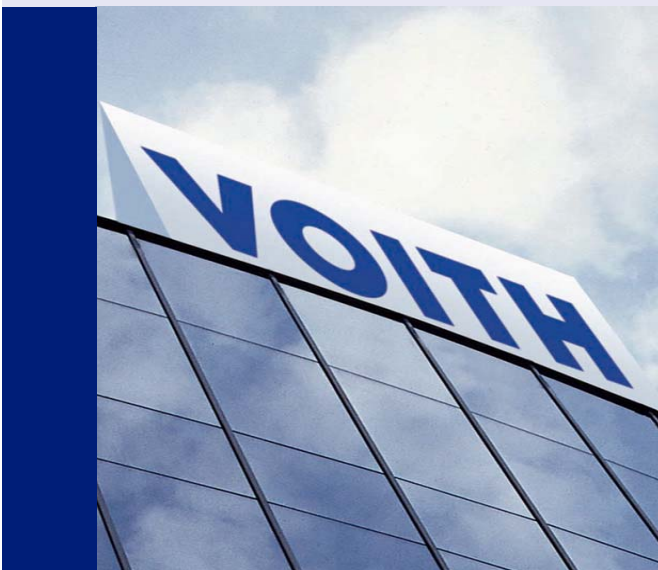




## Control within the papermaking process

Hermann-Josef Post  
*Voith Paper GmbH & Co. KG*  
*Heidenheim, Germany*

Jens Haag  
*Voith Paper Automation GmbH & Co. KG*  
*Heidenheim, Germany*



## One of the large family-owned companies in Europe

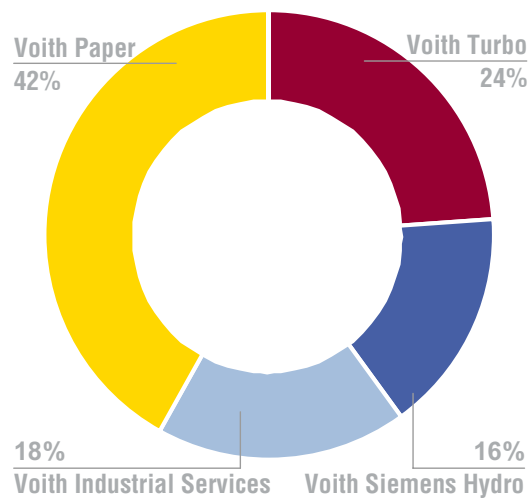
- 34,000 employees
- 250 locations
- Euro 3.7 billion in sales



## Our markets

- Paper
- Energy
- Mobility
- Service

### Sales



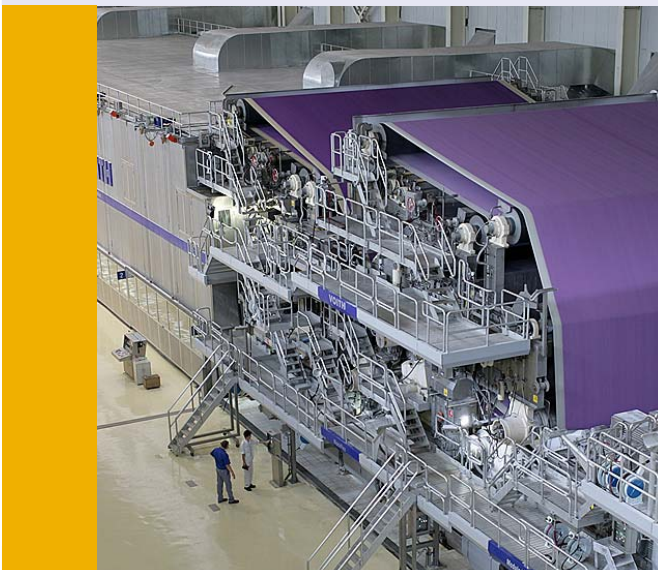
## Sales and employees 2005/2006 by division

- Voith Paper: € 1,570 million 10,000 employees
- Voith Turbo: € 890 million 4,300 employees
- Voith Siemens Hydro: € 610 million 2,400 employees
- Voith Industrial Services: € 650 million 16,900 employees



## Paper: A product no one can do without

- More than 2,900 kinds of paper
- Every third sheet of paper is produced on a Voith paper machine

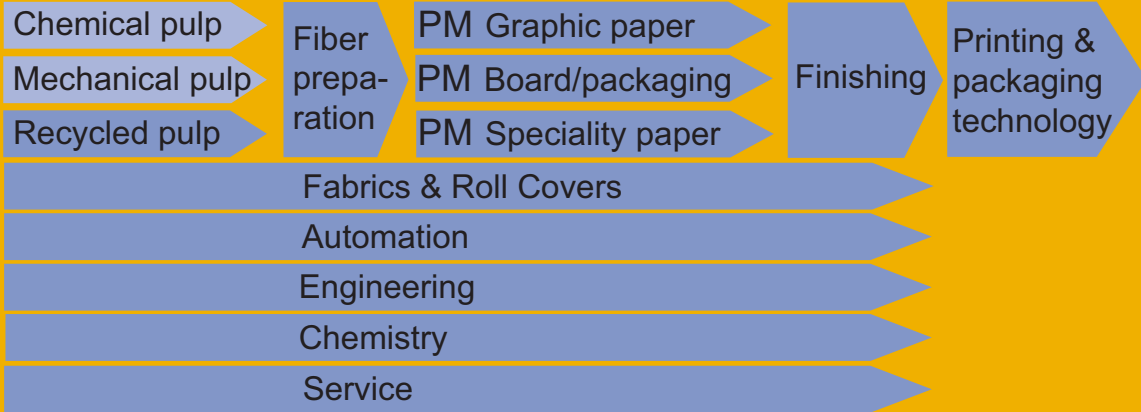


## Dagang PM3 – The largest paper machine in the world

- 3,200 tons of art paper per day
- Longer than three football fields
- Built from enough steel to construct two Eiffel Towers
- As much circuitry as in five Airbuses



