Physik Instrumente

Key to a Cost-Effective Photonics Manufacturing & Test Strategy

Scott Jordan
Head of Photonics
PI

The PI Group

Precision Automation, Nanopositioning, Piezo Technology

- ~1700 Employees
- 15 Subsidiaries
- Design & Service Centers in USA, Asia, Europe
- >100 man Years of Alignment Expertise

- Privately Owned – Not Driven by Quarterly Results
- Focused on Long Term Relationships w/Customers & Suppliers

Americas
North America
Central America
South America

Europe
PI UK
PI France
PI Italy
miCos Iberia
PI Benelux

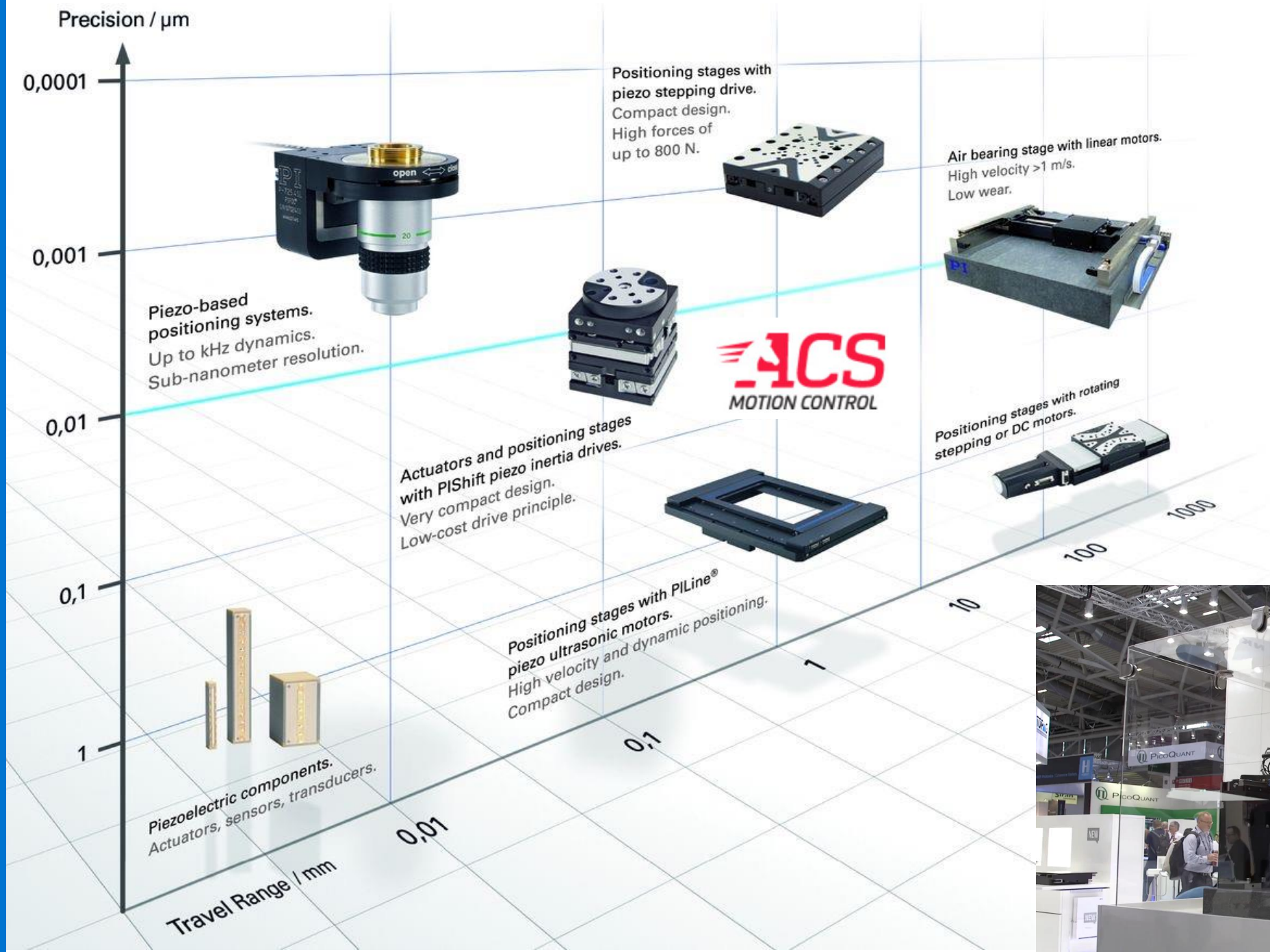
Germany
PI Karlsruhe
PI Ceramic
PI miCos

