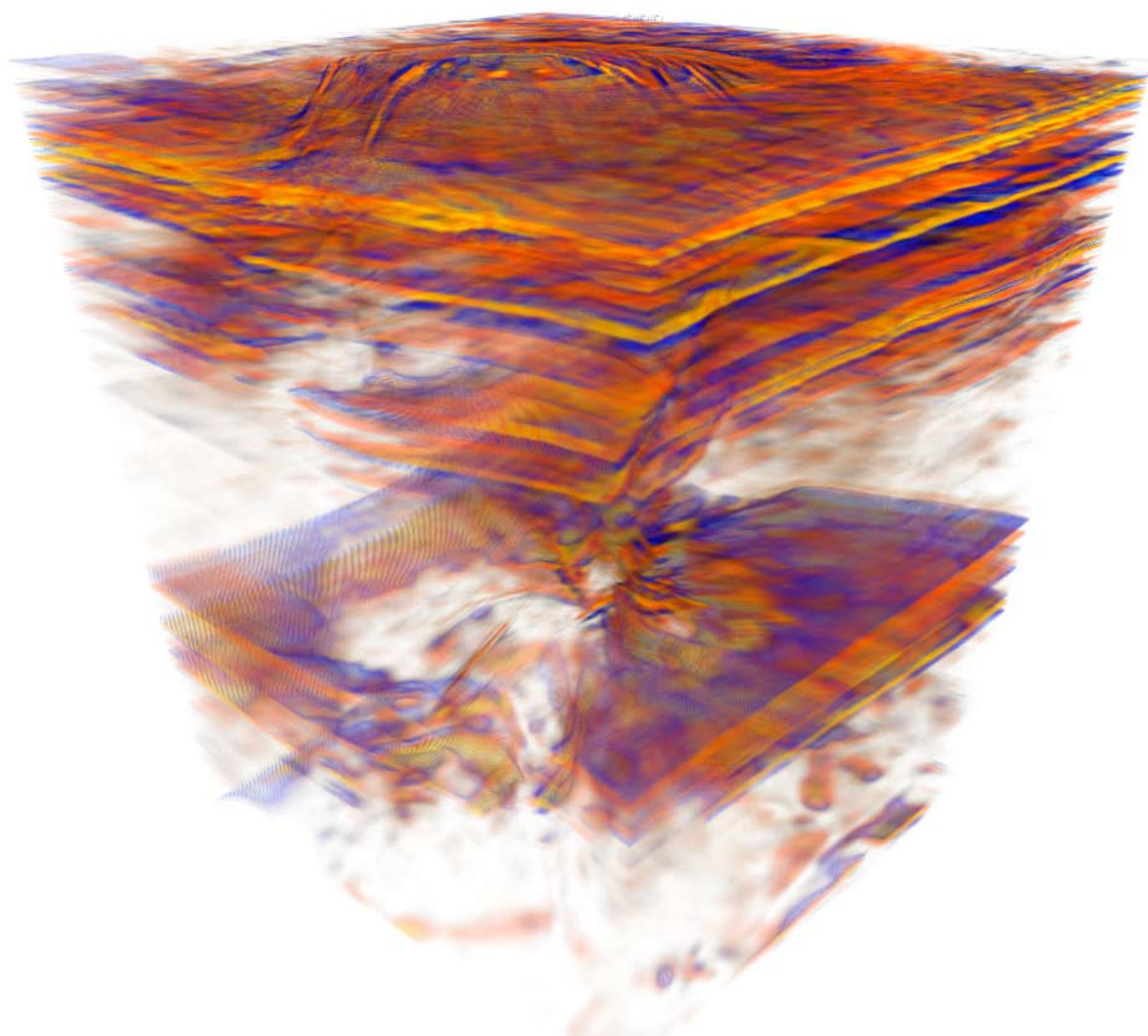


An Integrated, Real Time Velocity Model Building Solution

- **Faster and Better Velocity Models**
- **More Prospects with the Same Resources**
- **Reduced Drilling Risk**



FROM PROCESSING TO INTERPRETATION

The Rise and Rise of Velocity Modeling

With oil and gas demand continuing to outstrip supply, reservoirs becoming more complex, and operators under pressure to generate more prospects with fewer resources, the building of accurate velocity models to better target hydrocarbon reserves has never been more important.

