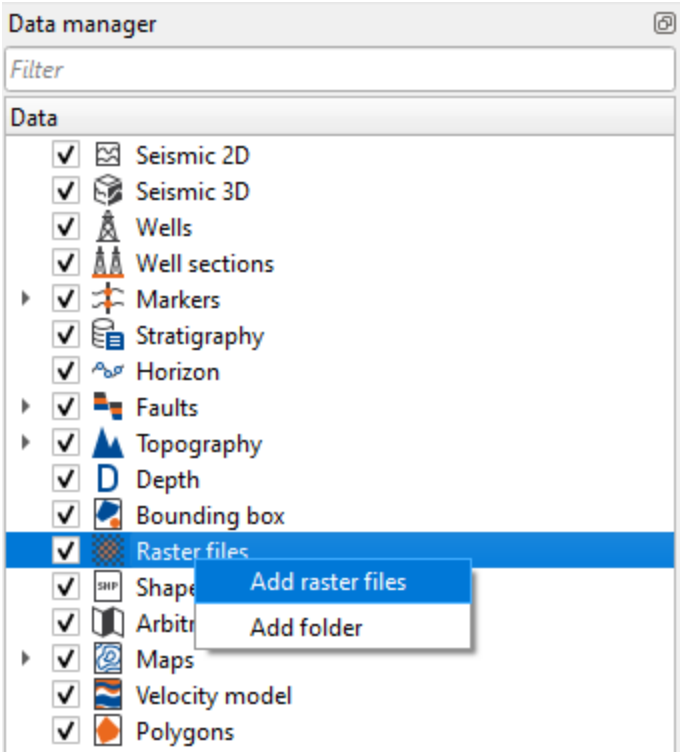
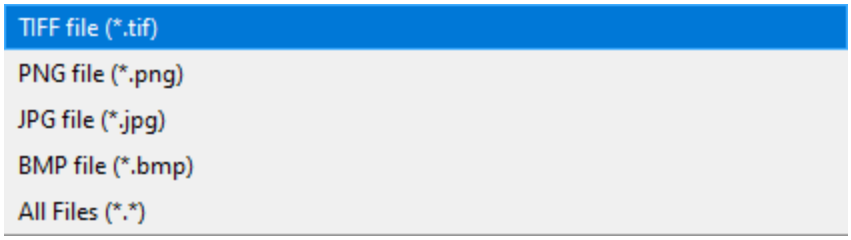


press Load picture file button

Option 2: On **Raster files** icon in Data manager press right mouse button and choose **Add raster files** option



Locate file and press Open. You can load geo-referenced tiff, png, jpg, bmp formats



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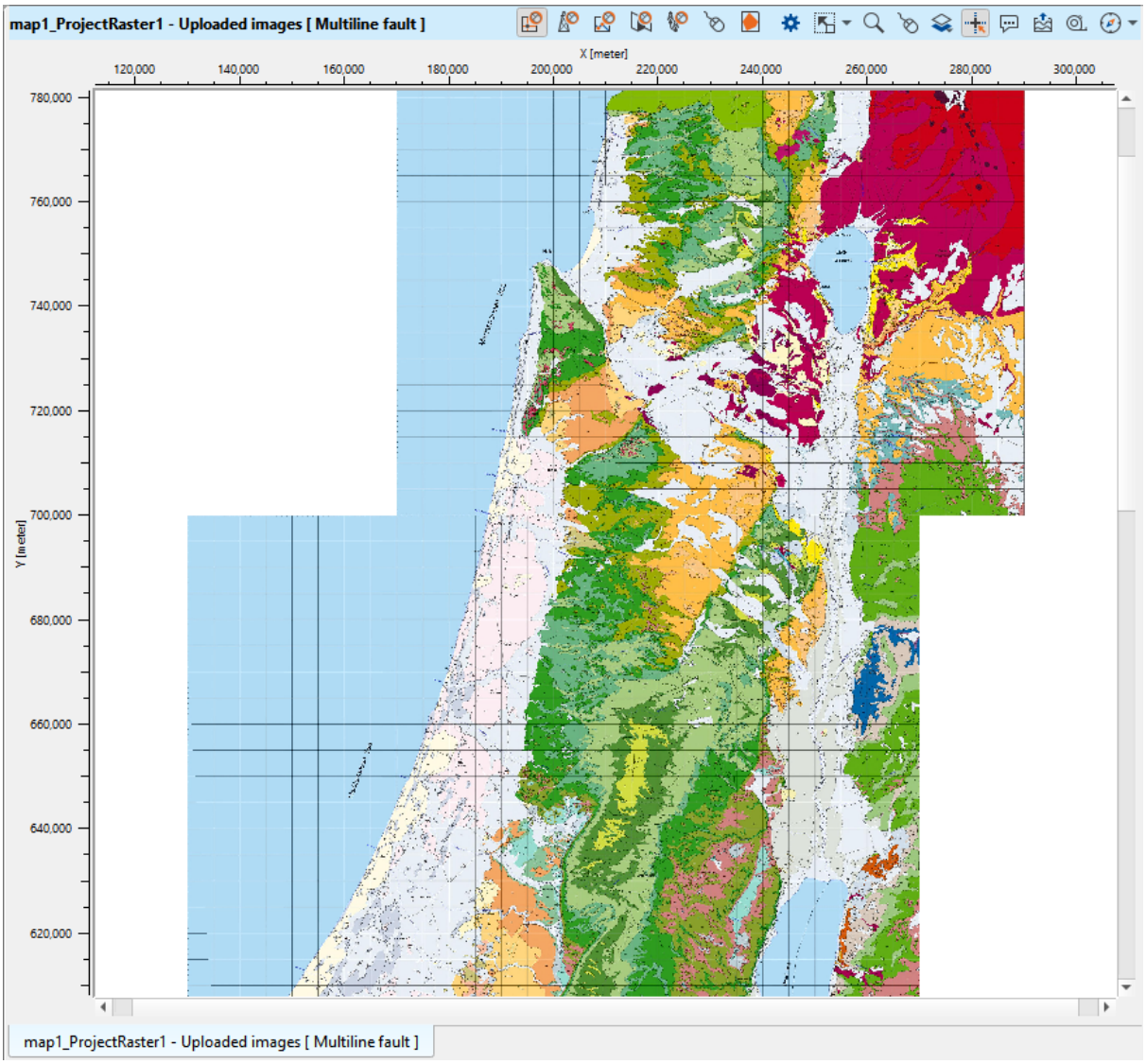
Loaded geo-referenced image on location map view



Note

The word file must have same name as image file and located in the same directory

Name	Size	Type	Date Mod
map1_ProjectRaster1.jgw	91 bytes	jgw File	6/28/2020
map1_ProjectRaster1.jpg	1.45 MiB	jpg File	6/28/2020
map2_ProjectRaster1.jgw	91 bytes	jgw File	6/28/2020
map2_ProjectRaster1.jpg	1.79 MiB	jpg File	6/28/2020
map3_ProjectRaster1.jgw	91 bytes	jgw File	6/28/2020
map3_ProjectRaster1.jpg	2.33 MiB	jpg File	6/28/2020
map4_ProjectRaster1.jgw	91 bytes	jgw File	6/28/2020
map4_ProjectRaster1.jpg	1.55 MiB	jpg File	6/28/2020

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For more information about geo-referenced formats see Image Data Formats 340

5.9 Import maps

There are three ways to import maps files into the project:

1. Load from text file
2. Load from CPS-3 grid file
3. Load from ZMap grid file

In Data manager 86 in Maps icon decide in which set of maps data will be loaded. Press right mouse button and choose one of three options:

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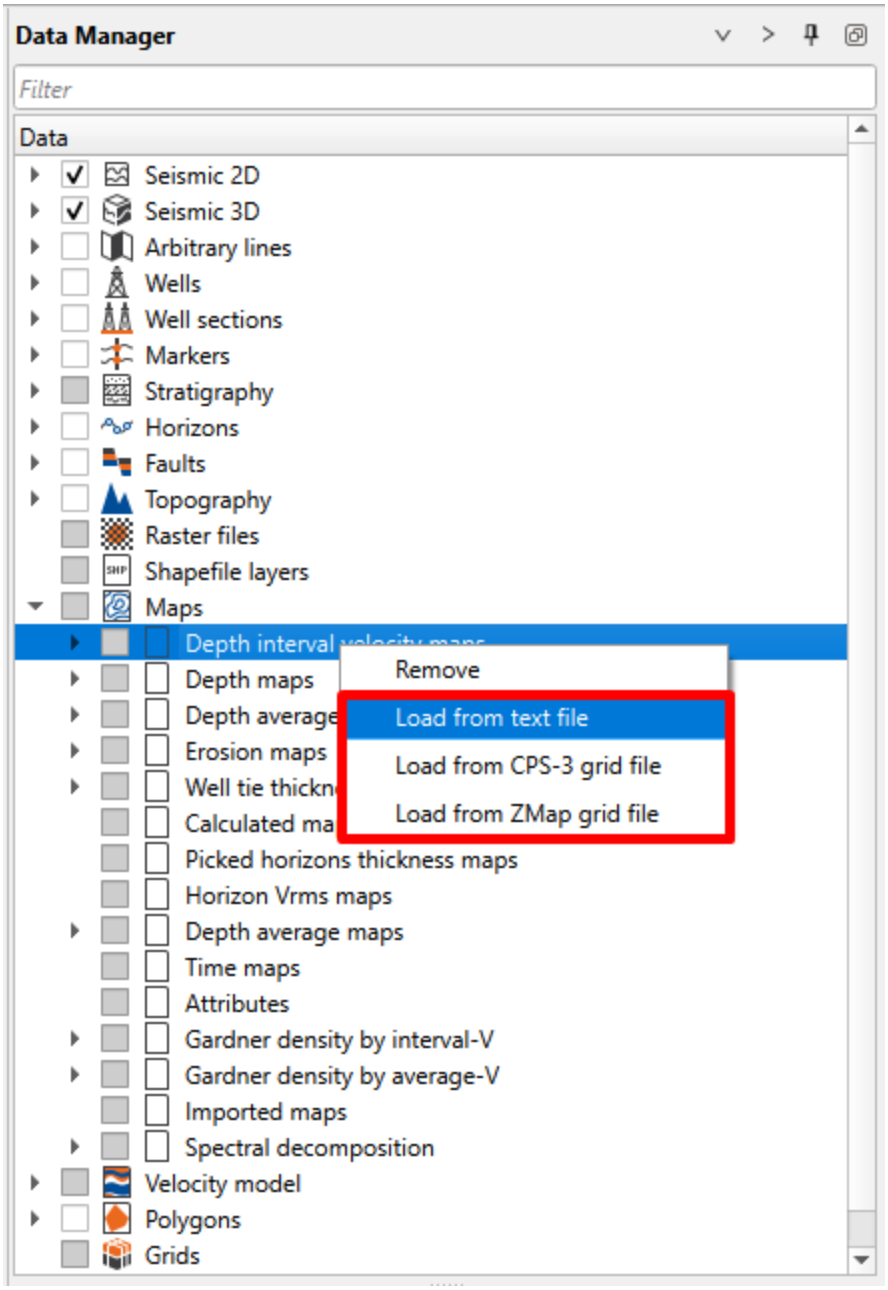

For more information about grid formats supported by g-Space refer to Maps Data Formats 338

5.10 Import grids

Currently, **only Eclipse format (.dat)** is supported for grid import in g-Space.

To import an Eclipse grid into **g-Space**, follow these steps:

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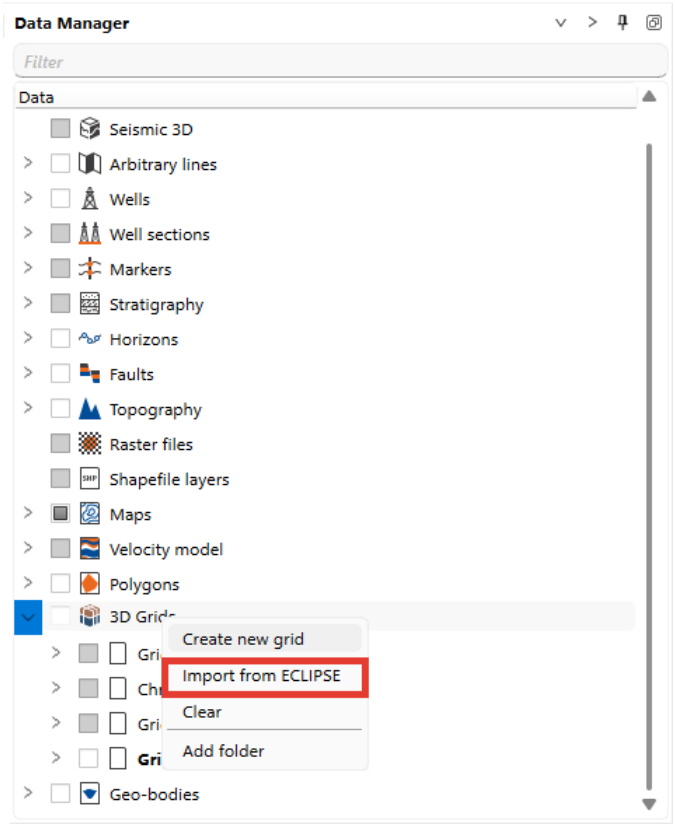
1. Open the **Data Manager**.
2. Navigate to the **3D Grids** folder.
3. Click **Import from Eclipse**.



4. A pop-up window will appear.
5. Select the **.dat file** that contains the Eclipse grid data.
6. Choose the correct **EPSG coordinate system** and if required.
7. Click **Open** to complete the import.

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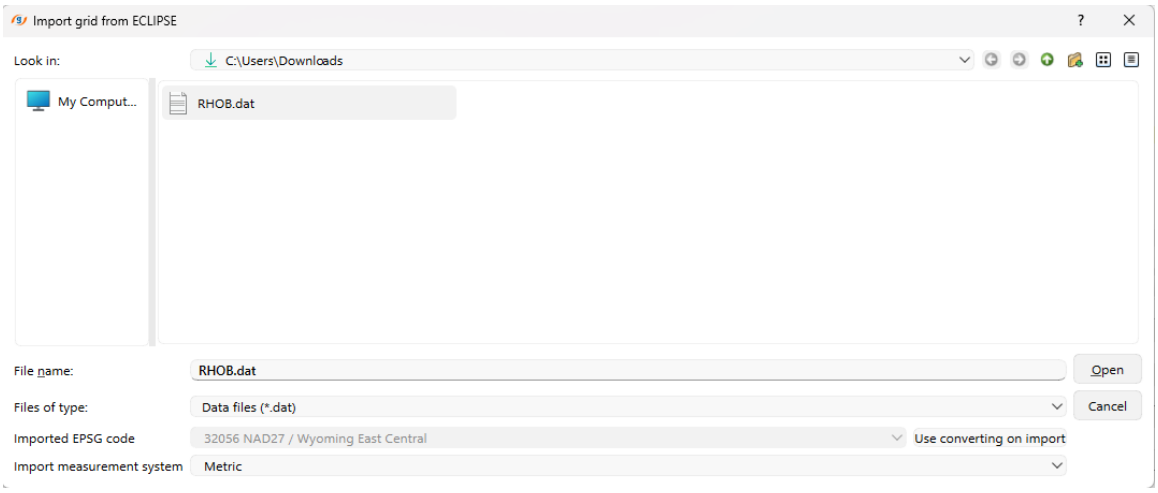

The imported grid will appear in the **3D Grids** folder and can be visualized and edited in g-Space.

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template if you want it completely blank.

Export data

6 Export data

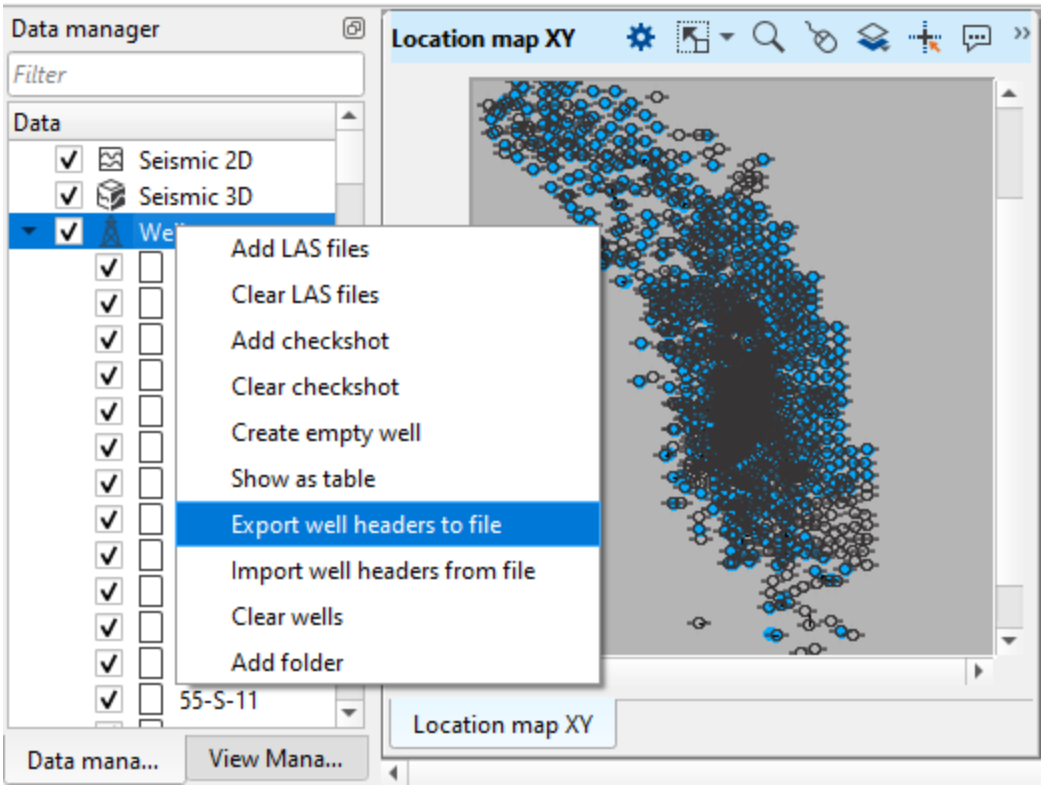
This chapter will guide you through exporting different types of data from g-Space.

Here is the list of the data types you are able to export form g-Space:
- Well data - well headers 308, markers 312, checkshots 314, well logs 318, well inclinometry
- Seismic horizons 322
- Fault sticks 325
- Grid data 328
- Polygons 329

For more information about supporting formats please refer to chapter Formats 332

6.1 Export well headers

To export well headers press Right Click Mouse on Wells icon in Data Manager 86 and choose Export well headers to file



Locate file directory, choose file format and click **Save**

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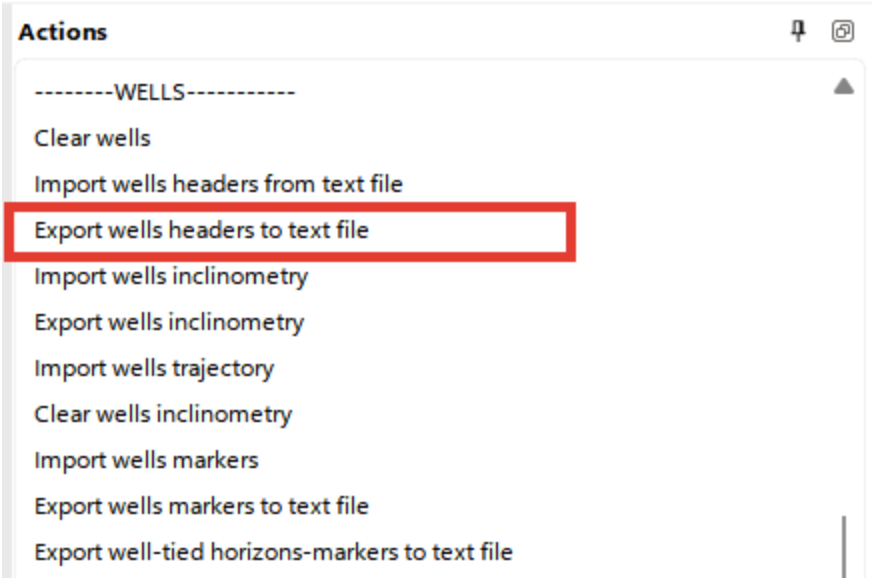
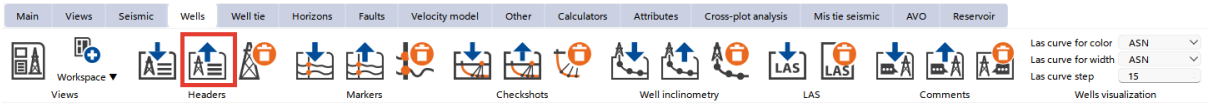
For more information about well headers format please refer to the chapter Well Data Formats 332

Export well data available from Actions panel 84 as well



And from the Wells bar 42 from Headers section



Exported Well Headers Content

The exported file will contain the following well header information by default:

- UWI
- Well Name
- Company Name
- Type and Status
- X (Easting)
- Y (Northing)
- Completion Date
- Total Depth
- Kelly Bushing
- Ground Level
- Coordinate Reference System (CRS)
- Comments/Annotations

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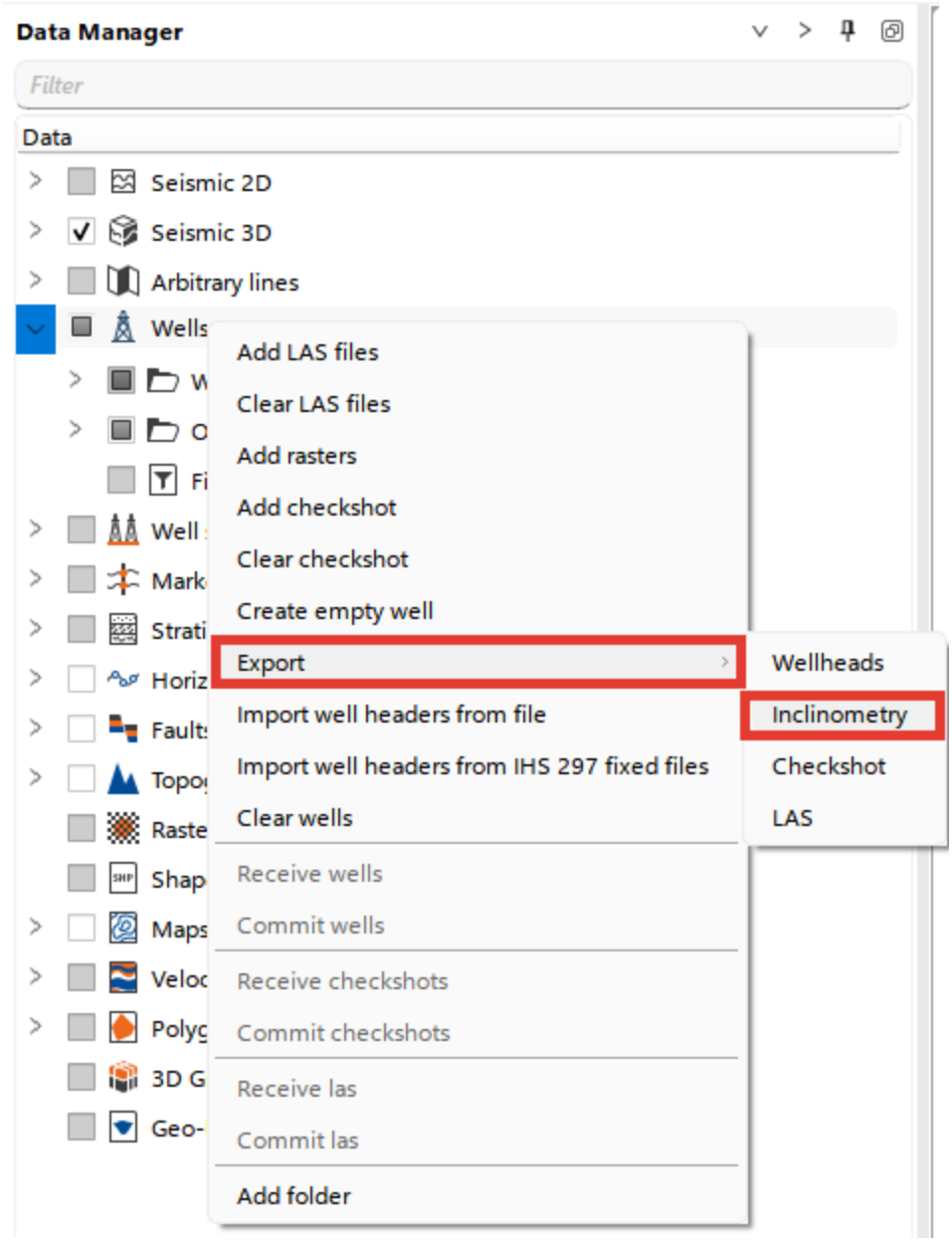
6.2 Export inclinometry

To export well inclinometry press Right Click Mouse on Wells icon in Data Manager 86 and choose Export data and then **Inclinometry**

Locate file directory, choose file format and click **Save**

For more information about well headers format please refer to the chapter Well Data Formats 332



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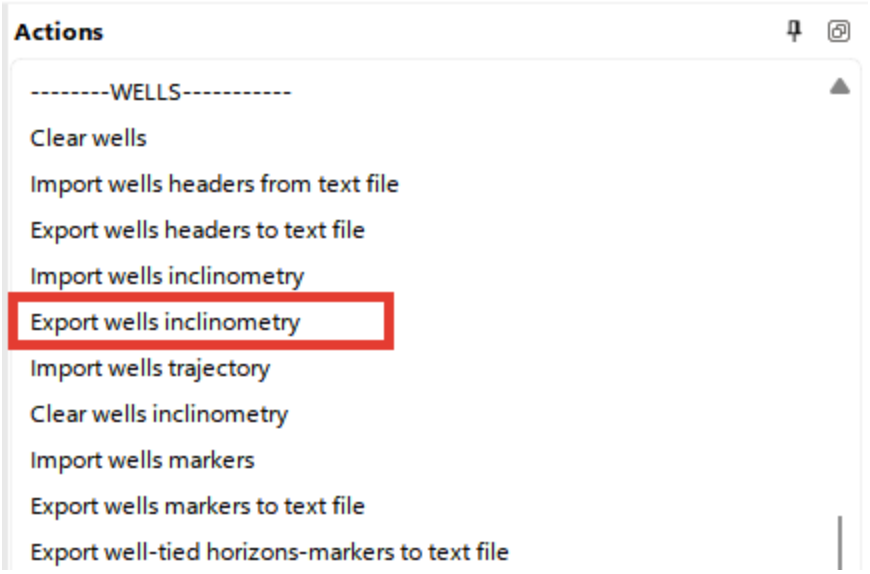
Export well data available from Actions panel 84 as well



And from the Wells bar 42 from Well inclinometry section

Exported Inclinometry Content

The exported file will contain the following inclinometry data by default:

- Well Name
- UWI
- Measured Depth (MD)
- Inclination (INCL)
- Azimuth (AZIM)
- True Vertical Depth (TVD)
- True Vertical Depth Subsea (TVDSS)
- Easting (X)
- Northing (Y)
- Coordinate Reference System (CRS)
- Comments/Annotations

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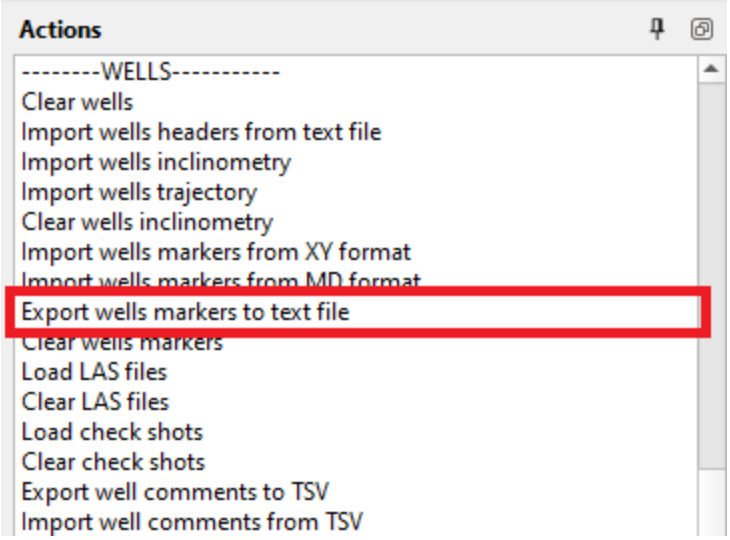
6.3 Export markers

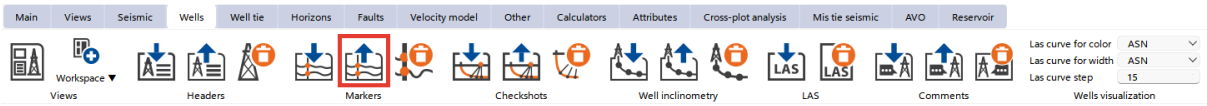
There are two options for exporting markers: **Export Wells Markers to Text File** for exporting standard well markers, and **Export Well-Tied Horizons-Markers to Text File** for exporting markers after performing a Well tie 379.

In Action panel 108 choose Export wells markers to text file



Locate file directory and click **Save**

It's also an option to export markers from Wells bar 42



For more information about well markers format please refer to chapter Well Data Formats 332

The exported file will contain the following marker information by default:

- **UWI**: Unique Well Identifier
- **Wellname:** Name of the Well
- **Marker:** Marker Name or Identifier
- **X:** Easting (X coordinate)
- **Y:** Northing (Y coordinate)
- **MD:** Measured Depth
- **Age:** Age of the Formation

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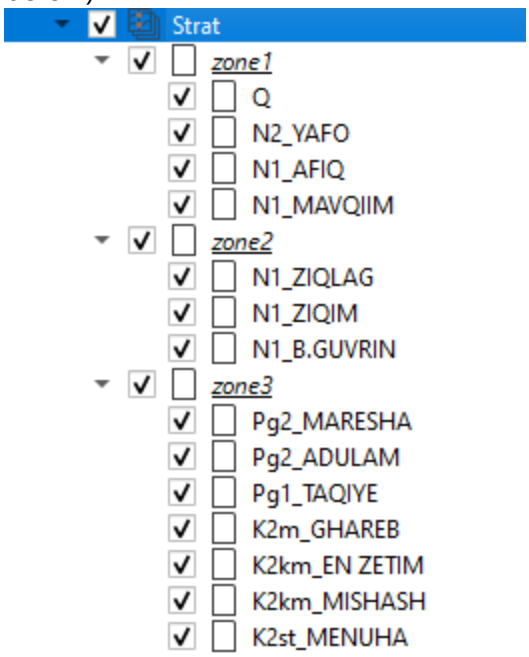
- **TVD:** True Vertical Depth
- **TVDSS:** True Vertical Depth Subsea
- **TWT_CRD:** Two-Way Travel Time (Corrected Datum)
- **TWT_SRD:** Two-Way Travel Time (Sea Reference Datum)
- **Type:** Type of Marker
- **Unconformity:** Indicates Unconformity Type or Status

6.4 Export markers structure

Sometimes markers need to be organized with different levels of hierarchy (see example below)



To export markers structure press Right Click Mouse on Markers set icon in Data Manager 86 and choose **Export markers struct**

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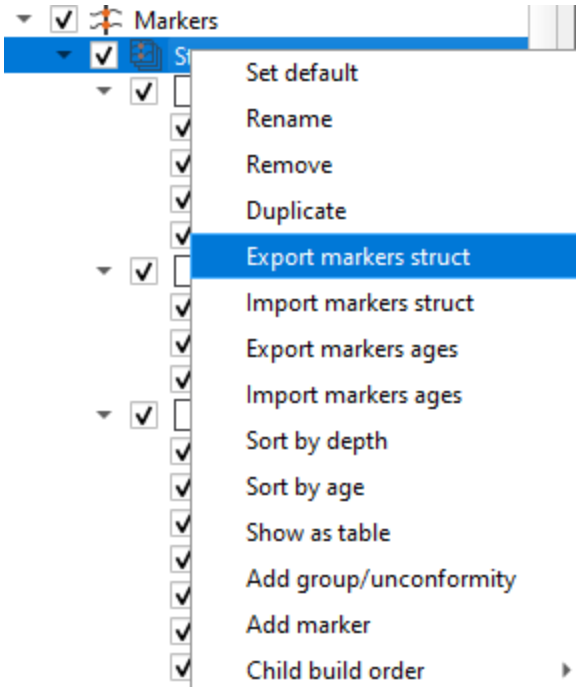

For more information about well markers structure format please refer to chapter Well Data Formats 332

6.5 Export checkshots

There are two options for exporting checkshots:

1. **Export Checkshots for All Wells**
   - To export checkshots for all wells:
     - In the **Data Manager**, right-click on the **Wells** icon and select **Export** > **Checkshots**.

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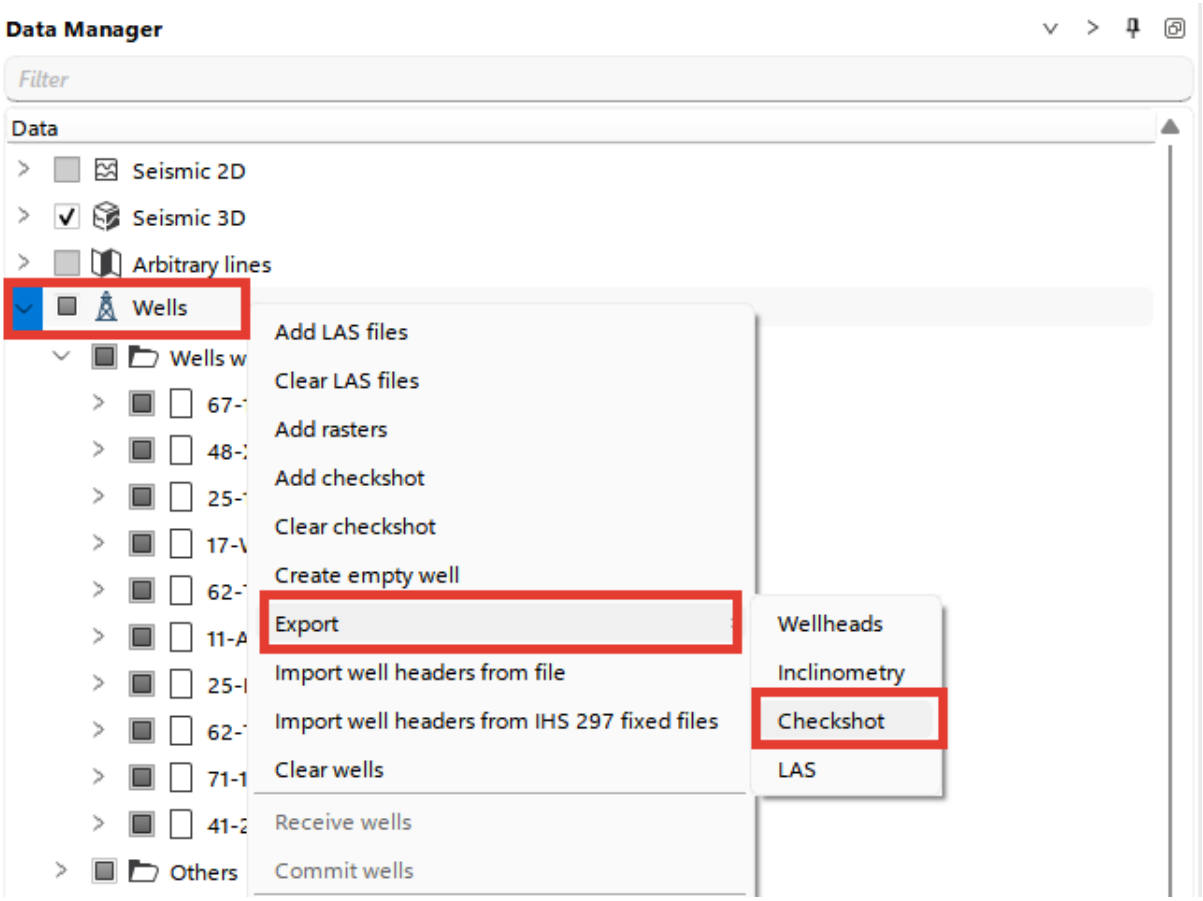

- Alternatively, go to the **Actions** panel and choose **Export all checkshots**.

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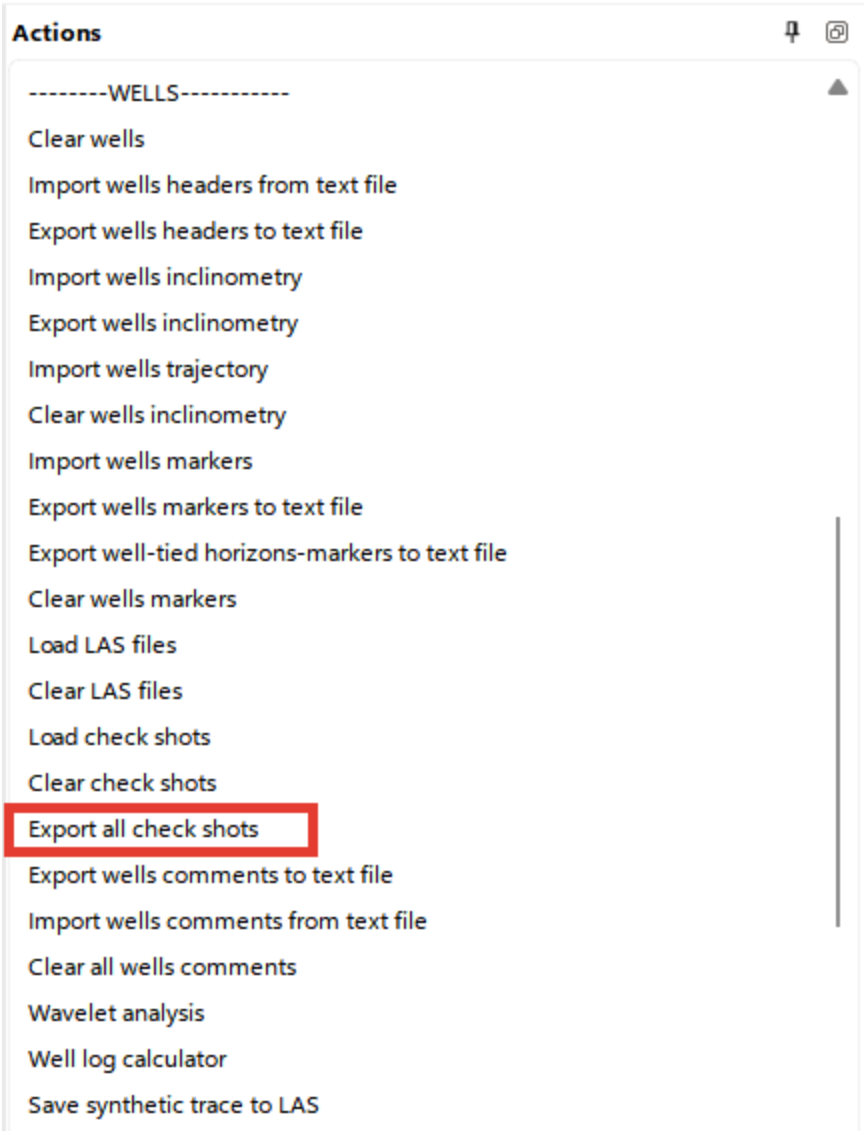
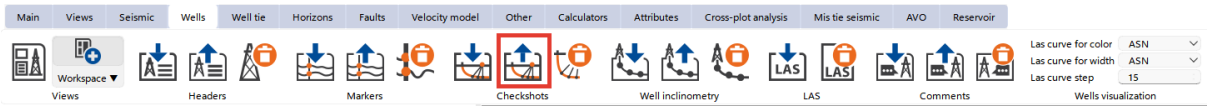


Or go to the Wells Bar and choose **Export all checkshots**.



2. Export Checkshots for a Single Well

- To export checkshots for an individual well:
  - In the **Data Manager**, right-click on the specific well name, then select **Export** > **Checkshot**.

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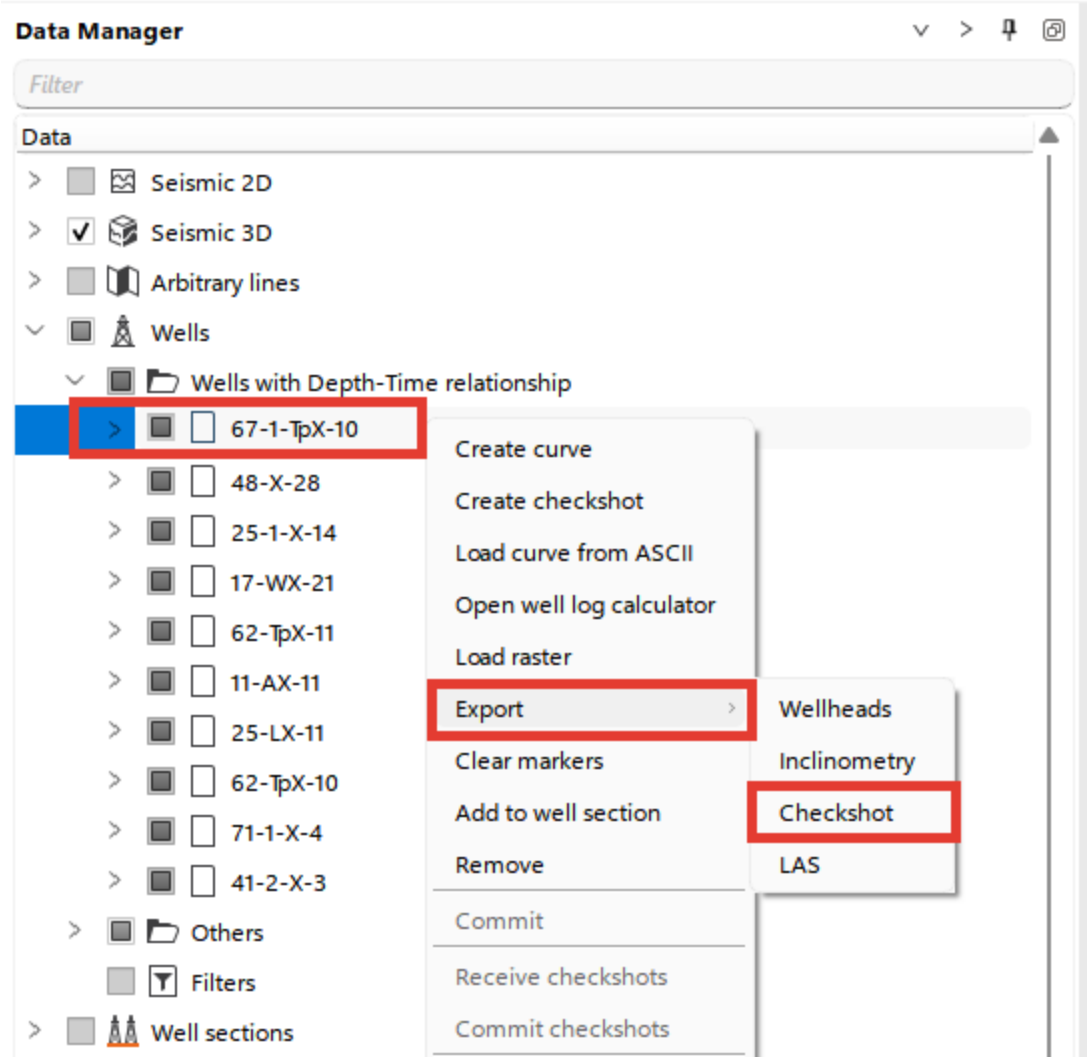
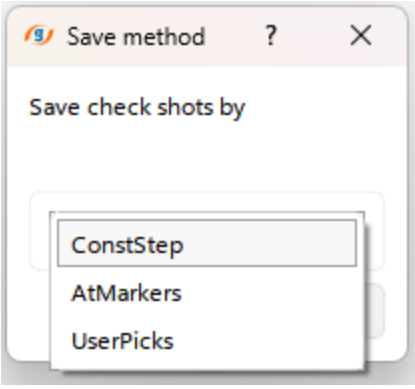


When exporting checkshots, a pop-up window will appear with options to save checkshots by different methods:



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- **ConstStep**: Save at constant depth intervals.
- **AtMarkers**: Save checkshots at predefined markers.
- **UserPicks**: Save checkshots at user-defined depths or picks.

Choose the desired method, then locate the directory and file format for saving, and click **Save**.

The exported file will include the following information by default:

- UWI (Unique Well Identifier)
- True Vertical Depth (TVD)
- One Way Time (OWT)

***Note**: Currently g-Space supports export checkshot data from KB datum.*

For more information about checkshot format please refer to chapter Well Data Formats 332

6.6 Export las

There are two options for exporting LAS files: **Export for All Wells** or **Export for a Single Well**.

Export LAS for All Wells

1. In the **Data Manager**, right-click on the **Wells** icon.
2. Select **Export** > **LAS**.

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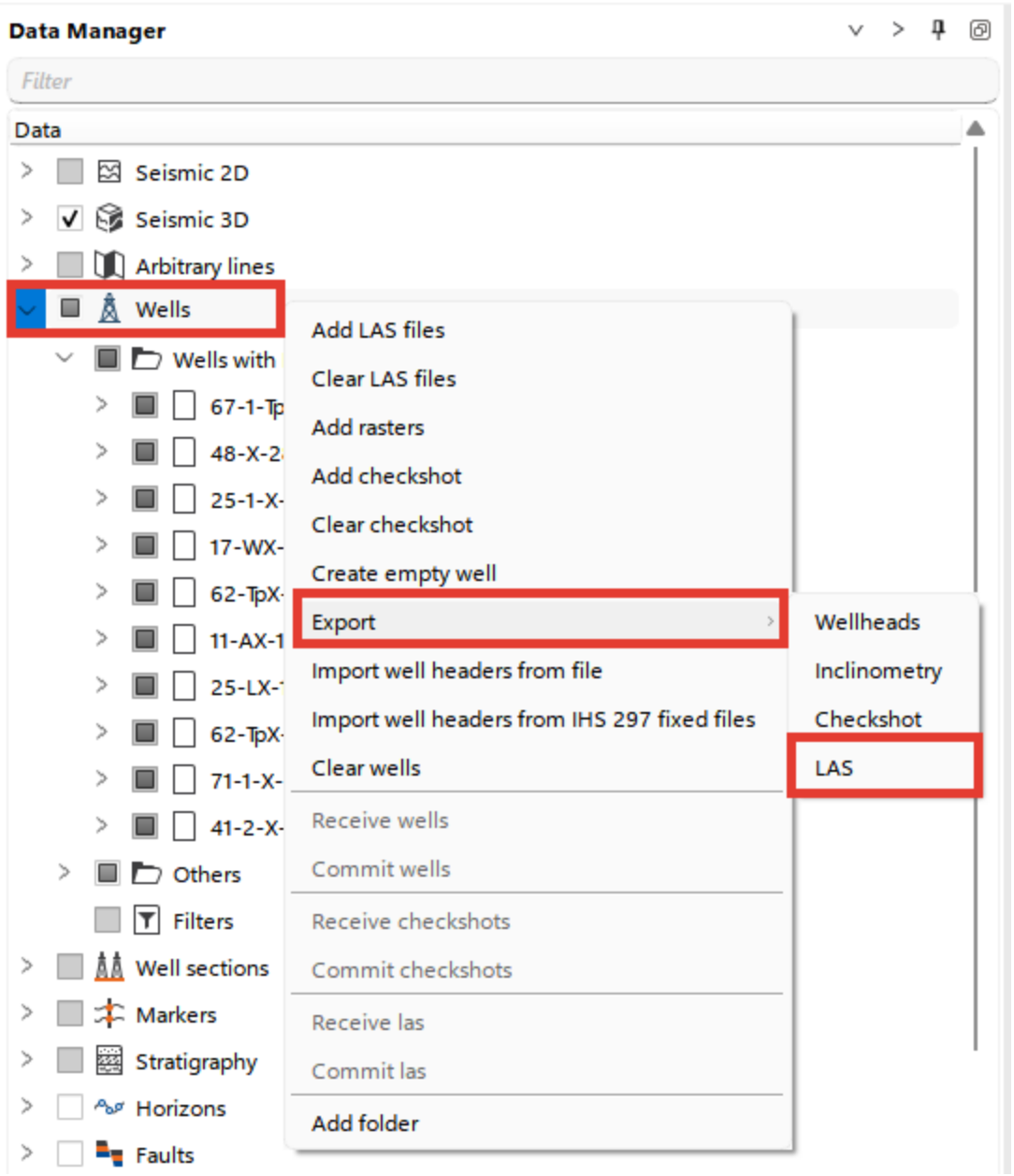

Export LAS for a Single Well

1. In the **Data Manager**, locate and right-click on the specific well name.
2. Select **Export** > **LAS**.

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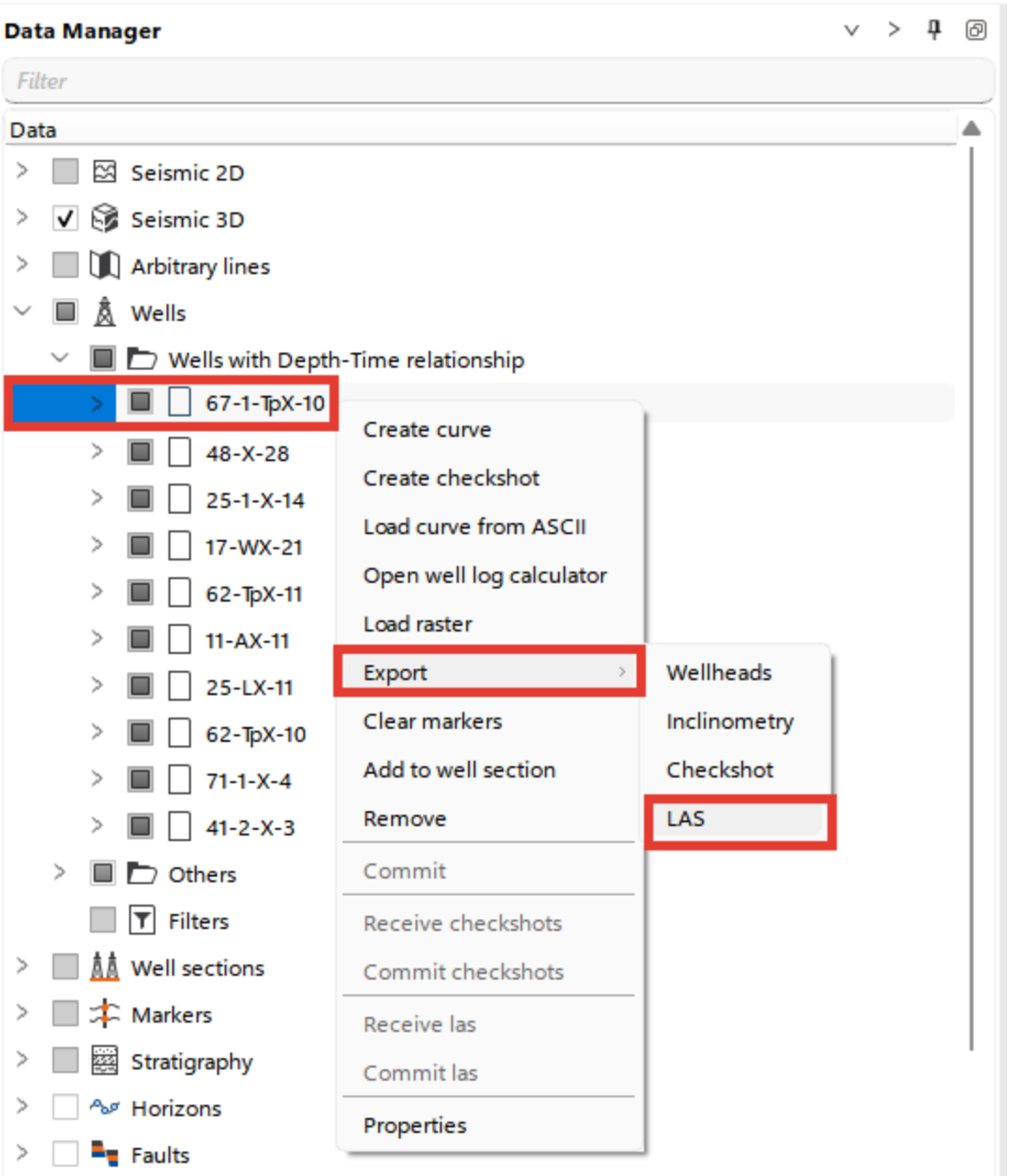

LAS Export Details

When exporting LAS files, the exported file will be in **Log ASCII Standard (LAS)** format and will include all available curves for each well, providing a complete log dataset for analysis.

For more information about LAS format please refer to chapter Well Data Formats 332

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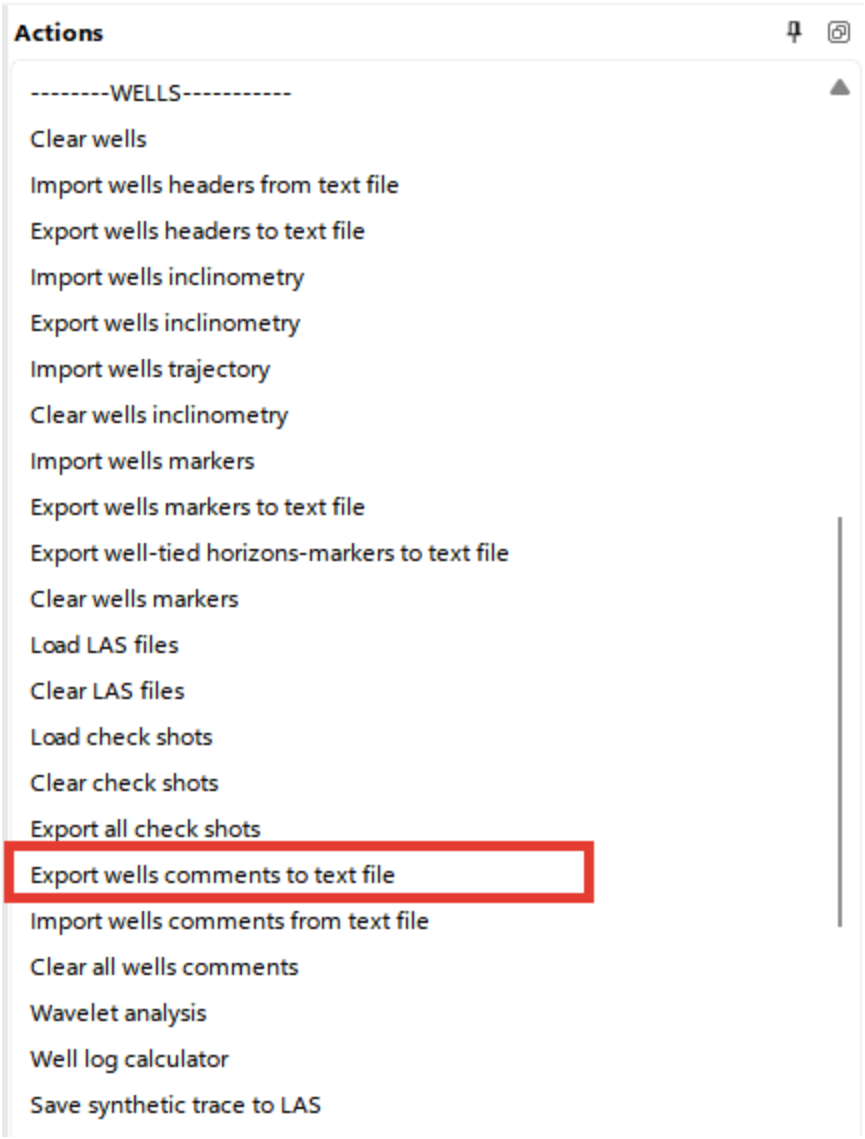
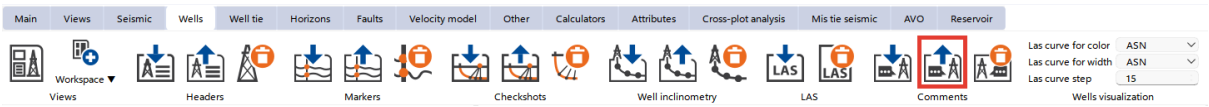
6.7 Export comment log

In Action panel 108 choose Export well comments to text file



This functionality is also available in the Wells Bar 42 in the **Comments section**



For more information about well comments format please refer to chapter Well Data Formats 332

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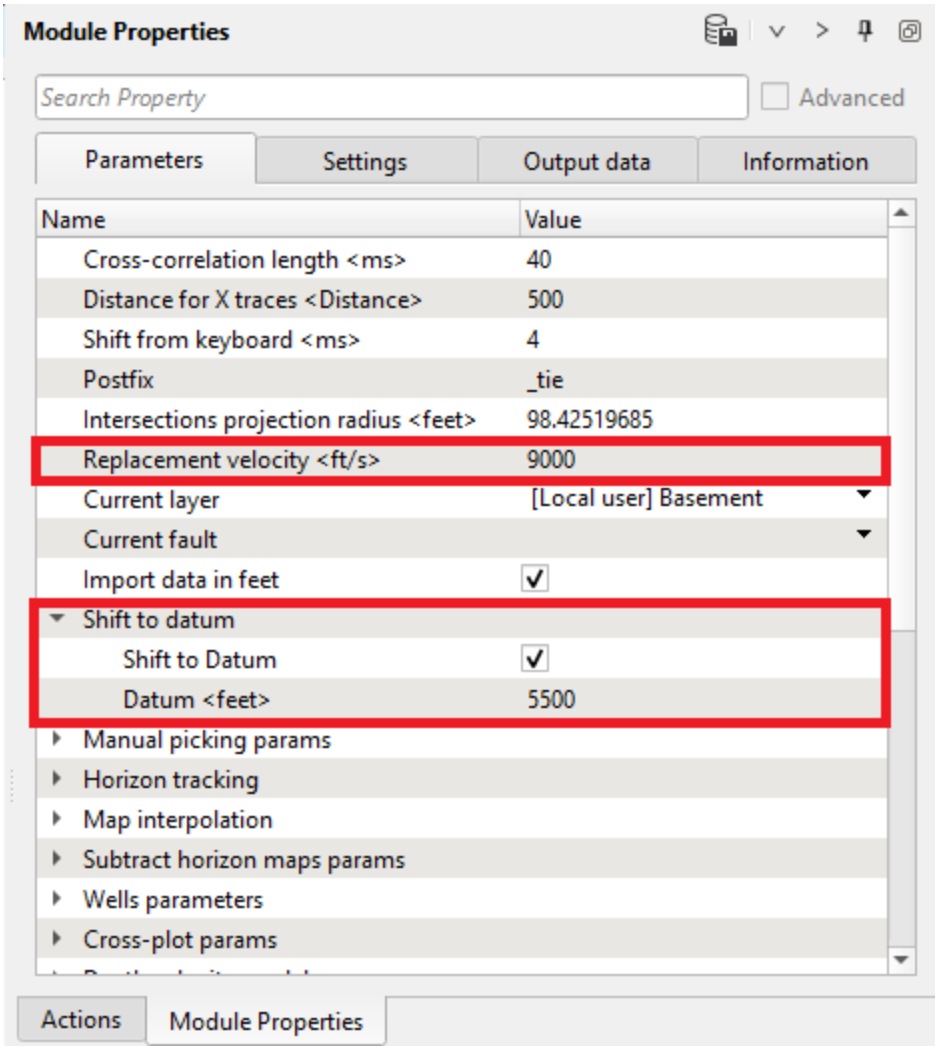
6.8 Export horizons

Note

Export horizons will be performed on current datum and replacement velocity. To check these values go to Module Properties[91] *panel --> Parameters tab*



There are a few options for exporting horizons:

In the Ribbon[33] go to the Horizons bar[64] and choose one of three options:

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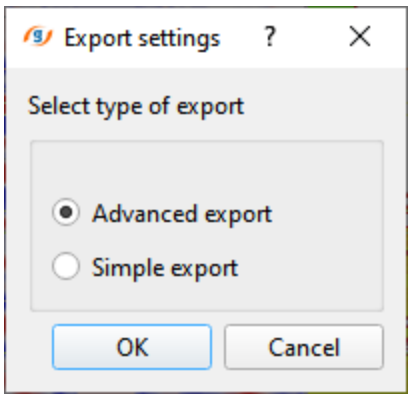
Option 1: Save horizons binary
In case of choosing first option g-Space will clone all horizons set existing in the project.

Option 2: Export current horizon ASCII
Second option supports exporting current horizon (simple export) and set of horizons with controlled parameters (advanced export)



Simple export - will export current horizon with project datum
Advanced horizon supports multi-horizon export

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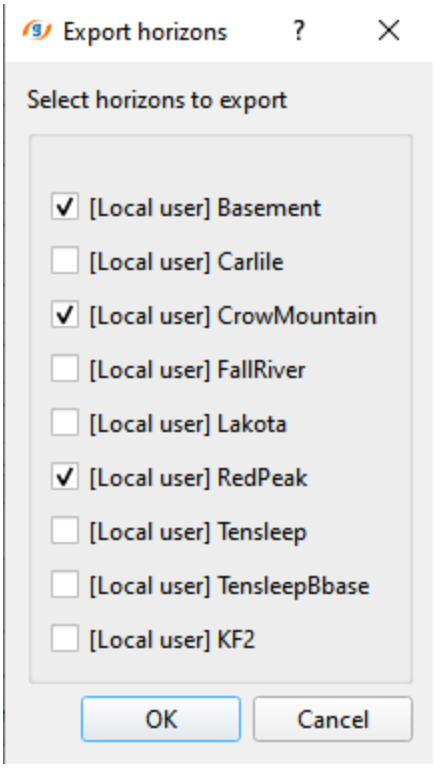
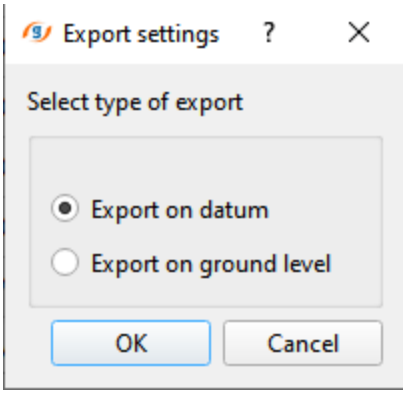


with recalculated datum



Option 3 is to export Horizons in Charisma format: In Actions panel 108 choose Import horizon (charisma format)

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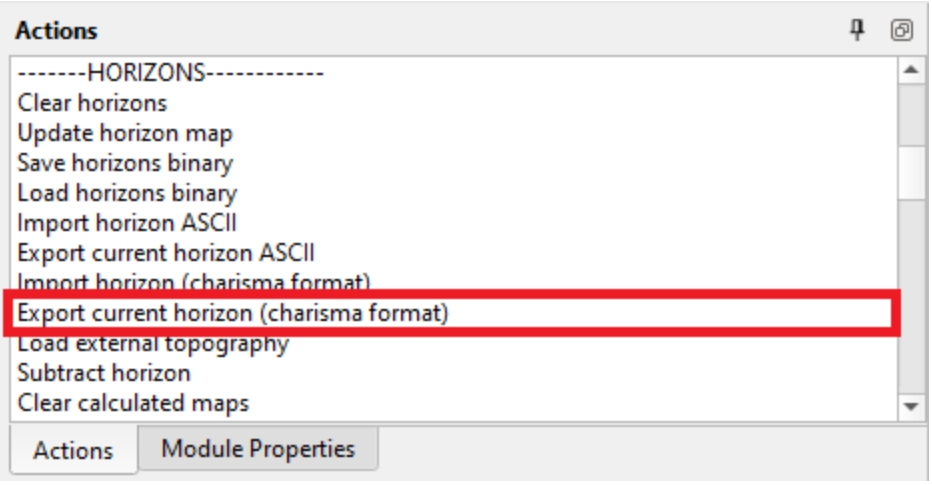

For more information about horizon format please refer to chapter Horizon Data Format 337

6.9 Export faults

Note

Export faults will be performed on current datum and replacement velocity. To check these values go to Module Properties 91 panel --> Parameters tab

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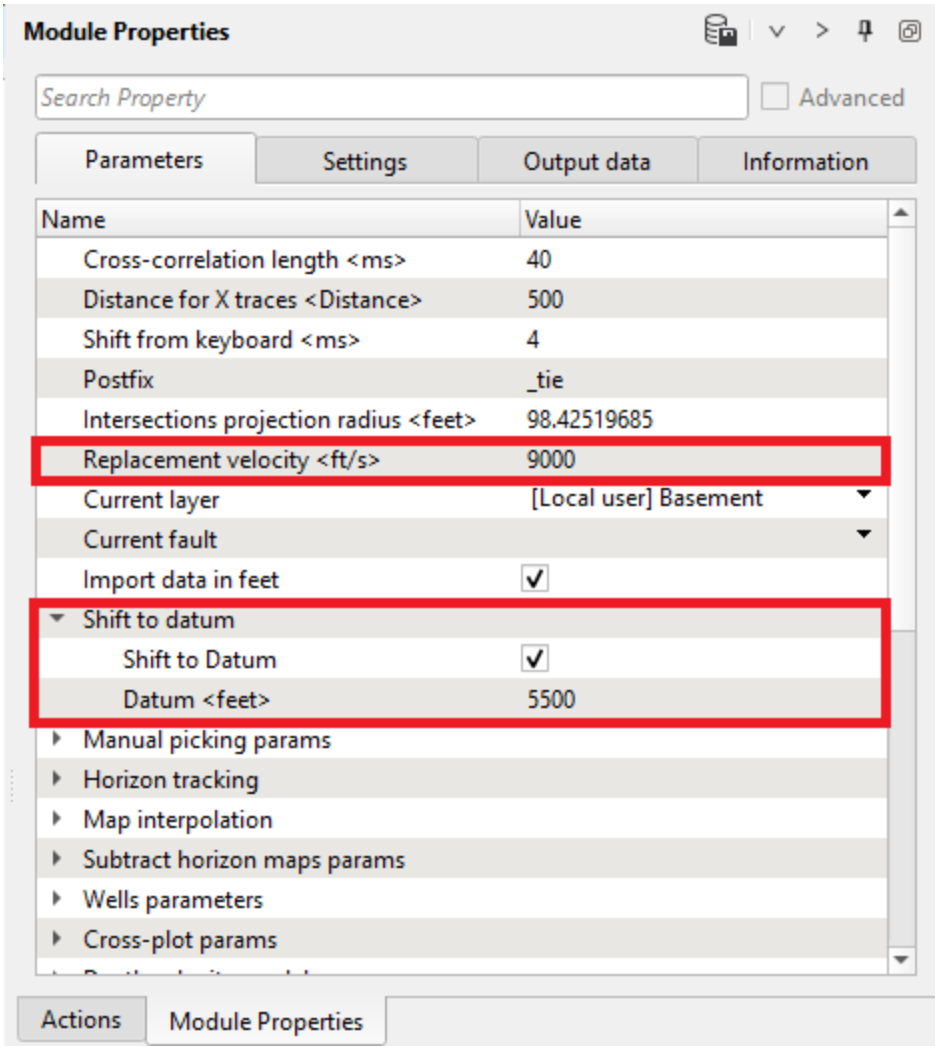

Exporting faults:
In Ribbon 33 go to Faults bar 65 and there are two options

Option 1: Press **Save faults binary** button and g-Space will export a copy of all faults

Option 2: Press **Export current fault (charisma format)** button , set the datum and save the file

Another option is to export faults in Charisma format: In Actions panel 108 choose Export current fault (charisma format)

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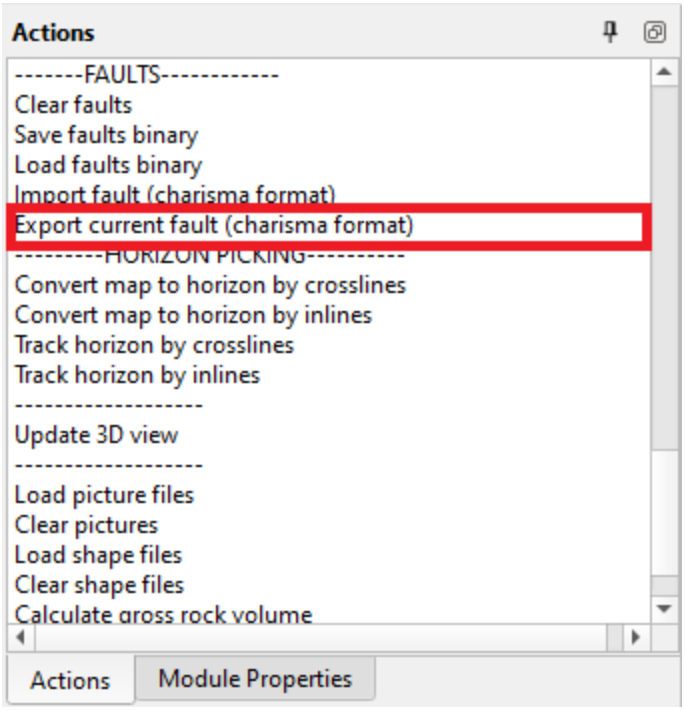

For more information about fault formats supported by g-Space refer to Fault Data Formats 339

6.10 Export maps

To export **Maps** stored in g-Space go to Maps in Data manager 86 and choose the Map you want to export

Right-click on the Map and choose one of the following options:

1. Save to text file
2. Save to CP3-grid file
3. Save to ZMap grid file

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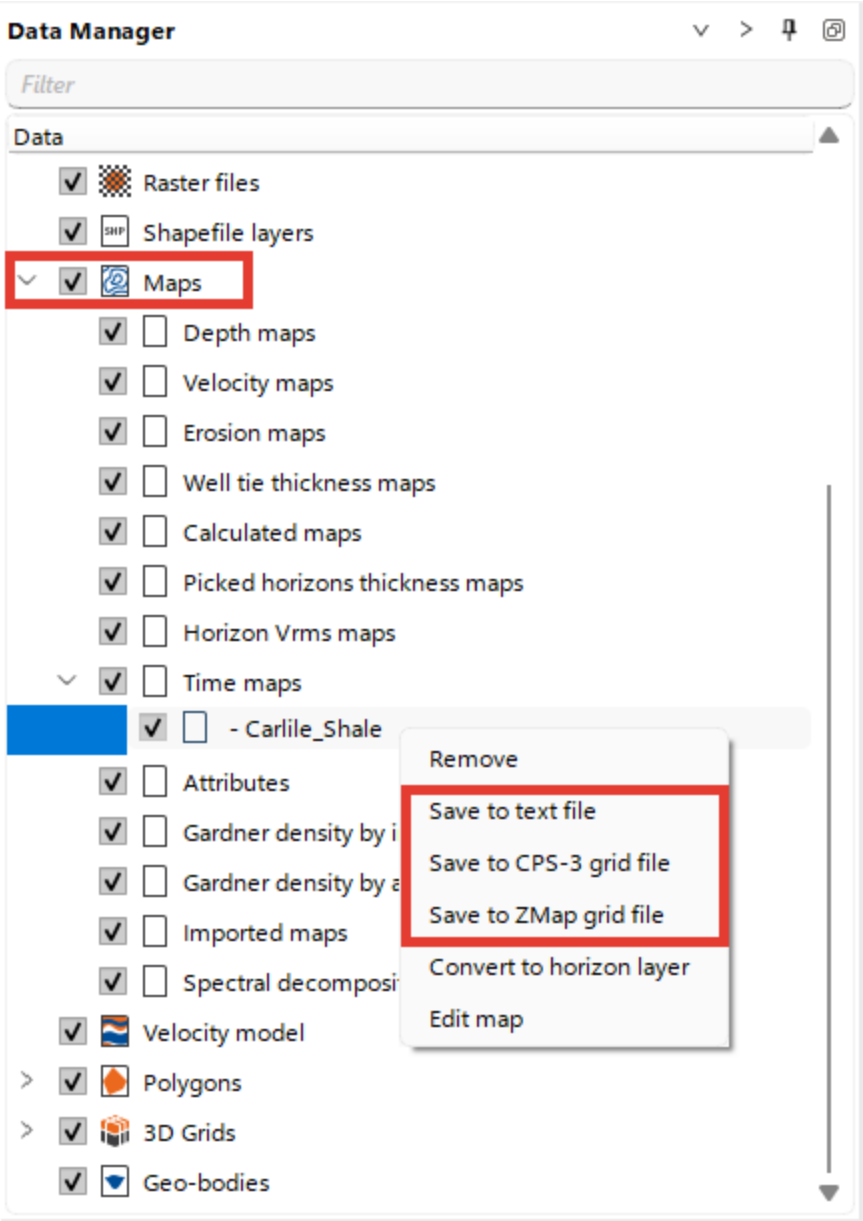

For more information about maps formats supported by g-Space refer to Maps Data Formats 338

6.11 Export grids

To export **Grids** stored in g-Space navigate to 3D Grids in Data manager 86, locate Grid you want to export

Right-click on the Grid, and there is an option to export the grid to Eclipse format

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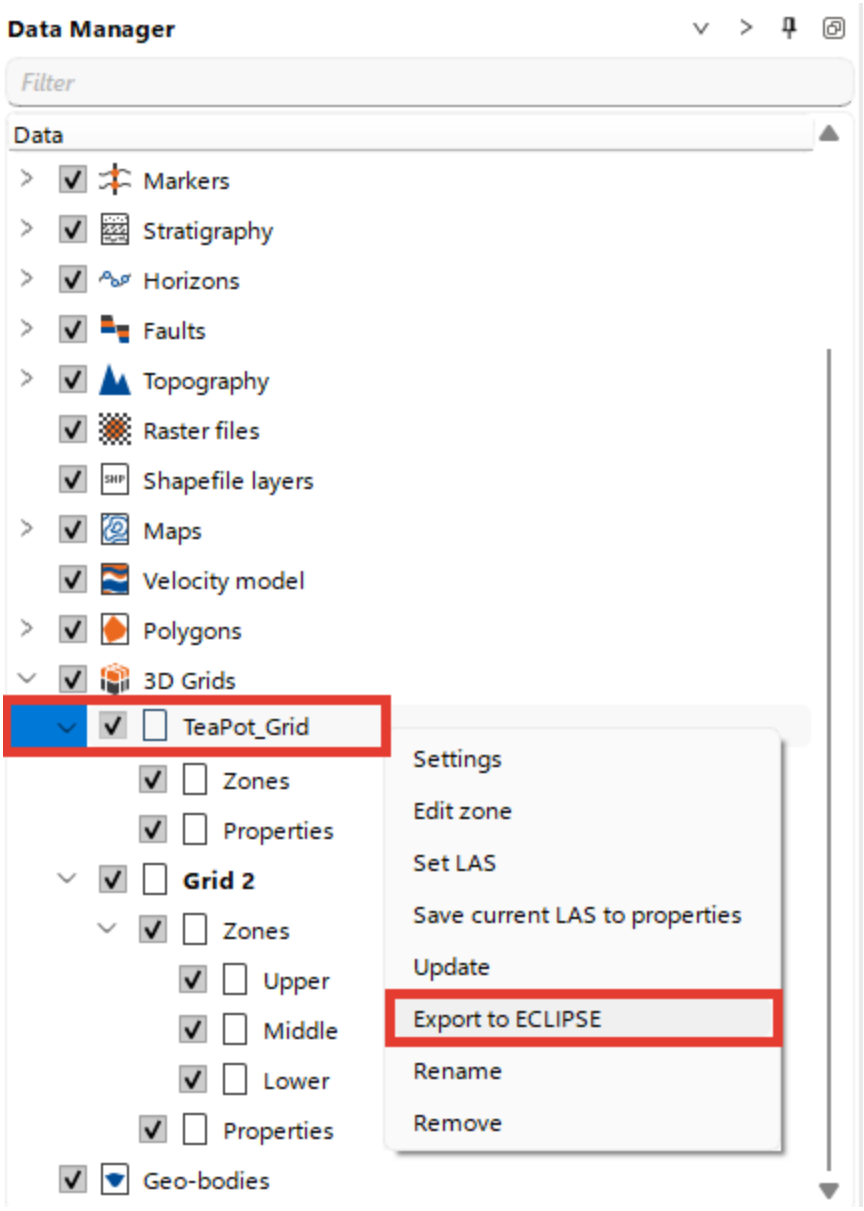

The export process will generate:

- A **.dat file** containing general grid information and property data.
- A **.GRDECL file** storing grid coordinates and structure.

For more information about maps formats supported by g-Space refer to Grid Data Formats 342

6.12 Export polygons

To export polygons from g-Space go to Polygons in Data manager 86 and press Right Click Mouse on polygon to export

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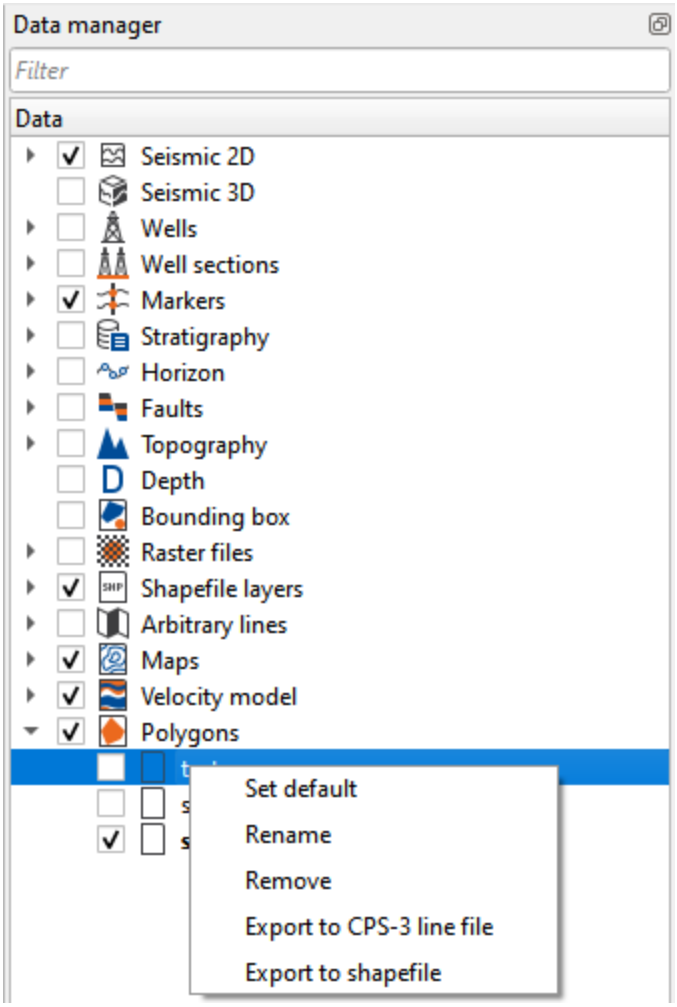

The polygon can be exported in two file formats: **CPS-3 line** and **shapefile**

For more information about polygon formats refer to GIS Data Formats 341

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Formats

7 Formats

This chapter provides description of currently supported formats for diffferent data types:

Well Data Formats 332
- Well Headers
- Well deviation
- LAS (continuous, discrete)
- Comment log
- Well markers
- Stratigraphic data
- Checkshots

Seismic Data Formats 336
- SEGY format for both 2D and 3D data - post-stack

Horizon Data Formats 337
- ASCII

Grid Data Formats 338
- ASCII

Fault Stick Data Formats 339
- ASCII

Image Data Formats 340
- Geo-referenced raster

7.1 Well Data Formats

This chapter summarizes well data formats currently supported by g-Space

All table data can be easily copied using **Ctrl+C** and pasted into any external application (e.g., Excel, Notepad) in **table format**.

Well headers format

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Wells in g-Space contain information about Well Name, Unique Well Identifier (UWI) and coordinates (X, Y, KB). Additionally well headers can store attribute information such as, Total depth (TD), Well type, Ground elevation (GL) etc.

	UWI	Well name	Class	X	Y	ompletion dat	Total depth	Kelley bushing	Operator
1	49025103970000	34-A-21	I	794810.9	974652.3		2914	4921	U.S. DOE
2	49025063180000	82-S-14	O	808959.2	950092	06/07/1962	1286	5293	U.S. DOE
3	49025063220000	71-SX-14	O	808258.9	950778.6		3052	5247	U.S. DOE
4	49025063250000	48-S-11	O	806496.9	951369.6		762	5192	U.S. DOE
5	49025063260000	88-St-11	O	809057.2	951458.9		2988	5289	U.S. DOE

Supported formats are:
- TAB delimited
- Comma separated (CSV)
- Fixed column width

For more information about loading these formats into g-Space see Import well headers 257

Well deviation (inclinometry) data format

Well deviation contains the information about well trajectory of the well such as Measured Depth (MD), Inclination (INCL), Grid azimuth (AZIM).

	MD	Inclination	Azimuth
1	0	0.0	0
2	1670	2.0	209
3	1741	1.8	206
4	1758	0.0	0
5	3108	2.5	252

Supported formats are:
- TAB delimited
- Comma separated (CSV)
- Fixed column width

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For more information about loading well trajectory into g-Space see Import inclinometry 263

Well markers format

There are to options supporting by g-Space:

Option 1: file format contains the information: **UWI, MD, Marker name** and optional attributes related to loading markers

	UWI	Marker	MD
1	49025220660000	SHNNu	902.35
2	49025220660000	SSXbase	541.44
3	49025220660000	SSXS	488.36
4	49025220660000	SHNNI	1005.26
5	49025220660000	SHNNbs	1070.76

Option 2: file format contains the information **UWI, X, Y, Z, Marker name** and optional attributes related to loading markers

Marker	TVDSS (meter)	X (meter)	Y (meter)	Age	Type
Pg2_ADULAM	-134.580000	186956.000000	623849.000000	49.00	Marker
Pg1_TAQIYE	-68.300000	186956.000000	623849.000000	54.80	Marker
K2m_GHAREB	7.700000	186956.000000	623849.000000	70.00	Marker
K2km_EN ZETIM	26.700000	186956.000000	623849.000000	71.30	Marker
K2t_JUDEA	177.700000	186956.000000	623849.000000	89.00	Marker

Supported formats are:
- TAB delimited
- Comma separated (CSV)
- Fixed column width

For more information about loading markers into g-Space see Import markers 268

Well markers structure format

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This is the g-Space binary format with extension *.msstruct which stores markers hierarchy

For more information about loading markers structure into g-Space see Import markers structure 277

LAS format
LAS format contains the information of the well log data (continuous or discrete)
The description of this file format is given here:
https://www.asprs.org/a/society/committees/standards/asprs_las_format_v12.pdf

For more information about loading LAS files into g-Space see Import LAS files 278

Checkshot format
Checkshot data files store the information depth-time relationship. g-Space supports format: **WELL NAME**-->**MD**-->**OWT (seconds)**

Well	MD	OWT
WELL 01	20	0.010555
WELL 01	25	0.013675
WELL 01	30	0.0168
WELL 01	35	0.01992
WELL 01	40	0.02304
WELL 01	45	0.026165
WELL 01	50	0.029285

Supported formats are:
- TAB delimited

For more information about loading checkshots into g-Space see Import checkshots 281

Comment log format
Comments log format contain the information about comments at specific depth in text format. **WELL NAME**-->**MD**-->**Comments (text)**

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WELL	MD	Comment
AX-36	345	shale
AX-36	900	lime
AX-36	1745	sand
AB-43	520	lime
AB-43	670	dolo
AB-43	800	anhy

Supported formats are:
- TAB delimited

For more information about loading checkshots into g-Space see Import comment log 287

7.2 Seismic Data Formats

Currently, g-Space supports only the SEG-Y format for seismic data. SEG-Y files store seismic traces along with essential metadata in trace headers. These headers contain crucial information such as inline and crossline numbers, elevation data, coordinates, and other attributes needed for seismic processing and interpretation.

Notes

SEG-Y files are binary formatted and structured in a way that data is stored in fixed byte locations within trace headers. The trace header is a 240-byte section preceding each seismic trace that holds metadata about that specific trace. Different software applications may use different byte positions for storing similar types of data, leading to variations in SEG-Y file formats. To address this, g-Space provides multiple preinstalled formats and allows users to define custom formats when necessary.

Preinstalled SEG-Y Formats in g-Space

To accommodate variations in SEG-Y files, g-Space includes several predefined formats. Each format specifies particular byte positions for critical data fields. The available formats are:

- **g-Space format** – Default format optimized for g-Space workflows.
- **Geomage format** – Used for data processed within Geomage software.
- **SegFormat** – A generic SEG-Y structure used in various industry applications.
- **Seg-Y, rev.1, 2002** – Standardized SEG-Y format based on the 2002 revision.
- **Geomage Office Post** – A format designed for post-processing seismic data.
- **Coordinates Only** – Contains only coordinate-related information in the trace headers.
- **Constant Elevation** – Used when elevation values are uniform across the dataset.
- **teapot_dome_3d** – A predefined format for specific datasets.

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- **Kingdom format** – A format adapted for compatibility with Kingdom seismic interpretation software.

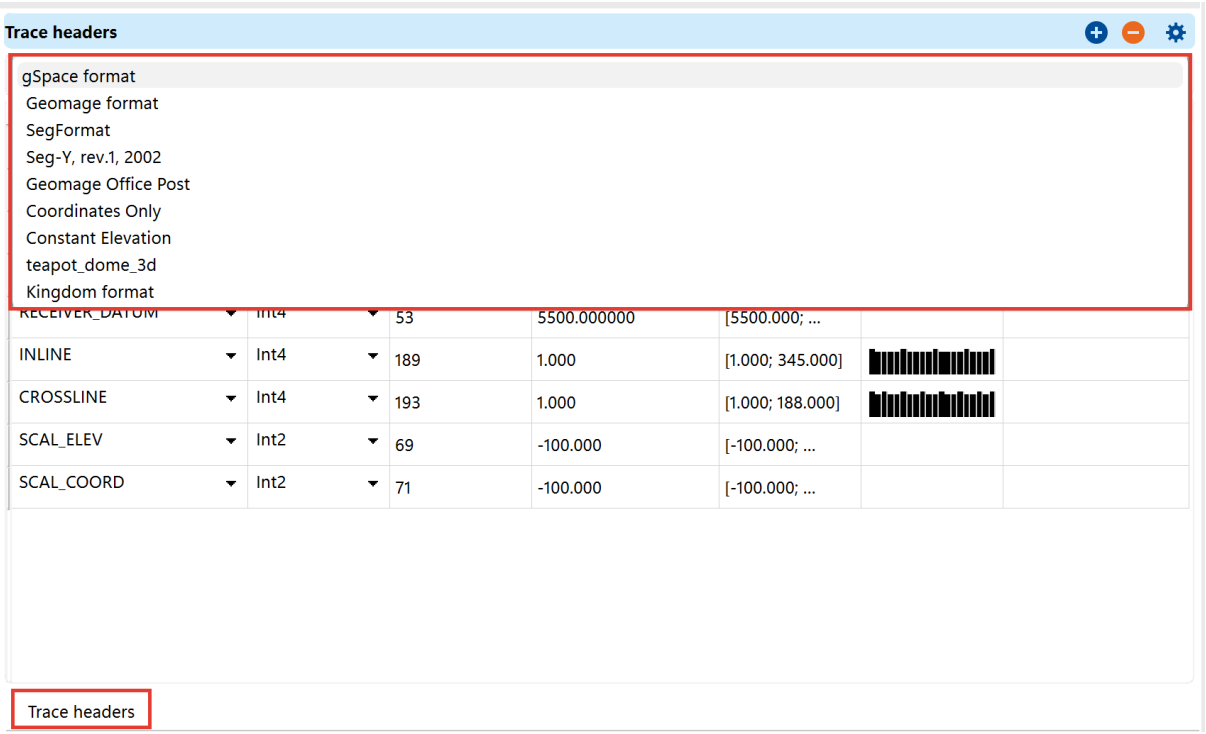
Managing Formats

Users can manage and customize SEG-Y formats in the Module Properties 91 under **SEG-Y format settings** and **Trace Header Format settings**. If the required format is not available among the preinstalled options, users can create a new format by specifying the correct byte positions for the necessary trace header information.

Importing Seismic Data

When importing seismic data, g-Space allows customization of geometry handling. Users should ensure that all relevant trace header information is properly configured before loading the data to facilitate seamless interpretation and analysis.

The data should have all geometry in trace headers and such information can be customized during the loading process of Import seismic 246



7.3 Horizon Data Formats

Horizon binary data format

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It is the internal g-Space format which can be used to shear information between workstations. It stores exact copy of all objects

---

Charisma horizon interpretation format

In header Horizon name.
The data has tab delimited format: Line name --> Point ID (if applicable) --> X --> Y --> TWT in milliseconds --> Seismic folder/group

```
#k2t
bp-2185__poststm__0103__0001.gsd    -100.00    182008.04000    583745.74000    -152.31716    PoSTM_std_NEW
bp-2185__poststm__0103__0001.gsd    -100.00    182008.04000    583745.74000    -152.31716    PoSTM_std_NEW
bp-2185__poststm__0103__0001.gsd    -100.00    182008.04000    583745.74000    -152.31716    PoSTM_std_NEW
bp-2185__poststm__0103__0001.gsd    -100.00    182146.43000    584039.62000    -161.11685    PoSTM_std_NEW
bp-2185__poststm__0103__0001.gsd    -100.00    182146.43000    584039.62000    -161.11685    PoSTM_std_NEW
bp-2185__poststm__0103__0001.gsd    -100.00    182146.43000    584039.62000    -161.11685    PoSTM_std_NEW
bp-2185__poststm__0103__0001.gsd    -100.00    182146.43000    584039.62000    -161.11685    PoSTM_std_NEW
bp-2185__poststm__0103__0001.gsd    -100.00    182175.55000    584108.75000    -147.91731    PoSTM_std_NEW
bp-2185__poststm__0103__0001.gsd    -100.00    182175.55000    584108.75000    -147.91731    PoSTM_std_NEW
```

Horizon interpretation point format (ASCII)

In file header of this format contain Horizon name, information about Replacement velocity and datum. g-Space imports and exports in project units.
The data has tab delimited format: X --> Y --> TWT in milliseconds

```
#[Local user] Horizon
#Replacement velocity 2000.000000 m/s
#Points on datum 1000.000000
185048.510000   578265.730000   1644.780138
184974.950000   578225.170000   1648.231571
184827.860000   578144.010000   1665.488733
184754.320000   578103.380000   1675.843030
184625.670000   578032.310000   1686.197328
184497.010000   577961.160000   1689.648760
184441.890000   577930.680000   1694.825909
184331.580000   577869.800000   1700.003057
184276.450000   577839.330000   1698.277341
184147.780000   577768.210000   1694.825909
185103.680000   578296.150000   1643.054422
```

7.4 Maps Data Formats

Grid point data and **external topography format**
These formats are tab delimited and contains X --> Y --> Z.

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X	Y	Z
106141.4	417319.1	494.876
106140.6	417232.3	492.402
106139.7	417145.4	490.259
106138.8	417058.6	491.842

Note

Parameter Z may have depth, time, velocity domains. It depends in which folder it is loaded.

For more information about importing this format into g-Space refer to: Import topography 298, Import grids 302

CPS-3 grid data format

Here is the file example

```
FSASCI 0 1 COMPUTED 0 -9999
FSATTR 0 0
FSLIMI 69249.028989 270249.028989 455368.532517 673368.532517 0.000000 2612.341309
FSNROW 437 403
FSXINC 500.000000 500.000000
->[Local user] Judea_SV_hor_mark_cs
-9999.000000    -9999.000000    -9999.000000    -9999.000000    -9999.000000
-9999.000000    -9999.000000    -9999.000000    -9999.000000    -9999.000000
-9999.000000    -9999.000000    -9999.000000    -9999.000000    -9999.000000
-9999.000000    -9999.000000    -9999.000000    -9999.000000    -9999.000000
-9999.000000    -9999.000000    -9999.000000    -9999.000000    -9999.000000
-9999.000000    -9999.000000    -9999.000000    -9999.000000    -9999.000000
```

For more information about importing this format into g-Space refer to Import grids 302

7.5 Fault Data Formats

Fault binary data format

It is the internal g-Space format which can be used to shear information between workstations. It stores exact copy of all objects

---

Fault sticks charisma format

File example

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```
INLINE-    61    572    148538.23000    583150.77000    722.90891    gerar_main    ds-0514_220
INLINE-    61    565    148785.90000    582903.48000    926.11104    gerar_main    ds-0514_220
INLINE-    61    557    149067.35000    582619.24000    1173.28441    gerar_main    ds-0514_220
INLINE-    61    549    149347.75000    582333.98000    1375.83423    gerar_main    ds-0514_220
INLINE-    61    544    149522.47000    582155.18000    1623.65997    gerar_main    ds-0514_220
INLINE-    61    540    149661.97000    582011.85000    1845.27326    gerar_main    ds-0514_220
INLINE-    63    169    168448.31000    587516.51000    582.41302    gerar_main    ds-0516_01
INLINE-    63    171    168504.19000    587433.58000    765.97565    gerar_main    ds-0516_01
INLINE-    63    177    168671.78000    587184.75000    1872.82383    gerar_main    ds-0516_01
INLINE-    64    309    158665.96000    586302.26000    354.43261    gerar_main    ds-0517_269
INLINE-    64    300    158924.28000    585933.79000    714.34766    gerar_main    ds-0517_269
INLINE-    64    293    159126.57000    585648.16000    905.68447    gerar_main    ds-0517_269
INLINE-    64    281    159473.47000    585158.62000    1479.69484    gerar_main    ds-0517_269
INLINE-    64    262    160015.98000    584378.76000    2093.09816    gerar_main    ds-0517_269
```

For more information about importing this format refer to Import faults 294

7.6 Image Data Formats

Geo-referenced image format

g-Space supports tiff, png, jpg, bmp formats coupled with world files. World files contain information about X and Y for each pixel of the image.
World file has 6 parameters:

- Line 1: *A*: *x*-component of the pixel width (*x*-scale)
- Line 2: *D*: *y*-component of the pixel width (*y*-skew)
- Line 3: *B*: *x*-component of the pixel height (*x*-skew)
- Line 4: *E*: *y*-component of the pixel height (*y*-scale), typically negative
- Line 5: *C*: *x*-coordinate of the center of the original image's upper left pixel transformed to the map
- Line 6: *F*: *y*-coordinate of the center of the original image's upper left pixel transformed to the map

File example:

```
38.1073406255
0.0000000000
0.0000000000
-38.1073406255
170003.4049205466
804998.5160054950
```

They must have same names as image files but different extensions and located in the same directory. Extensions have firs two characters of image file extension and additional 'w' at the end.

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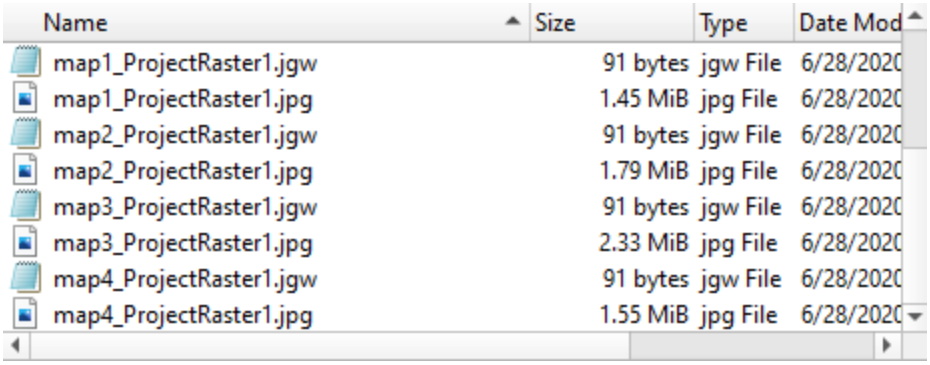

Name	Size	Type	Date Mod
map1_ProjectRaster1.jgw	91 bytes	jgw File	6/28/2020
map1_ProjectRaster1.jpg	1.45 MiB	jpg File	6/28/2020
map2_ProjectRaster1.jgw	91 bytes	jgw File	6/28/2020
map2_ProjectRaster1.jpg	1.79 MiB	jpg File	6/28/2020
map3_ProjectRaster1.jgw	91 bytes	jgw File	6/28/2020
map3_ProjectRaster1.jpg	2.33 MiB	jpg File	6/28/2020
map4_ProjectRaster1.jgw	91 bytes	jgw File	6/28/2020
map4_ProjectRaster1.jpg	1.55 MiB	jpg File	6/28/2020

For more information can be found here World file - Wikipedia.

7.7 GIS Data Formats

This chapter summarizes spatial data formats currently supported by g-Space

Shapefile format

Format description: https://www.esri.com/content/dam/esrisites/sitecore-archive/Files/Pdfs/library/whitepapers/pdfs/shapefile.pdf

For information about importing this format into g-Space refer to Import shapefile 296

Cultural point data format

this format is **tab delimited**, and has in first line headers of attributes
first 2 columns contain XY coordinates the rest - are attributes

X	Y	UWI	Well name	Status code
236526	549741	392	ADMON 01	O-DH
153386	594304	81	AFIQ 01	O-DH
151649	599226	303	AFIQ 02	G-DH
142141	550678	380	AGUR 01	G-DH

information about importing this format into g-Space refer to Import shapefile 296

CPS-3 line format

file format example:

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```
FFASCI 0 1 "LINES" 0 1e+10
FFATTR 0 1
->polygon_name
193859.269884 594222.387161 0.000000
189181.677974 599692.282867 0.000000
175939.481160 609182.222405 0.000000
162367.876464 615047.532259 0.000000
156438.534607 615970.165270 0.000000
138057.574849 587170.834864 0.000000
159600.850264 572145.097262 0.000000
160457.310755 567268.322777 0.000000
196692.177660 569047.686440 0.000000
195703.954017 583150.791032 0.000000
193859.269884 594222.387161 0.000000
```

For information about importing this format into g-Space refer to Import polygons 297

7.8 Grid Data Formats

Eclipse Grid Format in g-Space

Eclipse format (.dat) is used to store reservoir simulation grid data. The format consists of:

- **.dat file** → Contains grid dimensions, cell properties (porosity, permeability, etc.).
- **.GRDECL file** → Stores corner-point geometry for grid cell coordinates.

g-Space supports importing 303 and exporting 328 **Eclipse grids**, allowing seamless integration with reservoir modeling and simulation workflows.

7.9 Trace headers math

Here is located information about available functions in the trace header expressions

In this module the user can able to perform many mathematical operations to modify the trace headers reading.
User can use any of the following mathematical operations to create their own equation/expression.

To reference to the trace field use "data type (byte)". For example, the expression "int4(185)" returns the value read as a 4-byte integer from byte number 185.

g-Space uses following mathematical expressions in designing your equation:
Mathematical operators (+, -, *, /, %, ^);

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Functions (min, max, avg, sum, abs, ceil, floor, round, roundn, exp, log, log10, logn, root, sqrt, clamp, inrange);
Trigonometry (sin, cos, tan, acos, asin, atan, atan2, cosh, cot, csc, sec, sinh, tanh, d2r, r2d, d2g, g2d, hyp);
Equalities, Inequalities (=, ==, <>, !=, <, <=, >, >=);
Assignment (:=, +=, -=, *=, /=);
Boolean logic (and, nand, nor, not, or, xor, xnor, mand, mor);
Control Structures (if-then-else, ternary conditional, switch case);
Loop Structures (while loop, for loop, repeat until loop, break, continue)

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Remove this text from the manual
template if you want it completely blank.

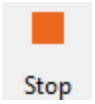
Service Tasks

8 Service Tasks

This topic describes service tasks implemented in g-Space

Execute process: Sometimes during loading the data it is necessary to recalculate all project parameters to integrate new data into the system.
Go to Ribbon 33 -> Main bar 34 and press Execute button

Stop process: If the process takes to much time and if it is necessary to abrupt the process it is possible to stop it.
Go to Ribbon 33 -> Main bar 34 and press Stop button



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Best Practice Flows

9 Best Practice Flows

g-Space software offers a comprehensive suite of tools for seismic interpretation and geological modeling, enabling users to efficiently analyze and model complex subsurface structures. To help users maximize the potential of g-Space, this section of the manual outlines best practice workflows, illustrated through a demo project based on the Teapot Dome oil field.

