Shift2Rail: Innovations contributing to noise and vibration reduction

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CCA Programme Manager

S2R Joint Undertaking

S2R OBJECTIVES

+50%

INCREASE RELIABILITY & PUNCTUALITY **BY 50%**

x2

DOUBLE RAILWAY CAPACITY

HALVE LIFE-CYCLE COSTS OF RAILWAY TRANSPORTS

CONTRIBUTE TO **REDUCTION OF NEGATIVE EXTERNALITIES**, SUCH AS NOISE, VIBRATIONS, EMISSIONS & OTHER ENVIRONMENTAL IMPACTS

CONTRIBUTE TO THE **ACHIEVEMENT OF THE SINGLE EUROPEAN RAILWAY AREA**

S2R PROGRAMME, ABOUT € 1BLN and A NEW APPROACH TO R&I IN RAILWAY

working together & driving innovation

Shift2Rail

28
MEMBERS

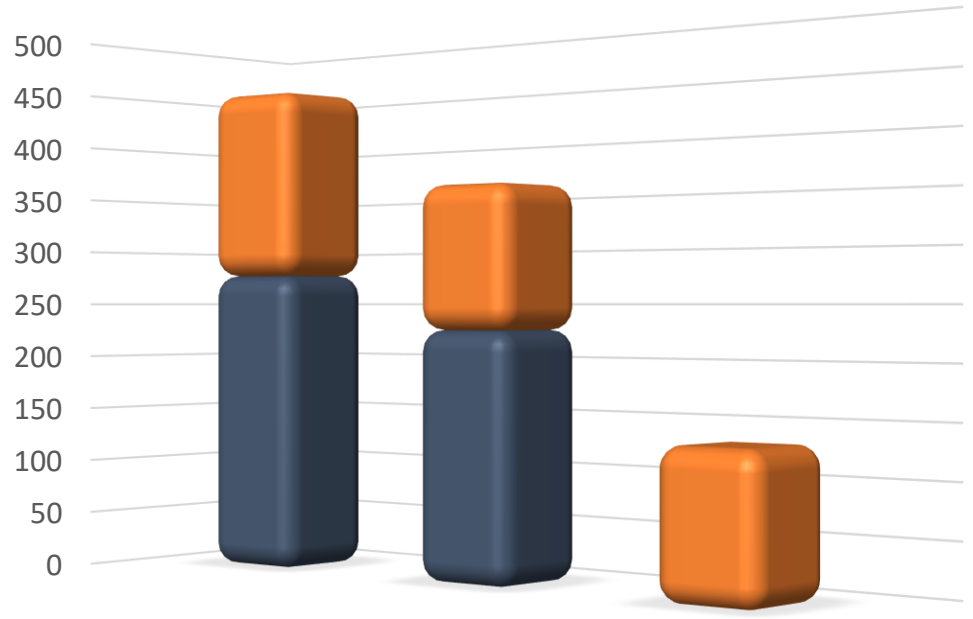
375
PARTICIPANTS INVOLVED
FROM **28** COUNTRIES

101
SMEs

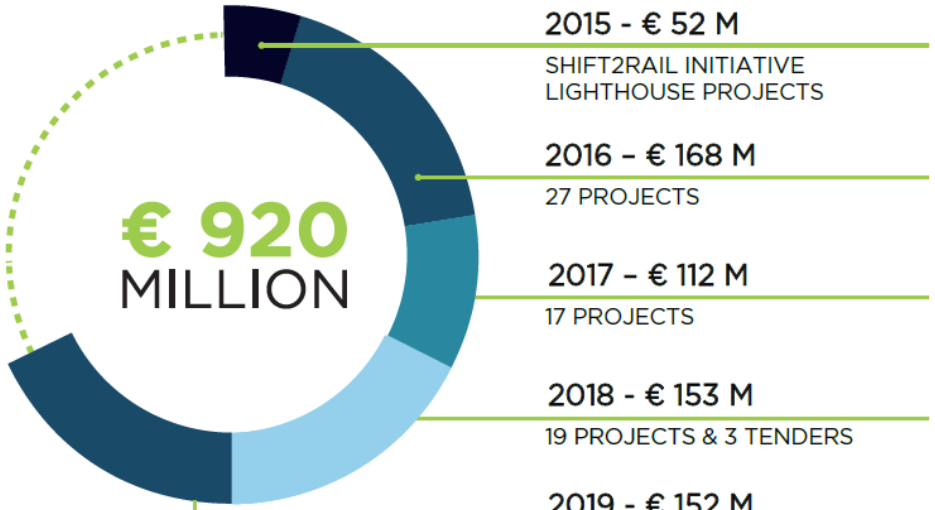
103
RESEARCH CENTRES
AND UNIVERSITIES

[1]Data extracted from CORDA database in February, 2019

AN OPEN and ACTIVE ORGANISATION



Values as at 1 Sept 2016 in Million EUR



2015 - € 52 M
SHIFT2RAIL INITIATIVE
LIGHTHOUSE PROJECTS

2016 – € 168 M
27 PROJECTS

2017 – € 112 M
17 PROJECTS

2018 - € 153 M
19 PROJECTS & 3 TENDERS

2019 - € 152 M
18 TOPICS & 4 TENDERS

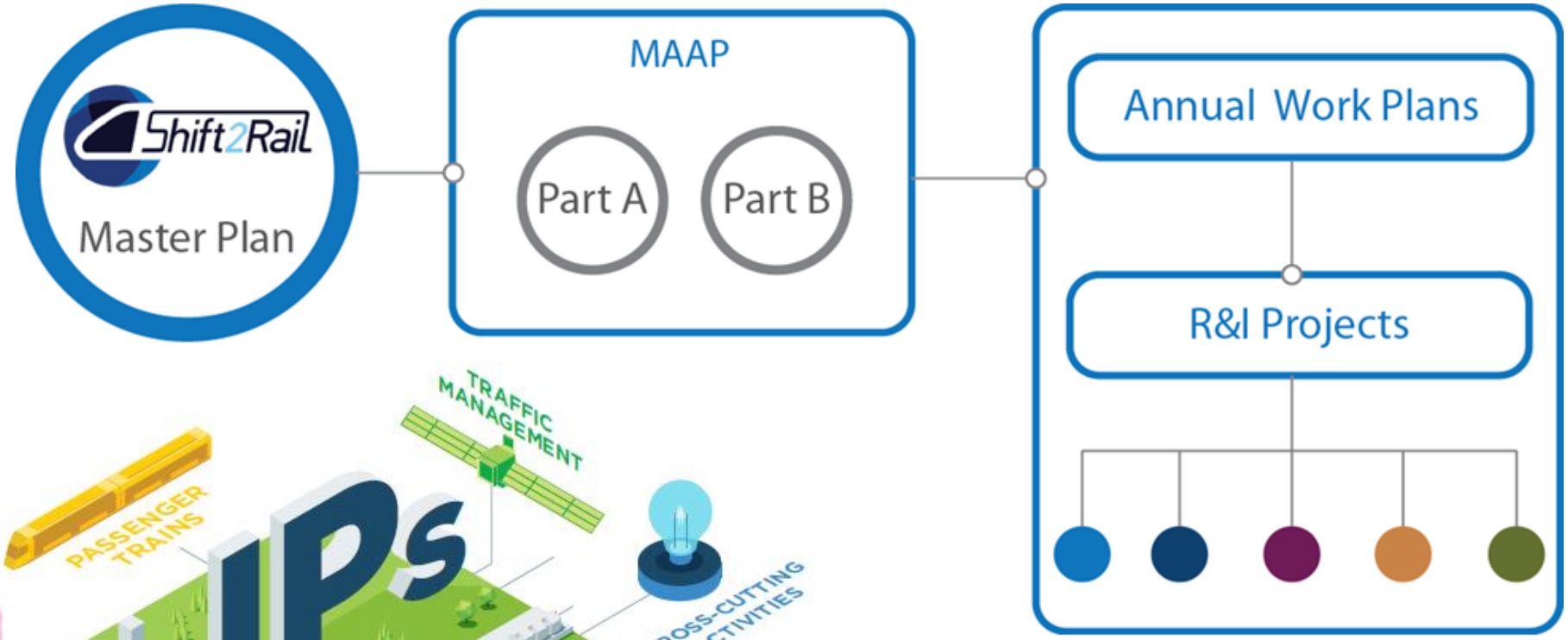
*incl. at least 120M€
of additional activities

