Advancing Real-time Dry Solids Measurements in the Brown Stock Washing Control

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Stora Enso Goals 2020 related to washing
Greetings from corporate R&D

- Sustainability!
- Greenfield pulp mill 50% less capital costs compared to 2010
- Reduction of COD- and ecological foot print by 20-40%
    - Minimization of water usage
- Highly energy efficient
    - New/Bigger business from energy sales and other bio based products
    - Intelligent and adaptive automation/control systems

- It is a huge work where co-operation, ideas and development work is needed

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How to get from A to B in 8 years?

- What can we do?

- Where we have potential?

- Does new technology help us to achieve your goals?

- How should we utilize it?

Experiences after 2 years field working:

- Question: *What does washer do?*
- Comments from operators: *"It transfers pulp forward in the process"*

- Question: *Why wash result is poor?*
- Comments from operators: *"They don't pay us to wash, just to produce pulp"*

- Question: *"What kind of lab research is needed to improve washing?"*
- Answer from mill R&D manager: *"If you figure that out, you have truly earned your salary!"*
-
- Comment from production manager:
  "After you have optimized washing you can focus on other optimization.."

- Experience after project:
  washing is a crossroad - after brown stock washing is optimized whole process is optimized!

  •

Wash optimization starts from the people

- *To run the process business wise people need*

- *- Right attitude*

- *- Clear goals:*

- *What we expect from wash process and how we follow it?*

- *- Working process design*

- *Mills are no longer the same as the day they were built. Different wood species, higher production, faulty machinery, etc. Some thing is always wrong*

- *- Process Info + understanding:*

- *Reasons for washing problems are not clear and can be understood totally wrong – root cause is not researched*

- *- Skills to run the process*

- *Best practises how to react with different problems and how to solve them, should be learned all the time.*

Utilization of advanced measuring technology
Setting the targets – losses

- How well are defined your own mills washing goals?
  - Wash loss to bleaching / out of the mill
  - how about wash water usage? is it followed regularly?
  - What is done when values exceeds the limits? Is it REALLY done?
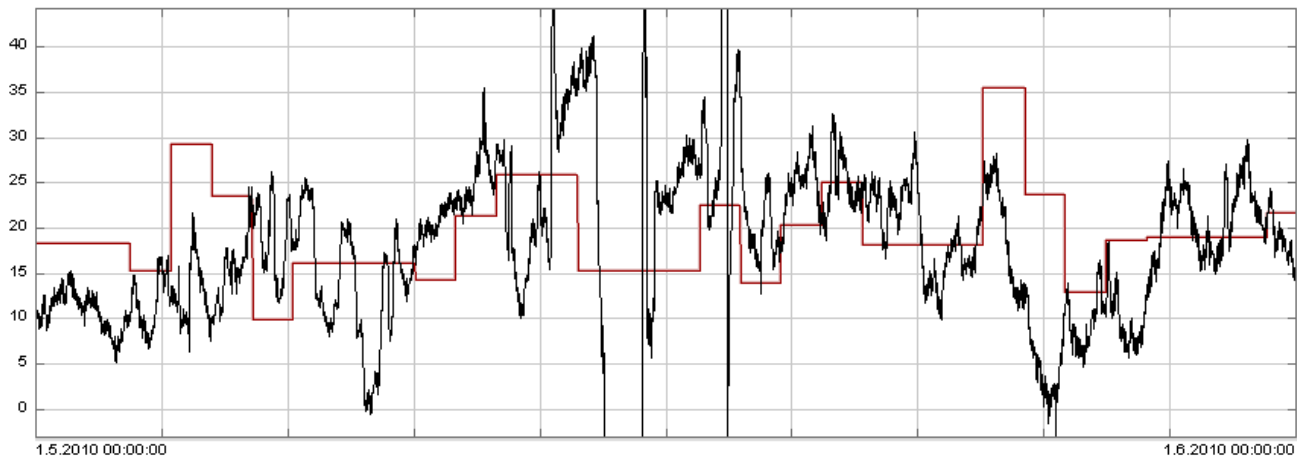
Lab wash losses [COD/Adt]   -6.33 - 111.6
realtime measurement [COD/Adt] 9.9 - 35.5

- Utilization of real time measurements gives possibility to understand what happens in the process more better
- With little lab work also e.g. make-up costs, Waste water treatment load can be estimated in fairly good way
  - Helps to understand the significance of process

