Production technology for LIDAR Systems: Optics manufacturing and Assembly

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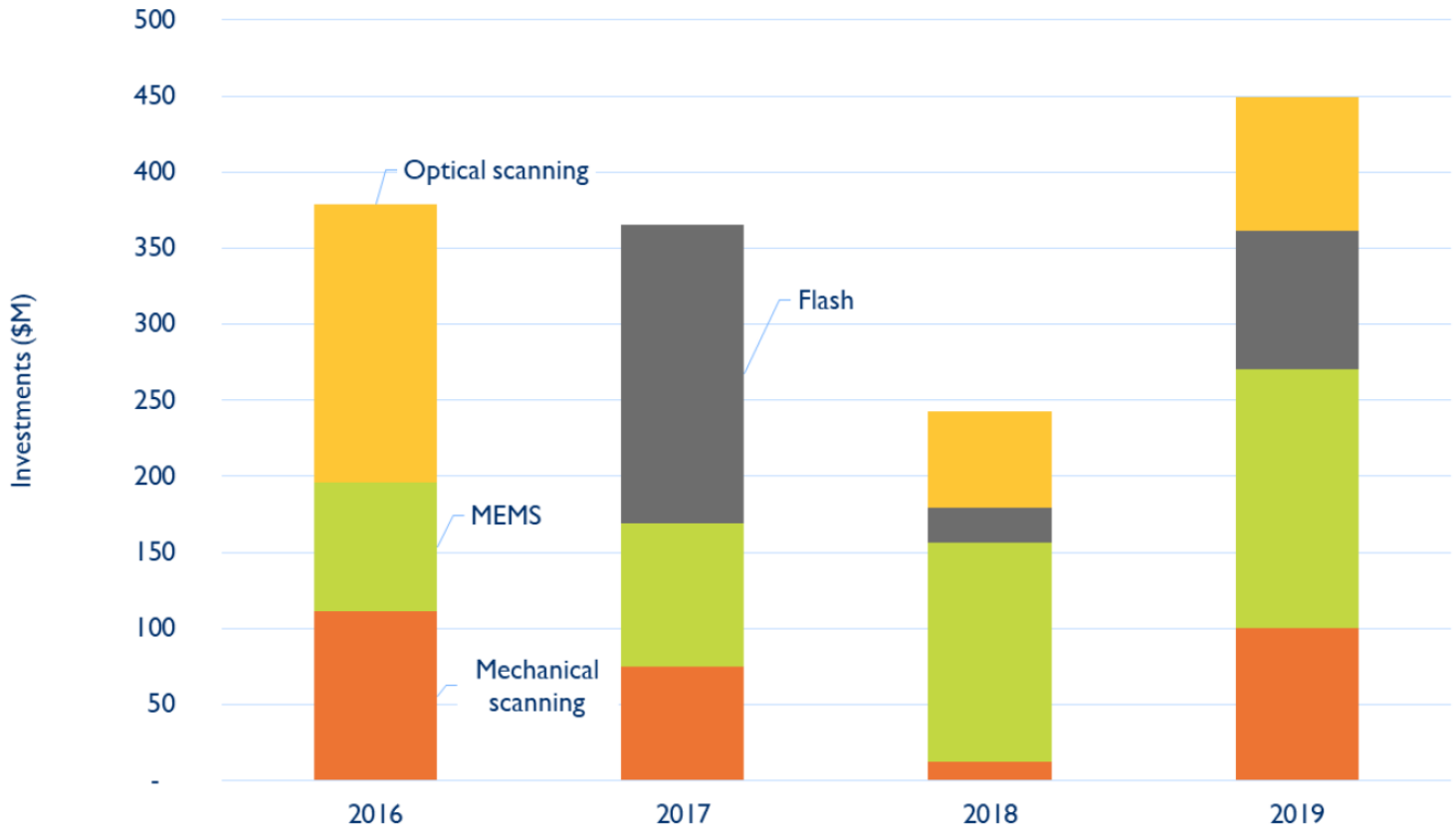
estments in the recent years

Private investments in the LiDAR industry since 2016 – Split by technology

Total private investments identified: **$1,437M**



Source: Alexis Debray, Yole Developpement, EPIC Meeting on LIDAR Technologies for Automotive 20

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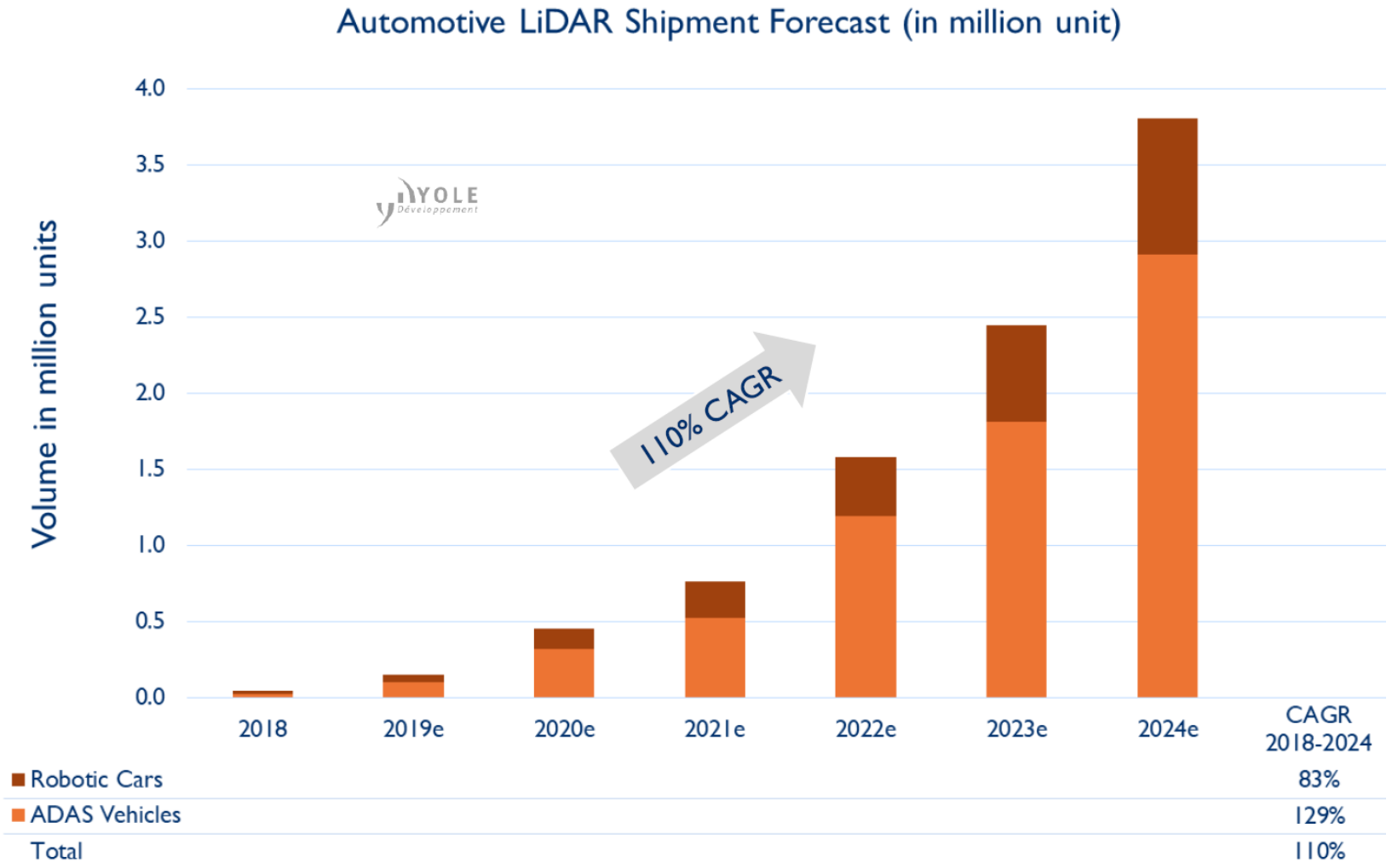
omotive LIDAR market forecast



