25TH ITS WORLD CONGRESS
COPENHAGEN
17 – 21 SEPTEMBER 2018
Quality of life

EVALUATION METHODOLOGY OF AUTOMATED DRIVING

Hendrik Weber M.Sc., Christian Rösener M.Sc.,
Univ.-Prof. Dr.-Ing. Lutz Eckstein, Dr.-Ing. Adrian Zlocki

ika Institute for Automotive Engineering | RWTH AACHEN UNIVERSITY

Copenhagen, 19. 09 2018

MOTIVATION
PUBLIC VIEW ON AUTOMATED DRIVING

- **Current Challenges and Research Activities for the Introduction of Automated Driving**

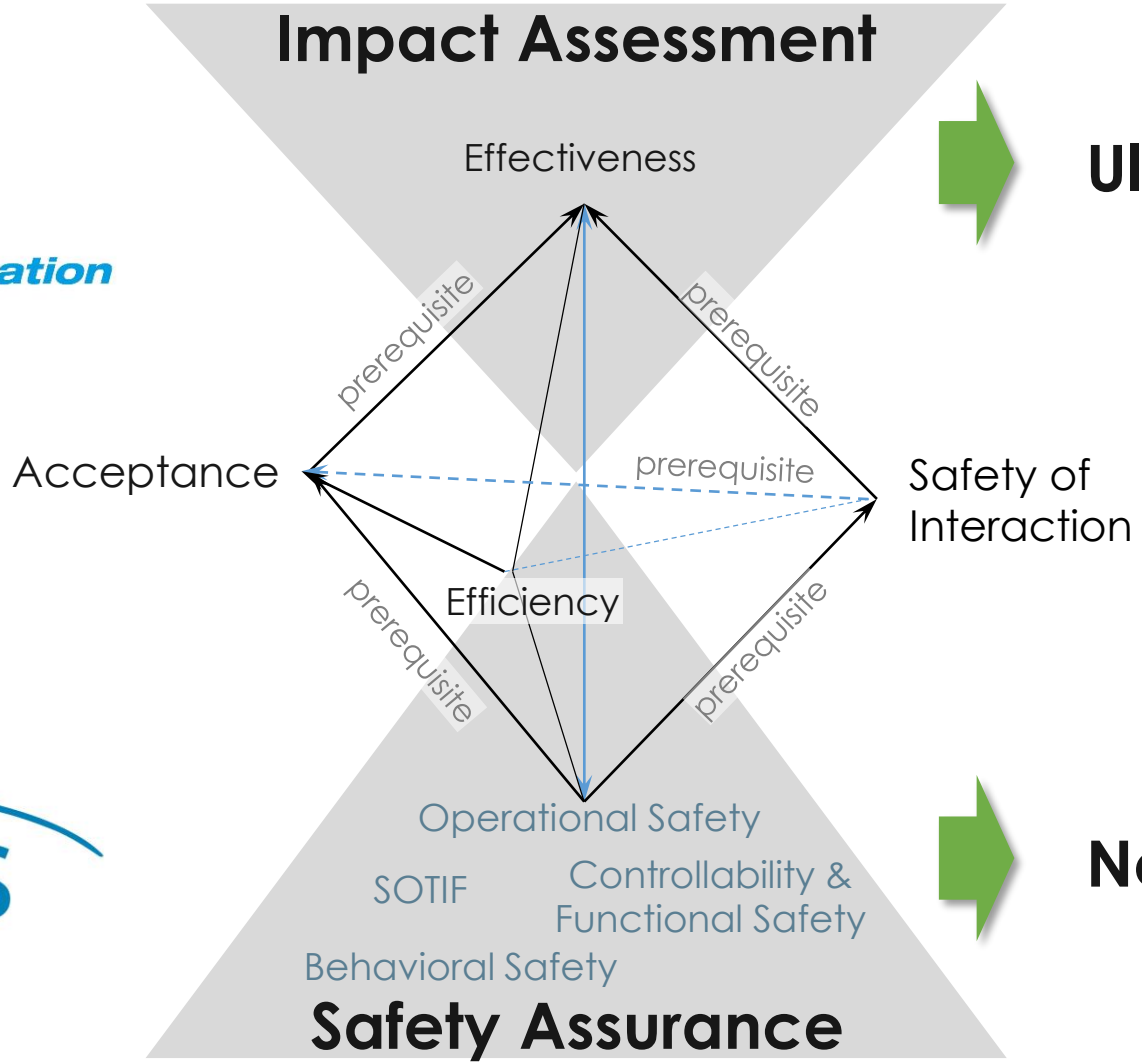
1. **What is the <u>safety</u> <u>level</u> of automated driving?**
   → Safety Impact Assessment

