TETRALE Group

TetraSeis & Tesseral Technologies Managing Co.

TESSERAL GEO MODELING

www.tesseral-geo.com

- ***With Oil & Gas industry moving to plays with complex geology, using of technologies mitigating economic risks is becoming critical***
- ***Tesseral Geo Modeling software suite provides a whole range of seismic modeling and model building solutions from simplest to the most complete allowing properly guide and QC different stages of the particular geological project workflow***

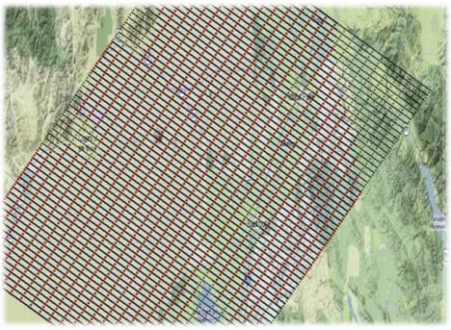
Software Package Tesseral Pro (Tesseral Professional Workstation)

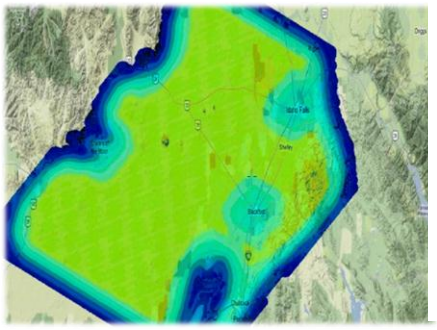
… additionally to all functionalities of *Workstation Standard Tesseral 2D* allows:

- ✓ designing 2D or 3D survey and compute fold and illumination maps
- ✓ designing geologic-geophysical model from a scanned picture or just from your imagination or producing compound multi-parameter model from available geophysical and geological data such as velocity cube, horizon maps, faults, well trajectories and tops, well logs
- ✓ generating and processing 1D/2D/3D multi-component (1C/2C/3C) synthetics for different kinds of active and passive sources using wide set of methods and wave equation approximations
- ✓ visualizing and investigating wave propagation movies and ray paths in their relation to recorded events

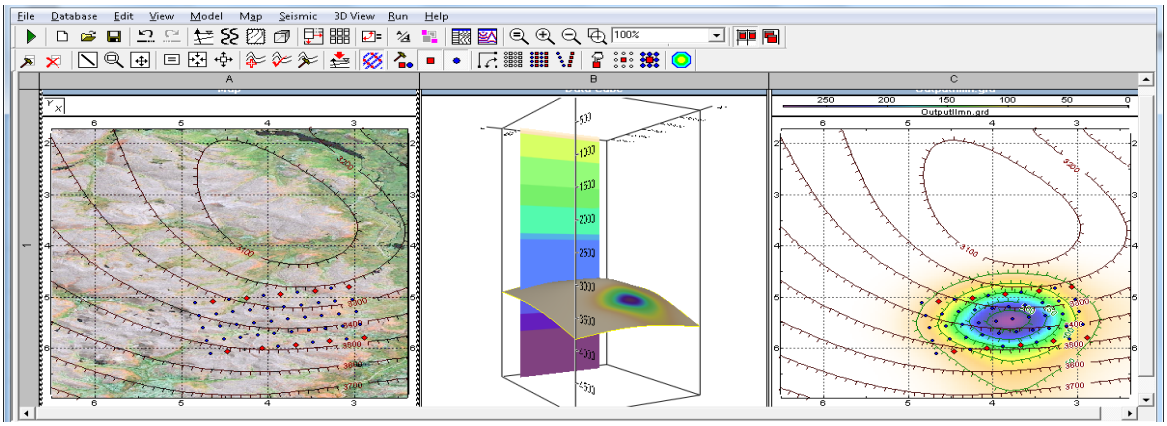
3D Survey Design

Bearing and recording patch from orthogonal, diagonal, shot in crankshaft pattern layouts, 2D and 3D VSP layouts, SPS file, a picture of the field map, a space photo or a scan of Google map can be put in background during the survey design. Fold map and the target object illumination maps are calculated.





