# WP5: Lifetime Performance Control

## Objectives

- Develop methods, systems and processes allowing a continuous optimized performance of the power plant throughout its lifetime

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## How

- Optimized control methods
- Adaptive lubrication system

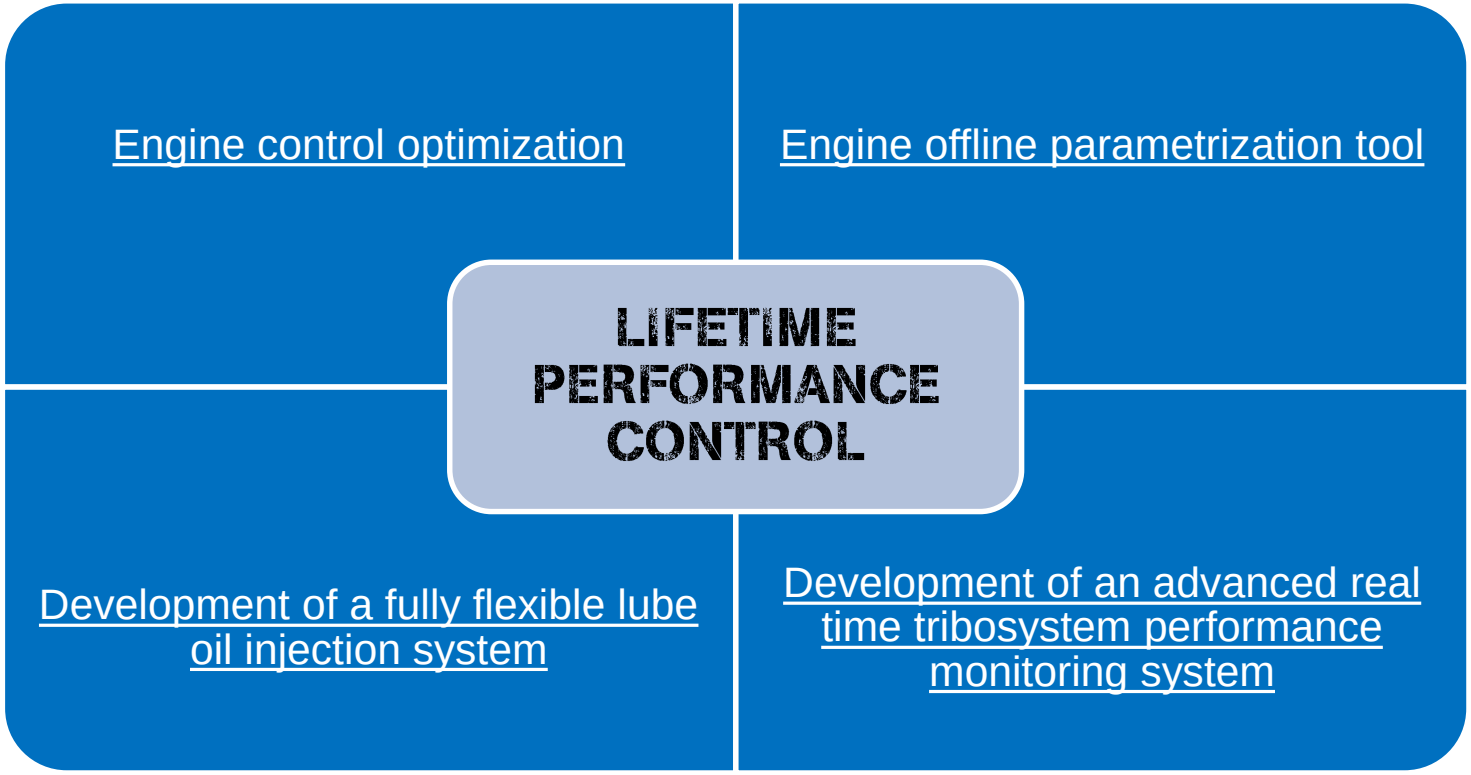
Partners:

## Expected Results

- Technology demonstrators at TRL 6
- Max 5% divergence of any performance parameter from “as-new” state
- Advanved lubrication control system
- Optimized lube oil feed rates
- 10% lube oil consumption reduction

## Structure

*Building blocks for lifetime performance*



# Structure: Subprojects, Activities: 5.1, 5.2

Sub-project 5.1: Engine control optimization

- Optimized control study, algorithm development, simulation, testing

Sub-project 5.2: Offline engine control parametrization tool

- Parametrization study, concept, prototype tool development, prototyping, testing

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Vaasan yliopisto UNIVERSITY OF VAASA

