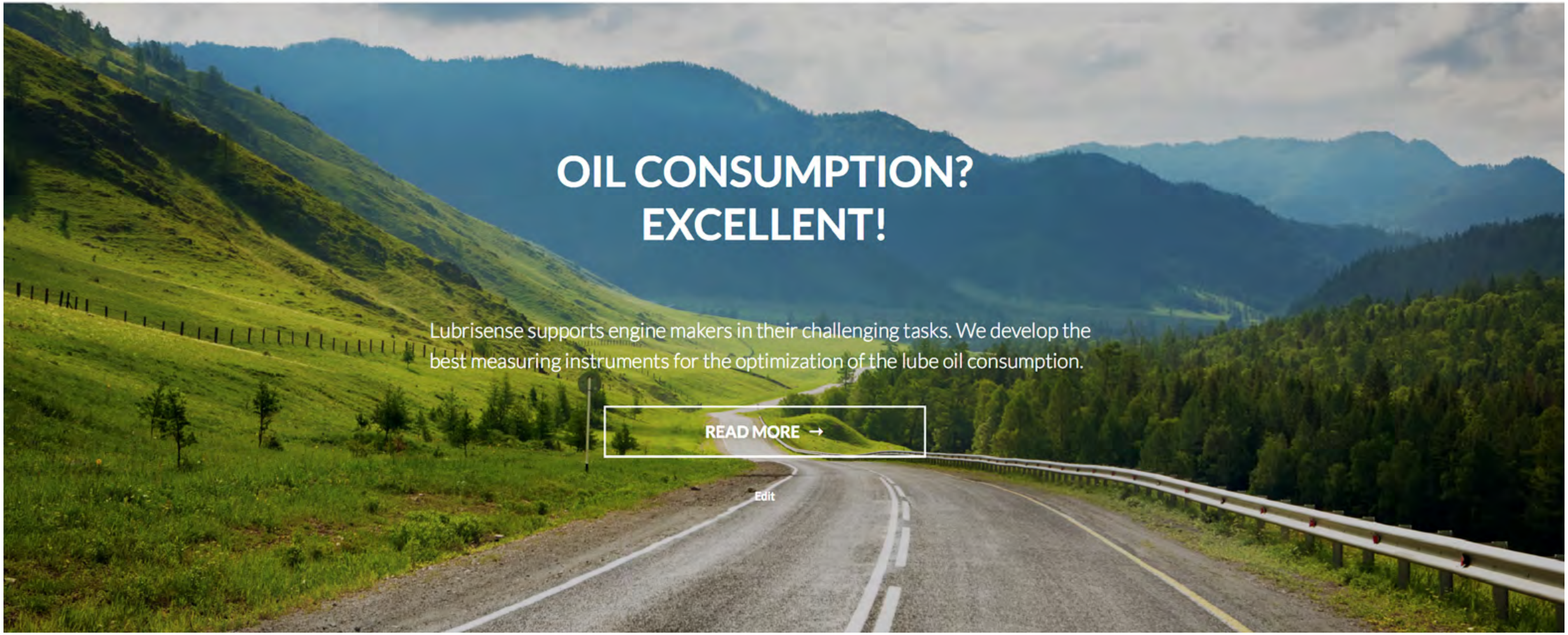
LUBRISENSE

Oil Emission Measurement Technology



Lubrisense at a glance

INSTRUMENTS

SERVICE

ENGINEERING

Lubrisense at a glance

Spin-off from Institute of Measurement Technology at Hamburg University of Technology (TUHH)

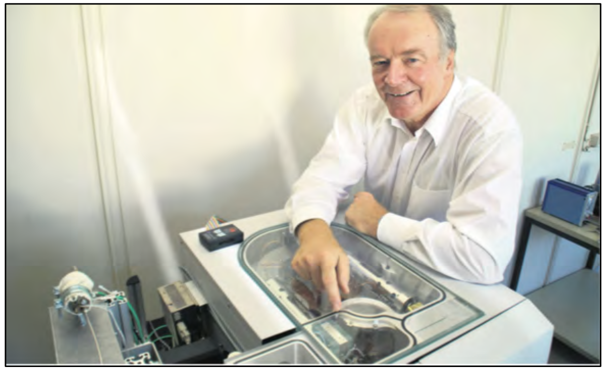
Office in Hamburg close to the campus of TUHH

Close cooperation with research faculty TUHH, IAM

Member from FVV, Hamburg Economy Organization, Research Organization for combustion engines

Lubrisense GmbH Tel.: +49 40 47 80 50 66 www.lubrisense.com info@lubrisense.com
Peutestrasse 53A, 20539 Hamburg, Germany

Lubrisense at a second glance



Founder: Prof. Dr. Matz

CKB CORPORATION

conexo

automotive engineering iav

PerkinElmer
For the Better

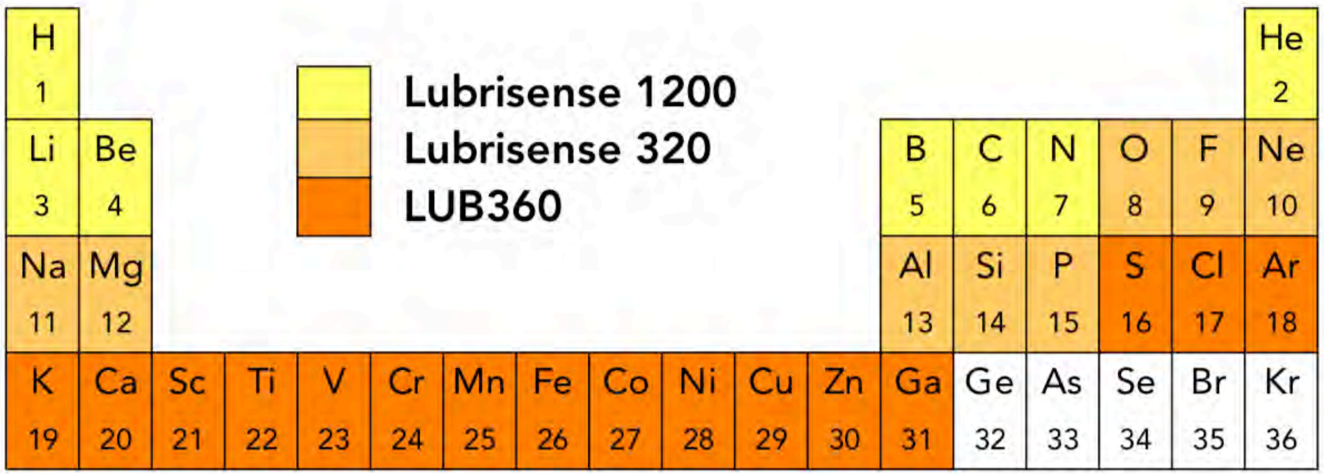
Partners

15 YEARS ANNIVERSARY

IAM
INSTITUT FÜR ANALYTISCHE MESSTECHNIK HAMBURG E.V.

Partners

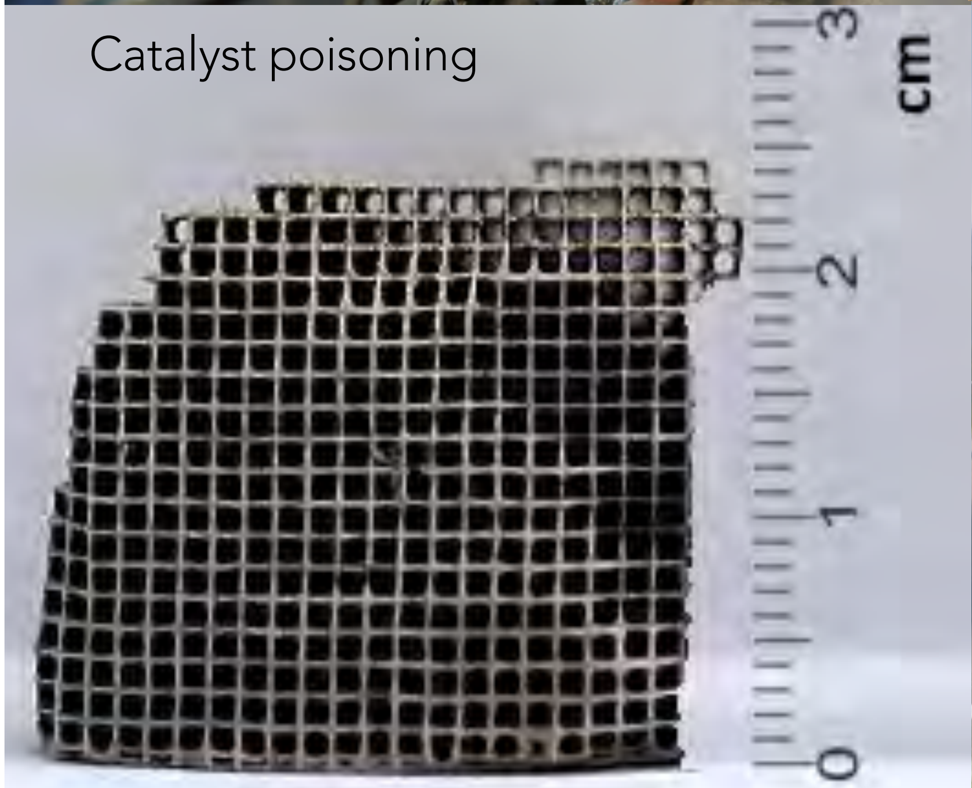
Systems sold



Why?


Jedes 5. Auto fährt
mit zu wenig Öl.*
Jetzt Ölstand prüfen.
Customer requirements


Emission regulations


Catalyst poisoning
cm
3
2
1
0


Real driving emissions

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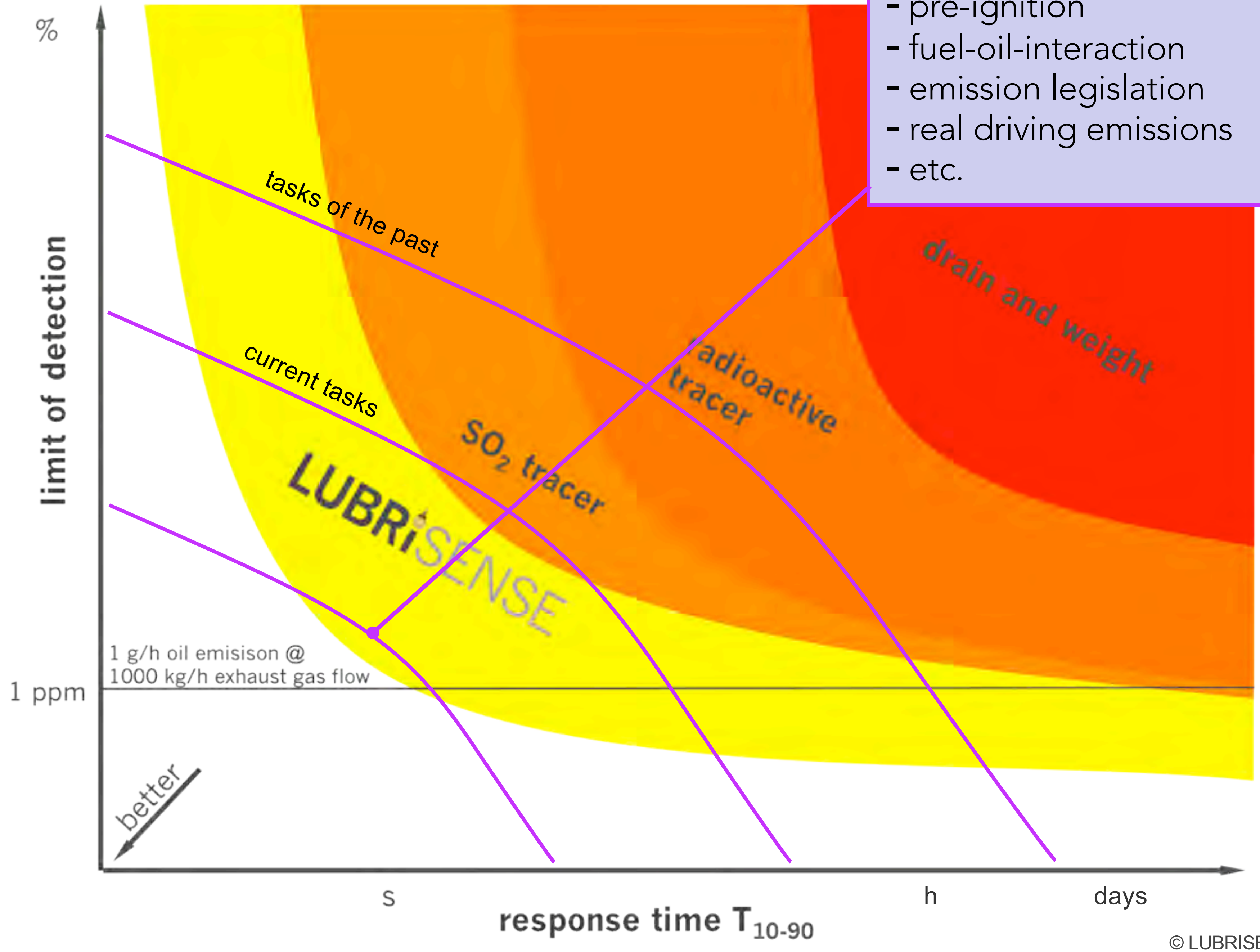
Oil Emission Measurement Technology

Tools for optimization of engine oil consumption

- Bio fuels
- fuel entrainment
- pre-ignition
- fuel-oil-interaction
- emission legislation
- real driving emissions
- etc.



