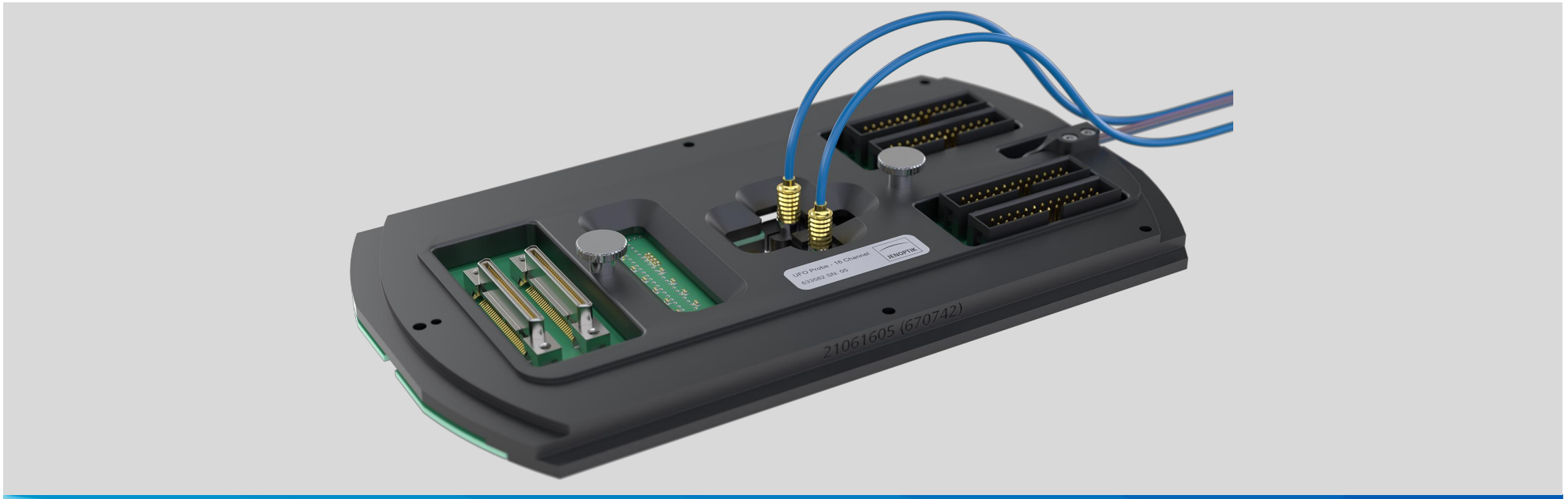
Not Just Chips

April 4-6, 2023

MEPTEC
THE NEXT GENERATION

www.meptec.org



JENOPTIK

MORE LIGHT

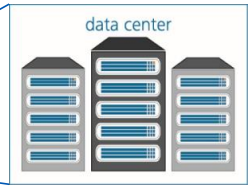
UFO Probe® Card: Enabling high volume data communication – solving the new challenges in PIC wafer testing.

Enabling high volume data communication…

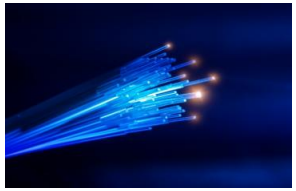
What can Jenoptik do?

It is all about optical communication…

Connected World

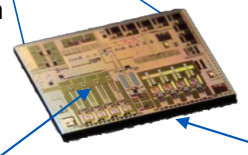


Higher data rates



Optical communication.

Signal conversion



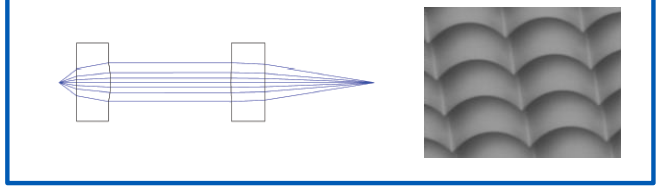
PIC as core component.

Courtesy of Sicoya

Optical Coupling

Micro-optics for coupling

- Fiber-to-PIC
- Laser-to-PIC
- Fiber-to-Fiber

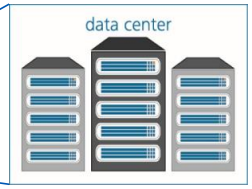


Enabling high volume data communication…

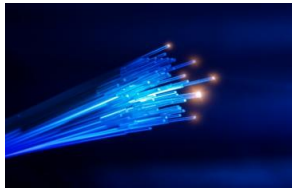
What can Jenoptik do?

It is all about optical communication…

Connected World

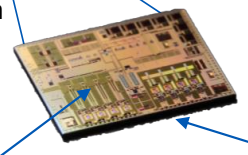


Higher data rates



Optical communication.

Signal conversion

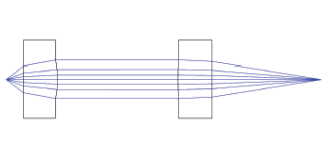


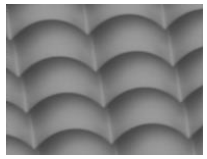
PIC as core component.

Courtesy of Sicoya

Optical Wafer-level Testing

Optical Coupling



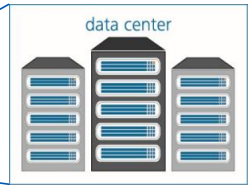


Enabling high volume data communication…

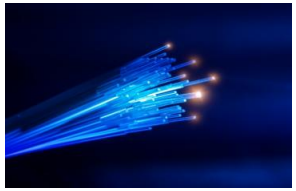
What can Jenoptik do?

