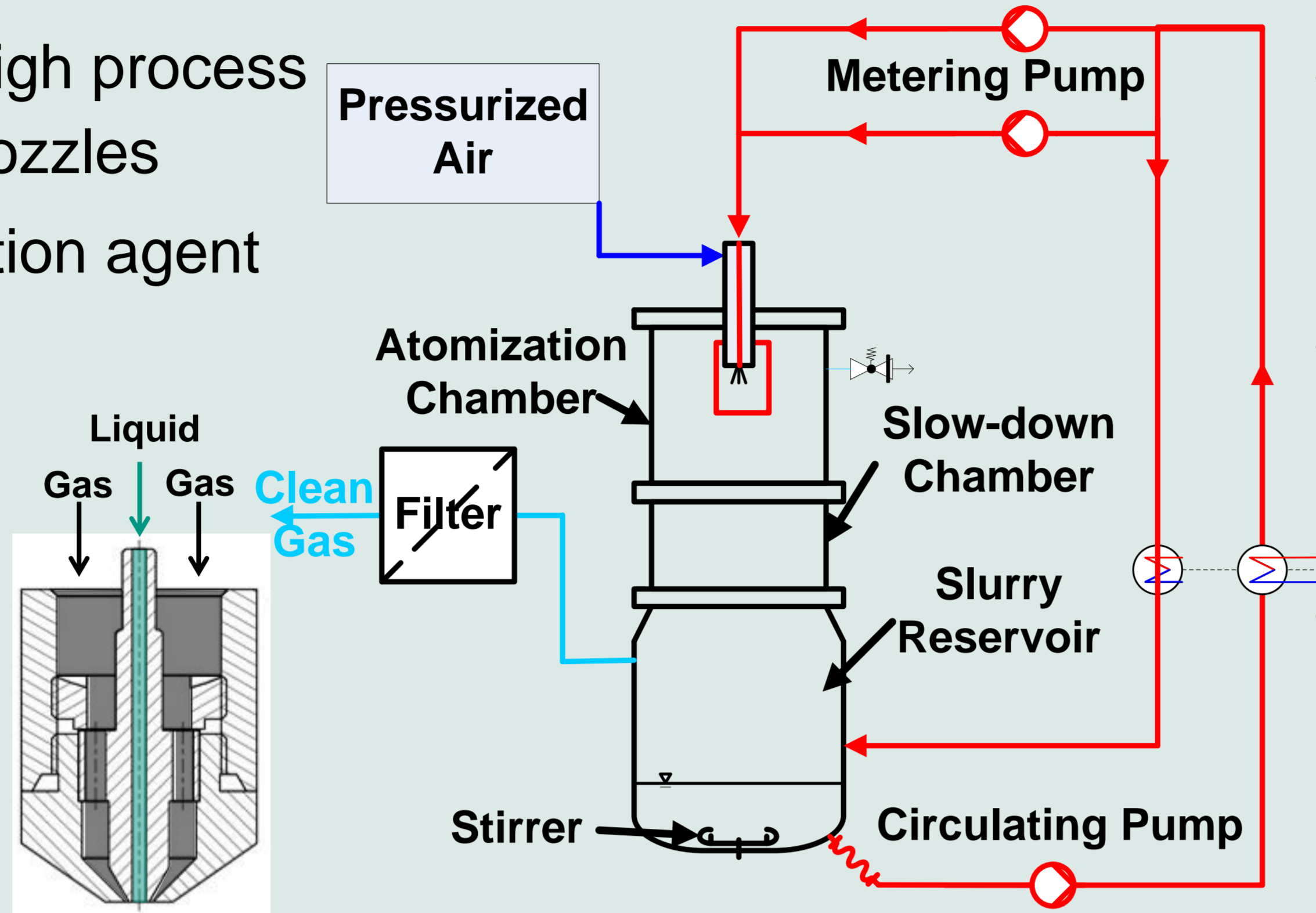


# Pressurized Atomisation Test Rig – PAT

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## Challenges

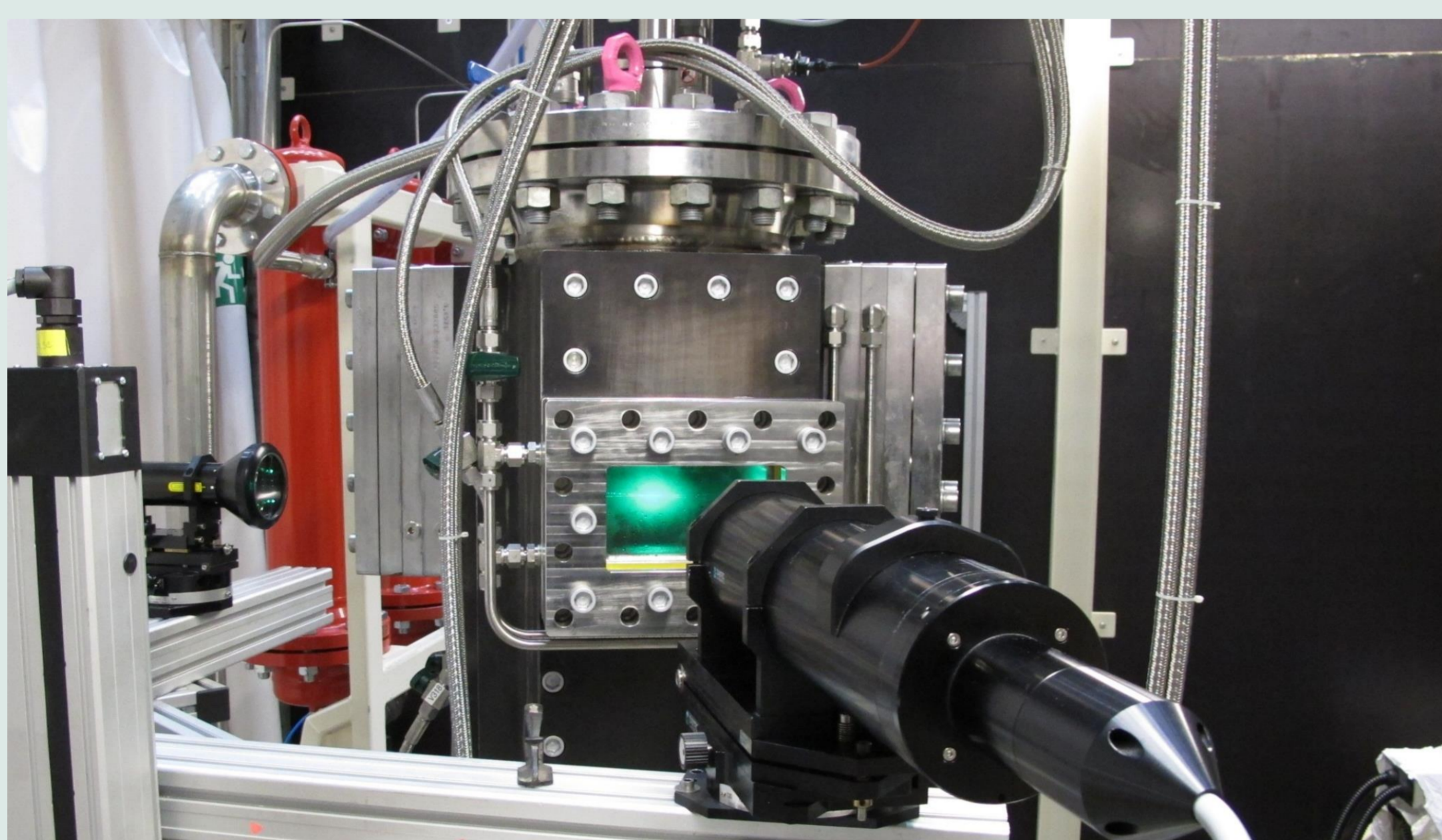
- Atomisation of slurries at high process pressure using air-assist nozzles
- Limited amount of atomisation agent (low GLR)
- Complex rheology of multiphase-fluid
- Measurement techniques for high process pressure (dense, opaque spray)



## Objectives

- Model based description of atomisation and particle size distribution of high viscous non-Newtonian slurry at high pressure conditions
- Optimization of atomization process for increased syngas quality in entrained flow gasifier
- Input / validation data for numerical simulations of technical entrained flow gasifiers (detailed → overall process)

