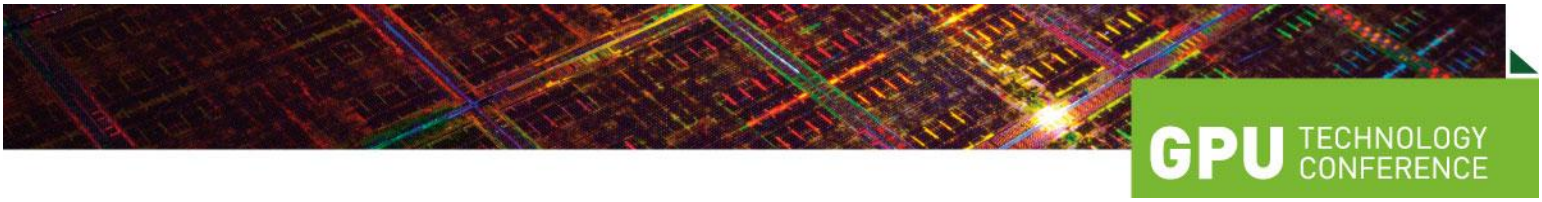

GPU Technology Conference, May 14-17, 2012
McEnery Convention Center, San Jose, California
www.gputechconf.com

Sessions on Energy Exploration (subject to change)

IMPORTANT: Visit http://www.gputechconf.com/page/sessions.html for the most up-to-date schedule.

S0321 - GPU-Based Monte Carlo Ray Tracing Simulation for Solar Power Plants
Claus Nilsson (Tietronix Software, Inc.), Michel Izygon (Tietronix Software, Inc.)
Day: Tuesday, 05/15 | **Time:** 2:00 pm - 2:25 pm
Topic Areas: Energy Exploration; Computational Physics; Ray Tracing
Session Level: Beginner

Learn about real time simulations of Concentrating Thermal Solar Power using GPU technology to enable performance optimization of these utility scale plants. By leveraging the power of GPUs and the parallel aspect of the field of thousands sun-tracking mirrors, we have been successful in cutting the computation time by orders of magnitude versus the previously required minutes and hours runtime. We will present an overview of the problem domain and describe how we used the GPU to derive a Monte Carlo physics ray tracing method to simulate the flux reflected by the mirrors onto the solar receiver.

S0436 - Integrated GPU Acceleration with Real Time Visualization of Terabyte Data
Kelly Walker (Hue)
Day: Tuesday, 05/15 | **Time:** 3:00 pm - 3:25 pm
Topic Areas: Visualization; Energy Exploration
Session Level: Beginner

Computation and visualization doesn't necessarily have to act as two separate entities. This talk explains the integration of real-time compute with real-time visualization. Industry and academia have provided attractive solutions for compiler-directive optimized code for computations. To support cases that involves massive yet ad-hoc data I/O and computation with interactive visualization, Hue developed a different model which bridges the gap between "complete system rewrite" and "compiler directive optimized code". The talk explains how highly optimized data I/O mechanisms coupled with predefined input and output definitions for kernels provide excellent scalability and interactivity during runtime.

S0336 - GPU Acceleration for Seismic Interpretation Algorithms
Jonathan Marbach (TerraSpark Geosciences)
Day: Tuesday, 05/15 | **Time:** 4:00 pm - 4:25 pm
Topic Areas: Energy Exploration
Session Level: Beginner

The oil and gas industry is already leveraging GPUs for seismic data processing, but what about 3D seismic interpretation? This session will cover how the GPU is being used by TerraSpark Geosciences to dramatically decrease the runtime of algorithms for enhancing faults, computing horizon orientation, and calculating volumetric curvature. We will share our experiences in porting these techniques to the GPU, the challenges encountered, the solutions found, and, of course, the benefits to execution time.

S0628 - Panel Session: Learn from Experts in the Oil & Gas Industry
Paulius Micikevicius (NVIDIA)
Day: Tuesday, 05/15 | **Time:** 4:30 pm - 6:00 pm
Topic Areas: Energy Exploration
Session Level: Beginner

This session will feature expert panelists that will share their experience adopting GPUs in their respective environments. Since 2009, these production systems have been boosting throughput, and shorten cycle times while delivering enhanced images using NVIDIA technologies. Featured panelists will include: Hess, Schlumberger, Petrobras, Chevron and more.

