

Open ETCS WP2 Workshop

Paris
November 22nd / 23rd



Agenda

Goals of the meeting

What are we talking about ? Reminders about ETCS

Results from TU BS « state of the art » study

Results from AeBT study

3 workshops:

- 1st workshop : Model and tools requirements

Proposed animators: Systemel (team 1) / Alstom (Team 2)

- 2nd workshop : Architecture / API (requirements)

Proposed animators: Alstom (team 1) / SNCF (team 2)

- 3rd workshop : Process / Methodology and V and V strategy

Proposed animators: DLR (team 1) / AeBT (team 2)



Thursday 22nd of Nov.:

14:00 : Introduction / Agenda (SNCF)

14:15 - 14:40: What are we talking about ? ETCS (SNCF)

14:40 - 15:15: Results presentation from the state of the art regarding Methods (TU BS)

15:15 - 15:45: Formal method at SNCF presentation (SNCF)

15:45 - 16:00: Break

16:45 - 17:15: WP3a presentation (expectation son WP2) (FormalMind)

17:15 - 17:45: Siemens presentation

16:30 - 17:30: 1st workshop session (two teams) => shifted to Friday

17:30 - 18:00: Put together / share results

Friday 23rd:

09:00 - 09:30: Results presentation from the state of the art regarding 50128 (AeBT)

09:30 - 09:45: workshop team composition and goals

09:45 - 11:15: 3 workshops

11:15 - 12:15: Put together / share results

12:15 - 13:30: Lunch

13:30 - 14:00: ERTMS Solution presentation

14:00 - 15:00: Define next steps

3 workshops:

- 1st workshop : Model and tools requirements
- 2nd workshop : Architecture / API (requirements)
- 3rd workshop : Process / Methodology and V and V strategy

10-15 - 11:30: 3 workshops

11:30 - 12:30: Put together / share results

12:30 - 13:30: Lunch

1st workshop : Model and tools requirements

□ Who ?

L. Mussat, V. Prevosto, F. Mejia, M. Glückmann, S. dal Zilio, S. Callet

□ Proposed animator / reporter: SNCF

□ Questions / thematics :

- Identify the toolchain needs vs different steps of design
- Identify choice criteria and importance
- Other

2nd workshop : Architecture / API (requirements)

□ Who ?

U. Steinke, D. Mentré, M. Pokam, M. Hasc, F. Cochetti, M. Rousseau

□ Proposed animator / reporter: Alstom

□ Questions / thematics :

- Identify the scope / architecture
- Which requirements on modularity (functional, software architecture includ. API)
- Other

3rd workshop : Process / Methodology and V and V strategy

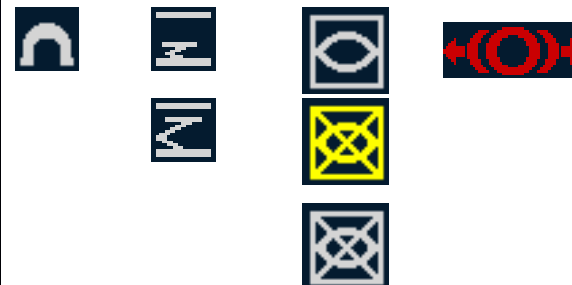
- Who ? M. Behrens / S. Jagush / J. Welte, R. Kaseroni, R. de Landtsheer, S. de la Maza
- Proposed animator / reporter: DLR
- Questions / thematics :
 - Identify the different steps of the project
 - Which process at which step
 - Link to « post Open ETCS » activities (application projects)
 - What about the demonstrator

What are we talking about ?

