PRIMES
COMPETENCE IN BEAM DIAGNOSTICS

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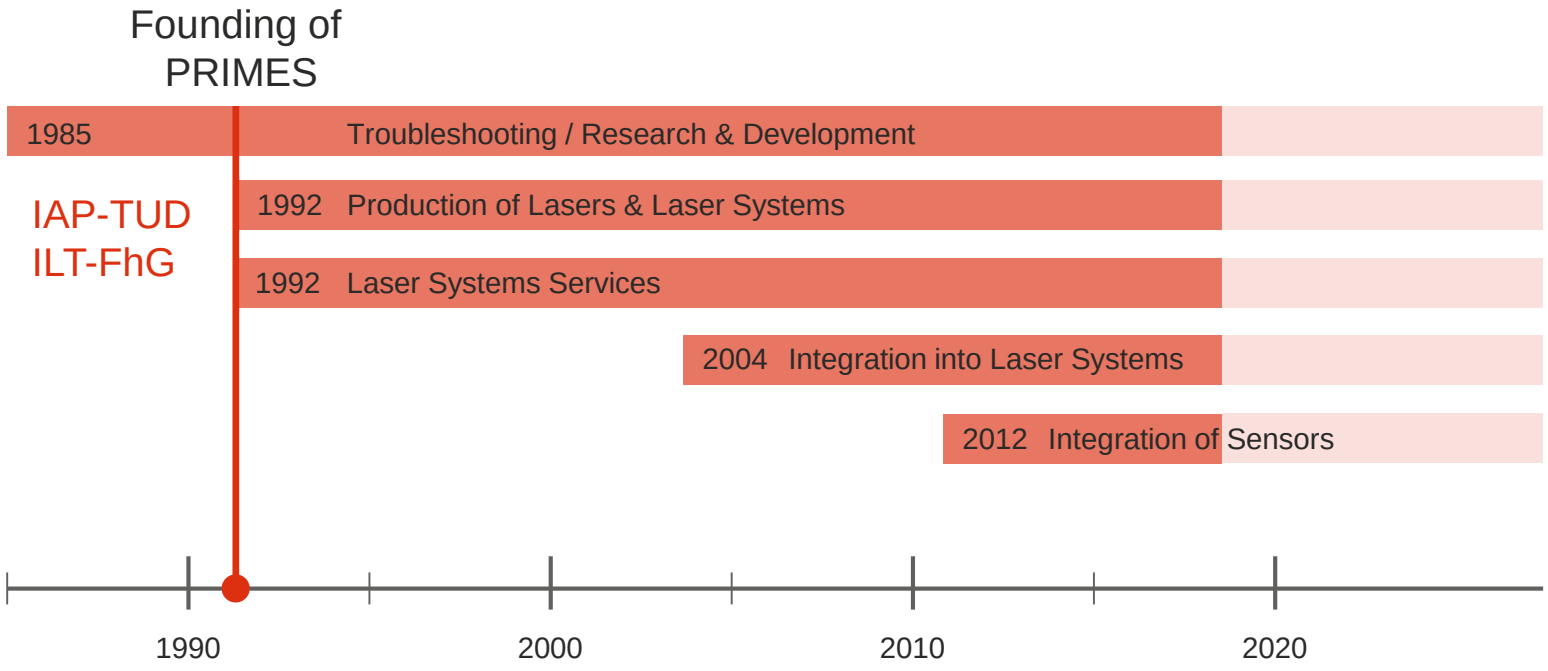
BEAM DIAGNOSTICS HEADING FOR INDUSTRIAL PRODUCTION

PRIMES Workshop 2018

PRIMES FACTS

- Core field: analysis of high-power laser beams
- Competence: development and production of complex opto-mechanical, opto-electronic systems for laser beam analysis
- Profound expertise of our 100 employees; 25 employees in R&D
- 10 % - 15 % growth per year
- Ongoing internationalization