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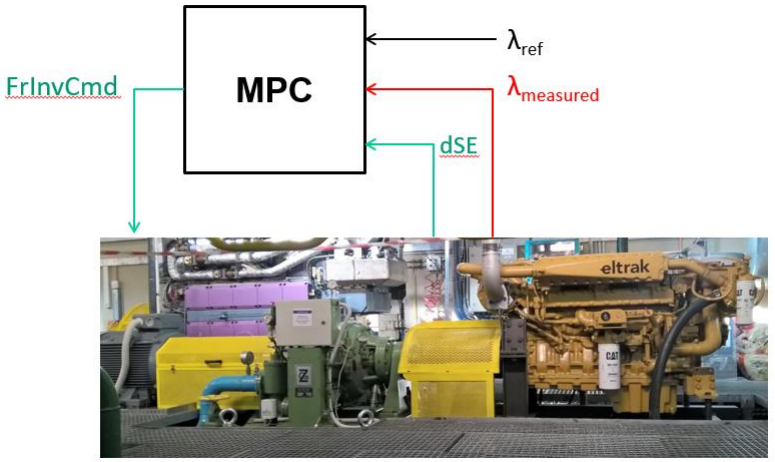
# Progress (5.1 & 5.2)

## 5.1 Engine control optimization

- Knock margin control model demonstrator testing on Wärtsilä 20 engine
- Optimized control methods demonstrator testing
- Hybrid engine control – MPC control implementation on the NTUA testbed

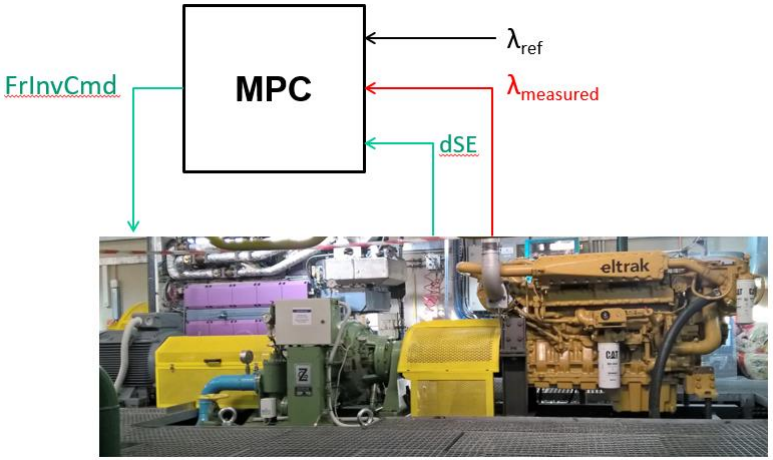



HIPPO-1

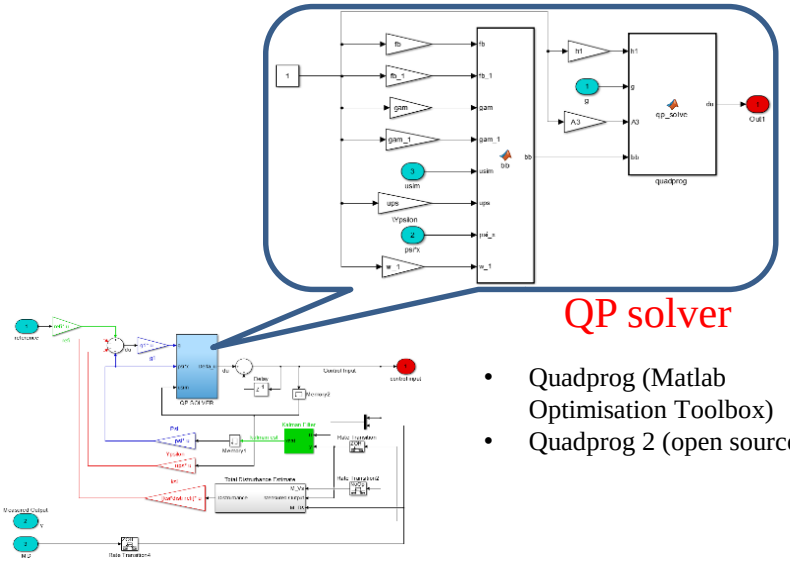
## 5.2 Offline engine control parametrization tool

- Offline parametrization tool testing done on engine at Aalto and ready for demonstrator testing at VEBIC
- BSFC (Break Specific Fuel Consumption) reduction under emission constraints studied

