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Velaro Novo

Conferência "Modo de Transporte Ferroviário – Eficiência e Transição Energética" – Coimbra, 20.04.2023

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[siemens.com/velaro-novo](https://www.siemens.com/velaro-novo)

by Bertrand Gauchet

Decisive requirements from operator's perspective



The focus of our innovation roadmap is the improvement of Life Cycle Cost

Velaro Novo: Targets and timeline

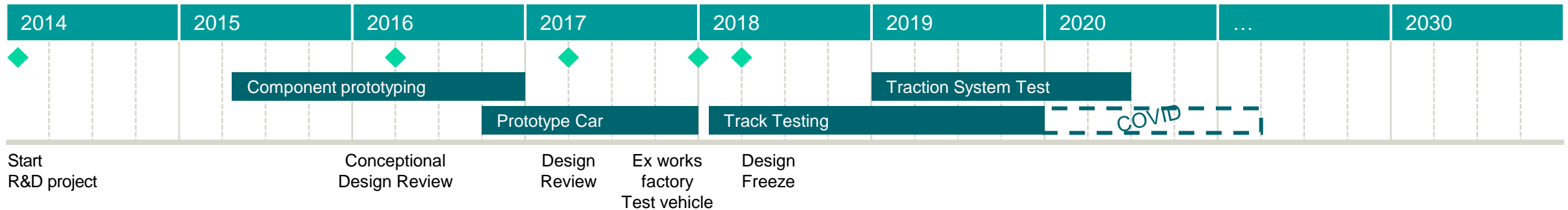


Invest	Maintenance cost	Passenger capacity
-20%	-30%	+10%
Trainset weight	Energy consumption	
-20%	-30%	



Compared to current Velaro-platform @ 320 kph

EMU train concept with scalable traction power for Intercity (250 kph) and High-Speed application (up to 360 kph)



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Aerodynamic
excellence

Bogie full
fairing

Streamlined
inter-car
gangway

Pantograph
housing

Roof high
voltage
equipment
coverage



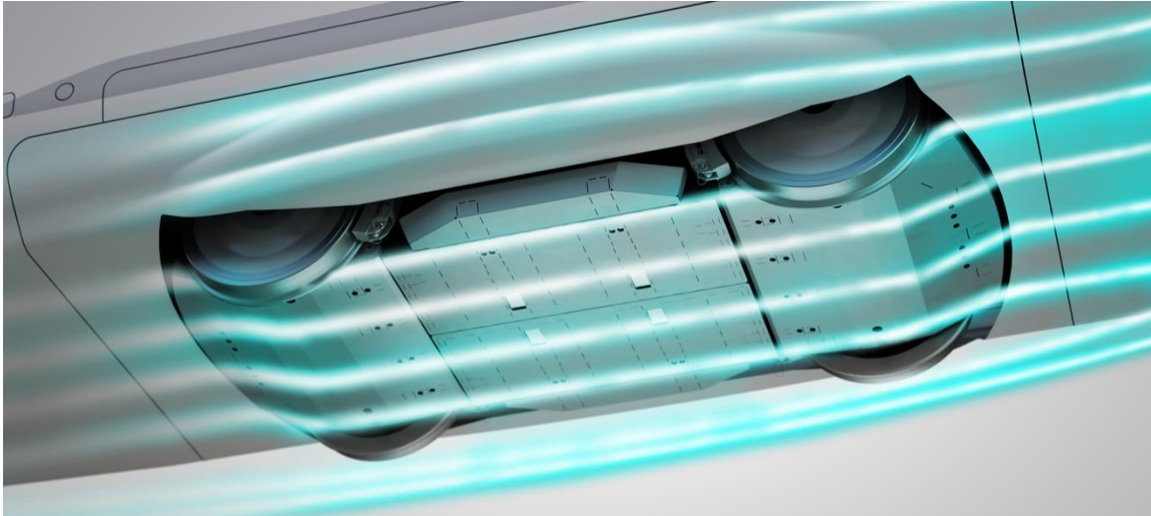
Aerodynamic drag is one major driver for energy consumption of high-speed trains



