

DIVP Driving Intelligence Validation Platform

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Weather Forecast



AD safety Assurance*



For Validation & Verification Methodology

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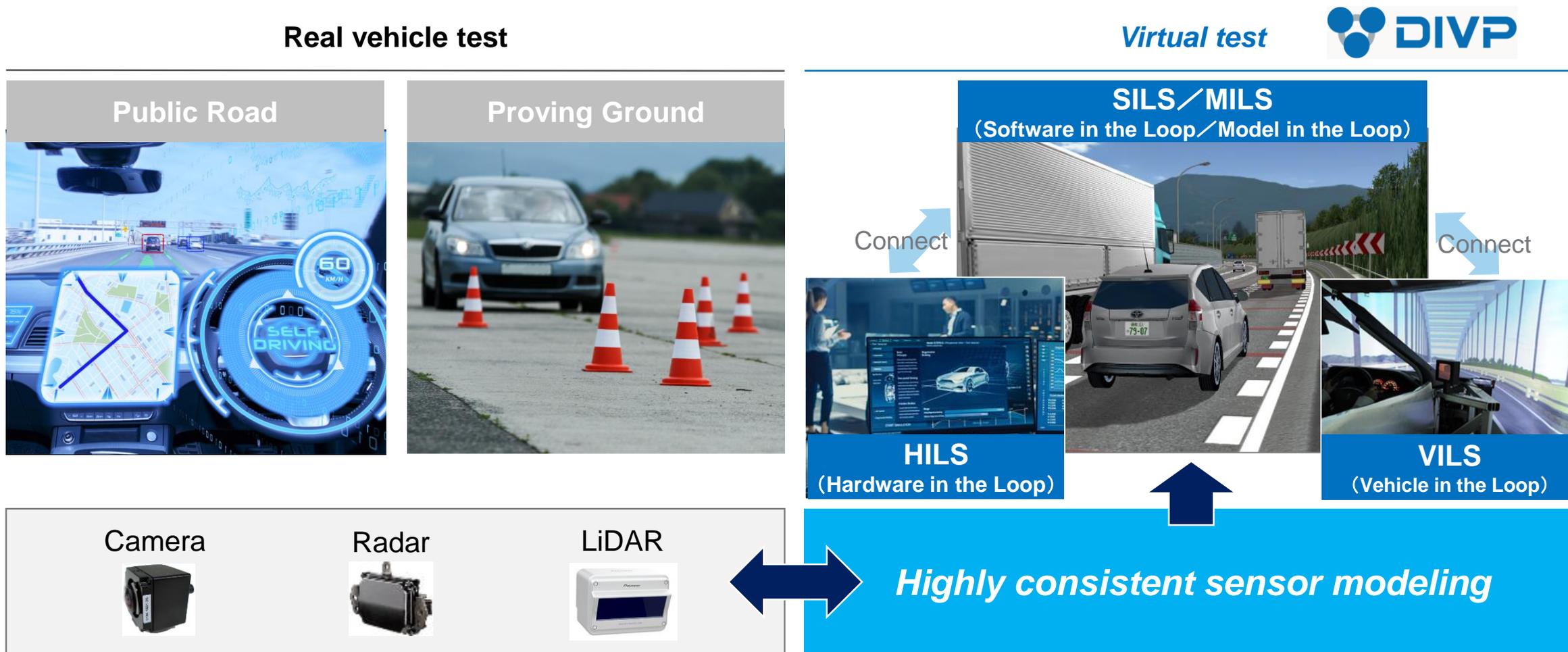
- Objective & Motivation

