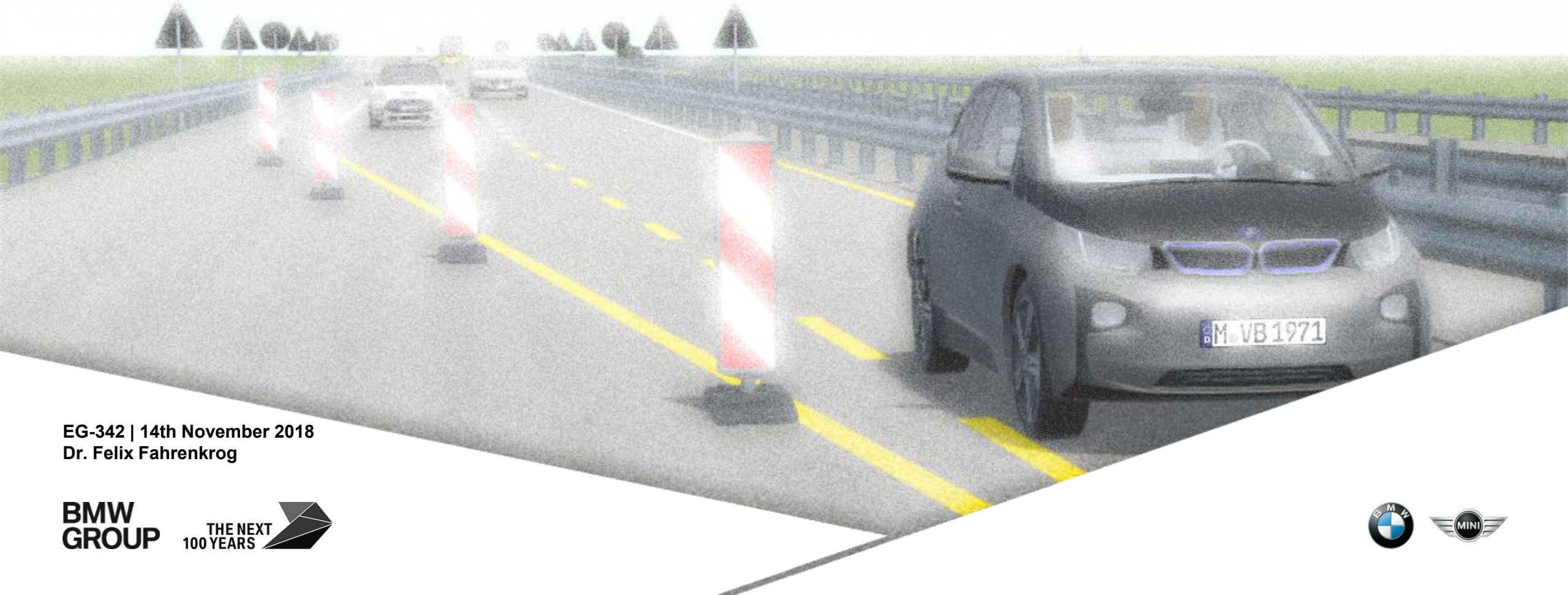
IMPACT ASSESSMENT FOR AUTOMATED DRIVING

SIP-ADUS WORKSHOP 2018

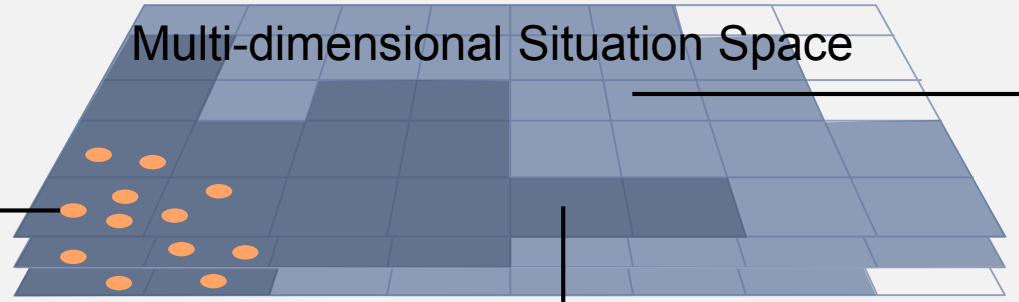


EG-342 | 14th November 2018
Dr. Felix Fahrenkrog

BMW GROUP THE NEXT 100 YEARS

TRAFFIC, ACCIDENTS AND TRAFFIC SAFETY. METHODS FOR SAFETY EVALUATION.