ETCS

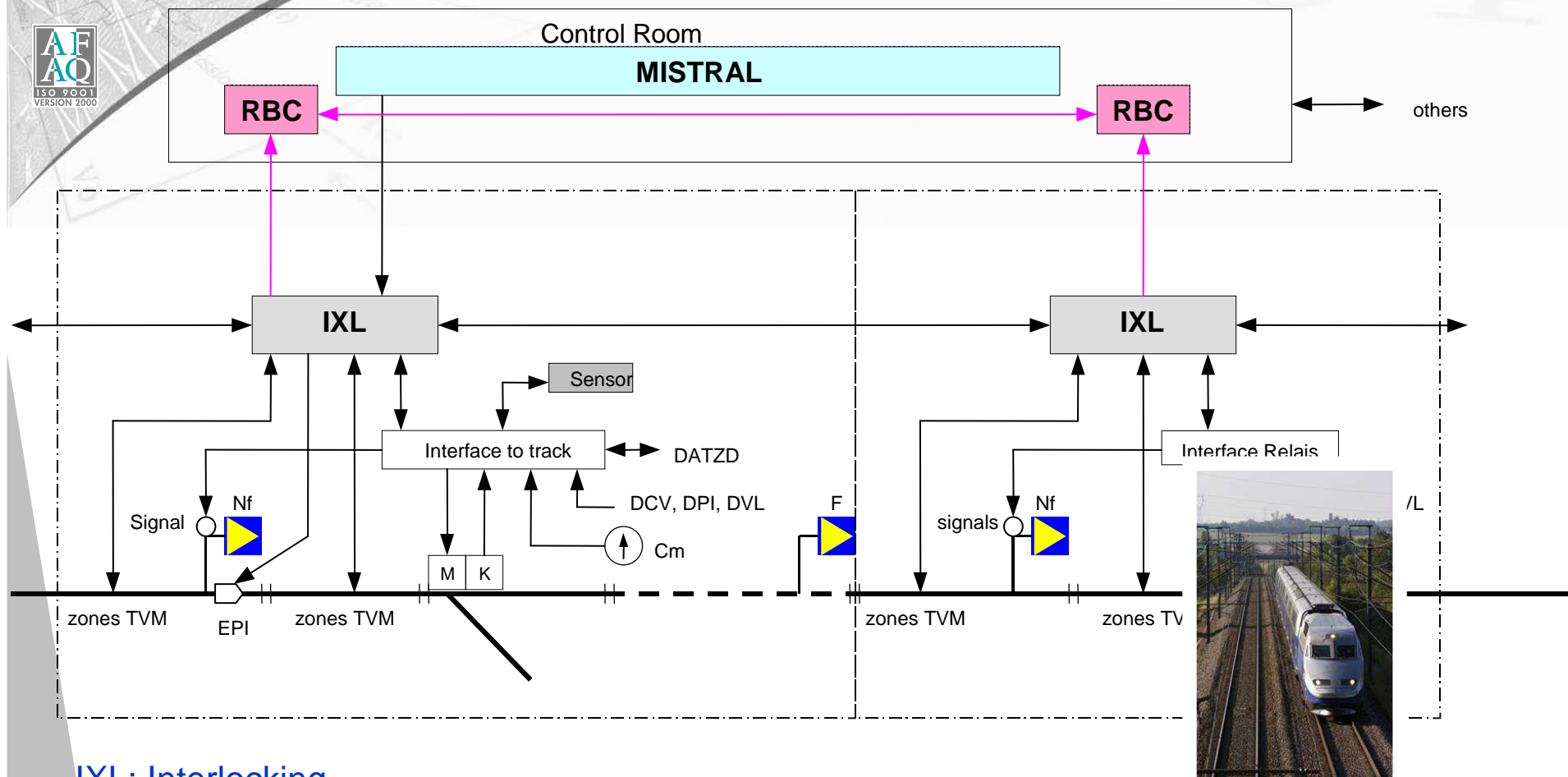
ERTMS fundamentals

- Cab signalling
- Speed control
- Orders to driver

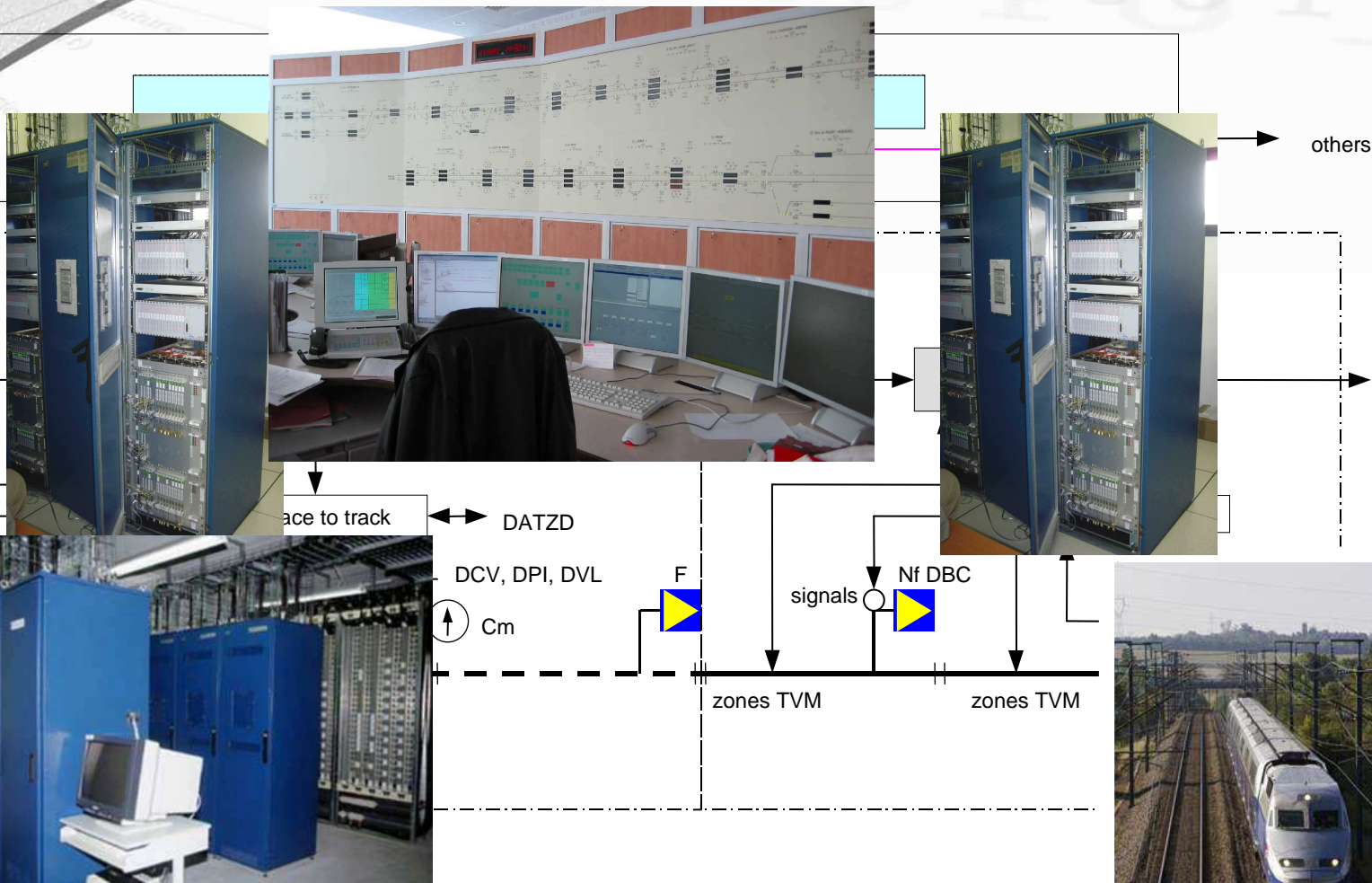


