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ROADVIEW

Robust Automated Driving in Extreme Weather

<https://roadview-project.eu/>

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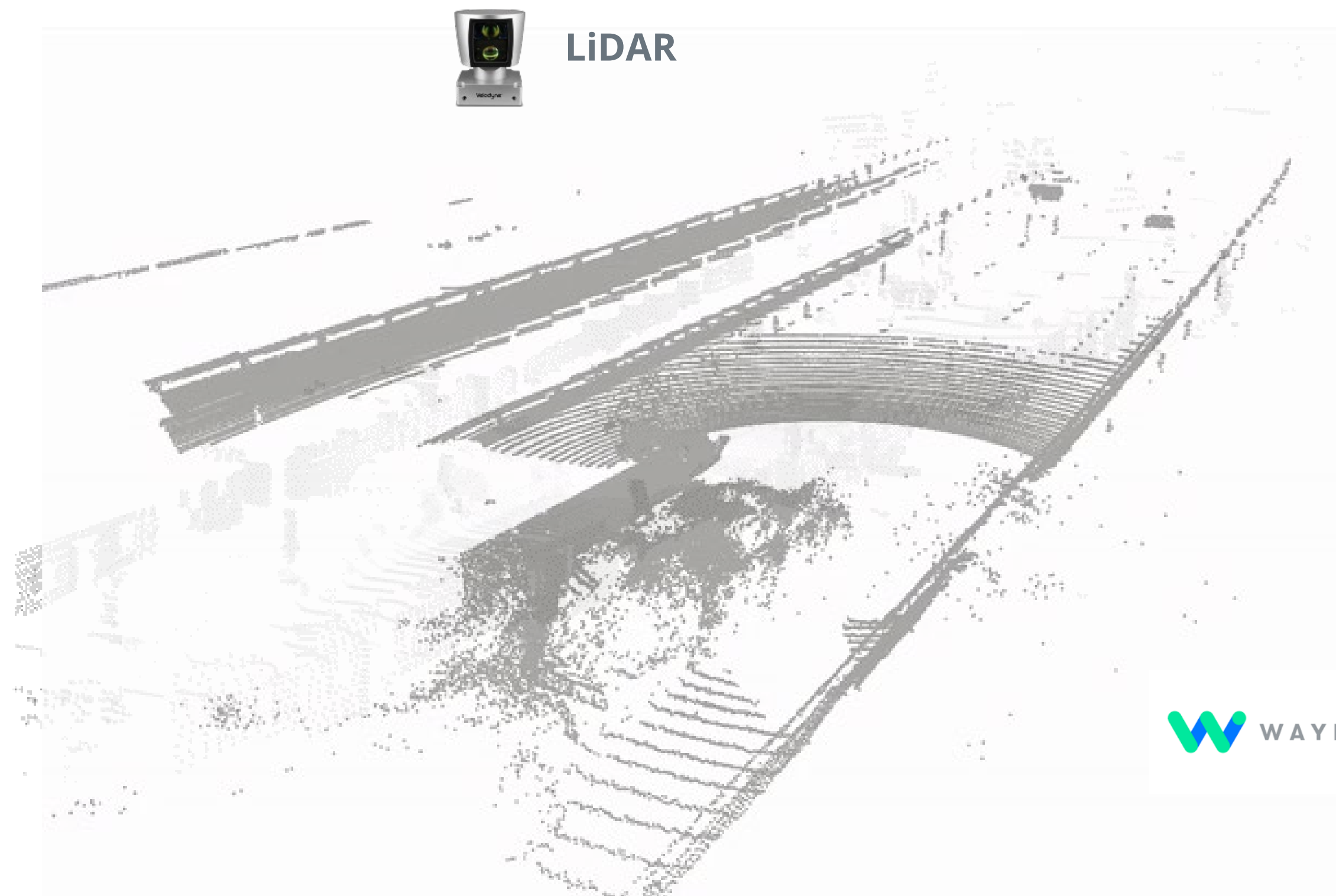
Not every kilometer driven is equal: Most automated vehicles have been **primarily trained and tested under optimal weather and road conditions with clear visibility!**



THE IMPACT OF ADVERSE WEATHER CONDITIONS ON AUTONOMOUS VEHICLES

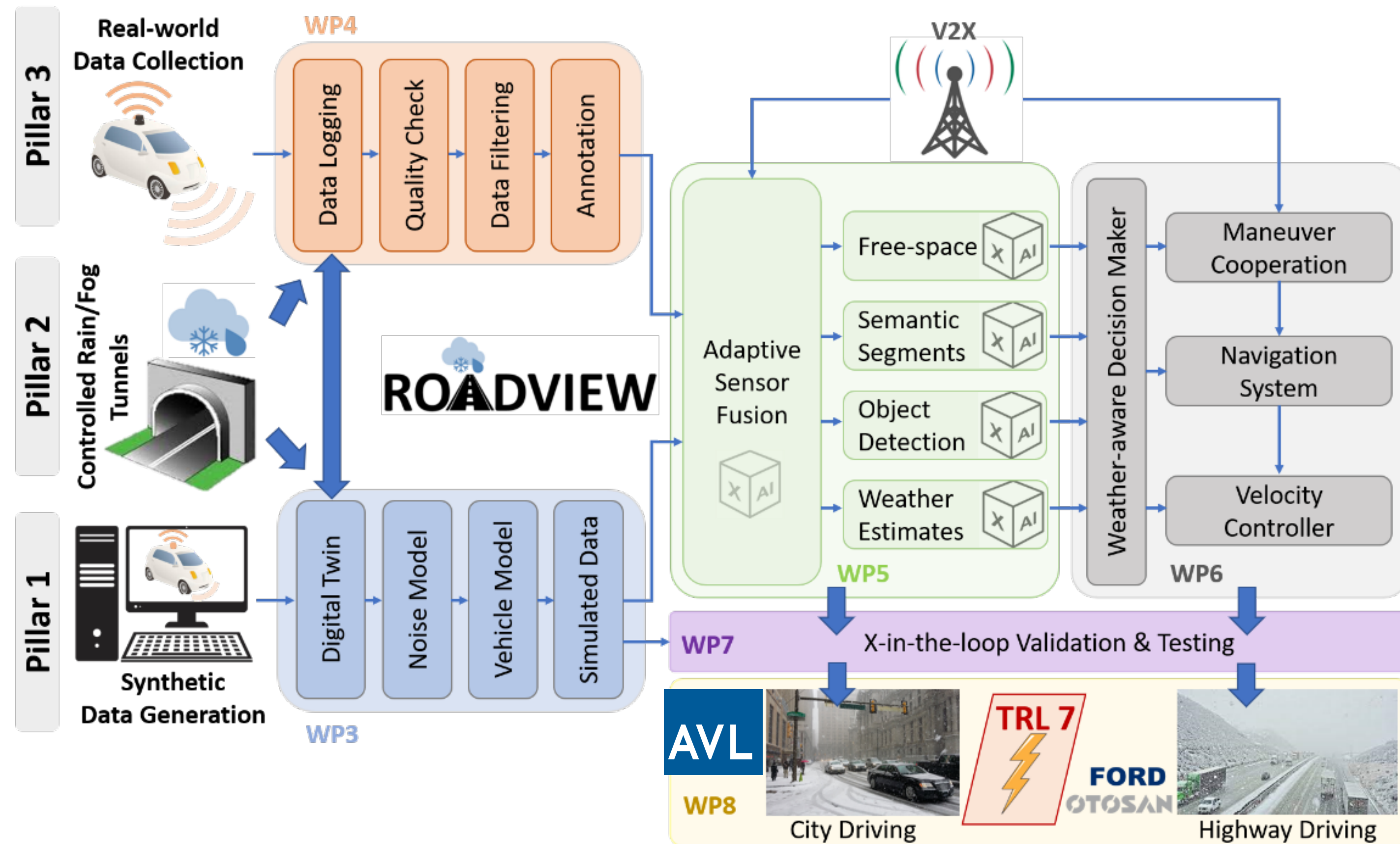
The **challenges** start with **harsh weather conditions**, such as **fog, rain, and snow**, which substantially affect the functioning of the key perception technologies and their development.

Both sensors are **negatively impacted by adverse weather conditions!**



ROADVIEW: Robust Automated Driving in Extreme Weather

ROADVIEW addresses these *weather-related challenges* by developing *robust and cost-efficient embedded in-vehicle perception* and *weather-aware decision-making systems* for *connected and automated vehicles* with enhanced performance *under harsh weather conditions*.



