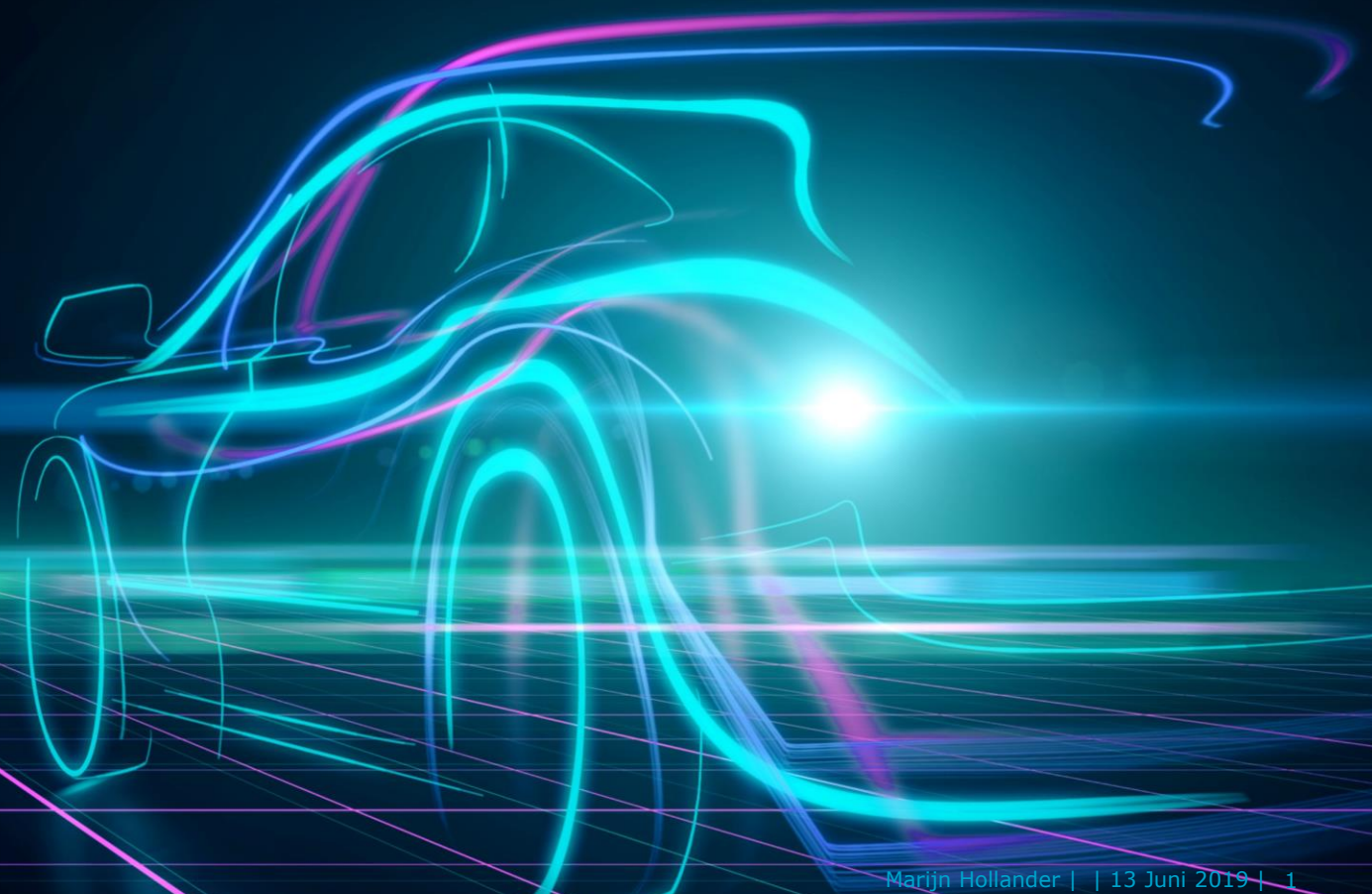


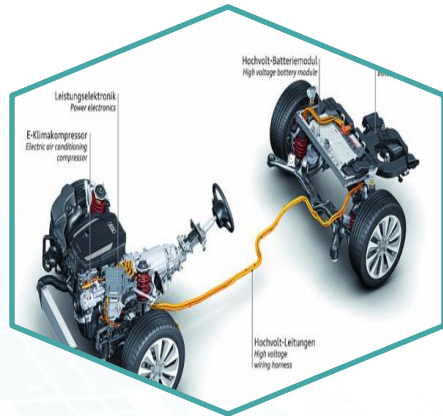
# Maximize the efficiency of in-vehicle testing and calibration for all types of powertrains!



# New challenges In-vehicle development



More and more vehicle variants have to be developed  
→ Up to 1000 models per OEM



NEW TECHNOLOGIES

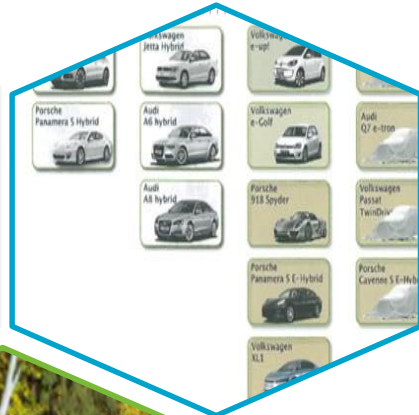
New technologies have to be connected with existing systems  
→ conventional, hybridization, electrification



TESTING KILOMETERS

Complex interactions with e.g. ADAS and autonomous cars need more and more tests  
→ 100 million testing kilometers and maneuvers

HIGH AMOUNT OF VEHICLE VARIANTS



TESTS UNDER REAL CONDITIONS

More stringent legislations expecting more tests und real conditions  
→ -7 ... +35°C, 0 ... 2400 meter

