

First Sensor 

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WE LEAD THE FUTURE

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COMPANY PRESENTATION



# OUR EXECUTIVE BOARD

Dr. Rothweiler and Dr. Gollwitzer are experienced industry managers



Dr. Dirk Rothweiler  
CEO

since Jan. 1, 2017  
appointed until Dec. 31, 2019

- 2017 CEO, First Sensor AG
- 2008 Executive Vice President Optical Systems, Jenoptik AG
- 2005 Vice President Sales and Service, TCZ
- 2000 Managing Director Asia-Pacific, Süss Microtec Co. Ltd.
- 1999 Director Sales & Marketing, Süss Microtec AG
- 1995 Project Manager for the Semiconductor Technology Division, Carl Zeiss
- 1995 Doctorate from the Department of Engineering, RWTH Aachen



Dr. Mathias Gollwitzer  
CFO

since Aug. 10, 2015  
appointed until Aug. 9, 2022

- 2015 CFO, First Sensor AG
- 2012 Vice President Group Controlling, EnBW Energie Baden-Württemberg AG
- 2008 CFO, Mercedes-Benz France SAS
- 2006 Director Corporate Controlling, DaimlerChrysler AG
- 2005 CFO, DaimlerChrysler Belgium/Luxembourg NV/SA
- 2002 Director Research and Technology, Daimler AG
- 1999 CEO, Temic Sprachverarbeitung GmbH
- 1995 Director Division Controlling, Telefunken Systemtechnik GmbH
- 1992 Expert Adviser Finance/Controlling, Deutsche Aerospace AG

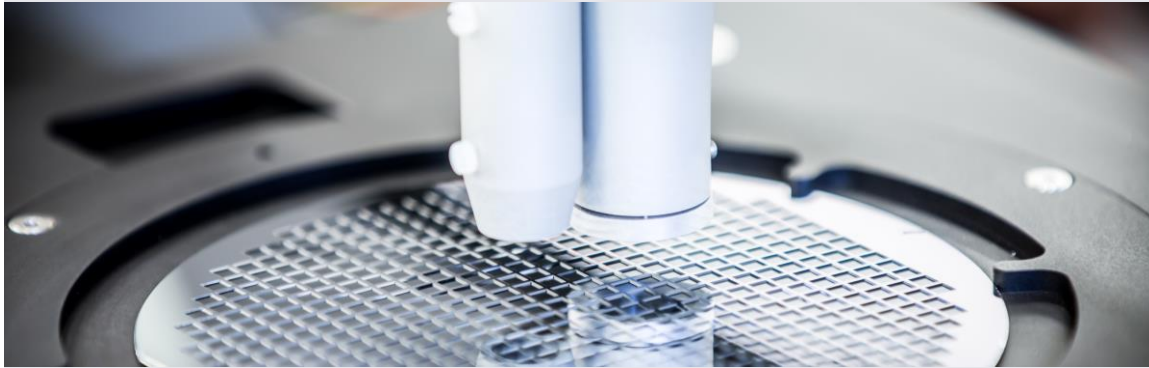
# FIRST SENSOR AT A GLANCE

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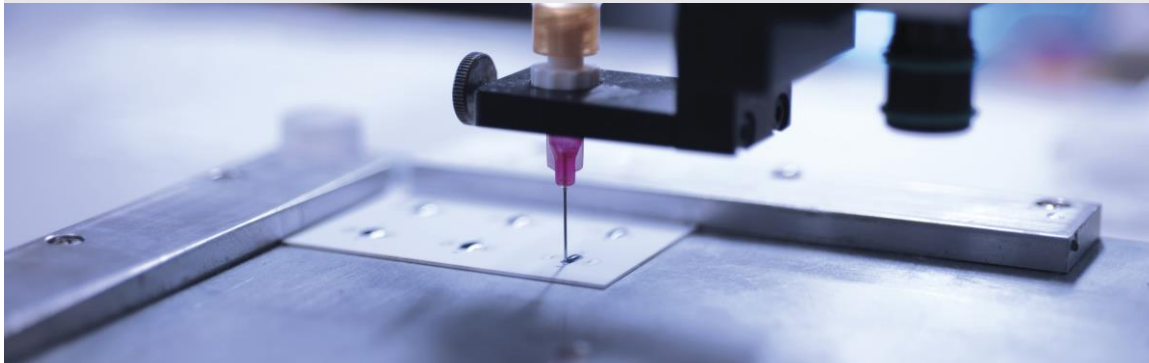
# OUR COMPETENCIES

With chip & packaging expertise we offer standard sensors & solutions

## SEMICONDUCTOR PRODUCTION



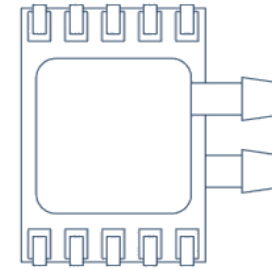
## MICROELECTRONIC PACKAGING



**30%**

**STANDARD SENSORS**

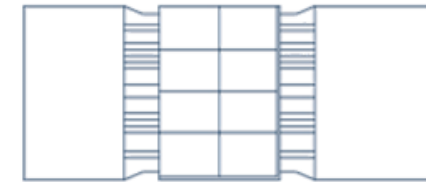
**SALES  
SHARE**



**70%**

**SENSOR SOLUTIONS &  
SYSTEMS**

**SALES  
SHARE**



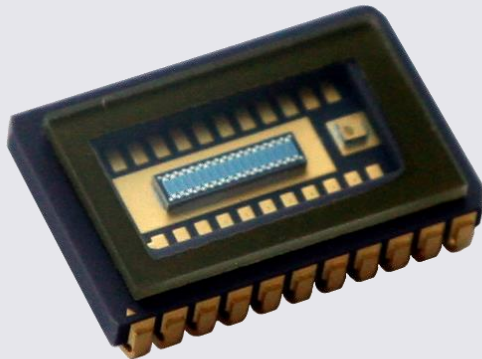
# OUR COMPETENCIES

We are an expert for photonics, pressure & advanced electronics

40%

SALES  
SHARE

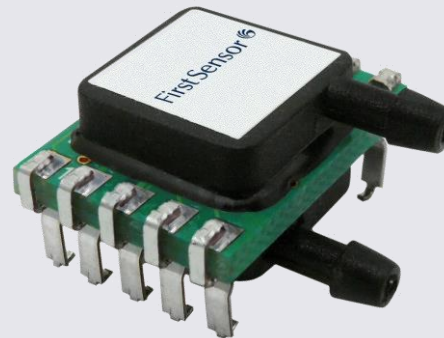
Photonics



45%

SALES  
SHARE

Pressure



15%

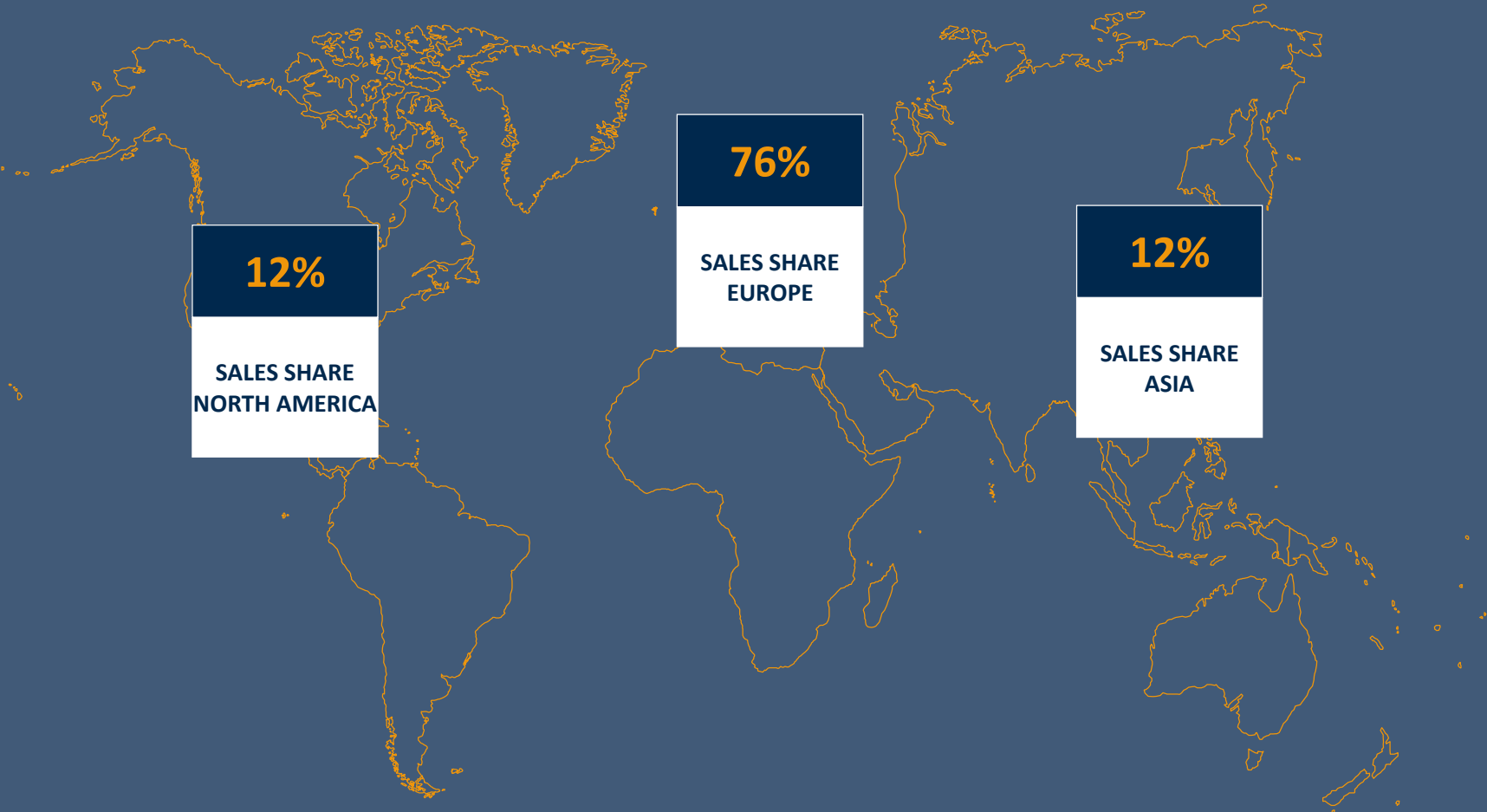
SALES  
SHARE

Advanced Electronics



# OUR PRESENCE

We are internationally positioned



# OUR PRESENCE

Around the globe, we are active in three growing B2B markets



**50%**  
SALES SHARE  
INDUSTRIAL

- Length Measurement
- Radiation and Security
- Smart Building
- Industrial Process Control
- Aerospace



**20%**  
SALES SHARE  
MEDICAL

- Breathing and respiration
- Dialysis
- Endoscopy
- Diagnostics

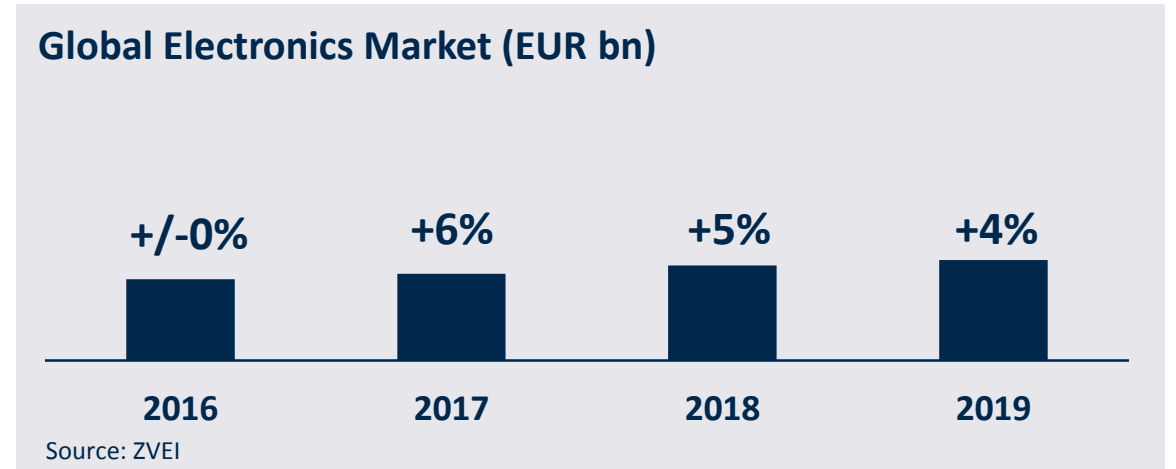
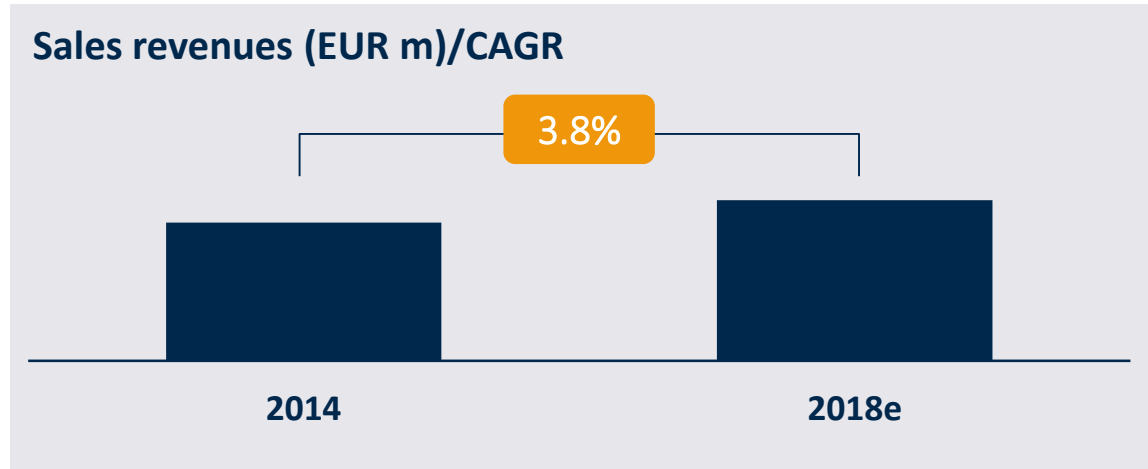


**30%**  
SALES SHARE  
MOBILITY

- Advanced driver assistance systems
- OEM pressure sensors

# INDUSTRIAL AT A GLANCE

## We support customers' increasing demand for industrial automation



Competitors

**HAMAMATSU**      **SENSIRION**  
THE SENSOR COMPANY

Detection Technology      SMI      Amphenol  
PRESSURE SENSORS      Advanced Sensors

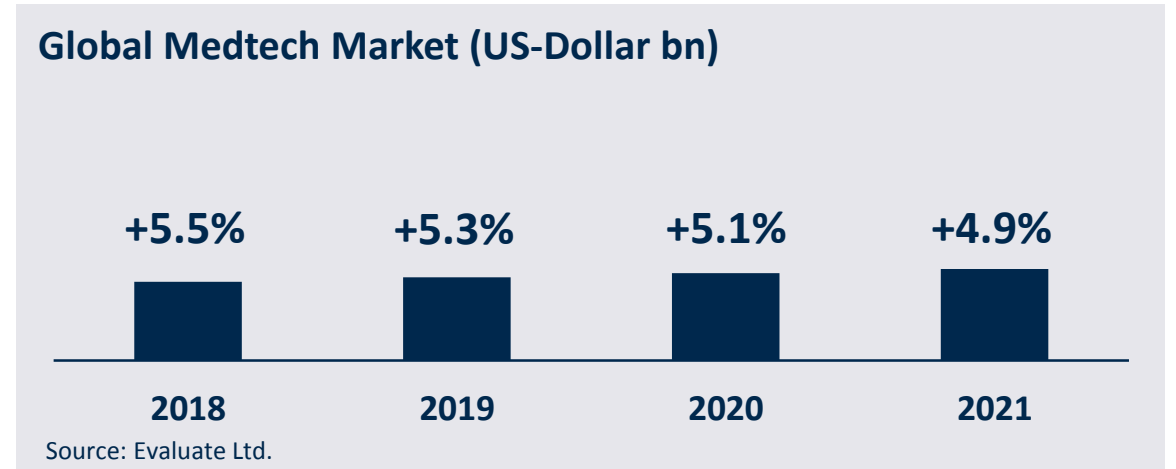
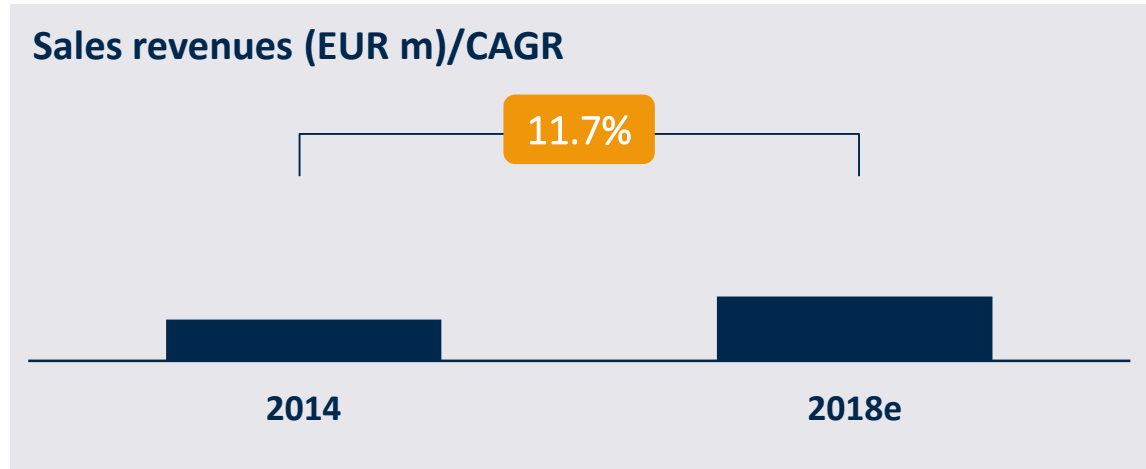
Strategy

- New APD generation for autonomous machines
- Expanding pressure business in Asia with H and K series
- Strengthening photonic business in North America



# MEDICAL AT A GLANCE

We participate in the ongoing technical progress in medicine



**Competitors**

OSI SYSTEMS, INC.

