

# HIGH PERFORMANCE COMPUTING FOR EXPLORATION, RESERVOIR DEVELOPMENT AND ENERGY TRANSITION

6-8 NOVEMBER 2023

SEG WORKSHOP

## TECHNICAL PROGRAMME

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### Monday, 6 November 2023

08:00 - 09:00 **Onsite Registration**  
09:00 - 09:05 **Hotel Safety Briefing**  
09:05 - 09:20 **Welcome by Committee Chairs**  
09:20 - 09:25 **Welcome by SEG Leadership**  
09:25 - 09:45 **Opening Address from Saudi Aramco**

09:45 - 09:55 **Committee and Sponsor Recognition**  
09:55 - 10:05 **Group Photo**  
10:05 - 10:20 **Coffee Break - 15 min**

Session 1 **TRADITIONAL HPC ON PREMISE OR CLOUD I**  
10:20 - 12:40  
Session Chairs: TBC

**KEYNOTE: The Potential for Improvements in Power Efficiency, Leveraging Hardware and Software Innovations**  
Ken Hester (NVIDIA)

**Code Optimization for Minimum Energy Usage**

Arnaud Hincelin (CGG)

**Time Reversal Approaches for Reverse Time Migration**

Hussain AlSalem (Saudi Aramco)

**Portable Wave-propagation Library for Geophysics**

Amik St-Cyr (Shell)

**Reducing the Memory Pressure for First-order Wave Equation Seismic Modeling with Temporal Blocking**

Pavel Plotnitskii (King Abdullah University of Science and Technology (KAUST))

12:40 - 13:40 **Lunch - 1hr**

Session 2 **MACHINE LEARNING, DEEP LEARNING, HPC FOR DATA ANALYTICS**  
13:40 - 15:45  
Session Chairs: TBC

**KEYNOTE: Active Learning Data Reduction: Advancing Full Waveform Inversion and Machine Learning in Geophysics**

Taqi Alyousuf (Saudi Aramco)

**Large Scale Training of 3D Convolutional Neural Network by Domain Decomposition**

Bingbing Sun (Saudi Aramco)

**Taking Advantage of Deep Learning Technology to Speed Up Seismic Processing Algorithms**

Aouf Abdulrahman Hamad Al Dabal (Saudi Aramco)

**ARCAID: A HPC Driven AI Seismic Interpretation Platform**

Abdulmohsen Alali/Bingbing Sun (Saudi Aramco)

**Leveraging the Power of HPC and GNNs for Enhanced Seismic Inversion**

Hussain Alfayez (Saudi Aramco)

Session 3 **NEXT GENERATION HARDWARE ARCHITECTURES**  
15:45 - 16:50  
Session Chairs: TBC

**KEYNOTE: Sustainable Horizons: Designing Energy-efficient Computing Platforms for the Future of Exploration and Energy Transition**

Mustafa Youldash (Imam Abdulrahman bin Faisal University (IAU))

**Next Generation Hardware Architectures: Geoscience System Balancing**

Essam Morsi (AMD Research Europe)

16:50 - 17:10 **Networking Coffee Break - 20 min**

### Tuesday, 7 November 2023

09:00 - 09:10 **Recap of Day 1**

Session 4 **SEISMIC IMAGING I**  
09:10 - 11:30  
Session Chairs: TBC

**KEYNOTE: Scaling the "Memory Wall" for Seismic Processing with Algebraic Compression**

David Keyes (King Abdullah University of Science and Technology (KAUST))

**Overcoming 10 Bottlenecks in GPU-accelerated Seismic Imaging Algorithms**

Maram Hesham Ali Badawi (Brightskies Technologies)

**Seismic Acoustic Impedance Refinement and Extrapolation through the Integration of Well Data**

Zainab Alabdulmohsen (Saudi Aramco)

**Parallel Matrix-free Solver for Heterogeneous Time-harmonic Wave Problems: Multi-level Deflation Preconditioning with Complex Shifted Laplacian Preconditioner**

Kees Vuik (Delft University)