# New challenges In-vehicle development

## Frontloading

Simulation

Virtual Test Bed

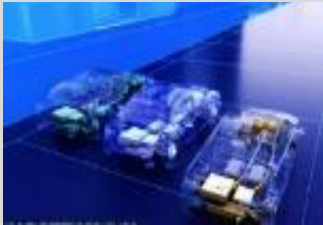
Component Test Bed

Engine Test Bed

Powertrain Test Bed

Chassis Dyno

Road Test



## Cost

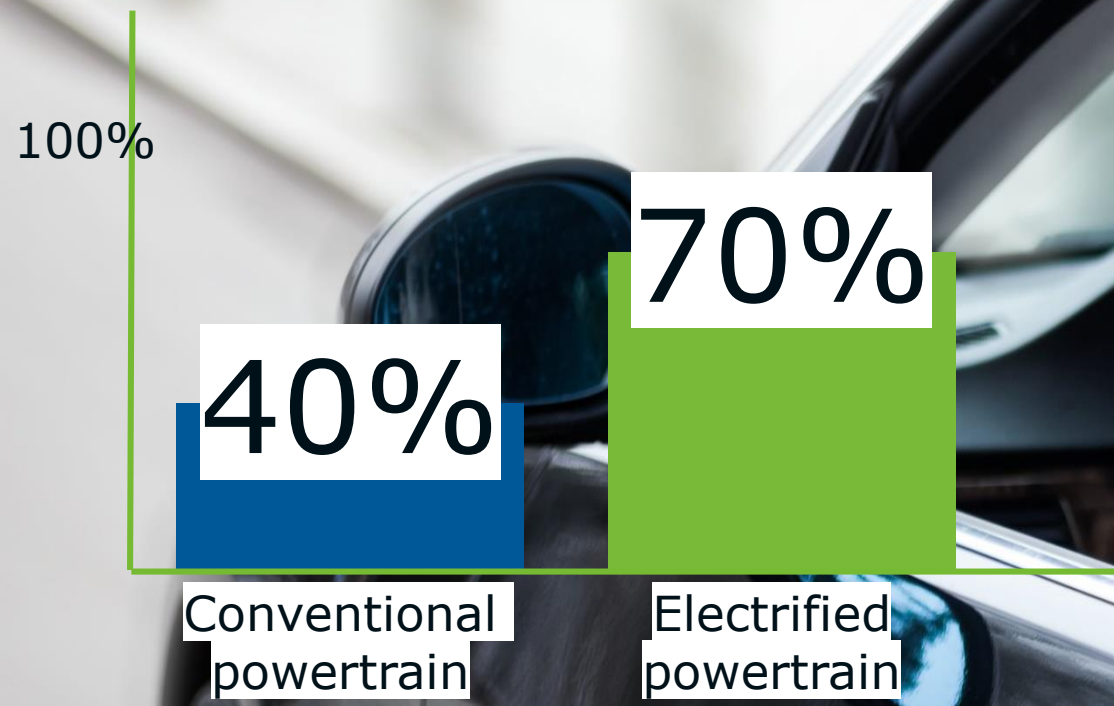
But what about the remaining tasks in the vehicle?



