RÉPUBLIQUE FRANÇAISE
Liberté
Égalité
Fraternité

ONERA
THE FRENCH AEROSPACE LAB

www.onera.fr

PROPOSITION DE STAGE EN COURS D'ETUDES

Référence : **DMPE-2025-34** *(à rappeler dans toute correspondance)*	Lieu :	Palaiseau
Département/Dir./Serv. : DMPE/LPA	Tél. :	+33 1 80 38 60 27
Responsable(s) du stage : B. Blaisot, G. Pilla, S. Petit	Email. :	benjamin.blaisot@onera.fr guillaume.pilla@onera.fr sylvain.petit@onera.fr

DESCRIPTION DU STAGE

Thématique(s) : Aerodynamics and Turbulence; Data Analysis; Reactive Flows

Type de stage : ☒ Fin d'études bac+5 ☒ Master 2 ☐ Bac+2 à bac+4 ☐ Autres

Investigation of the aerodynamics and turbulence in a representative hydrogen powered aeronautical combustor using particle image velocimetry (PIV)

The future of aircraft engines is heading towards the use of hydrogen as a fuel in an effort to decarbonize aviation. This change of fuel requires the development of new fuel injection technologies adapted to hydrogen. Characterization of the hydrogen flame in the combustion chamber during the various flight phases (take-off, flight, landing, etc.) is necessary to optimize the design of these technologies. Several experimental characterizations were carried out on the MICADO test bench (velocity fields, flame structure, pollutant emissions) for the flight conditions with hydrogen combustion, as well as flames numerical simulations. Due to hydrogen particular properties, the aerodynamics on the chamber plays a crucial role in the physics of flame stabilization. Therefore, an extended comprehension of the flow field interaction with the flame is required. In this context, the first objective of this internship will be to investigate the aerodynamics and turbulence of the hydrogen flame using the MICADO tests database. The second objective of the internship will be to compare the information obtained with the available flame structure and dynamics characterizations in order to gain a better understanding of the interaction between combustion and aerodynamics.

This work will start with a bibliography on hydrogen combustion, turbulence and applied optical metrology methods, in particular particle image velocimetry. The second part will focus on post-processing the experimental data, by calculating the velocity vector fields and assessing the local turbulence in the chamber. This work will be based on the numerical simulations carried out in parallel with the internship. Finally, depending on the progress of the work, the aerodynamic characterization will be compared with the flame structure and dynamics characterization obtained using optical diagnostics. The student will therefore be required to work in collaboration with ONERA's experimental and numerical teams, and will be expected to take part in experimental campaigns underway on ONERA's high-pressure combustion benches.

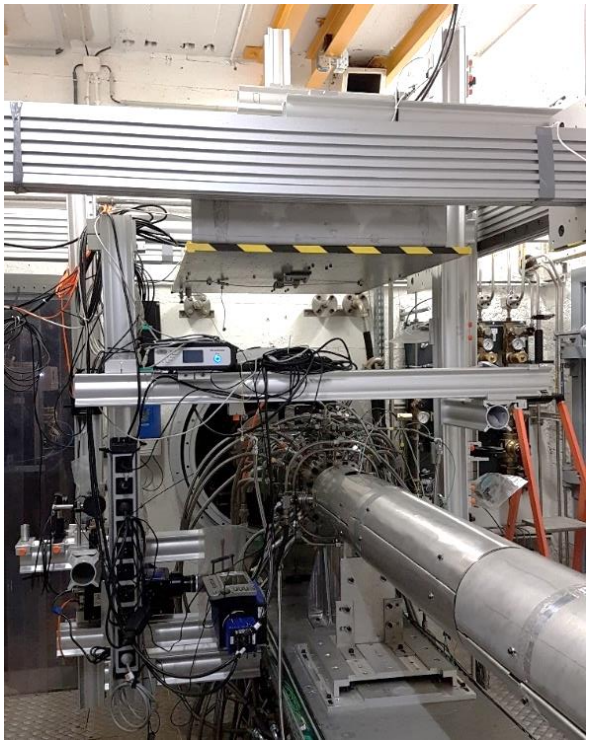

Figure 1 : Experimental configuration implemented around the test bench

Est-il possible d'envisager un travail en binôme ? Non

Méthodes à mettre en oeuvre :

☐ Recherche théorique	☒ Travail de synthèse
☒ Recherche appliquée	☒ Travail de documentation
☐ Recherche expérimentale	☐ Participation à une réalisation

Possibilité de prolongation en thèse : Non

Durée du stage : Minimum : 5 Maximum : 6

Période souhaitée : February-August

PROFIL DU STAGIAIRE

Connaissances et niveau requis :	Ecoles ou établissements souhaités :
M2 in fluid mechanics / combustion. Notions of image processing would be appreciated	University or engineering school