



AVL NVH Test Systems

Our commitment to silence

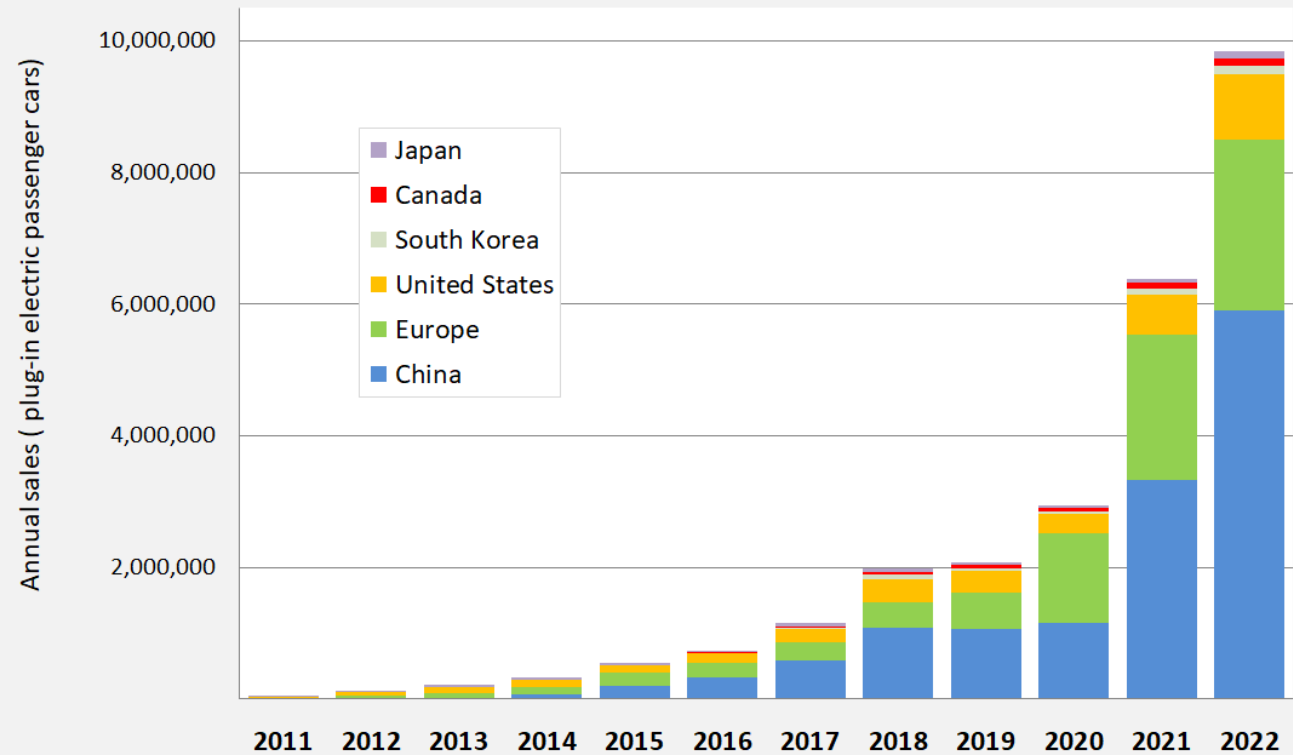
Reimagining motion

First Electric Car, 1884

Invented by Thomas Parker



Global annual sales of plug-in electric passenger cars in top selling markets (2011 - 2022)



By Mariordo (Mario Roberto Durán Ortiz) - Own work, CC BY-SA 4.0, <https://commons.wikimedia.org/w/index.php?curid=47854741>

AVL as your partner

Our values

NVH COMPETENCE CENTER

Over 120 AVL Engineers and over 100 person-years of experience in the NVH application team



ALWAYS CLOSE TO THE CUSTOMER

Our worldwide structure of test centres, well trained sales and engineering experts support your NVH project every day



WIDE NVH PORTFOLIO

AVL has a comprehensive NVH testing portfolio, and we are dedicated to find a solution for every UUT in the market