Teapot Dome, located in the Powder River Basin, Wyoming, is a geologically significant field known for its complex structural features and productive hydrocarbon reservoirs. The field primarily produces from the Cretaceous and Pennsylvanian formations, with key reservoirs including the Tensleep Sandstone and the Frontier Formation. The anticline structure of Teapot Dome, formed during the Laramide orogeny, plays a crucial role in trapping hydrocarbons, while regional seals such as the Mowry Shale ensure the accumulation and preservation of these resources.

All data available to the public and can be downloaded here https://wiki.seg.org/wiki/Teapot_dome_3D_survey

This demo project will guide you through the essential steps of seismic interpretation and geological modeling within g-Space, using real data from the Teapot Dome field. By following these best practices, users can effectively build accurate geological models, optimize their workflows, and make informed decisions for exploration and production activities.

When using this manual, remember that the methods in the Help section are tailored to a specific example with a particular dataset. Each geological model is different, with unique data and targets. So, the steps and methods you use may vary. By completing the correlation in the Demo project, you'll get to know the g-Space software interface and learn modeling techniques suited to the training data.

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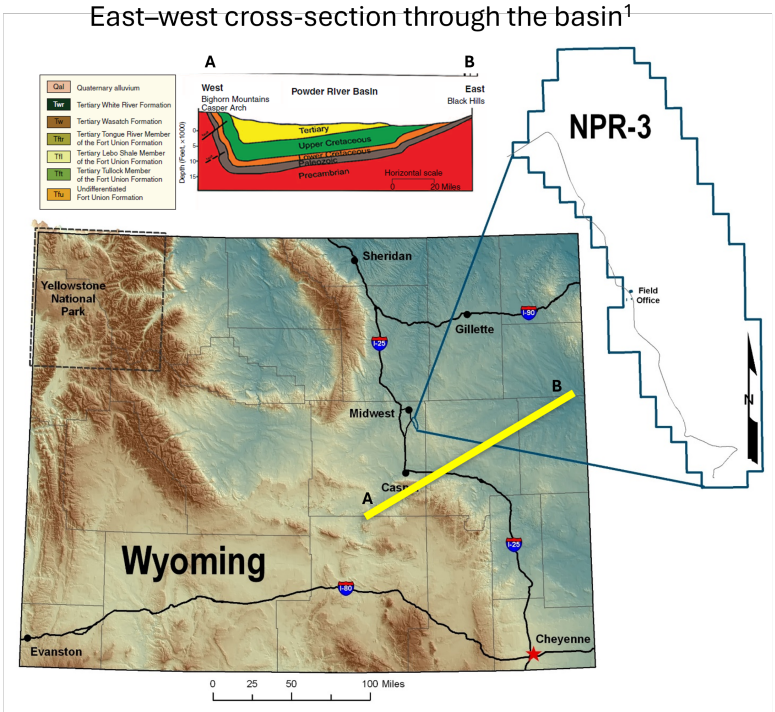
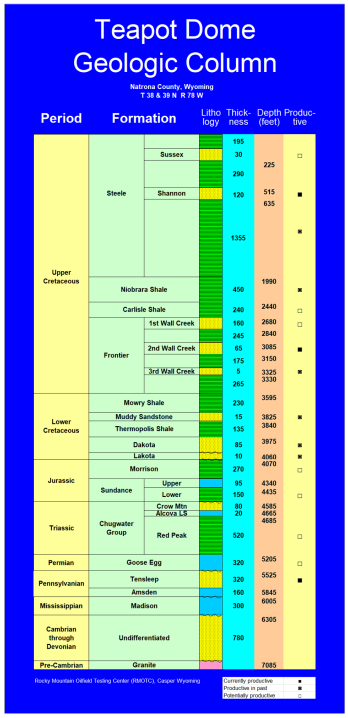
East–west cross-section through the basin[1]





[1]2018 M.Jafri, A. Lashin, El-Khedr Ibrahim, A. Hassanein, N. Arifi, M. Naeem «Improved reservoir characterisation using fuzzy logic platform: an integrated petrophysical, seismic structural and poststack inversion study»

Input data

The following data will be used as initial inputs for seismic interpretation and geomodeling:

- 2D and 3D seismic data (all data in feet, SRD=5500 ft above sea level, Vrep=9000 ft/s)
- Results of seismic data interpretation (horizons, faults)
- Well data (wellheads, inclinometry, log data, checkshots, markers)
- Topography
- Boundaries

Please note that all data in the Demo Project is presented in the imperial system of units, with feet as the base unit of measurement. Project coordinate system is 32056 NAD27 / Wyoming East Central.

The following seismic information will be used in the project

2D seismic profiles in SGY-format:

- line_A_ft
- line_B_ft
- line_C_ft

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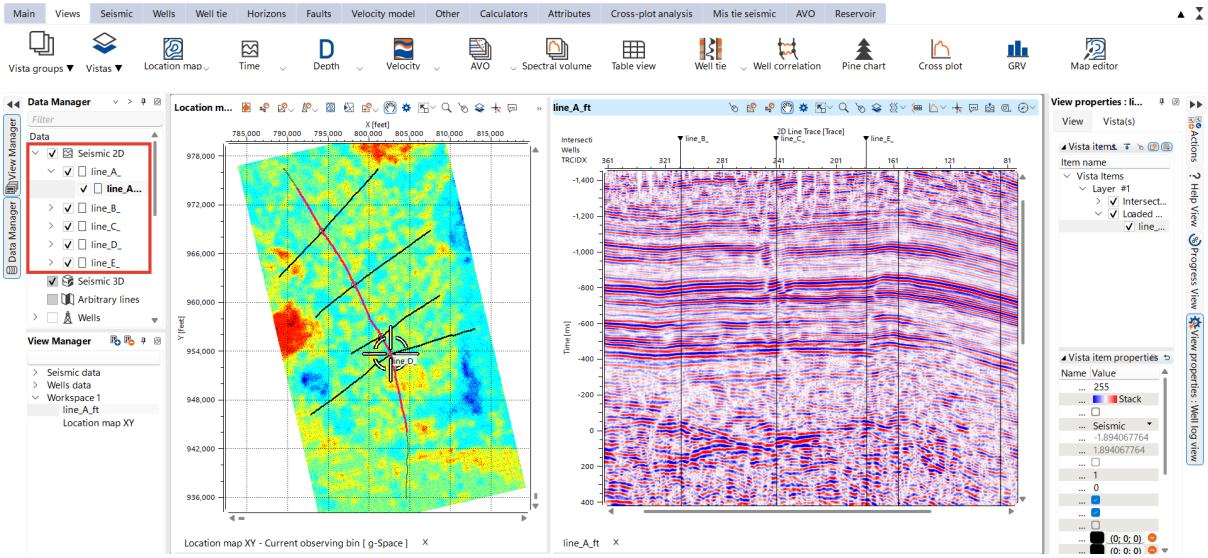
- line_D_ft
- line_E_ft



3D seismic volume in SGY-format:

- data_3D_teapot_ft

Inline located in byte 189
Crossline located in byte 193
X coordinate located in byte 181
Y coordinate located in byte 185

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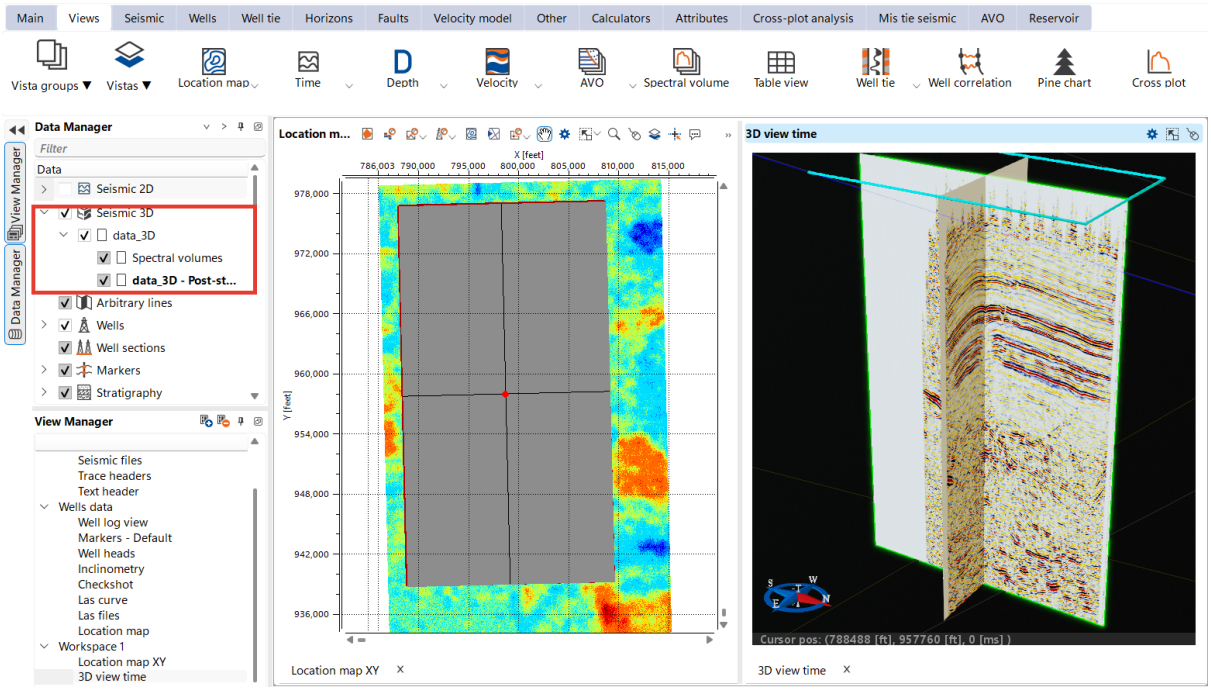

There are existed horizons and faults interpretation in the project.

Horizons are presented as text files with inline and crossline numbers and XYZ coordinates.

- Carlile_Shale
- Frontier_2_WC
- Lakota_Sand
- RedPeak_Shale
- SRD_5500_TimeZero
- Tensleep_Sand
- Topo_Time

An example of the file is provided below.

Please be mindful of the system of units and measurement units as well as Datum level

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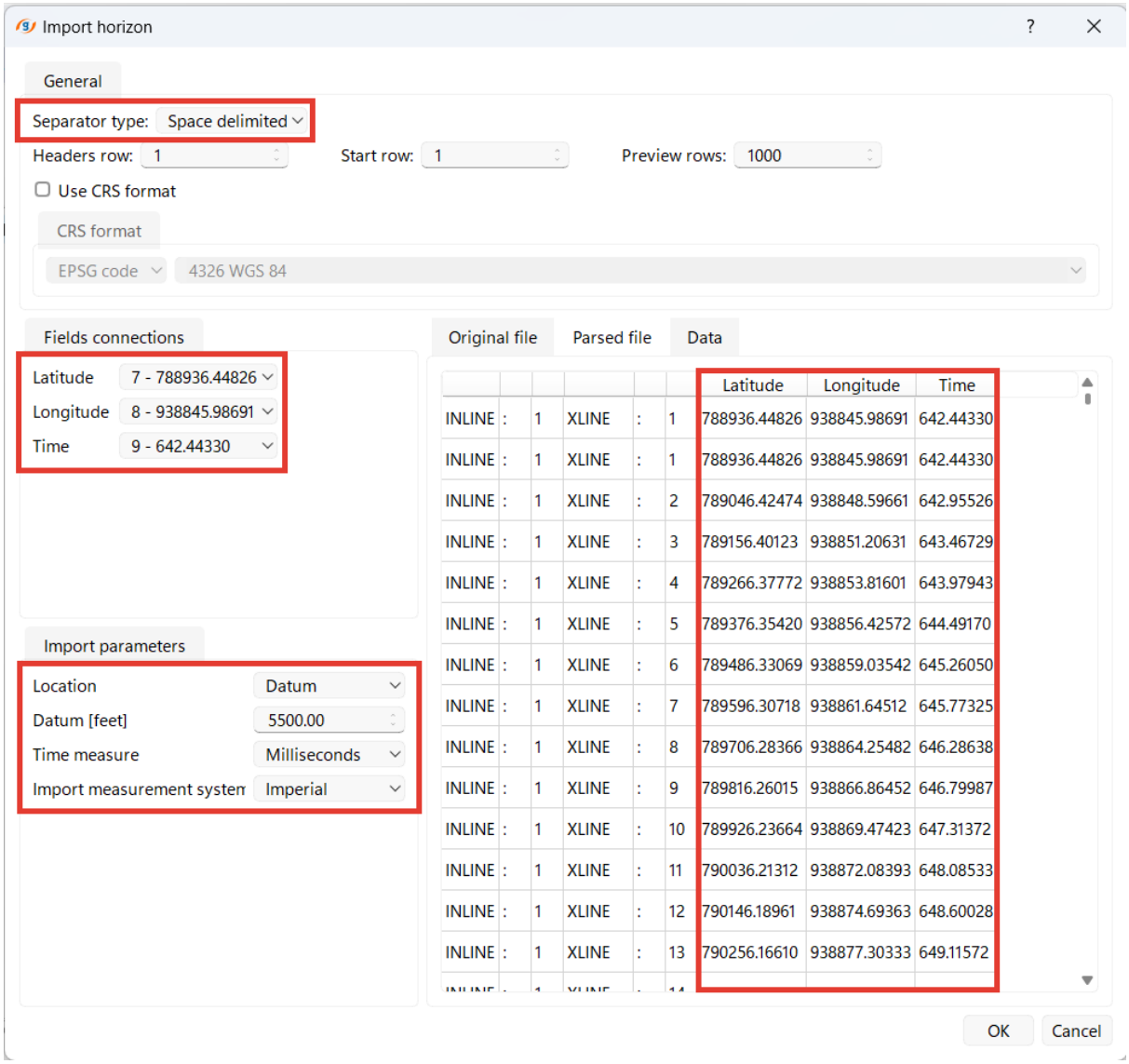

Faults are presented as text files with inline and crossline numbers, XYZ coordinates, Name and Sticks number (Charisma Stick Format):

- Fault_A
- Fault_B
- Fault_C
- Fault_B

An example of the file is provided below.

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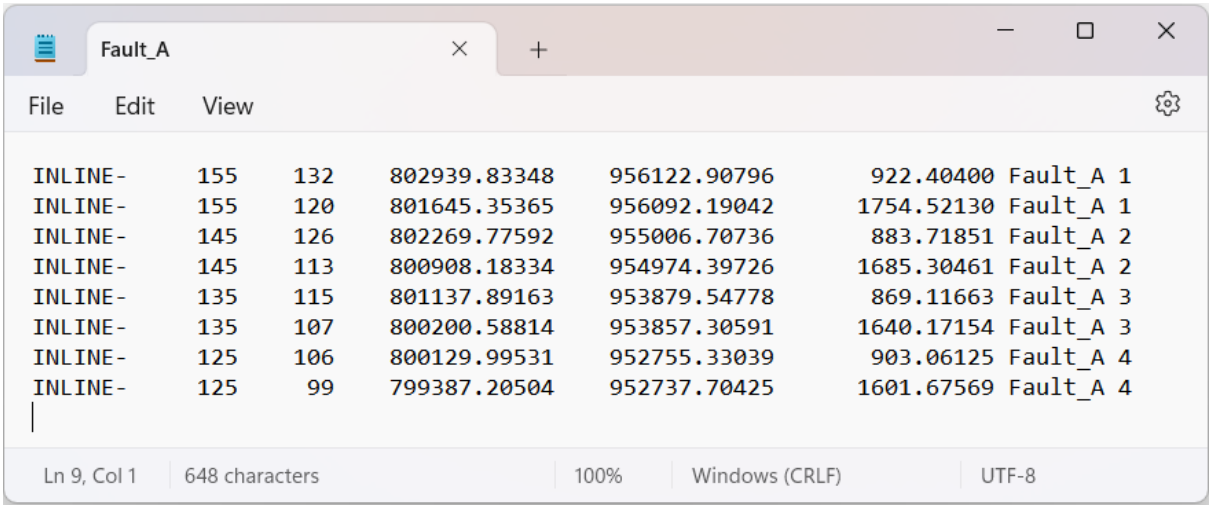
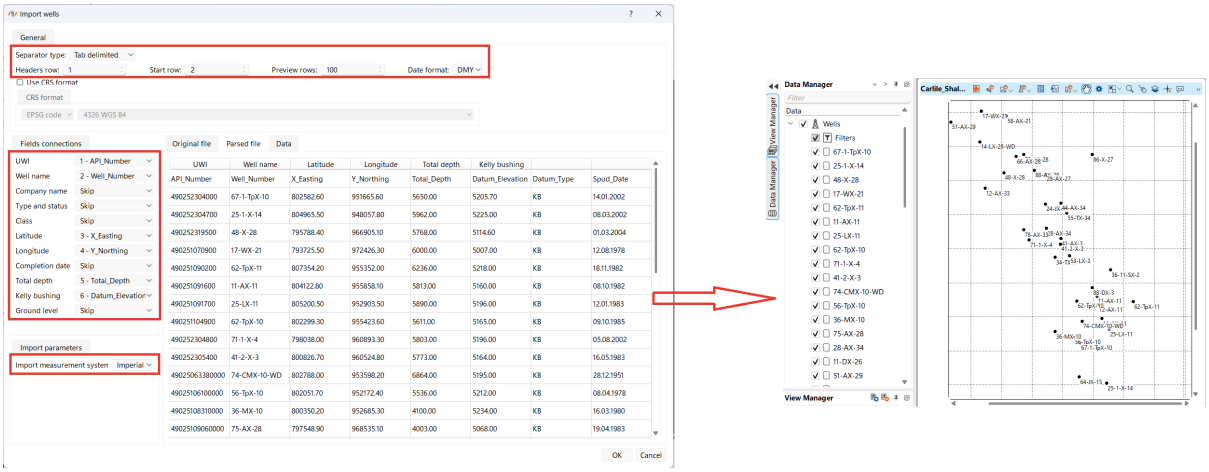


The Demo Project includes 36 wells, each accompanied by wellhead data, inclinometry, log data, and markers. For your convenience, the wells are categorized into those where acoustic and density logging has been performed and those where it has not.

The well heads data is in Well_heads.prn While loading please check parameters highlighted below.

All Coordinates in Wyoming East Central State Plane, NAD 1927



Well inclinometry is presented in the demo project as a set of files in the standard format *incl and includes 2 folders: Wells with long P-wave & Density and Others

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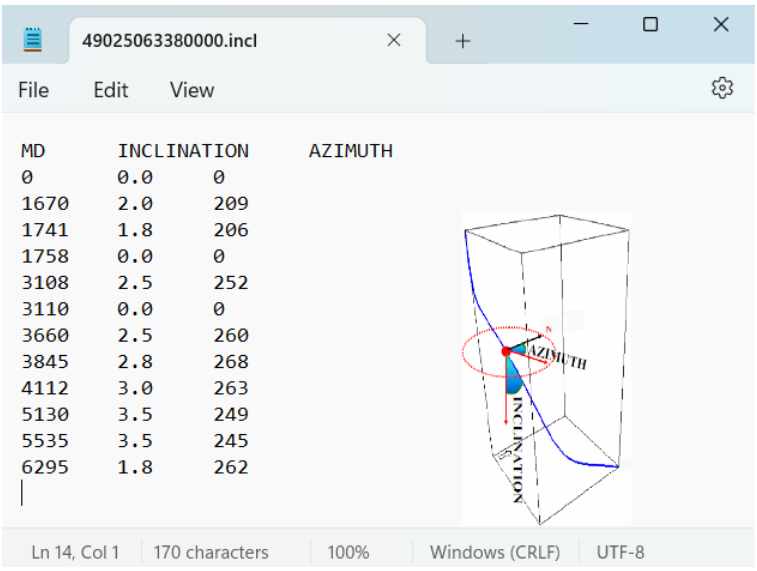

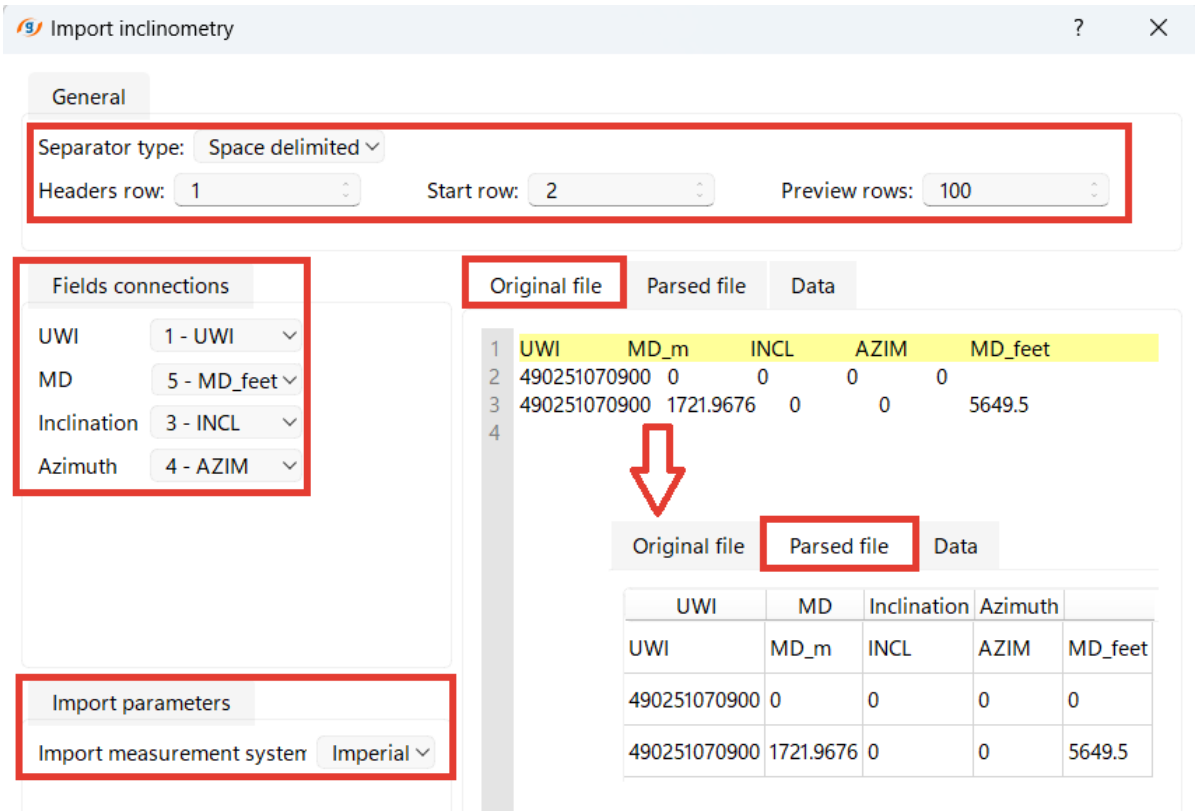

Easily check inclinometry data in the pre-installed Wells Data Workspace, where you can visualize all well data.

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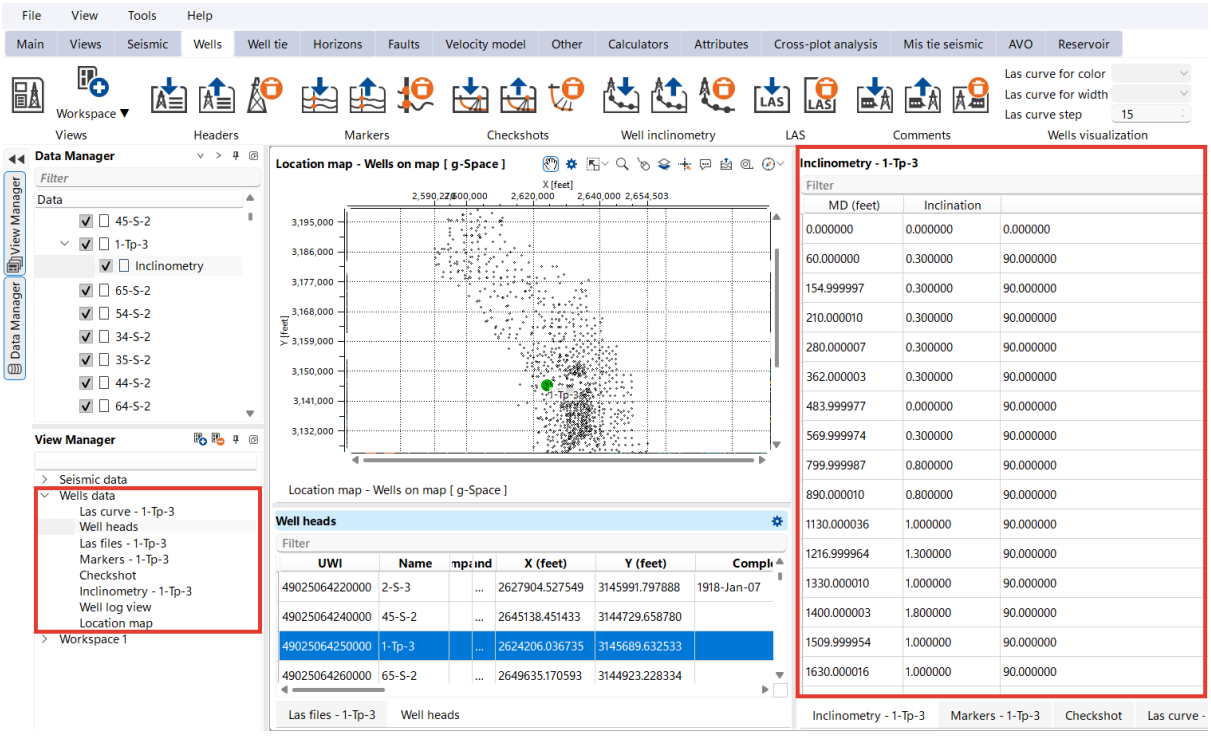

Log data for wells is presented in the form of standard LAS files and contains logging curves including density and acoustic.

Well markers are provided in text format and contain well names, marker names, X, Y, Z and MD.
Below is a list of marker names:

- Shannon_Up
- Steele_B
- Steele_F
- SteeleGD
- Niobrara_WS
- Carlile_Shale
- Frontier_2_WC
- Mowry_Shale
- Dakota_Sand
- Lakota_Sand
- Crow_M_Sand
- RedPeak_Shale
- Tensleep_Dolo
- Tensleep_Sand

Time-depth curves are available for 10 wells in the Demo Project.

It is convenient to view all well data within the installed Well Data Workspace.

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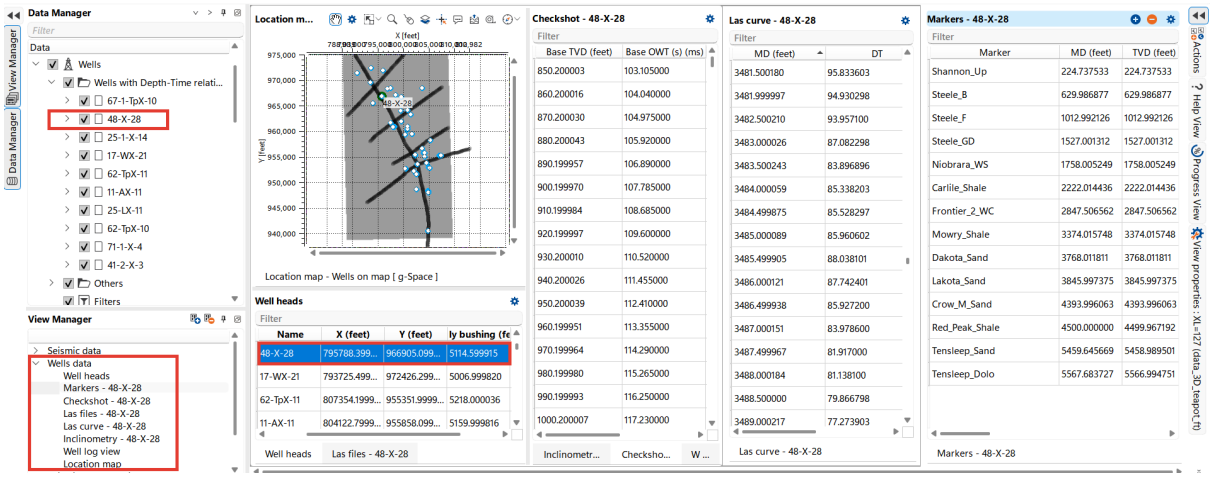


The database also includes a polygon with the project boundaries and topography data.

For data uploading, please use Import data 246 instructions.

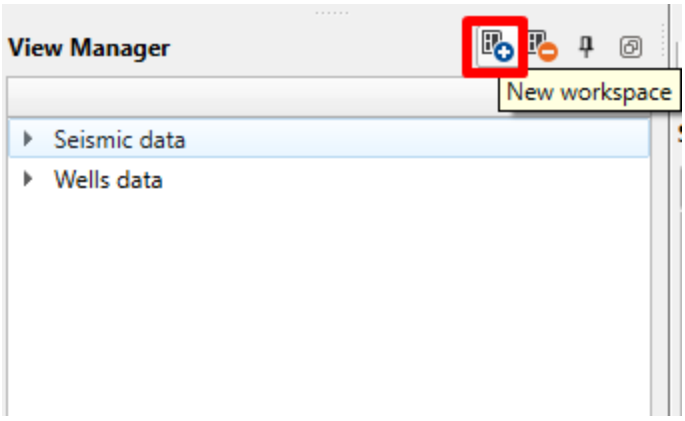
9.1 Well log correlation

This chapter will help you get started with well correlation.

Subscribe to our channel and watch the video on how to correlate wells in g-Space on YouTube

Information about wells data loading you can find here 256.

Once the data has been successfully loaded, proceed to the View manager 90 panel. Create a new workspace and assign it a suitable name:



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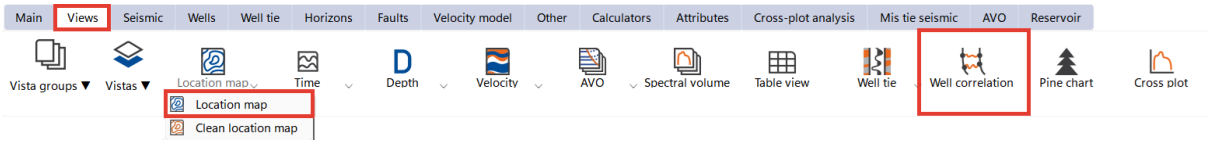
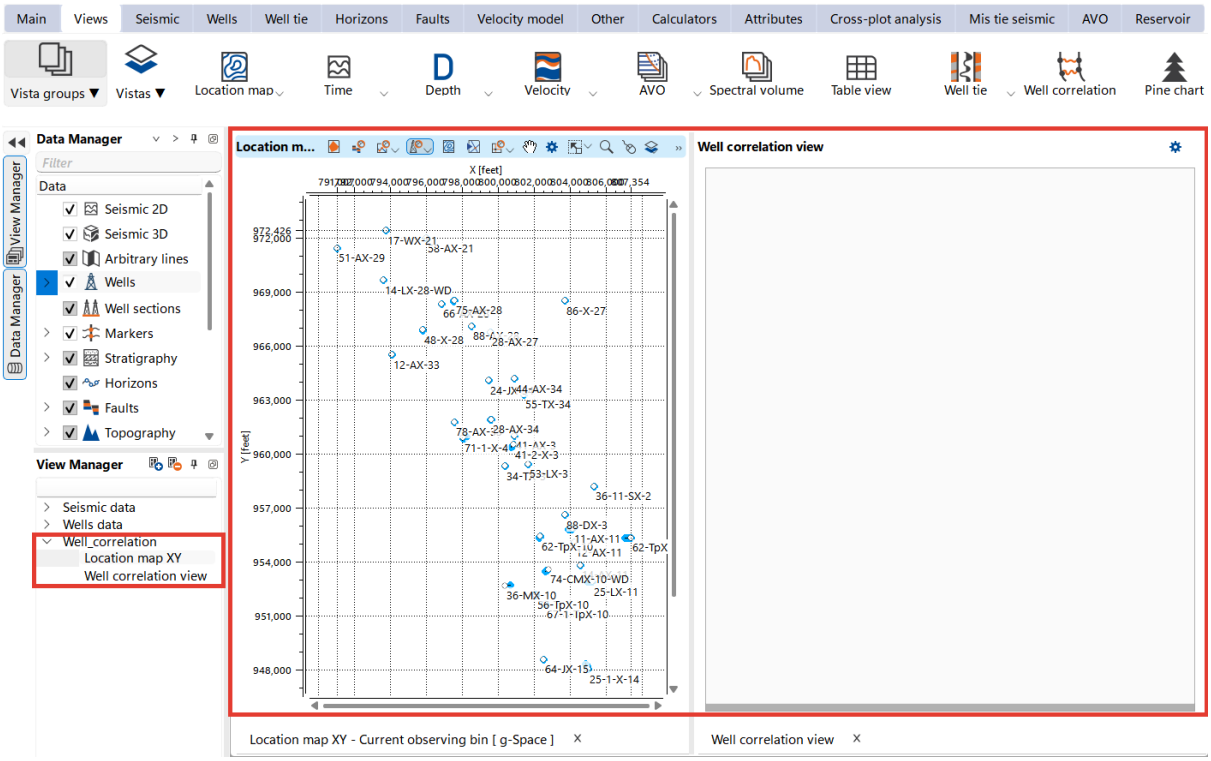
Create two views: Location map and Well correlation



Now there are two views in your workspace



To create a Well correlation section, click the Well button on the tool panel in the Location map view and select Well section.

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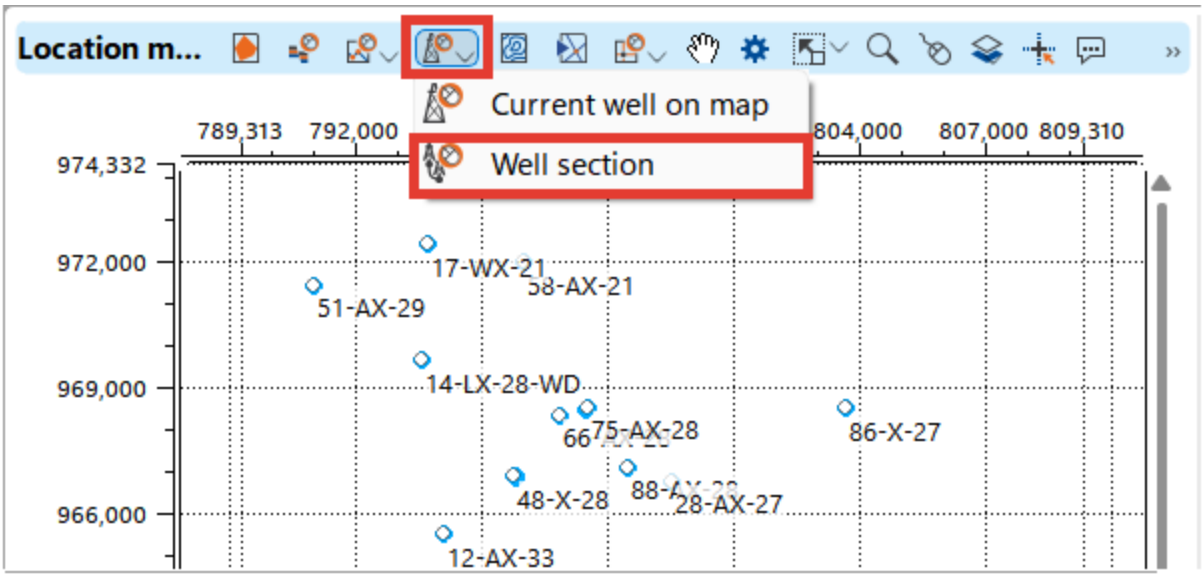
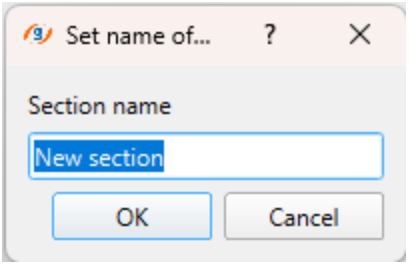


On the first well, g-Space creates a well section and prompts you to name it



Choose the wells you want to add to your section. The selected wells will appear in the **Well correlation view**. This workspace is where the core of your correlation work takes place, allowing you to visually compare and align well logs, stratigraphic markers, and other key data across multiple wells.

You can also add wells to the active section directly from the **Data Manager** by simply clicking on them.

Effective well correlation often requires tailoring the display settings to highlight the most relevant data for your analysis. Here's how you can customize your Well Correlation view:

Accessing Visualization Settings:
To adjust the appearance and properties of any object in the correlation window, simply right-click on the object. This will bring up a menu of visualization options where you can modify aspects such as color, scale, and labeling.

Let's examine the workspace of the Well correlation view.

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1. **Managing Well Sections in Data Manager:**

As you create and modify well sections, they will automatically appear in the Data Manager. This allows you to keep track of your sections and manage them alongside other project data.

2. **Adjusting Axis Settings:**

The axis settings provide control over the visualization of depth, time, and other relevant axes. You can customize parameters such as axis names, scales, colors, and label sizes to ensure the display is clear and informative.

3. **Configuring Track Settings:**

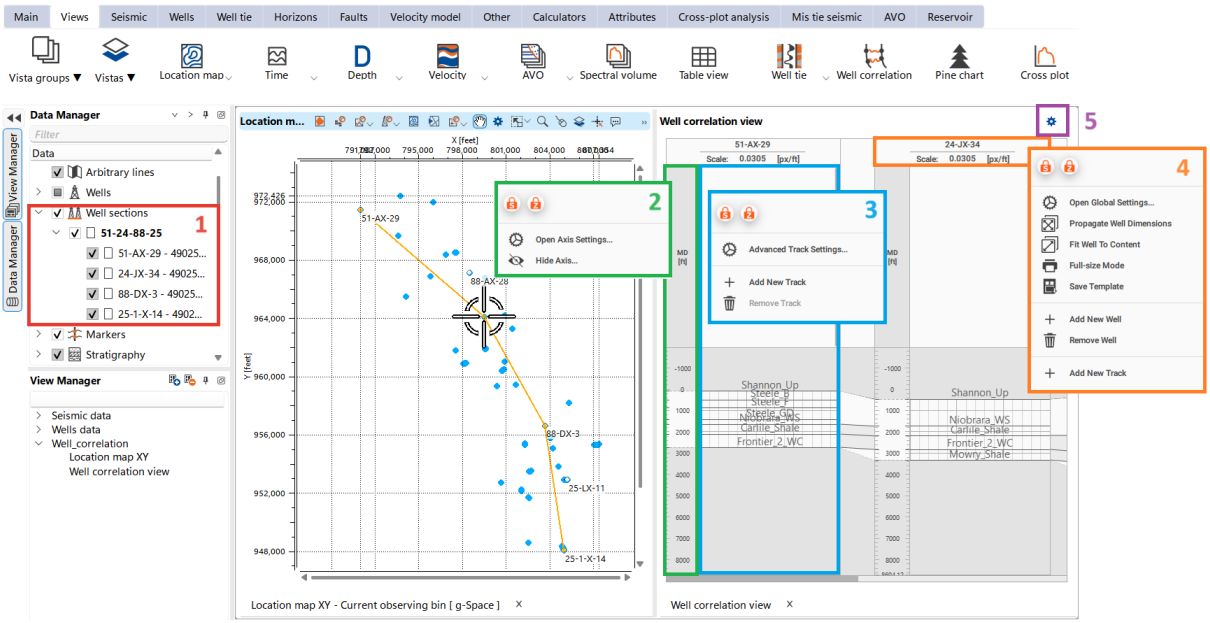
Each track in the correlation view — whether it's a log curve, stratigraphic marker, or another data type — can be customized to suit your analysis. Track settings include options for visualization, adding markers, and adjusting display properties.

4. **Saving Well Templates for Future Use:**

Once you've configured a well template that fits your needs, save it within the Well settings. This template can be easily recalled in future projects, streamlining your workflow and ensuring consistency across your work.

5. **Exploring Global Settings:**

The global settings in the Well Correlation view offer a comprehensive suite of tools for refining your correlation. These tools are described in detail within the Well correlation View 180 section of the Help documentation, providing guidance on advanced customization and usage.



Notes

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1. *Consider the structural framework of the area, such as faults, folds, or unconformities. These features can disrupt or offset geological layers, making correlation more complex. Recognizing these structures early on can guide your correlation and prevent errors.*
2. *Start your correlation with key wells that have the most reliable and detailed data, such as wells with core samples, high-quality logs, or known stratigraphic markers. These key wells serve as anchors, providing a solid foundation for correlating other wells with less detailed information.*
3. *Use multiple wells to cross-check correlations, especially in complex geological settings. This approach helps to validate the continuity of horizons and reduces the risk of misinterpretation.*
4. *Be aware that well logs from different wells may not always correlate perfectly due to differences in data quality, measurement methods, or geological variations. In such cases, use your geological knowledge to interpret these discrepancies rather than forcing a correlation.*
5. *If available, use seismic data to tie well correlations to broader regional interpretations. Seismic horizons can provide additional context and help validate well correlations, especially in areas with complex geology. Generating synthetic seismograms from well logs can help bridge the gap between well data and seismic interpretation.*
6. *Keep detailed records of your correlation process, including decisions made, marker positions, and any adjustments. This documentation is crucial for future reference and for communicating your findings with others.*

To accurately represent the proportional distance between wells on the correlation diagram, utilize the Relative Well Distance function found in the Global Settings.

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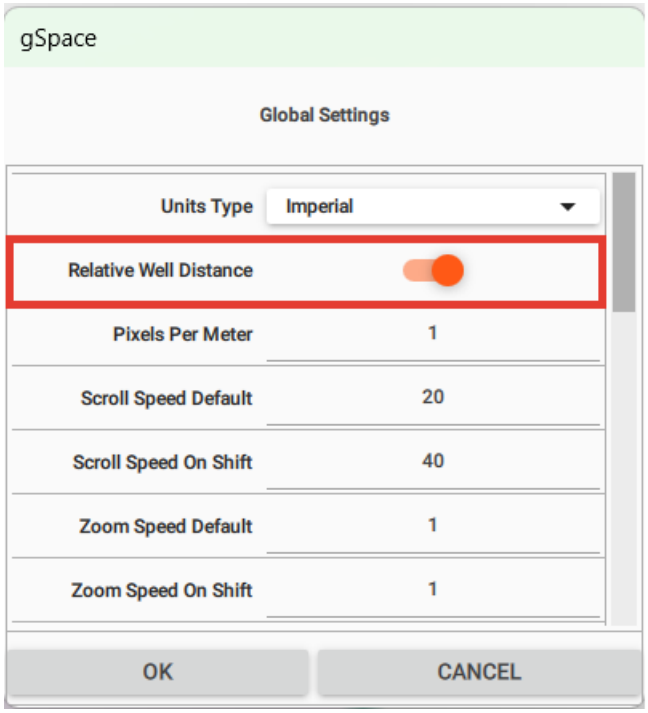
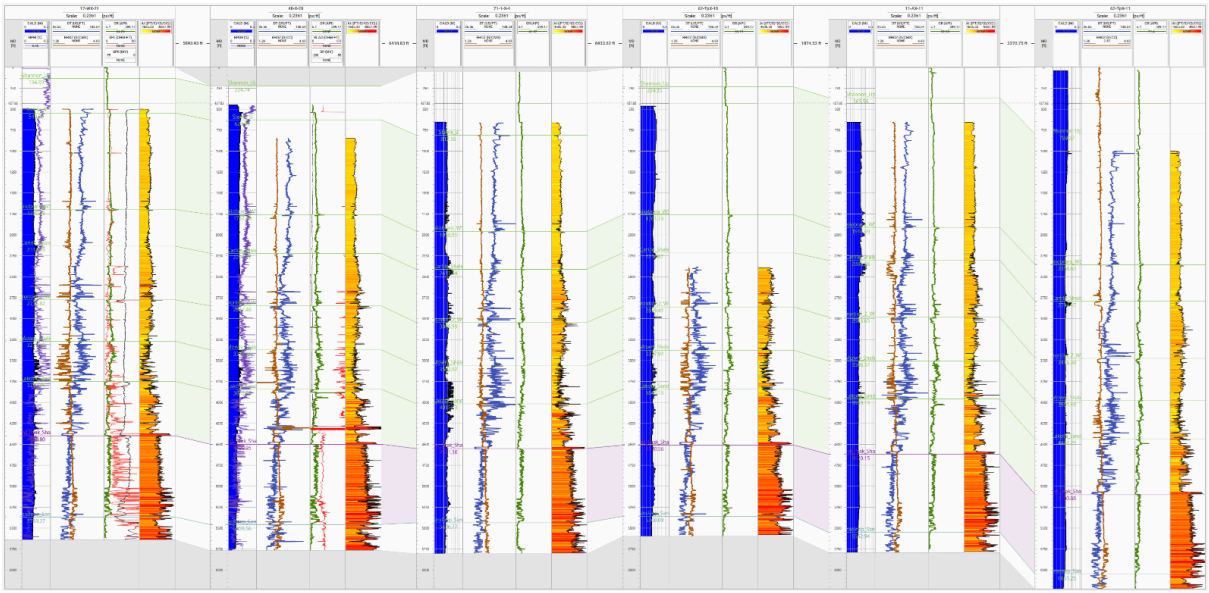


After customizing 362 your Well Correlation view and adding necessary markers 370, review your correlation to ensure accuracy and consistency across all wells.



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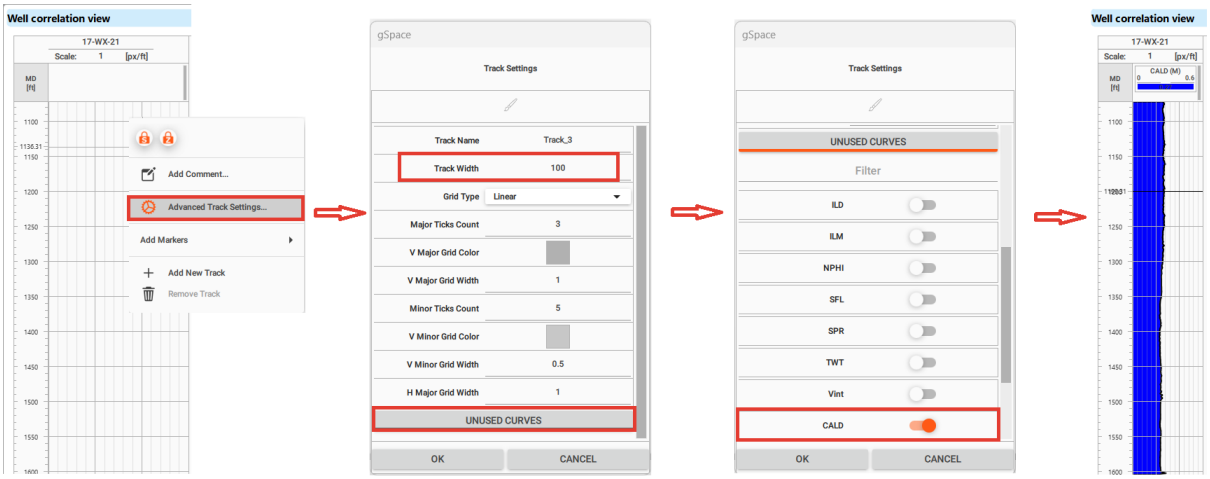
9.1.1 Setting Up a Well Template

To visualize a curve in an empty track, right-click on the track display and select **Advanced Track Settings**. This will open a settings window. For this example, set the **Track Width** to 100. Scroll to the bottom of the window and click on **Unused Curves** to display a list of curves that haven't been visualized yet. Select the **caliper** curve from the list. The curve will be visualized.



To set up curve visualization, right-click on the curve name field at the top of the panel (highlighted in red). This will open the curve visualization settings window.

In this example, the following adjustments were made:

- Renamed the **Curve Nickname**
- Updated the **Units**
- Selected a filled **Curve Type** (highlighted in green)
- Selected a **Step Style** (highlighted in blue)
- Set the **Min Value** and **Max Value**
- Chose curve **Color** and **Width**
- Chose **Fill color**

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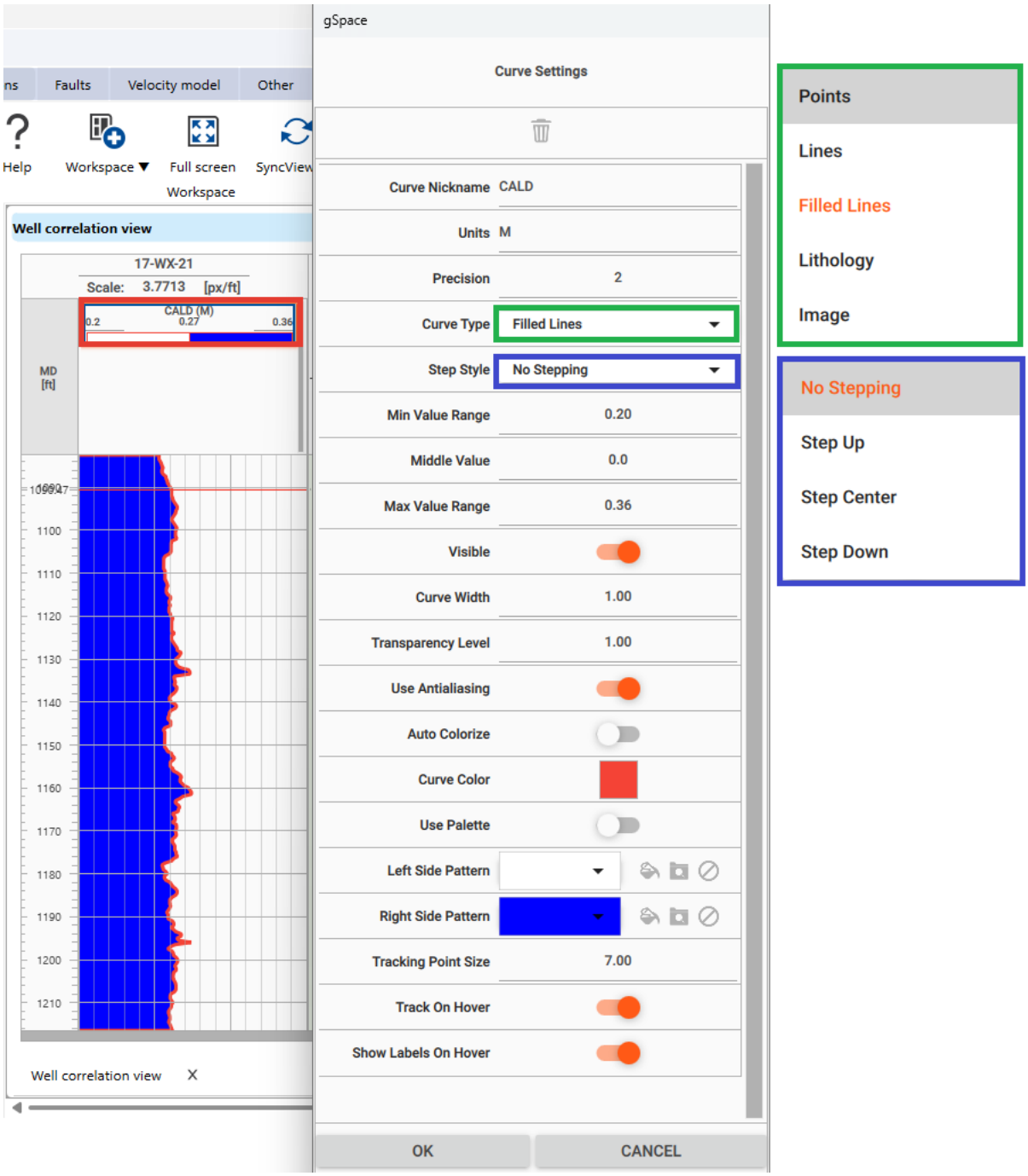

To add three additional tracks for the curves, right-click on the visualized track field and select **Add Track** (highlighted in red). Next, access the global settings (highlighted in green) by right-clicking on the well name at the top.
Scroll down to the **Axis Settings** and enable the visualization of **TVD** (True Vertical Depth) and **TWT** (Two-Way Time).

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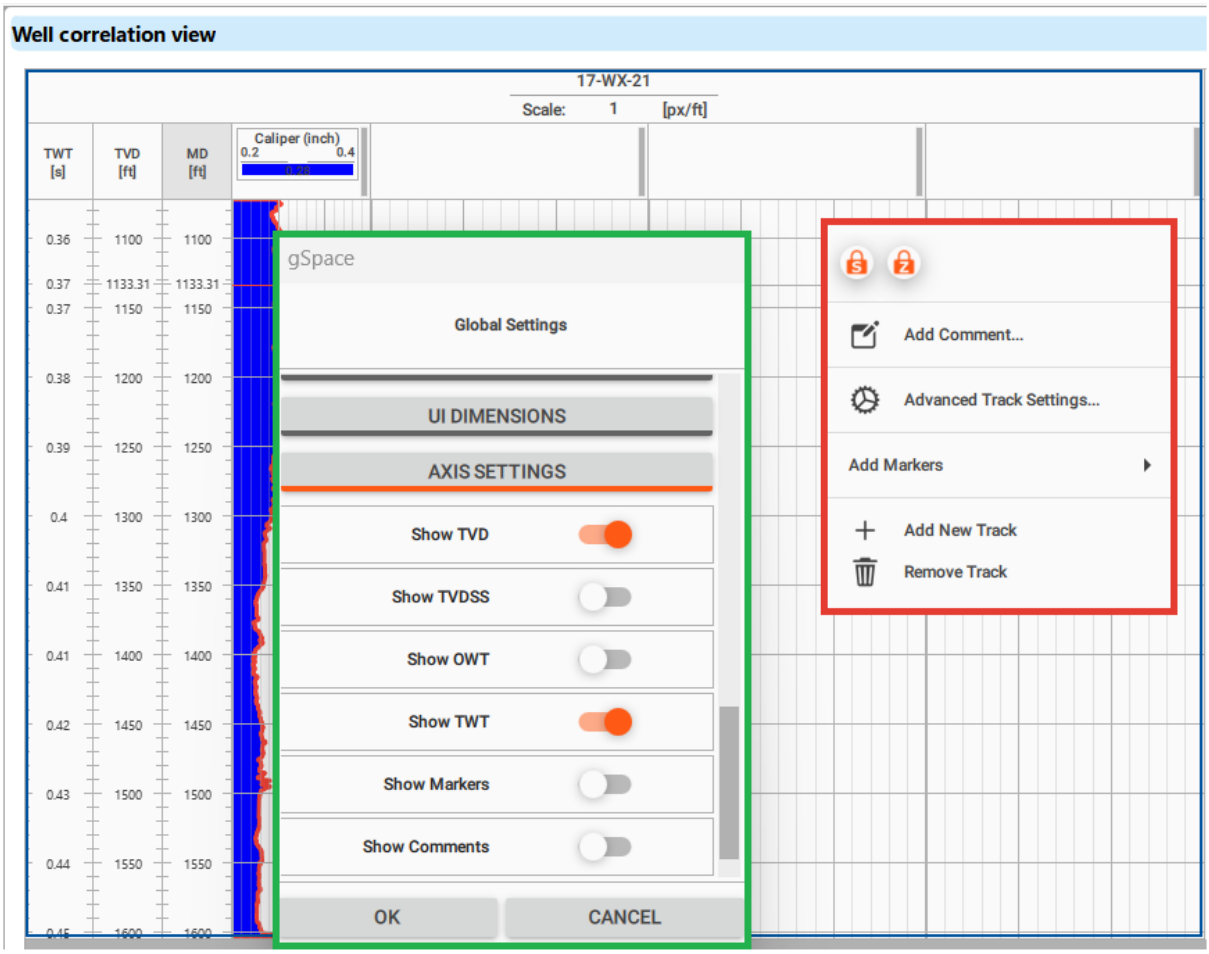

To set a priority scale, right-click on the scale field you want to designate as the main one. This will open the settings. Enable the **Active** function, and the selected scale will become the primary one, highlighted in gray in the label field at the top.

In the picture below, the active scale is set to **MD**. For the active scale, the **Active** function does not appear in the settings, as it's already designated as the primary scale.

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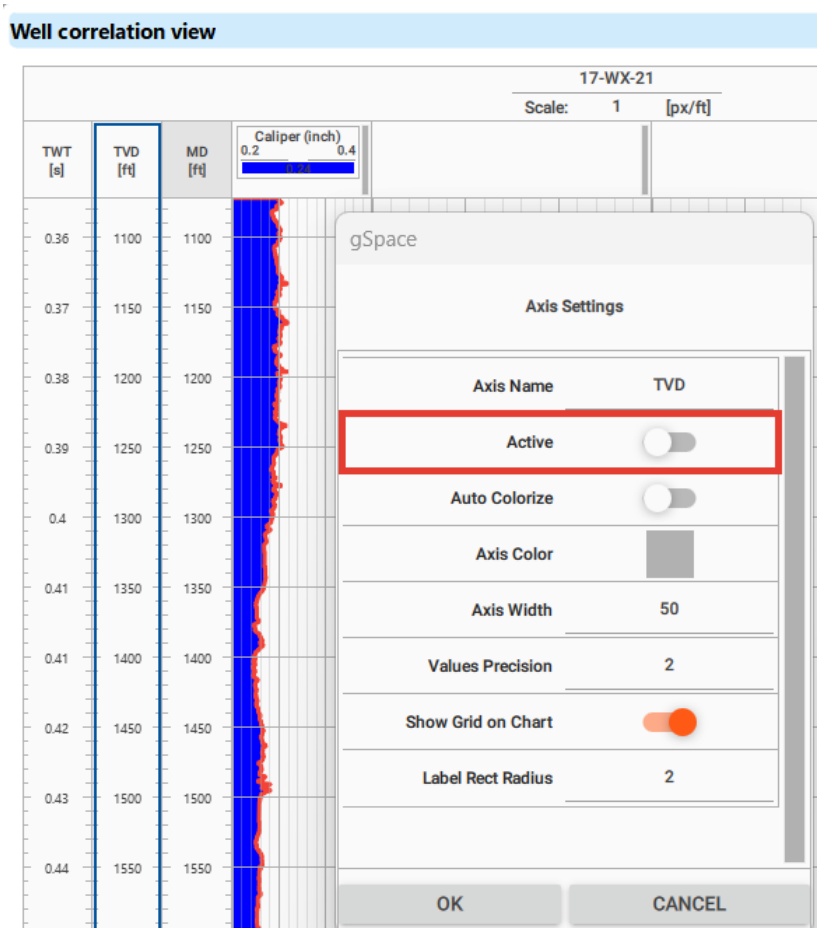

Lets add curves to the tracks as described above.

To adjust the size at the top of the panel, click and hold the left mouse button on the border (highlighted in red) of any axis field, then drag to resize the field.

You can change the minimum and maximum values by left-clicking on the curve name field (highlighted in orange) while it highlighted.

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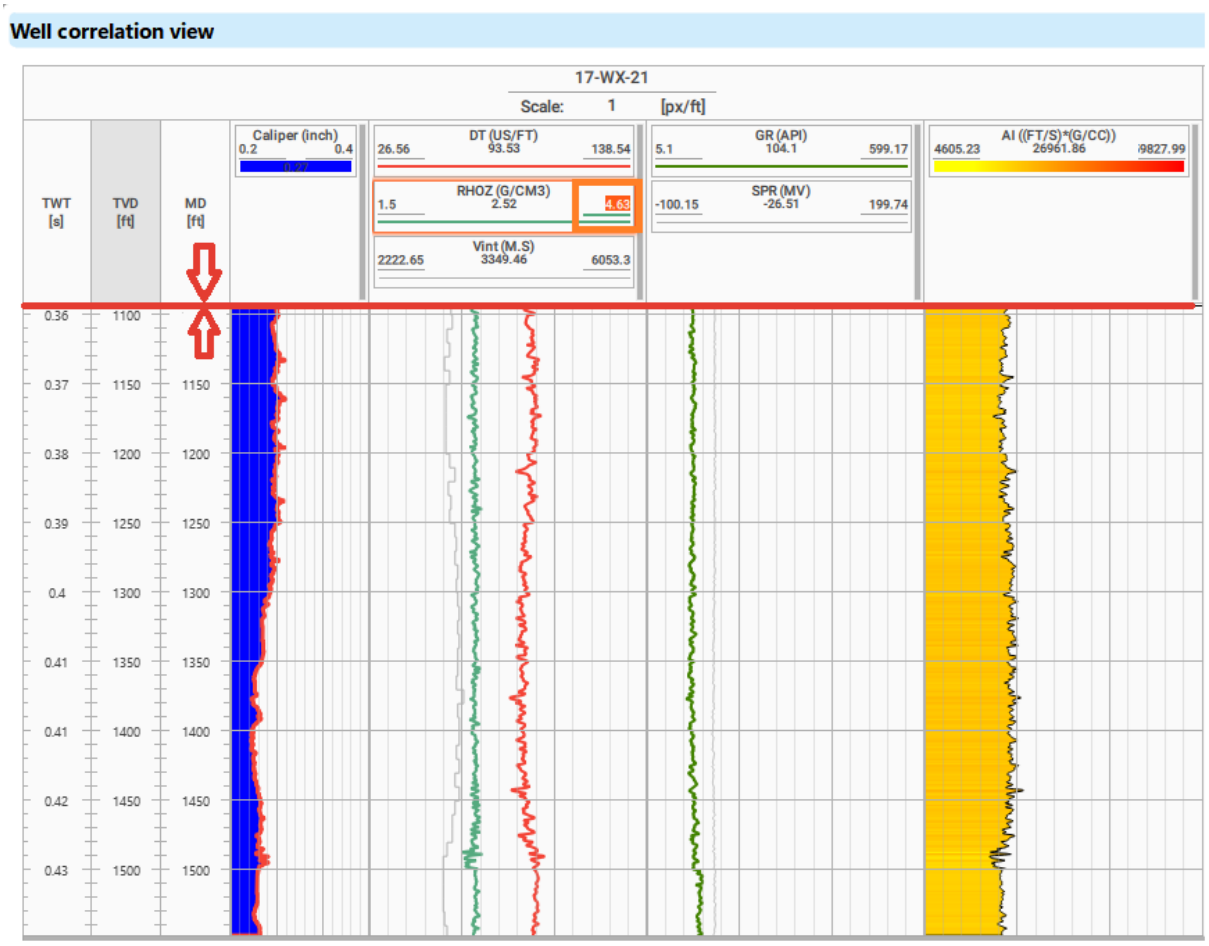

For continuous curves such as GR or Density, a convenient standard visualization type is linear.

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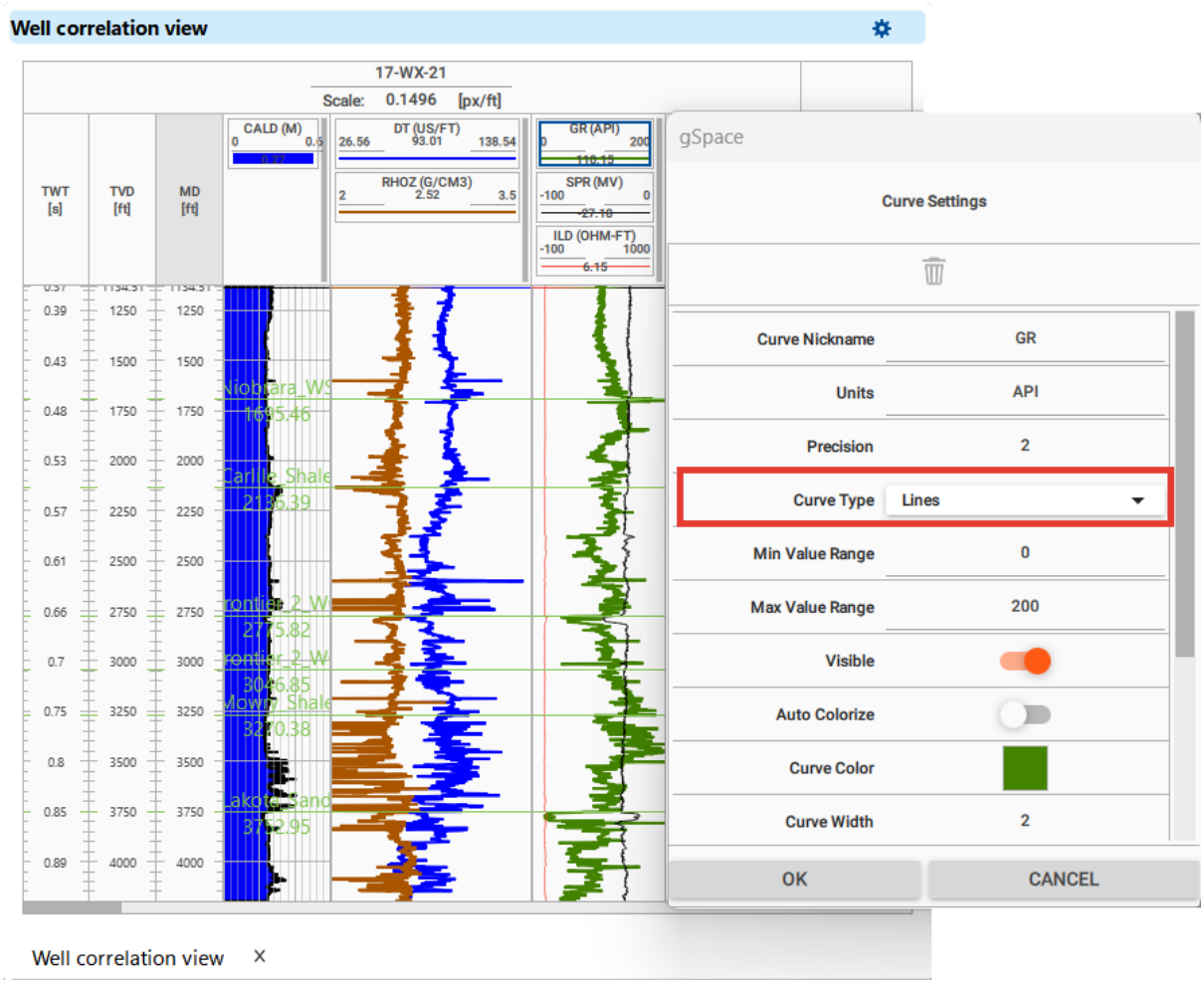

To visualize markers, open **Global Settings**, scroll down to **Markers Visibility**, and enable the markers you want to display.

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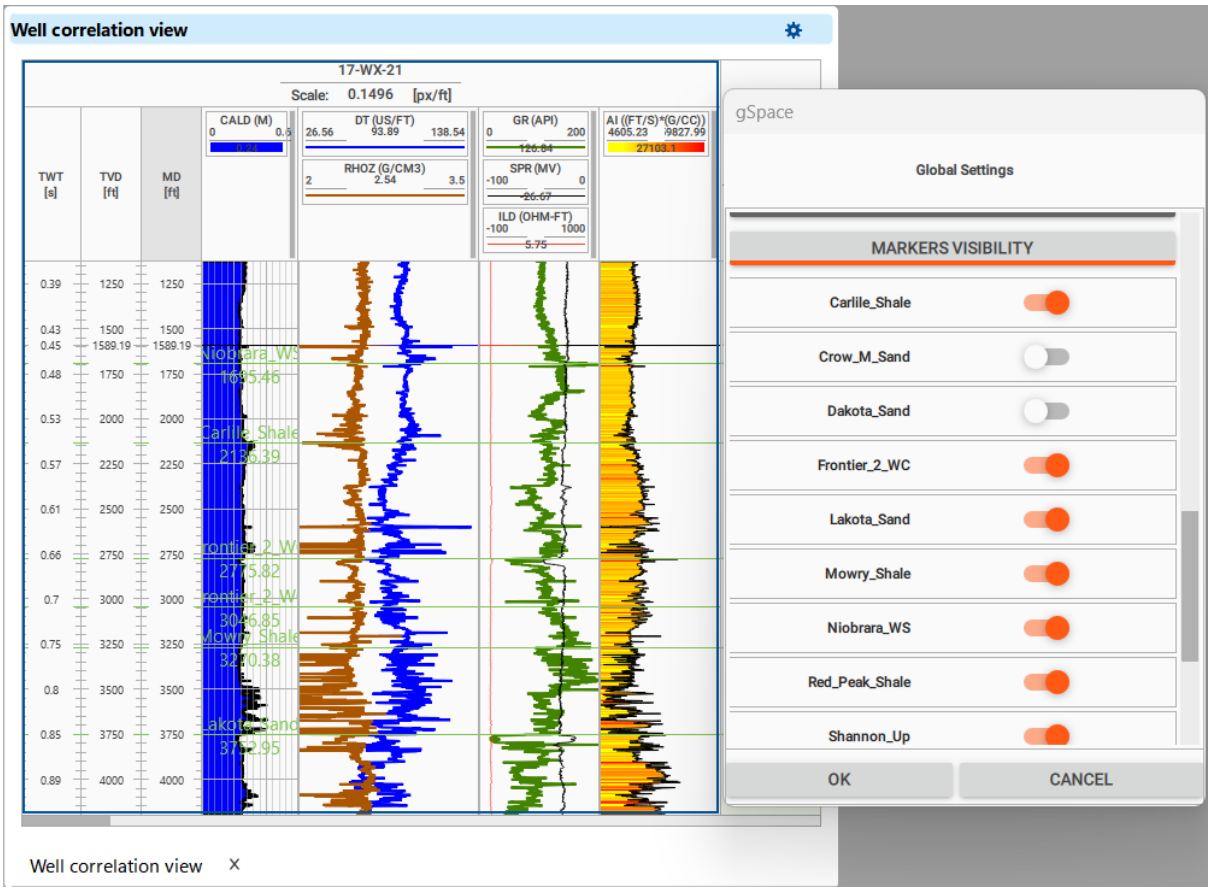

Once you have set up a Well template for correlation that suits you, save it and it will always be available in your project.

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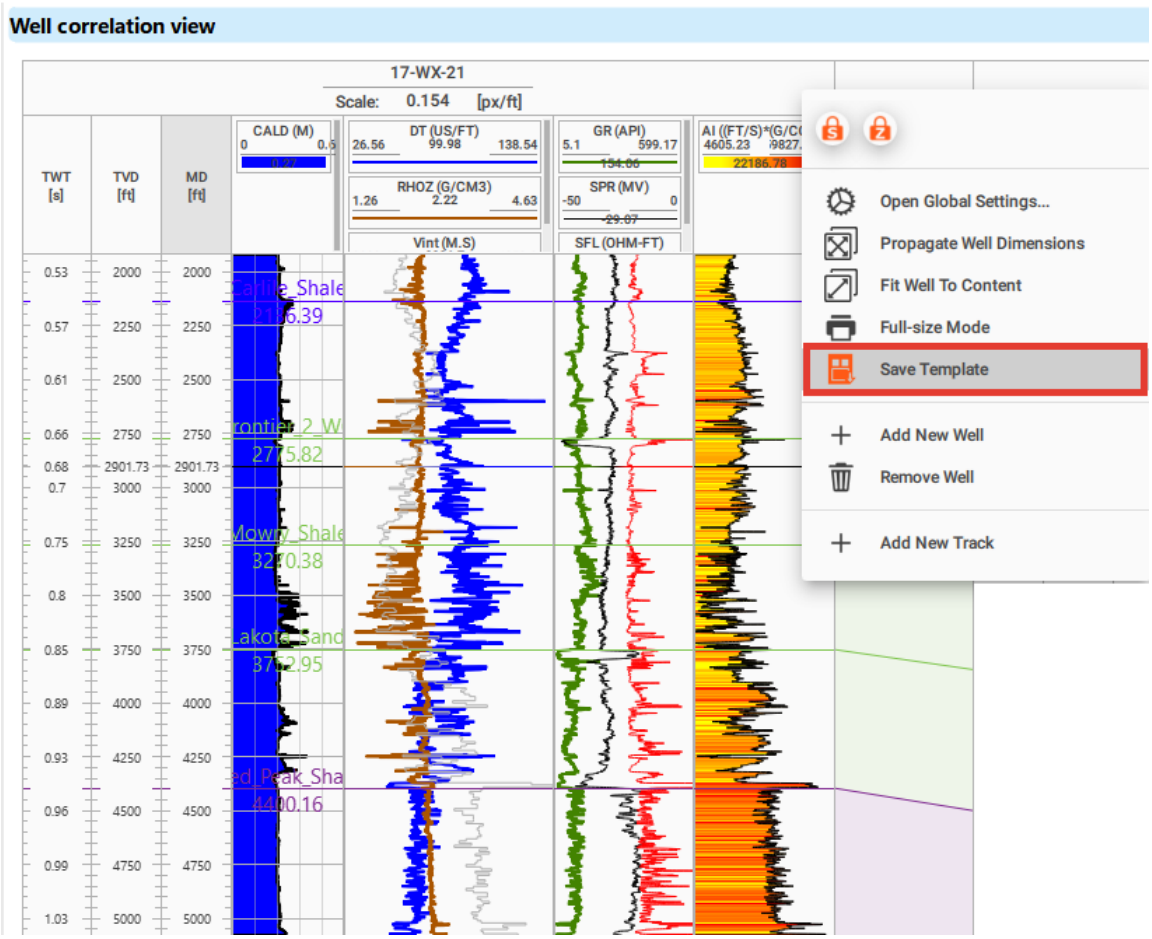
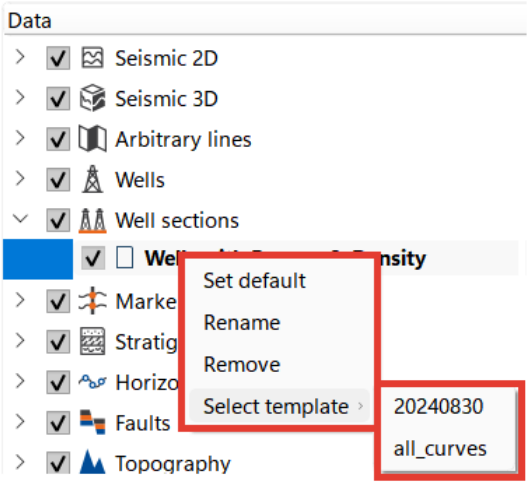


To apply a saved well template, right-click on the desired section within the Well Sections in the Data Manager.



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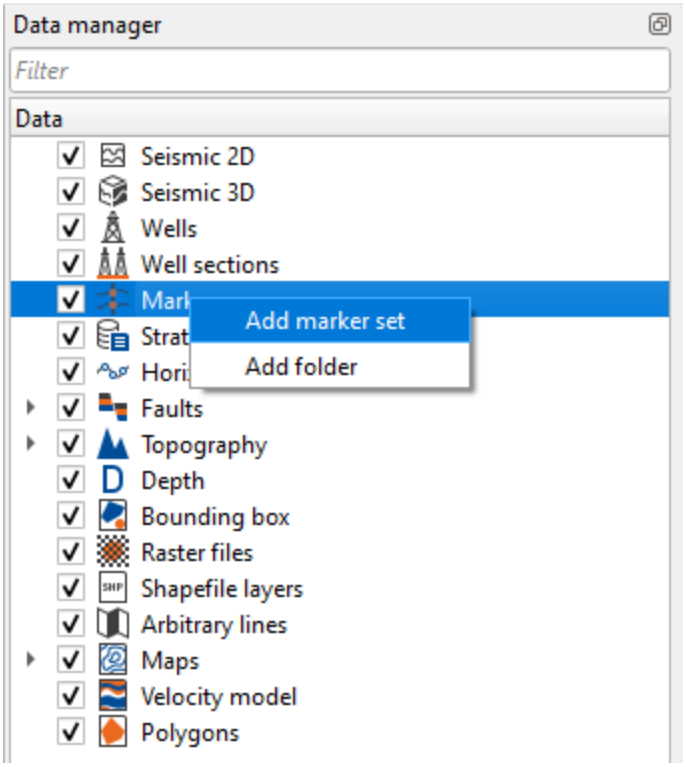
9.1.2 Working with Markers

Working with Markers in Well Correlation

1. **Creating and Managing Marker Sets:**

In the Data Manager, right-click on the Markers icon and select "Add Marker Set" to create a new set. Marker sets allow you to organize markers by stratigraphic sequence, lithology, or other criteria, facilitating more effective correlation.



2. **Adding and Editing Markers:**

Once a marker set is created, you can add individual markers by specifying their depth or time position.
You can also adjust marker positions, correct any inaccuracies, and delete markers as needed.
Markers can be grouped to represent specific intervals or sequences, further enhancing the clarity and usefulness of your correlation.

To access the marker settings in the **Data Manager**, stand on the marker and right-click. This will open a menu where you can adjust the age, specify whether the marker represents a horizon, fault, or intrusion, rename or delete the marker, and create a map based on it.

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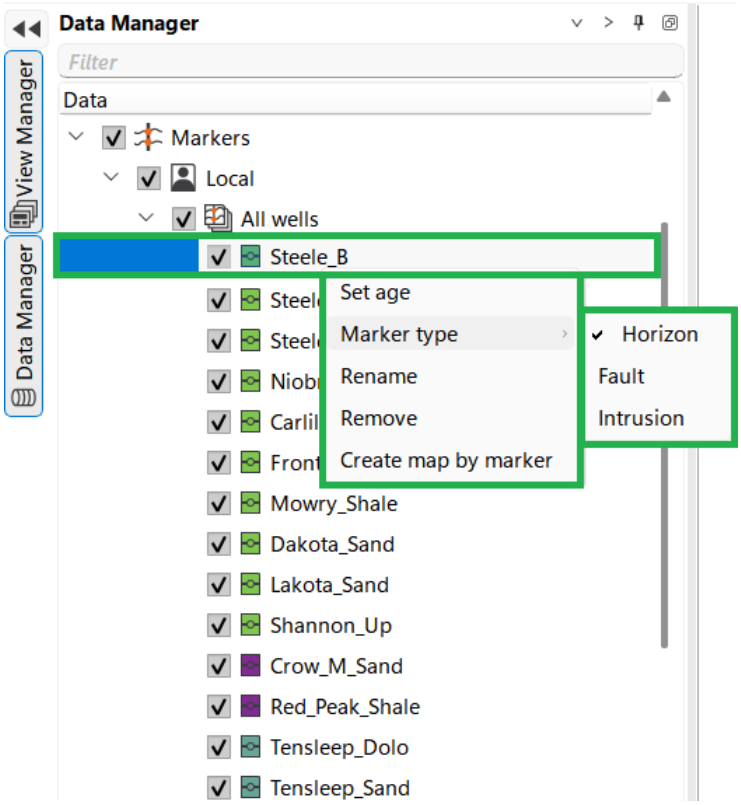

To configure a **Marker set**, right-click on it to open an expanded menu of options.

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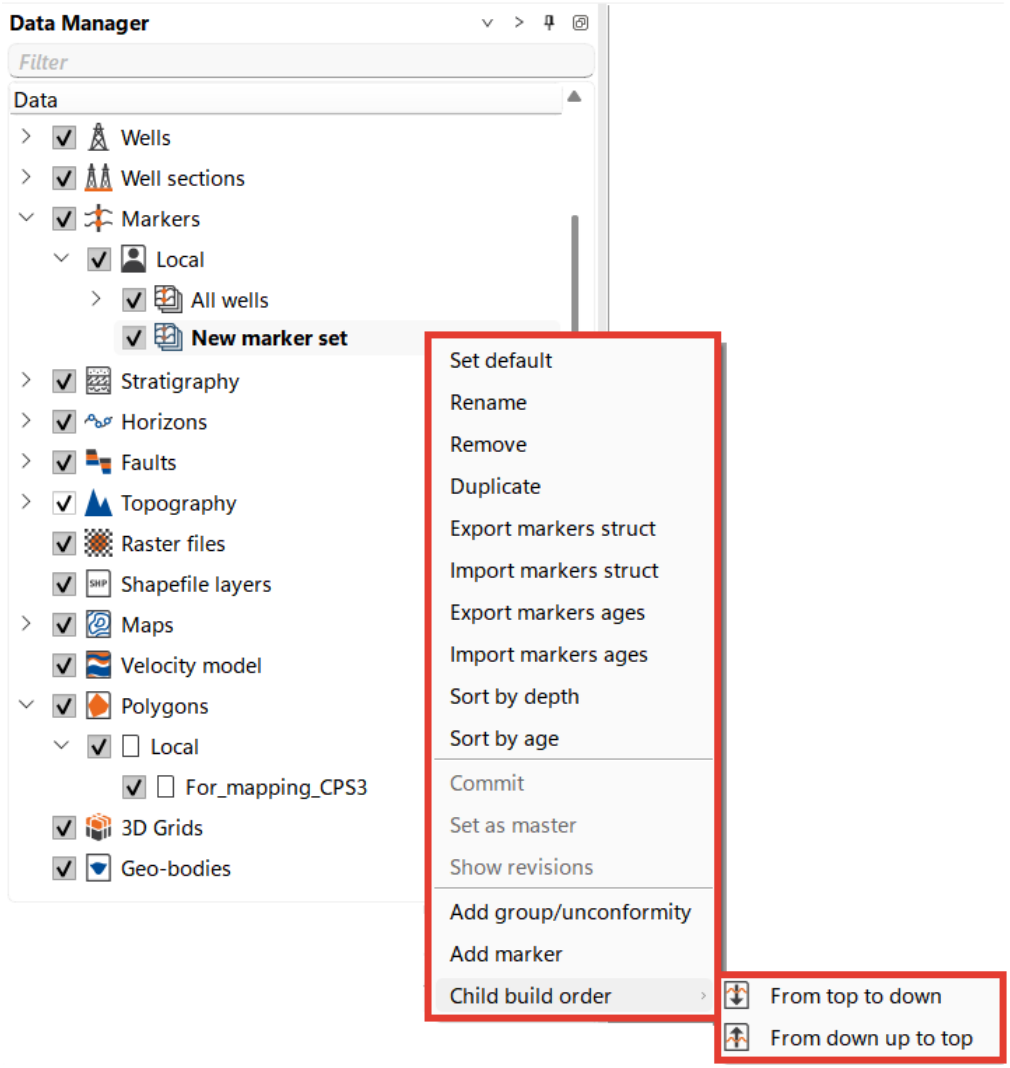

When performing correlation, it is often convenient to flatten the entire correlation scheme with a boundary.

To activate flattening, move the cursor to the desired marker. When the two-way arrow appears, the selected horizon line becomes bold, right click and open the horizon settings menu, click the first icon, highlighted in red in the picture, and the correlation diagram will align with the selected horizon. For this functionality "F" hot key is also available.

To switch between horizons, make the desired horizon active and press the "F" key again. To exit flattening mode, left-click in the axis field and press the "F" key once more. The horizons will then return to displaying their actual depth values.

To exit horizon selection mode, press the Escape key.

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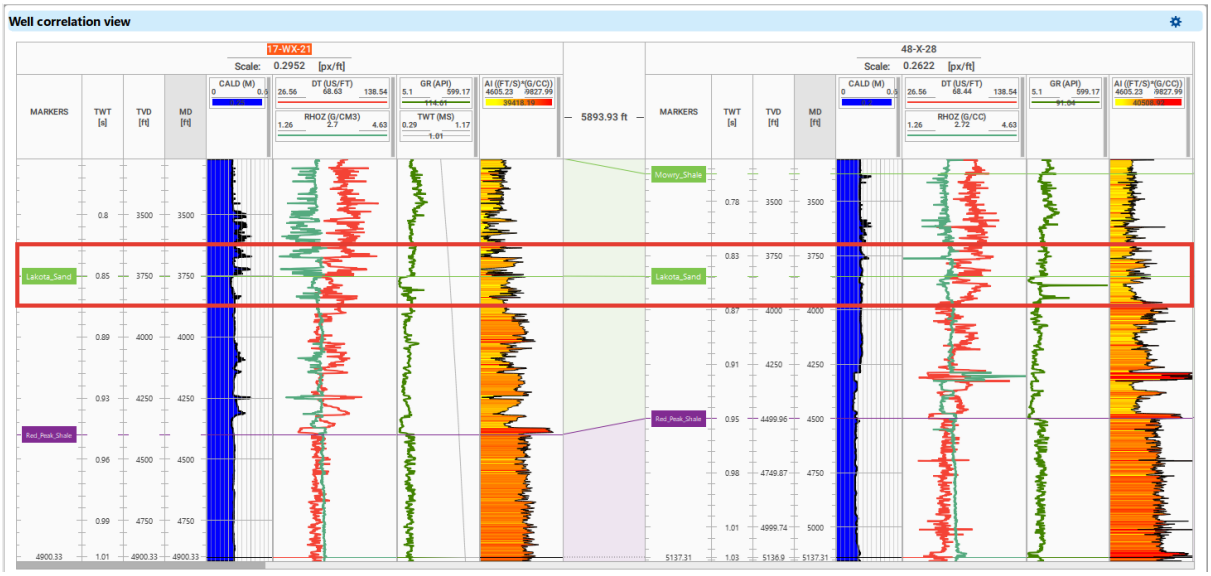

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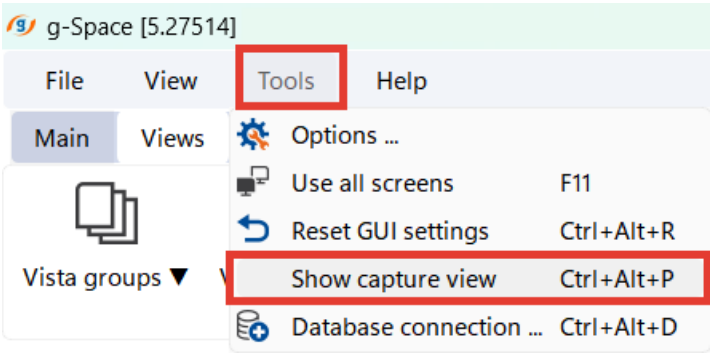

It's often helpful to compare the curve trajectory of one well with others. since the correlation is carried out from key wells with known markers to new ones. To facilitate this, you can use the "Ghost Curves" feature.

Navigate to the **Main menu**, select **Tools**, and then choose **Show Capture View**. Highlight the section of the screen you wish to compare and drag it to the desired location. To exit this mode, simply press Escape.

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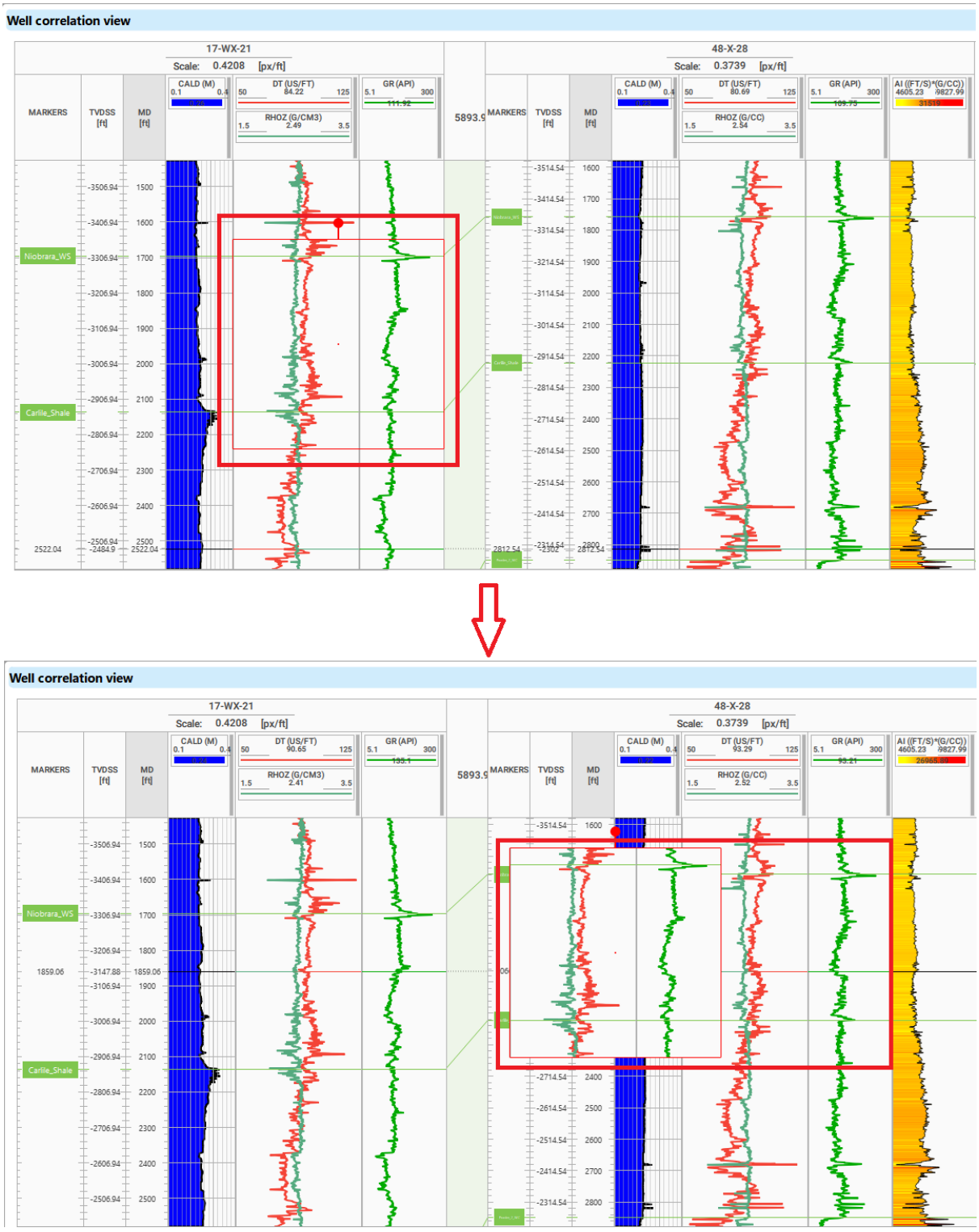

During well correlation, you might need to adjust the position of markers as you refine your geological model. To add or change marker positions:

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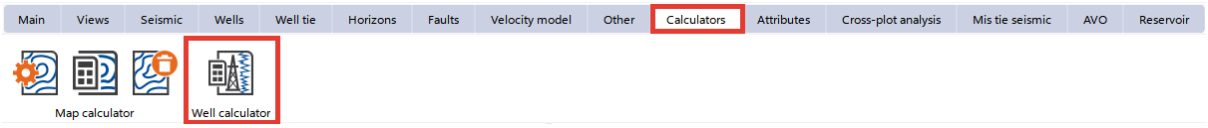
1. **Adding a Marker:** Click on the desired well log at the depth or time point where you want to place a marker. A new marker will be created at that position.
2. **Changing Marker Position:** To adjust an existing marker, click and drag it to the correct position within the well log. When you move the cursor close to a marker line, the cursor changes to a double-headed arrow. At this point, the horizon you click on will be highlighted, and its name will be displayed. Ensure the marker accurately represents the stratigraphic horizon or boundary you are correlating.

9.1.3 Well log calculator

The **Well Log Calculator** in g-Space is a tool that allows users to generate custom well log curves through mathematical expressions applied to existing well data. It is accessible from the **Calculators Bar** by clicking on the **Well Log Calculator** button, which opens a user-friendly wizard interface for quick and efficient log creation.



The wizard consists of two main tabs: **General** and **Preview**.

In the **General** tab, users can define the core parameters for the calculation process. It contains the following key components:

- **Output Log:** Users can either select an existing well log curve from the dropdown menu or create a new curve by naming it. This output will store the results of the calculation.
- **Expression:** This is the central area for performing operations. Users must input an arithmetic expression using the available well log curves (e.g., porosity, density) and mathematical operators. Expressions can be as simple or complex as needed, enabling flexibility in creating derived curves. Refer to the Trace Headers Math 342 for a description of the available mathematical functions.
- **History:** g-Space automatically saves previous expressions, making it easier for users to reapply calculations they have used in the past without having to rewrite them.

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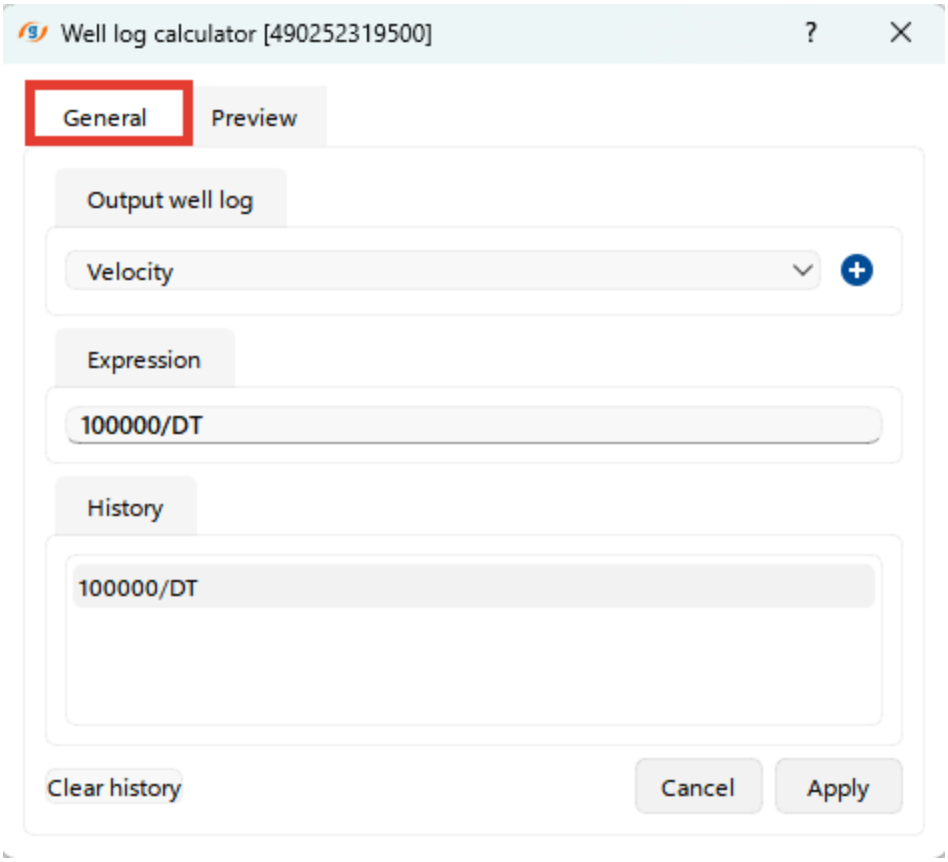

The **Preview** tab provides a real-time visualization of the data before finalizing the calculation. It consists of two columns:

- **Depth:** Displays the depth intervals for the well data in ascending or descending order.
- **Values:** Shows the resulting values based on the arithmetic expression entered in the **General** tab. This preview ensures that users can verify the output and confirm the expression before applying it to the entire dataset.

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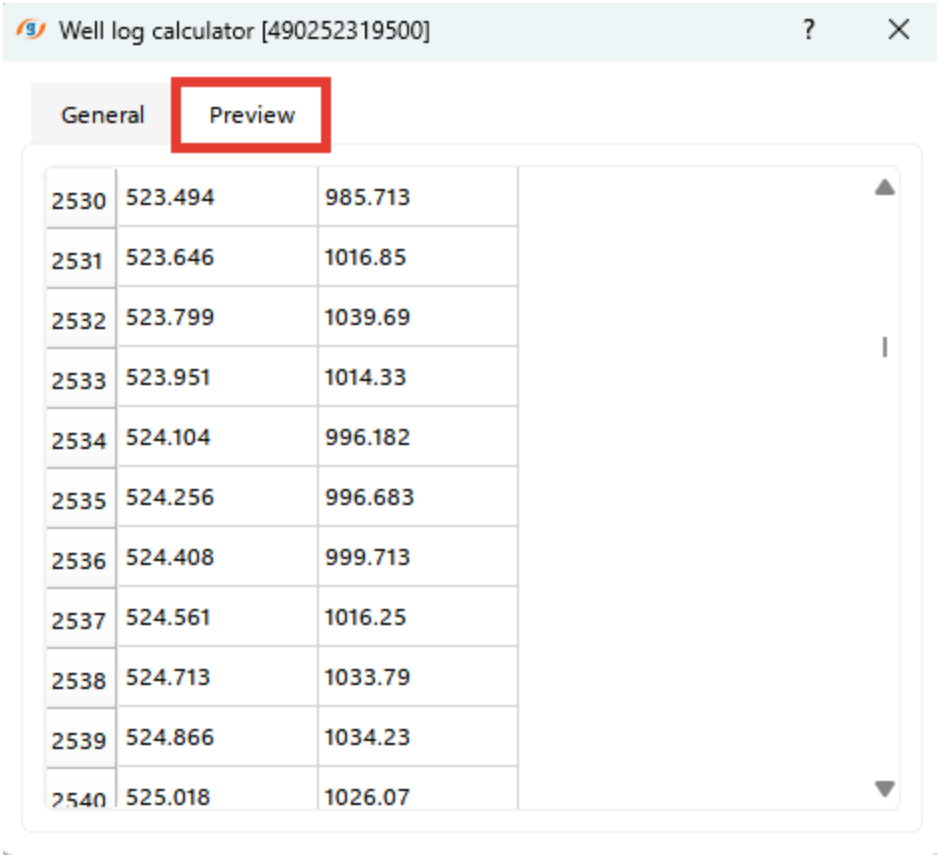

After completing the calculation, the newly generated curve is automatically saved in the **Las** folder within the **Data Manager** for each well in the project.

The curve will be calculated for the **Current well** on the Location map 124.

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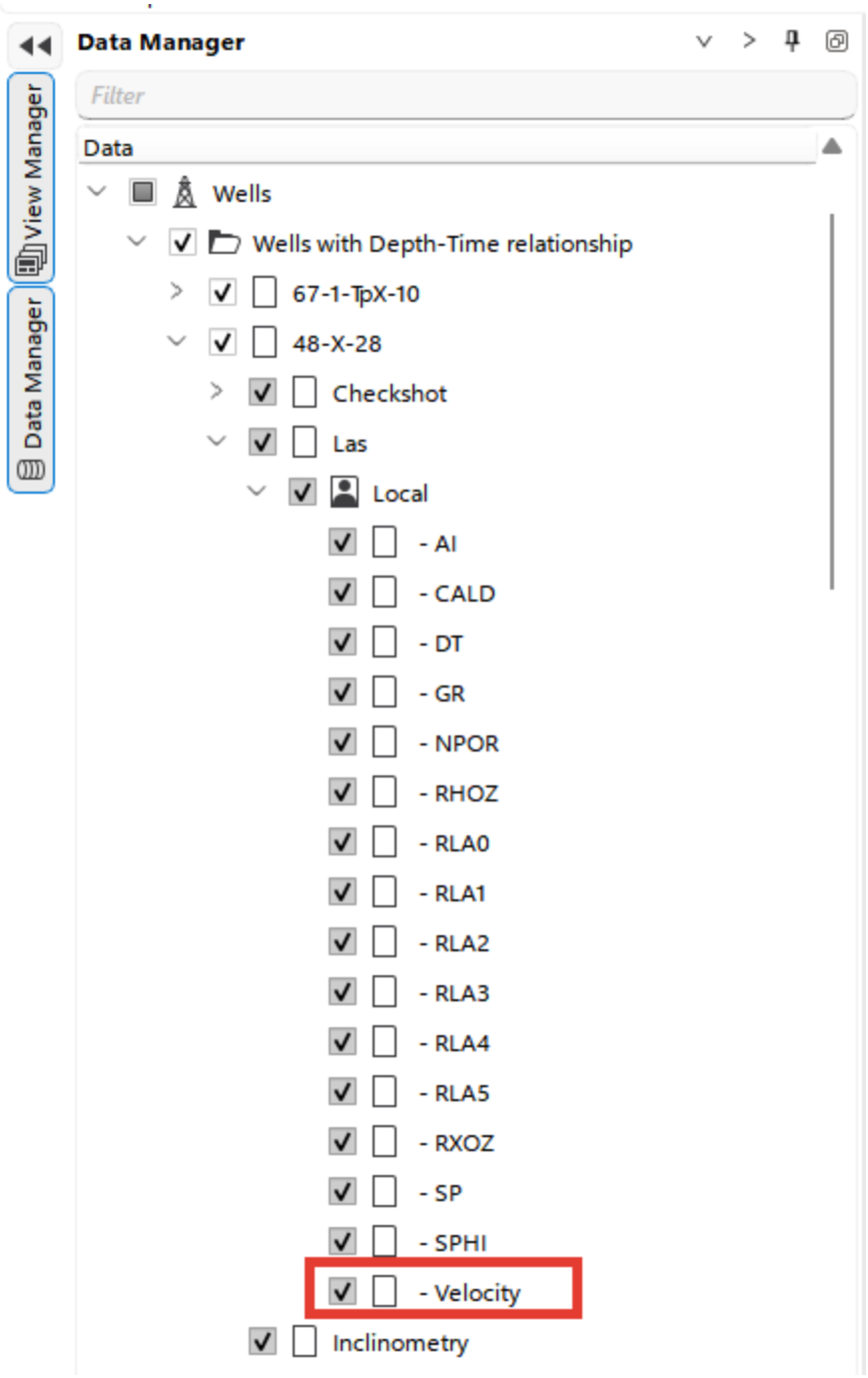

9.2 Well-Tie

Well Tie view in g-Space is a powerful tool that allows you to visualize and analyze well data, generate synthetic seismograms, and perform seismic-to-well tie operations.

