EAGE

**EUROPEAN
ASSOCIATION OF
GEOSCIENTISTS &
ENGINEERS**

Fourth EAGE Workshop on High Performance Computing for Upstream

HPC THROUGH THE 4ᵀᴴ INDUSTRIAL REVOLUTION

7-9 OCTOBER 2019 • DUBAI, UNITED ARAB EMIRATES

- **Final Announcement**

\Orchestrating a brighter world   **NEC**

WORKSHOP OVERVIEW

Comparing across multiple industries, our energy business undoubtedly exploits the largest High-Performance-Computing capacity. HPC plays a central role in seeking higher productivity, lowering costs and making better use of our data through high-performance simulation and data analytics. This is especially true while our industry experiences change through this fourth industrial revolution (4IR): digitalization. Algorithms performing as fast as possible on the best available hardware either on premise or in the cloud have a direct role and impact on many of the decisions shaping our business. The overlap and cross pollination opportunities between data analytics, big data, AI, simulation and HPC is the underlying theme of this fourth instance of our HPC workshop: HPC through the 4IR.

Upstream simulation and modelling is our principal mechanism for the accurate location of hydrocarbons and their optimal production. The reliance on data for making better business decisions at a lower cost is becoming critical. Seismic data are explored using traditional imaging algorithms such as Reverse Time Migration (RTM), Full Waveform Inversion (FWI) and Electromagnetic Modeling (EM) to illuminate the hidden subsurface of the earth and reservoir simulation is used to optimally produce fields and predict the time evolution of assets. Both are highly compute-intensive activities, which push the leading edge of HPC storage, interconnect and calculation. The industry is evolving on several fronts. Changes in the underlying hardware with the advent of coprocessing technologies and many-core CPUs are challenging practitioners to develop new algorithms and port old ones to reap the most performance from modern hardware. The explosion of data and the recent rapid development in machine learning (ML) are leading to non-traditional ways of interpreting seismic and reservoir data. The emergence of significantly faster reservoir simulation technology is breathing new life into multi-resolution and uncertainty quantification workflows.

The ability to create and mine these data relies on the optimal utilisation of supercomputers. This is the result of various synergies between industries, companies, departments and, most importantly, people. HPC IT departments (or even HPC cloud solution providers) are focused on minimising turnaround times for various workloads, but also deploy the various compute architectures in a cost competitive fashion while adapting to the fast-paced innovation in the semiconductor industry. Research groups and software application teams in both academia and industry develop new algorithms and keep abreast with the latest while adapting and optimizing existing or new production frameworks to the latest parallel programming model, language and architecture. The workshop brings together experts in order to understand state-of-the-art key applications employed in the upstream industry and anticipate what ambitions are enabled by increased computational power.

The 3-day workshop will feature both oral & poster presentations, discussion sessions and keynotes from the leading experts in the industry, as well as insightful and interesting short courses embedded into the workshop technical programme.

TECHNICAL COMMITTEE

Amik St-Cyr (Co-chair)	Shell
Vincent Etienne (Co-chair)	Saudi Aramco
Alecio Binotto	IBM Research
Ali A. Alturki	Saudi Aramco
Andrew Jones	NAG Ltd
David Latino	Cray
Detlef Hohl	Shell Technology Center Houston
Fabrice Dupros	ARM
Gaël Youinou	CGG
Gerard Gorman	Imperial College London
Issam Said	Nvidia
JC Baratault	AMD
Jean-Yves Blanc	CGG
Jonathan A. Phillips	ExxonMobil Technical Computing Company
Ken Esler	Stone Ridge Technology
Patrick Demichel	Hewlett-Packard Enterprise
Paulo Souza	Rstor
Philippe Thierry	Intel
Rached Abdelkhalek	KAUST
Raed Al Shaikh	Saudi Aramco
Saber Feki	KAUST
Shintaro Momose	NEC
Stuart Midgley	DownUnder GeoSolutions
Tau Leng	Supermicro
Thierry Carron	Hewlett-Packard Enterprise
Yuhe Wang	Texas A&M University

