Studies of water mist produced by low-pressure nozzles arrays

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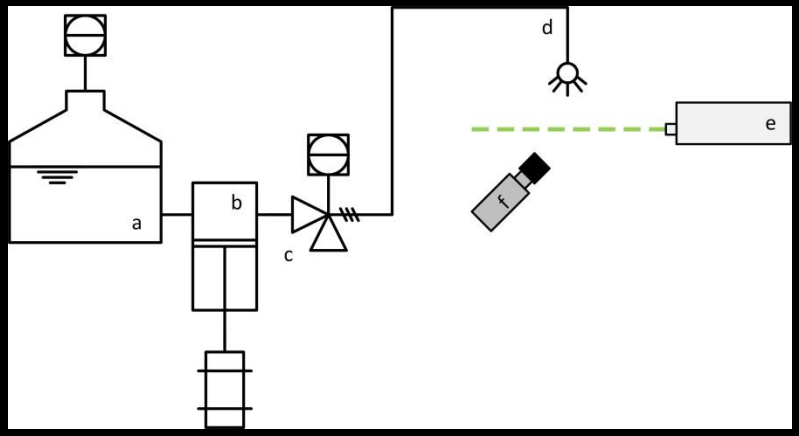
Objectives

- Optimisation of nozzle arrays for producing water mist at low pressures (P < 30 bar)
  - Configuration of the array
    - Position and orientation of the nozzles in the cluster
  - Relation between droplet size distribution and inlet pressure
  - Effect of additives on droplet size distribution

Procedure

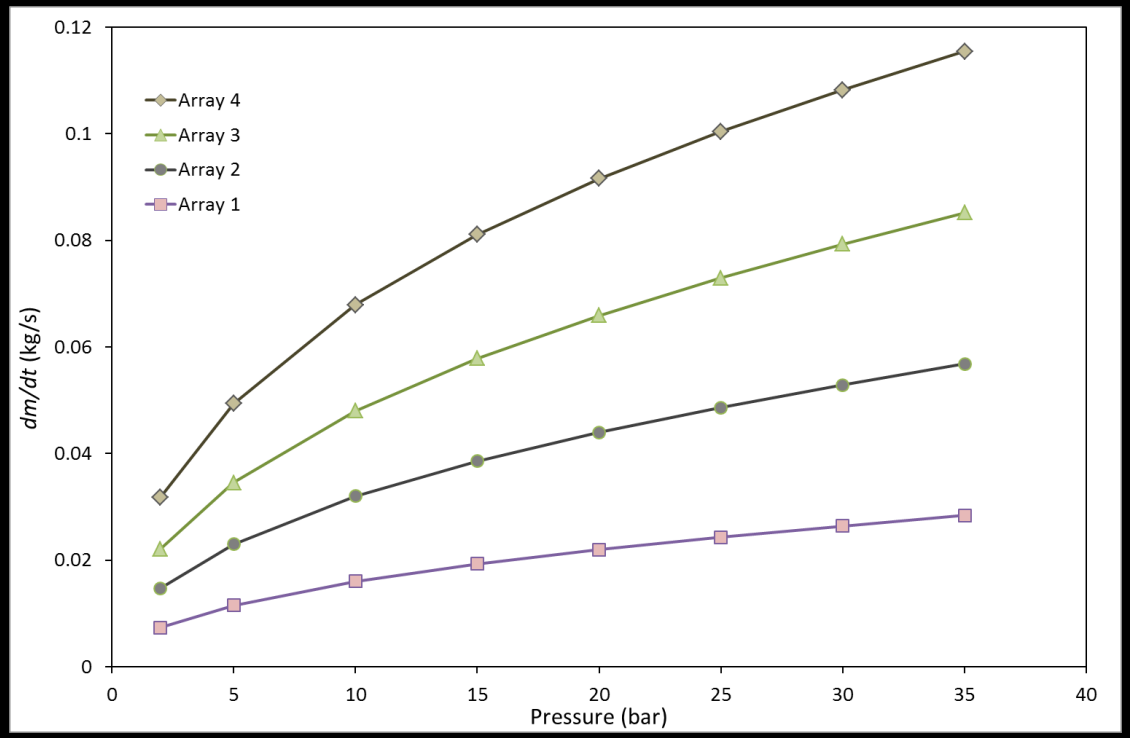
- Measurements of flow by gravimetric measurements
- Measurements of droplet size distribution by laser-based optical methods (interference based using GSV)
- Measurements done 600 mm downstream the nozzle for the studied configurations
- Water and water with an added surfactant (3 % in weight)