From Kirchhoff to wave equation to beam migration techniques, pre-stack depth migration (PSDM) and its ability to move seismic reflections to their correct positions in space through accurate velocity models, has become an industry norm.

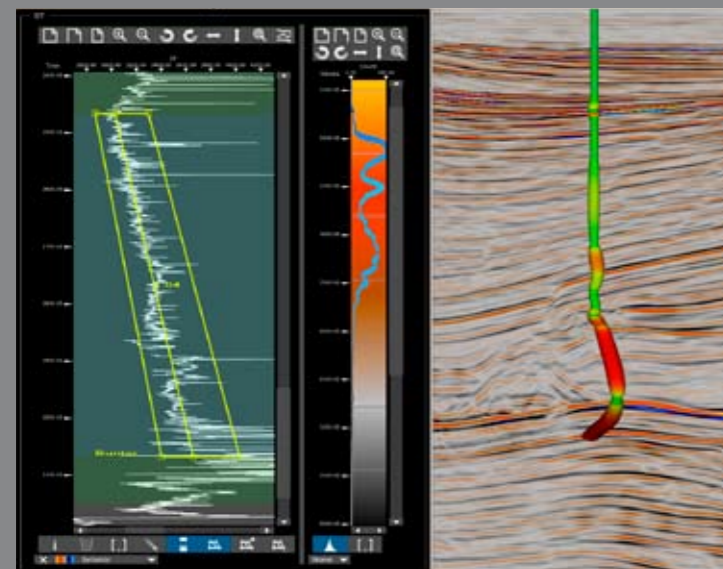
Challenges, however, remain. Velocity model building, migrations, model editing, and the running of tomography all too often suffer from a lack of integration, with a fragmented workflow between geologist and geophysicist, delays over migrations, and inadequate interpretation capabilities. Frequently, there are delays between the signing of leases and the go-ahead on drilling.

Introducing PGS hyperBeam

- Faster and Better Models
- More Prospects
- Reduced Drilling Risk

Petroleum Geo-Services (PGS) is addressing these challenges through a genuine industry breakthrough - PGS hyperBeam, a real time, velocity model building solution that generates faster and better models, more prospects with the same resources, and reduces drilling risk.

Through a collaborative workflow, PGS hyperBeam is making that vital transition from processing to interpretation, bringing the geologist and geophysicist closer together, creating faster and more precise velocity models, and shortening the exploration to production lifecycle.



A suite of well analysis tools within PGS hyperBeam utilizing the visualization capabilities of holoSeis. Well attributes can be displayed in 2D or 3D environments and analysis can be conducted based on geological intervals. Velocity gradients, maps, and starting velocities can all be obtained.

A Complete Solution – Reduced Cycle Times and Real Time Decision-Making

PGS hyperBeam leverages PGS' industry leading visualization and interpretation software, holoSeis® and its powerful hyperConnect™ scripting language to bring the AGS Beam processing and geophysical capabilities to the interpreter's desktop in one single, cross-disciplinary workflow.