Source: Alexis Debray, Yole Developpement, EPIC Meeting on LIDAR Technologies for Automotive 20

Requirements are known

⇔

Production challenges need to be solved

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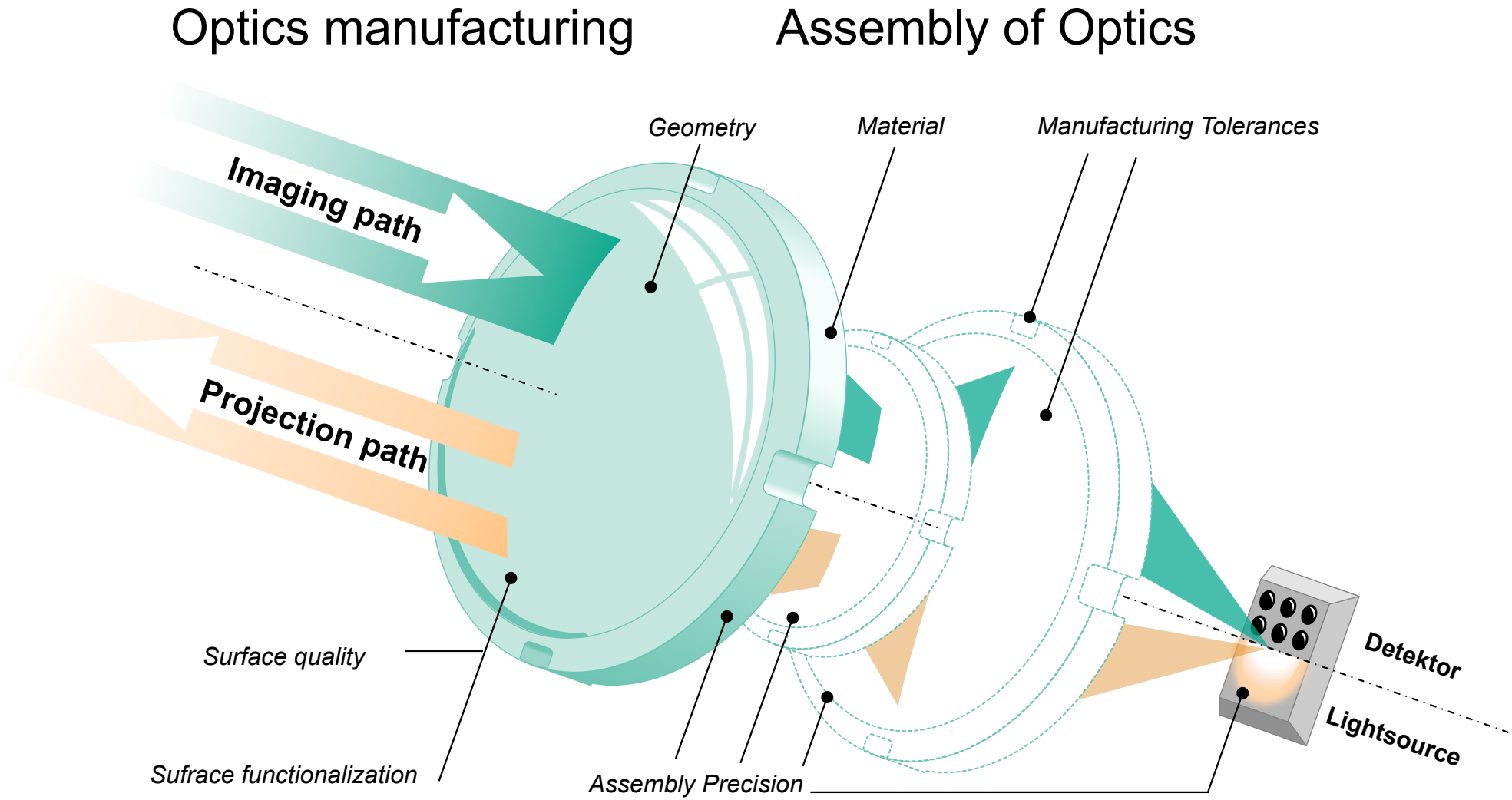
o Challenges in Production of LIDAR Systems



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ics in Aachen
m Manufacturing over Assembly to System integration

