PHIX photonics assembly

“Advanced driver assistance systems from prototype to volume production”

Jeroen Duis CCO

phix PHOTONIC ASSEMBLY

PHIX Mission

PHIX is to become a world leader foundry in packaging and assembly of Photonic Integrated Circuits (PIC's) by supplying PIC based components and modules in scalable production volumes.

- Initiated by LIONIX INTERNATIONAL in 2017
- Started operations in 2018
- Specialized in hybrid PIC assembly and fiber array interfacing

Wide field of

Technologies

- Time of flight
- FMCW: frequency-modulated continuous-wave:
- Random-Modulation Continuous-Wave (RM-CW)

Wavelength

- NIR
- SWIR
- LWIR
- Hybrid

Photo Detector

- Multiphoton
- Single Photon Detector
- Antenna Array

Specifications

- Field of Fiew
- Detection Range
- Size
- Aesthetics integration
- Cost

Beam steering

- Mechanical
- Micro – mechanical
- Pure solid state
- Hybrid

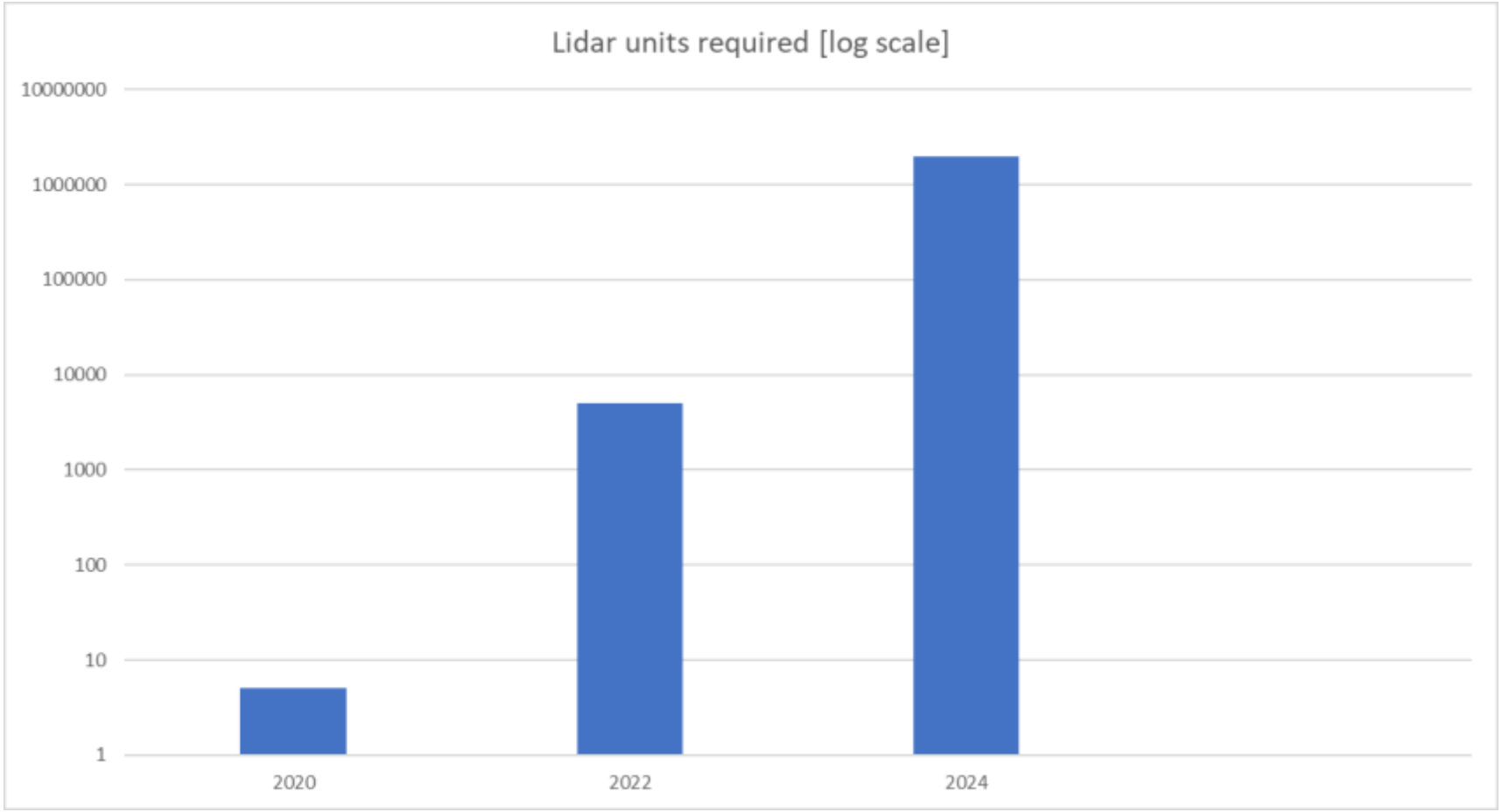
Opportunity for each customer: Find the optimal configuration for a specific application area meeting the automotive requirements

Customers first meeting

- We make something for a big market, can you support us?
- Can you ramp up quickly for us?
- Can you manufacture millions of units?

