STARS

SATELLITE TECHNOLOGY FOR ADVANCED RAILWAY SIGNALLING

Prague, Nov 27th 2018

STARS FINAL EVENT

STARS Measurement Campaign

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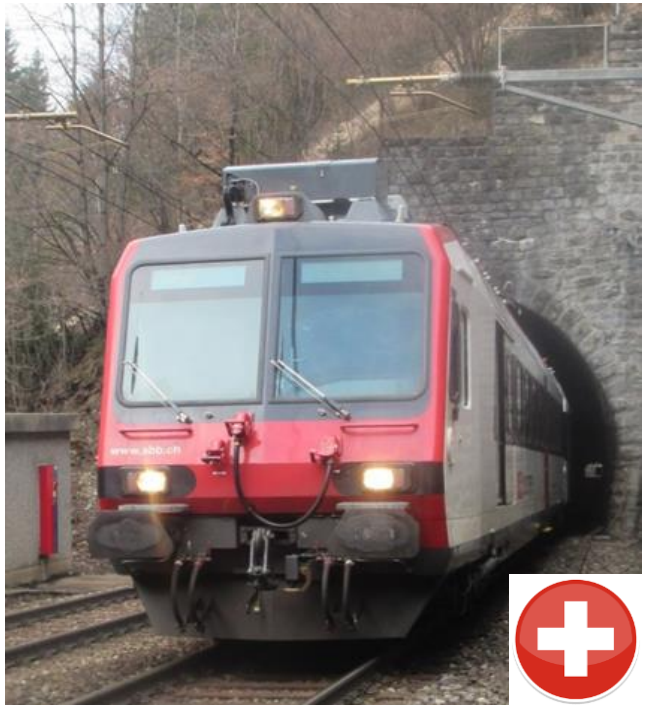
Siemens Mobility

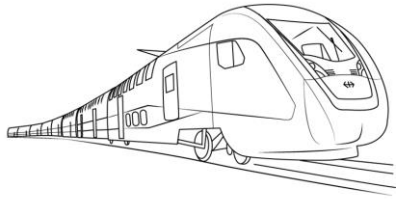
This project has received funding from the European Union's Horizon 2020 research and innovation program under grant agreement No. 687414