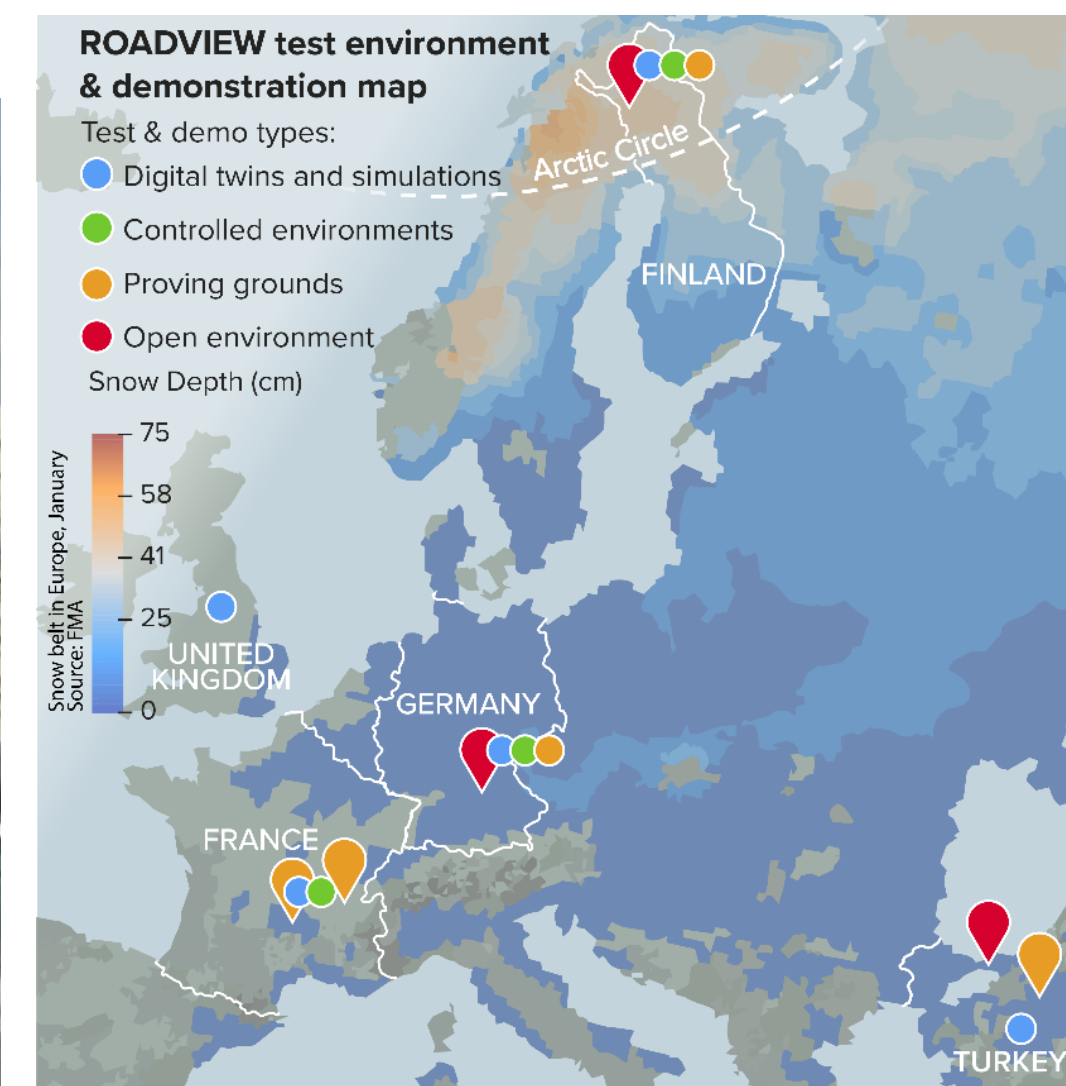
ROADVIEW aims to move toward systems at *Technology Readiness Level 7*

