SCANTINEL® PHOTONICS
Scan | Detect | Navigate

DVN
Driving Vision News

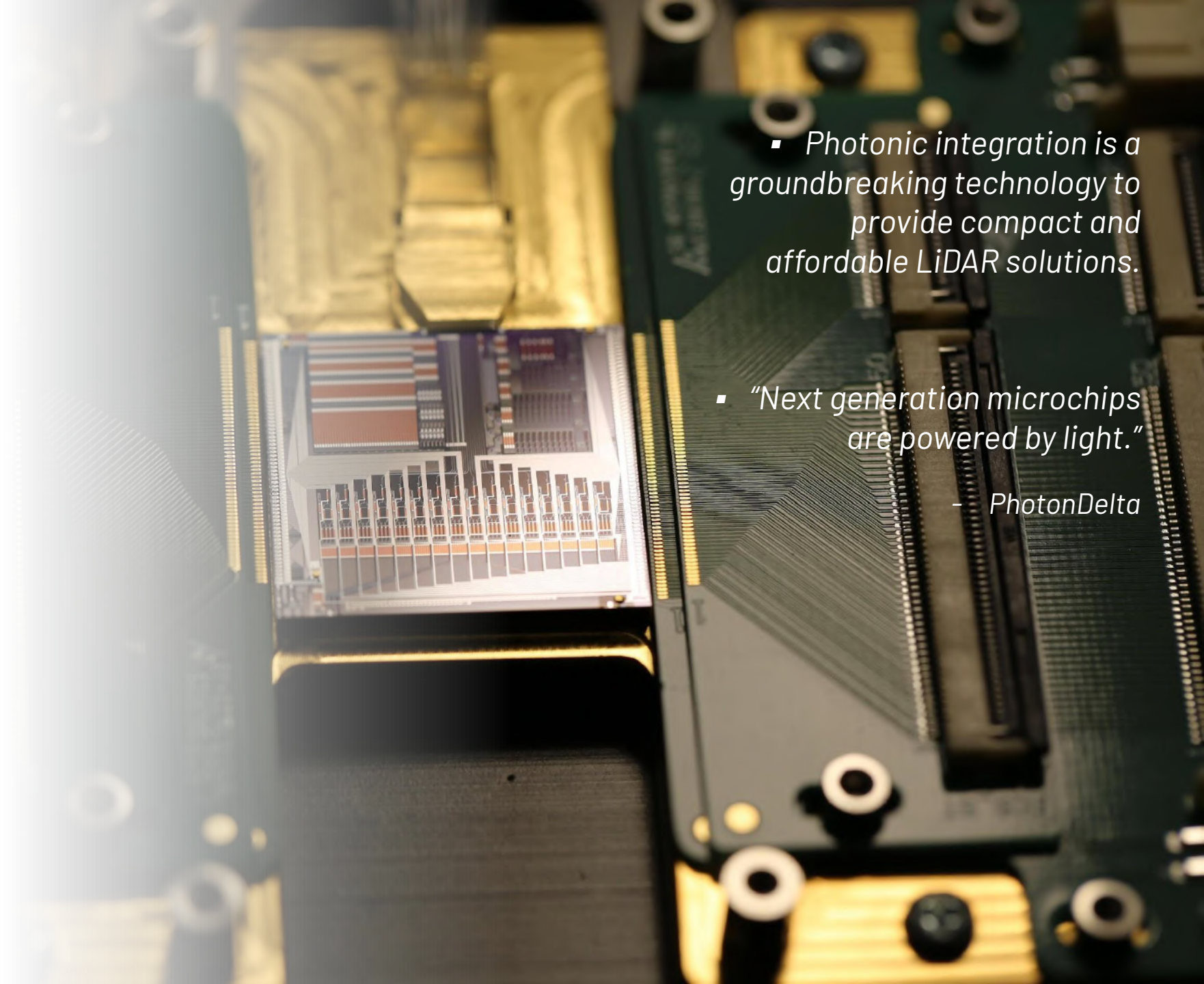
Photonic Integration Enables Modular Solid-State FMCW LiDAR Sensing

Andy Zott - Managing Director

Frankfurt, Germany, Nov. 2022

SCANTINEL® PHOTONICS

Scantinel Photonics
is developing a
highly integrated
Frequency-Modulated
Continuous-Wave (FMCW)
solution based on
Photonic Integration
to overcome
the **obstacles of**
Time of Flight (ToF)
LiDAR systems