2. **How is <u>safety</u> of automated driving <u>assured</u>?**
   → Safety Assurance Methodology

EVALUATION METHODOLOGY
DIMENSIONS FOR LEVEL 3 VEHICLE AUTOMATION

L3Pilot Driving Automation

PEGASUS



Ultimate Design Goal

Necessary Prerequisite


1,000
drivers
100
cars
10
countries
L3Pilot
Driving Automation
→ Field Data Collection

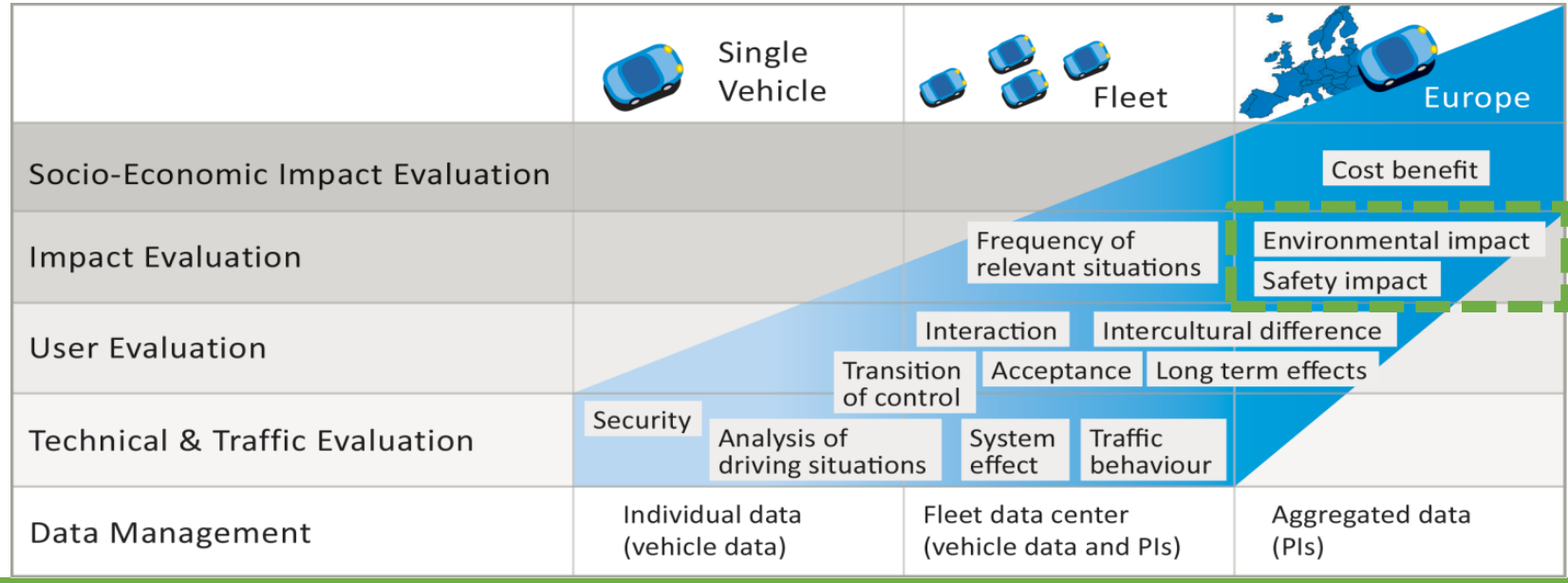
IMPACT ASSESSMENT
EVALUATION SCOPE IN L3PILOT

25TH ITS WORLD CONGRESS COPENHAGEN 17 – 21 SEPTEMBER 2018 Quality of life

- Overall evaluation of automated driving function with respect to the influence on technical, user & acceptance and driving & travel behavior aspects
- Assessment of long-term effects of automated driving on user attitudes and acceptance
- Assessment of the readiness and reliability of automated driving functions

L3Pilot Driving Automation

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 723051.



