



The RobustSENSE Approach

Werner Ritter, Daimler
16.05.2018 Ulm, Germany

Introduction

Today's driver assistance systems stop working
in harsh environmental conditions like rain, snow or sun-flare.



Overcome the limitations of existing sensor systems
and provide enhanced sensing capabilities.



A robust and reliable platform for automated driving

- ▼ ensuring **safe** and **comfortable** travel
- ▼ under **all** existing driving conditions
- ▼ introducing **adaptability** to failures on every system level
- ▼ taking an **integrated** system approach

RobustSENSE Consortium



DAIMLER



RobustSENSE Facts



- ▼ Duration: June 2015 - June 2018
- ▼ Program: Horizon 2020 - ECSEL
- ▼ Budget: € 10.7 million, thereof €3.3 million EU funding
- ▼ Coordinator: Dr. Werner Ritter, Daimler AG



15

**EUROPEAN
PARTNERS**



5

**EUROPEAN
COUNTRIES**



2018

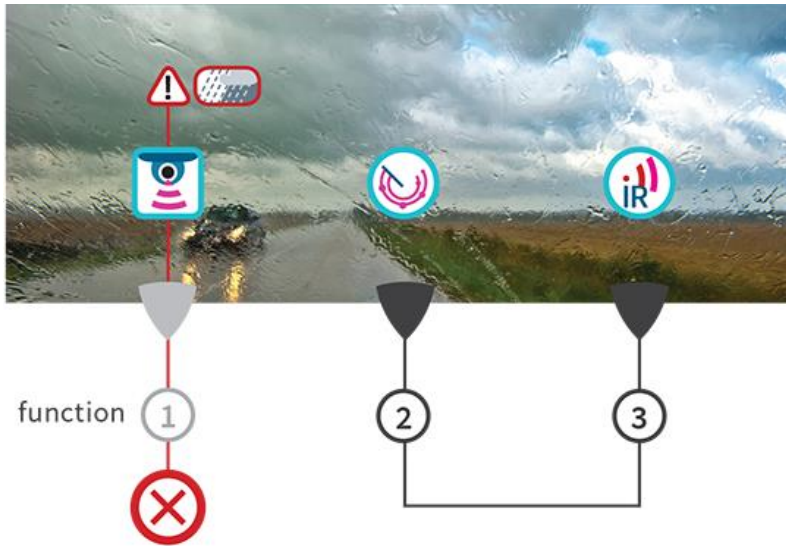
**PROJECT
COMPLETED**

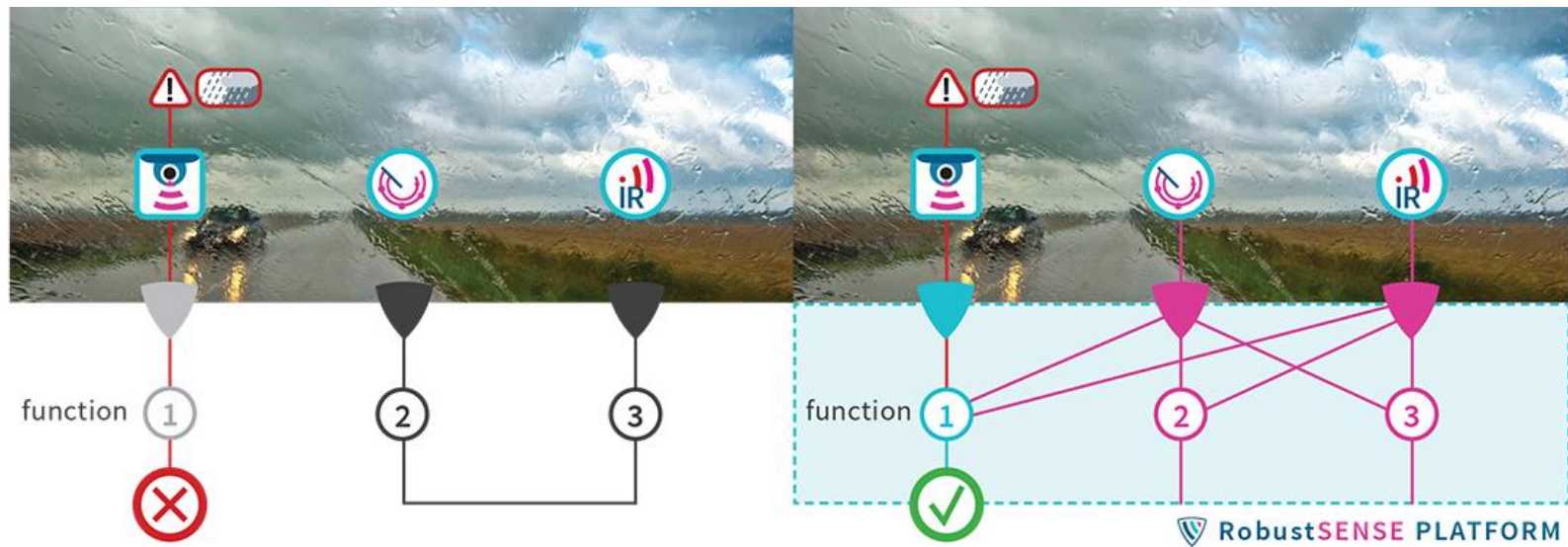


10.5

**MILLION EURO
BUDGET**

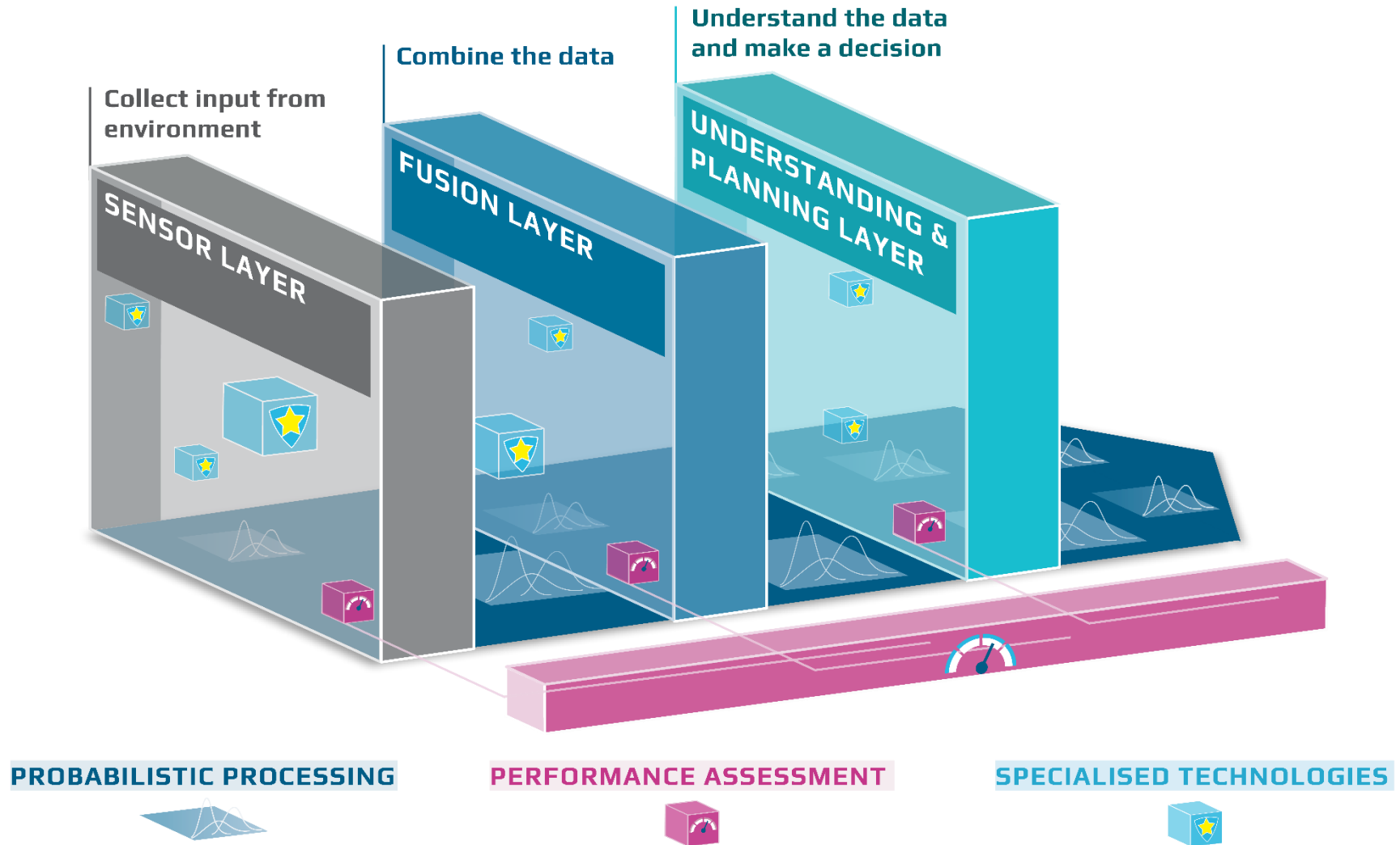
RobustSENSE Platform



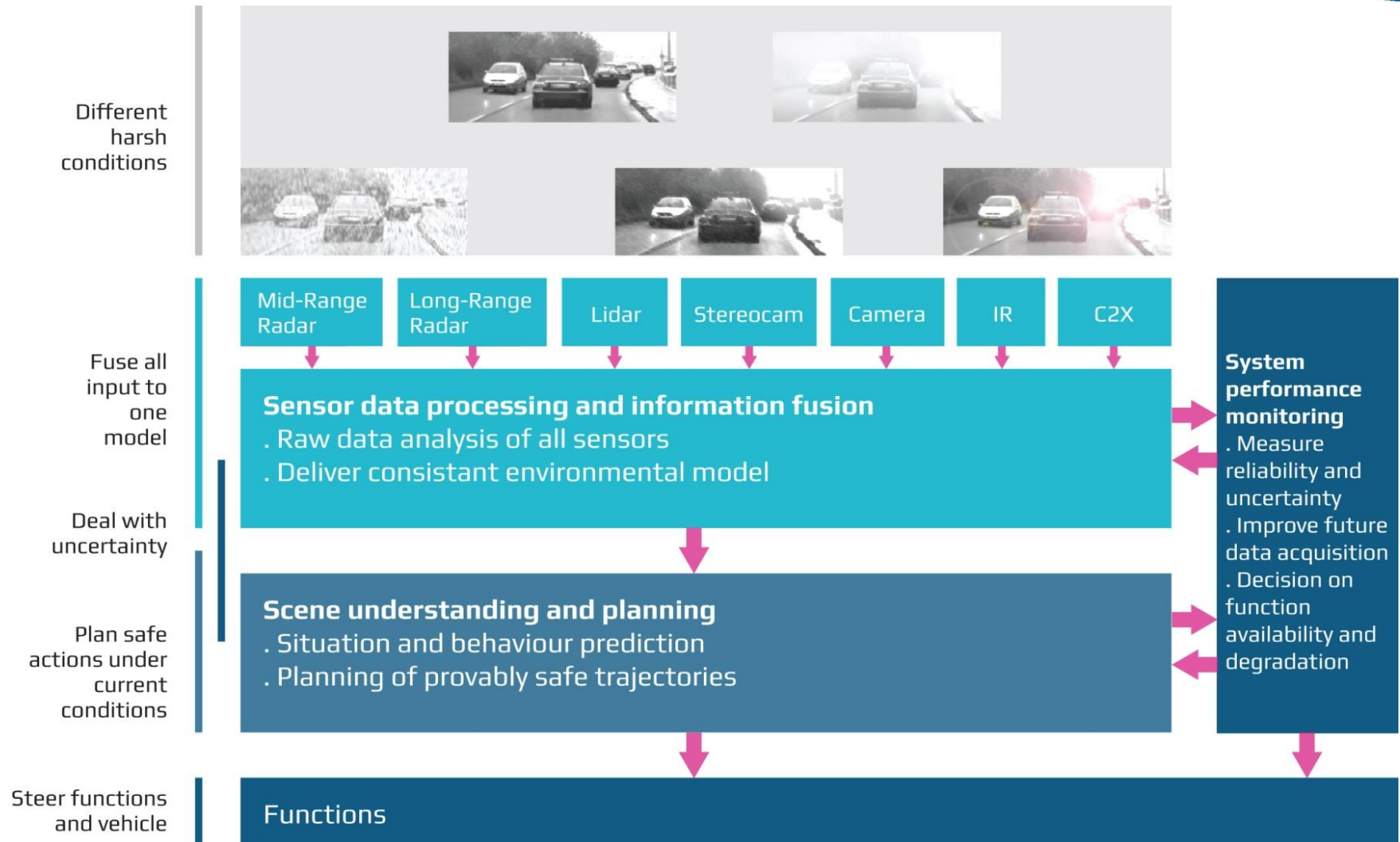


Enable better system operation by combining independent subsystems to an integrated and comprehensive solution.

