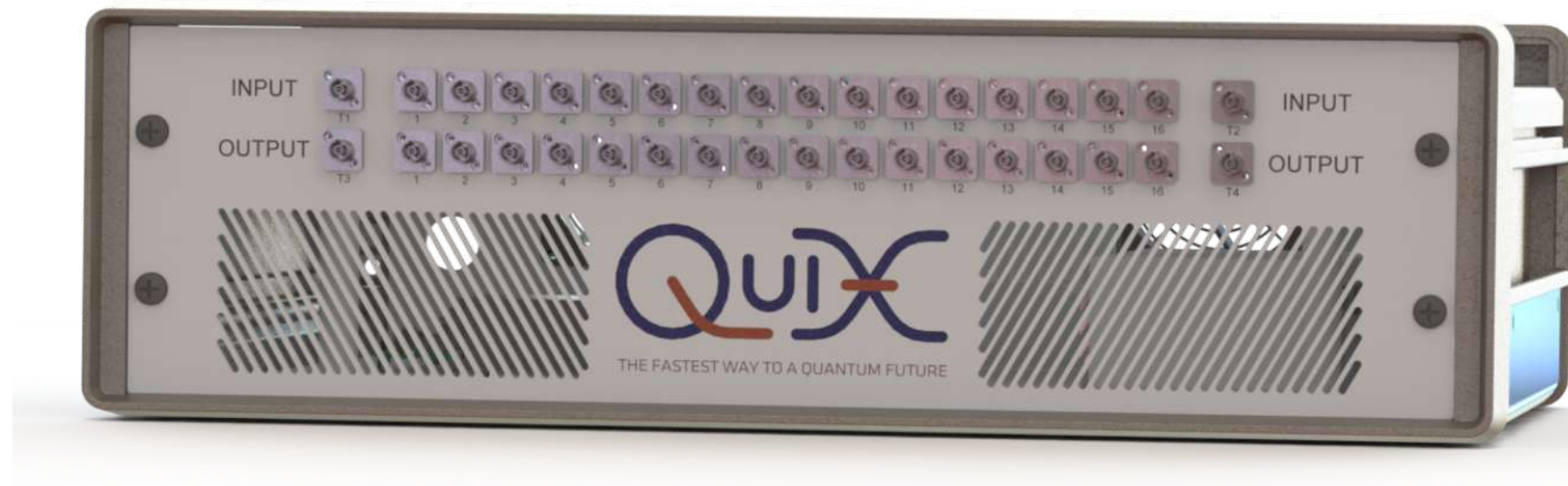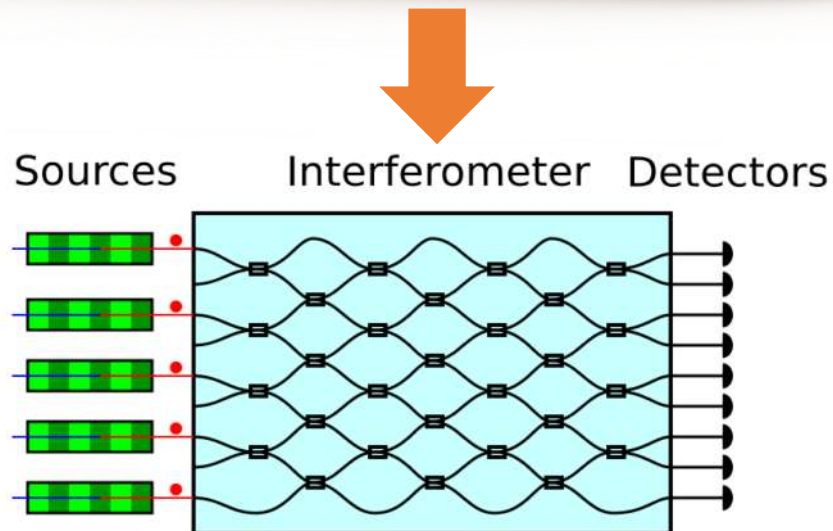# Quantum technology solutions based on Si_3N_4 PIC

