



**HEXAGON**

## **eMobility**

### **"The Dawn of a Revolution"**

"Helping you accelerate electrification & Carbon neutrality"

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Hexagon Manufacturing Intelligence division

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# Agenda



## The Hexagon Story

Why autonomy matters to Hexagon



## Accelerating electrification

**100% EV**



## Key Components for EV

Comprehensive Design & Engineering



## Smart Manufacturing for eMobility

Towards digital transformation



## Digital transformation

Enabling smart manufacturing in your industry



# I. The Hexagon story

Global leader in **sensor**, **software**,  
and **autonomous** technologies committed to

**empowering an autonomous future**



# Building the leading technology portfolio for smarter manufacturing



# Hexagon's global reach in manufacturing

A vast and talented technology support and development network

Americas  
**28%**

EMEA  
**32%**

ASIA  
**40%**



Over **8,000** employees



**10%** of net sales invested in R&D



Reached **~€1.4bn** sales in 2020



More than **500,000** software licences installed,  
**10,000** devices shipped in 2020



Over **2,800+** software developers and engineers

# The road to autonomy

Enabled by our unique set of core competencies

PHYSICAL WORLD



We digitally **CAPTURE** and **POSITION** the physical world

## SENSOR SOLUTIONS

data capture

## AUTONOMOUS SOLUTIONS

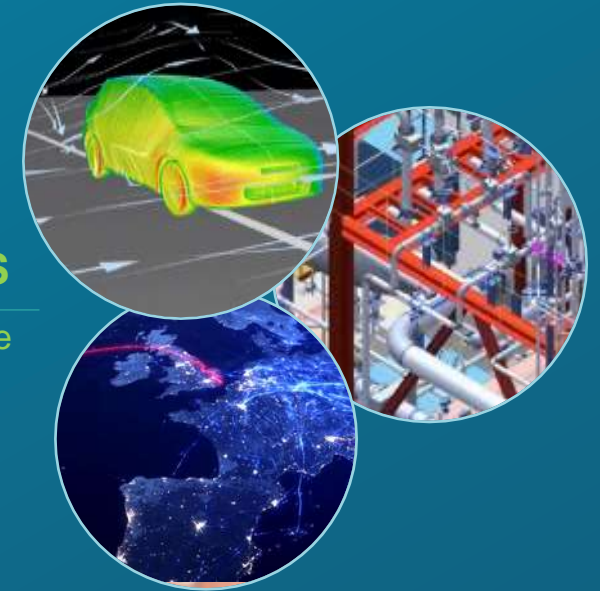
data leverage



We fuse the physical and digital worlds and leverage the power of algorithms to achieve **AUTONOMY**

## SOFTWARE SOLUTIONS

data intelligence



We digitally **DESIGN** assets, **SIMULATE** real-world scenarios, and deliver situation awareness with **LOCATION INTELLIGENCE**

DIGITAL WORLD



# Power your processes

Digitally connect:

- Data from the physical and virtual worlds
- Data from throughout the product lifecycle
- Data from all functions and departments

Seamless and autonomous workflows



Embedded and assured quality



Flexible scalability



Advanced analytics



Collaborative innovation



Cost optimisation



Increased productivity





# II. Accelerating electrification



**China**

25% of vehicles to  
be electric



**Japan**

23-33% electric  
passenger vehicles



**USA**

California

No new gasoline or diesel  
powered passenger cars



**Germany**

100% electric  
passenger vehicles







**100% EV**

**Plug into a holistic suite of eMobility solutions for design and engineering, production and metrology.**

Hexagon offers industry an integrated approach to improve, speed up and simplify the development of electric vehicles by targeting key challenges facing designers, engineers and manufacturers.





## **New simulation technologies help you tackle your biggest EV challenges, including:**

- Thermal management
- Range anxiety
- Quality and performance
- Noise, vibration and harshness
- Safety
- Environmental impact
- Driver and passenger experience





## Key Components for EV



**Electric motor**



**Body structure**



**Cabin interiors**



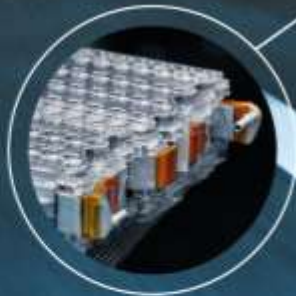
**Exterior and aerodynamics**



**Drivetrain**



**Battery and fuel cells**



**Power electronics**



**New materials development**





# EV Design & Manufacturing Challenges:

## Vehicle Performance & Safety

- Acceleration
- Torque Vectoring & Vehicle Dynamics
- Noise, Vibration & Harshness
- Durability
- Battery Safety & EMI Protection
- Thermal Management & Leakage

