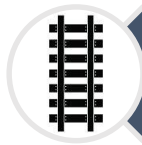# Objectives

MAIN GOAL

To develop 4 ready-to-use new services to provide prognostic information about the health status of the railway's most demanding assets in terms of maintenance costs, at the points of interaction between the vehicle and the infrastructure (wheelset, pantograph, rail & catenary)

iWheelMon

iPantMon

iRailMon

iCatMon

Common features:

- Plug-in WW based on Web App
- Real-Time info about assets' status
- Prognostic health status assessment
- Integration with operation systems

European
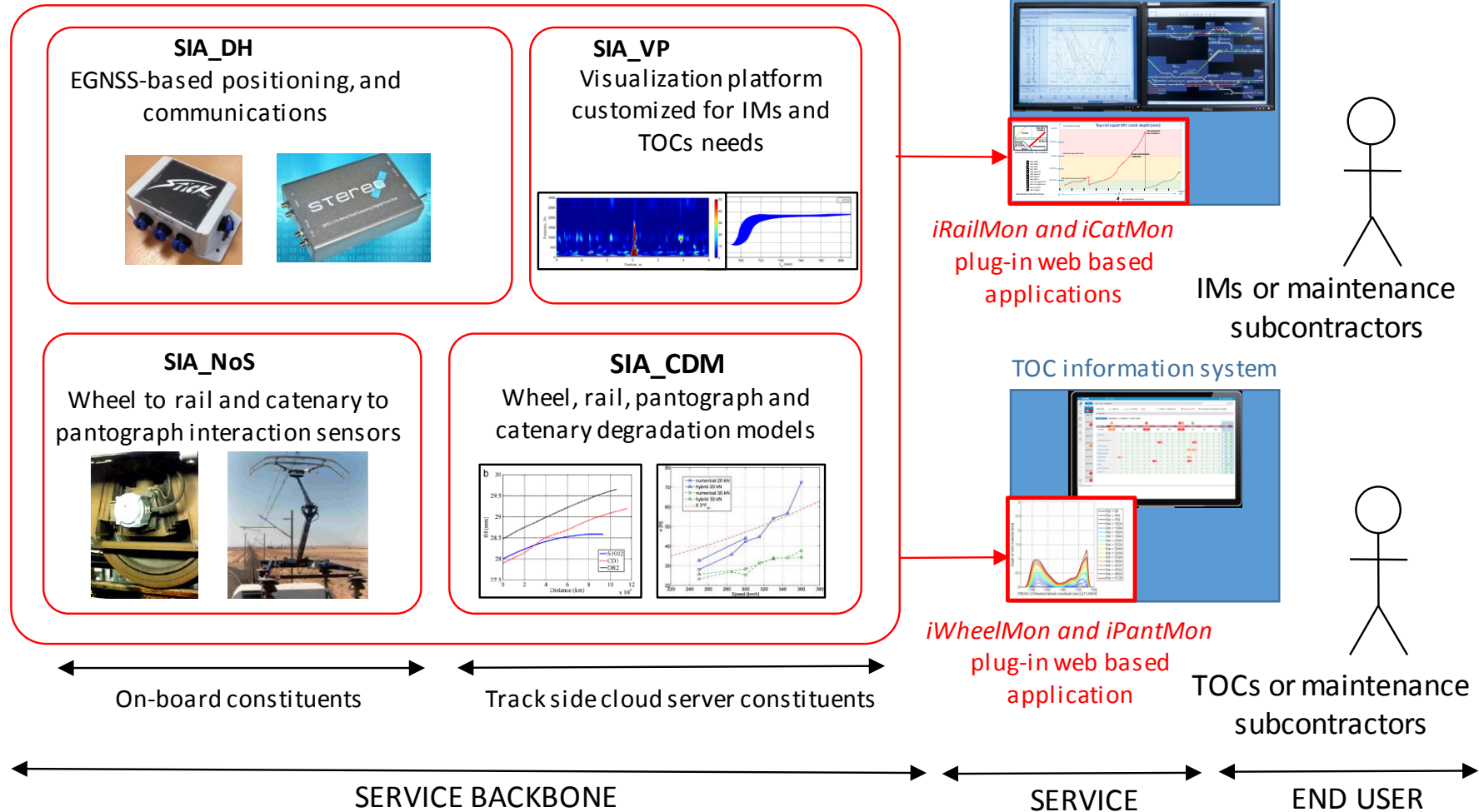Global Navigation
Satellite Systems
Agency

