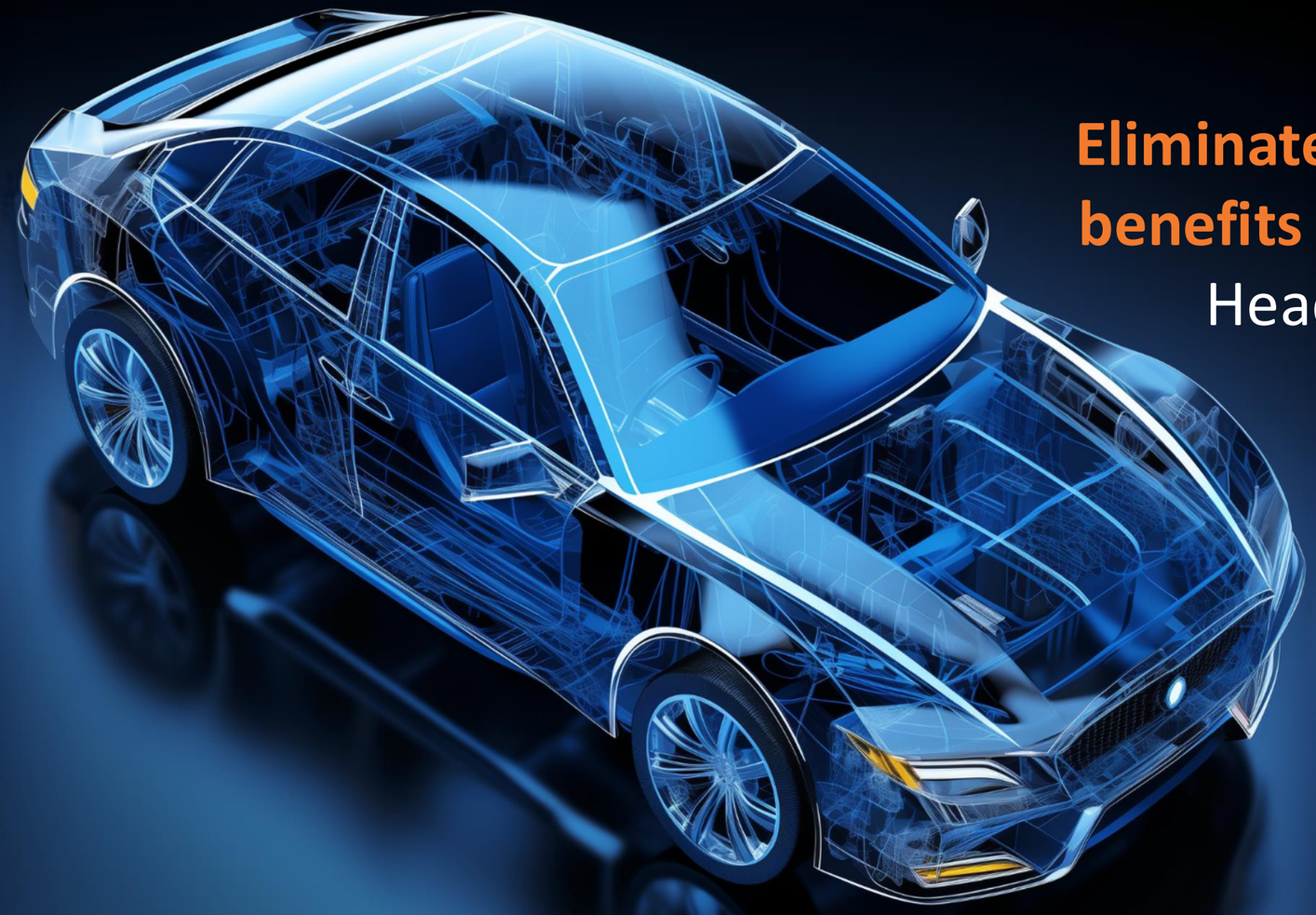
COMPREDICT
VIRTUAL SENSORS FOR MOBILITY

x

AUTO.AI
EUROPE



Eliminate Costly Hardware and drive tangible benefits from your SDV stack: How to replace Headlight & Tire Pressure Sensors with AI

