

EVOLUTION OF THE OPERATION IN INTERCONNECTION POINTS WITH DIFFERENT GAUGE

PASSENGER TRAIN

Gauge 1

Gauge 2

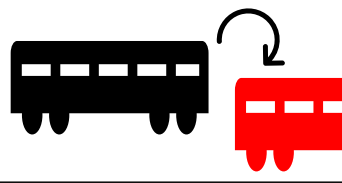
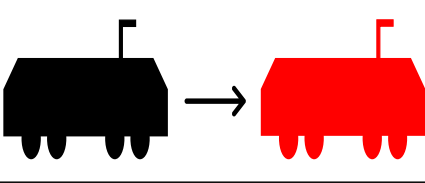
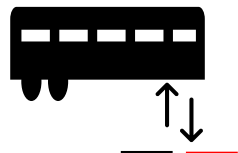

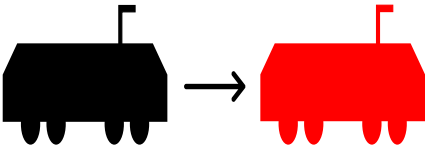
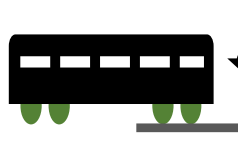

TRANSFER OF PASSENGERS BETWEEN TRAINS

BOGIE INTERCHANGE

AUTOMATIC CHANGE IN COACH

LOCO CHANGE

AUTOMATIC CHANGE IN LOCO

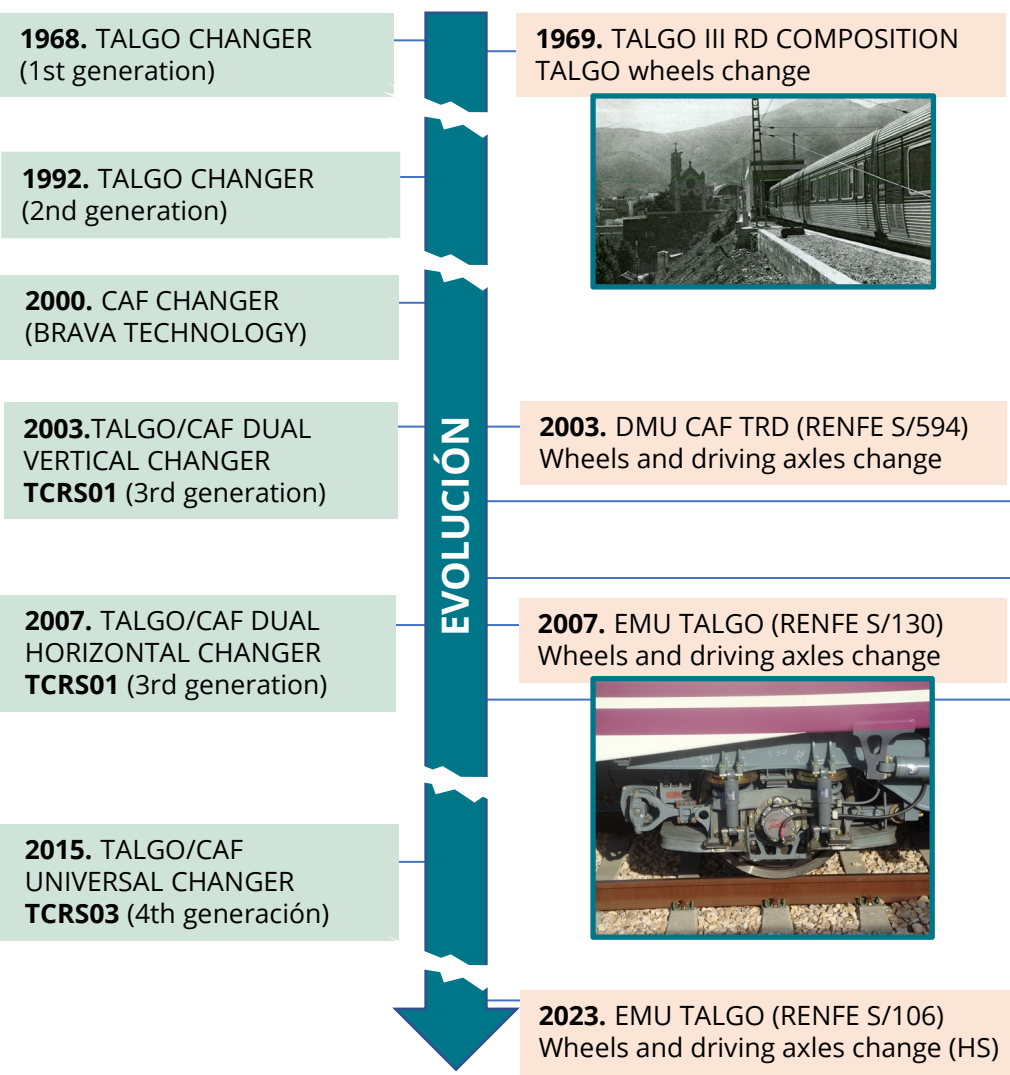
	Coach	Loco
Until 1968		
1968 – 2003	 	
2003 – present		

FULL TRAIN

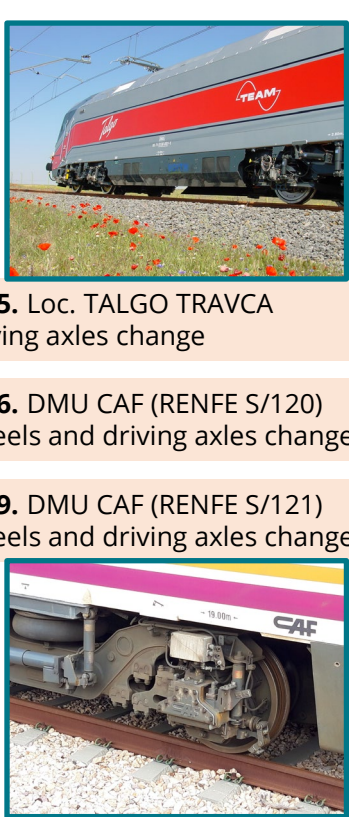
- Lower axle load
- Homogeneous vehicles
- Better manoeuvrability
- Economic cost with less impact on the operation
- Higher operating speed

Large number of R&D programs→ Technology successfully consolidated in the Spanish network

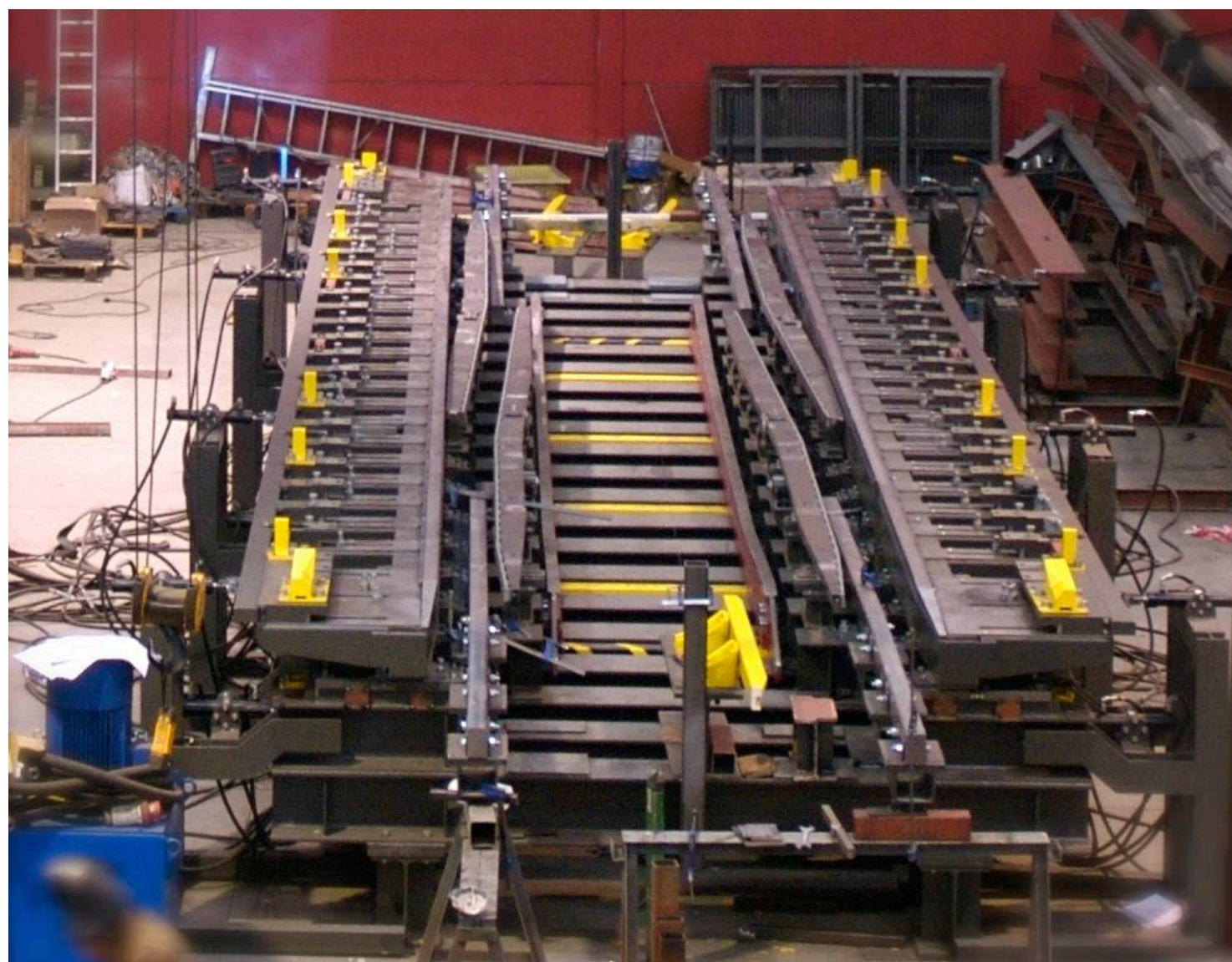
Evolution of the changer



Evolution of the Rolling Stock



UNICHANGER prototype. Universal changer. ADIF. 2010



UNICHANGER prototype. Universal changer. ADIF. 2010

FREIGHT TRAIN

Gauge 1

Gauge 2

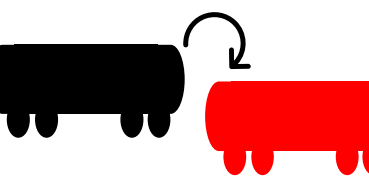
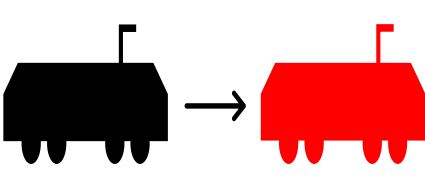
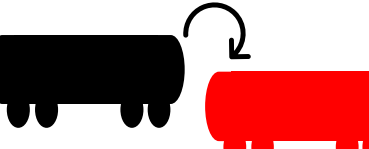
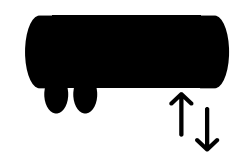
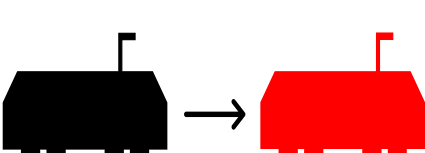

