MANUFACTURING MADE LIGHT

Solutions for integrated photonics. Built to scale.

ficonTEC

photonics assembly & testing

PHOTONICS AUTOMATED ASSEMBLY AND TESTING

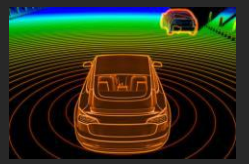
FROM LAB TO FAB

ficonTEC

SCRAMBLUX

NEXT LEVEL OF LiDAR TEST AND CALIBRATION

DVN Lidar Conference
Nov 29-30, 2023



MANUFACTURING MADE LIGHT

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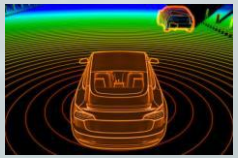
A new approach to comprehensive LiDAR End of Line test and calibration for ficonTEC LiDAR production lines

Dr. Mirvais Yousefi, CTO at SCRAMBLUX GmbH



DVN Lidar
Conference
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About ficonTEC

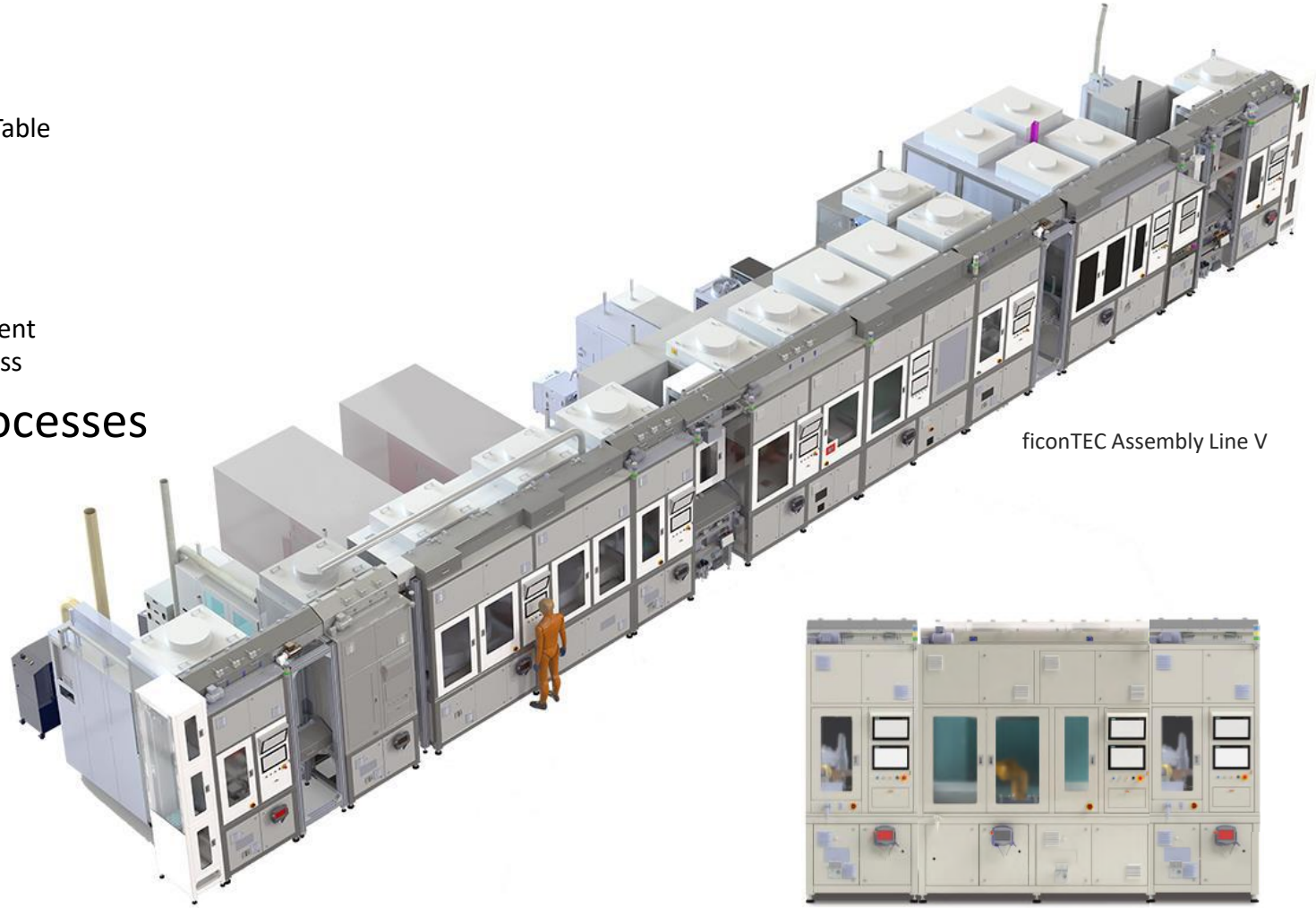
- Based in Achim, Germany, 200+ employees
- 20+ Years of vertical expertise in Photonics Assembly and Test systems, 1300+ delivered Systems, Global Footprint
- Core Expertise in R&D, Application Engineering and DFM
- Solutions: NPI, Low-, Mid, High-Volume Production and Test Systems
- Core Markets: Telecom/Datacom, PIC, HPLD, Automotive, AR/VR

