SeisLink Velocity

Calibrated Seismic Imaging and Interpretation
Accurate Solution for Prospect Depth, Size & Geometry
Accurate Time-to-Depth Conversion

SeisLink Solutions

Explorationists can have fullfilling expereince in drilling successful wells by utilizing sound **SeisLink** technologies, which provide geologically feasible solutions for velocity modeling and applications strongly influenced by velocities, such as, seismic depth imaging, time-to-depth conversion, depth adjustment after PSDM and pore pressure prediction.

SeisLink Tools: A suite of novel technologies had been developed at Unocal Corp. and further developed at SeisLink. The unique set of tools were packaged and licensed as a part, of solutions which enable geoscientists to build velocity models using seismic and well data. Also SeisLink has developed imaging tools, such as curved-ray PSTM, Kirchhoff Pre-stack depth migration and reverse time migration.

What do we offer for Oil and Gas industry?

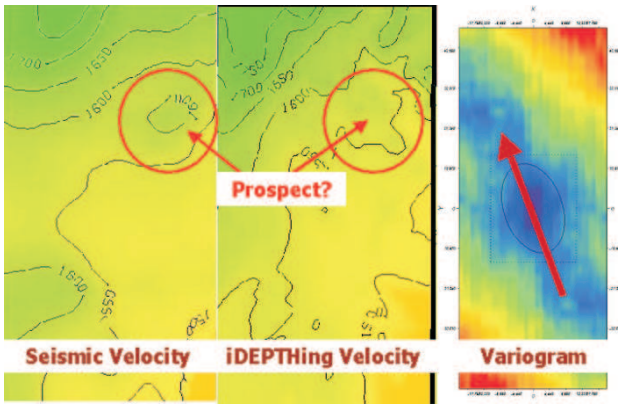
SeisLink's novel technologies have been put into the test over a decade with tremendous drilling success. We offer 1) technology development for target basins for national oil companies, 2) software development and licensing, 3) services on imaging, time-to-depth conversion and pore pressure prediction.

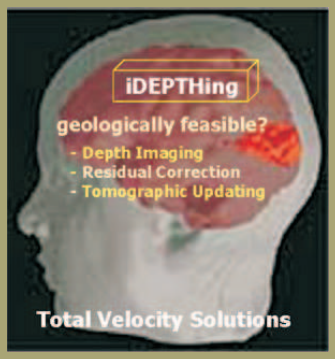
Key Technologies

__3D Geostatistical Velocity Assessment and Model Building
__Cell-based Reflection Tomography
__Time-to-Depth Conversion combining Seismic and Well Data
__High Resolution Velocity Modeling for Pore Pressure Analysis
__Residual Moveout Correction using Dip-corrected Residual Moveout Equation
__Seismic Depth Imaging

Time-to-Depth Conversion

Accurate time-to-depth conversion is essential for generating, assessing prospects and well planning. **SeisLink Velocity** handles depth conversion making use of seismic and well velocities, which has significant advantages over typical single-function conversion. Seismic velocities were improved in terms of higher resolution (left figure) and structural anisotropy. The result of geostatistical Kriging shows anisotropy





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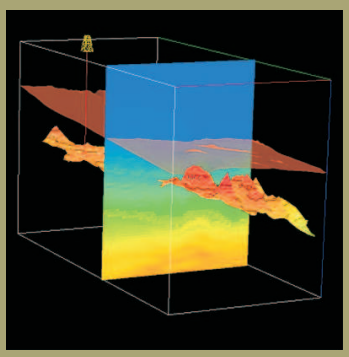


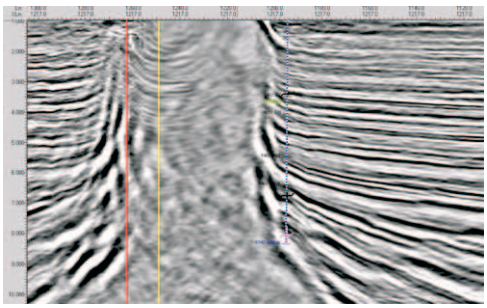
Products

iP3
iRTM
iDEPTH
iPRIM
iTOMO

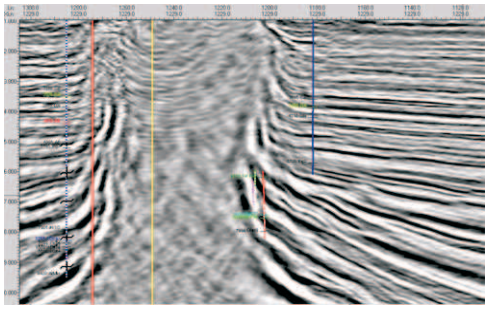
Indicating rock property changes in NNW direction. As a result of checkshot calibration, the prospect size was 40% smaller. Only one check-shot made the difference for this work in a 200-block offshore area. Geostatistical methods for calibration was advantageous. The drilling result confirmed that our evaluation was accurate.