TECHNICAL PROGRAMME

Oral Presentations | Monday 7 October

08:00	**Registration & Welcome Coffee**
GRAND BALLROOM	
08:30	**HSE from Hotel**
08:35	**Co-chair Welcome**
08:45	**Keynote: David Keyes (KAUST)**
Seismic Modelling & Imaging - Part I Session Chairs: V. Etienne (Saudi Aramco), A. St-Cyr (Shell Global Solutions)	
09:30	**HPC01 - GeoDRIVE, an HPC flexible platform for seismic applications -** G. Sindi[1]*, V. Etienne[1], A. Momin[1], T. Tonellot[1] [1] Saudi Aramco, EXPEC Advanced Research Center
10:00	**HPC02 - One-way wave equation migration of common-offset vector gathers: parallel multi CPU/GPU implementation -** A. Pleshkevich[4], V. Lisitsa[2]*, D. Vishnevsky[1], V. Levchenko[3] [1] Trofimuk Institute of Petroleum Geology & Geophysics SB RAS; [2] Sobolev Institute of Mathematics; [3] Institute of Applied Mathematics RAS; [4] Central Geophysical Expedition JSC of Rosgeo
10:30	**Coffee Break**
Performance Analysis & Optimization - Part I Session Chairs: S. Momose (NEC Deutschland Gmbh), P. Thierry (Intel)	
11:00	**HPC03 - A Checkpoint of research on the implementation of geophysical stencils on multicore platforms. -** F. Dupros[1]*, C. Hillairet[1] [1] Arm

11:30	**HPC04 - Saving FLOPs in Geophysics with optimal p-adaptivity -** V. Etienne[1]* [1] Saudi Aramco, EXPEC Advanced Research Center
12:00	**HPC05 - Alleviating the pressure on memory for seismic modeling -** R. Abdelkhalak[1]*, H. Ltaief[1], V. Etienne[2], K. Akbudak[1], T. Tonellot[2], D. Keyes[1] [1] Extreme Computing Research Center, King Abdullah University of Science and Technology; [2] EXPEC Advanced Research Center, Saudi Aramco
12:30	**Lunch**
14:00	**Breakout Session: HPC Technology Evaluation and Benchmarking -** Andrew Jones (NAG)
15:45	**Coffee Break**
16:15	**Keynote: Robert Sutor (IBM)**
17:00	**Wrap-up Discussion**
17:15	**End of Day 1**

Oral Presentations | Tuesday 8 October

08:00	**Morning Coffee**
	GRAND BALLROOM
08:30	**Keynote: Felix J. Herrmann (Georgia Institute of Technology)**
	Emerging HPC Technologies - Part I Session Chairs: P. Demichel (HPE), A. Alturki (Saudi Aramco)
09:15	**HPC06 - Automated Distributed-memory Parallelism from Symbolic Specification in Devito -** F. Luporini[1], R. Nelson[1]*, T. Burgess[2], A. St-Cyr[3], G. Gorman[1] [1] Imperial College London; [2] DownUnder GeoSolutions; [3] Shell
09:45	**HPC07 - Total takes the deep dive into GPU for Seismic Imaging -** L. Boillot[1]*, D. Klahr[1], L. Qu[1], X. Lacoste[1], M. Bonnasse-Gahot[1], J. Montel[1], E. Bergounioux[1], J. Briche[1] [1] Total
10:15	**Coffee Break**
	Performance Analysis & Optimization - Part II Session Chairs: J. Phillips (ExxonMobil), P. Souza Filho (Atrio Inc)
10:45	**HPC08 - CGG: A Journey from Software to Hardware -** V. Arslan[1]*, F. Pautre[1], J. Blanc[1], T. Barragy[1] [1] CGG
11:15	**HPC09 - Weak scalability analysis of GPGPU-based iterative solvers in a two-phase pore-scale flow simulator -** C. Thiele[1], M. Araya-Polo[2], F. Alpak[2], B. Riviere[1], D. Hohl[2]* [1] Rice University; [2] Shell International Exploration & Production, Inc.
11:45	**HPC10 - Scalable High-Resolution Seismic Tomography -** L. Boillot[1]*, P. Basini[1] [1] Total
12:15	**Lunch**
	Emerging HPC Technologies - Part II Session Chairs: S. Feki (King Abdullah University of Science & Technology), G.Y. Youinou (CGG)
13:45	**Keynote: Philippe Thierry (Intel)**
14:30	**HPC11 - Seismic Processing with Hybrid HPC -** P. Souza Filho[1]*, A. Sardinha[2], C. Ávila[1], A. Azambuja2, F. Sierra[1], D. De Paula[2], M. Vecino[1], L. Silva[2], N. Ji[1] [1] Atrio Inc; [2] Petrobras
15:00	**HPC12 - Potential applications of quantum computing in upstream -** M. Dukalski[1]* [1] Aramco Overseas Company B.V.
15:30	**Coffee Break**
16:00	**Panel Discussion: Opportunities & Challenges in HPC for Oil & Gas** Patrick Demichel (HPE) Fabrice Dupros (ARM) Shintaro Momose (NEC) Issam Said (Nvidia) Moderator: Andrew Jones (NAG)
16:45	**Wrap-up Discussion**
17:00	**End of Day 2**
19:30	**Workshop Dinner**