Israel
ACS MOTION CONTROL

Asia
PI Japan
PI Shanghai
PI Singapore
PI Taiwan
PI Korea

50 YEARS ENABLING INNOVATION SINCE 1970

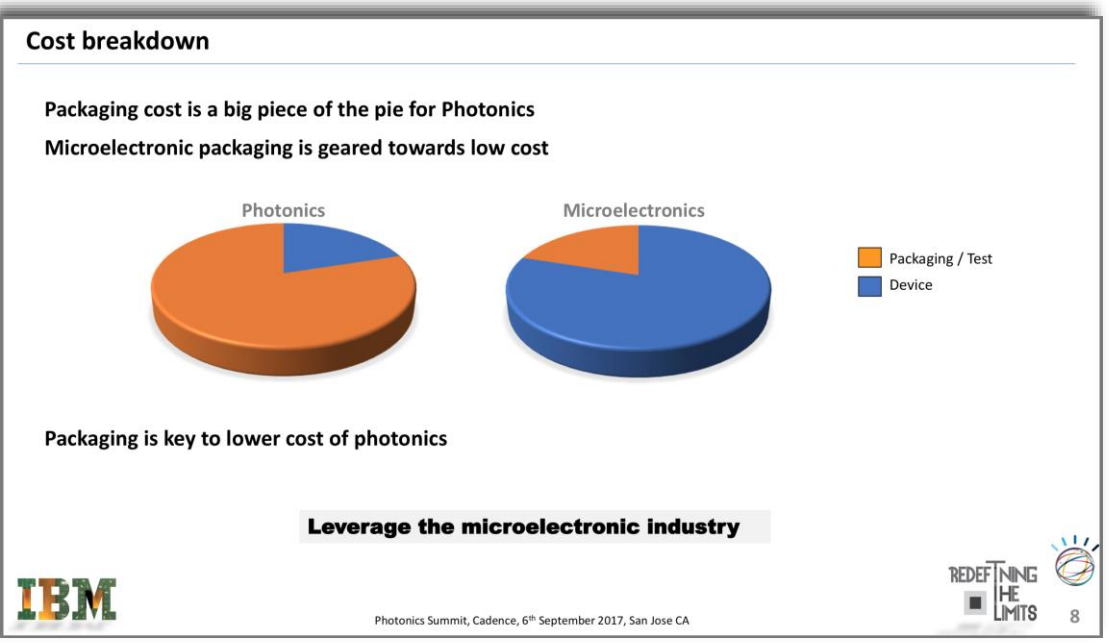
PI's spectrum spans the world of ultra-precision



PI

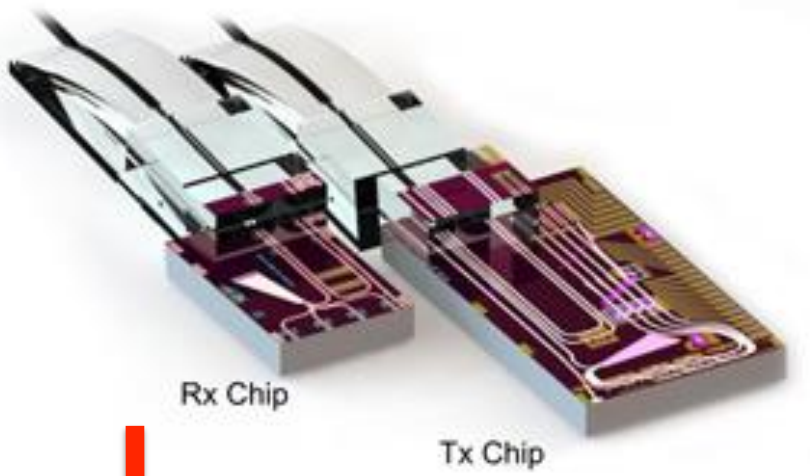
PI's Engineered Systems Group Builds World-Class Automation Platforms