- Achievement

- Summary

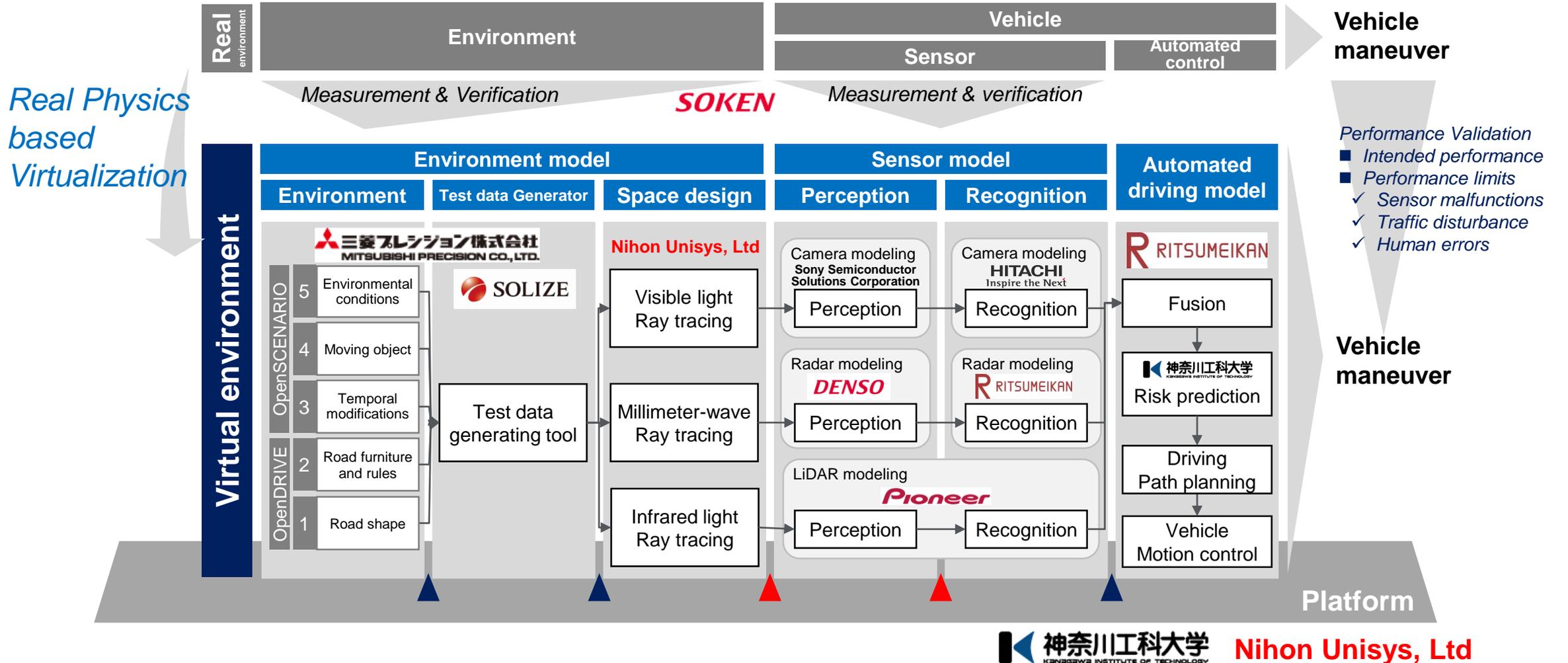
Highly Consistent Sensor Modeling is a key enabler of virtual validation for AD/ADAS safety assurance. HCSM indicates environmental, ray trace, and sensor models.

Motivation : Highly Consistent Sensor Modeling (HCSM)



Designed project architecture, Precisely Duplicate from Real to Virtual, and Verification of consistency with real testing by 10-experts as DIVP[®] Consortium

DIVP[®] project design



Achievement

- **Highly consistent sensor modeling**
- Validation expansion on virtual community ground

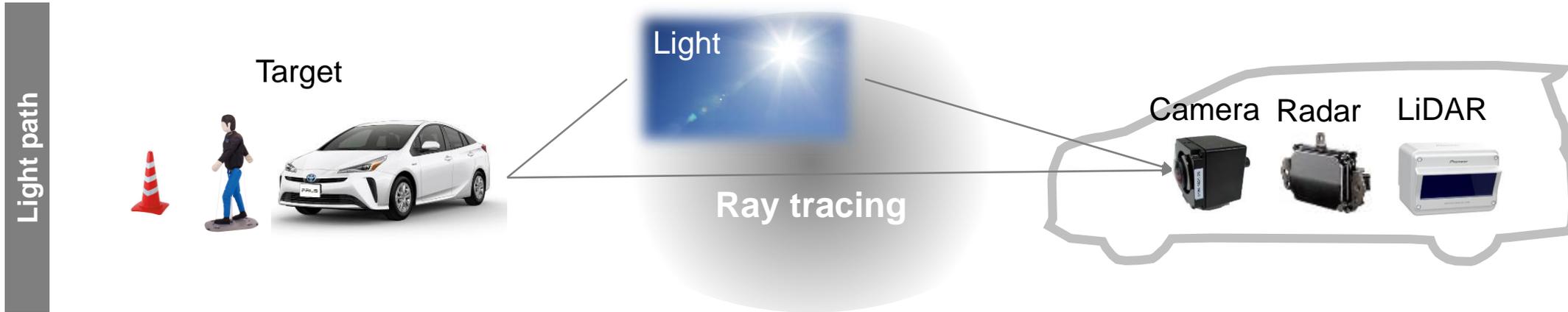
Investigated model units and Interfaces based on light path from source to sensor output, and defined Environmental, space design and Sensor perception & recognition models