RETROSPECT


Founding of PRIMES
1985
Troubleshooting / Research & Development
IAP-TUD
ILT-FhG
1992 Production of Lasers & Laser Systems
1992 Laser Systems Services
2004 Integration into Laser Systems
2012 Integration of Sensors
1990
2000
2010
2020

CRITERIA OF OUR SUCCESS

- We deliver beam parameters for our customers´ systems and processes
- PRIMES innovations define industrial standards (e. g. FocusMonitor)
- We help our customers to improve
- Our customers trust and loyalty
- Solid and reproducible diagnostics
- Technical support on all levels
- Customer-specific development

PowerMeasuringModule

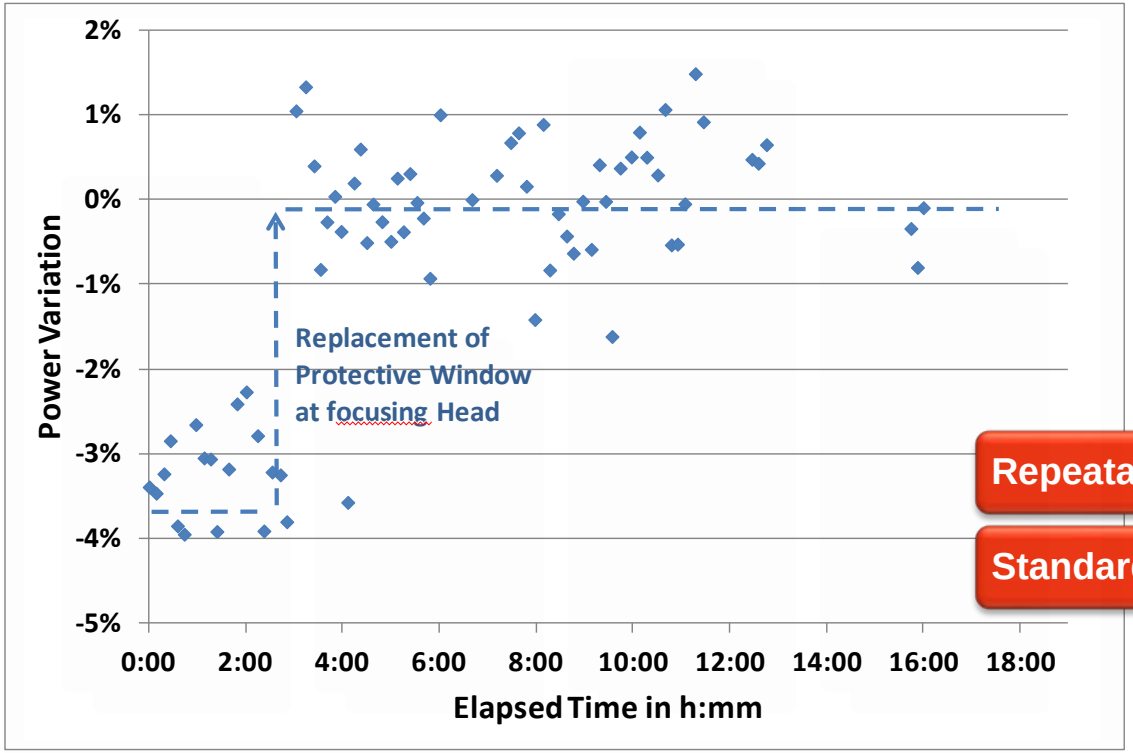
Technical data

Wavelength:	780 – 1090 nm
Typ. beam diameter:	15 – 25 mm
Power range:	400 – 8000 W
Max. power density:	1,5 kW / cm²
Accuracy:	± 3 %
Repeatability:	± 1%
Exposure time:	0,1s – 1s
Nominal measuring frequency:	1 cycle/min
Available interfaces:	ProfiNET, ProfiBUS
	DeviceNet, EtherNET IP,…