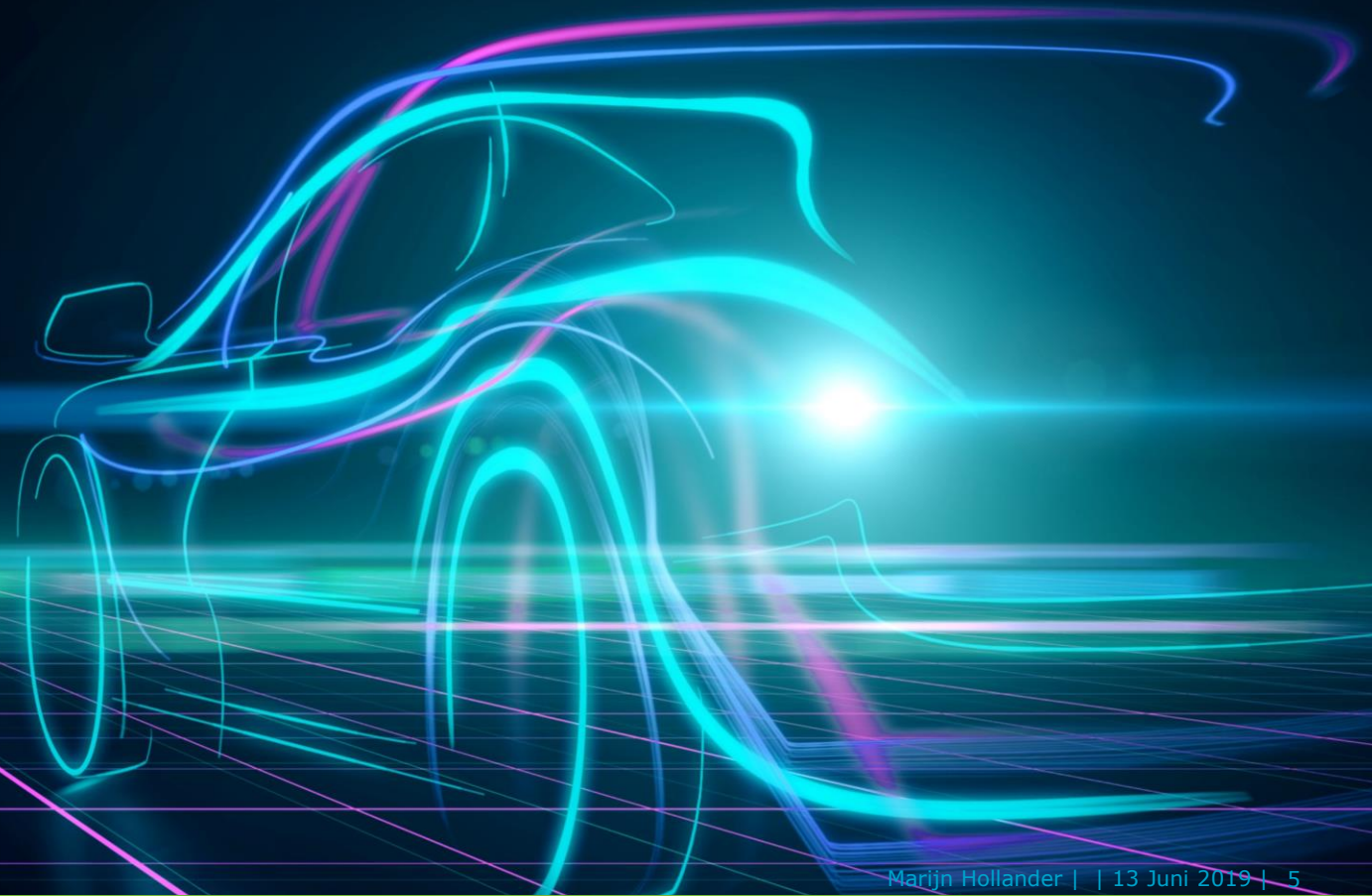
# New challenges In-vehicle development



## Calibration activities in the **vehicle**

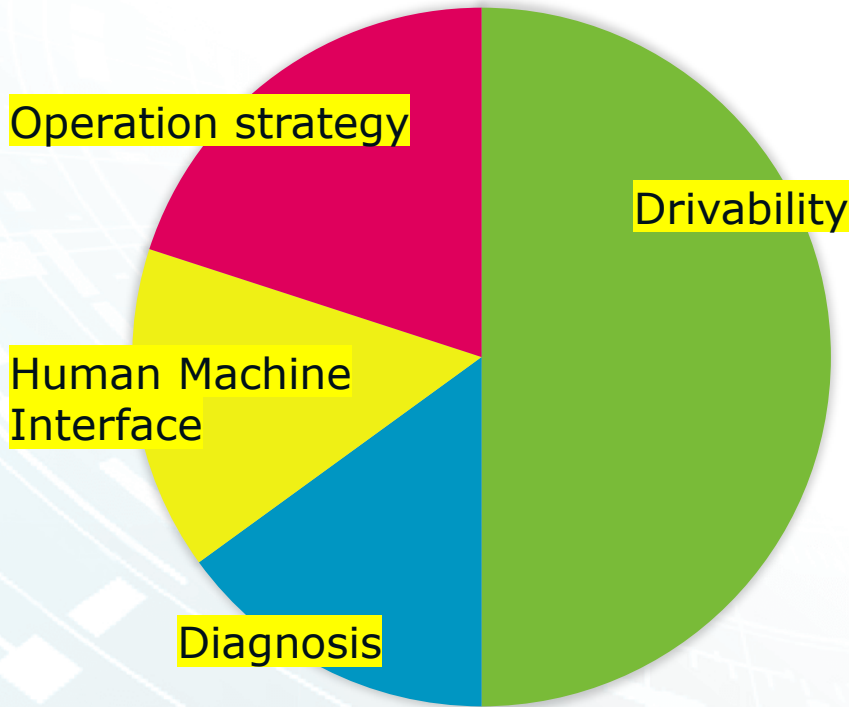


# Example 1



# Electrification challenges

## Engineering effort



## Drivability calibration in the vehicle consists of many specific maneuvers

conventional	Plug-In Hybrid	electric	Manouever	conditions	procedure	vehicle mode	gear [-]	accel. pedal [%]	deceleration rate [m/s <sup>2</sup> ]	vehicle speed [kph]	correspondent events	
SST		x	Selflearning	Open the selflearning tab within AVL-DRIVE (vehicle configuration)	1) perform self learning for Gear ratio calibration	Normal						
SST		x	Coast down CoastDown Each > 2x	close windows, sunroofs... perform maneuver in both track directions avoid lane changes (drive straight ahead)	accelerate to 160kph shift to "N" coast to 10kph NO braking/steering	Normal	N			160kph to 10kph	-	
SST		x	TipIn at Deceleration / TipOut in "Automatic mode" TipIn_TipOut_D_"VEHICLEMODE" Each 2x	Set automatic gear shift mode Set aircondition ON	drive at speed +20kph above target speed (e.g.: 1st measurement point: 30kph + 20kph = 50kph) ensure to reach highest possible gear decelerate to target speed without braking Hit the accelerator pedal quickly (pedal gradient between 300 and 800 %/s) and hold the pedal constant until the vehicle speed increases by 30kph release the pedal quickly to perform a "TipOut" NO braking during deceleration NO Kickdown repeat measurement for all described speed points	Normal	Sport	automatic	50 +2 75 +2 100		50 +2 70 +2 80 +2 100 +2 120 +2	Tip in - Vi
SST	SST		GarageShifts & Maneuvering GS_LeverChange_Manuevering Each 2x	Set air condition ON vehicle must be warmed up Set Auto Start / Stop OFF	set P->R and wait for trigger "Idle - Normal" set R->N and wait for trigger "Idle - Normal" set N->D and wait for trigger "Idle - Normal" set D->N and wait for trigger "Idle - Normal" set N->R and wait for trigger "Idle - Normal" set R->P and wait for trigger "Idle - Normal" set P->D and wait for trigger "Idle - Normal" set D->P and wait for trigger "Idle - Normal" set R->D and wait for trigger "Idle - Normal" set D->R and wait for trigger "Idle - Normal" set P->N and wait for trigger "Idle - Normal" set N->P and wait for trigger "Idle - Normal"	Normal				D/R		
SST			Deceleration at high SOC Deceleration_SOC_high_"VEHICLEMODE" Each 2x	Set air condition ON maintain battery SOC at high level	accelerate vehicle to 110kph decelerate vehicle without brake until creep speed is reached repeat for all other deceleration levels: keep brake pedal as constant as possible COOL DOWN VEHICLE / BRAKES after measurement	Normal				automatic		automatic -1 + -0.3 -2 + -0.3 -3 + -0.3 -4 + -0.3

