



Mechanical Issues related to Drive-train Electrification

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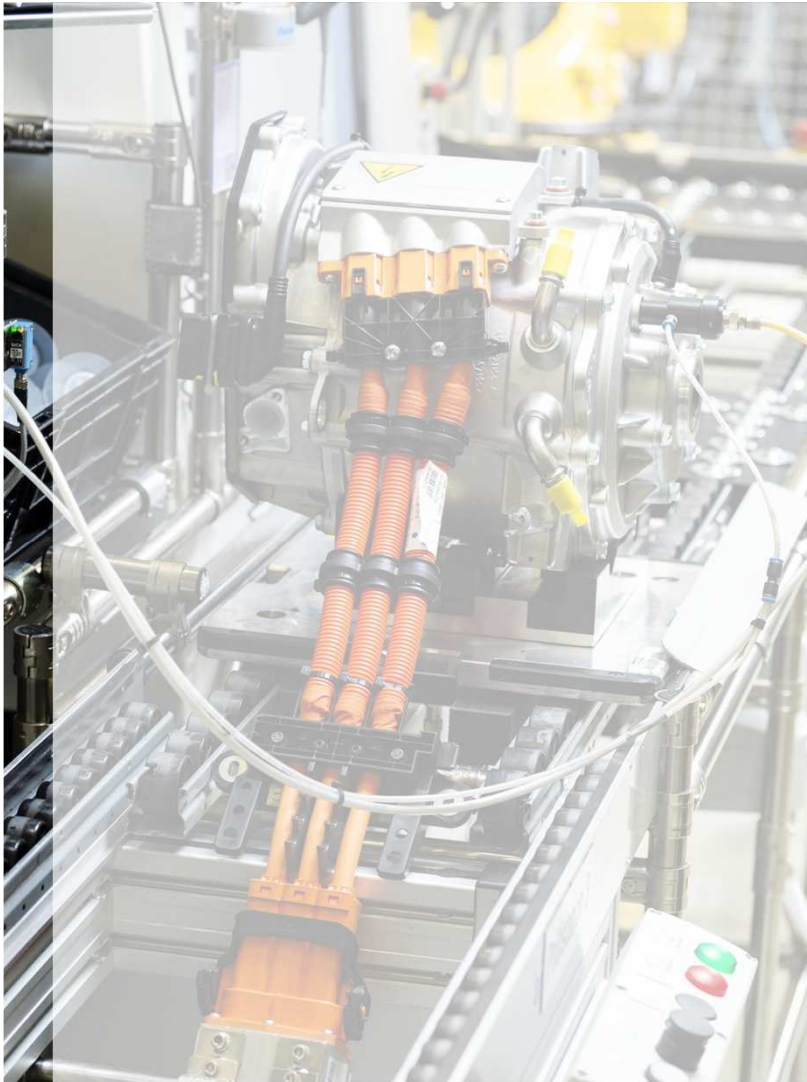