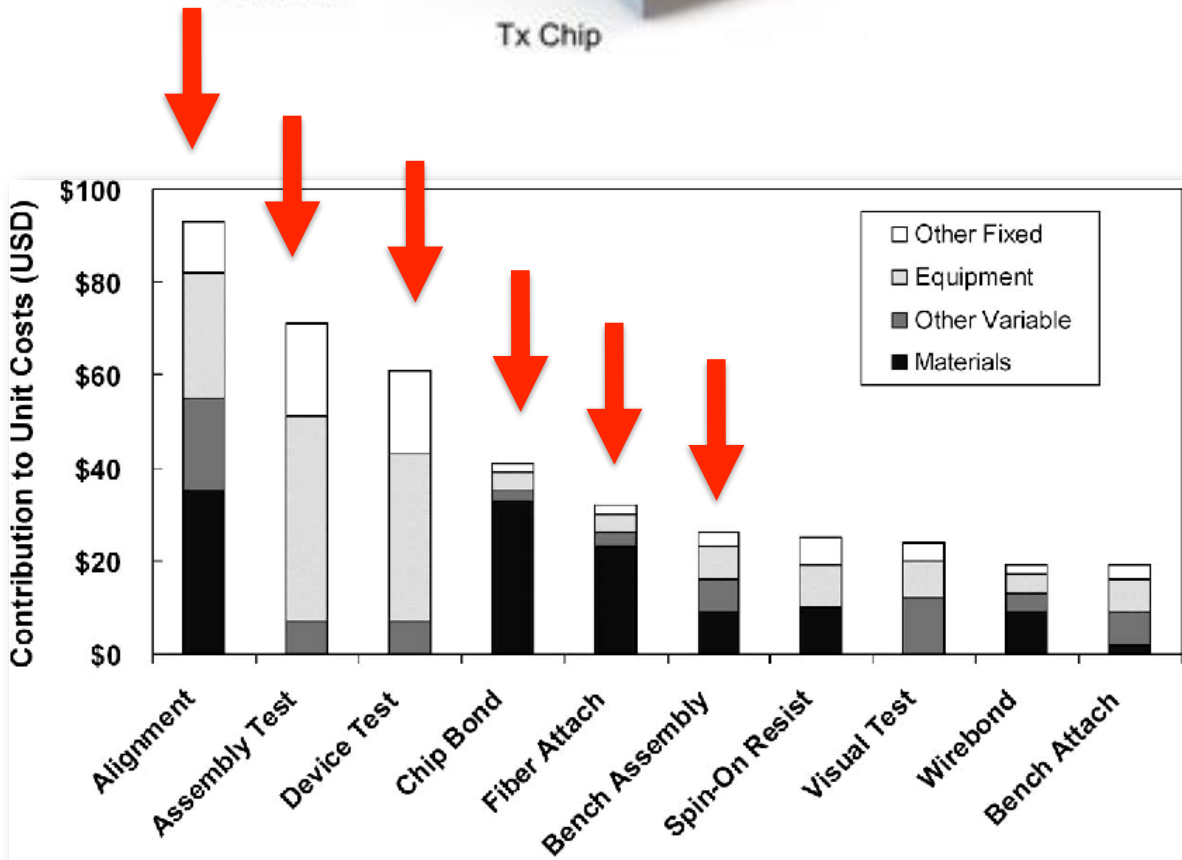
Alignment: The Repetitive Cost



"Automated High-Throughput Assembly for Photonic Packaging", Barwicz et al, *Photonics Summit*, Cadence, 2017, https://www.cadence.com/content/dam/cadence-www/global/en_US/documents/company/Events/summits/photonics/fortier-2017.pdf

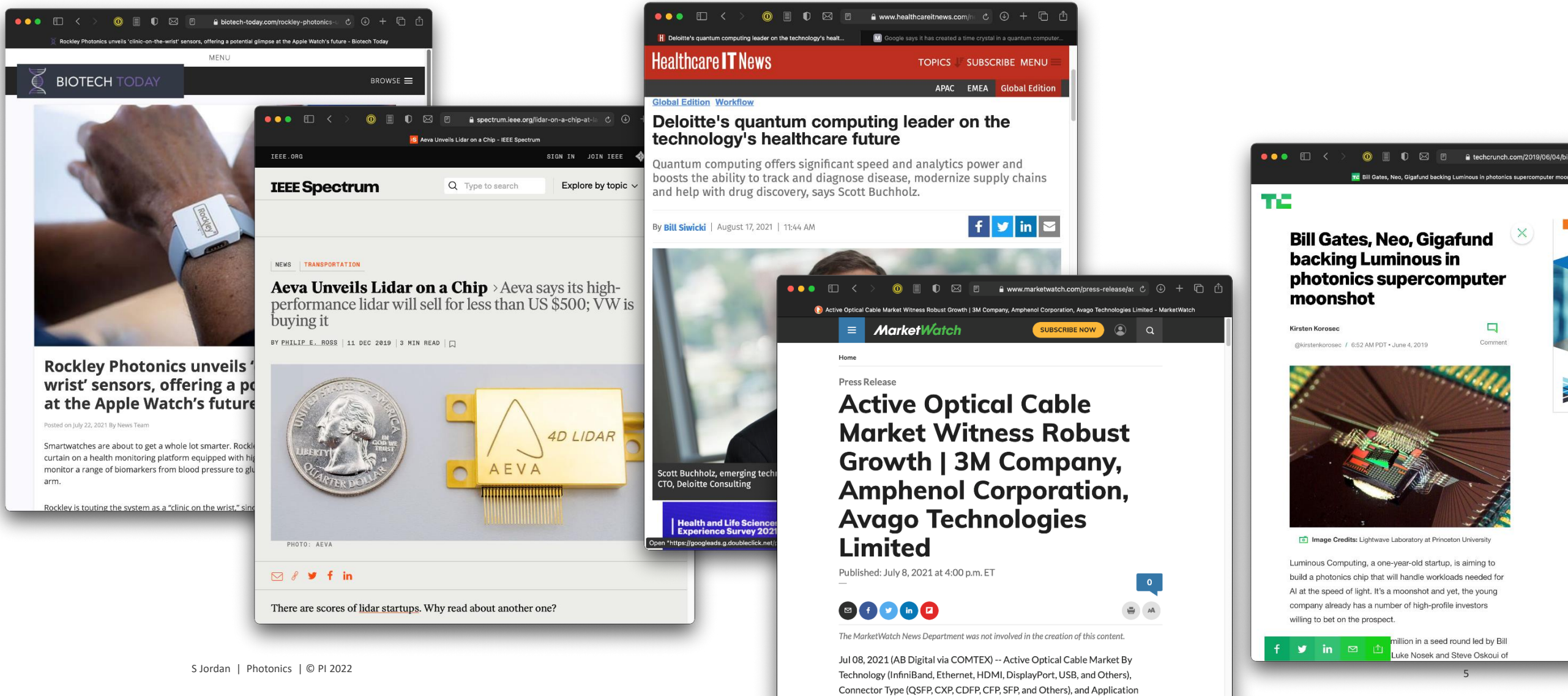
"Process-based cost modeling of photonics manufacture…", E. Fuchs et al, J. Lightwave Tech., 2006, https://www.semanticscholar.org/paper/Process-based-cost-modeling-of-photonics-the-cost-a-Fuchs-Bruce/125e24b2e2e71860f088526441ee5ce16e6ce42c