About SCRAMBLUX

- Based in Hamburg, Germany
- Start-Up founded in 2023
- Focus on LiDAR Test and Calibration Solution to enable volume Production with reasonable CT and footprint
- Core Markets: Automotive, ADAS, Mobility, Robotics, Logistics, Industry
- Roadmap:
  - Full-Prototype: H1-2024
  - Alpha-Model: H2-2024
  - Turnkey System: 2025

The Volume Production
ficonTEC V product platform

- **Material Handling**
  Robots, Feeding System Linear Stages, Conveyor Belt, Index Table
- **Cleaning/Activation**
  Taifun Cleaning, Plasma, Ionized air
- **Bonding**
  Adhesive dispensing and UV curing, Solder-Pre-Form placement and laser soldering, Screwing processes, Laser welding process
- **Micro Assembly and Handling Processes**
  Active/Passive alignment/placement, Screwing processes, Sensor Protection Foil removal. Laser writing, PIC packaging and bonding
- **Test**
  Leak Test, End of Line Test, PIC Testing
- **Data Handling**
  Real-Time Data Monitoring and MES interface
- **Sustainability**
  re-use of base system and individual components to reduce cost and CO2 footprint



ficonTEC Assembly Line V

The Problem

LiDAR Test and Calibration is a bottleneck

Today's test and calibration solutions are not standardized and mass-production ready…

- Cycle time ≈ 1min to 2h/LiDAR
- Footprint ≈ 20 x 3 x 2 m^3
- Manual/semi-automated
- Indirect Measurement
- Non-real-world measurement condition

Test Range

Lab Setup

Large Test Chamber

Top-5 Challenges for Lidar EOL testing

Volume production capable LiDAR Test and Calibration solution

Requirements

I. Short Cycle time

II. Small Footprint

III. Full FOV capturing in a single measurement

IV. Long Range measurements up to the full Range of the LiDAR

V. Support measurement of multiple Performance Parameters through a modular and reconfigurable approach

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The Value Proposition of our Solution
BeamScrambler

SCRAMBLUX

The Beam Scrambler is an advanced optical measurement tool specifically designed for **testing** and **calibrating** LiDAR sensors and enables ..