S0171 - Numerical Modeling Of 3D Anisotropic Seismic Wave Propagation On MultiGPU Platforms
Denis Sabitov (Schlumberger)
Day: Wednesday, 05/16 | **Time:** 9:00 am - 9:50 am
Topic Areas: Energy Exploration; Algorithms & Numerical Techniques; Supercomputing; Molecular Dynamics
Session Level: Intermediate

We present an efficient and accurate numerical algorithm for the simulation of seismic experiments. The basis of the approach is a heterogeneous spectral element method implemented on MultiGPU applied to anisotropic elastic wave equation. The approach was designed to simulate wave propagation in 3D arbitrary anisotropic elastic media. Due to the use of an unstructured grid, the spectral element algorithm enables handling complicate geometries of the layers. We discuss results and computational efforts of simulation on MultiGPU platform. Several aspects of the code implementation are considered: optimal domain decomposition, data transfers between GPU by means of P2P and UVA, etc.

S0125 - Memory Efficient Reverse Time Migration in 3D
Chris Leader (Stanford Exploration Project)
Day: Wednesday, 05/16 | **Time:** 10:00 am - 10:25 am
Topic Areas: Energy Exploration; Computational Physics
Session Level: Intermediate

Learn how we can image the interior of the Earth in three dimensions using Reverse Time Migration. We discuss how GPUs accelerate this method using parallel wave propagation kernels, texture memories and minimal device to host transfers. Further we discuss how the progression to 3D presents a multitude of new problems, particularly memory based - causing the system to be IO limited. By manipulating boundary positions and values to a pseudo-random form we show how many of these memory restrictions can be diminished and how detailed subsurface images can be fully constructed using GPUs.

S0140 - Accelerating Reservoir Simulation and Algebraic Multigrid with GPUs
Kenneth Esler (Stone Ridge Technology), Vincent Natoli (Stone Ridge Technology)
Day: Wednesday, 05/16 | **Time:** 2:00 pm - 2:25 pm
Topic Areas: Energy Exploration
Session Level: Intermediate

Given a model of a reservoir's rock and well properties, a reservoir simulator solves the PDEs for the multiphase flow through porous rock to predict well production. Over the past several decades, simulation has progressed from coarse 2D models to detailed 3D models, providing strong fidelity to empirical production rates. By reformulating the Marathon Oil Corporation's Multiscale Flow Simulator to use GPUs, we improve the overall execution speed by a factor of over 100, allowing fast turnaround on a GPU workstation. We also introduce GAMPACK, a fully-accelerated GPU algebraic multigrid solver, and demonstrate its performance relative to CPU

solvers.

S0432 - New Ideas for Massively Parallel Preconditioners
John Appleyard (Polyhedron Software Ltd), Jeremy Appleyard (Polyhedron Software Ltd.)
Day: Wednesday, 05/16 | **Time:** 3:00 pm - 3:25 pm
Topic Areas: Algorithms & Numerical Techniques; Computational Fluid Dynamics; Energy Exploration
Session Level: Advanced

Linear Solvers on serial machines tend to be highly recursive, but that's not an option on GPUs. In this paper we describe a new preconditoner for GMRES and similar Krylov subspace linear solvers that is highly parallel, but also provides effective mechanisms to reconcile remote driving forces in a spatially discretized system. We will present results, taken from some real-world studies using a commercial oil reservoir simulator, showing how it compares with a state of the art serial solver, and showing how performance scales in a domain decomposition formulation run on a multiple CPU+GPU cluster.

S0433 - Accelerated FDTD Technique for Marine Controlled Source Electromagnetic Imaging
Geoff Clark (Acceleware Ltd.), Michal Okoniewski (Acceleware Ltd.)
Day: Wednesday, 05/16 | **Time:** 3:30 pm - 3:55 pm
Topic Areas: Energy Exploration
Session Level: Intermediate

Find out about the newest method for Marine Hydrocarbon Exploration. In this session we will profile the use of Finite Difference Time Domain (FDTD) technique in combination with Mittet's method and GPUs to produce faster, cheaper, more accurate forward modeling for electromagnetic imaging (Controlled Source Electromagnetic or CSEM). Unlike many frequency domain CSEM techniques this accelerated method does not require simplifying assumptions to reduce the memory and computational burden and has excellent scaling properties (essentially linear) across clusters of GPU accelerated nodes. CSEM is used in the industry to enhance confidence in hydrocarbon reservoir discoveries.