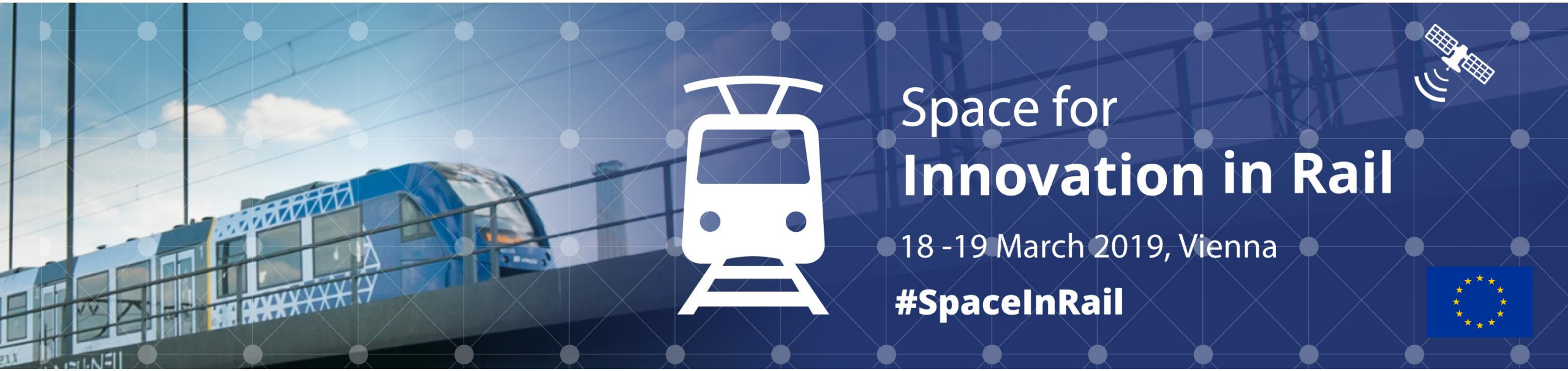

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ERSAT PROJECTS

E-GNSS based solution for Low density lines and its certification path within ERTMS

Wien - Space for Innovation in Rail

Massimiliano Ciaffi, RFI - Rete Ferroviaria Italiana

19 March 2019 Austria

Towards a full ERTMS network in Italy

Current status

- ERTMS on 727 km HS without fall-back system in operation since 2005.
- Migration program to the ERTMS starting from the main sections of the EU Corridors (6.300km) and the extension to the entire TEN-T network to 2050 (about 10.400km)

New Objective

- The economic advantage of the ERTMS in conjunction with a simultaneous de-commissioning of the Class B could bring approximately **30% savings** on the current maintenance costs of signalling systems.
- On 2018 October 26th, FSI presented the **ERTMS Acceleration Plan*** to deploy the ERTMS on the entire Italian railway infrastructure (**16800 km**) by 2035, and equipping **5,000 vehicle,** by exploiting different sources of financing (CEF, structural funds, national funds, private funds)

→ **first ERTMS deployment on Regional lines**

Reduce operational cost also in ERTMS enviroment: « Zero Staff Responsible Time»