Experimental set-up



a) pressurised liquid reservoir
b) electrically driven reciprocating pump
c) pressure regulator
d) cluster with equidistant nozzles (PNR 01090B1)
e) doubled framed camera
f) Nd:YAG laser

Flow through the nozzles (water)

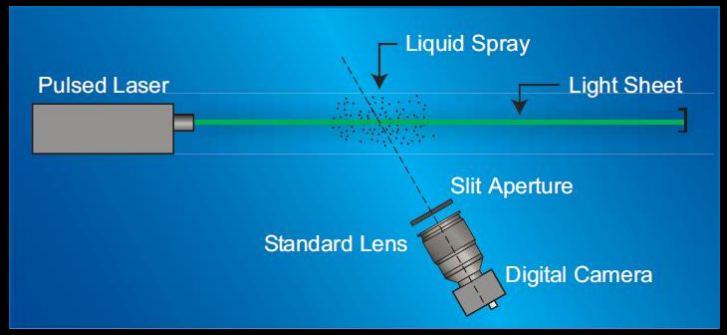


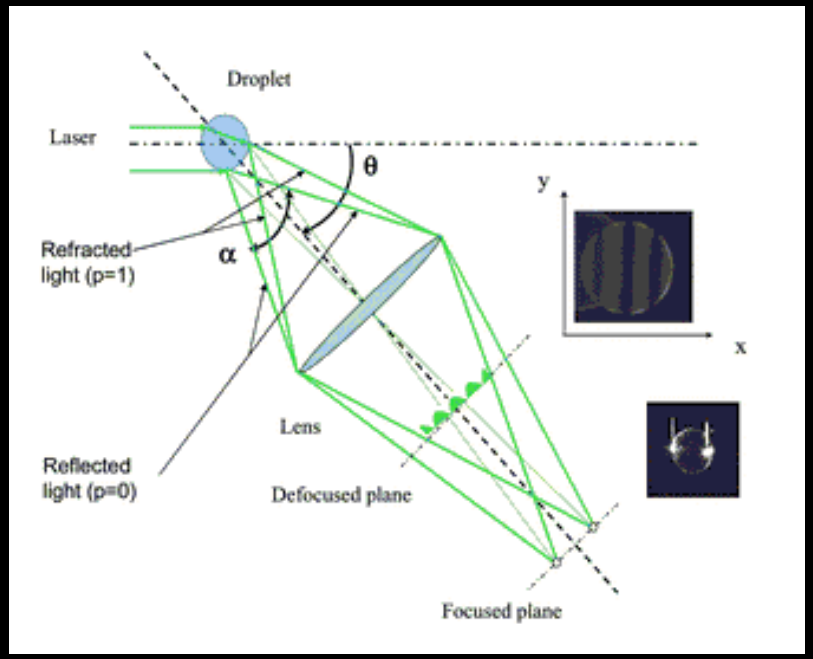
A1

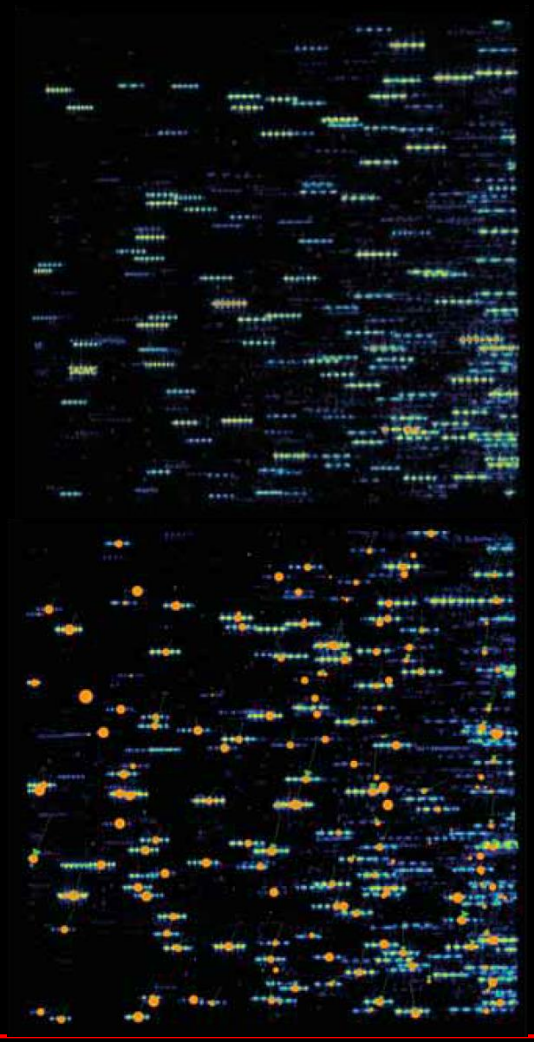