## Voith Paper: Process & service supplier



Fiber Systems



Graphic and Special Paper Machines



Board and Packaging Paper Machines



Fabrics



Finishing

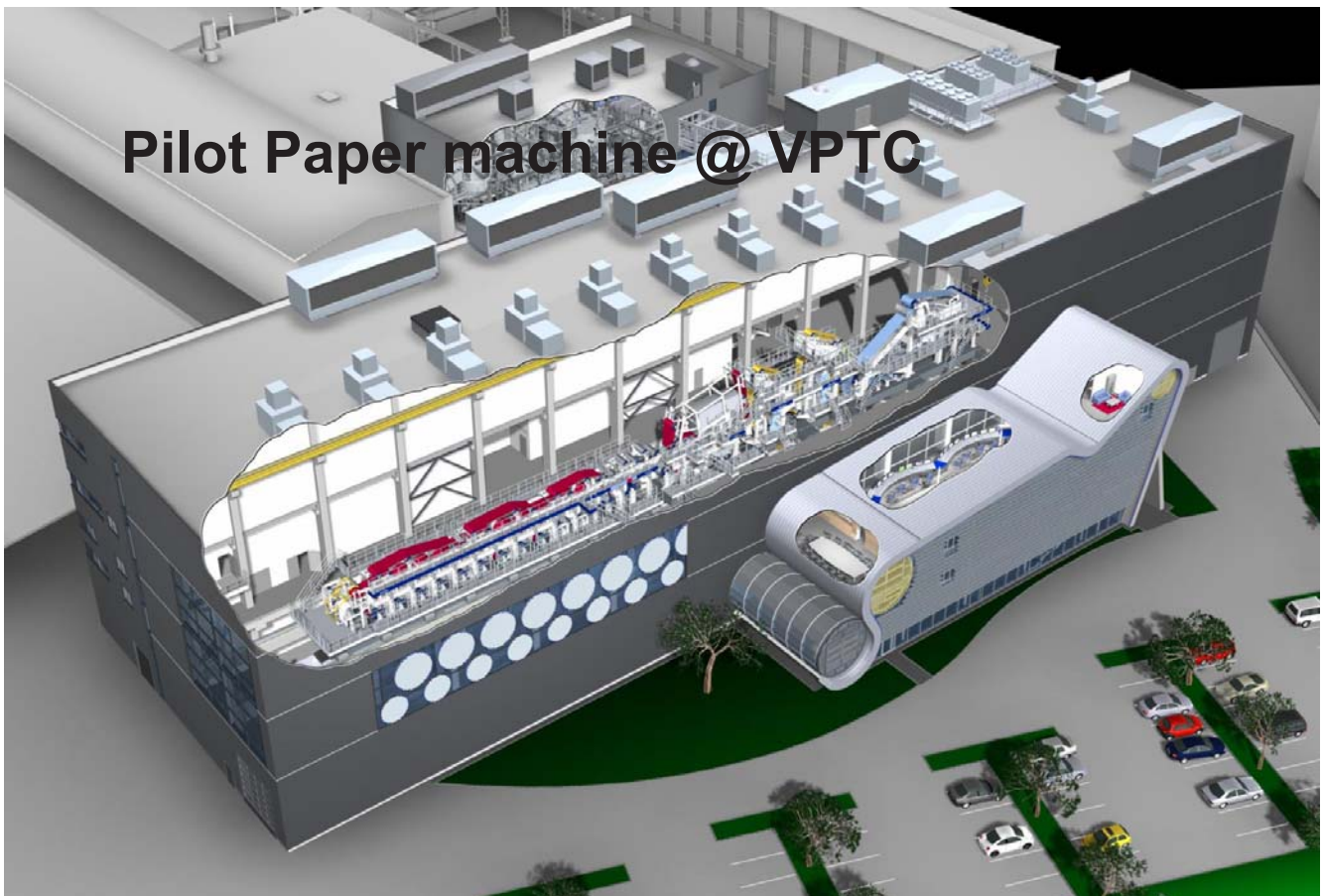


Rolls



Automation

# Pilot Paper machine @ VPTC

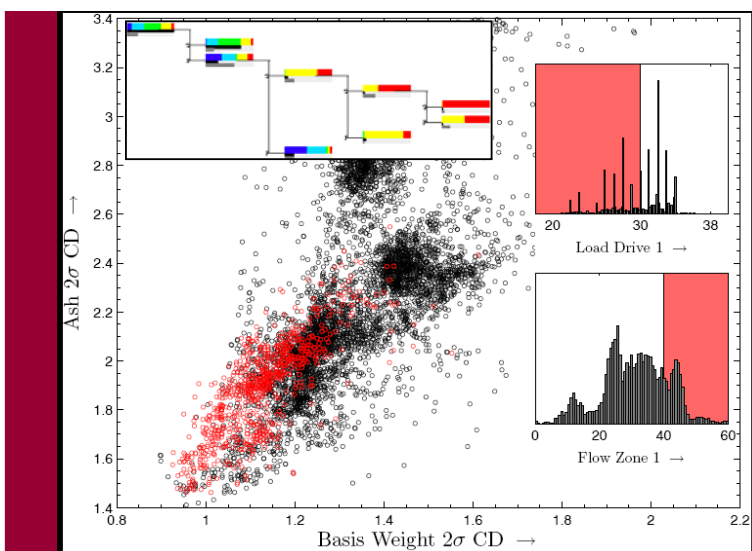


**VOITH**

Voith Paper

**VOITH**

## Applications of Computer Simulation

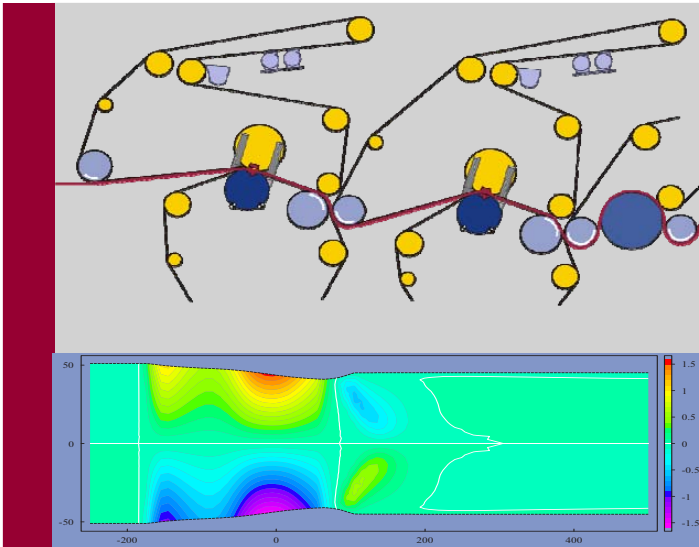


*Voith PaperMiner*

### Data Driven Methods

- Offline Data Analysis  
Voith PaperMiner
- Online Applications  
Voith OnV VirtualSensors
- Image Analysis

## Applications of Computer Simulation



*Dewatering and Rewetting in a Shoe Press*

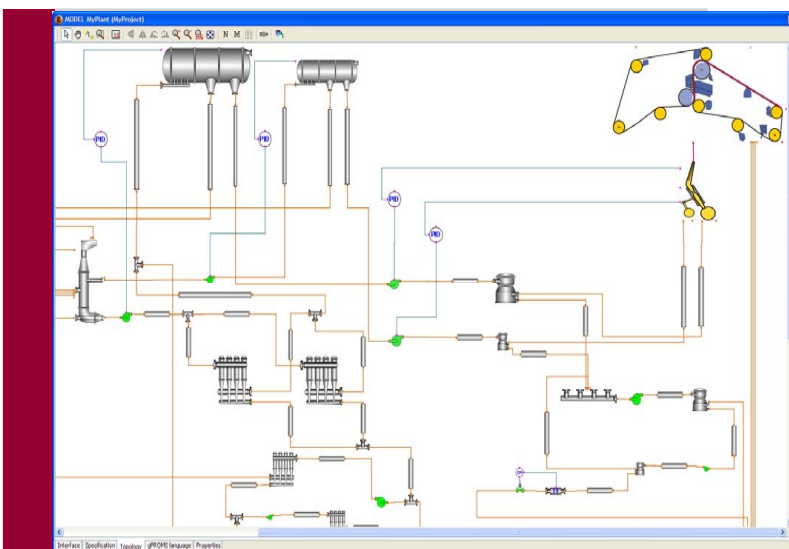
### Data Driven Methods

- Offline data analysis  
Voith PaperMiner
- Online Applications  
Voith OnV VirtualSensors
- Image Analysis

### Rigorous Physical Modelling

- Stiffness and deflection analysis of complex structures
- CFD analysis
- Virtual Prototypes

## Applications of Computer Simulation



*Process Flowsheet in gPROMS*

### Process Simulation

- Large number of process units
- Many chemical and physical phenomena
- High productivity requires:
  - Well designed process
  - Advanced control systems
  - Optimized process chemicals

## Simulation provides Support During the Entire Project Lifecycle

- Design of experiments
- Interpretation of experiments
- Scale-Up interpolation
- Evaluation of different process concepts
