



ARTIFICIAL INTELLIGENCE ENHANCING VEHICLE VISION IN **LOW VISIBILITY CONDITIONS**

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HOW CAN WE ENSURE THAT
AUTOMATED VEHICLES DRIVE RELIABLY
EVEN IN ADVERSE WEATHER CONDITIONS?

THE GOAL



- Develop a **robust and fault-tolerant** novel sensing technology and associated AI
- Enable automated driving in **all relevant weather & lighting conditions** (snow, heavy rain, fog)
- Permit safe driving **24h / 365-days**

THE CHALLENGE



- Currently commercialization of automated vehicles is difficult due to their **inability to drive under any relevant weather and lighting conditions.**
- Testing takes place in **small designated areas with good weather conditions.**
- Prototypes **struggle or completely fail** in adverse weather.

THE INNOVATION



- Prepare the broad market entry of automated vehicles
- Extend the **Operational Design Domain (ODD)** of today's systems
- Make **prototypes functional in real driving conditions.**

THE CONCEPT



- High resolution adaptive all-weather sensor suite with novel sensors
- AI platform for predictive detection of prevailing environmental conditions including signal enhancement and sensor adaptation
- Novel simulation path which allows to realistically simulate adverse weather near the sensor to adapt and test the system on both real and artificially generated road scenes
- High definition maps with dynamic layers adaptable to changing weather conditions

ALL WEATHER MULTI-SENSOR PERCEPTION SYSTEM SUPPORTED BY AI



The AI platform will include the development of:

- **Multisensory data fusion approach:** Deep Sparse Multi-Scale Convolutional Neural Networks
- **Predictive detection** of prevailing environmental conditions and sensor adaptation
- **Signal enhancement** via Generative Adversarial Networks (GAN)
- **Sensor-near simulation models** of all active sensors
- **Synthetic inclement weather datasets** for AI