A Real Time Decision-Making Workflow

- Bringing the Geophysicist Closer to the Reservoir
- RealTime Imaging ahead of the Drill Bit
- More Accurate and Robust Models

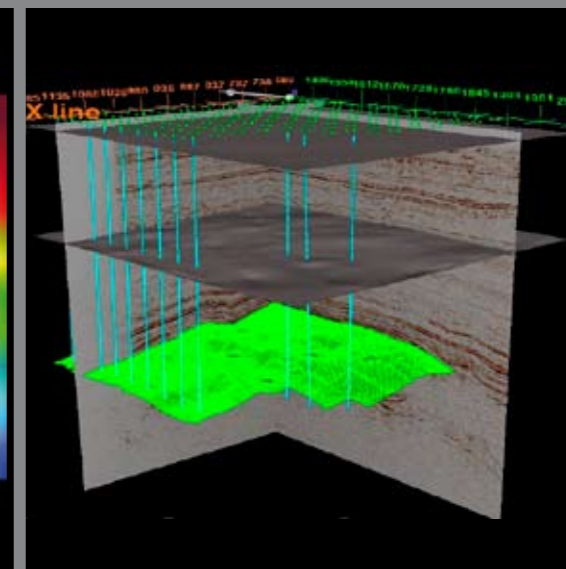
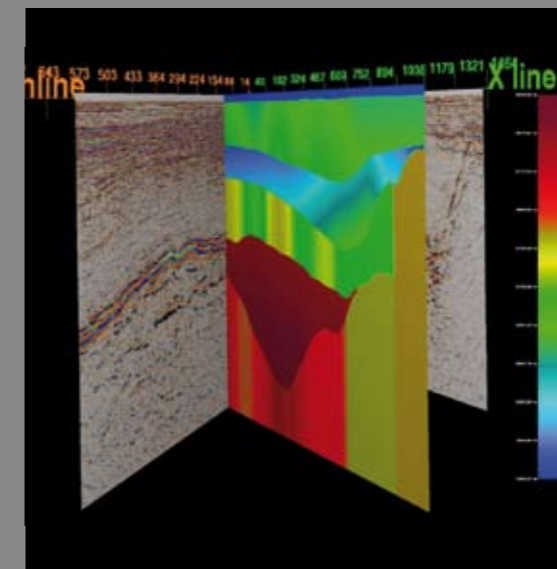
The reduced cycle time in building velocity models creates a real time, interactive decision-making environment. PGS hyperBeam brings the geophysicist closer to the reservoir with the real time imaging of surface seismic data just ahead of the drill bit.

A complete pre-stack depth migration, previously taking up to a week, is now completed in minutes with PGS hyperBeam. A full pre-stack TTI depth migration on 300 square kilometres, for example, now lasts under five minutes.

Users can have immediate access to stack data to allow for the next velocity model building step to begin with minimal wait time and migrations can even continue to run in the background while the current model is interpreted – all saving valuable time and increasing efficiencies.

PGS hyperBeam also allows for volumetric QC of model updates and its hyperConnect scripting system creates a full audit trail to cover all decisions.

Reduced cycle times also enable multiple velocity model scenarios to be tested within existing budgets and time frames, leading to more accurate and robust models and increased confidence when making those crucial drilling decisions.



The holoSeis Velocity Model Builder allows the user to view the model simultaneously with a number of data volumes and conduct map migrations of picked horizons.

A Wide Range of Interpretation Options

- 'What If' Scenario Testing
- Interpretation Capabilities Suited to All Geologies and Geometries

From subsalt in the Gulf of Mexico to the layered models of the North Sea, PGS hyperBeam has a wide array of interpretation capabilities suited to all geologies and geometries. Data can be interrogated and dissected with a maximum degree of flexibility with each oil and gas prospect going through more variations in less time.

'What if' scenario testing and depth demultiple, delta models, Eta scans, and tomography parameterization can all be evaluated within PGS hyperBeam's model building and editing workflow. Users are also able to access PGS' standard reflection tomography, Dipscan Tomography (which provides better edge detection), and PGS' wide-azimuth tomography solution, wTomo.

PGS hyperBeam has advanced capabilities for isotropic and anisotropic (VTI and TTI) velocity model building, imaging and tomography. Migration modules, such as ray path discrimination, improved tomographic inversion and proprietary techniques, such as SmartFlood™, have all been incorporated to provide a complete depth migration and imaging solution.