It is all about optical communication…

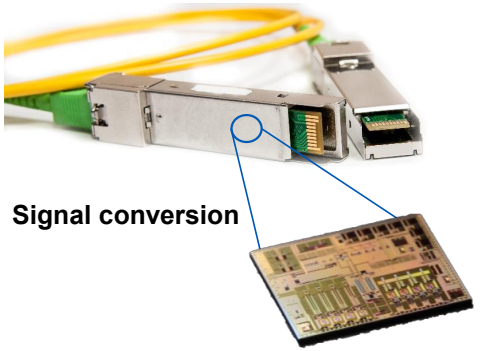
Connected World



Higher data rates



Optical communication.



Signal conversion

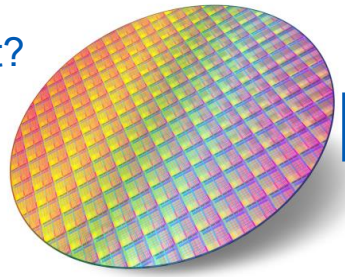
PIC as core component.

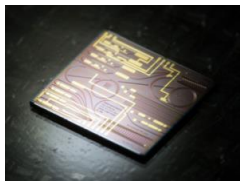
Courtesy of Sicoya

Optical Wafer-level Testing

Market and Application

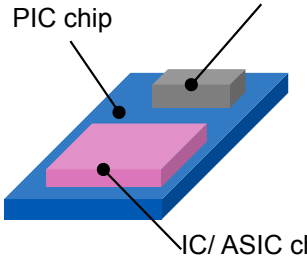
PIC fabrication on wafer level – Where to test?