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Oil Emission Measurement Technology

LUBRISENSE – LUB360

Oil Emission Measurement System

LUB360

PerkinElmer
For the Better

AxION iQT

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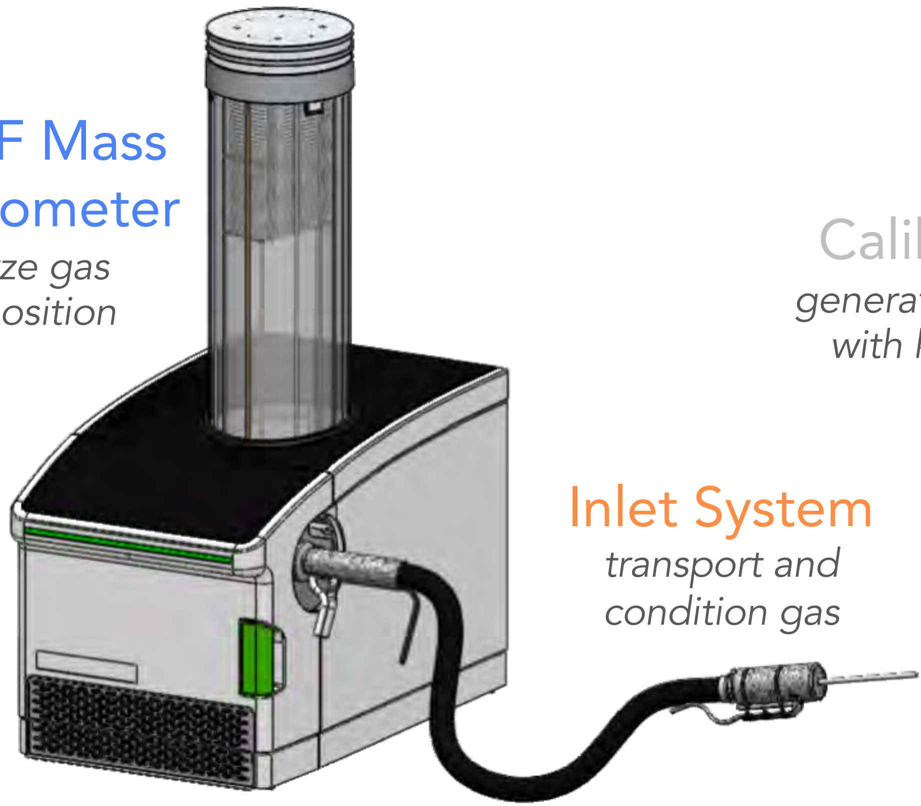
Oil Emission Measurement Technology

LUBRISENSE – LUB360

Oil Emission Measurement System

Q-TOF Mass Spectrometer
analyze gas composition



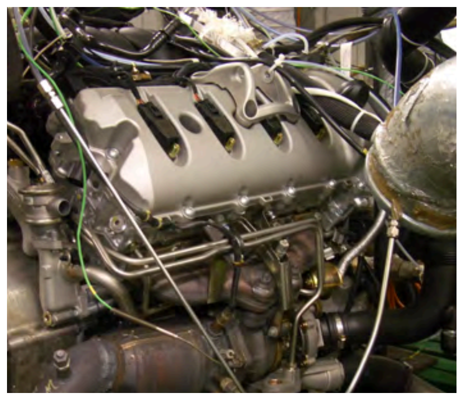
Inlet System
transport and condition gas

PiKal X Calibration System
generate artificial exhaust gas with known concentration

