WP5: Lifetime Performance Control

Objectives

• Develop <u>methods, systems and processes</u> allowing a continuous <u>optimized</u> <u>performance</u> of the power plant <u>throughout</u> <u>its lifetime</u>

How

• Optimized control methods
• Adaptive lubrication system

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
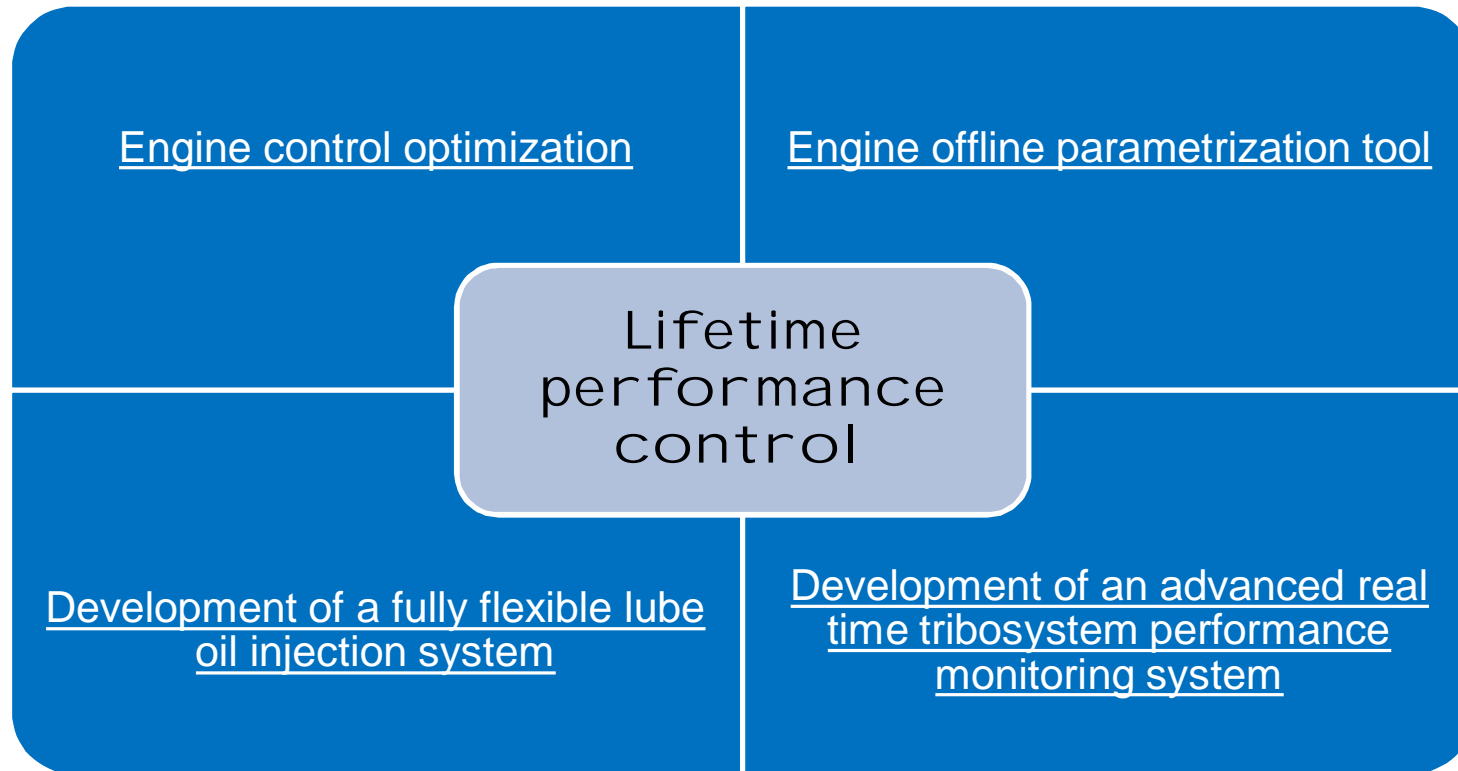
WP Leader: Jonatan Rösgren
WP Deputy: Matthias Stark

Partners:

WÄRTSILÄ

The University Of Sheffield.