- No yesses here result in no further discussion

What is it all about



Urgent need

Need to be prepared for growth

Next challenge

- Cannot share what is exactly on the chip
- Push the module-specific details towards the future focus on prototype requirements first

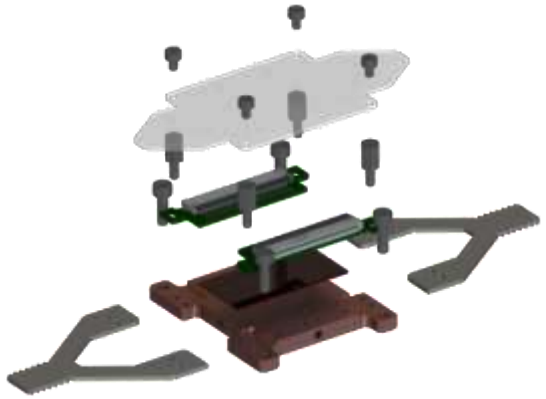
Chip level

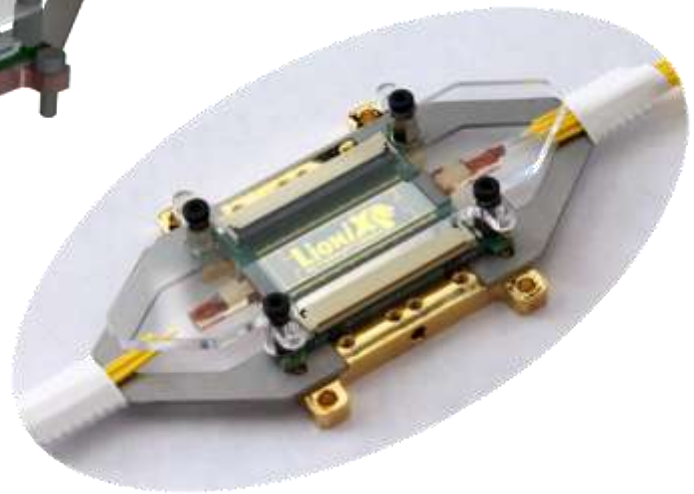
- Lasers
- Modulators
- Photodiodes
- Couplers
- Splitters
- Wavelength selective components

Module level

- Electrical
  - DC connections
  - RF channels
  - Current requirements
- Optical
  - inputs
  - outputs
  - Facet preparations
- Fiber connections
  - Polarization maintaining
  - Single mode
- Thermal requirements
- Multi chip integration

