European Freight DAC Delivery Programme

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Europe's Rail: Vision

European Green Deal

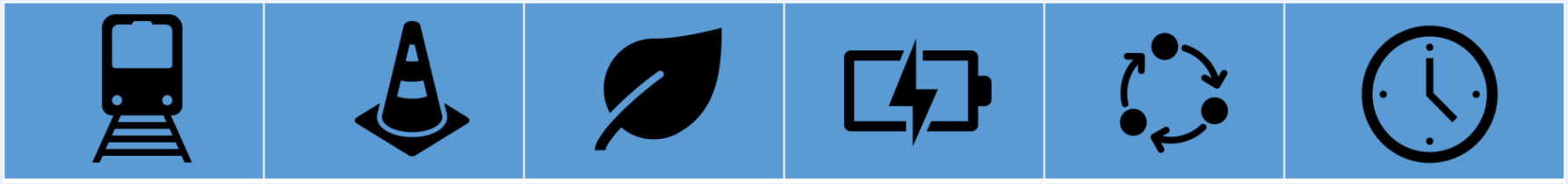
EU policy priorities

- An economy that works for people: New Industrial Strategy
- A Europe fit for the digital age: Shaping Europe's Digital Future
- Europe in the world

Sustainable and Smart Mobility Strategy

EU-RAIL VISION

To deliver, via an integrated system approach, a high capacity, flexible, multi-modal, sustainable and reliable integrated European railway network by eliminating barriers to interoperability and providing solutions for full integration, for European citizens and cargo.



DELIVER AN **INTEGRATED EUROPEAN RAILWAY NETWORK** BY DESIGN

DEVELOP A **UNIFIED OPERATIONAL CONCEPT AND A FUNCTIONAL SYSTEM ARCHITECTURE** FOR INTEGRATED EUROPEAN RAIL TRAFFIC AND CCS/AUTOMATION

DELIVER A **SUSTAINABLE AND RESILIENT RAIL SYSTEM**

DELIVER A **COMPETITIVE, GREEN RAIL FREIGHT** FULLY INTEGRATED INTO THE LOGISTICS VALUE CHAIN

DEVELOP A **STRONG AND GLOBALLY COMPETITIVE EUROPEAN RAIL INDUSTRY**

EUROPE'S RAIL:

ONE INTEGRATED R&I PROGRAMME

SYSTEM PILLAR

OPERATIONAL CONCEPTS

FUNCTIONAL SYSTEM ARCHITECTURE

A SINGLE COORDINATING BODY FOR THE WHOLE SECTOR EVOLUTION

OPEN INTERFACES TO OTHER TRANSPORT MODES AND BUSINESSES

SYSTEM REQUIREMENT SPECIFICATIONS

INNOVATION PILLAR

TECHNOLOGICAL AND OPERATIONAL SOLUTIONS FOR SERVICES OF FUTURE

FLAGSHIP PROJECTS

LARGE-SCALE DEMONSTRATIONS

EXPLORATORY AND FUNDAMENTAL R&I

1	**EUROPEAN RAIL TRAFFIC AND MOBILITY MANAGEMENT**	Manage and improve rail traffic at EU level Adjust rail traffic management in function of the mobility demand
2	**DIGITALISATION & AUTOMATION IN TRAIN OPERATIONS**	ATO implementation Digital train operations
3	**SUSTAINABLE AND DIGITAL ASSETS**	Integrated assets testing & life-cycle framework Zero-emmission, silent rail system
4	**COMPETITIVE, DIGITAL, GREEN RAIL FREIGHT**	New digital customer interaction & innovative rail freight services Multimodal and rail freight innovation integration
5	**REGIONAL RAIL SERVICES IN LOW DENSITY AREAS**	New system approach to regional rail services in low density areas

DEPLOYMENT GROUP

FUTURE SOLUTIONS DEPLOYED IN A COORDINATED AND CONSISTENT WAY AT EUROPEAN LEVEL, TAKING INTO ACCOUNT ALTERNATIVE ROLLOUT SCENARIOS, BEHAVIOURAL AND ORGANISATIONAL CHANGES, SYNERGIES WITH OTHER MODES OF TRANSPORT


DACcelerate
Transforming the European Rail Freight System
Capacity
Productivity
Quality & Safety

The DAC and automation benefits for EU

rail freight sectoral | society & environment

Capacity

Smart capacity, more efficient than conventional extension & much faster

Increasing Infrastructure Capacity

Productivity

Reduction of time/efforts (€),

increase of system speed and asset efficiency

Increasing Rail Freight Efficiency

Quality

Increased flexibility and reliability,

innovative customer services and information

worker's & rail safety

Automation of manual processes,

invest in human capital

Economics & employment

10+ bn EUR value creation in Europe

better work-places in rail

EU Green Deal

- 10 to -20 mn tons CO_2 equiv. p. a.

Delivering the European Green Deal

Interoperability

Competitiveness

new markets and growth

+ 50% rail freight | - 55% GHG emissions until 2030

Use cases: DAC Core system and DAC applications (Full Digital Freight Train Operations)

benefits =

gains in the processes (time, system time, cost savings, capacity, reliability, quality, safety)

+ induced modal shift

DAC Core system

- Automated coupling & manual uncoupling and digital backbone
- Recording of train composition
- Automatic (remote) uncoupling
- Heavier & longer trains (within existing infra limitations)
- Increased payload
- Increased speed via improved longitudinal forces

DAC train preparation

- Automatic brake test & calculation of brake capacity
- Automated technical wagon inspection

DAC telematics (wagon & goods monitoring)

- Predictive / preventive maintenance
- detection of cargo condition
- Cargo surveillance, intrusion alarm
- Wagon data & loading information on mobile device

DAC shunting

- Automated parking brake
- Draining of auxiliary air tanks
- Automated air valve
- Rear view camera for train driver
- Proximity detection
- Sound signals when train in motion

DAC train run

- Tail light (train integrity prior OTI function)
- Train end device (intermediate solution?)
- Vital on train integrity (OTI), enabling ETCS L3 moving block operations
- Increased speed via better braking performance
- Multiple loco traction and trains up to 1500m
- Derailment detection

DAC loading & unloading

- Automatic loading/unloading processes (replacement of hydr/pneum components, electro-mechanical actuators for bridge plates, automated cargo securing, heating elements for defrosting, …) via ext. energy supply
- illumination for worker's safety & interior

DAC: state of play

- **EDDP participation** increased to more than **80 actively participating companies**
- **ER JU FP5 TRANS4M-R** project has been **awarded** and **started,** with 27 Beneficiaries/71 partners,> 100 Mio. TPC, 2022-2026
- **DAC4EU project** will **continue** its work

- **Scharfenberg design** selected as a EU-standard (09/21), inclusion of DAC in the technical report of **TSI revision 2022** (05/22)
- **DAC specification (mechanical/pneumatical)** far progressed and transferred to EU-Rail Flagship Project 5
- **DAC specification "energy"** closed and transferred to FP5, **DAC spec "communication"** to be closed asap in FP5 after tests

- **DAC target operational procedures** nearly ready for the first use cases (first EU-harmonised basis ever)