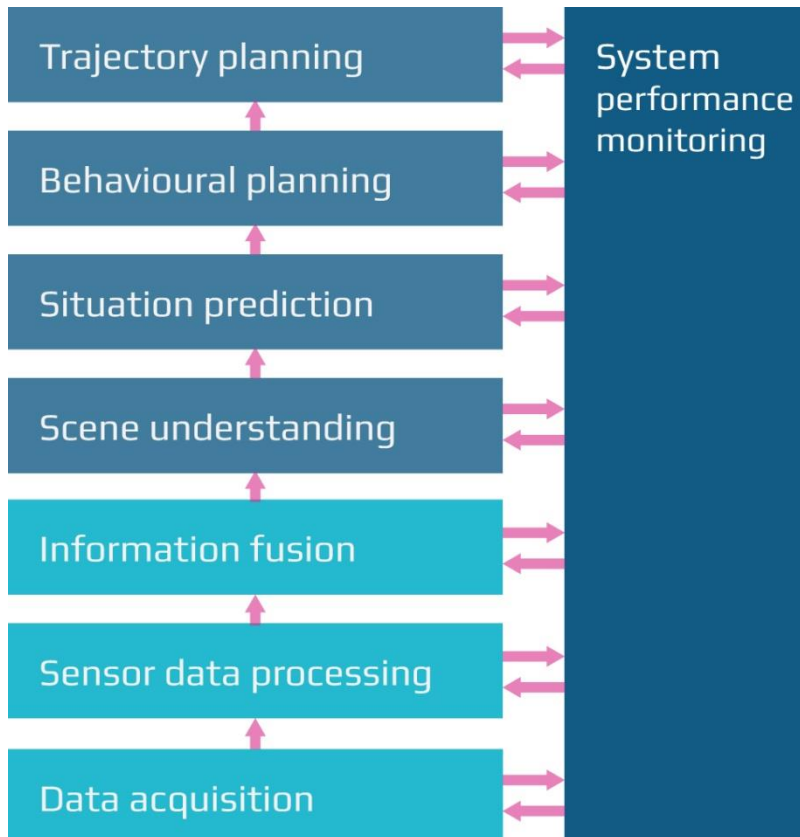
The RobustSENSE Approach



Concept of the sensor platform

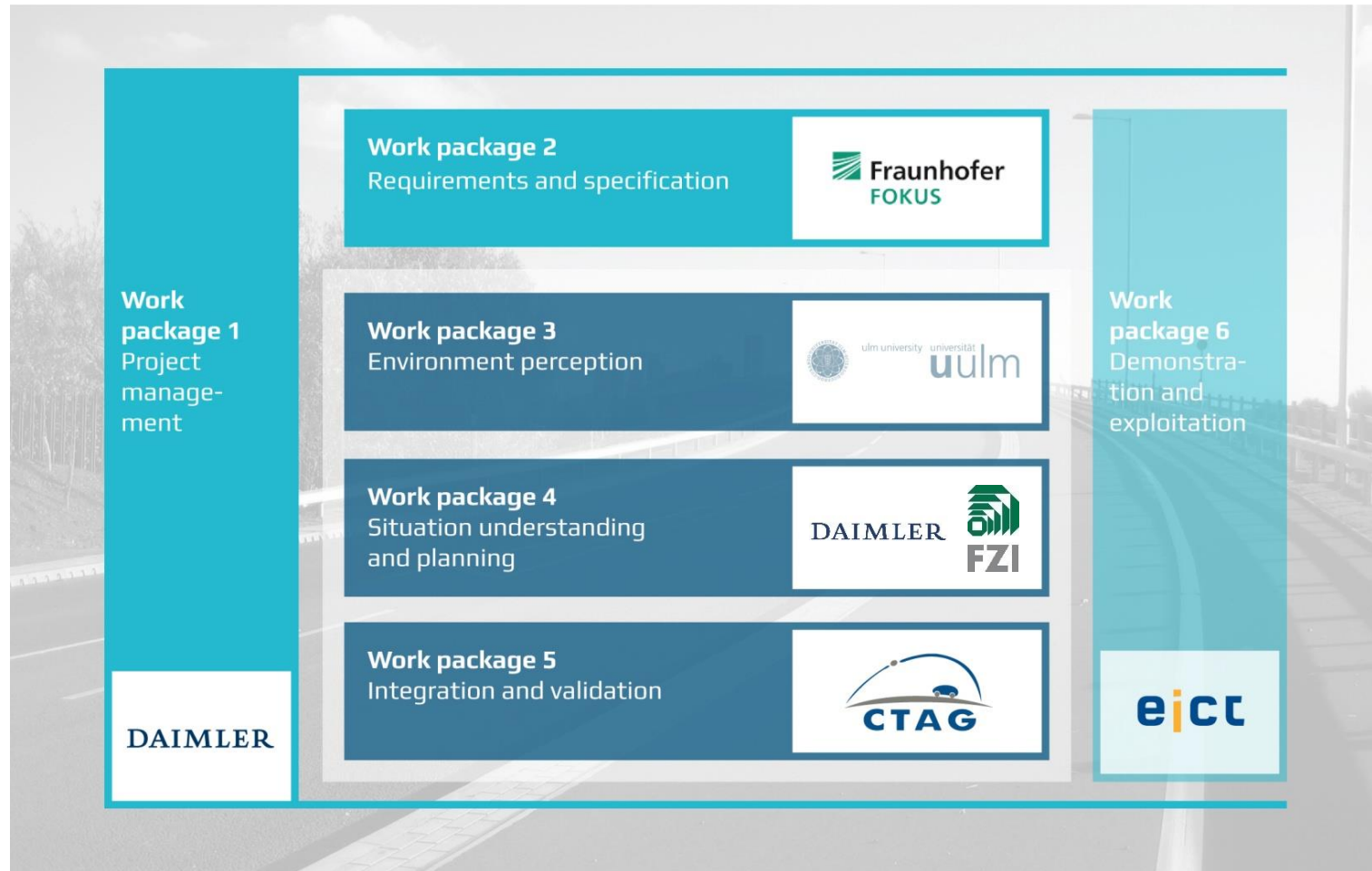


Layers of the RobustSENSE System

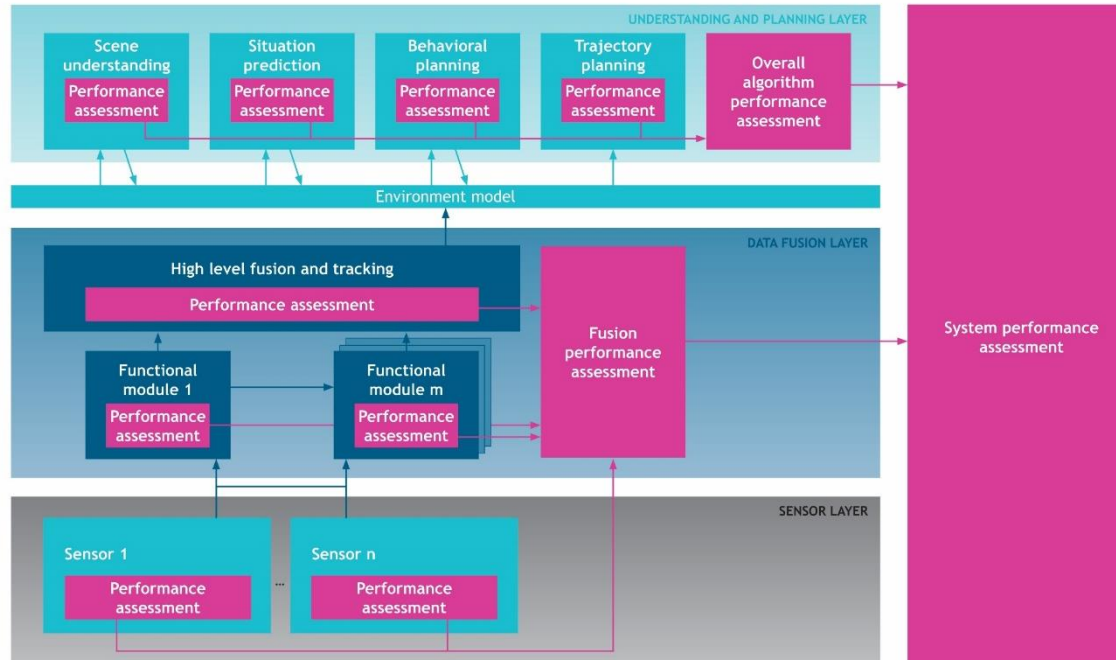


- ▼ Relating to the data and information flow within an intelligent sensor system
- ▼ Reacting to real world conditions
- ▼ Managing diversity and complexity
- ▼ Horizontal task: System performance monitoring
 - ▼ Enables overall system assessment
 - ▼ Drawing conclusions