- **15x shorter Cycle Time /LiDAR**
- **100% automated**
- **5 weather conditions**
- **120x smaller Footprint**
- **ZERO impact on DUT**

The Target Markets of our Solution
BeamScrambler

It will offer a groundbreaking opportunity throughout the LiDAR ecosystem. More specifically, we aim to serve…

Production (Tier 1 & 2)

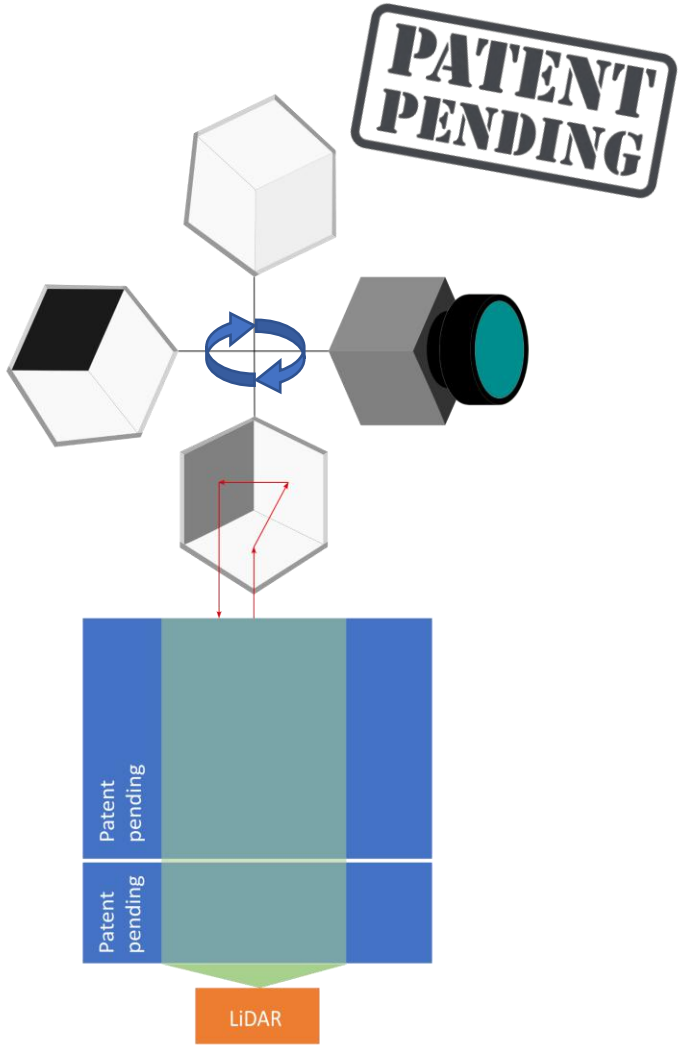
Installation on vehicles (OEM)

Aftermarket Validation /Calibration (car repair shop & certifier)