Effect on Energy Consumption

Bogie full fairing

-15%



Aerodynamic drag is one major driver for energy consumption of high-speed trains



Effect on Energy Consumption

Streamlined vehicle roof

-10%





Intelligent motion

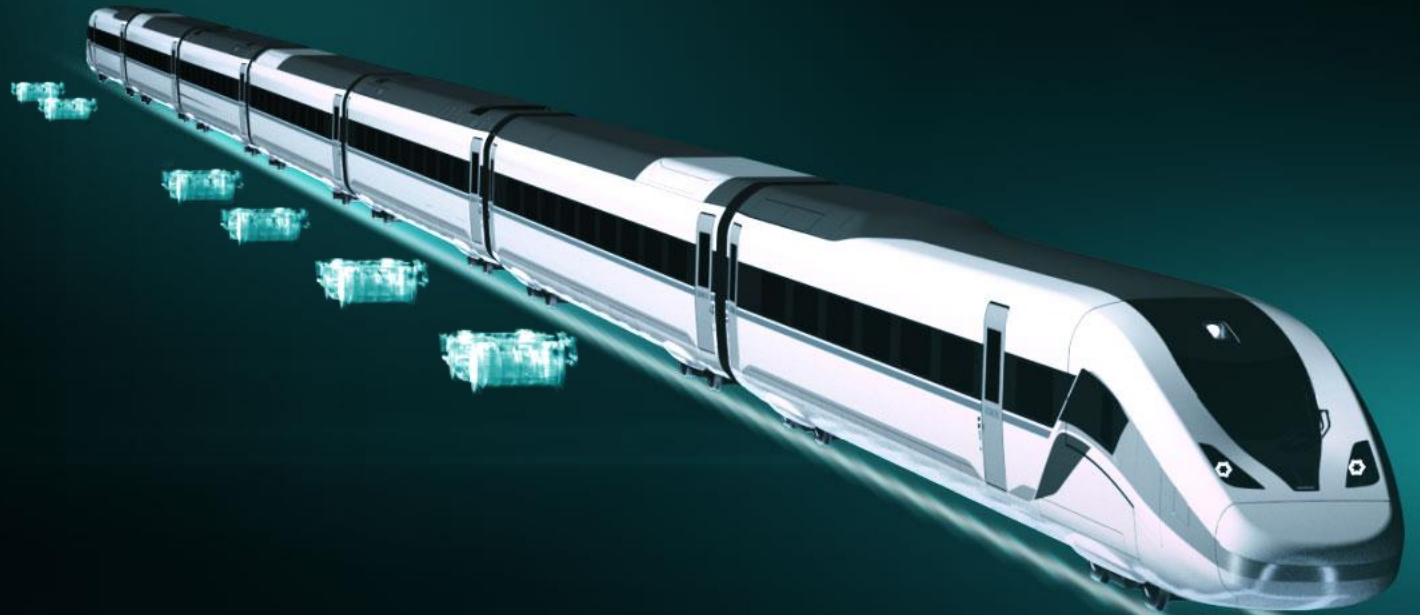
Flexibles,
innovative drive
system

Permanently
excited
synchronous motor

Better performance values can be achieved by optimizing the overall concept

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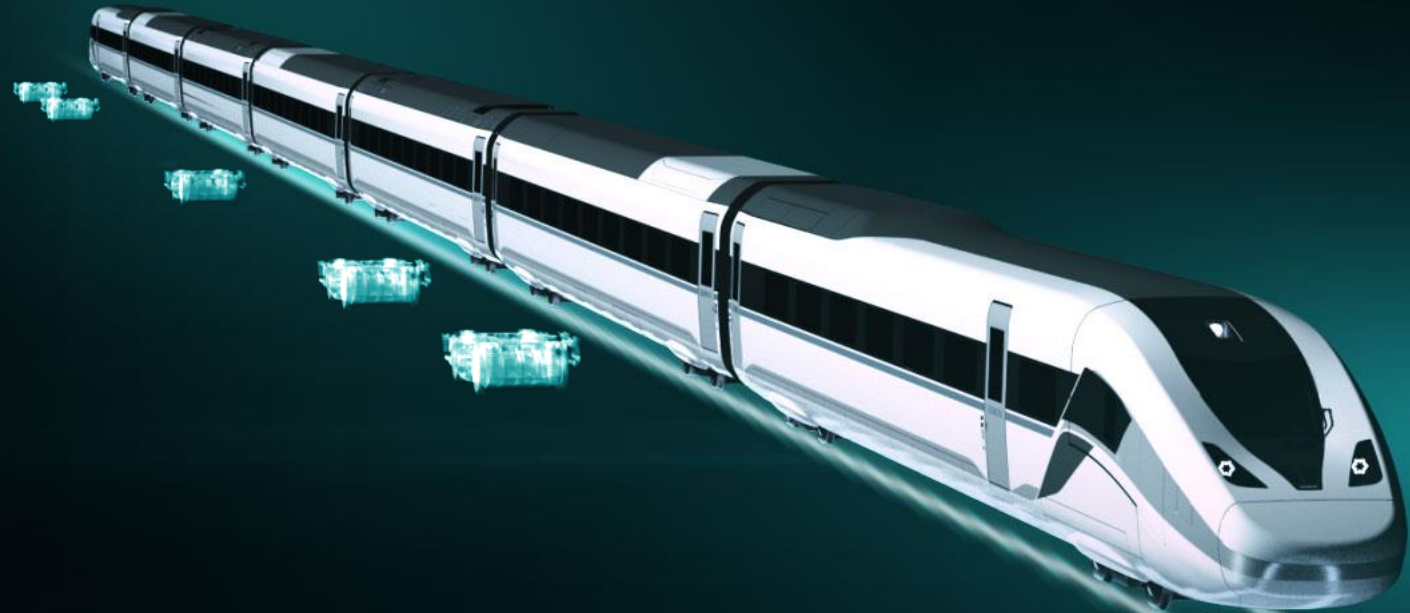
Velaro Novo 360 km/h	
Number of motors	12
Traction power	8000 kW
Starting effort	275 kN
Regenerative braking power	11800 kW
Rheostatic braking power	8400 kW
Weight (TSI occupancy)	420 t
Length	202 m



