



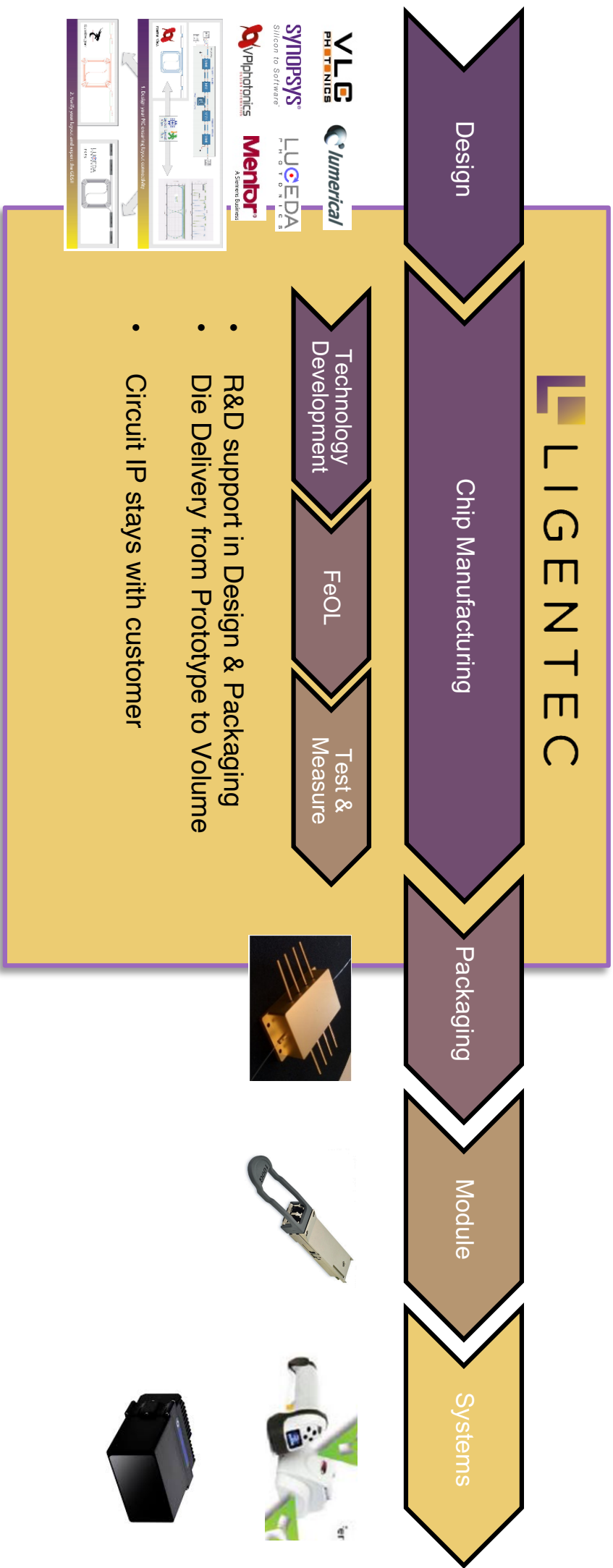
Building blocks for microwave photonics

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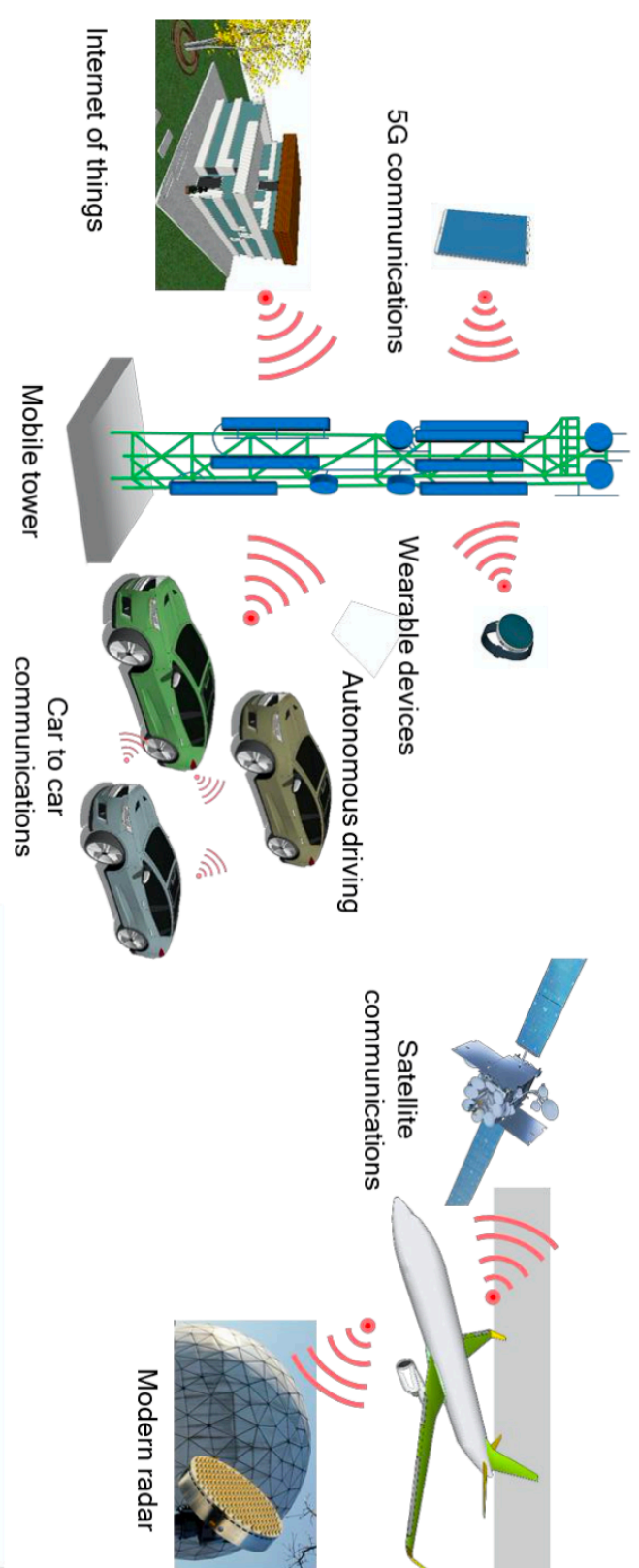
Business Model & Offering



