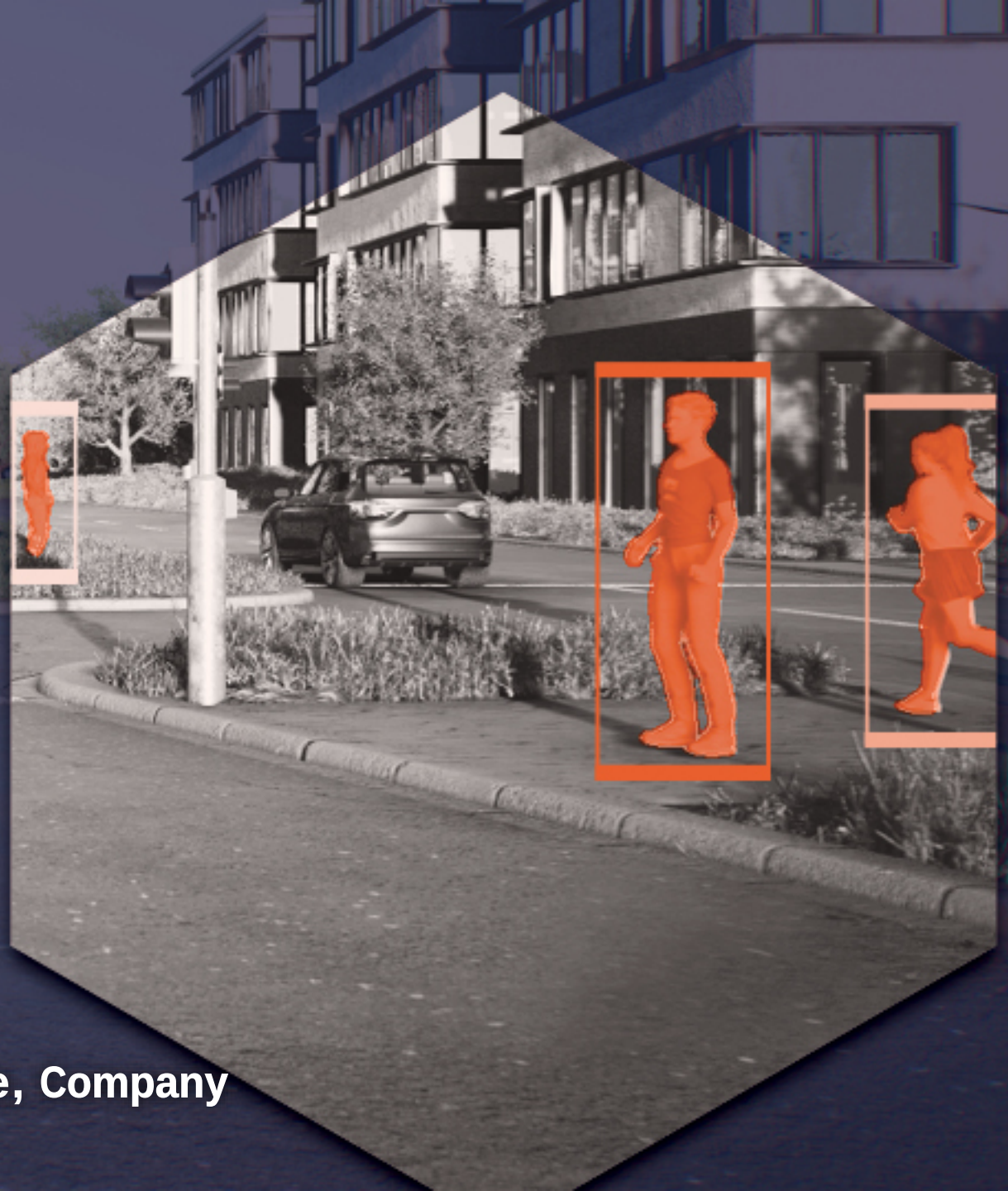
KI ABSICHERUNG

Safe AI for Automated Driving



Date, place, occasion

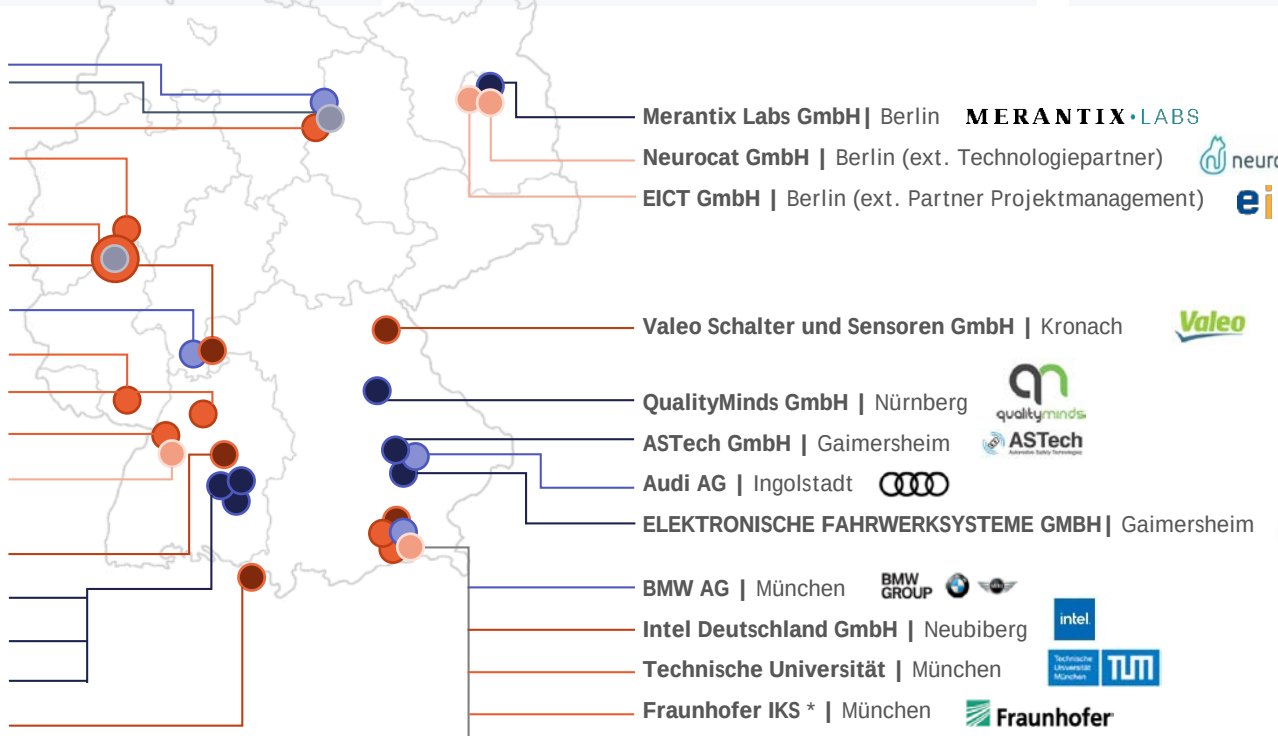
KI Absicherung
Project presentation

Name Surname, Company

Name Surname, Company

KI Absicherung – Safe AI for Automated Driving

Consortium lead:	***Volkswagen AG***	*Budget:*	***€ 41M***	*Duration:*	***36 months***	***24 partners***
Deputy consortium lead and scientific coordination:	***Fraunhofer IAIS***	*Funding:*	***€ 19.2M***		***01/07/2019 – 20/06/2022***	



Volkswagen AG | Wolfsburg
DLR | Braunschweig
Bergische Universität | Wuppertal
Fraunhofer IAIS | Sankt Augustin
Continental Automotive GmbH | Babenhausen
Opel Automobile GmbH | Rüsselsheim
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Robert Bosch GmbH | Abstatt
MackeVision Medien Design GmbH | Stuttgart
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Merantix Labs GmbH | Berlin
Neurocat GmbH | Berlin (ext. Technologiepartner)
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Technische Universität | München
Fraunhofer IKS * | München
BIT Technology Solutions | München
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Consortium lead · OEMs · Tier-1 · Technology provider · Research · External Partner

Supported by:
Federal Ministry for Economic Affairs and Energy
on the basis of a decision by the German Bundestag

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Project vision and goals

Vision

KI Absicherung is making the safety of AI-based function modules for highly automated driving verifiable.

