



## Train Conformity Check System

A measuring and monitoring solution for train's maintenance and safety

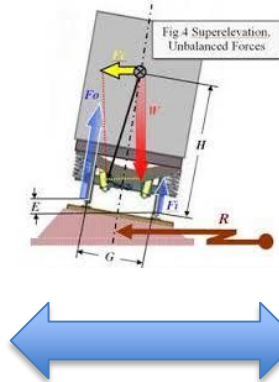
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Naples, 22<sup>nd</sup> of November 2016, Intelligent Rail Summit

# Railway Systems Main Components



Infrastructure



Interaction



Rolling Stocks



Increase operations safety in response to systems evolution and European standards / requirements.

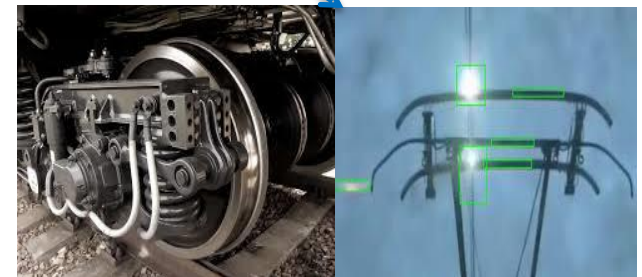


Increase monitoring capability to support preventive/predictive maintenance (cost reduction).

# Railway Monitoring Systems



		ASSET	
		Infrastructure	Rolling stocks
TECNOLOGY	Infrastructure	Wayside system monitoring railway infrastructure condition	Wayside system monitoring Rolling Stocks condition
	Rolling Stocks	On-Train system monitoring railway infrastructure condition	On-Train System monitoring Rolling Stocks condition



# The Train Conformity Check System (TCCS)

TCCS is a highly technological innovative system aimed to detect rolling stock faults and/or dangerous situations for safety and/or maintenance purposes with wayside analysis and no impact to rolling stocks.



TCCS can be installed on lines up to 330 km/h, operating day & night and under critical weather conditions.



# AUTOMATIC ROLLING STOCK IDENTIFICATION AND TRAIN CLASSIFICATION

Rolling Stock classification can be performed using:

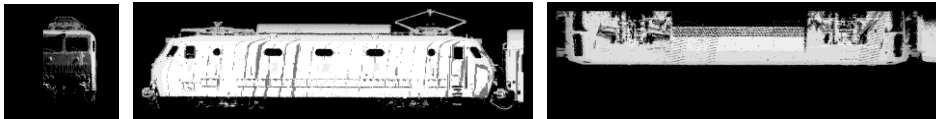
- Axle pattern based recognition
- RFID identification
- Information coming from Traffic Management Systems
- Plate recognition through Image based analysis



Wagon	ID	Description	Len. (m)	Height (m)	Axles count	Gauge	Visuals
1	OLN00017900000000000000970	Loco_EMD_SD70ACS-92165	22.63 m.	4.95 m.	6		<a href="#">Details</a>
2	OLN00017900000000000000081a	Loco_EMD_SD70ACS-92165	22.63 m.	4.95 m.	6		<a href="#">Details</a>
3	OLN000089000000000000000067	CRS_Sulphur_Wagon	15.14 m.	4.54 m.	4		<a href="#">Details</a>
4	OLN000089000000000000000009	CRS_Sulphur_Wagon	15.14 m.	4.54 m.	4		<a href="#">Details</a>
5	OLN0000890000000000000000146	CRS_Sulphur_Wagon	15.14 m.	4.54 m.	4		<a href="#">Details</a>
6	OLN0000890000000000000000132	CRS_Sulphur_Wagon	15.14 m.	4.54 m.	4		<a href="#">Details</a>
7	OLN2010240000000000000001204	CRS_Sulphur_Wagon	15.14 m.	4.54 m.	4		<a href="#">Details</a>
8	OLN000179000000000000000024ee	CRS_Sulphur_Wagon	15.14 m.	4.54 m.	4		<a href="#">Details</a>
9	OLN00008900000000000000000d8	CRS_Sulphur_Wagon	15.14 m.	4.54 m.	4		<a href="#">Details</a>
10	OLN00008900000000000000000a6	CRS_Sulphur_Wagon	15.14 m.	4.54 m.	4		<a href="#">Details</a>
11	OLN00008900000000000000000b6	CRS_Sulphur_Wagon	15.14 m.	4.54 m.	4		<a href="#">Details</a>
12	OLN0000890000000000000000013a	CRS_Sulphur_Wagon	15.14 m.	4.54 m.	4		<a href="#">Details</a>
13	OLN000089000000000000000000e1	CRS_Sulphur_Wagon	15.14 m.	4.54 m.	4		<a href="#">Details</a>
14	OLN00008900000000000000000003	CRS_Sulphur_Wagon	15.14 m.	4.54 m.	4		<a href="#">Details</a>
15	OLN20102400000000000000001209	CRS_Sulphur_Wagon	15.14 m.	4.54 m.	4		<a href="#">Details</a>