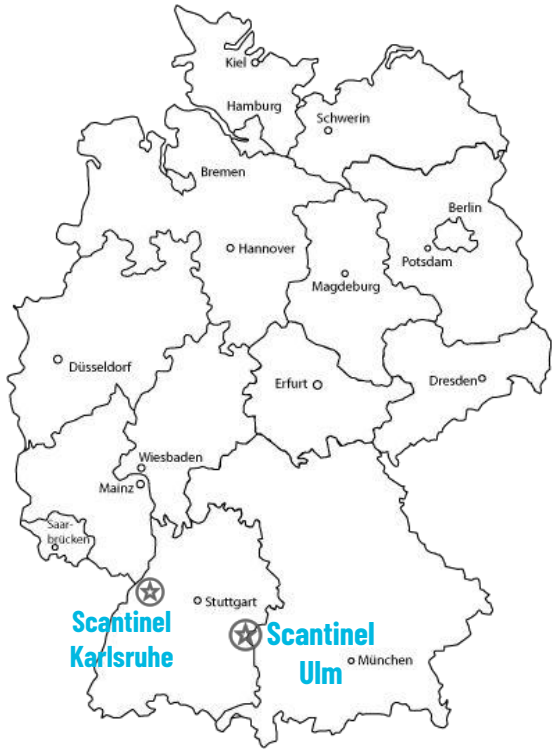


- *Photonic integration is a groundbreaking technology to provide compact and affordable LiDAR solutions.*

- *"Next generation microchips are powered by light."*

  - PhotonDelta

SCANTINEL PHOTONICS



- Spin-off start-up from ZEISS
- Located in Ulm & Karlsruhe, Baden-Württemberg, Germany
- Solid-state FMCW LiDAR sensing technology enabling detection range >300m for mobility and industrial applications
- International team of 40 experts from >10 different countries (80%+ engineers, 40%+ PhDs)

Our mission is to create optimum value for our customers and partners by providing outstanding LiDAR solutions

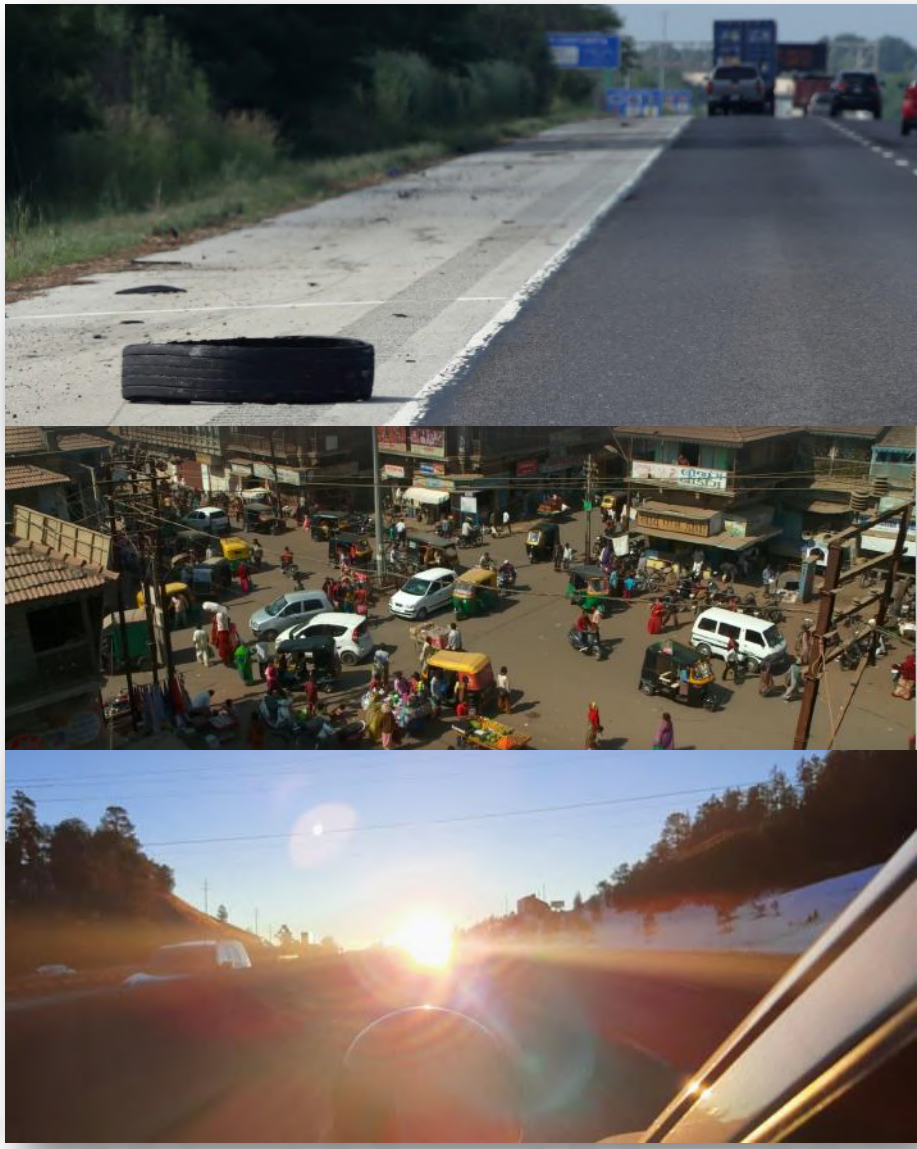
ZEISS SCANIA PhotonDelta Gateway to Integrated Photonics