Example Camera modeling

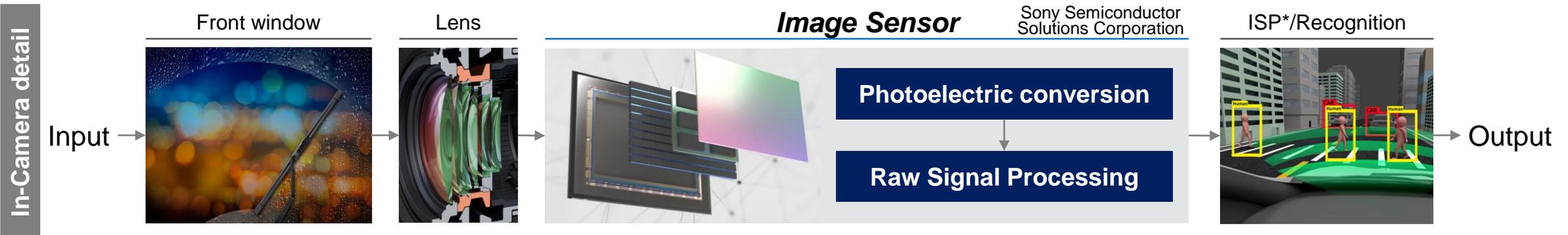
HITACHI
Inspire the Next

Sony Semiconductor
Solutions Corporation

DENSO SOKEN Pioneer



Next Step is to Virtualize Image sensor
for precise Perception



20% deviation on Camera output Real to Virtual. This is similar to the actual Camera tolerances, meaning that this is capable as a sensor validation method.

Camera Consistency verification result*

Sony Semiconductor
Solutions Corporation

Real test result



SIM result (Clear sky)