Microwave Photonics applications and needs



Marpaung et al., "New opportunities for integrated microwave photonics", arXiv:1810.02585 (2019)



Needs

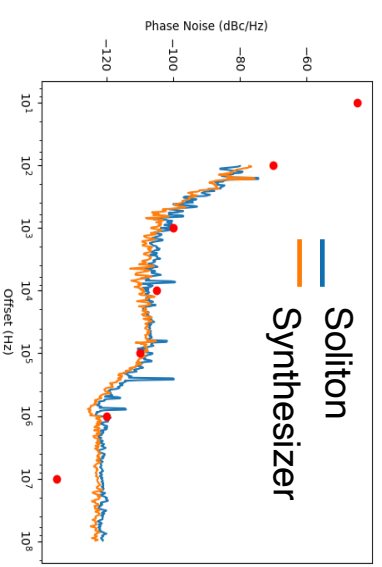
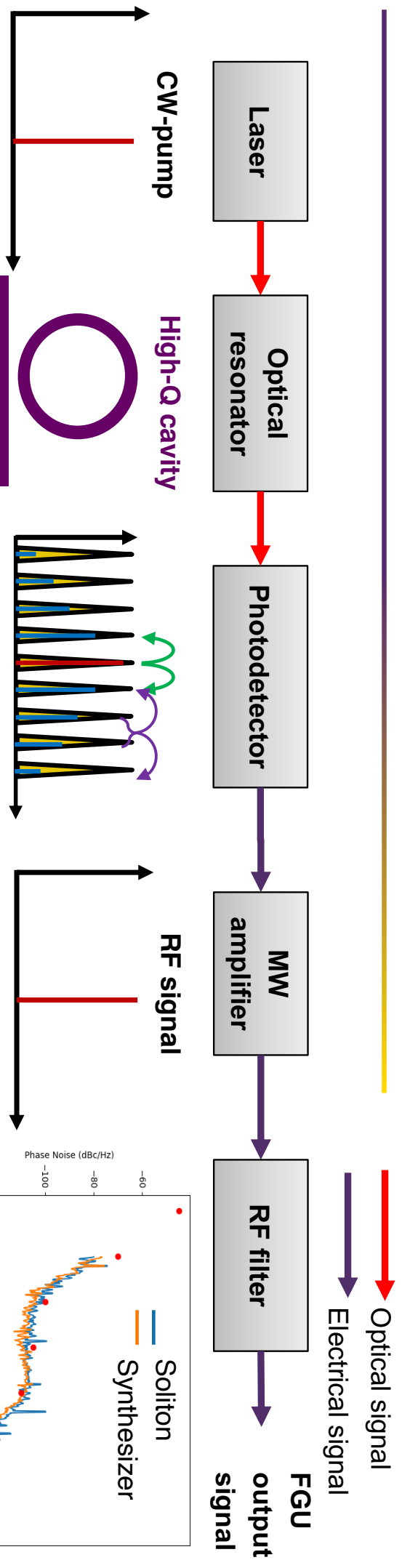
Filters