Scantinel is backed by ZEISS Ventures, Scania Growth Capital and PhotonDelta

Key benefits of FMCW sensing for autonomous mobility

Key Benefits of **Scantinel FMCW** Technology

Long range	Detect objects at >300m with high accuracy
Superior resolution	Detect small objects at distance like road debris or lost cargos
Direct instantaneous velocity on every pixel	Enables faster object detection and tracking
Immunity to interference	Retroreflectors blooming, sun glare and interference from other systems



https://whiplashstlouis.com/8-types-of-road-debris-that-can-cause-a-st-louis-car-accident/
https://www.codot.gov/travel/sunglare
https://www.youtube.com/watch?v=KnPiP9PkLAs

FMCW drives next generation LiDAR sensing technologies

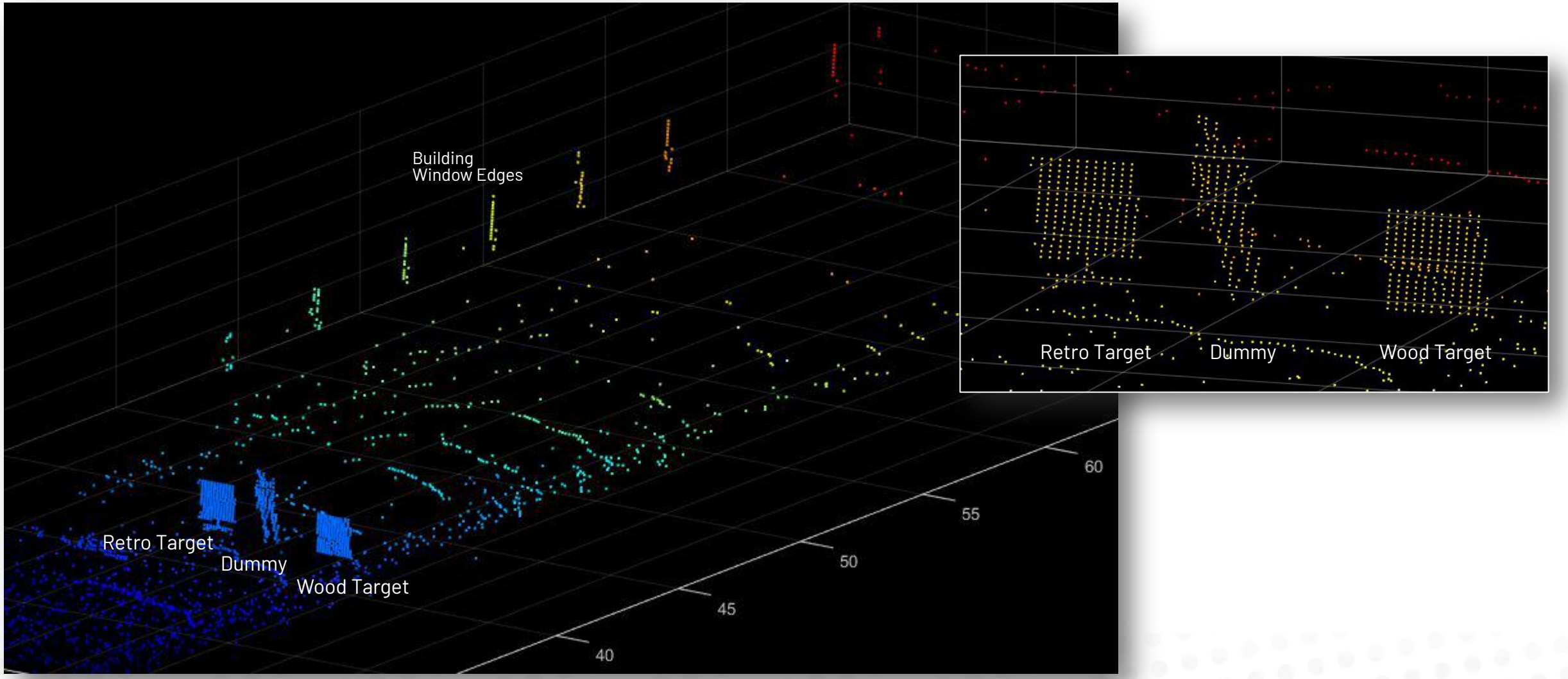
First wave LiDAR technology 905nm	Second wave LiDAR technology 1550nm	
905nm ToF	1550nm ToF	FMCW
Legacy system with **limited performance** on range and velocity	**Photonic integration not possible** due to high peak power **High cost** for Fiber Laser Amplifier and InGaAs Detector	**Cost and size reduction by photonic integration**