## Pressurized Atomisation Test Rig – PAT



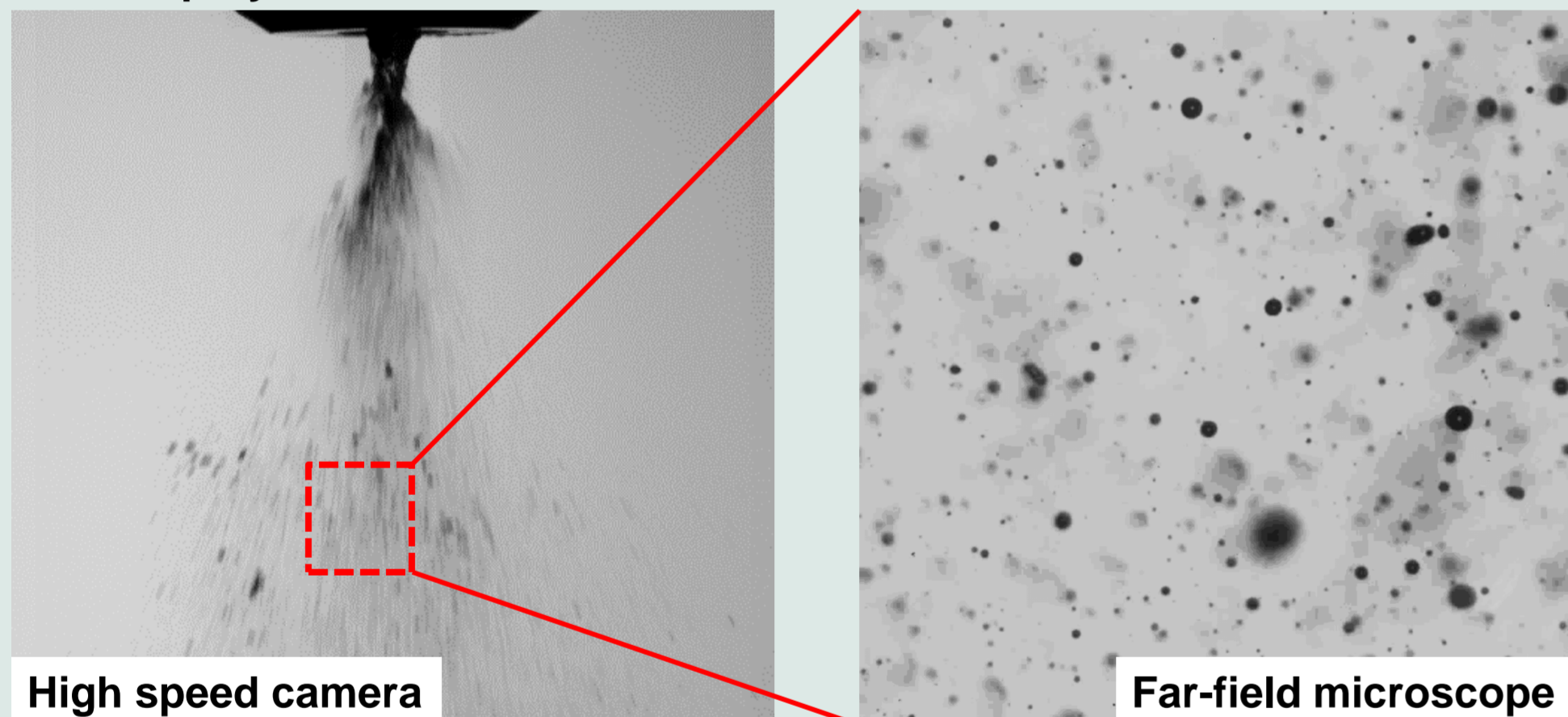
### Features:

- High pressure vessel  $p_{\text{reactor,max}} = 20 \text{ bar}_g$
- Operation with high viscous suspensions  $\eta_{\text{liq,max}} = 1000 \text{ mPa}\cdot\text{s}$
- Optical accesses with purge system
- Axial movable nozzle
- 3-d movable traverse rig for measuring technique

### Measuring Technique:

- **Phase Doppler Anemometer – PDA**  
→ drop-size and velocity distribution in pure transparent liquid spray
- **Shadow-Sizing**  
→ drop-size and velocity distribution in opaque slurry spray
- **High-Speed-Camera & Far-field microscope**  
→ qualitative investigation of atomisation mode and spray pattern

