A facility for testing ERTMS/ETCS conformity and human factors

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Overview

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- **Human factors' influence on the operational safety**
  - Aim and Objectives
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  - Error models and simulation of erroneous system behaviour
  - Test scenarios
  - Formalization of tests
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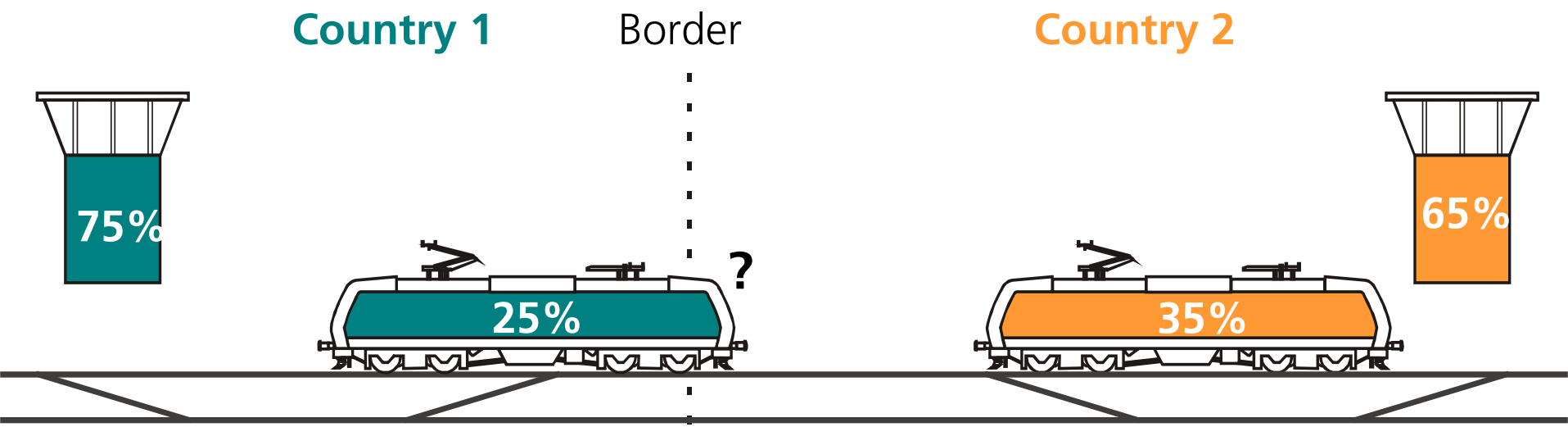
- **Perspective**

Introduction: Safety implication of operational rules

Example for the safety allocation problem



- **Identification and comparison of rules and regulations for safe normal and fallback operation needed.**
- **Comparison of rules for the allocation and distribution of safety responsibility to trackside and on board.**

Objectives and Aims

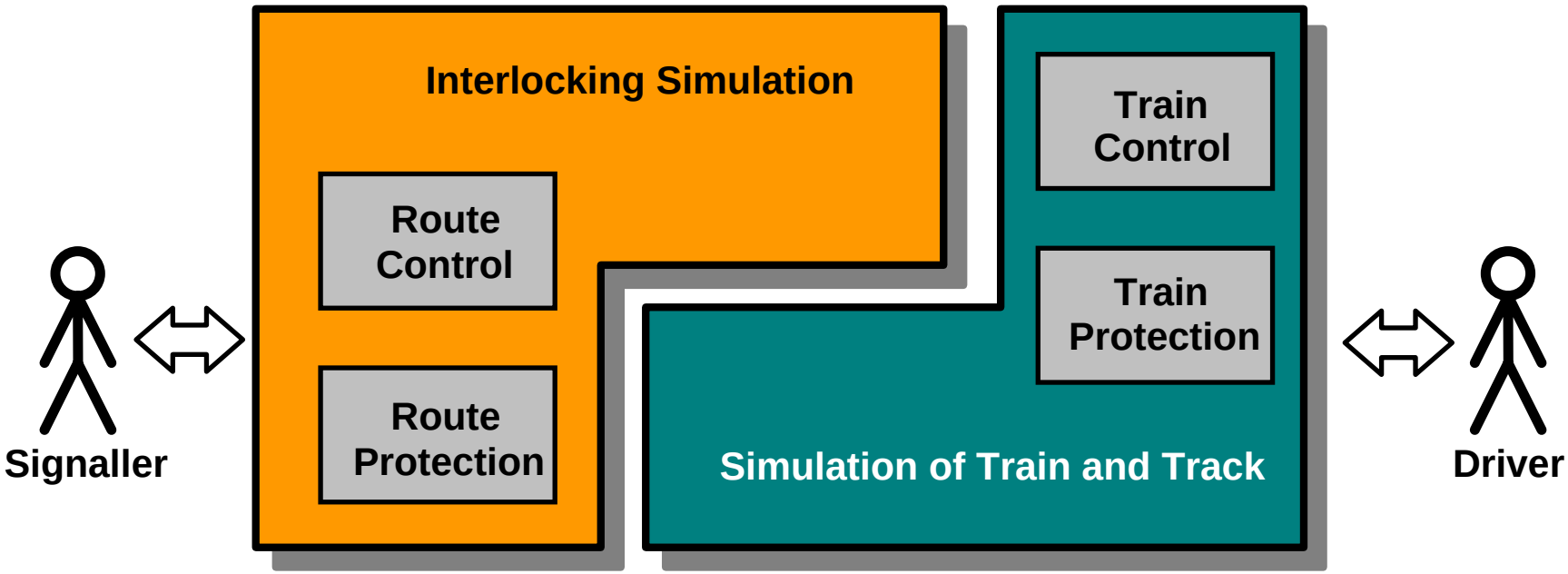
Most accidents in Railways happen due to the interaction of the man machine system and more in fallback than in normal operation.

