

FOCUSLIGHT

Never stop exploring

4D Beam Shaping Solutions

Enabling Advanced

Structured Light & Computer Vision

Dirk Hauschild

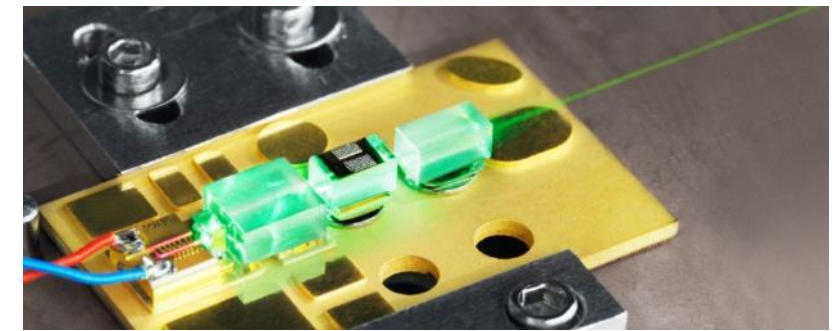
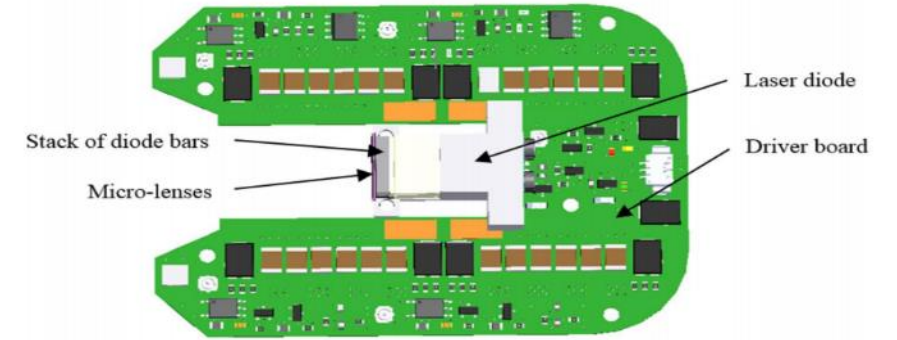
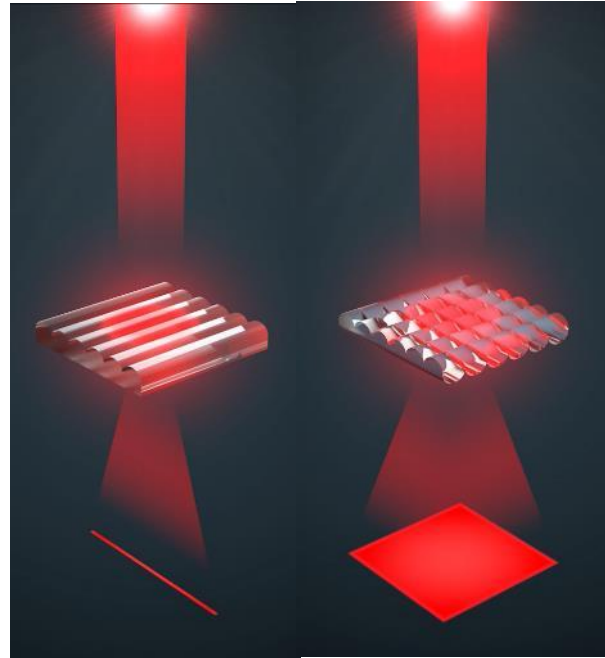
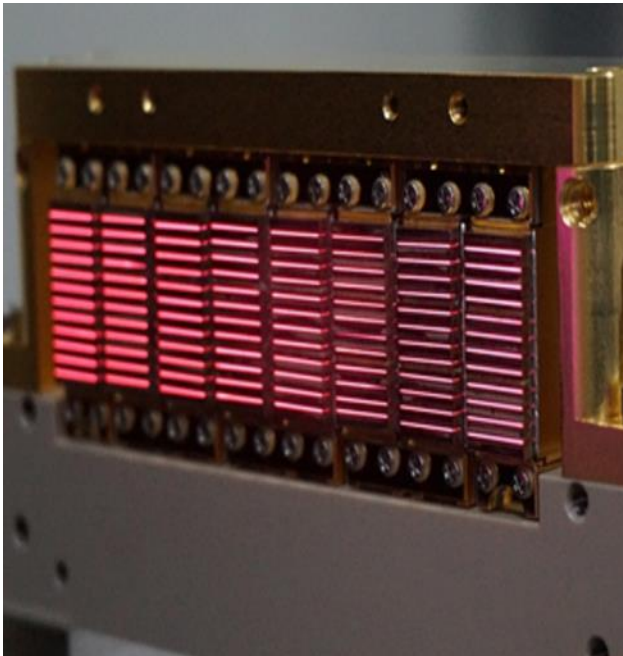
Head of R&D Laser Optics Business Unit