The Specification
BeamScrambler

SCRAMBLUX

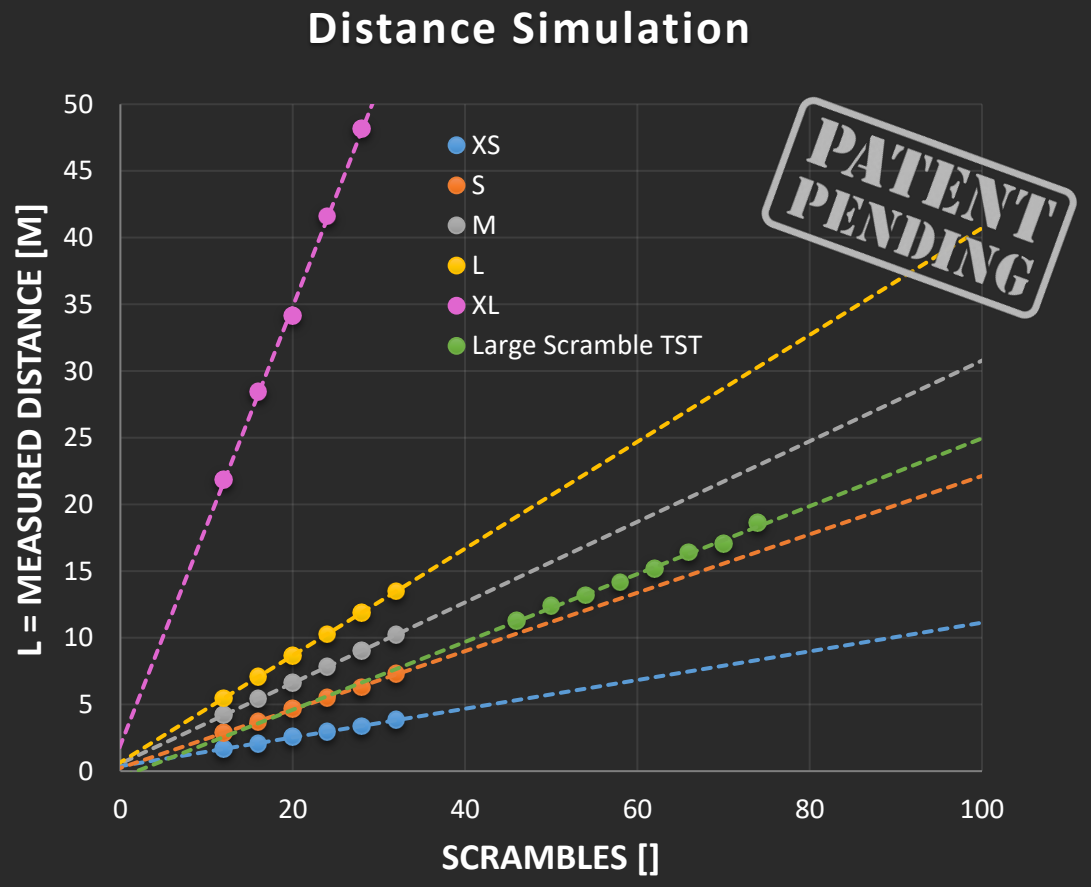
- **We have developed a LiDAR Test and Calibration solution that is optimized for**
  - Short Cycle time
  - Small Footprint
  - Full FOV measurement in a single measurement
  - Long distance measurements up to the full Range of the LiDAR
  - Measurement of multiple parameters through a modular and reconfigurable approach
- **The Beam Scrambler has a LiDAR Interface module, which allows it to handle a wide range of LiDARs**
  - e.g. Scanning mirror, MEMS, FMCW, Silicon Photonics, OPA
- **The instrumentation deck can house a range of sensors, including Cameras, reflectors, photo diodes and moving targets**
  - Platform suitable for a wide range of tests



