



Rail research Successes and challenges



 **DEUFRAKO** – 30 ans de coopération franco-allemande dans le domaine de la recherche sur les transports
Alain Le Guellec, SNCF Direction de l'Innovation et de la Recherche

donner au train des idées d'avance



WHY DEUFRAKO?

- 30 years of cooperation
Development of high speed surface transport
- In 1978, NO European research Programme
How to work together?
- From 1978 to 1998, DEUFRAKO cooperation only rail research
- DEUFRAKO workshop (“Carrefour du PREDIT” Paris 7th of May 2008)
“Rail research in the frame of the French-German cooperation”
France and Germany
 - **leaders** in the domain of high speed
 - rail **industry leaders**, even in the world market
 - largely involved in the implementation of the Rail European legislation (**STI**), European Standards (**EN**)
 - **DEUFRAKO** has a **FUTURE!**

SUCCESSSES OF THE DEUFRAKO RAILWAY RESEARCH

Technical comparison of high speed systems (1978 – 1996)

Appendixes A1 to A2 - Comparison



Aerotrains (air cushion system)
TGV (wheel/rail system)

Transrapid (magnetic levitation)
Intercity E (wheel/rail system)

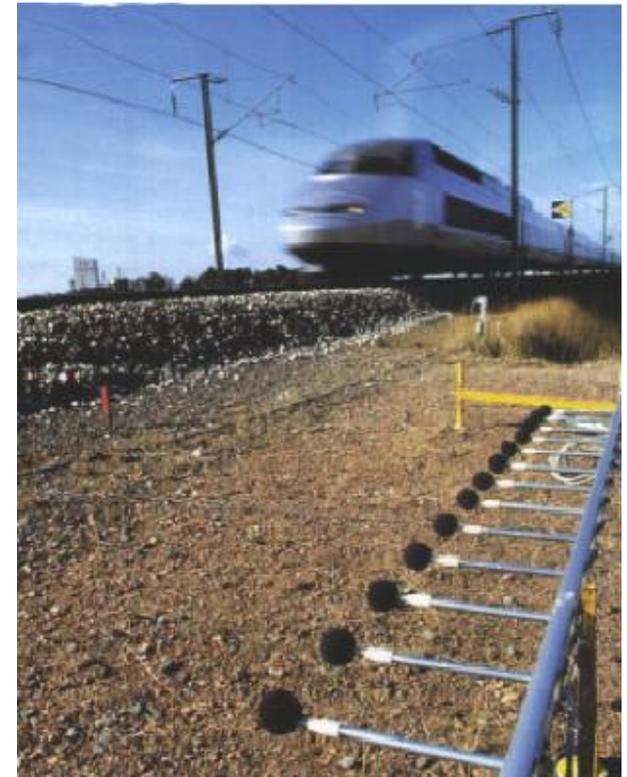
Their operating costs



SUCSESSES OF THE DEUFRAKO RAILWAY RESEARCH

Acoustic phenomenon studies (1981 – 1998)

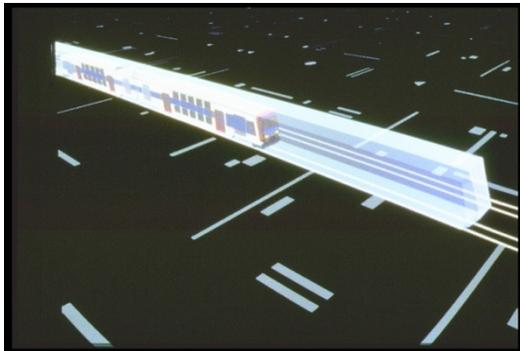
- From electromagnetically-guided levitation vehicles to rail vehicles ...
- **Appendix D** Geometric parameters of rolling stock
- **Appendix K** - Evaluation impact of different sources of noise
 - K1 \Rightarrow noise emission of HS trains (France and Germany)
 - K2 \Rightarrow Better knowledge and understanding of the phenomena generating aerodynamic noise and certain type of mechanical noises



“better understand the noise reduction potential on HS systems”

SUCCESSSES OF THE DEUFRAKO RAILWAY RESEARCH

Railway command-control (Appendix M – 1990–1996))



