Warsaw University of Technology

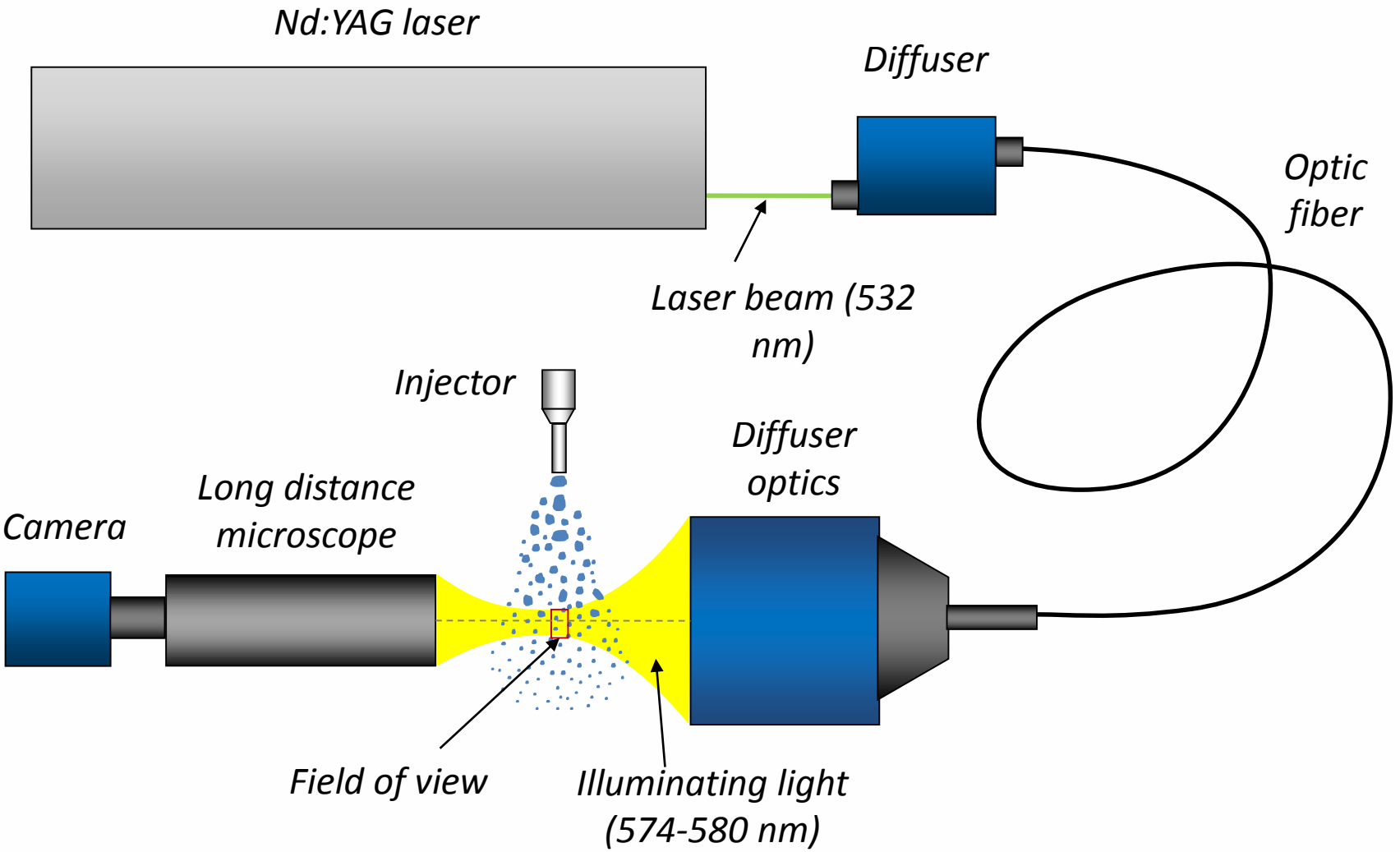
Laser Diagnostics Laboratory

Łukasz Jan Kapusta

Laser Diagnostics Laboratory

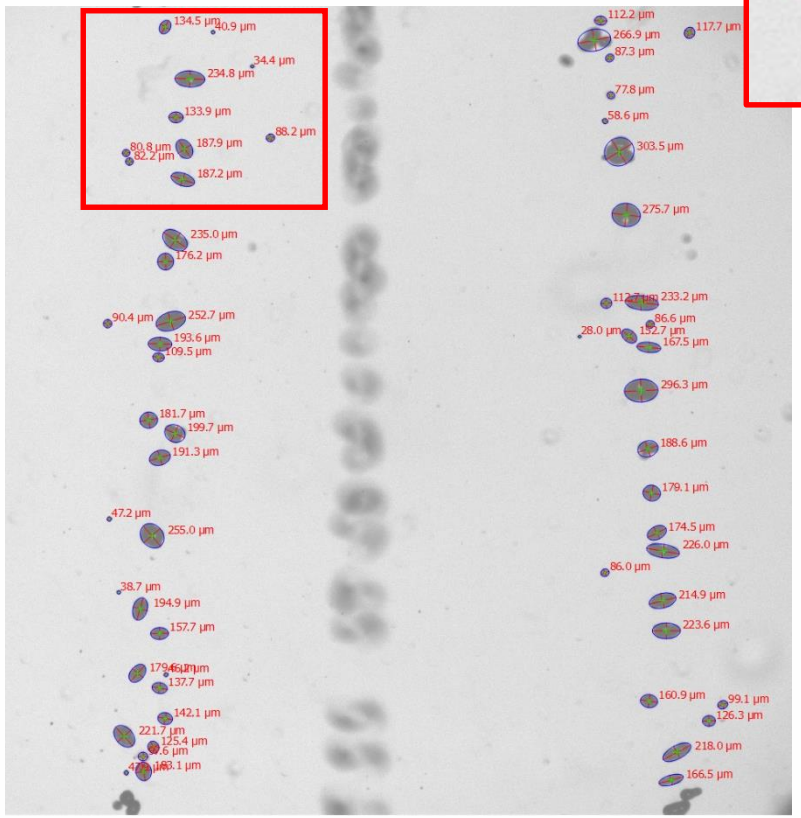
- Experimental techniques
  - Long distance microscopy
  - High speed imaging
  - LIF/Mie droplet sizing
  - SLIPI - Structured Laser Illumination Planar Imaging
- Constasnt volume combustion vessels