Shift2Rail

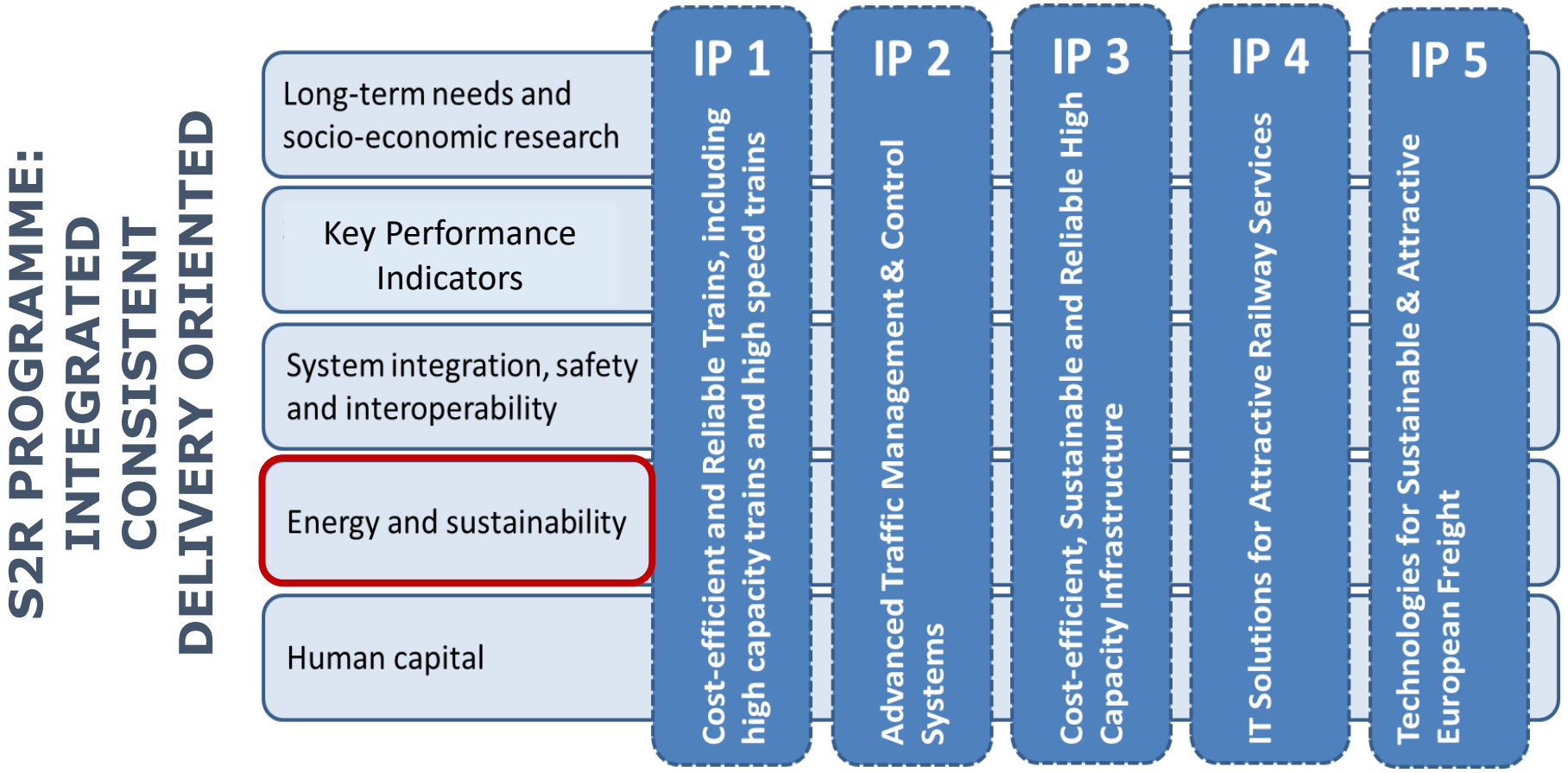
USER FIRST

…opening up new Capabilities coming from emerging technologies or concepts!