The Performance
BeamScrambler

SCRAMBLUX

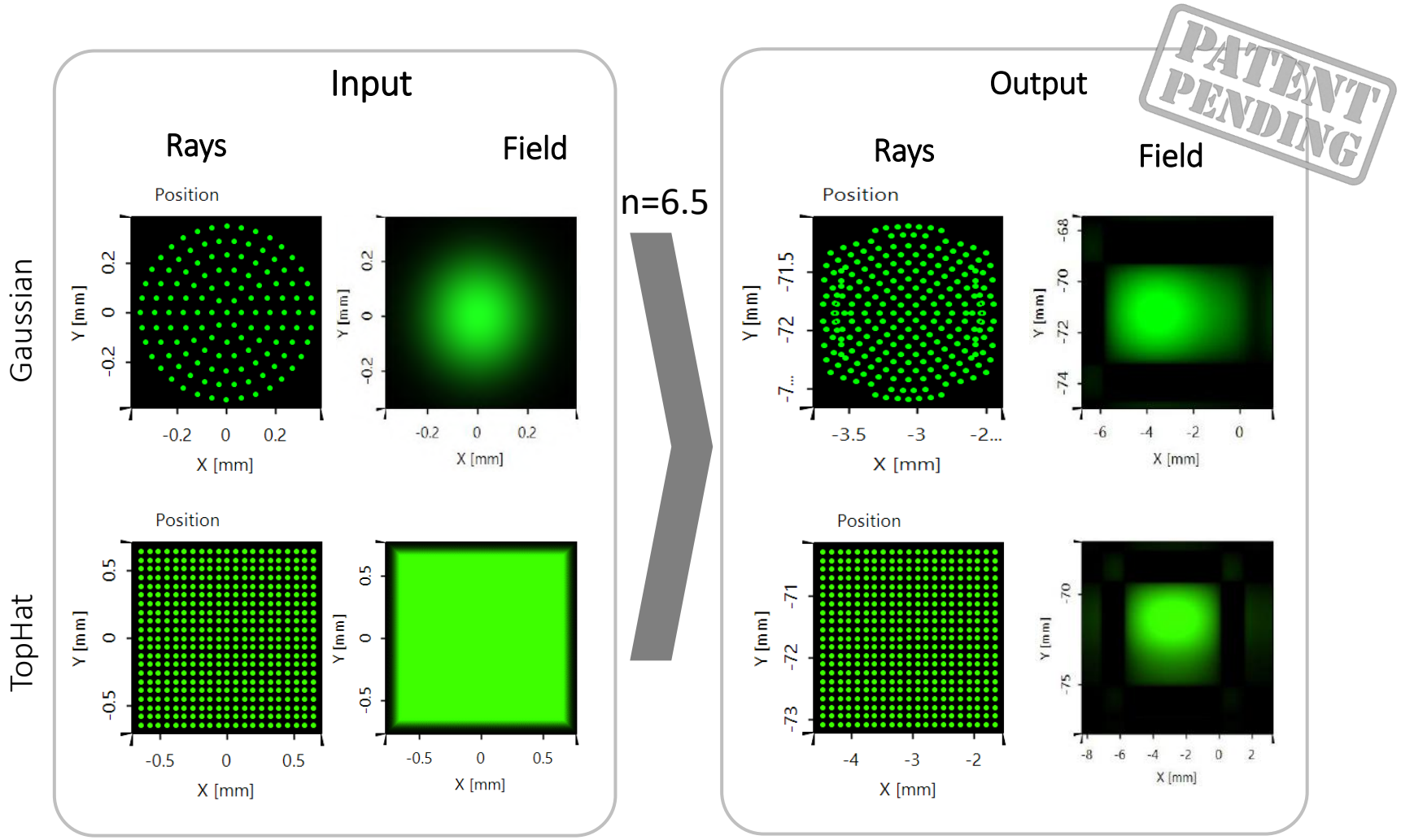
- The validation of different configurations of the technology proves:
  → **Our Technology is linear**
- The flexibility in re-configuring of our prototype allows us to conclude:
  → **Our Technology is scalable**
- There are **no (theoretical) upper limit** to maximum range
- Our Technology **does not contain transmission optics**
- Our Technology has been **validated with common market LiDAR**



