



PHOTONICS ASSEMBLY

# Assembly of photonic IC based products from prototype to volume production

Joost van Kerkhof – COO & co-founder

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**EPIC MEETING ON ELECTRONICS & PHOTONICS**  
15 NOVEMBER 2022

# Agenda

- PHIX introduction
- What is needed for volume production?
- How to get there from a PIC design?
- Why has PHIX been successful?

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# Who we are

PHIX is a world leading foundry for packaging and assembly of Photonic Integrated Circuits (PICs) and MEMS, supplying components and modules in scalable production volumes.

- Started operations in 2018
- Independent pure play packaging facility
- Specialized in hybrid PIC assembly and fiber array interfacing



# Where we're going

## New 1800 m<sup>2</sup> building in 2023

- 600 m<sup>2</sup> production facilities
- 600 m<sup>2</sup> auxiliary workspace
- 600 m<sup>2</sup> room for further growth
- Up to ISO 5 clean room space

## New funding

- New €3M investment round for the short term
- €20M from the National Growth Fund for the long term
- Nearly €4M for research projects in 2022 to further technological readiness



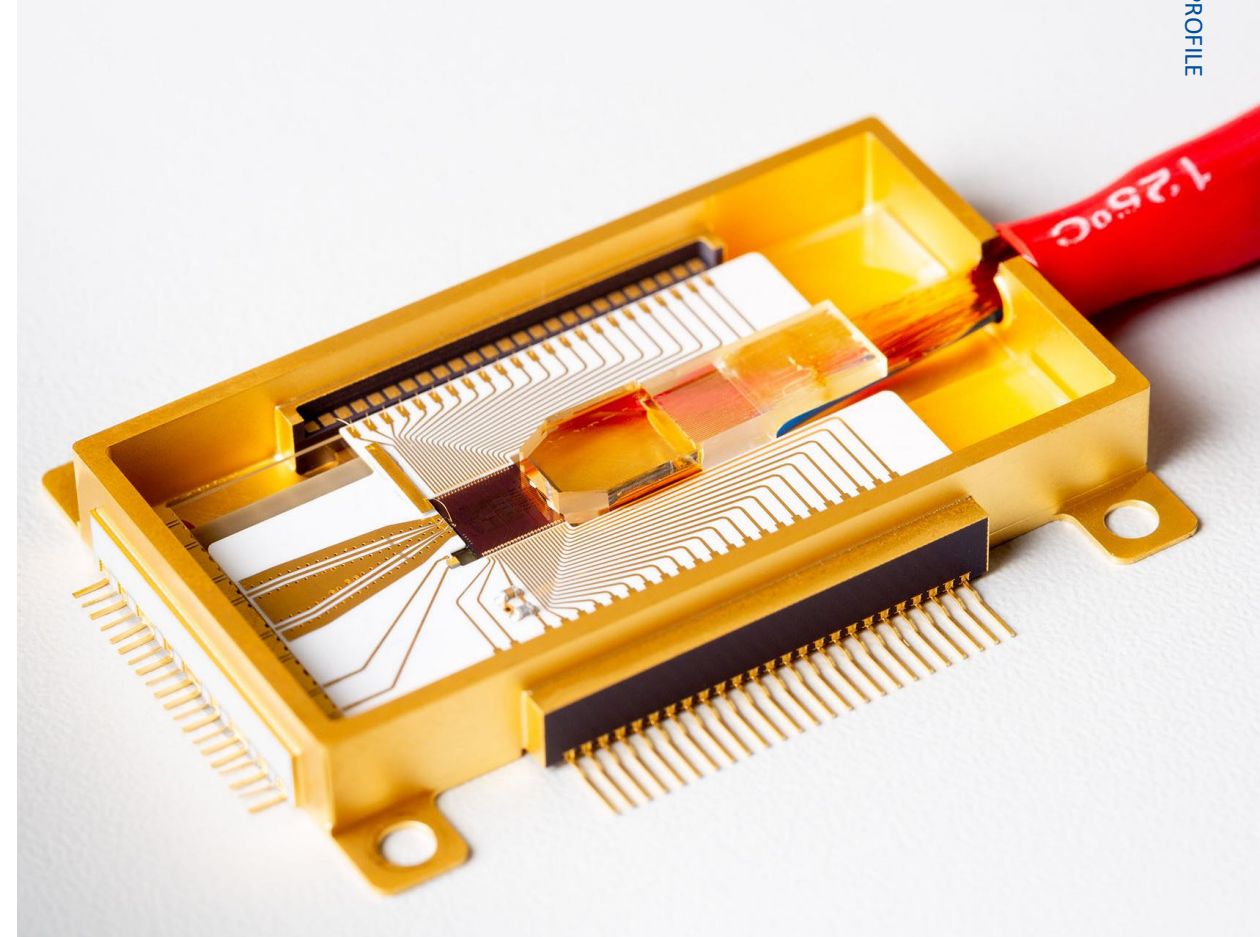
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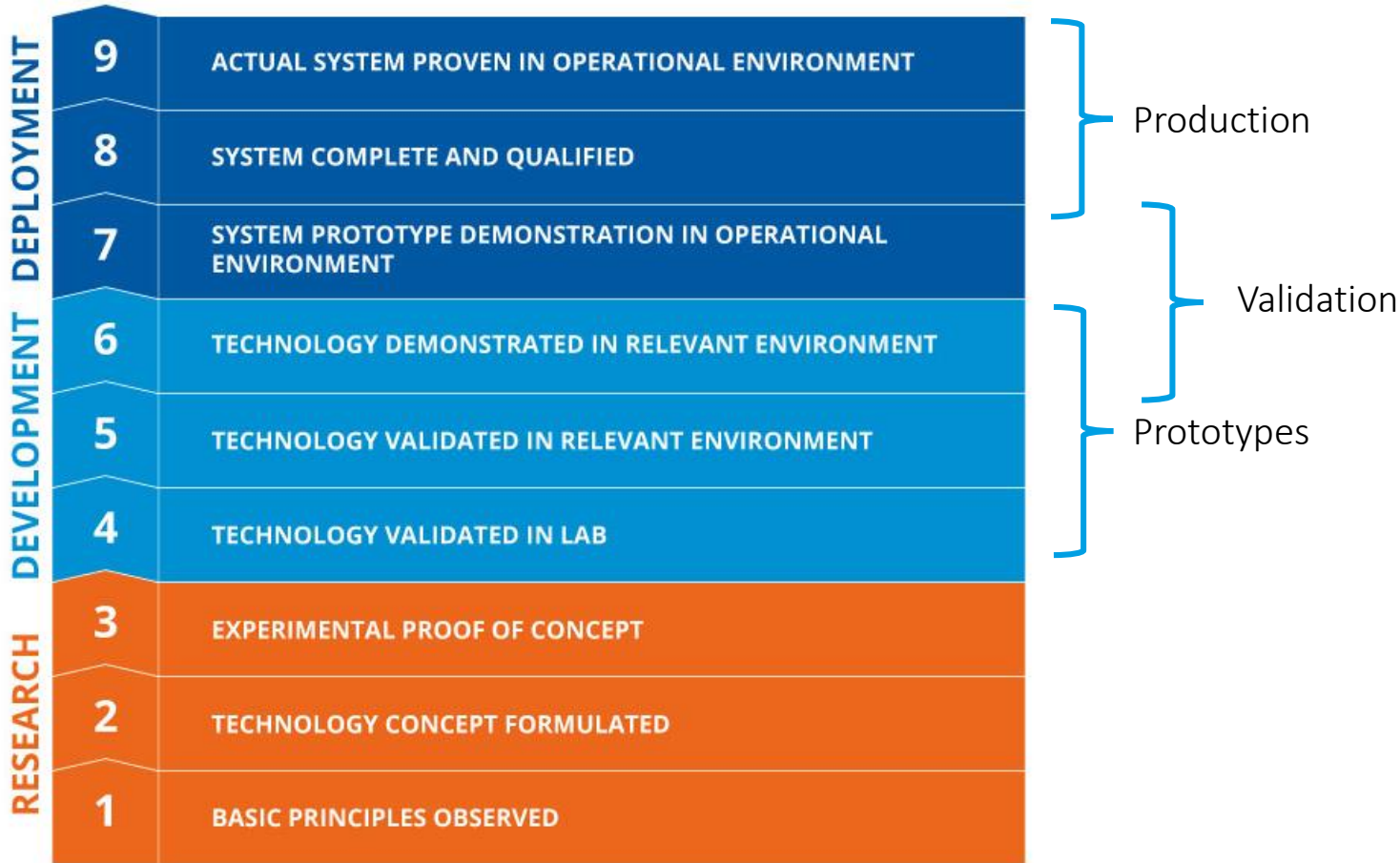
# A PIC by itself is not a product!