Operation Control Center

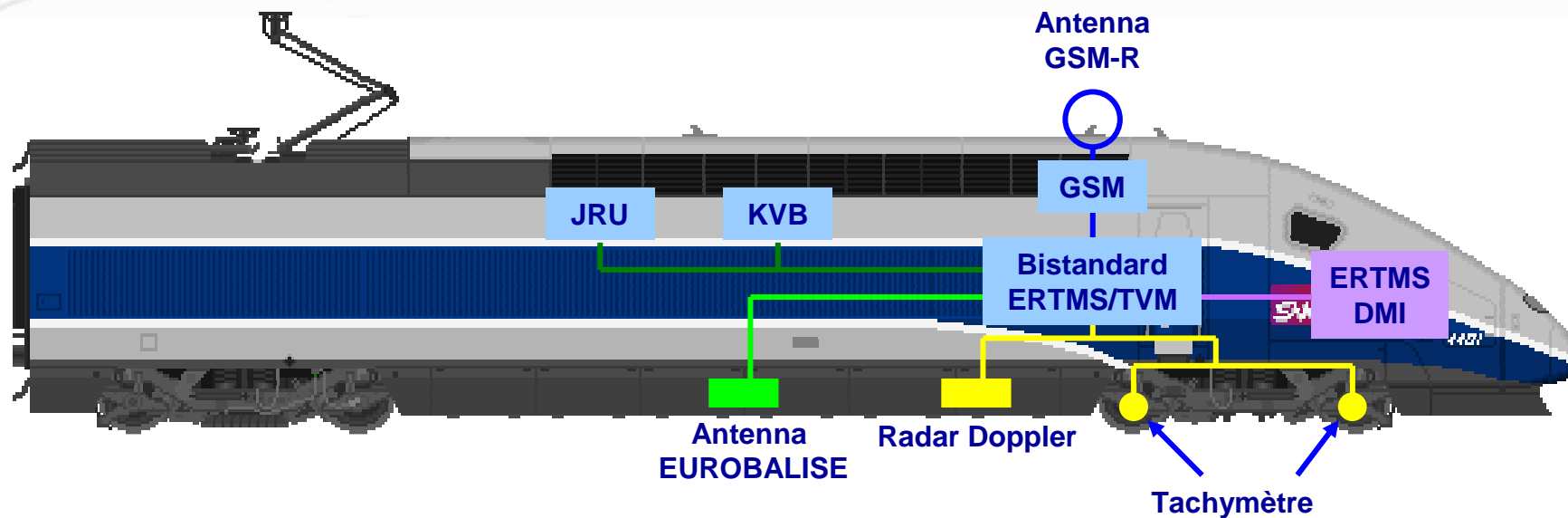




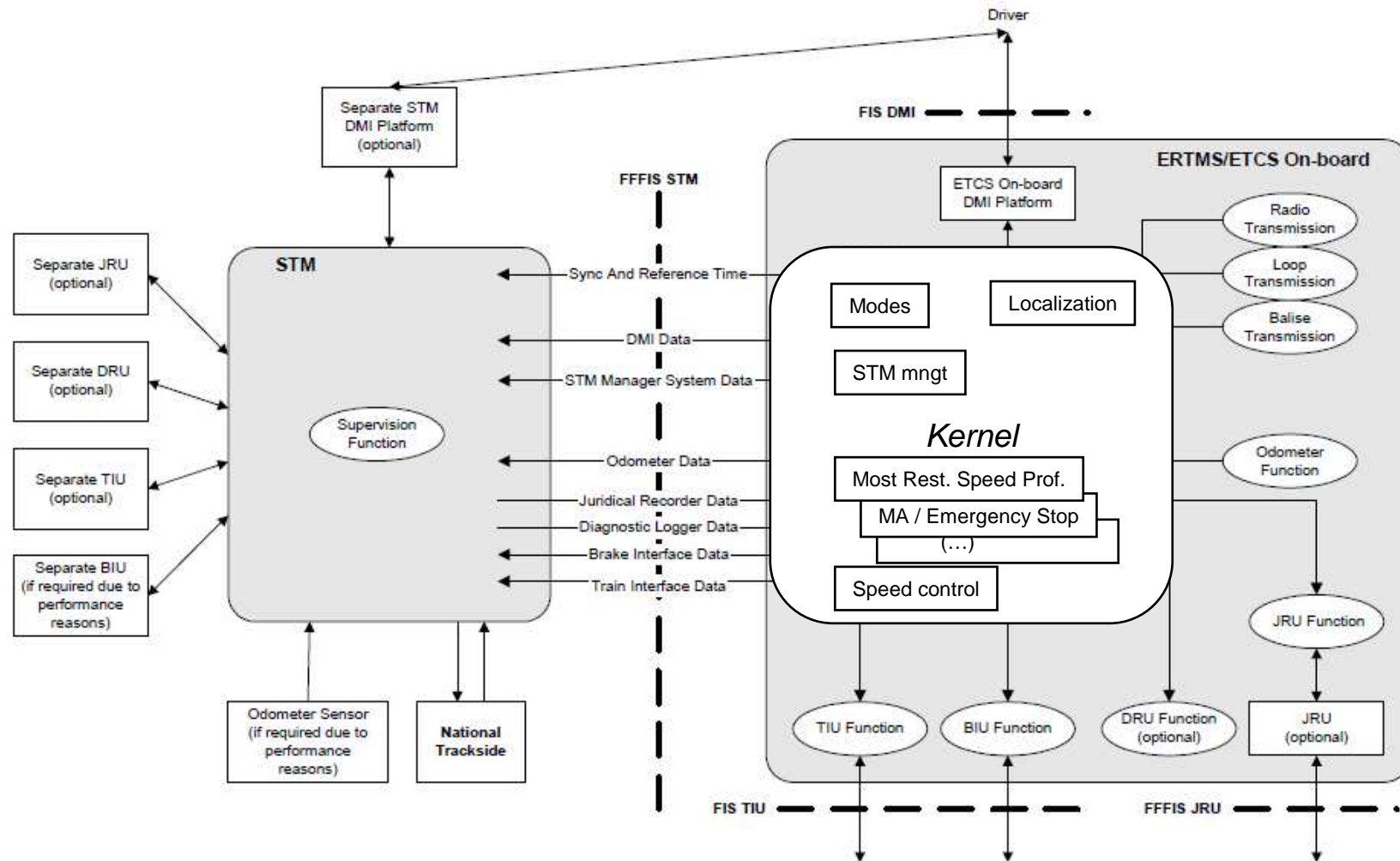
IXL: Interlocking
RBC: Radio Block Center



