



**Silicon Nitride integrated photonics
for communications and computing**

LIGENTEC

European PIC company with global reach



Ghent, Belgium



Lausanne, Switzerland



> 80 photonic enthusiasts



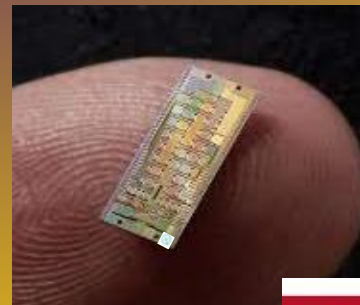
Corbeil, France



Global Reach

Best-in-class integrated passive SiN

- Low Loss SiN
(< 5 dB/m SM to < 0.5 dB/m MM)
- 3 Technologies
(AN150, AN350, AN800)
- Extensive PDK

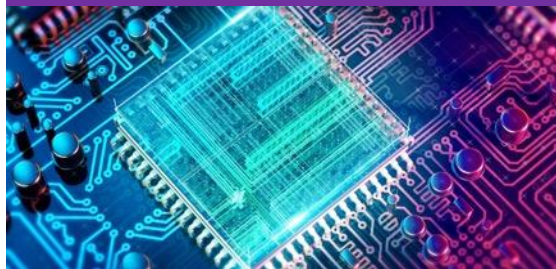


ISO 9001
BUREAU VERITAS
Certification



Advanced Computing

Quantum Computing
Neuromorphic Computing
Optical I/O (AI)
...



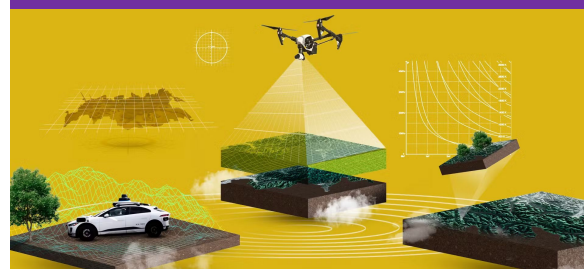
Communication

QKD
Telecom
Data Transmission
Satellite Communication
...



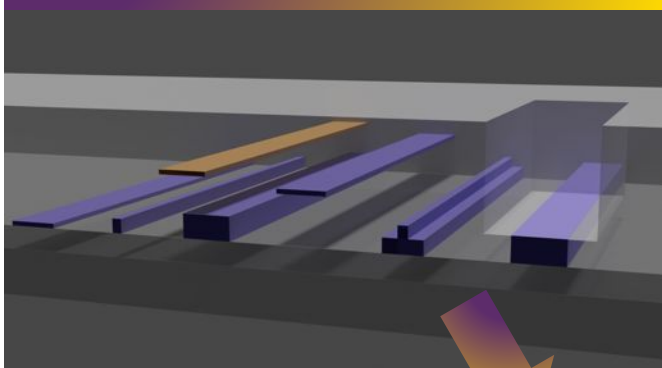
Sensing

Metrology
OCT / LiDAR
Atomic Clocks / GPS-less navigation
Fiber sensing
...

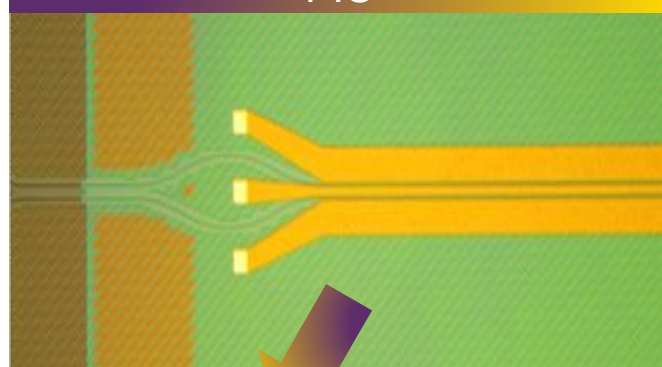


Unleash the potential of PICs!

