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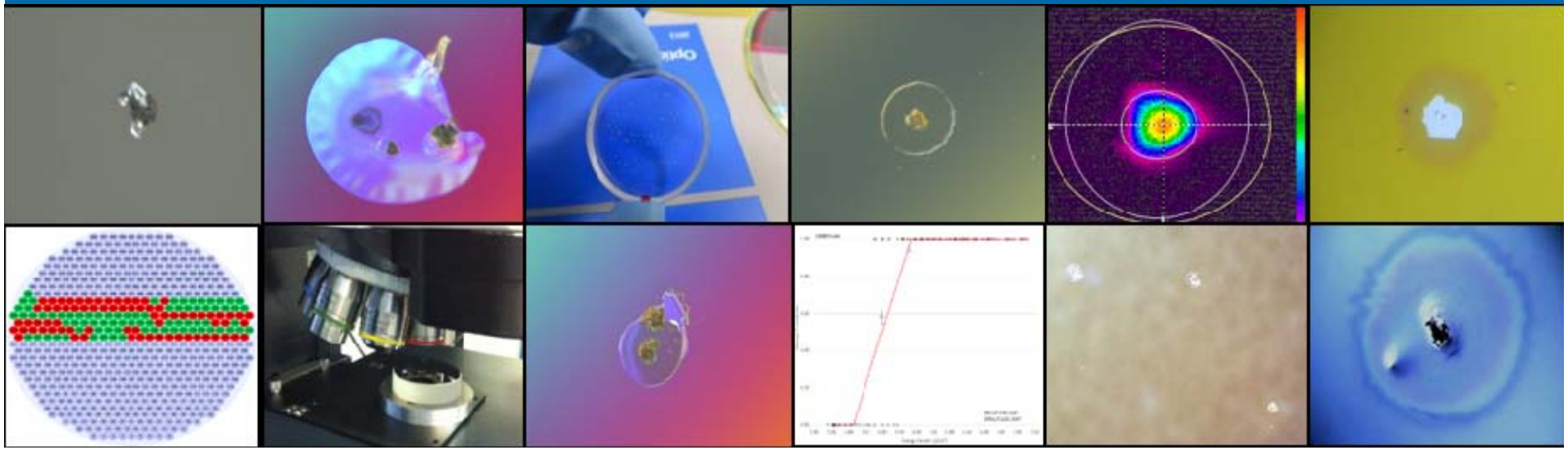
FHO Fachhochschule Ostschweiz

The RhySearch LIDT Testing Facility at the NTB Buchs

Workshop on Optical Coatings for Laser Applications, Thursday, 11th June 2015

Dr. Roelene Botha
RhySearch / NTB Buchs



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RhySearch: The Rheintal Research and Innovation Centre

- Precision Manufacturing
- Packaging Technology
- **Coating Technology**

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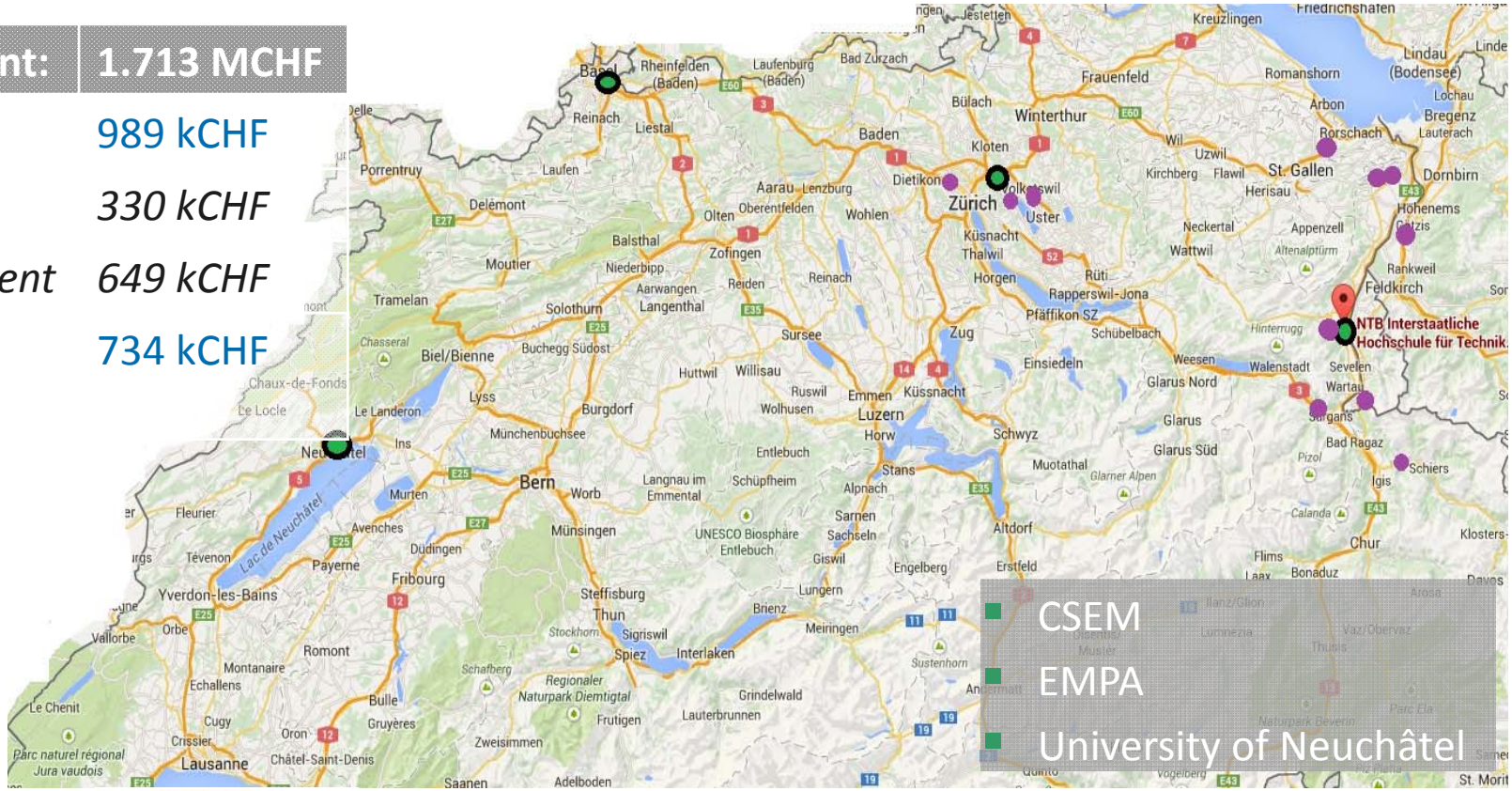
KTI-Project: LIDT and Degradation Testing for Industrial Applications