ON-BOARD ERTMS(-TVM) ARCHITECTURE



ERTMS fundamentals



The diagram illustrates the control stack architecture, which is organized into three main layers within a rounded rectangular container:

- Top Layer:** Contains two boxes: "Modes" (highlighted in blue) and "Localization". A blue arrow originates from the "Modes" box and points towards the right, extending beyond the container boundary.
- Middle Layer:** Contains a single box labeled "STM mngt".
- Kernel Layer:** Indicated by the italicized text *Kernel* centered below the "STM mngt" box. It contains a stack of three boxes:
 - Top box: "Most Rest. Speed Prof."
 - Middle box: "MA / Emergency Stop"
 - Bottom box: "(...)"
- Bottom Layer:** Contains a single box labeled "Speed control".

Arrows indicate the flow of control or data: a blue arrow from "Modes" points right, and a black arrow from "Localization" points down to the "Speed control" box, passing through the "Kernel" layer.

[illegible]



ERTMS Main Functionalities

ONBOARD-FUNCTIONS	N P	S B	S H	F S	S R	O S	S L	N L	U N	T R	P T	S F	I S	S E	S N	R V
Data Consistency																
Check linking consistency				X		X										
Balise Group Message Consistency		X	X	X	X	X		X	X	X	X			X	X	X
Check correctness of radio messages		X	X	X	X	X	X	X	X	X	X			X	X	X
Check radio link (only level 2/3)				X		X										
Determine Train Speed and Location:																
Determine train speed, train acceleration, train standstill		X	X	X	X	X	X	X	X	X	X		O	X	X	X
Determine Geographical Position		X		X	X	X		X	X	X	X					X
Report train position		X	X	X	X	X	X	X	X	X	X	X	O	X	X	X
Manage MA																
Request MA Cyclically (level 2/3)				X		X										
Determine EOA/LOA, SvL, Danger Point, etc...				X		X								X		
Handle Co-operative MA revocation				X		X										
Manage Emergency Stop				X	X	X					X					



ERTMS Main Functionalities

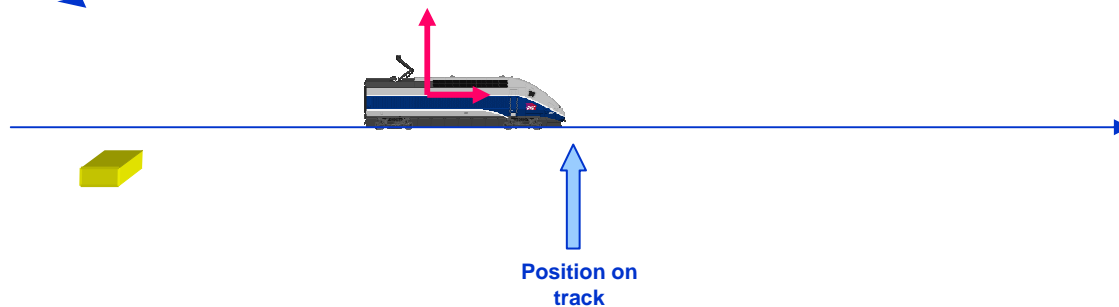
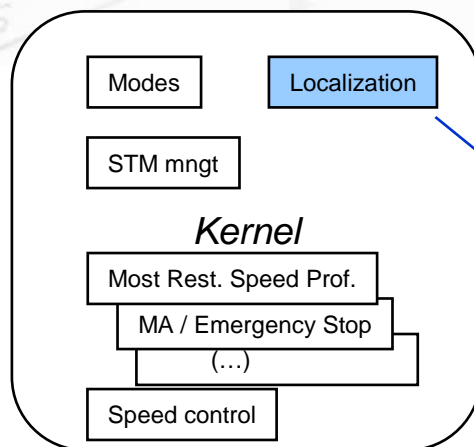
ONBOARD-FUNCTIONS	N P	S B	S H	F S	S R	O S	N L	U N	T R	P T	S F	I S	S E	S N	R V
Determine Most Restrictive Speed Profile, based on :															
SSP				X		X									
ASP				X		X									
TSR				X	X	X		X							
Signalling related SR				X		X									
Mode related SR			X		X	X		X							
Train related SR			X	X	X	X		X							X
Ceiling speed for revers. superv.															X
Supervise Train Speed															
Dynamic Speed Monitoring based on MRSP, MA, release speed, gradient, mode profile, and route unsuitability location				X		X									
Dynamic Speed Monitoring based on STM Profile Data (MRSP, MA and gradient)													X		
Dynamic Speed Monitoring based on MRSP								X							
Dynamic Speed Monitoring based on MRSP, allowed distance to run in Staff Resp. mode					X										
Ceiling Speed Supervision (no DSM) based on MRSP			X												X
Supervision of permitted speed limit when "Override EoA"			X		X			X					X	X	



