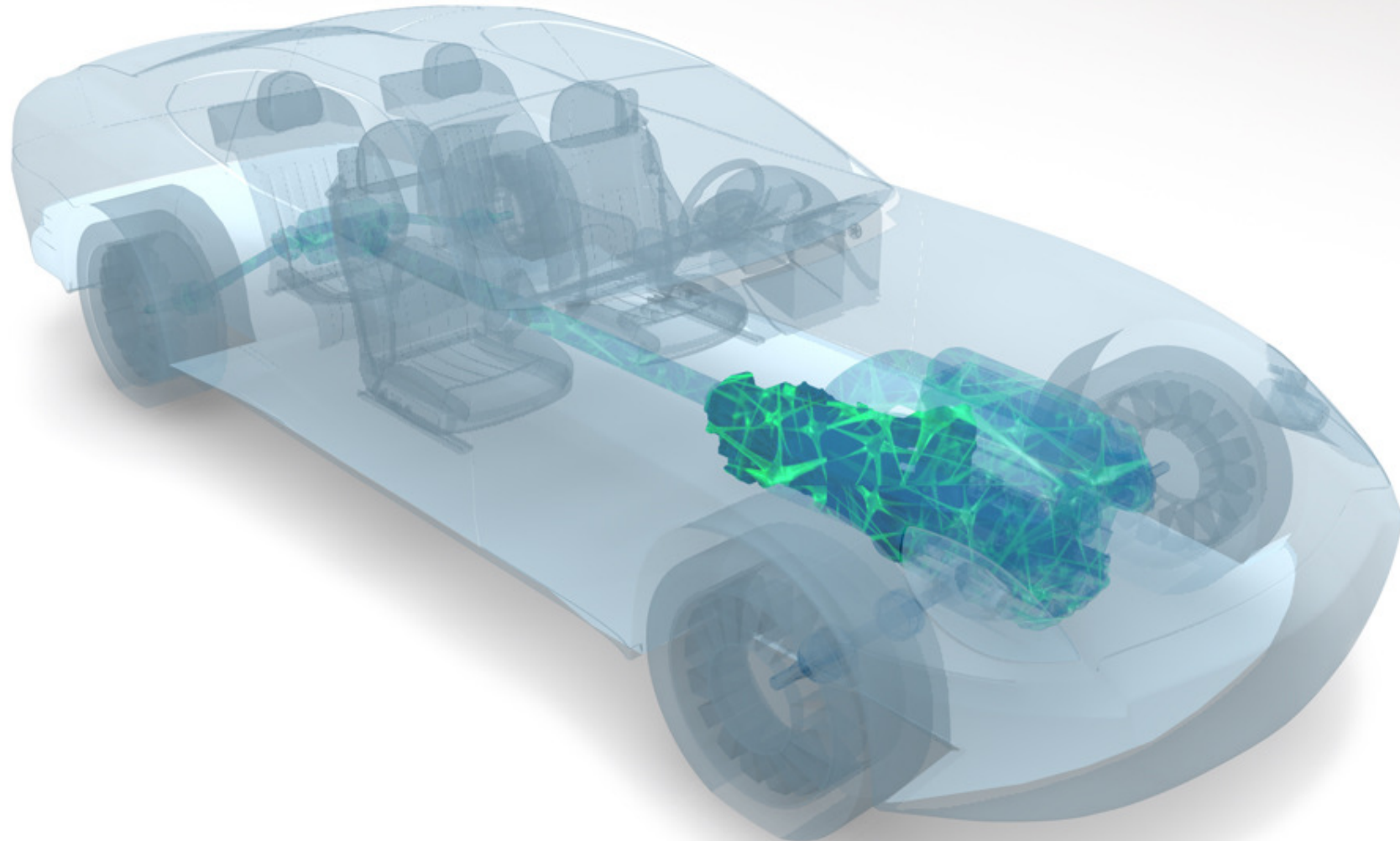


AVL CAMEO Transmission

breakthrough in transmission calibration technology





Contents

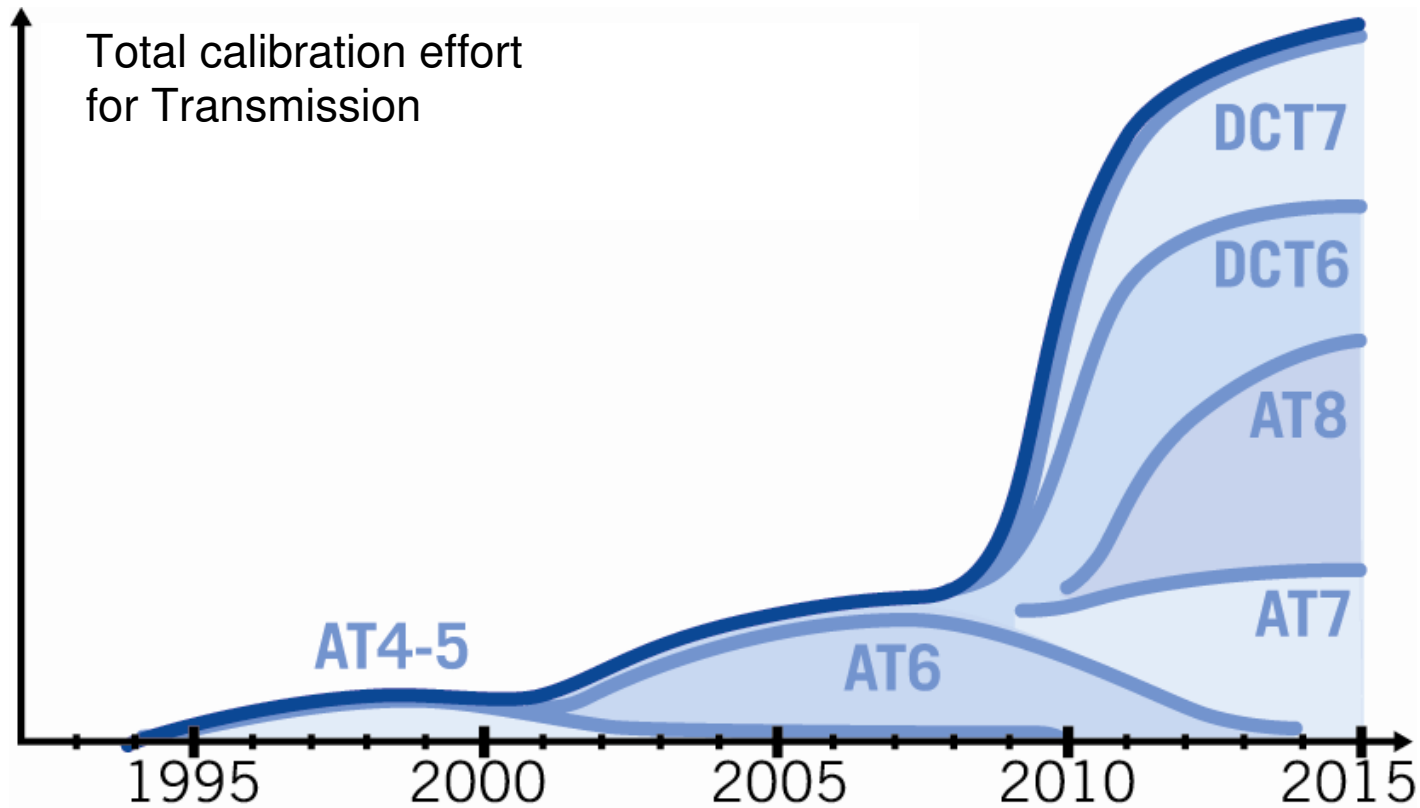
Transmission Calibration

- Market needs
- The calibration task

Automated Transmission Calibration

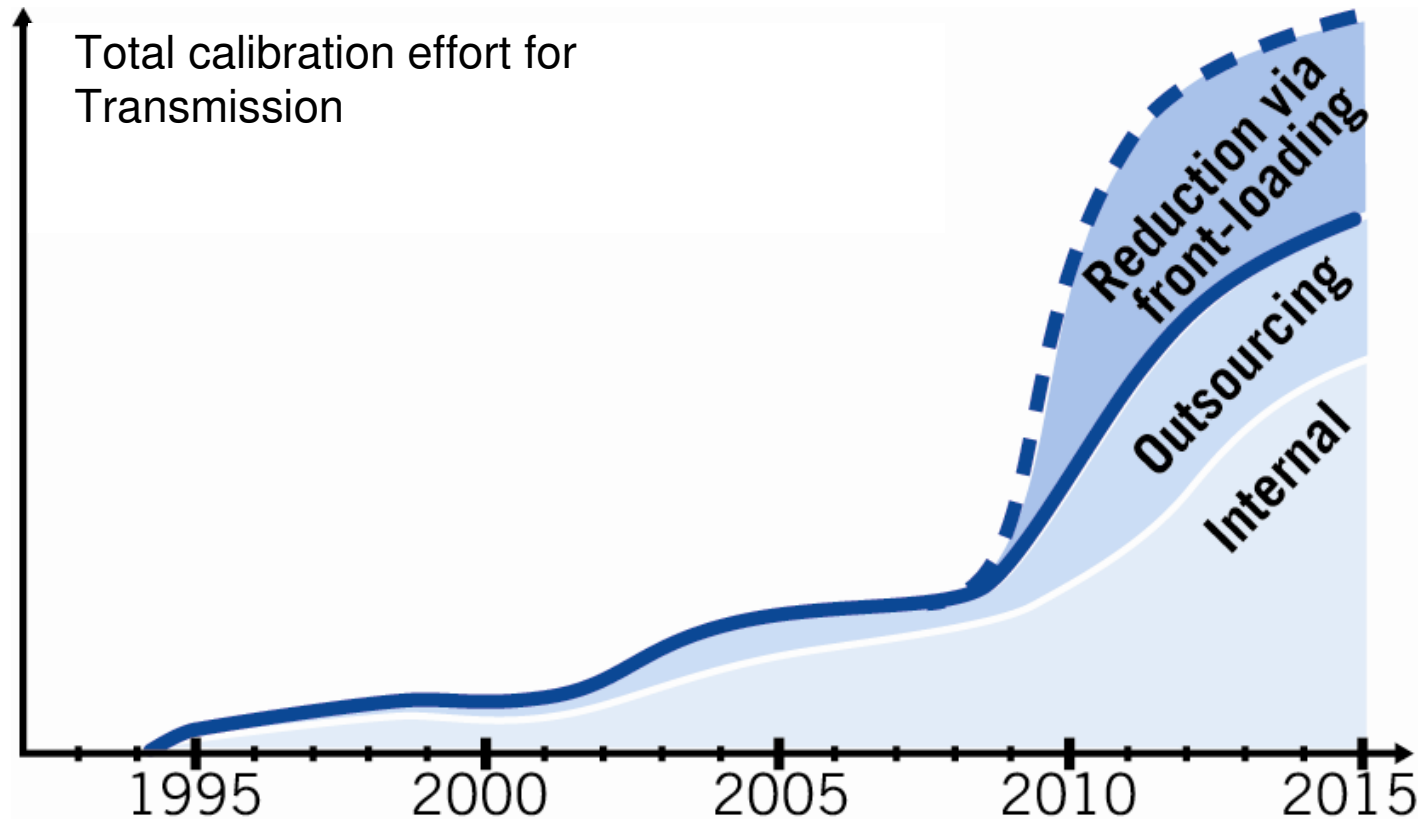
- AVL Solution: AUTOMATED CALIBRATION FOR TRANSMISSION
