Objectives

• Develop <u>methods, systems and processes</u> allowing a continuous <u>optimized performance</u> of the power plant <u>throughout 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
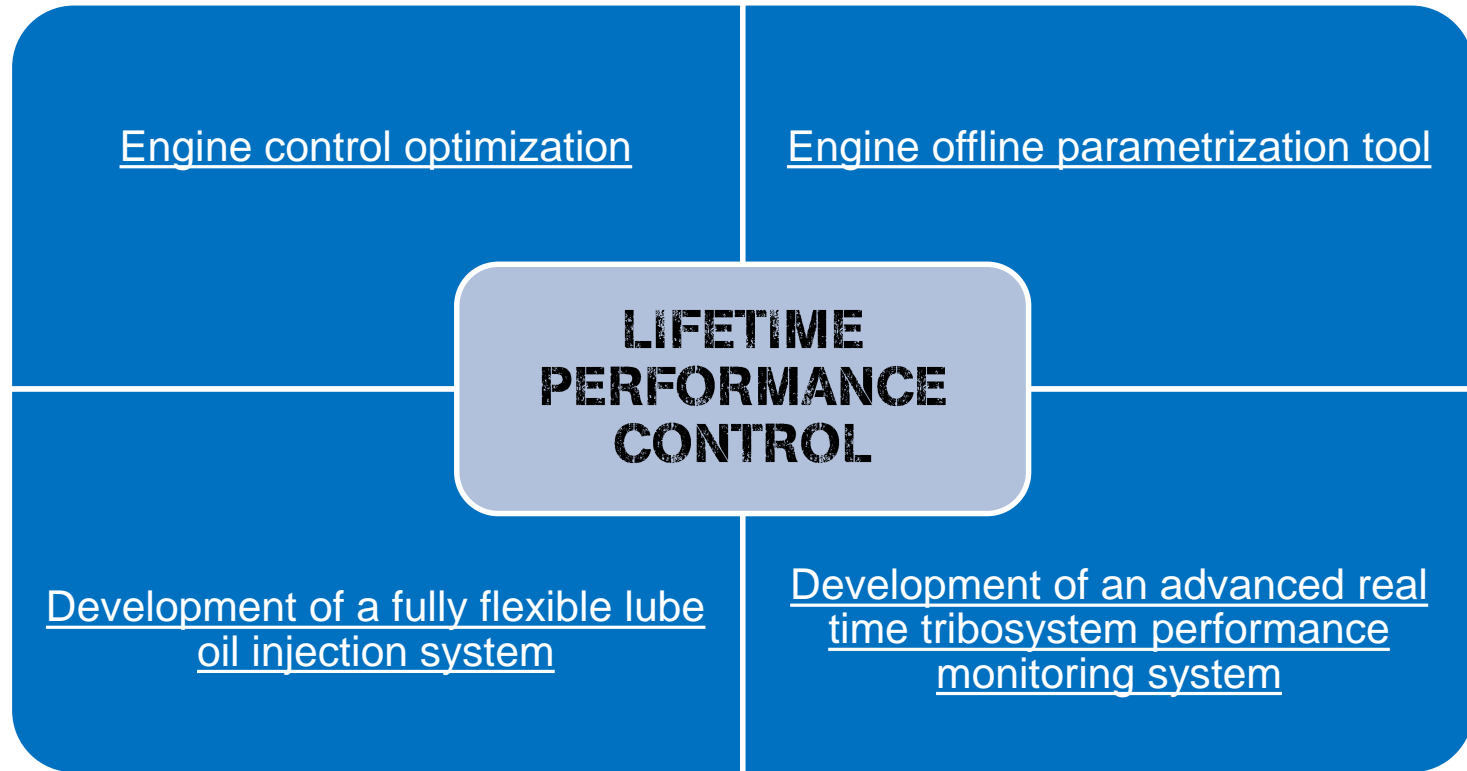• 10% lube oil consumption reduction

WP Leader: Jonatan Rösgren
WP Deputy: Matthias Stark

Partners:

