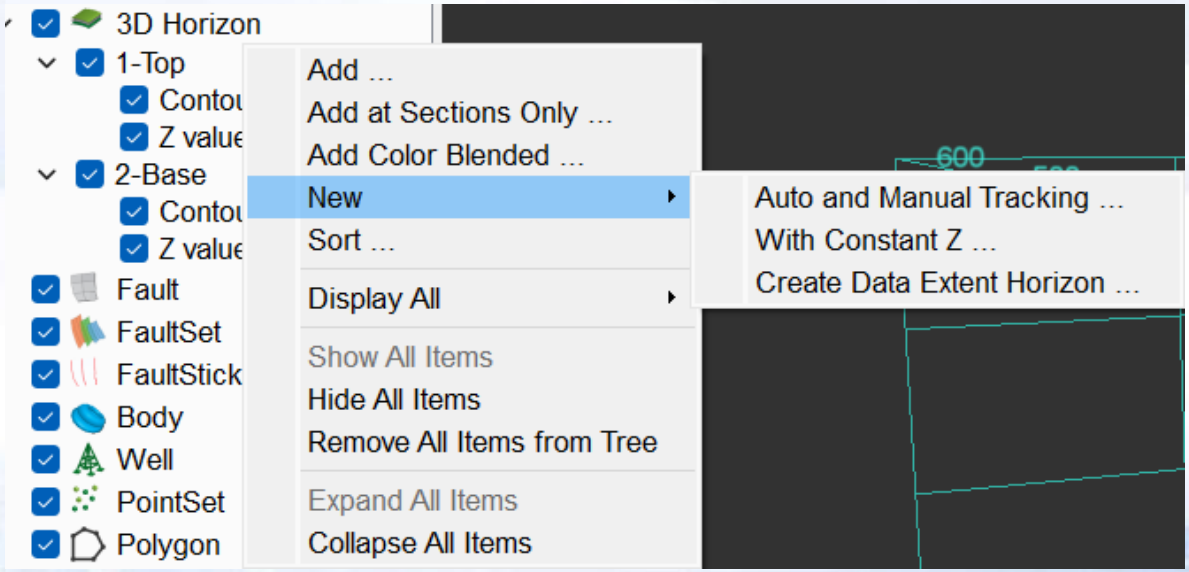
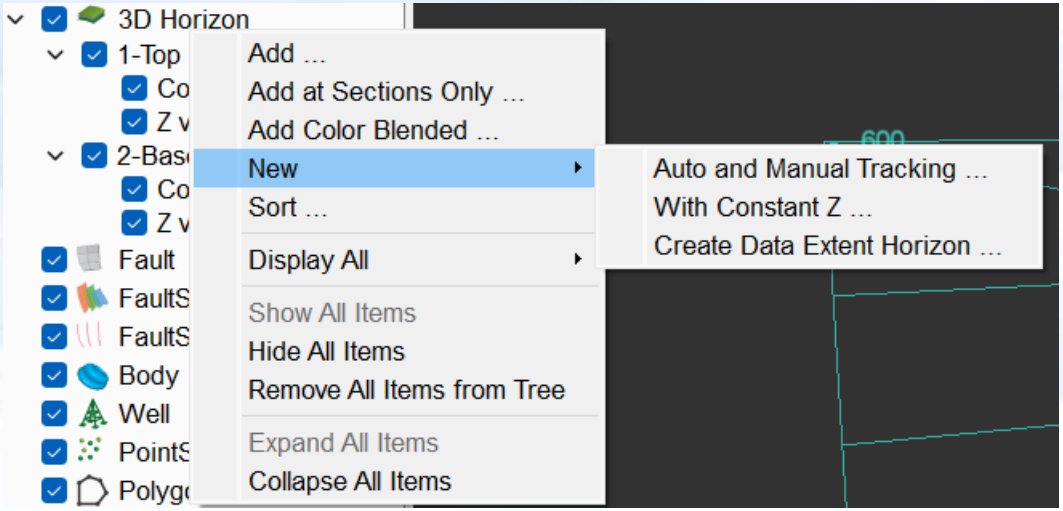
3 Tree和Elements



3.8 New （创建/跟踪新的层位）

手册中3.8节是2D Horizon，GNU版本软件中未发现2D Horizon模块。

3.7.7 New Horizon （创建新的层位）



手动和自动跟踪层位

教学视频：
https://videos.opendtect.org/?id=30

- **Auto and Manual Tracking**: interpret a horizon in a highly interactive 3D Auto-tracking workflow, or perform traditional interpretation using Section Auto-tracking and Manual Draw.
- **With Constant Z**: create a horizon with constant Z value
- **Track Unconformity** (requires Dip-Steering plugin): create a horizon from picked seed positions by inverting the dip field (given in the form of a Dip-Steering Cube). This tool can be used to track unconformities, seismic events corresponding to well markers, and/or create a quick geologic model with minimal input from the interpreter. For more details refer to the dGB Plugins documentationdGB Plugins documentation.

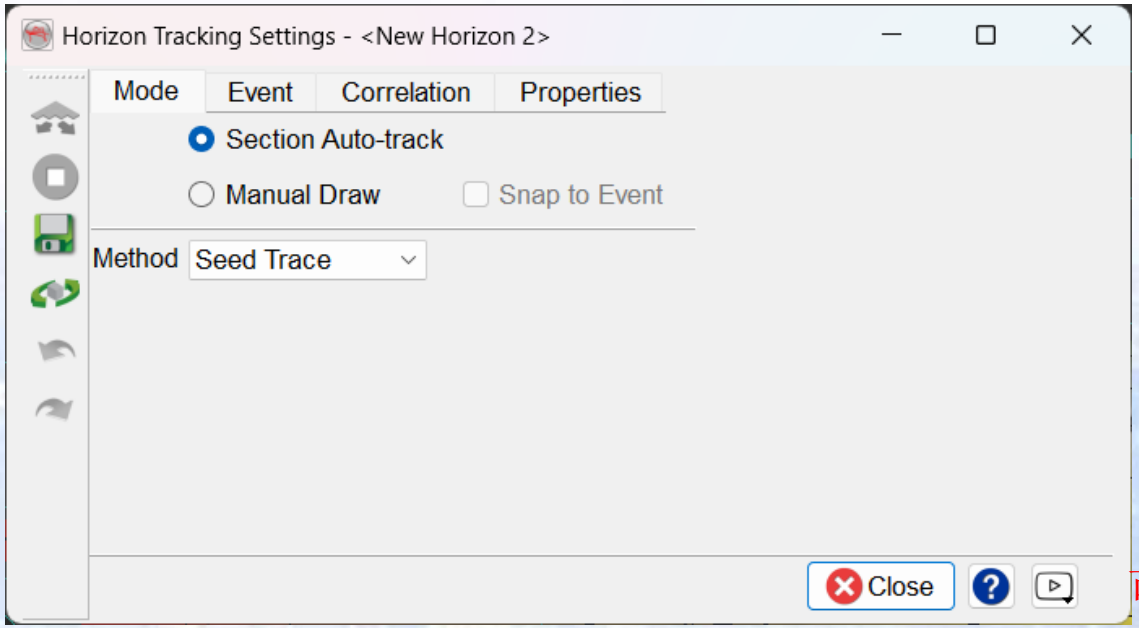
Create Data Extent Horizon

跟踪不整合面

1 Auto and Manual Horizon Tracking

3D horizon interpretation in OpendTect can be conveniently started from the right-click menu of *3D Horizon* > *New* > *Auto and Manual Tracking* in the Tree of either 3D scene or 2D viewer.