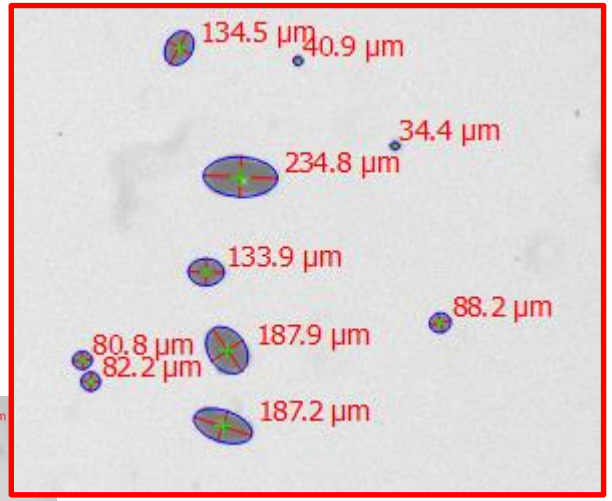
Long distance microscopy



Long distance microscopy

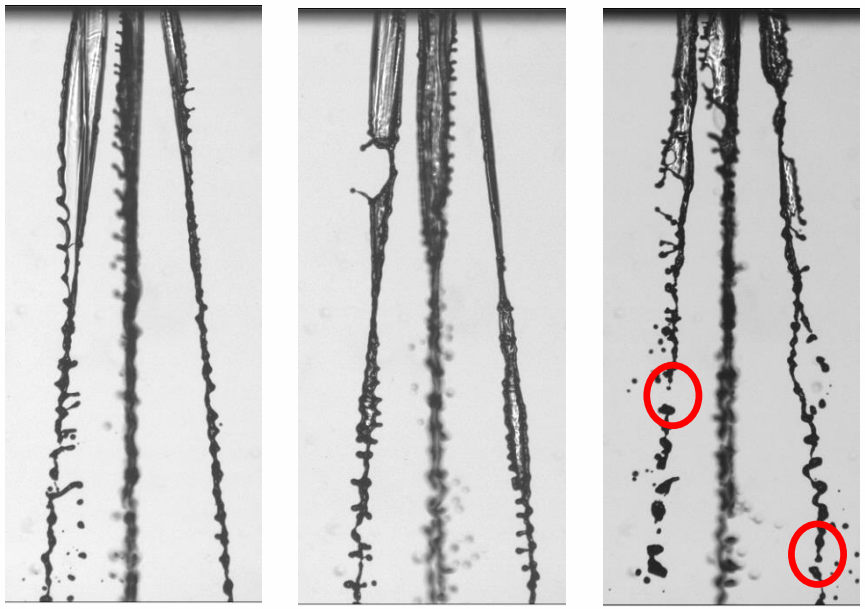
- Droplet size
- Eccentricity



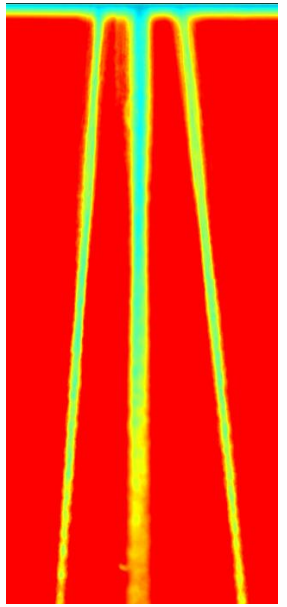


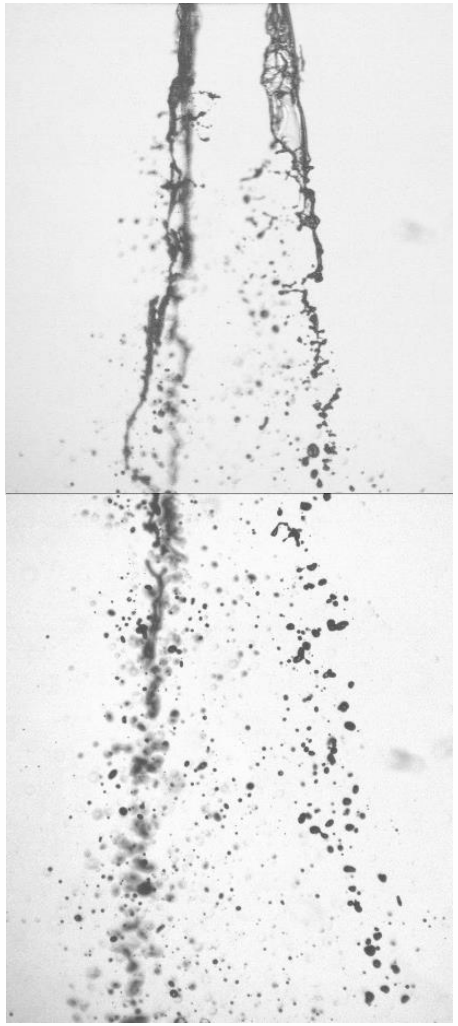
Long distance microscopy

- Unbroken liquid length
- Jet directions