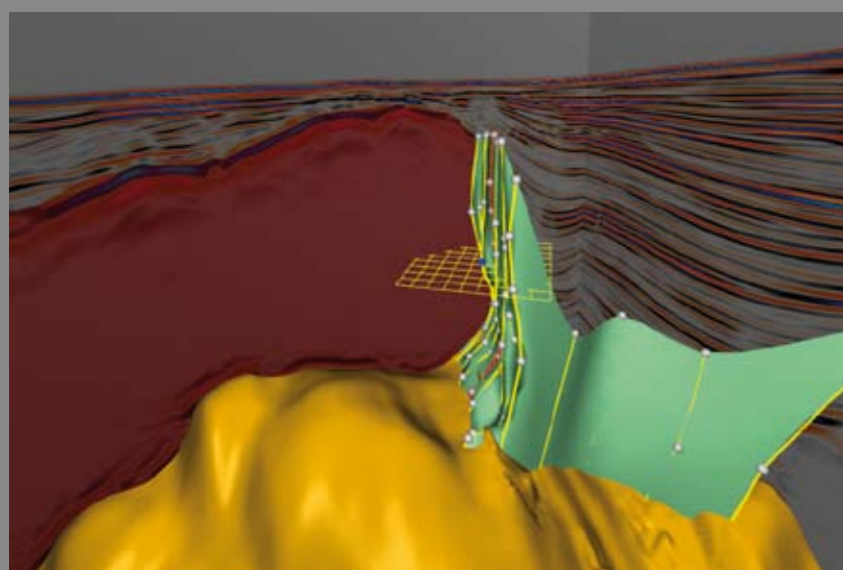
Finally, PGS hyperBeam gives users access to a wide variety of sophisticated model editing tools, including well log functionality, attribute overlay, horizon interpretation and manipulation capabilities of holoSeis. New editing capabilities in holoSeis also include the ability to create and interactively edit overhangs.

Fully Scalable With No Volume Constraints

- Full Volume Images in Minutes
- Seamless Integration with Existing Workflows

PGS hyperBeam is a highly customizable, open and fully scalable solution that runs on 'off the shelf' hardware and the Linux operating system, and can produce full volume images of hundreds of square kilometres in minutes. It can integrate seamlessly within an operators' existing depth imaging workflows or can be customized as a standard turnkey project within PGS' data processing centers in London and Houston.

Everybody has a velocity model building tool today. Nobody has a tool which allows you to conduct your model building so fast, so accurately and so efficiently, with no constraints on volume.



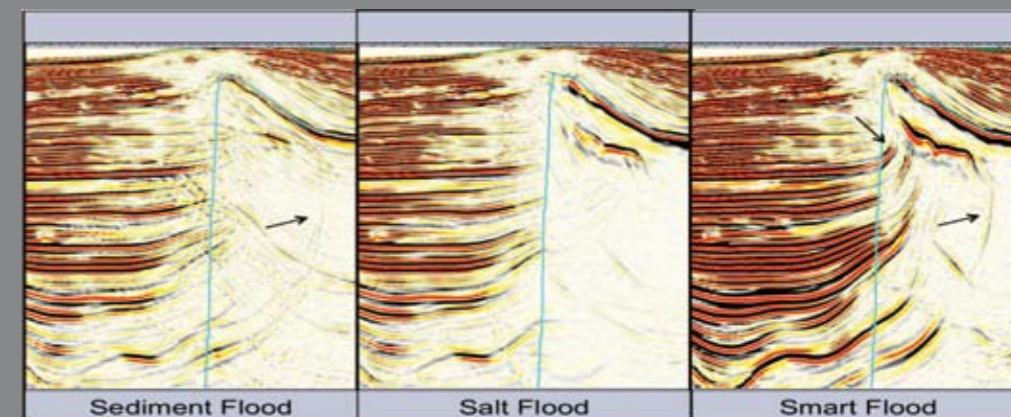
This image from the Gulf of Mexico illustrates the ability of holoSeis to create and interactively edit overhangs in a velocity model. The light green surface is built up by a number of lines, with each line developed by calculating Bezier curves between two or more control points and the user able to move these points around to alter the shape of the surface. Control points can be added to lines if more detail is required and more lines can also be added or moved. The movement is fully interactive, and any shape can be added. The grid indicates the plane in the 3D space that the mouse can move the control point in.

