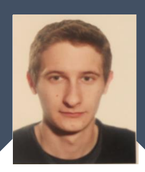
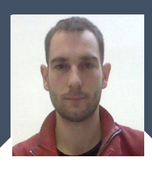
# Design of an agricultural nozzle: Experimental investigation of a round jet impacting vertically a horizontal disc


Sofiene Ouled Taleb Salah[1,2,3]  Nicolas De Cock[1]  Alexis Duchesne[3]  Mathieu Massinon[1]  Frédéric Lebeau[1]  Stéphane Dorbolo[3] 

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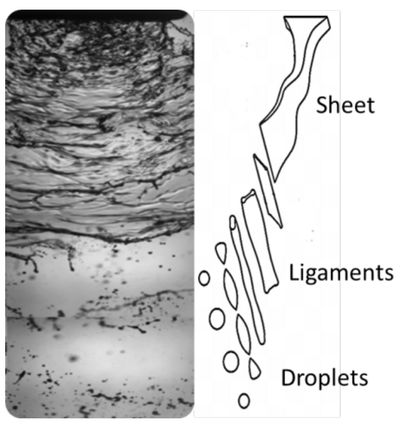
## Jet Break Up

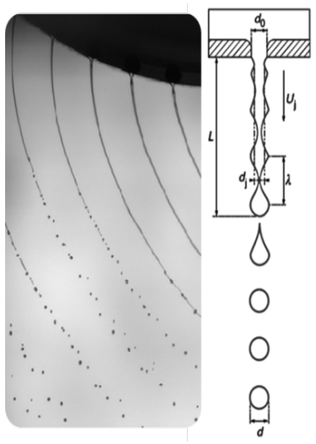
### 1 Flat fan nozzle

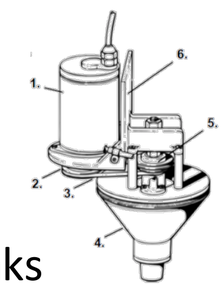



Random liquid sheet break up

Extended droplet spectrum

### 2 Rotary atomizer (centrifugal forces)





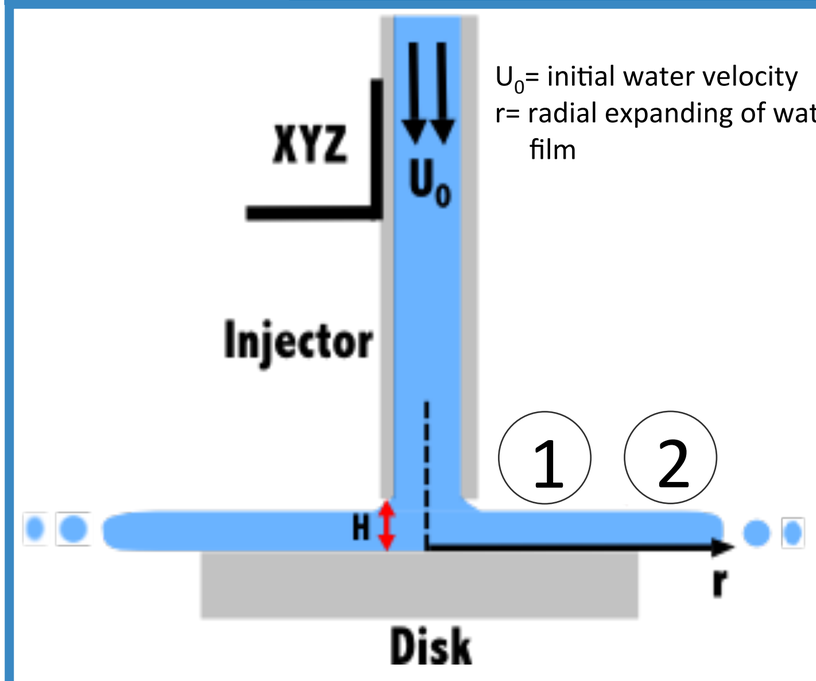

Rayleigh plateau regime
(the most unstable perturbation breaks the jet in droplets of 1.89 times the jet diameter)

Narrow droplet spectrum

## Goal

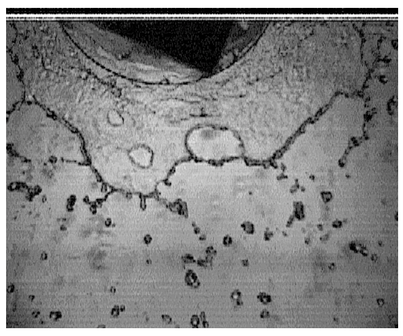
This study is the first step to optimize a design of a hydraulic nozzle producing a narrow droplet spectrum based on the Rayleigh-Plateau break up mode.