Honeywell

ALL SENSORS

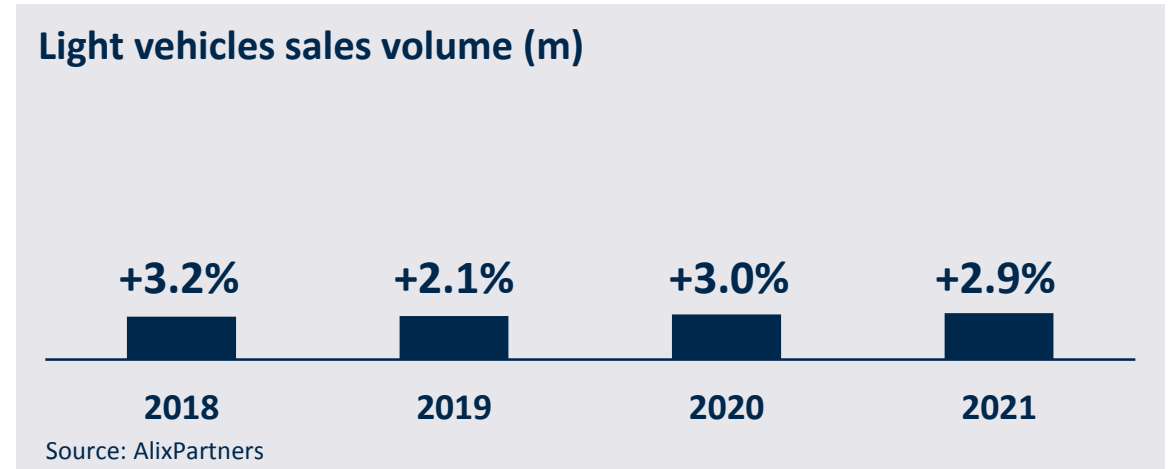
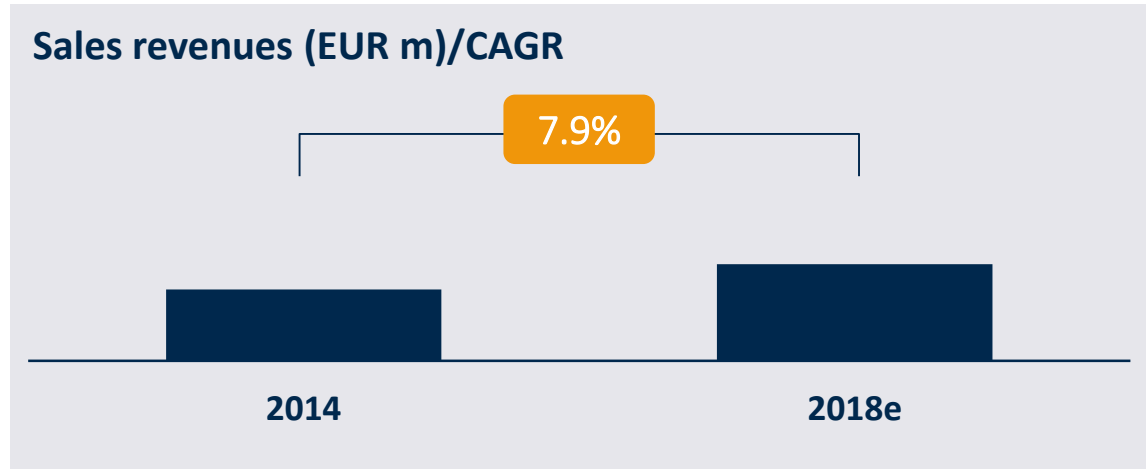
MERIT SENSOR

**Strategy**

- Next generation H series
- Increasing production capacities
- Growth with digital imaging

# MOBILITY AT A GLANCE

We are a strategic partner for realizing a new idea of transportation



### Competitors

Sensata Technologies

BOSCH

EXCELITAS TECHNOLOGIES

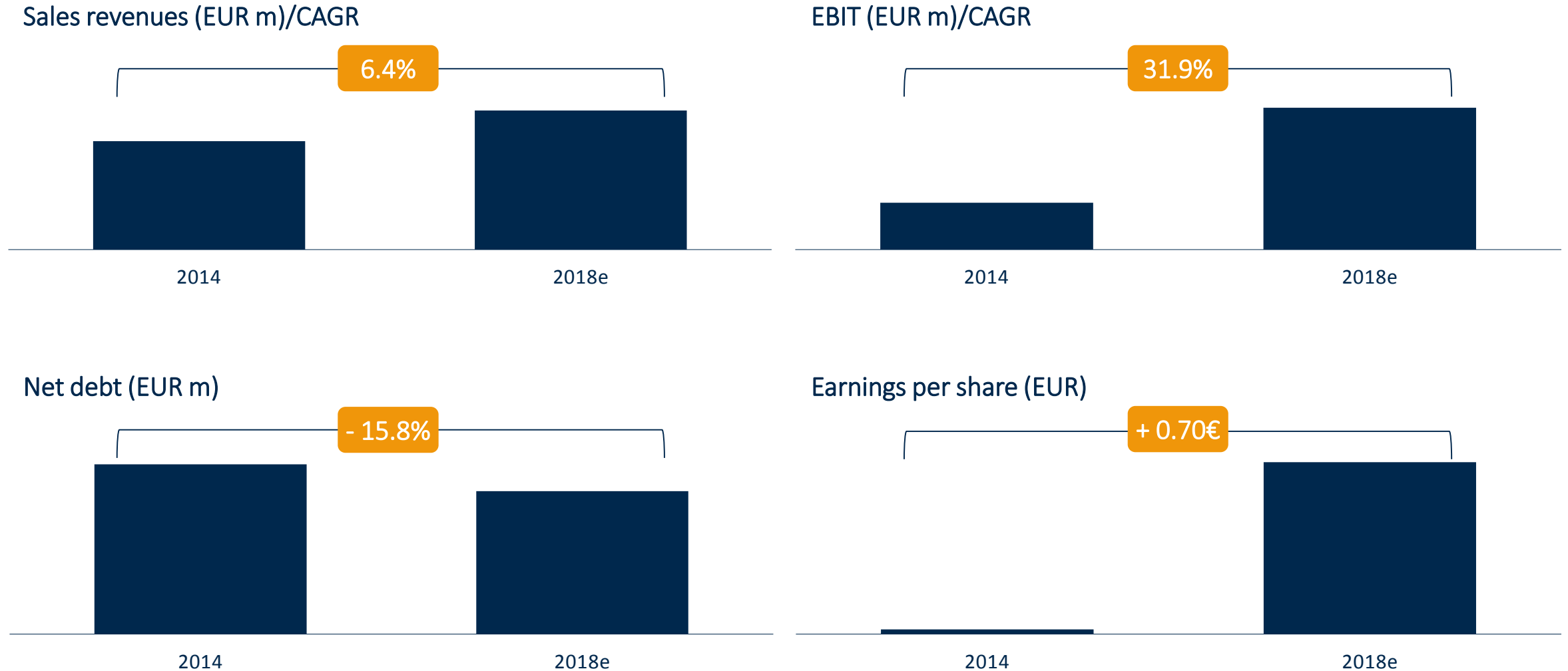
HAMAMATSU

### Strategy

- Volume production with new camera family
- Sensor fusion with Embedded ECU & software competencies
- Growth with commercial & special vehicles

# FINANCIAL FIGURES AT A GLANCE

## We improved sales revenues, profitability and financial strength

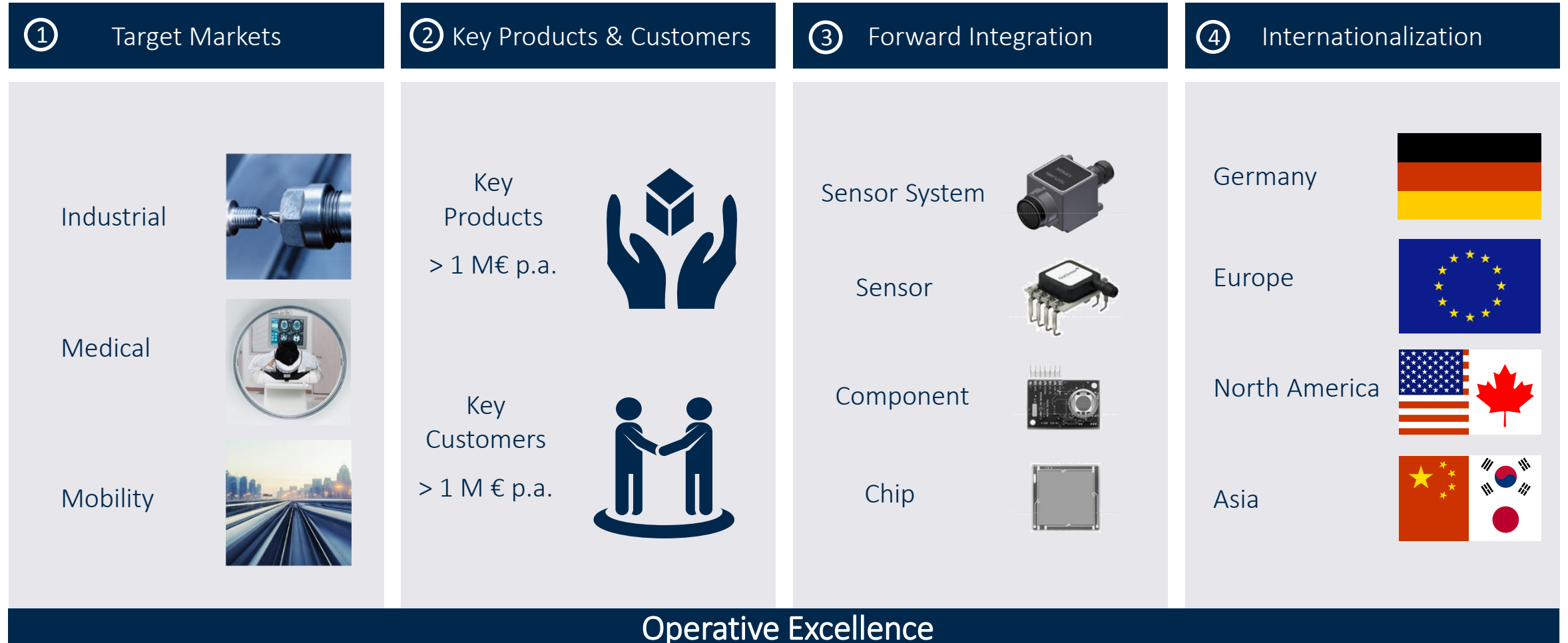


# OUR STRATEGY FOR PROFITABLE GROWTH

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# OUR STRATEGY FOR PROFITABLE GROWTH

## We generate and utilize economies of scale in four dimensions



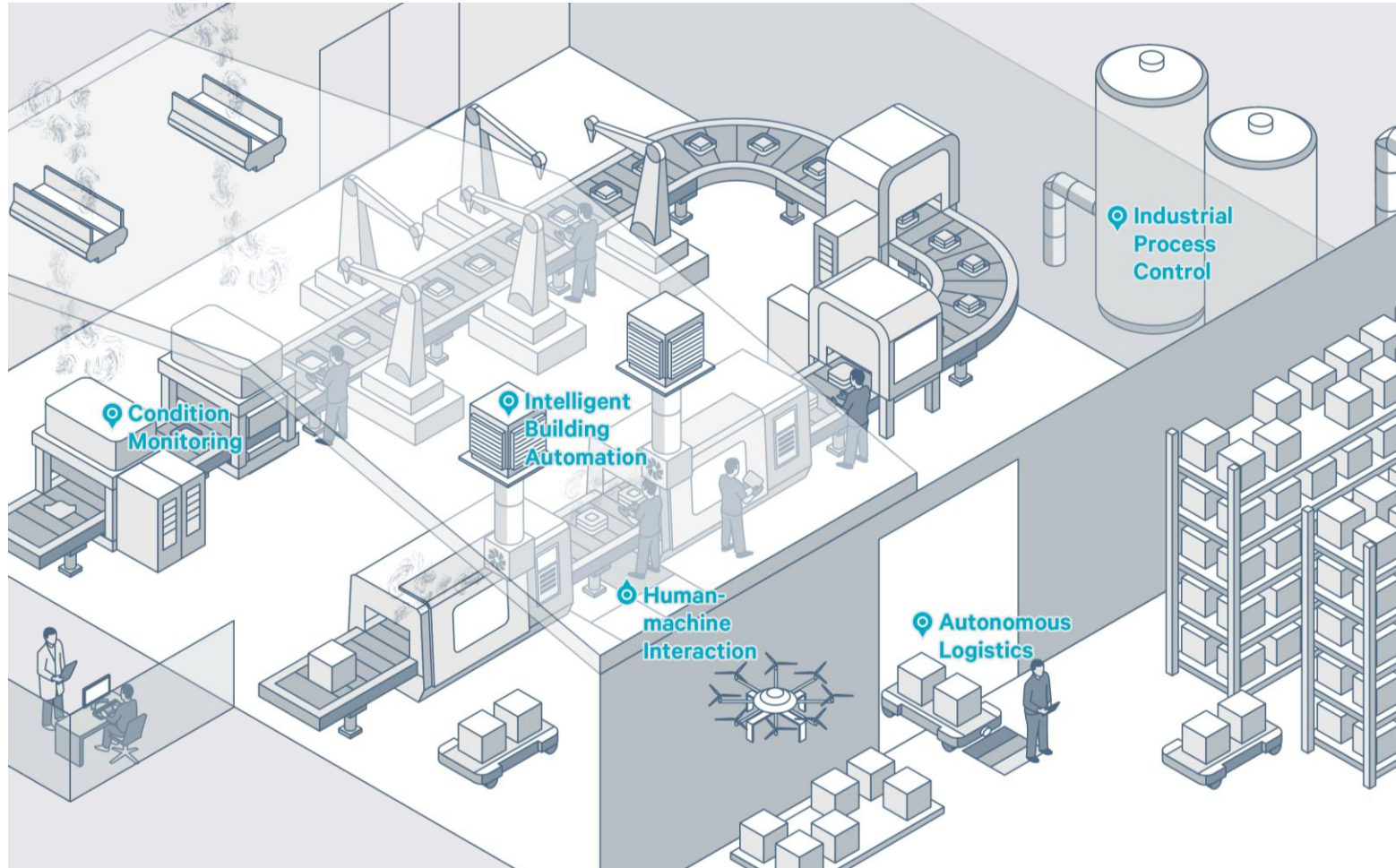
# OUR STRATEGY FOR PROFITABLE GROWTH

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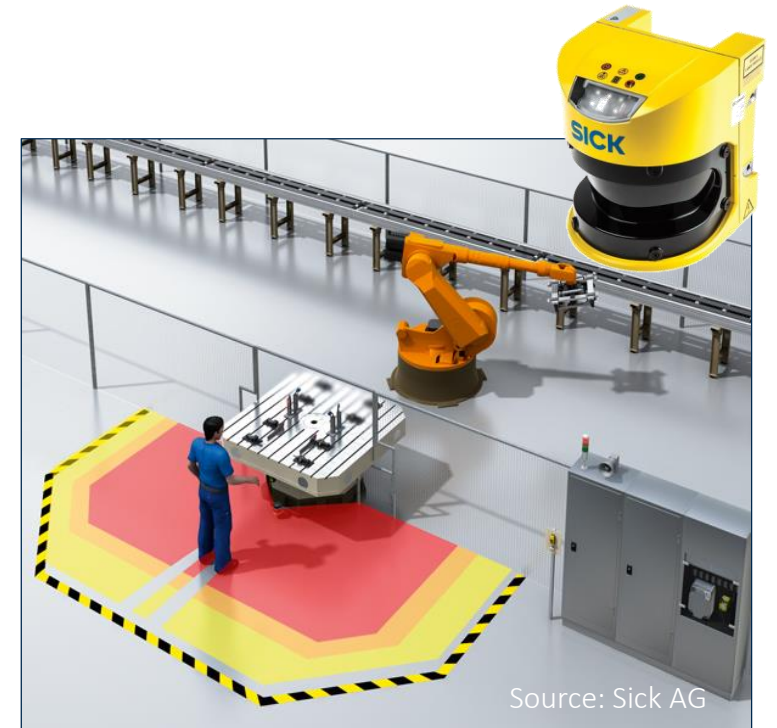


# DIMENSION 1: CLEAR FOCUS ON THREE TARGET MARKETS

## The industrial market is marked by smart processes



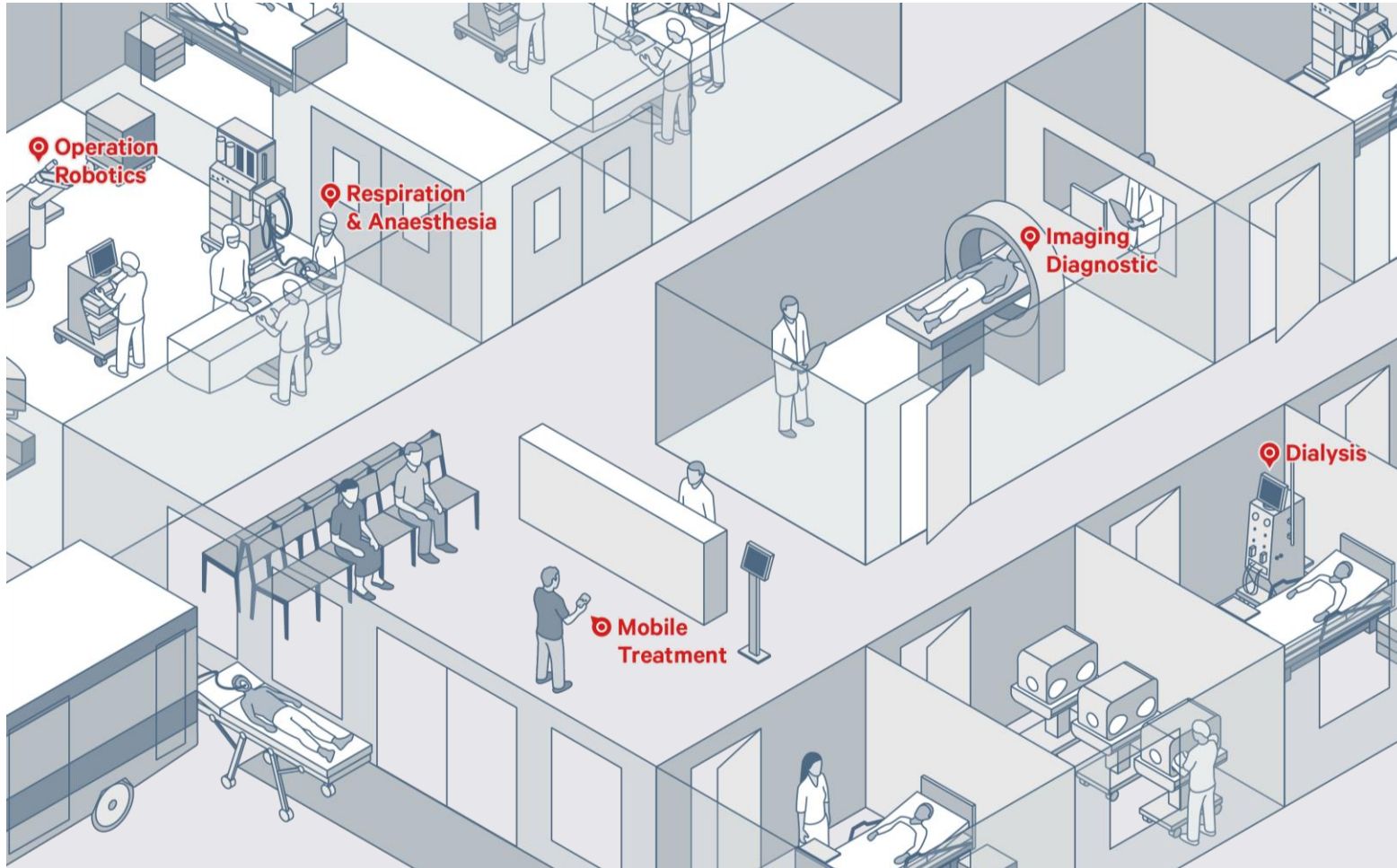
Intelligent sensor systems control applications such as condition monitoring, predictive maintenance or human-machine collaboration.



