LaVision

FOCUS ON IMAGING

Endoscopic Imaging

camera based systems for keyhole imaging of flames, sprays and flow fields

LaVision provides a variety of endoscopes for visible and UV light applications, such as flame visualization, sprays and flow field measurement.
Integrated camera systems are tailored to measurements with optical access to enclosed cavities of IC-engines, gas turbines, furnaces and industrial reactors.

FlameMaster *inspex* – flame visualization based on visible or UV self-emission
EngineMaster *inspex* – monitoring of fuel sprays, flame propagation and soot formation inside a running IC-engine

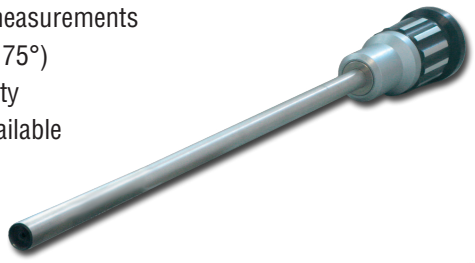
- **flame structure, species, soot** - spectral imaging of flame emissions
- **flame temperature** - pyrometry for sooty flames
- **flame instabilities & burner vibration** - temporal flame analysis
- **ignition & flame front propagation** - high-speed imaging
- **keyhole imaging in large scale furnaces** - endoscopic flame imaging

Standard CCD and CMOS cameras provide a cost-effective solution for process monitoring and phase locked videos. Using high-speed cameras will generate time-resolved movies of fast processes. Image intensifiers rise the sensitivity to extremely low light level applications.

Camera endoscope for visible light

LaVision's **Camera Endoscope** is designed for flame visualization and flow field measurements in closed compartments such as engines and heat exchangers. It is optimized for high light throughput, flat image plane and good PIV particle imaging quality

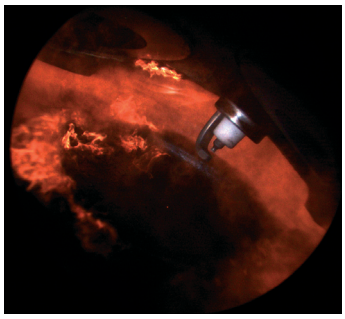
- designed for spray & flame imaging and flow field measurements
- high light throughput and large viewing angle (45° / 75°)
- flat image plane and good PIV particle imaging quality
- optimized for use in IC-engines – sealing sleeves available
- diameter 8 mm, length ~200 mm,
  operation temperature up to 120 °C



Fired cycle #1

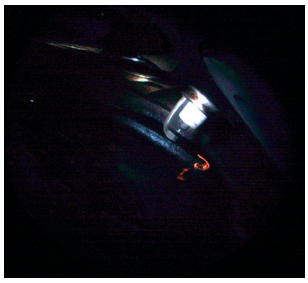
Pool fire on cold piston

#2



Soot formation near cold walls

#3



Residual diffusion flames

#4

Clean combustion

Cold start emissions: Pool fire inside an IC engine for the first four cycles - crank angle locked recording at 25°CA aTDC, courtesy of Karlsruher Institute of Technology (KIT) - IFKM

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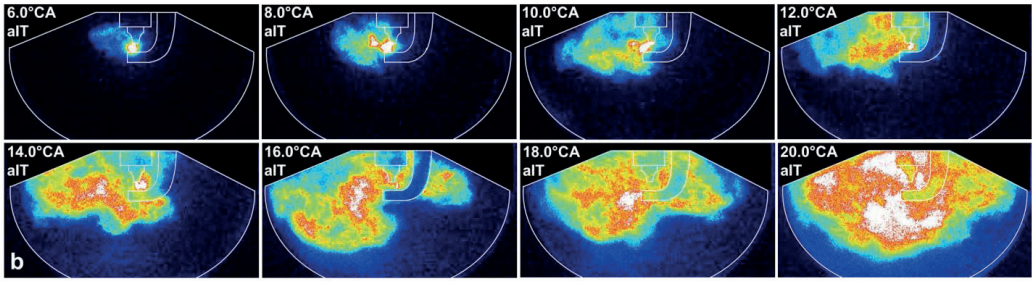
UV enhanced hybrid endoscope

LaVision offers a new kind of **UV Hybrid Endoscope** that benefits from included diffractive optics, which allows improving the image quality such as brightness and chromatic performance in an outstanding manner compared to classical optics. Providing an image quality and brightness comparable to classical UV-optimized lenses, the **Hybrid Endoscope** is tailored for minimum invasive optical access, especially in automotive engine applications, such as fuel-air-ratio LIF and 2D gas temperature imaging. The **Hybrid Endoscope** works perfectly together with LaVision's image intensifiers (IRO - Intensified Relay Optics)

- for very low light applications - designed for intensified imaging
- high image quality and brightness: effective f# 4.5
- UV optimized wavelength range: 280 - 340 nm (opt. 380 - 440 nm)
- compact view port with high pressure sealing for IC-engine applications



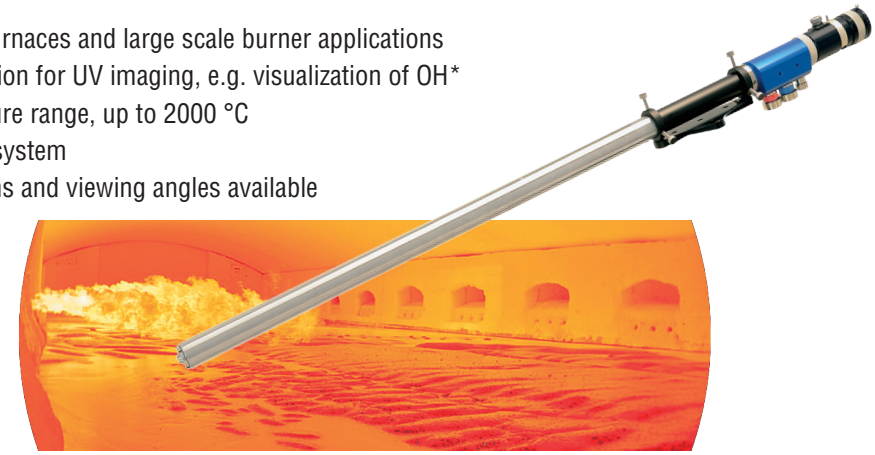
Endoscopic imaging of early flame propagation inside an IC-engine, courtesy of M. Goschütz et al, University of Duisburg-Essen, SAE Paper 2014-01-1178

High temperature endoscope vis / UV

The **High Temperature Camera Endoscope** is designed for measurements and observations of visible and ultraviolet (UV) emissions especially for furnaces and large scale burner applications. The **High Temperature Camera Endoscope** is compatible to LaVision's cameras and Intensified Relay Optics (IRO). It is equipped with different exchangeable objective lenses which allow to change its direction of view.

A cooling system effectively protects the endoscope against heat and dust.

- designed for furnaces and large scale burner applications
- optimized version for UV imaging, e.g. visualization of OH*
- high temperature range, up to 2000 °C
- water cooling system
- different lengths and viewing angles available



Flame visualization in a large scale furnace

Nov-16

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