Better performance values can be achieved by optimizing the overall concept

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Velaro Novo 320 km/h	
Number of motors	10
Traction power	6600 kW
Starting effort	230 kN
Regenerative braking power	9900 kW
Rheostatic braking power	7000 kW
Weight (TSI occupancy)	416 t
Length	202 m



Better performance values can be achieved by optimizing the overall concept

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Velaro Novo 280 km/h	
Number of motors	8
Traction power	4700 kW
Starting effort	230 kN
Regenerative braking power	7200 kW
Rheostatic braking power	5600 kW
Weight (TSI occupancy)	412 t
Length	202 m



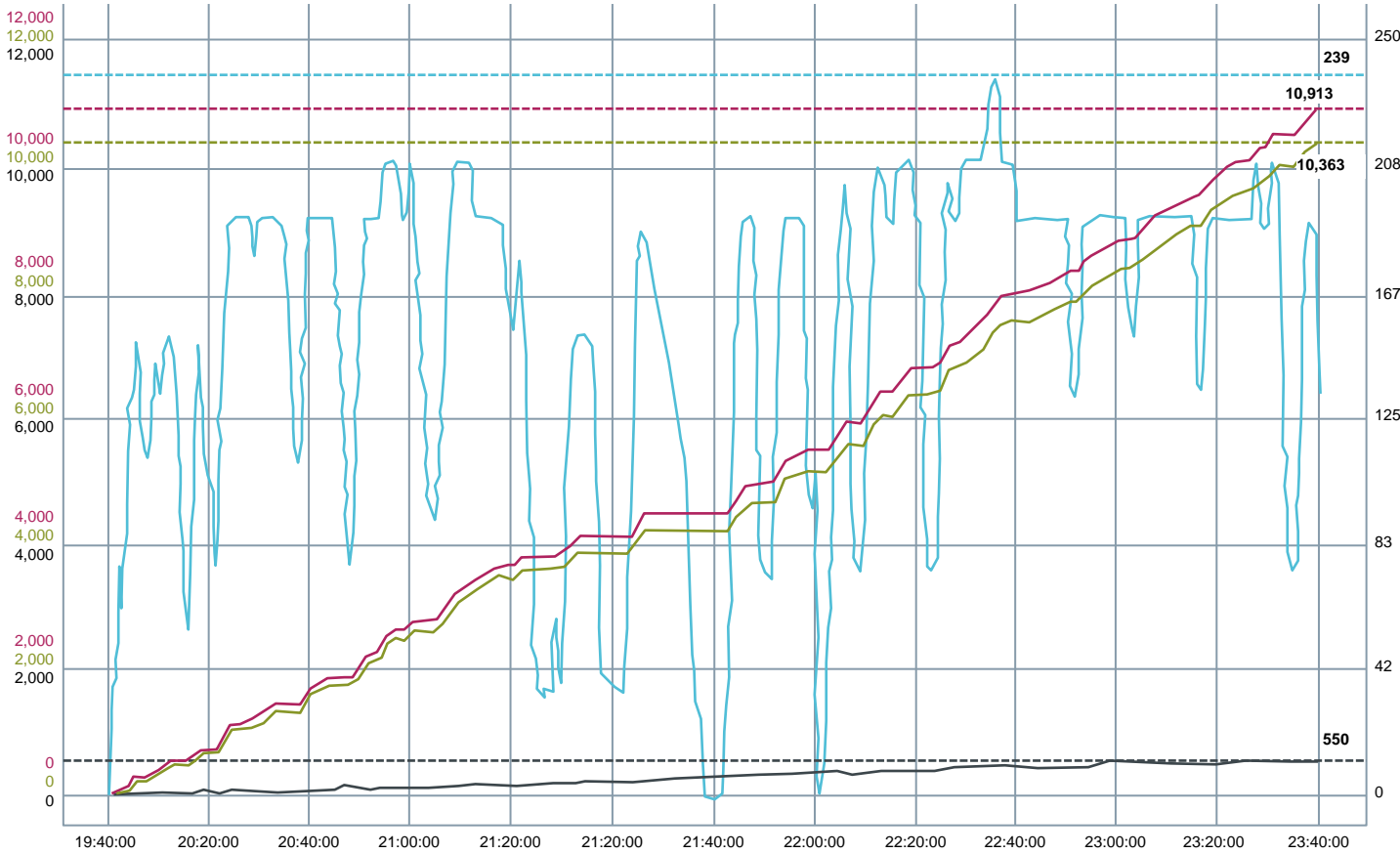
Better performance values can be achieved by optimizing the overall concept



