

## 21.11.10 SIPadus Workshop, Safety Assurance Plenary Session



**A scenario database linked to a virtual platform for automated driving safety development and evaluation purposes**

**Jacobo Antona-Makoshi, Ph.D.**

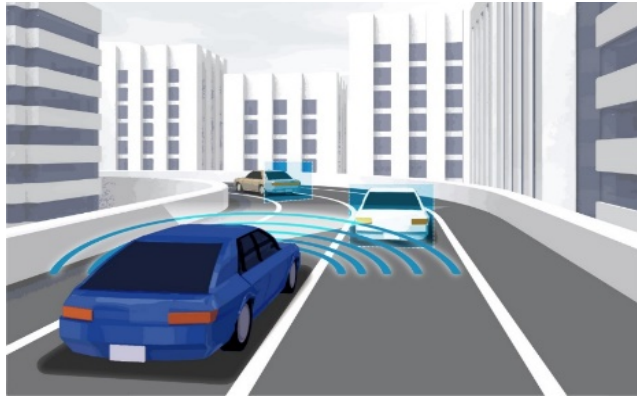
**SAKURA project**

**Japan Automobile Research Institute**

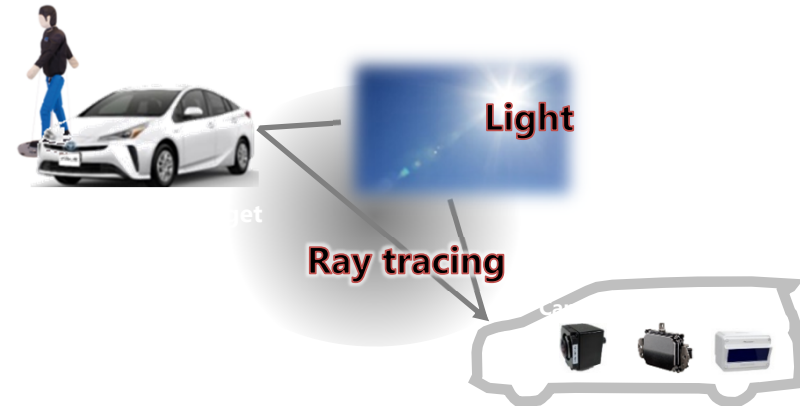
# AD safety assurance major challenges

AD safety cannot be ensured with long-distance endurance driving tests alone

High complexity of traffic environment



Virtual test environment (including perception)



Challenge  
1

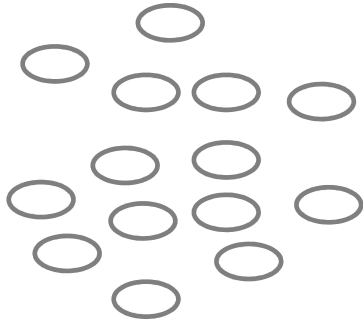
Safety validation scope

Challenge  
2

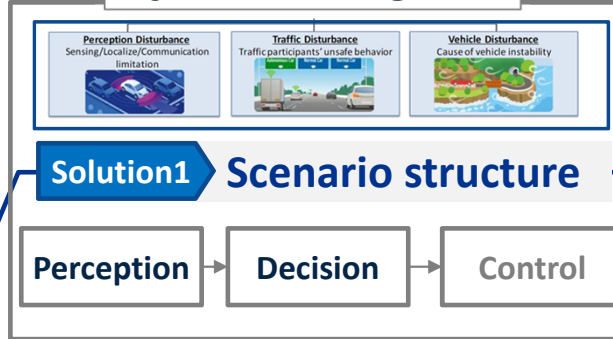
Virtual platform consistent with reality

# Our approach to overcome the challenges

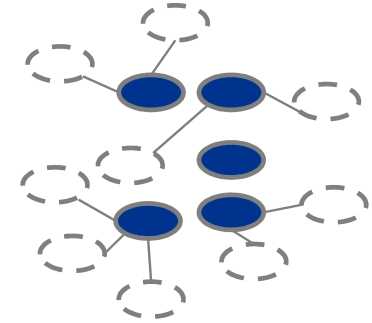
**“Non-deterministic”** scope due to traffic causal complexity