ERTMS Main Functionalities

ONBOARD-FUNCTIONS	N P	S B	S H	F S	S R	O S	S L	N L	U N	T R	P T	S F	I S	S E	S N	R V
Supervise Train Movements																
Backwards Distance Monitoring											X					X
Roll Away Protection			X	X	X	X			X		X			X		X
Reverse Movement Protection				X	X	X					X			X		X
Standstill Supervision		X														
Supervise "danger for shunting" information and list of expected balises for shunting			X													
Supervise "Stop if in SR"					X											
Command Emergency Brake	X									X		X				
Determine Mode and Level																
Determine ERTMS/ETCS Mode	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Determine ERTMS/ETCS level		X	X	X	X	X	X	X	X	X	X		X	X	X	X
Other functions																
Manage Communication Session		X	X	X	X	X	X	X	X	X	X			X	X	X
Delete Revoked TSR		X		X	X	X			X		X					
Override (Trip inhibition)			X		X				X					X	X	
Manage Track Condition		X	X	X	X	X	X	X	X	X	X	O		X	X	X
Manage Route Suitability				X		X										
Manage Text Display to the driver		X		X	X	X		X	X		X					
Manage RBC/RBC Handover				X	X	X	X	X		X						
Manage Track Ahead Free Req		X			X	X					X					
Allow access to MMI, train itf, JRU and odometer for STM														X	X	
Provide Fixed Values, and Default/National Values		X	X	X	X	X	X	X	X	X	X			X	X	X
Capture Train Data		X		X	X	X			X					X	X	
Capture Additional Data		X		X	X	X		X	X					X	X	
Provide Date and Time		X	X	X	X	X	X	X	X	X	X			X	X	X
Record Juridical Data		X	X	X	X	X	X	X	X	X	X	X		X	X	X