Measurement Campaign

3 Countries, 3 trains, 3 Measurement Campaigns – One Goal



Overview

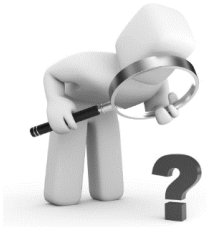


Equipment Procurement & Preparation of vehicles and tracks

May 2016 – Nov 2016

Installation of equipment & Certification

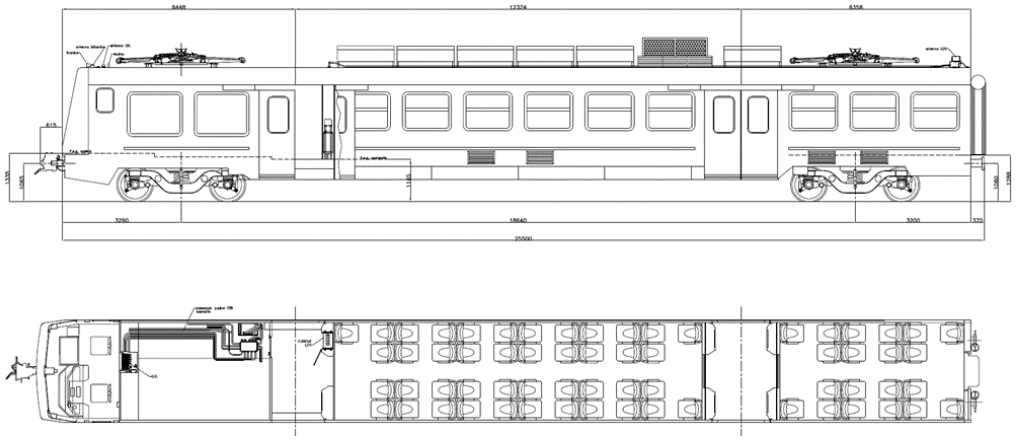
Sept 2016 – Mar 2017



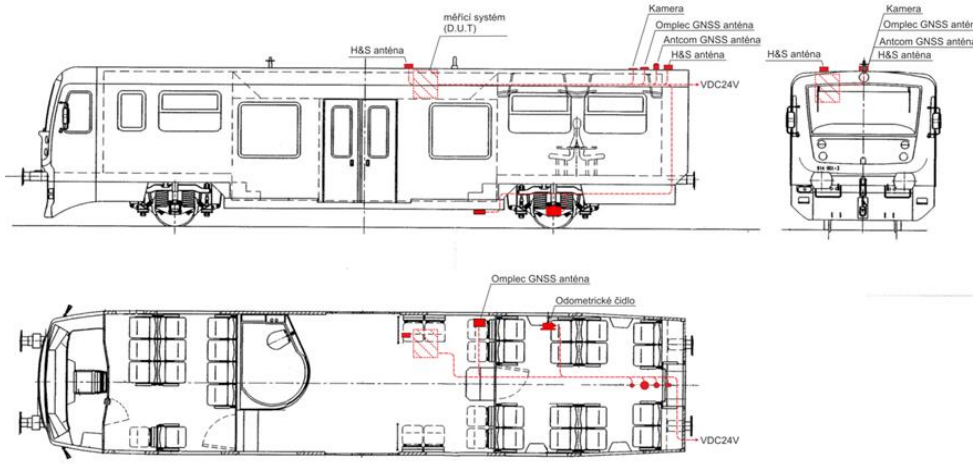
Field measurement & Data Storage

Jan 2017 – Aug 2018

Equipment Procurement & Preparation of vehicles

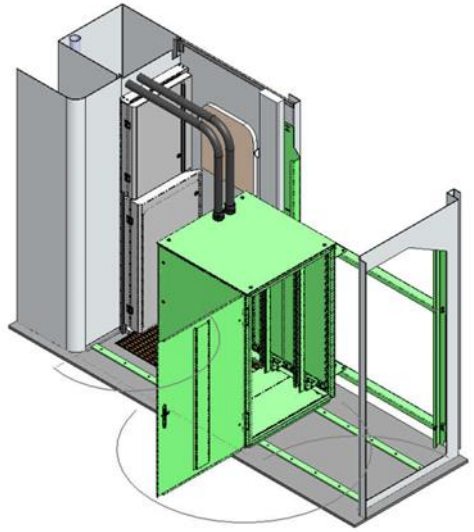


Ansaldo Train Installation Design



AZD Train Installation Design

- Minimum Common Equipment for three sites purchased
- Unexpected delays in the procurement of the Equipment