# GAUGE ANALYSIS

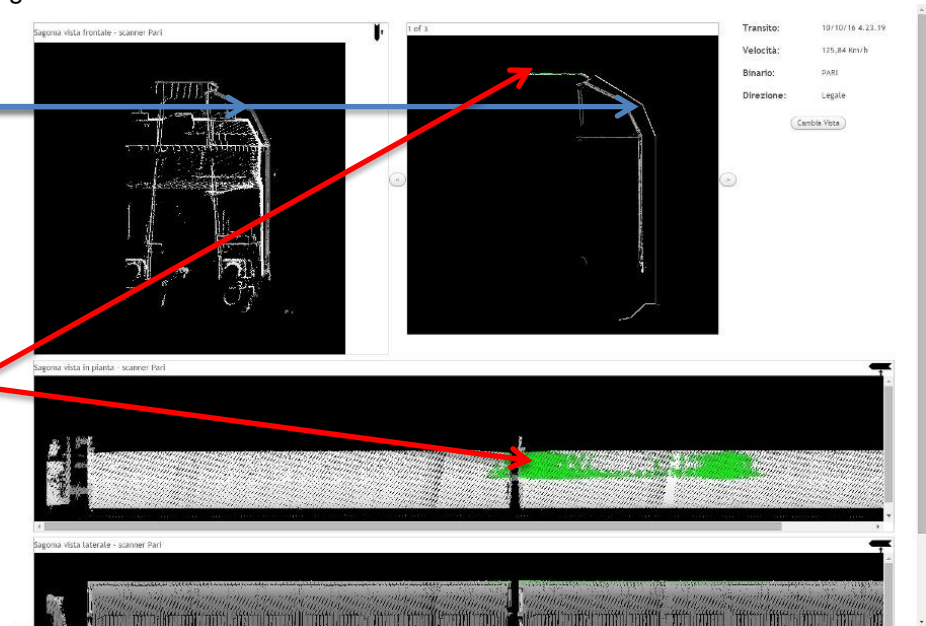
As a train approaches and passes through the measurement area, TCCS is able to scan each railcar, produce 3D images and evaluate potential non conformity