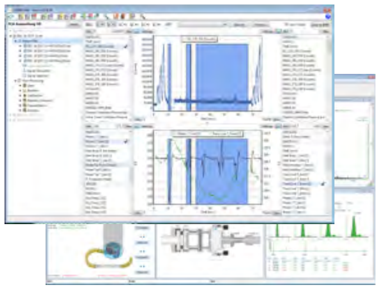
Calibration

Engine Measurement

Engine under Test
in engine test cell or on chassis dynamometer



Control & Evaluation Software

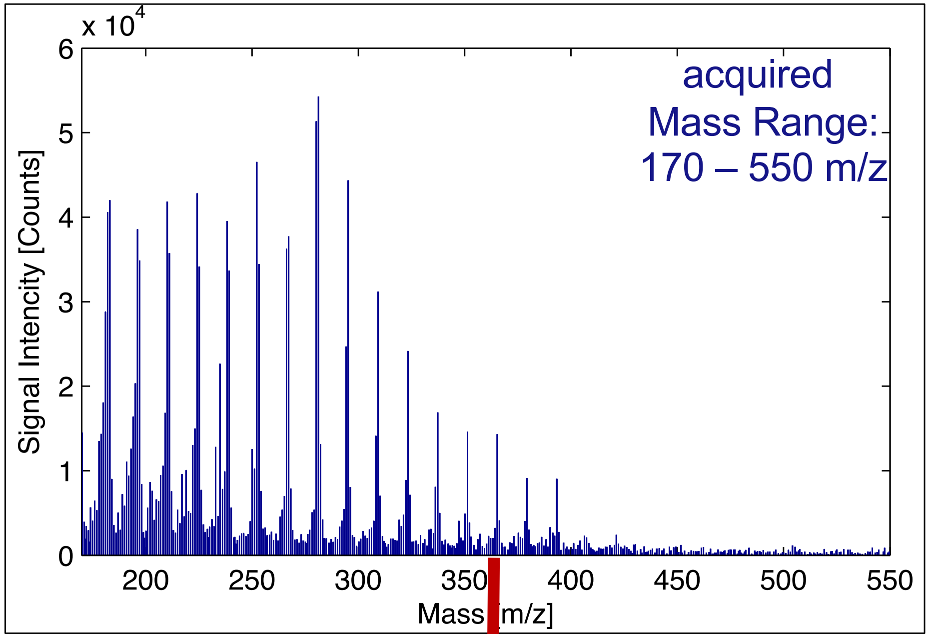


Data Acquisition

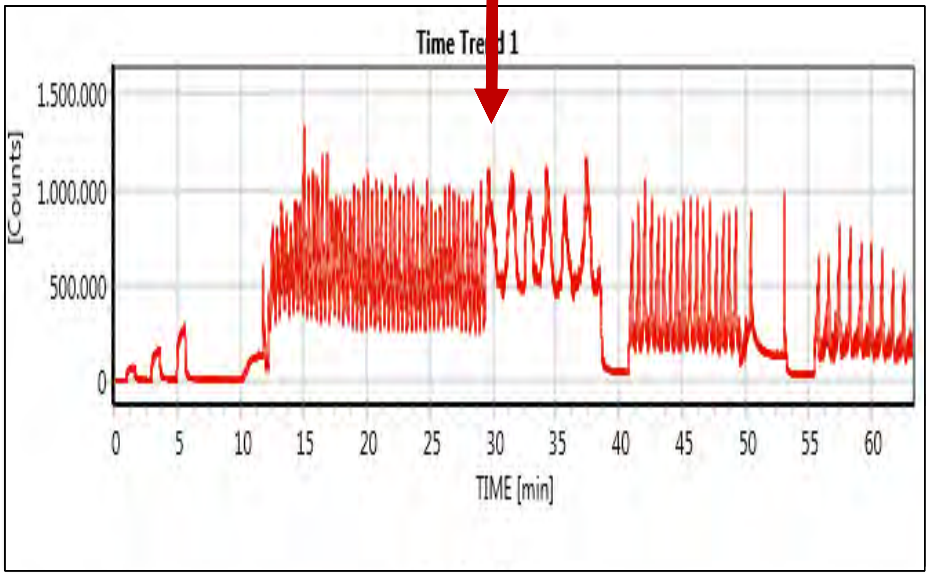
LUB360 Signal Processing

Mass Spectrum and Time Trend Data

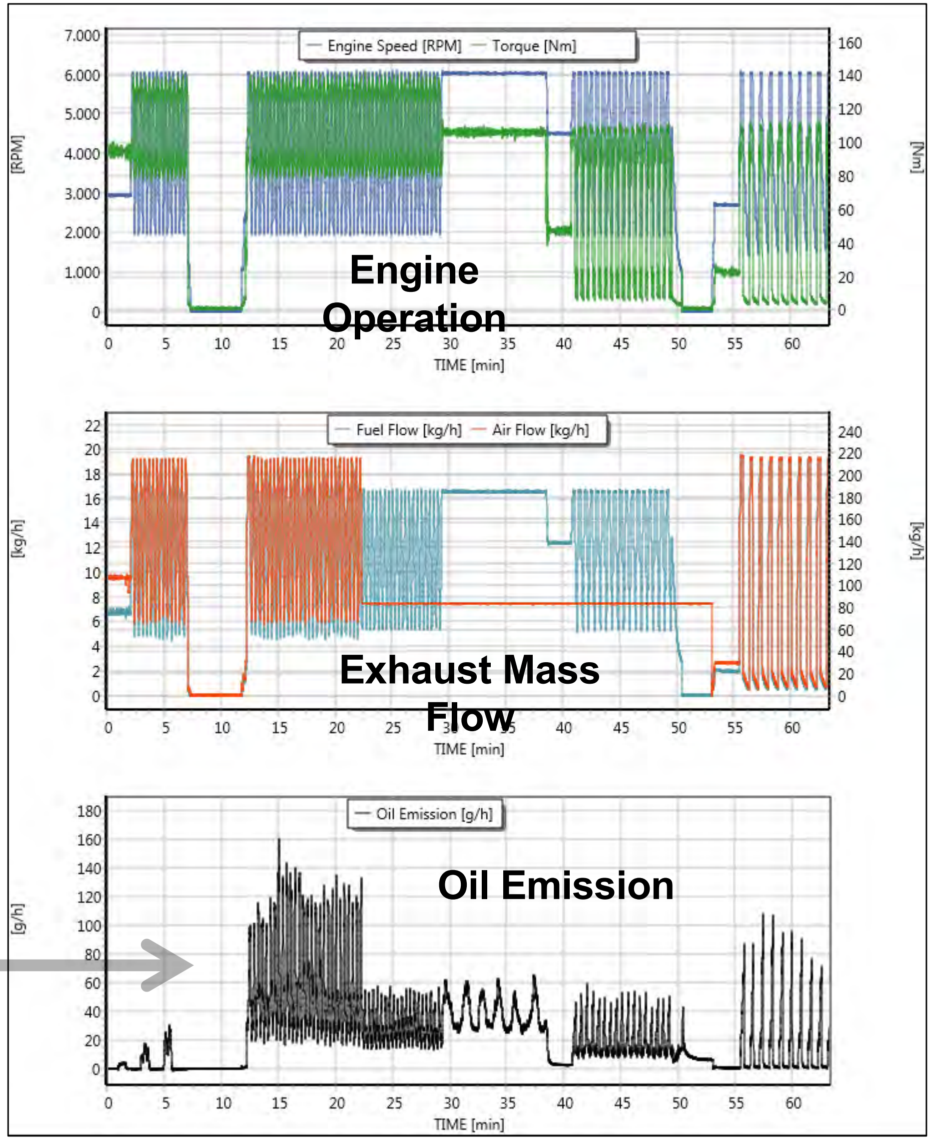
Mass Spectrum



Time Trend Data



Engine Data and Calculated Results



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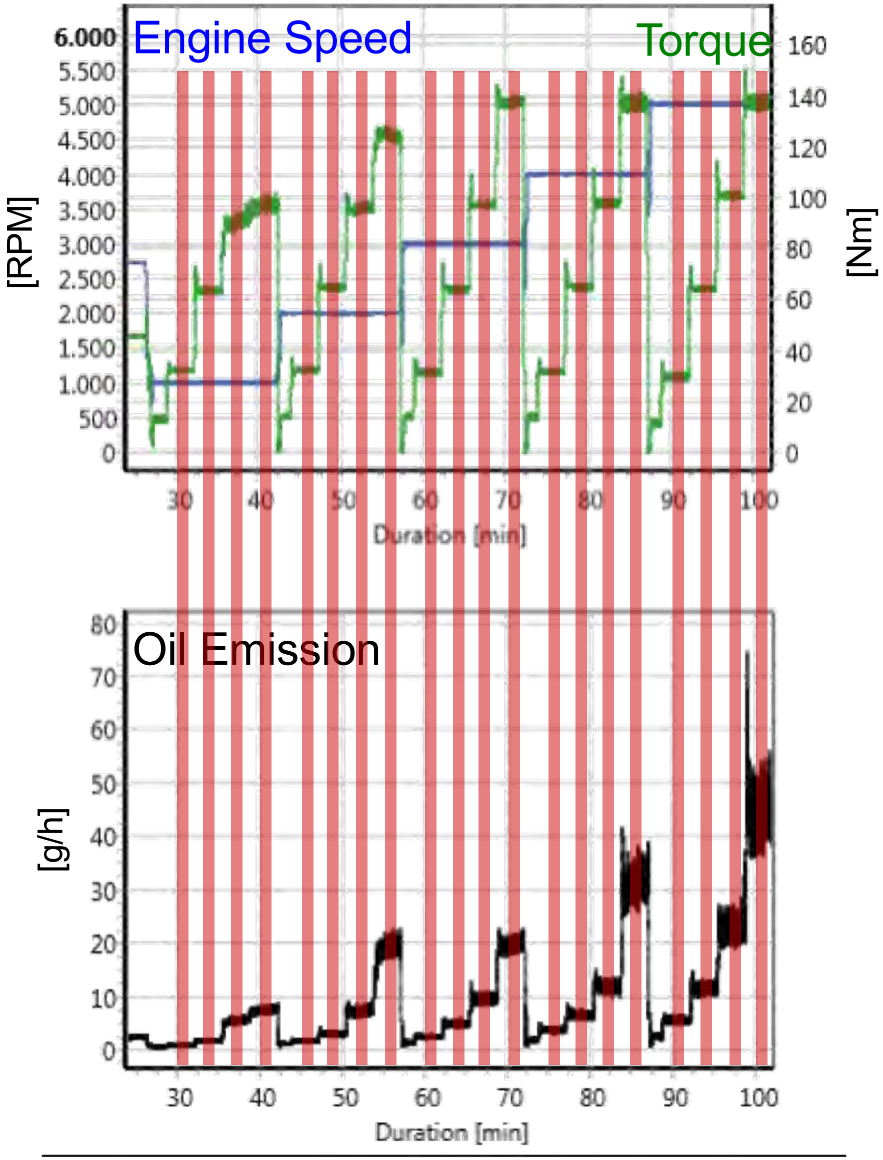
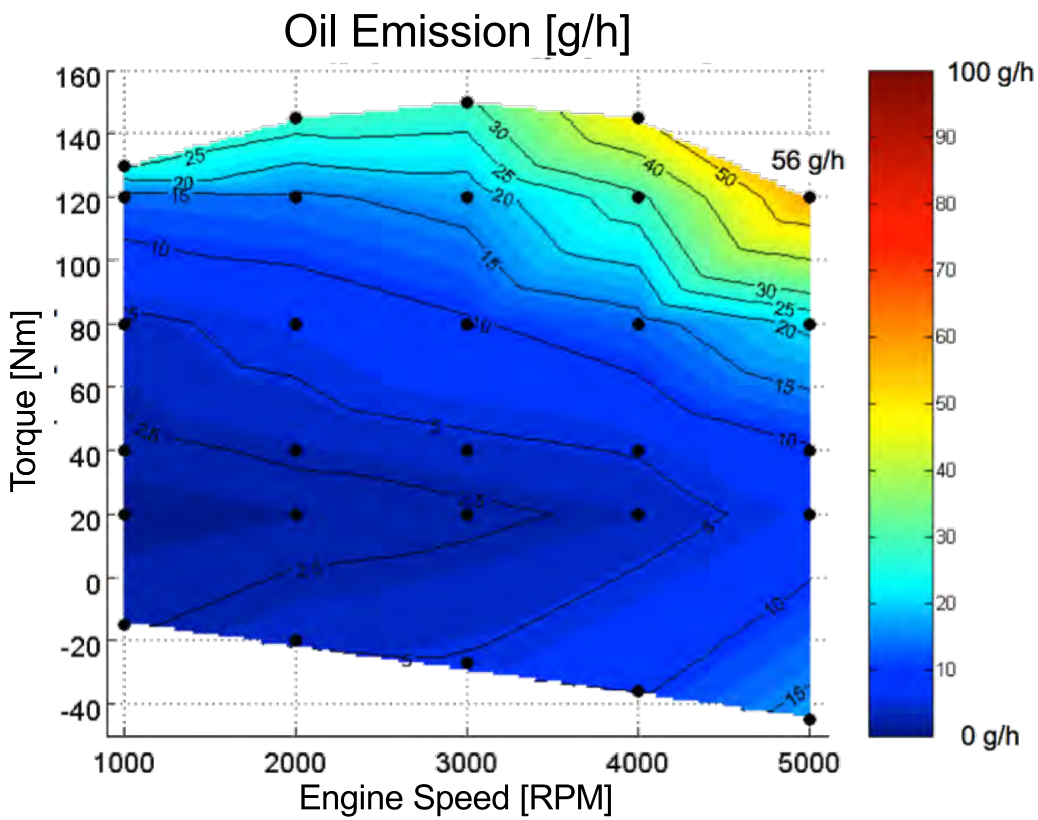
Oil Emission Measurement Technology

LUB360 Typical Applications

Steady State Operation / Oil Emission Map





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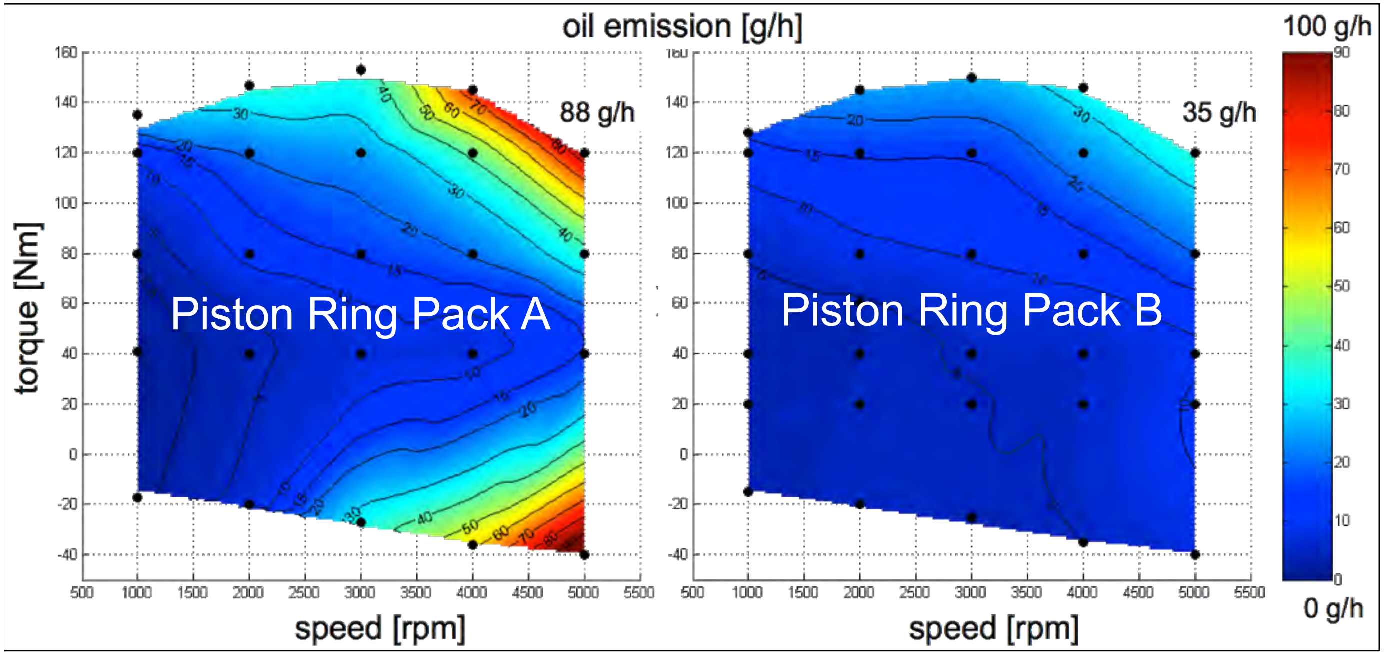
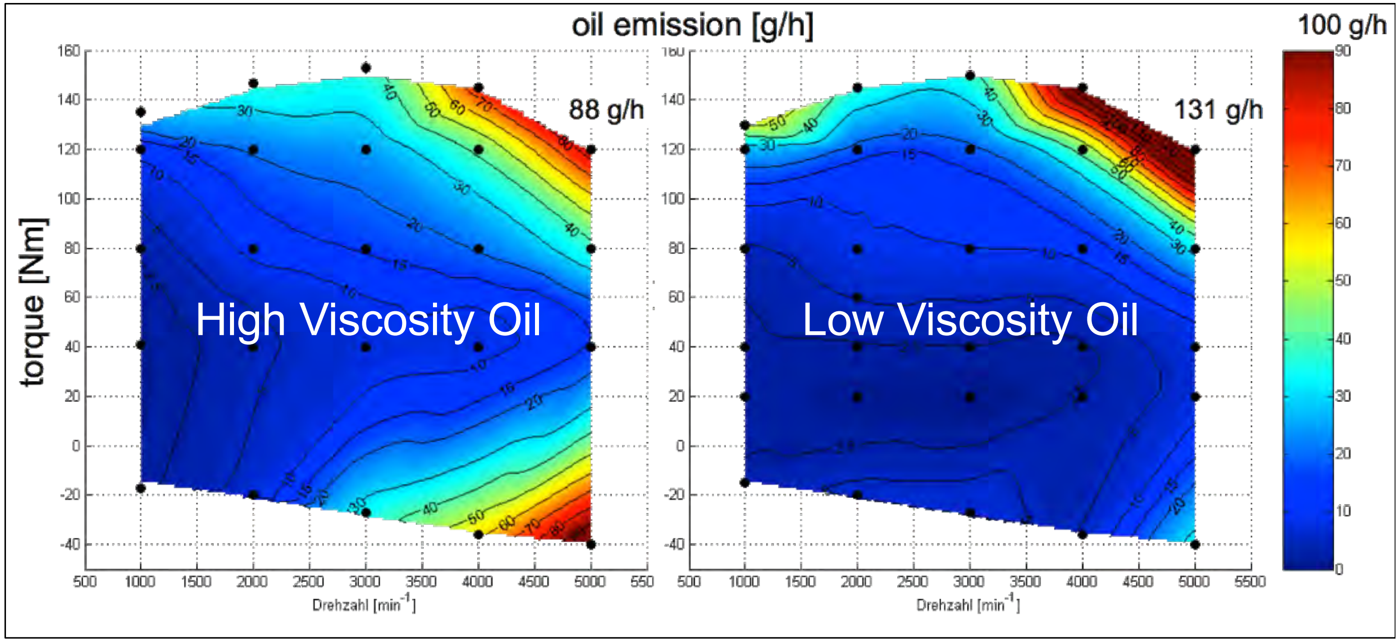
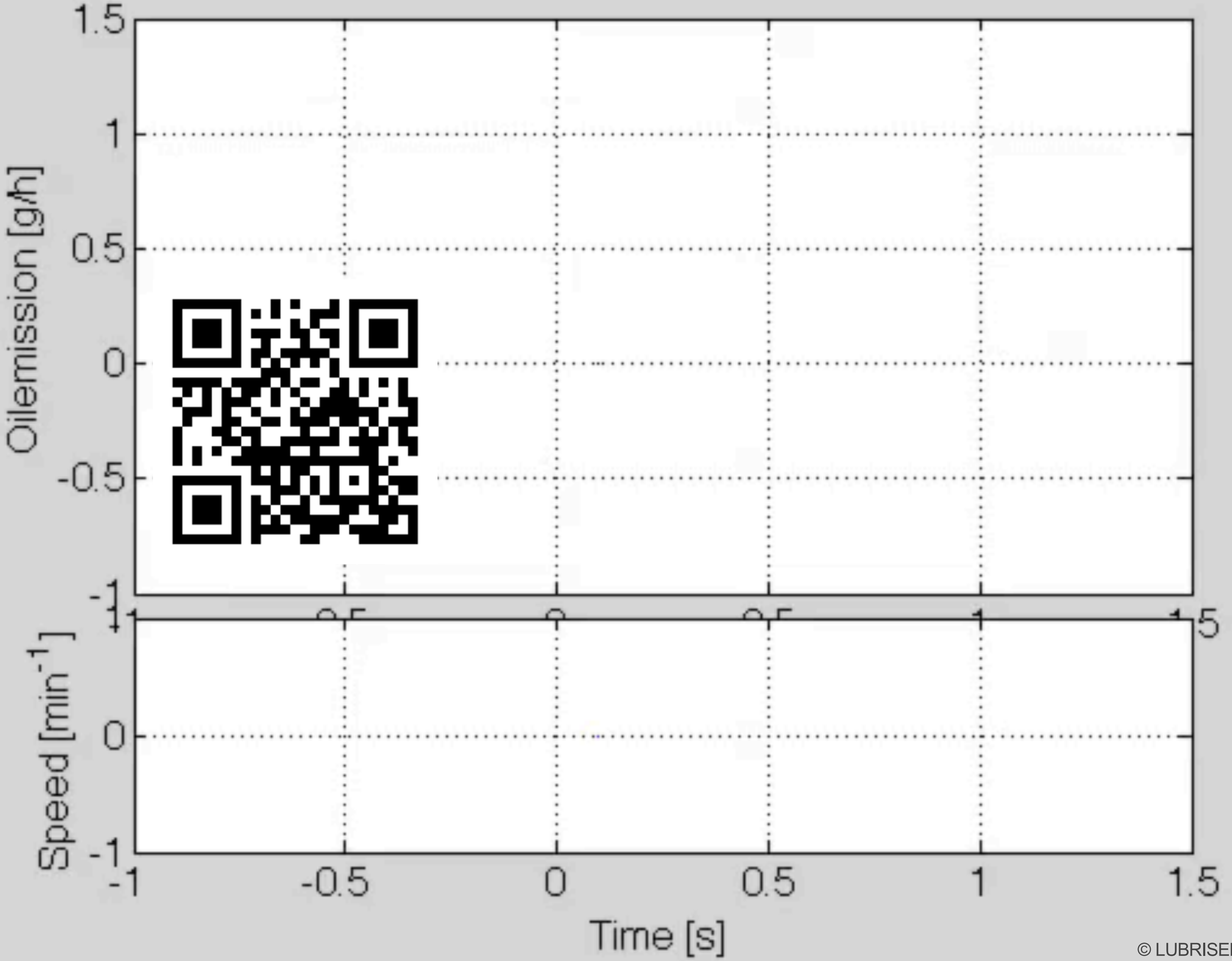
Oil Emission Maps