## Dynamic Driving Task



**“Deterministic”** scope through identification of root causes



## Solution2

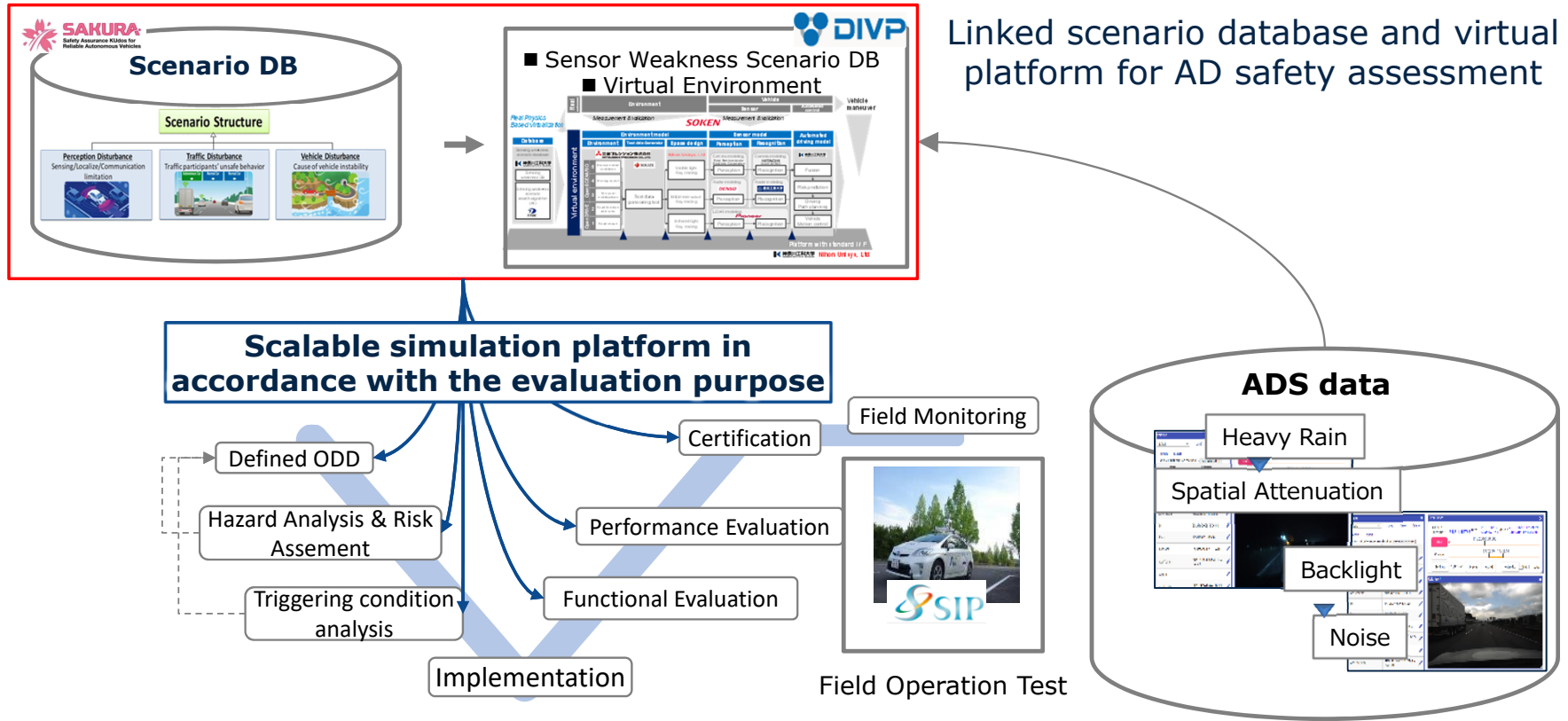
## Virtual platform



- Structured scenarios to address root causes affecting the three subtasks of the DDT
- Qualified virtual platform including simulation of sensor weaknesses

