ASSURED PRECISE POINT POSITIONING TECHNIQUES DRIVING THE FUTURE

ION GNSS+ 2020

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Session B4: GNSS Applications in Space

D. Calle, E. Carbonell, A. Chamorro,
A. González, C. Mezzera,
P. Navarro, D. Rodríguez,
I. Rodríguez, G. Tobías
GMV - Spain

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gmv INNOVATING SOLUTIONS

Contents

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AUTONOMOUS DRIVING OVERVIEW

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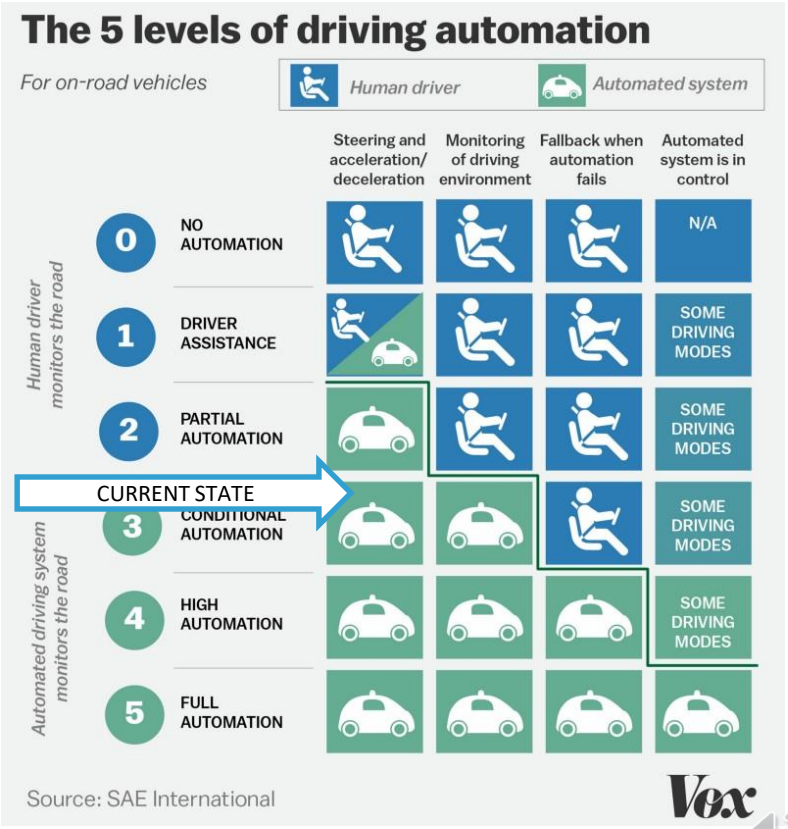
AUTONOMOUS DRIVING OVERVIEW

Driving automation levels:

- Level 0 → Like defined by Henry Ford ☺
- Levels 1-2
  - L1: The car is able to assist: cruise control, lane-cross detection
  - L2: The car is able to perform steering and acceleration, but with human monitoring.
- Levels 3-5
  - L3: The car performs environment detection and most driving tasks but with human overriding (steering, acceleration, lane change...).
  - L4: The car executes all driving tasks under certain circumstances/environments.
  - L5: Zero human attention.



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SAFE POSITIONING IN AUTONOMOUS DRIVING

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SAFE POSITIONING IN AUTONOMOUS DRIVING

