

The logo features a stylized graphic on the left consisting of two parallel orange diagonal lines that merge into a solid orange trapezoidal shape pointing to the right.

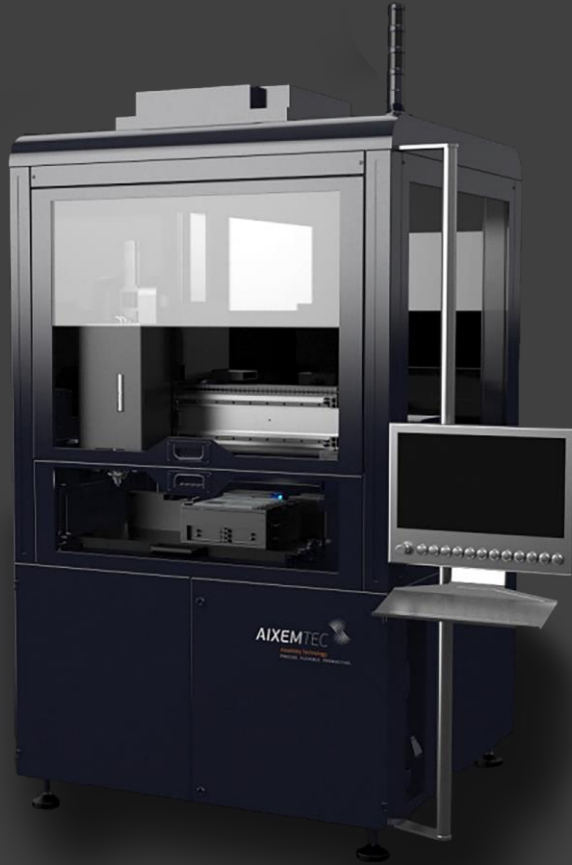
**AIXEMTEC**  
PRECISE. FLEXIBLE. PRODUCTIVE.

# AUTOMATED ASSEMBLY OF QUANTUM PHOTONIC SYSTEMS BY ACTIVE AND PASSIVE ALIGNMENT FOR ULTIMATE PRECISION

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EPIC Industrial Quantum Photonics Technology Summit,  
University of Glasgow, September 7<sup>th</sup> 2022

# ASSEMBLY TECHNOLOGY FROM AACHEN - AIXEMTEC GMBH -



## WHO ARE WE?

<b>Location</b>	Herzogenrath, Germany
<b>Founded</b>	November 2016
<b>Origin</b>	Spin-off Fraunhofer IPT
<b>Ownership</b>	Private, fully independent
<b>Install-base</b>	35+
<b>Headcount</b>	40
<b>CAGR</b> Since 2016 <a href="#">(Link: Financial Times)</a>	147%, organic-growth



# ASSEMBLY TECHNOLOGY FROM AACHEN

## - AIXEMTEC GMBH -






## WHO ARE WE?

**Core Business** Precision Assembly & Testing Machines and Services

**Technological Excellence** Flexible Precision Machine Platform

**Mission** Enhance and accelerate our customers' R&D and Production

### USPs

-  Highly flexible Machine Platform and intelligent Software
-  Open access platform for your own enhancements
-  Combined Business Model of Machines and Services

**Your Benefits** Short time to market with minimal technical and financial risk!



# KEY COMPONENT MICRO MANIPULATOR UNIT

## KEY FACTS ON AIXEMTECS MICROMANIPULATION TECHNOLOGY

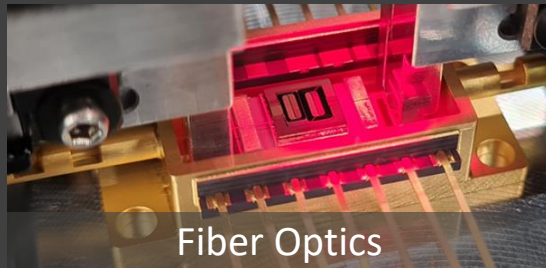
3D-Motion in six degrees of freedom, maintenance free!

