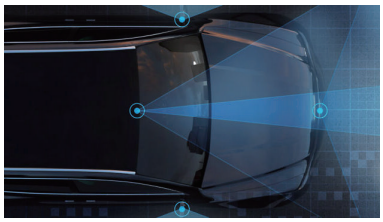
Ansys
part of SYNOPSYS®

Empowering Innovators to Drive Human Advancement

Ansys AVxcelerate ADAS/AD Simulation Solution

Ansys AVxcelerate

AVxcelerate Sensors



Develop, Test & Validate Sensors DSP/Perception

AVxcelerate provides accurate real-time sensor simulation capabilities enabling you to test your ADAS/AV feature including sensors perception faster than with physical prototypes.

- Optical Camera, Thermal
- Camera, Radar, Lidar
- HiL, MiL and SiL Connectivity

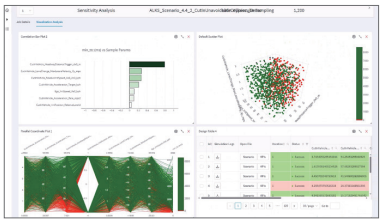
AVxcelerate Headlamp

Develop, Test & Validate Headlamp functions

AVxcelerate allows you to test headlamp design, combined with its control software, in a virtual environment that replicates the physical world.

- Analyze & develop lighting systems
- Perform regulation in simulation
- Optimize your systems rating

AVxcelerate Autonomy



Develop, Test & Validate Safe ADAS/AV

AVxcelerate allows development and validation of ADAS/AD software in large scale scenario exploration in regard to safety.

- Manage scenarios
- Optimal exploration of design domain
- Assess sensitivity and probability of failure using simulation.

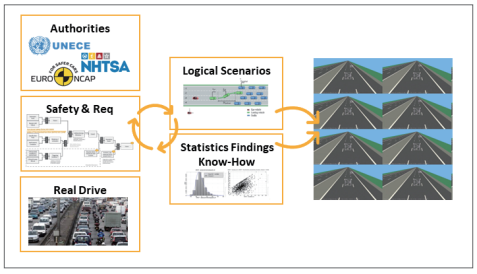
Ansys AD/ADAS Simulation Solution

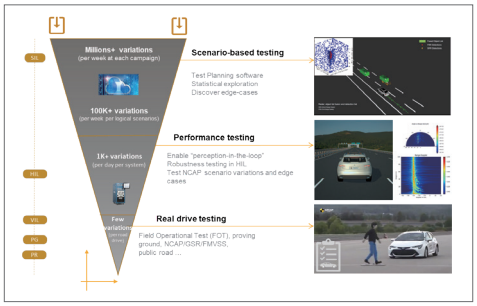
AVX Products

- **Autonomy** Cloud Scenario-based Simulation for Safety/Regulation
- **Sensor** Physical Sensor for Perception in loop Simulation
- **Headlamp** Vehicle headlamp simulation

Value

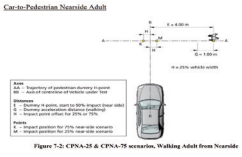
- Simulation tools for Europe L3 R157 projects.
- Simulation tools for Europe L2+ R171, GSR R152, etc.
- Simulation tools for Europe ENCAP 2026.
- Innovation tools for SOTIF analysis and AD development workflow.
- Physical sensor model for perception in loop simulation.
- Excellent performance in AD/ADAS simulation credibility.
- Accurately capacity to rebuild edge scenarios.
- Deeply cooperation with NVIDIA Omniverse.





