WP5: Lifetime Performance Control

Objectives

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

WP Leader: Jonatan Rösgren
WP Deputy: Matthias Stark

How

- Optimized control methods
- Adaptive lubrication system

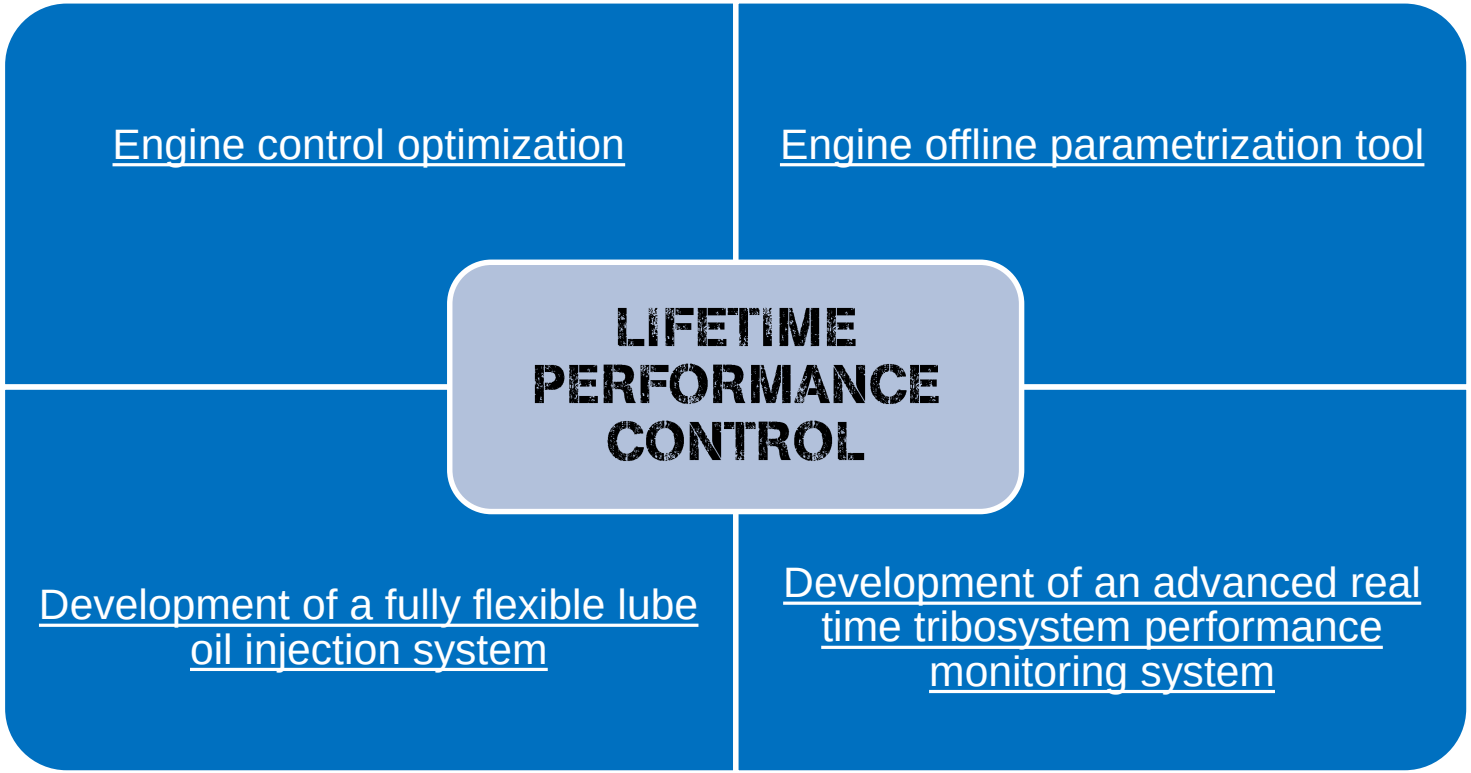
Partners:

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

WÄRTSILÄ

ETH Eidgenössische Technische Hochschule Zürich Swiss Federal Institute of Technology Zurich