Total Investment:	1.713 MCHF
Industry:	989 kCHF
Personel	*330 kCHF*
Misc./Equipment	*649 kCHF*
Research:	734 kCHF
Personel	



vectronix · TRUMPF · swissoptic · onefive · Montfort Laser GmbH

evatec process systems · FILTROP AG · FISBA OPTIK · GMP General Microtechnology & Photonics · IMT Precision on Glass

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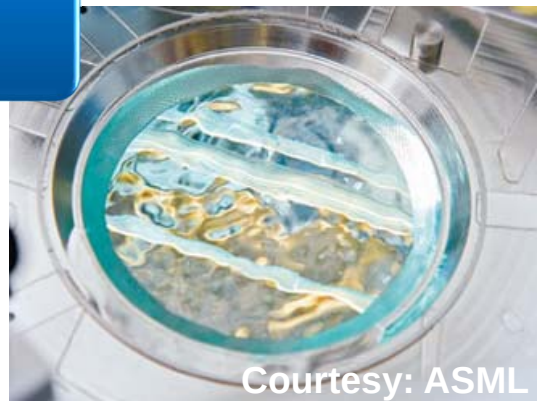
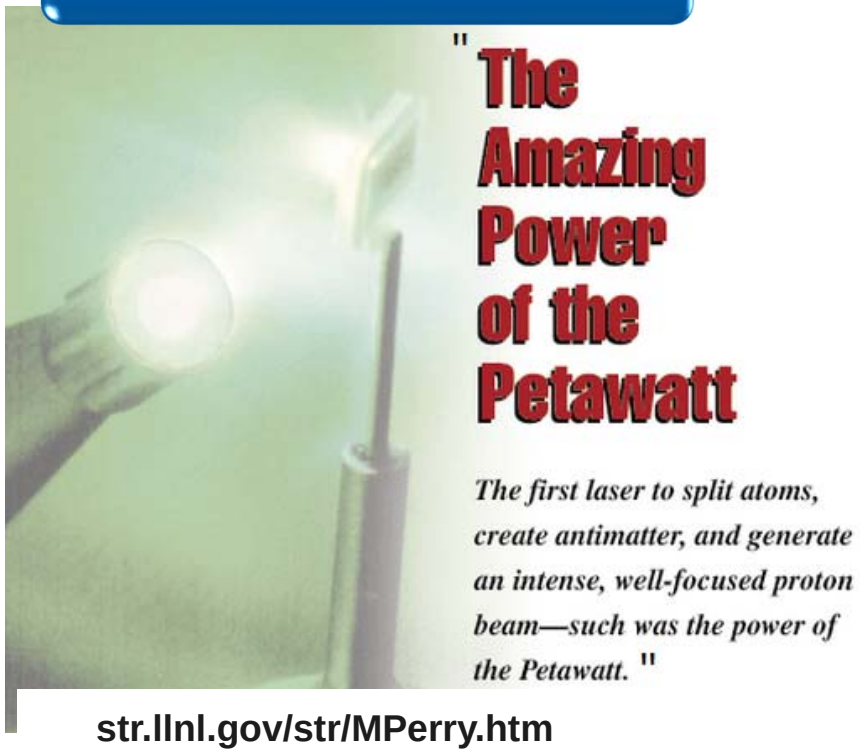
Some High-Power Coatings Applications