RobustSENSE Structure




Key Achievement: Innovative System Architecture

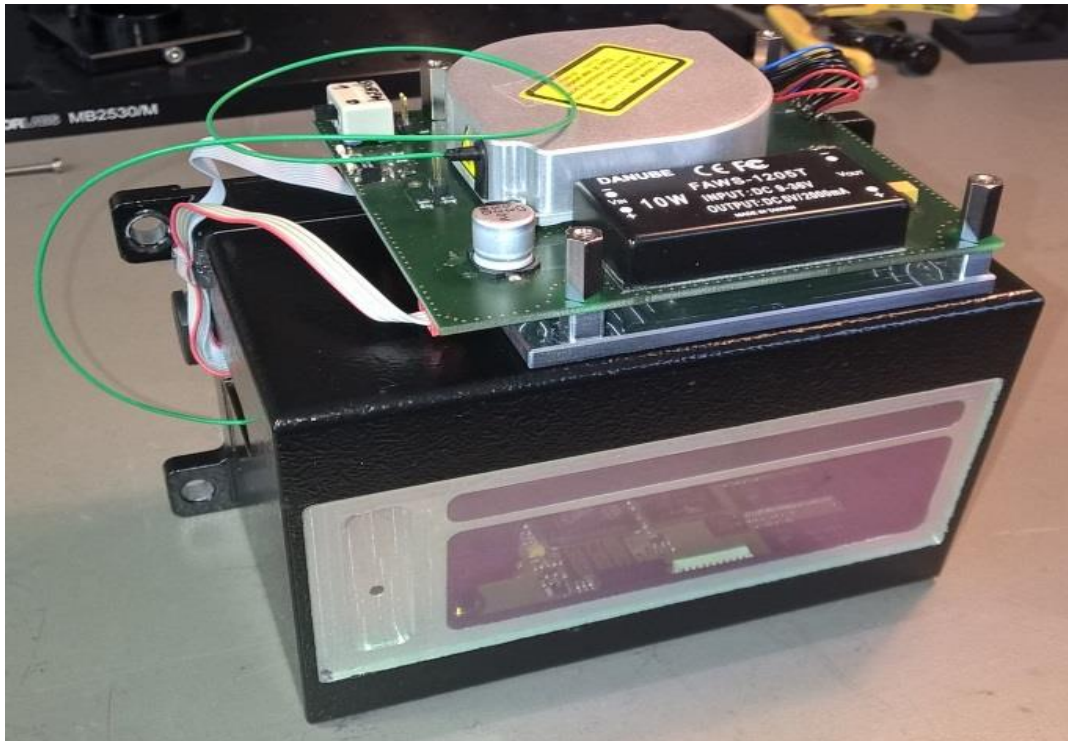




 Continuing functionality guaranteed

 Sensor-set independent and modular

 Adaptivity to input quality on every layer

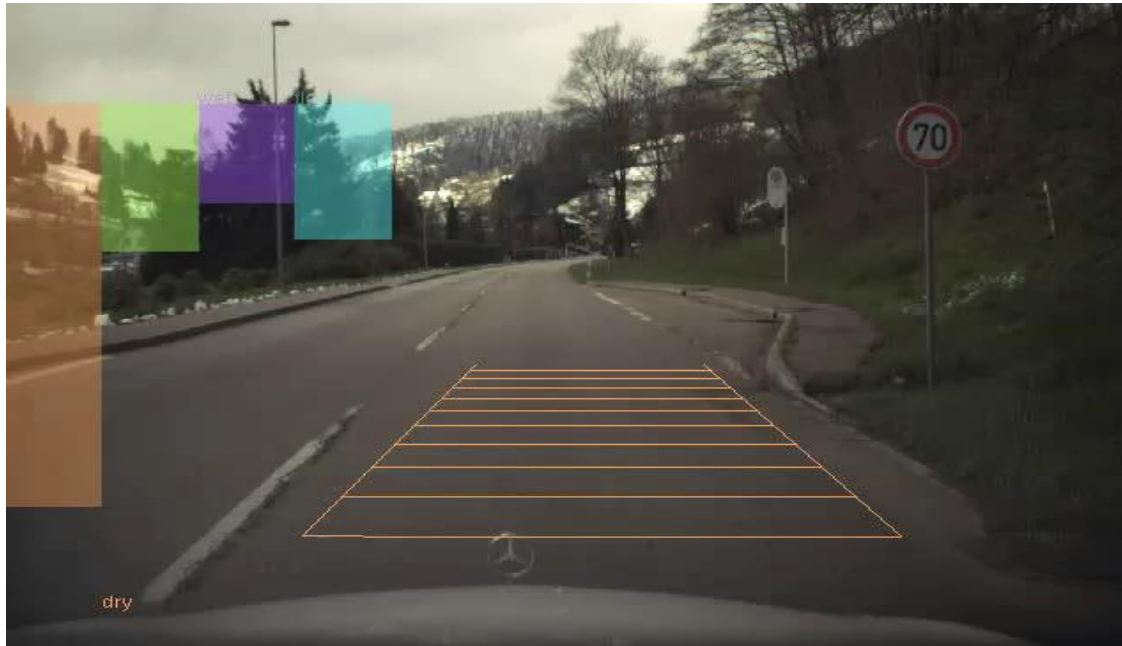