Step resolution 10 nm and 5  $\mu$ rad in cartesian coordinates

Industrial grade: 1.000.000 automotive driving assistance cameras assembled



# TYPICAL MACHINE CAPABILITIES IN QUANTUM APPLICATIONS

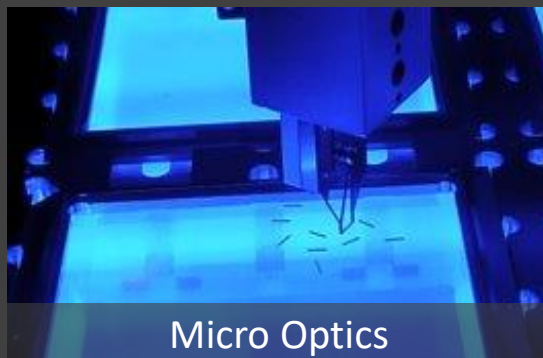


Fiber Optics

Source: AIXEMTEC

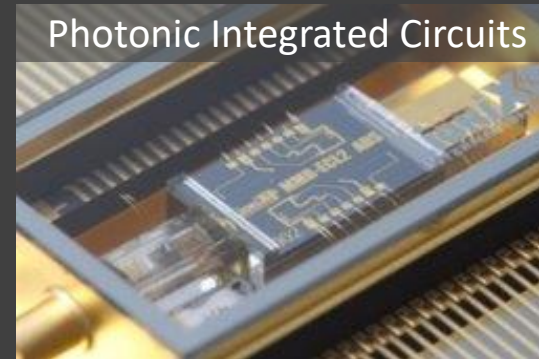
- Single mode and multimode fiber coupling
- Alignment of polarization-maintaining fibers
- Fiber array assembly
- 2 fiber butterfly package

