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Multi-Parameter Medium Model

for Seismic Data Processing

& Interpretation

Worldwide

Tesseral Pro – *Suite of Modelling Solutions for Seismic Survey Planning, Processing and Interpretation QC*

Tesseral Technologies Inc. since 1997 provides exploration geophysicists with software for modelling based analysis of complex geology effects on seismic survey.

Tesseral Pro is a user-friendly Windows program with highly optimized computation engine for a multicore PC with or without GPU, a computing cluster or a local network. It generates synthetic shotgathers, wavefield snapshots and illumination maps for realistic detailed models with true support of converted waves, thin layering, viscosity, complex anisotropy and fracturing.

Tesseral Pro allows:

✓ to design 2D or 3D survey and compute fold and illumination maps;

✓ produce compound multi-parameter model from available geophysical and geological data such as velocity cube, horizon maps, faults, well trajectories and tops, well logs;

✓ or to design geologic-geophysical model from a scanned picture or just from your imagination;

✓ to generate and process 1D/2D/3D multi-component (up to 9C) and passive seismic synthetics using wide set of methods and wave equation approximations;

✓ to visualize and investigate 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. 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.
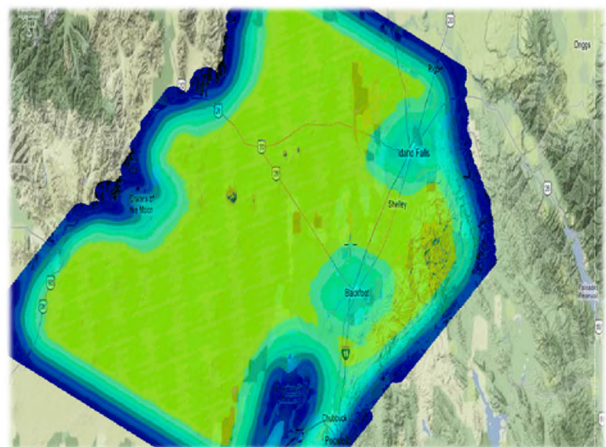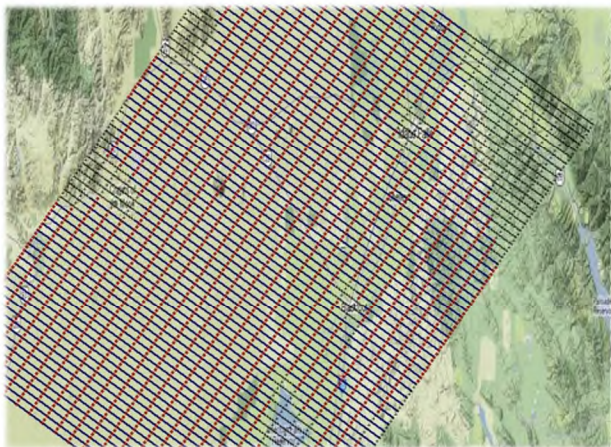

A picture of the field map, a space photo or a scan of Google map can be put in background during the survey design. Fold map is quickly calculated. Illumination maps are calculated for the imported target object maps.
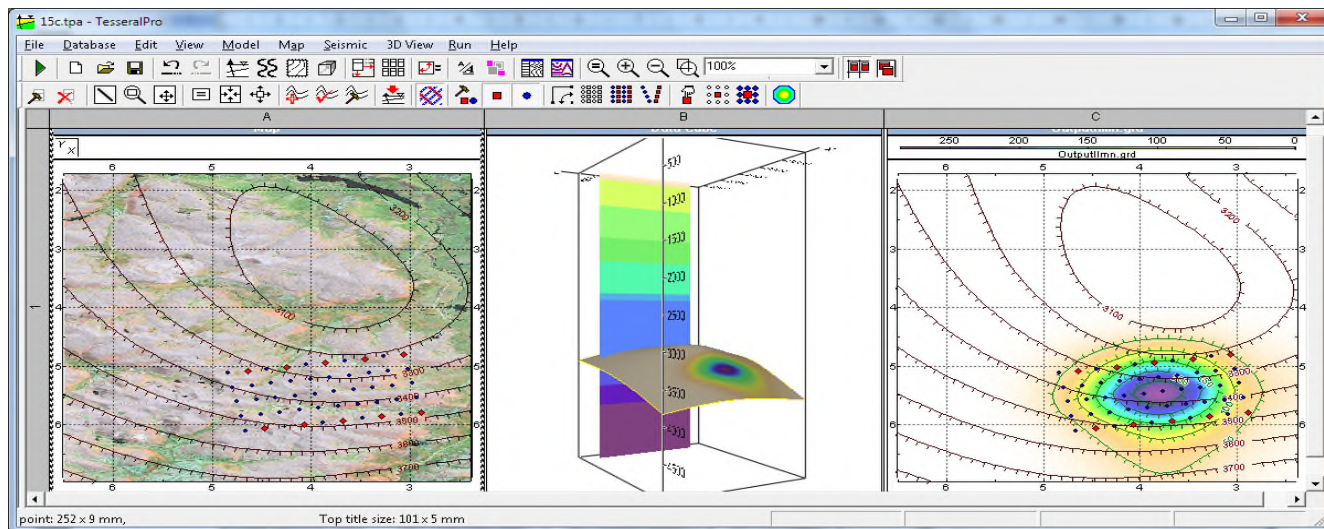
From left to right: (1) the target horizon and the survey, (2) the illumination in 3D, (3) the illumination map.