Key Achievement: Upgraded Sensor Capabilities with 1550nm Lidar



-  Increase in range by up to 2.5 in bad weather
-  Superior performance under foggy conditions

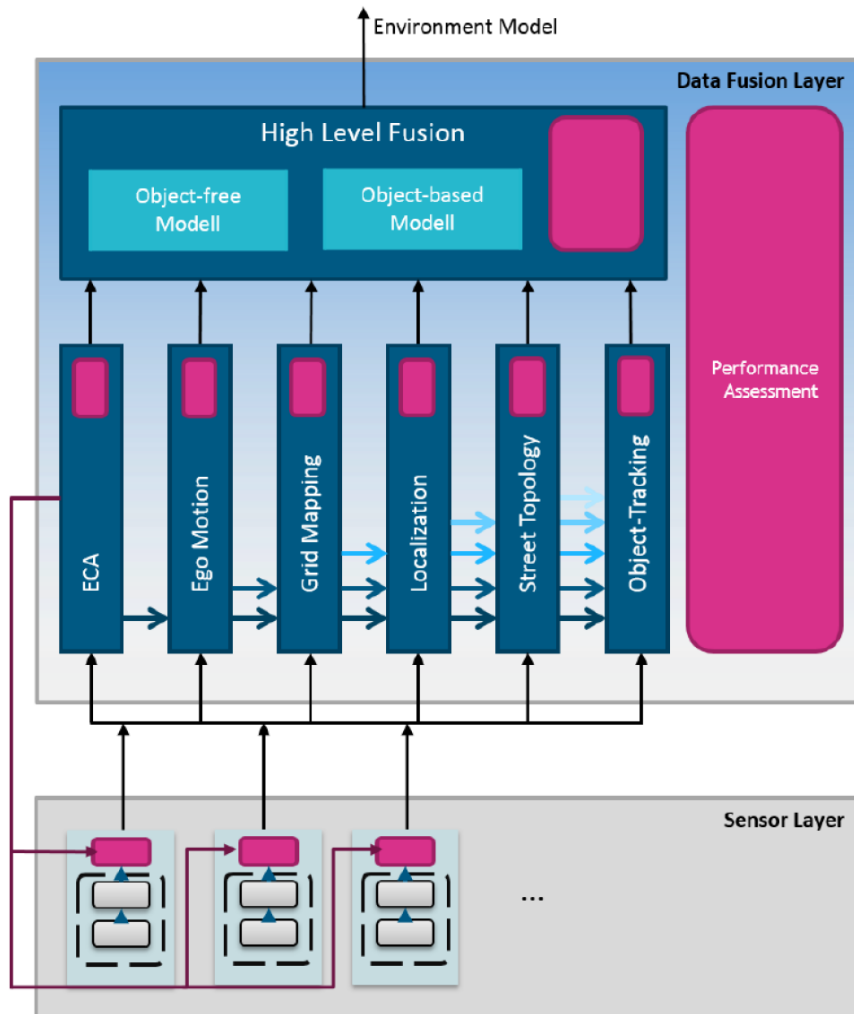
Key Achievement: ECA (Environment Condition Assessment)