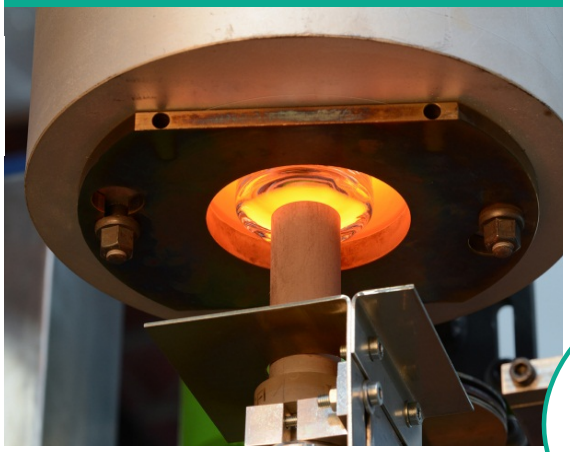
INNOLITE

ooling

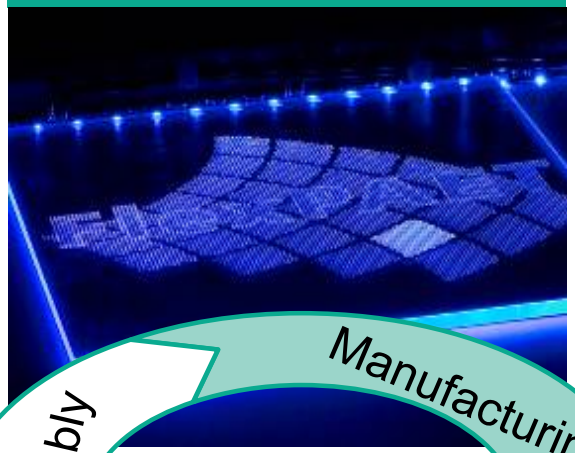
ENERIC

AIXEMTEC

Glass Optics



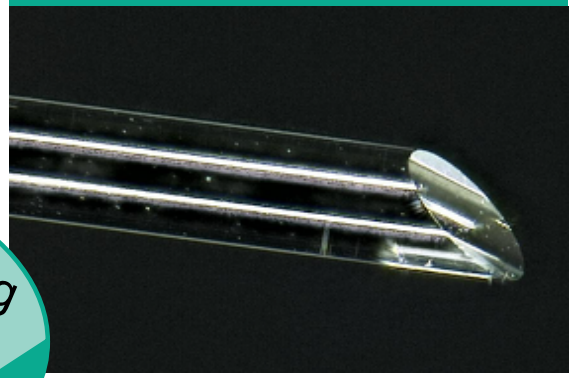
Polymer Optics

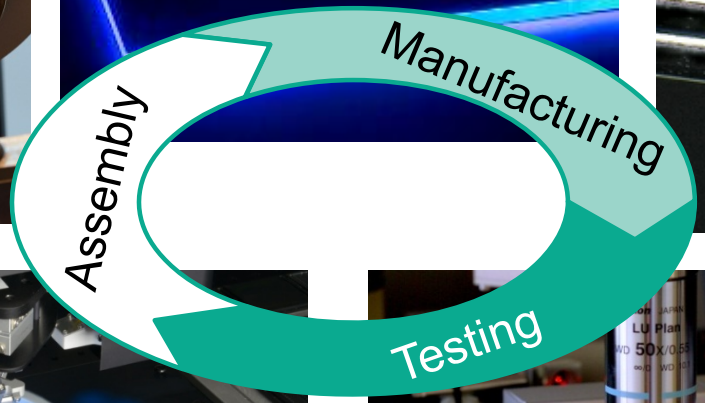


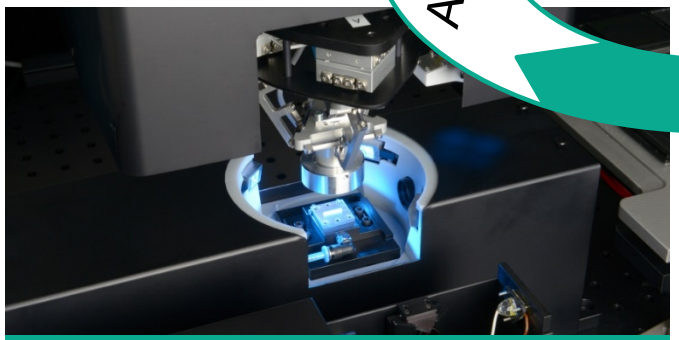
son(x)

polyscale

Fiber Optics







Automated assembly of Optics

Evaluation of Optics

fionec
fiber optic sensor technologies

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tfolio in Optical Engineering

nsidering the entire Production Process Chain

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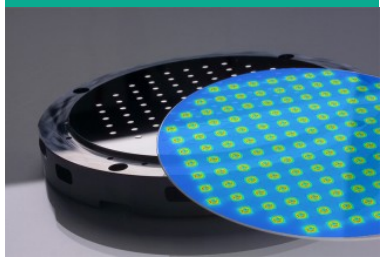
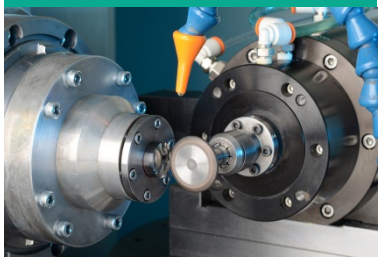
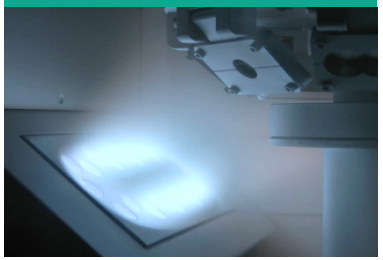
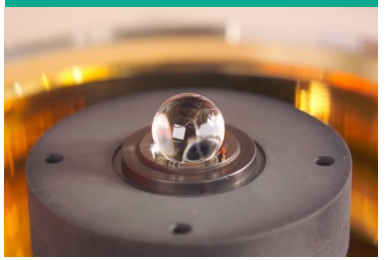
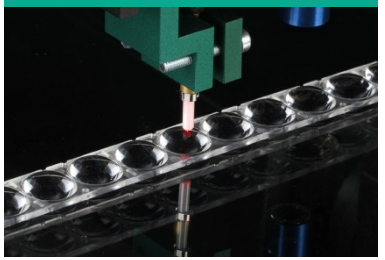
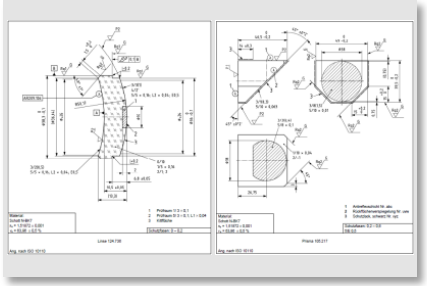
Simulation	Tool Manufacturing	Coating	Molding	Metrology
				

Optical Design



»Based on your optical design we develop technologies for an efficient production of optical components«

»We cover the entire process chain from simulation to qualification of the optics«

