PEGASUS

General introduction to PEGASUS &
Opening of the exhibition

PEGASUS

Prof. Dr. Thomas Form |9th November 2017

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for Economic Affairs
and Energy

on the basis of a decision
by the German Bundestag

Starting Position for Automated Driving

Top issue!

Automated driving is tomorrow's subject matter (together with electric driving)

Technology works

Basic functionality is technologically given

Has been demonstrated in various projects

Confidence

High standards regarding quality and performance of the automated vehicle

➔ Measures that product needs to meet

Testing differently

Existing measures for testing and release are insufficient, too cost-intensive and too complex

➔ Consequently, the introduction of highly automated driving features today can only be achieved with great expenditure.

Starting Position for Automated Driving

Prototypen

- Multitude of prototypes built by OEM with HAD-functionality
- Evidence, that HAD is technologically possible
- Partially tested in real traffic situations
- Test drives involve backup safety driver all the time

Labor / Testgelände

- Individual analyses to optimize prototypes
- Current test m
  proving grou
  provide enou
  coverage fo
  currently in f
- There is no pr
  adequate testin
  performance) of
  systems

Produkte

- No release or introduction of variety of HAD-features without sufficient assurance

Advancement through PEGASUS

current

PEGASUS key facts

project for the establishment of generally accepted quality criteria, tools and methods as well as scenarios and situations for the release of highly-automated driving functions

42 months term	01. Januar 2016 – 30. Juni 2019
17 partners	▪ OEM: Audi, BMW, Daimler, Opel, Volkswagen ▪ Tier 1: ADC Automotive Distance Control, Bosch, Continental Teves ▪ Tech.Prüforganisation: TÜV SÜD ▪ SMB fka, iMAR, IPG, QTronic, TraceTronic, VIRES ▪ scientific institutes: DLR, TU Darmstadt
Affiliated partners & Subcontracts	▪ i.a. BASt, dSPACE, IFR, ika, OFFIS
Project volume	▪ approx. 34,5 Mio. EUR ▪ subsidies: 16,3 Mio. EUR
Personnel deployment	▪ approx. 1.791 man-month or 149 man-years

Central Issues of the PEGASUS Project

What level of performance is expected of an automated vehicle?
How can we verify that it achieves the desired performance consistently?

Scenario Analysis & Quality Measures

- What human capacity does the application require?
- What about technical capacity?
- Is it sufficiently accepted?
- Which criteria and measures can be deducted from it?

Implementation Process

- Which tools, methods and processes are necessary?

Testing

- How can complete-ness of relevant test runs be ensured?
- What do the criteria and measures for these test runs look like?
- What can be tested in labs or in simulation? What must be tested on proving grounds, what must be tested on the road?

Reflection of Results & Embedding

- Is the concept sustainable?
- How does the process of embedding work?

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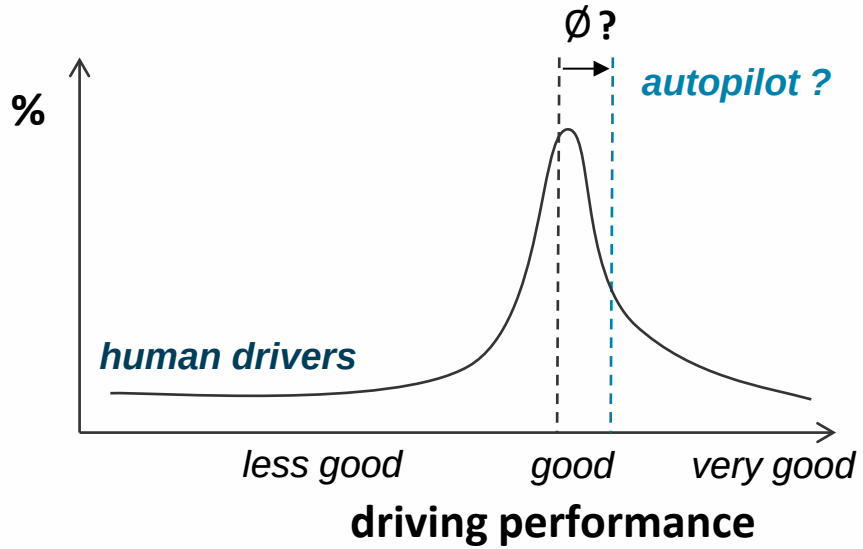
Scenario Analysis and Quality Measures

How good is good enough?