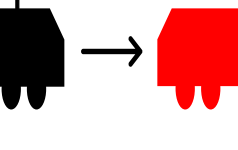
TRANSFER OF GOODS BETWEEN TRAINS

AXLES INTERCHANGE

AUTOMATIC CHANGE IN WAGON

LOCO CHANGE

AUTOMATIC CHANGE IN LOCO

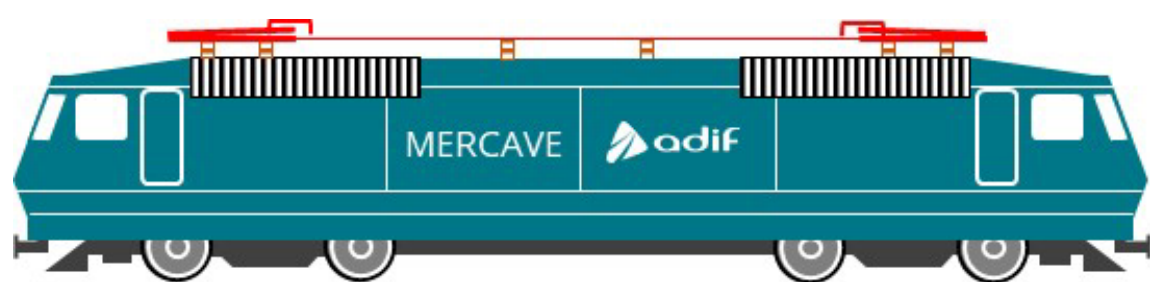
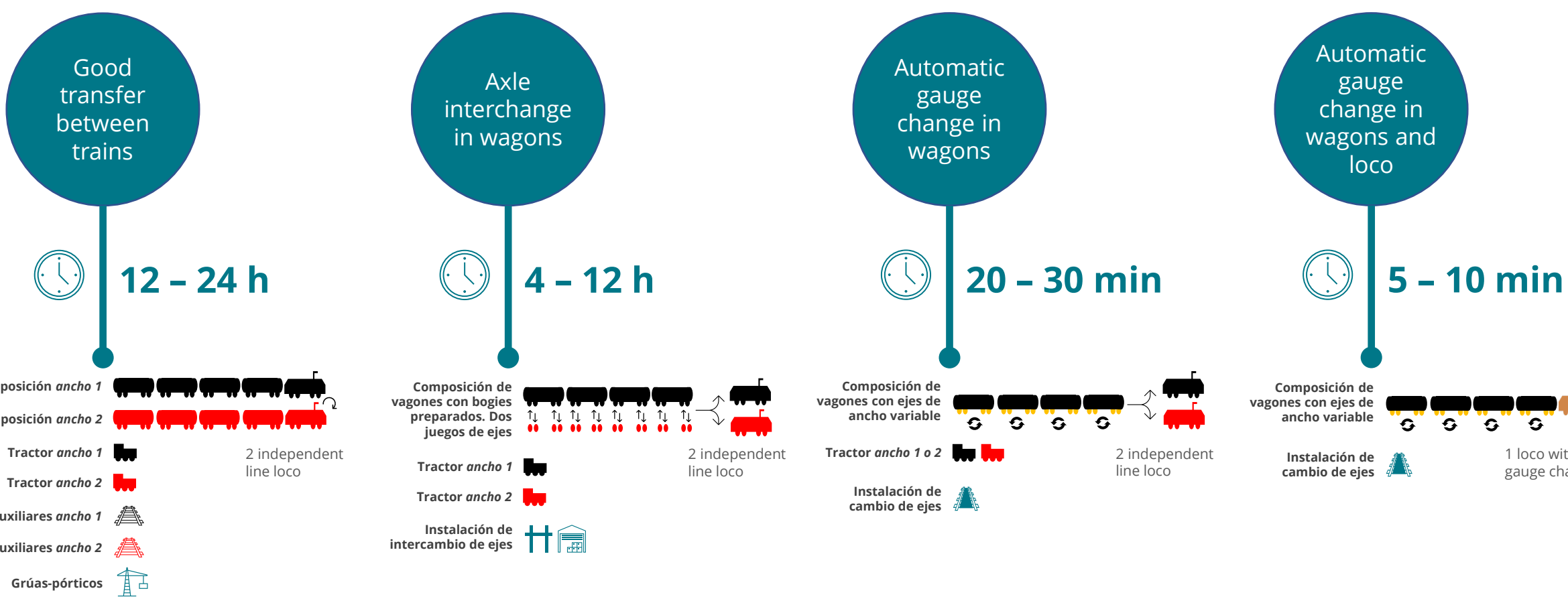
	Wagon	Loco
Until 1950		
1950 – present	 	
Future		

MERCAVE Program

MORE
COMPLEX
TECHNICAL
SOLUTION

- Higher axle load
- Less homogeneous vehicles
- Less manoeuvrability
- Economic cost with strong impact on the operation
- Lower operating speed

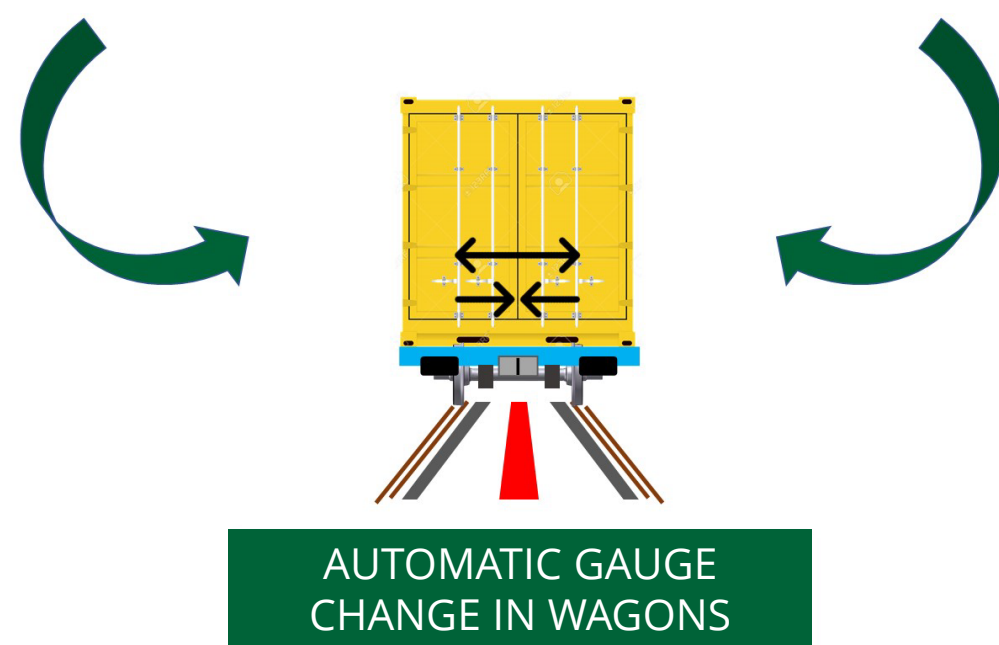
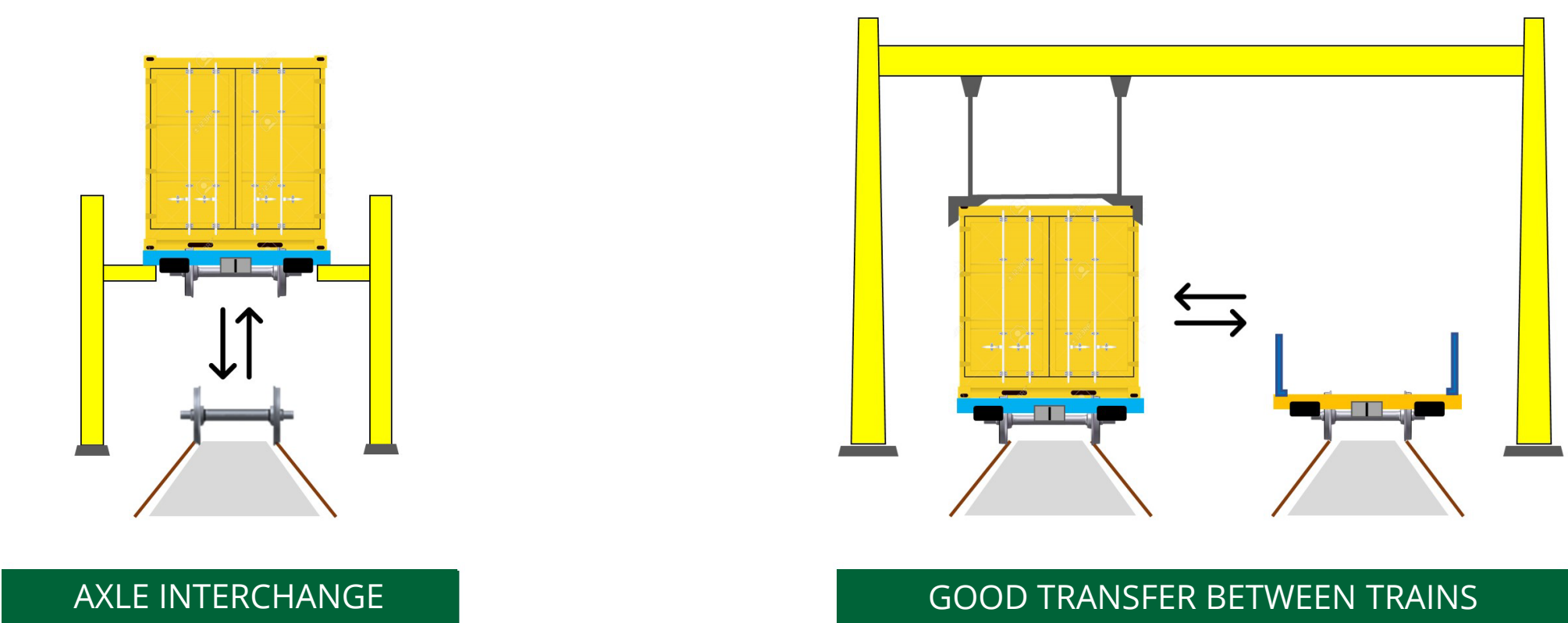
MERCAVE Program → Technology to be consolidated in the Spanish network