## Nozzle design



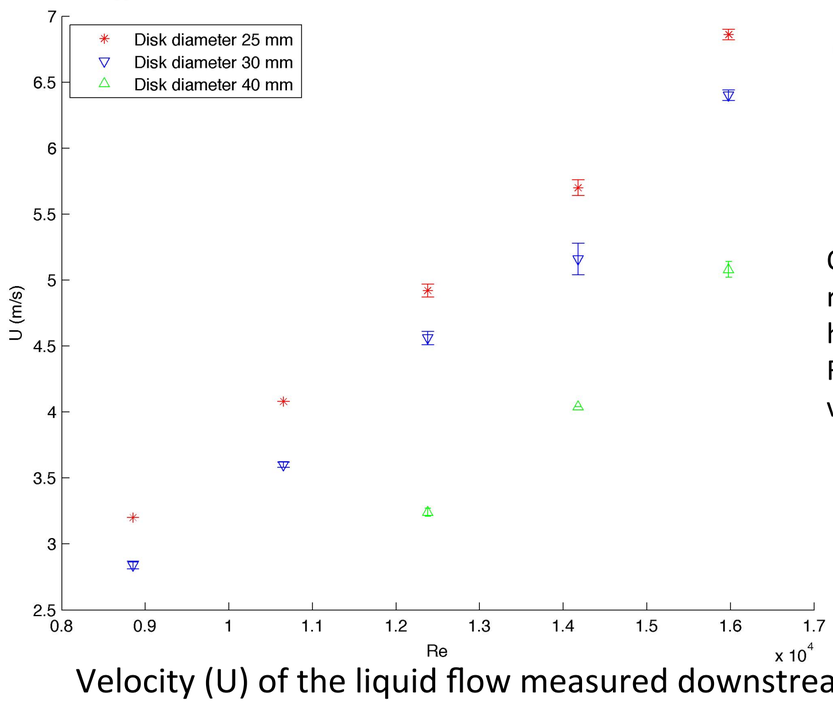

Experimental setup

$U_0$= initial water velocity
r= radial expanding of water film



Top view of a tap water film bordering a motionless disk.