Structure

Building blocks for lifetime performance

Engine control optimization

Engine offline parametrization tool

LIFETIME PERFORMANCE CONTROL

Development of a fully flexible lube oil injection system

Development of an advanced real time tribosystem performance monitoring system

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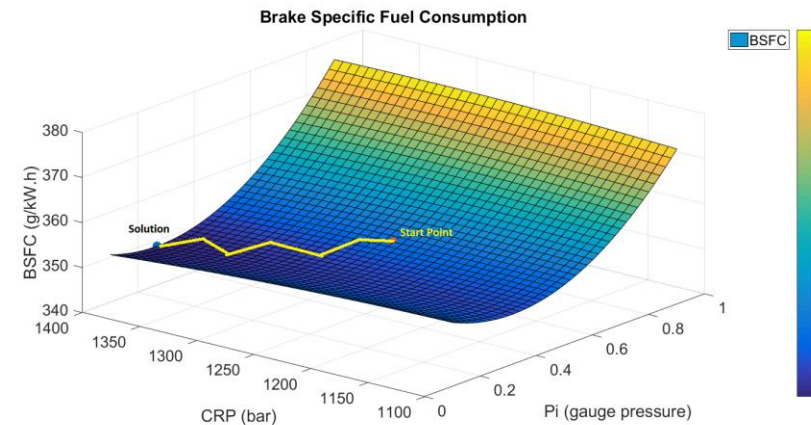- Parametrization study, concept, prototype tool development, prototyping, testing

Progress (5.1 & 5.2)

5.1 Engine control optimization

- Knock margin control model integrations to Wärtsilä system and knock control schemes design
- Cylinder pressure accuracy concept study done
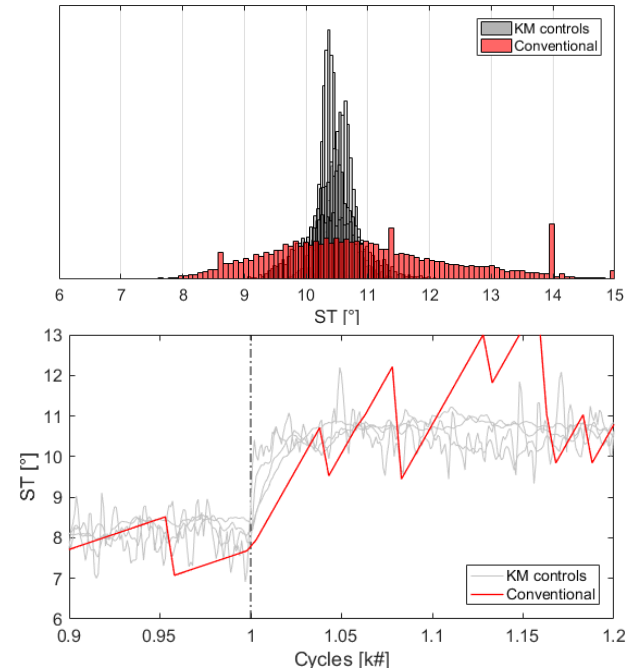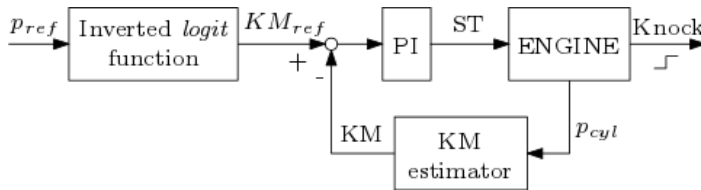- Hybrid engine control – prototype testing

Parametrization tool maps

5.2 Offline engine control parametrization tool

- DoE-based offline engine parametrization tool developed for semi-automatic tuning of engine control maps
- BSFC (Break Specific Fuel Consumption) reduction under emission constraints studied
- Parametrization tool test run on Aalto engine

- Knock margin control results
  The analysis of the knock margin control scheme shows the following advantages compared to the conventional strategy:

  - Faster controller action

  - Lower variability on the control action

  - Capable of fitting the knock control problem in a standard model-based design framework (PI control can be used)