Preparing for Well-to-Seismic Tie

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To perform a seismic-to-well tie, you must have the following data loaded:

- **Seismic Data:** 2D lines or 3D volumes.
- **Well Information:** This includes check shots, sonic logs, density logs, and optionally, impedance data.

Subscribe to our channel and watch the video on how to perform Well tie in g-Space on YouTube

In this chapter, we will guide you through the well-to-seismic tie process using the Demo project for the Teapot oil field.

We will focus on the well 67-1-TpX-10, which is equipped with sonic and density logs, as well as checkshot data. The goal is to tie this well to a 3D seismic volume by generating a synthetic seismogram, comparing it to the seismic composite trace at the well location, and then analyzing the outcomes.

Let's have a look at the data

Well Correlation View (left panel) is used to visualize the well logs, including the sonic and density logs for well 67-1-TpX-10. The logs are plotted against depth and time. Markers are annotated alongside the logs, aiding in the correlation with seismic data.

Location Map displays the position of well 67-1-TpX-10 within the seismic survey area.

Inline Seismic View shows a vertical slice of the 3D seismic volume passing through the well location.

Checkshot Table View (right panel) provides a checkshot data for well 67-1-TpX-10, which includes both True Vertical Depth (TVD) and One-Way Travel Time (OWT). Well correlation view automatically recalculates and displays TWT values along its axis.

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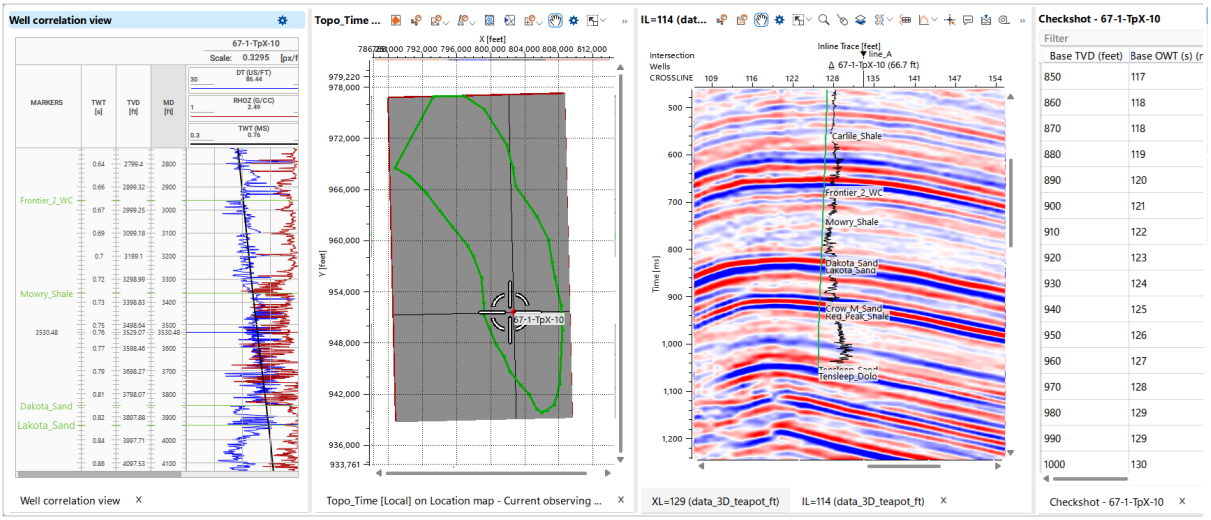
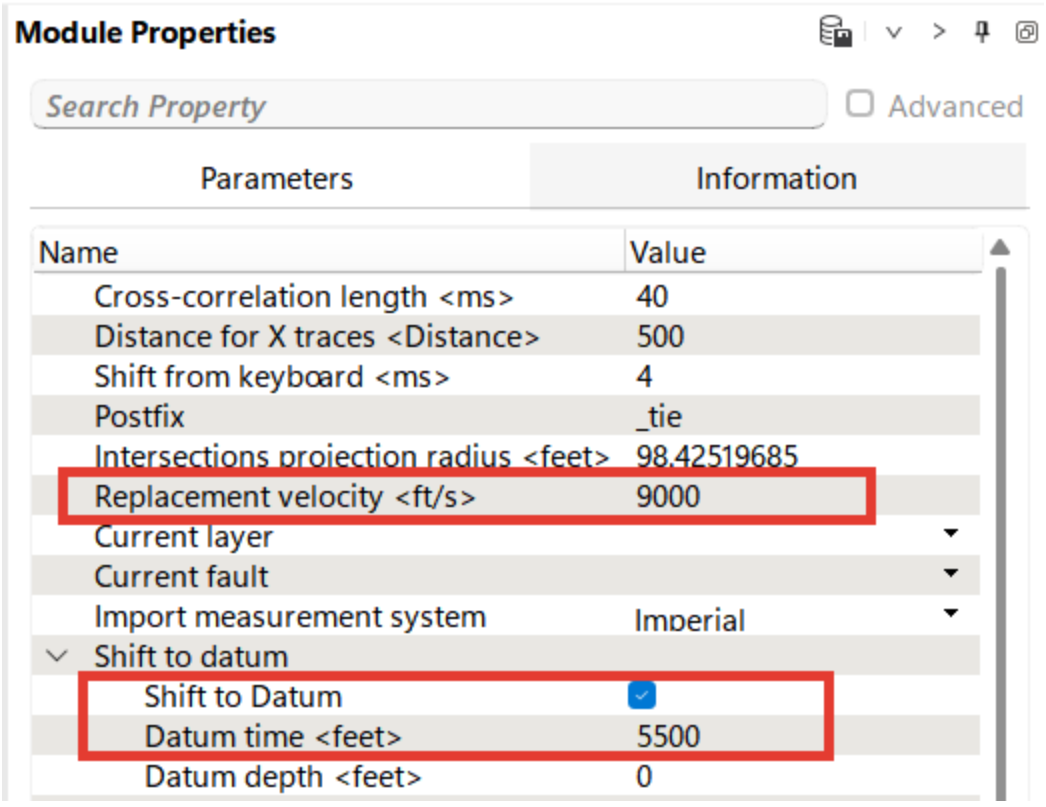
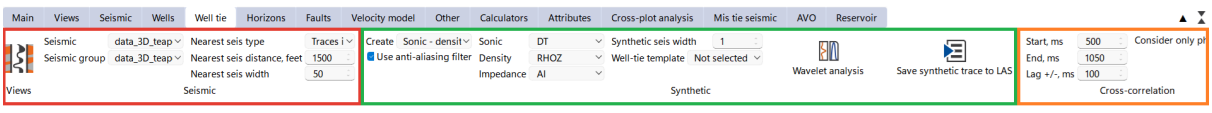


Please verify the 3D seismic reference level and replacement velocity in the Module Properties. Ensure that the **Datum** is set to 5500 feet and the **Replacement Velocity** is set to 9000 ft/s.



Navigate to the Well Tie Bar 62, which will be the workspace for this process.



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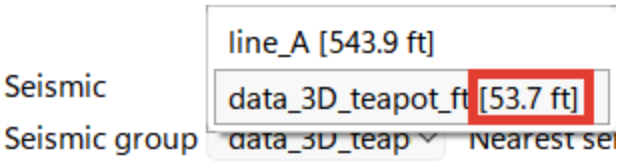
Setting Up the Well Tie Bar

The **Well Tie Bar** is divided into three main sections: **Seismic**, **Synthetic**, and **Cross-correlation**.

Seismic section (highlighted in red) allows the user to select the seismic lines or volumes that are near the selected well. It displays options to choose specific seismic data from the drop-down menu, such as the seismic volume or group. In this Demo project, we will be performing the well tie to a 3D seismic volume.

The **Nearest Seis Distance** field displays the distance from the selected well to the nearest seismic line or volume. For example, in this case, the distance is 53.7 feet.



The user can define a specific distance for the nearest seismic data using the **Nearest Seis Distance** setting. For instance, if a distance of 1,500 feet is specified, only seismic lines within this radius from the well will be considered.

Nearest Seis Width defines the number of seismic traces to be displayed around the well location. In this case, we set it to 50 traces.

Synthetic Section (highlighted in green) is dedicated to generating and analyzing the synthetic seismogram. It includes tools for creating synthetic traces based on the sonic and density logs and performing wavelet analysis.

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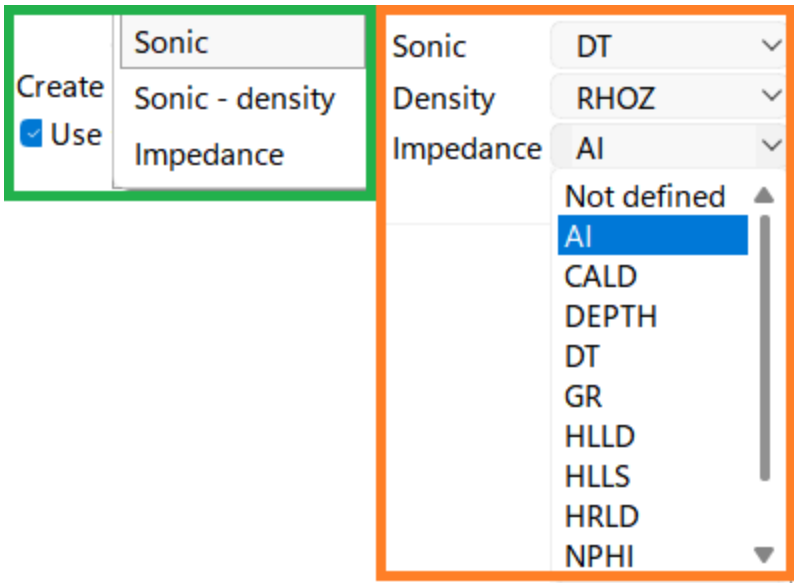


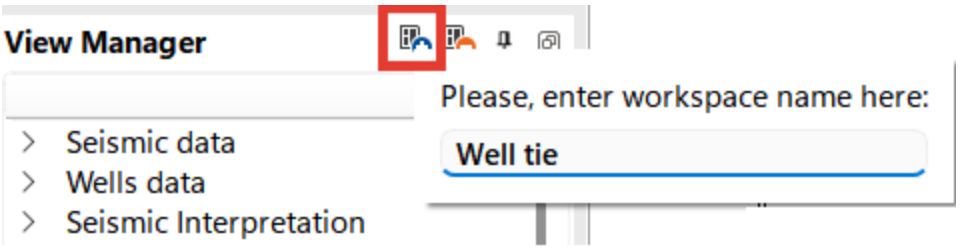
To create the synthetic curve, you need to specify the type of data that will be used in the process. In our scenario, we have both **acoustic (sonic)** and **density logs** available. To proceed, in the drop-down menus (highlighted in orange), select the appropriate curves that correspond to the available data:

- For the **Sonic** log, choose the curve labeled **DT**
- For the **Density** log, select the curve labeled **RHOZ**

Use anti aliasing filter we will set by default, checked.

Synthetic Seis Width allows you to define the width of the synthetic seismogram by specifying the total number of seismic traces to include. For our project, we will set this value to **1 trace** to generate a single synthetic trace.

To visualize the well-to-seismic tie process, start by creating a new workspace in the **View Manager**.



To display the tie, you'll need to include a **Location Map** where the wells will be displayed. As you choose a well with time-depth data, it will be visualized at Well tie View.

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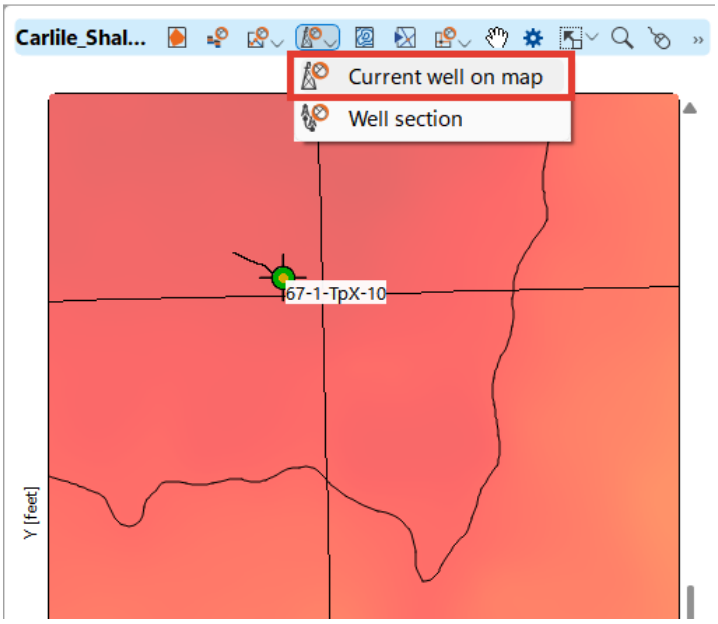
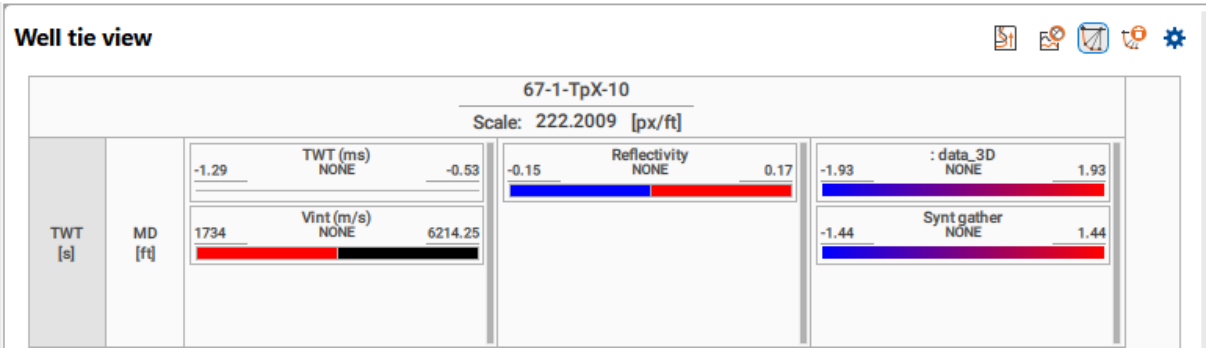


Following this, create a **Well Tie View** by clicking from the Well tie bar. This function is also available in Views Bar 36, choose the same button Well tie 172.

The default **Well Tie View** will open in front of you. Let's review and configure it.



The display consists of three tracks showing the following data:

- Two Way Time
- Interval velocities
- Synthetic trace
- A seismic section with the synthetic trace overlaid at the well intersection

You can also check all the settings in the Module Properties 91 panel.

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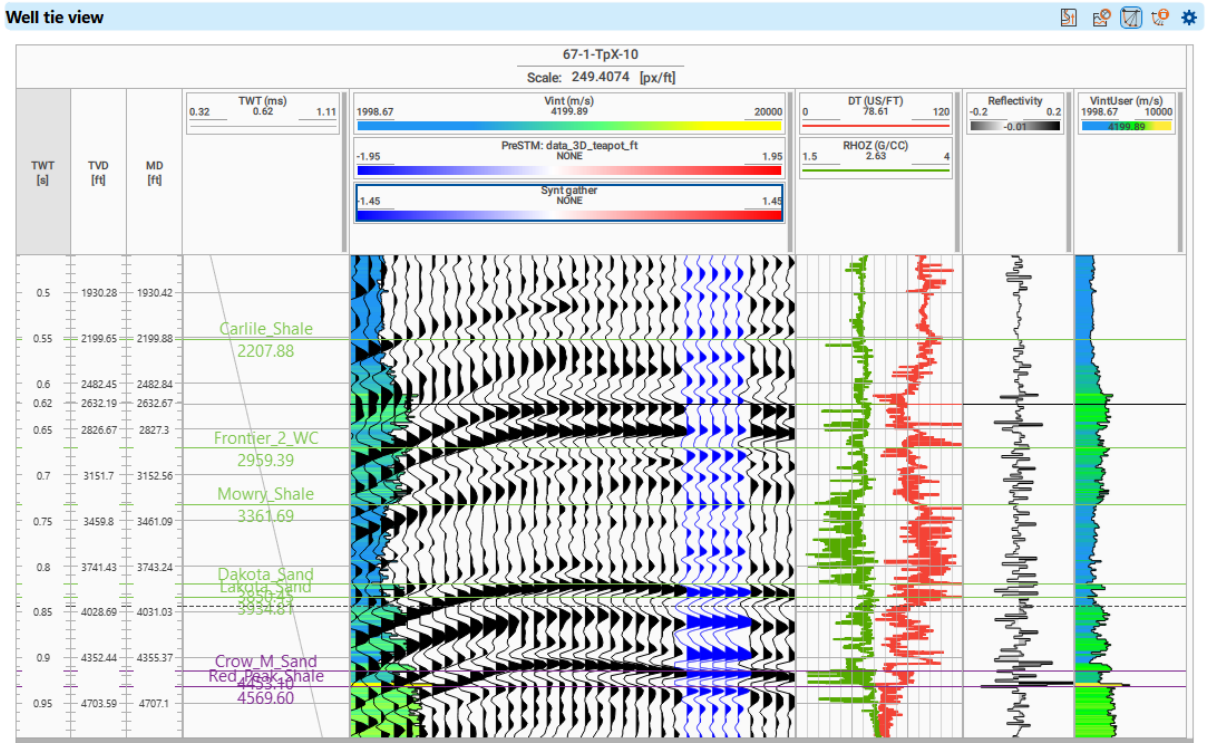
Let's configure the template and adjust it to a view that suits your preferences. The full settings description for **Well Tie View** are available here 172. The curve settings are similar to the settings in Well correlation 356

By right-clicking, you can access global settings, where you can easily add scales, such as TVD, which is especially useful for horizontal wells.

For this example, the seismic section was configured to display as wiggles, and the number of synthetic traces was adjusted for easy visual comparison. Markers were also visualized along with the well logs to enhance the interpretation.



To save the settings as a template, right-click in the well name field and select **Save Template**.

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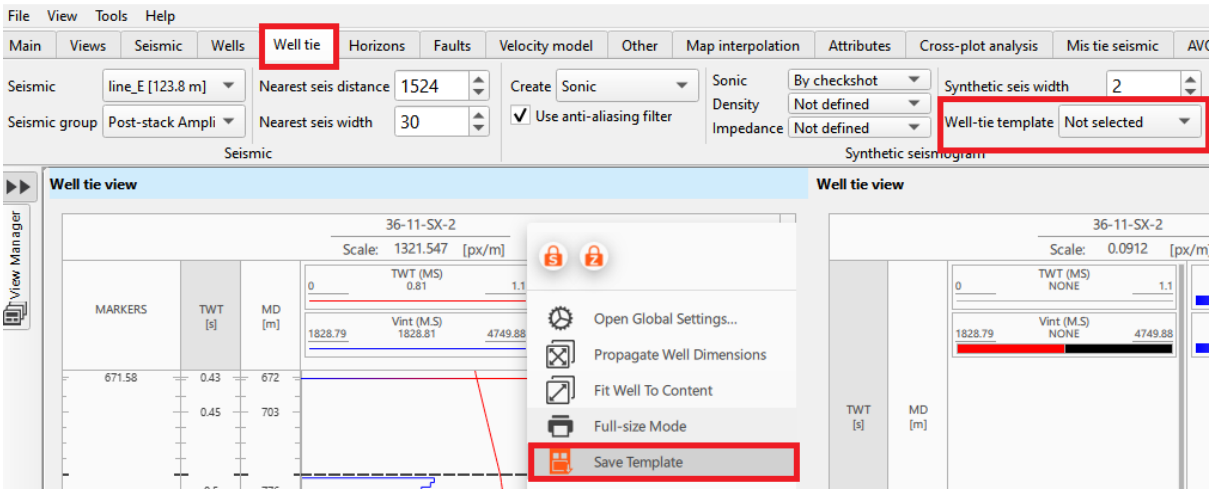
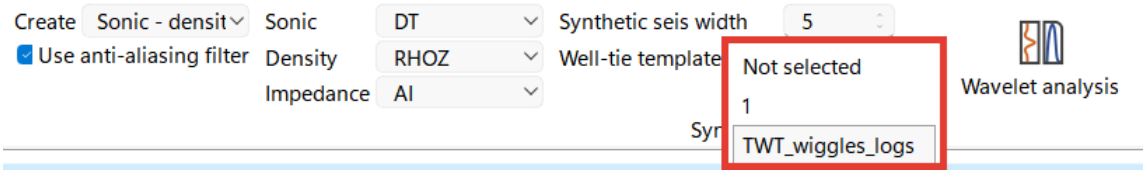


To apply the template, navigate to the **Well Tie Bar** and select the desired template from the drop-down menu.



The **Wavelet Analysis** option allows for the selection or extraction of a wavelet, which is used to generate the synthetic seismogram.

By default, the system uses a Ricker wavelet, but the user has three options for wavelet creation:

1. **Manual:** The user can design the wavelet by specifying parameters according to their specific requirements.
2. **Auto:** The wavelet is automatically generated using the input data, but the wavelet type remains Ricker.
3. **Detect from Data:** The system detects and extracts the wavelet directly from the input seismic data, allowing for a more customized wavelet that matches the actual data characteristics.

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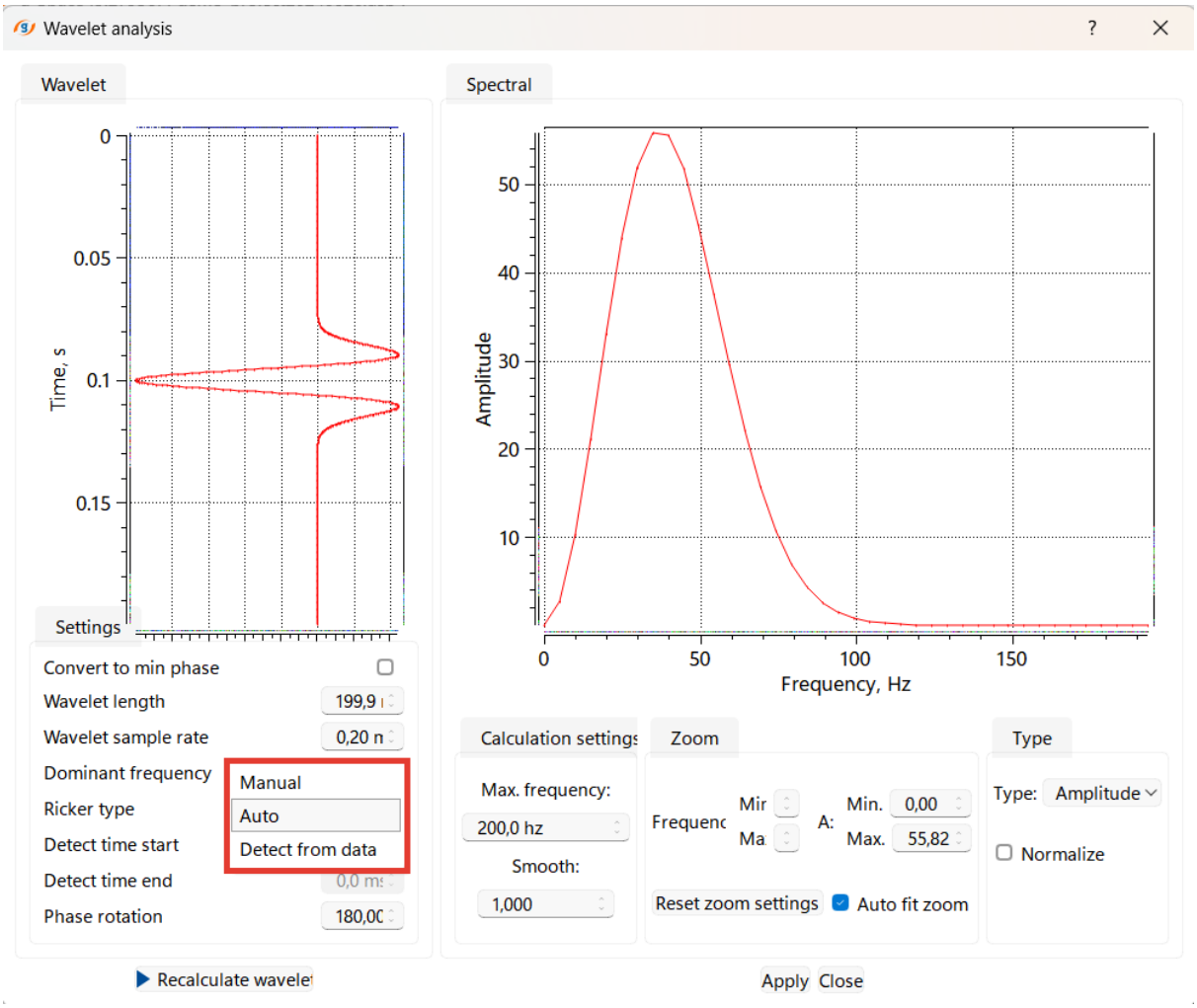

Additionally, users can save the synthetic trace to a LAS file for further analysis.

If the user makes any parameter changes in the wavelet analysis window then they should click on **Recalculate wavelet** and then on **Apply** and **Close** to commit the changes to get the updated wavelet and synthetic trace.

Cross-correlation section handles the cross-correlation process between the synthetic seismogram and the seismic data. It includes settings for the time range (start and end times) and the lag in the Well tie bar 62. The user can adjust these settings to optimize the match between the synthetic and seismic data.

Note

For accurate results, it is recommended to set the cross-correlation calculation window to at least 2-3 wavelet lengths.

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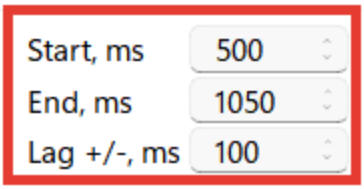

Let's move on to Seismic to Synthetic Comparison and Time-Depth Adjustment

Begin by identifying and matching known reference reflections between the seismic and synthetic data.

Activate the anchor change function. Then, select a reference reflection and double-click the left mouse button to place an anchor on it. Anchors act as tie points, allowing users to align the seismic data with the synthetic trace. Hold the left mouse button to drag and position the anchor at the desired interval.

For optimizing the correlation, use the auto-shift function, which automatically adjusts to achieve the maximum cross-correlation coefficient.

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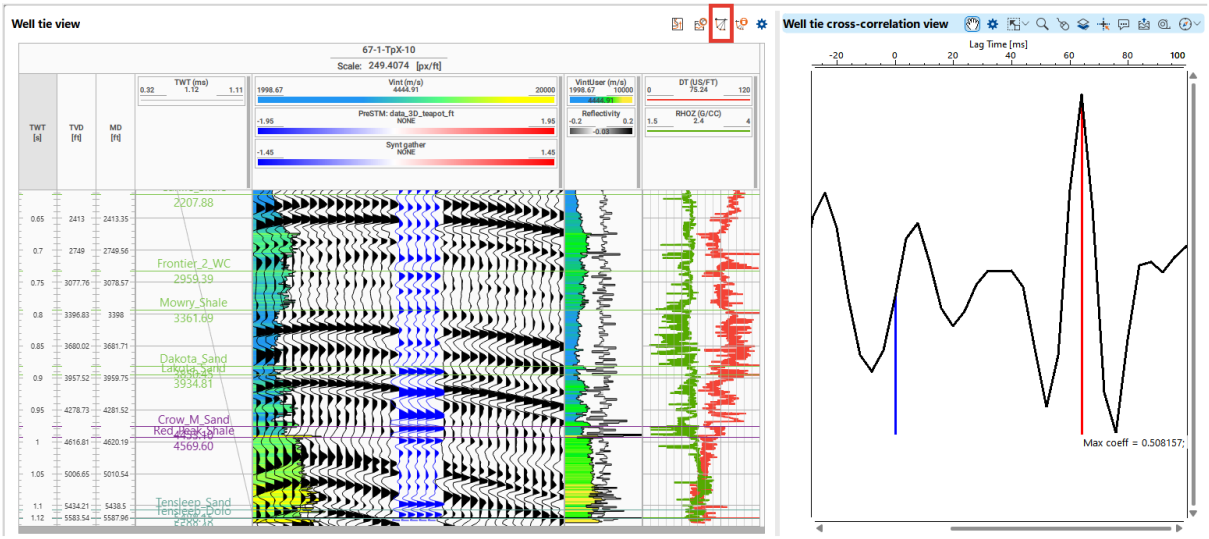

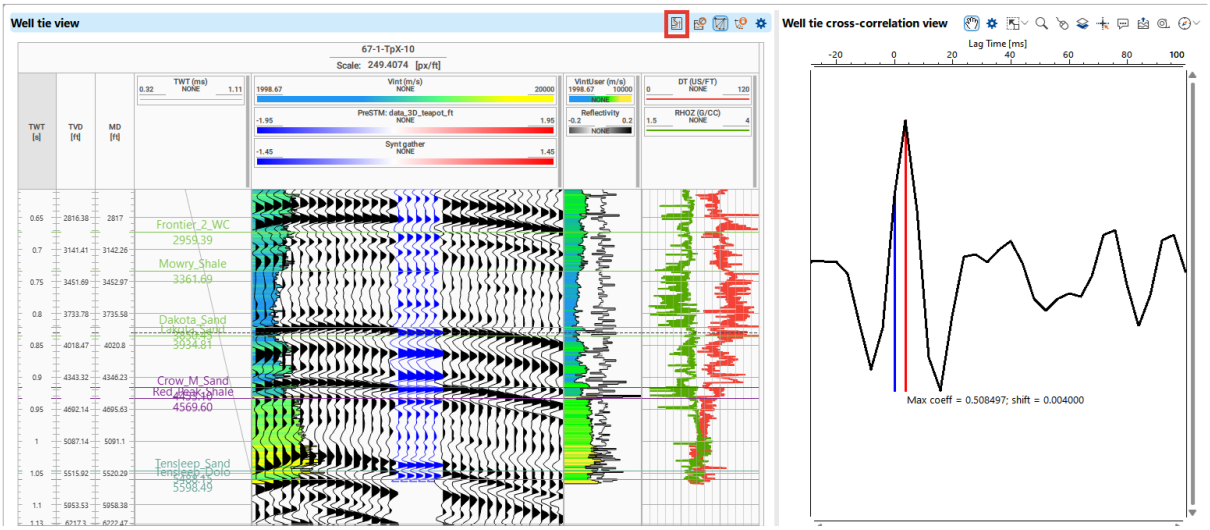

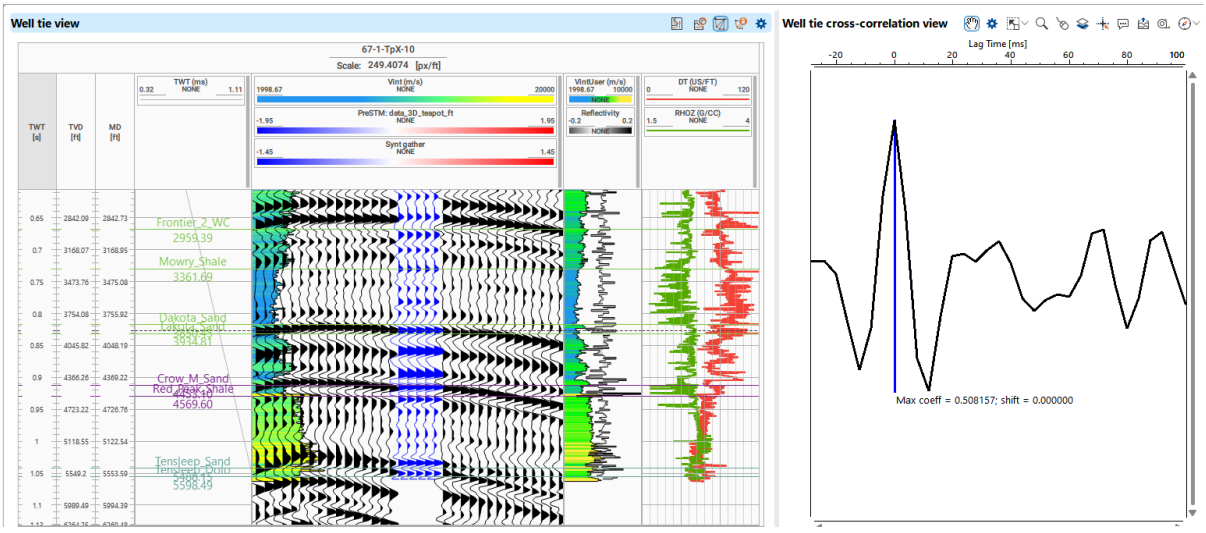

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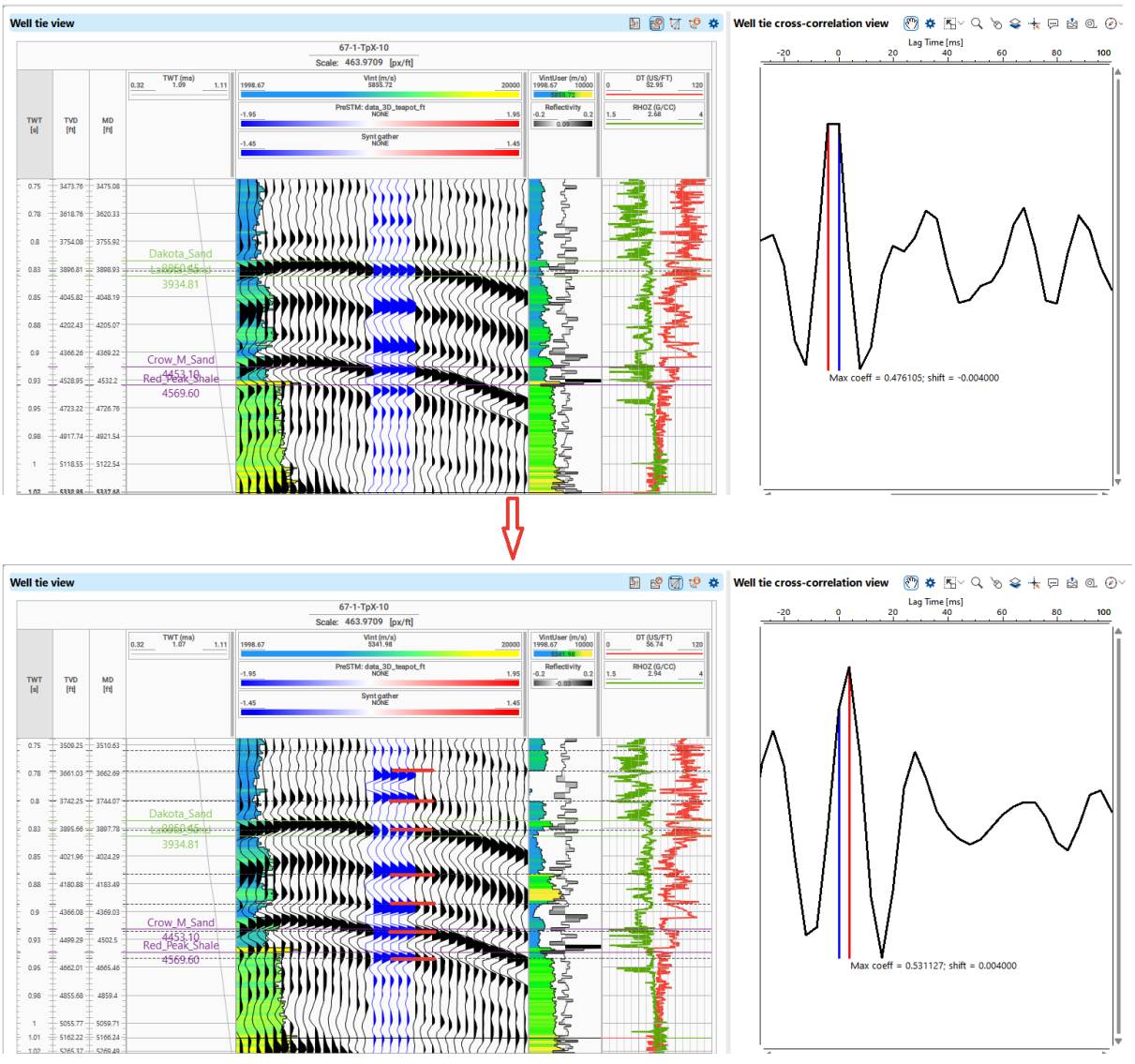
If you are working on a specific interval, we recommend reducing the correlation interval and placing a series of anchors over a larger scale. Visually inspect the alignment of key reflectors between the synthetic and the seismic trace. And correlate them by using anchors (highlighted in red on picture below).



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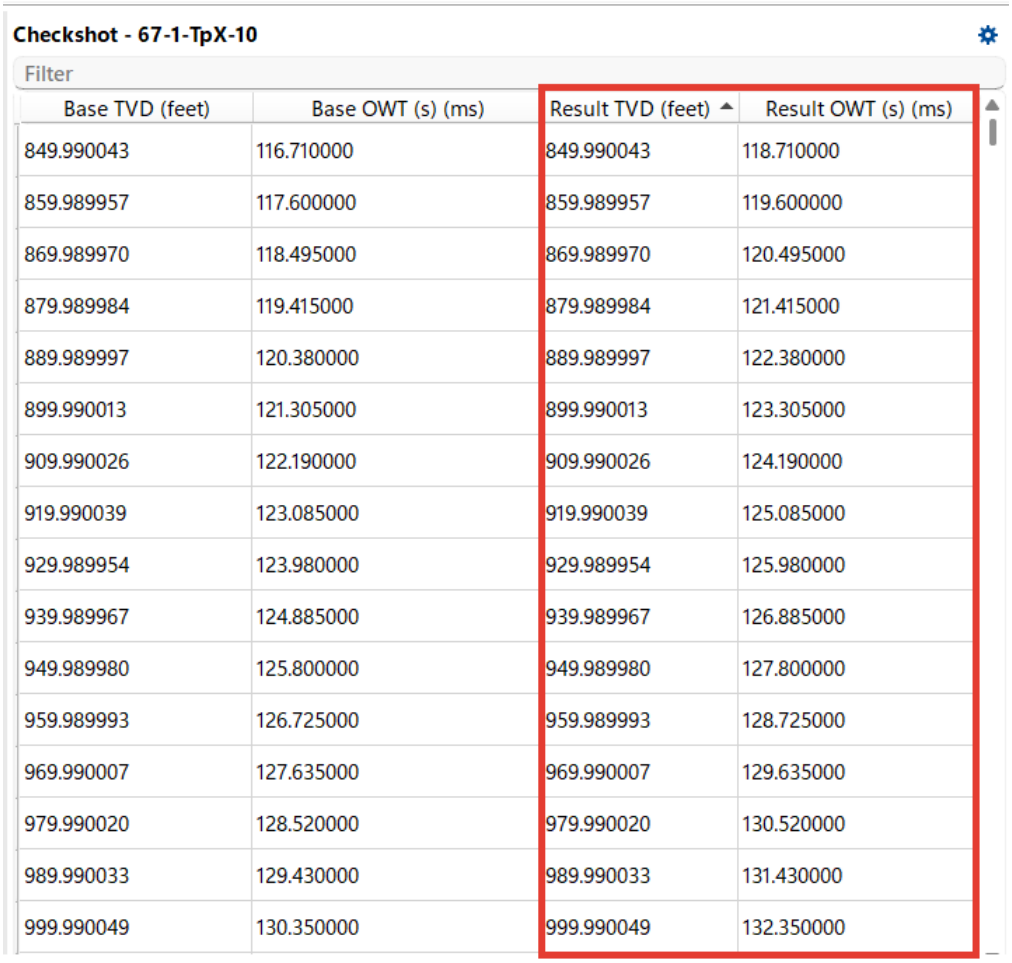
Note that as the curve changes, you see changes in the cross-correlation graph and in the time-depth table. There are two new columns for Result TVD and result OWT.



Checkshot - 67-1-TpX-10

Filter

Base TVD (feet)	Base OWT (s) (ms)	Result TVD (feet)	Result OWT (s) (ms)
849.990043	116.710000	849.990043	118.710000
859.989957	117.600000	859.989957	119.600000
869.989970	118.495000	869.989970	120.495000
879.989984	119.415000	879.989984	121.415000
889.989997	120.380000	889.989997	122.380000
899.990013	121.305000	899.990013	123.305000
909.990026	122.190000	909.990026	124.190000
919.990039	123.085000	919.990039	125.085000
929.989954	123.980000	929.989954	125.980000
939.989967	124.885000	939.989967	126.885000
949.989980	125.800000	949.989980	127.800000
959.989993	126.725000	959.989993	128.725000
969.990007	127.635000	969.990007	129.635000
979.990020	128.520000	979.990020	130.520000
989.990033	129.430000	989.990033	131.430000
999.990049	130.350000	999.990049	132.350000

To delete the current version of your checkshot, select **Remove All Anchors** from the top menu. This will also update the checkshot curve.

In g-Space, you can upload multiple checkshots. To perform a well tie, select the active checkshot in the Data Manager by double-clicking on it.

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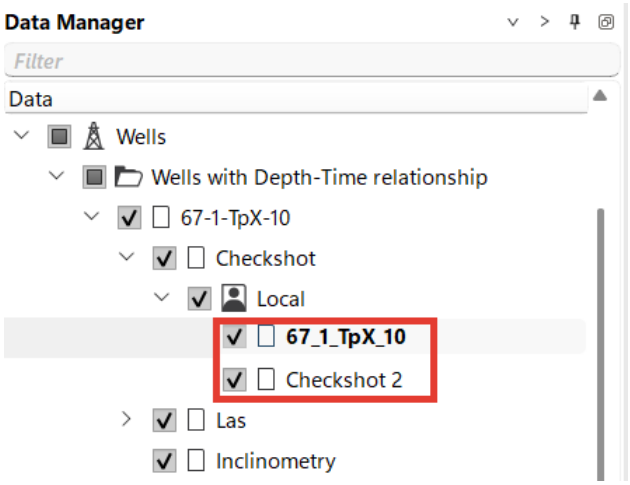

Creating a check-shot from sonic log

If the wells with Sonic logs are not loading for well-tie, please perform the following steps:

1. Create a new checkshot for this well in the Data Manager; make sure that this checkshot is active.

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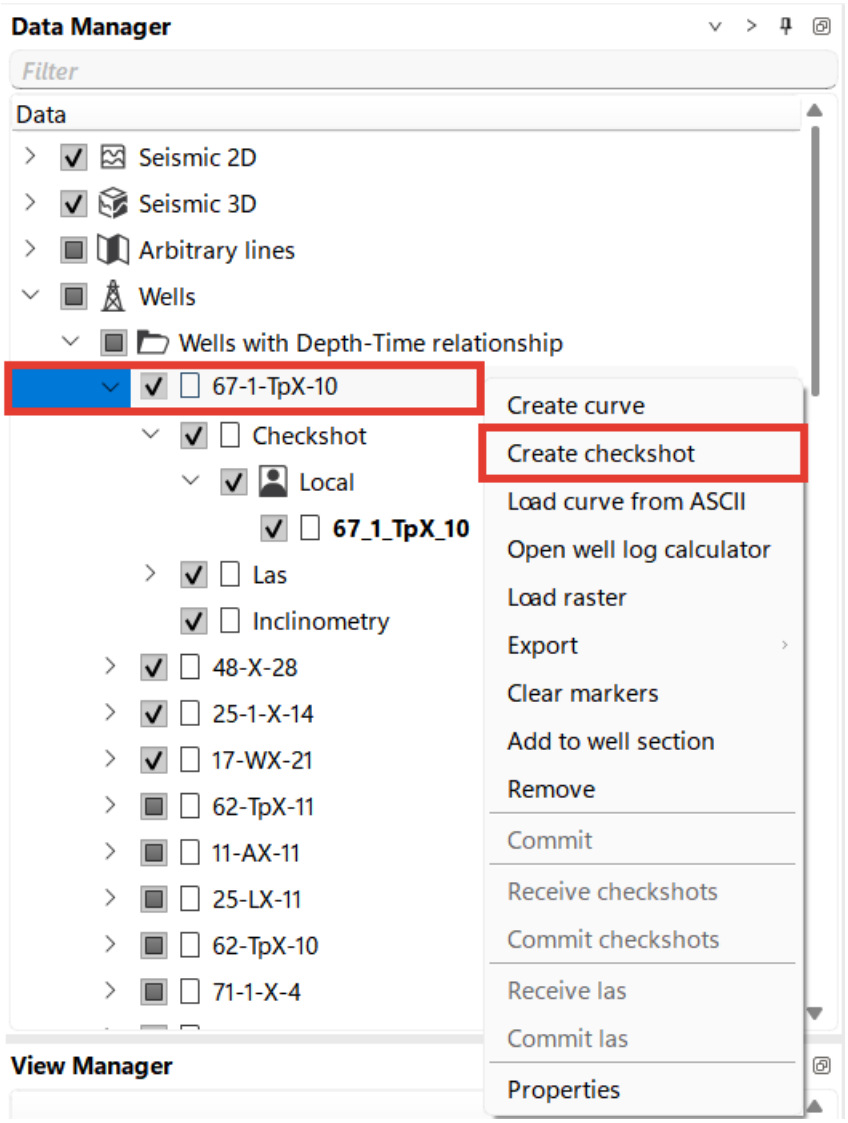

2. Go to **Location map** and select "**Current well on map**" icon

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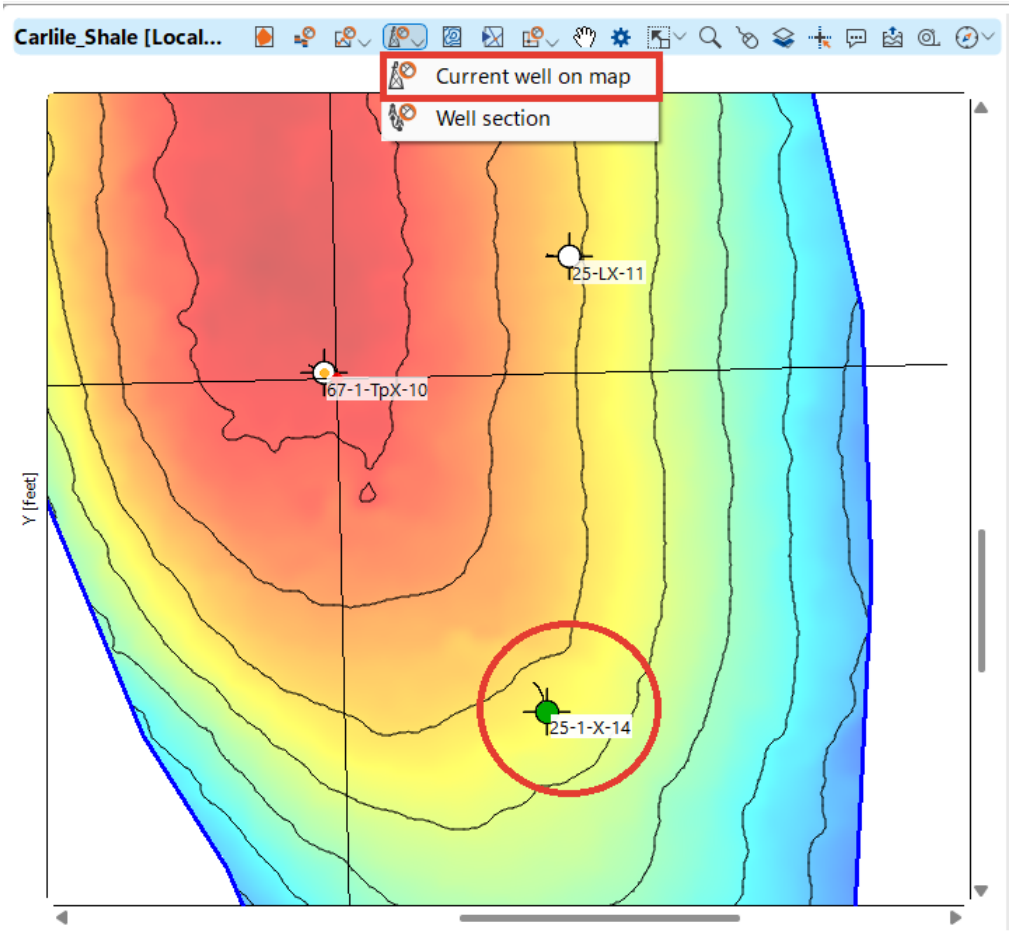

Click on the well and it will display a new window as shown below

Now set the curve corresponding to the sonic from the drop-down list, in our case **DT** log, and make sure the units are correct.

Set **Step** for checkshot and **First velocity value**

Notes

1. *The process of generating a checkshot from a sonic log involves using the sonic log data to estimate the travel time of seismic waves through the subsurface. A sonic log provides interval transit times (Δt), which is the time it takes for a sound wave to travel through a unit length of rock. By integrating these transit times over the depth of the well, we can calculate the cumulative travel time and create a synthetic checkshot.*
2. *However, the sonic log often does not cover the uppermost part of the well, leaving a gap in the data. In such cases, the user must manually set a velocity value for the first available depth in the log. This user-defined velocity serves as an approximation for the travel times through the upper layers that are not recorded in the sonic log.*

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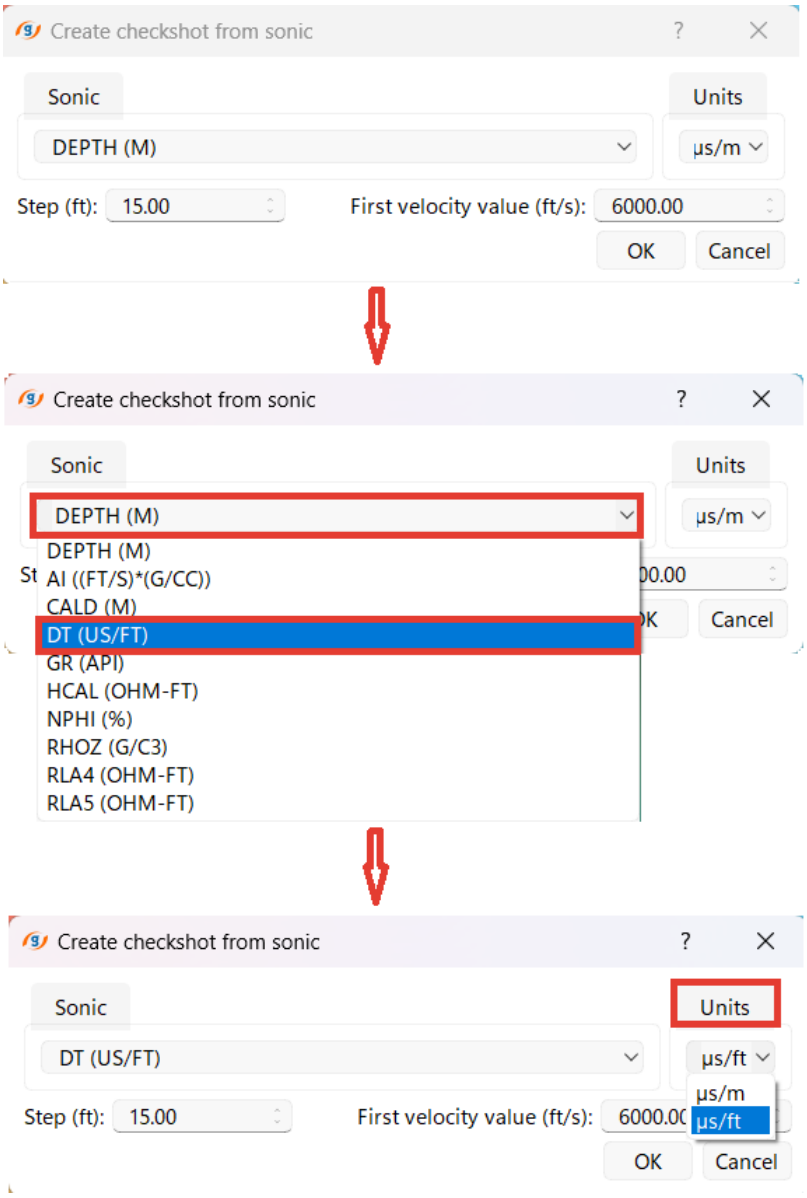

User can see the created checkshot in the well folder in the data manager and open it as a table

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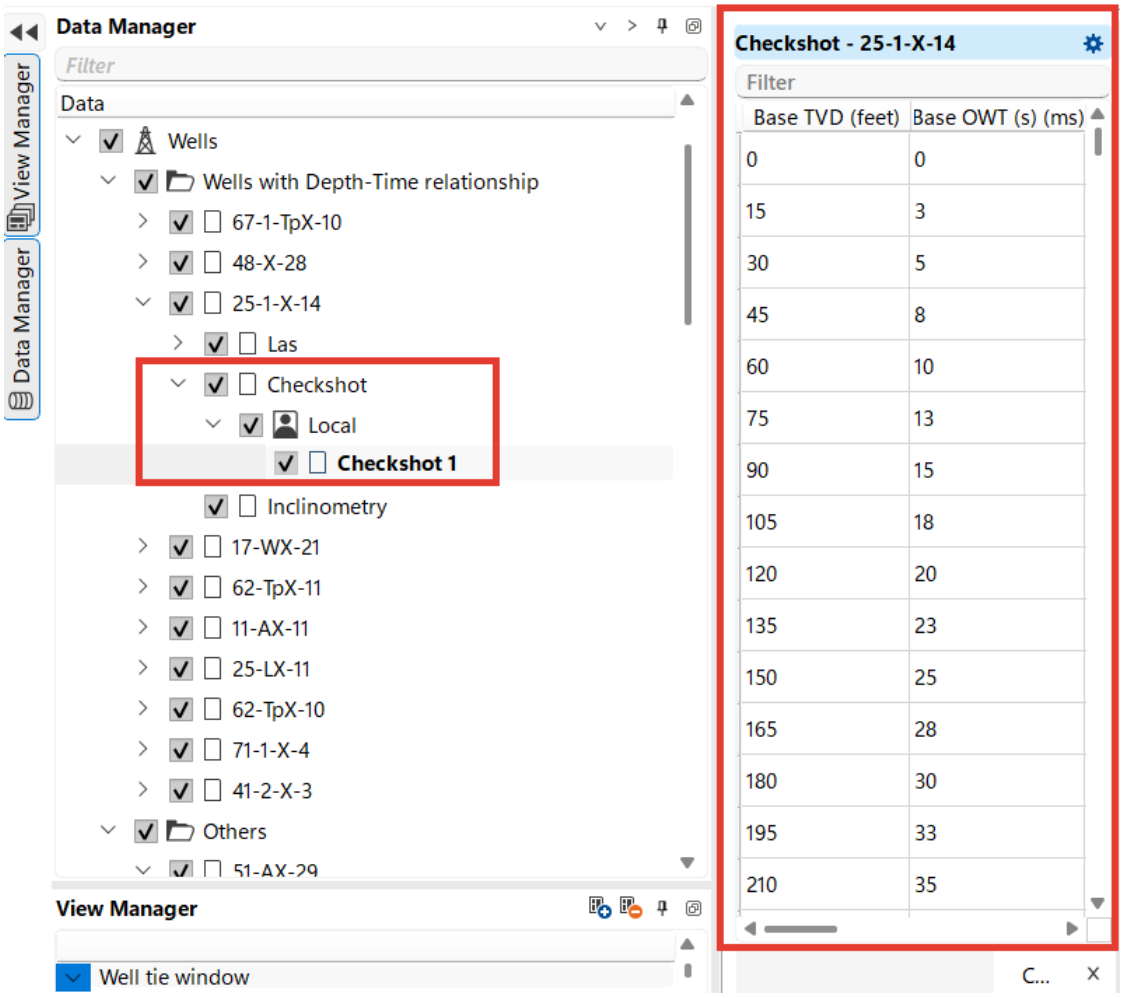

Once satisfied with the tie, finalize it by saving the synthetic seismogram and the adjusted Time-Depth curve.

Notes

1. *Datum Level Consideration. The datum level represents a reference point, usually the mean sea level or another fixed elevation, from which depths are measured. Ensuring that all wells and seismic data are tied to the same datum level is essential to avoid misalignments.*
2. *Understanding Different Data Scales and Resolutions. Be aware of potential mismatches in resolution when correlating seismic and well data. For example, subtle geological features visible in well logs may not be as apparent in seismic data.*
3. *Reviewing Log Data for Errors. Log data may contain errors, such as spikes, shifts, or inconsistent readings, which can lead to incorrect synthetic seismograms and false reflections. A thorough review of the log data by a petrophysicist is recommended before proceeding with the well-to-seismic tie.*

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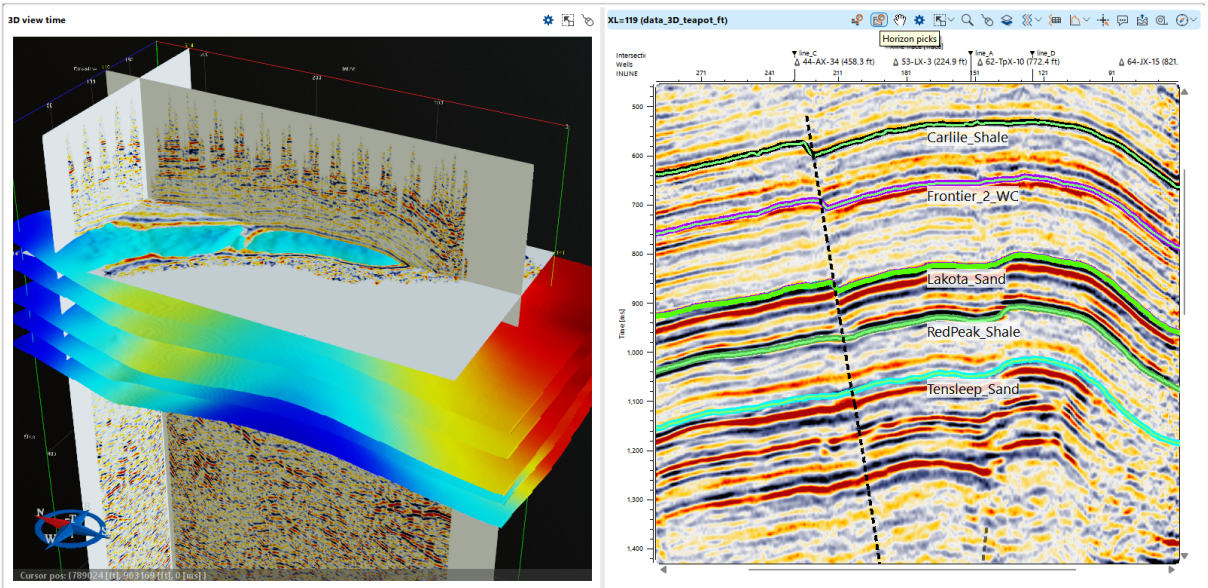
4. *Calibration with Checkshot Data. Always calibrate your well logs against checkshot data, if available. Checkshots provide more accurate time-depth information and help correct any discrepancies between the log-derived and actual time-depth relationships. Cross-verify the time-depth data with multiple sources, such as VSP (Vertical Seismic Profiling) data, to ensure consistency and accuracy.*

9.3 Seismic picking

The **Seismic Picking** in g-Space allows users to interactively select seismic features, such as horizons and faults, from both 2D and 3D seismic data.

In this guide, we will explore the various tools available under Seismic Picking using the 3D seismic volume and the 2D profiles from the Demo project.

Subscribe to our channel and watch the video on how to trace horizons in g-Space on YouTube



9.3.1 Seismic data visualization

Effective visualization helps in identifying and tracing geological features, which are essential for building accurate geological models.

In g-Space, several types of data visualization can be utilized, each serving a specific purpose in the interpretation process. These include 2D seismic 399 sections for detailed

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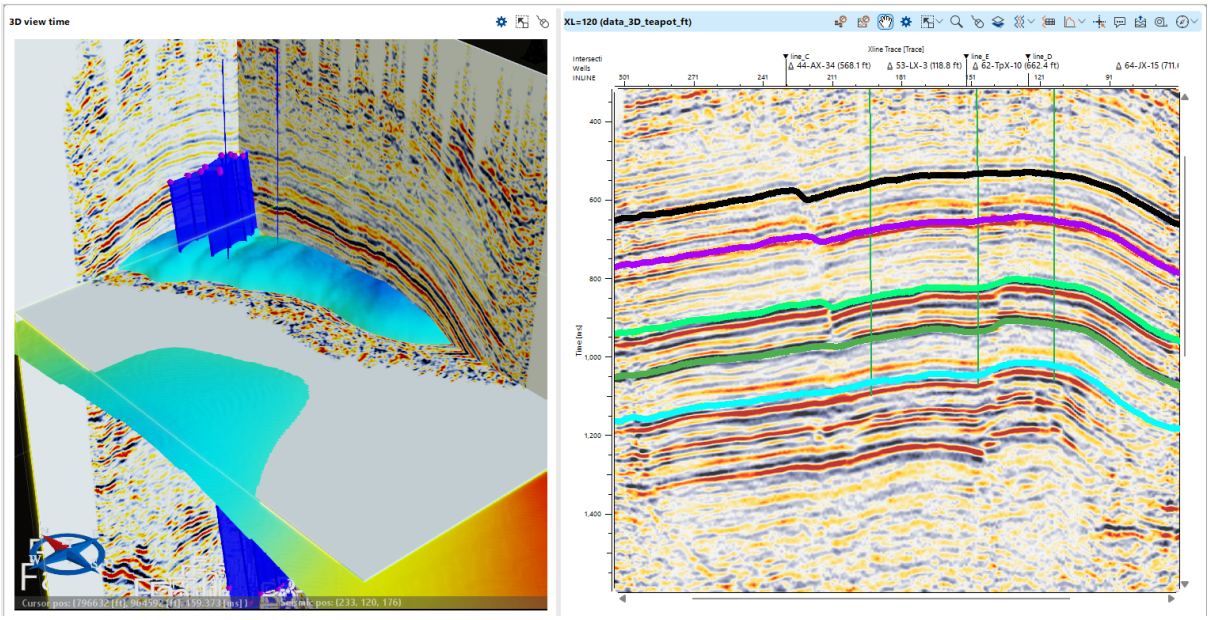
layer-by-layer inspection, 3D volumes 409 for a more comprehensive spatial overview, and attribute maps 68 that reveal specific characteristics such as amplitude or coherence anomalies.

The availability of multiple visualization modes in g-Space, such as interactive zooming, rotation, and filtering, enhances the user's ability to accurately interpret seismic data. Users can switch between these views through the View Manager 90, enabling seamless navigation and analysis across different data types. This flexibility supports both large-scale structural analysis and finer-scale reservoir characterization.



When tracing horizons, use the flattening feature in g-Space to align your seismic data along a selected horizon. This makes it easier to identify continuous features and avoid misinterpretation.

Remember that seismic data can sometimes contain noise or artifacts. Use filters and attribute analysis to enhance the clarity of your data before making final interpretations.

Notes

Without effective visualization, it is challenging to interpret complex seismic datasets, as the relationships between geological features can easily be overlooked.

Visualization also plays a role in attribute analysis. Seismic attributes, such as amplitude, frequency, or coherence, provide additional insights into rock properties and

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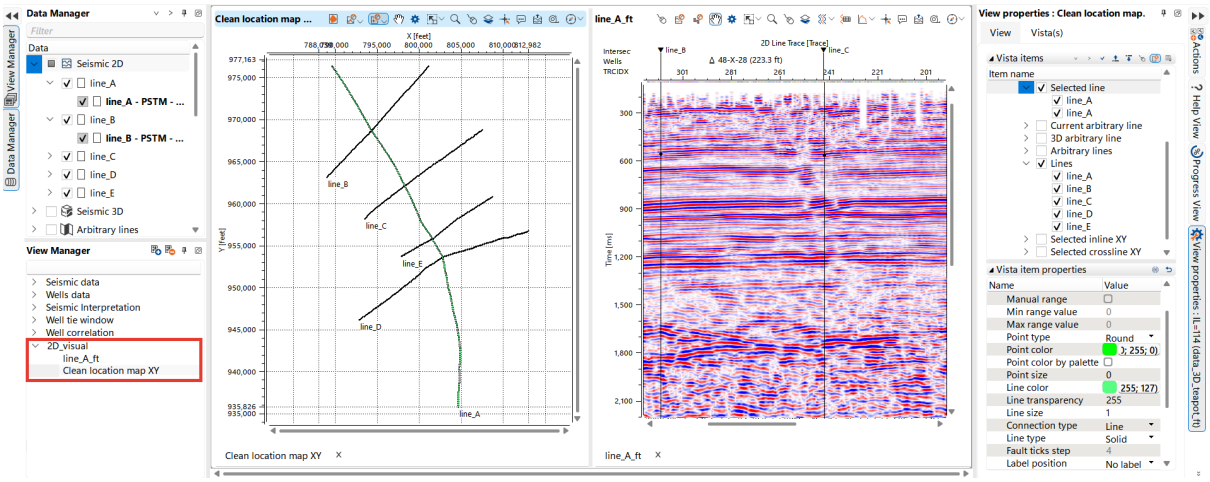
fluid content. Displaying these attributes in visual formats, such as attribute maps or color-coded 3D volumes, allows interpreters to analyze subtle changes in the seismic response, leading to a more detailed and accurate geological interpretation.

In g-Space, these theoretical principles are put into practice through tools that support dynamic data manipulation, real-time updates of seismic displays, and interactive exploration of multi-dimensional datasets.

9.3.1.1 2D data

2D seismic data can be visualized in g-Space both on a section or within a 3D window, depending on the interpretation needs. Let's explore how seismic data is displayed in section and review visual settings that aid in picking geological horizons, faults, and other subsurface structures.

In this example, a workspace is prepared in View Manager 90 to visualize 2D seismic profiles. The workspace consists of a *Location Map* window on the left and a *2D Time Section* window on the right. These windows are synchronized for seamless interpretation. The active profile is highlighted in green, and you can easily switch between different seismic profiles, which are visualized both on the map and as seismic sections.



Users can control the appearance of the seismic lines and points by adjusting their properties in the View Properties 101 panel. Below is an example of a visual setup of a seismic section.

Click on ⚙ and the Panel View Properties will be opened.

There is a list of data that can be visualized in the View. Here, we have shown 3D horizons and fault interpretations on 2D data. You can set a familiar color palette for seismic visualization by clicking on the seismic data, and the settings will be available below in **Vista Item Properties**.

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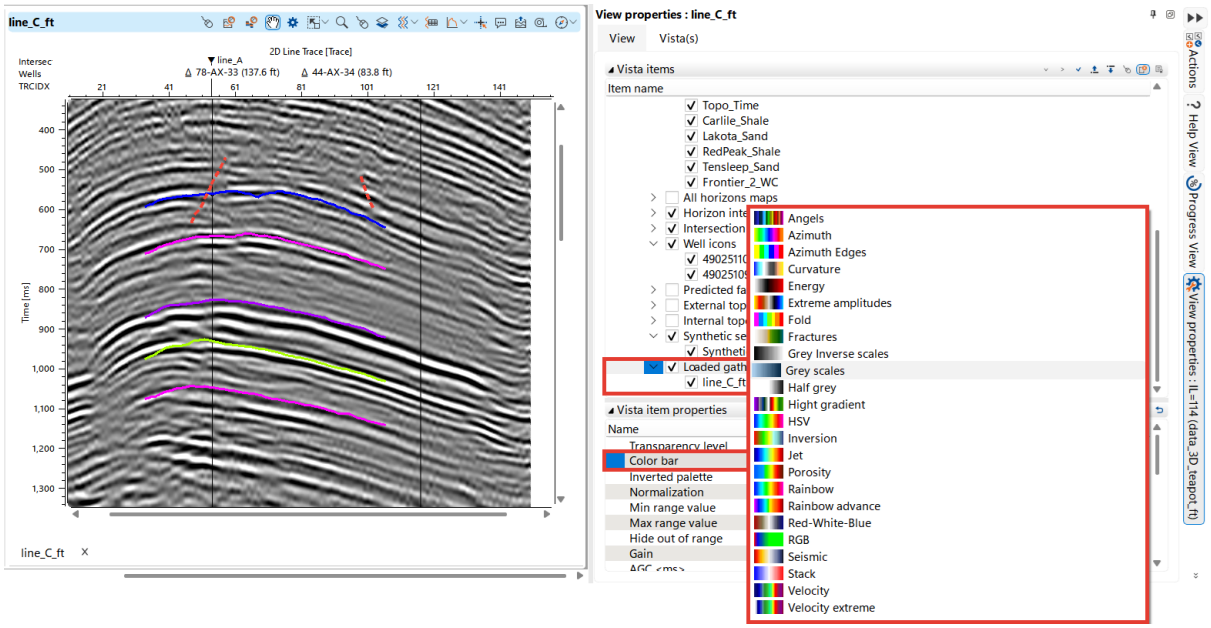
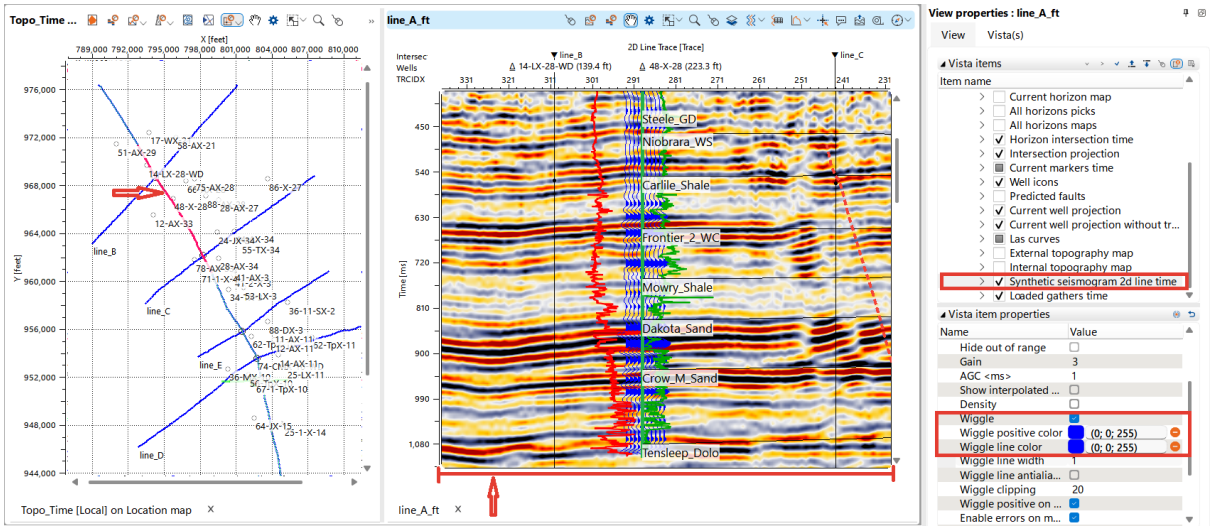


The example of well data visualization on a seismic section in the image below shows the well trajectory, log, synthetic trace, and markers. You can adjust the fill and line colors, the thickness of the synthetic trace, choose to display it as wiggles or in color, and modify the amplitude for the most effective visualization.

The part of the 2D line displayed in the seismic section is highlighted in red on the Map View.



The user has the option to display all logging curves or select specific ones. Settings can be adjusted for all curves by clicking on **Las Curves**, or for individual curves by clicking directly on the curve name.

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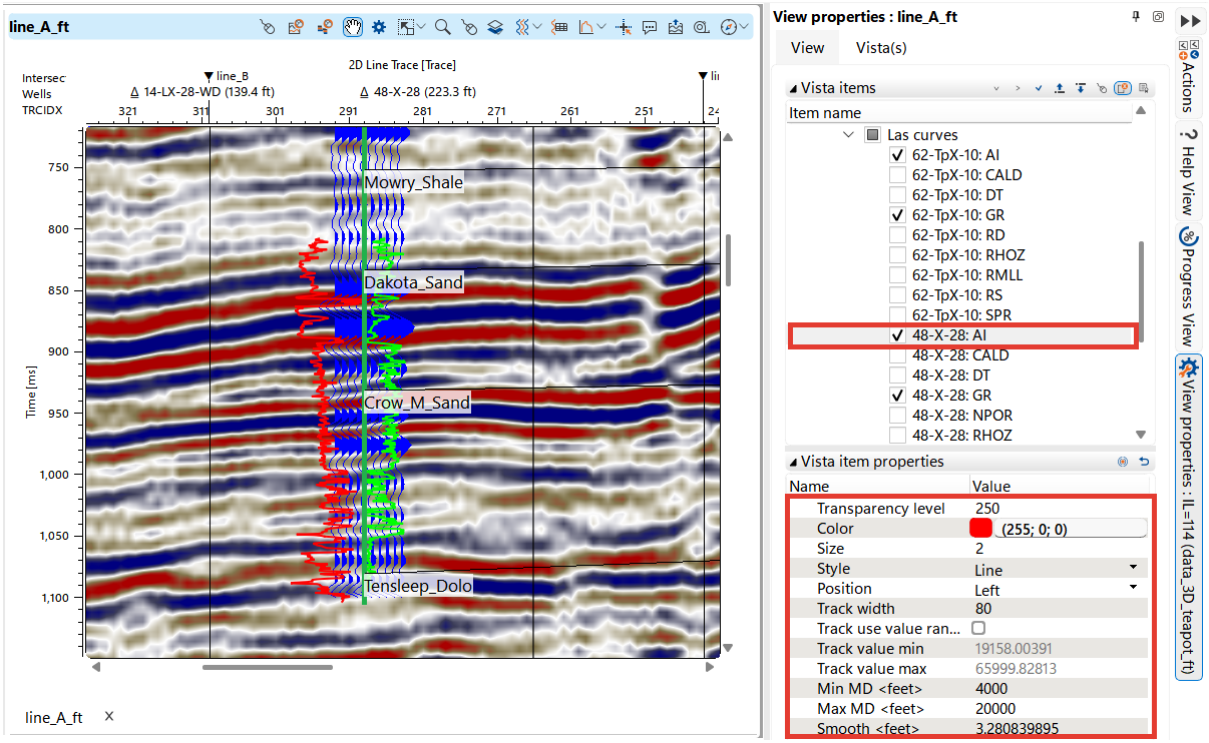
In this image, the Acoustic Impedance and Gamma Ray curves have been customized with selected color and thickness, are displayed to the left and right of the well trajectory, and have their tracks width and depth interval modified. Additionally, transparency settings and minimum and maximum value adjustments are available.



Using the **Arbitrary Line** Tool in g-Space

Arbitrary Line is particularly useful in the following scenarios:

- **Comparing 2D and 3D Data:** This tool is essential for comparing and assessing the quality of different seismic surveys. By creating custom lines that traverse both 2D profiles and the 3D seismic volume, users can directly compare the resolution and continuity of seismic reflections, leading to a better understanding of the subsurface.
- **Correlating Wells:** The arbitrary line is helpful for correlating wells, especially when you need to understand the structural and lithofacies features of the interwell space. By drawing a line that connects multiple wells, you can visualize how stratigraphic horizons and structural features change between wells. A detailed description is available in the 3D Data 409 chapter, as these tasks are most commonly handled with 3D data.

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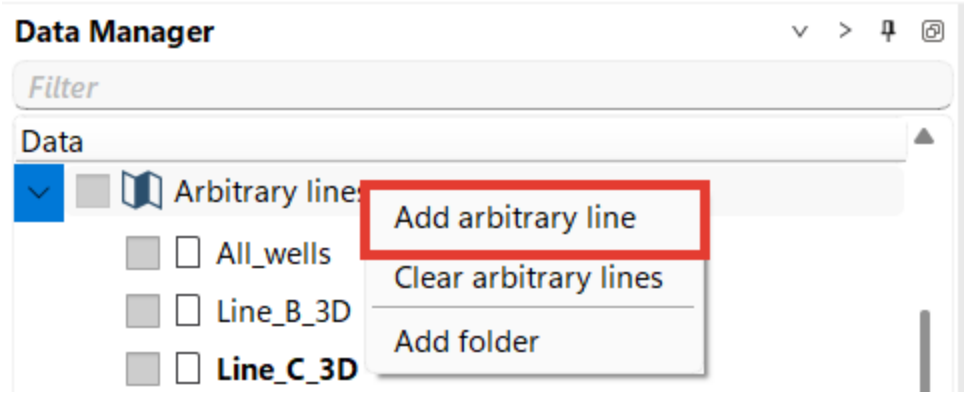
- **Tying Directional Wells:** When dealing with directional or deviated wells, the arbitrary line allows you to create cross-sections that follow the wellbore trajectory. This aids in accurately tying the well data to seismic data, ensuring a more precise integration of well and seismic interpretations.
- **Analyzing Geological Structure:** For fields with complex geological features, such as the anticline fold in the Demo project, the arbitrary line tool is particularly useful for analyzing geological structures both along and across the fold axis. Given that the fold has a curved structure relative to the geometry of the seismic survey, arbitrary lines enable a more flexible and accurate examination of the fold's features, which might not align with standard seismic lines.

Notes

Use the Arbitrary Line tool to investigate complex geological structures that might not be apparent on standard inline or crossline sections.

To create an **Arbitrary line** from 2D profile segments, follow these instructions:

In Data manager click on Arbitrary lines folder and choose **Add arbitrary line**, a pop-up will open, name the line



In the **View bar** select **Time**, then **Arbitrary line**. Now there are two Views in Workspace - **Location Map** and empty **Arbitrary line view**.

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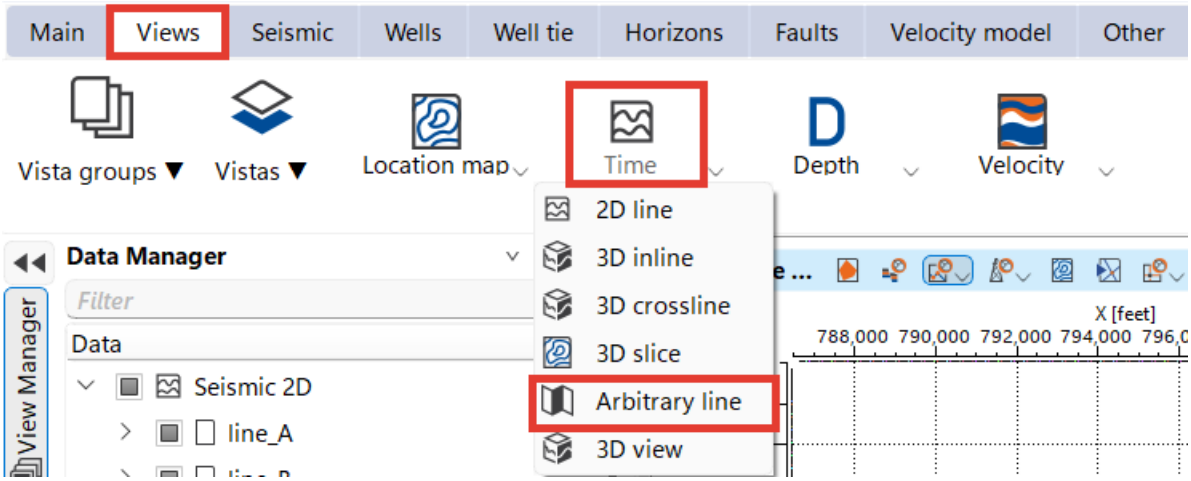
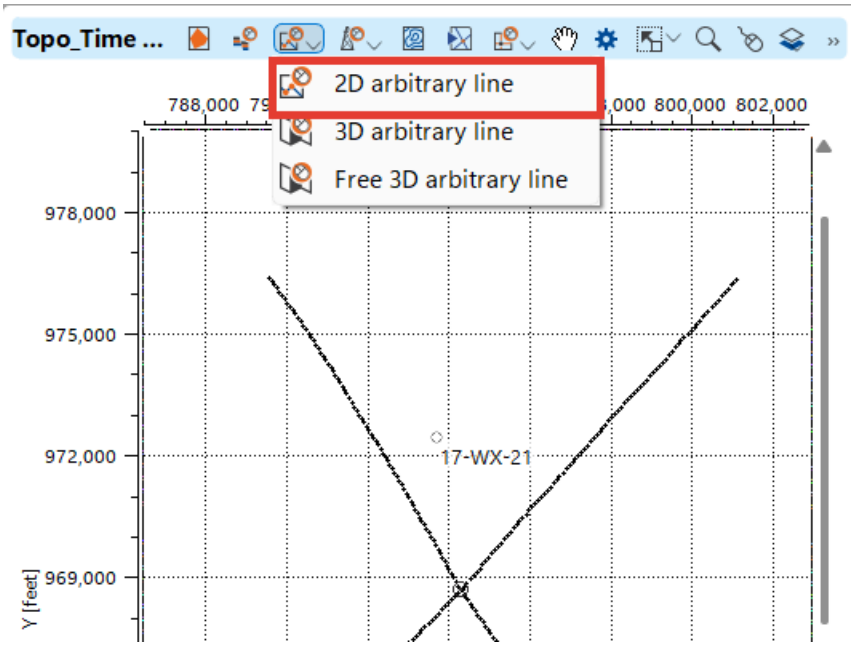


On Map View click Arbitrtary line and choose 2D arbitrary line.



The cursor will change to an active cross. By clicking on the desired 2D line segments, the user will create the geometry of the arbitrary line.

To complete the curve creation, double-click the left mouse button at the last point.

To remove a point from a created arbitrary line, select it by holding down the right mouse button.

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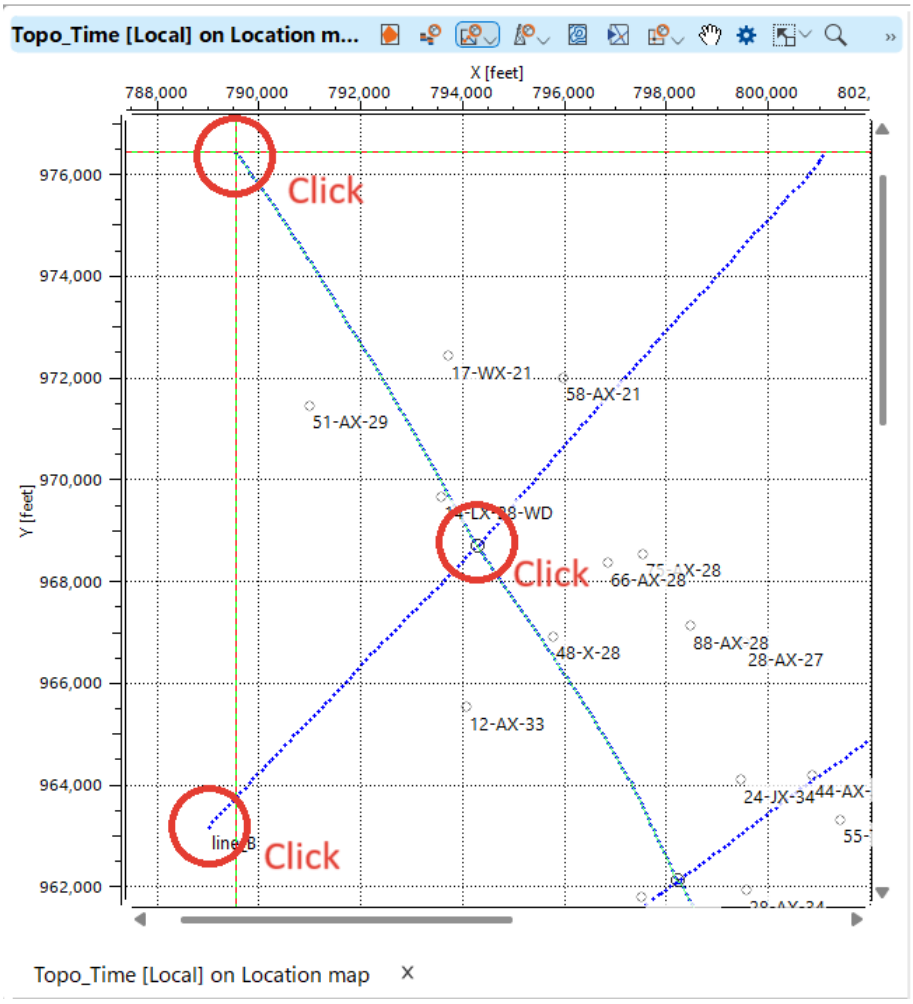

A new arbitrary line will be created, you will see it both on the **Map** and in the **Arbitrary line** window, the visualization settings can be set in the View Properties, in the case below the name of the line is added as well as a color is set.

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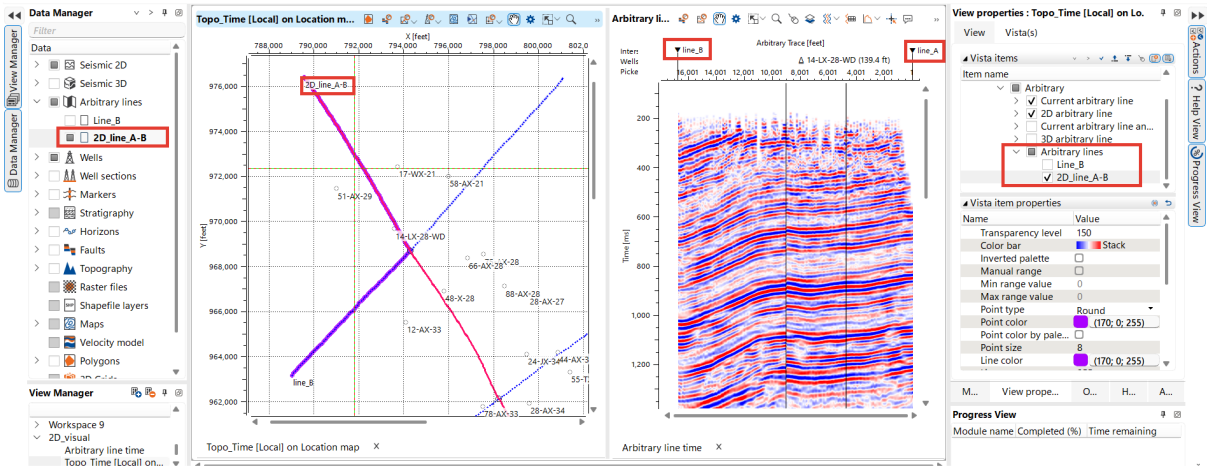
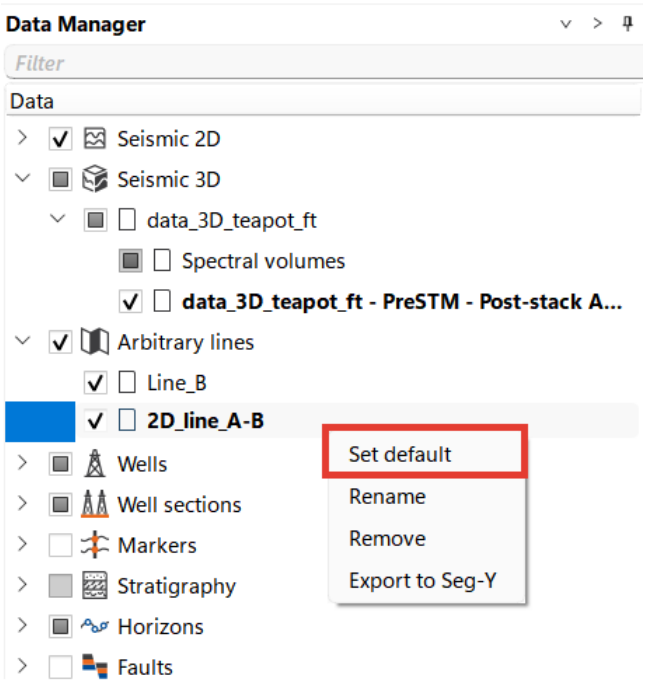


For comparing 2D and 3D Data, make the 2D Arbitrary line (or profile) active in the Data Manager.



Create 2 Arbitrary lines, go to **Views** - **Time/Depth** scales, then choose **Arbitrary line**.

Next, right-click on the 3D dataset you want to visualize and select **Show on Active View** from the drop-down menu.

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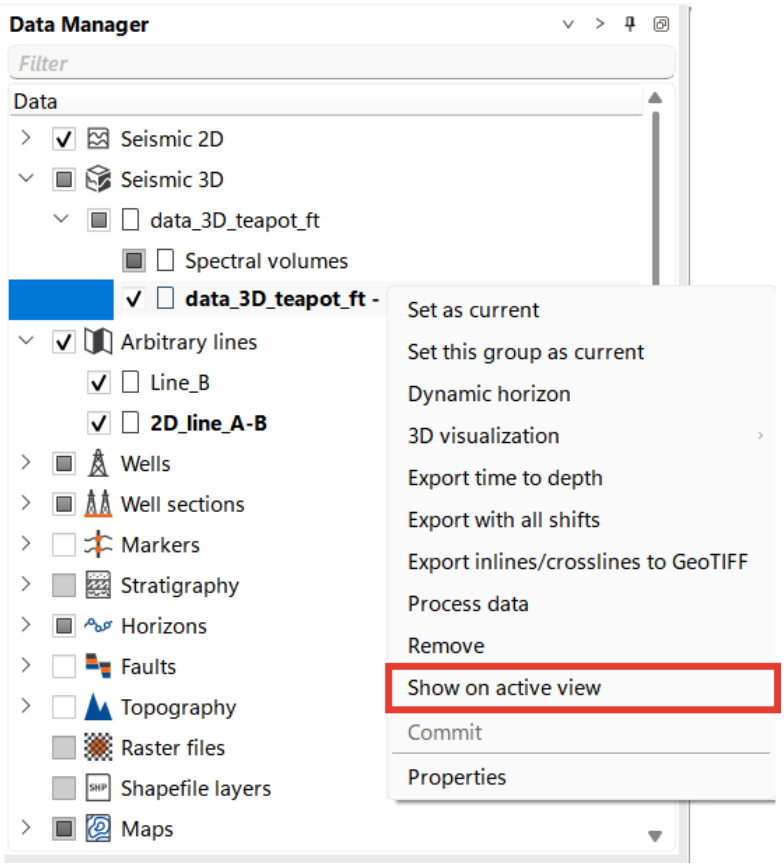
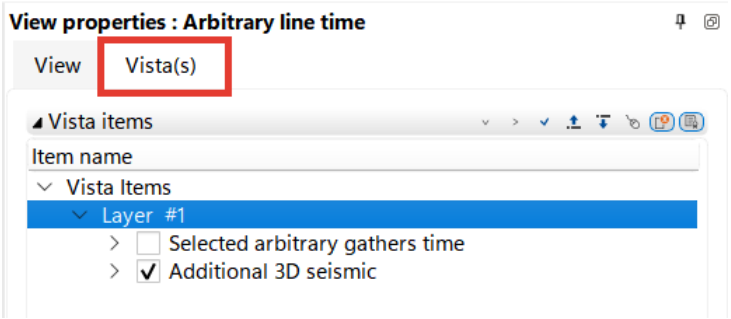


Open the View properties for the Arbitrary line. In the **Vista(s)** tab, select Arbitrary line (2D data at the example below) for one Arbitrary line View and **Additional 3D data** for the other view, respectively.



A full description of the settings can be found in Seismic View 130

To synchronize views, go to the Main bar and click SyncViews. Additional settings are available in the drop-down menu.

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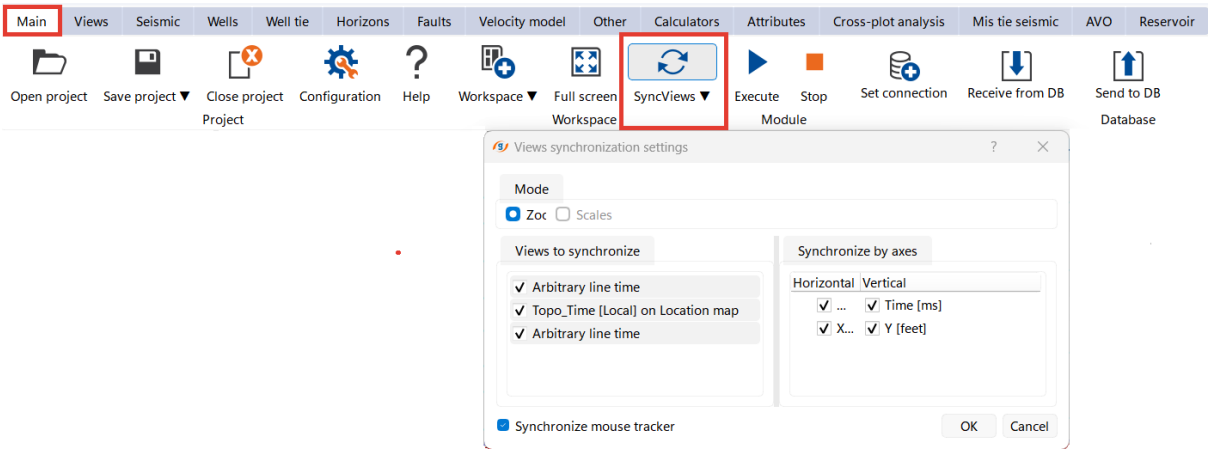

You can now visualize and compare the generated arbitrary lines. In our example, the image below illustrates the comparison results.

This visual comparison helps highlight how arbitrary lines drawn from 2D and 3D data can show differences in the continuity and resolution of seismic events. It's important to analyze both representations to better understand the subsurface geology.

*The **2D data** appears smoother with well-defined reflectors, especially in the shallower section. The reflectors are more continuous.*
*The **3D data** in the lower section shows greater variability and more detailed structure, which is common for 3D seismic data, as it provides additional subsurface information.*

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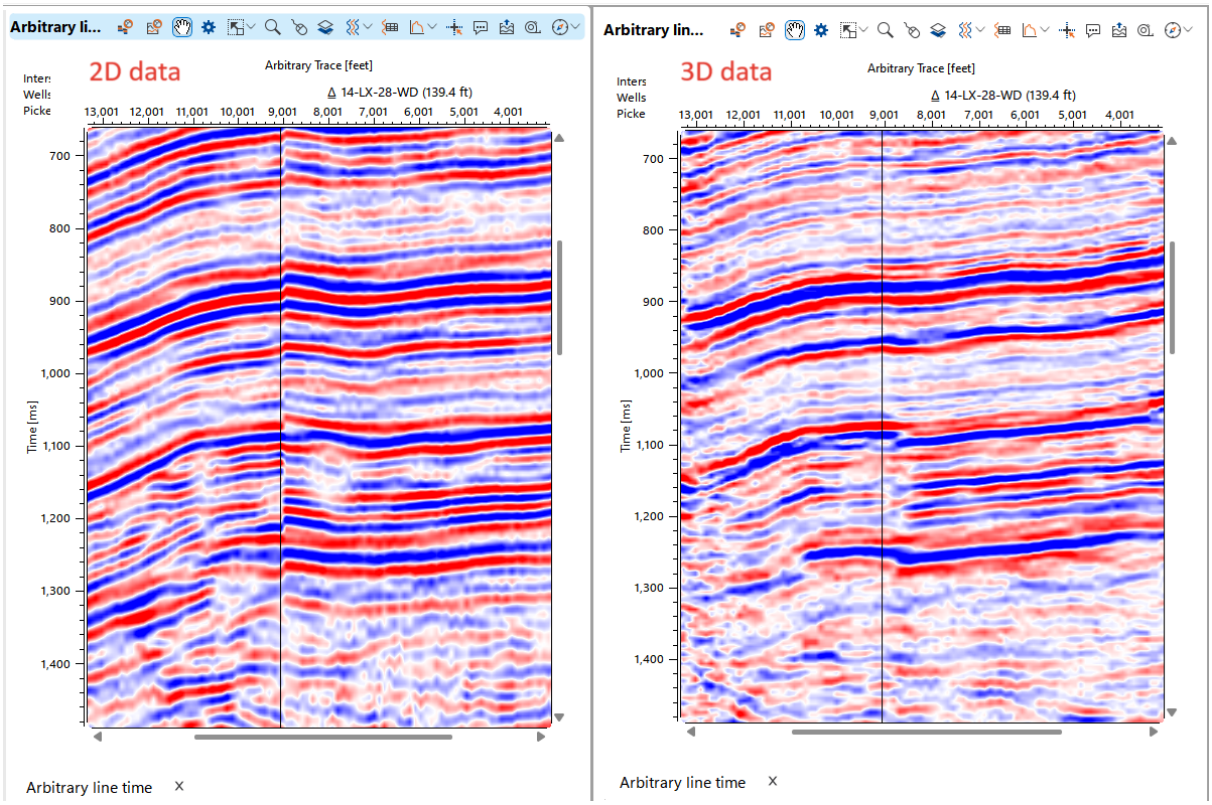

To display 2D profiles in 3D, select 3D view[133] in time or depth scale depending on your data.

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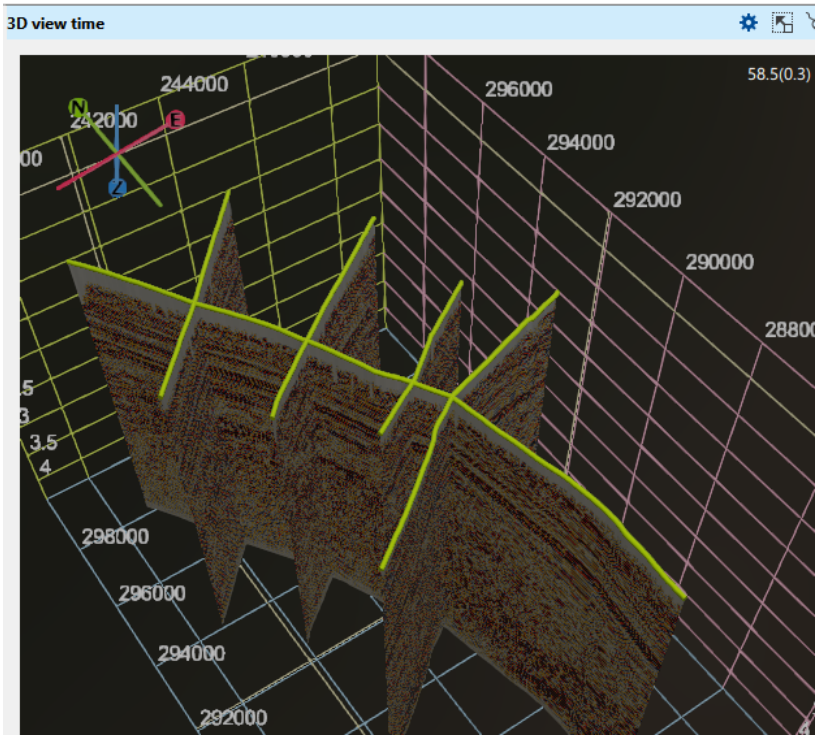

A full description of the settings can be found in 3D View 133

9.3.1.2 3D data

3D seismic data can be visualized in g-Space both on a section or within a 3D window, depending on the interpretation needs. Let's explore how seismic data is displayed in section and review visual settings that aid in picking geological horizons, faults, and other subsurface structures.

To create a 3D view, go to the Views 123 in the Ribbon Bar 33, select a Time or Depth scale and a 3D view.