Pillar 1: Synthetic Data Generation

Simulator



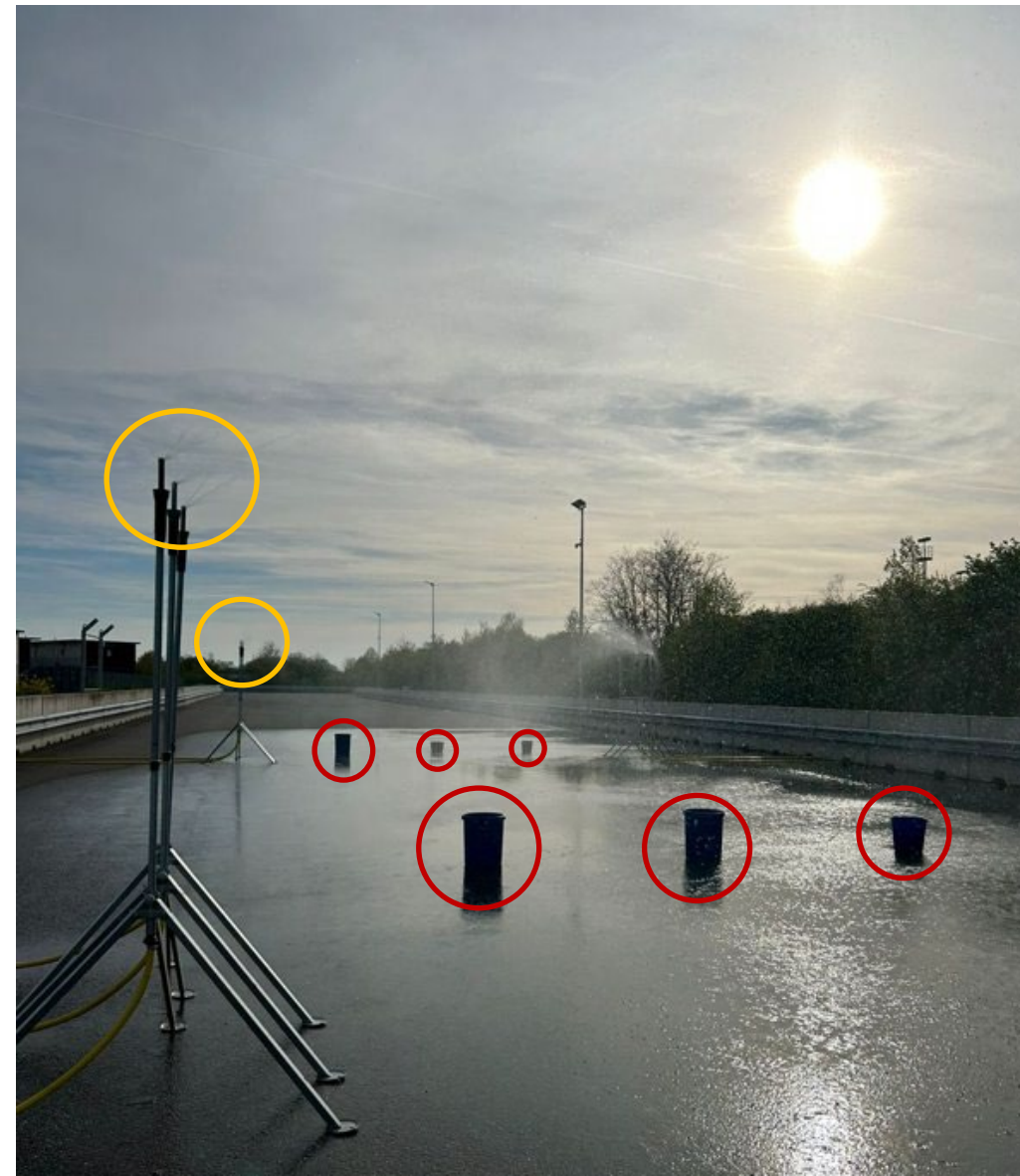
Digital Twins



Pillar 2: Controlled Rain/Fog Tunnels



Outdoor Rain Simulation Facility



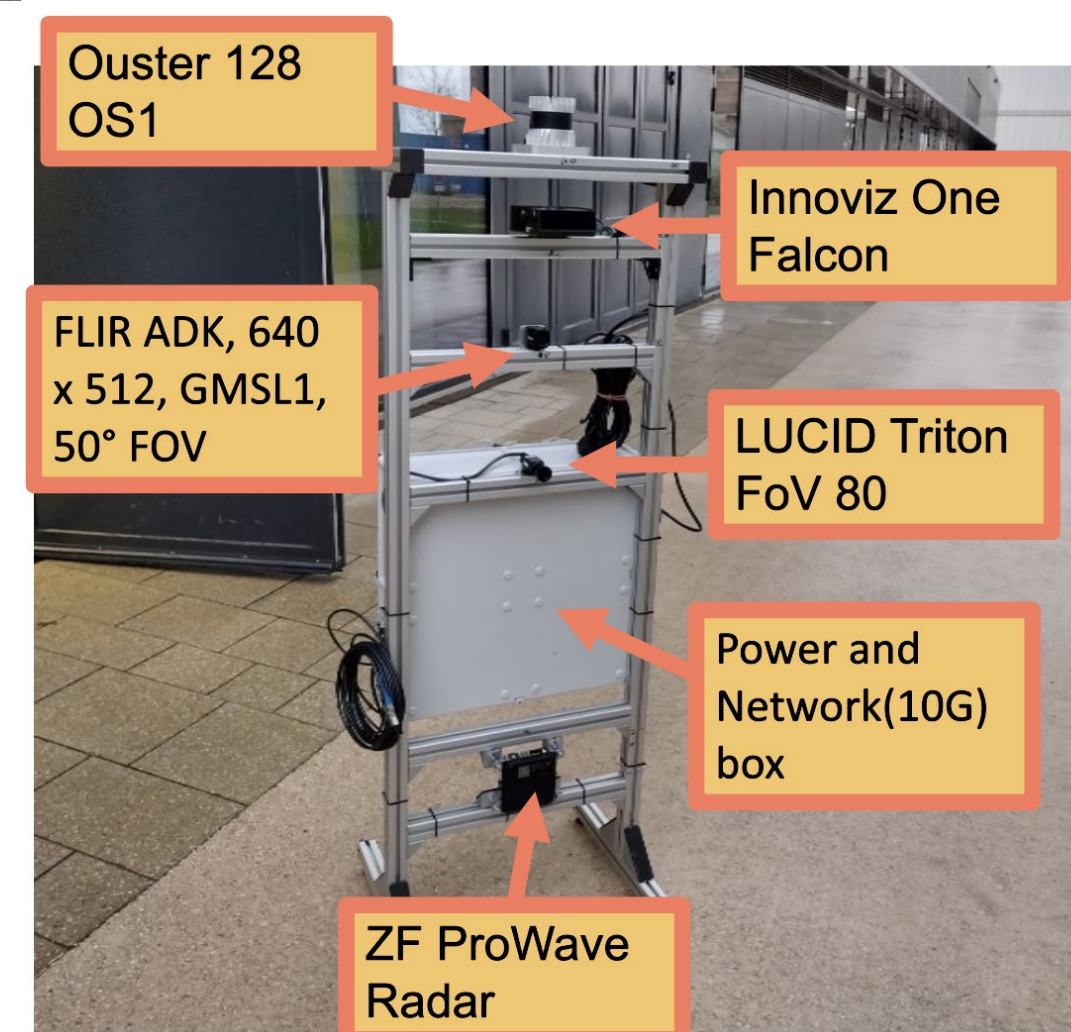
Rain Measurement Tools

- Sprinklers
- Buckets
- Disdrometer (rain)
- Anemometer (wind)

