PHIX photonics assembly

“VCSEL based solid state LiDAR”

Jeroen Duis CCO

PHOTONIC ASSEMBLY

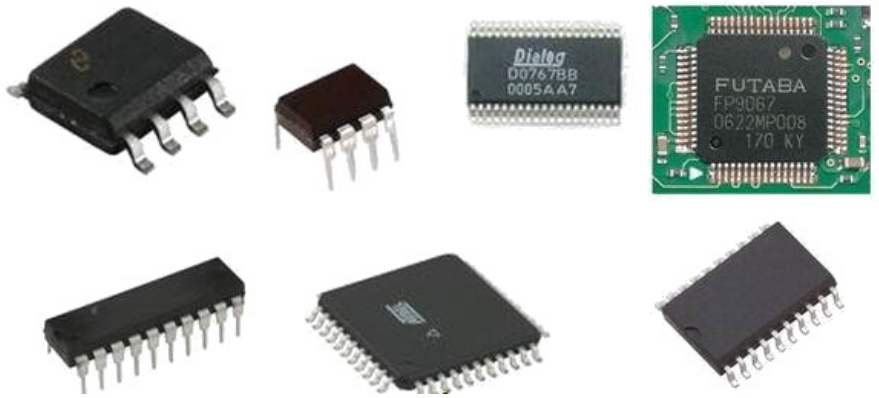
PHIX Mission

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

The challenges of PIC packaging

Like in electronic ICs, one could dream of a generic PIC package that can be configured such, that it fits all technologies and all applications, just like electronic ICs that are nowadays in almost every electronic device…



However… there are some major differences between ICs and PICs…

Why is photonic assembly different from electronic assembly?

Electronic assembly:

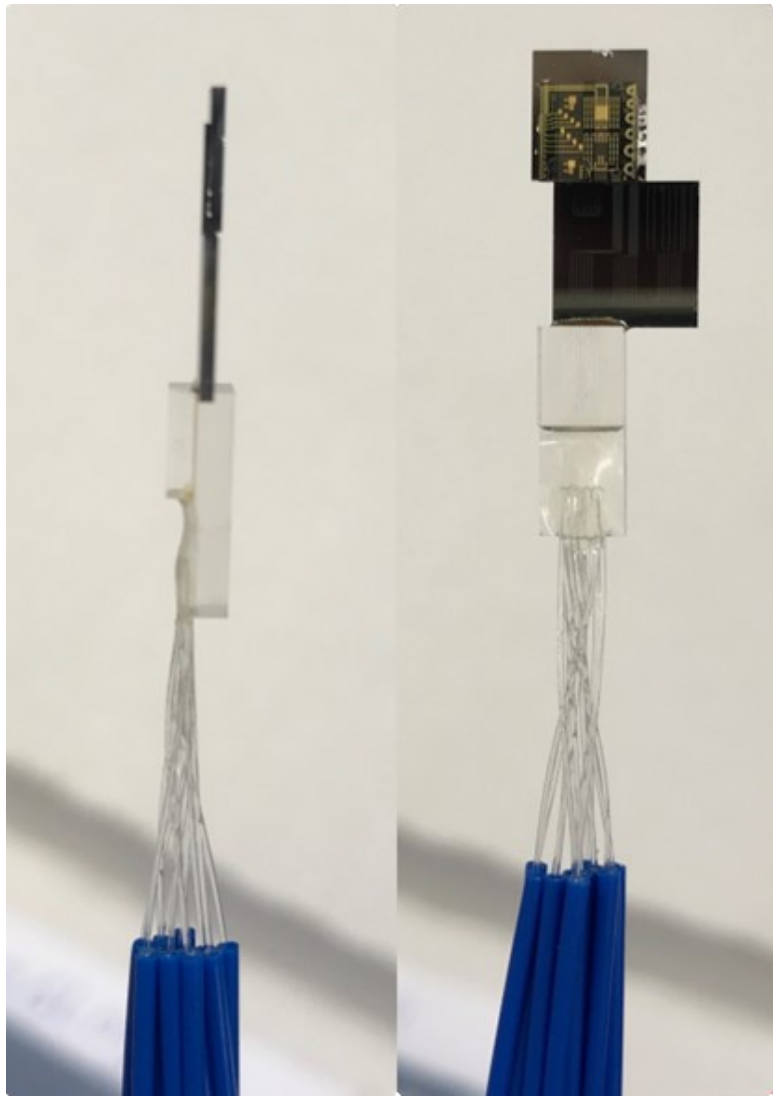
- Established semiconductor component supply chain (IC foundries, test houses, IC-packaging houses)
- Established PCB/flex/ceramic population supply chain; only electrical interfaces
- Established packaging and assembly equipment options
- Many low, medium and high volume contract manufacturing companies
- Established interfaces between supply chain partners (specs, yield, performance)

Photonic assembly:

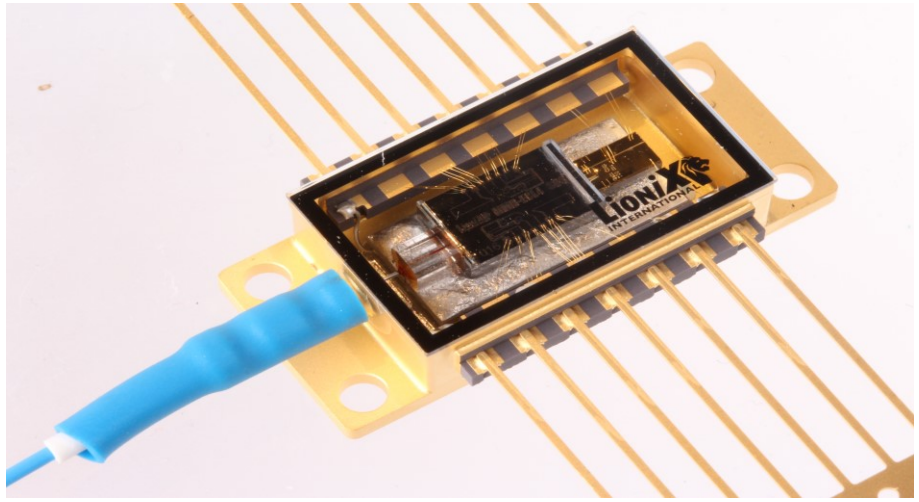
- Multiple Photonic IC technologies, not compatible with each other
- No standard PIC *component* packaging available (in reference to IC packages)
- Additional parts needed for optical interfaces (fibers, lenses, isolators); both optical and electrical interfaces
- Complex optical interfaces which require submicron alignment
- No standard substrates (vs. PCB, Flex); custom submounts and MOBs (micro-optical-bench)
- No clear interfaces established (e.g. performance bare PIC vs. performance packaged module)
- Packaging challenges compare better with micro-assembly of multi-component sensor products than with semiconductor component packaging or electronic assembly

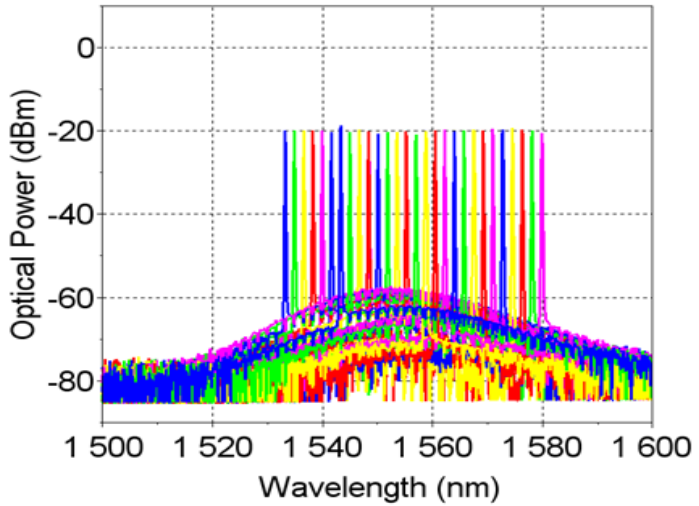
Competencies

- Die preparation
- Die alignment and bonding
- Electrical interfacing
- Thermal Packaging
- (Polarization Maintaining) Fiber Arrays
- High Power
- Free Space packaging
- Hybrid assembly



Tunable laser application





	Tuning range	Tuning speed	Linewidth	Output Power	Size
Tunable laser Module 25 kHz	C-band (40nm)	1 kHz	< 25 kHz	10mW	3x2x1 cm
Tunable laser Module 5 kHz	C-band (40nm)	1 kHz	< 5 kHz	10mW	3x2x1 cm
Tunable laser Module 1 kHz	C-band (40nm)	1 kHz	< 1 kHz	10mW	3x2x1 cm

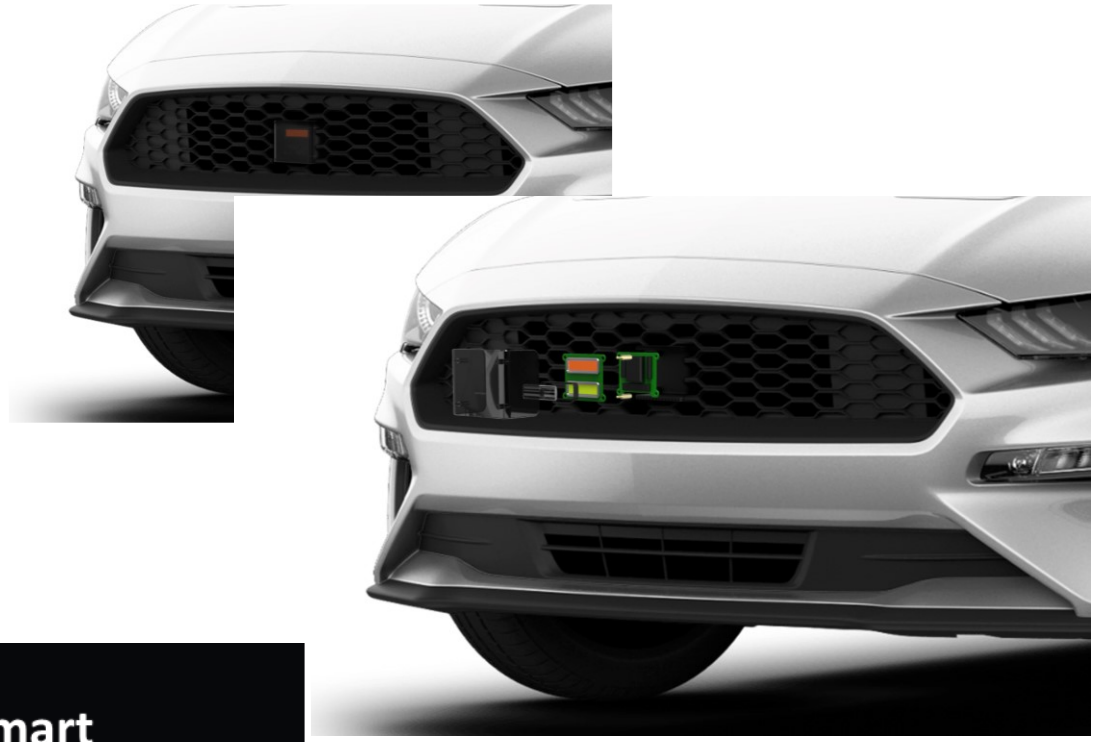
Latest result: extremely small bandwidth (290 Hz) with 13 mW power in output fiber, >80 nm tunability