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WHO WE ARE

VALEO BUSINESS GROUPS



POWERTRAIN
SYSTEMS



COMFORT & DRIVING
ASSISTANCE SYSTEMS



THERMAL
SYSTEMS

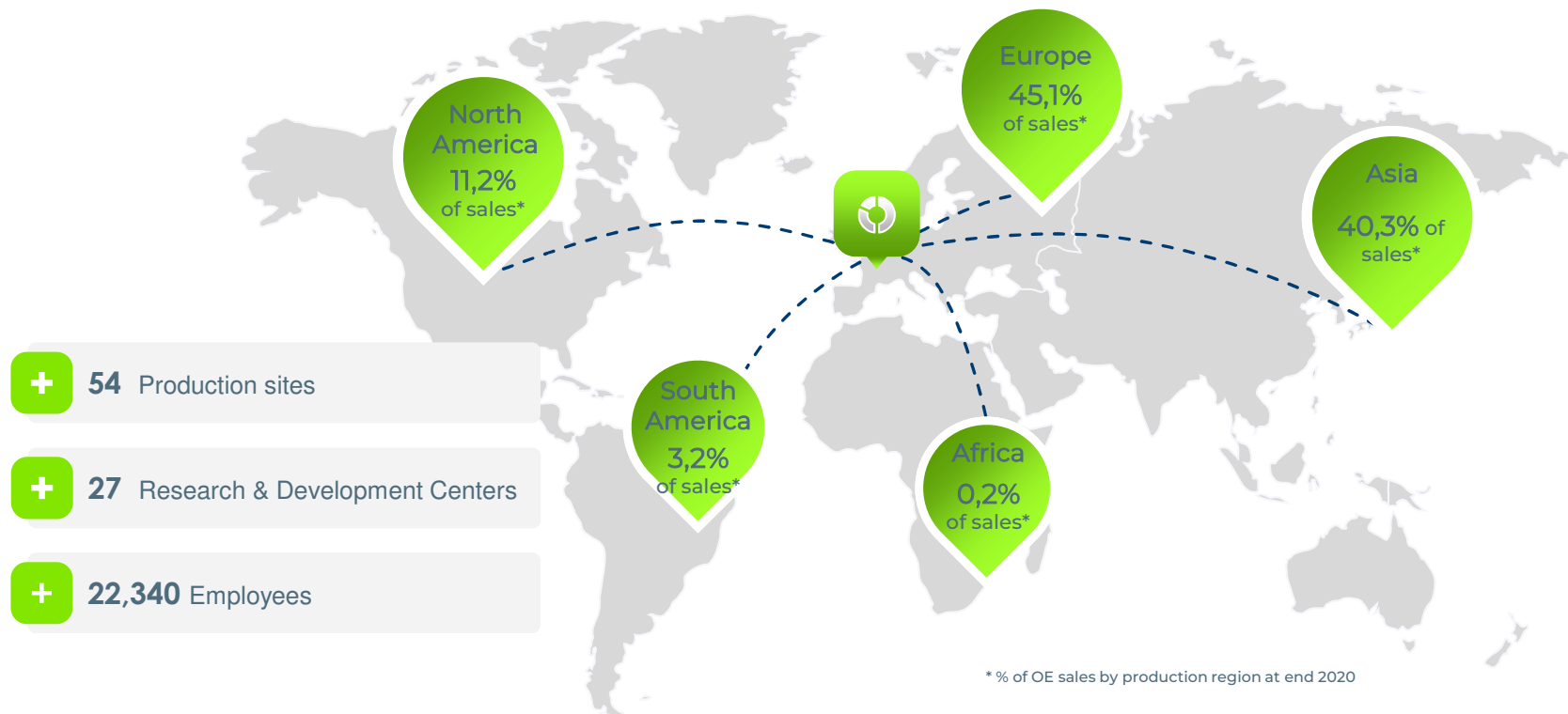


VISIBILITY
SYSTEMS

[Link to the Valeo Corporate Presentation](#)

WHO WE ARE

POWERTRAIN SYSTEMS FOOTPRINT





Zero emission zone
Small mobility
≤ 100km
≤ 50km/h

BUSINESS CORE ELECTRIFICATION SOLUTION



Up to 70%* CO₂ benefits on WLTP (up to 40% in 48V)
PHEV over 50 km (City 25km in 48V)

Electrification solutions

LOW VOLTAGE SOLUTIONS

HIGH VOLTAGE SOLUTIONS



Zero emission zone
Light mobility
100km – 150km
Up to 100 km/h
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4 to 6%* CO₂ benefits on WLTP
First level of hybridization



Up to 15%* CO₂ benefits on WLTP (up to 20% in HV)
Diesel alternative
Affordable cost

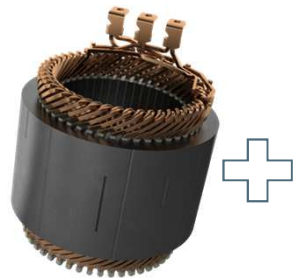


Zero CO₂ emission
Performance

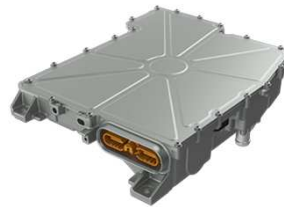


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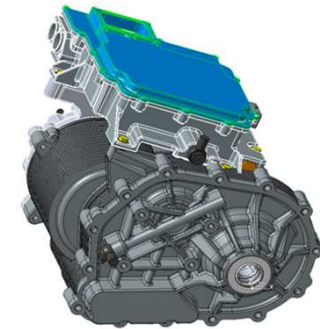
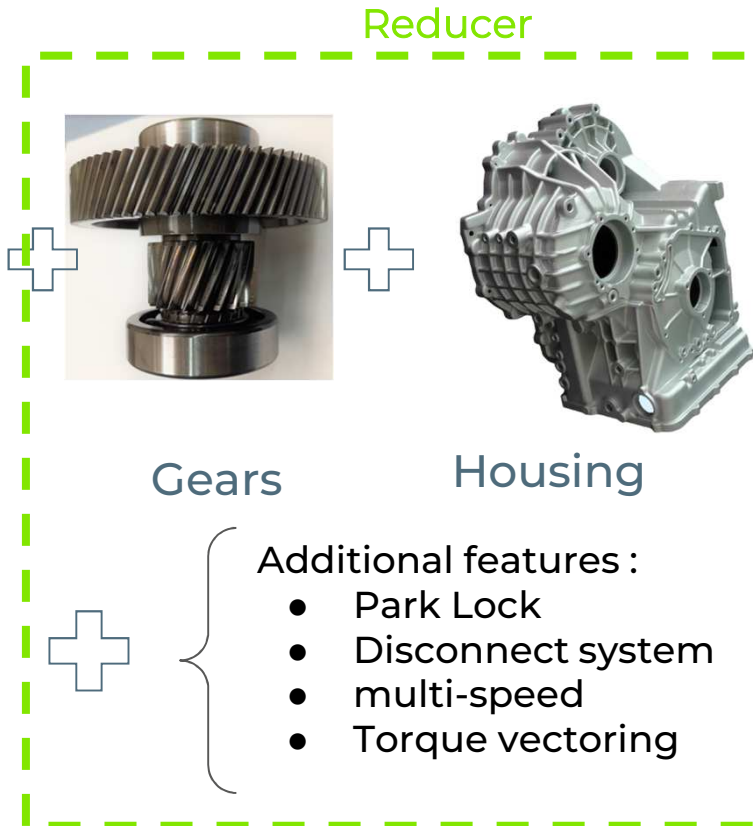
What is an eDRIVE ?