SIA
SYSTEM FOR VEHICLE-INFRASTRUCTURE
INTERACTION ASSETS HEALTH STATUS MONITORING

Objectives

- Development of **low-cost sensor nodes (SIA_NoS)** for wheel to rail and pantograph to catenary interaction characterization.
  - Sensors
  - Pre-processing Hardware
  - Wireless communications
  - Autonomous / Wired Power supply
- Development of **data hub (SIA_DH)** that collects on-board information, provides accurate position and time stamping with high availability, and transmits the information to a trackside visualization platform.
  - Galileo Initial Services multi-constellation / multi-frequency approach
  - EGNOS information
  - IMU
  - Finger printing algorithms
- Development of **predictive component degradation models (SIA_CDM)** that will enable to connect the monitoring information from wheelset, rail, catenary and pantograph with the asset management information system of end-users.
  - Physical models
  - Combination with monitored data
- Development of a **visualization platform (SIA_VP) with two plug-in software modules specific for the railway** infrastructure (track and catenary) and vehicle maintenance (wheelset and pantograph).
  - Cloud hosted
  - Big-Data visualization techniques
  - Prognostic health monitoring of the key assets
  - Real-Time early detection service of wheel flats and broken rails

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SIA — SYSTEM FOR VEHICLE-INFRASTRUCTURE INTERACTION ASSETS HEALTH STATUS MONITORING