Prestack Depth Migration (PSDM-onshore GOM)

Remarkable pre-stack depth migration results were generated by using iDEPTHing interval velocities and Kirchhoff pre-stack depth migration with hybrid paraxial ray tracing. PSDM used the same data that were applied pre-stack time migration.



PSDM-1

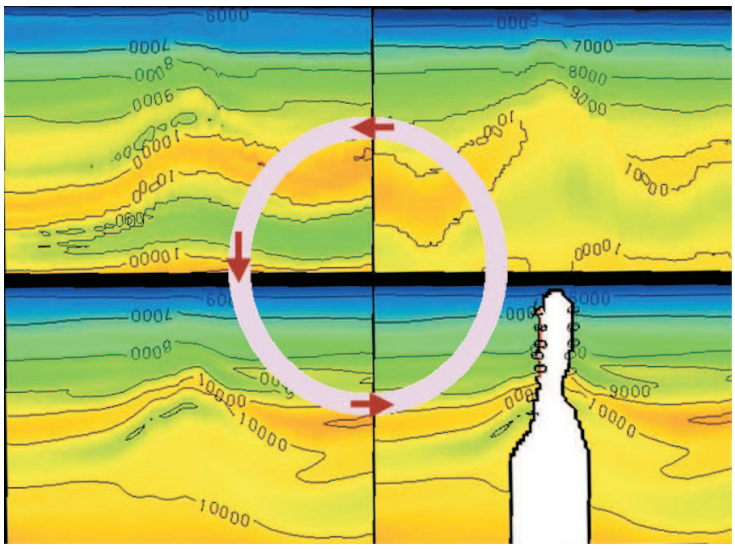


PSDM-1

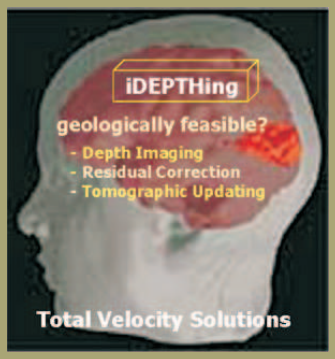
PSDM shows improved imaging of salt boundaries and dipping events are migrated to better positions of flat bed termination. However, the flat events are equally well calibrated both in PSTM and PSDM.

Velocity Modeling Cycle

Velocity modeling takes the following procedures, 1) Variogram modeling for startigraphic units and Kriging, 2) checkshot calibration, 3) tomography update after PSDM, 4) salt flooding if necessary.



Velocity modeling procedure for PSDM-onshore-GOM



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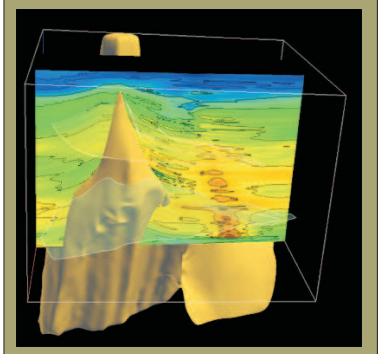

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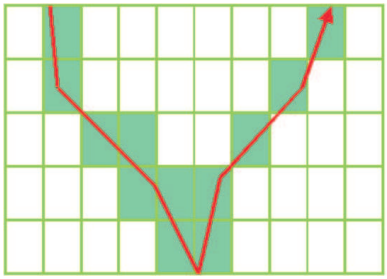
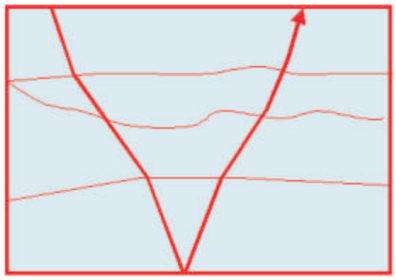
Tomographic Velocity Updating (iTOMO)

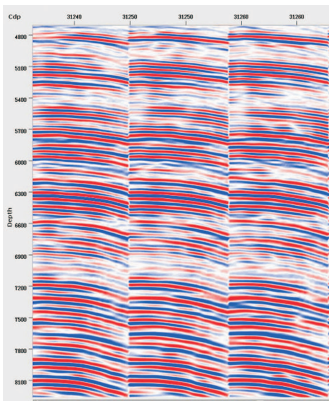
Pre-stack depth migration will generate common image point gathers (CIPG). Residual velocity errors are scanned for tomographic inversion. For given common image point gathers (CIPG),ray tracing computes path lengths of cells along the ray and residual time errors are used as data for tomographic inversion. Skeletons are auto-picked as horizons. RMO are auto-picked and quality controlled for inversion. Cell-based tomography is more flexile to solve problem in geologically complex areas.