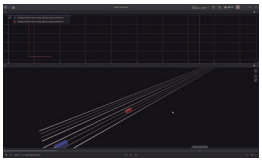
Customers

Solve the Autonomy validation challenge



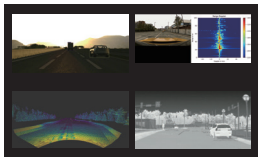
Explore Design Domain

- Define scenario variation from parameter distribution
- Define iterative smart exploration



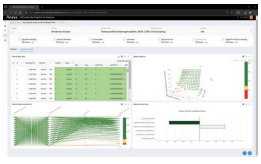
Simulate Scenario

- Generate concrete scenario (ASAM OpenScenario)
- Connect SUT, Sensors model and KPI evaluator



Generate Sensor Data

- Prepare sensor model and physicalized 3D environment
- Generate accurate outputs for perception



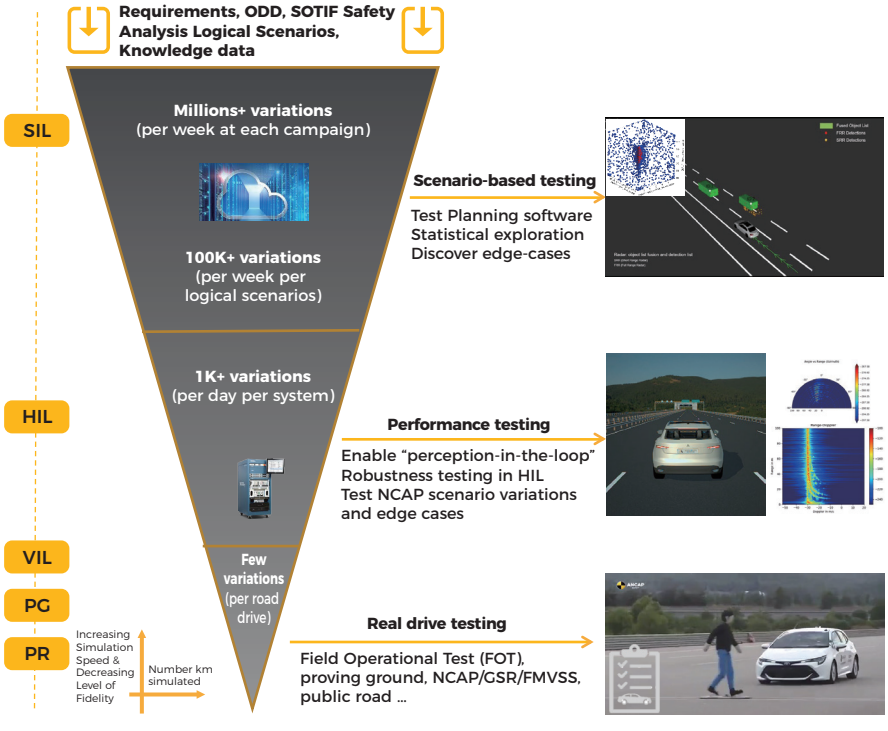
Analyze Results

- Sensitivity & reliability analysis
- Report safety and regulation assessment

AVxcelerate Autonomy™ | AVxcelerate Sensors™ | AVxcelerate Autonomy™

Medini™ SOTIF | Optics & HFSS™ | SOTIF Medini™

Ansys AVxcelerate enables simulation test space analytics at scale



Simulation usage examples

1) Hyper-scalability (SIL Cloud) – faster than real-time Example: Validation engineer: Continuously assess the AD software reliability considering overall safety

Execute Millions+ variations over 30 to 300 logical scenarios
Use Smart and Optimized sampling
Evaluate probability of failure

2) High-scalability (SIL Cloud) – faster than real-time Example: Verification engineer: Continuously verify the AD software considering performance & regulations (NCAP 26, ALKS R157)

Execute 100K+ variations per logical scenarios
Generate PASS/FAIL report based on KPIs

3) Scenario Scalability (SIL) – faster or slower than real-time Example: AD developer: Ease development of AD software considering performance and robustness