ISO26262

In-car Functional Safety

ISO/PAS 21448

Safety of the Intended Funcitonality

SOTIF

ISO/SAE 21434

Cybersecurity and Security Measures

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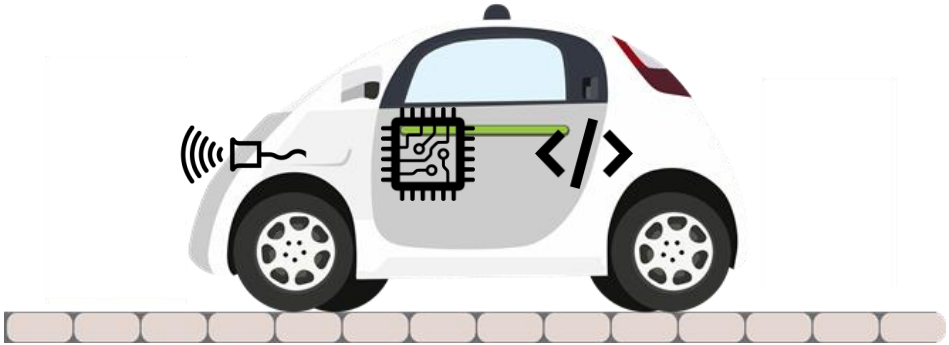
SAFE POSITIONING IN AUTONOMOUS DRIVING

ISO26262 Automotive Functional Safety:

- Goal
  - Avoid systematic failures (bugs in HW, SW, design, tools)
  - Avoid random HW failures
  - Control exposure to risk, reaction time and behaviour in case of failure
- How
  - Control the process: mainly based on documentation and verification activities i.e. processes super-controlled.
  - Control the tools
  - Driven by ASIL level required



ISO 26262
Road Vehicles - Fuctional Safety

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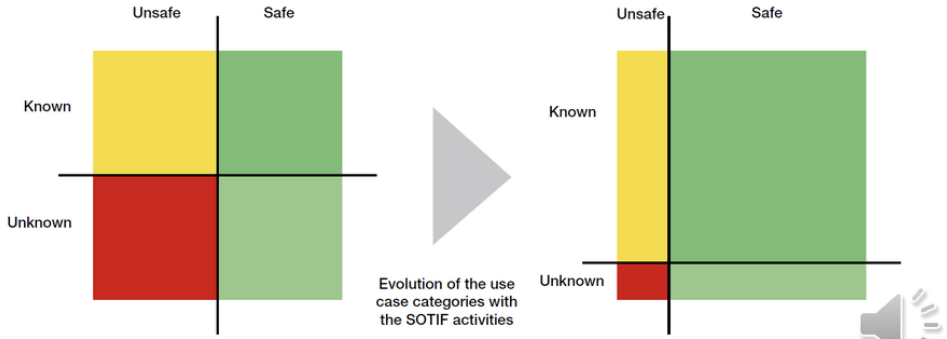
SAFE POSITIONING IN AUTONOMOUS DRIVING

SOTIF 21448 Safety of Intended Functionality:

- Goal
  - Complement ISO26262 to cover cases where there is no malfunction in the in-car HW/SW system
  - Control unintended behaviour without fault
  - Effect cause by environmental conditions (Unintentional)
- How
  - Identify the unknown and unsafe areas of operation and containing it to an acceptable level of risk.
  - Impose new requirements on sensors and monitors to reduce those areas.
  - Verification based on analysis and simulation. Complemented with real cases.



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SAFE POSITIONING IN AUTONOMOUS DRIVING

ISO/SAE 21434 Automotive Standard Security

- Goal
  - Reduce the risk associated to the new paradigm of connected vehicle. (A hacker can take control of bulb… but not of our cars)
  - Ensure that SW/HW development is “Secure by design”.
- How
  - TARA: Identification of assets, possible threats, attacks, vulnerabilities and potential damage.
  - Determination of risk levels based on damage scenarios and the probability of successful attacks
  - Implement necessary countermeasures to reduce the remaining risk to an acceptable level.
  - SW security audits, periodic pentesting, SW patching…

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GMV’s PPP IN AUTONOMOUS DRIVING