- Beam shaping of free space beams
- FAC-/SAC-lens to laser diode
- Beam combining (spatial, spectral, polarization)
- Wavelength stabilization and tuning: ECDL-building or gratings



Micro Optics

Source: AIXEMTEC



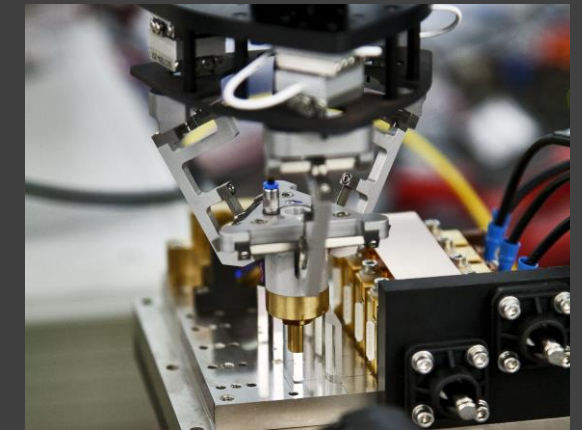
Photonic Integrated Circuits

Source: Lionix

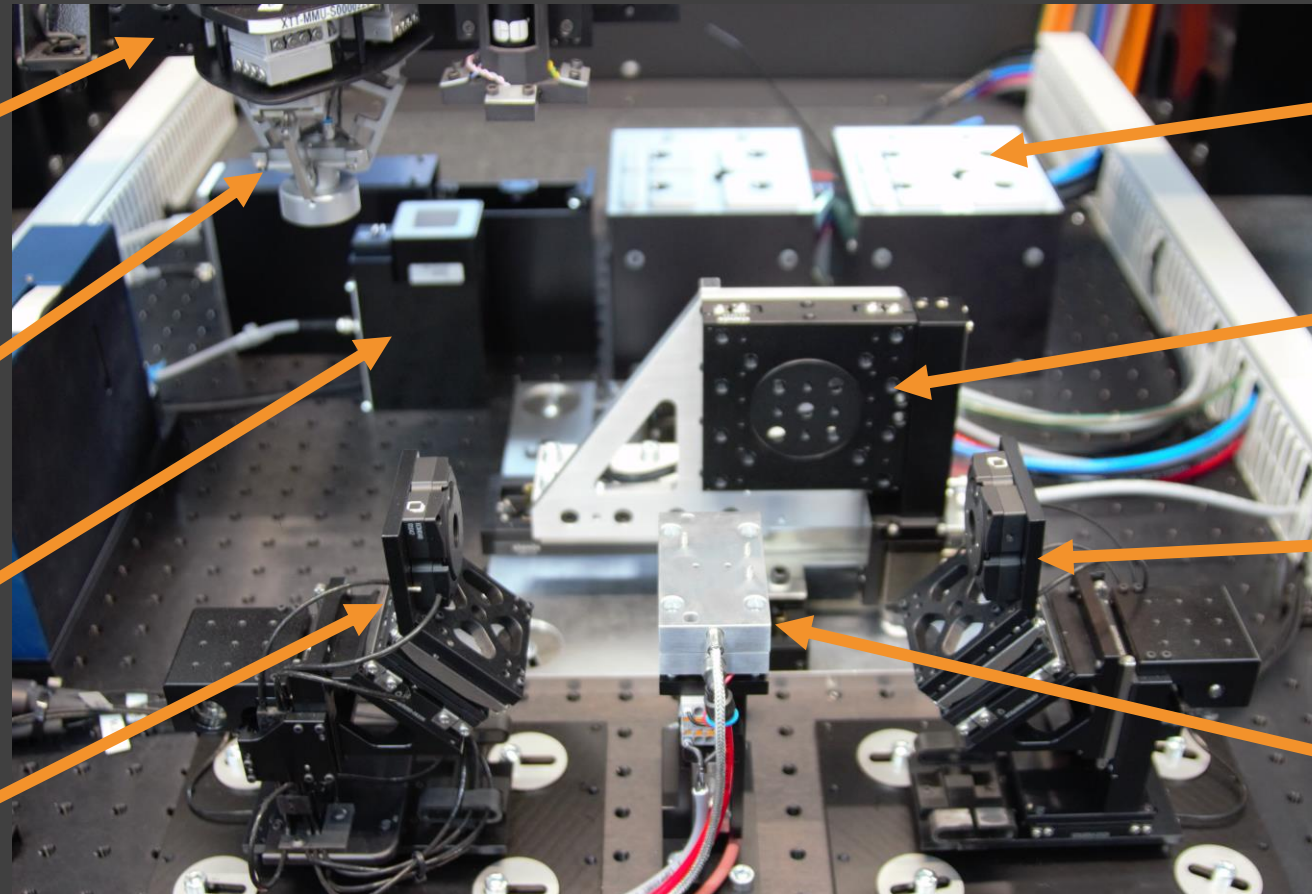
- Chip testing
- Fiber attach
- Up to 3 collaborating MMUs for combined active alignment