PGS HYPERBEAM – A TOOL FOR OUR TIMES

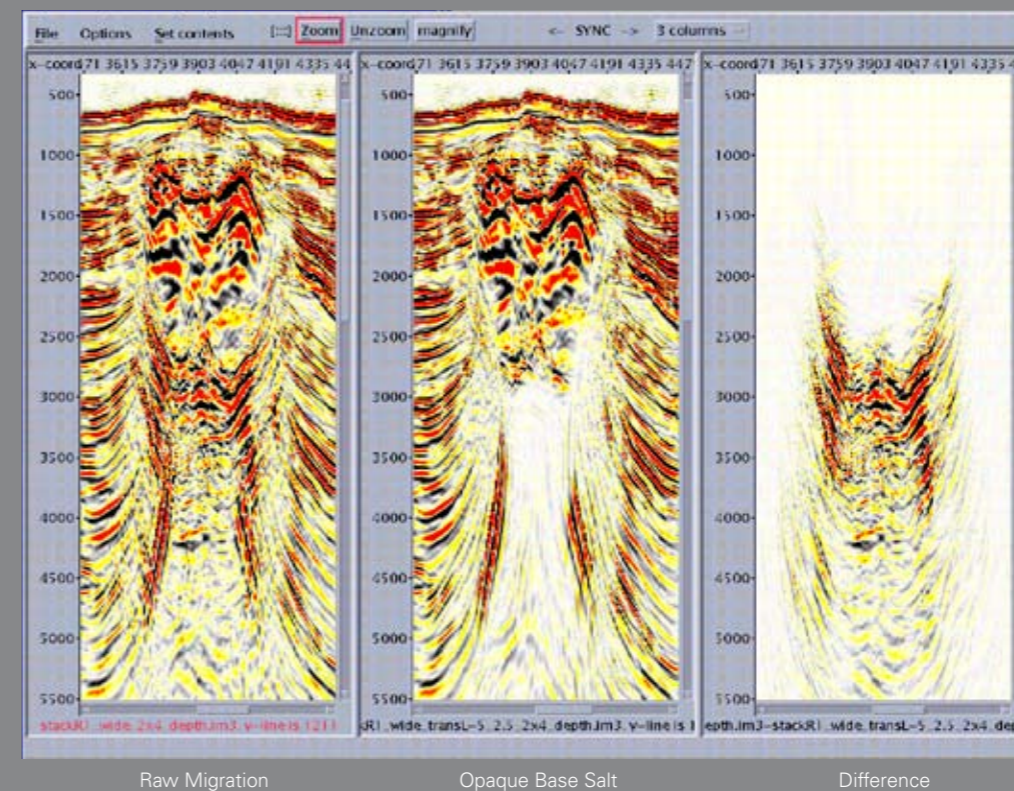
The faster cycle times, the testing of more scenarios, and an integrated workflow all lead to the ultimate goal for geophysicists, geologists, and interpreters:

Velocity Models That You Can Have Confidence In.

With the quality of depth imaging almost solely dependent on the quality and accuracy of the velocity models and with depth imaging the preferred tool for the most challenging of reservoirs, PGS hyperBeam is a tool for our times - a critical element in imaging the earth, generating more prospects, and reducing drilling risk.