Caterina Taballione - Quantum system engineer

A quantum photonic processor

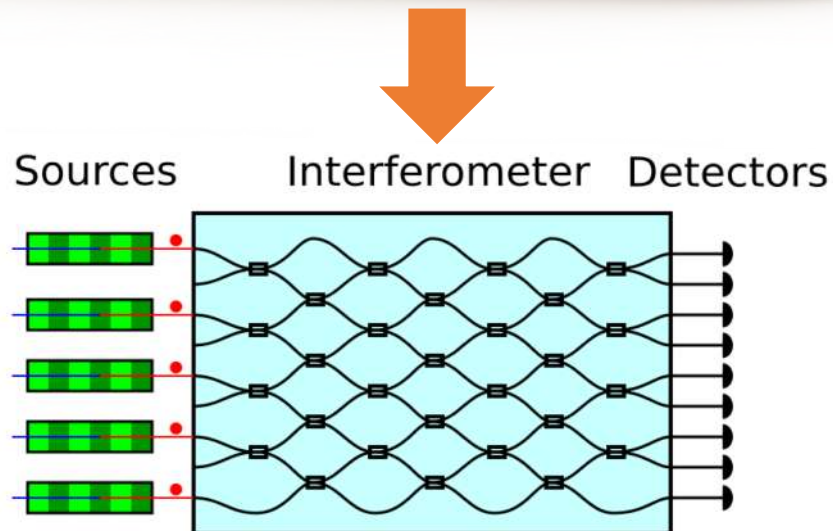Reconfigurable photonic chip
Arbitrary Unitary transformation

EPIC Online Technology Meeting
on Quantum Computing
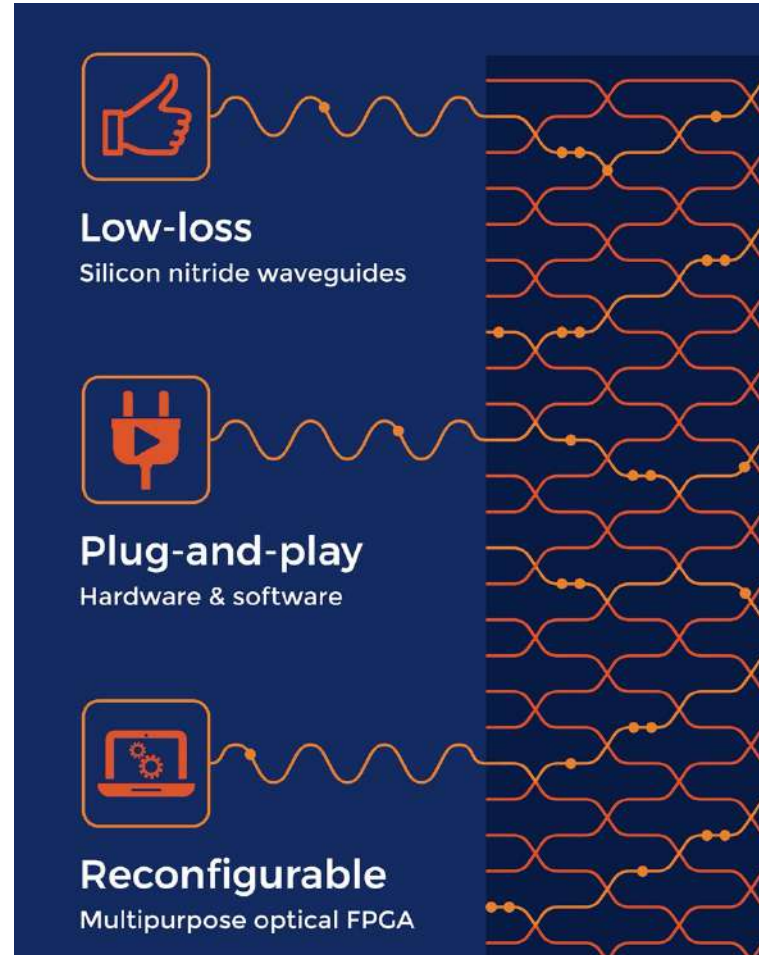
Caterina Taballione