Overview



Products and Businesses



**Photon
Generation**

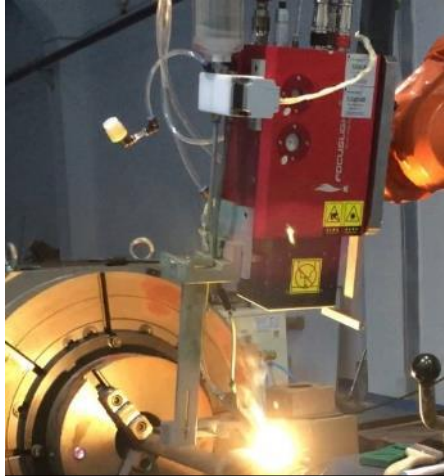


**Photon
Control**



**Photonics
Application
Solutions**

Markets



Advanced Manufacturing

- Pumping
- Laser Cladding
- Plastic Welding
- Photonics
- 3D Printing
- Photovoltaic
- Thermal Imaging



Health

- Hair Removal
- Medical Devices
- Medical Aesthetics



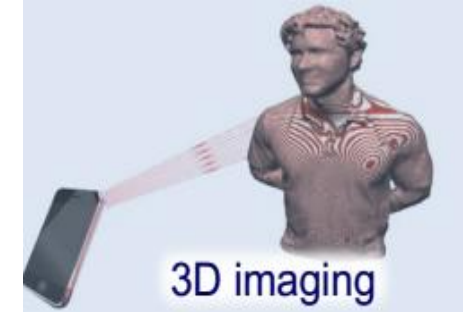
Research

- Scientific Research
- Pumping
- Energy
- Materials
- Photonics



Automotive

- LiDAR
- Sensors
- Body Welding
- Lighting



Information Technology

- Machine Vision
- Display
- Lithography
- Printed Electronics

Markets



Advanced Manufacturing

- Pumping
- Laser Cladding
- Plastic Welding
- Photonics
- 3D Printing
- Photovoltaic
- Thermal Imaging