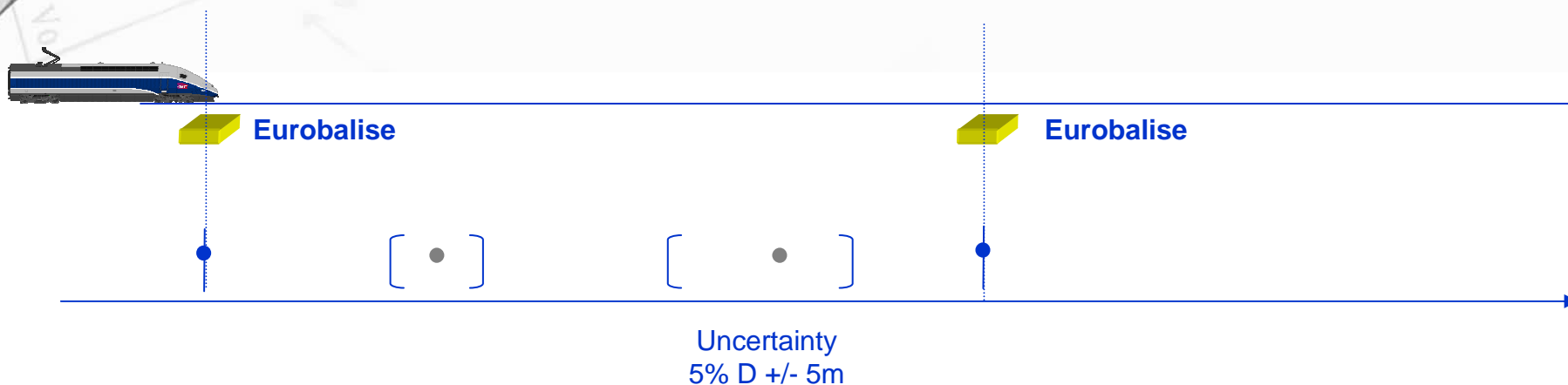
ERTMS fundamentals





□ Train position

ERTMS fundamentals



Odometers examples

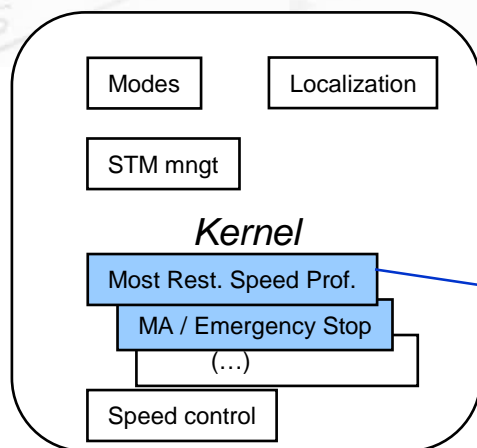


odometer

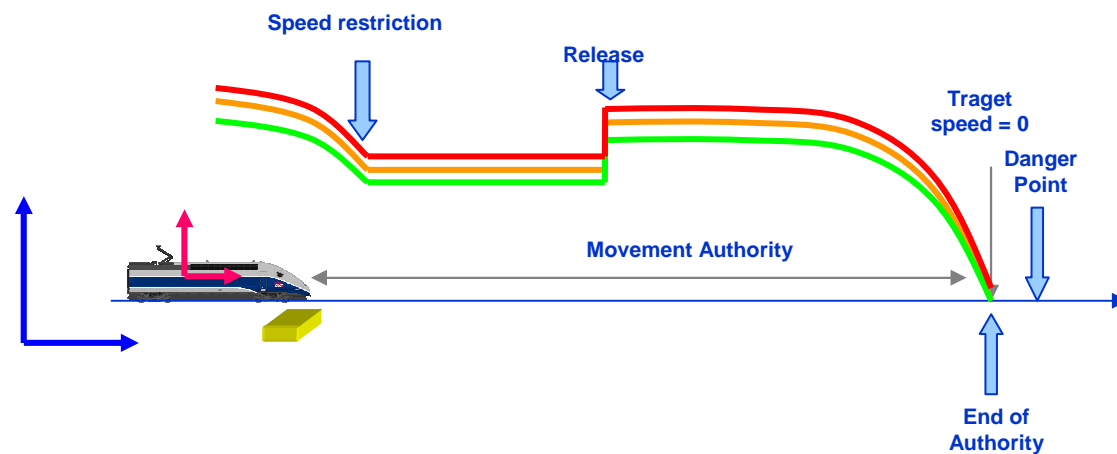


radar doppler

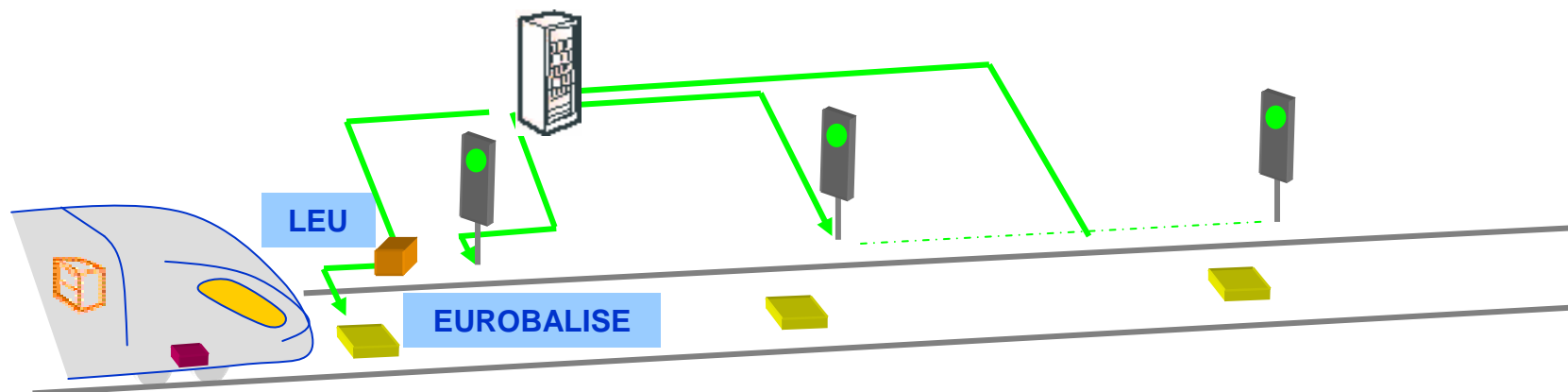
ERTMS fundamentals



□ Movement Authority

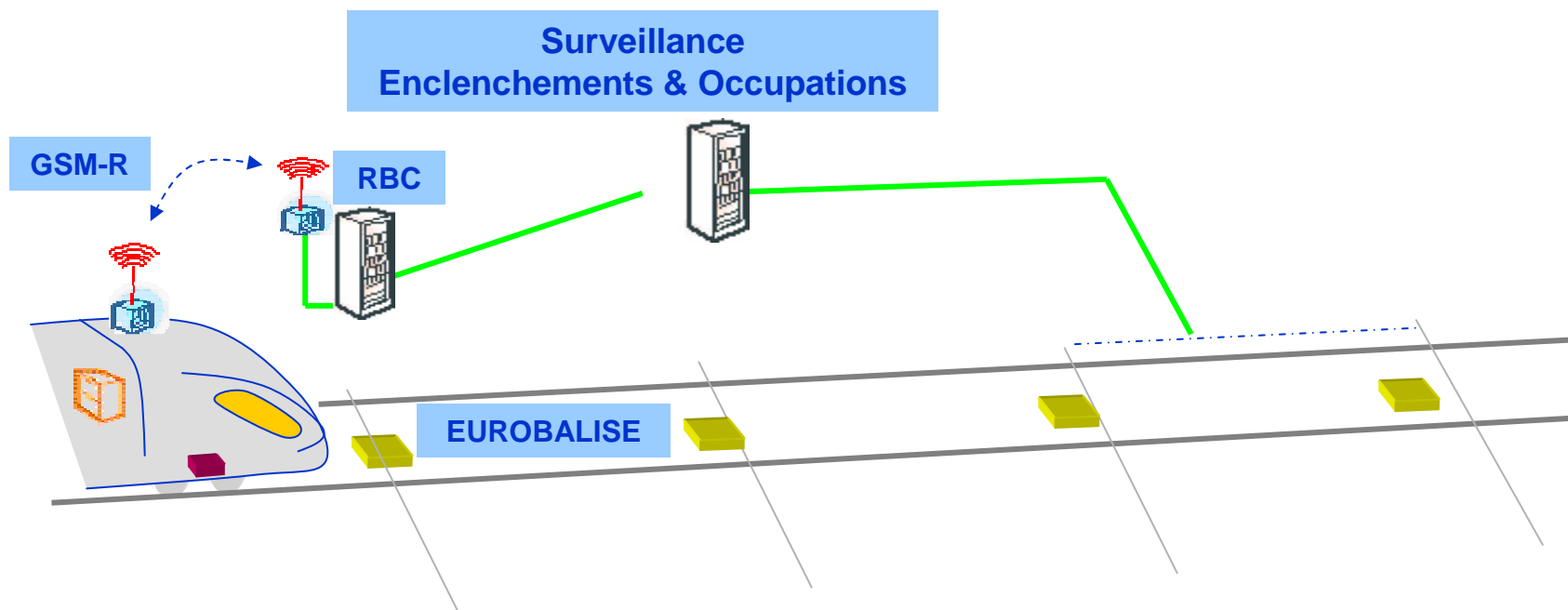


IXL / Track occupancy



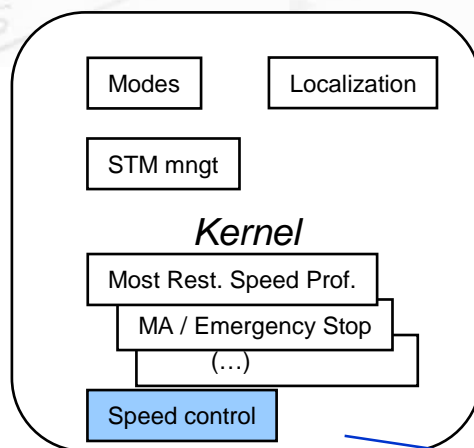
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ERTMS fundamentals – Level 2