A quantum photonic processor

Reconfigurable photonic chip
Arbitrary Unitary transformation

Linear optical quantum computing

Knill, Laflamme, Milburn Nature 409, 46-51 (2001)

EPIC Online Technology Meeting
on Quantum Computing

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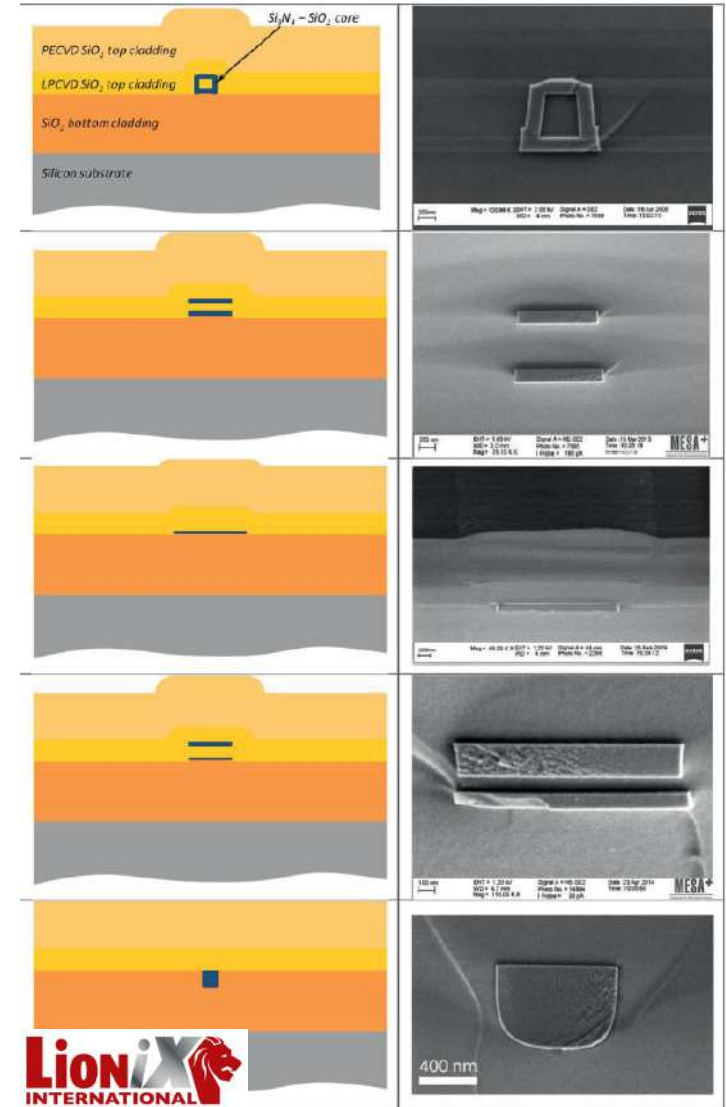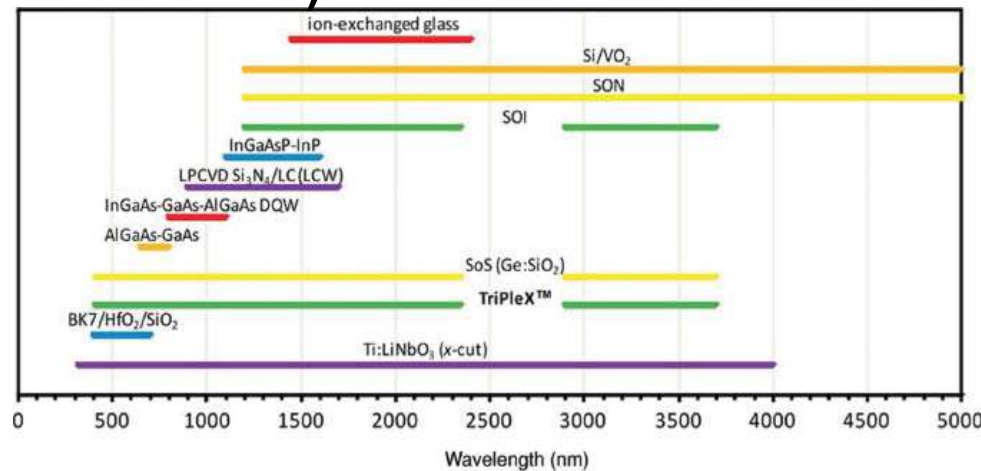# QuiX photonic processor