General Specifications for ERTMS-based Regional lines to industries

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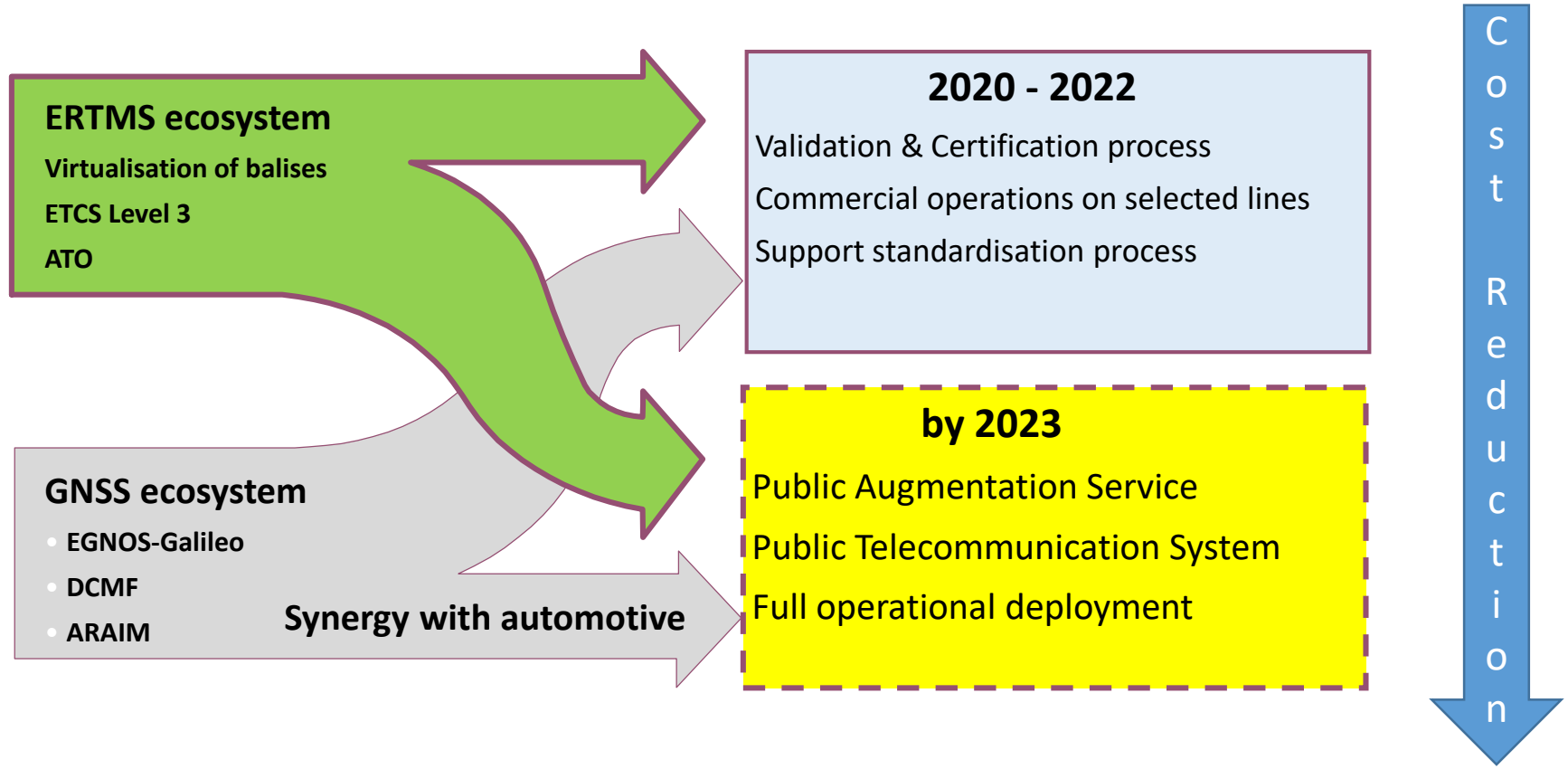
ERSAT: the Ertms-SATellite ecosystem



ERSAT program started in 2012 with a plan to develop & validate the sat-technology for the ERTMS