Electric Motor

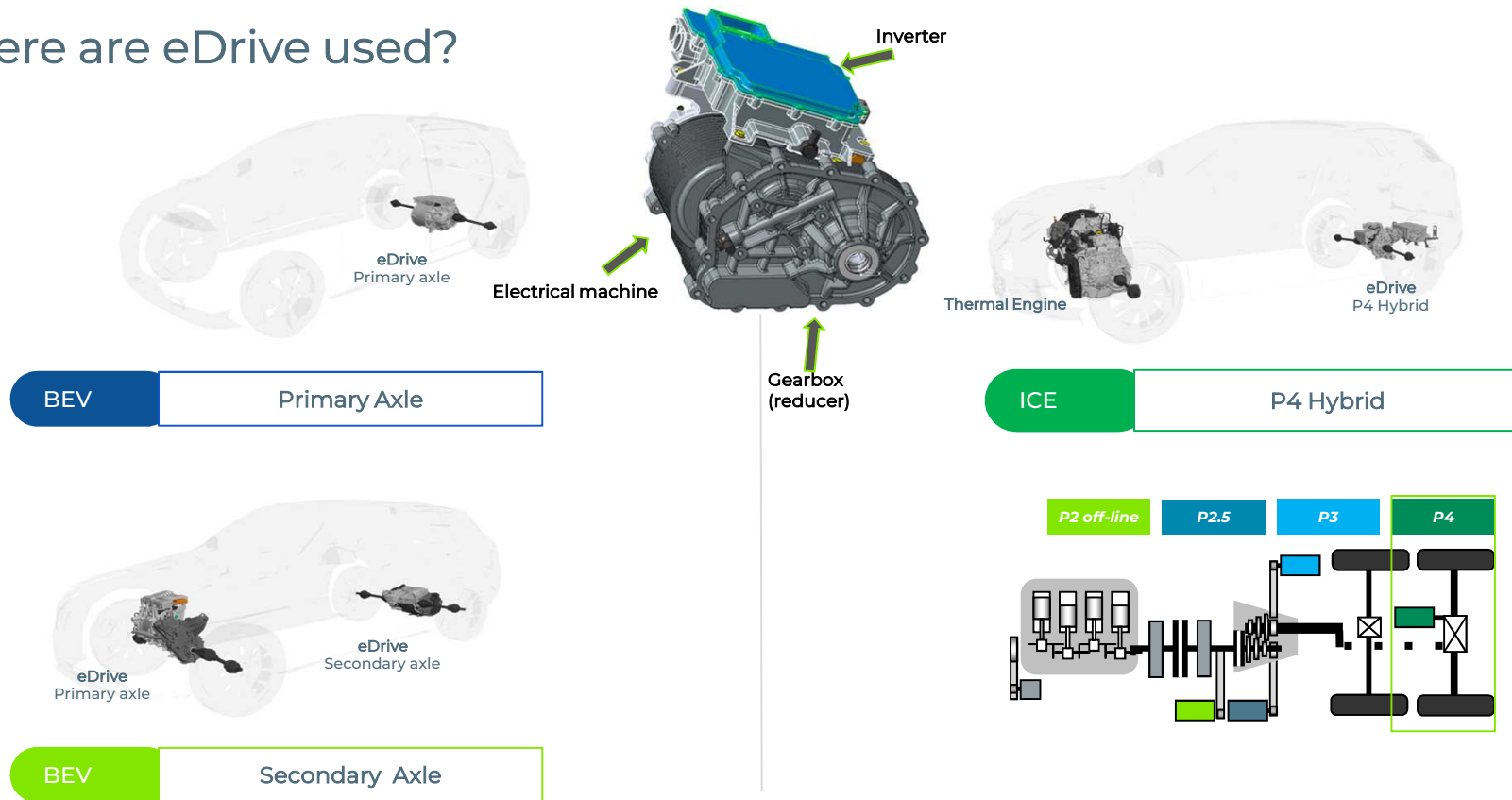


Inverter



eDrive

Where are eDrive used?



EDrive are used either in EV or in Hybrid vehicles as P4 (auxiliary axle)

Valeo Reducer platform competencies & capacities

Created in 2018 to offer 48V and HV voltage full eAxle solution

Strong human competency ramp up

- Experienced engineers hired from OEMs and gearbox manufacturers in Europe and Asia
- More than 72 people in Reducer R&D + 44 people prototype, simulation and NVH departments

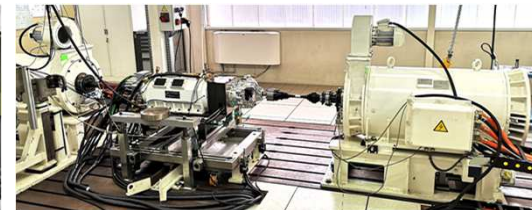
Engineering partners to reinforce competency (1st step), design and testing capacity (2nd step)