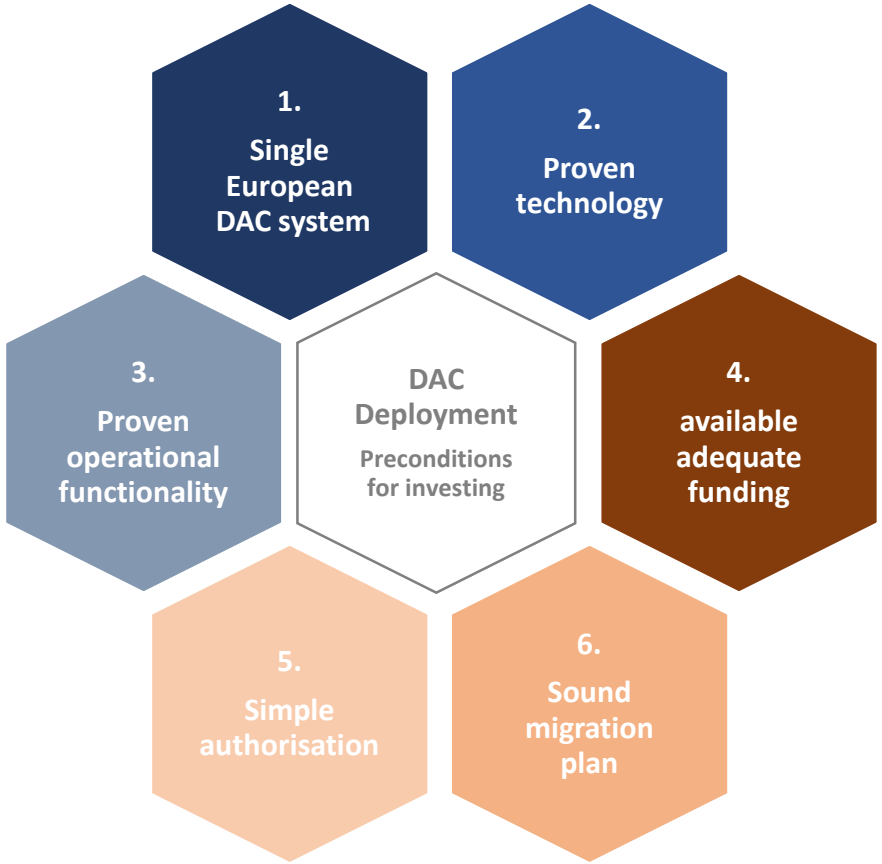
- **Operational DAC tests** (enabled by DAC4EU) took place in European countries
- Development of solid and feasible **migration scenarios** (first time ever in Europe)
- Analysis on impact on workers (worker's safety, new job profiles / skills)
- **Cost-Benefit Analysis under sector consultation** (until 31/10)
- Ongoing work on a **European Investment Plan for DAC**

- Intensified **dissemination activities** (e. g. SEE/CEE)
- **Further developed EDDP structure** complementing EU-Rail's Innovation & System Pillar activities on DAC

DACcelerate

This project has received funding from the Shift2Rail Joint Undertaking under the European Union's Horizon 2020 research and innovation programme under grant agreement no. 101046657.

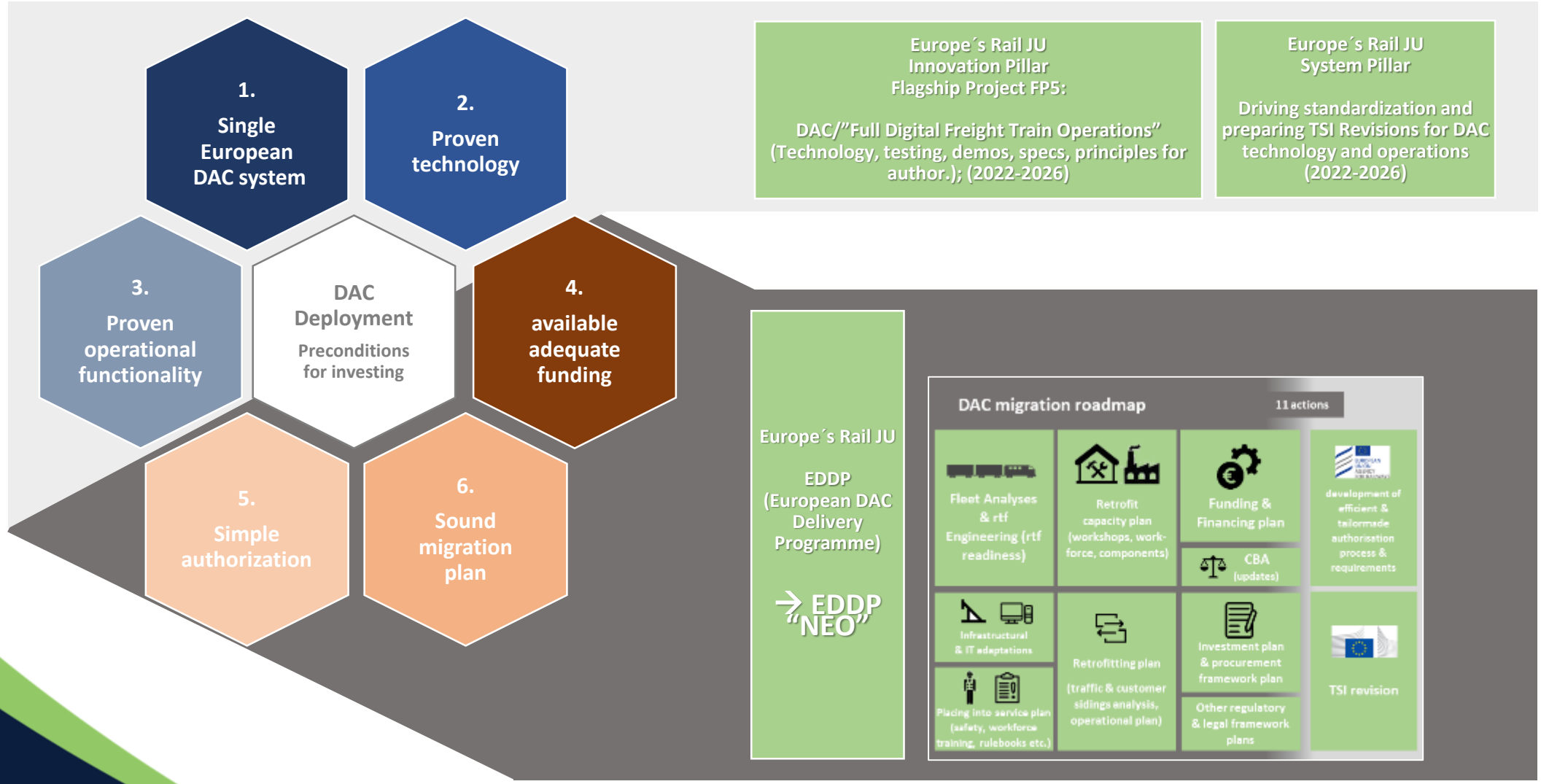
Preconditions for investing in DAC deployment
(= everything that needs to be proven before investment decisions will be taken)



1. DAC-Technology (incl. additional DAC based technology) and DAC-operations/functionalities are clearly defined (tech. package) and **harmonised (Single European DAC System)**
2. The **technology** meets all essential requirements - in particular in the area of RAMS (reliability-availability-maintainability-safety/security) - proven through large demonstrations
3. The **operational functionalities/use cases** bring the expected benefits - proven through large demonstrations incl. safety aspects
4. Positive **CBA incl. adequate funding programs** (by EU and MS) are made available and guaranteed
   - to all European wagon and locomotive operators (RU) and keepers (as they will have to invest)
   - in order to generate positive business cases in a maximum 10y perspective
   - considering the individual/regional conditions such as the cases where upgrading is not possible/feasible
5. Simple, tailor-made **"fast-lane" authorisation** procedures are available & authorization risks are mitigated **procedures** for wagons and locos (incl. availability of relevant documentation)
6. A **sound migration plan** is set, guaranteeing simultaneous deployment in Europe (sector agreement and legal framework) based on available and adequate funding programs, established capacities for production and upgrading of wagons and locomotives, staff training, and availability of the necessary infrastructure and IT adaptations

The DAC initiative is built on several elements

we need to focus on the overall picture in order to achieve progress



- ✓ Implemented
- ➢ Risks: Resources and timeline

- ➢ EDDP "neo" to be launched
- ➢ Structure and elements of plan are agreed
- ➢ Migration Roadmap services not yet implemented
- ➢ Call for management services for migration roadmap
- ➢ Main elements are still not yet funded nor resources are secured → time critical !!!

