

# Kirchhoff Pre-stack Time Migration

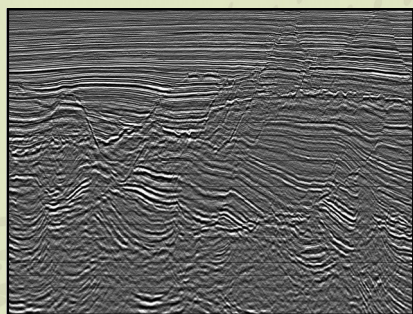
ION's GX Technology (GXT) group possesses an amplitude-preserving Kirchhoff pre-stack time migration (PreSTM) routine that is ideal for imaging in relatively complex geologic conditions or for velocity fields that do not require employing full pre-stack depth migration to meet the imaging goals. Our methodology is not limited to the straight ray approximation as most other PreSTM software packages that use the two-term double square root equation. Our program accounts for higher order terms in the travel-time versus offset and NMO expansion by explicit raytracing. This technique accurately models ray bending in a medium up to angles of 150°. As a result, there is no bias in the velocity estimate or the positioning of steep dips. The input consists of a 3D RMS velocity field and pre-processed time gathers. The package can be used to iteratively build the 3D RMS velocity field through target outputs in the form of inlines, crosslines, CRP gathers, and full 3D volumes. This output is the basis of further refinement of the velocity field using GXT's velocity model builder. Once the desired velocity field is obtained, the program is applied to the entire dataset to obtain a high-fidelity 3D PreSTM volume.

## KEY FEATURES AND BENEFITS

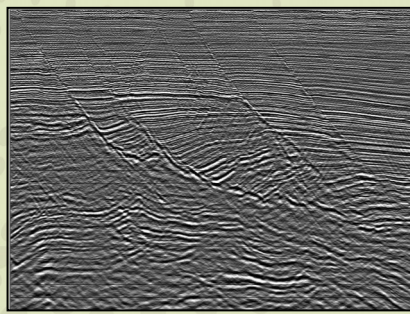
**Amplitude Preservation** – The PreSTM algorithm offers superior amplitude preservation by using the correct amplitude weighting. Together with accurate handling of ray bending effects, the gathers serve as the ideal input for AVO analysis, especially in areas of complex geology.

**Operator Anti-aliasing** – Migration noise as a result of operator aliasing is mitigated very effectively through the use of a multi-frequency anti-alias operator that controls the frequency content as a function of dip. This way, steep dips are preserved while time migration noise is minimized.

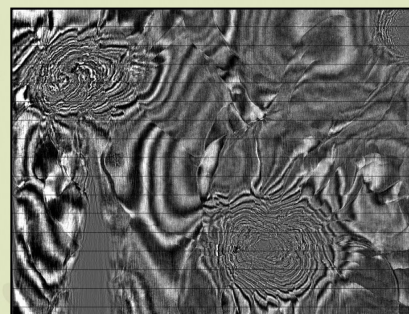
**Turning Ray Imaging** – The program can image very steep or overturned seismic events, migrating events accurately up to 150°.



Inline Kirchhoff PreSTM section from a 3D survey conducted in the Gulf of Mexico shelf



Crossline Kirchhoff PreSTM section from the 3D survey



Horizontal time slice section from the 3D survey

## **KEY FEATURES AND BENEFITS (Continued)**

**Velocity Analysis** – Gathers for velocity analysis are produced during migration rather than after, taking into account the lateral movement of events at non-zero dips and accelerating the convergence to the final velocity field.

**Anisotropy** – Our solution can image from vertically transversely isotropic (VTI uniaxial anisotropy) velocity models. The medium is parameterized in terms of Thomsen's parameters (i.e., epsilon and delta) and the vertical velocity, all of which may be spatially variant. The result is a higher-quality time image of the subsurface that better matches the time of geologic structures from wells.

**Topography** – Topography has a kinematic effect on the pre-stack seismic data, and unless it is properly accounted for, the velocity model and the resulting image quality will be compromised. The program honors topography exactly in all its imaging stages.

**Bandwidth** – The bandwidth of the input data is preserved by accurately interpolating during imaging all necessary runtime parameters such as the travel-time tables and the amplitude weighting coefficients. This produces better event coherency and lateral resolution than what is offered by other commercial pre-stack time migration software.

**Efficiency** – The high performance allows the use of “no compromise” migration parameters, resulting in the efficient production of high-quality PreSTM volumes.

**Application** – PreSTM is designed for 2D and 3D land and marine seismic data. The program is used when the complexity of velocity or geology does not require pre-stack depth migration to meet project imaging goals.

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