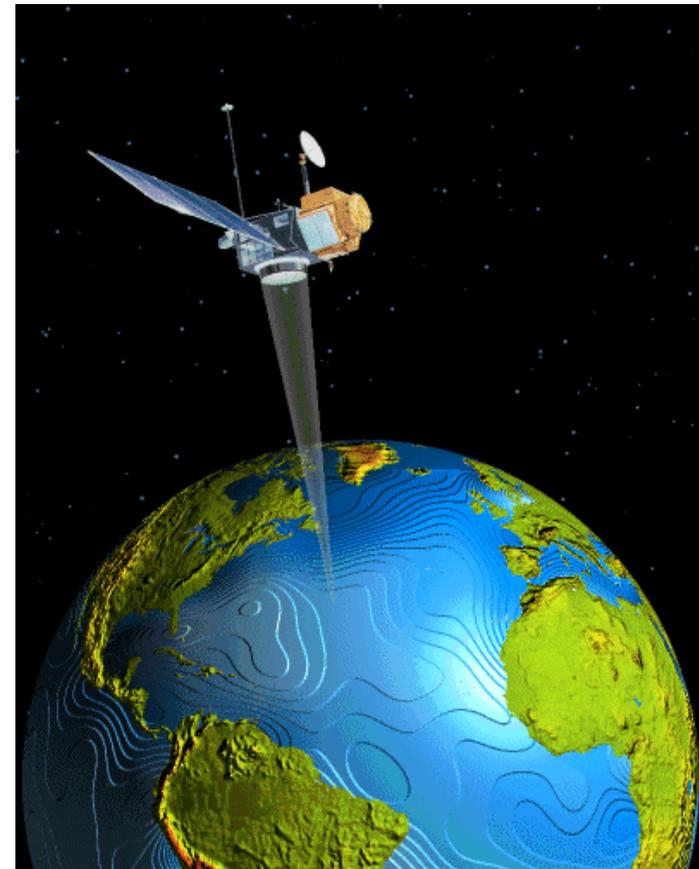
- From ASTREE / DIBMOF to ERTMS/ETCS ...
 - ➔ **Appendix M**
 - From projects ASTREE (France) and DIBMOF (Germany)
 - A pioneering role in the specifications of the European command-control system ARTEMIS
 - Functional and architectural specifications of the new system, in particular
 - Odotachygraph
 - Bilateral radio transmission data ⇨ Selection of the GSM as the radio transmission platform

“... Based on the work carried out by DEUFRAKO and also by UIC, the new European ERTMS command and control system was born with the Italian, the Dutch, Spanish and British railways joining DB and SNCF. The movement was off and running ... And there was no turning back.”

SUCSESSES OF THE DEUFRAKO RAILWAY RESEARCH

Railway command-control (Appendix P – 1997-1998)

- Satellite-based tracking technology
From the military domain to the rail domain ➔ **Appendix P**
 - Requirements and constraints of railway operators
 - Tracking and associated telecommunications
 - Analyse of existing solutions
 - Assessment economic viability of potential applications



“ ... this study has shown that other applications apart from safety, such as fleet management, can yield great benefits and are accessible today.”

SUCSESSES OF THE DEUFRAKO RAILWAY RESEARCH

Freight Express (1997 – 1998)



- Long term alternatives for the HS freight traffic ➔ **Annex O**
- 3 areas proposed
 - Express freight market
 - Loading units and handling/stowing devices
 - Standardisation of interfaces
 - Integration with intercontinental air services and continental rail and highway traffic
- Feasibility of freight transport service at 200 km/h