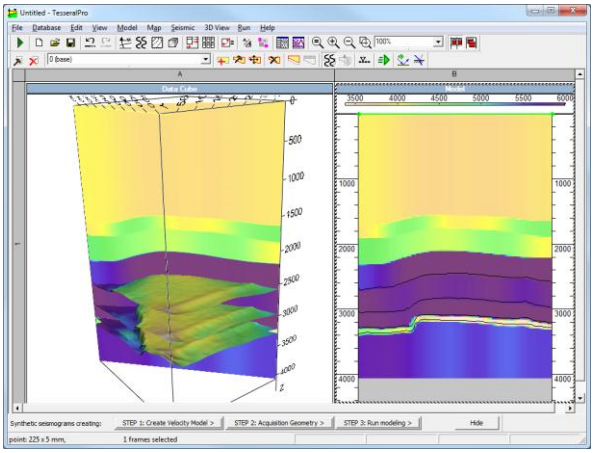
- A picture of the field map, a space photo or a scan of Google map can be put in background during the survey design.
- Fold map is quickly calculated
- Illumination maps are calculated for the imported target object maps

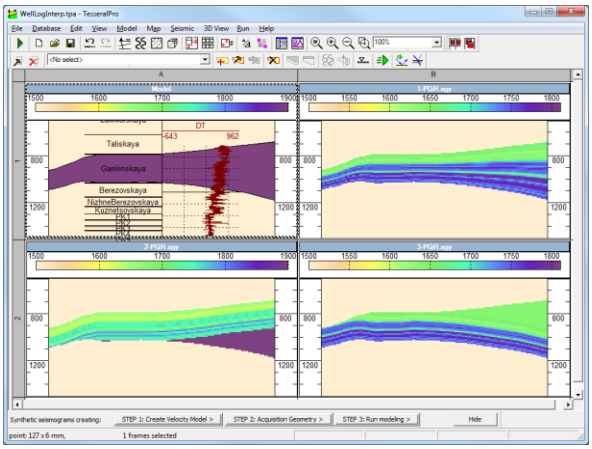


From left to right: (1) the target horizon and the survey, (2) the illumination in 3D, (3) the illumination map.

Multi-Parameter Model Design from Velocity Cube, Horizons, Well-Logs

8 gridding techniques, including splines, min curvature, kriging, natural neighbourhood are implemented. Grids also can be imported from 10 popular formats. Known faults are considered.

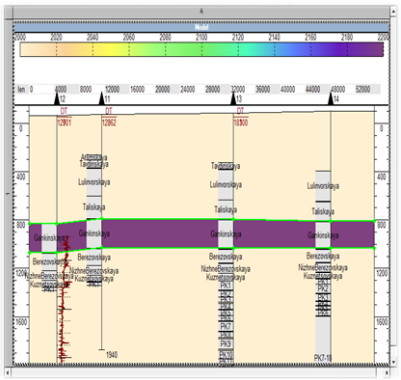


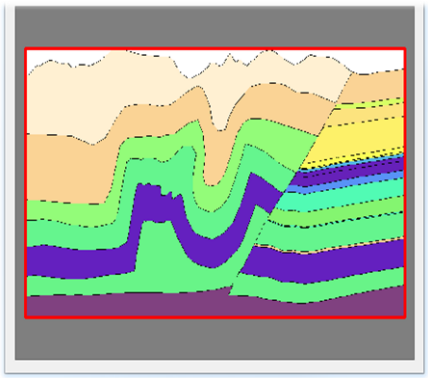


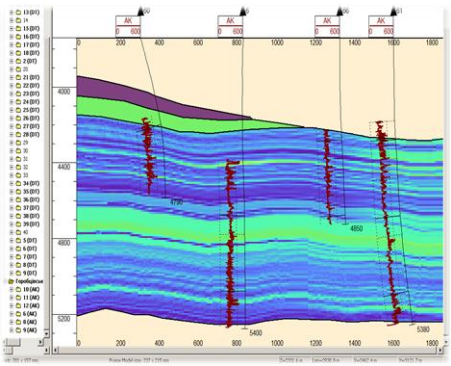
A set of gridding methods and thin-layer interpolation modes can be used together for automated development of realistic multi-parameter models

