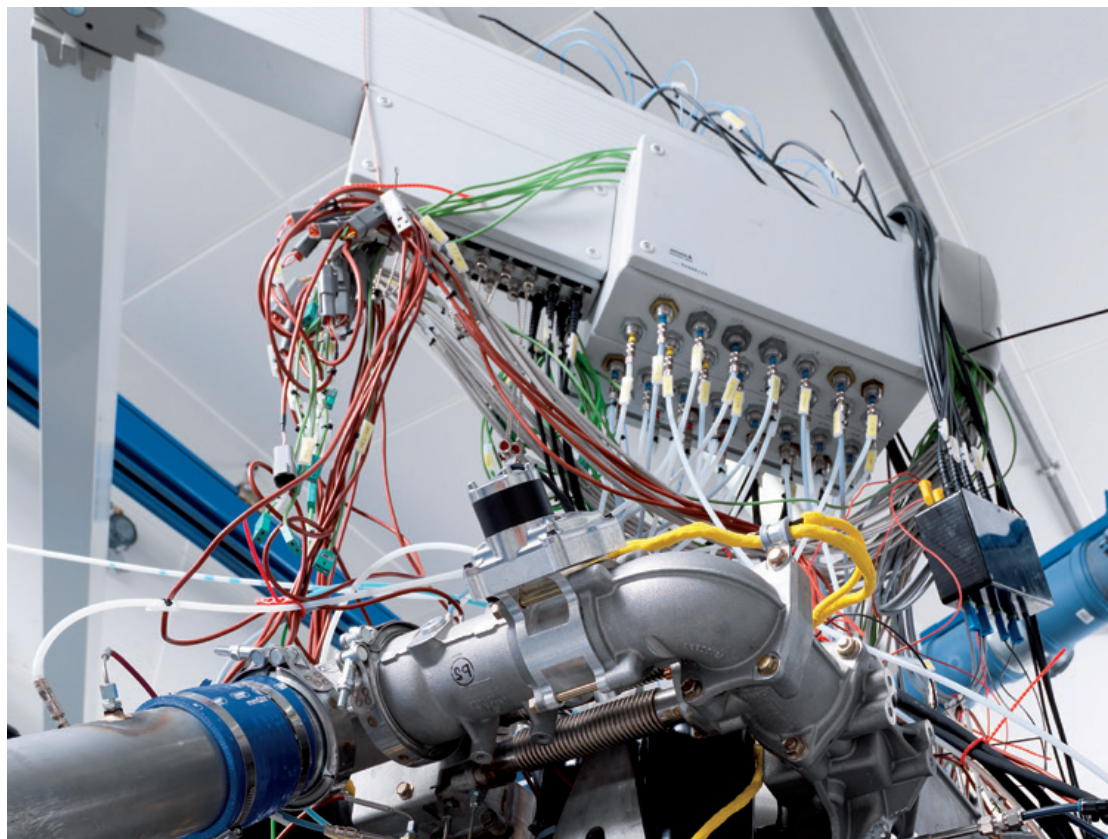


## Engineering Center Steyr



## Intelligent Calibration Tool

- Design of Experiments
- Online Optimization
- Map Generation
- Fast Engine Calibration

**ICT** software

INTELLIGENT CALIBRATION TOOL

[ict.ecs.steyr.com](http://ict.ecs.steyr.com)

**ICT is a tool which introduces new ways for an automated and intelligent calibration of static and dynamic engine characteristics or adjustment of controllers. By defining the optimization target (e.g. emission, boost pressure...) and the actuators (e.g. injection initiation point, fuel consumption...) an optimization model is calculated, using genetic algorithms or gradient based methods.**

Additionally to data management, the knowledge gathering from existing information sources and the data acquisition process the analysis and modeling methods are core features which should be as flexible as possible. To cover all the needs for calibration and function development ICT was designed as a framework with a well defined workflow. This workflow is independent from the exercise, which means independent if the task will be done static or semi (quasi)-dynamic on a test bench or a chassis dyno due to a flexible analysis layer.