Vaasan yliopisto UNIVERSITY OF VAASA

Aalto-yliopisto

Progress (5.1, 5.2)

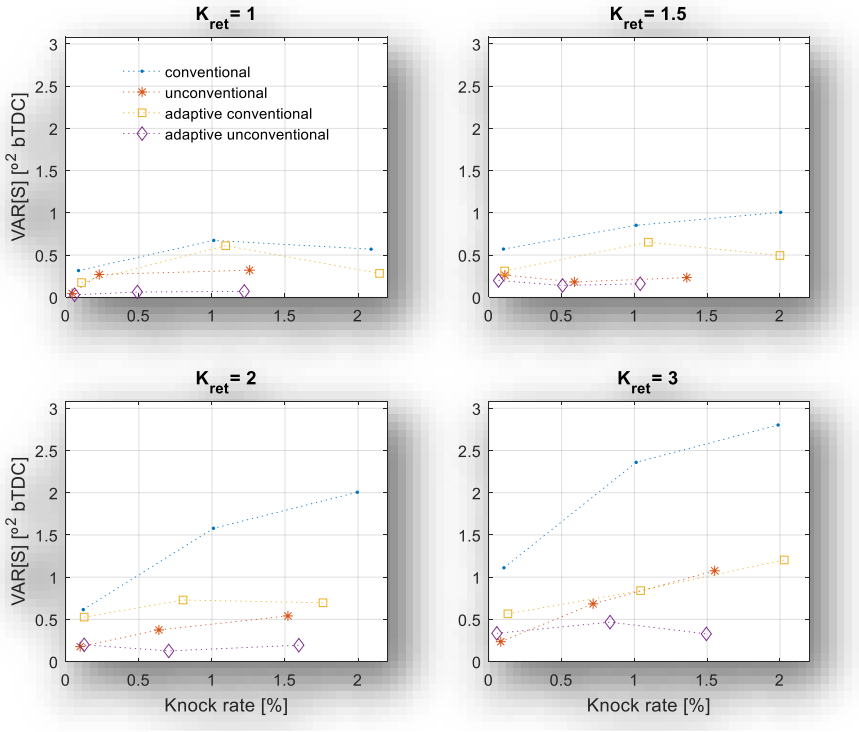
5.1 Engine control optimization

- Hercules C: stochastic knock margin identification, adaptive controllers development

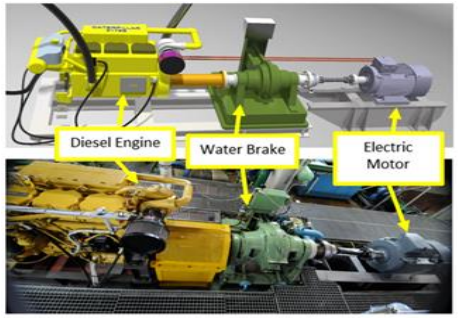
- Hercules 2: knock & optimal control control strategies and methods including measurement chain accuracy

Progress:

- Adaptive knock control strategies – strategy development and testing ongoing
- Measurement chain accuracy study
- Engine laboratory setup (Vaasa)
- Hybrid engine control – lambda regulation development



Spark timing variance. Comparison of the adaptive strategies.



Hybrid engine setup

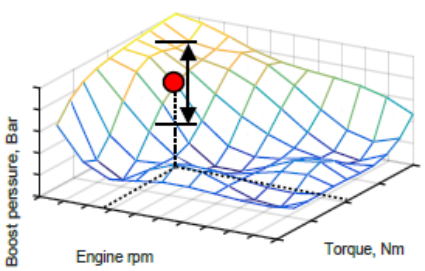
Progress (5.1, 5.2)

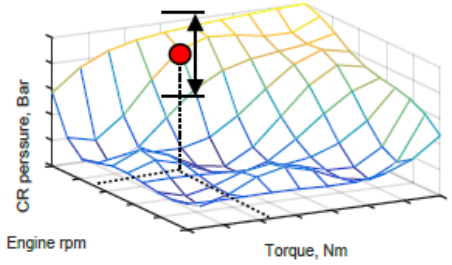
5.2 Offline engine control parametrization tool

