LAVISION

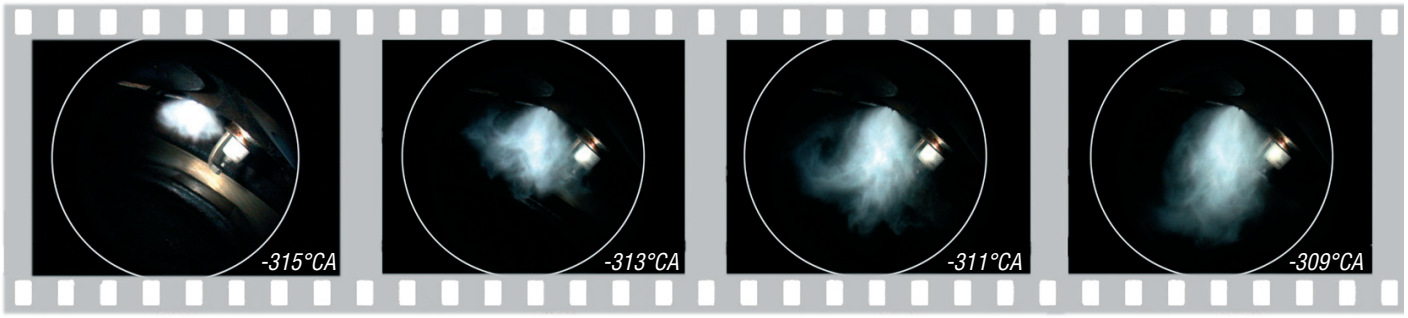
FOCUS ON IMAGING

EngineMaster *inspex*

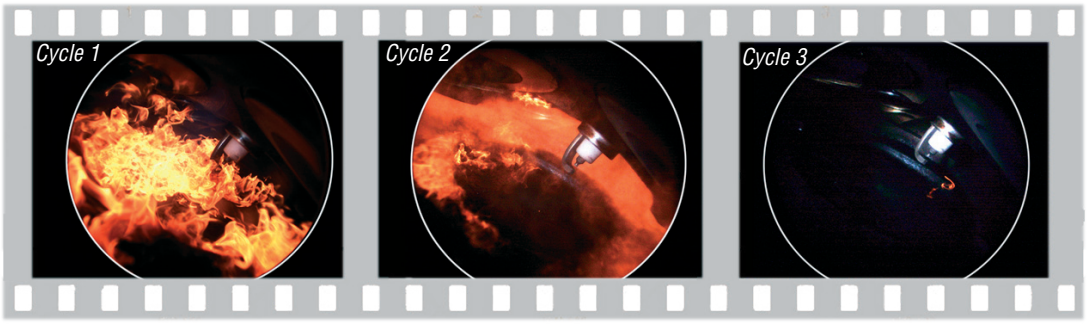
In-cylinder endoscopic imaging for spray and combustion visualization and quantitative optical indication in real engines

For the optimization of near-production engines endoscopic imaging can be applied to visualize in-cylinder phenomena. Key-hole imaging using endoscopes is a minimally invasive technique to monitor real-time in-cylinder processes such as fuel spray injection, ignition, combustion and soot formation. In combination with standard pressure indication endoscopic imaging links engine performance and emissions with in-cylinder phenomena such as pre-ignition, wall wetting and particle generation.

EngineMaster *inspex* imaging systems provide quantitative information on spray geometry, flame propagation as well as soot temperature and soot volume fraction (KL-factor) in combination with the appropriate analysis options.



Crank-angle resolved spray imaging of gasoline direct ignition



Soot formation in GDI engine during first cycles of a cold start at fixed crank angle position

Applications

- spray visualization: propagation, geometry, wall interaction (wetting)
- combustion visualization: on-set of ignition, misfire, flame propagation, in-situ soot formation

Indicated engine parameters

- spray geometry
- flame propagation
- soot temperature and soot volume fraction (KL-factor)

System features

- direct visualization of the entire in-cylinder combustion cycle
- quantitative imaging of engine parameters
- full engine synchronisation with advanced triggering features
- crank angle synchronized recording (standard)
- crank angle resolved multiple cycle recording (high speed)
- minimally invasive endoscopic illumination and imaging
- high transmission endoscopes
- high resolution digital color cameras
- engine adaptation including engine sealing sleeves

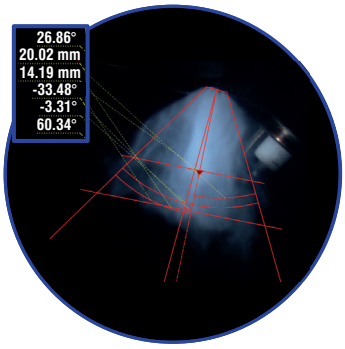
LaVisionUK Ltd
2 Minton Place / Victoria Road
Bicester, Oxon / OX26 6QB / United Kingdom
E-mail: sales@lavision.com / www.lavisionuk.com
Phone: +44-(0)-870-997-6532 / Fax: +44-(0)-870-762-6252