Dr. Rafael Fietzek
Co-Founder and CTO

Stefan Hassels
Head of Product

September 23rd 2024

COMPREDICT

Your Virtual Sensor Experts today

Dr. Rafael Fietzek

Co-Founder and CTO

fietzek@compredict.de

Stefan Hassels

Head of Product

stefan.hassels@compredict.de

COMPREDICT

Agenda

01 Importance of Virtual Sensors in SDVs

02 Headlight Adjustment Sensor Replacement

03 Tire Pressure Sensor Replacement

04 Business Impact

05 Q&A

COMPREDICT

Agenda

01 Importance of Virtual Sensors in SDVs

02 Headlight Adjustment Sensor Replacement

03 Tire Pressure Sensor Replacement

04 Business Impact

05 Q&A

COMPREDICT

How to create value from SDVs

Superior Product

- Increased Willingness to Pay
- Higher Market Share
- Higher Customer Lifetime Value

Optimized Bill of Materials

- Reduced Hardware Costs
- Scalable Software Licensing
- Data Driven Optimization

Efficient Enterprise

- Efficient R&D + Manufacturing
- Less recall costs through OTA
- Increased Time to Market

Source: Boston Consulting Group (2021)- Chasing the Software-Defined Dream Car; Illustration and numbers based on BCG Analysis

COMPREDICT

Meet COMPREDICT

We are specialized in developing Virtual Sensors, intelligent algorithms turning available vehicle signals into valuable insights. To achieve this, we combine deep data science
know-how and automotive domain expertise.

Customers

- Automotive OEMs
- Tier1 Suppliers

Investors

woven capital | TOYOTA
SHIFT4GOOD
VEKTOR
BlackBerry
thi investments
FLIXBUS

Latest Announcement

COMPREDICT's Virtual Sensors for Tire & Break Wear will be deployed in over 10 million vehicles across the Renault, Dacia and Alpine brands by 2030.

COMPREDICT

Enable the future of mobility today, with Virtual Sensors

From hardware sensors in vehicles…

Vehicle Data

101
001
010

Data Science &
Machine Learning

COMPREDICT

Automotive Domain
Expertise

Insights

…to valuable software solutions

- Hardware replacement
- Vehicle health monitoring
- New digital services

and many more…

COMPREDICT

Virtual Sensors application areas

Hardware Sensor Replacement & Redundancy

- Lower the total cost of ownership
- Reduce hardware dependency
- Increase safety with virtual redundancy

Additional Measurement Capabilities

- Drastically reduce R&D costs
- Obtain R&D functionalities in production vehicles
- Continuous improvement of vehicle development

Health & Usage Monitoring

- Sustainable component replacement bases on usage
- Increase maintenance planning reliability
- Avoid vehicle downtime

COMPREDICT

Virtual Sensors Portfolio

Hardware Sensor Replacement & Redundancy

Portfolio

- Headlight Adjustment
- Tire Pressure
- Tire Temperature
- Brake Temperature
- E-Motor Temperature