Oral Presentations | Wednesday 9 October

08:00	**Morning Coffee**
	GRAND BALLROOM
09:00	**Keynote: Suha Kayum (Saudi Aramco)**
	Reservoir Modelling & Simulation / Digital Rock Physics Session Chair: K.P. Esler (Stone Ridge Technology)
09:45	**HPC13 - 3D simulation of active–passive tracer dispersion in polygonal fractured geometries -** S. Khirevich[1]*, T. Patzek[1] [1] King Abdullah University of Science and Technology
10:15	**HPC14 - Optimization of Wellbore Placement and Design for Full-Field Development using Computational Mathematical Modeling -** M. Al-Ismael[1]*, G. Al-Qahtani[1], A. Al-Turki[1], A. Al-Hezam[1], K. Dai[1] [1] Saudi Aramco
10:45	**Coffee Break**
	Seismic Modelling & Imaging - Part II Session Chairs: I. Said (NVIDIA), P. Thierry (Intel)
11:15	**HPC15 - Boundary Conditions for Seismic Imaging: Computational and Geophysical Points of View -** E. Algizawy[1]*, A. Nasr[1], F. Ahdy[1], K. Elamrawi[1], P. Thierry[2] [1] Brightskies Inc; [2] Intel
11:45	**HPC16 - A GPGPU pipeline for fast synthesis of 3D seismic -** S. Moore[2], A. Costa Nogueira Junior[1]*, J. Hoffmann[1], M. Paredes Quinones[1], J.L. Sousa Almeida[1] [1] IBM Research Brazil; [2] IBM Research Australia
12:15	**Lunch**
13:45	**Breakout Session: Quantum Computing 101 - IBM**
15:30	**Best Presentation Recognition Award**
15:45	**End of Workshop**

Poster Presentations

GRAND BALLROOM FOYER

POS01 - Incorporating Lossless Compression in Parallel Reservoir Simulation - M. Rogowski (Saudi Aramco)*, S.N. Kayum (Saudi Aramco), F. Mannuss (Saudi Aramco)

POS02 - Digital Twin of Multiscale Geological Media: Faults, Fracture Corridors, Caves. Seismic simulation and imaging - V. Cheverda (Trofimuk Institute of Petroleum Geology & Geophysics SB RAS)*, G. Reshetova (Trofimuk Institute of Petroleum Geology & Geophysics SB RAS), V. Lisitsa (Trofimuk Institute of Petroleum Geology & Geophysics SB RAS), M. Protasov (Trofimuk Institute of Petroleum Geology & Geophysics SB RAS)

POS03 - A Scientific Workflow for Reverse Time Migration under Uncertainty - C.H. Barbosa (Federal University of Rio de Janeiro)*, B. Silva (Federal University of Rio de Janeiro), C. Alves (Federal University of Rio de Janeiro), R. Silva (Federal University of Rio de Janeiro), L. Kunstmann (Federal University of Rio de Janeiro), H. Costa (Federal University of Rio de Janeiro), J. Alves (Federal University of Rio de Janeiro), M. Mattoso (Federal University of Rio de Janeiro), F. Rochinha (Federal University of Rio de Janeiro), D. Filho (Petrobras), A. Coutinho (Federal University of Rio de Janeiro)