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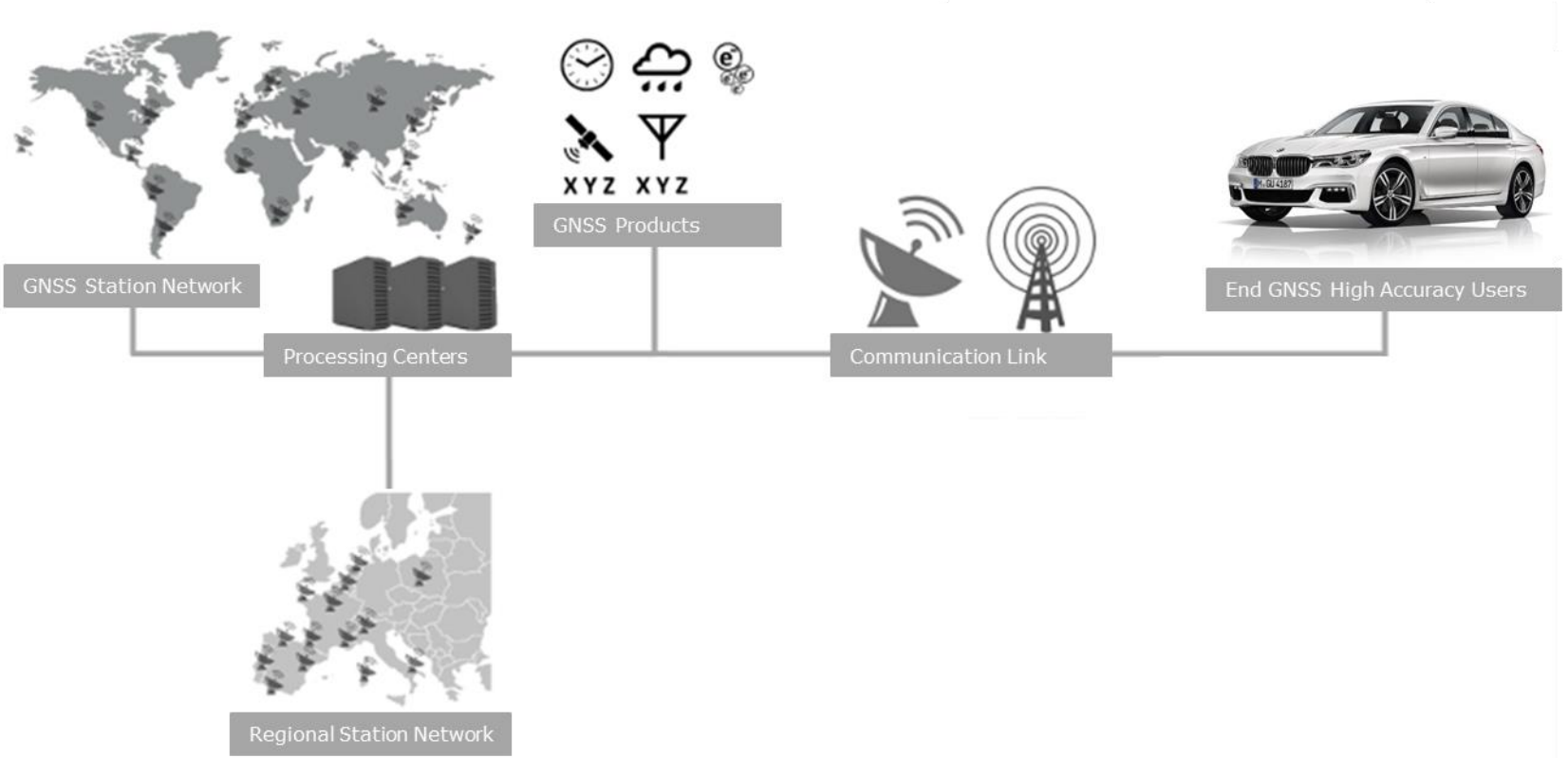
GMV's PPP IN AUTONOMOUS DRIVING