- It would mean better rotation than 2 independent locomotives (cost savings)
- The added value would be very high
- Can always be used in single gauge (low risk)
- Very complex technical development (it is difficult to use current locomotives)

LOCOMOTIVE WITH VARIABLE GAUGE TECHNOLOGY
MAIN ASPECTS

ADIF / ADIF AV	Railway company	Final user	Providers of other services and rolling stock manufacturers
<ul style="list-style-type: none">Maintenance rolling stock compatible between conventional and high-speed subnetworks.Complementary solution to the 3-rails track.Simplification of border operations (Irun and Port Bou).Support in the management of a possible track gauge evolution process in the network.Opportunities associated with innovations and their export to other networks.	<ul style="list-style-type: none">Increased reliability and reduction of border operations times.Potential cost reduction (at least for certain traffic).Potential increase in international freight traffic.Rolling stock interoperable with European standard gauge network.Tare increase in wagons.	<ul style="list-style-type: none">Increased reliability and minimization of risk of damage to goods in border traffic.Potential cost reduction (at least for certain traffic).Availability of a high-performance mode of transport for international traffic.	<ul style="list-style-type: none">Emergence of new alternative solutions to the current axle interchange or cargo transfer process.Opportunities associated with innovations and their export to other networks.



The current operations carried out on the border are complex from a logistical point of view since they require important facilities and resources (crane bridges, bogie and axle lifting systems, auxiliary roads to park different compositions, etc.

IMPACT ON OPERATIONS
TIME DIFFERENTIAL ANALYSIS

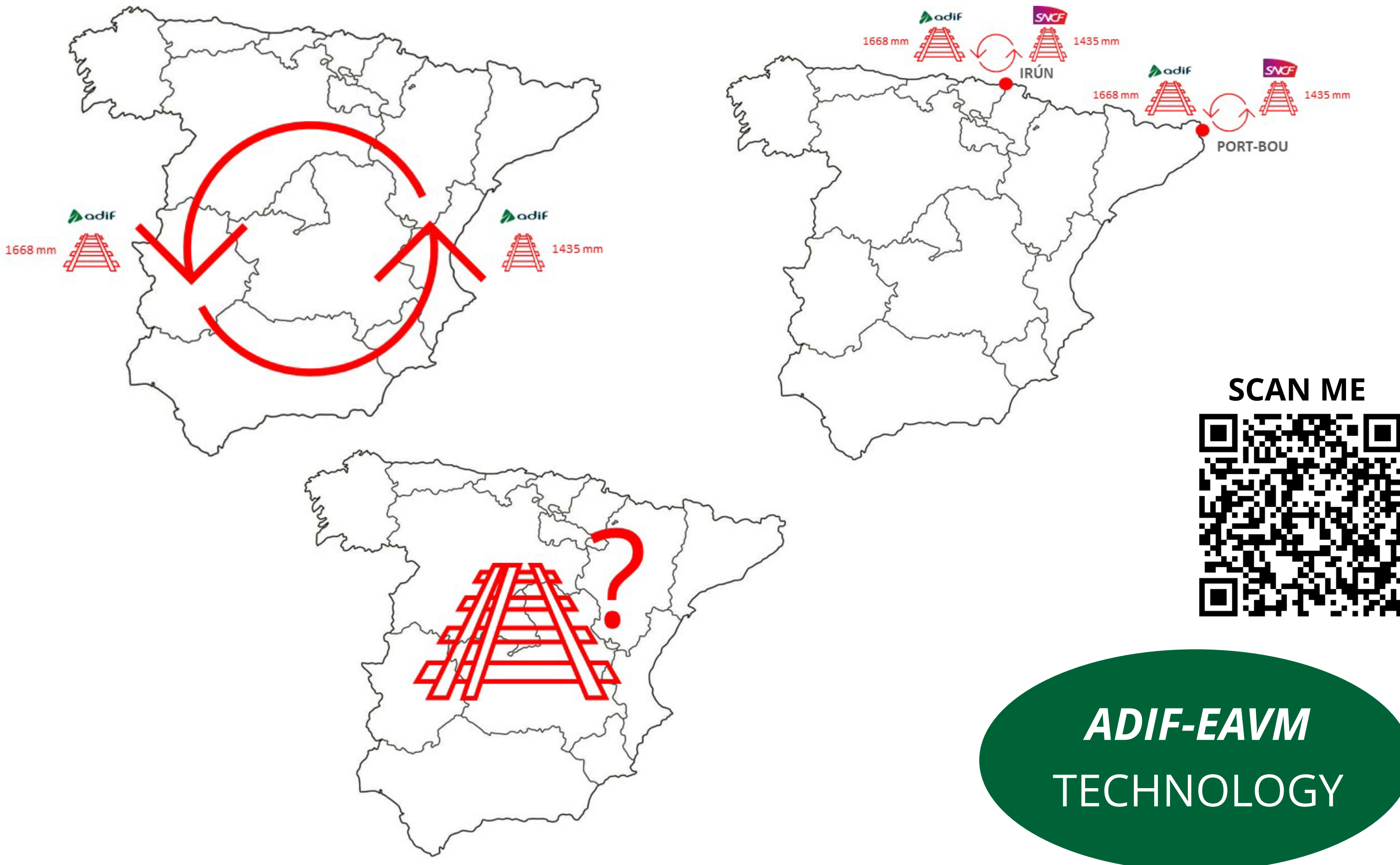
GENERAL IMPACT ON THE SECTOR
ACCORDING TO AGENT

“AUTOMATIC VARIABLE GAUGE SYSTEM FOR RAIL FREIGHT TRAFFIC” (MERCARE PROJECT)

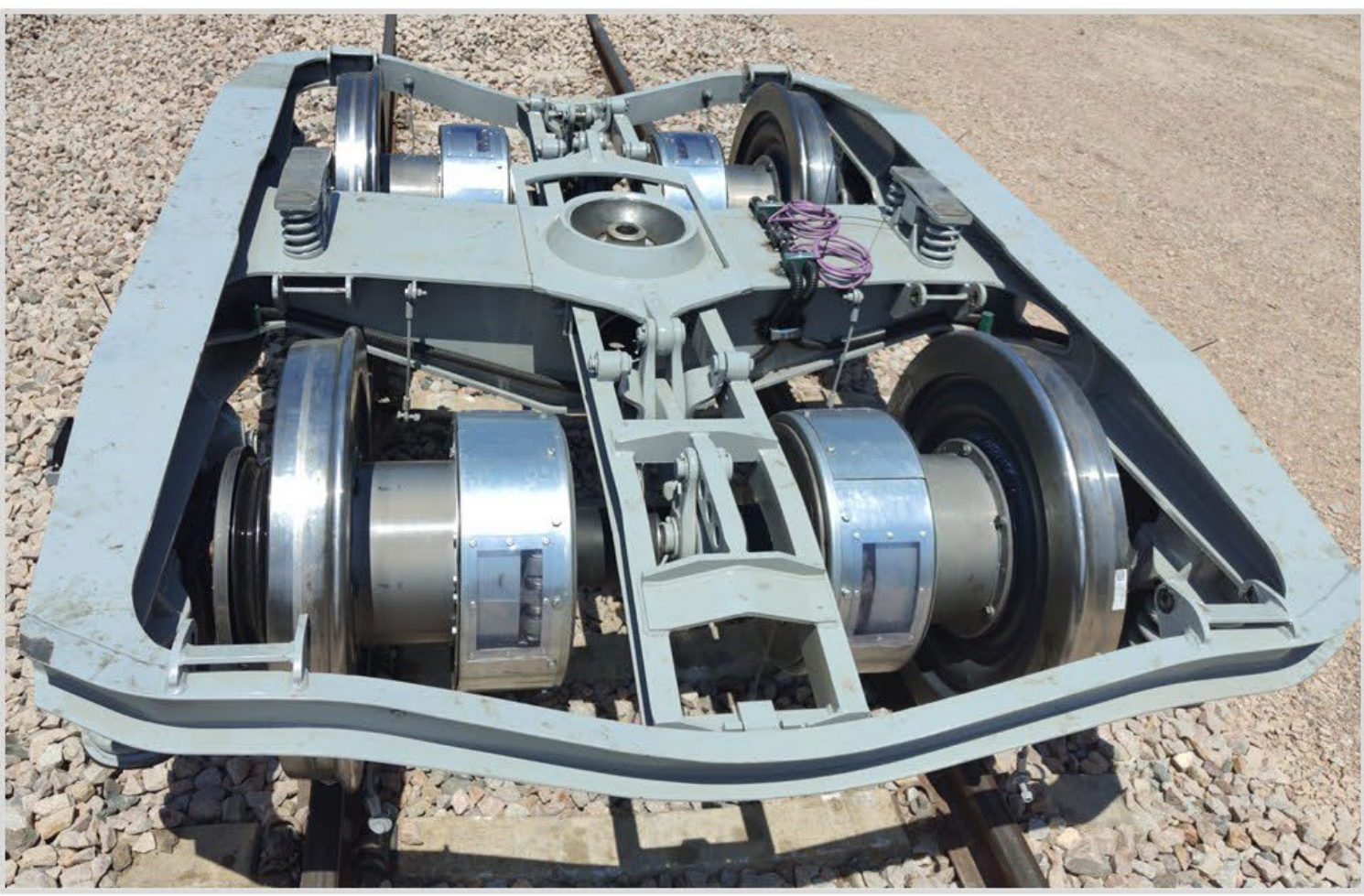
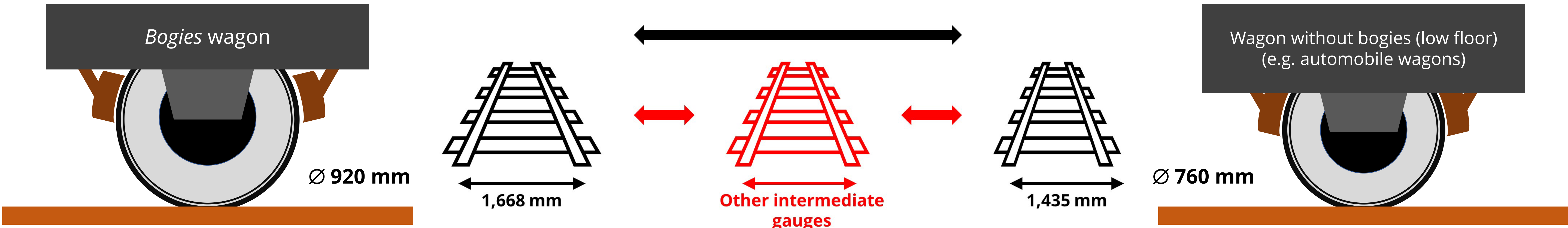
In **2015** Adif began an **R&D program** for the *development* and *homologation* of a new technical solution that allows the **automatic change of track gauge of freight wagons** (*trailed variable gauge axle*). Currently this program is called **MERCAVE**.