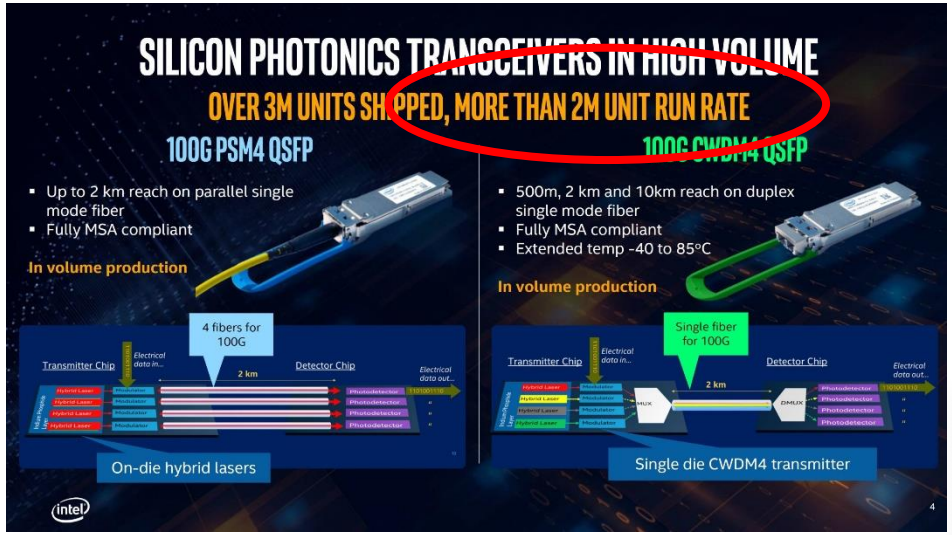
Observation:

Silicon Photonics is *not just about the data center anymore*

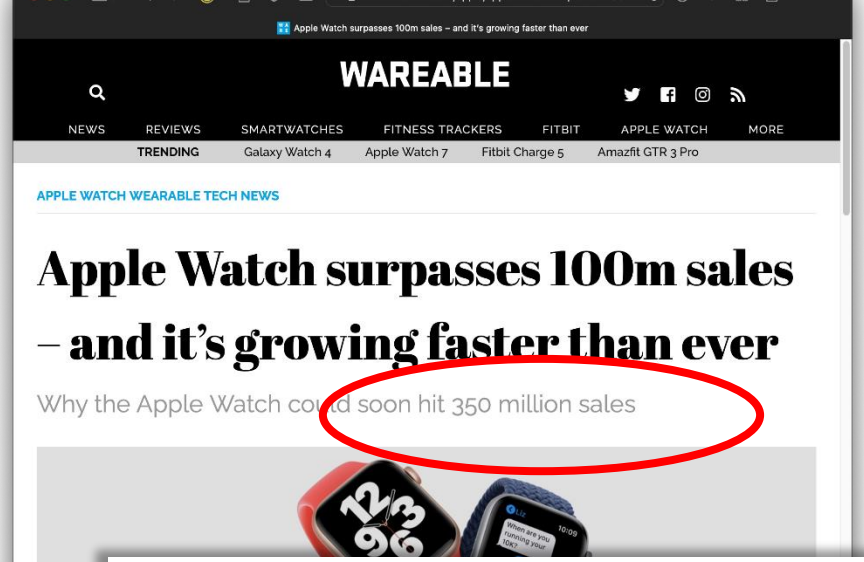


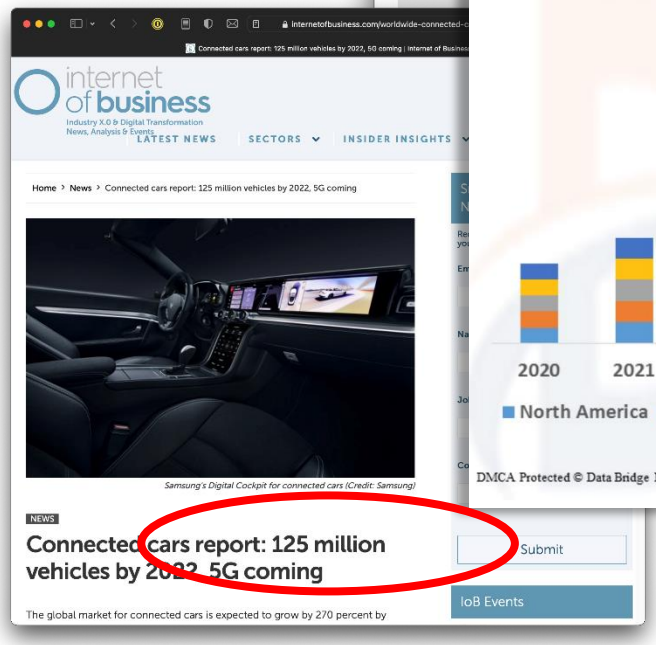
What this means:

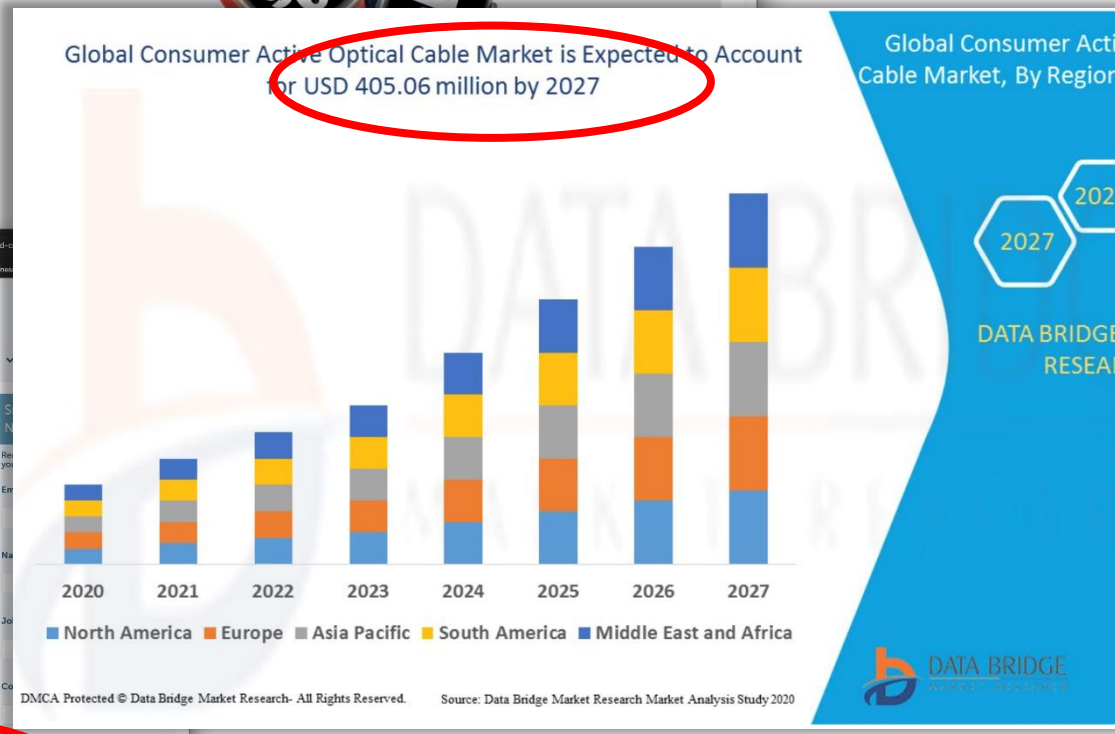
Fasten your seatbelts



Intel







Data Bridge Market Research

These are Early Days

Parallels to 1980s chip industry:

- Ecosystem just being born
- Custom equipment
- In-house and captive integrators

