



2.3 Deep-dive Chassis Systems

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Dr. Dirk Kesselgruber (45)

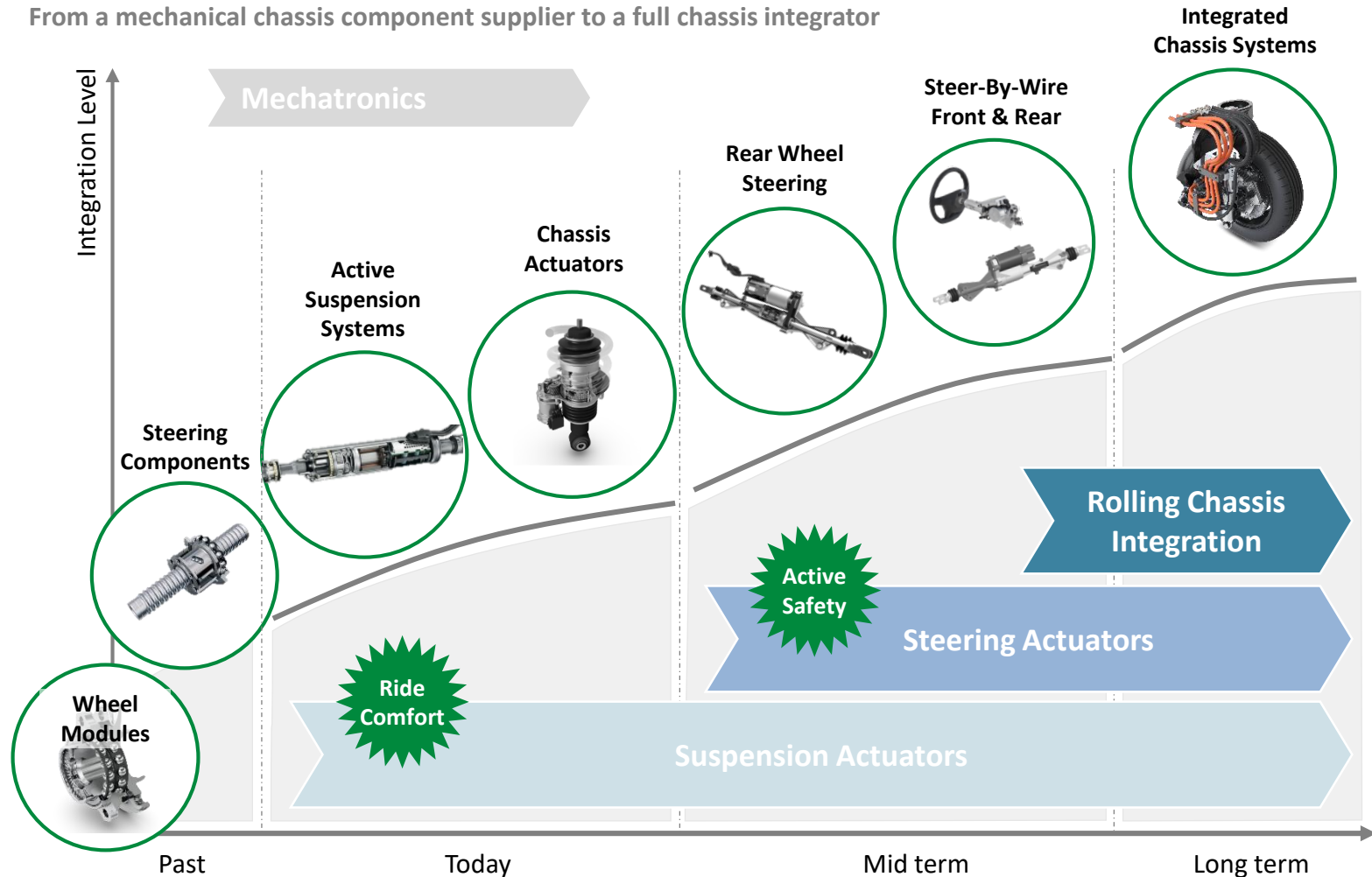
President Business Division Chassis Systems