Main goals

1. Methods for training and testing of AI-based functions
KI Absicherung develops and investigates means and methods for verifying AI-based functions for highly automated driving.

2. Safety argumentation
For the pedestrian detection use case, the project is developing an exemplary safety argumentation and methods for verifying a complex AI function.

3. Communication with standardization bodies on AI certification
The project‘s results will be used in the exchange with standardization bodies to support the development of a standard for safeguarding AI-based function modules.

The challenge of proving the safety of AI-based function models

Before KI Absicherung

Artificial Intelligence / Machine Learning / Deep neural networks

Experts working independently of one another

Established safeguarding processes not applicable

Functional safety and safety of use

In KI Absicherung

Artificial Intelligence / Machine Learning / Deep neural networks

Cooperation of the relevant industry and scientific experts

Development of a joint safety argumentation

Functional safety and safety of use

The KI Familie and its projects

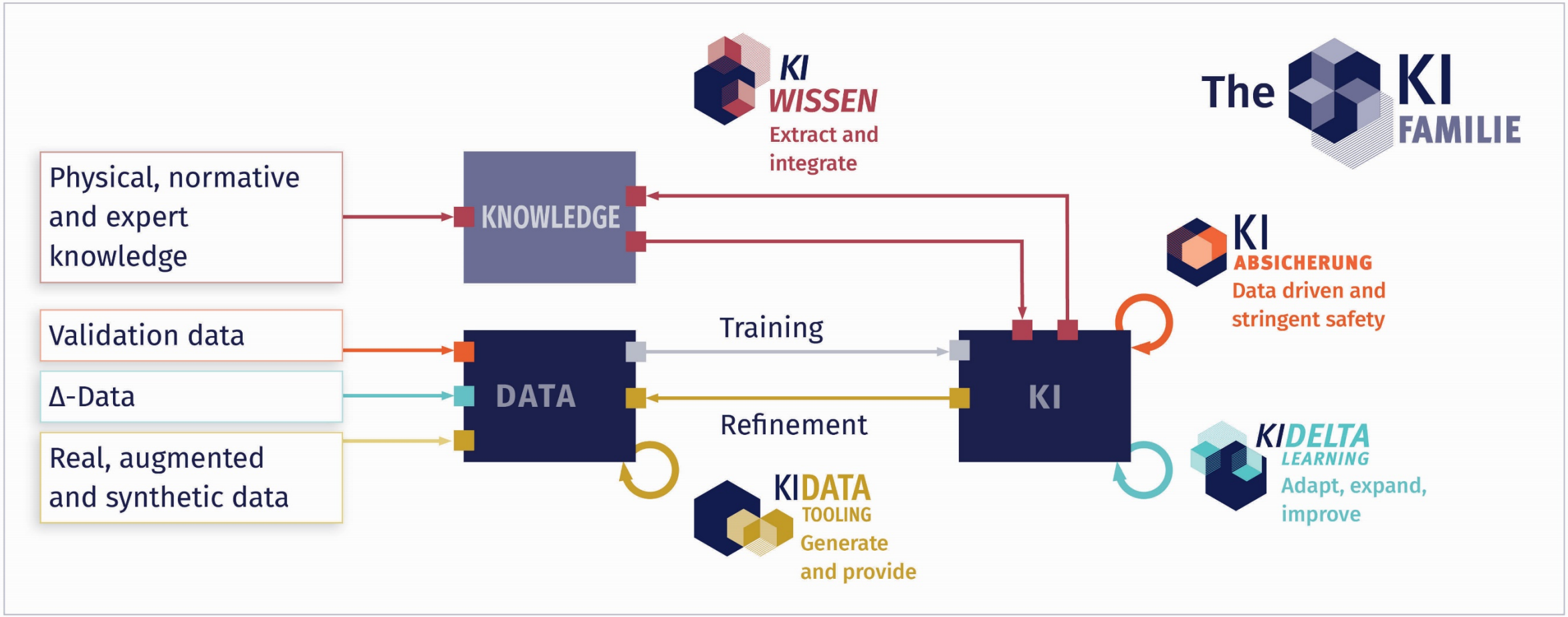
KI WISSEN Development of methods for the integration of knowledge into machine learning