Low noise MW

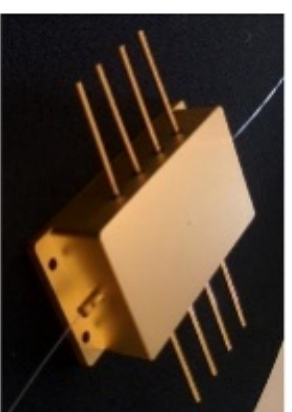
Optical modulation

High dynamic range

Low noise RF frequency generation unit via optical signal



ultralow phase noise reference LO (8-10GHz)

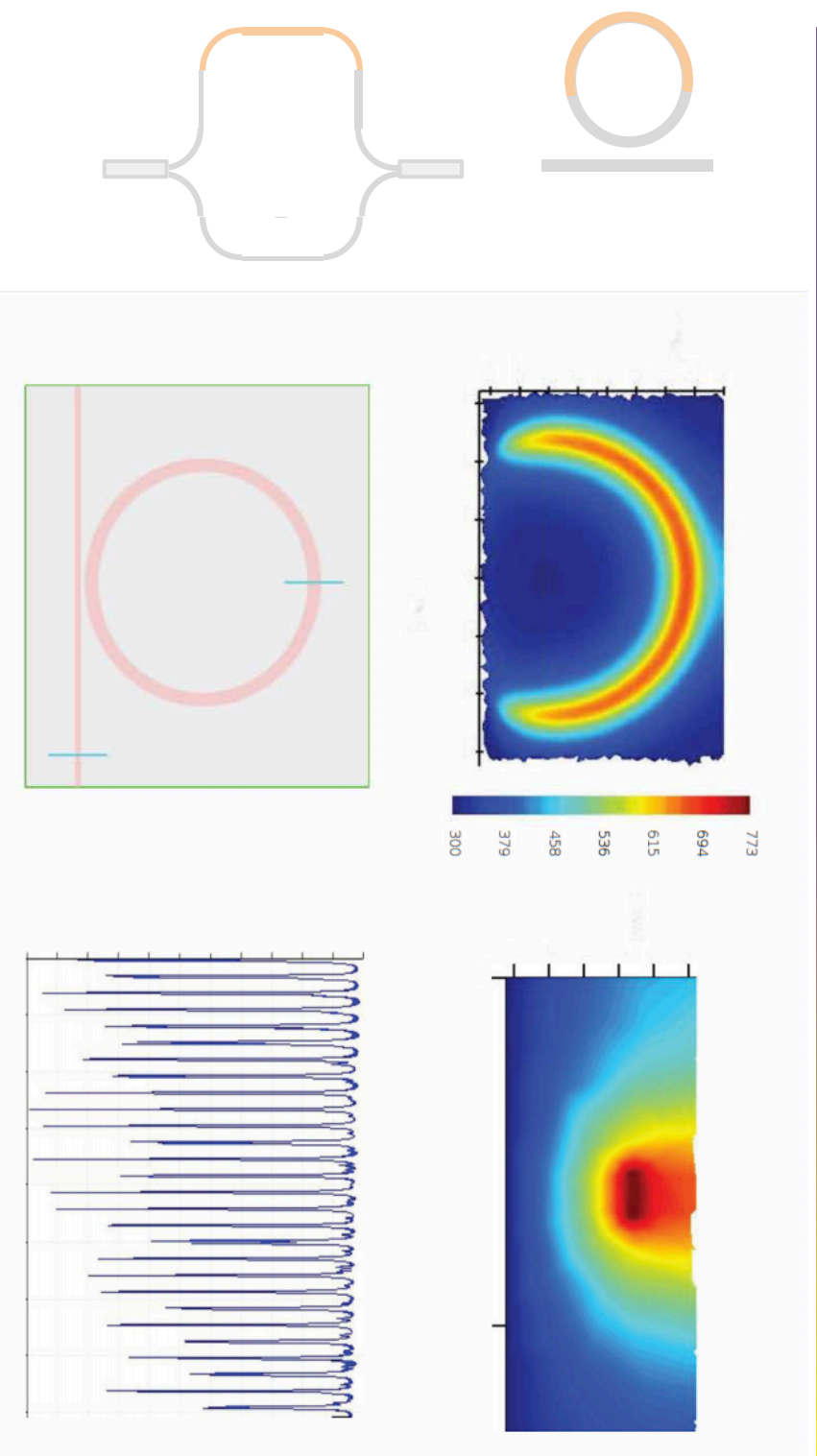


Pulsed soliton regime:
no excess phase noise

Phase Shifting - Thermal circuit tunability with no additional losses.



