

First Sensor 

LIDAR Technology: from automotive to New Space

12/09/2019

Pierre Chazan

Sales Manager and A&D leader



OUR COMPANY

We are a leading provider of sensor technology

Short facts



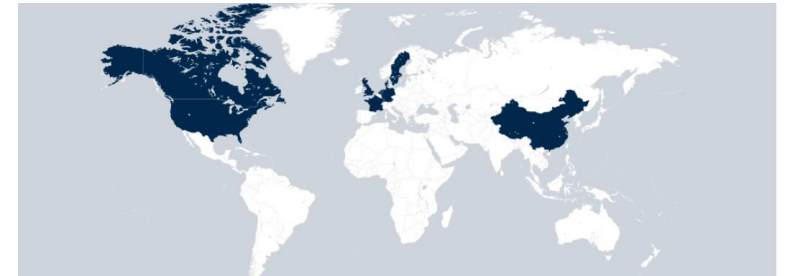
- Founded 1991 in Berlin, Germany
- 1,000 employees
- € 155.1 m sales revenues in 2018
- Stock-listed in Germany

Capabilities



- 7 clean room production sites: chip design and production, microelectronic packaging
- Automotive, medical and aerospace certifications
- Complete sensor value chain in one company

Markets & Products



- 3 target markets: industry, automotive, medical
- Know-how in photonics, pressure and advanced electronics
- Development and production of customized solutions and standard sensors

space capabilities at First Sensor Lewicki

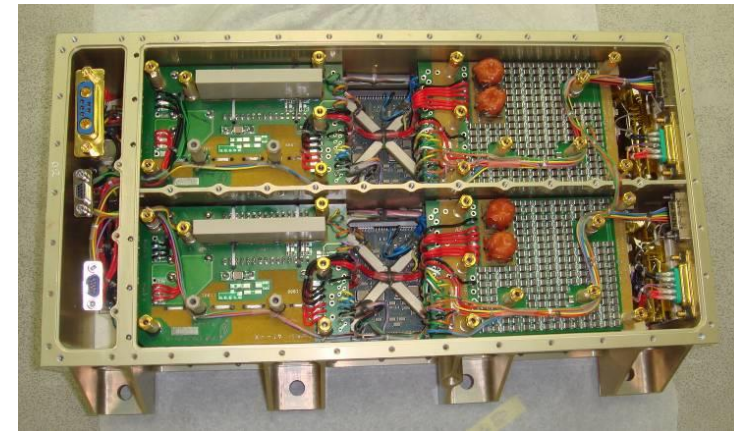
- Space Qualification “Assembly & Test House” in accordance with DLR Specs successful completed in July 2015.
- Space Qualification “High Power Diode” in progress
- EnMap
- EUCLID
- ExoMars
- GeReLEO-MFA on Heinrich-Hertz
- GALILEO 2nd generation
- Firebird
- DEOS
- Sentinel-1A (Copernicus)
- VIBANASS
- LISA Pathfinder Photodiodes Assemblies

- Rad-hard sensor chip
- Hybrid assembly and qualification
- In orbit since 2014



SUN SENSOR

Motor driver system for hydro-mechanical cooling application



- Hybrid assembly, space-qualified PCB population and harnessing
- In-orbit operation since 2014

LIDAR development for A&D

Wavelength range	1480nm-1550nm	905nm-1064nm
Technologie Emitter / detector	InP/InGaAs InGaAs	Laser : GaAs/ InGaAs Detector : Si APD
Eye safety	YES	Maximum power density/pulse width
Laser power / achievable range	High power 1480nm laser	High power available at 980nm
Reliability of the emitter	Telecom & Space heritage	980nm laser available / space qualification studies (*).
Reliability of the detector	Telecom heritage	Automotive qualification at First Sensor

