

DIVP material initiatives for OpenMaterial through VIVID collaboration

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German-Japan joint virtual validation methodology for intelligent driving systems – VIVID

DIVP® – VIVALDI



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VIVID has been co-created to establish virtual test environments for CAD-safety assurance by confirming the commonalities and complementarities of VIVALDI and DIVP through each JTs.

On the Way to Reliable and Realistic Validation for CAD safety assurance

• Base value through commonalities

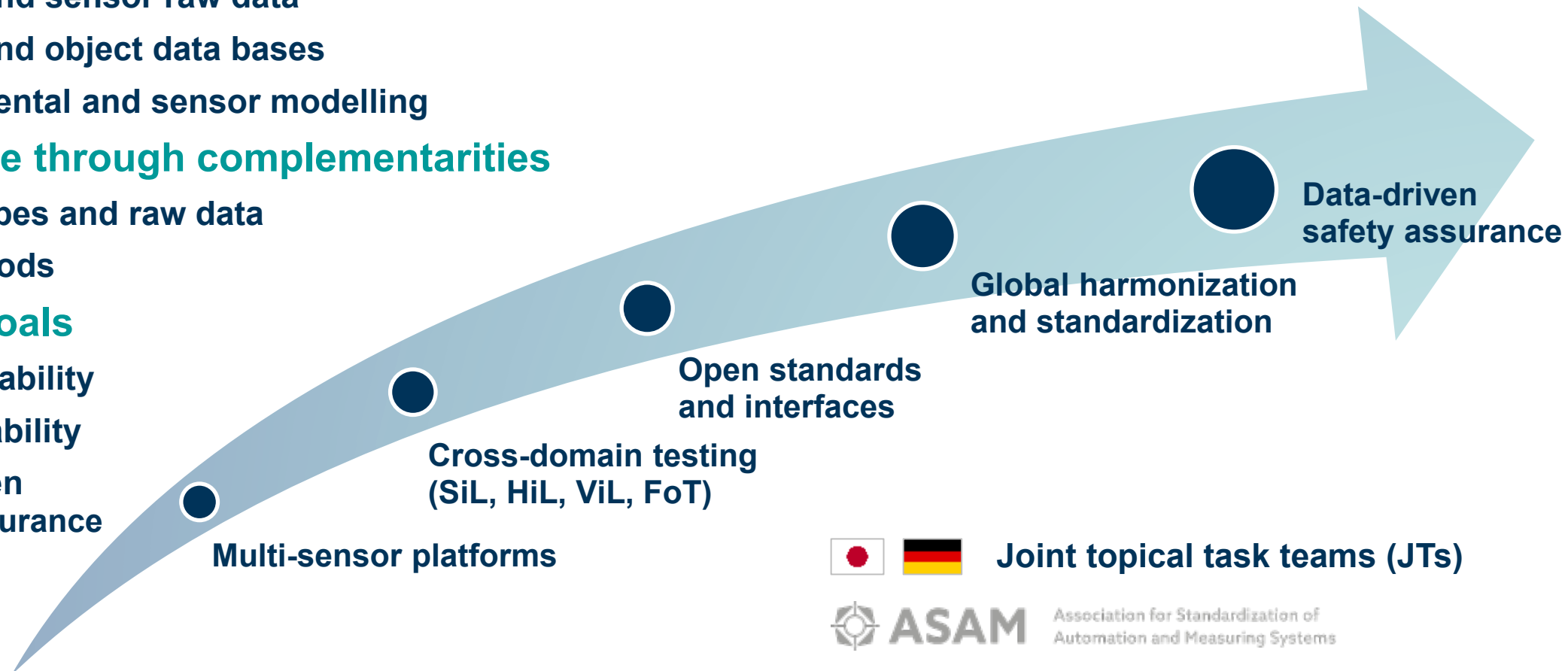
- HD map and sensor raw data
- Material and object data bases
- Environmental and sensor modelling

• Added value through complementarities

- Sensor types and raw data
- Test methods

• Common goals

- Exchangeability
- Interoperability
- Data-driven Safety assurance



Joint topical task teams (JTs)