„Those who copy great masters do them honour.“

- Confucius

APPLICATION – POWER MEASUREMENT

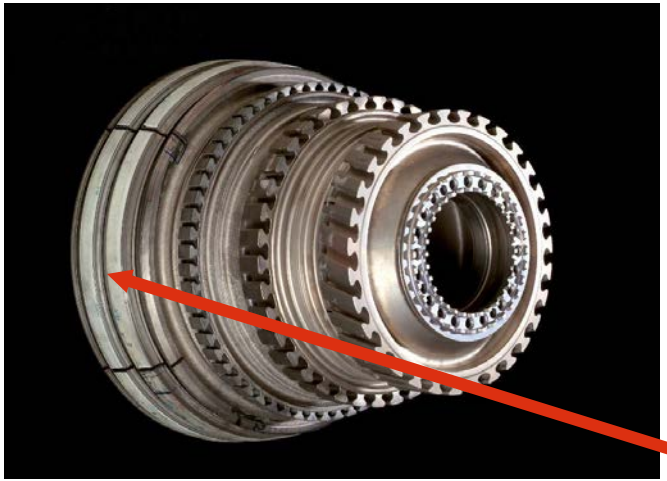


Repeatability: ± 1,5%

Standard deviation: 0,6%

LASER CLADDING FOR TURBINE REPAIR
RECONDITIONING OF DAMPING WIRE GROOVES

Front drum



Laser cladded groove

Before/after cladding

Main challenges

- Accessibility
- Processing without affecting opposite wall

Source:

RWTH LLT Rheinisch-Westfälische Technische Hochschule Aachen Lehrstuhl für Lasertechnik

Fraunhofer ILT Institut Lasertechnik

MACHINE IMPLEMENTED AT ROLLS-ROYCE, OBERURSEL, GERMANY

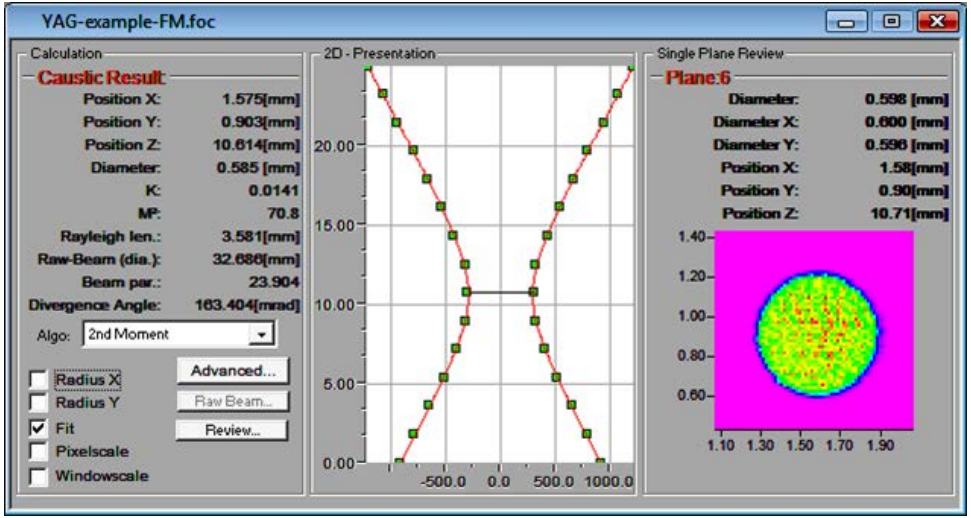
- 1 kW Nd:YAG laser
- 5 + 2 axis (turning table)
- Automated powder mass flow measurement
- Automated laser power and focus measurement (PRIMES)