The S2R Programme implementation



R&I FOR INNOVATION CAPABILITIES



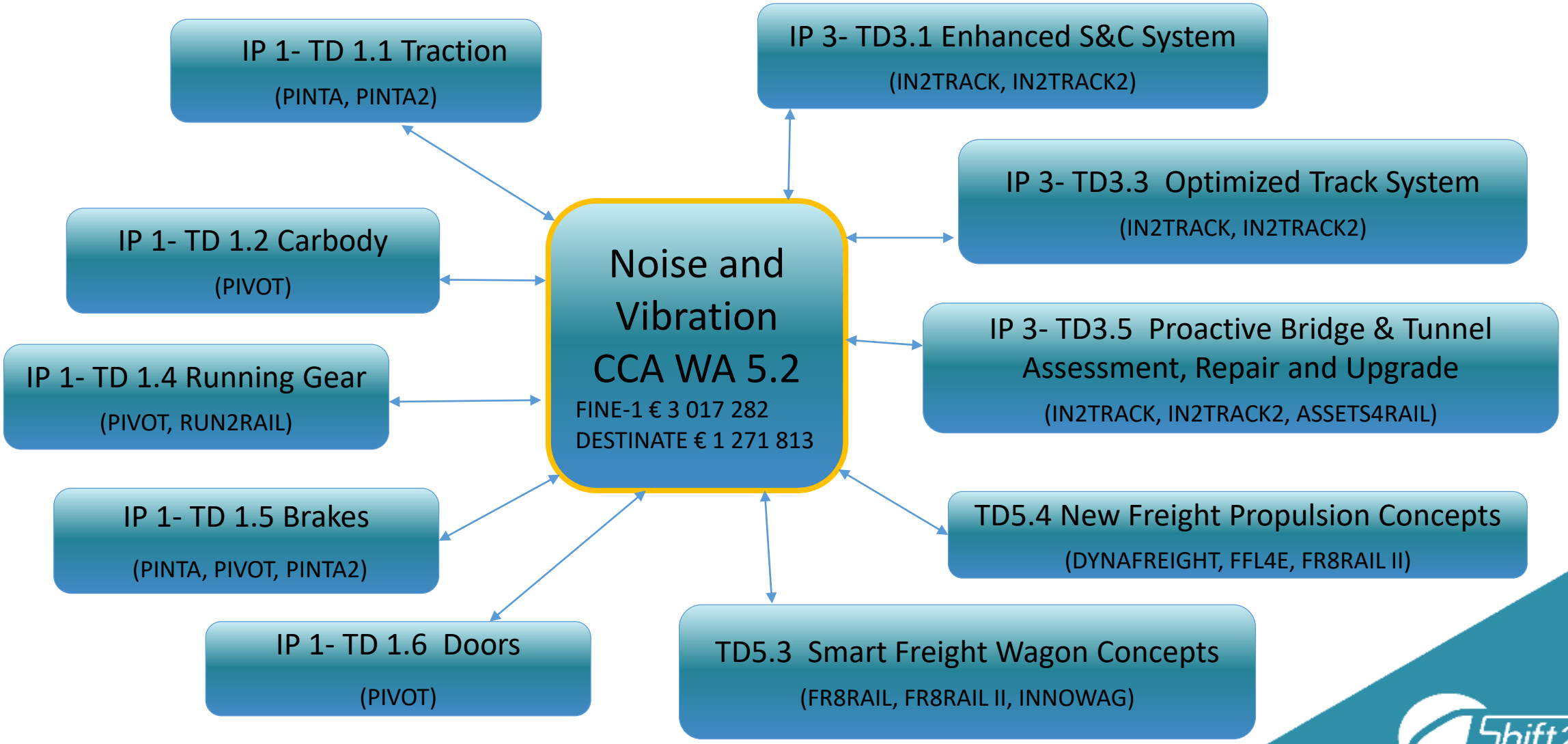
S2R objectives on Noise & Vibration WA

N&V represent one of the **biggest environmental challenges** for the railway. The end result of this work area is to **reduce the annoyance** and exposure to noise and vibration related to the railway sector in Europe. To facilitate effective **N&V management**, it is crucial to apply an **overall system approach and enable efficient mitigation actions**.

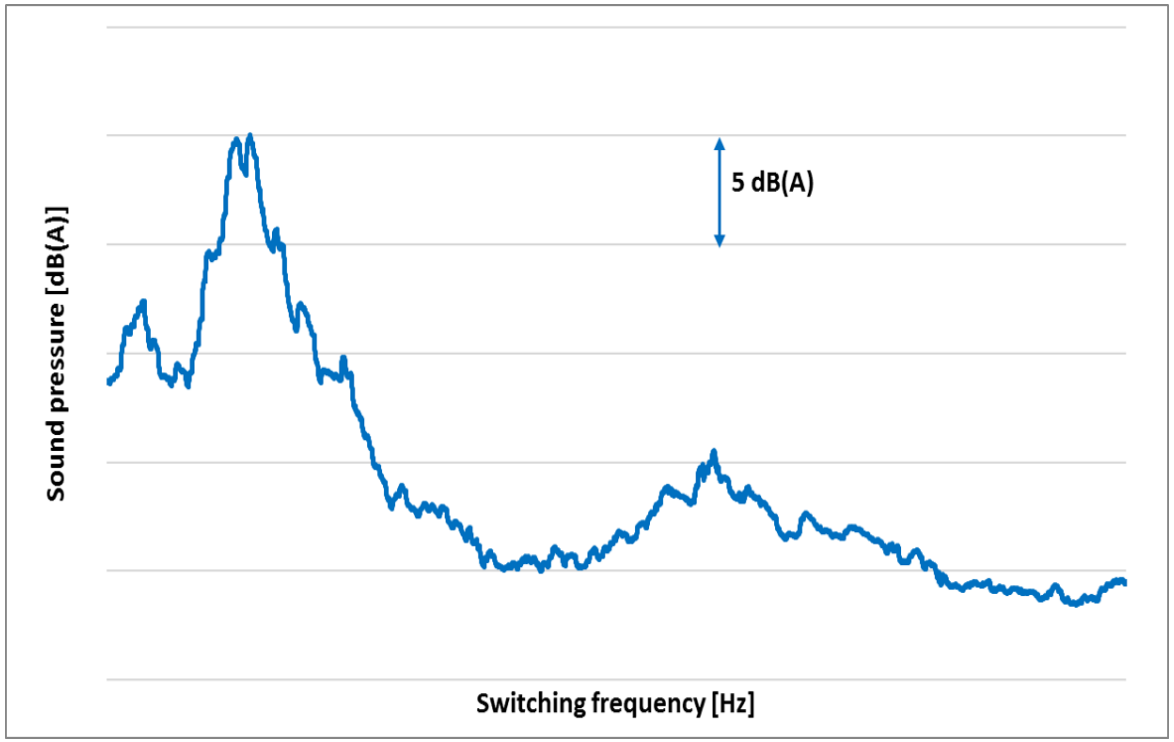
- Develop practically useful methods for predicting noise and vibration performance on system level including both rolling stock infrastructure and its environment.
- With an accurate ranking and characterisation of each contributing source it will be possible to optimise cost benefit scenarios.
- Ensure that N&V needs are properly considered and integrated in all relevant Technology Demonstrators within the different S2R IPs

N&V mitigation contribute to strengthen the railway sector by improving passenger comfort and facilitating efficient product development.