KI DELTA LEARNING
Development of methods and tools for the efficient expansion and transformation of existing AI modules in autonomous vehicles to meet the challenges of new domains or more complex scenarios

KI ABSICHERUNG Methods and measures to safeguard AI-based perception functions for automated driving

KI DATA TOOLING Methods and tools for the generation and refinement of training, validation and safeguarding data for AI functions in autonomous vehicles

KI Absicherung in connection with the KI Familie



Overview of the main project results

New algorithms for developing and verifying deep neural networks:

- Effectiveness-assessed measures and methods to identify and reduce systematic insufficiencies of an AI function.
- AI-based algorithms for pedestrian detection that are improved in their detection performance and safeguarding capabilities.

New methods and tools to test and verify characteristics and qualities of deep neural networks:

- Test methods and process chains to make the safety of a data-driven AI function verifiable.
- Processes and interfaces to systematically generate synthetic training and test data for analyzing and assessing systematic insufficiencies of AI-based techniques.

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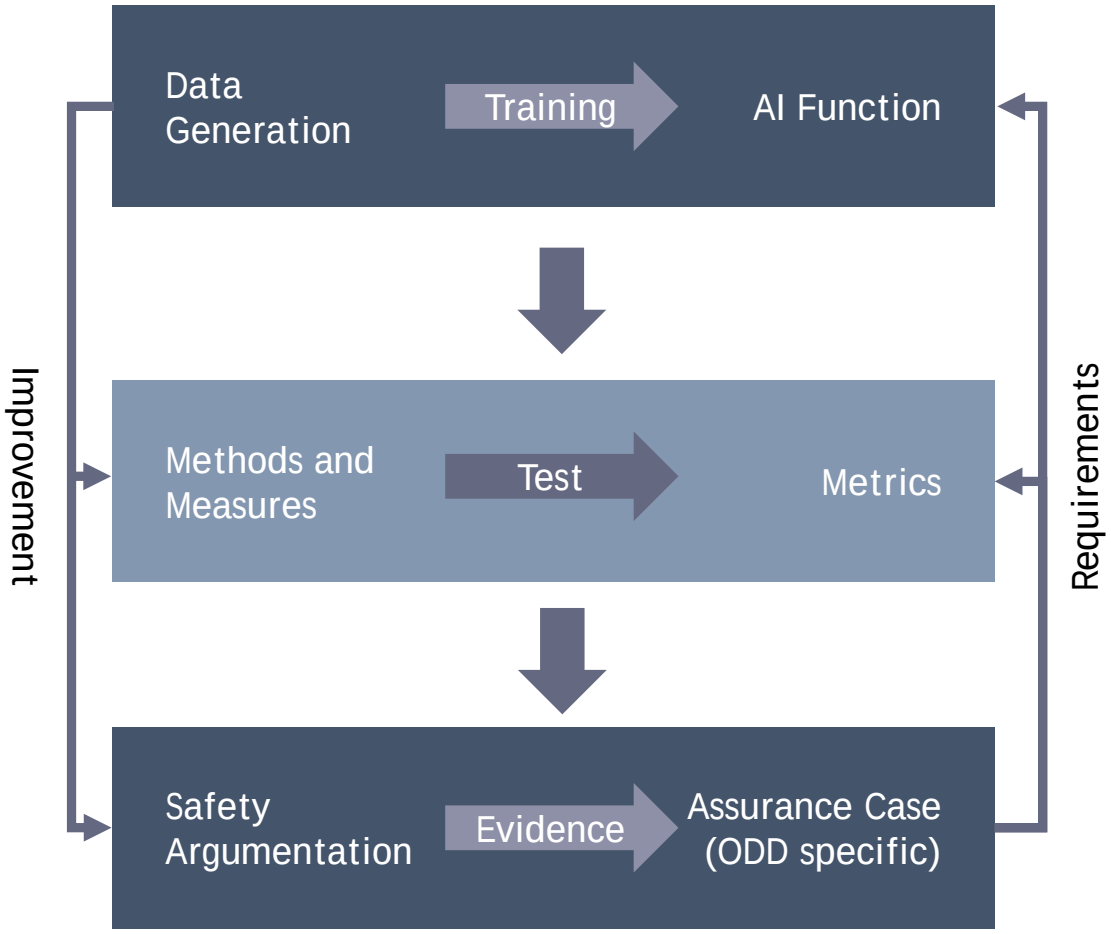
Methodological and conceptual approach