## Driver & Passenger Experience

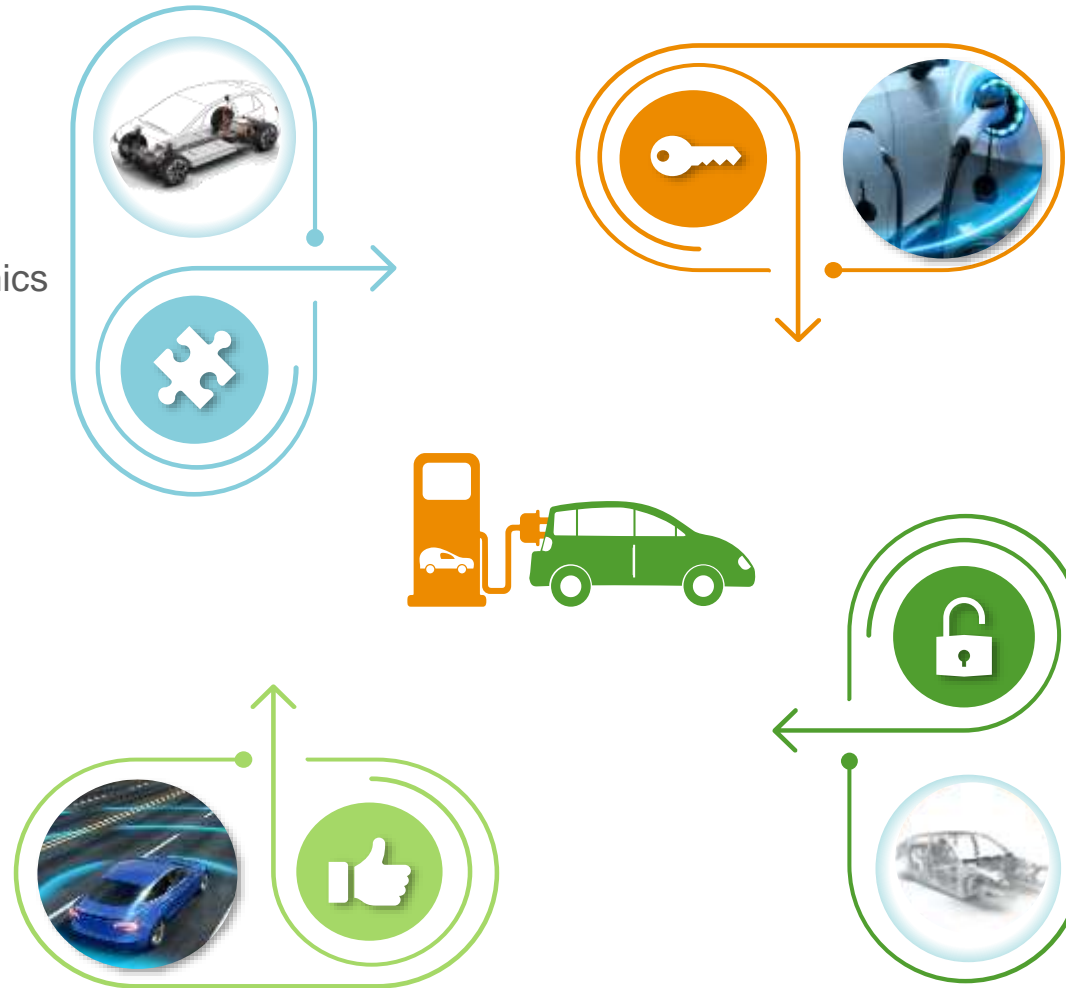
- Cabin Comfort & Cabin Noise
- ADAS
- Infotainment, telematics

## Range Anxiety

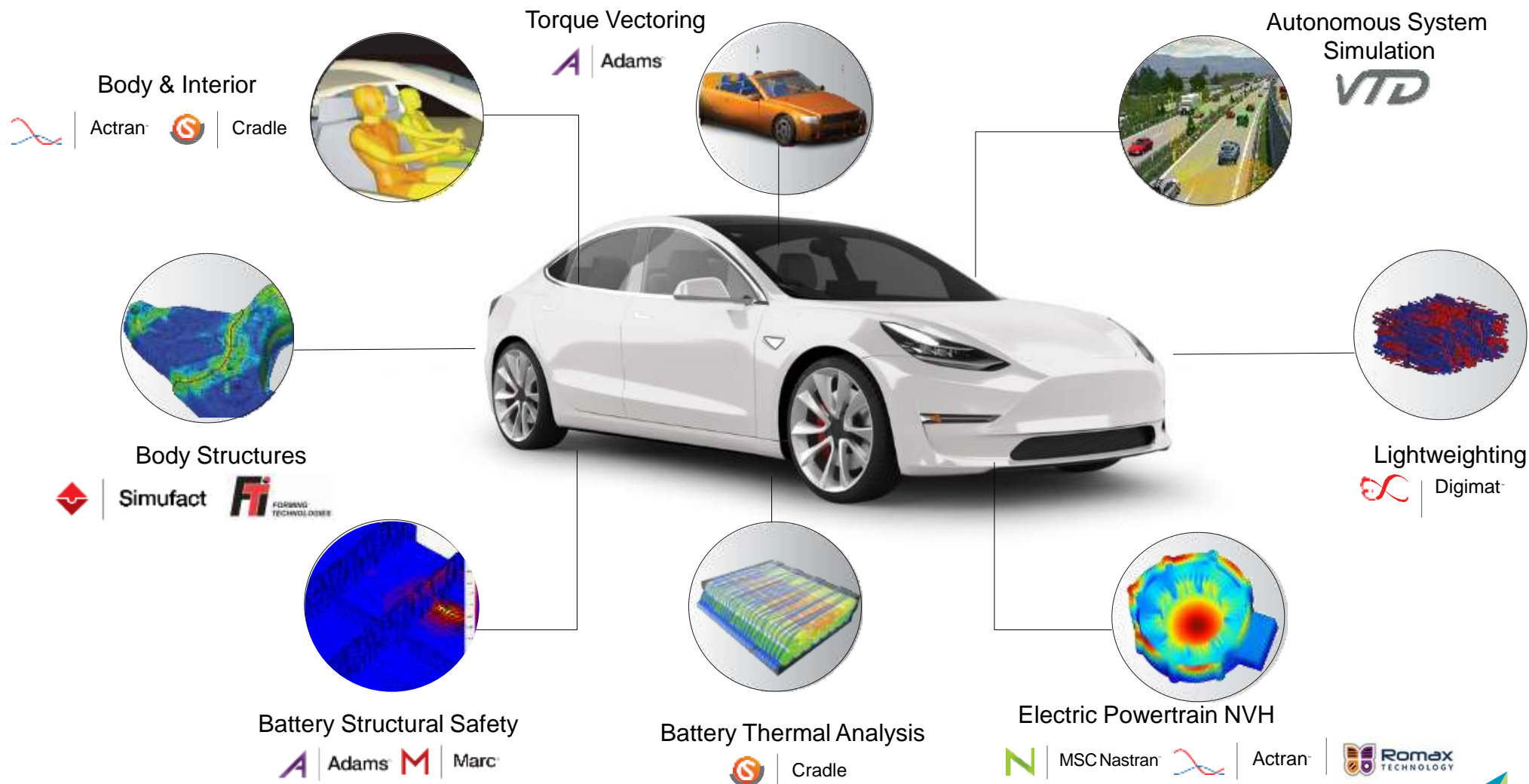
- Powertrain Optimization
- Battery Thermal Management
- Lightweighting, Alternate Material exploitation
- Tire Rolling Resistance