- Which functional performance do highly automated driving functions need to be accepted by driver and society?



➔To answer this question **generally accepted quality criteria, tools and methods** are developed.

- employed to the sample application of the highway chauffeur

Scenario Analysis and Quality Measures

Results are e.g..:

System boundaries
Metric perspectives
Classes of automation risks

Deduction of requirements
based on the accepted measure of quality

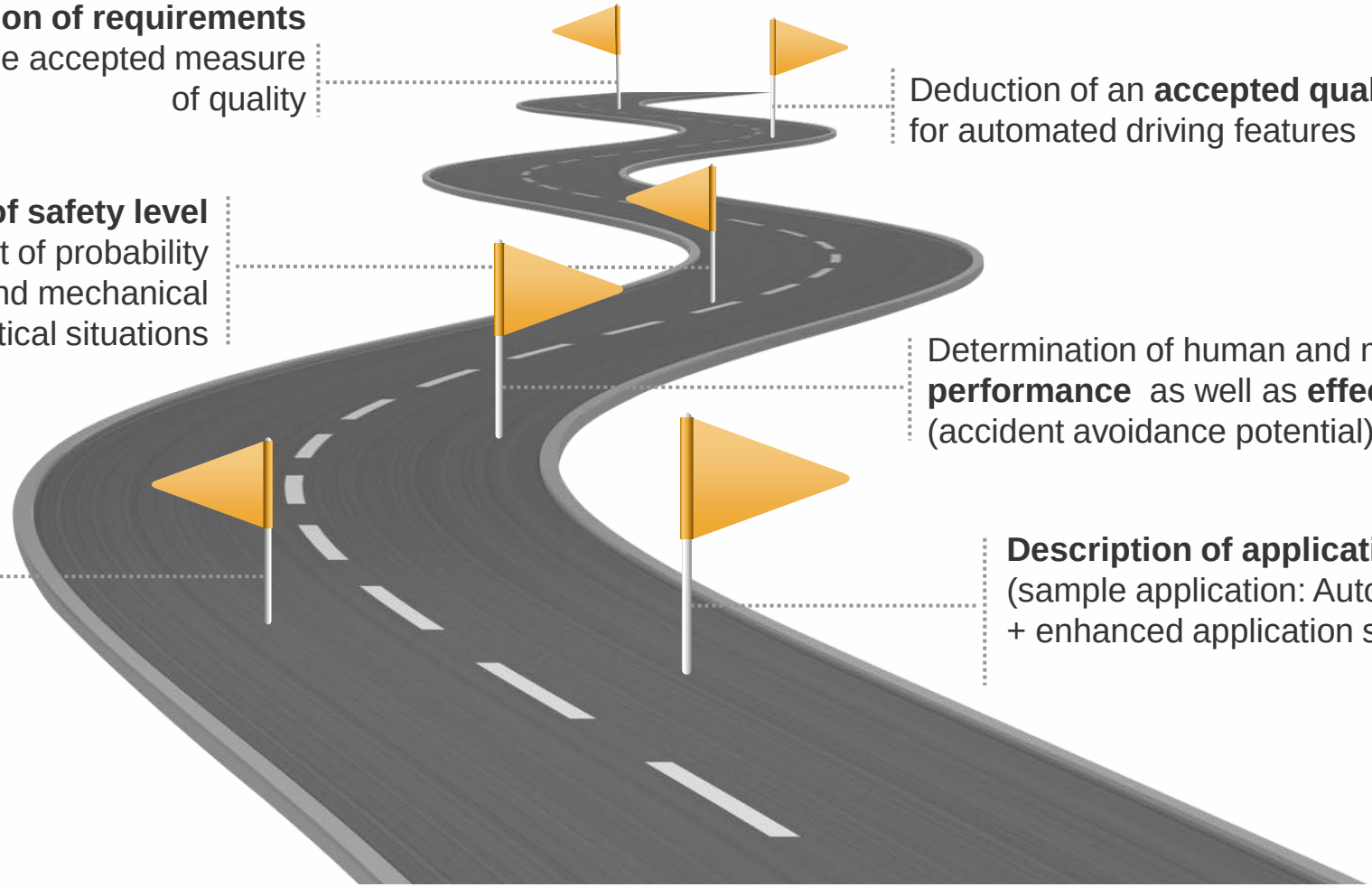
Deduction of an **accepted quality measure** for automated driving features