## Our Measurement capabilities:

- Wavelength (various scales)
- Power (Free space, coupling efficiency)
- Beam shape (Vis-LWIR)
- Optical Axis
- $M^2$ , Smile, Residual divergence



# EXEMPLARY MACHINE CONFIGURATION



**TOOLHEAD**  
Dispenser & Camera

**3D HEXAPOD**  
For lenses and mirrors

**PROCESS PLATE**  
Camera, needle cleaner...

**FIBER ALIGNER 1**  
3D alignment engine

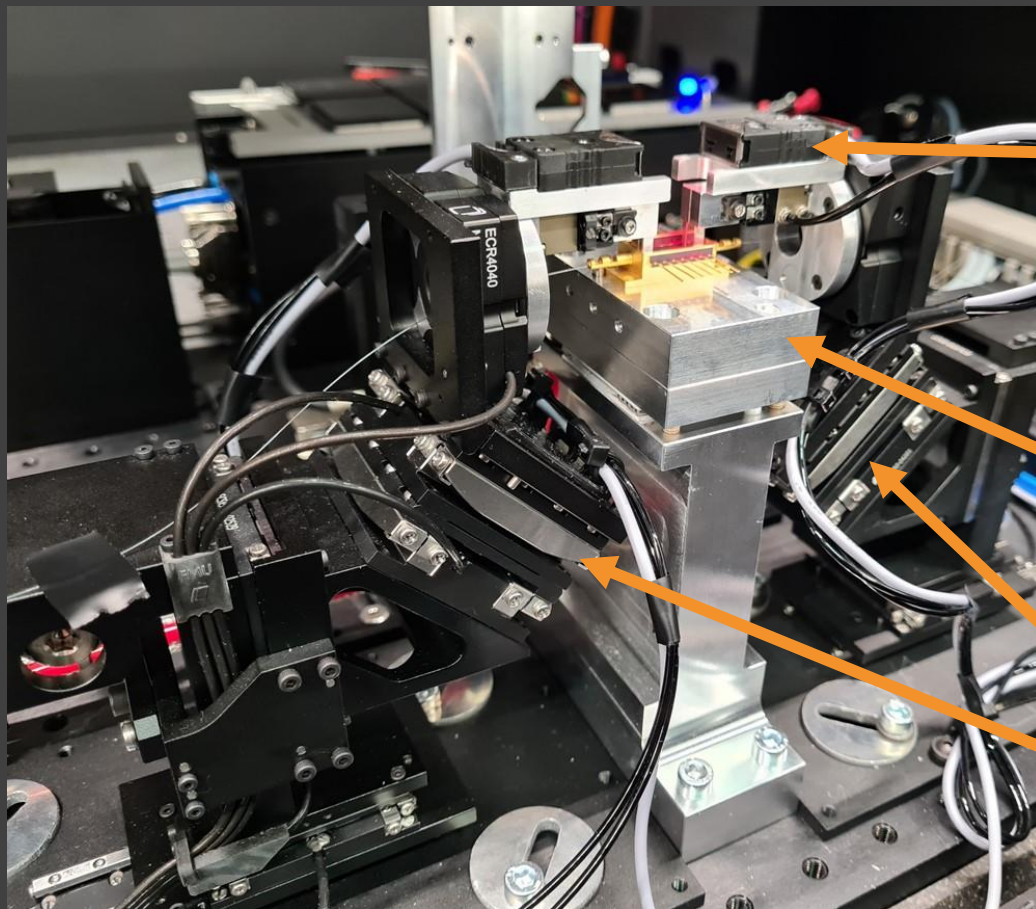
**FEEDING**  
2" and 4" Holders

**PROBING**  
Motorized probing unit

**FIBER ALIGNER 2**  
3D alignment engine

**SAMPLE HOLDER**  
TEC-controlled chuck

# SINGLE MODE FIBER QUANTUM SYSTEM ASSEMBLY



## SENSORS

Photodetectors for first light detection

## INSTRUMENTATION

High-speed Testing  
Equipment embedded



## SAMPLE HOLDER

TEC-controlled, multifunctional PIC sample holder  
for single PICs, Butterfly packages, and PICs on PCBs

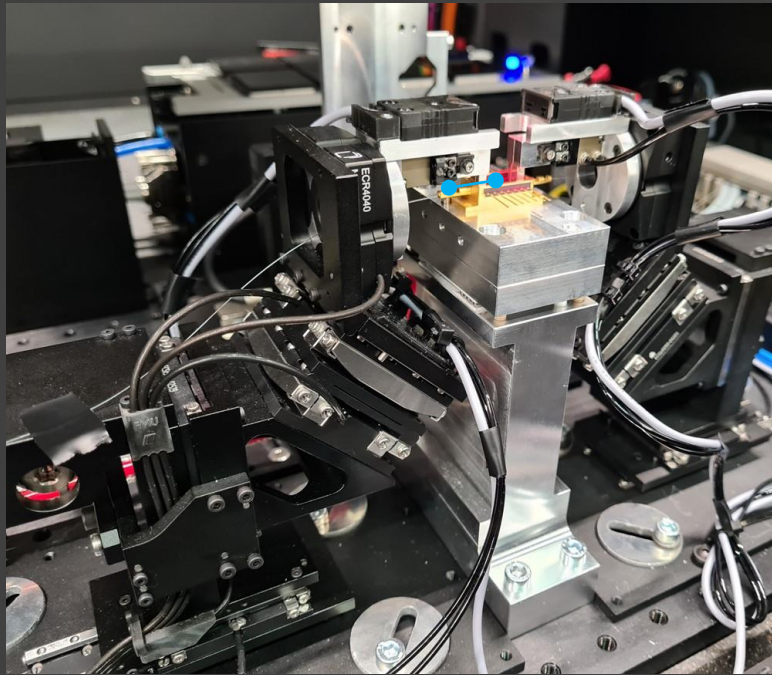
## ACTIVE ALIGNMENT

Double sided nanometer Precision 6-axis alignment  
tools for single fibers and fiber arrays