This includes:

- Which items should be evaluated
- Which physical parameters should be taken
- How to evaluate the physical parameters
- How to drive a test vehicle



# In-vehicle Calibration and validation

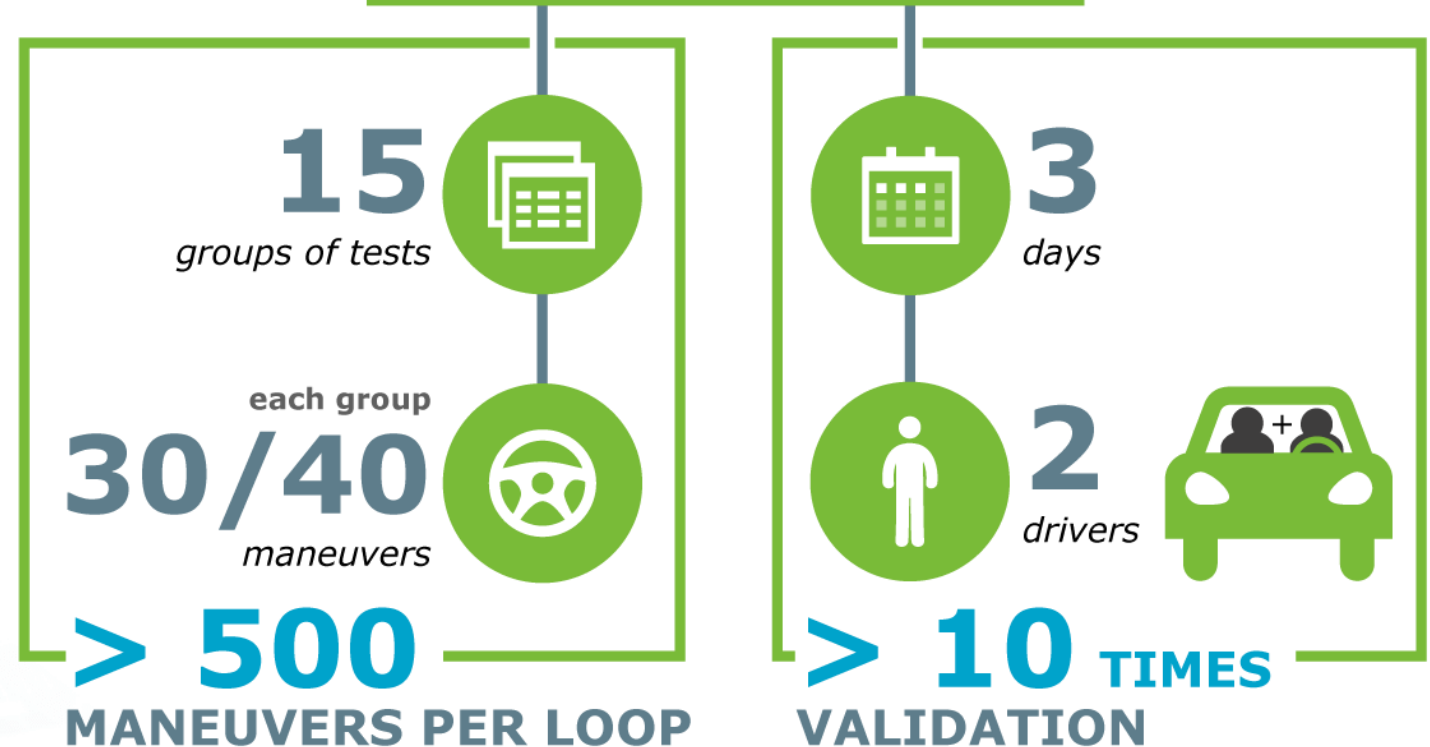
## Electrified powertrain function development and calibration project:

During the project the function development evolves

For each loop the functions have to be calibrated and validated in the vehicle

*example of an AVL project*

### testing in the vehicle



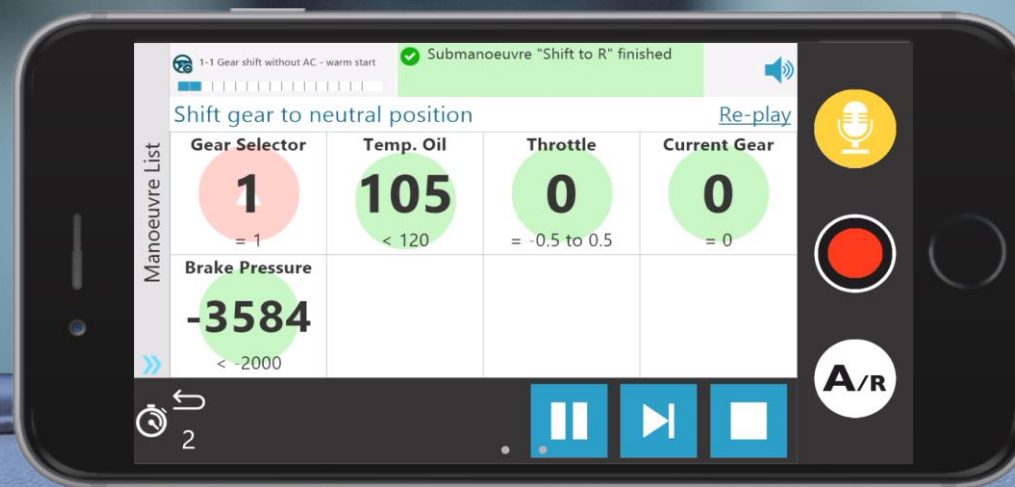
# Smart Mobile Solutions Calibration package