"290 Hz Intrinsic Linewidth from an Integrated Optical Chip-based Widely Tunable InP-Si3N4 Hybrid Laser", Y. Fan et al, post deadline oral presentation, CLEO USA, San Jose, (CA) , 14-19 May 2017

Supporting assembly of 3 major PIC platforms

Automotive struggle

- Solid State / moving parts
- Resolution
- Refresh time
- Distance measurement (time) + Speed (wavelength) + ……
- Line scan – 2D image
- Output power vs detection sensitivity
- Integrated Photonics, discrete optics, combination
- Introduction into market
- Environmental requirements
- Reliability
- Volume scale up



Smart Optical Sensors LAB

SOS LAB Co., Ltd.

Bio-info

Since
2016

Funding
$ 6M

members
40+

Business

Clients

Mando

SK telecom

SEMES

kt

Awards

CES ASIA 创新奖 INNOVATION AWARDS 2019 获奖产品 HONOREE

创启未来 PKUSP

SIIF SILICON VALLEY INTERNATIONAL INVENTION FESTIVAL

KIC CHINA Korea Innovation Center

K-GLOBAL @ Silicon Valley 2018

SIIF Seoul International Invention Fair

Hybrid Scanning LiDAR

SL-1

Gwanghwamun Gate

	A	B	SSLAB
MOTOR	1EA	N/A	1EA
MEMS	N/A	1EA	1EA
LD/PD/ Signal Processing	64/128EA	4EA	1EA

Up to 150 m
Detection Range

0.15 ~ 0.6° (H) x 0.25 ° (V)
Angular Resolution

< ± 2 cm
Distance Accuracy

5 ~ 20 FPS
Measurement Speed

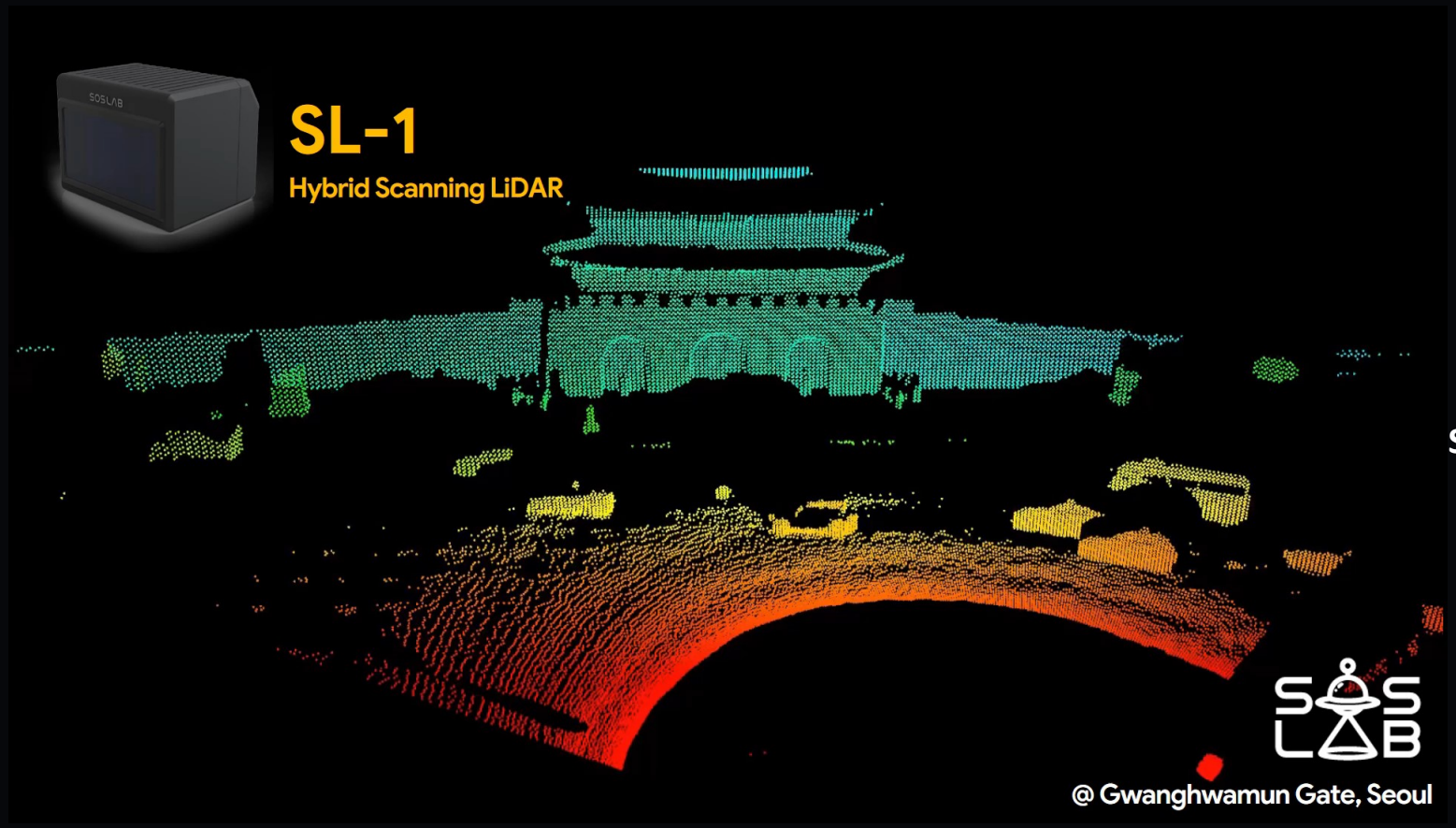
120 ° (H) x 20 ° (V)
Field of View

110 x 85 x 100 mm
Dimensions (WDH)