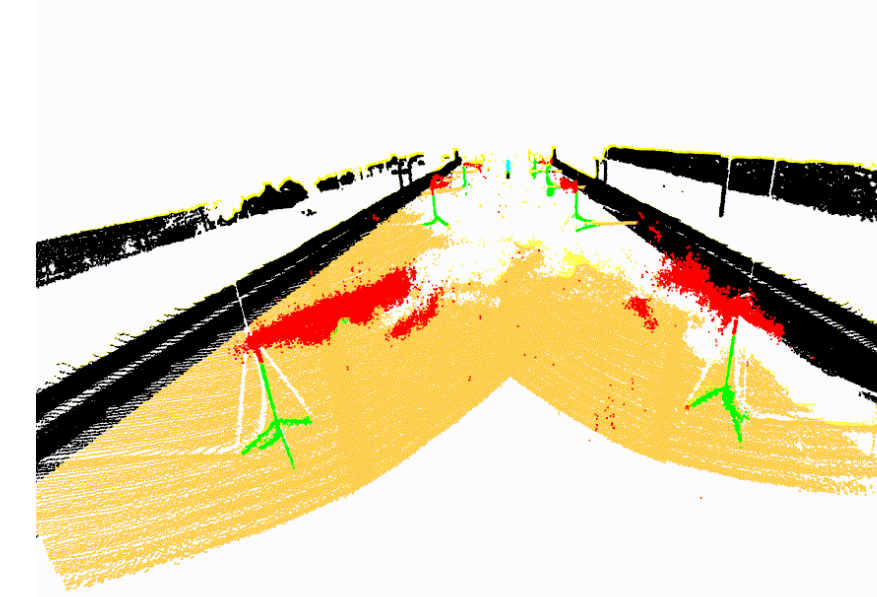
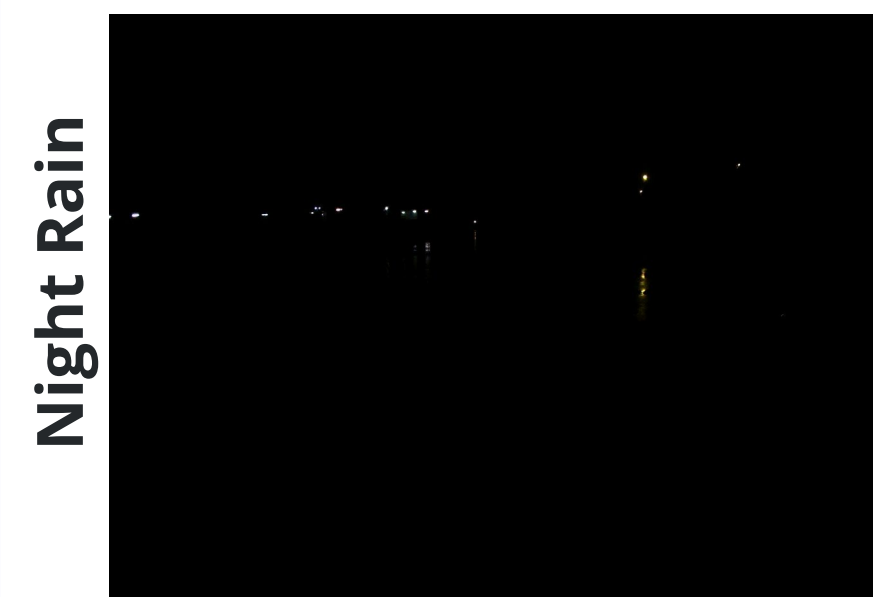
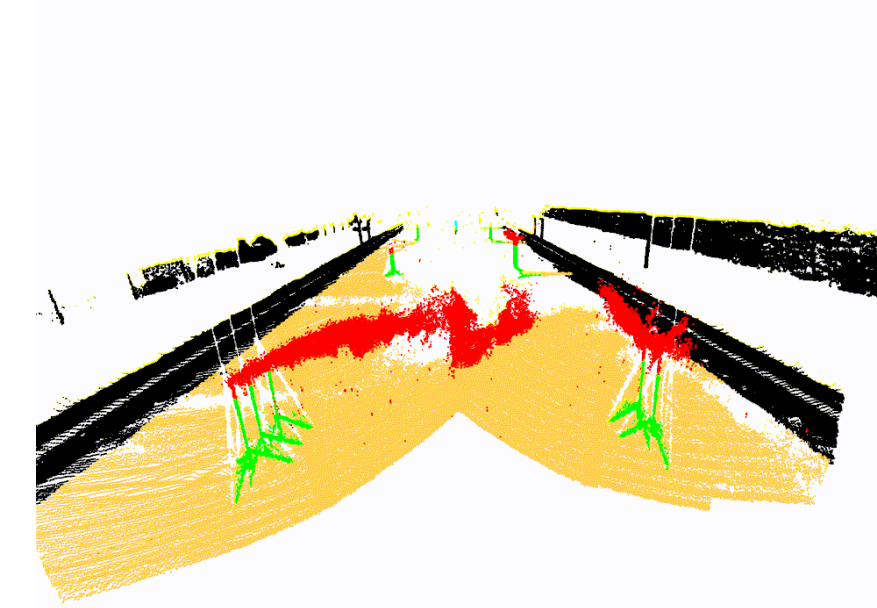
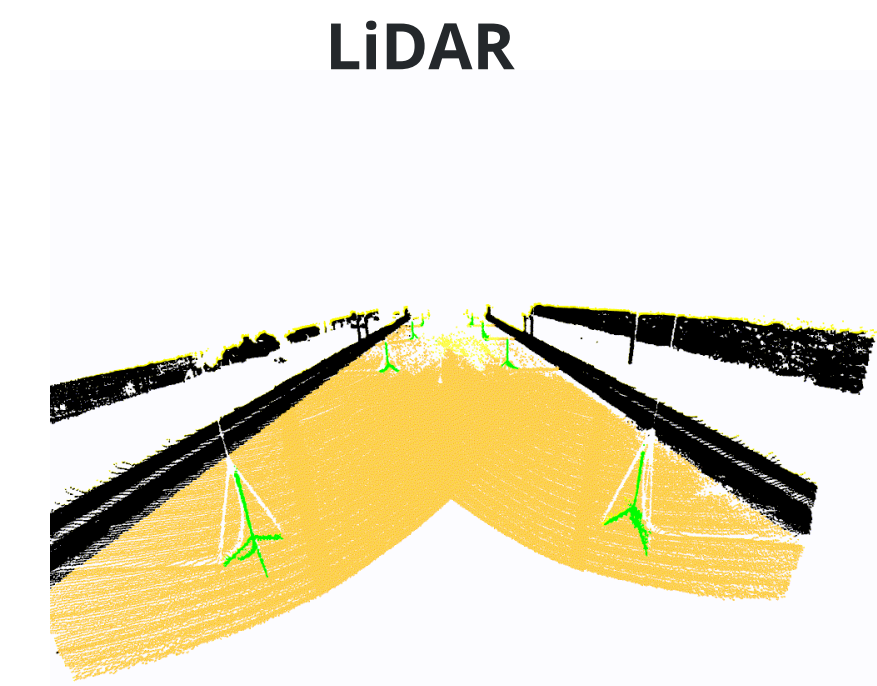
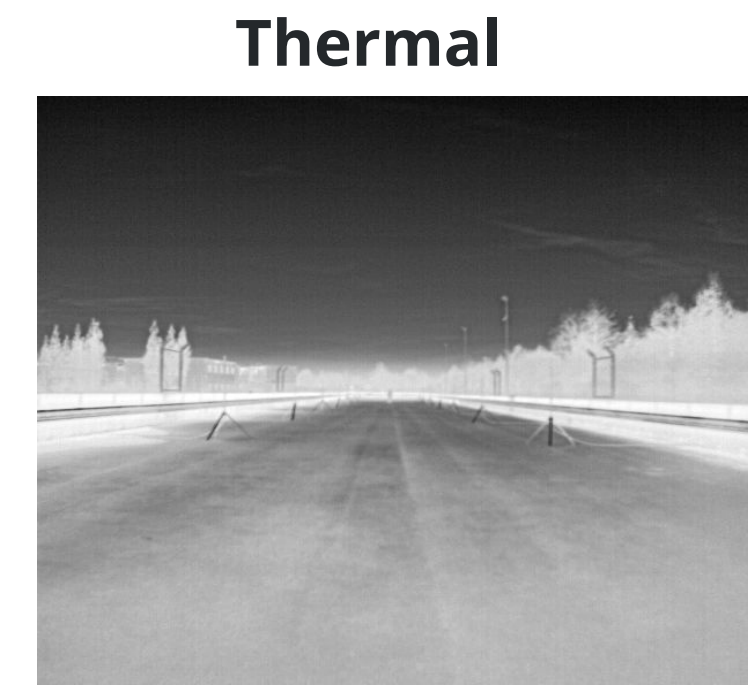
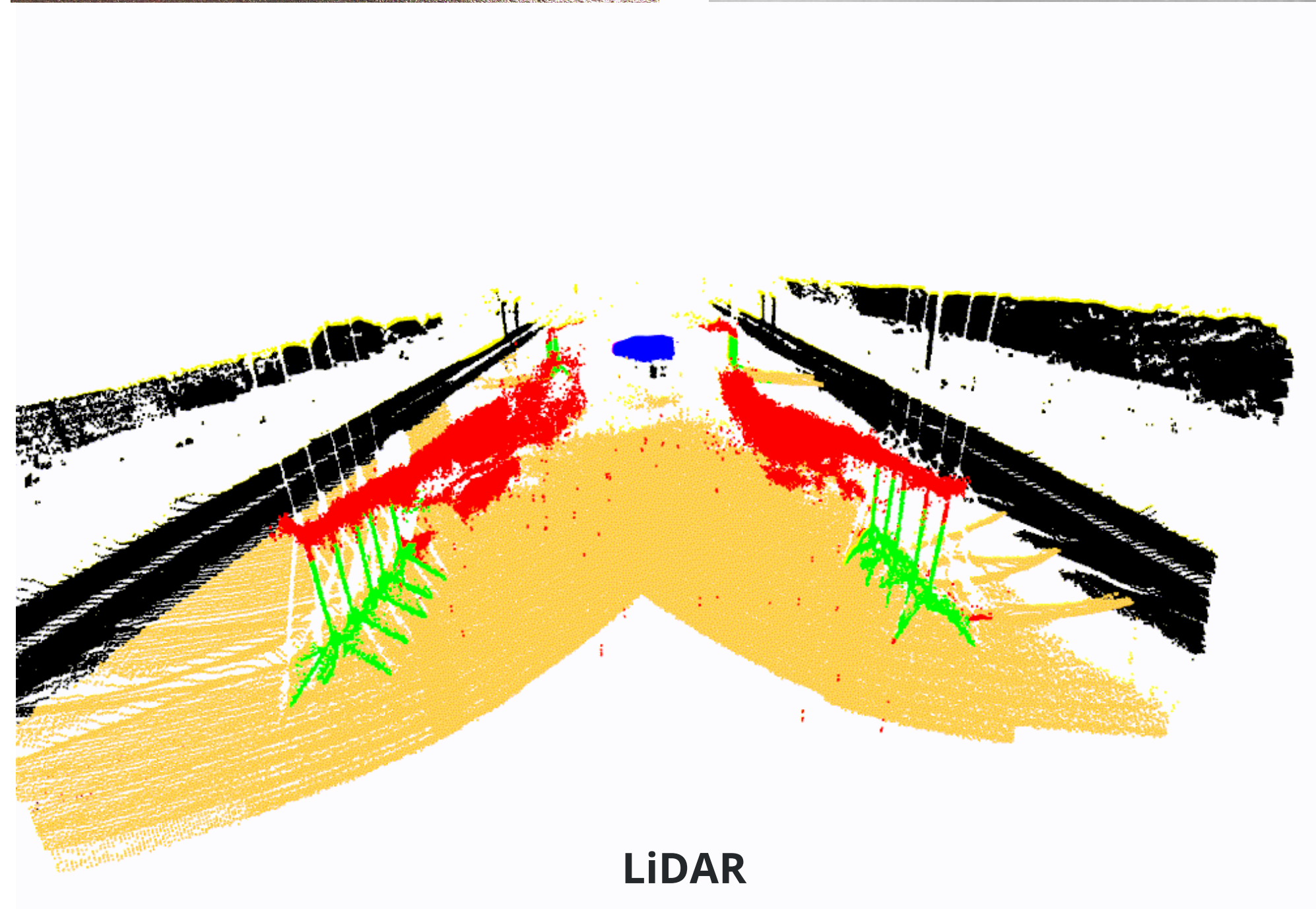
Sensor Setup

- Automotive grade
- RGB Camera
- Thermal Camera
- LiDAR (Innoviz One)
- 4D Radar

Validation of the best sensor suit!



