GOALI CPS: Maneuver and Data Optimization for High Confidence Testing of Future Automotive Cyberphysical Systems

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Challenge:

Current lack of a toolchain for high confidence testing, verification and validation of advanced, connected and autonomous vehicles can impede and even entirely prevent the introduction of such vehicles into mass production.

Solution:

• Develop theory, methods, and tools for generating and optimizing test trajectories and data inputs that can maximize opportunities to uncover faults in both physical and cyber domain in future automotive vehicles.

— CPS/Smart Black Box with principled sampling-based vehicle data acquisition and management strategies to uncover faults in both existing and future vehicle fleets

— Game theory based simulation environment to inform in-traffic relevant trajectories

— Model-free trajectory optimization techniques for actively falsifying time domain specifications

Vehicle sensors

Cameras

Speed   Lidar

CPS/Smart Black Box
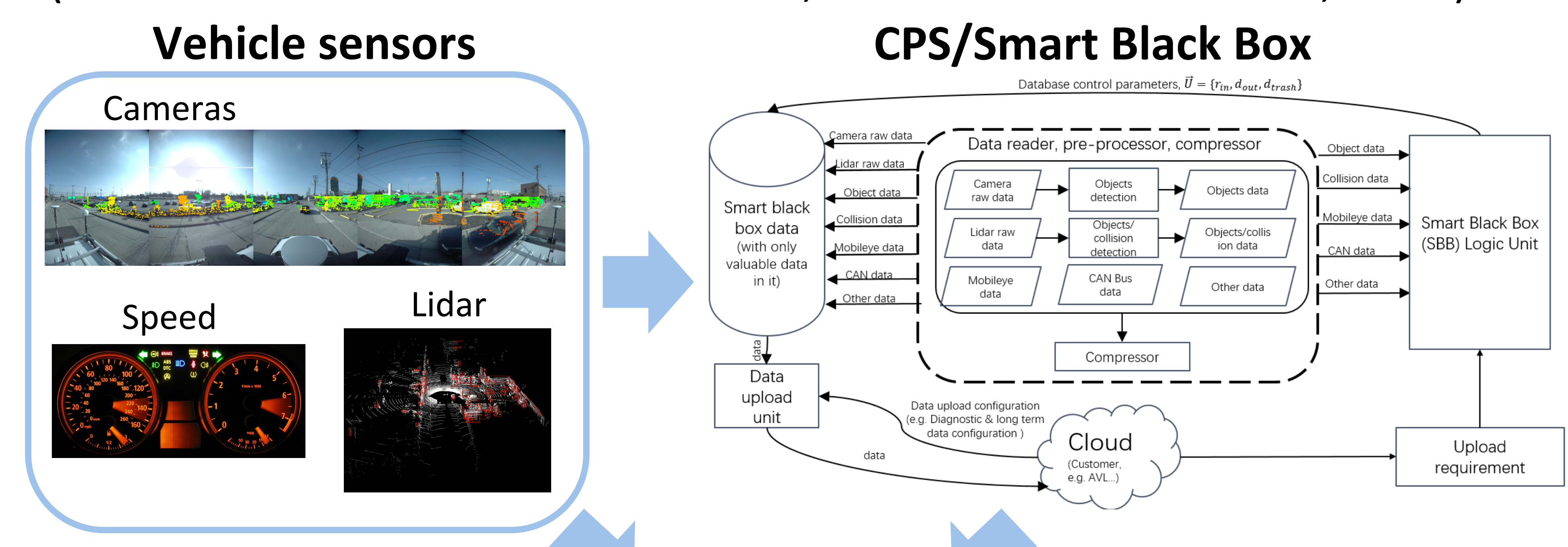
Trajectories and data inputs for testing of future autonomous vehicles