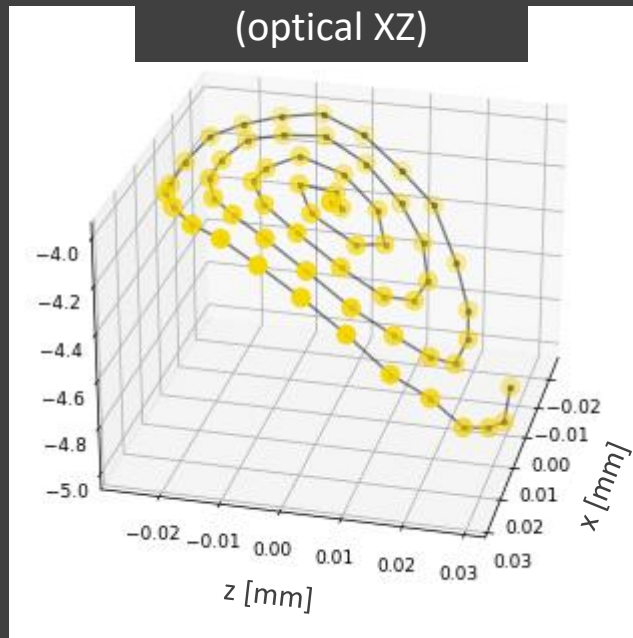


# PIVOT POINT ADJUSTMENT

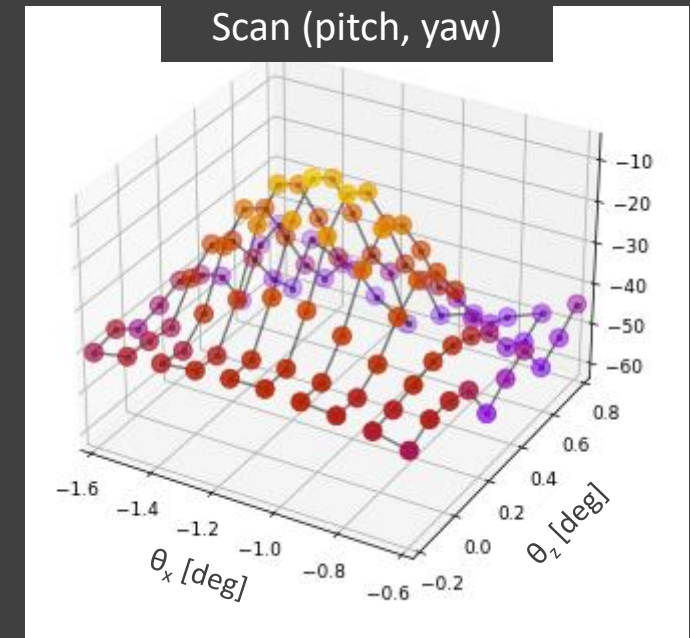
Pivot point can be adjusted by Software → Active alignment of pitch and yaw



Position Spiral Scan  
(optical XZ)



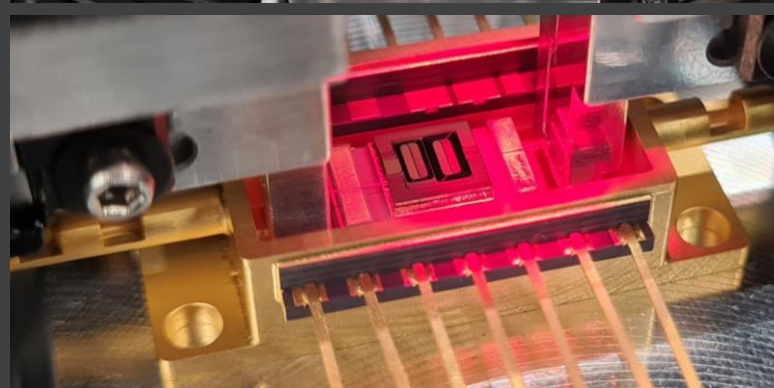
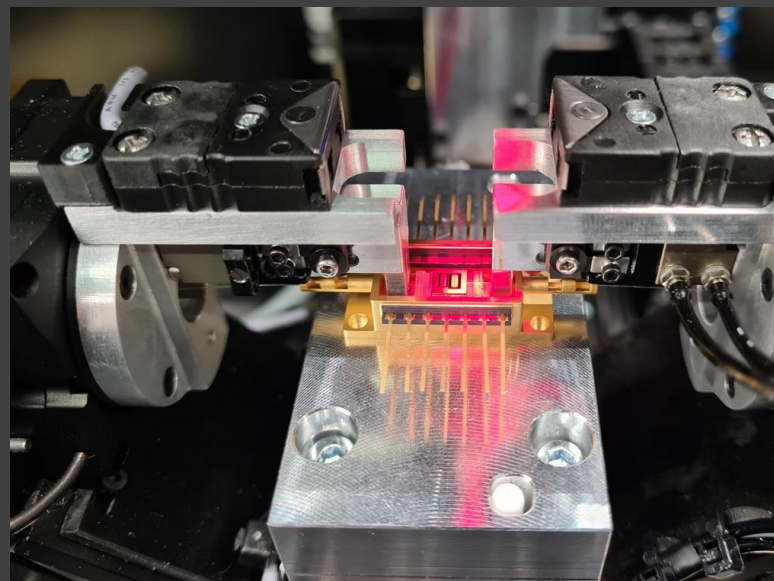
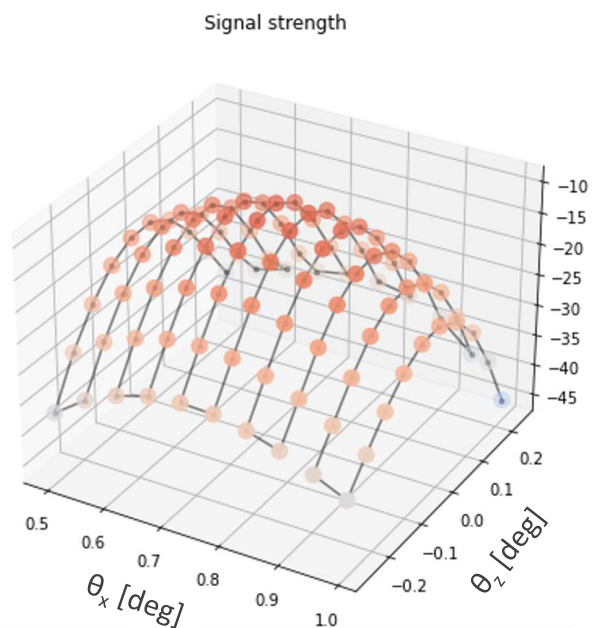
Angle Meander Scan  
(pitch, yaw)



