

光电子集成电路(PIC)测试技术与EXFO晶圆级测试方案介绍

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EXFO 大中华区及日韩区

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EXFO

光电子集成电路 (PIC) 的市场与应用



CONSUMER
PRODUCTS

MEDICAL & BIO



AUTONOMOUS CARS

PHOTONIC PROCESSING
& COMPUTING



GOVERNMENT
& MILITARY

DATA COM

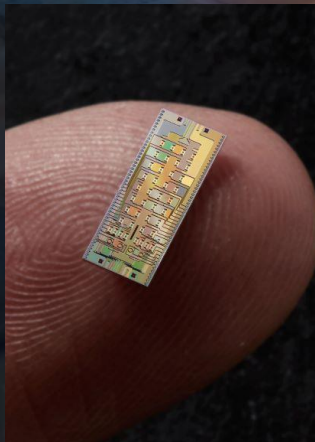


INDUSTRY 4.0

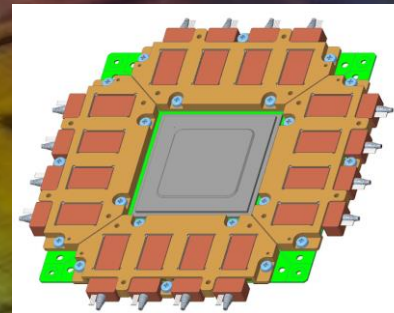
TELECOM (FTTx)



