

RTM

Reverse Time Migration

A Preferred Solution in Areas of Complex Wave Phenomena

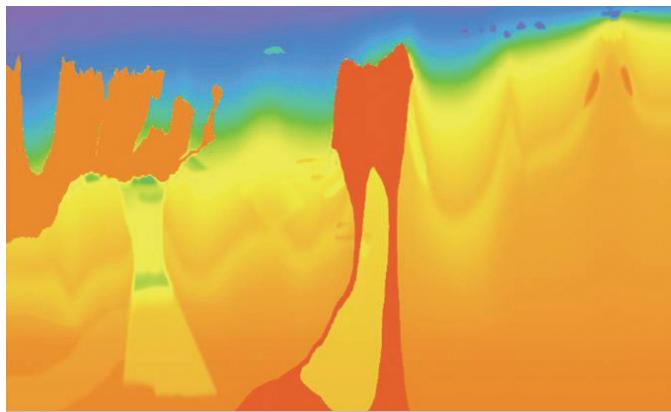
Reverse Time Migration (RTM) is a preferred solution for modeling and imaging seismic data in areas of complex wave phenomena. It is able to handle the most severe combinations of structural dip with high velocity contrast, conditions common in salt basins and other geologic basins with complex structures and velocity distributions. This makes it popular in areas like the deep-water Gulf of Mexico, offshore Brazil, and the North Sea, where salt structures severely distort propagating wavefronts and images. RTM is able to construct images using all possible arrivals, including caustic and prismatic waves, and can handle extreme lateral velocity variations without any dip limitations.

Power and Flexibility

As the leading supplier of seismic processing and imaging solutions to the oil and gas exploration and production industry, Emerson has partnered with Acceleware® Corp., a company that specializes in accelerating compute-intensive applications on clusters of heterogeneous, multiple core (CPU or GPU) processors. Echos™ RTM includes support for CPU and GPU configurations, to accommodate customer investment and preference. There is no “switch” cost involved in using different technologies.

Accuracy, Performance and Innovation

The Echos RTM solution is rich in geophysics and high-performance computing. Innovative features ensure maximum accuracy and quality (reduced dispersion) while balancing runtime performance. A flexible, multi-level parallelization scheme allows efficient distribution and processing of the seismic data within and across compute nodes. Illumination scaling can be applied as part of the migration or as a post-RTM process. Correlation noise is a well-known source of image degradation in RTM and the solution offers various filtering methods to address this during or after the migration, including Laplacian, Velocity-dependent XYZ, and KxKyKz domain filters. Hosted by the Echos seismic processing system, users are able to apply intelligent muting, super-shot formation, and stacking of common image gathers with the convenience of one system.



▲ BP 2004 Salt Model and Echos RTM



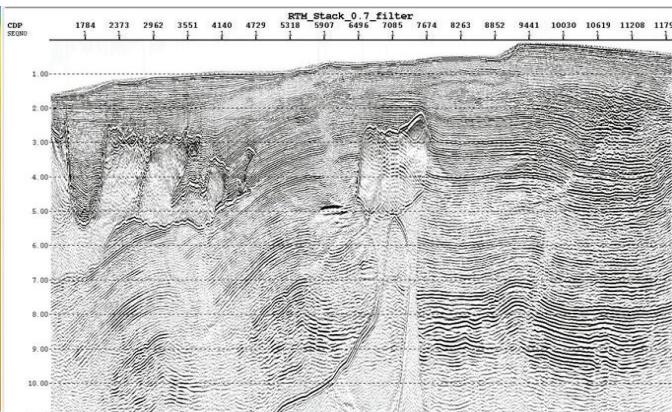
Fully Integrated

The industry-leading Echos system was designed and optimized for trace-based or record-based seismic data processing, and is an ideal host for the shot ordered approach of RTM. In the feature-rich Echos processing environment, one platform is used for data preconditioning, seismic imaging, and post-image processing. The shot record approach employed by RTM is highly suitable for data distribution in Echos and can be used for any type of seismic survey. Echos data display windows, job monitoring and data QC facilities are attractive complements to the migration.

Echos RTM is driven by velocity models developed with and refined by the GeoDepth™ velocity determination and modeling product suite, and by the SKUA™ structural modeling application. These provide workflow efficiencies when investigating and updating the seismic image. Echos RTM is also fully integrated with Epos™ seismic and velocity model repositories, and is able to leverage this consistent framework for Isotropic, VTI and TTI subsurface velocity models.

