Kingdom™ Seismic Inversion

Spend time analyzing and improving results not moving data

S&P Global
Commodity Insights

Applying seismic inversion to predict reservoir properties is traditionally performed with specialist software packages where it is common for the geophysicist to spend more time with data import, QC, and export rather than analyzing and validating the results with the rest of the team.

Kingdom Seismic Inversion helps you get maximum value from your seismic data and make the best use of your time by providing advanced and integrated prestack and post stack seismic inversion so you can spend the most time in areas of the workflow that are the most important.

Benefits

Improved Outcomes – Produce more comprehensive results with confidence by leveraging the strengths of the entire technical team to analyze and integrate results in real-time during the seismic inversion process.

Workflow Efficiency – Eliminate days or weeks from the back and forth between specialist apps or service providers and the interpretation platform to speed up time to first results and project completion.

Ease of Use – Utilize a complete suite of guided workflows and approaches that can help you solve a broad range of geologic challenges such as predicting geo-mechanical properties or identifying fluid and lithology changes with ease and accuracy.

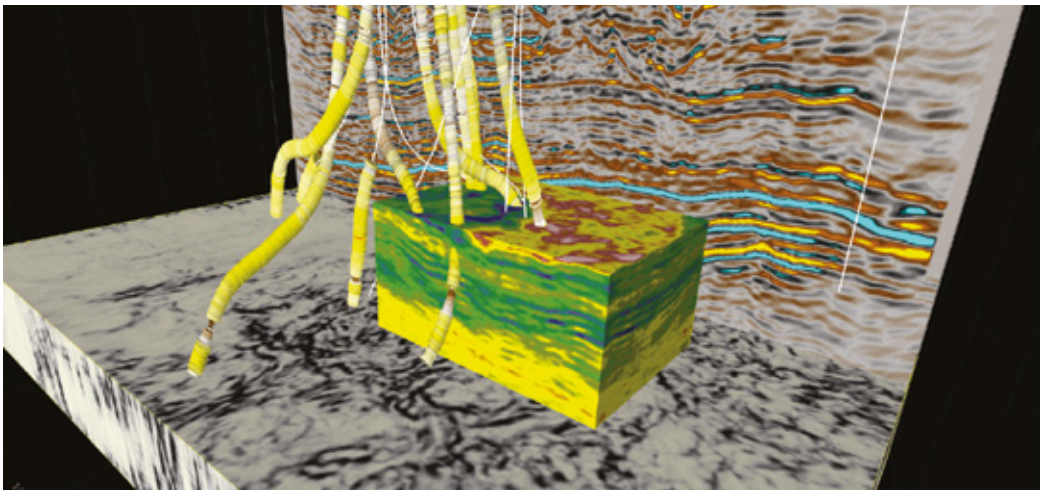

Figure 1. Prestack inversion results ready for interpretation are visualized with input amplitude, fault attribute, and critical well data.

Key Workflows

Colored Inversion

Colored Inversion is a robust method for "quick-look" inversion that allows you to match the amplitude spectrum of the seismic to that of the acoustic impedance logs in the project area. The result is a relative impedance seismic data type that can be much cleaner, easier, and more reliable to interpret than amplitude seismic.

Its speed and simplicity mean that it can be applicable to most data sets. It is most ideal for exploration areas with little well data or as a first step to determine feasibility in a detailed inversion project for seismic reservoir characterization.

Key features include:

- Ideal 'quick-look' inversion tool for use prior to more detailed inversion studies
- Supports single and multi-well analysis for matching seismic to well acoustic impedance
- Automatic seismic to well phase correction
- Doesn't require a wavelet or low frequency macro-model

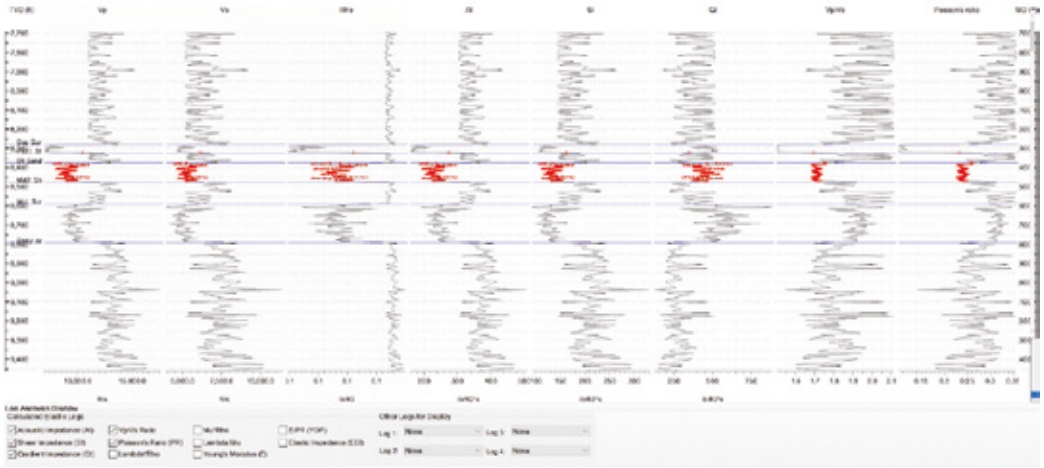

Figure 2. Generate key Petrophysical and Elastic Logs from Vp, Vs, and Density. Red highlights intervals from cross-plot polygon.