Traffic Situations



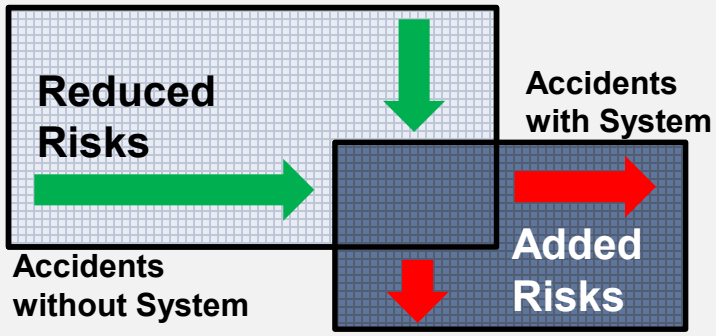
Tools

Test Track / Simulator

Field Test

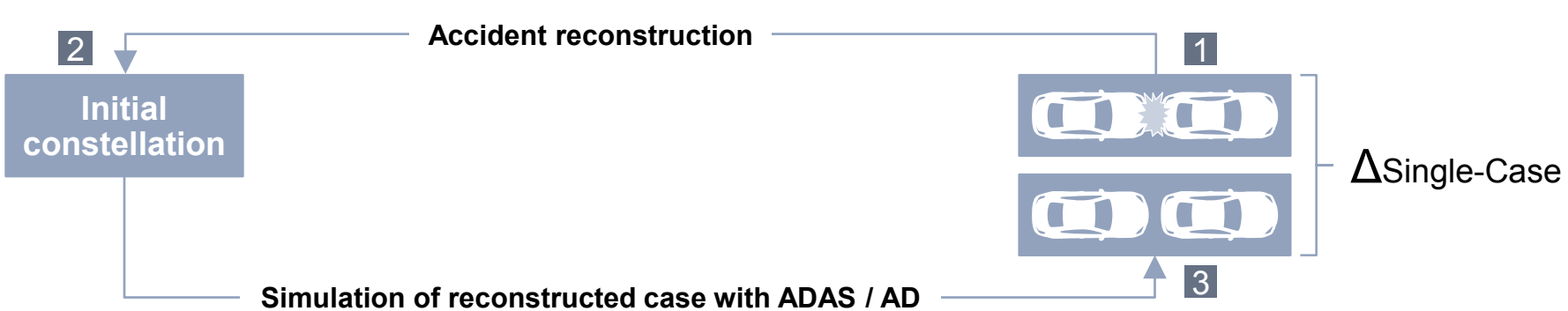
Simulation

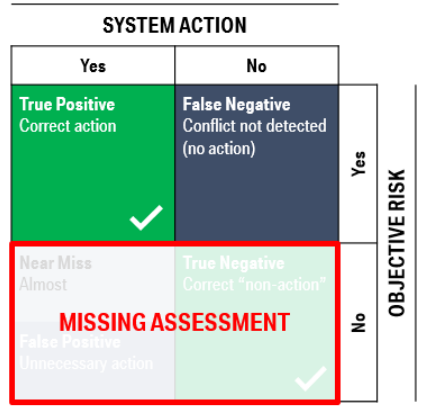
Safety Evaluation



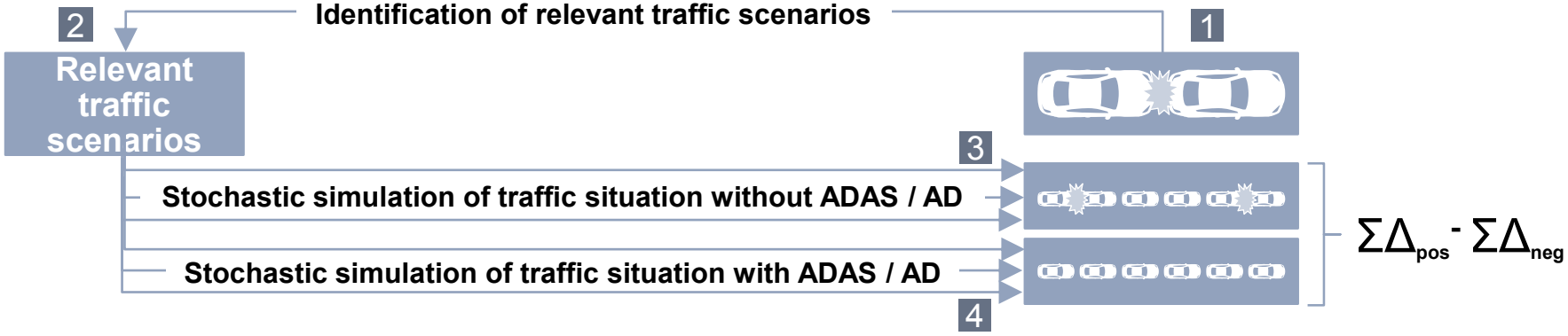
IMPACT ASSESSMENT.
METHODOLOGY - ACCIDENT- VS. TRAFFIC-BASED APPROACH.