Emerson E&P Migrations

Emerson E&P endeavors to provide the industry with differentiating next-generation ray-based and full wave solutions. The combined and highly compatible offering of local angle domain imaging solutions (CRAM Advanced Beam Migration and EarthStudy 360™ full



Reverse Time Migration

azimuth angle domain imaging) and RTM is a valuable addition to any project where seismic data is considered an important exploration or development asset. The local angle solutions can be used for isotropic and anisotropic velocity determinations, velocity model updating, seismic characterization, and any project where there are azimuthal dependencies on the model, outcomes and image. The RTM global full wave solution can then be used for final imaging and intermediate checks on the velocity model accuracy. RTM can also be run on poststack data.

Interoperability

All Epos™-based applications enable interoperability with third-party data stores, including:

- RESQML 2.0.1
- OpenWorks® R5000.10
- GeoFrame® 2012
- Petrel® 2019 & 2018
- Recall™ 5.4.2

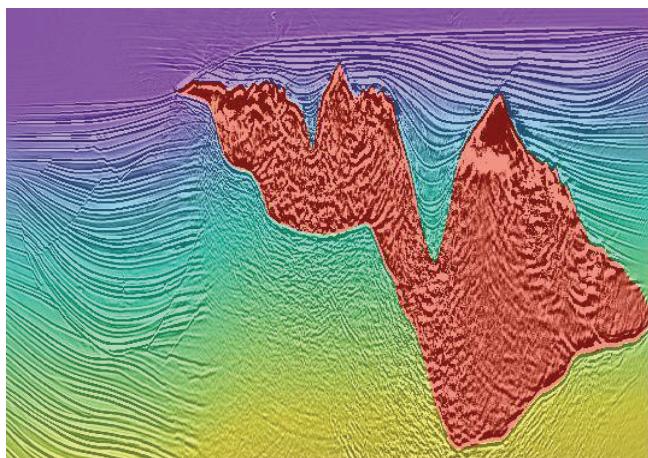
(*is a mark of Schlumberger)

System Specifications

- Red Hat® Enterprise Linux® 6.8 and subsequent minor releases, and 7.1 and subsequent minor releases
- NVIDIA Tesla Series GPU's (optional)

The Emerson E&P Software Advantage

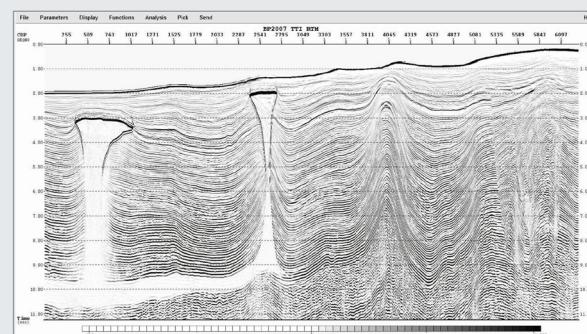
- A zero cost switch solution for multi-core CPU/GPU platforms.
- A VTI and TTI imaging solution for streamer, Ocean Bottom Cable, and onshore acquisitions with irregular topography.
- A single solution for forward modeling and migration, and imaging of surface and subsurface (VSP) recorded seismic data.
- Integration with the Epos solution suite, enabling workflow efficiencies.



▲ Kirchhoff Migration

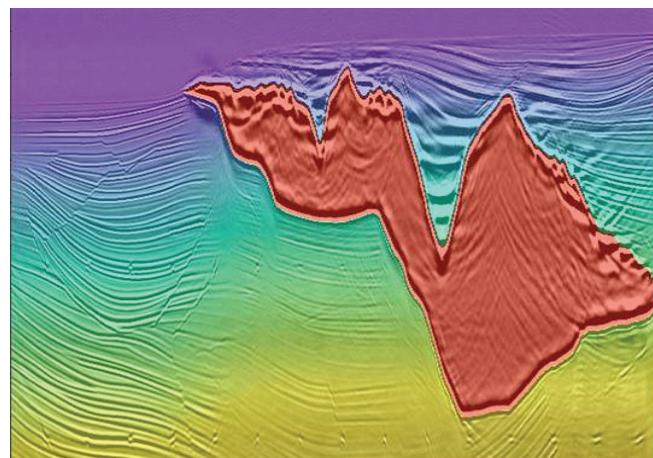
What is Reverse Time Migration?

Reverse time migration belongs to the class of two-way full wave migration solutions. Rather than performing imaging by extrapolating the data in depth, as in traditional one-way full wave solutions, RTM solves the wave equation forward in time for the source modeling field and backward in time for the recorded receiver field for that shot. At each time step, the depth image is obtained by cross-correlating the two fields. Reverse time migration has been demonstrated to achieve a significant level of multiple energy attenuation by nature of its two-way extrapolation backward in time.



3D imaging of the SEG/EAGE salt model using Echos Reverse Time Migration

RTM is offered as a separately-licensed module of Echos.



▲ Reverse Time Migration