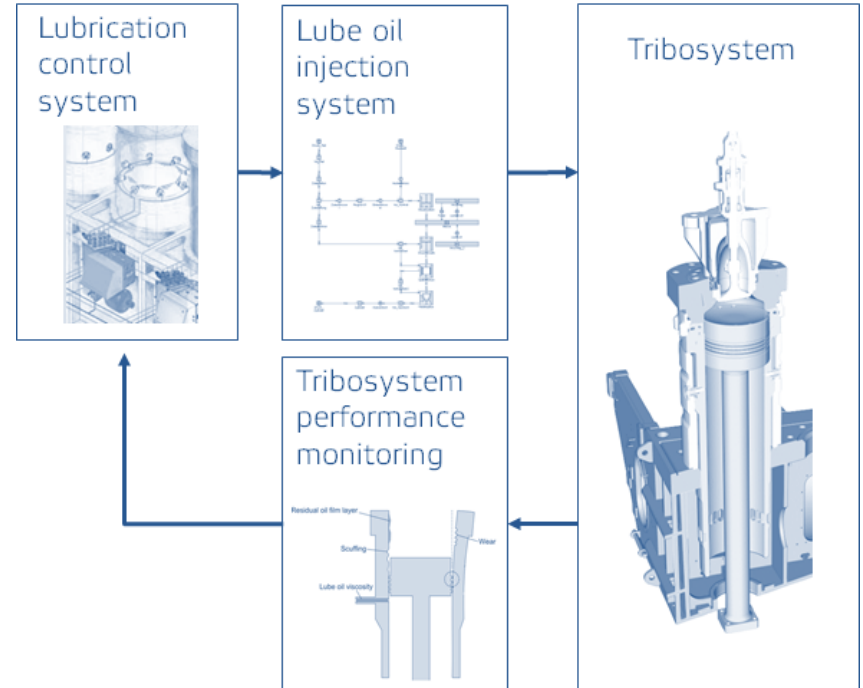## Structure: Subprojects, Activities
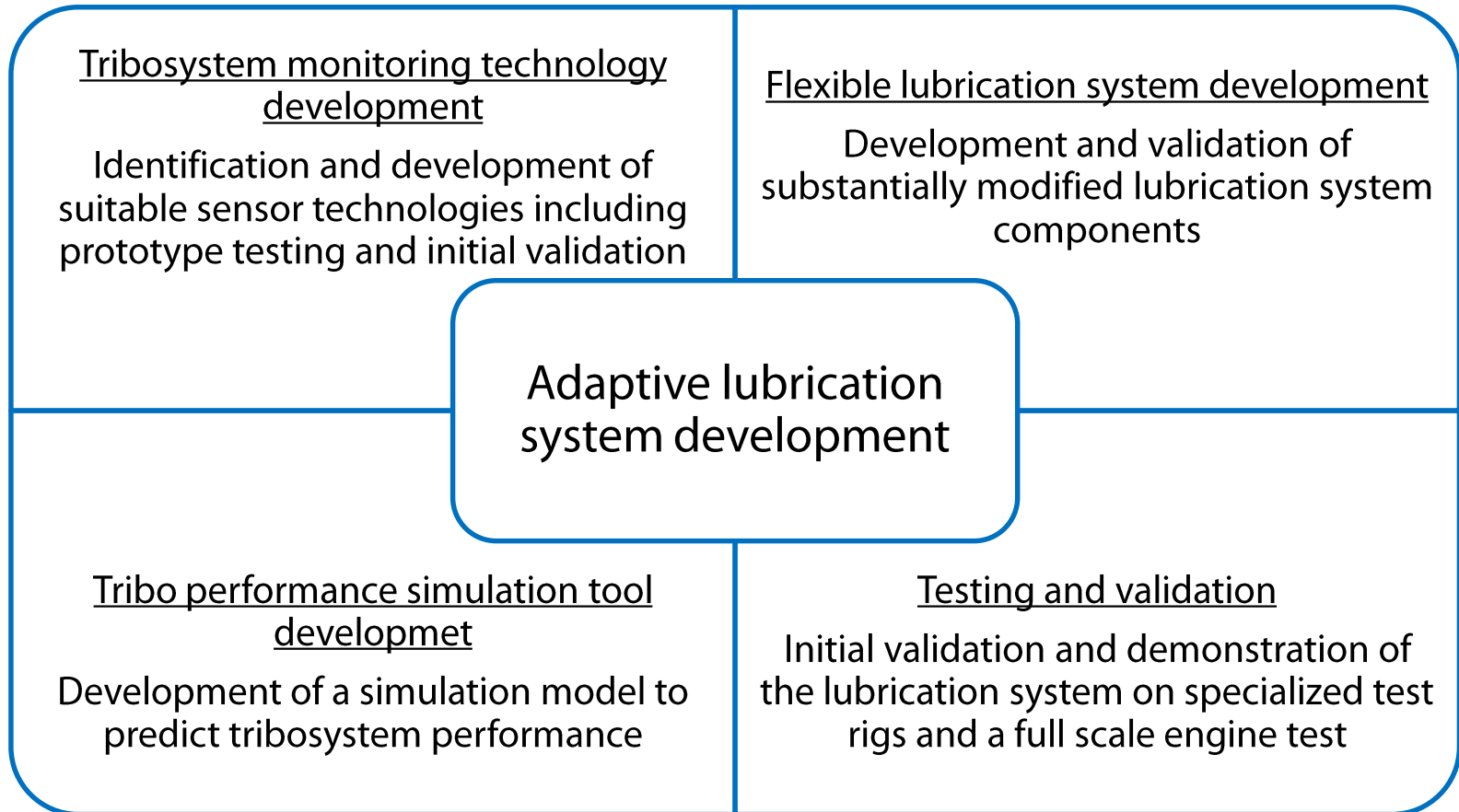
DWP Leader: Matthias Stark