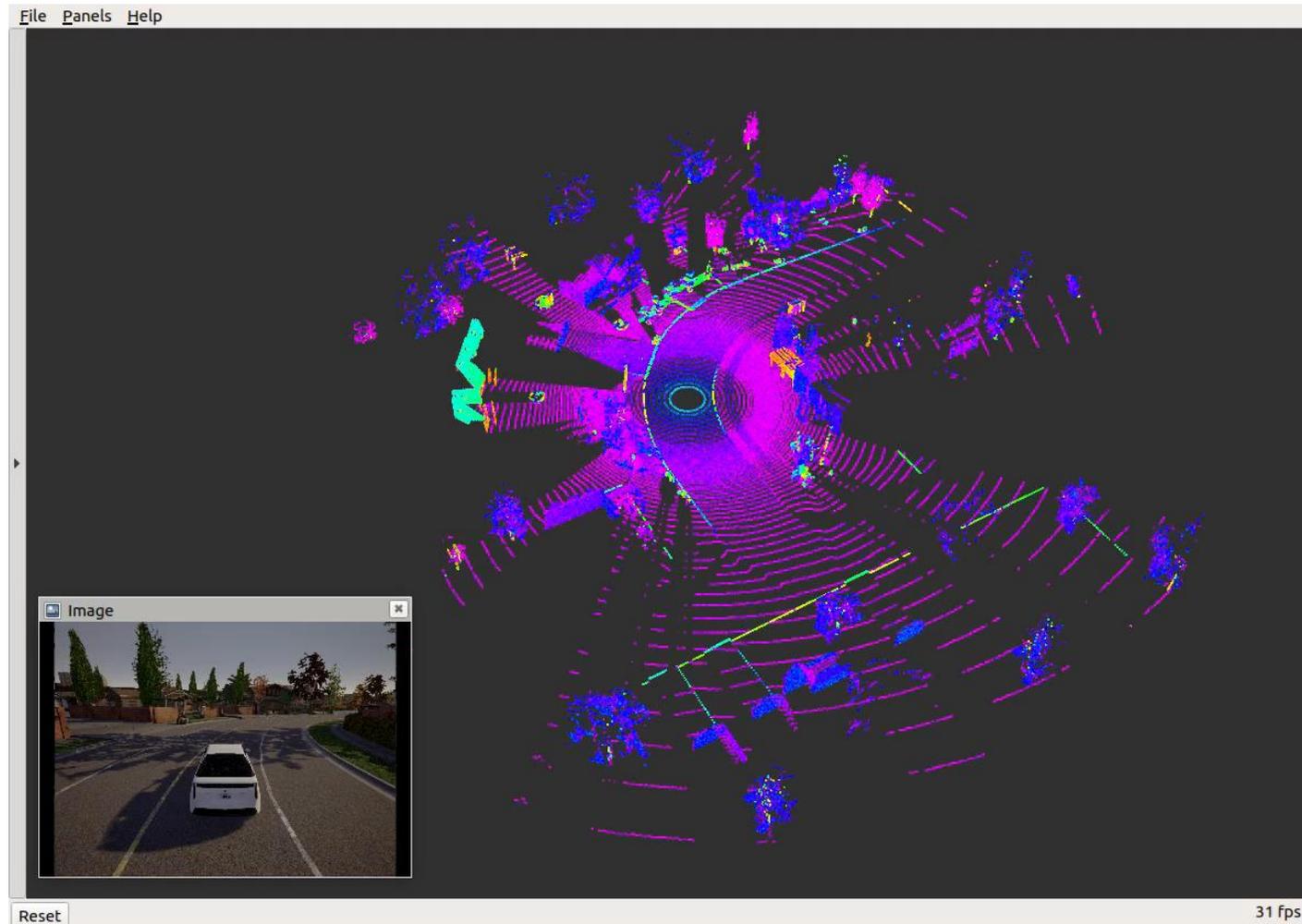
Brightness level is similar

LiDAR modeling & verification was implemented

LiDAR simulation

Nihon Unisys, Ltd

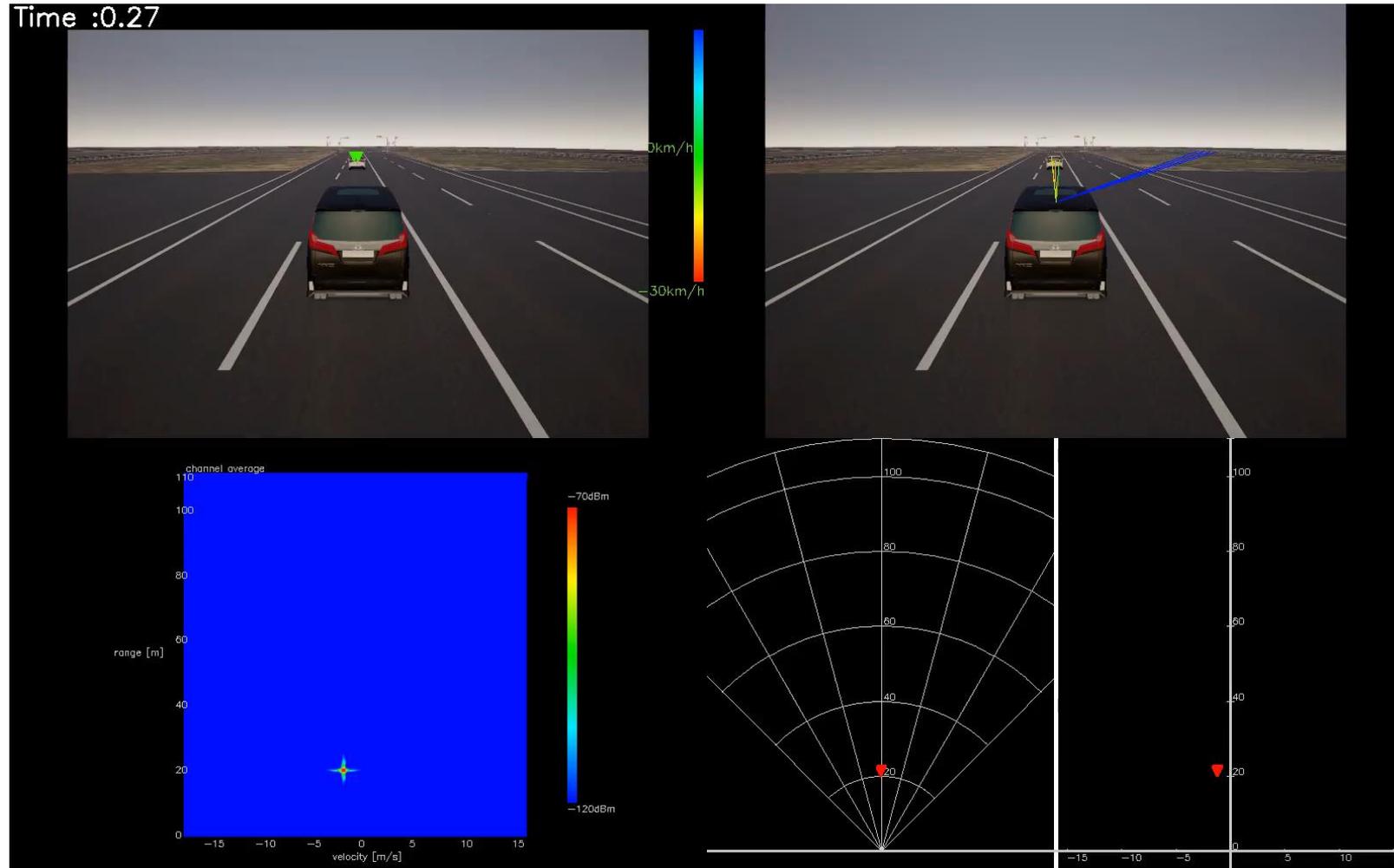
Pioneer



Radar model was implemented & under validation of Real vs Simulation consistency

Radar simulation

DENSO SOKEN Nihon Unisys, Ltd



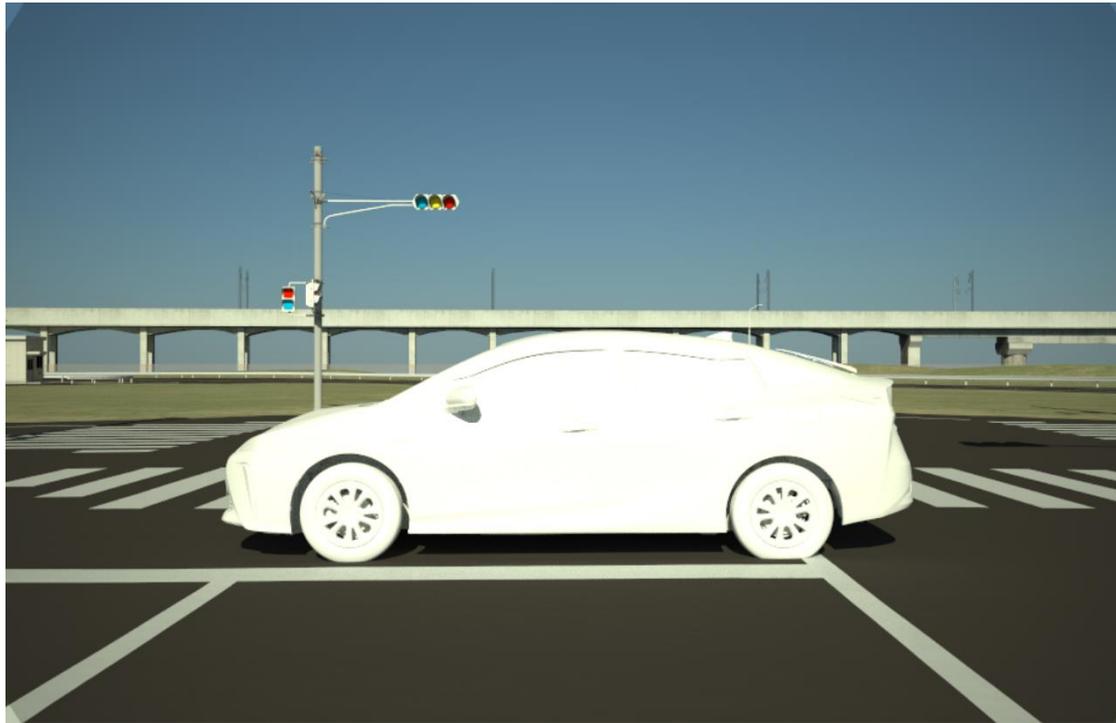
Application “Property” onto model surfaces realize precise objects in virtual environment

Properties

Nihon Unisys, Ltd **SOKEN**  三菱プレシジョン株式会社
MITSUBISHI PRECISION CO., LTD.

No Property

The result is flat with no color or texture.



With Property

The characteristics of the material are reproduced, and the strength and transparency of color and reflection can be reproduced.