- ▶ 1997 – 2000 Brake Systems Development at BMW AG
- ▶ 2000 – 2002 Development Steering Acoustics at TRW
- ▶ 2002 – 2013 Various leadership positions at TRW
- ▶ 2013 – 2017 CTO at TRW Steering Systems
- ▶ Since 2017 President Business Division Chassis Systems at Schaeffler

Chassis Strategy – A stepwise approach

Chassis Evolution

From a mechanical chassis component supplier to a full chassis integrator



Key points

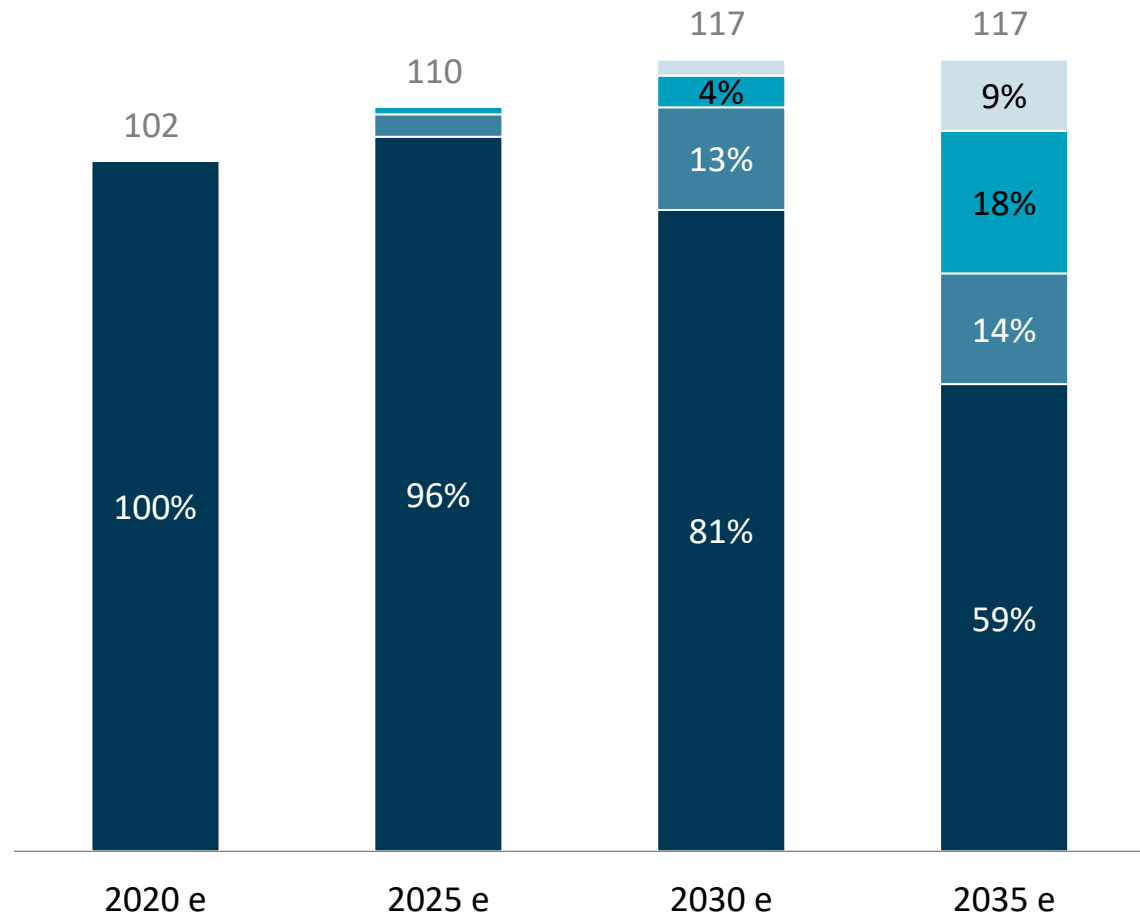
- ▶ Schaeffler has a long history in making precision chassis components
- ▶ Autonomous driving will see a significant market penetration
- ▶ Key contributor to autonomous driving are mechatronic chassis systems for vehicle guidance
- ▶ Schaeffler is in the process of transforming its chassis business from a components supplier through mechatronic bridge products towards a full chassis systems integrator