Focus on Dry/Moist/Wet/Flooded

The Robust SENSE logo, consisting of a stylized 'R' made of three curved segments in white, teal, and pink, followed by the text 'Robust SENSE' in a sans-serif font, with 'Robust' in black and 'SENSE' in pink.

Classification of road condition

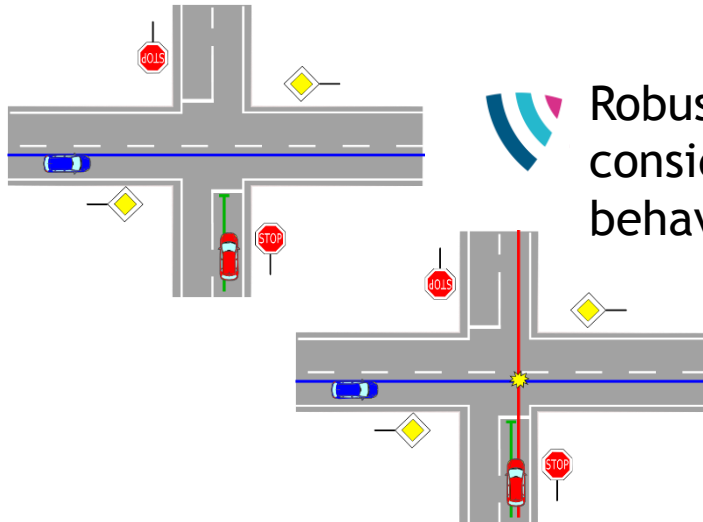
Key Achievement: Fusion Layer



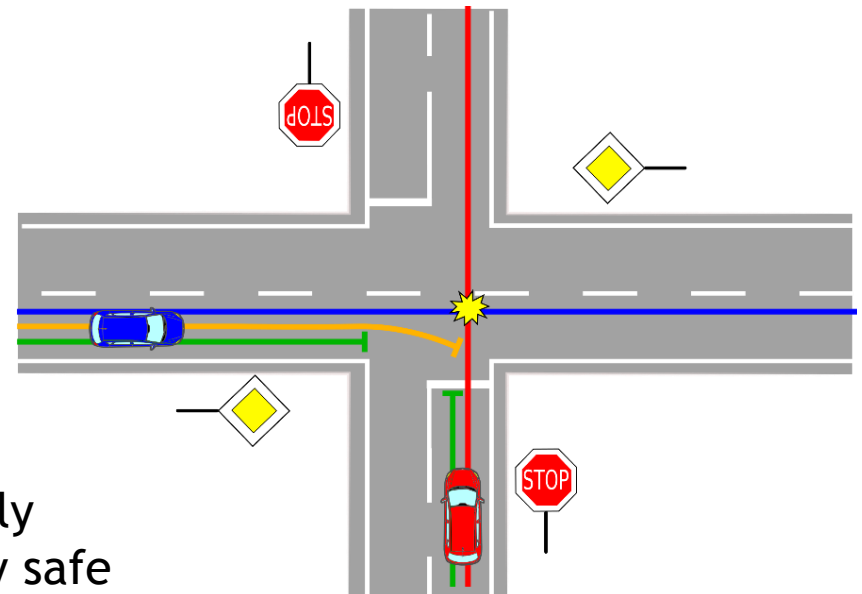
-  Environment condition assessment included in sensor performance monitoring
-  Probabilistic assessment of object state uncertainty and existence
-  Performance assessment of fusion components