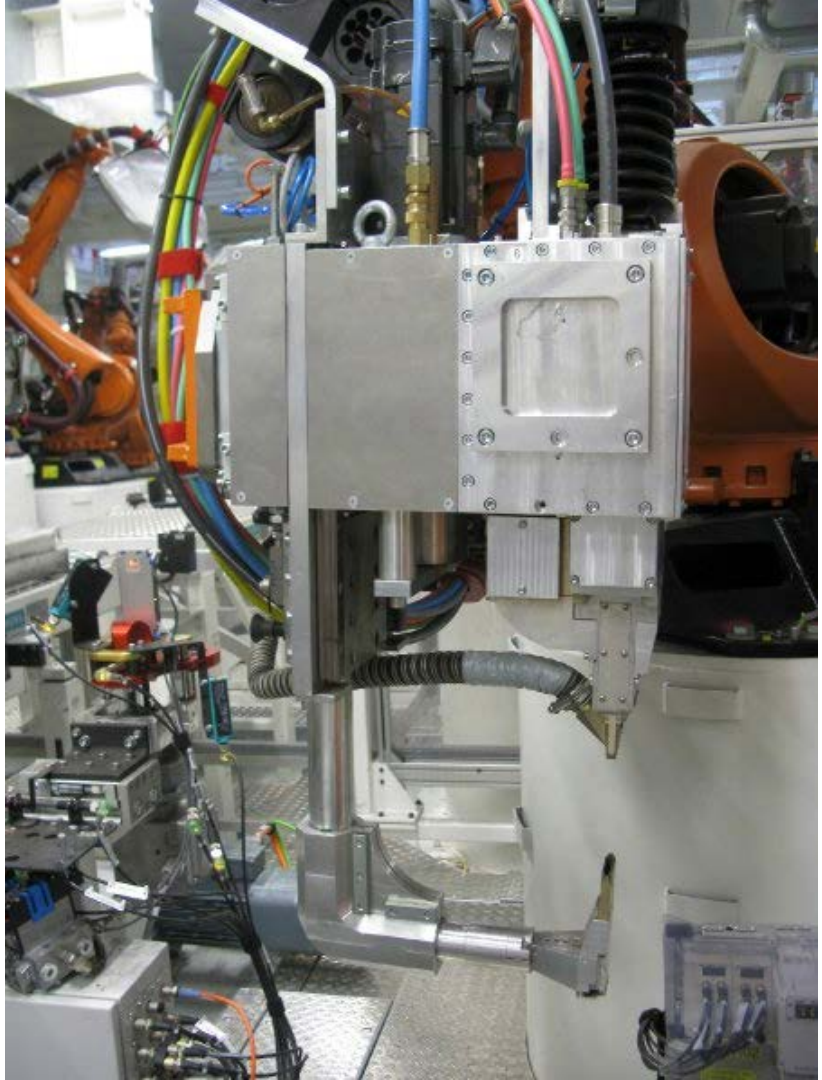
Source:

CAUSTIC MEASUREMENT

According to ISO 11146

- Measuring power density distribution at different z-positions
- Determination of the corresponding beam width
- Recalculation on the beam propagation parameters:
  - focus width
  - focus position in space
  - beam propagation ratio





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Measuring Laser Power, Beam Dimension and Position in the Process Zone

Operation of the „laser-seam-stepper“ at VW

TECHNICAL DATA

Measurement quantities:

- power
- beam geometry (focus)

Technical data:

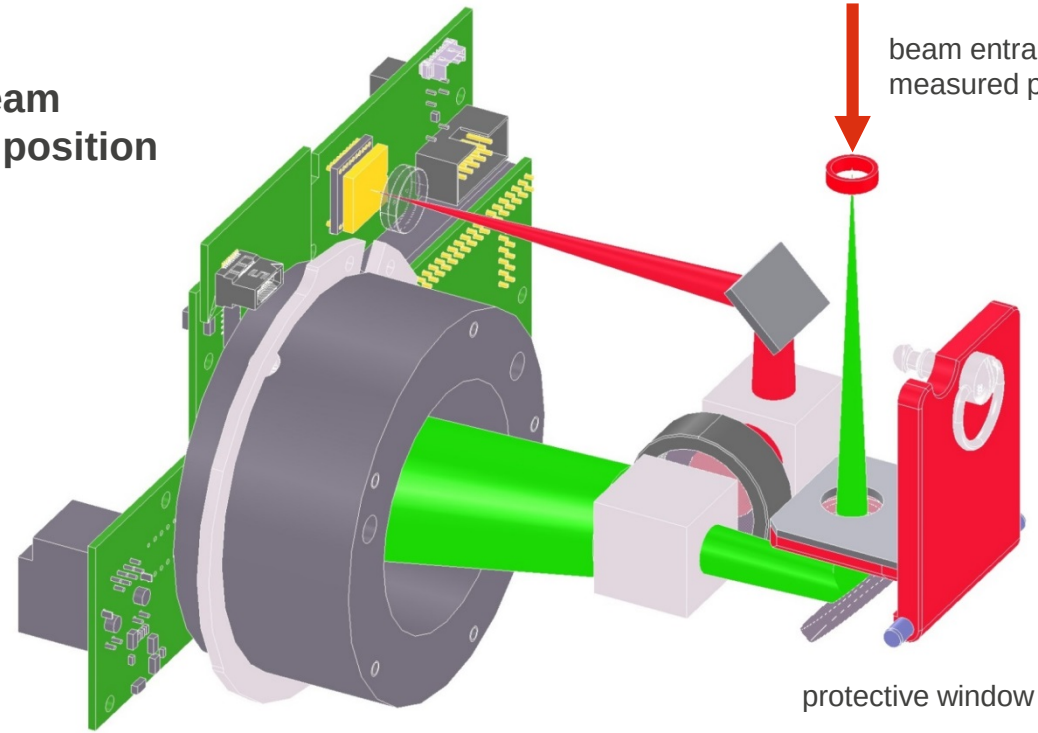
power	100 W - 8 kW
energy typically	400 J / pulse
exposure time	300 ms - 1s
beam width	60 - 600 µm
divergence	60/100 mrad

Highlights:

- no water cooling
- protective window
- field bus interface
- shutter
- IP64

FocusParameterMonitor – INTERNAL BEAM PATH

Measurement of beam diameter and beam position



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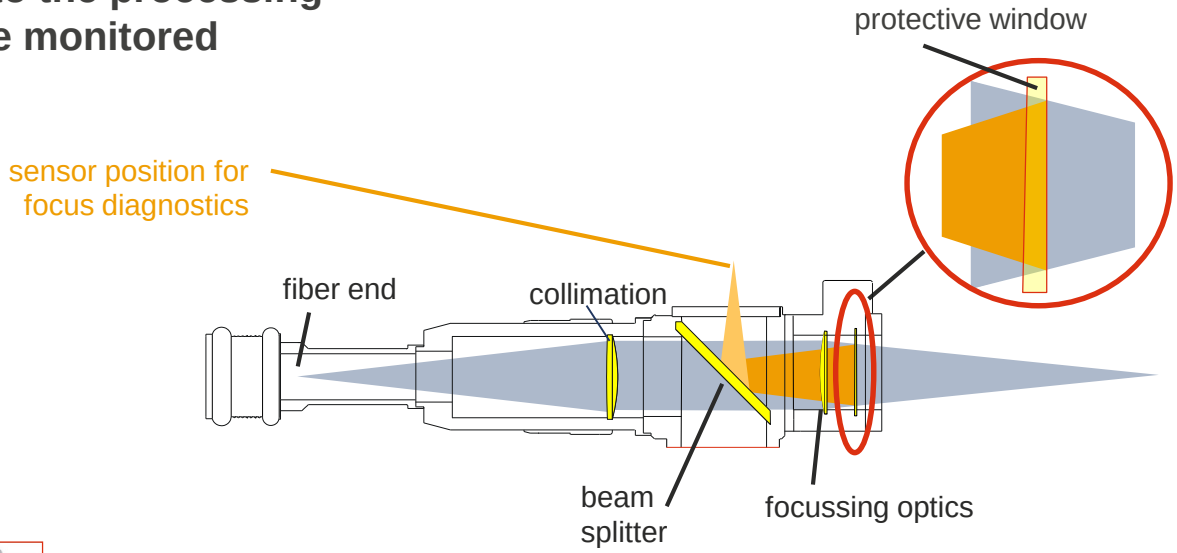
ONE STEP CLOSER TO INDUSTRY 4.0