Deep and Extreme UV Lithography



High-Energy Petawatt Lasers



str.llnl.gov/str/MPerry.htm

Space Applications

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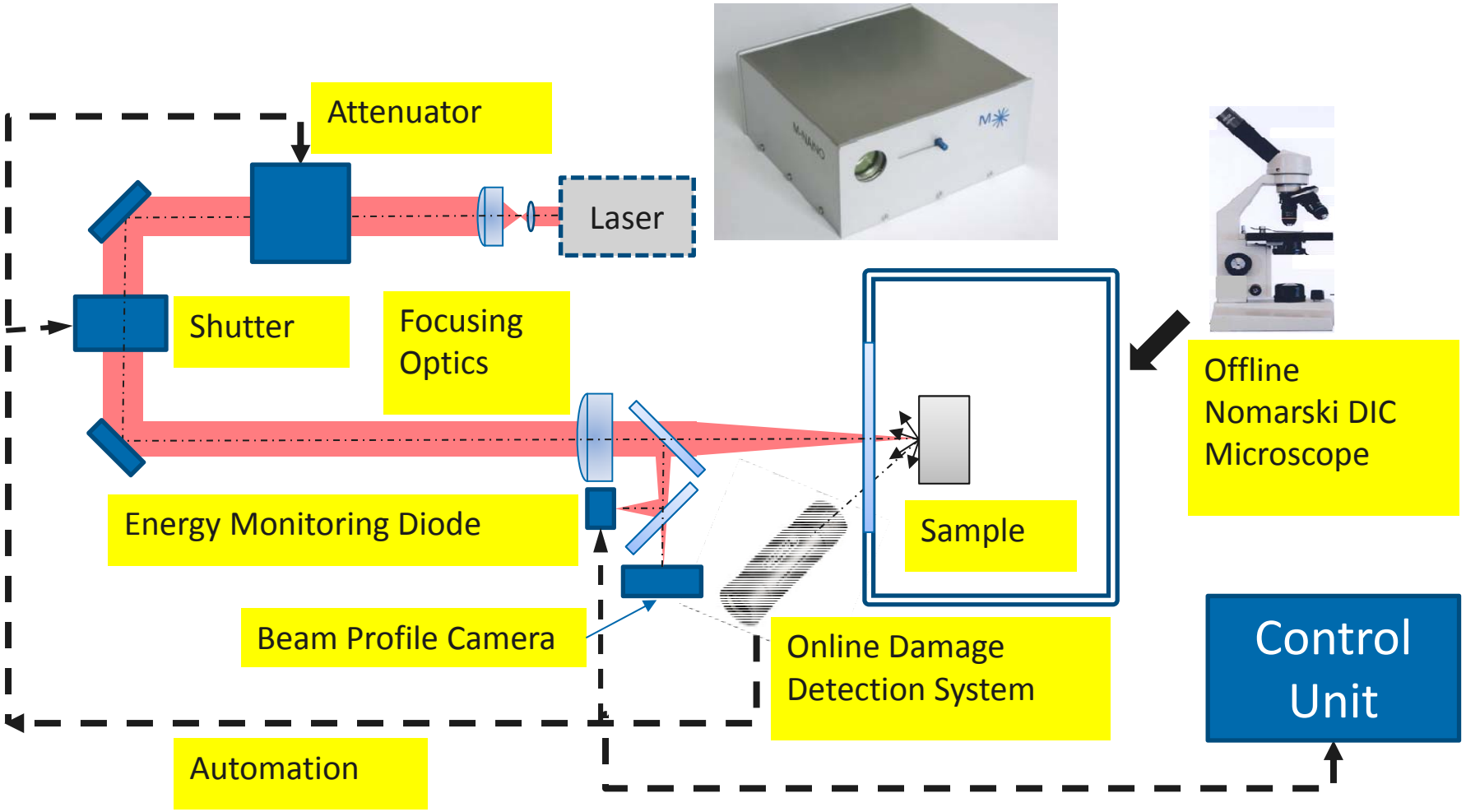

- *Measurement according to ISO Norm 21254 (1 - 4)*

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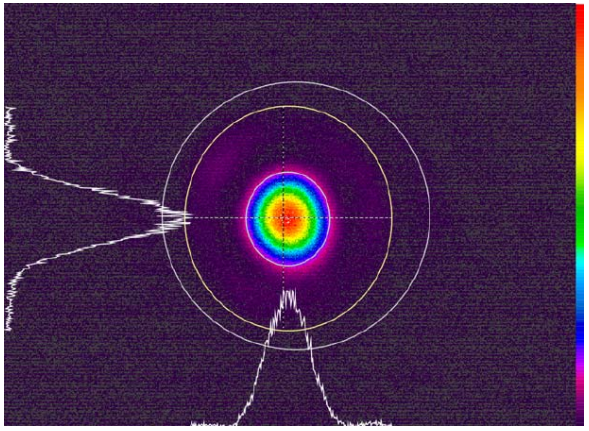
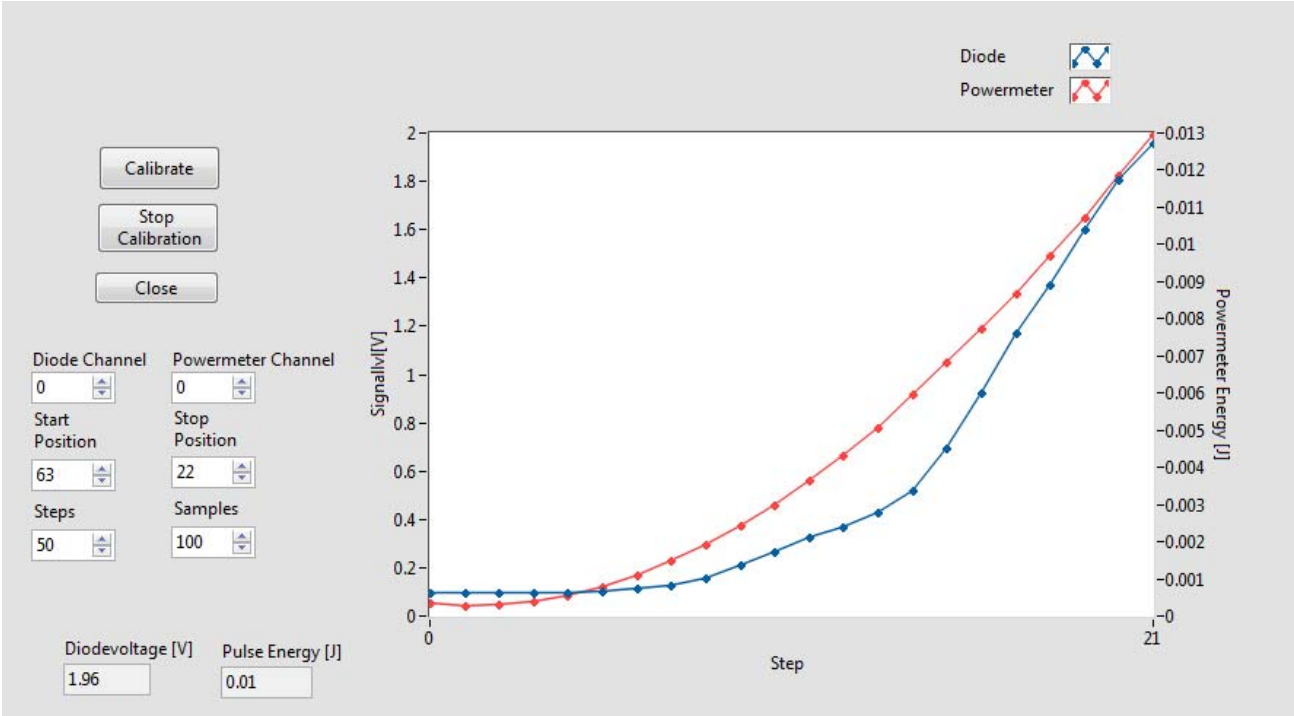
An LIDT Measurement Process: S-on-1