SCANTINEL® PHOTONICS
Scan | Detect | Navigate

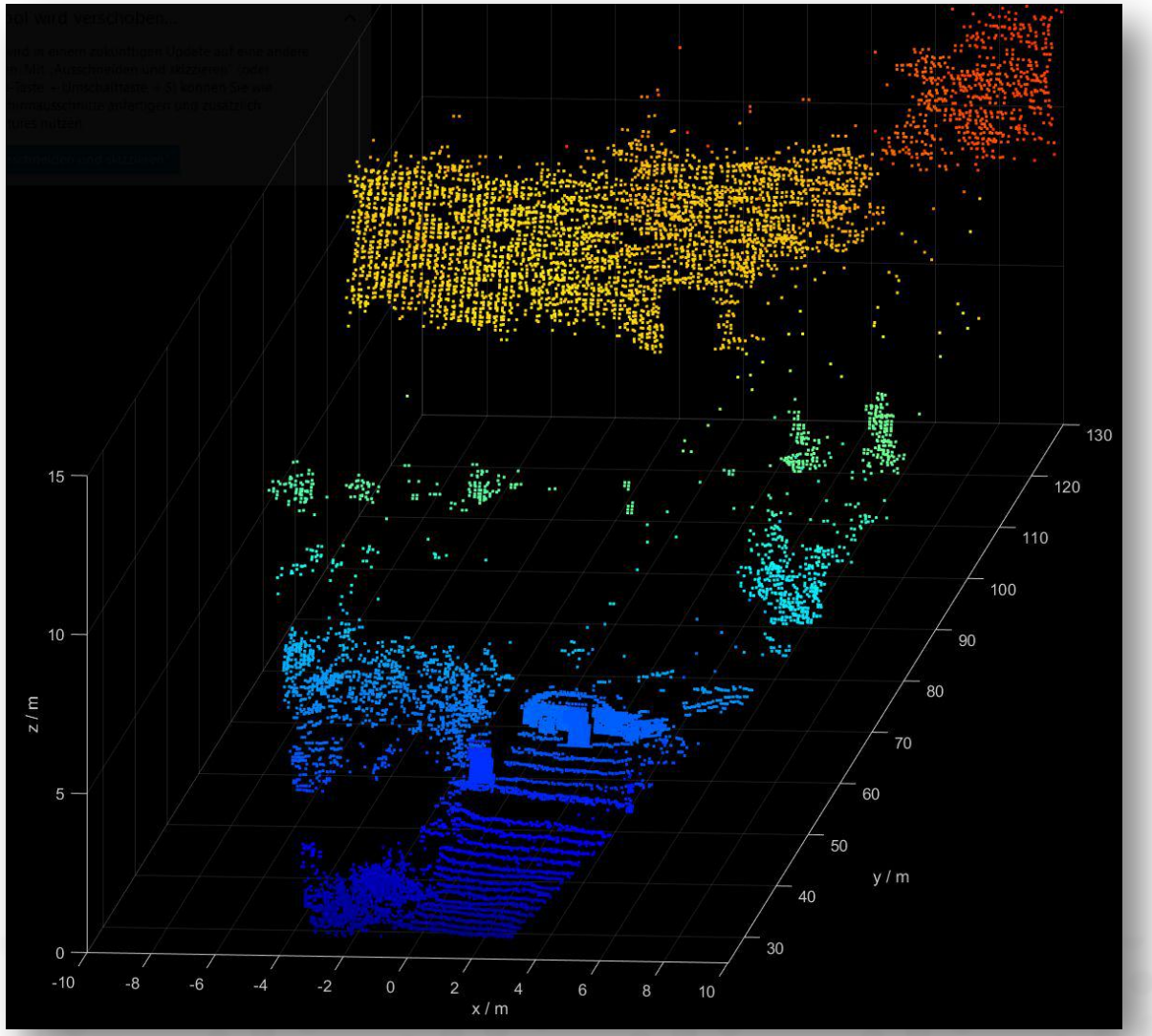
Scanning – The Hardest Challenge for FMCW LiDAR Systems

Requirement	2D mechanical scanner	Optical Phased Array scanner	MEMS scanner	Scantinel PIC Scanner
Large optical aperture (~20mm)	✔	o Required phase shift grows quadratically with aperture	✖ Size in combination with FoV incompatible with wafer manufacturing	✔
Low power operation	✔	o Prohibitive power consumption of thermal phase shifter	✔	✔ Single digit W
Mechanical robustness	o	✔	o	✔ No moving parts (fast axis)
Applicability to coherent systems	✖ Loss of coherence and coupling efficiency	✔	✖	✔
Manufacturability	✔	✖ Too high number of phase shifters required	o	✔ CMOS compatible processes
Large FoV	✔	✖ side lobes	✖	✔