It needs:

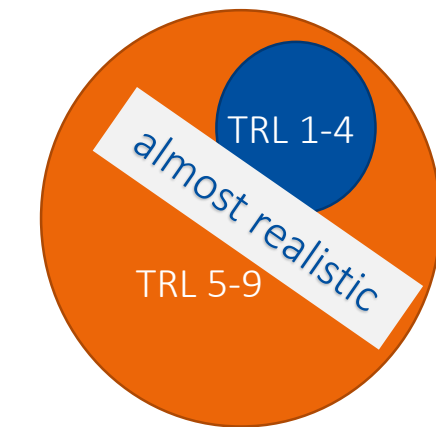
- Optical interconnection (fibers/free-space)
- Electrical interconnection (wire bonds/electronic ICs)
- Thermal management (active/passive)
- Mechanical support (robust package)



# Technology Readiness Levels (TRL)

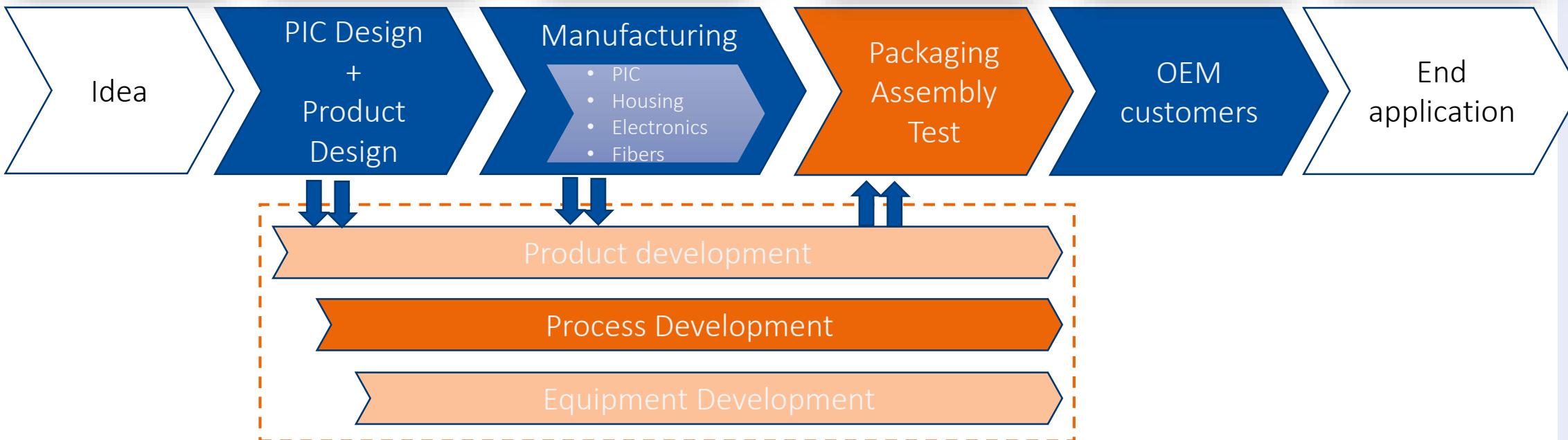
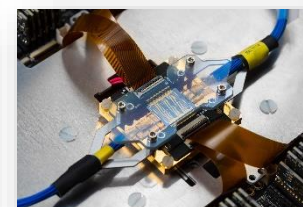
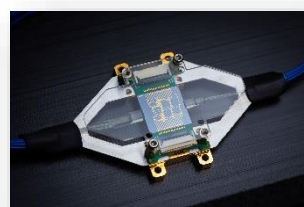
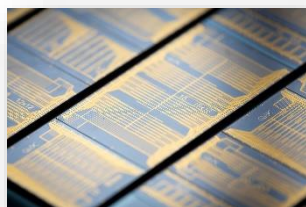
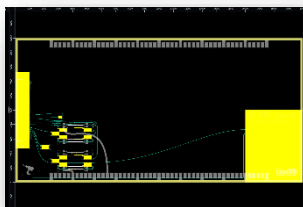
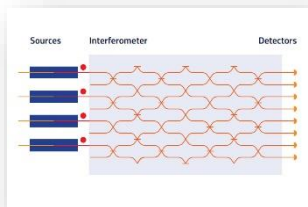