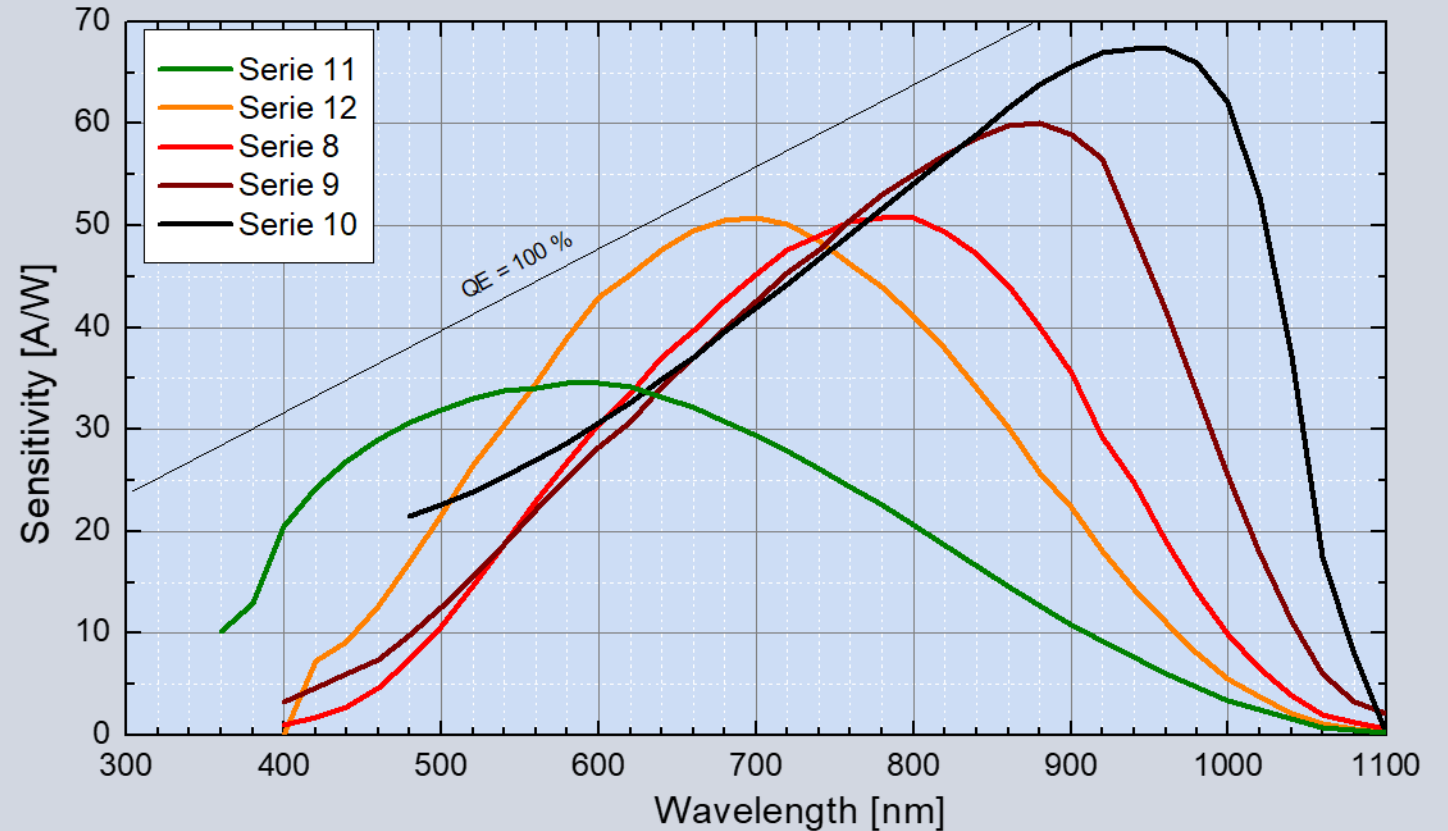
(*) Pedroza et Al. Long term in-vacuum reliability testing of 980nm Laser Diode Pump Modules for Space Applications. IEEE Aerospace Conference Proceedings. 1-14. 10.1109/AERO.2014.6836254.