Wearable Spectrometer – Apple/Rockley



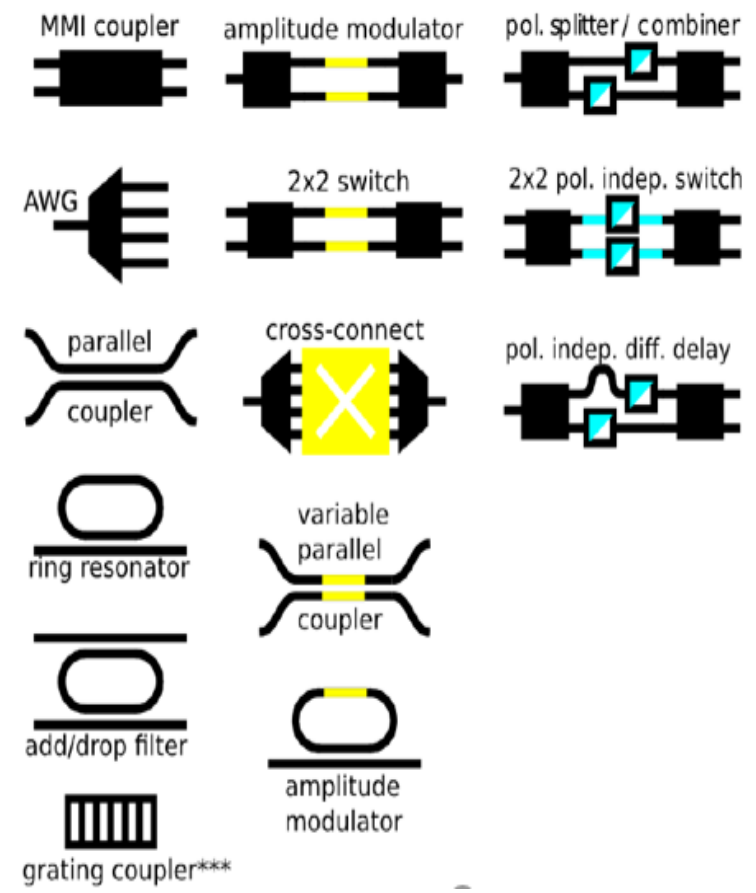
Quantum photonic chip (die) – Xanadu X8



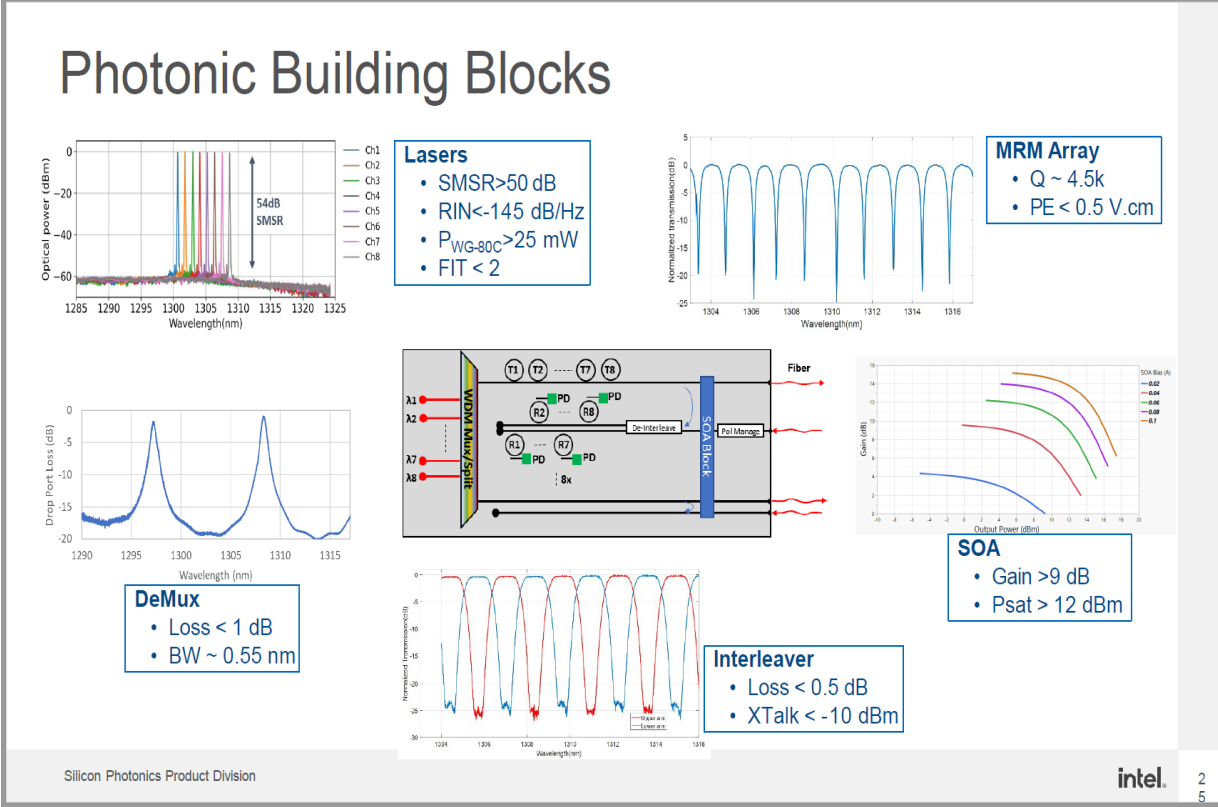
EXFO

硅光不同类型器件与系统

Typical SiPh component



CPO building block (from intel)



测试目标与挑战

Accurate / repeatable

Traceable results, no assumption or extrapolation.

Dynamic range

See the full spectral contrast in a single measurement.

Speedy

Minimize total testing time.

Integrated

Simple design easily connects to a system.

Flexible / scalable

Ability to add functions and features over time.

Automated

Full test control, quicker configuration.

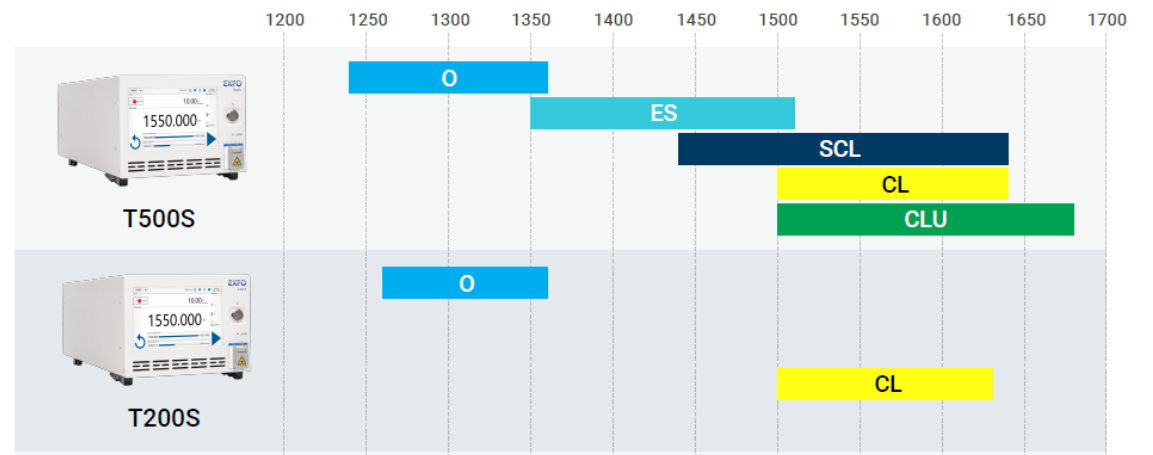
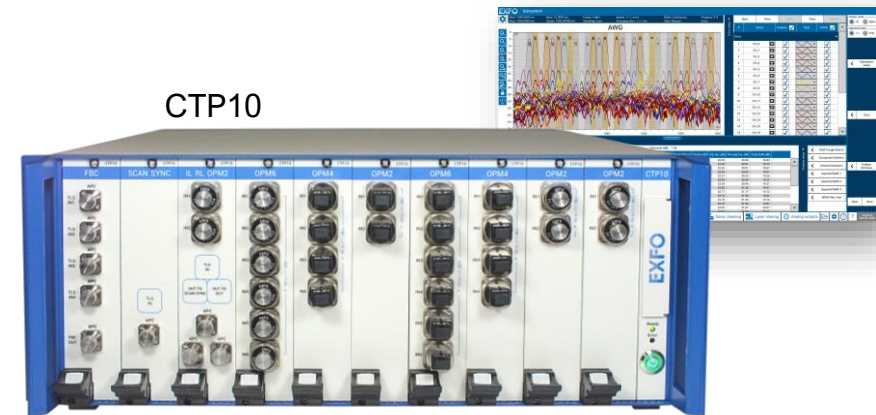
SPECTRAL TESTING RING RESONATOR

- 1240 – 1680 nm
- ± 5 pm acc, < 1 pm repeat
- 1 pm Resolution
- 70dB in a single scan
- 1dB/ μ s tracking

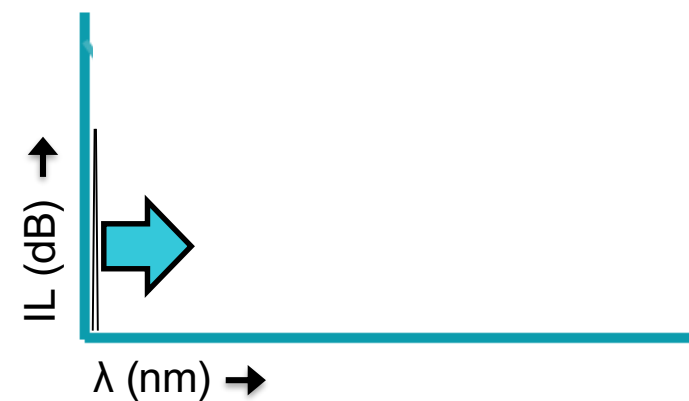
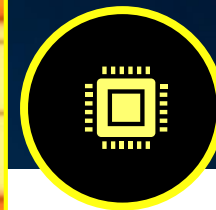