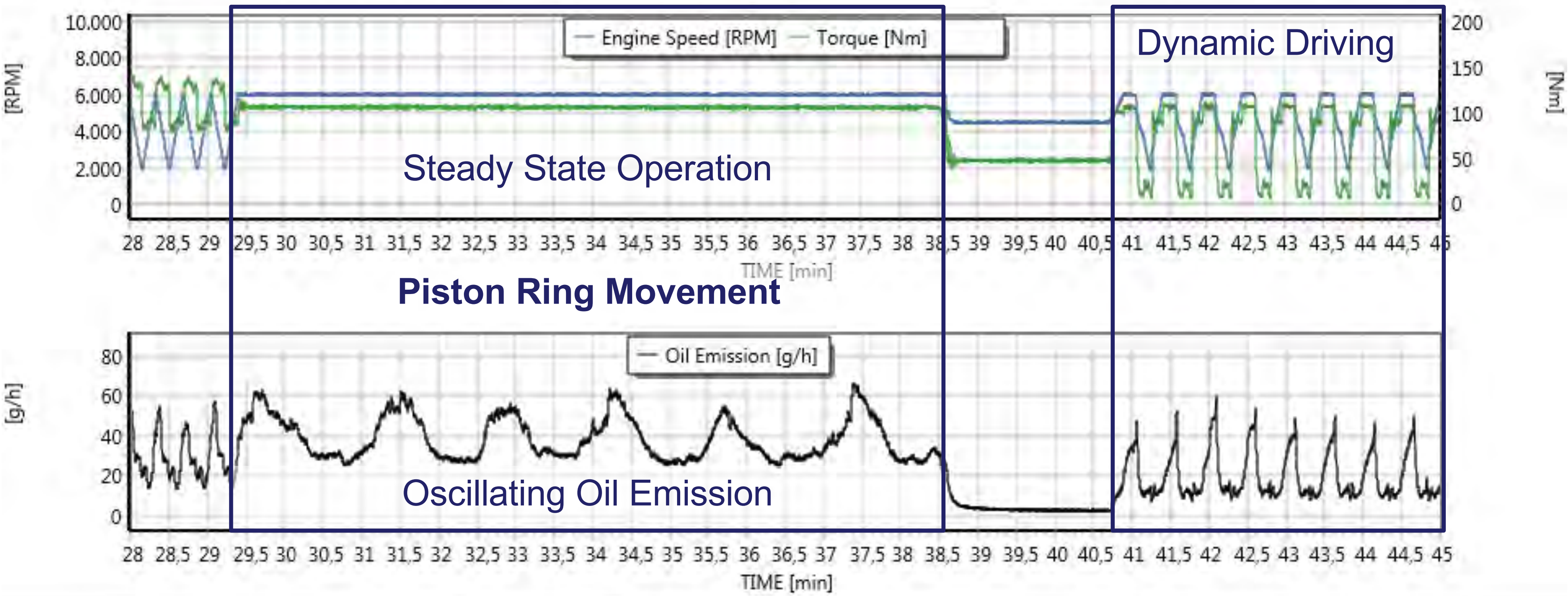


steady state vs. dynamic oil emissions



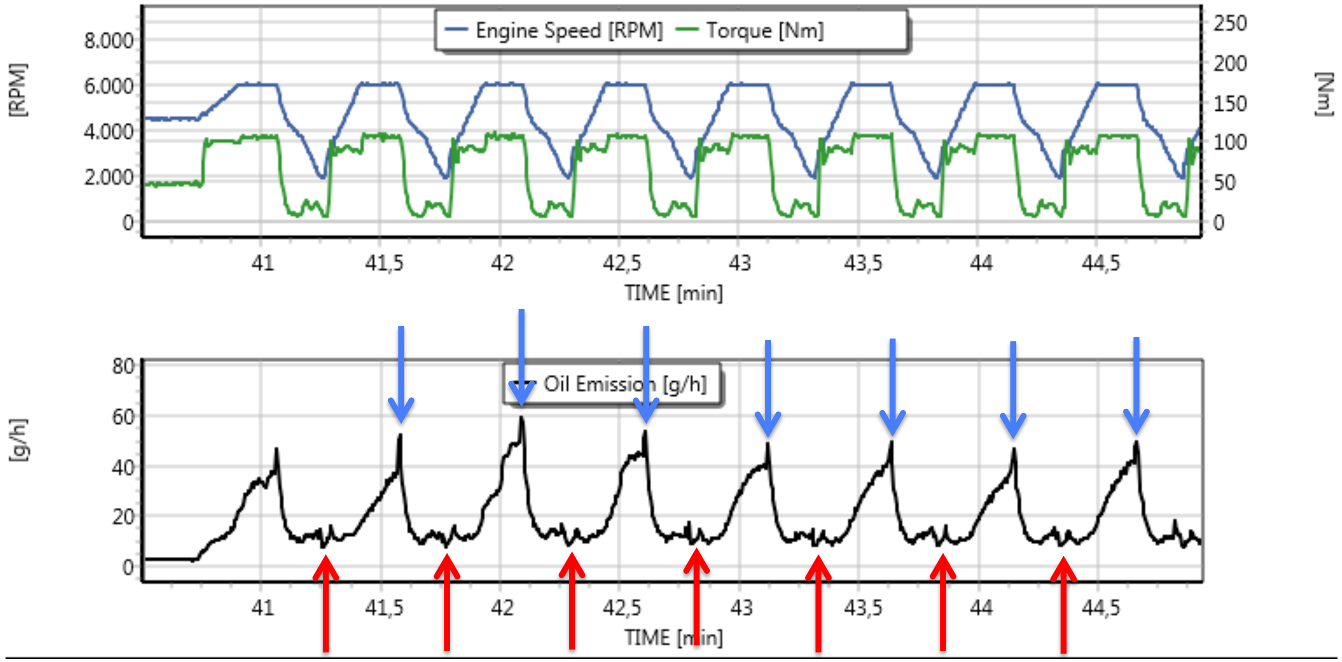
Dynamic Effects in Oil Emission

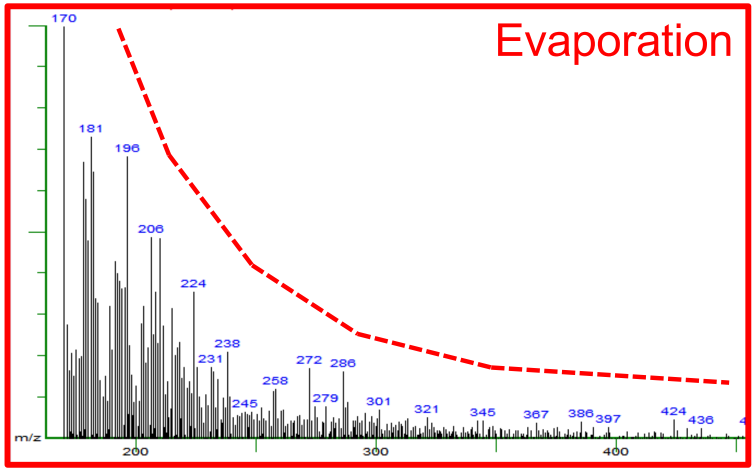
Steady State / Dynamic Driving

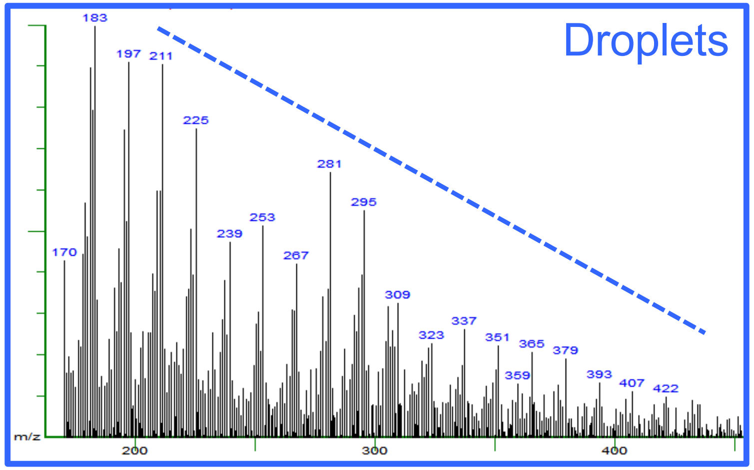


Dynamic Effects in Oil Emission

Different Emission Mechanisms







Real Driving Emissions

Cooperation with IAV Chemnitz

LUBRISENSE Real-Time Measurements

LUBRISENSE
Oil Emission Measurement Technology

Research Applications

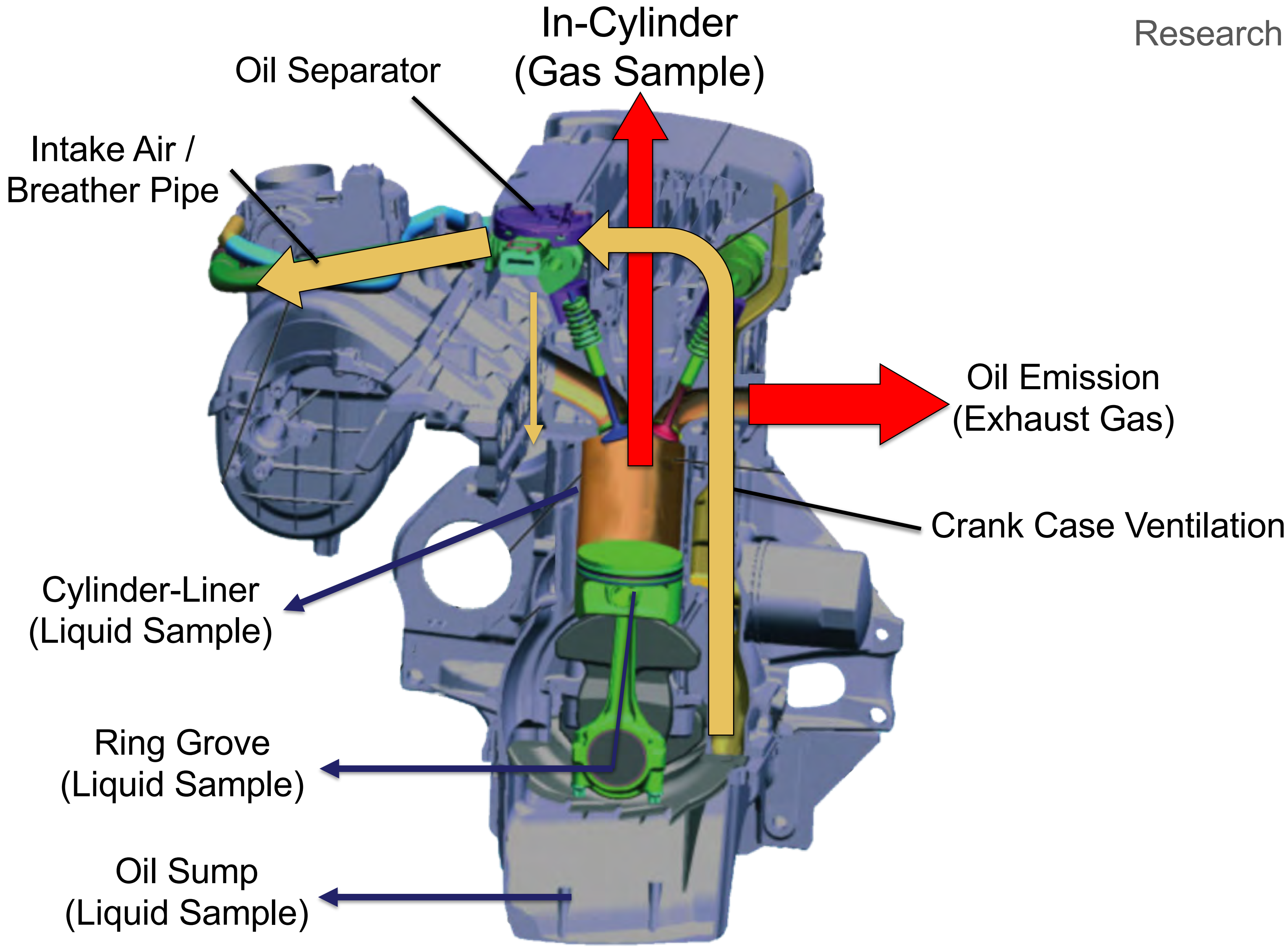


Image: MTZ

2014 – Tools for the Development of the Mechanical Components of Turbochargers

MTZ worldwide, July 2014, Volume 75, Issue 7-8, pp 12-17
Authors B. Kehrwald, A. Jäger, M. Sailer, J. Hadler
Source: Springer Automotive Media Wiesbaden GmbH (2014)