Additional Measurement Capabilities

- Wheel Force Transducer
- Tie Rod Forces
- Driveshaft Torque
- Damper Forces

Health & Usage Monitoring

- Tire Wear
- Brake Wear
- Vehicle Mass
- LV / HV Battery SOH

COMPREDICT

Agenda

01 Importance of Virtual Sensors in SDVs

02 Headlight Adjustment Sensor Replacement

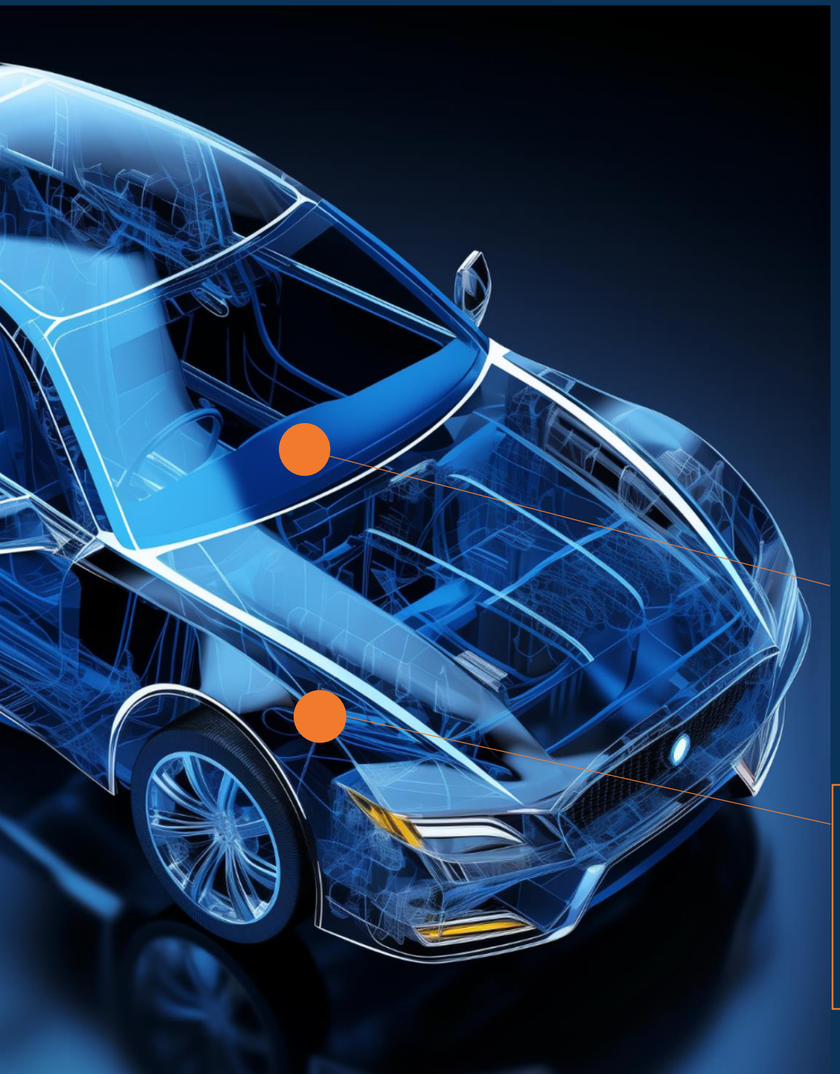
03 Tire Pressure Sensor Replacement

04 Business Impact

05 Q&A

COMPREDICT

Headlight Leveling Sensors



Role & Importance:

Headlight adjustment sensors automatically align headlights based on pitch changes from load, acceleration, or road conditions, enhancing safety by reducing accident risk and preventing glare.

Legal Regulation:

Automatic headlamp levelling mandatory for all new passenger vehicles from September 2027 (UNECE's GRE, Regulation 48, October 2023).

Ambient Light Sensor:

Detect the surrounding light levels outside the vehicle to automatically adjust the brightness and operation of headlights. **Bill of Material: $5 – 15$ per vehicle***

Level Sensors:

Can be replaced by VS

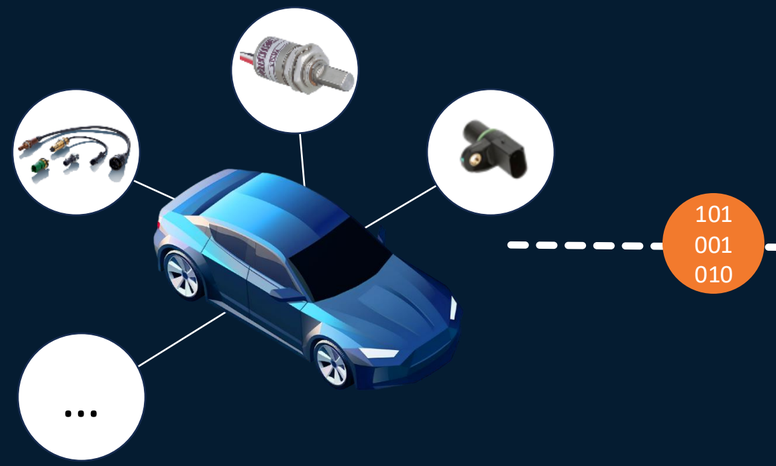
Often potentiometers or accelerometers that measure the vehicle's pitch and send signals to the headlight control module. **Bill of Material: 10€ – 20€ per vehicle***

*Own calculation based on customer projects