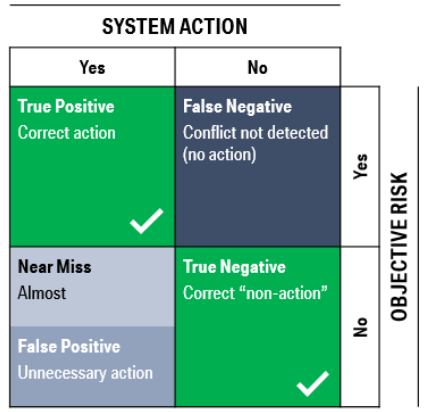
1) Accident-based





2) Traffic-based





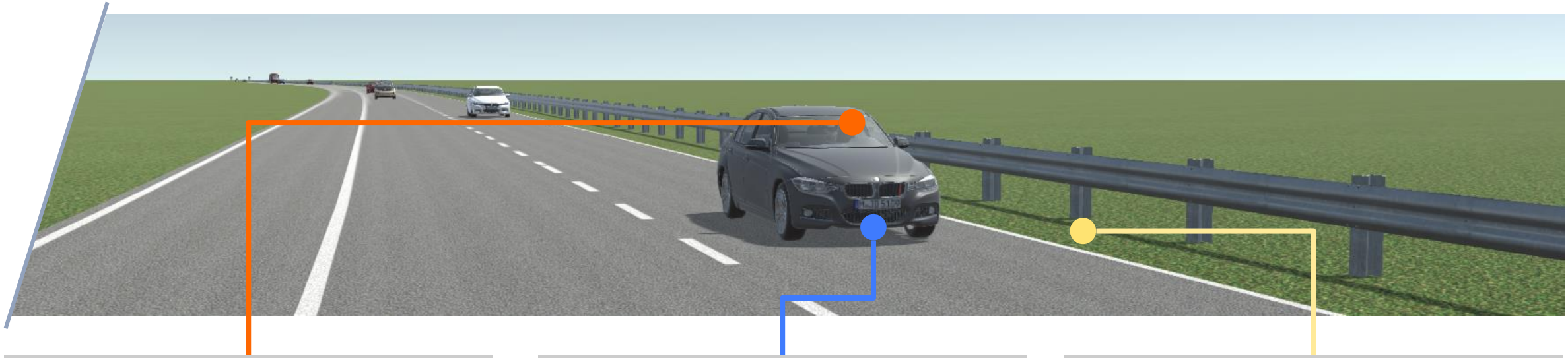
TRAFFIC, ACCIDENTS AND TRAFFIC SAFETY. RESEARCH & HARMONIZATION EFFORTS IN SAFETY EVALUATION.

	Assessment Tools & Data	FOT & Data	Impact Assess-ment Method	Impact Assess-ment Tool
Objective	Analyse test tools for (the validation of) automated driving functions. Provide a common set of relevant situations (→ database).	Test of automated driving function on public roads. Collect data with the automated driving (AD) function.	Harmonize / standardize methods for prospective safety performance assessment by virtual simulation of ADAS & AD in order to overcome the issue of variety.	Provide a transparent software platform that enables the simulation of traffic situations to predict the real-world effectiveness of ADAS and AD.
Harmonization Activity	PEGASUS HAF	L3Pilot Driving Automation	PEARS	openPASS
Research Activities	AdaptIVe	Ko-HAF KOOPERATIVES HOCHAUTOMATISIERTES FAHREN	MeBeSafe	PROSPECT Pedestrians and Cyclists	MUSE	SAFIR

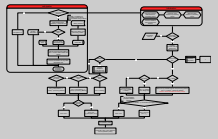
IMPACT ASSESSMENT. METHODOLOGY - P.E.A.R.S.

