

Production Based Energy Management Tools for the Food Processing Industry

1st Colloquium of the Munich School of Engineering
“Sustainable Energy Supply for the Future”

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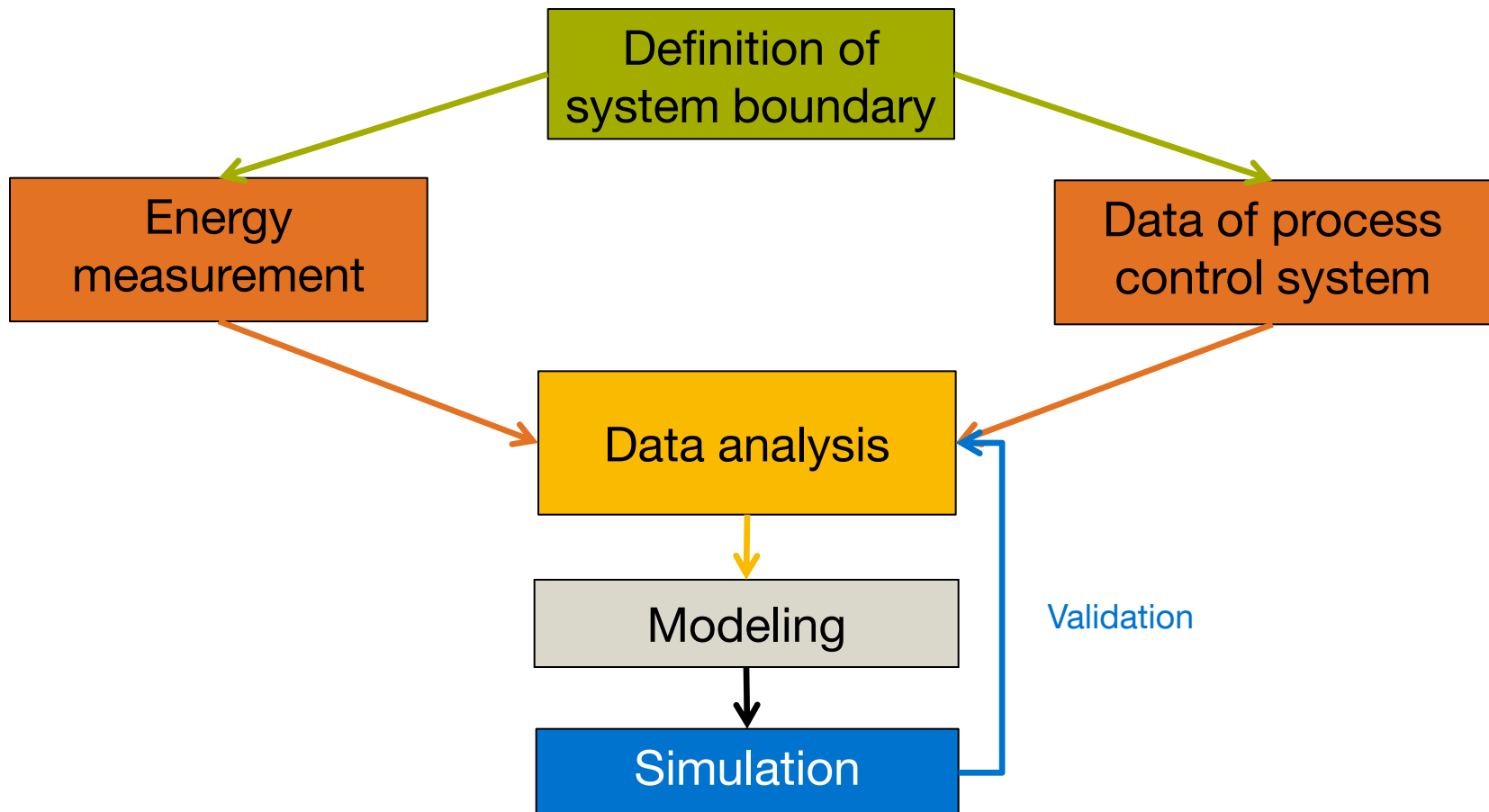
Chair of Food Packaging Technology