GOALS

- Have a complementary technical solution on routes or branches that require the assembly of a three-rail track.
- Reduce the passage time of freights compositions on the border with France (compared to current axles interchange operations or cargo transfer between trains).
- Allow the permeability of operation of this type of freight compositions between the networks of different gauges of the Spanish Railway Network (RFIG).



MERCAVE: Gauge change between **1,668 mm** and **1,435 mm** (and vice versa) for two types of widely used wheels (**Ø 920 mm** and **Ø 760 mm**). The system is also prepared to implement other gauges used in other European countries.



Technical evolution of the
Trailed Axle on modified ADIF
wagons
(CPTI)



Technical evolution of the
Changer
(CPTI)



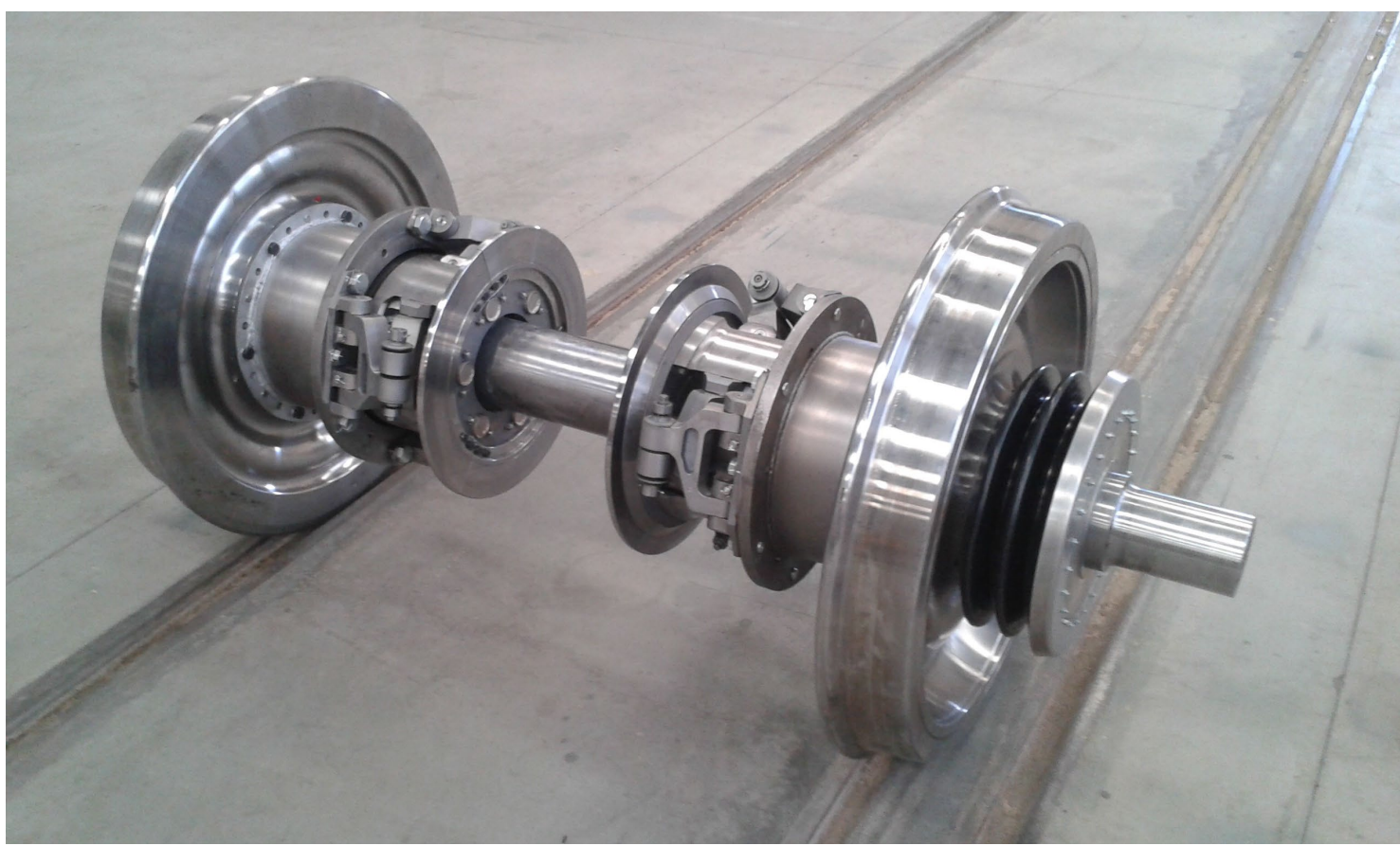
Feasibility study on a
Tractor Axle
(CPP)

CPI MERCAVE Project

Strategy for deployment (support activity)

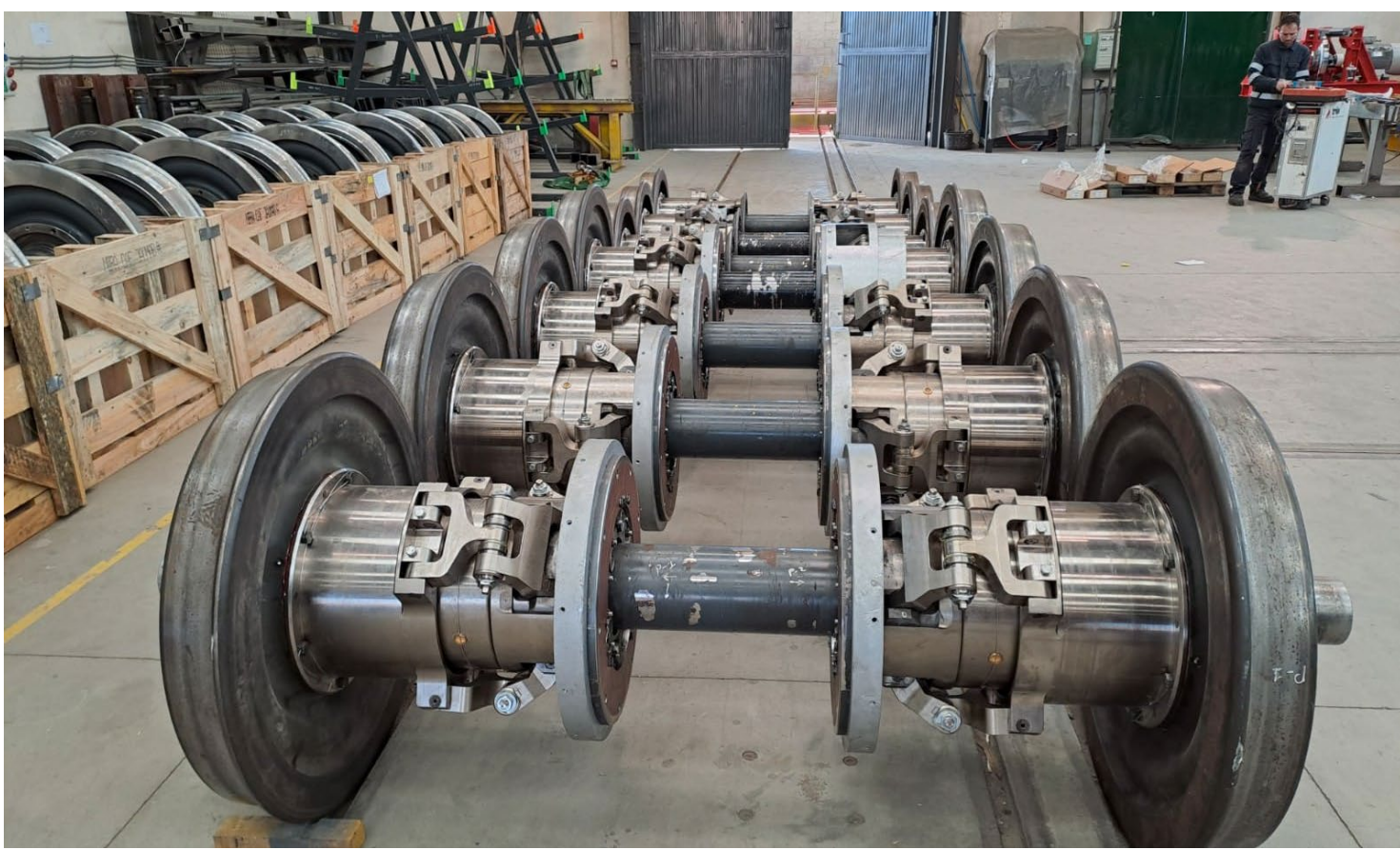
EUROPEAN REGIONAL DEVELOPMENT FUND (ERDF)