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.
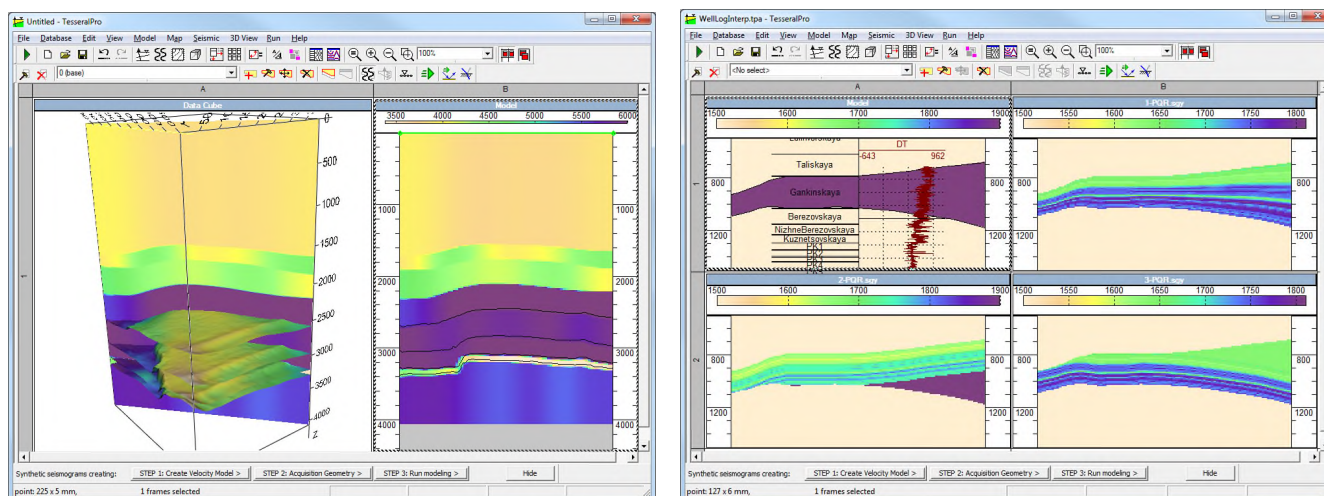

A set of gridding methods and thin-layer interpolation modes can be used together for automated development of realistic multi-parameter models

2D Model and Survey to Generate Synthetics

Full-wave 3D simulation methods are too complex to generate and process synthetics during routine survey planning. Using less precise 2D and especially 2.5D 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.
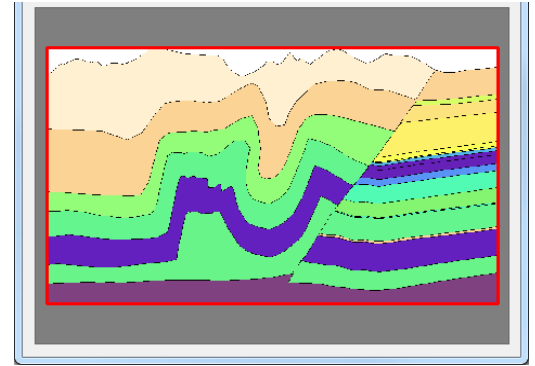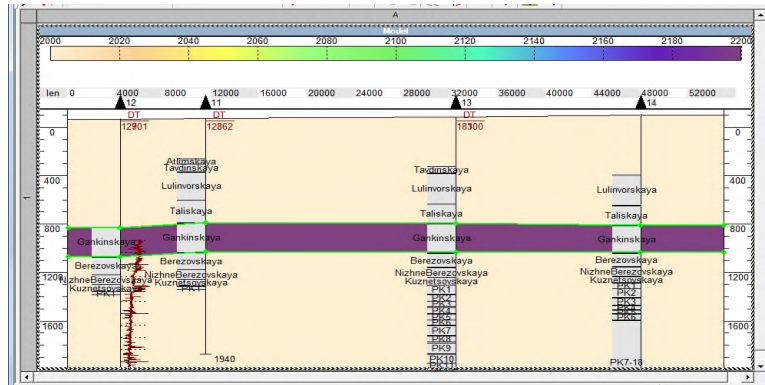
Shotpoint and receiver positions are derived from the basic 3D survey if it exists. Else they can be imported from SPS, SEG-Y, or a simple text format. One can specify a 2D survey step-by-step using a special wizard.