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

Lubrication control system

Lube oil injection system

Tribosystem

Tribosystem performance monitoring

WIN G2D
Winterthur Gas & Diesel

UNIVERSITÀ DEL SALENTO

The University Of Sheffield.

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

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

Lube oil injector prototype

Spray impingement
Spray penetration
Upper spray cone angle
Lower spray cone angle
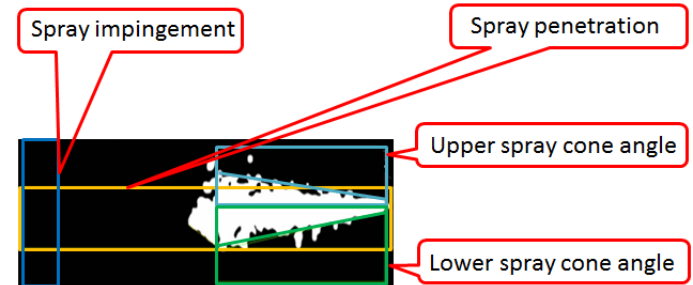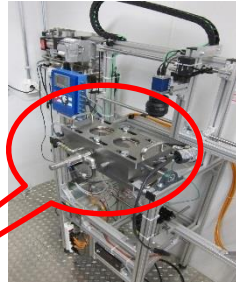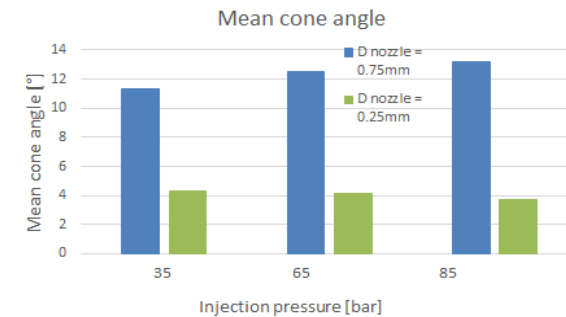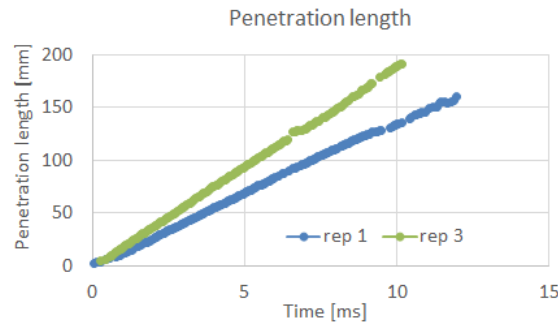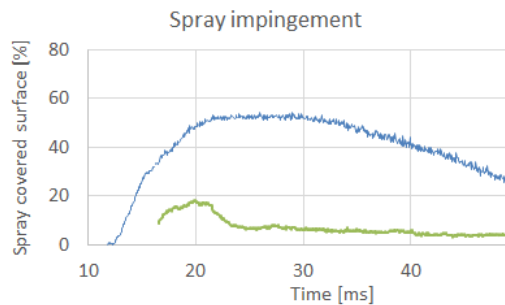
➢ Prototype injector validation and optimization