- Optimisation of process stability and energy consumption
- Design of advanced controls
- Factory acceptance tests
- Customer training
- Process evaluation
- Education

**R&D****Eng.****Aut.****Startup**

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## Voith Paper Automation

- Product overview
- OnQ Quality control
- OnV Virtual sensor



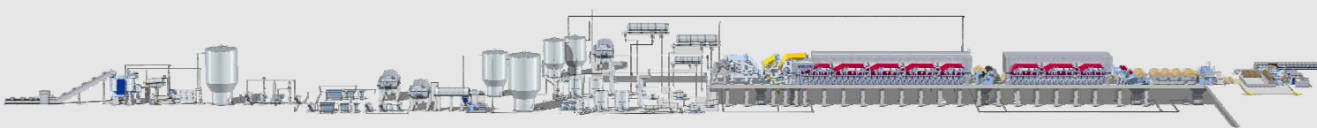
## Comprehensive product portfolio for integrated automation solutions

			
<b>OnControl</b> Process & Machine Control System	<b>OnQuality</b> Quality Control System	<b>OnView</b> Information System	<b>OnSite</b> Service & Process Solutions

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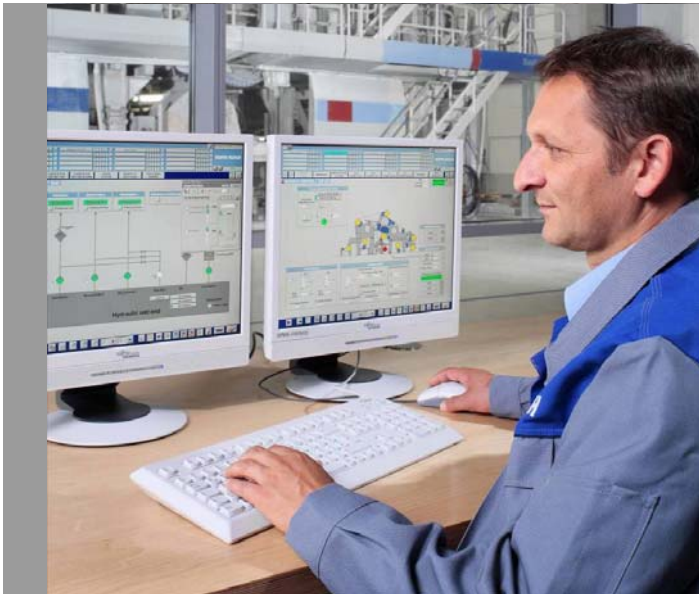
## Structure of the VPAut product portfolio

<b>OnControl</b>	Controlling and monitoring of processes and states (functional workflows, movements, temperature, fill level, etc.) with alarm function in case of error.
<b>OnQuality</b>	Measurement and control systems for quantitative determination and modification of machine direction and cross-direction paper characteristics.
<b>OnView</b>	Information systems that display, analyze and simulate data of the paper itself, the individual paper machine components and production processes.
<b>OnSite</b>	Custom-tailored automation system service concepts such as field service, training or spare parts handling as well as detailed process studies.