Example of 3D images produced during passage through TCCS gate

Reference gauge

Out of gauge alert



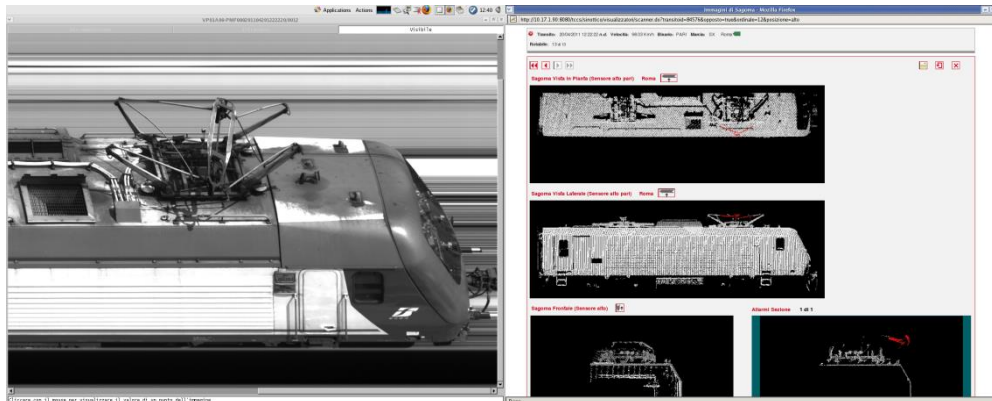
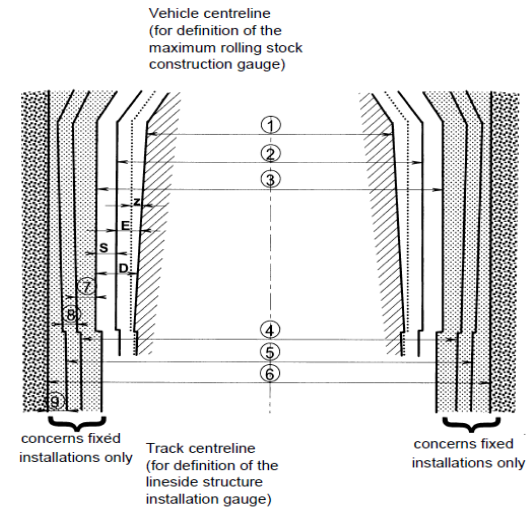
# GAUGE ANALYSIS



## Safety oriented:

### **Out of gauge** detection based on:

- Standards (UIC 505);
- Specific loading gauge.

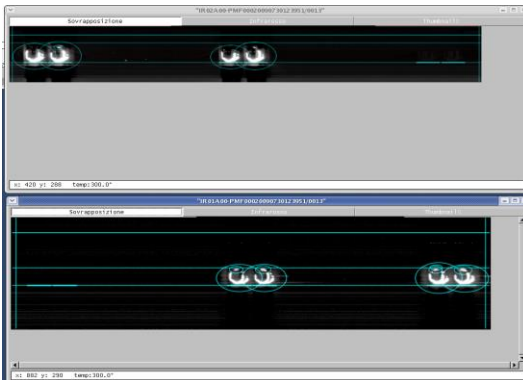


## Maintenance oriented:

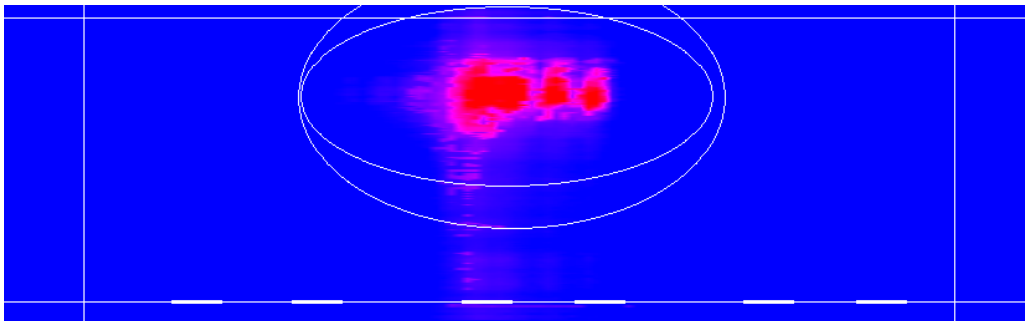
- **Out of alignment** components
- **Damaged** areas
- **Unbalanced** wagons

## THERMAL ANALYSIS (1/2)

As a train approaches and pass through the measurement area, the TCCS is able to scan the surfaces of each railcar producing thermal maps useful to perform automatic overheating detection and / or fire on board