3 development sites

- Amiens Advanced Engineering Center, France
- Nanjing R&D Center, China
- Erlangen, VSeA site support

Prototype & Testing facilities @ Amiens

- Wire cutting, Machining center, Grinding (Q1-2023)
- Tilt bench test, 2 and 3 Dyno benches
- New test track



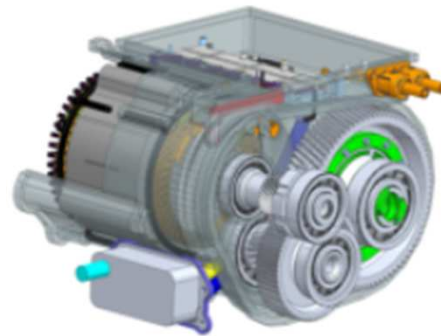
High Efficiency Roadmap

low operating reducer oil level
“dry sump”

Secondary (main) shaft in
upper position

Low viscosity oil

Common eMachine/Reducer oil
circuit



Gears: Optimization of Module /
Width / Center distance / Helix
angle / Ratio distribution

Gear teeth polishing process

Bearings: Ball bearings

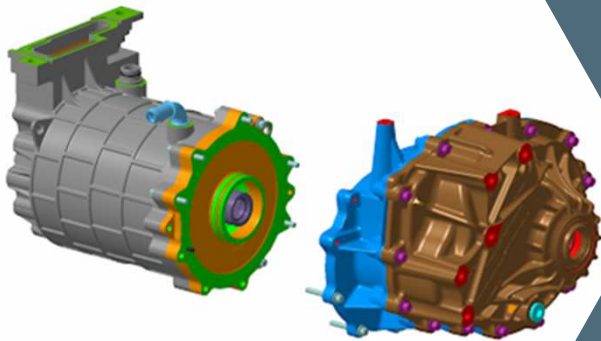
Mechanical concept: 2 bearings

Common Rotor / reducer shaft

A specific roadmap to anticipate the increasing demand of high efficiency eDrives

Competitive advantage of integrated design

Stand Alone Design



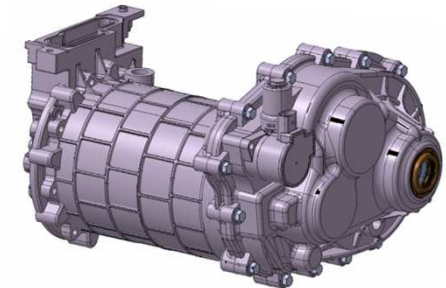
Pros:

- Fewer Parts (Housing, bearings, screws)
- Cost (10% to 20%)
- Weight (~20%)
- Packaging
- Efficiency

Cons:

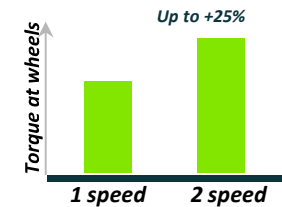
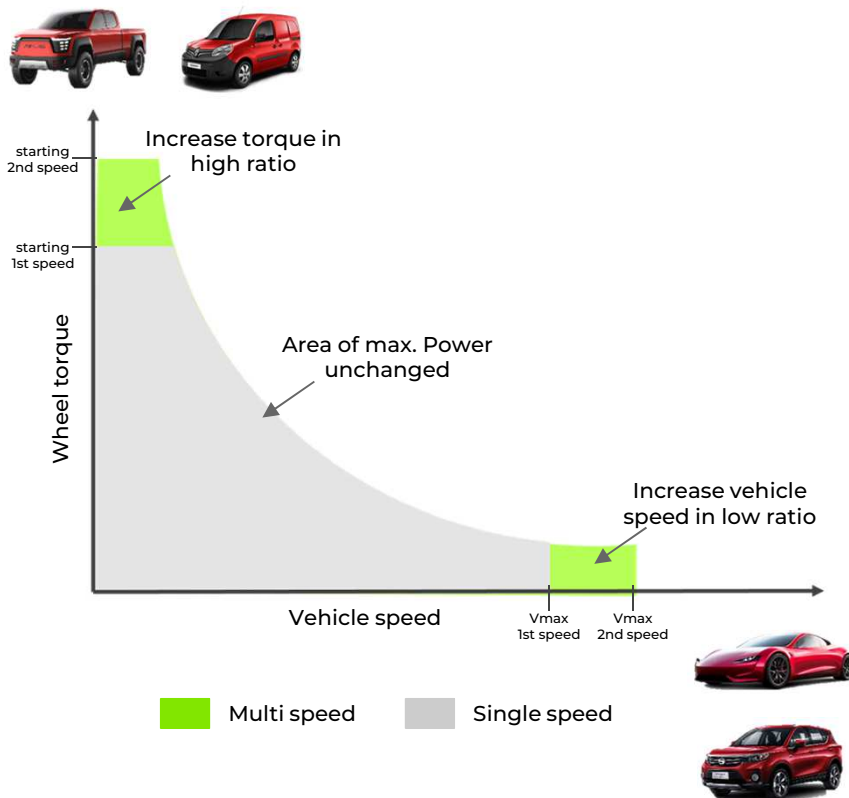
- More complex system
- Integrated assembly line
- Reduction of modularity