Simulating Annealing Inversion

Simulated Annealing Inversion derives both relative and absolute acoustic impedance from stacked seismic data. It uses the global optimization technique of simulated annealing to provide results that best match the seismic data guided by an input model. This model driven approach enables the impact of seismic wavelet to be removed while achieving the transformation from boundary to layer properties.

Impedance seismic volumes derived by this form of inversion are critical for predicting geologic reservoir properties between wells using seismic data.

Key features include:

- Generates relative and absolute impedances and a synthetic seismic section for QA
- Minimal input requirements (a good sonic log over the target zone, T-D curve, volume to invert)
- Built-in HiDef velocity volume generation for low frequency model
- Guided workflow facilities use by the interpreter or the expert geophysicist
- As a layer property it is ideal for interpretation and petrophysical characterization

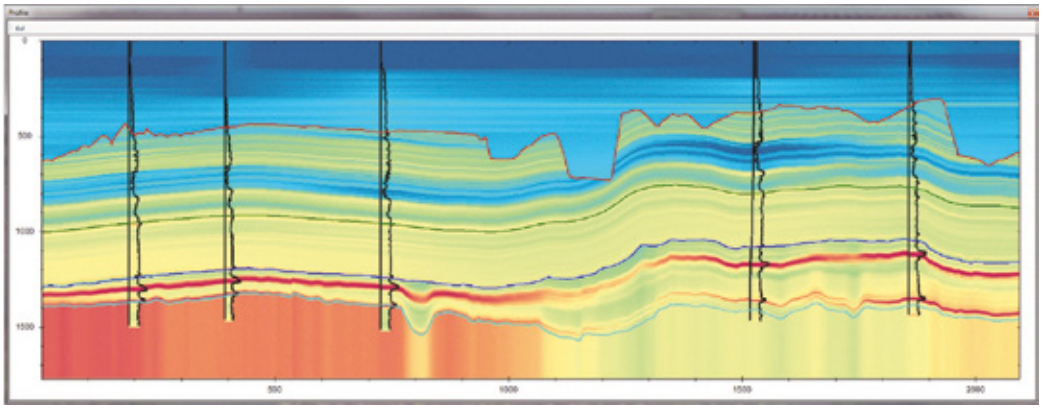

Figure 3. HiDef macromodel builder with the high-resolution input for simulated annealing inversion. Well data and model show a very good match.

Prestack Inversion

Accurately predicting sand from shale and wet from hydrocarbon bearing reservoirs using seismic data requires an inversion workflow that produces shear impedance at a minimum and density impedance in a best-case scenario. These cannot easily be derived from simple stacked data, but by utilizing offset stack information, such as angle stacks or AVO intercept and gradient stacks. Kingdom pre-stack inversion provides the tools and workflows to create these essential seismic data sets along with innovative workflows to best apply them for improved reservoir understanding.

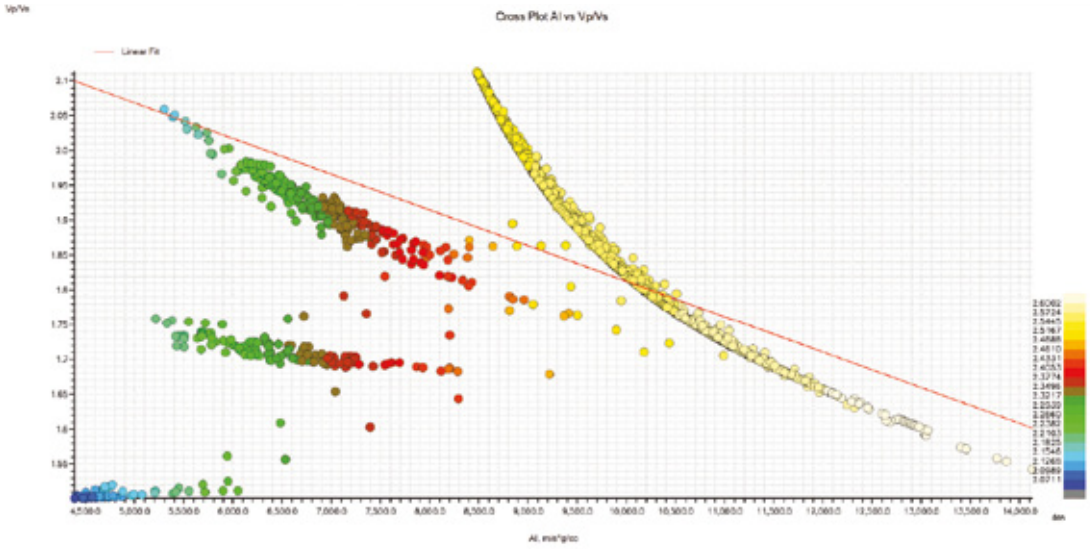

Figure 4. Cross-plot result indicates that fluid and lithology can be separated better when adding Vp/Vs as a second attribute in addition to Acoustic Impedance. Color Values are Porosity.