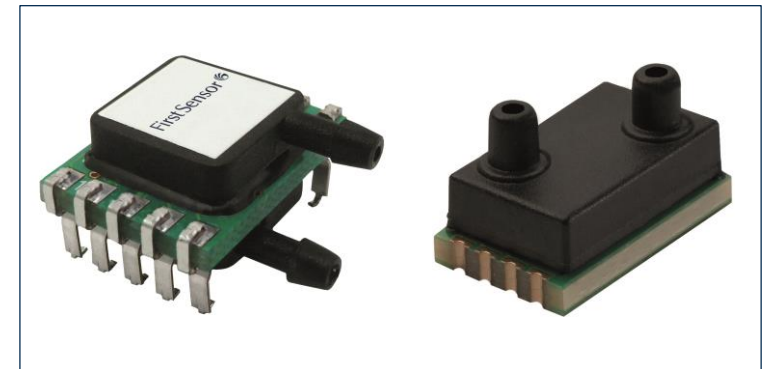
Source: Sick AG

# DIMENSION 1: CLEAR FOCUS ON THREE TARGET MARKETS

The medical market is characterized by miniaturization & digital health



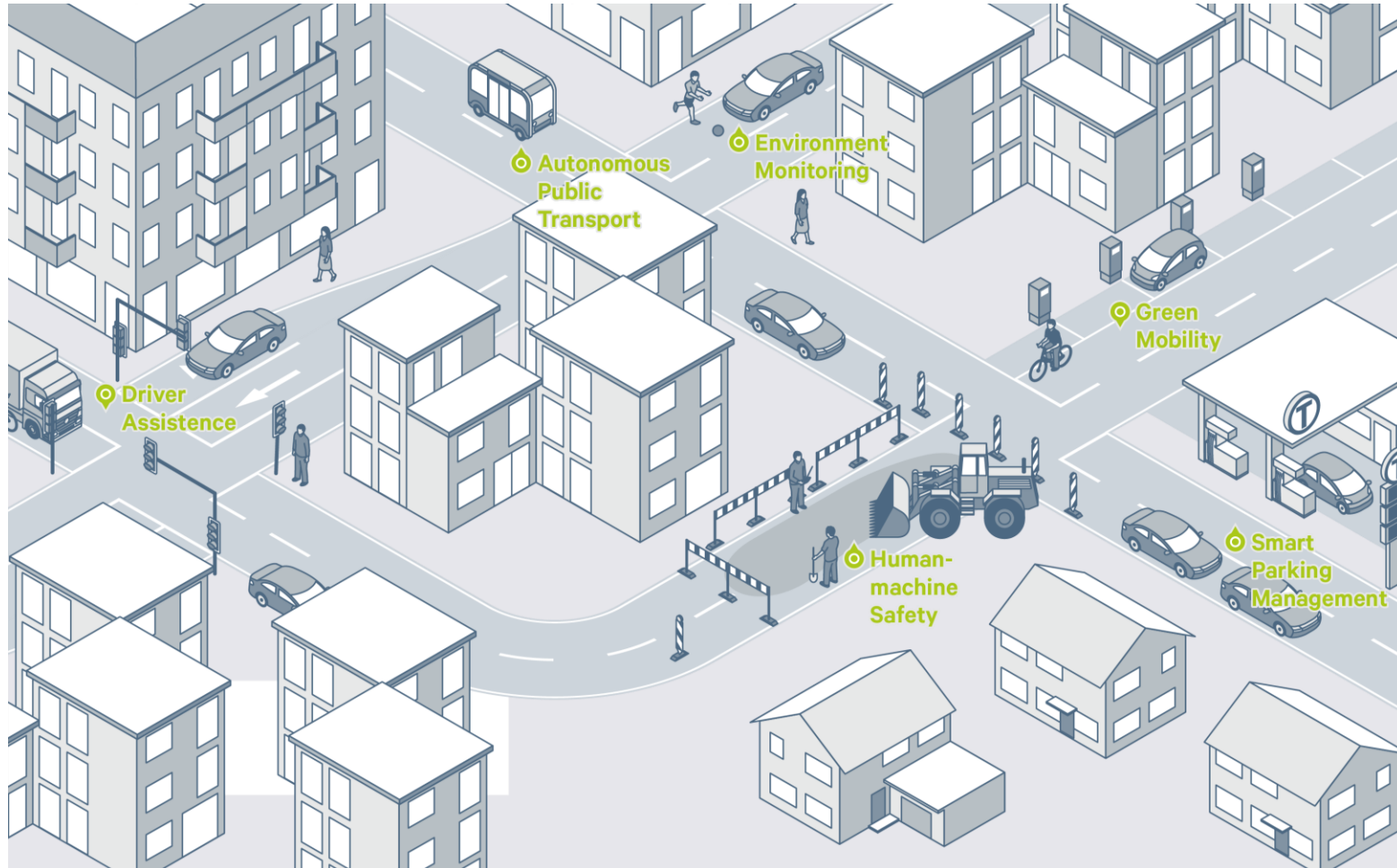
Devices in the nanometer range for new applications, e.g. ventilators for home use, are no longer merely visions of the future.



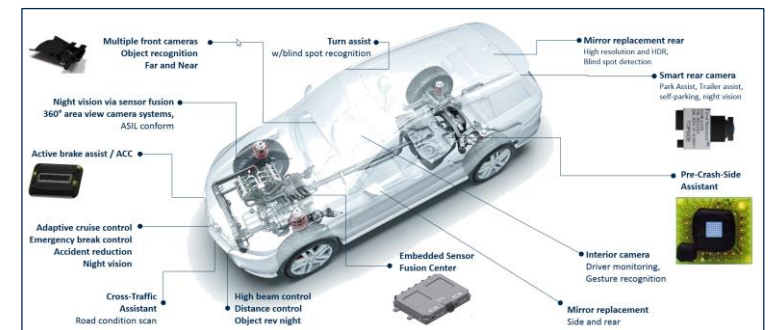
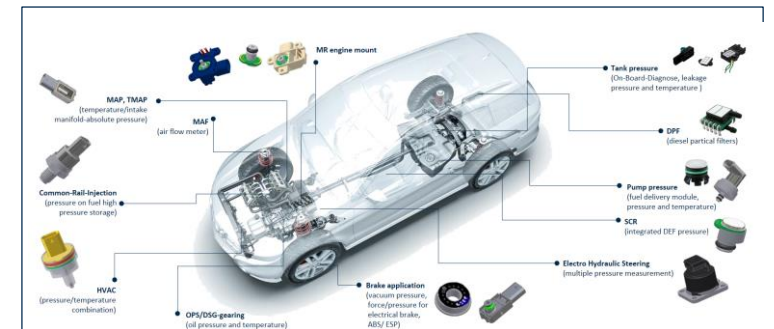


# DIMENSION 1: CLEAR FOCUS ON THREE TARGET MARKETS

## The mobility market is driven by a new idea of transportation



The trend towards partially and fully autonomous vehicles is possible only thanks to sensor-based driver assistance systems.



# OUR STRATEGY FOR PROFITABLE GROWTH

## We generate and utilize economies of scale in four dimensions



# DIMENSION 2: CLEAR FOCUS ON KEY CUSTOMERS & PRODUCTS

## Why is this efficient?

### Key Customers

### Key Products

- ▶ Single respective product developments result in relatively large quantities and therefore sales volumes.
- ▶ Sales per head in both sales and engineering increases – our existing team will be able to handle larger revenue streams.
- ▶ „Mix & Noise“ in operations are decreased due to reduced parts variety and transactions per revenue.
- ▶ Our supply chain and own production will gain in productivity and can be managed with fewer resources per revenue.
- ▶ With higher quantities per part, our purchasing power will increase.
- ▶ With more varietal purity we increase the stability of our value creation process.
- ▶ Lead time, on time delivery and quality will improve as a result.

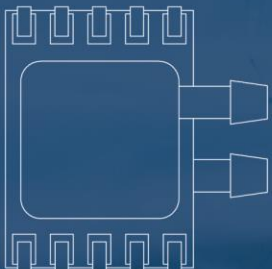
Our growth becomes more scalable and our profitability increases.

# Irreplaceable Together



## H Series

Our standard piezo-resistive pressure sensors measure extremely low pressures in dry, non-corrosive gases. Their applications include fields such as medical technology, measurement technology and air conditioning technology.

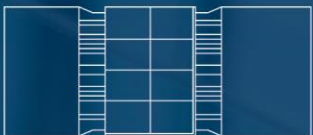


# Giving Perspectives Together



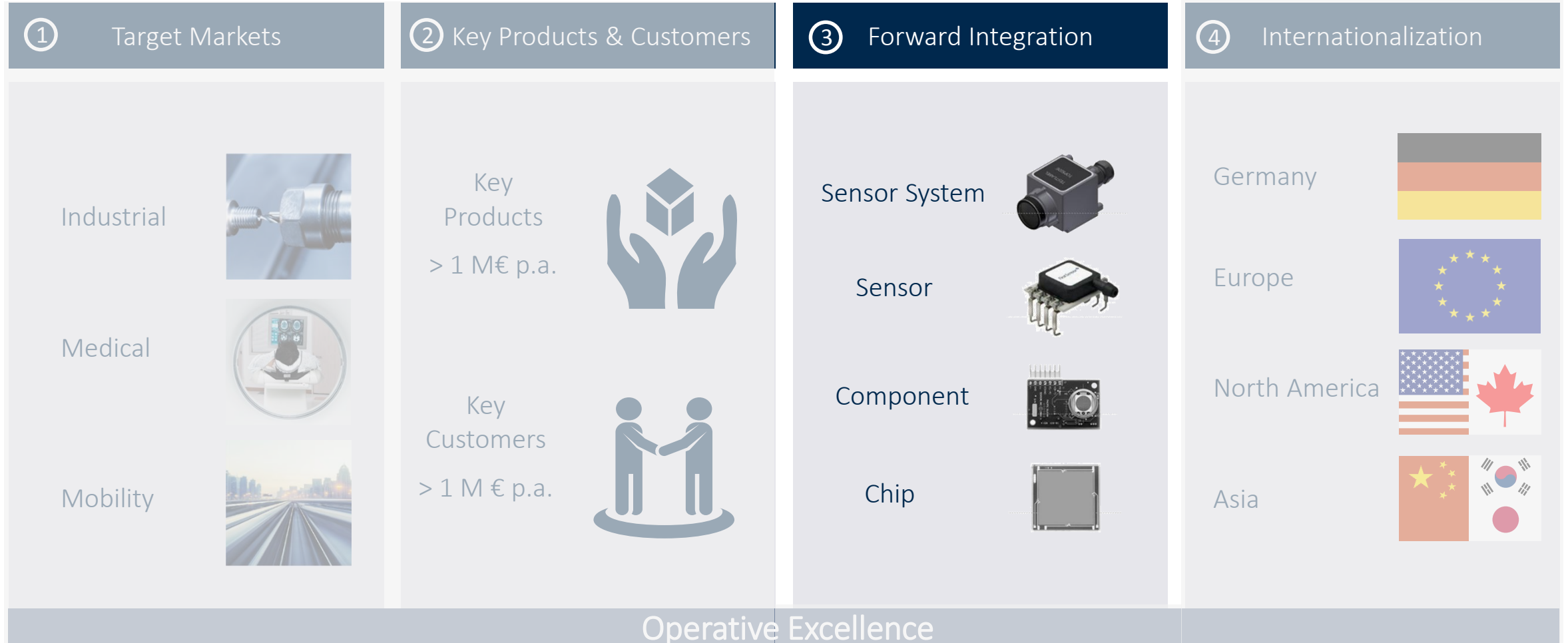
## Assembly of Arrays

When building large detector arrays, we mount sensor chips on a backing using state-of-the-art flip chip technology to achieve the best possible fitting accuracy with this solution.



# OUR STRATEGY FOR PROFITABLE GROWTH

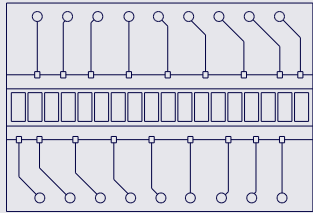
## We generate and utilize economies of scale in four dimensions



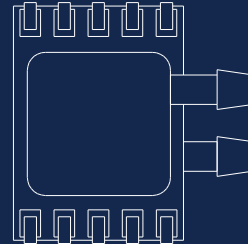
# DIMENSION 3: CLEAR FOCUS ON FORWARD INTEGRATION

## We base our forward integration initiatives on clear product roadmaps

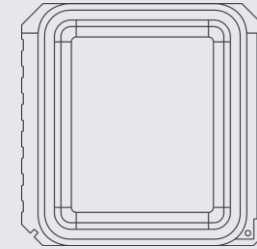
Radiation



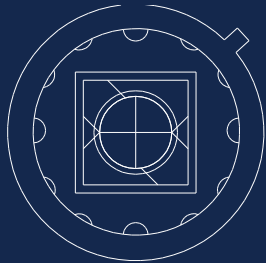
Pressure



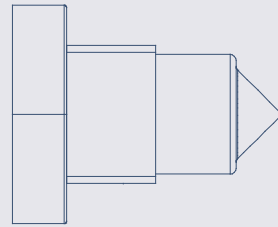
Acceleration



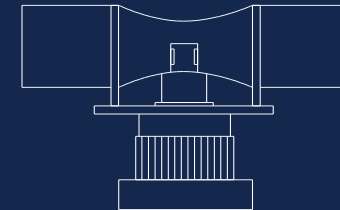
Optical



Level



Flow



Integrated Manufacturing Services



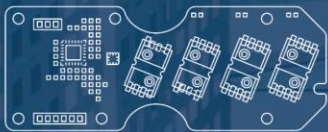
Multi Sensor Systems



# Thinking Joined-Up Together

## LMI Multi-Sensor System

On a tailored printed circuit board, this solution combines electronic components with four of our LMI differential pressure sensors that can detect the smallest differences in pressure.





# Going into Series Production Together

EPC 1089

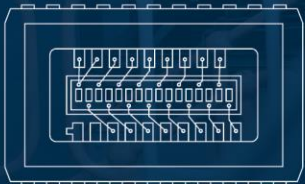
ST 420 L  
ZONE 6

ST 420 R  
Center Fit

ST410L  
TAILGATE  
HANDLER

## Avalanche Photodiodes

Our high-performance diodes measure light pulses in the nanosecond range. As one of the leading manufacturers, First Sensor also develops and produces array solutions for LiDAR systems.



# OUR STRATEGY FOR PROFITABLE GROWTH

## We generate and utilize economies of scale in four dimensions



# Staying One Step Ahead Together



## STARe K Series

Our standard piezo-resistive components are used in industry and medical technology. Pressure sensor chips based on STARe technology ensure their long-term stability and precision.

# Responsibility Together

## sensEdge Pressure Sensors

High-pressure sensors based on sensEdge technology are suitable for pressure changes up to 3,000 bar. Our solutions are used in steer-by-wire systems, for example.



# OUR STRATEGY FOR PROFITABLE GROWTH

## We generate and utilize economies of scale in four dimensions



# THE FUNDAMENT: FOCUS ON OPERATIVE EXCELLENCE

We have started six core initiatives to improve our operative excellence

## Top Initiatives

▶ T's & C's Harmonization	✓	
▶ Harmonized Core Processes	✓	
▶ OneERP	✓	Implemented at 4 sites, next 2 sites in 2019
▶ Lead Time, On-Time Delivery, Quality	✓	Ongoing project
▶ Portfolio Optimization	✓	Continued project execution
▶ Portfolio Consolidation	✓	Review of further product families

# THE FUNDAMENT: FOCUS ON OPERATIVE EXCELLENCE

## Portfolio consolidation: Casestudy for one selected product family

		PRODUCTS		
		A products	B products	C products
CUSTOMERS	A customers	11 % products	8 %	5 %
		69 % customers	6 %	> 1 %
	B customers	6 %	12 %	17 %
		12 %	9 %	1 %
	C customers	> 1 %	3 %	38 %
		> 1 %	> 1 %	2 %

### Top Measures

- ▶ Threshold order quantities for new products
- ▶ Minimum order quantities for existing products
- ▶ Bundling of demand
- ▶ Recommendation of product alternatives
- ▶ Last call options if necessary