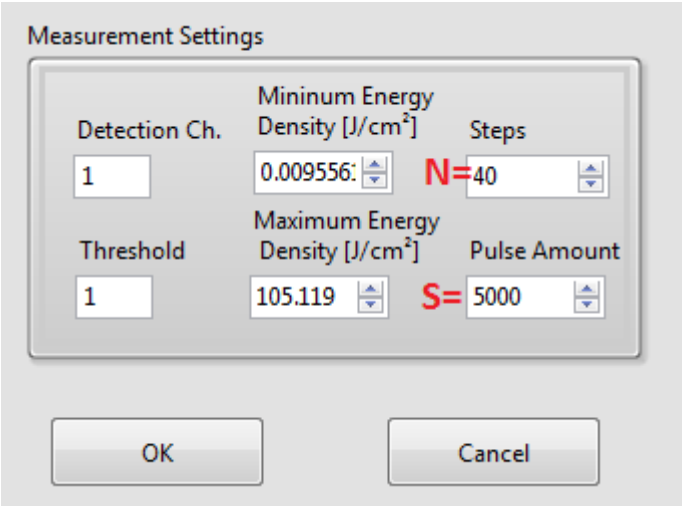
- **Measurement of the Laserparameters: Diameter, Profile, Pulse duration**
- **Powermeter/Energydiode calibration**