Perform research to improve safety of Railways, e.g.:

- The design of work places and driver desks,
- The design of signs and optical and acoustical signals,
- The optimisation of operational rules, e. g. to minimise ambiguous rules and misunderstandings (in real use!),
- The validation of usability, ergonomics and human factors of automation approaches,
- Experiments to safety-critical errors of the operators.

And to construct and operate the needed large-scale research infrastructure.

Human factors' influence on the operational safety: Simulation approach

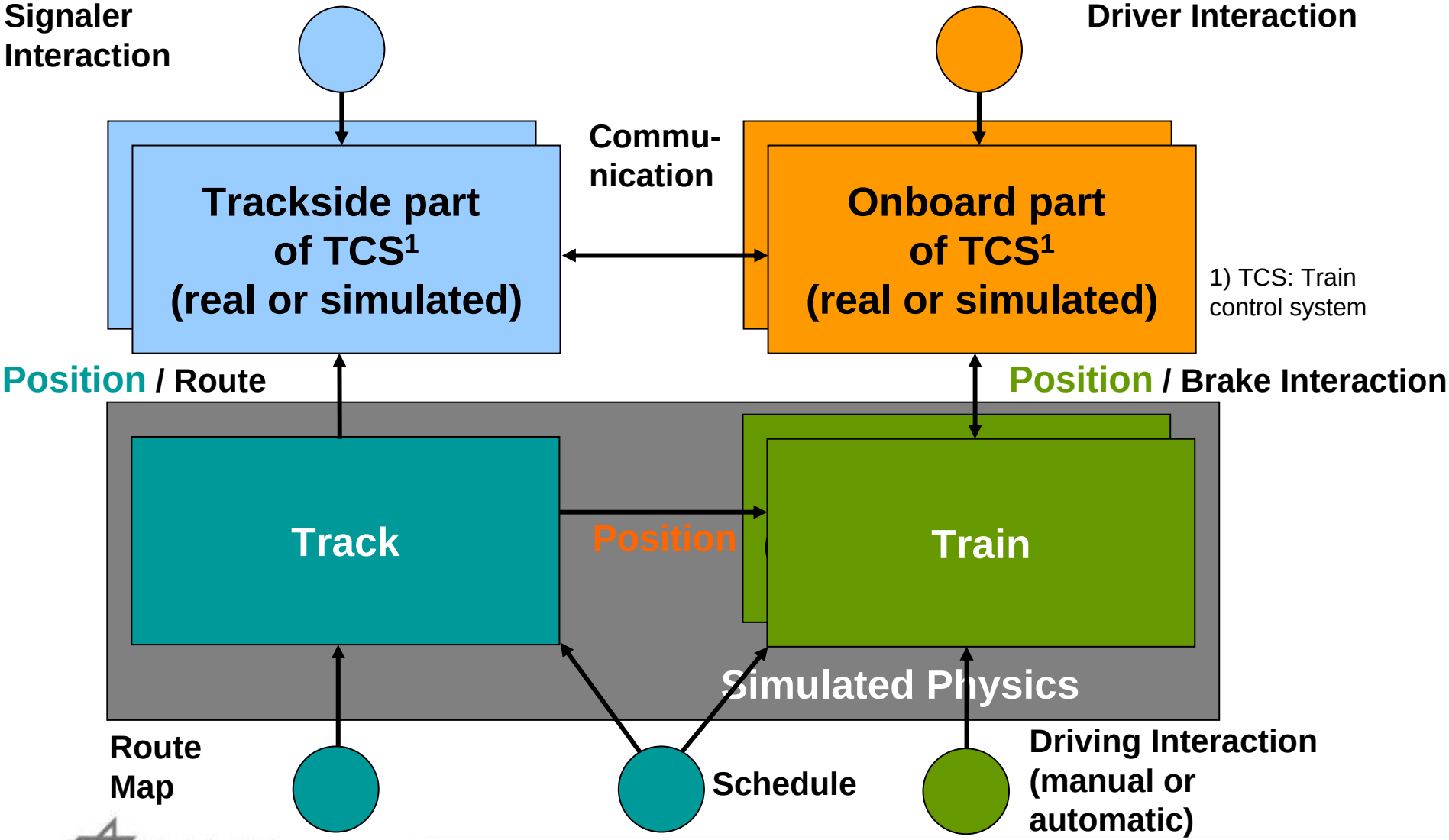


Sensors, measured data and methods

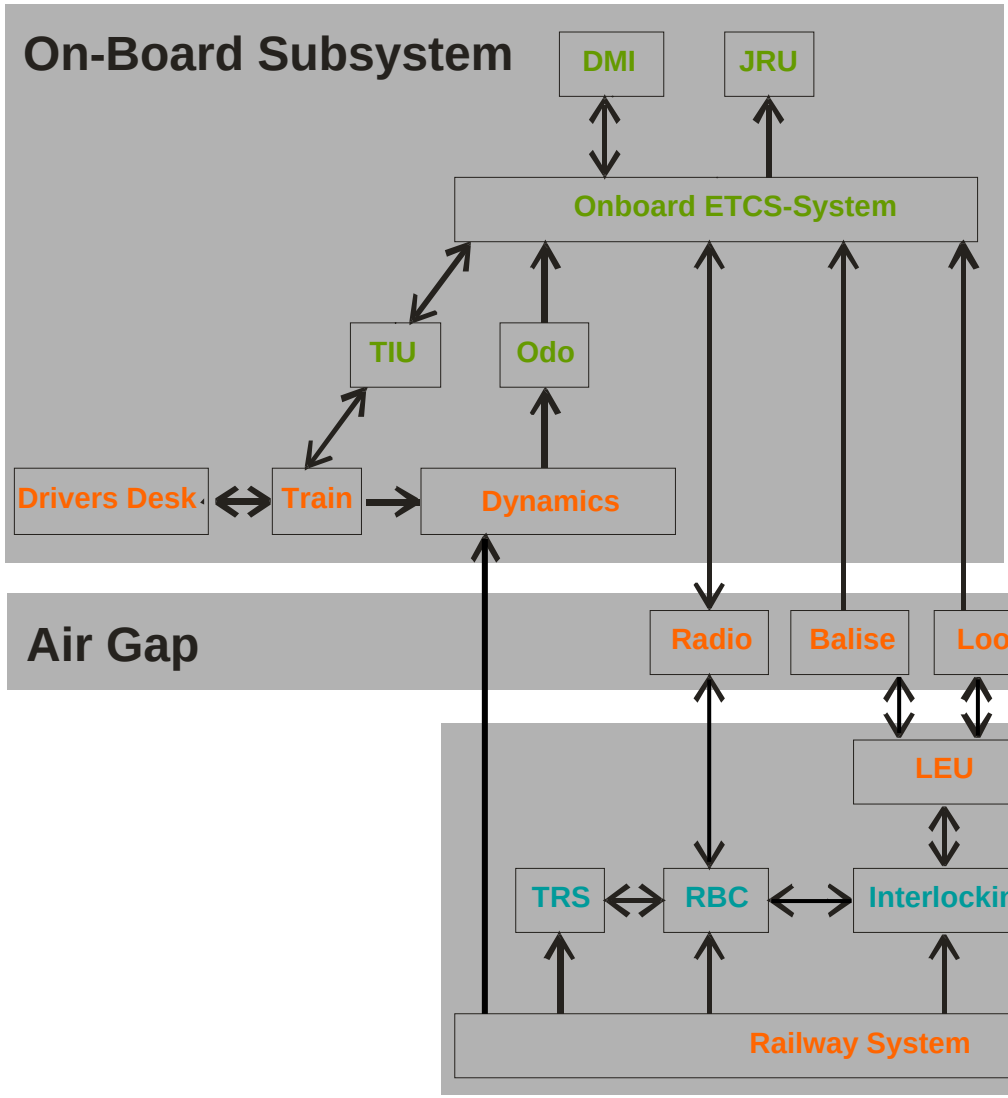
Loggers, Sensors and measuring devices installed according to the requirements of the particular investigation