AXLE FOR AUTOMATIC GAUGE CHANGE



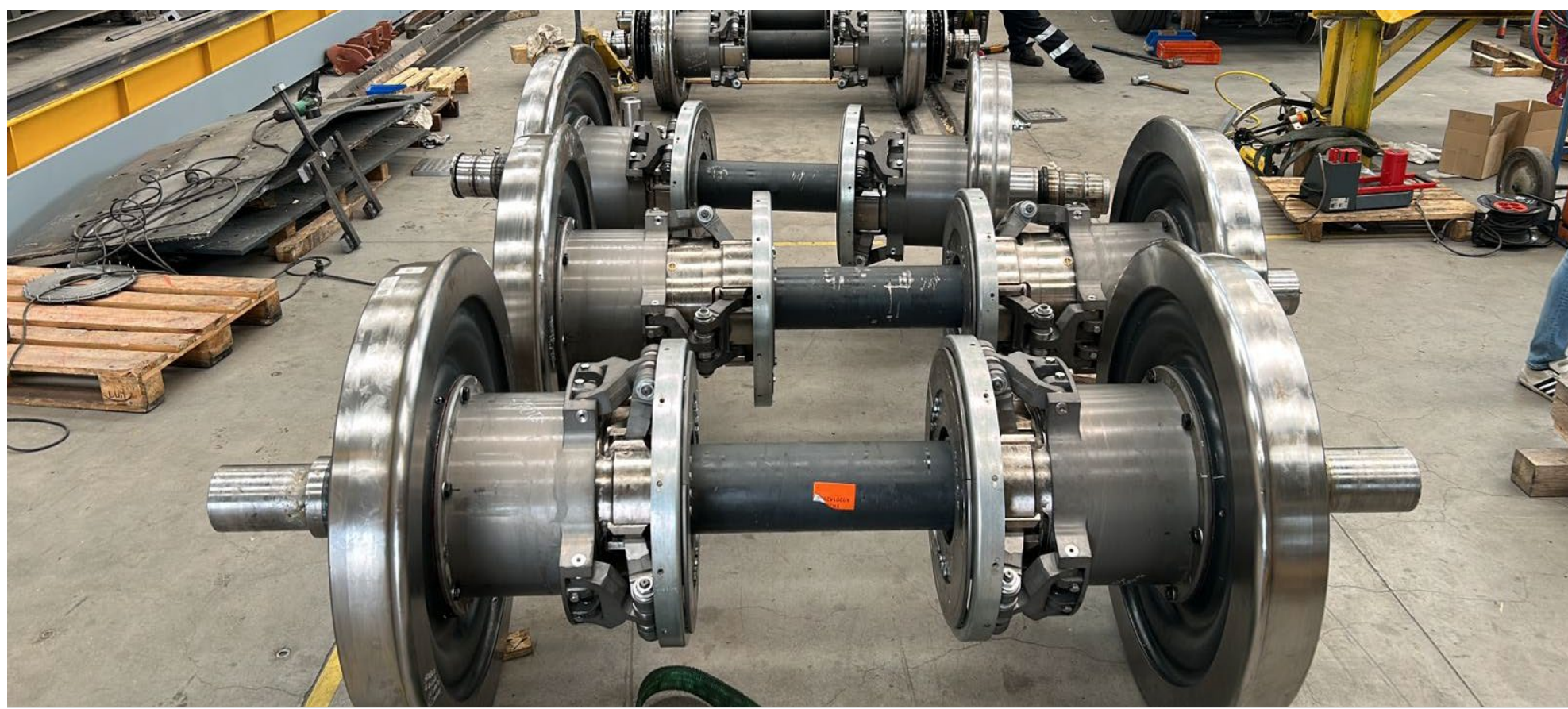
AXLE 1.0

EVOLUTION



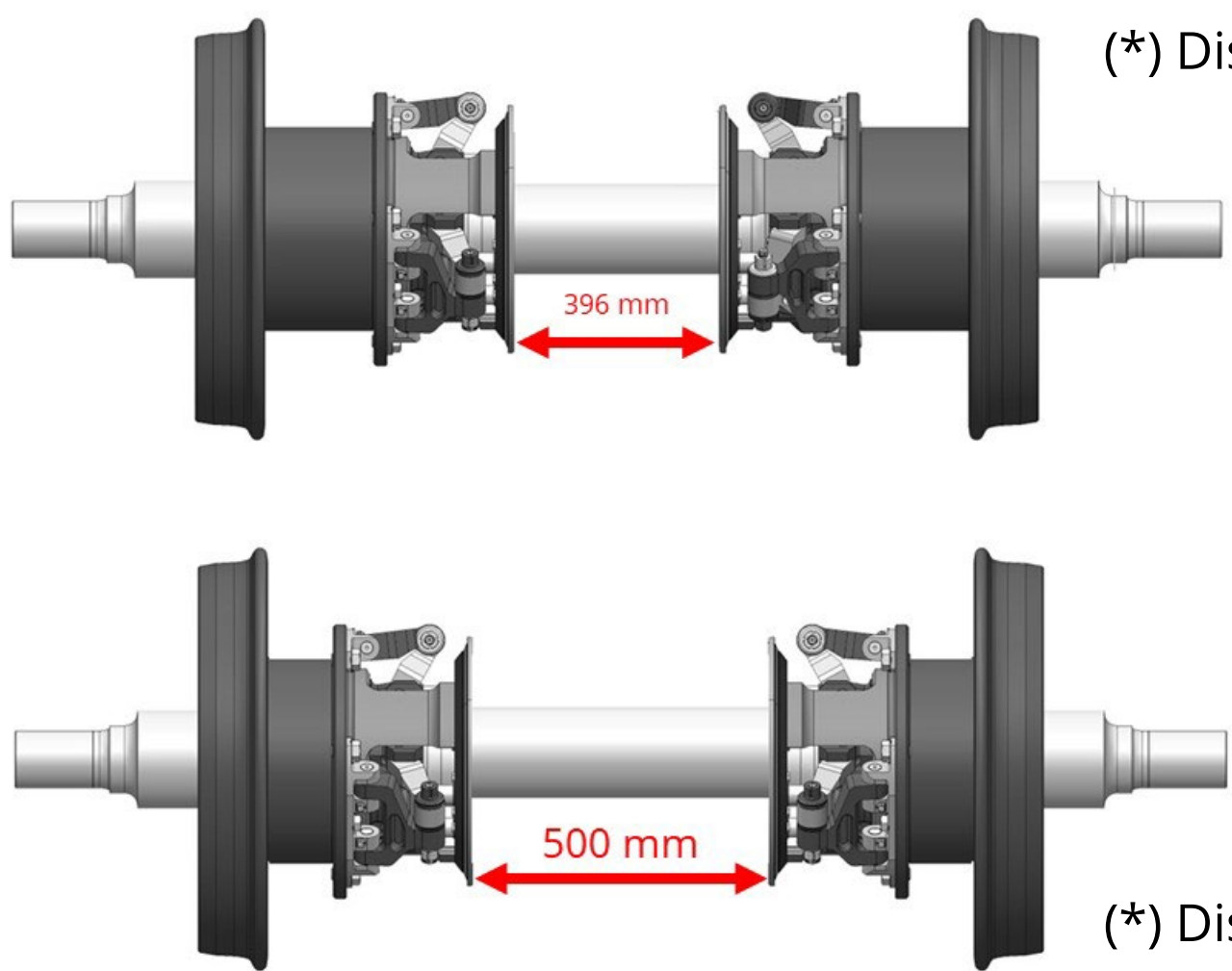
AXLE 1.1 (MERCAGE)

EVOLUTION



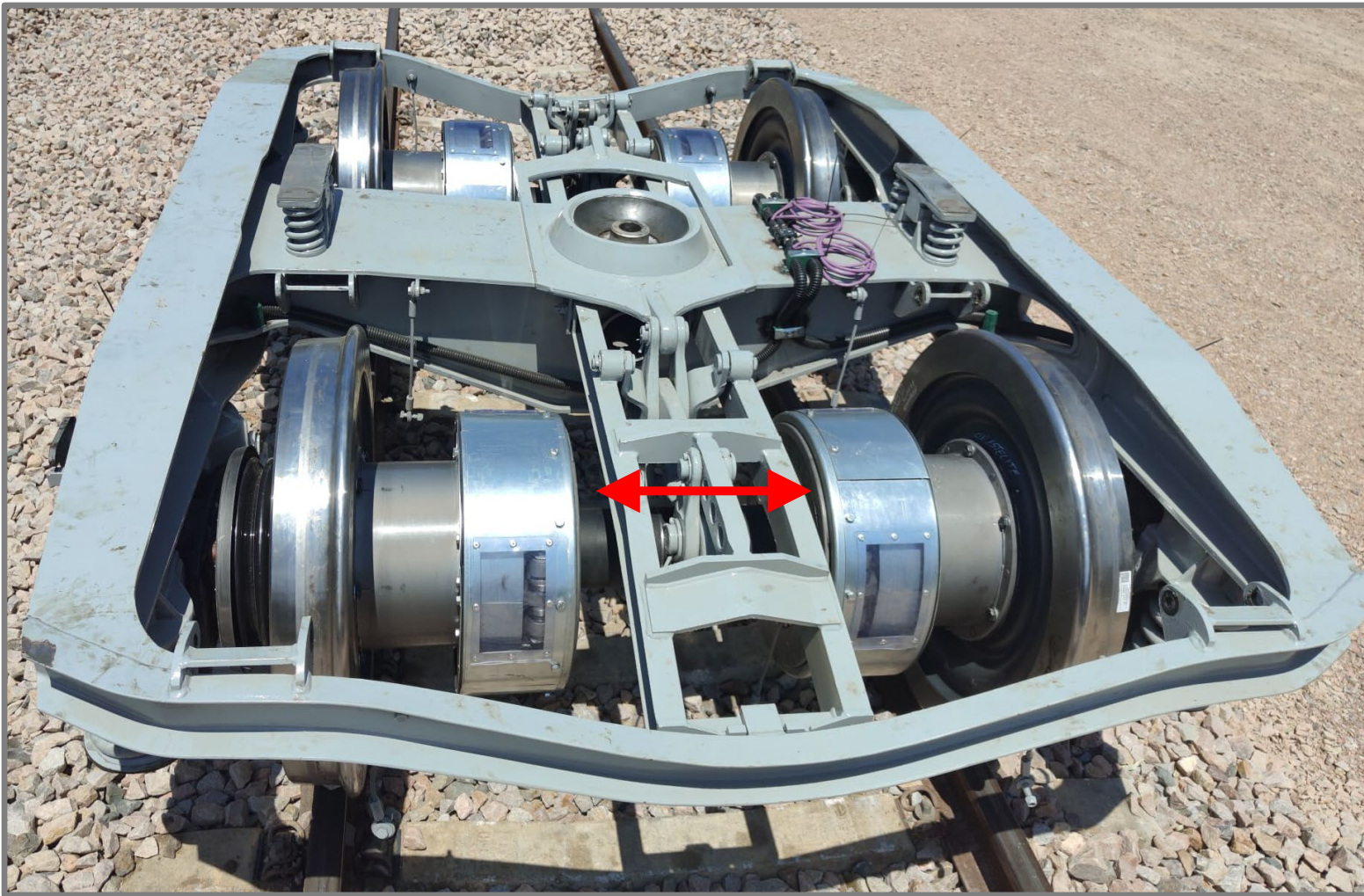
AXLE 2.0 (MERCAGE)