ETH Eidgenössische Technische Hochschule Zürich Swiss Federal Institute of Technology Zurich

UNIVERSITÀ DEL SALENTO

WIN G2 Winterthur Gas & Diesel

Vaasan yliopisto UNIVERSITY OF VAASA

A! Aalto-yliopisto

POLITECNICO DI MILANO

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

WP5: Lifetime Performance Control

Progress (5.1 & 5.2)

### 5.1 Engine control optimization

- Rapid prototyping system (Wärtsilä) completed
- First full engine testing with knock margin control performed
- Cylinder pressure accuracy concept study done
- Hybrid engine control – predictive lambda regulation control development

5.2 Offline engine control parametrization tool

- Rapid prototyping systems introduced at Aalto
- Design of Experiments (DoE) algorithm development & simulation ongoing
- Engine testing initiated
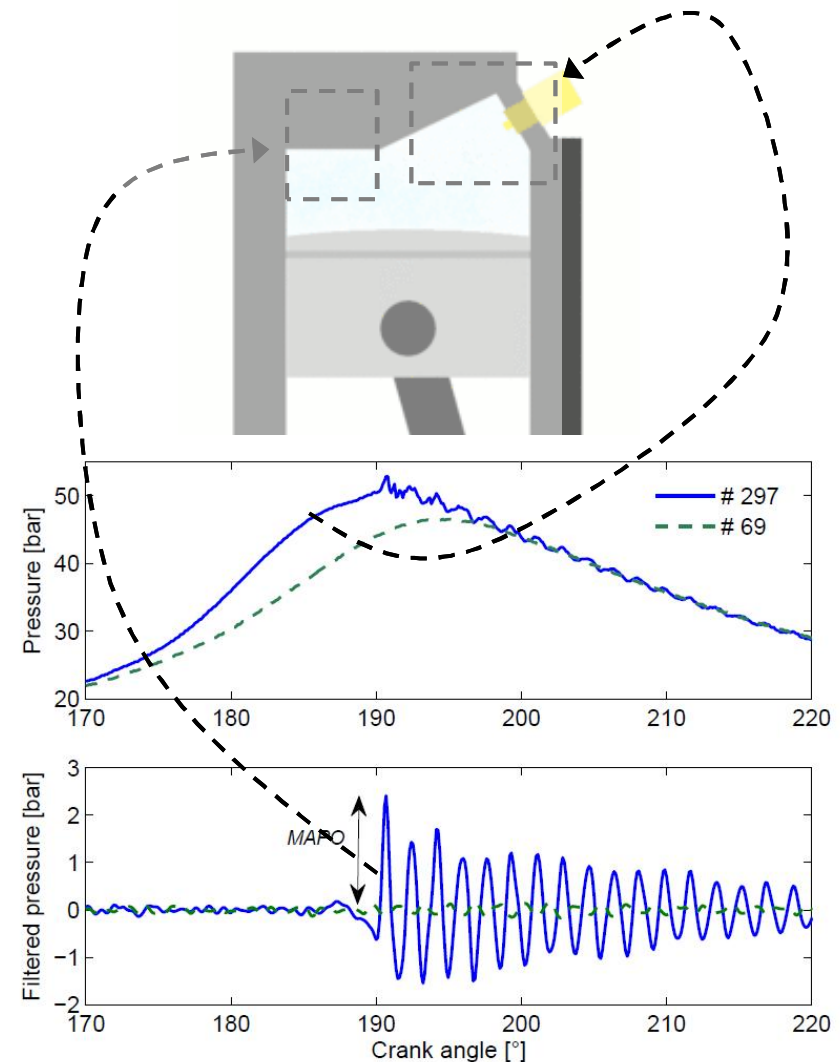
WP5: Lifetime Performance Control
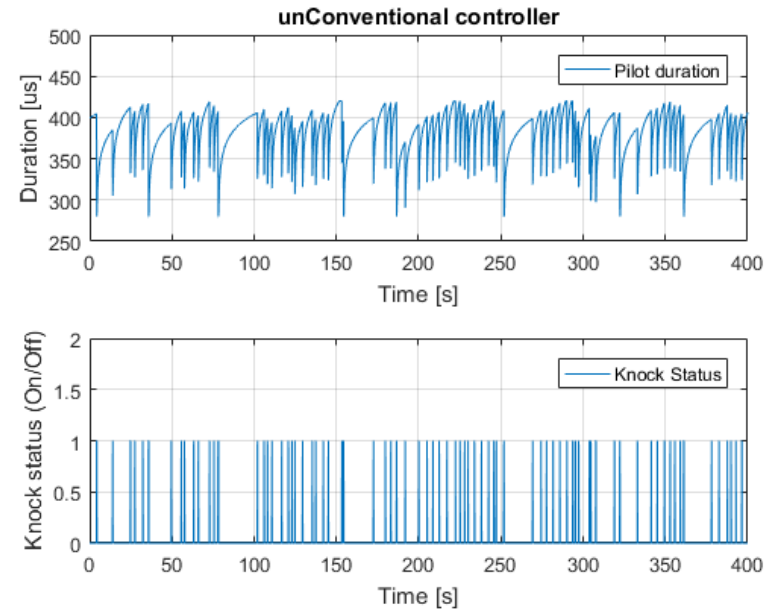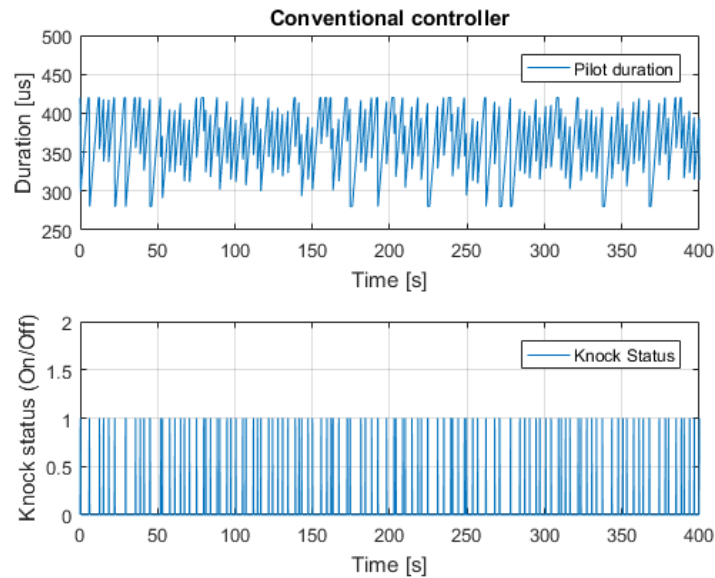
- The new unConvetional controller clearly improves engine operation in operating points close to the knock-margin. Engine operation close to highest allowed knock-level is maximized with the unConventional controller