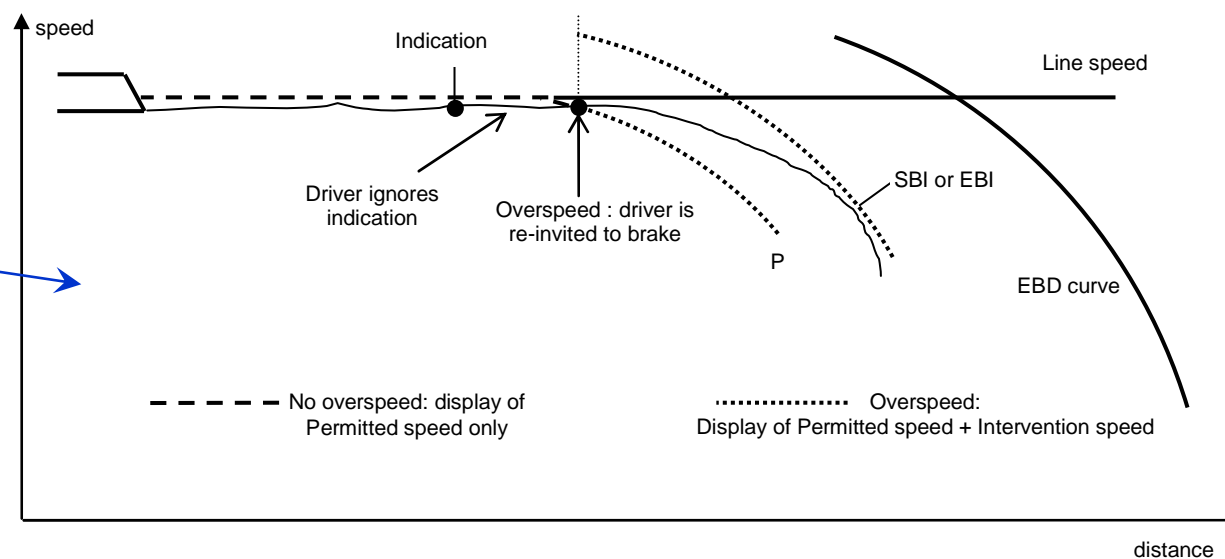


The diagram illustrates the concept of Movement Authority (MA) in a train control system. It shows a train moving along a track divided into blocks: block 1, block n, and block n+1. The train is currently in block 1. A green line represents the Movement Authority, which is the distance the train is authorized to travel. This authority is determined by the position of the next train in the block ahead (block n+1) and the position of the train itself. The diagram also shows a signal system with a red signal and a green signal, indicating the status of the track ahead. A green line connects the signal system to the train, representing the communication link. The green line also connects the train to the next block ahead, indicating the movement authority. The diagram shows that the movement authority is limited by the position of the next train in the block ahead. The green line represents the distance the train is authorized to travel, which is determined by the position of the next train in the block ahead and the position of the train itself. The diagram also shows a signal system with a red signal and a green signal, indicating the status of the track ahead. A green line connects the signal system to the train, representing the communication link. The green line also connects the train to the next block ahead, indicating the movement authority. The diagram shows that the movement authority is limited by the position of the next train in the block ahead. The green line represents the distance the train is authorized to travel, which is determined by the position of the next train in the block ahead and the position of the train itself. The diagram also shows a signal system with a red signal and a green signal, indicating the status of the track ahead. A green line connects the signal system to the train, representing the communication link. The green line also connects the train to the next block ahead, indicating the movement authority. The diagram shows that the movement authority is limited by the position of the next train in the block ahead.