www.railway-asset-management.org

Concept & Components

SIA constituents

SIA_DH
EGNSS-based positioning, and communications

SIA_VP
Visualization platform customized for IMs and TOCs needs

SIA_NoS
Wheel to rail and catenary to pantograph interaction sensors

SIA_CDM
Wheel, rail, pantograph and catenary degradation models

On-board constituents

Track side cloud server constituents

IMs information system

iRailMon and iCatMon plug-in web based applications

IMs or maintenance subcontractors

TOC information system

iWheelMon and iPantMon plug-in web based application

TOCs or maintenance subcontractors

SERVICE BACKBONE   SERVICE   END USER

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SIA
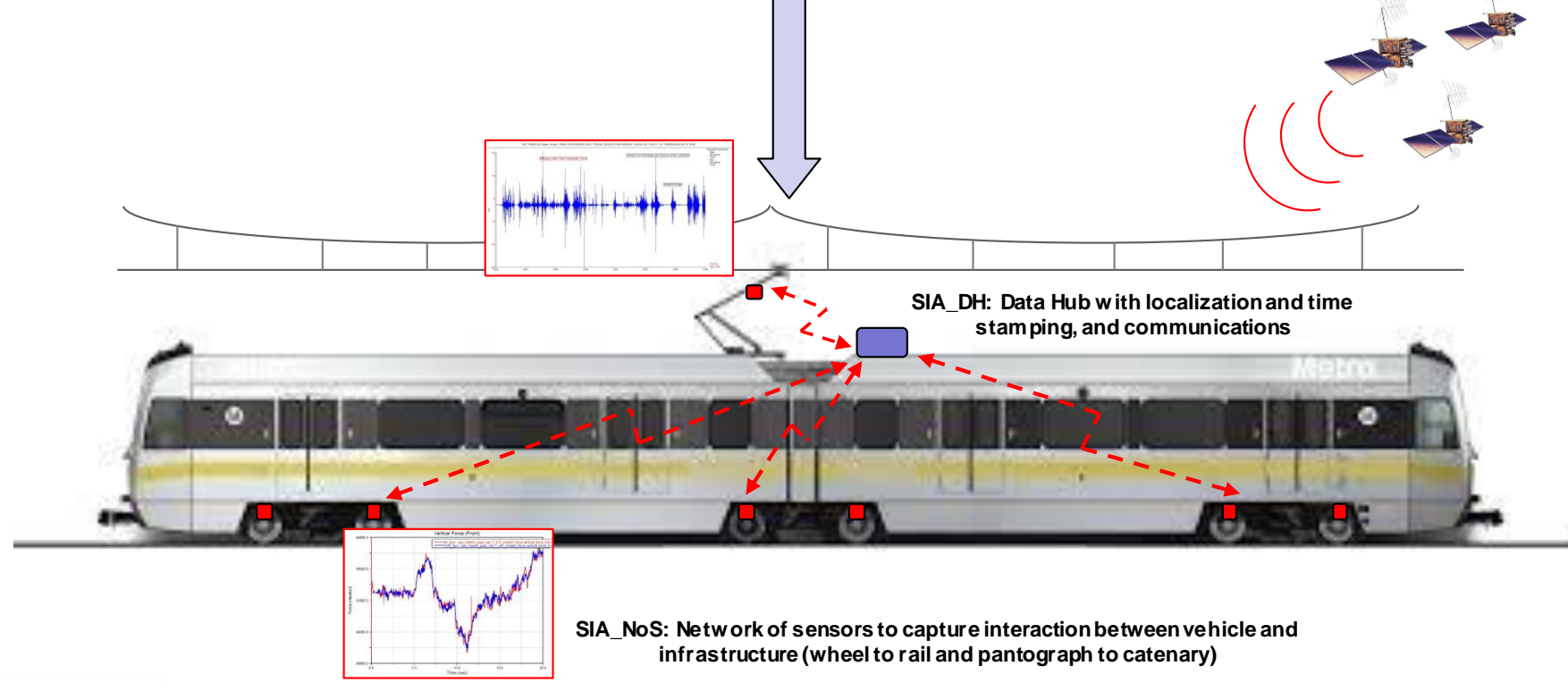SYSTEM FOR VEHICLE-INFRASTRUCTURE INTERACTION ASSETS HEALTH STATUS MONITORING

Concept & Components

SIA_VP: Vehicle prognostic health monitoring visualization
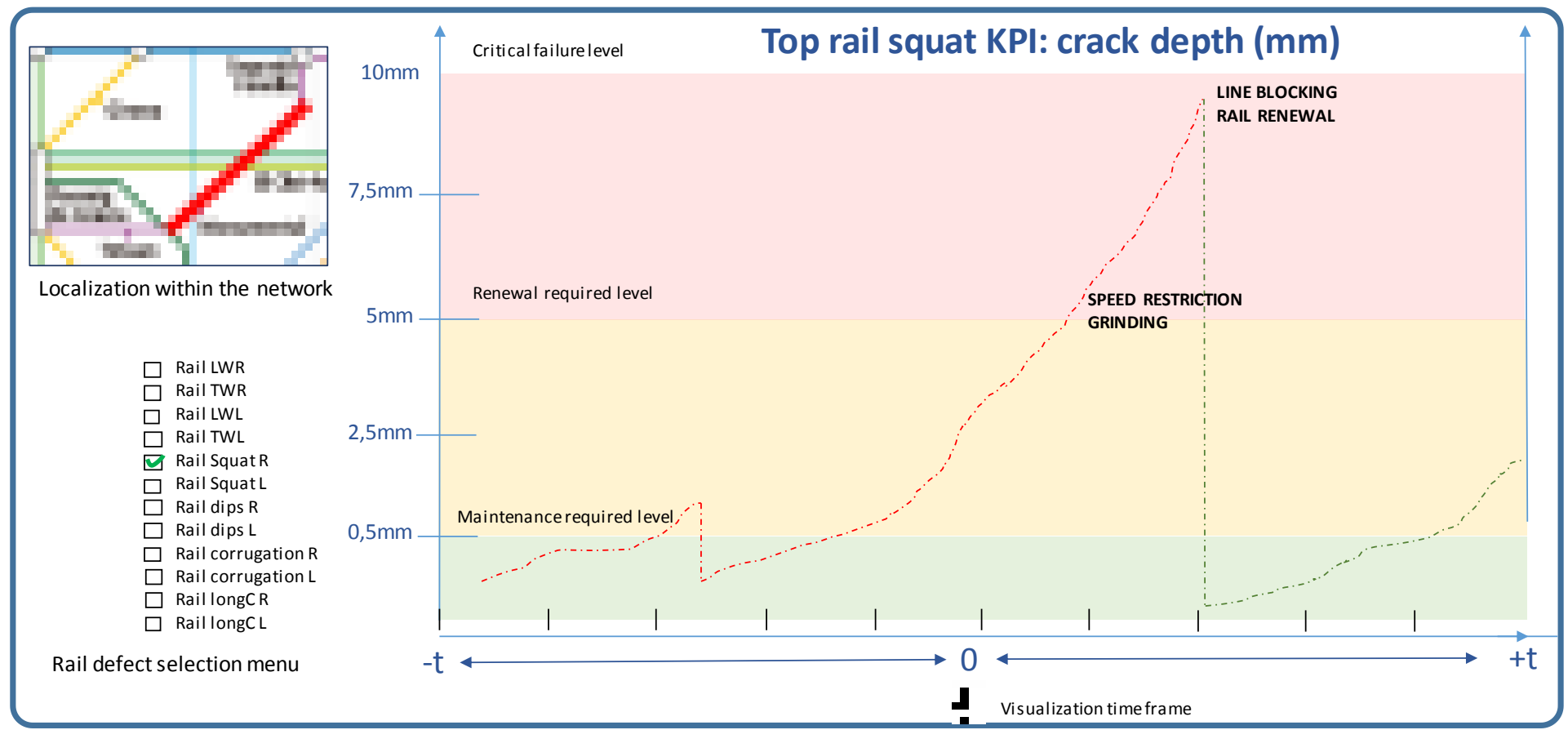SIA_CDM: Vehicle component degradation models