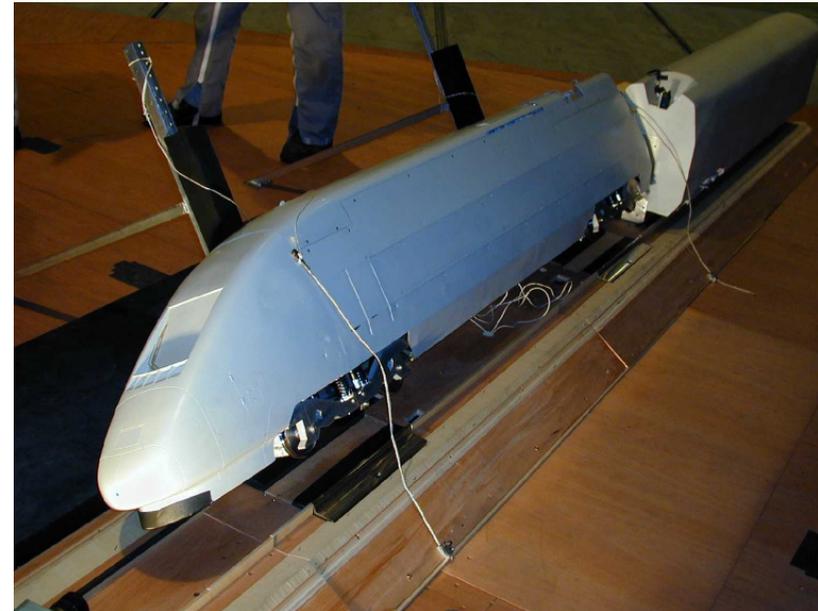


➔ Up to Railway Operators “to meet shippers needs over the long hauls.”

SUCSESSES OF THE DEUFRAKO RAILWAY RESEARCH

Crosswind (2000 – 2002)

- **CROSS-WIND**
 - ➔ Generic method to deal with wind sensitiveness
- Crosswinds topic applied to railway high speed traffic
 - To define a general framework for the railway field, especially for the rolling stock
- Year 2003 ➔ DB and SNCF have presented a common method to evaluate crosswinds risks
 - Method included in the High Speed TSI



SUCSESSES OF THE DEUFRAKO RAILWAY RESEARCH

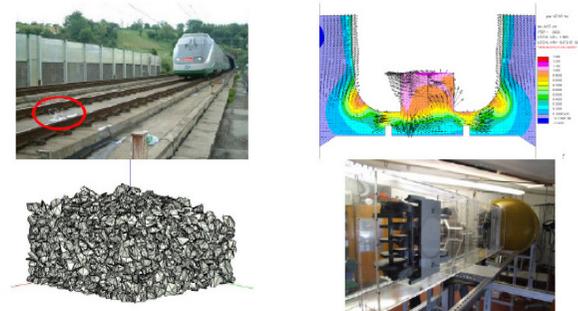
Aerodynamics in Open Air – AOA (2005 – 2008)

- **Objective:** To gain deeper knowledge in some specific vehicle-infrastructure inter-action issues
 - **Underfloor Aerodynamics (WP 1)**, ballast projection phenomenon noise and drag reduction implications of fairings
 - **Cross Wind Issues (WP 2)**, points left open in Cross Wind issues
- *Partners from all over Europe (United Kingdom, Italy, Spain)*



DeuFraKo Project „Aerodynamics in Open Air“
(AOA)

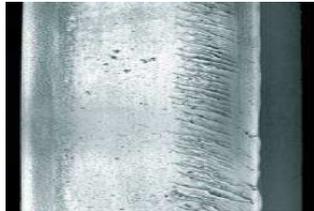
WP 1 Underfloor Aerodynamics
Summary Report



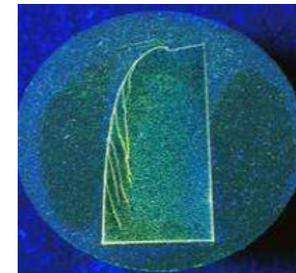
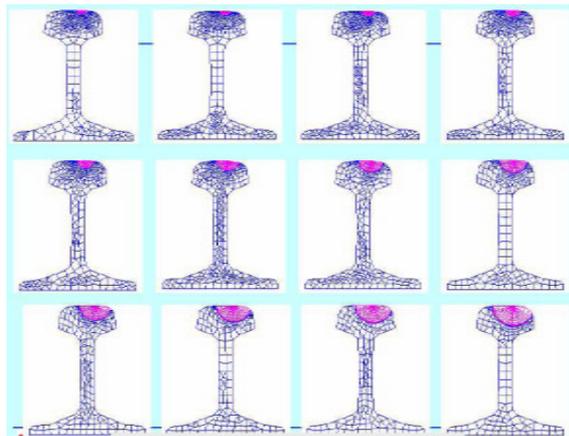
Version: Final report
Date: February 29th, 2008
Report edited by: Hans-Jakob Kaltenbach (WP 1 coordinator)
Company name: Deutsche Bahn AG, DB Systemtechnik
Department: Aerodynamics and Air Conditioning, VTZ 113
Völckerstrasse 5
80939 München
Germany

SUCCESSSES OF THE DEUFRAKO RAILWAY RESEARCH NOVUM (2004 – 2007)

- **New methods of quantitative prediction of the rail performance under the increasing operating stresses**