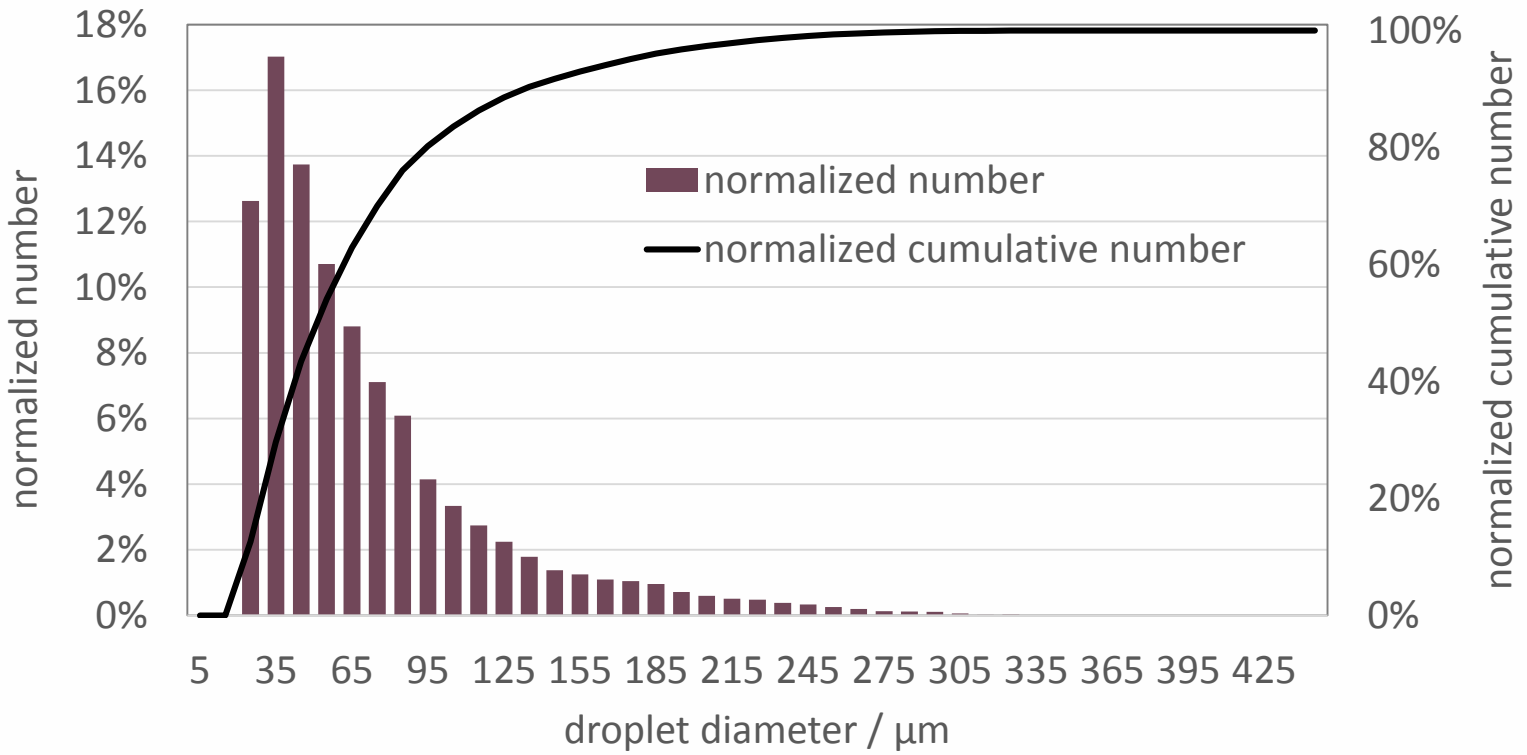
25 °C 40 °C 60 °C

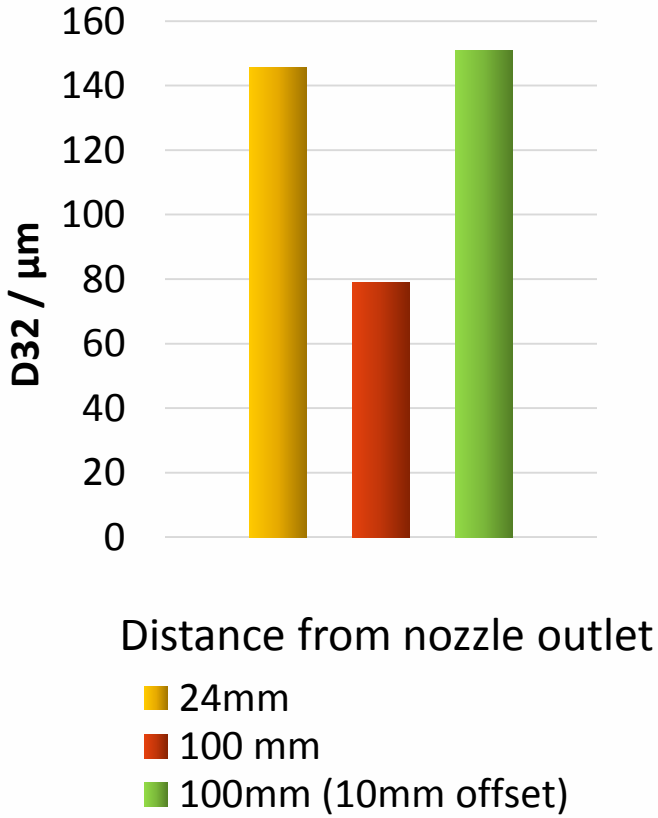




Long distance microscopy

Droplet statistics





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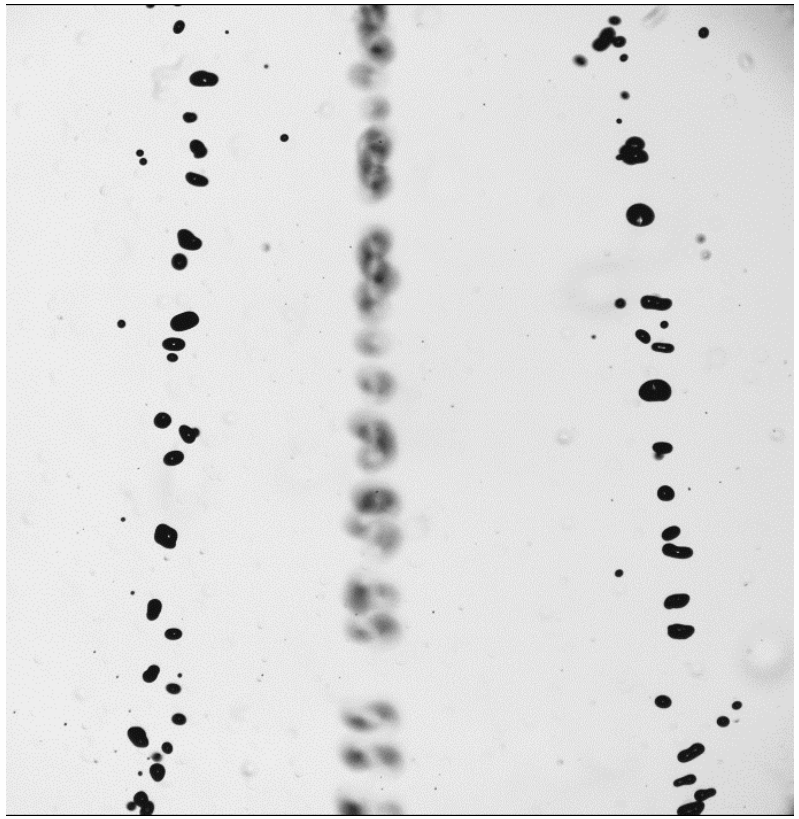
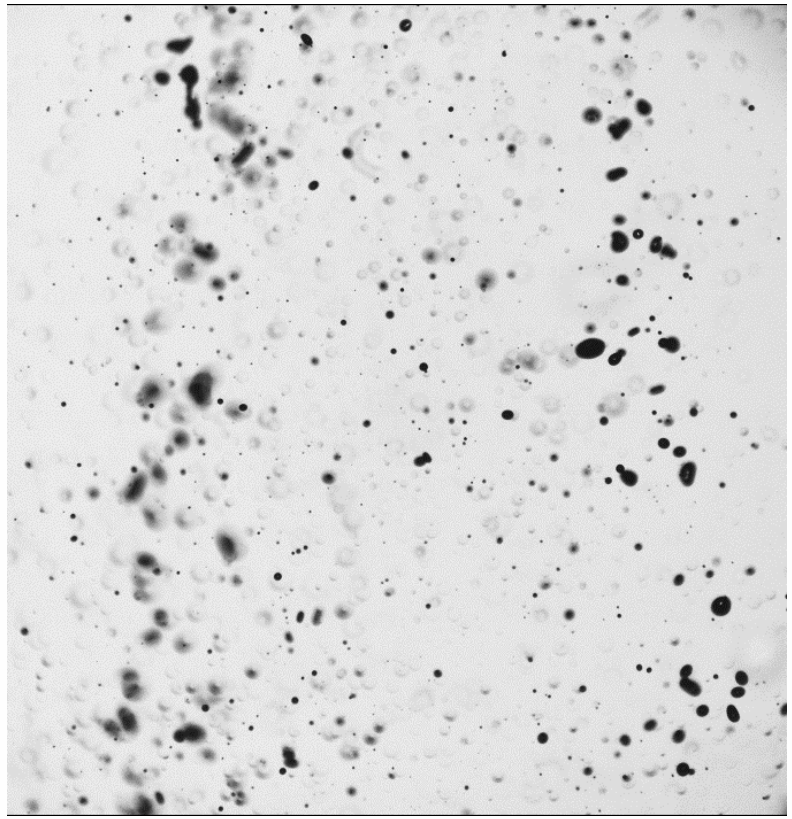
Long distance microscopy