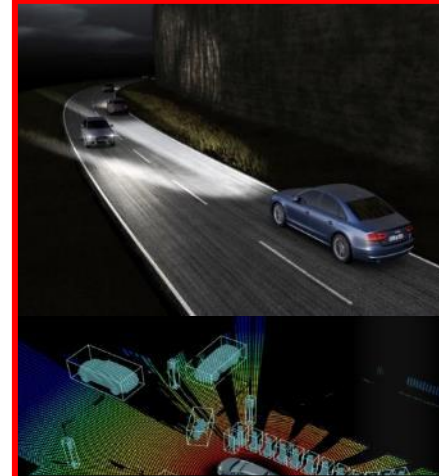
Health

- Hair Removal
- Medical Devices
- Medical Aesthetics



Research

- Scientific Research
- Pumping
- Energy
- Materials
- Photonics



Automotive

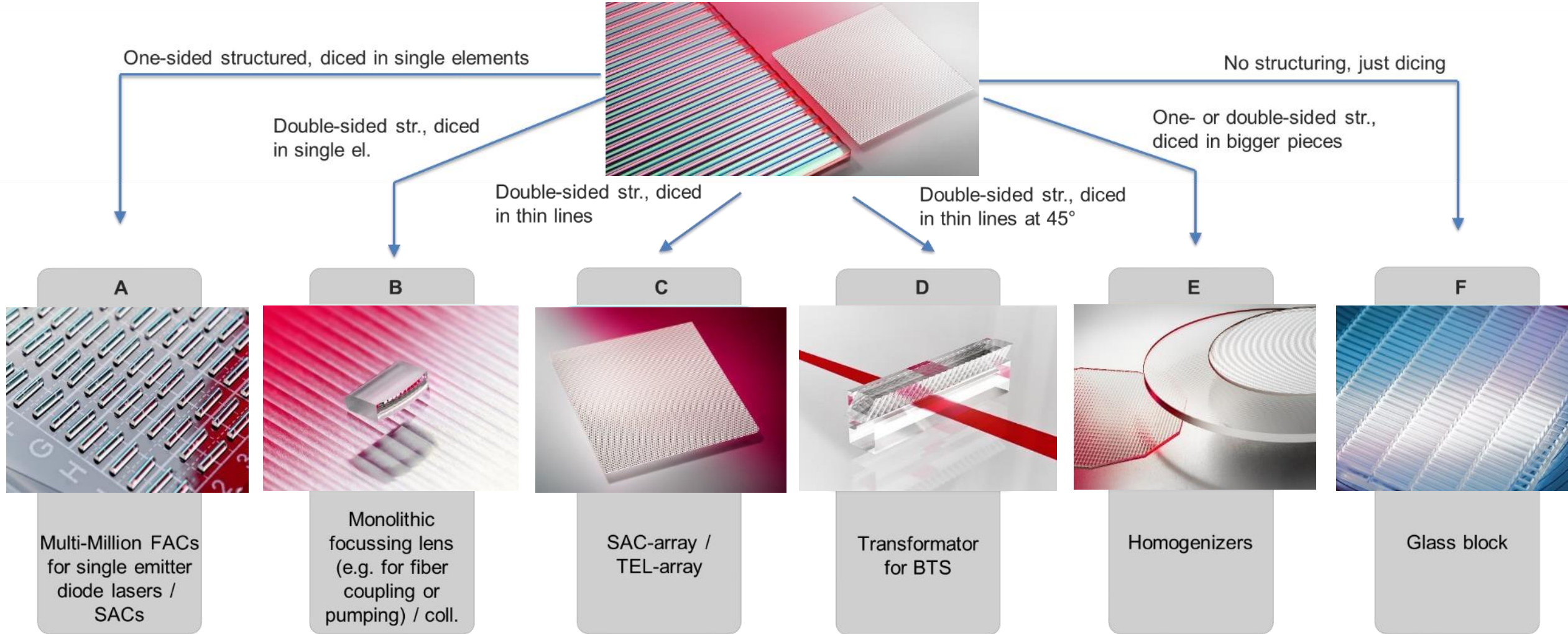
- LiDAR
- Sensors
- Body Welding
- Lighting