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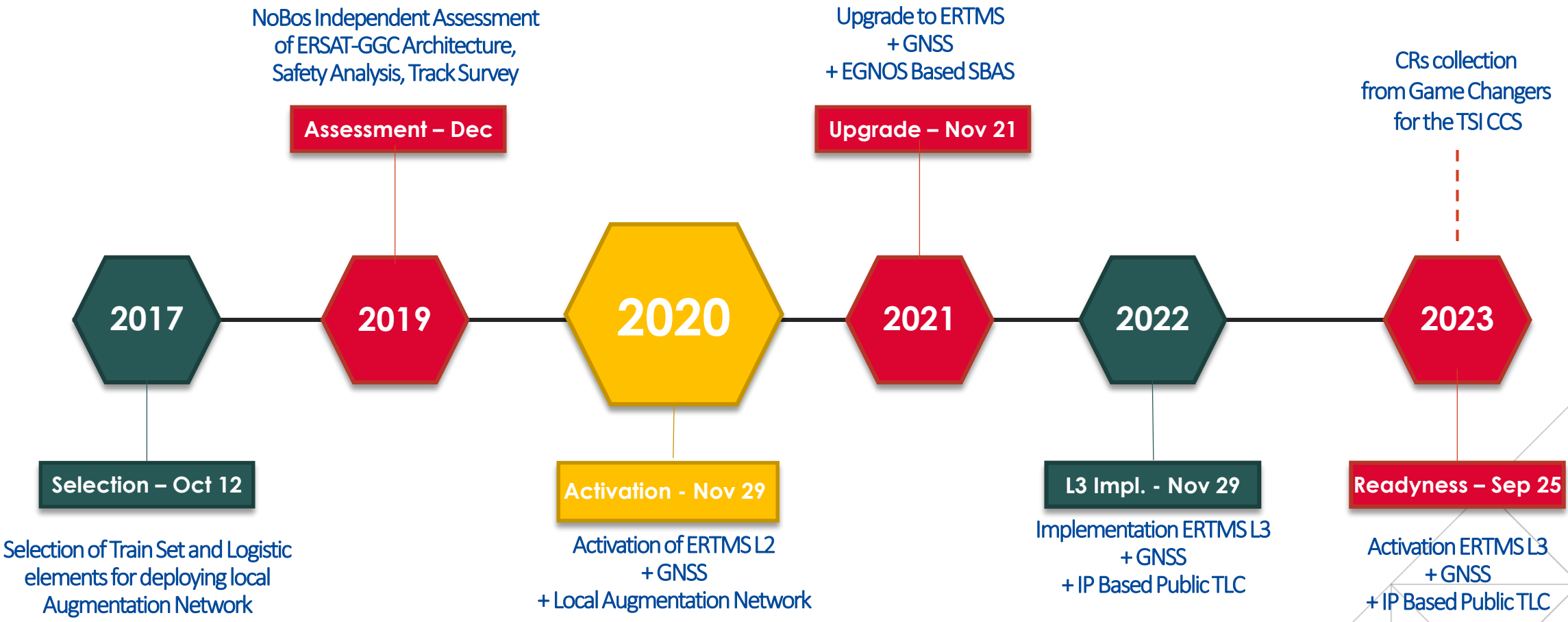
ERSAT Masterplan 2017-2023 - PINEROLO SANGONE LINE