Ready-to-use Optic

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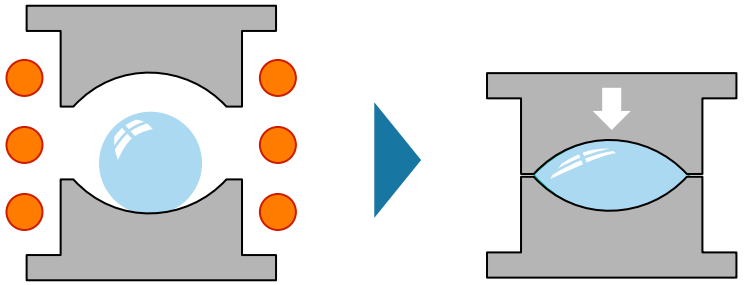
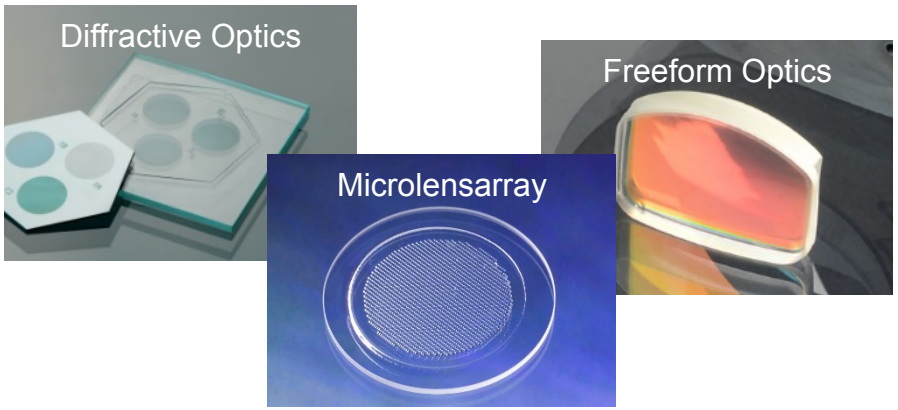
oduction & Motivation

h Potential of Replicative Optics Manufacturing

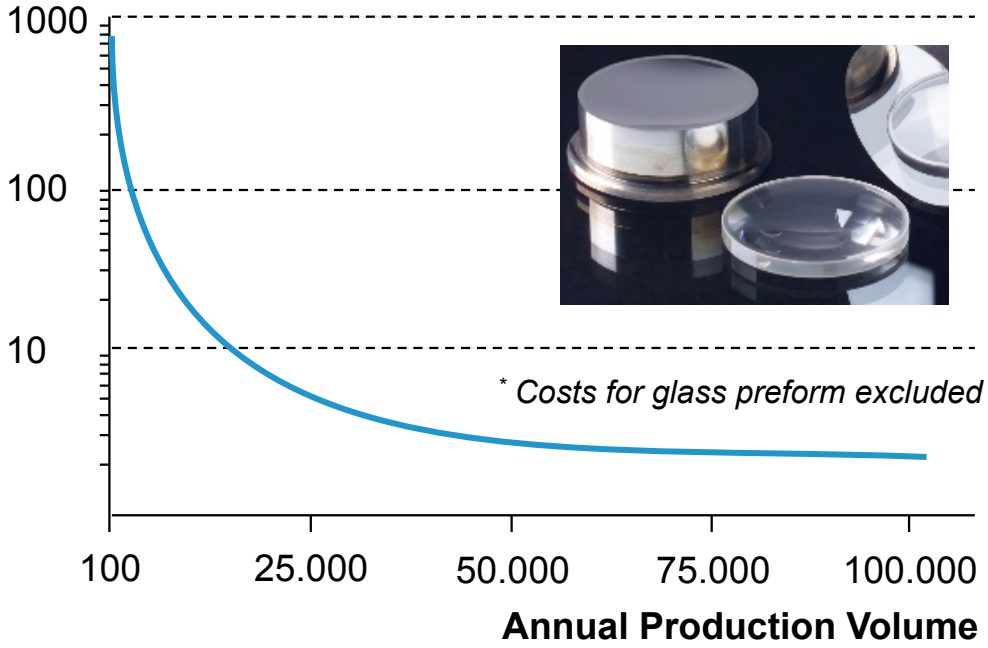
Precision Glass Molding Principle



Complex Lens with high acurracy



Manufacturing Costs* per Unit [US-$]



Precision Glass Molding can potentially meet the requirements of complex geometries, high accuracy at low costs

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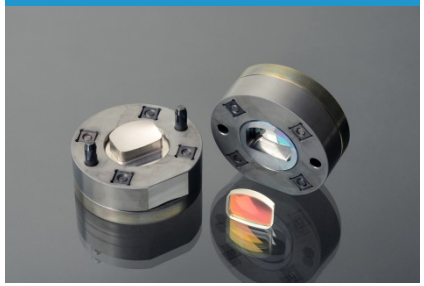
cision Glass Molding

