CLUG 2.0: Project overview

EUSPA UCP – 07/11/23

Valentin Barreau – SNCF
CLUG 2.0 project technical coordinator

Context & Objectives

Interne

CLUG 2.0 In a Nutshell

Partners: **10**

Duration: **24 months**

Starting date: **Feb 23**

End date: **Jan 25**

unife THE EUROPEAN RAIL INDUSTRY

RINA

DB

SNCF

SBB CFF FFS

SIEMENS

AIRBUS

CAF

SYNTONY GNSS

ENAC

Interne

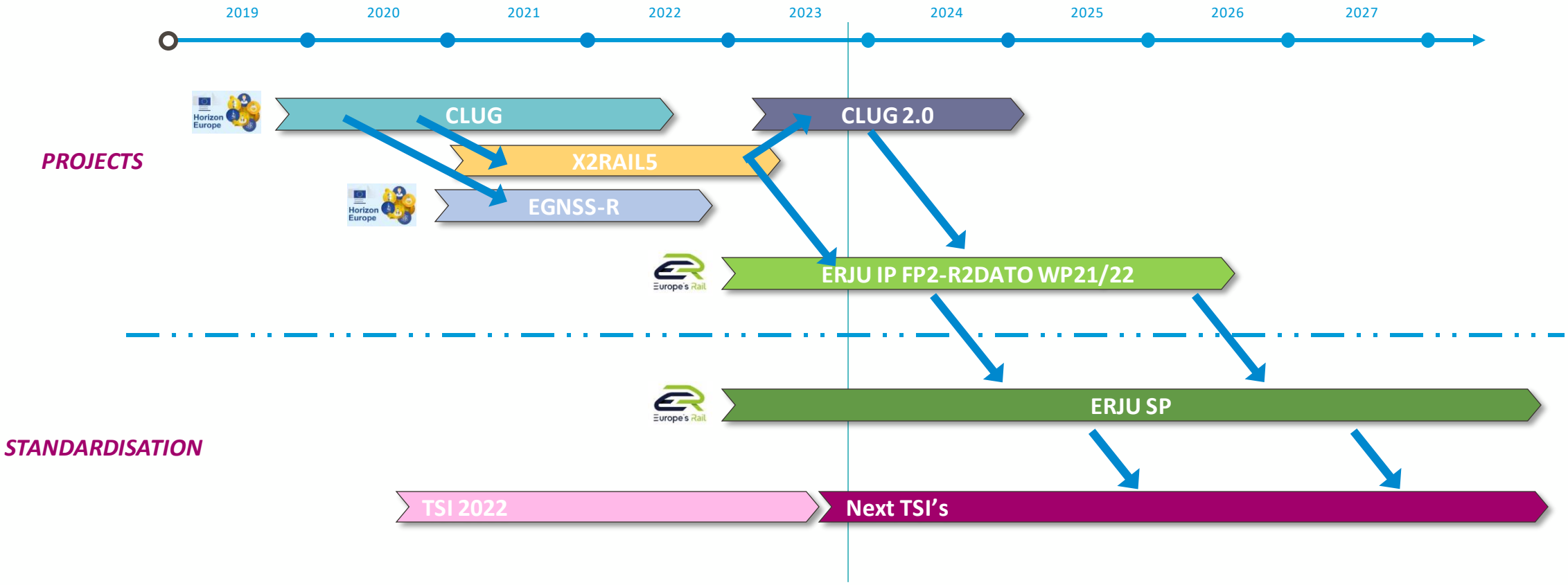
CLUG 2.0 OBJECTIVES

Demonstrate the technological readiness of an on-board GNSS+EGNOS based multi-sensor fusion architecture enabling absolute safe train positioning for signalling in a ETCS frame

- The main objectives of CLUG 2.0 are based on work performed in CLUG
  - Consolidation of user needs and system requirements (Along Track, Start of Mission and Track selectivity)
  - Consolidation of safe localization system architecture and prototype new critical functionality
    - Track Selectivity and Safety
    - Sensor and system levels FDE algorithms
    - Confidence Intervals computation and global Integrity concept
  - RAMS analysis on the consolidated functional architecture of the system.
  - Live demonstration (Switzerland) and Replay to consolidate readiness of the CLUG multi-sensor fusion algorithms