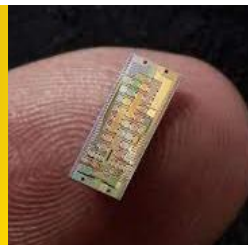
Provide **lowest loss**
Passive PICs at **scale**



Integrate **light modulation** on the
PIC



Unleash the potential of PICs
‘Let’s PIC it’



A base to build on
Versatile Platform



3+ thicknesses

10+ process modules

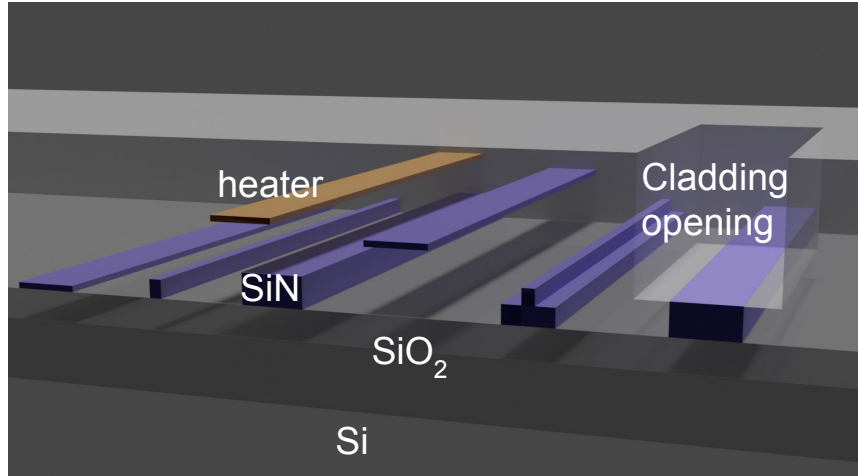
Extensive PDK

800 nm

350 nm

150 nm

custom



One basis, large diversity in the add-ons

Materials and Functionalities

Many great materials, each with their own merits:

InP

GaAIAs

BTO

Plasmonics

Polymer

LNO

AlN

...