Outdoor measurement of different targets with superior resolution

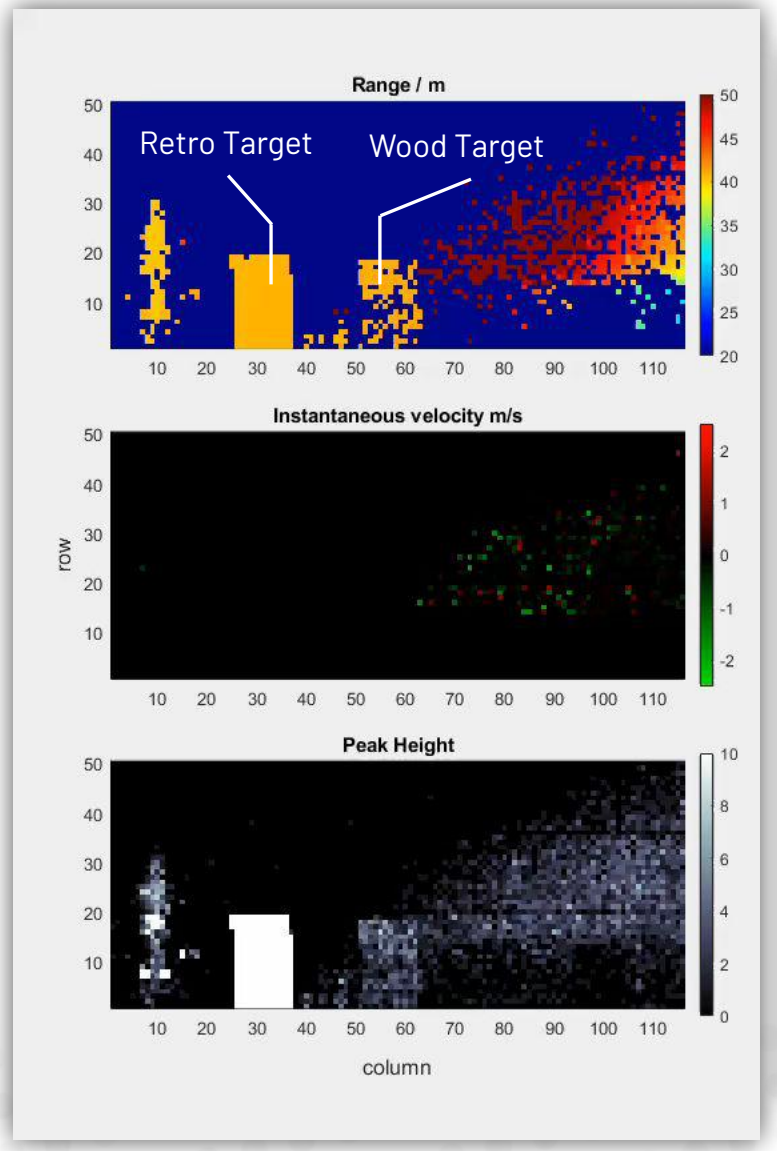


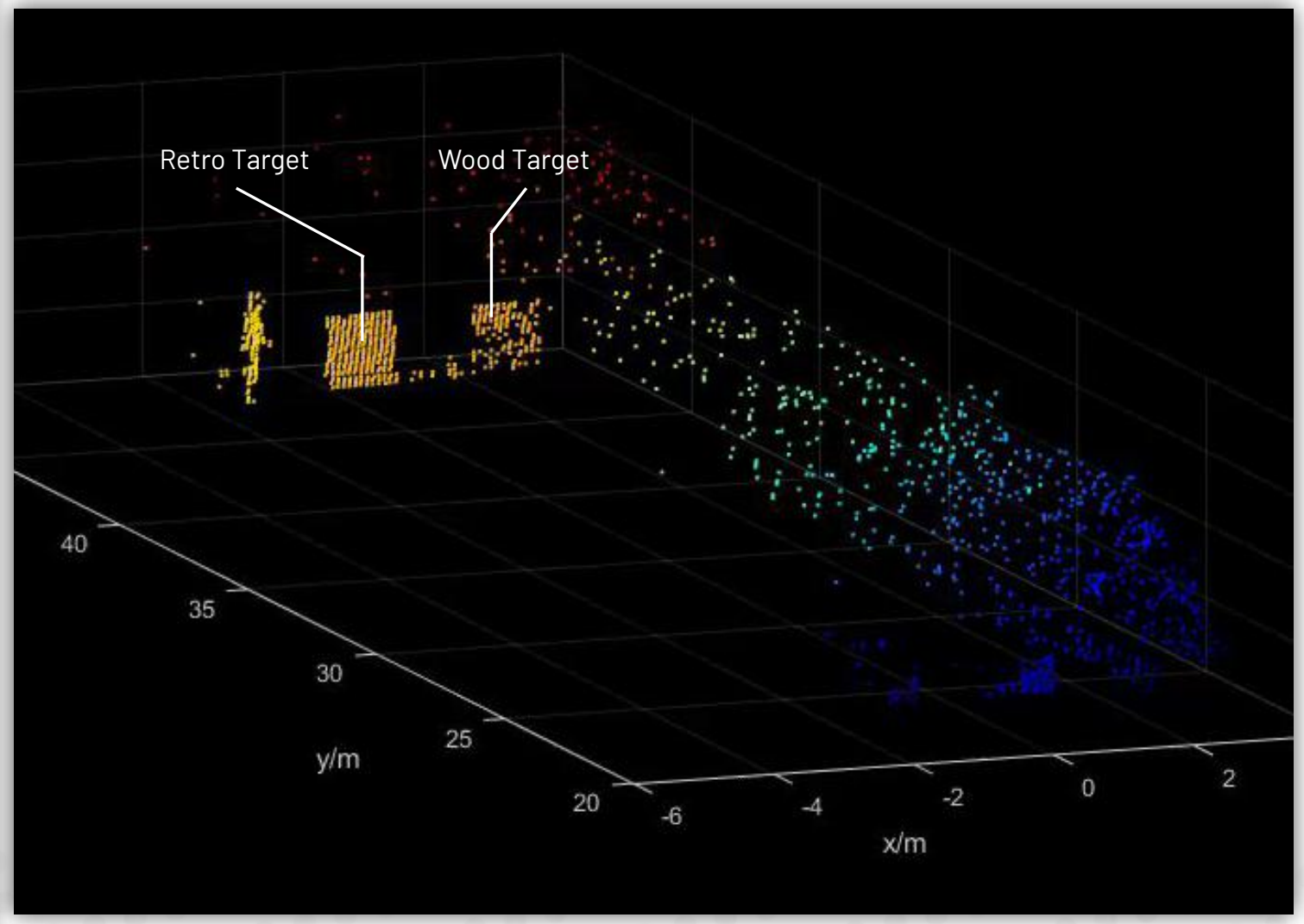
Outdoor measurement of different targets with superior resolution