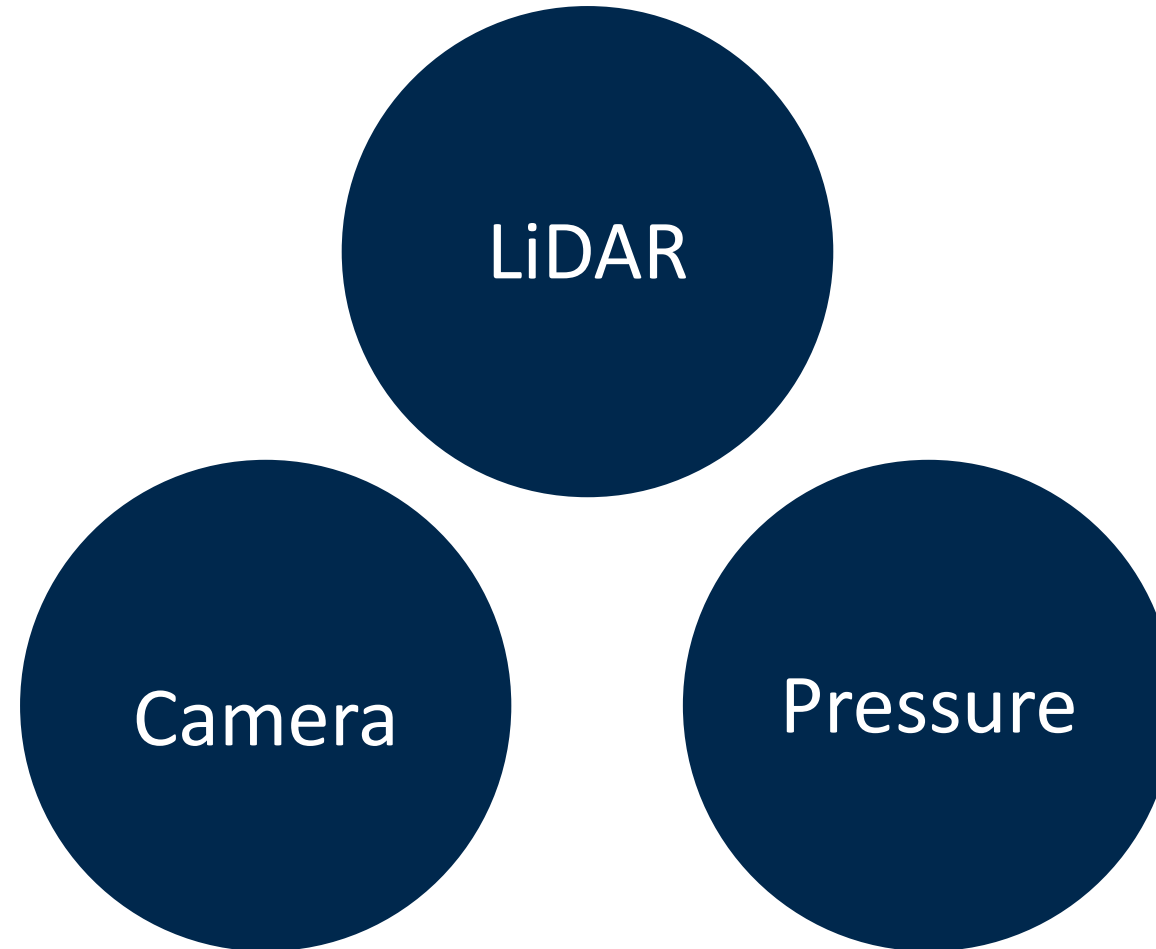
# GROWTH DRIVERS

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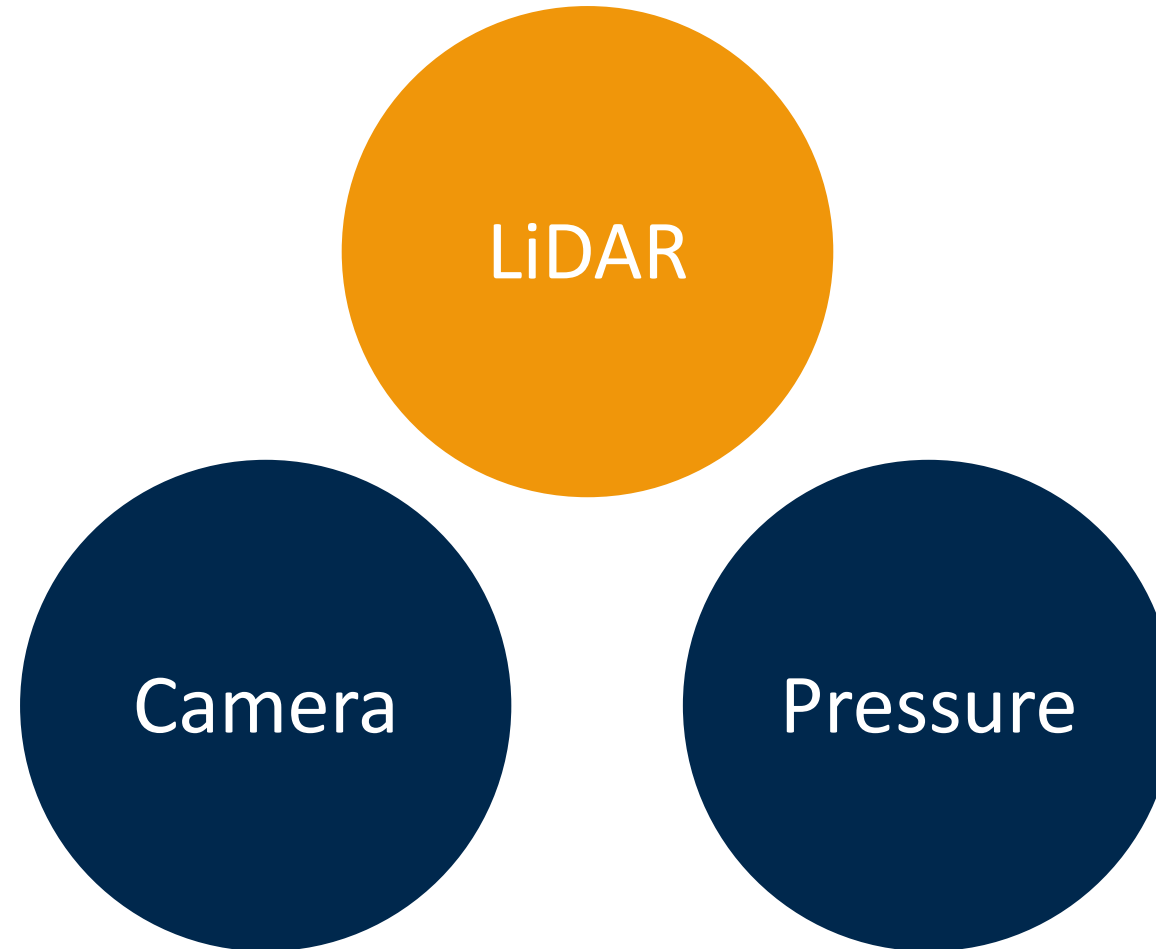
# GROWTH DRIVERS

We concentrate on three growth drivers



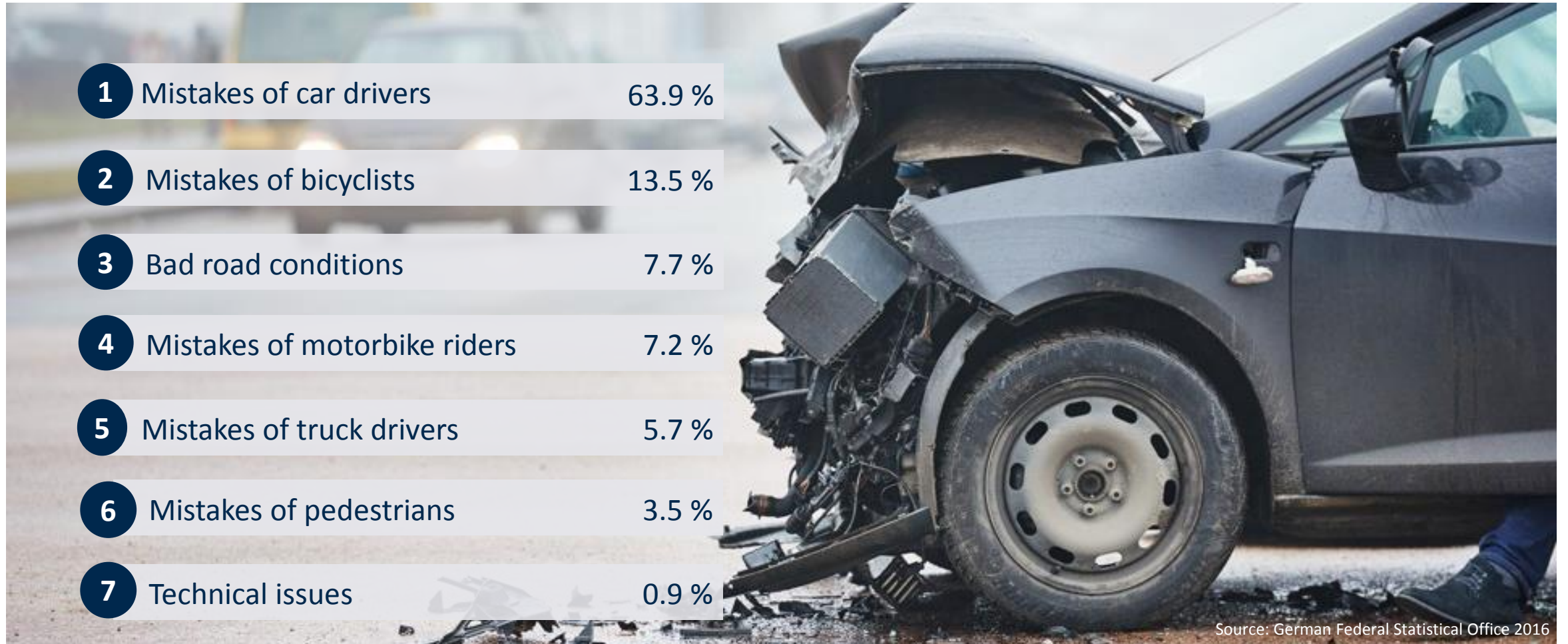
# GROWTH DRIVERS

We concentrate on three growth drivers



# GROWTH DRIVER LIDAR

## Main reasons for accidents are preventable human mistakes



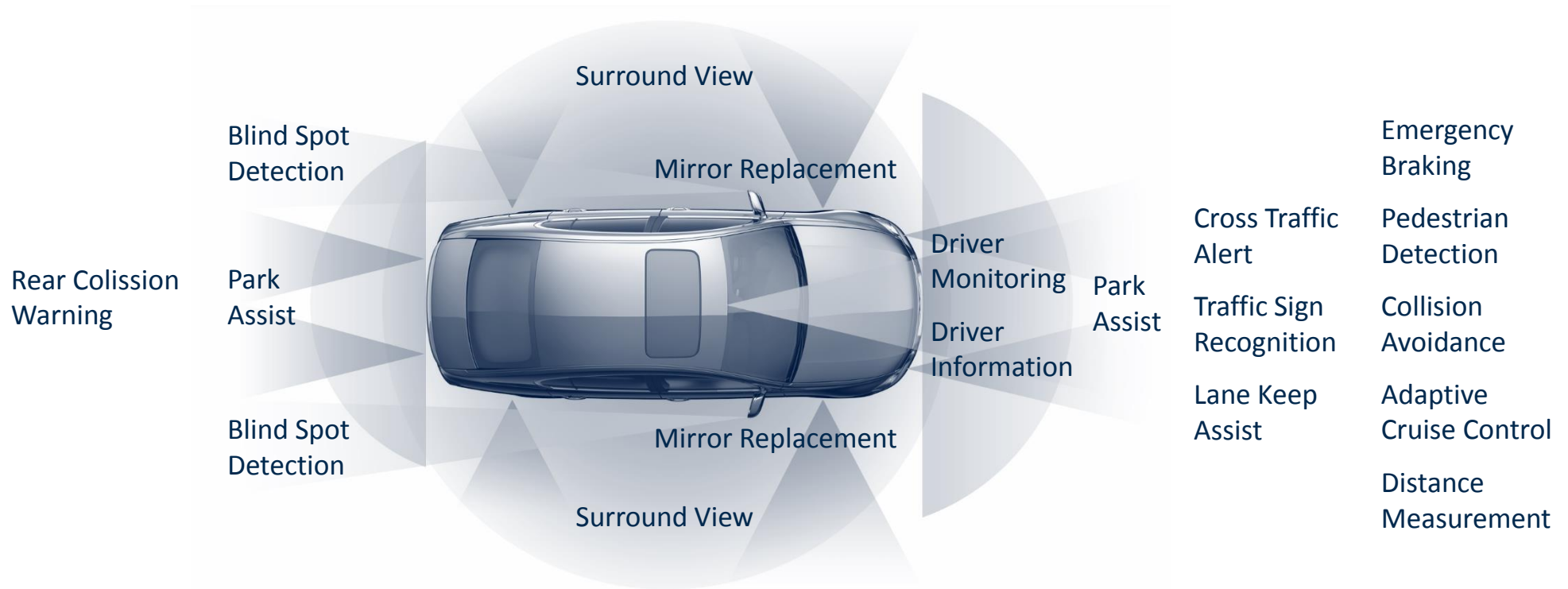
# GROWTH DRIVER LIDAR

Therefore cars become more and more autonomous

Autonomous Levels	Level 1 Assisted Driving	Level 2 Partly Automated	Level 3 Highly Automated	Level 4 Fully Automated	Level 5 Driverless
Functionality	Active Cruise Control (ACC) Lane departure warning system (LDWS)	Lane Keep Assist (LKA) Park Assist (PA)	Automatic Emergency Brake (AEB) Driver Monitoring (DM) Traffic Jam Assist (TJA)	Autopilot on Highway (AP)	Autopilot everywhere
Sensors	Ultrasonic Radar (long range) Front Camera	Surround Camera	Radar (short range) Driver Camera LIDAR	SENSOR Fusion	SENSOR Fusion

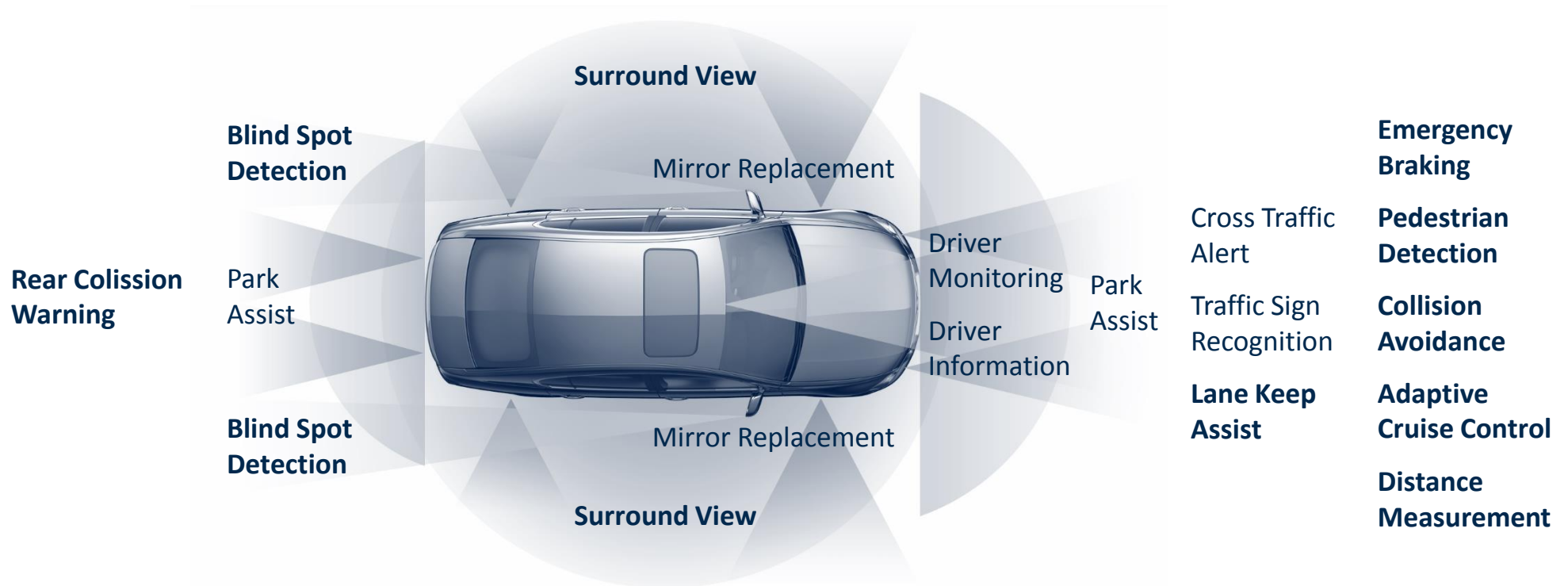
# GROWTH DRIVER LIDAR

## Sensors in vehicles assist the driver and provide more road safety



# GROWTH DRIVER LIDAR

LiDAR is an important technology for many of these safety applications



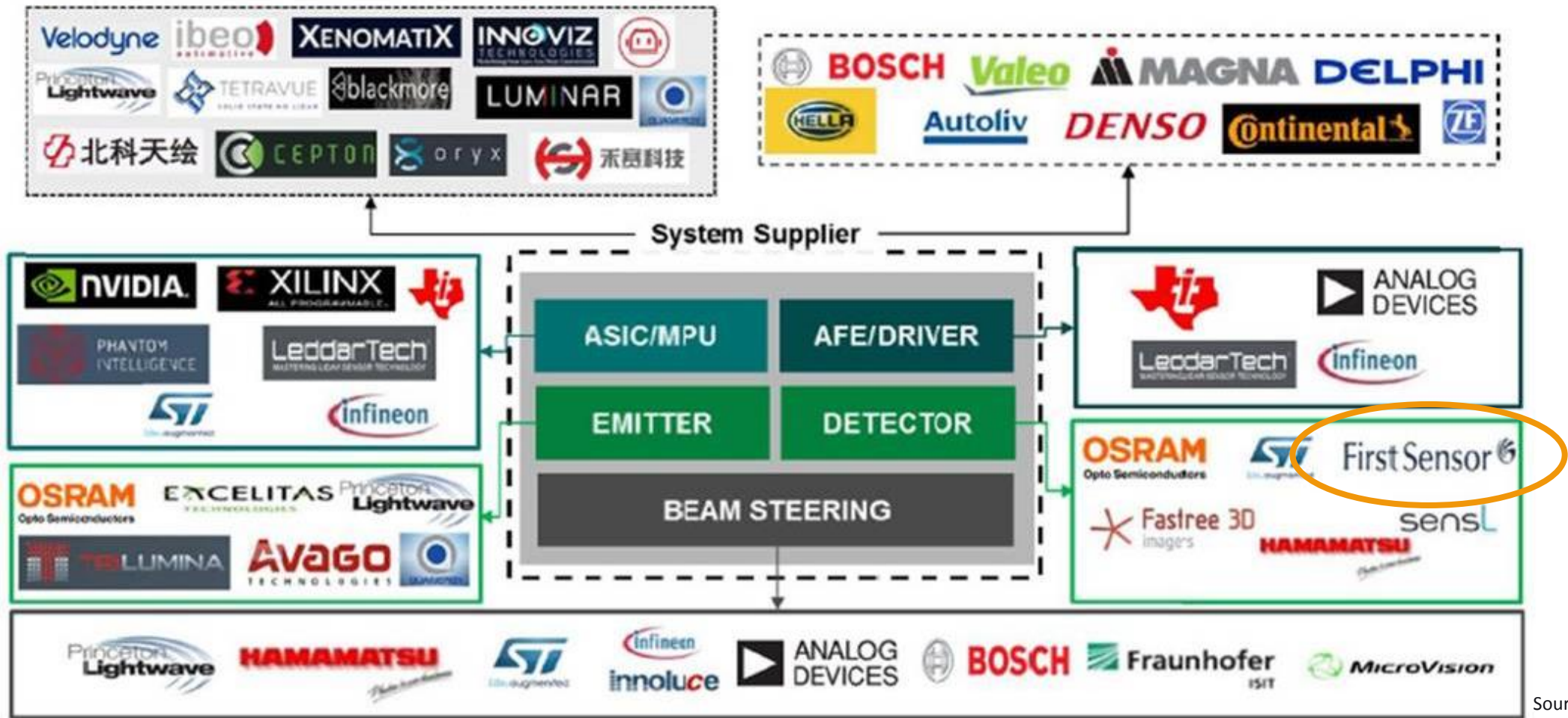
# GROWTH DRIVER LIDAR

Reason: LiDAR provides the highest resolution even for large distances

Criteria	LiDAR (pulsed ToF)	Radar		Ultra-sonic	Cameras		PMD
		Short distance	Long distance		Mono	Stereo	
Max range (m)	150 - 250	55 - 100	150 - 200	2 - 4	40 - 60 (120 coarse)	60	7 - 10
Min range (m)	1	0,25 - 1	1	0.25	0.3	0.3	0.3 - 0.8
Precision (m)	0.1 (newer: 0.04)	0.25 - 0.75	0.3 - 3.75	Very good	3	0.2 - 0.3	good
Velocity measurement	Indirectly via distance t1-t0	directly via Doppler effect		hardly	hardly	Indirect via dist.	Indirect via dist.
Horizontal field of view	30° - 180°	55° Scan: 120°	16°, Scan: 60°	60°	45° - 190°	45°	40 - 69°
Horizontal resolution	0.01° - 1°	10.5°	3.5°	bad	< 0.1° - 0.3°	< 0.1°	0.2°
Vertical field of view	3° - 16°	3° - 13°	3° - 13°	30°	45°	45°	40 - 56°
Vertical resolution	0.8° - 1°	4.5°	4.5°	bad	< 0.1°	< 0.1°	0.2°