+

SiO₂

SiN

SiN

SiN

Si

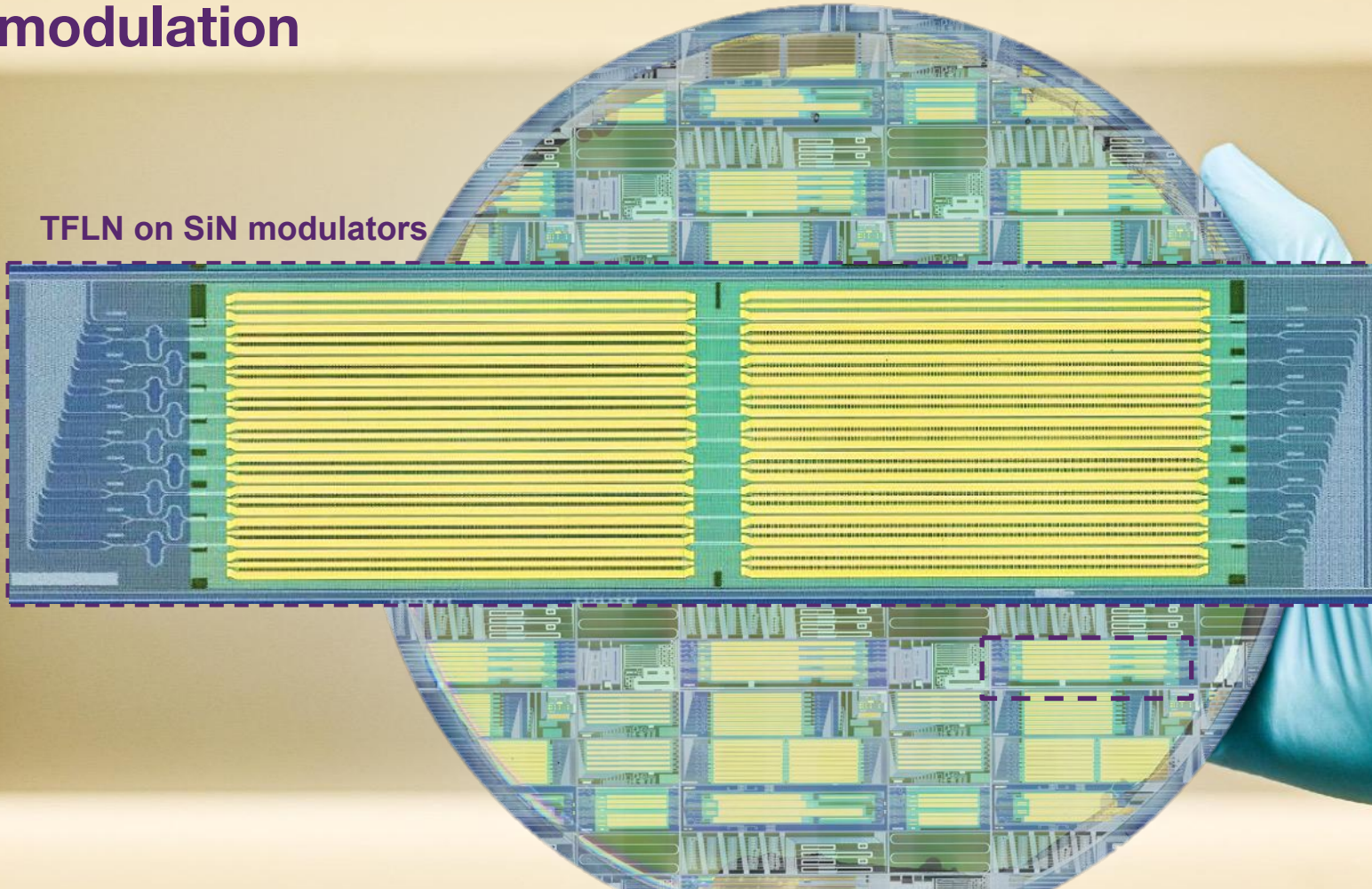
On-chip gain

PhotoDetectors

Fast modulation

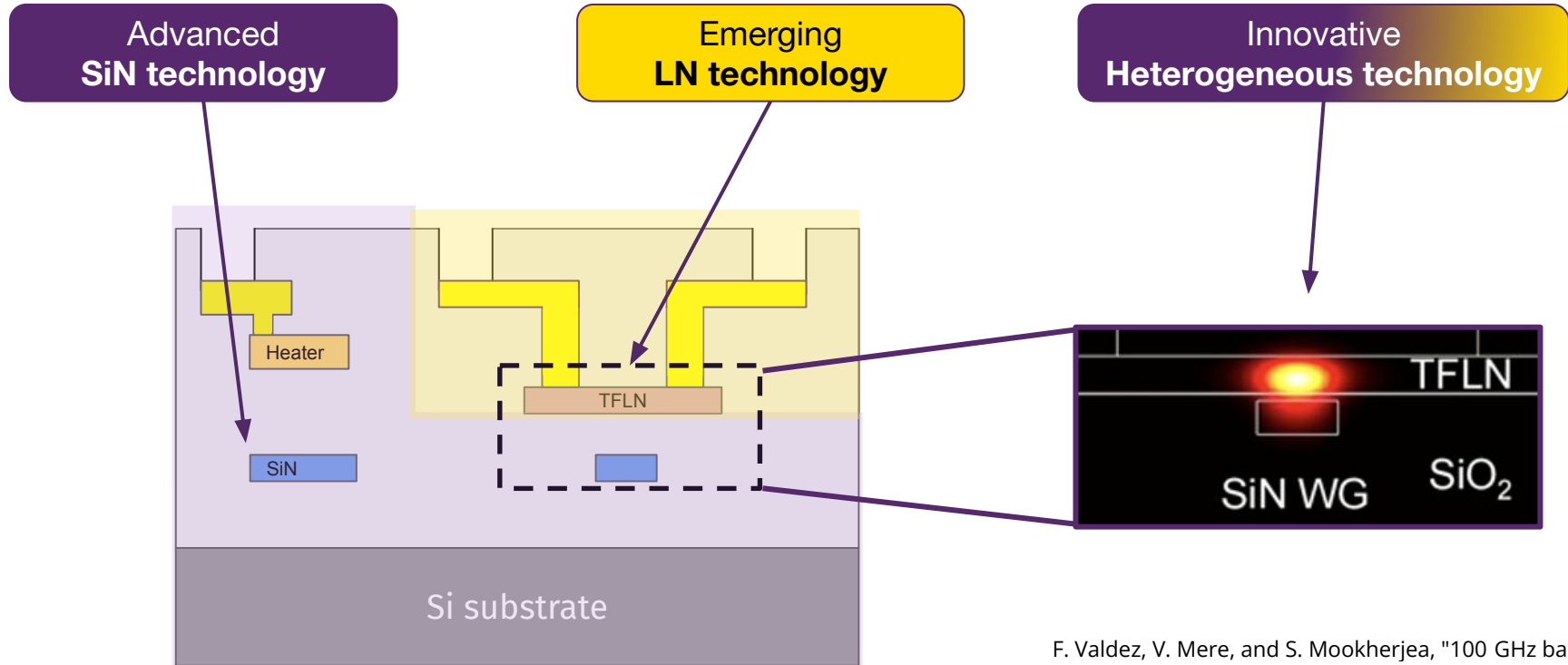
Lithium-Niobate on SiN integration allows for low-loss RF modulation