- Measured data of rail dynamic stress
- Simulation of rail dynamics
- Simulation of thermal influenced rail
- Documentation of head check; initialisation at a test ring
- Simulation of crack propagation in the rail



- ➔ **Longer rails under greater solicitations**
- ➔ **Better performance with less in situ tests**

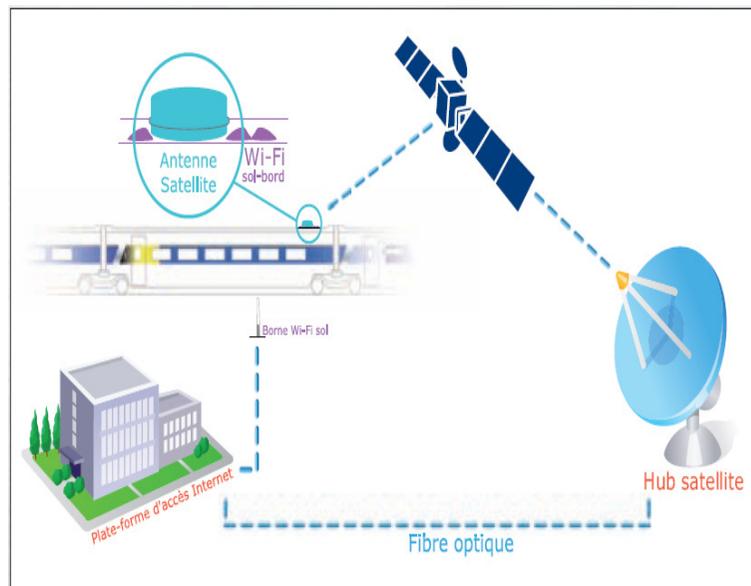


AND CHALLENGES FOR THE RAILWAY RESEARCH ?

Increasing mobility of people and goods Towards an intelligent mobility

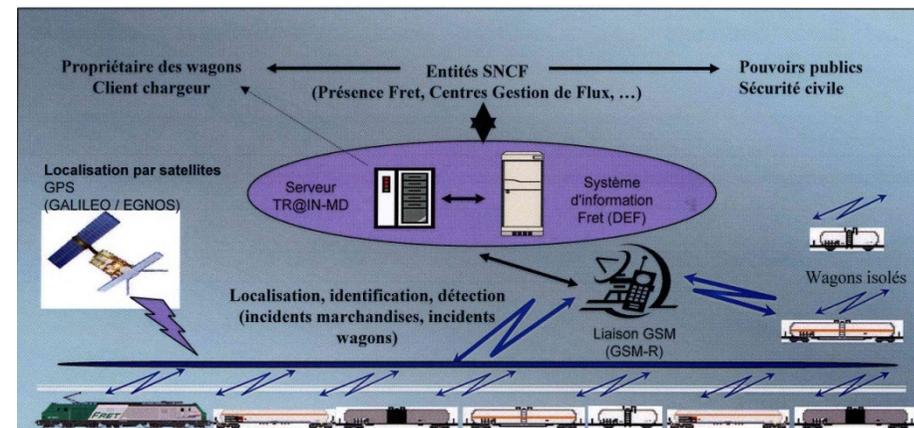
Passengers

- Real time information
- Permanent connexion to information networks



Freight

- Tracking and tracing
- Alarm for hazardous goods
- Permanent monitoring of goods
- Direct information to customers



Energy and Environment (1)

Towards Eco-mobility – Noise

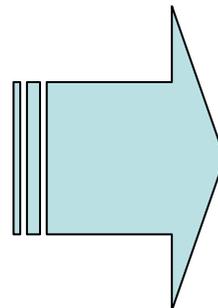
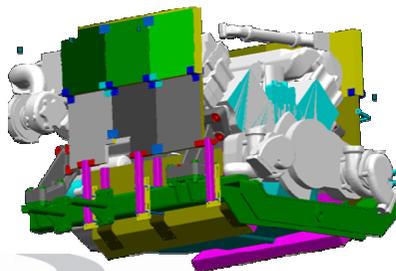
Optimised fans : -7, -9 dB(A)