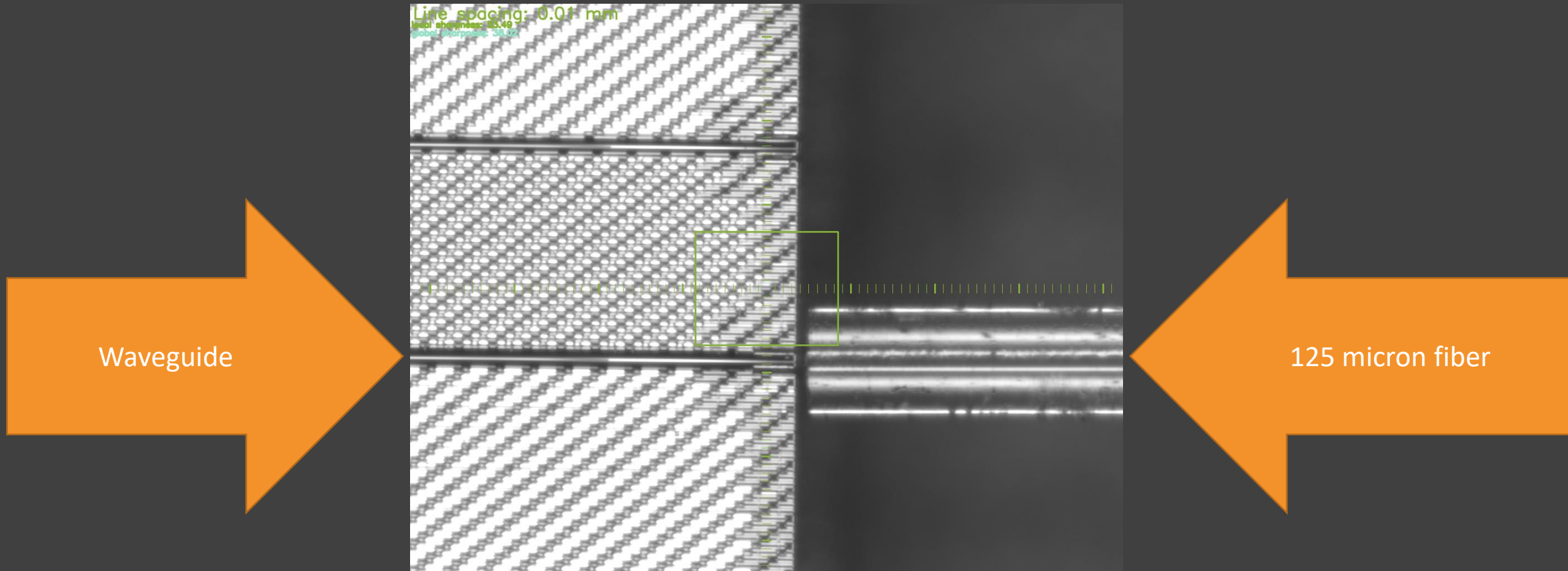
# ULTRA LOW-LOSS FIBER COUPLING

## Typical Results

→ Alignment precision to the physical limits