From a data-driven AI function to an Assurance Case for the use case pedestrian detection

- Process-related generation of synthetic learning, testing and validation data.
- Development of measures and methods that improve the AI function over a wide array of metrics.
- Development and validation of testing methods for these metrics.
- Stringent argumentation for the AI function and its Operational Design Domain (ODD).



Conceptual approach

1. Provide the AI function for pedestrian detection.
2. Generate synthetic learning, testing and validation data.
3. Develop and evaluate measures and methods for the verification of the AI function.
4. Establish an overall safety strategy for the AI function.
5. Define and implement an Assurance Case.

1. Providing the AI function for pedestrian detection

KI Absicherung develops algorithms for the AI-based detection of pedestrians based on image and depth data:

- Detection in 2D/3D, pose estimation, semantic segmentation
- Approaches for fusion of camera and depth-sensor data

Expected results:

➔ State-of-the-art analyses.

➔ Neural network architectures.

➔ Trained models.

➔ Quality metrics for assessing the safety of the AI function.

Synthetically rendered scenes and their semantic segmentation.

2. Generating synthetic learning, testing and validation data

The systematic development and analyses of safeguarding measures and methods will be done with synthetically generated training, test and validation data. This allows for easy variation and control of context dimensions and impacting factors.

Expected results:

- ➔ Process for methodological derivation and creation of corner cases.
- ➔ Concurrent data generation and tool development based on sensor models and correct rendering.
- ➔ Methods to evaluate synthetic data.

Synthetically generated data: Scene variations with unchanged sensor position.

3. Developing and evaluating measures and methods for the verification of the AI function

We develop, combine and evaluate measures and methods to identify and reduce systematic insufficiencies of the AI function.

Expected results:

- Toolbox with methods and measures for verifying the AI function that have been evaluated with regard to their safety effectiveness.
- List of inherent and systematic insufficiencies of deep neural networks.
- Effectiveness and safety metrics and measures for AI algorithms.

Heat map to check the plausibility of the AI function.

4. Establishing an overall safety strategy for the AI function

The system context is determined by a common description language and ontology. The AI-specific insufficiencies and mitigation measures are analyzed and evaluated.

Expected results:

- ➔ Proof of sufficient mitigation of the systematic insufficiencies of an exemplary AI function for pedestrian detection.
- ➔ Test procedure to prove the safety-relevant effectiveness of the measures.
- ➔ Establishing a consensus on the stringent structure of a process chain and test methodology to prove the safety of a data-driven AI function for pedestrian detection.