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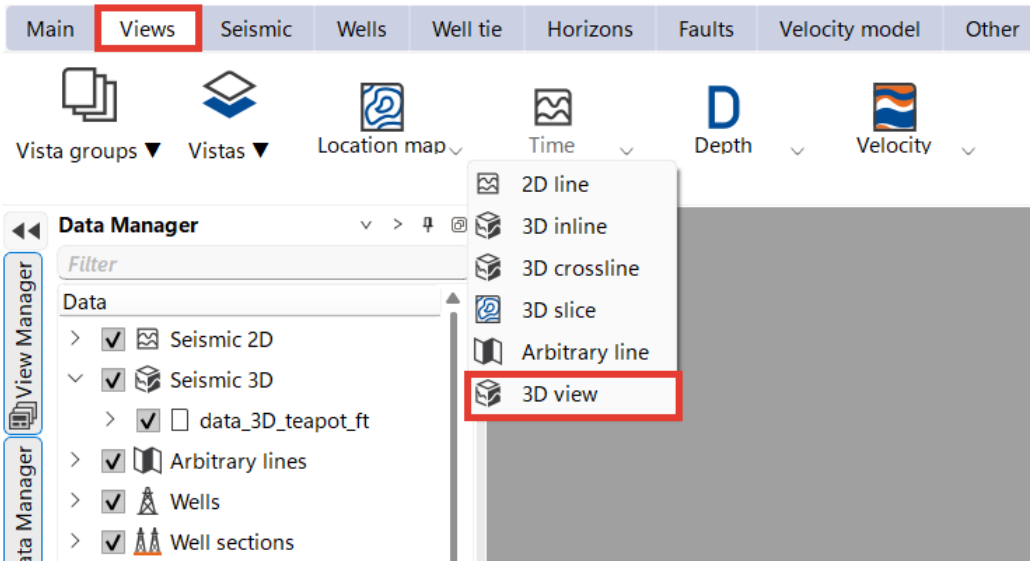
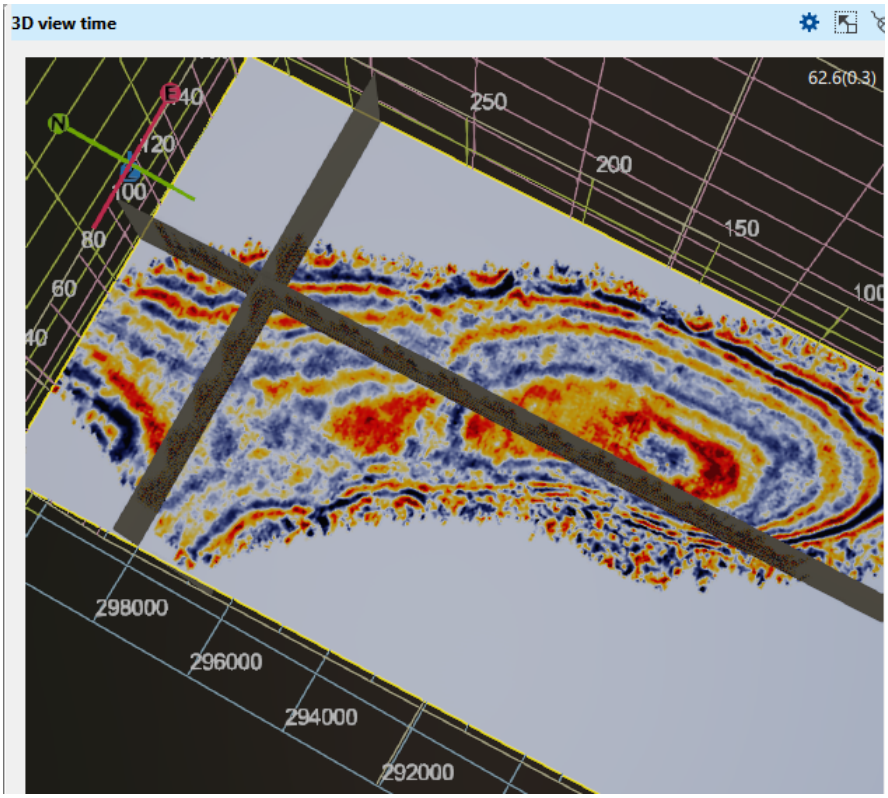


By default, all the data of your project will open in the new 3D view. To turn off visualization, uncheck the boxes in the Data Manager[86] (highlighted in red).

You can view an entire 3D volume or seismic sections and time/depth slices in 3D View.



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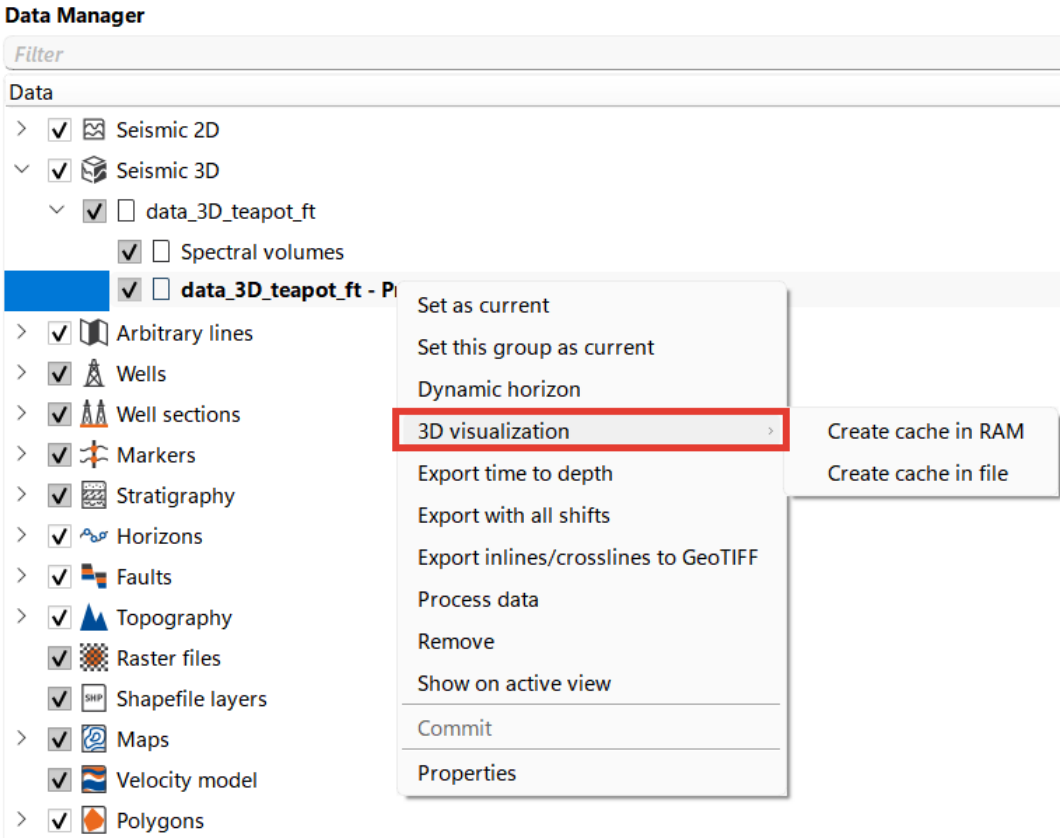
Right click on the 3D volume you want to display, select **3D visualization** and create a cache for it in a RAM or file. You can find detailed explanation which path to choose in 3D View 133



Within the **View Manager** (highlighted in orange) users have the capability to construct a customized workspace by combining multiple views.

The highlighted blue **Workspace** displays active views. To add a desired view, navigate to the Views 123 in the Ribbon bar. To close a View, click on the 'x' at the bottom of the view next to its name and confirm your choice.

On the right-hand side, you can find the Settings area. For each active element in the Data Manager, its visualization settings will be displayed in the View Properties 101. To switch to another object, click on it in the **Data Manager**.

Detailed settings and Hot keys described in chapter 3D View 133

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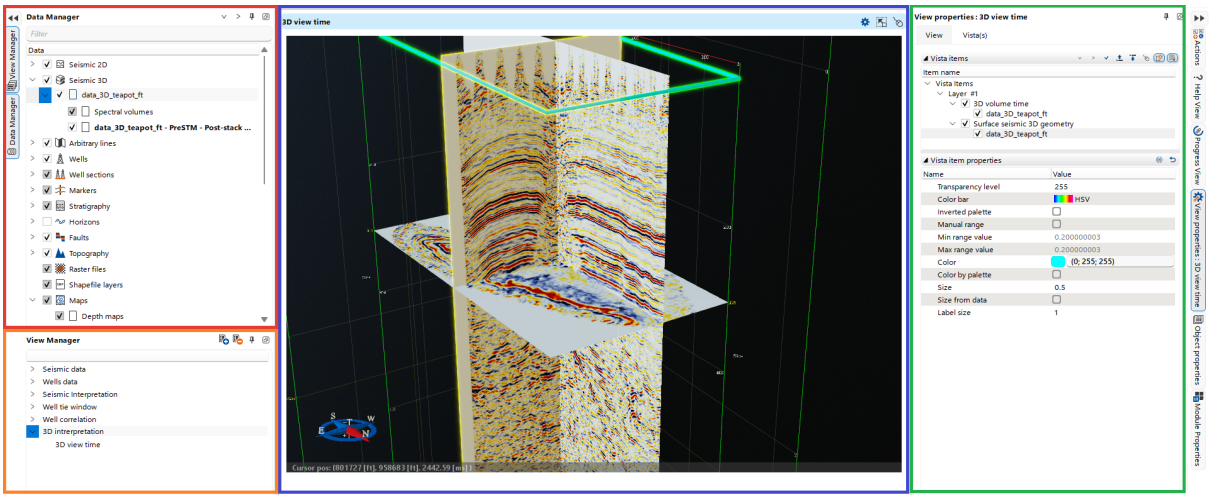
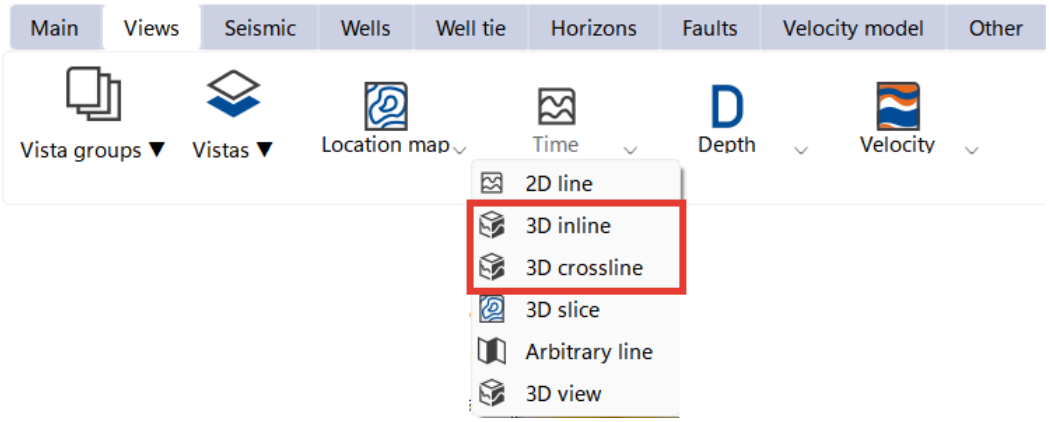


The primary visualization parameters when working with 3D seismic cubes are inlines and crosslines. To create new inlines or crosslines, navigate to the time or depth domain under the Views and select **3D inline** or **3D crossline**



The image below shows the inline and crossline sections, as well as the 3D volume on the Map view with the indicated sections and the intersection point (highlighted in red on map and in blue lines on the sections). It is convenient to visualize inline and crossline views and synchronize them using the Synch feature in the Main Bar.

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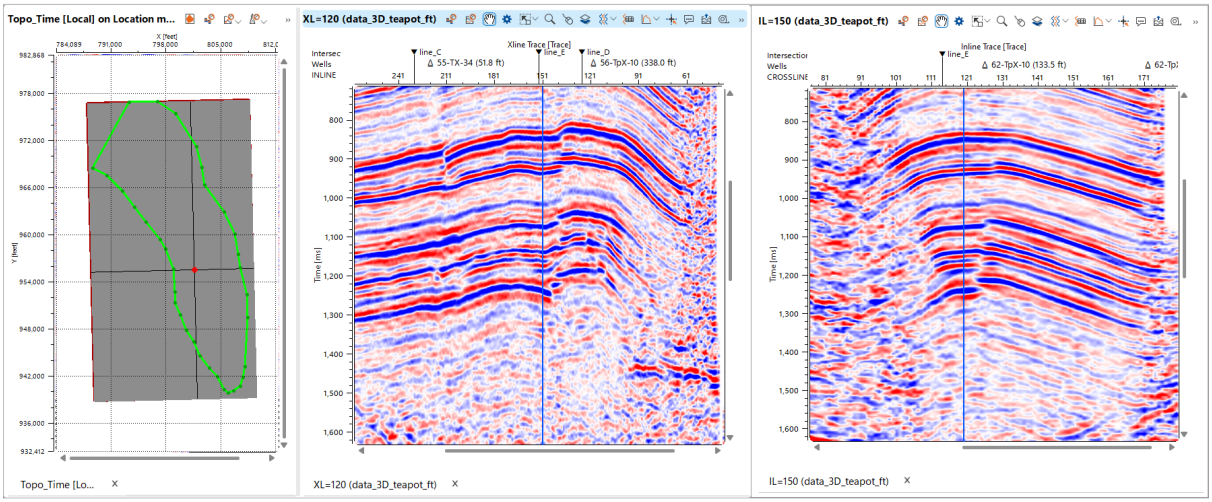

Open the Module Properties 91 panel on the right. Here, you can set the step for switching between inlines and crosslines, as well as view or specify the current value that will be displayed in the view.

Hot keys are available:

Up and **Down** move the active section up and down in the set scale

Ctrl+Left and **Ctrl+Right** move crosslines with a set step

Ctrl+Up and **Ctrl+Down** move inlines with a set step

Or **Page Up** and **Page Down** buttons move both inlines and crosslines in the active view

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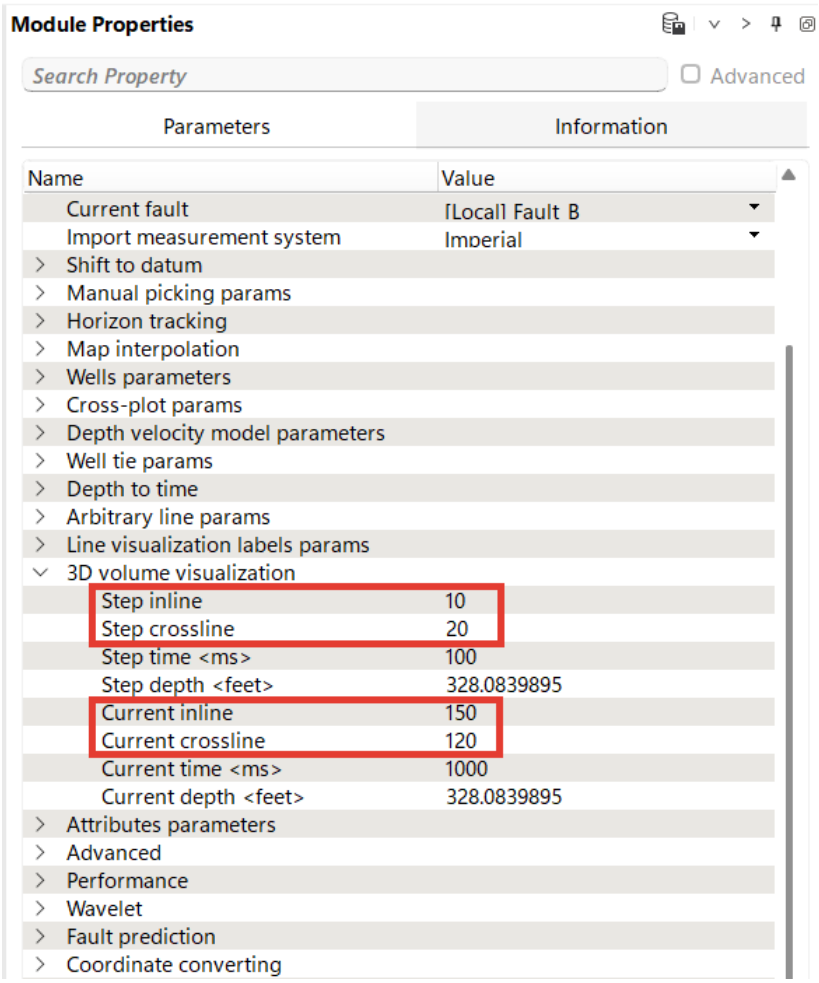

To arrange multiple windows vertically in the workspace, click and drag the view tab (highlighted in blue) to either the top or bottom edge of the window. As you drag, a blue vertical field (highlighted in red) will appear, indicating where the window will be placed. Release the mouse button to align the windows in a vertical order within the workspace.

Similarly, to arrange windows horizontally, drag the view tab to the top or bottom edge of the window. A blue highlighted box will appear, indicating the placement. When held in place, additional layout options will be available. If the entire window is highlighted in blue, you can add the current view as a new tab to the existing view.

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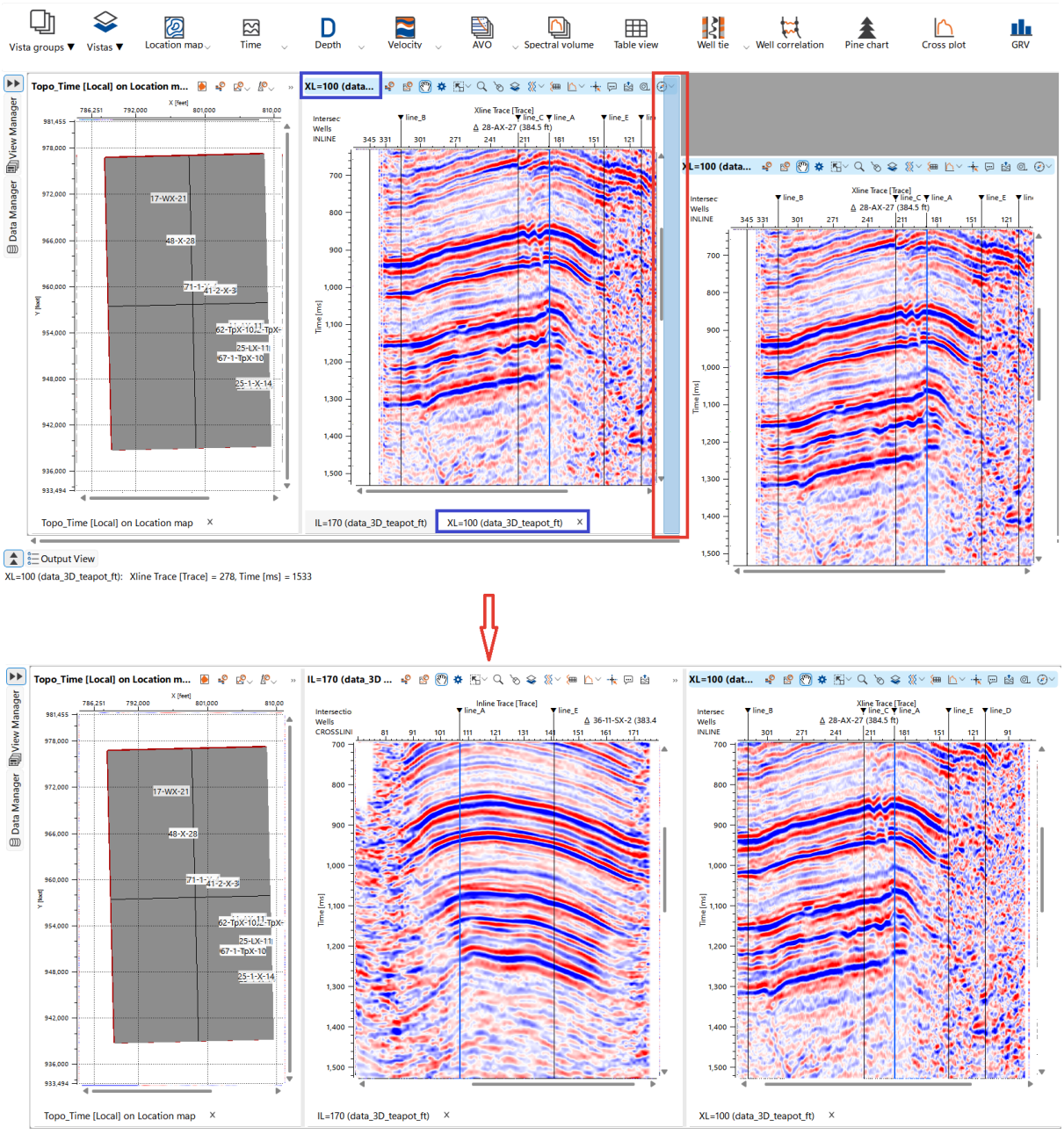

Time or depth slices offer horizontal cuts through the 3D seismic volume, displaying a snapshot of the subsurface at a specific time or depth level. This visualization is particularly useful for analyzing lateral continuity of geological features like channels or reefs.

To generate a time or depth slice in g-Space, go to the Views Bar 36 and select either Time 3D Slice or Depth 3D Slice. Define the specific time or depth level in Module Properties, and adjust the visualization settings to enhance clarity in View Properties 101.

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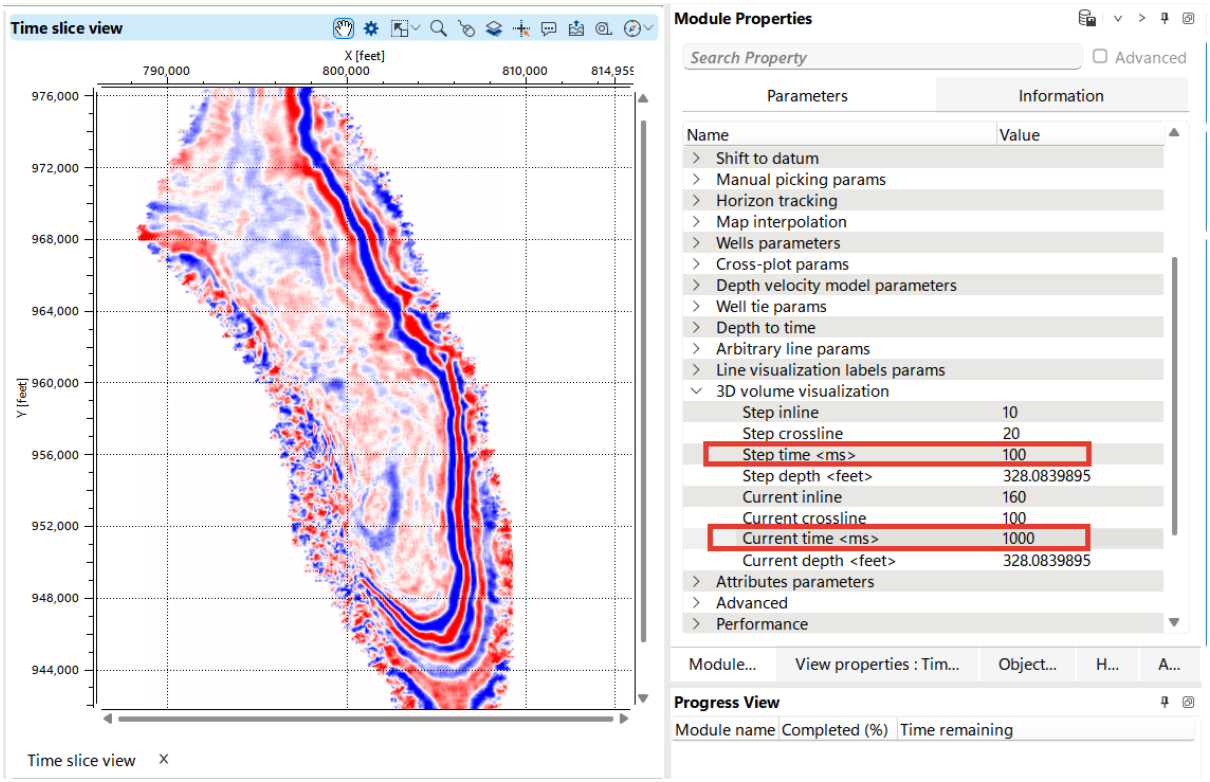

Use hotkeys **Ctrl** + **"+"** and **Ctrl** +**"-"** to switch up and down the seismic volume

Using the **Up, Down, Left** and **Right** keys you can move the image within the view.

In 3D View 133 it is convenient to visualize the seismic volume as 3 planes - inline, crossline and time slice.

The settings menu is accessible via the gear icon in the upper right corner.

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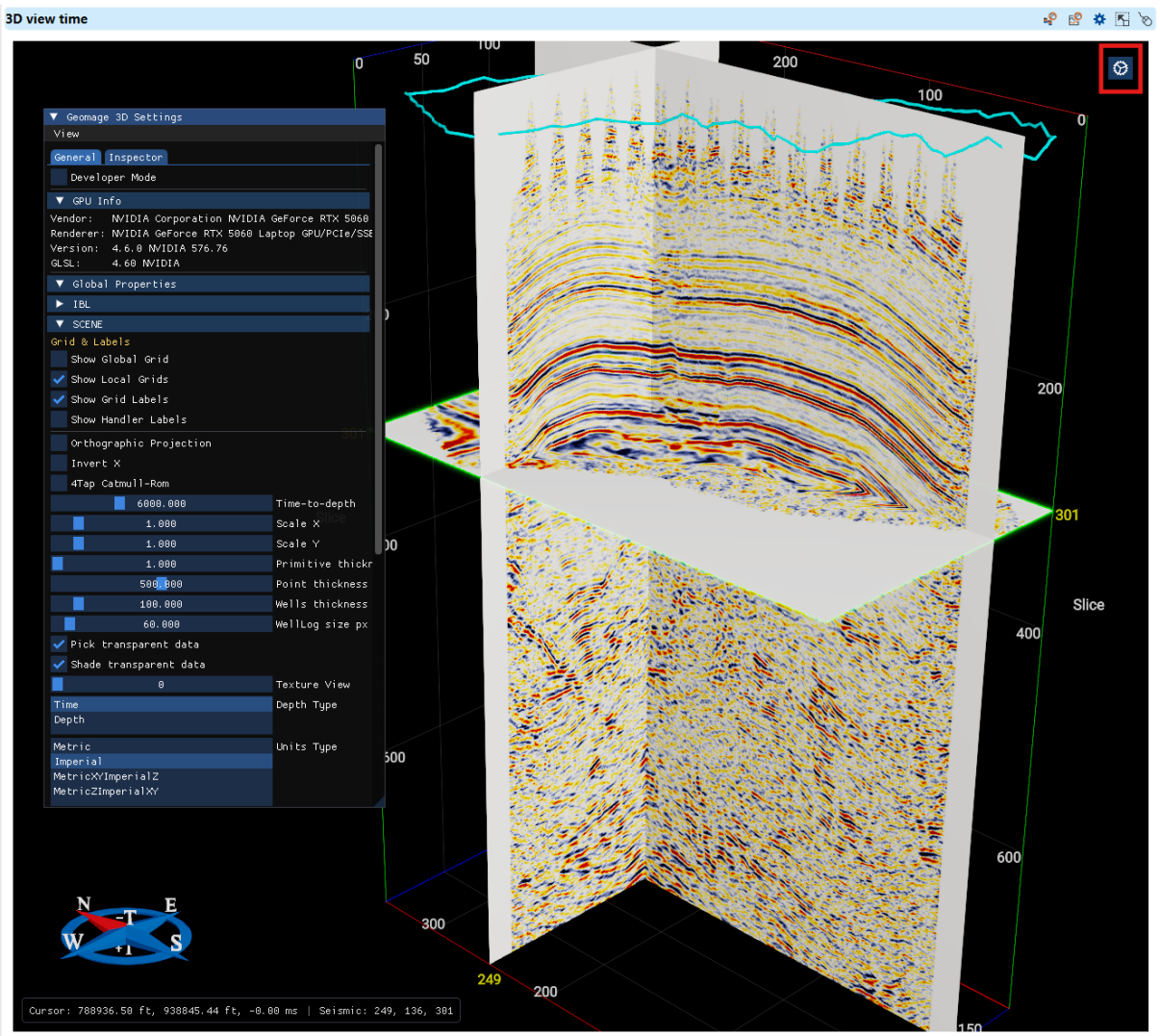

To create additional sections, use the **L** key.

While the cursor is positioned on the active section (Inline or Crossline), press **L**. A new section will be created perpendicular to the currently active one.

For example:

- If an **Inline** section is active, pressing **L** creates a new **Crossline** at the cursor position.
- If a **Crossline** section is active, pressing **L** creates a new **Inline** at the cursor position.

The new section is generated at the exact location where you click within the active view.

For removing them click Delete.

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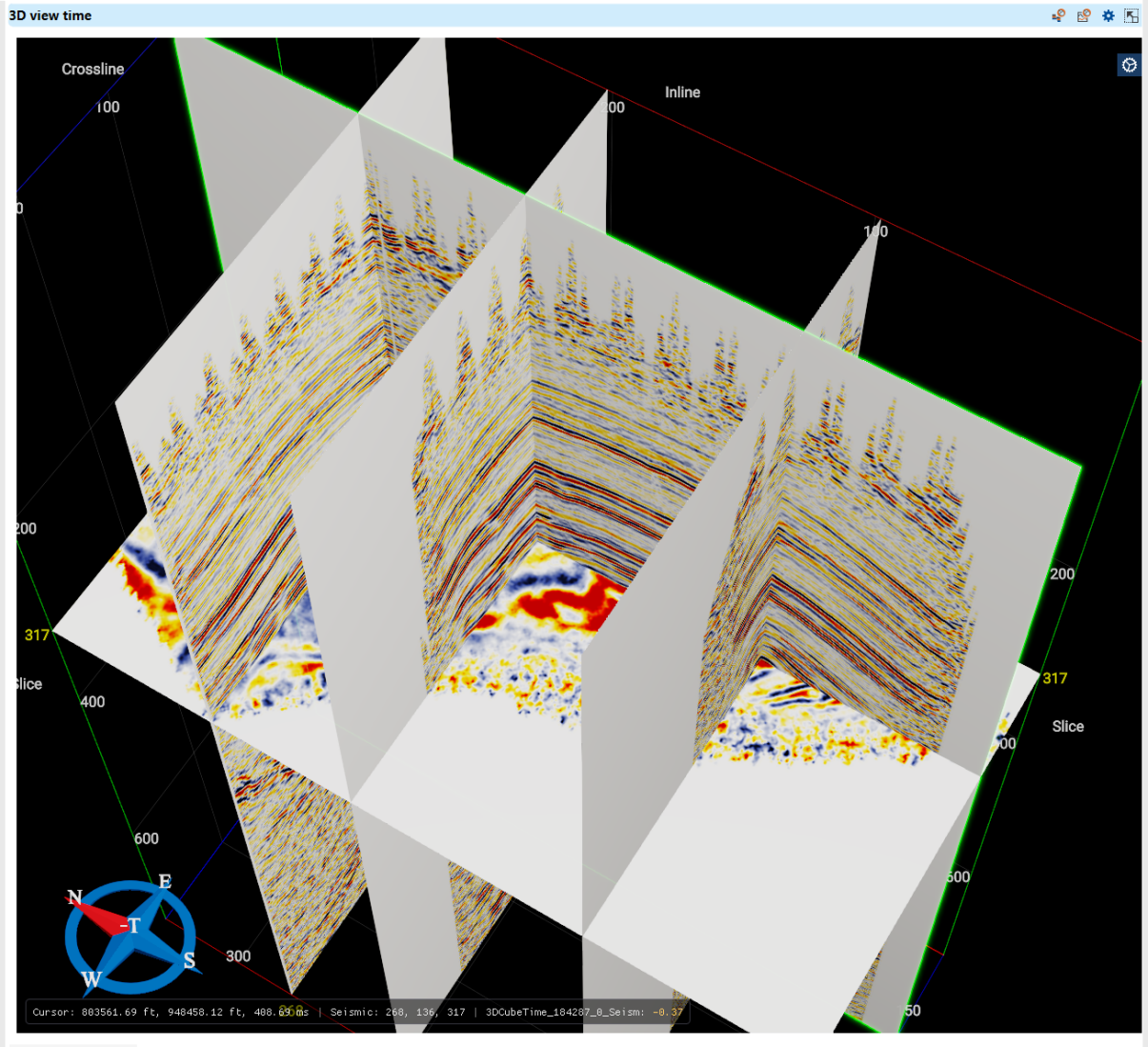

For additional slices click **S** key.

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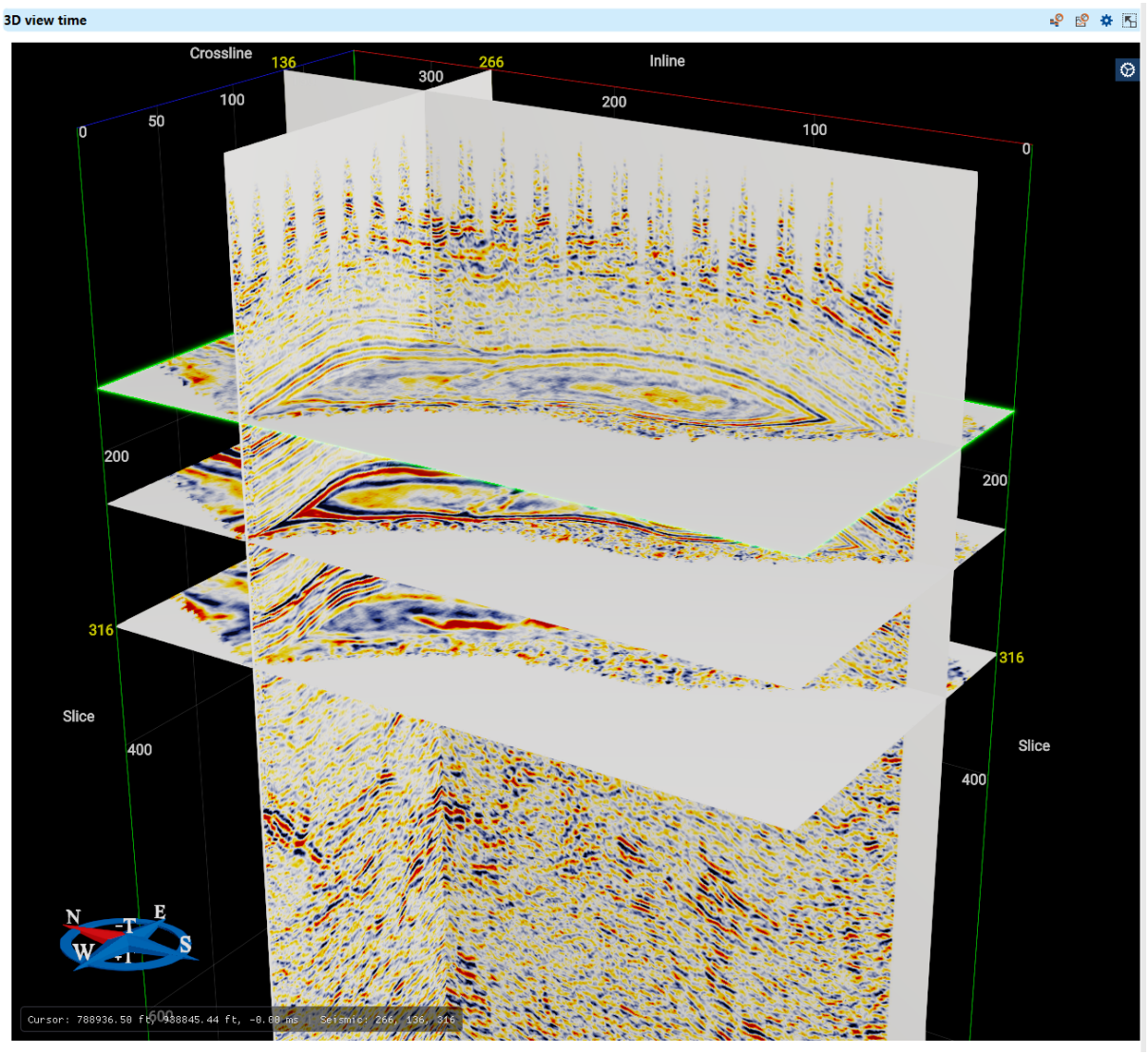

Check Tab Parameters in Module Properties 91 Panel for visualization and objects settings

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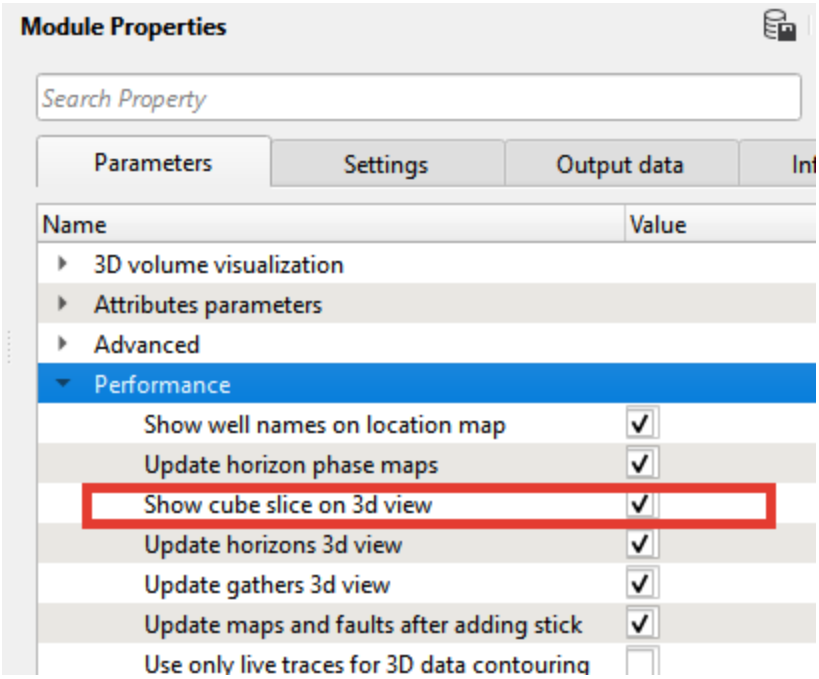

Using the **Arbitrary Line** Tool in g-Space

Arbitrary Line is particularly useful in the following scenarios:

- **Comparing 2D and 3D Data:** This tool is essential for comparing and assessing the quality of different seismic surveys. By creating custom lines that traverse both 2D profiles and the 3D seismic volume, users can directly compare the resolution and continuity of seismic reflections, leading to a better understanding of the subsurface. A detailed description is available in the 2D data 399 chapter.
- **Correlating Wells:** The arbitrary line is helpful for correlating wells, especially when you need to understand the structural and lithofacies features of the interwell space. By drawing a line that connects multiple wells, you can visualize how stratigraphic horizons and structural features change between wells.
- **Tying Directional Wells:** When dealing with directional or deviated wells, the arbitrary line allows you to create cross-sections that follow the wellbore trajectory. This aids in accurately tying the well data to seismic data, ensuring a more precise integration of well and seismic interpretations.
- **Analyzing Geological Structure:** For fields with complex geological features, such as the anticline fold in the Demo project, the arbitrary line tool is particularly useful for analyzing geological structures both along and across the fold axis. Given that the fold has a curved structure relative to the geometry of the seismic survey, arbitrary lines enable a more flexible and accurate examination of the fold's features, which might not align with standard seismic lines.

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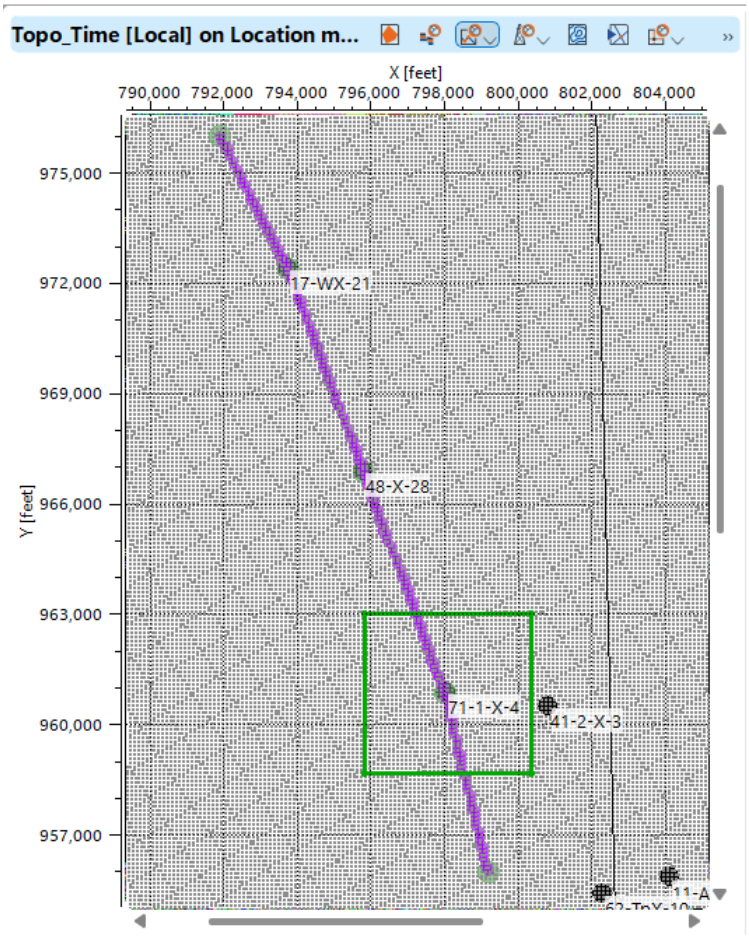
Creating **Arbitrary line** using wells location.

In the **Data Manager**, create a new **Arbitrary line** and name it.

Visualize the wells and 3D seismic in the Map window. From the top menu, select the **3D arbitrary line** tool and draw the line through the well locations. Depending on your objectives, you may find it useful to visualize either the wellheads or the projection of the entire well trajectory.

To remove points from the arbitrary line, hold down the right mouse button and select the unwanted point(s) (highlighted by a green polygon).



On the created arbitrary line, you can visualize well data, including well trajectories or vertical projections of the wellheads. Additionally, it's possible to display logging curves and synthetic traces for further analysis.

To display wells in the time domain, the user must have a checkshot.

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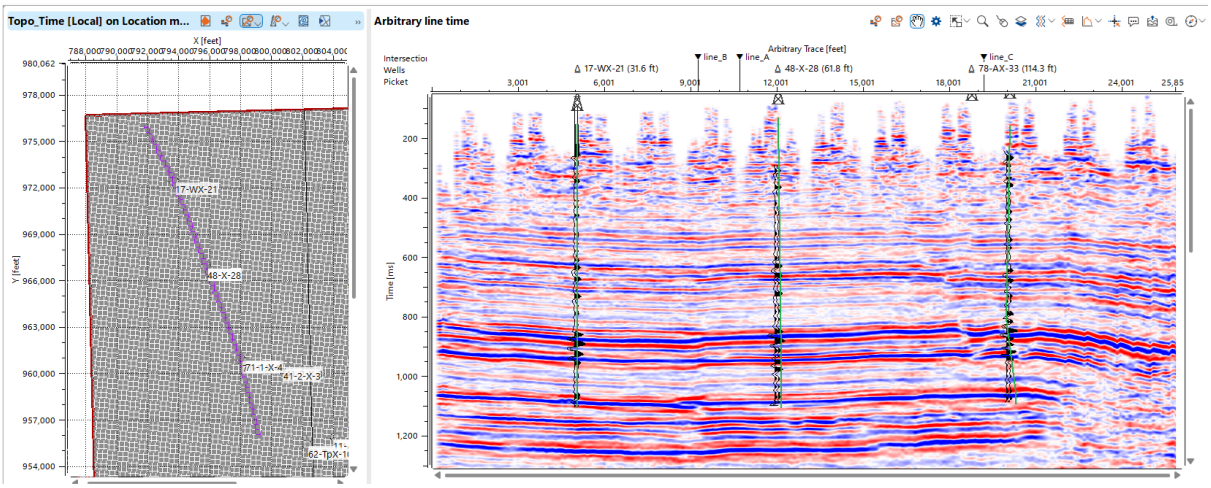
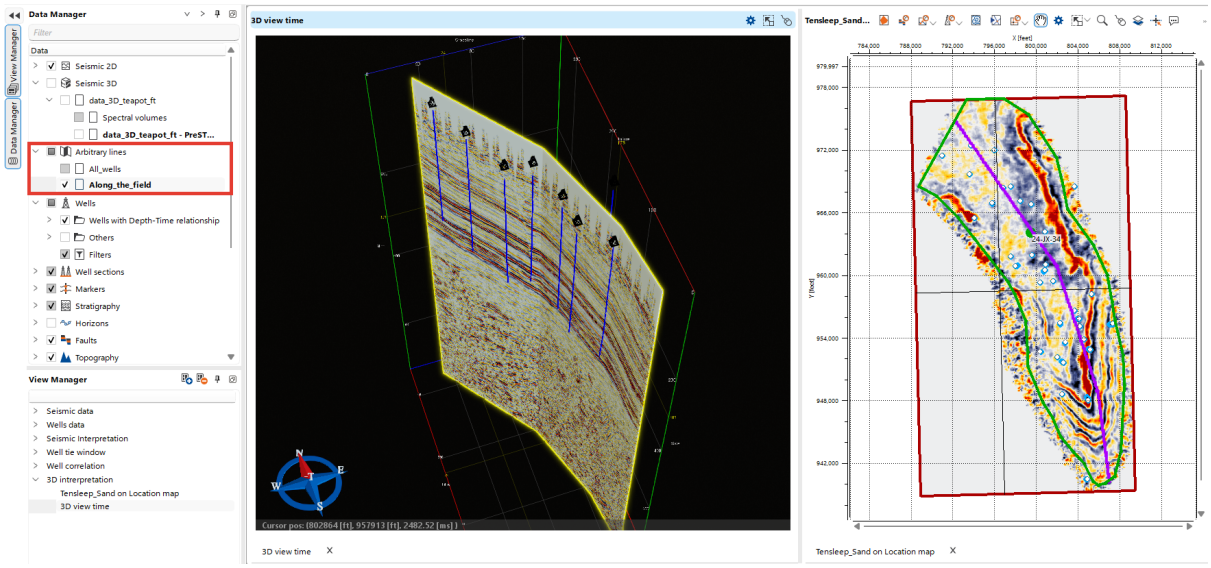


To display an arbitrary line in 3D View, open the Time/Depth 3D View. In the Data Manager, select the arbitrary line(s) you wish to visualize.



To display a seismic section along a deviated well, it is useful to create an arbitrary line with such a geometry that the trajectory lies within a single plane.

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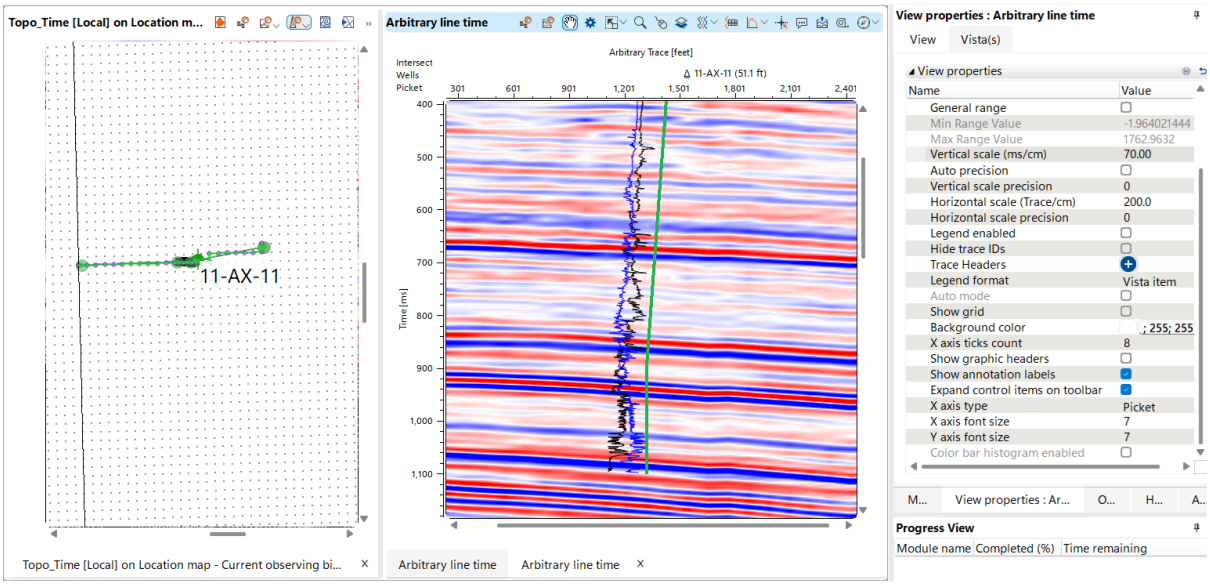

g-Space supports the creation of multi-panel displays where you can visualize different types of views (e.g., inline, crossline, time slice) simultaneously. This setup provides a more comprehensive interpretation workspace.

9.3.2 Horizon picking

Seismic horizon correlation is aimed at mapping continuous reflectors that represent geological horizons across a seismic dataset. The process relies on several core principles:

Waveform Continuity, Stratigraphic Context, Well Data Integration, Spatial Consistency.

These principles underpin the practical steps for seismic horizon correlation in g-Space, which includes Well tie 379, Horizon picking, and Mapping 517.

Notes

Methodological Approaches

1. Phase correlation focuses on tracing reflectors by maintaining the continuity of specific phases (peaks, troughs, or zero crossings).

This method is effective in areas with clear, consistent reflectors. It involves:

- *Picking a phase (e.g., peak or trough) and tracing it across the dataset.*

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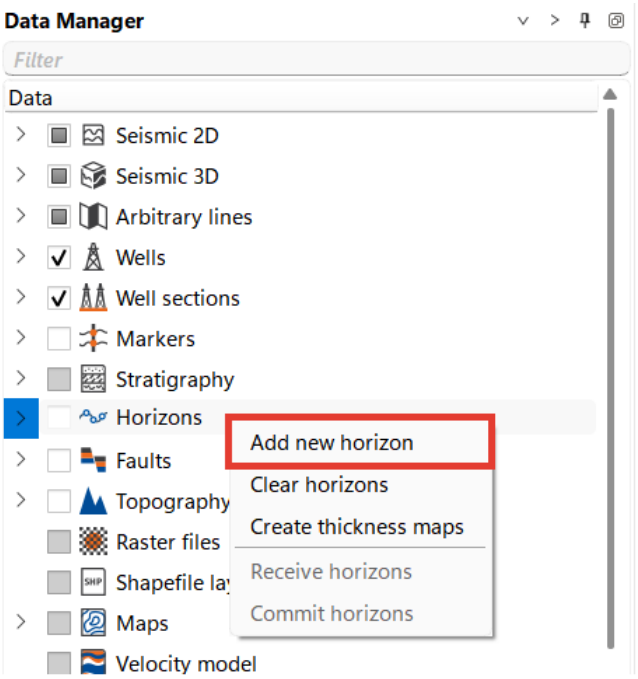
- *Ensuring that the selected phase remains consistent across traces, using g-Space tools to automatically track reflectors where possible.*

2. Seismostratigraphy is the process of identifying depositional sequences and stratigraphic surfaces from seismic reflection patterns. This method is often used to:

- *Identify key stratigraphic boundaries (e.g., unconformities or maximum flooding surfaces).*
- *Correlate horizons based on depositional features such as onlaps, downlaps, or erosional surfaces.*

Begin picking horizons at well locations where the reflectors have been tied to known formations using the Well tie 62 functionaity.

To create a new horizon go to Data manager 86 and press Right Click Mouse on the Horizon icon. Choose **Add new horizon**



or on Seismic view in tool bar press Horizon picks button and press **Alt + Right Click Mouse** button on seismic view and choose **Create new horizon**

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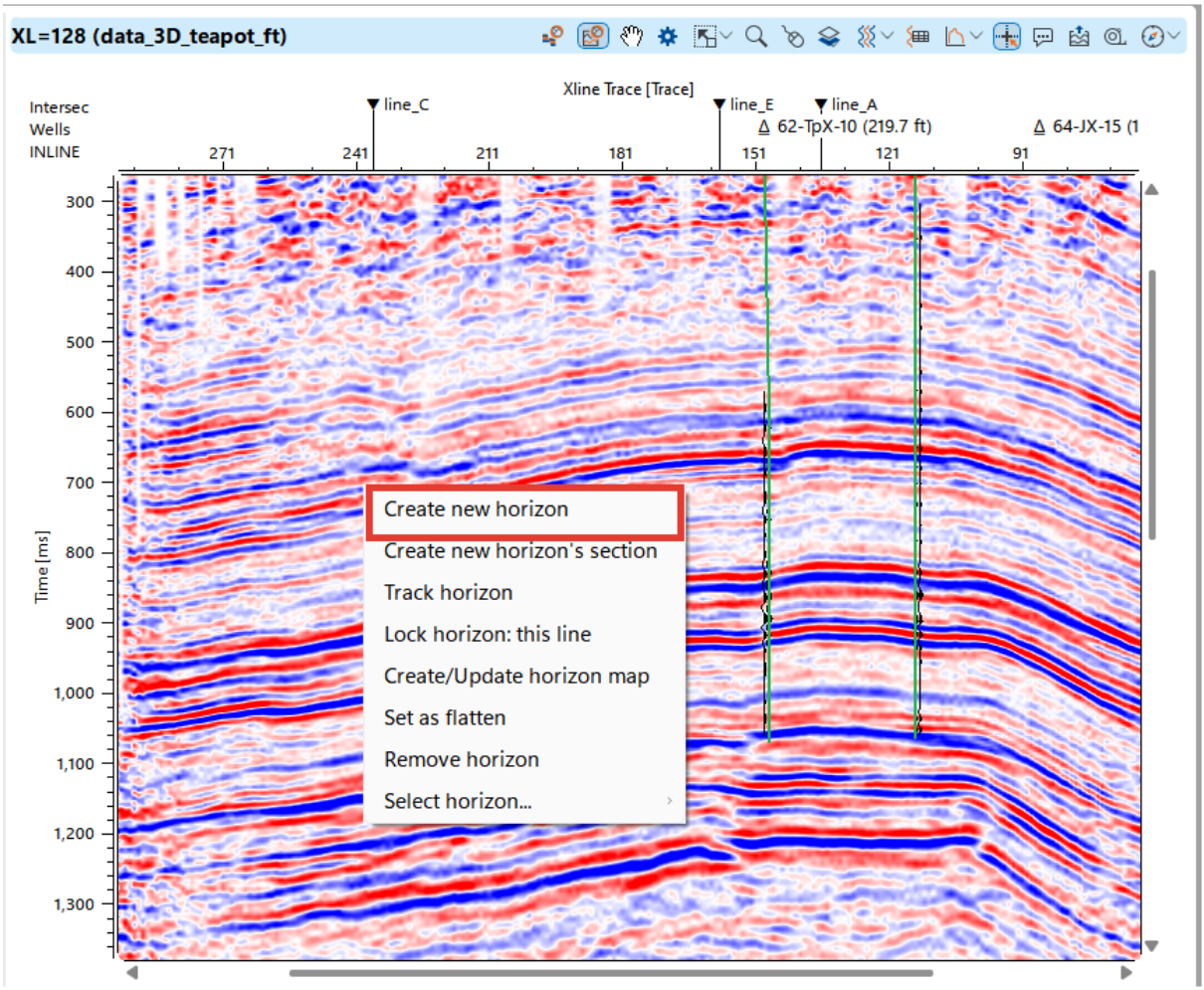

Let's set up a workspace for horizon picking. In this example, a map is displayed showing a seismic volume, inline and crossline sections, wells, as well as inline and crossline views with linked wells, synthetic traces, and markers. The Module Properties 91 panel is open, highlighting key settings for horizon picking.

Subscribe to our channel and watch the video on how to pick horizons in g-Space on YouTube

Click on **Horizon Pick** (highlighted in red) in the top panel of the view to begin picking horizons.

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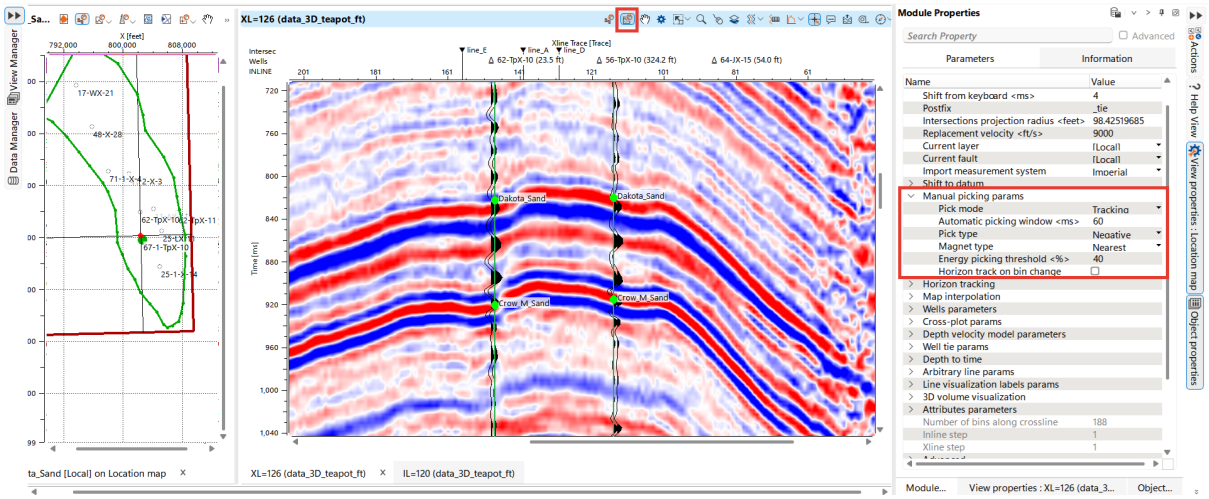
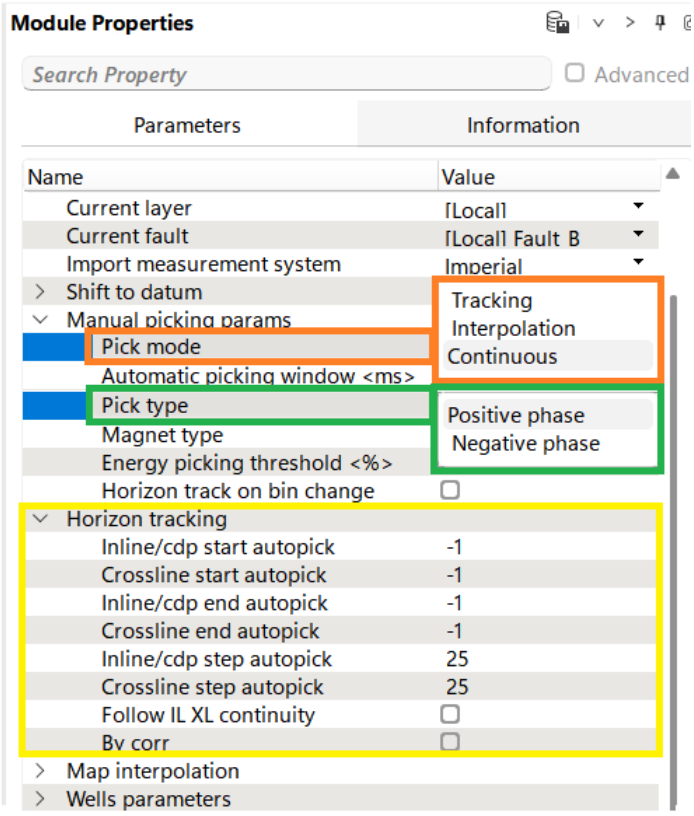


Let's review some horizon picking settings in the Module Properties panel.



Pick Mode (highlighted in orange): Users can select between three modes - **Tracking**, **Interpolation**, **Autopicking** and **Continuous,** which define how the software traces and connects horizon picks across the data.

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Automatic Picking Window: This parameter defines the time or depth window for automatic horizon picking.

Pick Type (highlighted in green): Allows users to choose between picking on the **Positive Phase** or **Negative Phase**

Horizon Tracking (highlighted in yellow): These options control the automatic picking for inline and crossline sections. Users can specify start and end points, step sizes, and choose to follow continuity along the inline or crossline for efficient horizon tracking.

Below are the pick modes available for horizon picking:

1. **Tracking**: Automatically follows seismic events across the section based on the selected pick phase. Click the left mouse button, in the example the click points are highlighted with black circles, to finish, click the left mouse button twice

Notes

In tracking mode, the software automatically follows a seismic event based on amplitude and phase consistency. This is ideal when horizons are well-defined and exhibit minimal interruptions or distortions, such as in clear stratigraphic layers. It reduces the amount of manual picking and ensures consistent interpretation over large sections.

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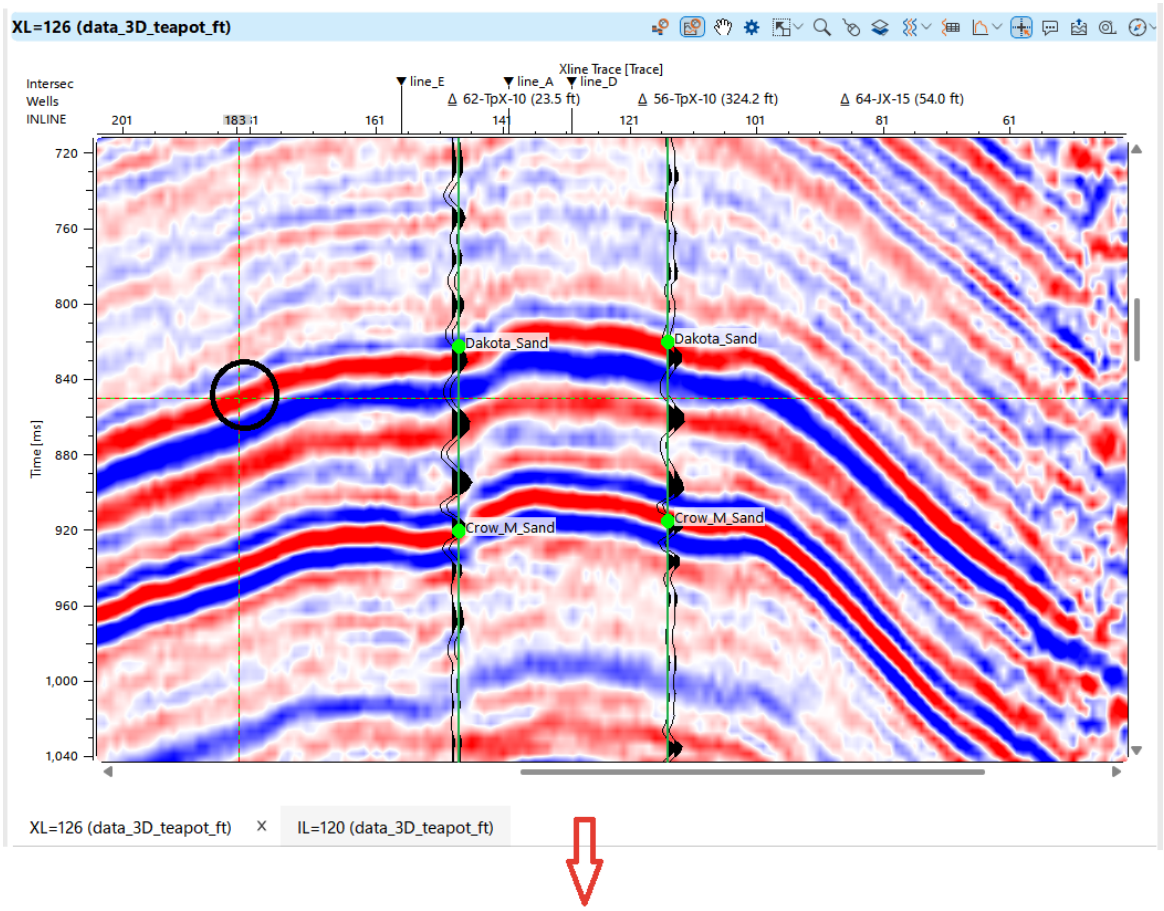
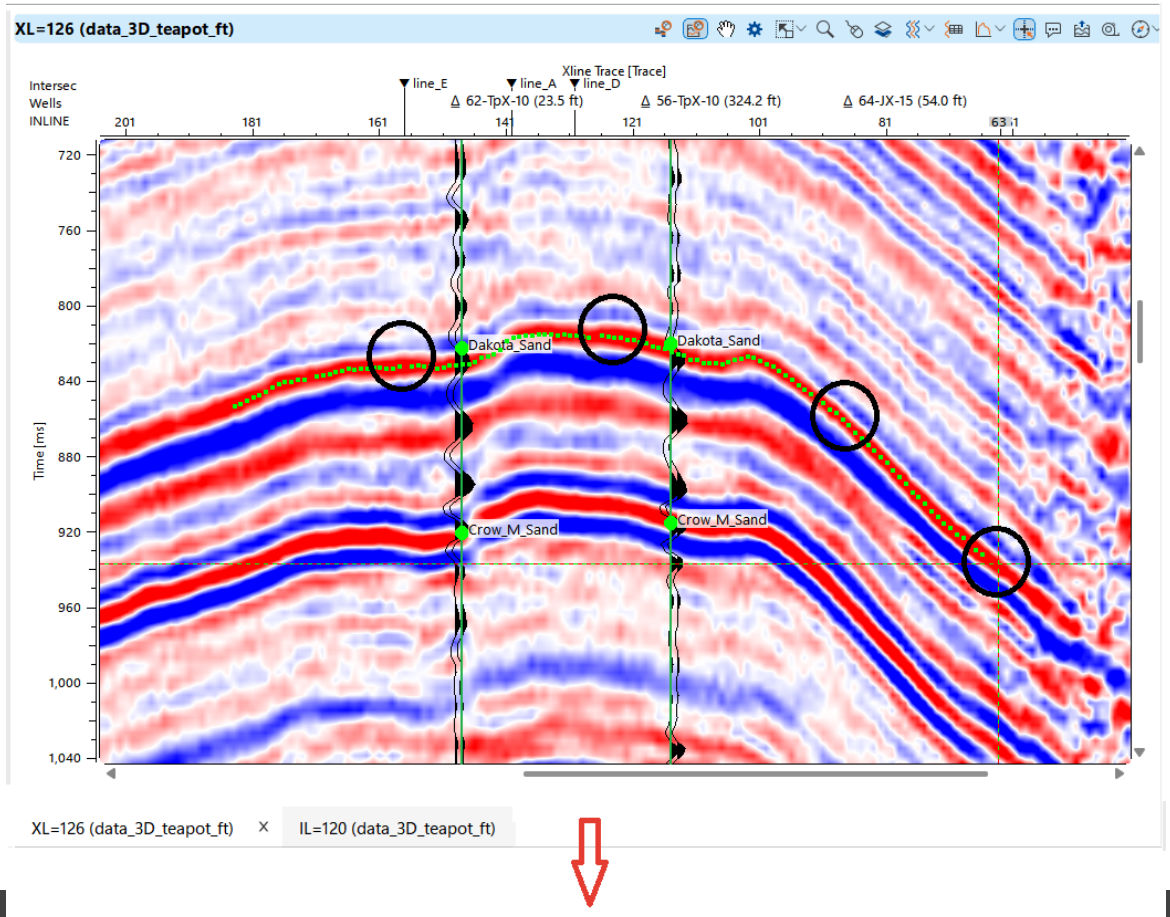
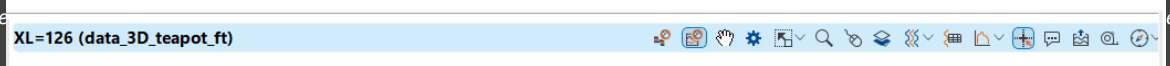
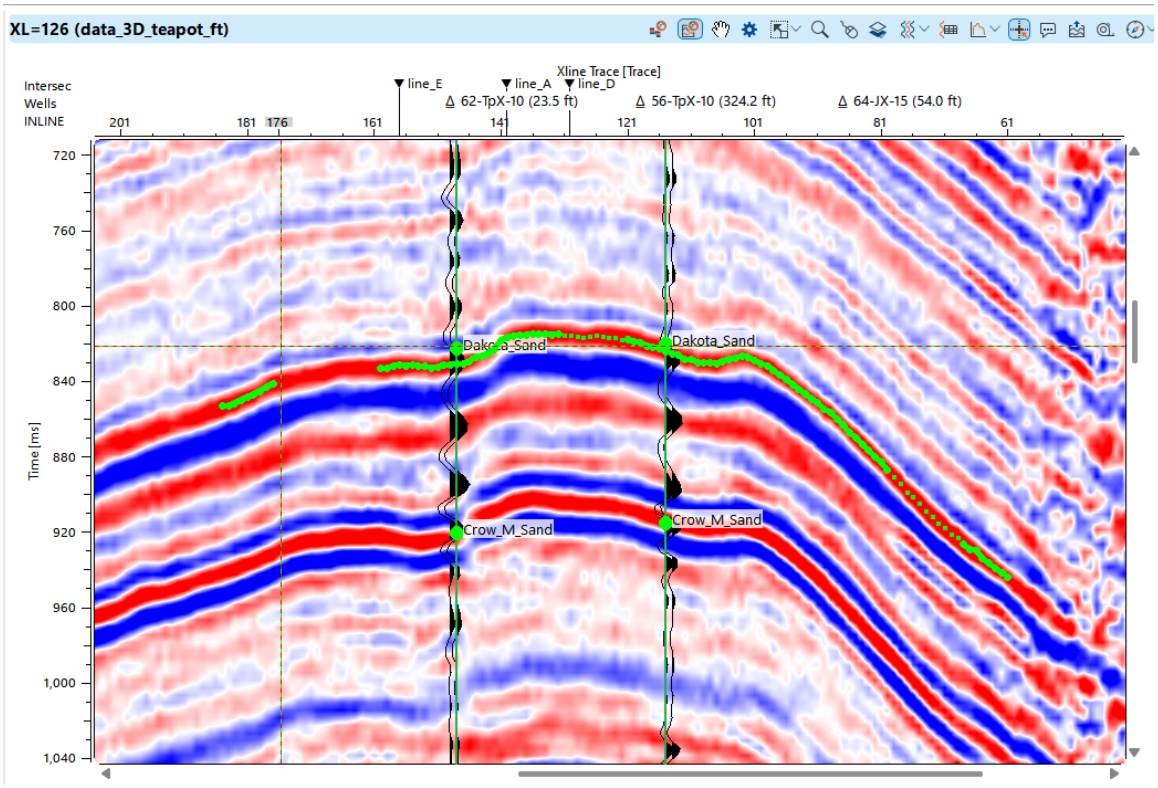

XL=126 (data_3D_teapot_ft)
Intersec
Wells
INLINE
Xline Trace [Trace]
line_E
line_A
line_D
Δ 62-TpX-10 (23.5 ft)
Δ 56-TpX-10 (324.2 ft)
Δ 64-JX-15 (54.0 ft)
201
181
161
141
121
101
81
61
720
760
800
840
880
920
960
1,000
1,040
Time [ms]
Dakota_Sand
Dakota_Sand
Crow_M_Sand
Crow_M_Sand
XL=126 (data_3D_teapot_ft)
IL=120 (data_3D_teapot_ft)


XL=126 (data_3D_teapot_ft)
Intersec
Wells
INLINE
Xline Trace [Trace]
line_E
line_A
line_D
Δ 62-TpX-10 (23.5 ft)
Δ 56-TpX-10 (324.2 ft)
Δ 64-JX-15 (54.0 ft)
201
181
161
141
121
101
81
63
720
760
800
840
880
920
960
1,000
1,040
Time [ms]
Dakota_Sand
Dakota_Sand
Crow_M_Sand
Crow_M_Sand
XL=126 (data_3D_teapot_ft)
IL=120 (data_3D_teapot_ft)


XL=126 (data_3D_teapot_ft)

To delete a segment of interpretation, press and hold the right mouse button and select the area to delete. You can also immediately proceed to editing and put new points on these segments.



In the **Tracking mode**, when transitioning to another section, the **Track Horizon** function from Horizons Bar 64 can be utilized. g-Space will automatically correlate the horizon on the newly opened section.

The user also has access to the autotracking function for the whole volume in the Horizons Bar.

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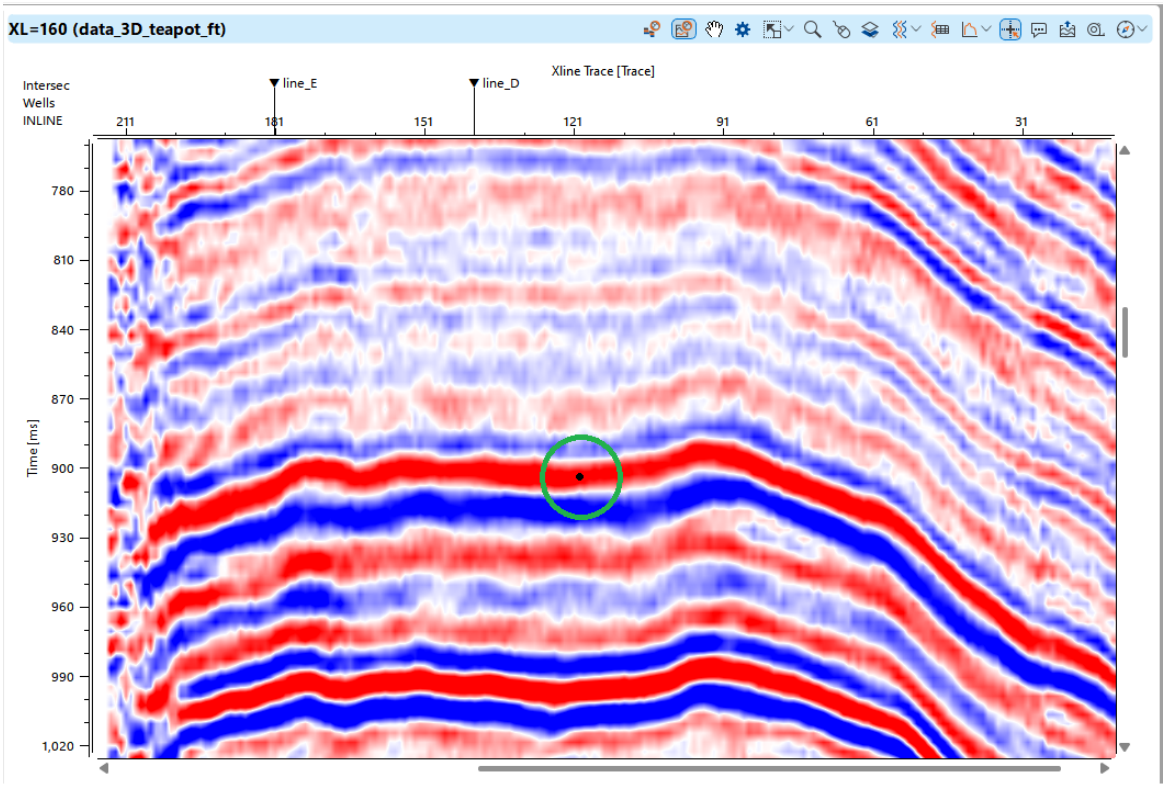

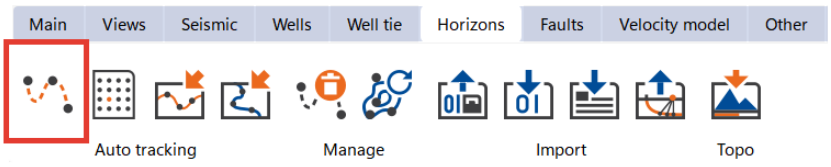

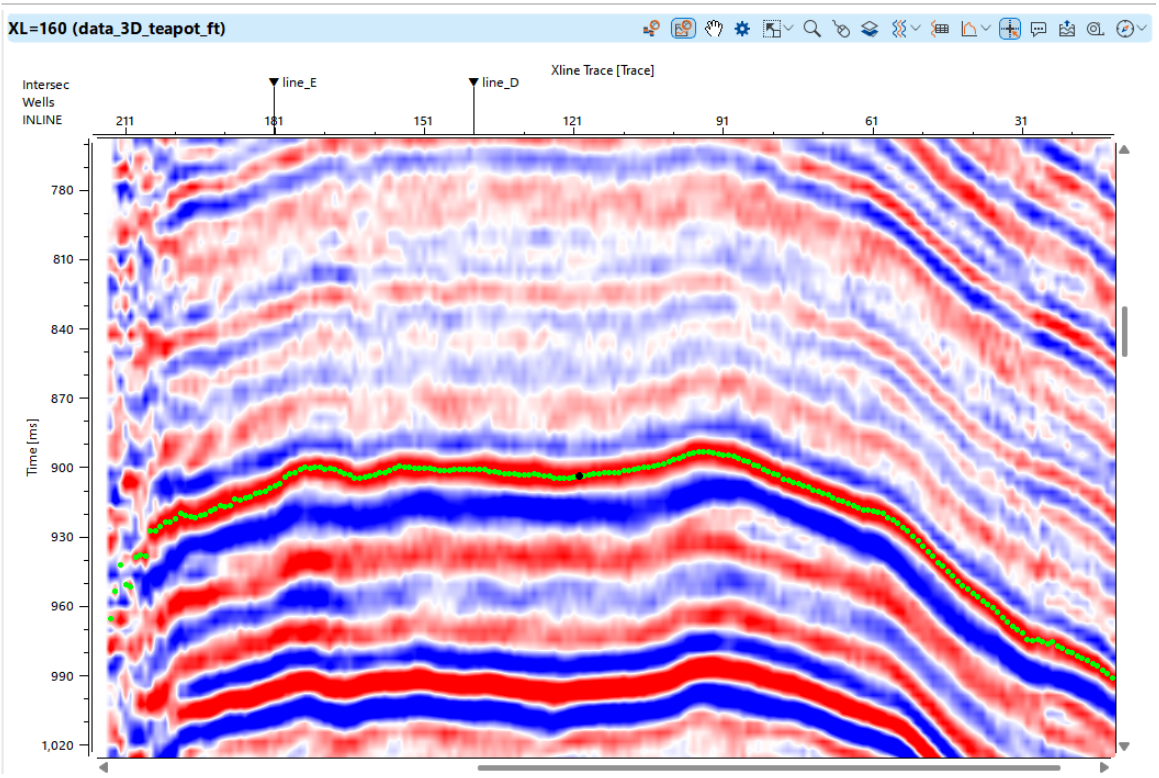

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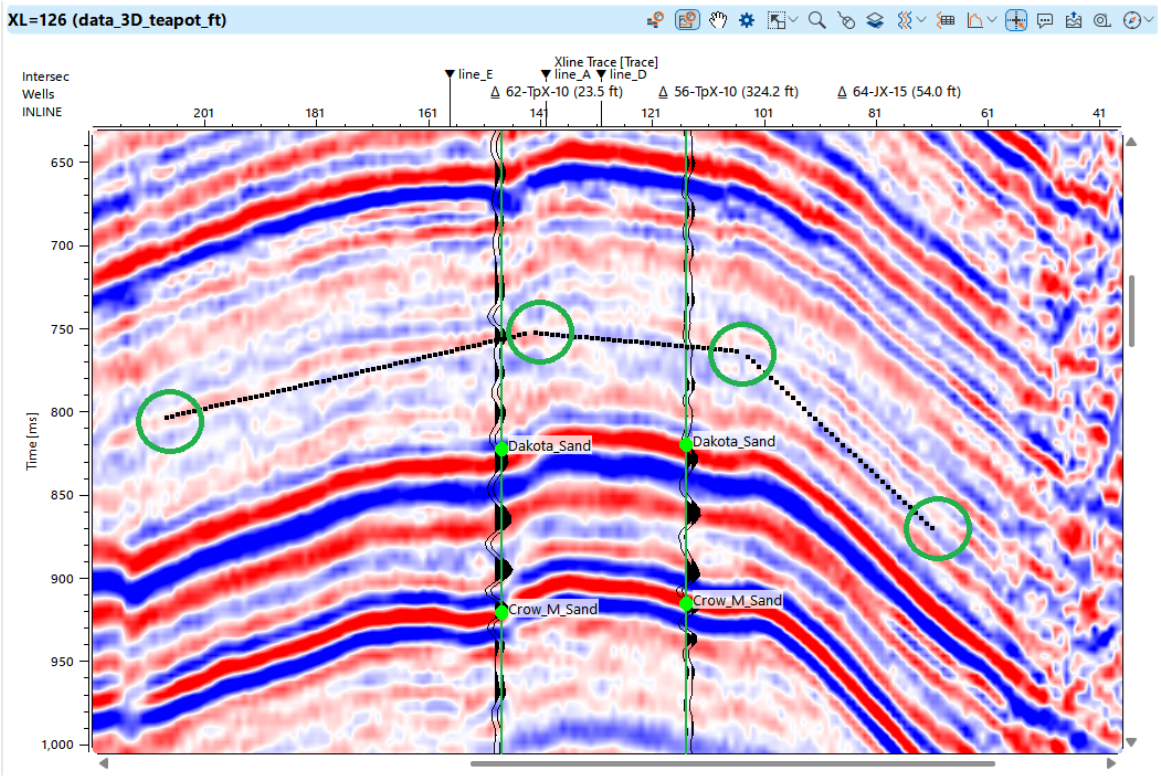
2. **Interpolation**: Picks points at intervals and interpolates between them to define the horizon.

Notes

Interpolation mode is useful when seismic horizons are partially obscured, interrupted by faults, or have variable continuity. The user selects key points along the horizon, and the software interpolates between these points to create a complete pick. This approach balances manual input with automatic interpretation, allowing for more flexibility in challenging areas with less-defined reflectors.



3. **Continuous**: Enables continuous manual picking across the section, allowing the user to define the horizon in real-time. The process looks like drawing on a seismic image.

Notes

Continuous mode is fully manual and allows the interpreter to continuously pick the horizon across the section. This mode is helpful when there are significant geological complexities, such as in areas with faulting, folding, or high noise levels, where automated tracking or

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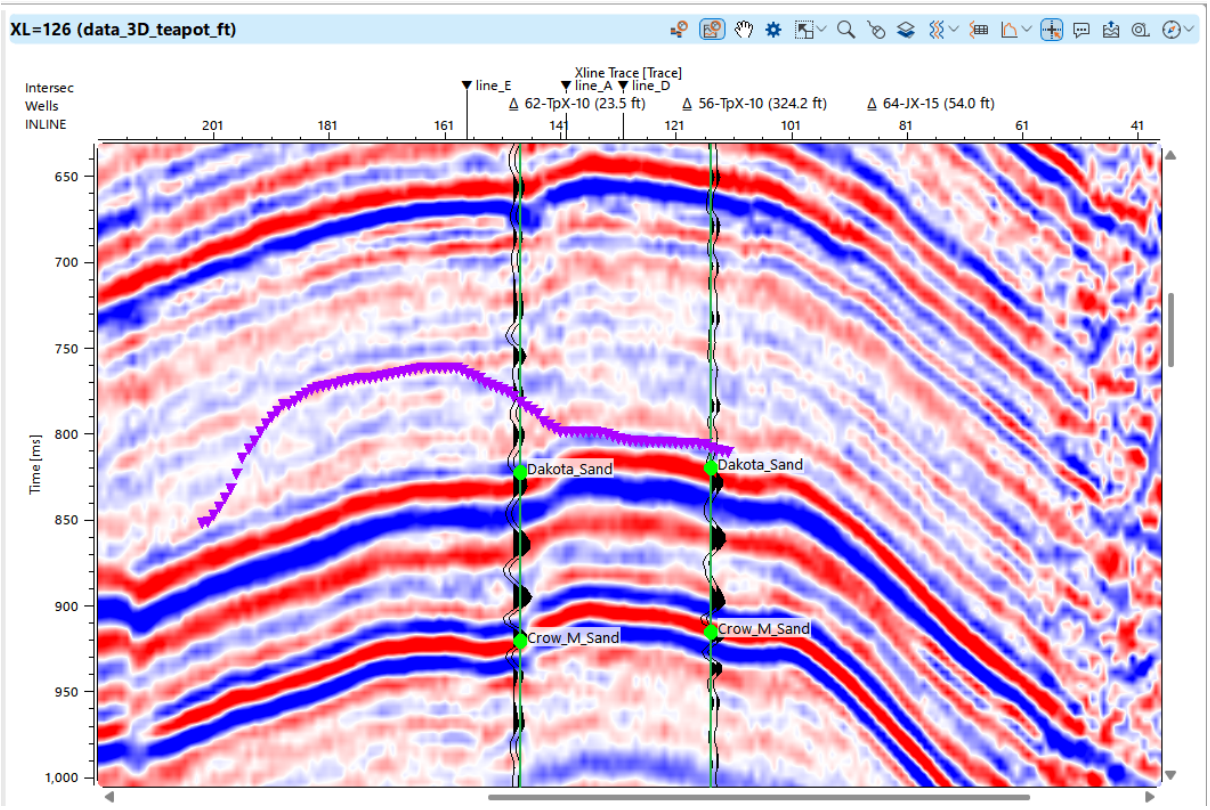
interpolation might not perform accurately. The interpreter retains full control over the horizon pick, ensuring precision in difficult regions.



Hot keys for seismic section views:

Up and **Down** move the active section up and down in the set scale

Ctrl+Left and **Ctrl+Right** move crosslines with a set step

Ctrl+Up and **Ctrl+Down** move inlines with a set step

Or **Page Up** and **Page Down** buttons move both inlines and crosslines in the active view

During the horizon picking process, the horizon surface is updated in real-time within the map view.

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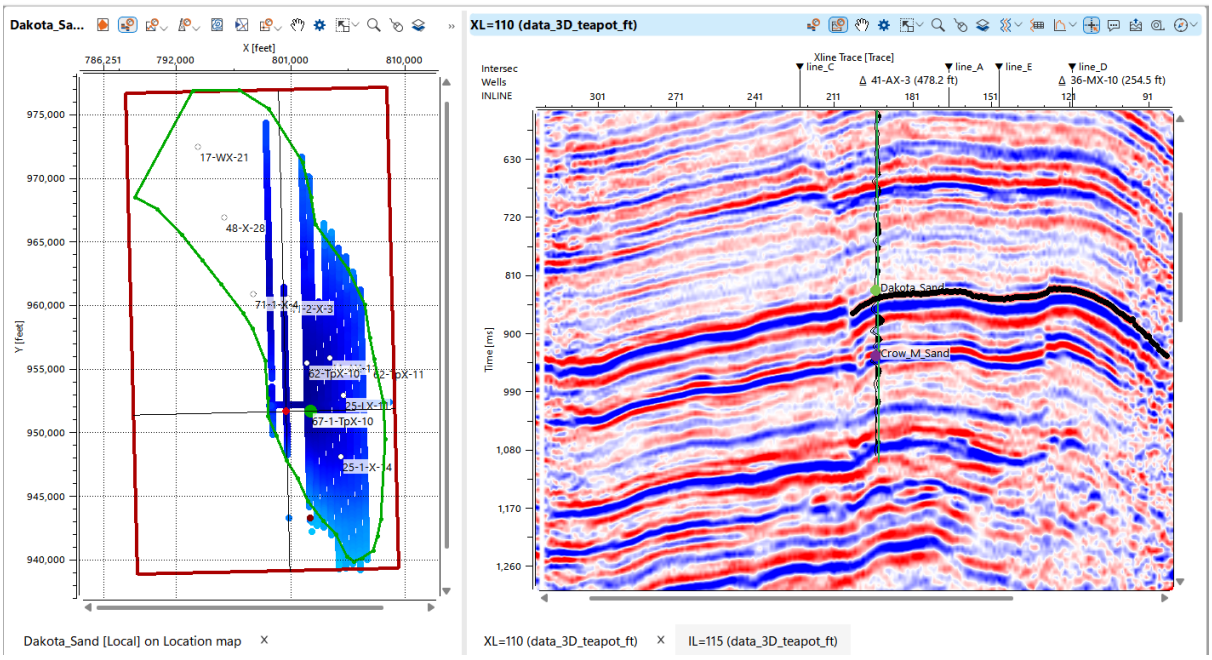
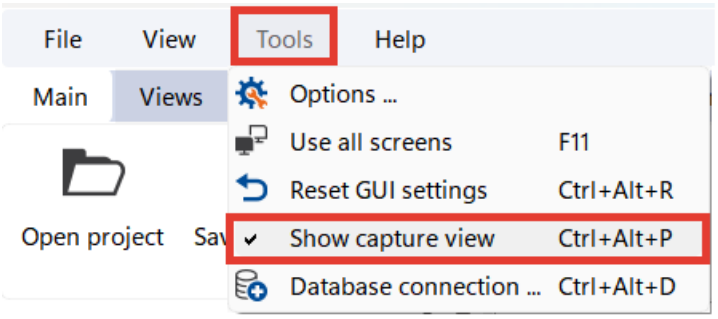


When interpreting seismic volume areas remote from wells, across fault blocks, or around geological features that disrupt reflecting horizons, the ghosted view tool in g-Space is particularly useful. This tool allows the user to take a screenshot of a specific interpretation, drag it to a new location, and overlay it on the current view, simplifying the horizon picking process.

Additionally, the tool enables rotation of the screenshot, making it adaptable to various structural alignments. This method is particularly effective in complex tectonic settings, ensuring more accurate seismic horizon correlation.



Open drop-down menu in Tools in Main bar 34 and choose Show capture view or use hot keys **Ctrl + Alt + P**

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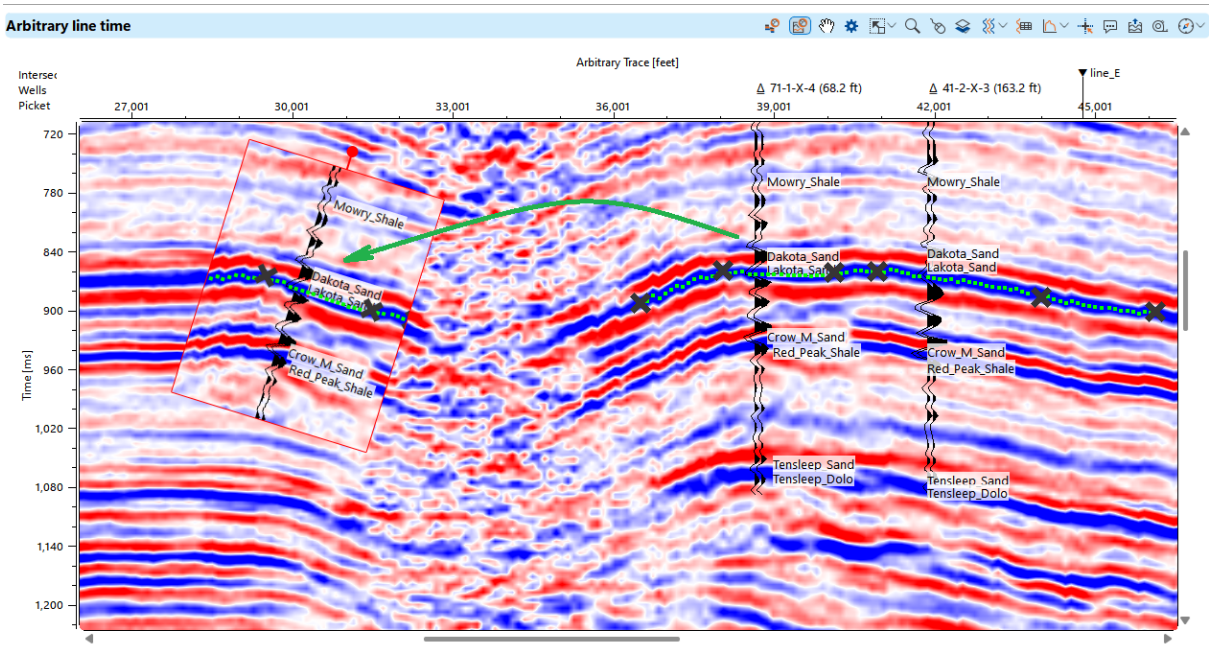

The **Flatten Horizon** tool can be very useful to effectively remove structural complexities and focus on stratigraphy.

To flatten a seismic section to a specific horizon, right-click on the horizon name and select **Set as flatten** from the drop-down menu. The seismic section will then be flattened to the selected horizon. To return to the normal view, repeat the steps and choose **Unset as flatten**.

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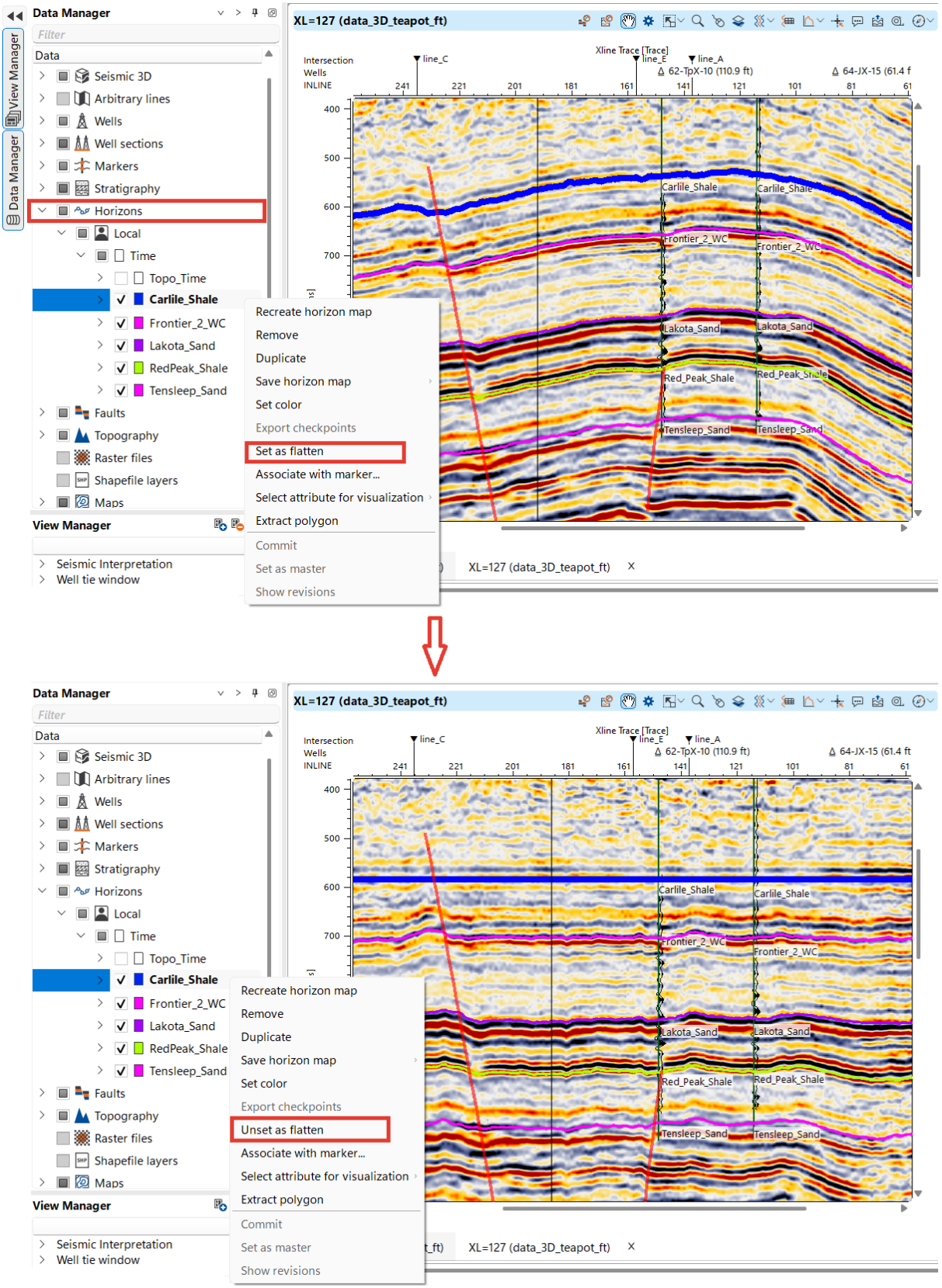

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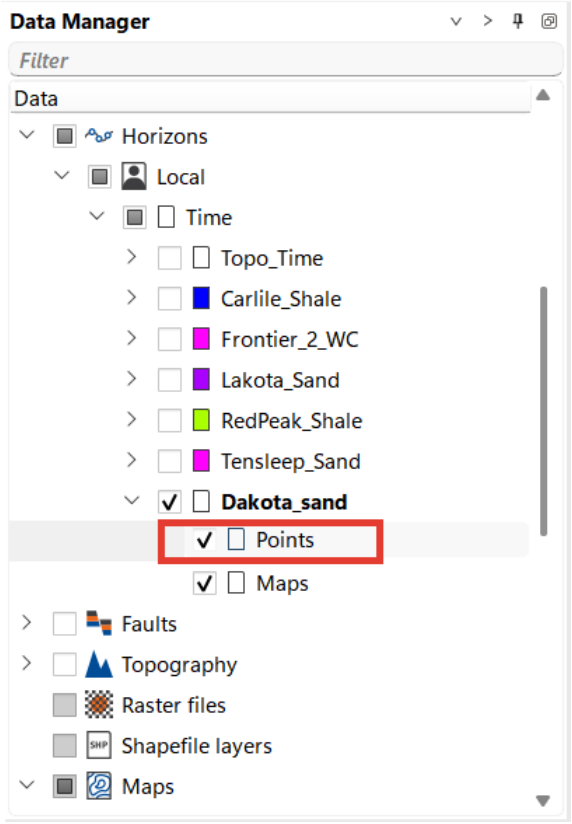
The outcome of the interpretation consists of points, each associated with a specific set of attributes, Time in our case.



There is a drop down menu in Data manager for Horizons where user can create maps, flatten horizons, set colors, etc. At any point user can rebuild the map of the selected horizon.

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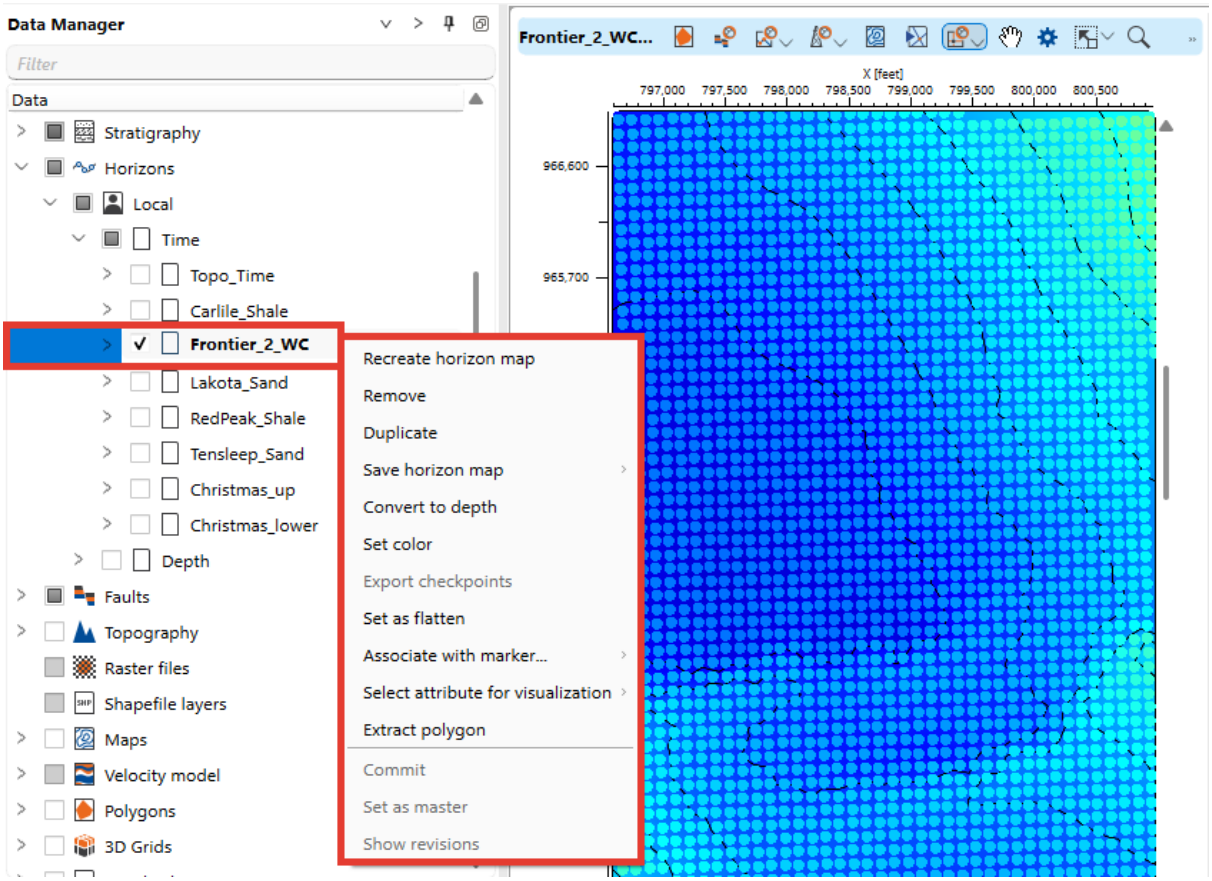

For **3D visualization**, g-Space offers a feature that allows **time-domain data to be displayed within the 3D depth view** using the current velocity model.