Steer-By-Wire is the key enabler to reach the next level

Vision Chassis – Market shifting towards autonomy

Vision Chassis

Global vehicle production [in mn units]



Source: IHS Autonomy and McKinsey / Values based on Light Vehicles < 6 tons only
 L0 = No Automation, L1 = Driver Assistance, L2 = Partial Automation, L3 = Conditional Automation, L4 = High Automation, L5 = Full Automation

Steer-By-Wire Systems

Key growth technology for automated vehicles by allowing the steering wheel to disappear conditionally or being eliminated entirely



Automation Level	Definition	Fitment rate Steer-by-Wire
L5	Autonomous	100 %
L4	Fully automated	20 - 30%
L3	Highly automated	20 - 30%

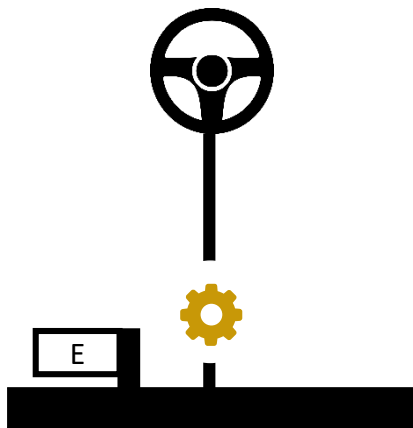
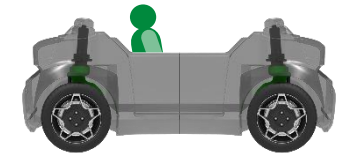
Vision Chassis – Evolution of steering systems

2018 Manual & Assisted (<L3)

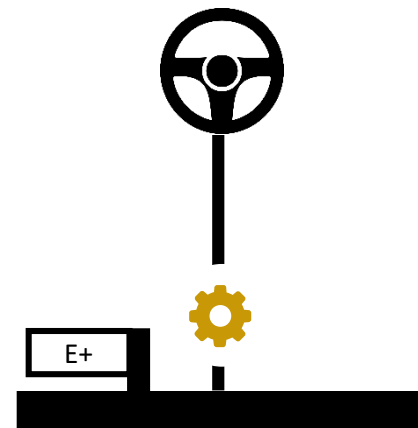
2021 Conditionally Automated (L3)

2023 Highly Automated (L4)

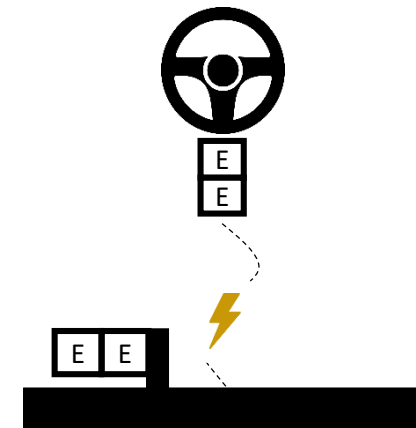
2027 Autonomous (L5)