Noise and vibration activities in S2R



Traction noise - Reduced tonality of motors with new technology



- Introduction of SiC convertes in PINTA allows higher switching frequncies to be used (ie the rate at wich the voltage is switched, pulsing DC to AC.)
- Higher switching frequncies reduces the tonal electromagnetic noise consdierably.

PINTA

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Traction motor cooling noise

Before:

- Over-dimensioning of cooling fans
- Little design for noise at concept level

Now:

- Validated aero-acoustical CFD simulations
- Iterations and optimizations since concept

PINTA

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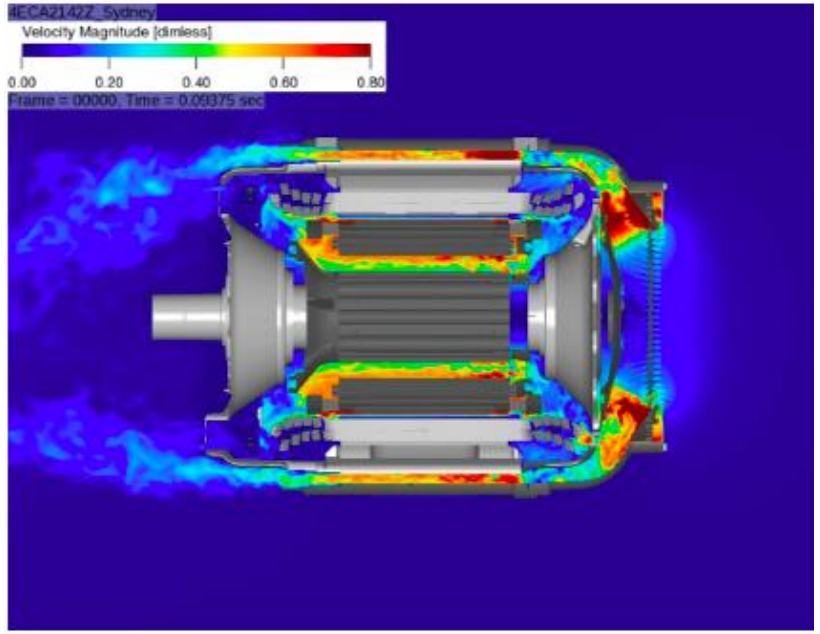
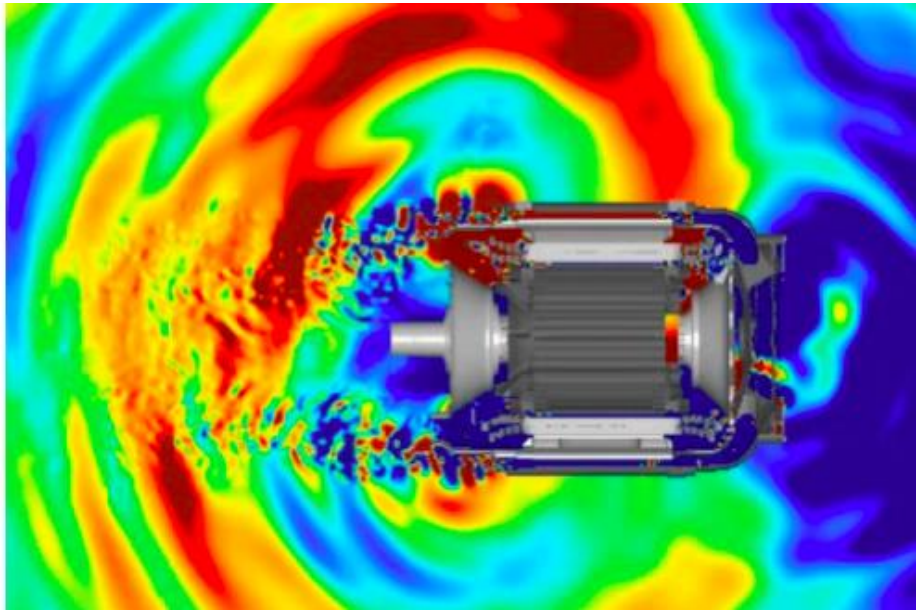
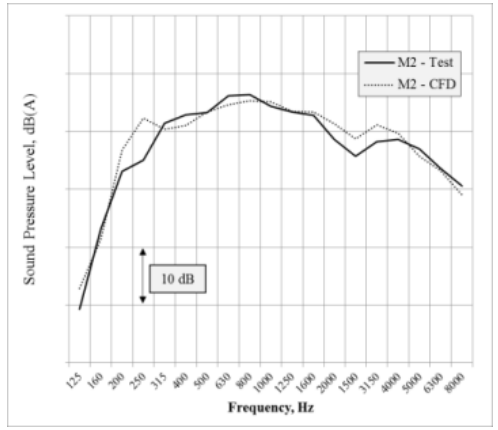
Traction motor cooling noise - simulations