This is especially useful during interpretation, as it enables reviewing results in time without requiring full data conversion to the depth domain

9.3.3 Fault picking

Fault picking is aimed at identifying discontinuities or breaks in subsurface reflectors that indicate faults. The process in g-Space follows core principles similar to those used in Horizon picking 423 but with an emphasis on identifying and mapping structural breaks.

Notes

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Methodological Approaches

1. *Discontinuity Identification Fault picking focuses on identifying breaks or offsets in seismic reflectors. The key steps include:*
    - *Locating regions where reflectors are abruptly truncated, offset, or disrupted.*
    - *Using g-Space tools, such as attribute maps, to highlight areas of high discontinuity or variance in reflector continuity.*
2. *Structural Interpretation Faults often follow particular structural patterns, which can help guide the picking process. This involves:*
    - *Recognizing common fault geometries (e.g., normal, reverse, or strike-slip faults).*
    - *Identifying associated structures like rollover anticlines or drag folds that accompany fault systems.*
3. *Seismostratigraphic Context Faults often correlate with stratigraphic markers. Integrating seismostratigraphic information can help refine fault interpretation by linking faults to stratigraphic units, sedimentary processes, and depositional environments.*

The Data Manager 86 in g-Space organizes fault data into a structured hierarchy that allows users to work within either the **Time** or **Depth** domain, depending on the seismic data and the interpretation workflow.
The Local folder is active by default for multi-user mode and the results of interpretation are stored in your local project.

Free Sticks:
Faults can be visualized and manipulated as Free Sticks, representing vertical fault traces along seismic sections. This view allows users to pick fault segments and analyze them in a stick-based representation, which is useful for initial interpretations and quality control.

Surface Mode:
Users can switch from the stick representation to Surface Mode, which converts the fault sticks into continuous fault surfaces. This mode is helpful for visualizing the complete geometry of a fault plane, providing a more holistic view of the fault structure within the seismic volume.

You can define faults in the **Map View**, **3D View**, **2D View**, **Inline** and **Crossline** Views as well as in the **Arbitrary line View**.

g-Space also provides options to Import faults 294.

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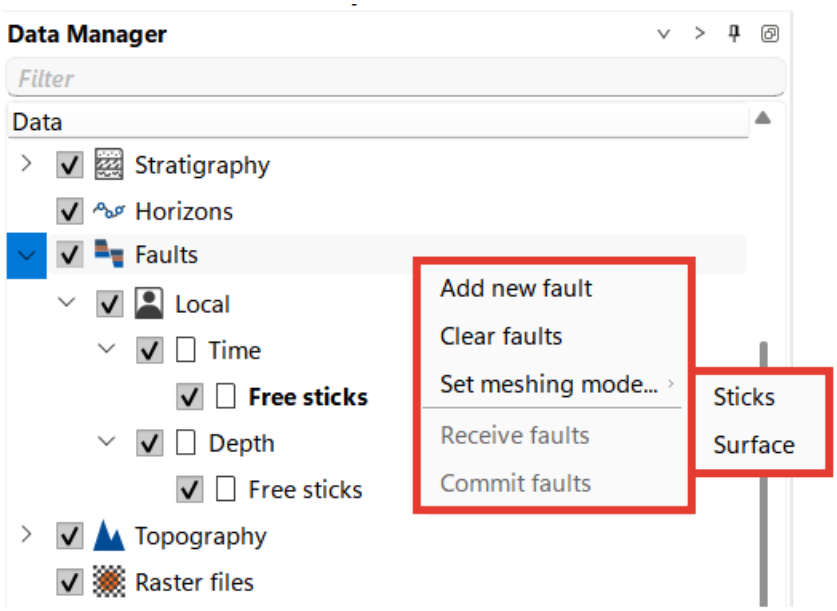

To start fault picking, create a new fault in the **Data Manager** or directly on the seismic section by pressing **Alt + Right Click Mouse** with the **Fault Picks** mode enabled (highlighted in red)

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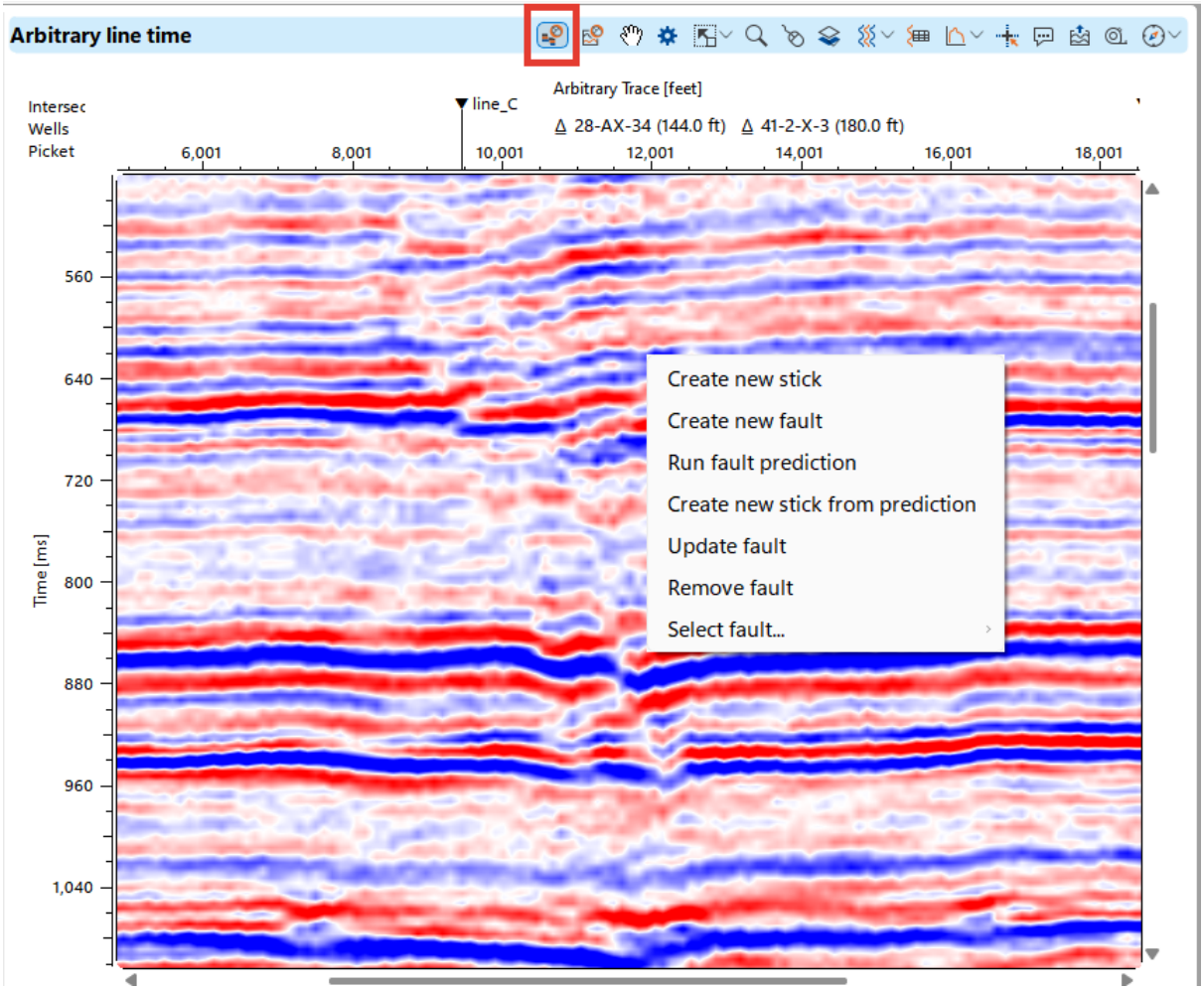

Users have access to various settings for visualizing faults in the View Properties 101 panel.

Make the object you want to customize active in the Data Manager 86, it will appear in the **Vista(s)** tab and visual settings will be available for each element at the bottom of the right area at the **Vista item properties**.

In the image below, a color palette is configured specifically for the seismic section, while the visualization of already picked faults and the current fault is managed separately.

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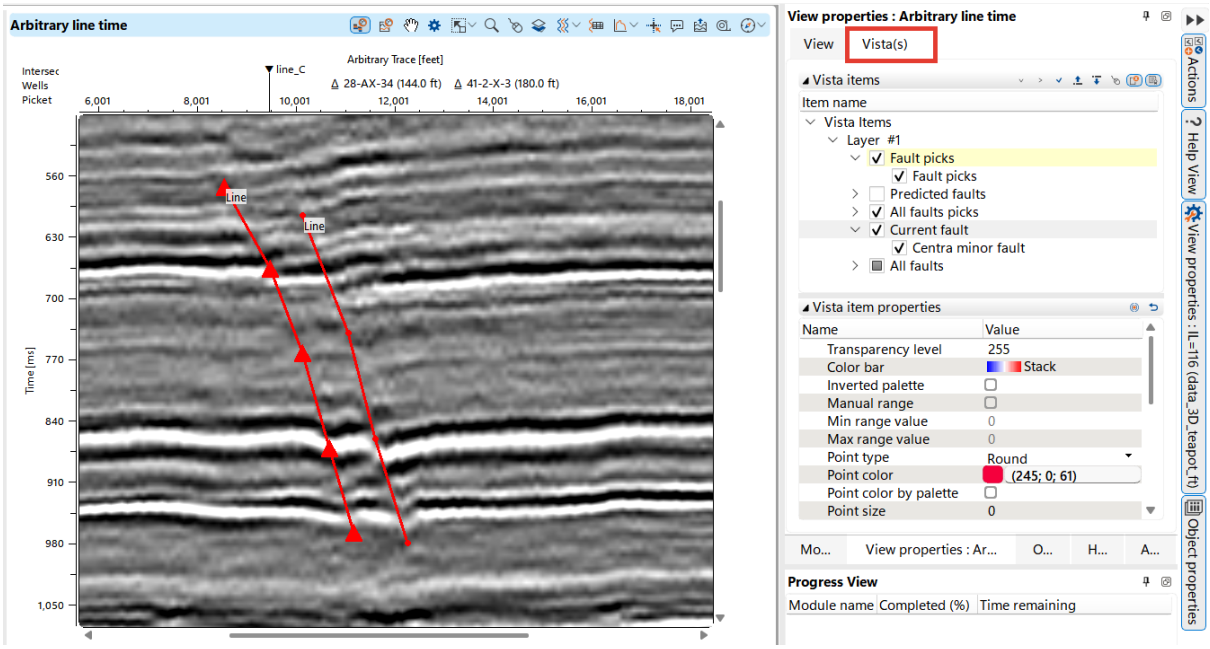
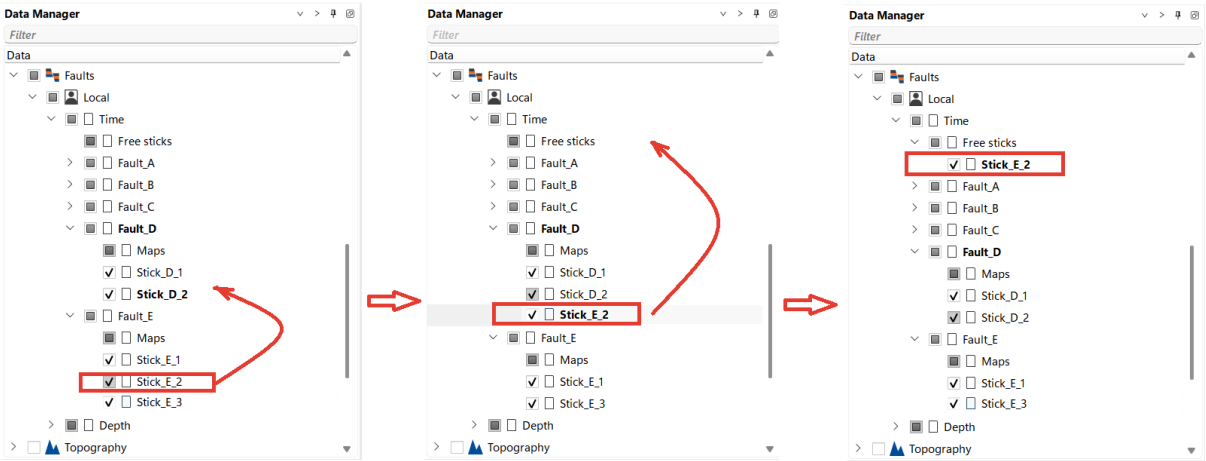


,

During the fault picking process, the user creates sticks within the folder of a specific fault. If a stick is mistakenly assigned to the wrong fault, the interpreter can easily correct this by selecting the stick with the left mouse button and dragging it to the correct fault folder. In cases where it is unclear which fault a particular stick belongs to during interpretation, the user can temporarily store it in the **Free Sticks** folder for later assignment.



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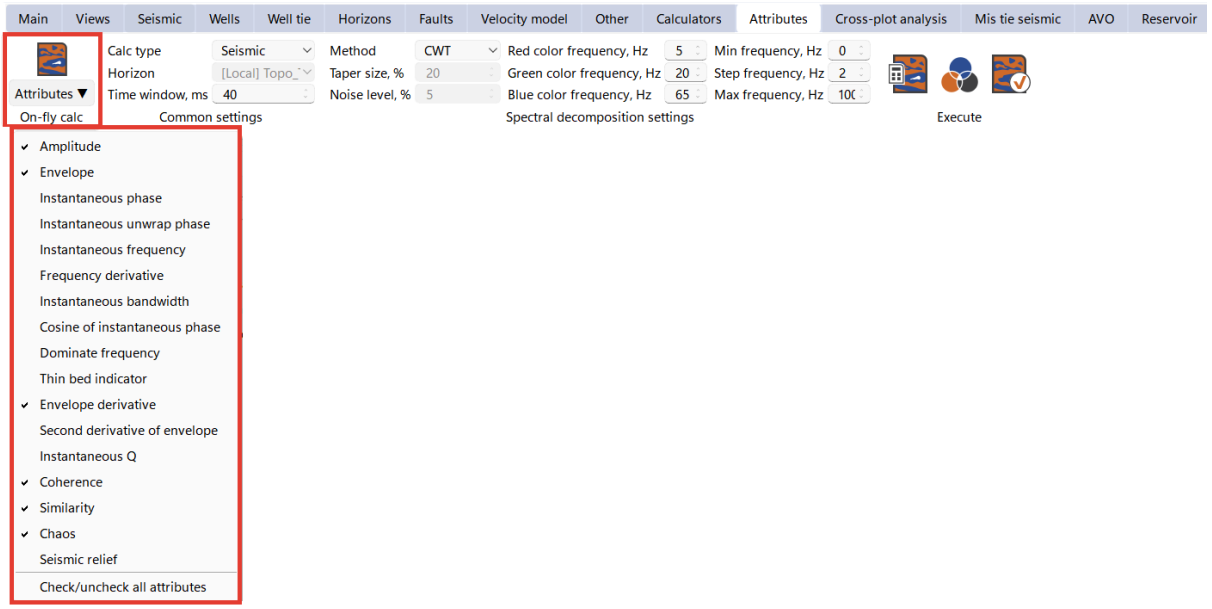
It is a common practice to use seismic attributes to enhance fault identification. While there is an entire chapter dedicated to Attribute analysis 472, here we will focus specifically on the **On fly attributes calculations** to aid in fault picking.

In the Attributes Bar 68, select **On fly calculation** and select the attribute you need, it will instantly appear on the section you have open.



Set up the palette for maximum efficiency and perform a fault pick.

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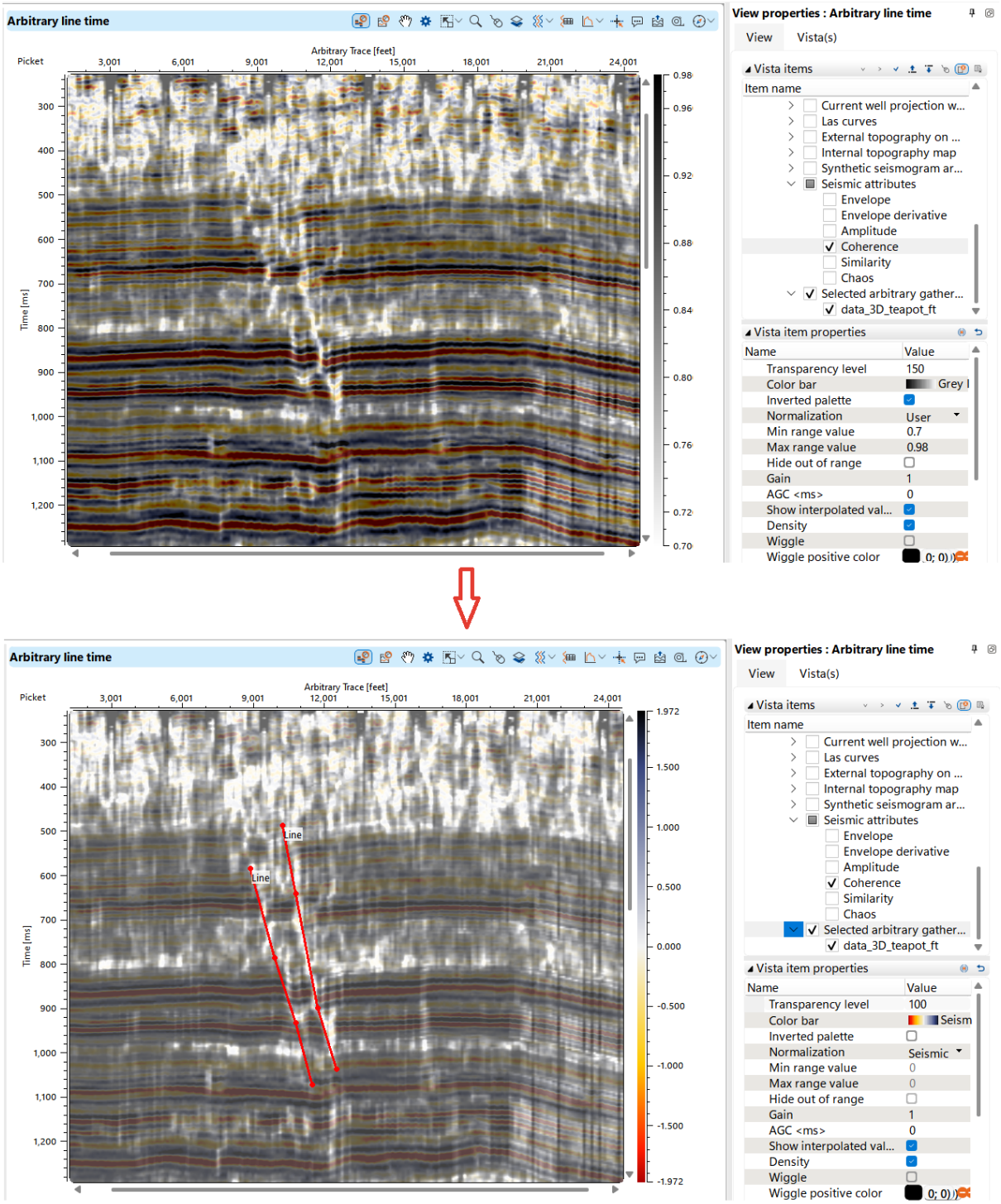

By default, in g-Space, all objects are displayed layer by layer in the map window, so the fault plane projection will be visible on the map. Users can filter and organize objects in the **Vista tab** tools menu located on the top panel.

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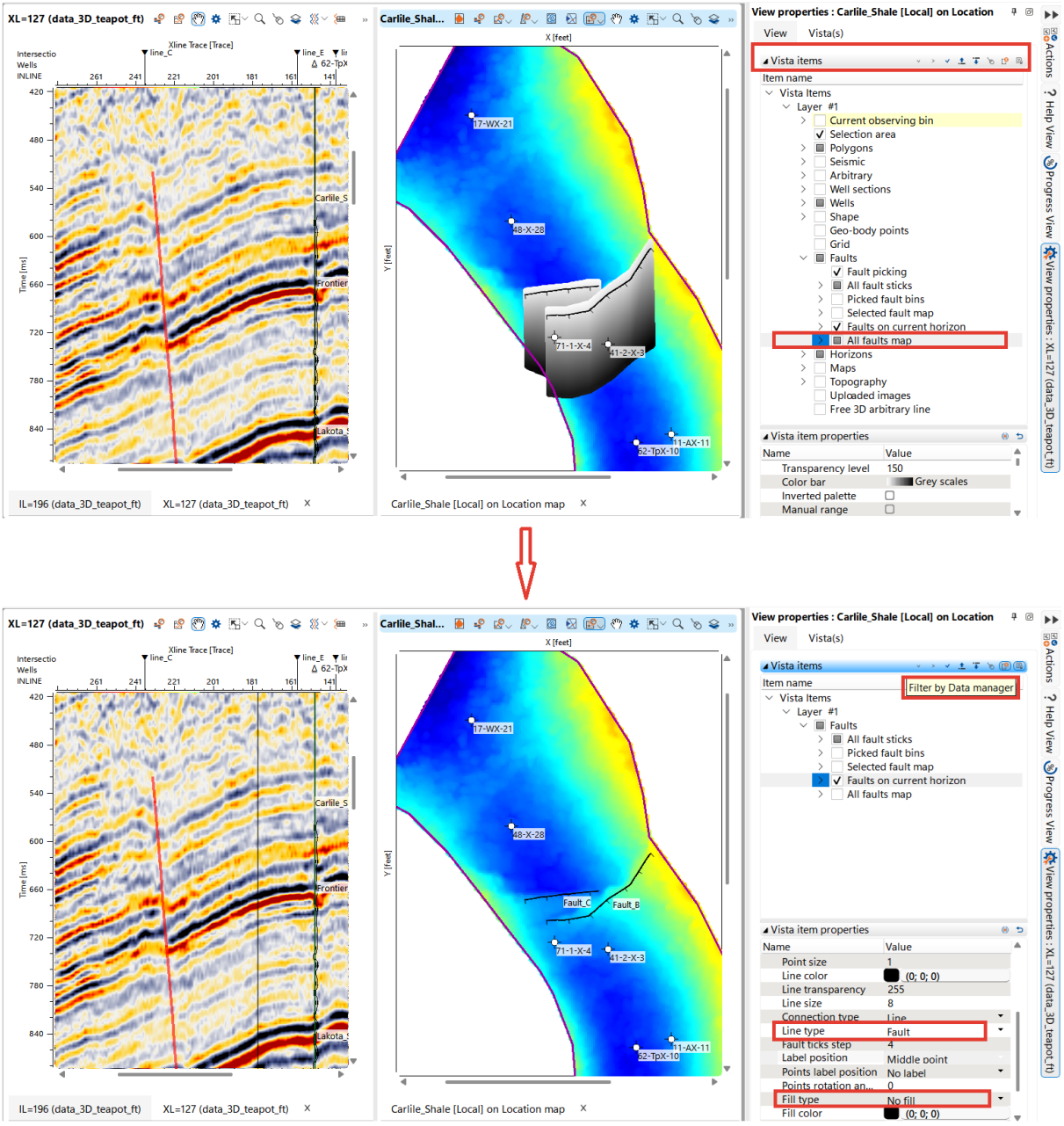
To display faults on the horizon map as a line, select **No fill** option in the Vista item properties and choose Fault line to create an image similar to the one shown below.

For more details on panel properties, refer to the Vista(s) and View Properties sections.



To rebuild the horizon map with faults included, go to the **Map interpolation** settings in **Parameters** and check the option **Use faults for map creation**. Then, in the **Data Manager**, right-click on the horizon and select **Recreate Horizon Map**. A pop-up will

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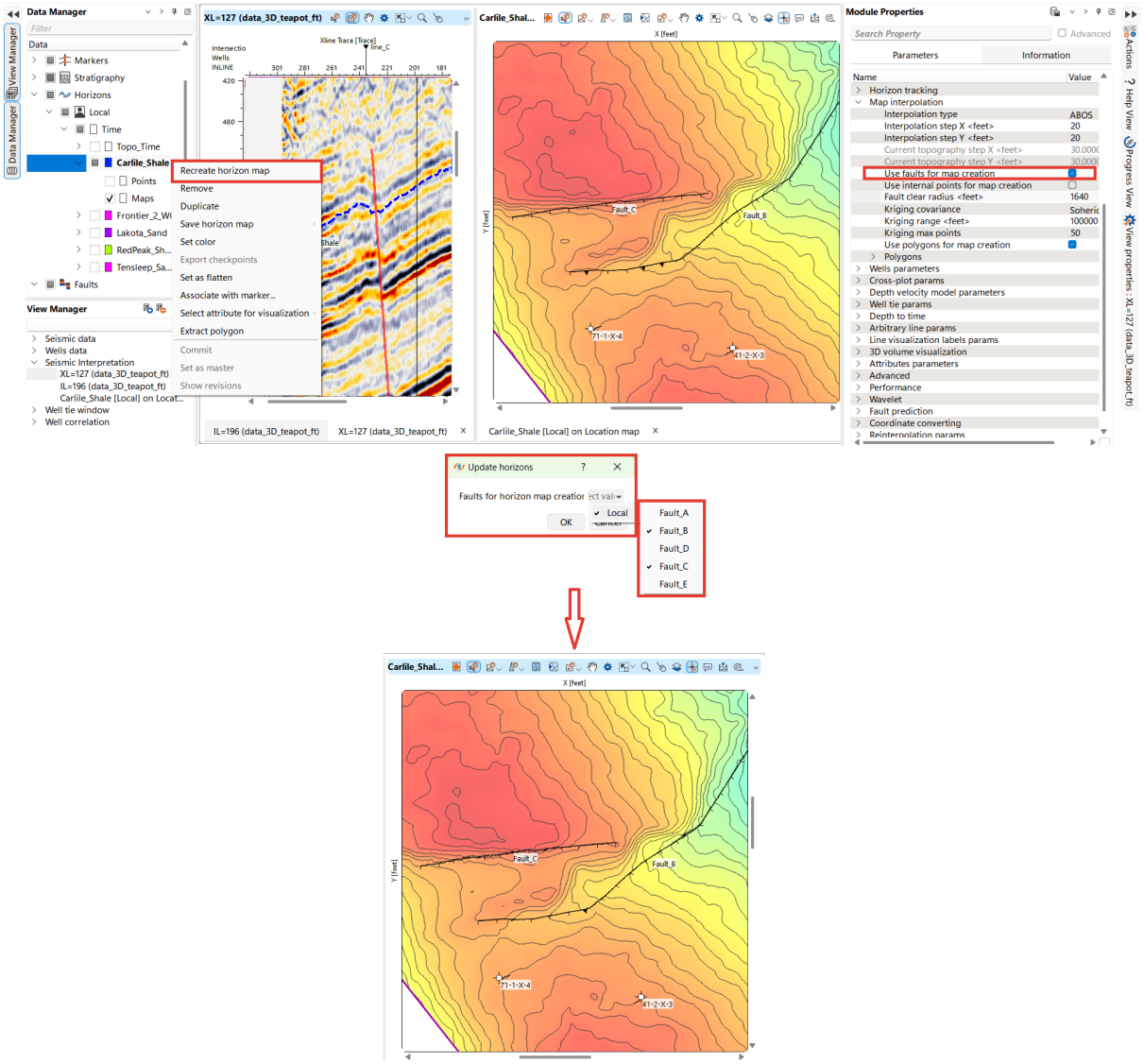
appear, allowing you to select a set of faults. From there, you can choose which faults to use for rebuilding the current map.



In the g-Space Map Editor 214, users can create a fault from a polygon. To do this, first create an empty polygon in the **Data Manager**. Then, draw the polygon on the map at the expected fault location, enabling the **Draw fault** function. Once you finish drawing by double-clicking, the polygon will resemble a fault, and the map will automatically update.

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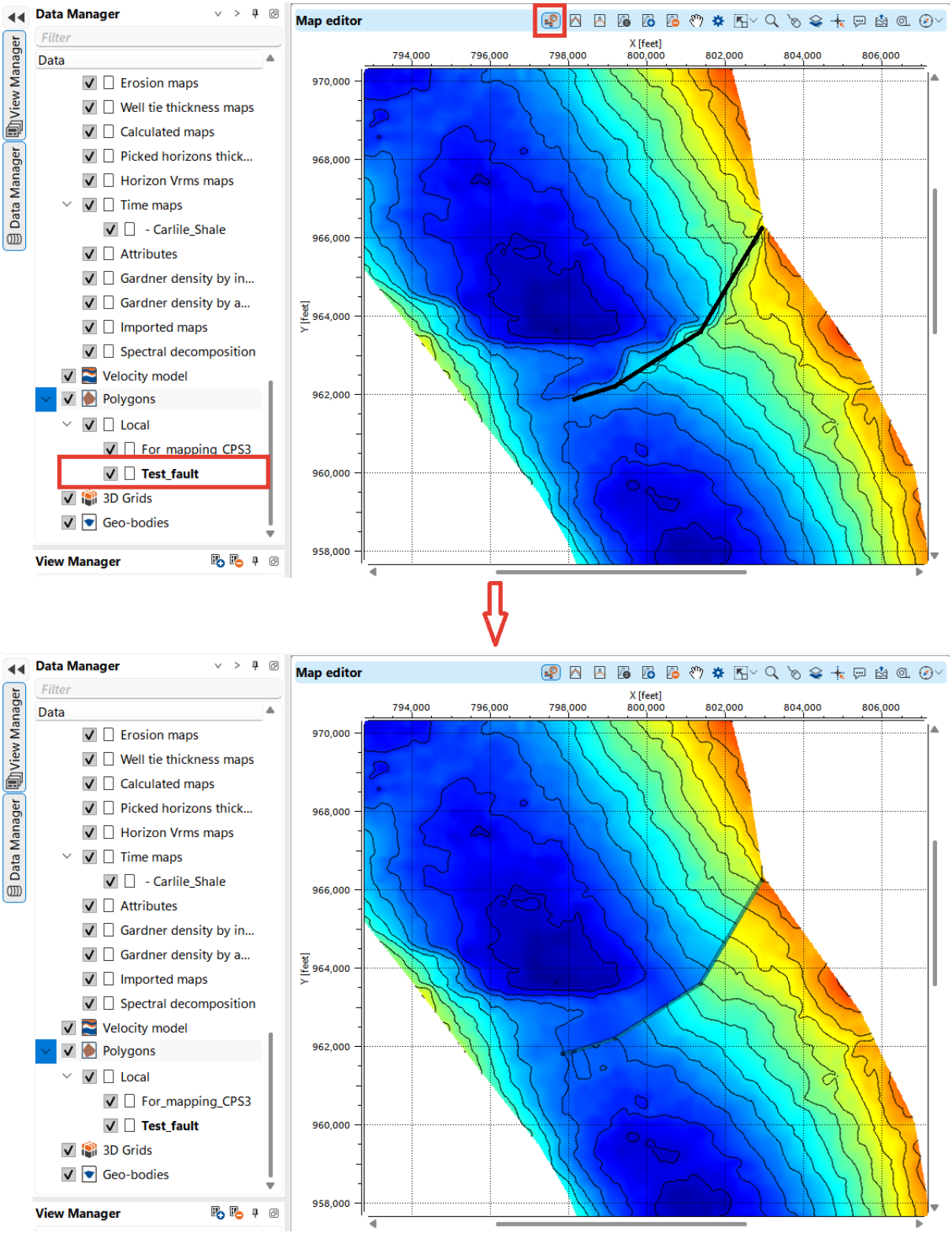

To save the polygon as a fault in the Data Manager, press **Alt + right-click** and select **Create fault from polygon**.

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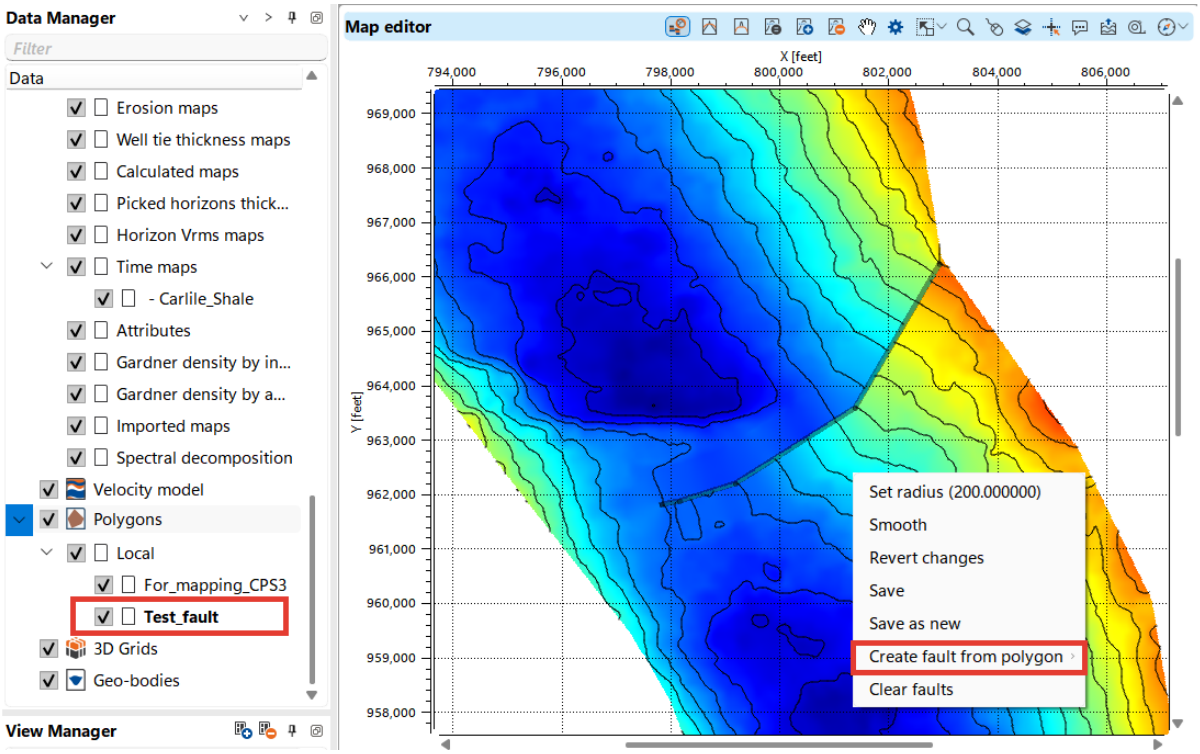

In the **Data Manager**, you can transfer data from polygons to faults by selecting the desired polygons, holding down the Shift key, and right-clicking. This will bring up the **Create fault** function in the menu. A pop-up will appear where you need to set the number of sticks for the break. We recommend setting the number of sticks to be no less than the number of polygon points.

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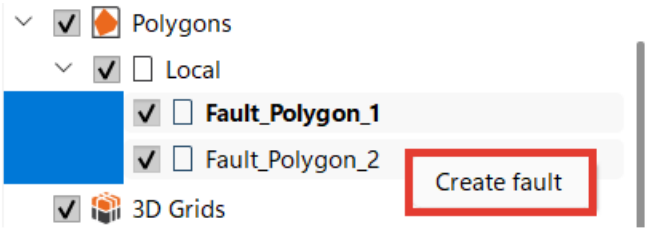
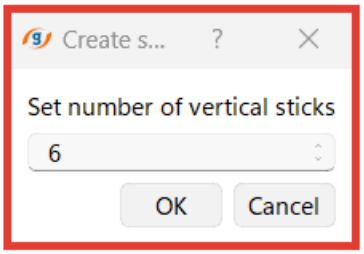
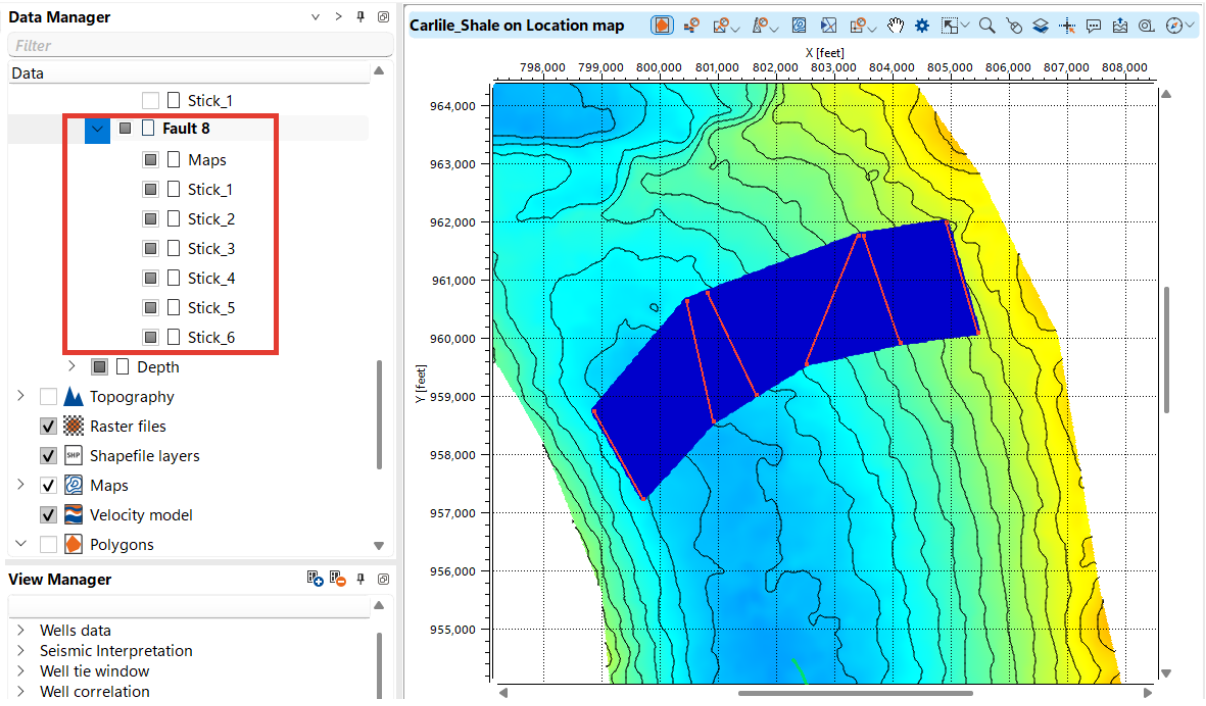




Name this fault and it will appear in the Data manager folder.



To work with faults in 3D view 133, you can set up visualization in the form of picks, sticks, fault maps and combine different types of visualization as shown in images below.

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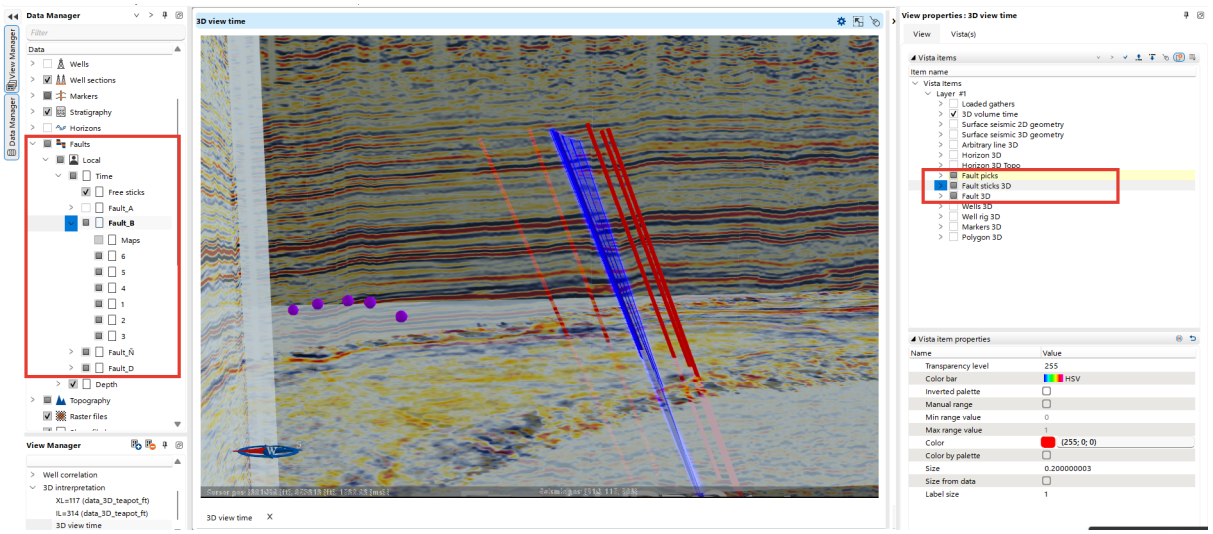
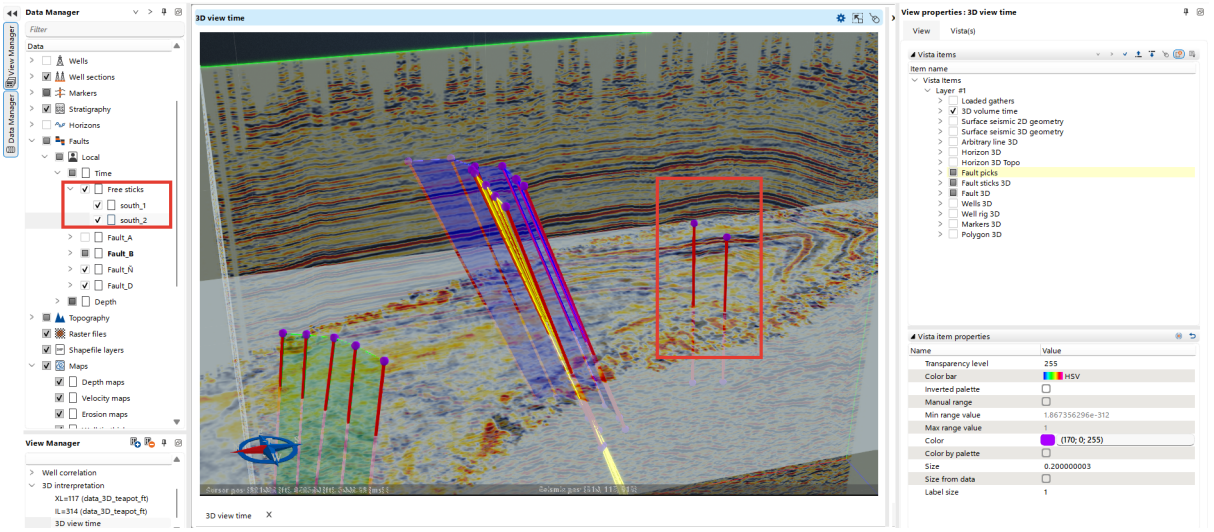


The user can also work with free sticks and customize their visualization.



Using the Faults bar 65 you can export the created faults.

9.3.3.1 Fault prediction

The **Fault Prediction** tool in g-Space helps identify and analyze fault structures in seismic data. Access this tool by pressing **Alt + right-click** on any seismic section.

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Time Analysis Parameters

- Correlation time window: Defines the vertical analysis window for examining seismic trace patterns, measured in milliseconds. A larger window considers more data vertically.
- Correlation window: Determines how many adjacent traces to analyze horizontally. Larger values include more neighboring traces for pattern recognition.
- Maximum shift: Sets the maximum allowable time shift when correlating traces, measured in milliseconds. Limits the search range for matching patterns.

Visual Enhancement

- Time stretch: Controls the vertical exaggeration percentage of the display. Higher values enhance fault visibility by making them appear more vertical.

Smoothing Controls

- Sigma for local faults: Fine-tunes the smoothing for detailed fault features. Lower values maintain more local detail.
- Sigma for generalized faults: Controls regional fault trend smoothing. Higher values emphasize major fault systems.
- Sigma for noise reduction: Determines noise filtering intensity. Higher values produce cleaner images but may reduce subtle details.

Processing Control

- Autopicking step: Sets the increment between automatic fault picks. Lower values increase detail but require more processing time.

9.3.3.2 AI Faults Wizard

AI Faults Wizard is a tool for automatic fault detection in 3D seismic data using neural networks. The wizard performs a complete processing cycle: from fault detection to generation of geometric objects ready for interpretation and analysis.

Purpose

The tool is designed for:
- Automating fault detection in seismic data
- Accelerating structural features interpretation
- Improving quality and detail of fault mapping
- Reducing subjectivity in manual interpretation

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Features

- Automatic fault detection using trained neural networks
- Calculation of planarity (reflector continuity) and faultness (fault centerline) attributes
- Determination of fault orientation in space
- Generation of fault geometry (fault sticks) with automatic clustering into faults
- Preset parameters for quick start

Workflow

The wizard includes three sequential steps (tabs):

1. **AI Fault Attribute** — fault detection using neural network
2. **Attribute Processing** — calculation of planarity and fault characteristics (faultness and orientation)
3. **Sticks & Faults** — fault geometry construction

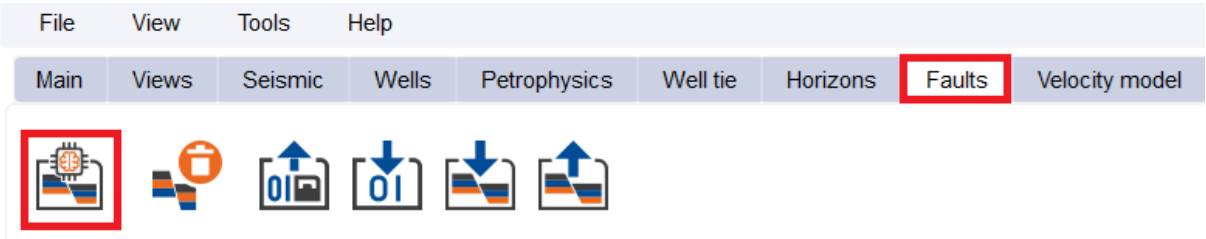
Requirements

- 3D seismic cube in SEGY format loaded into the project
- Seismic data available in Data Manager 86
- Sufficient RAM for cube processing

Launching the Wizard

Launch methods:

- Through **Wizards** panel (if activated)
- Through Ribbon 33 menu → **Faults** → **AI Faults Wizard**



The wizard opens as a dialog window with three tabs (**AI Fault Attribute**, **Attribute Processing**, **Sticks & Faults**). Each tab contains parameters for the corresponding processing stage.

Results:

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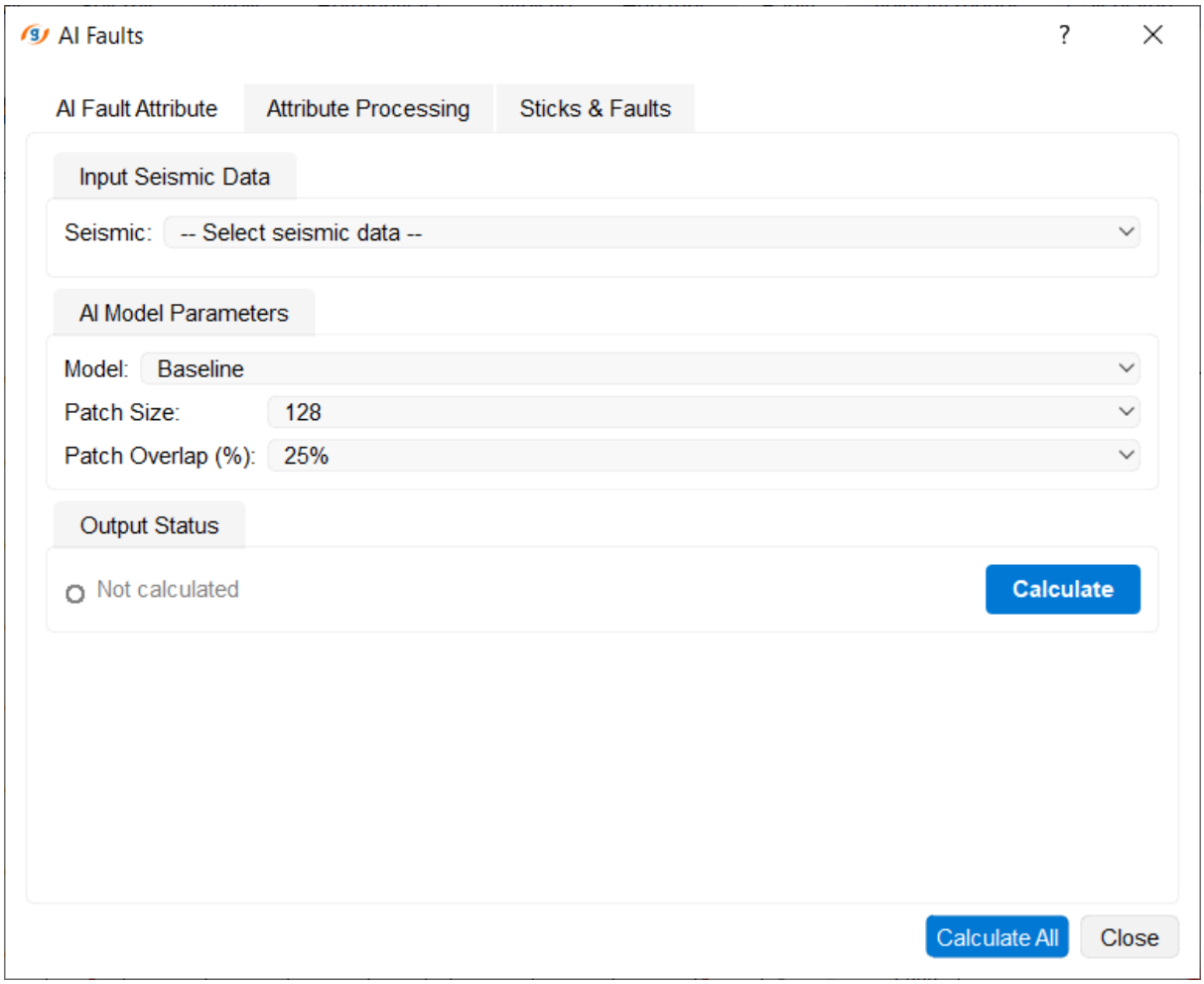
- All calculated attributes are automatically saved in Data Manager in the **Seismic Data / Attributes** section
- Each attribute is assigned a suffix for identification: `_AIFaults`, `_Planarity`, `_Faultness`, `_Orientation`
- Visual indicators (green checkmark) show successful stage completion
- Results from one step automatically become available for selection in the next step

Step-by-Step Guide

AI Fault Attribute Tab: Fault Detection

Application of a trained neural network for automatic fault detection in seismic data. The neural network analyzes fracture patterns and creates a probability map of fault presence.



Procedure:

1. Select seismic cube

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- In the **Input Seismic Data** group, select a 3D seismic cube from the **Seismic:** dropdown list
- Only 3D data is supported (2D is not supported)

2. Configure parameters

In the **AI Model Parameters** group:

Model: — neural network model selection
- **Baseline** — base model (default)

Patch Size: — neural network processing window size:
- **32/64** — fast processing, but worse at capturing large structures (for preview)
- **128** — optimal balance of speed and quality, good for medium and large structures (default, recommended)
- **192/256** — maximum detail, best for large structures, but slow processing (for final analysis)

Patch Overlap (%): — overlap of adjacent processing windows:
- **0%** — maximum speed, possible artifacts at window boundaries
- **10%** — fast with minimal boundary smoothing
- **25%** — optimal balance (default, recommended)
- **50%** — maximum quality, minimum artifacts, slow processing

3. Run calculation
- In the **Output Status** group, press the **Calculate** button
- Processing may take from several minutes to several hours depending on cube size and parameters
- Result is automatically saved in Data Manager with suffix `_AIFaults`
- After completion, a green checkmark and the calculated attribute name appear in the **Output Status** group

Result:
AI Faults attribute (SEGY format) — probability map of fault presence, where high values correspond to areas with high fault probability.

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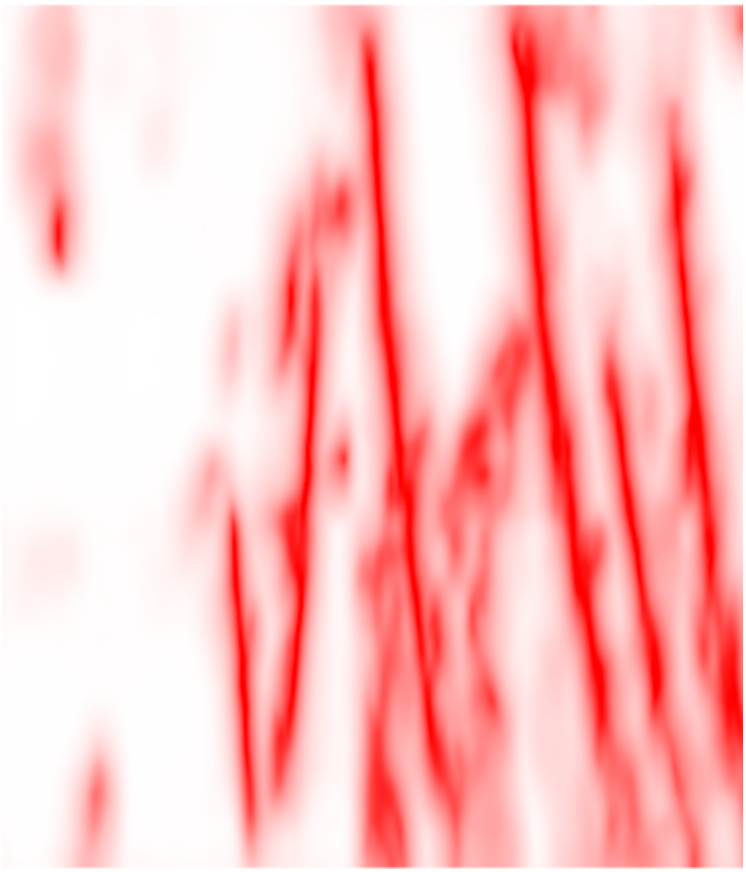

Attribute Processing Tab: Attribute Processing

Calculation of planarity and fault characteristics attributes. The tab contains two processing stages.

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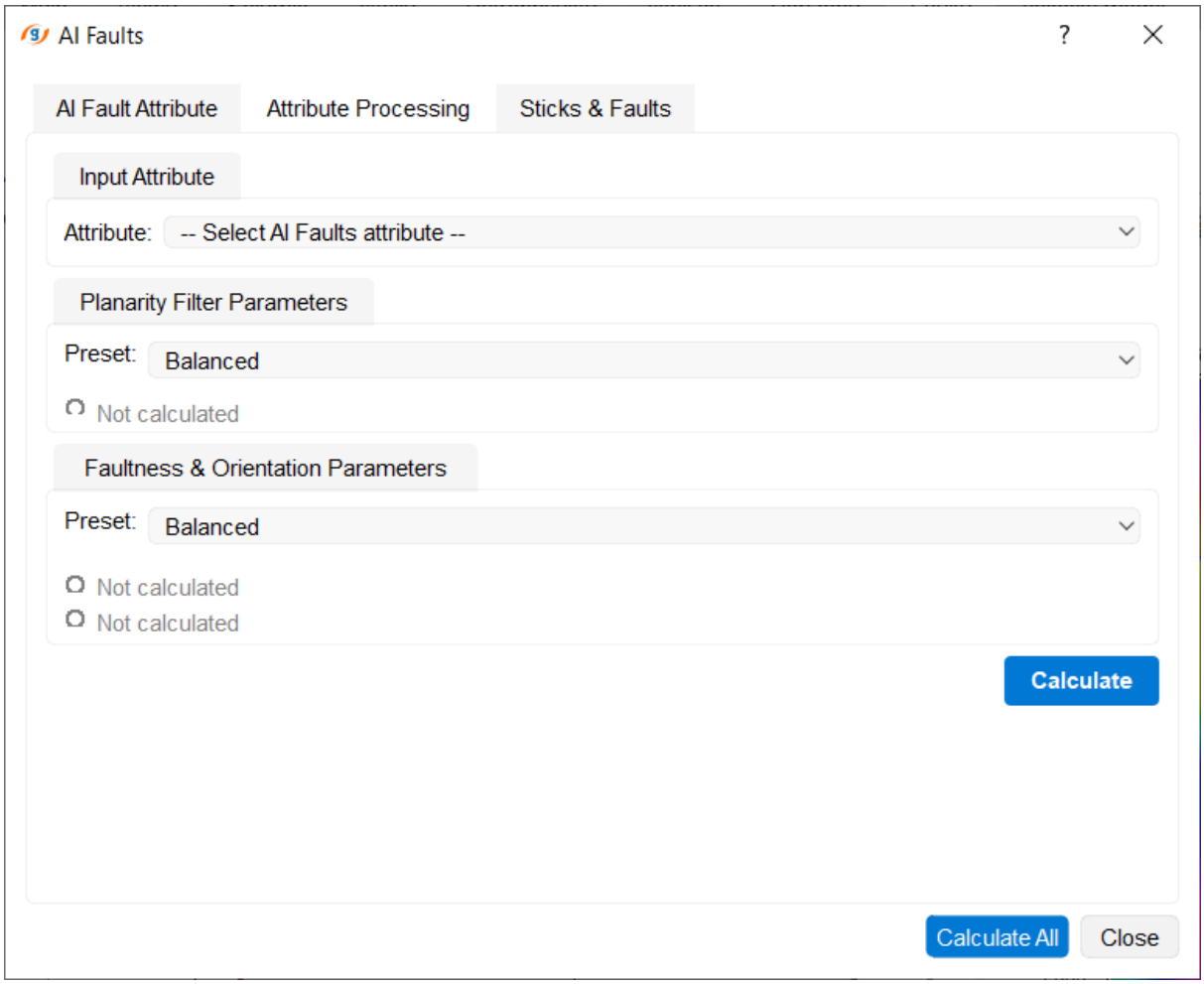

Stage 1a: Planarity

Calculation of planarity — a measure of seismic reflection continuity. Planarity helps identify areas with disrupted continuity (faults) and improves quality of subsequent analysis.

Procedure:

1. Select attribute

- In the **Input Attribute** group, the AI Faults attribute from the **AI Fault Attribute** tab is automatically selected
- You can manually select a different attribute if needed

2. Configure parameters

In the **Planarity Filter Parameters** group:

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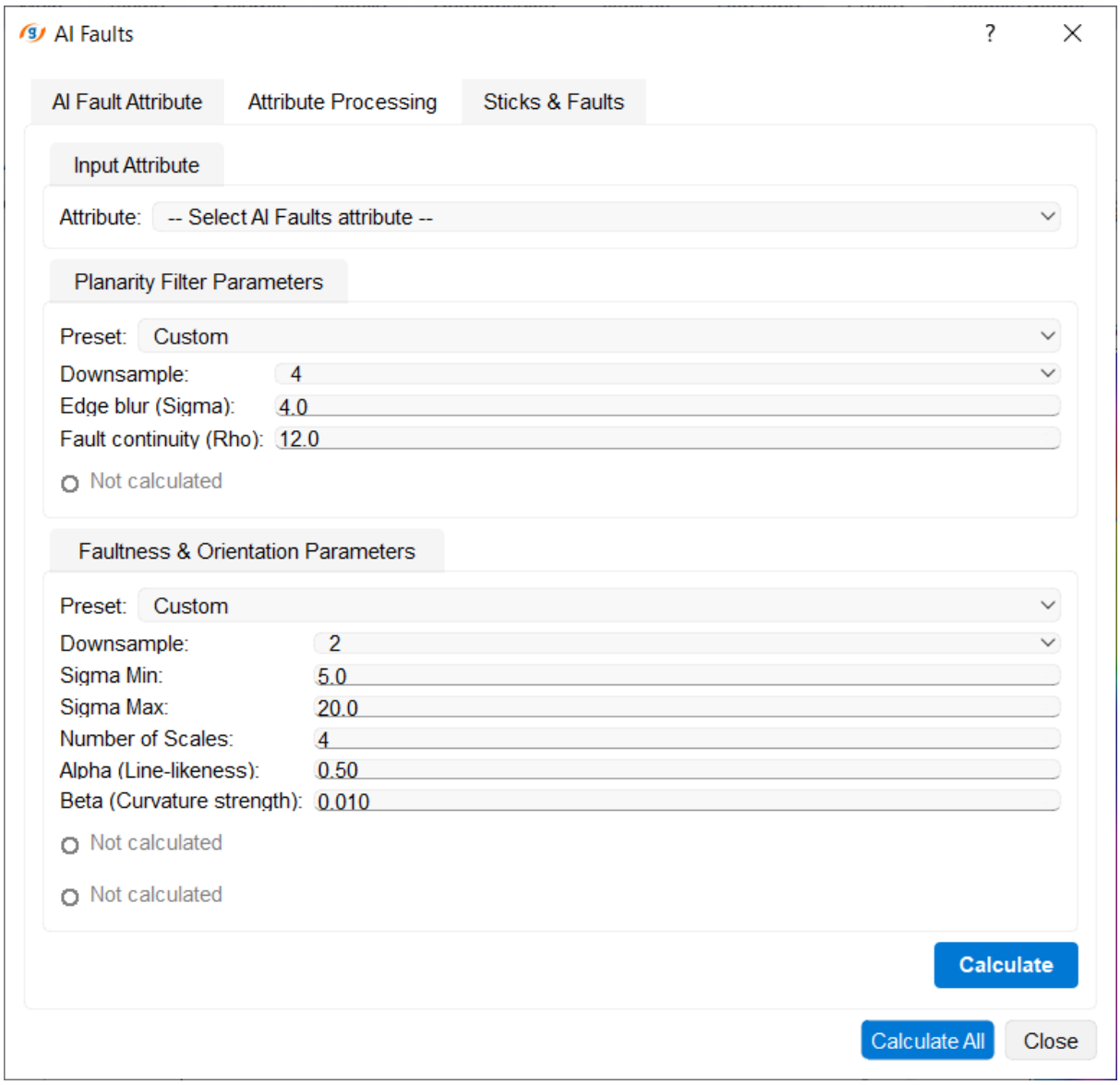
Preset: (recommended to start with):
- **Sharp** — for clear, well-defined faults (minimal smoothing)
- **Balanced** — universal option for most cases (default)
- **Smooth** — for noisy data or weakly expressed faults
- **Custom** — manual adjustment of all parameters

When **Custom** is selected, the following parameters become available:
- **Downsample:** Data simplification for faster calculation (1 = full resolution, 2 = every second trace/sample)
- **Edge blur (Sigma):** Smoothing radius when detecting fault edges
- **Fault continuity (Rho):** Structural continuity analysis radius around a point



3. Run calculation

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- Press the **Calculate** button (at the bottom of the tab)
- Result is automatically saved with suffix `_Planarity`
- After completion, a green checkmark and calculated attribute name appear in the **Planarity Filter Parameters** group

Stage 1b: Fault Attributes

Calculation of fault centerline (Faultness) and fault orientation (Orientation) attributes.

Faultness — attribute that highlights the fault centerline (ridge), showing the fault axis where the value is maximum. Instead of a wide fault zone, faultness creates a thin centerline, which is used for automatic stick construction. This allows precise determination of fault position and geometry construction along its axis.

Orientation — attribute of fault strike azimuth in the horizontal plane (fault direction in map view), necessary for correct geometry construction and grouping of sticks into individual faults.

Input data:
- Planarity result from Stage 1a is used automatically

Configure parameters:

In the **Faultness && Orientation Parameters** group:

Preset:
- **Sharp** — clear faults, minimal smoothing
- **Balanced** — universal option (default)
- **Smooth** — smoothed results for noisy data
- **Custom** — manual adjustment of all parameters

Run calculation:
- Press the **Calculate** button (at the bottom of the tab)
- Two attributes are generated simultaneously: **Faultness** (fault centerline for stick construction) and **Orientation** (fault strike azimuth in horizontal plane)

Results:
- Planarity attribute (SEGY) — planarity map
- Faultness attribute (SEGY) — fault centerline (ridge)
- Orientation attribute (SEGY) — fault strike azimuth in map view

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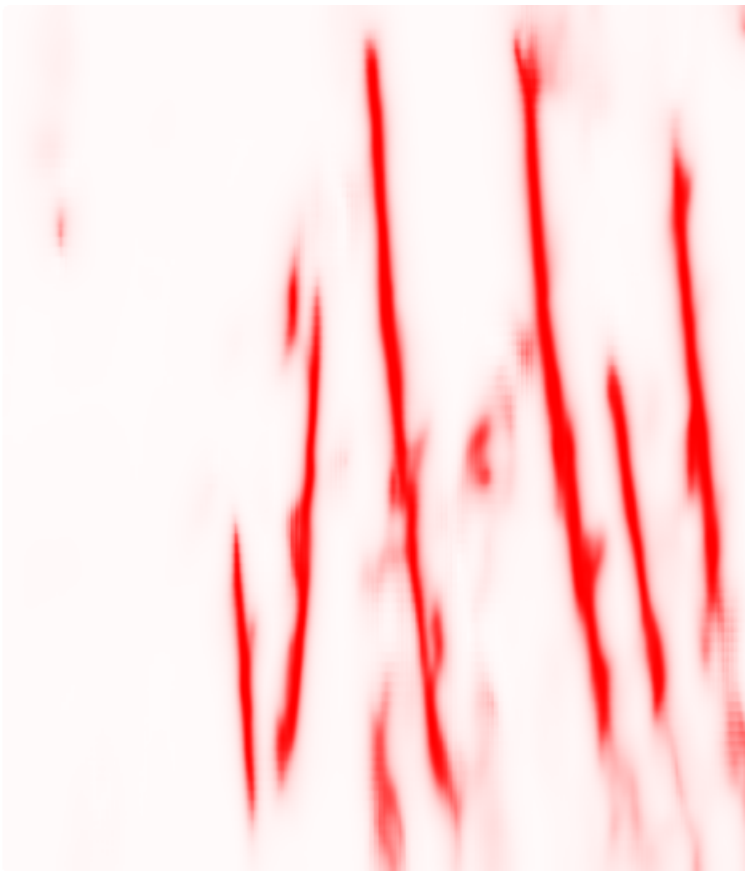

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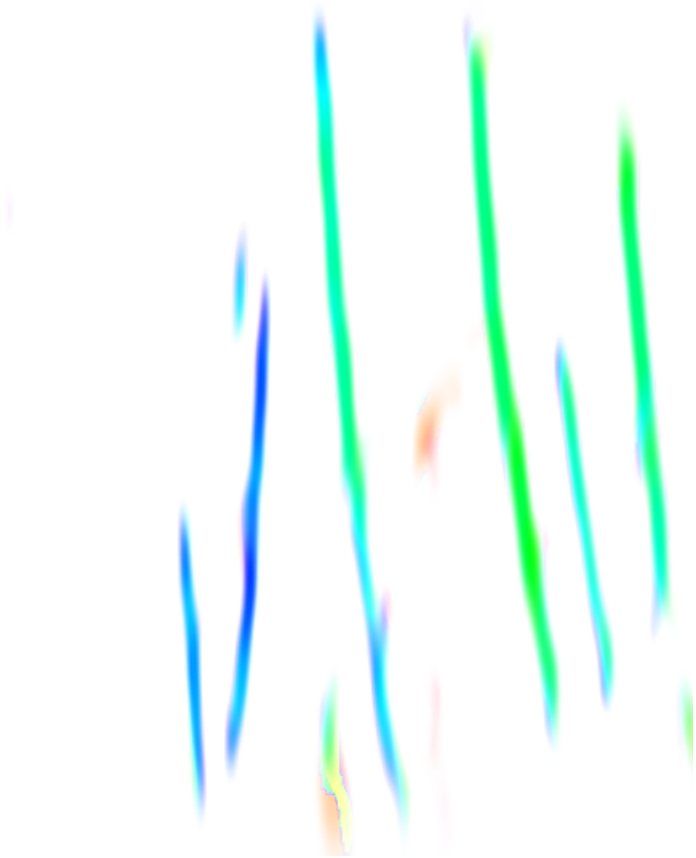

Sticks & Faults Tab: Fault Stick Generation

Construction of three-dimensional fault geometry (fault sticks) based on fault centerline (Faultness) and orientation (Orientation) attributes. Faultness highlights the fault axis (ridge), allowing automatic stick construction along the centerline.

Process consists of two stages:

1. **Stick tracing** — construction of vertical lines along fault central axes. Each stick extends while the fault remains pronounced (high Faultness) and the fault strike azimuth does not change more than the tolerance (Orientation Tolerance).
2. **Grouping into faults** — for each stick in each time slice, the algorithm searches for neighbors in two directions along the fault strike (along the high Faultness line). Sticks are combined into one fault only if they are mutual neighbors: if stick A sees stick B on the left, then stick B must see stick A on the right. This prevents erroneous merging at fault branches.

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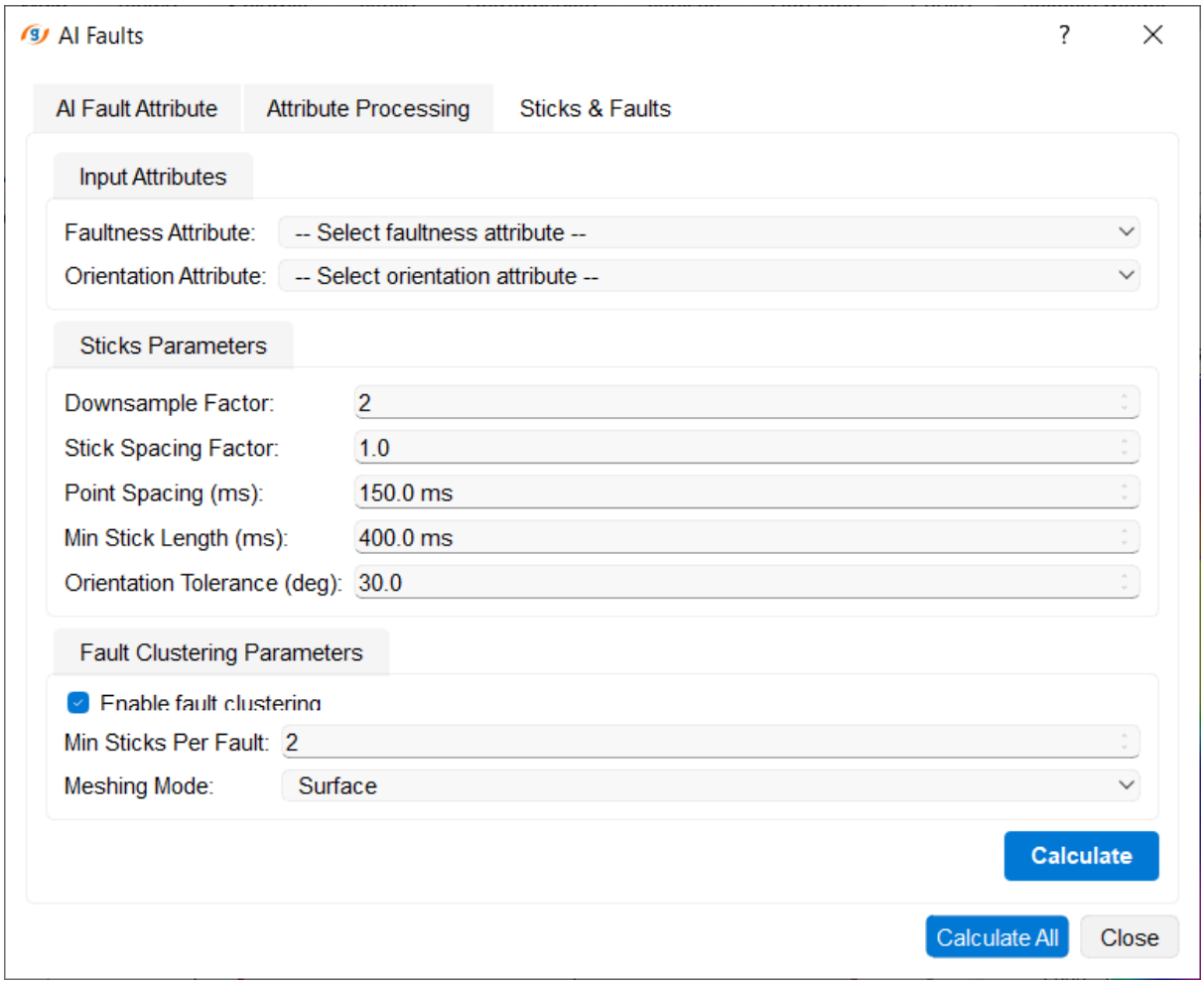

Procedure:

1. Select attributes

- In the **Input Attributes** group, select the fault centerline attribute (Faultness) and orientation attribute (Orientation) from the Fault Attributes stage
- Both attributes are selected automatically if the **Attribute Processing** tab is completed

2. Configure parameters

In the **Sticks Parameters** group:

- **Downsample Factor:** Resolution reduction coefficient for faster processing
- **Stick Spacing Factor:** Distance between sticks as a multiplier of fault thickness (1.0 = spacing equals thickness)
- **Point Spacing (ms):** Distance between points along the stick (0 = no reduction, keep all points)
- **Min Stick Length (ms):** Minimum stick length for inclusion in results

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- **Orientation Tolerance (deg):** Allowable change in fault strike azimuth when extending the stick

In the **Fault Clustering Parameters** group:
- **Enable fault clustering:** Enable/disable automatic grouping of sticks into faults
- **Min Sticks Per Fault:** Minimum number of sticks to form a fault
- **Meshing Mode:** Surface (continuous surface reconstruction) or Sticks (display as individual stick lines)

3. Run calculation
- Press the **Calculate** button (at the bottom of the tab)
- Results are automatically added to Data Manager 86 (Faults / Time or Depth)

Result:
Fault Sticks — three-dimensional fault geometry represented by a set of vertical lines (sticks), grouped into individual faults. Available for:
- Visualization in 3D View 133, Map View, Seismic Sections
- Conversion to Surface Mode 437 (fault surfaces)
- Export to other applications
- Further editing and interpretation

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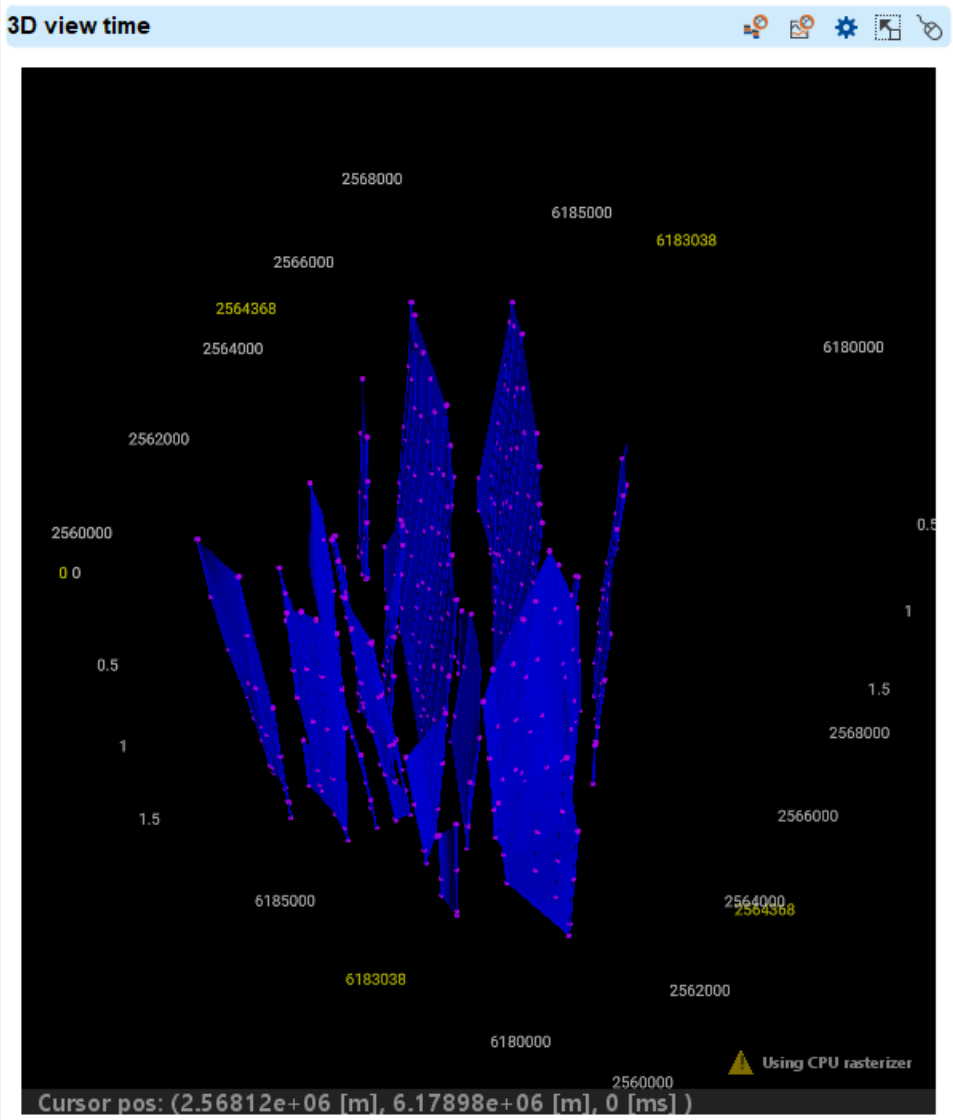

3D view time ×

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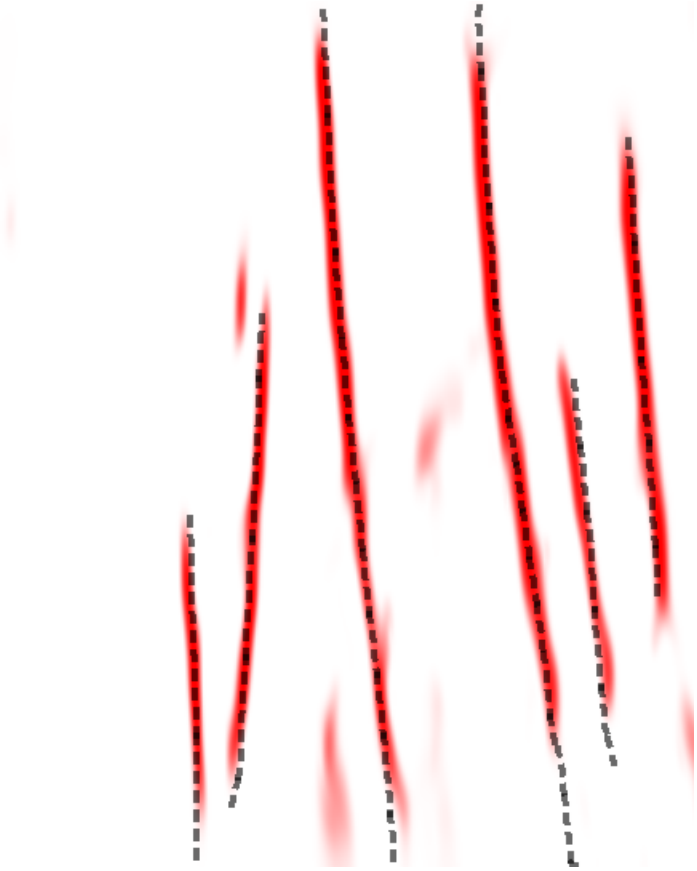

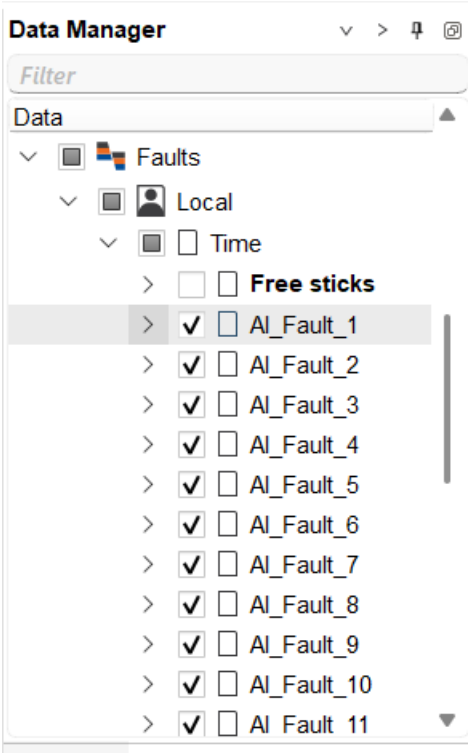

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Calculate All

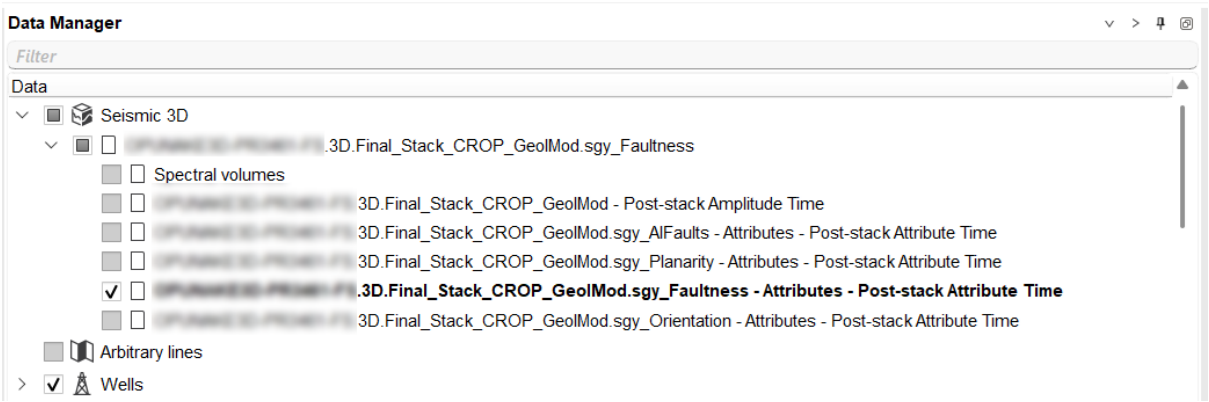
The **Calculate All** function performs all three steps sequentially in automatic mode — from fault detection to geometry generation. This is the most convenient method for complete processing.

Procedure:
1. Go to the **AI Fault Attribute** tab and select the seismic cube
2. Review and configure parameters on all three tabs (or leave defaults for quick start)
3. Press the **Calculate All** button (at the bottom of the wizard window, next to the **Close** button)
4. The wizard will automatically execute all stages in correct sequence

Advantages:
- Time saving: No need to manually switch between tabs
- Reliability: Automatic transfer of results between stages
- Convenience: Ideal for first run with default parameters

Visualization of Results

Viewing Attributes:
After executing **AI Fault Attribute** and **Attribute Processing**, attributes are available in Data Manager 86 → **Seismic Data / Attributes**. Attributes can be visualized in 2D/3D Seismic Views.



Viewing Fault Sticks:
Sticks & Faults results are available in Data Manager 86 → **Faults / Time (or Depth)**. Visualization options: 3D View 133, Map View 124, Seismic Sections. Mode switching: Free Sticks or Surface Mode 437. Display settings in View Properties 101 (color, thickness, transparency).

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Recommendations

General Approach:
- Start with Preset=**Balanced** for first run
- Use **Calculate All** for automatic execution of all steps
- Follow iterative approach: quick assessment → result analysis → detailed processing
- Use polygons to limit processing area for parameter testing

Performance Optimization:
- Reduce Patch Size (64) and Overlap (10%) for quick assessment
- Use Downsample=2 or 4 on large cubes
- Increase Stick Spacing Factor to 2.0-3.0 for preview calculations

Quality Improvement:
- Check seismic data quality (structural smoothing can improve results)
- For clear faults: use Preset=**Sharp** with minimal smoothing
- For noisy data: use Preset=**Smooth** with increased regularization
- For curved faults: increase Orientation Tolerance to follow fault bends in horizontal plane

See Also

- Fault picking 437
- Seismic attributes 472
- Data Manager 86
- Import faults 294
- Export faults 325

9.4 Velocity model

The **Velocity Modeling** in g-Space allows users to create and refine velocity models interactively, utilizing /// data.

In this guide, we will explore the various tools available under Velocity Modeling using the /// from the Demo project.

> *Subscribe to our channel and watch the video on how to build a velocity model in g-Space on YouTube*

Grid maps can be created in g-Space by converting horizons to time grids or running velocity model which stores all results in Maps folder in Data Manager 86

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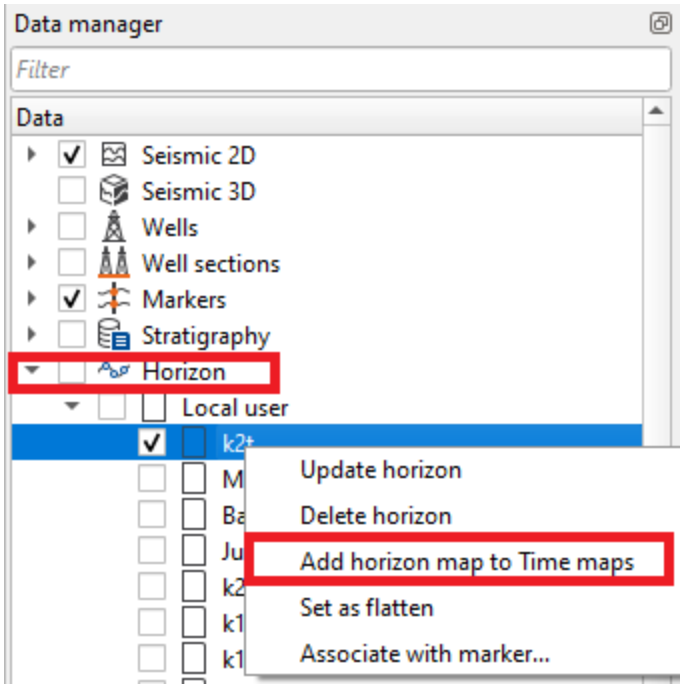
To convert horizon to time grid press Right Click Mouse on horizon to convert on Horizon icon in Data Manager and choose **Add horizon to Time Maps**



The **Data Manager** for velocity models in g-Space has a hierarchical structure to manage different velocity model types and their associated data. Here's a breakdown of the structure as shown in the image:

1. **Velocity Model**: This is the top-level category where all the velocity models are organized.
2. Model name: This section holds data related to the specific velocity model.
   - **Velocity**:
     - **Interval Velocity**: Displays the constant velocity values used in the interval velocity calculation./ **Interval Velocity**: Shows interval velocity values for specific horizons (e.g., Carlile_Shale, Lakota_Sand, Tensleep_Sand).
     - **Average Velocity**: Displays the constant velocity values used in the average velocity calculation. /**Average Velocity**: Shows average velocity values for the same horizons.
   - **Skeleton**:
     - **Time**: Represents the time skeleton of the velocity model.
     - **Depth**: Provides depth information for the horizons.
   - **Depth**:
     - **By Interval Velocity**: Represents the depth calculated using interval velocity.
     - **By Average Velocity**: Represents the depth calculated using average velocity.
   - **Wells Mismatch**:

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        - **Points**: Represents any mismatch between the well data and the velocity model.
    - **Map**:
        - **By Interval Velocity**: Shows interval velocity maps for horizons.
        - **By Average Velocity**: Shows average velocity maps for horizons.

9.4.1 Setting up the velocity model

The **Velocity Model** tool in g-Space allows users to create different types of velocity models for seismic data interpretation. This chapter describes the available options, how to set up each model, and the parameters required for accurate velocity modeling.

1. Constant Model

The **Constant Model** generates a velocity model with a uniform velocity value throughout the entire geological section. The user needs to set the following parameters:

- **Datum**: The reference depth from which the model is calculated.
- **Max Depth**: The maximum depth for the velocity model.
- **Depth Step**: The vertical resolution or step size for calculating velocity.
- **Velocity**: The constant velocity value that will be applied throughout the entire depth range.

2. Constant Layered Model

The **Constant Layered Model** allows for the definition of velocity between multiple horizons with constant velocities for each layer. The user must:

- **Select Horizons**: Choose the horizons that will define the layers within the model.
- **Set Velocity for Each Horizon**: Specify the constant velocity for each layer between the horizons.
- **Set Parameters**:
    - **Datum**: The reference depth.
    - **Max Depth**: Maximum depth for the model.
    - **Depth Step**: Vertical resolution for velocity calculation.
    - **Number of Supersamples**: Controls the number of intermediate velocity samples for improved precision in the model.

3. Markers + Horizons

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In the **Markers + Horizons** model, the velocity is derived using both well markers and seismic horizons. This method interpolates velocities between well markers, adjusted by the seismic horizons, allowing for a more geologically driven velocity model. The user must:

- **Select Markers**: Choose the well markers to anchor the velocity model.
- **Select Horizons**: Add horizons to further refine the model's vertical velocity structure.
- **Adjust Parameters**: Set additional parameters such as depth step and max depth for model accuracy.

4. Grid velocity by markers + horizons

5. Checkshot Extrapolations

6. Checkshots + Markers

The **Checkshot Extrapolation** option allows users to incorporate checkshot data for accurate time-depth conversion and velocity model creation. This method extends velocities from available checkshots through extrapolation to provide a smooth, reliable velocity field. The process includes:

- **Selecting Checkshots**: Import or select checkshot data from wells.
- **Extrapolation Settings**: Define the method of extrapolation for areas beyond available checkshot data.

7. Checkshots + Markers + Horizons

This option combines **Checkshots**, **Markers**, and **Horizons** to create a detailed velocity model. By integrating all three data types, the model reflects both well control (checkshots and markers) and seismic horizon information. The process involves:

- **Selecting Checkshots**: Import checkshot data.
- **Selecting Markers**: Choose well markers to define key depth points.
- **Selecting Horizons**: Add seismic horizons for further refinement.
- **Setting Extrapolation Options**: Define how velocity is interpolated or extrapolated between the data points.

8. From Vrms

The **From Vrms** option generates a velocity model based on RMS velocity data. This method is particularly useful when working with pre-stack seismic data where Vrms velocities have been calculated. The workflow includes:

- **Importing Vrms Data**: Load the RMS velocity information into the model.

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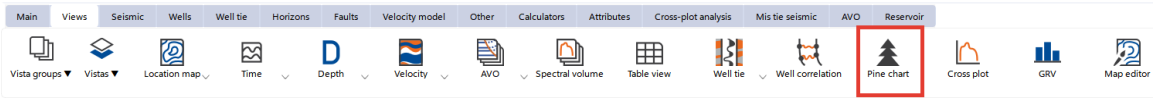
- **Defining Parameters**: Set up the depth step, max depth, and interpolation method for converting Vrms to interval velocities.

9.4.2 Velocity model QC

To access the **Velocity model QC** tool navigate to the Views and

The Pine chart tool allows users to visualize and compare the velocity model with well data in a two-dimensional space. The chart is structured as follows:

- **X-Axis (Offset)**: Represents the distance from
- **Y-Axis (Depth)**: Indicates the depth of the geological layers, which is essential for correlating seismic data with subsurface features.



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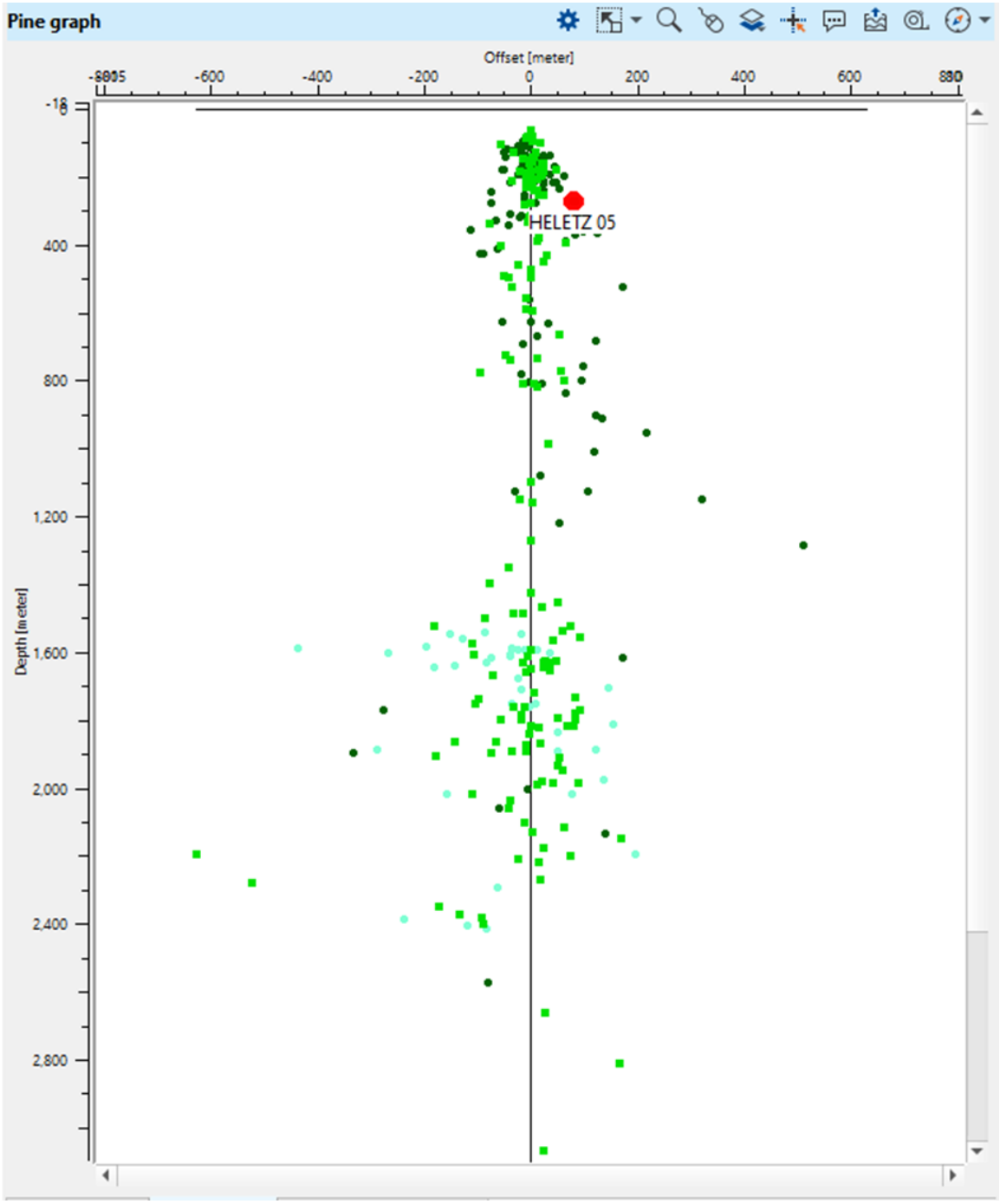

To compare depth horizons in the **3D view** using different velocity models, you can convert time horizons to depth maps based on the currently active velocity model. Depth maps are stored in the **Maps** folder in the **Data Manager**.

To perform this comparison:

1. Set the active velocity model.
2. Convert the time horizon to a depth map.

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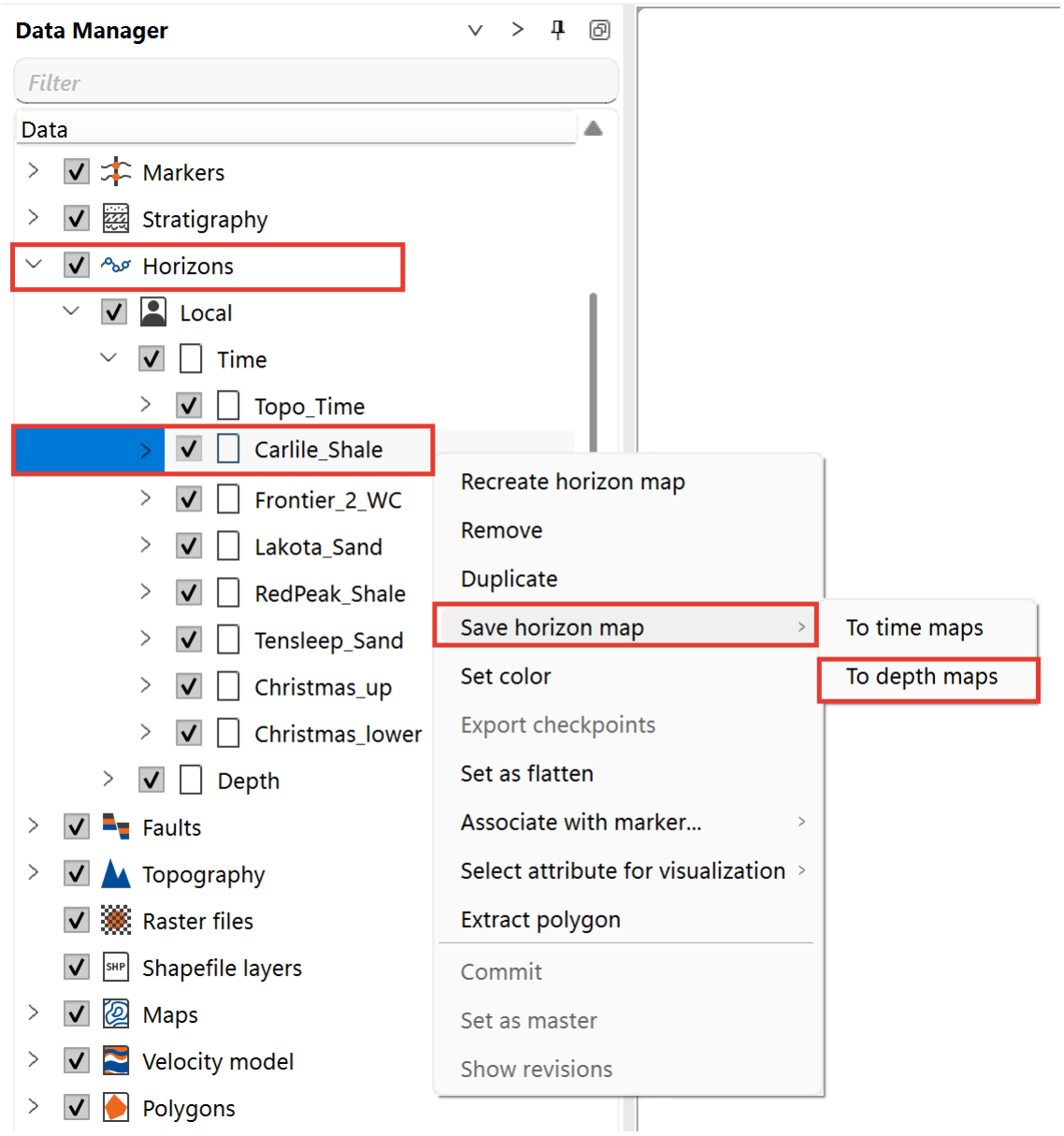
3. Change the active velocity model.
4. Repeat the conversion process for the same time horizon.

This workflow allows you to visualize and compare depth variations resulting from different velocity models directly in the 3D view[133].



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9.5 Seismic attributes

In g-Space, seismic attributes are tools that extract additional insights from seismic data, offering detailed information about the subsurface.
Seismic attributes can be computed on 2D and 3D data, providing flexibility for seismic volume analysis, horizon interpretation, and fault detection. The attribute settings are configured in the Attributes bar 68.

First, it's important to note that g-Space offers two methods for calculating attributes: a quick **On-fly calculation** and a more comprehensive full **Calculate attributes** for seismic volumes, including spectral decomposition.

How to Generate On-fly calculation Seismic Attributes

1. Click on the **Attributes** icon in the toolbar.
2. Set the time window if applicable to the attribute.
3. Select the seismic attributes you wish to calculate from the drop-down list. You can choose one or multiple attributes simultaneously.