- Speed 25kHz
- 100mW for pi shift
- Up to 4nm tuning, several FSR / pi-shifts

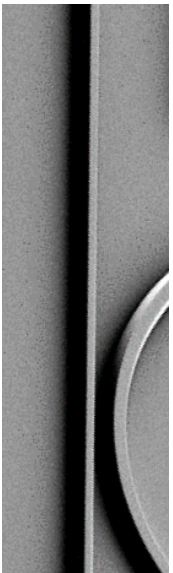


Narrow gap & high mode confinement results in efficient tuning

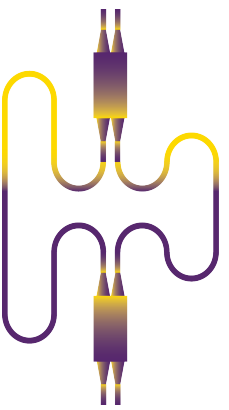
True time delay & Delay Line Interferometers (DLIs)



- Short bend radii
 - Low loss 5 dB/m
- => Long delay lines



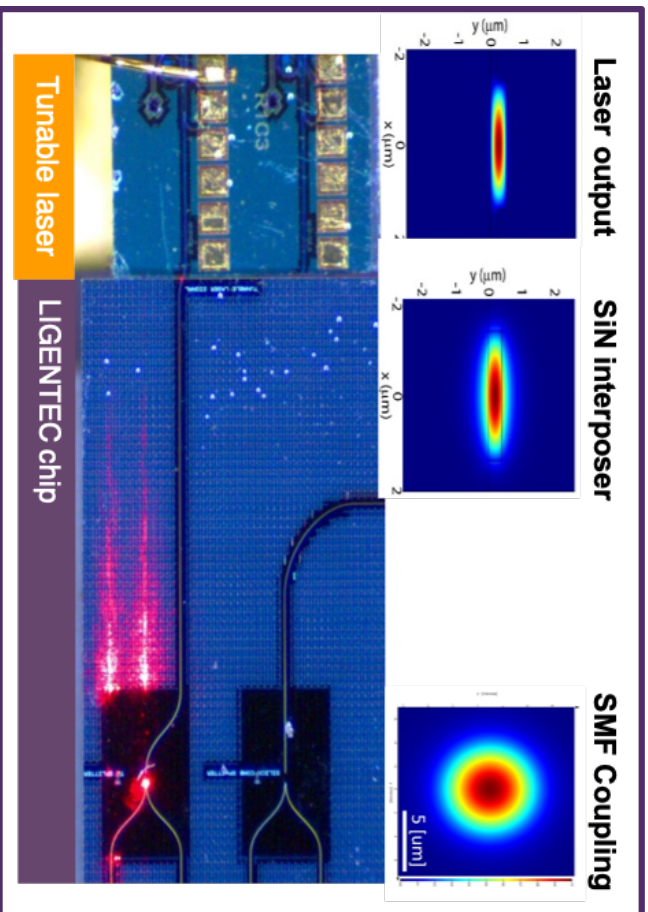
- Small waveguide roughness
 - High mode confinement
- => Low loss & low phase noise