Future interconnection of all DAC-related activities elements to be worked on

Europe's Rail Flagship Project 5	EDDP «neo» development/follow-up of migration roadmap, sector– wide coordination, risk management, prep. of decision-making	EC/ERA	Europe's Rail System Pillar	ESOs

DAC/"Full Digital Freight Train Operations"

target operat. proc.
functional requ'mts
system architecture
tech. development
testing & demos
tech. specification
authoris. dossiers

FP 5 FDFTO sounding boards

Technology (mirroring & sector feedback)

Operational Procedures (mirroring & sector feedback)

DAC migration roadmap

11 actions

- Fleet Analyses & rtf Engineering (rtf readiness)
- Retrofit capacity plan (workshops, work-force, components)
- Funding & Financing plan
- CBA (updates)
- Infrastructural & IT adaptations
- Retrofitting plan (traffic & customer sidings analysis, operational plan)
- Investment plan & procurement framework plan
- Placing into service plan (safety, workforce training, rulebooks etc.)
- Other regulatory & legal framework plans

development of efficient & tailormade authorisation process & requirements

TSI revision

operational procedures standardisation (plan & execution)

Technical harmonisation: preparing TSI revision & driving EU standardisation

alignment of rail & DAC system architecture

Executing European standardisation

DAC current challenges

1. Target **operational procedures** (shunting, train prep, train run) based on consolidated use cases
2. Critical **technical points/issues list and open points for decision** (techn. package, e-coupler design,…)
3. **Transition** EDDP→ EDDP neo + ERJU FP5+SP (incl. ramp-up)
4. Starting work on tailor-made **“fast-lane” authorization** procedures are available & authorization risks are mitigated **procedures** for wagons and locos (incl. availability of relevant documentation)
5. Key **stakeholder outreach** (in particular SEE/CEE) as well as “daily” **management**
6. **Migration Roadmap** (fleet analysis !!!, capacities of workforce and workshops, resources for migration plan development etc.)
7. **CBA/ funding** financing (setting the scene)

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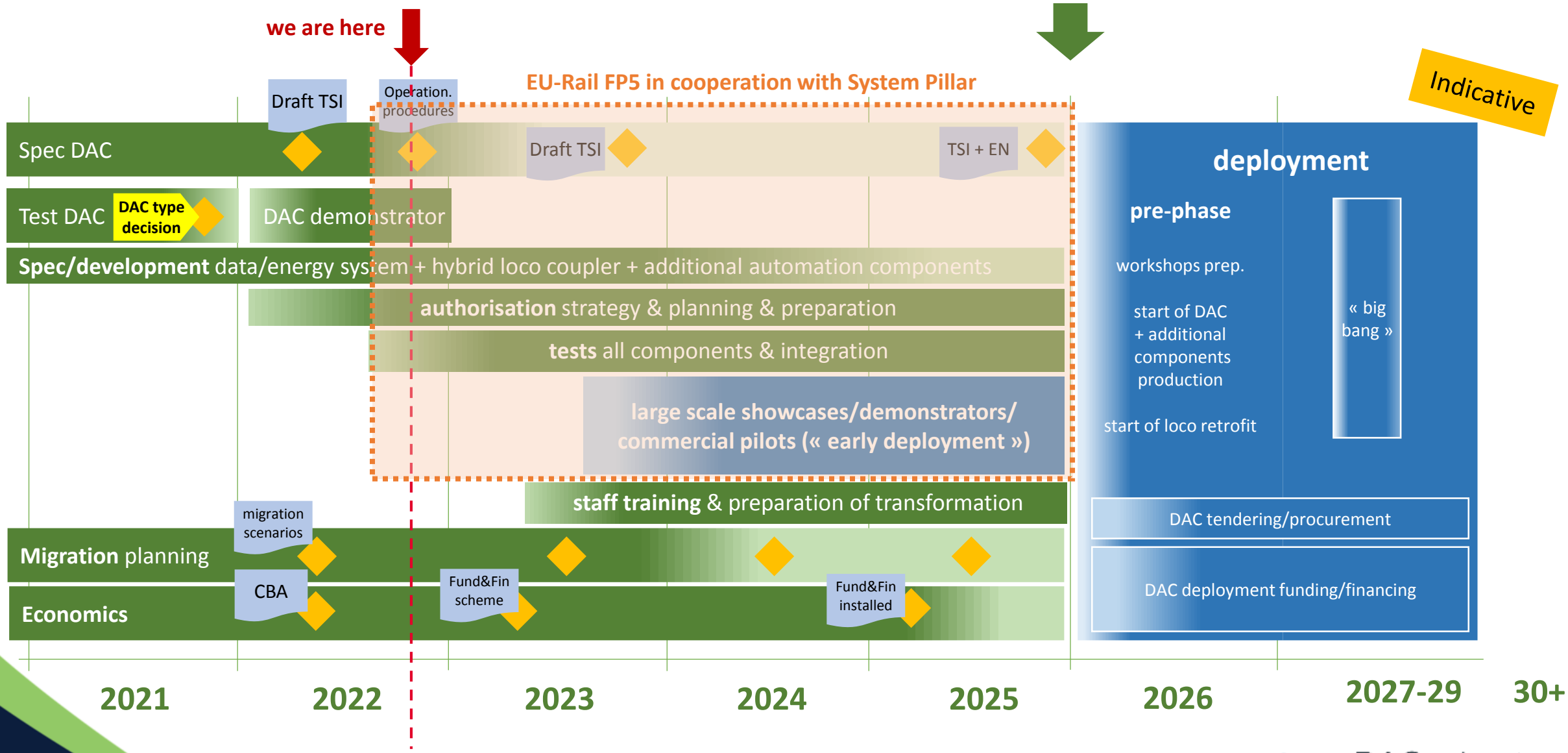
European Investment Plan: status update

- **EY** has been **contracted** by **Europe's Rail** to work on a study " European Investment Plan" in Feb 2022
- The study **builds upon work of EDDP** WP3 Migration and EDDP WP5 CBA
- Baseline findings:
  - **No funding / financing** plans **available** at EU level yet
  - **No coordinated** and consistent **deployment** at European level established **yet**

- **Alternative models based on limitations are analysed** for: EU/MS grants, EIB, subsidies during ramp up phase operations, stakeholders' equity /debt
- **Assessment criteria for alternative options**: fragmentation of sources, engagement risk, transaction costs, funding / financing risk, financial sustainability for the EU DAC migration plan, necessity of subsidies during ramp up phase, requirement of a financial vehicle (SPV), etc.
- **Common conditions:**
  - Establishment of a **central** and **single control booth** to **manage complexity** and **synchronization** of the DAC **migration** plan across all the EU Stakeholders
  - **Public funding optimized** to address the market failure and by **avoiding over-subsidization** and **distortion** of **competition** of any kind