Easy setup of maneuver play list

Audio-visual feedback

Touch screen functionality

Automatic evaluation and reporting





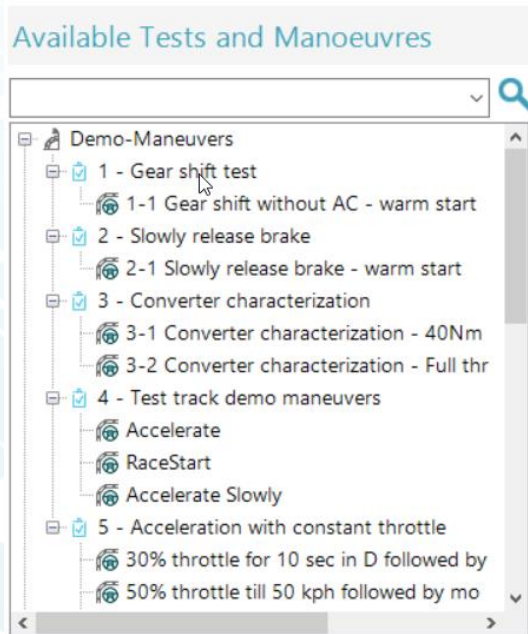
# Crossing the finish line

preparation

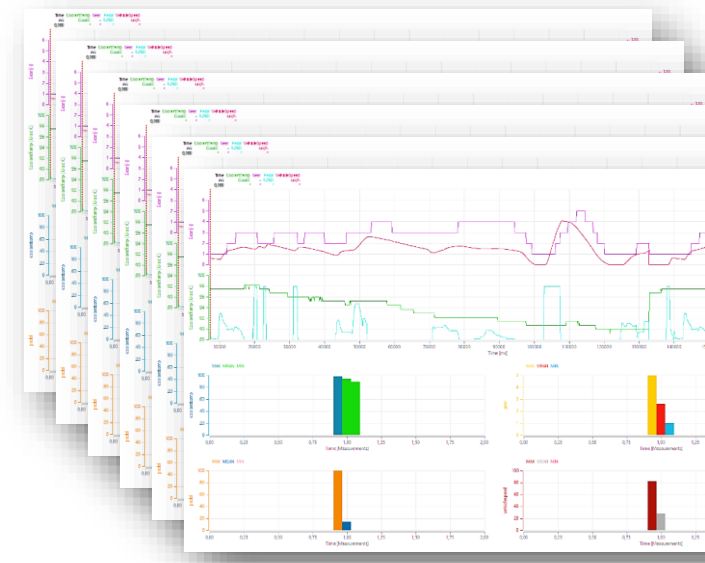
execute

reporting

Select maneuvers out of a library



Automatic reporting





# Example: NRMM monitoring and remote connection



Jennifer is a testing engineer at a European OEM for construction equipment

Her task is to measure perform the In-service-monitoring measurements for StageV

But to do this efficient and correct there are some challenges



**Machine work marking:** how can I monitor if I collected enough events?

**Minimum Test duration:** how to monitor if the work is between 5-7 time NRTC work?

Am I within the ambient boundary conditions

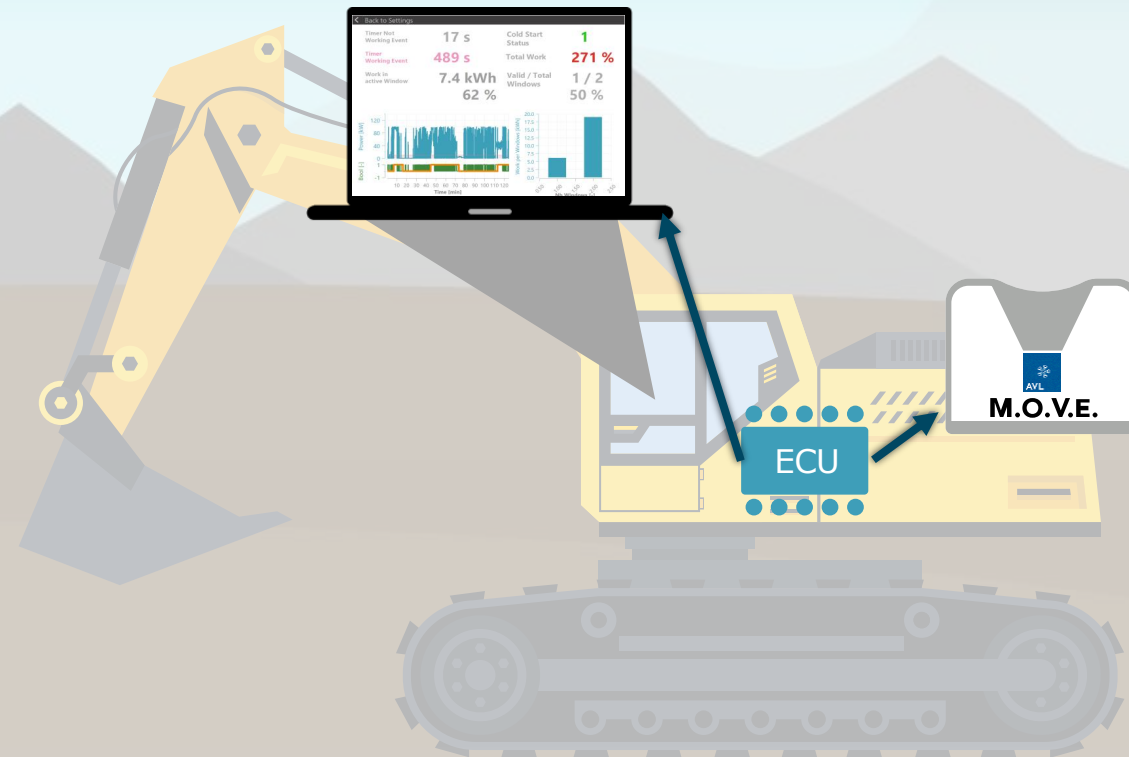
Many criteria to fulfill but how do I monitor all this **real-time** and **remotely**?