## Manufacturing & QA

- New Manufacturing Process
- Joining Dissimilar Materials
- Digital Twins
- Improving productivity and efficiency with smart manufacturing solutions

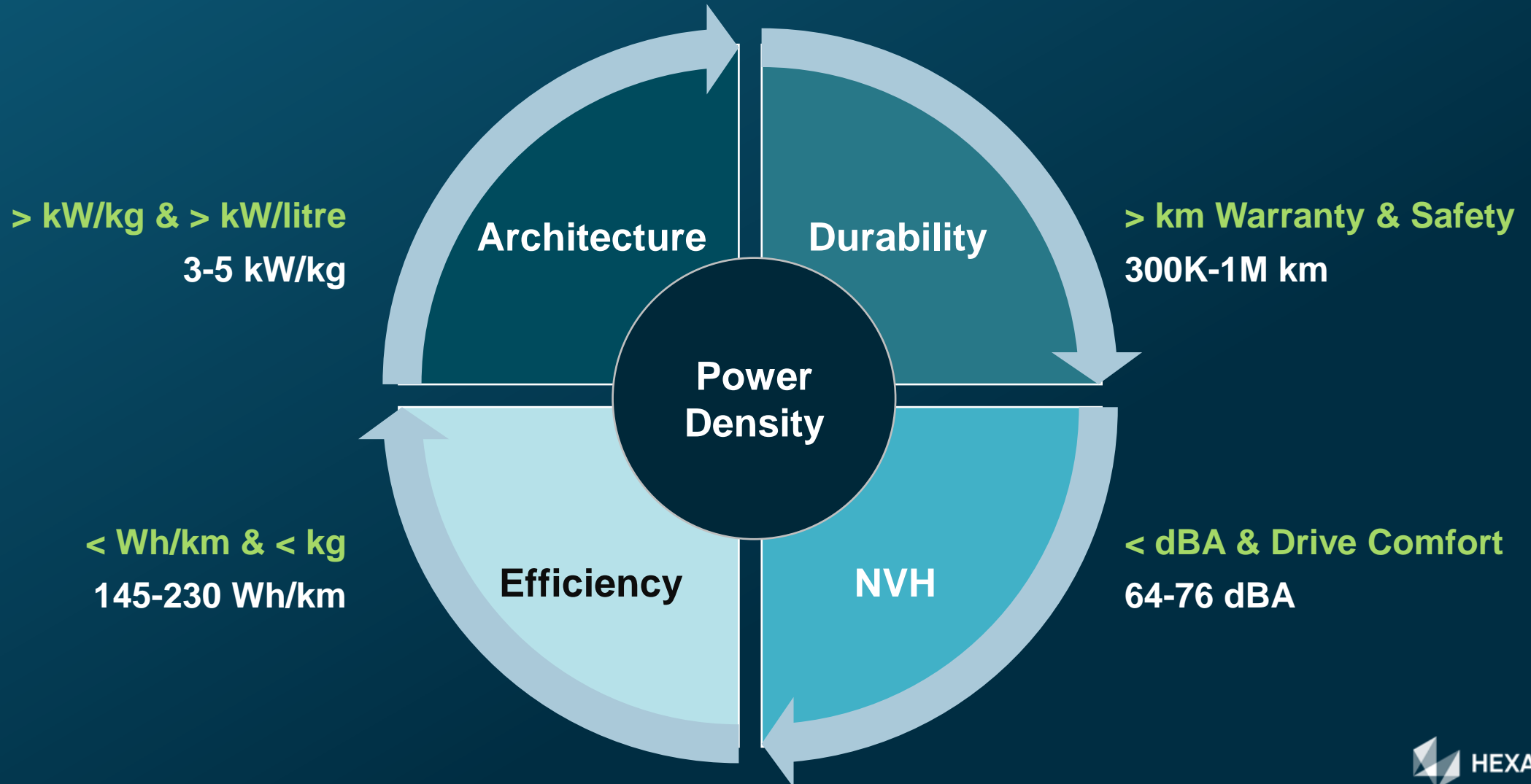


# Comprehensive Design & Engineering Technologies for Electric Vehicles



# ePowertrain Design Challenges

Target & Current Level of Achievement in the Market

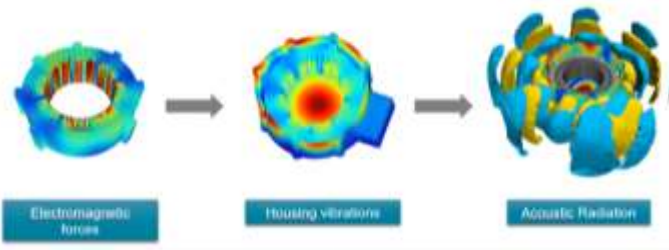




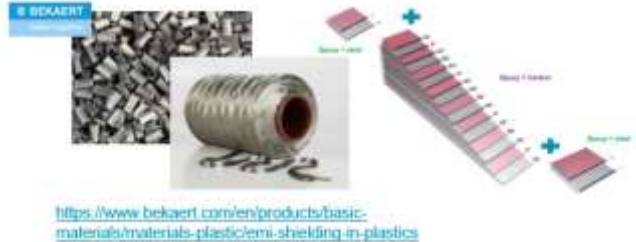
# Required ePowertrain Core Technologies

## Motor & Gearbox

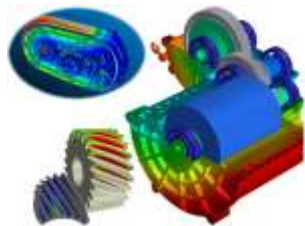
### Electric Motor Noise



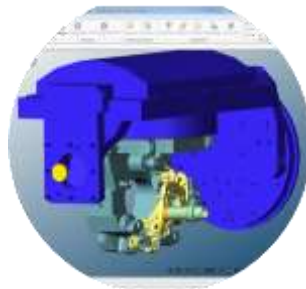
### EMI Shielding Material Design and Modelling



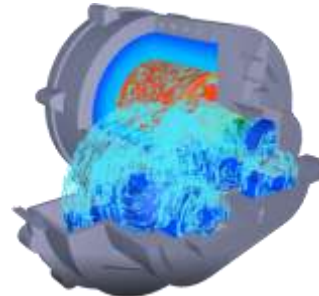
### Fatigue Life



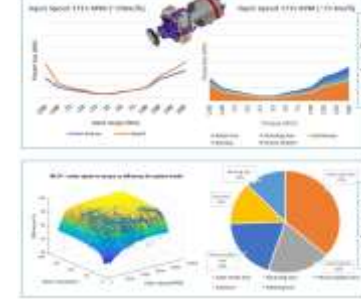
### CNC Simulation



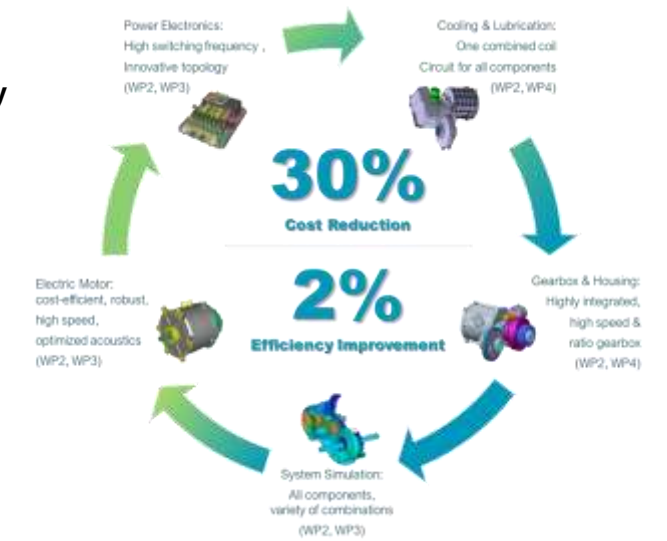
### Thermal Management



### ePowertrainSystem Efficiency



### Optimised ePowertrain Architecture Selection



### Dimension Inspection of the drive motor

The drive motor converts new energy into a driving force.

#### Motor cover and housing

- Precision turned & profile
- High strength & thermal stability
- High precision & reliability



#### Motor stator, Rotor core

- Precision turned & profile
- High strength & thermal stability
- High precision & reliability



#### Motor shaft

- Precision turned & profile
- High strength & thermal stability
- High precision & reliability



#### Gears, splines

- Precision turned & profile
- High strength & thermal stability
- High precision & reliability



### Ultra-high accuracy CMMs



### Drive motor dimension detection

- Global series Bridge Measuring Machine (CMM)
- PC-DMS - DCC-Scanning + XTS
- PC-DMS GEAR (Special module for detecting gears and splines)