# Safety assurance strategic activities in Japan

Today's focus



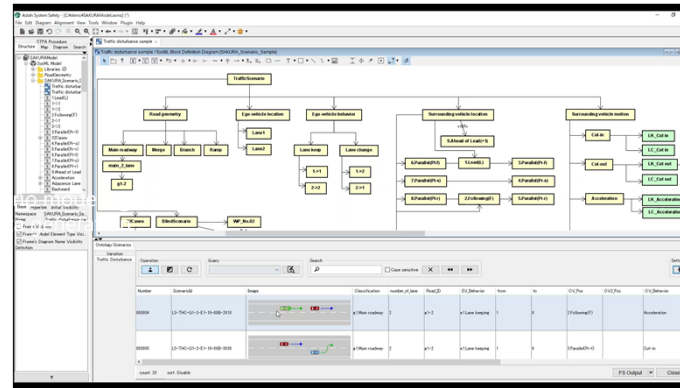
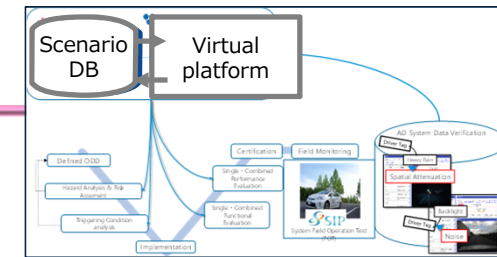
Linked scenario database and virtual platform for AD safety assessment

Scalable simulation platform in accordance with the evaluation purpose

ADS data

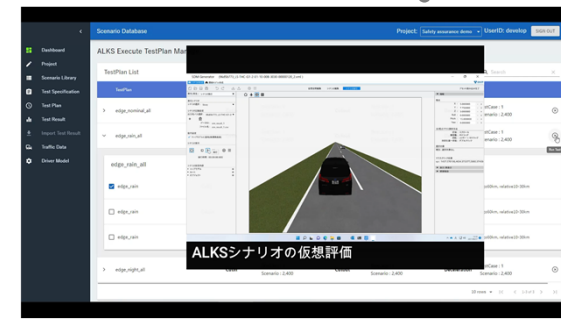
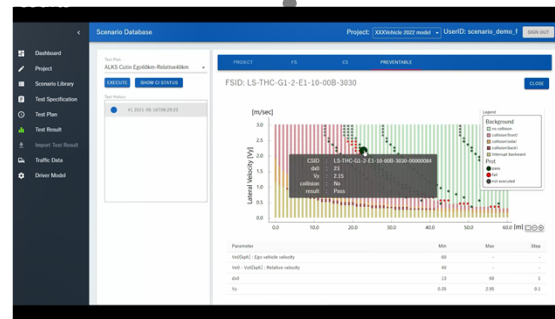
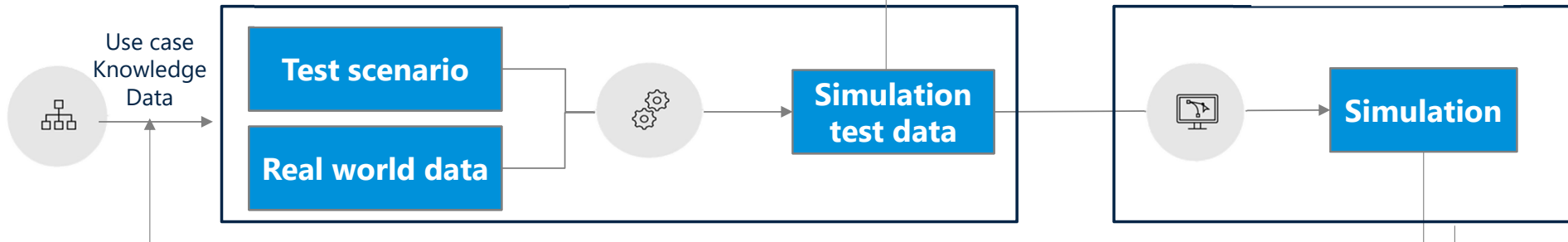
Aim at a scalable simulation platform to support ADS safety development and evaluation