A2

A3

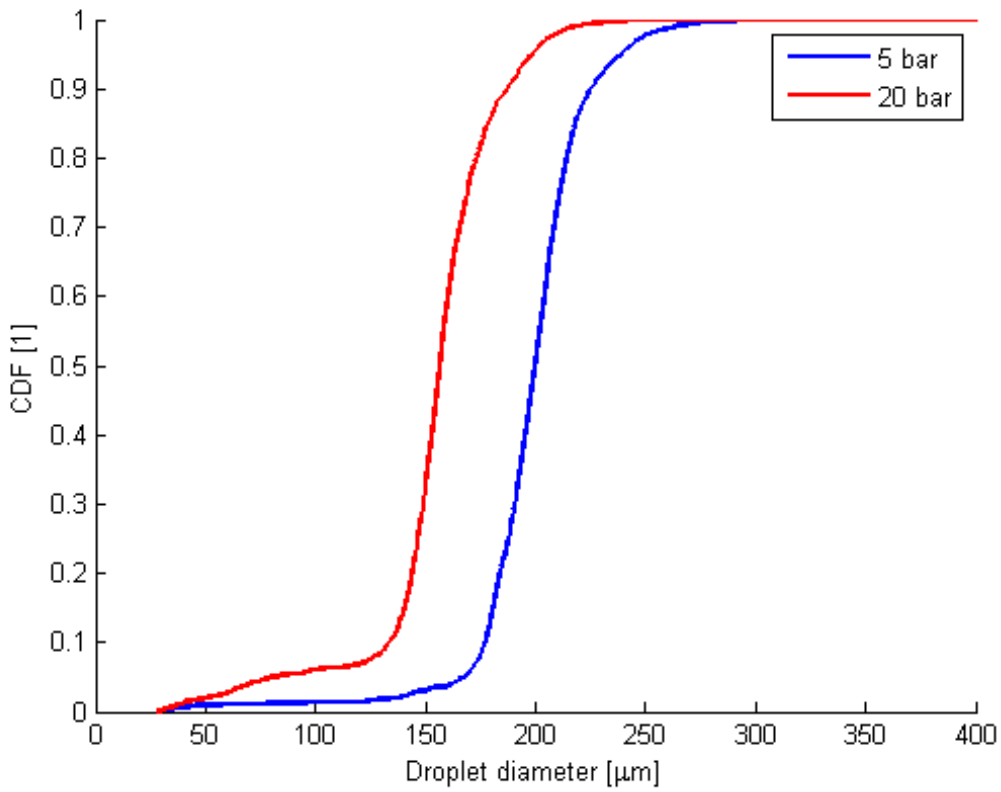
Working principle

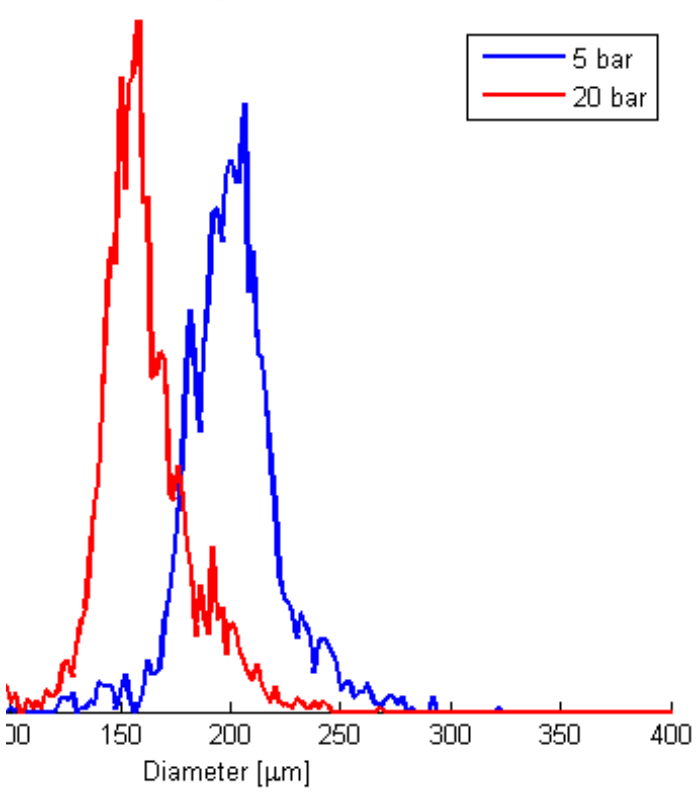




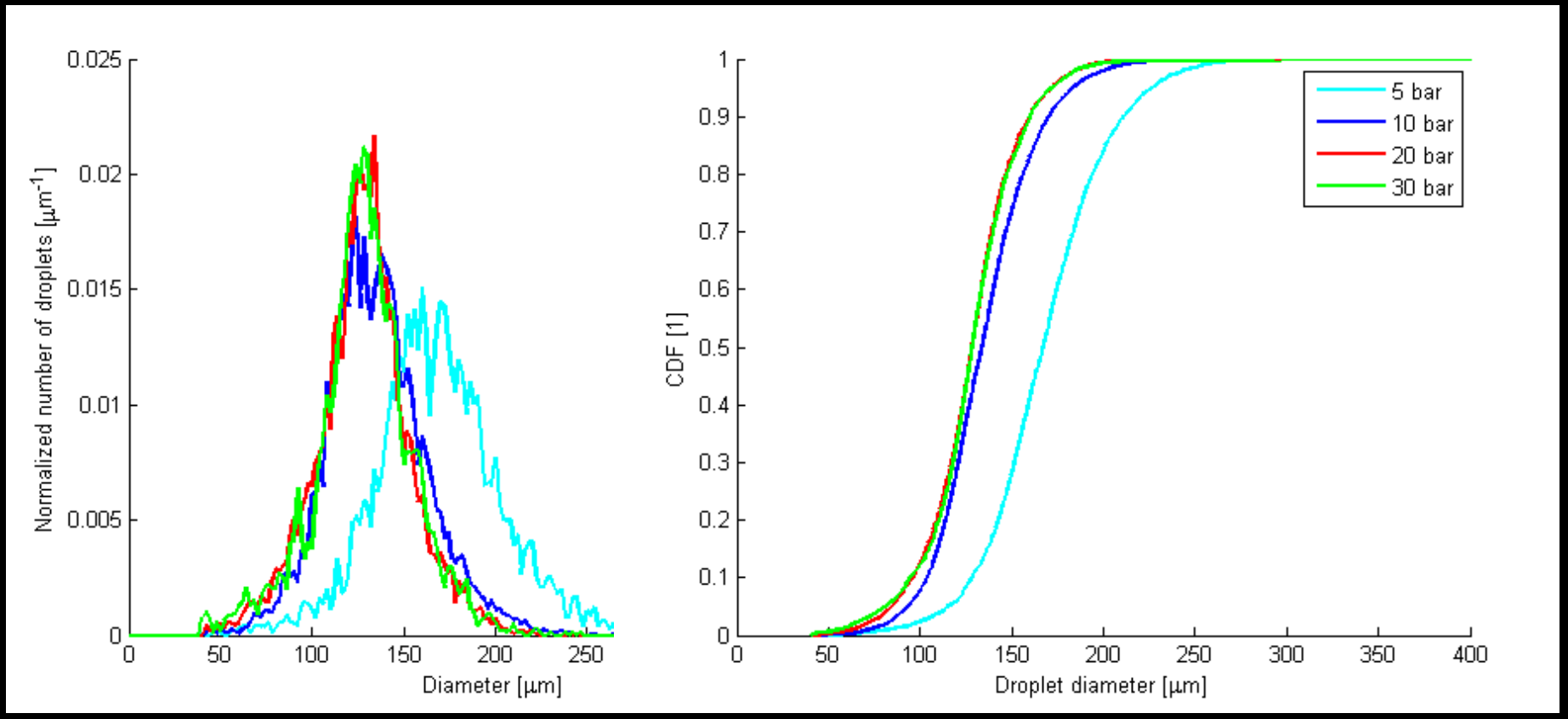


Spray characterisation (A1)