# GROWTH DRIVER LIDAR

First Sensor is an important supplier for detectors in LiDAR systems



Source: YOLE



# GROWTH DRIVER LIDAR

In our LiDAR business we stand out through eight key respects

1

20+ years experience  
in APDs

2

Customizing capability  
for die, package and  
modules in-house

3

ISO TS 16949 certified  
production and testing

4

Chip & packaging  
company

5

Lowest noise

6

Highest sensitivity  
for 905nm

7

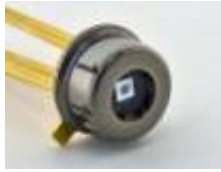
AEC-Q 101 qualified  
APD arrays

8

Innovative roadmap

# GROWTH DRIVER LIDAR

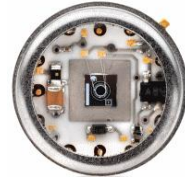
With our APD we have captured a leading share for more than 10 years



Single APD with amplifier



DARPA Urban Challenge; First Sensor APDs in all winning teams



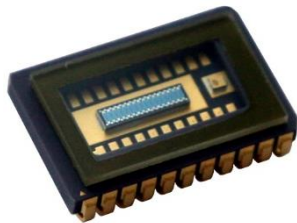
Industrial hybrids (APD+TIA in one package)



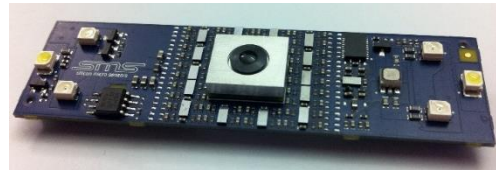
Few Pixel APD-Array in SMD package for ACC / AEC-Q 101 qualified by FIS



12 Pixel APD-Array in ceramic package for ACC



Gesture recognition with 64 pixel APD-Array



Receiver module with APD-Array, HV, TIA, MUX, Timing discriminator

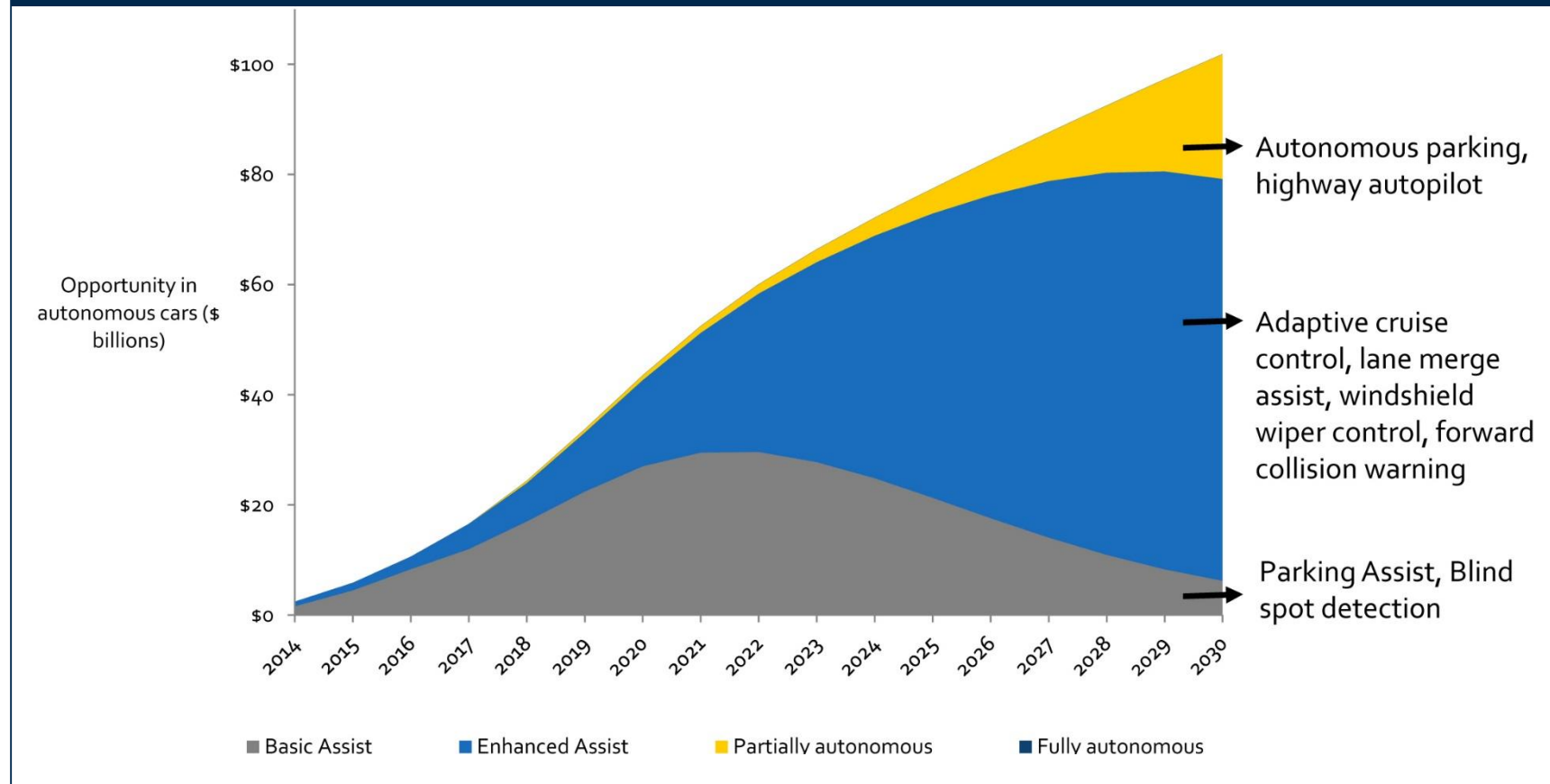


Receiver module with APD and electronics integrated in one package

# GROWTH DRIVER LIDAR

## Therefore we will participate in the growth of the driver assist market

Global driver assist market will grow to \$102 billion by 2030

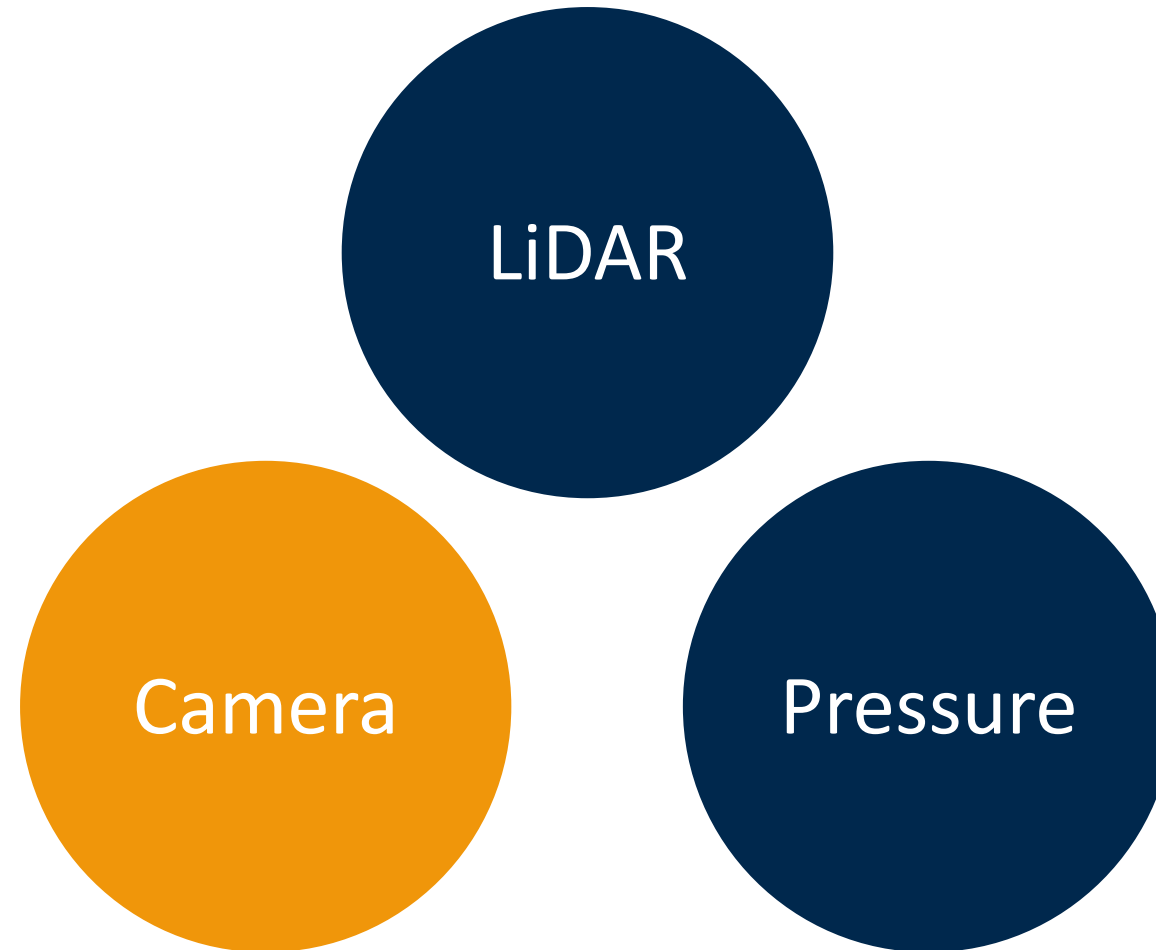


- 2017: 94 m vehicles produced (2.2% CAGR 17-22, 2017 IHS Markit)
- Automotive semiconductor revenue for ADAS grows with 20.9% (CAGR 17-22, 2017 IHS Markit)
- Estimates as high as 10% of new cars with self-driving features in 2020

Source: Lux Research 2017






# GROWTH DRIVERS

We concentrate on three growth drivers



# GROWTH DRIVER CAMERA

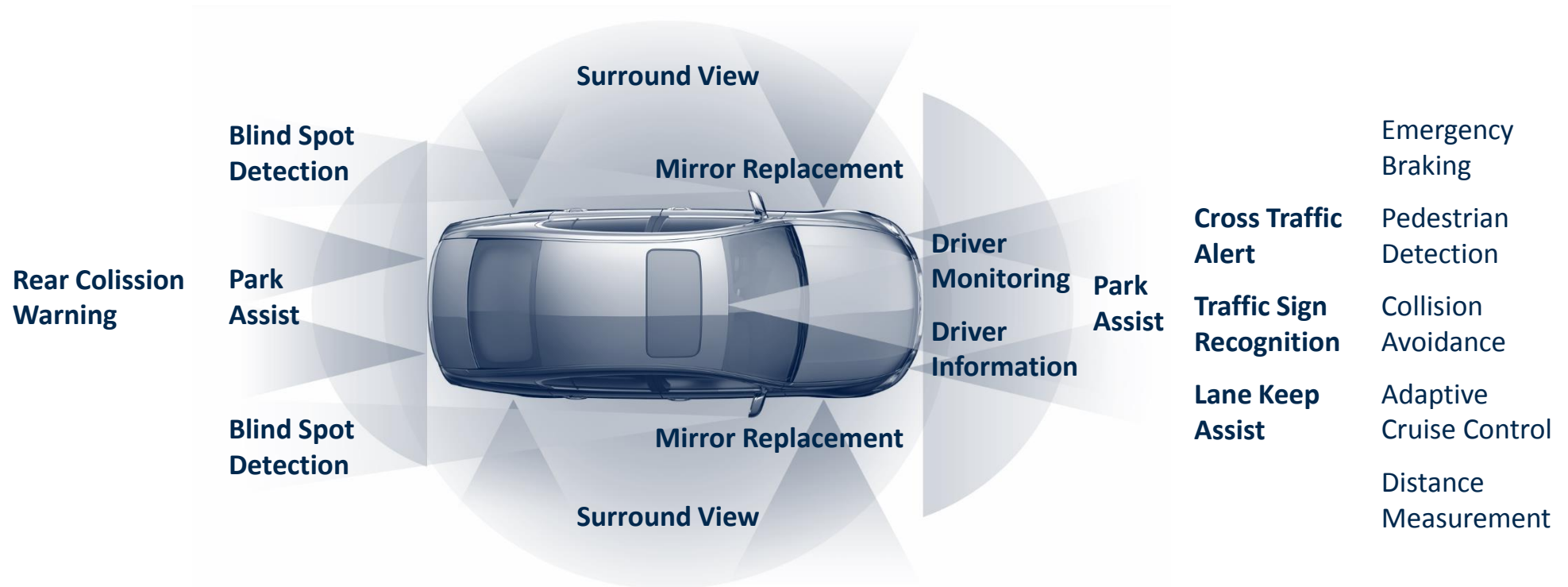
Besides LiDAR, cameras are irreplaceable for a safe surround view

On Board Sensor Capability			 <b>LIDAR</b> (Detection & ranging)	 <b>Camera</b> (Monitoring & classification)	 <b>RADAR</b> (Detection & ranging)	 <b>V2X &amp; Cellular*</b> (Information)	 <b>Map &amp; Location</b> (Information)	
Detection Performance	Traffic objects	Car/Trucks	★ ★	★	★ ★ ★	★		
		Motorcycle	★ ★	★	★ ★	★		
		Bicycle	★ ★	★	★	★		
		Pedestrian	★ ★ ★	★	★	★		
		Animal	★ ★	★				
		Debris	★ ★	★				
	Infrastructure traffic constraints	Road marking	★	★ ★			★ ★	
		Traffic signs		★ ★			★ ★ ★	
		Traffic lights				★ ★ ★	★	
	Path/Road structure	Curve	★					
Guard rails		★ ★		★ ★				
Wall/Obstacle		★ ★		★ ★				
			← Dynamic →				← Static →	
360° View			★ ★ ★	★ ★ ★				
Robustness	Rain/Snow	★ ★	★	★ ★ ★	★ ★ ★	★ ★ ★	★ ★ ★	
	Fog			★ ★ ★	★ ★ ★	★ ★ ★	★ ★ ★	
	Night	★ ★ ★		★ ★ ★	★ ★ ★	★ ★ ★	★ ★ ★	

\* Depends on coverage

# GROWTH DRIVER CAMERA

## They support and complement LiDAR functionalities



# GROWTH DRIVER CAMERA

In our camera business we stand out through eight key respects

1

Long-standing camera experience

2

Automotive network in new markets

3

Specialist for harsh environment and low-light applications

4

Tailor maid solutions also possible in small-scale production

5

New industrialized “Blue Next” camera generation

6

Camera to system concept

7

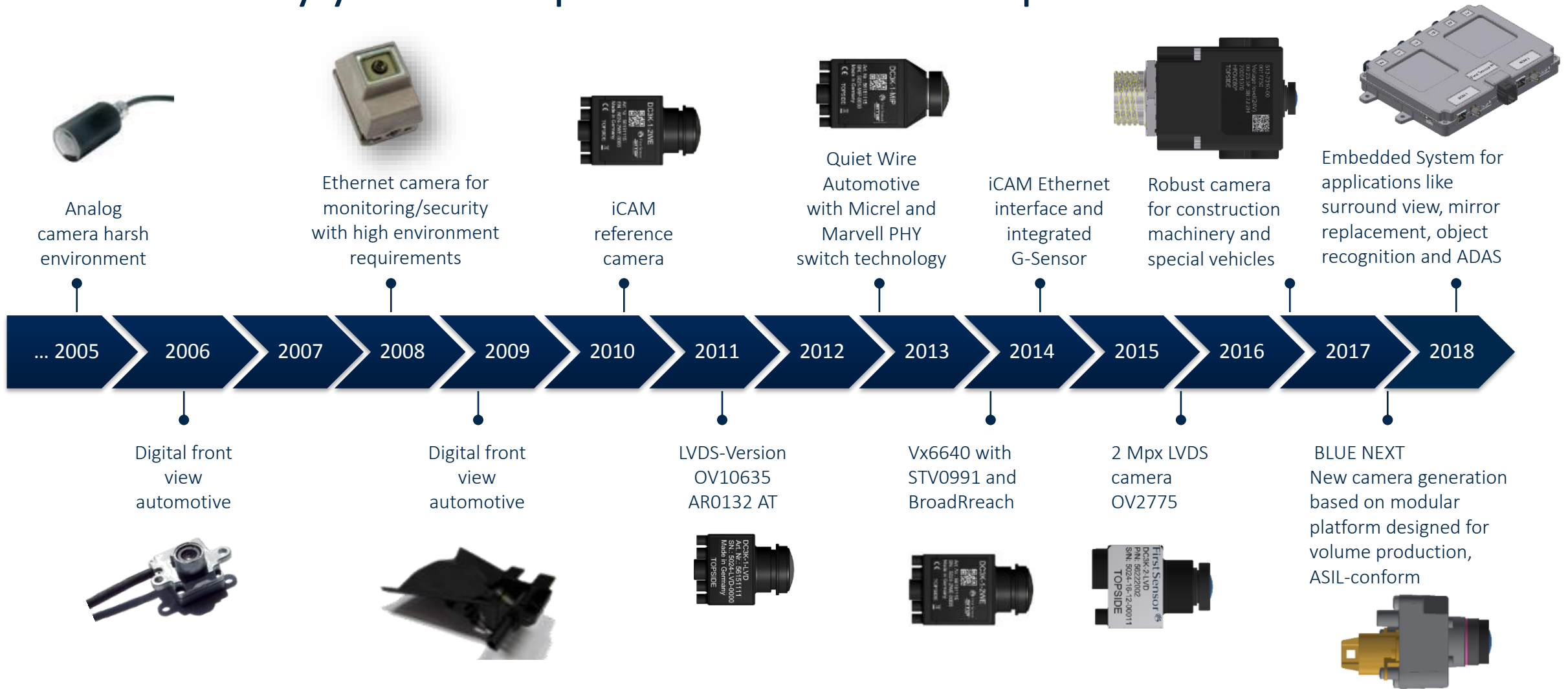
Embedded ECU platform for sensor fusion

8

Production and development “Made in Germany”

