Digital Twin – heart of the new process control technology

The “Digital Twin driven control” of technological processes is a tool for

- discovering existing production capacities,
- harmonizing energy usage,
- increasing production efficiency and
- driving equipment to its best possible performance.

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Digital Twin – heart of the new process control technology

This technology far surpasses the current control approaches in the paper industry.

It’s incomparable faster, more accurate and more complex than standard Model Predictive Control (MPC) technique.

The control loops are “informed” about the entire process state and its dynamic development in the near future.

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Digital Twin is a virtual copy of the real process.

Every single process variable measured as well as unmeasured has a “small digital twin” in this virtual process.

Not only physical quantity such as temperature, flow, pressure are exact controlled, but also pointer to quality crucial occurrences as surface inhomogeneity, delamination, yellowing etc. can be avoided through sophisticated additional control loops.

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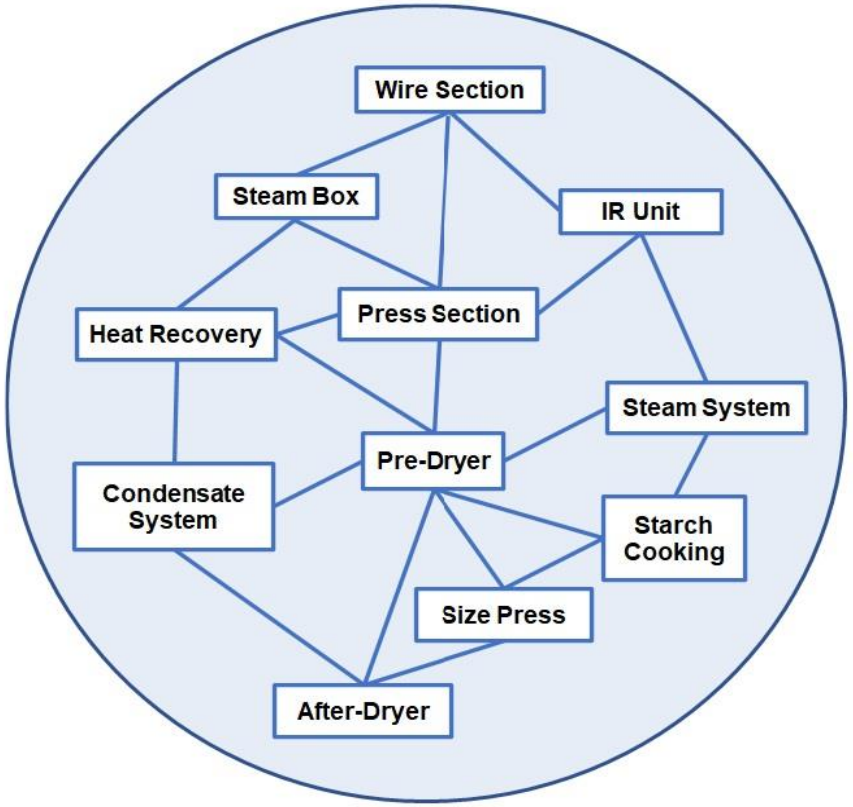

- The high efficiency and precision of the drying process control is based on the mathematical linking of all individual processes running in parallel.
- Every single control loop is “informed” about the reactions of other control loops and calculates control steps accordingly.
- The Digital Twin eliminates real process dwelling time practically to zero. Control steps lead directly to the target in the shortest possible time (technical and technological).

