# Playing the game of reverse-time migration

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Photo Courtesy EMGS

In November 2006 Repsol YPF launched an unlikely project. Dubbed "Kaleidoscope," the aim was to create a major advance in computerized techniques for seismic imaging. Pulling together a "dream team" of geophysicists, computer scientists, and organizations from around the world, Kaleidoscope participants hoped to unlock new ways of using reverse-time migration (RTM), a proven technology for peering beneath salt in deepwater areas around the world.

The dream is now a reality. Recently the team announced that by using IBM's Cell Broadband Engine technology, it was able to speed up the processing for RTM significantly. Ironically, the computers used were powered by the IBM PowerXCell 8i processor, originally developed for next-generation gaming consoles.

Despite the fact that terms like "supercomputers" dot the press release, Francisco Ortigosa, director of geophysics for Repsol, said the hardware costs to do this type of work are not prohibitive. "Because the Cell processor was initially designed for a mass market, the cost is low," Ortigosa said. "It's lower than any other processor because it's strongly marketed for all kinds of electronic applications."

The real cost, and the real competitive advantage for Repsol, is in the code. "If you take your software and run it on a Cell, it will run," he said. "The performance is not so effective, but it will run.

"But to have this order of magnitude of increased performance, you really need to tailor, readapt, and rewrite all of the codes and algorithms for this processor, and this is the objective of the Kaleidoscope project."

Already the new process is being used on four production processing projects in the Gulf of Mexico, Ortigosa said, and another 15 projects are scheduled.

Despite the gains made in the past year and a half, Kaleidoscope is not finished. The partnership will have two challenges going forward – to adapt to new generations of Cell processors in which compute speed will increase even more, and to move beyond RTM to other compute-intensive processes such as waveform inversion.

“If you think that two years ago reverse time migration required one order of magnitude compute power to be able to be applied and widely available to the industry, waveform inversion is like an iteration of several RTMs, which will of course require more compute power. This is what we foresee in the next one or two years.”

Repsol has successfully collaborated with some of the world’s most experienced technology partners, including IBM, the Barcelona Supercomputer Center (BSC), 3DGeo, a Houston-based imaging company formed by Stanford University professor and seismic imaging pioneer, Biondo Biondi, and Stanford University’s Stanford Exploration Project (SEP),For more information, visit www.kaleidoscopeproject.info.