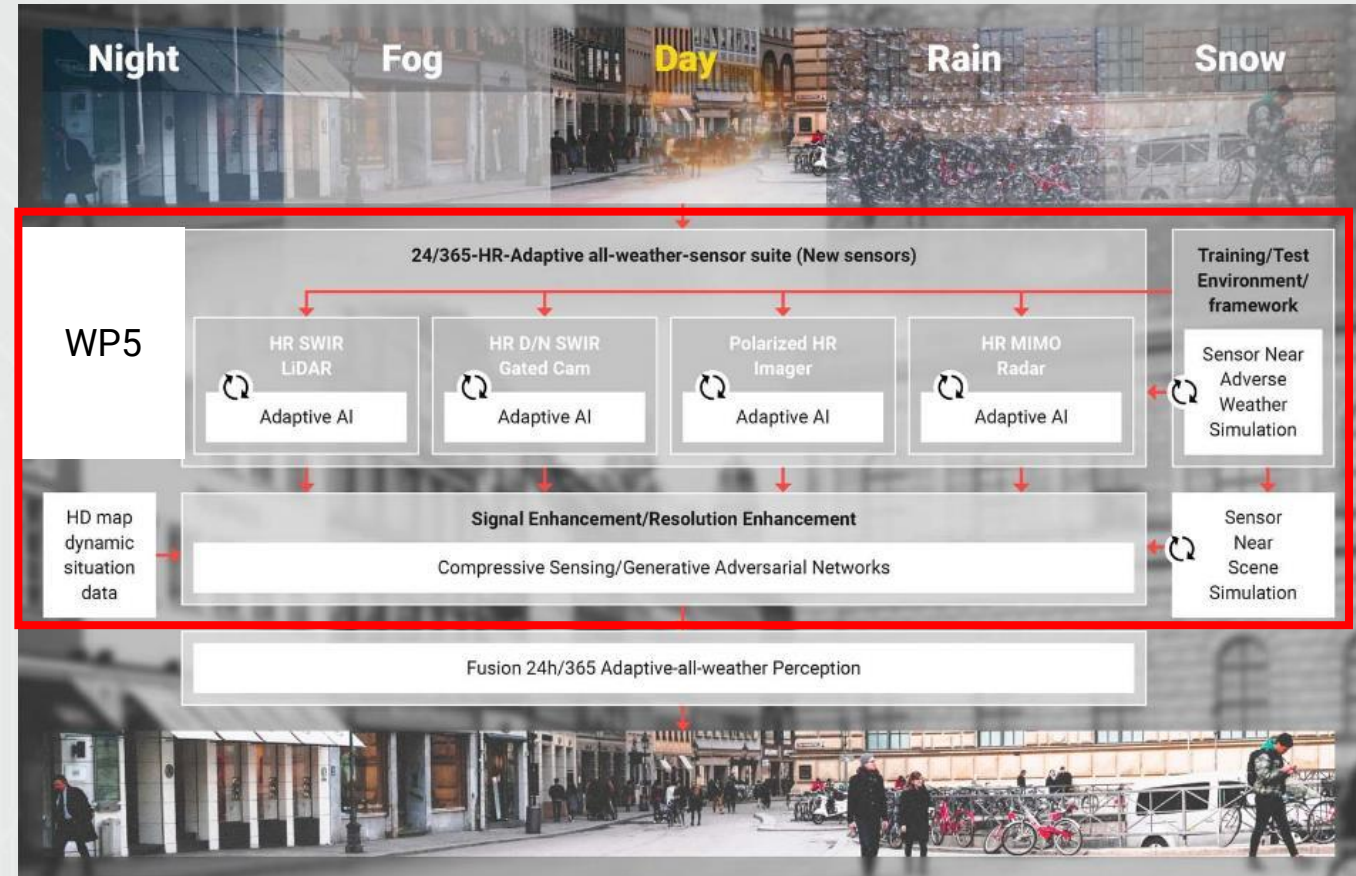
SIMULATION AND VALIDATION

The background is a solid red field with various white geometric patterns. These include a large circle on the left, a square with diagonal lines in the upper center, a square with horizontal lines in the lower center, and a square with vertical lines on the right. There are also several smaller circles, squares, and lines scattered throughout the composition.

WP5 - SIMULATION AND VALIDATION



- Specification/Setup of a Simulation Platform
- Modelling of inclement weather environment
- Modelling of the new sensor suite
- Modelling of static und dynamic scenarios
- Generation of Synthetic Sensor Raw Data by Simulation
- Validate Simulation results versus static Lab Measurements
- Validate Simulation results versus dynamic Scenarios on test tracks

