

LIDAR QUO VADIS

How Solid-State Sensors are Making Automated Driving Suitable for Mass Production

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Dokumentenklasse: Public

IBEO IN A NUTSHELL



400+ employees in Germany, Netherlands, USA.



Developing automotive LiDAR sensors since 1998.



One of the Top 100 most innovative companies in Germany.



Strong partners ZF and AAC Technologies. Production site at ZF Brest (France) set up.



Ibeo brought the Valeo SCALA in cooperation Valeo into series production in 2017.



First LiDAR series supplier in China for Great Wall Motor. Start serial production end of 2022.

IBEO AUTOMOTIVE SYSTEMS – READY FOR SERIAL PRODUCTION



- Backed by strong investors ZF Friedrichshafen and AAC Technologies
- Production facility is set-up and ready for ibeoNEXT SOP in 2022
- Extensive serial experience through industrialization of Valeo Scala®
- Supply chain ready with trusted partners
- Best-in-class price performance

An advertisement for IbeoNEXT. The left side has a red background with white text and graphics. The right side is a black and white photograph of a man, Martin, with his hands clasped.

WHY DO WE PREFER
SERIAL PRODUCTION TO
JOKES? IT GETS BETTER
WITH REPETITION.

 **ibeoNEXT**
GERMAN
ENGINEERING

ibeo
automotive

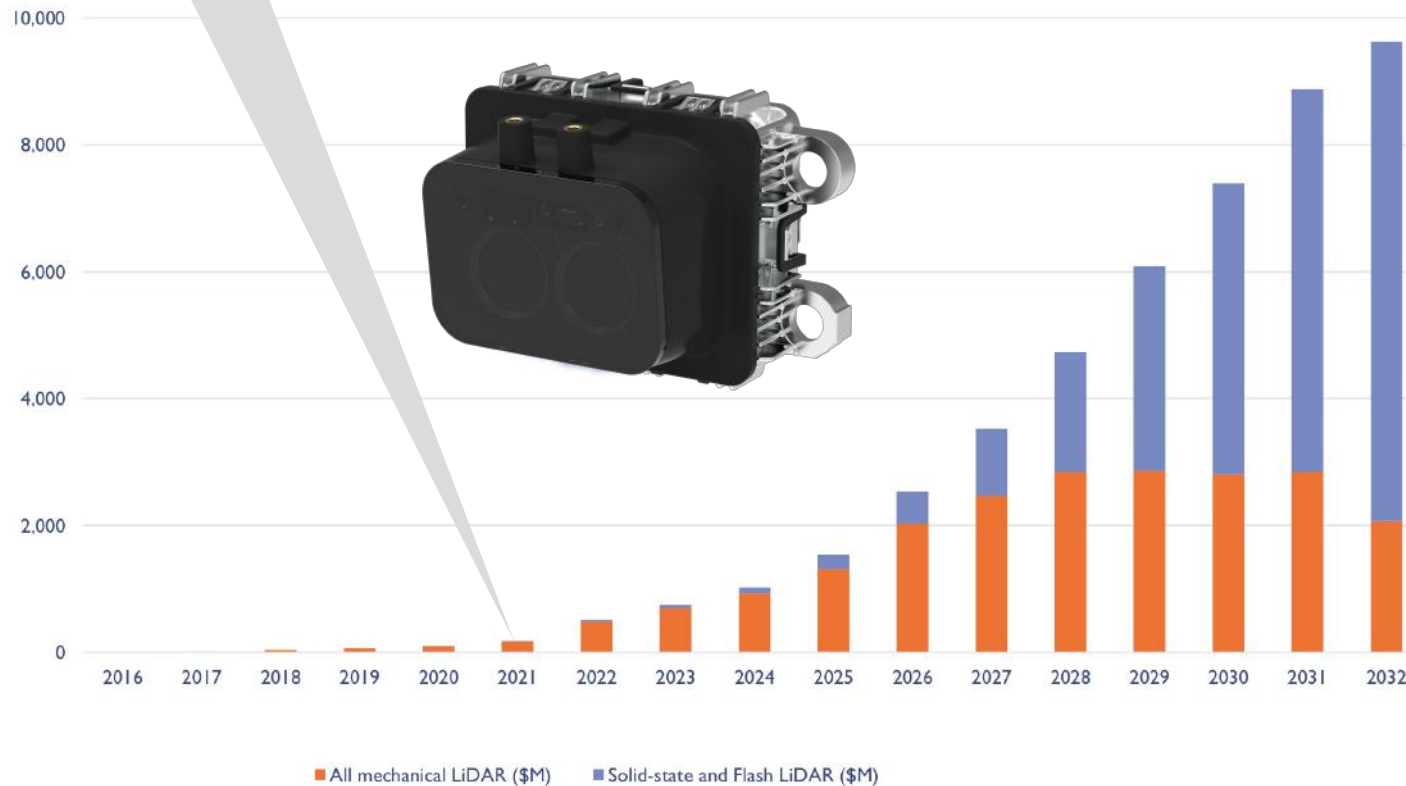
Ready for the big stage: ibeoNEXT sets new standards for autonomous vehicles, in close cooperation with our strong partners ZF and AAC. This extensive serial production experience makes us ready for the future right now. Accurate, reliable and safe. Discover the future today: [ibeo-as.com](https://www.ibeo-as.com)