Siemens Test Cabinet Design

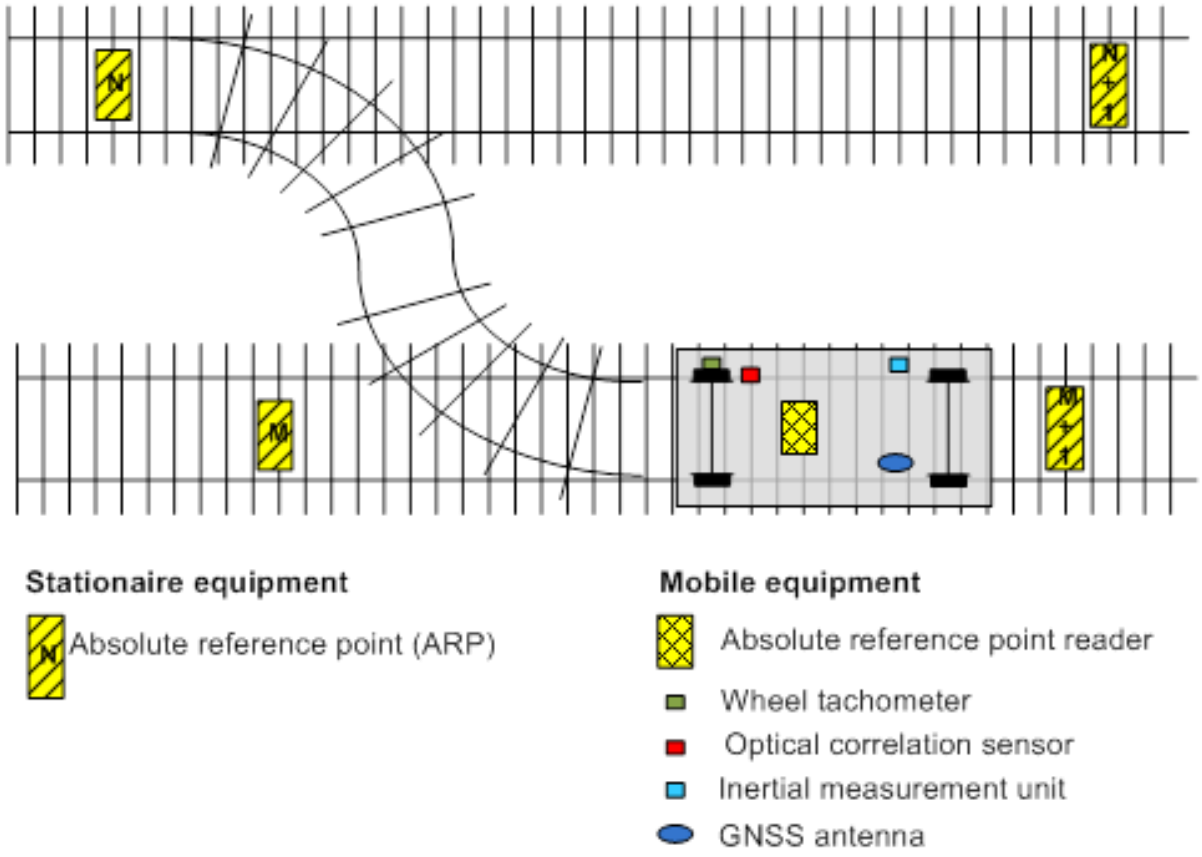
Installation of Equipment & Certification

Cabinet Installation at Swiss Train

- Challenges with the Certification Process and installation of the equipment
- Preparation of the Ground Truth generation

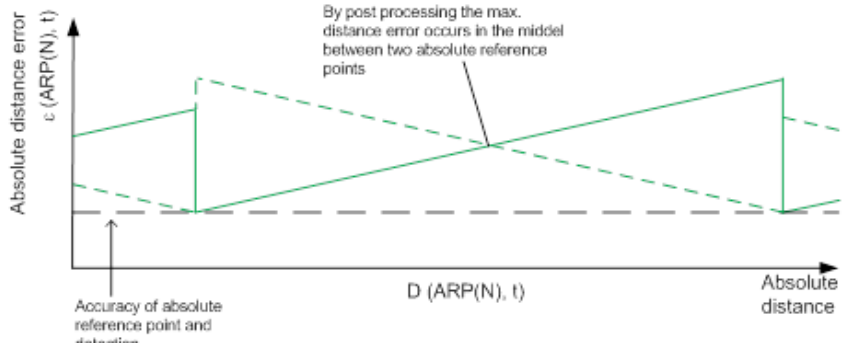
RF ID antenna and radar installation at Czech Train

Ground Truth Generation



This is the basis of the GNSS Quality Analysis

- Track Database Available
- Absolute reference data (Balises, RF IDs)
- Relative reference data (tacho, radars)

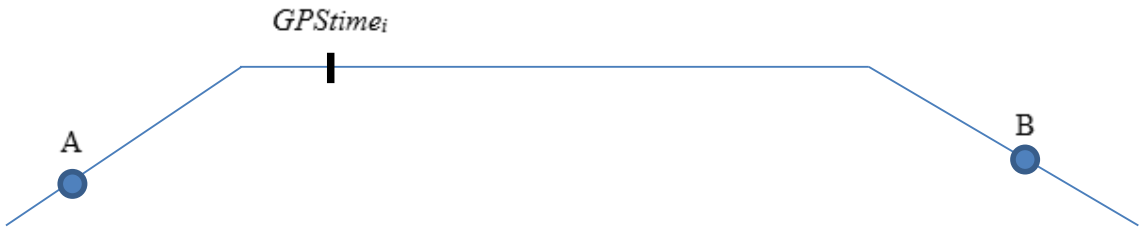


Italy -Ground Truth Data

Methodology developed for STARS based in odometry and real-time acquiring system

Precise timer counter for calculating the elapsed time

Interpolation of time (GPSTime) between two read balises (A, B)