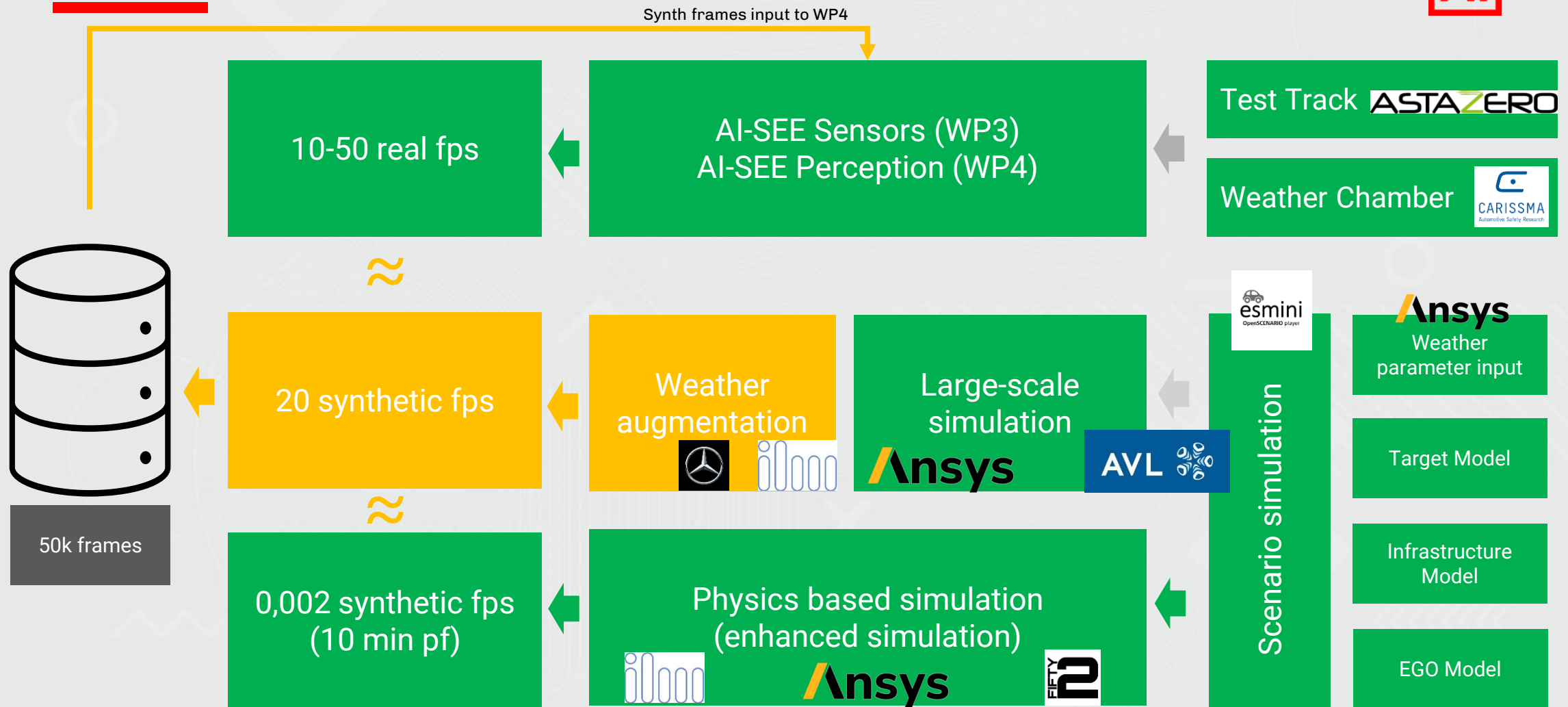


WP: Work Package

WORKFLOW OVERVIEW

Done

In progress

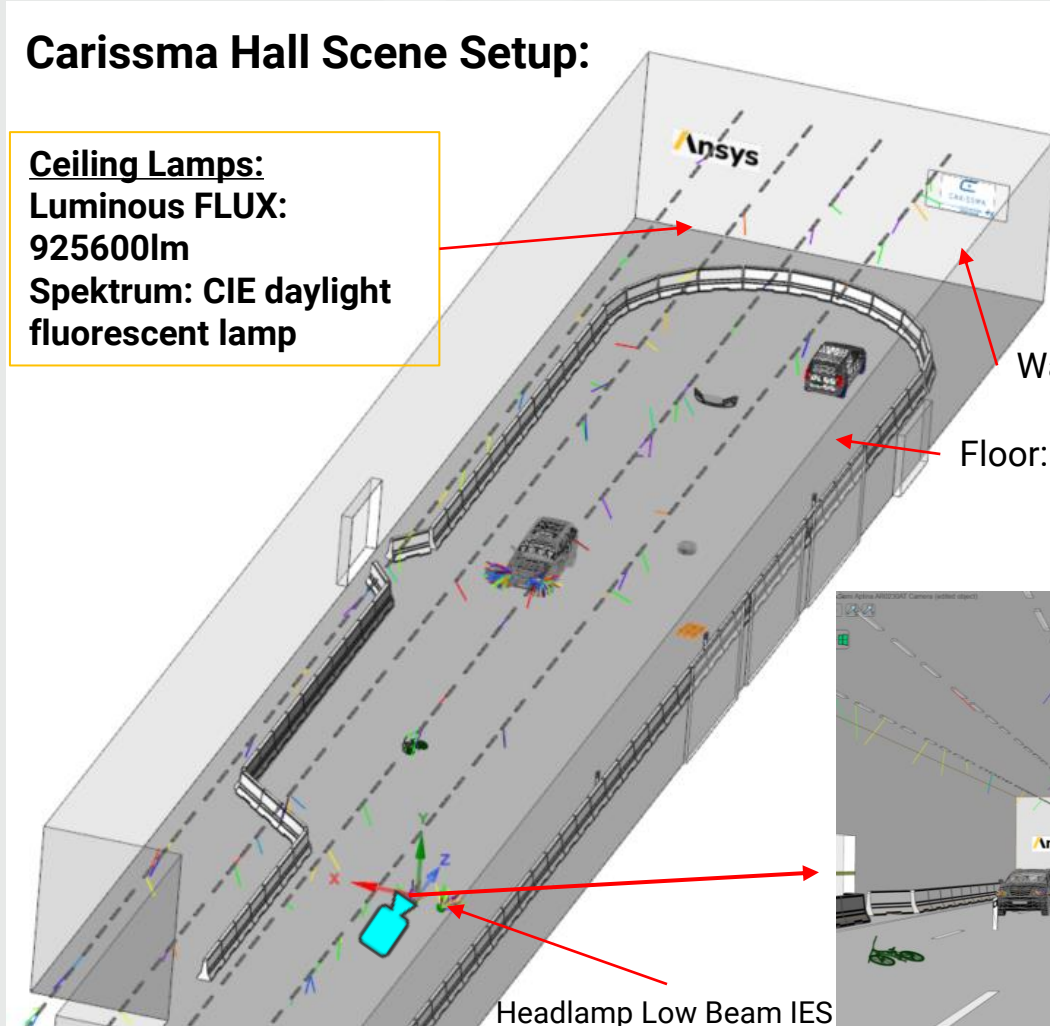


MAGNIFYING GLASS: SIMULATION SETUP – 3D SCENE

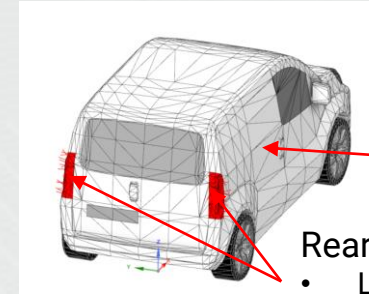