Basemap (requires OpendTect Pro license) significantly enhances any interpretation workflow. For example, it allows to conveniently operate random lines when QCing results of 3D auto-tracking.

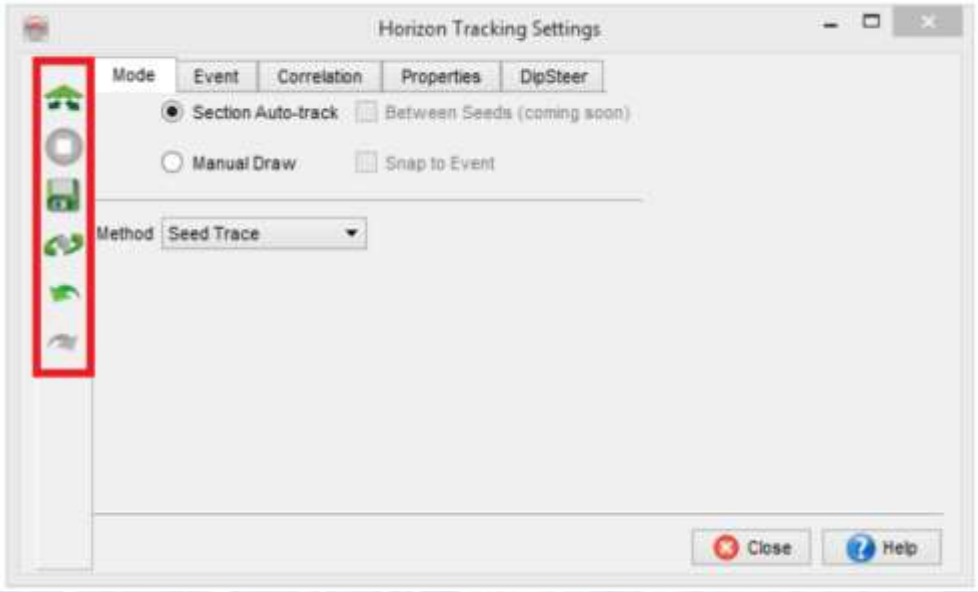


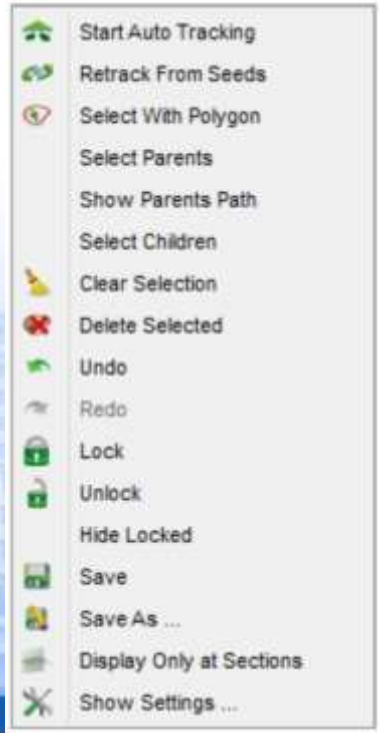
可以观看自动跟踪层位的视频

3D Auto-tracking

3D Auto-tracking is the primary, highly interactive workflow for horizon interpretation in OpendTect. The user starts with a few picked seeds, auto-tracks in volume, interactively QCs, as needed re-tracks with updated parameters and/or edits, and locks QC-ed interpretation. Then interpretation continues by iteratively repeating the steps. The advantage of this workflow is that the horizon is QC-ed while interpreting and, therefore, saves time on editing. Any remaining holes can be filled at a later stage using one of the gridding algorithms.

The workflow operates in the 3D scene via Horizon Tracking Settings window, *Ctrl* + right-click menu, and/or keyboard short keys (*Shift* + *?* to see all).





与mhe(Dave Hale)的程序做个比较？

A seismic event in 3D volume is tracked starting from user-picked seed locations following user-set rules (Horizon Tracking Settings window) on:

- which seismic event (min/max/zero-crossing) to follow within a search window;
- and when to stop auto-tracking by comparison of the current tracking position with either a user-picked seed location (*Seed Trace* method) or a preceding auto-tracked position (*Adjacent Parent* method) based on event amplitude (either relative difference threshold or absolute amplitude cut-off) and (optionally, but recommended) trace cross-correlation within comparison window.

Optionally, seismic dips can be used to guide the auto-tracker (a Dip-Steering license is required).

The *Seed Trace* method is more conservative and is recommended in structurally complex areas. The *Adjacent Parent* method tracks larger areas with the same set of input seeds and tracking parameters, which makes it faster to produce horizons, but the risk of loop-skipping increases. It is recommended only for continuous horizons.

3D数据体中地震事件的层位跟踪，是从用户拾取的种子点位置开始，根据用户设置的准则执行：（1）哪个地震事件；（2）合适停止自动跟踪
可使用地震倾角指导自动跟踪（需要Dip-Steering许可证）

Section Auto-tracking

没有发现该功能

Using Section Auto-tracking mode without 3D Auto-tracking functionality is a traditional interpretation workflow, in which the interpreter points a horizon on a certain grid (usually regular: for example, every 10th inline and 10th crossline). It can be done both in 3D scene and in 2D viewer. The interpreted horizon is then interpolated using one of the gridding algorithms.

Manual drawing

This option is used to manually pick horizons in areas where auto-tracking is not feasible.

1 Auto and Manual Horizon Tracking

1.1 Horizon Tracking Settings

3D horizon interpretation in OpendTect can be conveniently started from the right-click menu of *3D Horizon* > *New* > *Auto and Manual Tracking* in the Tree of either 3D scene or 2D viewer.