TFLN on SiN modulators



Technology breakthrough

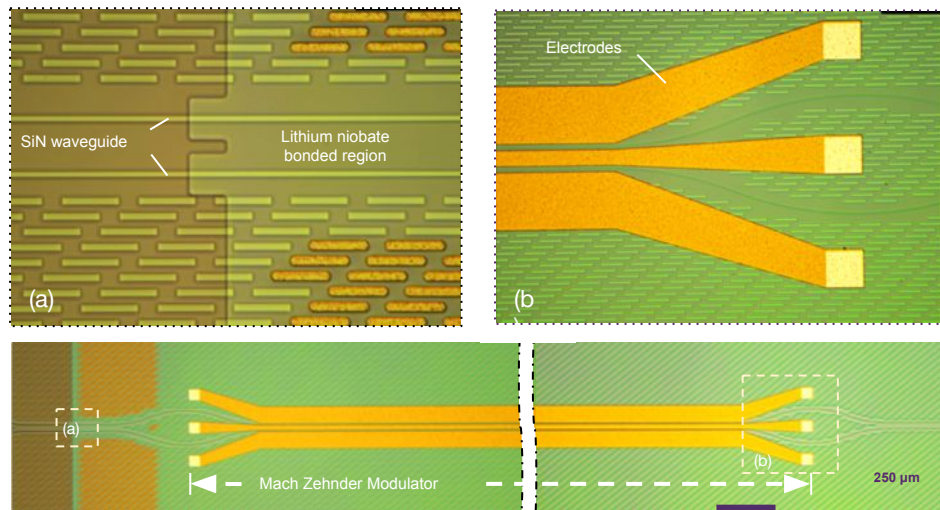
Heterogeneous integration of SiN and LN



F. Valdez, V. Mere, and S. Mookherjea, "100 GHz bandwidth, 1 volt integrated electro-optic Mach-Zehnder modulator at near-IR wavelengths," Optica 10, 578-584 (2023)