Time/ effort





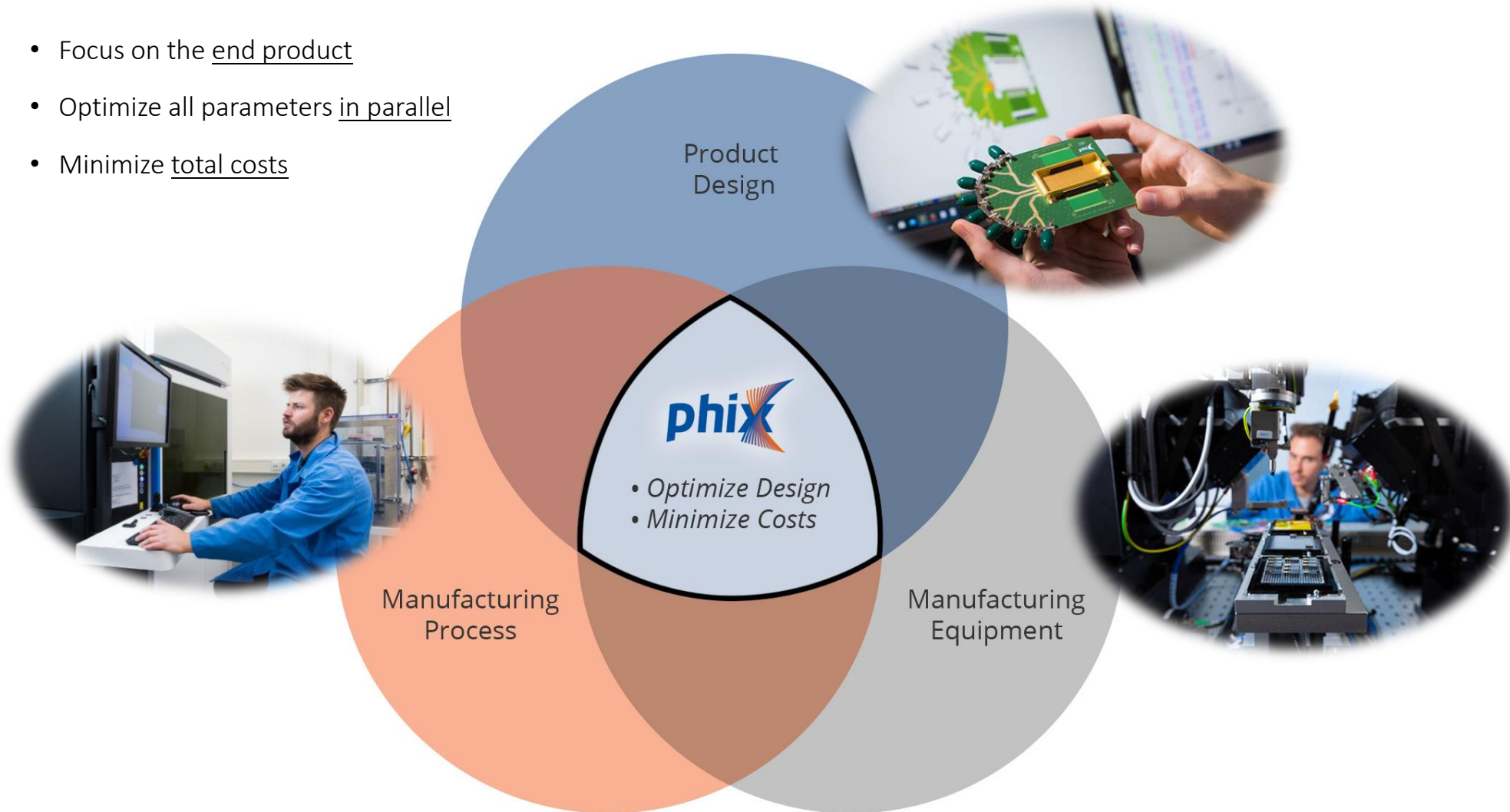
# PIC product development chain



Images courtesy of QuiX Quantum

# PHIX Approach to Successful Packaging & Scale-up

- Focus on the end product
- Optimize all parameters in parallel
- Minimize total costs



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# Engineering support



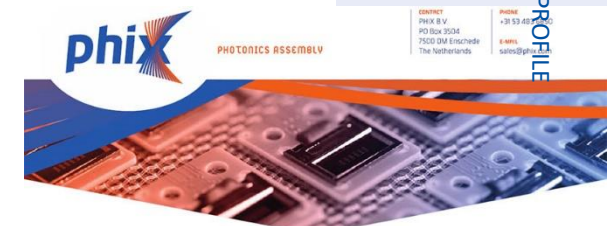
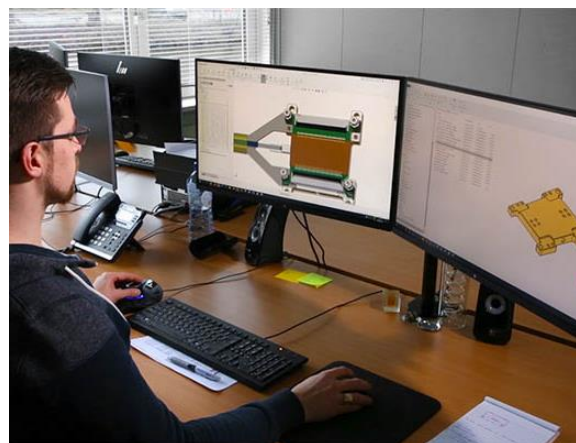
## Take off quickly

- Benefit from standard package types and building blocks
- Optional standard electrical (DC/RF) fan-out boards
- PIC Design Guidelines documentation and engineering support



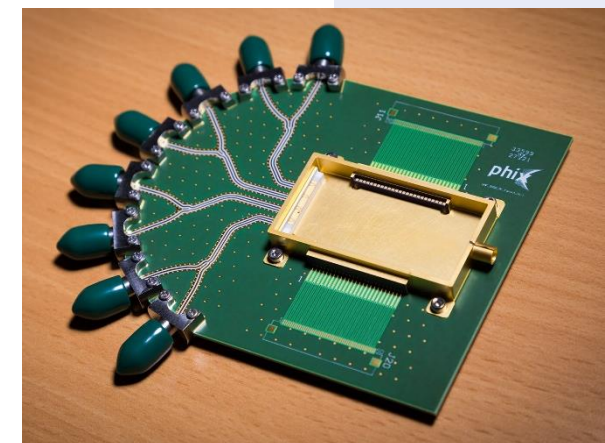
## Fly to great heights

- We help you define a roadmap toward volume manufacturing
- We optimize equipment, processes and the bill of materials with the total costs in mind



### Design Guidelines for Photonic Integrated Circuit Packaging

PHIX is a one-stop-shop for the manufacturing of modules powered by photonic integrated circuits (PICs), from design to volume production. This document describes the core design guidelines for PICs that will enable PHIX to package your chip into a high performance and cost-effective module that is suitable for a scale-up to volume manufacturing. It will also help you select the standard package type that best suits your needs.



# Three stages

## Characterization / prototype packages

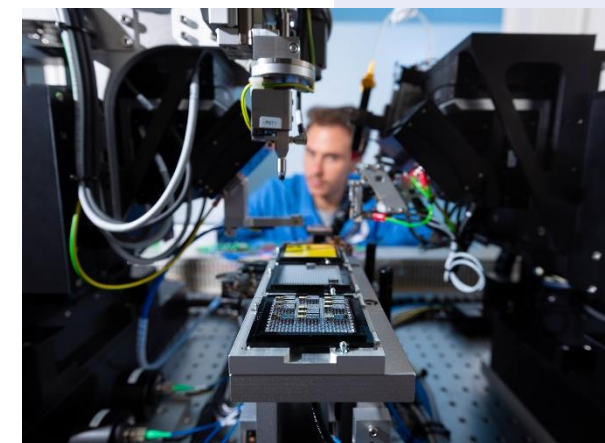
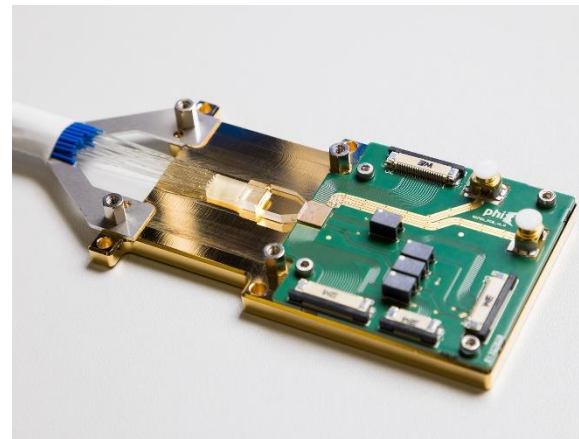
- Chip measurements and system integration tests
- Feasibility studies and system demonstrators
- 1-100 units

## Volume packages

- Optimized for manufacturing and reliability
- Testing to firm acceptance criteria
- 100+ units