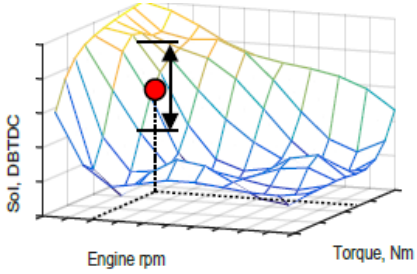
- Hercules C: focusing on adaptive controllers (PID)
- Hercules 2: focus on reference maps.
- Reference maps big affect on engine characteristics

Progress:

- Rapid prototyping systems introduction ongoing (Aalto & Wärtsilä)
- Design of Experiments (DoE) algorithm development & simulation ongoing
- Screening experiments with $\mathbf{2^3}$ factorial design: construction of linear regression model
- Engine testing to be initiated in October 2016.





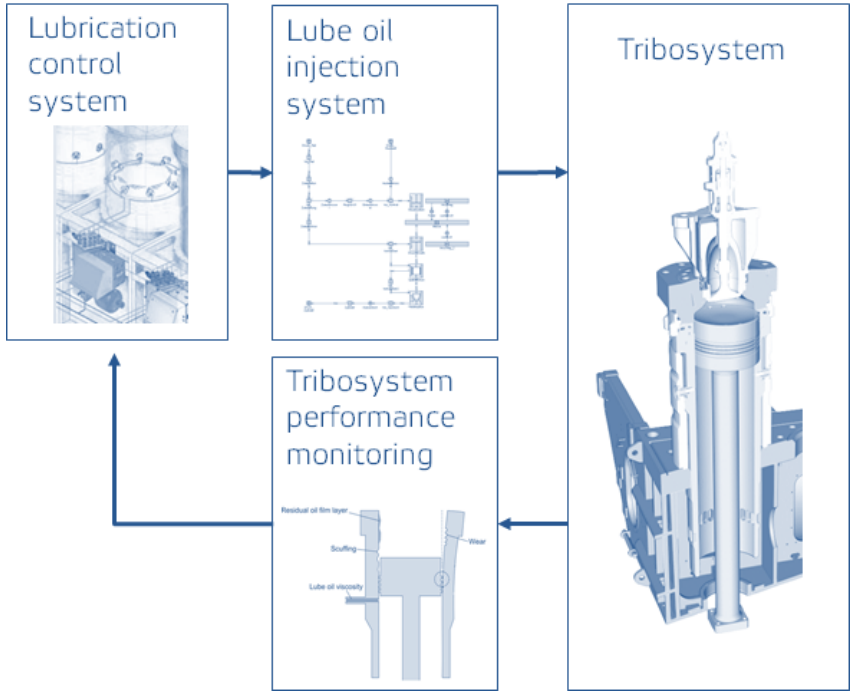


Structure: Subprojects, Activities

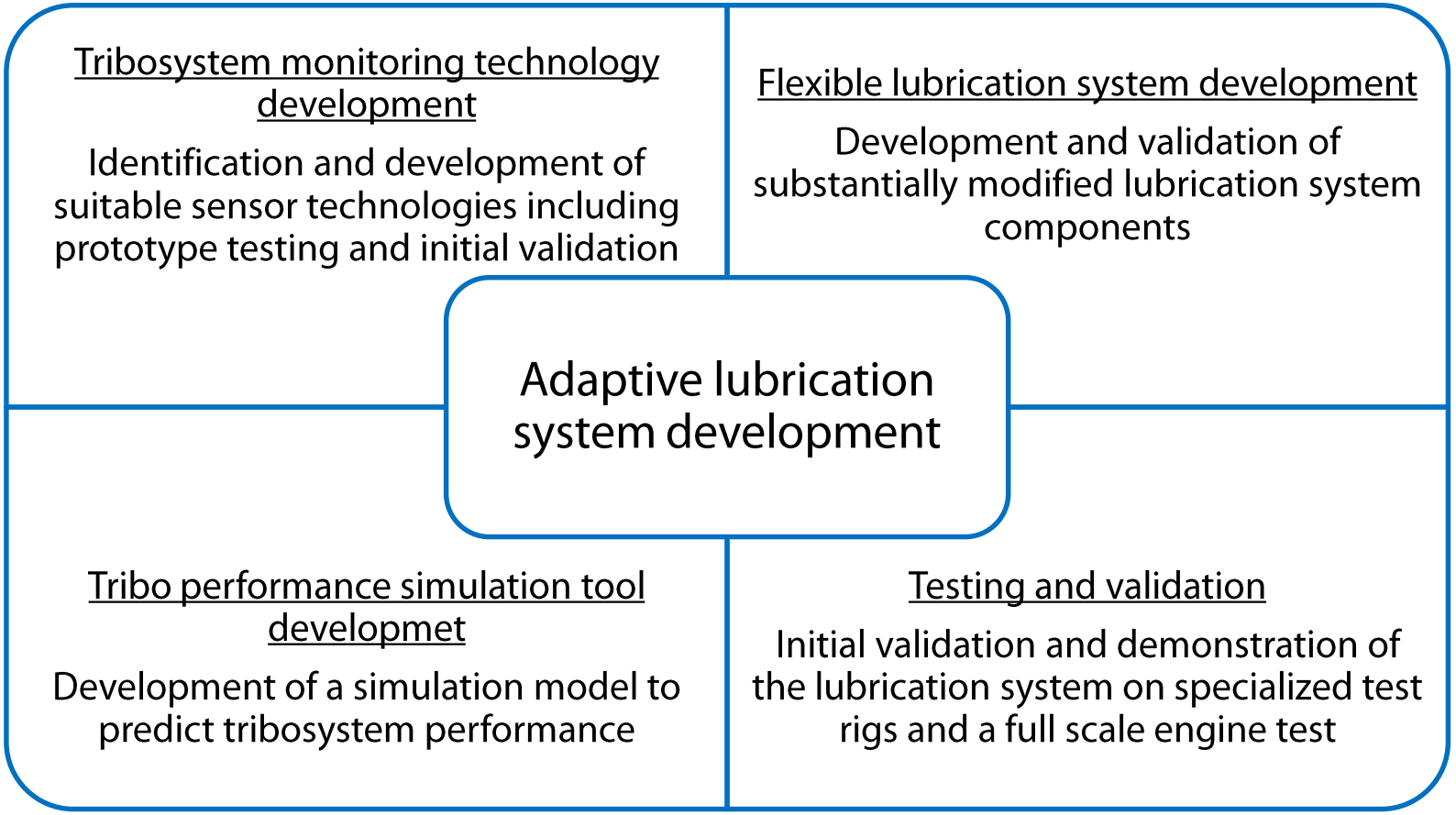
DWP Leader: Matthias Stark

Sub-project 5.3:
Development and simulation of an adaptive lubrication system

Sub-project 5.4:
Development of an advanced real time tribosystem performance monitoring system