**High
Q-factor**

COMPONENT TEST PLATFORM & TUNABLE LASERS

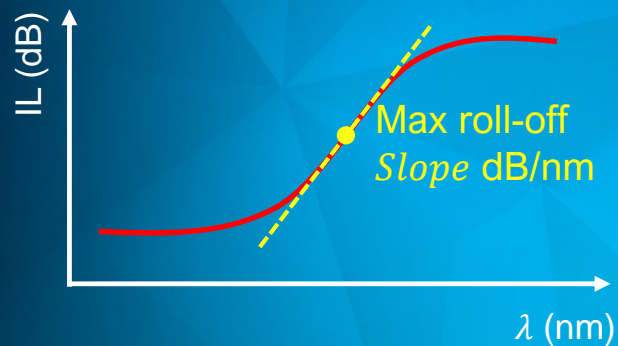


测试举例：先进器件的光谱测试



EXFO component testing solution

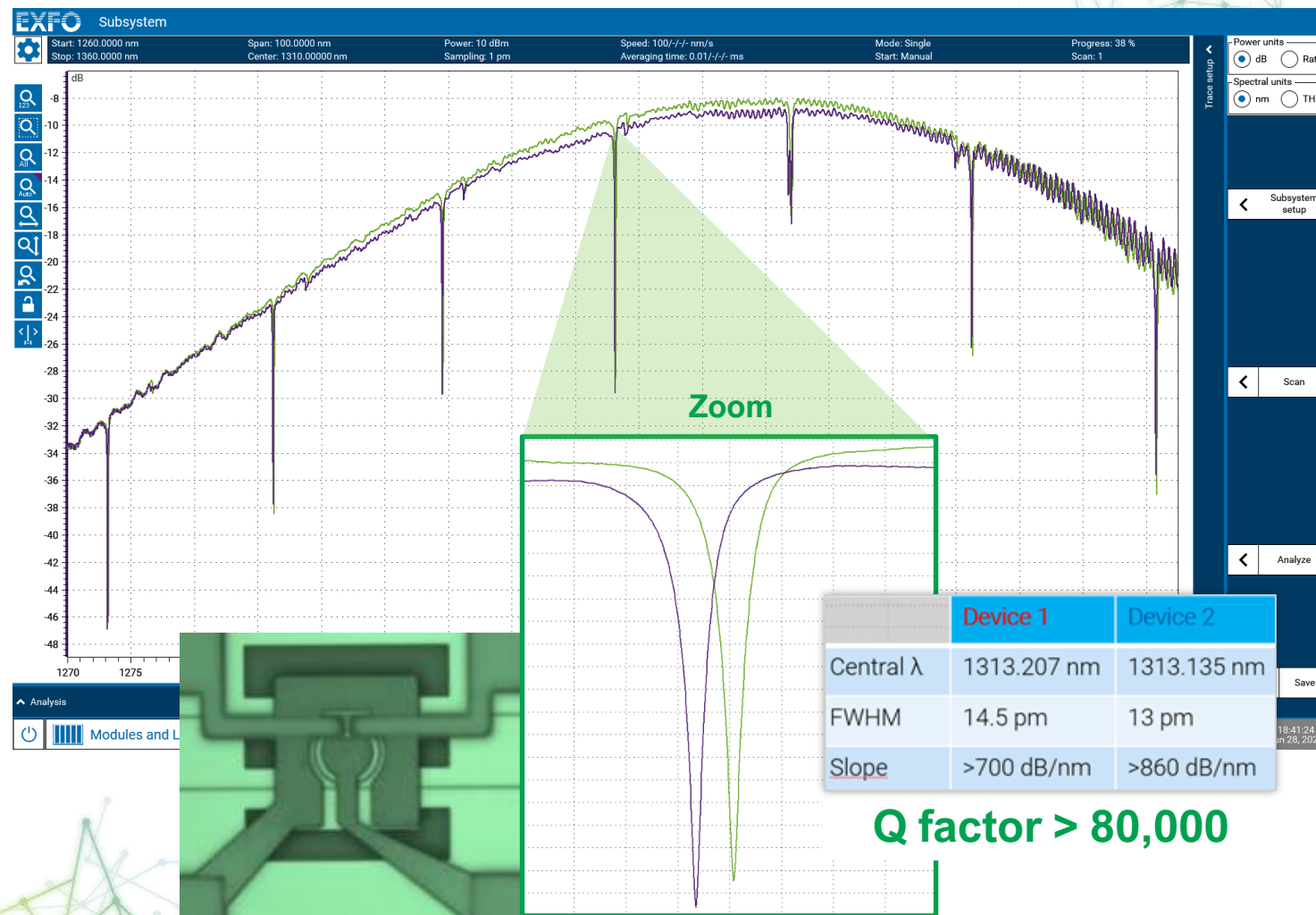
陡峭沿跟踪



Future
Proof