Integrated Design “3 in 1”: e-Motor & Inverter & Reducer

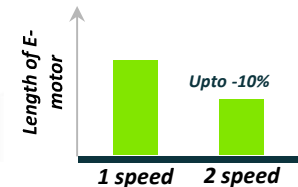
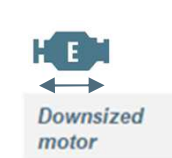


Integrated Design is currently the mainstream architecture for e-Drives

Benefits of Twin speed gearbox for single Powertrain BEV



For the same eMachine Power:
 - The 1st short gear ratio enables 25% higher Torque.
 - The 2nd gear ratio increases the max speed



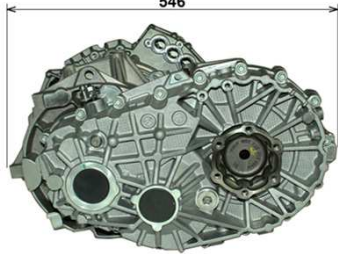

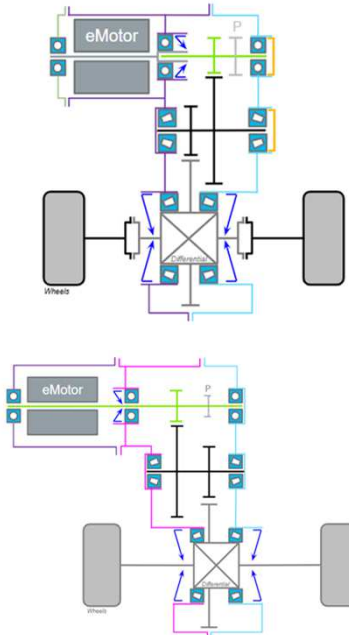


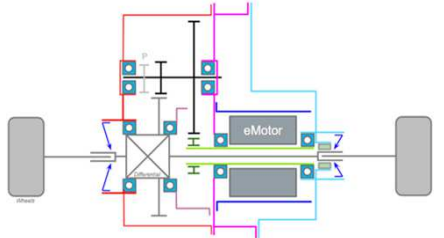
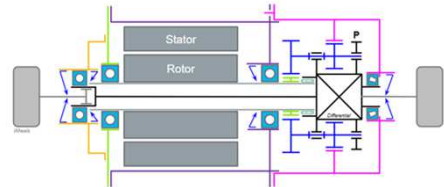
For the same Torque @ wheel, a ~ 10% smaller eMotor Power is required:
 => ~10% shorter eMotor length
 => smaller packaging



2 - 5 % efficiency gain on WLTC Vs Single Speed transmission, thanks to optimization of the eMachine operating range

Disconnect function integrated with the Neutral function.

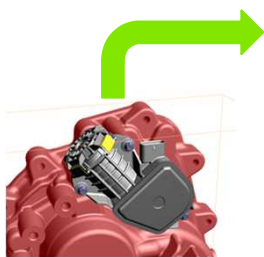
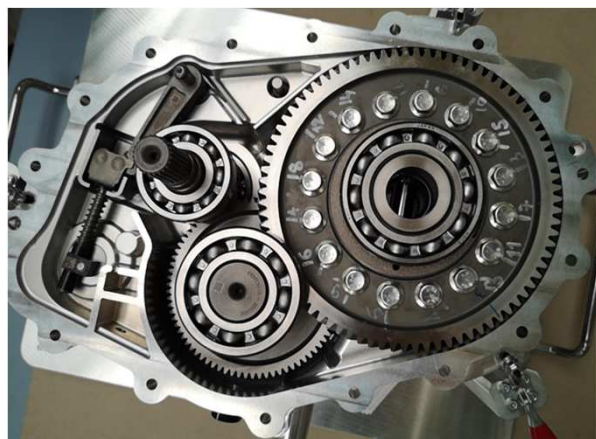
ARCHITECTURES: Offset & Coaxial Gearboxes

OFFSET GEARBOXES motor axis parallel to differential axis	COAXIAL GEARBOXES motor axis coaxial to differential axis
<p>VW e-Golf VII</p>  <p>Renault Zoé</p>  	<p>Opel Ampera</p>  <p>Jaguar I-Pace</p>   <p><i>With parallel gears</i></p>  <p><i>With planetary gears</i></p>

Actuator Park lock mechanism



SOP
Q2 2024



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Customer assets

- **Optimized** Park Lock system combining mechanical architecture, actuator and control
- **Patented roller system** associated with 180 deg stroke to **reduce** the actuator **size and weight**

Key characteristics

- Engagement speed = 2 to 3.5kph
- Max actuator engagement time = 300ms
- Max actuator disengagement time = 450ms
- Locking device = Self locking actuator (worm gear set)
- Max vehicle roll-in (10% slope) = 150mm
- Working temperatures = -40°C to +120°C
- Lubrication / Cooling = integrated cooling: inverter / Motor / Transm oiled cool
- Specific feature = disconnect optional