Salt interpretation has been dramatically improved through SmartFlood. Combining the best features of sediment and salt flood migrations, SmartFlood provides improved interpretability of images in areas with steep salt-flanks through the correct positioning of steeply dipping, and overhanging, salt boundaries.



Ray path discrimination in the deepwater Gulf of Mexico.

MORE THAN THE SUM OF ITS PARTS – PGS HYPERBEAM'S CORE TECHNOLOGIES

PGS hyperBeam has been developed around three core technologies – the AGS PSDM and tomography software, the PGS holoSeis visualization and model building system, and PGS' hyperConnect scripting language.

The AGS Beam PSDM - Much More Than An Algorithm!

At the heart of PGS hyperBeam is the AGS Beam migration code – a technology that can be traced back to the early 1990's and which is known today as the AGS Pre-Stack Depth Migration (PSDM) algorithm.

AGS Beam migration, which has three key steps – Decomposition, Migration and Reconstruction – provides an effective alternative to traditional Kirchhoff and Wave Equation techniques by combining the steep dip benefits of Kirchhoff and the multi-arrival imaging of wave equation. Because of its ability to handle multiple arrivals, it is well suited for complex geologies.

Functionalities include ray path discrimination techniques and ray tracing routines, which support spatially varying TI earth models for better images around salts, gas clouds and other anomalies. As well as faster migrations, the Beam migration also incorporates a focus discrimination which effectively acts as a demultiple routine to provide cleaner output gathers for RMO analysis.

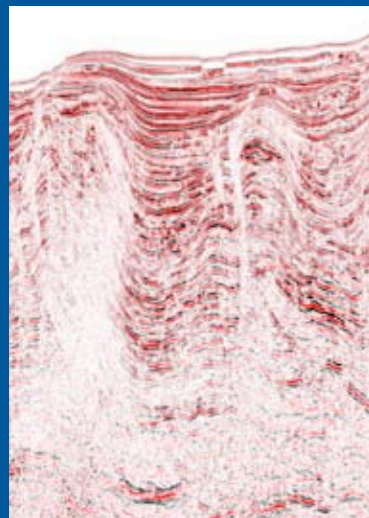
The Beam migration also offers residual move-out correction. The 3D RNMO procedure provides automated gather flattening in the most complex of

areas and is especially useful at depth, where offset constraints hamper the effectiveness of tomography.

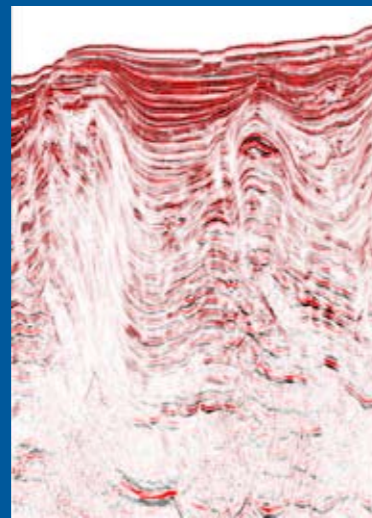
The AGS Beam's ability to handle steep and overturned dips, reject coherent noise, incorporate anisotropy speed for migration iteration, as well as its wide array of functionalities and migration modules, has made it much more than just an algorithm. Today, it is an extensive toolkit for depth imaging and velocity model building.

PGS HYPERBEAM MIGRATION MODULES

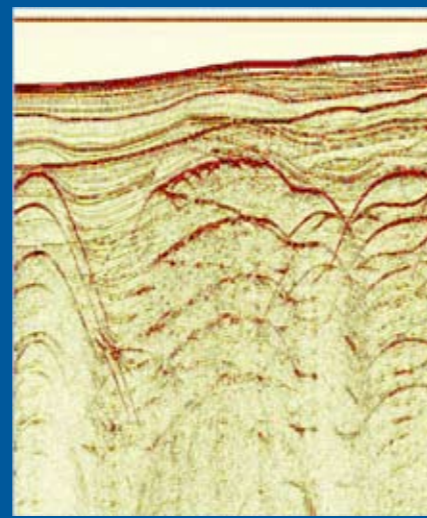
1. Beam Migrated Common Image Gathers (CIGs) & Stack
2. Isotropic & Anisotropic (VTI/TTI)
3. Depth Demultiple
4. Reflection & Dipscan Tomography
5. Ray Path Discrimination
6. SmartFlood™
7. 3D RNMO