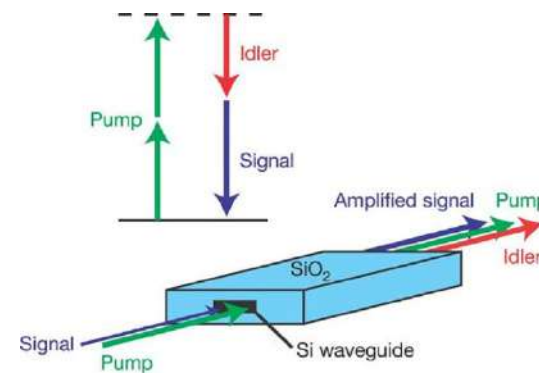
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Low loss: Si_3N_4
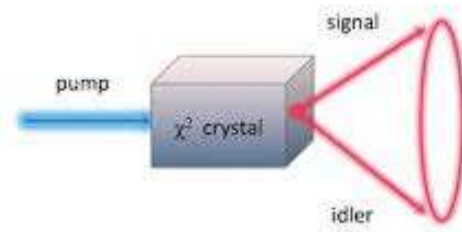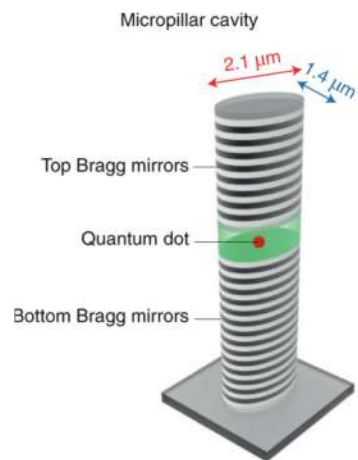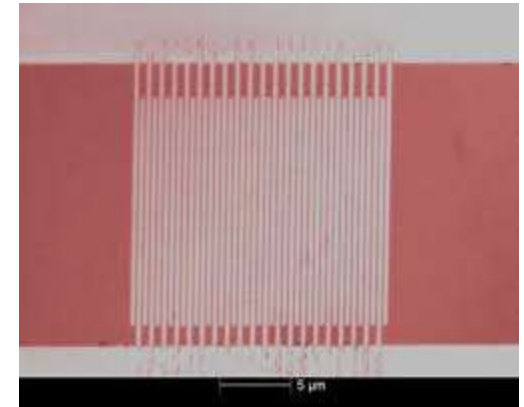
- Low loss (0.1 dB/cm)

- Maturity of Triplex technology

- Wide transparency window (425 – 3700 nm)

Low loss: Si$_3$N$_4$

- Wide transparency window (425 – 3700 nm)