Hybrid Scanning LiDAR

SL-1

Gwanghwamun Gate



	A	B	SOS LAB
MOTOR	1EA	N/A	1EA
MEMS	N/A	1EA	1EA
LD/PD/ Signal Processing	64/128EA	4EA	1EA

Up to 150 m Detection Range	0.15 ~ 0.6° (H) x 0.25 ° (V) Angular Resolution
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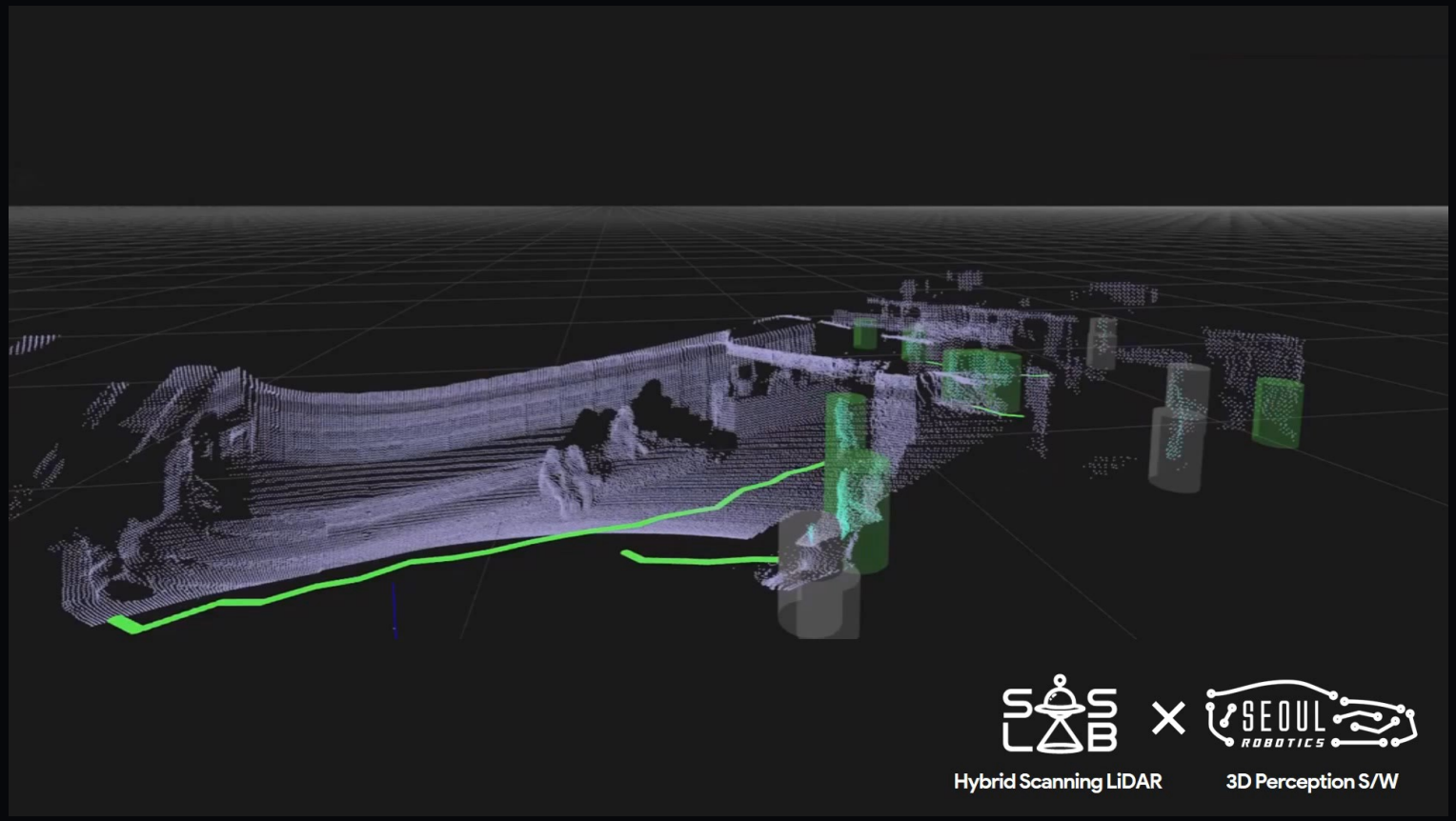
Hybrid Scanning LiDAR