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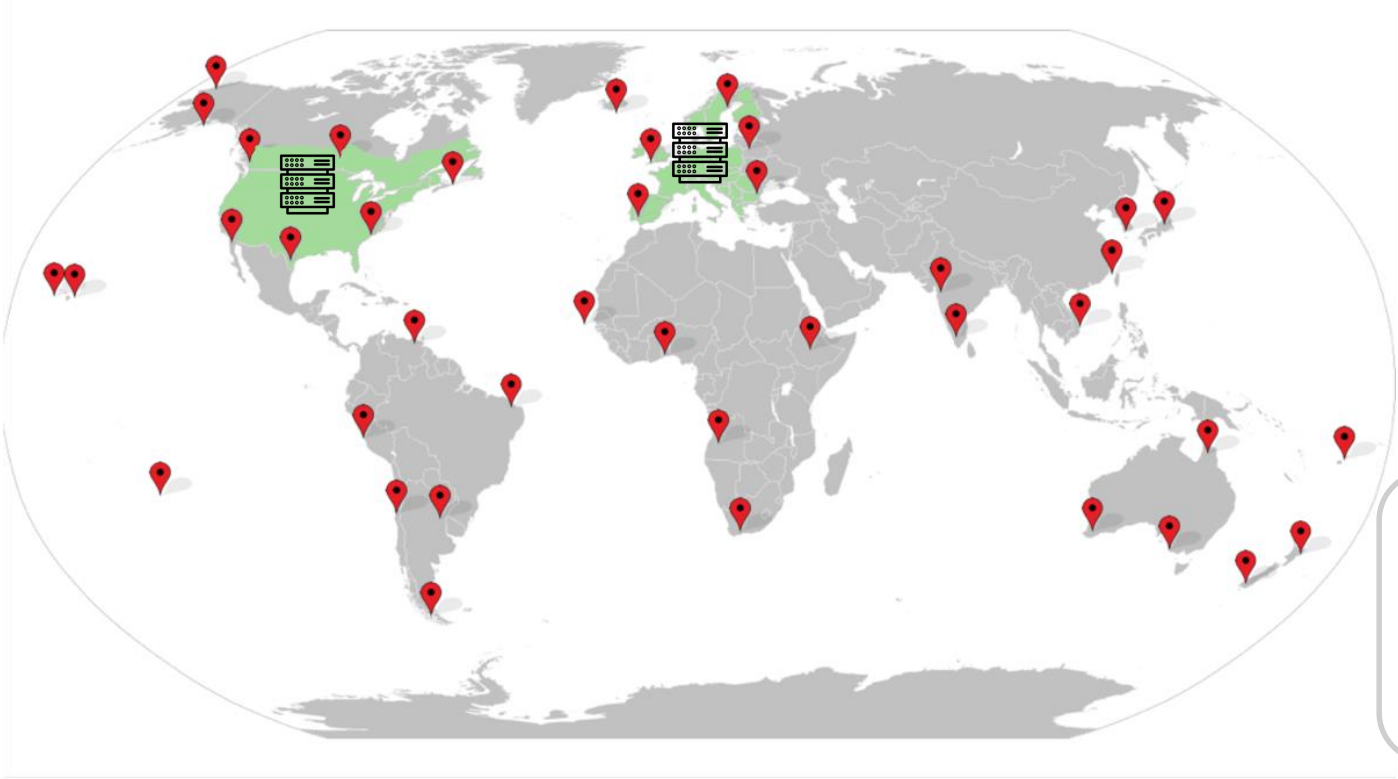
GMV's PPP IN AUTONOMOUS DRIVING