- Example Results
- Customer Benefits

Worldwide trends in transmission calibration

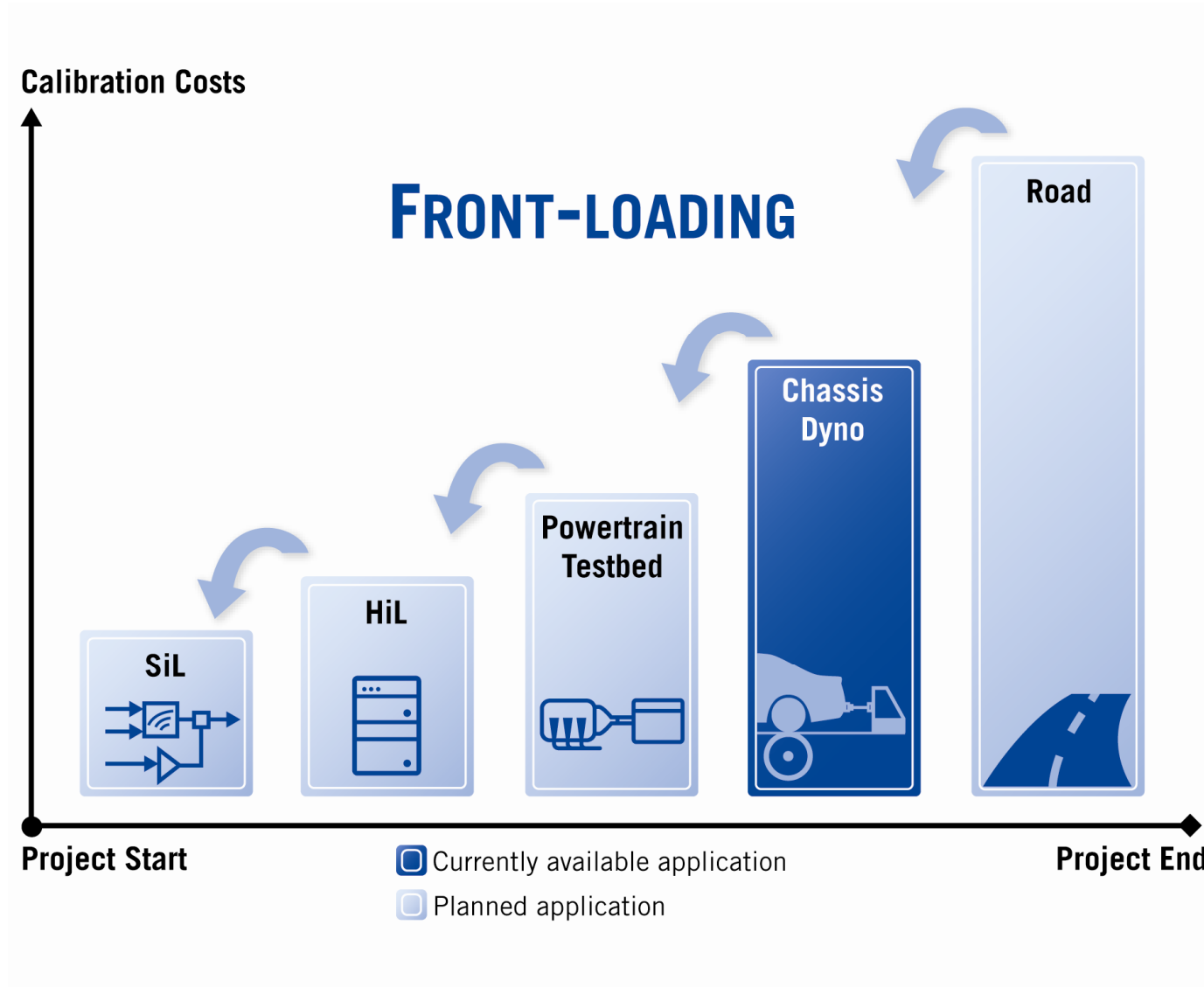


Worldwide trends in transmission calibration

The approach to reduce the calibration effort



Transmission calibration Market Needs – AVL solutions



Front-loading – Increasing profitability (less prototypes, less tesbed usage)