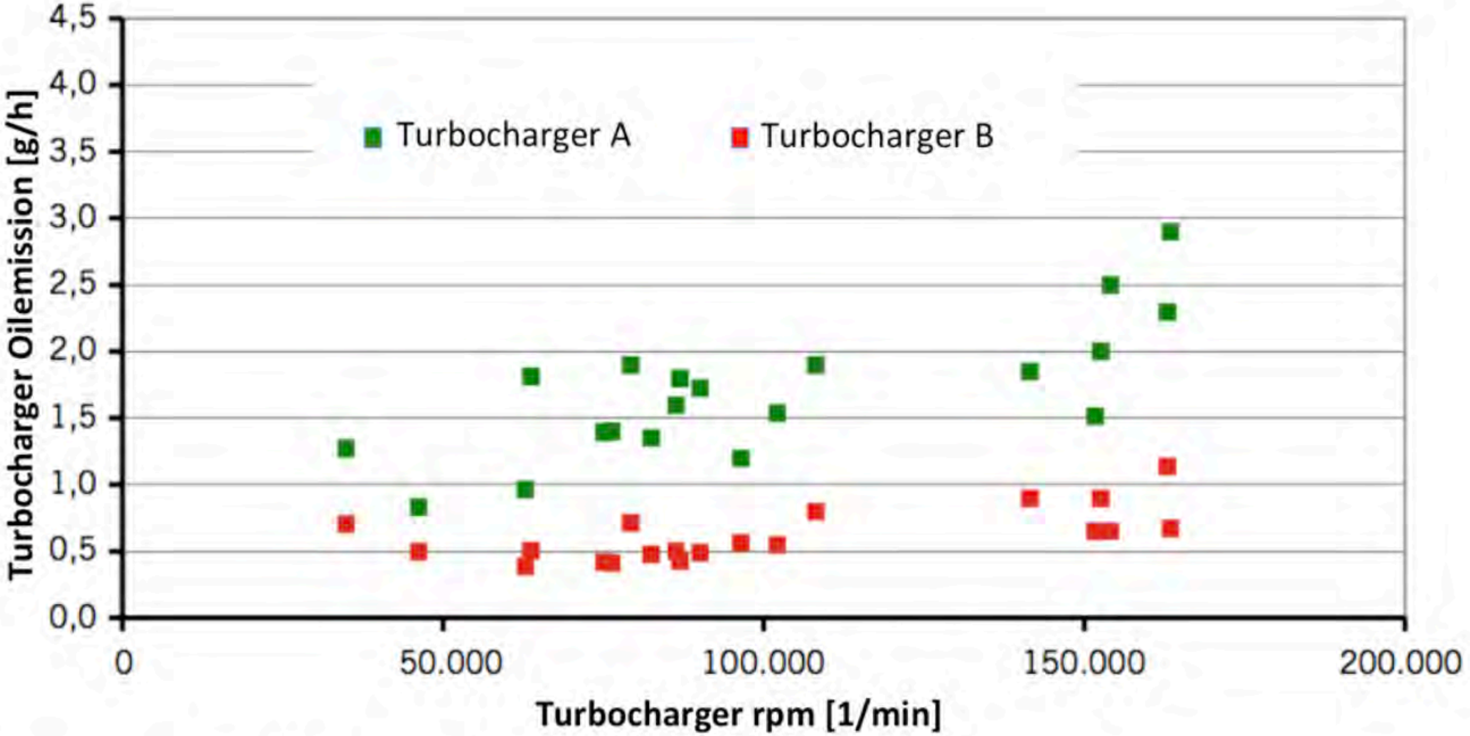


Figure 5 – Oilemission of different Turbocharger-Setups

2015 – Methods for the development of a RDE-capable powertrain

MTZ worldwide, June 2015, Volume 76, Issue 7-8, pp 32-37
Prof. Dr.-Ing. Jens Hadler, Dipl.-Ing. Christian Lensch-Franzen, Dr.-Ing. Marcus Gohl, Dr.-Ing. Carsten Guhr

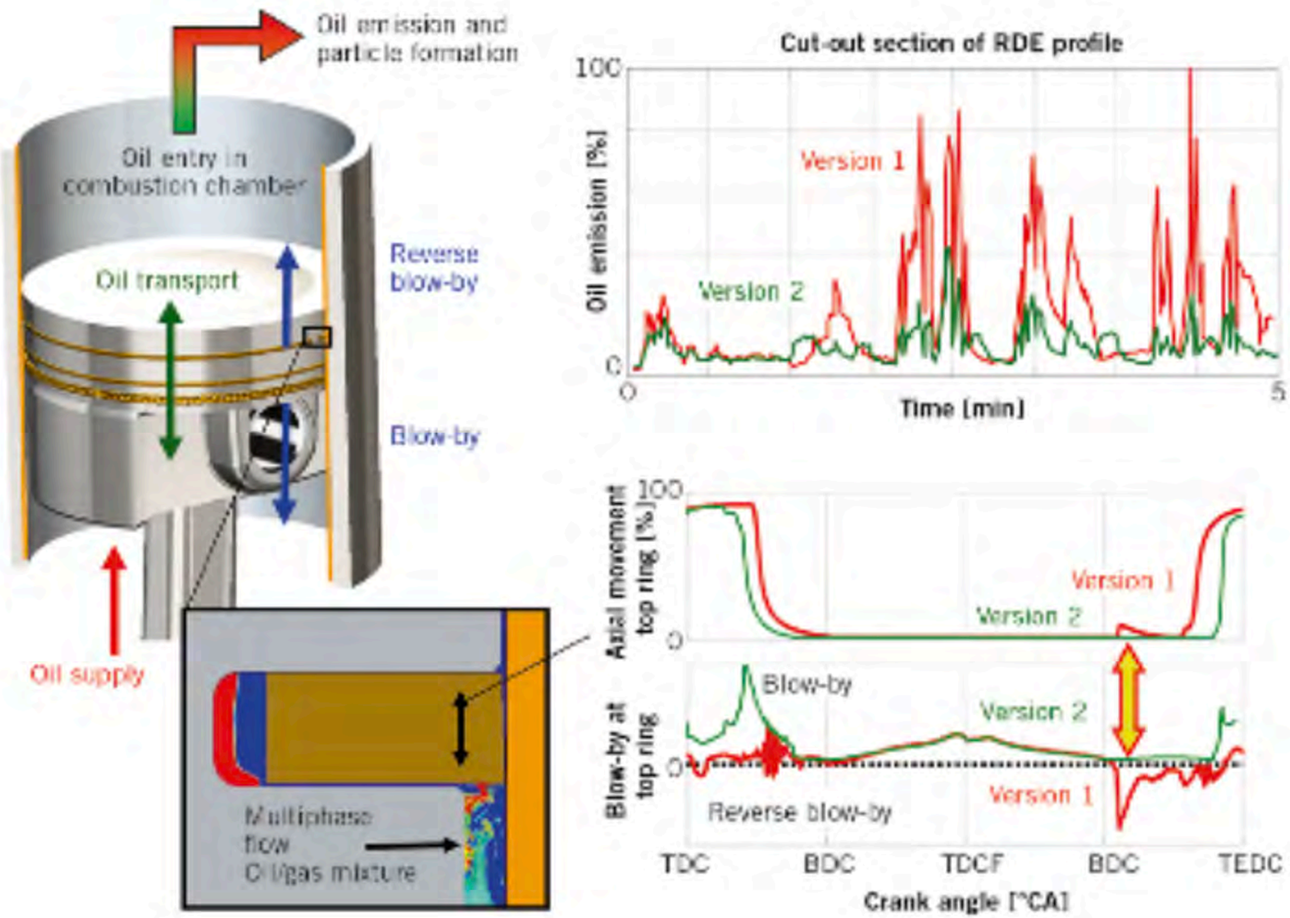


Figure 2 – Oil emission measurement and simulation of the functional group piston/pistion ring/cylinder wall for optimisation

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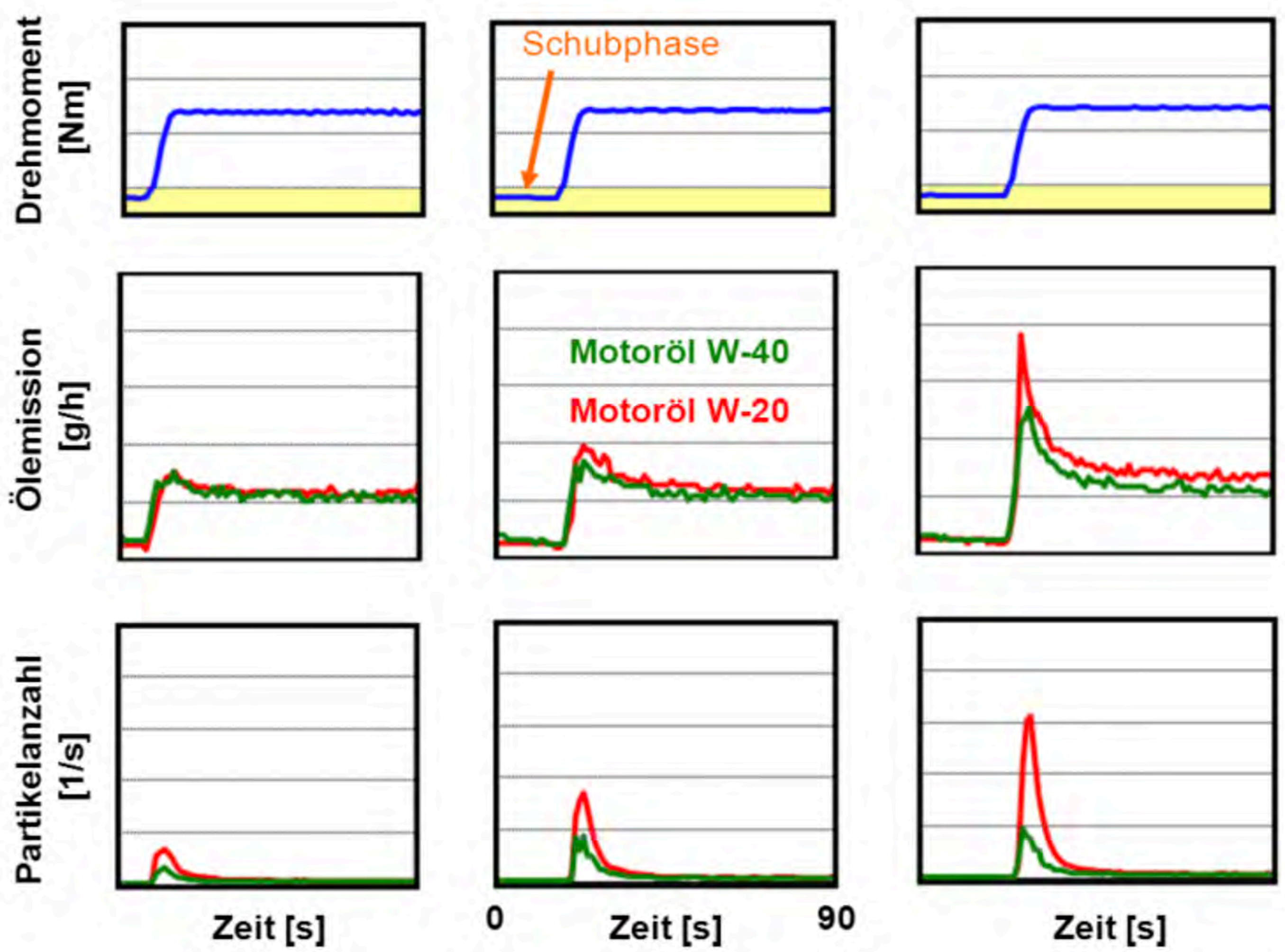
Oil Emission Measurement Technology

Publications

2015 – Emission Reduction A Solution of Lubricant Composition, Calibration and Mechanical Development

MTZ worldwide, August 2015, Volume 76, Issue 9, pp 30-33
Prof. Dr.-Ing. Jens Hadler, Dipl.-Ing. Christian Lensch-Franzen, Dr.-Ing. Marcus Gohl, Dipl.-Ing. Tobias Mink



The influence of piston drain holes on the oil emission off a turbo charged gasonline engine

Dipl.-Phys. **I. Papadopoulos**, MAHLE International GmbH, Stuttgart
Dr.-Ing. **A. Frommer**, MAHLE GmbH, Stuttgart
Dr.-Ing. **R. Künzel**, MAHLE International GmbH, Stuttgart

Variante 1 (V1)	Variante 2 (V2)	Variante 3 (V3)	Variante 4 (V4)
- Keine ÖRB - Kein Volumen unter Ölabstreifring	- Keine ÖRB - Mit Volumen unter Ölabstreifring	- 4 ÖRB - Mit Volumen unter Ölabstreifring	- Keine ÖRB - 2 Scupper Slots - Mit Volumen unter Ölabstreifring

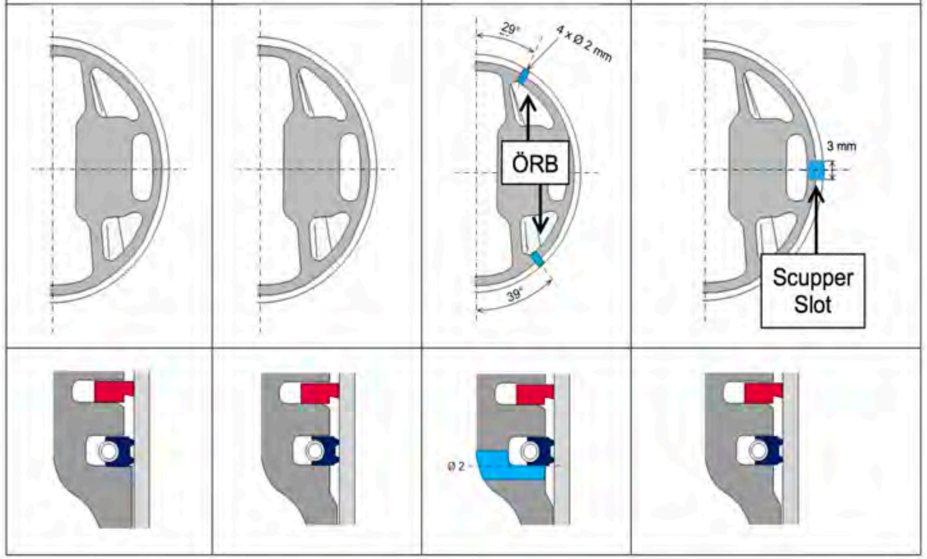


Bild 1: Schematische Darstellung der vier untersuchten Kolbenvarianten mit Abbildung eines horizontalen Schnitts in der 3. Nut (oben) und eines vertikalen Schnitts (unten)