# Custom MPC Controller



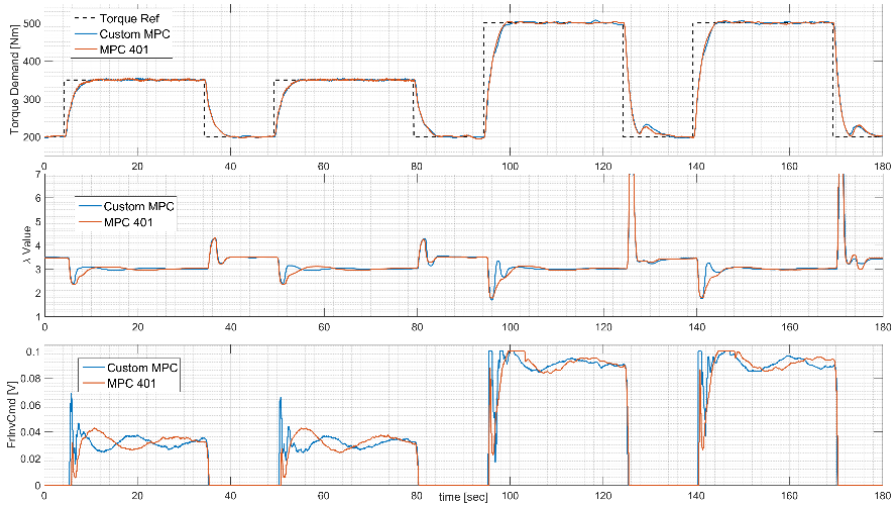

HIPPO-1

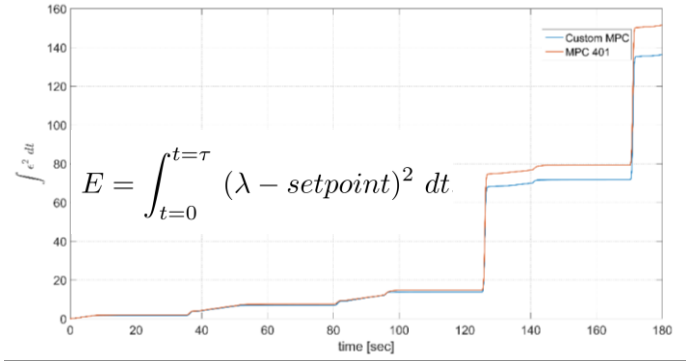


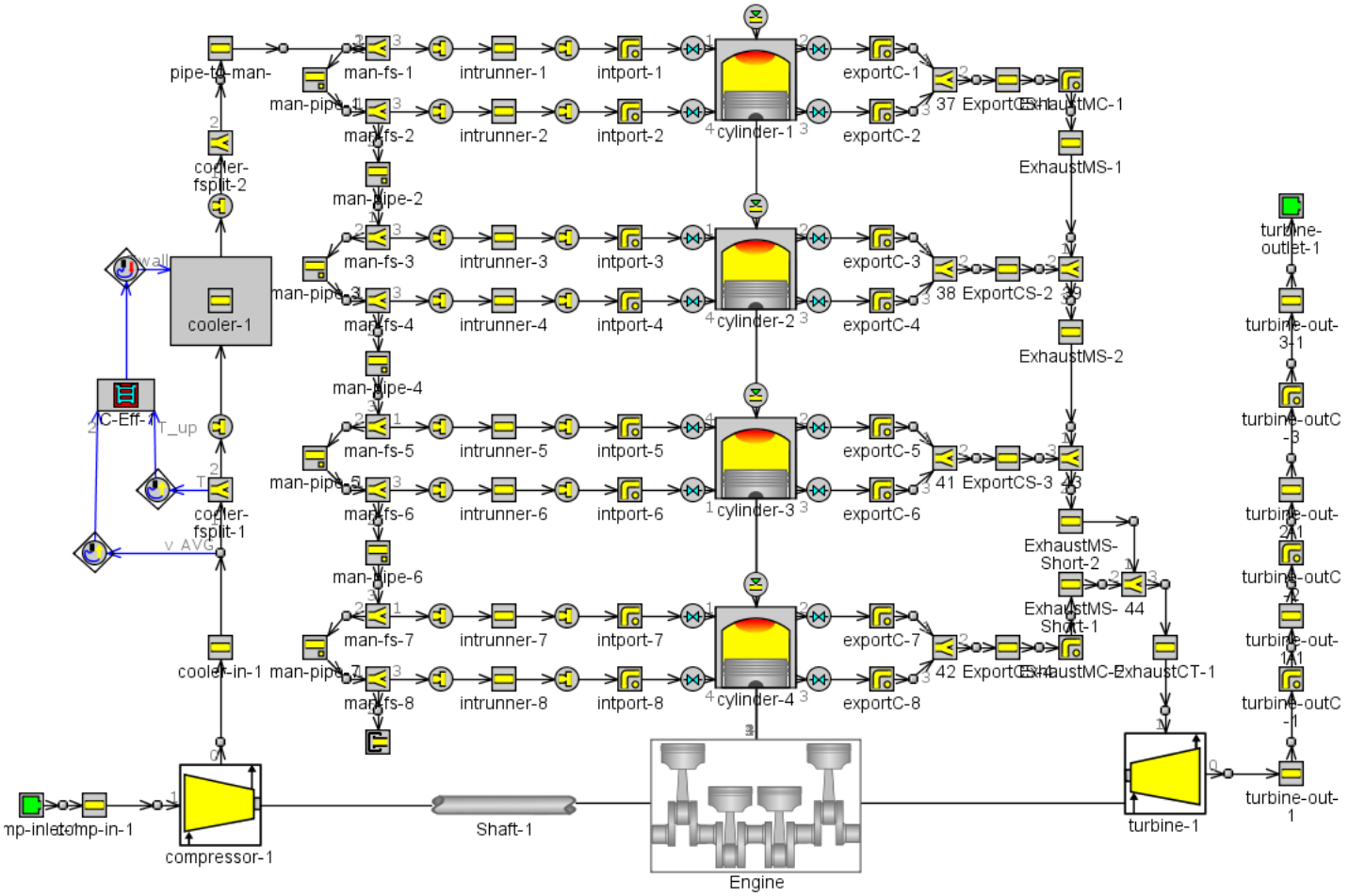

QP solver