Horizons can be tracked in various modes:

- Section Auto-tracking ⟶ 没有
- Volume Auto-tracking
- Manual Drawing with and without snapping

1 Auto and Manual Horizon Tracking

1.1 Horizon Tracking Settings

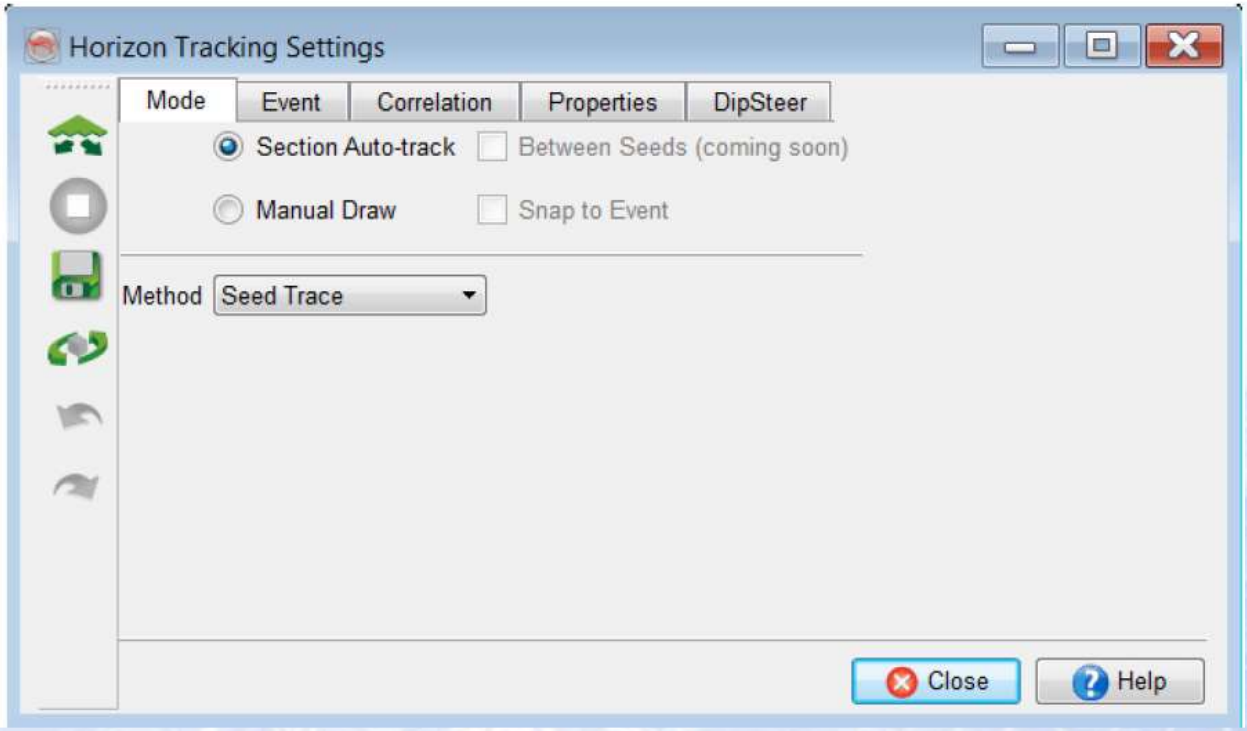
OpendTect supports the following ways of picking:

1. Auto-tracking mode:
   - Recommended: Left-click to add seeds (seeds are stored with a horizon).
   - Optional: hold Left-click and draw along the section, seeds will be automatically added.
   - Ctrl + Left-click to remove seeds.
2. Mouse draw:
   - Recommended: hold Left-click and draw along the section to create an individual patch (patches can be connected by simply drawing with overlaps).
   - Optional: left-click to pick an individual patch and double-click to finish it.
   - Hold (Ctrl + Left-click) and drag to erase interpretation along the line.

Horizon Tracking Settings window.

Right-click *3D Horizon* in the tree and select *New* > *Auto and Manual Tracking*. This will launch *Horizon Tracking Settings* window which contains several tabs. Optionally, the dialog can be retrieved by right clicking on the horizon in the Tree and choosing *Tracking* > *Change Settings*.

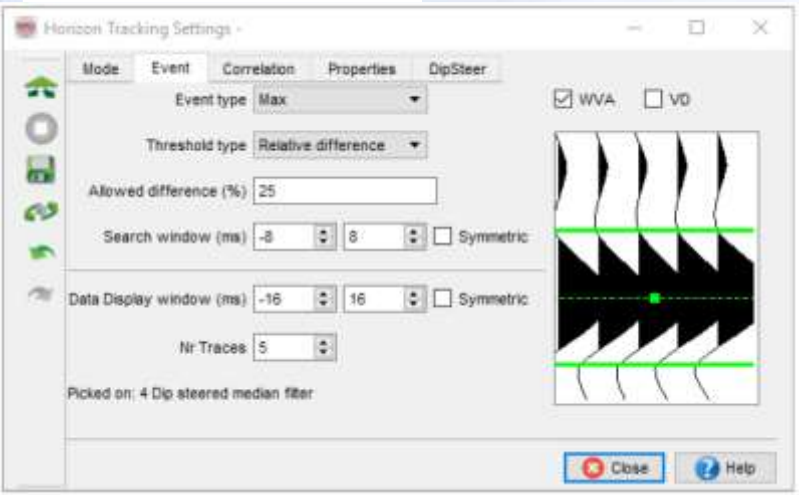
Mode Tab

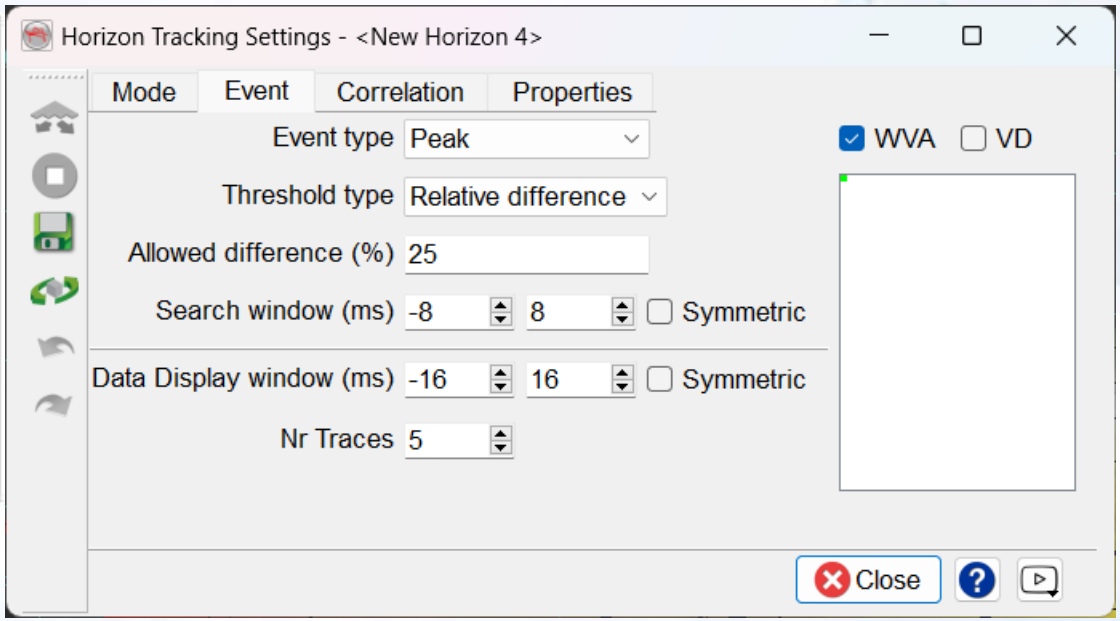


Choose the tracking mode:

- *Section Auto-track* is used to auto-track a horizon along a section (inline, crossline, and random line) of a given volume. If a sub-volume is preloaded, only the sub-volume area will be auto-tracked. When this mode is selected, the volume auto-tracking icon  will be active, which requires seeds.
  - **Seed Trace** is an auto-tracking method which only compares seeded traces to do auto-tracking.
  - **Adjacent parents** utilizes the last known trace positions to compare amplitudes to do auto-tracking. This increases chances of loop skipping.
- *Manual Draw* mode will manually pick a horizon (interpolated line) between two clicked or mouse dragged positions. Optionally, it also snaps to a selected event between the picked positions. This mode is used in difficult areas, for example to cross faults, noise zones or to interpret unconformities.