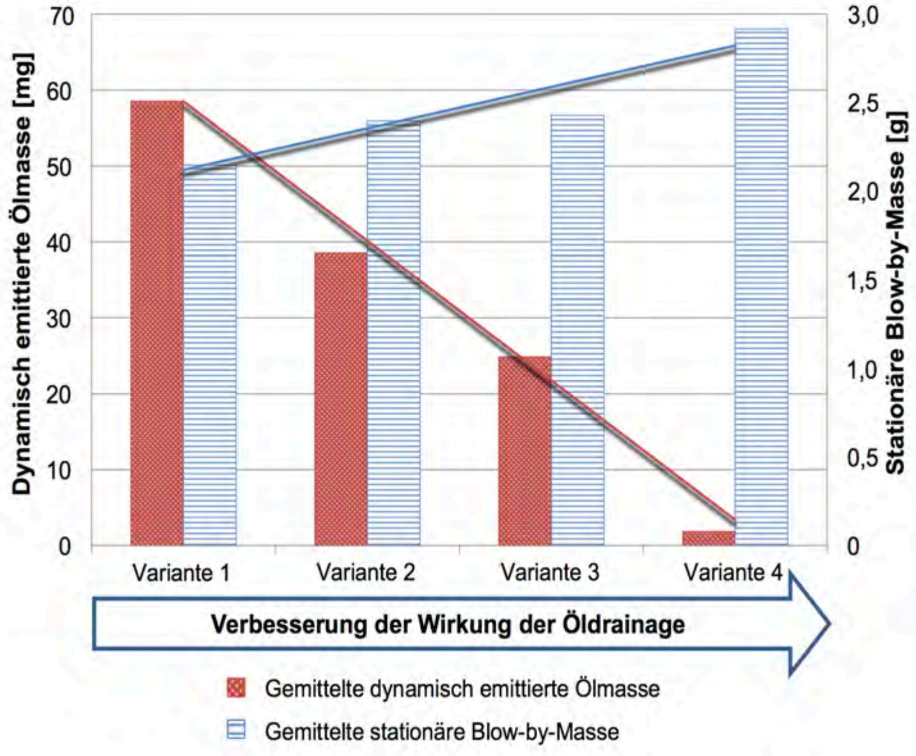


Bild 11: Graphische Darstellung der dynamisch emittierten Ölmasse und der stationären Blow-by-Masse, gemittelt über alle Betriebspunktwechsel mit positiver Laständerung des transienten Prüflaufprogramms

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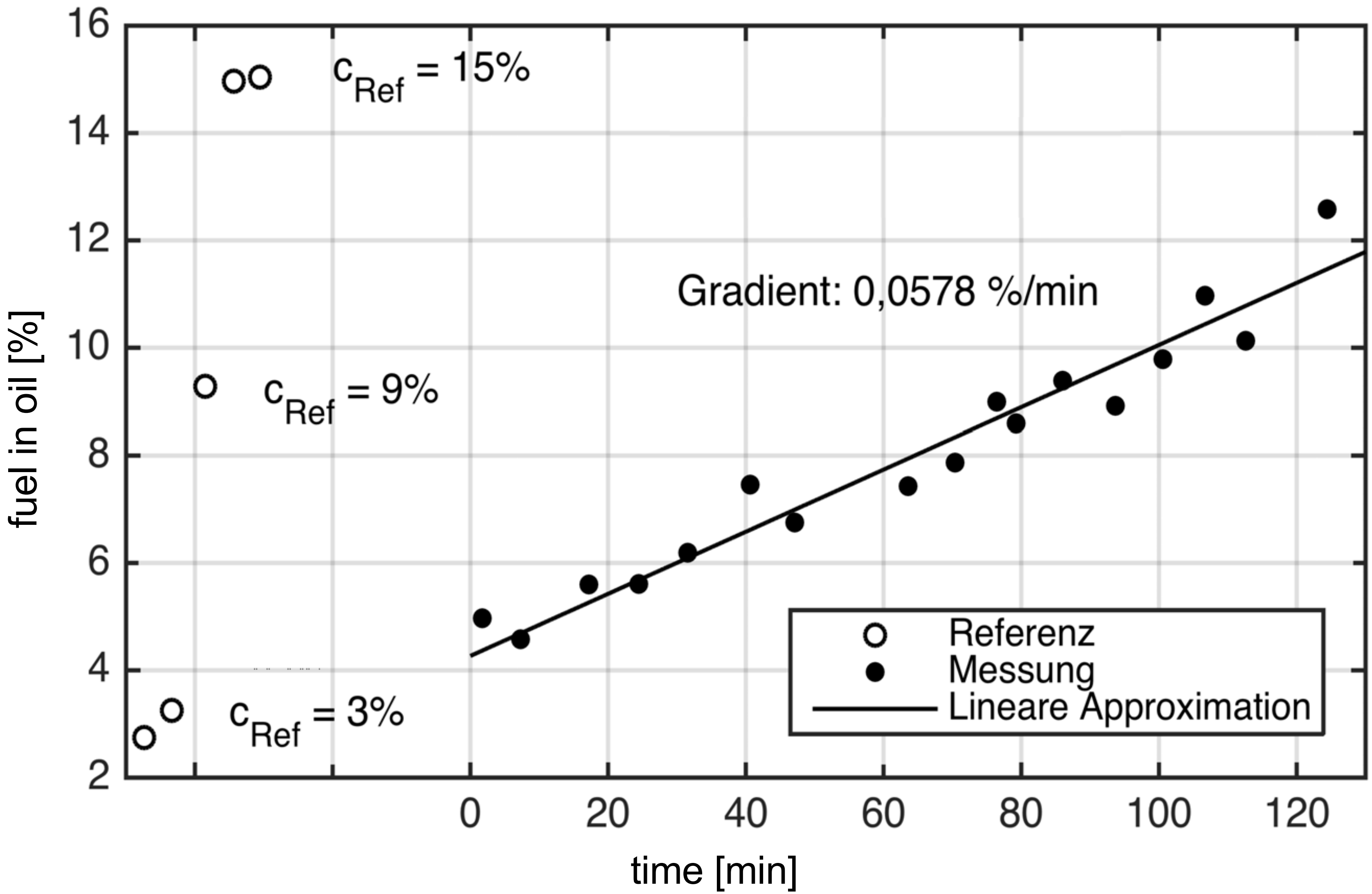
Oil Emission Measurement Technology

Publications

2015 – Fuel in Oil

Investigation of the fuel lubrication oil interaction on oil dilution during particulate filter/ NO_x storage catalyst regeneration



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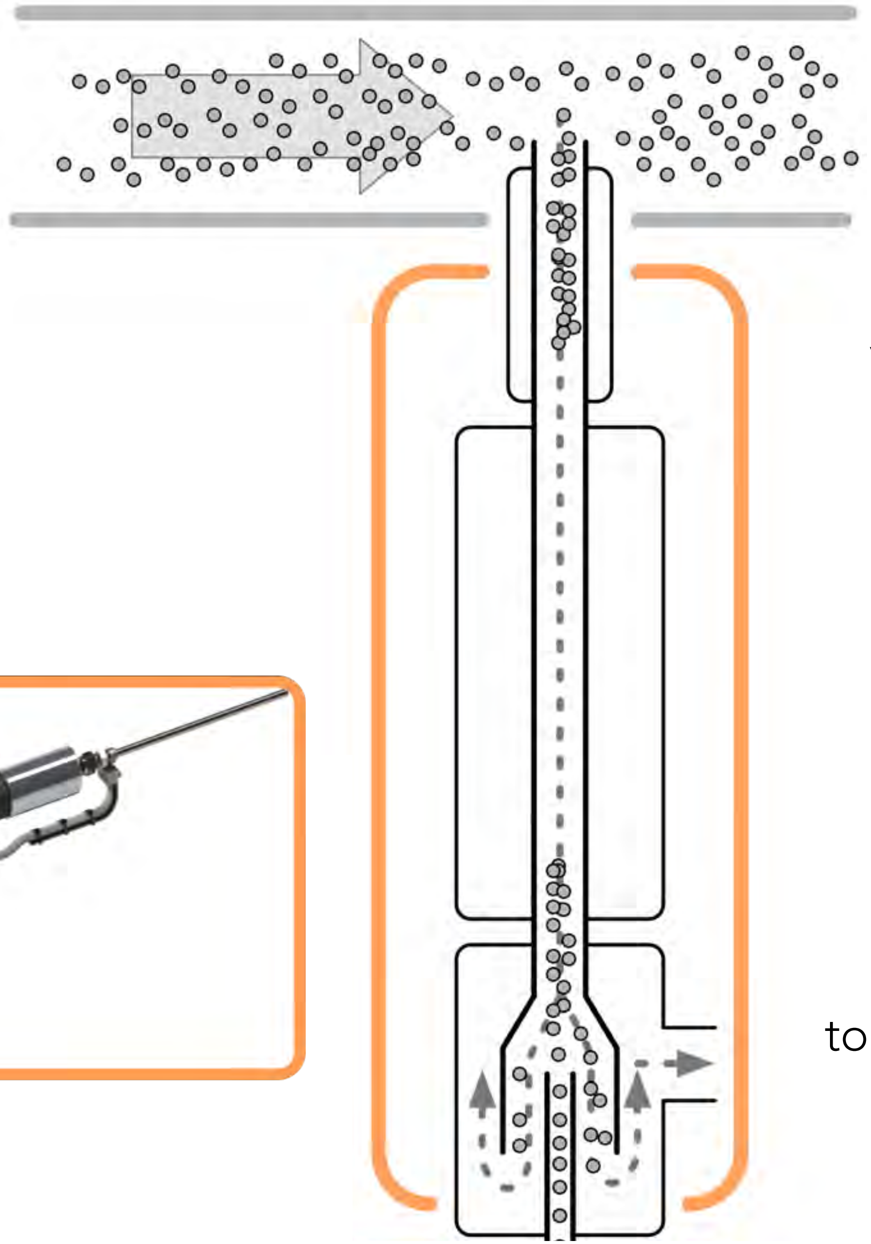
Oil Emission Measurement Technology