duct Spectrum & Scope of Application

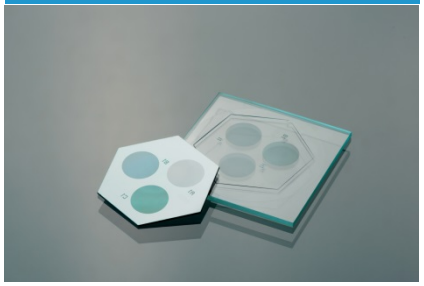
Aspherical Optics

Freeform Optics

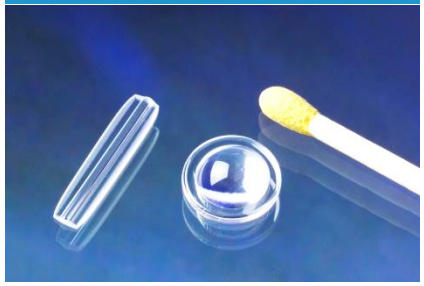


Lighting Optics

Diffractive Optics

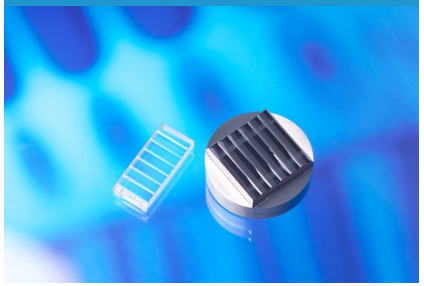


Micro Optics



Infrared Optics

Cylindric Lenses



Lens Arrays

Wafer Optics

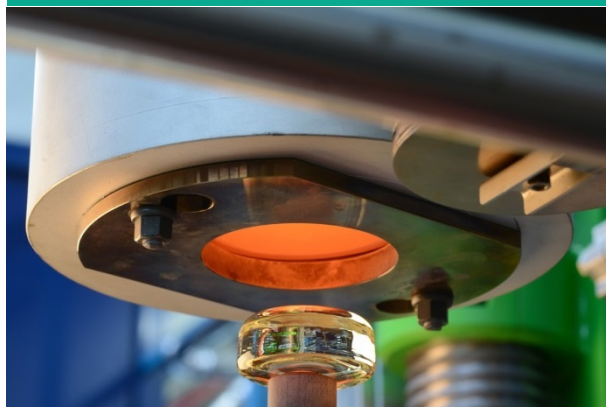
- Wide range of possible geometries
- Accuracies can be adjusted accordi to the field of application:
  - Imaging
  - Lighting
  - Laser Optics
- High reproducibility/ repeatability as consequence of the molding proces
- Scalable production through Spinoff companies and technology transfer

INGENERIC

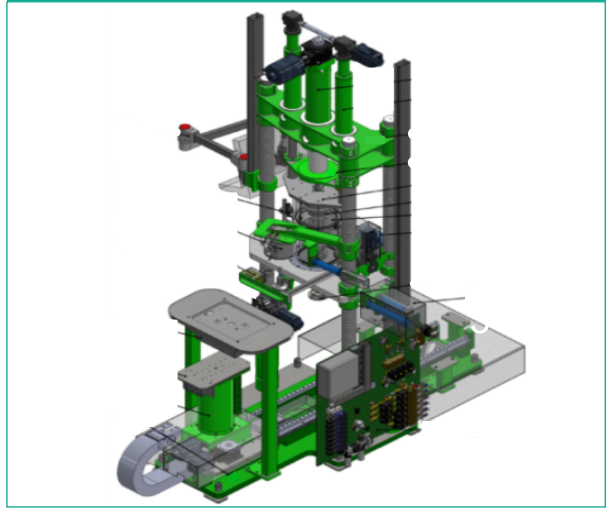
aix toolin

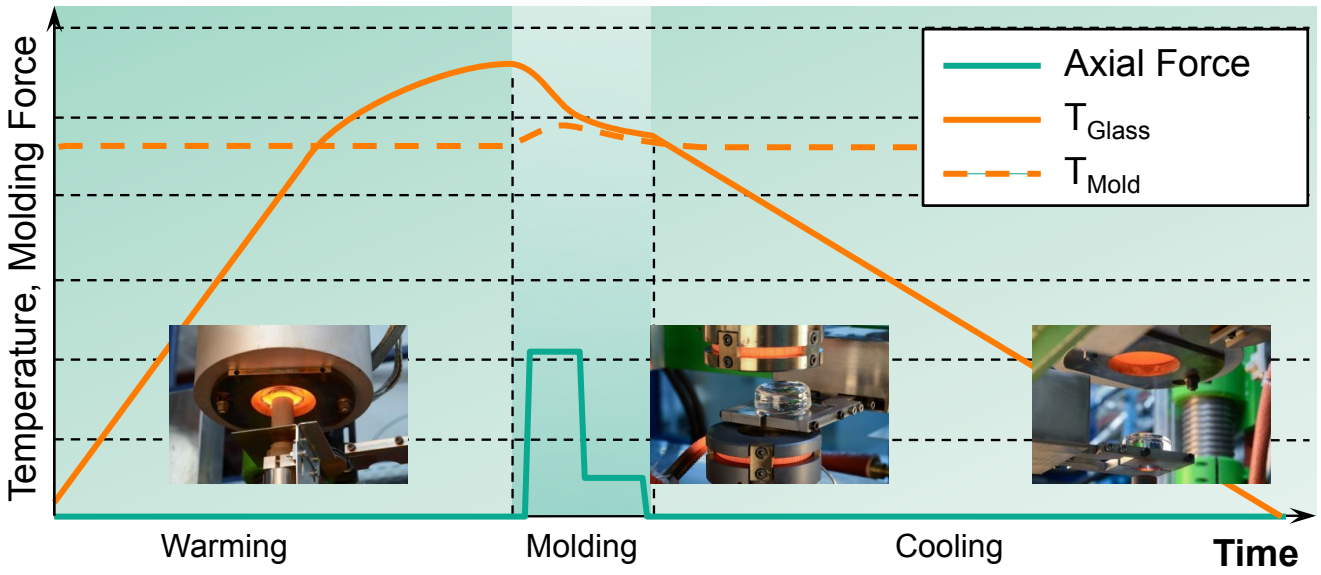
sidering the entire Production Process Chain
ss Molding – Non-isothermal Glass Molding for low-cost glass optics

Glass Molding



Non-isothermal Glass Molding





- Glass is heated up externally and subsequently molded by constantly tempered molding tools (Non-isothermal: $T_{Glass} > T_{Mold}$)
- Non-isothermal molding enables fast processing and short cycle times
- Predestined for die cost-efficient mass production

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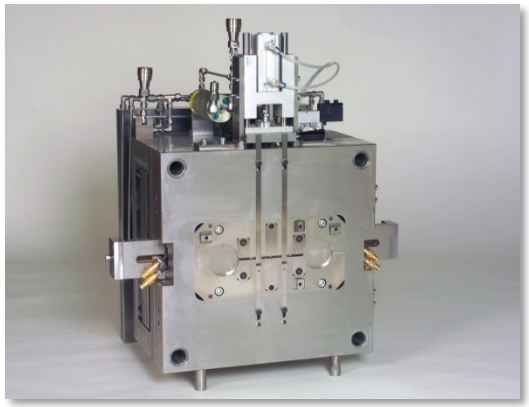
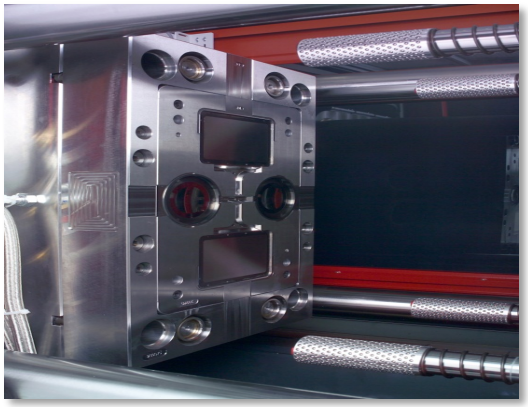
blication of Polymer Optics at Fraunhofer IPT