Determination of safety level
through assessment of probability of occurrence and mechanical manageability in critical situations

Determination of human and mechanical **performance** as well as **effectiveness** (accident avoidance potential)

Determination of critical **traffic situations**

Description of application scenario
(sample application: Autobahn-Chauffeur + enhanced application scenario)



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Implementation Process

Analysis

of modification needs of existing metrics and automobile series development processes

Transfer

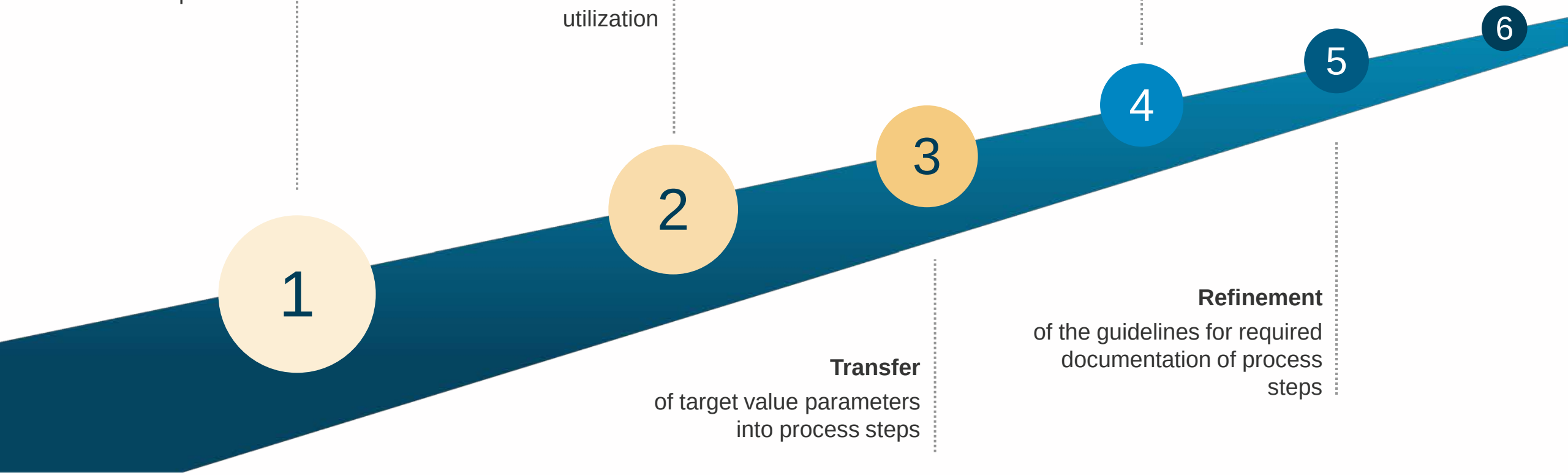
of systematic scenario guidelines into process steps in consideration of system classifications and levels of vehicle utilization

Preparation

of requirements definition for simulation, lab tests, proving ground and field coverage

Guidelines and Protocols

for the documentation of technological state-of-the-art compliance during the development process