Indicative overall time plan

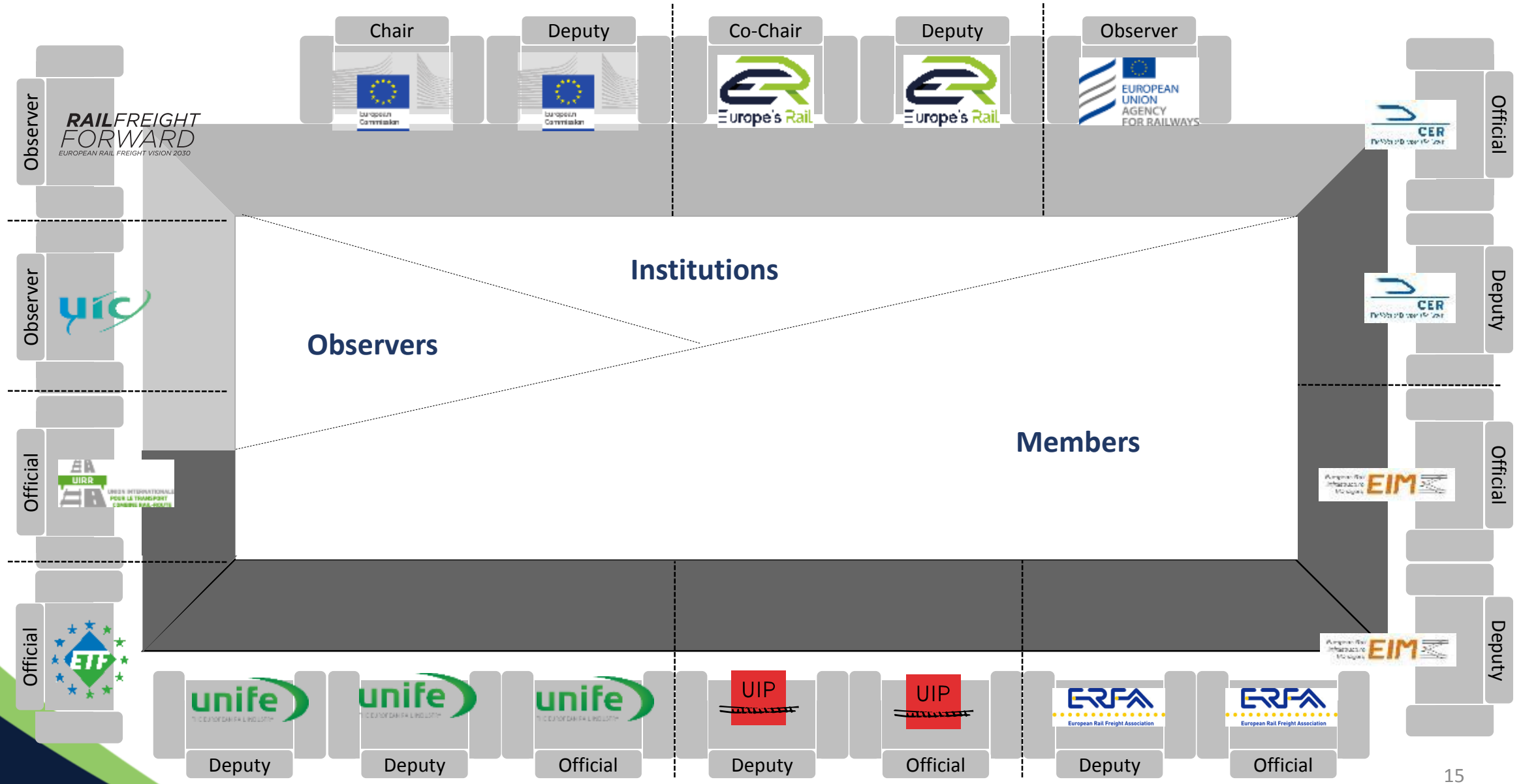


DACcelerate

Europe's Rail

EDDP Governance – Programme Board

EDDP Governance – Supervisory Board



EU DAC Governance – programme and WPs

Programme Management

Mark Topal-Gökceli (ÖBB)

Jens Engelmann (railiable)

WP 1	WP 2	WP 3	WP 4	WP 5	WP 6	WP 7	WP 8
Technology, Operations and Standardisation	Testing & Demonstrators & Pilot Projects	Migration	Rail System Capacity and Green Deal	Costs, Business Cases and Financing	Communication and Dissemination	Intelligent Rail Freight	Authorisation strategy

Tests and validations within S2R IP5

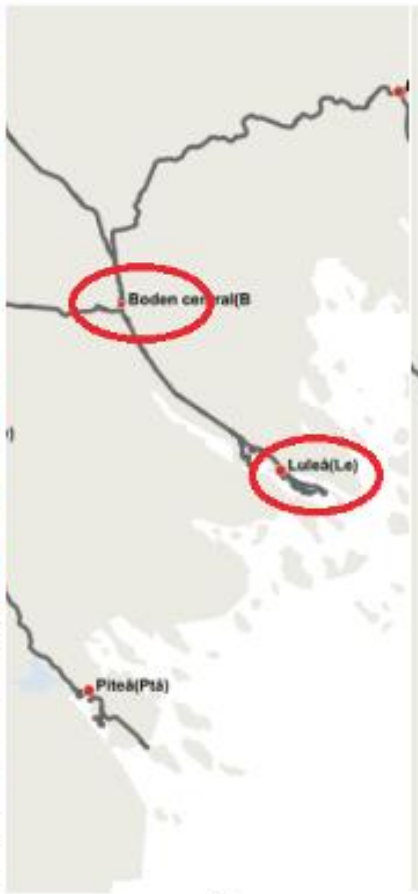
Aims & Goals

- Test the different DAC Prototypes in preparation for the selection of the future DAC standard at an EU level.
- At second stage focus on testing the selected Scharfenberg Latch type to assure product adherence to specifications.
- Test DAC integration with locomotives in hybrid DAC versions.

Winter tests in Sweden

DAC tests in FR8RAIL IV led by Trafikverket

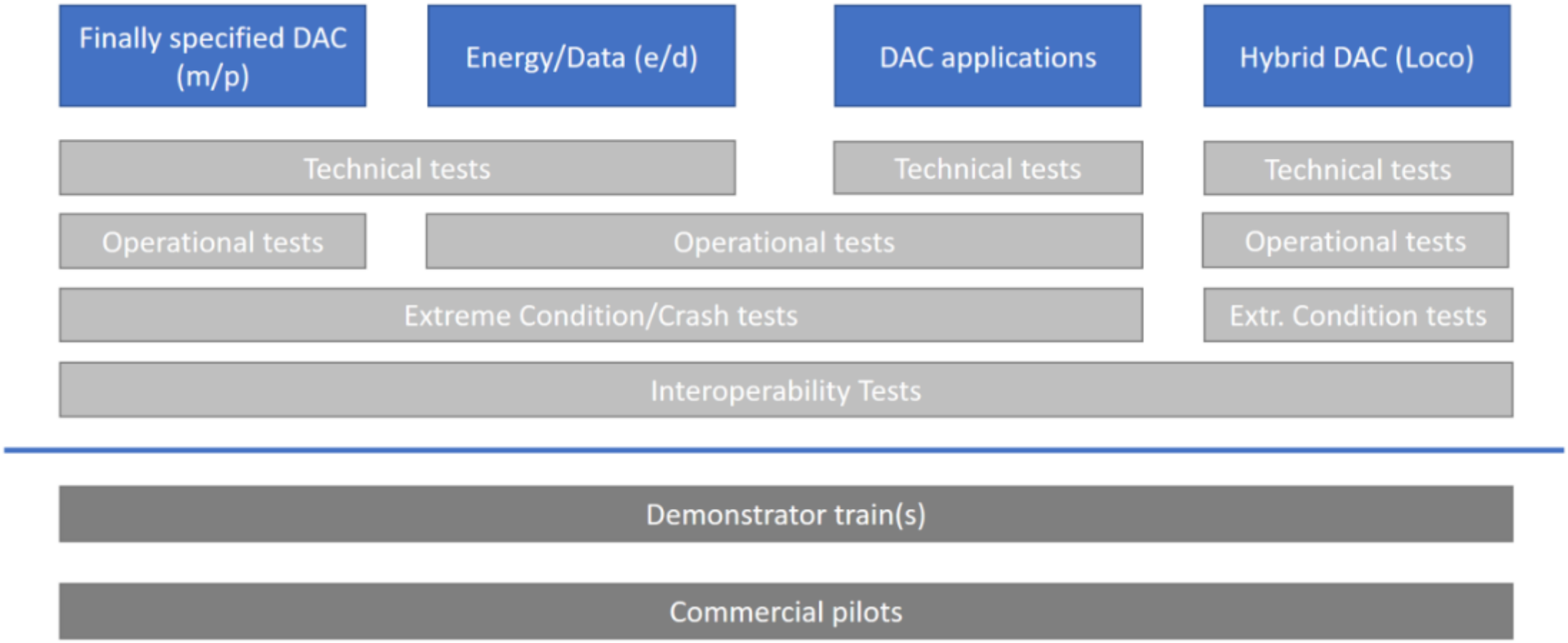
Test tracks



1st campaign (A)

2nd campaign (B)

Next: Test Programme to ensure market ready DAC



Europe’s Rail

Delivery of the demonstrators validating:

- Full Digital Freight Train Operations based DAC Type 4 in different regions with several train sets under real operational condition including technical enablers
- energy supply & data/communication solution
- Type 5 upgradability,
- Retrofitting process of existing wagons with DAC technology and existing locomotives with
- Hybrid DAC

- DAC-based telematic applications for: transported goods monitoring, asset performance management, condition-based management, distributed power system and electro-pneumatic brake.
- Yard automation equipment, wagon identity system allowing automatic shunting, video gates and way side check points with visual recognition and AI tools for yard automation.