Conventional EPS System



Conventional EPS System
w/ higher reliable electronics



Steer-by-wire
w/ full electronics redundancy



Intelligent Chassis Corner

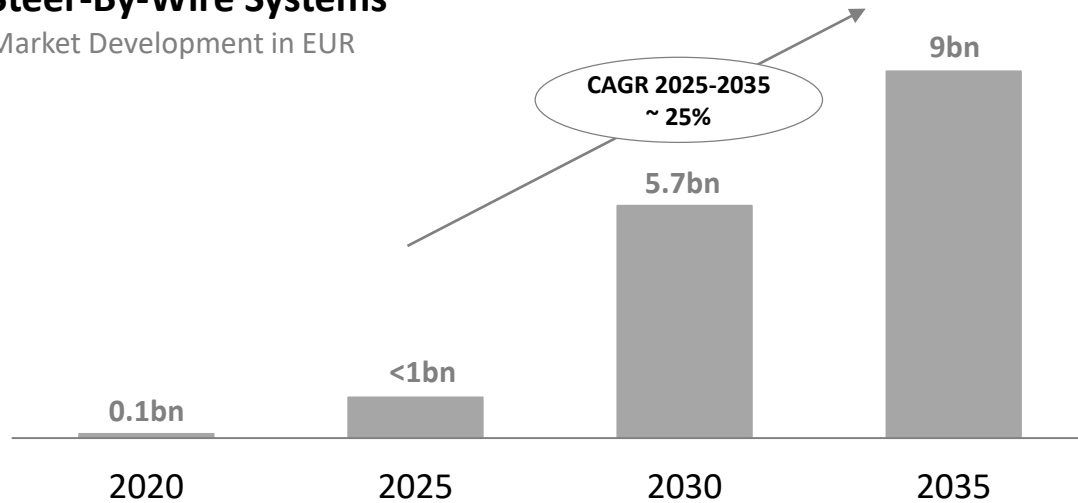
Key aspects

- ▶ Steer-By-Wire Systems will begin to replace conventional Electric Power Steering (EPS) from 2023 onwards, driven by the high reliability demands of automated driving on steering systems and leading to a interior revolution
- ▶ Schaeffler has acquired a proven by-wire technology to enter the steering market and accelerate the development in addition to establishing a reputation for safety critical chassis products

Steer-By-Wire – Creating Schaeffler USPs

Steer-By-Wire Systems

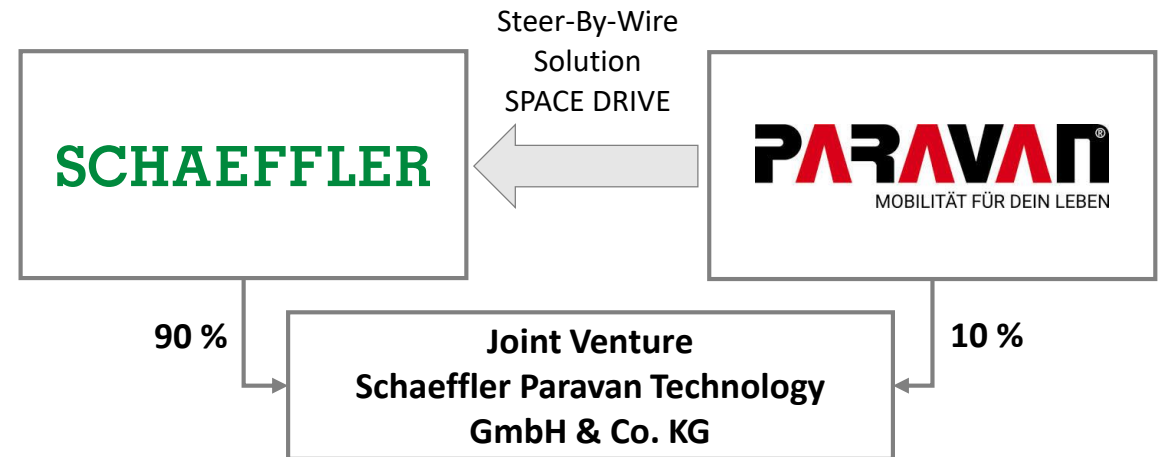
Market Development in EUR



- ▶ Schaeffler will focus on Steer-By-Wire, a key growth area and perfect match for the current core chassis business
- ▶ Paravan’s unique SPACE DRIVE technology is the only Steer-By-Wire System in the market which:
 - ▷ is road approved (> 500 Mio. Kilometers)
 - ▷ meets latest safety regulation standards
 - ▷ can operate also braking and secondary vehicle functions
 - ▷ can be scaled in to mass production

Schaeffler Paravan Technology GmbH & Co. KG

A Schaeffler and Paravan Joint Venture



- ▶ Schaeffler acquires Steer-By-Wire (SBW) technology from Paravan
- ▶ Key missions of the JV
 - ▷ Develop next generation SPACE DRIVE system and support Schaeffler in the industrialization of SBW for mass production
 - ▷ Support automotive OEMs and new mobility service providers with SPACE DRIVE applications for their autonomous fleets
 - ▷ Develop chassis solutions for autonomous transportation systems, e.g. people mover