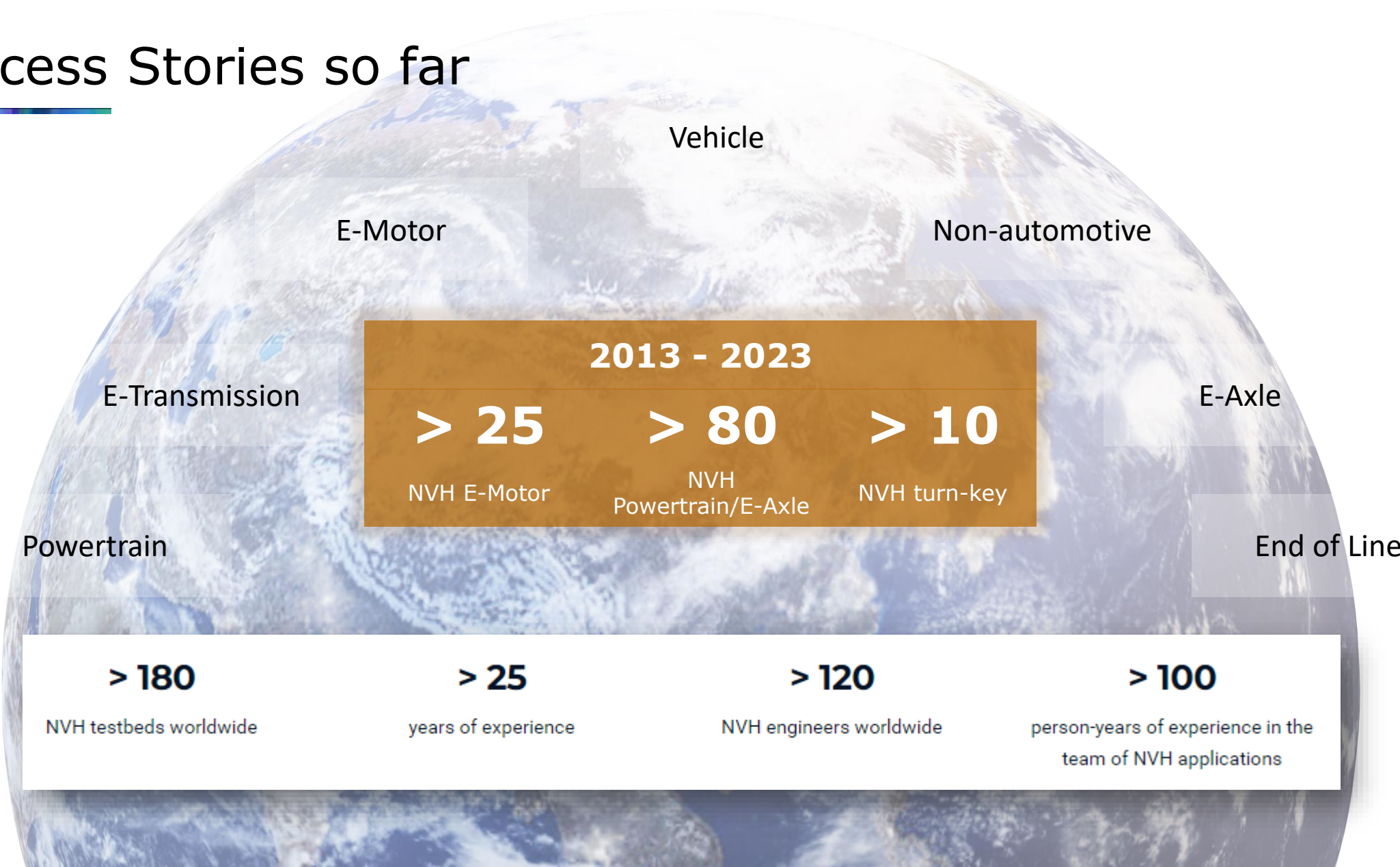


FROM CONSULTING TO TURNKEY PROJECT

You choose how much you want to involve AVL, from consulting on NVH solutions to complete turnkey projects



Success Stories so far





News & Environments

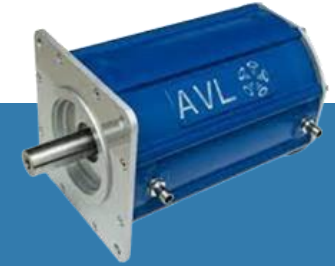
NVH Market Trends



NVH Development trends

E-Motor

High speeds
Motor cooling
Low noise level



E-Powertrain

High input speed
Increasing torque, moving towards mid-duty
Flexible adaptations to mechanic interfaces
Increasing demand for NVH development in heavy duty sector