Integration in already existing vehicle maintenance information system

SIA_VP: Infrastructure prognostic health monitoring visualization
SIA_CDM: Infrastructure component degradation models

Integration in already existing infrastructure maintenance information system

SIA_DH: Data Hub with localization and time stamping, and communications

SIA_NoS: Network of sensors to capture interaction between vehicle and infrastructure (wheel to rail and pantograph to catenary)

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Concept. Visualization example

Localization within the network

Rail defect selection menu
- ☐ Rail LWR
- ☐ Rail TWR
- ☐ Rail LWL
- ☐ Rail TWL
- ☑ Rail Squat R
- ☐ Rail Squat L
- ☐ Rail dips R
- ☐ Rail dips L
- ☐ Rail corrugation R
- ☐ Rail corrugation L
- ☐ Rail longC R
- ☐ Rail longC L

Top rail squat KPI: crack depth (mm)

Critical failure level

10mm

LINE BLOCKING
RAIL RENEWAL

7,5mm

Renewal required level

5mm

SPEED RESTRICTION
GRINDING

2,5mm

Maintenance required level

0,5mm

-t ⟷ 0 ⟷ +t

Visualization time frame

Methodology

- 4 pilot projects in 2 validation scenarios
- Integration of information within end-users' information systems
- Validation of degradation models
  - 5 years of historic records (from validation scenarios)
  - Years 1-2 for model calibration
  - Years 3-4 for predictions assessment
  - Year 5 for operative validation
- Maintenance cost reduction validation
  - Historical cost records
  - Potential reduction with the new services
- Business plan validation
  - INNOTRANS 2020
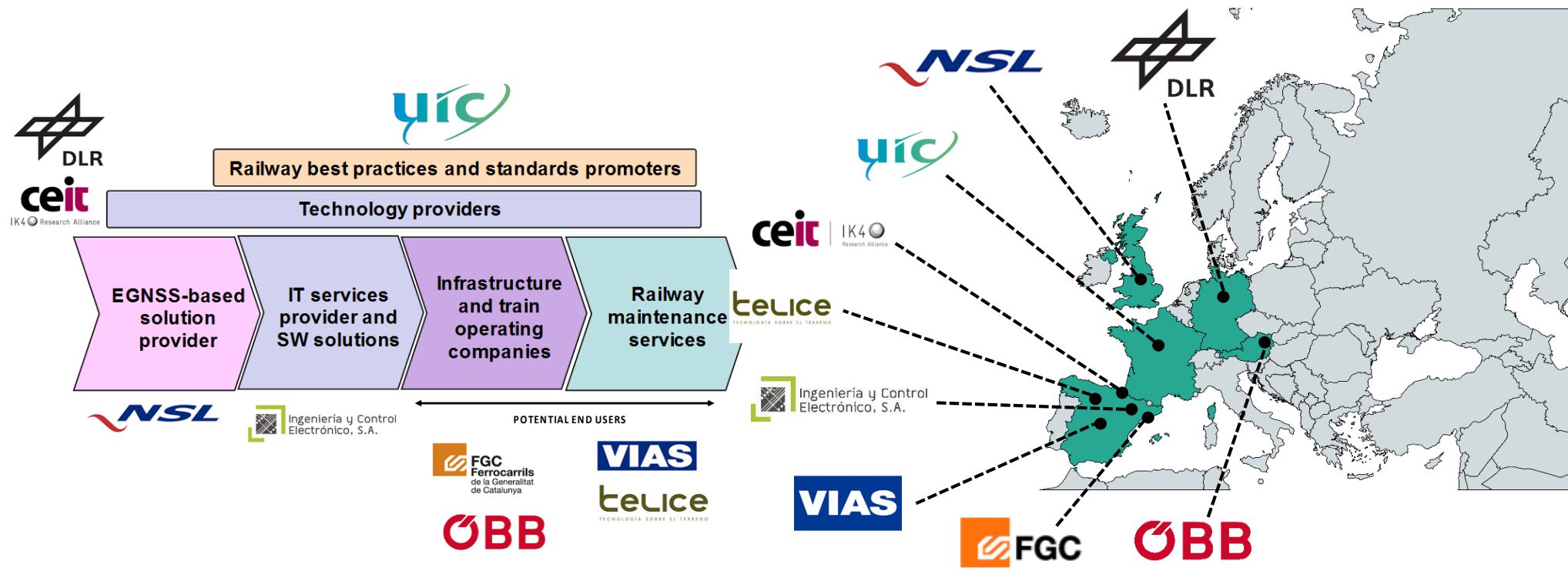 - 20 potential customers during pilots

Ambition

- Progress beyond the State-of-the-Art
  - **Prognostic health monitoring** of key railway assets
    - Low-cost Real-Time monitoring system
    - Energy harvesting capabilities
  - **EGNSS localization techniques**
    - Low-cost positioning solution that provides high accuracy and high availability in the railway environment
    - Finger printing using vehicle dynamics gathered data
    - Positioning algorithm testing tool
  - **Component degradation models**
    - Degradation models: combination of physical modelling & sensors' data
    - Predictive algorithms
- SIA innovation
  - New end-to-end EGNSS based services to address end-user needs
  - Combination of cutting-edge technologies to provide added value to end users
  - Innovation in business model

Impact statement

- Maximize the potential of the **EGNSS** and its adoption in transport
- Demonstrate the benefits of the use of **Galileo** and **EGNOS** in rail transport
- More **modern, efficient** and **user friendly** rail transport system
  - 25% reduction of unscheduled maintenance activities
  - 15% reduction of maintenance cost
  - 15% reduction of derailment-risk
- **Coordination** of multiple actors and other pilot projects
  - Presence in Shift2Rail and participation in other H2020 projects
  - UIC leading dissemination activities
  - Advisory Group
- Encourage **market take-up** of the developments
  - TRL8 developments
  - Business plan
  - Consortium as a whole

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SIA
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INTERACTION ASSETS HEALTH STATUS MONITORING

Consortium

UIC Railway Asset Management Global Conference 2019

17 - 19 APRIL 2019
UIC HEADQUARTERS, PARIS

Thank you for your attention !

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