

## Mission

Safe4RAIL (Safe architecture for Robust distributed Application Integration in roLLing stock) Brake by Wire targets to provide the requirements and the architectural concept design for the electronic control of highest safety train braking functionalities, the Emergency Brake. In doing it the Brake by Wire project will use the new high safety Train Control Monitoring System TCMS platform developed by the other S4R Working Parties.

# Safe4RAIL

## Brake-by-Wire

## Concept

Conventional train brakes systems are based on pneumatic and/or mixed pneumatic electronic architectures. The highest safety demanding function, the Emergency Brake (EB), is still relying on a completely pneumatic technology. Brake by wire project aim to develop a concept architectural design for a new electronic brake system based on electronic devices and communication systems (brake by wire) with high integrity safety performances.

## Objectives

Brake by Wire activities range from: the revisitation for the whole train braking system functionalities with a new approach for their integration, across their requirements definition to finally the concept development for the new high safety electronic control architecture.

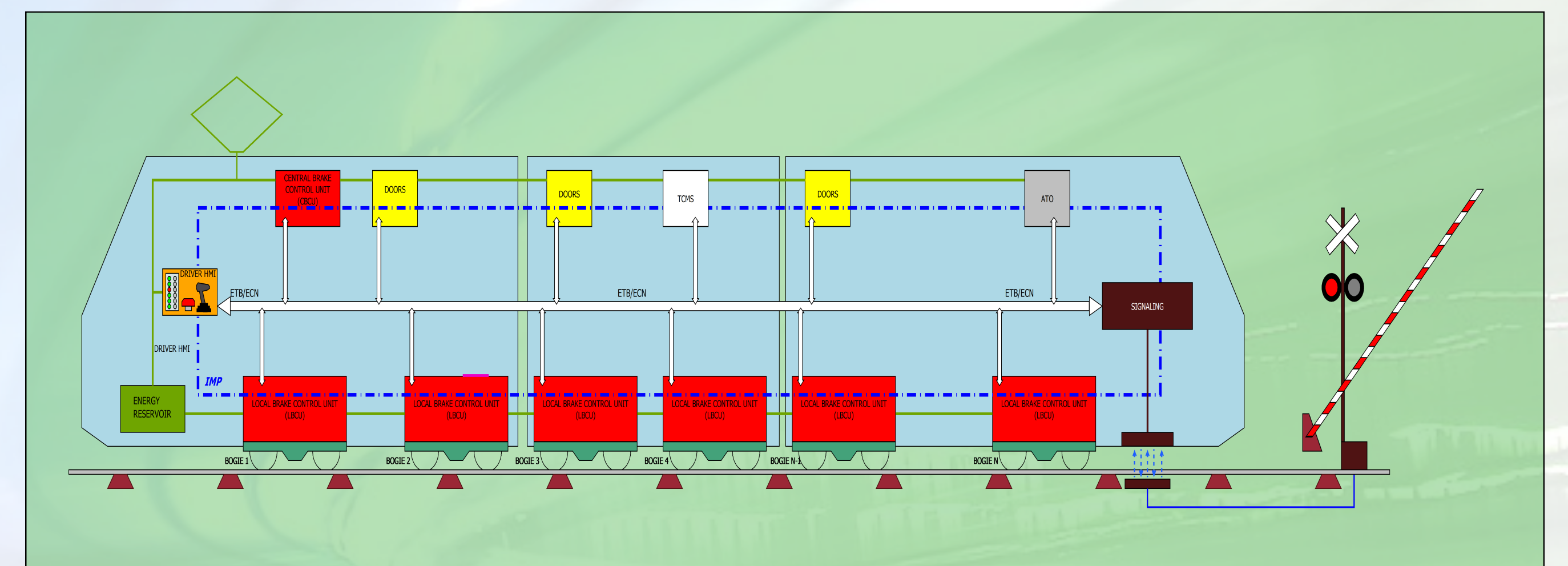
The cooperation with CONNECTA project supports the system requirements definition and the concept design for the non electronic brake system parts.

The set of European applicable standards is used in the project and a link between traditional safety requirements included in TSI LOC&PAS and the CENELEC 50126/8/9 is established.

A EN5026 safety development process is established and planned with safety verification and final assessment phases.

The Brake by Wire objectives include the following ones:

- System requirements specification, requirements analysis, risk analysis and safety requirements allocation.
- Definition of the electronic control concept and safety architecture with the identification of the train communication infrastructure suitable to cover requested safety levels
- Assessment of the proposed concept architecture and V&V criteria, planning of the concept development and validation activities for certification.
- Proof of concept and assessment preparation.



## Project Phases

### Phase 1 – State of the Art

The aim of this phase is to grant a knowledge base about present braking system and Standards applied in the railway applications. Train braking functionalities are defined and explained, their presently mainly used architectures are presented and analyzed. Limitation coming from the use of pneumatic and/or electro-pneumatic solutions are identified and consequently possible evolution are proposed.

### Phase 2 – Requirements definition

The aim for this phase is to define the set of requirements to be applied to a high safety electronic brakes control. Work is focused, after a wide analysis on all brakes functionalities, on the highest safety level of the Emergency Brake. Electronic Control requirements are defined with a V step down process that define system requirements and a system pneumatic and physical brakes design. A new approach in the integration for different braking functionalities and its consequences in the local axle and bogie peripherals is used as result for the cooperation with CONNECTA project.

### Phase 3 – Concept architectural design

The aim of this phase is to define at train level the architecture to be applied to the Electronic Control. Architecture is based on the new TCMS platform developed inside S4R featuring a fully distributed high safety system with a centralized electronic control, peripheral brakes control, system diagnostic capabilities and interfaces to other train systems.

### Project Coordinator:

Arjan Geven

TTTech Computertechnik AG

Schönbrunner Straße 7

1040 Vienna

Austria

Tel.: +43 158 5343 4942

Email: [arjan.geven@tttech.com](mailto:arjan.geven@tttech.com)

Project start: 1<sup>st</sup> of October, 2016

Project duration: 2 years

### Contact person in/for WP4:

Ugo Prosdociami

Eletech Srl – Innovation In Electronics

Via Garcia Lorca, 29

23871 Lomagna (LC)

Italy

Tel. +39 039993401

e-mail: [ugo.prosdociami@eletechsrl.it](mailto:ugo.prosdociami@eletechsrl.it)



This project has received funding from the Shift2Rail Joint Undertaking under grant agreement No. 730830. This Joint Undertaking receives support from the European Union's Horizon 2020 research and innovation programme and Austria, Spain, Germany, Czech Republic, Italy, France. The content of this document reflects only the author's view—the Joint Undertaking is not responsible for any use that may be made of the information it contains.