Available process

Modulator for low insertion loss modulation



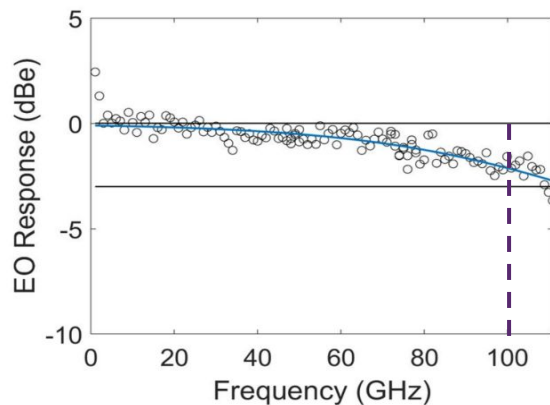
Key specs of current technology

- > 10 GHz 3-dB bandwidth
- < 1 dB coupling from SMF fibre to chip

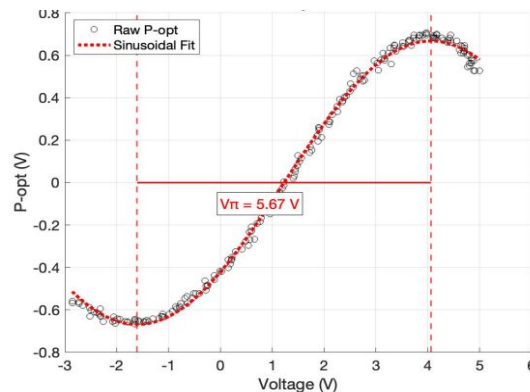
AN800 + AN350 PDK compatible

- High Q ring resonators
- All standard building blocks available

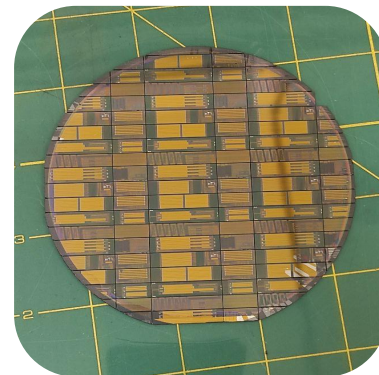
High speed modulators demonstrated



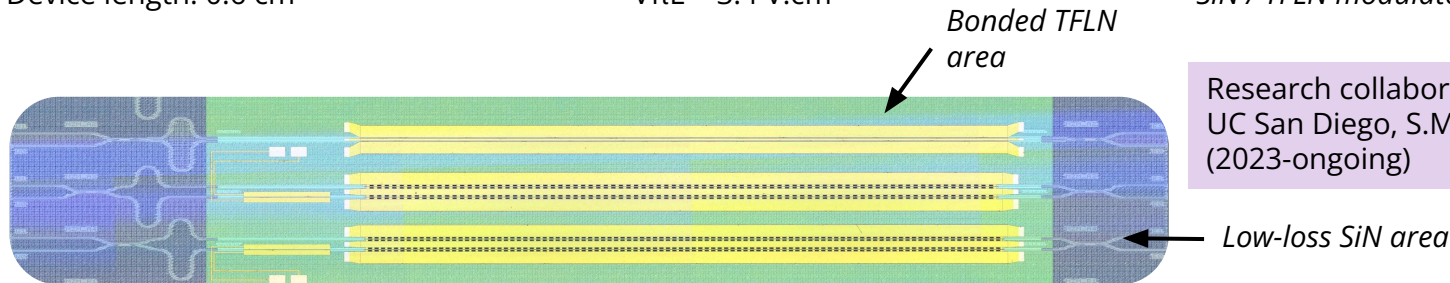
Bandwidth up to **110 GHz** measured
Device length: 0.6 cm



MZM insertion loss < 5 dB
 $V_{\pi}L = 3.4 \text{ V.cm}$



LIGENTEC wafer with high-bandwidth
SiN / TFLN modulators



Research collaboration with
UC San Diego, S.Mookherjea
(2023-ongoing)