# ePowertrain – Solving the Core Issues of the Core of an EV

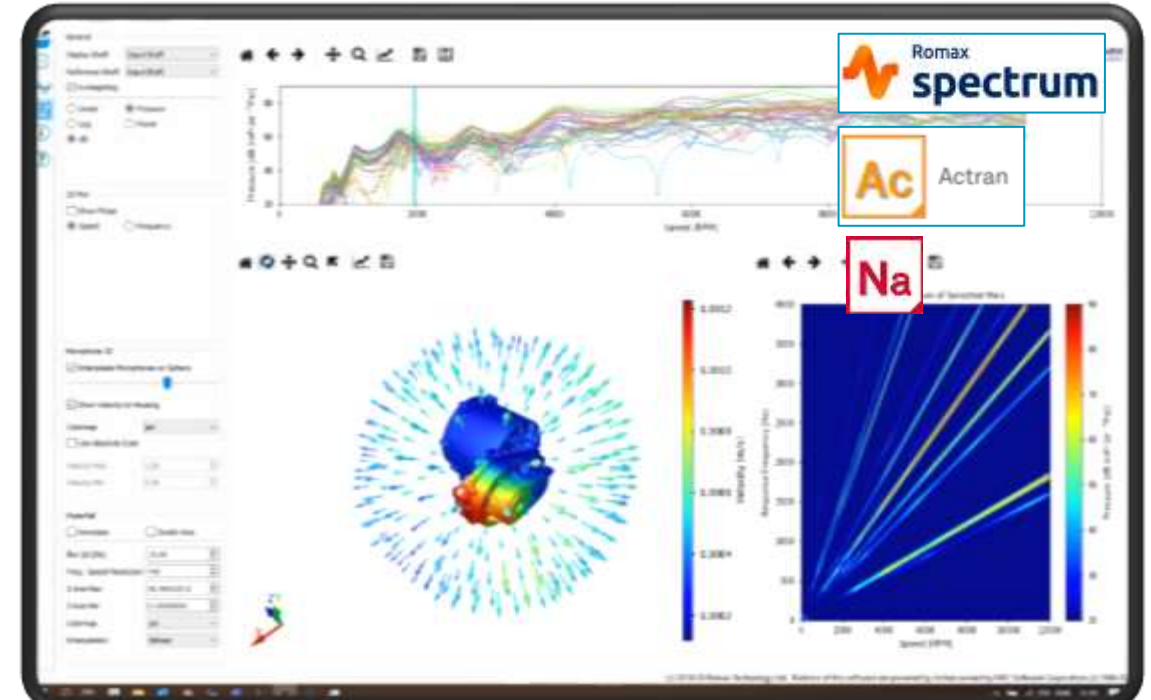
## Cool it down!



 Cradle | scFLOW  
 Cradle | scSTREAM

Heat loads of the ePowertrain limit its performances and durability. Optimal cooling allows downsizing, lightweighting and big money savings!

## The Sound of Silence

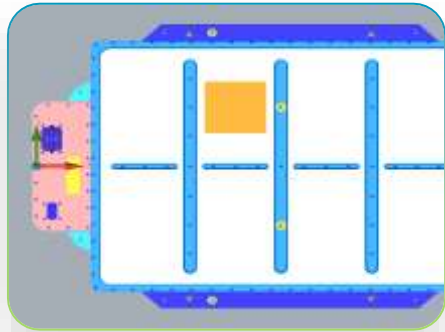


An internal combustion engine has a voice, an electric motor only wines...

A quiet drivetrain is the hallmark of a quality EV and is the only thing that the customer will hear.

# Dimensional quality monitoring

Deliver what was Designed



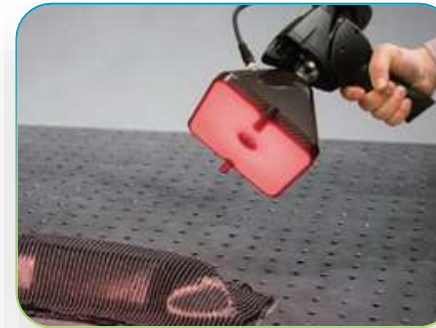
## Power system

Battery pack, driving motor, ...



## Car body

BIW scan, Flush and gap inspection, ...



## New material

Processing defect detection,  
3D data analysis, ...