**Target Oriented Seismic Imaging for CO2 Sequestration Applications**

Abdulmohsen Alali (Saudi Aramco)

11:30 - 11:40 **Coffee Break - 10 min**

Session 5 **TRADITIONAL HPC ON PREMISE OR CLOUD II**  
11:40 - 12:45  
Session Chairs: TBC

**KEYNOTE: High Performance Computing in the Energy Sector**

Othmane Bouhali (Gatar Computing Research Institute)

**Leveraging High-performance Computing for Seismic Interpretation and Geological Modeling**

Muhammad Haseeb Badar (Saudi Aramco)

12:45 - 13:45 **Lunch - 1hr**

Session 6 **TRADITIONAL HPC ON PREMISE OR CLOUD III**  
13:45 - 14:35  
Session Chairs: TBC

**Multi-parameter FWI Imaging and HPC: A Seismic Shift**

Tom Rayment (DUG Technology)

**Optimized GPU-based Wavefield Traveltime Inversion using Fast Sweeping Eikonal Equation and Nvidia BitComp Compressor**

Young Seo Kim (Saudi Aramco)

14:35 - 14:50 **Coffee Break - 15 min**

Session 7 **SEISMIC IMAGING II**  
14:50 - 16:55  
Session Chairs: TBC

**Demultiple Applications for High Channel Count 3D Seismic Data Sets a Quest for Fast Turnaround Time**

Constantine Tsingas (Saudi Aramco)

**Parallel Computation of Traveltime with High-order Fast Sweeping Method**

Yi He (Aramco Research Center)

**GPU-based Parallel Implementation of 3D Seismic Noise Filter**

Khalid Al-Gharni (Saudi Aramco)

**An Optimized Implementation of 3D Seismic Noise Reduction Filter Using Graphics Processing Units (GPUs)**

Zahra AlHadab (Imam Abdulrahman Bin Faisal University (IAU))

**Enhancing Efficiency and Scalability of Kirchhoff Depth Migration through MapReduce-based Implementation**

Yujin Liu (Aramco Beijing Research Center, Aramco Asia)

### Wednesday, 8 November 2023

09:00 - 09:10 **Recap of Day 2**

Panel Session **CHALLENGES IN AI, HPC AND QUANTUM COMPUTING FOR THE ENERGY INDUSTRY**

**Panel Speakers:**  
Marcin Dukalski (Aramco Research Center Delft)  
Othmane Bouhali (Gatar Computing Research Institute)  
Ali Dogru (Saudi Aramco)  
Mustafa Youldash (Imam Abdulrahman Bin Faisal University (IAU))  
David Keyes (King Abdullah University of Science and Technology (KAUST))

**Moderated by: TBC**

10:40 - 10:55 **Coffee Break - 15 min**

Session 8 **QUANTUM COMPUTING**  
10:55 - 12:25  
Session Chairs: TBC

**KEYNOTE: Quantum Computing with Neutral Atoms with Applications in Energy**  
Chayma Bouazza (Pasqal)  
**The Mathematical Foundations of the Universal Quantum Computing**  
Patrick Demichel (CGG)  
**Reviewing Potential Analogue Quantum Computing use Cases in Upstream Business**  
Marcin Dukalski (Aramco Research Center Delft)

12:25 - 13:25 **Lunch - 1hr**

Session 9 **RESERVOIR SIMULATION**  
13:25 - 15:35  
Session Chairs: TBC

**KEYNOTE: High-performance Computational Framework for Modelling of Energy Transition Subsurface Applications**  
Denis Voskov (TU Delft)  
**Massively Parallel Reservoir Simulation Multiscale Solvers on High-Performance-Computing (HPC) Architectures**  
Abdulrahman Manea (Saudi Aramco)  
**Optimizing Fluid-flow Inverse Modeling using High-performance Computers to Reduce Permeability Structure**  
Saleh Al Nasser (Saudi Aramco)  
**KEYNOTE: Trends in High Performance Computing Reshaping Modern Reservoir Simulation**  
Karthik Mukundkrishnan (Stone Ridge Technology)

15:35 - 15:50 **Closing by Committee Co-chairs**