5. Assurance Case and holistic safety argumentation

Definition and exemplary implementation of a systematic and holistic approach to a specific AI function for pedestrian detection

Input space structuring and formalization

- Definition of basic and usage context
- Domain analysis, description language, ontology

Test methods and testing

- Methods to identify missing test data
- Test strategy and plan

- Trained AI function algorithms
- Synthetic data and corner cases
- KPIs, methods and measures to safeguard AI functions

Conditions and safety goals

- Overall function and system architecture
- Safety contracts including assumptions and guarantees

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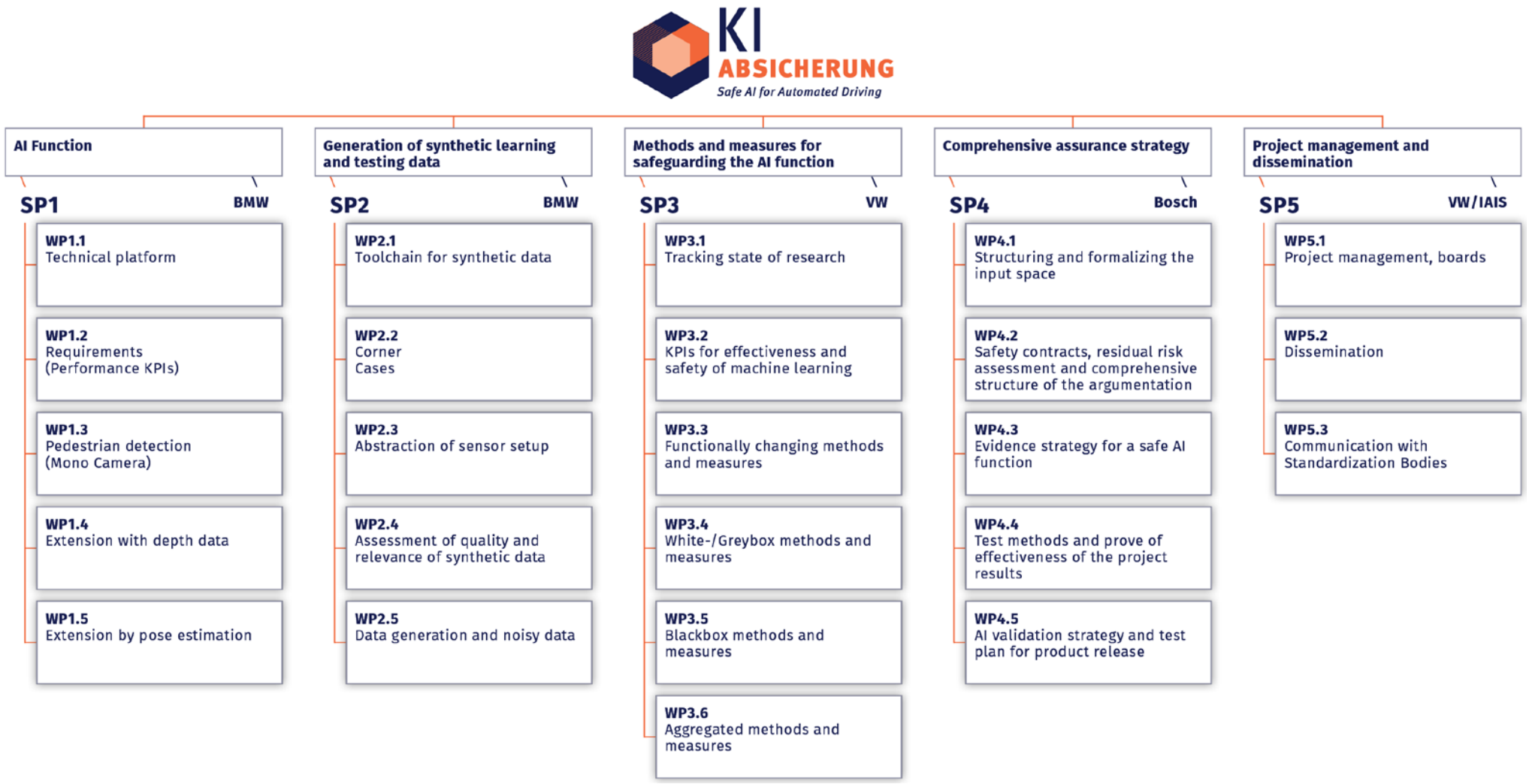
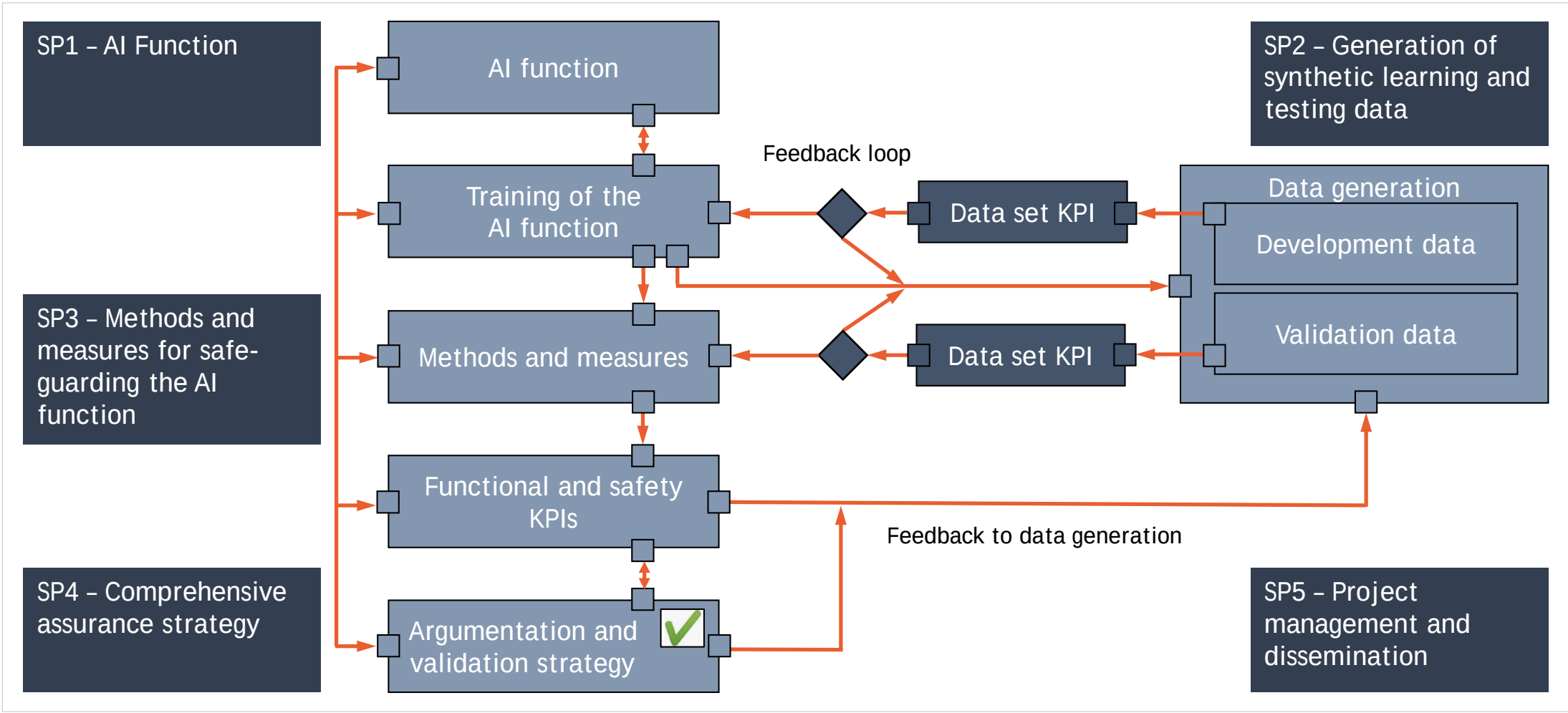
Project structure