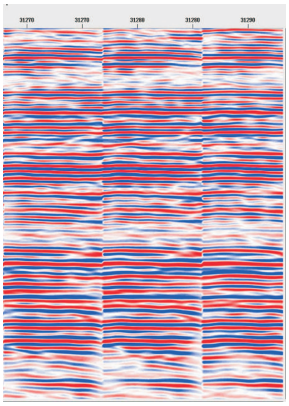
Cell-based



Layer-based



Gathers before tomography

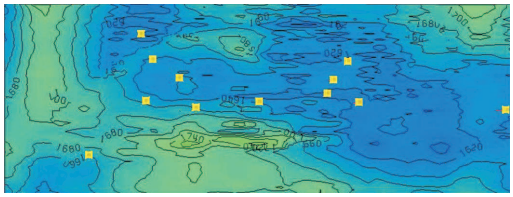


Gathers after tomography

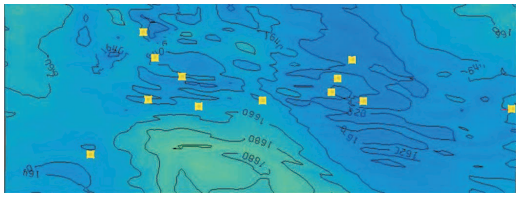
Demigration and parsimonious migration loop make iteration efficient. Anisotropy analysis allows to incorporate well tying and imaging. A turn key solution with proper hardware can solve tomography more effectively.

Regional Well Calibration(iDepth)

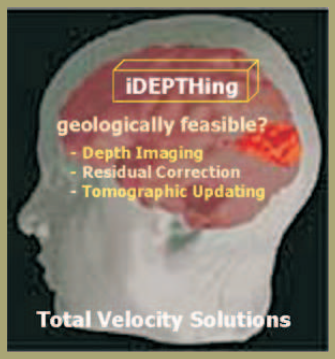
Regional well calibration not only corrects vertical depth adjustment to tie well tops but also corrects lateral heterogeneity. Identifying stratigeaphic units, well data can be calibrated to correct vertical thin-layer effect and lateral velocity variations.



Before well calibration



After well calibration



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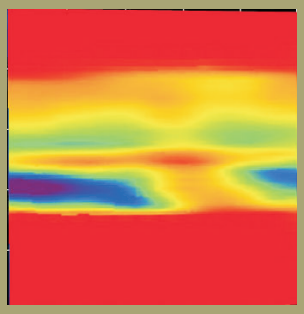

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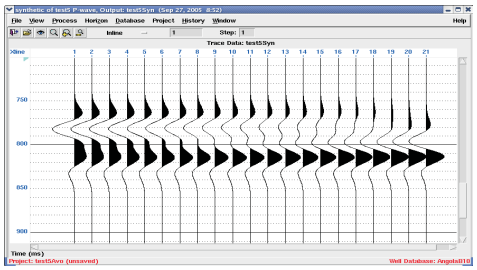
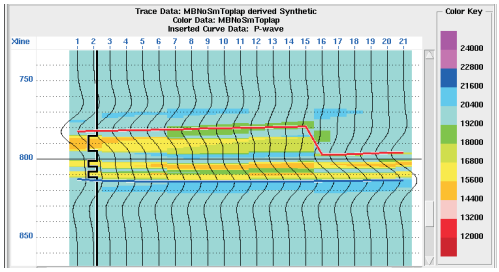
IPay

i*PAY* (monochromatic Pay Thickness) estimates net-pay thickness for stacked thin beds. Errors in net-pay thickness will turn into errors in reserve estimation, a critical but often unreliable component in prospect evaluation. The thickness of thin beds below seismic resolution is commonly estimated either by using amplitude or by resolving the thin beds with resolution enhancement. There are a myriad of inversion and resolution-enhancement methods aiming at resolving thin beds, which can be worthwhile *if* the thin beds can indeed be correctly resolved after enhancement. However, depending on the data, stacked thin beds of economic value often cannot be correctly resolved.