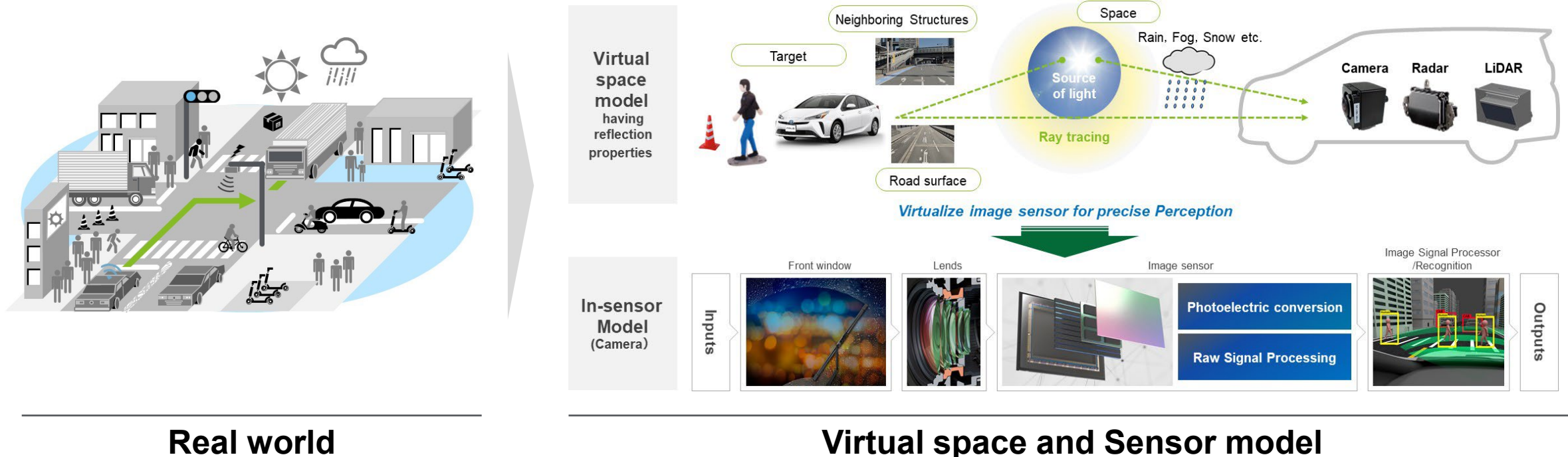
ASAM

Association for Standardization of
Automation and Measuring Systems

Building a virtual space simulation platform having highly consistent sensor models with real-world phenomena to contribute to the safety assessment of automated driving.

DIVP motivation

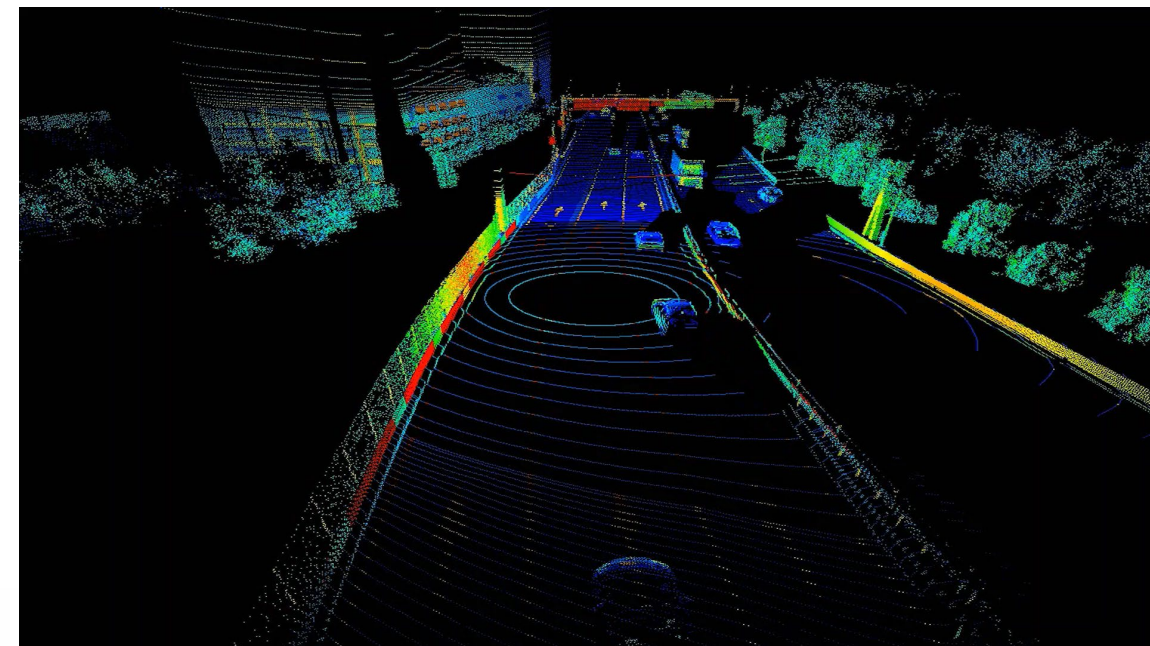
- Sensor modeling that is highly consistent with physical phenomena.
- Platform that enables AD-evaluations throughout “scenario creation”, “verification of recognition”, “validation of vehicle control”.
- Enhanced connectivity with existing simulation software.