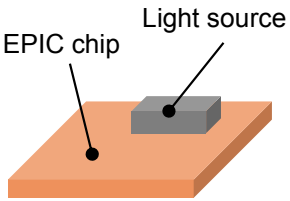


Photonic integrated circuit

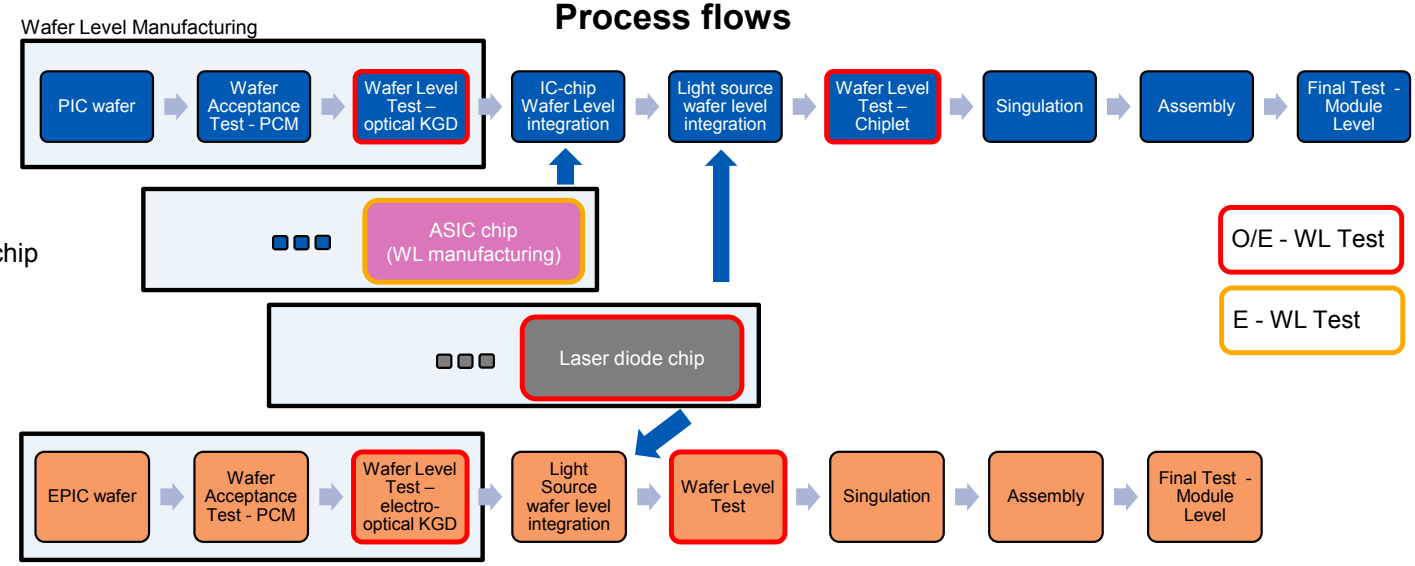
Heterogeneous integration



Monolithic integration



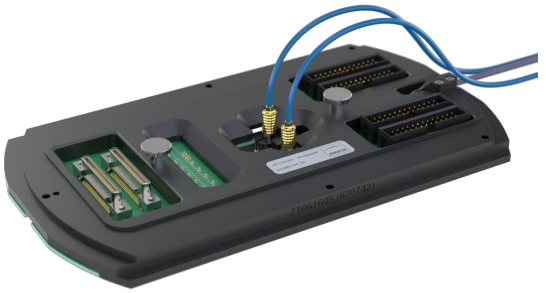
Process flows



Market and Application

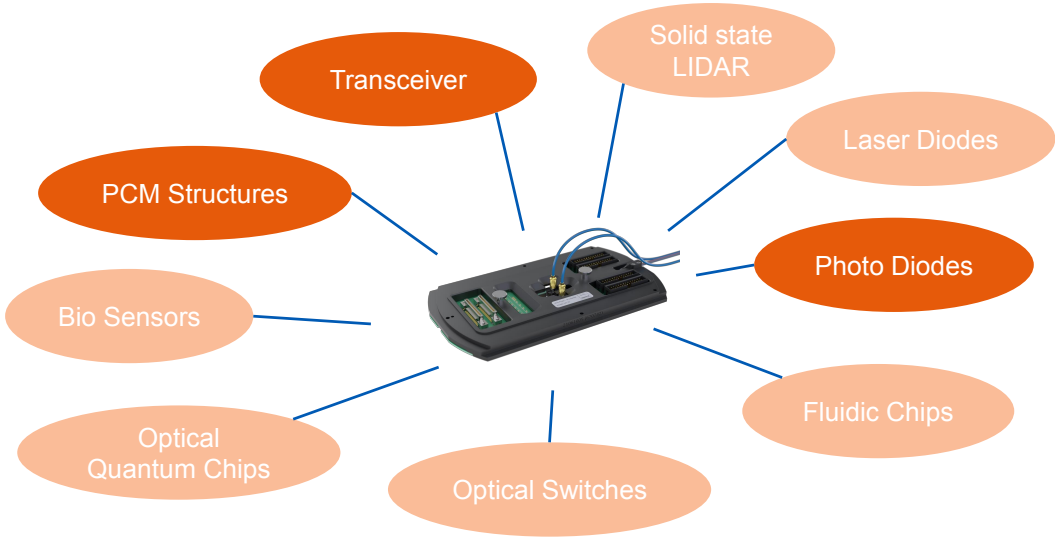
UFO Probe® - ultra-fast opto-electronic probe card.

JENOPTIK's solution for high-volume wafer level test of photonic integrated circuits (PIC).



Current PIC Test Applications in focus

- **Optical Transceivers** – ramping up
- Monitoring PIC manufacturing process (PCM)



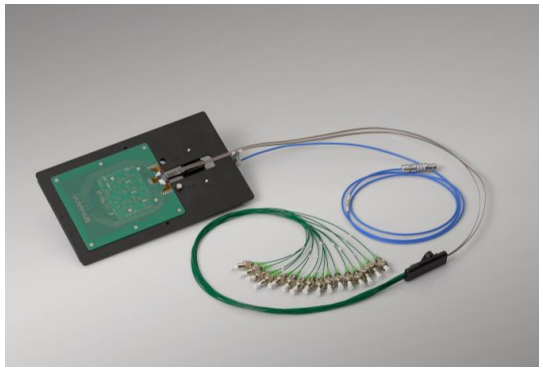
UFO Probe® Card – Jenoptik's solution for PIC WLT

USP

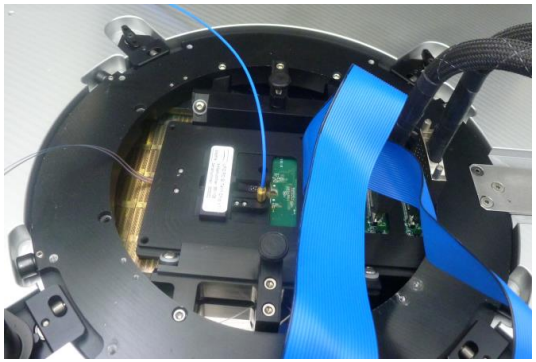
- **Plug & Play' ready** for existing **standard IC wafer probers** and **automated test equipment**
- **No active alignment** time per chip
- **Parallel qualification** possible → multi-DUT regime
- Operated by same personnel as standard IC equipment

Benefits

- optical and electrical probe integrated in **a single probe card**
- Compatible to existing interfaces
- **Optics** that works **alignment insensitive** and
- Deals with **‚coarse' prober alignment tolerances**
- Scalable solution with simple handling