Demo trains

Sweden

Norway

Germany

Austria

Italy

Switzerland

Europe's Rail


DB
ermewa
GATX
Rail Cargo Group
Member of ÖBB
SBB CFF FFS Cargo
VTG
Europe's Rail
In collaboration with
EUROPEAN DAC
DAC4EU
Bundesministerium
für Digitales
und Verkehr
Testing the DAC in Operation throughout Europe
European DAC Day
Prague
2022-10-04

Project Overview
Schedule

Start of project & modification of wagons

Decision for coupler head design

Finalization Phase II – Operational Testing

Finalization of project

Phase I

Tests of 4 coupler designs

Phase II

Testing in real operational scenarios

Phase III & IV

- extension of the initial project
- necessary for further development of designs

Phase I – Design Evaluation

Single Coupler Tests

- Dedicated test site

- Climate chamber
  - Dry and wet
  - -25°C to +40°C
  - Snow and ice

Outcome:

- 2000 individual tests
- 200 climate tests

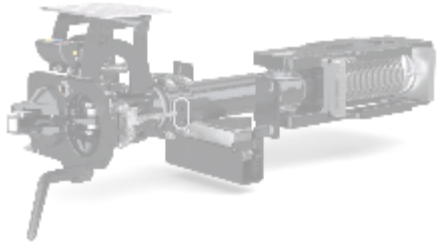
→ For KO-workshops

Phase II – Operational Testing
Coupler Configuration

Decided for the Latch-Type / Scharfenberg Coupler Head

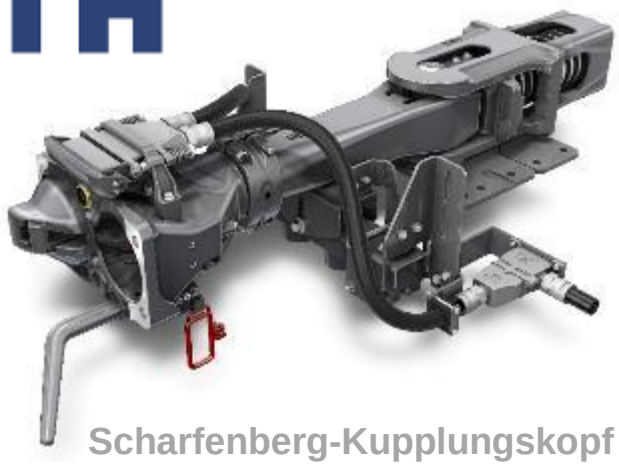
- 84 organizations
- > 232 participants
- from 20 countries

Generation 1



Generation 2

Latch-Type-Kupplungskopf



Scharfenberg-Kupplungskopf

Phase II – Operational Testing

Wagon Composition

Eanos x-059

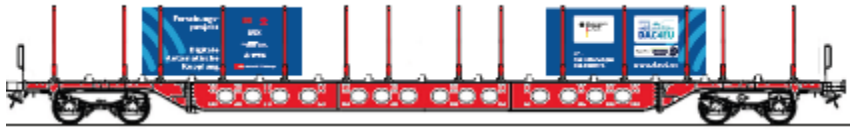
EX90 Fanps

Zags 119

Sgmmns 40

Hbbins 306

m^2 -wagon

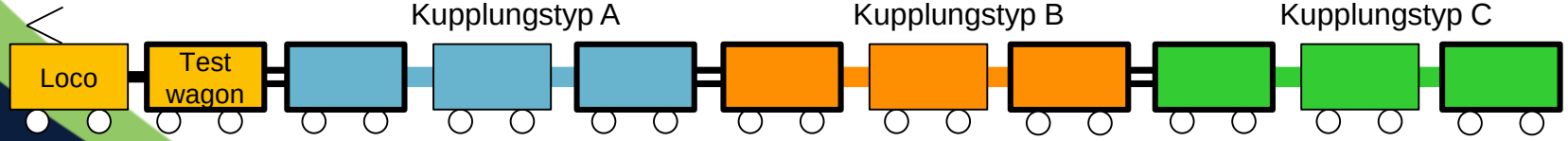


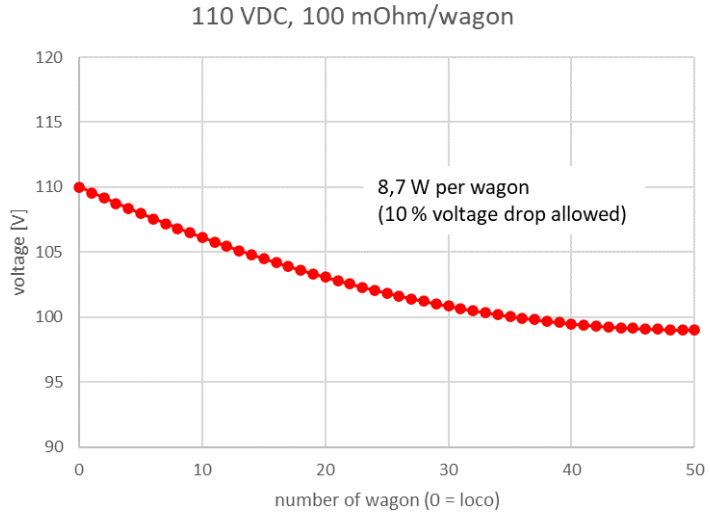
Phase II – Operational Testing

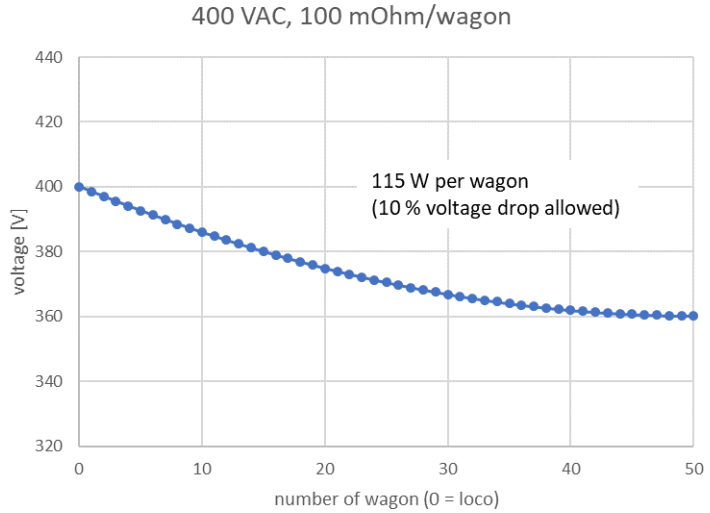
Results Power Transmission

Based on the tests, we could show:

- For 110V DC only ~9W per wagon in 50-wagon-configuration available
- Changing voltage to 400V AC enables 115W per wagon
- *Calculation based on 16mm² cable cross section with a voltage drop of 10% from loco to last wagon (e.g. EN 50388:2012)*