ERTMS fundamentals

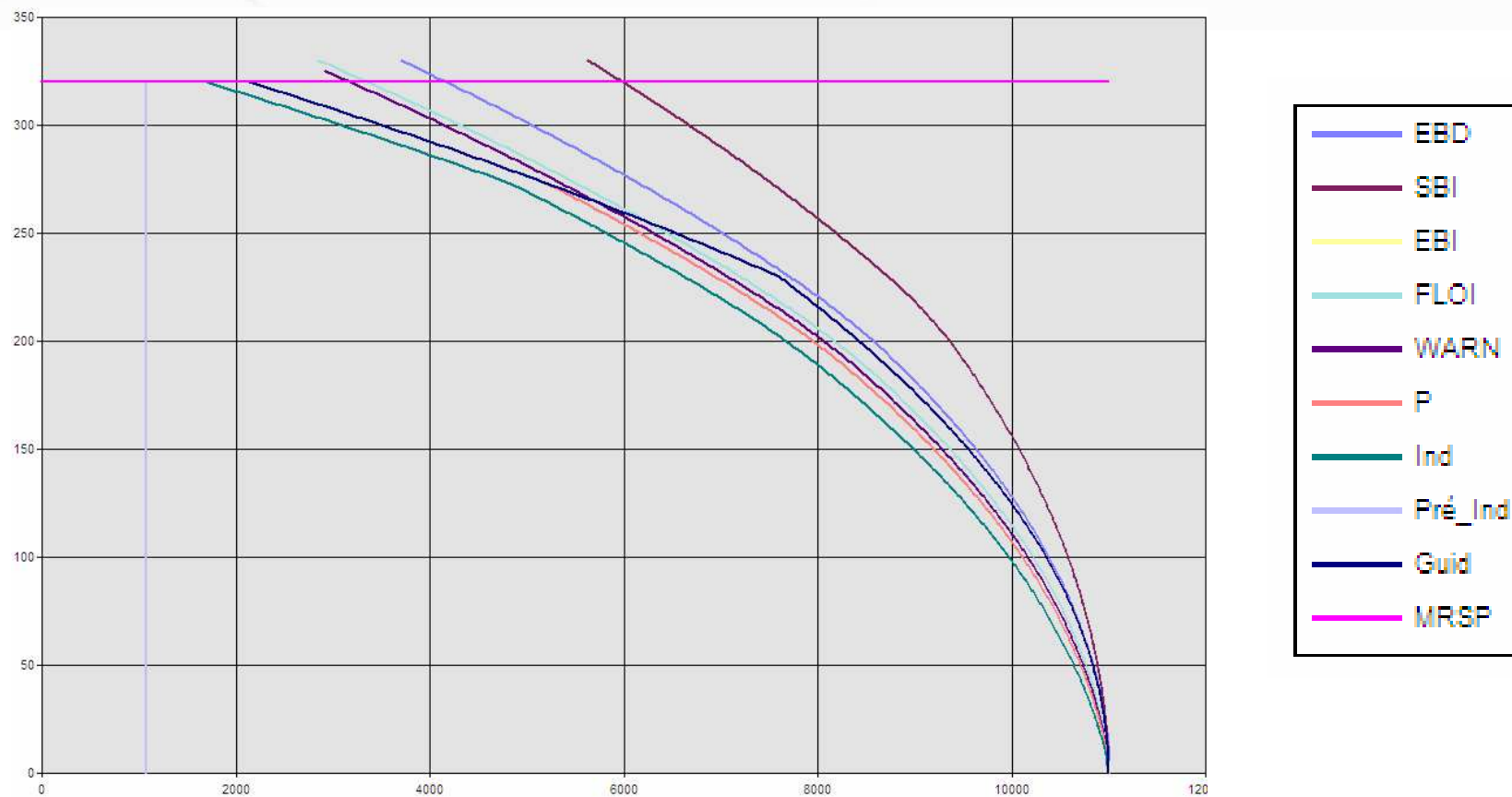


□ Different curves



ERTMS fundamentals

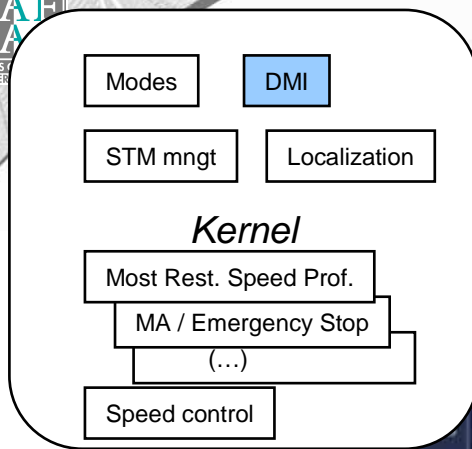
□ Different curves





ERTMS fundamentals

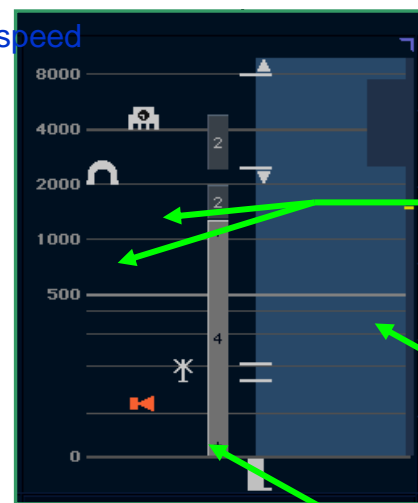
TRACK CHARACTERISTICS



Target distance



Max speed



Particular points

Speed profile

Slopes / ropes

Actual speed

Target speed

ERTMS Main Functionalities

Modes

Localization

STM mngt

Kernel

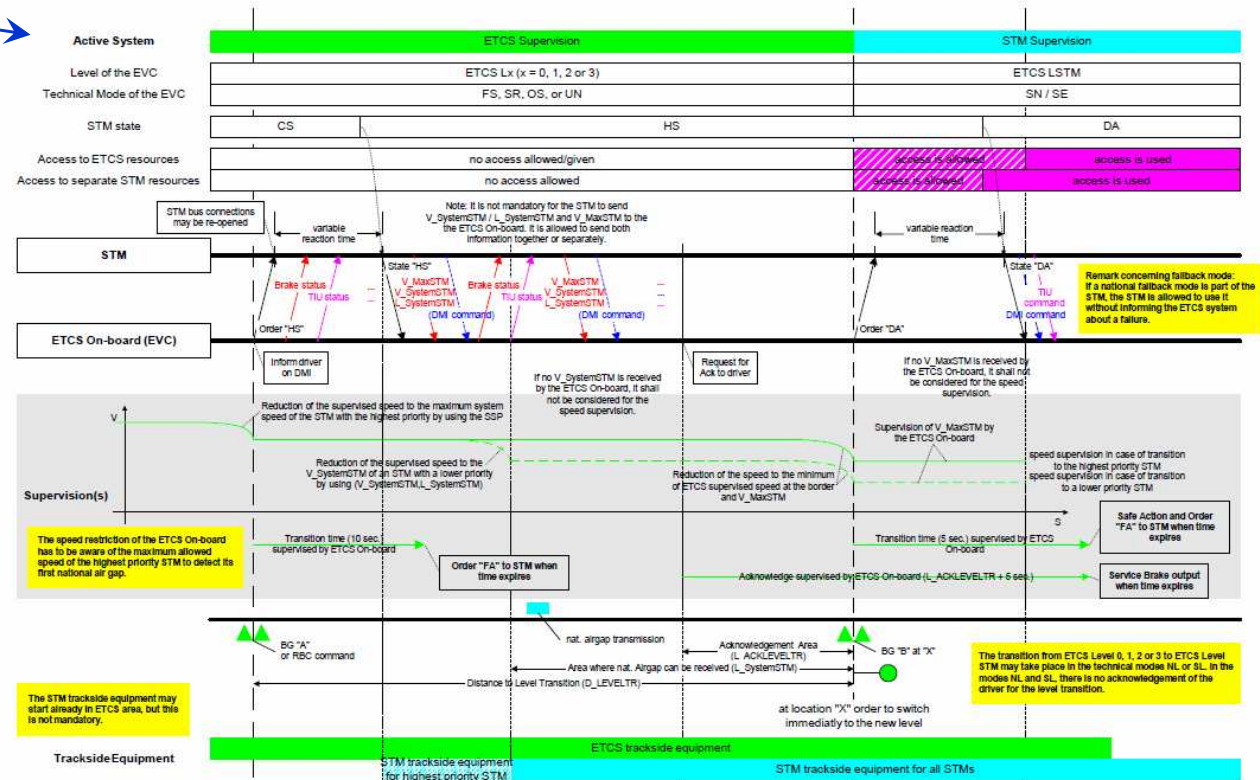
Most Rest. Speed Prof.

MA / Emergency Stop

(...)

Speed control

ETCS -> STM



Overall system