PSDM with poor steep dip imaging in complex geology



Beam Migration



Superbins in a common offset section as part of the AGS Beam PSDM's decomposition stage.

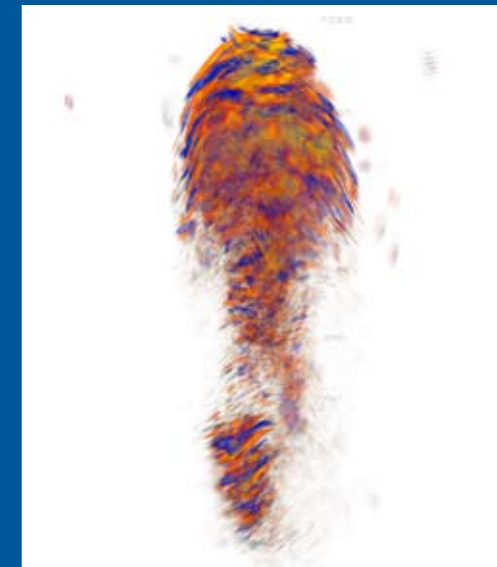
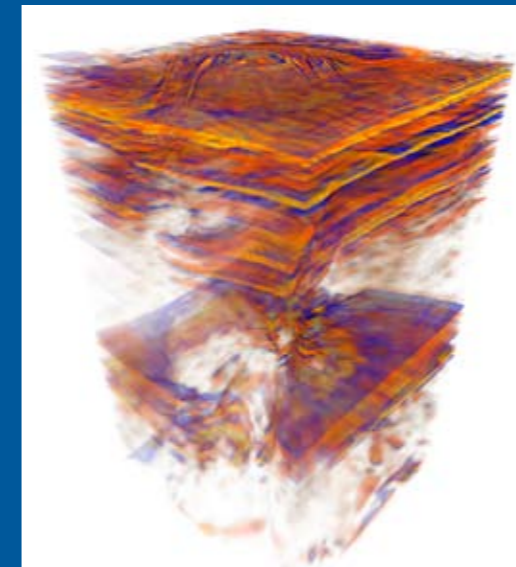
PGS holoSeis

holoSeis serves as the front end of the PGS hyperBeam software platform and an integral component of the velocity model building workflow. It is only through the integration of AGS Beam with holoSeis that the full interpretation and collaborative workflow capabilities of PGS hyperBeam can be leveraged.

The holoSeis visualization capabilities provide control and QC at every stage of the model building process. As the main interface for the tomography, holoSeis allows the user to parameterize, launch and check reflection tomography runs.

holoSeis also provides a range of velocity model building functionalities, such as full 2D and 3D horizon picking and direct manual picking for complex areas. holoSeis' 3D volume editing also enables the manipulation, editing and interpolation of isolated 3D bodies, based on a range of selection criteria.

PGS hyperBeam and holoSeis make geoscientists and geophysicists better and more effective at doing their jobs through an integrated workflow and the ability to interrogate and dissect data to create more variations and more potential prospects.

