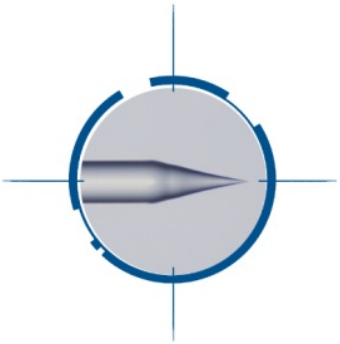
M2 Spray Analyzer

Application cases



A2 PHOTONIC SENSORS
c/o Grenoble INP/Minatec
3 Parvis Louis Néel
CS 50257
38016 Grenoble Cedex 1 - France
Phone: +33 456 529 543
www.a2photonicsensors.com

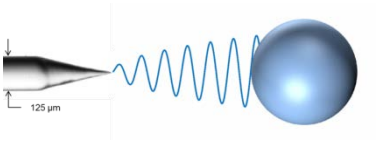
1. M2 Sensor presentation

A2 PHOTONIC SENSORS' M2 spray analyzer is dedicated to the measurement of droplet size and velocity, as well as liquid/gas ratio.

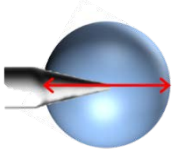
The core of the system is an optical fiber probe, to be immersed in the spray. The probe is connected to a portable optoelectronic module, which is itself plugged to a standard computer where the M2 software is installed. The whole system can get up and running in minutes.

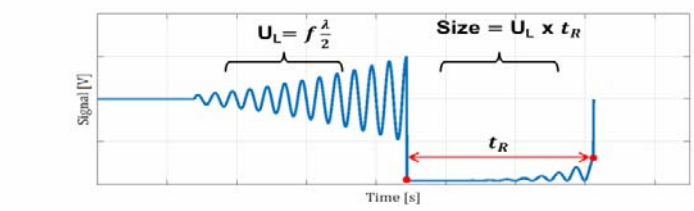
Measurement principle:

The velocity of each droplet is measured in a contactless manner when the droplet gets close enough to the probe tip (less than 100 µm). During this approach phase, the droplet reflects the laser light emitted by the optical fiber probe and creates an interference phenomenon, the frequency λ of which is proportional to the droplet velocity U_L.



As the droplet gets then pierced by the probe, the time of residence t_R of the probe tip inside the droplet is measured, giving access to the droplet size.

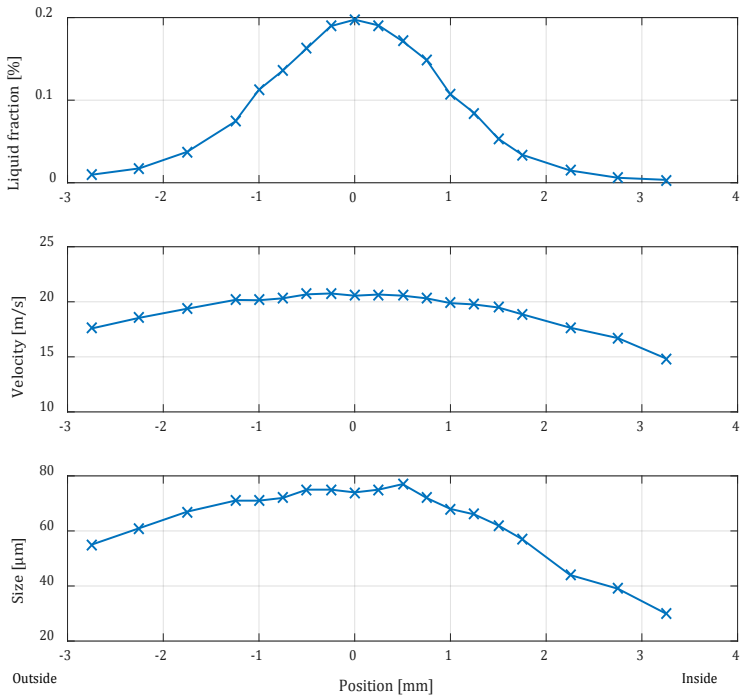


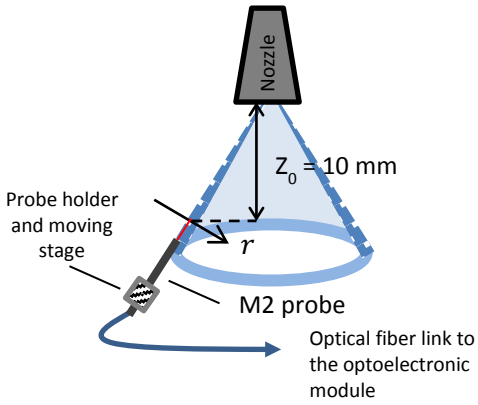


2. Agricultural spray nozzle case

This experiment aimed at characterizing an agricultural spray nozzle close to (10 mm) its output, by measuring the mean droplet size and velocity as well as the liquid fraction over a radial profile.