# GROWTH DRIVER CAMERA

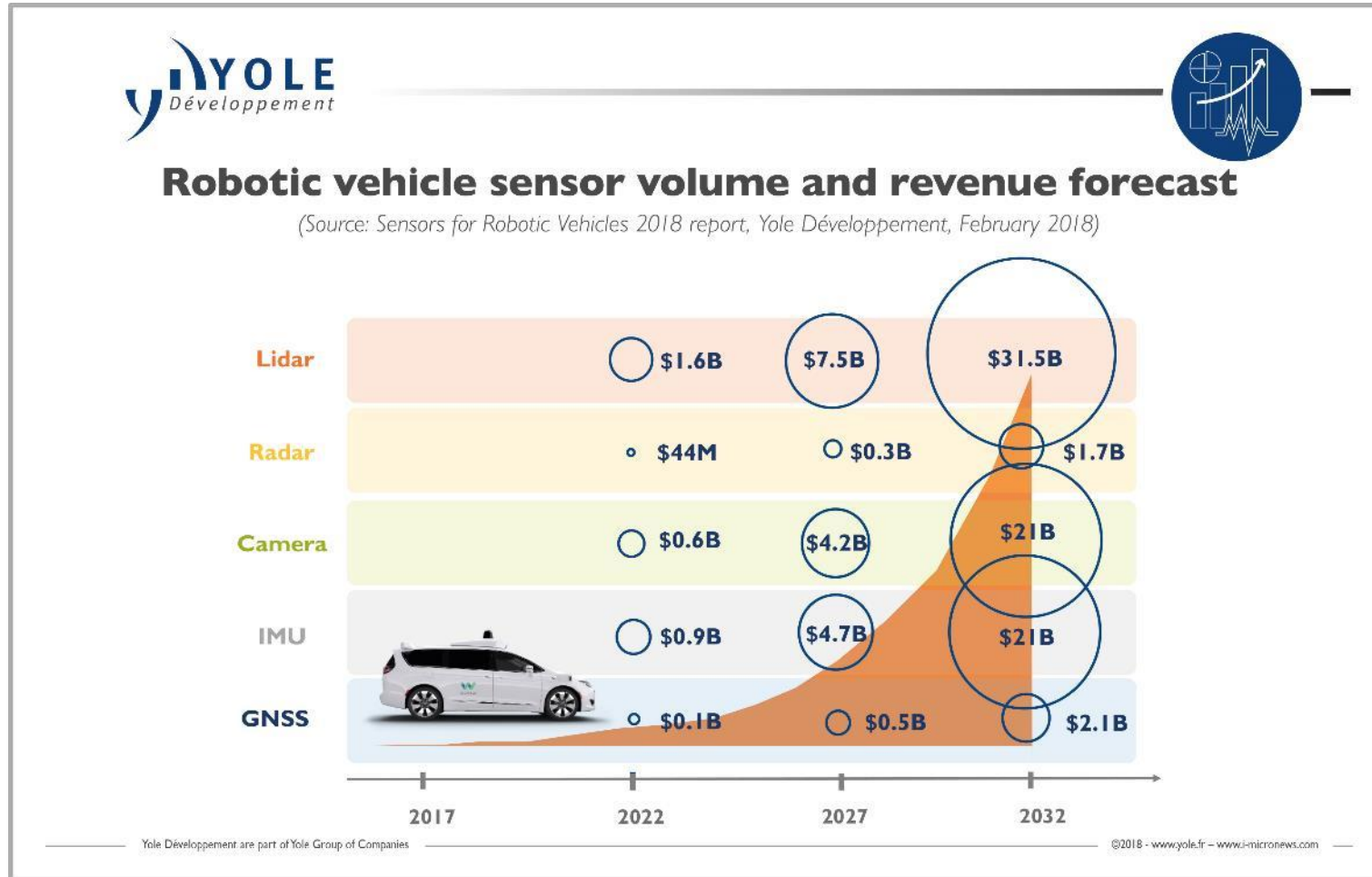
## We have many years of experience in the development of cameras







# GROWTH DRIVER CAMERA

With our expertise we participate in the growing camera market



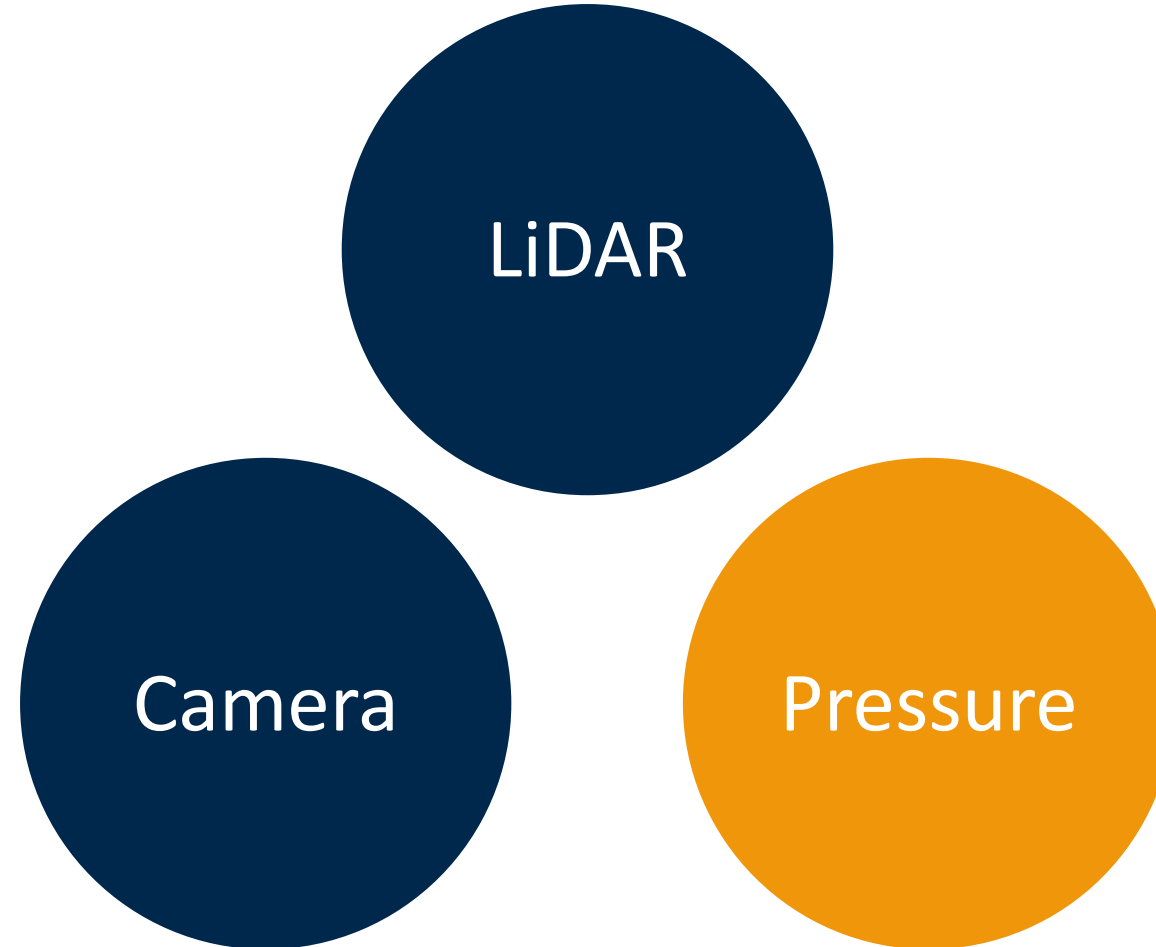
# GROWTH DRIVER CAMERA

Our focus is on target customers & leads with significant annual sales

<div style="text-align: right;"><b>Segments</b></div> <div style="text-align: left;"><b>Customers</b></div>	<b>LIDAR</b>	<b>Cameras</b>	<b>Camera Systems</b>	<b>ADAS Systems Multiple Sensors Sensor Fusion</b>
Car OEM & Tier 1	Components	Customized cameras		
Commercial & Special vehicles OEM & Tier 1	Components, Subsystems and Manufacturing services	Standard cameras, tailor made solutions	Surround view, Mirror replacement, Blind spot detection	Turn assist, Break assist, Platooning, Pedestrian recognition, Autonomous driving

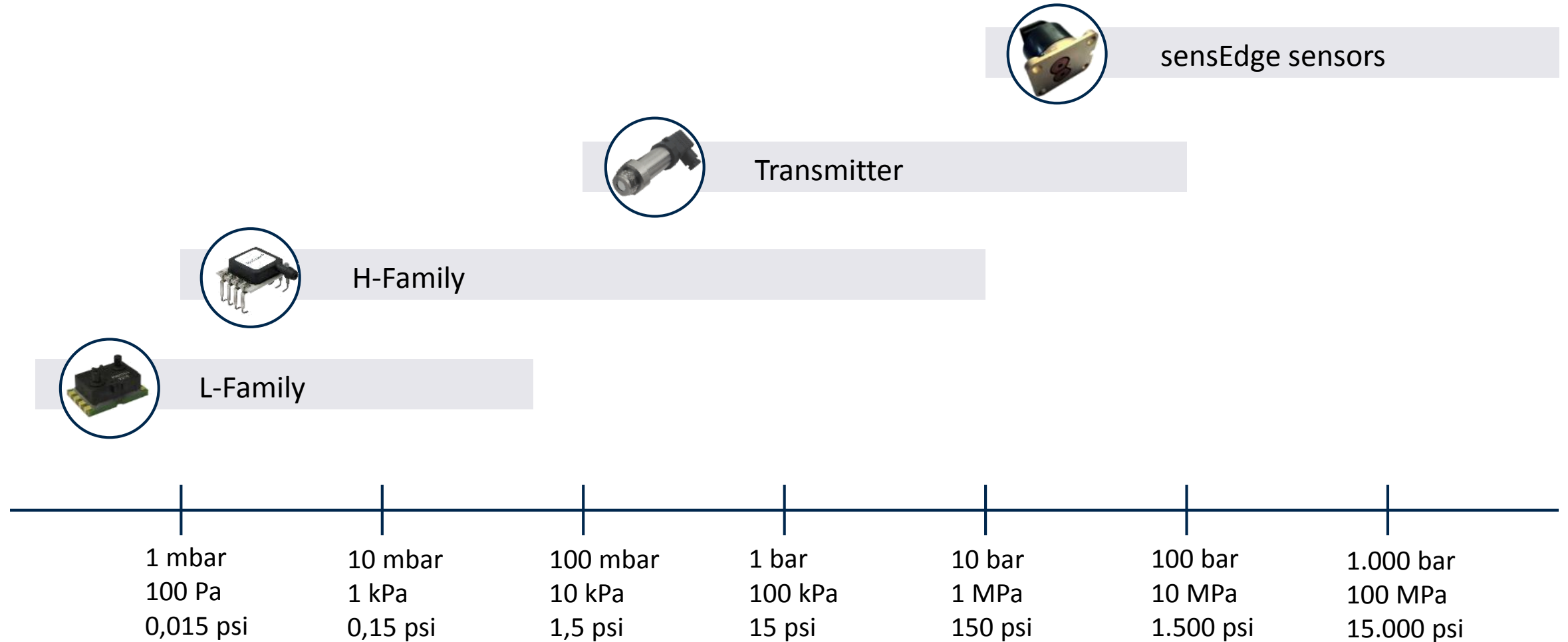
## GROWTH DRIVER

We concentrate on three growth drivers



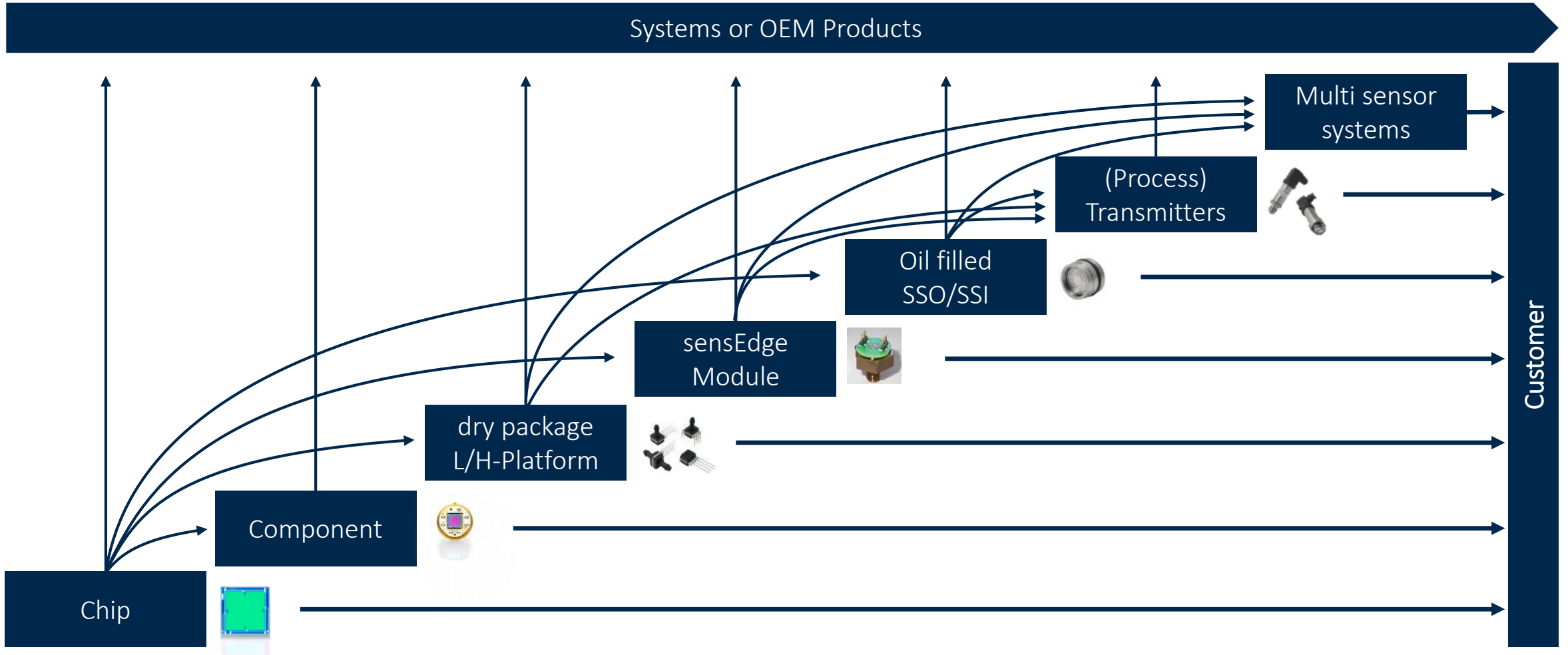
# GROWTH DRIVER PRESSURE

We offer a broad range from ultra-low to high pressure sensors



# GROWTH DRIVER PRESSURE

We cover the value chain from chip to sensors and sensor systems



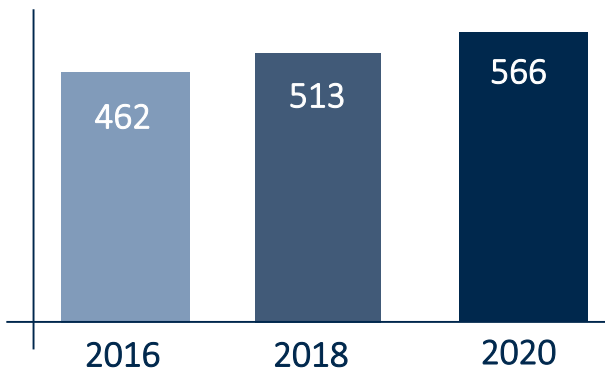
# GROWTH DRIVER PRESSURE

## Our pressure sensors business is driven by megatrends, too

### Smart Factory



Global market (\$100 mn)

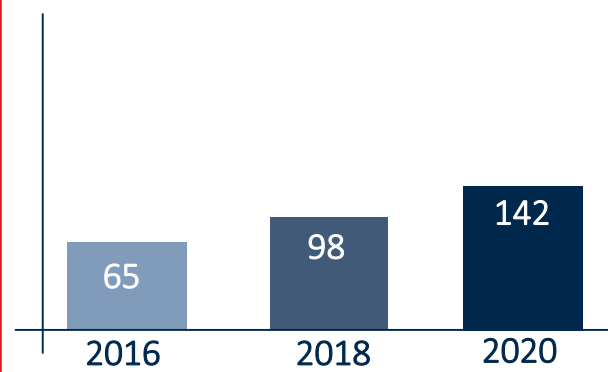


Source: MarketsAnd Markets, KESSIA

### Smart Health



Global market (\$100 mn)

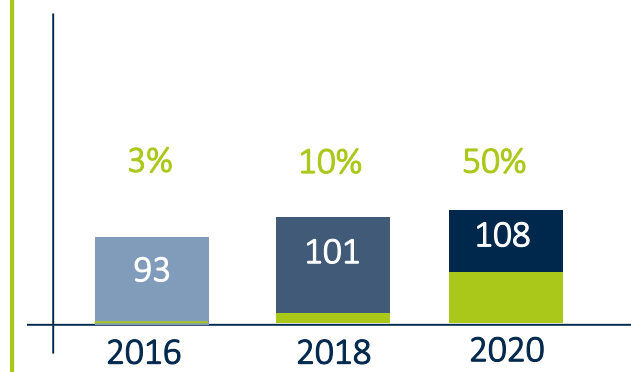


Source: Statista

### Green Mobility



Global light vehicle assembly & share of alternative drives (mn units)