Research project PEGASUS

Database of relevant scenarios as a tool for safety assurance of automated driving

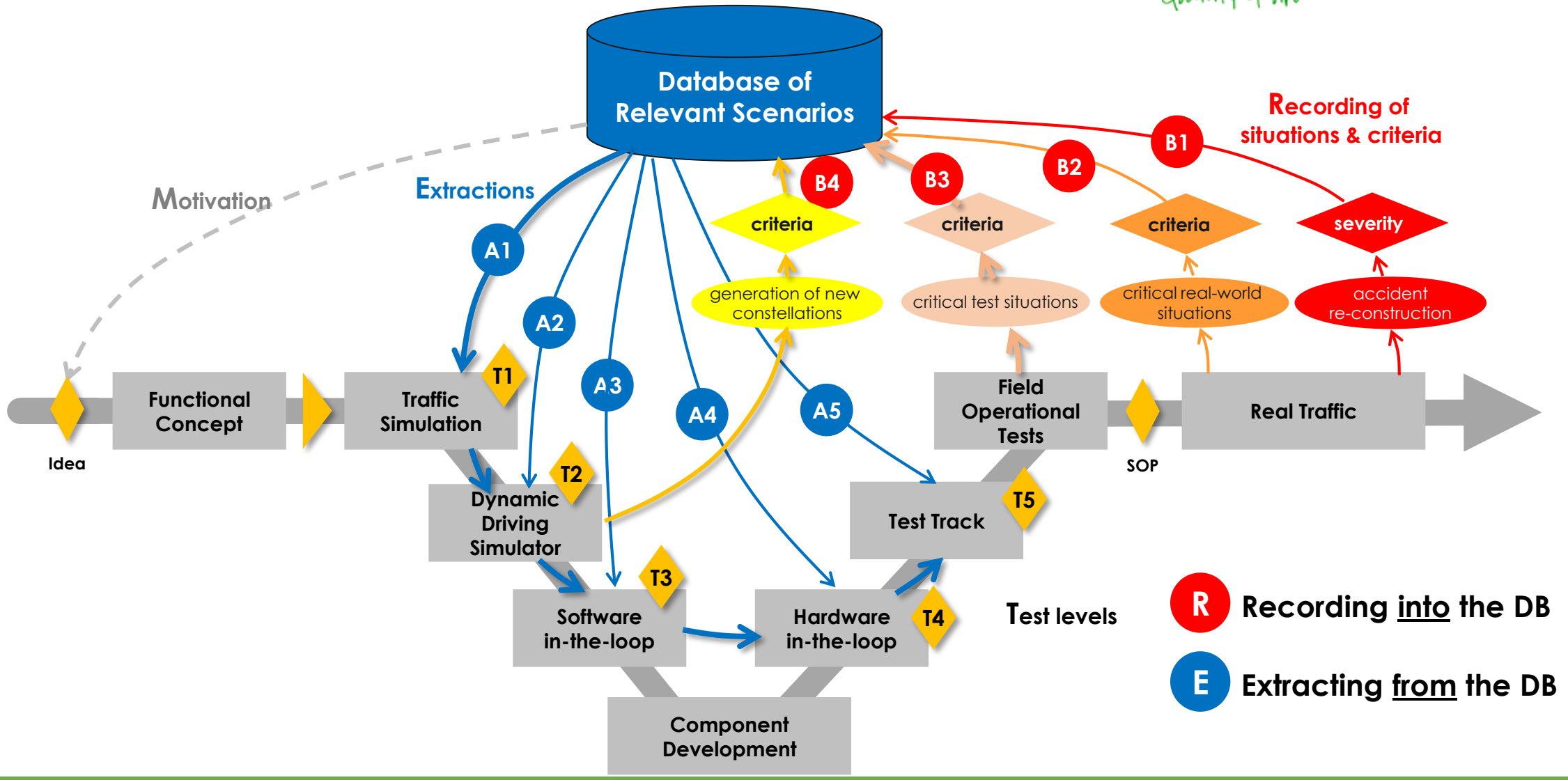
PEGASUS

Supported by:

Federal Ministry
for Economic Affairs
and Energy

on the basis of a decision
by the German Bundestag

VALIDATION OF AUTOMATED DRIVING
PROPOSAL FOR VALIDATION METHODOLOGY

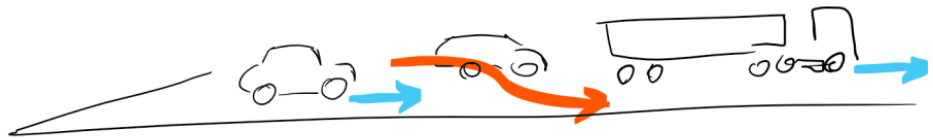


STORING THE SCENARIOS
LAYER MODEL

Layer 5

Environment conditions (L5)
- Influence on properties of other levels

Layer 4

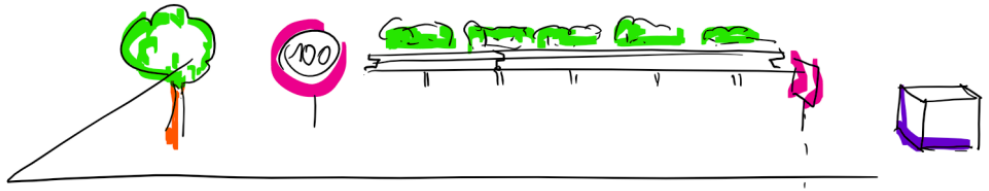


Movable objects (L4)
- Interactions
- Maneuvers

Layer 3

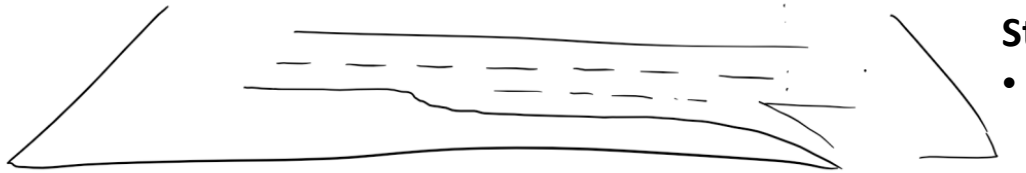
Temporal modifications L1 and L2 (L3)
- Geometry and topology overlay
- Time dependent < 1 day