Event Tab





GNU版本

At the bottom of this tab, one may see a status note on picked/current data on which interpretation is being performed.

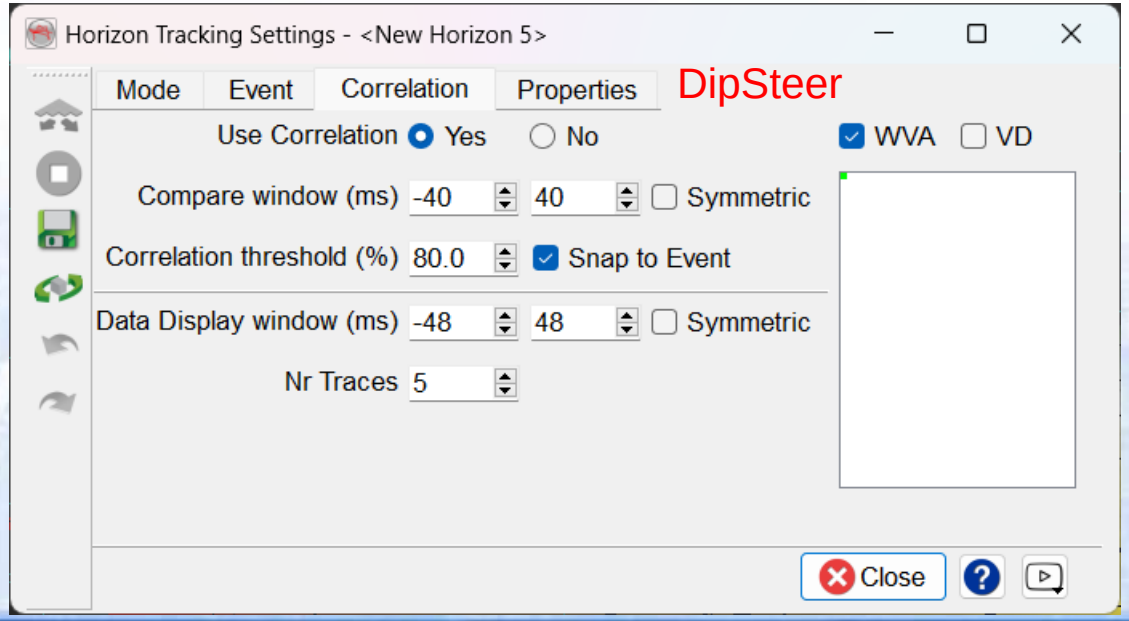
Event Tab contains the defining parameters for Section / Volume auto-tracking.

- Input data: The input data is automatically selected when you pick on a section. This can be the original seismic volume, or a filtered seismic volume (preferred) or any other attribute. The horizon is linked to this input seismic. you can change the input seismic at any time: it won't change your saved interpretation. If you change the data during interpretation, the next click on the new data may show a warning message. If you continue, then the new data will be used to do auto-tracking.
- Event type: Specify the event type you want to pick. The tracker can track negative reflectors (Min), positive reflectors (Max), a Z-type zero-crossing (0+-), or a S-type zero-crossing (0-+). If the tracking does not seem to work, check that the event type corresponds to the event you actually interpreted the seed(s). If *Seed Trace* method is chosen then one can interpret a mixed phased horizon.
- Threshold type:
  - *Cut-off amplitude*: Here, an absolute amplitude is used as the stopping criteria for the tracker. When the tracker encounters a value below this threshold value it stops tracking. (For a max-event the tracker stops if the value is below this threshold value, and for a min-event when it is above this threshold value). Tip: point your mouse at the event and the amplitude value is displayed at the bottom of your screen.
  - *Relative difference*: The tracker will compare the amplitude of the last tracked point to the amplitude of the point that is candidate for tracking. If the difference exceeds the chosen percentage, the tracker stops tracking. Further explanation on Steps is given below.
- Search Window: The tracker searches for the chosen event type based on amplitude in a time window relative to the last tracked sample.
- Display Window: This controls the display of WVA/VD of the surrounding trace segments near the last picked seeds. One can control the display window and number of traces. This gives an overview of the picked location. In the display, one can also change the search window by moving the green lines up/down.