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Actuator Integrated Disconnect

Exists as stand alone differential with integrated disconnect



Customer assets

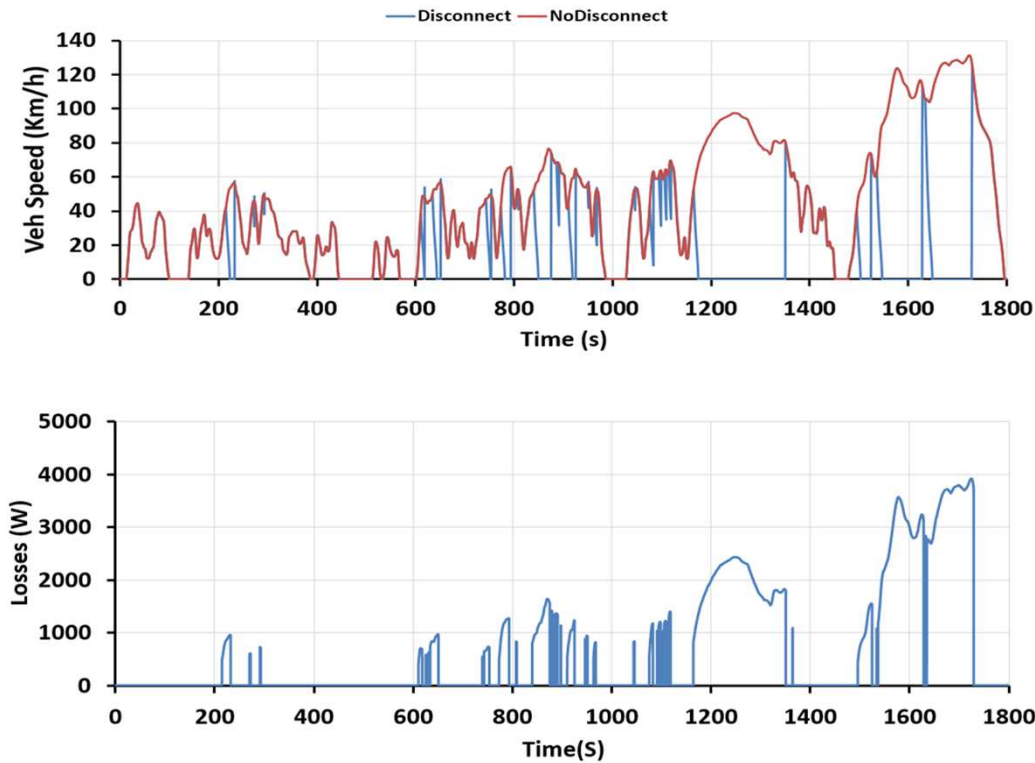
- eDisconnect powered by Solenoid, 12 and 48 V variants:
- Improving powertrain and vehicle **efficiency**

Key characteristics

- Disconnect integrated in the differential allows drag torque <1Nm
- Scalable design for power, torque and packaging targets
 - Up to 4000 Nm
 - Connection time <80ms

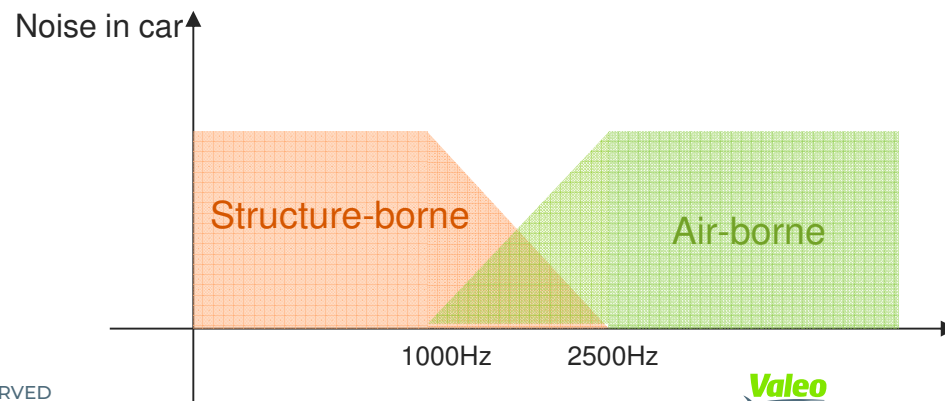
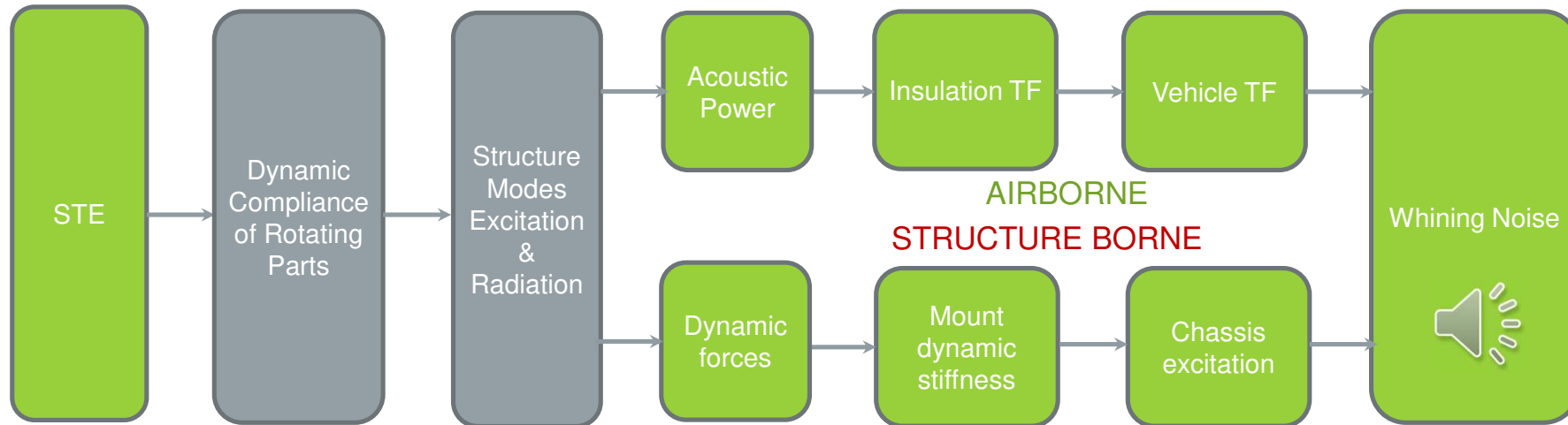
DISCONNECT NEED: eMachine Losses from defluxing over WLTC