The Laser Beam
Impact on profile

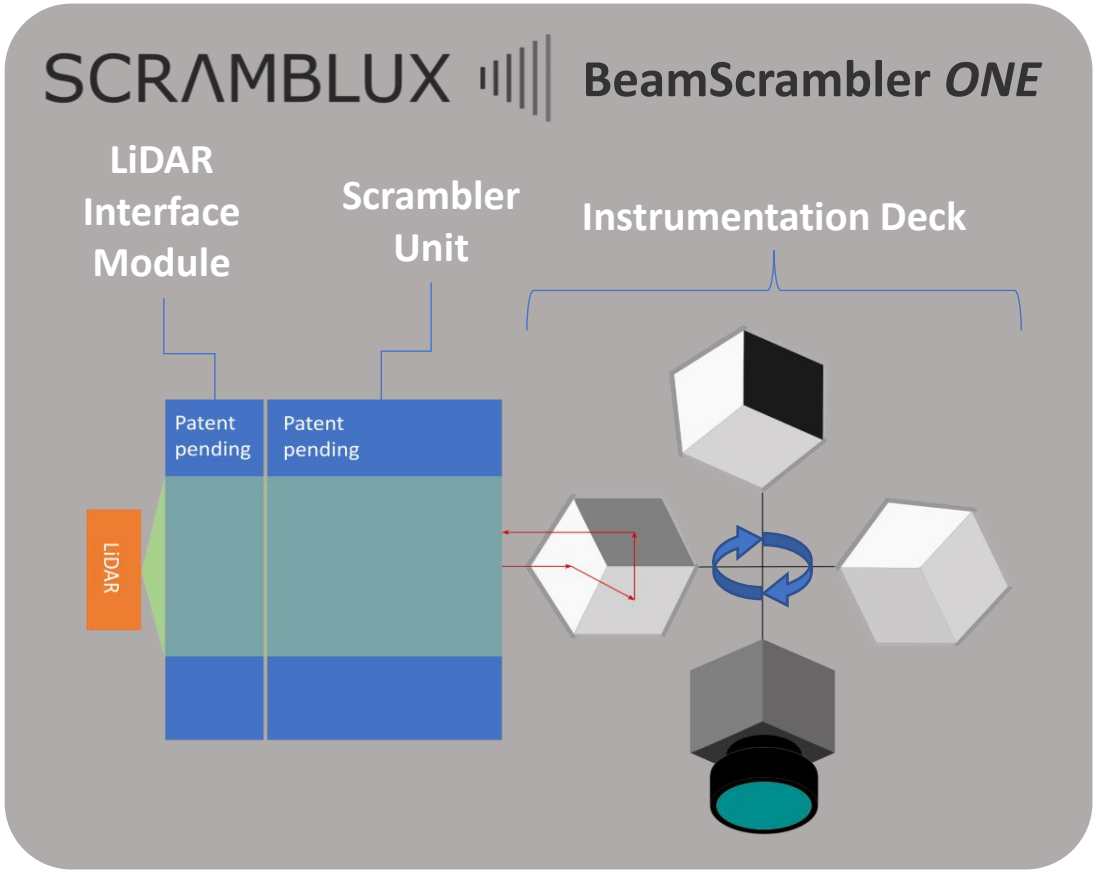
SCRAMBLUX

- Minimum of beam distortion
  - Minimum geometric distortion
  - Minimum dispersion
  - Minimum pulse distortion
- SIMUALTIONS OF Gaussian and TopHat beam profiles demonstrate this fact



The Automation
Integrated in ficonTEC V Platfom

In cooperation with ficonTEC, SCRAMBLUX will provide a compact, fully automated test solution



Our USPs
BeamScrambler

SCRAMBLUX

I. **Direct measurement** of key performance parameter in a single measurement system
(Field of View, Range, Resolution, Channel specific pointing, Eye Safety)