- Goal of the wash line: Separate the dissolved wood and chemicals from pulp for the recovery process in a economically way.
  - Small amount of water and small emissions/losses
- Goal in numbers per ton of pulp:
  - 1,15t dissolved wood + 600kg chemicals.
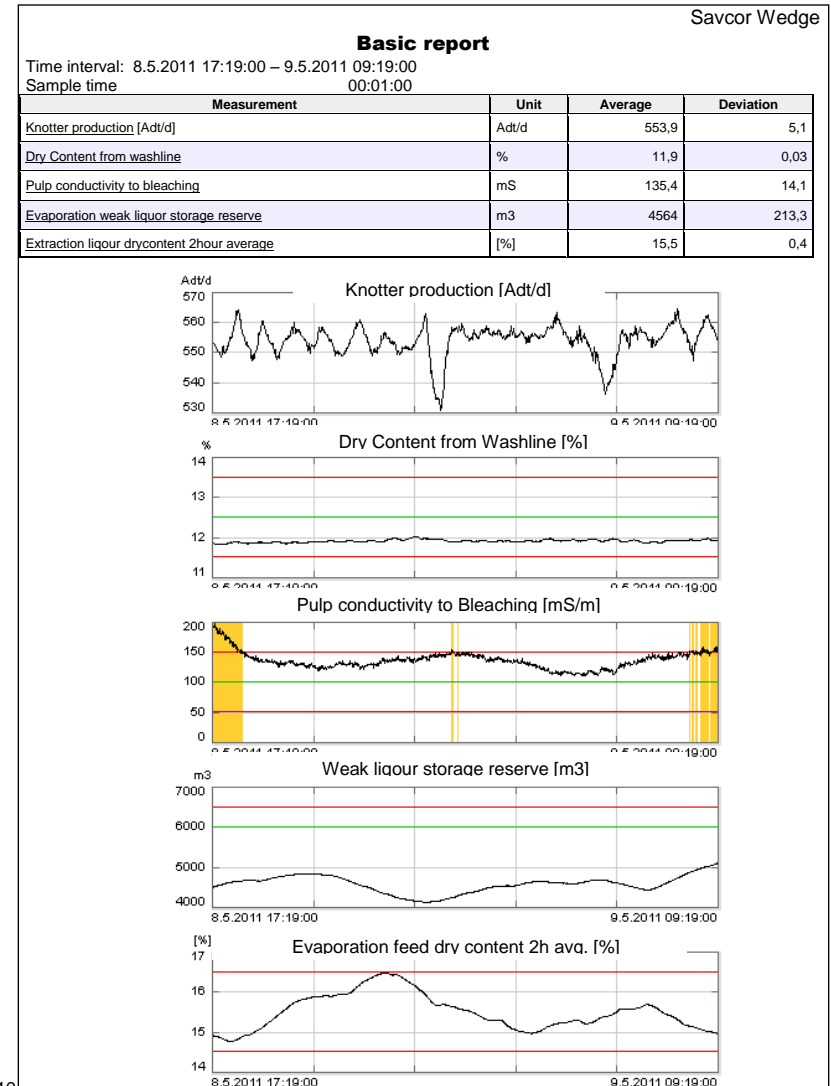 - Recovery load app. 1750 kg/ tp
  - Emissions < 50kg/tp
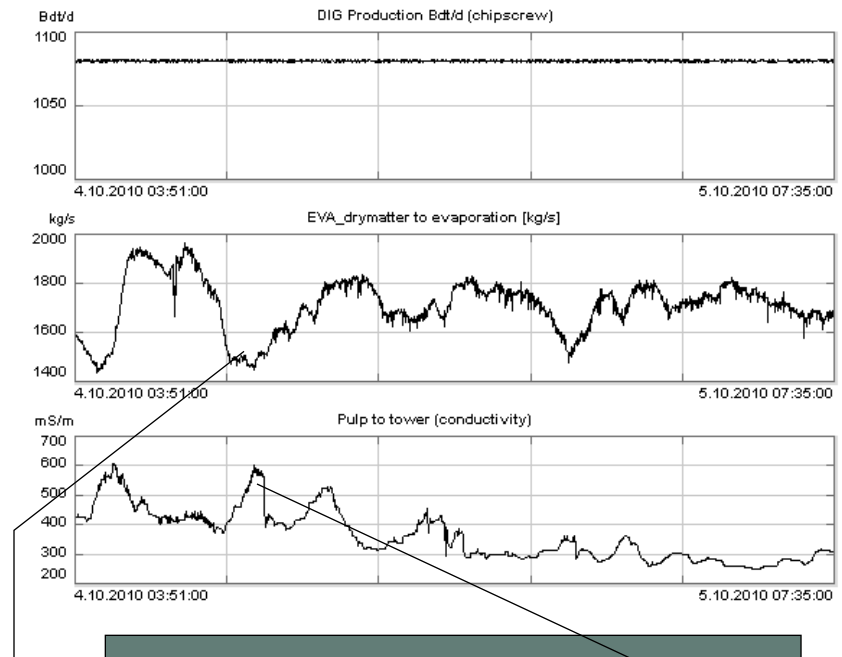
Why does the amount of dry matter leaving from the fibre line vary heavily, even if the production is constant?