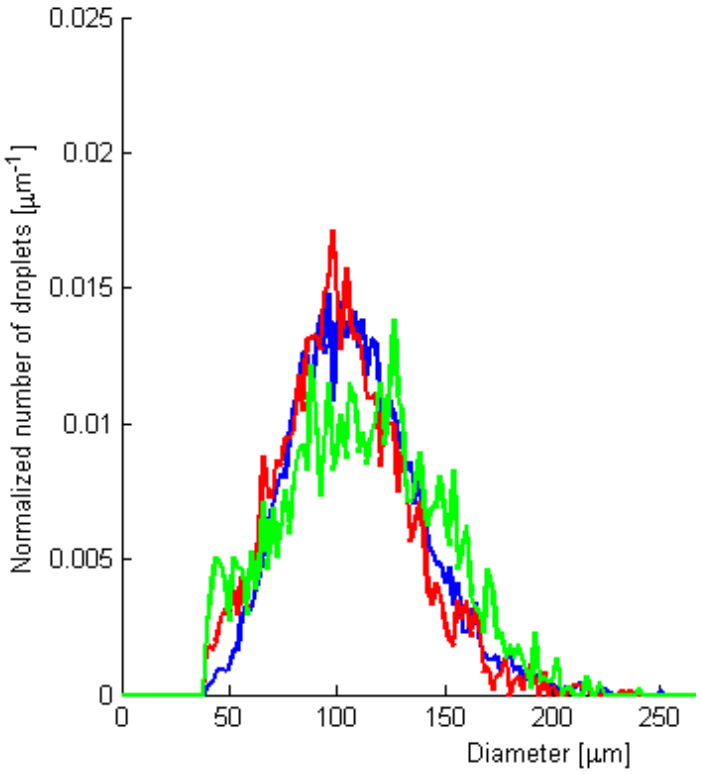


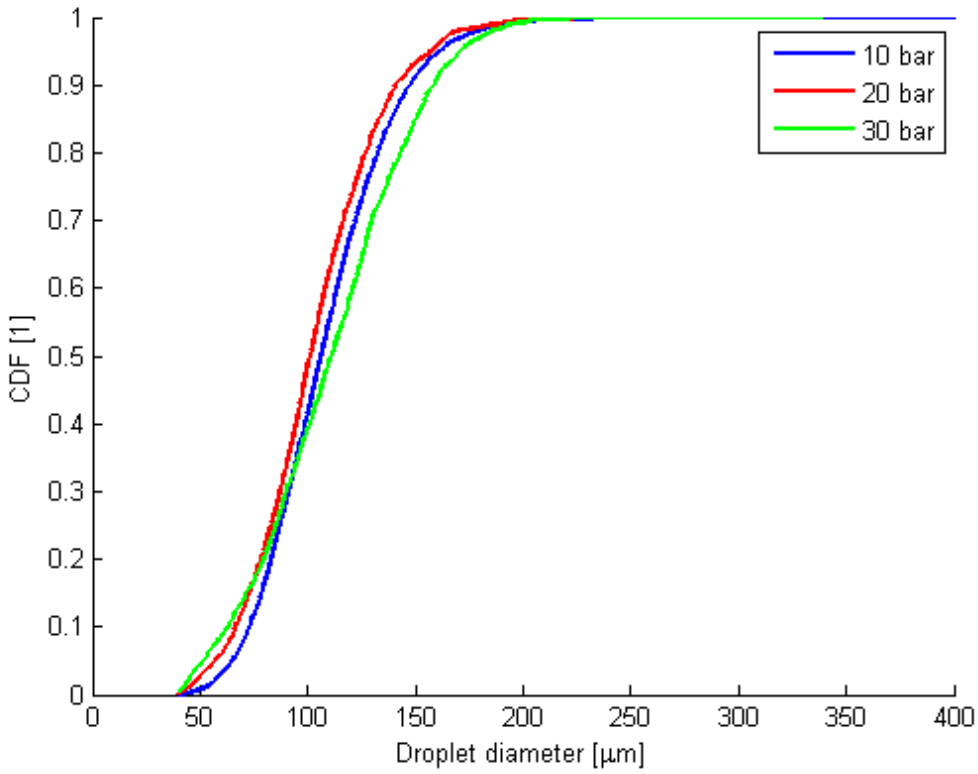


Spray characterisation (A2)