Martin
Application Architect

THE GOLDEN AGE OF SOLID-STATE LIDAR IS HERE



We are here



- Lidar technology has evolved from pure prototype development into serial-ready technology
- Audi brought Lidar onto automotive stage with introduction of Valeo Scala® in 2017
- What's needed to take full advantage of golden age of Lidar technology?
 - Scalability
 - Production-readiness
 - Strong and experienced partner network

Source: Woodside Capital Partner & Yole Développement (2018): The Automotive LiDAR Market.

IBEONEXT FULFILLS ALL CRITICAL USE CASES REQUIRED BY OEMS

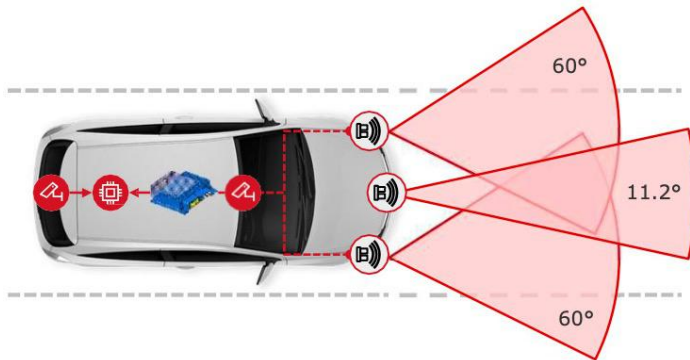


Highway Pilot (L3) overview

- Automates start-stop traffic and driving on the highway
- Driver has to be **available within 5 seconds**
- Hands do not have to be on the steering wheel at all times
- **Useful in passenger cars** as it still requires a driver

Value propositions

- ✓ Increase road safety
- ✓ Cut emissions
- ✓ Returns previously unusable times to consumers



IBEONEXT only LiDAR sensor able to address all corner cases

1 Small obstacles



Needs to detect **small objects**

✓ IBEONEXT: **high resolution at distance** to detect objects

2 Overhanging load



Unusual objects close by need to be detected and located **horizontally and vertically**

✓ IBEONEXT: **scans large vertical field of view (VFOV)**, enabling safe detection

3 Close cut-ins



Requires **sensor cover-age of the front area of the vehicle** and adjacent lanes

✓ IBEONEXT: sensors located in the front corners of the vehicle for **early detection of vehicle cut-ins**