## OnControl Process control system components



### Human Machine Interface

- Control desks
- Operator panels
- Operator stations

### MCS / DCS

- PCS7 and Rockwell Hardware
- Control cabinets
- Software

### Actuators

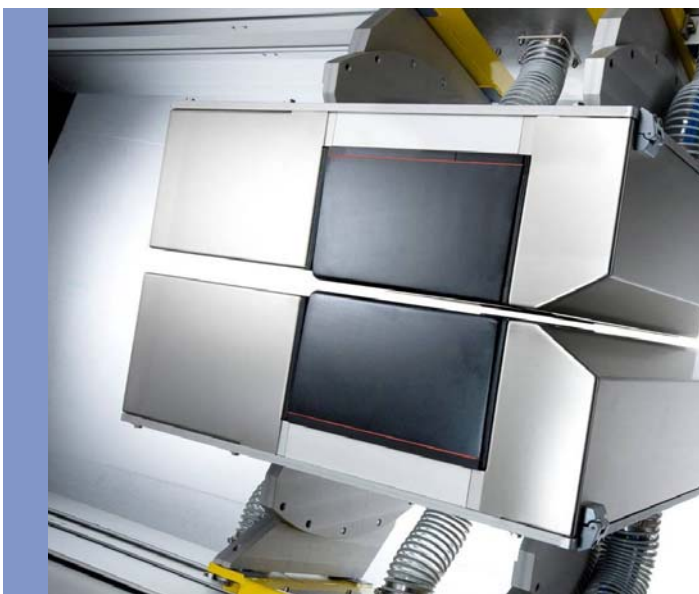
- Hydraulic, Pneumatic
- Motors
- On/Off & Control Valves

### Sensors

- Limit switches & position transducers
- Pressure, level and temperature
- EMF, Mass, Vortex Flow Sensors



## OnQuality Quality control system



### Scanners

- Robust O-frames, C-Frames,
- Single-sided scanners

### Sensors

- SST Basis Weight (Kr, Pr, Sr)
- Infrared & Microwave Moisture
- SST Ash Sensors
- Caliper: Light Touch & Air Bearing

### MD Controls

- Multivariable controls (BW, MOI, etc.)
- Fast "Model Predictive Controls"
- Coord. speed and grade changes

### CD Controls

- Fast initial control tuning
- "Automapping" function
- Eliminates periodic re-verification



## OnView Information System



### Mill-wide information system

- Collection, archiving, visualization of process and machine information
- Trending & Reporting

### Monitoring Systems

- Machine monitoring (bearing)
- Technology Monitoring (pulsation; nip vibration, etc.)

### Camera Systems

- Integrated WIS & WBA system
- Single-ply formation measurement

### Others:

- Real-time prediction of paper quality
- Online felt condition measurement
- Optimization of winding quality



## OnSite Service and Process Solutions



### Service

- Initial services
- Field services
- Process optimization
- Training
- Spare parts program
- Life cycle care

### Process Solutions

- Systematically analysis of the entire production process



## Some latest innovations



**OnV FeltView**  
Online measurement of felt characteristics



**OnV FlocSpotter**  
Single-ply formation sensor



**OnC DriveCommand**  
Total integration of the drive control into the process control system



**OnV VirtualSensors**  
Real-time predicting of quality parameters



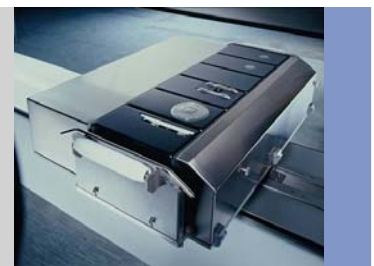
**OnC ElectricDrives**  
Integration of electric drives to Voith solution



**OnC FieldInstruments**  
Various sensors and actuators for the process and the paper machine

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## OnQuality OnQ Scanners and Sensors

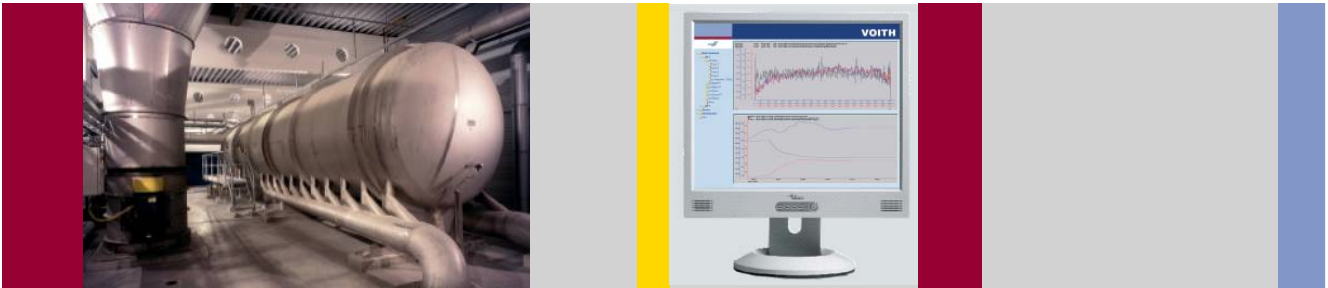


- OnQ Scanners with their fast signal processing provide high-resolution profiles based on an intelligent measurement system with CAN-bus technology.
- OnQ EnviroScan: Single-sided scanner with embedded moisture and sheet temperature measurements designed for harsh environments.