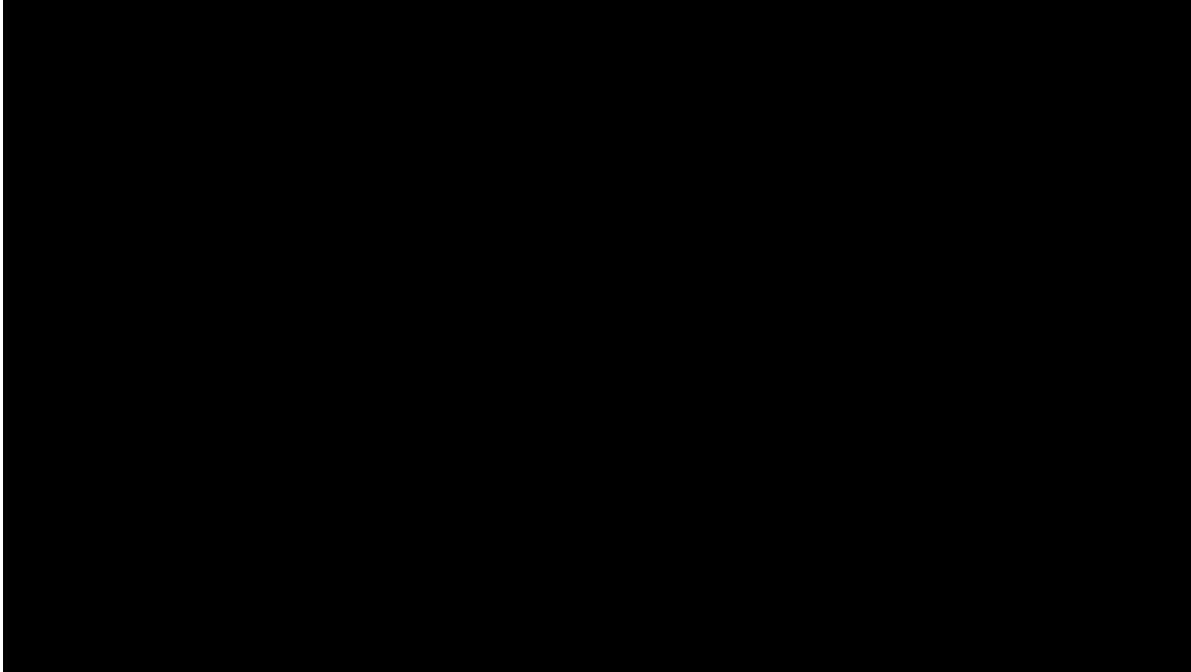
## Data analysis

Statistical analysis of measuring  
data, Smart mfg platform, ...

