



CARISSMA

Automotive Safety Research

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*Center of Automotive Research on Integrated Safety Systems and
Measurement Area*

Thomas Hempen
Prof. Dr. Werner Huber

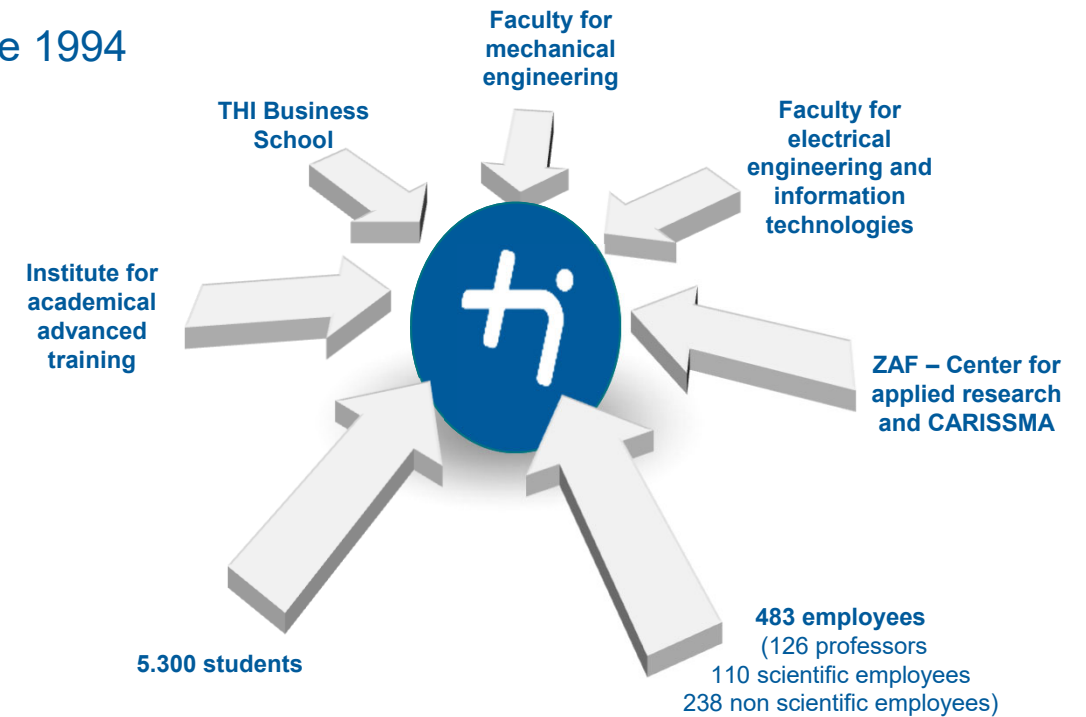
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THI – Technische Hochschule Ingolstadt

Avantgarde in practically relevant teaching and applied research – since 1994

CARISSMA 



Center for applied research (ZAF)

- Focusing THI research activities in the Center of Applied Research
- **Established in 2004**
- **> 7,0 Mio. € third-party funding** in 2016 (expected)
- More than **80 business partners**: regional, overregional as well as international partners in industrial and scientific research
- **Cooperative doctorates** with well chosen national and international partner universities (e.g., college mobility and transport with TUM)

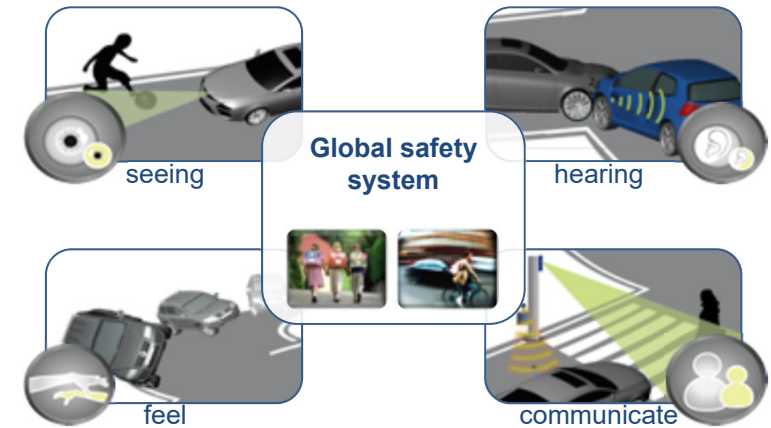


CARISSMA – building

- **launch:**
 - first conceptual plans by Prof. T. Brandmeier: 2008
 - recommendation by the German Federal Science and Humanities Council (Wissenschaftsrat) in 2010
- **unique feature:** first large scale funded research center for an University of Applied Sciences
- **beginning of the official planning process (building authority / architects):** 01/2012
- **start of construction / start of operation:** 04/2014 / 06/2016
- **budget:** ~ € 28 million (invest only; 50 % Federal Government, 50 % Free State of Bavaria)
- **precondition:** high national/international relevance in research
- **10 testing facilities**