Simulations match measurements very well

Good representation of spectra and directivity

Tested on two motors with different cooling architecture

PINTA

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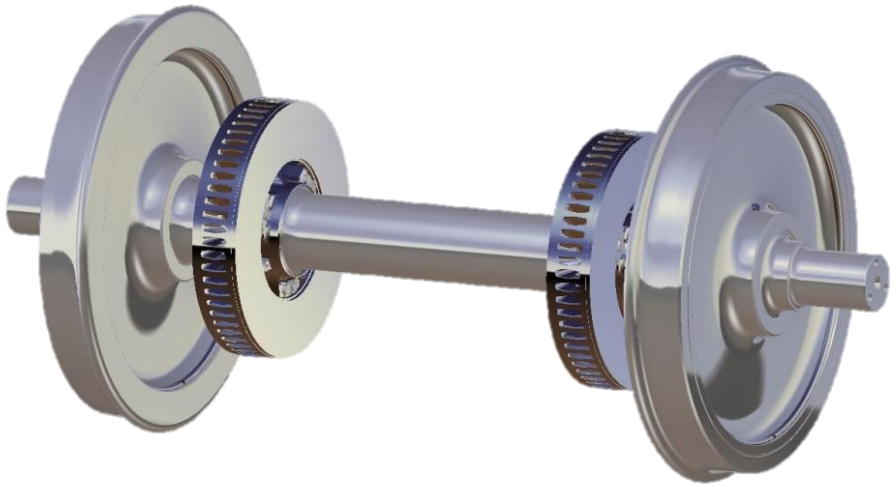
Silent Wheelset

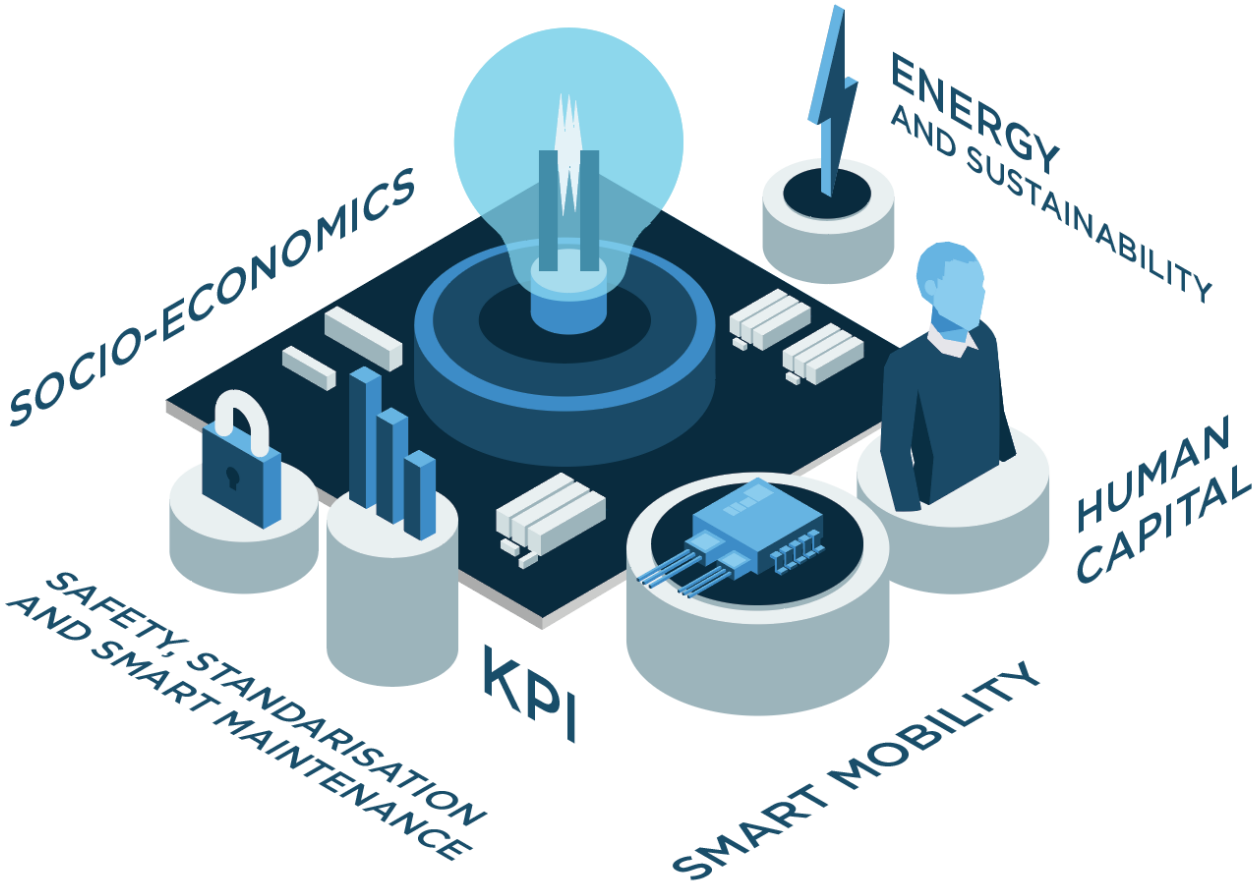


This new wheelset, provided with brake discs, will contribute to reduce noise emission.