### Case #1: Steady state map optimization

Map and Curve optimization

Characterization

- Global variables
- Local variables

Optimization

- Based on local models
- Map generation out of optima
- Map merging out of all strategies

### Case #2: Dynamic controller optimization

Scalar optimization

Characterization

- Constant (e.g.: engine speed for load step)
- Local variables

Optimization

- Local combination is optimized

### Case #3: Dynamic map optimization

Load step or cycle defined via test bed

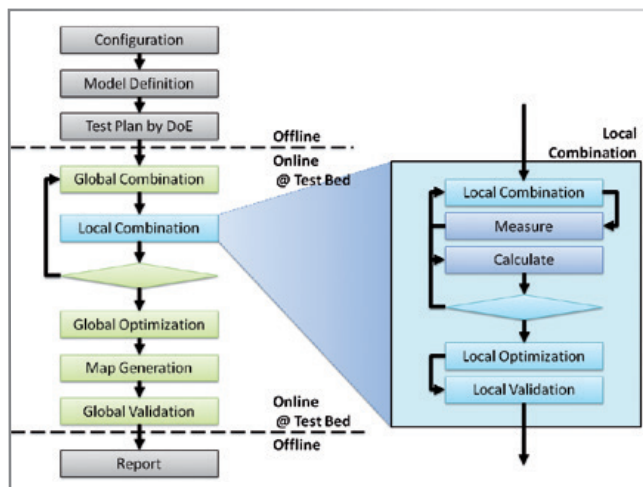
Map and Curve optimization

Characterization

- Global variables
  - ♦ Define ambient conditions
- Local variables
  - ♦ Parameter of map change

Optimization

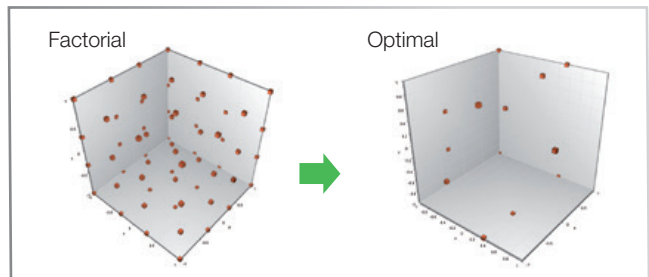
- Local combination is optimized



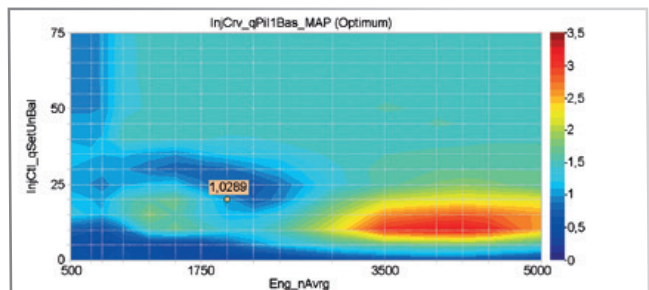
ICT automated calibration workflow

### Key Features

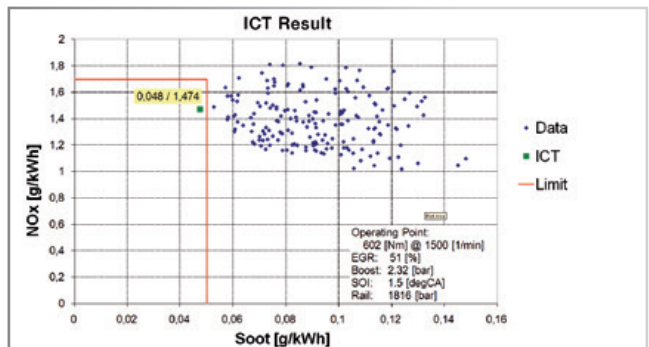
- Model based DoE
- Section design including hysteresis (calibration of different strategies at once)
- Map optimization + generation
- Validation (best combination + map)
- Safety Strategies
- Steady State Detection (gradient or time based)
- Process pause, resume and rewind
- Offline adaption's possible
- Standard interfaces (ACI, ASAP3, CAN)
- Automatic measurement error detection



Design of Experiments



Map optimization + generation



Validation (best combination + map)

ict.ecs.steyr.com

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