Slope measurement up to 10,000 dB/nm at 100 nm/s

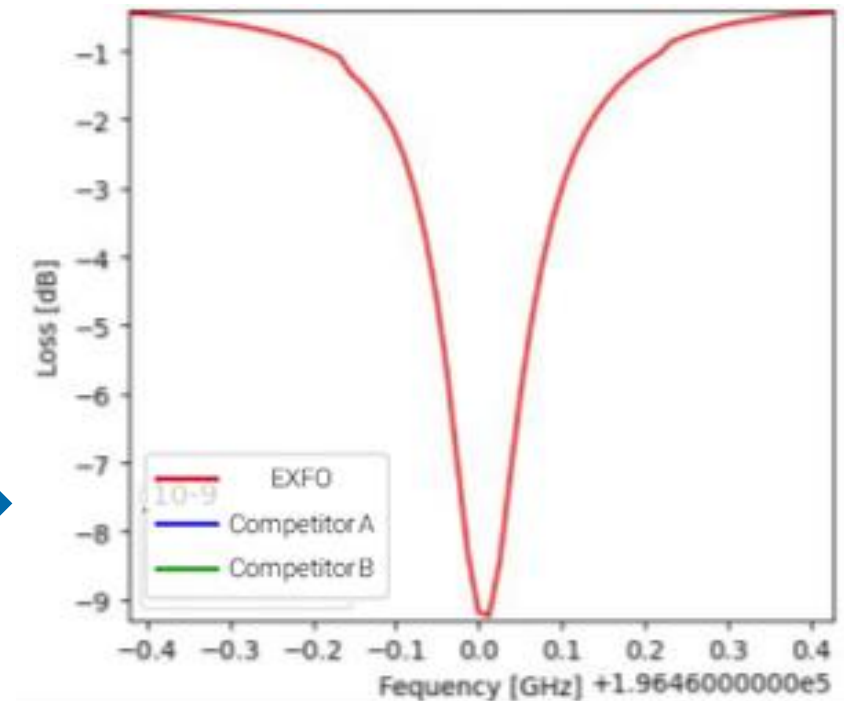
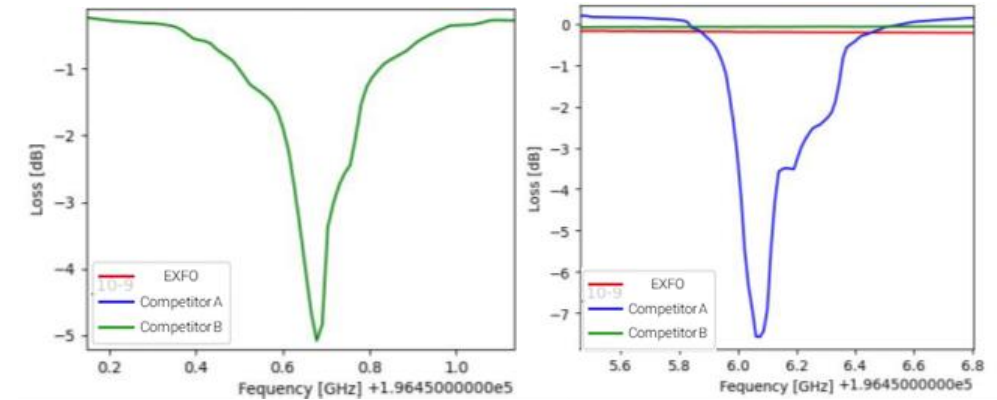
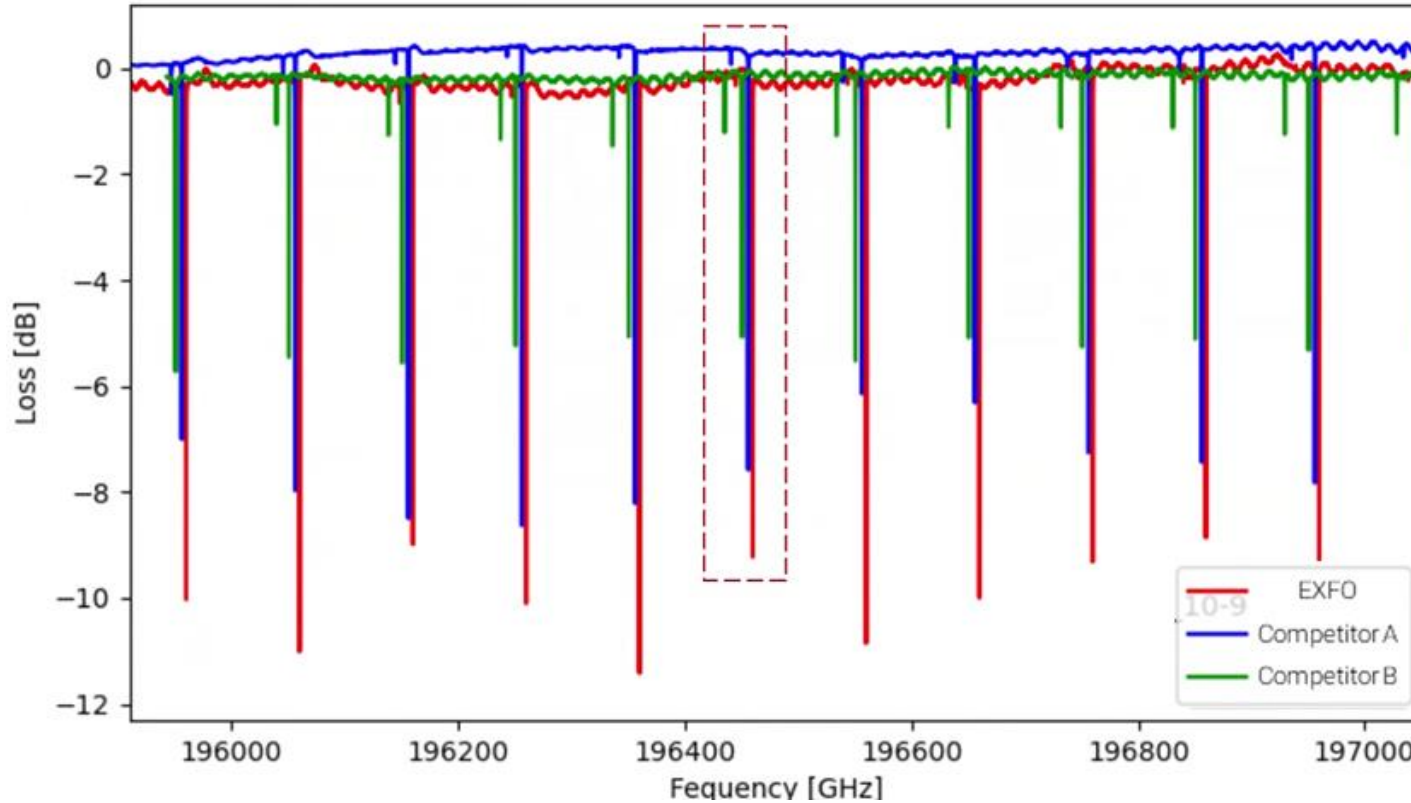
Future-proof measurements for high-Q ring resonators.