Micropillar cavity

Top Bragg mirrors

Quantum dot

Bottom Bragg mirrors

THE FASTEST WAY TO A QUANTUM FUTURE
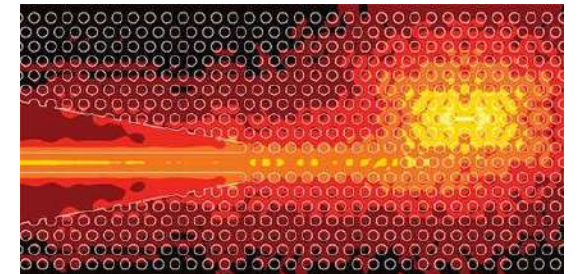
Plug-and-play

- Electronically and optically packaged. Allowing for easy integration
- Low loss fiber interconnects
- Chip is thermally stable
- All heaters individually tunable to achieve a full phase shift of more than 2π.
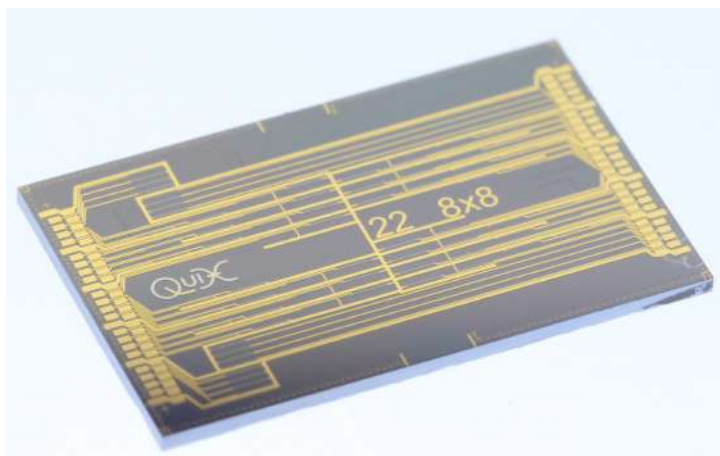
Plug-and-play

- Easily swap out the chip in the box
- Remotely controllable
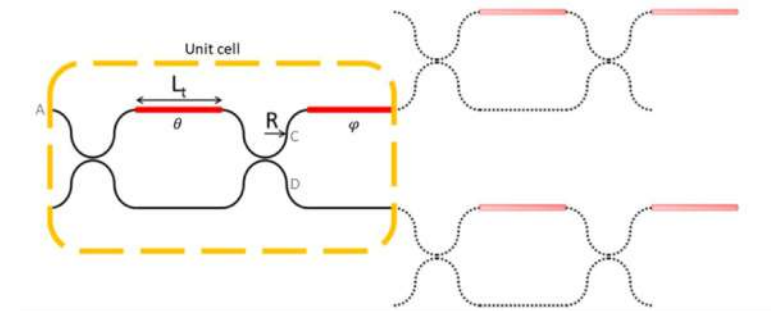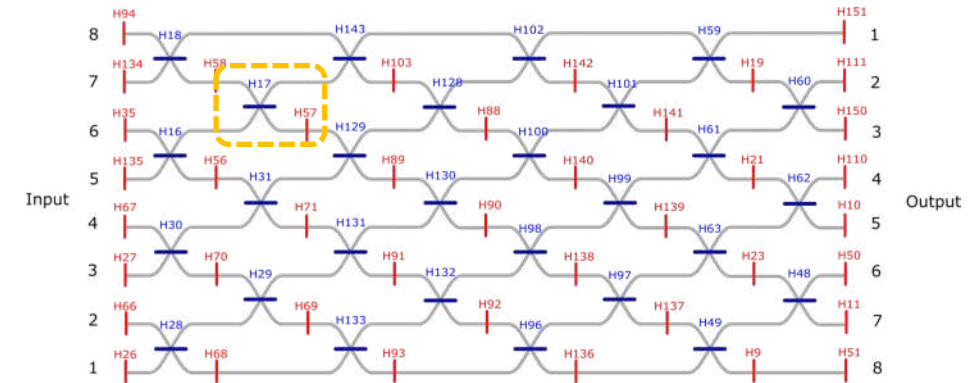- Integrated software package for full control.