Source: PwC Autofacts

# FINANCIAL KEY FIGURES

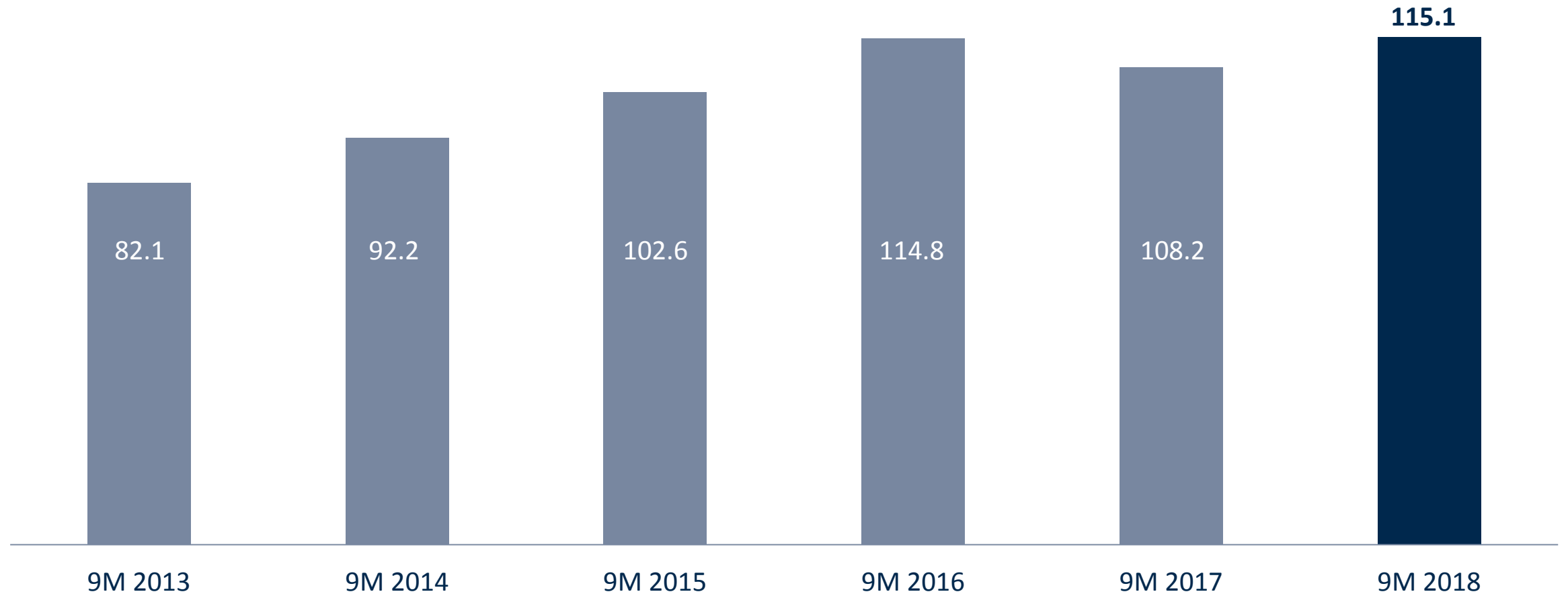
## 9M INTERIM REPORT

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# FINANCIAL KEY FIGURES

We reported sales up 6.4% on the previous year's figure

Total sales in € million



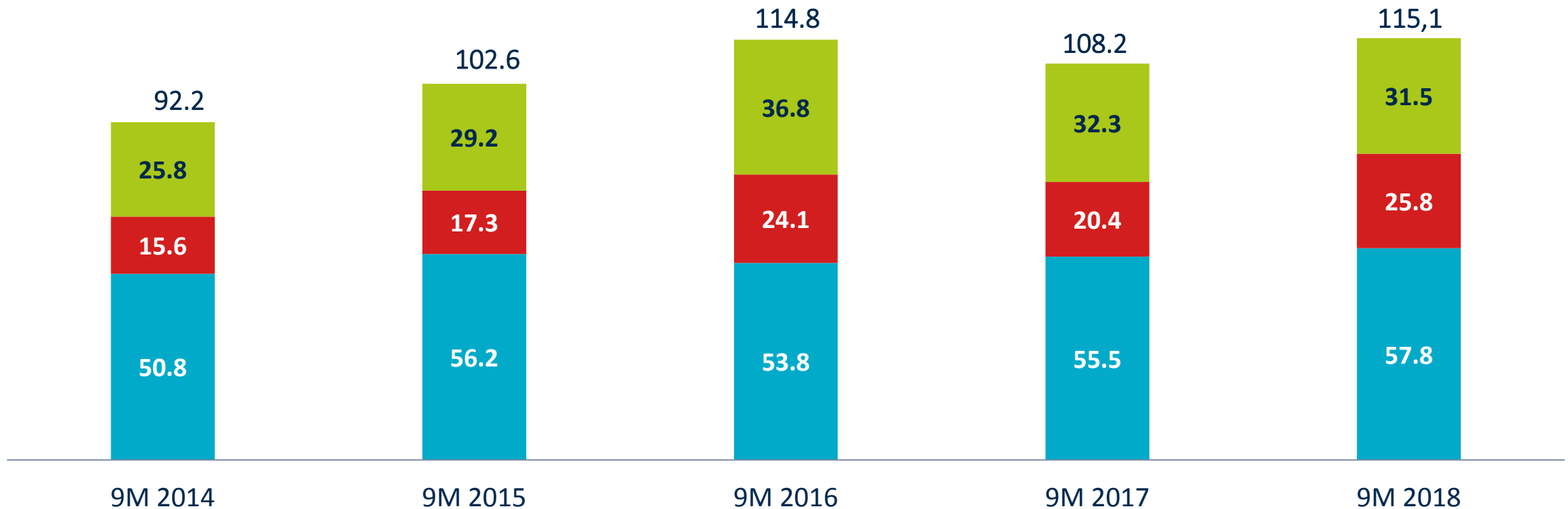


# FINANCIAL KEY FIGURES

## Demand in Industrial, Medical & Mobility markets increases constantly

Sales by target market in € million

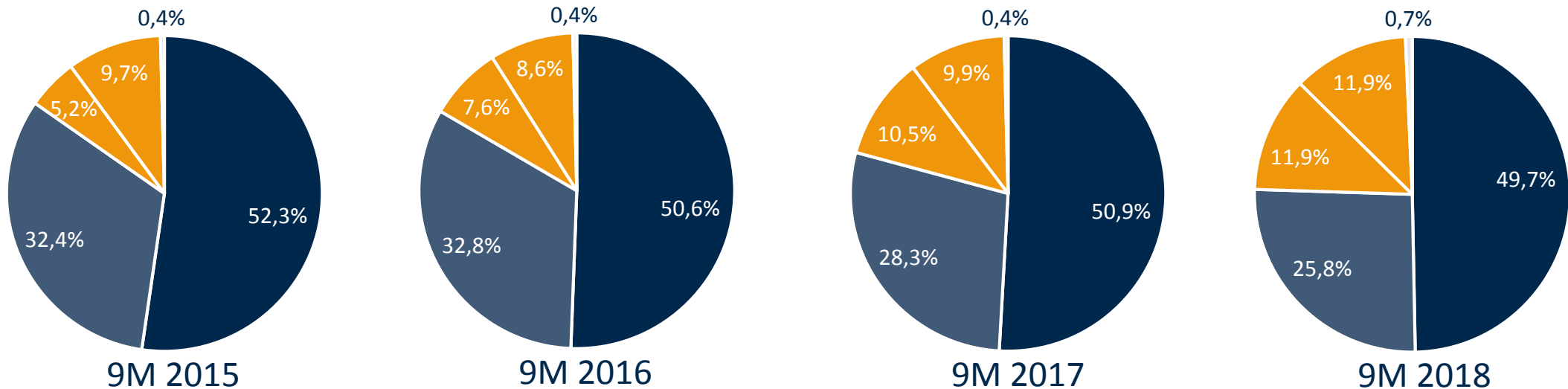
■ INDUSTRIAL ■ MEDICAL ■ MOBILITY



# FINANCIAL KEY FIGURES

## We are moving forward with our internationalization

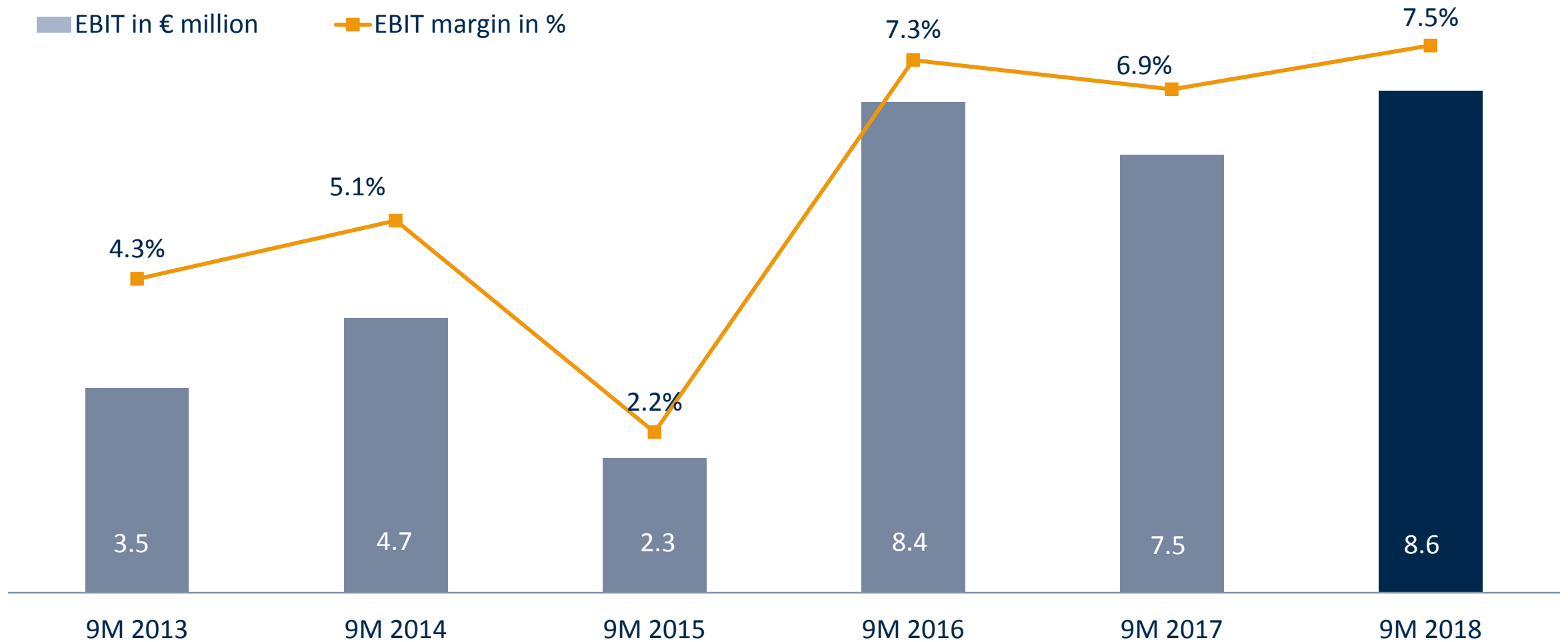
Sales by region in %



■ DACH region ■ Rest of Europe ■ North America ■ Asia ■ Rest of World

# FINANCIAL KEY FIGURES

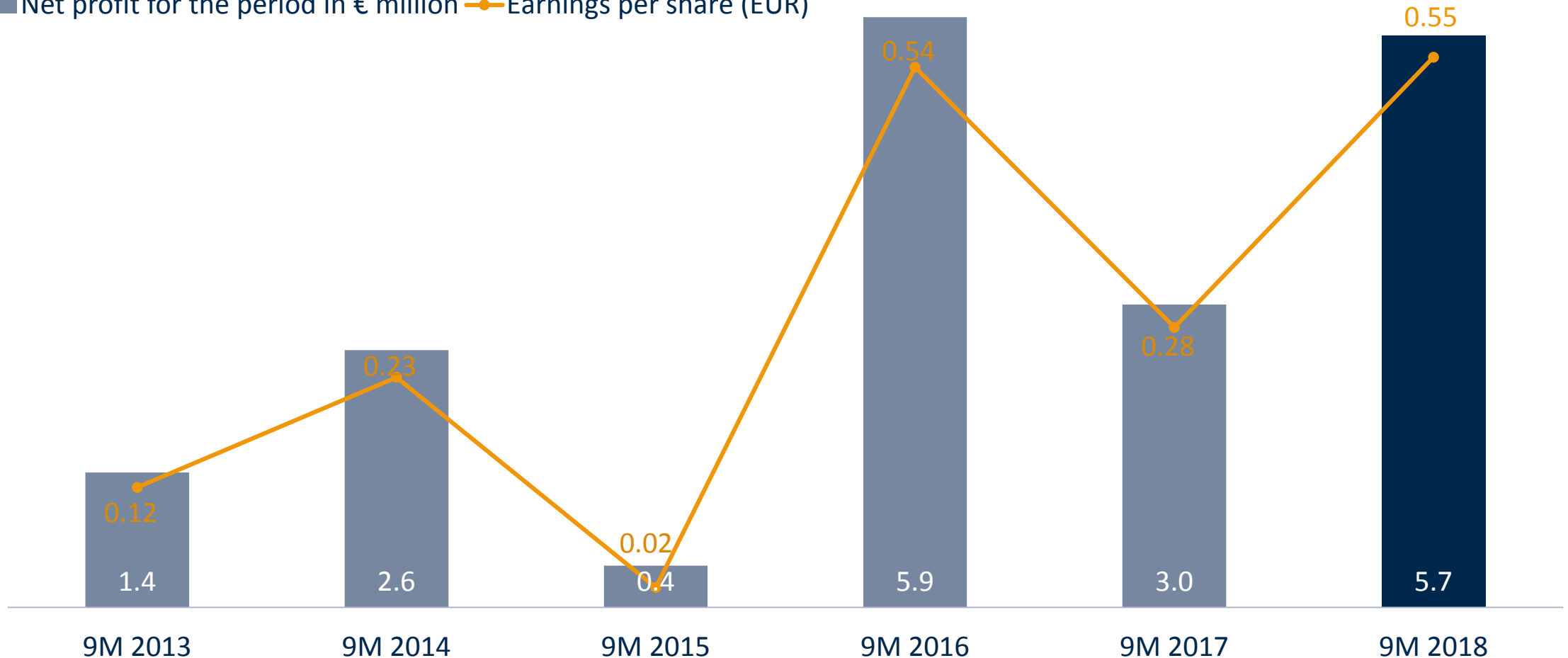
## Our strategy for profitable growth shows first results in the EBIT line



# FINANCIAL KEY FIGURES

This success is also reflected by our net profit and earnings per share

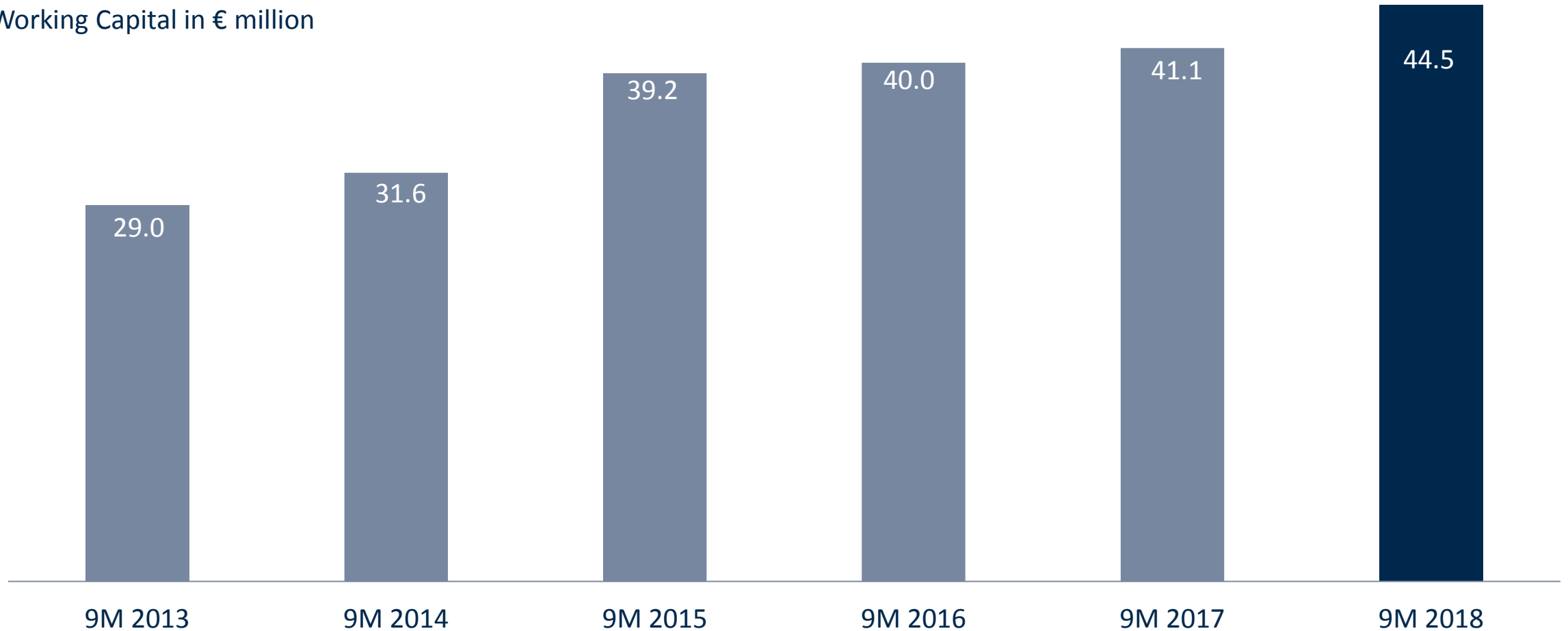
■ Net profit for the period in € million — Earnings per share (EUR)