Characterization Package Standard

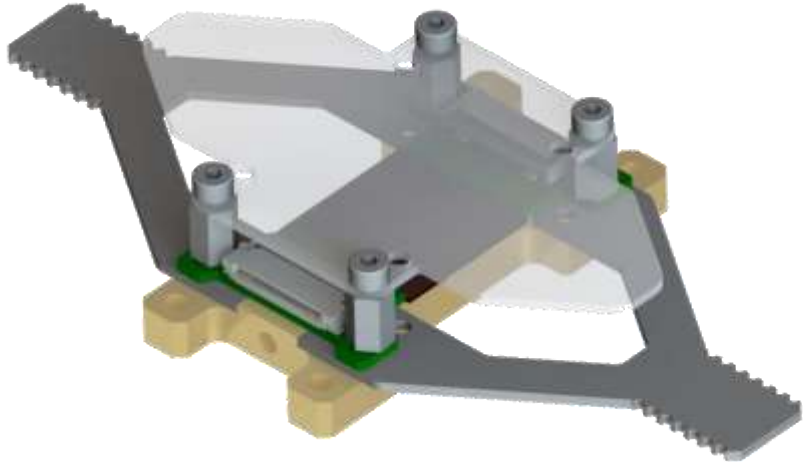


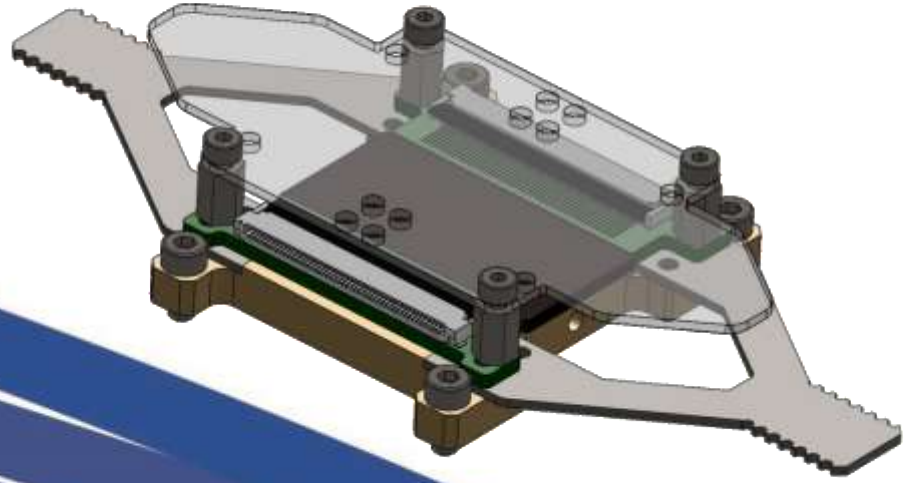


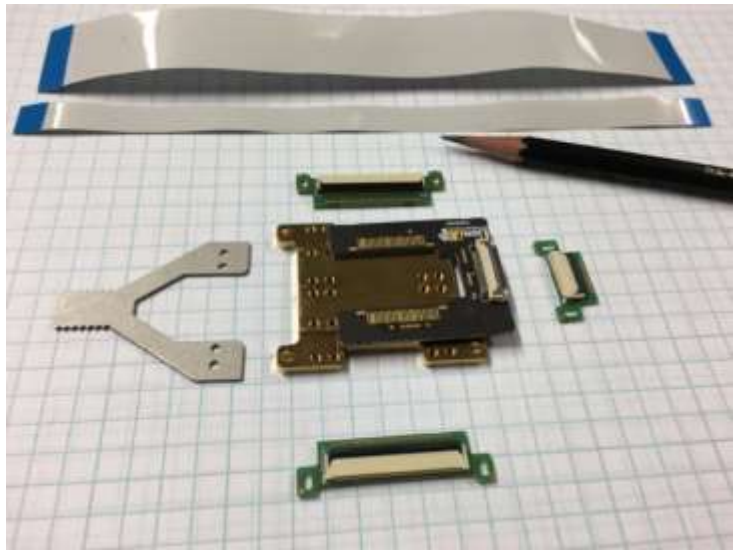
Characterization Package Service:

- Modular package approach for stand alone functional PIC characterization
- Capable of addressing several form factors and interfaces
- Applicable for edge and grating optical fiber interfaces
- Up to 32 fibers in and out
- Up to 300 electrical contacts
- Up to PIC's in a line
- Chip design guidelines available for compatibility with CPS