C-SUV 48V MHEV P0 / P4



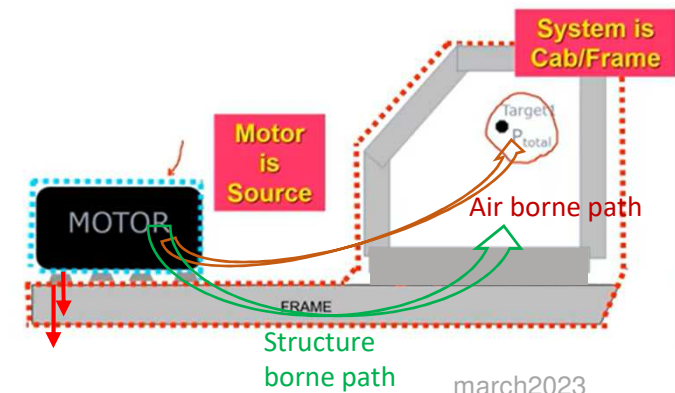
Resulting losses from the defluxing of the P4 eMachine during forced connection

E-drive Gear Whining noise



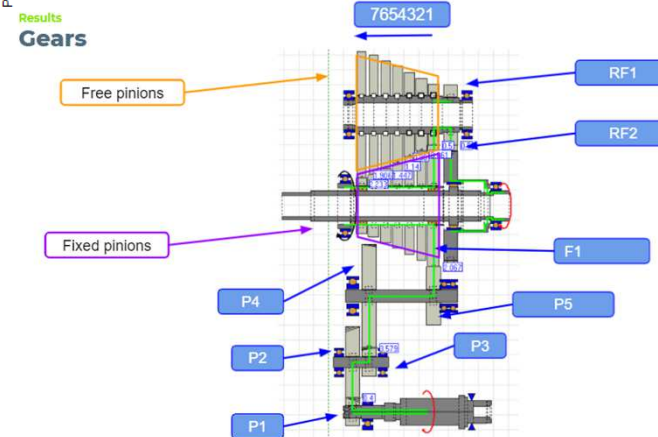
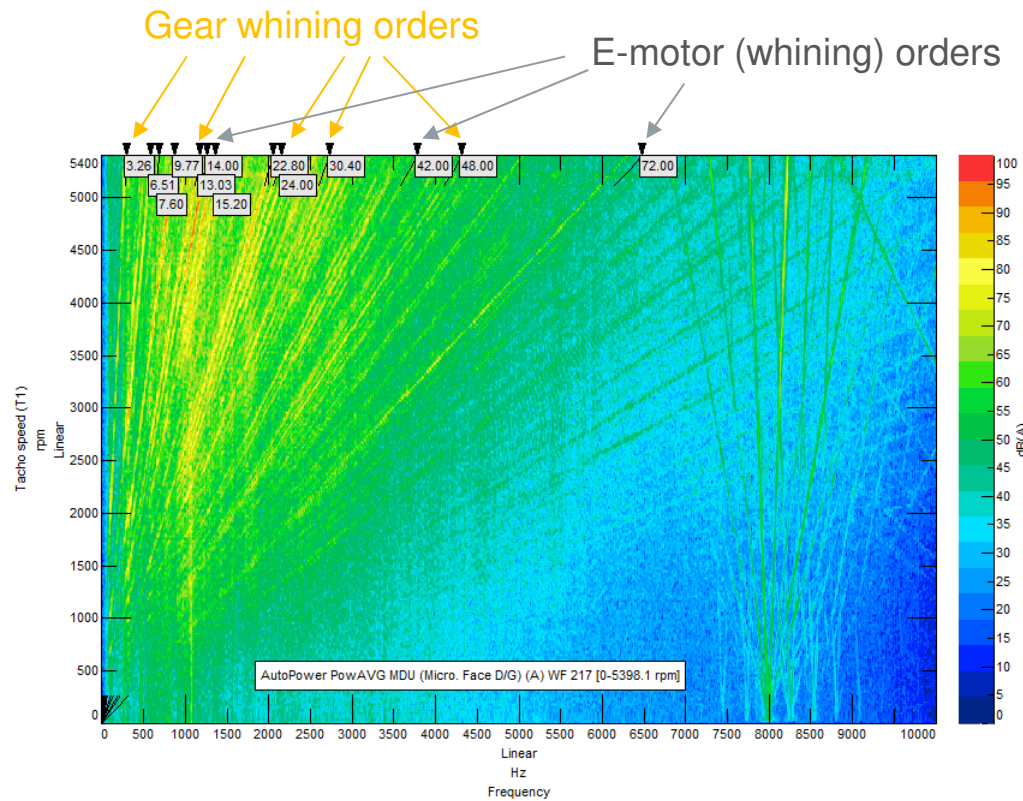
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Valeo