- In the traditional transmission calibration for every combination of calibration (degrees of comfort), vehicle, engine and transmission a measurement on the road is necessary.
- One of the advantages of the front-loading is to reduce the measurement effort:

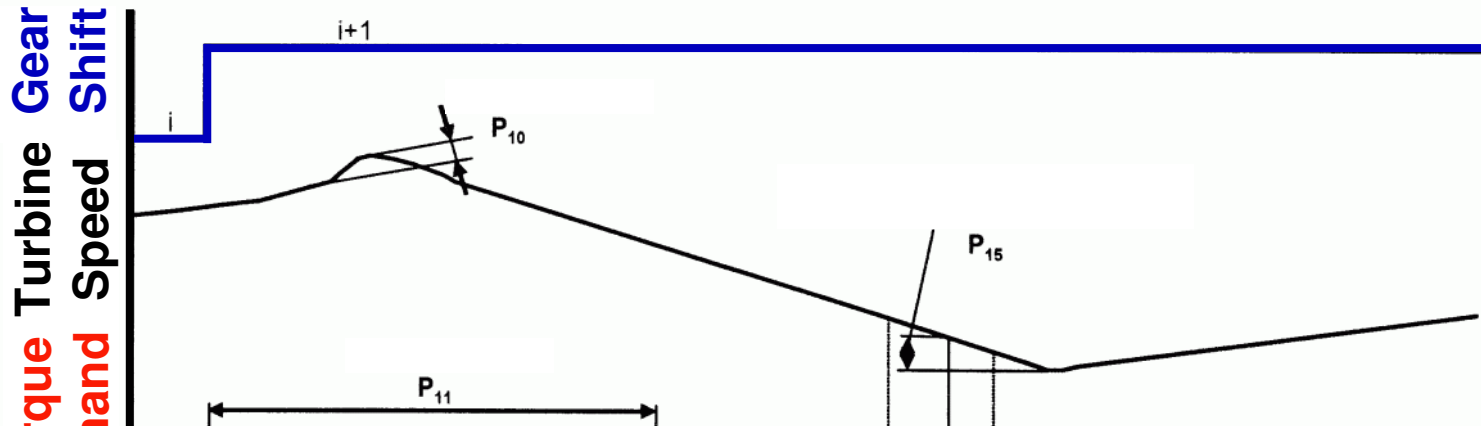
The target is:

Calibrate all the variants with the same measurement set!

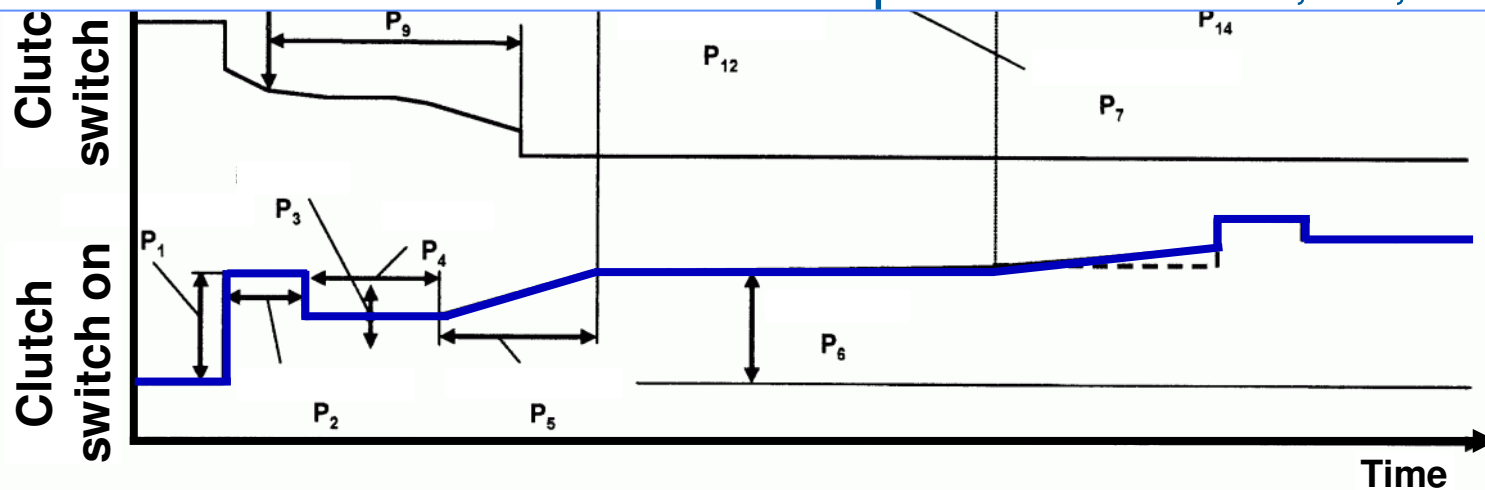
Variants	Engine variants	X	X	X	Possible
	Vehicle variants	X	X	Possible	Possible
	Calibration variants	X	Possible	Possible	Possible
		Road	Chassis Dyno	Powertrain Tesbed	Transmission Tesbed
Test Environments					

Gearshift quality calibration

Which are the parameters that have to be calibrated?