Exhaust
Manifold



Inlet velocity
$v = 50 - 100$ m/s

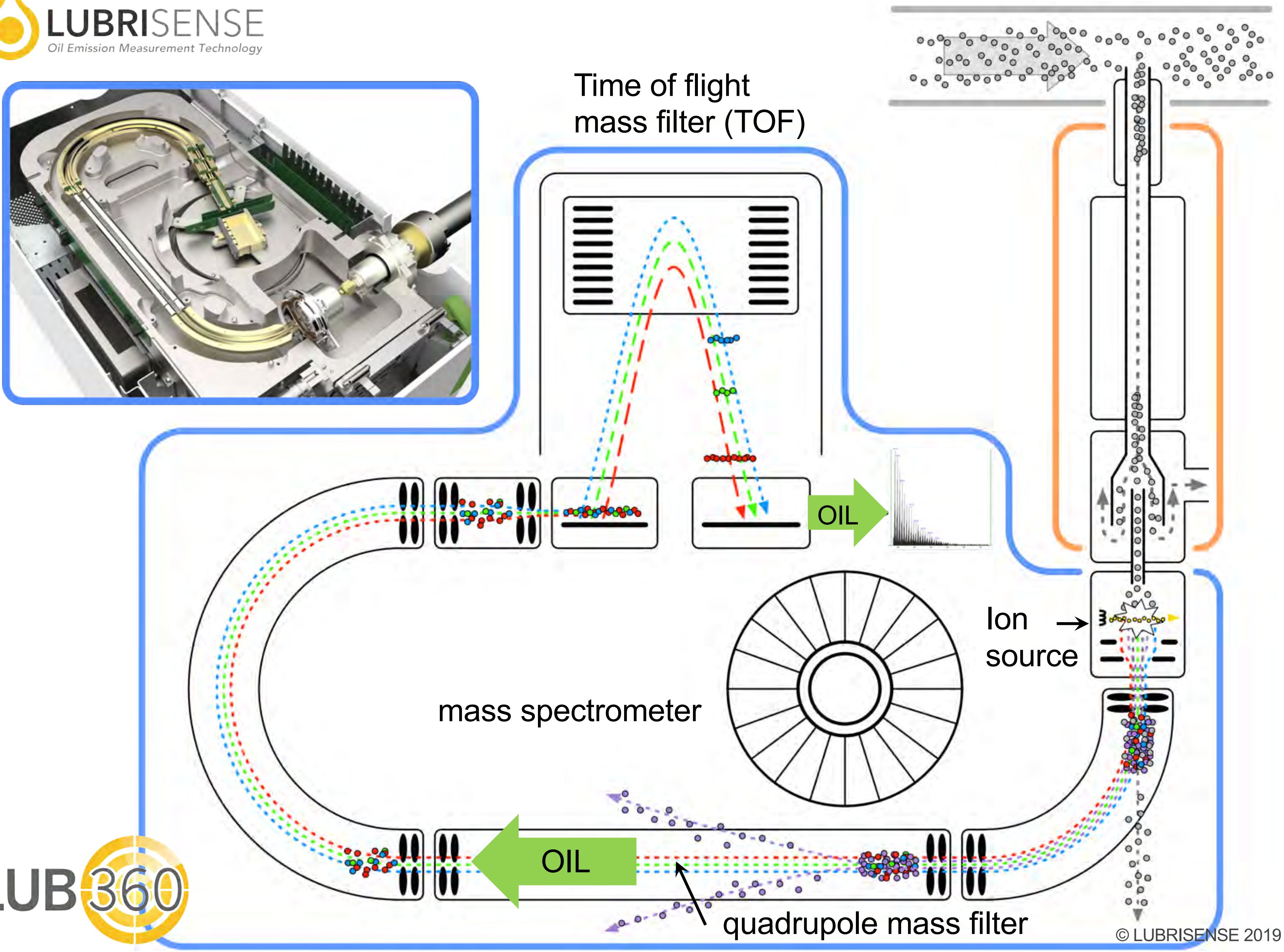
Total transfer time
$t \sim 40$ ms

to MS

to Pump

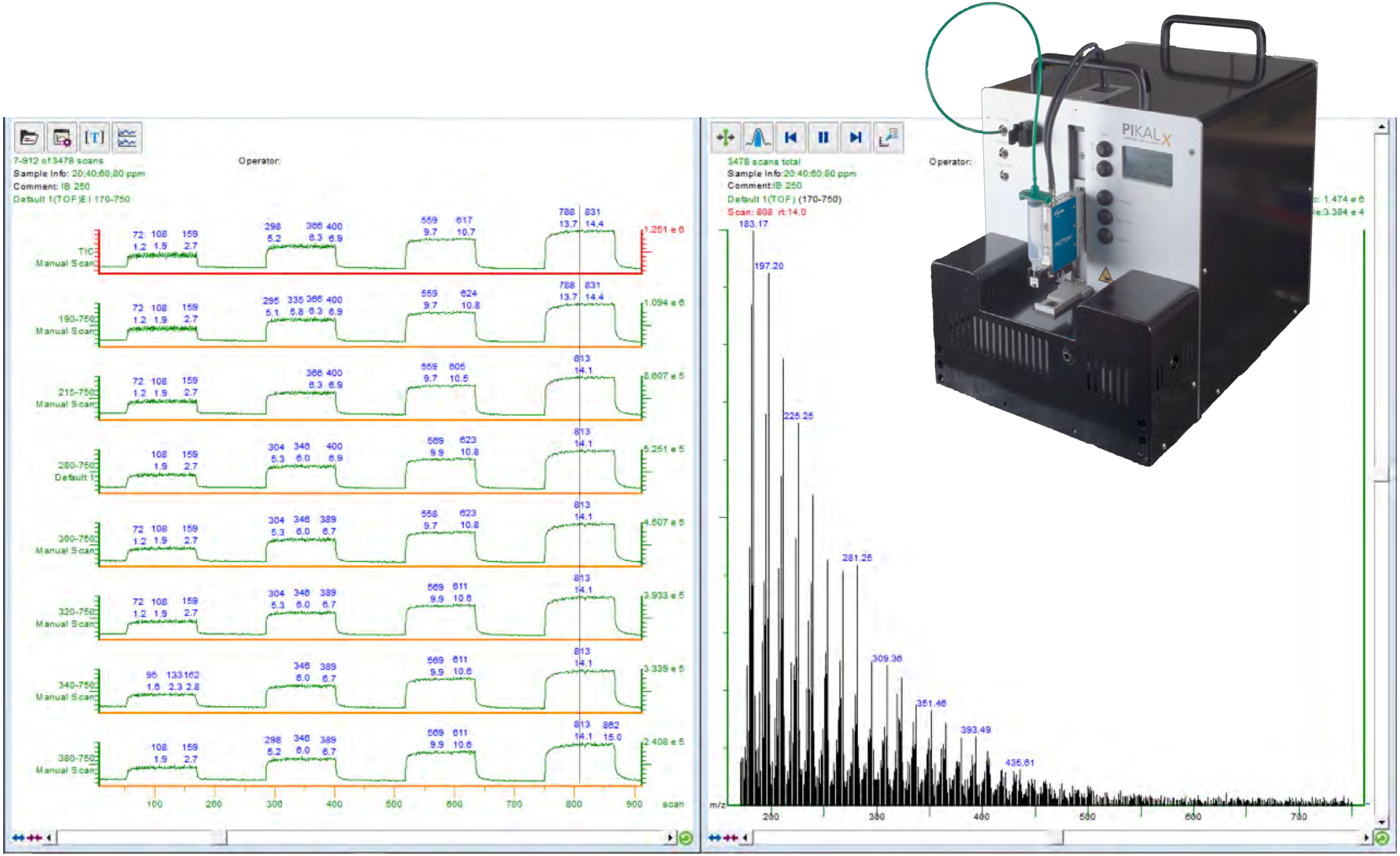
LUB360

LUBRISENSE
Oil Emission Measurement Technology

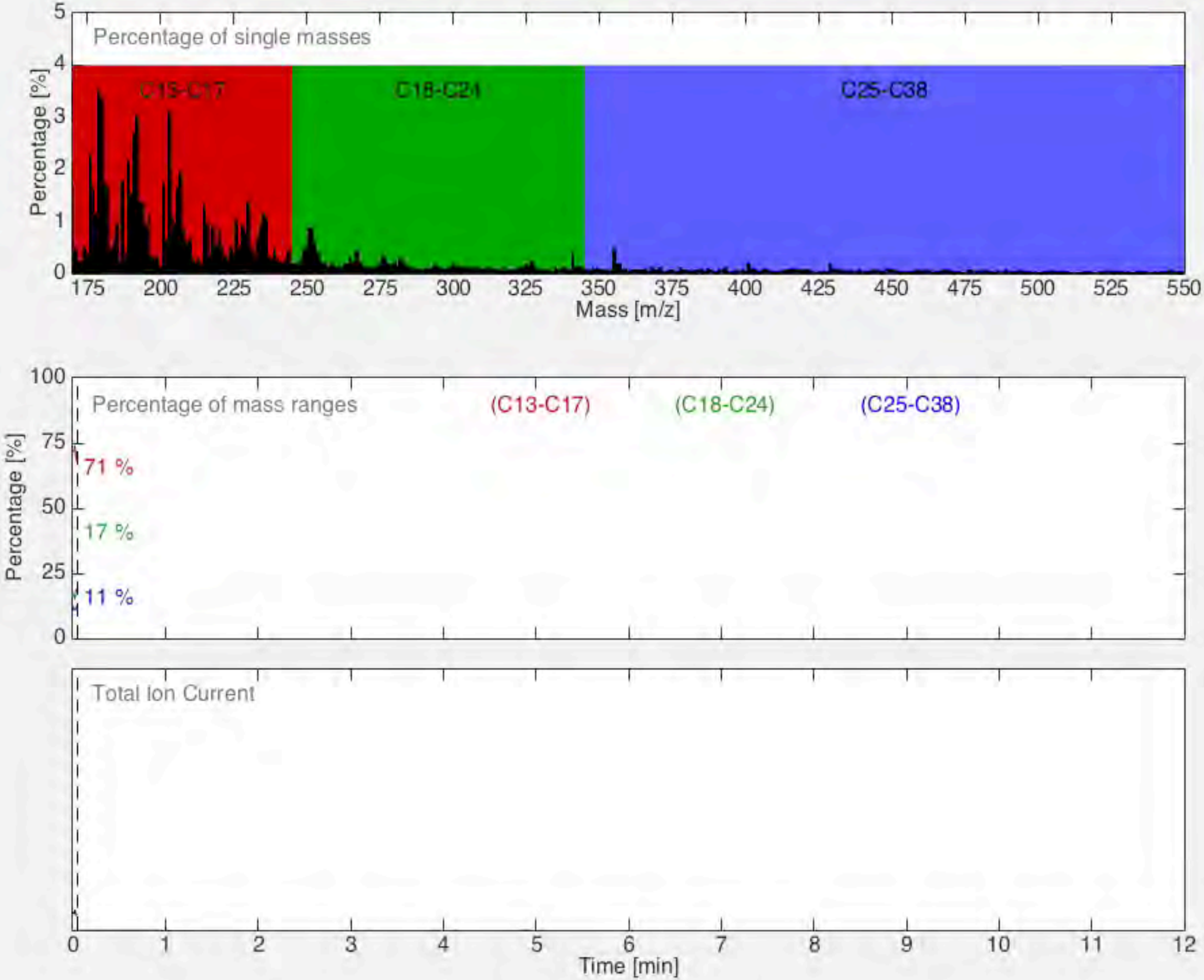


LUB360

PikalX Calibration



20, 40, 60, 80 ppm



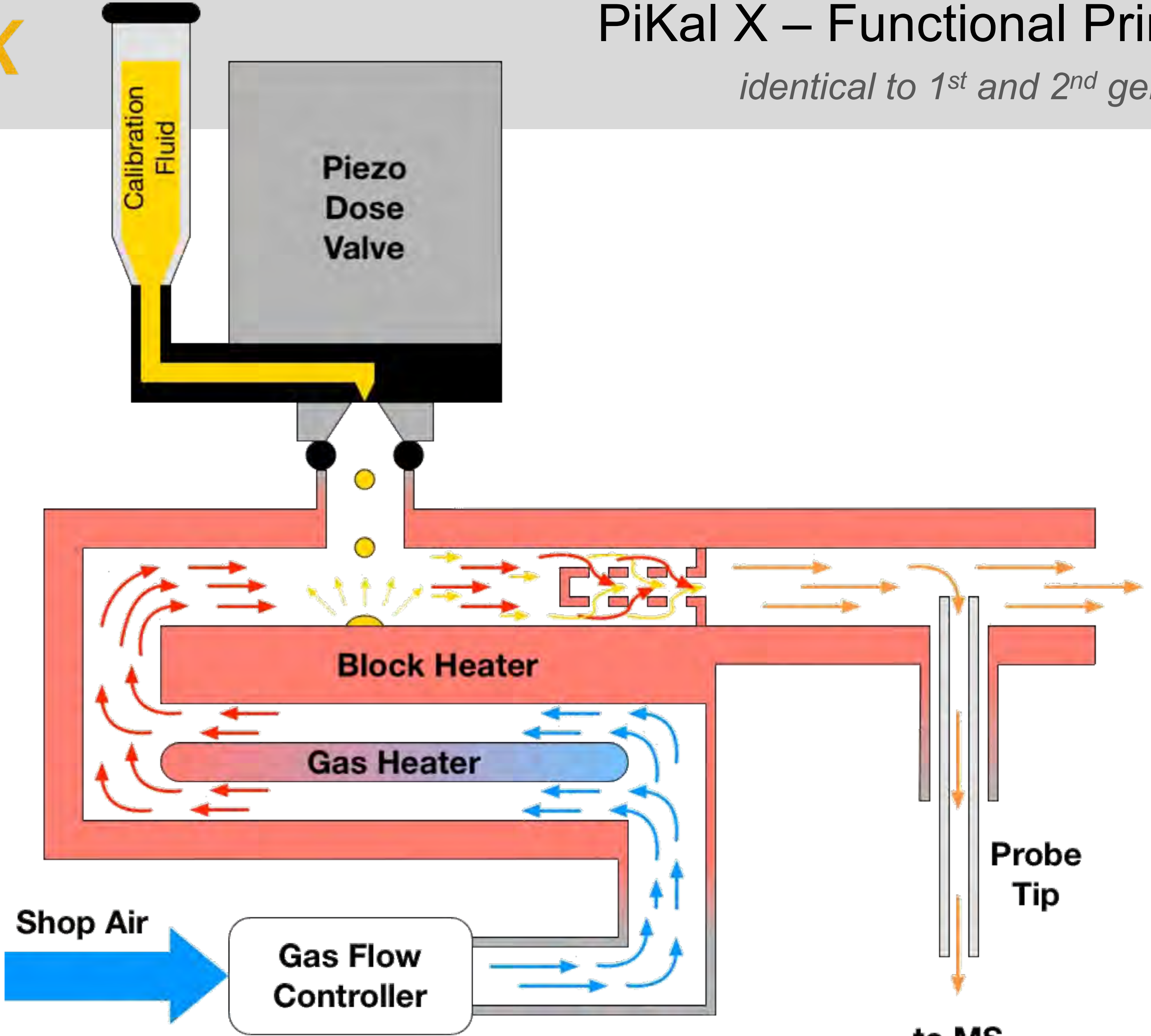
Percentage of single masses
C13-C17
C18-C24
C25-C38
Percentage [%]
Mass [m/z]
Percentage of mass ranges
(C13-C17)
(C18-C24)
(C25-C38)
71 %
17 %
11 %
Percentage [%]
Total Ion Current
Time [min]