- Representative assessment of **active safety and automated driving** requires **harmonized methods**.
- For simulation: **methods, processes,** and **models** for prospective assessment have to be **harmonized**.
- P.E.A.R.S. is an open working platform to **create of a worldwide standard** for the **evaluation of systems within the pre-crash phase**.
  - WG A “Method, Models and Effectiveness Calculation”
  - WG B “Round Robin Simulation”
  - WG C “Data and Validation & Verification”
  - WG D “ISO and External Communication”
- ISO Technical Report 21934-1: ”**Road vehicles — Prospective safety performance assessment of pre-crash technology by virtual simulation -- Part 1: State-of-the-art and general method overview**“

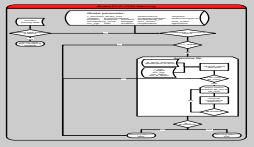
IMPACT ASSESSMENT.
VIRTUAL ASSESSMENT.

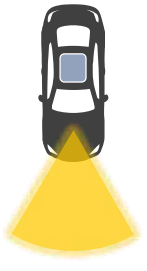


Driver Behaviour Model

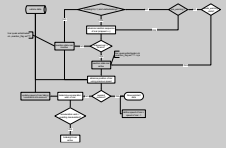


Vehicle and Function Model





Scenario Model



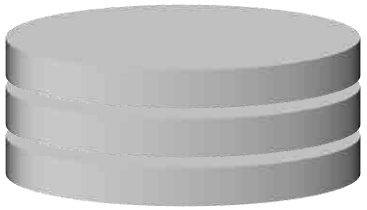
IMPACT ASSESSMENT.
VIRTUAL ASSESSMENT - SIMULATION FRAMEWORK OPENPASS.

- OpenPASS is a **new software framework** for simulation and evaluation of ADAS and automated driving
  - **Join initiative** of OEMs (Daimler, VW, Toyota and BMW), Suppliers (Bosch) and other partners (TÜV Süd, itk) with scope of harmonization of simulation tools
- **Realistic traffic models and simulation** → investigate interaction between different traffic participants
- **Fast and efficient simulation** → consider a high number of situations
- **Open source approach** → generate trust and acceptance by authorities and public
  (**Eclipse project: sim@OpenPASS**)

openPASS

IMPACT ASSESSMENT.
IDENTIFICATION OF TOP-SCENARIOS FOR AUTOMATED DRIVING.

A

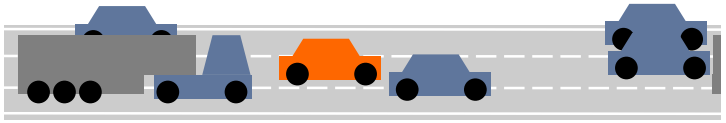


Accident data (e.g. GIDAS) /
Critical situations (FOT)