Correlation Tab

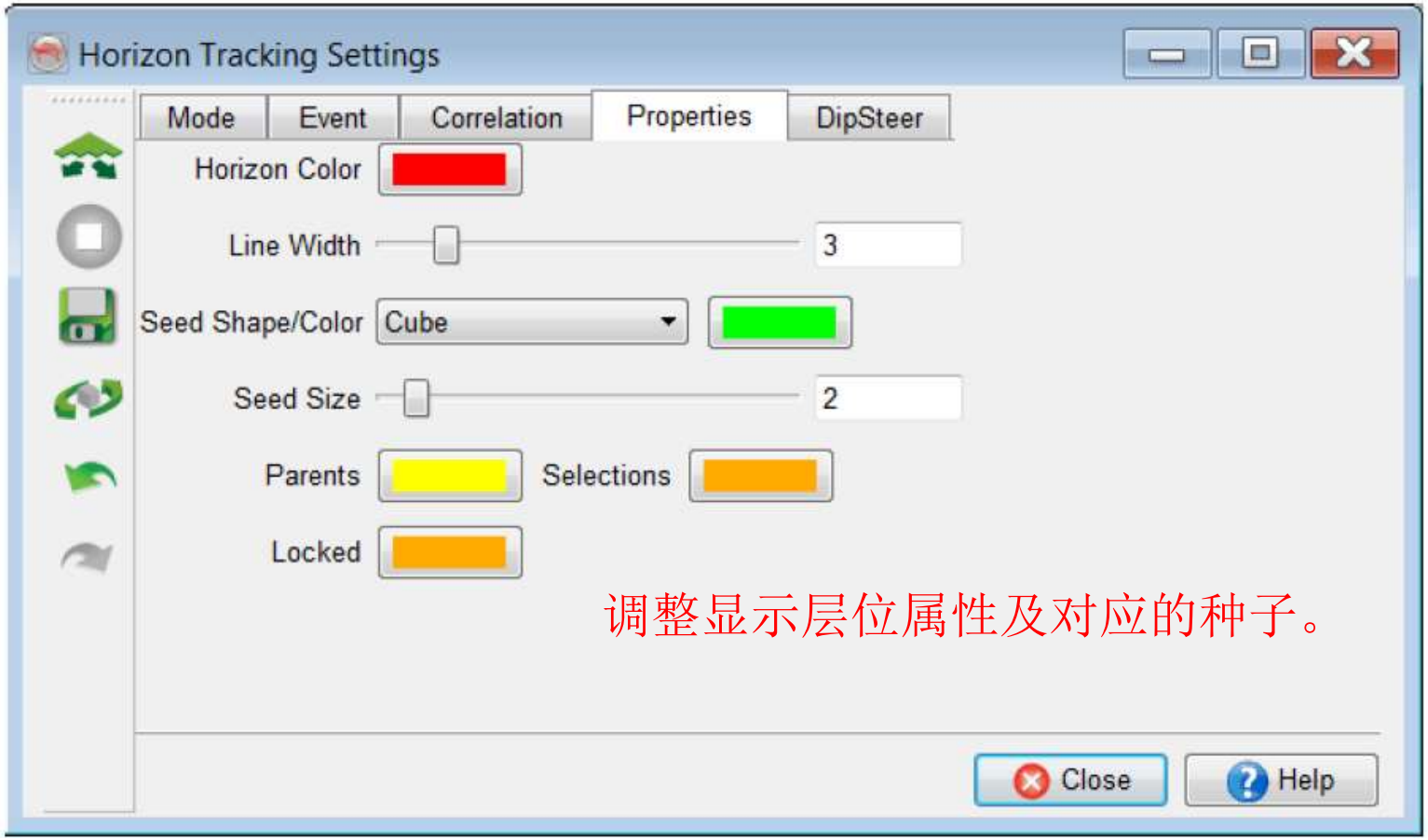
A trace segment around the last tracked point is compared to all the trace segments on the neighboring traces around the points that lie within the Search window (See figure below).

In this tab, one can do auto-tracking by turning the correlation ON. The correlation window should be small enough to ensure a waveform. The threshold is generally strict (80% or higher) to track only high quality amplitudes. The correlation window size can be changed by moving the green lines in the display window.



GNU版本

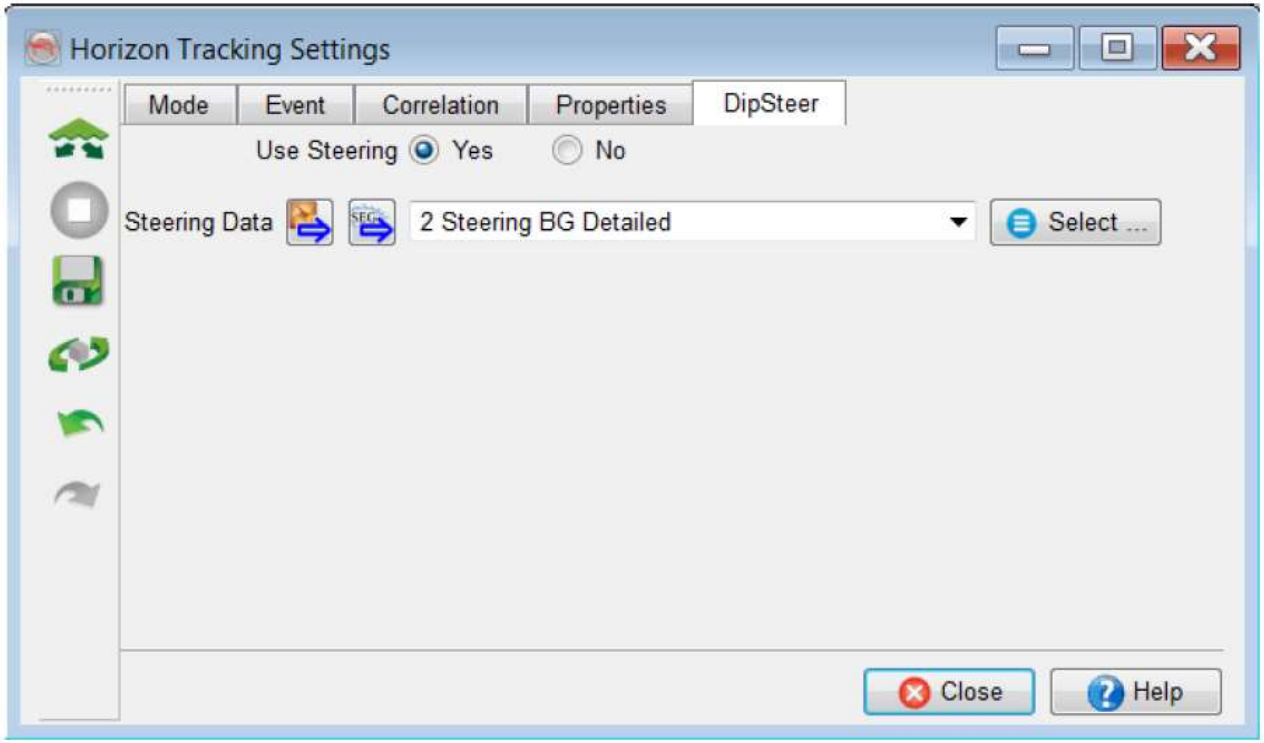
Properties Tab



This tab is used to adjust the display properties of the horizon and corresponding seeds. Optionally, you can also change the color codes for various parts (parent paths, selection of a horizon if you intend to remove through a polygonal selection, locked tracking areas) of the horizon.

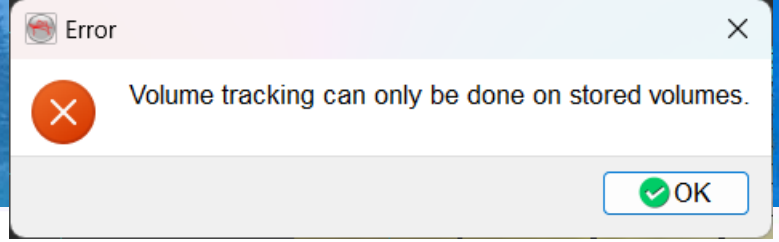
Dip Steering Tab

Pro用户使用



SteeringCube作为层位解释的约束，将改进层位跟踪（在dipping relectors的区域）

A SteeringCube can be added as a constraint for horizon interpretation. This will improve the horizon tracking especially in the areas of dipping reflectors. Dip steering gives structural information.



3D Auto-Tracking Menu

启动自动层位跟踪

A dedicated 3D Auto-tracking menu is generally launched by CTRL + right click in 3D scene.