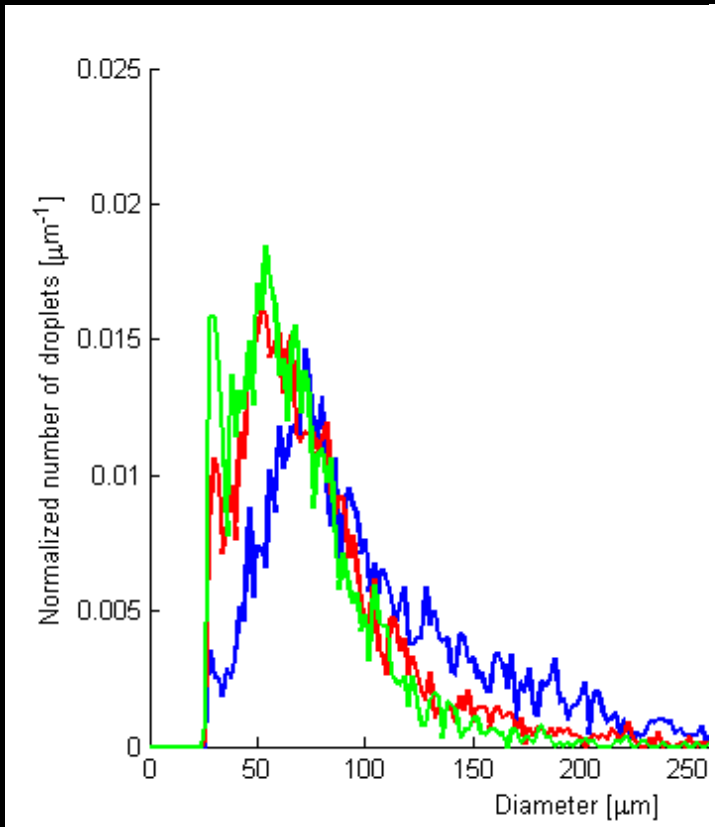


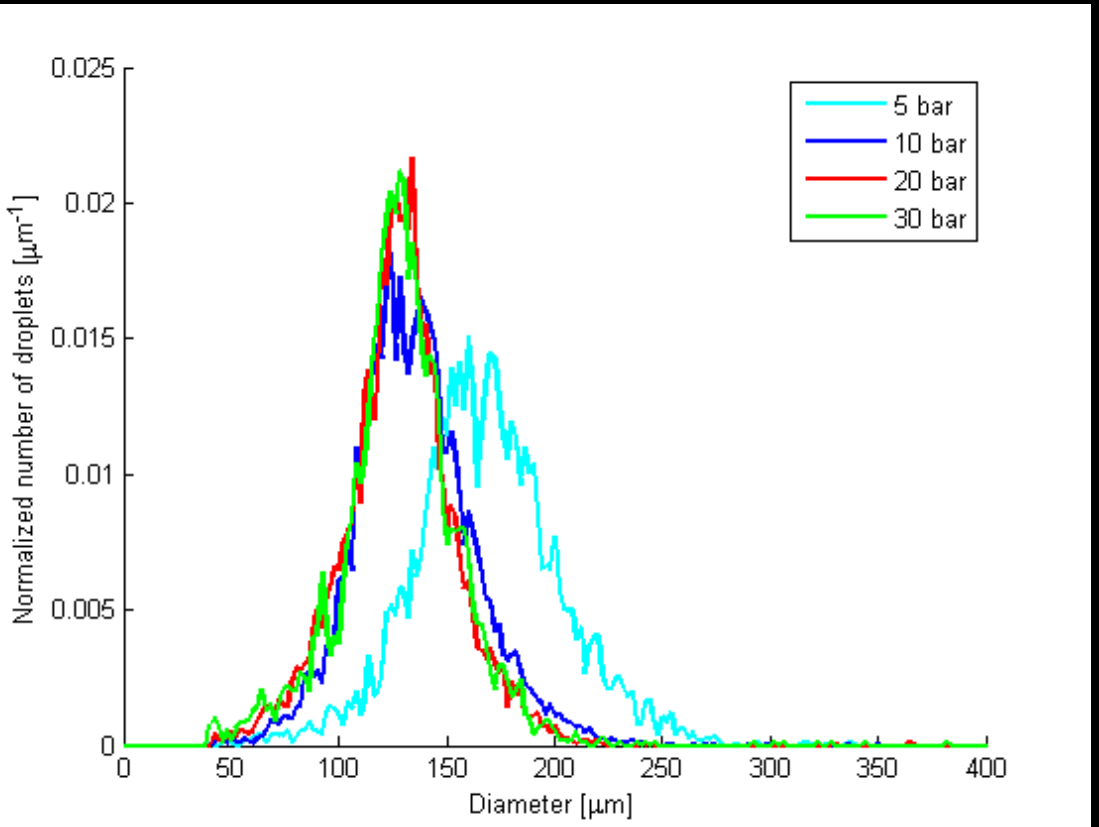
Spray characterisation (A3)