Injectors comparison

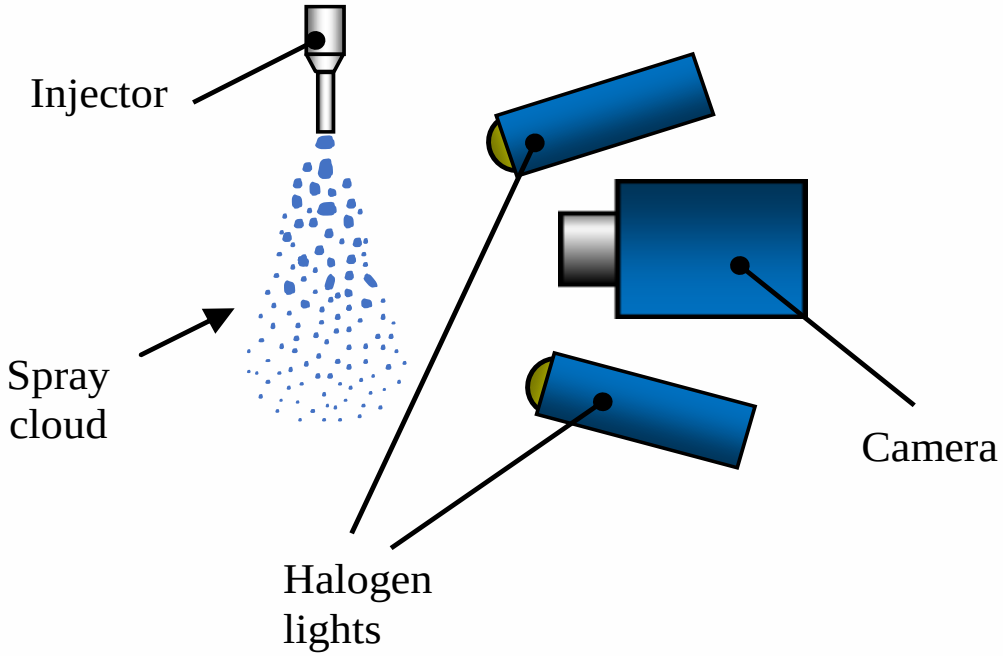


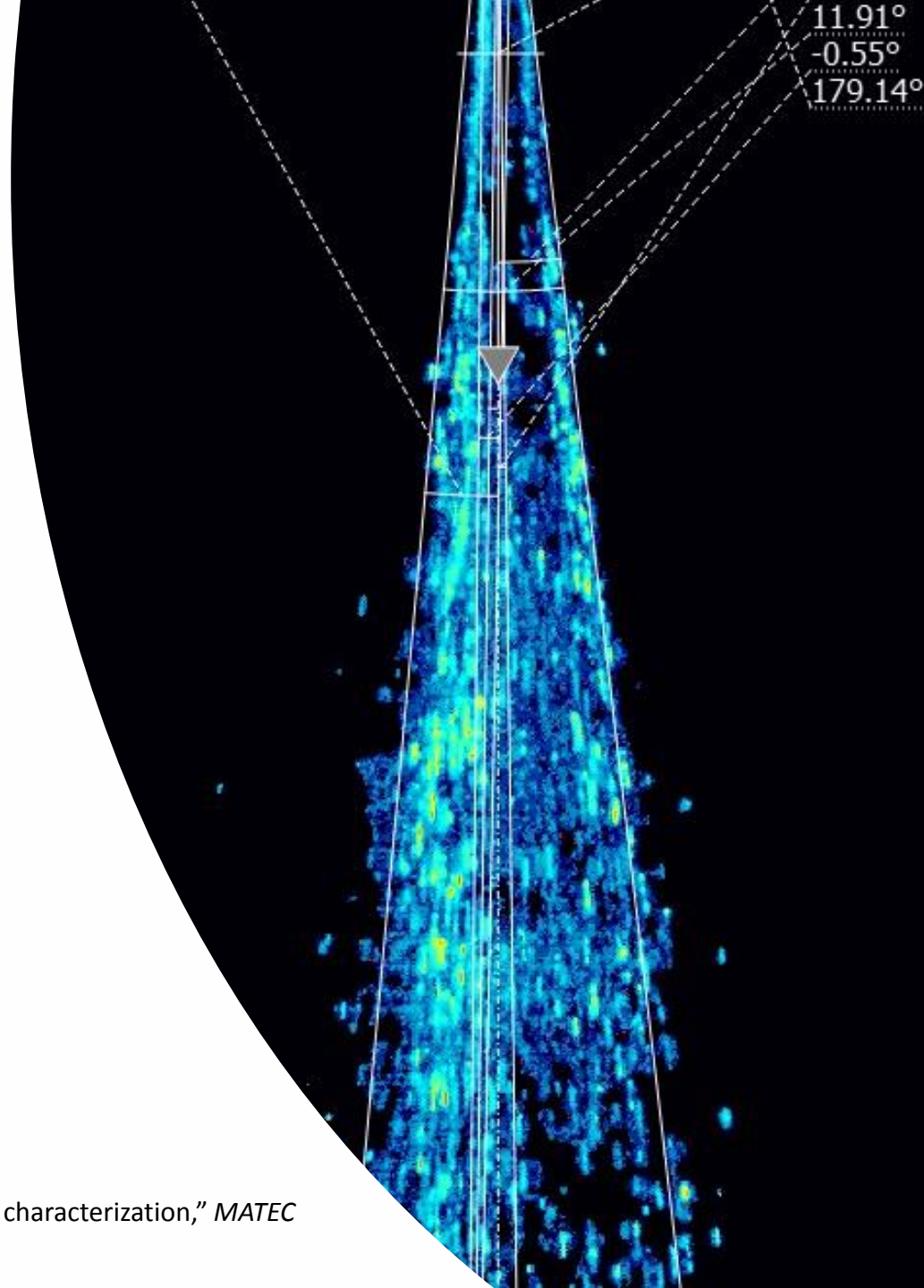


Ł. J. Kapusta, "Spray measurements in SCR systems development," in DIPSI Workshop 2018 on Droplet Impact Phenomena & Spray Investigation, 2018, no. May, pp. 13–16.

High speed imaging

- Spray tip penetration
- Spray angle
- Initial jet velocity





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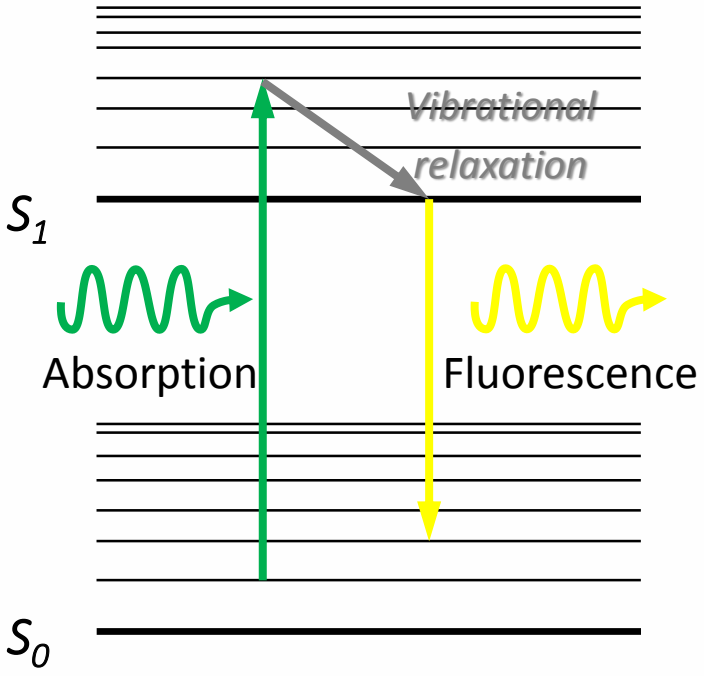
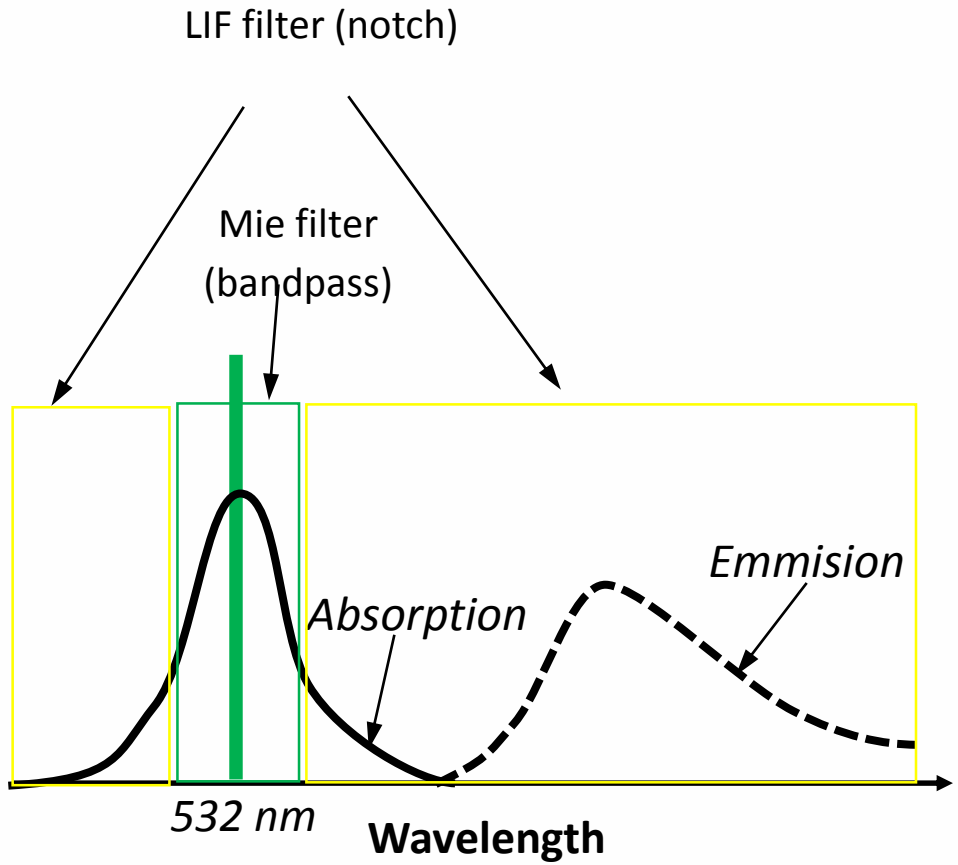
Ł. J. Kapusta and A. Teodorczyk, “Laser diagnostics for urea-water solution spray characterization,” *MATEC Web Conf.*, vol. 118, no. 00029, pp. 1–6, 2017.