Example hot wheels detection



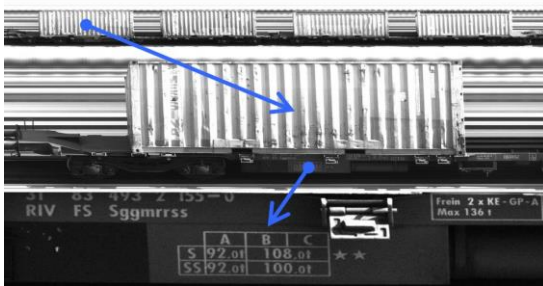
Example hot braking rheostat



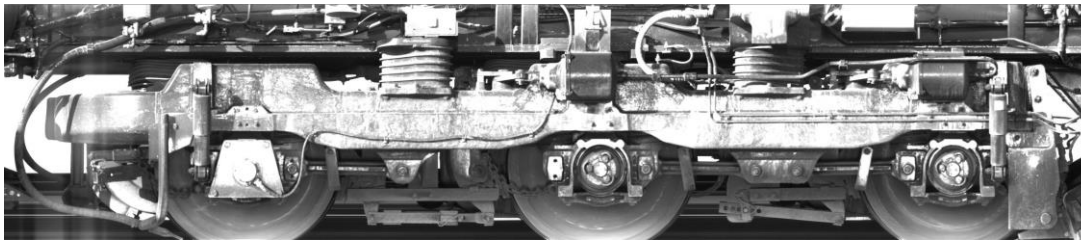


## HIGH DEFINITION IMAGING

As a train approaches and passes through the measurement area, TCCS is able to acquire high definition images for each railcar useful to perform automatic recognition of visible items



Example of high definition imaging for automatic plate recognition



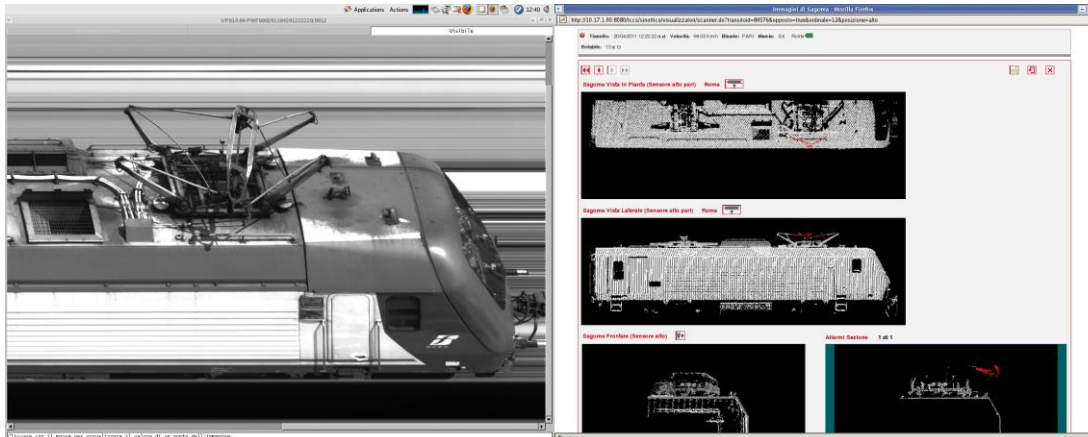
Example of high definition imaging for automatic mechanical defect recognition