- Further research work needed to finding the most optimal control signal on a dual-fuel engine
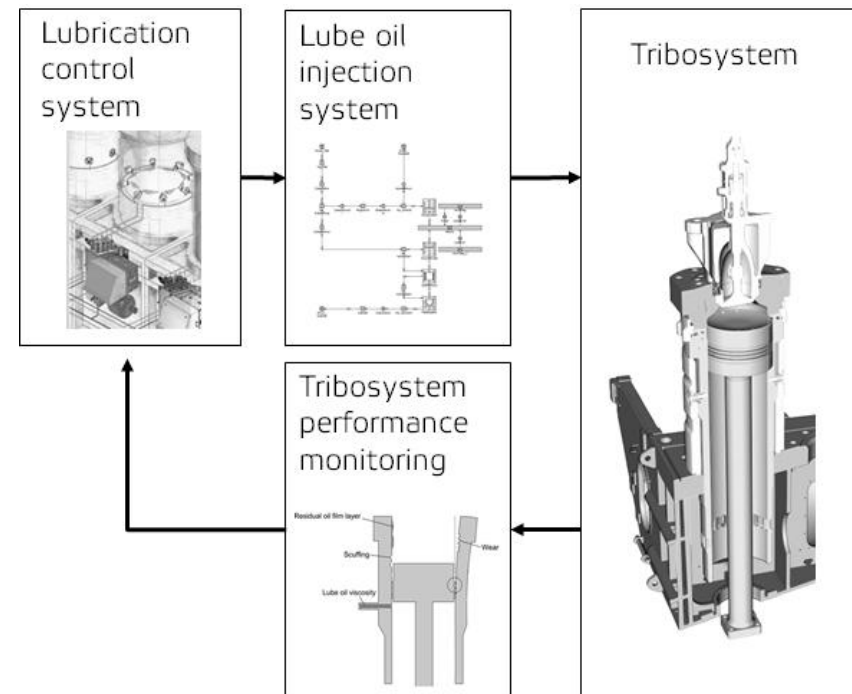
Structure: Subprojects, Activities
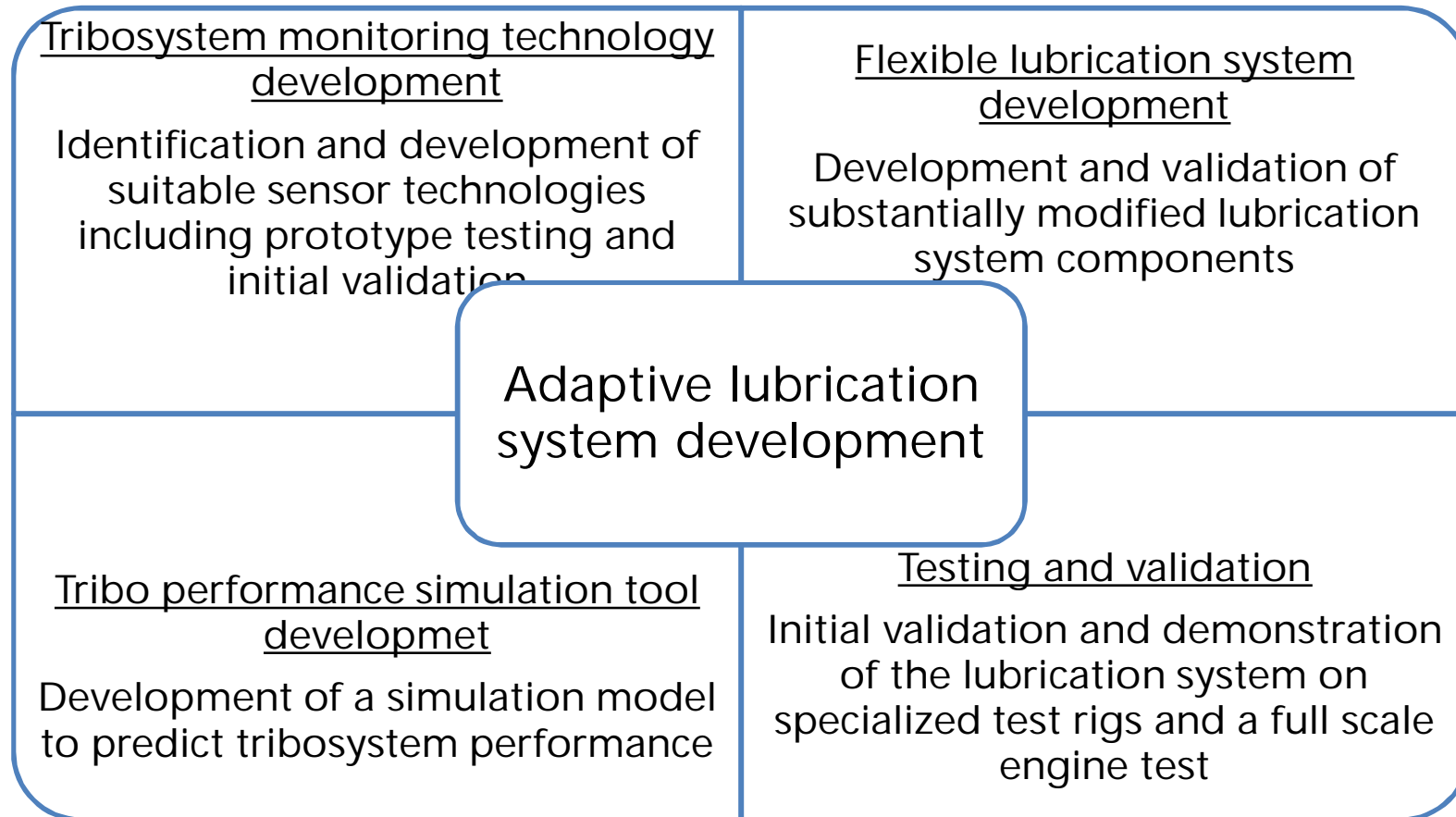
DWP Leader: Matthias Stark