LIF/Mie droplet sizing

Simultaneous LIF (Laser Induced Fluorencence) and Mie scattering visualization

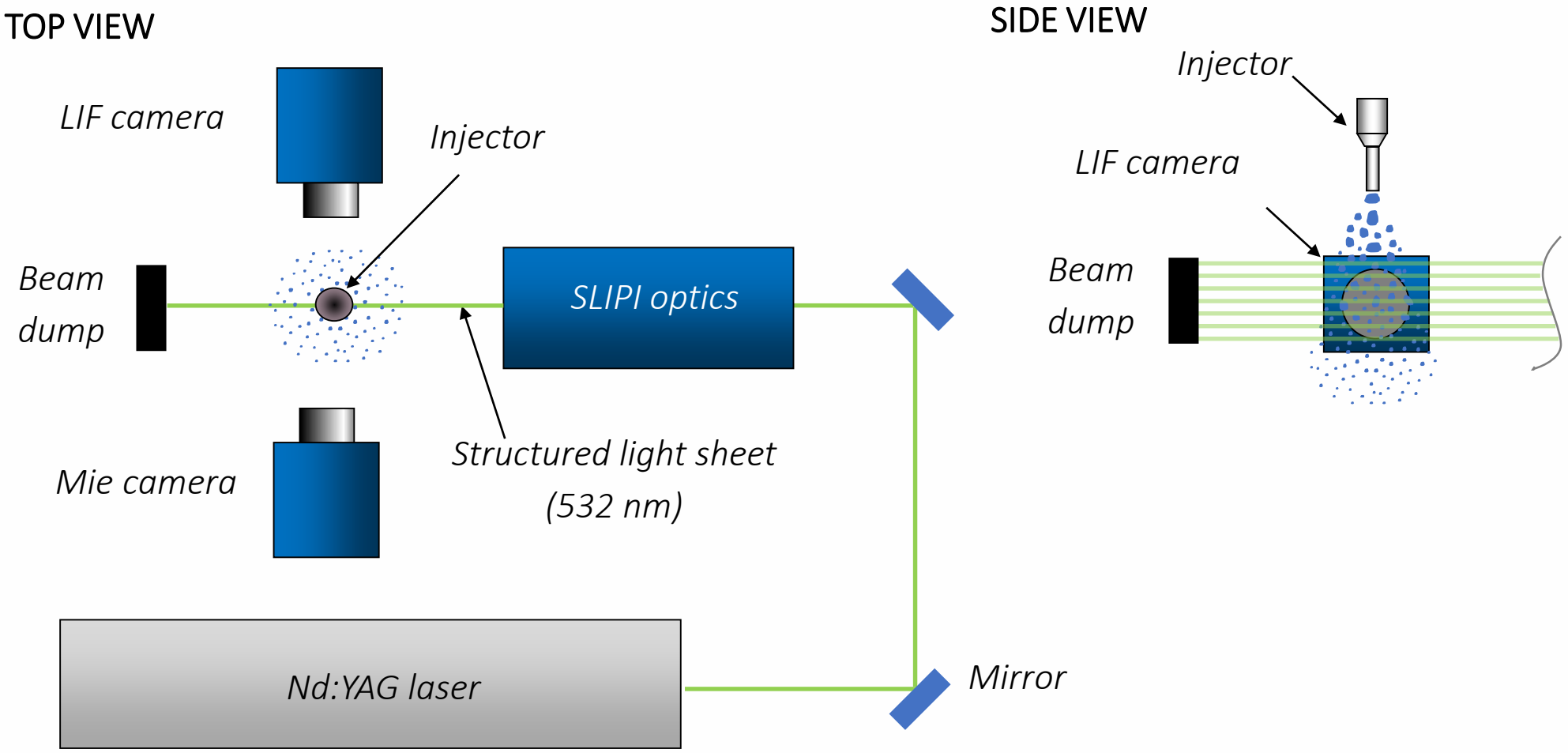
for SMD (Sauter Mean Diameter) determination





Structured Laser Illumination Planar Imaging

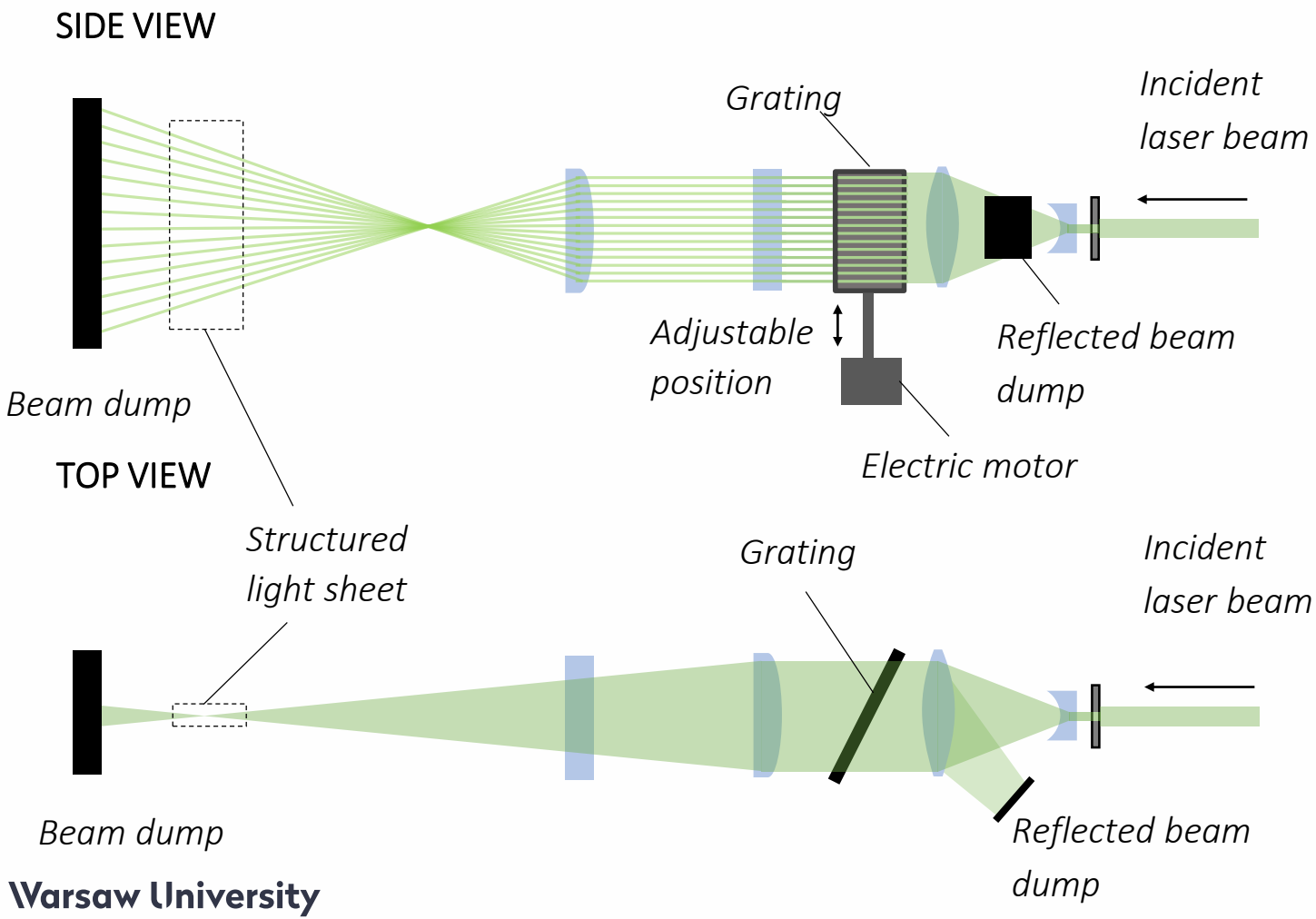
Important upgrade for LIF/Mie droplet sizing