Transfer

of target value parameters into process steps

Refinement

of the guidelines for required documentation of process steps

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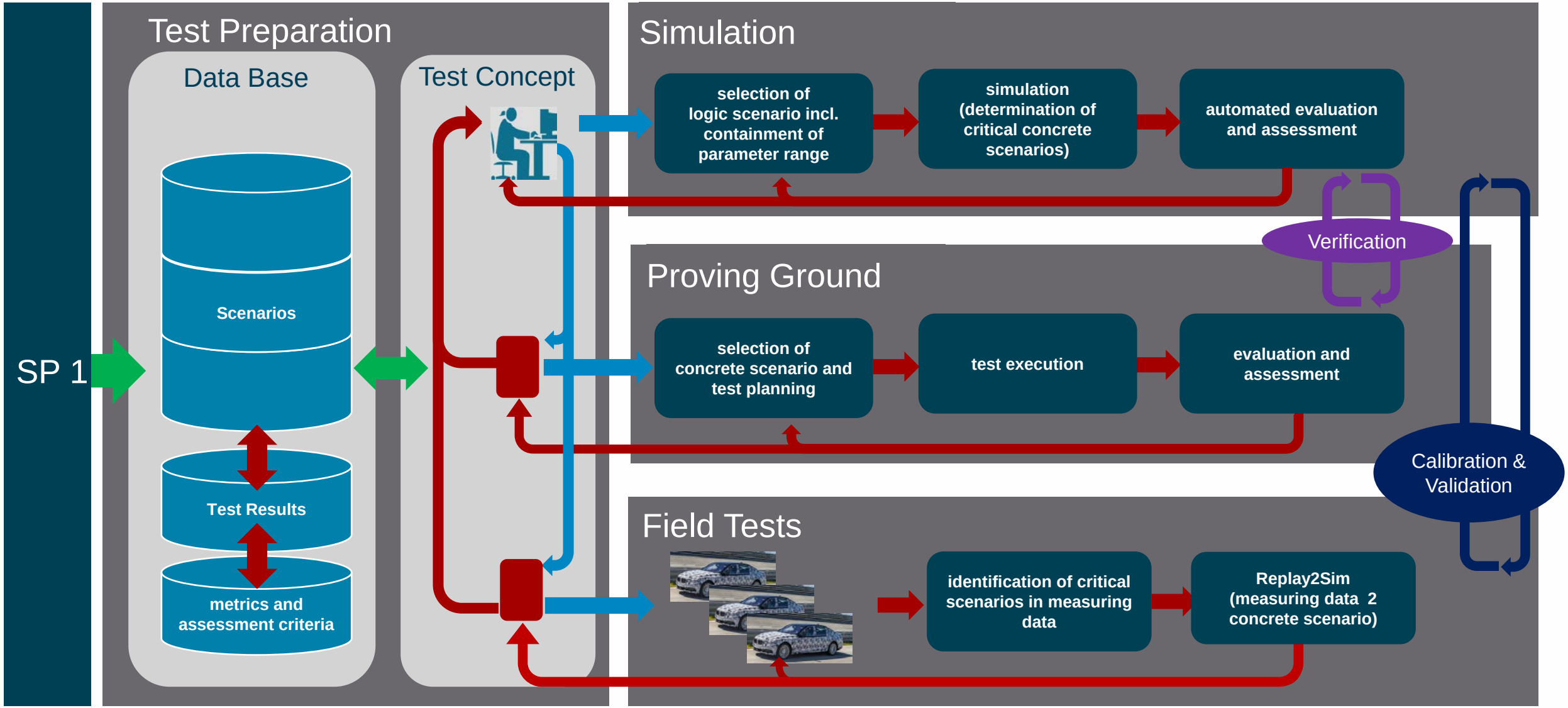
Testing

- What does a test strategy need to look like to cover the range of situations sufficiently?
- How can all safety relevant scenarios in the application scope of the function be ensured?
- How can we determine the functional limitations – and prove that we rule them?
- How can we verify and validate our test methods, test instances and test results?

Testing


SP 1
Test Preparation
Data Base
Scenarios
Test Results
metrics and assessment criteria
Test Concept
Simulation
selection of logic scenario incl. containment of parameter range
simulation (determination of critical concrete scenarios)
automated evaluation and assessment
Verification
Proving Ground
selection of concrete scenario and test planning
test execution
evaluation and assessment
Calibration & Validation
Field Tests
identification of critical scenarios in measuring data
Replay2Sim (measuring data 2 concrete scenario)

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Reflection of Results & Embedding

