

Spray diagnostics with CAVILUX HF

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Description

The Institute of Engineering Thermodynamics at the Friedrich-Alexander University of Erlangen-Nürnberg is using CAVILUX HF laser illumination in various applications (Figure 1 – 3). The full potential of the laser lighting can be seen in shadowgraphy of fluid flows in injection nozzles. The camera, nozzle and illumination are aligned in this order at an optical rail. The laser illuminates through the transparent nozzle directly into the camera. Different phases of the liquid fuel lead to changes in the refractive index of the fluids. This can be captured by the camera. The field of view is 5 mm x 5 mm. The objective is a Navitar Long Distance Microscope. The depth of field can be adjusted with the aperture of the optics. However, this results in significant light losses. The high brightness of the CAVILUX laser illumination solves this challenge. The speed of the fluid stream in the nozzle is about 100 – 200 m/s which is captured by the camera with 200 kHz. Very short exposure times are needed to reduce motion blur. The camera does not provide short enough shutter times. Therefore the light source is the only option to reduce the motion blur. The pulsed mode of CAVILUX HF that creates short pulses at high frequencies allows to capture high quality images.

The visualization of fluid flows in the injection nozzles and the cavitation of the flows created in the nozzle would not be possible without CAVILUX HF laser illumination.



*Figure 1: Spray of fuel oil captured at 20.000 fps.
Use of an effervescent nozzle. Field of view of 5 mm x 20 mm*

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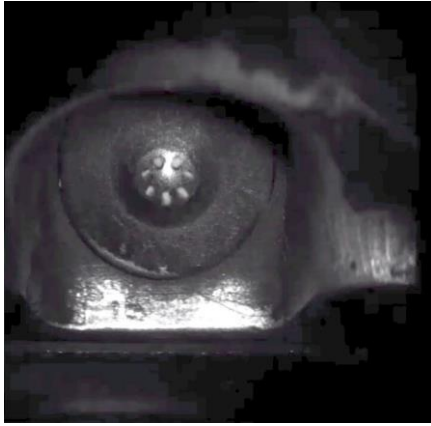


Figure 2: Fuel spray in engine

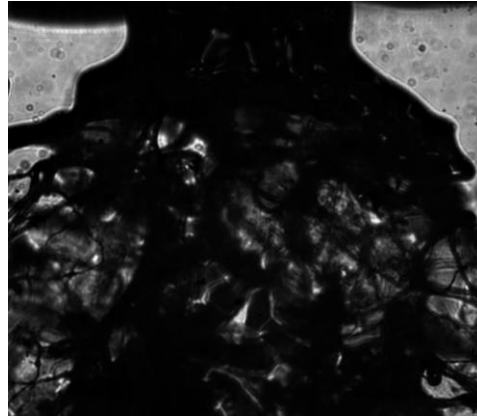


Figure 3: Spray of fuel oil captured at 100.000 fps.
Field of view 1,5 mm x 1,5 mm with nozzle size of 0,7 mm.

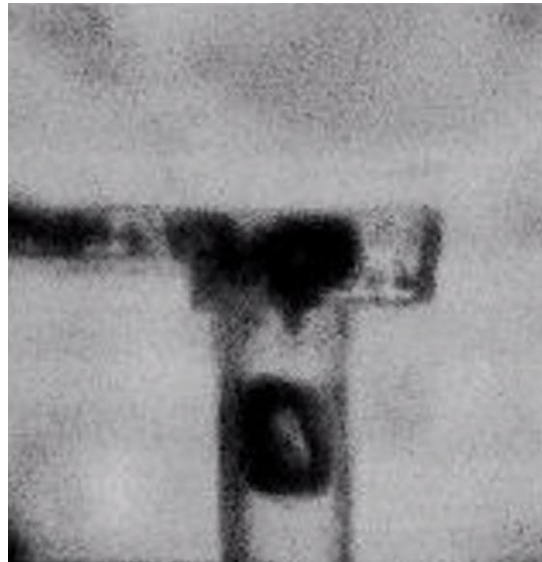


Figure 4: Flow in transparent nozzle captured at 200.000 fps with field of view of 5 mm x 5 mm.

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