Integration of a sensor into the optics head of a high power cutting machine

- Inline process information on focus position and diameter
- Information is available for operator, service technician, control center

SETUP OF ONLINE / IN-PROCESS FOCUS MONITORING

Aim: Preparation of a probe beam that is identical to the processing beam and can be monitored

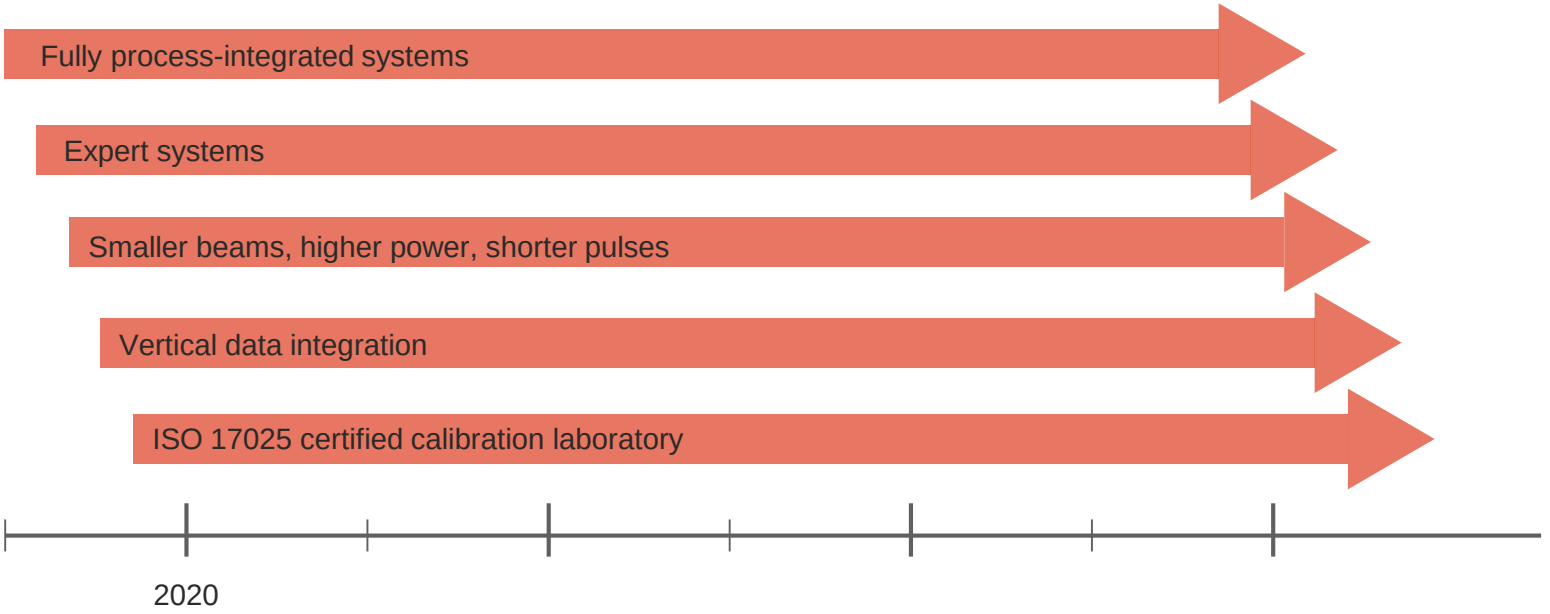


sponsored by:

CUSTOMER BENEFITS

- **Tool uptime**
- **Preventive maintenance**
- **Remote diagnostics**
- **Increased process speed by lower safety margins**

UPCOMING CHALLENGES



PREMISES FOR MORE GROWTH

By more growth we can …

- offer more customer-specific solutions
- create more innovative technology
- produce more cost-efficiently
- offer world-wide support

This requires a strict policy of risk minimization and risk management!

What´s next …

- New technologies
- New facilities
- New laboratories

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THANK YOU FOR YOUR ATTENTION!

PRIMES Workshop 2018

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