A-Sample results with instantaneous velocity

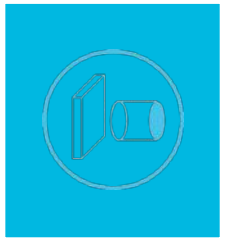
FMCW immunity to highly reflective objects enables robust sensing capability under adverse ambient conditions





Scantinel's approach is a 1550nm solid-state FMCW LiDAR leveraging maximum integration on Silicon Photonics

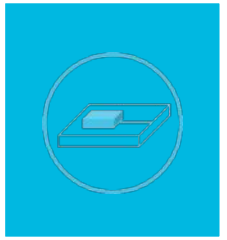
Enabled by **Silicon Photonics**



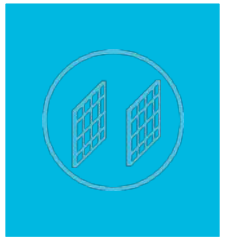
Solid-State Scanning

- PIC-based scanner (Optical Enhanced Array - OEA™)
- Long range detection (> 300m) with superior angular resolution

Maximum Integration



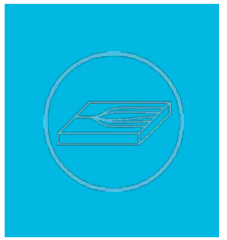
- Integration of Laser and Detector
- Semiconductor Optical Amplifier (SOA)