- Quadprog (Matlab Optimisation Toolbox)
- Quadprog 2 (open source)

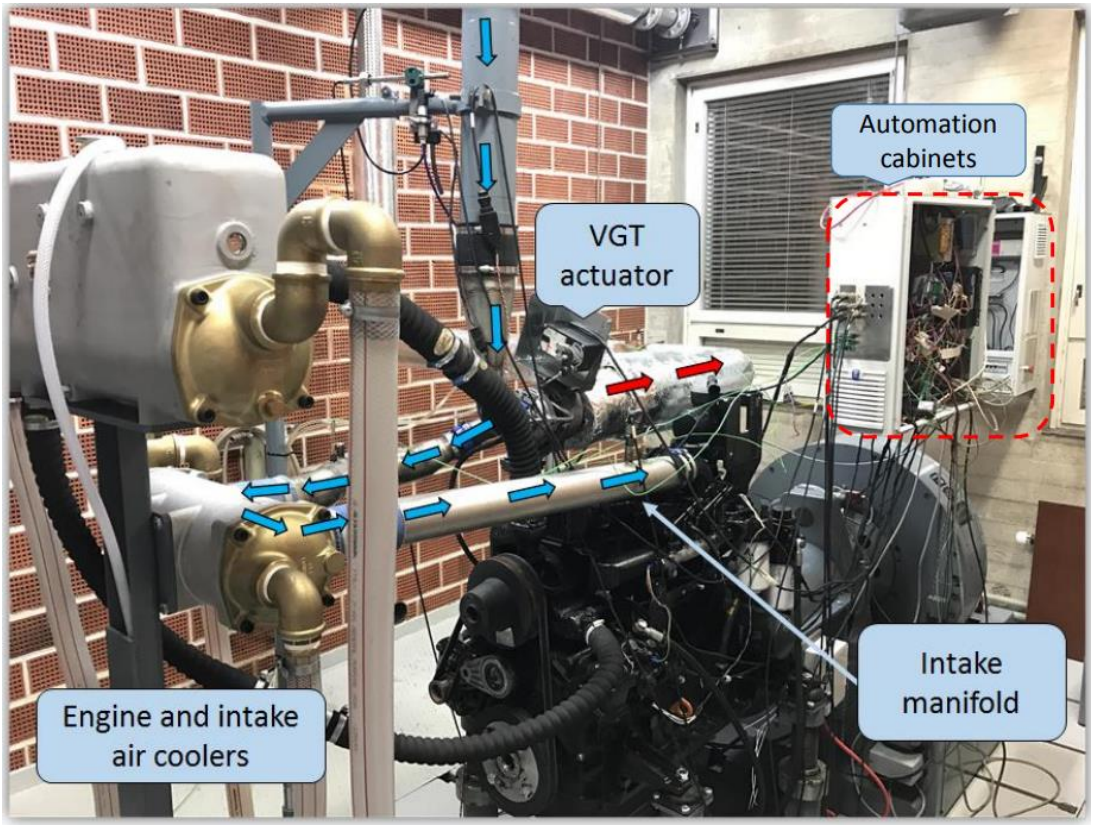
- Case 1 Hp=30, Hu=1, Sampling Time=0.1, Fast Controller
  Load: 200-350 & 200-500 Nm