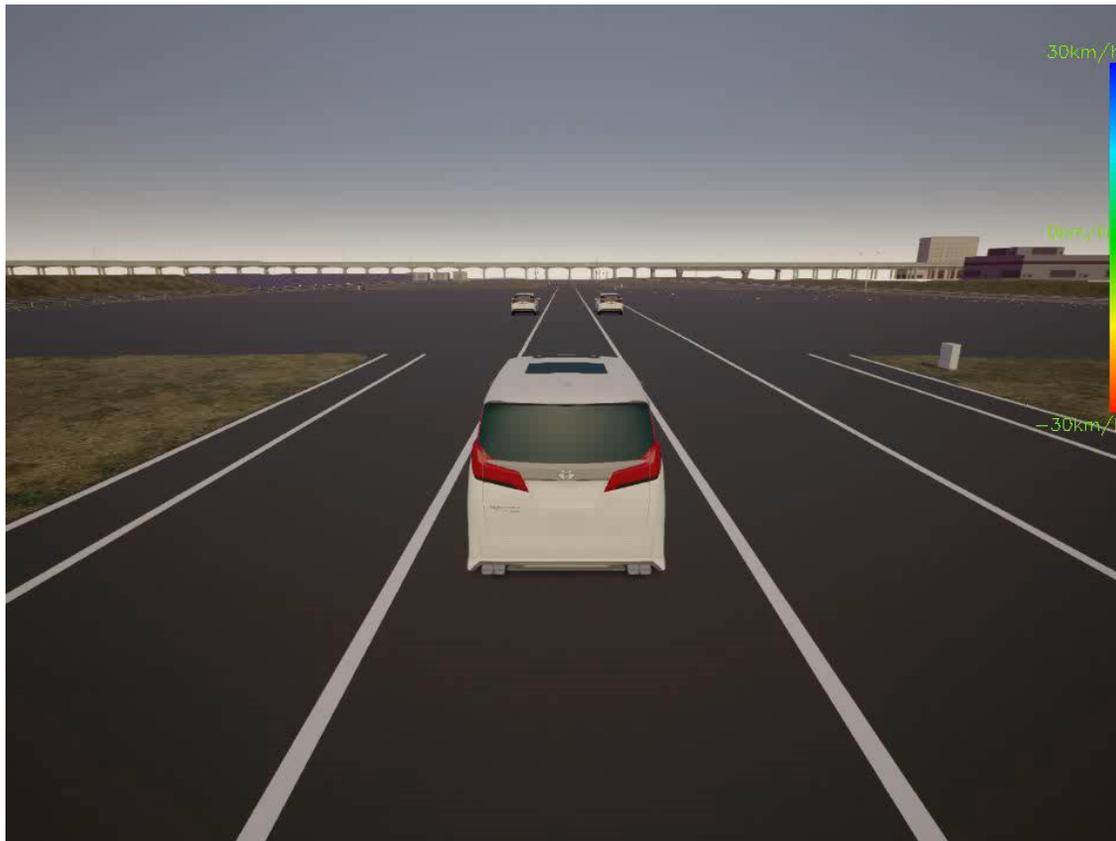


Close Multi objects correctly detected object by object with High resolution Radar

Example of Radar performance evaluation



Low resolution



High resolution



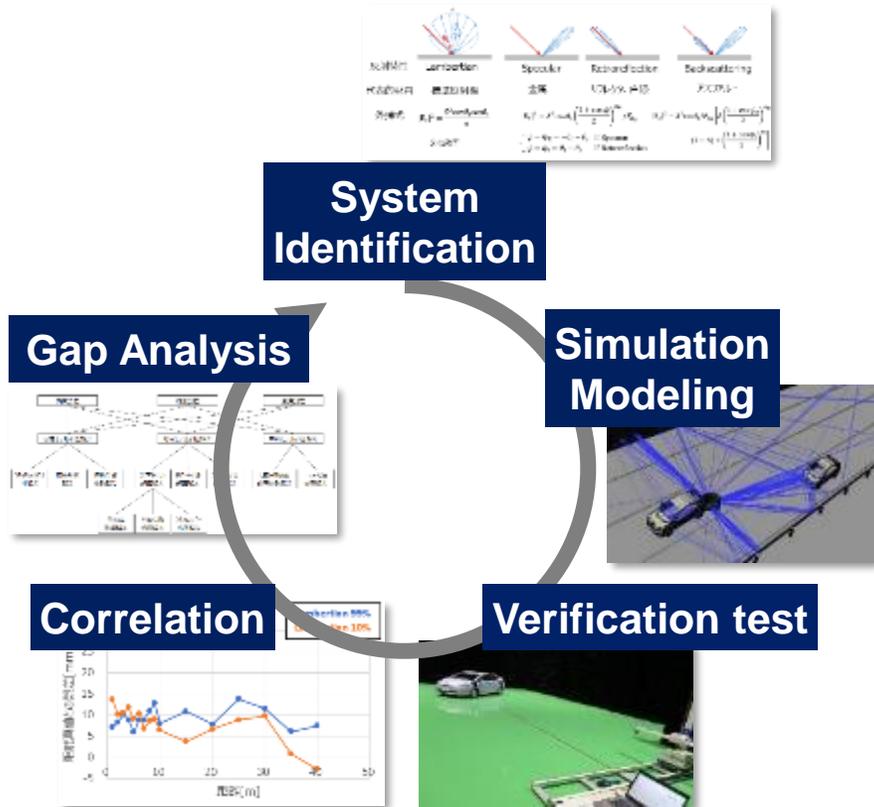
Achievement

- Highly consistent sensor modeling
- **Validation expansion on virtual community ground**