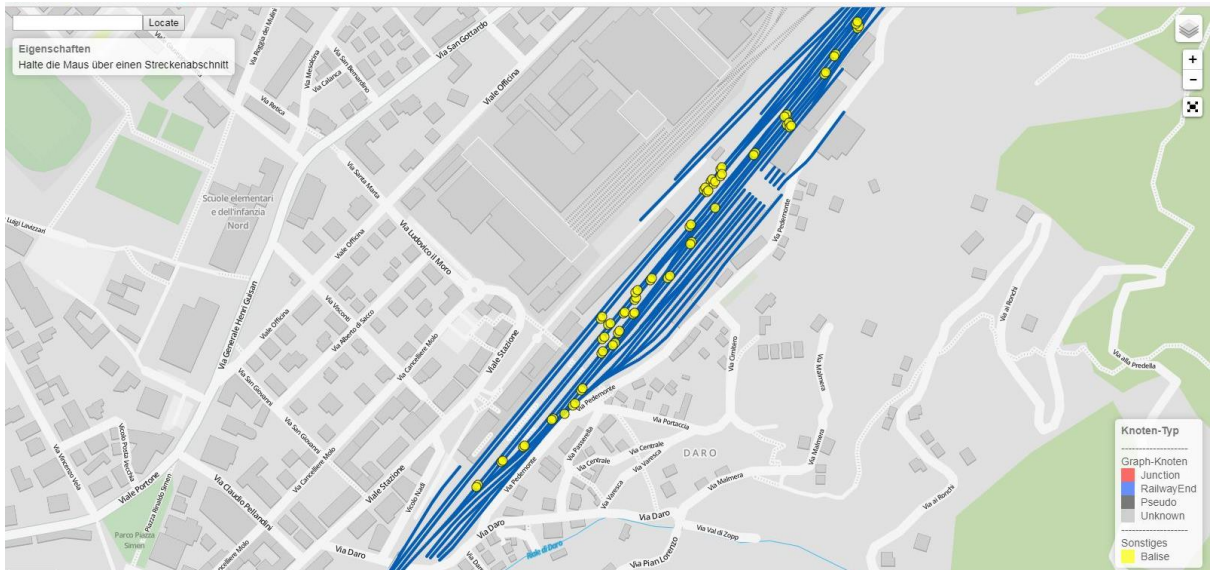


Switzerland - Ground Truth Data

Specific SW Tool Box had to be developed to generate ground truth from this huge data volume

Train running in commercial in lines through all Switzerland (1000 km of track covered)

- SBB provided track database in CH1903+/LV95 coordinate format
- Data measured and synchronized with the Odometry (also images at post-processing)
- Balises used as absolute references