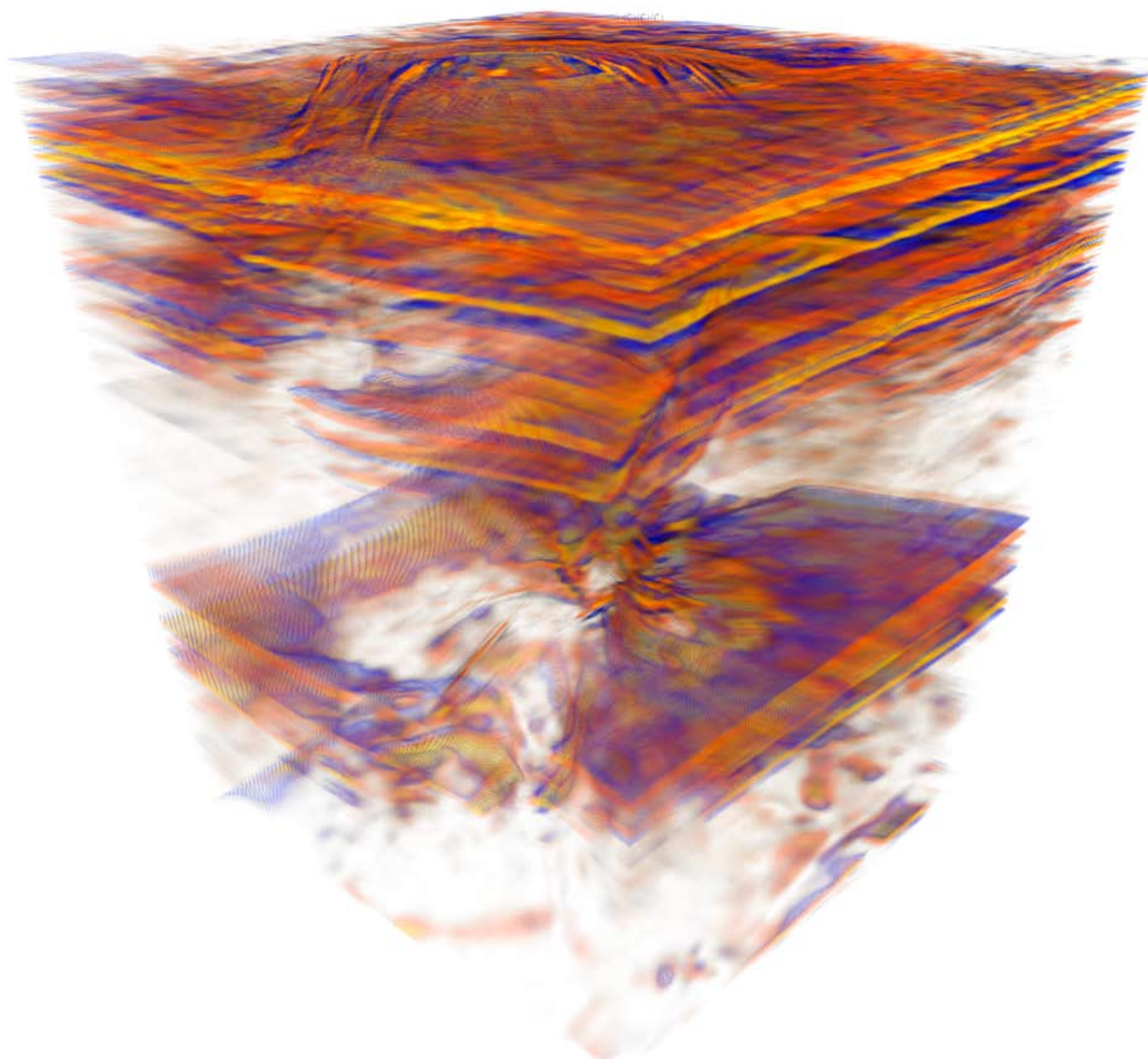


The AGS Beam uses internally developed anisotropic ray tracing routines to compute the migrated event locations. This image shows transparent 3D displays of a Salt Body from the Norwegian sector of the North Sea. On the left, wavelets are imaged that have ray traced only through sediment and on the right only those wavelets that have ray traced through the salt.

PGS hyperBeam™

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