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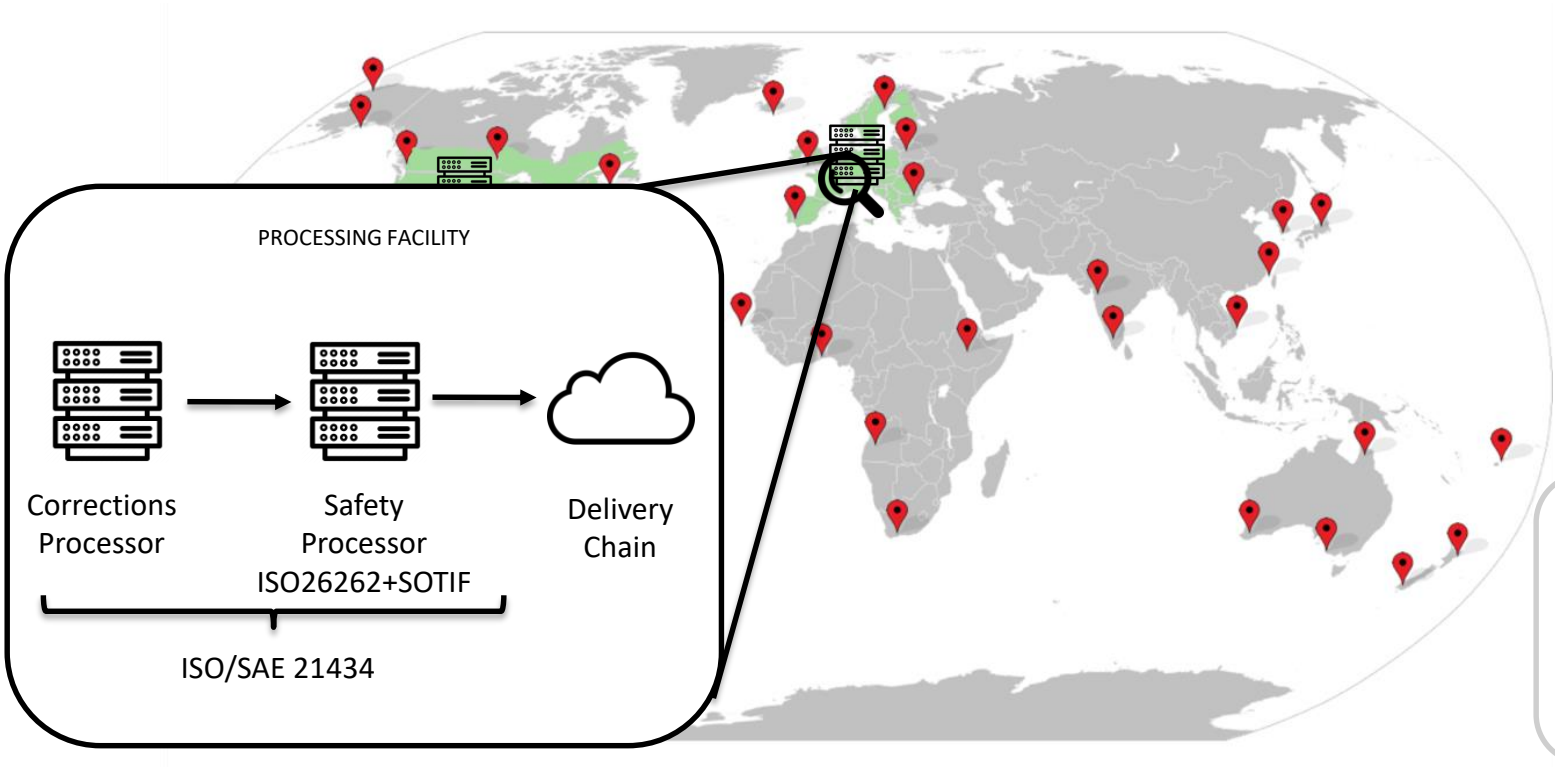
GMV's PPP IN AUTONOMOUS DRIVING



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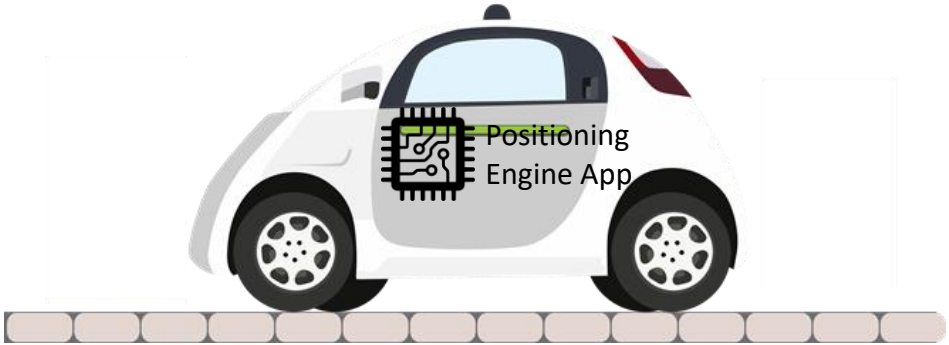
GMV's PE IN AUTONOMOUS DRIVING