2D-2C, 2.5D-3C and 3D-3C Modelling

Full-wave 3D simulation methods are too complex to generate and process synthetics during routine survey planning. Using less precise 2D-2C and especially 2.5-3D-3C simulation methods one can do the modelling based survey analysis in acceptable time. The methods use cross-section 2D models which are easy to design in ***Tesseral Pro***. Generate the cross-section from a 3D model by couple mouse clicks an tune, compute as inter-well correlation, or just draw from a picture or from scratch.







Shotpoint and receiver positions are derived from the basic 3D survey if it exists. Else they can be imported from SPS, SEG-Y, or a simple text format. One can specify a 2D survey step-by-step using a special wizard.

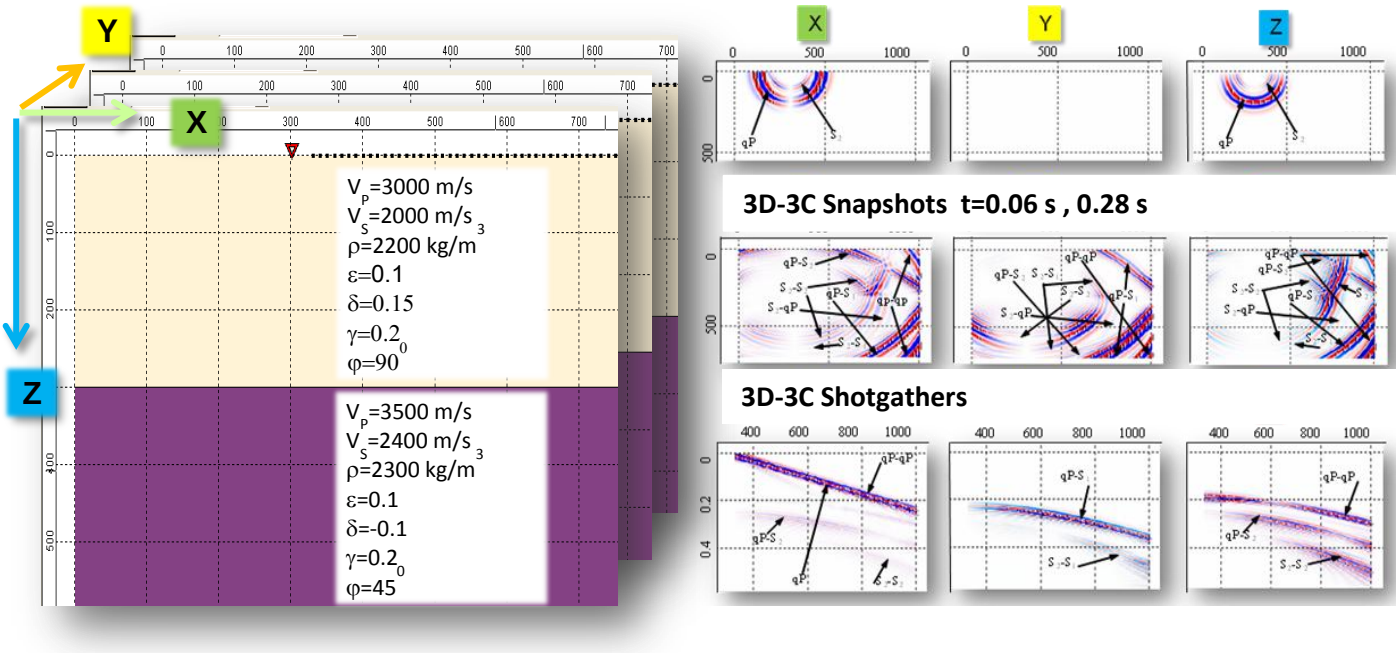
A cross-section model of *Tesseral Pro* consists of ordinary polygons, layer-like polygons, top and bottom type horizons and polylines such as faults. It can be automatically generated from the horizon maps or well strata layouts. The polygons are visually edited and smoothed. Corresponded P/S velocities, density, anisotropy and fracturing properties can be specified with gradient, imported from SEG-Y cubes or well logs.