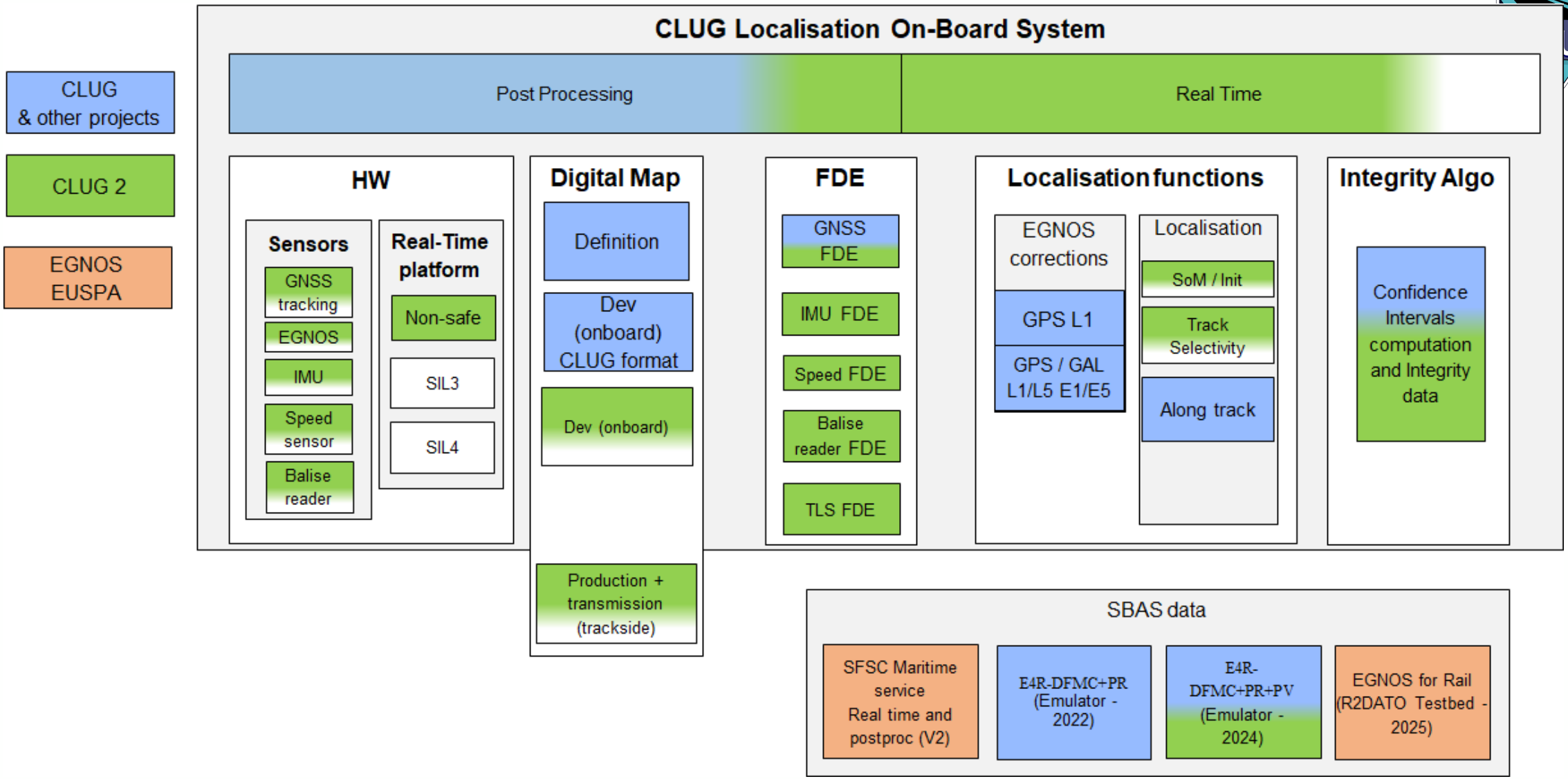
Interne

CLUG REASONING and ROADMAP



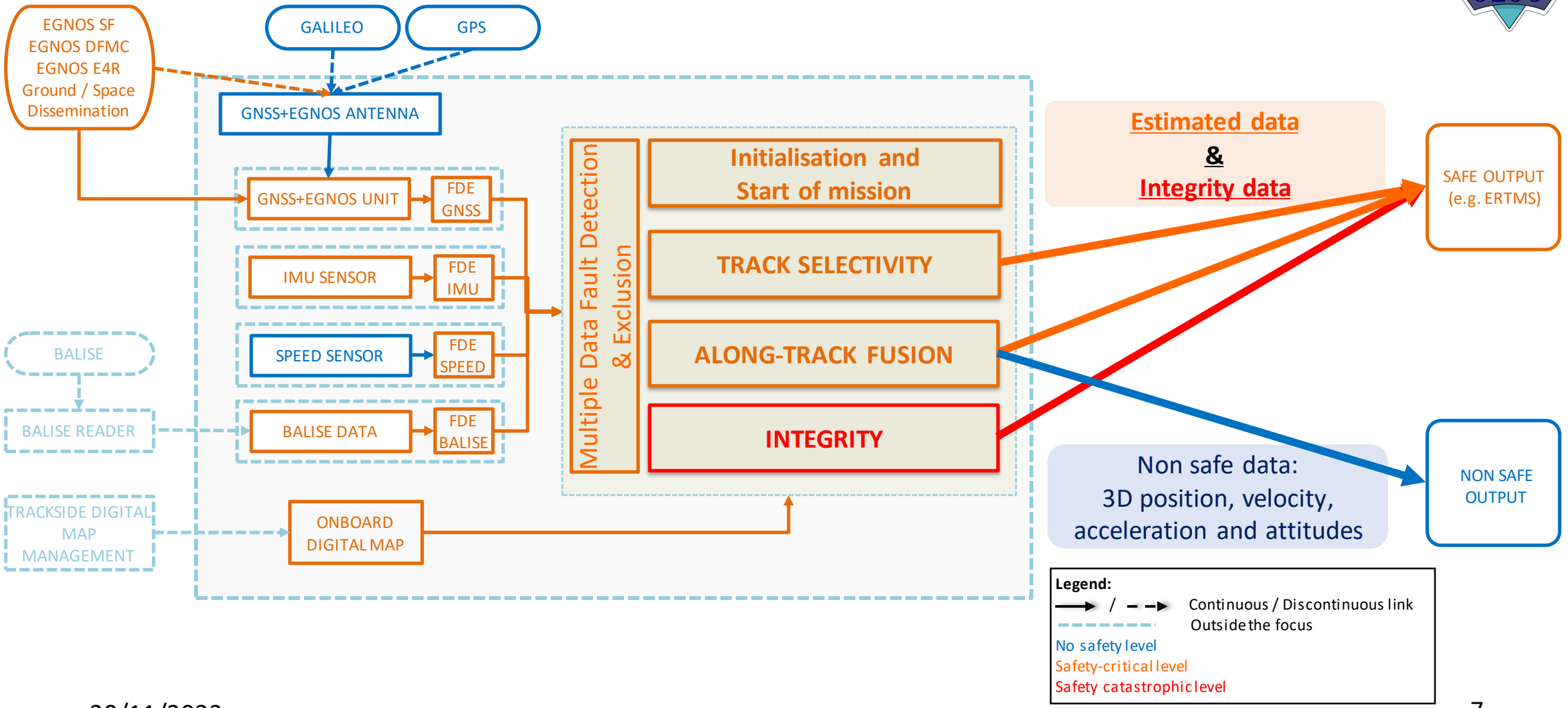
Interne

CLUG REASONING and ROADMAP