COMPREDICT

Headlight Adjustment Sensor Replacement with AI

Readily Available Vehicle Signals



- Up to 15 signals required (i.a. Wheel Speed, Steering Angle)
- Optimal Frequency ≧ 10Hz

COMPREDICT

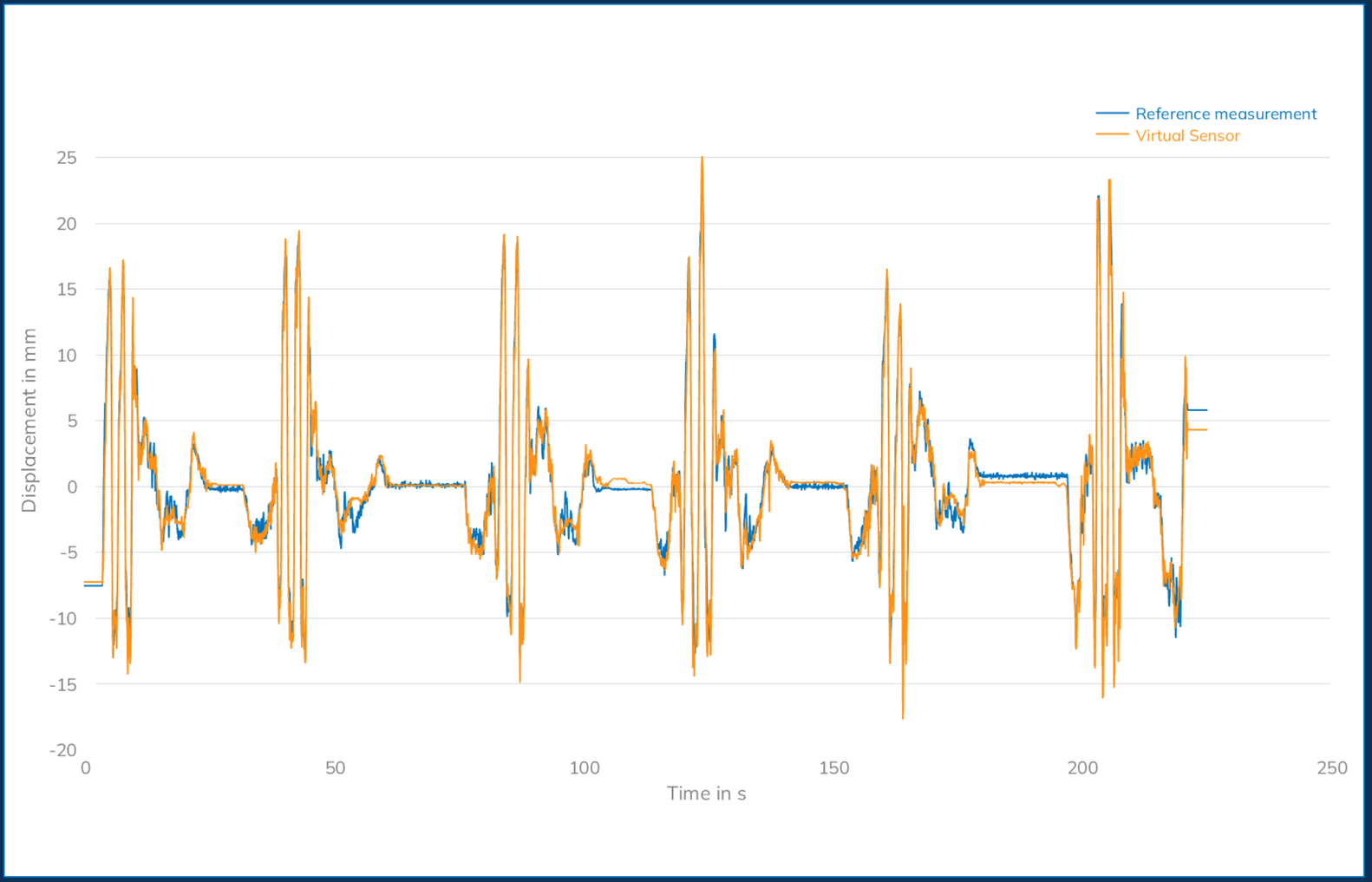
Virtual Sensor for Headlight Adjustement