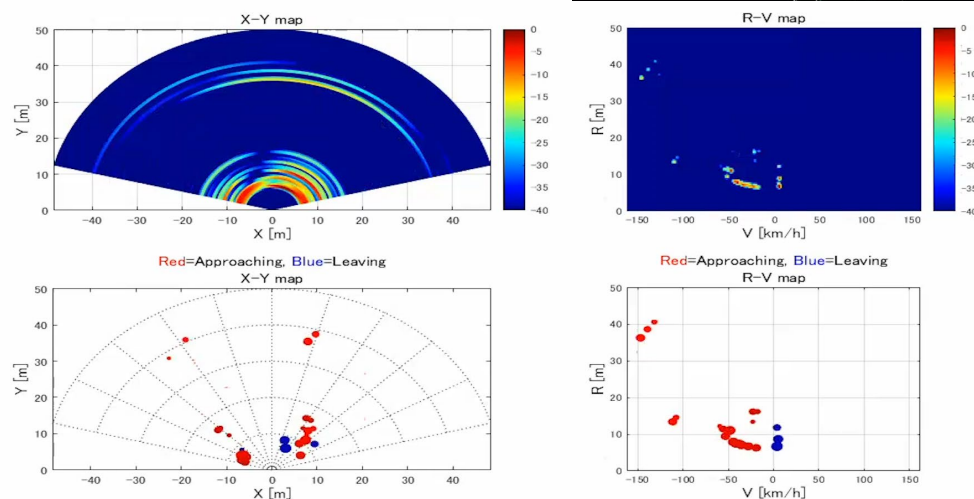
Using DIVP Material, simulation results of LiDAR, Camera and Radar appear realistic.



Camera



LiDAR



Radar

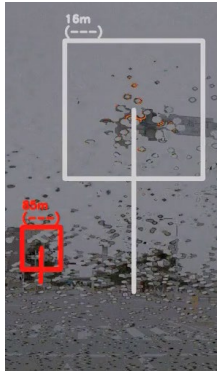
Traffic signal recognition in rainy weather; verification of recognition limit performance is possible with virtual space simulation

Contribution to safety assessment for AD-system evaluation using virtual space model

Difficult to catch signal recognition limit conditions in public road due to lack of control over rainfall condition levels



DIVP® simulation allows for intense rainfall settings
→ Signal recognition limit verification is possible



Evaluation by extrapolation is possible

Public road tests	Normal weather	Rainy weather (a few mm/h)
Recognition rate	0.982	0.984

DIVP® simulation	Normal weather	Intense rainy weather
Recognition rate	0.989	0.868