Example of high definition imaging:  
panoramic view

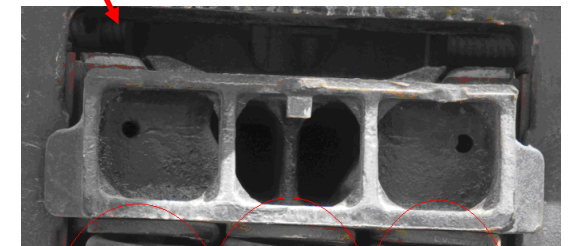
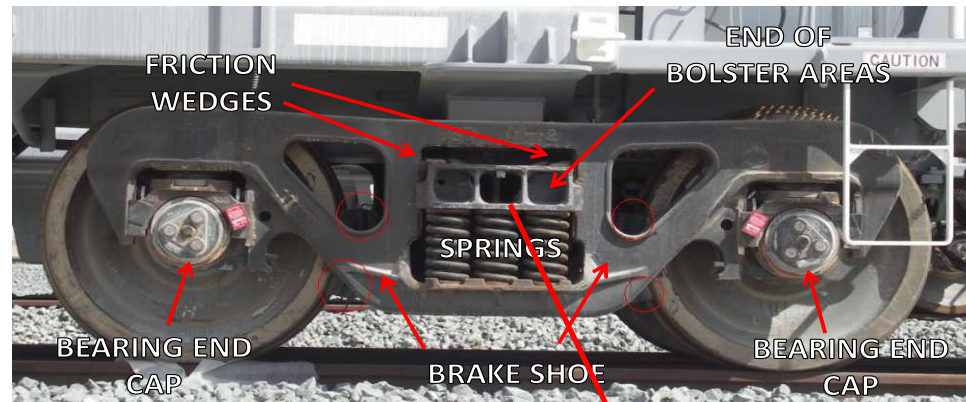
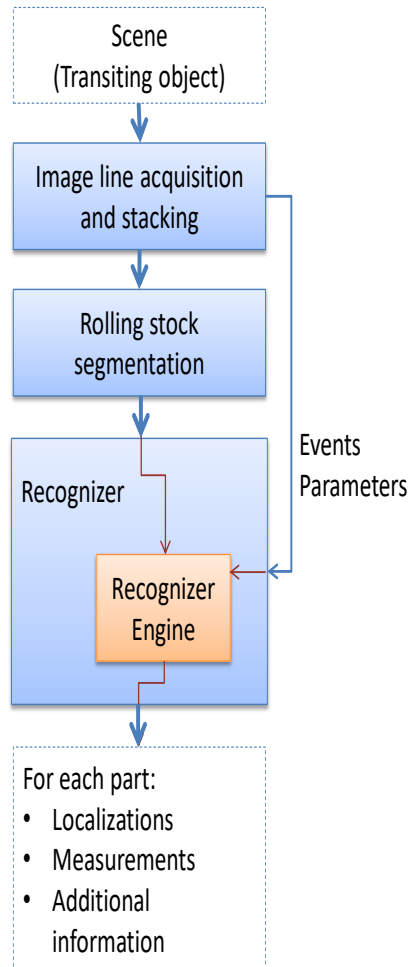
# HIGH DEFINITION IMAGING

Safety: Use of High Definition Images for visual alarms verification



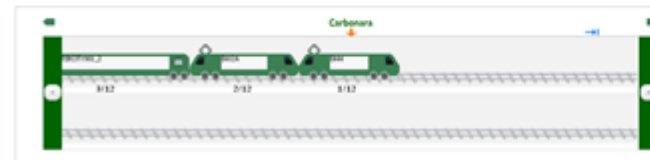
# HIGH DEFINITION IMAGING

Maintenance: Use of pattern recognition and image based measurement techniques





## Human Machine Interface



Vel.: 155.43 km/h Bin.: PARI Dir.: LEGALE N.assi: 40 L.: 209.41 m

**Dettaglio transito: 01/04/16 9.33.36**

Stazione	MT	Descrizione	Vel. (m)	Altezza (m)	Numero assi	Segnale	Visibile	Pericolo
1	FAVA	17.22 m	4.30 m	4	Dettagli	Dettagli	Dettagli	
2	EMSA	18.44 m	4.24 m	4	Dettagli	Dettagli	Dettagli	
3	INTERCITYNO_2	26.38 m	4.16 m	4	Dettagli	Dettagli	Dettagli	
4	INTERCITYNO_2	26.38 m	4.16 m	4	Dettagli	Dettagli	Dettagli	
5	INTERCITYNO_2	26.38 m	4.16 m	4	Dettagli	Dettagli	Dettagli	
6	INTERCITYNO_2	26.38 m	4.16 m	4	Dettagli	Dettagli	Dettagli	
7	INTERCITYNO_2	26.38 m	4.16 m	4	Dettagli	Dettagli	Dettagli	
8	INTERCITYNO_2	26.38 m	4.16 m	4	Dettagli	Dettagli	Dettagli	
9	INTERCITYNO_2	26.38 m	4.16 m	4	Dettagli	Dettagli	Dettagli	
10	INTERCITYNO_2	26.38 m	4.16 m	4	Dettagli	Dettagli	Dettagli	
11	INTERCITYNO_2	26.38 m	4.16 m	4	Dettagli	Dettagli	Dettagli	
12	INTERCITYNO_2	26.38 m	4.16 m	4	Dettagli	Dettagli	Dettagli	