Carissma Hall Scene Setup:

Ceiling Lamps:
Luminous FLUX:
925600lm
Spektrum: CIE daylight
fluorescent lamp



Assets:

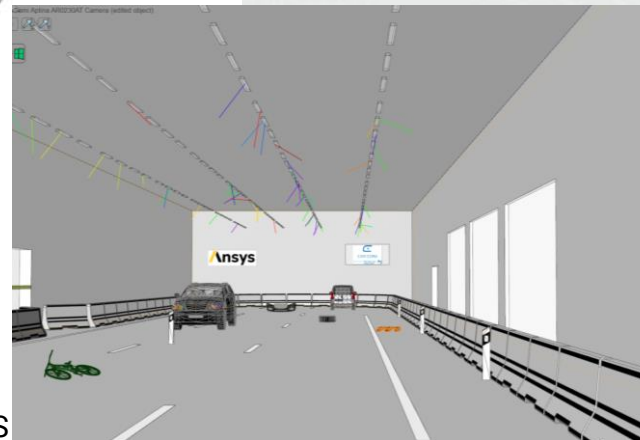
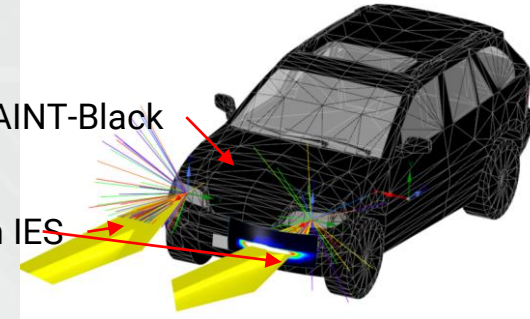