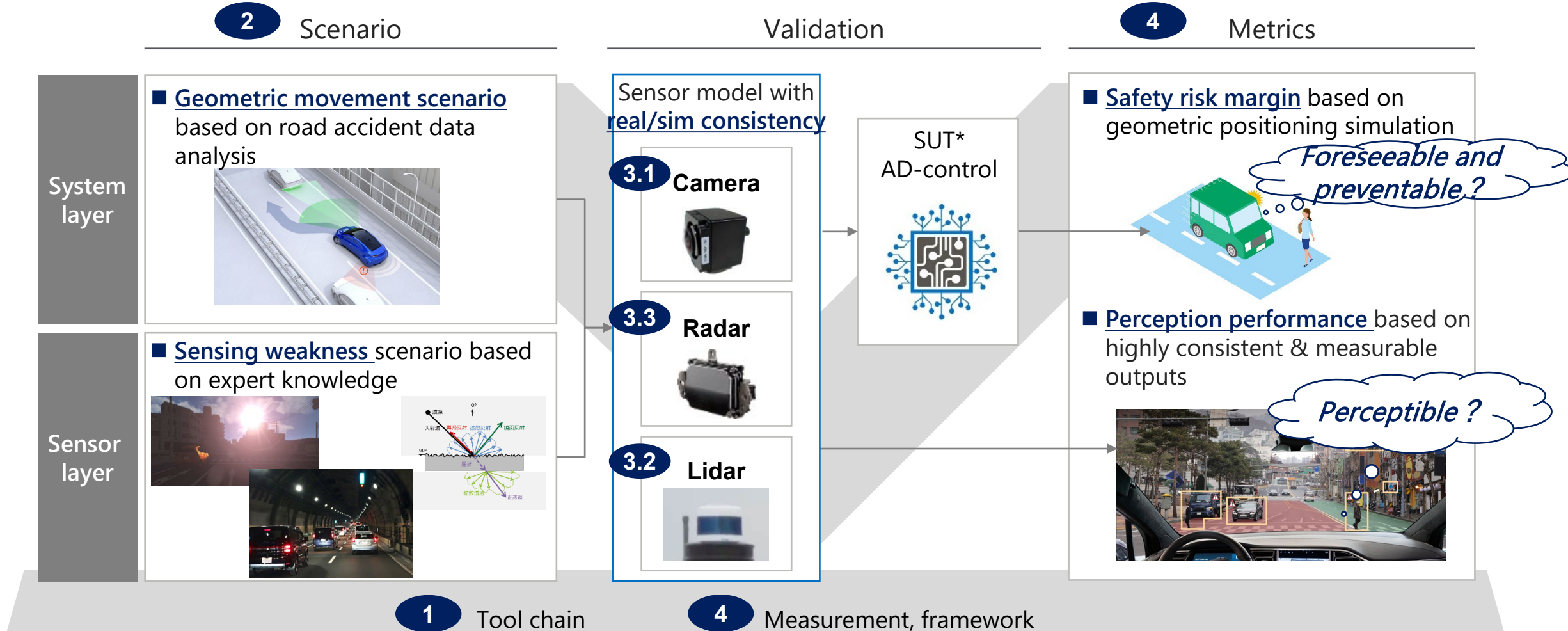
The overall recognition rate deteriorated with increasing rainfall in DIVP® simulation.

- Undetected due to shielding by raindrops
- Misrecognition due to color change, etc.

For AD safety assurance, geometrical input for system layer & physical materials input for sensor layer are needed as total validation framework