Source: Accretech

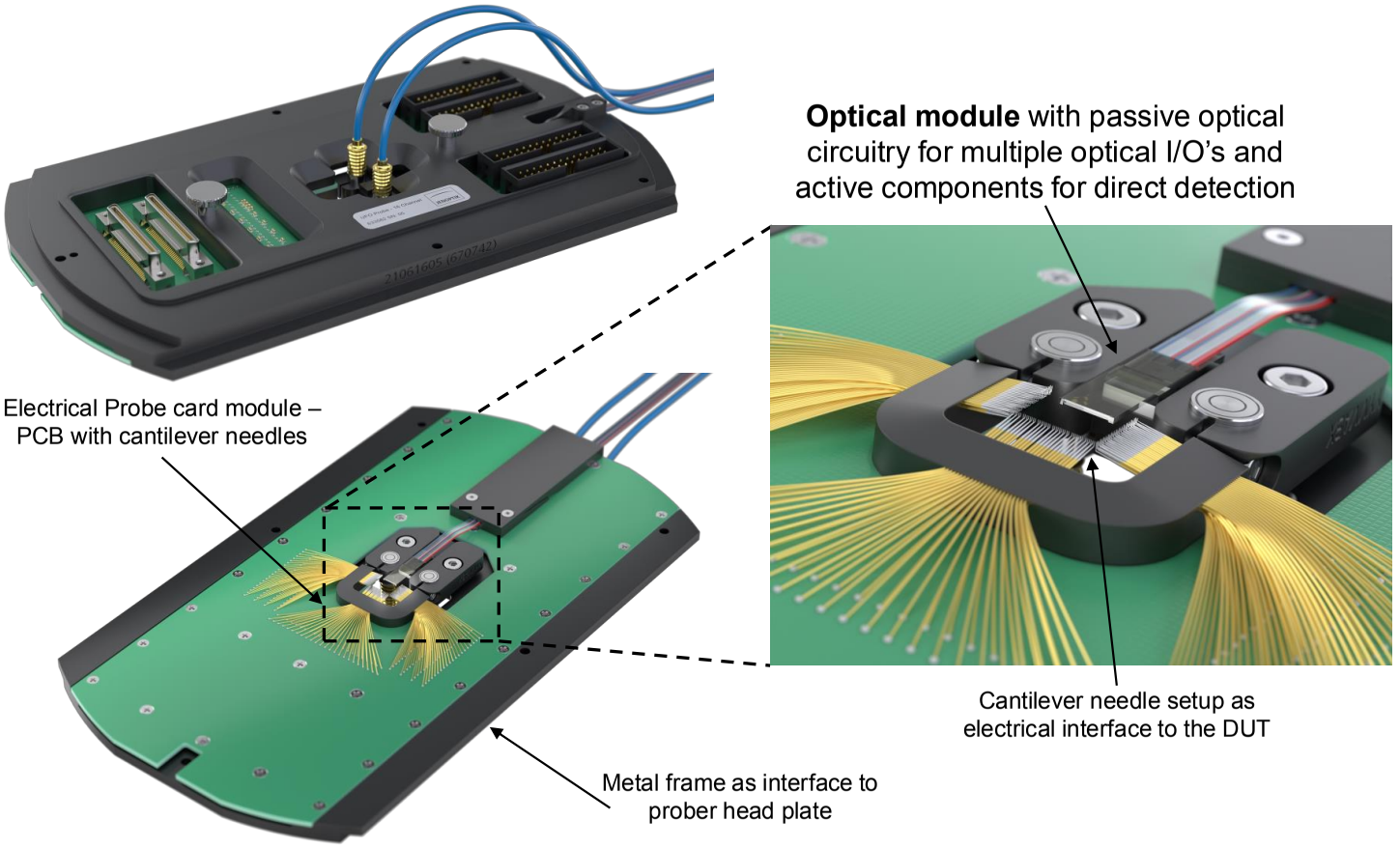


Courtesy of Rood Microtec

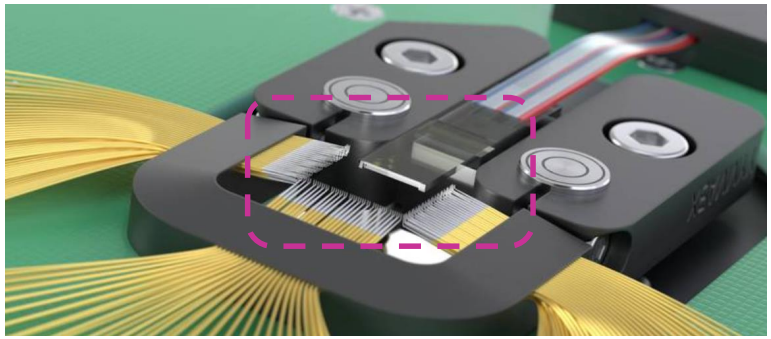
UFO Probe® Card – Key Figures

Key figures

- Standard prober interface (Eurocard format)
- **Monolithic optical module with 16 optical I/O's** (up to 32ch)
- Alignment insensitive optical coupling for **vertical emitting** PICs
- Simultaneous optical and electrical probing
- Utilize **proven needle technology** (partnering with probe card manufacturer)