SL-1

COEX Starfield



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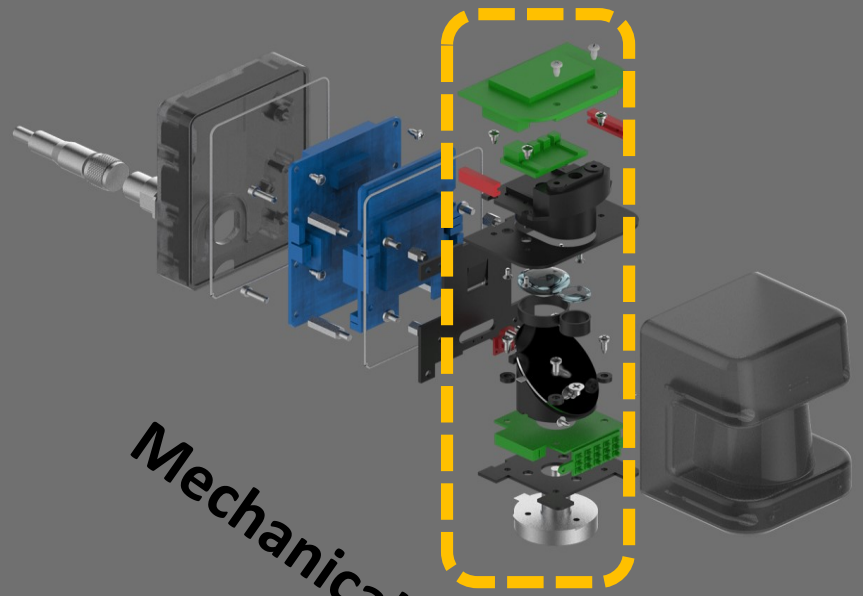
True Solid-State LiDAR

The LiDAR (ML-1)

Bulk Optics (Lens/Mirror)

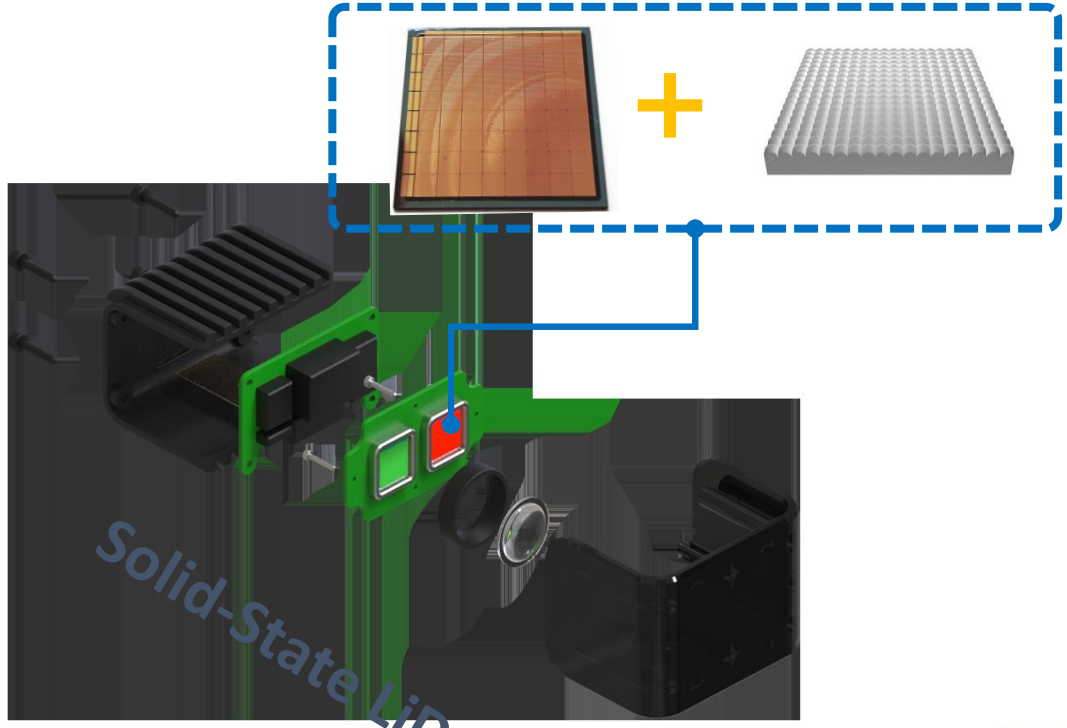
+ Mechanical Rotator



Mechanical LiDAR

Matrix Addressable VCSEL

BCSC (Beam Collimation & Steering Component)