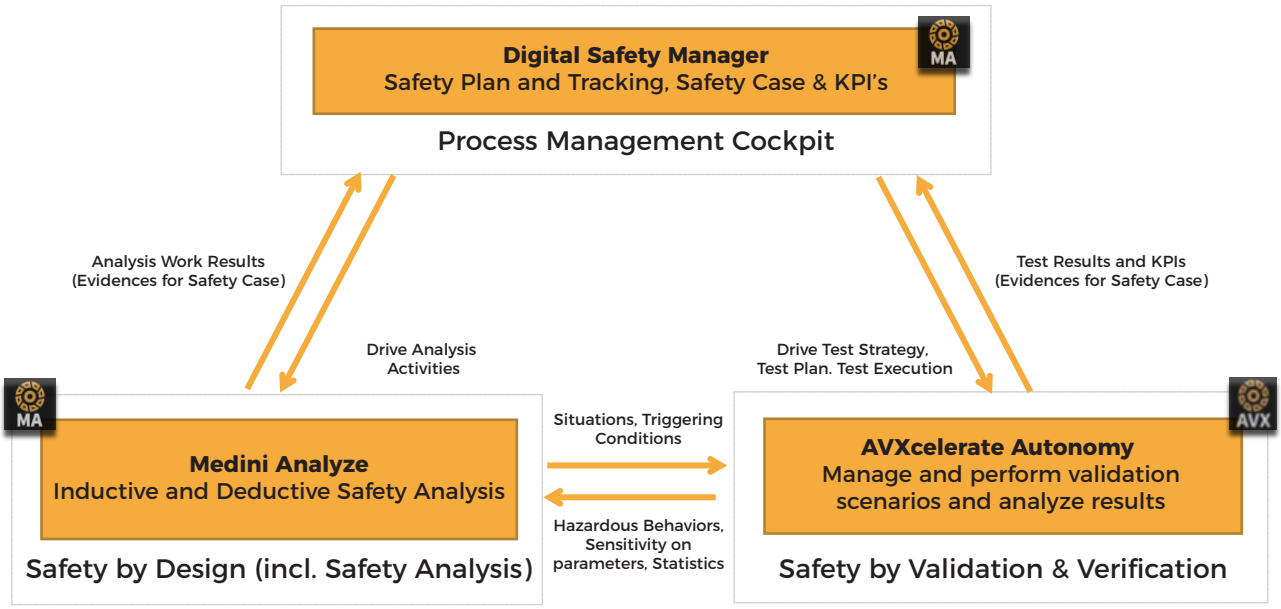
Execute 1K+ variations as unit tests
Use Sensitivity Analysis to understand issues in AD software

4) Critical scenarios (HIL) – in real-time Example: HIL engineer: Performance testing considering synthetic data injection in ECU (inc. vision sensor systems)

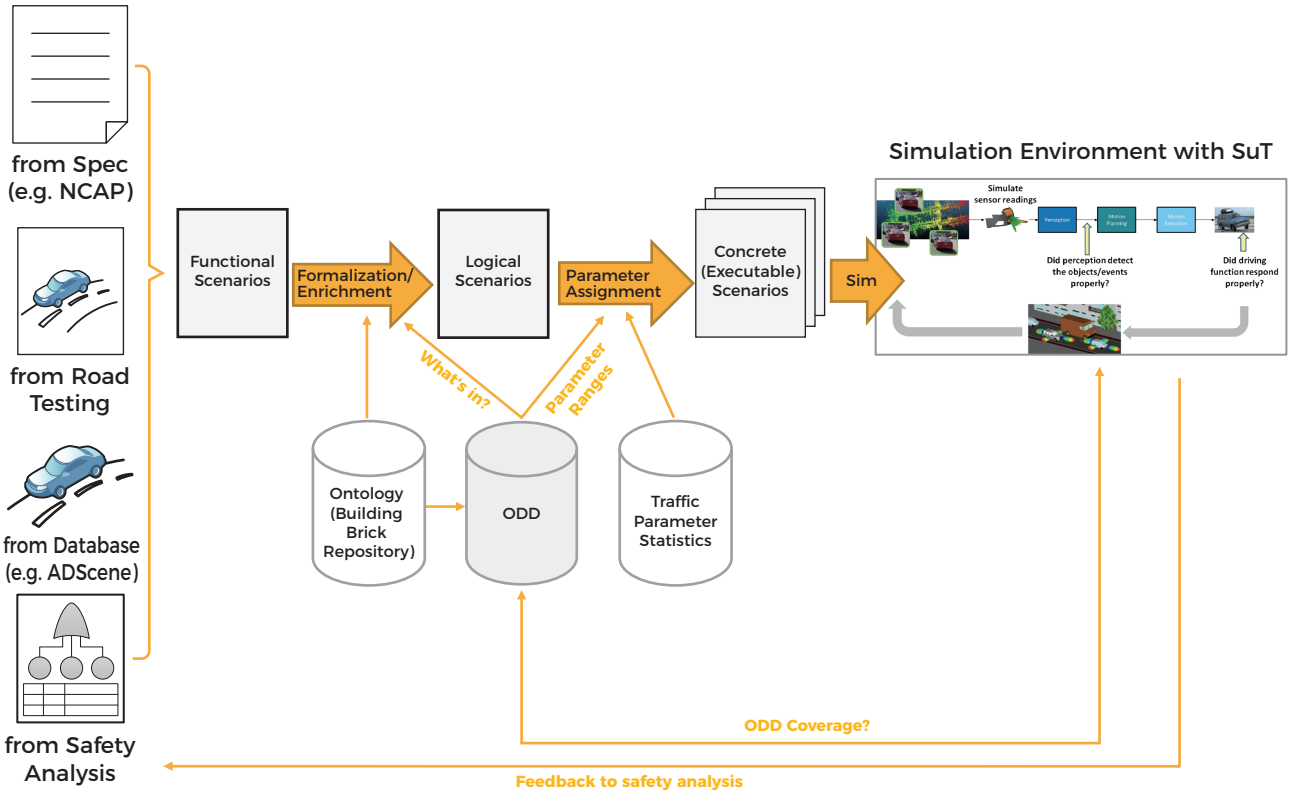
Execute virtual drive in real-time on selected critical scenarios
Measure performance