Velaro Novo main data

	Velaro Novo (8 motors)	Velaro Novo (10 motors)	Velaro Novo (12 motors)	Velaro (1-voltage system)	ICE4 (7-car)
Number of motors	280 km/h	320 km/h	360 km/h	320 km/h	250 km/h
Traction power	4700 kW	6600 kW	8000 kW	8000 kW	4950 kW
Starting effort	230 kN	230 kN	275 kN	300 kN	225 kN
Regenerative braking power	7200 kW	9900 kW	11800 kW	8200 kW	5100 kW
Rheostatic braking power	5600 kW	7000 kW	8400 kW	-	-
Weight (TSI occupancy)	412 t	416 t	420 t	485 t	432 t
Length	202 m	202 m	202 m	201 m	202 m

Drive with the permanently excited motor (PEM) enables better efficiency during operation



PMM 12-month field testing in Russia: -5%

— V_IST (km/h) — E_16ASM (kWh) — E_12PMM (kWh) — DeltaE (16ASM-12PMM) (kWh)

- Traction power **+10%**
- Braking effort **+70%**
- Efficiency **+5%**



Reduced total costs

Weight

Thin wall aluminum profiles and
friction stir welding
Inner bearing bogie

Energy

Flexibility and Efficiency

Maintenance

High performance electric
brake with braking resistors
Reliability

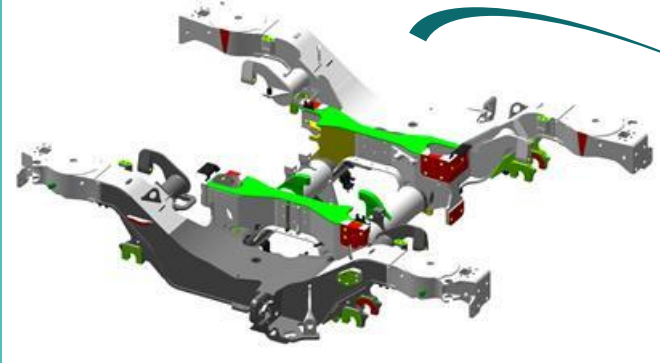
Velaro Novo car body shells: 10% weight reduction compared with Velaro