B

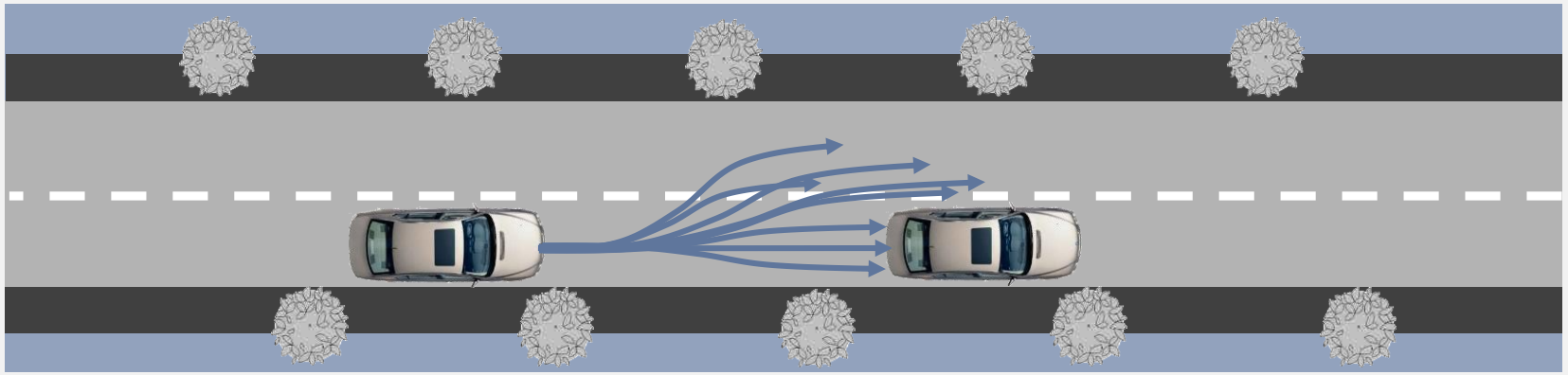
Based on specification
of function

C



Virtual FOT → Relevant Scenarios

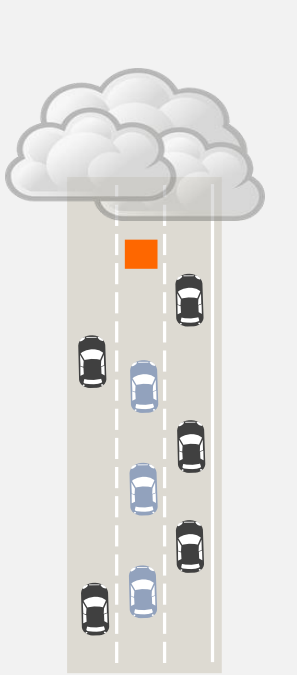
Top Scenarios



Simulation of traffic scenarios

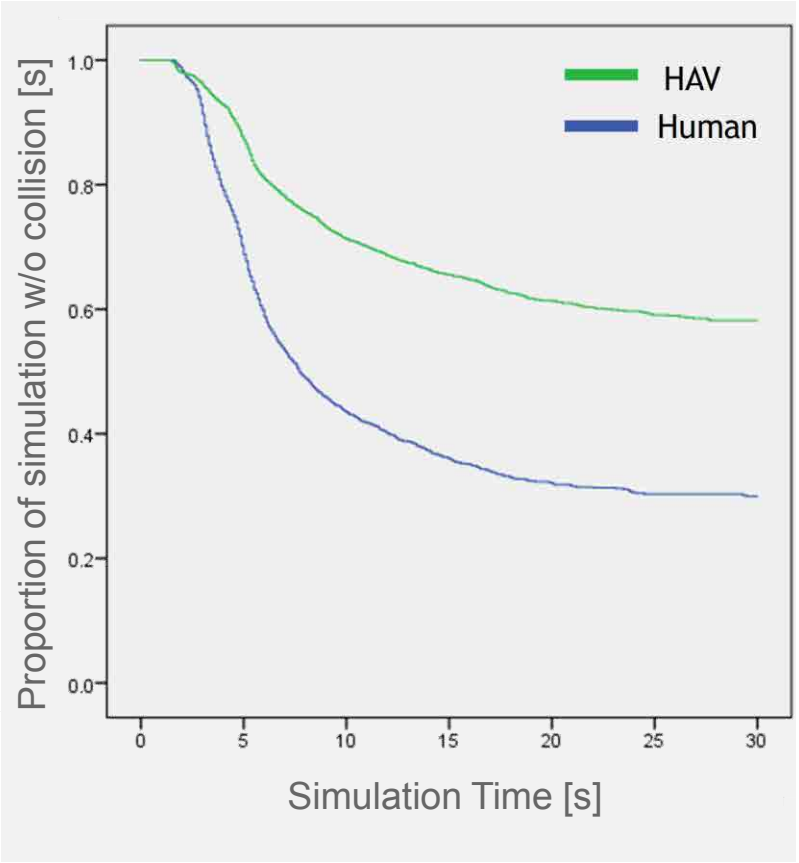
RESULTS FROM EU RESEARCH PROJECT ADAPTIVE. OBSTACLE IN THE LANE.