➢ Simulation tool development and validation

Sub-project 5.3: Development and simulation of a fully flexible lubrication system – Prototype injector validation
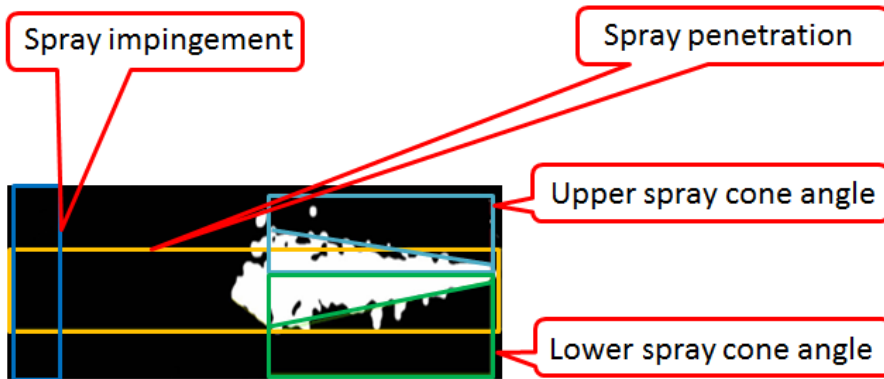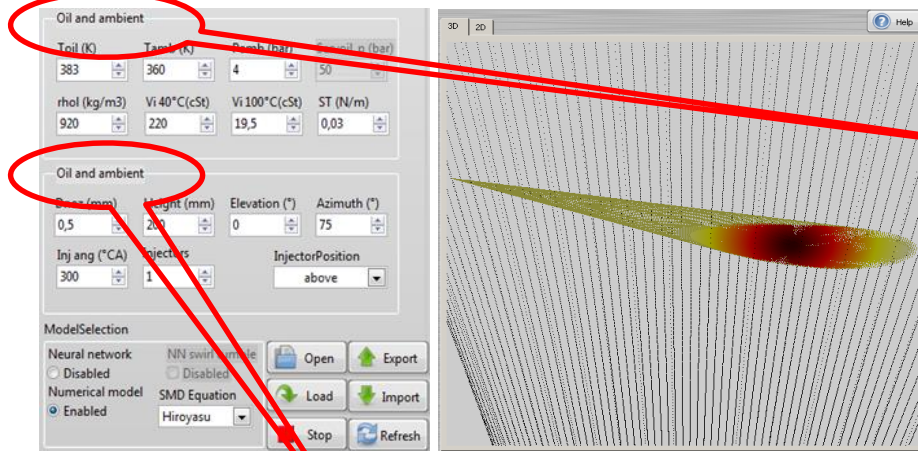