ASML

APPLIED MATERIALS make possible

TEL TOKYO ELECTRON

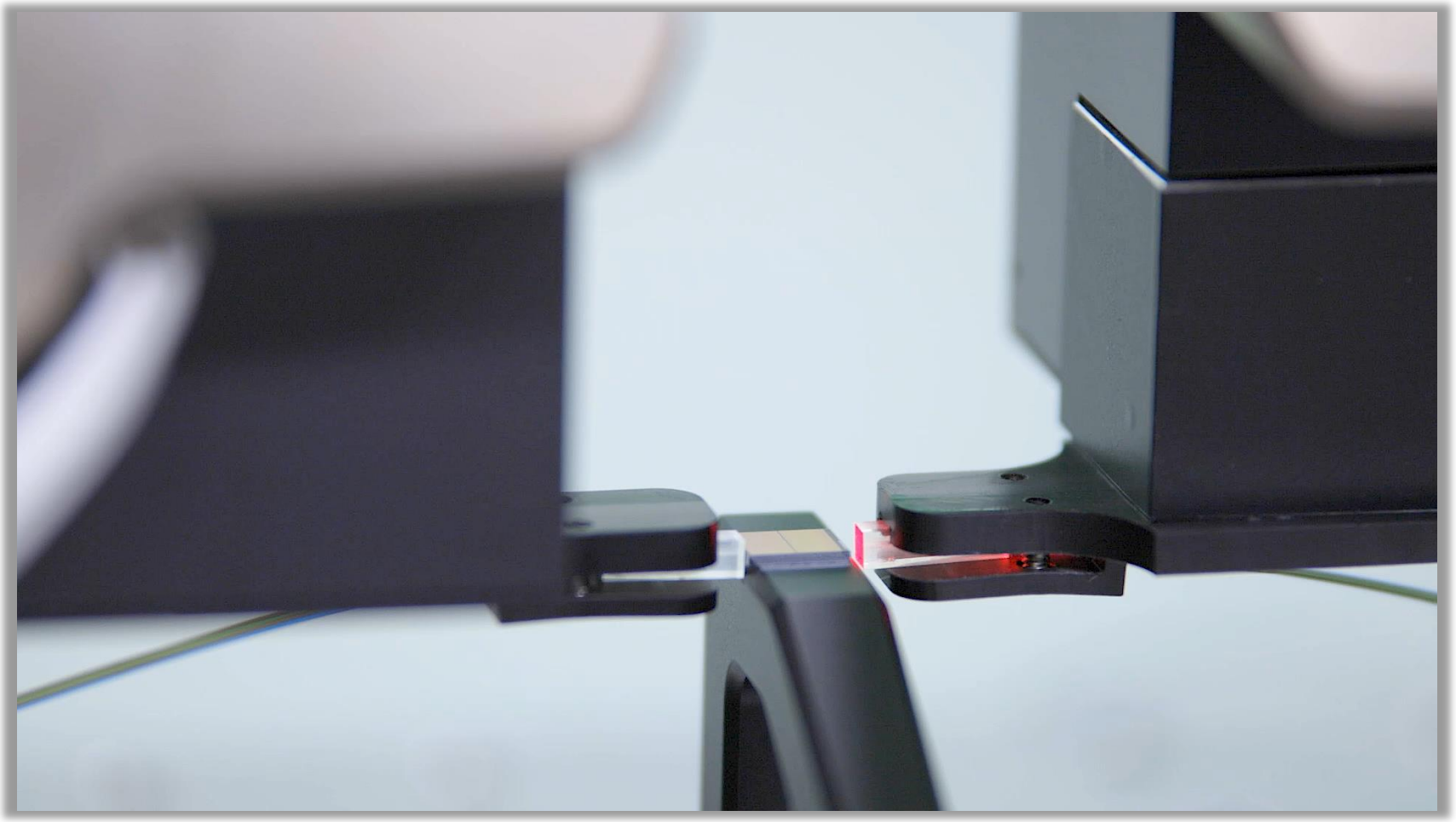
Lam RESEARCH

KLA

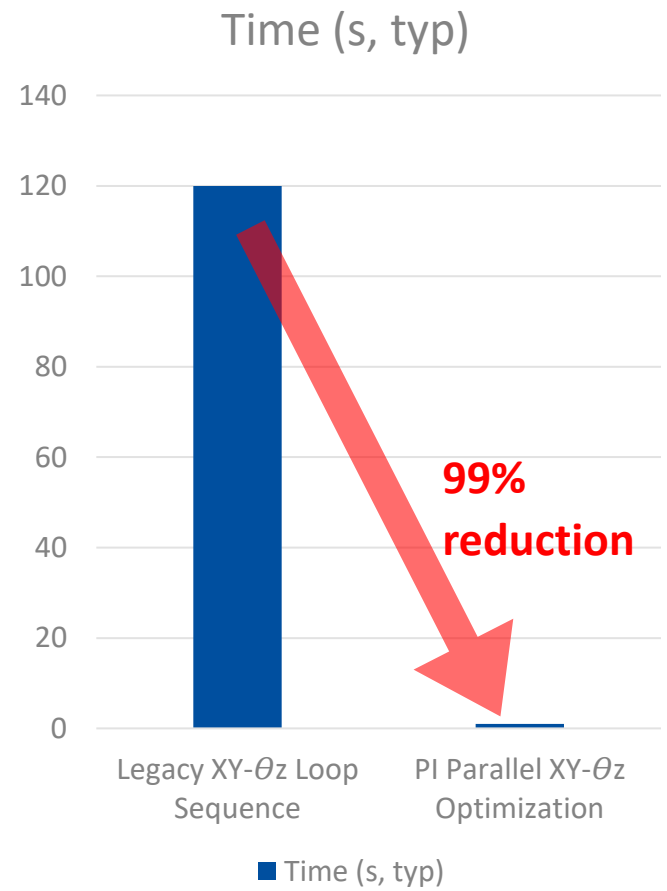
Fast forward to today:

- You can build a fab by writing POs

Excerpted from https://www.chiphistory.org/128-an-intel-wafer-fab-cleanroom-circa-1980



PI's Novel Parallel Multi-DOF Optimization



Partnering with Pioneers

Example: Improving Silicon Photonics process-economics with automated, multi-DOF optimization