End of Line

Highly automated quality control
Complex data analysis
Minimizing cycle time



Vehicle

Indoor testing
Lowered noise emission
Tyre noise





NVH E-Motor Testing

AVL solutions for any purpose

NVH E-Motor Efficiency Setup



NVH E-Motor Precision Setup



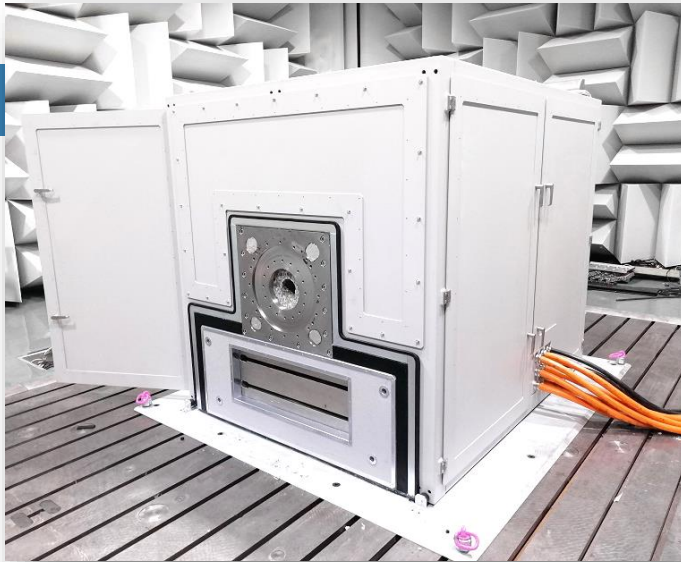
NVH E-Motor Premium Setup





AVL's solutions

Retrofit of existing test systems or semi-anechoic chambers



NVH E-Motor Efficiency Setup

Cost saving solution

Low impact to facility

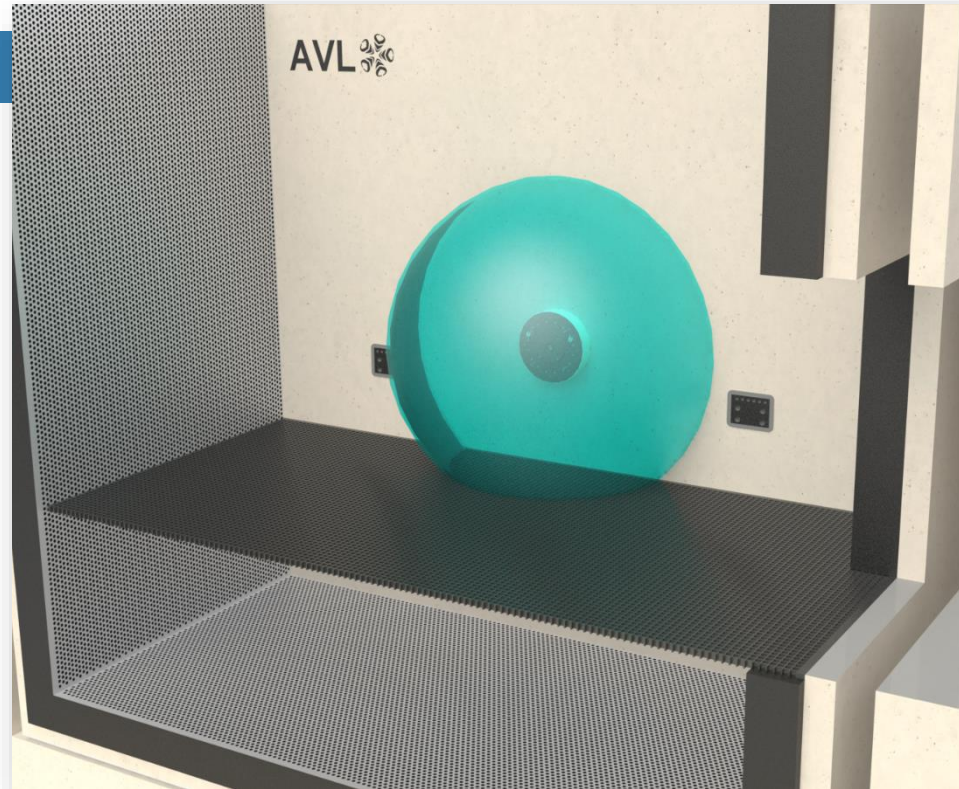
Operating noise level of 65 dB(A) at 16 krpm *