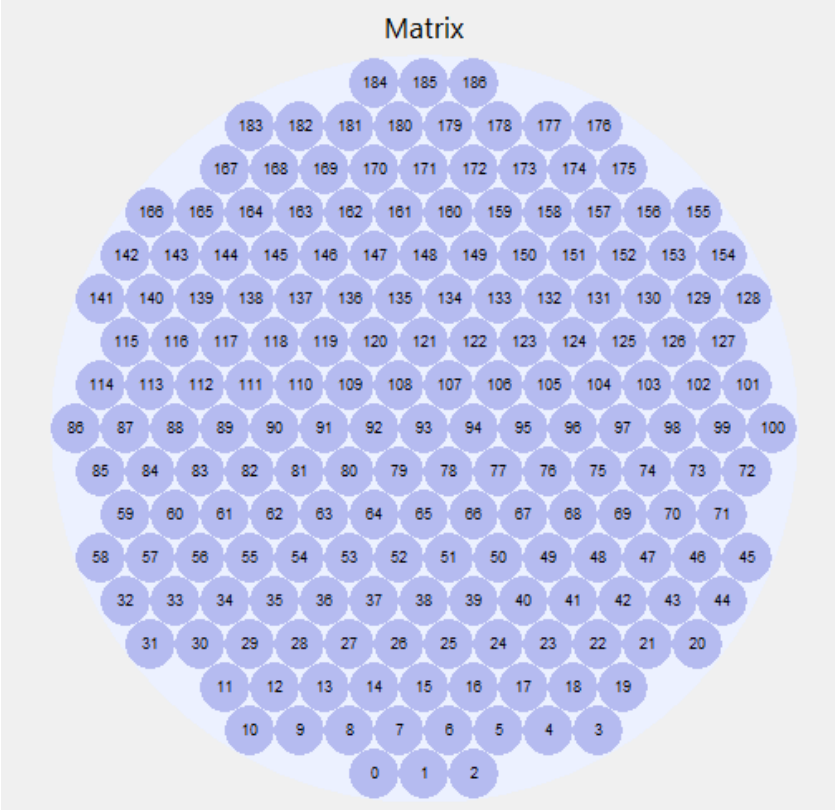




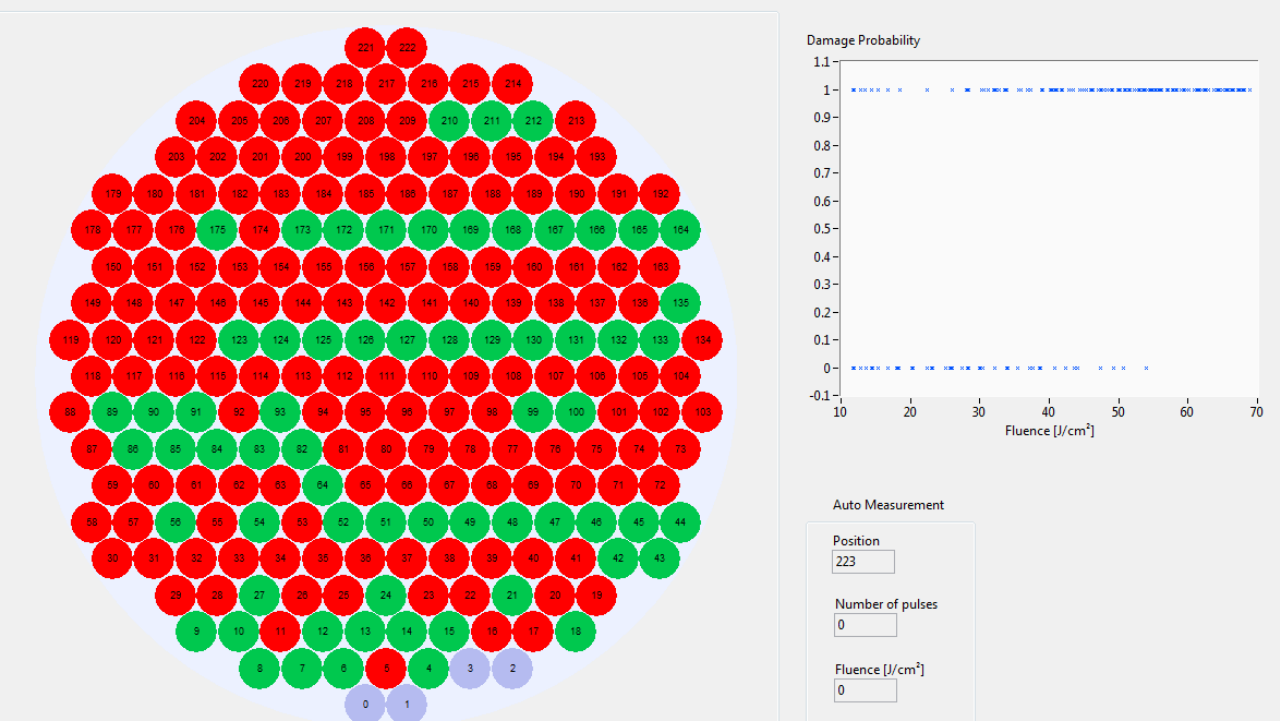
An LIDT Measurement Process: S-on-1

- Measurement of the Laserparameters: Diameter, Profile, Pulse duration
- Powermeter/Energydiode calibration
- **Define laser fluence range of interest**
- **Define the fluence steps to be used (N)**
- **Divide substrate into a matrix of sites**





An LIDT Measurement Process: S-on-1



- Each site is irradiated with S Pulses at a specific fluence

  → if no damage occurs, irradiate next site (increased laser fluence)

  → If damage occurs before S Pulses, log information and irradiate next site

Each fluence-increment is used several times → Increased statistics

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An LIDT Measurement Process: S-on-1

- Measurement of the Laserparameters
- Powermeter/Energydiode calibration
- Define laser fluence range of interest
- Define the fluence steps to be used
- Divide substrate into a matrix of sites

- Each site is irradiated with S Pulses
  - → if no damage occurs, irradiate next site (increased laser fluence)
  - → If damage occurs before S Pulses, log information and irradiate next site

Each fluence-increment is used several times → Increased statistics

- **Post LIDT Testing damage verification using a Nomarski DIC Microscope (100x)**
  - **→ Deviations are incorporated into the measured results**

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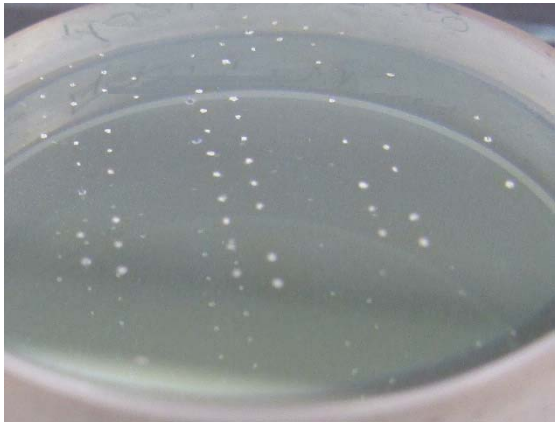
Example of an LIDT Test: Double Sided AR Coating

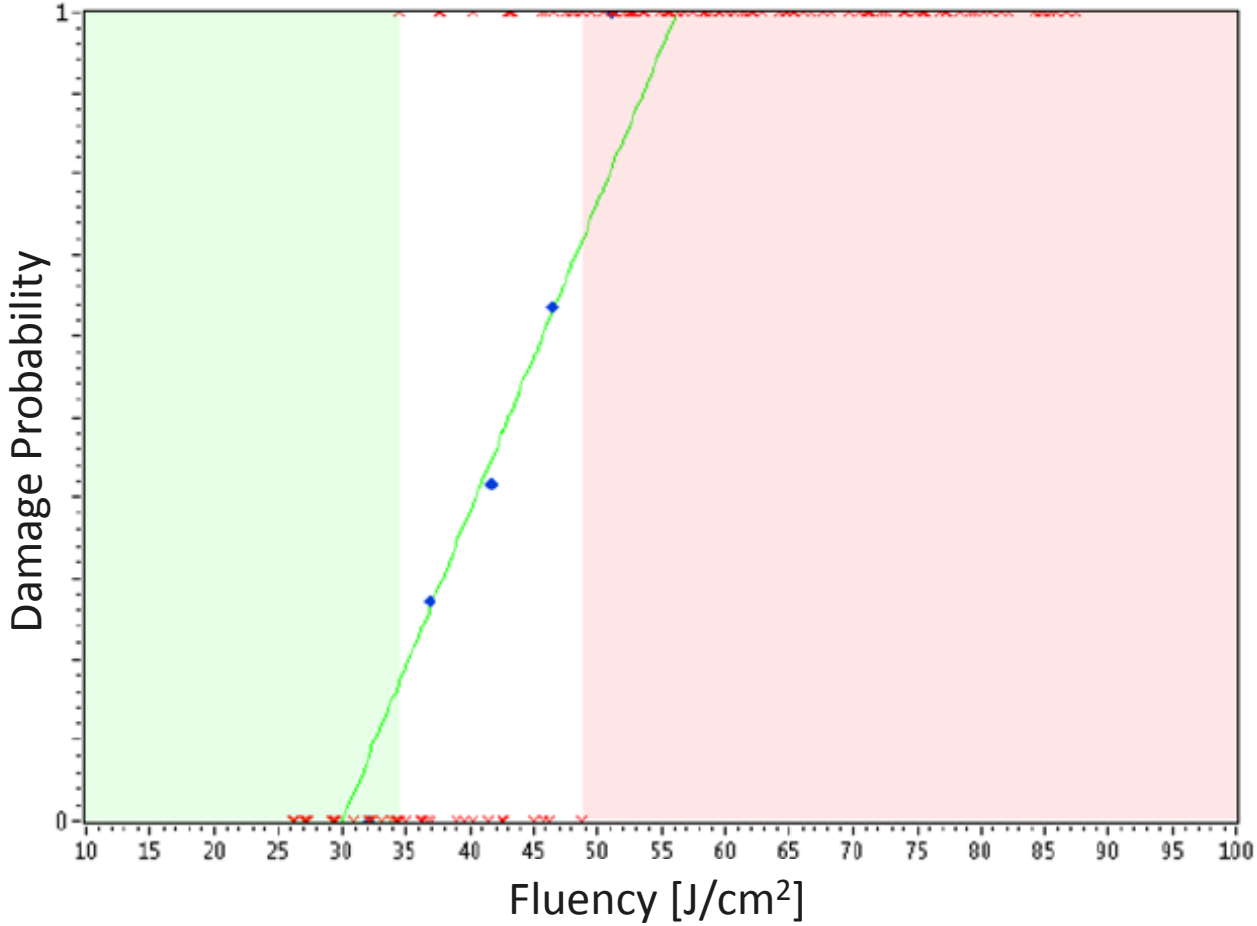
- Test procedure: 5000-on-1
- Number of matrix sites: 150
- Beam diameter:
  190 µm ± 10µm