	Distance between discs (mm) (*)	Weight (Kg)	Protection	Standardization in manufacturing	Interaction with the brake (improvement)	Digitization
AXLE 1.0 (Ø 760 mm)	396	1,628	NOT	NOT	NOT	NOT
AXLE 1.0 (Ø 920 mm)	396	2,030	NOT	NOT	NOT	NOT
AXLE 1.1 (Ø 760 mm)	440	1,594	NOT	NOT	YES	NOT
AXLE 1.1 (Ø 920 mm)	440	1,996	NOT	NOT	YES	NOT
AXLE 2.0 (Ø 760 mm)	500	1,552	NOT	YES	YES	YES
AXLE 2.0 (Ø 920 mm)	500	1,964	YES (**)	YES	YES (***)	YES (****)
AXLE (NORMAL) (Ø 760 mm)	N.A.	1,488	N.A.	YES	N.A.	NOT
AXLE (NORMAL) (Ø 920 mm)	N.A.	1,456	N.A.	YES	N.A.	NOT



(*) Distance between discs (AXLE 1.0)

(*) Distance between discs (AXLE 2.0)



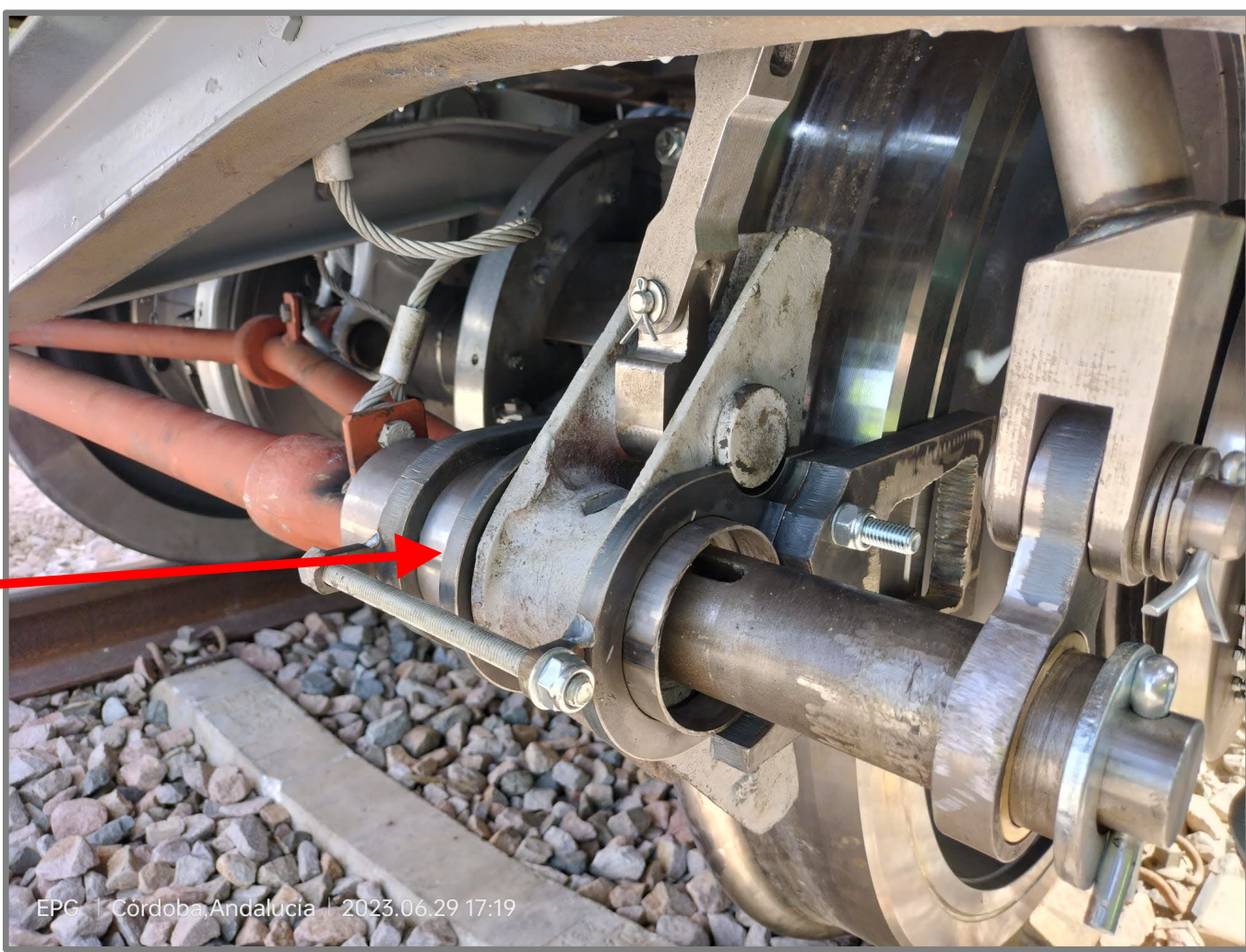
(*) Improved bogie interaction



(**) Protection



(***) Improvement in the brake system



(***) Improvement in the brake system



(****) Acceleration, temperature and position sensor

GROUND CHANGER



CHANGER 1.0

EVOLUCIÓN

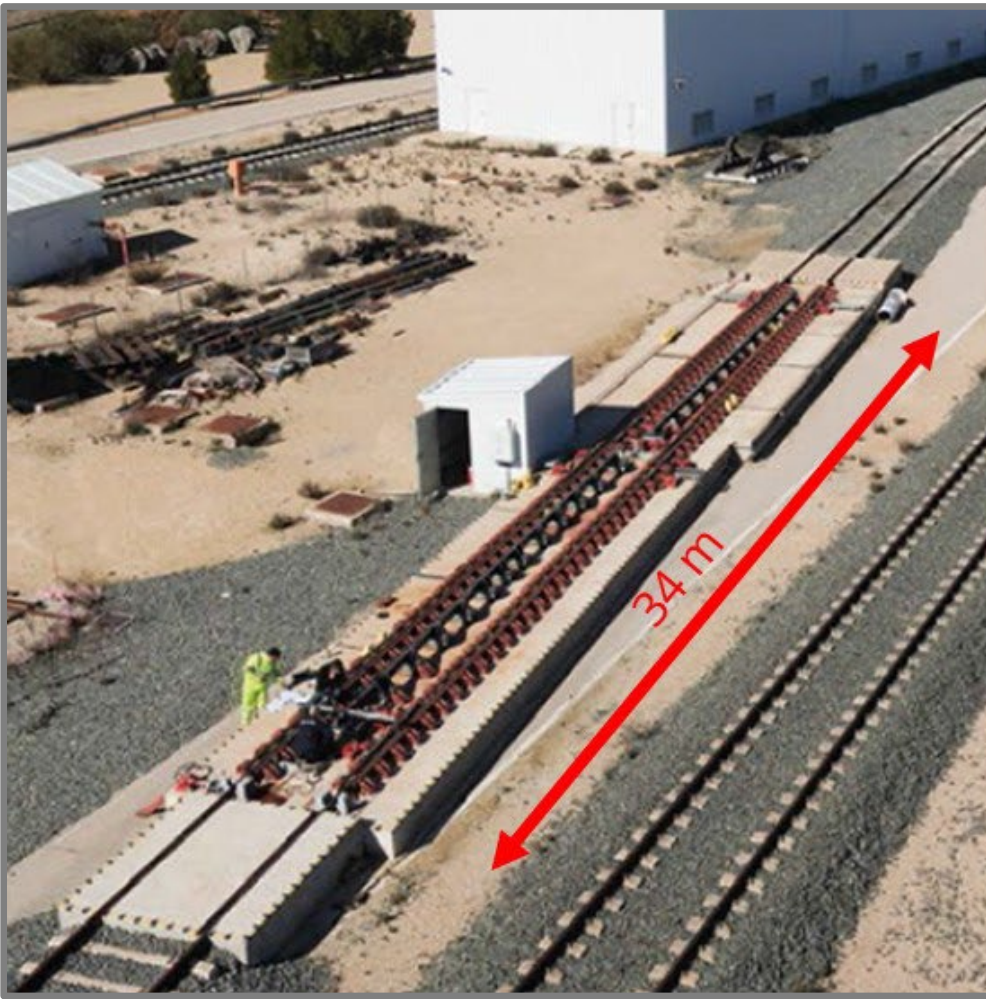


CHANGER 2.0 (MERCAGE)