* Microphone distance 1m/45° to the shaft hole, opening closed



AVL's solutions

Very precise measurement of sound power level

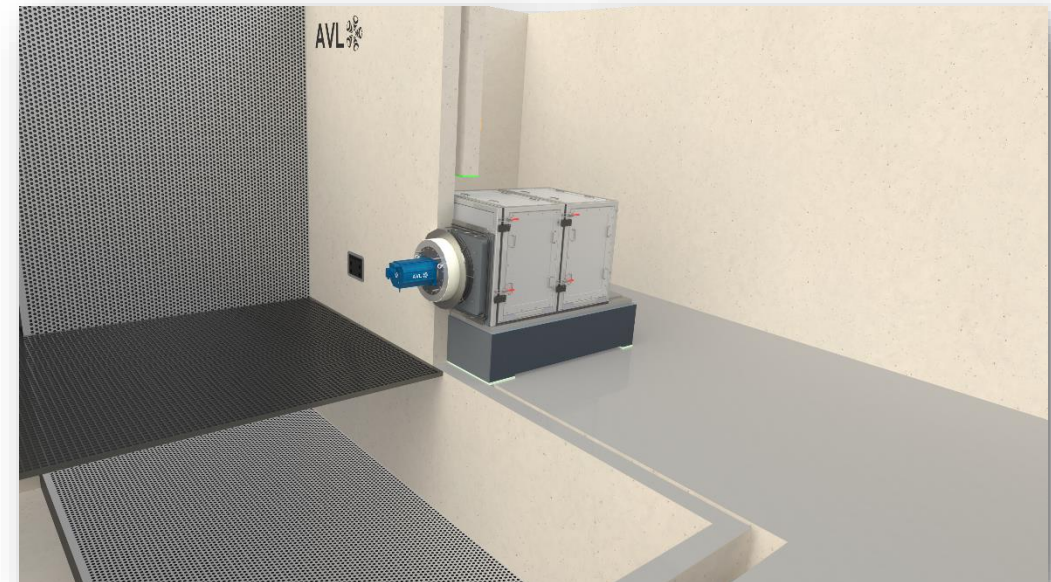


NVH E-Motor Precision Setup

Full installation of ISO3745 microphone hemisphere

Low operating noise level of less than 60 dB(A) at 20 krpm *

Semi-anechoic chamber with customizable cut-off frequency



* Microphone distance 1m/45° to the shaft hole, opening closed



AVL's solutions

High SNR for acoustic development

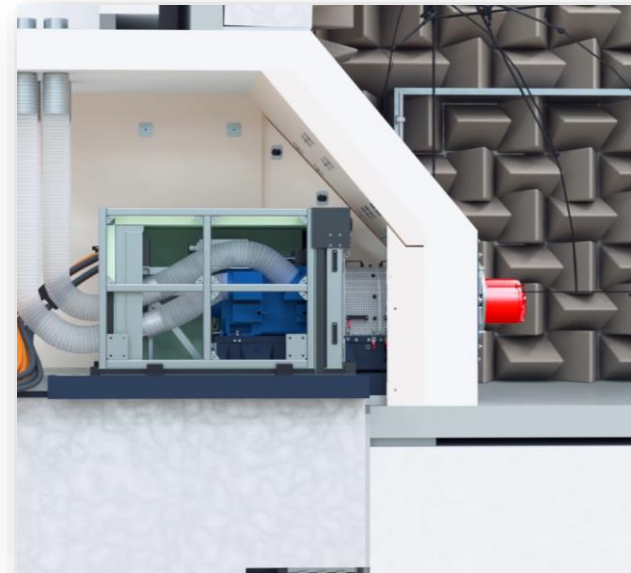


NVH E-Motor Premium Setup

Fully decoupling between load unit and UUT

Market-leading operating noise level < 50 dB(A) at 20 krpm *

Highest measurement accuracy



* Microphone distance 1m/45° to the shaft hole, opening closed



AVL's solutions

On a par with the limits of modern e-drives

Optimization of load units

New development of dynamometers > 25.000 rpm

Simulation based development of intermediate shafts

In-house hardware development with dummy UUTs

Pushing the limits of intermediate bearings



Tailored solutions

Project details

NVH E-Motor Test System "Premium Setup"