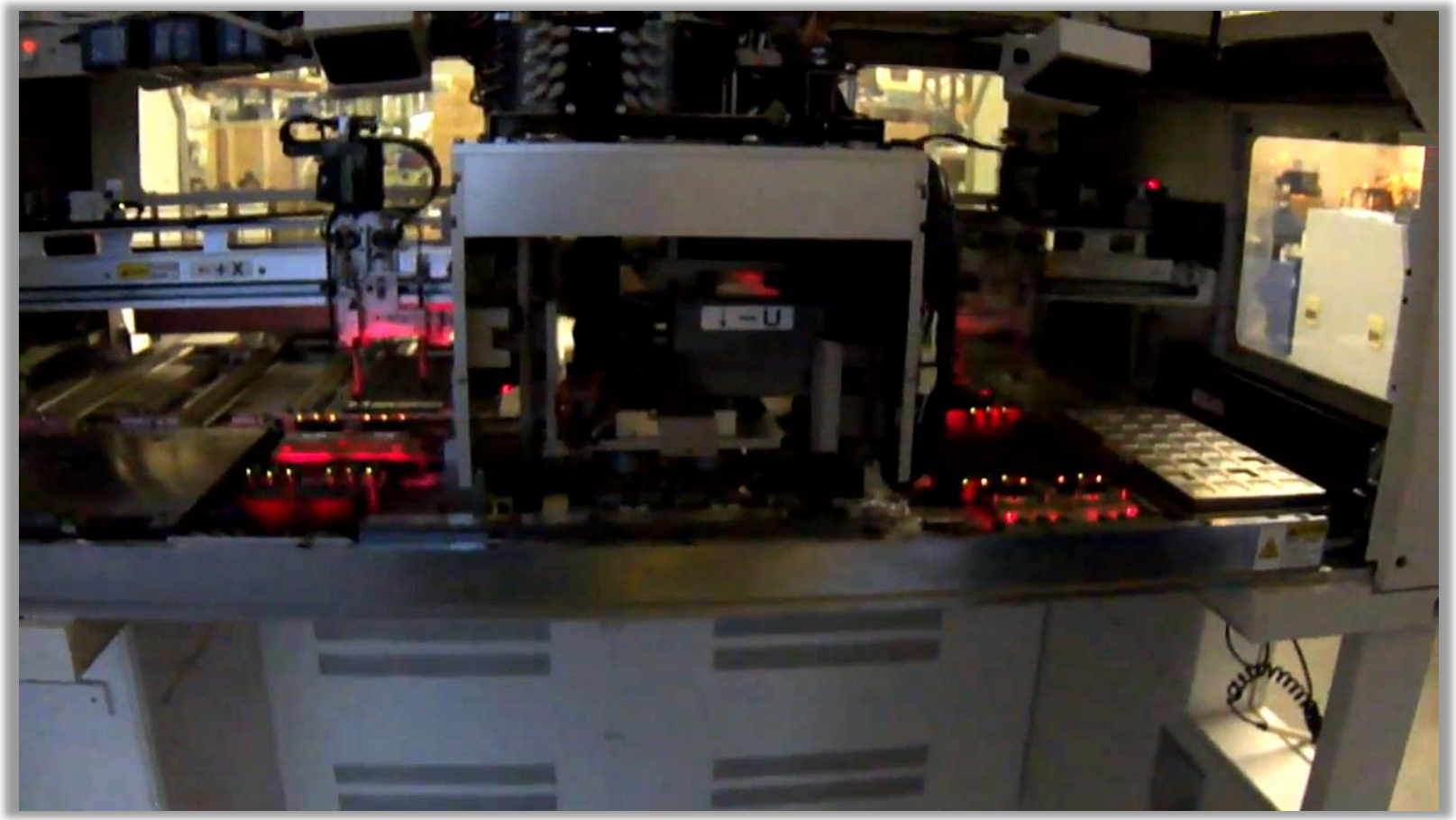
FORTUNE 100 FASTEST GROWING COMPANIES

Excerpted from https://www.TinyURL.com/new-FF-video

Automated Assembly Equipment solutions by Etteplan | Etteplan

Partnering with Pioneers

Example: Chip Tester Change Kit with embedded alignment



Large-format applications: PCBs, Trays, Carriers...

YouTube:

Unacknowledged!

…Meeting an ~~unfilled~~ need

Test and assembly are back-end processes.

Who cares about super cleanliness in back end processes?

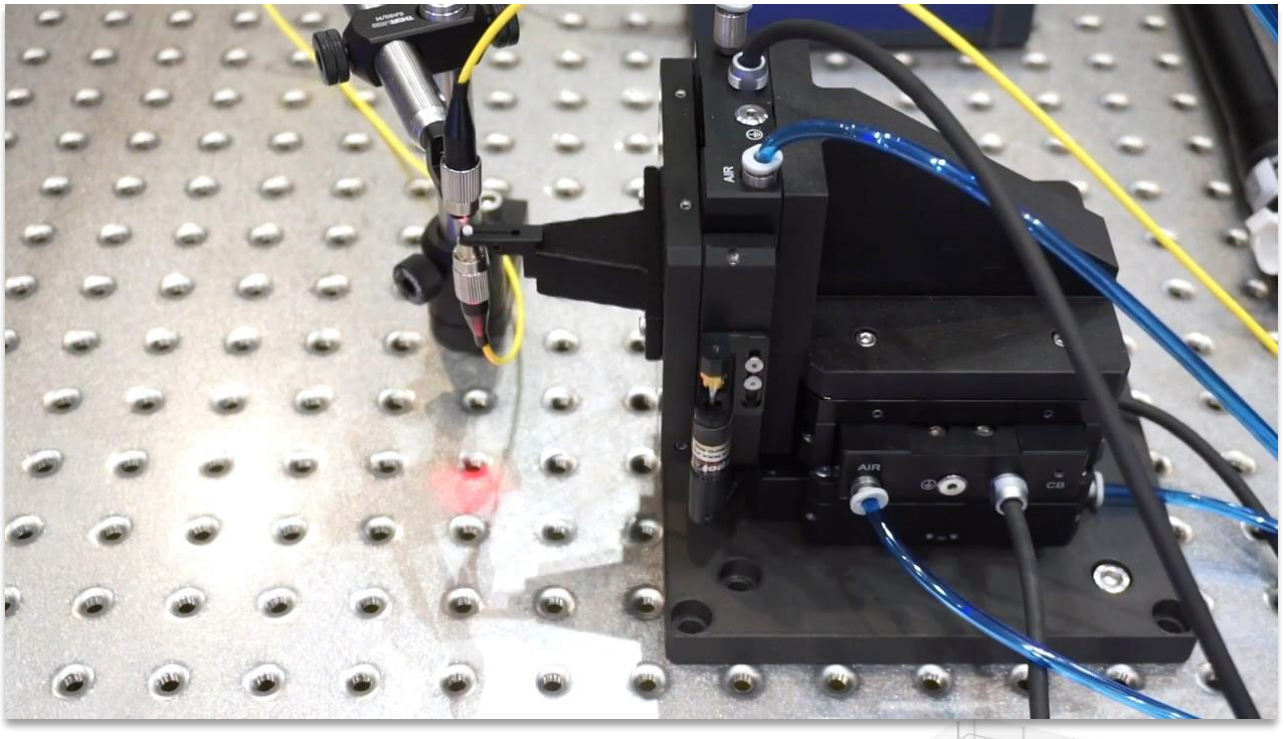
…Photonic chips do!