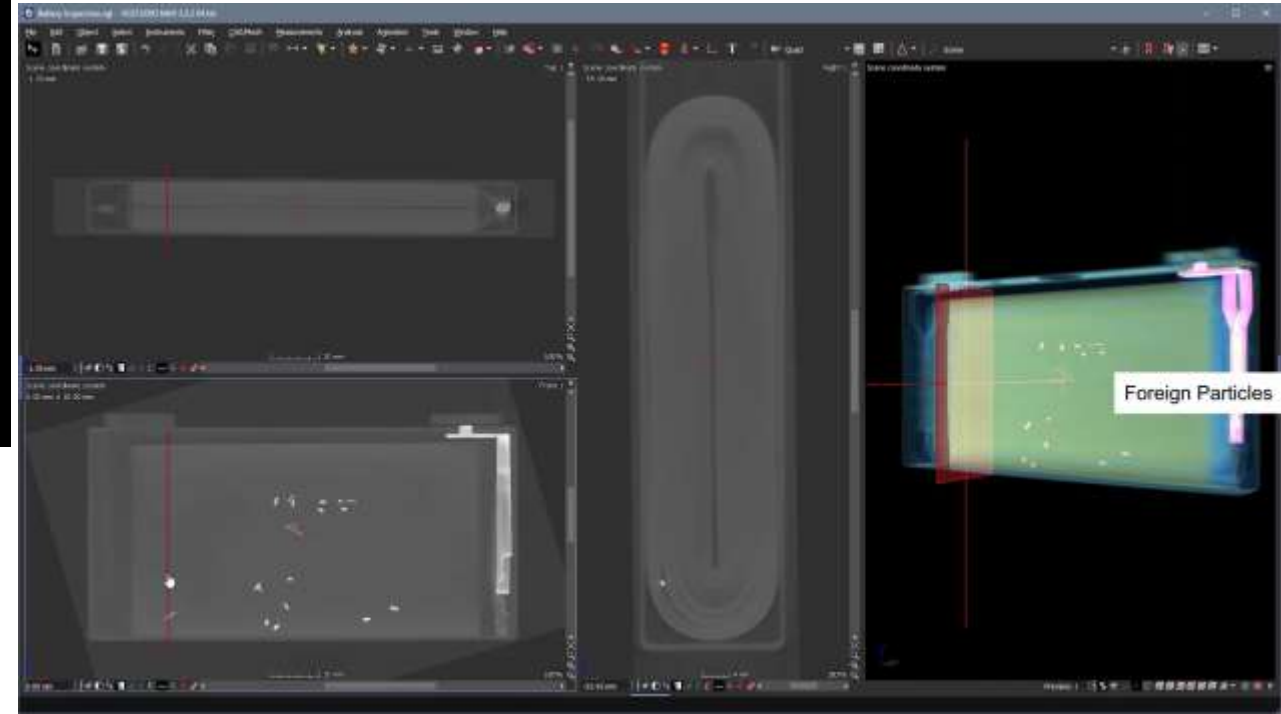


# Key Technologies for Battery Packs

## Thermal Management



## CT for Inclusions and Defect Identification





# Material & ICME Solution for EV

## New material development

- SMC, Recycled grades, ..
- Shorten time to market

## Lightweighting

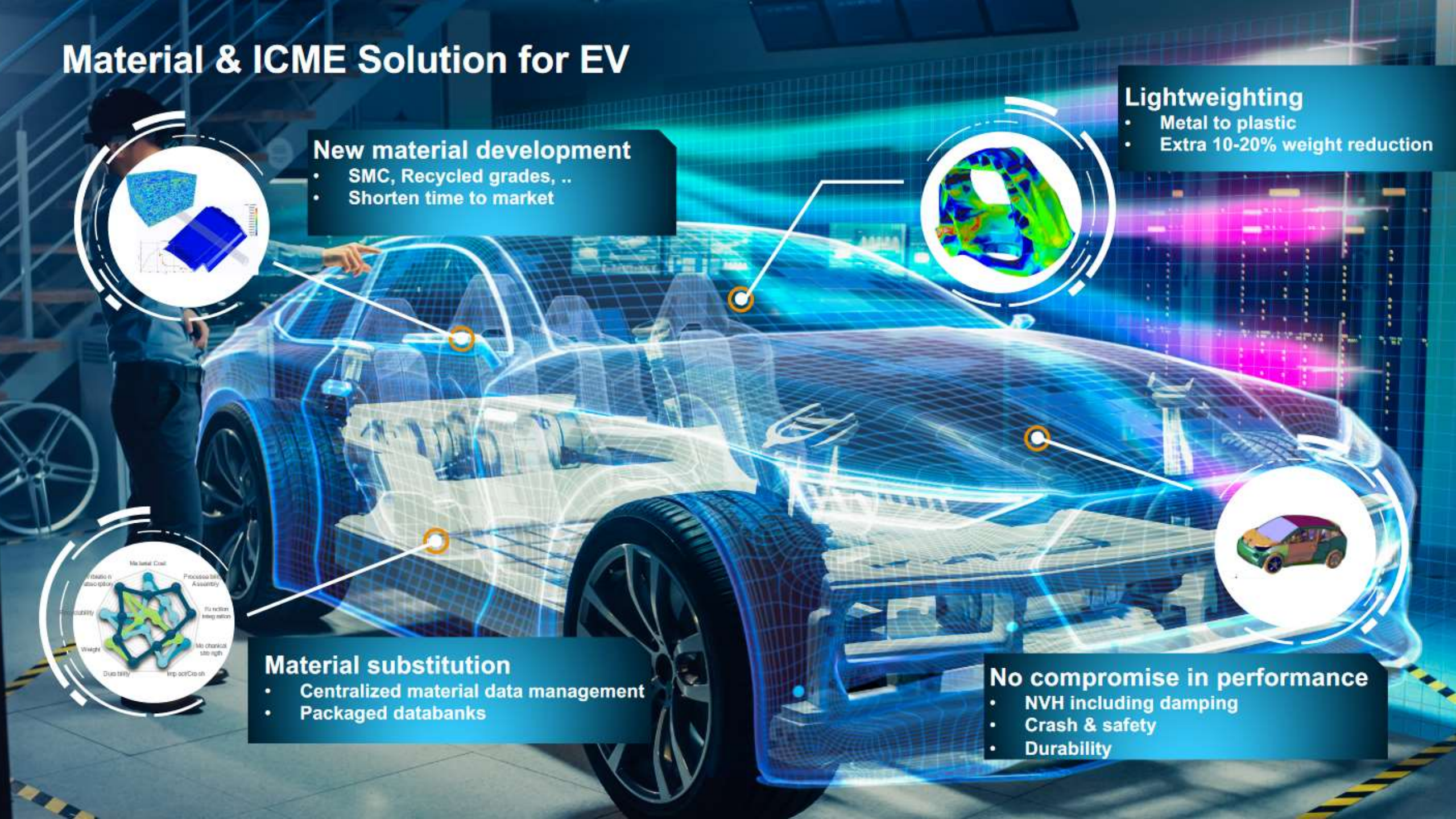
- Metal to plastic
- Extra 10-20% weight reduction

## Material substitution

- Centralized material data management
- Packaged databanks

## No compromise in performance

- NVH including damping
- Crash & safety
- Durability







# Smart Manufacturing for eMobility

# Smart Manufacturing

## Enabling

Autonomous processes  