LaVision GmbH
Anna-Vandenhoeck-Ring 19
D-37081 Göttingen / Germany
E-mail: info@lavision.com / www.lavision.com
Tel. +49-(0)551-9004-0 / Fax +49-(0)551-9004-100

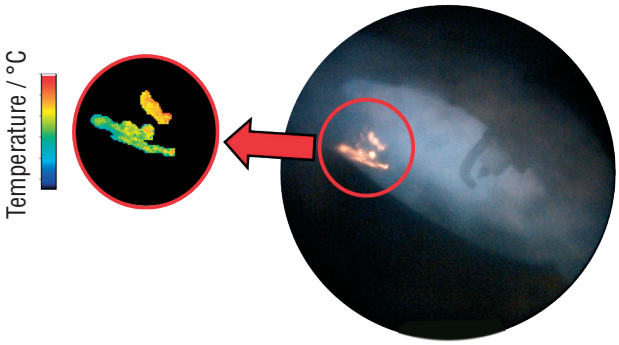
LaVision Inc.
211 W. Michigan Ave. / Suite 100
Ypsilanti, MI 48197 / USA
E-mail: sales@lavisioninc.com / www.lavisioninc.com
Phone: (734) 485 - 0913 / Fax: (240) 465 - 4306

LaVision

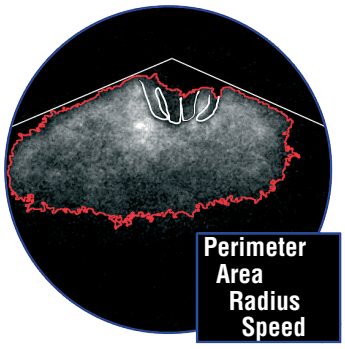
FOCUS ON IMAGING



Spray geometry

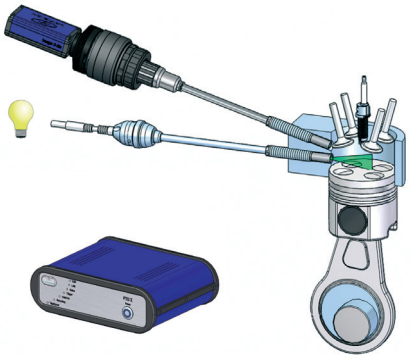


Temperature and KL-value from soot pyrometry



Flame propagation

EngineMaster *inspex* configurations



LaVision offers three different types of turnkey endoscopic imaging systems for in-cylinder spray and combustion visualization. The systems combine endoscopic illumination for spray and background contour illumination, a high quality imaging endoscopes and a choice of three different camera types. All systems come with full engine synchronization electronics and laptop computer with recording and visualization software. Software packages allow quantitative imaging of in-cylinder parameters. Engine sealing and equipment mounting is also provided by LaVision.

EngineMaster *inspex*	Standard	High-speed	High-speed laser
Description	Crank angle sync. cycle-based imaging	Crank angle resolved imaging	Crank angle resolved imaging
Recording rate	~1 image / cycle	~1 image / crank angle	~1 image / crank angle
Time resolution	8 µs flash width	Typical exp. 1-200 µs	~170 ns @1 kHz
Light source	Stroboscope *(0 - 200 Hz)*	Cold light source *(cw)*	High-speed laser *(10 kHz)*
Illumination endoscope	Engine illumination unit with fibre coupling (ø 8 mm; ø 4 mm for HS-laser) for in-cylinder contour and spray illumination		
Camera endoscope	Camera endoscope for visible wavelength range (ø 8 mm)		
Camera	High sensitive color camera 100 Hz (1936x1216 pix)	Compact high-speed CMOS color camera 3.26 kHz (1280x800 pix) 11.5 kHz (512x512 pix)	High-speed CMOS color camera 7.53 kHz (1280x800 pix) 25 kHz (512x512 pix)
Engine sync.	PTU X engine synchronization unit		

EngineMaster *inspex* applications

		Standard	High-speed	High-speed laser
Visualization		Spray + combustion		
Quantitative analysis	**Spray geometry**	★★★	★★	★★★
	Flame propagation	★	★★★	★★★
	Soot temperature + KL-factor	★★★	★★★	★★★
OH* imaging		Requires EngineMaster *inspex* UV system with intensified camera and endoscope		

Oct-19

LaVisionUK Ltd
2 Minton Place / Victoria Road
Bicester, Oxon / OX26 6QB / United Kingdom
E-mail: sales@lavision.com / www.lavisionuk.com
Phone: +44-(0)-870-997-6532 / Fax: +44-(0)-870-762-6252

LaVision GmbH
Anna-Vandenhoeck-Ring 19
D-37081 Göttingen / Germany
E-mail: info@lavision.com / www.lavision.com
Tel. +49-(0)551-9004-0 / Fax +49-(0)551-9004-100

LaVision Inc.
211 W. Michigan Ave. / Suite 100
Ypsilanti, MI 48197 / USA
E-mail: sales@lavisioninc.com / www.lavisioninc.com
Phone: (734) 485 - 0913 / Fax: (240) 465 - 4306