Validation framework for AD safety assurance and VIVID JT's position

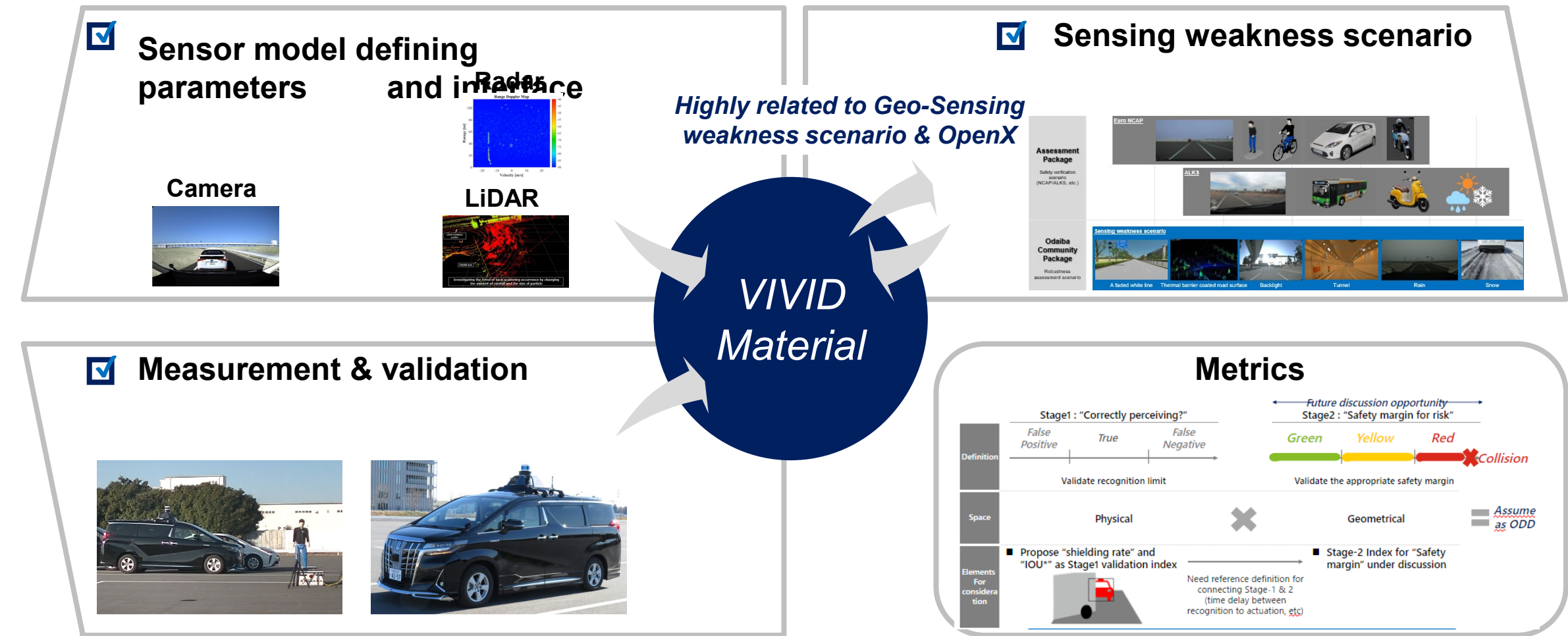
● JT activity



* SUT : System under test

DIVP® would like to propose the formulation of “VIVID material” as a joint material format for sensor validation contributes to AD-Safety assurance