Scenario-based testing is the key approach for ADAS in Model-based systems engineering (MBSE) Continuity of methods and tools along the development cycle is important to lower risk and thus reduce development costs and efforts.

Demonstrating Safety of AD Functions



Workflows leading to scenario simulation



AVxcelerate Autonomy

Streamline Development & Validation of L2+, L3 & above ADAS/AD systems

End-to-End safety driven toolchain that combines statistics and simulation at scale to perform sensitivity and reliability analysis critical for the development of ADAS/AD functions. Enables OEMs to develop safe workflows for L2/L2+/L3 signoff and homologation.

Safety By Validation

Scenario-Based Validation
Demonstrate Safety on known/unknown scenario using simulation (XiL).

Real-Drive Validation
Extract scenarios and probabilities of occurrence. Correlate simulation with real drive samples.

Workflow:
- Import scenarios using OpenScenario to cover ODD
- Optimized Sensitivity & Reliability analysis on subset of scenario
- Run simulation at scale in HPC or Cloud
- Analyze KPIs for max probability of failure

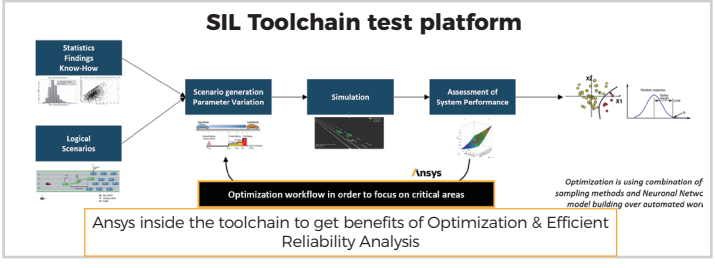
100k^X — **Reduction** in development time and cost to compliance

Increased Productivity — **Efficiency gains** as reliability of SAE L3+ feature is continuously assessed

Safety — **End-to-end traceability** delivers safety evidence for ISO 26262 certification and sign-off process

Scenario Variation and Reliability Analysis

Mercedes S-Class & EQS L3 approval - using Ansys



KBA real world test drive: ~50 h and ~1500 km only thanks to evidences from simulation

Delivering Quantified Business Impact

	Performance	Time & Cost
10^{-9}	1000x	90%
Determine risk per scenario class for very low probability of failure	Massive reduction of scenario to be simulated per class	Simulation time saving lead to strong cost saving