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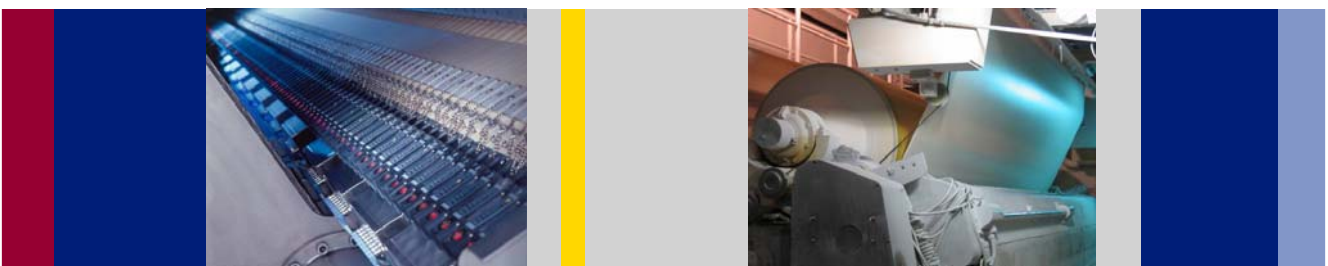
## OnQuality Intelligent control for deinking plants



- OnQ BleachControl extends your deinking plant beyond its current capabilities.
- OnQ BleachControl leads to a reduction of brightness variations and long deadtimes can be compensated.

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## OnQuality CD and MD Controls



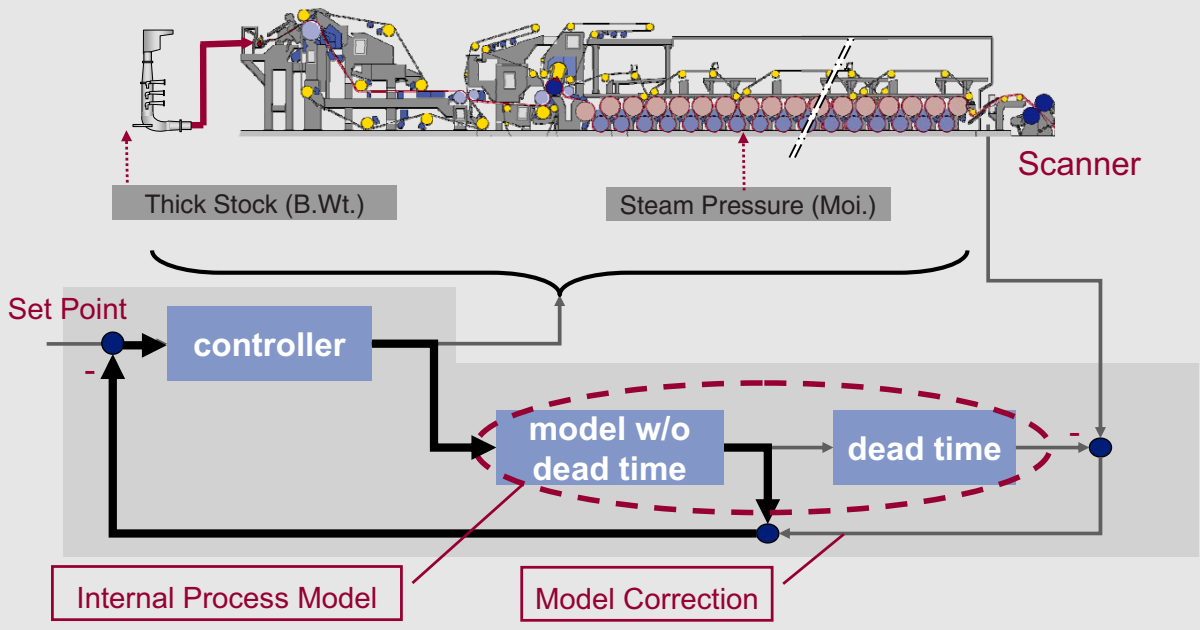
- Combination of machine section (headbox, coater, etc.), Profilmatic control software and the actuator systems leads to 2-sigma improvement.
- Based on sensor data, we offer a wide range of machine direction controls for all quality parameters and advanced controls (coordinated grade and speed change, etc.)

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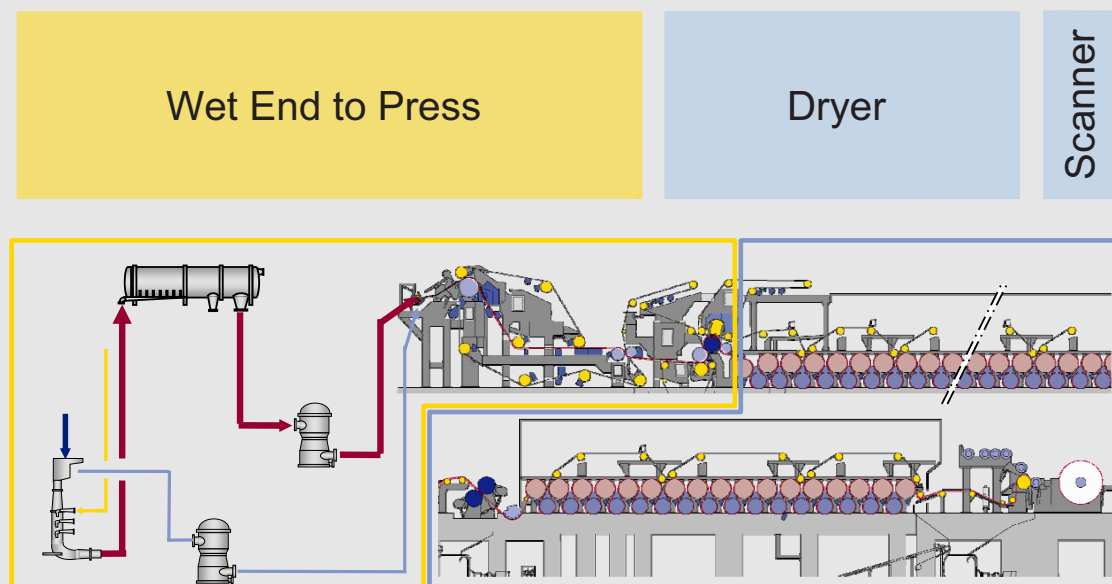
# The Internal Model Control Concept