Cross-plots and correlation sections are generated to examine rock and elastic properties and petrophysical parameters to determine which help best meet your objectives.

After inversion, the appropriate petrophysical and elastic seismic volumes can then be derived for your particular geological setting. For example, Vp/Vs and AI for conventional reservoir's and Youngs Modulus and Poisson's ratio for unconventional targets.

Key features include:

- Easy generation and cross-plotting of elastic logs against any well log in the database
- Ability to correlate petrophysical or elastic logs to the extended elastic impedance (EEI) log
- Built-in AVO analysis on angle stacks
- Constrained, cascaded inversion to acoustic impedance, shear impedance, and density
- Transformation of inversion results to elastic or petrophysical volumes such as EEI, Poisson's ratio, Young's modulus etc.
- Visually highlight parameters on the seismic section via polygons on the cross-plots

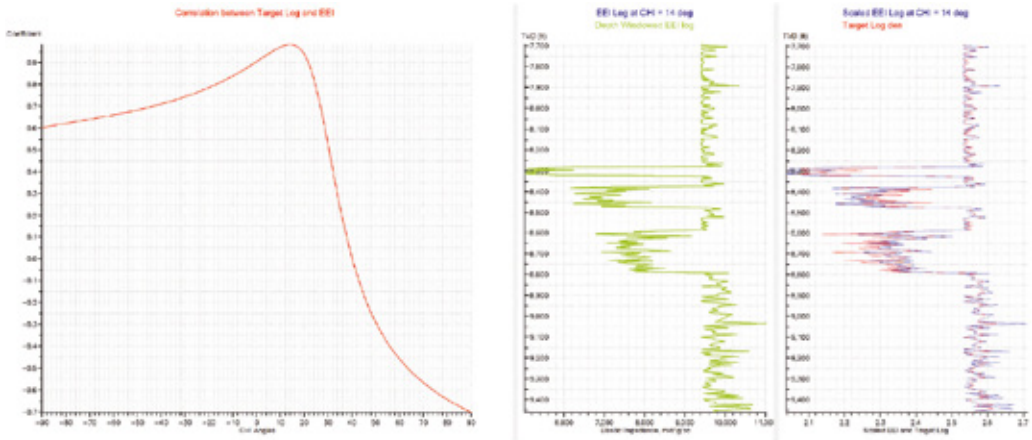

Figure 5. Extended Elastic Impedance tool measures correlation with important properties such as GR, porosity, and water saturation.

Key outputs from Kingdom Seismic Inversion

- Relative Acoustic Impedance
- Acoustic Impedance
- P Reflectivity
- S Reflectivity
- Density Reflectivity
- Shear Impedance
- Density Impedance
- Vp/Vs
- Poisson's Ratio
- Lambda*Rho
- Mu*Rho
- Lambda Mu
- Young's Modulus
- E/PR (YOP)
- Gradient Impedance
- Extended Elastic Impedance
- Litho-Fluid Cross Plot Class Volumes

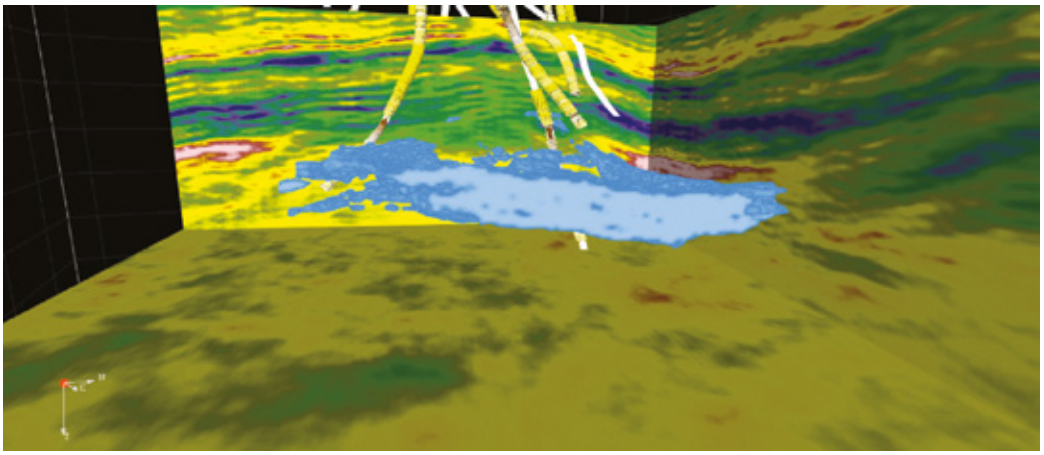

Figure 6. Volume sculpting of Litho-Fluid output (in blue) highlighting a key target body.

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CONTACT US

Americas

+1 800 447 2273

Europe, Middle East & Africa

+44(0) 134 432 8300

Asia-Pacific

+604 291 3600

Japan

+81 3 6262 1887

Customercare@ihsmarkit.com