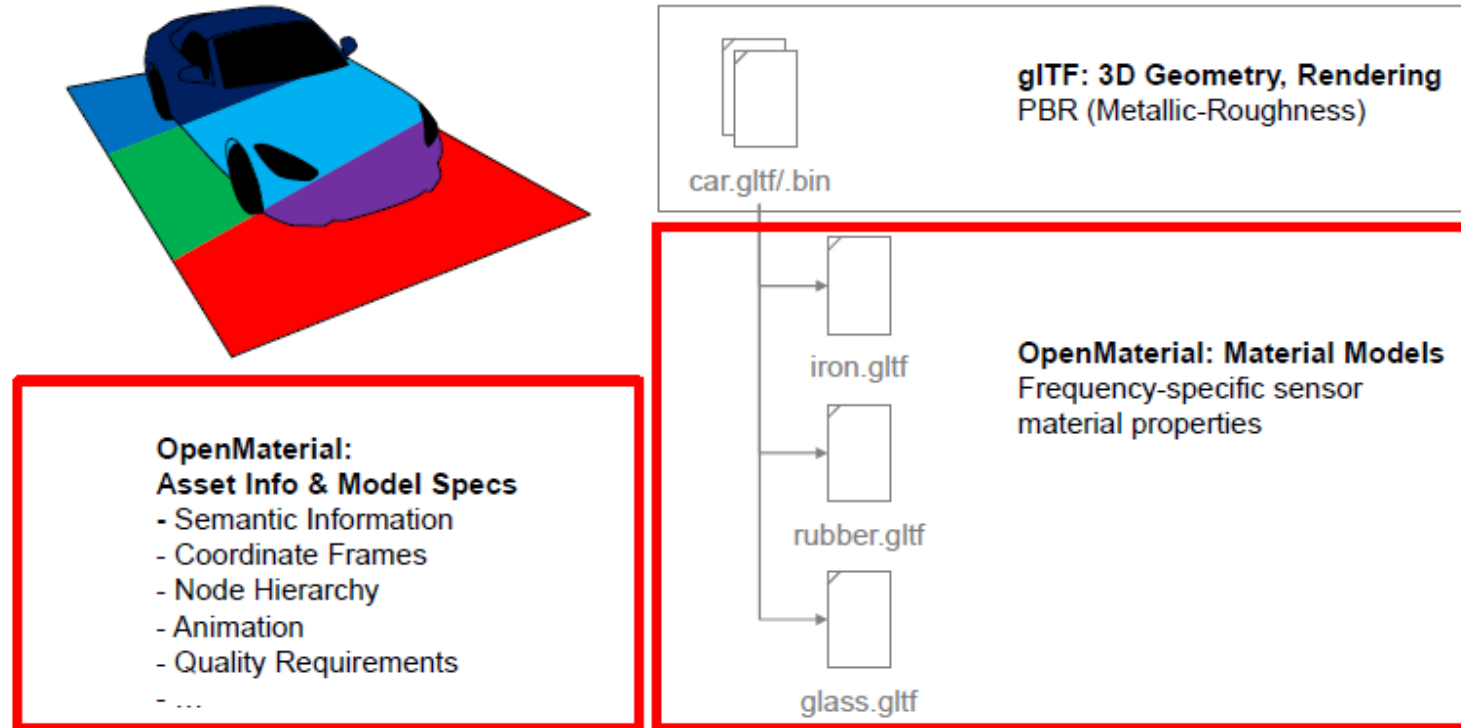
VIVID material



BMW's OpenMATERIAL proposal has two pillars, Asset Info & Model Specs and Sensor material properties, which are very similar to ours. In particular, the latter is exactly the same.