- Test cell pressure
- Lube oil temperature
- Injection pressure
- Nozzle geometry
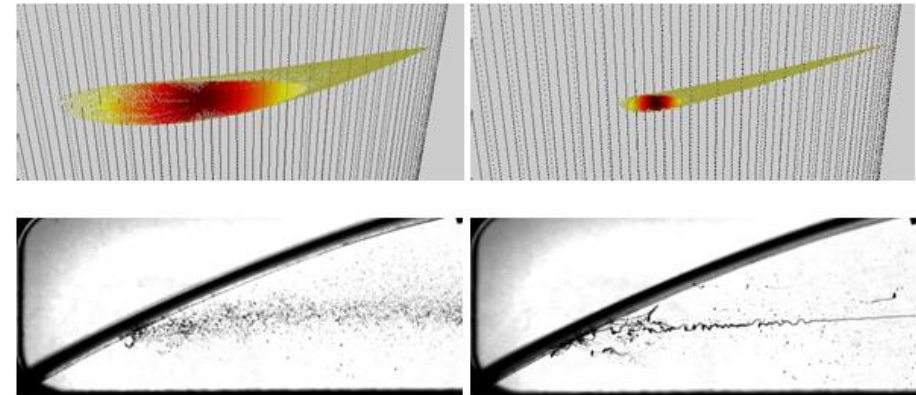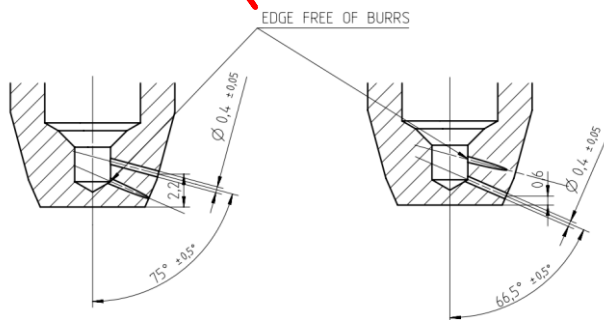- Lubricant property variations

➢ Characterization of spray and impingement characteristics

Sub-project 5.3: Development and simulation of a fully flexible lubrication system – Simulation tool development
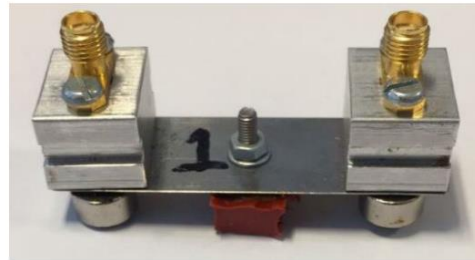

- - Test cell pressure
- - Lube oil temperature
- - Injection pressure
- - Nozzle geometry
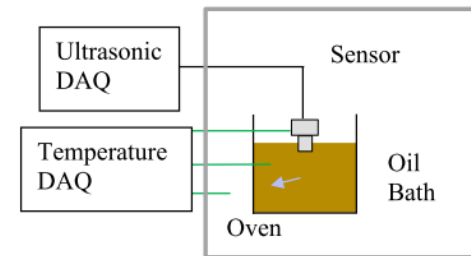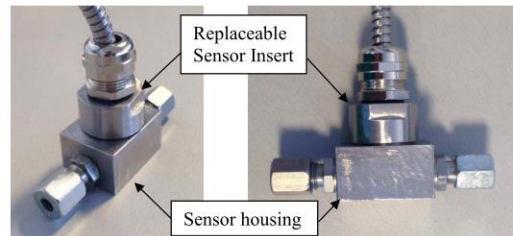- - Lubricant property variations

EDGE FREE OF BURRS

> Prediction of spray and impingement characteristics

Sub-project 5.4: Development of an advanced real time tribosystem performance monitoring system – Component optimization
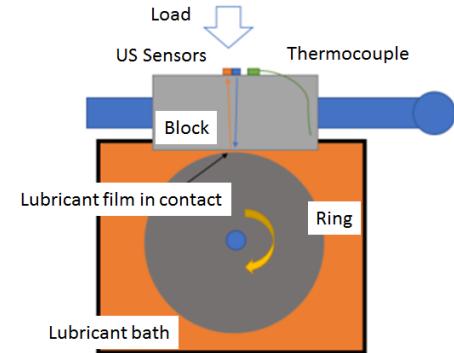
In-line scuffing indicator prototype optimization

In-line viscosity indicator prototype optimization