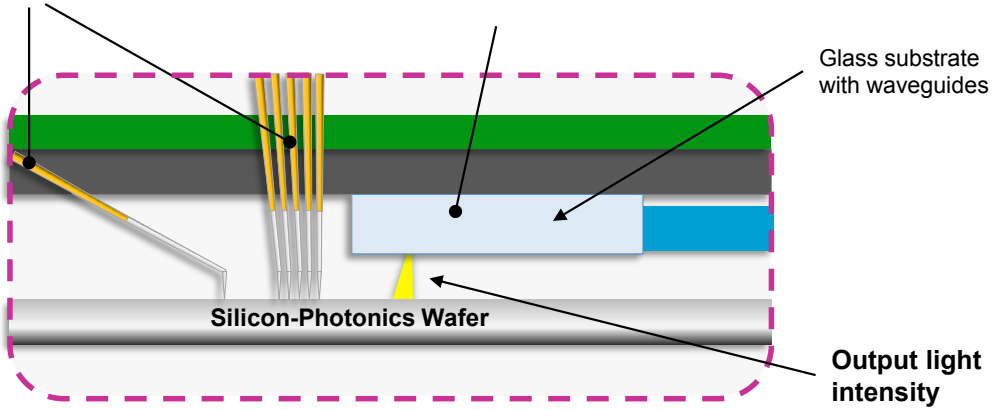


UFO Probe® Card – Working Principle

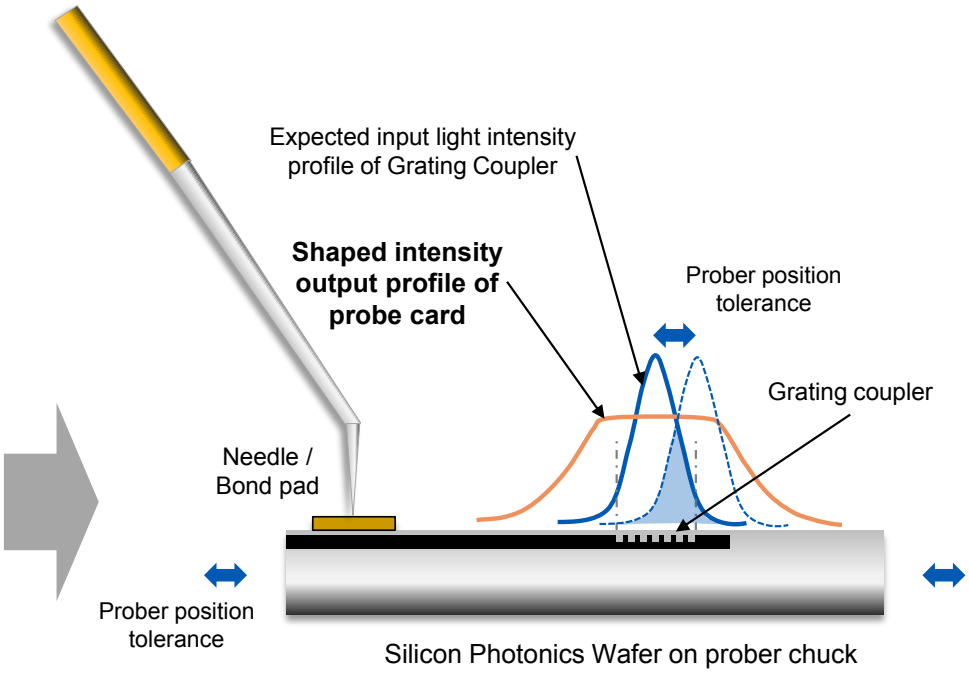


Electrical Probe Module
PCB with cantilever needles

Optical Probe Module with passive optical circuitry for multiple optical I/Os

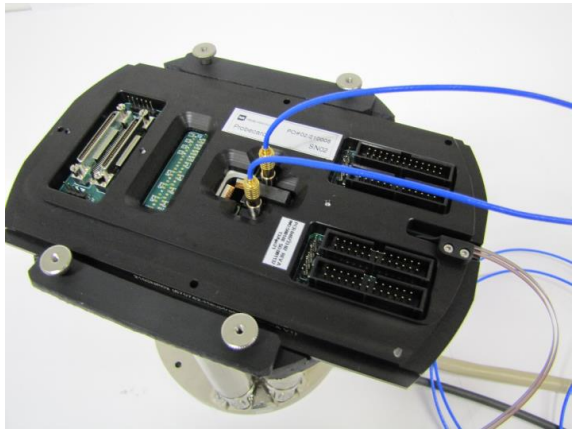


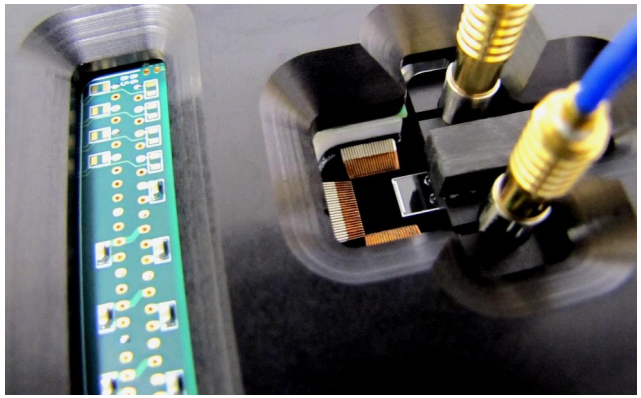
Optical concept compensates prober alignment tolerances.



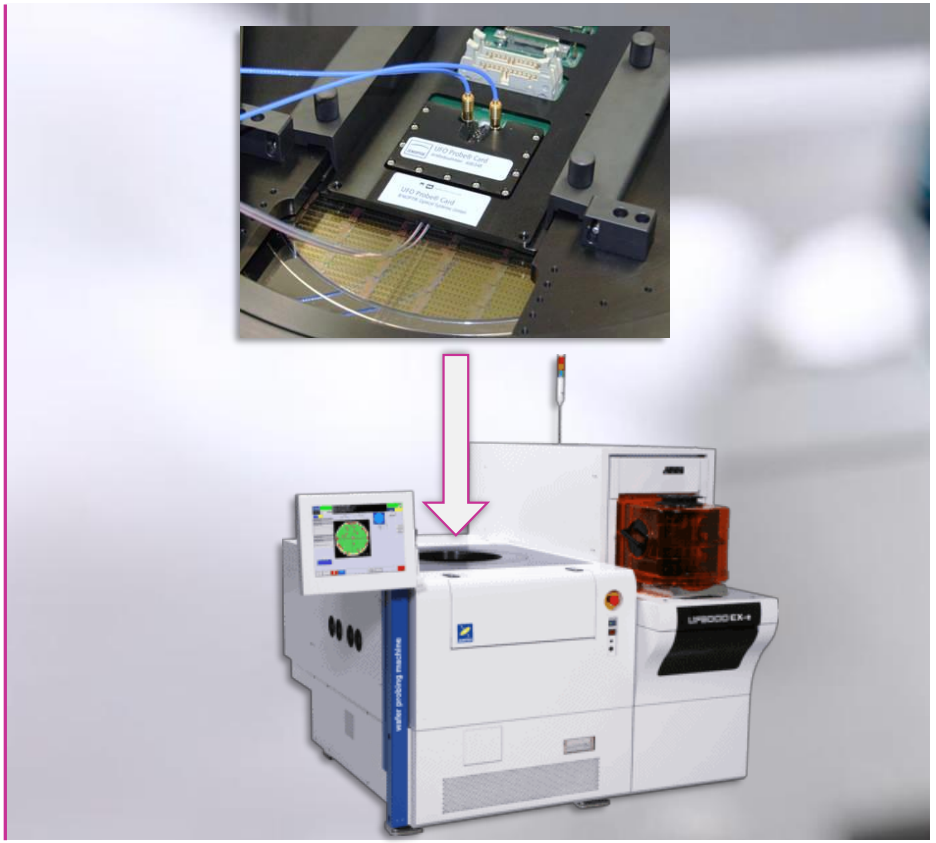
UFO Probe® Card – Integration in existing IC infrastructure