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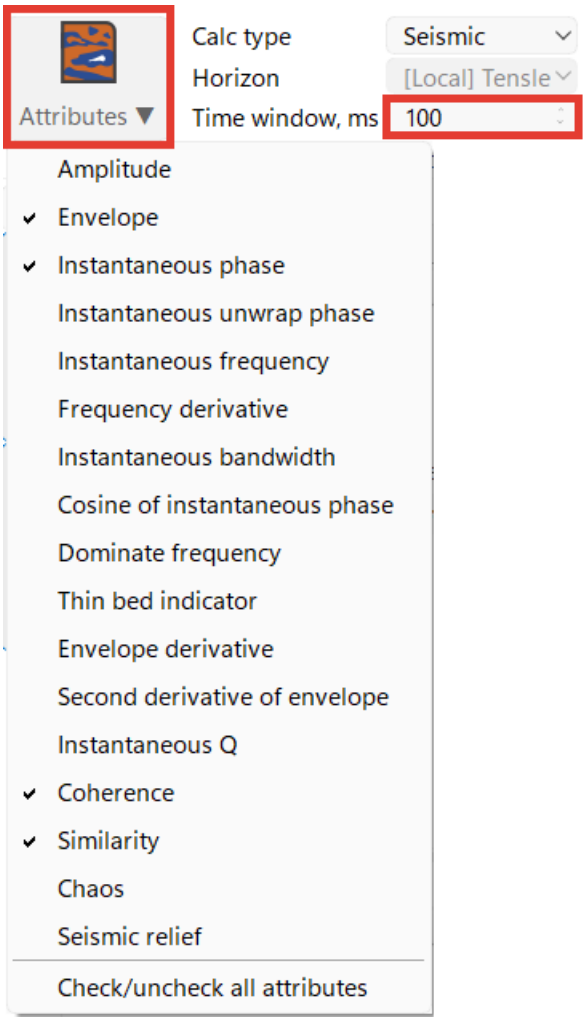
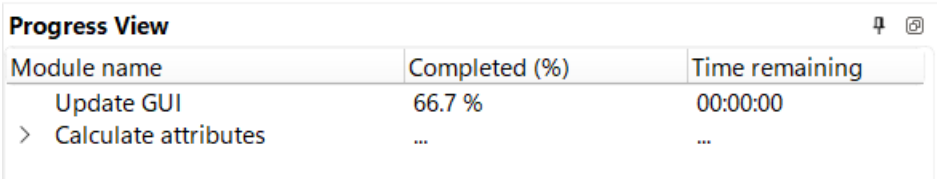


The process takes seconds, the progress can be seen on the right side in the Progress View.



The calculated attribute will be accessible in any seismic view. In the example below, it is shown in the Crossline view. In the **View Properties** panel, users can select one or multiple attributes to display, customize the color palette, adjust transparency, and modify other visualization settings.

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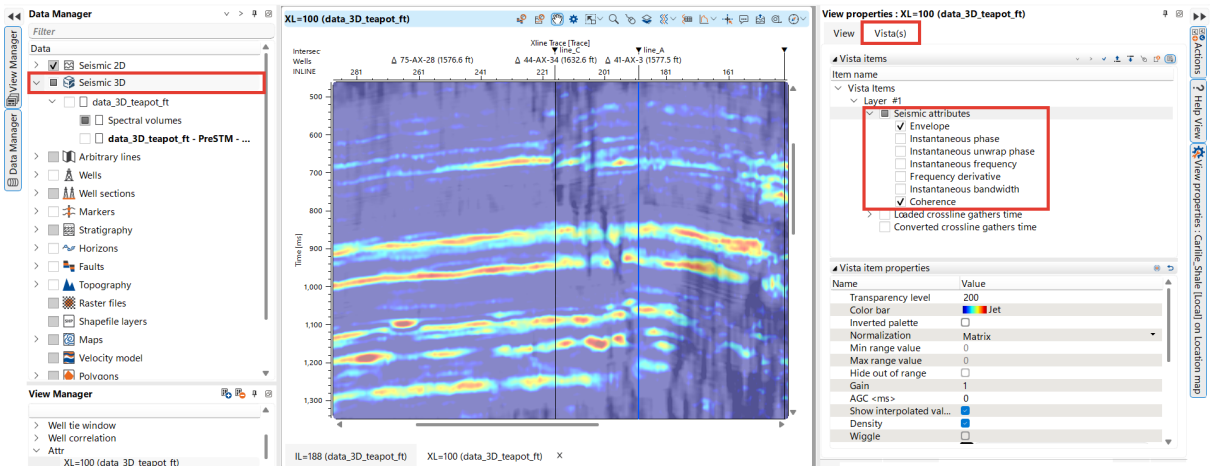
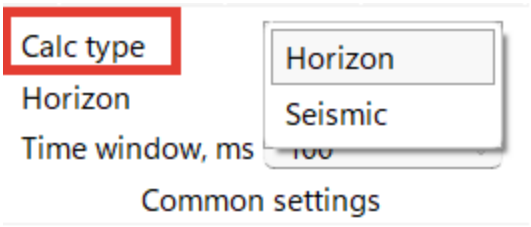


How to Generate Volume based Seismic Attributes



First, navigate to the **Attributes** bar and, in the **Common Settings** tab, select the calculation type — **Horizon** or **Seismic**. Then, go to the **Execute** tab and click **Calculate Attributes**. A pop-up window will appear, where you can choose seismic data and attributes for calculation.

There are two options — extract attribute along horizon or using a window.

For **Extract along horizon**, the user simply selects a horizon from the drop-down menu.

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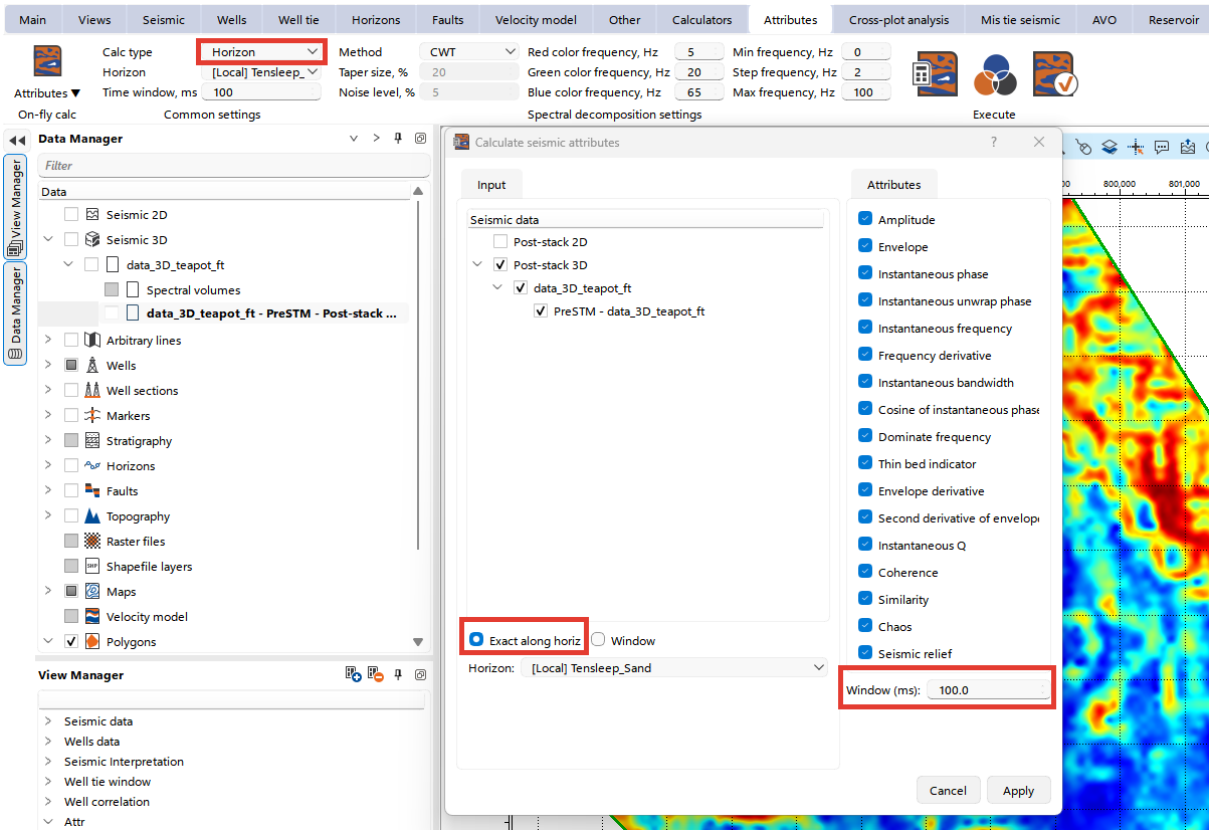

The **Window** option allows users to calculate seismic attributes over a specified time window relative to a selected horizon or time interval.

There are three options available:

Between time: attributes are calculated over a specific time interval. Users can specify the start and end times (in milliseconds) within the seismic data.

Between horizons: the option calculates attributes between two selected horizons. Users can choose the start and end horizons from the drop-down menus.

Single horizon: the option to calculate attributes around a single horizon. Users can select the desired horizon from the drop-down menu. The **Window** (in milliseconds) determines the time range used to calculate the attributes. The window can be positioned **Above**, **Below**, or **Centered** (with the horizon in the middle, equally above and below) for attribute calculation.

Users can select different statistical operations such as **Interval average**, **RMS value**, **Maximum**, **Minimum**, **Average positive/negative value**, or **Most common value** to be applied within the specified window.

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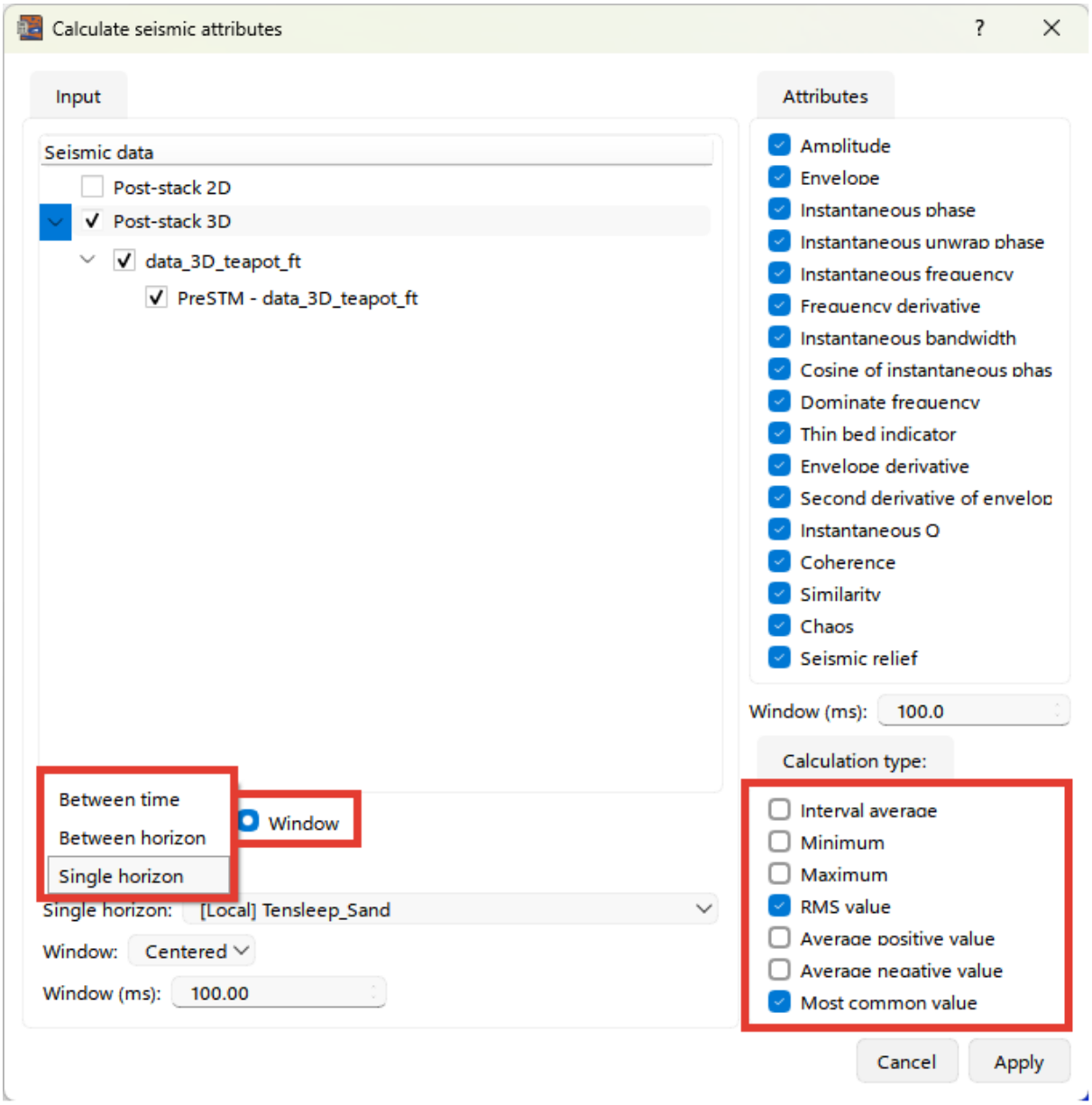

For the **Seismic** calculation type, users can either calculate the entire attribute volume or define specific limits. You can set a **time limit interval** or choose the **horizon limit** option, where the attribute volume will be calculated between two horizons. Next, set the vertical step for the volume and click **Apply**. You can monitor the calculation process in the **Progress View**.

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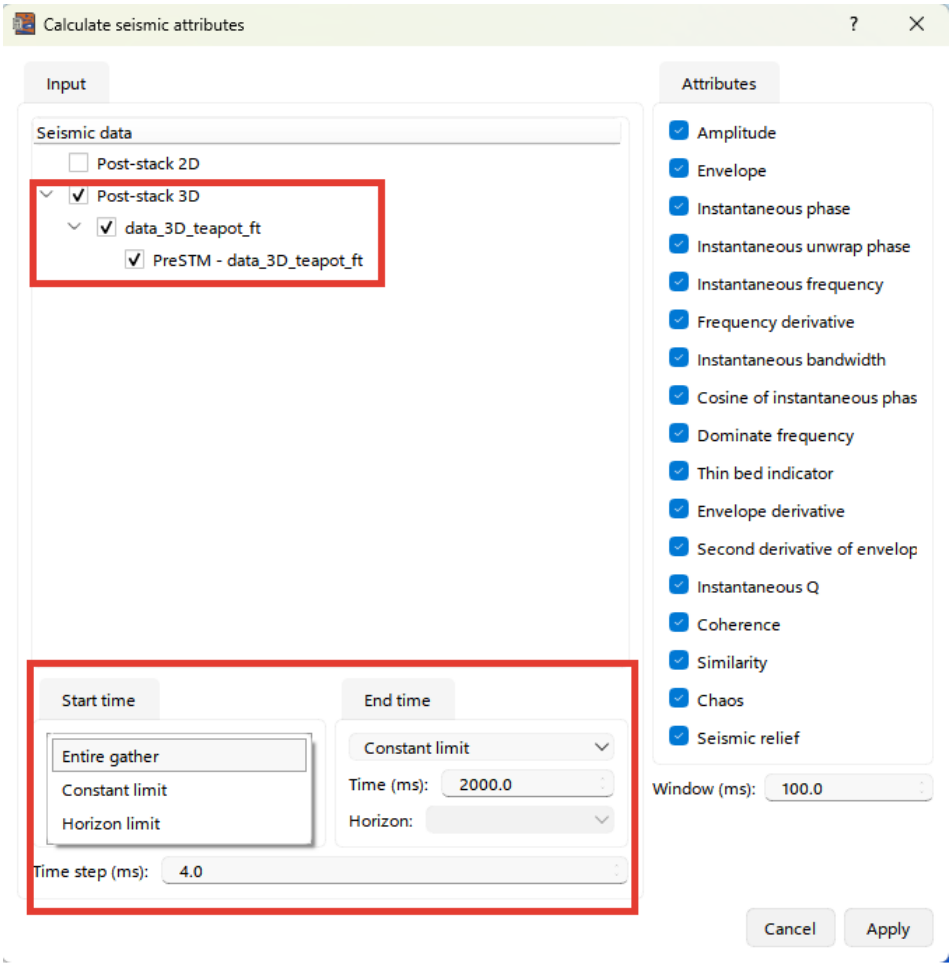

View Attributes:

To view the attributes, user should go to **Maps** section in the **Data Manager.** Expand the **Maps** section and click the **Attributes** section.

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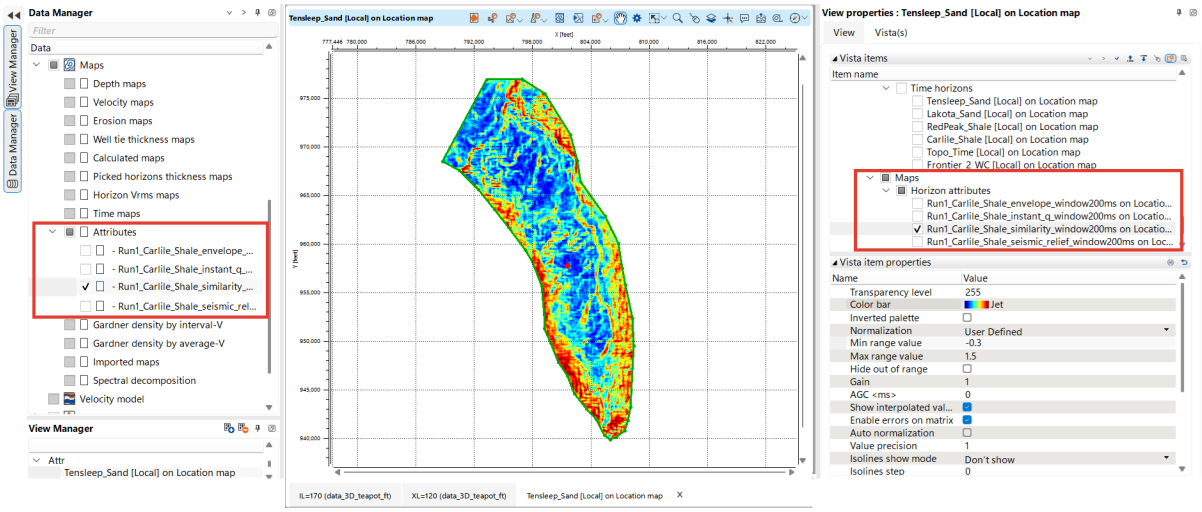

All the calculated attributes should be visible on the Location map.

The user can visualize the calculated attribute volumes as any 3D seismic data 409. To do this, you need to create a cache in RAM or in a file by right-clicking on the calculated attribute volume in the Data Manager 86. A special volume palette is available in 3D view to customize the visualization of attribute volumes. Adjust the image by dragging the slider along the horizontal and vertical scale.

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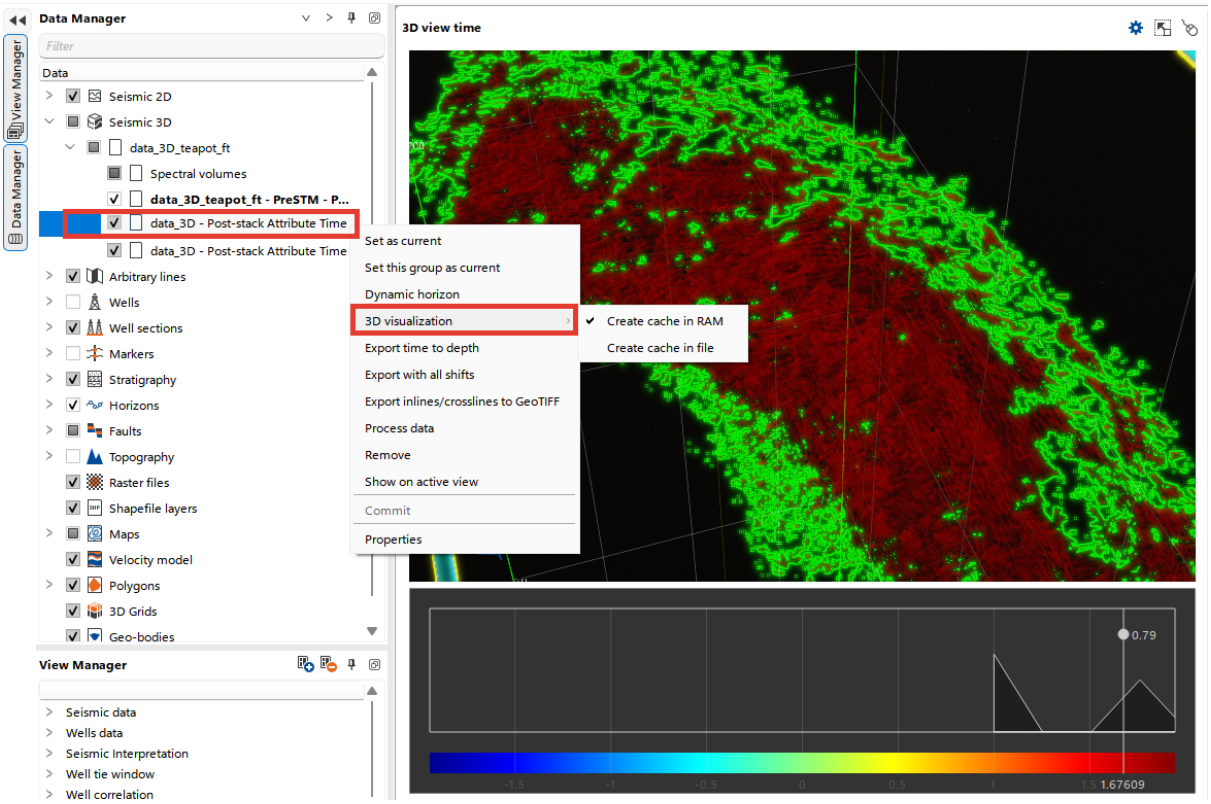

9.5.1 Spectral decomposition

Spectral decomposition is a technique in seismic interpretation used to analyze the frequency content of seismic data. By using spectral decomposition, we can visualize how different frequency bands respond to subsurface features, enhancing reservoir characterization.

How to Perform Spectral Decomposition

First, open the **Attributes Bar** 68 where you can configure your spectral decomposition settings. From here, you'll select the horizon or seismic data and the time window for which you want to perform the spectral decomposition.

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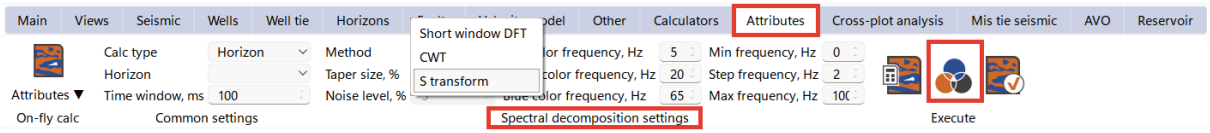

g-Space offers three calculation Methods for spectral decomposition. Choose the one that fits your geological objectives. These methods vary in terms of how they handle time windows and frequency ranges, which may affect the resolution and interpretability of the results.

1. Short Window DFT (Discrete Fourier Transform)

The Short Window DFT method applies a fixed-length time window to the seismic trace and performs a Discrete Fourier Transform within that window. This approach offers a balance between time and frequency resolution but may lose precision for rapidly changing signals due to its fixed window size. Ideal for stable, continuous stratigraphy or thick-bedded sequences where uniform frequency content is expected over short intervals.

2. CWT (Continuous Wavelet Transform)

The CWT method uses wavelets of varying scales to analyze the seismic signal. Unlike DFT, the CWT provides a multi-resolution analysis by adapting the time window size to the frequency — wider for low frequencies and narrower for high frequencies. Best for resolving thin beds, complex stratigraphy, and fault zones where frequency content changes rapidly over short time periods.

3. S-Transform

The S-Transform combines elements of both the Short Window DFT and CWT. It uses a variable window length, similar to CWT, but retains a direct relationship with Fourier analysis. The S-Transform provides both good time and frequency localization, making it suitable for detecting frequency anomalies at different scales in complex geological environments. Effective for detecting tuning thickness, complex channel systems, and subtle reservoir heterogeneities due to its balance of time and frequency resolution.

Set Frequency and Window Parameters

After choosing your method, you need to set several key parameters:

- **Taper Size (%)**: This controls how the edges of the time window are smoothed to avoid abrupt discontinuities that can distort the frequency analysis.
- **Noise Level (%)**: This determines how much noise reduction will be applied during the decomposition process.
- **Color Frequencies**: Assign specific frequencies to each color (Red, Green, Blue) for visual blending. This helps to emphasize different frequency components in the final output.

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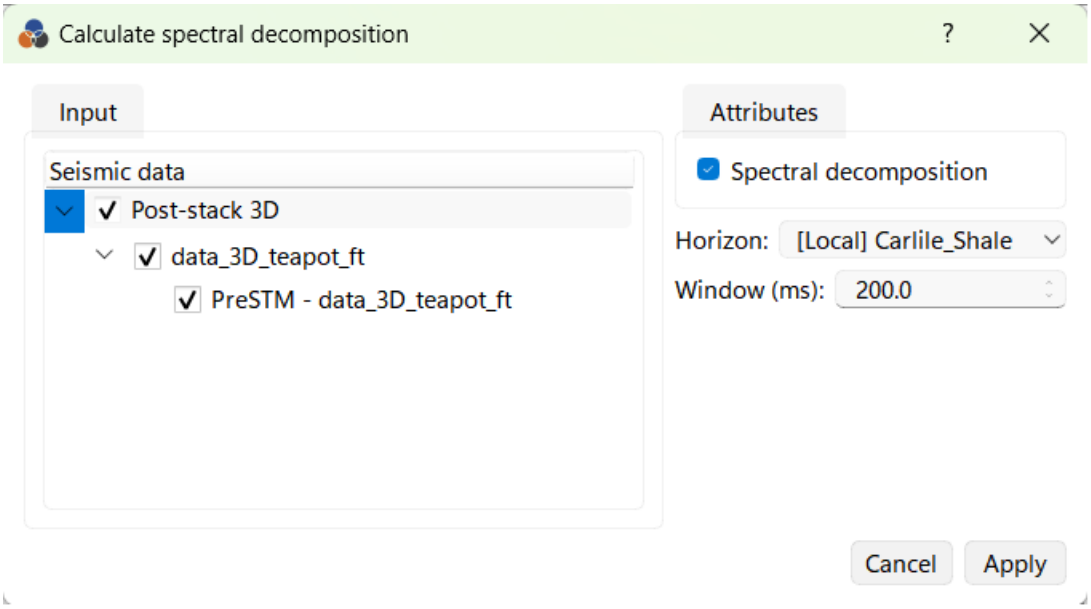
- **Min, Max, and Step Frequencies**: Define the range and increment of frequencies analyzed. The **Min** frequency represents the lowest frequency to analyze, the **Max** frequency is the highest, and the **Step** frequency defines the intervals between frequency bands.

Once all parameters are set, click the **Run Spectral Decomposition** button at the Execute Tab in the Attributes Bar. In the subsequent window, select the seismic cubes you want to calculate, as well as the horizon and calculation window. When ready, click **Apply** to initiate the calculation.



After processing, a new map folder will appear in the **Data Manager** under the **Maps** folder. This map represents the spectral decomposition output and can be visualized on the location map. The method and the frequencies used in the calculation will be automatically written into the map name.

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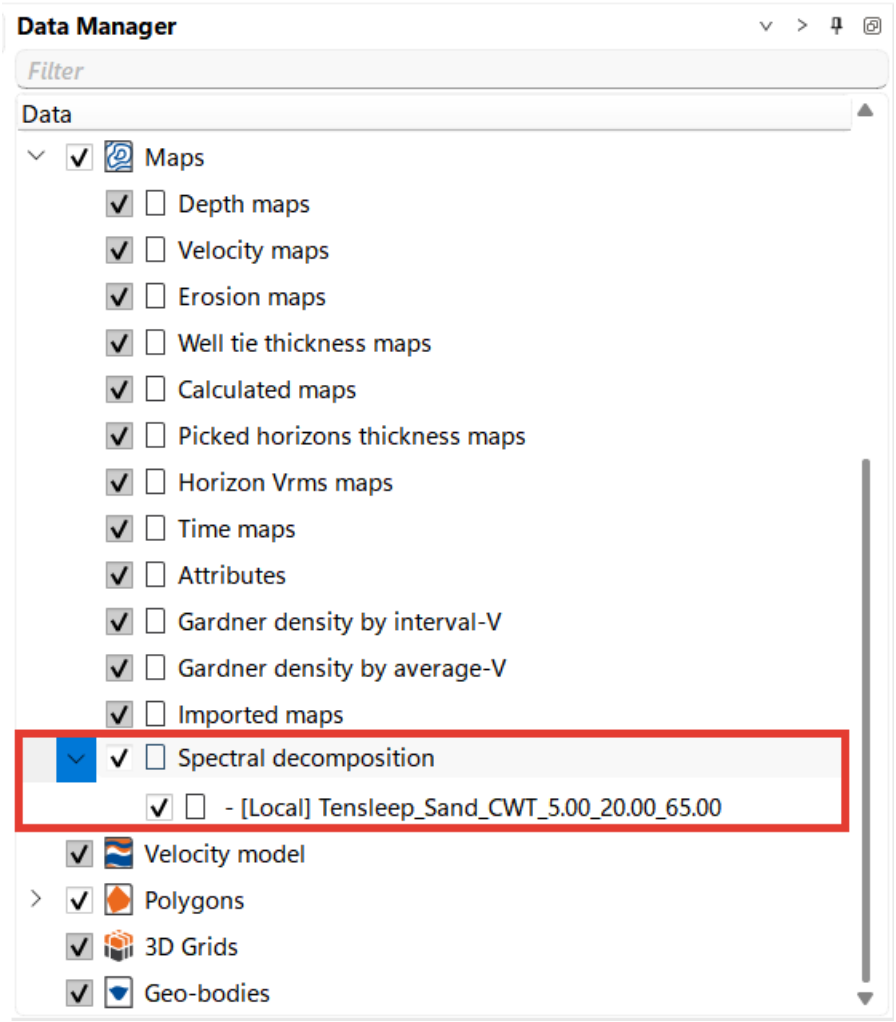

An example of a spectral decomposition map visualization is shown below. Users can customize the visualization in **View Properties** by adjusting the color palette and other available options.

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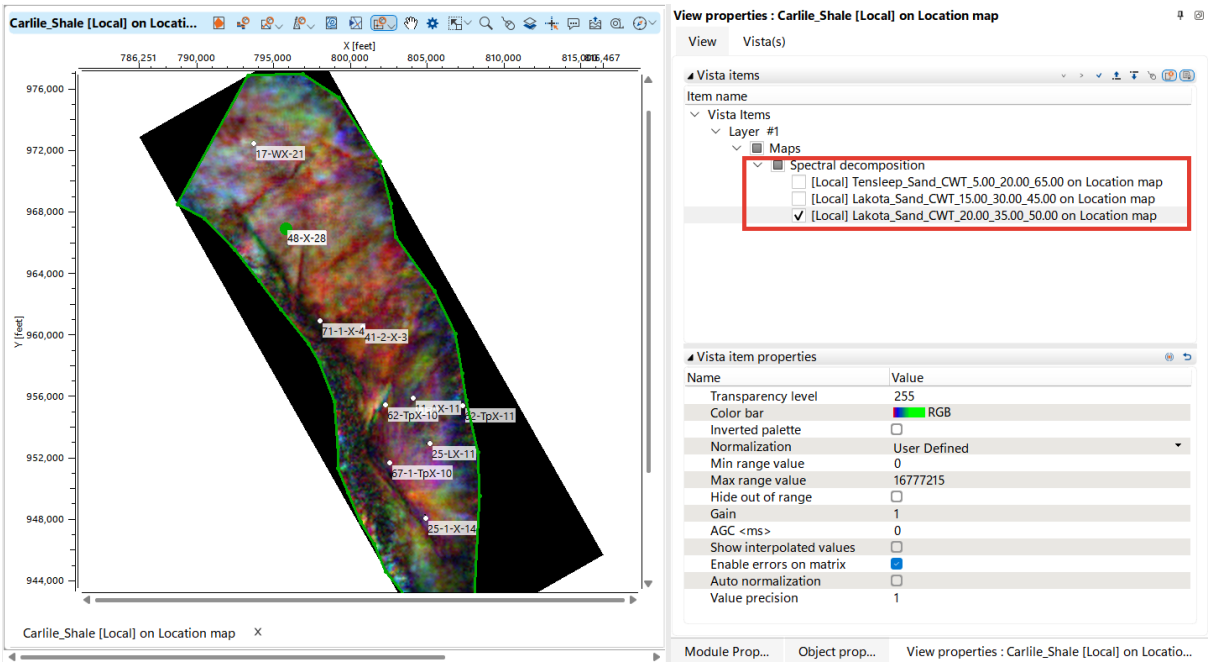

9.6 Gather conditioning

g-Space allows performing seismic data processing by connecting the g-Navigator package via the g-Space Flow module.

Navigate to **Data Manager**.
Right-click on the seismic data and choose **Process Data**.

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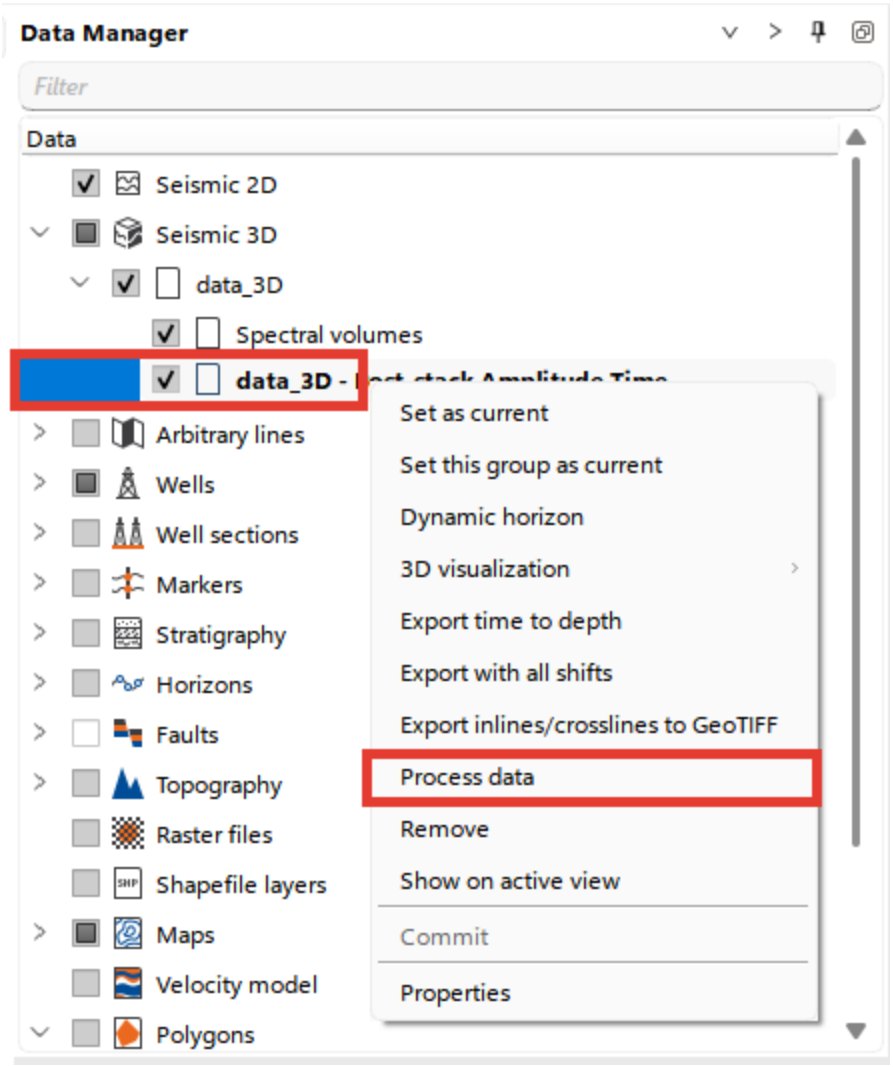

The **Open g-Space Navigator** window will appear. Fill in the display names and click **OK**.

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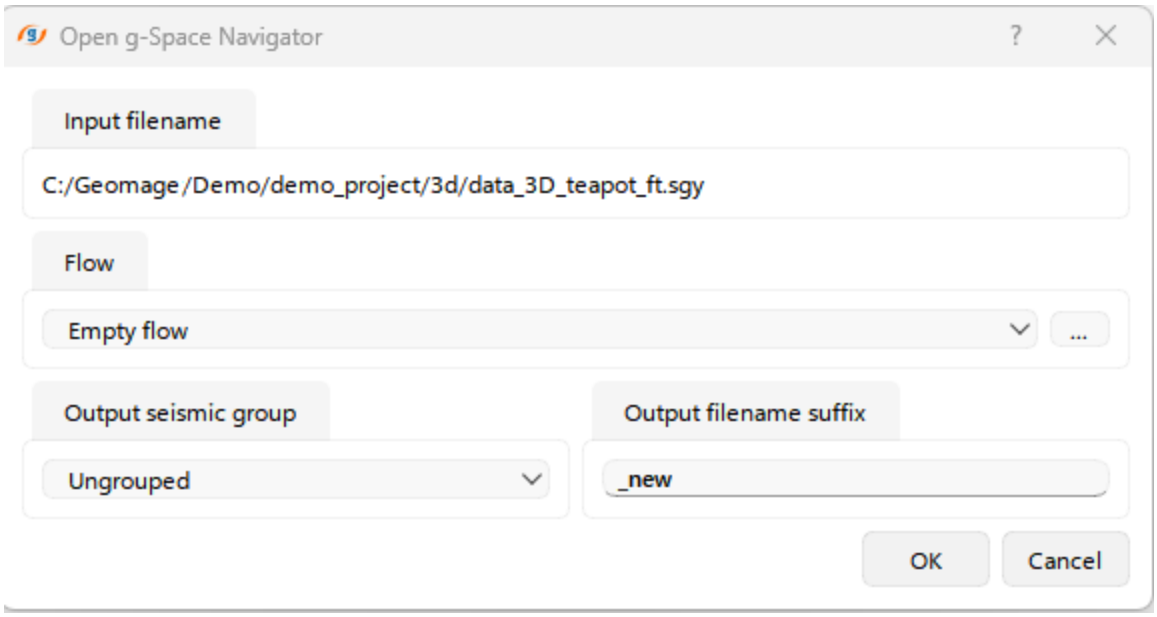

The **g-Space Navigator** module will open.

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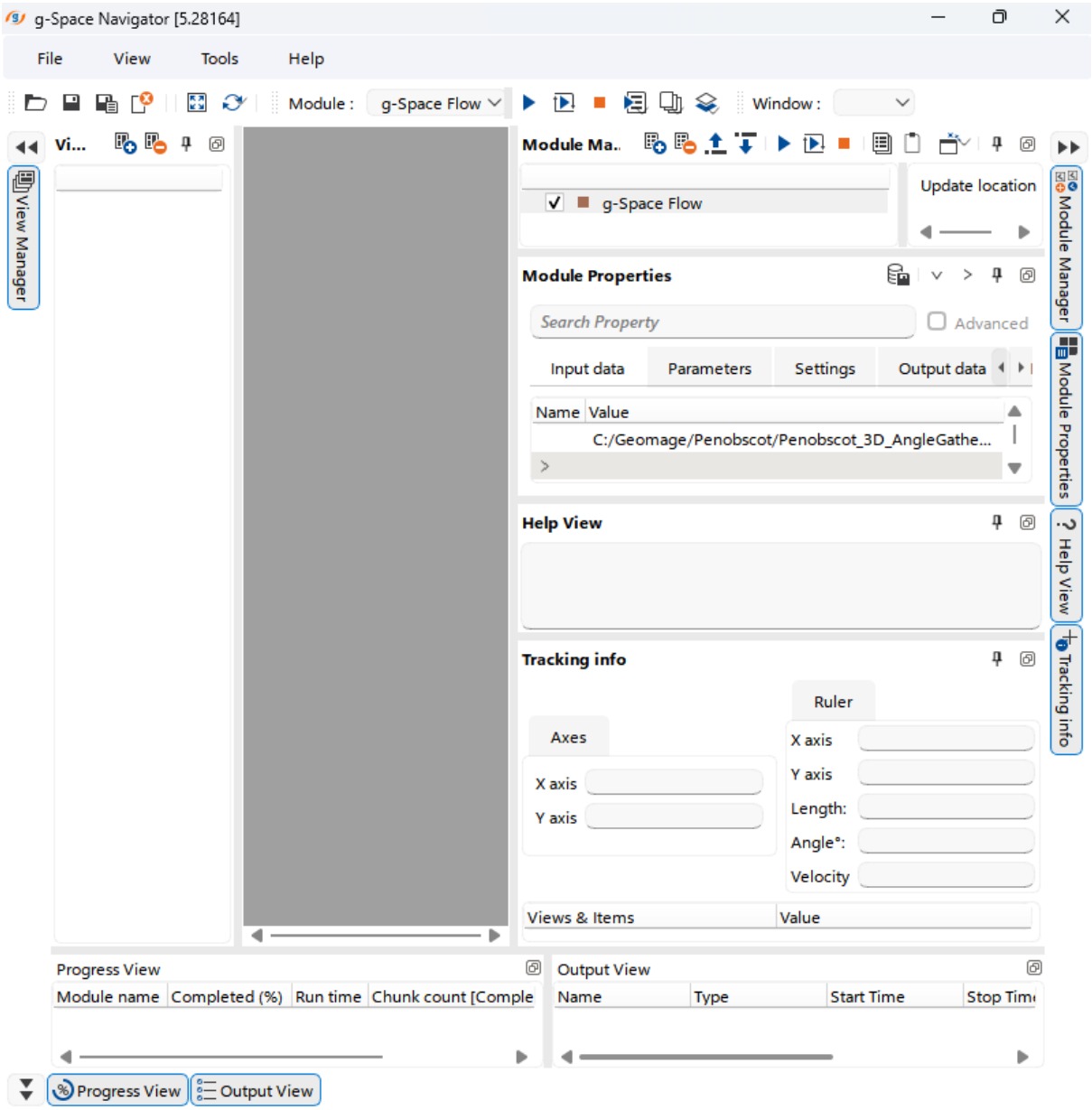

In the **Navigator module**, click the **+** button and create a new workspace.
Select the newly created workspace to proceed.

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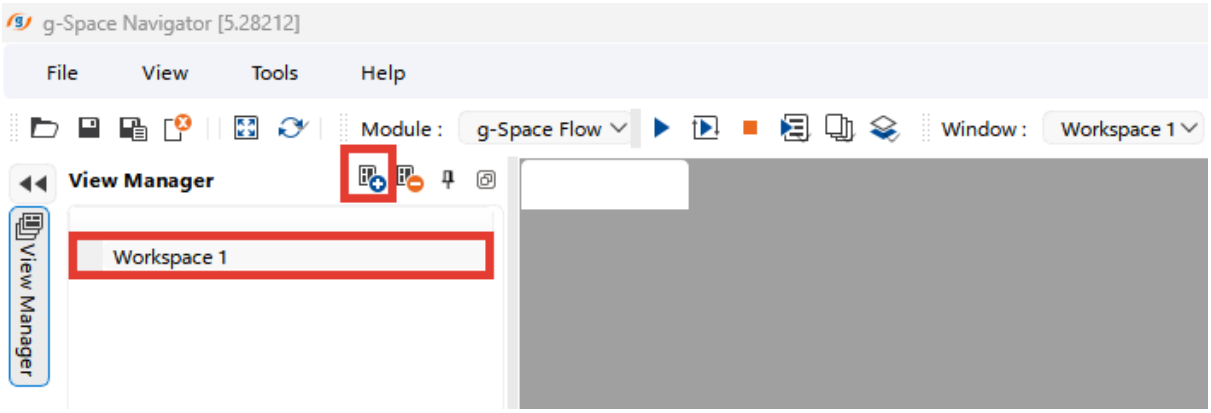
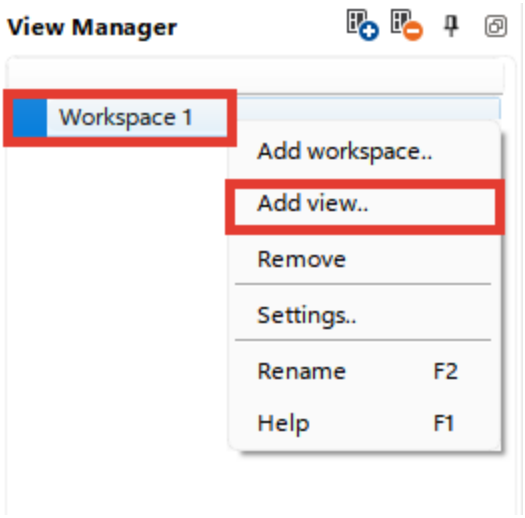


Then create a new view for your data.



Choose **View type** and a particular pair of **Axes**

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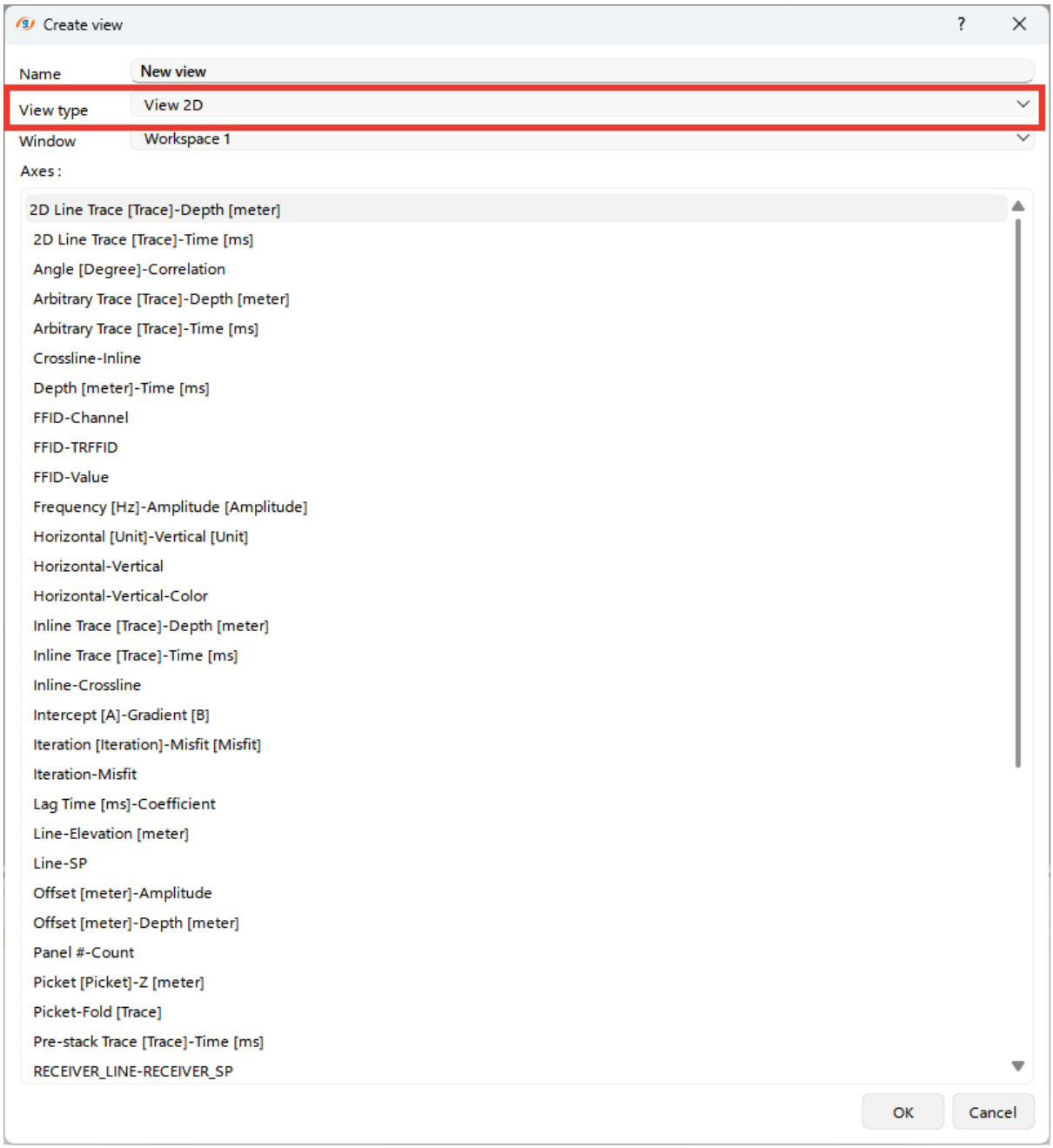

Then navigate to the **Module Manager**, right-click and select the desired modules

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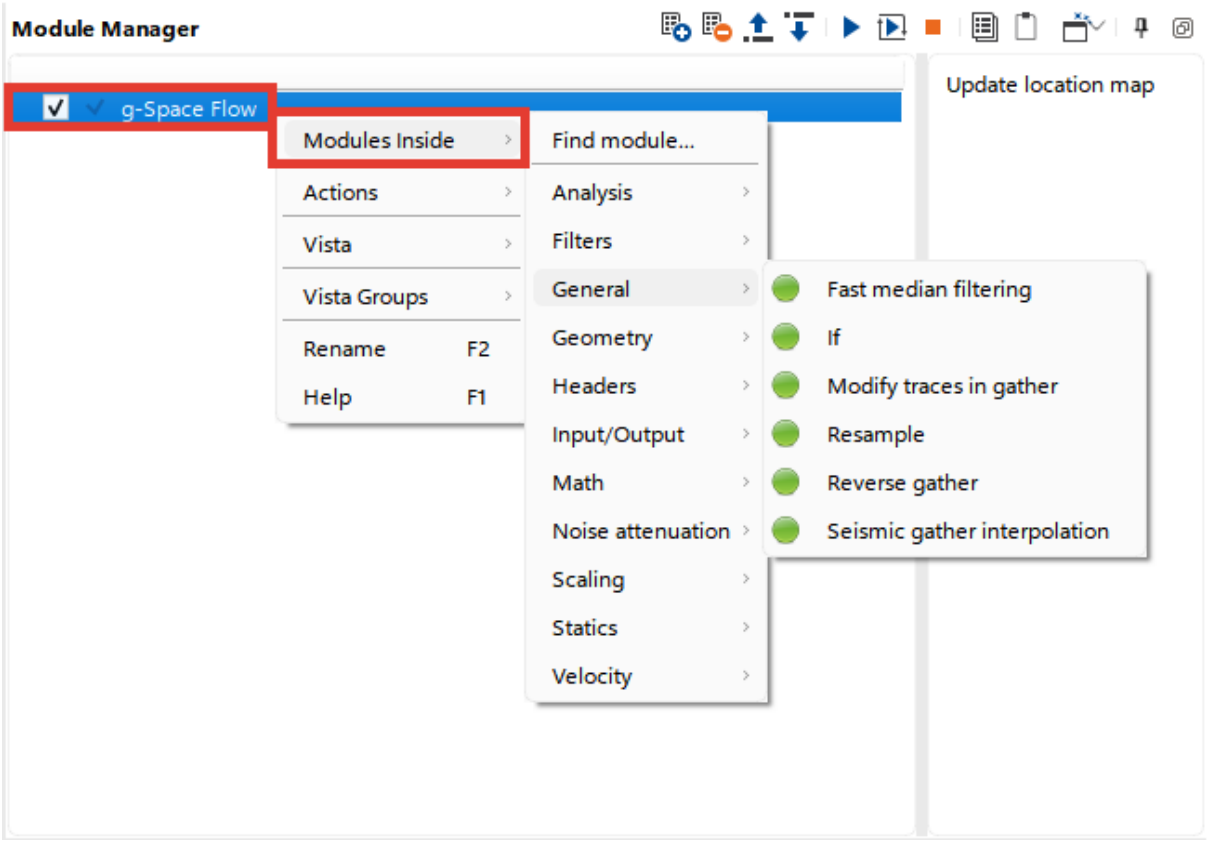
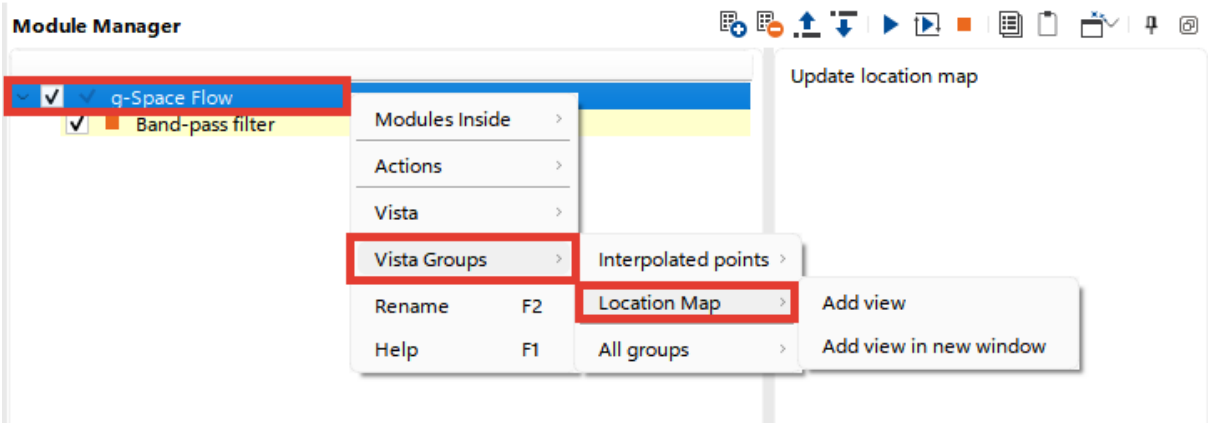


After that click on the **g-Space flow** and add the **Location Map view** that will allow you to select and visualize the data you are working with



Click on the selected modules to display the Input and Output views for quality control.

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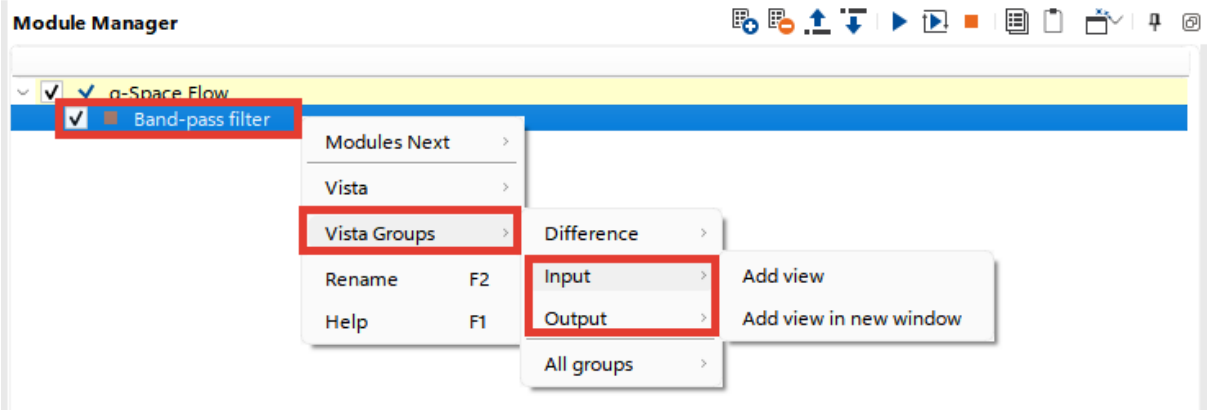
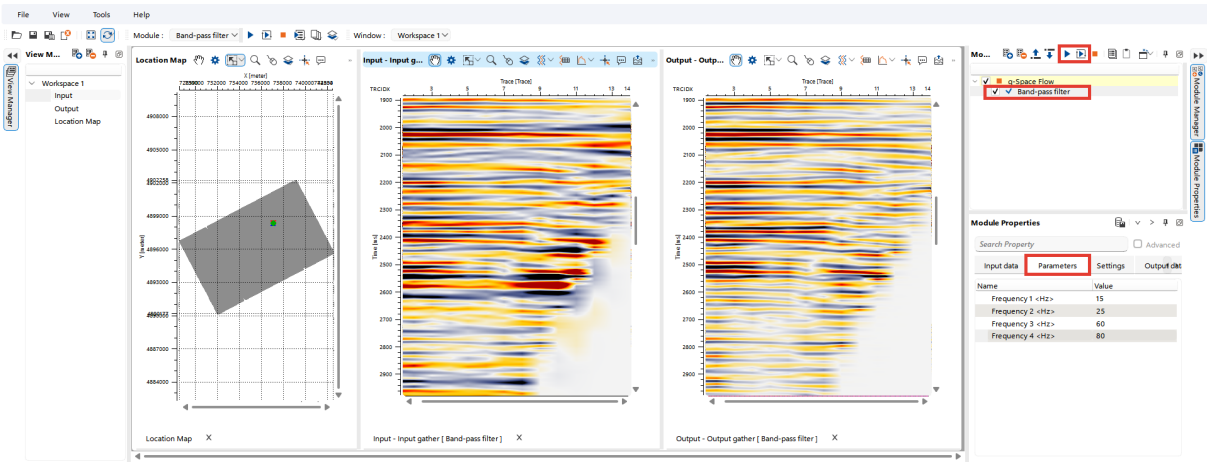


The configured interface displays the **Parameters** section, where you can set parameters for the selected module. Results appear instantly in the configured Input and Output views for a selected bin active on the **Location Map**.
Use the **Execute** or **Execute All Modules** buttons to process the data.



For details on seismic data processing functionality, refer to the g-Platform

After obtaining the results, return to g-Space. In the Seismic Data workspace, you will find your files. Upload them if needed.

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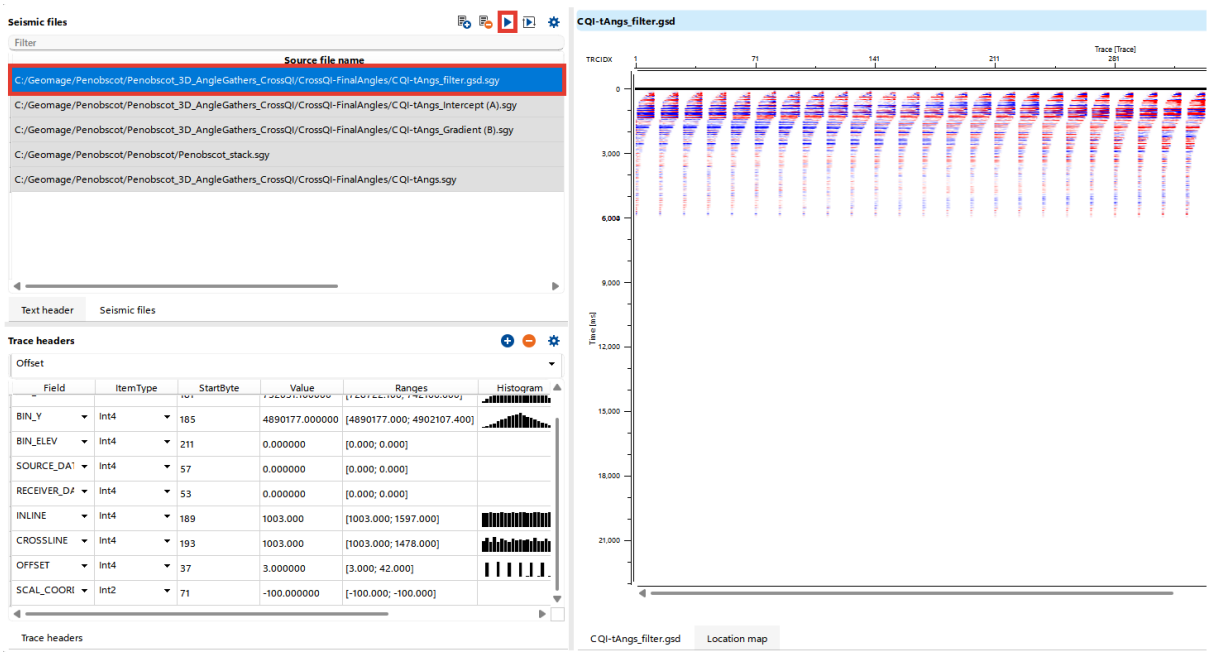
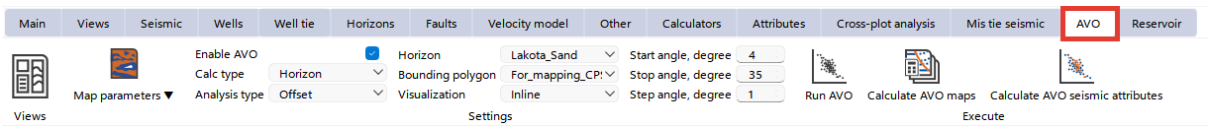


Note

The default file name for upload is limited to 7 characters. If you add a suffix to the original file name during processing, ensure the full name fits within the 7-character limit before uploading.

9.7 AVO

AVO (Amplitude Variation with Offset) analysis in g-Space allows users to measure rock properties and differentiate between various subsurface materials based on how seismic amplitude changes with offset. Through this analysis, users can generate key parameters like the **Intercept**, **Gradient**, and their products to assess the subsurface.



In the AVO tab, there are three main sections:

1. **Map Parameters**: Where the user can select different AVO attributes like Intercept, Gradient, or their products.

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2. **Settings**: Options to enable or disable AVO, choose 2D/3D visualization, and select available horizons.
3. **Execute**: The section where the user runs the AVO calculations.

A full description of the functionality is available in the AVO bar 80

To visualize the output(s) of AVO, the user can open **Views** in the AVO bar or AVO views 158 in the **Views** bar.

AVO Analysis procedure

To conduct AVO analysis, you will need:

- Migrated gathers
- Interpreted horizons

Follow these steps for AVO analysis:

1. **Open a New Workspace**: Start a new session and add a location map from the **Views** tab.
2. **Select the Image Gather**: In the location map, click the **Selected image bin** icon to display the image bin.
3. **Display Vista Items**: Go to **Views** and select the appropriate vista items such as **Image gather**, **AVO cross-plot**, and **AVO graph**.

When the **Enable AVO** option is selected, the current horizon (displayed as a black line on the image gather) will appear along with the AVO graph. The user can then run AVO calculations, which are displayed on the AVO cross-plot.

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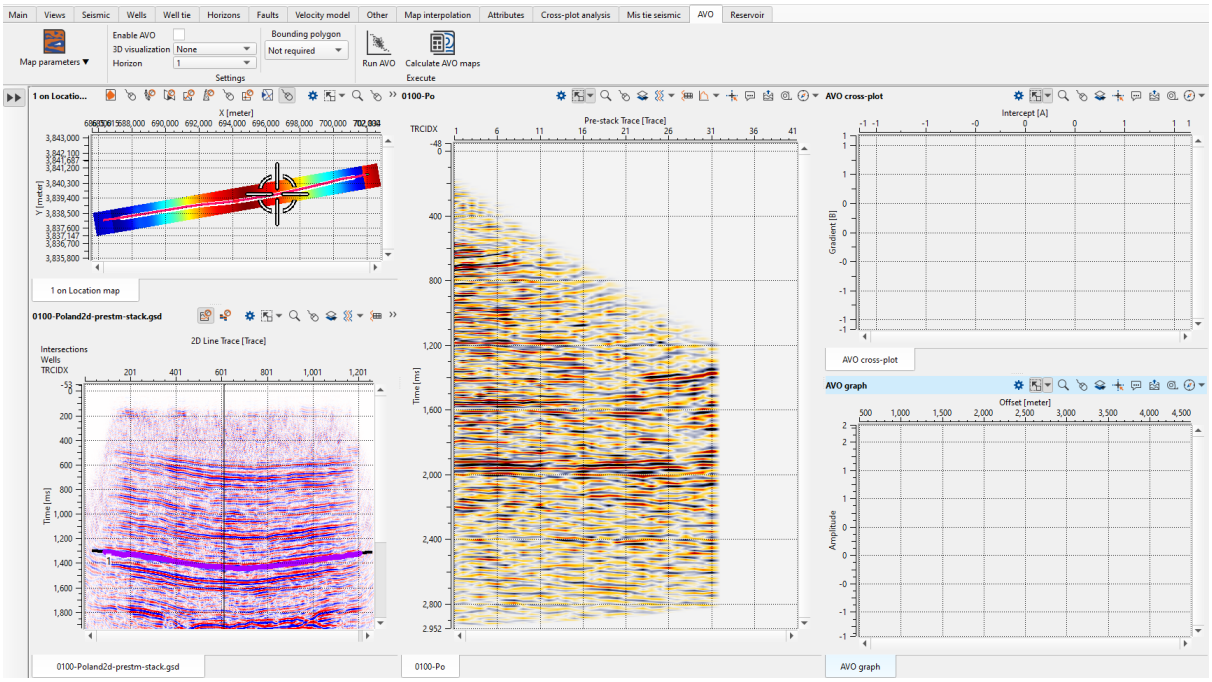

Now click on **Enable AVO** option. It will display the Current Horizon (black line on the image gather) along with AVO graph with Aki-Richardson regression graphs as shown below.

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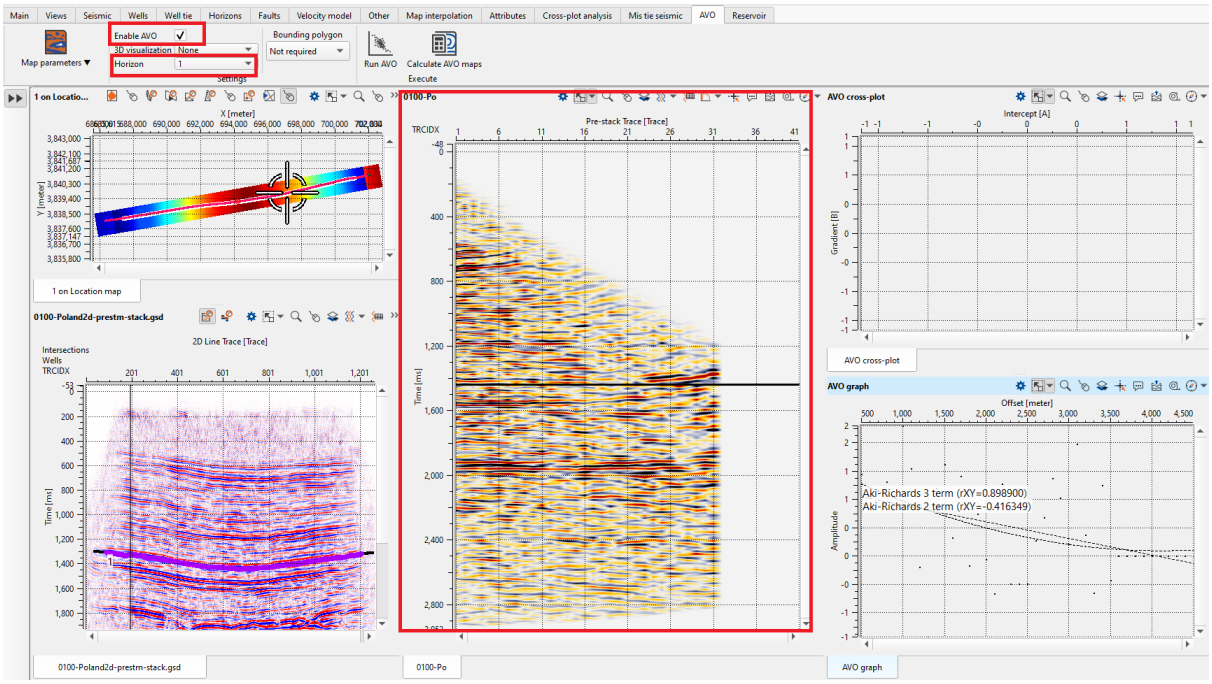

To generate the AVO cross-plot, click on the **Run AVO** icon. It will create the cross plot as shown below.

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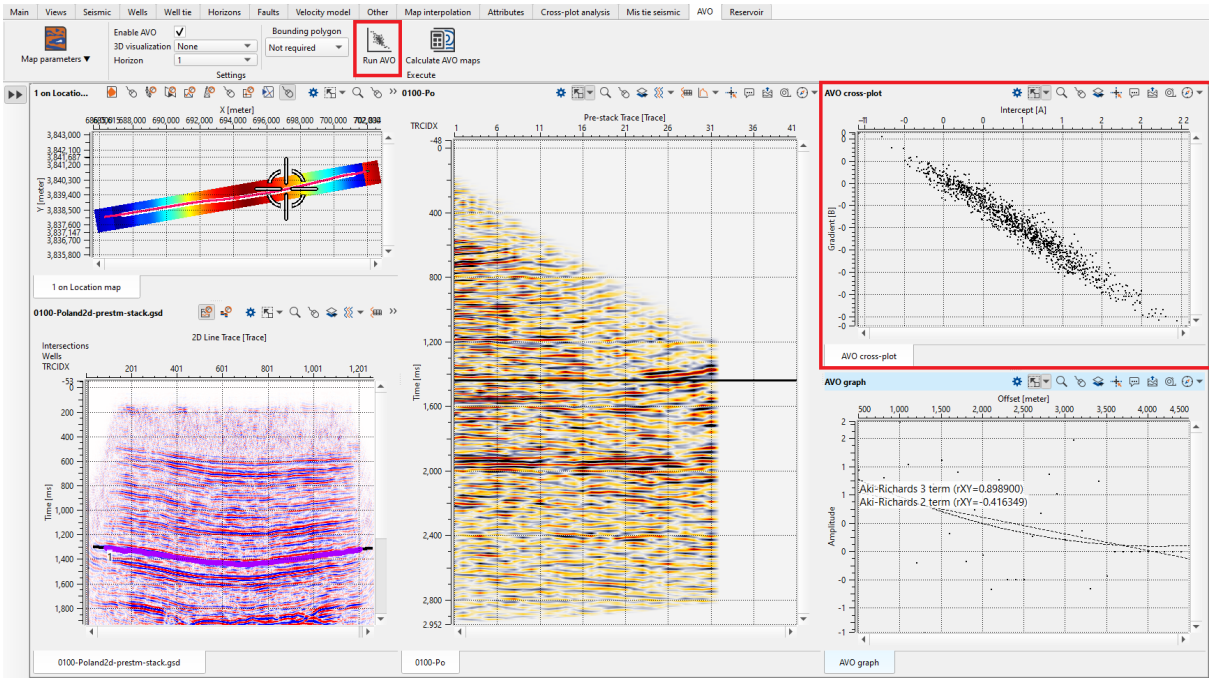

Inside the **AVO cross-plot** view, the user can pick a polygon and the corresponding bins falling inside the polygon are display on the location map. To pick a polygon, select **Control item** icon on the **AVO Cross-plot** view.

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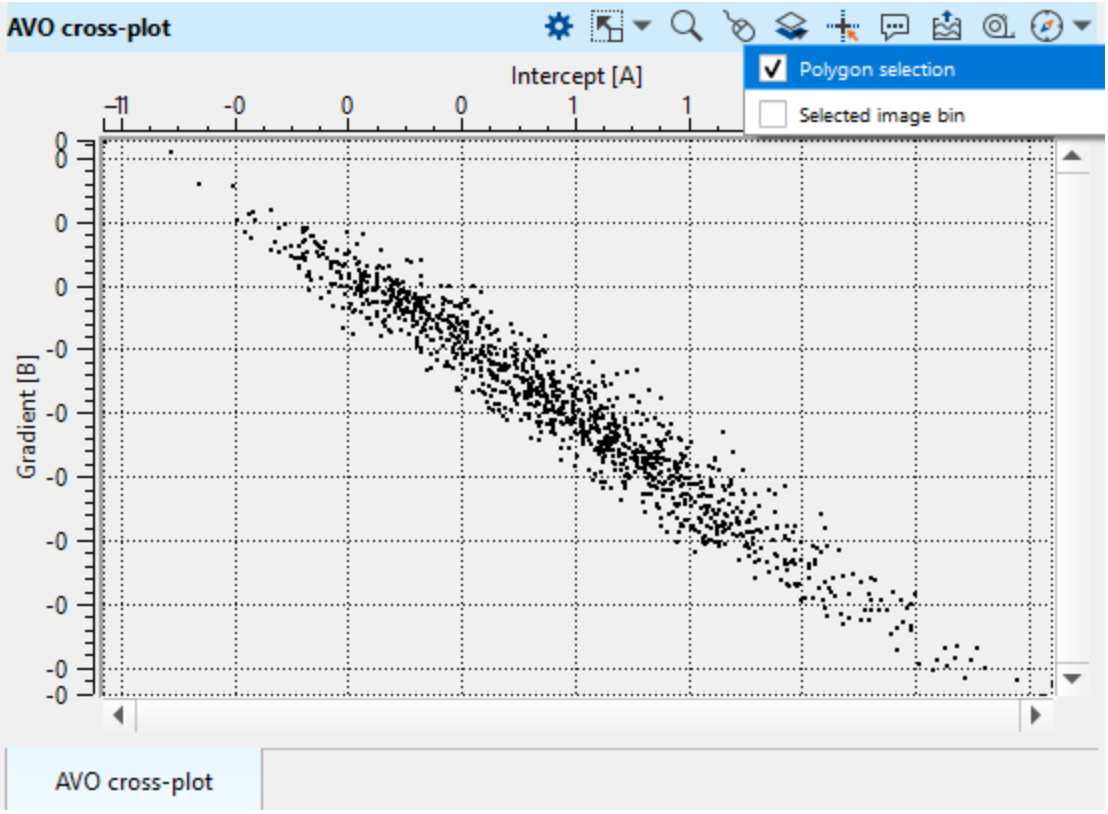
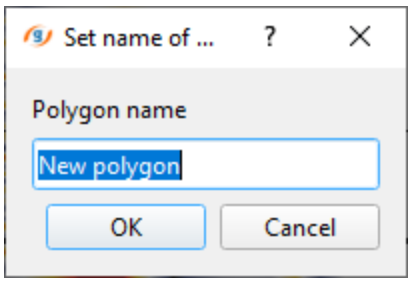


It will pop-up a window. Give a name to the polygon.



Picking a Polygon on the Cross-Plot

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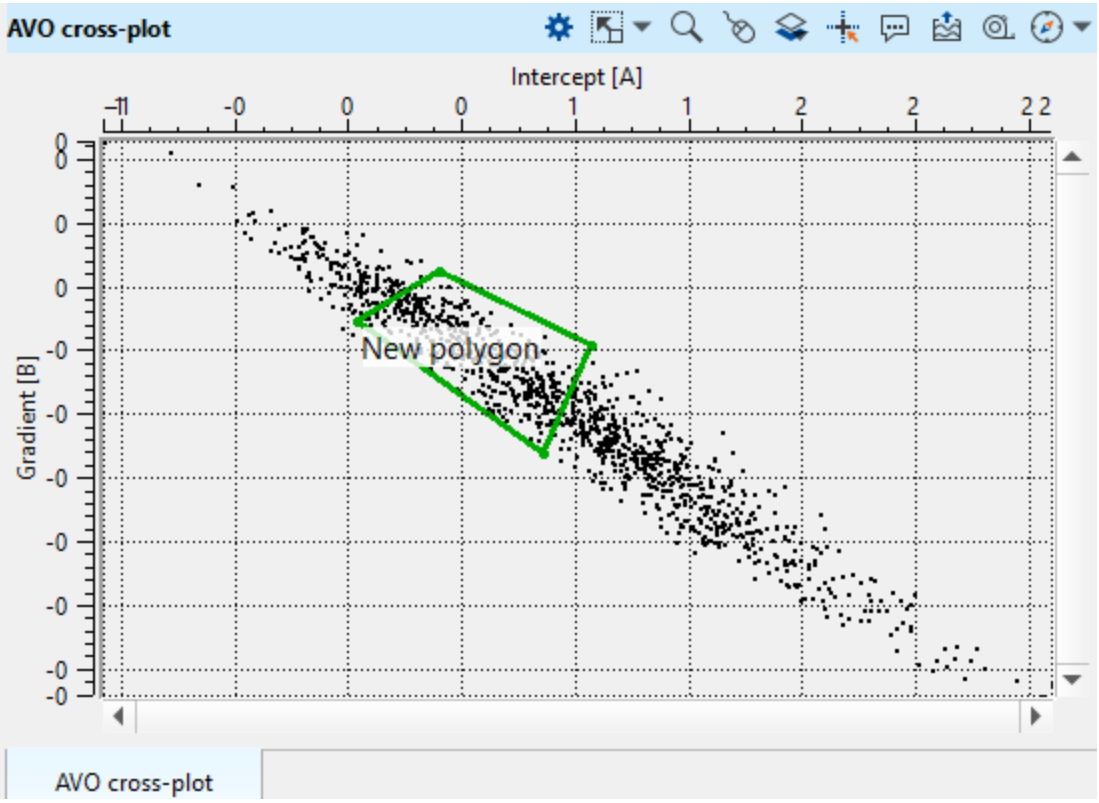
Once the AVO cross-plot is generated, users can pick polygons to analyze specific data points. Clicking on the cross-plot display allows for polygon picking, and these polygons will correspond to bins on the location map. Users can also assign different colors to polygons for better visual analysis.



Now hold **ALT+Right click** to get more options. Here the user can choose different options like create a new polygon or set a color to the existing polygon etc. We selected Set color option as shown below.

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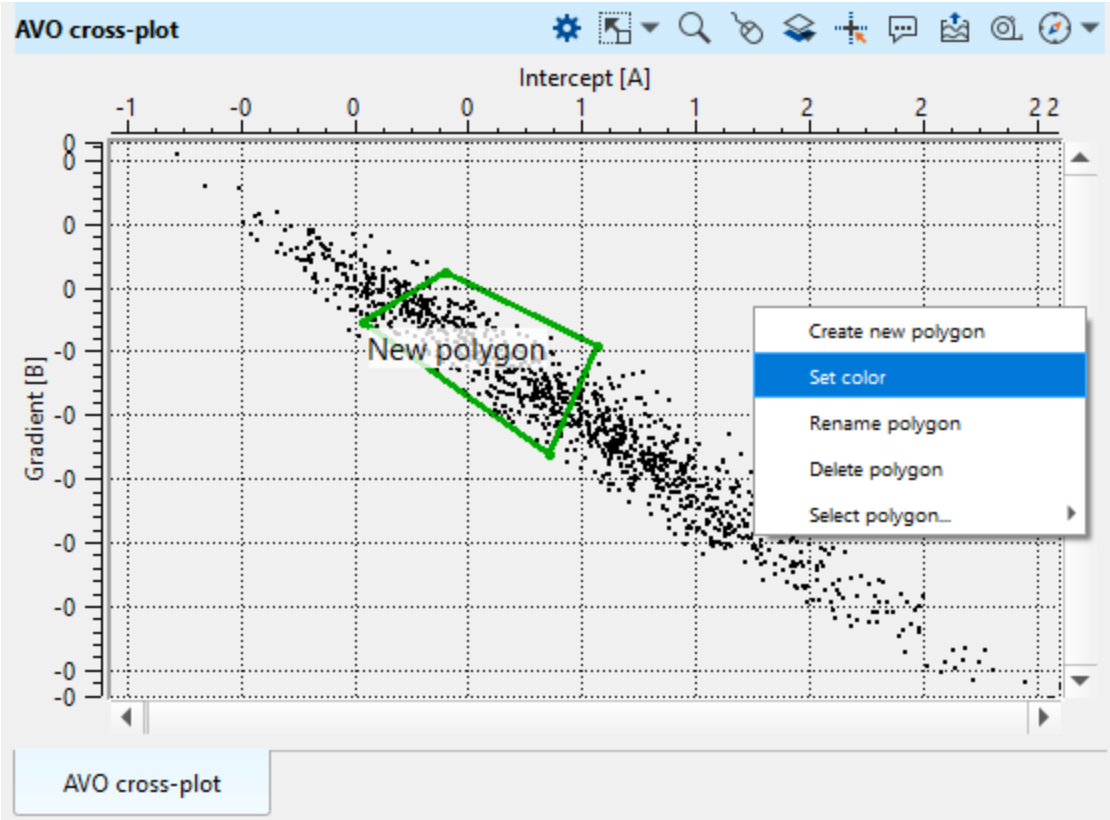

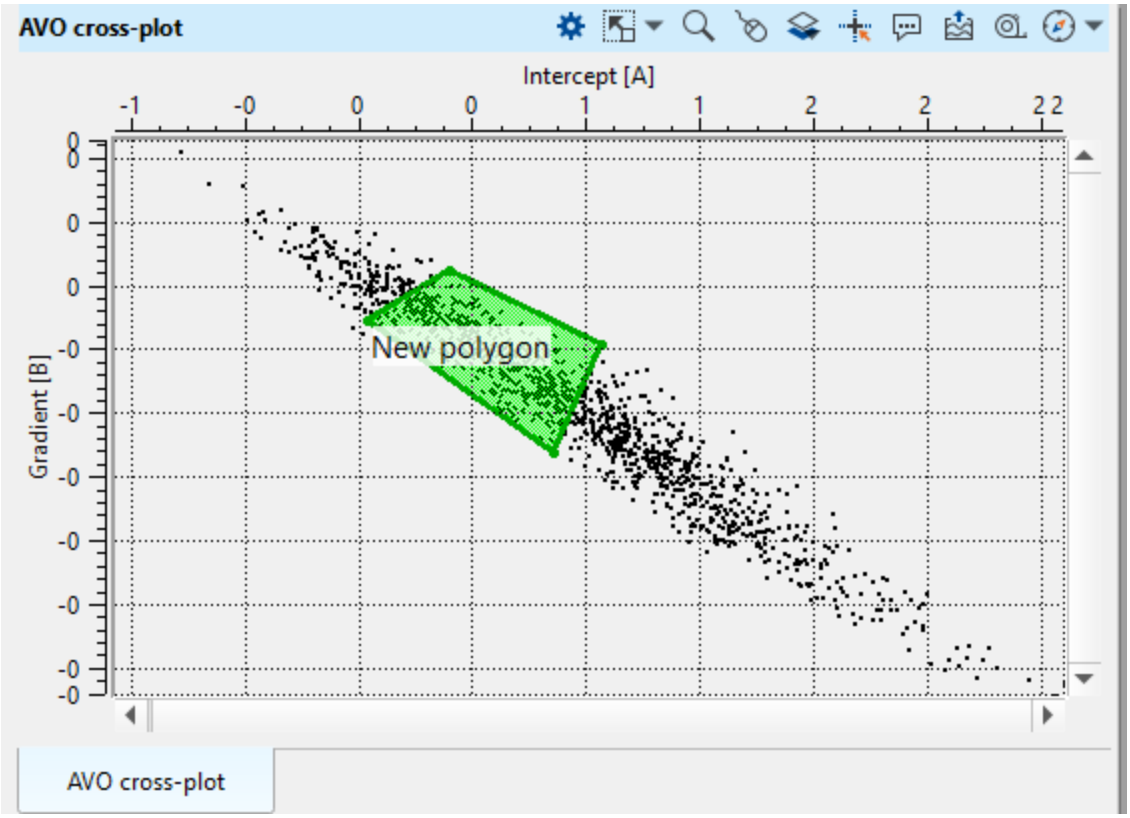

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Within the polygon, whatever the bin points present will be displayed on the location map as well as on the picked horizon. All the green dots on the location map are the corresponding bins within the polygon.

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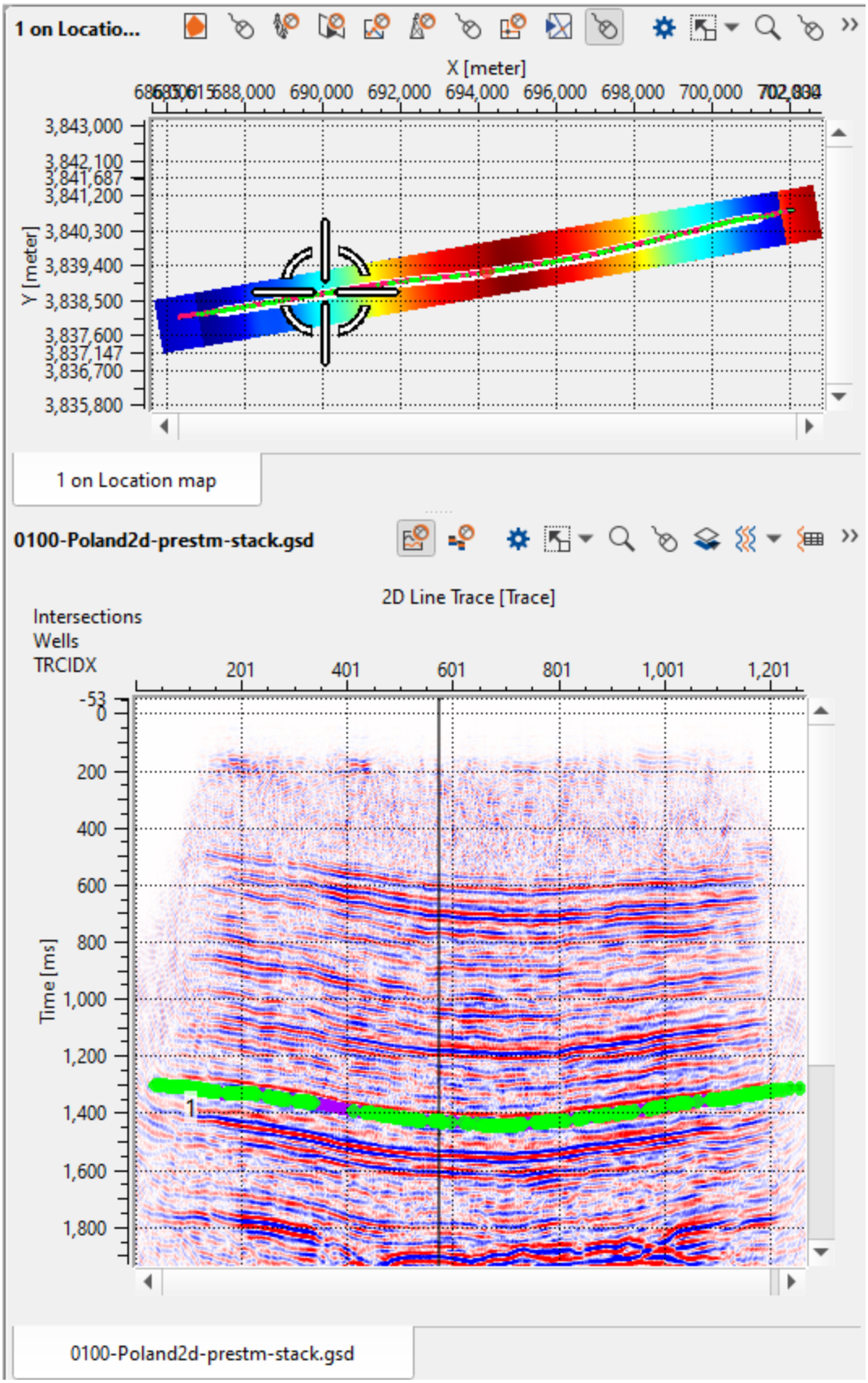

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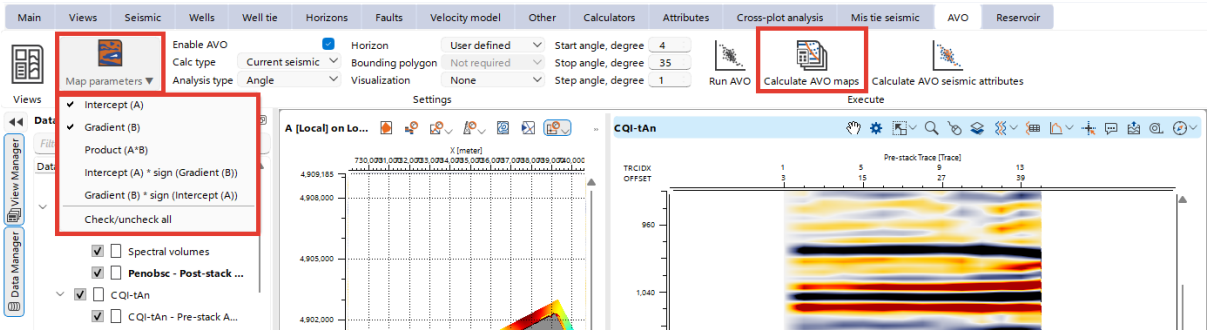
Calculating AVO Maps

To calculate AVO maps, such as Intercept and Gradient, the user should select the appropriate options from the **Map Parameters** drop-down menu and click **Calculate AVO Maps**. The outputs will be available under the **View Properties** of the location map, where the results will be stored under the **Horizon Attributes**.



In the example below, there is the Intercept option is selected. **The output** of the **Intercept** should be available at the **View properties** of the **Location map** under **Horizon Attributes**

Note

To view the attributes, first uncheck the Time horizons vista items

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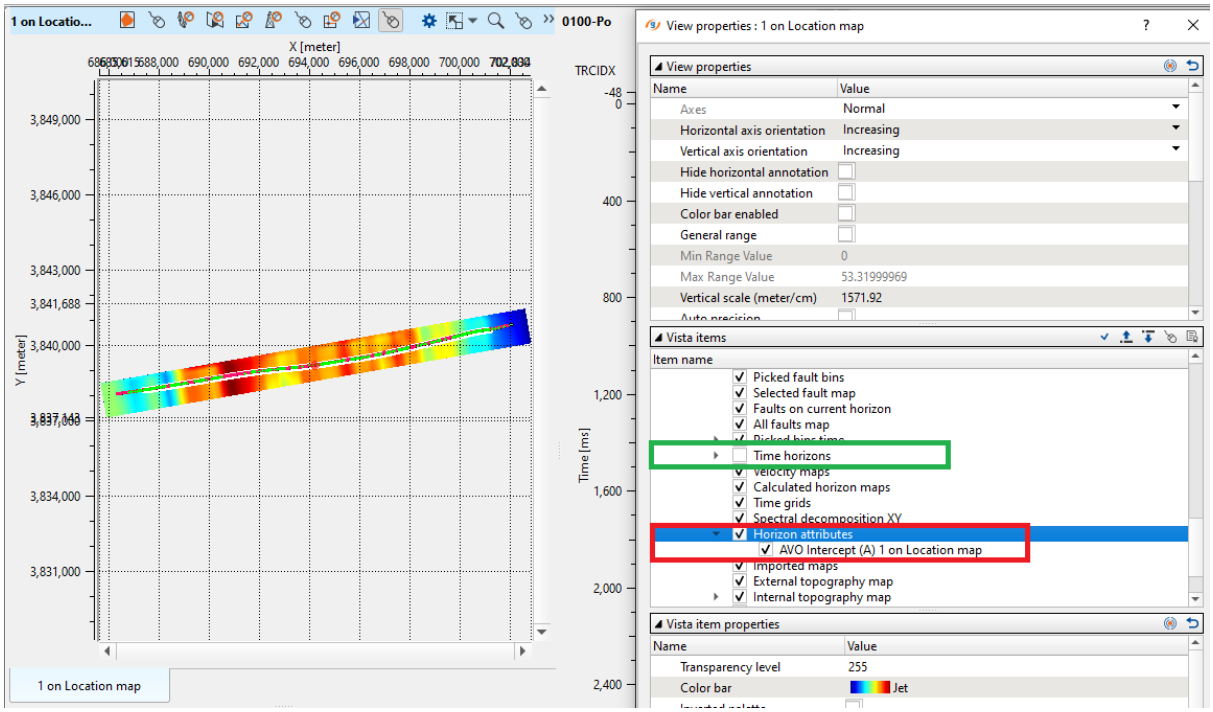
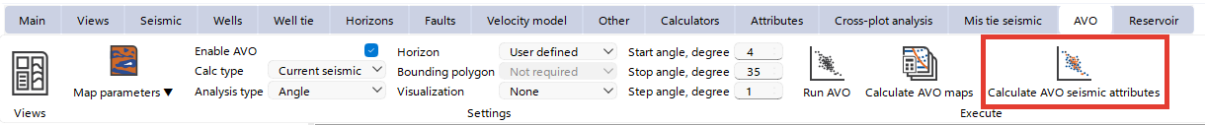


In the **Calculating AVO seismic attributes** section, users can configure and compute various AVO parameters such as *Intercept*, *Gradient*, and other derived attributes. Click on **Calculate AVO seismic attributes** in the AVO bar 80



The **Calculate seismic attributes** wizard will be opened

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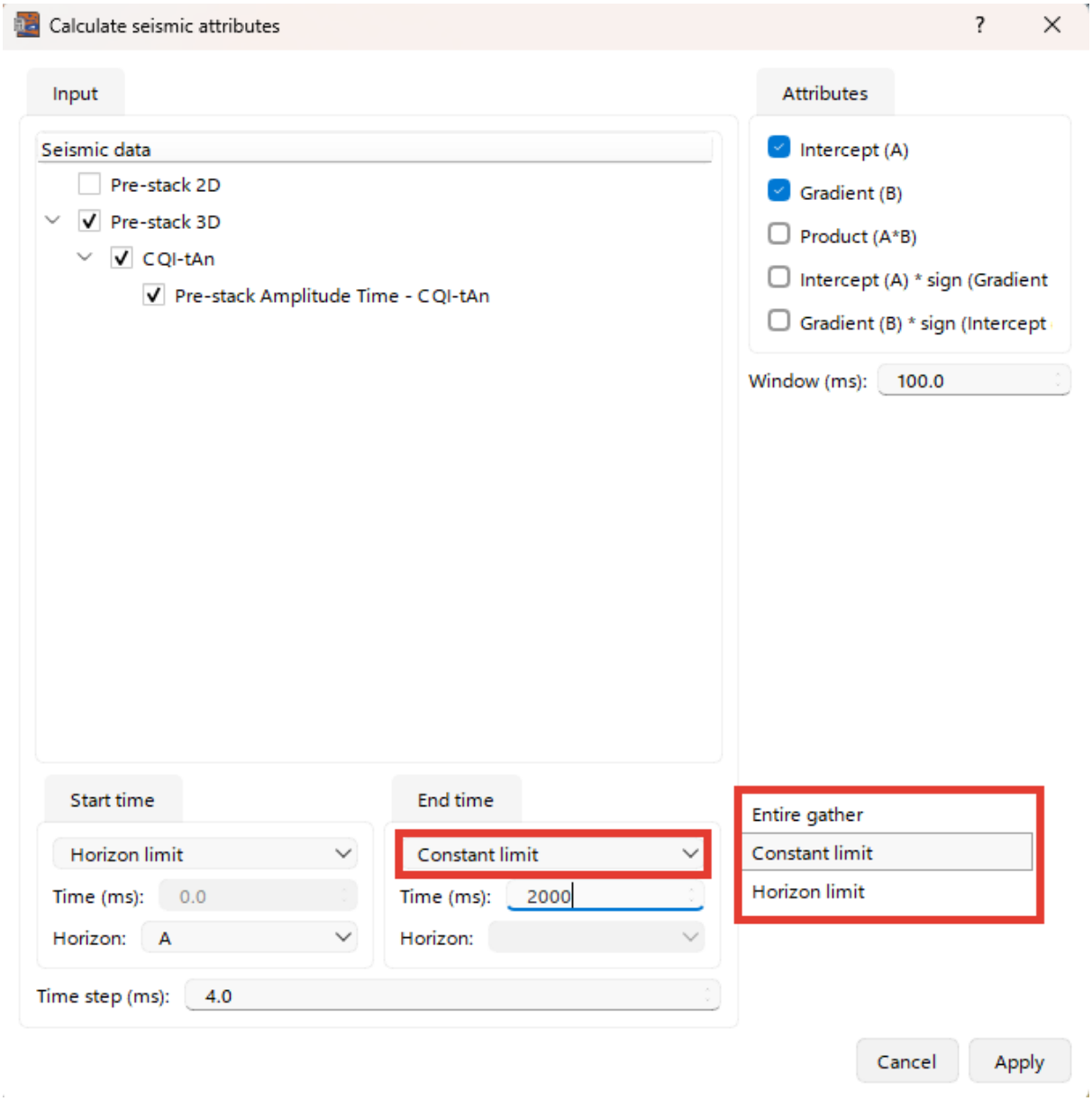

In the ***Seismic data*** panel, select the dataset for AVO analysis. Available data types may include *Pre-stack 2D* and *Pre-stack 3D*.

Then set the ***Start time*** and ***End time*** intervals for the AVO calculation:

Start time: Choose either a specific time in milliseconds or set a *Horizon limit* or the *Entire gather* to define the start boundary based on a seismic horizon.

End time: Similarly, you can set the end boundary.

In the ***Attributes*** **panel**, choose which seismic attributes to calculate. Define the time window (in milliseconds) over which the attributes will be calculated.

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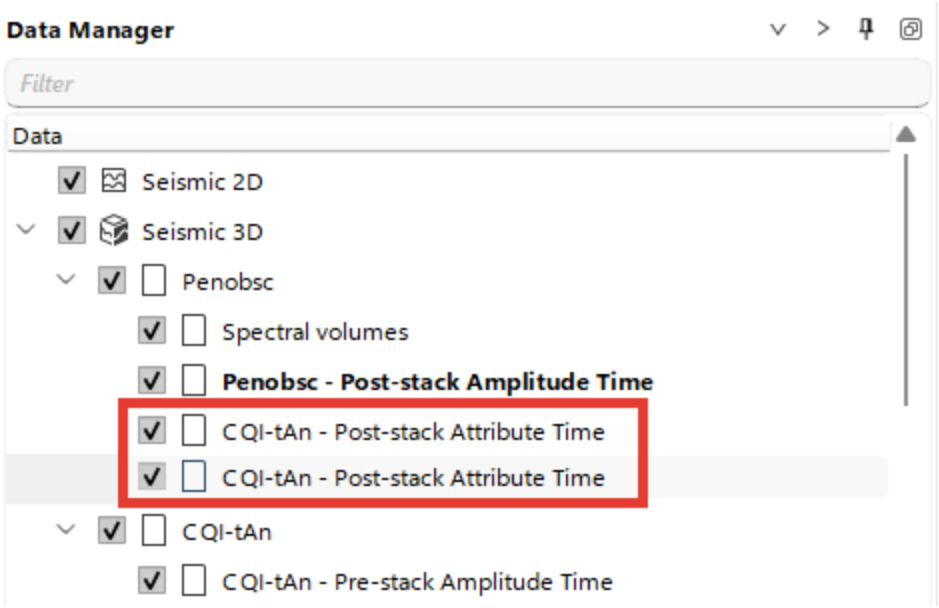
Once all parameters are configured, click ***Apply*** to begin the calculation. The selected AVO attributes will be generated for the defined time interval and data range.

After computation, the results will be stored in the **Seismic folder** in the Data manager 86 and can be visualized in the AVO views 158.



Users can adjust visualization settings such as **transparency**, **color bar**, and **density** options in the property panel to refine the display for more detailed analysis.