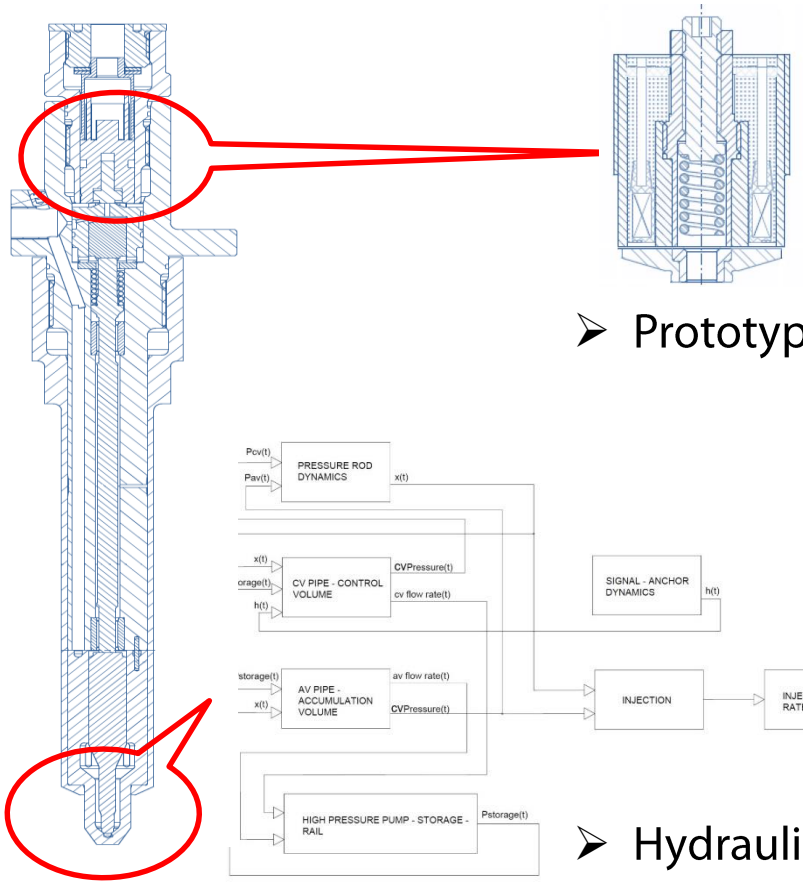


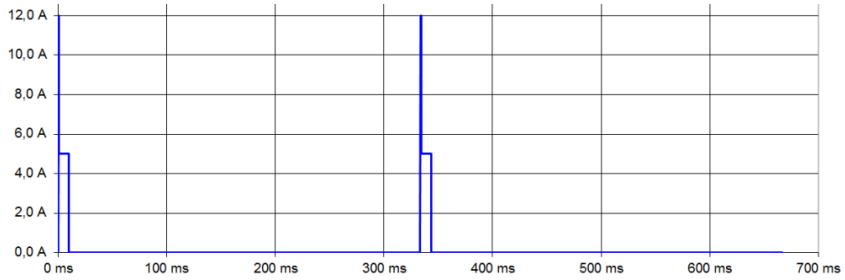
Objectives / Expected Results



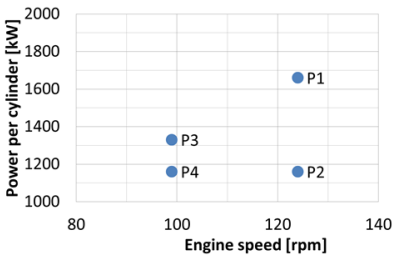
Partners: WIN GD Winterthur Gas & Diesel; Università del Salento; The University Of Sheffield.

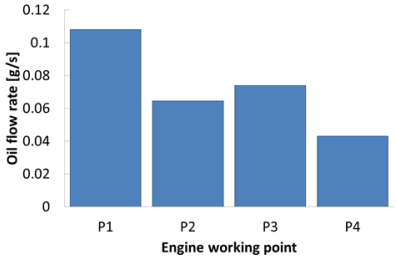
Sub-project 5.3: Development and simulation of a fully flexible lubrication system