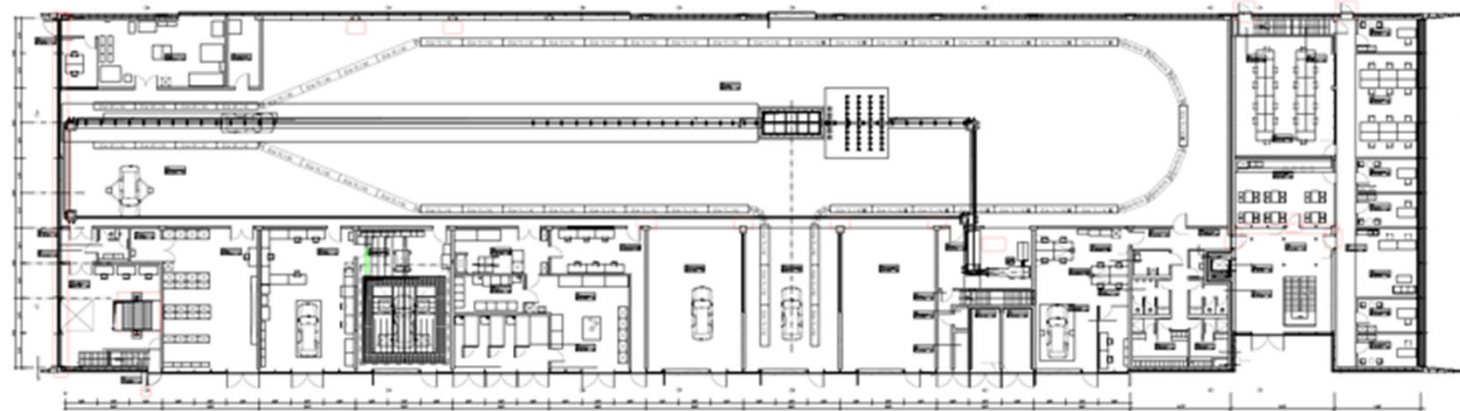
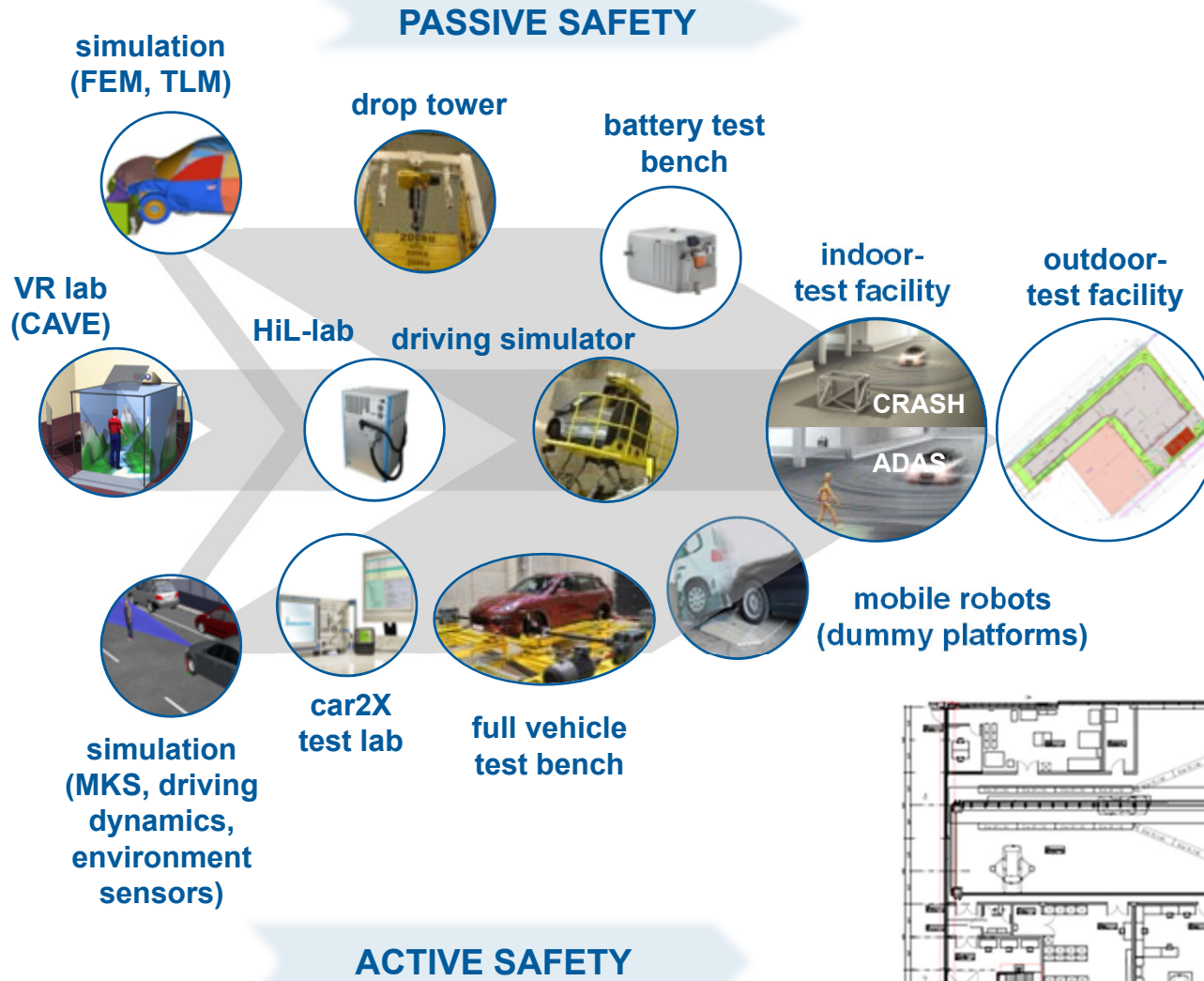
CARISSMA – research