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Reconfigurable

- ## Grid of Mach Zehnder interferometers

 Clements et al. Optica, 3, 1460–1465 (2016).

8x8 photonics processor
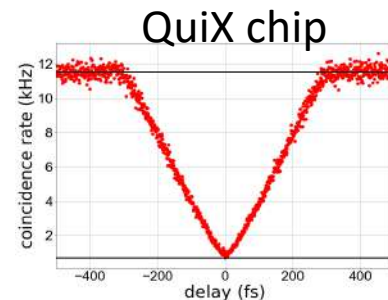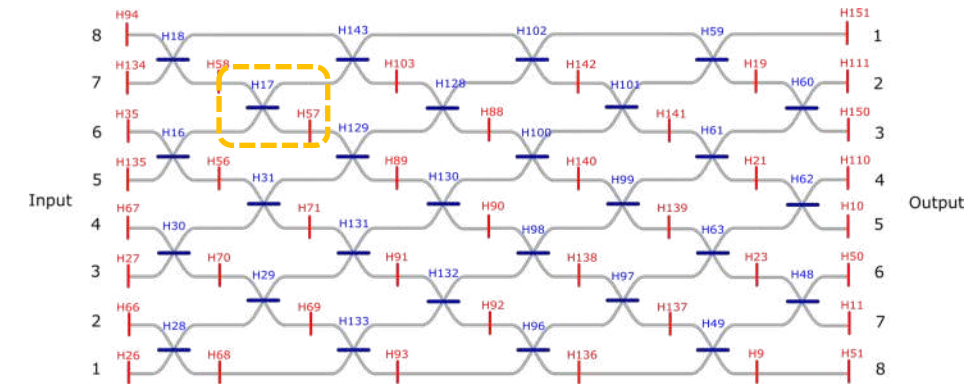
Reconfigurable

- Grid of Mach Zehnder interferometers

  Clements et al. Optica, 3, 1460–1465 (2016).

- Fiber to Fiber loss 3.1 dB (49% transmission)
- Fidelity of the transmission when implementing a unitary (97%)
- Fidelity quantum interference (99%)

8x8 photonics processor

QuiX chip

Source

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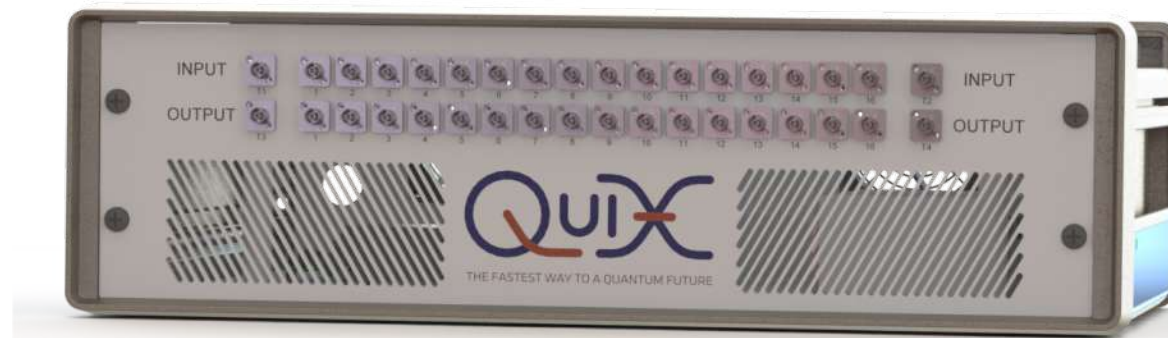
QuiX