➢ Prototype development of the new lube oil injector





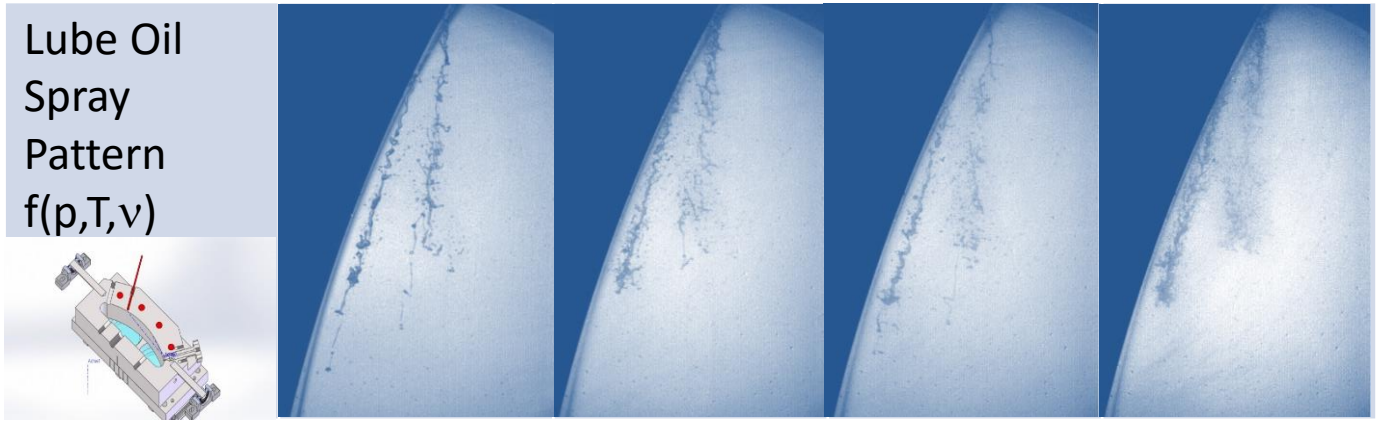
➢ Hydraulic simulation optimization results

WIN GD
Winterthur Gas & Diesel

UNIVERSITÀ DEL SALENTO

Sub-project 5.3: Development and validation of a fully flexible lubrication system

Experimental setup

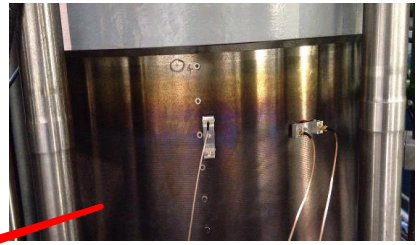
Engine Load Load [%]	25	50	75	100
Lube Oil Spray Pattern f(p,T,ν)				

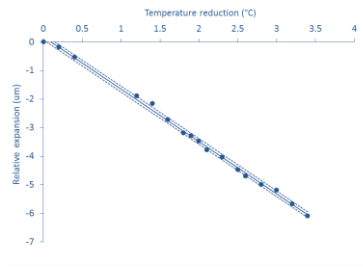
Simulation of engine load conditions

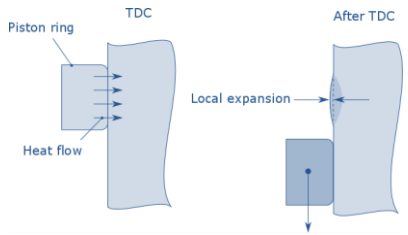
Software and hardware modifications

Pulse jet lubrication system testing

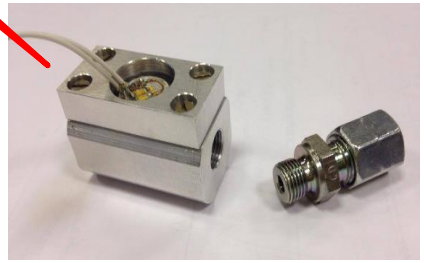
Sub-project 5.4: Development of an advanced real time tribosystem performance monitoring system

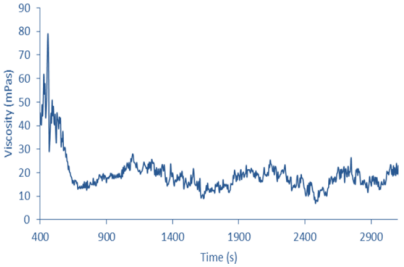


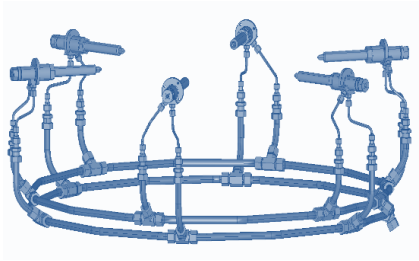




In-line scuffing indicator prototype testing







In-line viscosity indicator prototype testing

WIN GD
Winterthur Gas & Diesel

The University Of Sheffield.