Multi-Channel Parallelization

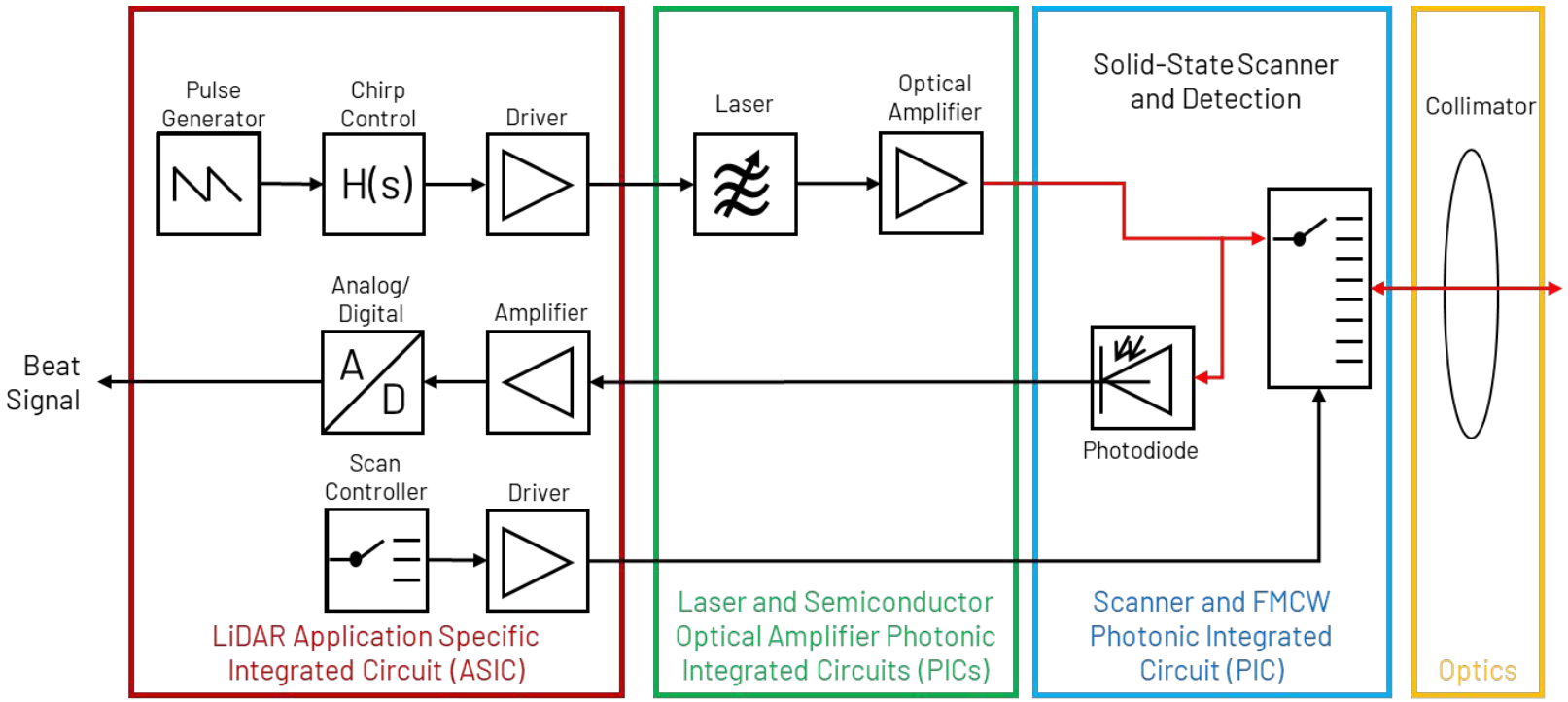
- 5D point clouds (xyz, direct velocity, reflectivity)
- Dense pixel information at 2MP/s from 32x parallel channels

Scalability



- CMOS compatible for volume manufacturing
- Adaptive to various eco-systems and use cases

Photonic Integrated Optoelectronics Core Module



Scantinel OCM™

SCANTINEL® PHOTONICS
Scan | Detect | Navigate

OCM™ Partitioning

- Active and passive electronic functions
- Optoelectronic active components
- Optoelectronic passive components
- Additional optical components

Illustration only

Scantinel's highly integrated Photonic LiDAR Engine (OCM™) provides highest level of flexibility