In-Vehicle Deployment

1. Accurate prediction of vehicle mass and mass distribution
2. Prediction of dynamic suspension travel on wheels
3. Estimation of the vehicle’s pitch angle
4. Target value for headlight adjustment

COMPREDICT

Precision Insight -Suspension Travel



GENERAL	
Applicability	Passenger Vehicles, LCV, Trucks, Buses, Fleets
Output	Suspension displacement per wheel in mm
ACCURACY	
Deviation	1mm (RMSE)
Relative RMSE	4.4%
OPERATING SCOPE	
Weather	ALL (Hot, Wet, Snow)
Speed Range	0-200 km/h
Road Condition	ALL (Asphalt, Corrugated, Paved)
Manoeuvres	ALL (incl. extreme maneuvers)

COMPREDICT

Agenda

01 Importance of Virtual Sensors in SDVs

02 Headlight Adjustment Sensor Replacement

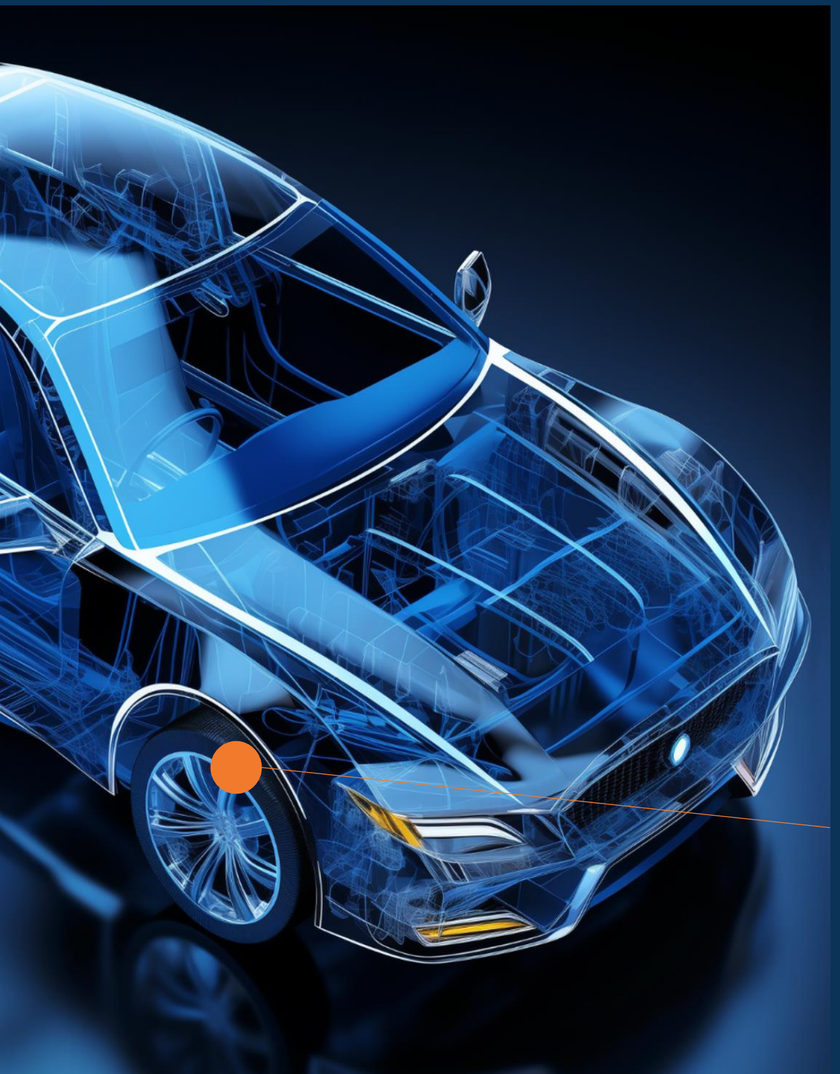
03 Tire Pressure Sensor Replacement

04 Business Impact

05 Q&A

COMPREDICT

Tire Pressure Sensors



Role & Importance:

Continuous monitoring of the absolute tire pressure for all tires ensures optimal vehicle performance, safety, and fuel efficiency. Properly inflated tires reduce the risk of blowouts, improve braking response, and enhance overall handling.

Legal Regulation:

Tire Pressure Monitoring System (TPMS) mandatory for all new passenger vehicles from September 2007 (UNECE's GRE, Regulation 64, November 2007).

Hardware Replacement Options:

OEMs can replace with COMPREDICT's Virtual Sensor all four tire pressure sensors. The Virtual Sensor can be implemented without sacrificing accuracy.

Tire Pressure Sensors:

Sensors that monitor and report a vehicle's tire pressure at any time to ensure proper inflation for safety and efficiency. **Bill of Material: 15€ – 25€ per vehicle***