### 1 Generate a homogeneous liquid film



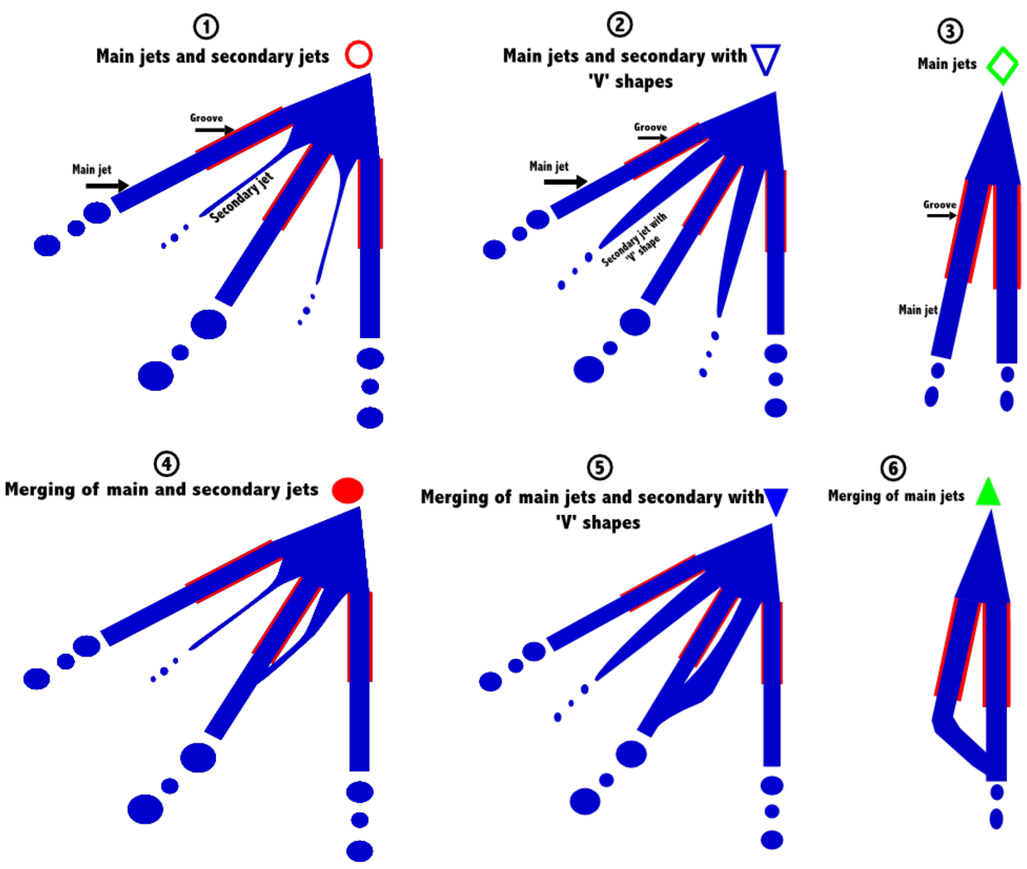

$$U = \frac{Q}{2\pi r h}$$

$$Re = \frac{2Q}{\pi R \nu}$$

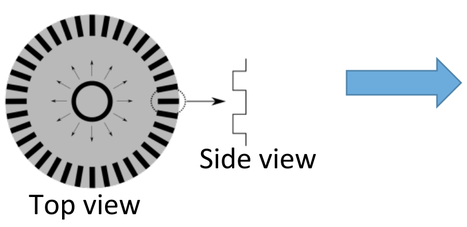
Q: flow rate
r: flow radial distance
h: film thickness
R: injector Radius
v: cinematic viscosity

Velocity (U) of the liquid flow measured downstream (1 mm before of the disk border) as a function of Re

### 2 Split the liquid sheet in multiple round jets using grooves

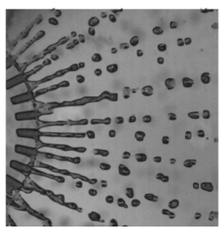


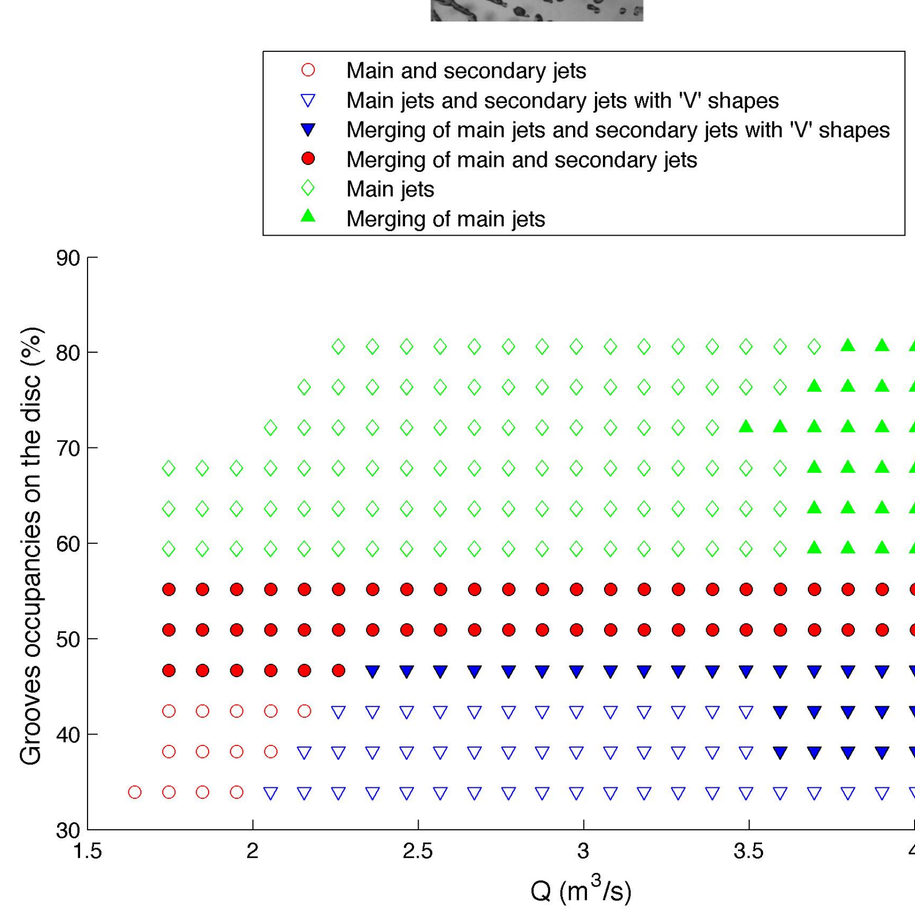

Different scenarios of the liquid behavior on the disk depending on groove configurations.



Top view

Side view






Percentages of grooves occupancies (calculated as the number of grooves multiplied by their widths and divided by the disk perimeter) as a function of the flow rate (Q).