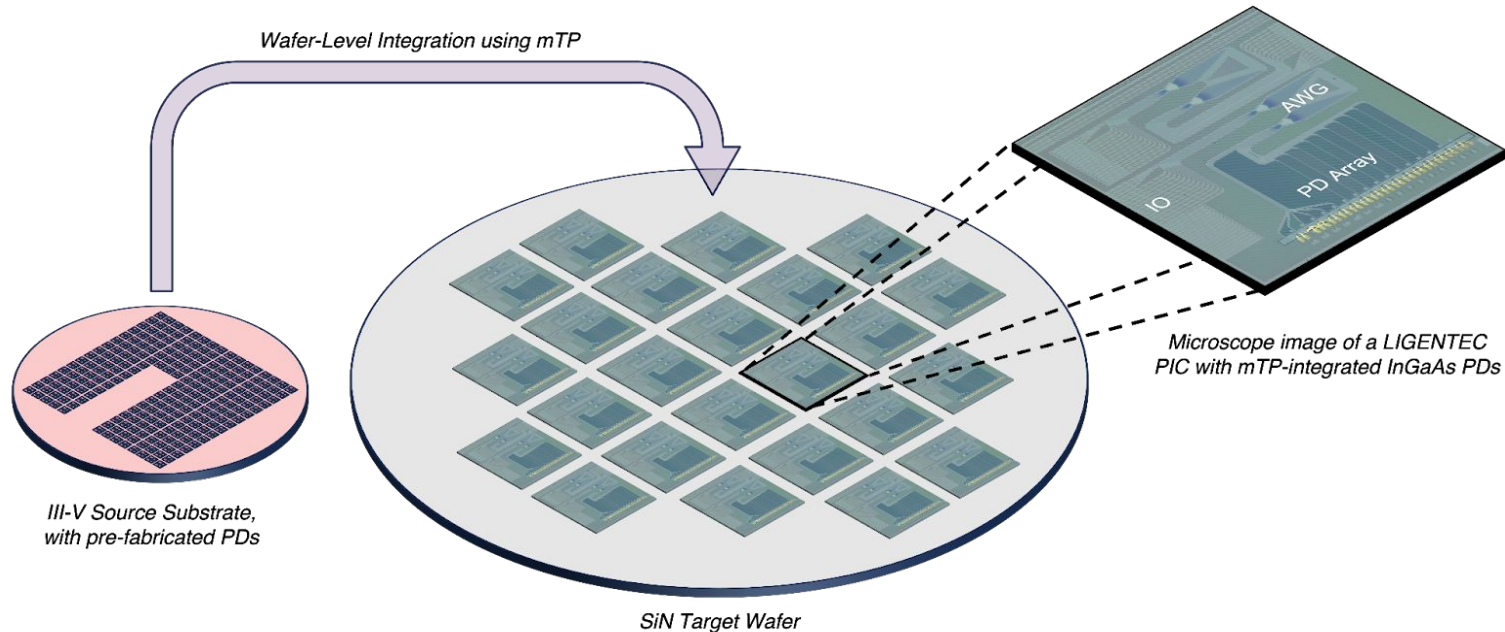
"High-performance Hybrid Lithium Niobate Electro-optic Modulators Integrated with Low-loss Silicon Nitride Waveguides on a Wafer-scale Photonics Platform" (Preprint, 2025)

Detection



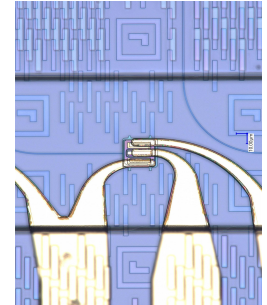
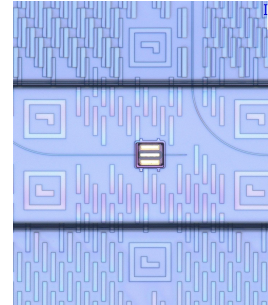
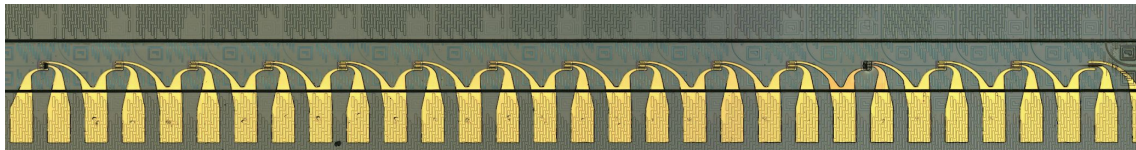
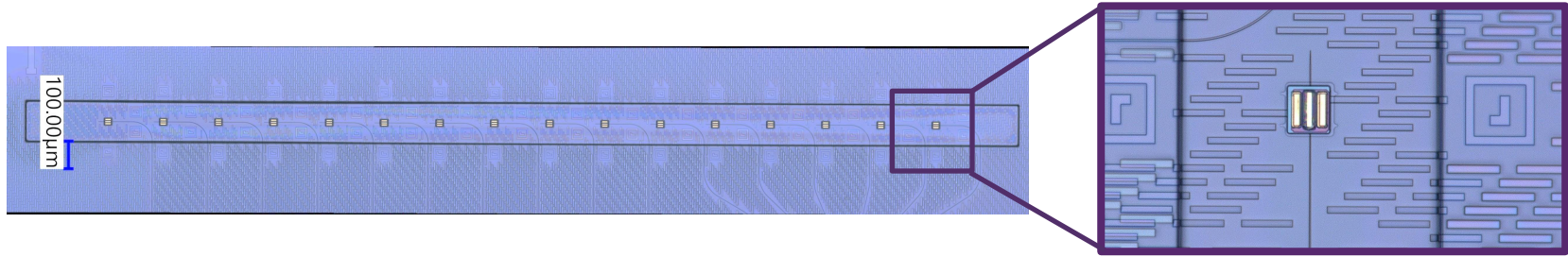
Heterogeneous integration of photodiodes