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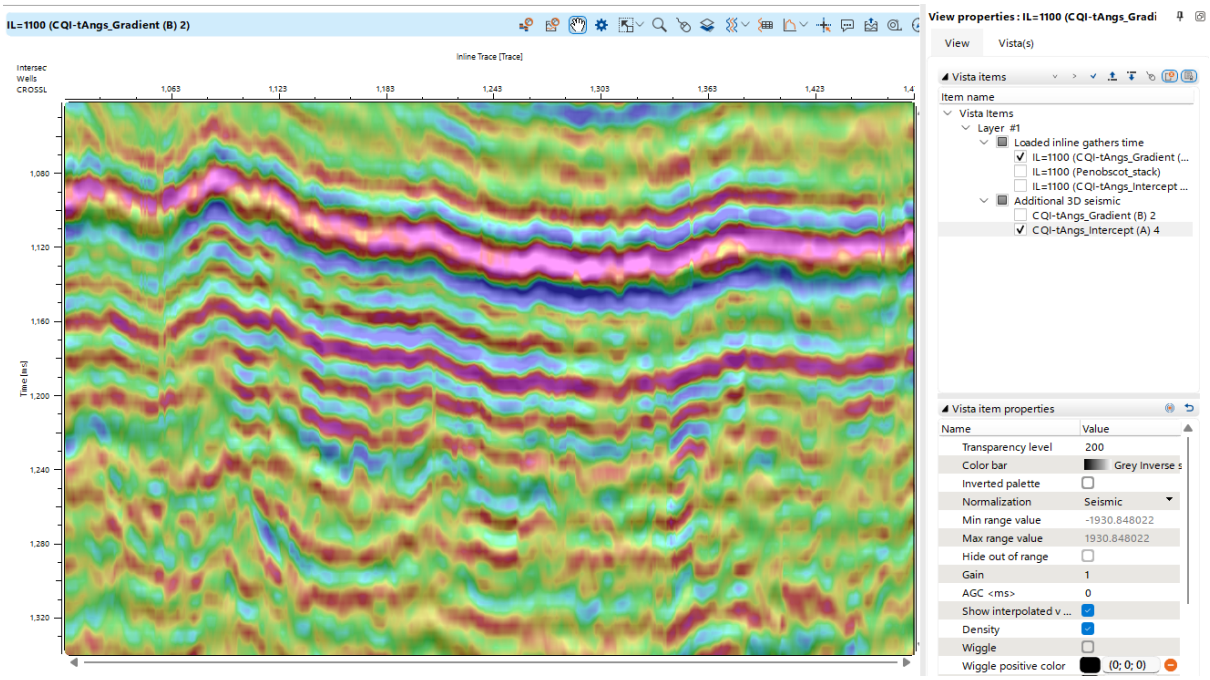

9.8 Mis-tie correction

If you encounter mis-ties in your 2D seismic line set or in 3D seismic volumes, it may be necessary to apply corrections to properly correlate horizons and faults. g-Space offers powerful functionality for addressing mis-ties.

Subscribe to our channel and watch the video on how to correct mis-ties in g-Space on YouTube

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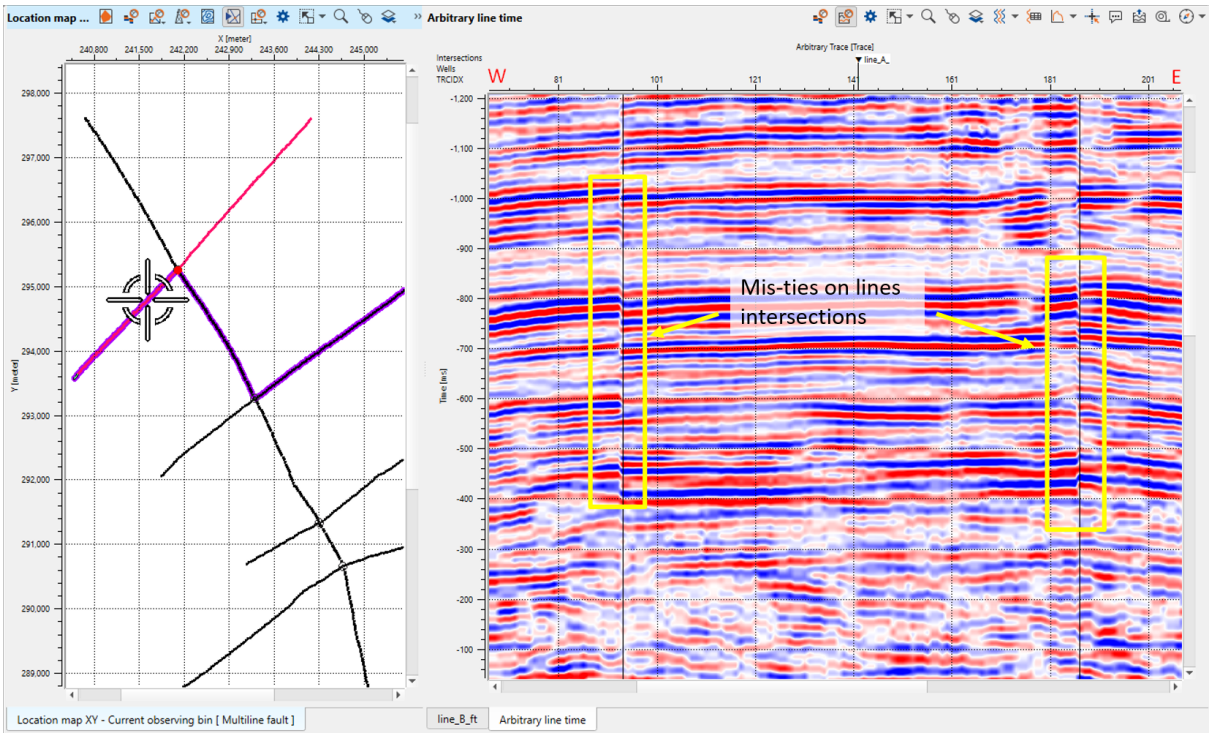
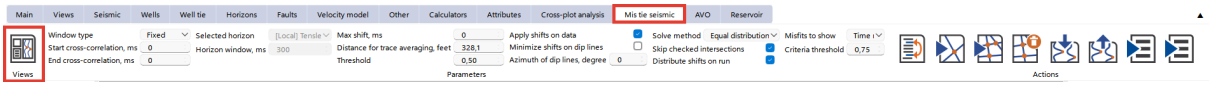


Access the Mis-tie Bar 78 and click on **Add/Show Mis-tie Views**.



This action opens a new workspace with following view types:

- **Location Map**: Visualizes the selected intersections for 2D and 3D seismic data, highlighted in yellow.

For 3D data, highlighted in green

- **Volumes shift table:** Displays all seismic volumes
- **Intersection 3D cross-correlation:** Displays correlation function between volumes

For 2D data

- **Cross Points Table:** displays all intersections with phase and time shifts, highlighted in yellow.
- **Section Views**: Provides four possible sections of the selected intersection, highlighted in red.

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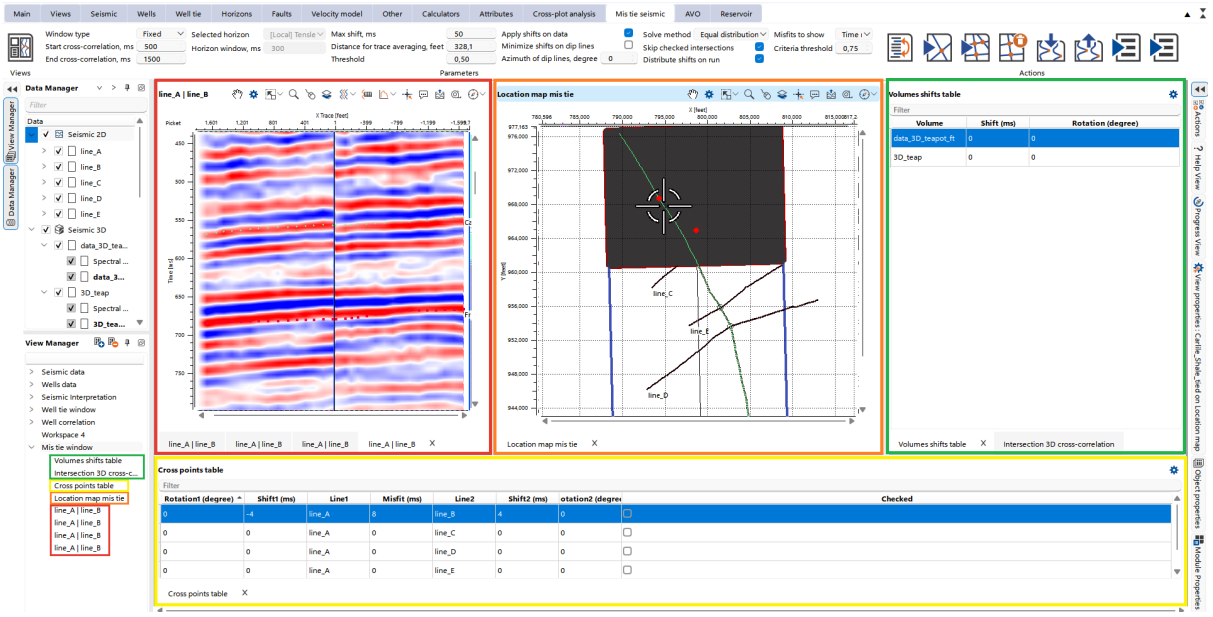

Step-by-step workflows can be found further in the chapters for 2D lines[507] and 3D volumes[512].

9.8.1 2D mis-ties correction

Arrange your workspace as desired, ensuring relevant views (e.g., seismic sections, location maps) are visible.

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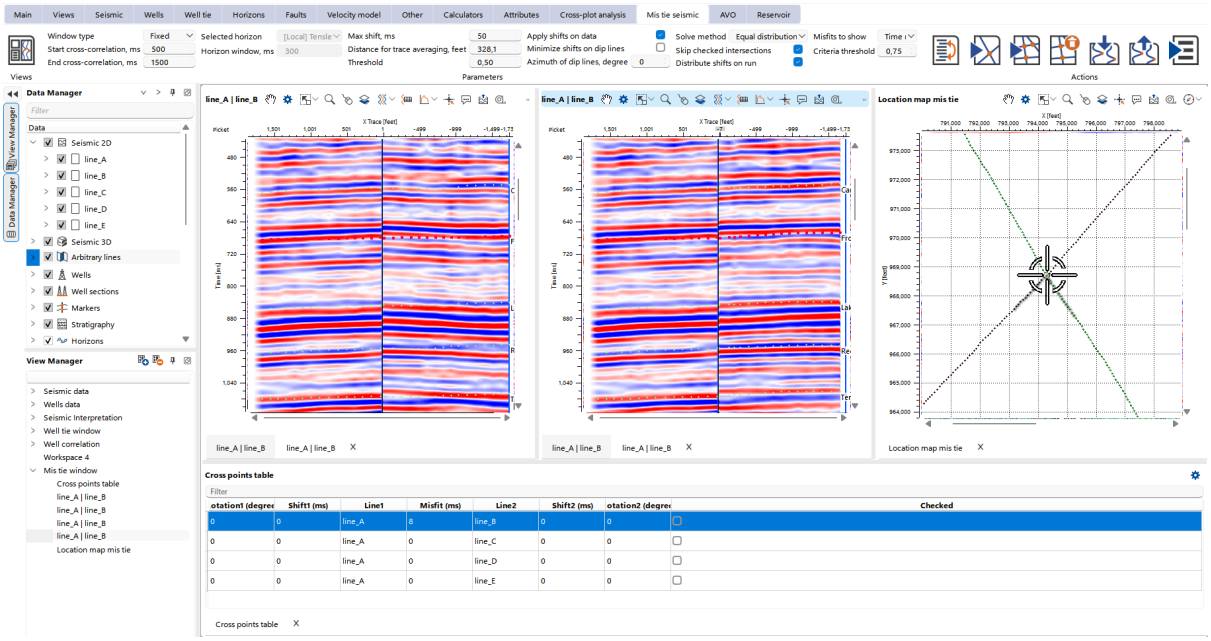
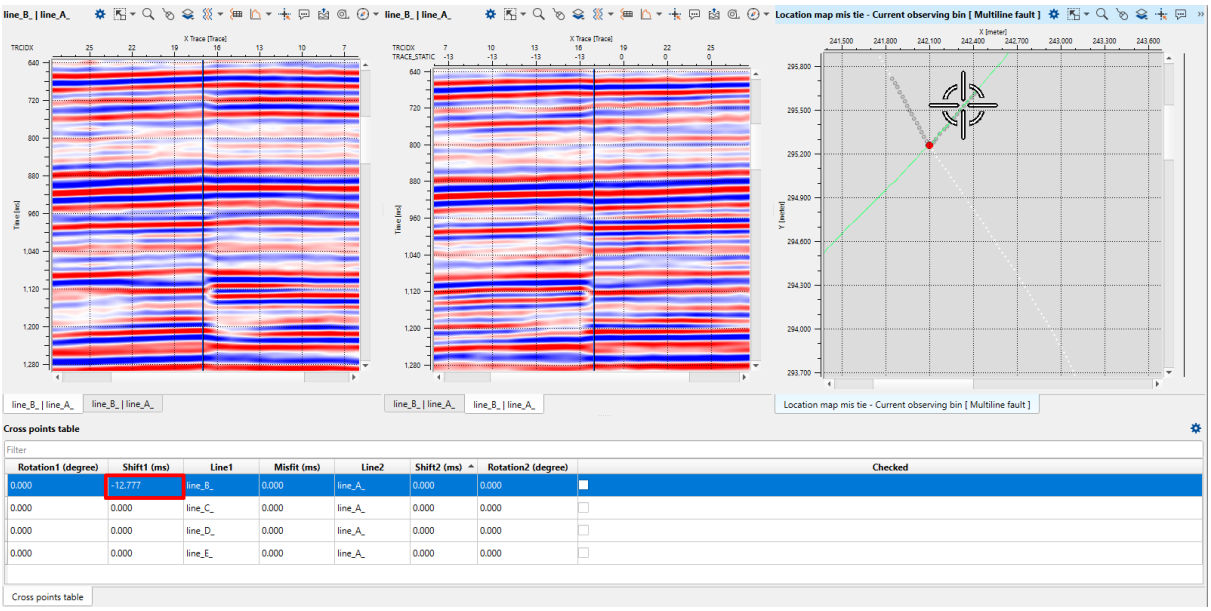


Use the **left mouse button** to drag the seismic section up or down, applying shifts to specific parts of the section. These shifts will be recorded in the **Cross Points Table**.



To clear shift click by right mouse button on the section.
To add phase rotation put the value to the cross point table

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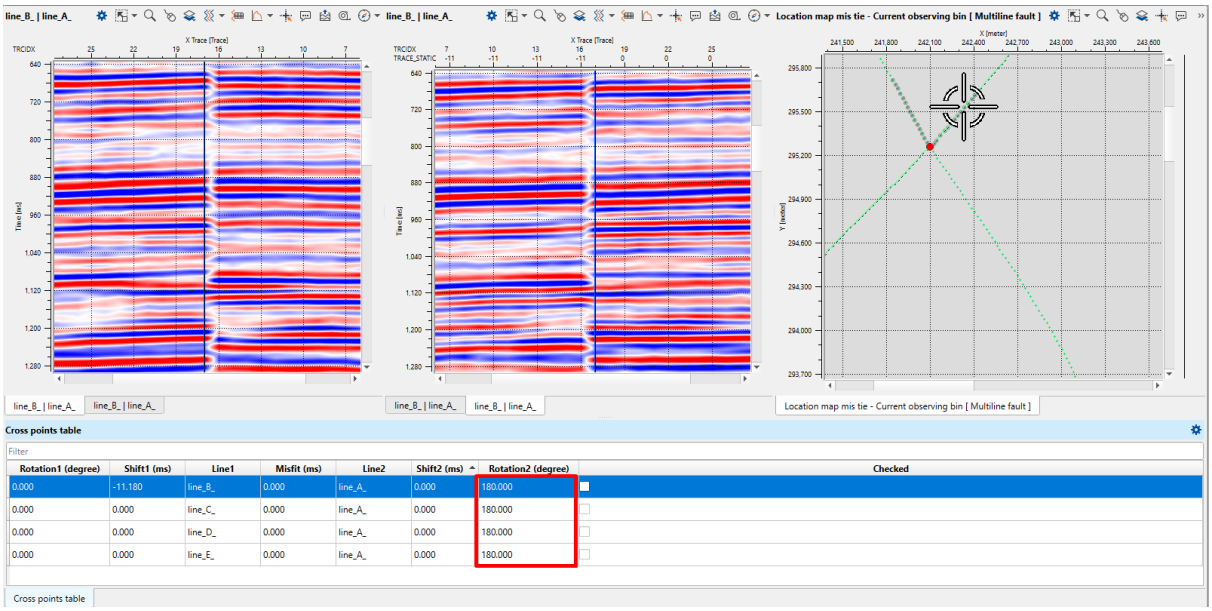
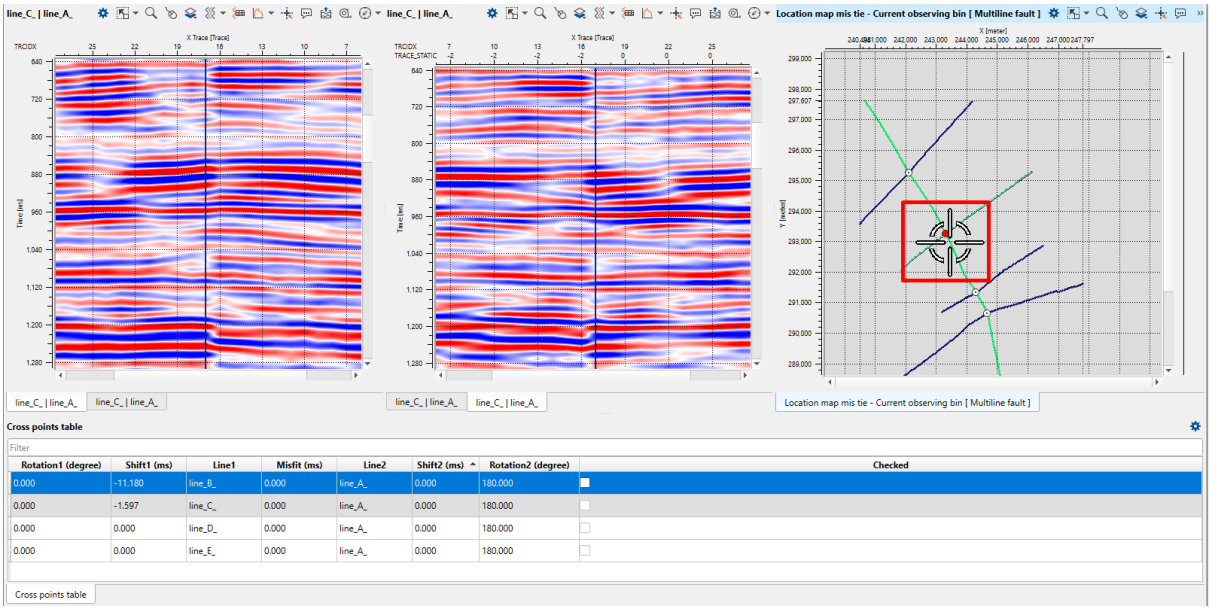


Once adjustments are complete, move to the next intersection via the location map or by selecting the corresponding entry in the **Cross Points Table**.



After finishing work on an intersection, you can mark it as "checked" by double-clicking the relevant box. Checked intersections will be highlighted in green on the map.

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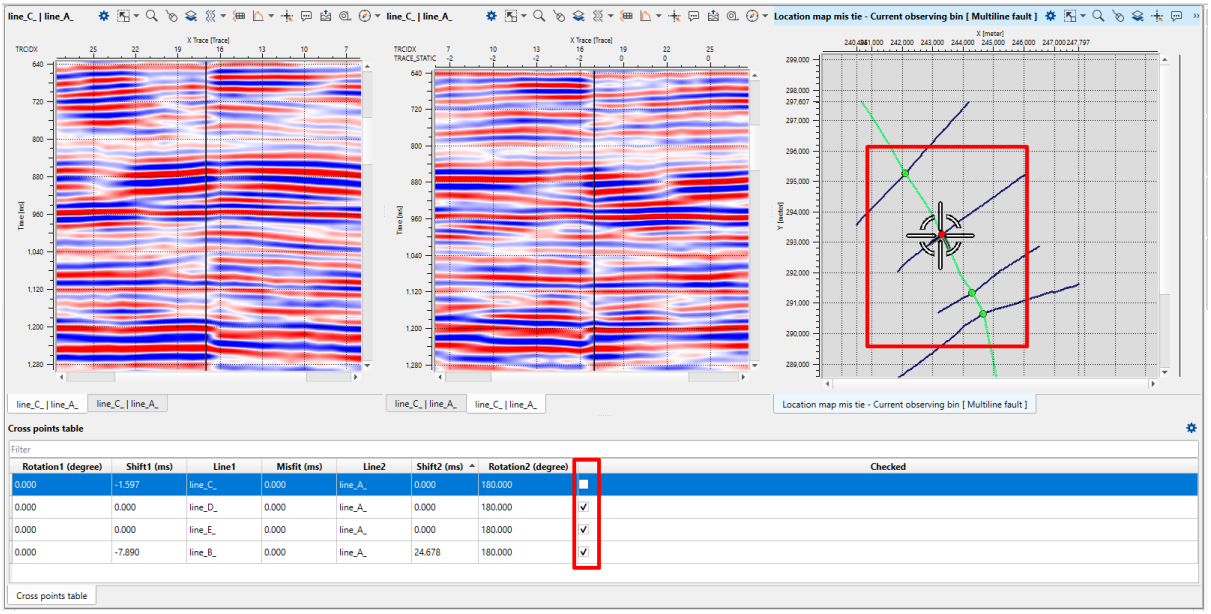
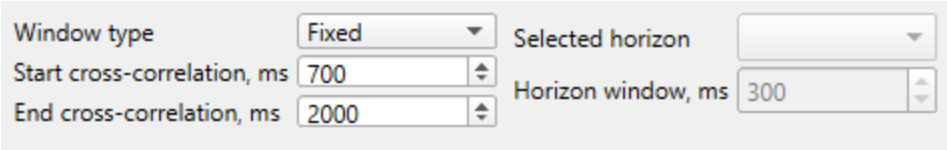


Automatic Mis-tie Correction: In addition to manual corrections, automatic mis-tie correction through time-shift calculation is available. This method leverages cross-correlation and requires specific settings input in the **Mis-tie Seismic** toolbar:

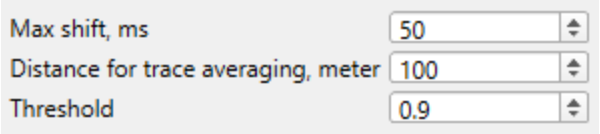
1) **Cross-correlation settings:**

- Choose between a fixed time window or a window centered around a particular horizon. If a horizon is selected, it will form the center of the specified window.



2) **Time-shift parameters:**

- Set the maximum allowable time shift.
- Specify the distance for trace averaging, which will be used for comparison.
- Define the threshold for adding traces from the specified distance to the average.



3) **Applying shifts:**

- Enable shifts to be applied to the seismic data.
- Optionally, activate shift minimization for lines with a specific azimuth, useful in cases involving dipping horizons where azimuth alignment can improve results.

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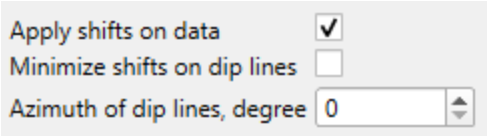
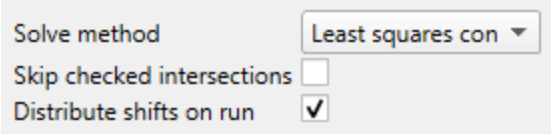
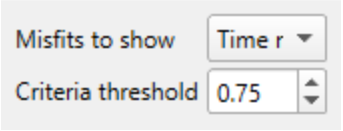


4) **Shift calculation methods:** Select from various methods:
- **Equal distribution:** Splits mis-tie values evenly between intersecting lines.
- **Least squares:** Minimizes the sum of squared mis-tie corrections.
- **Least squares with constant time:** Same as above but with a constraint that the time shift is constant for each line.
- **Least squares with constant time + phase:** Includes phase shifts in the calculation.

Optionally, skip intersections marked as "checked" in the calculations. Also, choose whether to apply shifts directly to the data or just visualize them on the map.



5) **Mis-tie visualization:**
- Choose whether to visualize mis-ties on the map based on **time** or **phase**.
- Set a **threshold** to halt the binding process once a certain accuracy is achieved.



6) **Group priority:**
- If multiple seismic groups exist, prioritize them for mis-tie correction using the appropriate button.

You can perform shift calculations on individual intersections or across the entire dataset:

When calculating across all lines, the **Cross Points Table** will automatically populate with the calculated shift values.

Enable **Misfit Points** in the properties menu, which will be color-coded based on their mis-tie value, and displayed on the location map.

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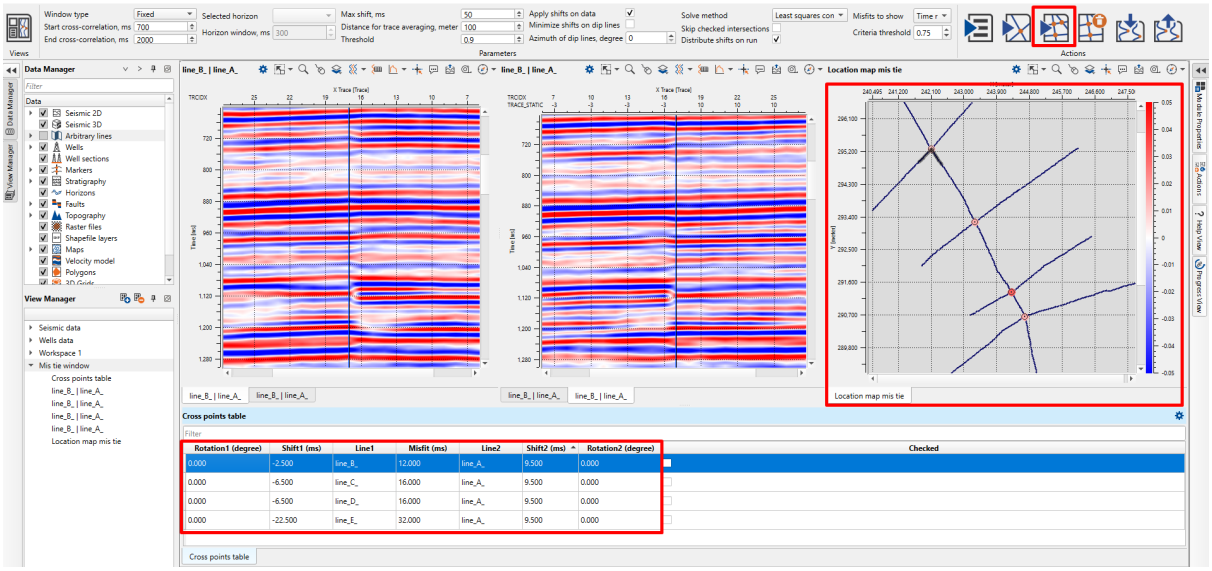

9.8.2 3D mis-ties correction

The **3D Mis-ties Correction** tool in g-Space enables the adjustment of seismic datasets for time and phase shifts between intersecting 3D seismic volumes. This correction improves the consistency between datasets, particularly when dealing with different acquisition or processing workflows.

To begin, configure your workspace as demonstrated in the image below, ensuring that the **Location map**, the **Volumes shifts table** and the **Intersection 3D cross-correlation** views are visible.

In the image below, the Location map shows two volumes in different colors. It is also convenient to view the results interactively in the section view.

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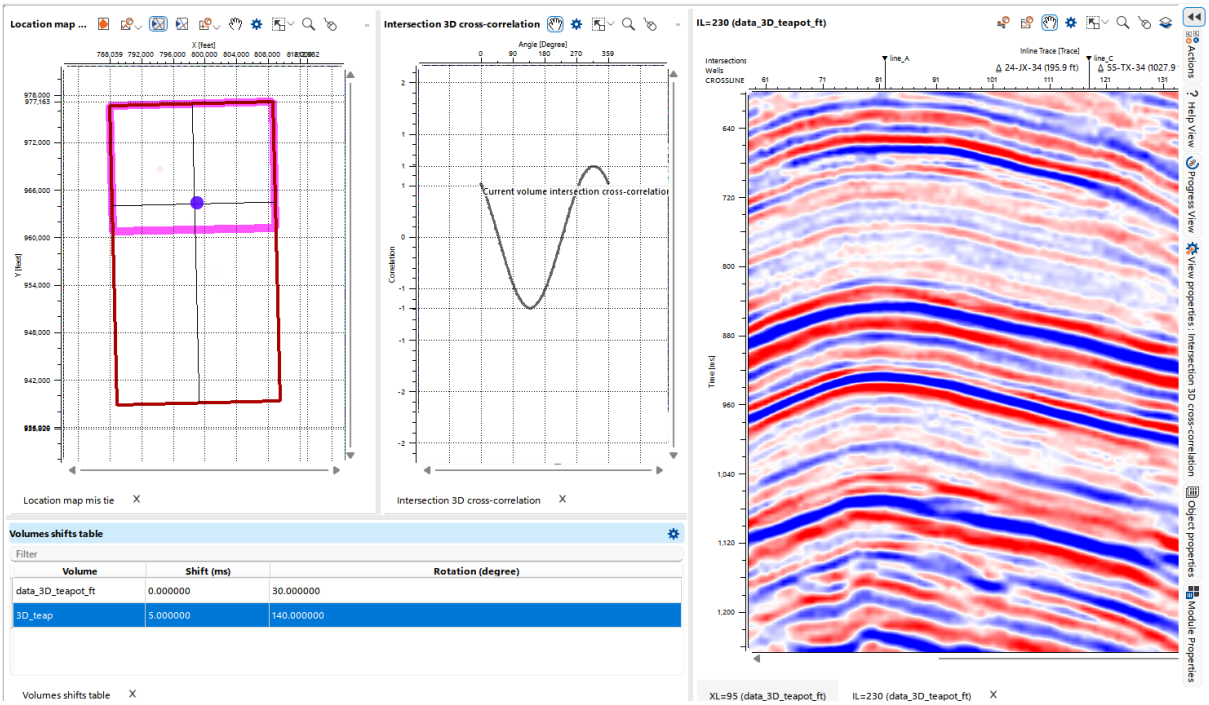

If your project includes multiple seismic processing groups, the priority for applying corrections can be adjusted using the **Seismic Group Priority** button

Calculate the intersections of volumes by clicking the **Calculate volumes intersection** button in the bar, new objects will appear in **Vista(s)**

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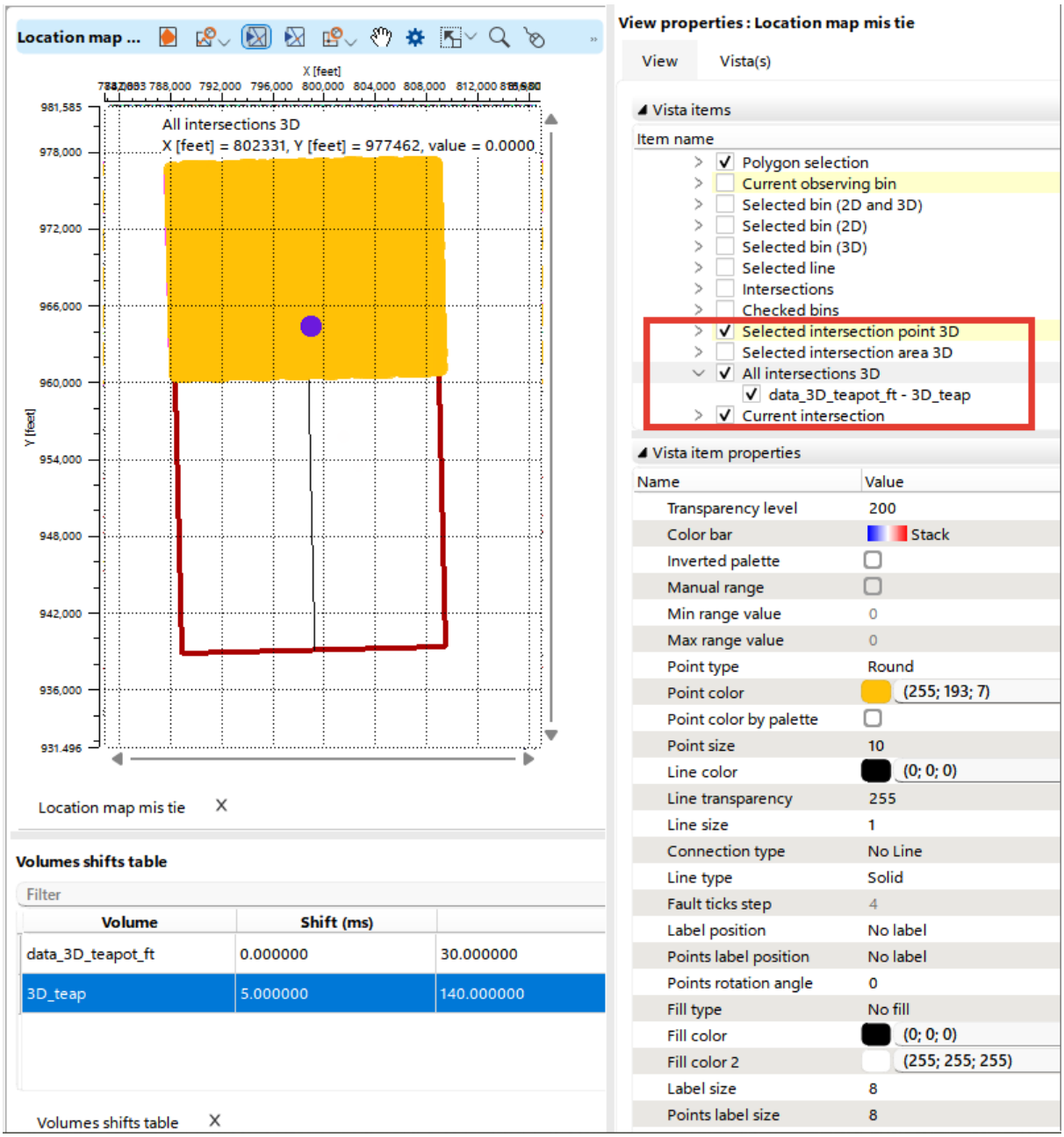

Select the **intersection point 3D,** at this point the mis-ties and cross-correlation will be calculated.

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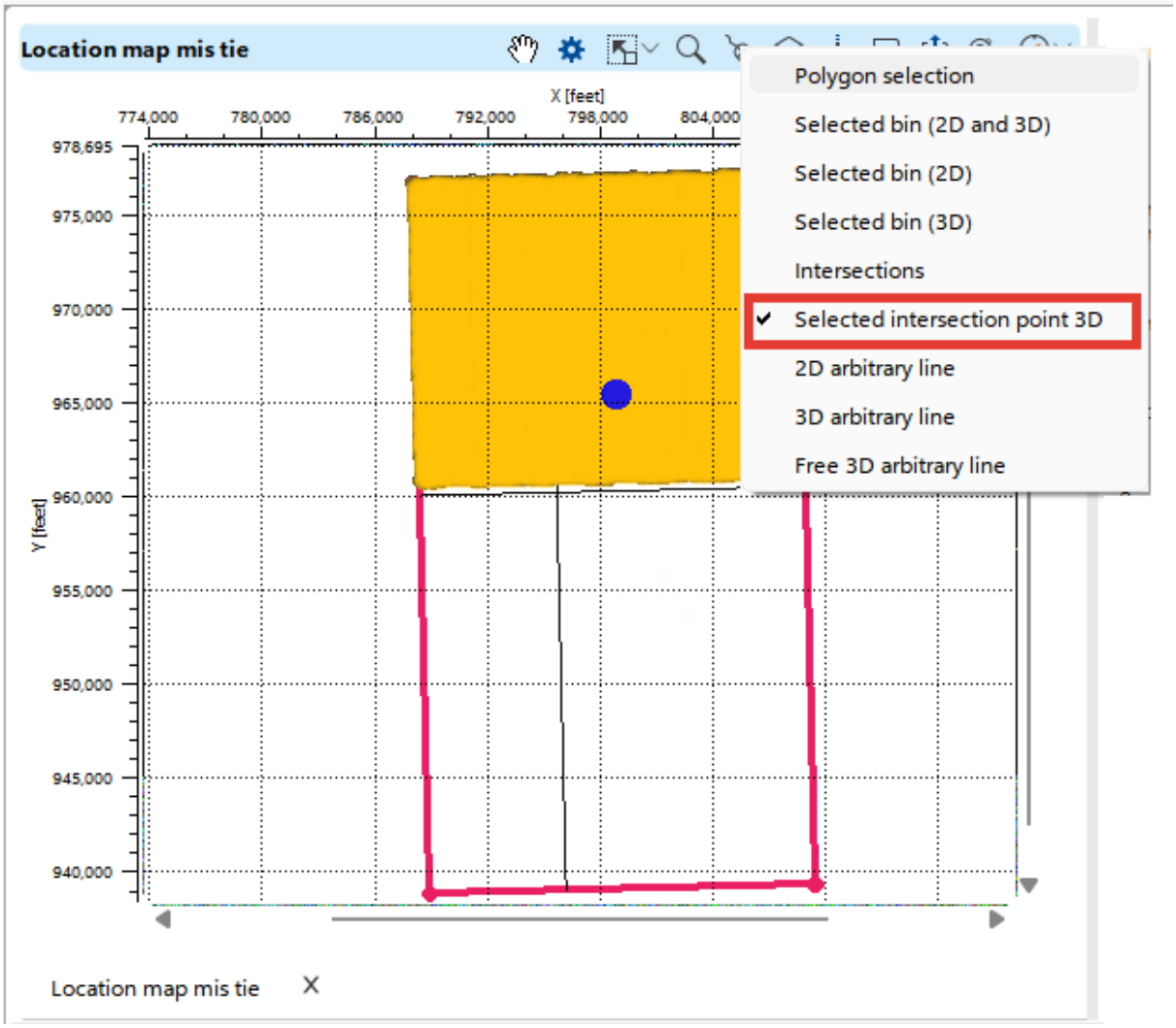
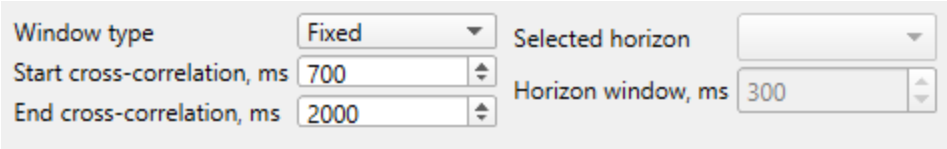


Choose between a fixed time window or a window centered around a particular horizon. If a horizon is selected, it will form the center of the specified window.



Then click **Auto fit volume** button in the bar and in the pop-up window that appears, select the volume relative to which the correction and the time, phase, or both variants of the residuals will be calculated.

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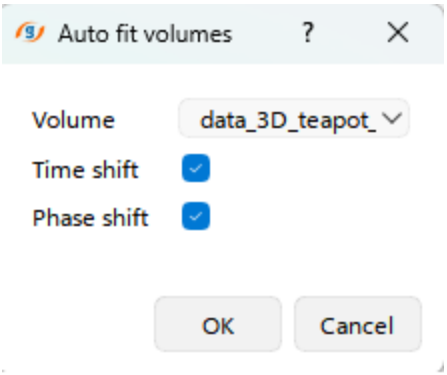
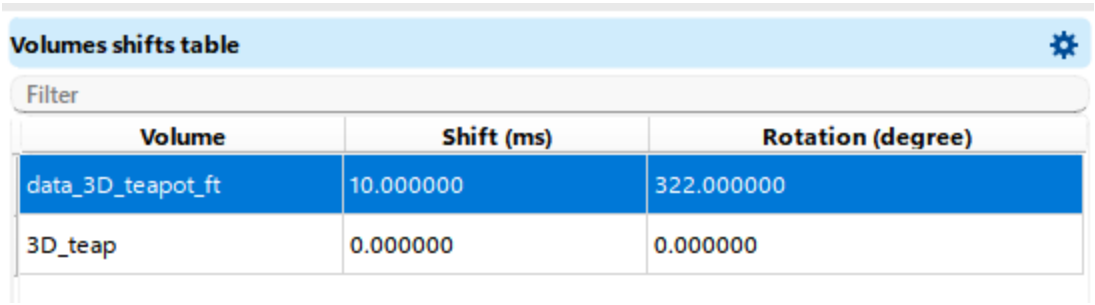


The calculated shifts will appear in the Volumes shift table.
If necessary, you can enter the time and phase shifts into the table manually.
Once the calculation is done, the shifts will be applied to the seismic volume.



To efficiently visualize the results, you can use the **Show in Active Window** function available in the Data Manager for seismic data. This option allows seamless display of the selected seismic data within the active visualization window. For more detailed information on how to display and work with seismic data, refer to the Seismic Data Visualization 397 chapter in this manual.

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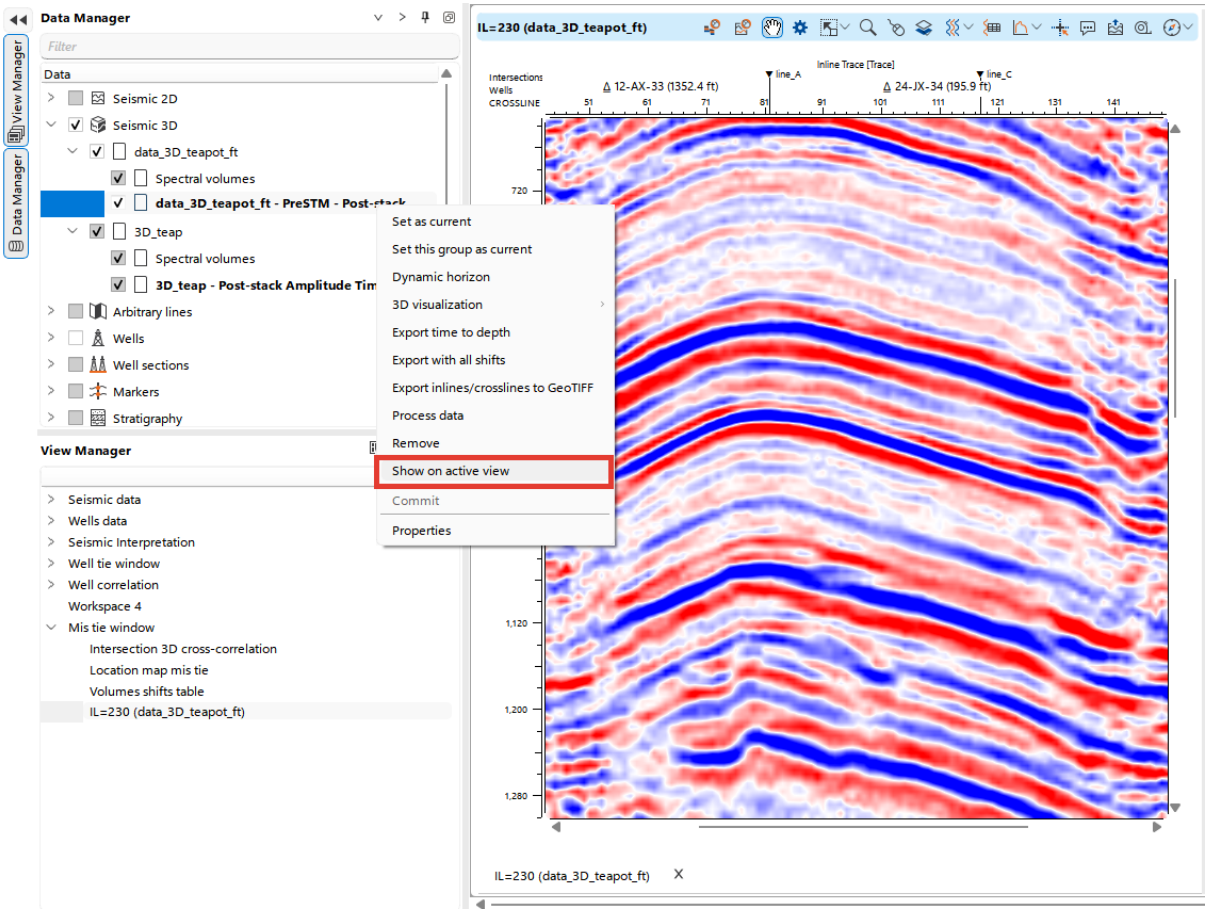

9.9 Mapping

g-Space provides a variety of preinstalled map folders within the **Data Manager** and allows users to modify settings in **Module Properties** for customized outputs.

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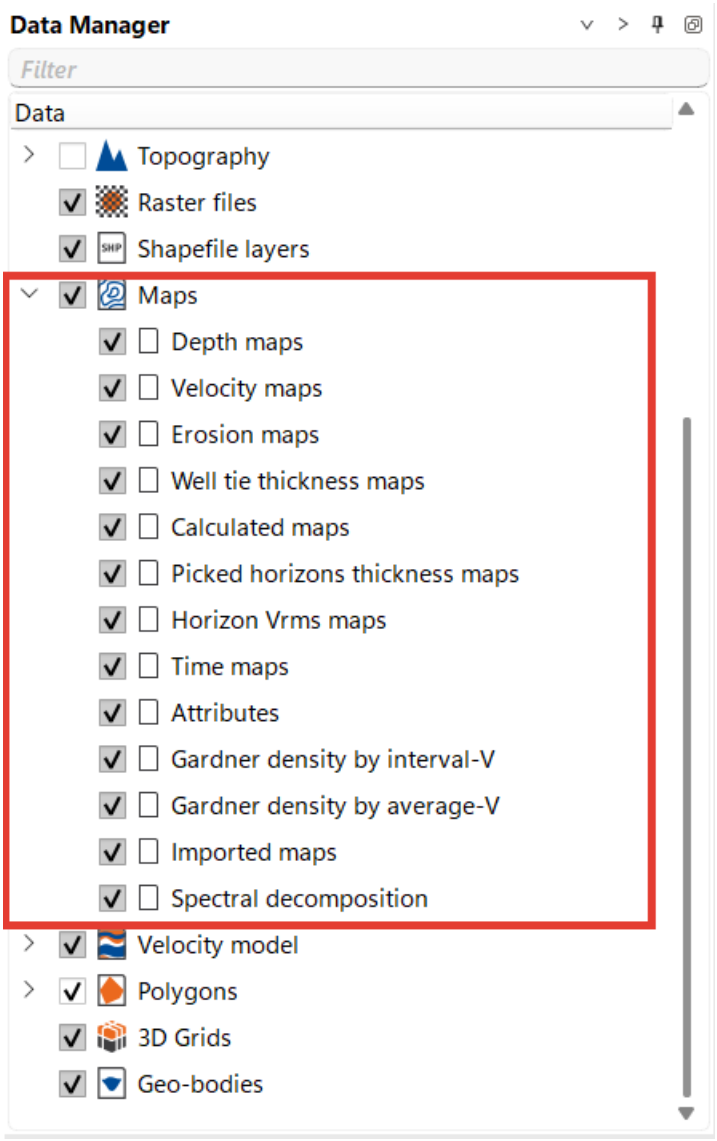

Interpolation settings for creating maps are available in the Calculators Bar 67 by clicking on the Settings icon

In **General** tab you can set Interpolation type, Steps, Faults, Polygons for Mapping.

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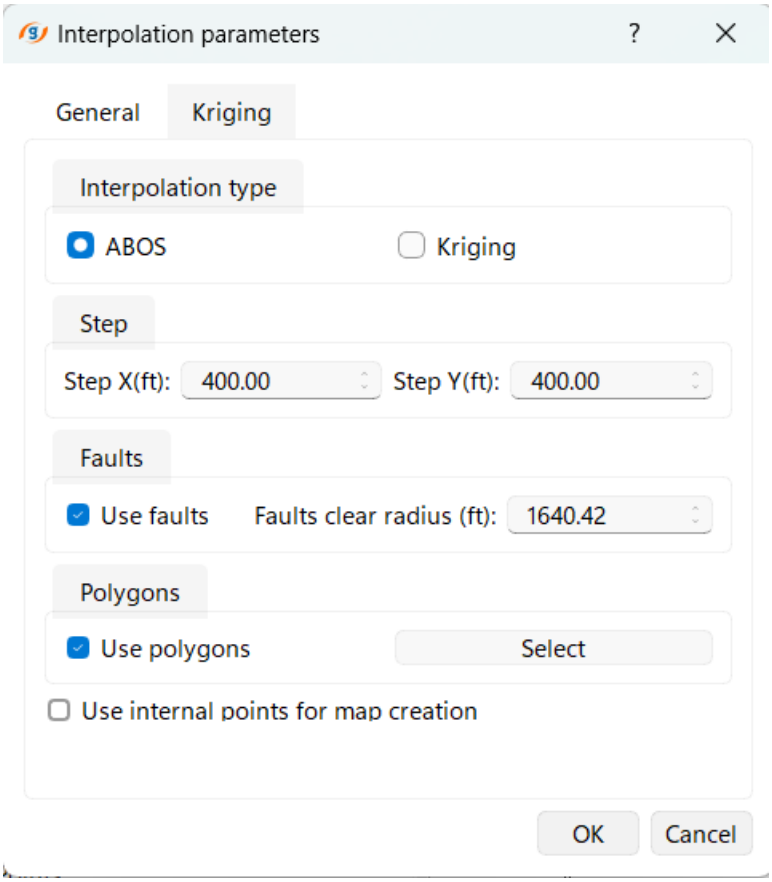

In **Kriging** tab you can set covariance, range and max points

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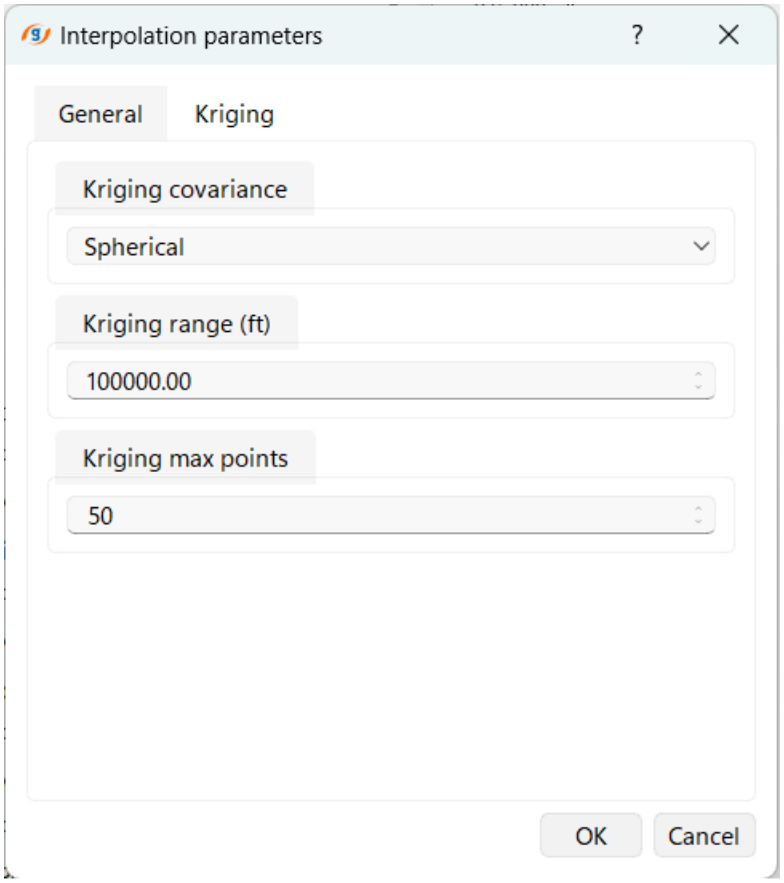

Advanced interpolation settings are available in the Module Properties 91.

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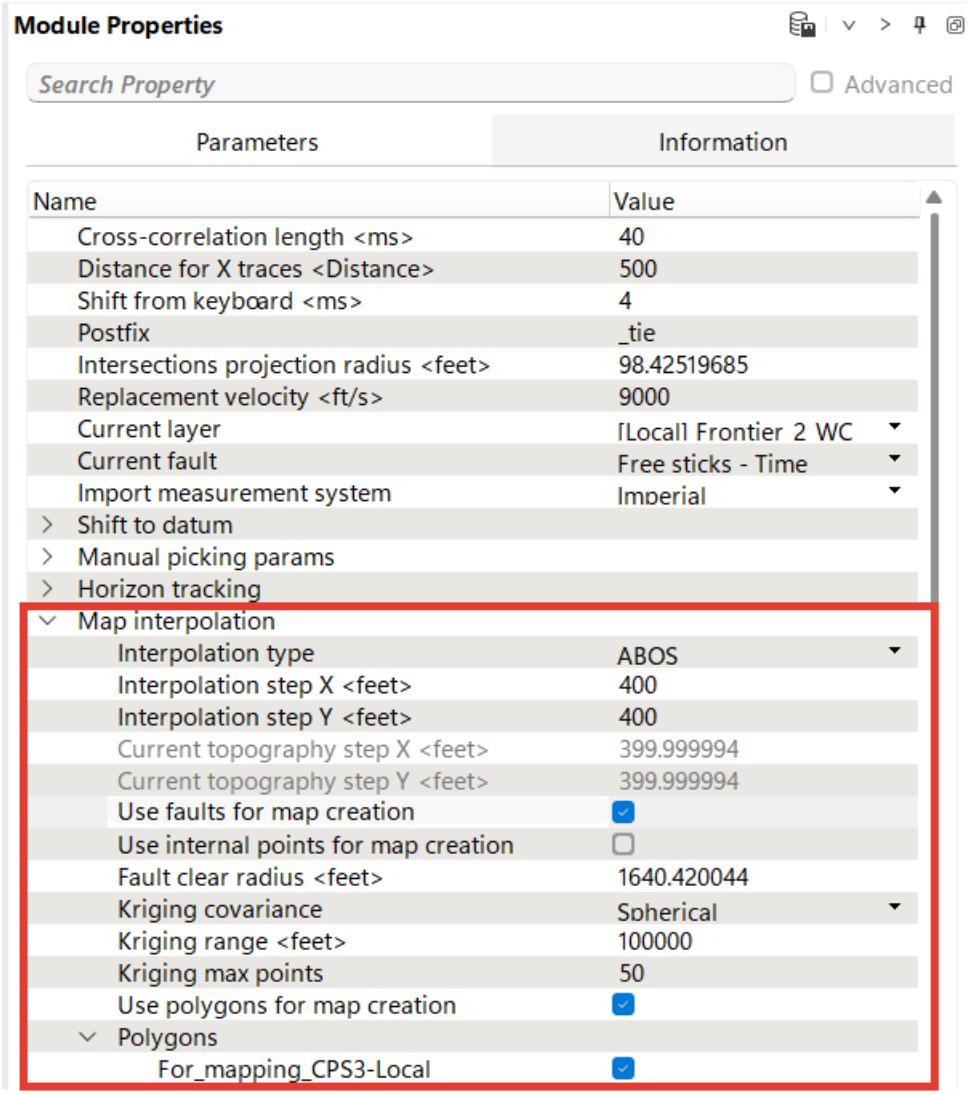

The g-Space map creation process is highly customizable, with options to adjust settings for different geological scenarios. By using preinstalled map folders, applying appropriate interpolation methods, and incorporating faults and polygons, users can generate detailed and geologically accurate maps.

Mapping in g-Space allows you to generate and edit maps of various geological and geophysical properties. This process includes creating maps 522 from horizons, applying velocity models to generate depth and thickness maps etc., and editing maps 524 through the Map Editor tools.

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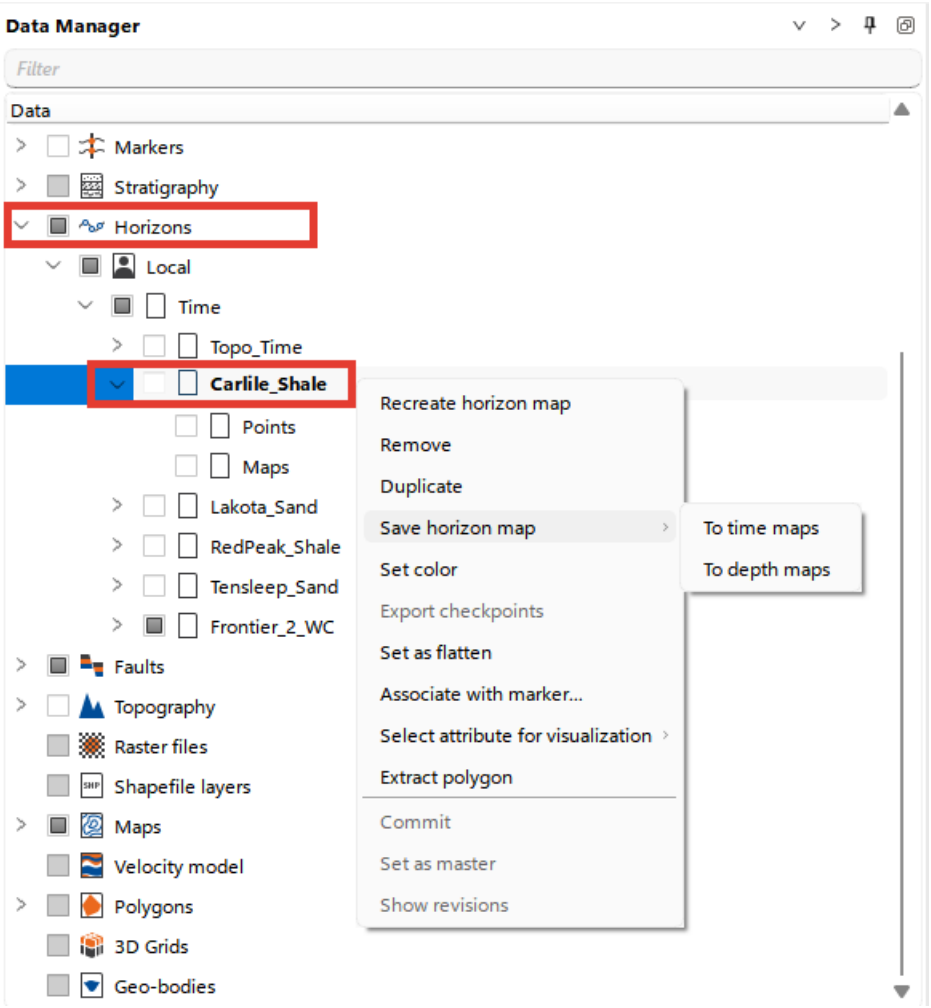
9.9.1 Map creating

The **Horizons** folder in the **Data Manager** stores data as Points and Maps. When a horizon is picked, only points are created initially. To generate a map, right-click on the horizon and choose **Recreate Map**. You can then save the generated map to the Maps folder by selecting **Save horizon map** from the Horizons folder and choosing either the time or depth scale, depending on the type of data you are working with. To convert time horizons to depth maps, a velocity model must be present in the project. By default, the active velocity model is used for this conversion.



The user can set the mapping settings in the **Calculators bar** in the **Map Calculator** tab by clicking the **Settings** button, as well as in the Module Properties.

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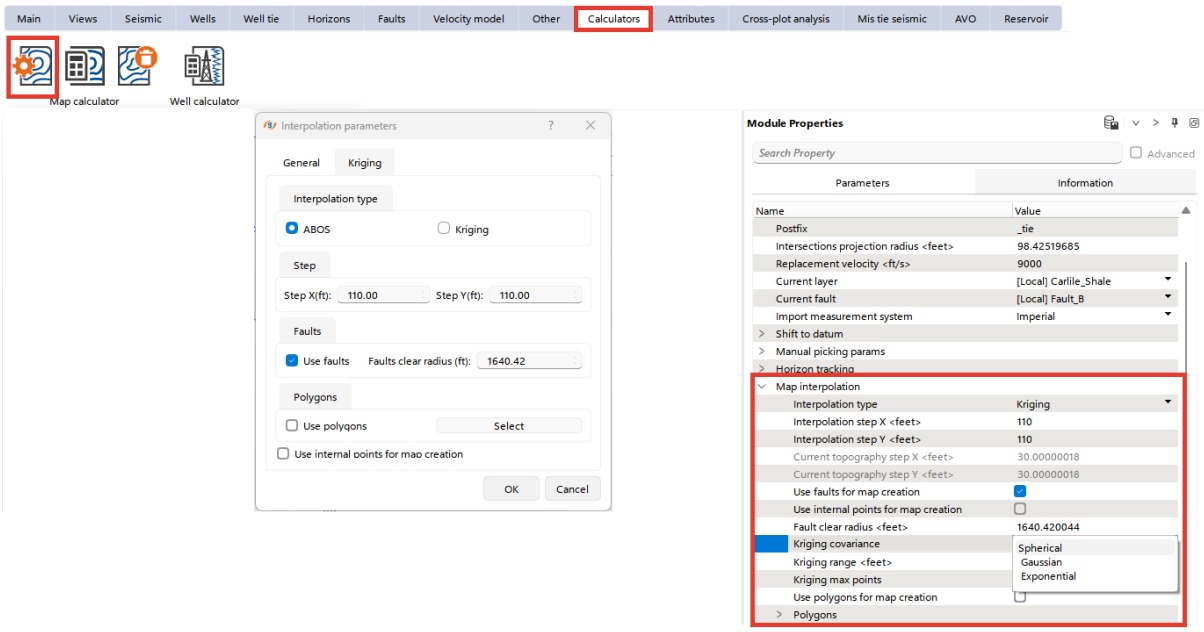
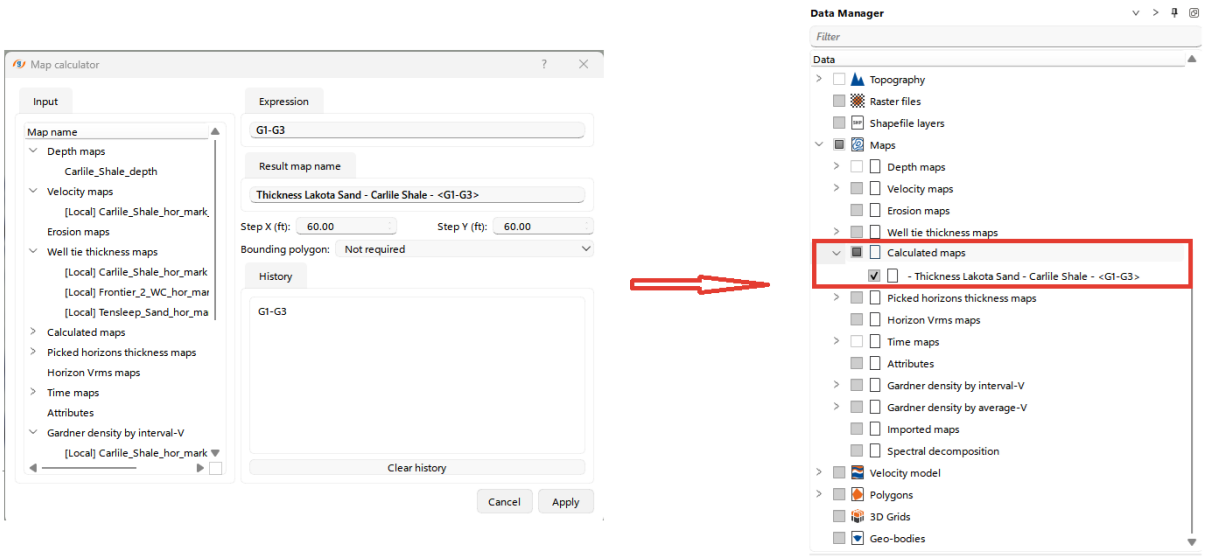


To convert time maps into depth maps and back, a [Velocity model](#) 465 must be created in the project. By default, the active Velocity model is used for conversion.

The **Map Calculator** allows users to create new maps by performing calculations using existing map data. To open the **Map Calculator**, navigate to the **Calculators bar** in the **Map Calculator** tab and click



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In the **Input** tab, select the maps you want to use in your calculations. The maps are organized into categories, such as depth maps, velocity maps, and thickness maps. You can choose multiple maps from the available options.

In the **Expression** tab, define the mathematical operation or formula you want to apply to the selected maps. You can reference maps by their names, as shown in the list.

Refer to the Trace Headers Math 342 for a description of the available mathematical functions.

Enter a name for the new map in the Result Map Name field. This is how the new map will be saved and displayed in the Data Manager.

Define the grid step sizes for the X and Y axes in the corresponding fields (e.g., 60 ft). This determines the resolution of the resulting map.

If you wish to restrict the calculation to a specific area, select a bounding polygon. If no restriction is needed, leave this as "Not required."

The history of the expressions used in the calculation is displayed for reference, allowing users to track their operations.

Once the input maps, expression, and settings are configured, click **Apply** to generate the new map. The resulting map will be saved in the **Calculated Maps** folder in the Data Manager. In the data manager you can drag and drop maps from Calculated Maps to any other folders

In g-Space, users can calculate and visualize attribute maps. A detailed workflow is described in the Seismic Attributes 472 chapter.

9.9.2 Map editing

Once the maps are generated, they can be edited using g-Space's Map Editor 214. The editor provides tools for refining, annotating, and enhancing your maps for presentations or further analysis.

In the Views bar 36, select the **Map Editor View** to open the map editing interface.

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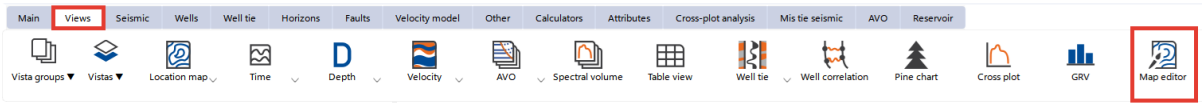
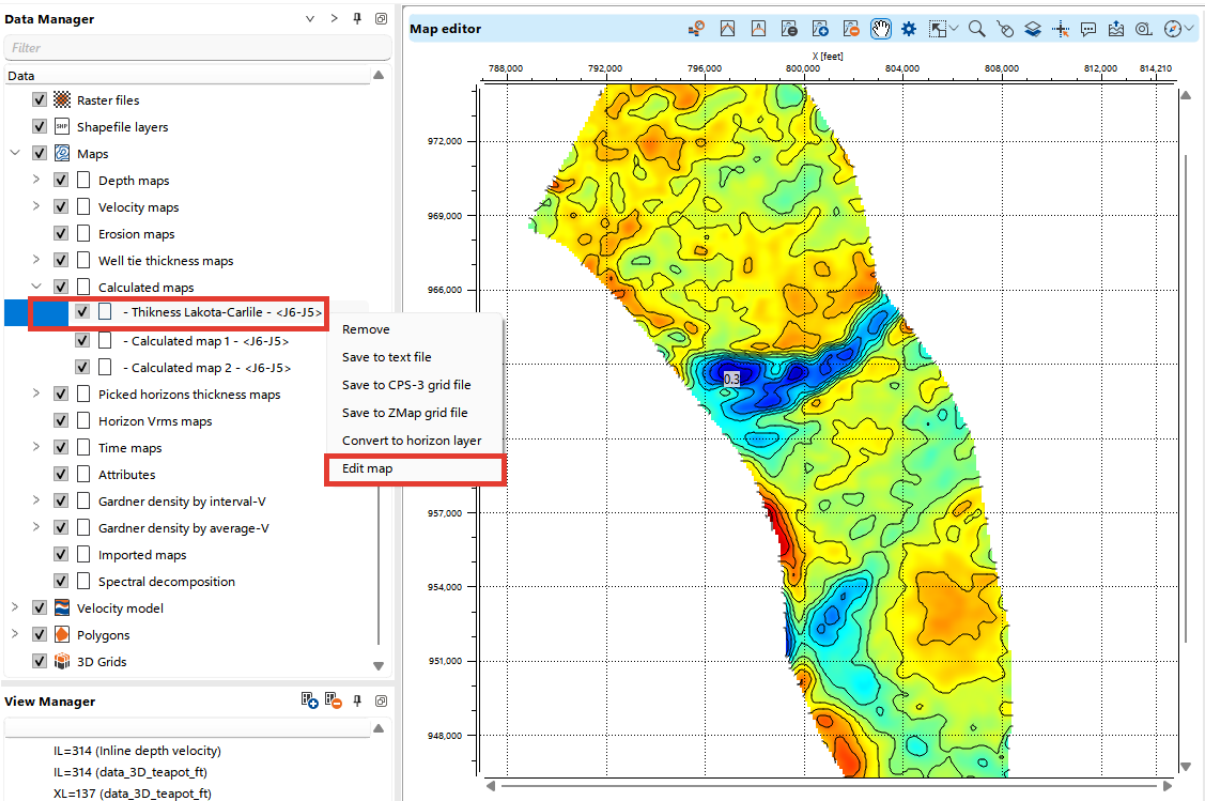


In the **Data Manager**, locate the map you want to edit.

Right-click on the map and select **Edit map**. The selected map will then be displayed in the **Map Editor View**.

In the **View Properties** panel, adjust the visualization settings to customize the appearance of the map. This includes color scales, isolines, and other display options to better represent the data.



The full range of settings is available in the description of the Map editor view 214

Below are some practical examples of using map editing tools.

The **Smooth** tool is designed to reduce sharp gradients, noise, or irregularities in map data, making it more continuous and geologically realistic.

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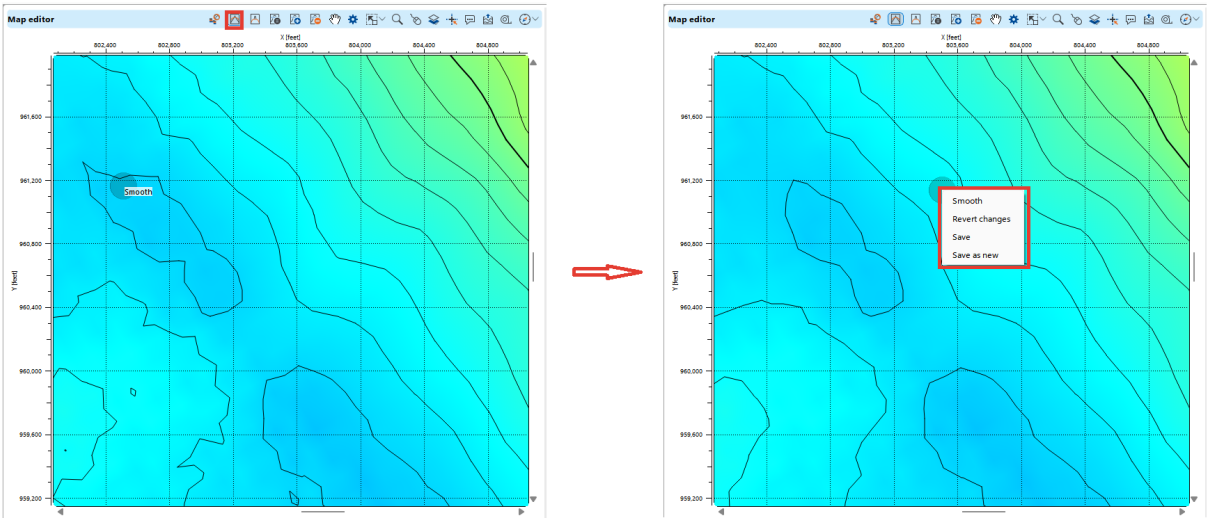
To undo changes, press **Alt** and right-click the mouse. A menu will appear, providing options to revert the changes or proceed with other actions.



Notes

Depth maps generated from seismic horizons can sometimes exhibit small, unnatural variations caused by interpolation or gridding.

Velocity models often have abrupt changes between zones that may not accurately reflect the gradual transition of rock properties.

Faults may introduce sharp breaks or offsets in horizon maps.

After gridding well, seismic, or attribute data, sharp transitions may occur due to data gaps or uneven distribution.

The **Remove Peak** tool is particularly useful in geophysical and geological workflows where small, isolated, or anomalous high points (peaks) in the data may distort interpretation or modeling.

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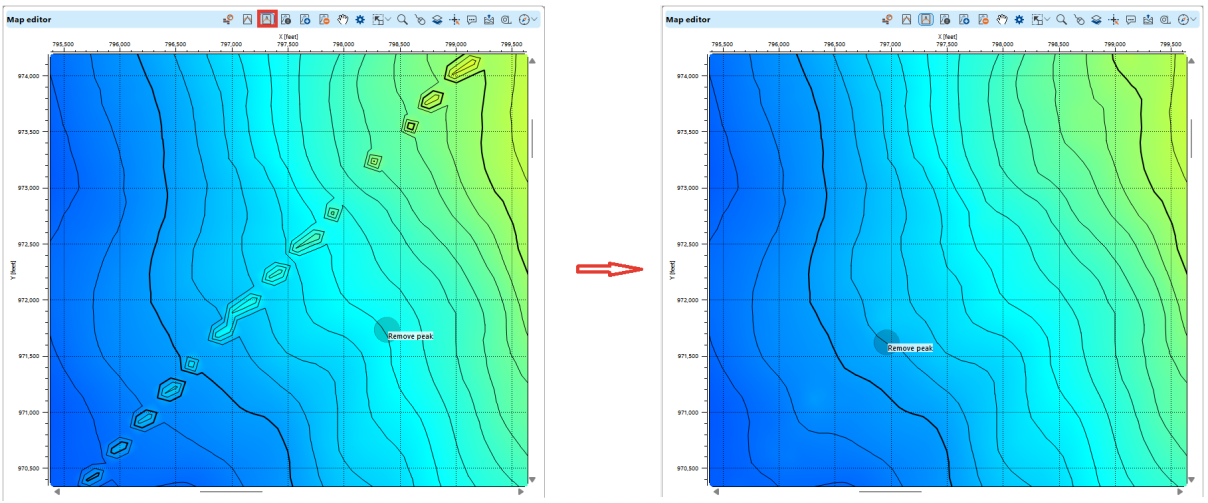

Notes

Seismic attribute maps, such as amplitude or frequency maps, may occasionally contain small, spurious peaks due to noise or localized data inaccuracies.

In structural geology, isolated peaks in depth or time maps may not represent true geological structures but rather noise or interpolation artifacts.

For large regional studies, maps may exhibit peaks that are not representative of the broader geological trend, often due to noise, small-scale structures, or surface irregularities.

In velocity modeling, spurious velocity spikes may cause errors in depth conversion and lead to misinterpretations of subsurface features.

The **Set value** tool allows you to assign a specific value to any part of the map. This is useful for correcting or standardizing certain areas of the map where the data may not accurately represent the real geological or geophysical structure.

To set a particular value or revert changes, press **Alt** and right-click the mouse. A menu will appear, providing options.

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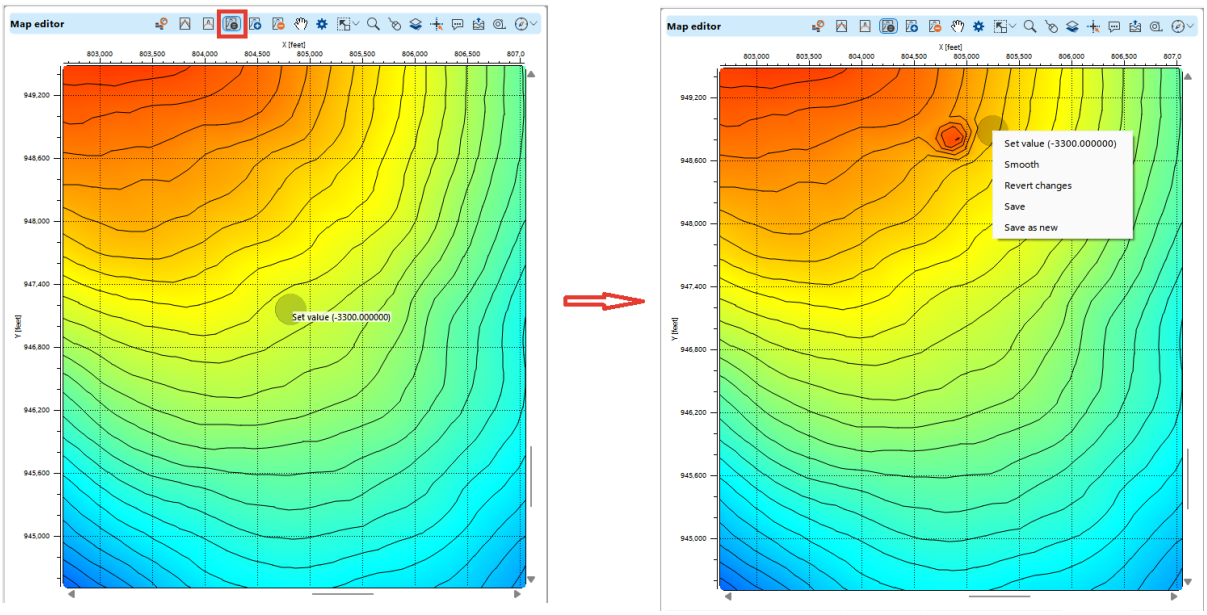

The **Add value** and **Subtract value** tools allow you to increase or decrease the values at any part of the map by a specified amount, facilitating data adjustments; after selecting the tool, you can define the amount you want to add or subtract from the current map values by pressing **Alt** and **right-clicking** the mouse, at which point a menu will appear, providing options.

Creating, editing and saving faults in Map editor View is described in detail in the Faults 437 chapter.

9.10 Statistical analysis

The **Statistical Analysis** view provides a robust toolkit for analyzing and visualizing relationships between well log attributes, data distributions, and structural orientations.

By selecting the appropriate **Graph Type** — Cross-Plot 529, Histogram 532, Variogram, or Stereonet 539 — users can gain valuable insights into their data through targeted visualization techniques.

For effective analysis, users can fine-tune graph settings such as **data source selection**, **axis parameters**, and **filters** to focus on specific intervals or attributes of interest. The use of **Bounding Polygons**, **MD ranges**, and **markers** allows for precise control over the data included in the analysis, enabling more accurate and meaningful results.

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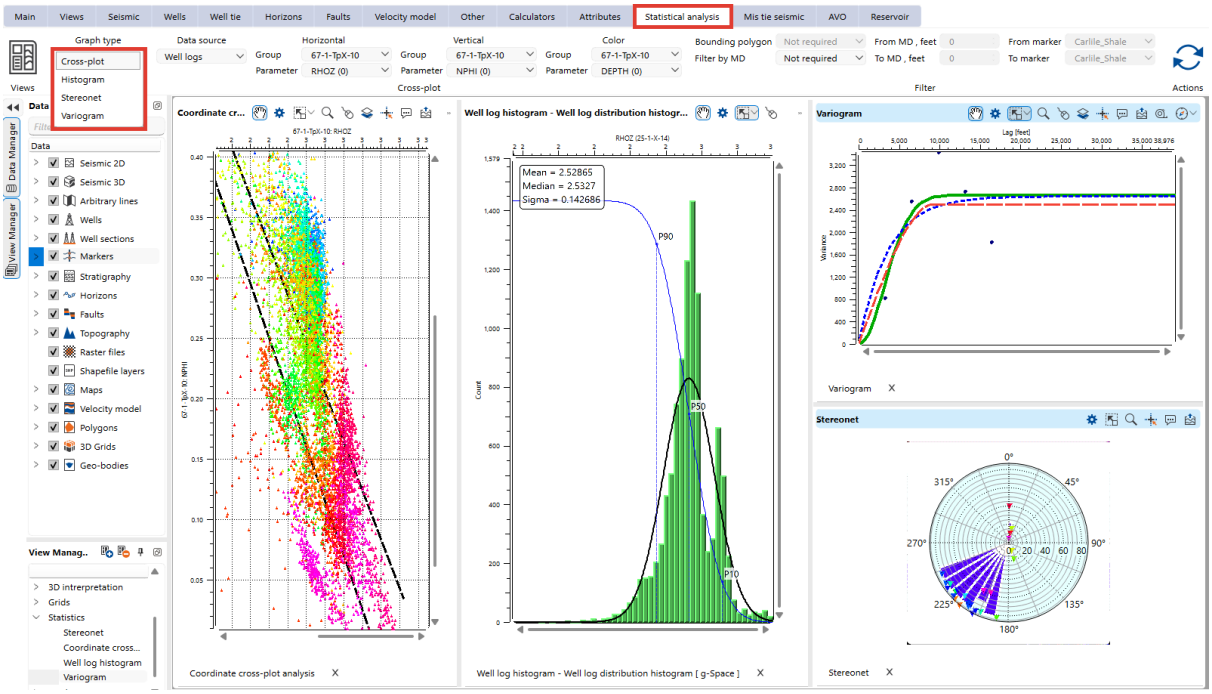
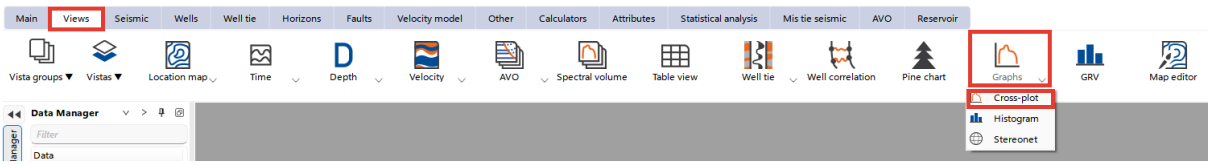
Visual customization is an essential part of the workflow. Adjusting **color schemes**, **point size**, and **bin settings** helps improve clarity and enhances the interpretability of graphs.



9.10.1 Cross plot

Cross-plot analysis is allowing users to compare two variables on a scatter plot to identify relationships, trends, or anomalies.

To create cross plot view go to the Views bar 36, navigate to **Graphs** and click on **Cross plot** button:



To set what data to be analyzed set parameters in the Statistical analysis 72 bar:

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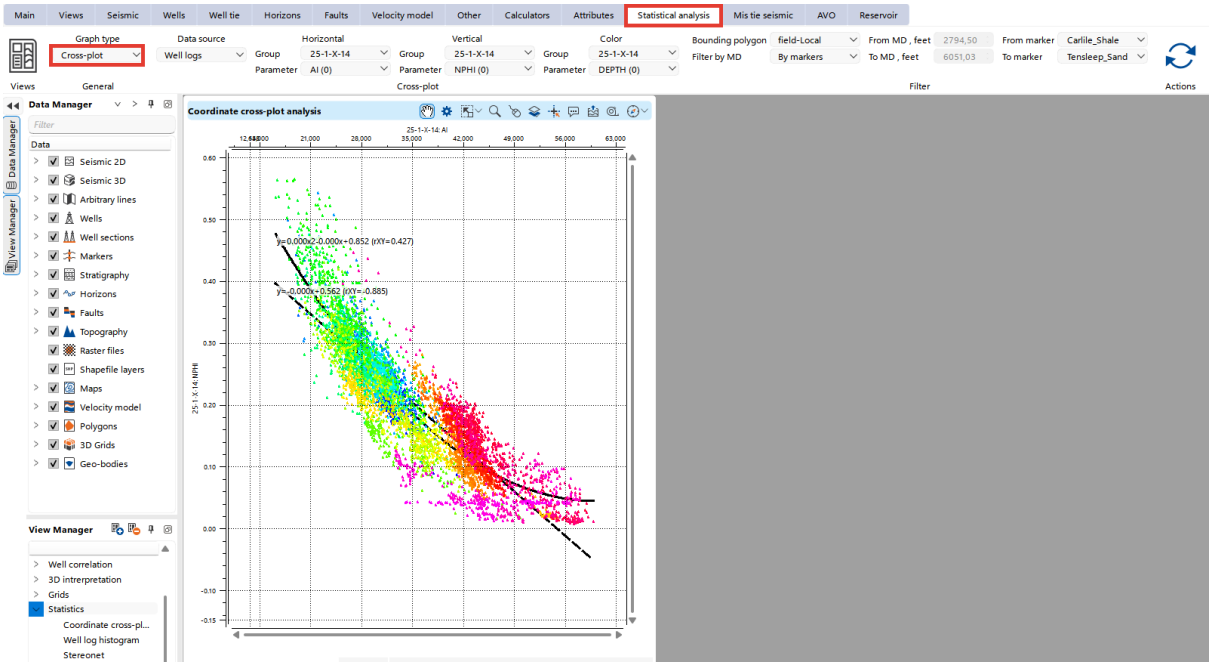
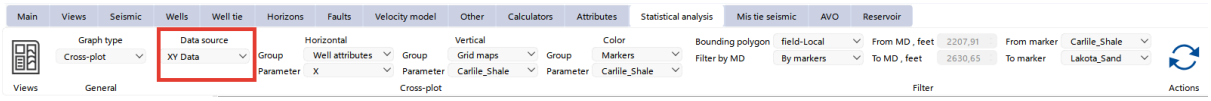


Cross-plot analysis is helpful to the user to understand the relation between two or more seismic attributes. In this cross-plot analysis bar the user can able to select the seismic attributes and generate the cross plot in Views

In the **Data Source** dropdown menu, you can choose the type of data to analyze. Available options include **XY Data** and **Well Logs**.



When **XY Data** is selected as the data source in the **Cross-Plot Analysis** tool, the interface allows users to analyze relationships between two variables (X and Y coordinates). This mode is particularly useful for investigating well attributes, seismic attributes, or any spatially correlated data that can be expressed in an XY format.

For the **Horizontal Group (X-axis)** and **Vertical Group (Y-axis)**, you can select a group of well attributes (such as X, Y, KB), markers, topography, grid maps, or horizons as the group for analysis. You can then specify the desired parameter from each group.

The **Color** option allows you to define a third parameter for analysis, which will be used to color the data points on the cross-plot. This additional dimension provides deeper insight into data distribution or behavior. For example, you could color the data points based on a seismic attribute like amplitude or porosity, adding another layer of interpretation.

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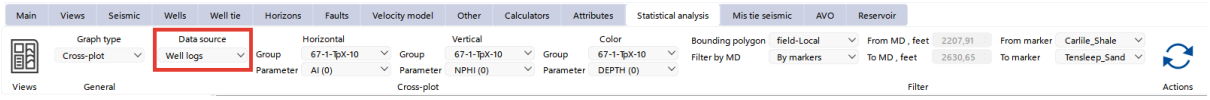
The **Bounding Polygon** option allows you to limit the analysis to specific areas of interest. By defining a polygon, you can filter out data points outside the selected region. If no polygon is required, leave this option set to **Not required**.



When **Well Logs** is selected as the data source in the **Cross-Plot Analysis** tool, the interface enables the analysis of relationships between well log measurements for individual wells. This is especially useful for examining the correlation between different well log parameters (e.g., porosity, resistivity, sonic log) within a specific well.

For the **Horizontal Group (X-axis)** and **Vertical Group (Y-axis)**, you can select a specific well from the **Group** dropdown menu and then specify the parameter from the selected well (such as **RHOZ**, **DEPTH**, **DT**, etc.).

The **Color** option enables you to add a third parameter to your analysis. This third parameter is used to color the data points in the cross-plot, allowing you to visualize how a specific log (such as sonic log **DT**) varies across the plotted data.

Filter by MD

- **Manual**: Allows you to manually input the MD values.
- **By markers**: Uses predefined geological markers to select the interval of the analysis.

In the **Cross-plot** view, you will find two regression functions: **linear** and **quadratic**. These functions help in identifying trends and correlations between the selected parameters. Both regression lines are also accessible through the **Vista** tab within the **View Properties** panel, where you can further customize the visual settings, such as line color, thickness, and other aesthetic preferences, to suit your needs.

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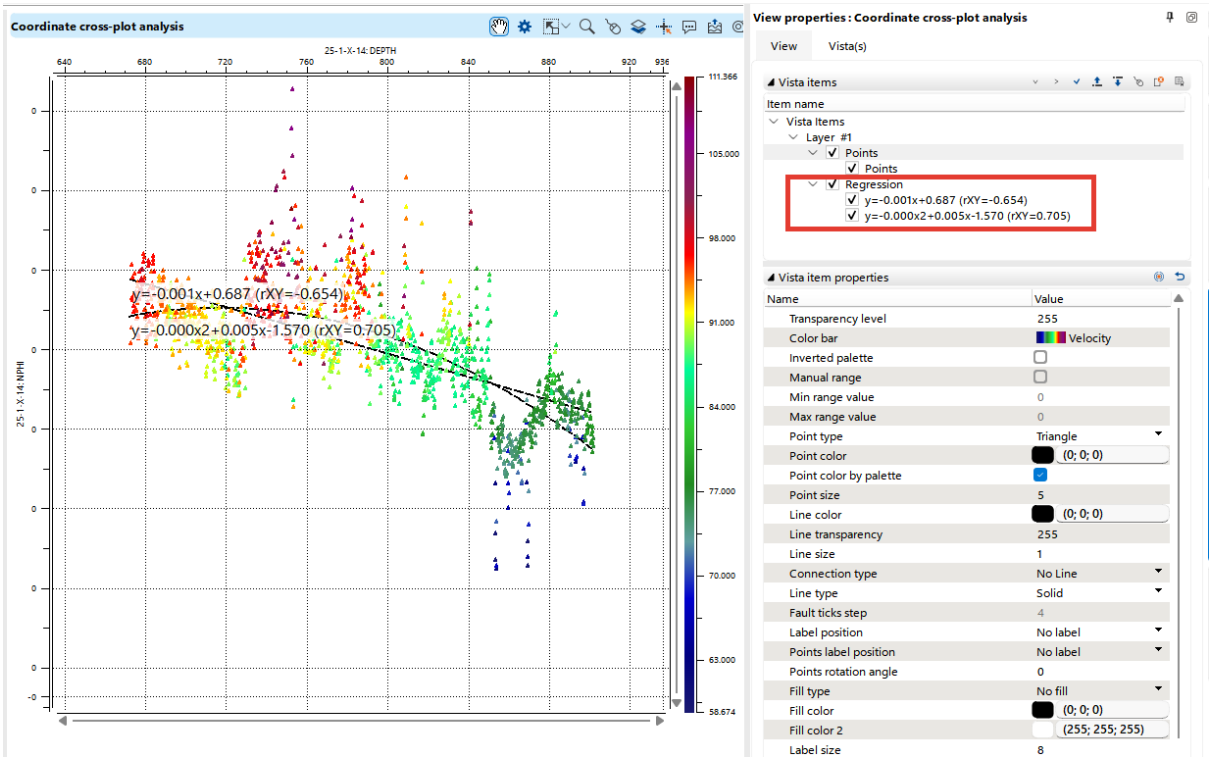
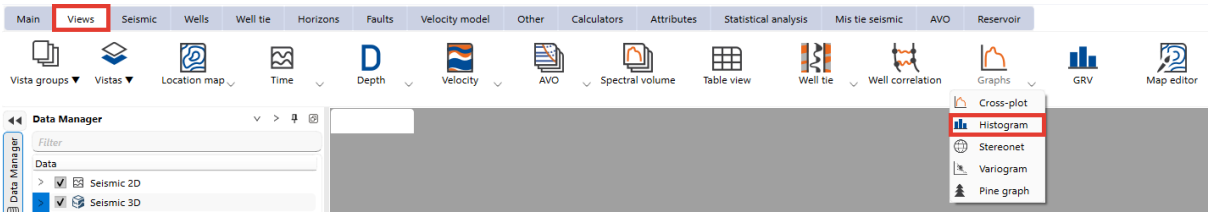


9.10.2 Histogram

Histogram analysis allows users to visualize the distribution of a single variable, helping to identify frequency patterns, ranges, and data trends.

To create Histogram view go to the Views bar 36, navigate to **Graphs** and click on **Histogram** button:



To configure the analysis, set the parameters in the Statistical Analysis 528 bar:

- **Data Source**: Available options include **Well Logs** and **XY Data**.

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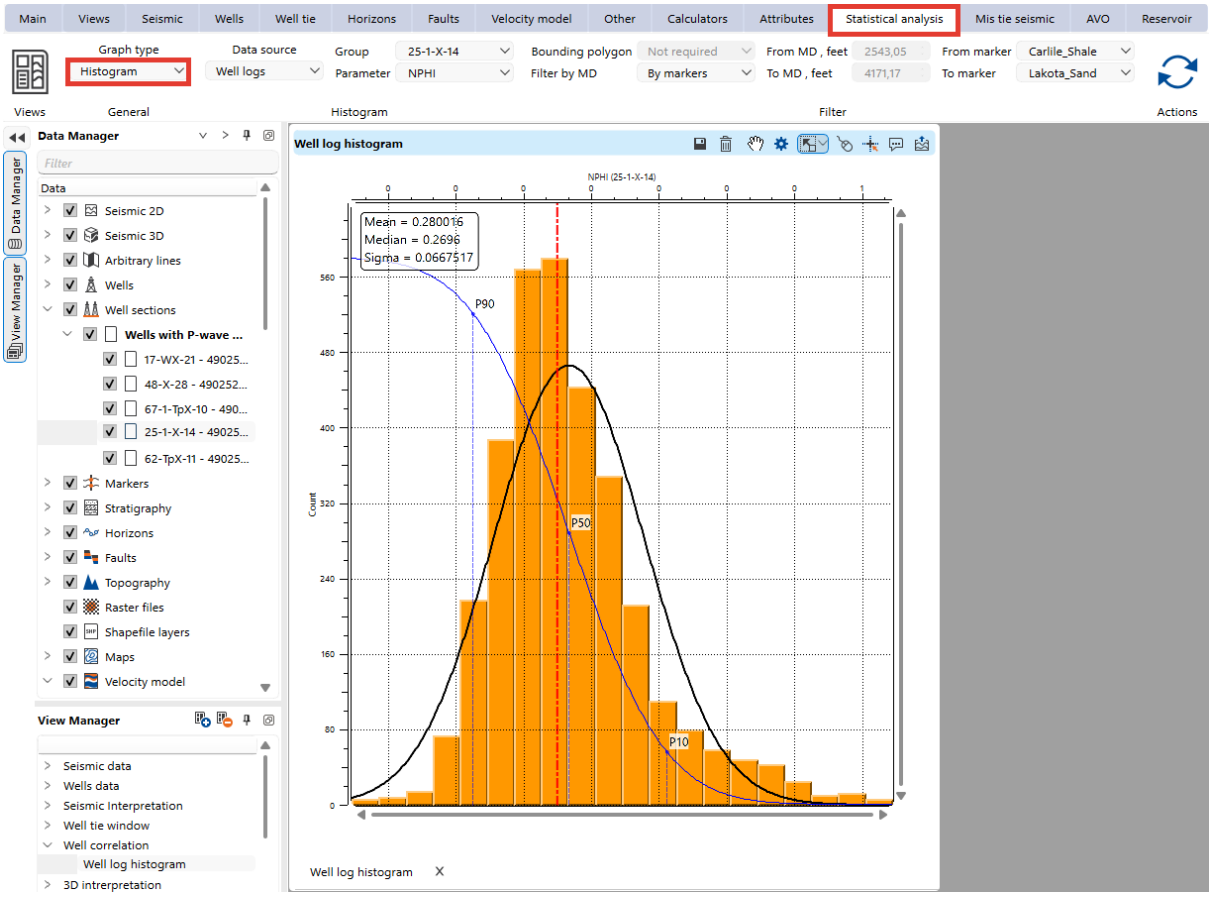
- **Well Logs**: Select a specific well and choose a parameter such as **RHOZ**, **DT**, or any other well log measurement.
- **XY Data**: This mode allows users to analyze numerical values, such as seismic attributes or spatial data, represented in XY format.

- **Group and Parameter**: When working with **Well Logs**, users can specify the desired well log group and the parameter to be analyzed. For **XY Data**, users can select a group containing numerical datasets (e.g., amplitude, porosity).
- **Filter Options**: Use **Bounding Polygon**, **MD Range**, or **By Markers** to refine the data included in the analysis:
  - **Filter by MD** allows you to define the depth interval manually or through predefined markers.
  - **Bounding Polygon** restricts the analysis to specific areas of interest.



The **Histogram** view automatically displays the following statistical parameters for the analyzed data:

- **Mean**
- **Median**
- **Standard Deviation**

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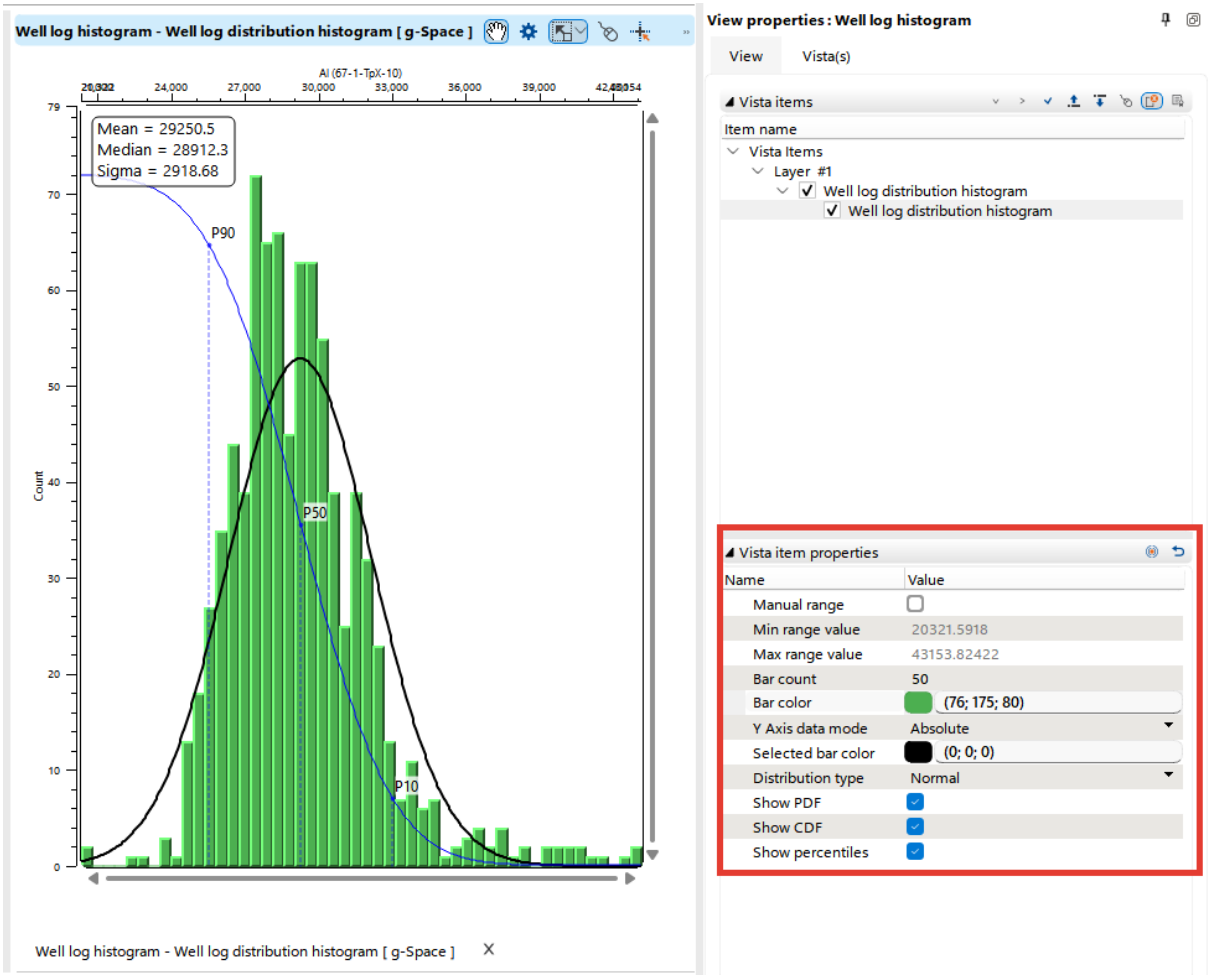

Visual Settings

Users can customize the **Histogram** display for better interpretation:

- **Bar Count**: Adjust the number of bars to control the resolution of the histogram.
- **Bar Color**: Set the color of the bars for improved visual clarity.

Optional overlays can be added to the histogram:

- **Probability Density Function (PDF)**: Visualizes the likelihood of data values within the distribution.
- **Cumulative Distribution Function (CDF) Curve**: Represents the cumulative frequency of the dataset.
- **Percentile Markers**: Visualize key percentiles, such as **P90**, **P50**, and **P10**, for additional statistical insights.

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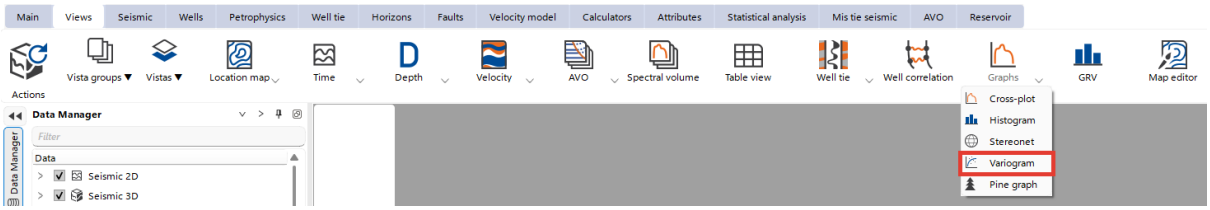
9.10.3 Variogram

Variogram analysis is a crucial statistical tool used in geoscience to measure spatial variability and correlations between data points. This chapter explains how to perform variogram analysis using the provided tools and interface, illustrated with images for clarity.