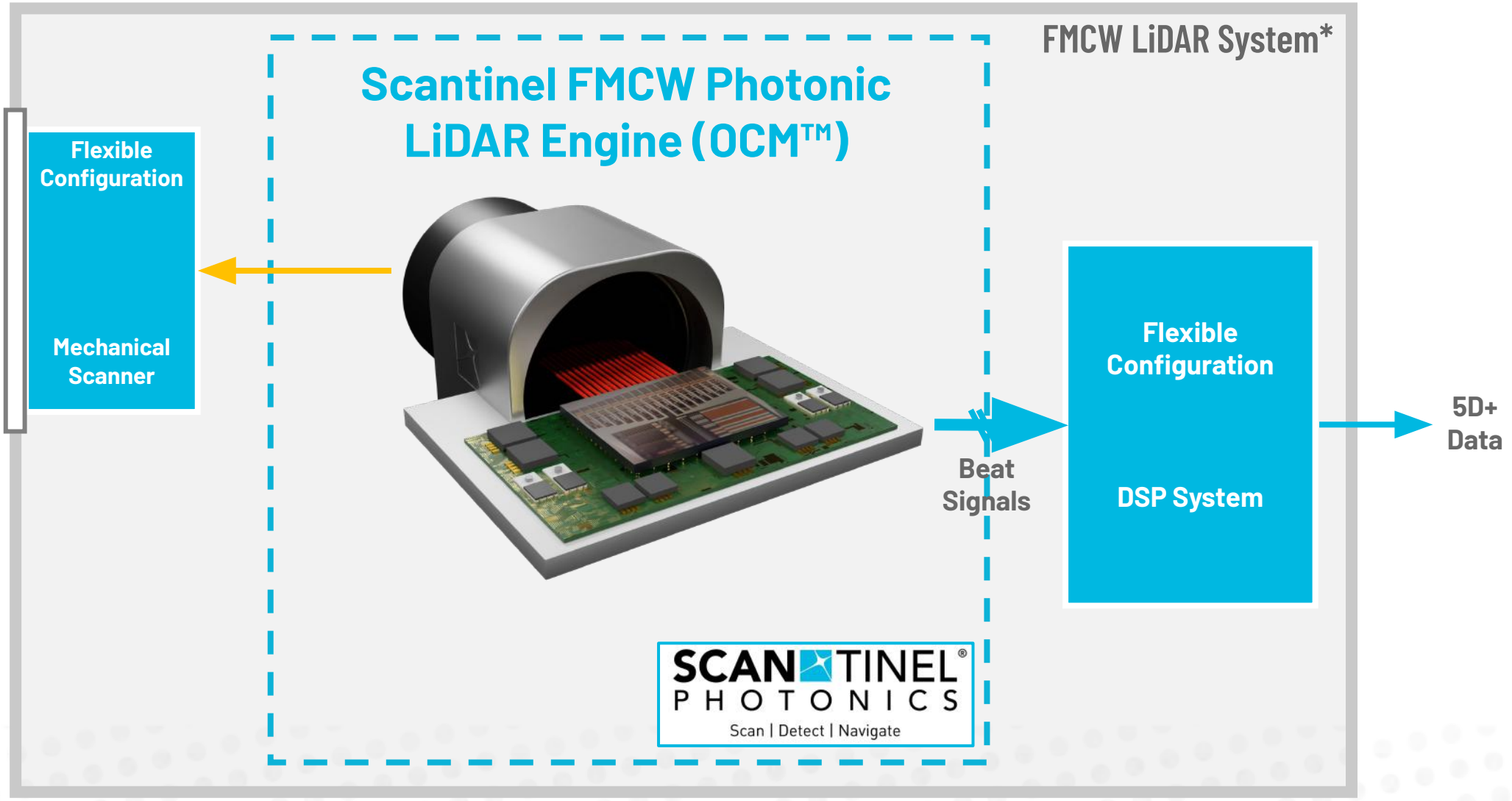
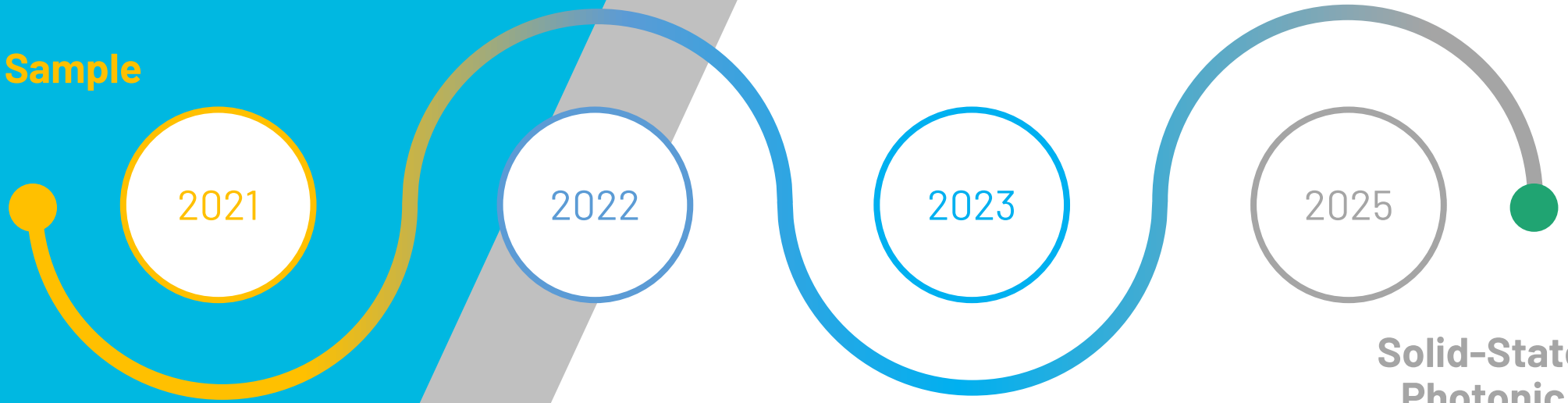


Illustration purpose only
OCM™: Optoelectronics Core Module

Scantinel's development roadmap

SCANTINEL® PHOTONICS
Scan | Detect | Navigate



PoC Sample

2021

2022

A-Sample

2023

Highly Integrated Photonic LiDAR Engine (OCM™) Sample

2025

Solid-State FMCW Photonic LiDAR Engine (OCM™) for Industrialization

Key Takeaways

- Photonic integrated FMCW LiDAR on Chip will be the most promising approach towards low-cost, high-performance automotive grade sensing technology.
- Scantinel has developed a holistic FMCW LiDAR concept including scanning, multichannel parallelization, laser integration and manufacturability.
- Mobility industry is gaining more interests in FMCW technology thanks to its distinctive benefits.
- Scantinel is providing the core photonic and optical functionality as a compact FMCW LiDAR Engine (OCM™) to system integrators.

SCANTINEL® PHOTONICS

Scan | Detect | Navigate

SCANTINEL® PHOTONICS

Scan | Detect | Navigate

Let's stay in touch!

Andy Zott
Managing Director
andy.zott@scantinel.com

Scantinel Photonics GmbH
Söflinger Str. 100
89077 Ulm
Germany
info@scantinel.com