Layer 2



Traffic infrastructure (L2)
- Construction barriers
- Signs, traffic guidance

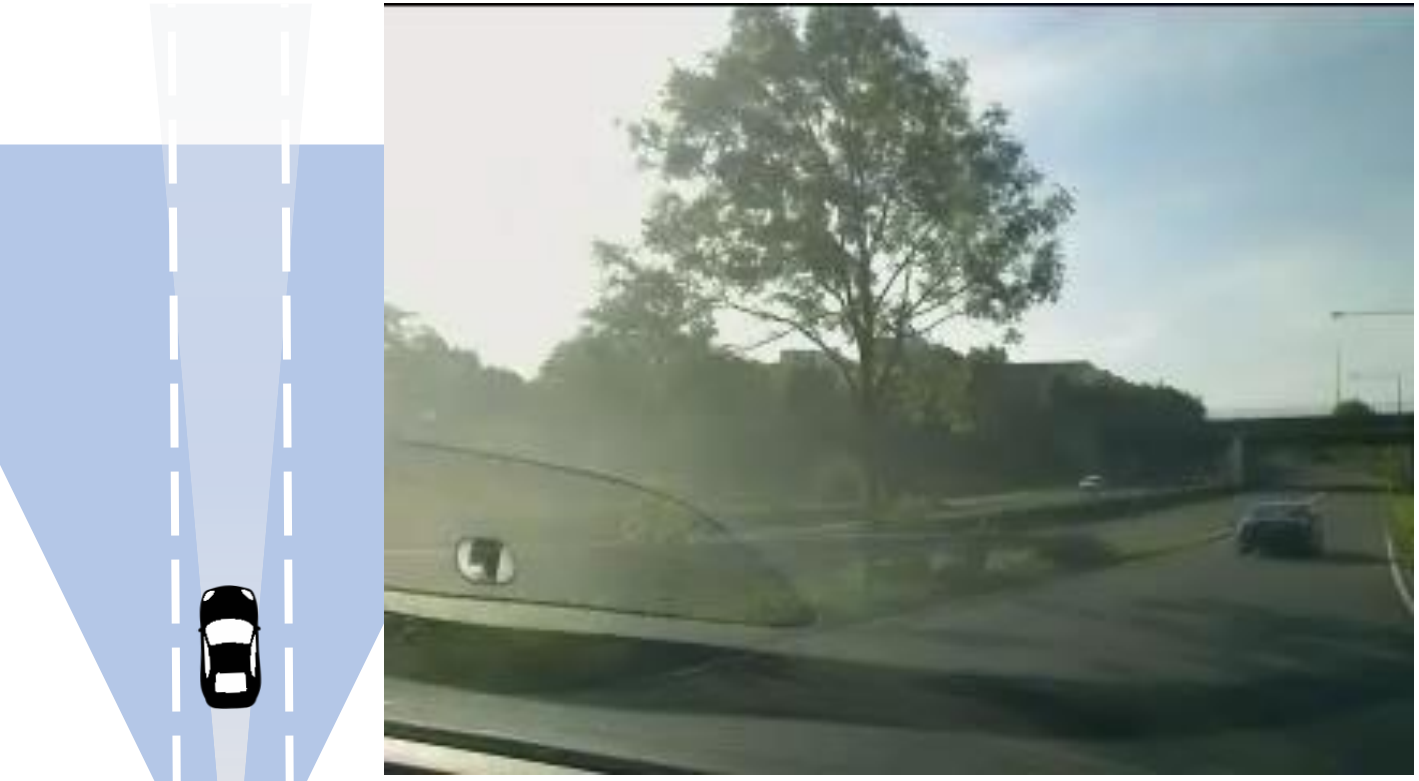
Layer 1



Street level (L1)
- Geometry

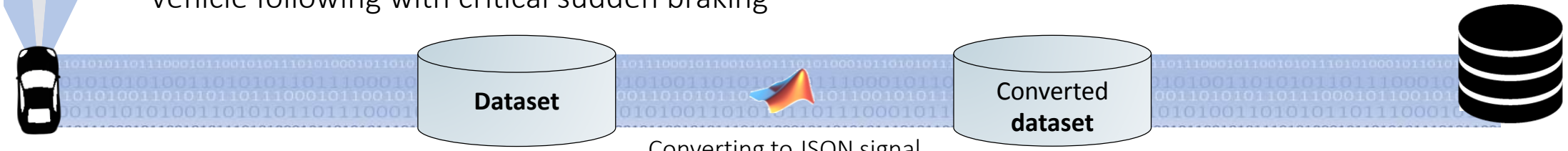
Source:
Gerrit Bagschik, Till Menzel and Markus Maurer, 2018
Ontology based Scene Creation for the Development of Automated Vehicles

PROCESS TO UPLOAD DATA INTO THE DATABASE



Vehicle following with critical sudden braking

- ✔ Signals according to JSON definitions
- ✔ Minimum requirements on dataset
- ✔ Format: Mat or HDF5



SAFETY ASSURANCE OF AUTOMATED DRIVING

EXAMPLE: TESTING A CONCRETE SCENARIO IN SIMULATION

- Extraction of concrete scenario from database
- The selected concrete scenario can be reproduced in the simulation.
  A HAD-function integrated in the simulation can be tested
- Here: Vehicle following with sudden critical breaking maneuver (from input data example)

SUMMARY

- Prospective safety **impact assessment** for automated driving requires new methodologies
  - Current research activities start data collection for safety impact assessment

- **Safety assurance** also requires new methodologies
  - Scenario based data base approach is under research within different international projects

THANK YOU FOR YOUR ATTENTION!

Hendrik Weber

Institute for Automotive Engineering (ika)
RWTH Aachen University
Steinbachstr. 7
52074 Aachen
Germany

Phone +49 241 80 25711
Email hendrik.weber@ika.rwth-aachen.de
Internet www.ika.rwth-aachen.de

QUESTIONS?