ect examples of IPT mold and tool making

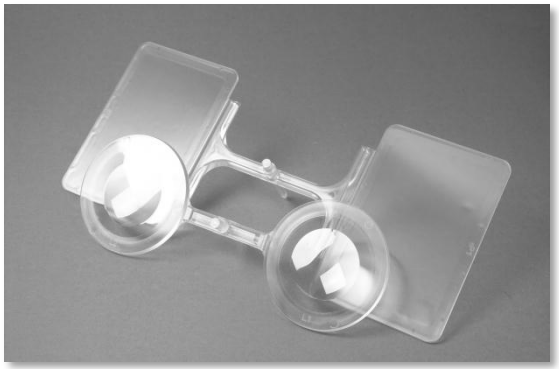


Injection compression molding tool with integrated measuring sensors

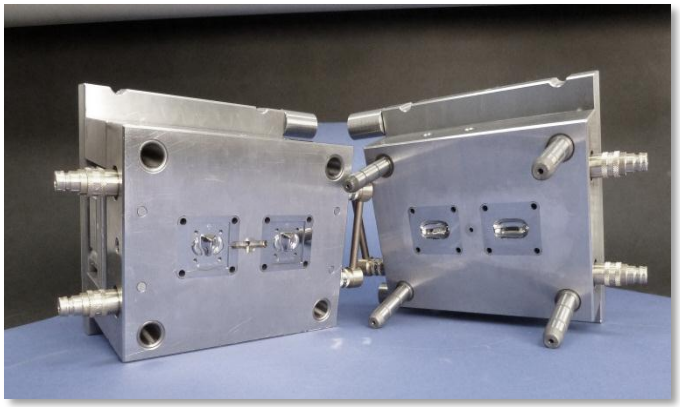
Freeform optic for automotive lights



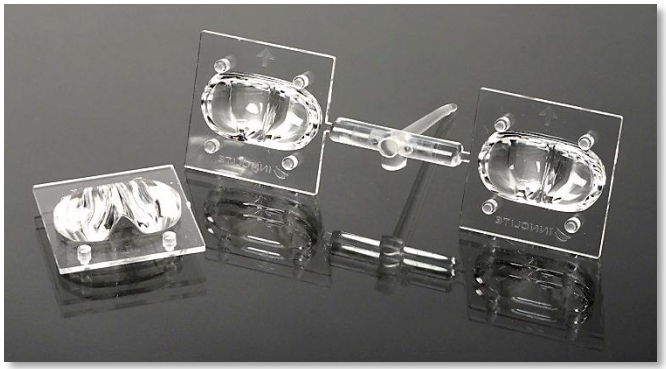
2+2-cavity injection molding tool with dynamic cooling



Microstructured Lightguides



Compact injection compression molding tool with integrated hydraulic unit



Thick-walled LED-focus lens with freeform surface

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cision Assembly and Automation in Aachen

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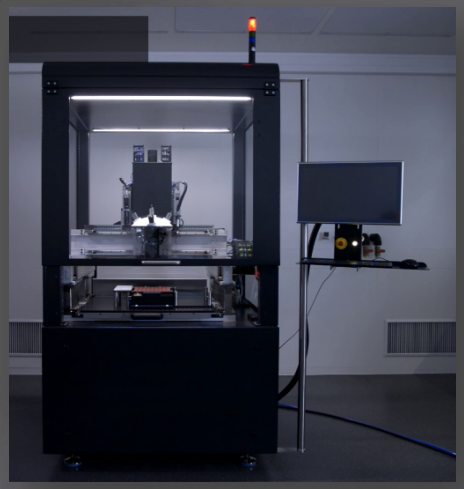


AIXEMTEC

2008
First Micromanipulator
„Commander 6“

2010
First active alignment of
Fast Axis Collimators

2015
First Assembly Machine in
industrial environment

2016
Spinoff Aixemtec founded

2018
Multiple applications launched
(Lidar, Fiber-Array, Microoptic, …)

2019
10+ Machines in the field
Automotive, Laser Industry,
Consumer Electronics, Datacom,
Sensing, Quantum Photonics

Automated Precision Assembly
Markets and Applications

tomotive applications
- LiDAR systems
- Driving assistance cameras
- Headlight systems

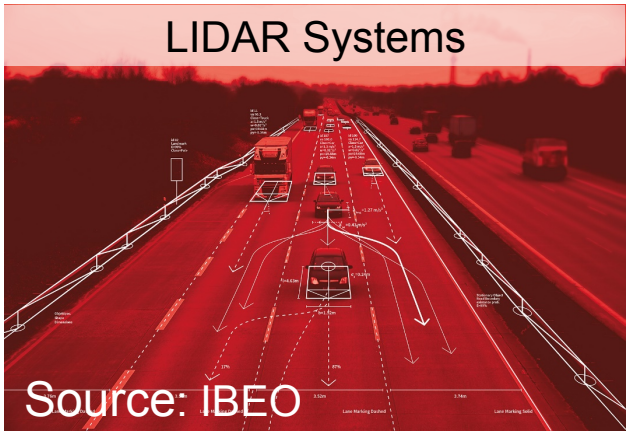
aging systems
- Mobilephone Camera lens (Lens-Barrel)
- Endoscopes

otonic Integrated Circuit
- Chip Testing
- Fiber assembly
- Chip coupling

sersystems
- FAC-lens assembly

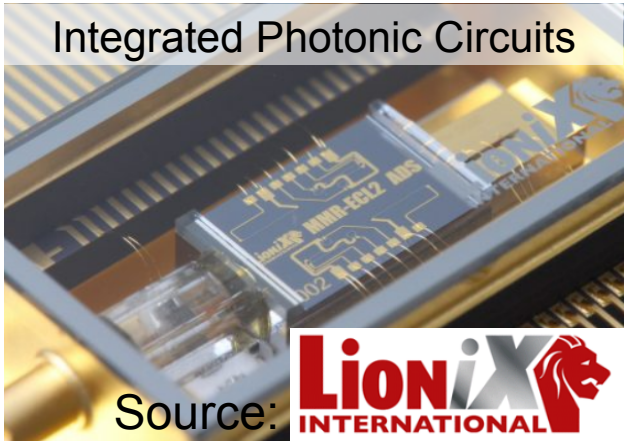
nsumer electronics
- Face ID & Gesture recognition