BMW's OpenMATERIAL

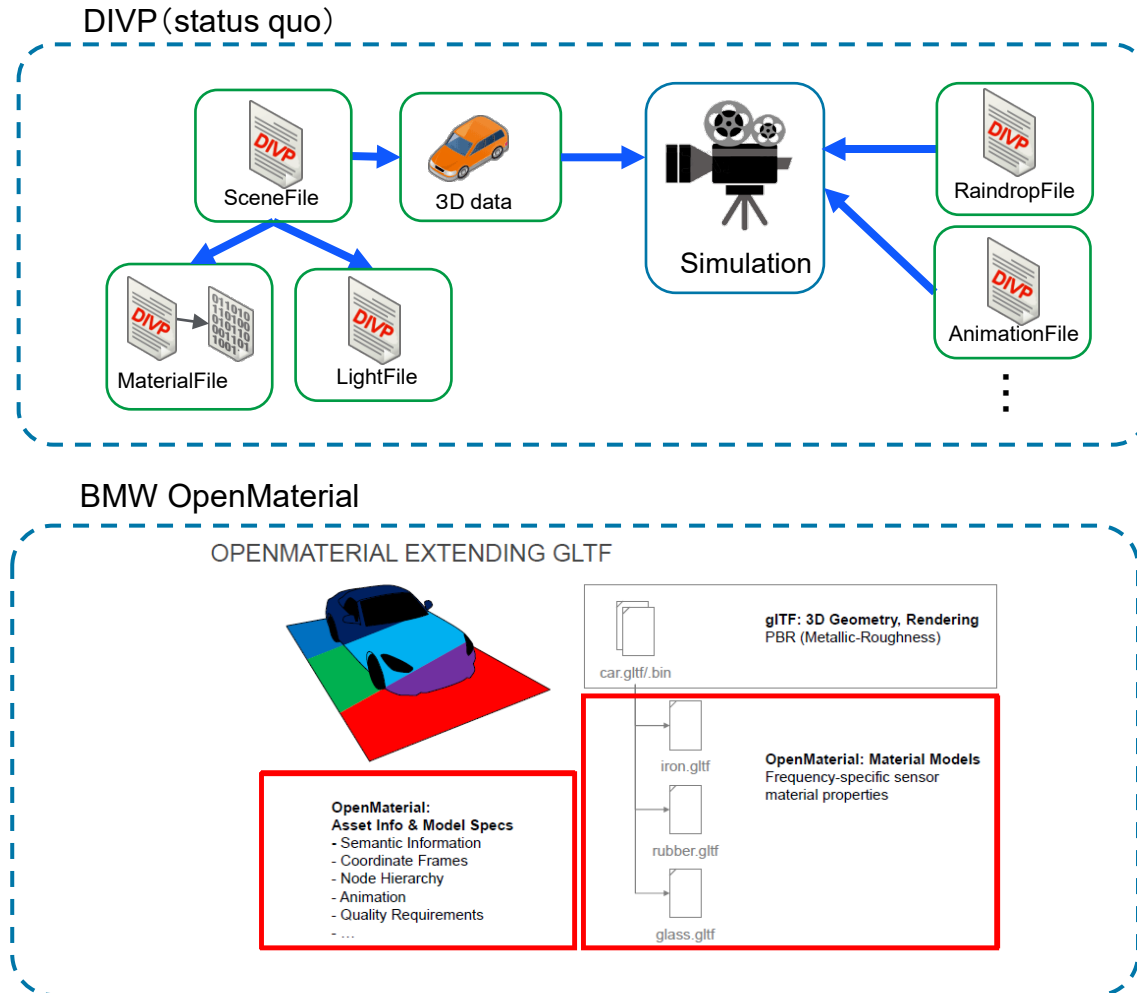
OPENMATERIAL OPENMATERIAL EXTENDING GLTF



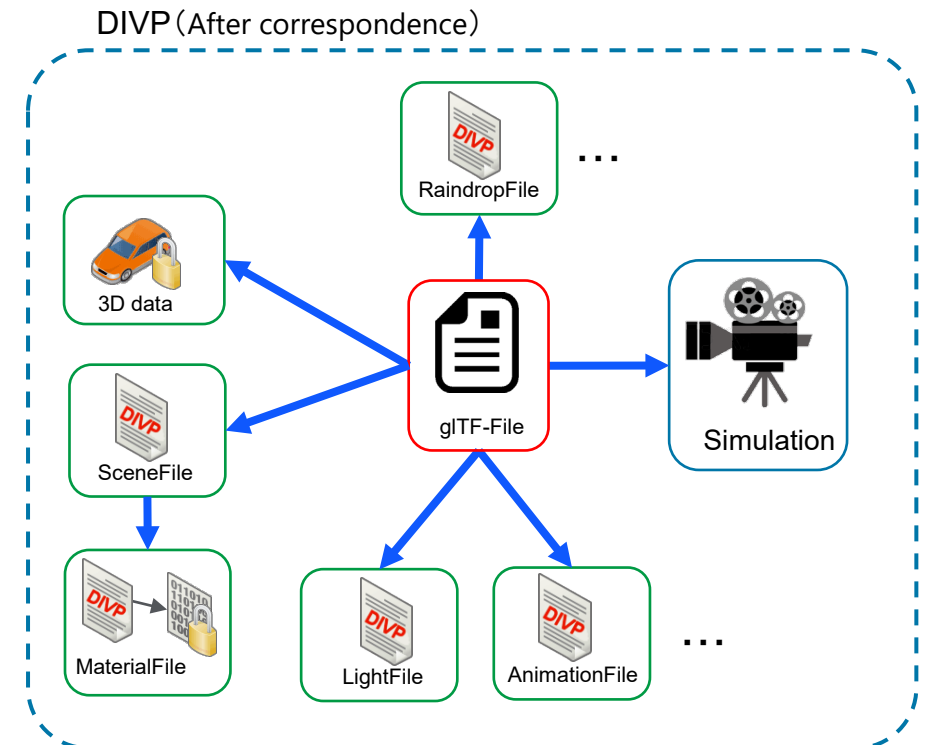
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DIVP also implements glTF support and collaborates with BMW for standardization

Our proposal for BMW's OpenMaterial



Example of data structure for exchange that will lead optimization of development and validation process.



Using URI reference, the DIVP Material file and various configuration files are referred to from glTF.

The information you want to close can be set as a password and concealed.

DIVP collaboration under the VIVID framework concerning material distribution.

Key focus

- Measurement data of physical properties is critical for the fidelity of simulation.
- 3D data and material measurement data are two pillars of OpenMATERIAL.
- Data exchangeability will lead the standardization of OpenMATERIAL.



VIVID supports the OpenMATERIAL initiative by BMW and will propose a potential ASAM Concept Project.



Thank you for your kind attention!

Tokyo Odaiba → Virtual Community Ground

END