Positioning Engine Application

- PE Application able to process GNSS + IMU
- ISO26262 ASIL-B compliant. SW faults < 1e-7
- SOTIF compliant. Control external conditions, achieving 1e-7.
- ISO/SAE 21434. Not only SW, jamming and spoofing also covered.
- Flavours: Linux standalone and Autosar application
- Fast convergence, robust and safe solution thanks to advance algorithms and threat monitors
- Protection level provision (Error bounding).
- SSR2OSR Library for integration with RTK modules



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PLUG&PLAY DEMO UNIT

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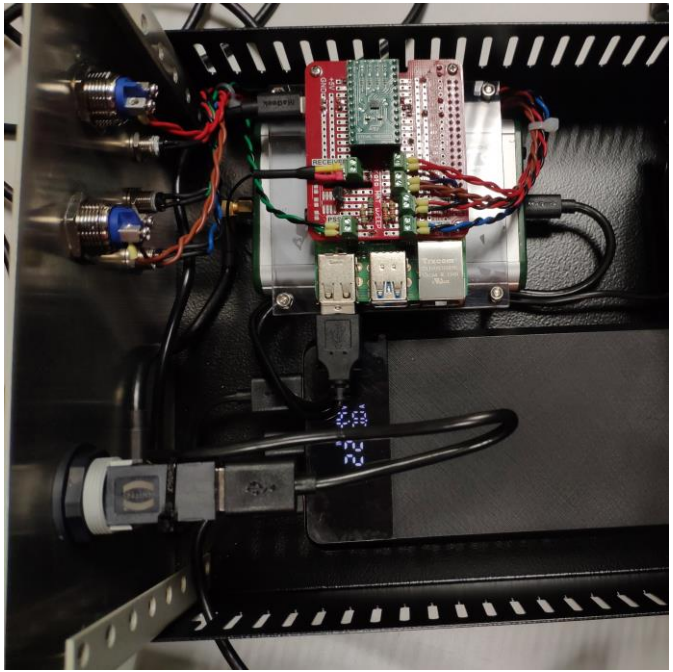
DEMO UNIT

Positioning Engine Application Demo Unit

INSIDE VIEW



ENCLOSURE VIEW

VISUALIZATION APP

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PERFORMANCE TESTING RESULTS

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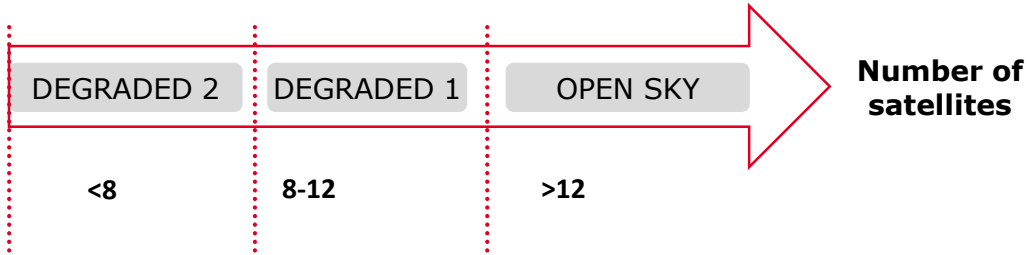
PERFORMANCE TESTING RESULTS



Metric	Solution Type	OS	DEG1	DEG2	∑
95%	GNSS + IMU	0.20m	0.25m	0.40m	0.25m
99.7%	GNSS + IMU	0.35m	0.45m	0.50m	0.50m

