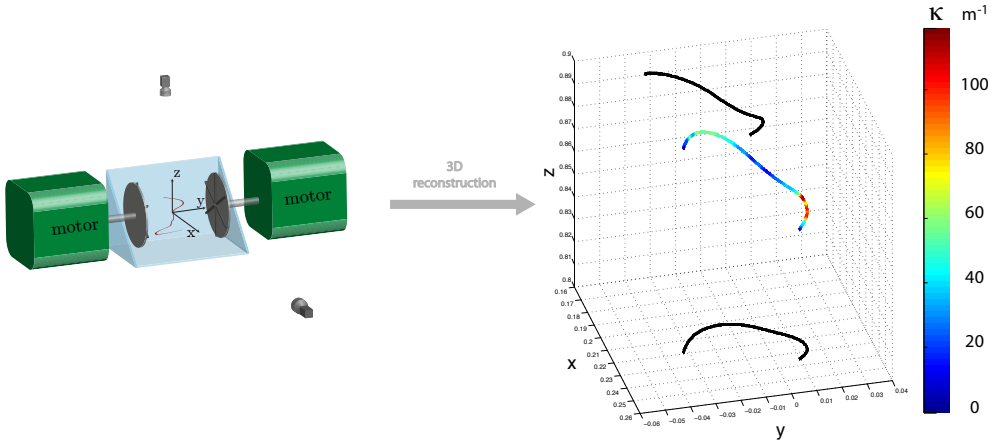
Fragmentation of brittle objects in turbulence

Abstract: The fate of plastic pollution in the ocean is a major issue in environmental science. The lifetime of plastic in the ocean is of the order of hundred of years. This pollution is a threat for the wildlife causing disease and death of animals, the propagation of invasive species,... It also costs more than $10 billion per year to the global economy affecting mainly the fishing and tourism industries. Campaigns of measurement show that the plastic is mainly accumulating in the center of the oceanic gyre. However the quantity of plastic estimated by these measurements is by far smaller than expected, posing the question of the becoming of plastic in the ocean. The evolution of the size of fragments is a crucial element in the understanding of the transport of plastic debris [1]. Chemical ageing plays a role in altering the properties of the materials, but ultimately, fragmentation driven by fluid forces is responsible for the evolution of the fragment size distribution. However a detailed knowledge of the physical processes at play during the fragmentation driven by turbulent flows is still missing.

The aim of the proposed work is to study the breakup of brittle fibers in a turbulent von Kármán flow in order to document the sequence of events leading to the fragment size distribution. A flexible fiber placed in a turbulent flow deforms because of the inhomogenity of the fluid forces it experiences. The scale of its deformation depends on the fluid properties, the mechanical properties of the fiber and the intensity of turbulence. Through detailed and simultaneous measurements of the flow field, the shape of the fibers and their fragmentation using high speed imaging, we intend to improve the understanding of the fragmentation dynamics. This study is in the continuity of a continued effort at IRPHE on the characterization of fiber deformations in turbulence [2].



[1] A. Cózar *et al.*, Plastic debris in the open ocean, *PNAS*, **11**(28), 10239-10244, 2014.

[2] A. Gay *et al.*, Flexible fibers in turbulence: why size matters, *to be submitted*, 2018.

Profile: Candidates with a taste for experimental work and with a background in physics, mechanical engineering, applied mathematic or any related field are invited to apply.
Duration: The postdoctoral position is for one year (ANR). We will begin to review submissions in March 2018 and will continue until the position is filled.

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