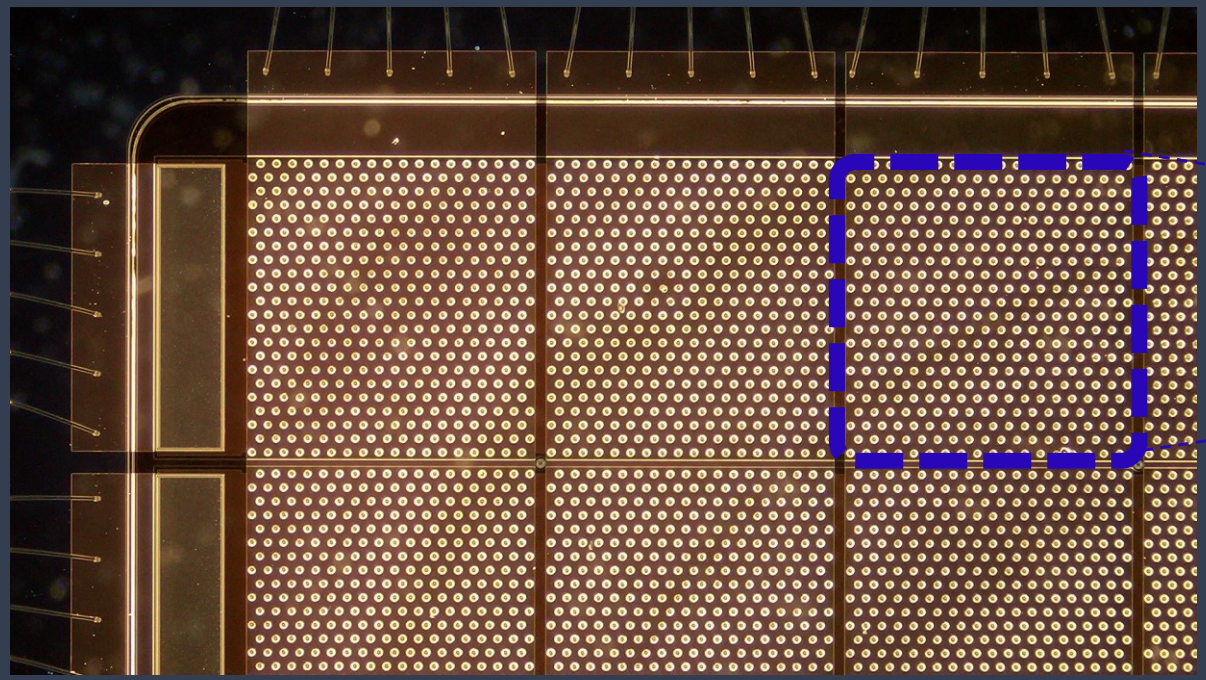


Solid-State LiDAR

Matrix Addressable VCSEL

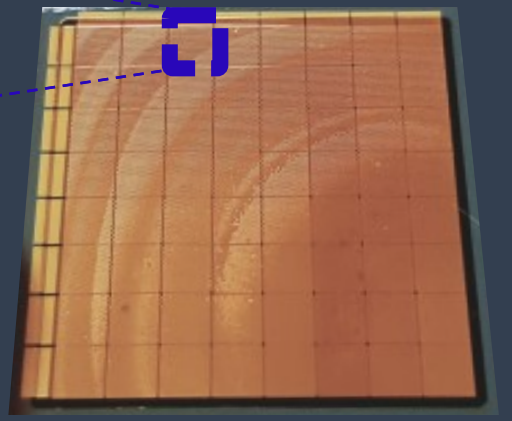
The LiDAR (ML-1)

Addressable Multi-Beam



Individually Controllable

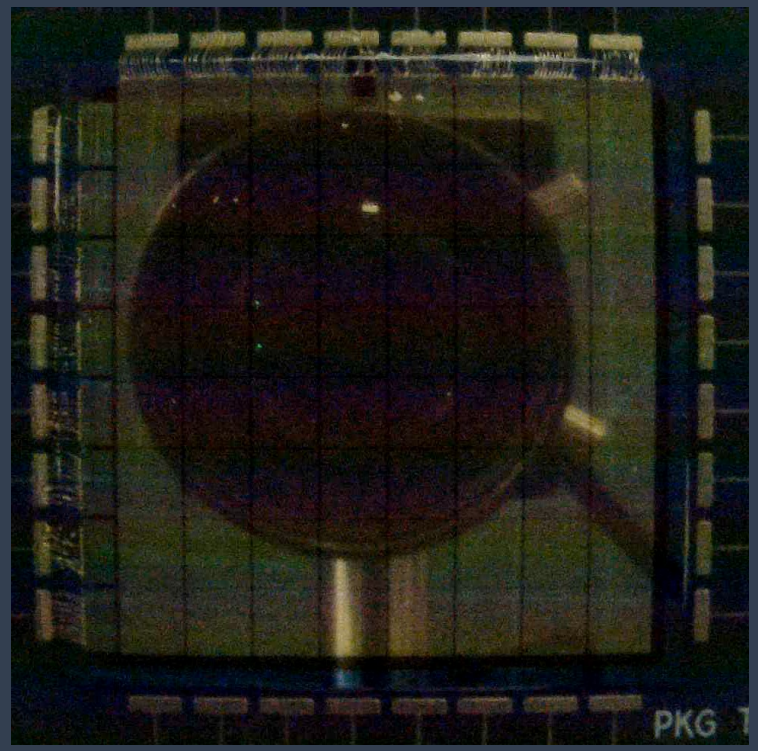
Incredible Power
For
Wide Angle & Long Range



Matrix Addressable VCSEL

The LiDAR (ML-1)