Si NIR IR Lidars with Si APD can be of interest for the Space LIDAR Market

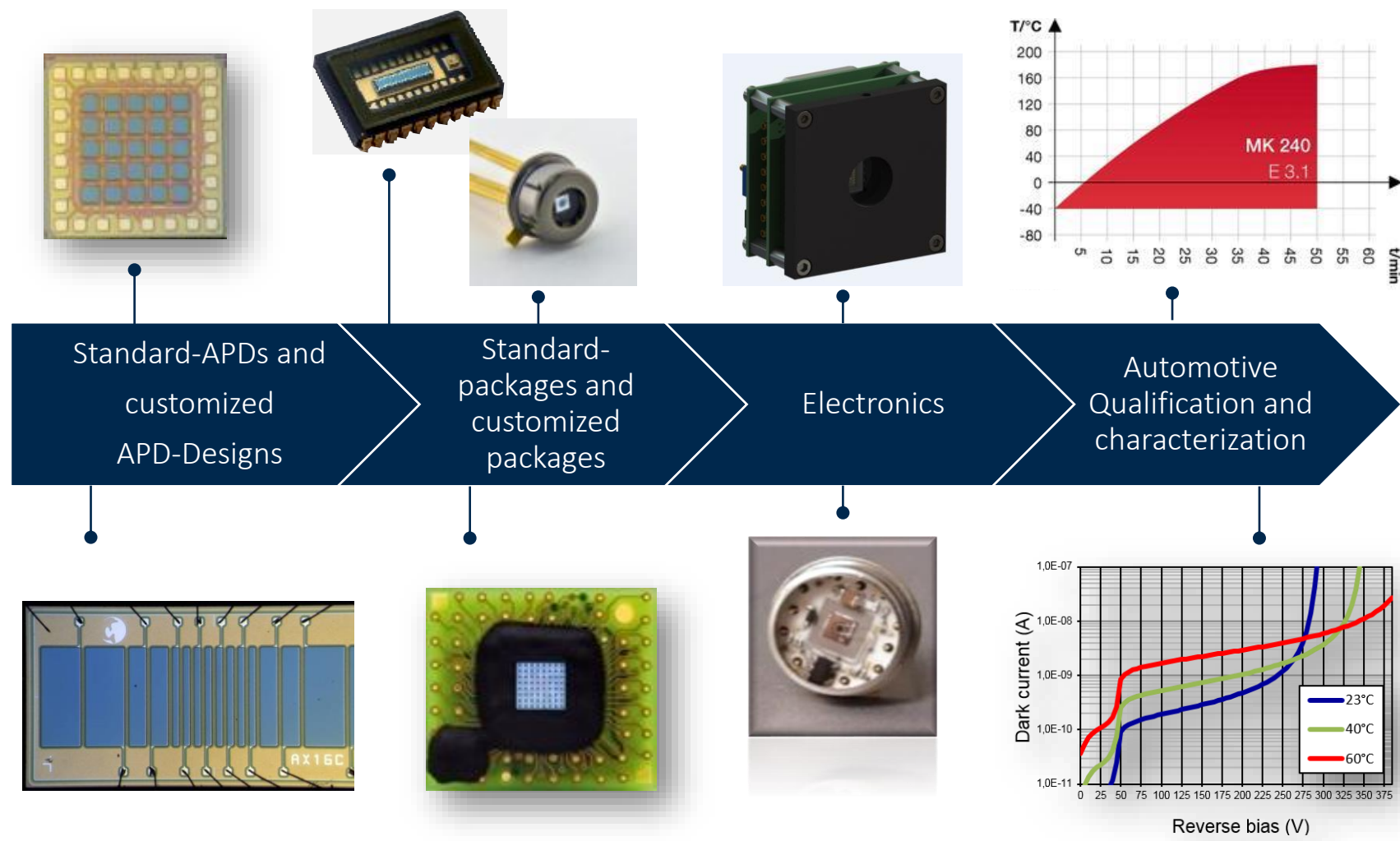
What Makes our APDs so successful for LIDAR applications ?

