## Engine Calibration & Tuning

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### LEVEL
Advanced

### PURPOSE
This course provides a better understanding engine tuning and calibration. It gives an overview of the tuning process to specialists (project, architecture, system design, software development, component development, software integration, functional validation, calibration, …).

### LEARNING OBJECTIVES
Upon completion of the course, participants will be able to:
- understand the relationship between engines physical functionalities and customer requirements,
- manage the requirements compromise,
- understand how EMS affects engine performances,
- understand the relationship between design and customer requirements,
- understand EMS tuning process and development,
- know tuning procedures and calibration tools,
- master the theory and the interest of DoE,
- practice develop and DoE,
- understand numerical optimization tools,
- understand the use of numerical models for tuning,
- practice calibration tools and synthesize engine control tuning.

### WAYS AND MEANS
The last two days are based on concrete and practical exercises:
- teaching design of experiment is enhanced by the use of computer tools (Matlab),
- teaching optimization settings is facilitated by the use of industrial computer tools.

### PREREQUISITES
No prerequisites for this course.

### Agenda

#### INTRODUCTION
Engine management system fundamentals. Tuning process and calibration in a V development cycle. Customer requirements, relationships between engine technical definition and customer requirements.

| 0.25 d |

#### FUNDAMENTALS OF ENGINE PERFORMANCE TUNING

| 1 d |

**FUNDAMENTALS OF ENGINE CONSUMPTION - POLLUTION & OBD TUNING**


**FUNDAMENTALS OF ENGINE CONSUMPTION TUNING**


**DESIGN OF EXPERIMENTS**

Customer and cycle driving operating points. Design of experiments (DoE) theory. Impact of engine operating parameters on tuning. Practice of the design of experiments with Matlab. Numerical models and optimized operating variables. Model quality and predictability validation. Impact on the DoE nature. Local or global DoE. Calibration methodologies associated with the DoE.

**FUNDAMENTALS OF ENGINE DRIVABILITY**


**SYNTHESIS & OPTIMIZATION OF THE ENGINES CALIBRATION**