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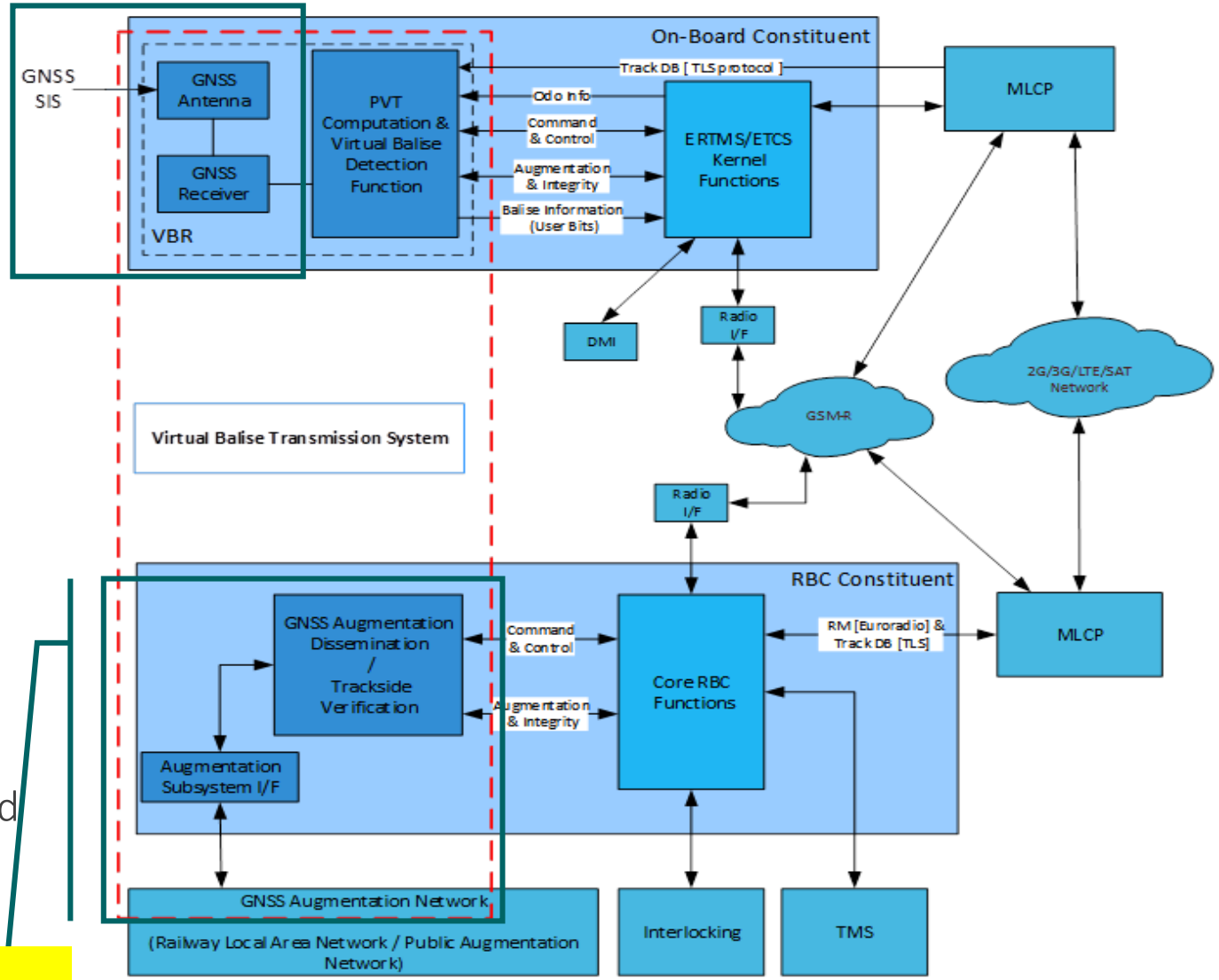
ERSAT-GGC Architecture

Up-gradeable with Multi-constellation,Multi-frequency, ARAIM Multi Sensor under development

- No changes in ERTMS core functionalities (location principles and train positioning function as Subset 026 and 034)
- SIL4 guaranteed by the ERTMS core functionalities
- New Certification required only for add-on components
- Qualitative and Quantitative Safety Analysis performed in ERSAT-GGC (fault-tree – THR apportionment)
- Backward compatibility to upgrade On-board & Track-side systems with new technologies



Compatible with GBAS and SBAS/EGNOS Augmentation services

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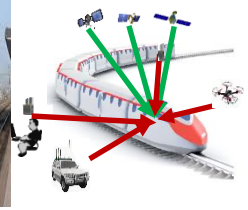
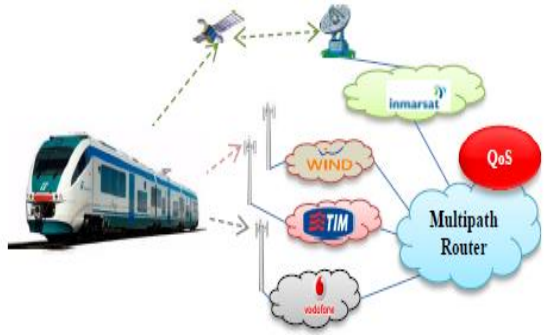
ERSAT Program Milestones - 2019

Enhanced Functional ERTMS Architecture
GNSS and Public Radio TLC Technologies

Safety Analysis with GNSS



Virtualized
Test Bed



Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	ERSAT GGC MTR			SBS 2.1 CDR	DB4Rail CDR		Gate4Rail SRR			Sat4Train Field Tests	

Projects involve in different consortiums the following companies:
ADIF
Ansaldo STS
Bocconi
Bureau Veritas
Cedex
DLR
Guide
IFSTTAR
Ineco
Italcertifer
M3
Qascom
Radiolabs
RFI
RINA
SNCF
UNIFE

ERSAT GGC — European Global Navigation Satellite Systems Agency — **Safety and Technological assessment**