# Current setup



## PROVING GROUNDS

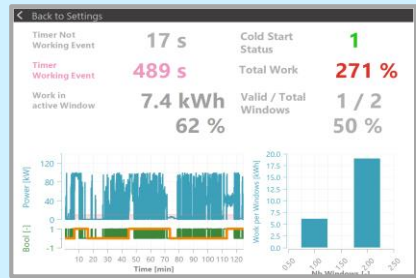




# Smart Mobile Solutions

## IN THE OFFICE

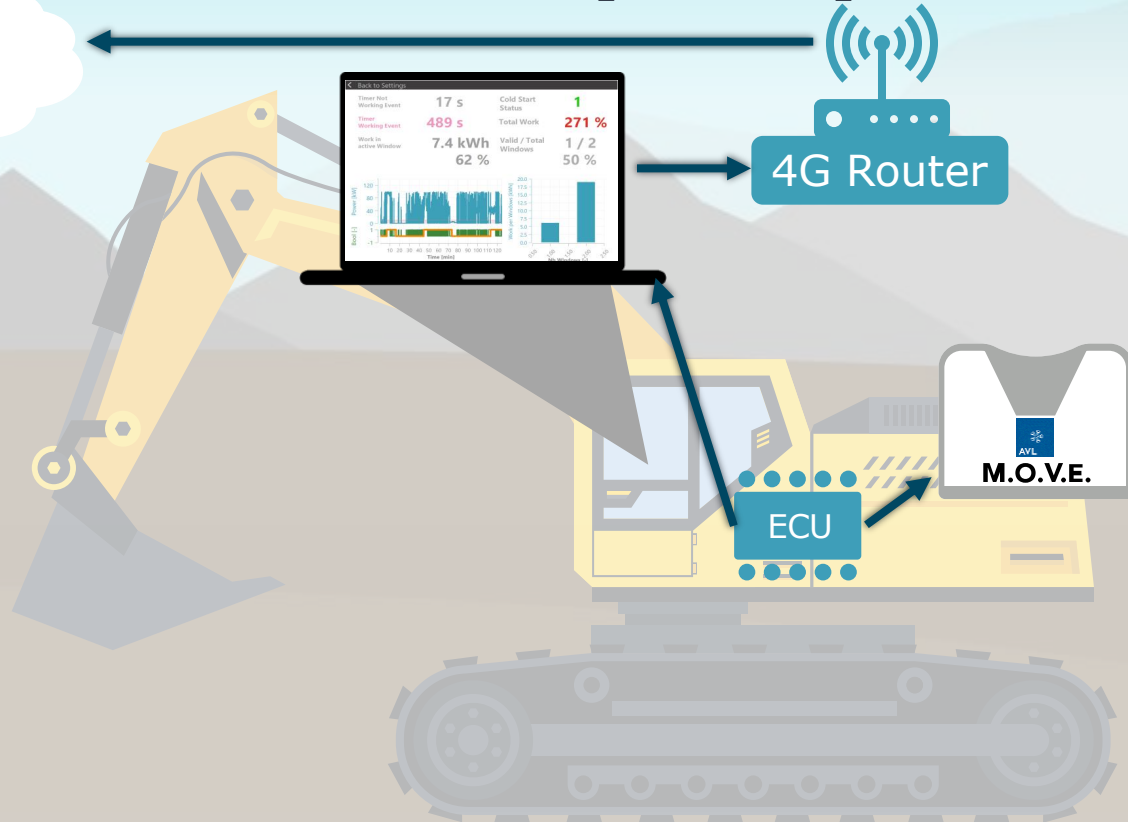
## PROVING GROUNDS



Server Based Data Processing



Measurement data [secured]



This makes Jennifer happy!