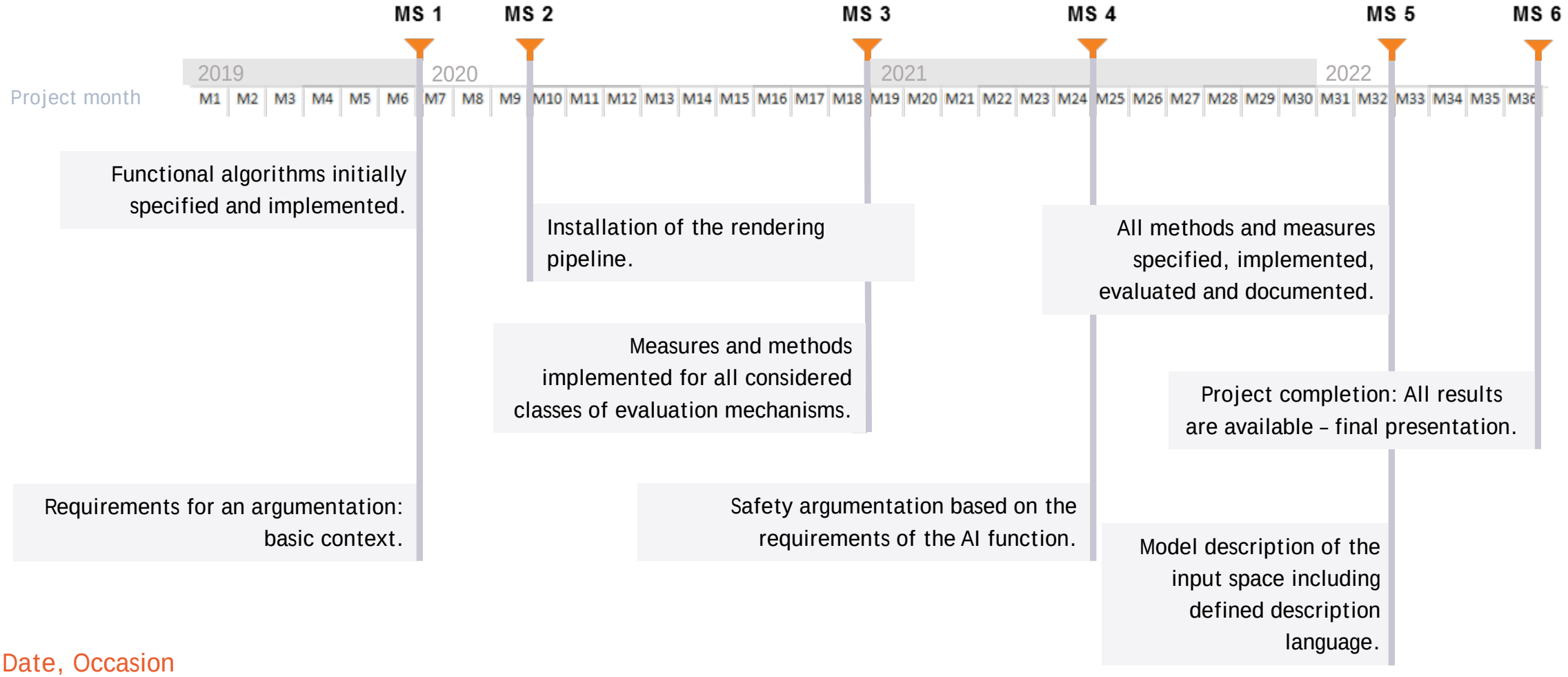
Project structure with sub-projects and work packages



Workflow of the sub-projects in KI Absicherung



Overview project milestones



Contact persons

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KI ABSICHERUNG

Safe AI for Automated Driving

KI Absicherung is a project of the KI Familie. It was initiated and developed by the VDA Leitinitiative autonomous and connected driving and is funded by the Federal Ministry for Economic Affairs and Energy.

KI FAMILIE

Supported by:

Federal Ministry for Economic Affairs and Energy

on the basis of a decision by the German Bundestag

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