If the dry matter way to evaporation is blocked it will try to continue to bleaching

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We need Common way of setting goals and following the results

- Savcor Wedge is good follow-up tool choice for the job

Savcor Wedge

Basic report

Time interval: 8.5.2011 17:19:00 – 9.5.2011 09:19:00
Sample time   00:01:00

| Measurement	Unit	Average	Deviation
Knotter production [Adt/d]	Adt/d	553,9	5,1
Dry Content from washline	%	11,9	0,03
Pulp conductivity to bleaching	mS	135,4	14,1
Evaporation weak liquor storage reserve	m3	4564	213,3
Extraction ligour drycontent 2hour average	[%]	15,5	0,4

- Washing process

Dilution factor

- Liquor is transporting dry mater away from the wash line.
  - Single most important control factor is the dilution factor.
    - Many mills the amount of water exiting from last washer is not measured ☹

- Dilution factor is not controlled well enough - which costs money.
  - Production control, bleaching
  - Control of losses
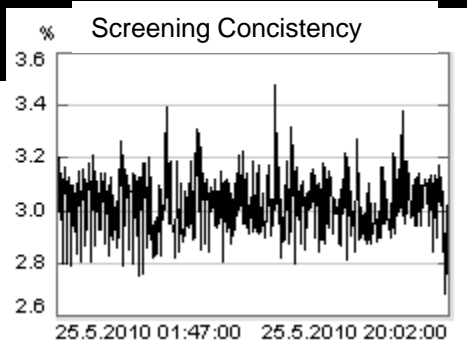 - Evaporation control etc.
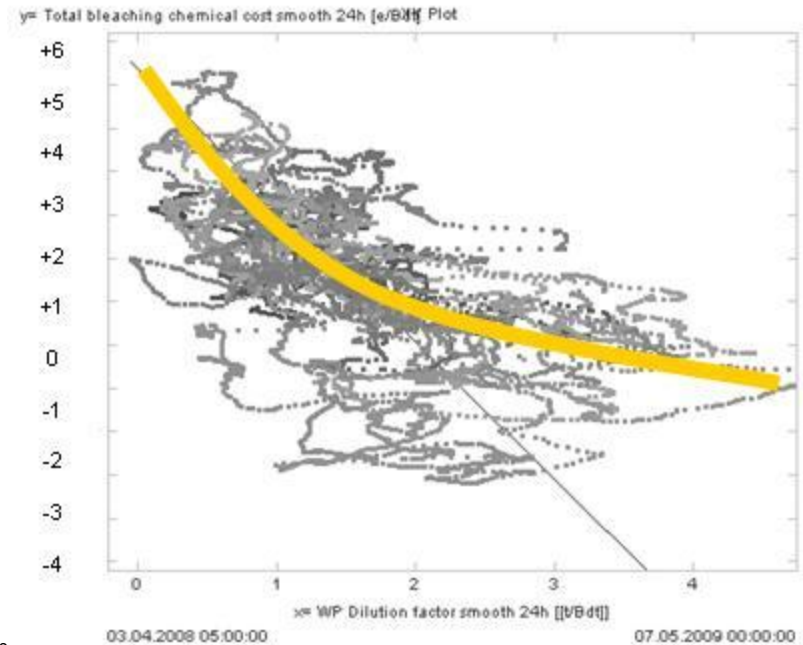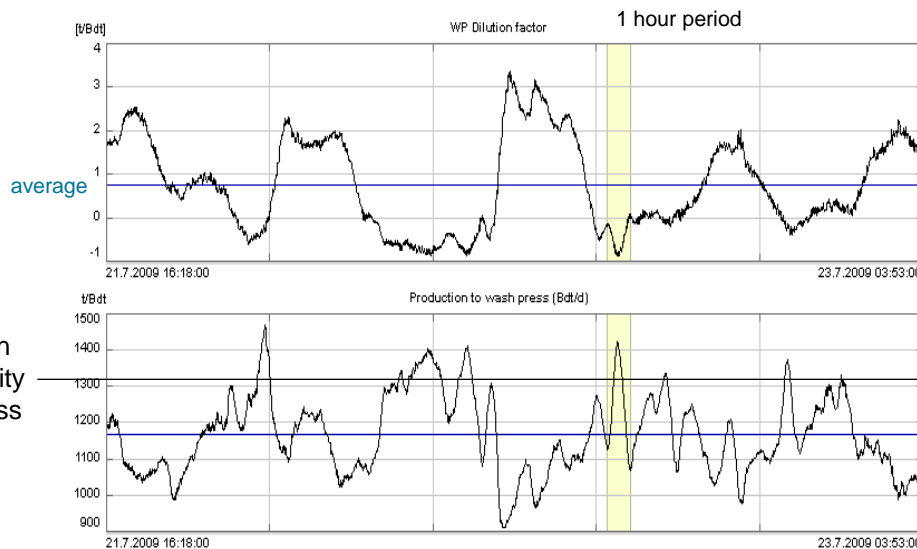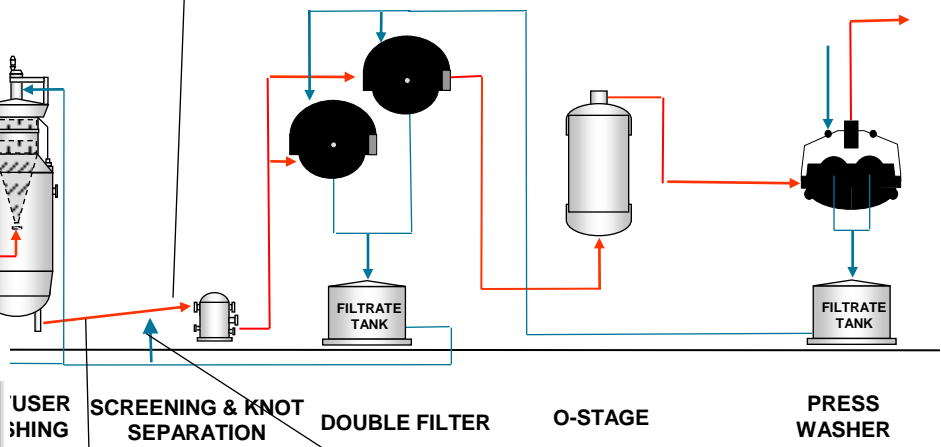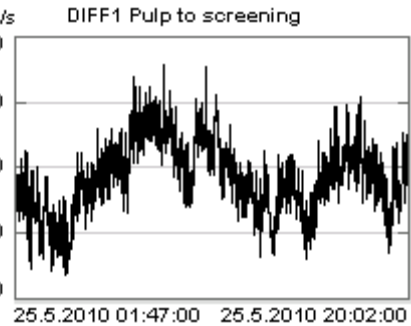
Hierarchy in wash line problem solving
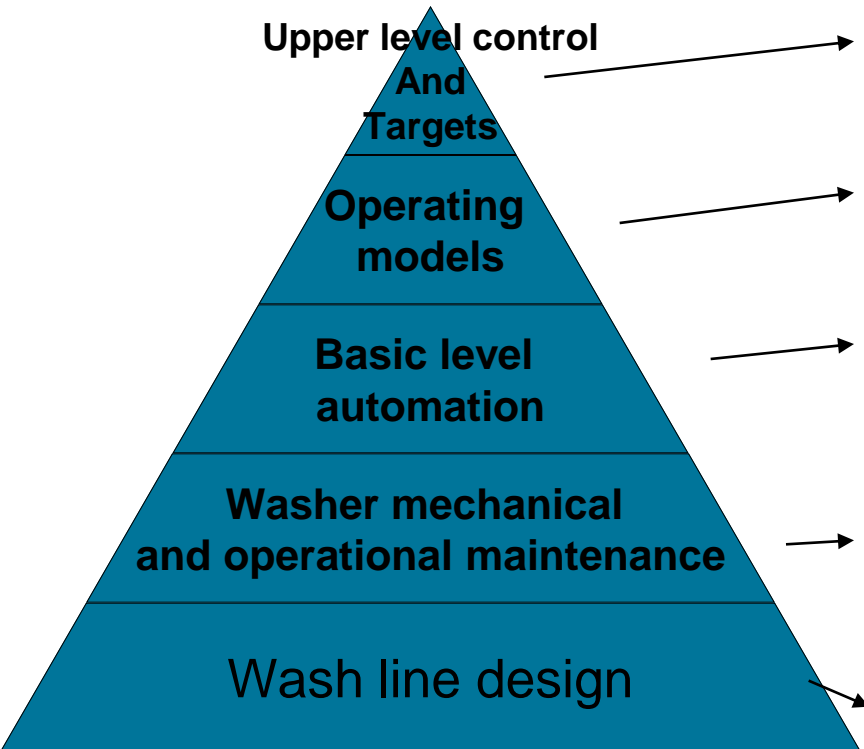
Amount of problems	Examples
20%	Complex systems needs training and support and maintanance. What is necessary and what is causing only problems?
20%	Feed pressure set points, pressure differences over screens, screen speeds, etc
20%	Drop leg control, pulp tower surface control, filtrate tank surface controls
30%	Wash liquor screens were blocked and limiting whole wash line dilution factor, Broken valve leads liquor to cleaner side of a wash line, wrong cascade prevents washer to operate over -2 dilution factor
10%	Too small valve in a wash filtrate suction pipe was replaced=>bypassing of a washer was no longer needed