- **Lightweight solution, noise optimized wheels and an increased load capacity**
- **Will contribute to the modal shift from road to railway, by an increased freight transport volume**
- **This solution targets all the European freight wagons**
- **2 dBA noise reduction in the wheel emission, fostering class A “very silent wagons“**
- **Reduced wear in the wheels, increased wheel life and LCC reduction**
- **Increased load per axle, from 22,5 to 25 Tn**

FR8RAIL

CCA: Cross Cutting Activities



Aurilisation & visualisation 1/2

Violeta Bulc, EU Commissioner for Transport, is testing the Auralisation at InnoTrans 2018.

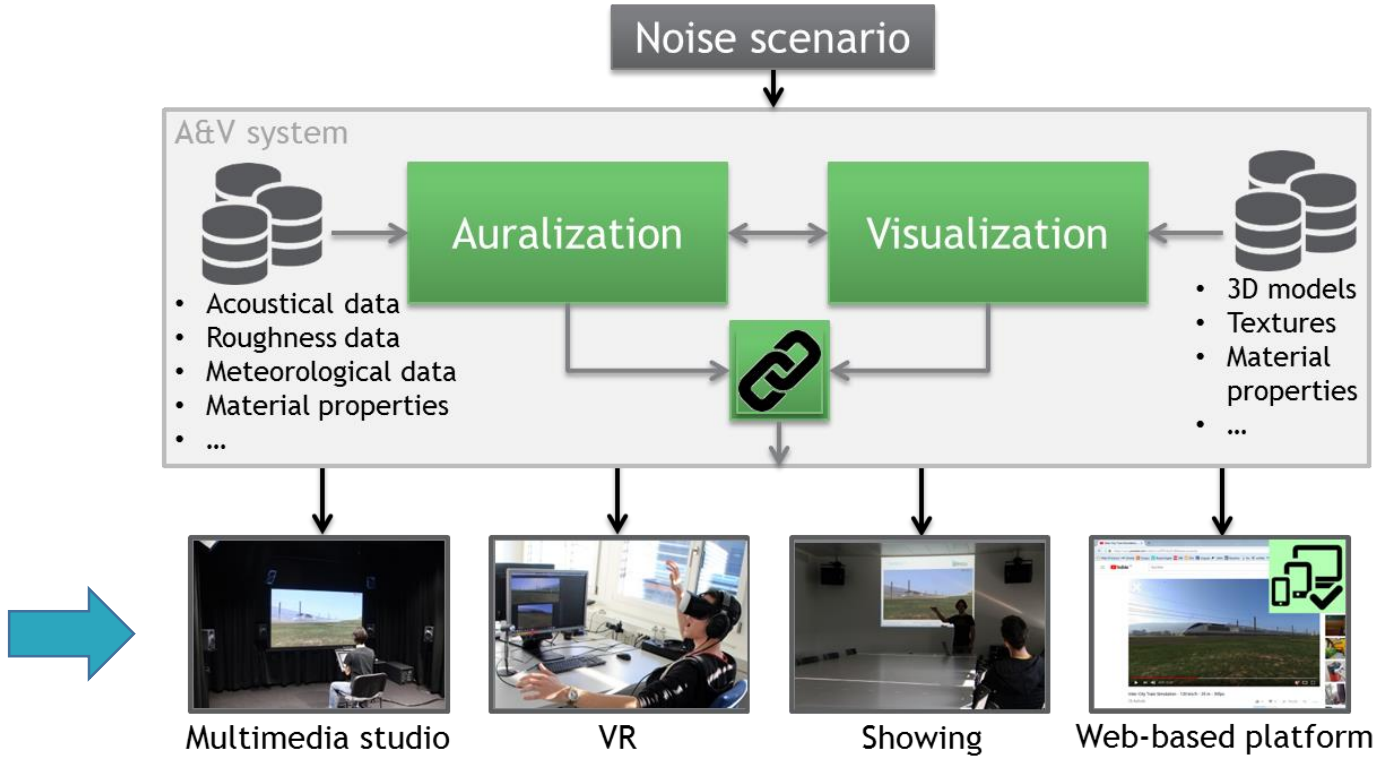
The technology gives the possibility of listening and experiencing visually the noise of trains passing on a certain track, long before it is built.

Further examples: https://www.youtube.com/playlist?list=PLFHEzMwLXvjGY4KUMNR1PWGPWXj40jXnk

Aurilisation & visualisation 2/2

The aurilisation system is based on synthesized signals and not on recorded signals as in earlier systems.