## Principle of a Internal Model Controller

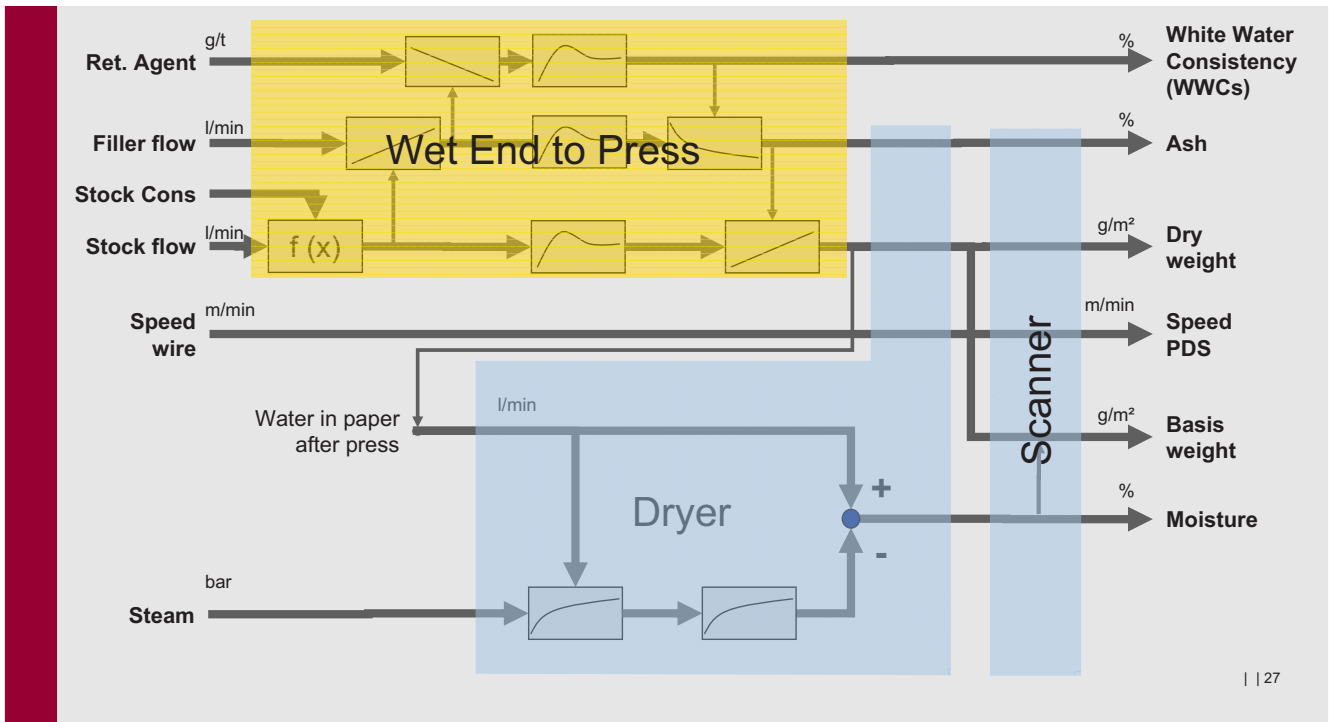


# The Internal Model Control Concept

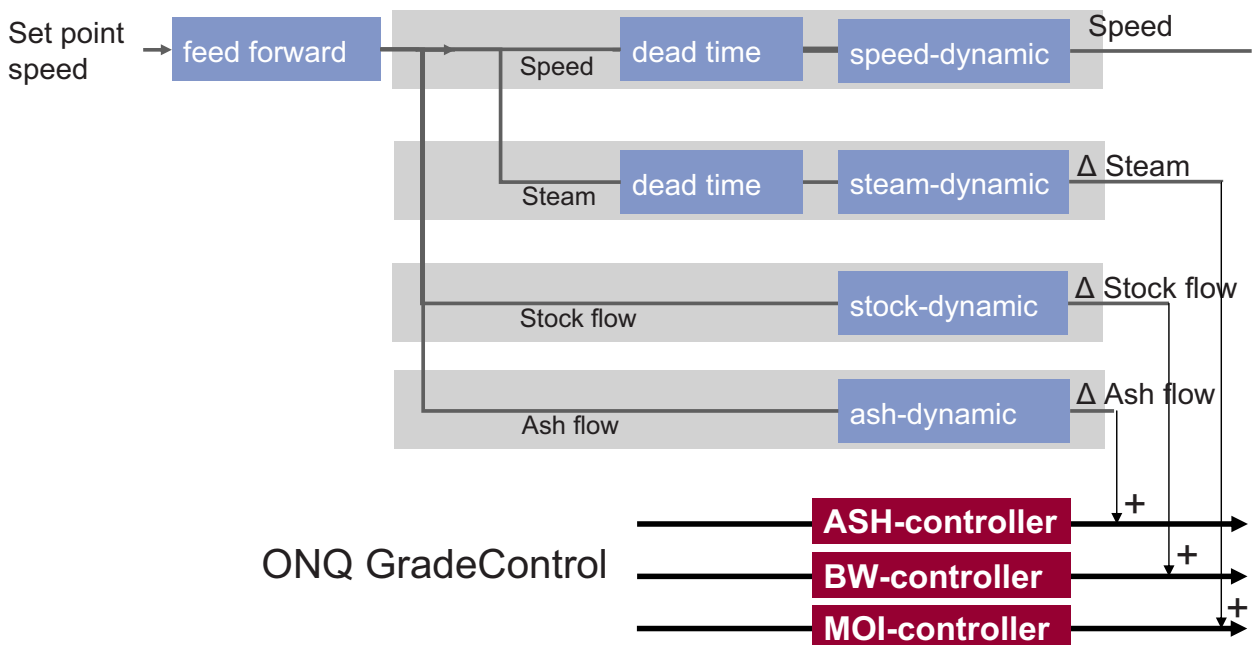
## The Model used in the IMC



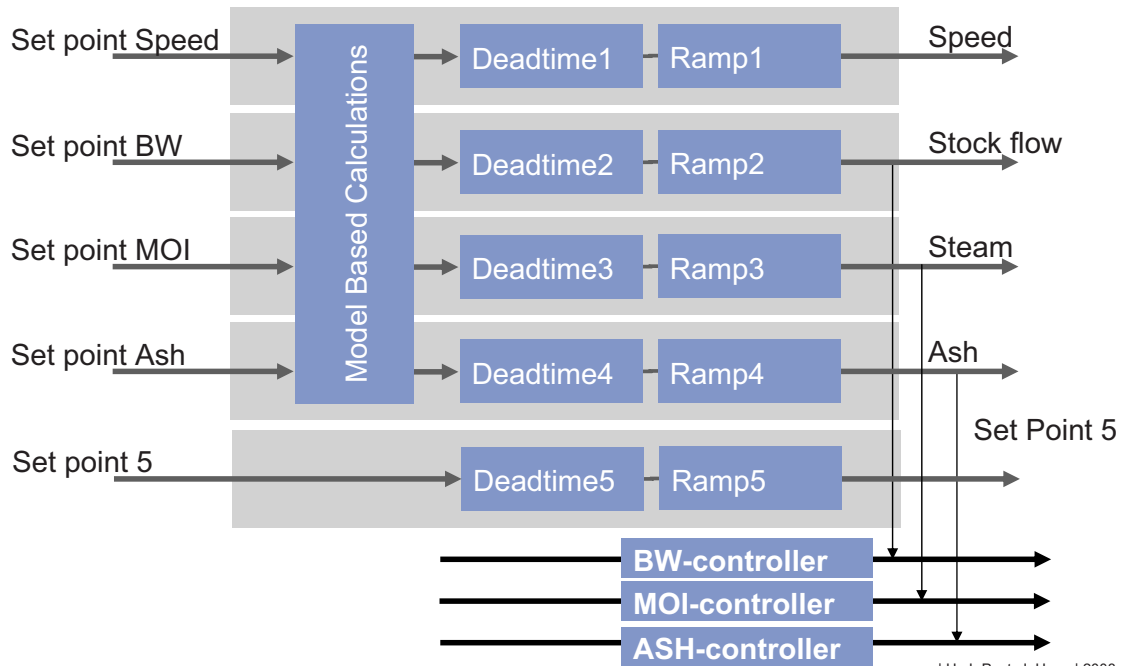
## The Internal Model Control Concept The Model used in the IMC