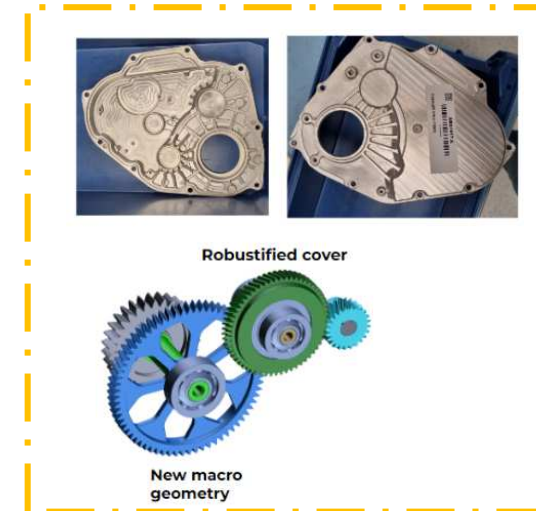
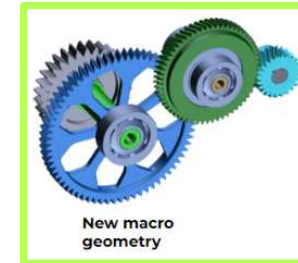
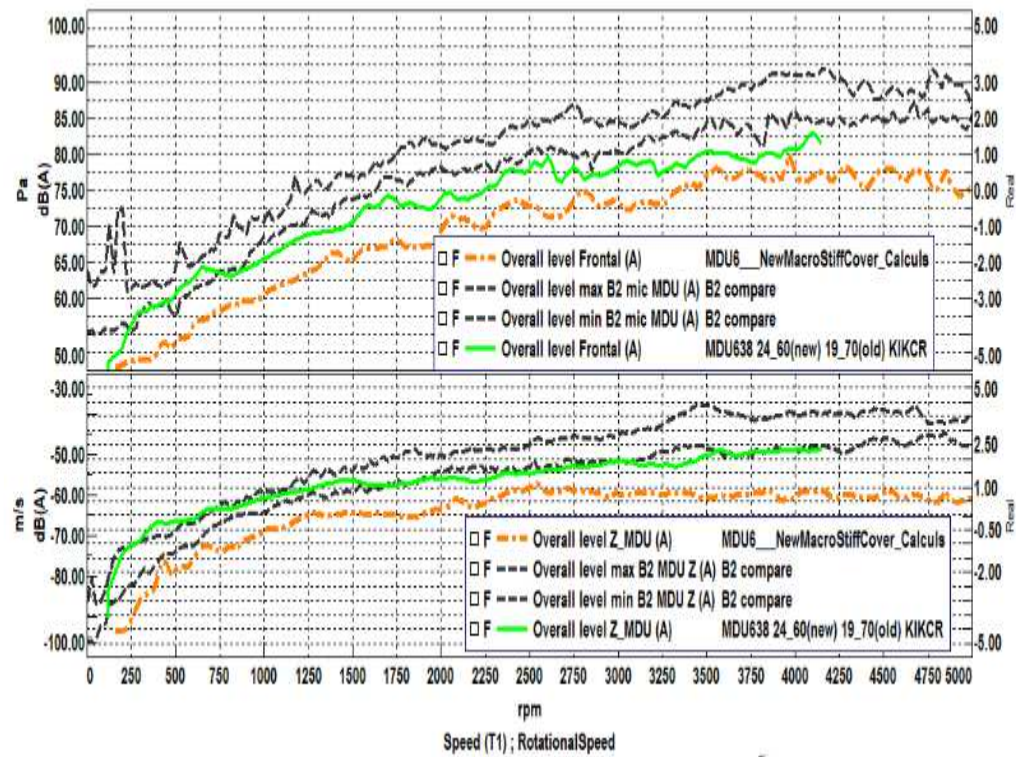
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Example : E-bike



Example : E-bike

--- :SOP (B2) Design



Example : Electrified rear axle