Radial profiles were built from 19 measurement points evenly spaced: 500 µm on each side, 250 µm at the center of the liquid sheet for better resolution.





Validation: these values have been used to calculate the liquid flow rate of the spray, by integration under axisymmetric condition. It resulted in a computed flow rate of 21.1L/h, very close to the 20L/h displayed by a flowmeter used as a reference.

Experimental setup:

Nozzle: Albuz ATR-80 hollow cone

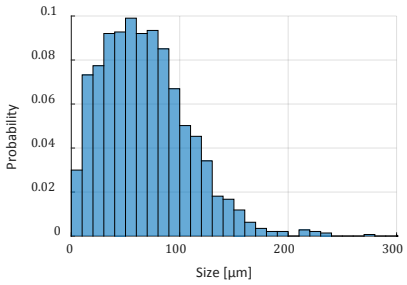
Pressure: 5 bars

Flow rate: 20L/h

M2 probe position: $z_0 = 10\text{mm}$ / 40°

Probe radial step: 250 and 500 µm

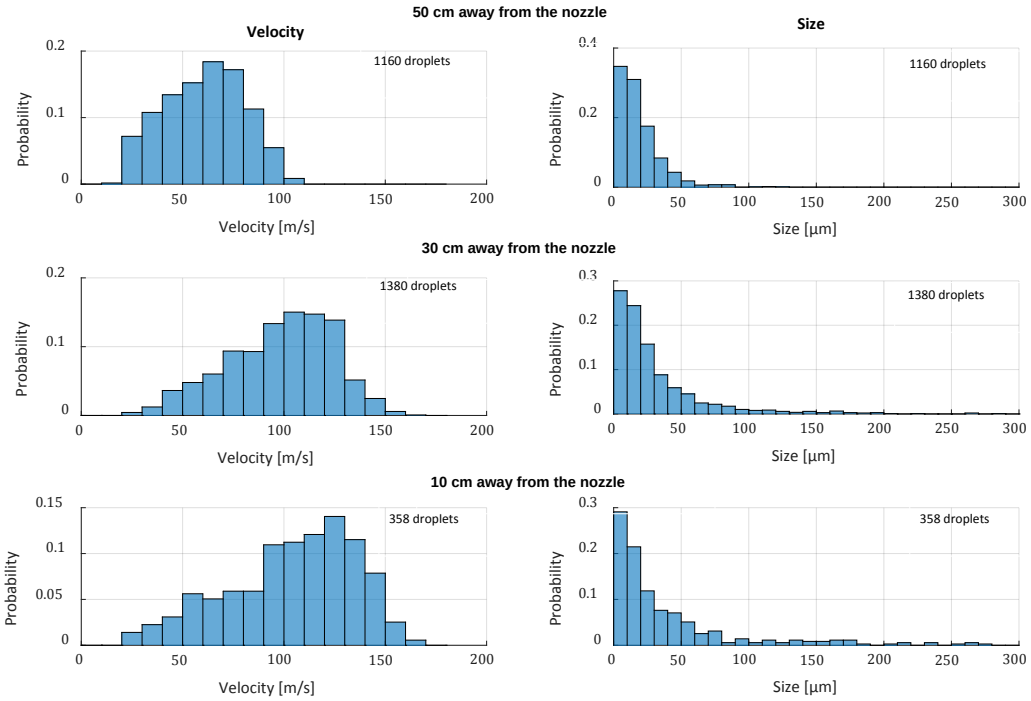
Additional information: each point on the profiles above is a mean value over about 1000 droplets. It is to be noticed that the M2 software gives also access to the detailed distributions at each probe location.



3.High pressure cleaner case

In this application, the M2 analyzer was used to measure the drop size and velocity evolution along the main axis of a liquid jet generated by a commercial high pressure spray cleaner.

Measurements were performed at 3 distances from the nozzle: 50 cm, 30 cm and 10 cm.



Each raw data acquisition has been recorded in less than 30 s and processed within a minute. Thanks to the M2 sensor's ability to deliver immediate results, the operator can tweak the parameters of the spray on the fly and rapidly observe the effects of the changes.