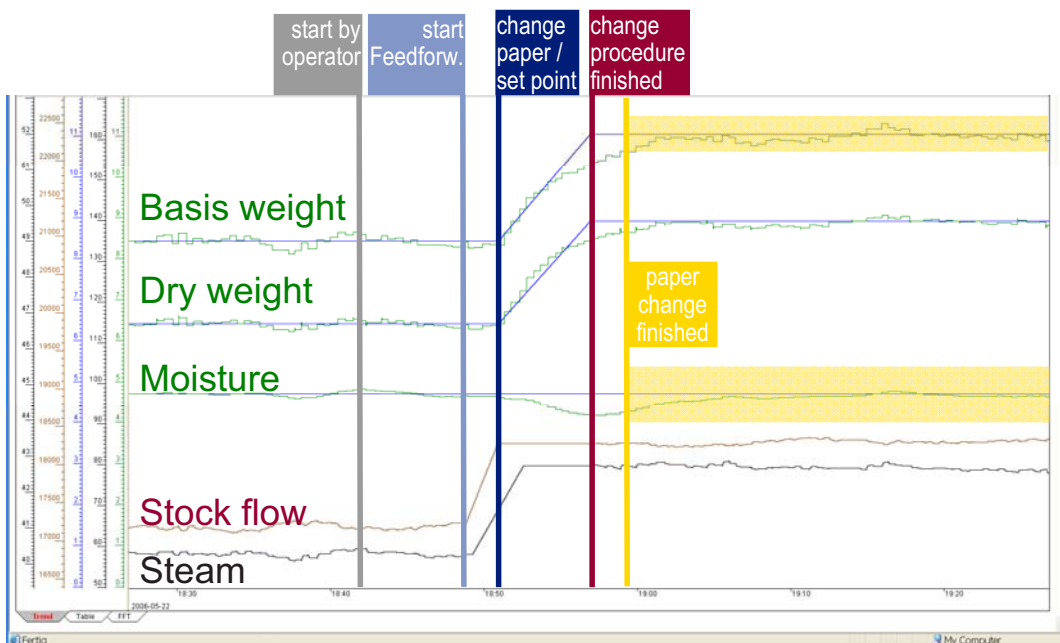
## SpeedChangeCoordinator Principle



## Grade Change Principle



## Grade Change Principle

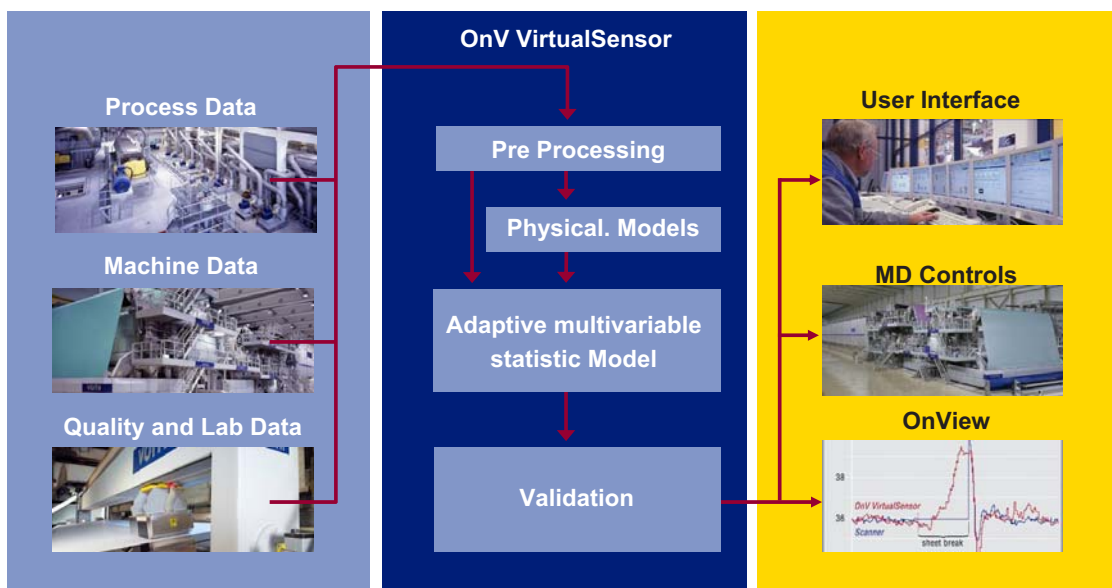


## OnV VirtualSensors – Proactive intelligence



- OnV VirtualSensors is a software, predicting quality parameters based on readings from process data – in real time.
- Instead of time consuming lab tests, the papermaker can observe changes in the process in real time and thus can react quickly – before a loss of production occurs.
- Therefore, our customers achieve higher production by reducing waste – e.g. after sheet breaks.

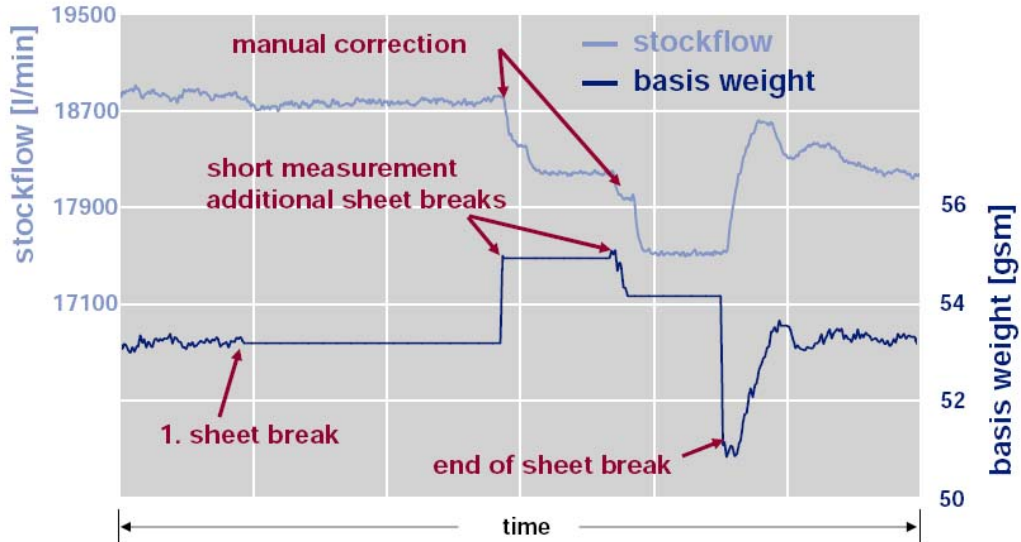
## Create knowledge out of existing online data with OnV VirtualSensors





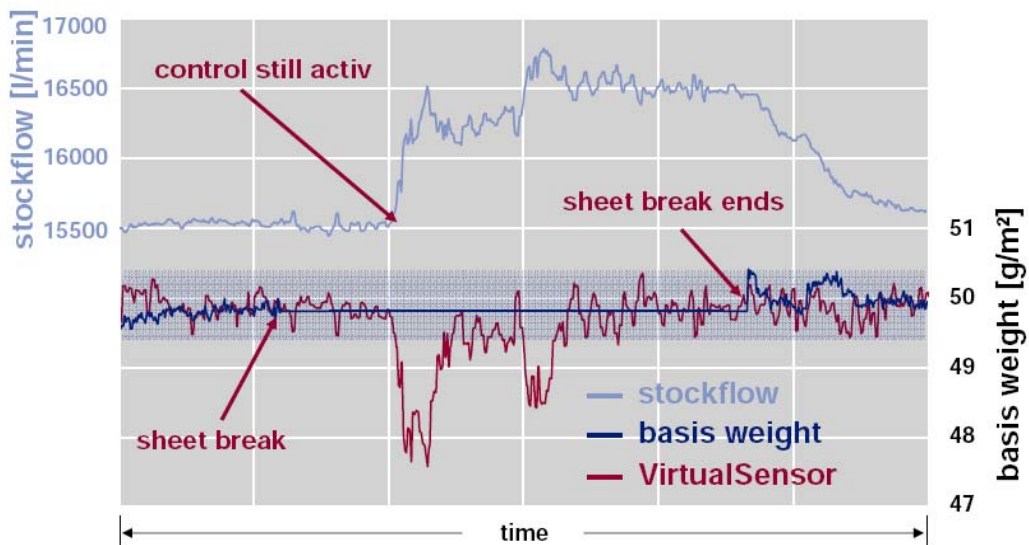
## OnV VirtualSensors @ Stora Enso Maxau PM 6

Problem: Basis weight variations after sheet break



## OnV VirtualSensors @ Stora Enso Maxau PM 6

Result: Basis weight on target after sheet break ends



## Summary

- **Voith Paper Automation** offers a complete portfolio of Automation products for the papermaking industry:
  - Sensors (Field sensors, scanners)
  - Machine, Process and Quality Control Systems
  - Information system (reports, data visualisation and analysis)
- **Quality controls** are based on physical models:
  - **Cross-Directional** controls via dedicated profiling actuators
  - **Machine Direction** controls via DCS control set-points
- Inputs for the Quality controls are obtained...
  - from traversing **scanner** measurements (Hardware)
  - from **Virtual Sensors** based on alternative on-line process measurements (Software)
- **Model reduction** will play an important role in the near future

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**VOITH**  
*Engineered reliability.*

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