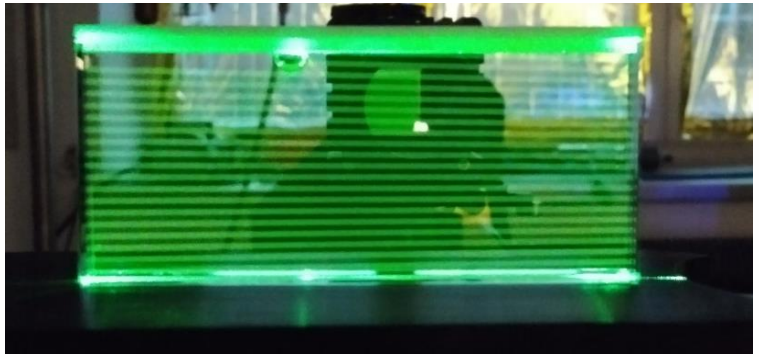


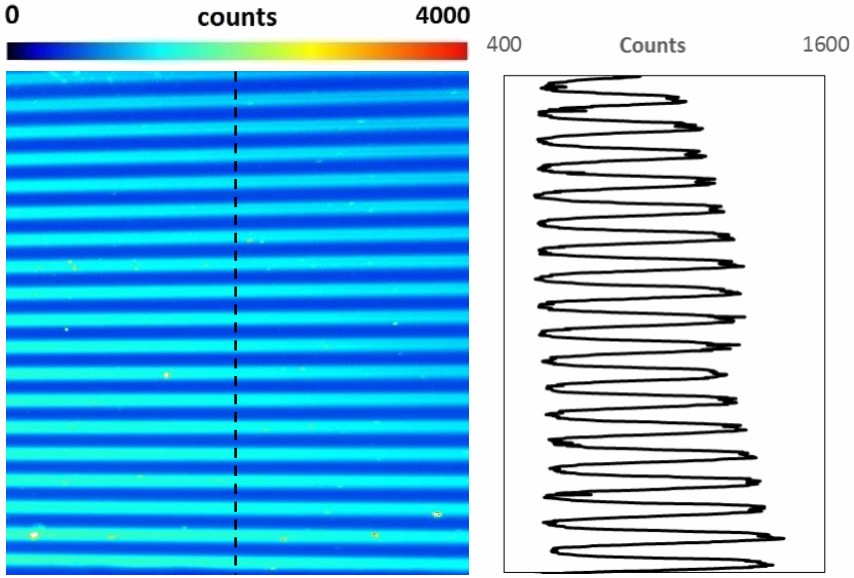
Ł. J. Kapusta, "LIF/Mie Droplet Sizing of Water Sprays from SCR System Injector Using Structured Illumination," in *Proceedings of ILASS2017 - 28th European Conference on Liquid Atomization and Spray Systems*, 2017, pp. 580–587.

Structured Laser Illumination Planar Imaging

Multiple scattering and background reflections suppression







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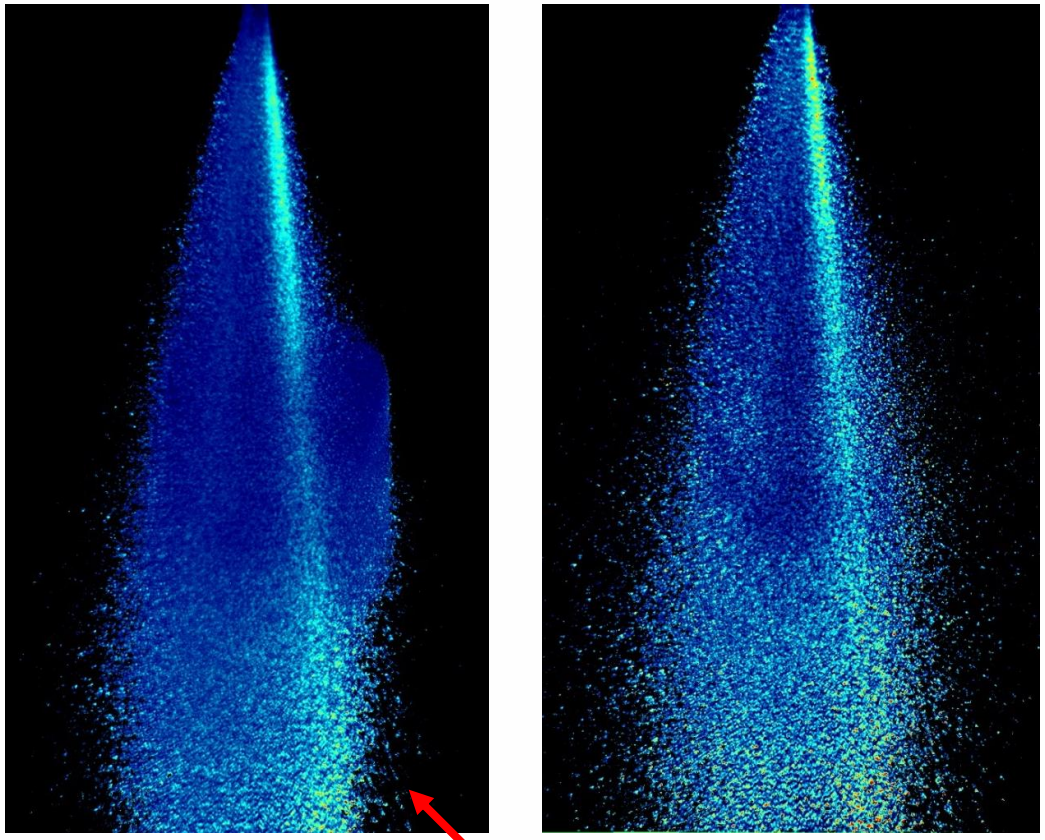
Ł. J. Kapusta, "LIF/Mie Droplet Sizing of Water Sprays from SCR System Injector Using Structured Illumination," in *Proceedings of ILASS2017 - 28th European Conference on Liquid Atomization and Spray Systems*, 2017, pp. 580–587.

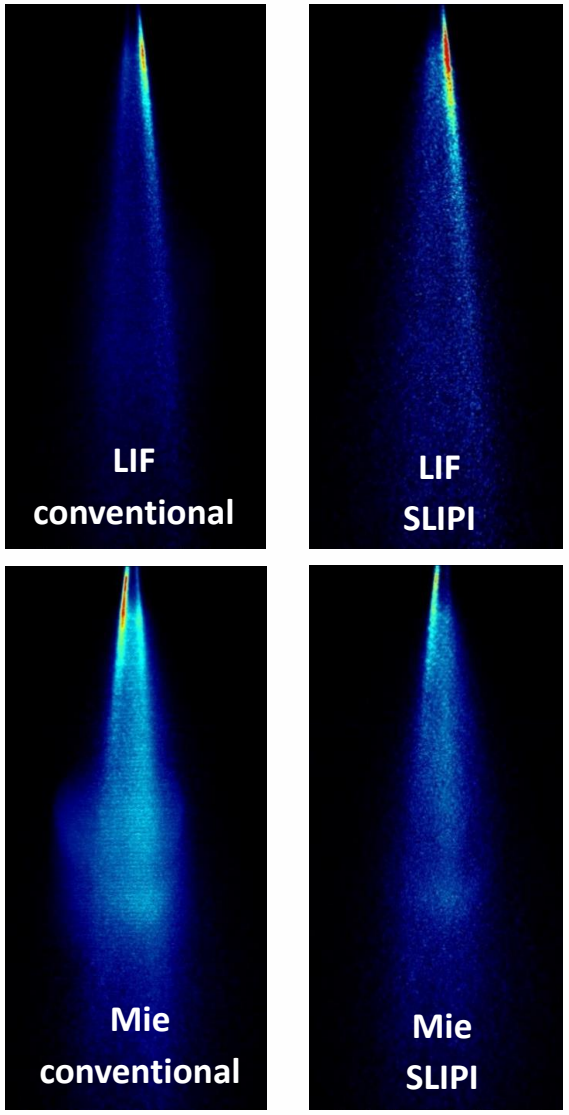
Structured Laser Illumination Planar Imaging