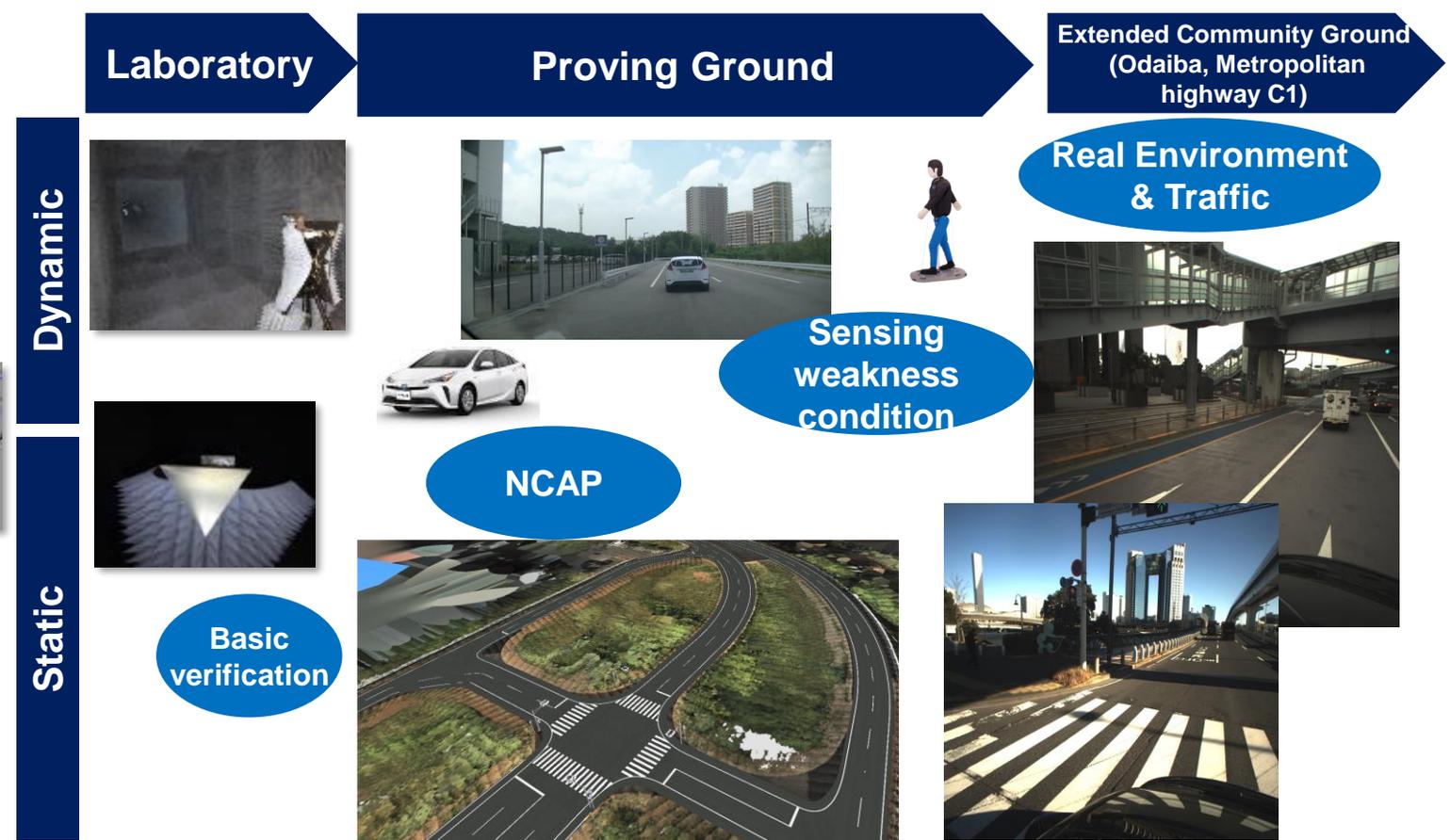
With PDCA modeling & validation testing, DIVP® duplicate Virtual-PG/CG capable for some NCAP protocols and sensing weakness condition

Measuring based Modeling framework

Measurement based approach



Enhancement roadmap



DIVP® focusing on making the simulation capable for sensing weakness validation and construct Virtual-PG/CG for AD-Safety assurance