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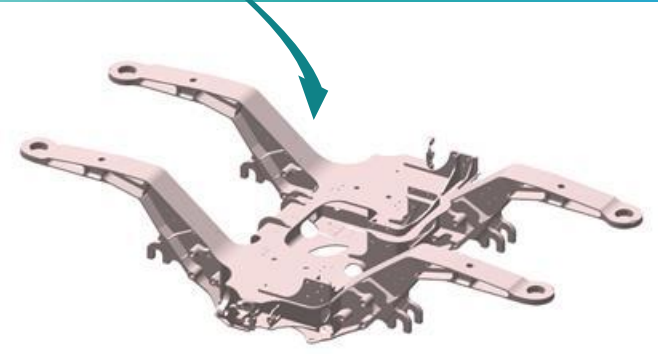
Velaro Novo bogie frame: 40% weight reduction compared with Velaro

SF500 frame
Steel S355



closed Box beam

-40% SF900 lightweight frame
High strength steel



open I-beam with reduced plate thicknesses



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Empty tube
concept

New TCN
Architecture



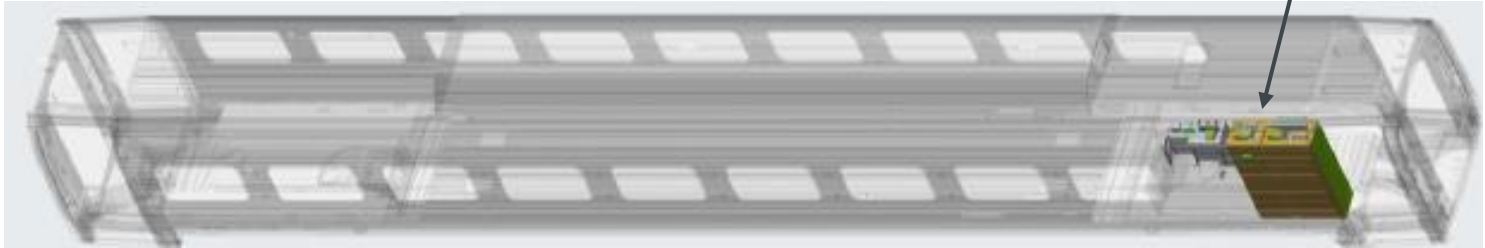
The "empty tube" concept offers the perfect balance of flexibility and economy



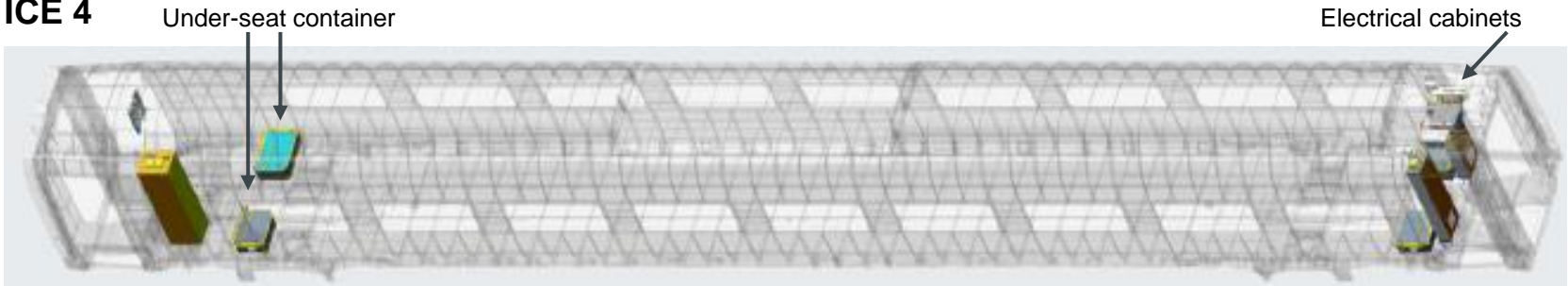
Available space **+10%**

- Elimination of technical equipment that adversely influences interior flexibility
- Standardized fixations for interior fittings