Model-free trajectory optimization

Game-theoretic interactive simulation environment
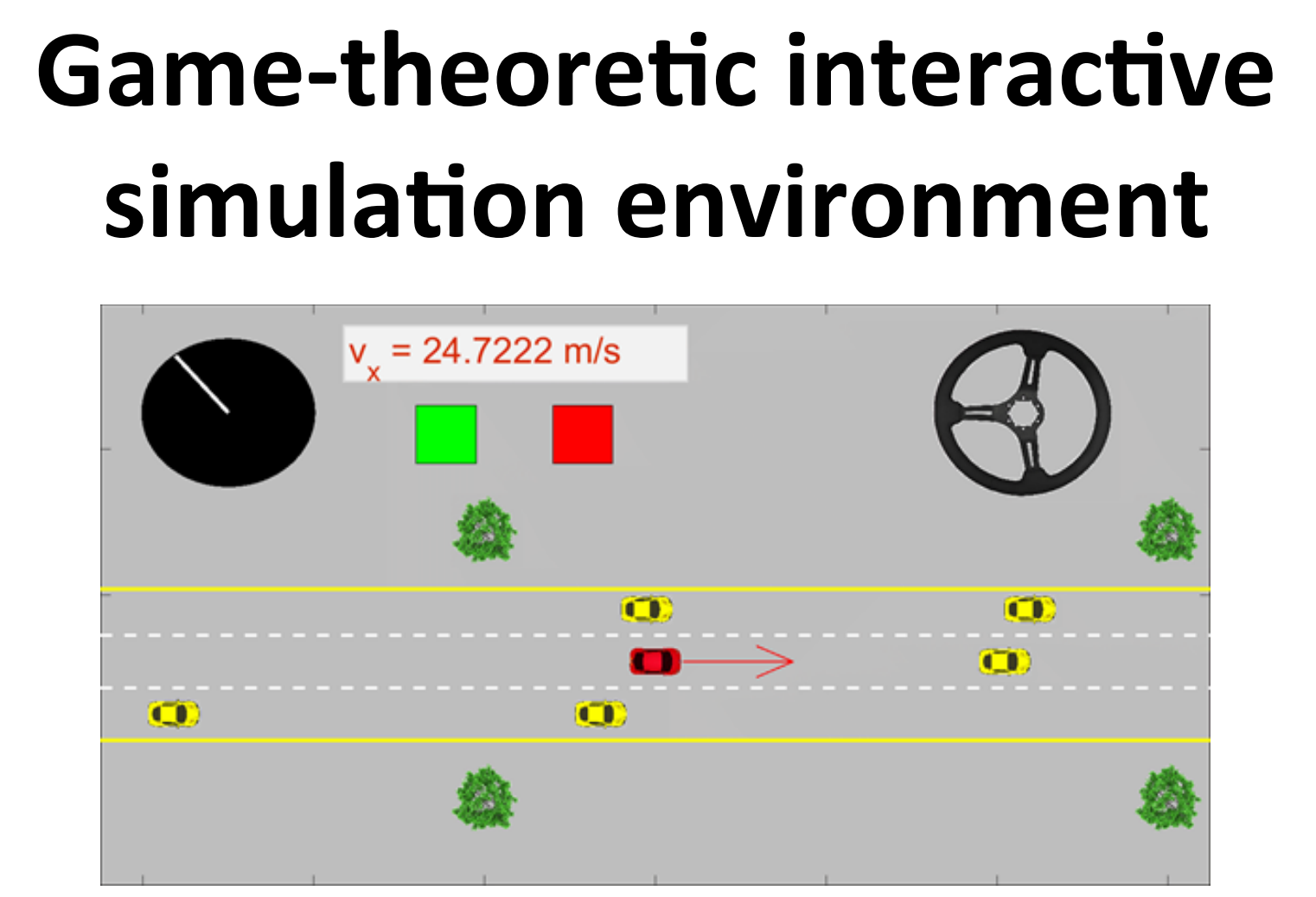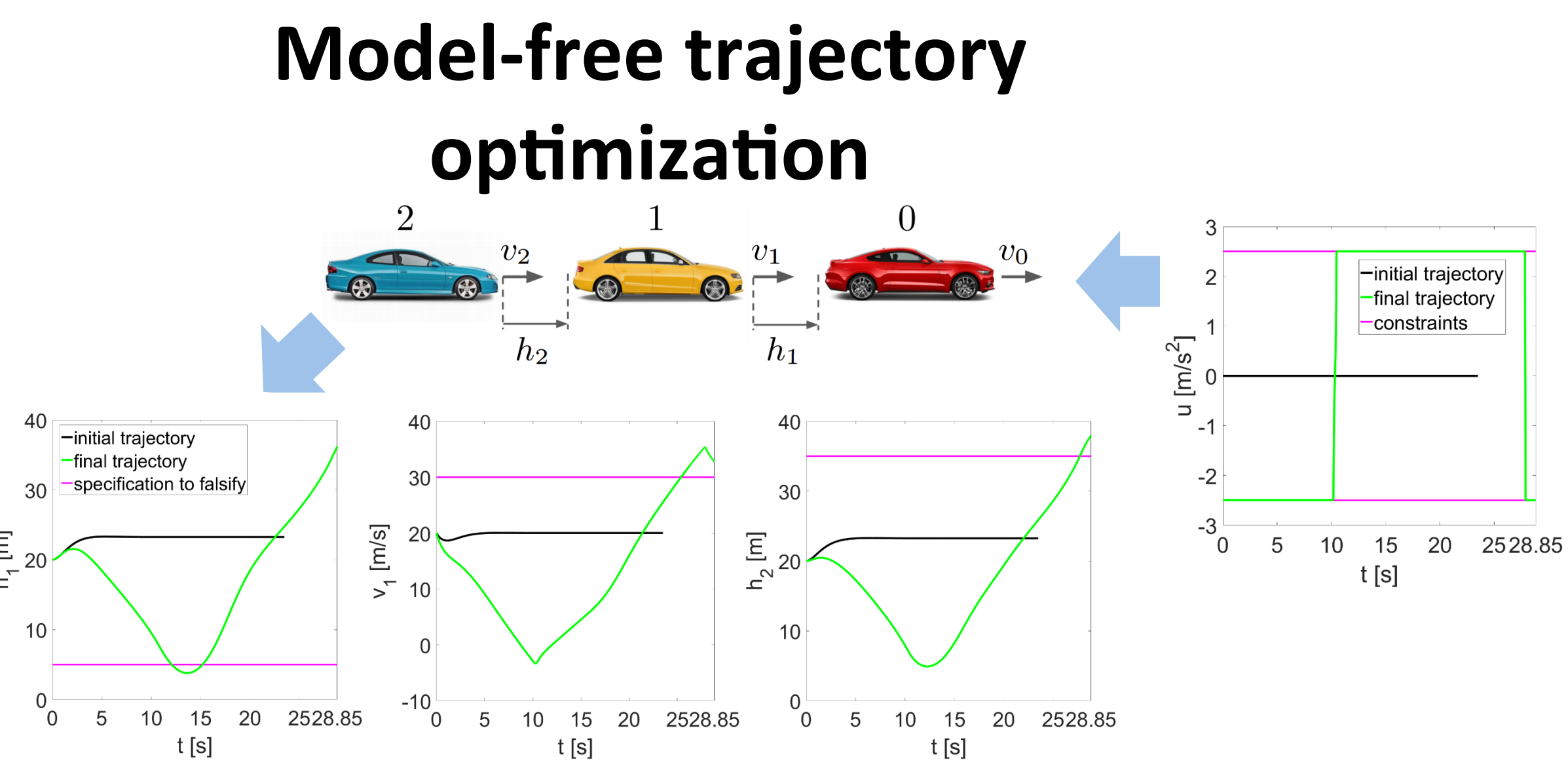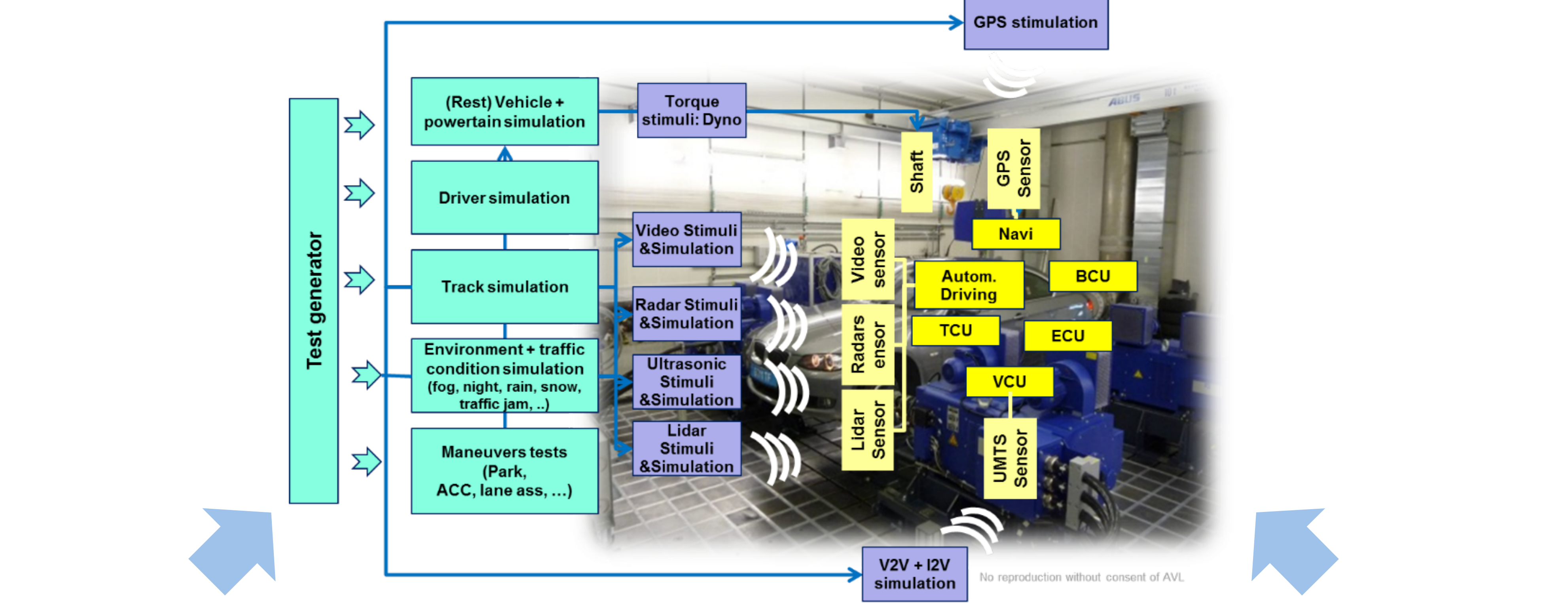
Scientific impact:

• Research advances CPS vehicle lifecycle management with focus on test generation and verification & validation.

• Research advances game theory, optimal control, information theory and data mining for applications in autonomous/automated vehicle setting.

• Data acquisition and sampling strategies can be applied broadly to connected vehicle & devices.

Broader impact:

• Research supports the automotive industry in introduction of autonomous/automated vehicle technology into mass production.

• Autonomous vehicles will have a significant societal impact, e.g., enabling transportation for people who are not able to drive.

• Interdisciplinary advances are integrated into courses and tutorials.

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