II. **Ultra-Fast** (CT ≤ 10sec/LiDAR), **one shot** and **full FOV** measurement at **multiple ranges**

III. **Compact footprint** (≤ 1m²) and fully automated test system which can be integrated in production lines

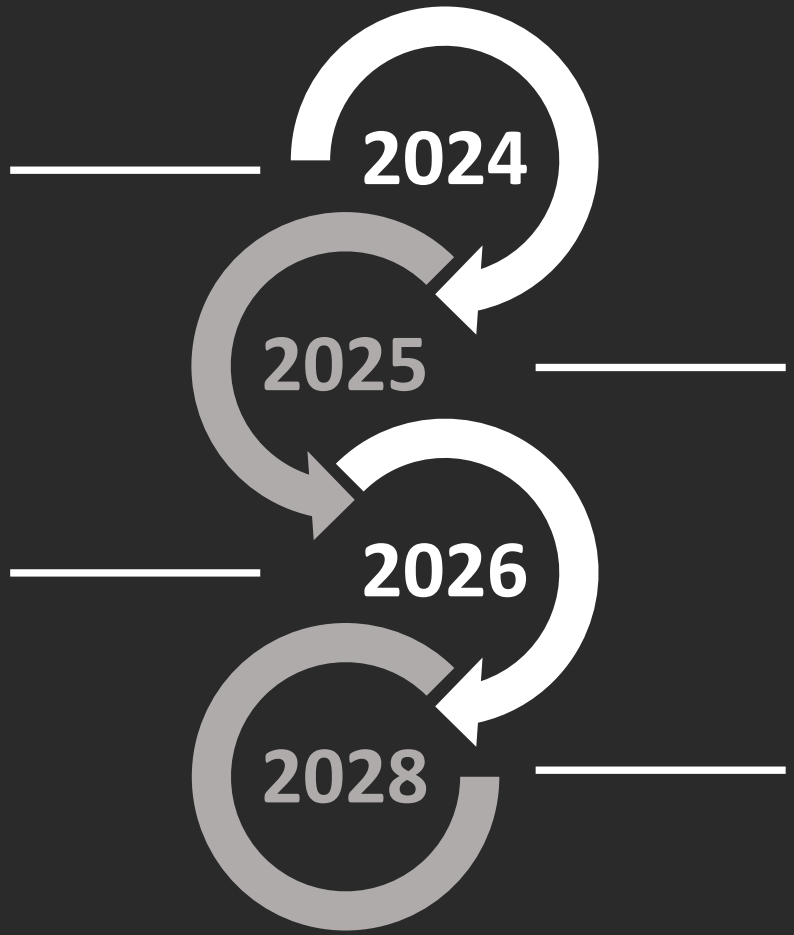
IV. **Testing** under **real-world environmental conditions**
(Snow, Rain, Fog, Splash, Dust and other performance limiting factors)

The Product Roadmap
BeamScrambler

SCRAMBLUX

ALPHA
- Prototype System
- Production Line Ready

COMPACT
- Compact System
- Final Assembly Line Ready
- Lower Cost
- Ready for Aftermarket Testing



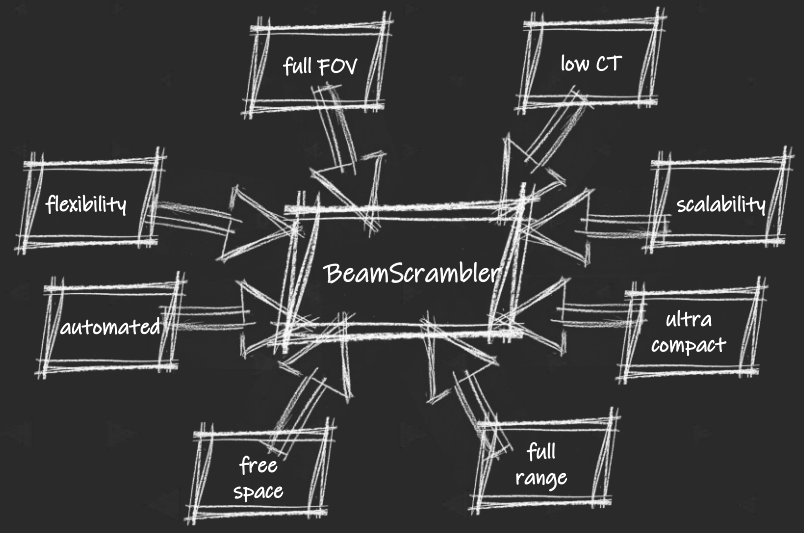
ONE
- Production System
- Optimized for Production Line
- Extended Features
- Stand-Alone Development System

X
- Ultra-Compact System
- Handheld
- Optimized for Aftermarket
- Cost optimized for Aftermarket

The Summary

SCRAMBLUX

- We have solved the biggest challenges in LiDAR EOL Testing
- Our solution is ultra-compact, ultra-fast, fully scalable and suitable for all LiDAR types
- A single measurement provides data on the full FoV of the LiDAR
- Our turn-key solution will be based on ficonTEC V automation platform, making it immediately suitable for the factory



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SCRAMBLUX
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