Obstacle in the lane

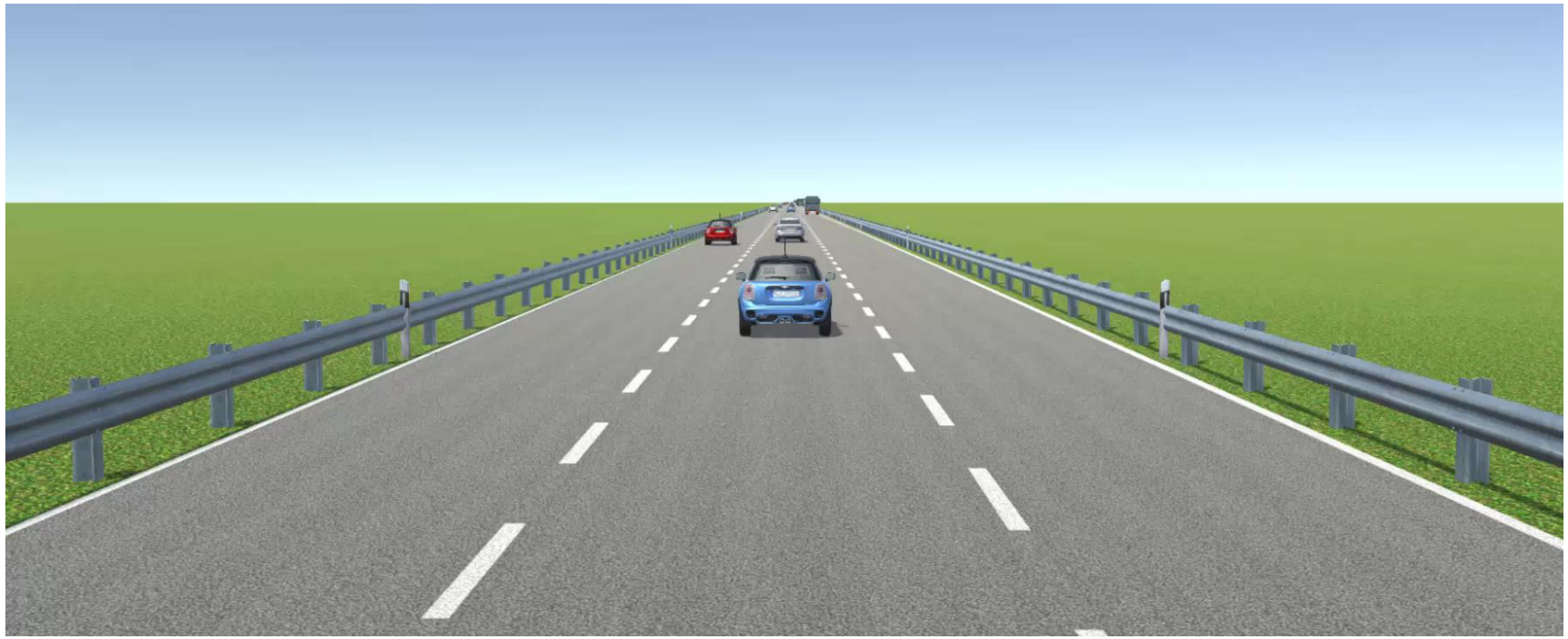


Scenario Conditions		Probability of remaining crash-free [-]			
Parameter	Value	SCM Driver	ADF	Delta (absolute)	Delta (relative)
Overall	-	29.9%	58.2%	-28.3%	-48,6%
Traffic volume	900 veh./h	30.9%	61.6%	-30.5%	-49,8%
	1200 veh./h	28.9%	54.8%	-25.9%	-47,3%

The survival function



RESULTS FROM RESEARCH PROJECT KO-HAF. “MINIMUM RISK MANOEUVRE”.