Project description



Turnkey solution including semi-anechoic chamber

Dyno noise level < 50 dB(A) at 20.000rpm

Cut-off frequency 200Hz





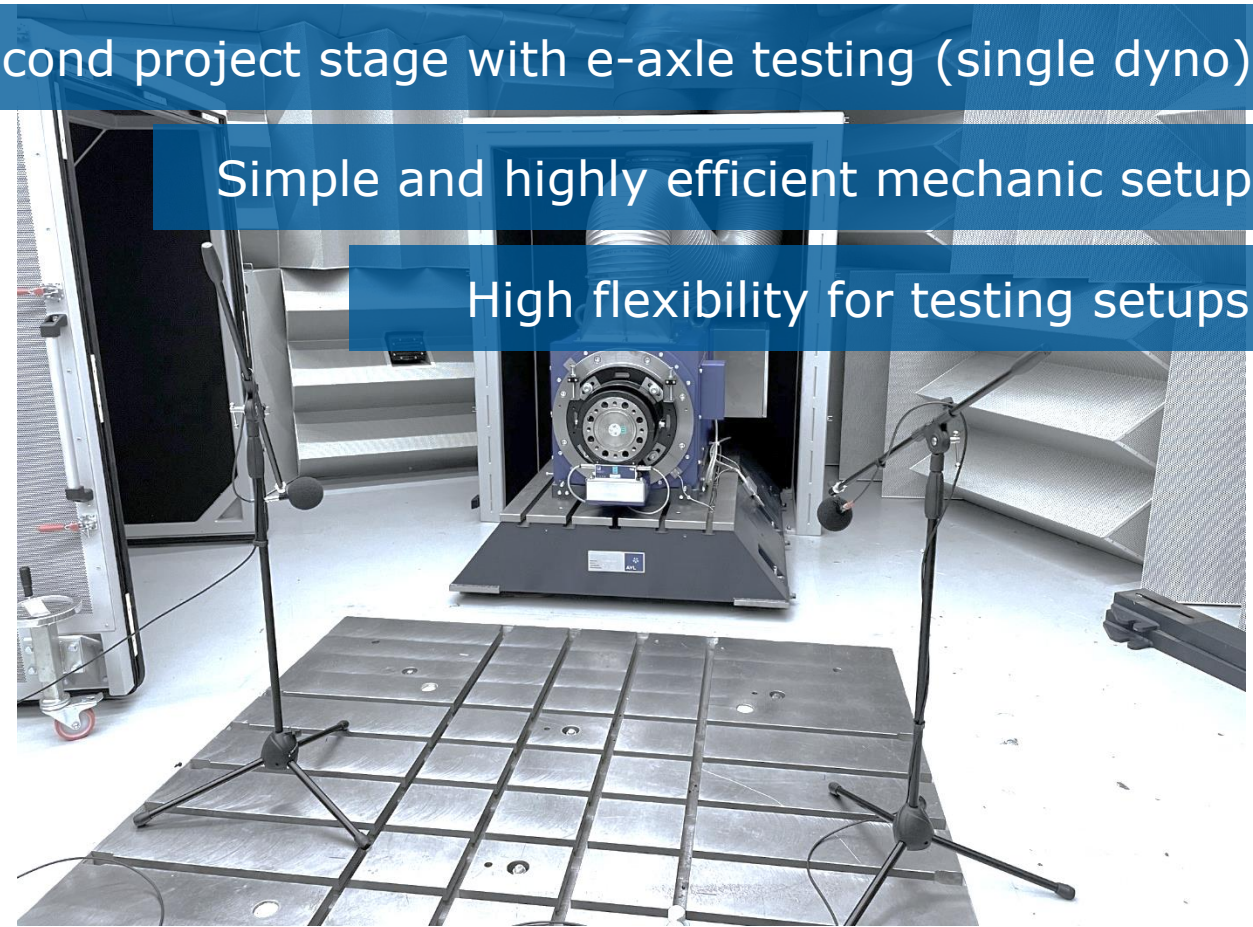
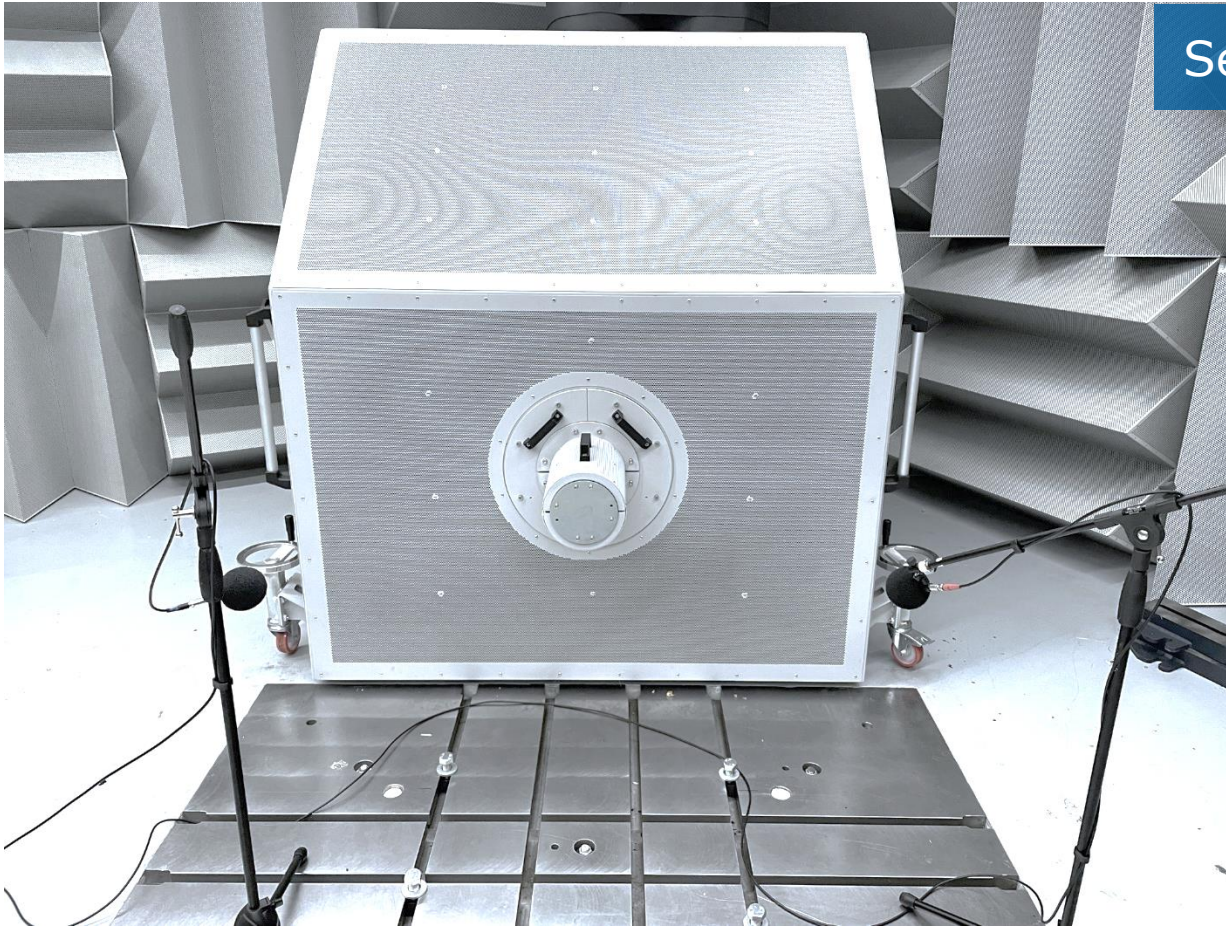
Extension by NVH E-Axle Dyno

Project description

Second project stage with e-axle testing (single dyno)