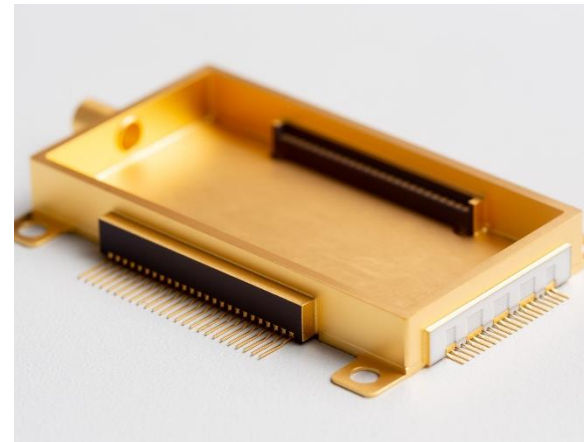
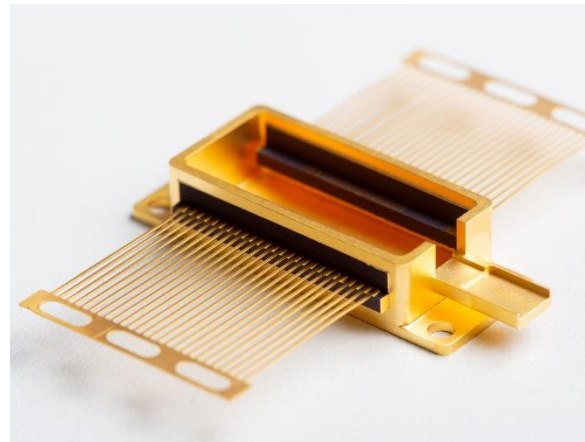
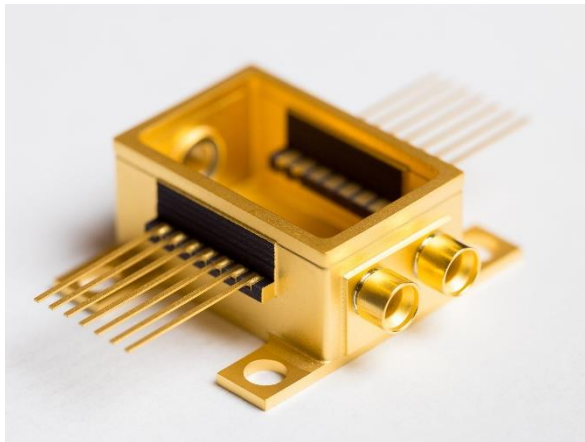
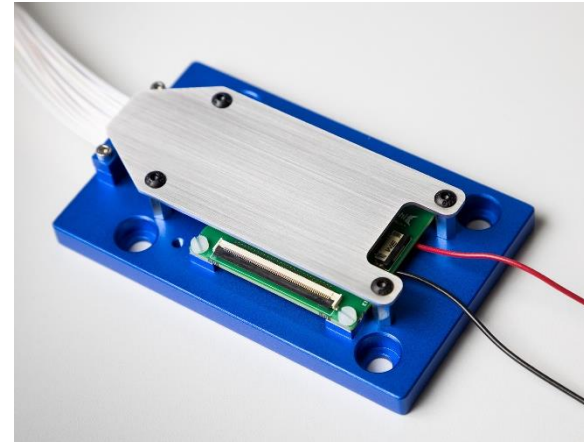
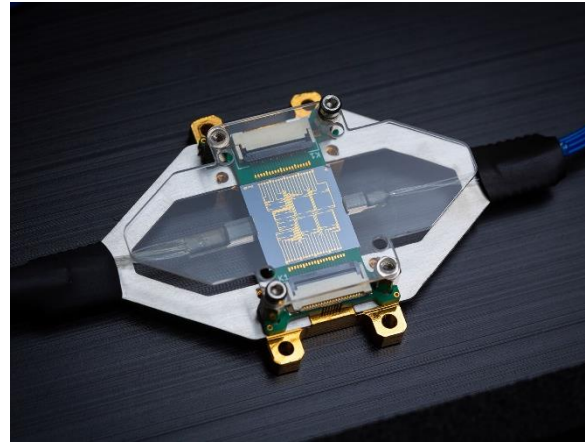
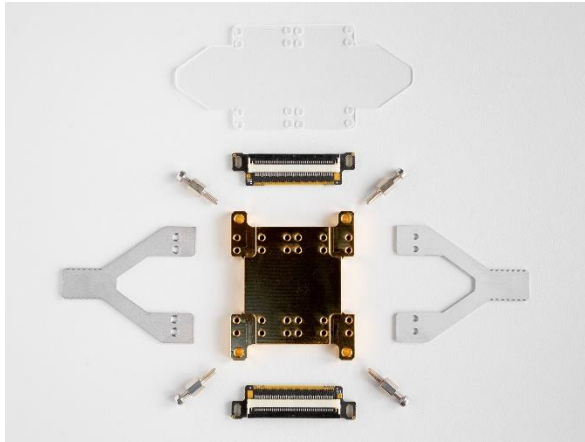
## Contract manufacturing

- Providing outsourced or second-sourced component production



# Characterization and prototyping

Providing building blocks and standard housings



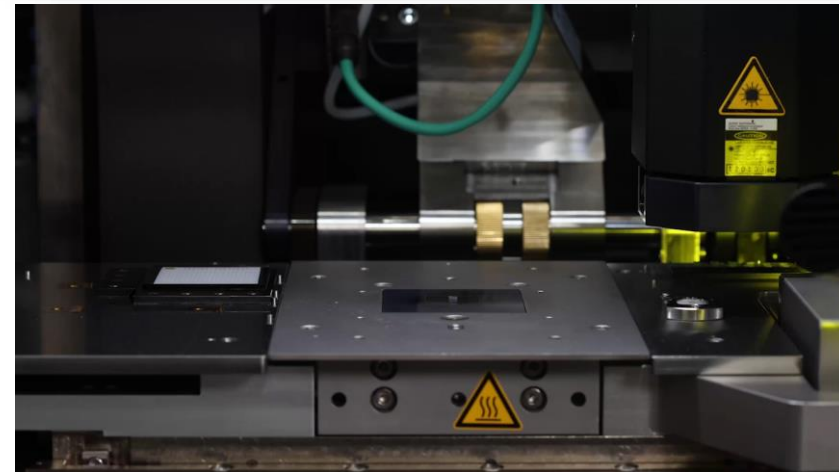
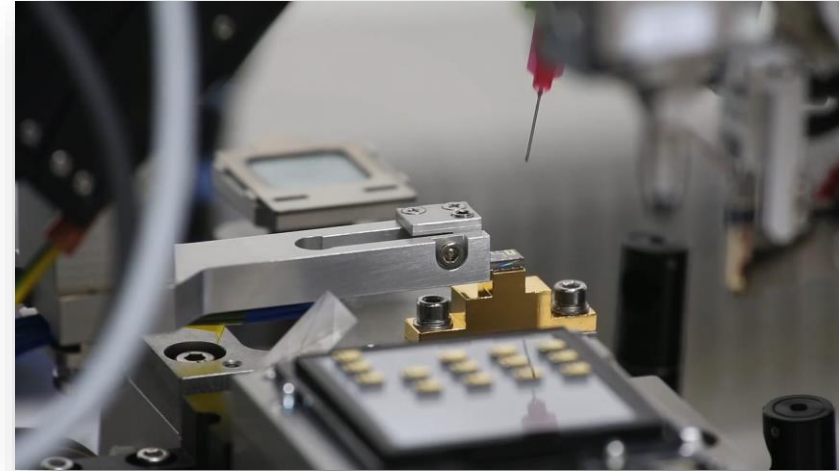
# Volume packaging and contract manufacturing