Pillar 2: Controlled Rain/Fog Tunnels



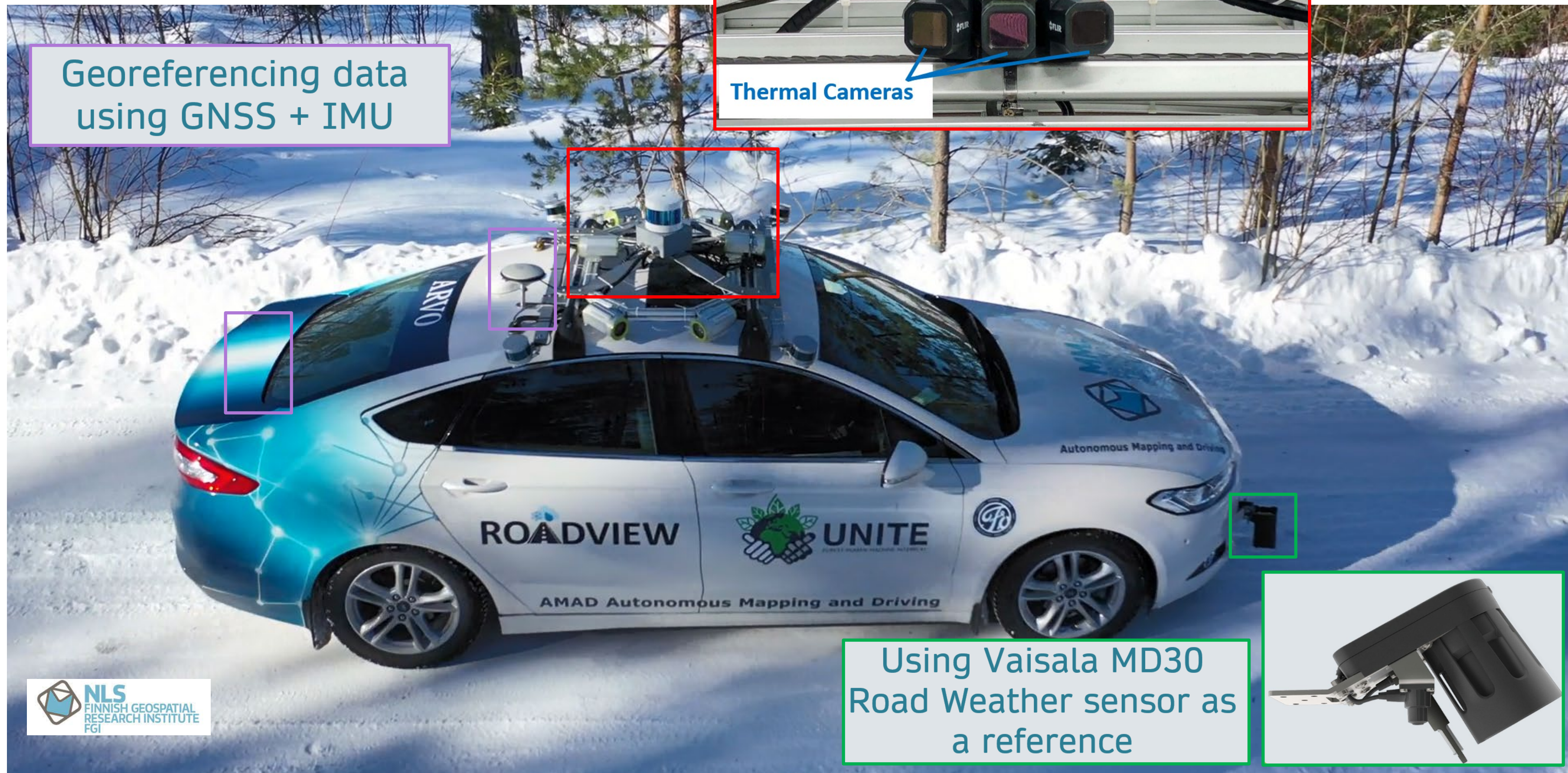
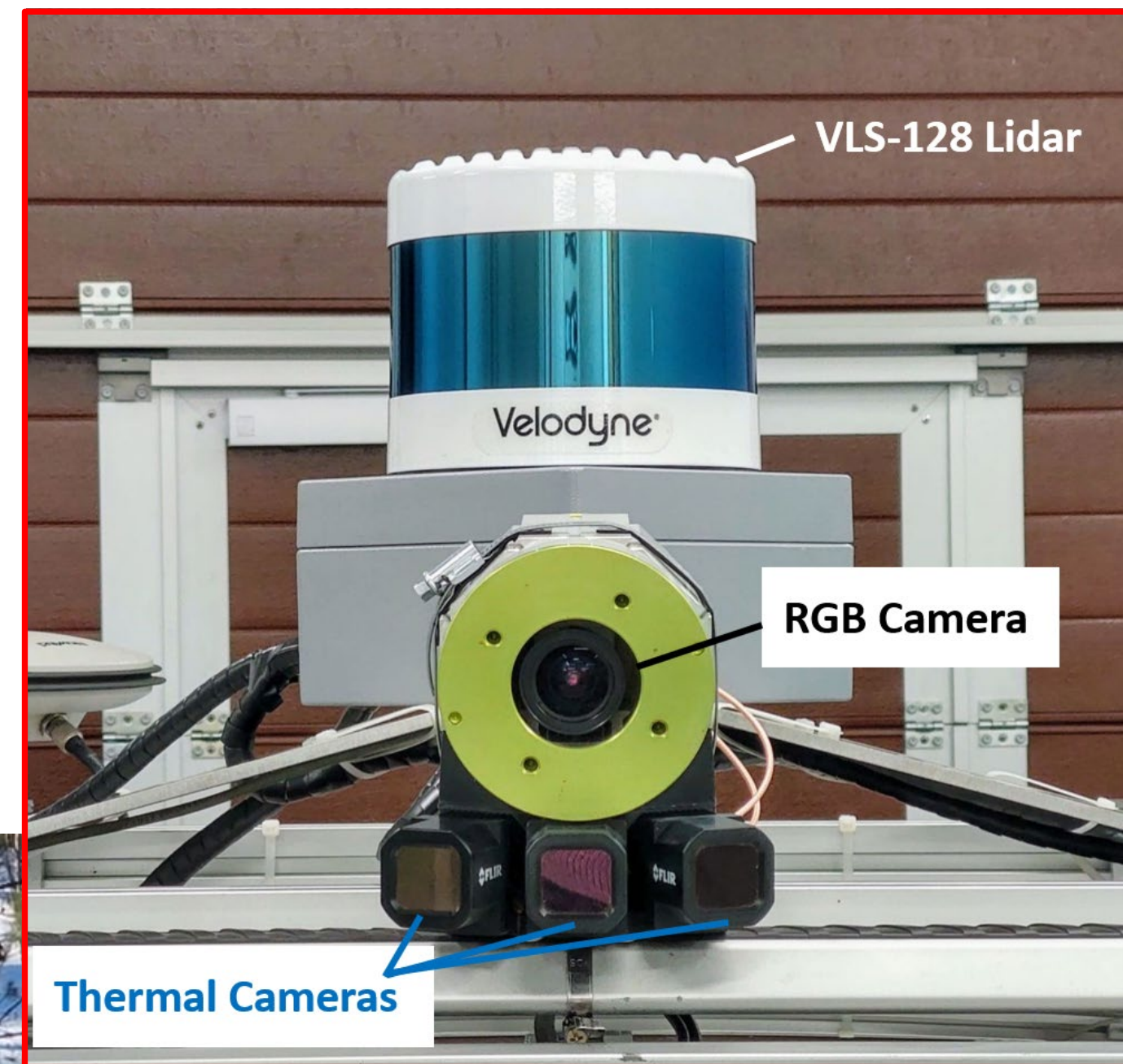
- 8 Classes:
- Background,
- Car,
- Sprinkler,
- Rain,
- Pedestrian,
- Biker,
- Targets,
- Road.

Pillar 3: Real World Data



Sensor Fusion

- RGB Camera (Basler acA1920-155um),
- 3 Thermal Cameras (Flir ADK 640x512), and
- LiDAR (Velodyne VLS-128)
- All sensors hardware time-synchronized
 - PPS pulse every second
 - GNSS time in NMEA messages