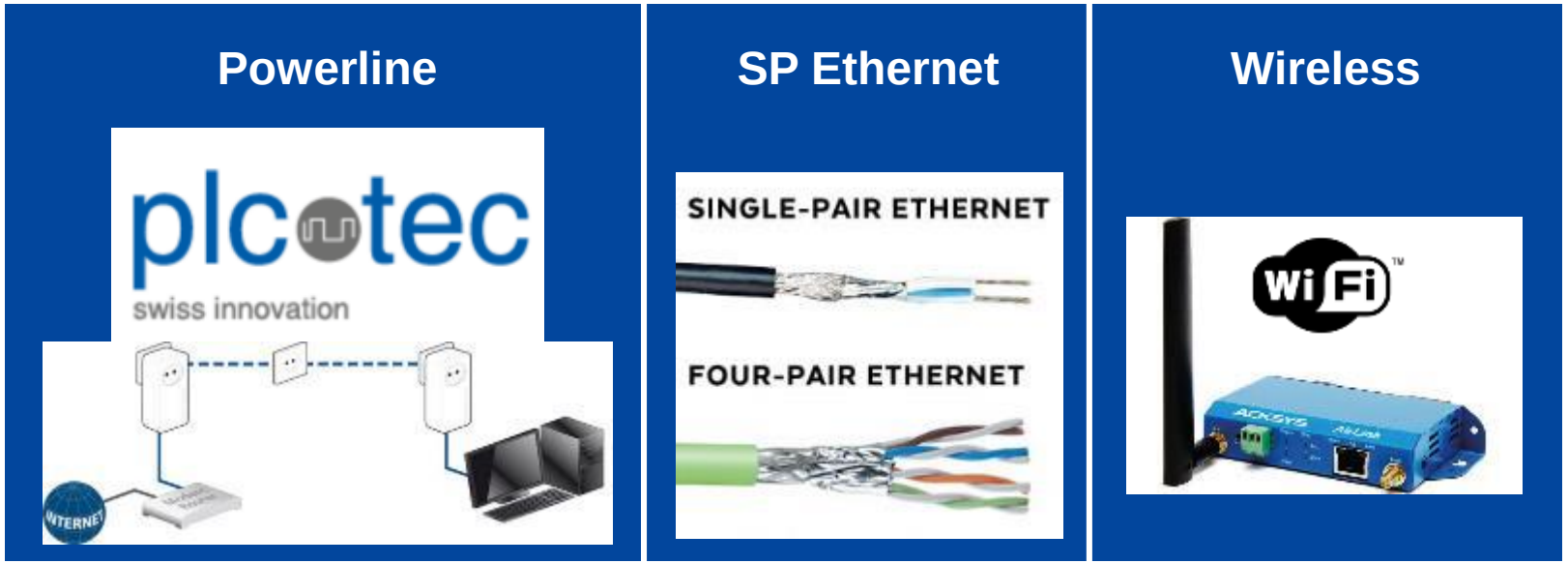


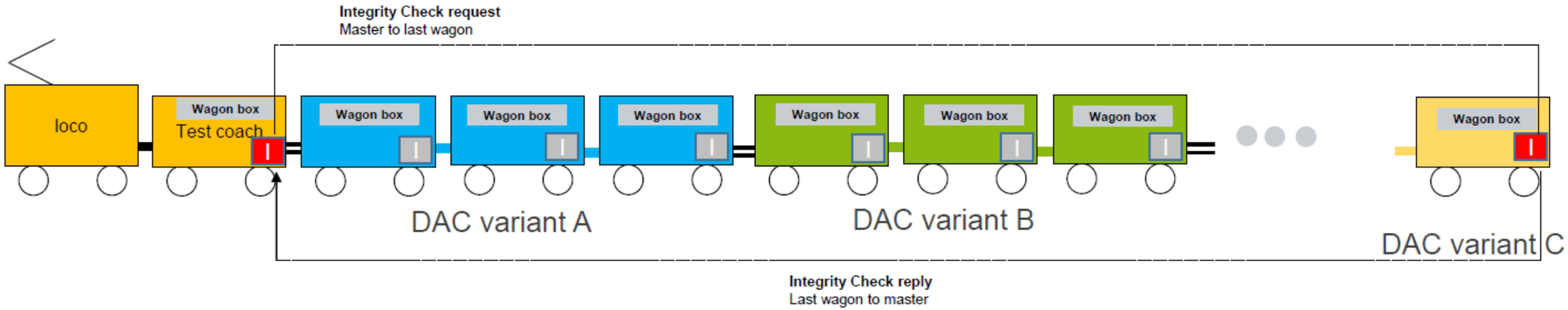


Phase II – Operational Testing

Data Communication

- Performance and reliability
- Show cases for:
  - train integrity
  - train inauguration
  - wagon order and direction



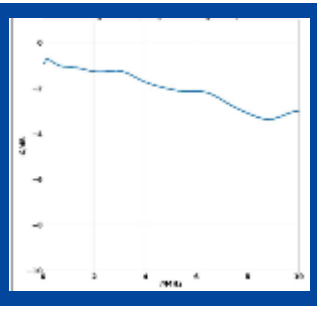


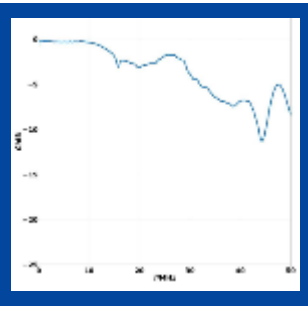
Phase II – Operational Testing

Results Data Communication

static tests

measurements of physical channels





- communication possible with all systems
- slight differences between coupler types visible

performance measurements with communication systems over different DAC

data rate: **1 – 6 Mbit/s**
package rate: **330 – 2600 p/s**
latency (RTT): **6 – 200 ms**

(12 wagons)

- requirements fulfilled by WiFi, CAN-FD, Powerline-PLUS and SPE
- differences in bandwidth and latency independent of coupler

dynamic tests

- detailed analysis of data
- if needed adjusting the measurement setup

further tests needed

- strengthen the communication systems
- modifying the contacts

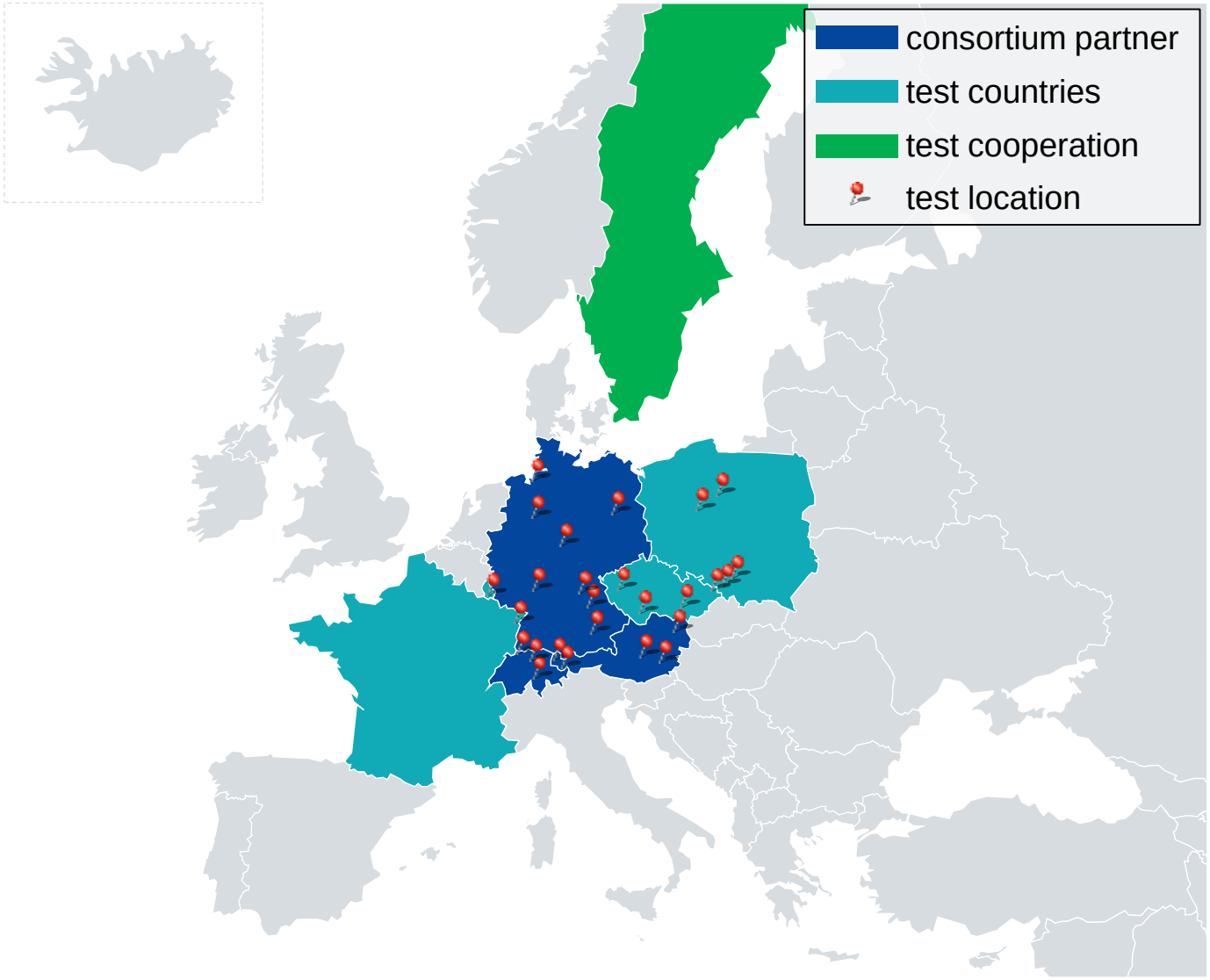
tests of improved systems during **test runs**