THE FASTEST WAY TO A QUANTUM FUTURE
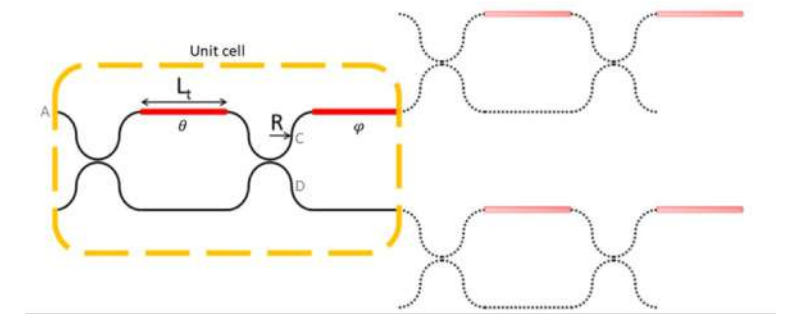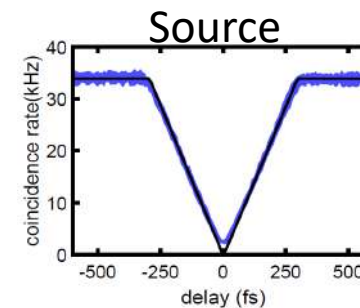
Applications

- Matrix multiplications
- Large multimode interferometer
- Machine learning
- Quantum information processing
- Quantum mechanical simulations:
        materials
        (bio) chemistry
  - Quantum key distribution

Sources   Interferometer   Detectors

QuiX

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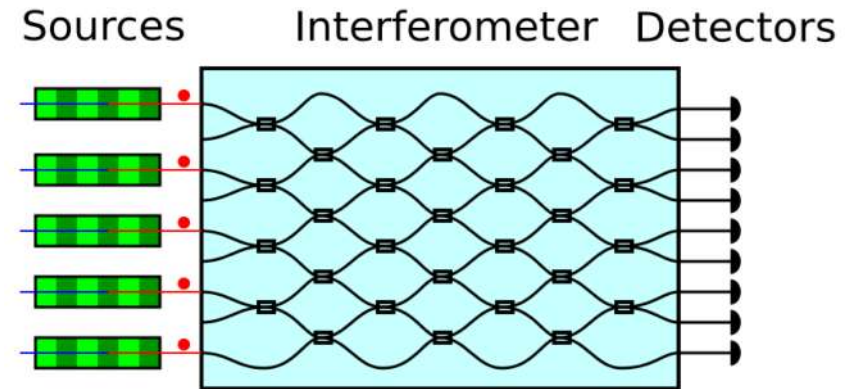
Products