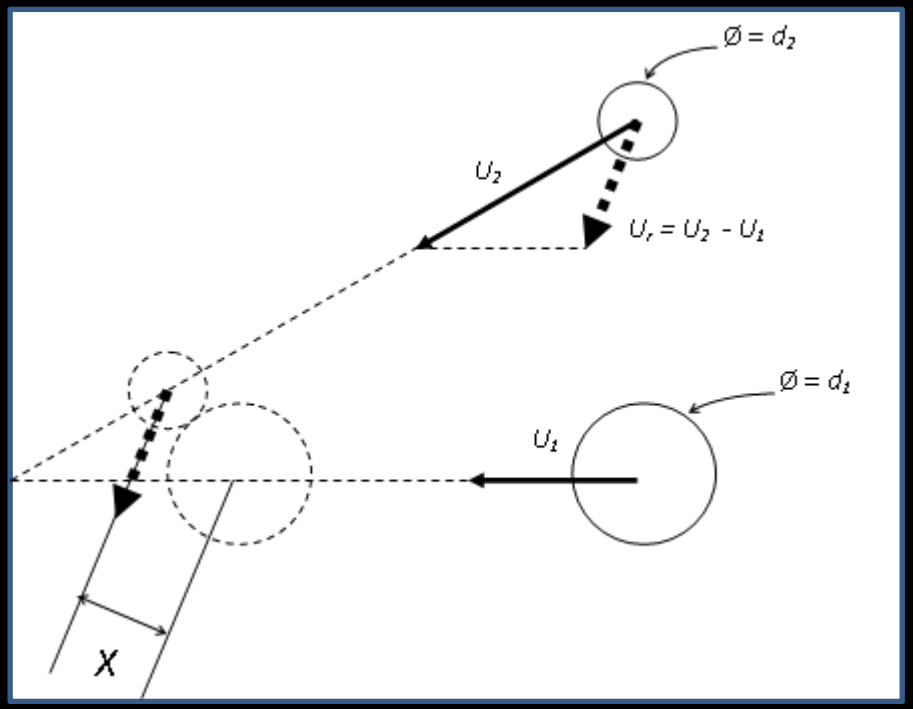


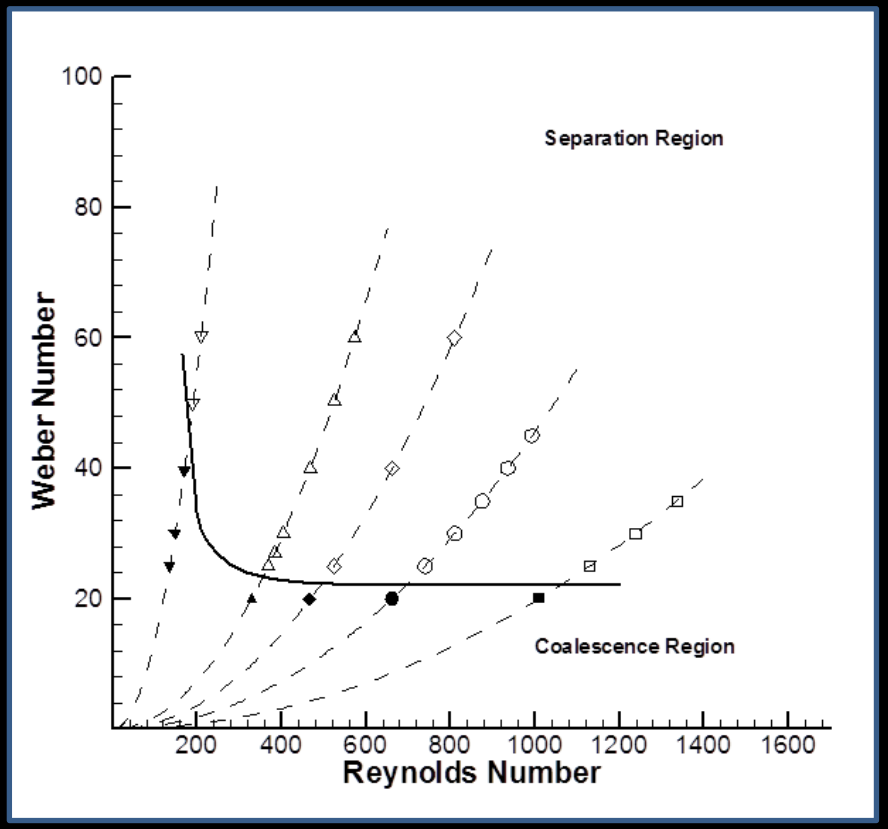
Spray characterisation (A2, s&w)





Coalescence





Conclusions

- Droplet size is, as expected, reduced as the pressure is increased reaching a quasi-asymptotic limit (~125 µm and ~120 µm)
- The array 2 configuration leads to a high shear stress among colliding jets resulting in coalescence with larger droplets at the centre of the spray
- The addition of surfactant led to reductions in droplet size diameter (~50 %)

Acknowledgements

- Lena Bernhed from PNR Nordic for providing the experimental nozzles