	Device 1	Device 2
Central λ	1313.207 nm	1313.135 nm
FWHM	14.5 pm	13 pm
Slope	>700 dB/nm	>860 dB/nm

Q factor > 80,000

Latest innovation: Sub-picometer tracking



Better Lorentzian shape with EXFO, faster!
Sub-picometer resolution down to 20fm

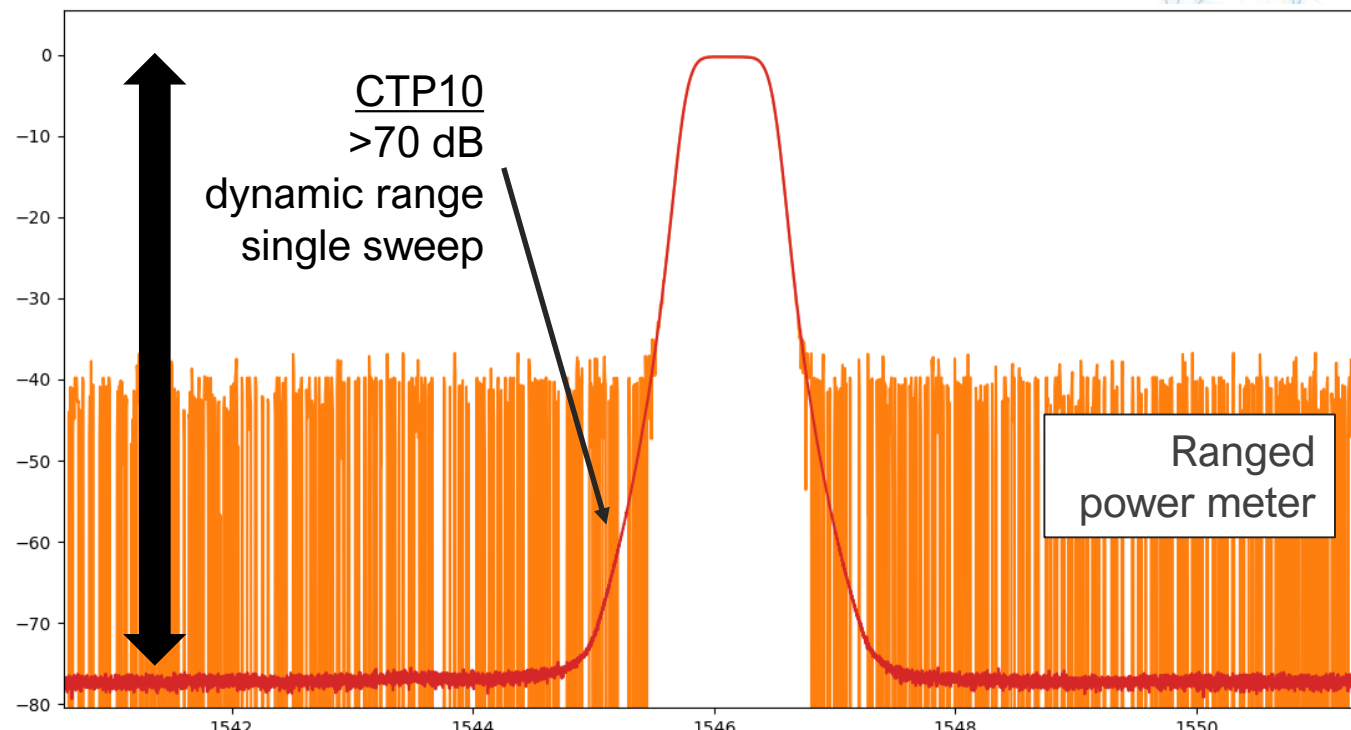
如何提升动态范围



**2 to 3x
speed
increase**

Range-free optical detectors

Single sweep measurement with >70 dB dynamic range ensures faster and more accurate measurements.



- 2 to 3 times speed improvement
- Single sweep, independent of system's repeatability
- No post-processing (trace stitching)

