

Spray Activities at TKK/ICEL

Experimental research

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Diesel Spray Measurements in 1993-2004

- Pressurized measurement chambers at room temperature
- orifice sizes 0.14...0.9 mm, mechanical and CR-injection systems



- Measured parameters

Imaging

Spray geometry

spray tip penetration, width of the spray

Droplet size

shadowgraphy, forward scattering

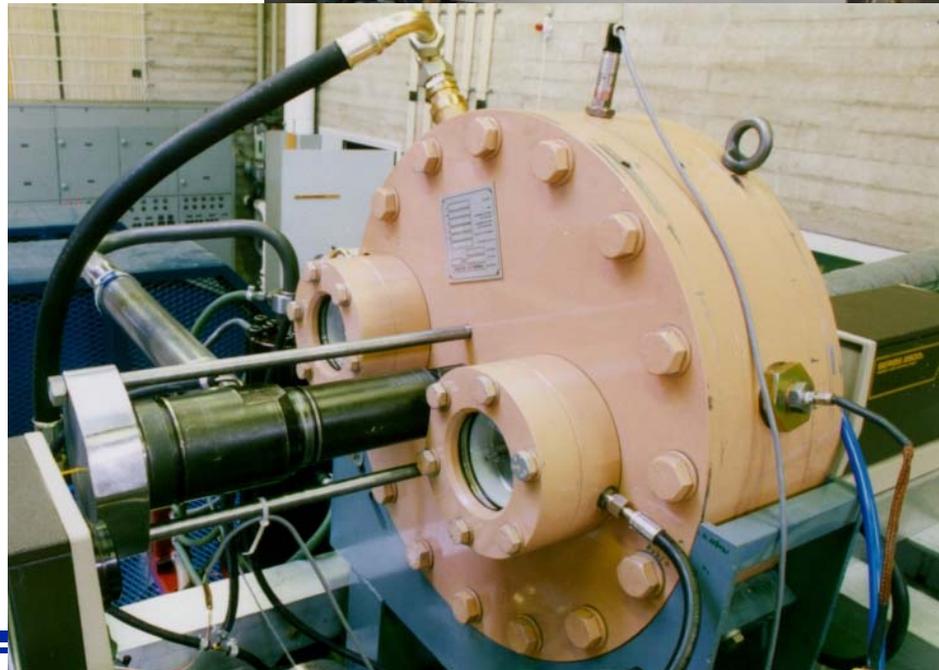
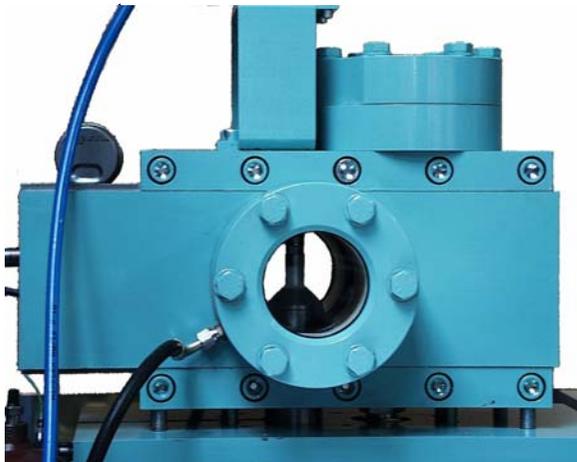
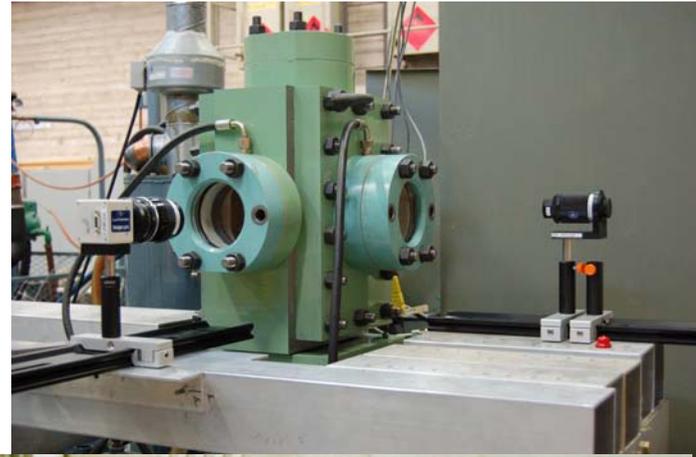
Velocities

FFT, LDV



Fuel spray at room temperature

- Pressurized measurement chambers at room temperature
- Gas densities up to 50 kg/m^3
- orifice sizes $0.14 \dots 0.9 \text{ mm}$, mechanical and CR-injection



Spray measurement instruments

Imaging

Spray geometry

Particle Image Velocimetry (PIV), flowfield

Laser Induced Incandescence (LII), soot

Laser Induced Fluorescence (LIF) OH, NO, CH

Tracer-LIF

- Mixing of air and fuel, concentration of fuel
- Exhaust gas circulation,

Droplet size:

Forward scattering

Background illuminated images

LIF/Mie scattering ratio

2-d pyrometry



Equipment mainly for PIV

- **Double pulsed Nd:YAG laser**
 - New Wave Gemini 200-15, 2x200 mJ @ 532 nm, 15 Hz
- **Laser guide arm**
- **CCD camera:** pair, Imager Pro 4M, cross correlation, 15 frames/s, 2048x2048 pixel
- **Camera lens:** pair, 50mm f1.8
- **Bandpass filters:** pair, 532nm
- **Scheimpflug mount:** pair
- **Calibration kit**
- **Aerosol seeding generator:** up to 10 bar
- **Solid particle generator**