# CAMERA BASED PREPOSITIONING

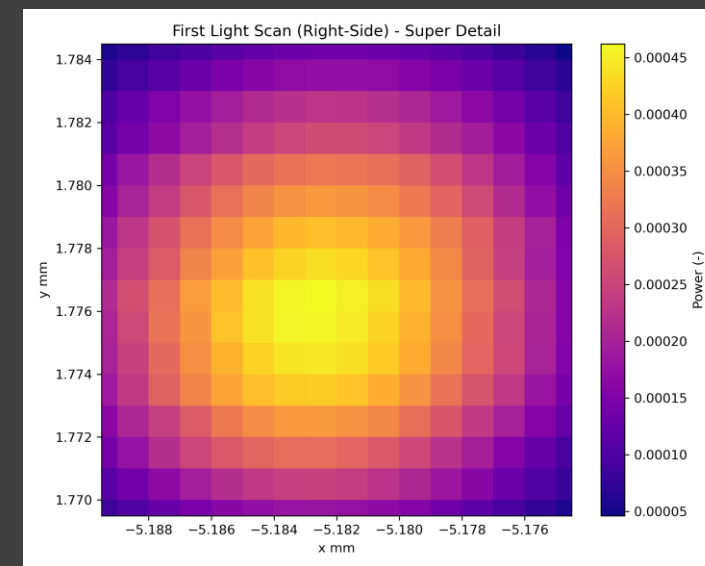
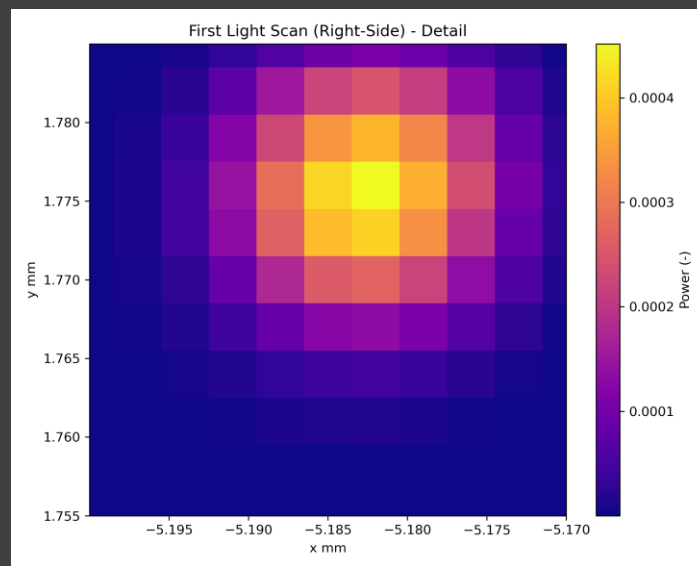
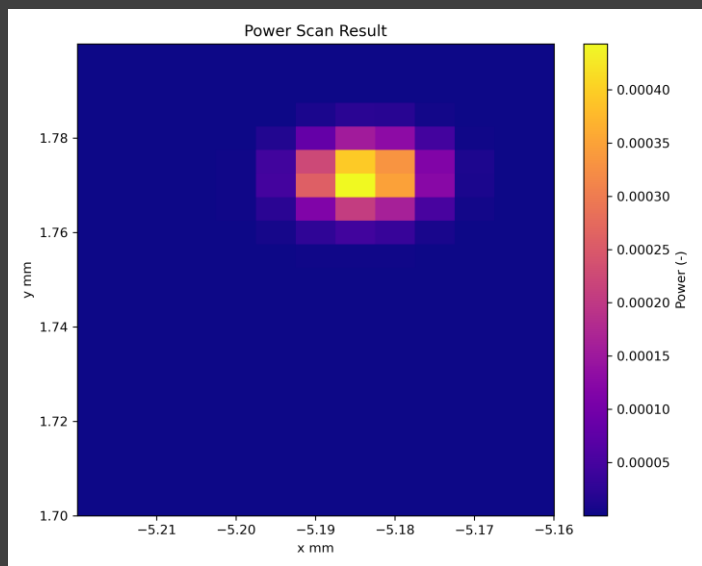


