CERFACS

JOB OFFER – STAGE

DEVELOPMENT OF A PARALLEL COMPUTING FRAMEWORK FOR ADVANCED CFD ANALYSIS

OFFER INFORMATION

Reference: AAM-2025-CM-001
Location: 42 Avenue Gaspard Coriolis – 31057 Toulouse
Team: AAM

Supervisors:

- Carlos MONTILLA, montilla@cerfacs.fr

Gratification: 800€ net per month - M2 level or last year at engineering school

Period: 6 months - from: 01/02/2026

Key words: Parallel computing, data analysis, MPI, Python, CFD, Antares

CERFACS

Cerfacs is a private research, development, transfer and training center for modeling, simulation and high-performance computing. Cerfacs designs, develops and proposes innovative software methods and solutions to meet the needs of its partners in the aeronautics, space, climate, environment and energy sectors. Cerfacs trains students, researchers and engineers in simulation and high-performance computing.
Cerfacs works closely with its seven partners: Airbus, Cnes, EDF, Météo France, Onera, Safran et TotalEnergies.

HOSTING TEAM - AAM

The Advanced Aerodynamic & Multiphysics (AAM) team is dedicated to developing cutting-edge numerical methods, physical modeling, and High-Performance Computing (HPC) techniques for new Computational Fluid Dynamics (CFD) solvers. The work focuses on fluid dynamics simulations for aircraft, rockets, and turbomachinery, in close collaboration with Cerfacs partners.

CONTEXT

The Antares library, developed at Cerfacs, is a Python-based framework for the pre-, co-, and post-processing of numerical dataset with a special focus to CFD simulations. Antares is actively used by our academic and industrial partners, such as Airbus and Safran Group, to analyze complex phenomena in a wide range of applications, including aerodynamics, aeroacoustics, turbomachinery and combustion.

Antares is a modular and easily extensible library, designed to enable researchers and engineers to implement advanced data analysis algorithms. Within this framework, Cerfacs is committed to the continuous development of Antares to address the evolving requirements of its academic and industrial partners, including the need to efficiently handle large numerical datasets on modern HPC architectures.

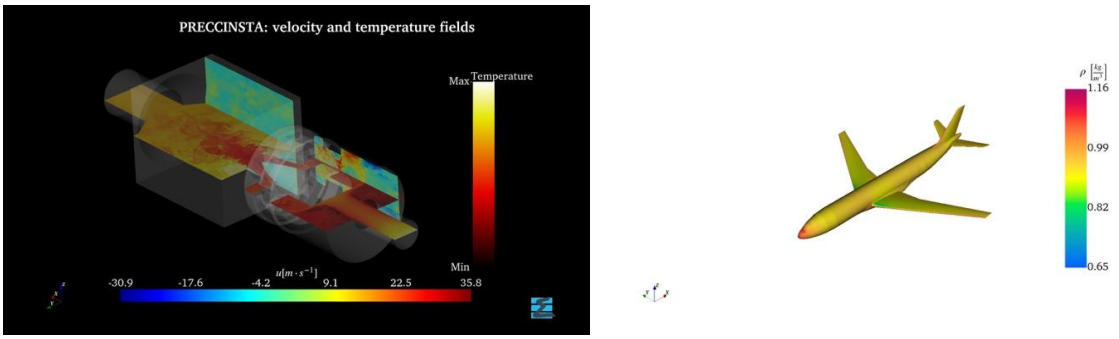

Figure 1. Example of study cases that have used Antares. Right: analysis of the temperature and velocity fields in the PRECCINSTA burner. Left: study of the flow field around the DLR F12 aircraft.

MISSION

The goal of this internship is to add parallel computing capabilities to Antares. The candidate will begin by studying the core of the library, including its data structures and workflows, and will propose modifications to adapt the Antares kernel for parallel HPC architectures. Next, they will examine the existing data analysis algorithms and determine how to adapt them for parallel execution, ensuring that computations scale efficiently across multiple processors.

The proposed solutions will then be implemented in Antares and tested on both academic and industrial datasets. These tests will be carried out on our HPC facilities, giving the candidate access to a variety of CPU architectures with thousands of cores. Finally, the candidate will document, benchmark, and optimize the new parallel implementations using in-house tools developed at Cerfacs.

DESIRED PROFILE

- The candidate has a good background in Python programming and its HPC libraries (numpy, scipy).
- A first experience in parallel programming paradigms would be highly appreciated but not mandatory.
- Within a research framework, the candidate must be able to present their work to the research team (written or oral).
- Teamwork skills.

WHAT WE OFFER AT CERFACS

- Broad access to technology, a rich interpersonal environment, in-house skills recognized nationally and internationally.
- An inclusive and equitable work environment.
- A structure accessible to people with disabilities.
- Possibility of benefiting from 1.83 days of reduced working hours per month, linked to your choice of a 39-hour rather than 35-hour working week.
- 50% reimbursement of public transport costs.

HOW TO APPLY ?

To apply, please send your CV and covering letter to montilla@cerfacs.fr, applications are open until 01/01/2026.

See you soon at CERFACS!