Pyramid (top to bottom):
- Upper level control And Targets
- Operating models
- Basic level automation
- Washer mechanical and operational maintenance
- Wash line design

Washing have to be fixed from bottom to up

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Small problems cumulated to big problem

Screening Concistency

Production to O2 stage

Production to wash press

QC2 – fairly working

Broken dilution valve

Wash line df [m3/Adt]

DIFF1 Pulp to screening

**FFUSER
SHING**   **SCREENING & KNOT
SEPARATION**   **DOUBLE FILTER**   **O-STAGE**   **PRESS
WASHER**

QC1 – not working

Broken dilution valve + flow meter
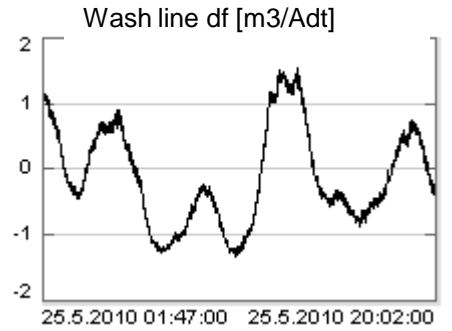
Production deviation
screening feed   20
O2 feed   63
Press feed   88
Four times higher!!!

Summary

- **A developing of working dilution factor control has clearly huge potential**
- **To achieve significant results in reducing water usage we need to**
    - Develop leadership
        - Set right goals
        - Follow the results
        - Give support
    - Invest in workers
        - Training and best problem solving models
    - Invest in process
        - Solve basic level problems

- **Wash process and controls needs to be more user friendly and informative!** Refraktometer could be used for this.
    - Self diagnostics included in the washer in future?
    - Could there be portable measurement devices, that could be used in education purposes at the mill in live situations?

    - Refraktometers could be used as a better online measurement for the wash losses
        - Online cost models to optimize washing
    - Could be used in O2 stage control to compencate high wash loss

- **Refraktometer does not solve problems by itself**
    - Ideas, co-operation and field work/projects are needed to achieve goals.
        - Lets develop it for the people

rethink.

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Who? - Marko Harinen

Lappeenranta university of technology
- Electrical department
- Embedded control systems
- Master thesis: new quality measurements for debarking
- Graduated 2006/12

- R&D Engineer in pulp competence centre (PCC) 2006/9->
  - Debarking + raw material control
  - Bleaching upper level system development
  - Wash development work with in SE

- Competence
  - Data handling and analyze
  - Control systemen development + analyze