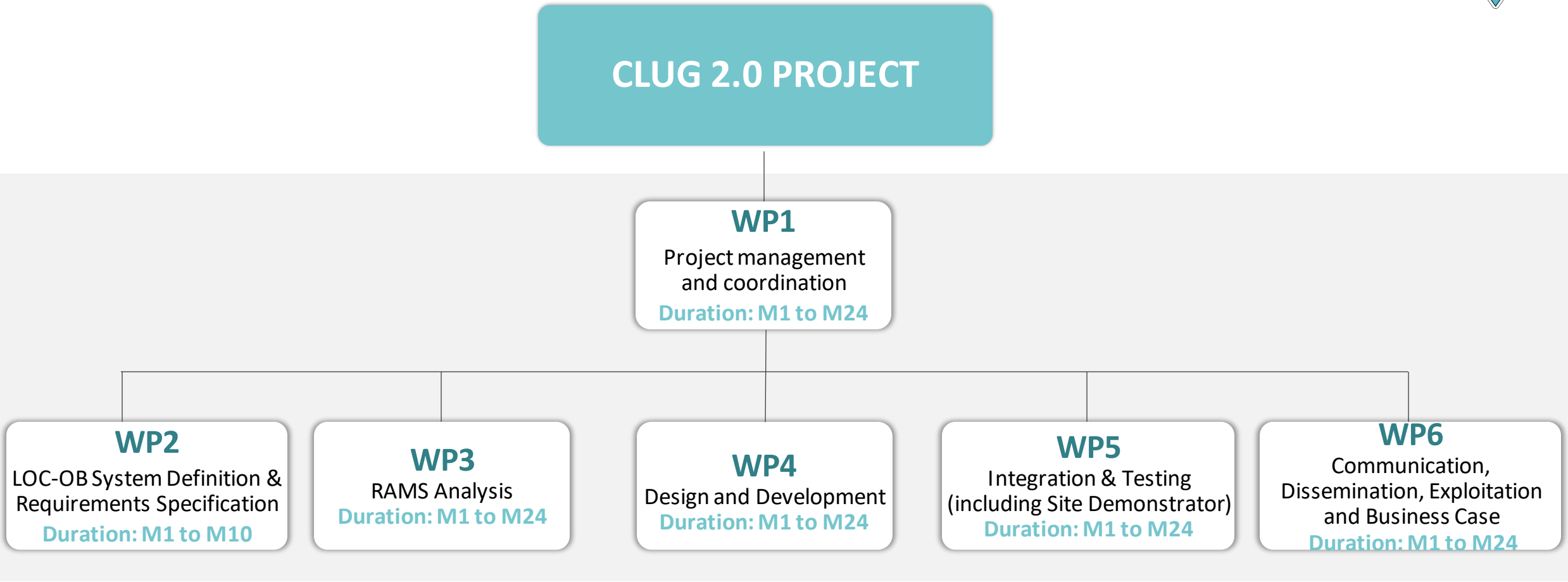
Interne

CLUG architecture



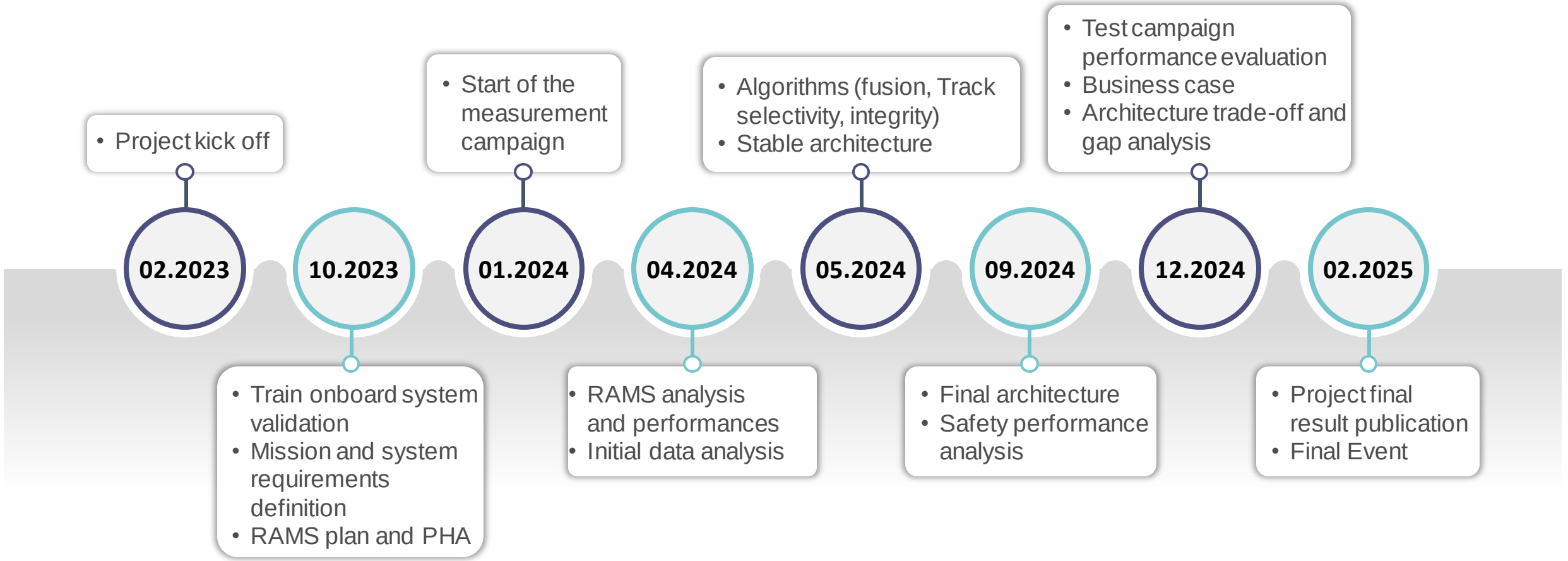
Interne

WP organisation



Interne

High level timeline



Interne

Project technical status

Interne

WP2

Define the user needs, operational context, initial assumptions, system boundary and requirements