# Linked scenario database & virtual platform



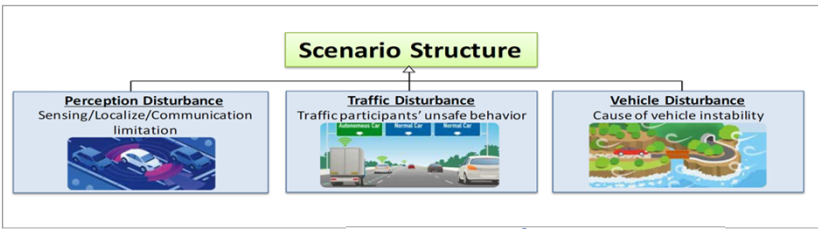
Scenario database

Virtual platform



# Scenario database

ISO DIS34502 Scenario based safety evaluation (Annex A to D)



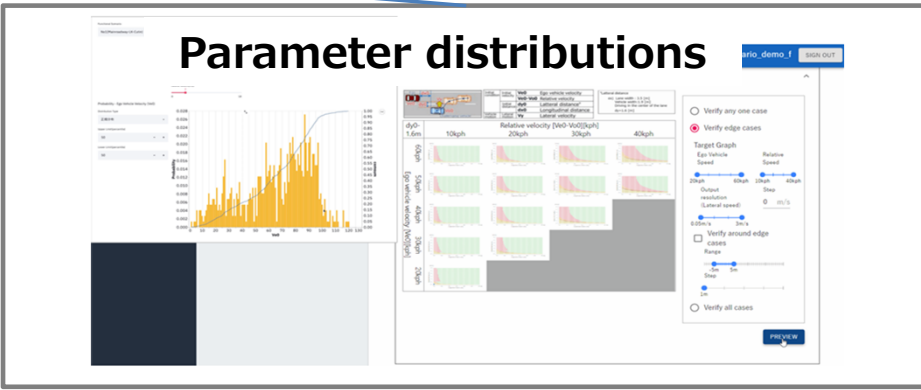
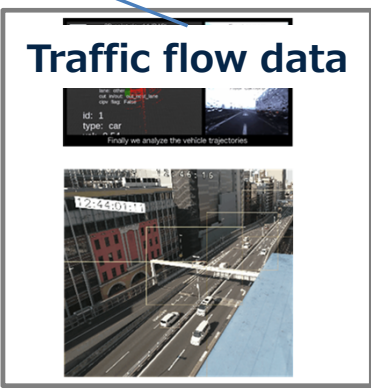
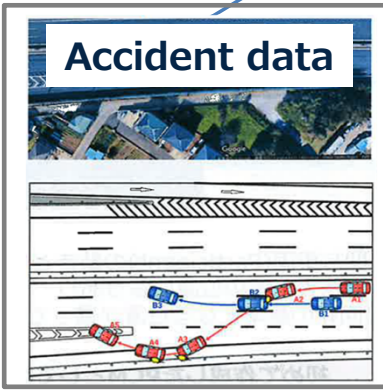
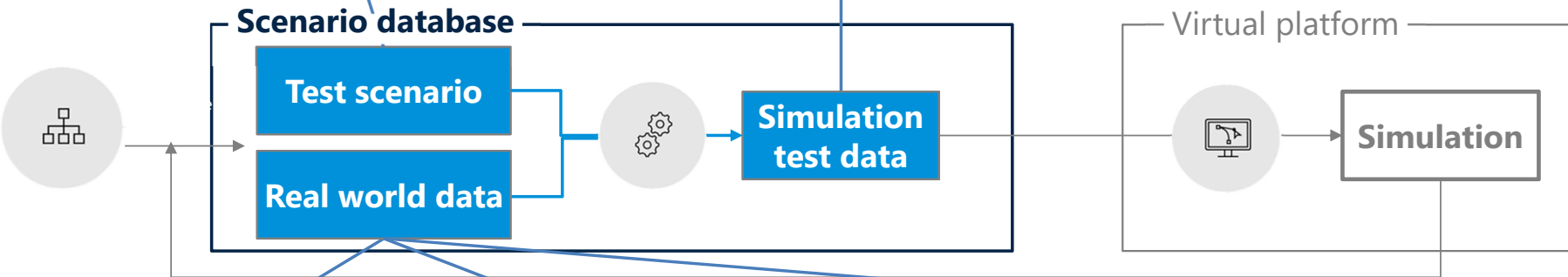
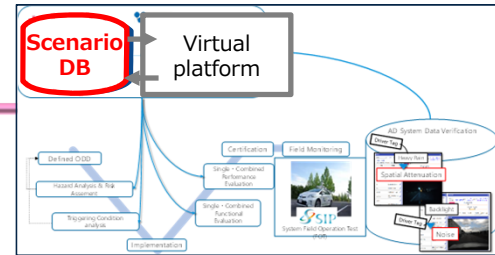
Standard format