CAR-PAINT-ValloireWhite1600

Rearlamp:
• Lambertian 60 deg
• Spektrum: Gaussian Red

CAR-PAINT-Black

Headlamp Low Beam IES

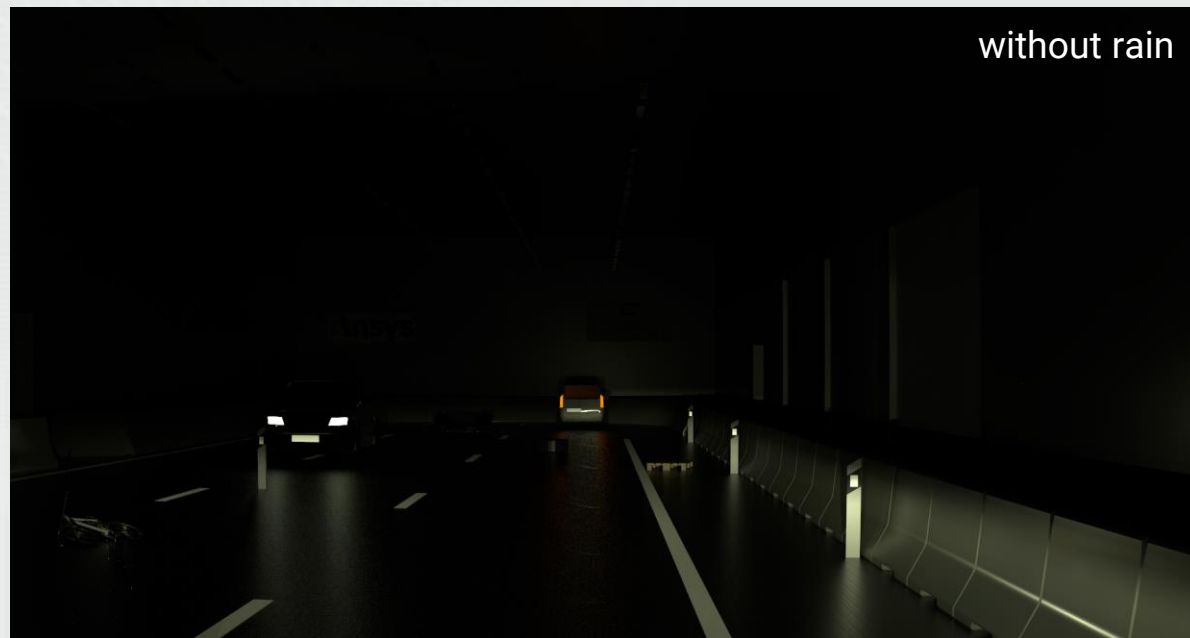


Mercedes EGO Vehicle FOV:
Stereo Camera: OnSemi Aptina
AR0230AT

MAGNIFYING GLASS WORKFLOW: NIGHT-RAINY-WET



Measured Camera Image

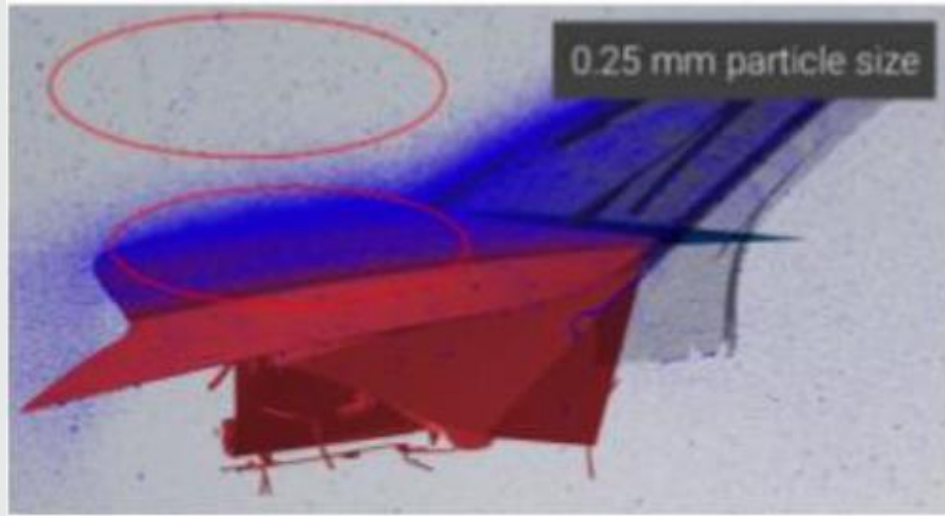


Simulation result (specular material +
normal map texture)