Considerations

- Mass-market Rx and IMU
- Calculated against reference trajectory system (high-end GNSS, tactical IMU, dense RTK base network)
- Only considering FIX and Dead-reckoning epochs
- Number of epochs: ~720,0000

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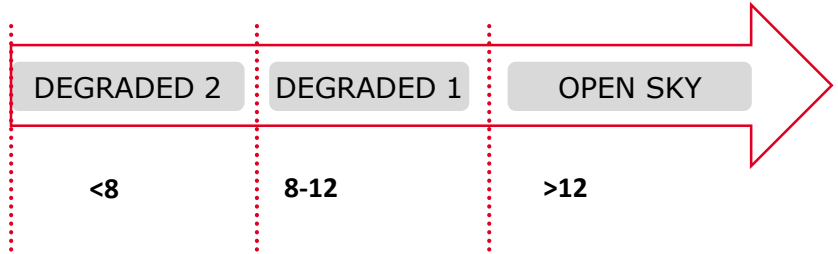
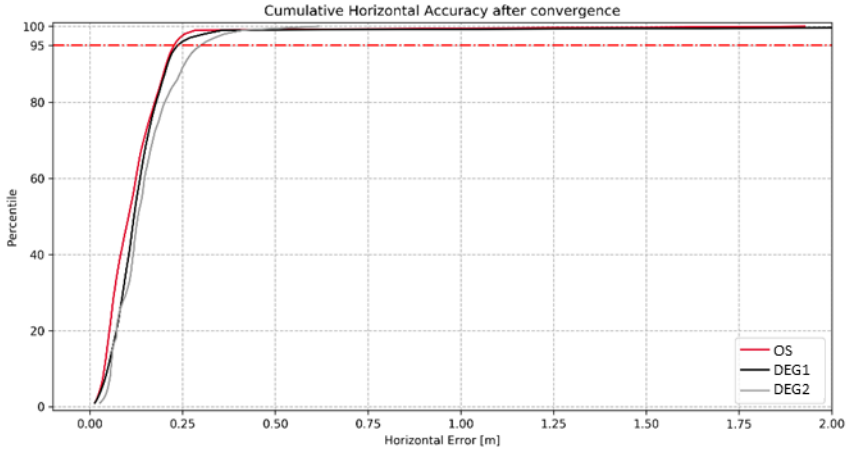
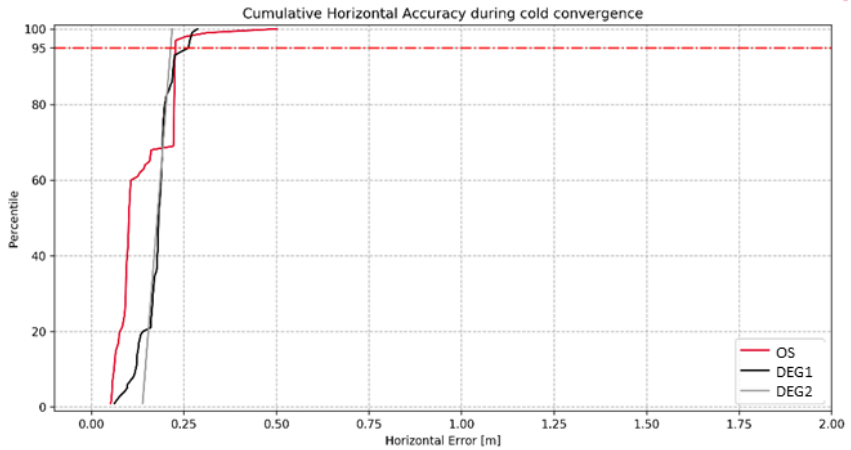
PERFORMANCE TESTING RESULTS