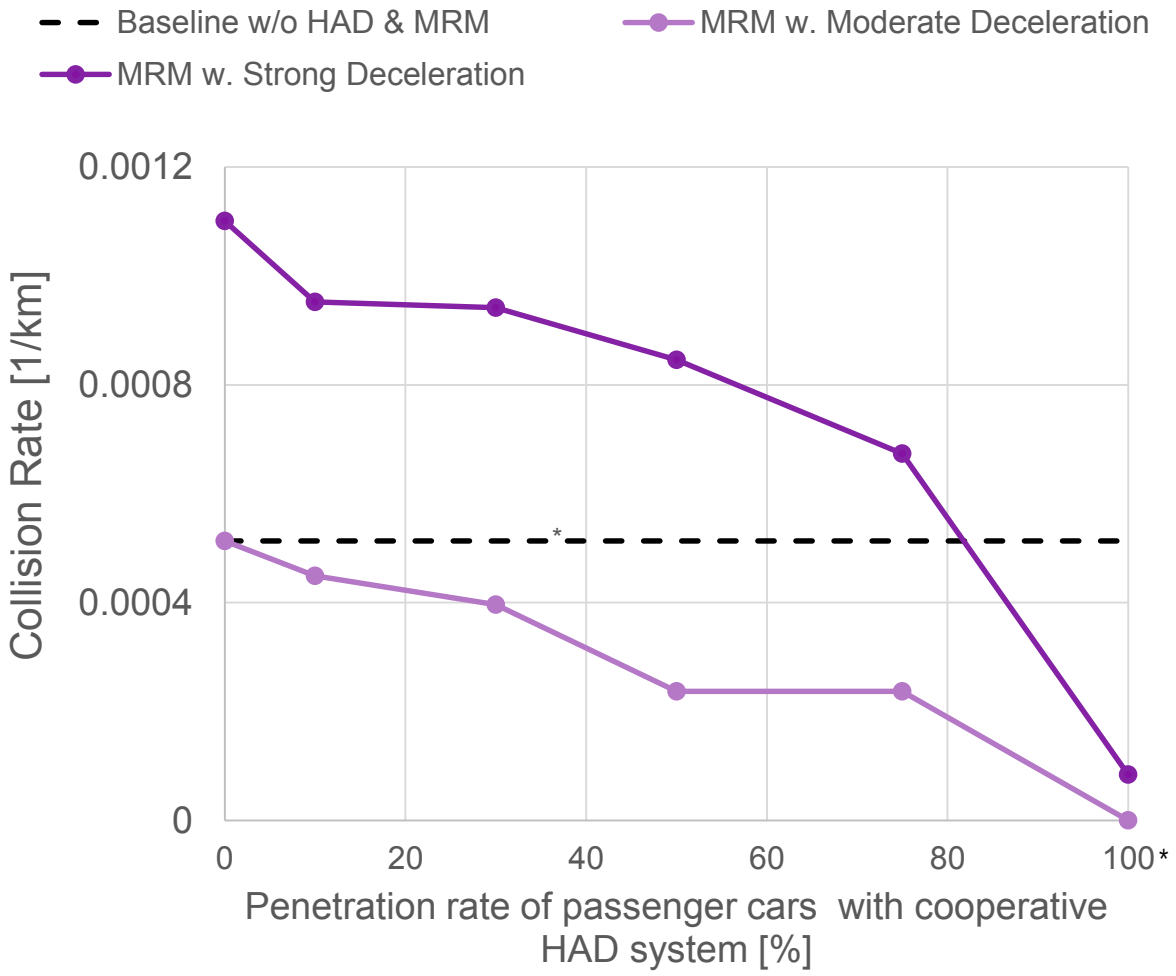


– Analyse the consequences of two artificial Minimum Risk Manoeuvre (MRM) that consider only braking in the lane (moderate braking vs. strong braking).
– The effect of the MRM was simulated for 13 conditional variations in partial factorial design considering the following parameters: speed limit, traffic density and penetration rate of cooperative automated vehicles.

RESULTS FROM RESEARCH PROJECT KO-HAF. “MINIMUM RISK MANOEUVRE”.

– A lower deceleration while the MRM seems to be beneficial in terms of traffic safety benefits, however it requires a longer operation of the system.

– V2V communication shows a benefits in the simulation, however larger effects are observed at high penetration rates (>75 %).

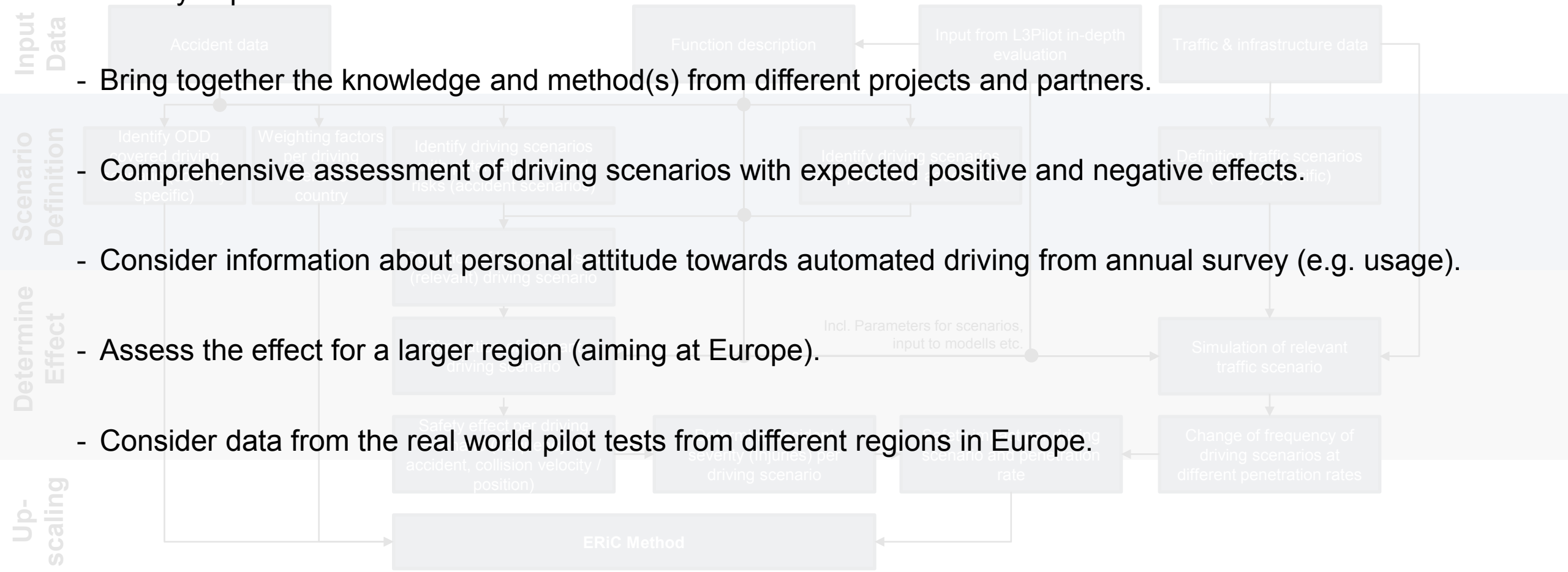


*: The case with 100% penetration rate of the passenger cars with a cooperative HAD represents a pure theoretic case that is not realistic.