To create Variogram view go to the Views bar 36, navigate to **Graphs** and click on **Variogram** button:



To start variogram analysis, navigate to to the Statistical Analysis 528 bar and select the **Variogram** option under the Graph type dropdown menu.

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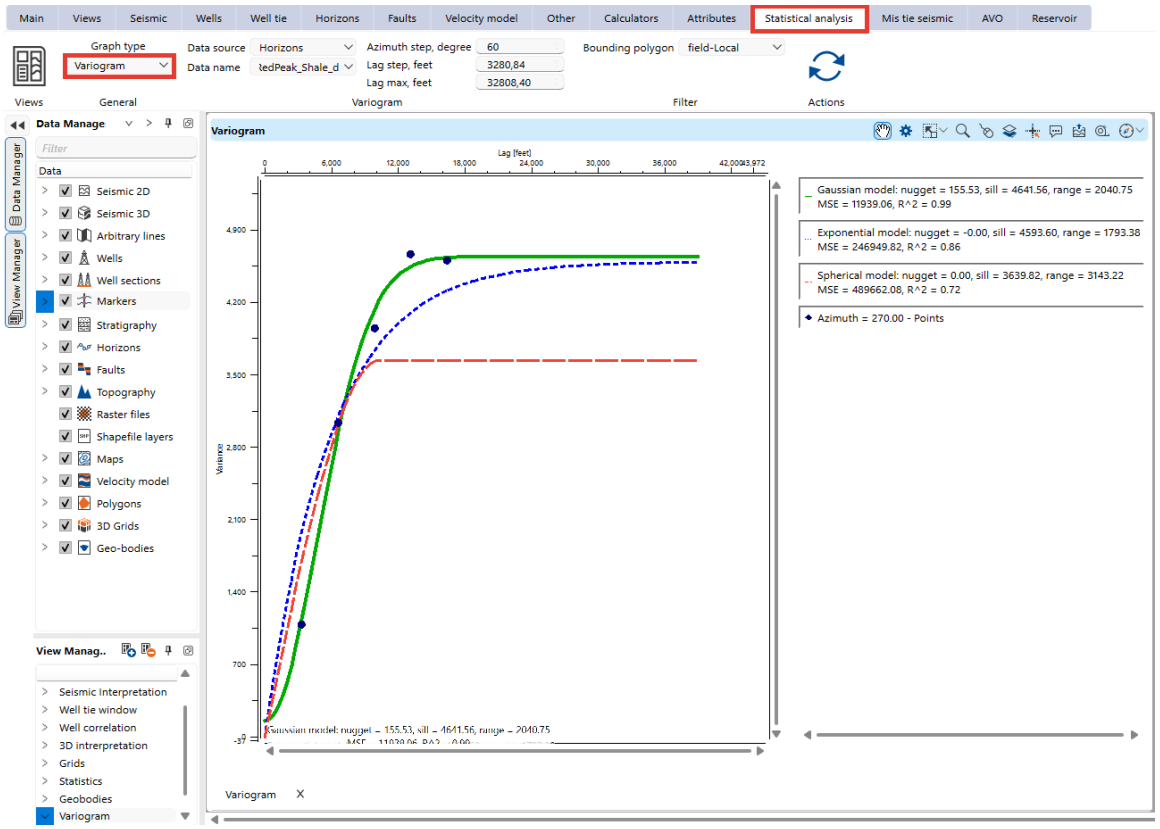


Data Sources for Variogram Analysis

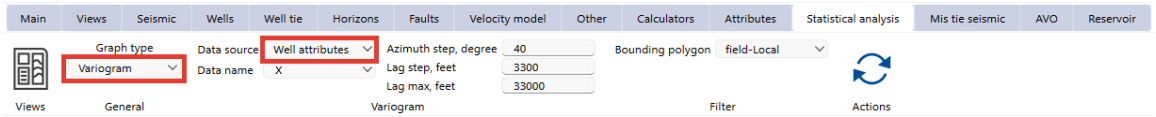
1. Well Attributes

Select "Well Attributes" as the data source from the dropdown menu.

Choose the attribute (X, Y, Total depth, KB or Ground level) from the Data Name field.

Specify parameters:

- Azimuth step
- Lag step
- Maximum lag distance



2. Well Logs

Choose "Well Logs" as the data source.

Select a specific well log Data Name field.

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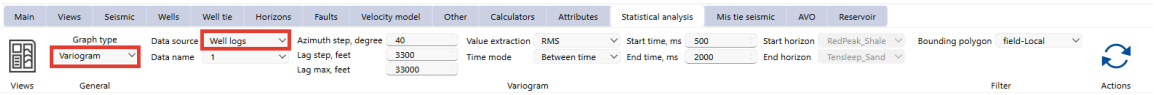
Specify parameters:

- Azimuth step
- Lag step
- Maximum lag distance

Additional settings include:

- Value extraction method (Average, RMS, Dominant, Min, Max, Median)
- Range for analysis - between depths or horizons
- Bounding polygon for spatial filtering.



3. Markers

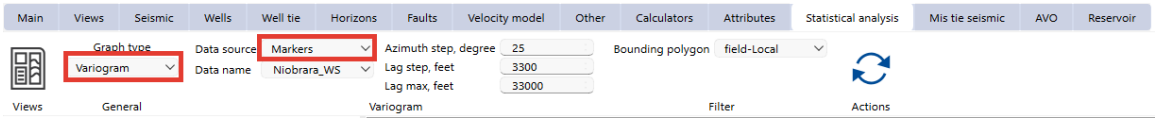
Select "Markers" as the data source.

Choose a geological marker from the Data Name dropdown menu.

Define azimuth step, lag step, and maximum lag distance for spatial analysis.

Additional settings include:

- Bounding polygon for spatial filtering.



4. Grid maps

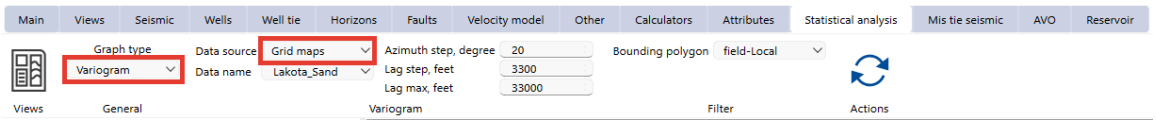
Select "Grid maps" as the data source.

Choose a map from the Data Name dropdown menu.

Define azimuth step, lag step, and maximum lag distance for spatial analysis.

Additional settings include:

- Bounding polygon for spatial filtering.



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5. Horizons

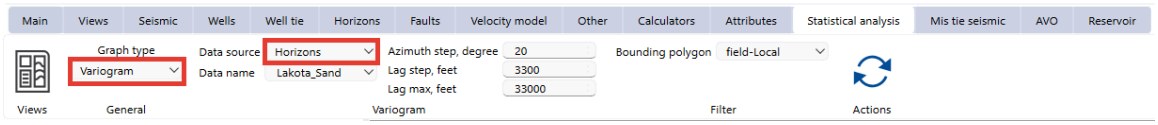
Select " Horizons" as the data source.

Choose a horizon from the Data Name dropdown menu.

Define azimuth step, lag step, and maximum lag distance for spatial analysis.

Additional settings include:

- Bounding polygon for spatial filtering.



Once you generate a variogram, it appears in the **Variogram view**. The plot displays experimental variograms as points and fitted models as curves.

Fitted Models:
The tool provides three common variogram models:

Spherical

Exponential

Gaussian

Each model is characterized by:

Nugget: Represents measurement error or micro-scale variation.

Sill: The total variance where the model flattens out.

Range: The distance at which spatial correlation diminishes.

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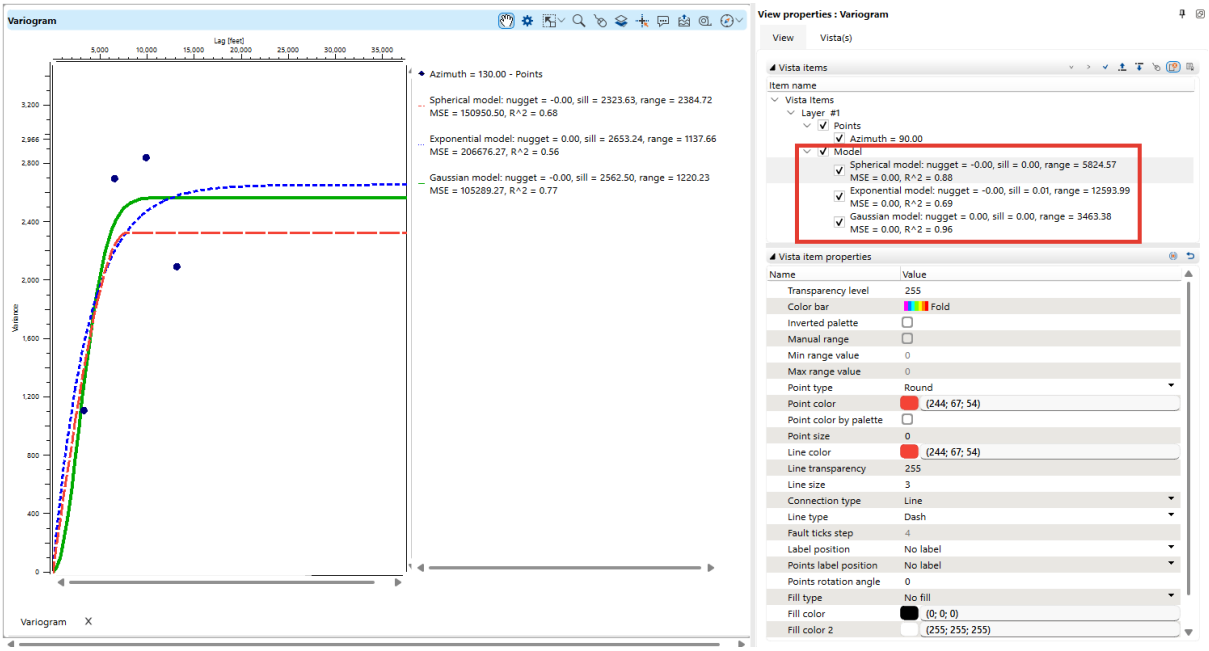


In the View Properties panel, users can adjust visual settings for better interpretation:

- Transparency levels
- Color schemes
- Line types and thickness
- Point size and shape

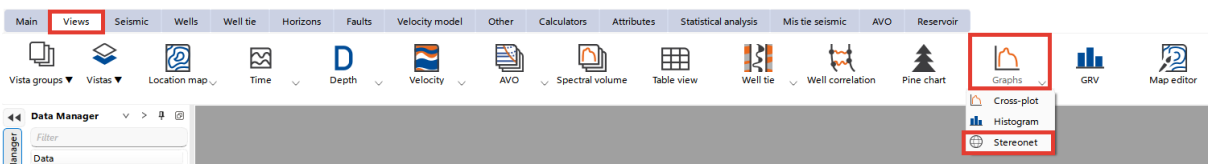
Users can also enable or disable specific models to focus on relevant data trends.

9.10.4 Stereonet

Stereonet analysis is a powerful tool for visualizing structural data, such as dip and azimuth measurements, to analyze geological orientations and patterns.

Import LAS file[278] containing **Azimuth** and **Dip** values into g-Space.

Go to the **Views bar** in the Ribbon bar. Choose Graphs - Stereonet



In the **Statistical analysis bar for Stereonet graph** select your LAS data columns for **Dip** (inclination angle) and **Azimuth** (horizontal angle).

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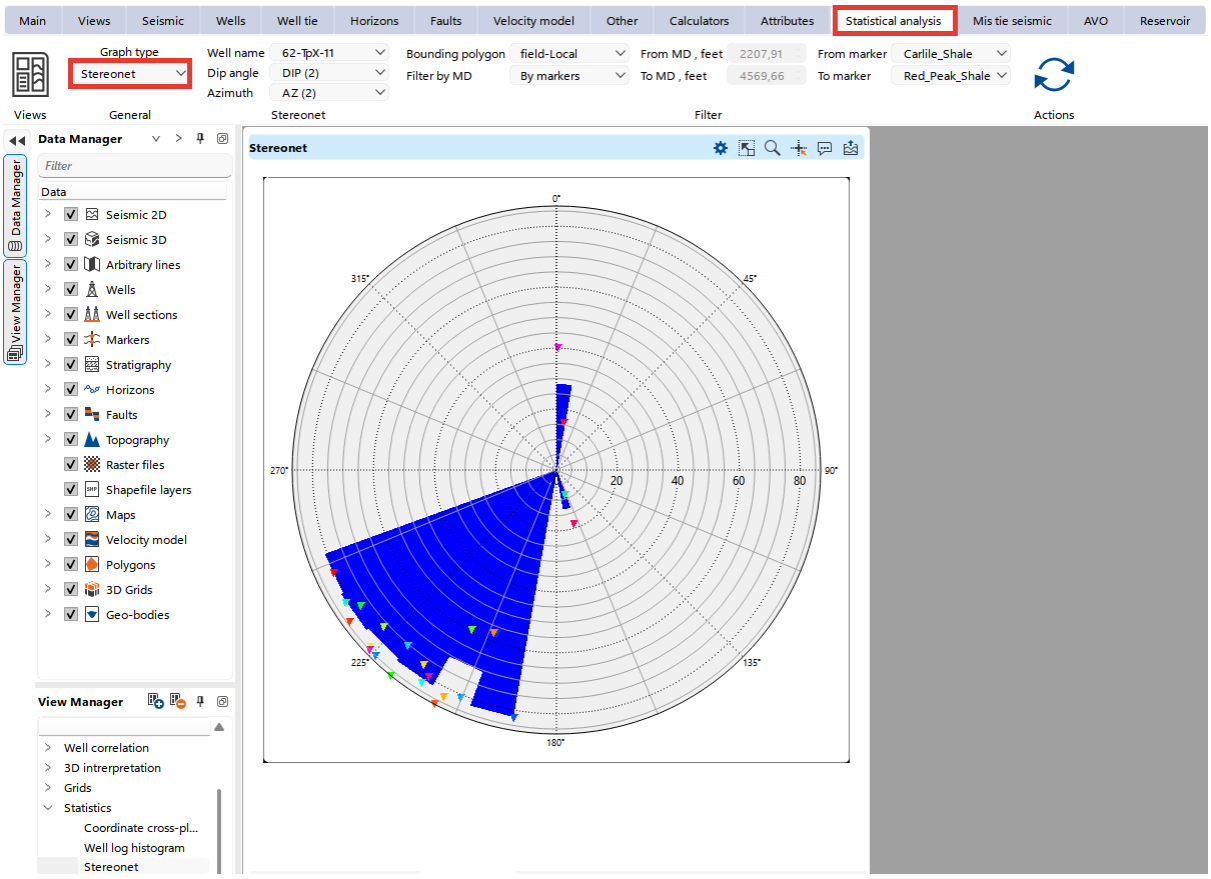

Visual Settings

Users can customize the **Histogram** display for better interpretation:

Line and Rose Diagram Colors: Set custom colors for lines and the rose diagram to enhance clarity.

Depth-Based Color Palette: Visualize points based on **depth** using a color palette.

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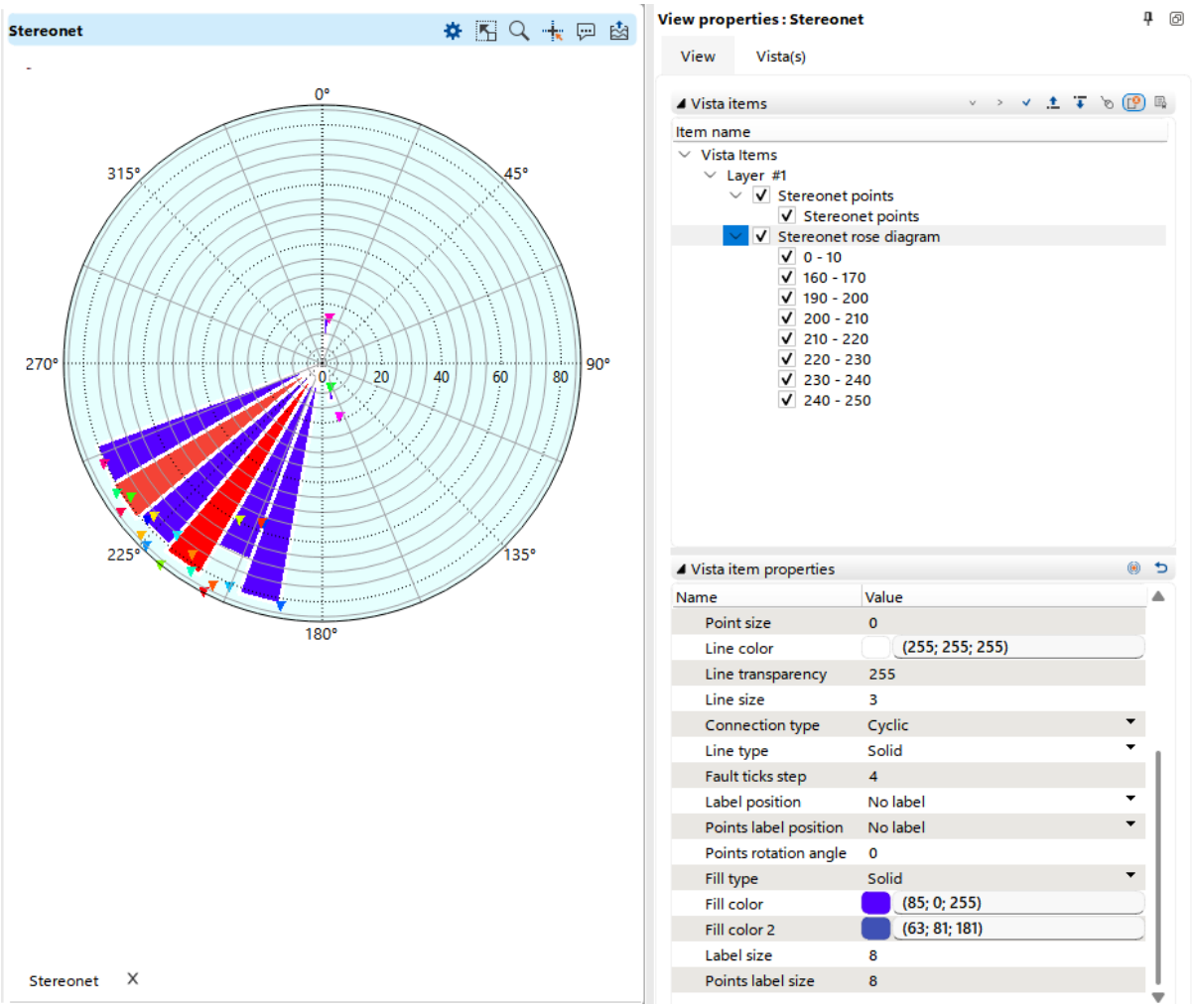
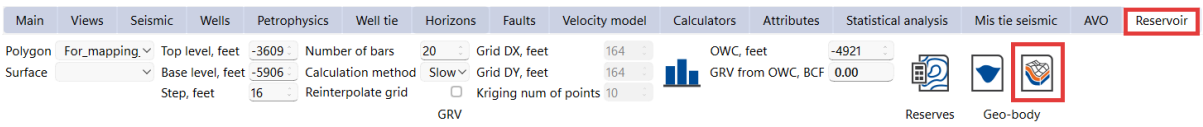


9.11 Geological modeling

In g-Space, the geological modeling workflow allows users to create detailed structural models of subsurface geology.

To start navigate to the Reservoir bar and click Create 3D geological model.



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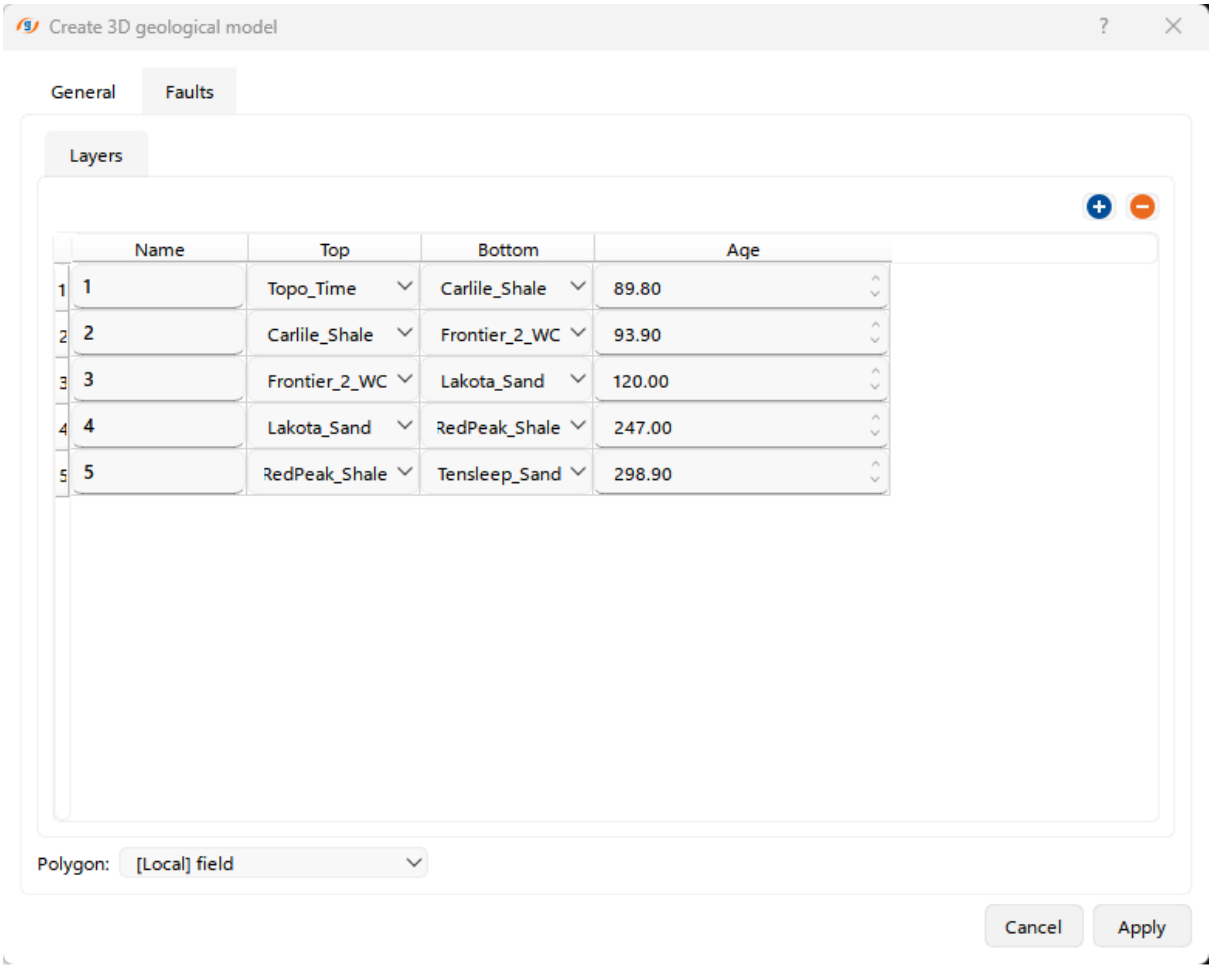
This process is streamlined through a user-friendly wizard that guides users through defining essential geological features such as layers and faults.

The **General** tab, currently displayed, handles layer definitions.



Layers Section allows the user to define the stratigraphic layers within the 3D geological model. Each row represents a layer in the model, with the following parameters:

- **Name**: The layer's identifier, which can be adjusted manually.
- **Top**: The geological horizon that defines the top of the layer. Users can choose a predefined depth map.
- **Bottom**: The geological horizon that defines the bottom of the layer.
- **Age**: This column allows for defining the geological age of the layer according to **Stratigraphy** in the Data manager 86.

The **"+"** and **"-"** buttons on the right top of the wizard allows users to add and remove layers.

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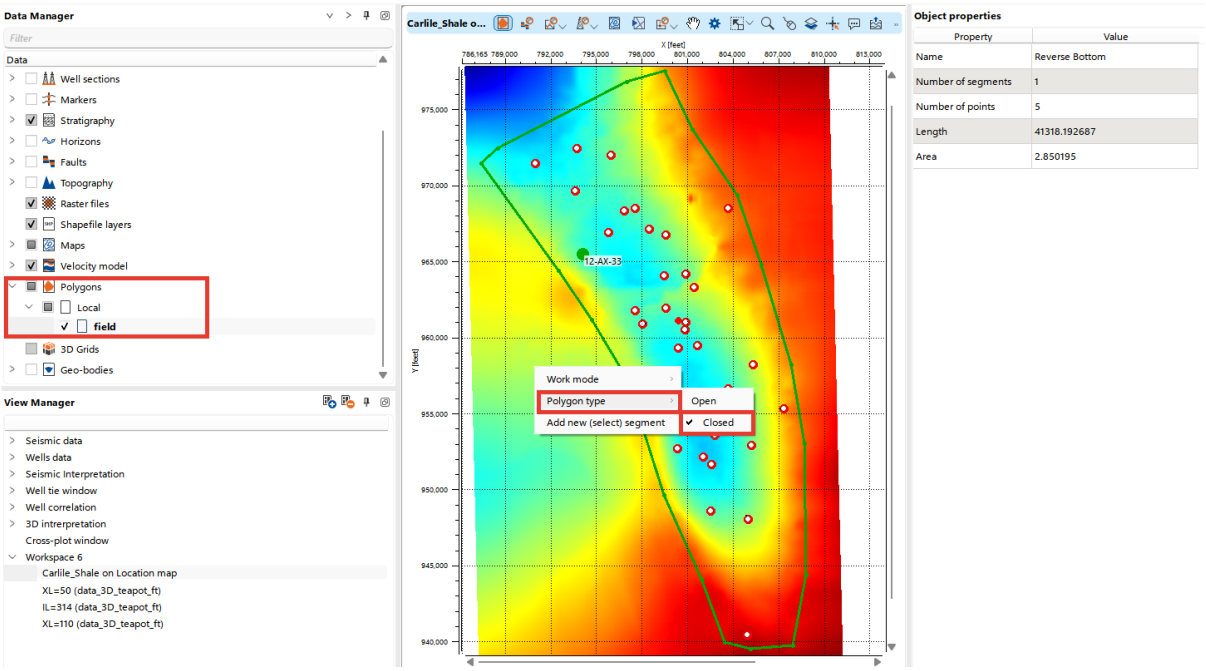
Notes

Ensure that the depth maps are derived from reliable, high-quality data, as this forms the basis of your structural model. Check for consistency between seismic-derived depth maps and well tops to avoid discrepancies in your model.

Ensure that the faults are accurately interpreted from high-quality seismic data and validated against well data or geological maps. Faults should be checked for continuity and consistency across different horizons to prevent misalignment in the model. Pay attention to fault throw and displacement, ensuring that they align with geological observations.

The dropdown at the bottom enables users to select a **Polygon** to define the spatial extent of the model.
When creating a polygon to define the modeling area, ensure that the polygon type is set to **Closed** by pressing **Alt + right-clicking**.



The **Faults** tab allows the user to select faults to build a geological model.

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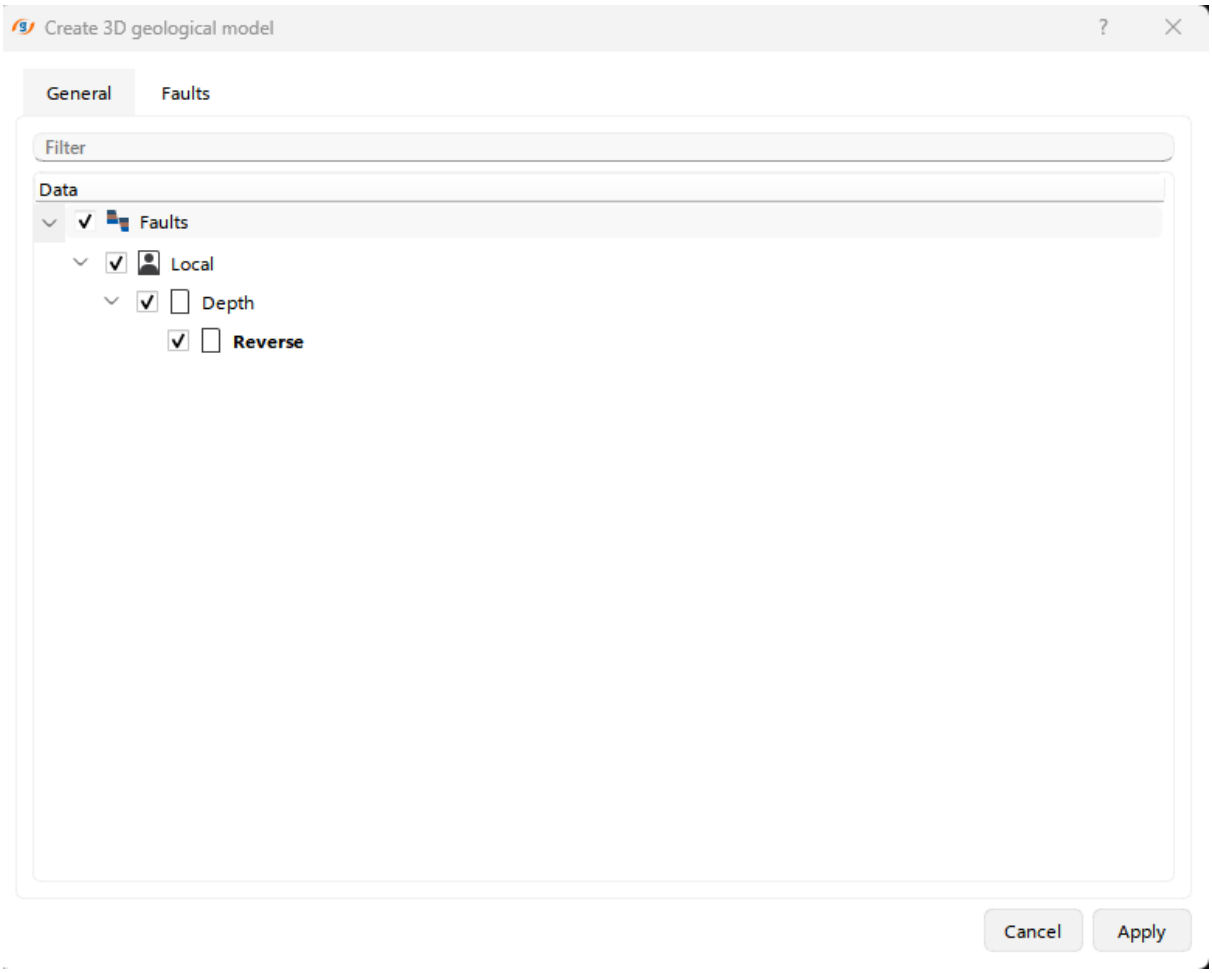

You can see the resulting model in the Geo-bodies folder in the **Data Manager**.

For each layer, an object will be created automatically. If the layer is divided by a fault, multiple objects with a numeric suffix will be generated, as shown in the example below, where each layer has an object with its layer number (e.g., 1), along with additional objects for faulted segments (e.g., 1.2). To rename any object, simply right-click on it and select **Rename** from the menu.

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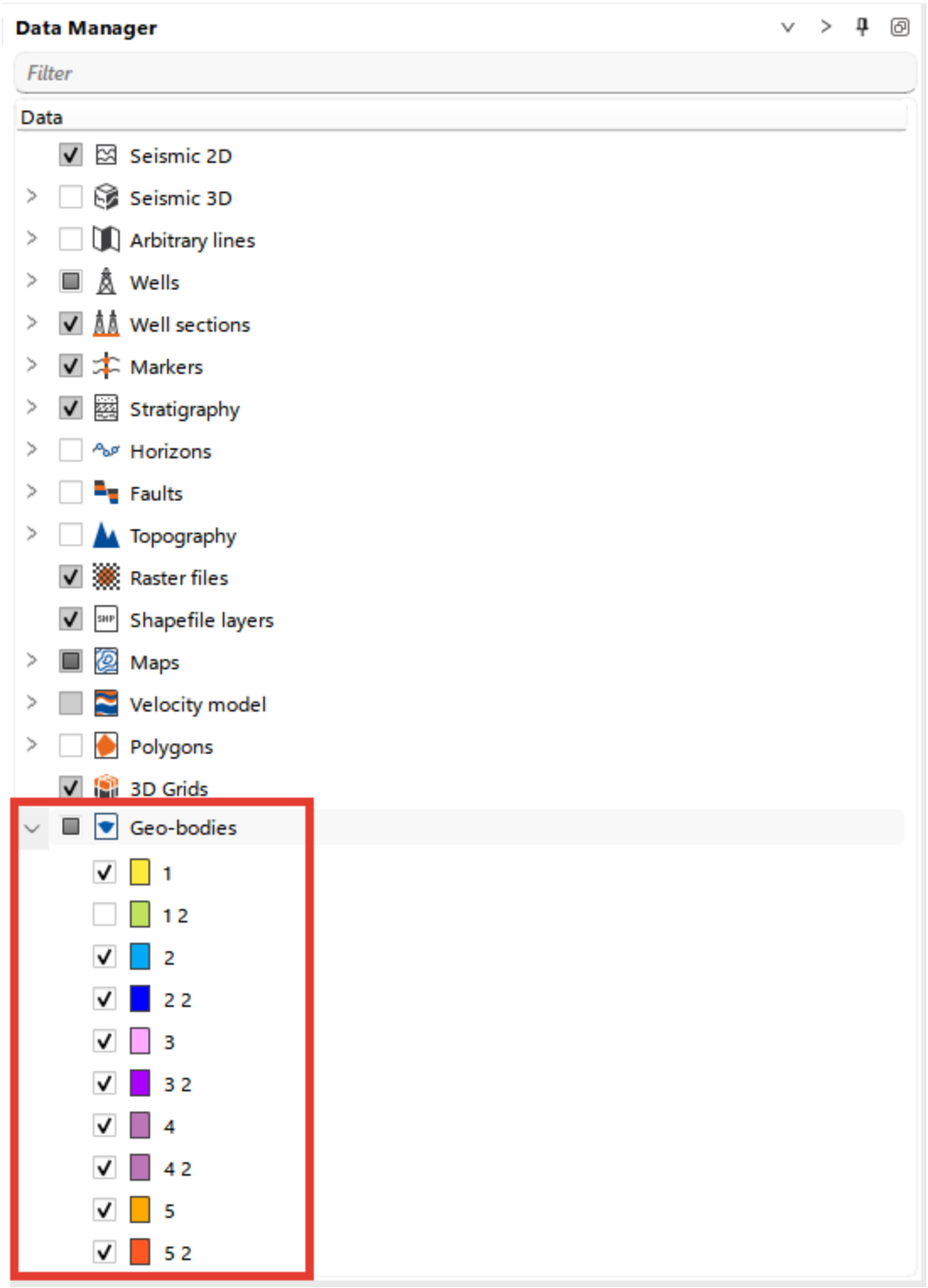

You can visualize the model in **3D view**, as well as in sections. Each object can be visualized individually via the **Data Manager**.

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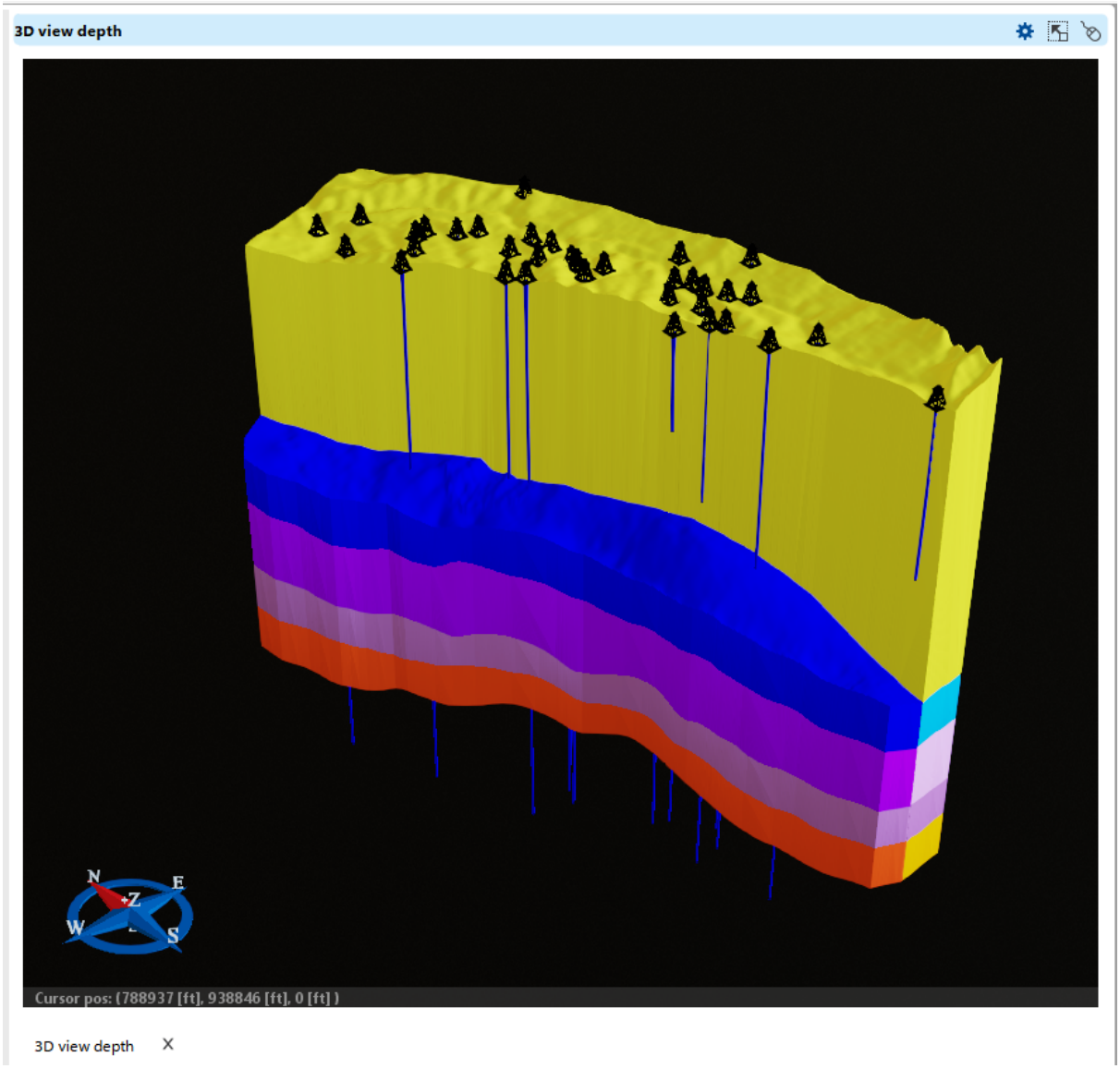

The **Slicer** mode, accessible by right-clicking on the **Geo-bodies** folder in the **Data Manager**, allows you to interactively view geomodel sections in 3D. The active slicing plane is highlighted in light green, as shown in the example figure, where the plane is oriented along the field.

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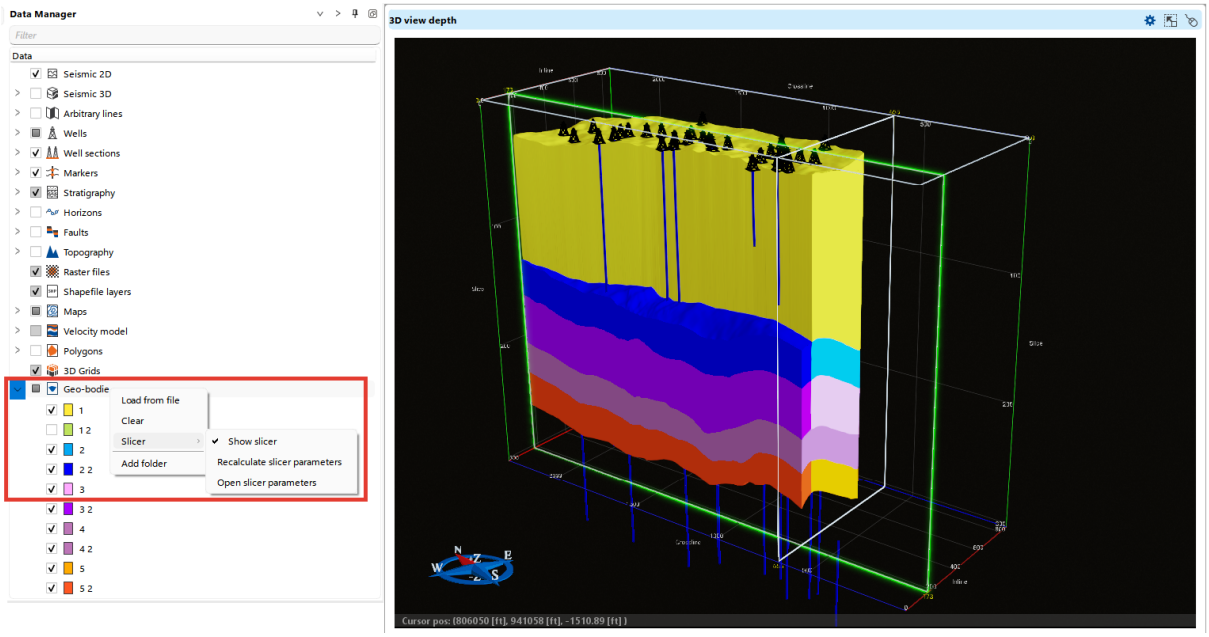

9.12 3D grid creating

3D grids are essential tools used to organize and visualize subsurface data in a structured format. The process typically involves the interpolation of scattered data points (e.g., well tops or seismic picks) across a predefined grid.

Grids are built using interpolation techniques that estimate unknown values between data points. The grid can vary in resolution, based on the interpolation steps defined by the user, allowing flexibility in adapting to different geological complexities.

To begin the 3D gridding process in g-Space navigate to the **Data Manager**, find the 3D Grids section. This is where grid data will be organized and stored.

To create a new grid right-click on the **3D Grids** folder and select Create Grid, then name it in the pop-up window. This will open the grid creation panel.

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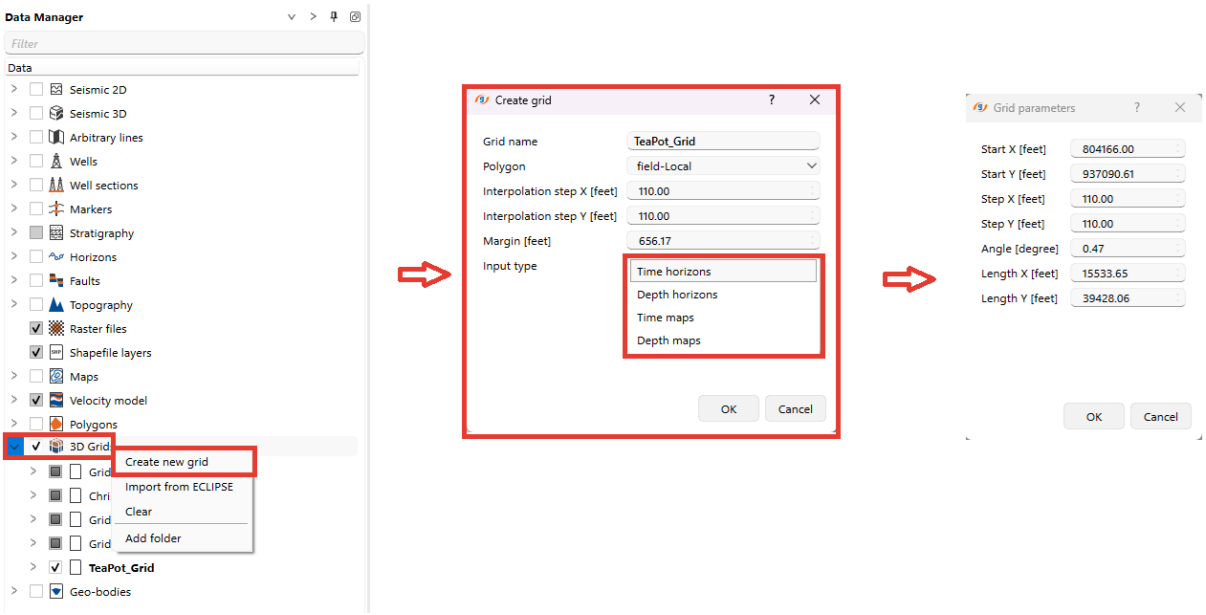

In the grid creation window, you will define key parameters that influence the resolution and extent of the grid.

- **Polygon**: If available, you can select a polygon to limit the grid to a particular area. Choose "Not required" if the grid is intended to cover the full extent of the data.
- **Interpolation Step X [ft/m]** and **Interpolation Step Y [ft/m]** These define the resolution of the interpolated data. Smaller steps result in higher grid resolution, capturing finer geological details but increasing computational demand. Larger steps provide a more generalized view but are faster to compute.

Notes

Geological Context: In regions where fine stratigraphic details or thin reservoirs are critical (e.g., offshore channels, thin carbonate layers), smaller steps (10-20 ft/1-5 m) may be appropriate. In contrast, for larger, homogenous geological structures (e.g., broad anticlines or synclines), larger steps (50-100 ft/20-50 m) may suffice.

- **Margin [ft/m]**: This parameter sets an additional boundary around the grid. A larger margin might be useful in areas where you expect the geology to extend beyond known data points.
-

Click **OK** to proceed to the next step, where you define the grid parameters.

After defining the interpolation settings, you will be prompted with the **Grid Parameters** window (as shown in the image above). This window controls the structure and size of the physical grid.

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- **Start X [ft/m]** and **Start Y [ft/m]**: These values define the starting coordinates of the grid in the X and Y directions.
- **Step X [ft/m]** and **Step Y [ft/m]**: These values determine the spacing between the grid nodes along the X and Y axes. Smaller grid steps result in a finer grid, while larger grid steps produce a coarser, more general representation.

Notes

Geological Context: For detailed geological structures, use smaller grid steps (e.g., 10-20 ft/1-5 m). Larger grid steps (e.g., 50-100 ft/20-50 m) can be used for large-scale structural features.

- **Angle [degree]**: This defines the rotation of the grid relative to the coordinate system.

Notes

Grid rotation is essential for aligning the grid with key features to improve accuracy and efficiency:

1. ***Tectonic Structure Alignment**: Rotate the grid to match elongated tectonic features, minimizing the number of cells inside the reservoir contour while preserving horizontal resolution.*
2. ***Well Patterns**: Aligning the grid with injection and production wells ensures more direct fluid flow paths, reducing filtration time and increasing efficiency.*
3. ***Fault Orientation**: Rotating the grid along fault trends prevents grid distortion near faults, maintaining smooth geological transitions.*

- **Length X [ft/m]** and **Length Y [ft/m]**: These define the total dimensions of the grid, controlling how far the grid will extend in the X and Y directions. Adjust these based on the size of your study area.

Once these parameters are set, click **OK** to generate the 3D grid.

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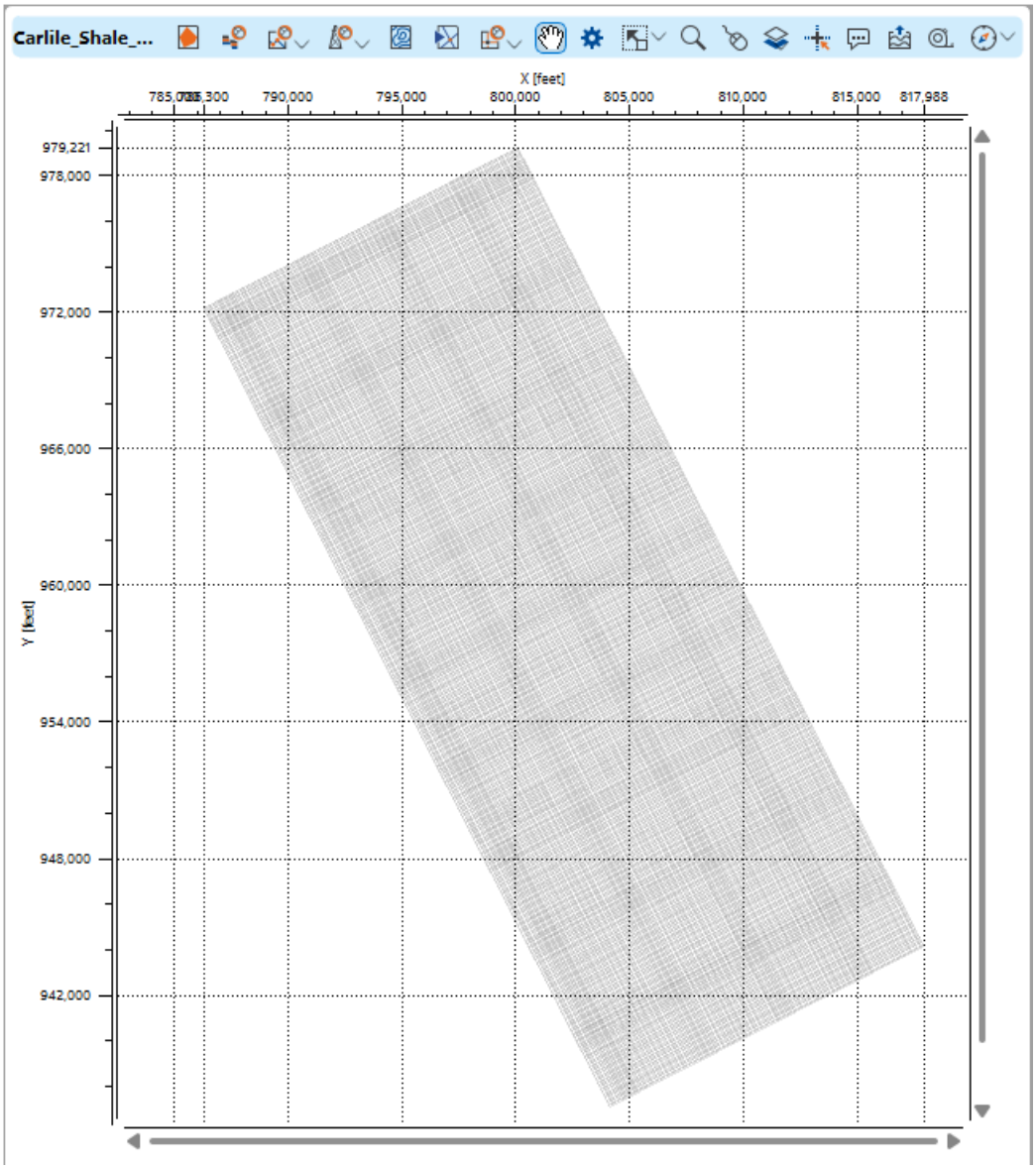

In this menu from the **3D Grid** section of the **Data Manager**, various options are available for working with a specific grid (in this case, named "TeaPot_Grid"). Here is a breakdown of each option:

Settings: Opens the settings window where the user can modify grid parameters, such as interpolation and grid steps, margins, and other key parameters related to the grid structure.

Edit zone: Allows the user to modify or create zones within the grid. Zones represent specific regions of interest within the grid that may have different geological properties or require separate analysis. Using the top buttons **+** and **-** the user can add and remove zones, and adjust the number of layers in them on the grid manager panel

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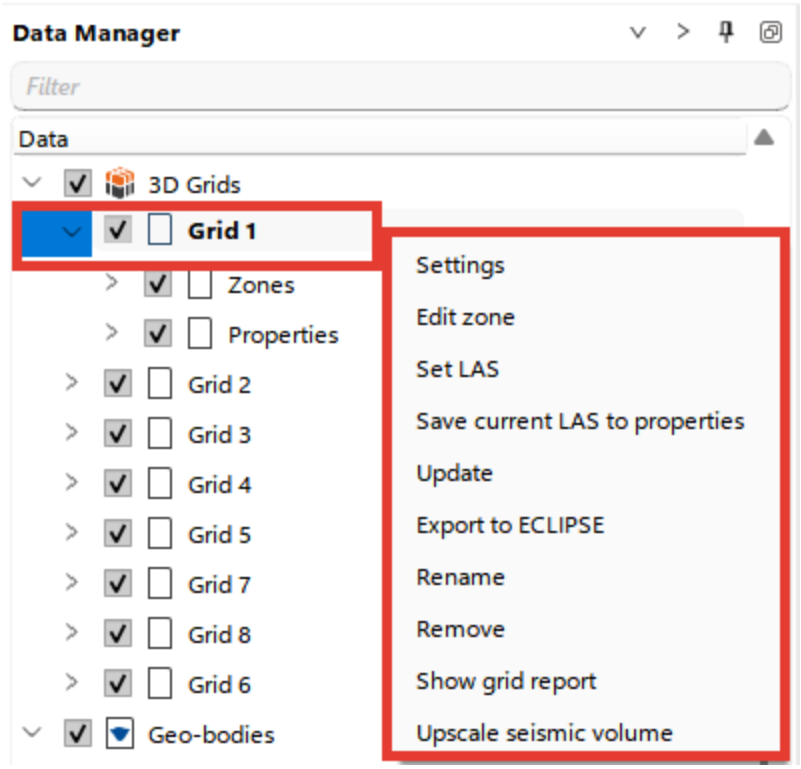

Notes

The number of layers in a zone, is influenced by several factors:

1. ***Geological Heterogeneity:*** *The vertical variability in properties, like the average thickness of reservoir layers, dictates layer thickness. For instance, if the average layer thickness is 1 meter, grid cells larger than 50 cm shouldn't be used to capture details effectively. This is assessed using histograms of layer thickness.*
2. ***Well Data Sampling Interval:*** *Typically, well data is sampled at intervals of 0.2 to 0.4 meters, which affects layer thickness.*
3. ***Total Thickness:*** *The entire thickness of the interval to be subdivided impacts the number of vertical layers required.*
4. ***Computer Limitations:*** *The computational power available may restrict the grid resolution that can be practically implemented.*

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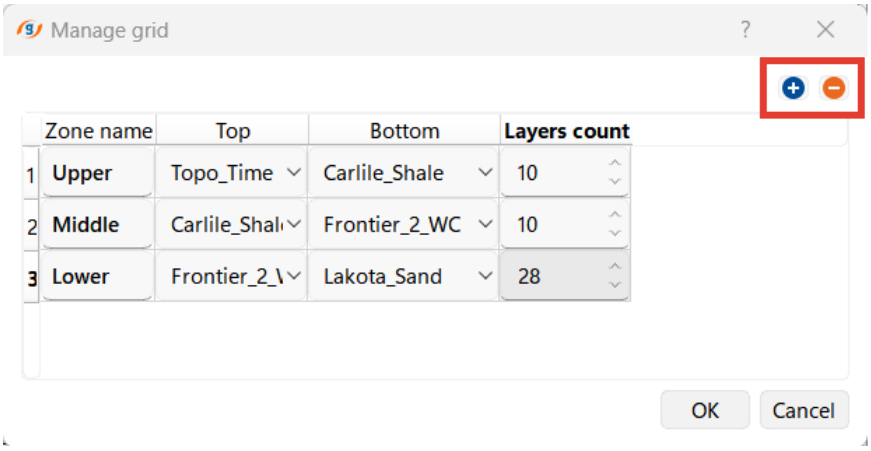
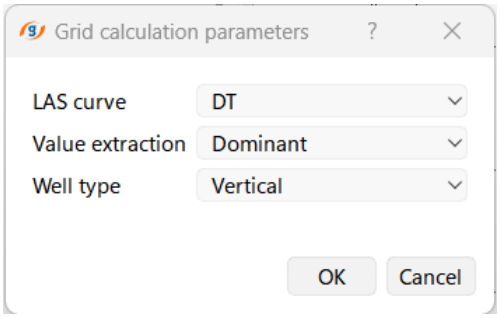
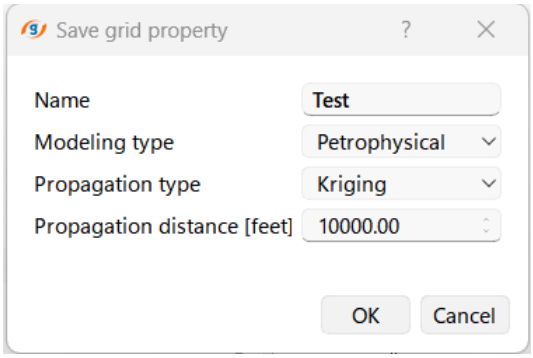


Set LAS: This option is used to assign a LAS file (Log ASCII Standard) to the grid, enabling integration of well log data for further interpretation or visualization.



Save current LAS to properties: Saves the LAS data currently assigned to the grid as a property, which can be used for various geological calculations and further analysis.



Update: Refreshes or recalculates the grid, applying any recent changes in data or grid parameters.

Export to ECLIPSE: Allows the user to export the grid to the **ECLIPSE** format, which is widely used for reservoir simulation and modeling. This function is critical for taking the grid data from g-Space into reservoir simulation software.

Rename: Renames the selected grid in the Data Manager for organizational purposes.

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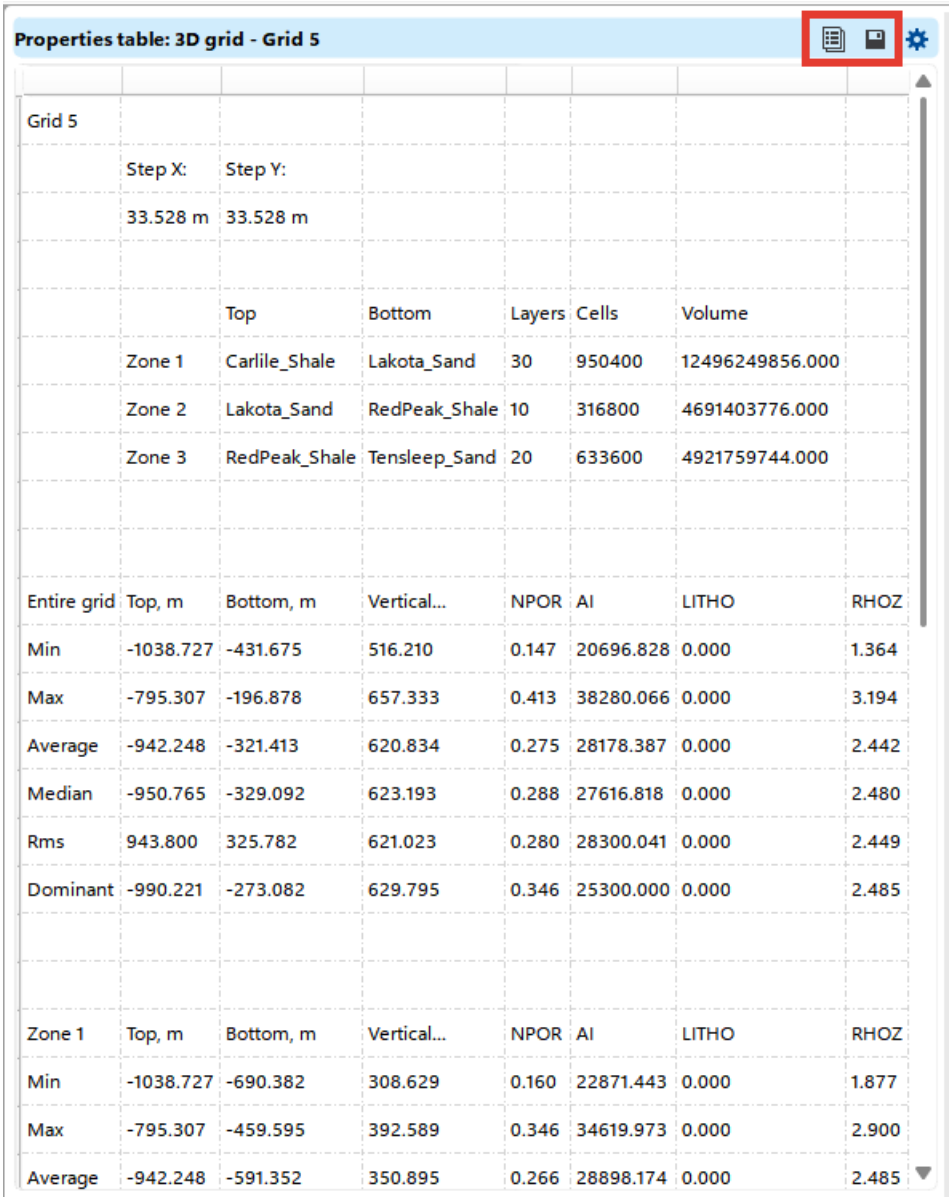
Remove: Deletes the selected grid from the project.

Show grid report: Opens a table displaying general parameters of the grid, such as dimensions, resolution, and volume. Additionally, the report provides detailed information for each zone within the grid. The data from the grid report can be copied directly or saved as a *.CSV* file



Properties table: 3D grid - Grid 5

Grid 5							
	Step X:	Step Y:					
	33.528 m	33.528 m					
		Top	Bottom	Layers	Cells	Volume	
	Zone 1	Carlile_Shale	Lakota_Sand	30	950400	12496249856.000	
	Zone 2	Lakota_Sand	RedPeak_Shale	10	316800	4691403776.000	
	Zone 3	RedPeak_Shale	Tensleep_Sand	20	633600	4921759744.000	
Entire grid	Top, m	Bottom, m	Vertical...	NPOR	AI	LITHO	RHOZ
Min	-1038.727	-431.675	516.210	0.147	20696.828	0.000	1.364
Max	-795.307	-196.878	657.333	0.413	38280.066	0.000	3.194
Average	-942.248	-321.413	620.834	0.275	28178.387	0.000	2.442
Median	-950.765	-329.092	623.193	0.288	27616.818	0.000	2.480
Rms	943.800	325.782	621.023	0.280	28300.041	0.000	2.449
Dominant	-990.221	-273.082	629.795	0.346	25300.000	0.000	2.485
Zone 1	Top, m	Bottom, m	Vertical...	NPOR	AI	LITHO	RHOZ
Min	-1038.727	-690.382	308.629	0.160	22871.443	0.000	1.877
Max	-795.307	-459.595	392.589	0.346	34619.973	0.000	2.900
Average	-942.248	-591.352	350.895	0.266	28898.174	0.000	2.485

Upscale seismic volume: Allows the user to integrate seismic data into the grid by upscaling a seismic volume. The user selects a seismic volume and defines modeling parameters in a pop-up wizard. This process involves resampling the seismic data to match the grid resolution, enabling the use of seismic attributes in property modeling and reservoir analysis.

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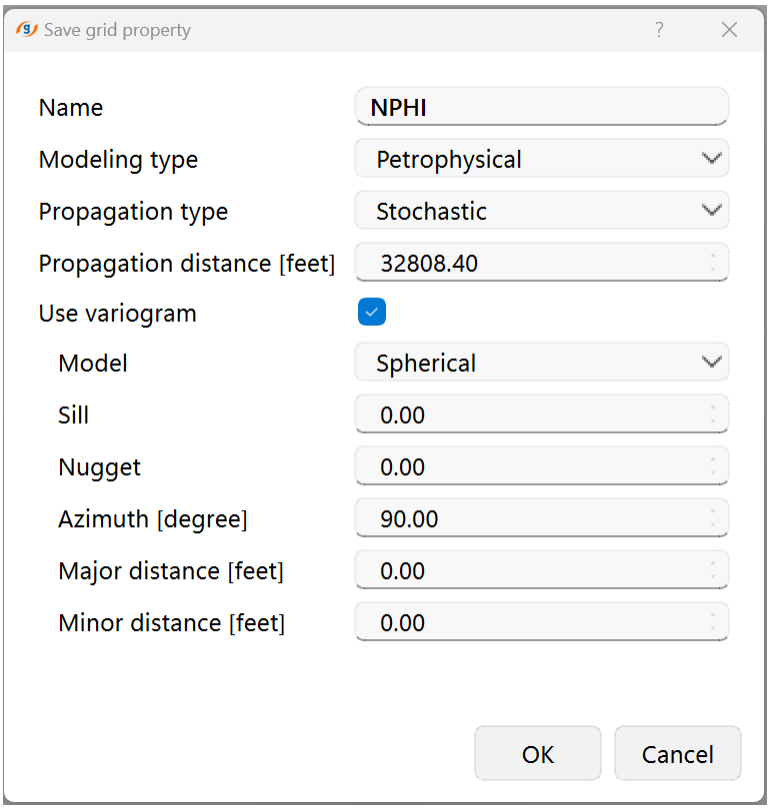

Advanced Options and Applications

Polygon Clipping: If you are working in a specific region of interest, using a polygon to limit the grid's extent can reduce computation time and ensure focus on relevant data.

Time vs. Depth Grids: Grids can be created in both time and depth domains. Time grids are typically based on seismic data, while depth grids incorporate well data and velocity models for more accurate geological interpretations.

3D grid can be visualized in 3D depth view as well as in section view. Visualization settings can be configured in the View properties, in the example below, lithological fill type is selected for the **Grid zones**.

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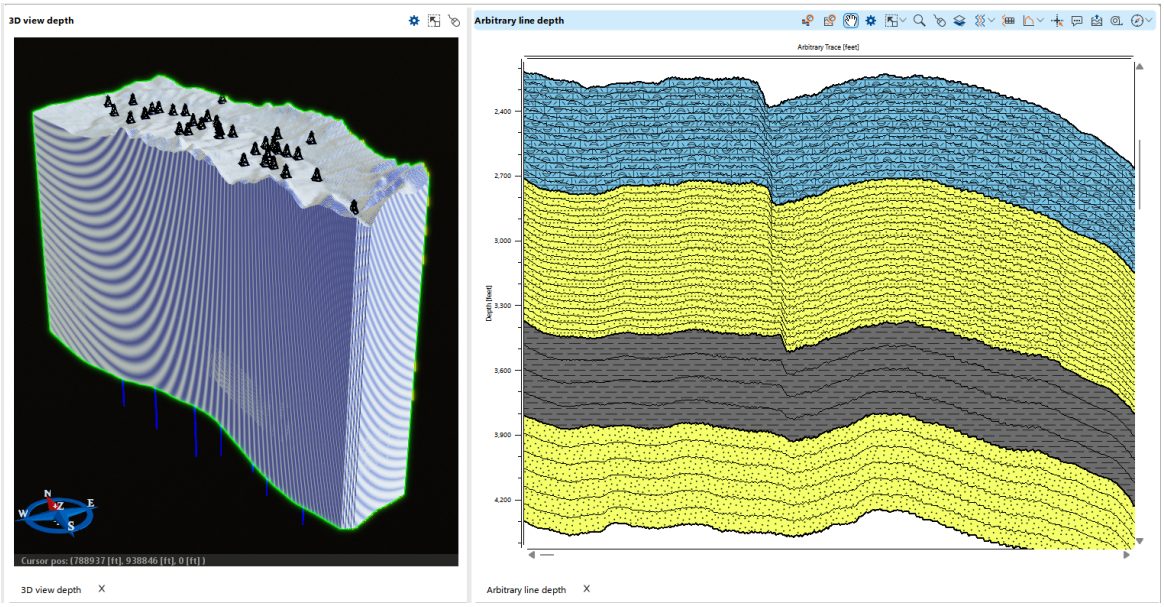

9.13 Properties modeling

In g-Space, **Properties modeling** involves the integration and calculation of well log data and other geological properties to populate 3D grids 547 with meaningful information, such as porosity, permeability, and fluid saturation.

To start, navigate to the Data Manager, Select the desired grid (e.g., "Grid 1") by clicking on it. This action highlights the grid and makes it the active selection.

Right-click on the selected grid to open the context menu. This menu contains various options related to the selected grid, allowing for efficient data management.

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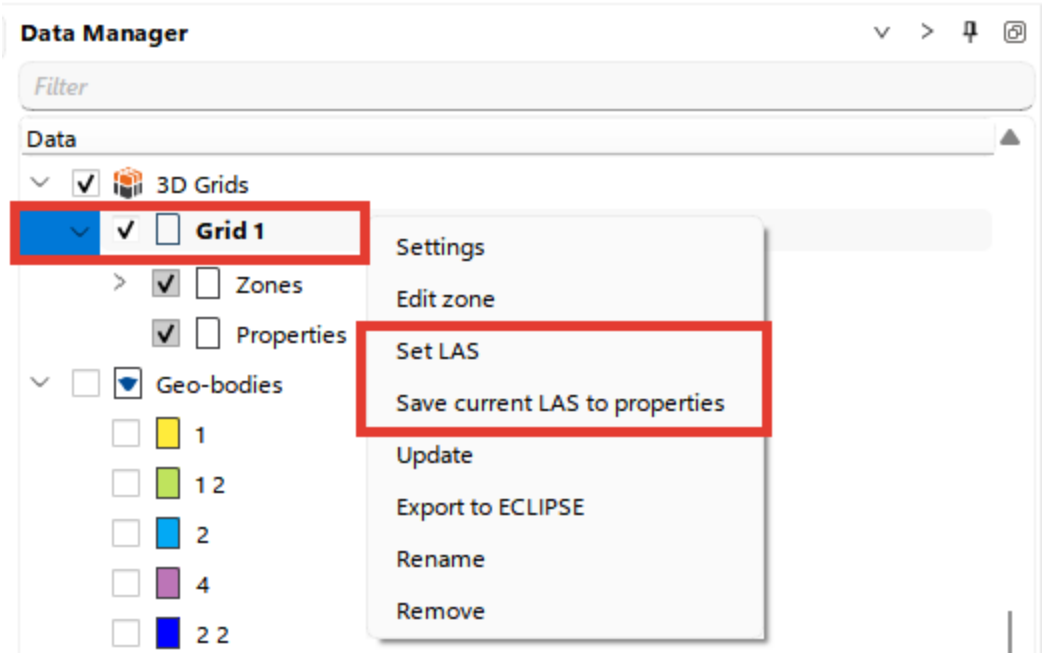
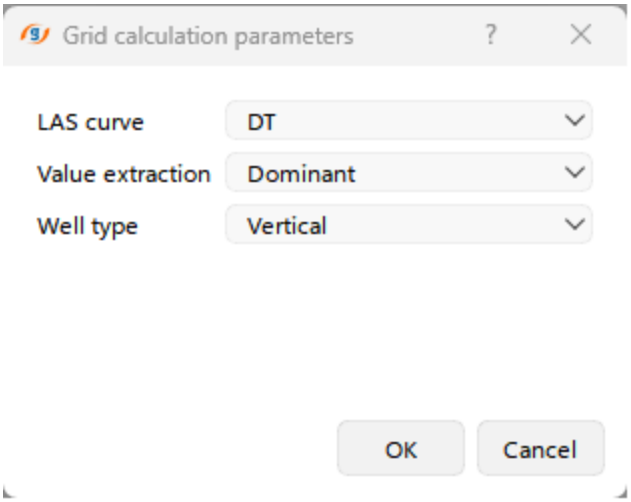


Set LAS option allows you to assign a LAS file to the grid, integrating well log data for analysis and visualization. The **Grid Calculation Parameters** window will appear, prompting you to select the appropriate LAS file from your data.



1. **LAS Curve Selection:** The user can select the type of curve from the dropdown, e.g., DT (Sonic), GR (Gamma Ray), etc.

2. **Value Extraction:** dropdown offers multiple statistical methods to extract well log data into the grid:

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- **Average**: Computes the arithmetic average of the selected well log data over the specified interval.
- **RMS**: Extracts the Root Mean Square value, providing a weighted average of the data, emphasizing higher values.
- **Minimum**: Selects the minimum value of the LAS curve in the given interval.
- **Maximum**: Extracts the highest value of the LAS curve in the interval.
- **Dominant**: Identifies the most frequent or significant value within the LAS data.
- **Median**: Extracts the median, giving the middle value of the LAS curve data, minimizing the impact of extreme values.

3. **Well Type:** allows users to specify whether the well is **Vertical** or **Horizontal**.

Save Current LAS to Properties

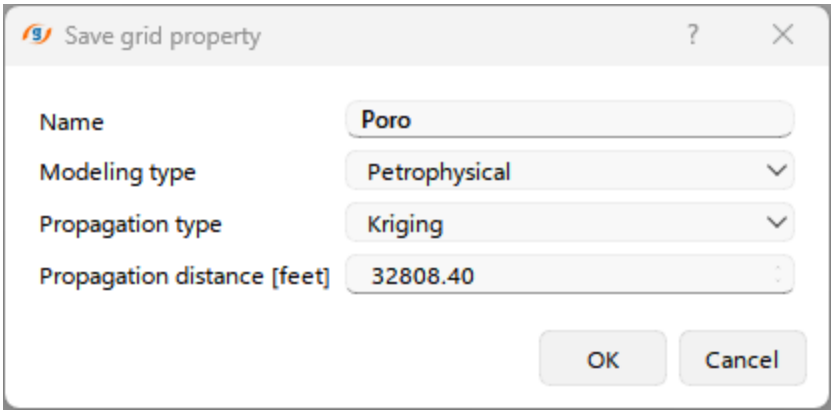
Once the LAS data is assigned and processed, this option allows the user to save the well log data (LAS) as a property within the grid. This property can then be used for subsequent geological and reservoir calculations, modeling, and further analysis.
Name the property, then select the **Modeling type** — either Petrophysical or Facies Modeling.

g-Space supports two types of Modeling properties:

Petrophysical: These are scalar properties like porosity, permeability, and saturation that vary smoothly across the reservoir. Choose this type for continuous curves.

Facies: These include categorical data such as lithology, facies codes, or rock types, typically constrained by facies boundaries. Choose this type for discrete curves.

Afterward, choose the **Propagation type** and set the **Propagation distance**.



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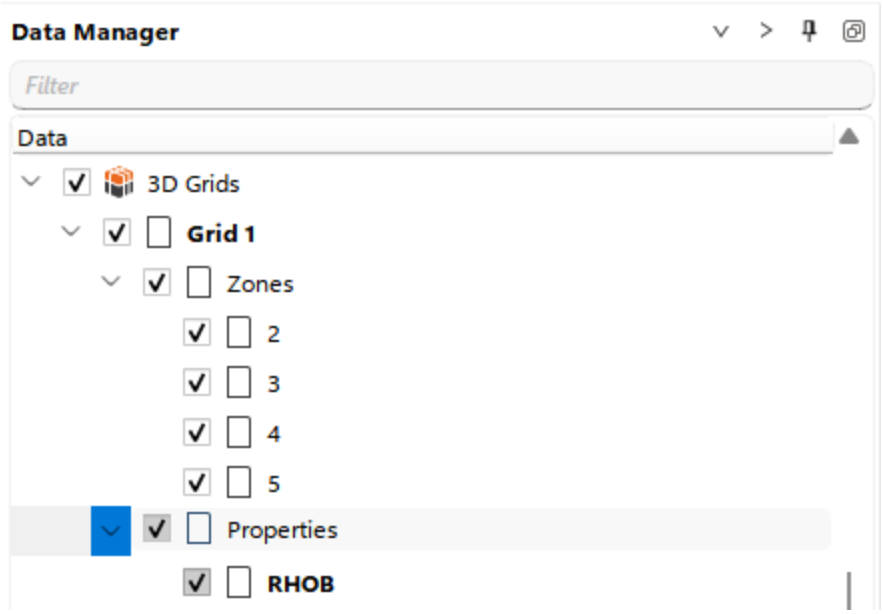
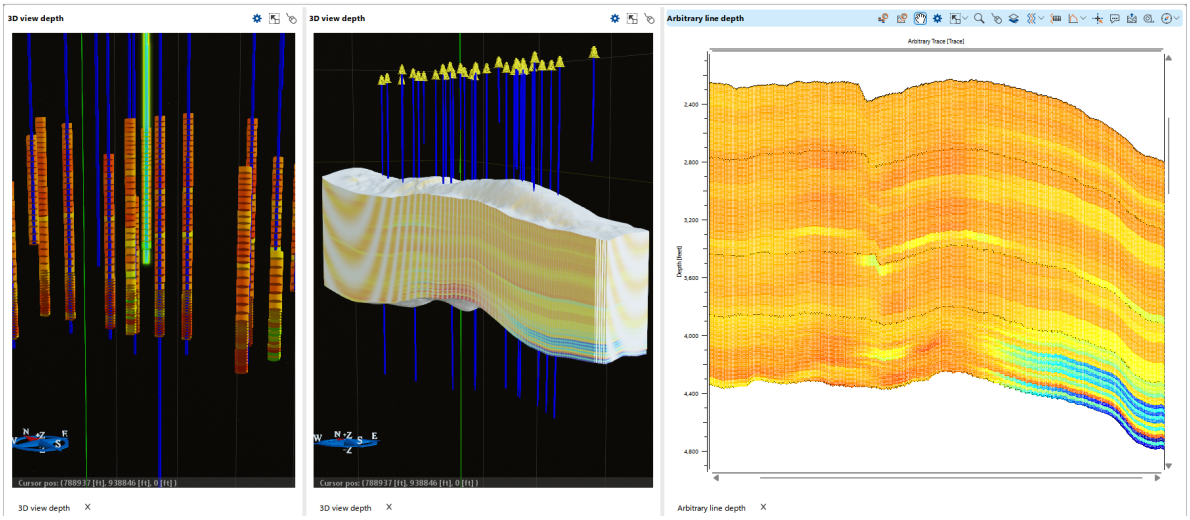
Upon creating grid zones and properties, the **Zones** and **Properties** folders will be added under the grid's main folder in the Data Manager. You can access a context menu for managing these objects by right-clicking on them.



You can visualize the grid in **3D depth view** as a complete cellular model, display grid cells along wells, and also view the grid in the section view for detailed analysis.
Visualization settings are available in the View Properties 101



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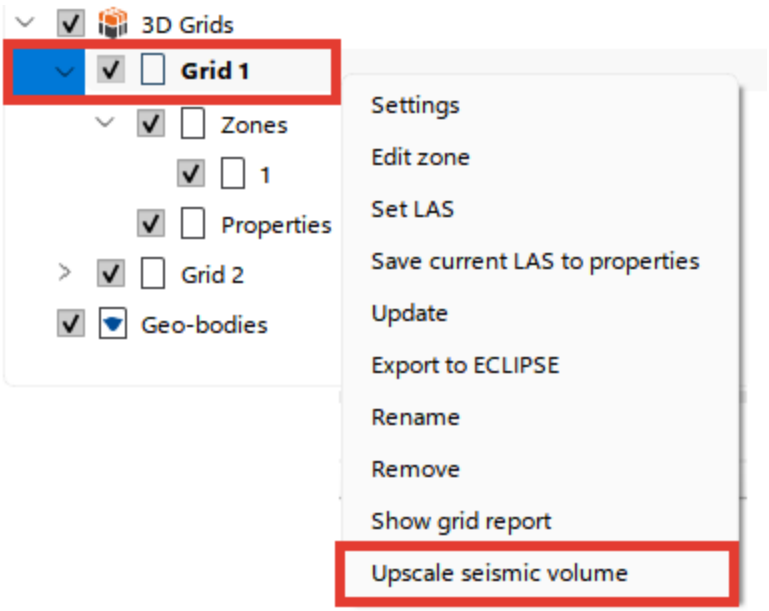
9.13.1 Seismic Data Upscaling

Seismic upscaling in g-Space allows users to integrate seismic data into a 3D grid, converting it into properties that can be used for geological and reservoir modeling.

Open the Context Menu

- Navigate to the **Data Manager** and locate the grid you wish to upscale seismic data for (e.g., "Grid 1").
- Right-click on the selected grid to open the context menu.
- Select the **"Upscale Seismic Volume"** option.



Configure Upscaling Parameters

A pop-up window titled **"Upscale Seismic Volume"** will appear. Fill in the required fields:

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- Name: Enter a name for the seismic property to be created (e.g., "Fractures").
- Seismic Data: Choose the seismic volume from the dropdown list.
- Value Extraction: Select the method to calculate values from seismic data. Options include:
  - **Average:** Computes the mean value over the selected seismic cells.
  - **RMS**
  - **Minimum/Maximum:** Selects the lowest or highest value, respectively, from the seismic data.
  - **Median:** Computes the middle value, reducing the effect of outliers.
  - **Dominant**
- Modeling Type: Specify the type of modeling as Petrophysical or Facies, depending on whether the property is scalar or categorical.
- Propagation Type: Choose Deterministic or Stochastic propagation based on how you want to distribute the seismic property across the grid.
- Propagation Distance: Define the maximum distance (in feet or meters) for propagating the seismic property.

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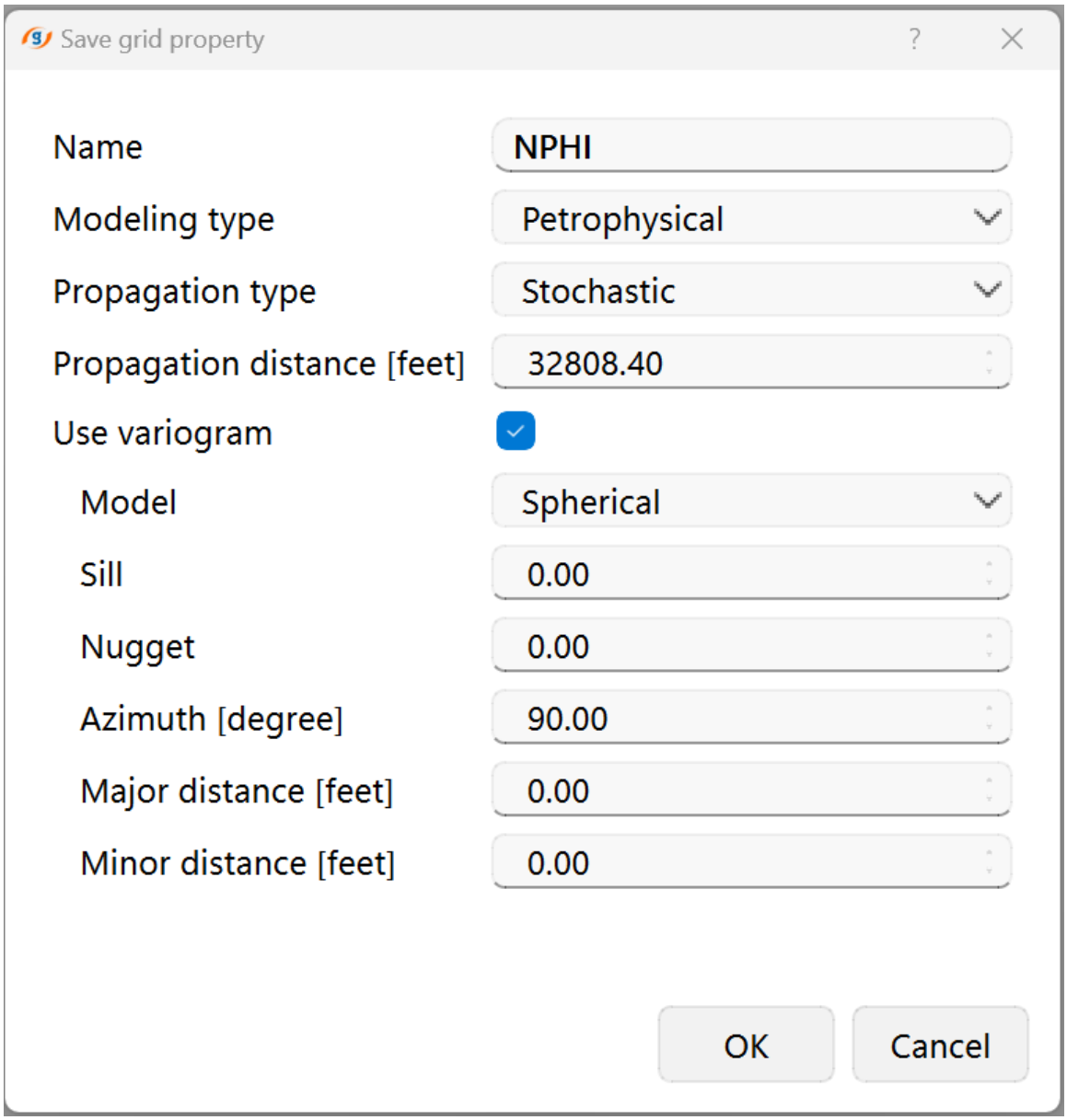
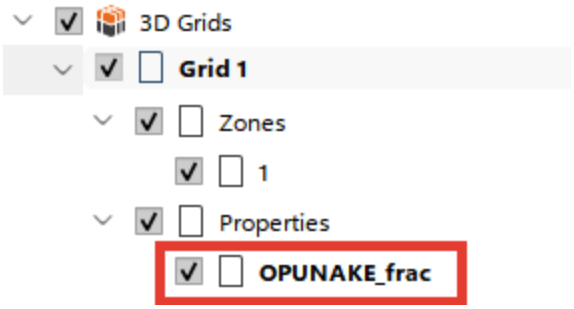


Execute Upscaling

- After configuring the parameters, click "OK" to start the seismic upscaling process.
- The system will populate the 3D grid with the seismic property based on the specified settings.



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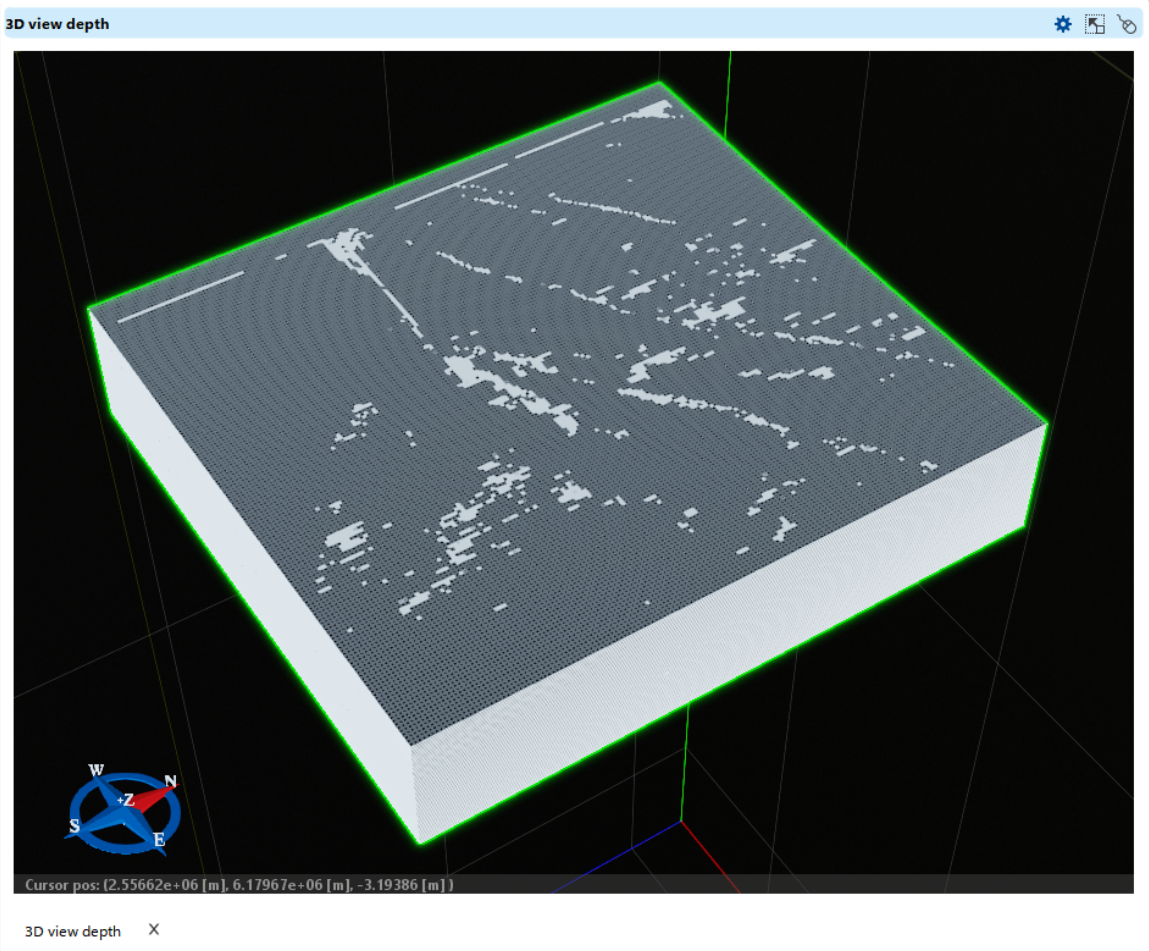
Review and Manage Properties

- Once the process is complete, the new seismic property will be added to the Properties folder under the grid in the **Data Manager**.

Visualize the Upscaled Property

- Open the 3D Depth View or Section View to analyze the grid with the newly upscaled seismic property.
- Adjust visualization settings in the View Properties panel to customize the display.



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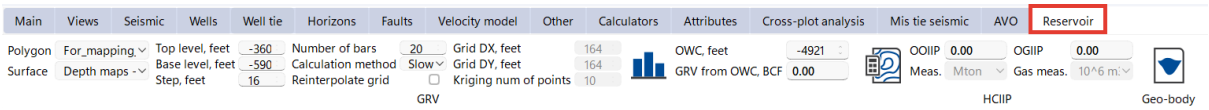
9.14 Volumetric calculations

In g-Space, volumetric calculations can be performed using the Reservoir Bar 83 interface, which simplifies the workflow by integrating reservoir data and applying volumetric formulas.
This chapter provides a step-by-step guide for calculating the **Original Oil in Place (OOIP)** or **Original Gas in Place (OGIP)**.



Steps in the Volumetric Calculation Process

1. **Define Reservoir Boundaries** using the **Reservoir Bar** to define the areal extent of the reservoir.

   Polygon: Use a polygon to outline the specific area of interest within the structural surface.

   Surface (Structure Map): Select a structural surface to serve as a reference for your reservoir. This map provides the depth or elevation data that defines the shape of the reservoir.

   Top Level: Enter the top depth of the reservoir, which serves as the upper boundary.

   Bottom Level: Specify the bottom depth, defining the lower limit of the reservoir.

   Step: The step parameter defines the vertical resolution or interval for calculating the reservoir volume between the top and bottom levels. A smaller step size will result in more detailed volume calculations, while a larger step size offers a quicker but less detailed estimate.

2. **Choosing the Calculation Method.** g-Space provides two methods for resource estimation: **Fast** and **Detailed**.

   Fast Method: provides a quick estimation using simplified parameters. Users can adjust the following:

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- **DX** and **DY Interpolation Step**: These parameters control the grid cell size for the calculation. A larger step size results in faster calculations but less precision.
- **Kriging Number of Points**: Defines the number of neighboring points used in Kriging interpolation, which influences the smoothness of the calculated surface.
- You can also **Recalculate the Input Map Grid** using these parameters to generate a simplified grid for faster processing and quick resource estimation.

Slow Method applies a more in-depth and exact calculation. It uses the input map's interpolation parameters and computes a more accurate grid that precisely describes the reservoir's boundaries. This approach is ideal for thorough evaluations where precision is crucial, but it takes longer to compute compared to the fast method.

3. **Defining Oil-Water or Gas-Water Contact Level**

Enter the depth level where the reservoir transitions from oil or gas to water

4. **Calculating Gross Rock Volume (GRV)**

Click on the **"Calculate gross rock volume"** button located in the **Reservoir Bar**.

The calculated value will be displayed next to the button, providing a quick view of the total rock volume within the defined area.

5. To proceed with calculating **Hydrocarbon Initially In Place** (HCIIP), Click on **Calculate HCIIP** button , which will open a wizard for detailed input.

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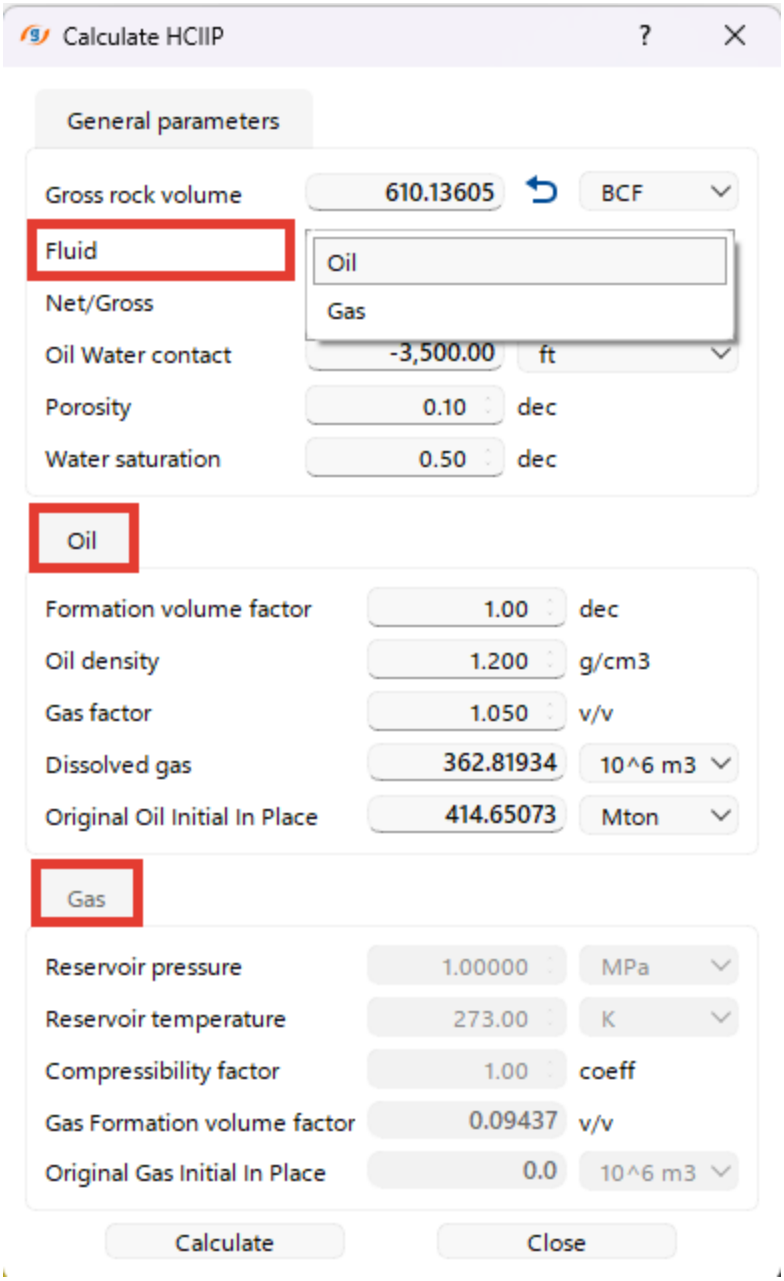

General Parameters:

- **Gross rock volume**: This is automatically populated based on the GRV calculation. It represents the total rock volume for the reservoir.
- **Fluid**: Select the type of fluid present in the reservoir (Oil or Gas).
- **Net/Gross**: Input the ratio of net reservoir thickness to total gross thickness.
- **Oil Water Contact (OWC)**: Specify the depth of the oil/gas - water contact level.

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- **Porosity**: Enter the porosity of the reservoir rock, representing the pore spaces. Please enter values in decimal form.
- **Water saturation**: Input the water saturation within the pores in decimal form.

Oil Section:

- **Formation volume factor**: This factor accounts for the change in oil volume from reservoir conditions to surface conditions.
- **Oil density**: Enter the density of the oil in g/cm^3.
- **Gas factor**: This value represents the volume of gas dissolved in the oil at reservoir conditions.
- **Dissolved gas**: Input the amount of gas dissolved in the oil.
- **Original Oil Initially in Place (OOIIP)**: This value is automatically calculated based on the input parameters and represents the total oil volume initially present in the reservoir.

Gas Section:

- **Reservoir pressure**: Specify the pressure within the reservoir.
- **Reservoir temperature**: Input the temperature of the reservoir.
- **Compressibility factor**: This factor adjusts for the compressibility of the gas.
- **Gas formation volume factor**: This accounts for the change in gas volume from reservoir conditions to surface conditions.
- **Original Gas Initially in Place (OGIIP)**: Based on your input, this value is calculated automatically, representing the total gas volume initially in the reservoir.

6. **Click Calculate**:
   - Once all the parameters are set, click the **Calculate** button to obtain the **HCIIP** values, which will then be displayed at the bottom of the wizard for review.

The user can generate a geo-body using the specified parameters and perform various operations on it. For more details, refer to the Geological Modeling 541 chapter.

To create the geo-body, click the **Create geo-body from GRV** button . The new geo-body will appear in the **Geo-bodies** folder within the Data Manager 86.

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9.15 Multi-user mode

Multi-User mode in g-Space enables collaborative project management by allowing users to work on shared projects using a centralized database.
This mode ensures that multiple team members can connect to the same project database, manage seismic data, and synchronize updates in real-time.

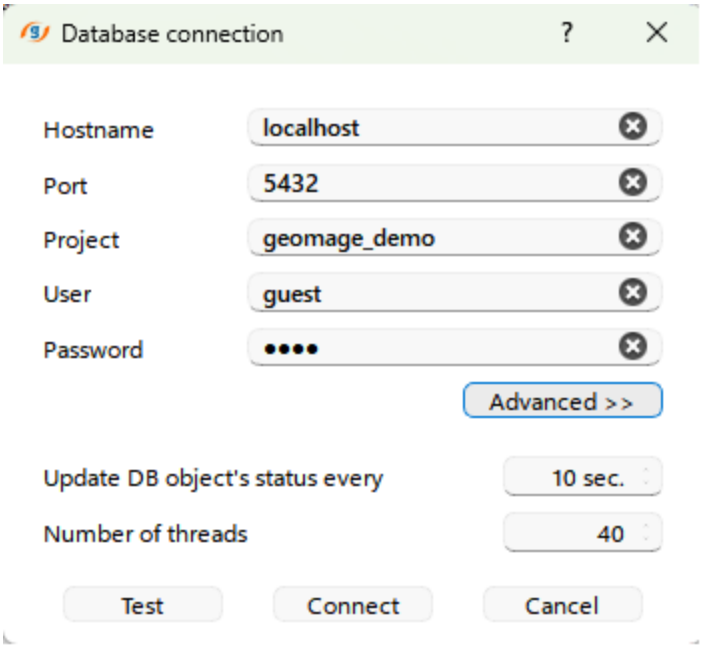
The main functions involved are setting up the database connection, receiving and sending data, and managing synchronization settings.

1. Set Connection

To enable multi-user functionality, you first need to establish a connection with the remote database. This can be done via the **Set Connection** window. The fields that need to be filled include:

- **Hostname**: The server address (e.g., localhost or a remote server IP)
- **Port**: Database connection port (e.g., 5432)
- **Project**: The name of the project within the database.
- **User**: The username to access the database.
- **Password**: The user's password for authentication.

Additionally, advanced options such as **Number of Threads** and the interval for **Updating DB object status** can be configured here. Once the details are set, users can **Test**, **Connect**, or **Cancel** the connection.



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2. Receive from DB

Once connected to the remote project, the **Receive from DB** function allows users to pull data from the shared database into their local environment. This ensures that you are working with the latest version of the project's seismic, well, and horizon data, among others.

Data can be received for specific objects such as **Volumes**, **Lines**, **Horizons**, **Faults**, **Wells**, **Checkshots**, and **LAS** files. It ensures that the local project is synchronized with the latest data on the database.

3. Send to DB

The **Send to DB** function allows users to push local changes to the database. This includes any modifications or new data added to the local project, such as edited horizons, seismic volumes, or well logs.

This feature is essential for maintaining data integrity across users, ensuring that the latest modifications are available for other team members working on the same project.

4. Sync Settings

The **Sync Settings** feature provides more granular control over data synchronization. Users can define how often their local project synchronizes with the database and specify which data types or project elements should be included in each synchronization cycle.

5. Delete DB

The **Delete DB** feature allows users with the necessary permissions to remove the project database entirely. This should be used cautiously, as it will permanently delete all data stored in the shared project database.

6. Data Manager Integration

Within the **Data Manager**, users can easily see which data files are stored locally and which are part of the shared remote database:

- **Local Folders**: These are the files saved on your local project and are not synchronized with the database.

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- **Database Folders**: Represent the shared project data stored in the database. Users can perform actions like **Receive** or **Commit** by right-clicking for specific data objects such as **Volumes**, **Lines**, **Horizons**, **Faults**, **Wells**, **Checkshots**, and **LAS**.

These options ensure flexibility and control over how data is managed and shared across multiple users in the project.

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