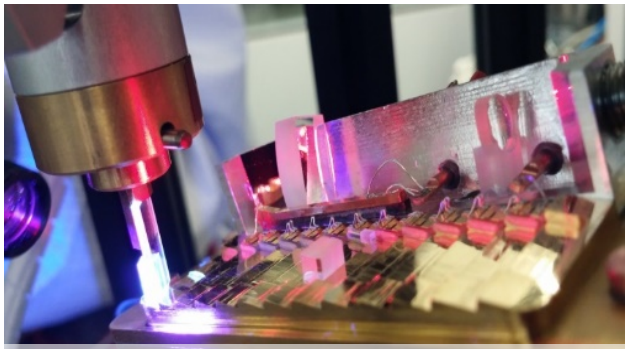
LIDAR Systems



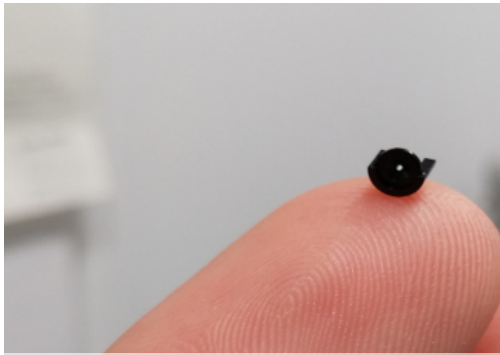
Link to press release!

Integrated Photonic Circuits



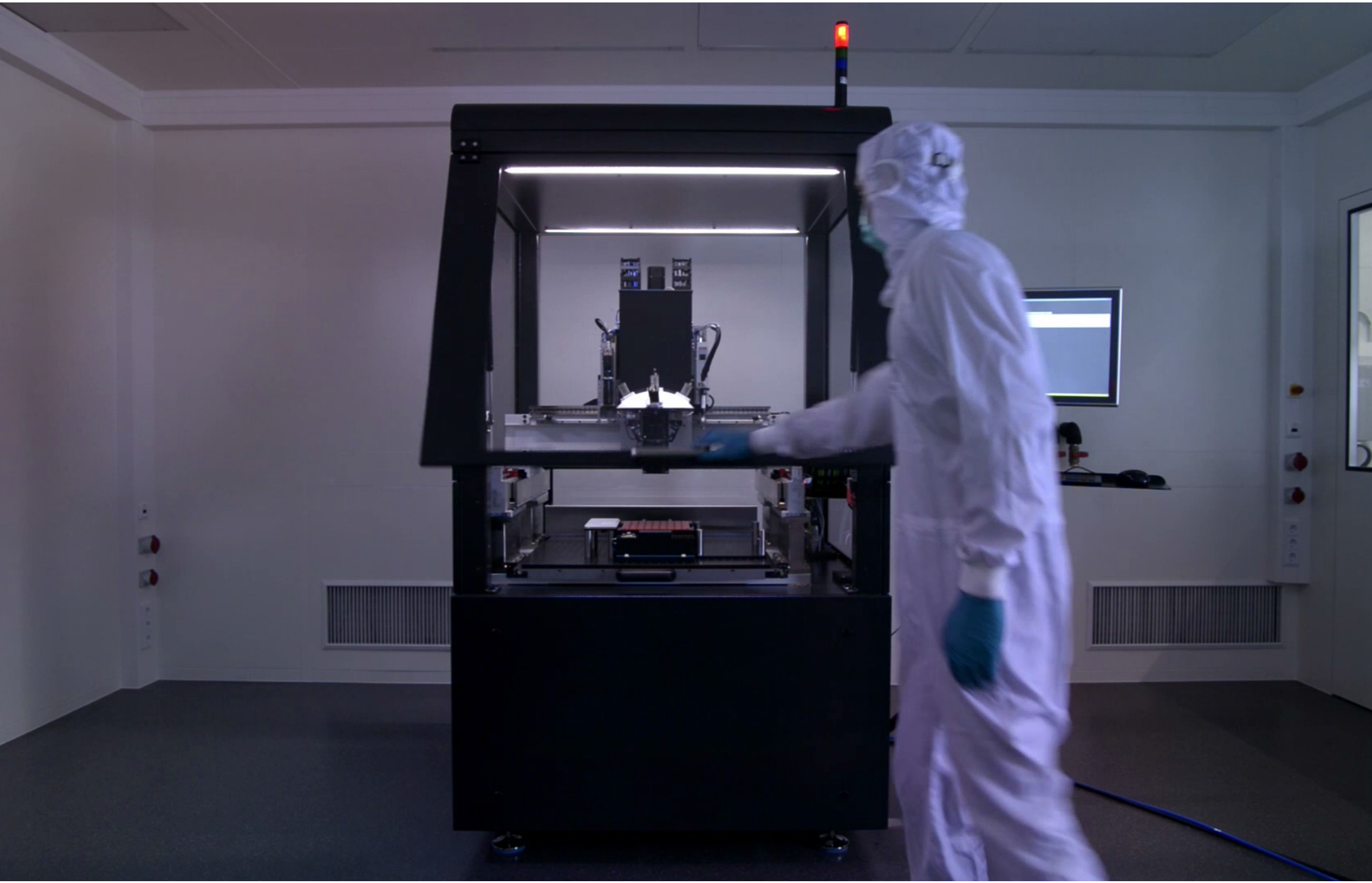


LASER Systems



Imaging Systems

Tobias.mueller@aixemtec.c



Automated Assembly of Solid State LIDAR Systems

facts on Aixemtec‘s Solid State Lidar Assembly Machine

stalled January 2019

timate alignment precision in micron range

traprecision alignment for sender and receiver side

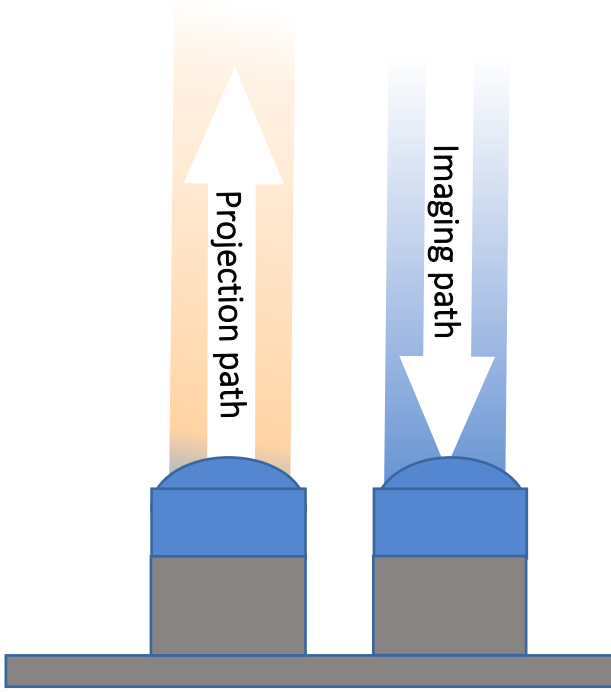
egrated UV-curing for high bonding repeatabilty