- **start of research:** 2004
- **founded** by the former Institute for Automotive Safety Systems (Prof. Thomas Brandmeier)
- **currently** 10 Professors (+ 3 vacant positions) and 47 employees (up to 80 in 2018)
- **extensive network** (more than 20 industrial and 10 research partners)
- **4 innovations implemented** (e.g. Crash Impact Sound Sensing Technology in VW Golf VI, 2008)
- numerous **prizes / awards**, e.g. Bavarian Innovation Prize 2008, 4 best paper awards, 2 BMBF awards, “Pro meritis scientiae et litterarum” 2012
- relevance in society, science and industry: **scientific advisory board**



CARISSMA-Vision: Integration of systems, which are able to see, hear, feel and communicate critical traffic scenarios or accidents

CARISSMA – Overview of Facilities (after complete assembly)





CARISSMA
Automotive Safety Research

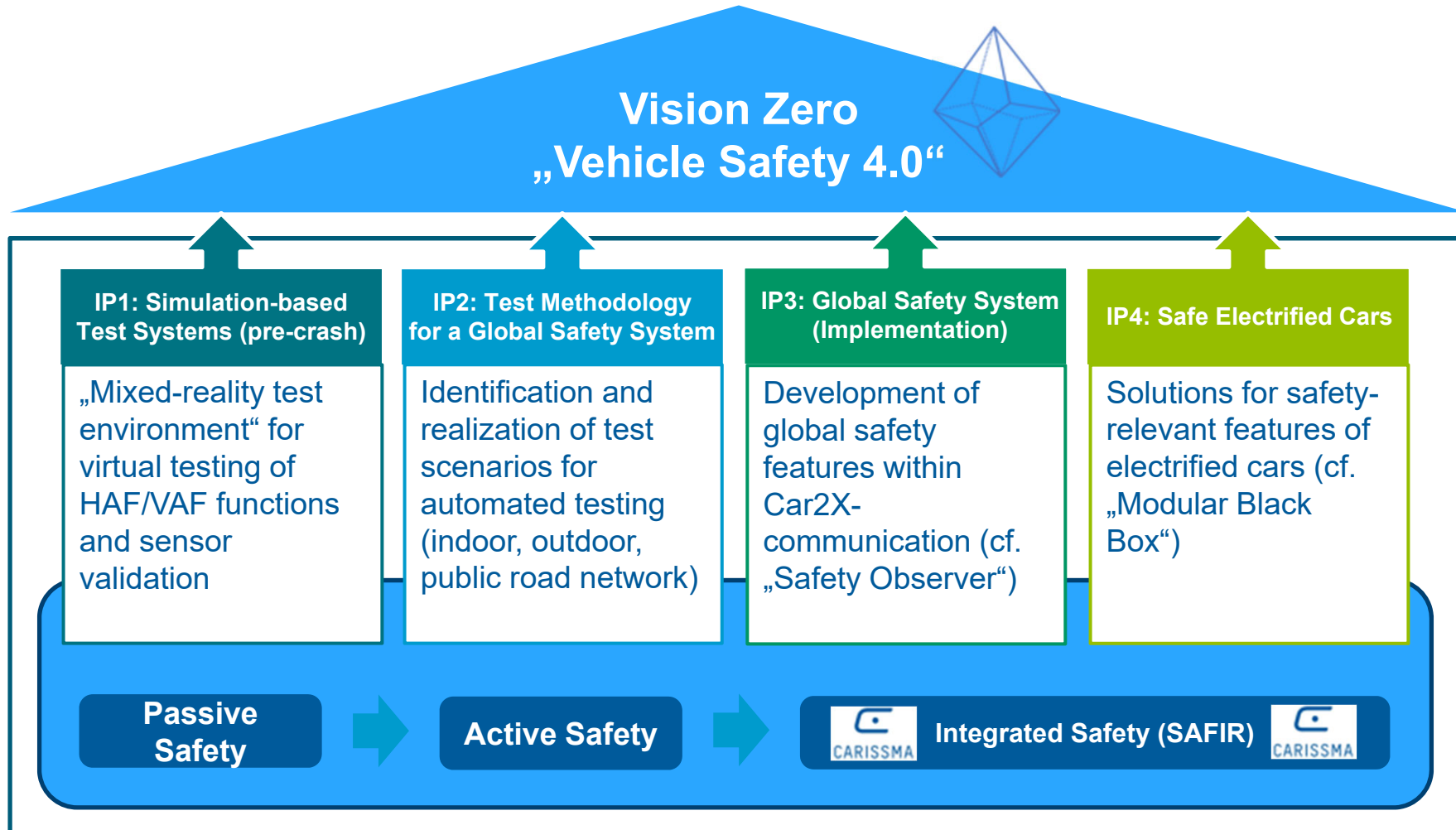