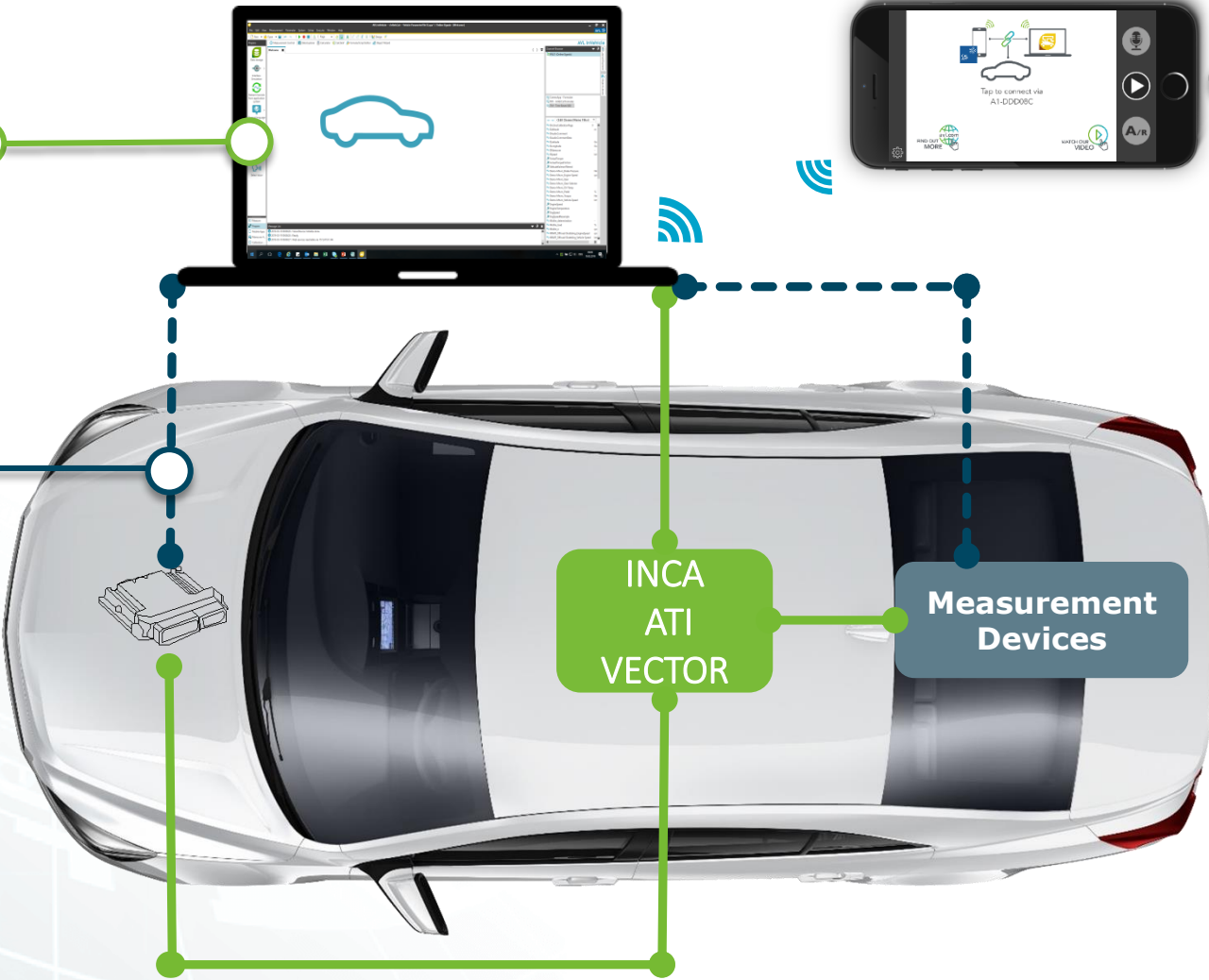


# Architecture

No **additional** hardware needed:  
Utilizes existing vehicle infrastructure, connect **directly** to INCA, ATI, CANAPE

Touch screen **CONTROL** –  
Improved driver safety and usability

But also supports CAN, XCP & CCP to connect to every desired device





# Smart Mobile Solutions Packages

## Calibration package

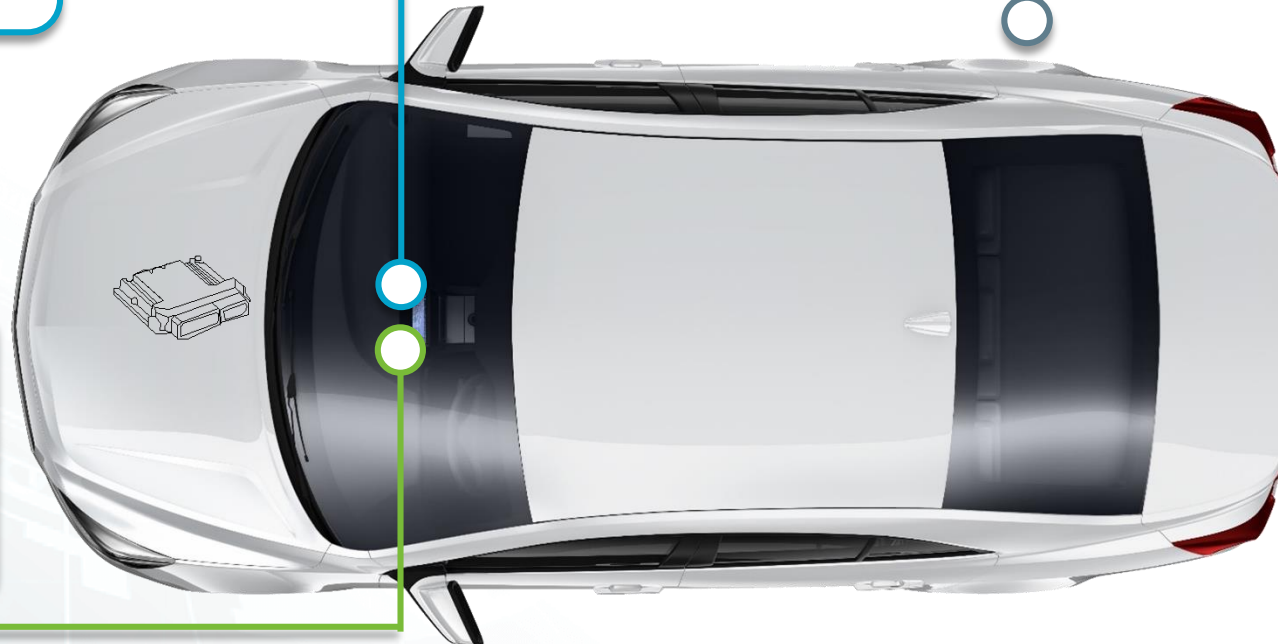
*for the calibration engineer  
Assistance in maneuver driving and in-vehicle calibration*