IBEONEXT FEATURES A MODULAR SYSTEM ARCHITECTURE



A standardized transceiver plate for all sensors



1 out of 4 proprietary designed optics



Long
Range
11.2°



Medium
Range
32°



Short
Range
60°



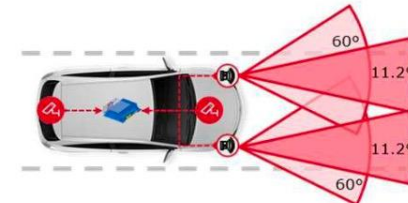
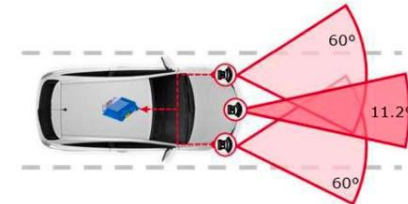
Near
Range
120°



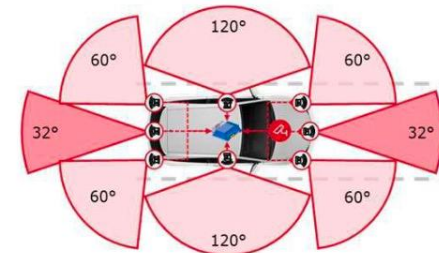
Endless LiDAR system
opportunities



Potential L3 system setup



360° L4/5 system setup



IBEONEXT PERCEPTION



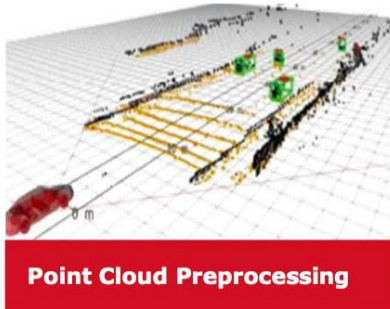
Range Estimation



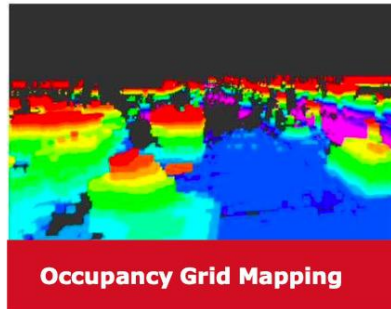
Dynamic Object Tracking



Object Classification



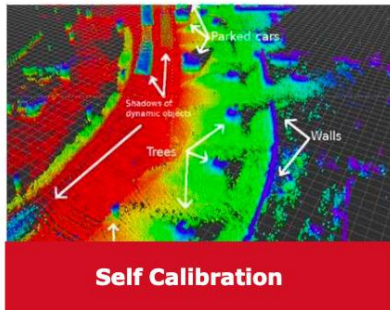
Point Cloud Preprocessing



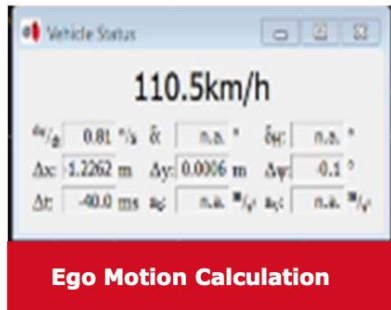
Occupancy Grid Mapping



Lane & Road Boundary Tracking



Self Calibration



Ego Motion Calculation



Freespace Detection

- LiDAR Perception SW based on **>20 years experience**
- SW development according to **ISO 26262** incorporating regulatory requirements like **ASIL** as well as **automotive SPICE** base practices
- **Perception SW Stack serving customer requirements** with respect to environmental modelling
- Generates an **object level representation of the environment** including dynamic objects
- **Detailed environmental map** based on a 3D Voxel map implementation
- **3D extended object tracking algorithms** for simultaneous estimation of dynamic and geometrical properties
- **SW modules for range estimation and self calibration**
- **Architecture suited to be enhanced** with additional sensor domains (e.g. Radar, Camera)

THANK YOU!

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