Using Vaisala MD30 Road Weather sensor as a reference

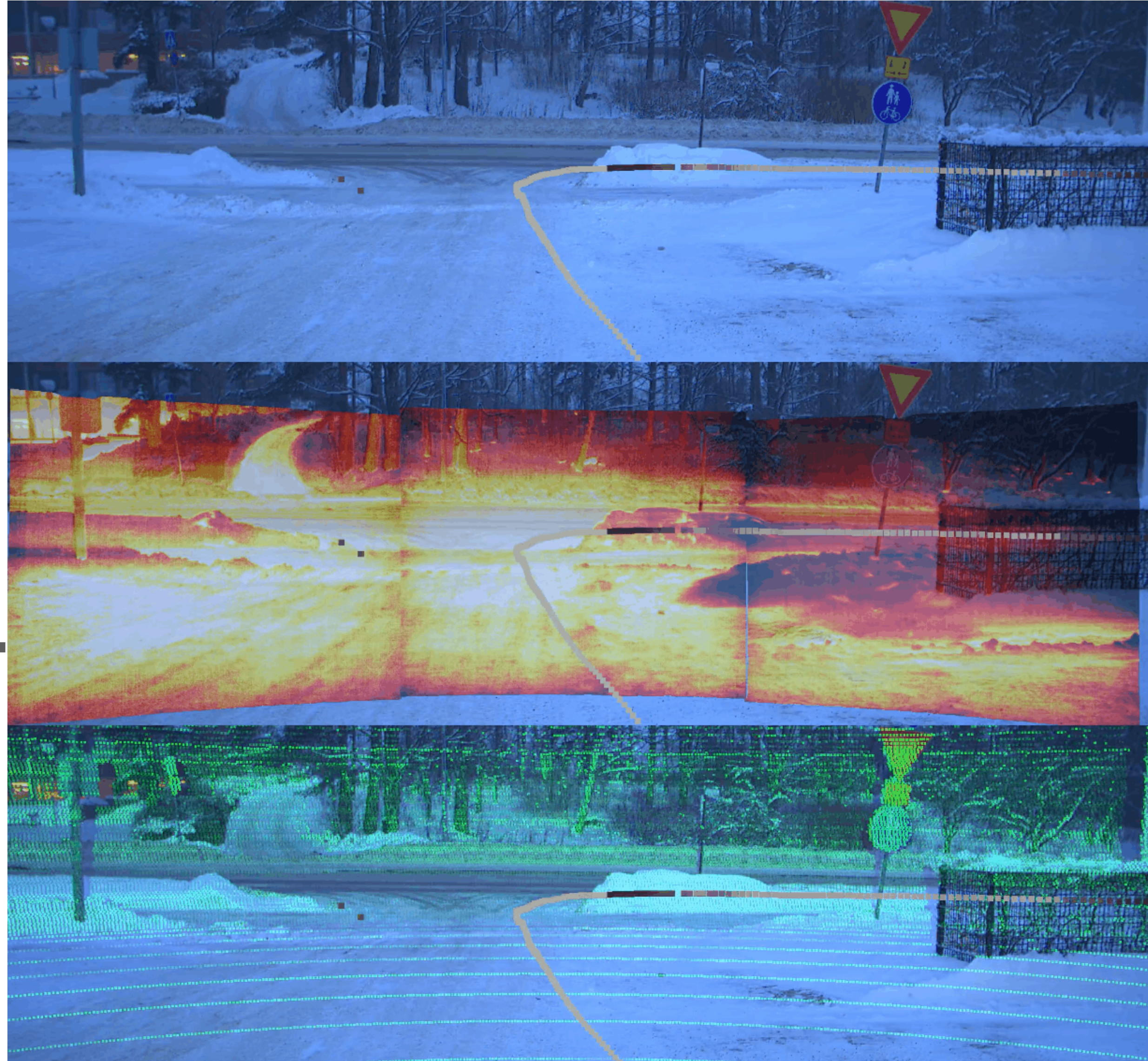


Pillar 3: Real World Data



Sensor Fusion for the Slipperiness Prediction

Sensor fusion
example in Finland



- Color Camera
 - High resolution
 - Calibrated

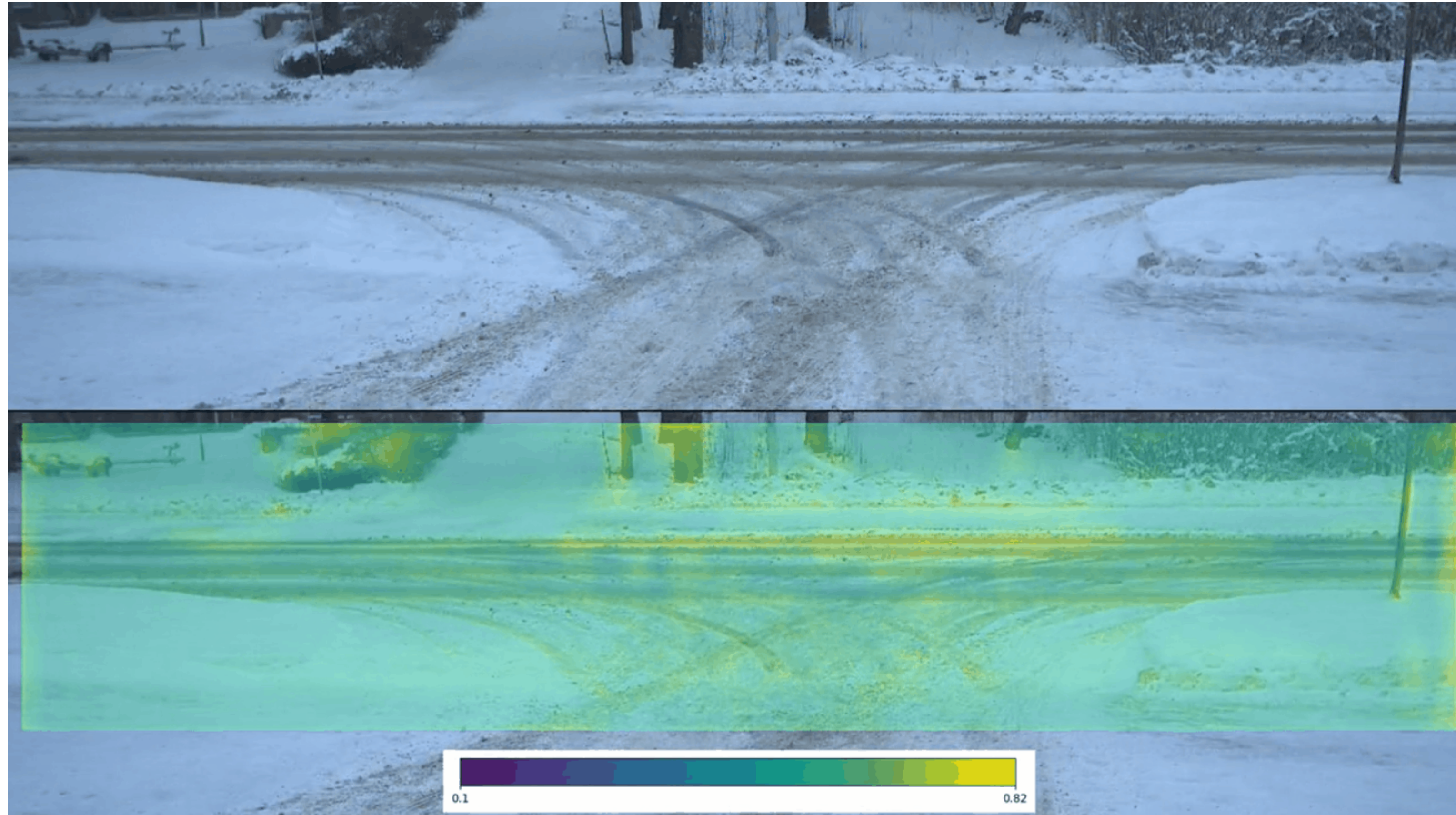
- Thermal Cameras
 - Synchronized
 - Calibrated