Simple and highly efficient mechanic setup

High flexibility for testing setups





Upcoming



Heavy Duty NVH Powertrain Test Bed

4WD wall pass shaft system with 50.000 Nm per shaft

Automatic wheelbase and track width adaption systems

Turnkey solution including semi-anechoic chamber



NVH E-Motor Test Bed

Test modes up to 20.000 rpm and 36.000rpm

Cooling concepts for UUT and drive line

Turnkey solution including semi-anechoic chamber



AVL NVH Component Test Systems

AVL E-Axle TS™ NVH



E-Axle TS™ NVH



Setup benefits

Minimum footprint of test equipment for low influence on room acoustics

Quick and flexible adjustment of wheelbase and track width

High torque capability with precise torque control

Easy access for rigging for minimal testing down-time





AVL NVH Highspeed Prime Mover

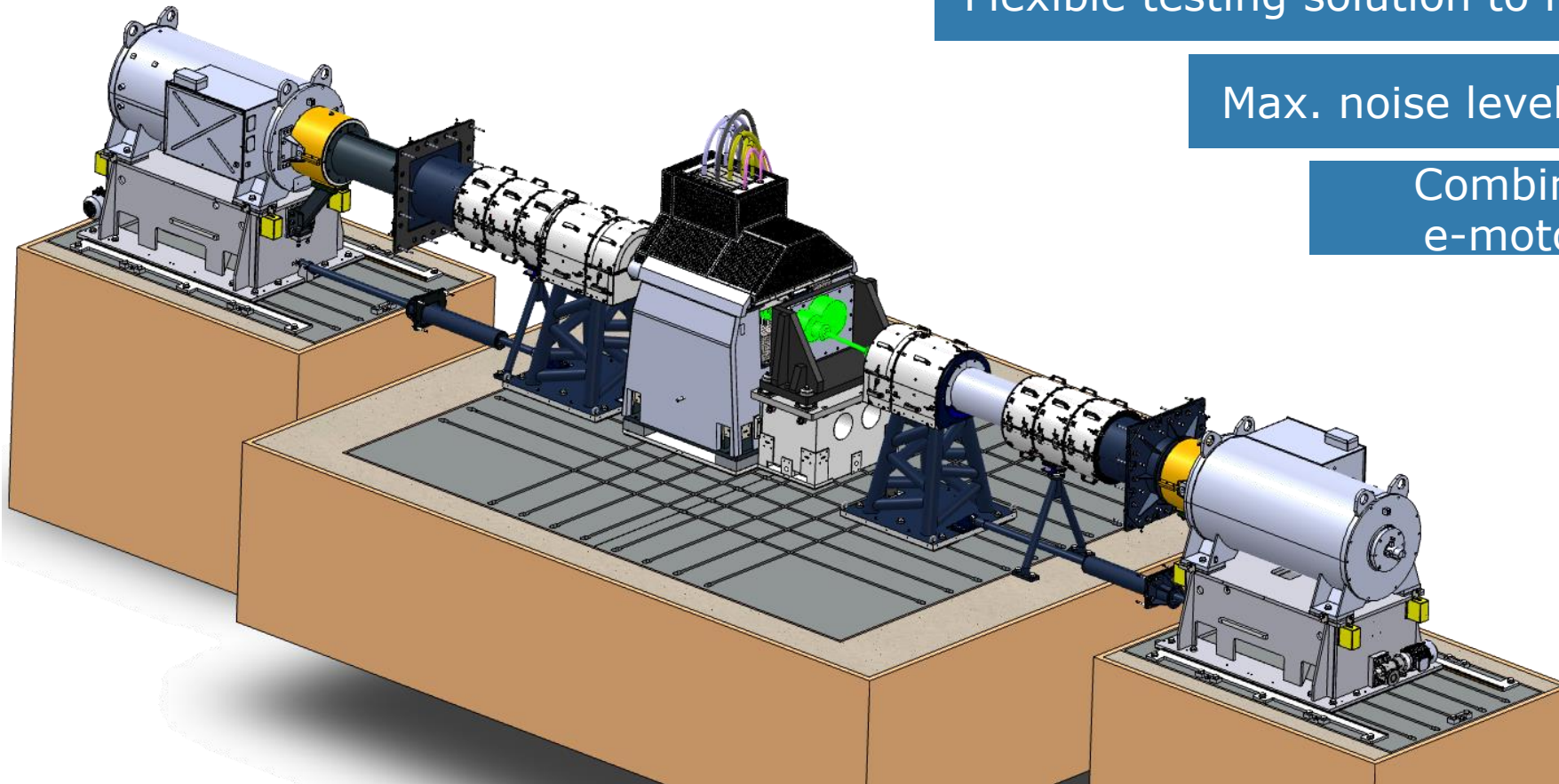
NVH Testing from E-Motor to E-Axle

Mobile and height-adjustable high-speed dyno in portal frame