Latest innovation – PCMx module



T500S – Continuously Tunable Lasers



CTP10 – Component Testing Platform

Optical



Photocurrent

**Photocurrent
testing**

**Photocurrent Meter
Modules**



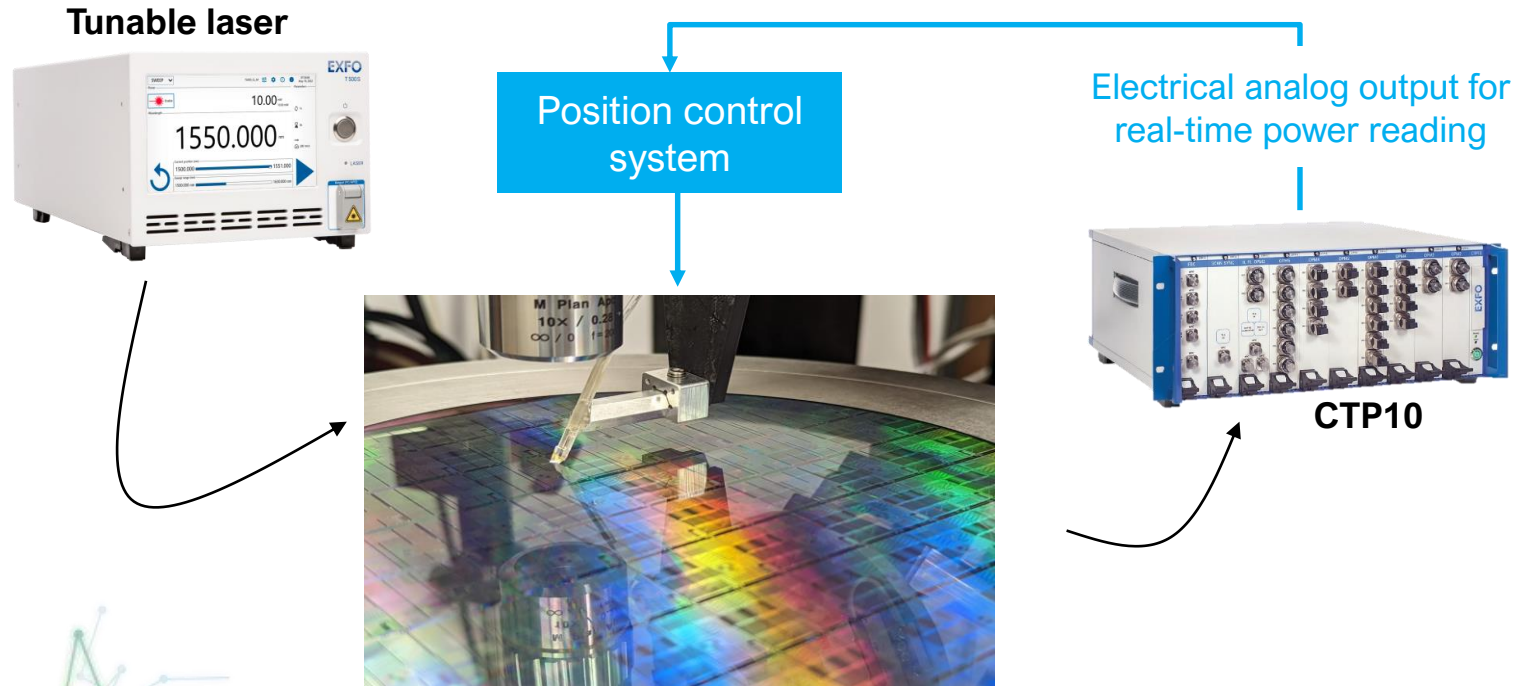
PIC测试需求: 速度与精度

Versatile optical testing

Multi-channel, from few to 100+ detectors with two CTP10

Multi-laser measurements with additional module

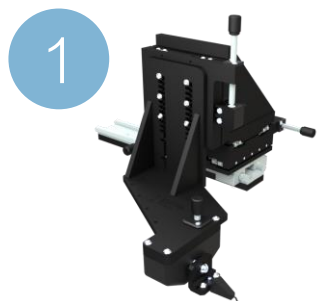
Analog output on powermeters, ideal for PIC alignment



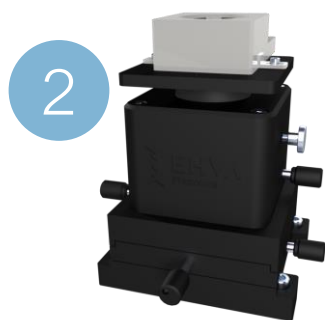
Flexible configuration on single-die station



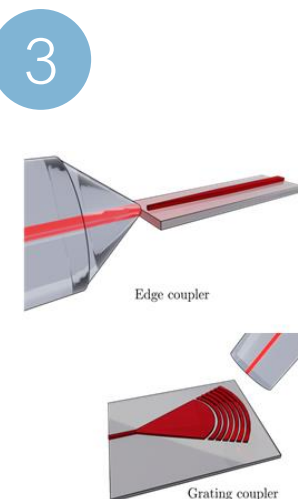
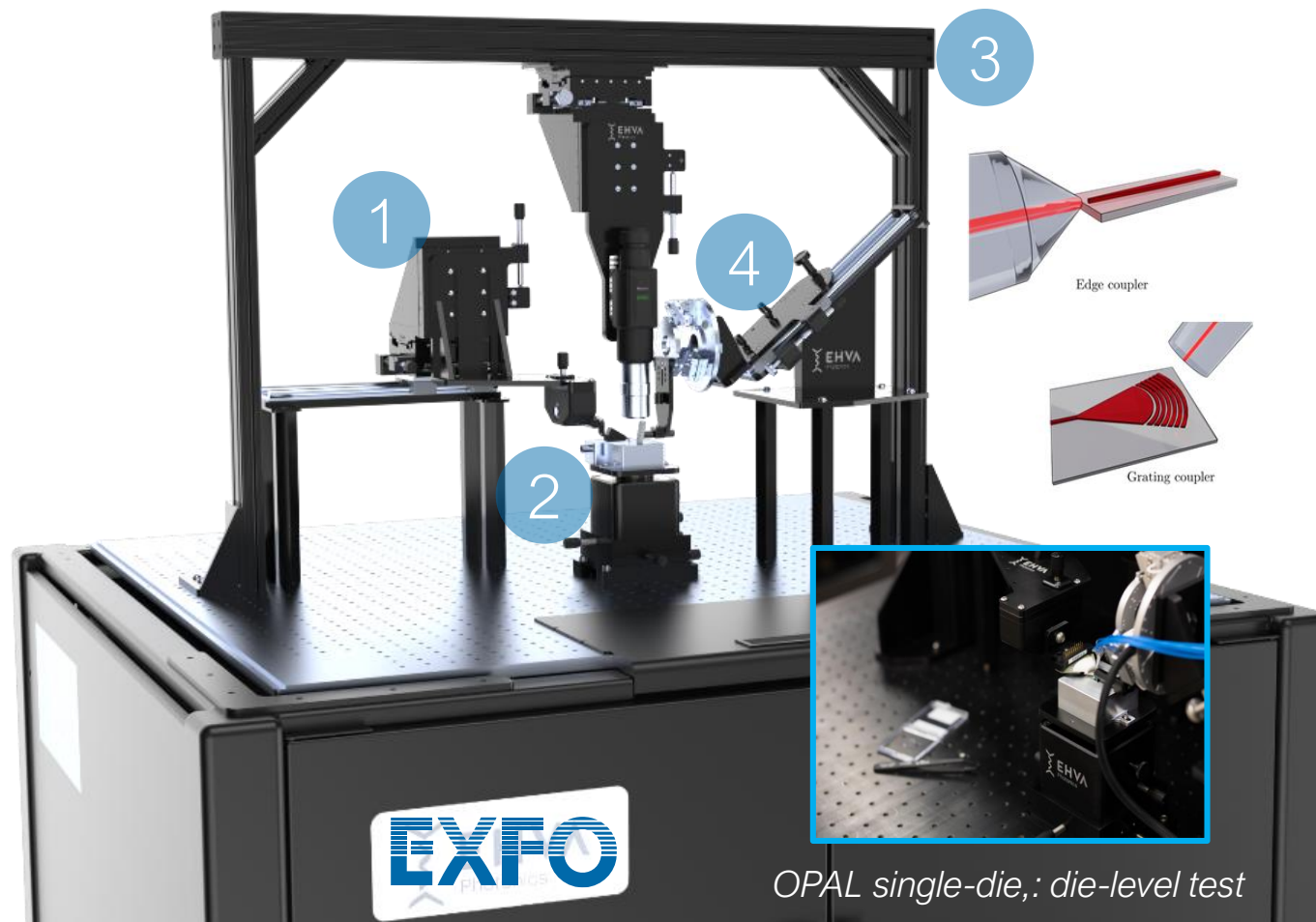
Semi-automated modular subsystems, fully compatible with wafer test stations