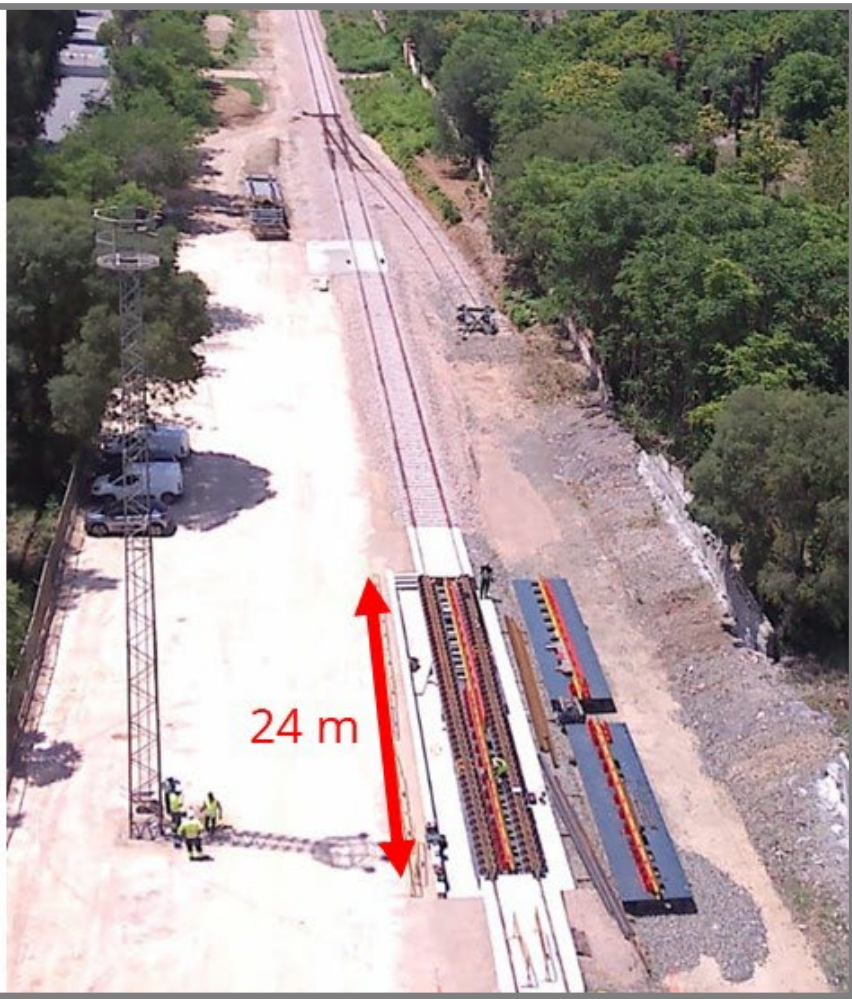
	Lenght (m) (*)	Portable system	Interaction with the axle (improvement)	Digitization
CHANGER 1.0	34	NOT	NOT	NOT
CHANGER 2.0	24	YES (**)	YES	YES (***)



(**) Portable system (2 sections)



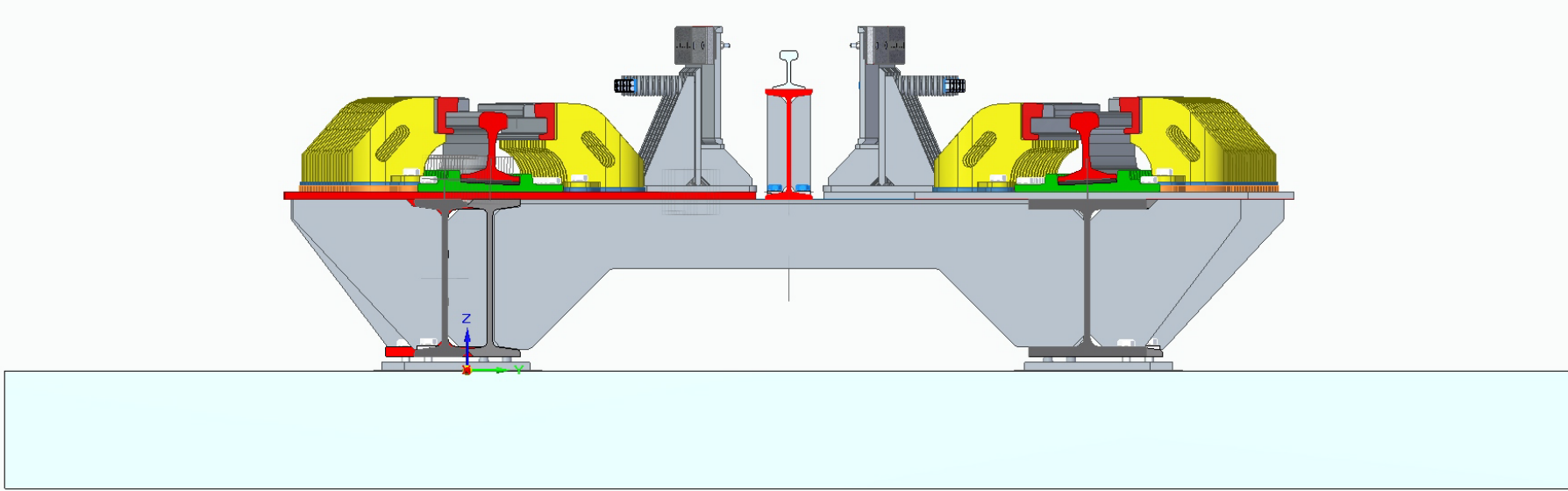
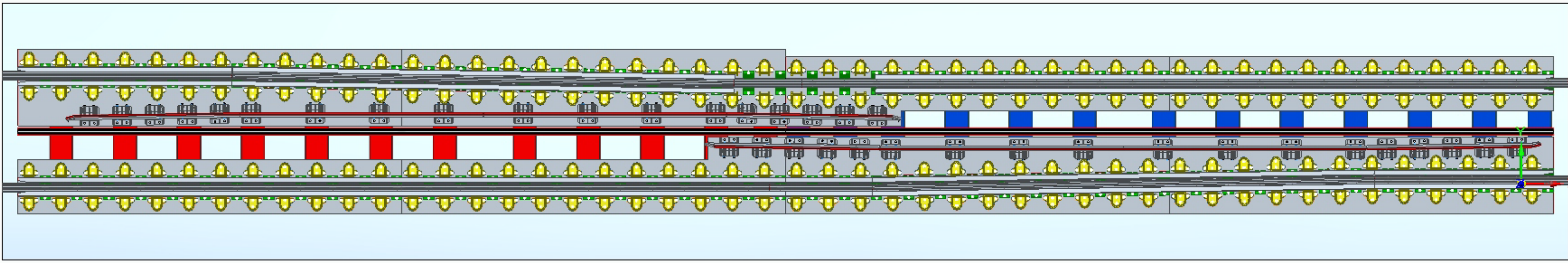
(*) Lenght (1.0 & 2.0)