Start Auto Tracking	Starts Auto-tracking using the selected method in the Mode tab of tracker settings.
Retrack From Seeds	Re-tracks a new horizon from the new seeds.
Select With Polygon	Draw a polygon to select parts of the horizon that you intend to remove.
Select Parents	Shows parents (as line) on the map.
Show Parents Path	Show parent paths in a 2D viewer where you can edit the interpretation.
Select Children	Selects all grid nodes near the clicked location which are children paths of auto-tracking.
Clear Selection	Clears the selected horizon parts.
Delete Selected	Deletes the selected parts of the horizon from the disk.
Undo	Undo the last changes.
Redo	Redo the last changes.
Lock	Lock the tracked horizon parts. Only the new positions will be editable.
Unlock	Unlock the tracked horizon parts.
Show Locked	Show locked option is used to show the read-only parts of the horizon.
Save	Save/Save As – to save the current horizon or save it as a new horizon.
Save As ...	
Display Only at Sections	Displays a horizon as a line on the sections.
Show Settings ...	Displays the tracker settings dialog.

Using this menu, you can control several tracking features.

Tracking Workflow

After adjusting the parameters in the tracker setup (which can remain open during tracking), start picking seeds on a displayed inline/crossline.

Please refer to How-to instructions for step-by-step workflow on 3D Auto-tracking and Tracking in 2D viewer.

工作流：
开始在显示的inline/crossline上拾取种子

https://doc.opendtect.org/6.6.0/doc/HTML_WF/Default.htm#tm6/workflows.htm?TocPath=_____1

Auto-tracking in a 3D volume

层位自动跟踪的步骤：

Auto-tracking in 3D is done in following steps:

1. Pre-load a sub-volume (Survey > Pre-load > Seismic) within which you intend to do auto-tracking. If the volume size is small, you may pre-load the entire volume in the memory.
2. Launch the basemap window (View > basemap) to move the sections and QC the inter-pretation.
3. Add inlines / crosslines / random line.
4. Add a new 3D horizon in the tree.
5. Pick several seeds on inlines / crosslines / random lines and adjust the tracking para-meters.
6. Press the auto-track button.
7. If the tracking result is good, you may lock  (CTRL + right click) the results so that they are not changed. You may unlock  the old tracking paths if you want to change them during interpretation.
8. Otherwise, you add more seeds and choose re-track from seeds  .
9. You can optionally, remove the wrong paths at a mouse location by using CTRL + right click menu (Select parent / children paths and relaunching the menu to remove the selection).
10. Another option is to launch a 2D Viewer of parent paths to edit auto-tracking errors. If you do that, then you may have to re-track  from seeds again.

Some Important Tracking Short-cuts:

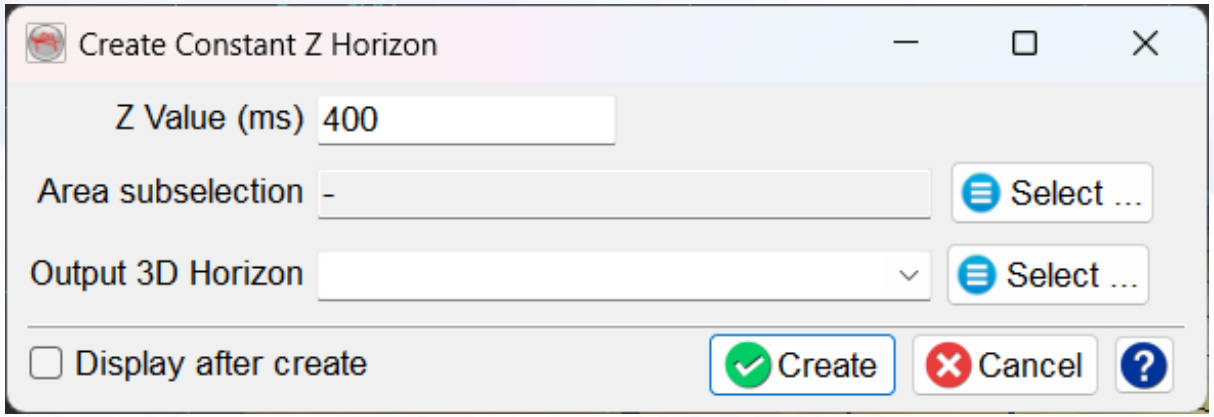
- CTRL + Z: Undo the last action.
- CTRL + Y: Redo the last action.
- CTRL + S: Saves the horizon.
- k : Auto-track.
- SPACE bar: Switches between picking (cross) horizon and dragging (green pointer) sections.

Manual Drawing on Sections (2D/3D)

You can manually interpret a horizon by drawing on the seismic section. OpendTect supports both picking methods: drawing like a pen (Tablet/Touch screen) or mouse clicks. If you have picked a part of a reflectors, a green colored (temporary) line will appear. To confirm interpretation, you will required to double click. This will show a horizon segment in actual color. This method is very useful for picking in difficult areas (noisier zones or unconformities).

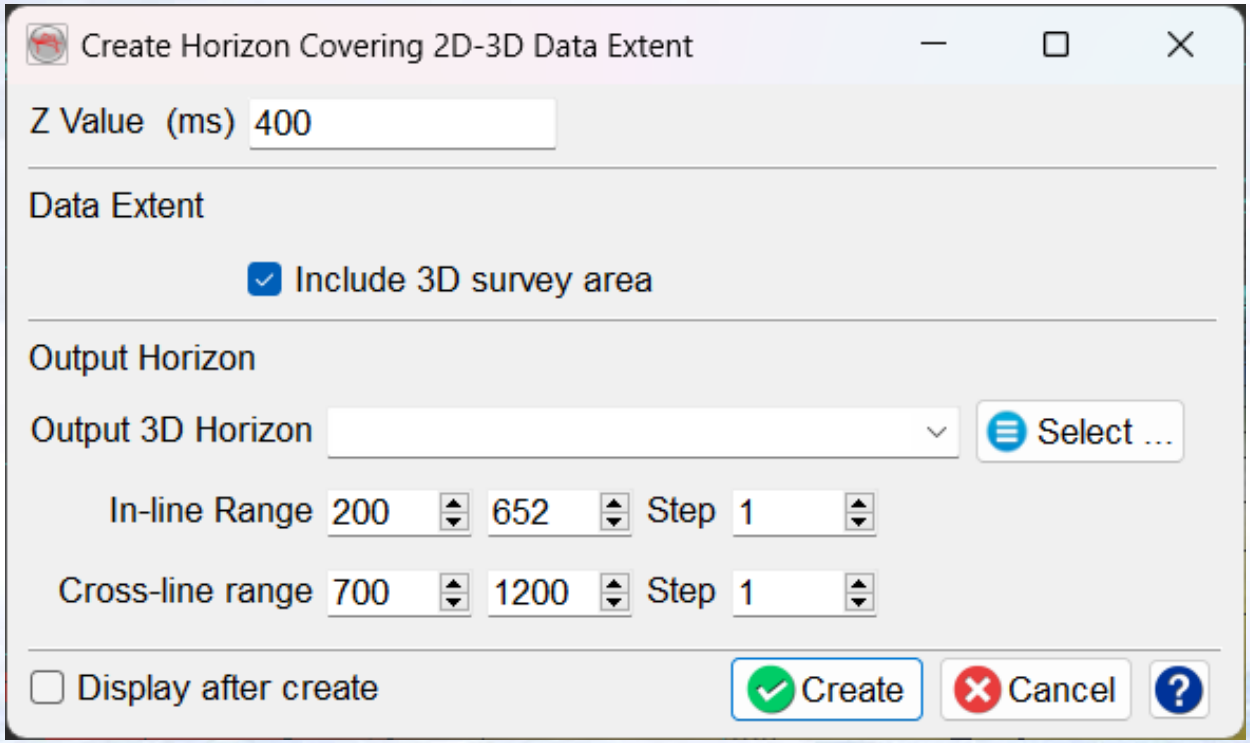
2 Create Horizon With Constant Z

3D horizon with constant Z-value can be created from the right-click menu of *3D Horizon* > *New* > *With constant Z*.