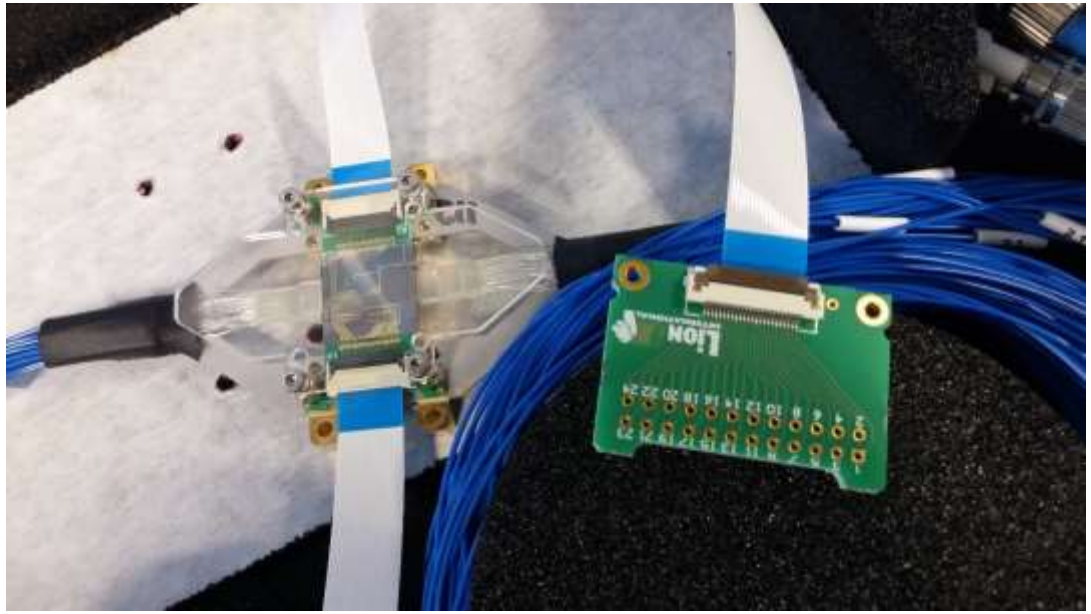
Characterization Packaging Service

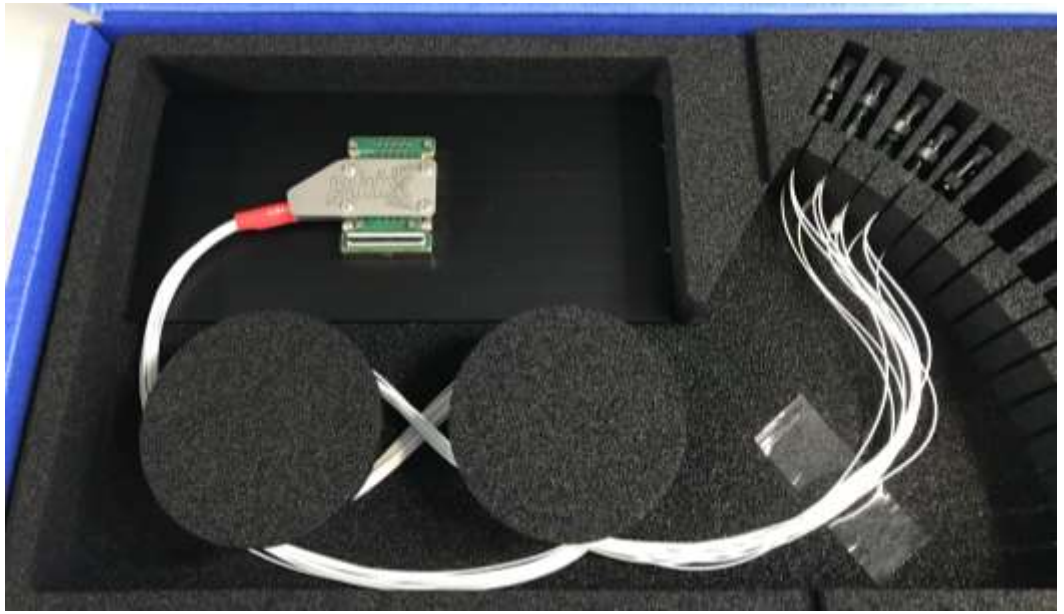




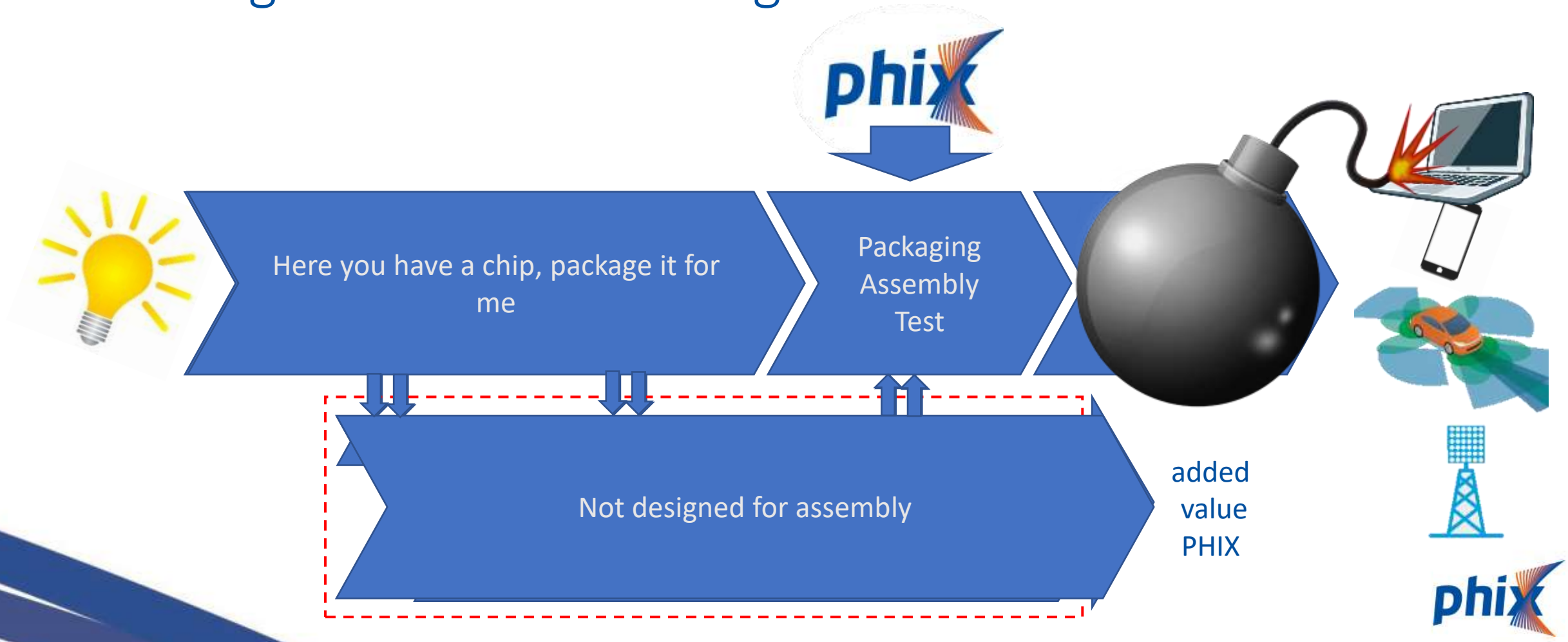


CPS Example: MPW customers

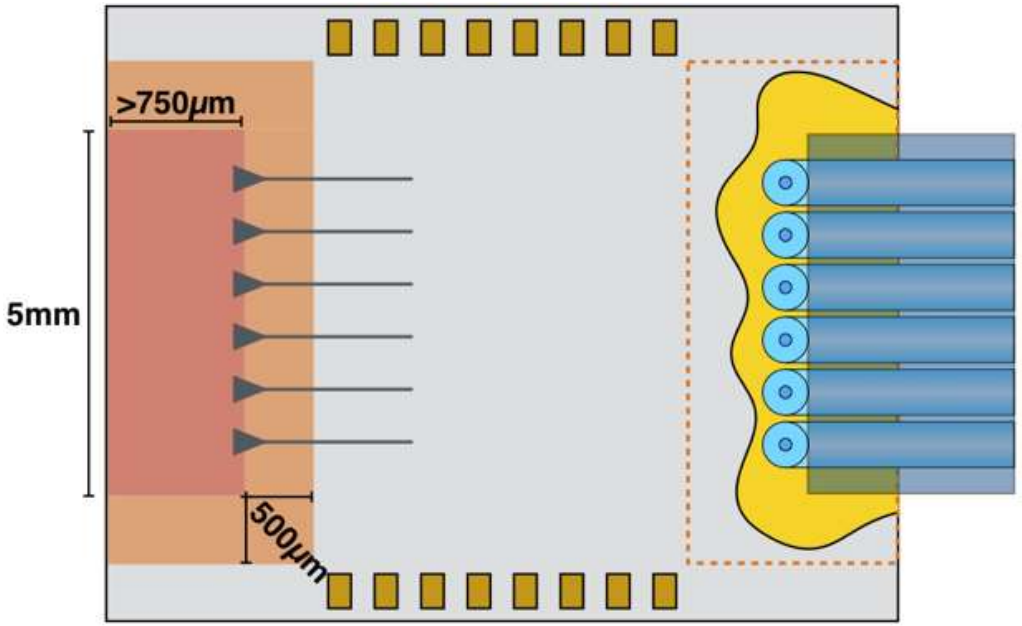


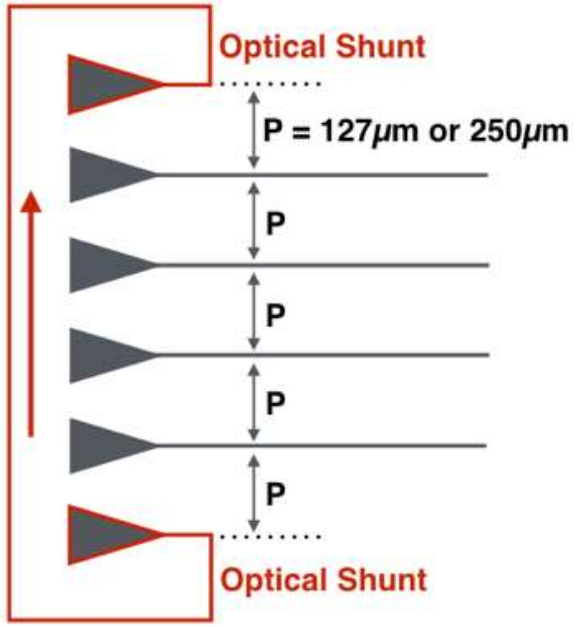


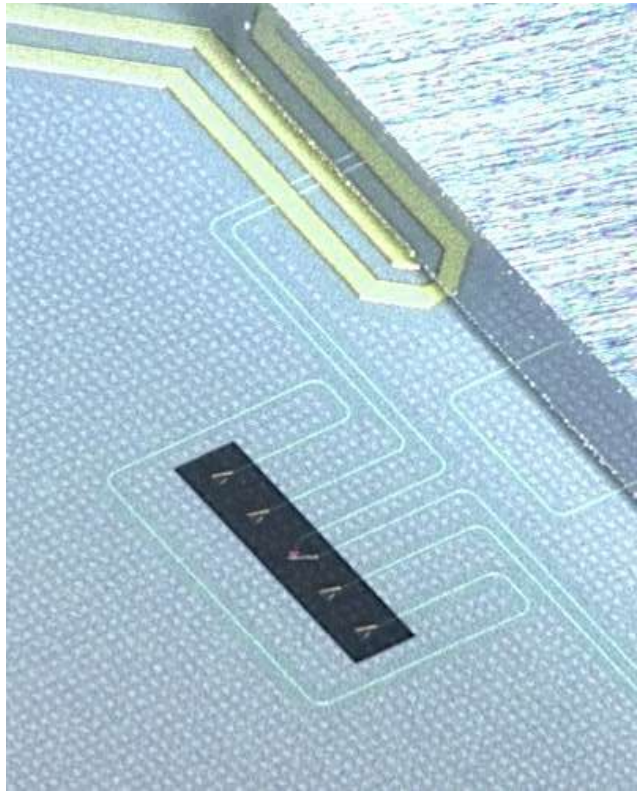
Challenge for low volume high mix

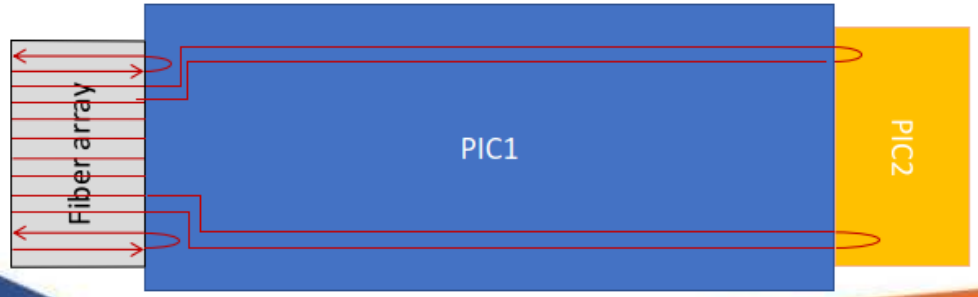


Design for assembly; design rules