MAGNIFYING GLASS WORKFLOW: PREONLAB - SPEOS COUPLING



- Workflow for coupling between PreonLab and Ansys SPEOS



ANSYS

FIFTY
2

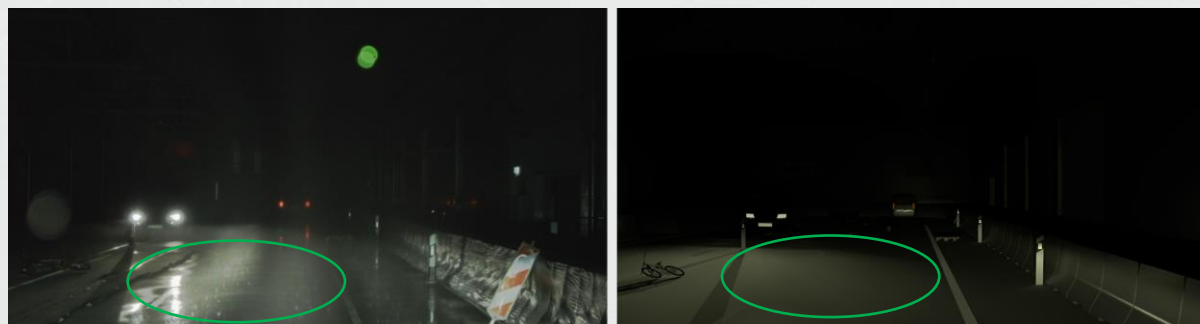
Ray tracing with Ansys Speos



VALIDATION – MAGNIFIER WORKFLOW EXAMPLE