POS04 - Optimal Order in Explicit Time Stepping - S. Delaney (Tullow Oil)*, T. Downes (Dublin City University)

POS05 - Exposing Fine-Grained Parallelism in Sequential Gaussian Simulation - M. Khait (TU Delft)*, K. Esler (Stone Ridge Technology)

POS06 - GPU Implementation of Line Solve Power Series Preconditioner used in Reservoir Simulation - O. Hajjar (Saudi Aramco)*, A. Alturki (Saudi Aramco), M. Baddouma (Saudi Aramco)

POS07 - Accelerating seismic parameter estimation with Adaptive Differential Evolution (JADE) and graphics processing units (GPUs) - J. Ribeiro (CEPETRO / UNICAMP)*, N.T. Okita (CEPETRO / UNICAMP), T.A. Coimbra (CEPETRO / UNICAMP), M. Tygel (CEPETRO / UNICAMP)

POS08 - High-Performance Computing Applications Transition to the Cloud in Upstream - S. Kayum (Saudi Aramco)*, M. Rogowski (Saudi Aramco)

REGISTRATION

REGISTERED AND PAID	FROM 1/5/2019 UNTIL 7/9/2019	FROM 8/9/2019 UNTIL 5/10/2019	ONSITE
EAGE Green Member	€ 945	€ 1045	€ 1045
EAGE Bronze/Silver/Gold Member	€ 795	€ 895	€ 895
EAGE Platinum Member	€ 795	€ 795	€ 795
EAGE Student Green Member	€ 425	€ 475	€ 475
EAGE Bronze/Silver/Gold Student Member	€ 400	€ 450	€ 450
Non-member*	€ 995	€ 1095	€ 1095
Student Non-member*	€ 450	€ 500	€ 500

*Memberships are provided for Non-Member registrations and the activation will only take place after the event, between 2-3 weeks.

All fees are in Euros (€). One Euro of your total registration fee is donated to the EAGE Green Fund. Please note that all fees are subject to 5% VAT as per UAE regulations.

Members please note: To qualify for the member registration fee, your EAGE membership dues for 2019 must have been paid and confirmed. The processing time for membership applications or renewals is 10 working days.

To qualify for the reduced student registration fee:
- Students must be enrolled in a full time study programme at a recognized university or institute
- The registration must be accompanied by a copy of a student ID card and/or official proof of enrolment.

Please note: Student non-members cannot be older than 34 years of age (when registering). The non-member fee includes EAGE membership for the remainder of 2019.

Please note that EAGE reserves the right to cancel the workshop due to low participation. In this case, payment will be refunded in full.

EAGE registration fees differentiate between EAGE membership recognition levels and non-members. First year members have Green membership status which gives you a € 50 discount (€ 25 for students) on the Non-member fee for each EAGE event registration; starting from Bronze status, you can benefit from an even greater reduced EAGE member registration fee. Please visit the EAGE website for more information about the recognition programme.

IMPORTANT DATES

Early Registration Close	7 September 2019
Regular Registration Open	8 September 2019
Online Registration Close	3 October 2019

BEST PRESENTATION RECOGNITION AWARD

The Technical Committee will be selecting one oral presentation to receive a recognition award, as well as the opportunity for the author to have their abstract published in First Break. The winner will be announced at the end of the workshop.

VENUE DETAILS

Grand Plaza Mövenpick Media City
Sheikh Zayed Road, opposite Innovation Hub
Media City
Dubai, United Arab Emirates

EAGE negotiated rates are available at the workshop venue for event attendees, please visit eage.eventsair.com/hpc2019 for more information.

SOCIAL PROGRAMME

Icebreaker Reception
Sunday 6 October from 18:00
Twenty Three Rooftop Bar @ Grand Plaza Mövenpick
Media City

Workshop Dinner
Tuesday 8 October 19:30

SPONSORSHIP

We would like to thank the workshop sponsors:

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See you in Dubai!