Goal:
highly robust and reliable communication system

Phase II – Operational Testing

Testing in Europe

- over 25 test locations in 7 countries
- tests in France and Luxembourg planned for end 2022
- close exchange with Trafikverket (Sweden)
  - winter tests
  - high mileage testing



→Operational requirements for DAC all over Europe

Phase II – Operational Testing

Testing in Czech Republic

Thanks to support from ČD Cargo we were able to test in Czech Republic as well

- yards for shunting tests
- drives for running tests
- mostly running with double traction
- extensive and well-organized program

Conclusion:

- we could further confirm our findings
- by chance testing at high temperatures

Phase II – Operational Testing

Intermediate Conclusion Operation

- 3 major technical/ operational requirements were identified

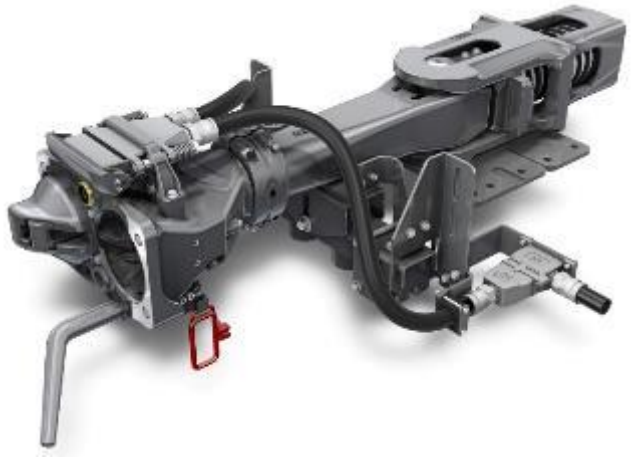
uncoupling from side of wagon	blocking of re-coupling	prepared for Type 5
• otherwise uncoupling while wagons are moving not possible • much easier and more efficient handling	• allows for pushing of wagons • for marshalling yards with a hump absolutely necessary • must be disengaged automatically	• goal is to enable full-automatization • DAC type 4.5 tests showed big potential for usage of actuators • avoid several migration waves

! For all three points there is a prototype

→

?
- no prototype fulfills all three at the same time
- integration into wagon and infrastructure must be improved

Further development and continuation of testing is absolutely necessary



Bundesministerium
für Digitales
und Verkehr

Europe's Rail

DAC4EU

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DB ermewa GATX Rail Cargo Group Member of ÖBB SBB CFF FFS Cargo VTG

How to deploy DAC in Europe?

DAC technology

EUROPEAN DAC DELIVERY PROGRAMME
Enabled by Shift2Rail

'Scharfenberg' latch-type design selected for future Europe-wide Digital Automatic Coupling (DAC) standard coupler head

DAC data/energy

DAC mechanical/pneumatical

DAC 4: manual uncoupling
DAC 5: automatic uncoupling

DAC migration/deployment scenarios

Principles:

- **No compatibility between screw coupling and DAC**
- **No hybrid couplers for wagons**

- Migration period as short as possible (2026-2030)
- Scope: in principle all wagons.
  Exceptions to be defined
- Locos to be retrofitted before migration with hybrid loco couplers

- **Preparatory measures** for production of DAC and retrofitting capacities **before migration**
- Aligned and available funding / financing & regulation (e.g. TSI= for synchronised migration in Europe)

"Instruments"/methods/tools

for feasible operational/technical/economical deployment:

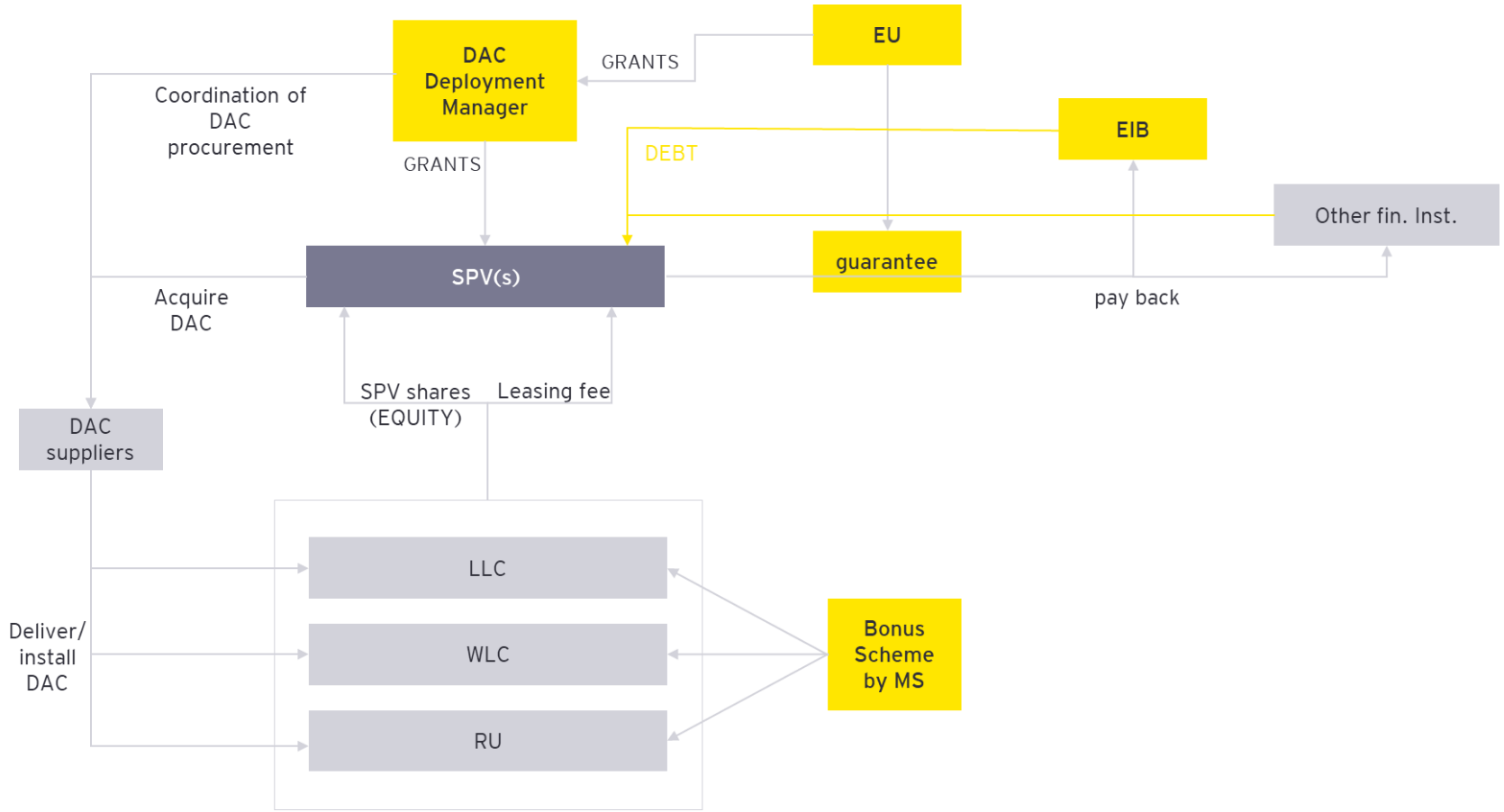
- **Block trains, closed systems**, etc. :
  migration in continuous **step-by-step approach**
- **Mixed/network traffic**: migration in **"Big Bang" approach**
  (max. preparation, min. migration time)
- **"DAC-ready":** prepare wagons during regular maintenance and then DAC "plug and play conversion" during Big Bang