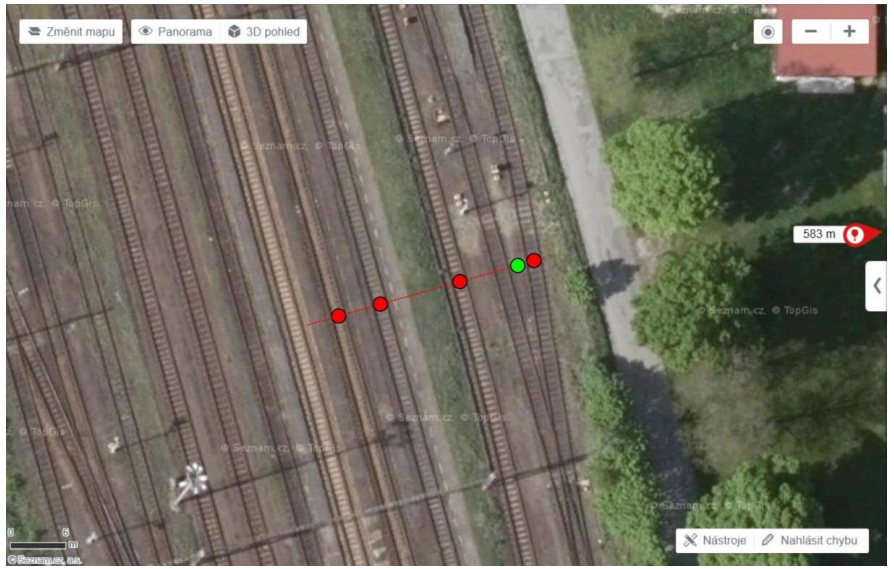
GT Visual view of Swiss Data Collection

Czech Republic - Ground Truth Data

RF ID installation for GT in Czech Train

Adaptation of the track necessary with RF ID tags

Algorithms implemented for track Selectivity



Italy – Measurement Campaign

Vehicle: ALN668

Line: Cagliari and San Gavino (Sardinia)

Line Longitude: 57 km

Duration: 45 minutes (one way)

Total: 17 days of data / 3,2 TB

Switzerland – Measurement Campaign

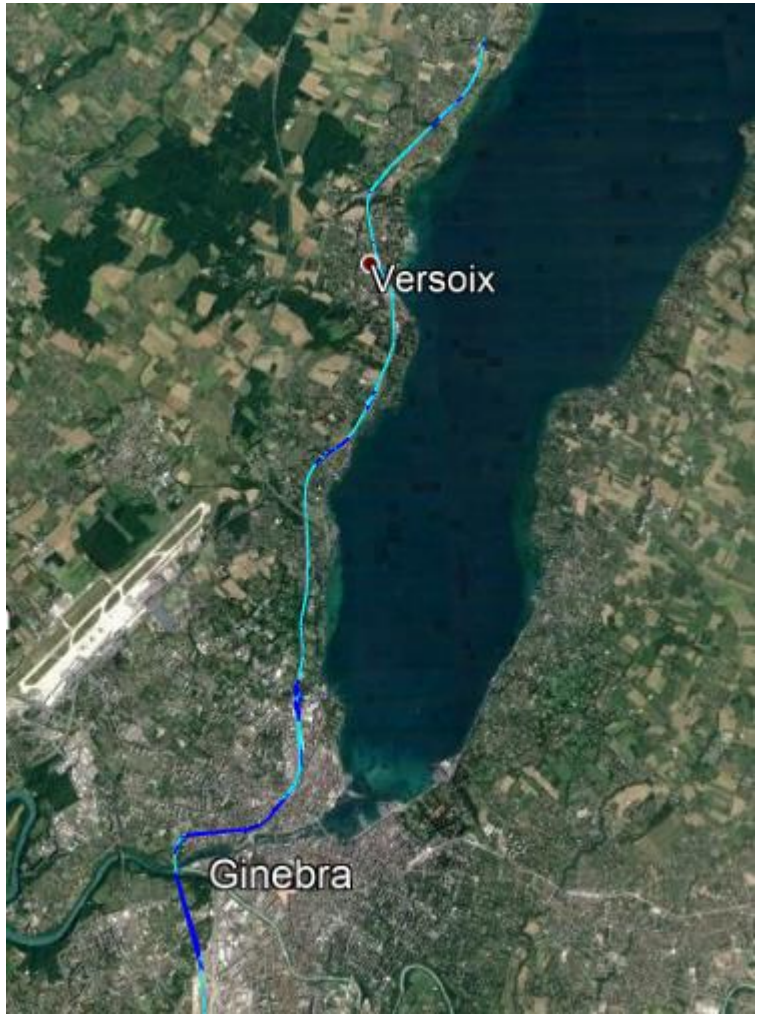
Vehicle: Domino E2W

Pool of vehicles which operates on many different lines (1000 km covered)

Duration / Line Longitude: Depending of the line

Total: 34 days of data (1,5 TB)