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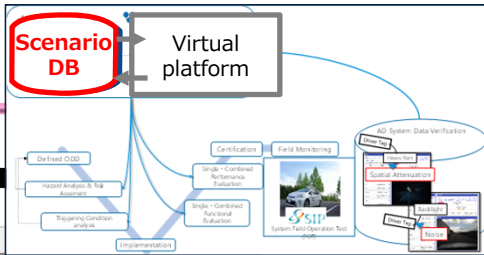
ASAM OpenSCENARIO®

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```



# Scenario database



Astah System Safety - [C:\demo\SAKURAModel.lxmz] (\*)

File Edit Diagram Alignment View Tools Window Plugin Help

STPA Procedure Structure Map Diagram Search

SAKURAModel SysML Model Libraries RoadGeometry SAKURA\_Scenario\_S Traffic disturbar Traffic disturbar 1.Lead(L) 1->1 1->2 2->1 2->2 3.Parallel(Pr-f) 32Cases 4.Parallel(Pr-s) 6.Parallel(Pr-f) 7.Parallel(Pr-s) 8.Parallel(Pr-r) 9.Ahead of Lead Acceleration Adjacence Lane Backward

Base Hyperlink Initial Visibility Namespace SAKURA\_Scenario\_Sa... Name Traffic disturbance sai  Frame Visibility  Frame's Model Element Type Visi...  Frame's Diagram Name Visibility Definition