SBS 2.1 — esa — **Pilot line – satellite technology**

Sat4Train — esa — **Multi-bearer telecom**

DB4Rail — esa — **Anti-Jamming Anti-spoofing**

Gate4Rail — Shift2Rail — **GNSS Virtual Test Bed**

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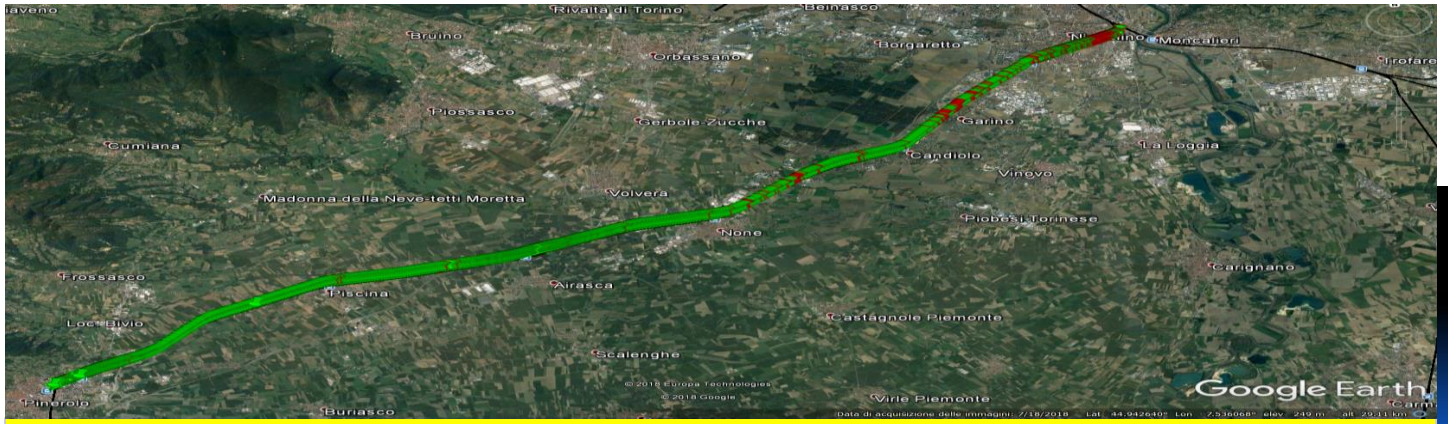
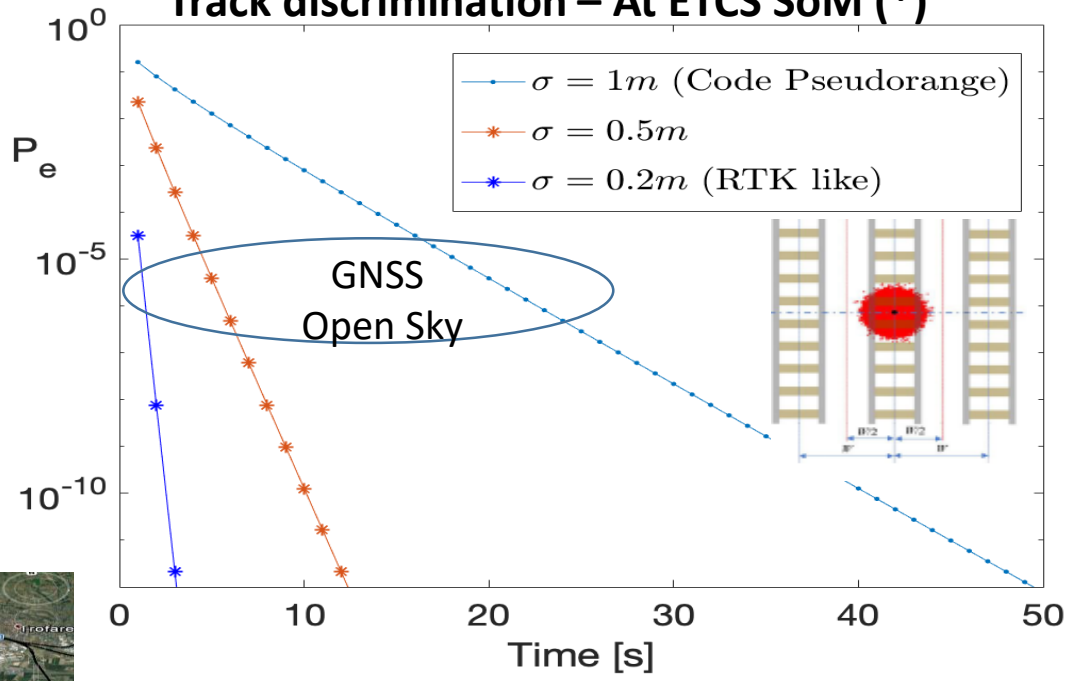
Challenges