0% LIDT: 31.6 J/cm^2

50% LIDT: 40.7 J/cm^2

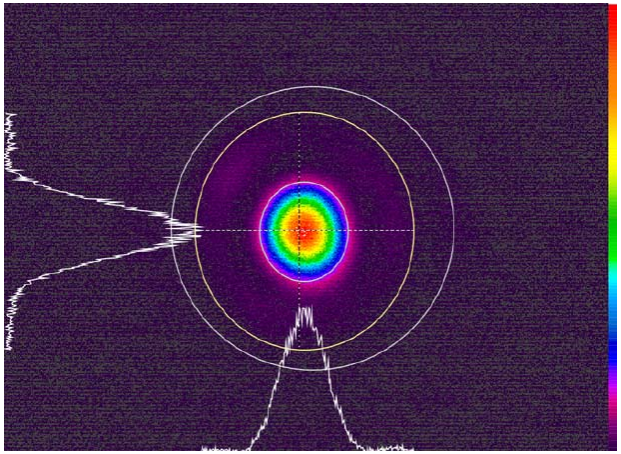
Fluence-Error: σ = 11.5%





Measurement Factors Influencing the LIDT of a Sample:

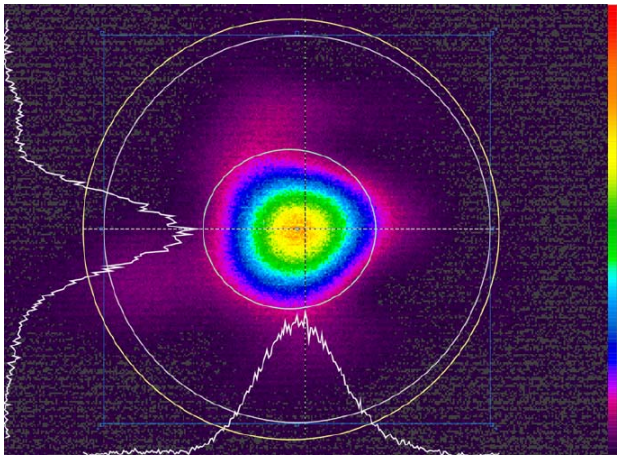
1. Measurement wavelength
2. Pulse duration
3. Pulse repetition frequency
4. Beam diameter and shape
5. Angle of Incidence



Next Steps:

1. Montfort M-Nano Laser extension to 532nm, 355nm
2. Adding a OneFive fs-Laser
3. Incorporation of Degradation Testing

    LIDT Certification for Lifetime Testing



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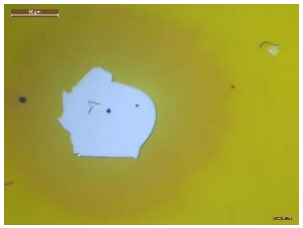
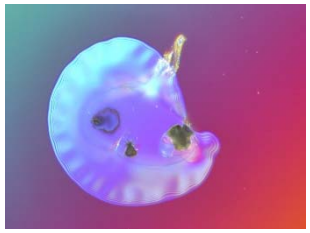
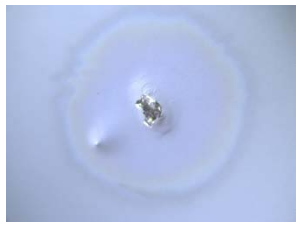
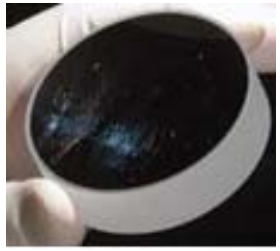
What Substrate and Coating Variables Cause Laser Damage?