LIF/Mie ~ SMD distribution



LIF/Mie conventional **LIF/Mie SLIPI**

Conventional imaging sensitive to background reflections



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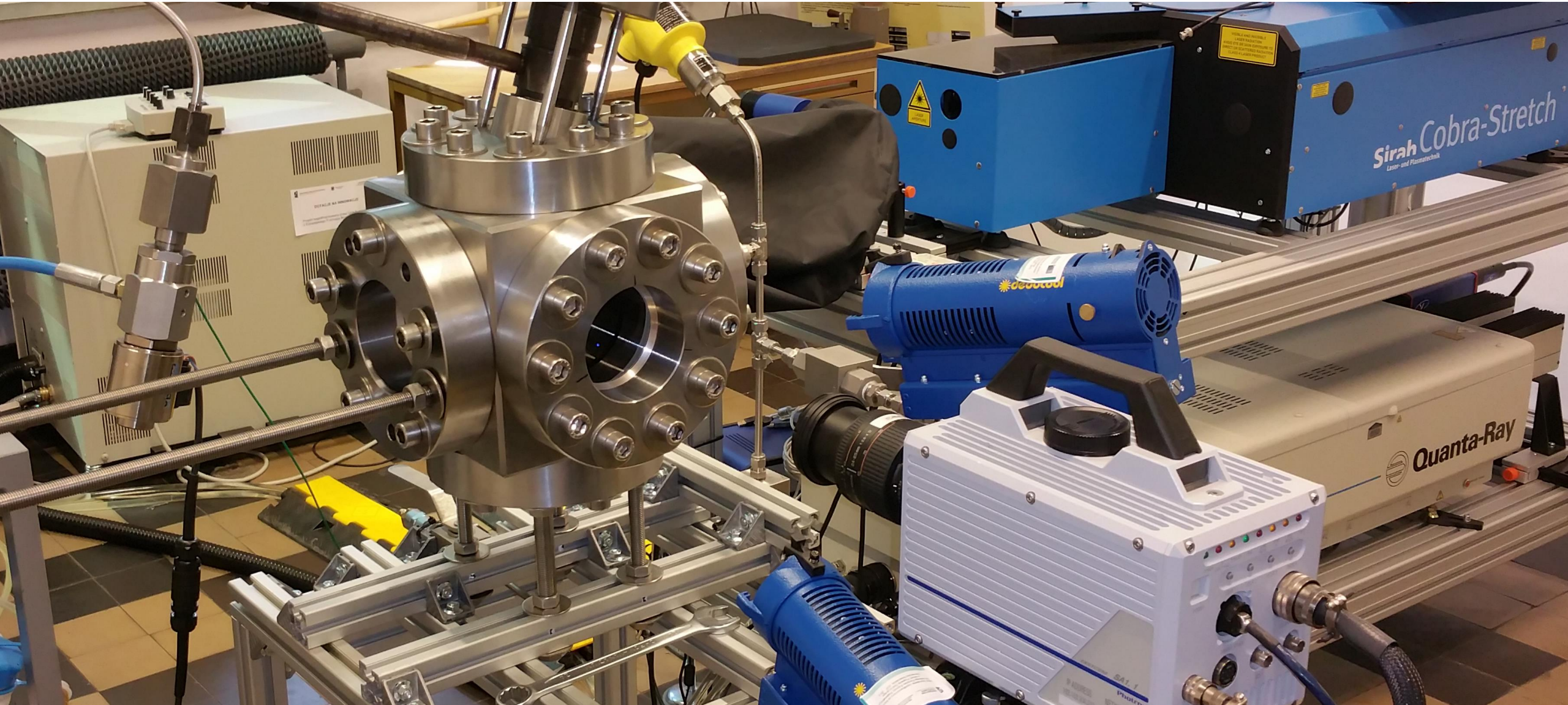
Ł. J. Kapusta, "LIF/Mie Droplet Sizing of Water Sprays from SCR System Injector Using Structured Illumination," in *Proceedings of ILASS2017 - 28th European Conference on Liquid Atomization and Spray Systems*, 2017, pp. 580–587.