Dry Scenario - Daylight



Rain Scenario - night



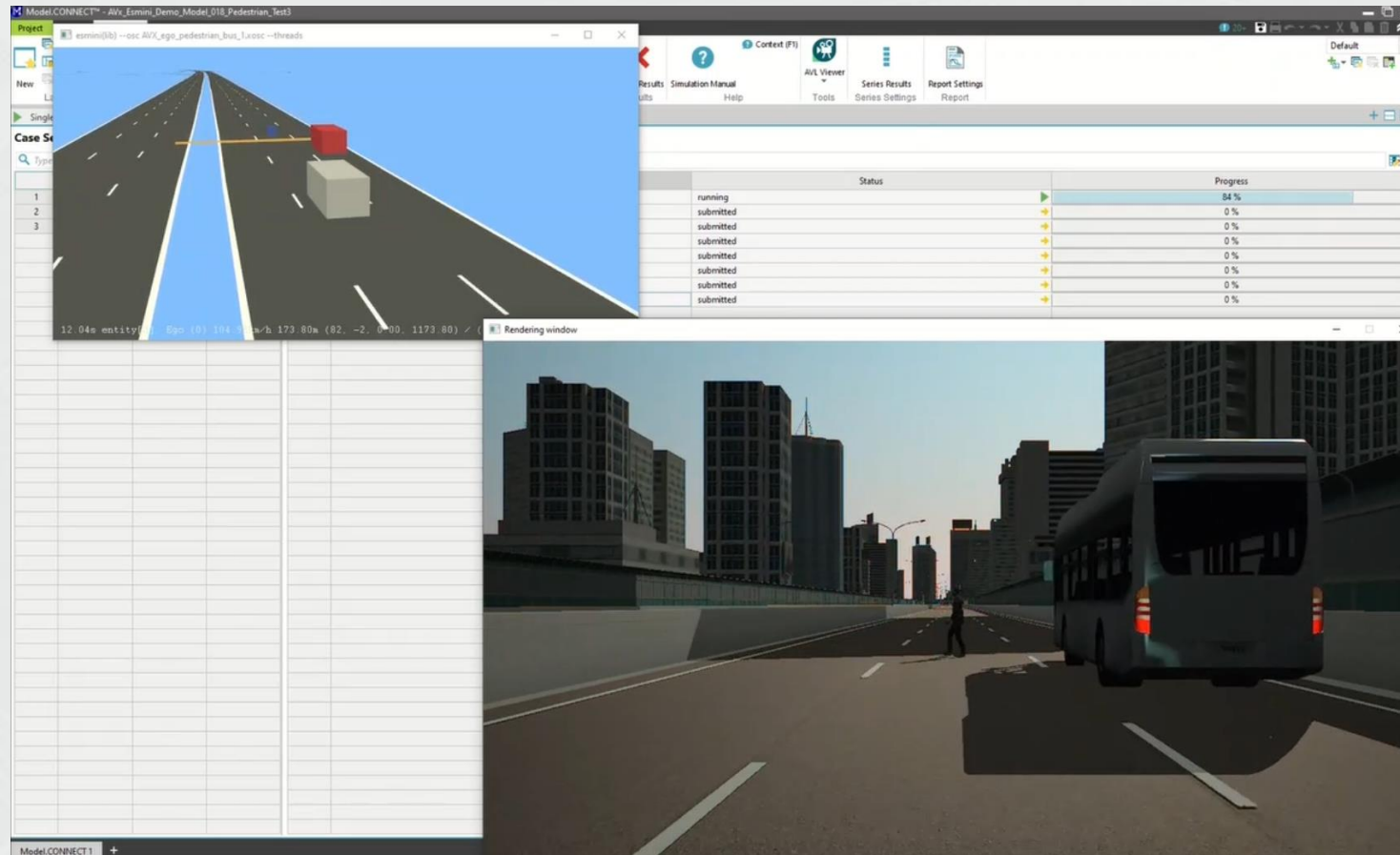
Fog Scenario - night

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VIRTUAL DATA SIMULATION – LARGE SCALE WORKFLOW - DEMO



[Link to the Video](#)