The technology was developed as interoperable on different media



Cost-efficiency modelling tool for N&V mitigation measures

Cost benefit analysis to ex ante (control) or ex past (mitigation) interventions to reduce noise or vibration impacts in the neighborhood of railway activity

For the case of a residential area along a railway track:

- CBA helped to decide about preferred measures and how different parameters (vehicle composition, traffic intensity, speed, track geometry) may affect the results.
- how the benefits for the residents in terms of “savings” in the cost for health effects can be assessed and compared to the cost.

For some cases, it was found that there are limitations:

- Choices often refer to track measures rather than vehicle related measures, due to the number of vehicles to be treated,
- For depot noise the options for track related measures are limited,
- For interior noise, appropriate indicators for the passenger response need to be developed and validated. A first approach focuses on passenger appraisal.

DESTINATE

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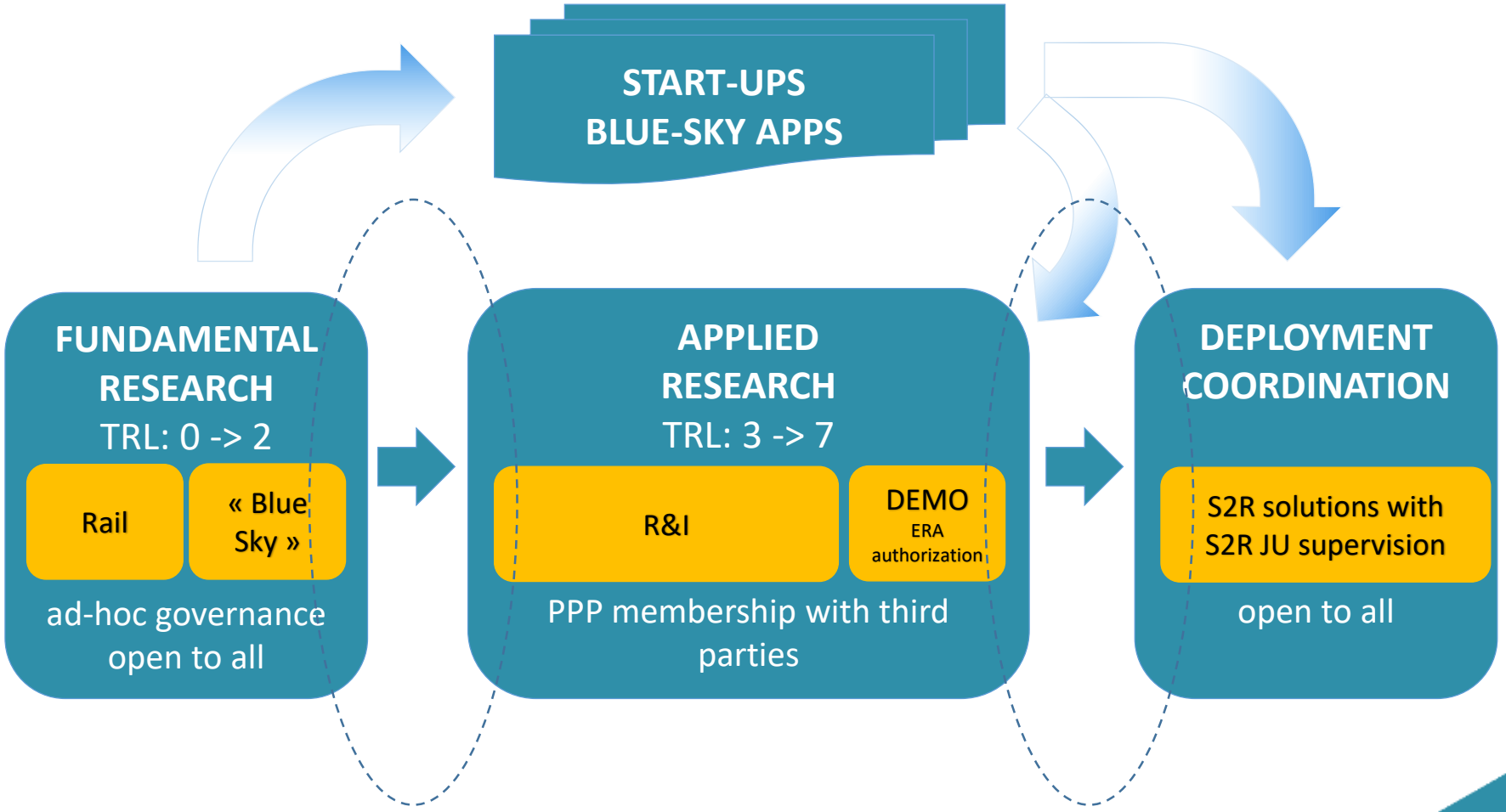
S2R Europe 2030 Research and Innovation beyond 2020



FOUNDING MEMBERS

ASSOCIATED MEMBERS

Virtual Vehicle Austria consortium+ (VVAC+)

European Rail Operating community Consortium (EUROC)

Swi'Tracken consortium

Smart DeMain (SDM) consortium

AERFITEC

Competitive Freight Wagon Consortium (CFW)

Smart Rail Control (SmartRaCon) consortium