Electrical head:
Manual 4D translation stage
DC and RF probing



Single-die base stage:
Manual 4D translation stage
Vacuum (and thermal) chuck



Vision system:
Bridge and 3D translation stage



Optical head:
6D motion system and rail system
Surface and edge coupling

OPAL single-die, : die-level test

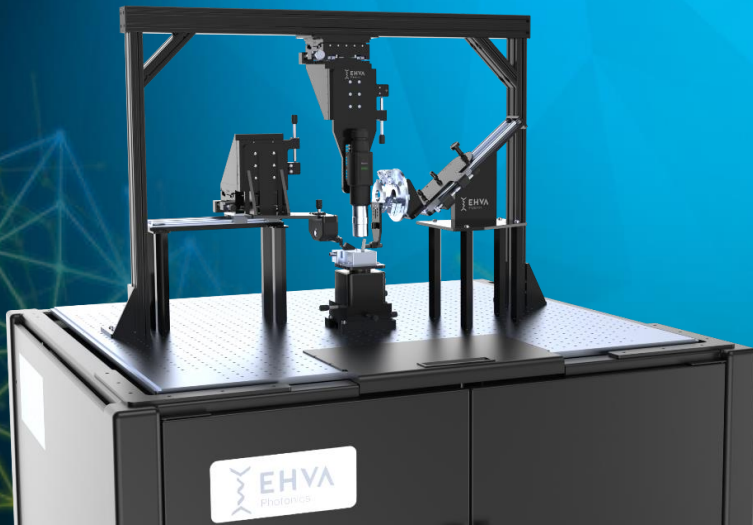
Covering single-die testing



Flexibility



Accuracy



Versatile configuration for E/O alignment

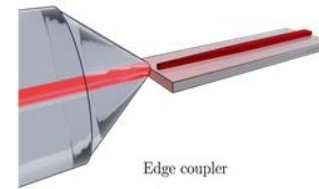
Choice of various probe handlers suitable for surface or edge coupling

Easy station configuration depending on E/O requirements

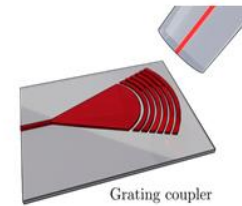
Thermal chuck as option



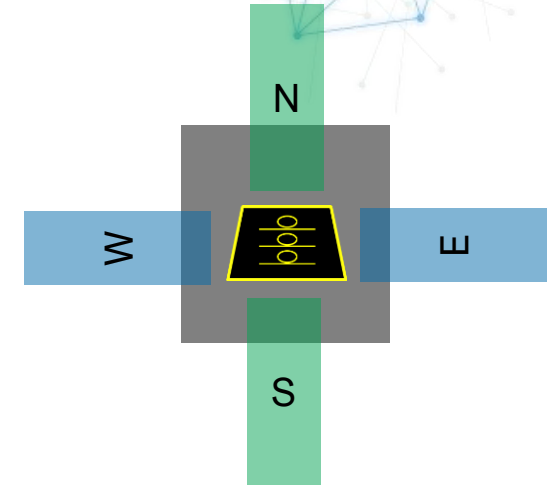
Optical



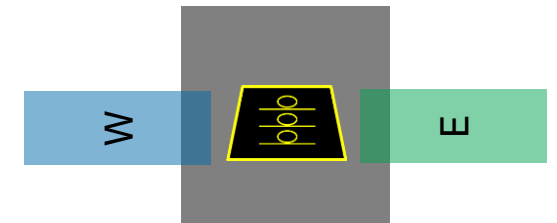
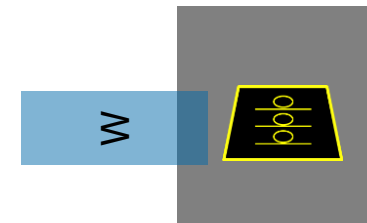
Edge coupler



Grating coupler



Electrical/RF



Easy to configure



Flexibility



Traceability



Speed

Single software for preparation, test and analysis

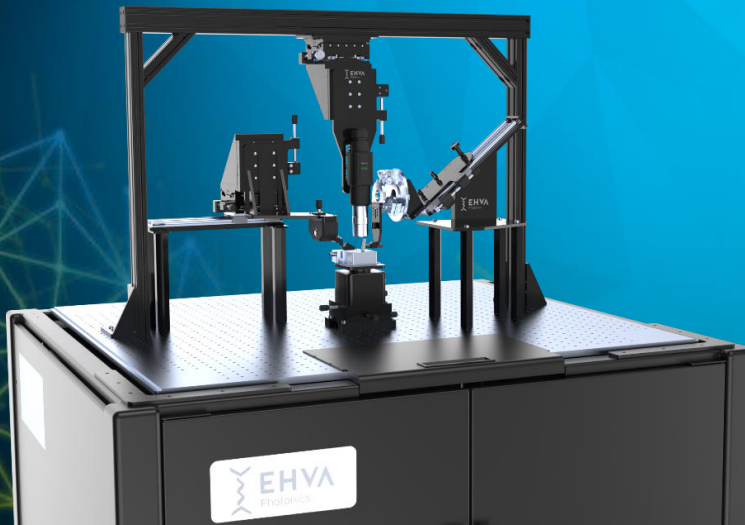
Automated flow from CAD file reading, chip parameter& test definitions, execution (movement, testing) and data analysis