Micro-Transfer Printing: high-throughput wafer-level integration technique



Heterogeneous integration of photodiodes

Compact active devices to be transferred onto processed SiN photonic circuits...



Provide **lowest loss**
Passive PICs **at scale**

MPW runs every 2 months
Dedicated runs any time

www.ligentec.com/offering/

Integrate **light modulation and**
detection on the PIC

 **LABS**
LIGENTEC

4 MPW runs per year
Dedicated runs any time

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Unleash the potential of PICs
‘Let’s PIC it’



LIGENTEC Labs provides early-stage to access advanced technologies

On-Chip Integrated Photodetectors

The heterogeneous on-chip integration of III-V photodetectors can greatly extend the functionalities and corresponding application scope of low-loss silicon nitride photonic integrated circuits, all while retaining the compact footprint, high performance, and possibility for manufacturing at scale.

For the integration of InGaAs photodetectors, LIGENTEC is making use of micro-transfer-printing to integrate the photodetectors at wafer-scale, and at customer-designed locations in order to allow the photodetectors to be used in a variety of applications, ranging from high-speed and balanced photodetector pairs for communication and sensing, to monitor detectors and detector arrays for multi-channel read-out.

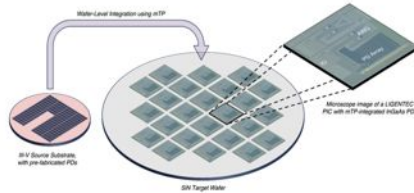


Figure 1: Illustration of the water-level integration of the InGaAs photodetectors. The detectors are pre-fabricated on a III-V wafer, before the transfer to the SiN wafer. After transfer, the devices are interconnected for read-out.

The micro-transfer-printing (mTP) method is ideally suited for wafer level integration of non-native materials on top of a CMOS fabricated ultra low-loss SiN platform. The non-native material, III-V InGaAs photodetectors (PDs) in this case, is fabricated in a dedicated III-V foundry. In this way, we get the best of both worlds: SiN waveguides out of the CMOS fab, and the III-V active components out of the dedicated III-V fab. The devices are printed at the photonic waveguide level, after opening up local parts of the top oxide cladding of the SiN wafer. The technology has a sub-micron alignment accuracy, and is capable of increasing throughput with respect to flip-chip integration. The mTP integration is done at the back-end-of-line level (BEOL) as one of the final procedures before wafer singulation.

The technology is capable of integrating different materials together at the same stage in the fabrication flow, ranging from InGaAs detectors to InP DFB lasers to Lithium Niobate modulators, to increase the overall capability of the photonic integrated circuit (PIC). By co-integrating more functionality on the PIC, the complexity and cost of the packaging assembly are reduced.

LIGENTEC SA
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- Early access to advanced technology in cost sharing mode
- Opportunity to steer technology developments from your application



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We are hiring!



Let's PIC it !