- Acquisition of information:
  - Inputs that the operator has recognised: *“classical” logging, eye-tracking, …*
  - Actions done by operator: *“classical” logging, video, …*
- Acquisition of the status of the operator:
  - Physical: *activity of muscles and heart, resistance of the skin, electrical activity of the brain, eye movement, …*
  - (Psychological: *rating of the situation, questionnaires, …)*

RailSiTe®: Principle



RailSiTe®: Architecture



DMI: Driver Machine Interface
JRU: Juridical Recorder Unit
TIU: Train Interface Unit
Odo: Odometry
LEU: Lineside Electonic Unit
TRS: Train Regulation System
RBC: Radio Block Center

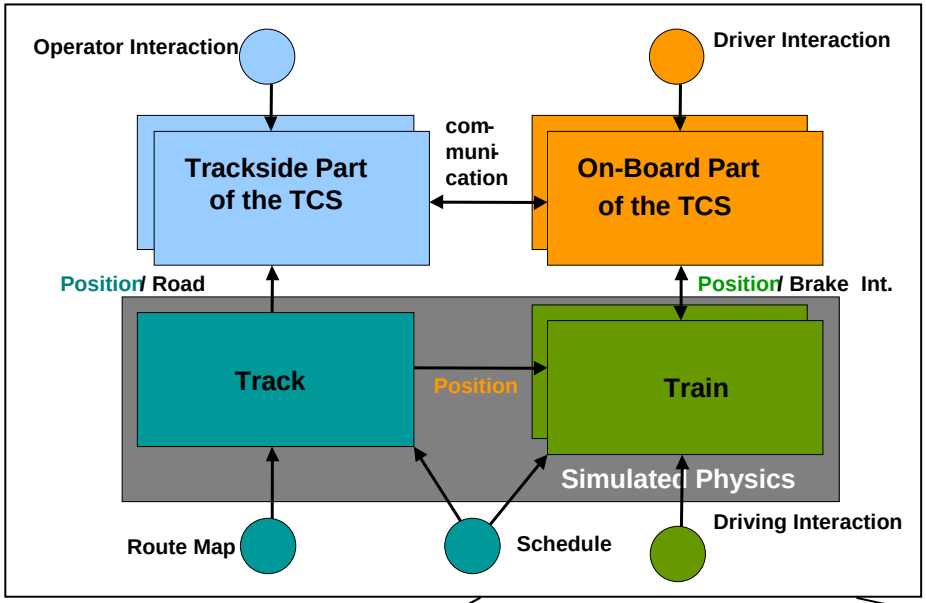
RailSiTe®: Current State

- Hard- and Software for Onboard and Trackside Equipment including the Environment Visualization
- Physical Odometry Simulator
- Interlocking Simulation
- Test Sequences (subset 76) can be performed

Certified as:

- UNISIG Reference Lab
- Inspection Body of the German Notified Body

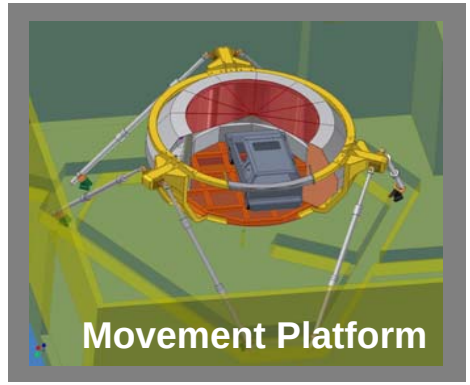
RailSiTe® – Extended Functionality



Real Handling
Simulated Environment

Simulated Environment
Simulated Operating Unit

Real Handling
Simulated Environment
Simulated Dynamics



Conclusion and Perspective

Most accidents in Railways happen due to the interaction of the man-machine-system and more in fallback than in normal operation.

To improve operational safety, we must look on the interaction of the operators with the system as well as the operational rules.

The RailSiTe® is a large scale research infrastructure which allows the consistent simulation of the train control system and their interaction with the trackside and on board operators.

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Thank you for your attention!