fs

Elektronically induced

ps

ns

Defects and Fatigue Effects

Surface Preparation

Environment

T
RH%
P

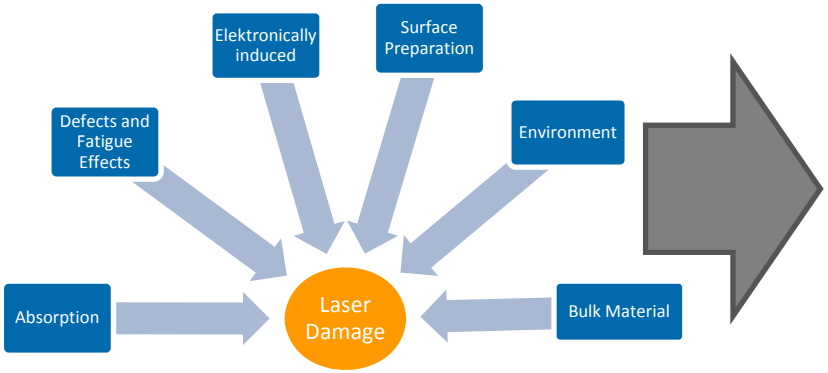
CW & µs

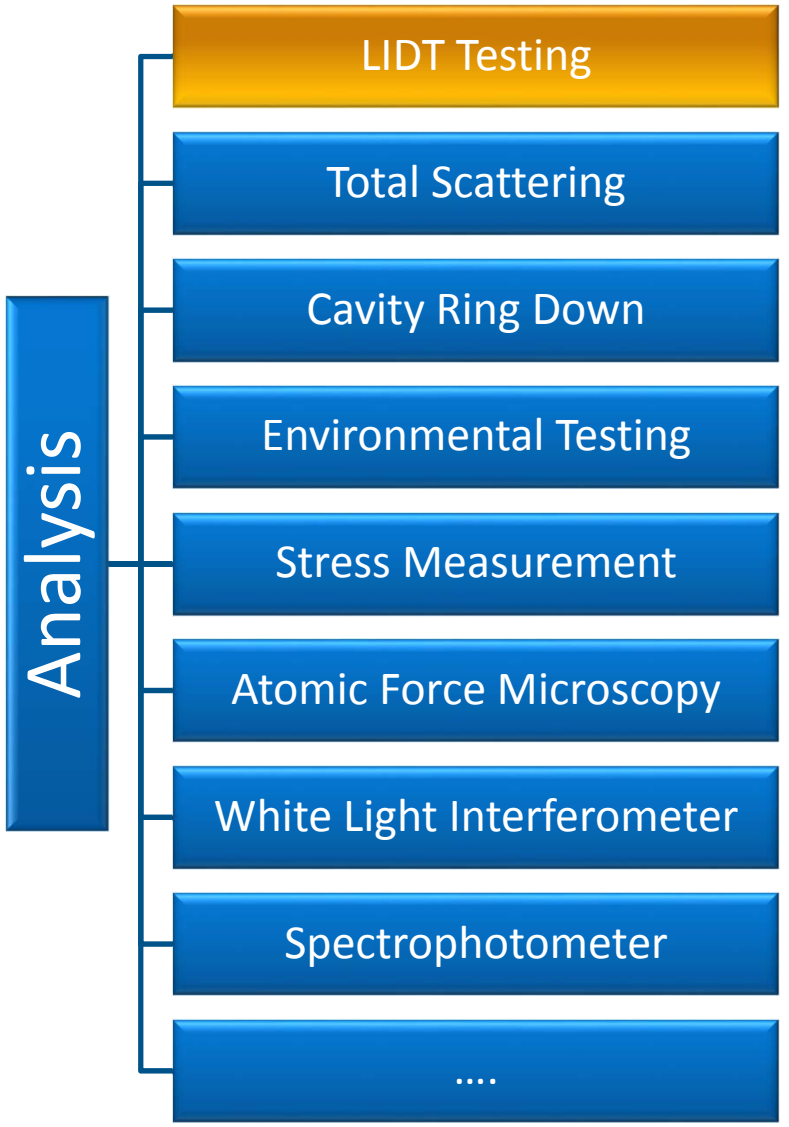
Absorption

Laser Damage

Bulk Material

What Substrate and Coating Variables Cause Laser Damage?





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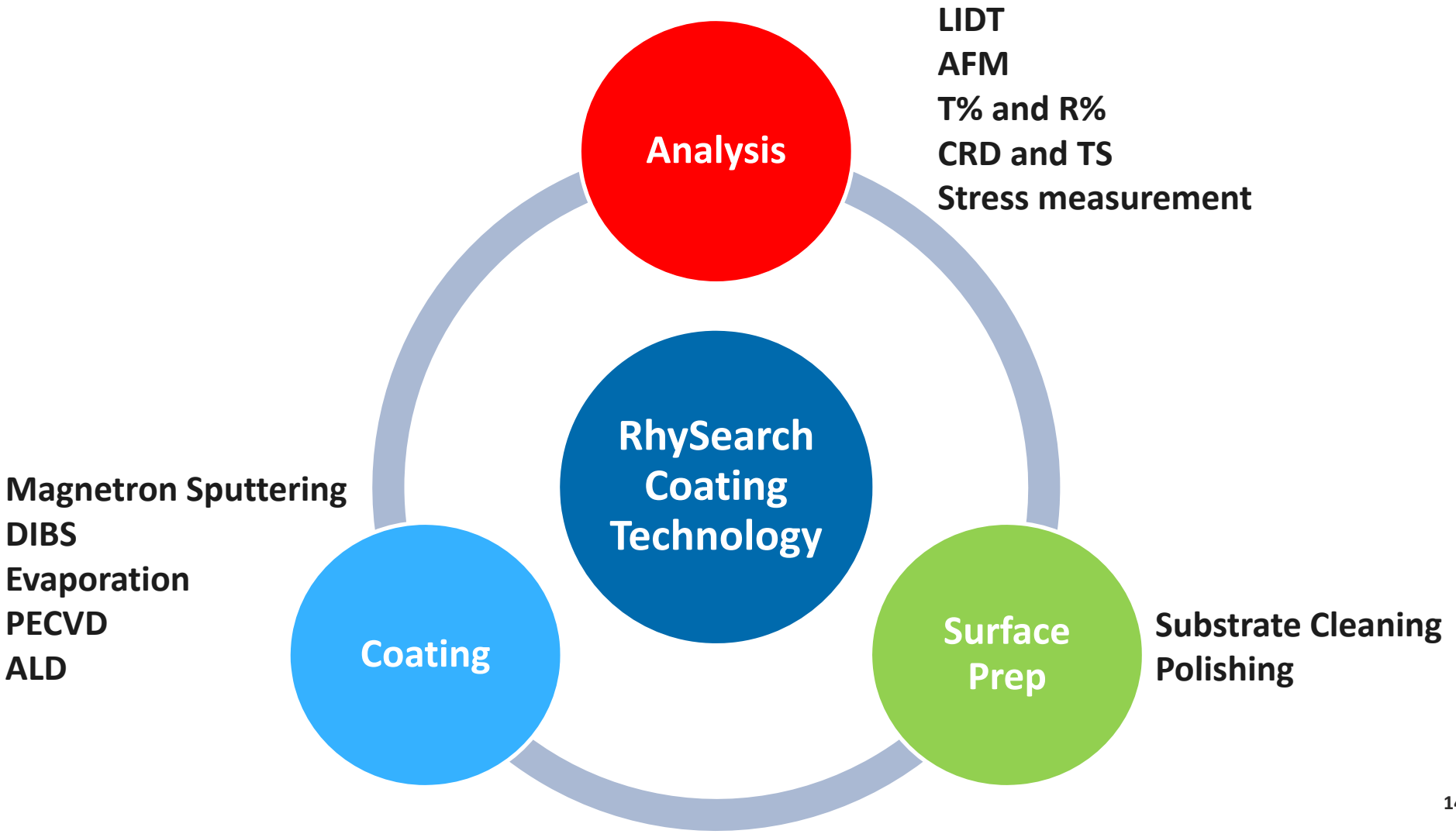
RhySearch Coating Technology: Future Perspectives