- The ERSAT-GGC track survey will help in the characterization of the line in terms of suitability of the area for the VB location, i.e.
  - Line green: VB can be placed even at small distances;
  - Line red: we need different solutions
- Frequent VBs increase performances through odometry reset

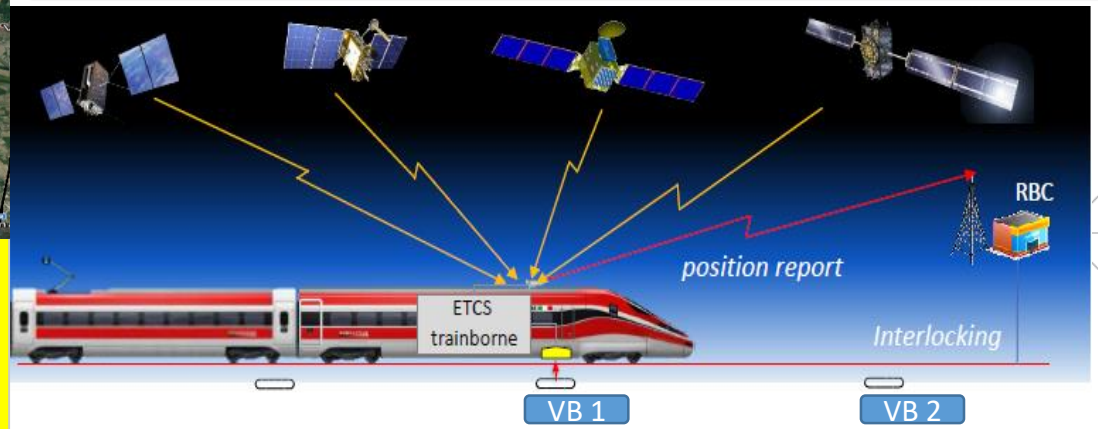


RFI is interested in the results of EU projects, as well as technological and market trends (DCMF, Non GNSS Sensors, Data Fusion) to extend current performances also in GNSS denied zones.

Track discrimination – At ETCS SoM (*)



Reduce SR travelled distance at Start Of Mission



SR travelled distance

(*) A. Neri, R. Capua, P. Salvatori "Track Constrained RTK-like Positioning for Railway Applications", *NAVIGATION, Journal of The Institute of Navigation*, Vol. 65, No. 3, Fall 2018,

Conclusions & Outlooks

- ERSAT Projects have developed and in-field verified the satellite technology for the ERTMS
  - Collaborative effort with satellite & railways stake-holders
  - Dedicated test bed to acquire & process data
- Master plan 2017 – 2023 has been defined aiming at:
  - Activate a first commercial line by the end of 2020
  - Promote development of new technologies (eg DFMC, multi-sensors…) impacting the Total Cost to Ownership (TCO)
  - Upgrade and test the Pinerolo Sangone line to operate with Public Augmentation service
  - Introduce train integrity technology for level 3
  - Co-operate with EU stake-holders for a standardized solution
- Team of experts involved for the certification process
  - Italian Safety Agency that on Feb 8th 2019 has indicated to RFI the guidelines for the certification process
  - GSA, ERA, S2R, ASI, ESA
  - Investigation of the suitability of EGNOS for Railways applications
- R&D effort coordinated with the Italian Space Agency

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Space for **Innovation in Rail**

18 -19 March 2019, Vienna

#SpaceInRail

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Co-funded by the Horizon 2020 programme of the European Union

ERSAT GGC

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