Reskilling of workers

## Reducing

Human error  
Time taken  
Material use  
Energy and material waste

## Delivering

Increased efficiency  
Higher productivity  
Inherent quality

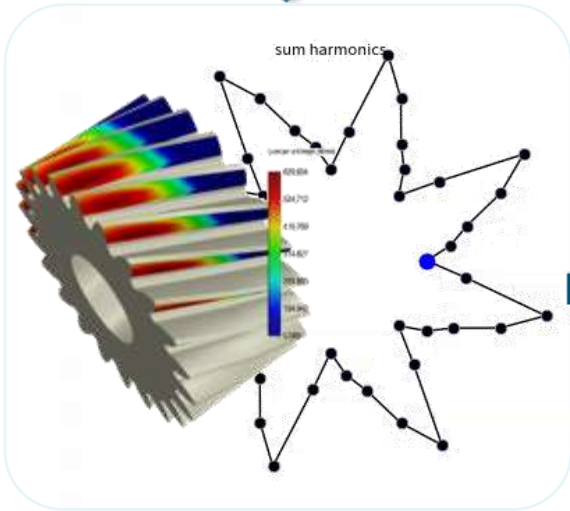
## Real-time feedback loops





# What could make Design & Manufacturing Smart?

Continuous Learning and Incremental Improvements



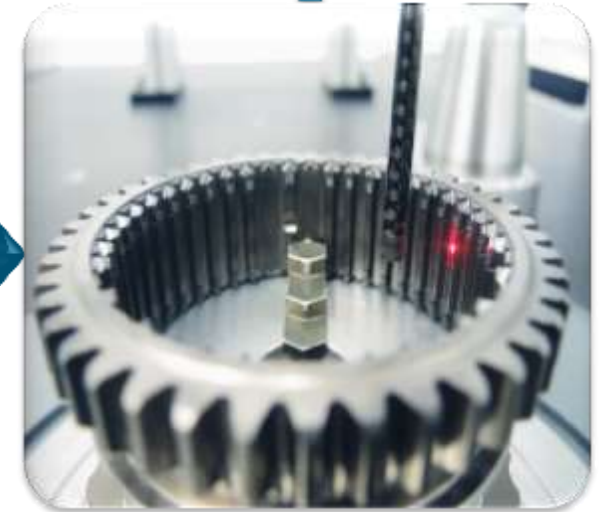
Design & Validation



Manufacturing



Quality



## Cognitive Engineering Evolution

Continuously Enhancing Quality & Productivity

# Digital transformation

Transform product development, production and operations with digital solutions built by manufacturers, for manufacturers.