uick reconfigurability for different FOVs

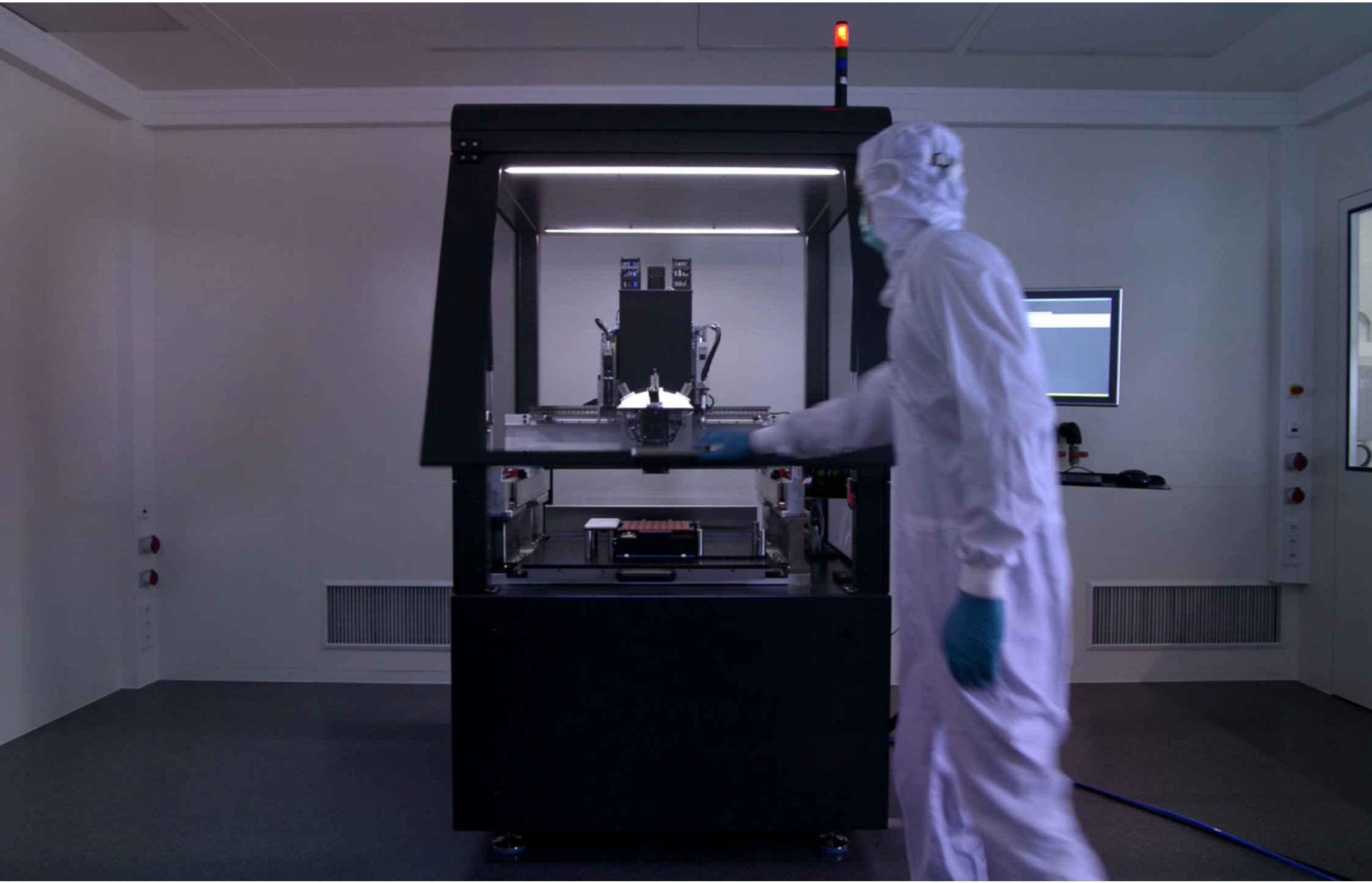
pen Source for process tuning through end-customer

Months projection time thanks to concurrent engineering

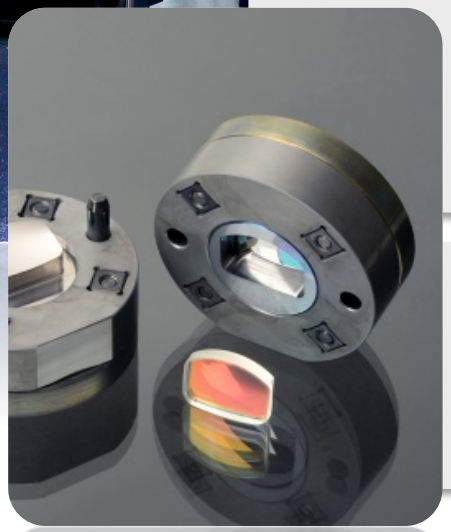
ommercial Service and Support through Aixemtec



Tobias.mueller@aixemtec.c



mmary and Outlook
ubation hub for novel LIDAR products



Development

Product development consulting
Prototyping and feasibility studies
Optics manufacturing and assembly

Market launch

Contract manufacturing for low- to mid-volume
Manufacturing of high-end optics
Prove of automated assembly

Industrial production

Turnkey solutions for industrial production
Commercial service and support
Commercialization through partner companies

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What can we provide?

Shortest **development** cycles for LIDAR **optics** and LIDAR **assembly** machines

Knowhow in **product design** for automation

Powerful **R&D team** and network for industrial product **incubation**

Shortest **time-to-market** and cost-efficient **scaling** of production

What are we looking for?

LIDAR Systems manufacturers looking to **develop** or **commercialize** their products

Ambitious companies looking for **strong development** partners

R&D and **industrialization** projects

Ultimately:

Making Europe the Innovation Hub for LIDAR Technology