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

Tribosystem monitoring technology development

Identification and development of suitable sensor technologies including prototype testing and initial validation

Flexible lubrication system development

Development and validation of substantially modified lubrication system components

Adaptive lubrication system development

Tribo performance simulation tool developmet

Development of a simulation model to predict tribosystem performance

Testing and validation

Initial validation and demonstration of the lubrication system on specialized test rigs and a full scale engine test

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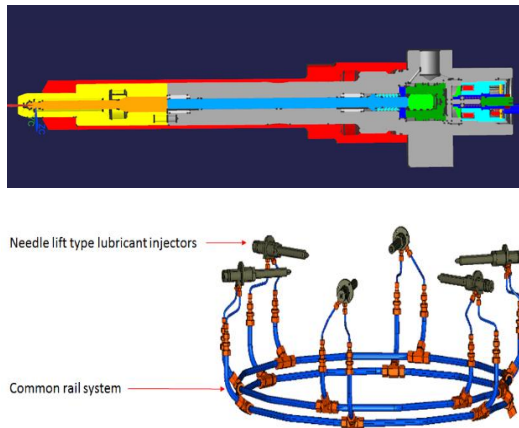
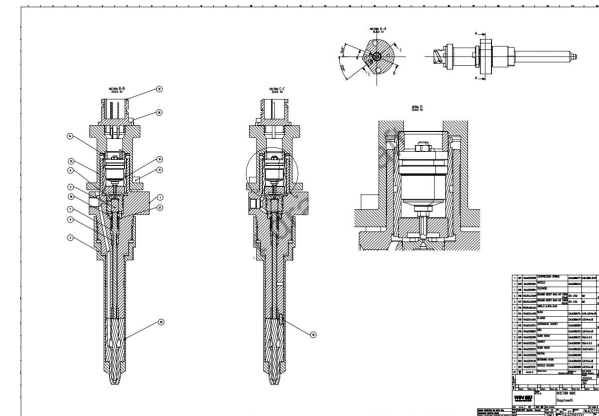## Sub-project 5.3: Development and simulation of a fully flexible lubrication system

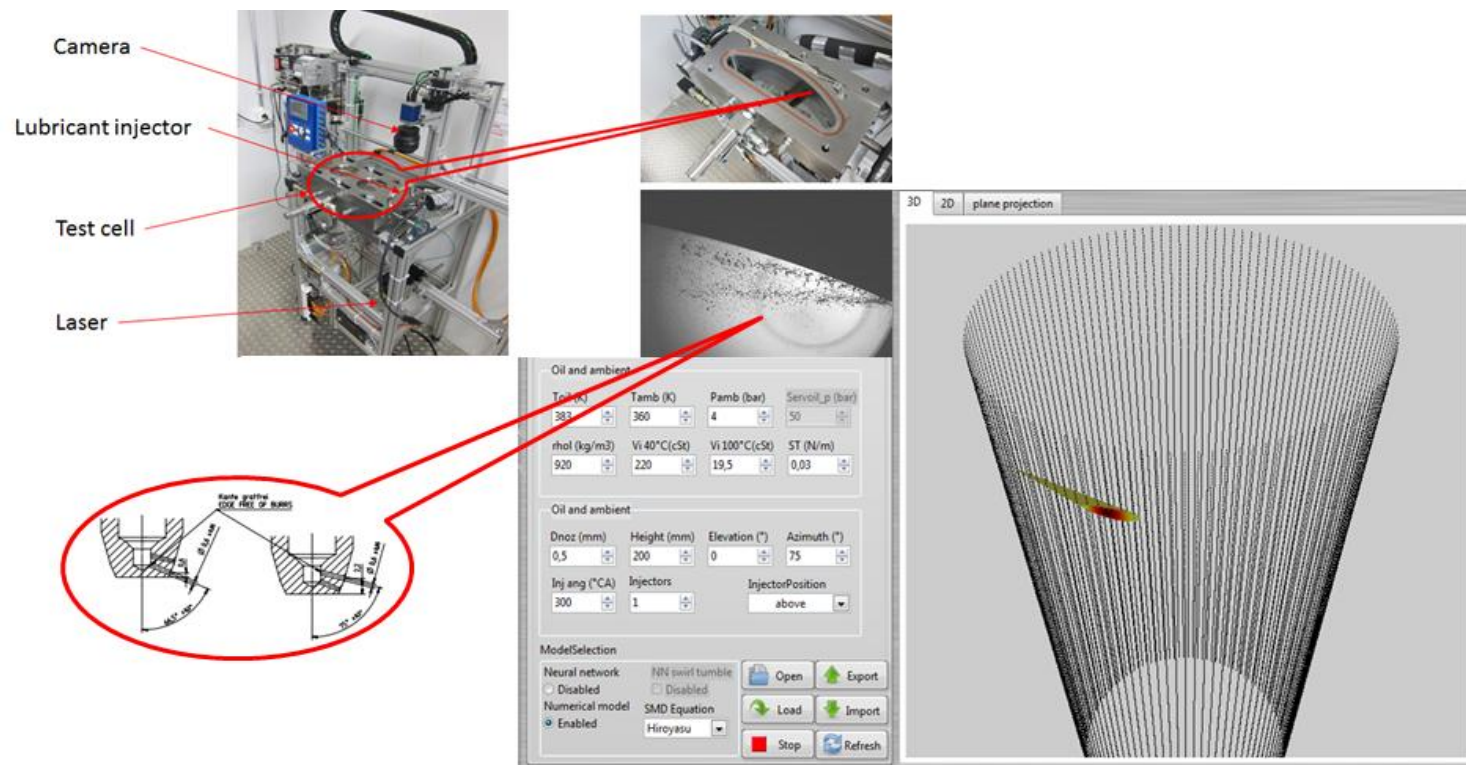| Pre-study and preliminary design	Hydraulic simulation optimization	Prototype manufacturing
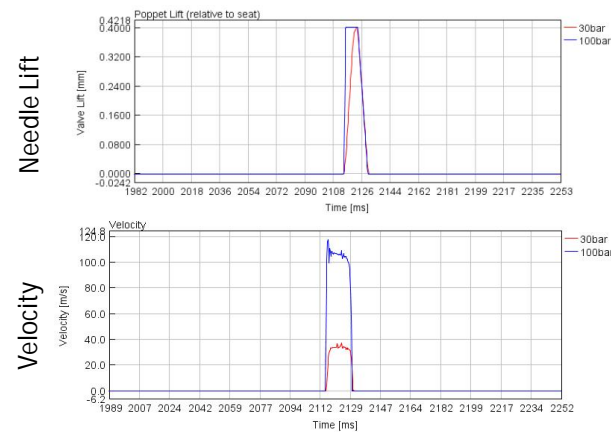
➤ Development steps towards the design of the new lube oil injection system