## Manufacturing scale-up of:

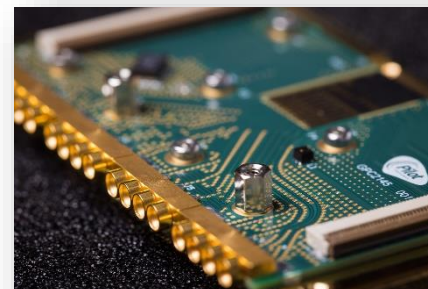
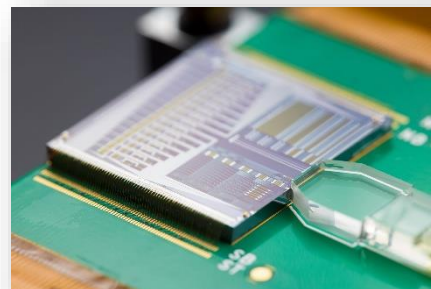
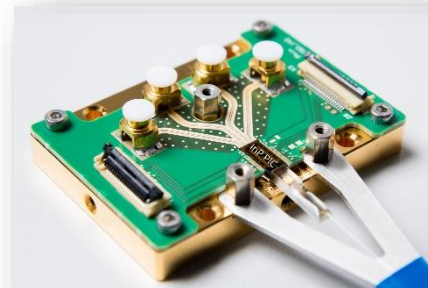
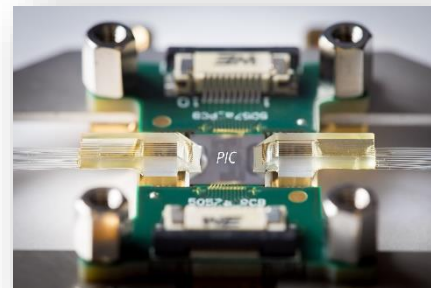
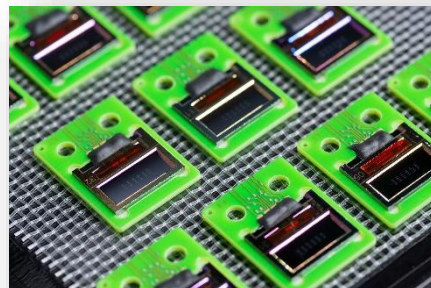
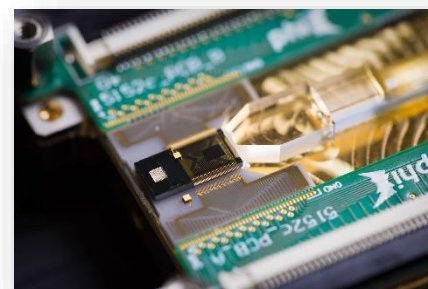
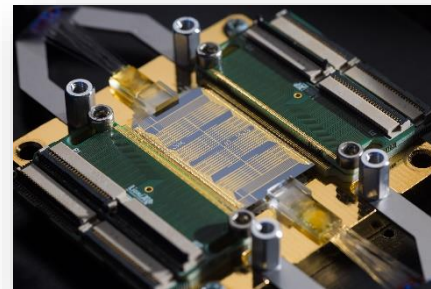
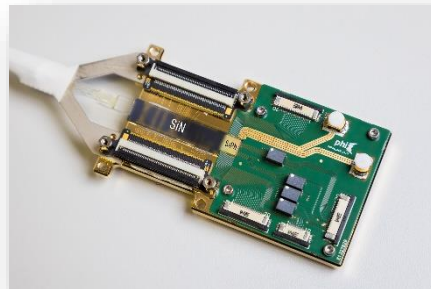
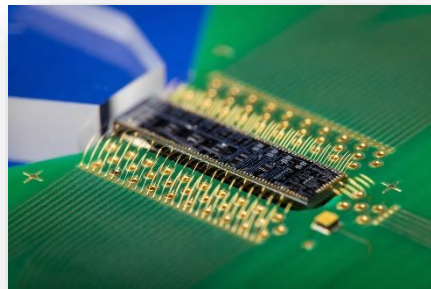
- Hybrid tunable lasers
- LiDAR modules
- MEMS-based mass flow sensors

## Automated processes for:

- Wire bonding
- Flip chip assembly
- Hybrid PIC edge coupling
- Fiber assembly
- Fiber attachment
- Epoxy dispensing
- and more...



# Product examples





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# PHIX value proposition

## Independent packaging foundry

Quality

Low scale-up cost

Speed

Flexibility

## Design engineering support

- One-stop shop
- Easy start-up
- Max. performance at min. cost

## Technological excellence

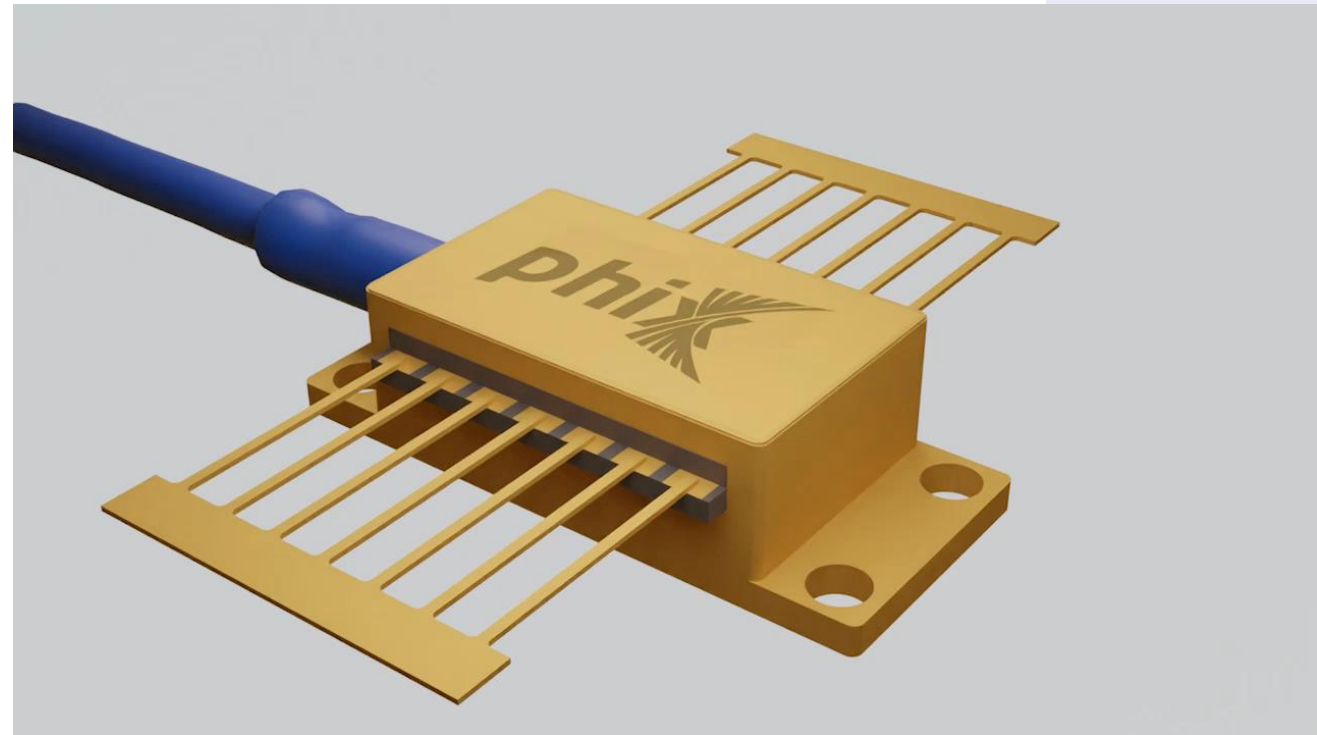
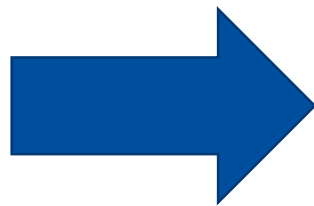
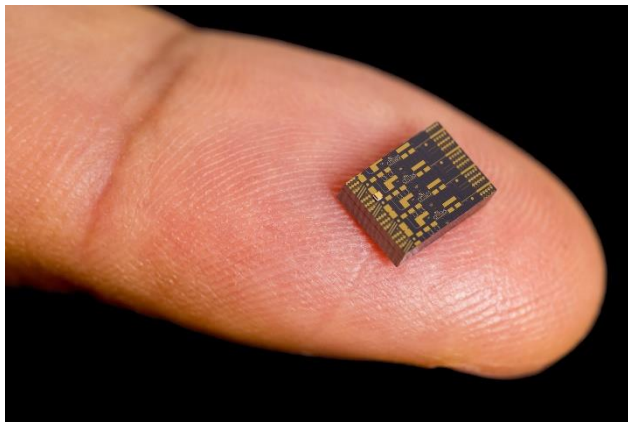
- Allround
- Harness the full power of PICs
- Low losses