Sensing domain based approach

Difficult for detection

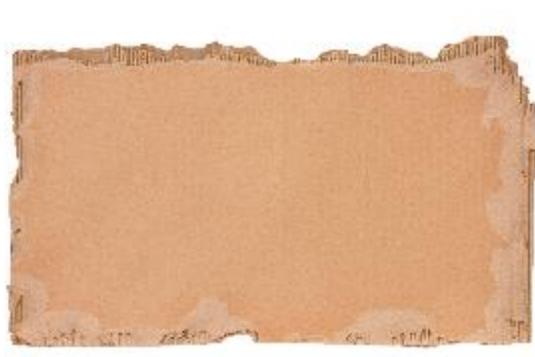
Black jacket



Group moving objects



Cardboard



Wet surface



Affects for light / millimeter wave propagation

Night



Millimeter wave Multi-path



Rain



Sunlight, Backlight



Virtual-PG realize Euro-NCAP and continuous expansion toward 2025

Euro-NCAP Simulation ; pedestrian darting out scenario

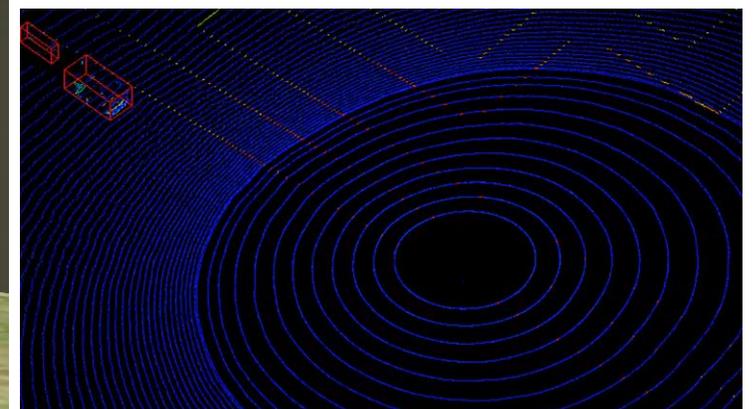
Pedestrian darting out scenario sim.



Camera sim.



LiDAR sim.



For the sensing weakness validation in Real situation construction Odaiba Community Ground and contribute to AD safety assurance

Odaiba Virtual Community Ground

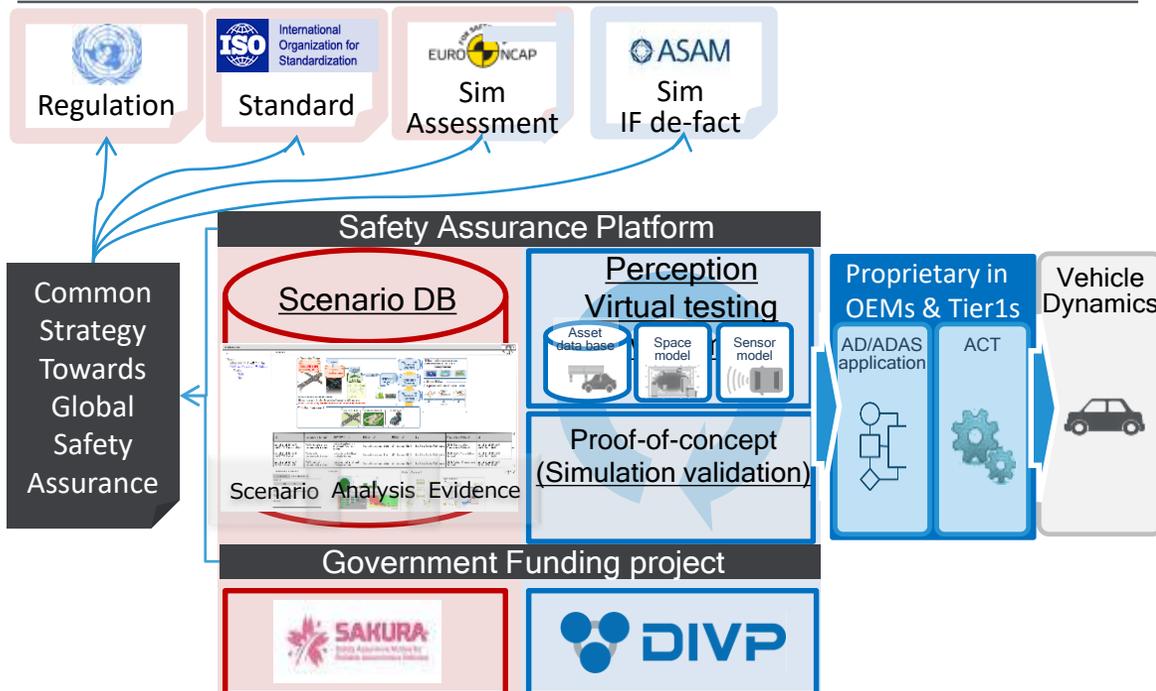


* The video is under development and may differ from the actual specifications.
Source : MITSUBISHI PRECISION CO.,LTD.

Summary

- DIVP® in SIP-adus believes that sensing domain based approach leads AD/ADAS to safer mobility society.
- DIVP® in SIP-adus will contribute to the standardization of I/F, reference modeling procedure with respective global activities.

Position in AD-safety assurance



DIVP® Objectives

- *Open Standard Interface*
- *Reference platform with reasonable verification level*
- *E & S pair model based approach (E : Environmental model, S : Sensor model)*

END

Tokyo Odaiba FOT area → Virtual Proving Community Ground