Switzerland – Measurement Campaign



Vehicle: Domino E2W

Line Coppet - Lanzy

Line Longitude: 25 km

Duration: 20 minutes (one way)

Switzerland – Measurement Campaign

Vehicle: Domino E2W

Yverdon-les-Bains – Lausane

Line Longitude: 40 km

Duration: 30 minutes (one way)

Switzerland – Measurement Campaign

Vehicle: Domino E2W

Line: Bellizona – Basel

Line Longitude: 239 km

Duration: 2:43 (one way)

Switzerland – Measurement Campaign

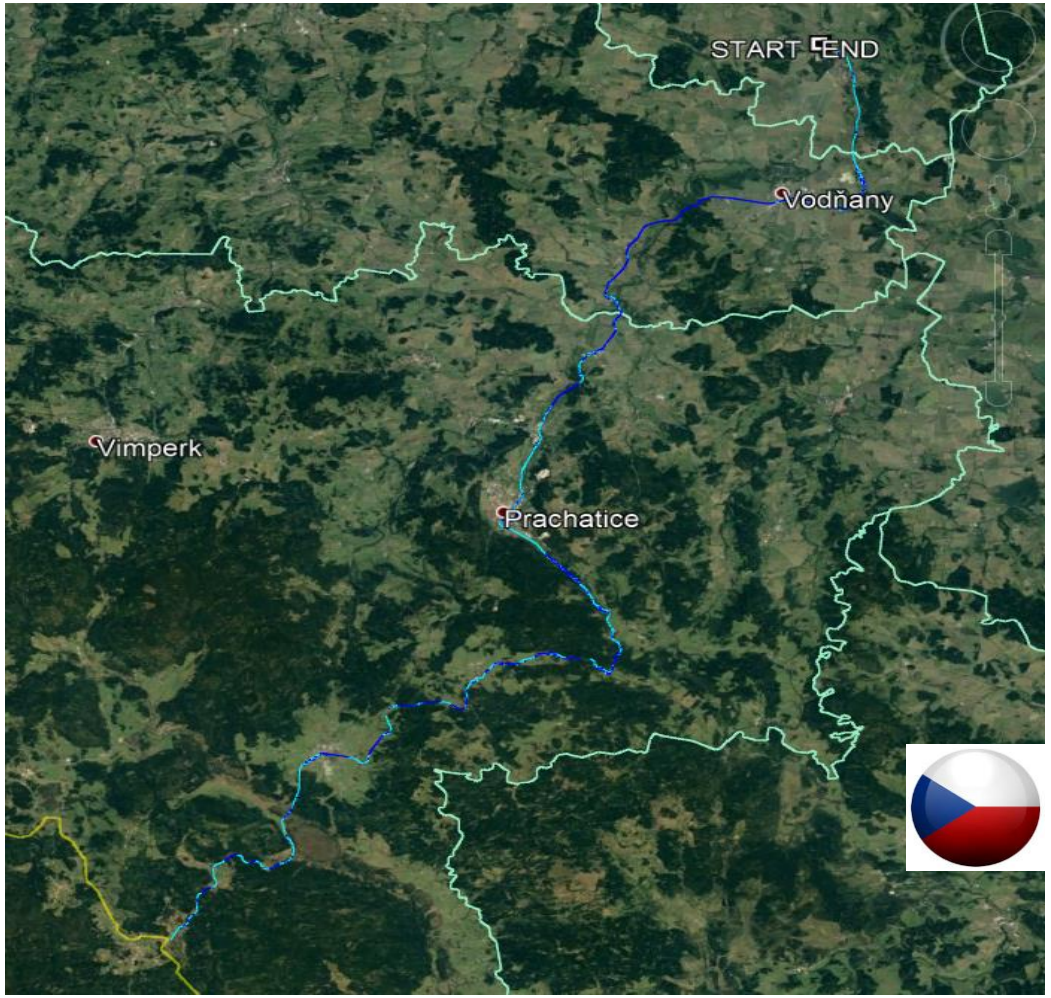
Vehicle: Domino E2W

Biel - Bellizona

Line Longitude: 250 km

Duration: 3 hours (one way)

