

GOAL – Booth No. 32

EMBEDDING PEGASUS RESULTS - OVERVIEW -

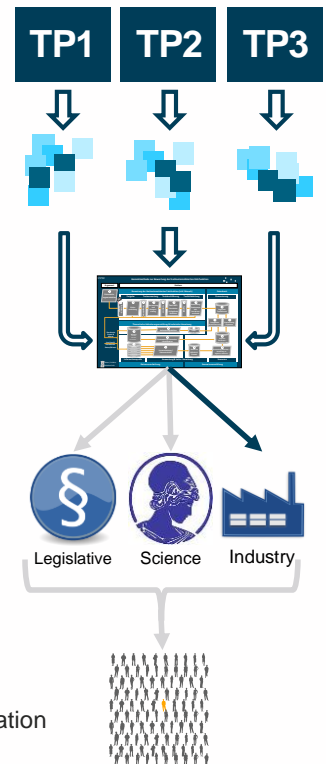


Objectives of PEGASUS Embedding Activities

The sub-projects of PEGASUS have generated several results, based on the individual work of the project partners. These results have been aligned, and combined via the PEGASUS method.

Nevertheless, legislation, science, as well as industry have existent processes, that require updates and adaptations, as discussed in TP2. To have these activities started as early as possible the embedding of PEGASUS results, is already started during the projects' lifetime.

The embedding of PEGASUS is an ongoing process. Our recommendation is to establish a community to set this as their Nr. 1 goal: embed and try to falsify existing and promote new proposals and thereby continuously improve the AD Verification & Validation approaches.



Approaches of Embedding Activities

- Embedding results to PEGASUS partner **companies**
 - PEGASUS defined embedding elements and two dimensions for evaluation
 - The companies are requested to embed and evaluate the results
 - The feedback of the companies is collected reported to the project partner

Einbettungselement	Einbettungsdimension	Einbettungselement	Einbettungsdimension	Einbettungselement	Einbettungsdimension
...

Technische Einsetzbarkeit
 wird bereits eingesetzt (Bitte kommentieren)
 wird bereits mit Anpassungen eingesetzt (Kommentar notwendig)
 ist potentiell (unerschöpfbar) einsetzbar (Bitte kommentieren)
 ist potentiell mit Anpassungen einsetzbar (Kommentar notwendig)
 ist nicht einsetzbar (Kommentar notwendig)
 eine Bewertung konnte nicht stattfinden (Kommentar notwendig)

Akzeptanz
 ist ein sinnvoller Ansatz (Bitte kommentieren)
 ist ein sinnvoller Ansatz mit Anpassungen (Kommentar notwendig)
 ist nicht sinnvoll (Kommentar notwendig)
 eine Bewertung konnte nicht stattfinden (Kommentar notwendig)

- Handing over PEGASUS results to upcoming **research** projects
 - SetLevel4to5 → see next slides
 - V&V Methods → see next slides
 - Other projects are welcome for further elaboration on PEGASUS results
- Proposing results of PEGASUS for **legislative** Activities → See Poster 31



Supported by:



on the basis of a decision by the German Bundestag

GOAL – Booth No. 32

EMBEDDING PEGASUS RESULTS - INDUSTRY -



Example of embedding

What can be learnt from the embedding of elements: *open drive and open scenario*

Example embedding of OpenX Standards: e.g. scenario for simulation and proving ground tests

How it is used during the project?

In "Development-accompanying proving ground testing" the test method is classified in the PEGASUS framework, and described on a high level.

A mapping of OpenDrive coordinates system to target coordinates on a proving ground is performed.

The calculation of a reference motion path is made for each lane. Lane offsets in intersection areas must be considered (OpenDrive modeling guidelines).

A generation of vehicle trajectories from OpenX formats is used.

Simulation results

In this case the "driver model" of a OpenScenario simulation tool has effects on vehicle movement (cornering, lane change behavior)

In addition the performance of a simulation depends heavily on the modeling of OpenDrive (i.e. difficulties at intersections).

Therefore, recorded vehicle movements from simulation, as input data for proving ground tests are seen as unsuitable. A different methodology for those is necessary.

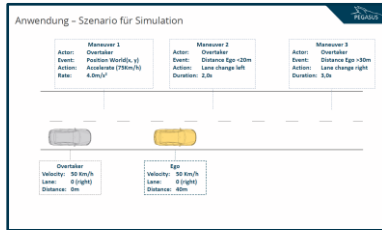
An example for this is shown in TP3 in stand nr. 23.

The above evaluation, was documented in the given „excel“, refer to table in picture nr. 3, For the whole of the embedding elements listing, an internal reflection was made, as to their adequacy of integration in the company internal methodology, this as well was documented in the given format.