## European based

- Connected
- Unique position
- Well-funded
- Trustworthy



# Questions?





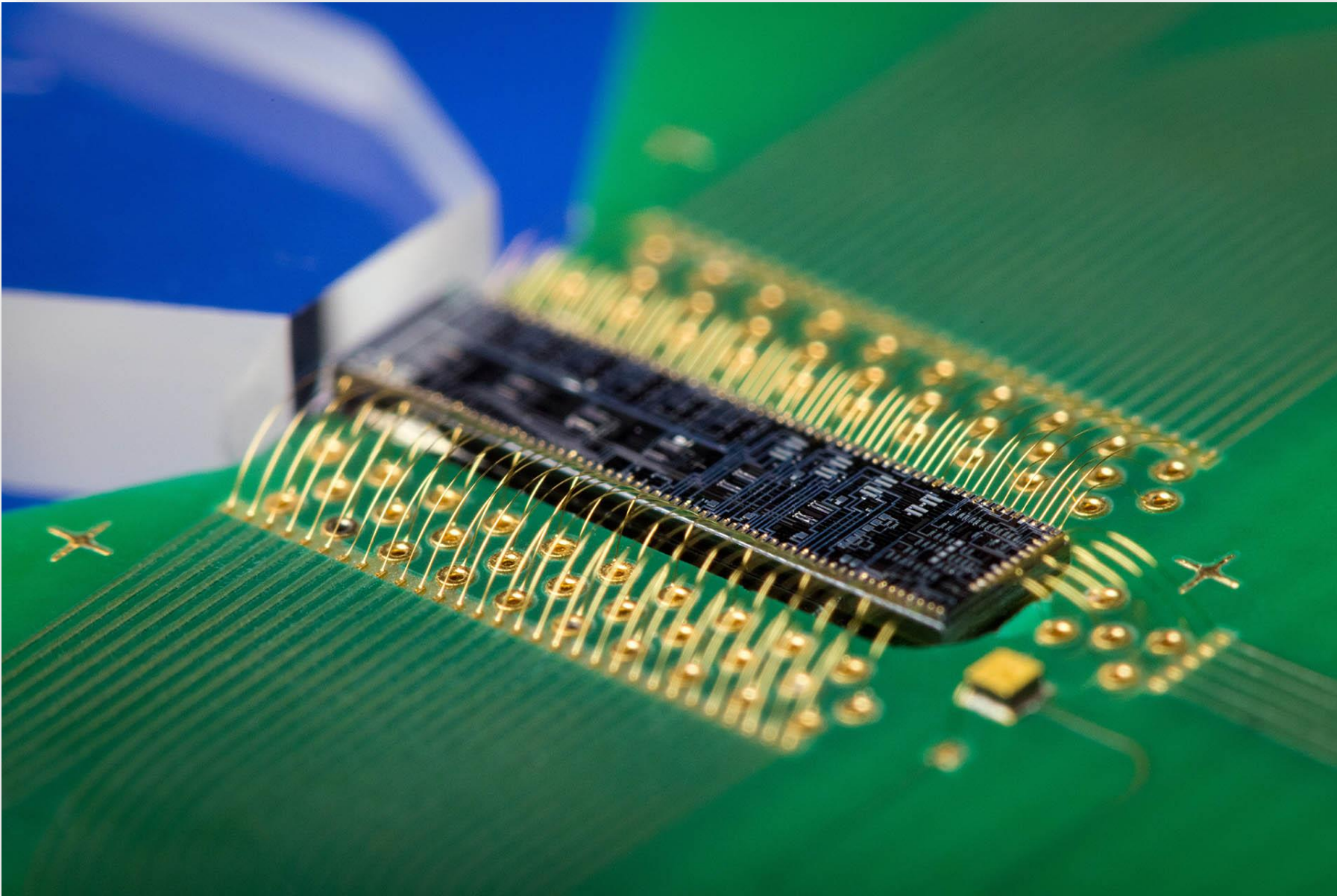
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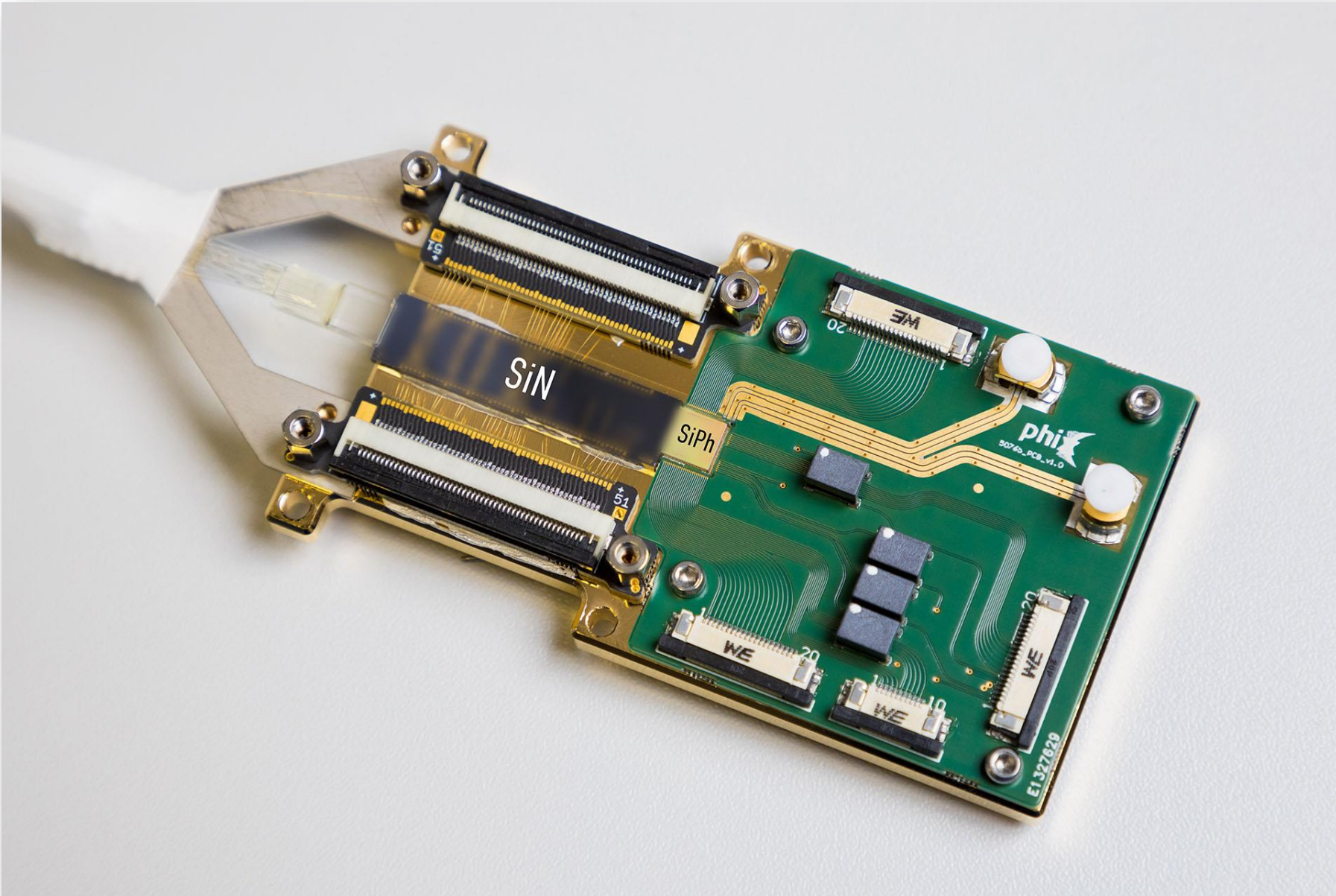