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

Generation and implementation of experimental data in an artificial neuronal network

> ➤ Prediction of spray and impingement characteristics

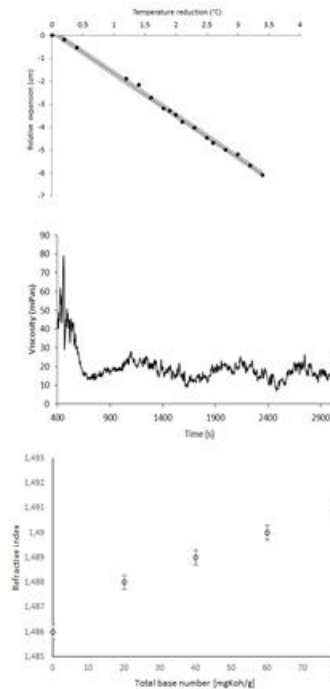## Sub-project 5.4: Development of an advanced real time tribosystem performance monitoring system

Determination of tribosystem monitoring components
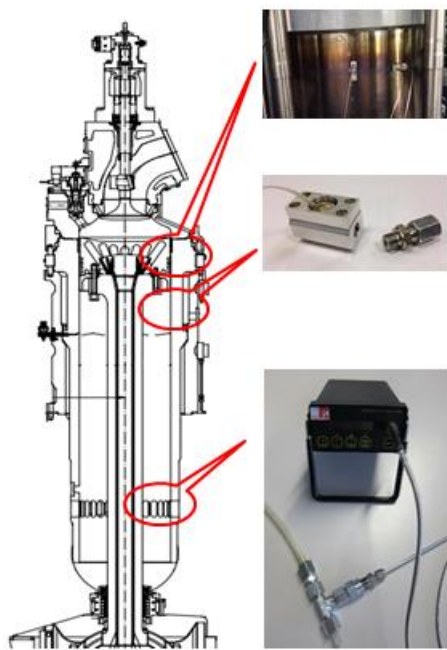
In-line scuffing indicator prototype

In-line viscometer prototype

In-line alkaline reserve sensor prototype

➢ **Successfull prototype testing**