(#118417) Next-generation seismic imaging: High-fidelity algorithms and high-end computing

Dimitri Bevc (3DGeo Inc., USA <dimitri@3dgeo.com>), Francisco Ortigosa (Repsol YPF, USA), Antoine Guitton (3DGeo Inc., USA) and Bruno Kaelin (3DGeo Inc., USA)

Future development of the Middle East's hydrocarbon resources will include exploration in increasingly complex environments such as the Red Sea, necessitating increasing advances in computationally intensive imaging technologies for both exploration and exploitation. Among these technological advances, *reverse time migration* (RTM) yields the best possible images. RTM is based on the solution of the two-way acoustic wave-equation. This technique relies on the velocity model to image turning waves. These turning waves are particularly important to unravel subsalt reservoirs and delineate salt-flanks, a natural trap for oil and gas. Because it relies on an accurate velocity model, RTM opens new frontiers in designing better velocity estimation algorithms. The chief impediment to the large-scale, routine deployment of RTM has been a lack of sufficient computer power. RTM needs 30 times the computing power used in exploration today to be commercially viable and widely used. To overcome these challenges, the *Kaleidoscope Project*, a partnership between Repsol YPF, Barcelona Supercomputing Center, 3DGeo Inc. and IBM brings together the necessary components of modeling, algorithms and the uniquely powerful computing power of the *MareNostrum Supercomputer* in Barcelona to realize the promise of RTM, incorporate it into daily processing flows, and to help solve exploration problems in a highly cost-effective way. Uniquely, the *Kaleidoscope Project* is simultaneously integrating software (algorithms) and hardware (Cell BE), steps that are traditionally taken sequentially. This unique integration of software and hardware will accelerate seismic imaging by several orders of magnitude compared to conventional solutions running on standard Linux Clusters.