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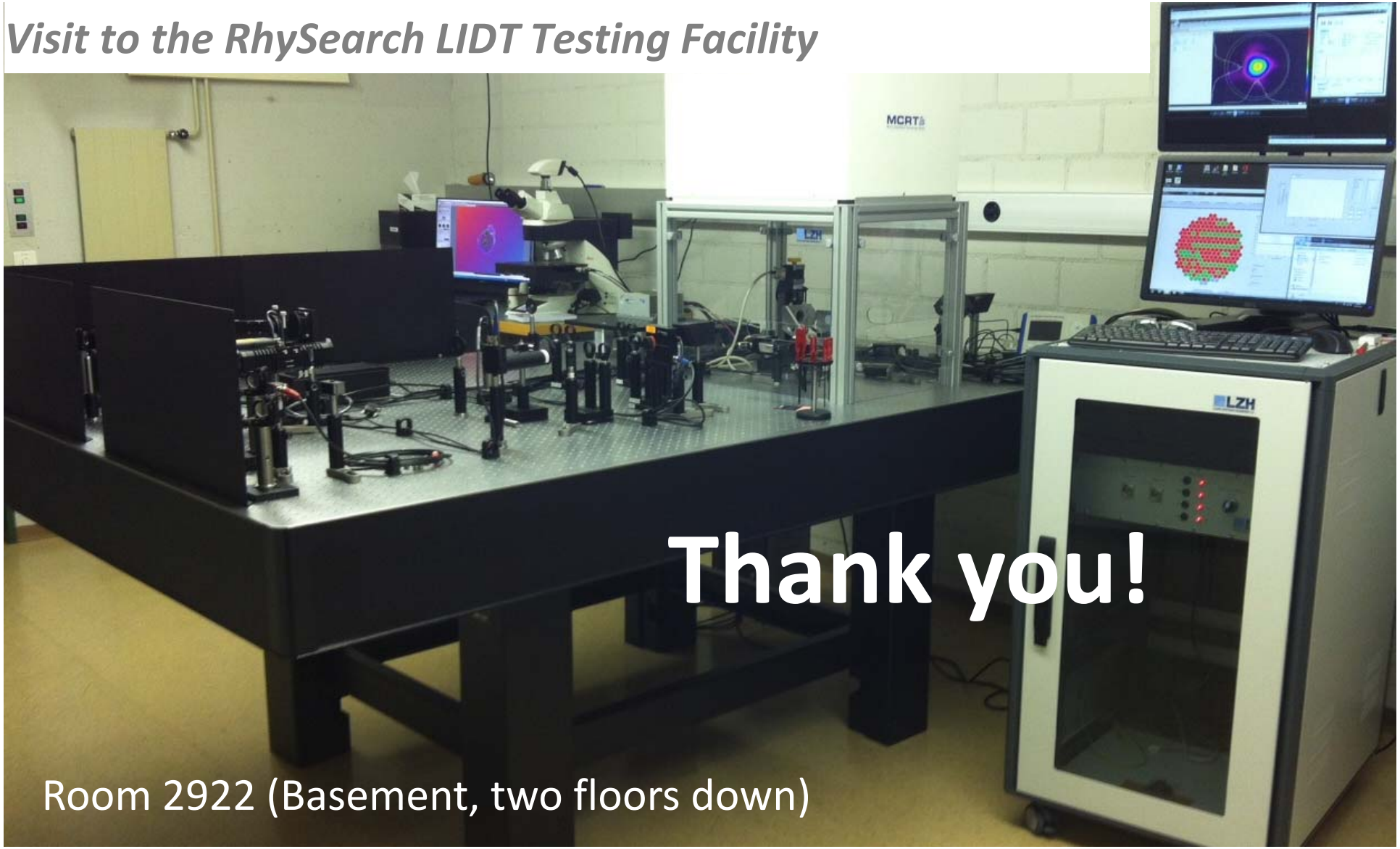
Visit to the RhySearch LIDT Testing Facility



Thank you!

Room 2922 (Basement, two floors down)