Institute for Mechanical Sciences and Industrila applications
Ecole Nationale Supérieure de Techniques Avancées
Institut Polytechnique de Paris
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Experimental Post-Doc position
Aerosol and turbulence interactions

Location : IMSIA (ENSTA, EDF, CEA, CNRS), Institut Polytechnique de Paris, France
Contact : Romain Monchaux (monchaux@ensta.fr)
Duration : 1 to 2 years from fall 2021
Application deadline: 15/07/2021

Context

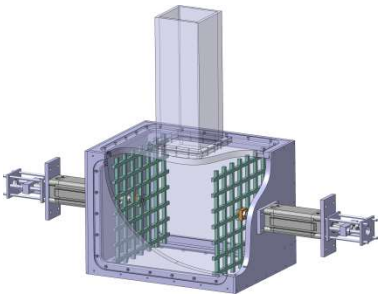
The movement of inertial particles in a fluid is strongly affected by turbulent flows that significantly alter particle concentration and settling rates. Conversely, particles exert forces on the carrier fluid and influence its flow field. The theoretical equations governing such systems include complex force balances and cannot be solved without considerable simplifications. Many numerical studies neglect most force terms in these equations, disregard the aforementioned double coupling between particles and fluid flow and use the point particle limit, as resolving the flow around even a small number of finite-sized particles is prohibitively challenging. In recent years, several teams started investigating the double coupling in terms of the particle loading and inertia. However, the point particle approximation still prevents the proper quantification of the particle influence on the energy transport in the flow, specifically between large and small scales. Experimental studies on inertial particle dynamics in turbulence have to our knowledge not been conducted yet. However, they promise to provide significant insight into the physical mechanisms at work without the need of approximate solutions or neglecting potentially important fluid-particle interactions. This project proposes to fill this gap.

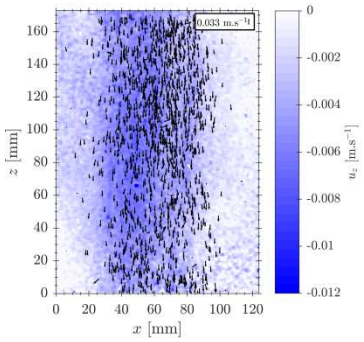
Project

We have recently designed an experimental set-up to perform simultaneous measurement of particle and fluid velocity fields by interfacing Particle Image Velocimetry and Particle Tracking Velocimetry systems. The present project funded by Direction Generale de l'Armement aims at using this system to systematically study the effect of particles on the carrier turbulent phase for a wide range of particle populations (density, size, loading). We have chosen to work in a closed flow, turbulence is produced by two vibrated facing grids.

Collaborations:

Marc Massot, CMAP, Ecole Polytechnique, Anne Dejoan, CIEMAT Madrid, Aymeric Vié, EM2C CentraleSupelec.





Left: the double grid experiment at ENSTA.

Right: simultaneous particle and flow field in the experiment.

Profile

Applicants should have a strong background in non-linear physics and/or in fluid dynamics. She/he should have obtained a PhD in experimental or theoretical physics, preferentially in the field of fluid mechanics, turbulence or dispersed phases.