New: Air Bearing Fast Alignment Engines

Super cleanliness

Zero maintenance, Zero wear

Highest MTBF

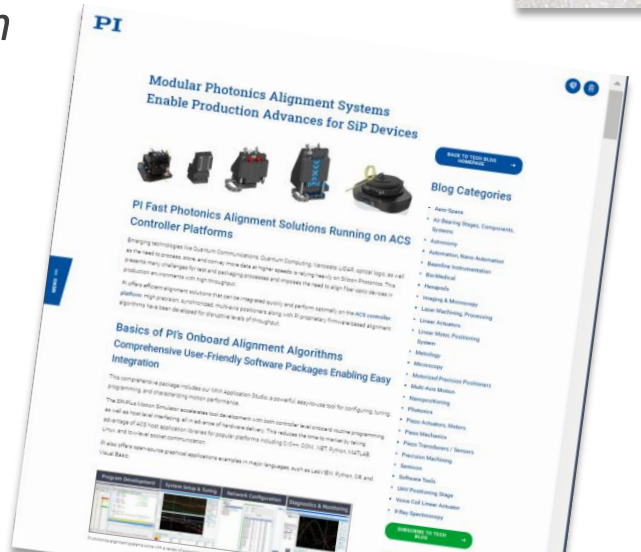


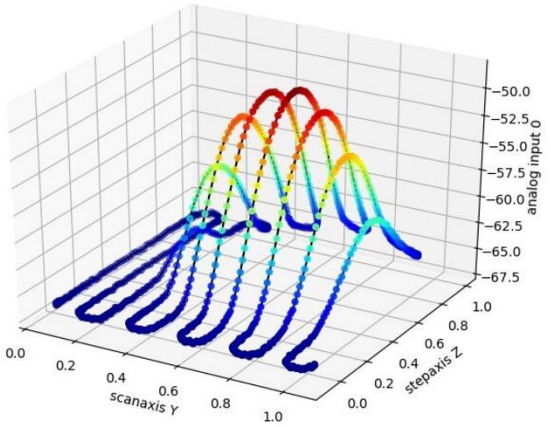
Fast Area Scan

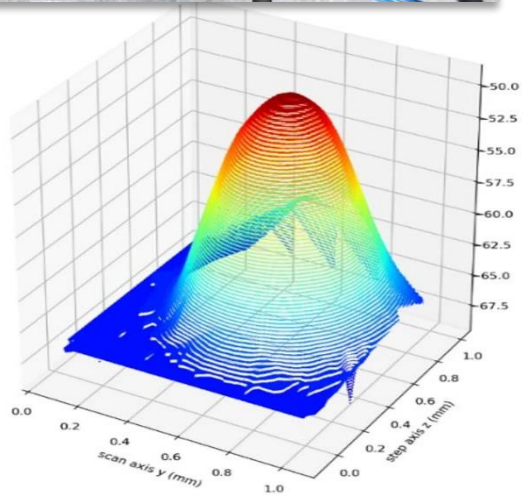
- *First light acquisition*
- *Profiling & characterization*

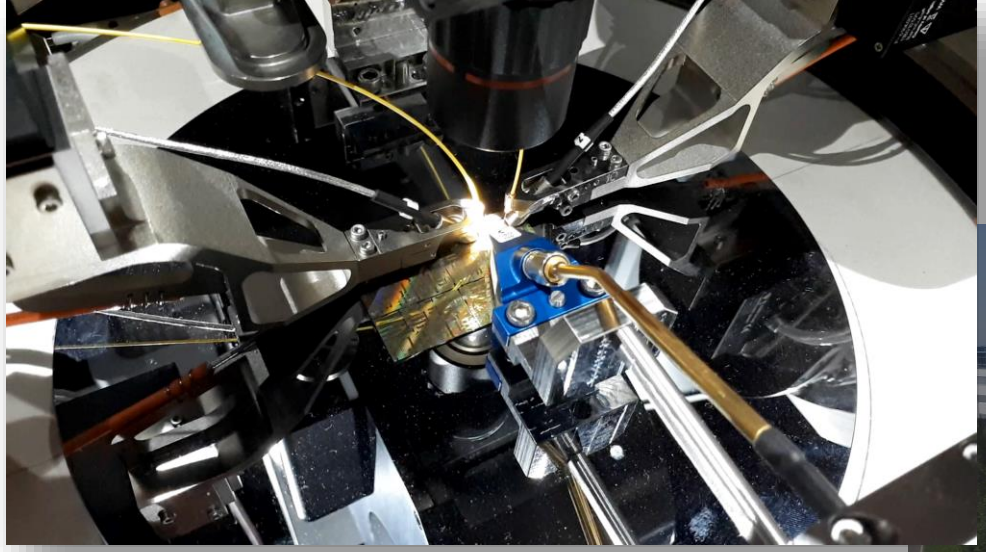
Parallel Gradient Search

- *Fast Optimization*
- *Real-time tracking across multiple DOFs*
- *Drift compensation*
- *Lock-on*









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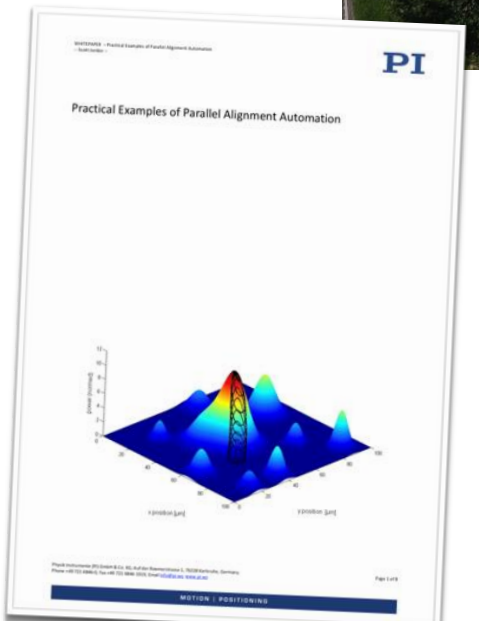

Ask for a free Tech Note on Parallelism in Optimization

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