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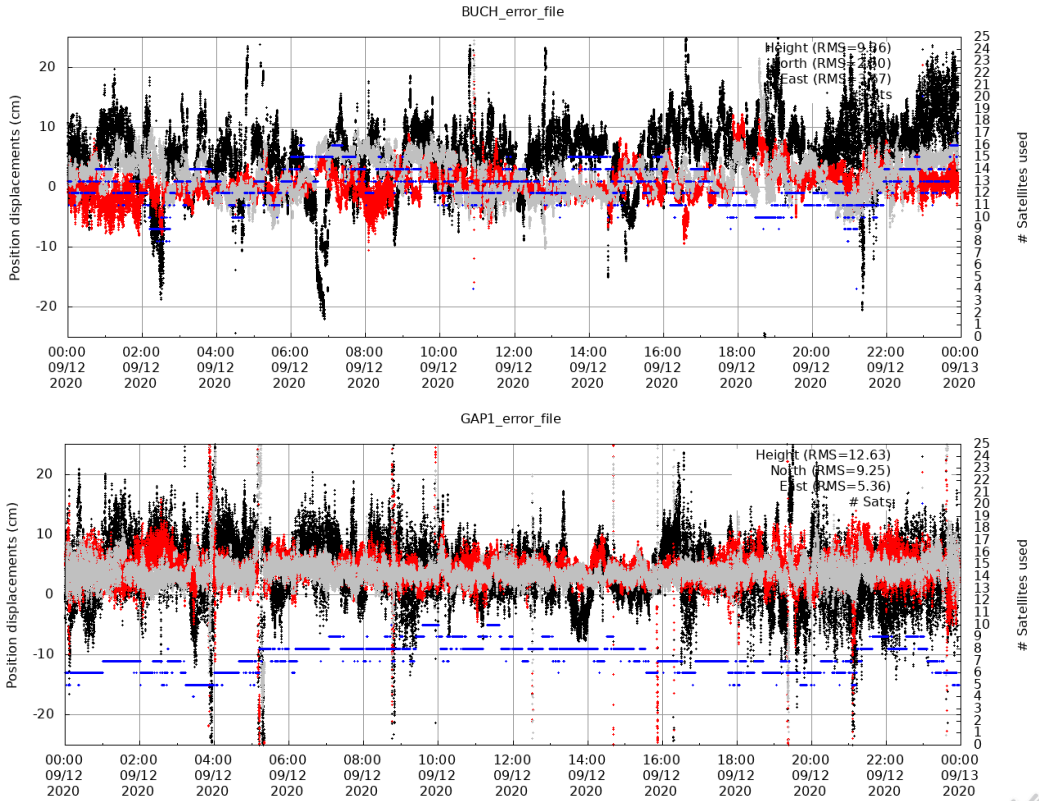
PERFORMANCE TESTING RESULTS

SSR2OSR

- RTK performance obtained with the SSR2OSR and RTKExplorer (RTKLib variant).
- Also tested with uBlox F9P internal RTK module with similar performances.
- Only the integration of GMV's SSR2OSR library is required.
- Horizontal Error RMS below 10cm.



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CONCLUSIONS

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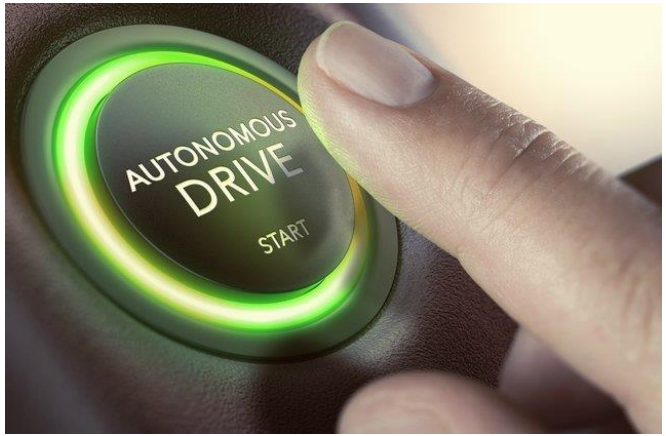
CONCLUSIONS

- End-to-end service for automotive applications is ready for the market.
- Safety and security compliance has been tackled based on ISO26262, SOTIF and Security standards.
- Plug&Play demonstration platform is ready for potential customers.



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Thank you!!

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