- VLS 128 LiDAR
 - Range
 - Reflectance

Pillar 3: Real World Data



Sensor Fusion for the Slipperiness Prediction

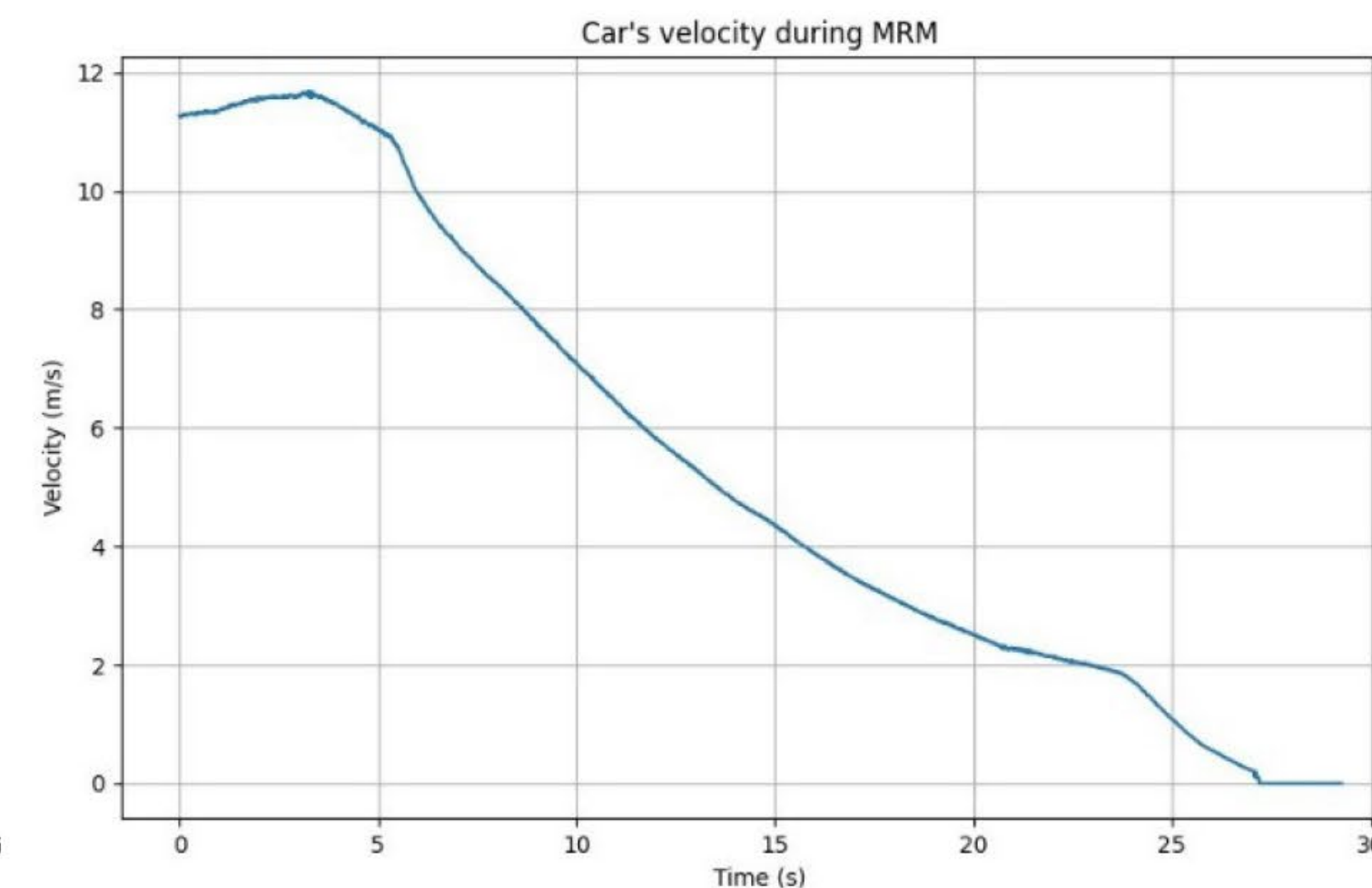
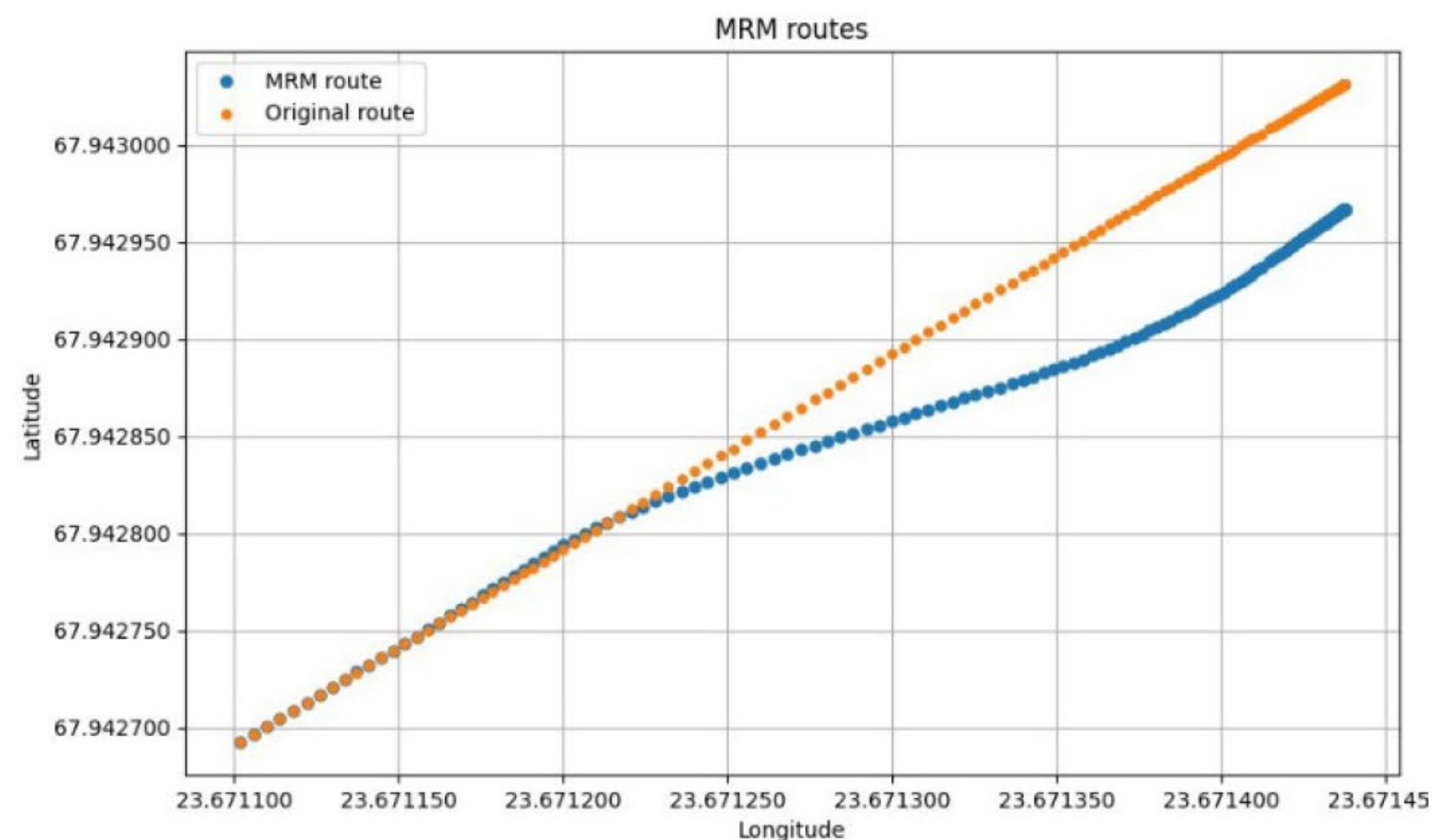


Inferring the Grip Map

Pillar 3: Real World Data

VTT On-board Weather-conditional Navigation system

Minimal Risk Manoeuvre (MRM) is executed to bring the vehicle into a safe state (e.g., decelerating to a full stop in a safe location). MRM can be activated, for example, based on **reduced visibility** or a **slippery road surface** (long braking distances).