Scope of work

- Operational needs of IM and RU and system capabilities to be fulfilled by absolute safe train positioning.
- Operational scenarios including nominal and degraded scenarios with regards to Start of Mission and track selectivity.
- System context, functions, and constrains of a LOC-OB system.
- LOC-OB System requirements including functional and non-functional requirements.

Status

- WP2 documents delivered to EUSPA by end of November 2023; publicly released early 2024
- The documents and their content is already been used in WP21 of FP2-R2DATO project in ERJU

Interne

WP3

To specify RAMS requirements and to demonstrate the safety targets for the CLUG LOC-OB, with respect to Common Safety Methods and CENELEC standards

Scope of work

- To specify the Reliability, Availability, Maintainability and Safety (RAMS) requirements in line with the overall SIL criteria of a railway embedded system to obtain a certifiable CLUG Localisation On-Board (LOC-OB) System
- To demonstrate that the CLUG LOC-OB functional system architecture and interfaces are in line with the specified safety targets
- To consolidate the remaining work to be performed to obtain a certifiable localisation unit in the future

Status

- RAMS Plan and PHA are about to be delivered (11/23)
- FMEA, RAM, functional and external interfaces analyses are about to start (11/23)

Interne

WP4

Design and development activities of the functional architecture of LOC-OB targeting the WP2 and WP3 requirements.

Scope of work

- Refine LOC-OB system and functions functional architecture
- LOC-OB critical Functions prototypes for design demonstrations: implementation of data FDE, track selectivity, Confidence status and Intervals computation, Along Track position and speed small upgrade
- LOC-OB safety performance analysis by engineering simulation: integrity availability assessment to provide compliant output data in accuracy and within the integrity level (SIL).
- EGNOS services data generation to enable prototyping tests in WP5.

Status

- Data FDE have been consolidated, ongoing prototyping
- Track Selectivity algorithm design & development ongoing
- On going along-track algo robustification

Interne

WP5

Design and develop tools and an onboard demonstrator to analyse and improve the performance of the CLUG positioning solution.

Scope of work

- Develop and install a system to collect field data from all sensors for the offline simulation of the CLUG solution, and perform live demonstrations on a train of SBB
- Prepare the data sets, generate the Ground Truth and validate the Digital Map for post processing with the fusion and integrity algorithms developed in WP4
- Analyse the performance of the developed solution and identify potential improvements

Status

- Onboard demonstrator has been developed and installed. On going validation
- Ongoing ground Truth process and Digital Map validation
- Test plan definition
- Ongoing analysis tools improvement

Interne

WP6

Ensure that the project results and outputs are disseminated widely and effectively exploited by their target groups

Scope of work

- Perform a cost-benefit-analysis (CBA), starting over the EUG-LWG CBA performed in 2022.
- Perform architecture Trade-off Analysis and Proposed Localisation On-Board System
- Conduct Gap Analysis on Proposed Localisation On-Board System Requirements
- Publish technical papers

Status

- Paper submitted for the TRA24 conference by SNCF/ADS, “Sensor fusion and GNSS augmentation services for safe train positioning - Accuracy and integrity performance evaluations”

Interne

Way forward

Interne

Way forward

- Share the work performed in WP2 with ERJU, notably FP2-R2DATO WP21 regarding rail user needs and system requirements

- Share the work performed in WP6 with ERJU, notably FP2-R2DATO WP22 regarding the ETCS gap analysis and LOC-OB system boundaries wrt ETCS

- Demonstrate the CLUG solution performance in the frame of FP2-R2DATO WP22

Interne

Thank you

Jose Bertolin – UNIFE - Project coordinator
Jose.bertolin@unife.org

Valentin Barreau – SNCF – Project technical coordinator
valentin.barreau@sncf.fr

CLUG 2.0 has received funding from the European Union's Horizon research and innovation programme under grant agreement No 101082624

Interne