基于常数值Z，创建层位（不是根据地质事件）

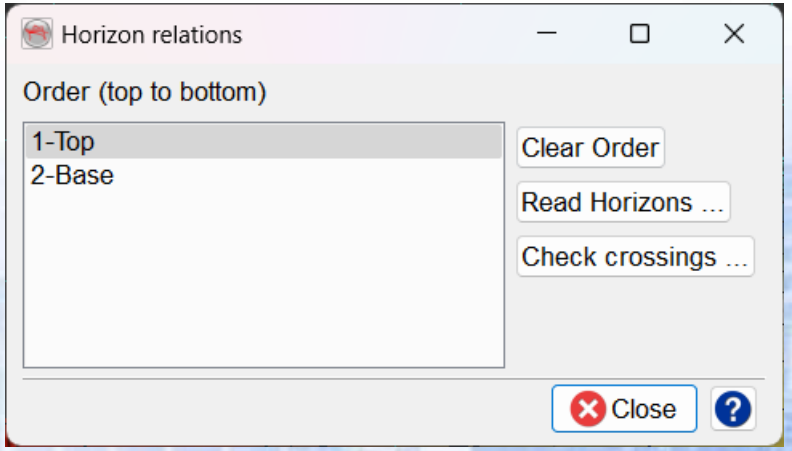
3 Create Data Extent Horizon



GNU 6.6新增的功能

3.7.8 Shift 换成Sort了

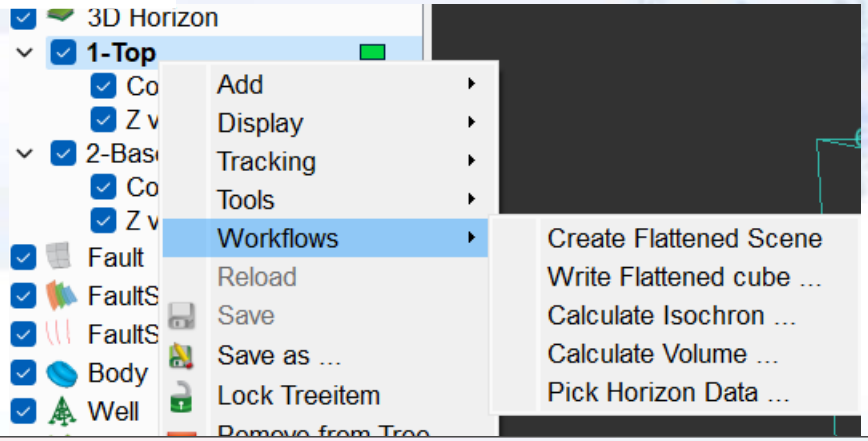
Shift: The scrollbar allows the user to scroll the 3D horizon vertically. The shift range allows the user to define the upper and lower boundaries of the scrollbar range. The step size defines the distance between each possible horizon position. (e.g. A range of -100 to +100 with a step of 10 allows for the user to scroll through 20 possible horizon positions, centered about the original position.) Different attributes can be calculated for the horizon in this user defined shift range. The user can then use the scrollbar to move up and down and view the attribute as it would appear on that horizon at the various shift positions. This shifted horizon can be saved as surface data to be viewed later.

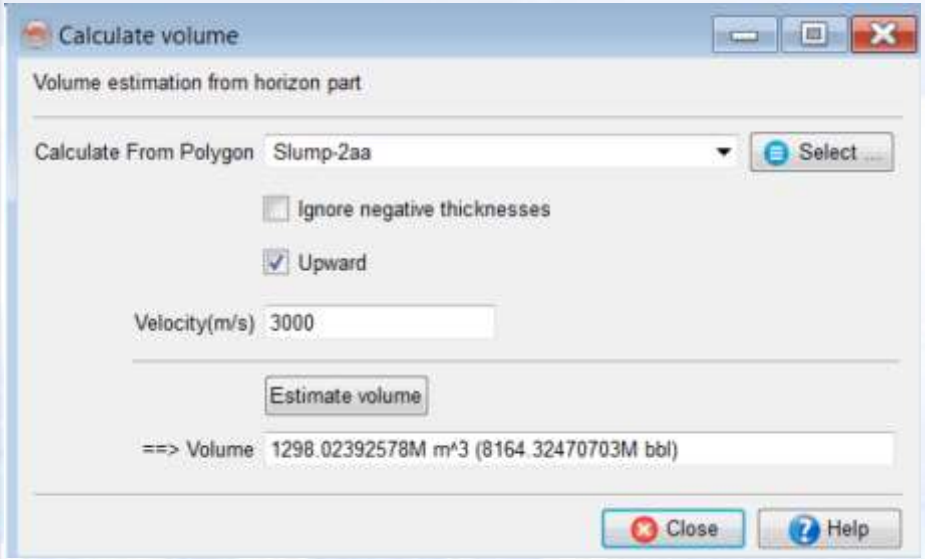


3.7.9 Calculate Volume

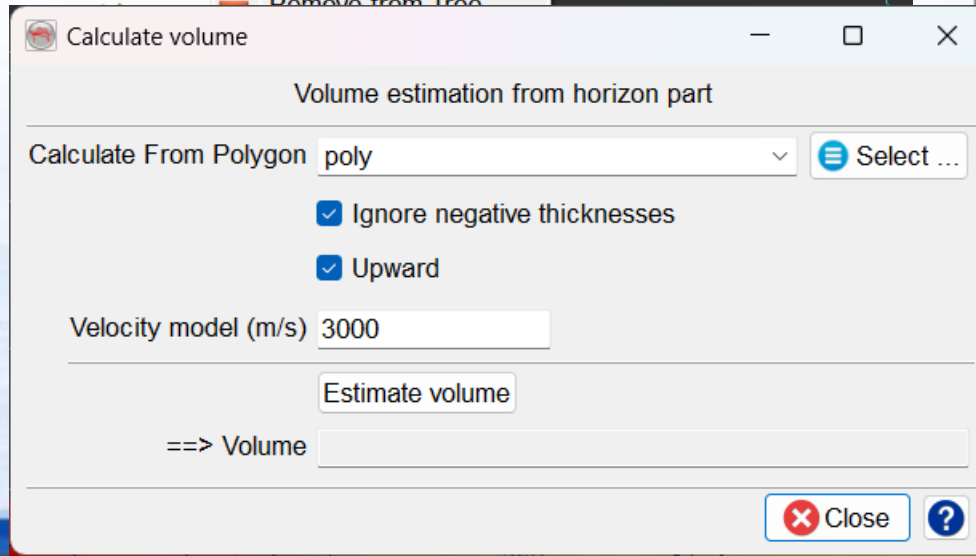
移到workflows了

Calculate volume: It is used to calculate the volume between the two horizons. The volume is calculated within an existing polygon. Select the polygon and press *Estimate Volume* button to calculate the volume within the polygon. To read more about this, please go to the chapter pointset: Pop-up Menus