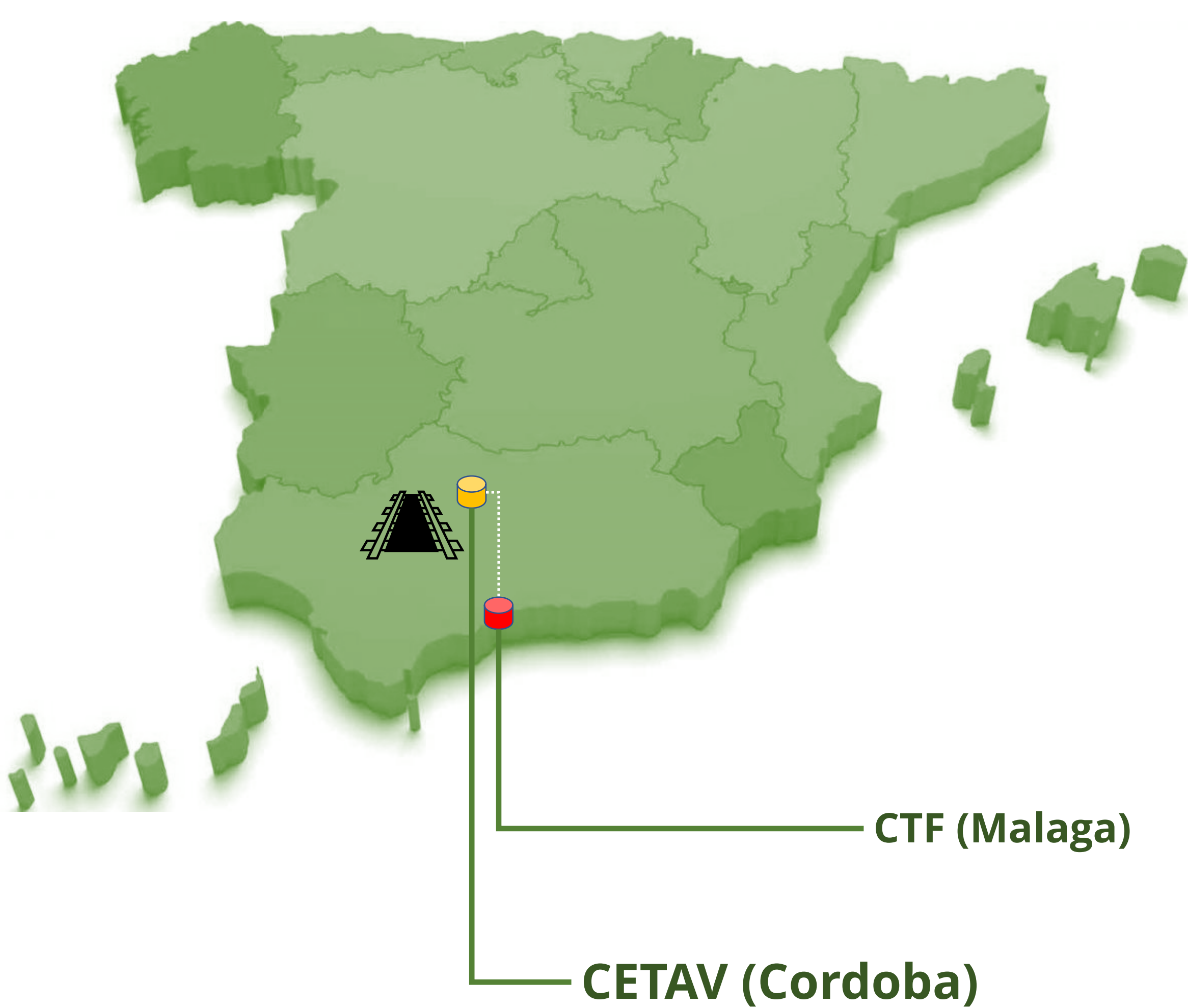
(***) Sensor control system



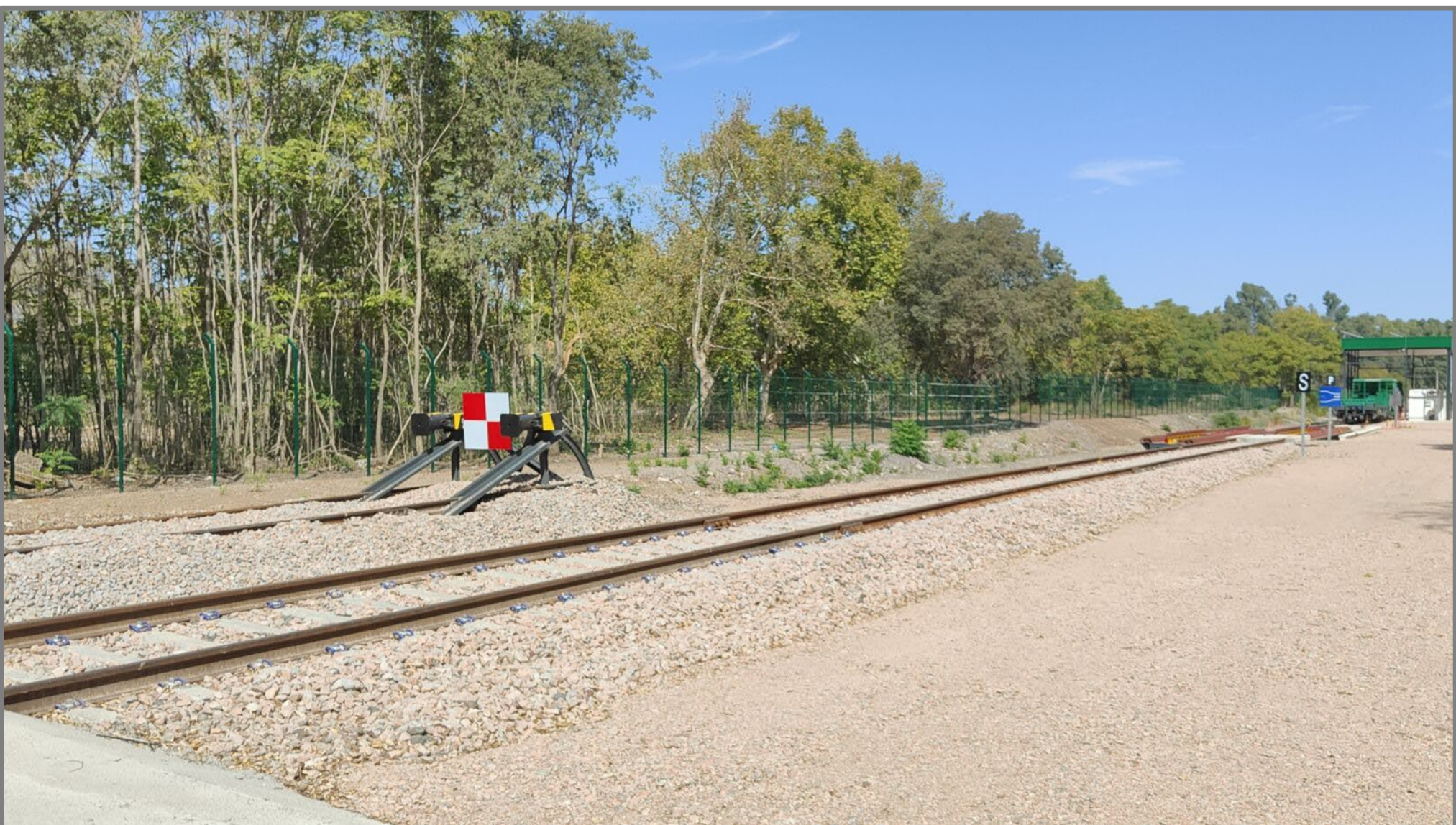
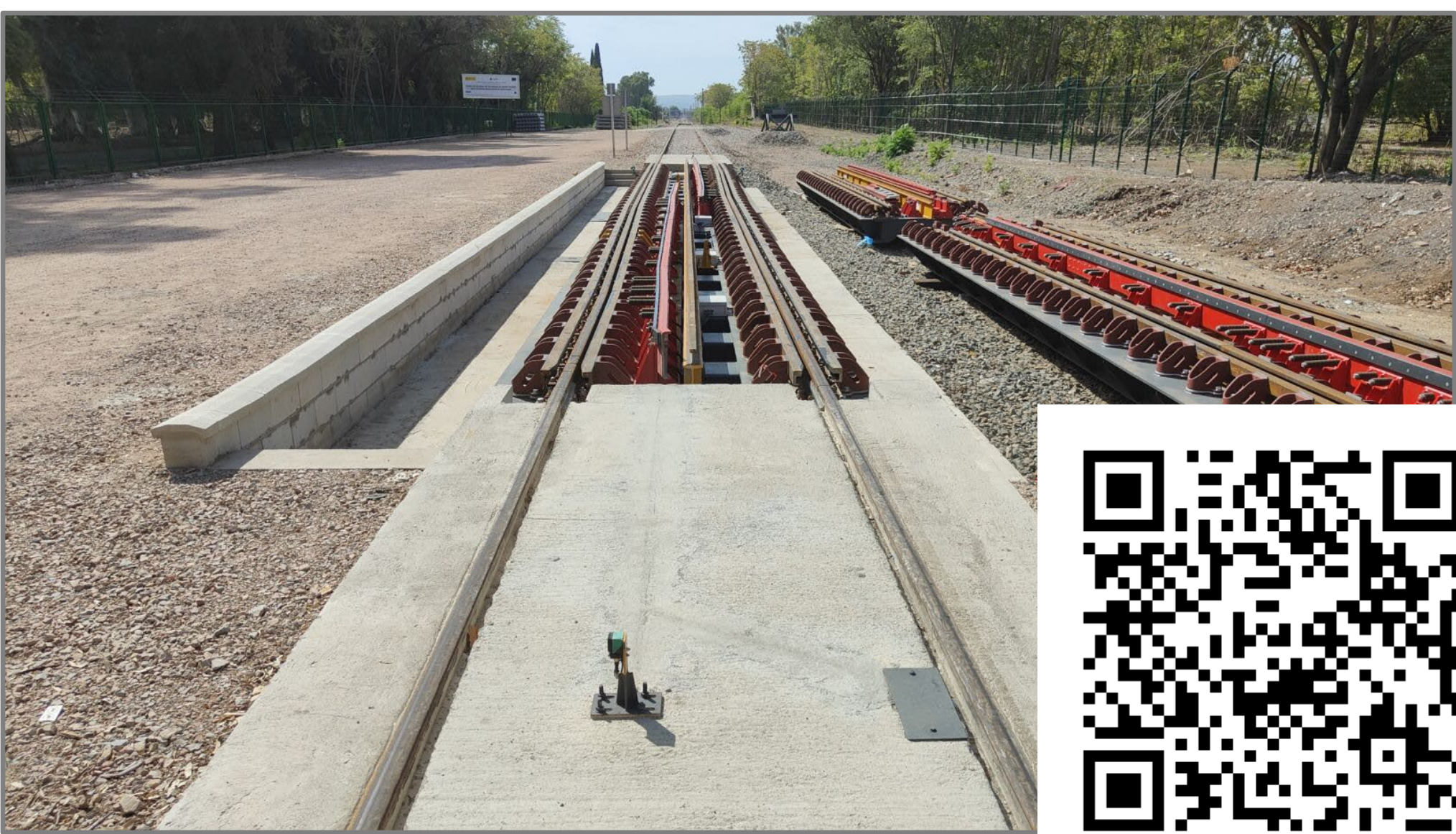
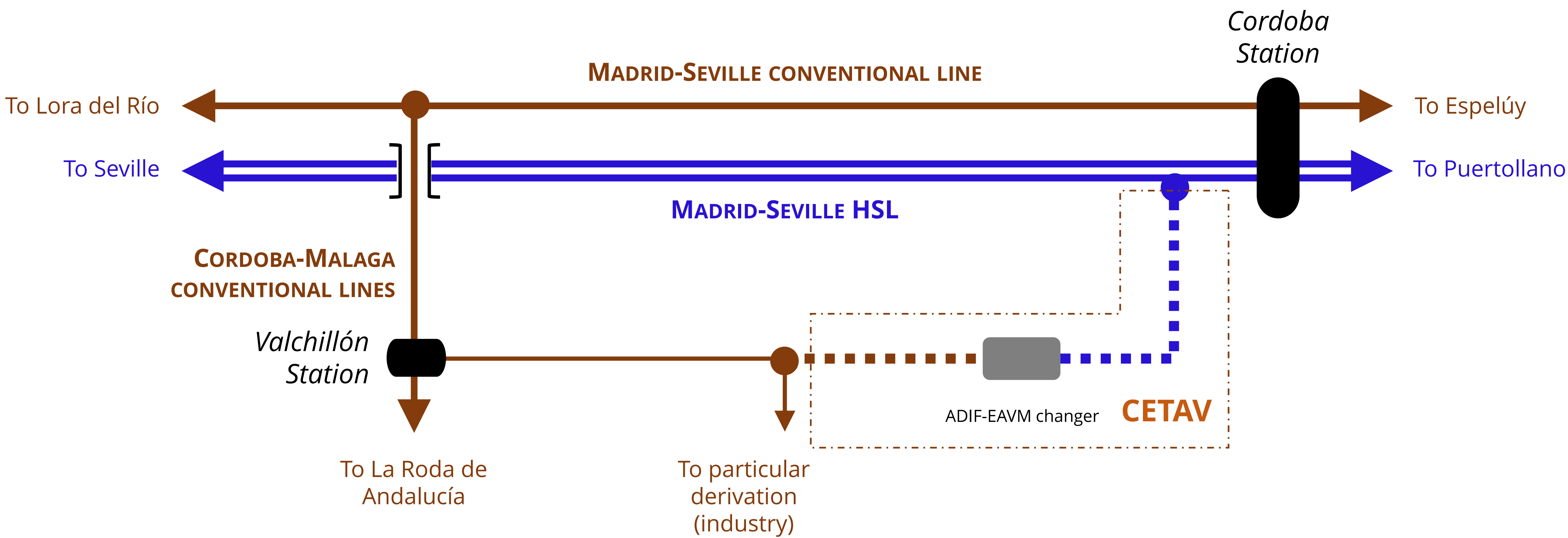
(***) Sensor control system



The **Variable Gauge Technology Test Center (CETAV)** of **Cordoba** is a new R&D facility developed in the **MERCAVE Project** for the installation of the evolved changers and the development of gauge change tests with the test wagons. It will allow tests to be carried out with any type of wagon adapted to the **ADIF-EAVM system**. The CETAV will be a permanent facility for experimentation and dependent on the *Railway Technology Center (CTF)* of ADIF in Malaga.



CETAV RAILWAY ENVIRONMENT



CETAV TRACK SCHEME