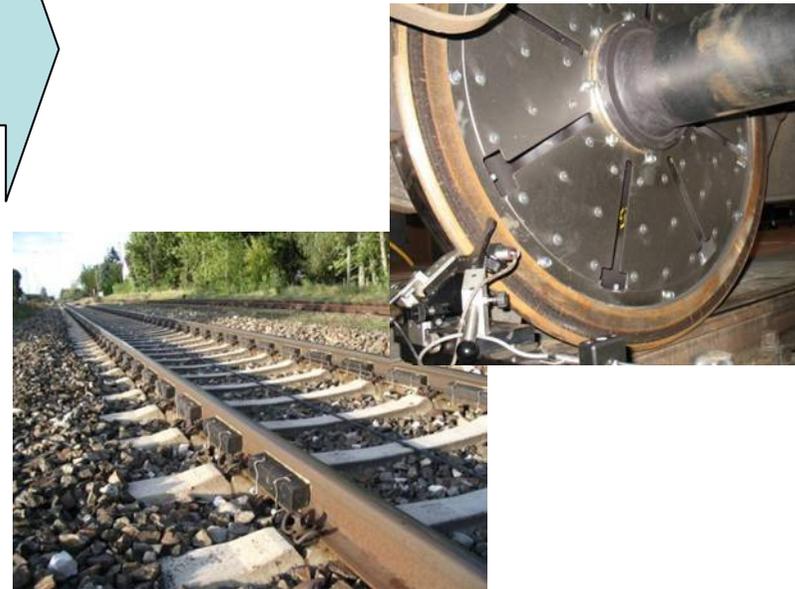
Wheel+ track absorbers: -4 dB(A)



Diesel noise reduction : -4 dB(A)



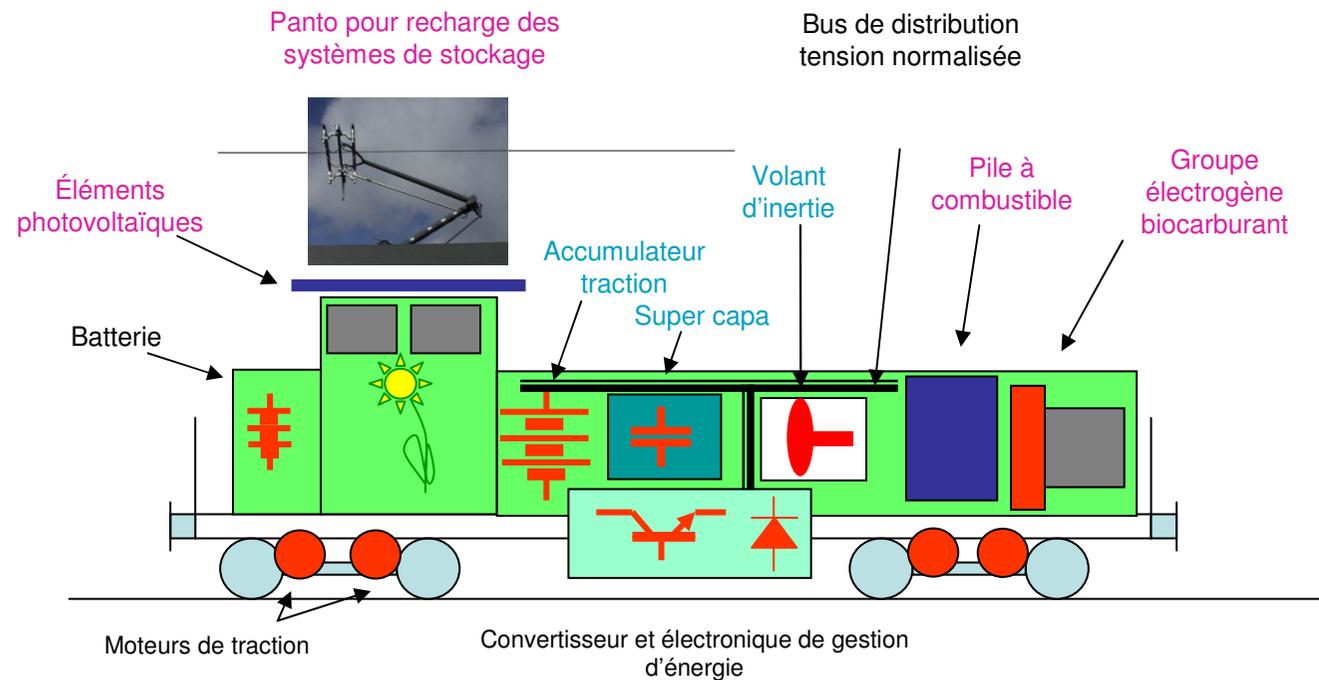
STARDAMP
Standardization
of damping technologies
for the
reduction of railway noise