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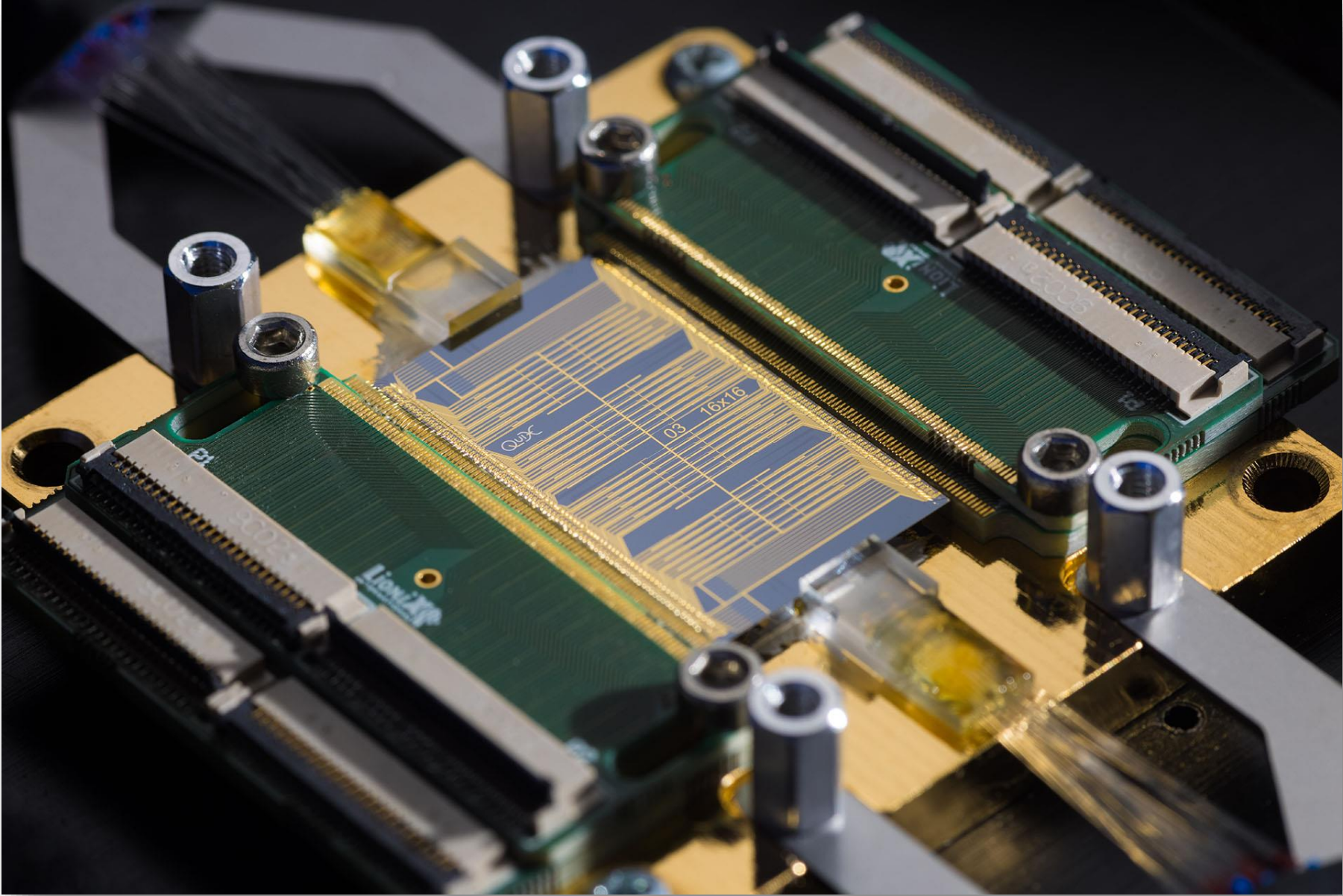
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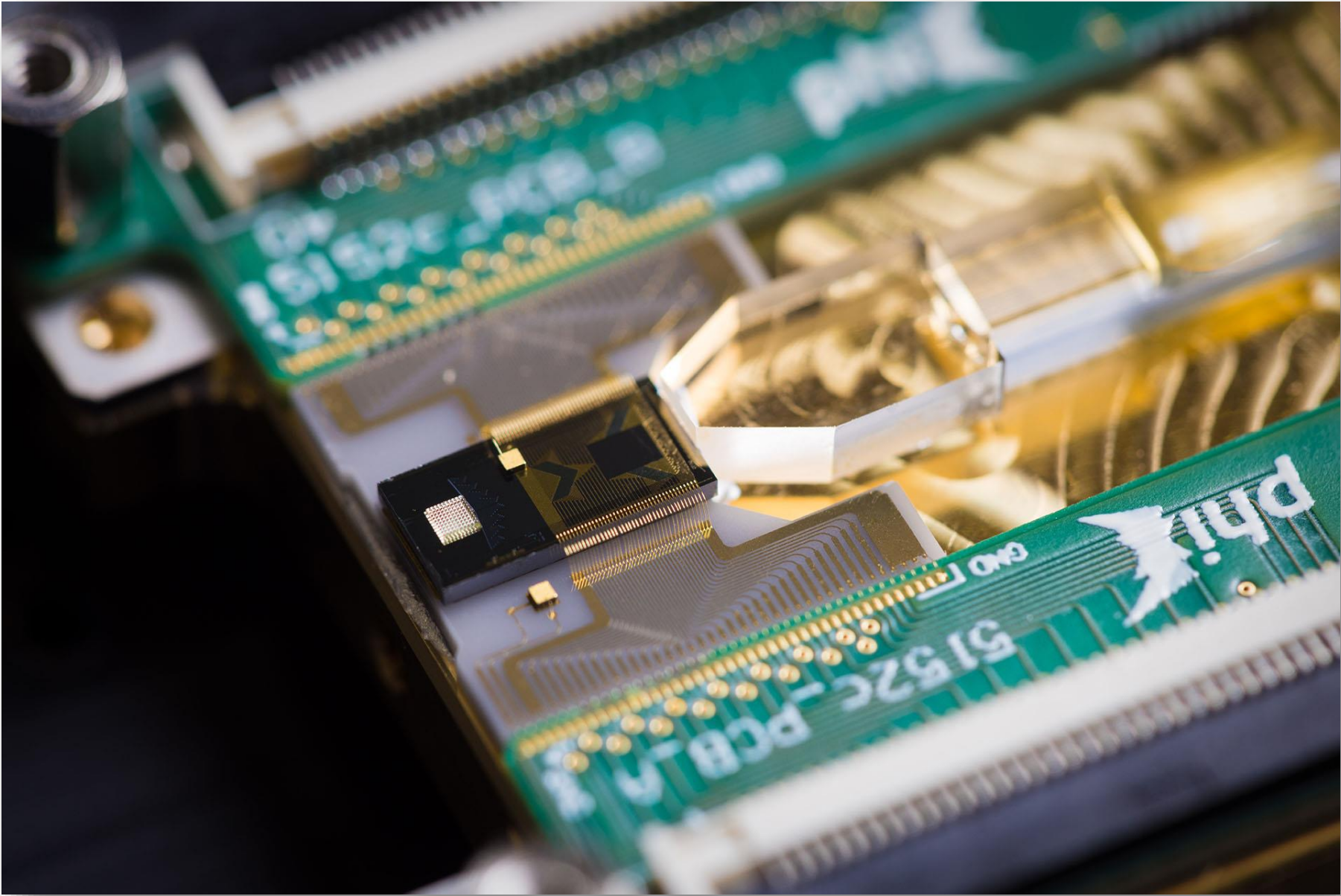
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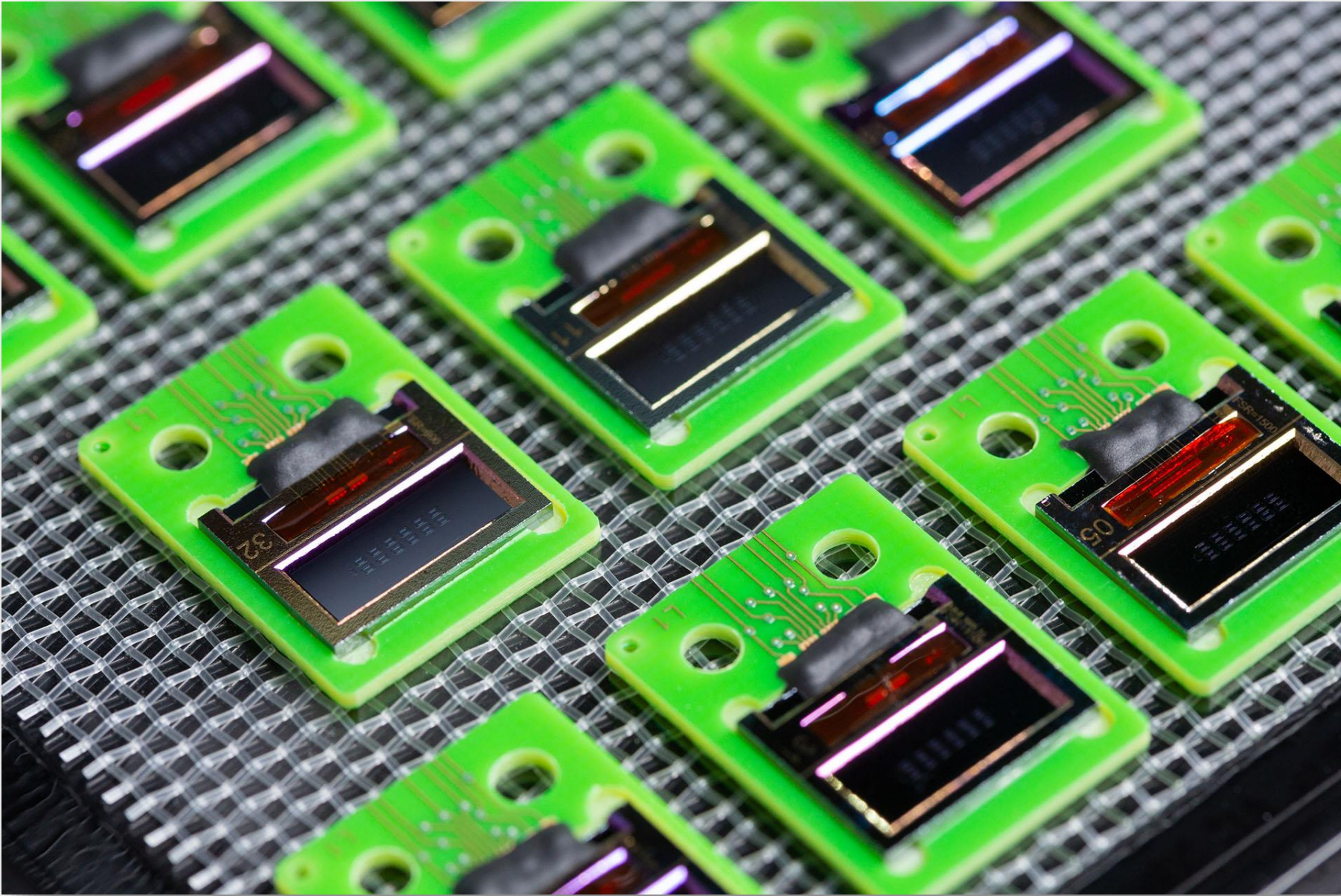