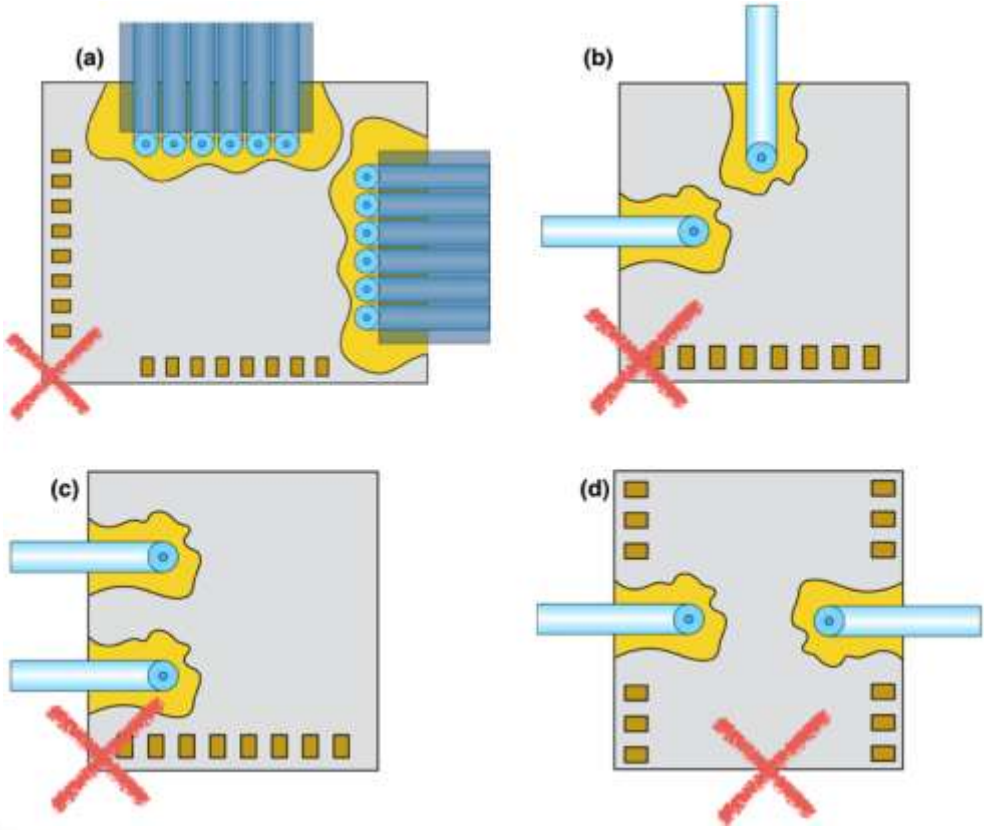


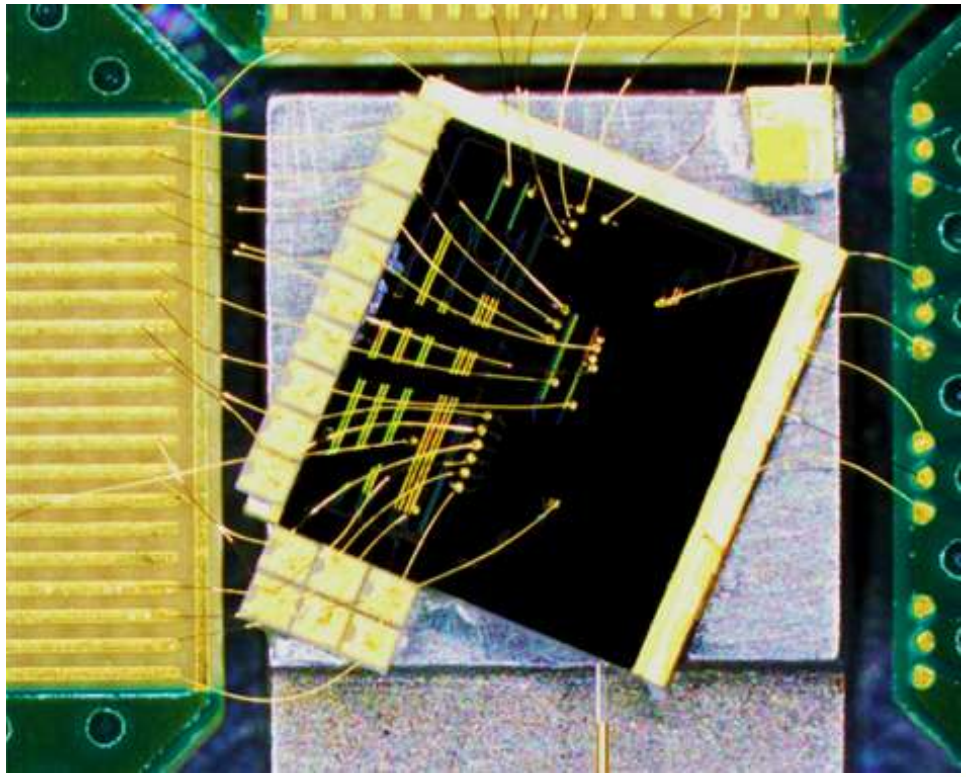






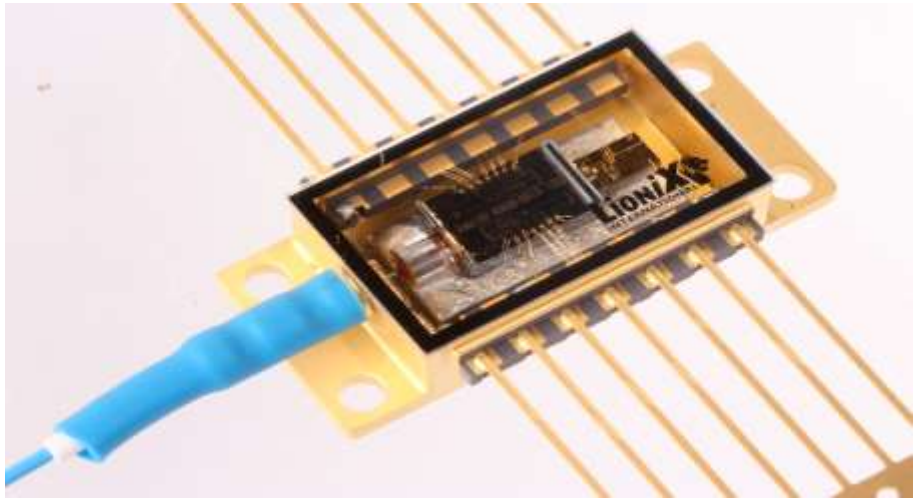
Design for assembly; design rules





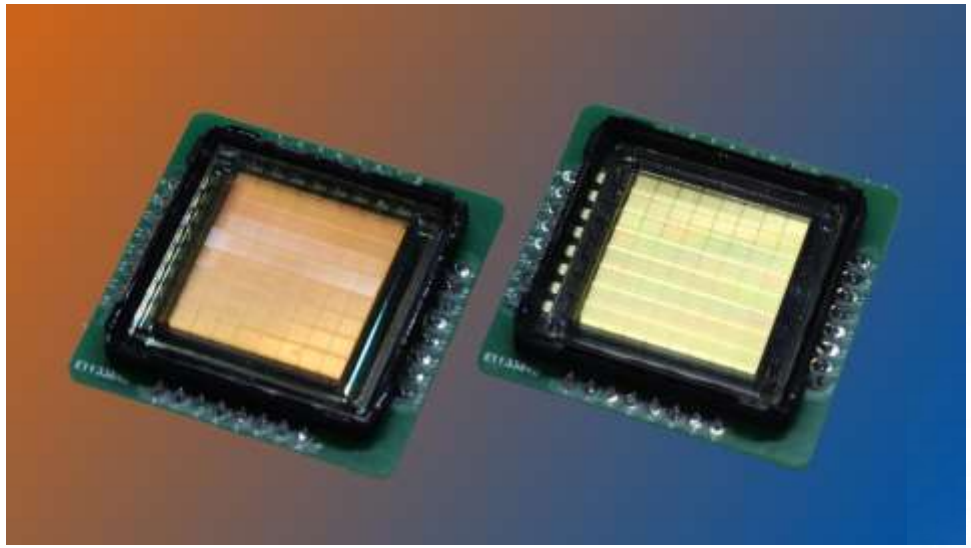
Photonic IC packaging advantages using CPS

- Limited details required to allow for succesfull packaging
- 100’s of designs packaged already for various markets
- Customisation only when required