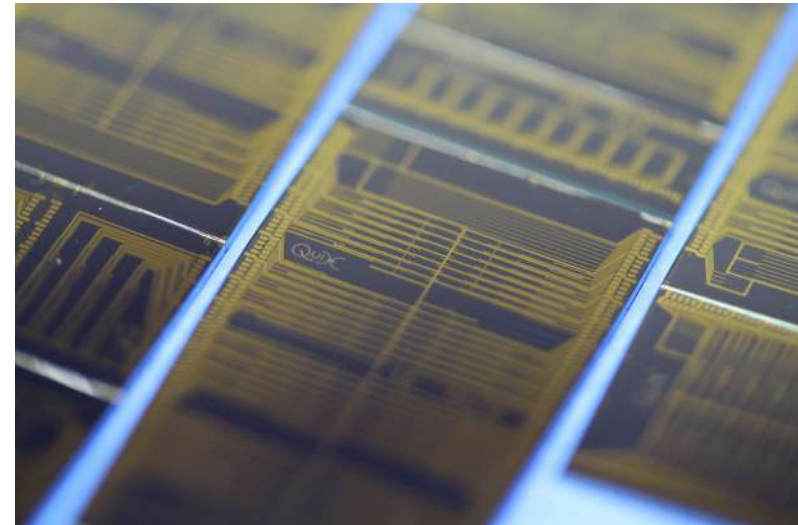## Photonic processor

Available at various mesh size
- 4 x 4
- 8 x 8
- 12 x 12
- 16 x 16

Possible to swap out the chip in the box
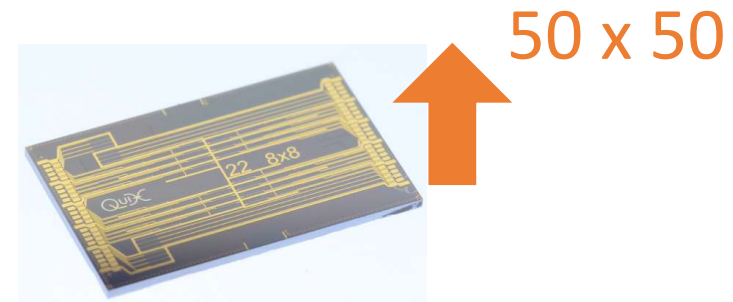
Customized solutions

Individual components we can make
- Beamsplitters
- Phase shifters
- Mach-Zehnder interferometer
- Delay lines
- Filters
- Ring resonators
- Spot size converters

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Future plans

- We are planning to growth to 50x50 system in a few years.

50 x 50
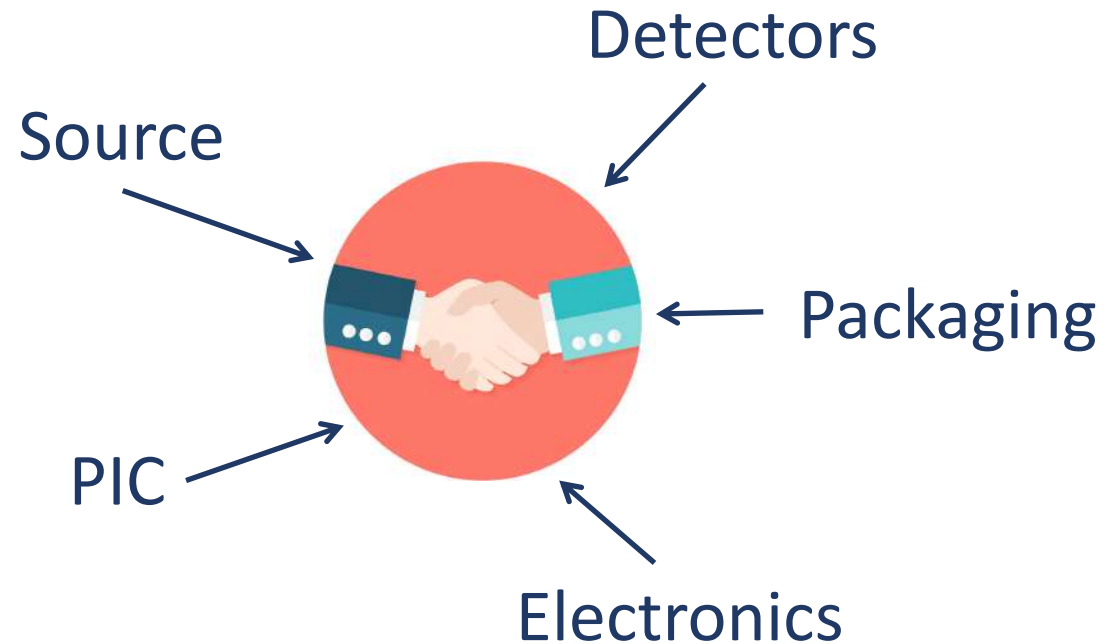
- Integrate the entire system with sources and detectors

Source Detectors

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Future plans

- Expand our team and network
  of collaborations

Detectors

Source

Packaging

PIC

Electronics

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Thank you!

Hans van den Vlekkert
CEO

Jelmer Renema
CTO

Caterina Taballione
Quantum system engineer

Henk Snijders
Quantum system engineer

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QUIX

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