UFO probe card in Eurocard format





Detail of electrical and optical contact module



UFO Probe® Card – Wafer-level Test of Customer Device

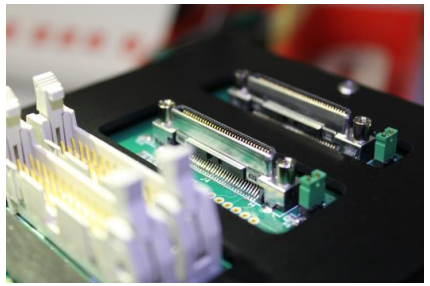
Wafer-level test of transceiver device

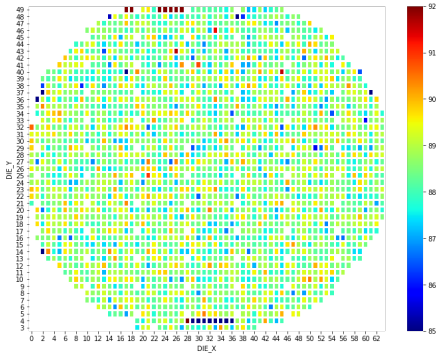
– Running as **final production test in a customer setup**

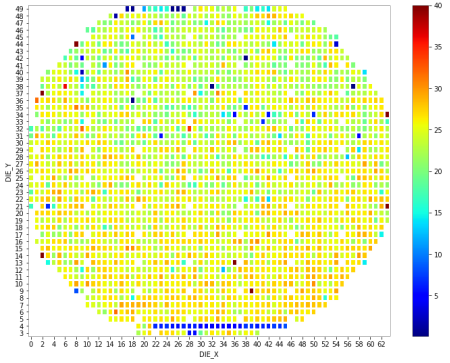
– RX, TX, alignment channel and comprehensive electrical tests in a **single touch-down**

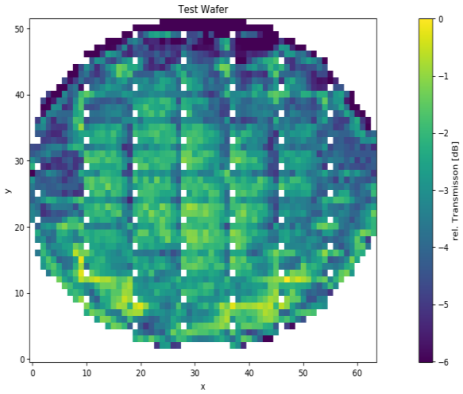
– **1x alignment per batch**, no additional alignment per chip

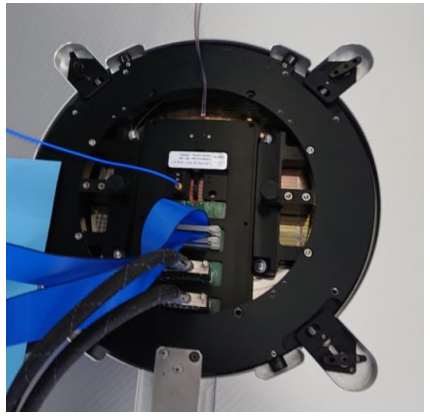
– Example of wafer map for Contact Resistance, Receiver supply current and optical alignment channel







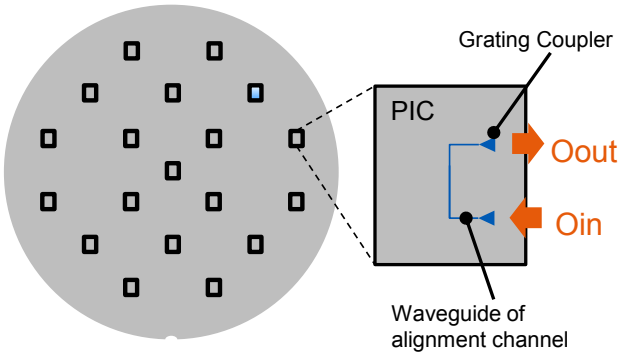


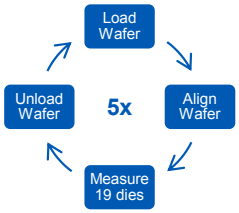


UFO Probe® Card – Measurement capabilities

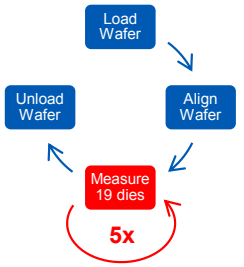
Verification of test capabilities under realistic conditions:

- Measurement of **insertion loss** of an optical alignment channel
- 19 different chips, spread over the complete wafer
- 5 repetitions of each measurement with and without wafer load

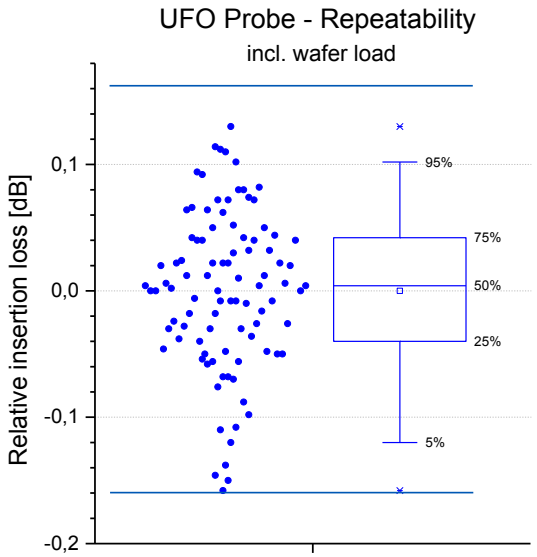


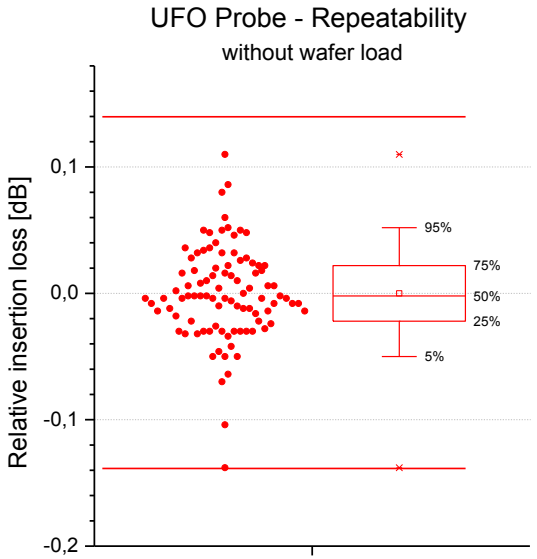


Max. : ± 0.16dB
95/5%: ± 0.12dB



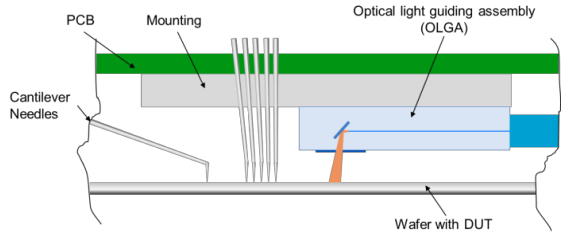
Max. : ± 0.14dB
95/5%: ± 0.06dB

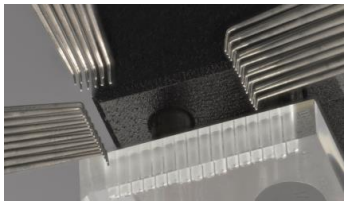




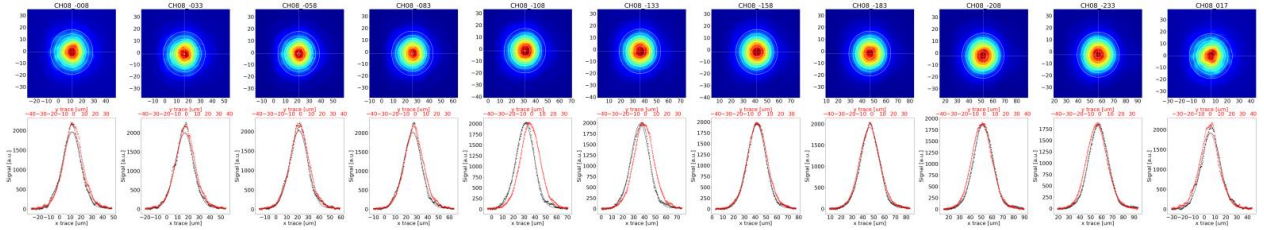
UFO Probe® Card – Full characterization of Optical Module

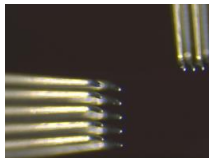
- **All optical channels**
  - Beam profile in different
  - Beam X,Y position and angle
  - Divergence
  - Wavelength dependency
  - Polarization dependency
  - Insertion Loss
- **Electrical needles**
  - Position
  - Relative position to optical channels
  - Tip quality
  - Electrical contact
- **PIC qualification**
  - Exit beam profile and parameters of PICs vs. input wavelength, polarization and propagation distance