Ontology Scenarios Variation Traffic Disturbance

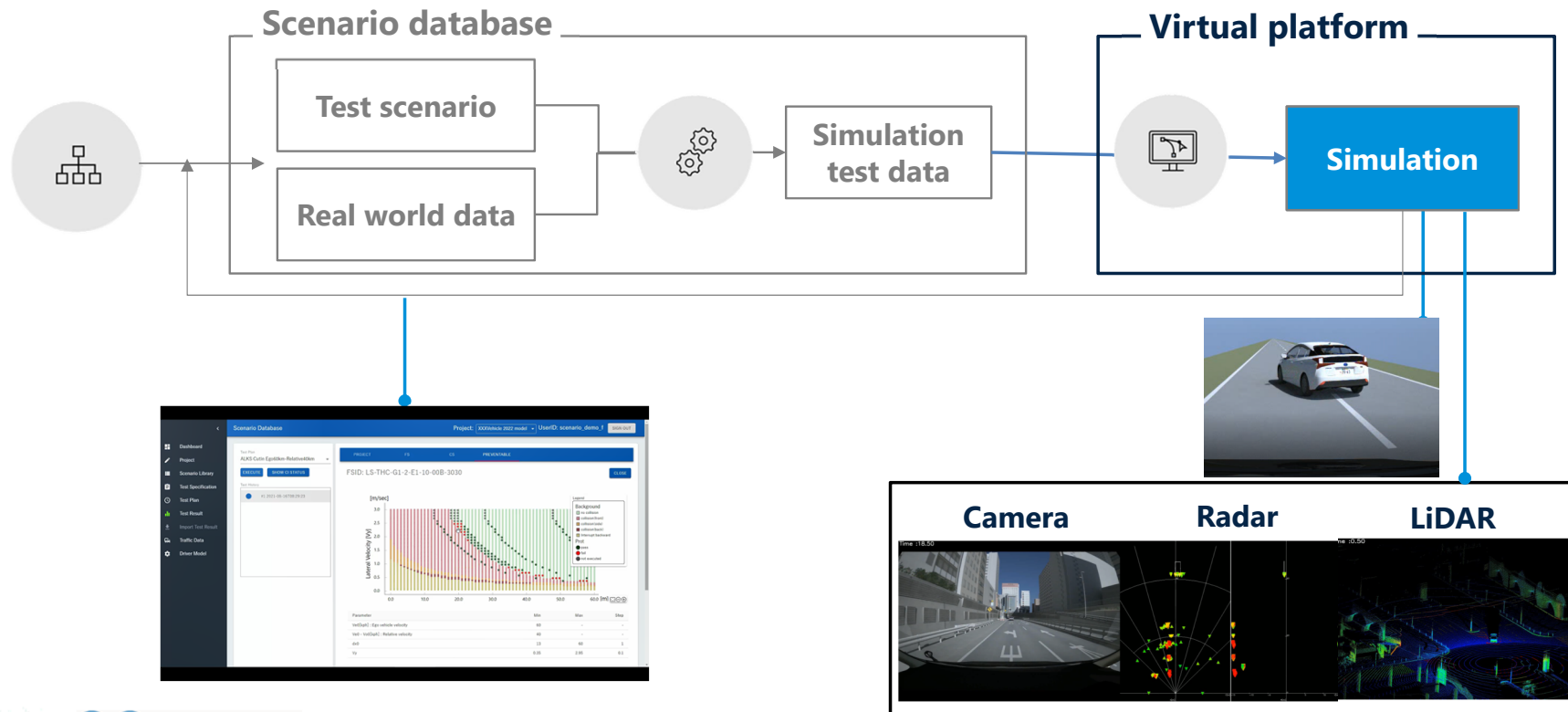
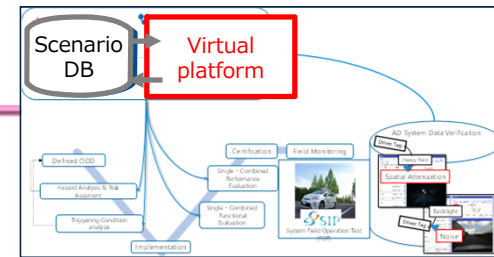
Operation    Query  Search   Case sensitive    Settings

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000004	LS-THC-G1-2-E1-10-00B-2010		e1.Main roadway	2	e1-2	e1.Lane keeping	1	0	2.Following(F)		Acceleration	
000005	LS-THC-G1-2-E1-10-00B-3030		e1.Main roadway	2	e1-2	e1.Lane keeping	1	0	3.Parallel(Pr-f)		Out-in	

count: 28 sort: Disable FS Output Close

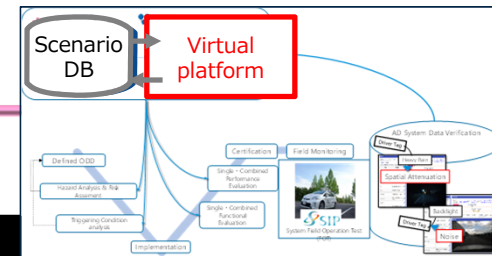


# Virtual platform and results management





# Virtual platform and results management



# Summary

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- ◆ SAKURA scenario database linked to the DIVP virtual platform for AD safety development and evaluation purposes
  - Conversion from a non-deterministic (infinite) traffic system into a deterministic (finite) problem by focusing on subtasks and root causes of the AD system
  - Compatible with simulation platforms and results management tools
  - Gradually incorporating perception scenarios including sensor weaknesses
  - Adaptable to international regulatory, standard, and consumer testing

**Thank you!**

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