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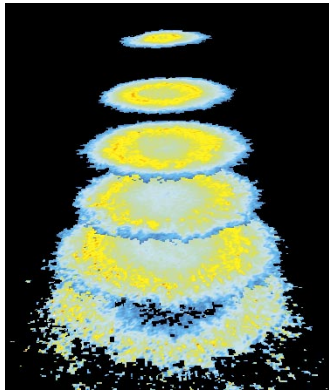
WE COUNT ON PHOTONS

SprayMaster Fuel

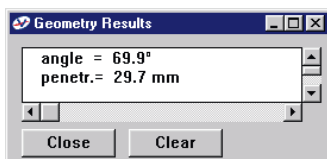
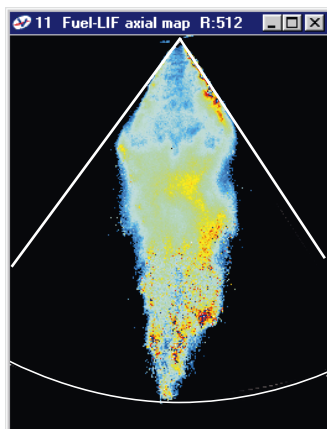
laser based imaging
for smarter spray
systems:

fuel injectors
pharmaceutical sprays
paint sprays
.....

global spray
characterization



radial fuel maps of a
hollow cone spray



Advanced laser light sheet imaging systems based on pulsed (UV) lasers for global spray characterization. Planar Mie scattering and Laser Induced Fluorescence (LIF) techniques are applied for

- ▶ geometrical spray analysis, patterning (spray symmetry, spray angle, tip penetration, statistics)
- ▶ fuel mass distribution
- ▶ planar droplet size mapping (D32 imaging)
- ▶ liquid / vapor transition
- ▶ flow field analysis*

*with double-pulse/double-frame upgrade versions supporting Particle Image (Tracking) Velocimetry, PIV (PTV).



SprayMaster
Fuel demo unit

- ▶ non-intrusive
- ▶ fast on-line operation
- ▶ highly sensitive (intensified) CCD imaging system
- ▶ 12 – 16 bit dynamic range
- ▶ high spatial resolution (more than 1.3 million measurement points)
- ▶ high temporal resolution (< 10ns laser light sheet illumination)
- ▶ pulsed UV laser for native (hydrocarbon) fuel-LIF measurements
- ▶ image doubler for simultaneous LIF & Mie recording
- ▶ light sheet intensity normalization
- ▶ powerful image correction routines
- ▶ movie presentation for transient sprays, 3D-presentation
- ▶ extensive software algorithms for axial and radial cuts
- ▶ ease-of-use
- ▶ reliable results
- ▶ exceptional performance

LAVISION GMBH

ANNA-VANDENHOECK-RING 19 / D-37081 GOETTINGEN / GERMANY

E-MAIL: INFO@LAVISION.DE / WWW.LAVISION.DE

TEL.: +49-(0)5 51- 90 04- 0 / FAX: +49-(0)5 51- 90 04- 100

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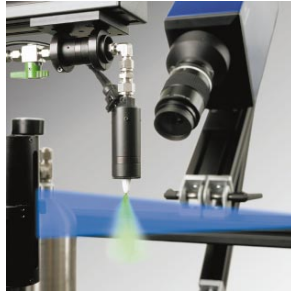
301 W. MICHIGAN AVE. / SUITE 403 / YPSILANTI, MI 48197 / USA

E-MAIL: SALES@LAVISIONINC.COM / WWW.LAVISIONINC.COM

PHONE: (734) 485- 0913 / FAX: (248) 465- 4306

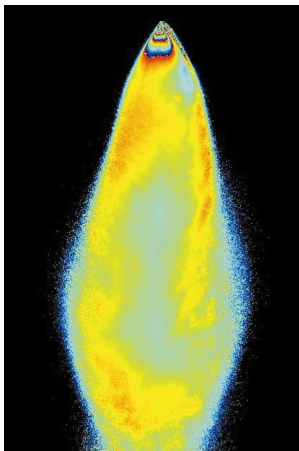
SprayMaster Fuel

focus on sprays



SprayMaster Fuel is an easy-to-use analytical tool for optical global spray characterization. Simple and reliable system operation allows the engineer to concentrate on analyzing spray performance. The system can provide in-process measurements of various spray parameters during manufacturing, quality control, or pre-assembly tests. The flexible and modular design of the **SprayMaster** system allows it to provide individual solutions for many different applications as well as for R&D work.

operating principle

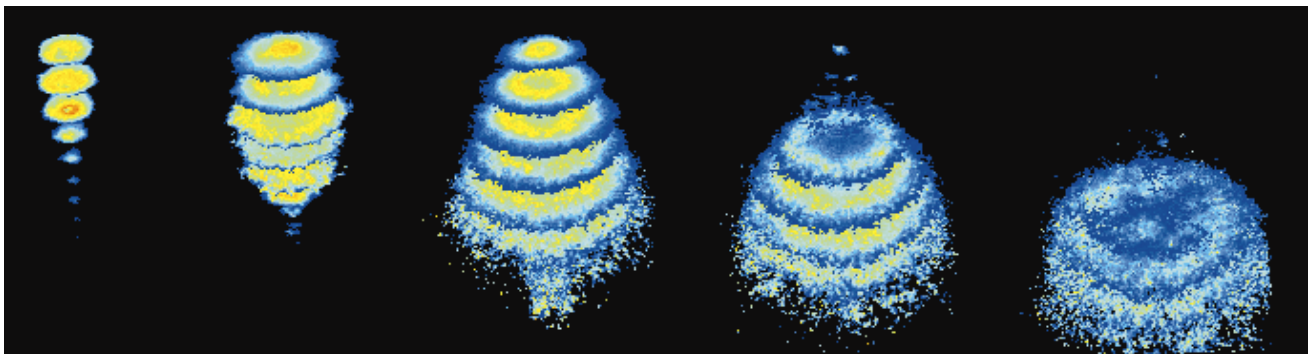


color-coded D32 droplet
size map

The visible or UV output of a pulsed laser is formed into a light sheet, which slices the spray at selectable orientations. A high resolution and time-gated (intensified) CCD camera records the laser induced emissions with maximum sensitivity. Elastic Mie scattering together with mass-related LIF signals can be recorded simultaneously from the same laser shot. Multiple laser shots can be recorded for on-chip accumulation as well as digital frame averaging. Mean and rms values are calculated automatically.

The planar distribution of the Sauter Mean Diameter ($SMD := D_{32}$) of the droplets is obtained from LIF/Mie image ratios. Time-correlated double exposures are used for flow field analysis applying PIV (PTV). Planar spray imaging can be extended to global spray inspection applying light sheet scanning. Light sheet optics allow simple rotation of the laser light sheet.

temporal evolution of a pulsed spray: time sequence of the global spray mass distribution



software features

- ▶ multi-tasking imaging control with precise synchronization
- ▶ complete control of all integrated devices incl. custom equipment
- ▶ spread sheet connectivity for data exchange
- ▶ automatic sequencing capability, batch mode operation
- ▶ multiple axes support (translation and rotary stages)

upgrades

- ▶ microscopic far field imaging for absolute size calibration
- ▶ system upgrades for spray combustion (**FlameMaster**, **EngineMaster**)

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