Key Achievement: Handling Non-Compliant Behaviours

Existing Systems assume compliant behavior

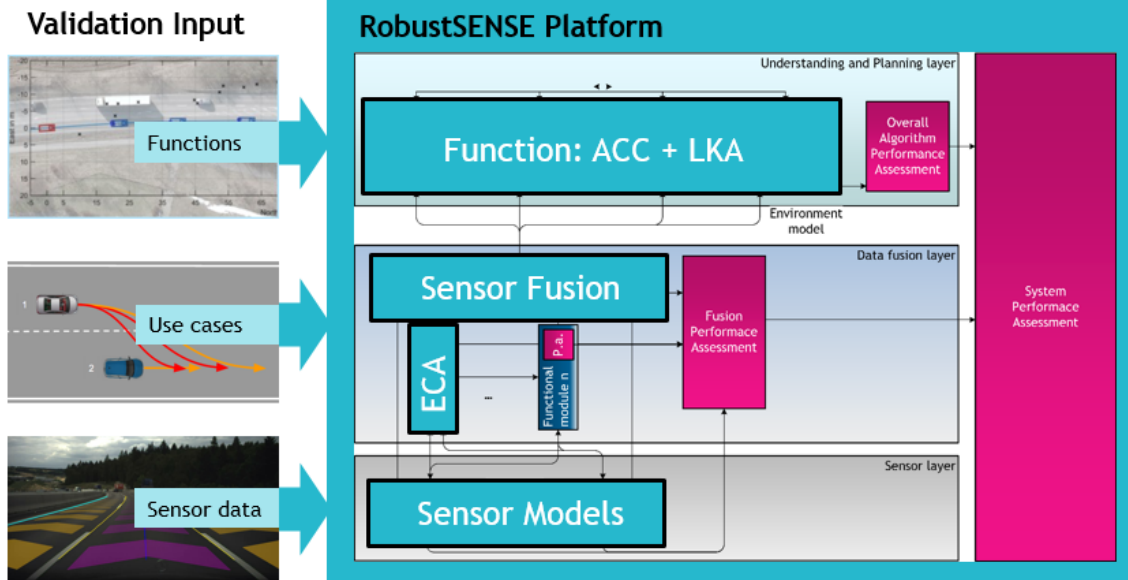


RobustSENSE system should consider non-compliant behaviors





Systems react early with decisions that are probably comfortable and certainly safe

Key Achievement: Simulation Framework



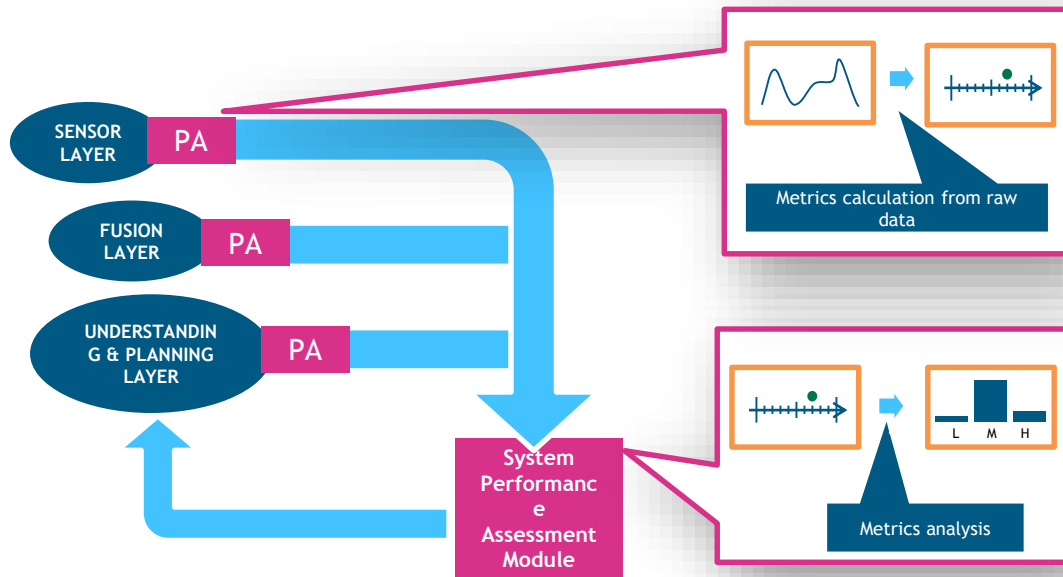
 Use of augmented generic sensor models

 Adverse weather always available

 Simulation especially in adverse weather and challenging situations



Key Achievement: SPAM (System Performance Assessment Module)



Problems that have not been detected in one of the layers can be identified in the overall SPAM

Autonomous functions are still available even when system is not performing at 100%

- ▼ With the **RobustSENSE platform** the vehicle's automation system is better aware of its state and fully reliable. With this the **next automatic driving system generations** have come way closer.
- ▼ With **enhanced performance and functional range of systems** the consortium partners bring highly automated driving systems to the market and build a **competitive advantage**.
- ▼ RobustSENSE has shown that **full-automation in all weather conditions is possible** and hence paved the way towards **road safety, reduced CO₂ emissions** and enhanced **driver comfort**.

RobustSENSE systems are robust and reliable,
key factors ensuring Europe's competitiveness in automotive markets.

Final Event Featuring



- ▼ **Presentations** underlining the key developments and technical highlights from different work packages.
- ▼ **Exhibition** presenting the RobustSENSE sensor platform prototype, and videos and posters describing it in more detail.
- ▼ **Driving demonstrations** showcasing different modules of the RobustSENSE sensor platform.
- ▼ **Chance to network** and discuss with industry experts, scientists and political representatives.



@RobustSENSE



www.robustsense.eu



RobustSENSE



Thank you.



Bundesministerium
für Bildung
und Forschung

Tekes



FFG



ECSEL Joint Undertaking
Electronic Components and Systems for European Leadership

Co-funded by
the European Union