- 25 years + of experience in APD development
- Lowest noise factor
- Highest sensitivity @ 905nm
- High speed ($T_r = 1 \text{ ns}$)
- Customizing capabilities
- Advanced packaging techniques available within the Group
- AEC-Q 101 qualified APD arrays
- IATF 16649 production and testing

Sensitivity / Wavelength in comparison



OPTICAL SENSORS - LIDAR Portfolio



high power laser integration

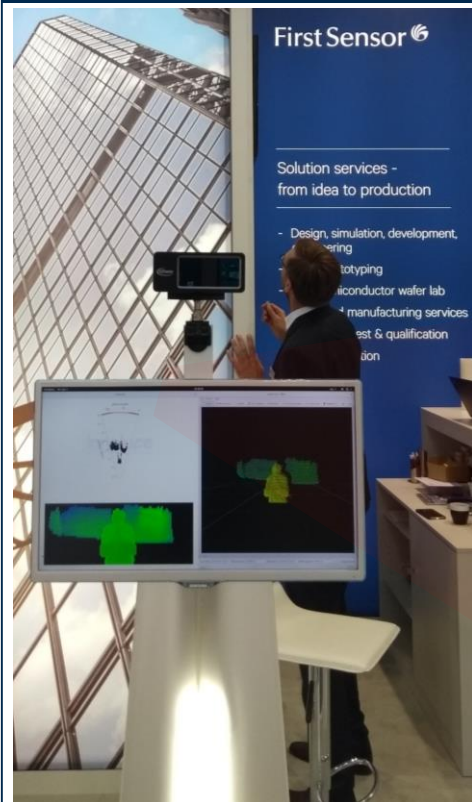
- Long-year experience in 905 nm
- high power pulsed laser technology well matched to Si detection
- Pulse-lengthes with optical outputs in single ns-range and 10 W peak power
- Optimized thermal design for maximized heat dissipation



CUSTOMIZED SOLUTIONS FOR LIDAR

Experience the system abilities of First Sensor avalanche photodiodes (APDs) with MEMS mirror scanning LIDAR demonstrator from Infineon