Project SAFIR



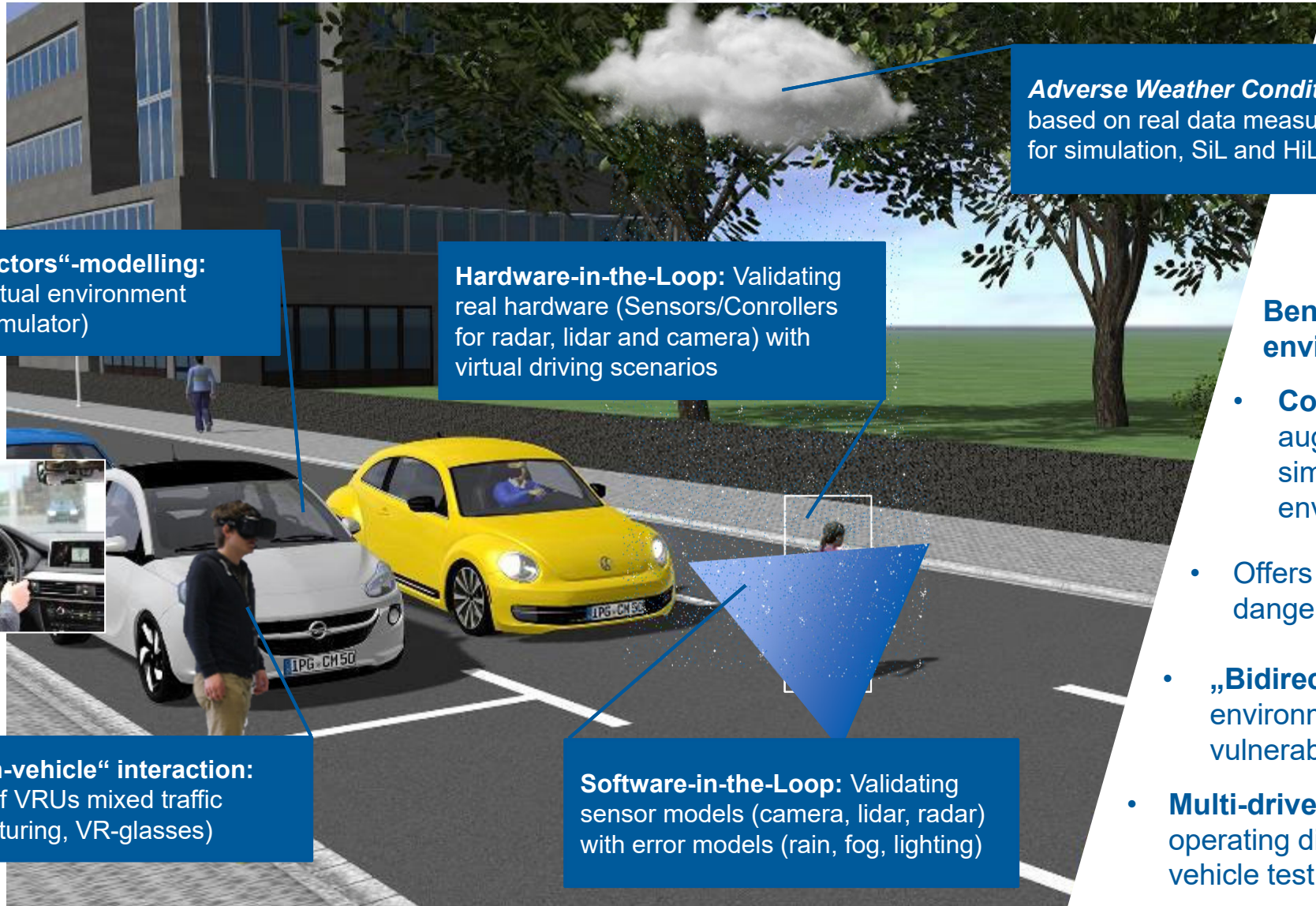
Project SAFIR

Fields of research (Whole project)

- **Industrial Partners:** 7 SME, Audi, BMW, Continental, DEKRA, EDAG, ELOGplan, EFS
- **Budget / Duration:** ~8 Mio. €, 1.1.2017 to 30.06.2021



Vision: „Mixed-reality test environment“



„Human Factors“-modelling:
Driving in virtual environment
(Hexapod simulator)

Hardware-in-the-Loop: Validating
real hardware (Sensors/Conrollers
for radar, lidar and camera) with
virtual driving scenarios

Adverse Weather Conditions:
based on real data measurement
for simulation, SiL and HiL

„Pedestrian-vehicle“ interaction:
Simulation of VRUs mixed traffic
(Motion Capturing, VR-glasses)

Software-in-the-Loop: Validating
sensor models (camera, lidar, radar)
with error models (rain, fog, lighting)

Benefits of the mixed-reality environment:

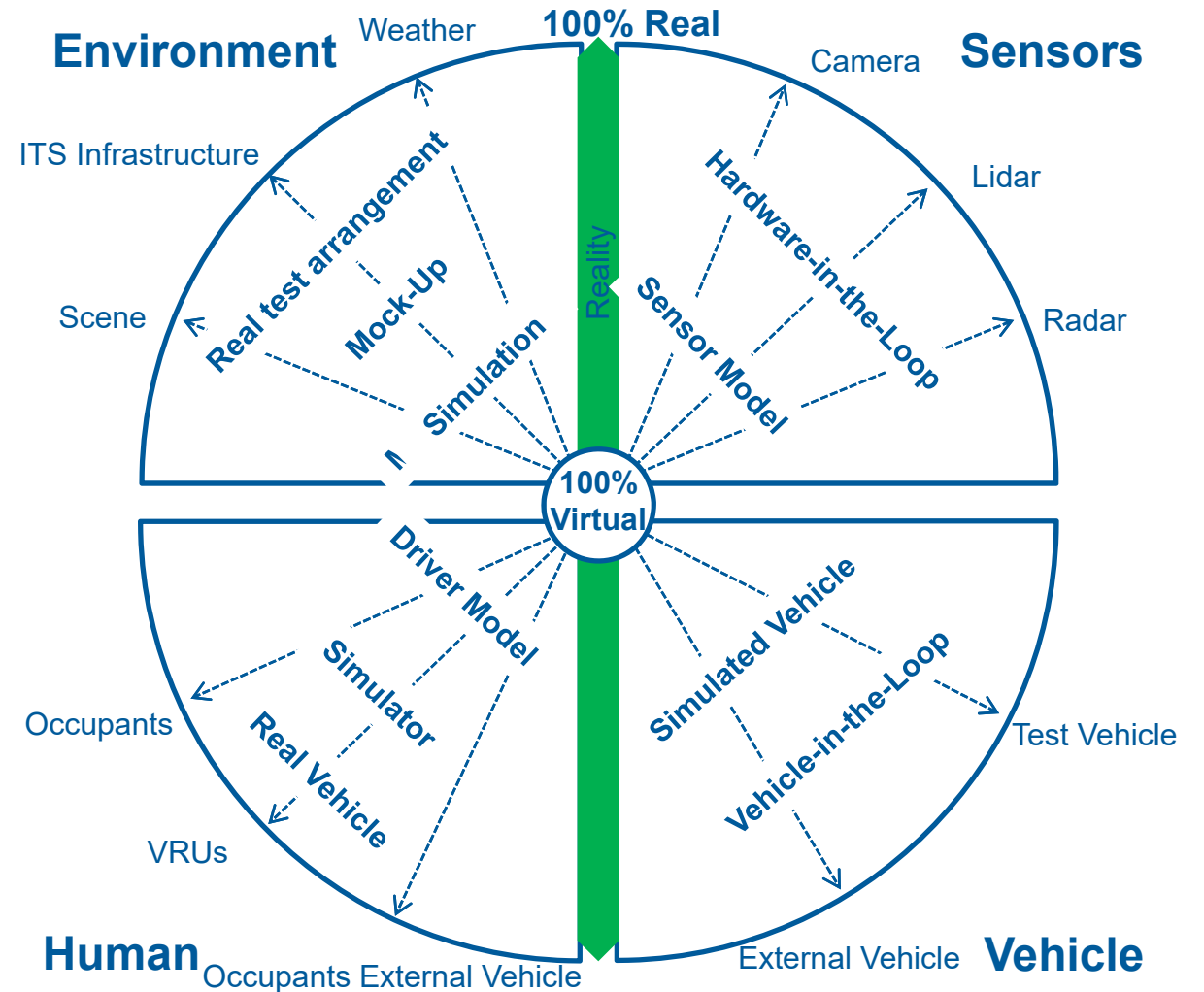
- **Combined use of** virtual reality (VR), augmented reality (AR), different simulation methods, and real environment
- Offers a **high rate of reality** without real danger to (other) road users
- „**Bidirectional simulation**“ through environmental simulation of e.g. drivers, vulnerable road users and vehicles
- **Multi-driver scenarios:** Multiple real persons operating different simulators (real car, full-vehicle test bench, hexapod simulator)

Mixed Reality

Realization of different levels of reality

Approach: Increasing the reality level along the different aspects depending on the test step and the test object:

- **Environment:** Include information about weather, ITS infrastructure, scenery within a test scenario.
- **Sensors:** New sensor models incorporating adverse weather conditions; modeling of disturbance.
- **Human:** Including all individual facets of diverse road users (vulnerable road users, driver of the ego vehicle, driving occupant in other traffic vehicles).
- **Vehicles:** Modeling of vehicle characteristics (weight, length/width, material) and components, controllers, inertial sensors, bus systems, etc..


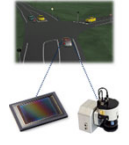
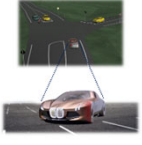
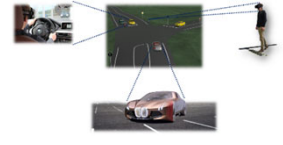



Aims of the Mixed Reality Environment

Connection of different labs in the project SAFIR for the purpose of testing

- Consistent testing to **decrease the number of test cases** needed in real environment situations
- **Within simulation, a very high amount of test cases** is possible
- **Retesting** and evaluation of previous tests **deliver information about the quality of the testing** environment and the test data
- **Delivers potentially risky situations** for more complex and time cost tests within higher rates of reality



Virtual Test	HiL Test	ViL Test	Mixed Reality Test	Driving Study
				
low	Immersion, Reality			high
high	Number of Test Cases			low

CARISSMA Trailer (Opening, 6 June 2016)

<https://www.youtube.com/watch?v=FhrNGPo0oS0&feature=youtu.be>

Aim: Interconnection of labs to perform high-quality research in the entire field of automotive safety

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