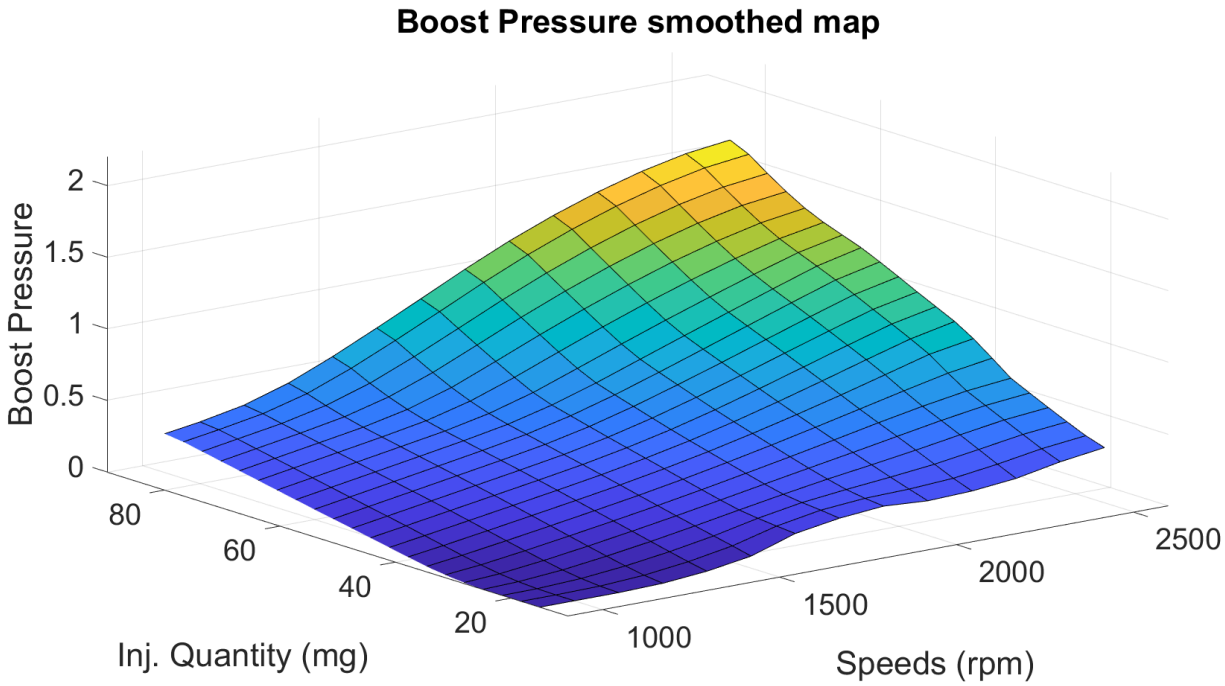





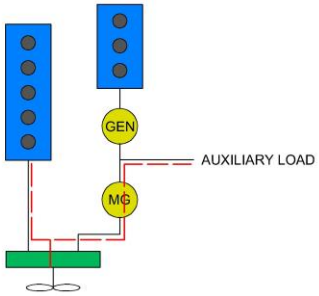

Testing was also done in GT-suite simulation model



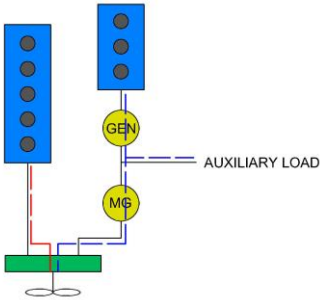

The 4-cylinder AGCO engine was used for the testing of the parameterization tool.



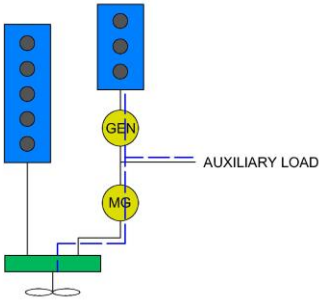

Example of the boost pressure map created by the tool.



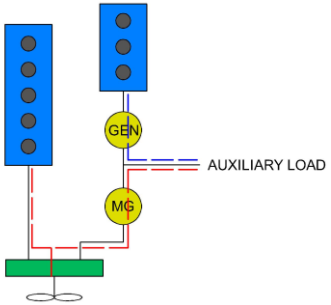

PTO – Transit mode




PTI – Booster mode




PTI – Diesel/electric mode




PTO - Parallel mode

Load profile from a High Speed vessel during arrival at port