- Some tricks, as "wagon pairing" and "swapping"

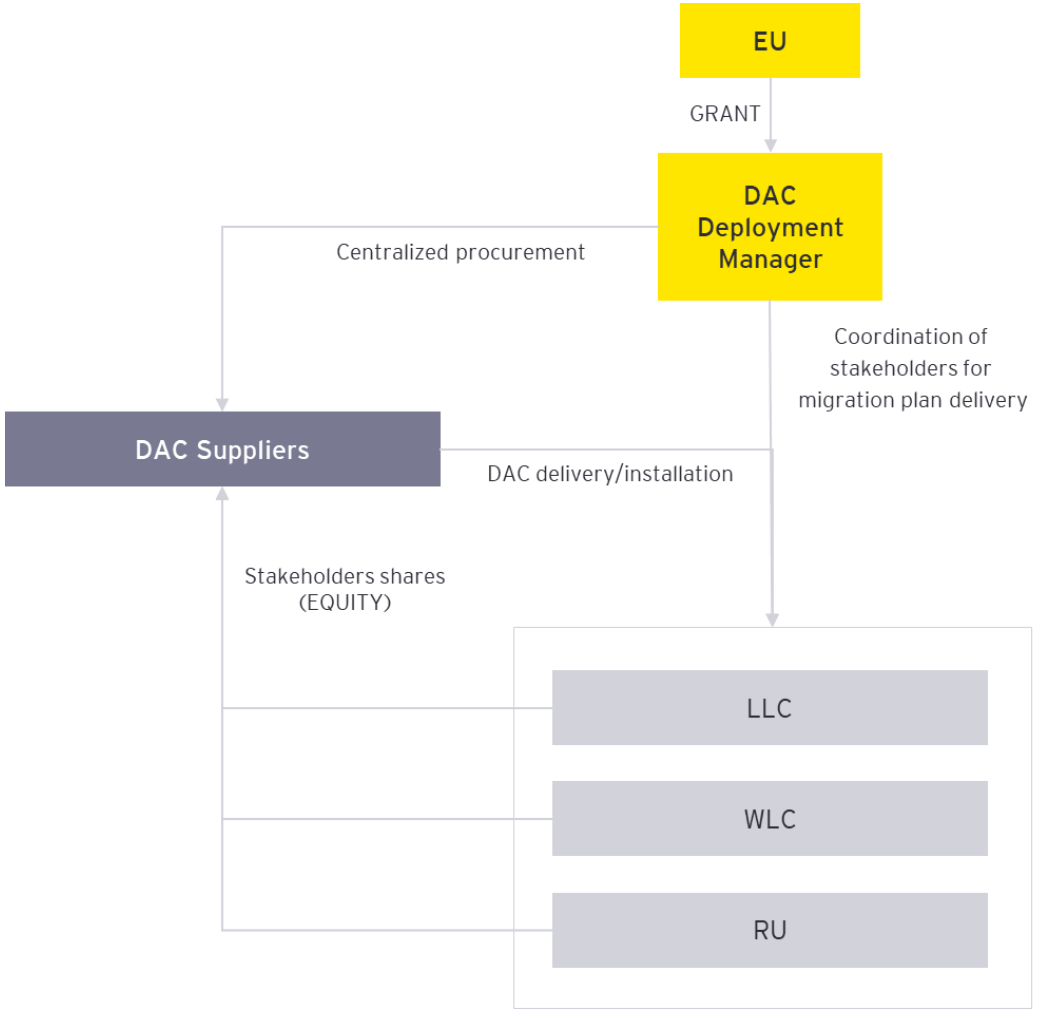
- *Wagon pool for exchange wagons during workshop stay (funded)*
- *Scrapping bonus*

Initial concepts about Investment Plan

Blended financing (draft)



Up-front public funding (draft)



What we need urgently

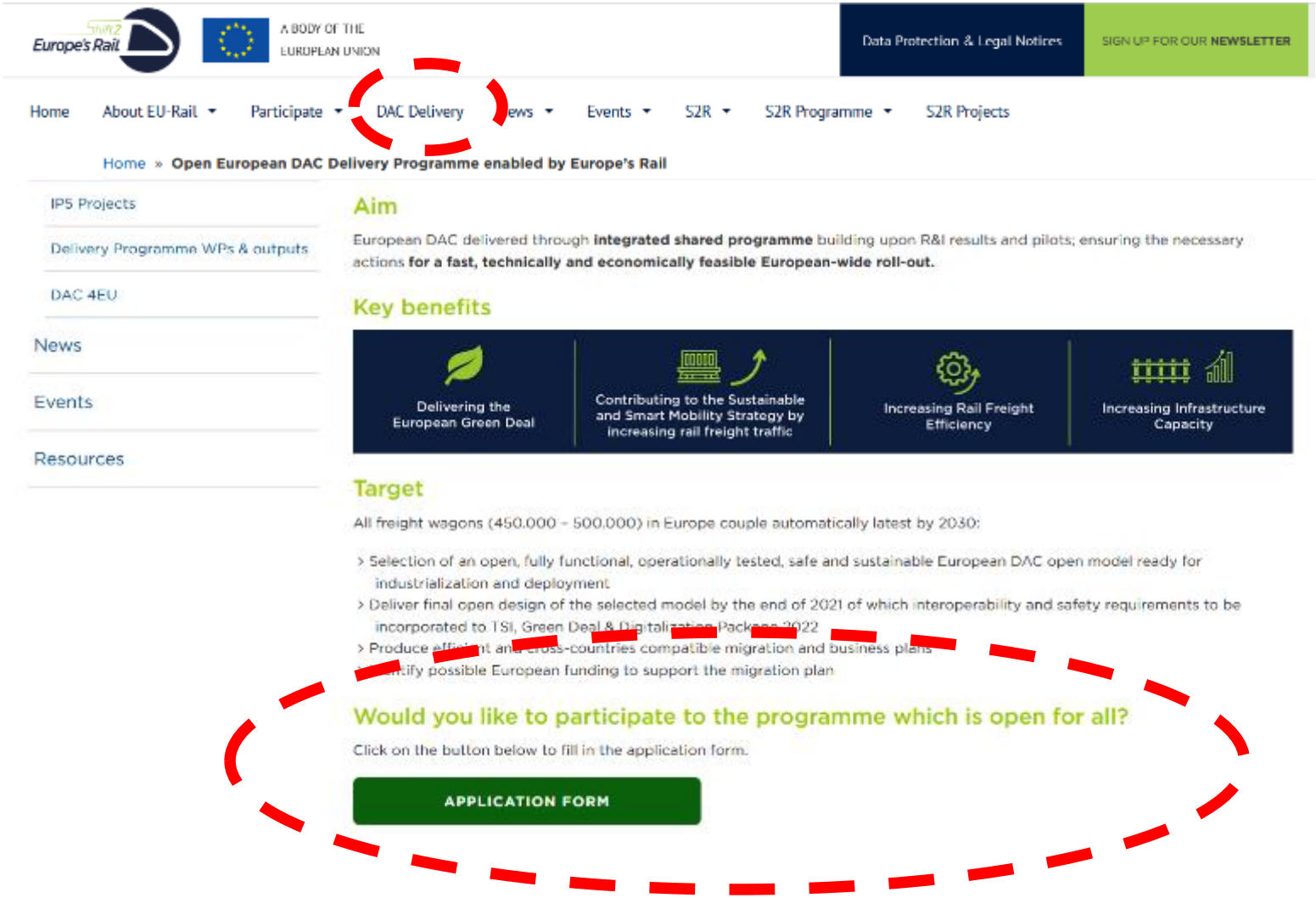
In-depth cooperation on

- Fleet analysis (loco & wagons): technical, age, …
- Workshop & workforce analysis
- Traffic & operations analysis
- CBA & funding/financing

We would like to welcome you all on board!

A single entry point for all Europe and beyond

https://rail-research.europa.eu/european-dac-delivery-programme/



EUROPE'S RAIL JU:

RAIL RESEARCH AND INNOVATION TO MAKE RAIL THE EVERYDAY MOBILITY

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