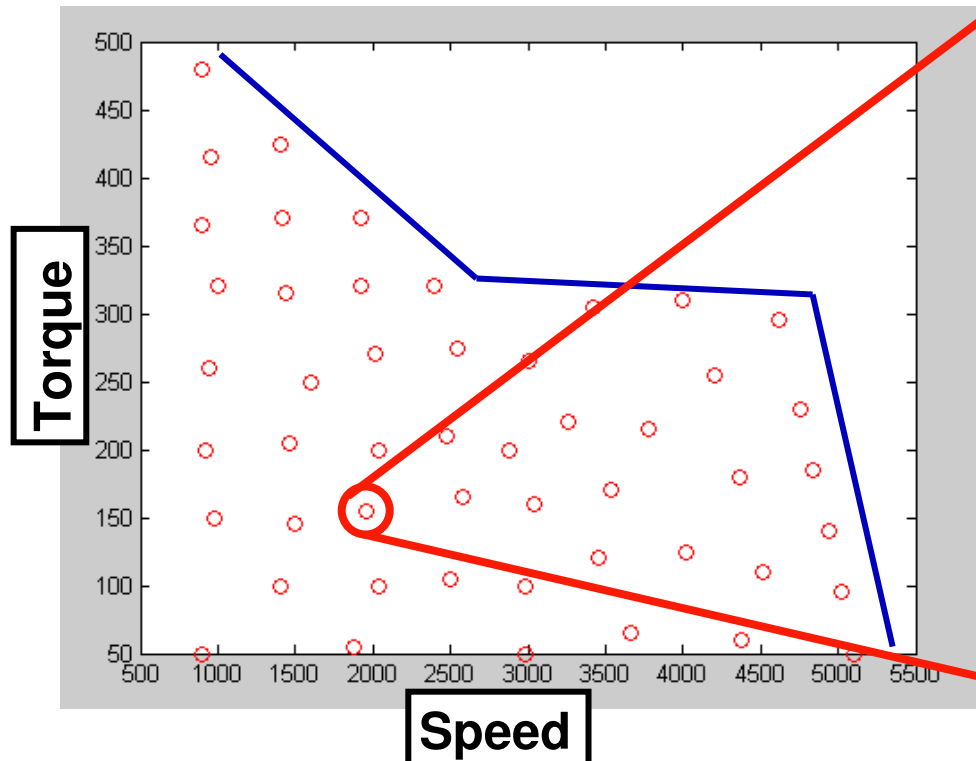
Calibration Task:
Find the best combination of parameters P_1, \dots, P_n



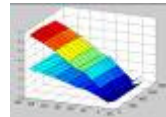
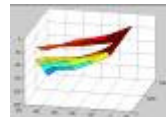
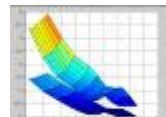
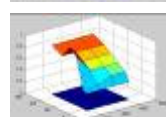
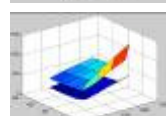



Gearshift quality calibration

Number of parameters involved during a gearshift

For each kind of gear shift event
 1→2, 2→3, 3→4, 4→5, 5→6 up shift
 6→5, 5→4, 4→3, 3→2, 2→1 down shift

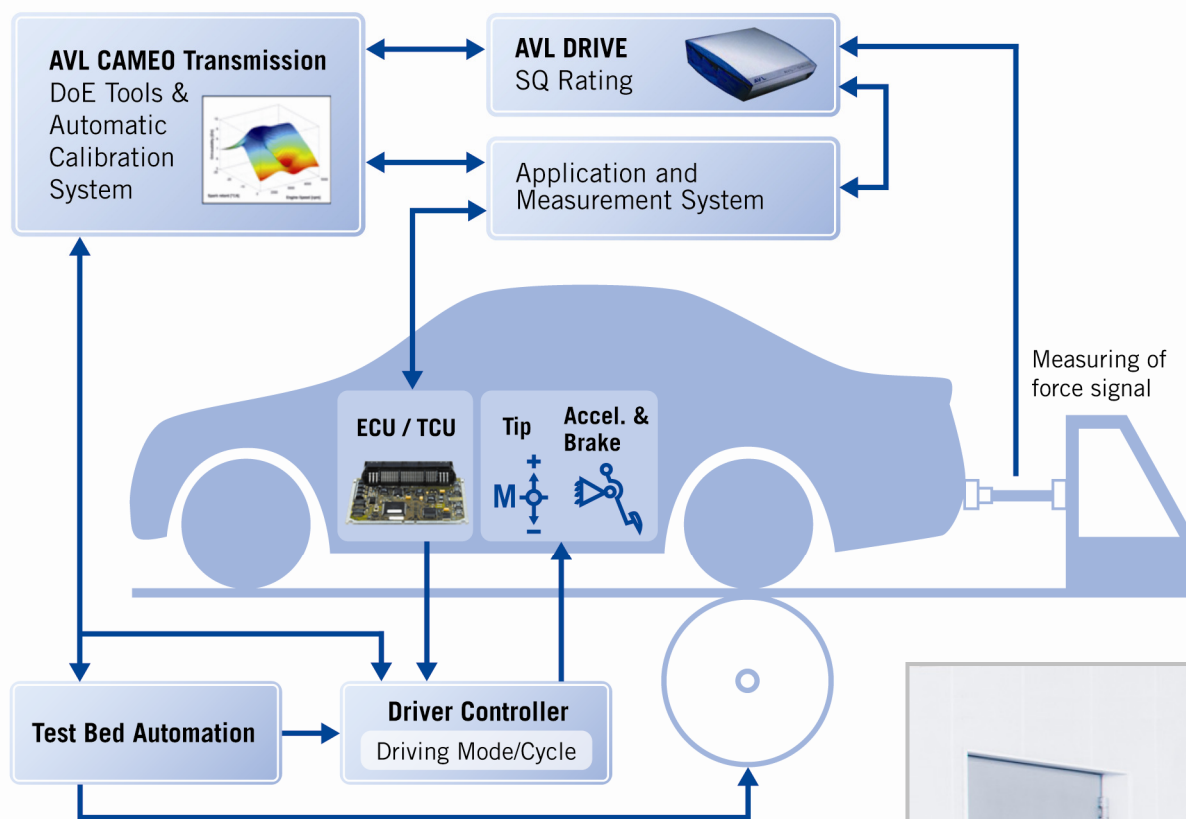


TCU Labels

P1		} 5 Maps
P2		
P3		
P4		
P5		
P6		} 3 Curves
P7		
P8		

AUTOMATED CALIBRATION FOR TRANSMISSION

Components and Tools for Chassis Dyno



AVL solution

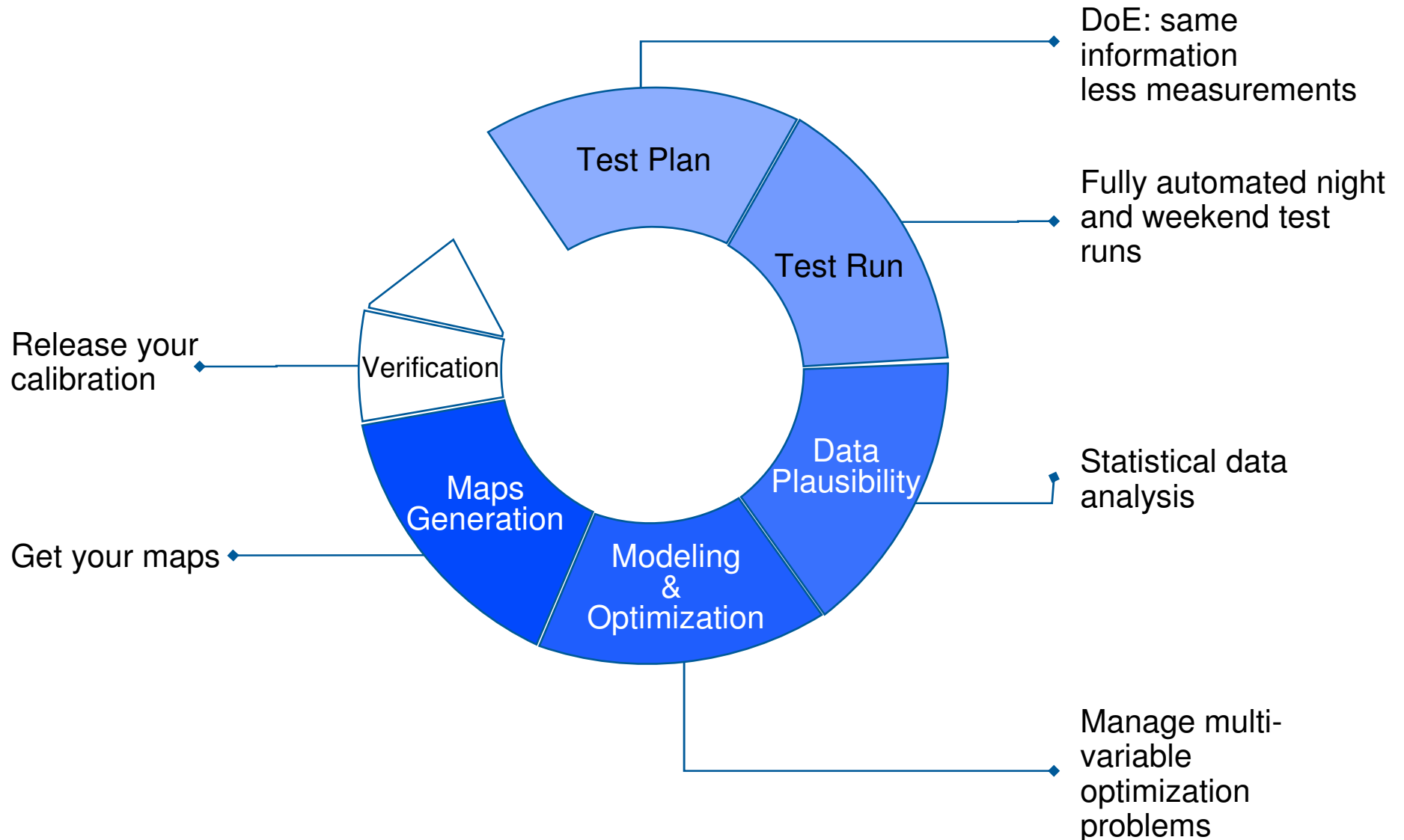
Breakthrough in transmission calibration methodology through an holistic approach:

- CAMEO TRANSMISSION
- DRIVE TRANSMISSION
- AVL POWERTRAIN KNOW-HOW



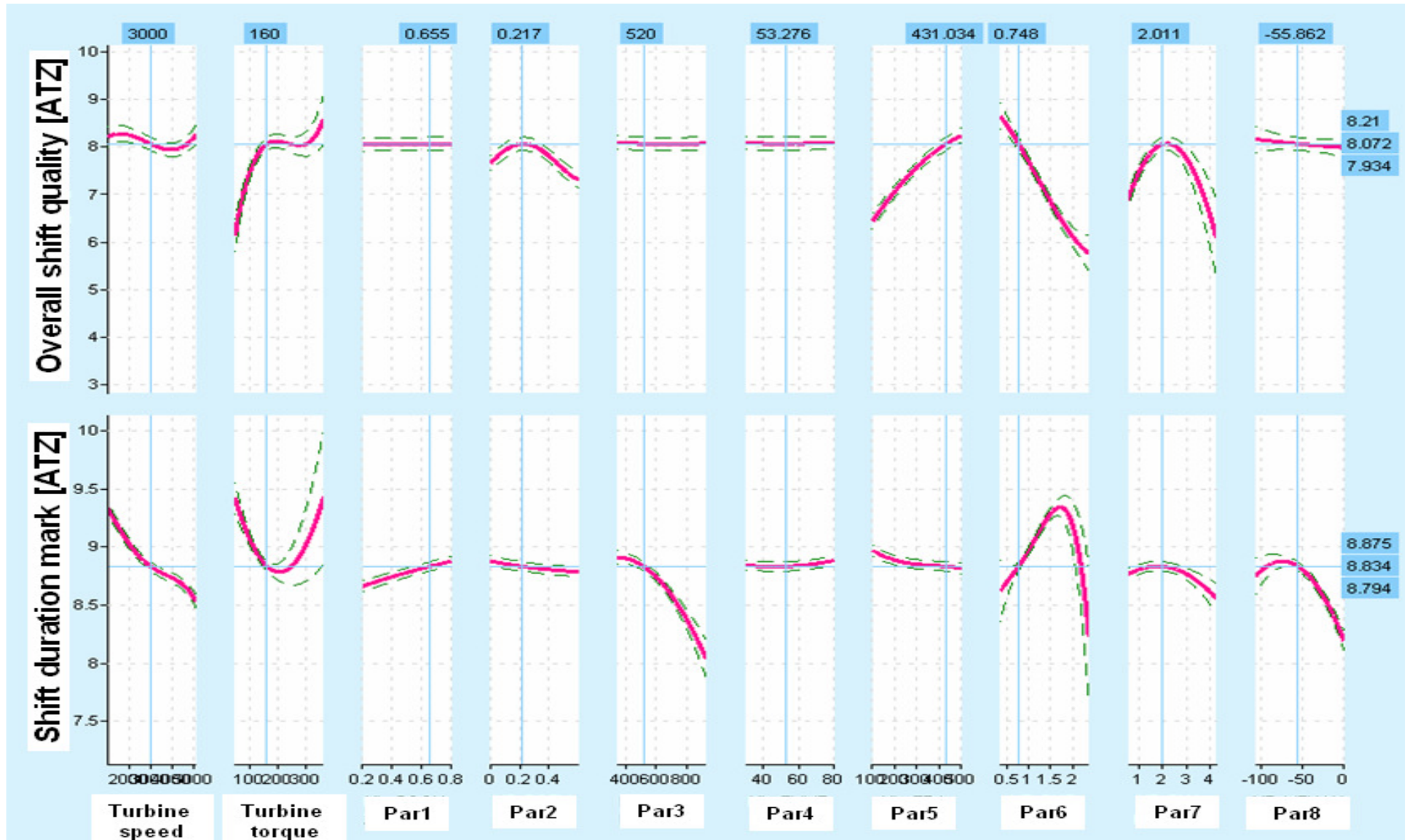


Cameo Transmission – The calibration workflow

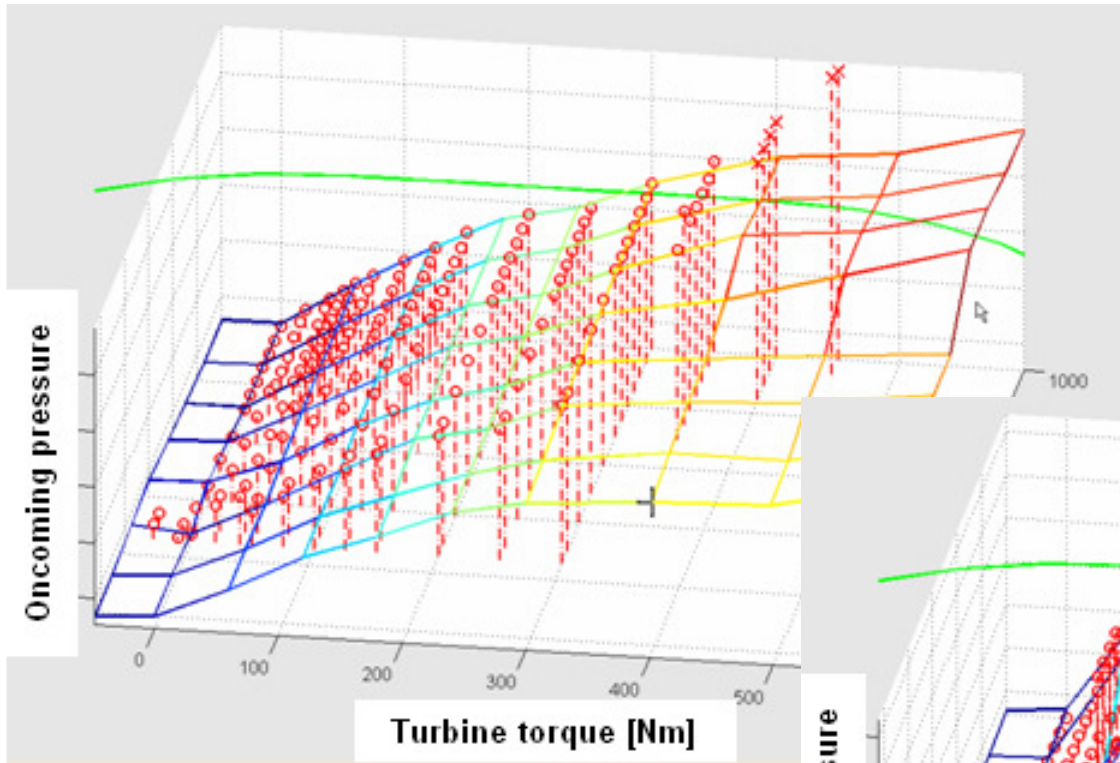


Global Model generation

Sensitivities of Calibration Parameters