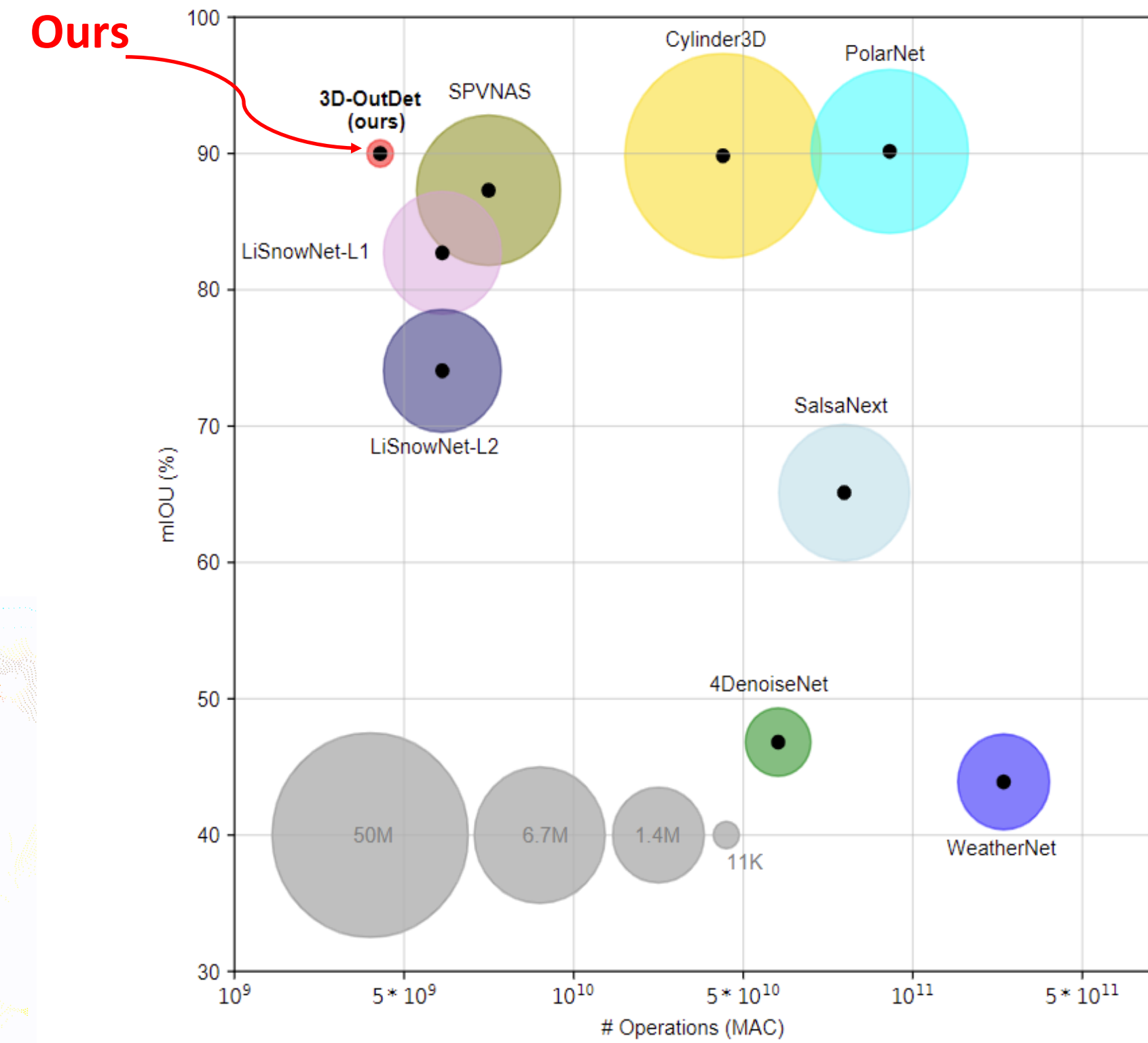
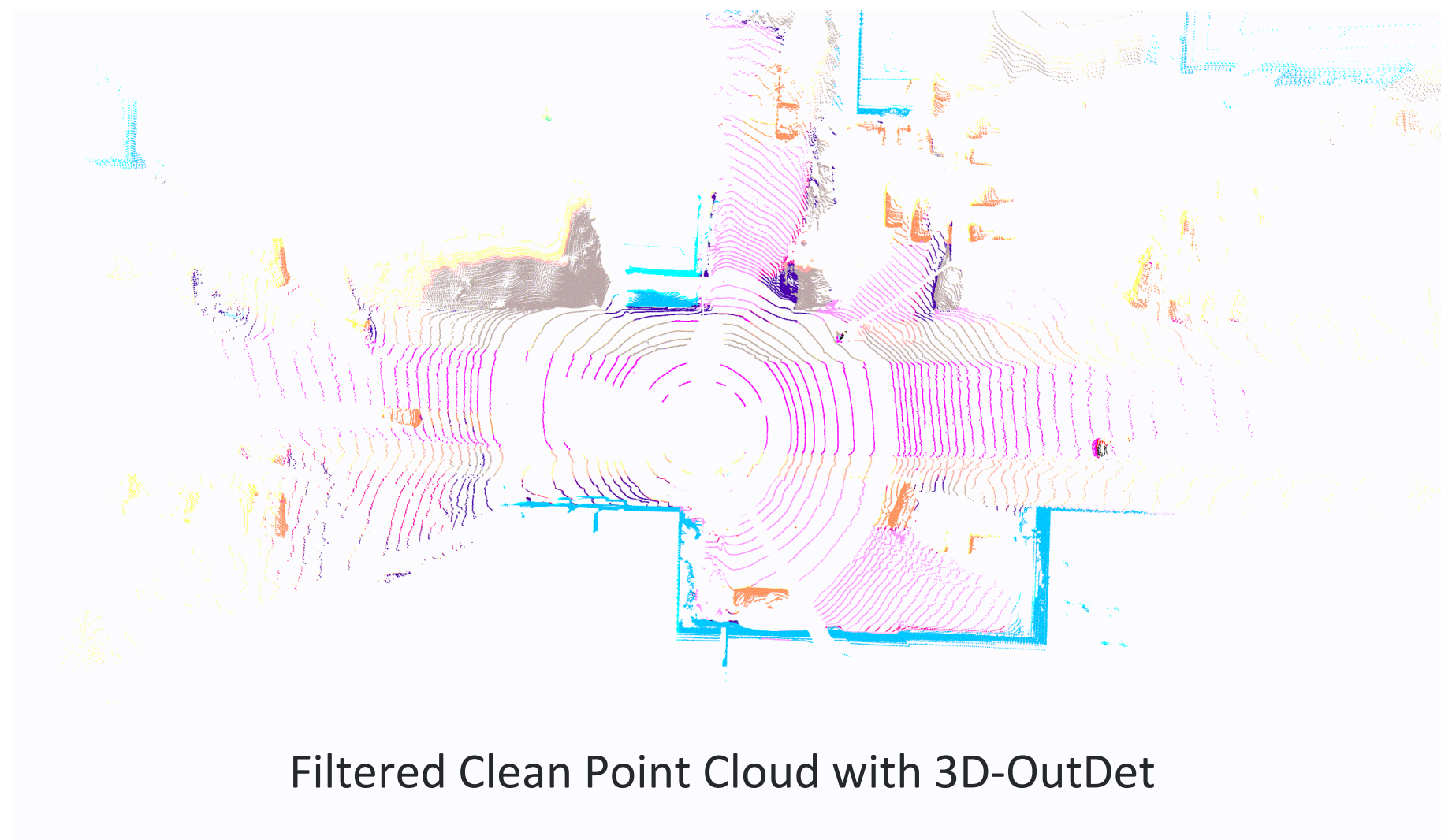
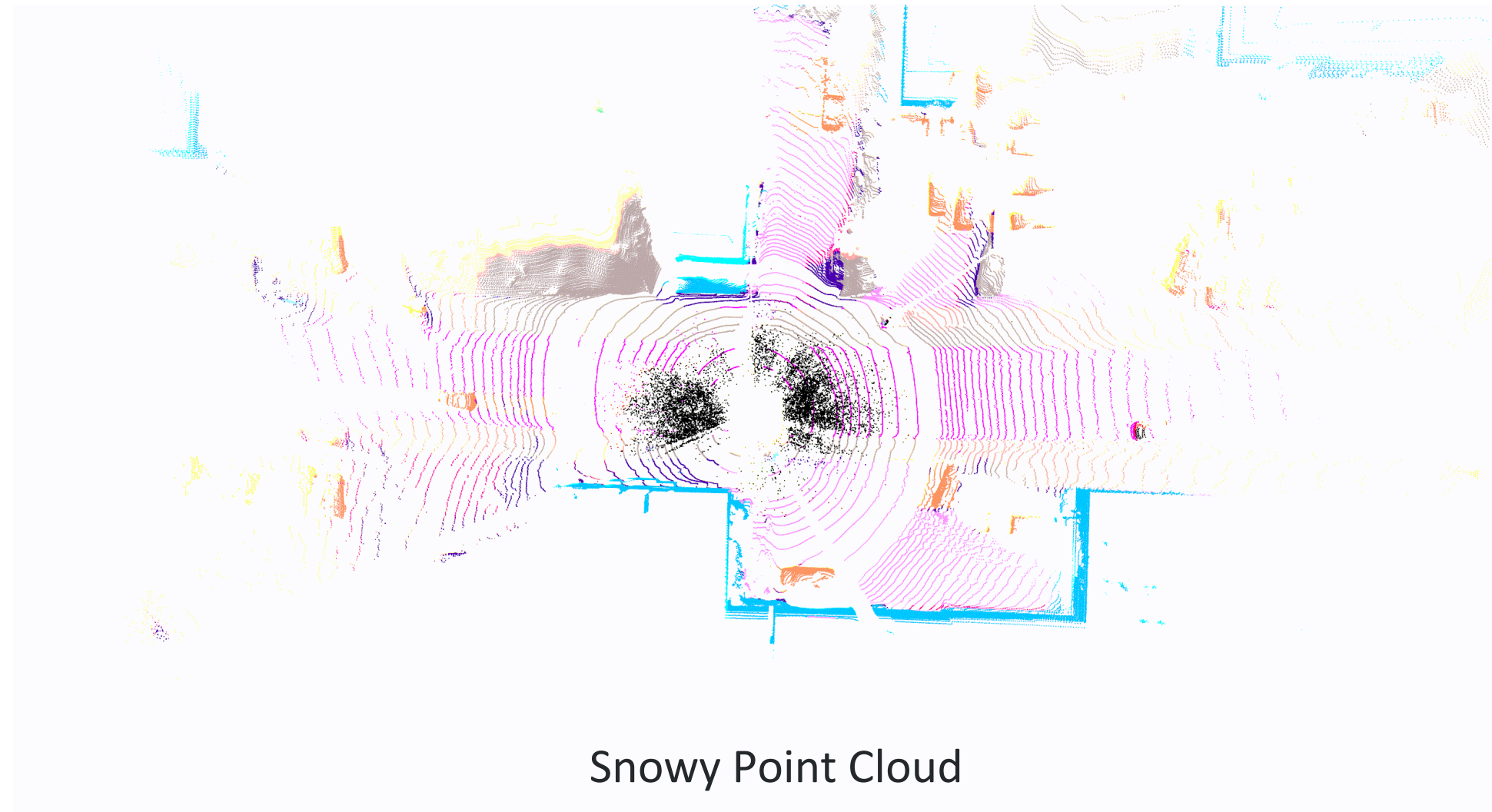


Modified vehicle trajectory and velocity measurement during MRM to a road shoulder.

Pillar 3: Real World Data



LiDAR Point Cloud Filtering



ROADVIEW

...going **“from autonomous to snowtonomous”**



Questions & Comments

<https://roadview-project.eu/>



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