Database management accessible to multiple collaborators

Easily save, find, sort and analyze results through machine learning

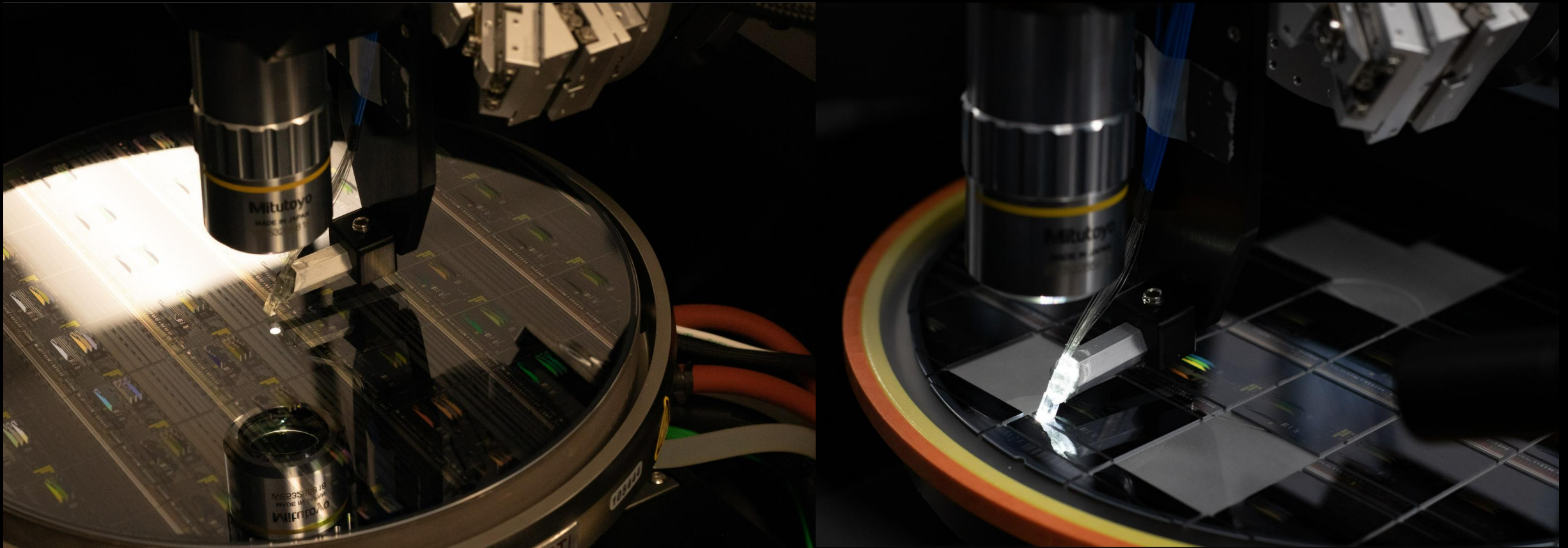


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727	11/03/2022 17:00	0.000000	Short15	D	2P_AEP_Refill50_L25	Optical spec	1520, 1520/010



Powerful capabilities, readily available

Stretch-tape and multi-die



Save many steps!

Trench coupling capability



Scalable



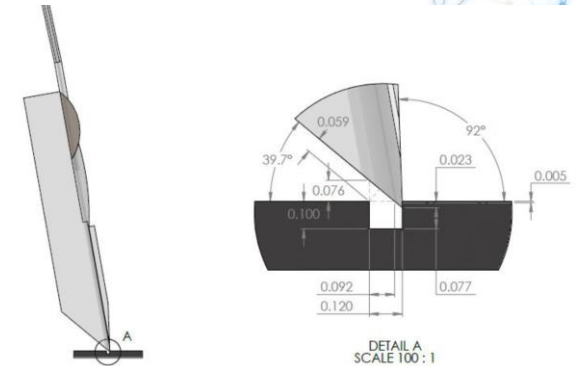
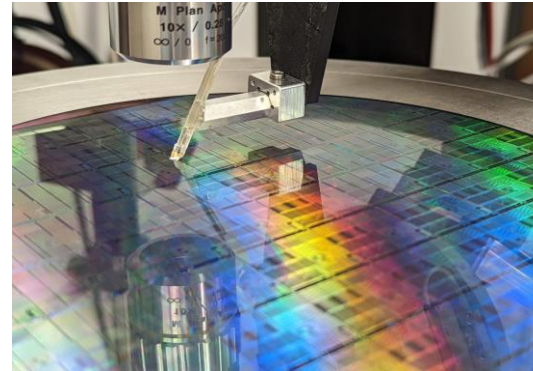
Accuracy



From die to automatic wafer-level testing without compromising performance

Test directly onto the wafer, even with trench coupling instrumentation

High accuracy and repeatability key to assure no collisions during wafer test

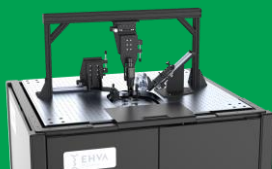


EXFO

R&D grade instruments, ready for integrated photonics volume production

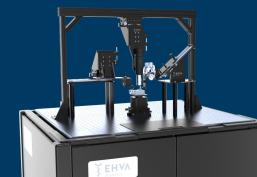
Probe station

OPAL
Wafer



OPAL Edge
coupling

OPAL
Single Die



Optical test
platform

Light sources, VOA, opt.
switch, OSA, power meters



LTB-12



OSICS

Matrix switch



MXS-9100

LAB-ON-A-RACK – PASSIVE + ACTIVE

Swept tunable lasers



T200S



T500S

Passive optical
component testers



CTP10



CT440

SPECTRAL – PASSIVE COMPONENT

Optical spectrum
analyzer



OSA20

Tunable filters

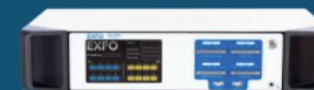


XTA-50

XTM-50

SPECTRAL – ACTIVE COMPONENT

BER tester



BA-4000

Sampling scope



EA-4000

Clock recovery



CD-4000

TRAFFIC ANALYSIS

PILOT – Full automation software

EXFO