Ansys contributes the certification of Mercedes S-Class & EQS level 3 as one of the validation pillars

Use physics-based accurate sensor models to test perception

Trustable synthetic sensor simulation in scenario

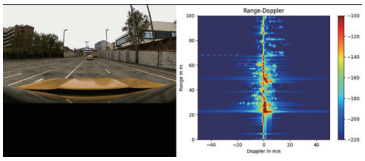
Complement recorded sensor data with reproducibledataset including edge cases scenarios

Use accurate physics-based virtual simulation to train and validate AI/ML based perception

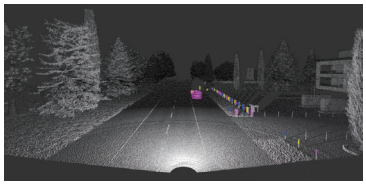
Continuously ensure perception stack safety from chip to mission

Benefit from an open solution scalable from Hardware-in-the-Loop (HiL) test benches to Software-in-the-Loop (SiL) in cloud

Camera



Radar

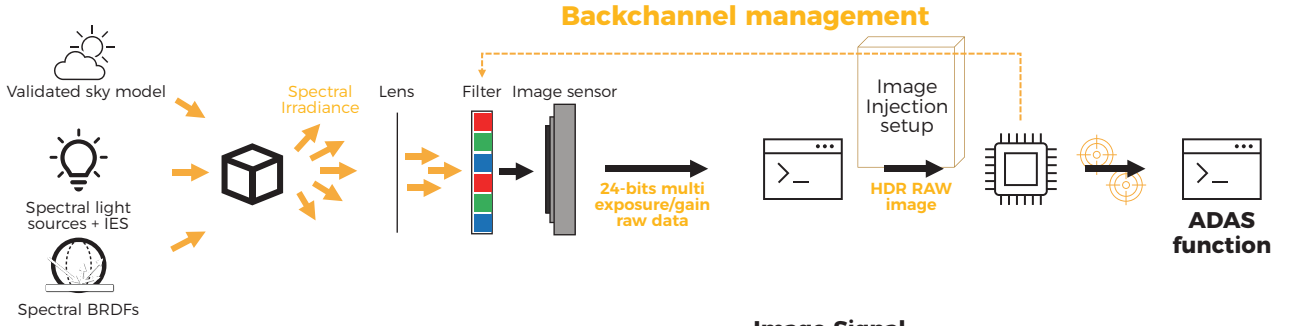


LiDAR

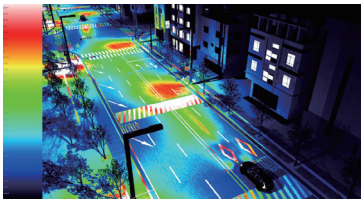
Thermal Camera

MUTLISPECTRAL • COMPONENT LEVEL • REAL-TIME ENABLES COMPONENT SOFTWARE ENGINEERING

Advantages of Physically Accurate Simulation for Testing Accuracy



Multi-Spectral Environment Simulation



Camera Sensor Simulation

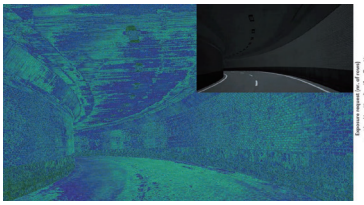
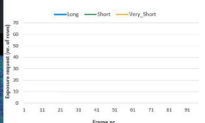


Image Signal Processing (e.g., exposure strategy)



Camera Sensor Simulation

Known automotive camera-based ADAS edge cases

Virtual simulation is a 'Necessity' to evaluate millions of unforeseen critical edge cases


1-Night reflections


2-noise & Low exposure


3-Blooming


4-Sun Light


5-Reduced visibility


6-Taillamp in fog


7-Motion Blur


8-Rain blockage

Radar – Edge Case Simulation

Real Life Inspired Edge Cases

Scenario 1

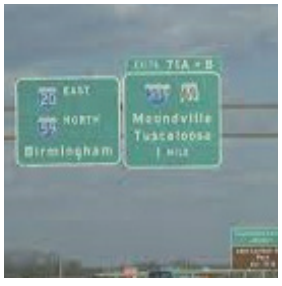
Driving over manhole cover.

