Master projet: Experimental study of a double chamber injector

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Training period : February to July 2020

Candidate profile: engineering or physics background with strong formation in fluid mechanics. Strong interest in experimentation and in measuring techniques. Experience in signal processing recommended.

Keywords: Atomisation, turbulence, experimental fluid mechanics

Context:
Atomisation of a double chamber injector is of interest for many industries as it significantly reduces the operation costs. Indeed, it has been found that these injectors working with non-newtonian fluids can obtain a high-quality spray with a significantly smaller pressure loss on the injector. However, the mechanisms from which this improvement is obtained are not clear yet. A possible explanation for the substantial reduction of the atomisation pressure required, would be that the first nozzle somehow perturbates the jet (making it turbulent and/or unstable, as shown in the following figure), while the atomisation actually occurs downstream the second one and is somehow "facilitated" by the turbulence generated upstream.

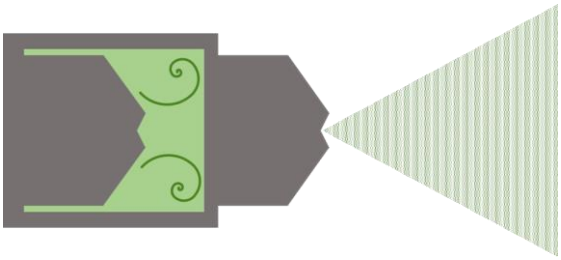

Figure: example of a double chamber and the flow within it.

This master project focuses on the validation of this hypothesis. Indeed, to understand the double chamber mechanism would allow to significantly increase the efficiency of atomisation in industry. The study will be developed on three stages:

- On a first step, the trainee will test commercially available double chamber injectors and verify that the pressure loss diminution is obtained with water.

- Then, he/she will characterise the spray with laser doppler velocimetry and optical probes. The objective is to quantify the size distribution of droplets for different pressures at the injector. The pressure loss within the chambers will be also characterised with a pressure sensor.

- Finally, the first two steps will be repeated for different distances between the injectors/chambers. A modification of the resulting spray will imply that the turbulence intensity of the intermediate jet may play a role on the atomisation process.

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