**Design and engineering**



Enterprise integration

**Feedback and improvement**

Artificial intelligence

Edge computing

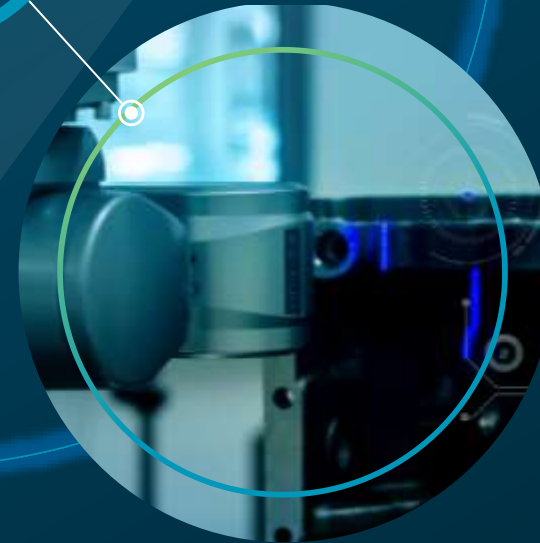
Advanced visualisation

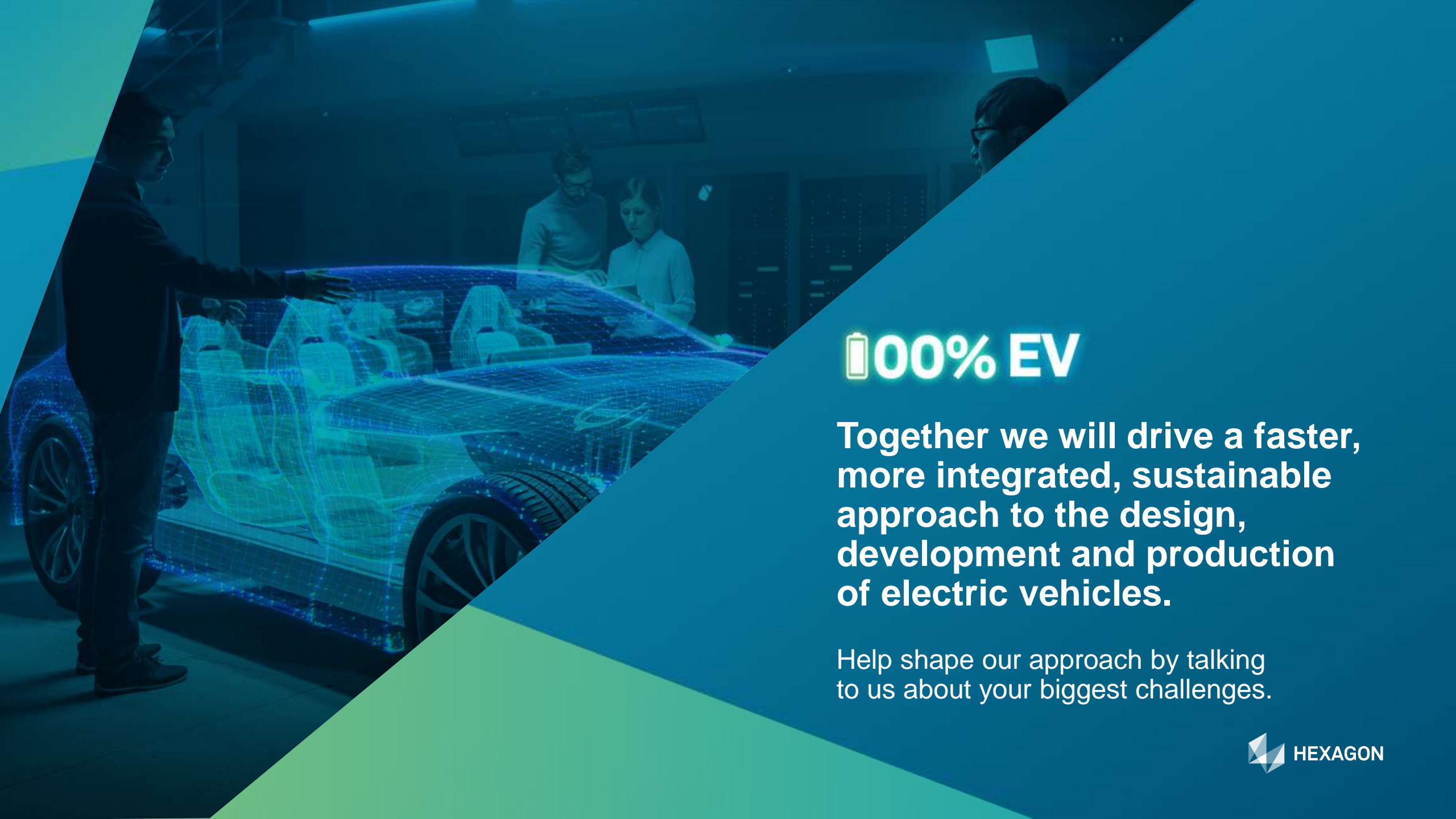
Mobility

**Production**



**Metrology and inspection**





## 100% EV

**Together we will drive a faster, more integrated, sustainable approach to the design, development and production of electric vehicles.**

Help shape our approach by talking to us about your biggest challenges.



# Thank you



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## Chat

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## Connect

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