

	Start date	1st October 2016
	Duration	48 months
	Budget	5,740,676.25 €
	Coordinator	Prof.Erik Dahlquist, MDH

FUDIPO targets plant-wide monitoring and control of data-intensive processes by combining and integrating physical models and data-driven techniques on a wide scale, showcasing radical improvements in energy and resource efficiency in complex industrial sectors by boosting the competitiveness of European industry. FUDIPO is demonstrator-driven and industry-lead consortium that will develop five demonstrators in complex process industries: a oil refinery, a pulp and paper mill, a micro and a large CHP plant, and a biological wastewater treatment plant. A direct output from the demonstrators is a set of tools for data validation and reconciliation, anomaly detection, diagnostics, prognostics, production planning, process optimization and, model-based control.

Pulp and Paper Demonstrator at BillerudKorsnäs – Gävle, Sweden



Pulp and Paper Mill: BillerudKorsnäs – Gävle, Sweden.

The pulp and paper or fiberline demonstrator is conducted at BillerudKorsnäs-Gävle, which is an integrated pulp and paperboard mill in Sweden. The demonstrator is tested for continuous pulp digesters. The main task of a pulp digester is to produce pulp with stable kappa number (i.e. measure of residual lignin in produced pulp) with sufficiently high yield. The pulp is made from wood chips in a digester that react with chemicals known as liquor at high temperature to remove lignin from wood chips in a continuous reactor called digester.



Continuous pulp digester 1, 2 and 3.

Problem statement:

- Controlling the Kappa number is a difficult task mainly due to the naturally varying feedstock, significant residence time, insufficient measurements and complex nature of the delignification process.
- Faults such as screen-clogging, hang-ups and channelling in the digester often occur and lead to fluctuation in blowline Kappa number.

Goal-1: Kappa number

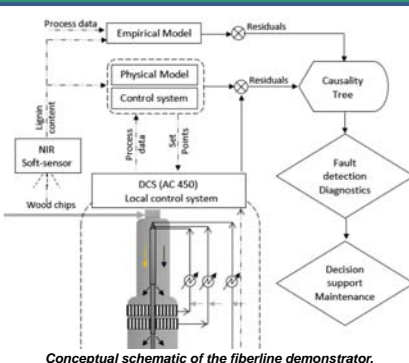
- Reduce the blowline Kappa number variation by 50%.
- 90% of the time, the Kappa should be within target by ± 5 .

Goal-2: Detection of faults and anomalies

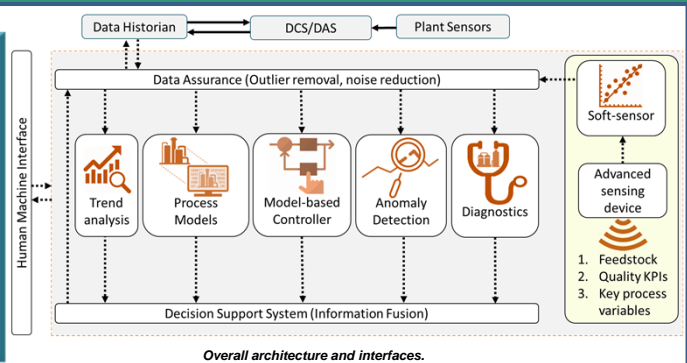
- Detection of **Digester Faults**
 - Screen-clogging.
 - Hang-ups and
 - Channelling
- Detection of **Anomalies**
 - Sensor faults
 - Something is wrong

SOLUTION AND DEMONSTRATOR SCOPES

- **Soft-sensor development and implementation:** NIR based lignin and moisture content and reactivity measurement.
- **Model development and deployment:**
 - ✓ Physics based model and
 - ✓ Data driven models.
- **Feedforward MPC development.**
- **Diagnostics algorithm development:**
 - ✓ Physics based
 - ✓ Data-driven
- **Decision support tool development** by combining all the outputs from different tools.

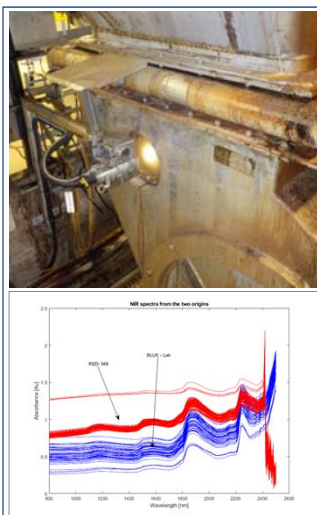


Conceptual schematic of the fiberline demonstrator.

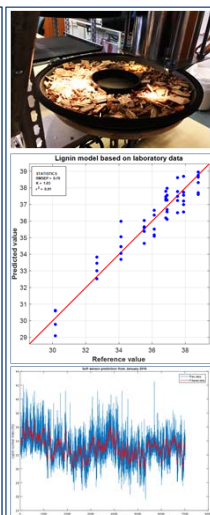


Overall architecture and interfaces.

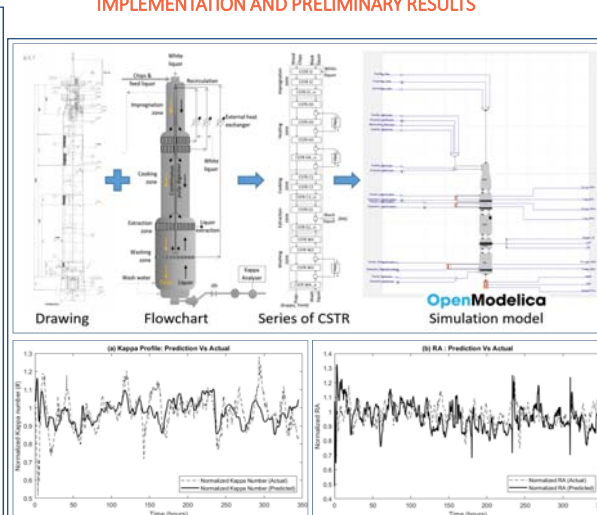
IMPLEMENTATION AND PRELIMINARY RESULTS



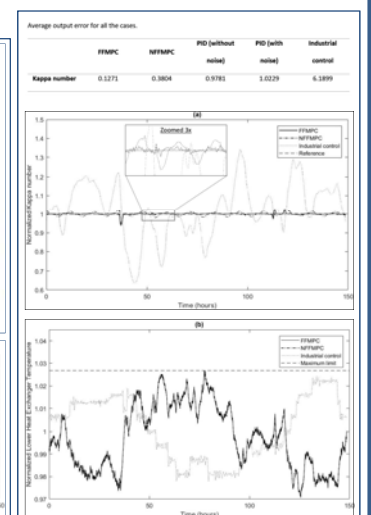
NIR sensor implementation.



Multivariate model for lignin.



Digester model implementation.



MPC implementation.

The online testing of all the building blocks of the pulp and paper demonstrator i.e. NIR spectroscopy sensor, physics-based process model, data-driven process model, multivariate model for Soft-sensor, Model Predictive Control (MPC) and Decision Support System (DSS) are performed in FUDIPO online platform.

The pulp and paper demonstrator is a joint effort among BillerudKorsnäs – Gävle, Mälardalen University, Tieto, IDENER, RISE-SICS, and Bestwood. This poster is prepared by Mälardalen University. To get more information please contact: moksadur.rahman@mdh.se +46-(0)210 10 15 94