Features / Benefits:
Net-pay thickness of stacked thin beds below seismic resolution.
Target oriented analysis.
Do not modify the seismic frequency content.
No need for wavelet information.
Need at least one calibration well.
Can produce redundant solutions for quality control and statistical analysis



Seismic response of stacked thin bed

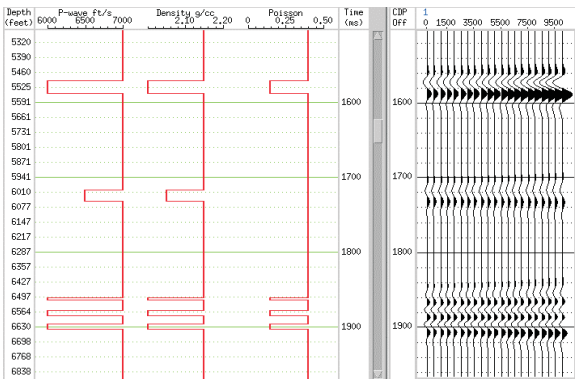


Impedance inversion result

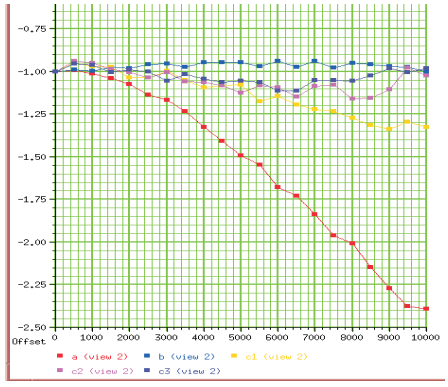
IAVO

i*AVO* (monochromatic AVO) is an AVO analysis tool that sees through wave interference (tuning), a common cause of false AVO indicators. i*AVO* exploits two ideas that contradict intuition: 1) High resolution can harm AVO analysis, and 2) low-frequency energy carries useful information of thin-bed rock property.

Features / Benefits:
True AVO response to rock properties rather than wave interference.
Target oriented analysis.
Not a scheme to compensate tuning effect.
No need to estimate wavelet.
Does not boost noise in spectral notches.
NMO stretch is readily handled.
Can produce redundant solutions for quality control and statistical analysis



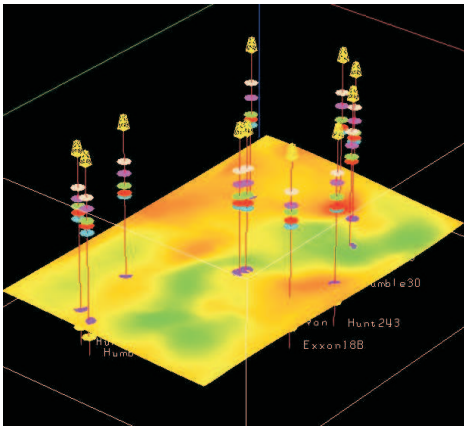
Synthetics with blocky, wet and stacked gas event

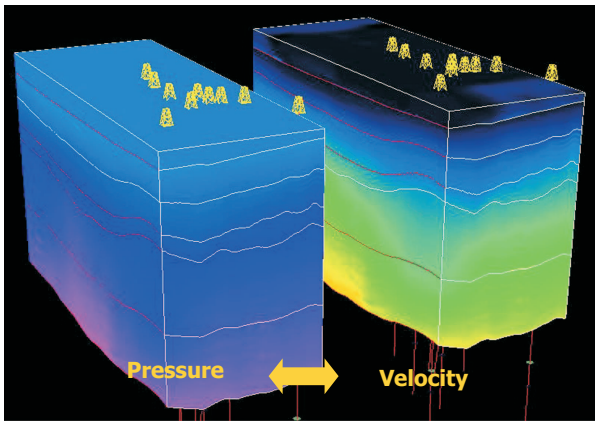


AVO curves

Pore Pressure Prediction(iP3)

Regional well calibration, well data integration and reflection tomography will insure us for geologically accurate velocities. Our advanced migration and velocity-pressure conversion techniques utilize geostatistics and well data calibration to deliver better results using our own tool iP3.





Pressure prediction from well and seismic data

Velocity Tools

iDEPTH: 3D Velocity Modeling and Calibration
iTOMO: Cell-based Reflection Tomography
iPRIM: 3D Residual Focusing
iP3: Pore Pressure Prediction

Imaging Tools

iRTM: Reverse Time Migration
iKZMIG: Kirchhoff Pre-stack depth migration
iKTMIG: Kirchhoff Curved-ray Prestack time migration

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