Energy and Environment (2)

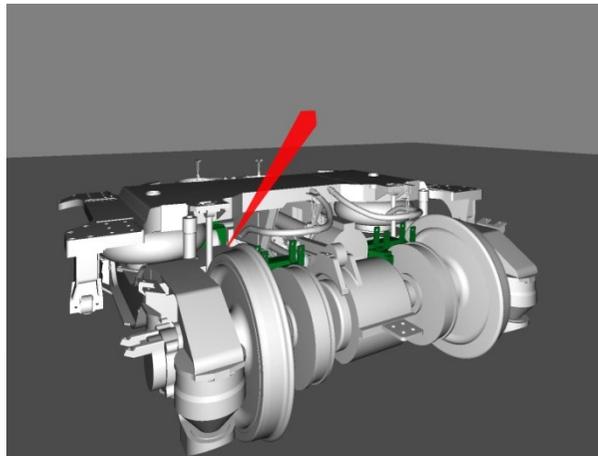
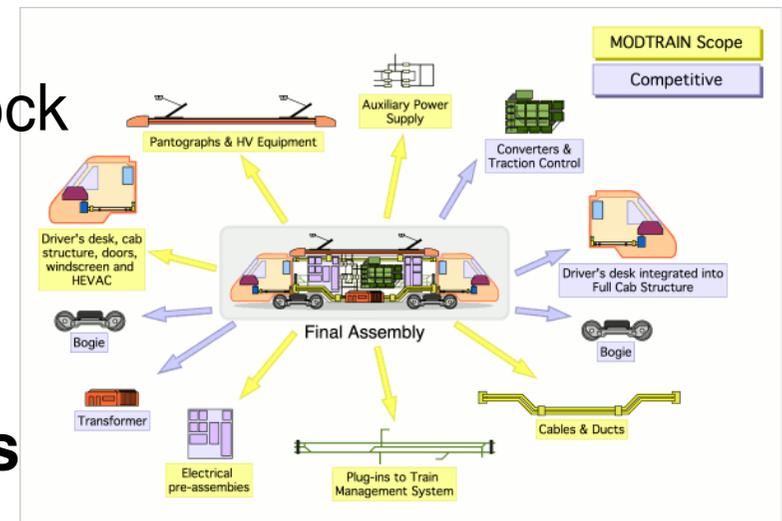
Towards Eco-mobility – Energy

- End of fossil fuels / necessity to save energy
- New power generation of energy: fuel cell ...
- Hybridization of energy \Rightarrow clever use of energy



Interoperability / cross-acceptance

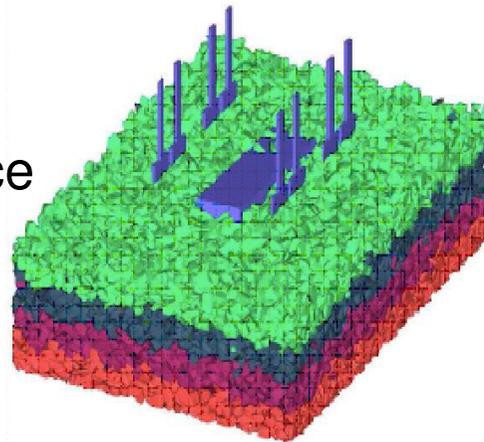
- **Modtrain EU FP6 project**
 - ➔ towards modular standardized specifications and reduced homologation costs for rolling stock
- **Interaction infra / rolling stock**
 - ➔ towards use of calculation to reduce homologation costs (UIC 518 leaflet in railway dynamics)
- **Ability to close TSI open points**



Competitiveness and enabling technologies

Infrastructure maintenance : automated on board inspection and process optimisation