Information Technology

- Machine Vision
- Display
- Lithography
- Printed Electronics

Products – Laser Optics BU



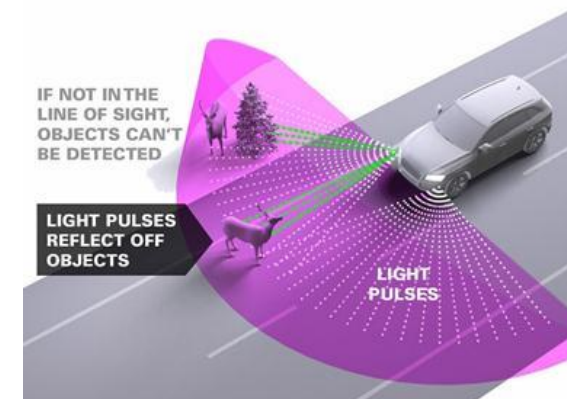
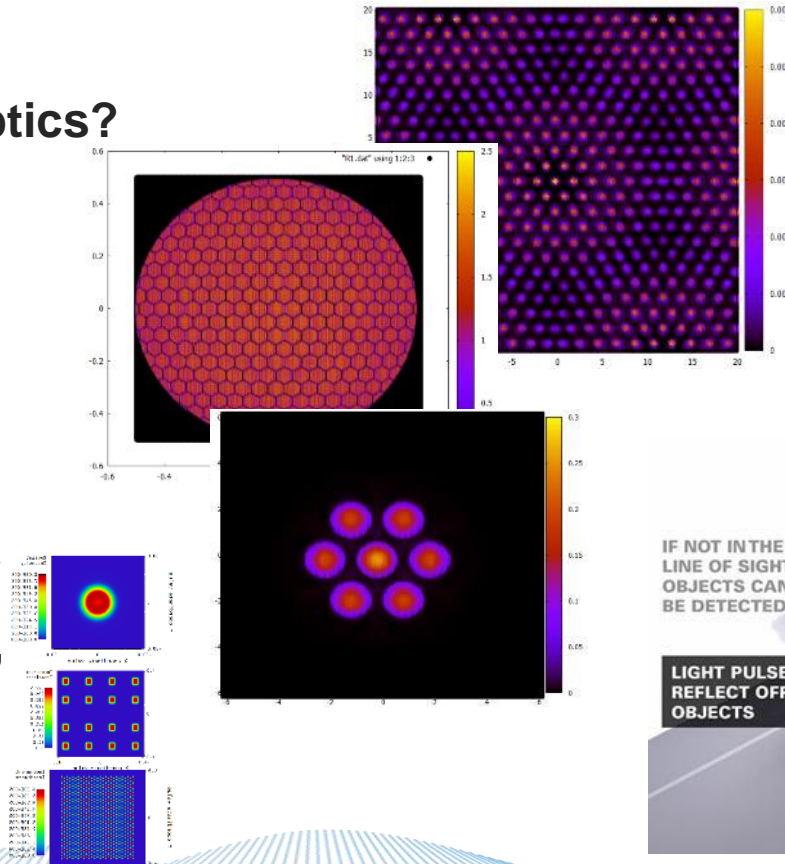
Optional: Micro-optical assemblies made of any combination of A - F

FOCUSLIGHT
CONTENTS

- **Structured light – new dimensions for human-machine interfaces**
- **ROE-DOE Hybrid Optics – designing functional light distributions**
- **1D – 2D light pattern in 3D environment**
- **What we offer to the EPIC community and what could the community offer to us**