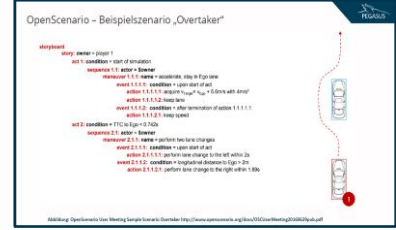
References: Aaron Heinz Audi AG, „PEGASUS-OpenX-Trajektorienengenerierung_Audi.pdf“, Pegasus Projekt, September 2018
 Dr. Ing. K.-H. Siedersberger, „2019_04-02_PEGASUS_Ergebnisreflexion_Audi.pptx“, Pegasus Projekt, April 2019

AP	Name des Einbettungselementes	PEGASUS Ansprechpartner	Typ	Format	Einbettung in ...	Hauptartefakt
AP13	OpenDrive und OpenScenario als Simulationstool der Simulationstests	Jan Schumann, Michael Albrecht, Schumann (SBA)	Simulation	Excel	Gesamtszenario/Geplantes/Proben/Geplantes/Geplantes	Sicherheitskennzeichnung (optional)
					Kapitel 3.5.3.1	Link: „Kernliste OpenDrive-Elemente“

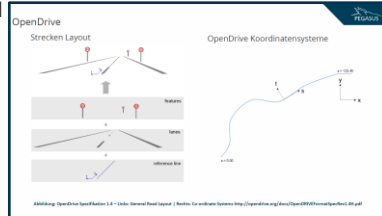
Picture 3. elements AP 3.2



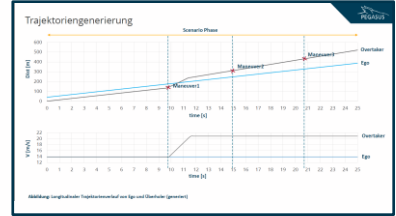
Picture 4. open scenario for simulation



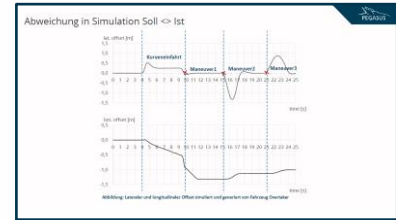
Picture 5. open scenario „Overtaker“



Picture 6. open drive „route layout / coordinate system



Picture 7. Trajectory generation



Picture 8. Deviation in simulation from actual vs. target



Supported by:



on the basis of a decision by the German Bundestag

GOAL – Booth No. 32

EMBEDDING PEGASUS RESULTS - SCIENCE -



VVMethoden



TARGET / FRAME

VVM develops the methodology for verification and validation of SAE Level 4 and 5 automation in an urban environment. VVM is an evolution of the PEGASUS project.

48 months

July 1, 2019 – June 30, 2023

23 partners

- OEM: BMW (lead), Audi, Daimler, Ford, Opel, Volkswagen
- Tier 1: Bosch (lead), Continental Teves, Visteon, ZF, Valeo
- Other industry: AVL, PROSTEP, DSPACE, TÜV-SÜD, (sub: understand.ai)
- Certification: TÜV-SÜD, BAST
- Scientific institutes: DLR, Fraunhofer, FZI, OFFIS, RWTH Aachen, TUBraunschweig, TUDarmstadt, OFFIS



VVM is part of the VDA Leitinitiative in the cluster “Verification and Validation of autonomous systems”



Supported by:



on the basis of a decision by the German Bundestag

GOAL – Booth No. 32

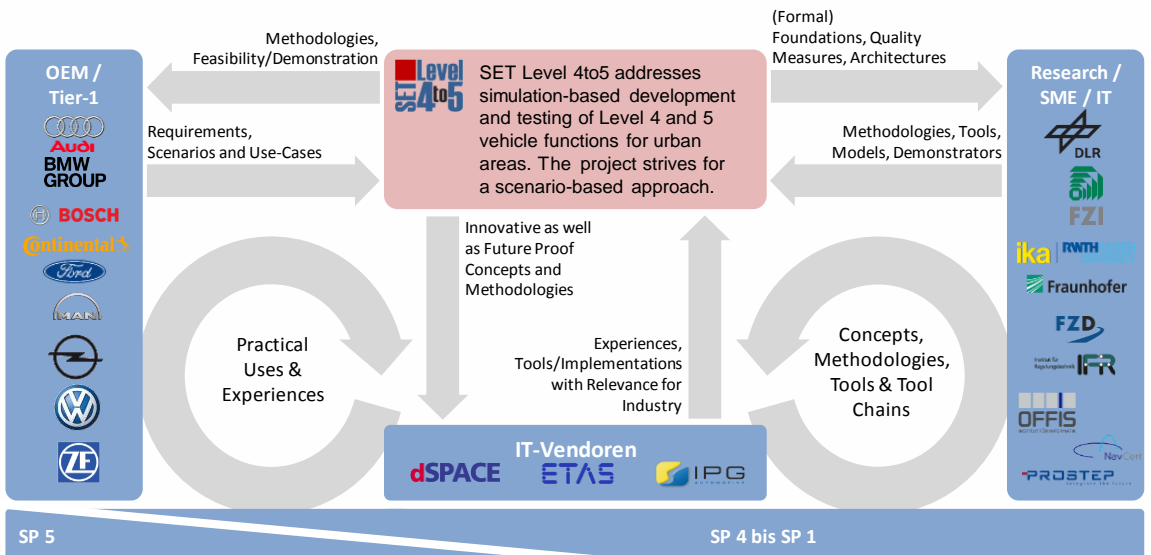
EMBEDDING PEGASUS RESULTS - SCIENCE -



SETLevel4to5



TARGET / FRAME



42 months

March 01st 2019 – August 31st 2022

23 partners

OEM: Audi, BMW, Ford, MAN, Opel, Volkswagen
 Tier 1: ADC, Bosch, ZF
 SME: IPG, PROSTEP
 IT: ETAS, dSpace
 Scientific institutes : DLR, FZD, LBF, FZI, OFFIS, Ika, IfR



Supported by:



on the basis of a decision by the German Bundestag