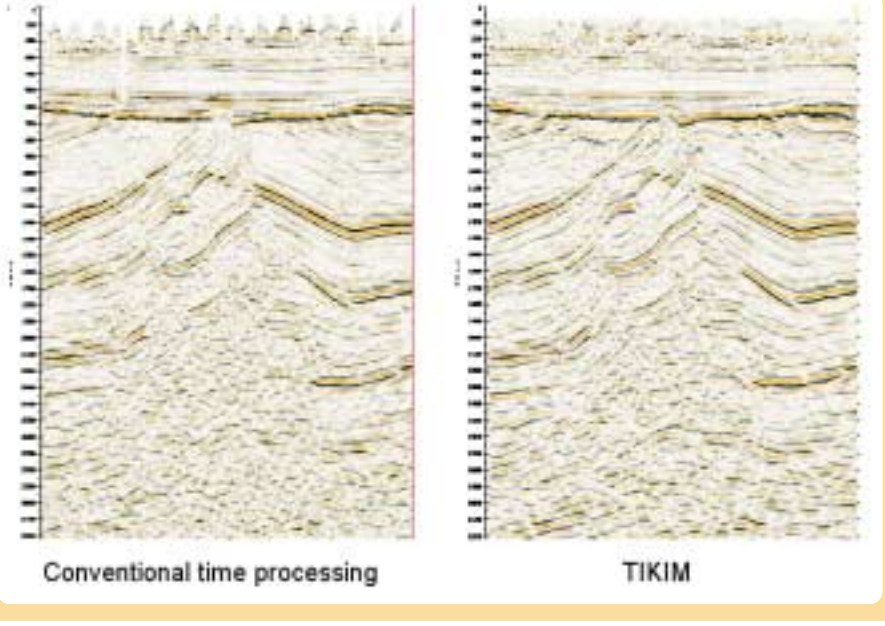
Real Time Processing™ with Geocluster

There is no question that the ultimate in seismic data processing is pre-stack depth migration. Yet this process is highly interpretative because it requires a detailed earth model, which is rarely available at the exploration stage. There is therefore a need for a method that can deliver rapidly a decent image of the subsurface and provide the interpreter with a "quick look" at the geology. This method is time imaging.

There have been many forms of time imaging over the years. First, a simple move-out and stack of the data, then post-stack time migration and later dip-move-out (DMO). A recent development involved zero-offset time migration of DMO offset cubes to simulate pre-stack time migration. All these incremental steps forward provided an improved approximation of the "true" pre-stack time migration algorithm, and were made possible by ever-increasing computer capacity.

The past couple of years have witnessed a genuine breakthrough in computer technology: **PC clusters.** PCs hardly qualify as a new technology, but recent advents in network capacity and chip design (clock-speed exceeding the GHz) have created a new generation of supercomputers. It is now possible to assemble Tflop machines for a fraction of the cost of an equivalent conventional mainframe. CGG has taken up the challenge of PC clusters and has ported its processing package to the new Linux operating system. The result, **Geocluster, was unveiled at the 2000 SEG convention in Calgary.** With this step change in computer technology, true pre-stack time migration (PSTM) becomes a reality. **CGG has optimized its 3D full Kirchhoff PSTM** algorithm (TIKIM) on PC clusters and has recently acquired enough nodes to process the largest surveys in record time. These achievements truly provide a paradigm shift for time processing.

Comparison between conventional time processing and full Kirchhoff PSTM on low-fold 3D land data. Note the sharper faults and the improved imaging of the deep data for the TIKIM result. Enhanced signal-to-noise ratio for velocity picking was the key difference.



Firstly, **velocities are picked at the correct migrated position** with the best possible signal-to-noise ratio. Secondly, **a single velocity field is used to image the pre-stack samples** to their final migrated position, which guarantees consistency compared to the conventional NMO-DMO-migration approach. Thirdly, the imaging algorithm has an improved handling of lateral velocity variations, and provides **AVO-ready preserved amplitude migrated gathers.** The accompanying figure presents an example of the gains in image quality expected from this new method.

The velocity model derived from this process is so good that it can readily be used as the **initial model for pre-stack depth migration.** In addition, anisotropic behavior can easily be identified and included in the migration process. With TIKIM on Geocluster, CGG provides **the best possible time imaging product in an amazingly short turnaround time.** In this sense, it truly represents *real time processing™* !

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