SR Version: 2.2-BETA-11-SNAPSHOT



Sto: [ ]

**Dettaglio transito**

Transito: 01/04/16 10.09.20

Velocità: 136.64 km/h

Binario: DISPARI

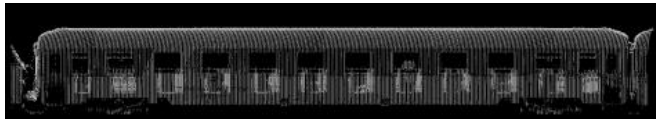
Direzione: LEGALE

Numero assi: 36

Lunghezza: 229.60 m

**Lista transiti**

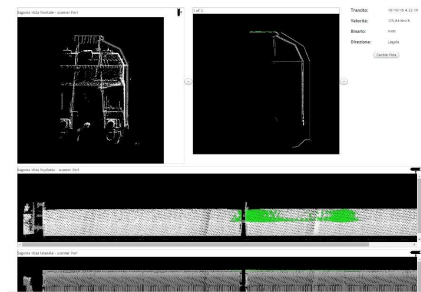
Data transito	MT	Binario	Pericolo
01/04/16 10.09.20	Carbonara	DISPARI	
01/04/16 10.06.54	Carbonara	PARI	
01/04/16 10.02.02	Carbonara	PARI	
01/04/16 9.59.27	Carbonara	PARI	
01/04/16 9.53.36	Carbonara	PARI	
01/04/16 9.18.11	Carbonara	DISPARI	
01/04/16 9.09.12	Carbonara	DISPARI	
01/04/16 8.59.29	Carbonara	PARI	
01/04/16 8.40.18	Carbonara	DISPARI	
01/04/16 8.34.26	Carbonara	PARI	
01/04/16 8.26.52	Carbonara	DISPARI	
01/04/16 8.08.47	Carbonara	DISPARI	
01/04/16 7.59.45	Carbonara	PARI	
01/04/16 7.37.26	Carbonara	DISPARI	
01/04/16 7.24.00	Carbonara	PARI	
01/04/16 7.10.54	Carbonara	DISPARI	
01/04/16 6.45.29	Carbonara	DISPARI	
01/04/16 6.35.08	Carbonara	PARI	
01/04/16 5.49.17	Carbonara	PARI	
01/04/16 5.36.55	Carbonara	PARI	