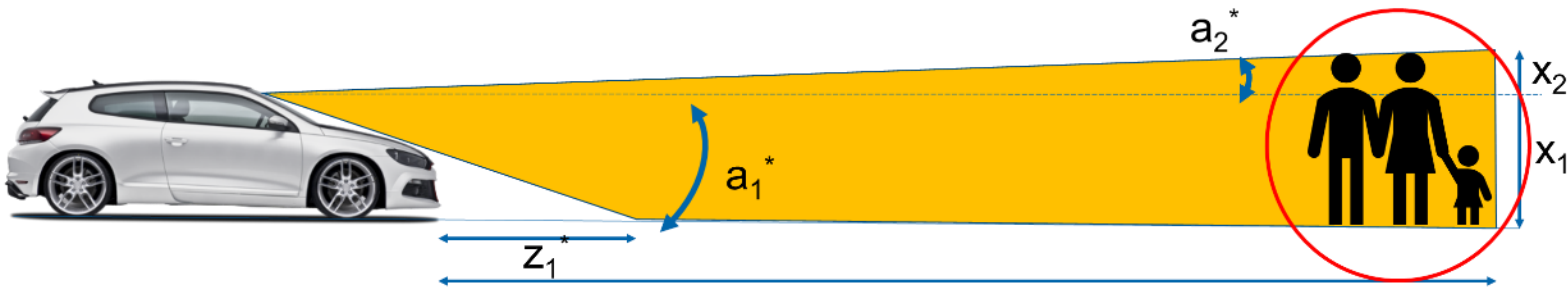
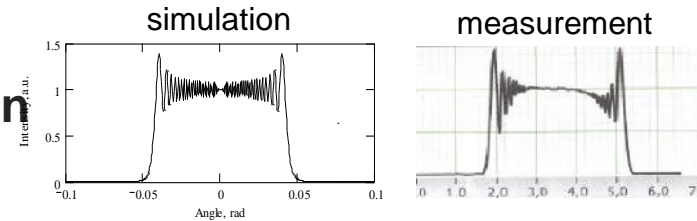
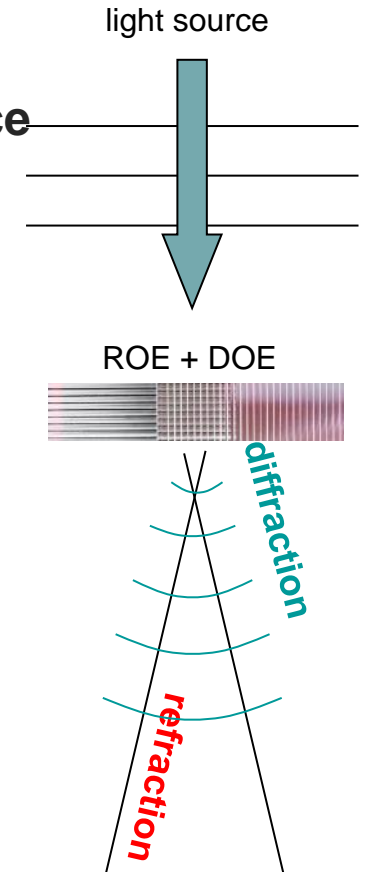
Structured Light

- Defined light distribution with regular or irregular 1D or 2D light pattern
- Enabling simplified measurement of geometries or distances
- How to select & design the right optics?
 - Application requirements
 - Select 3D Pattern
 - ROE-DOE optics design
 - Adaption of light source parameter
 - Light source: VCSEL, edge emitter, DPSSL, stacked emitters



ROE-DOE Hybrid Optics

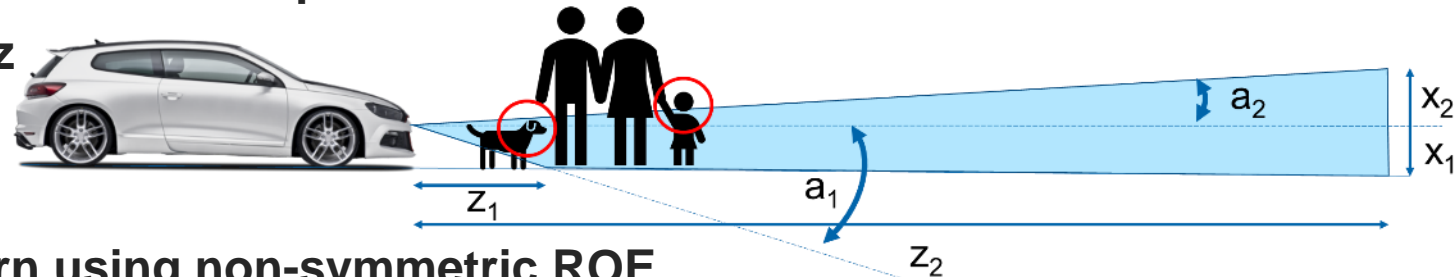
- Combination of refractive & diffractive optical features needed in one optical surface
- Accurate correlation of simulation and production technology needed
- Application specific near- and farfield distribution
- Non-symmetric pattern + laser safety without zero-order peak.