Statement

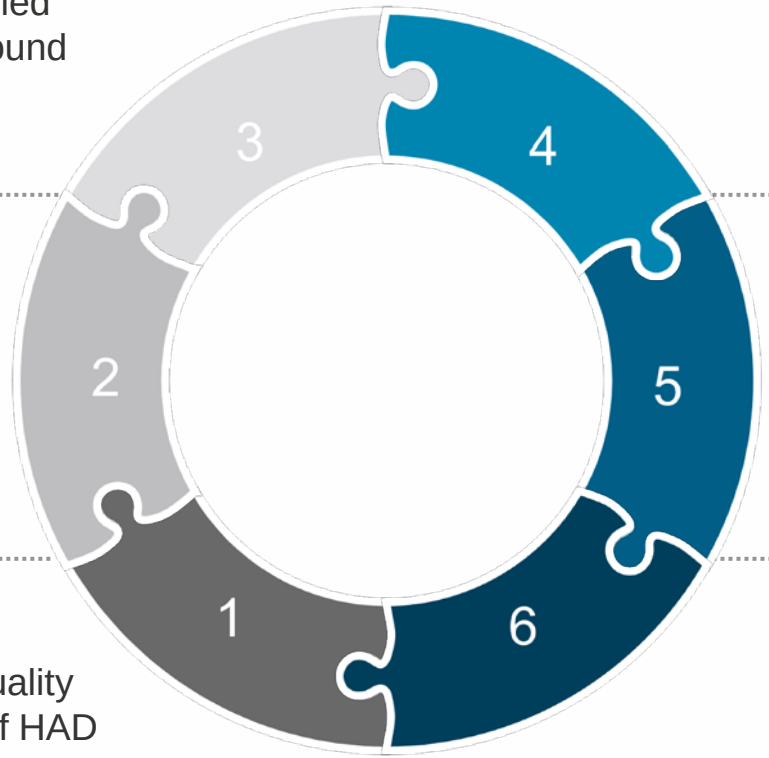
about the distribution ratio between the applied test methods (from simulation to proving ground to field test)

Assessment,

whether the test goal can be achieved with the utilized processes and methods in PEGASUS

Verification

of methods to identify relevant situations, quality and criticality measures for the assurance of HAD features



➔Proof of Concept

durch Verifikation (1), Bewertung (2) und Aussage (3)

Assistance

with embedding of acquired results with our project partners

Lessons learned

regarding the implementation of the results in existing corporate structures

PEGASUS

In close cooperation
the four PEGASUS-subprojects
developed the

Method for Assessment of Highly Automated Driving Function (HAD-F)