2.5D-3C Visco-Elastic 3D TTI Anisotropic Method

Tesseral Pro includes multiple seismic modelling methods from Ray Tracing and Haskell-Tomson's to finite-difference simulation-based ones. Among them 2.5D Visco-Elastic 3D TTI Anisotropic method is the most powerful due to its ability to generate multi-component 3D synthetics. Synergy of the 2.5D method with GPU technology results in impressive speedup of calculations. E.g. SEAM II 3D FWM project expended 3840 cores of the big cluster Sierra for about 13 hours per shot. 2.5D method can compute similar size synthetics for less

than 2 days per shot on a single PC equipped by NVIDIA Tesla M2070. ***Tesseral Pro*** can simulate multiple wavefilelds in parallel on a GPU cluster or in local Windows network.

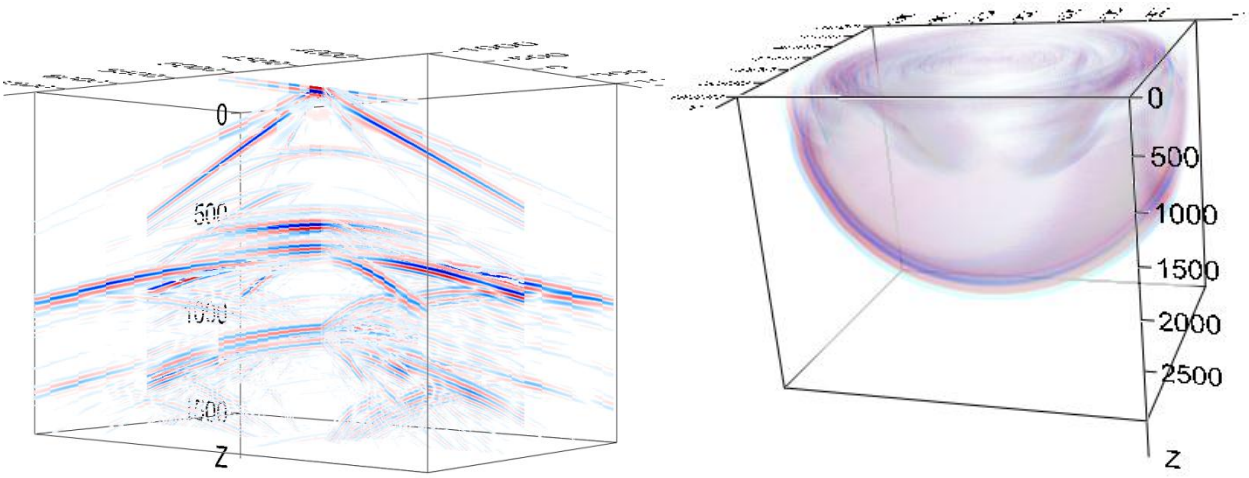
The below pictures show two-layered HTI-anisotropic 2.5D medium with azimuths of symmetry axis 90^0 and 45^0 and all properties fixed along Y and corresponding synthetic 3C snapshots and shotgather components.



The 2.5D method generates all type waves including qP, qSV(S_2) and SH(S_1). Arrival time of the reflected converted PS_1-wave is less, than of the reflected converted PS_2-wave.