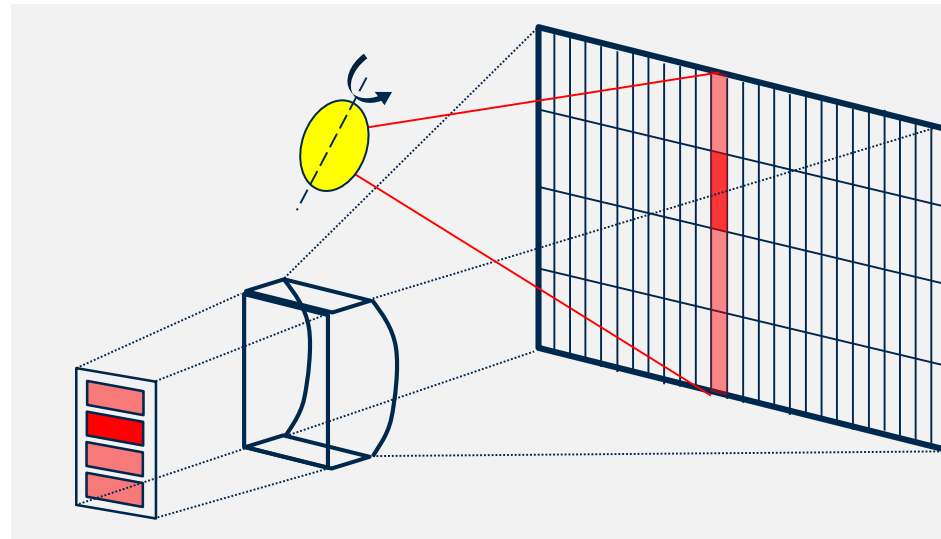
LiDAR demonstrator



FoV: 30° x 12°

Resolution: 120 x 32 Pixel

Common solid state LiDAR schematic for 1D MEMS

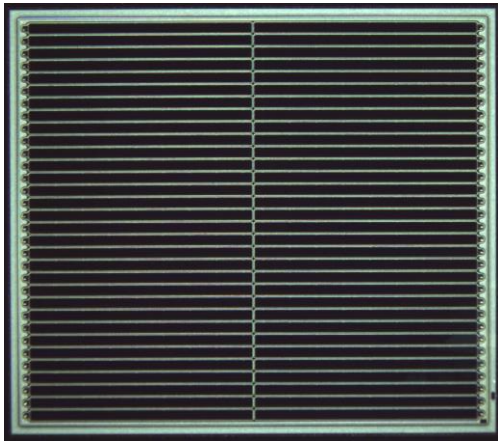


- Detector layout determined by **LiDAR system** architecture
- With size limitations of 1D MEMS-mirror **larger detector arrays are needed**
- **2D detector arrays** allow for segmented FOV to reduce ambient light influence

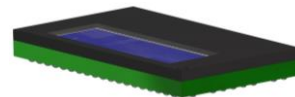
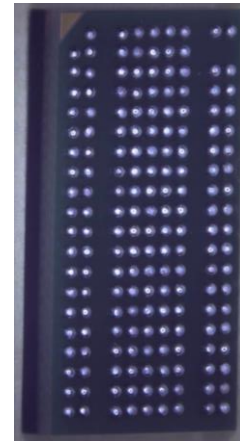
Customized solutions for lidar

APD-Arrays, package development, LiDAR receivers

Design and manufacturing of customized APD-Arrays fitting to your system architecture (e.g. 2x32 pixel APD-Array)



Automotive grade packaging (AECQ-102, robustness validation)

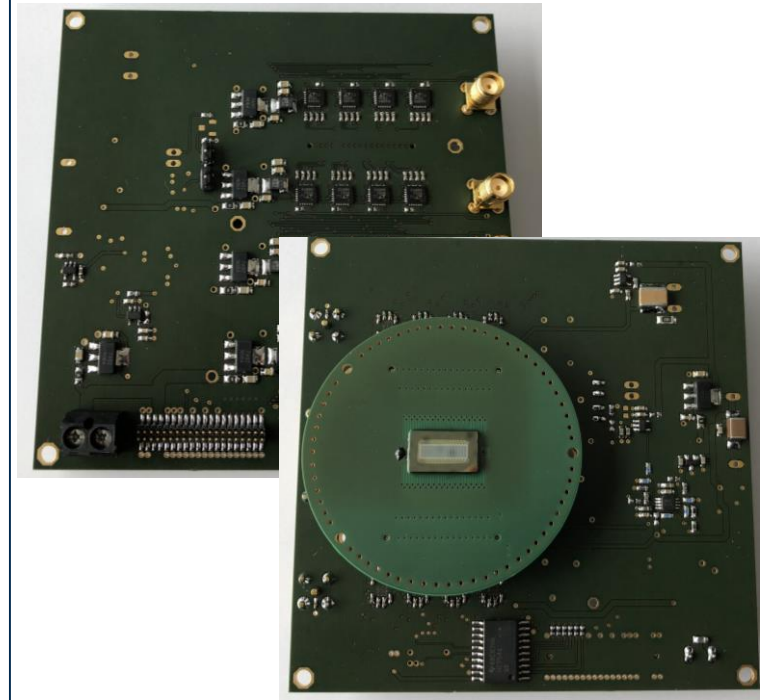


Grade 0: -40°C...150°C

Grade 1: -40°C...125°C

Grade 2: -25°C...105°C

LiDAR receiver solutions and evaluation boards



CONCLUSION

- First Sensor has **references** in the development of receiver modules for automotive LIDARS
- First Sensor can **adapt** Automotive concepts for Space applications
- However, the development of the A&D prototype needs reasonable **synergies** with our automotive activities
- we do not intend to produce a full Lidar System
- We need to **identify** for which missions the Si APD are relevant

We need a business partner



Thank You

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Pierre.chazan@first-sensor.com

First Sensor AG

www.first-sensor.com

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