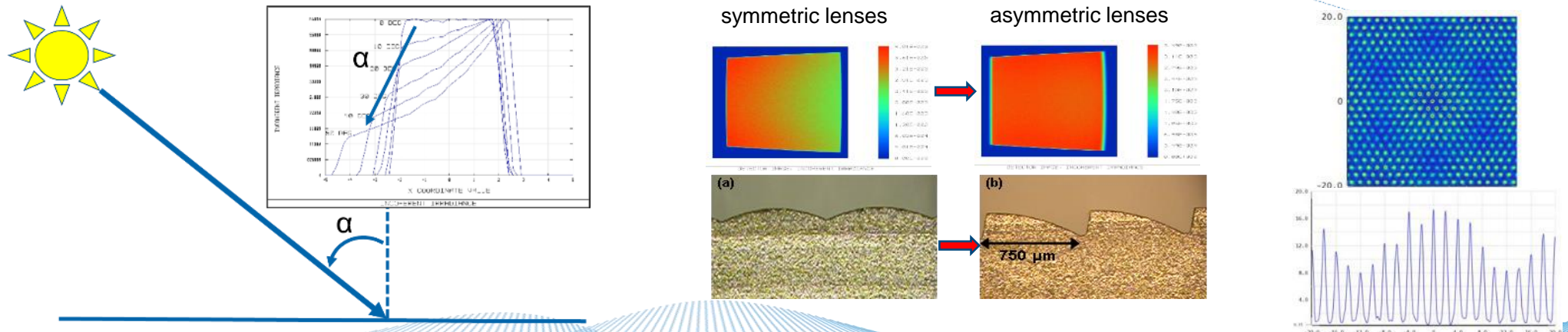
1D – 2D light pattern in 3D environment

- Why 4D beam shaping needed?
 - **Answer: 2D pattern projected into 3D environment needs more design dimensions!**

- 2D: intensity variation with dots, lines or stochastic pattern
- 3D: Different pattern resolution in x, y, z
- 4D: various angular segments 0° - 160°

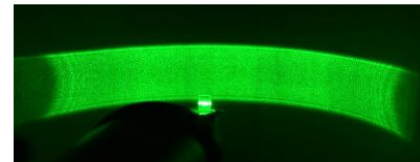
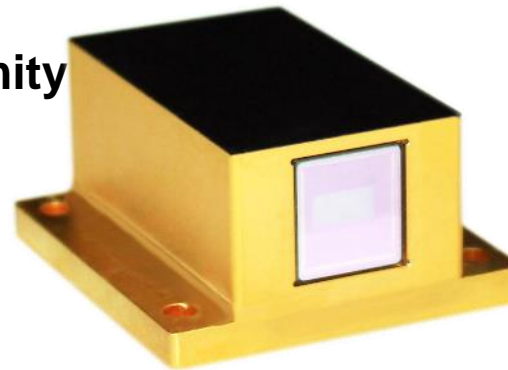


- Design and simulation of off-axis pattern using non-symmetric ROE



Summary

- **What we offer to the EPIC community:**
 - **Design, simulation, production of micro-optics on up-to 300mm wafer, handling of > 10Mio. pcs. p.a.**
 - **Production of laser sources with integrated optics**
 - **ISO9001, 45001 and IATF16949 conformity**
 - **IPMA project management**
- **What could the community offer to us:**
 - **Joint projects and challenges!**



[THANK YOU]



FOCUSLIGHT | **LIMO**
Never stop exploring | A Focuslight Company