# FINANCIAL KEY FIGURES

## Our working capital is up due to higher stocks securing further growth

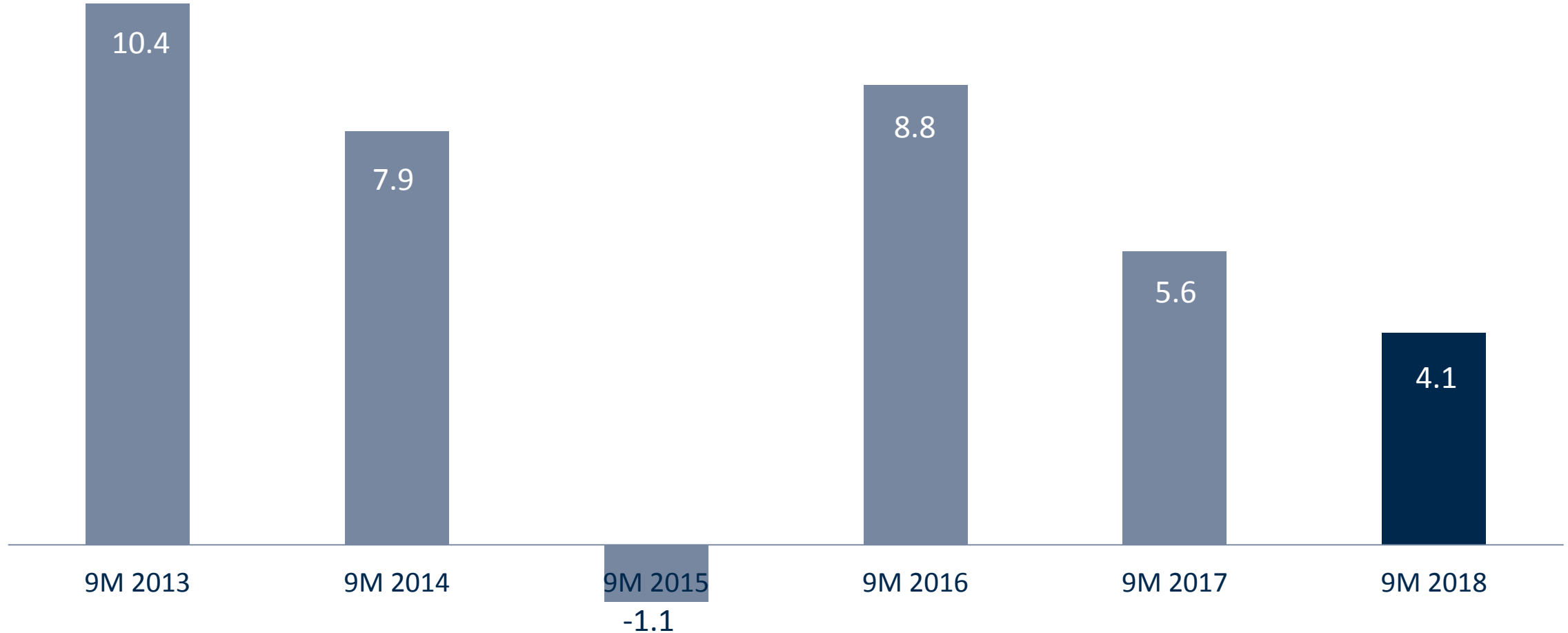
Working Capital in € million



# FINANCIAL KEY FIGURES

## Therefore our operating cash flow is further reduced

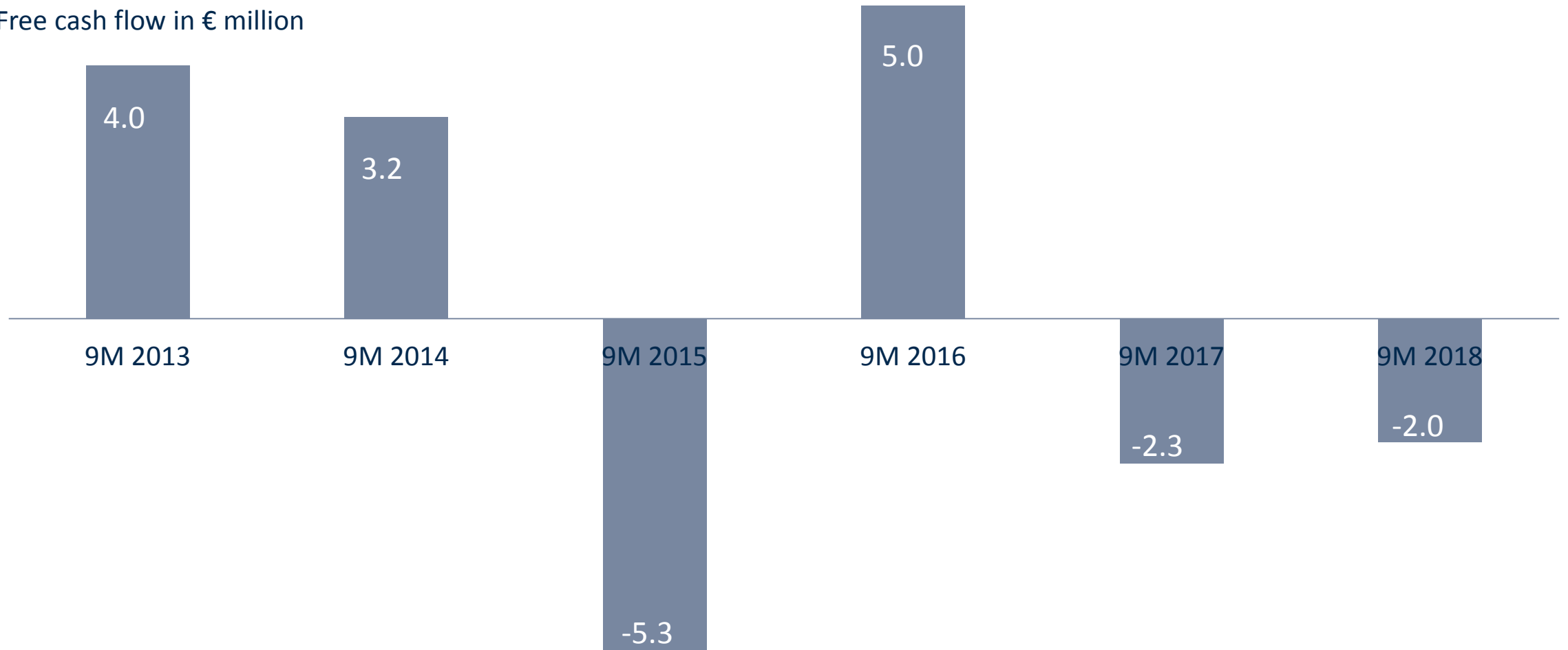
Operating cash flow in € million



# FINANCIAL KEY FIGURES

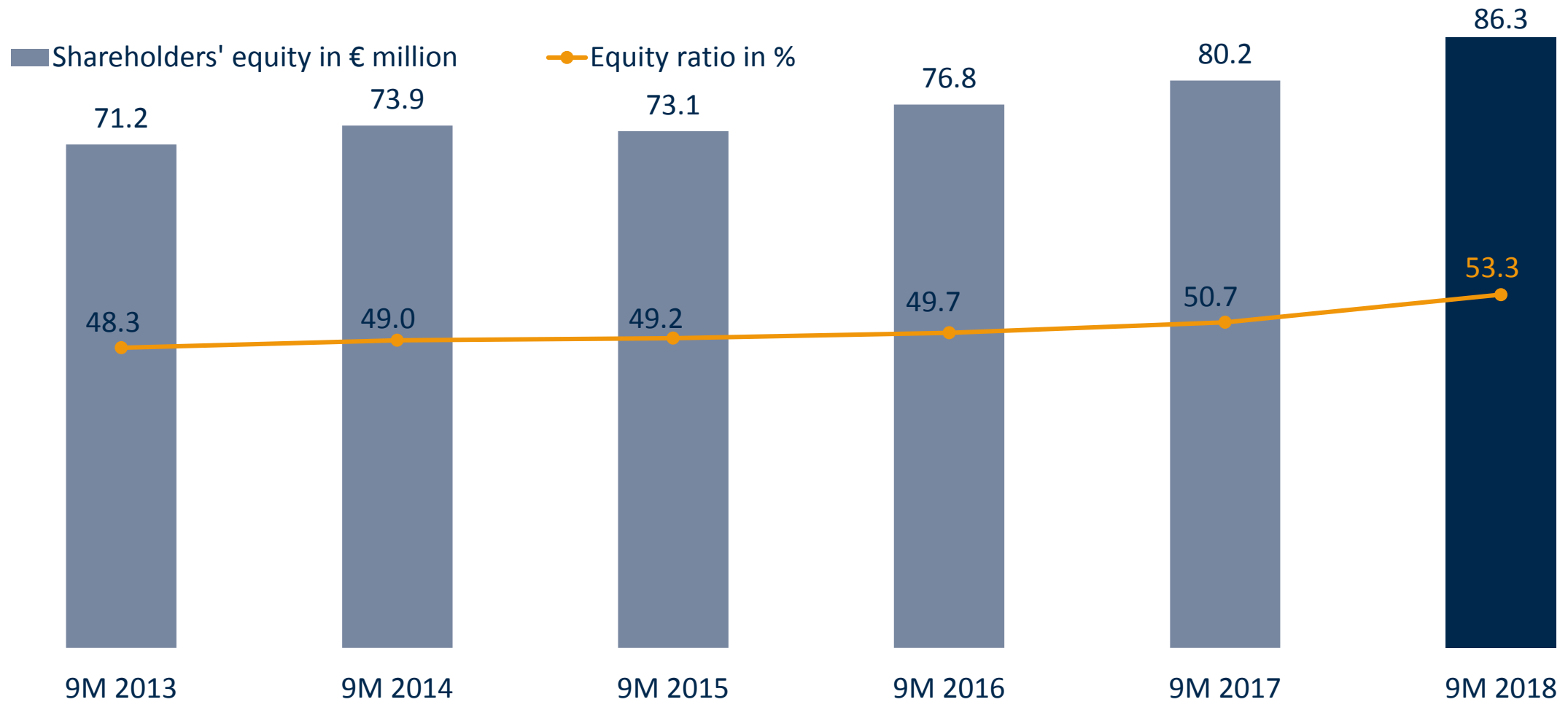
At the same time we improved our free cash flow slightly

Free cash flow in € million



# FINANCIAL KEY FIGURES

In total we have continuously improved our financial strength

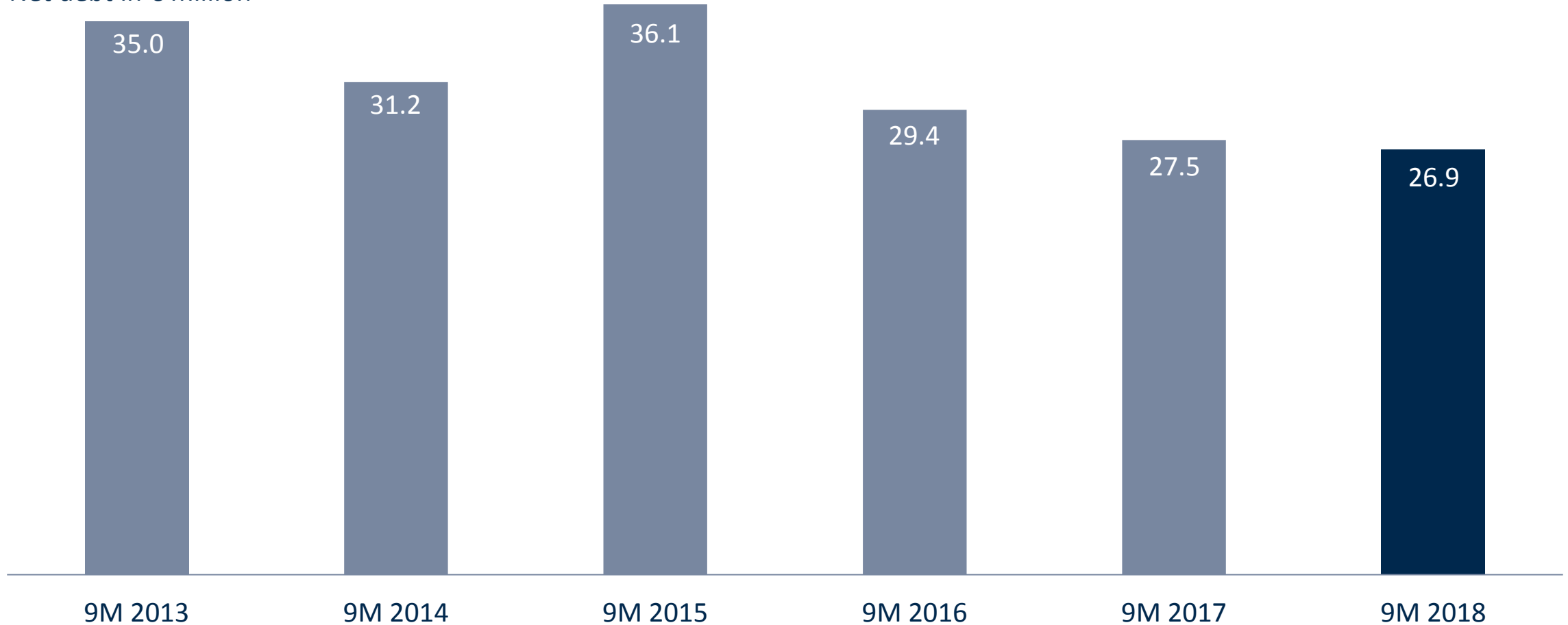




# FINANCIAL KEY FIGURES

This is also reflected by a reduced net debt

Net debt in € million

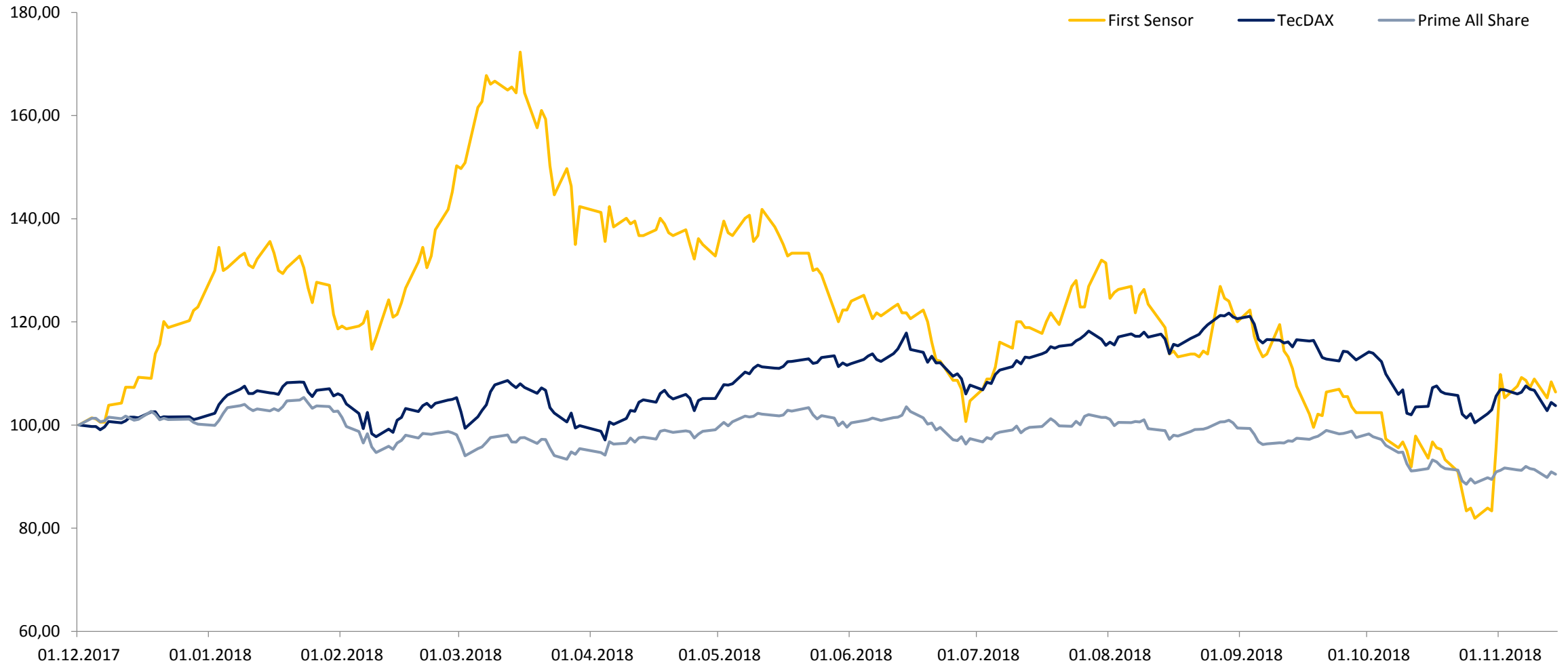


# THE SHARE

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# FIRST SENSOR SHARE

## Despite turbulences at stock exchanges our share is back on track

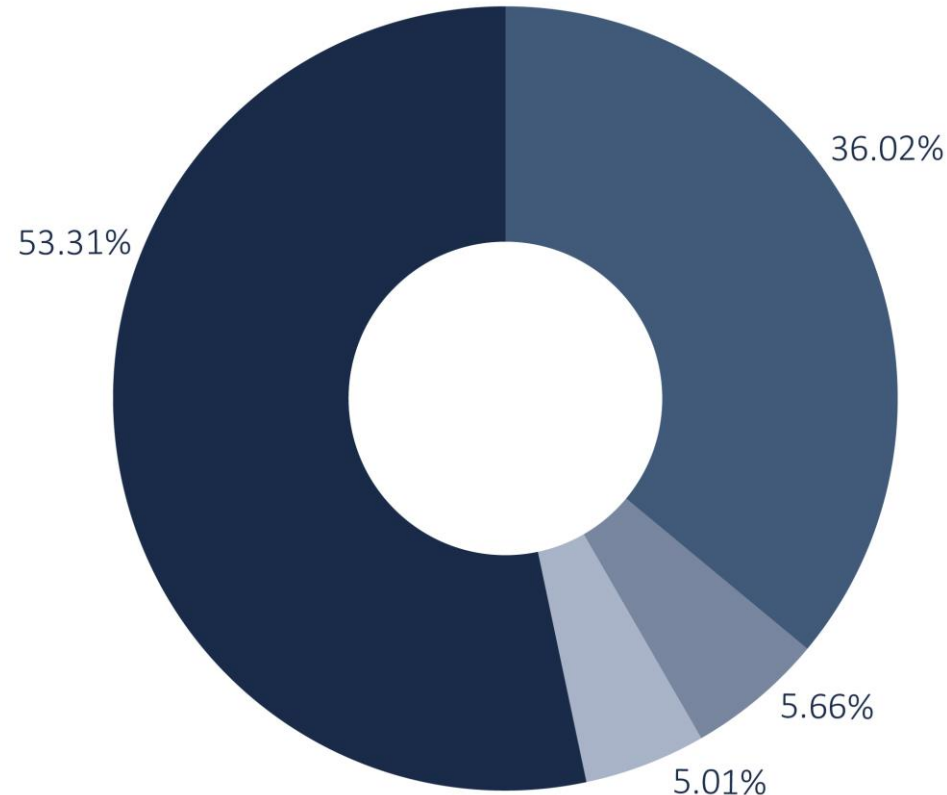


# FIRST SENSOR SHARE

Our main investor is considering to sell its shares; we have assigned Goldman Sachs to accompany this process

Key facts*	
Market Cap:	€ 189.5 m
Traded Stocks/Day:	22,897
30 Day High:	€19.75
30 Day Low:	€14.00
Index Ranking Free Float Market Capitalization:	60
Index Ranking Turnover:	48

\* November 15, 2018



Shareholder structure according to the existing voting rights announcements  
Date: August 14, 2018

- FS Technology Holding S.à.r.l.
- Midlin NV (managed by Teslin Capital Management BV)
- Gerlin NV (managed by Teslin Capital Management BV)
- Other shareholders

# FINANCIAL CALENDAR

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# FINANCIAL CALENDAR

## The Oddo BHF Forum in Lyon is your next possibility to meet us

When?*	What?
10./11.01.2019	Oddo BHF Forum 2019, Lyon
19./20.02.2019	Oddo BHF German Conference 2019, Frankfurt
21.03.2019	Annual Report 2018 & Press Conference, Berlin
03.05.2019	Annual General Meeting 2019, Berlin
14.05.2019	Interim Report Q1 2019
14./15.05.2019	German Spring Conference 2019, Frankfurt
14.08.2019	6M Financial Report 2019
14.11.2019	Interim Report Q3 2019

\*As we can not rule out the possibilities of delays, we recommend that you consult the latest set of dates at [www.first-sensor.com](http://www.first-sensor.com).

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# WE LEAD THE FUTURE

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This presentation contains forward-looking statements. This presentation does not represent any solicitation to purchase shares of First Sensor AG. Rather it is intended exclusively for information purposes with regard to possible future developments at the company. All future-oriented information in this presentation was produced on the basis of probability-based planning and represents statements regarding the future which cannot be guaranteed. Rounding differences may occur.

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