3D-3C Acoustic, Elastic (anisotropy Q3 2014) Method

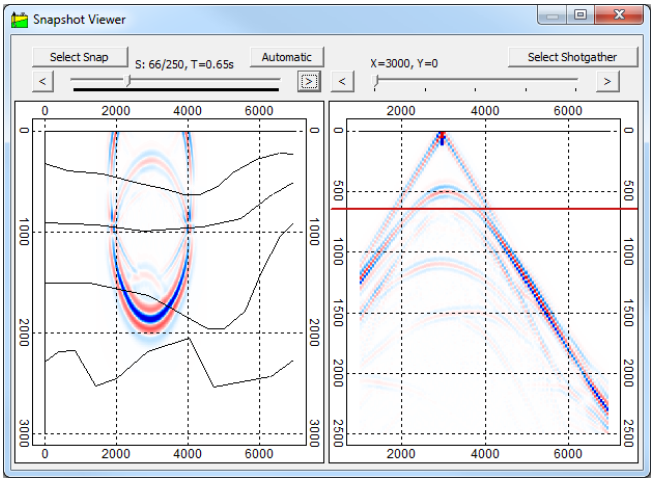
… allows approximating wave propagation in conditions of realistically heterogeneous (in all 3 directions X-,Z- and Y-) medium. This modelling can be applied to the objects like reefs, salt domes, different kinds of collapse/breakthrough chimneys or steeply inclined faults etc. in the areas where an accurate 3D reservoir characterization is required.

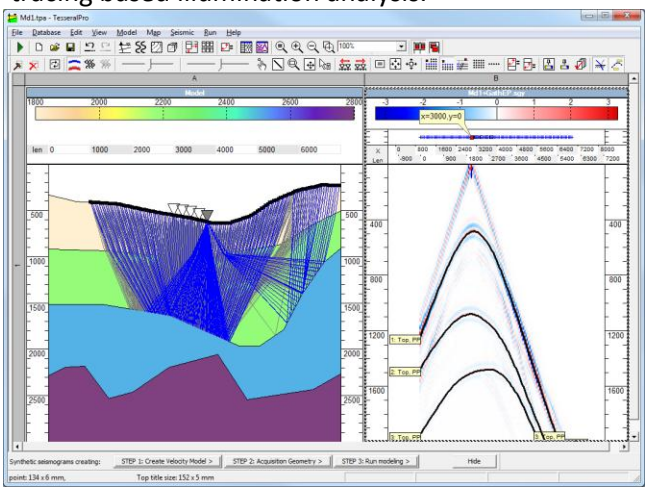


2.5-3D-3C Full-wave (finite-difference) modelling, due to its computational intensity, is based on *Parallel Options* including *multi-core, -node, -GPU* solutions allowing to run such simulations in a feasible turnaround time.

Visual Analysis Tools: Snapshots and Ray Tracing

To research the generated synthetics *Tesseral Pro* provides analysis tools including ray-tracing of target horizon and controlled movies of wave propagation (snapshots). The ray-tracing analysis supplements finite-difference modelling methods by ability to identify the events corresponded to either compression or converted waves reflected from target objects on a synthetic seismograms. Ray paths are visualized and can be grouped by the reflecting horizon in combination with a common shot point, a common receiver or a common reflection point. The ray-tracing analysis can also be supplemented by ray-tracing based illumination analysis.





Seismic Imaging

For more accurate research of the survey features, *Tesseral Pro* contains different pre-processing, pre- and post-stack processing procedures including gathering, NMO/STACK, 2D pre- and post-stack time and depth migrations, VSP-migrations, time/depth transformations, etc.

Presentation Graphics

Using the WYSIWYG approach you can combine maps, cross-sections, 2D and 3D drawings, multi-parameter models, seismic cross-sections and cubes, pictures and text strings to create high quality plots. Both overlay and controlled transparency of fields are supported. Composed documents can be either printed or exported in multiple picture formats.