FACTS & NUMBERS



COORDINATOR

Dr. Werner Ritter
Mercedes Benz AG



20 PARTNERS

OEMs, Automotive Suppliers,
Research Institutes,
Engineering Companies



43 MONTHS RUNTIME

01.06.2021- 31.12.2024



6 COUNTRIES

Austria, Canada, Finland,
Germany, Israel, Sweden



€20M

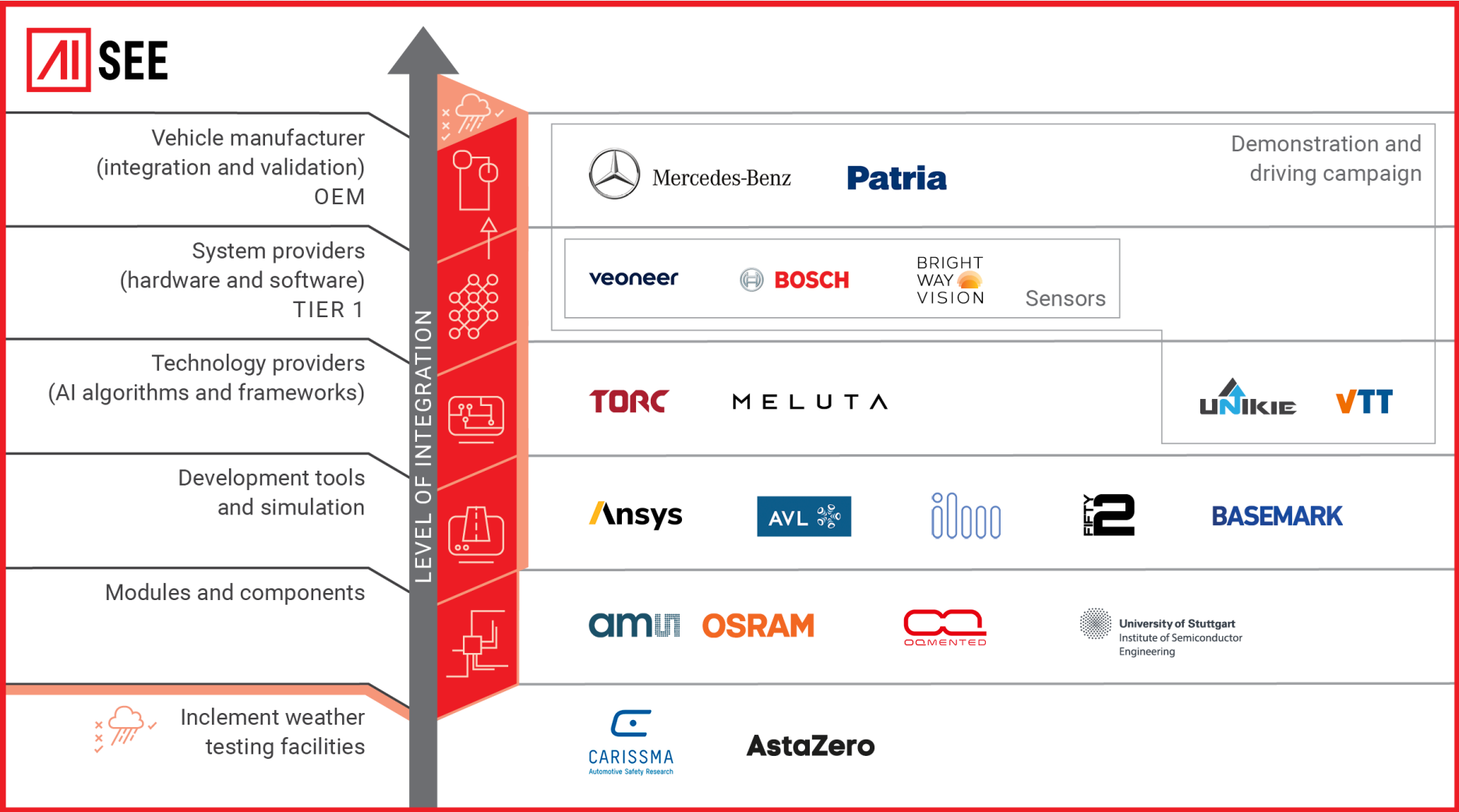
Total costs



€10M

Funding budget

CONSORTIUM OVERVIEW



CONSORTIUM OVERVIEW



OEMs



Mercedes-Benz

Patria

SYSTEM PROVIDERS (HARDWARE & SOFTWARE)



BOSCH

BRIGHT
WAY
VISION

veoneer

TECHNOLOGY PROVIDERS

TORC

M E L U T A

UNIKIE

VTT

DEVELOPMENT TOOLS & SIMULATION

Ansys

AVL

i0000

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BASEMARK

MODULES & COMPONENTS

amui OSRAM

OQMENTED

University of Stuttgart
Institute of Semiconductor
Engineering

INCLEMENT WEATHER TESTING FACILITIES

CARISSMA
Automotive Safety Research

AstaZero



THANK YOU VERY MUCH
FOR YOUR ATTENTION!



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