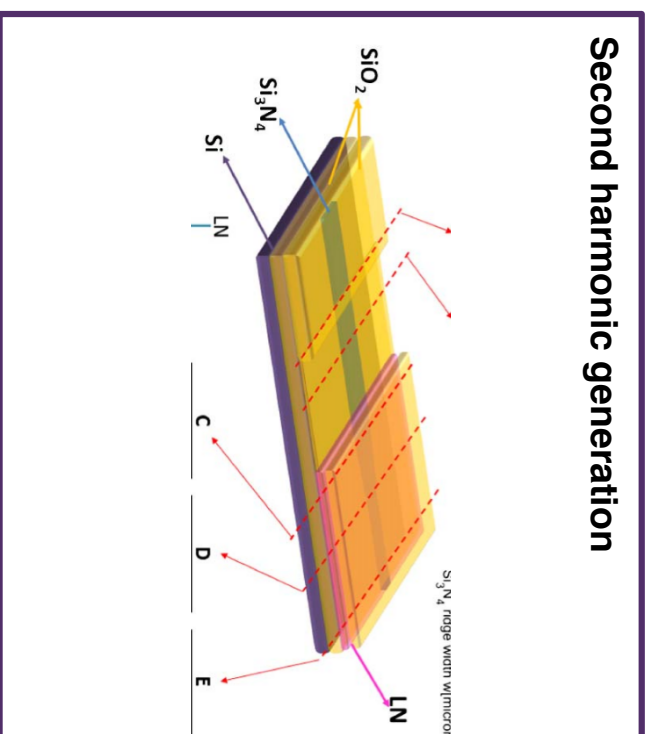
Delay lines up to 1 m on 5x5 mm²

Long and low phase noise delay lines

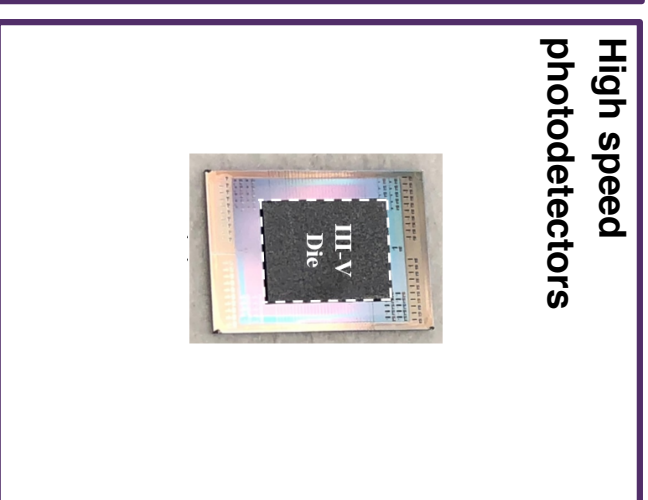
Best of all worlds: PIC platform integration Edge coupling / fiber coupling / LN / III-V



Stroganov et al., ECIO (2019)



Chang et al., Optics Letters (2017)



Yu et al., OFC (2020)

Potential of Photonic Integration



4 m³

1998

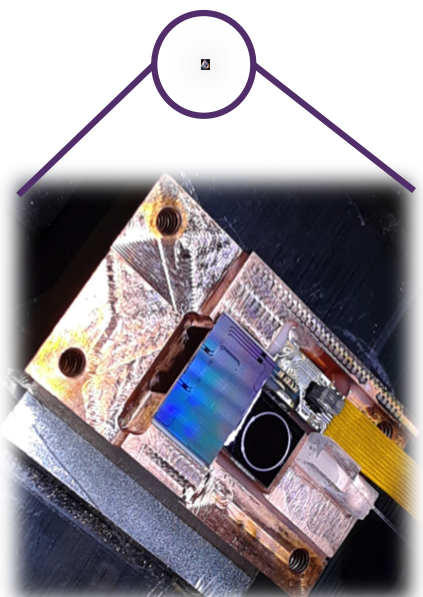
 MenloSystems



1 m³

2008

 COPRES
Chip-scale optical resonator enabled synthesizer



1 cm³

Spencer et al., Nature (2018)

2019

SWaP

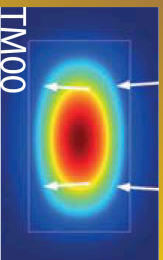
- ✓ Size
- ✓ Weight
- ✓ Power
- ✓ Robustness
- ✓ Cost

Low Loss SiN - Platform Overview



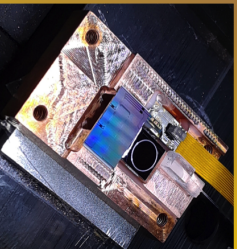
The Basics

- ✓ High Mode Confinement
- ✓ Low Loss
- ✓ Small Footprint
- ✓ High Power



Actives

- ✓ Electrical Tuning
- ✓ Modulators
- ✓ Lasers
- ✓ Detectors



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Issue 10 | DECEMBER 2018
<https://www.picmag.com/group/1628227>
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Award winning PIC innovation from LIGENTec

LIGentec focuses on silicon nitride for photonic integrated circuits

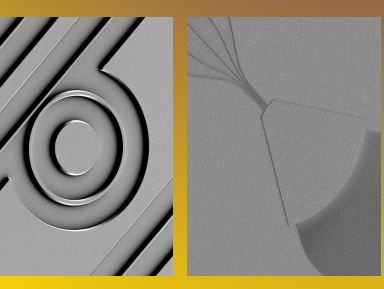


We are hiring

FAST TURN AROUND TIMES

Full Creativity

- ✓ Couplers
- ✓ Mux / DeMux
- ✓ MZIs / DLIs
- ✓ Resonators
- many more



World Connections

- ✓ Edge Coupling / U Grooves
- ✓ Spot Size Converter
- ✓ Grating Couplers
- ✓ Arbitrary Die Shape
- ✓ Bond pads