# FAST FIRST LIGHT SCANS

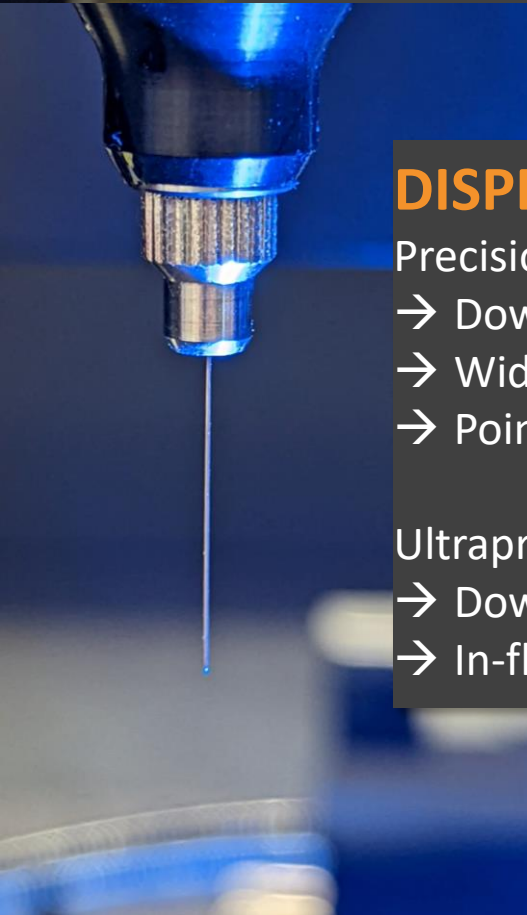
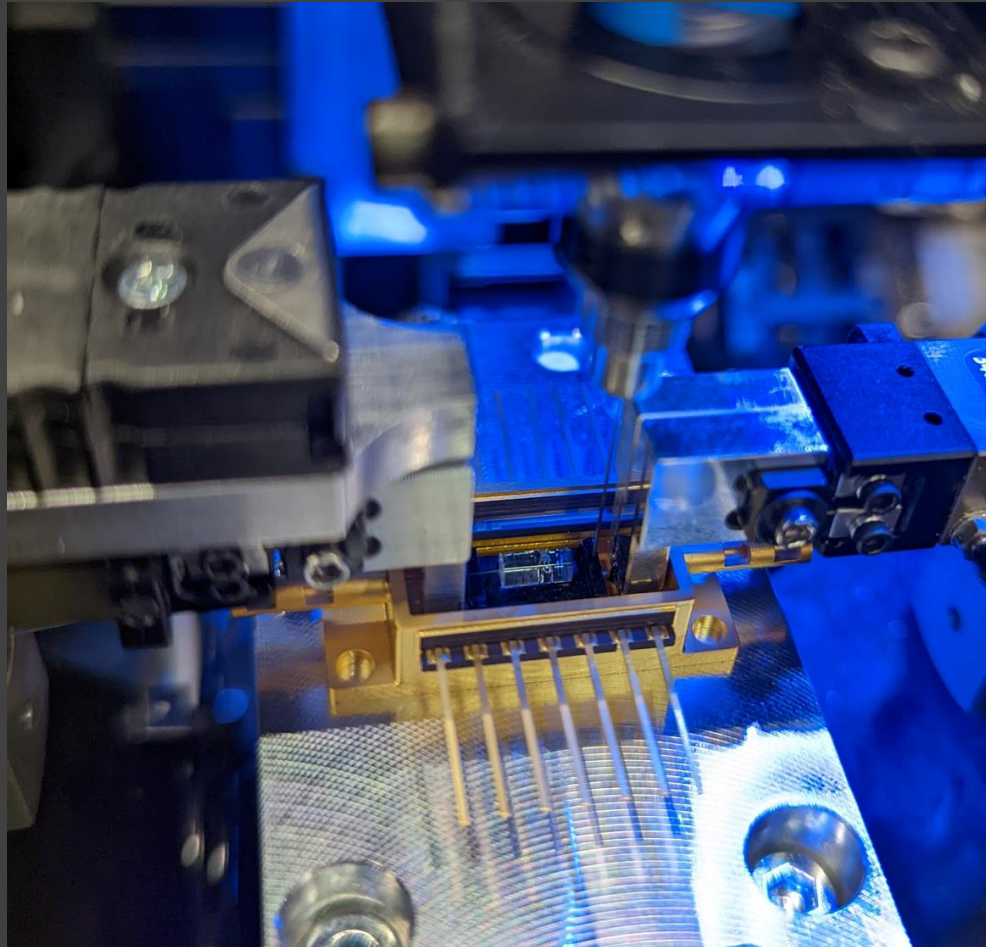
Coarse Power Scan

First light optimization 1

First light optimization 2



# PRECISION DISPENSING TOOLS FOR UV-CURING ADHESIVES



## DISPENSER OPTIONS

Precision Needle Dispensers

- Down to 1 nanoliter
- Wide viscosity range up to 100.000 cps
- Point and click drop on demand

Ultraprecision jet Dispensers

- Down to 300 picoliter
- In-flight drop volume calibration



# THANK YOU FOR YOUR ATTENTION

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