Challenge

- Detection of, strong, static target standing on the street.
- Unclear height of the target (can one drive over it?)

Scenario 2

Highway traffic sign.



Challenge

- Strong reflections at signposts (metal support beams with lots of corners)
- Unclear if one can drive underneath.

Scenario 3

Multi Bounces in Tunnel.

Challenge

- Multi-bounces inside the tunnel inducing multiple ghost targets.

Scenario 4

Motorway Guard-Rails Reflections.

Challenge

- Ghost targets mirrored at guardrail.

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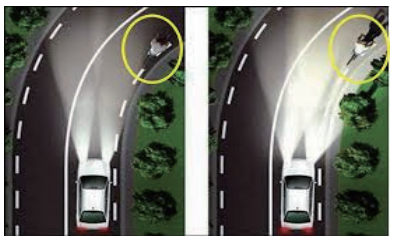
Intelligent Headlamp – Example of Control Law

Bending Light

- Dynamic bending light follows the steering wheel to illuminate turns.
- With AVxcelerate we can simulate the DBL (Dynamic Bending Light) system in virtual environment by rotating the headlamp module using the steering wheel as input



Matrix Beam

- Matrix Beam headlights keeps the High-beam active while switching to Low-beam only the part of the light area that is occupied by another road user.
  - The light path is created using numerous LEDs (e.g. 25 per headlight unit) spread over a matrix which are individually controlled.
  - Use of an ideal camera to detect traffic objects and SiL/MiL control law for switching on/off respective LEDs.

Pixel Beam

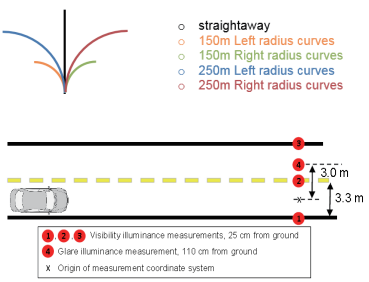
- Pixel Beam is a high-definition lighting system (xM Pixels)
  - It uses precise control on the individual LED chips or a DMD system adjust the beam shape in real time.
  - Multiple usages:
    - → Glare free high beam
    - → Pedestrian/Obstacles highlight
    - → Reduced glare for traffic sign recognition at night
    - → Improve AEB Nighttime performances...

Standard in AVx Headlamp

IIHS (Insurance Institute for Highway Safety)

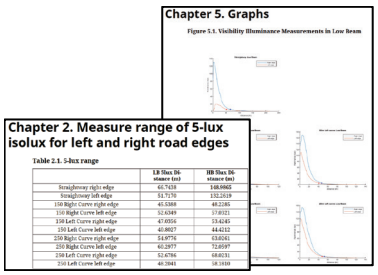
Ansys AVxcelerate uses a digital twin of the IIHS test track to reproduce the IIHS test for headlamp rating in an earlier phase of the development.

Allows OEMs to run the IIHS test independently from suppliers



C-IASI Rating

- Define test procedures for measuring and rating the on-road illumination provided by a passenger vehicle headlight system.
- Testing procedure based on illumination measurements on road sections with various horizontal curvatures.
- It allows you to test headlight systems and rate them on a scale of Good, Acceptable, Marginal or Poor.

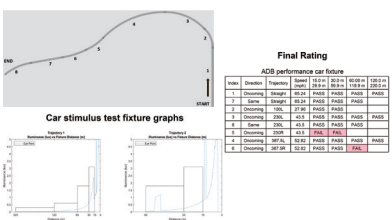


FMVSS108

FMVSS108 is an amendment to the FMVSS standard, permitting the certification of adaptive driving beam (ADB) headlighting systems on vehicles sold in the United States.

It consists of:
- 8 loosely defined trajectories.
- 3 strictly defined targets, equipped with illuminance sensors.
- 1 EGO car, equipped with an ADB system , at pre-determined speeds

The recorded values are then examined to assess compliance with the standard



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