Automotive OEM

Summary and Outlook

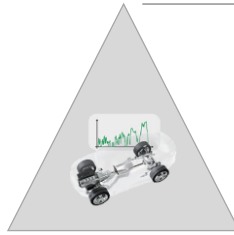
Matthias Zink
CEO Automotive OEM

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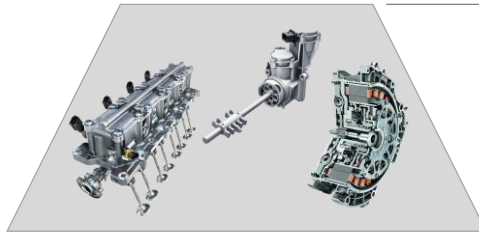
Powertrain Pyramid



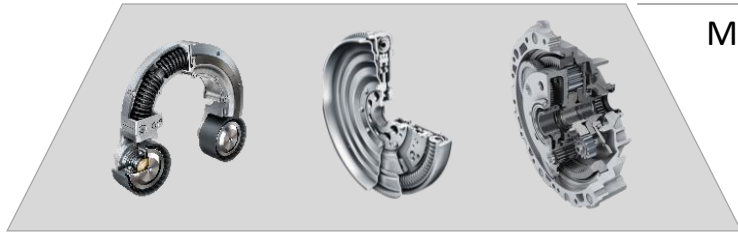
System Understanding



Mechatronic Systems



Mechanical Systems



Components



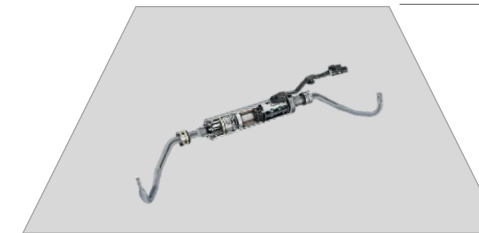
Chassis Pyramid



System Understanding



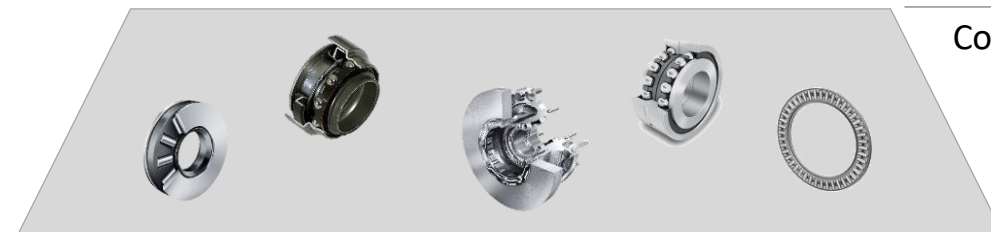
Mechatronic Systems



Mechanical Systems



Components



Schaeffler Symposium

- ▶ Every four years since 1978
- ▶ Technical presentations with insights into Schaeffler technologies and expertise
- ▶ Showing current and future product solutions



Highlights 2018

Baden-Baden and Detroit

- ▶ > 600 customers participated
- ▶ ~100 exhibits and 50 technical presentations
- ▶ 12 world debuts e.g. Schaeffler Mover and modular E-Axle

Schedule 2018



- ▶ April 11th – 13th, Baden- Baden, Germany
- ▶ September 4th – 6th, Detroit, USA
- ▶ October 30th – November 1st, Tokyo, Japan
- ▶ November 22nd – 23rd, Shanghai, China

1 Hybridization and further optimization of the conventional powertrain offers significant growth potential in Schaeffler's classic product portfolio

2 System understanding, mechanical know-how and integration expertise provide strong customer benefits for future mobility solutions (e.g. E-Mobility and drive by wire-solutions)

3 Robust profitability of the Automotive OEM Division will be preserved for the upcoming future

**Continued
profitable growth
above market**



Automotive OEM – Q&A