Flexible testing solution to maximize chamber efficiency

Max. noise level 80 dB(A) up to 23.000rpm

Combined testing of integrated e-motor and e-axle suggested

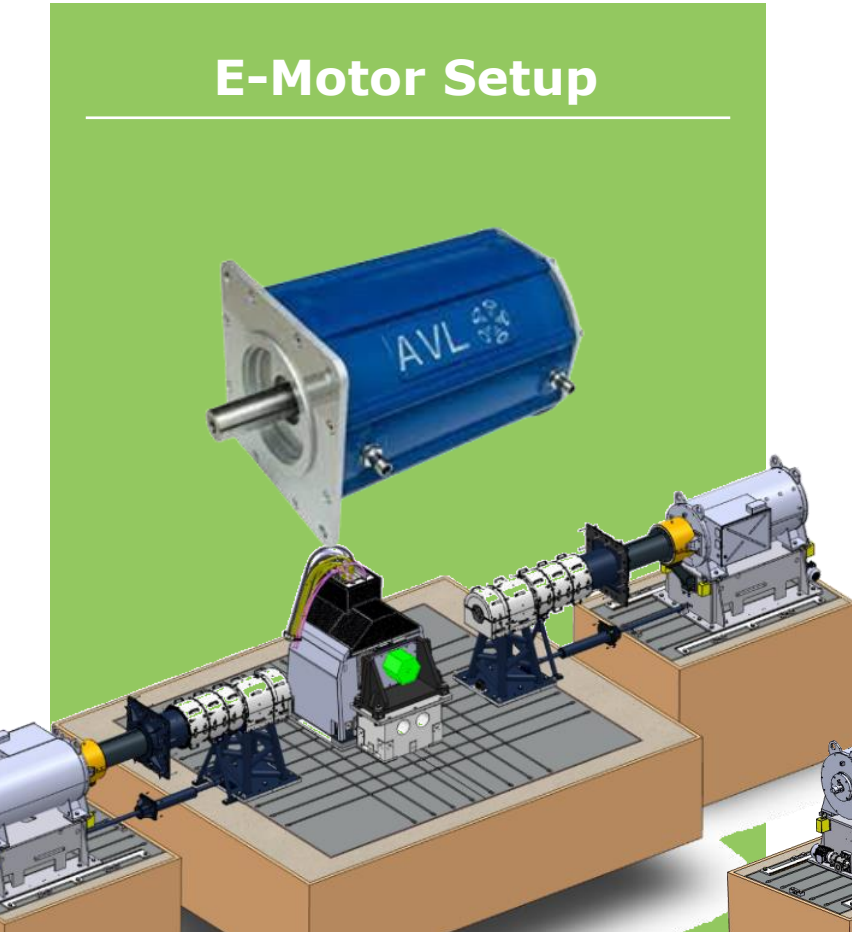




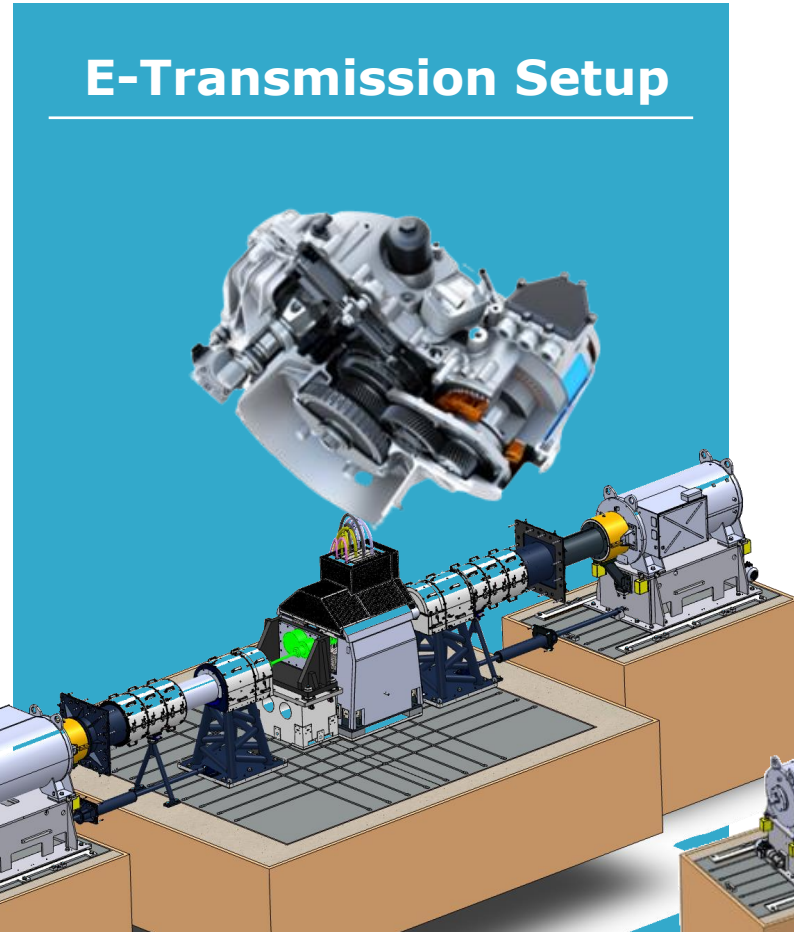
AVL NVH Highspeed Prime Mover

System Layouts

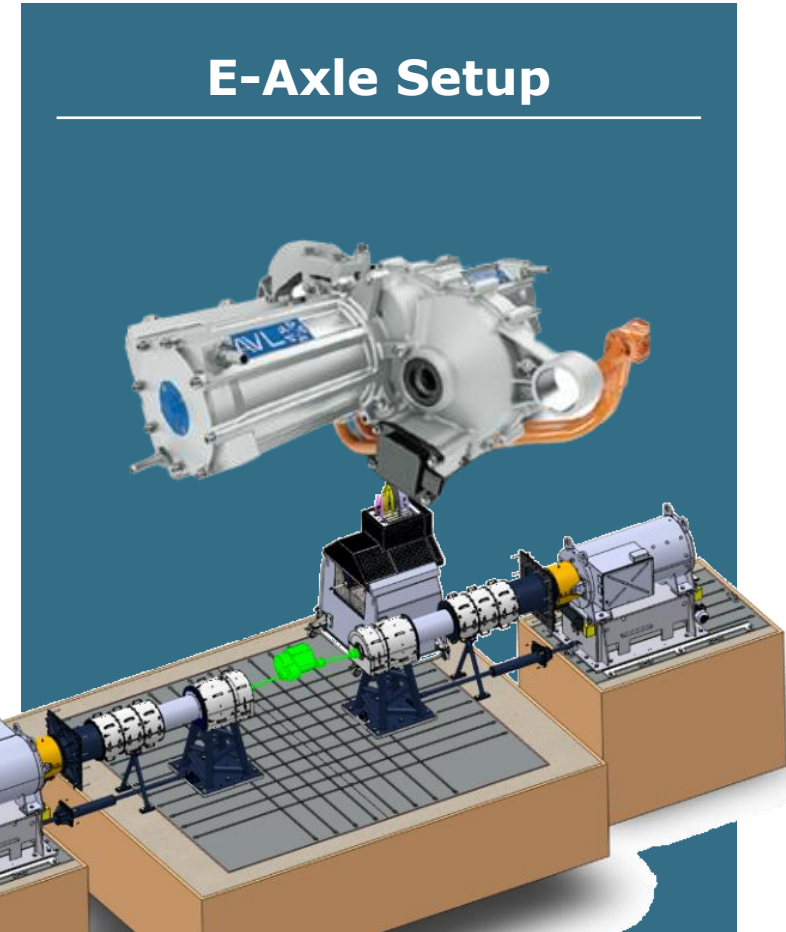
E-Motor Setup



E-Transmission Setup



E-Axle Setup





NVH Test System for efficient End-of-Line Testing

AVL End-of-Line Acoustic Quality Control



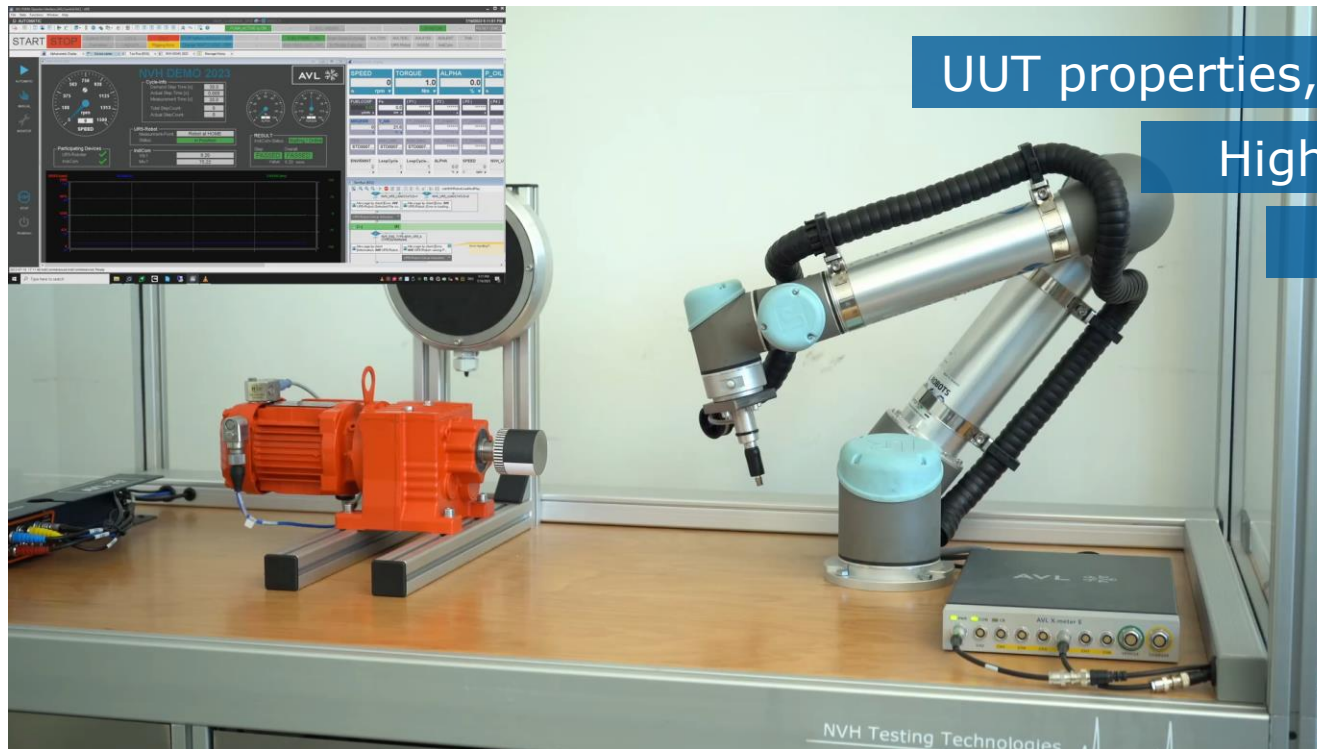
Acoustic Quality Control: System Overview

A sustainable way to reduce and eliminate expensive recalls

UUT properties, test data and quality results stored together

Highly customizable actuators and data processing

Seamless integration into AVL PUMA world





Sensors and interfaces

AVL NVH Toolkit



Our Tools for a Complete NVH Testing Solution



AVL X-ion™ NVH-Analysis

Direct connection of IEPE / ICP and charge sensors

Modular and adaptable

Sampling rate up to 500 kS/s and 24 bit



AVL NVH Toolbox

Quick and easy basic NVH analysis

Fully time-synchronized with all measured data (current, torque etc.)

Continuous extension of analysis functionality



Our Tools for a Complete NVH Testing Solution

AVL CAMEO™ for E-Drive



Characterization



Intelligent testing



Optimization

AI based optimization on self-defined parameters

Up to 40% reduction in testing & optimization time

Easy no-code test preparation and central maintenance

AVL PUMA 2™ E-Motor



Highly efficient with ready to use applications

Tremendous usability for both, beginner and experienced

Offline parameter editing and validation in the office

AVL stands for

A global network of experts

Unbeaten performance of NVH testbeds

Tailored solutions for NVH testbeds

Fully integrated NVH analysis and monitoring systems

Acoustic quality control



Thank you



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