Czech Republic – Measurement Campaign



Vehicle: DMU 814-914.104

Line: Číčenice-Volary

Line Longitude: 60km

Trip duration: 1.5 hours (one way)

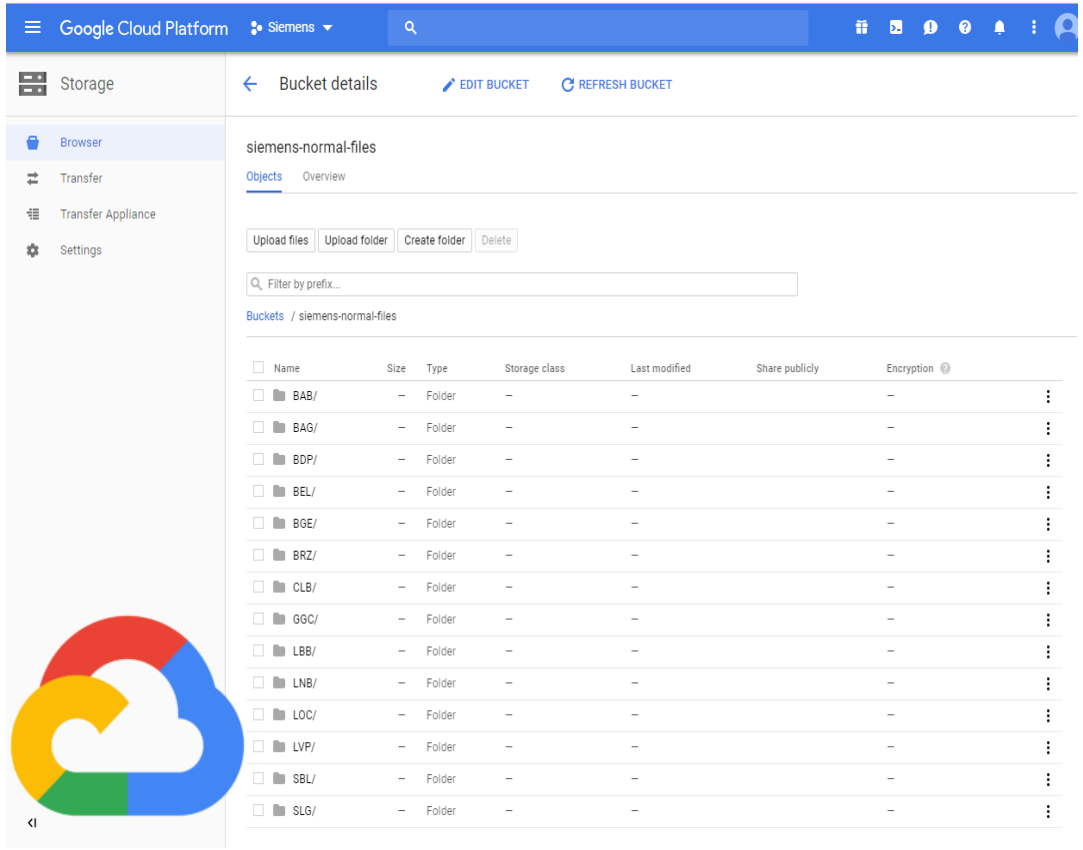
Total: 90 days of data / 2,4 TB

Establishment of Data Storage

Cloud Based data Storage has been created

Significant data volume (100 TB reserved)