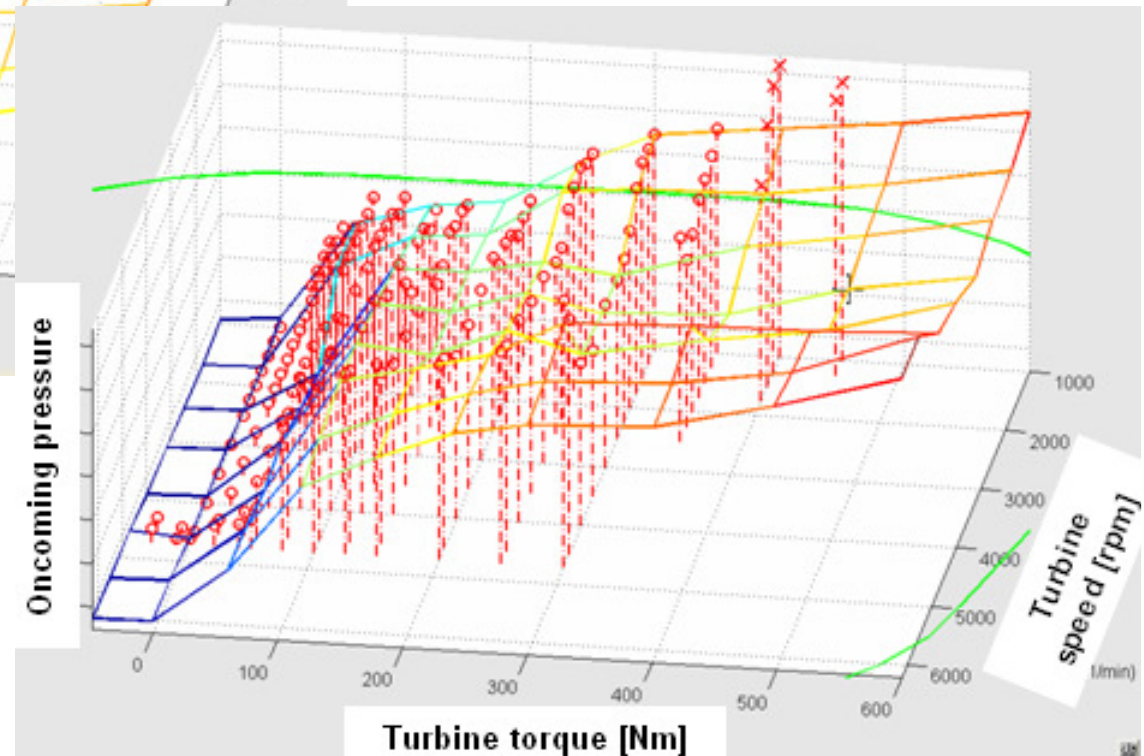


Calibration Map creation with the CAMEO ECU/TCU map generator



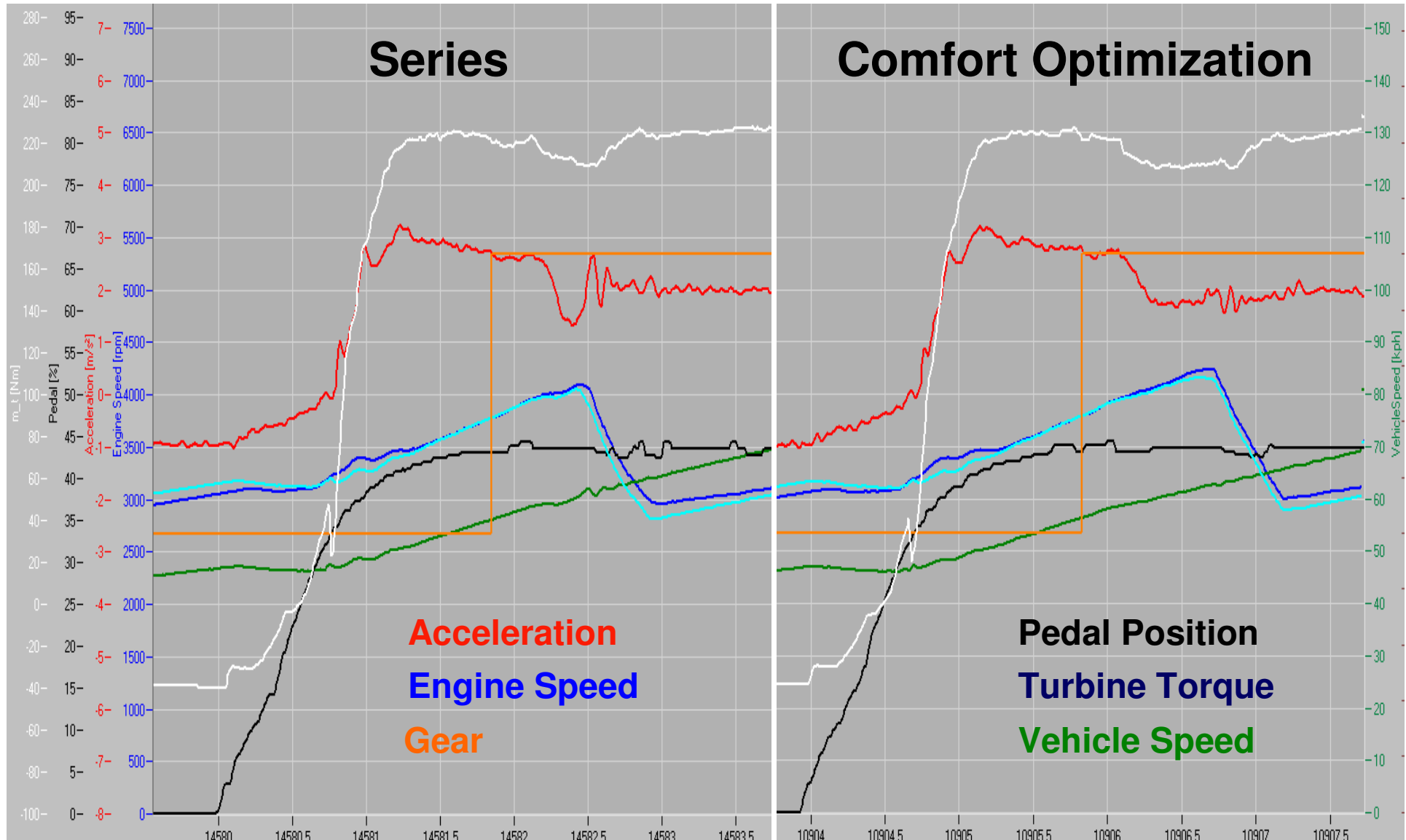
Comfort

Sport



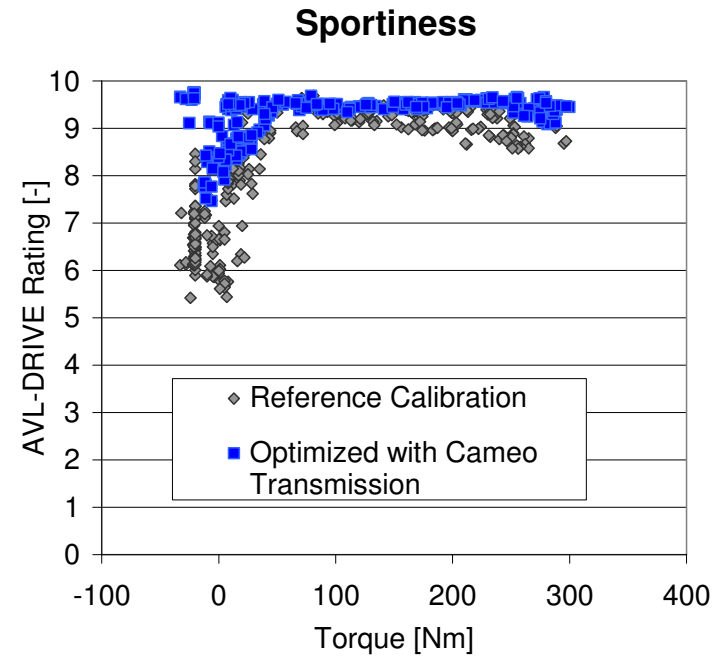
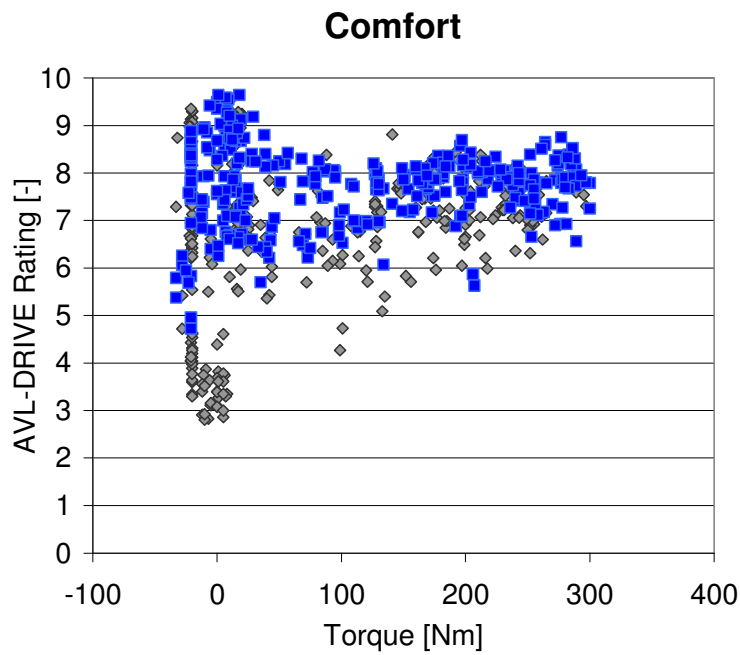
Automated Transmission Calibration

