Pre-Processing

Noise & Multiple Attenuation, Velocity Analysis & Quality Control

In order to optimize seismic data for advanced pre-stack time and depth imaging migration, including 4D and AVO analysis, the raw 2D and 3D seismic data require data conditioning to enhance the signal-to-noise ratio. Relative amplitude processing, rigorous noise analysis and its removal with appropriate tools, and stringent quality control using specially developed QC tools are necessary steps to accomplish these goals. In addition, ION's GX Technology (GXT) group strives to remove all artifacts that are not a part of the seismic signal such as noise, acquisition irregularities, and navigational errors. Amplitude inconsistencies are thoroughly investigated during each step of the processing workflow and in different domains. GXT has developed statistical and global quality control methods for quick identification of data problems, enabling delivery of high quality processing products on time.

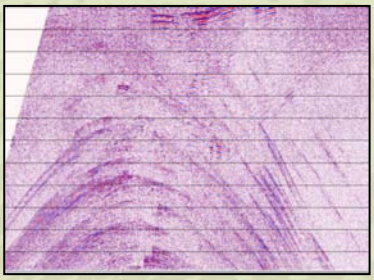
Our proprietary pre-processing methods are built around Landmark's ProMAX® processing system. GXT has enhanced the database-related tools in ProMAX allowing us to better accommodate large projects. GXT also uses several other commercial packages when needed.

KEY FEATURES AND BENEFITS

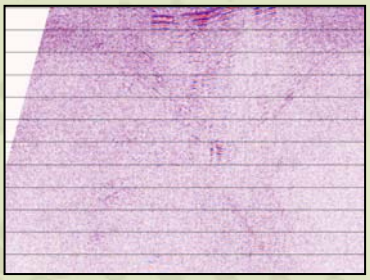
Quality Control – GXT provides a comprehensive suite of data validation and QC tools capable of rapid detection and subsequent correction of geometry errors, shot, sequence, and channel amplitude anomalies, and cold water static perturbations.

Noise Attenuation – GXT offers a variety of algorithms to attenuate most types of noise found in marine and land data. The core algorithm "swdnoise" is a frequency- dependent, data-adaptive method capable of attenuating spikes, noise bursts, and swell noise. For organized or coherent noise such as cable strum, guided waves, and ground roll, GXT offers modeling in the FK, FKK, Radial-trace, or Tau-P domain, followed by adaptive matching and subtraction.

Residual Velocity Analysis – GXT offers a range of residual velocity correction tools, including second- and fourth -order as well as trim-static based approaches. Correcting for residual moveout at large offsets (hockey sticks) by estimating weak anisotropy through 'eta' analysis enables exploitation of the data out to further offsets than is possible with only second-order techniques. For AVO-sensitive objectives, we offer AVEL (patent owned by BP), which estimates an optimum velocity using AVO methods rather than stack power. Employing RMO analysis and correction techniques can not only deliver high-resolution velocity fields, but also conditions gathers for AVO analysis and geopressure prediction.



Stack with interference noise



Stack after interference noise attenuation

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GX TECHNOLOGY

KEY FEATURES AND BENEFITS (Continued)

Interpolation – GXT has developed an extensive suite of 2D and 3D algorithms capable of interpolating regularly and irregularly sampled data beyond aliasing. These include GXT Beamsteer, FX, FKK3D, Recon 2D, and Recon3D.

Data Regularization – GXT offers a variety of 2D and 3D wavefield reconstruction and interpolation tools for data regularization.

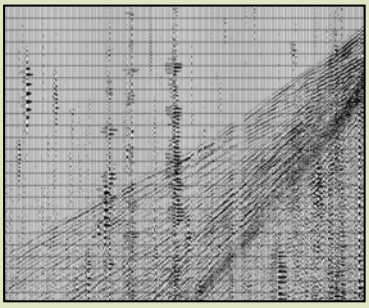
2D and 3D Surface Related Multiple Elimination – GXT's SRME algorithm is suitable for the attenuation of "free surface" multiples. It works equally well in both deep and shallow-water marine environments. The algorithm is production streamlined to efficiently handle large data volumes. It includes options for 2D and 3D cross-equalized adaptive matching using L2 or L1 norm operators.

Interbed Multiple Attenuation – GXT now offers IMA which extends the SRME algorithm to attack interbed multiples in both land and marine environments. GXT's processing sequence involves signal processing, then a pass to remove multiples with SRME, then an additional pass to remove the remaining interbed multiples using IMA.

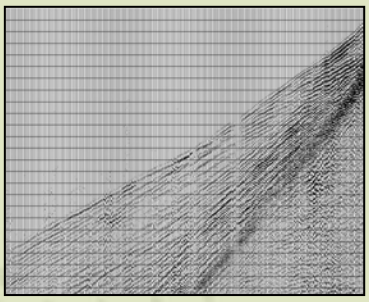
High-Resolution RADON Demultiple – GXT offers a variety of different parabolic RADON multiple attenuation algorithms including the true "high resolution" varieties. A Gaussian Beam option is available for improved handling of aliased and sub-optimally spatially sampled datasets. This algorithm avoids the need to precede the transform with a dedicated interpolation.

Apex Shifted Multiple Attenuation (ASMA) – GXT has developed a very effective "diffracted" multiple attenuation method that exploits the fact that in the CDP domain, the apex of a diffracted multiple occurs at non-zero offset. The method operates in the CMP domain and is designed to remove multiples that have different moveouts from primary reflections but don't necessarily have their apex at the zero offset. This type of moveout is associated with steeply dipping diffractions and reflections.

Signal Processing – GXT has developed robust methods for estimating far field source signature wavelets from the seismic data itself. From these, GXT is able to accurately capture and remove undesirable bubble energy and derive AVO compatible deterministic filters to shape data to any desired output. In addition, GXT has algorithms capable of deriving and applying detailed time and space variable Q factors.



OBC shot record with spikes & noise bursts



OBC shot record after spike & noise burst attenuation

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