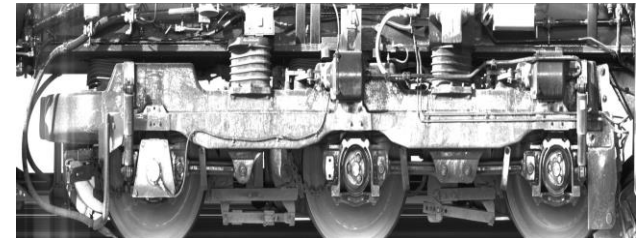


## TCCS & Safety

Out of gauge analysis



High definition Images for visual verification alarms

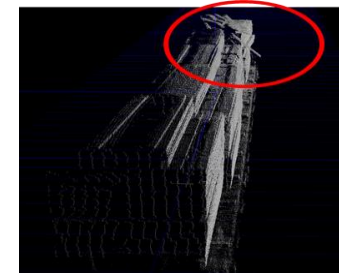


Fire on board

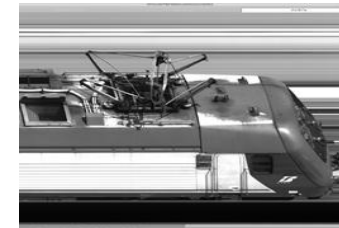


## TCCS & Maintenance

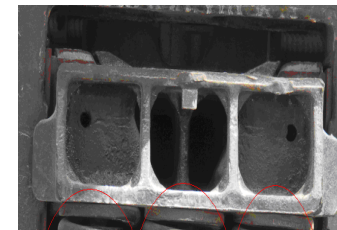
Out of alignment components



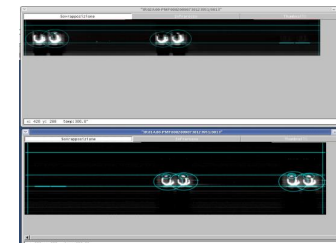
Damaged Areas



Components wear



Overheating



## TCCS System Integration



**Signalling**  
*Automatic train stop*



**Yards**  
*Intelligent Video-gate*



**Maintenance**  
*From On Condition to Predictive*

## TCCS integration with signalling

- SIL4 certification through:
  - 2oo2 architecture
  - Diversity
  - Continuous auto-diagnostic of components and of calibration
- Low FAR and high POD through:
  - High performing sensors
  - Sensors and algorithms parameters fine tuning

# Yard Management

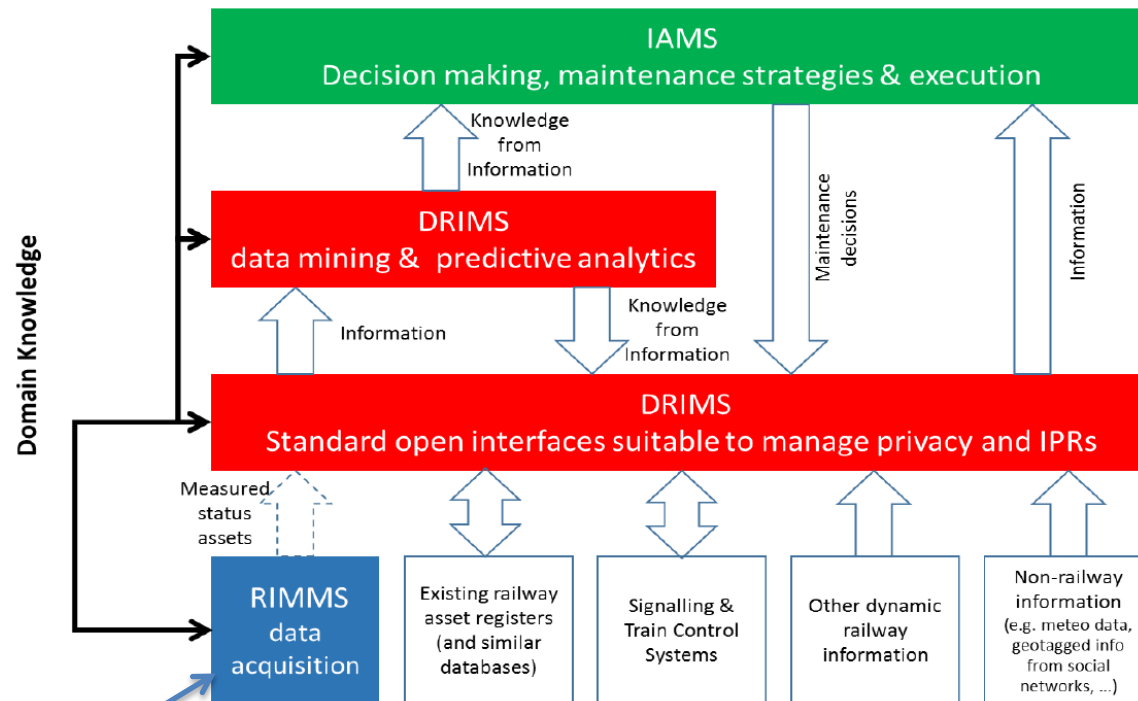
Impact the inbound and outbound yard procedures through:

- Automation of relevant logistic procedures
- Optimization of resources and activities





# Maintenance-Oriented Systems – In2Smart Case



TCCS

## Thank you for your kind attention



## Thank you for your kind attention



**Thank you for your kind attention**