- Thermal control loop can be developped / excluded
- Low engineering effort to build samples
- Short turnaround time
- Chip surface is accessibele, allowing for visual debugging
- Allows for quick ramp up leveraging exisiting investments for other markets



Picture courtesy LioniX international demonstating volume product initially developped using CPS platform

Fully solid state lidar scale up

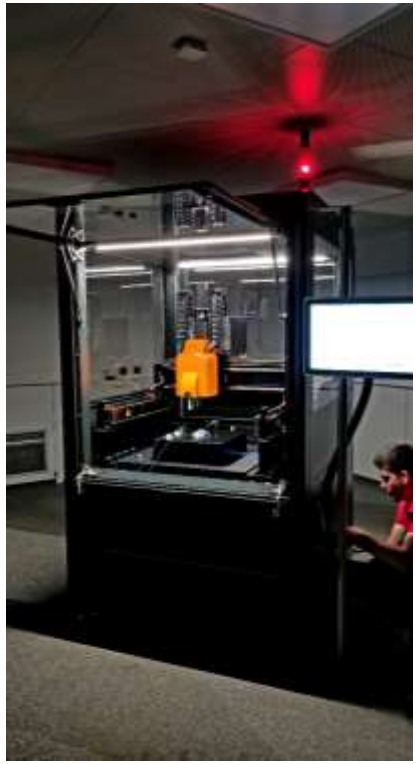


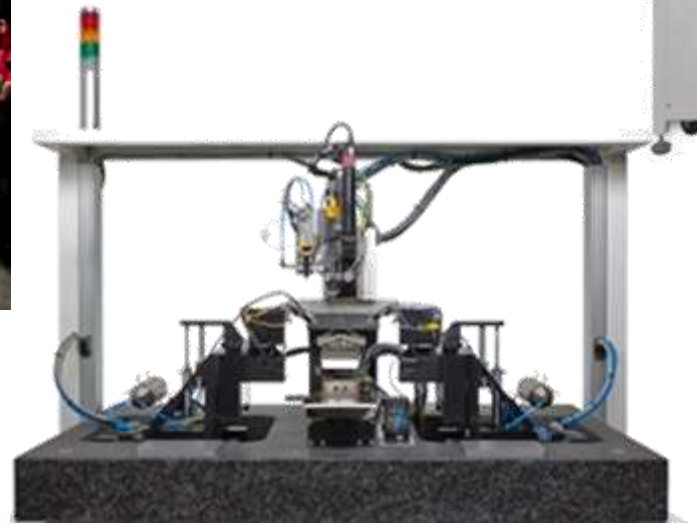
Picture courtesy of SOS lab

Picture courtesy of SOS lab

Base technology developped
for biosensor application

Scalable automation





The possibility's are endless, but think of packaging in an early stage and get a solid commercialization route

Jeroen Duis

j.duis@phix.com

EPIC question: “What can they do for you? What can you do for them?”

- Lower bill of materials
  - Housing metal gold box style / moulding
  - Hermeticity / reliability
  - Thermo Electric Cooler (athermal design)
  - Fiber feedtrough
  - PM vs SM fiber arrays
- Lower assembly time
  - Faster processes -> current tact time automotive: 2 seconds
  - Take out manual handling labor
  - Risk Scale up with generic / dedicated equipment
    - 10pcs, 10K pcs, 1M pcs, 100M pcs