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 Visco-Elastic 3D TTI Anisotropic Method to Generate 3D-9C Synthetics

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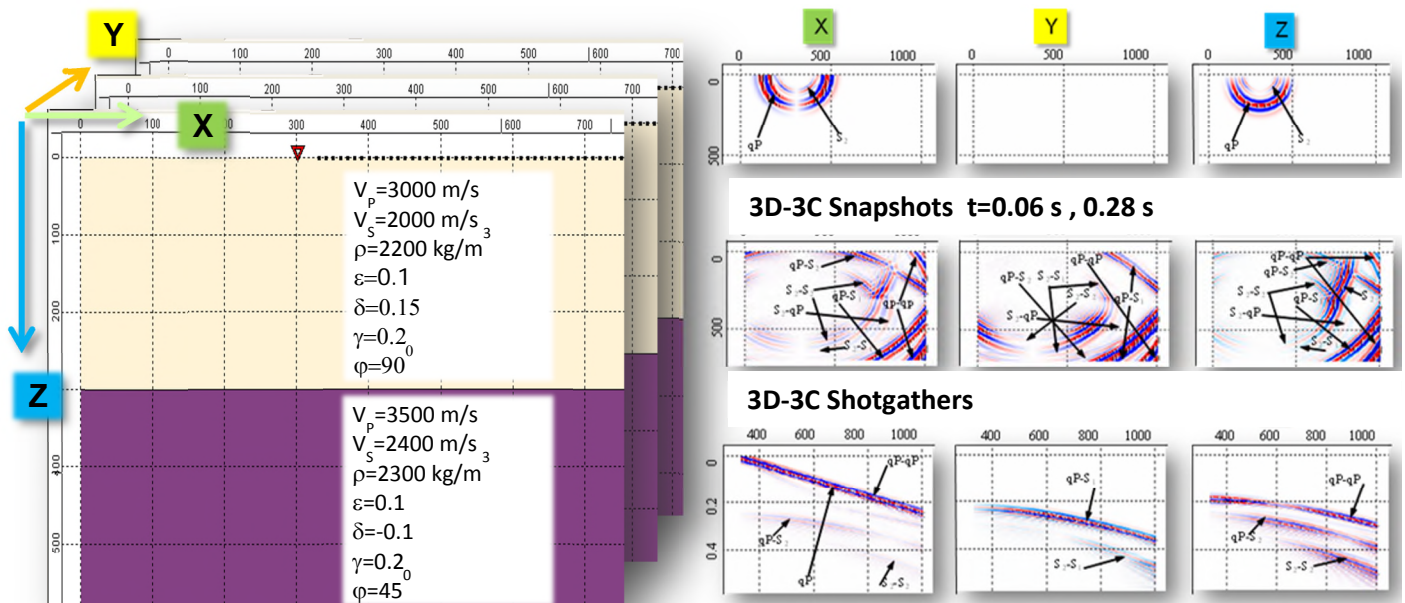
The 2.5D method generates all type waves including qP, qSV(S_2) and SH(S_1). Arrival time of the reflected converted PS_1-wave is less, than of the reflected converted PS_2-wave.

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. (Don't mismatch the ray-tracing analysis with the Ray Tracing method of synthetics generation and the Ray Tracing based illumination analysis also provided by **Tesseral Pro**.) 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.
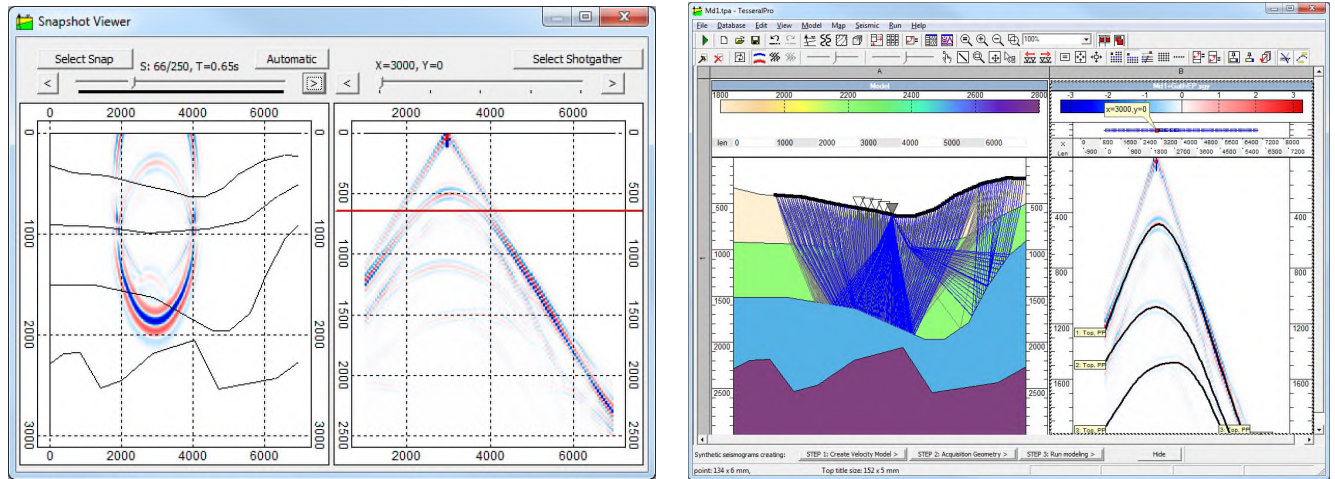
Pre- and Post-Processing

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