*Own calculation based on customer projects

COMPREDICT

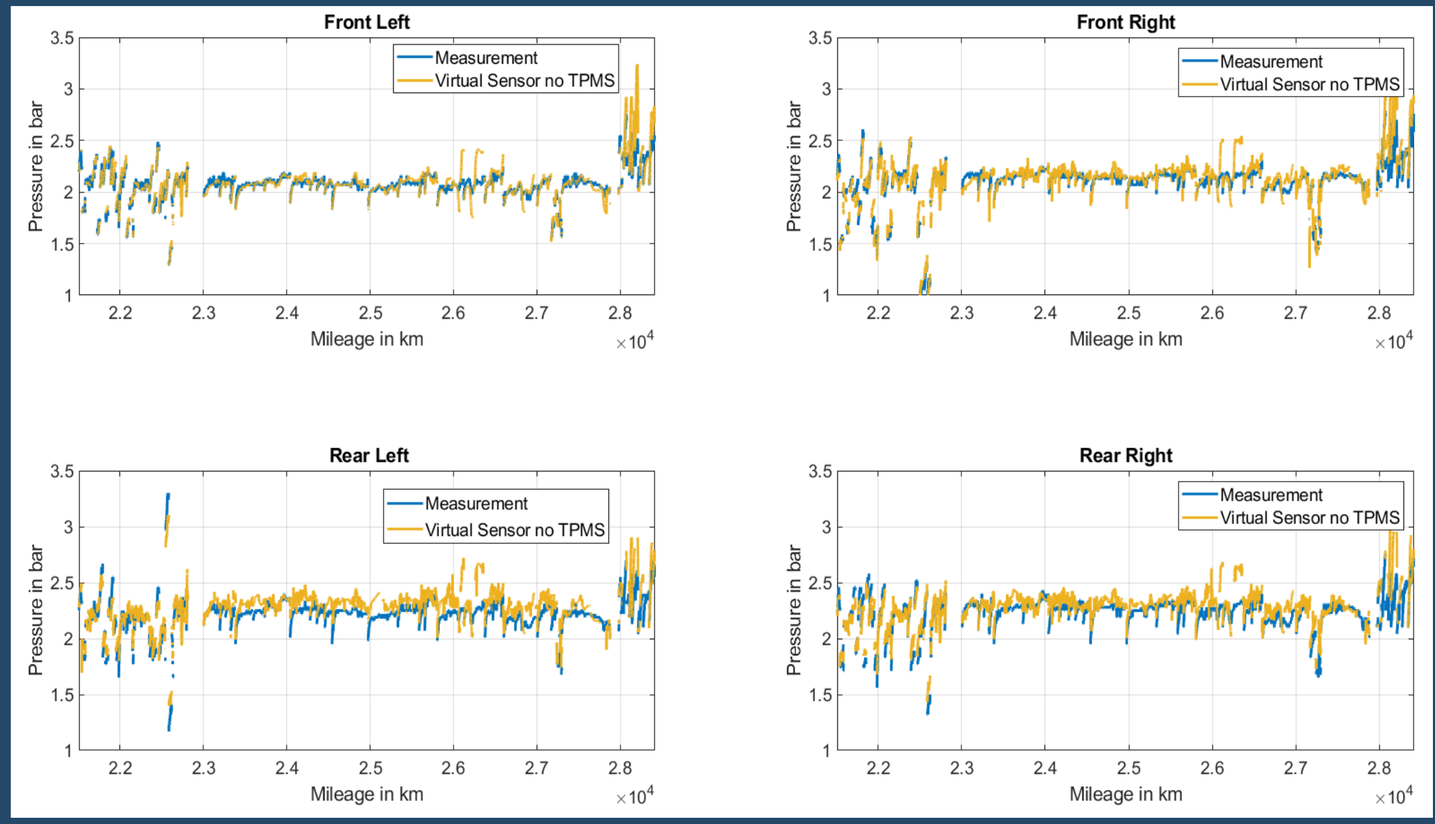
Fully Virtualized

0 x Hardware Sensor

4 x Virtual Sensor

Accuracy: +/- 0.2 bar (RMSE: 0.11 bar)

Required Signals: Up to 15 signals required; Optimal Frequency ≧ 10Hz



High cost-saving potential through complete omission of hardware sensors for tire pressure monitoring