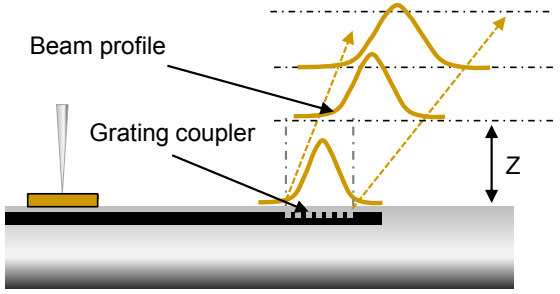


Beam profiles of Optical Module in Z-scan





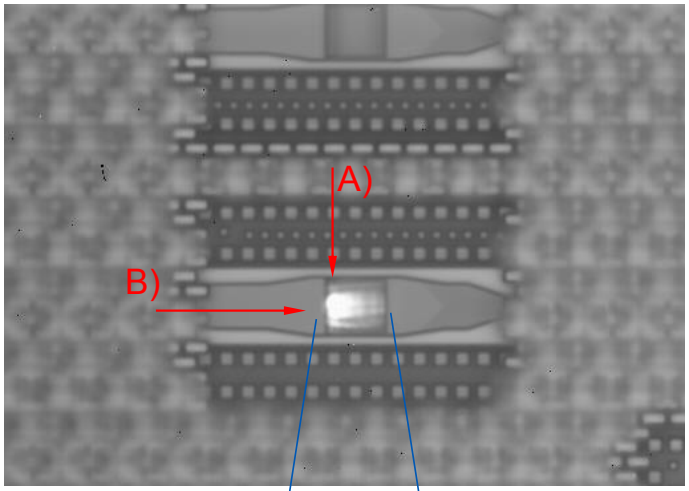
Different needle tip profiles



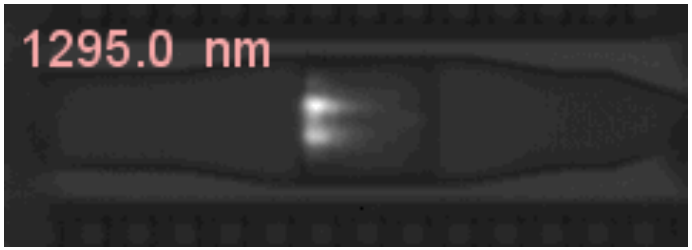
Beam profile of PIC Exit Channel in different Z-heights

PIC Qualification capabilities at Jenoptik

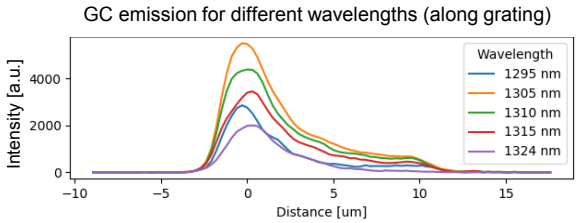
Emission profile of grating couplers at diff. wavelengths



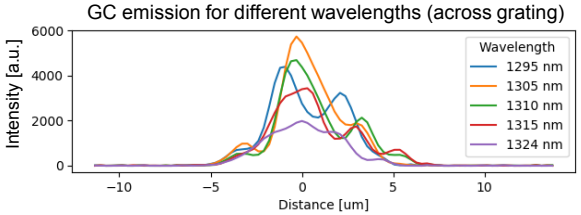
Wavelength Sweep
(run presentation to see video)



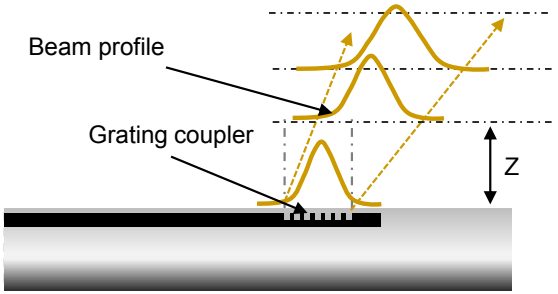
A) Beam profiles across GC

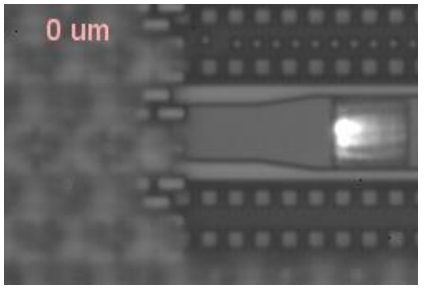


B) Beam profiles along GC



Beam profile of PIC Exit Channel in different Z-heights (WD = working distance)





(video, click to start)

UFO Probe® Card – General specifications

Specification	Current Generation	Next Generations
Device under test	Electronic and photonic integrated circuit (EPIC), Optical Transceivers for Datacom and Telecom Applications	EPIC for Transceivers, Sensors, Biosensors, LIDAR
Electrical needle technology	Cantilever, Vertical	Advanced
Optical coupling principle at DUT	Grating coupler	Grating coupler
Number of Optical Inputs/Outputs	Up to 32+	~200
Pitch OI/OO	250µm, 127µm	Typ. 250µm / 127µm, and non-standard
Layout configuration of optical OI/OO arrays	1D-Linear array with same direction of I/Os	Freely configurable (2D)
Coupling Angle	Range from 0-20°, typ. 0° and 11.6° in air	Range from 0-20°
Wavelength	1310nm and 1550nm	VIS to NIR (U-Band)
Insertion loss measurement	Repeatability: ~ 0.3 - 0.5dB	Repeatability Target: 0.1dB
RF-Measurement	Cantilever: up to 100 MHz, Vertical: GHz (digital), depending on specific needle type	Upper GHz range, depending on needle type
Number of PICs measured in parallel	1	Multi-DUT
Prober interface	Europa Card format	Europa Card format, ATE/ tester interfaces

Summary

UFO Probe®

The only commercially available solution for **High Volume PIC Testing** that runs on **standard equipment**!

Fab Proven!

Platform ready for other applications.

Supporting the digital world.

COPYRIGHT NOTICE

www.meptec.org

MEPTEC
THE NEXT GENERATION