SMART CALIBRATION

# AVL POWERTRAIN CALIBRATION TECHNOLOGIES

## PRODUCT PORTFOLIO

**Our Mission**

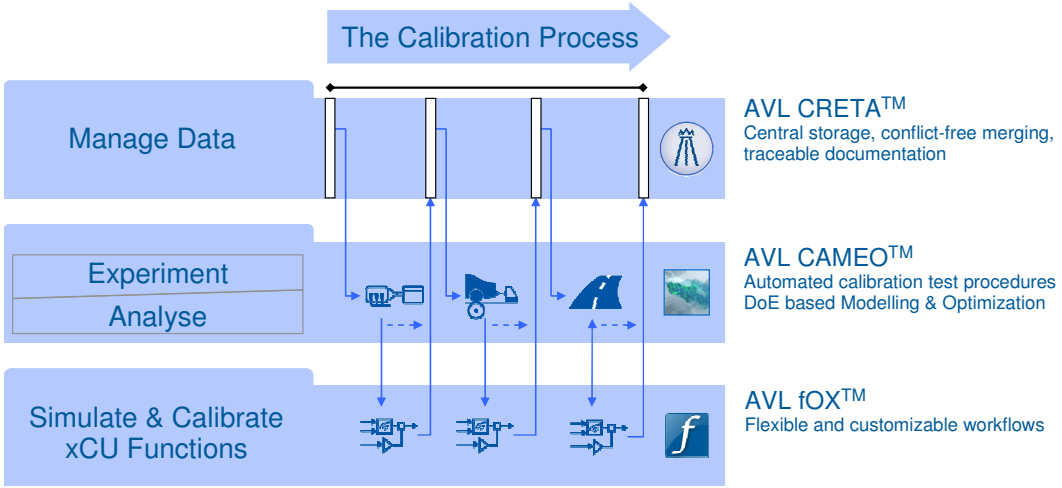
We provide professional software products for the calibration of modern powertrain systems, which allow a robust and affordable calibration process.

**The Product Portfolio**

Powertrain Control Unit Calibration has become a complex topic, driven by well-defined processes. For the sake of simplicity, calibrating mainly means managing calibration data, experimenting with powertrain behavior and finalizing the control unit maps (xCU parameters).

With our product portfolio we support the calibration engineer and methodology developer in all these 3 areas:

- Calibration Data Management
- Calibration Testing Strategies, Automated Intelligent Execution (e.g. Adaptive Online DOE), DoE Methodology.
- Control Unit Function Simulation, Conversion of the test results into control unit parameters, through professional and powerful tools (e.g. map interpolation, modeling, scripts, customized workflows, etc.)




*AVL CRETA – Calibration Data Management*

A high number of control unit parameters, lots of vehicle variants and globally distributed team assignments for calibration work are a common phenomenon within today's power train development projects. A major challenge of the complexity is the handling of control unit parameters. This includes

the well-structured and centralized storage of the big amount of parameters produced by various teams at different locations, the traceable documentation of changes and the conflict-free compilation of all single parameters to intermediate and final results without any inconsistencies. Robust final results are important to avoid cost-intensive vehicle re-calls or control unit re-flashing activities!
AVL CRETA calibration data manager contributes to meet nowadays challenges by offering an easy, centralized and traceable calibration data management which supports both, the calibration project manager and the calibration engineer in their daily datasets handling.

*AVL CAMEO – Automated Calibration Test Procedures and DoE Based Modeling & Optimization*
Every control unit functionality requires a specific calibration test procedure, which embodies also the know-how about the engine behavior and its limits. These test procedures are often time-consuming and high quality, affordable results can be guaranteed only through intelligent calibration procedures (iProcedures), which do not need an operator, are able to detect dangerous conditions and adapt the test automatically if necessary. Moreover, some of these functionalities are very complex to calibrate because of the number of degrees of freedom which the calibration engineer has to take into account to get the best result. One of the most common examples of these functionalities is the calibration of diesel combustion (emissions and fuel consumption). Because of the number of actuators, which are available in the modern engines (e.g. multiple injections, EGR, Swirl, Turbo, High pressure pump etc.), it is very challenging to manually find the powertrain optimum, therefore analytical methods, such as DoE methods (DoE Test Design, Statistical Regression Models, Optimization Algorithms), have to be used in order to come to a quick, robust and affordable result. With CAMEO AVL offers a tool, which contains intelligent calibration procedure and provides most of DoE, Statistical and Optimization methods.

*AVL fOX – Flexible and customizable workflows.*
Although today powertrain technology is very complex, a lot of physical variables cannot be directly measured onboard, because of cost or available technology reasons. For these reasons a high number of observers (virtual sensors or control unit models) in the powertrain control unit are available (e.g. air charge, torque model, catalyst models, OBD observers, cooler models etc…), which have to be calibrated. The measurement results can be testbed results, coming for example from a CAMEO intelligent procedure (iProcedures), or vehicle measurements. In either case, after collecting this data it is usually necessary to make some recalculation steps (data plausibility, filtering, recalculation through scripts, interpolations, map smoothing, control unit function simulations etc…). This post-processing work is one the most time-consuming parts of the calibration work, which needs a well defined process. With fOX AVL offers customized, professional and easily adaptable post-processing calibration procedures, which includes all the steps, macros and features that the calibration engineer needs to come to the final result: a set of control unit parameters.