## RDE simulation package

*Supporting RDE simulation from office to lab*

## RDE vehicle package

*Assistance in RDE route finding, online RDE testing and reproducing cycles*



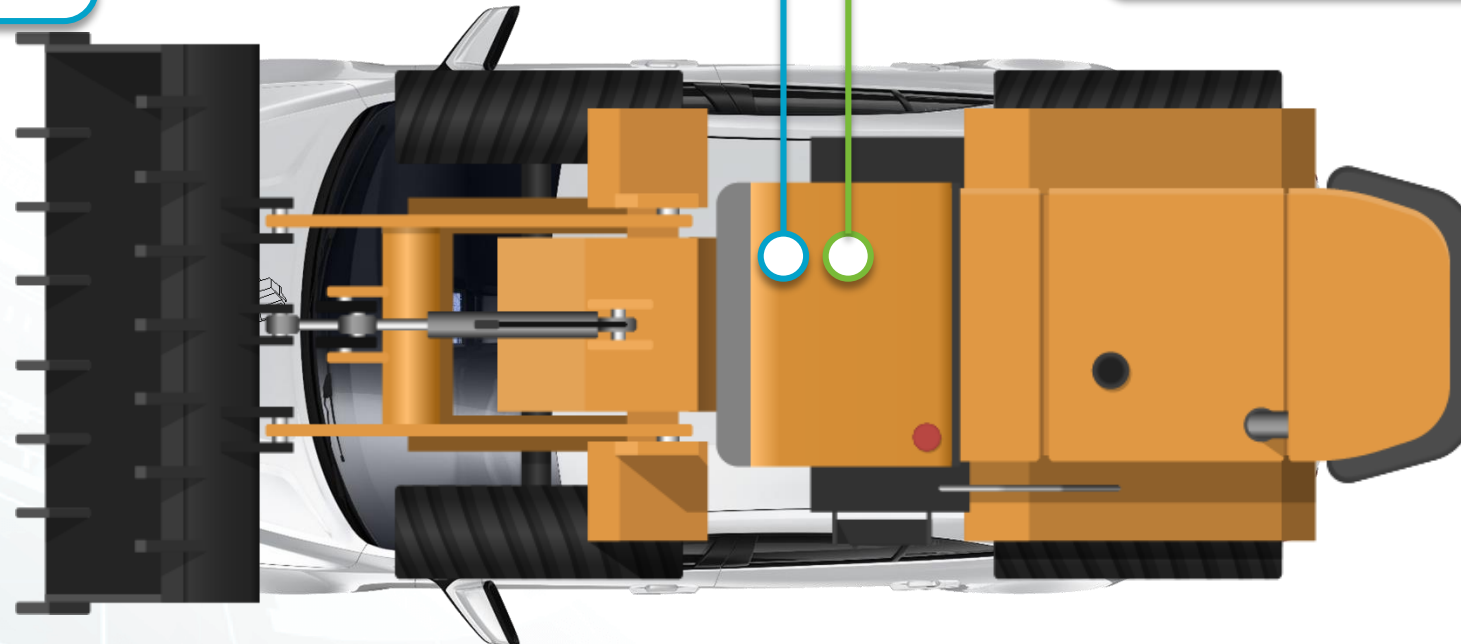
# Smart Mobile Solutions Packages

## Calibration package

*for the calibration engineer  
Assistance in maneuver driving and in-vehicle calibration*

## ISC package

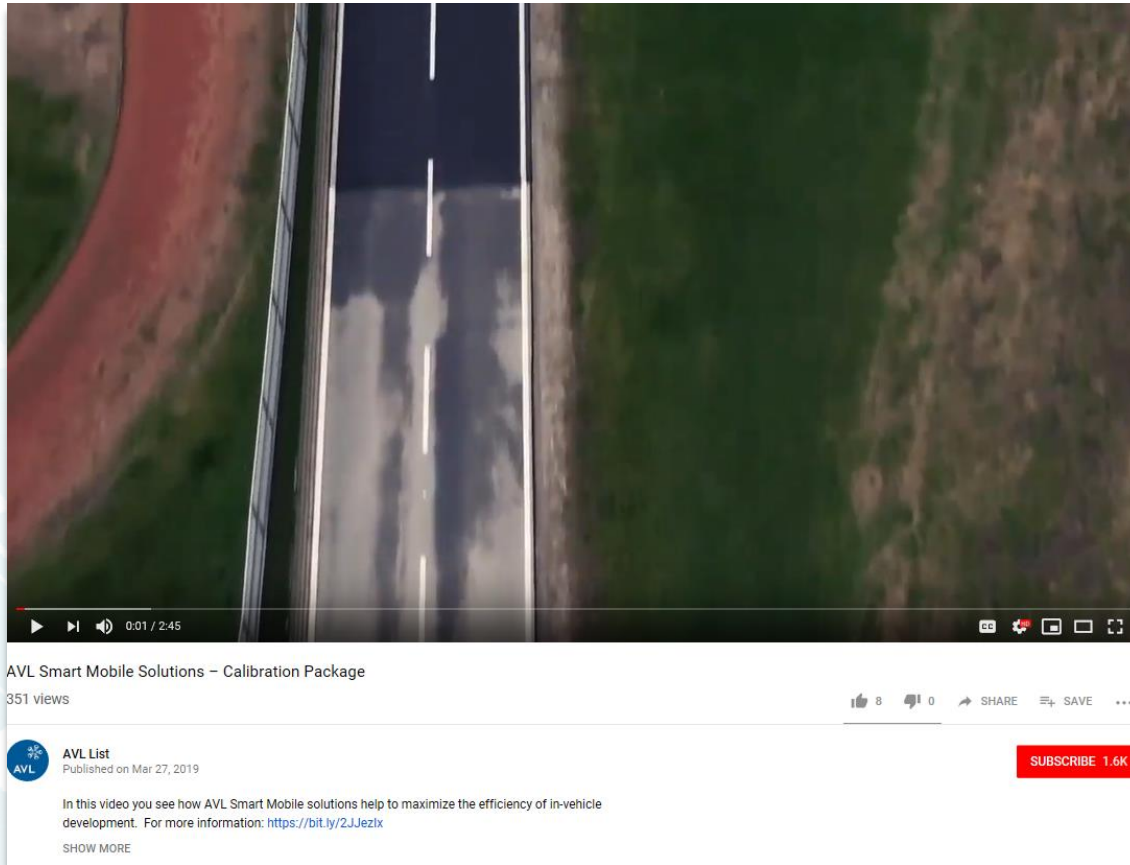
*Assistance in online PEMS testing for on- and off-road vehicle/machines*





## Contact us

Watch AVL Smart Mobile Solutions on youtube on the AVL List channel



Get more information or a free DEMO installation on:  
<https://www.avl.com/web/guest/-/avl-smart-mobile-solutions>

Try it yourself at our booth!