Example Improved Shift Quality



Verification of 23 upshift optimization DETAILED

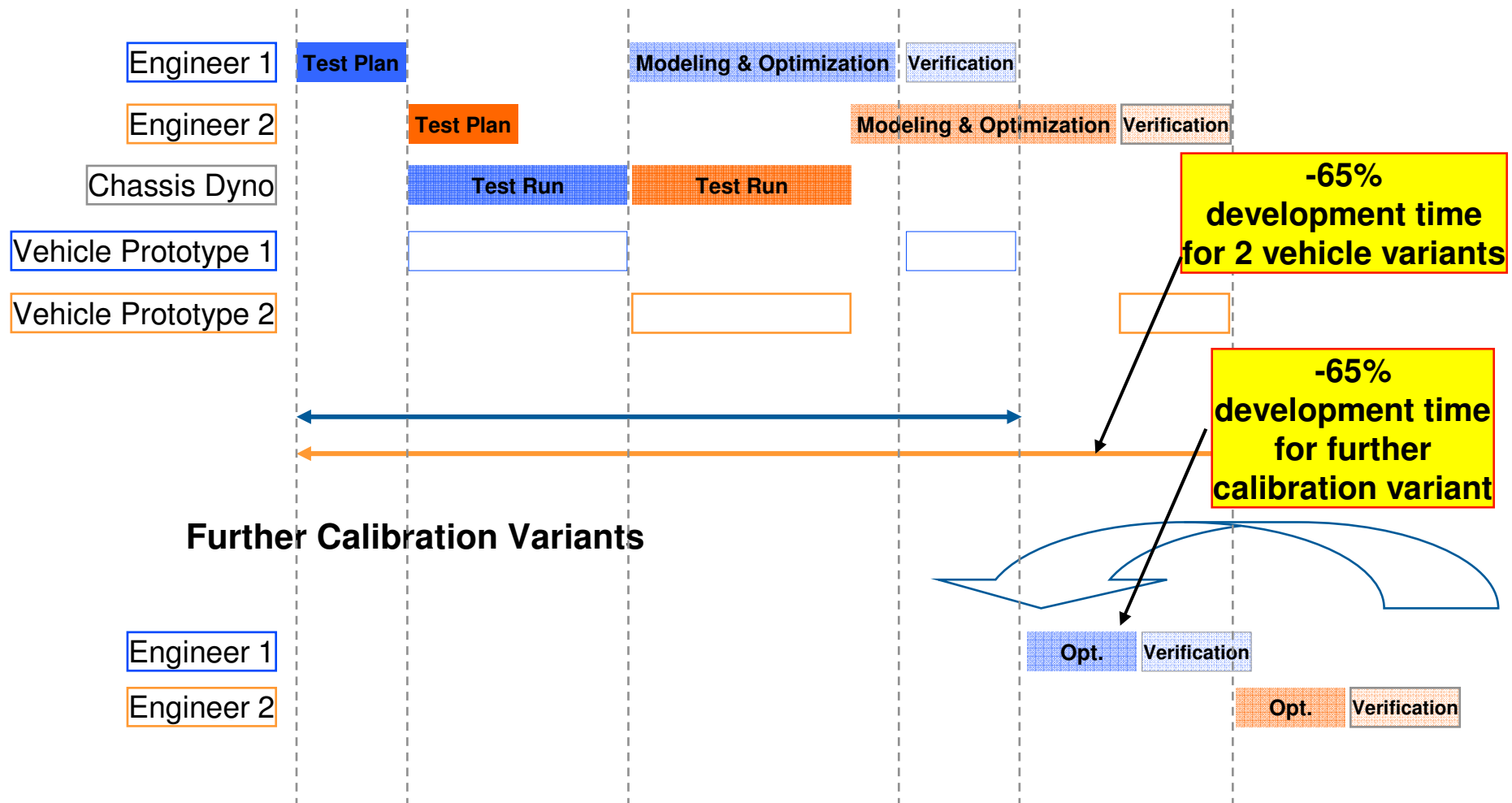
Source: ZF Friedrichshafen



Reduction of calibration cycle and resources through automated shifts quality calibration on chassis dyno