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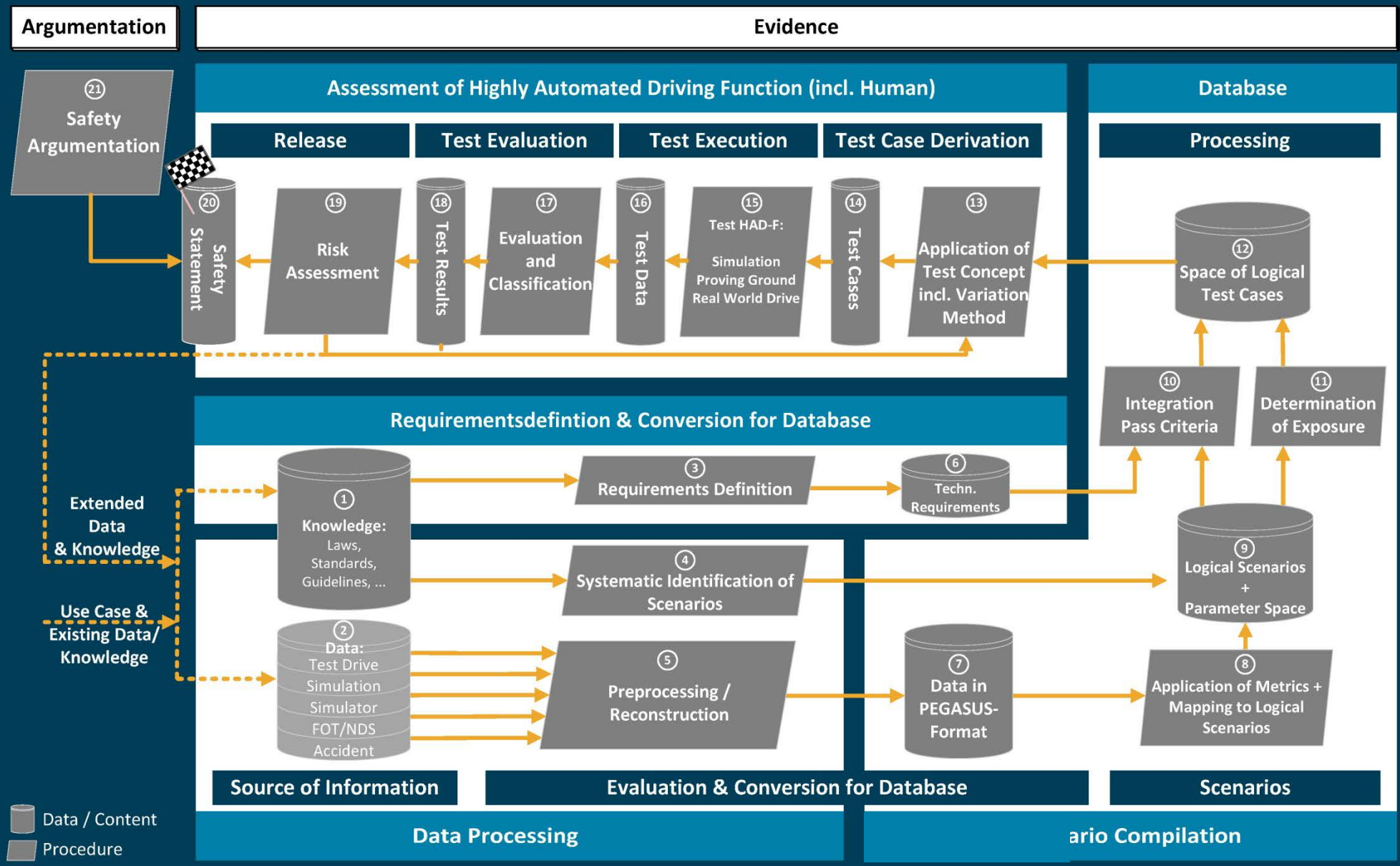
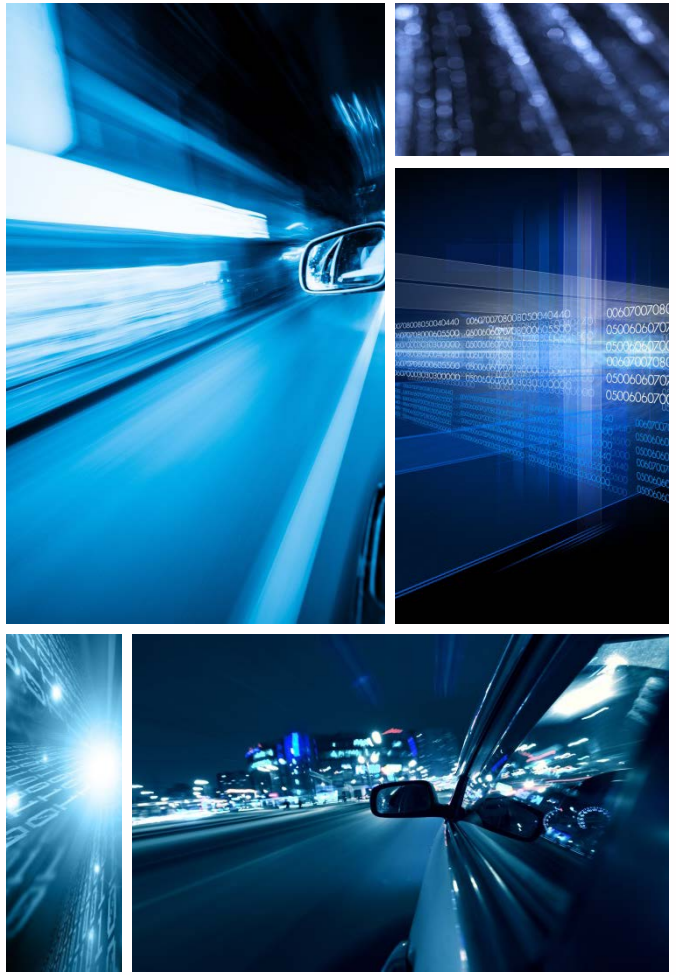


Summary / Selected Goals of the Project

- Development of a procedure for the determination of design criteria and establishment of quality measures.
- Considering the driver in regards to his abilities.
- Design of the development process for the release of highly automated vehicle systems.
- Conceptual design, assembly and demonstration of building blocks for an efficient toolchain for simulation, proving ground and field test.
- Embedding of findings in the industry.
- Distribution and pioneering of a standardization.

➔ All essential project results are freely accessible.



PEGASUS closes key gaps in the field of testing for highly automated driving functions

Prototypen

Labor / Testgelände

Produkte

Advancement through PEGASUS

…and prepares the way for introducing highly automated driving functions on the market!

current


PEGASUS