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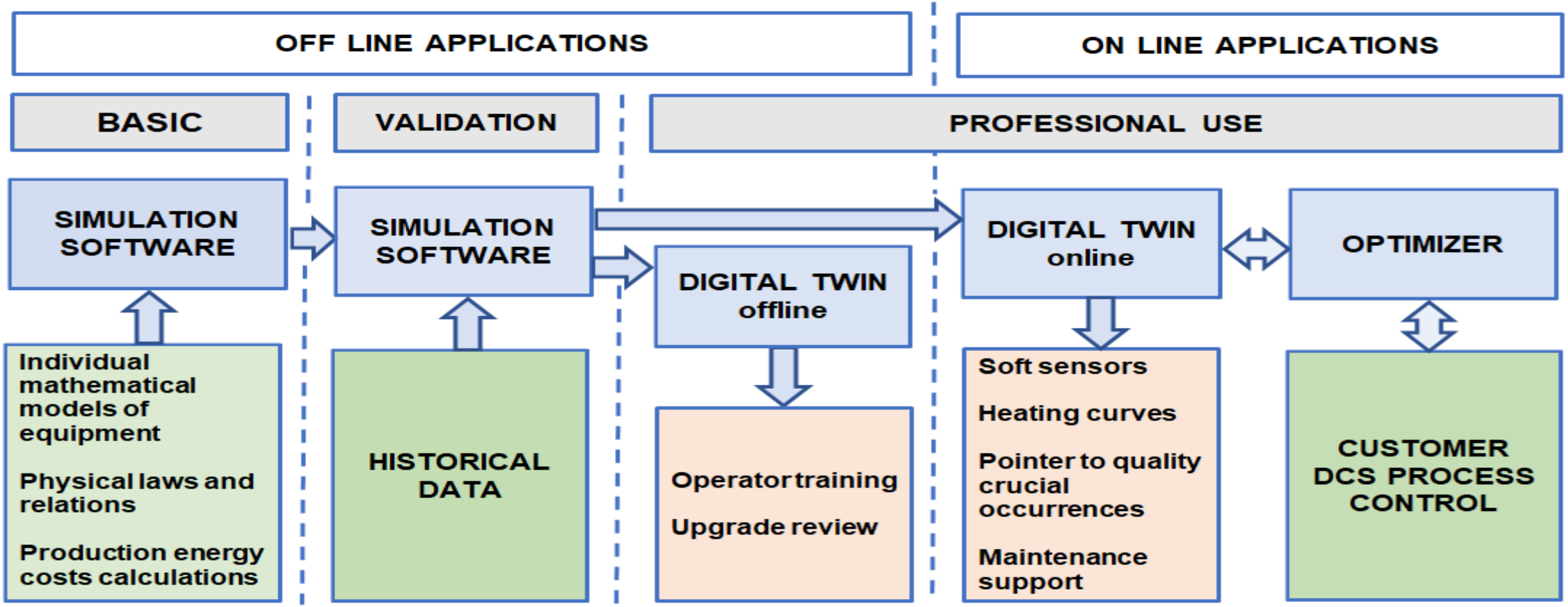
Digital Twin is characterized by its versatile use.



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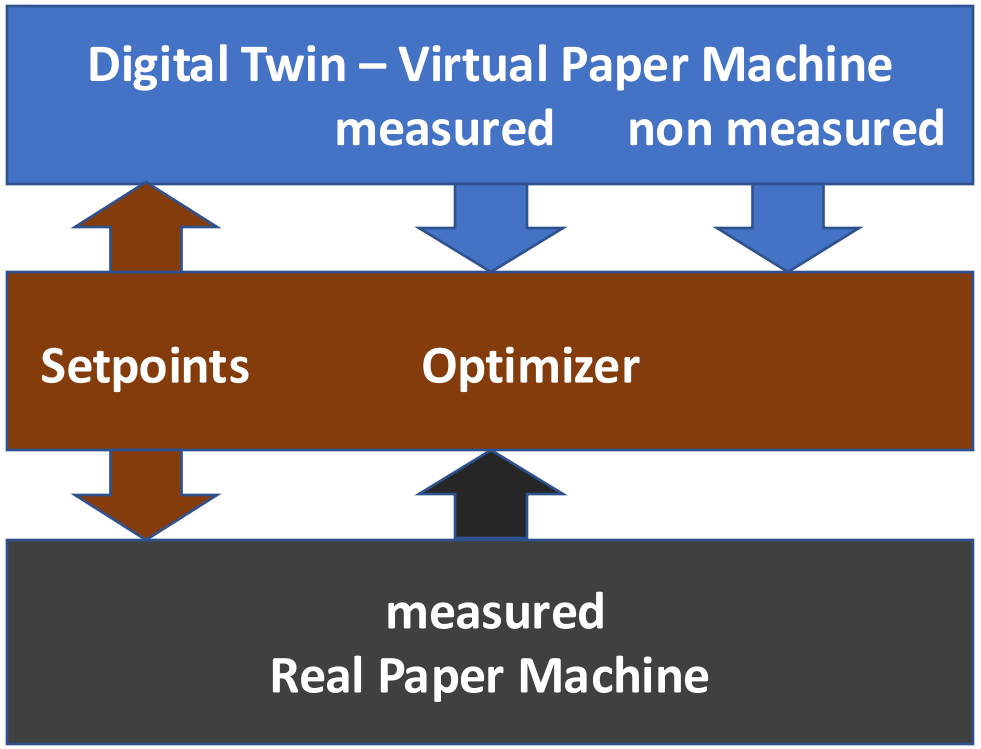
Unbeatable Control Technology



Both machines (real and virtual) are controlled with the same setpoints.