Constant volume combustion chamber

Medium pressure vessel – working pressure 40 bar



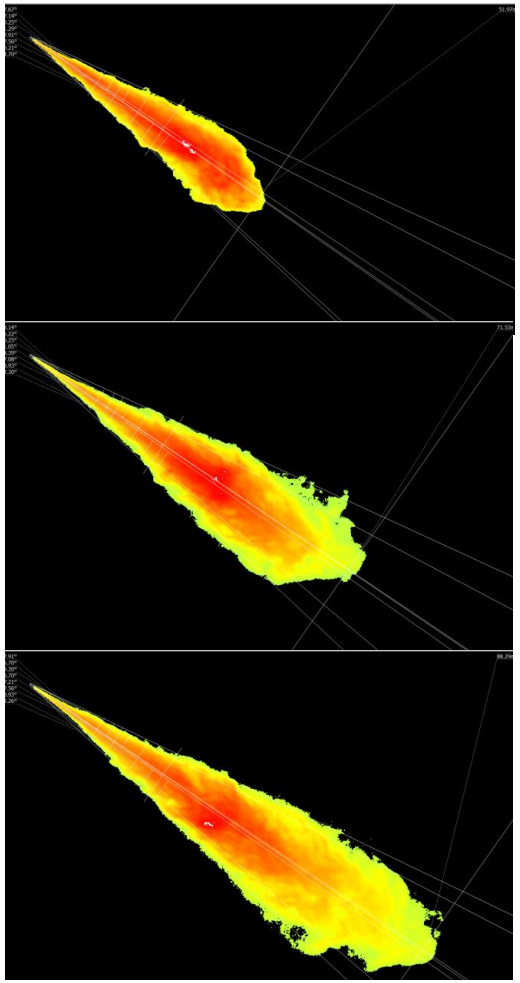
Constant volume combustion chamber

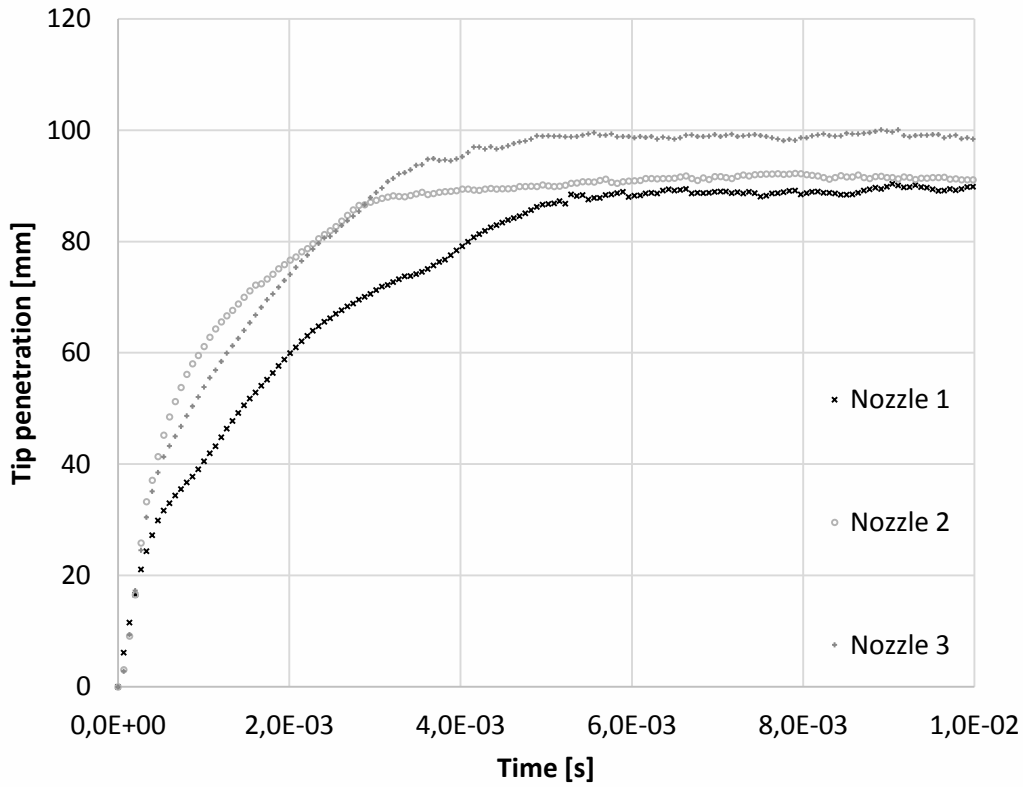
High speed imaging in high pressure conditions

1 ms ASOI

2 ms ASOI

3 ms ASOI





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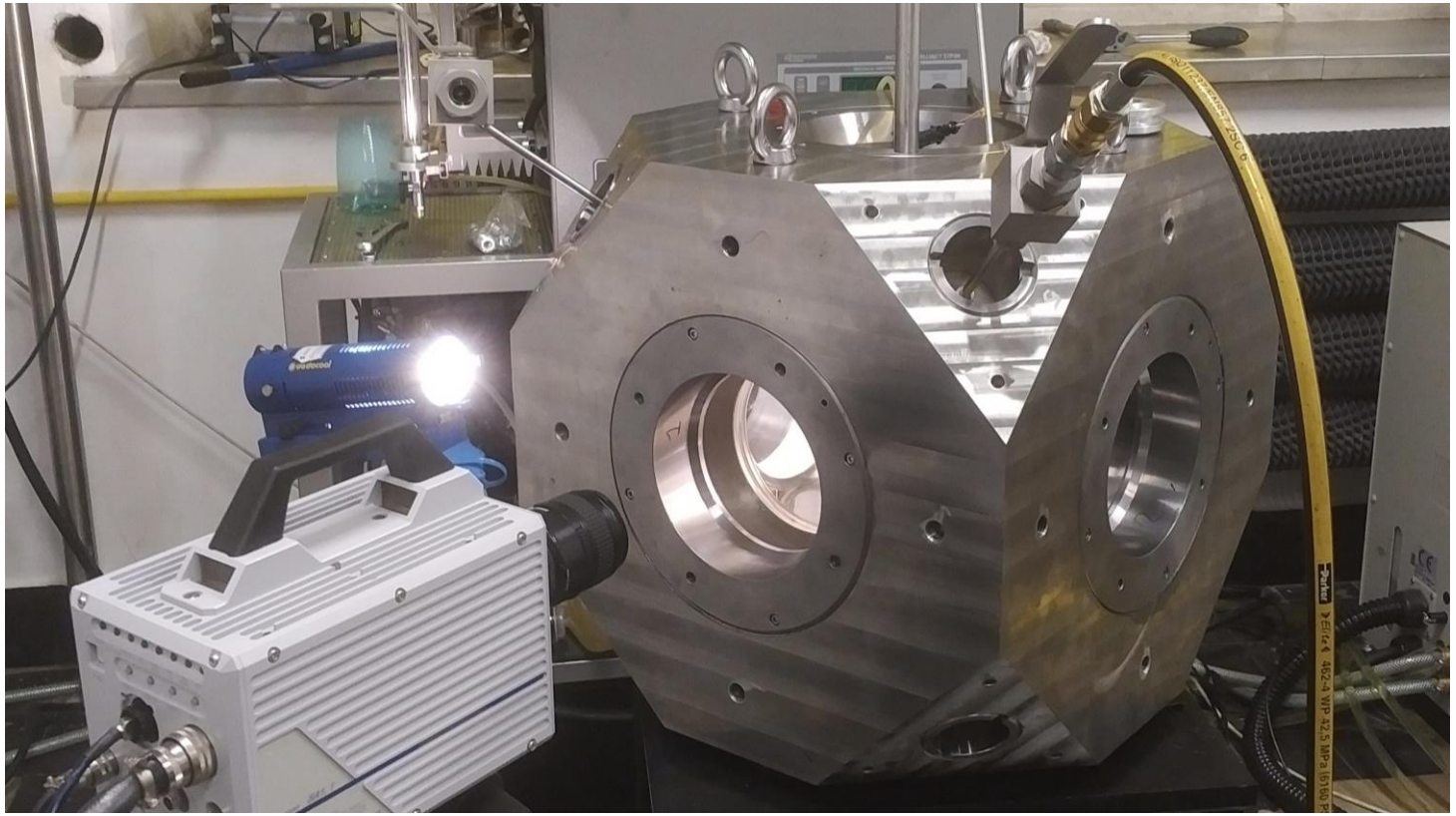
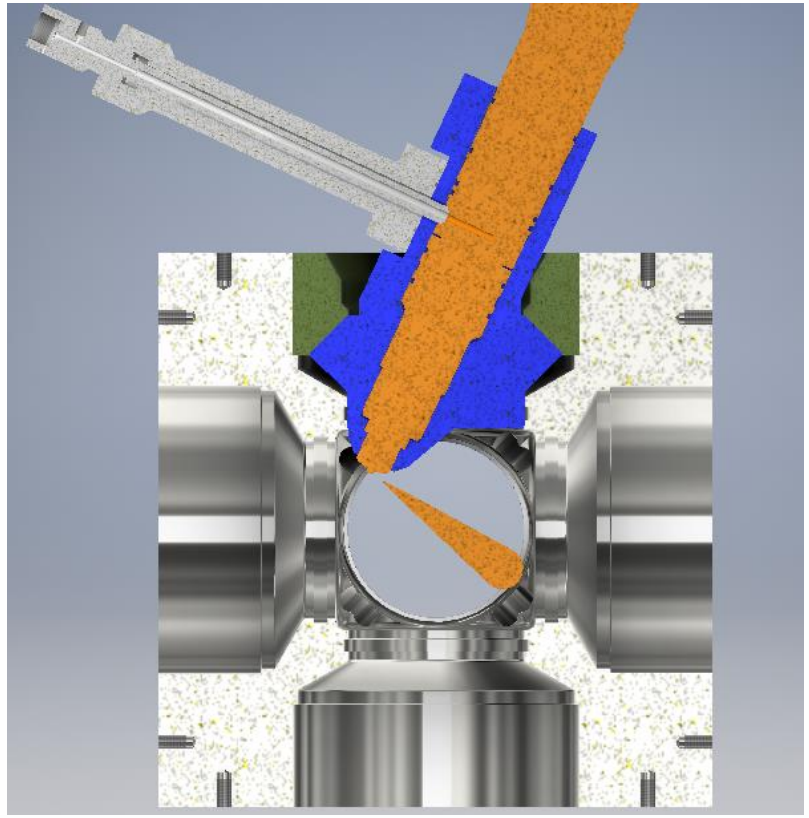
Constant volume combustion chamber

High pressure vessel – working pressure 120 bar (350 bar without windows – with metal plugs)

Designed for large engine injectors testing – optical access 160 mm





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