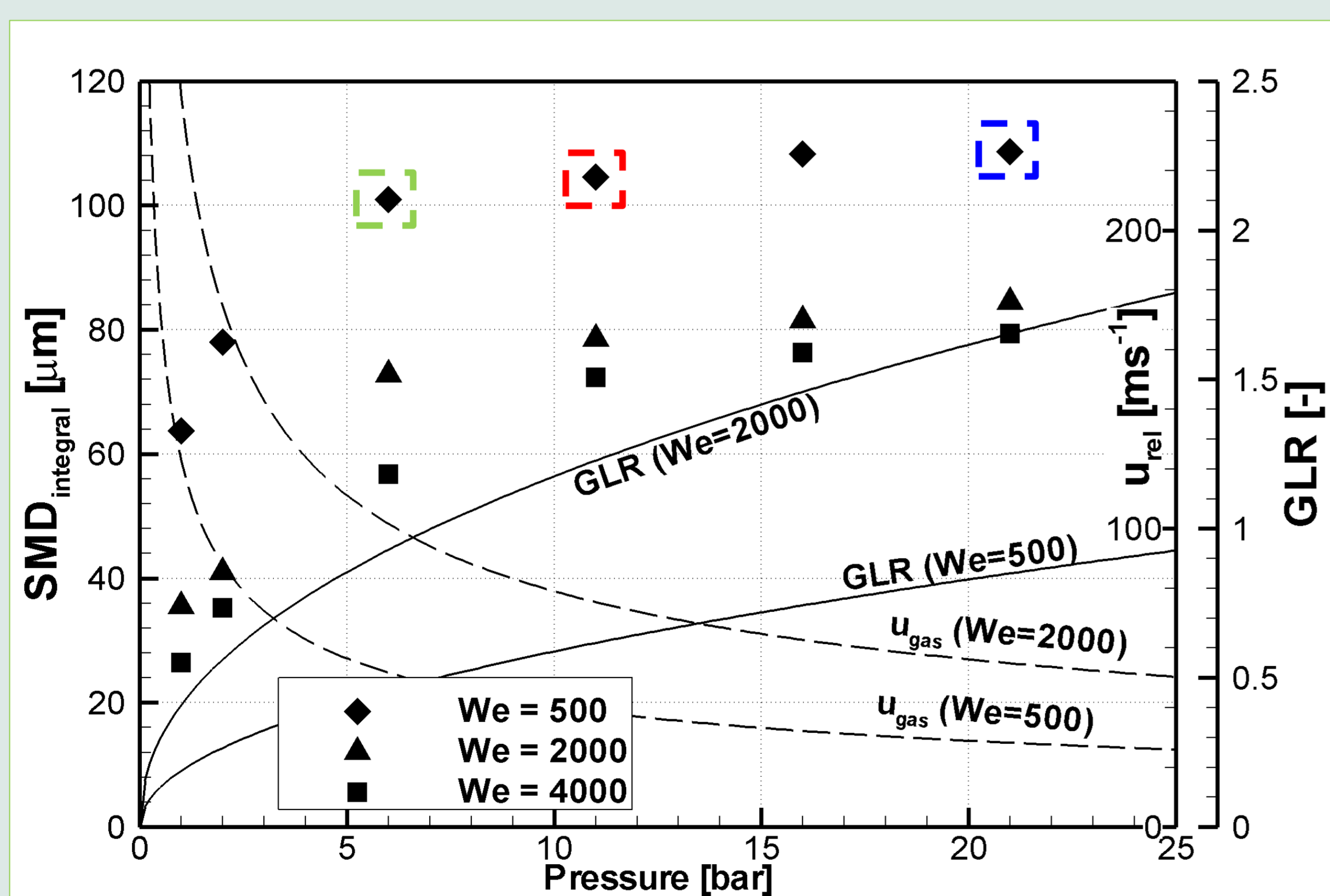
Water spray visualisation



High speed camera

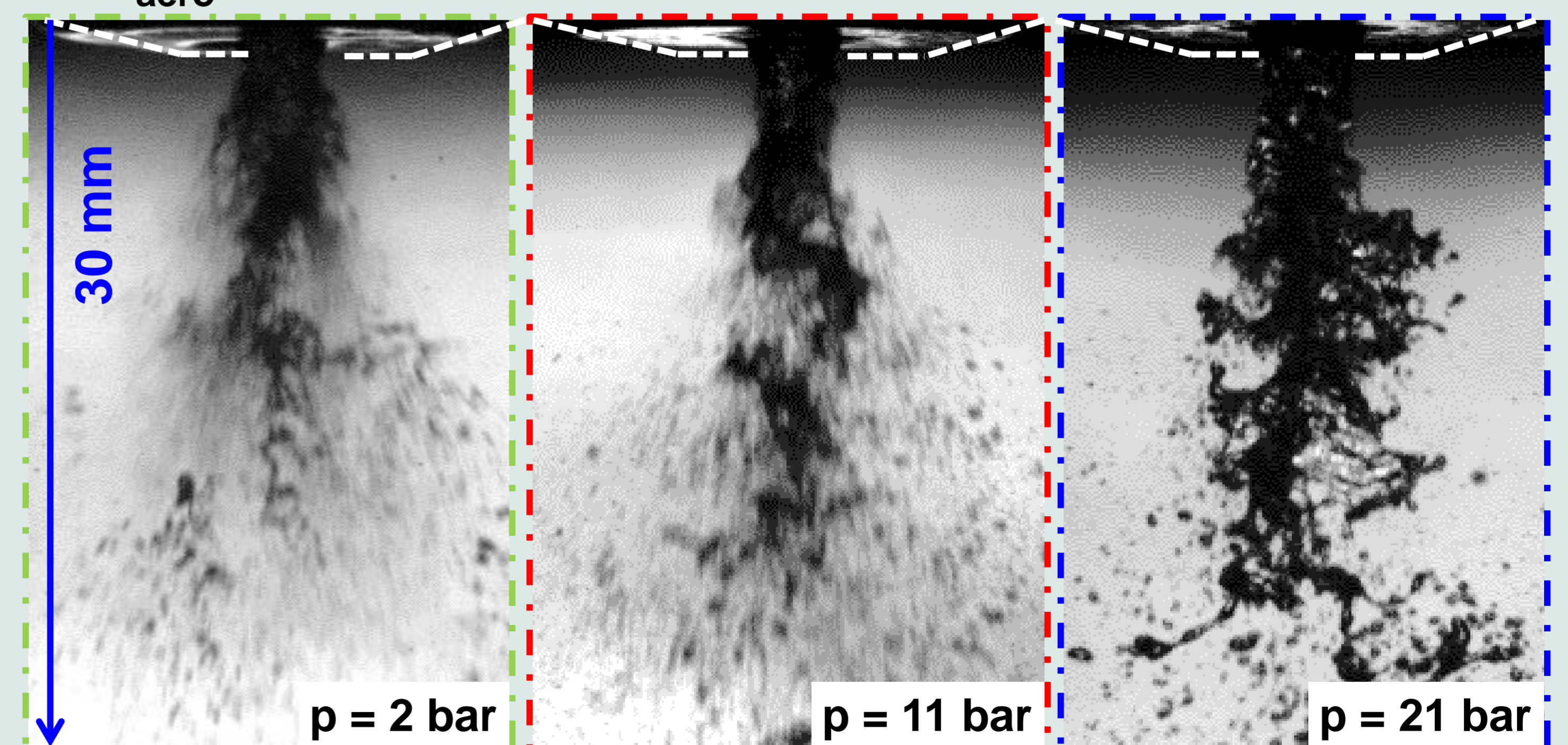
Far-field microscope

## Atomisation of Low Viscous Liquid as Function of Ambient Pressure



- Increasing SMD with increasing  $p_{\text{reactor}}$  for  $We_{\text{aero}} = \text{const.}$
- Decreasing SMD with increasing  $We_{\text{aero}}$  at  $p_{\text{reactor}} = \text{const.}$
- Increasing  $l_{\text{prim,jet}}$  with increasing  $p_{\text{reactor}}$  for  $We_{\text{aero}} = \text{const.}$

$We_{\text{aero}} = \text{const.}$



### Operating Conditions:

$M_{\text{liq}} = 20 \text{ kg/h}$ ;  $p_{\text{reactor}} = 1 - 21 \text{ bars}$ ;  
 $GLR = 0.05 - 3$ ;  $\eta_{\text{liq}} = 1 \text{ mPa}\cdot\text{s}$ ;  
 $z = 200 \text{ mm}$