

# 1st OpenFOAM HPC Challenge (OHC-1)

**JULY 1-2, 2025, VIENNA**

2-Day Mini-symposium to be held in the auspices of the  
2025 OpenFOAM Workshop

Organized by the OpenFOAM HPC Technical Committee (TC)

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## Objectives

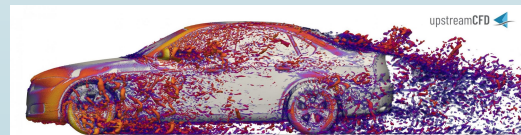
- Evaluate the **efficiency and scalability** of OpenFOAM on different hardware platforms (hardware track)
- Compare the performance of latest OpenFOAM **code enhancements** and flavors (software track)
- Propose **unified metrics** that will help guide the future development of OpenFOAM on next-generation hardware
- Bring together **hardware vendors, industrial users and developers** to discuss OpenFOAM performance
- **Publish benchmark performance** results of OpenFOAM on state-of-the-art hardware for guidance to users and developers

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## Scope

- The focus of this mini-symposium will be the industrial testcase of external flow over a **static DrivAer automotive model (case 2 of AutoCFD4)**, provided courtesy of AutoCFD4 (<https://autocfd.org/>)\*
- A **full OpenFOAM setup** of the testcase, including meshes, physical model, and solver selection can be found [here](#)
- **Reference numerical results** shall also be made available soon
- **In the hardware track**, participants are invited to submit and present results obtained with the **pre-defined setup using an official OpenFOAM version**, on any combination of hardware
- **In the software track**, participants are invited to submit and present results obtained with any OpenFOAM version and custom solver, on any hardware, so long as the mesh and physical modelling remains true to source, and accuracy is retained
- Participants are also invited to submit and present HPC enhancements related to **pre- and post-processing** of OpenFOAM data, applied to the above testcase

\*Special thanks to [Upstream CFD](#) for providing the OpenFOAM DrivAer setup, which has been adapted for the OHC-1



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## Rules (Hardware Track)

- **Objective:** Demonstrate and compare the performance of OpenFOAM on various hardware configurations
- **Hardware:** unconstrained\*, so long as it supports standard OpenFOAM
- **Software:** OpenFOAM.com v2412
- **Compiler:** unconstrained
- **MPI:** unconstrained
- **Case setup:** [occDrivAerStaticMesh](#), with fixed mesh, solver and numerical models (no changes allowed except for no. of processors for decomposition)
- **Mandatory** pre-processing stages (decomposition, renumbering, potentialFoam init)

\* Access to hardware may be applied through:  
[EuroHPC JU Benchmark Access call](#)

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## Rules (Software/Open Track)

- **Objective:** Showcase code/hardware optimizations that improve performance (time, energy), whilst retaining the basic level of accuracy as demonstrated with standard OpenFOAM
  
- **Hardware:** unconstrained\*
- **Software:** unconstrained, OpenFOAM-based code
- **Case setup:** [occDrivAerStaticMesh](#), with fixed mesh and physical modelling (temporal and spatial discretization, turbulence model)
  - Steady-state, incompressible flow
  - RANS with kw-SST turbulence model
  - Pre-defined fvSchemes (changes allowed but have to be reported)
- **Proposed topics for investigation:** accelerators, pre-/post-processing (I/O), mixed-precision, linear solvers, renumbering/decomposition

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## Metrics

### □ **Hardware/Software Track**

- Single- and Multi-node Scalability
  - Time-to-solution, excl. Pre-processing (decomposition, renumbering) and initialization (potentialFoam)
  - Energy-to-solution
  - FVOPS (finite volumes solved per second)
  - Accuracy w.r.t reference solution obtained with standard OpenFOAM
    - Drag coefficient
    - Pressure coefficients at selected locations
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- Automatic scripts will be provided to participants for analyzing metrics, in time for submission

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## Timeline

- **March 12, 2025: Call for Participation + Release of test case and ref. results**
- **April 30, 2025: Notice of intent to participate ([e-mail](#))**
- May 31, 2025: OpenFOAM Workshop [regular registration](#) deadline\*
- **June 1, 2025: Data submittal deadline**
- July 1-2, 2025: Mini-symposium (part of OpenFOAM workshop)
- August 1, 2025: Release of full performance data + manuscript submission to the OpenFOAM journal

**\* Registration to OFW is required for participating in the OHC-1 mini-symposium**

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## Organizing Committee

- Ivan Spisso, **Leonardo Company**
- Mark Wasserman, **Huawei**
- Sergey Lesnik, **Wikki GmbH**
- Charles Mockett, **Upstream CFD GmbH**
- Filippo Spiga, **NVIDIA**
- Neil Ashton, **NVIDIA**
- Gregor Olenik, **TUM**
- Elisabetta Boella, **E4 Computer Engineering**
- Fabrizio Magugliani, **E4 Computer Engineering**
- Simone Bna, **CINECA**
- Gavin Tabor, **Univ. of Exeter**