COMPREDICT

Agenda

01 Importance of Virtual Sensors in SDVs

02 Headlight Adjustment Sensor Replacement

03 Tire Pressure Sensor Replacement

04 Business Impact

05 Q&A

COMPREDICT

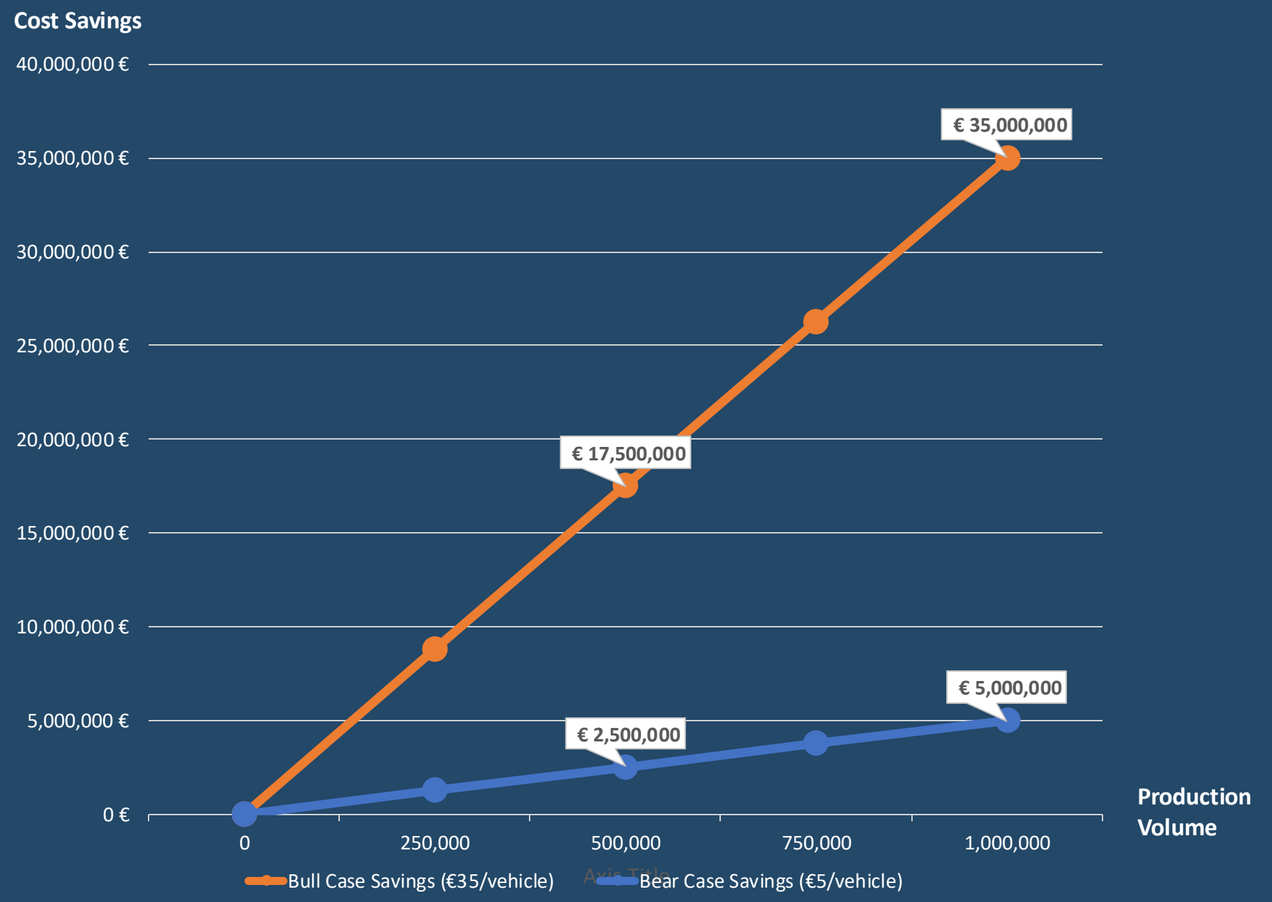
Strategic Importance & Business Impact

Improved Reliability
No mechanical failures and more consistent performance.

Supply Chain Resilience
Reduced dependency on hardware supply chains.

Cost Savings at Scale
Significant savings on the Bill of Materials (BOM).

Rough Financial Indication (accounting for Hardware Savings + Software Costs)



COMPREDICT

Agenda

01 Importance of Virtual Sensors in SDVs

02 Headlight Adjustment Sensor Replacement

03 Tire Pressure Sensor Replacement

04 Business Impact

05 Q&A

COMPREDICT

COMPREDICT

Thank you!

Visit us at **Booth 10 (Hall 3)** to get in touch with us to discuss your use cases and application areas of Virtual Sensors. Together we enable the mobility solutions of tomorrow

Contact us

Rheinstraße 40-42, 64283
Darmstadt, Germany

+49 6151 38 44 614

contact@compredict.de

https://compredict.ai

Follow us on
LinkedIn