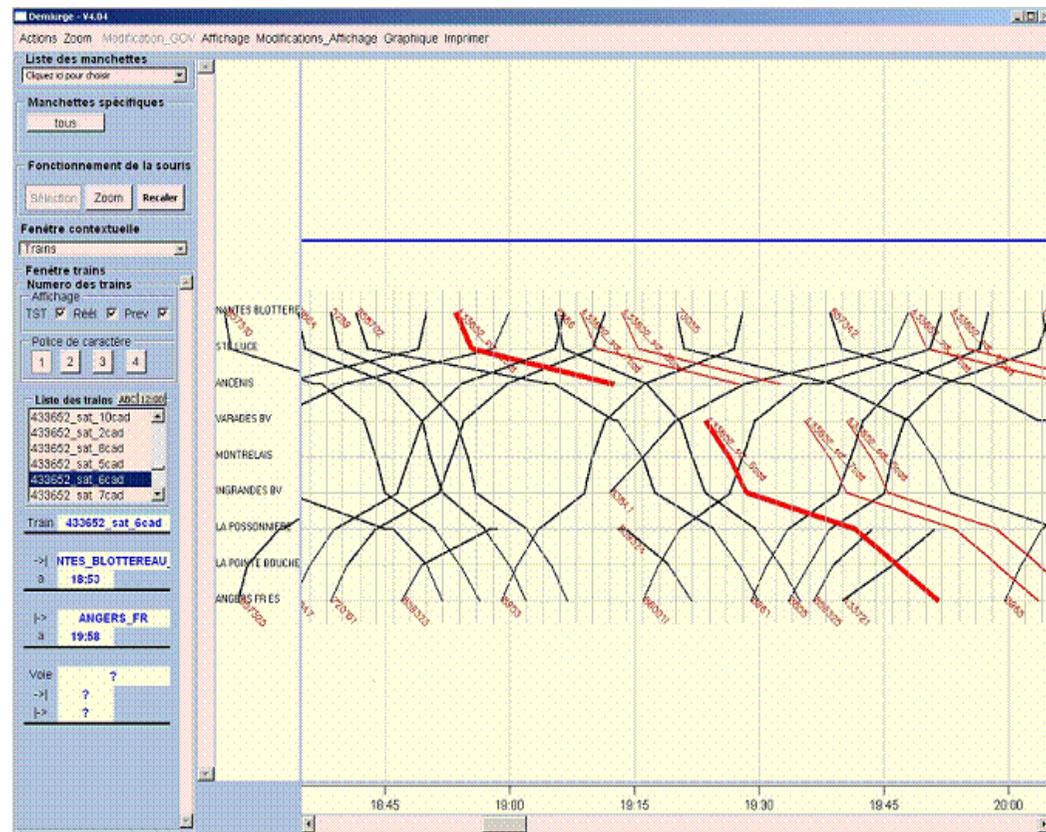
- Bridges and tunnel Inspections
 - new tools (Laser...)
- Track and catenary
 - continuous inspection at higher speeds
- Optimising track maintenance operations through mechanical modelling



Management of infrastructure and railway operations

Timetable Scheduling and operation management

- Improving the operations processes
- Dynamic management of paths
- Use of the most mathematical tools (operational research)

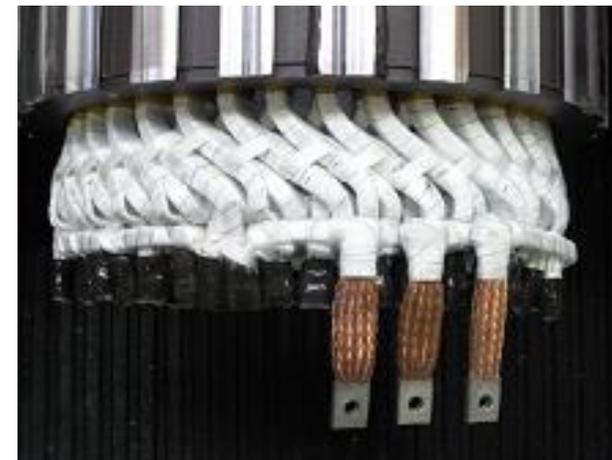


The 574,8 km/h World record

➔ implementing a series of innovations



- Permanent magnet motors
- Aerodynamic drag reduction
- New pantograph...



Rail research - Successes and challenges

Some conclusions

- The European leaders of the railway industry are mostly located in France and Germany
- The European leaders of the railway operators have a great part of their activities in France and Germany
- If both of them are greatly involved in the European research, DEUFRAKO is of interest
 - When they want to go faster in the interoperability process for the benefit of the rail sector
 - When they want to work on technical domains not covered by the European Research Framework Programme
- But DEUFRAKO cooperation will remain of interest with a better coordination process, between France and Germany !

Thank you for your attention !