Individually Controllable



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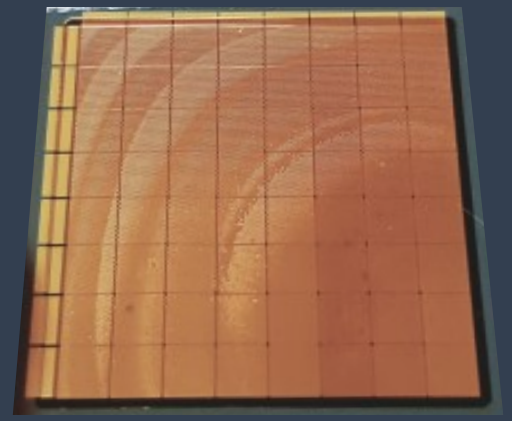
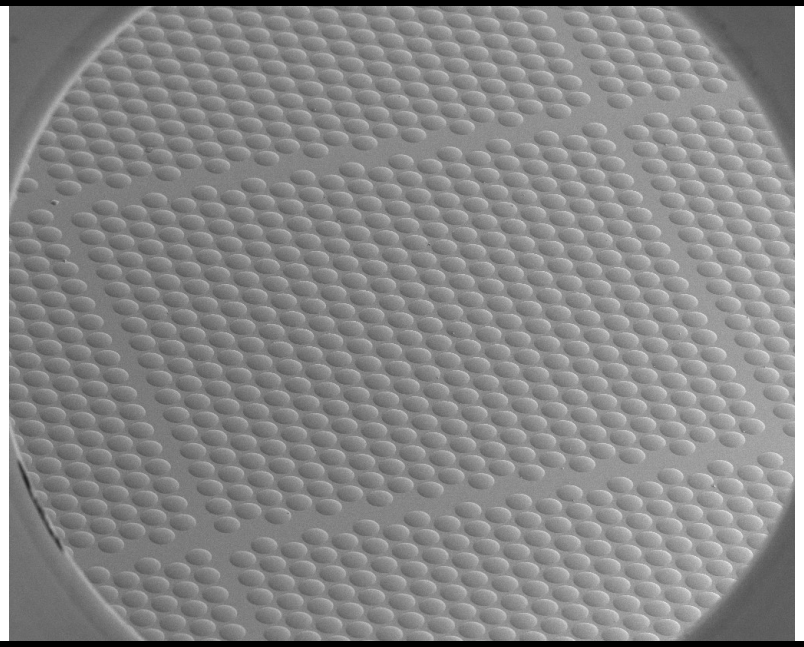
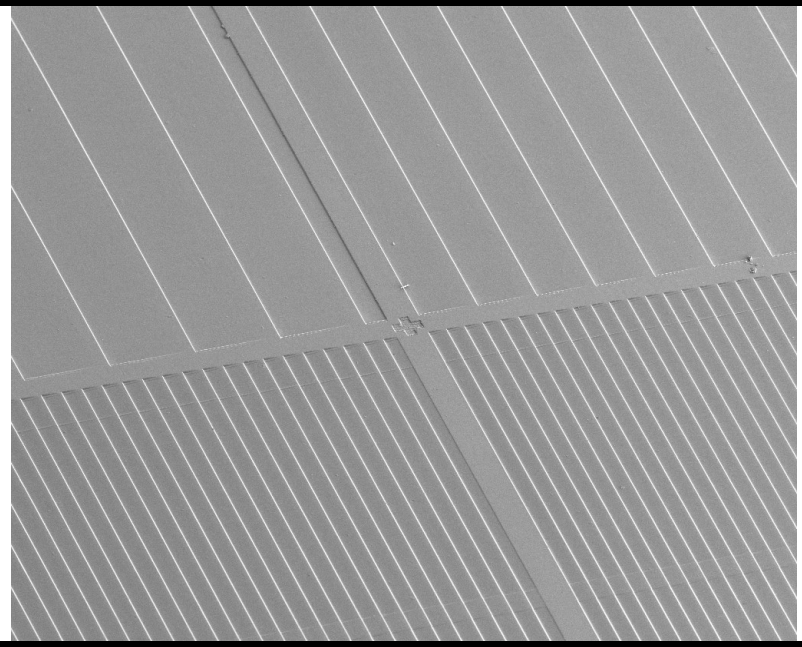


Beam Collimation & Steering Component

The LiDAR (ML-1)