PiKal X – Lubrisense Calibration System

3rd Generation for LUB360

PiKal X – Functional Principal

identical to 1st and 2nd generation



PiKal X – Lubrisense Calibration System

3rd Generation for LUB360

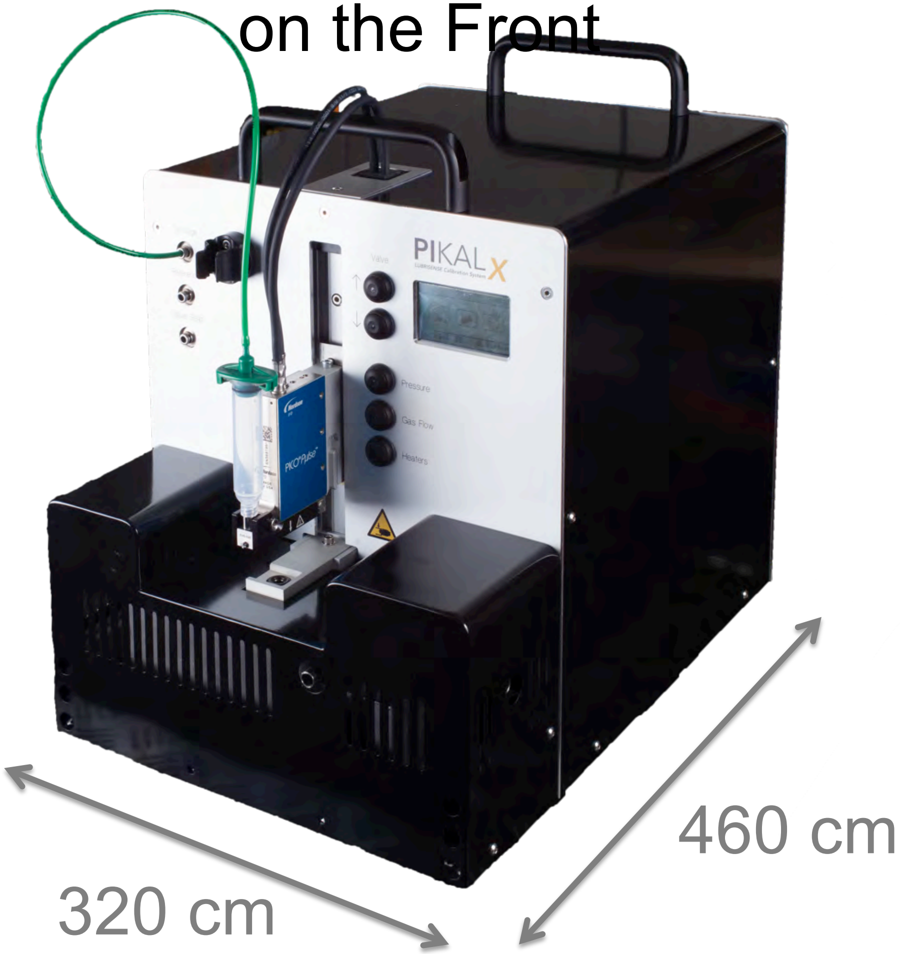
New Features

- **Smaller Footprint and 'One-Side-Access'**
  easier use | mountable onto LUB360 Trolley
- **Push Buttons and Touch Panel Display**
  versatile control directly at the unit
- **New Piezo Valve Design**
  easier to vent and clean
- **Automated Piezo Valve Lift**
  less user intervention | easier droplet weighing
- **Digital Flow and Pressure Regulator**
  easy to adjust | more stable operation
- **Integrated in iQT Driver Software**
  no extra software required | seamless workflow
- **Controlling and Logging of all System Parameters**
  widely automatable | easier troubleshooting

Smaller Footprint and 'One-Side-Access'

easier use | mountable onto LUB360 Trolley

Controls and Evaporation Unit on the Front



PIKAL x
LUBRISENSE Calibration System

Automated Piezo Valve Lift

less user intervention | easier droplet weighing

Piezo Valve moves
up / down automatically

Special vial holder
for droplet weighing

LUB360 Specifications

LUB360

System Specification
(Base Version without UPS and AC, 115VAC)

General	Dimensions (L x W x H)		930 x 580 x 1720 mm (without covers) 1100 x 715 x 1720 mm (with covers)
	Weight		200 Kg (without covers)
Installation	Installation		trolley with 4 lockable wheels, stationary during system operation indoor operation only, no excessive exposure to liquids, smoke, corrosive fumes, dust, direct sunlight or vibration
	Ambient Temperature (operational, no A/C)	°C / F	18 ... 28 / 64 ... 83
	Relative Humidity	%	20 ... 80
Power Supply	Power Supply		2 single phased, separately fused AC power lines
	Power Line A (Mass Spectrometer)		100...115 VAC, max. 20 A, typical 750 VA
	Power Line B (Control Unit)		100...115 VAC, max. 20 A, typical 1150 VA
Data Acquisition	Connection		optical data line, max. length 150m
	Acquisition rate	Hz	3 (typical), max. 10
	Molecular mass range	m/z	10...1200
	Ion source type		Electron ionization
	Mass filter type		Time of flight
	Analog input		-10...10 V (12x)
	Temperature input		Type K Thermocouple (4x)
Sampling Line	Probe Tip Diameter	mm	6
	Probe Tip lenght into exhaust line	mm	160, 350
	Transfer line length to mass spectrometer	mm	1000, 1500, 2000
	Height of mass spectrometer inlet from floor	mm	1025

PIKAL X

LUBRISENSE Calibration System

System Specification

General	Dimensions of base unit (L x W x H)		490 x 325 x 445 mm
	Weight of base unit		25 Kg
Installation	Installation		Base unit for standalone use or installation on top of LUB360 trolley indoor operation only, no excessive exposure to liquids, smoke, corrosive fumes, dust, direct sunlight or vibration
	Ambient Temperature	°C / F	10 ... 40 / 50 ...104
	Relative Humidity	%	20 ... 80
Supply	Power Supply		1 single phased, separately fused AC power line 115 VAC, max. 10 A or 230 VAC, max. 6 A
	Gas supply		Clean, dry air or nitrogen Min. 3 bar (44 psi), max. 7 bar (101 psi)
Control	Data Connection		USB 2.0
	Calibration control, Data Acquisition		Integrated into LUB360 control software
	Setup		In LUB360 control software or on system touch panel
Calibration	Calibration Method		Fluid evaporation in hot gas flow
	Fluid dosage		Piezo valve with ceramic valve seat
	Gas flow	nl/min	2 ... 50
	Fluid pressure	mbar	100 ... 2900
	Evaporation temperature	°C / F	Typical: 280 / 536, max. 450 / 842.
	Calibration Fluid		Typical: 1 ... 10 % of target substance in cyclohexane
	Concentration range	ppm	Typical: 1 ... 300

LUB360 Features

no tracer required

high detection strength

high speed measurement

deep insight

easy operation

2015 – Emission Reduction A Solution of Lubricant Composition, Calibration and Mechanical Development

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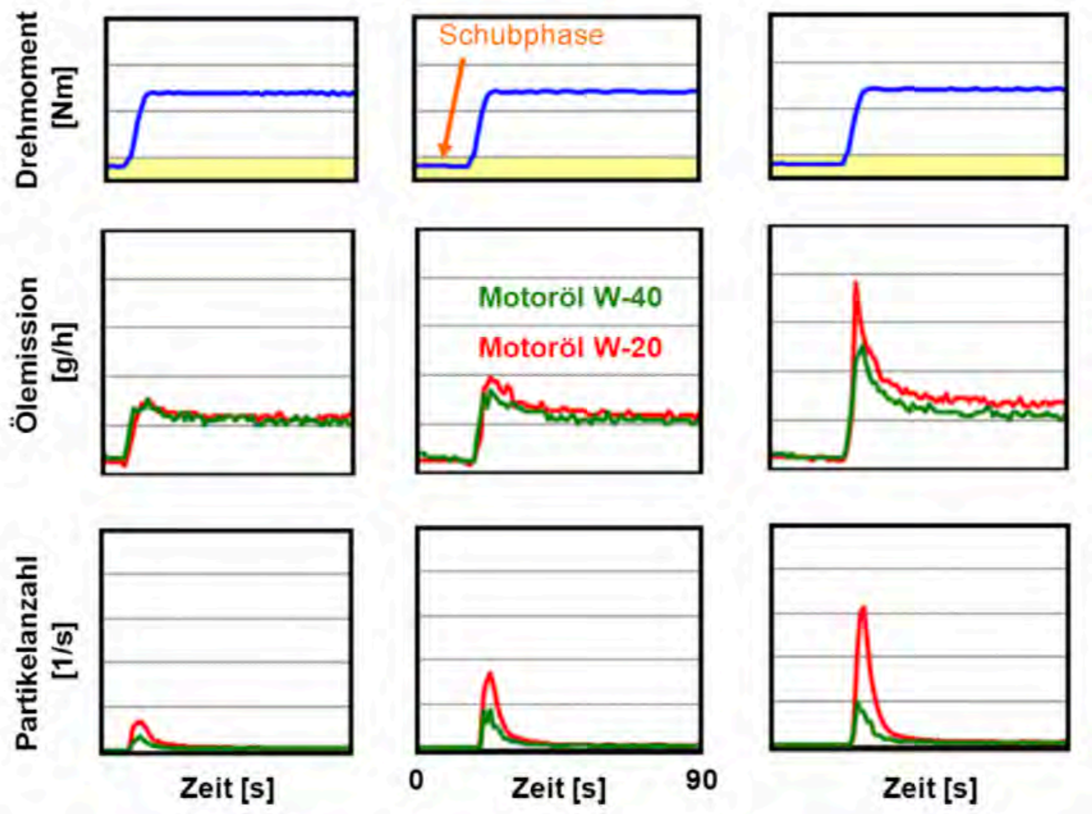

LUBRISENSE
Oil Emission Measurement Technology

2016

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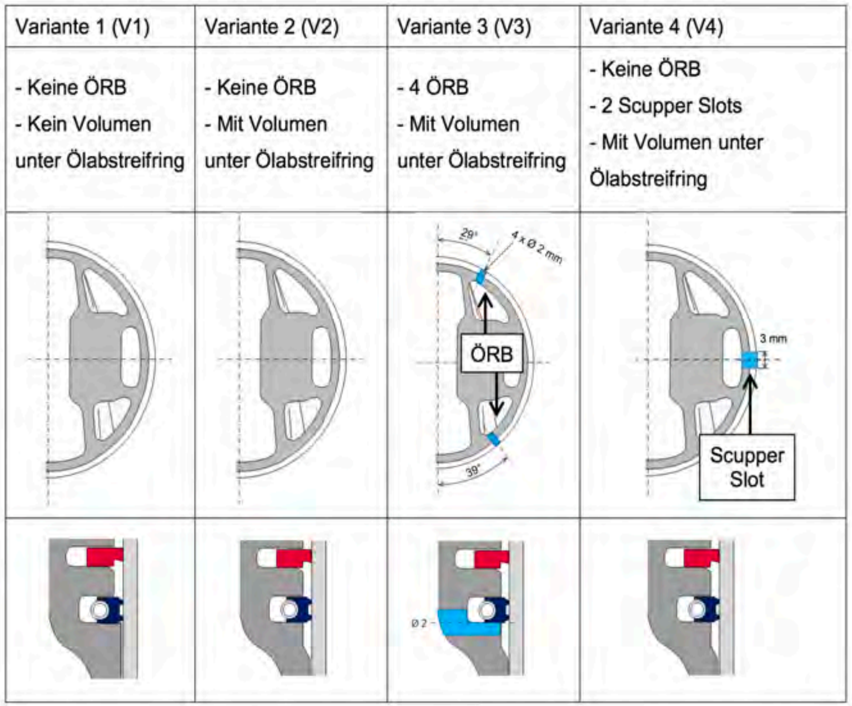

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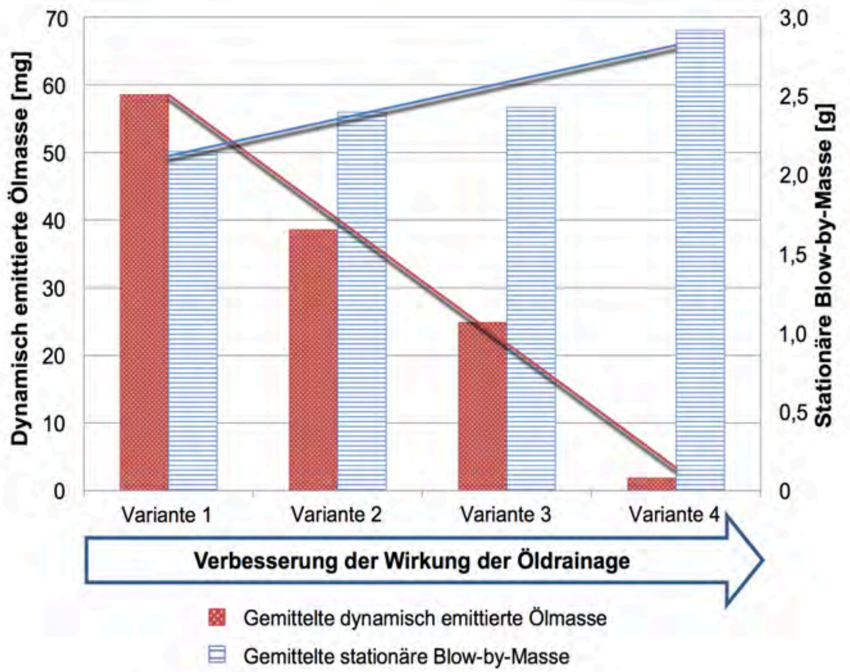

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SIMPLEXITY

QR Code