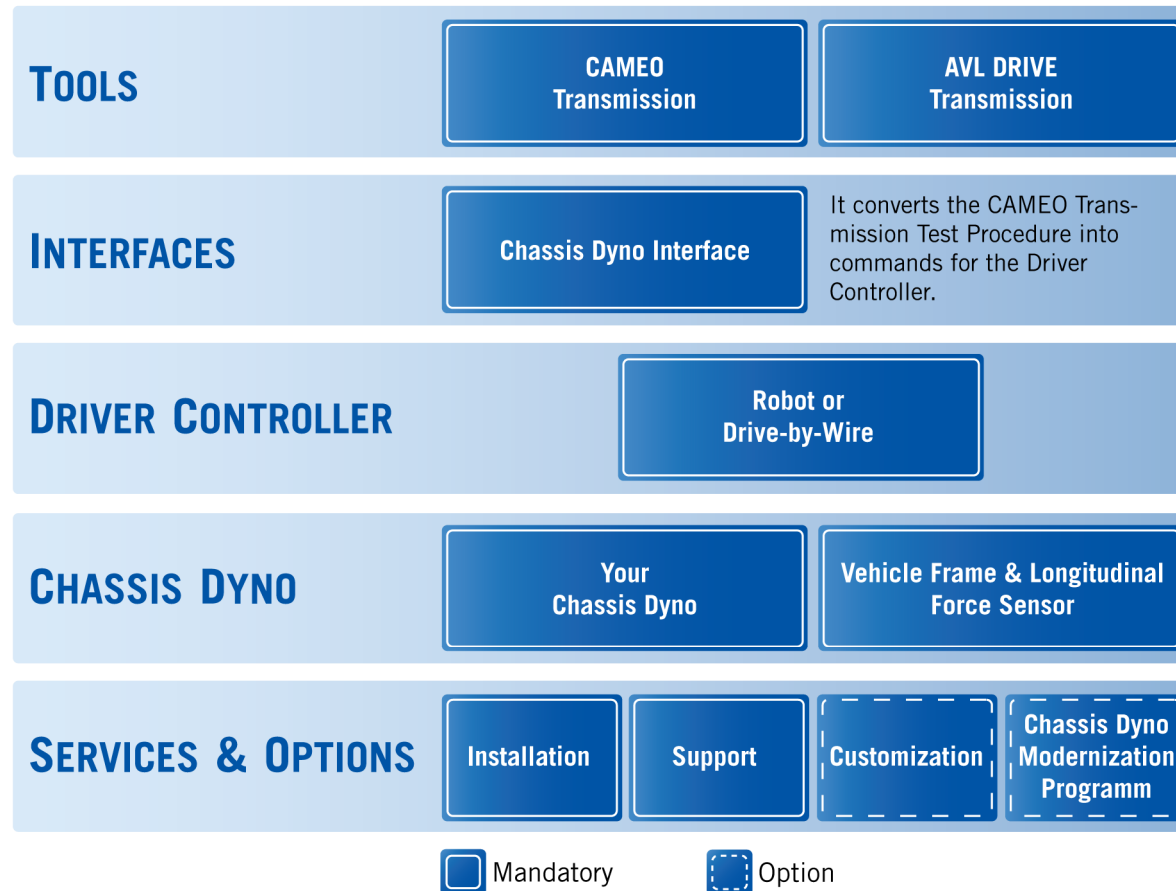


Example: complete single up/downshifts program for a 6-speeds automatic transmission for 2 vehicle variants

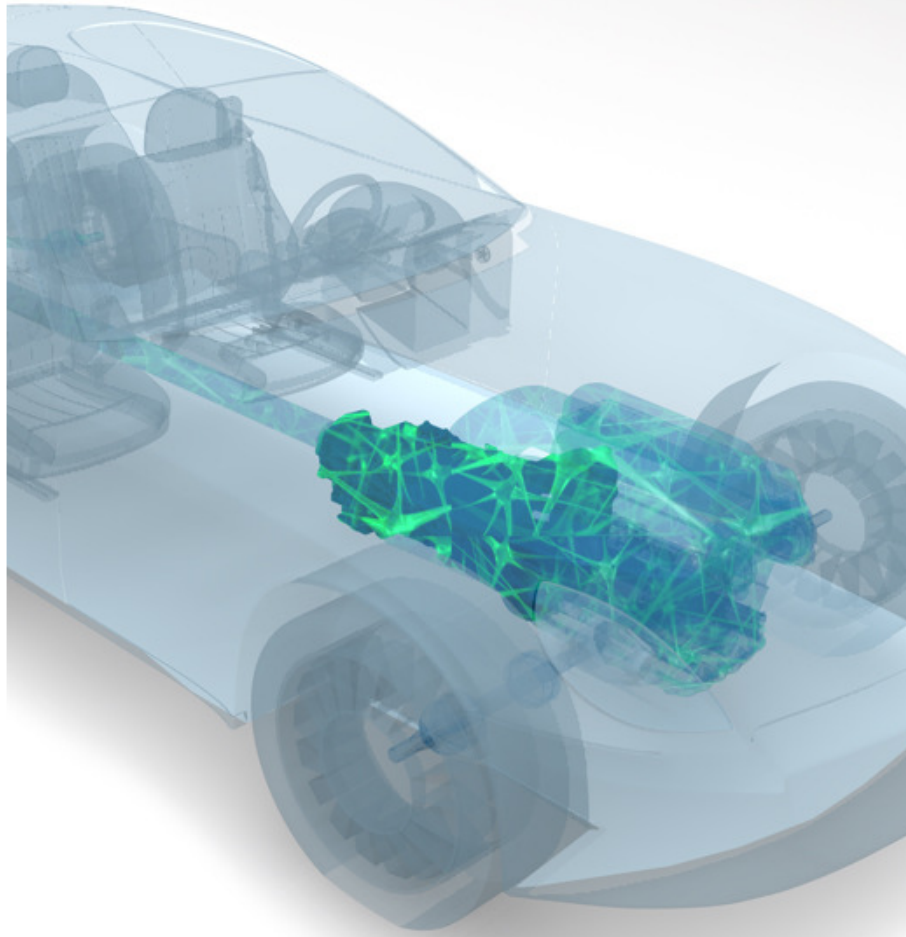


Cameo Transmission Chassis Dyno

What do I need to use this technology?



Customer Benefits



- **Reduced usage of prototypes**

A reduction in measurement time and therefore in the number of prototypes needed. Unmanned operation allows night and weekend test runs.

- **Objective shift quality evaluation**

The objective shift quality analysis, as obtained from the drivability analysis tool AVL-DRIVE™, ensures the measurability, reproducibility and traceability of a shift behavior.

- **ONE TOOL**

The integration of the complete calibration workflow into ONE TOOL improves the efficiency and the consistency of the calibration process.