Equipment mainly for LIF

- **Nd:Yag laser**, Spectra Physics LAB 170
 - 3rd and 4th harmonic generator, repetition rate 15 Hz, max pulse energy @ 532 nm: 450 mJ, @ 355 nm: 220 mJ, @ 266 nm: 90 mJ
- **Dye laser**, Sirah Cobra Stretch
 - Wavelength range 220-600 nm, line width 0.05 cm⁻¹ @ 570 nm
- **Laser shutter**
- **On-line energy monitor**
- **Moveable laser cradle and optics** for Nd:Yag and dye laser
- **Light sheet optics**
- **Filters**: 532nm band pass, for LIF measurement of OH, CH and NO, for fuel at 266 nm excitation, for Mie at 266 nm, spray exciplex, LII
- **CCD camera**: cross correlation, 12 bit, 1376x1040 pixel, pixel size 6.45 μm, 10 frames/s
- **Image intensifier**: lens coupled 25 mm high resolution
- **UV camera lens**: 94 mm f4.1
- **Mechanical camera shutter**



Research engines with optical access

- **EVE**

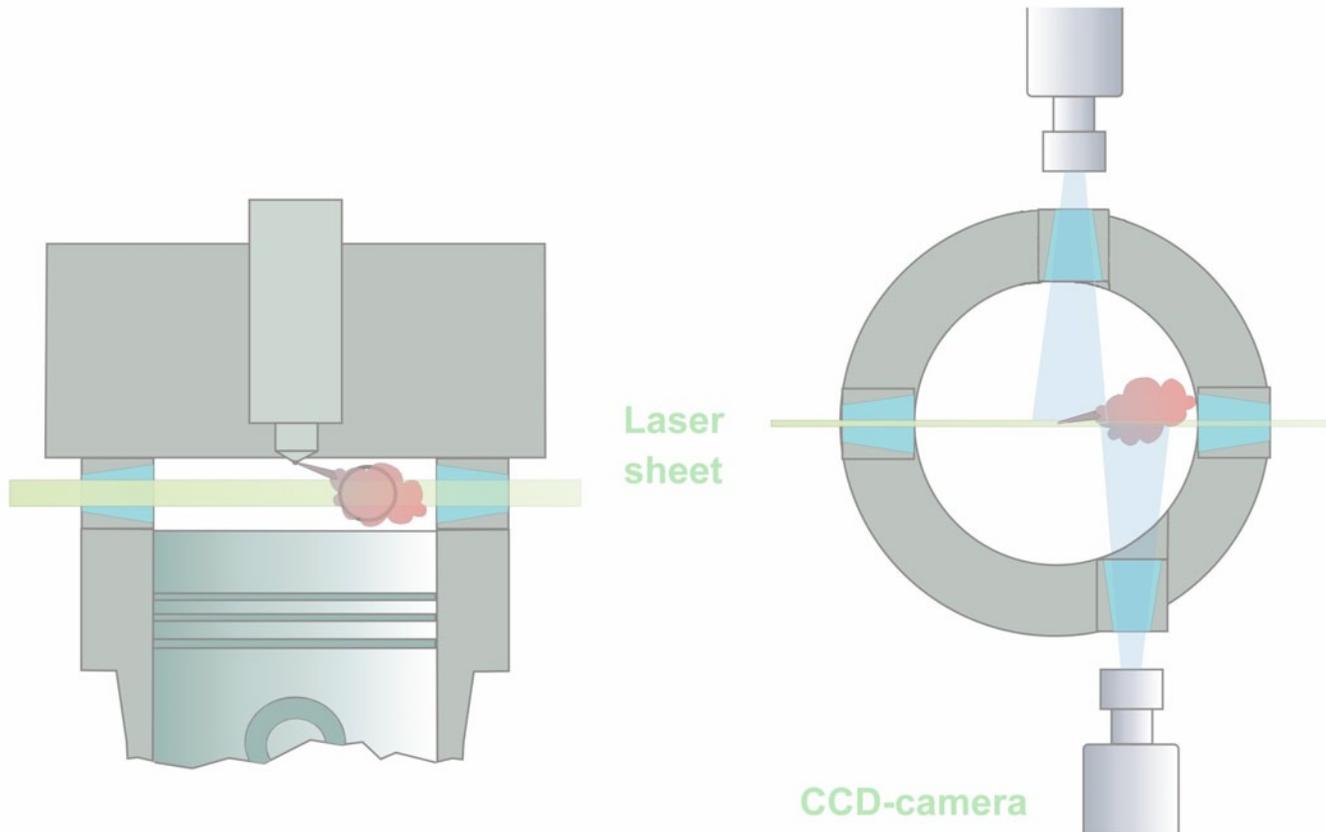
- single cylinder, full electro-hydraulic control (no camshaft)
- bore 200 mm, design pressure 200 bar
- optical access in 2006

- **LEO**

- six cylinder off-road engine with one cylinder in use
- bore 111 mm, design pressure 120 bar
- In use at beginning of year 2007



Research engine with optical access



Research engine with optical access