- Optimizer **(AutomationX software)** searches for the most efficient setpoints and then applies them to the real process. The optimizing criteria are free to select.
- Optimizer handles hard constraints for setpoints (lower, upper limits or speed of change restrictions)
- Soft sensors for unmeasured process data are used for quality / cost control

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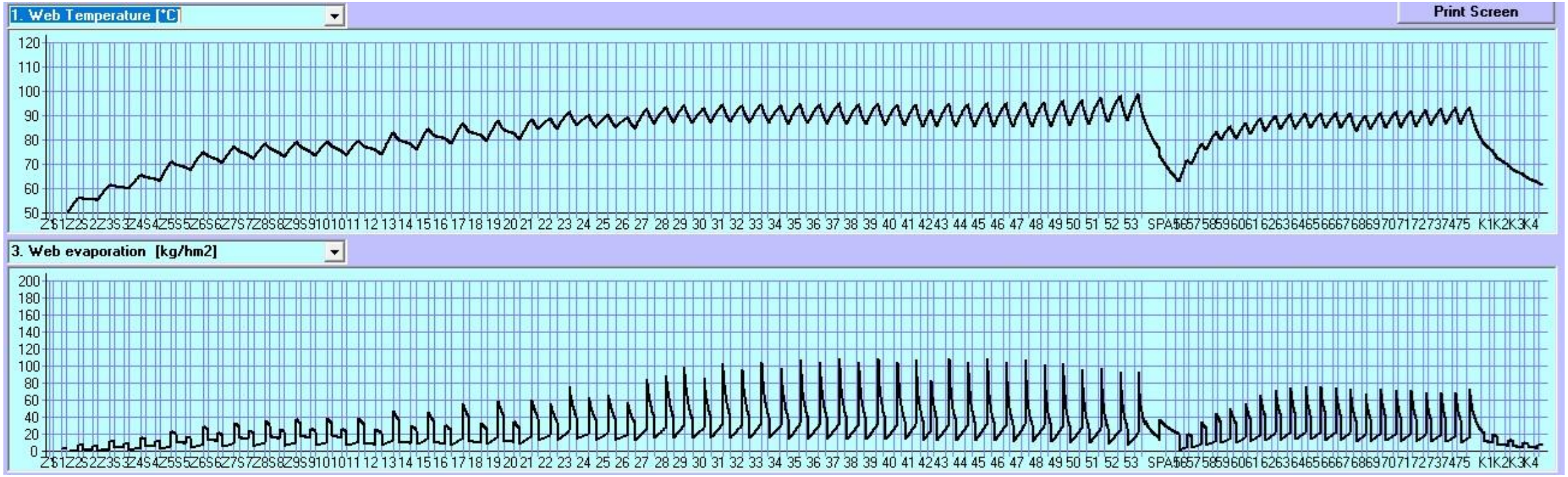
Quality control – Digital Twin continuously simulates (online) MD trends for every single paper parameter in the machine - e.g. paper web temperature, evaporation rate.



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Digital Twin combined with the optimizer allows following features:

- Energy reduction in individual processes of paper drying
- Cost optimization based on spot market prices
- Effect of wear on energy costs (dewatering efficiency, Heat recuperation)
- Energy costs evaluation in real time absolute and relative to production
- Evaluation of CO2 emissions in real time
- Impact of changes in raw material on dewatering and drying
- Exploring the limits of safe drying to increase production while maintaining consistent quality.

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Recent implementations demonstrate substantial savings:

- **Smurfit Kappa PM9, UK**: Over **7% energy reduction** in paper drying process focused on hoods and condensate control.
- **Weig Karton KM6, Germany**: Over **5% energy savings** in coating and pre-dryer sections.

Awarding

- first price for sustainability by CPI in England 2022,
- first price for the best project by VNP in Netherlands 2023
- second price Constantinus by WKÖ in Austria 2023.

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Solution potentials:

- **Energy reduction up to 10 %**
- **Production increase by 2%**
- **Development of solutions for quality disturbing occurrences**
- **Secure review and fine-tune machine upgrades**
- **Payback less than 1 year**

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References of digital twin technology in Pulp & Paper

- Paper and board machines
- Coating machines for all types of drying equipment and coating layers
- Pulp drying machines
- Batch digester houses
- Steam network for papermills
- Yankee machines, MG and Tissue

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Cooperating Companies:

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