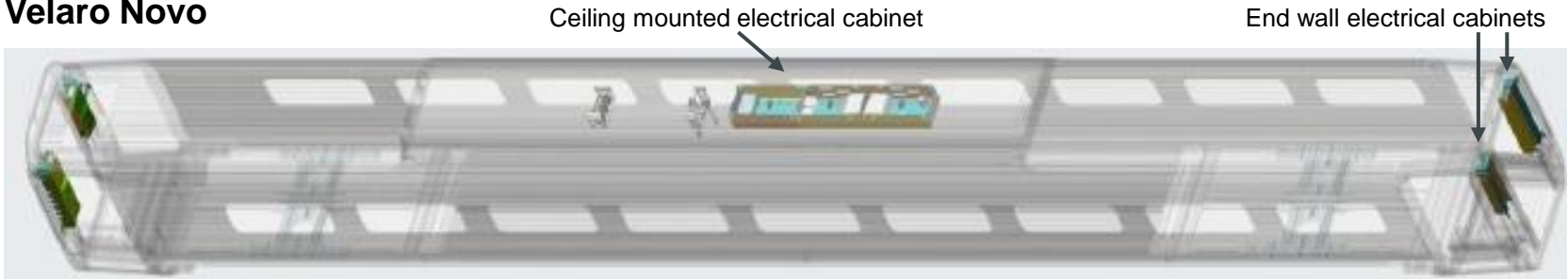
Velaro



ICE 4



Velaro Novo



Velaro Novo - interior flexibility



from standard...

Velaro Novo - interior flexibility



...to more sophisticated...

Velaro Novo - interior flexibility



...even to futuristic



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Proven technology

#seeitnovo
Test car on the track
since April 2018

3 billion kilometers
of experience

Worldwide
reference
projects

Stringent validation program to mitigate project risks and ensure reliability



- Aerodynamics
Pantograph
- Acoustics
roof
- Dynamic
car body
behavior
- New aluminum
Extrusions/
FSW welding
- Brake Resistor
incl. Flaps
- Lightweight
solutions

Door
pressure
tightness



Fire
protection
gangway

- Sanitary
system
- Ballast/Snow
protection
- Full bogie
housing
- Running
behavior
- Tread
brake
- Bogie
diagnosis



The test car reaching 331 km/h



Another time the speed of 363km/h was reached and the speed of 400km/h should be exceeded in the next future



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Reduced total cost

Aerodynamic excellence

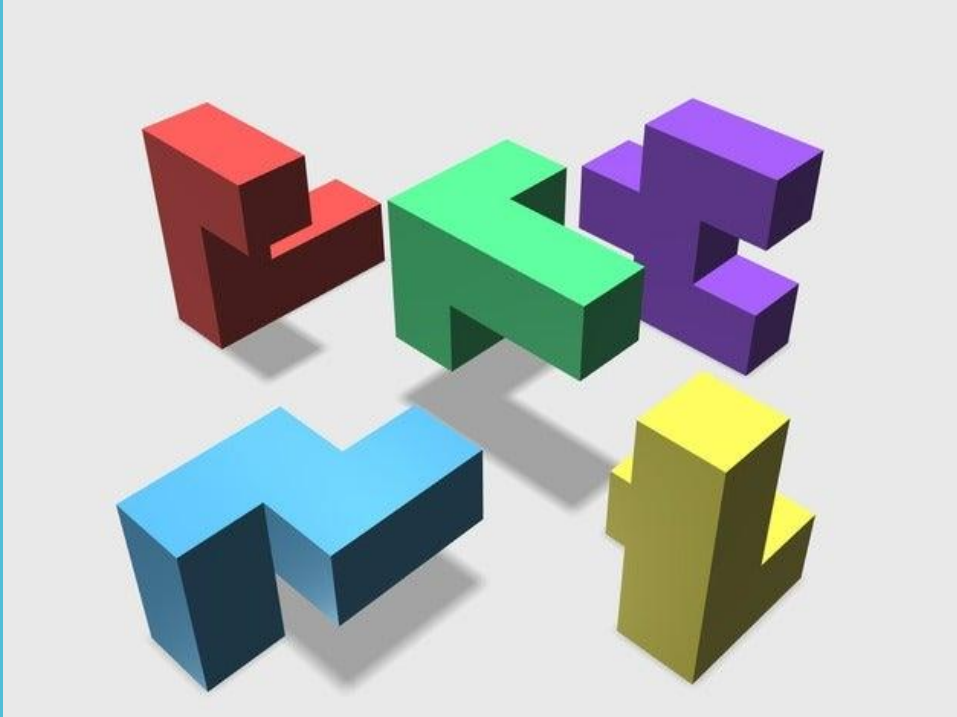
Variable train

Proven technology

Intelligent motion

The railway system is and has to be considered as a whole, composed of well interfaced sub-systems – INF, ENE, CCS, RST, OPE*

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***INF**rastructure, **ENE**rgy, **Com**mand/ **Co**ntr**ol** System, **Rolling S**tock, **OP**eration