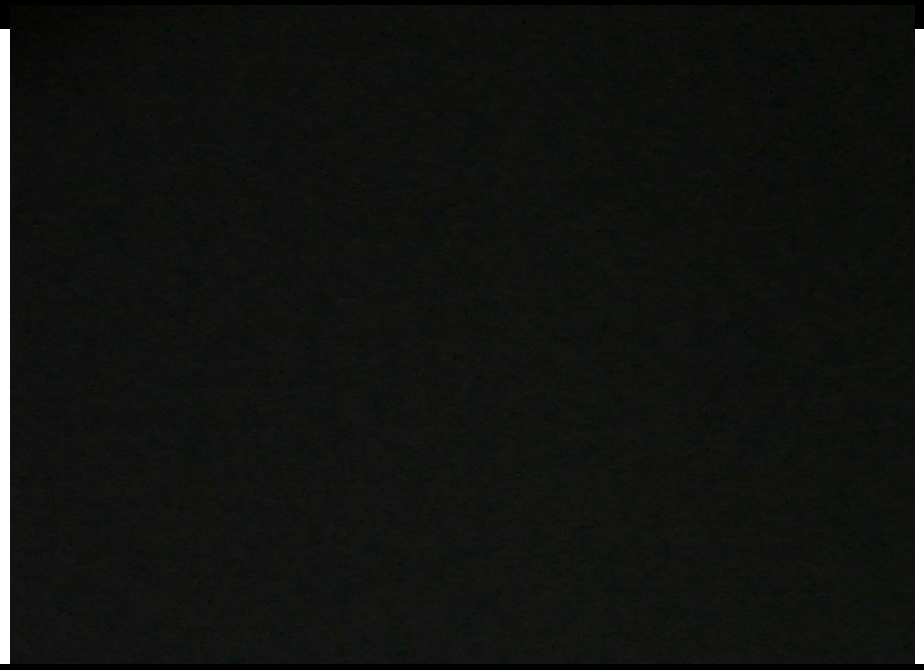


MicroLens for Collimation

MicroPrism for Steering

Beam Collimation & Steering Component

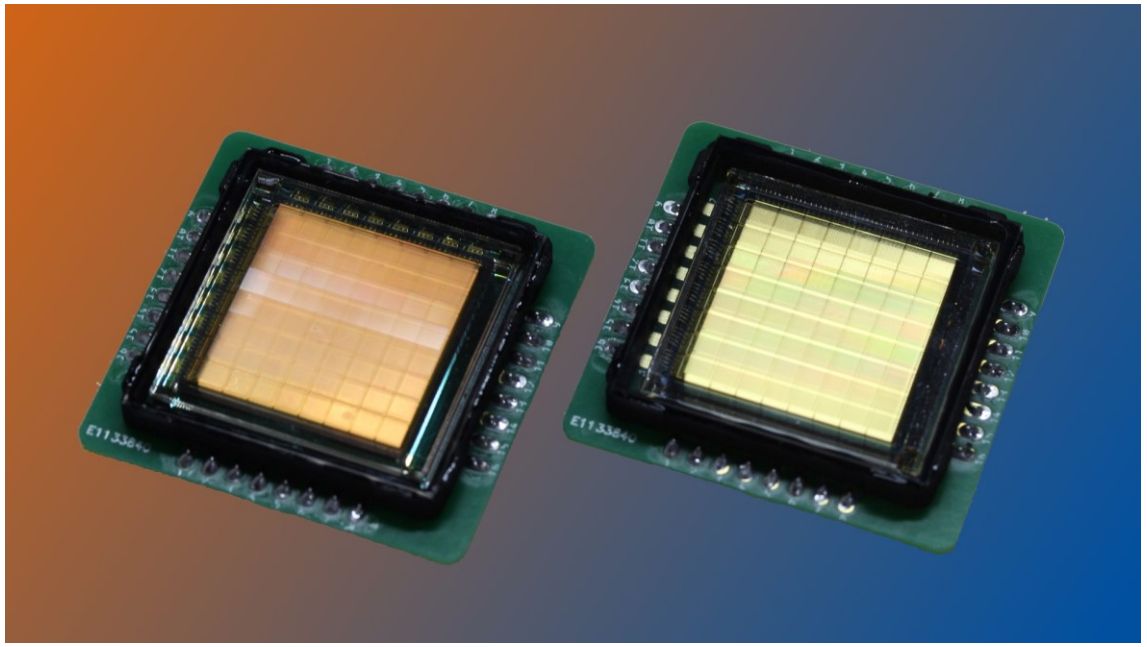
The LiDAR (ML-1)



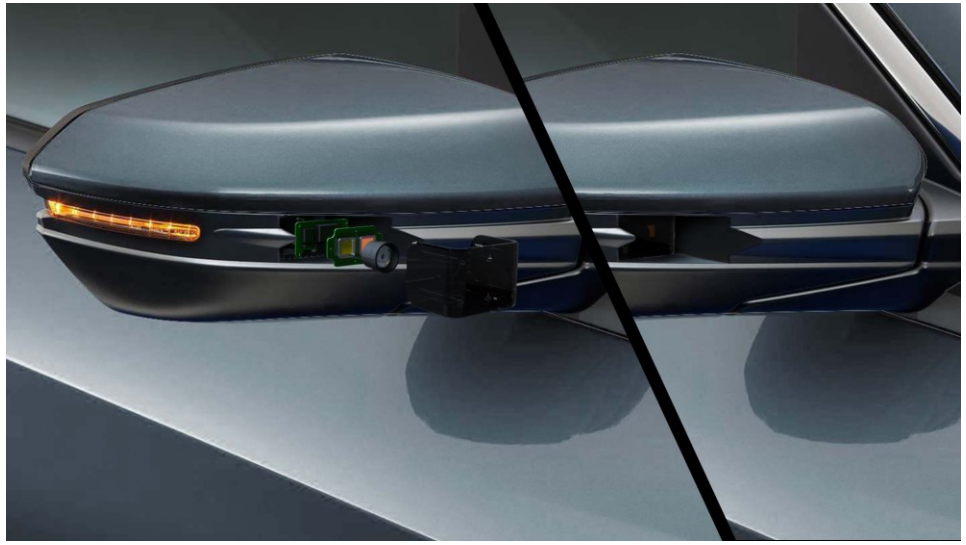
Collimation + Steering

High Power VCSEL integration challenges

- VCSEL power requirements feed 90V-30A
- Thermal management
- Placement of individual chips / wafer parts
- Hight tolerance stacking, VCSEL aperture, Lens, Prism
- Prism alignment <1 micron



Where can we support you



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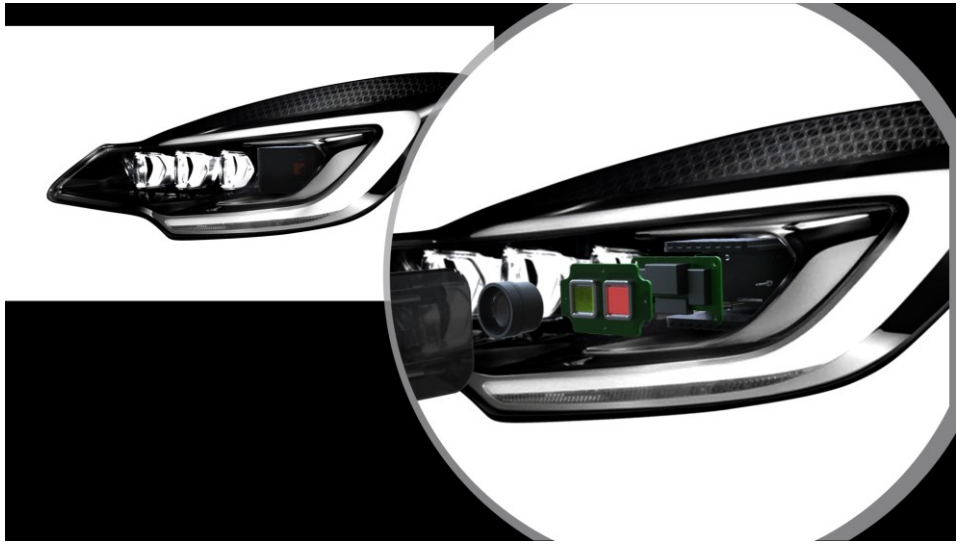

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