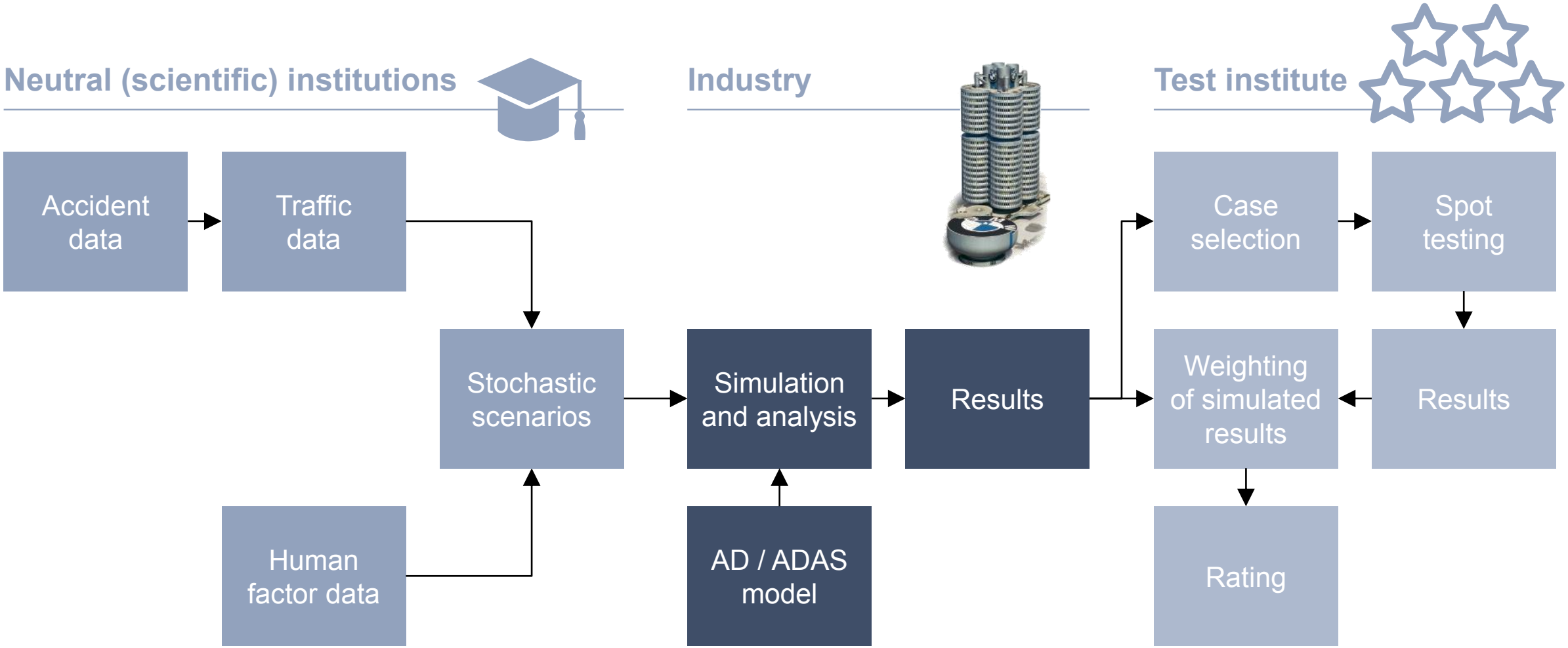
OUTLOOK: SAFETY IMPACT ASSESSMENT IN L3PILOT:

The safety impact assessment in L3Pilot aims at:

- Bring together the knowledge and method(s) from different projects and partners.
- Comprehensive assessment of driving scenarios with expected positive and negative effects.
- Consider information about personal attitude towards automated driving from annual survey (e.g. usage).
- Assess the effect for a larger region (aiming at Europe).
- Consider data from the real world pilot tests from different regions in Europe.



PROCESS AND ROLES.
VISION OF ACTIVE SAFETY EVALUATION.



THANK YOU