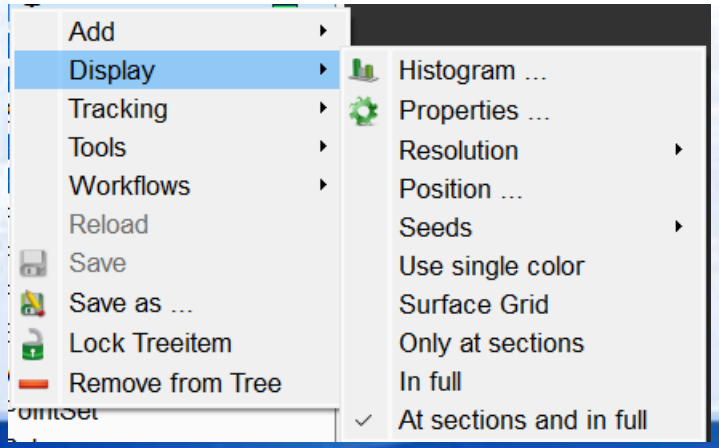
手册截图



3.7.10 Other Options

Properties: The *Material* window allows changing of the graphical settings like transparency, line style, and thickness.

Resolution: The resolution of a horizon can be changed for performance reasons. When using a low-end graphics card, performance during rotating and moving the scene may suffer. By showing the horizons in a lower resolution, scrolling and rotating becomes smoother. By default, the resolution is set to *Automatic*. This setting uses higher resolution in areas where a horizon has a complicated shape, and low resolution in relatively flat areas. Also, when rotating, the resolution will be set to low in order to enhance responsiveness of the rotation action. When released again, the resolution is set higher again. Attributes displayed will always have full color resolution, only the shape of the horizon surface is affected by this setting.



3.7.10 Other Options

Horizon default resolution and colortable settings can now be defined under the '*Horizons*' tab via *Utilities* > *Settings* > *Look and Feel*....

Quick UVQ: This option is related the Neural Network plugin license, if it is available. It is used to create a quick unsupervised facies map. For further information please refer to the plugin documentation.

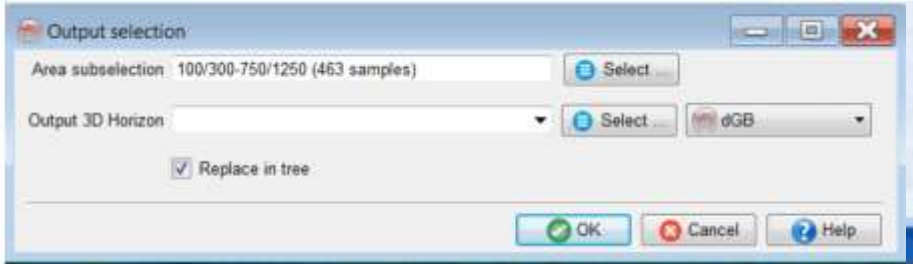
Use single color: When this option is selected, the horizon is displayed in a single color, which can be chosen from a standard color selection window.

Display: The horizon can be displayed on the sections (inline/crossline/2Dline/timeslice) as a line, as a 3D surface or both.

Tracking: Horizons can be edited and tracked through the survey. The various tracking options are described in here.

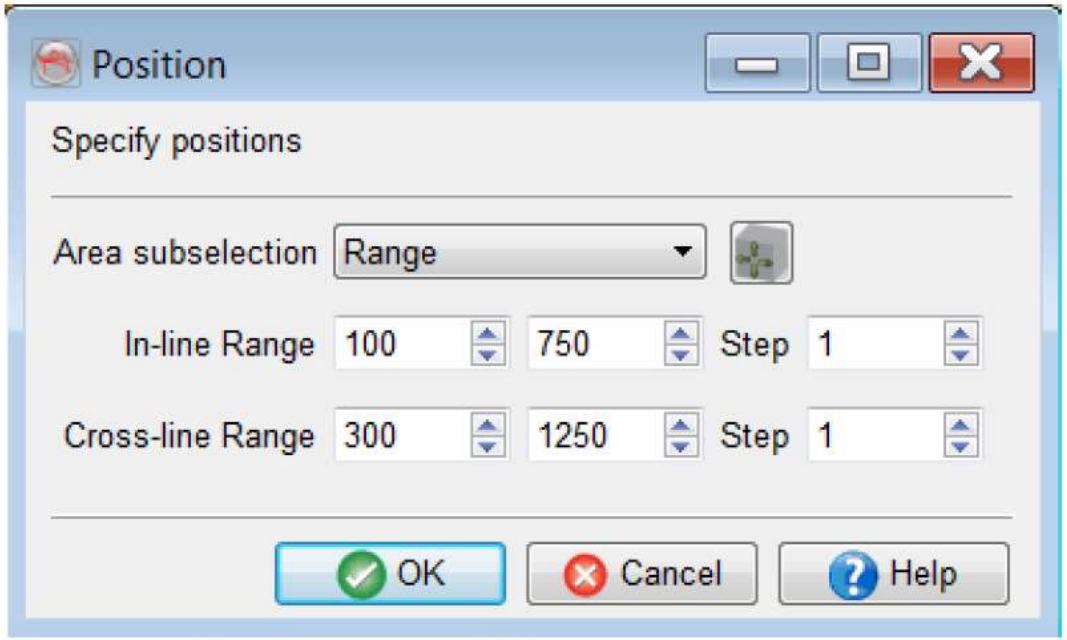
Save: The save option gets highlighted when changes are made to the surface geometry. *Save* saves the new geometry of the horizon. If a horizon consists of patches, you can save a sub-selection of these patches.

Save as: Save a sub-area or the complete horizon using an other name.



3.7.10 Other Options

Position: It is used to re-position (selected inline/crossline range) the displayed horizon. In the position dialog, set the ranges of the inline or crossline to sub-select the horizon display.



Lock: This will lock the selected object. It prevents accidental removing, moving, or displaying data on the object. After clicking unlock, all manipulations are possible again.

Remove: This option removes the horizon from the tree and the graphics area.