File naming convention created for the collected data

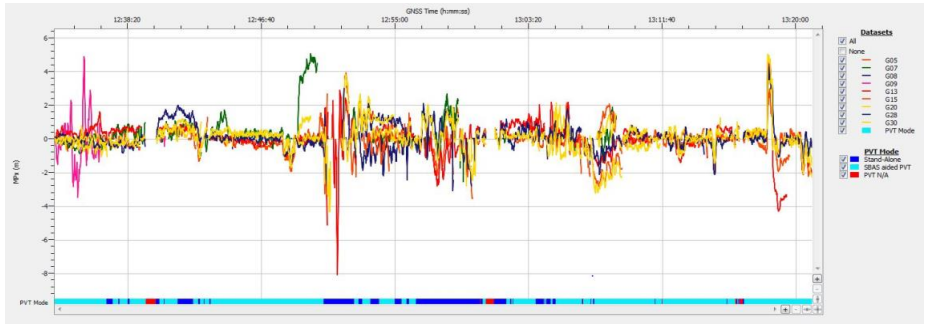


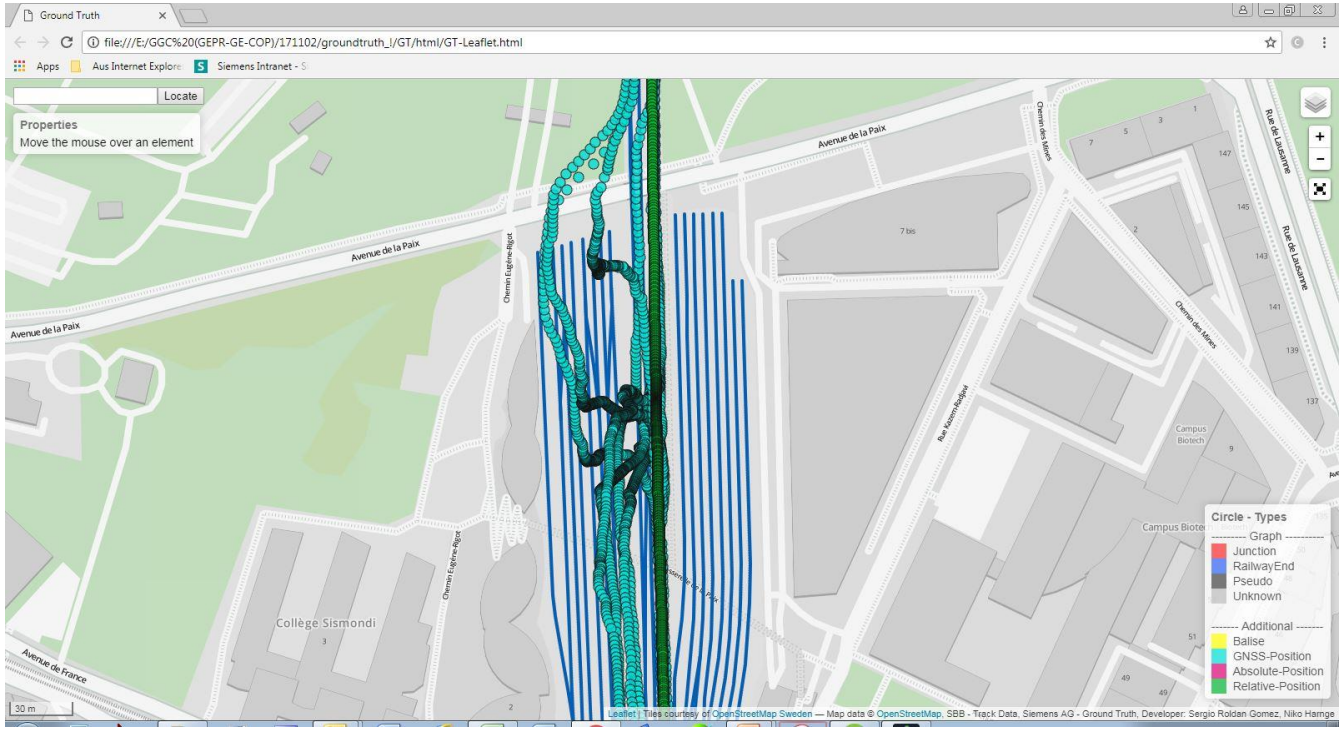
Preliminary Data Analysis

Check the validity of the data before uploading it to the cloud

Identification of critical location for GNSS

Use of the shelf tools and new developments





Summary

Data Collection campaign in three different sites has been successfully executed

Support and interest of the train operators and railway infrastructure managers has been key

Significant quantity of GNSS data has been collected at railway environments

The Collected Data has been the base of the performed data analysis and characterizations

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Thank you for your attention!

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This project has received funding from the European Union's Horizon 2020 research and innovation program under grant agreement No. 687414