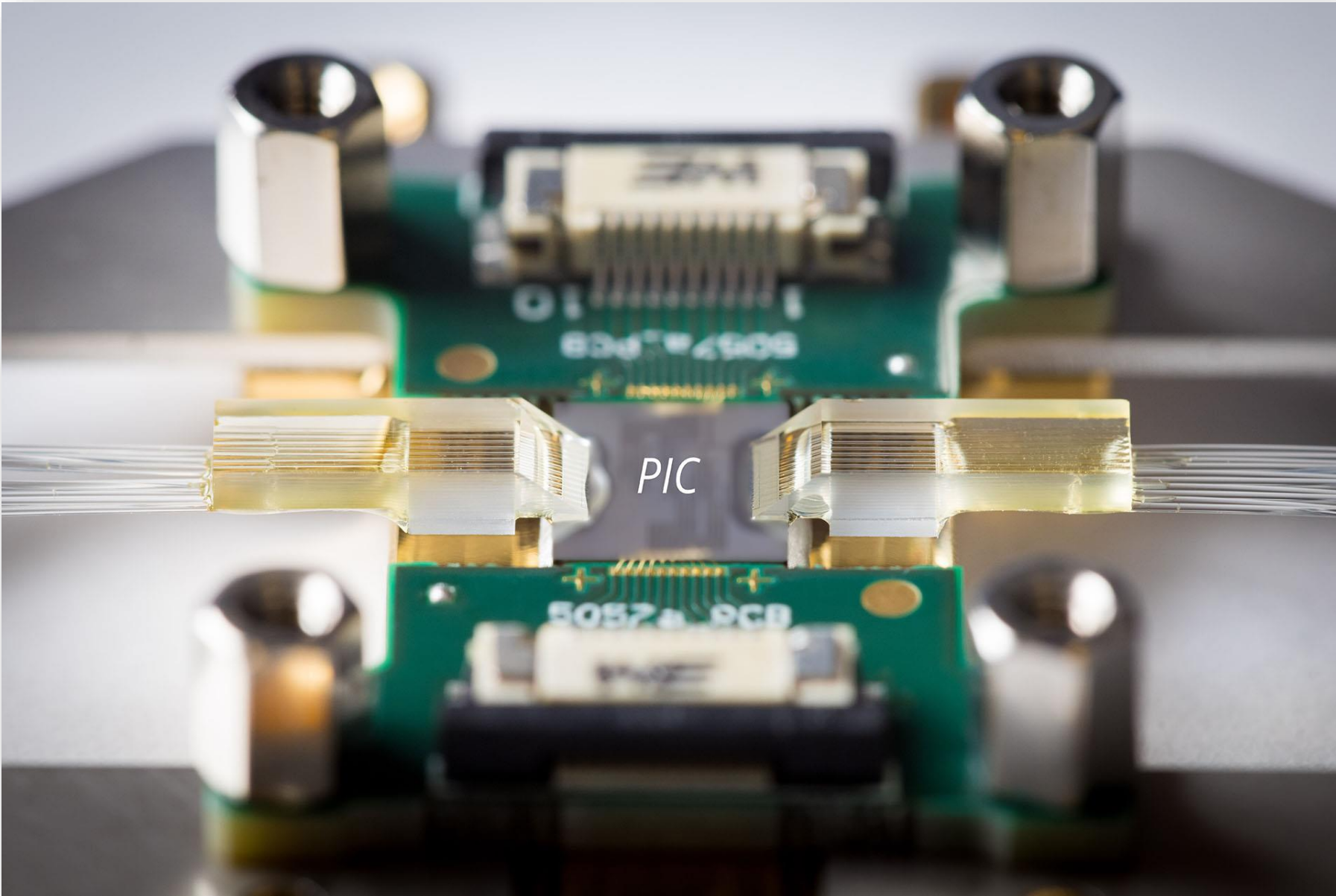












PIC