Prof. Dr. rer. nat. Horst-Christian Langowski

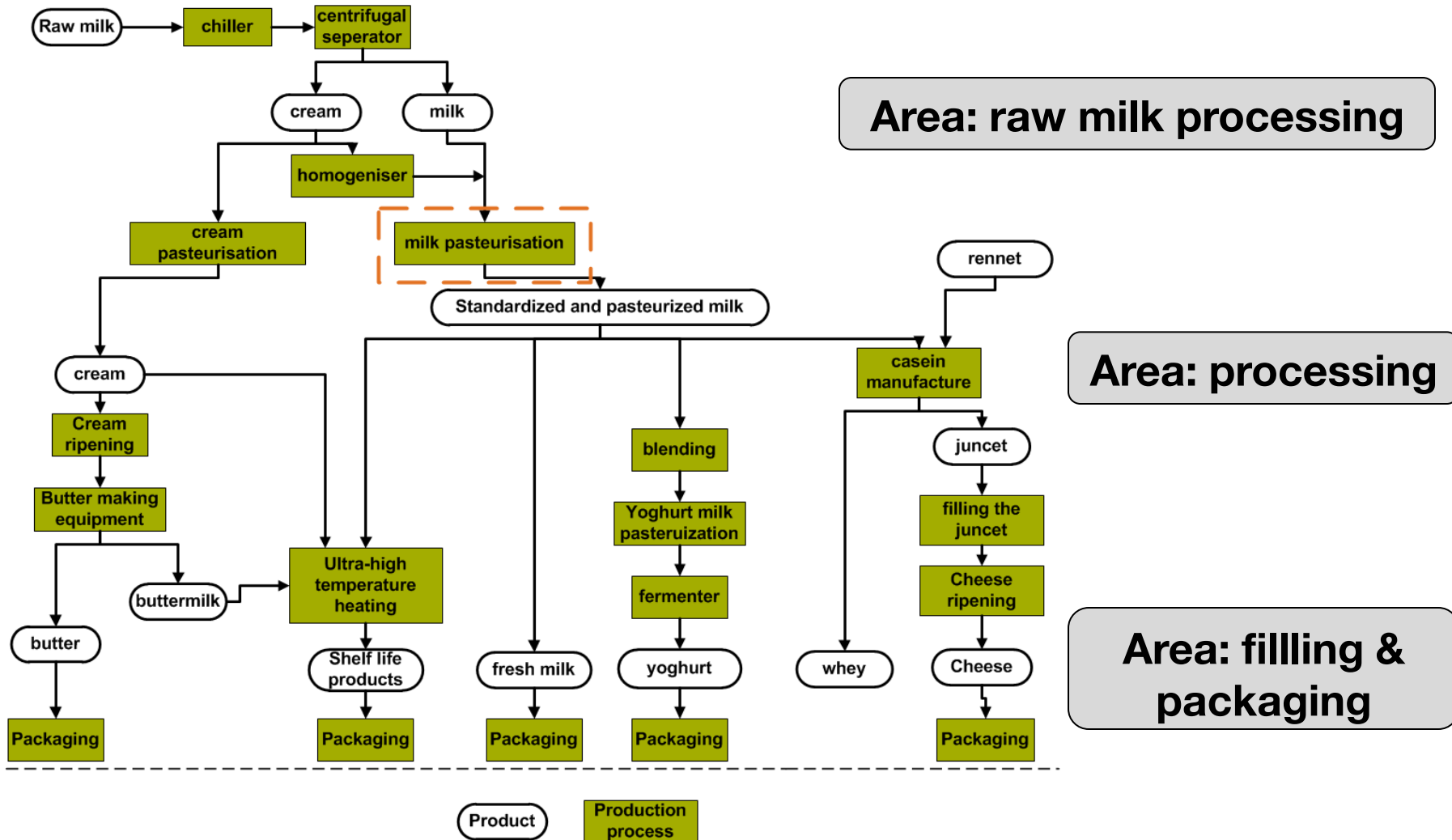
Approach of the production based energy management

- Plant data capture and data analysis
- Establishing measuring points for energy monitoring and energy performance analysis
- Development of models for describing and forecasting the plants demand for energy
- Structured analysis of manufacturing schedules
- Compliance with manufacturing and technological boundary conditions

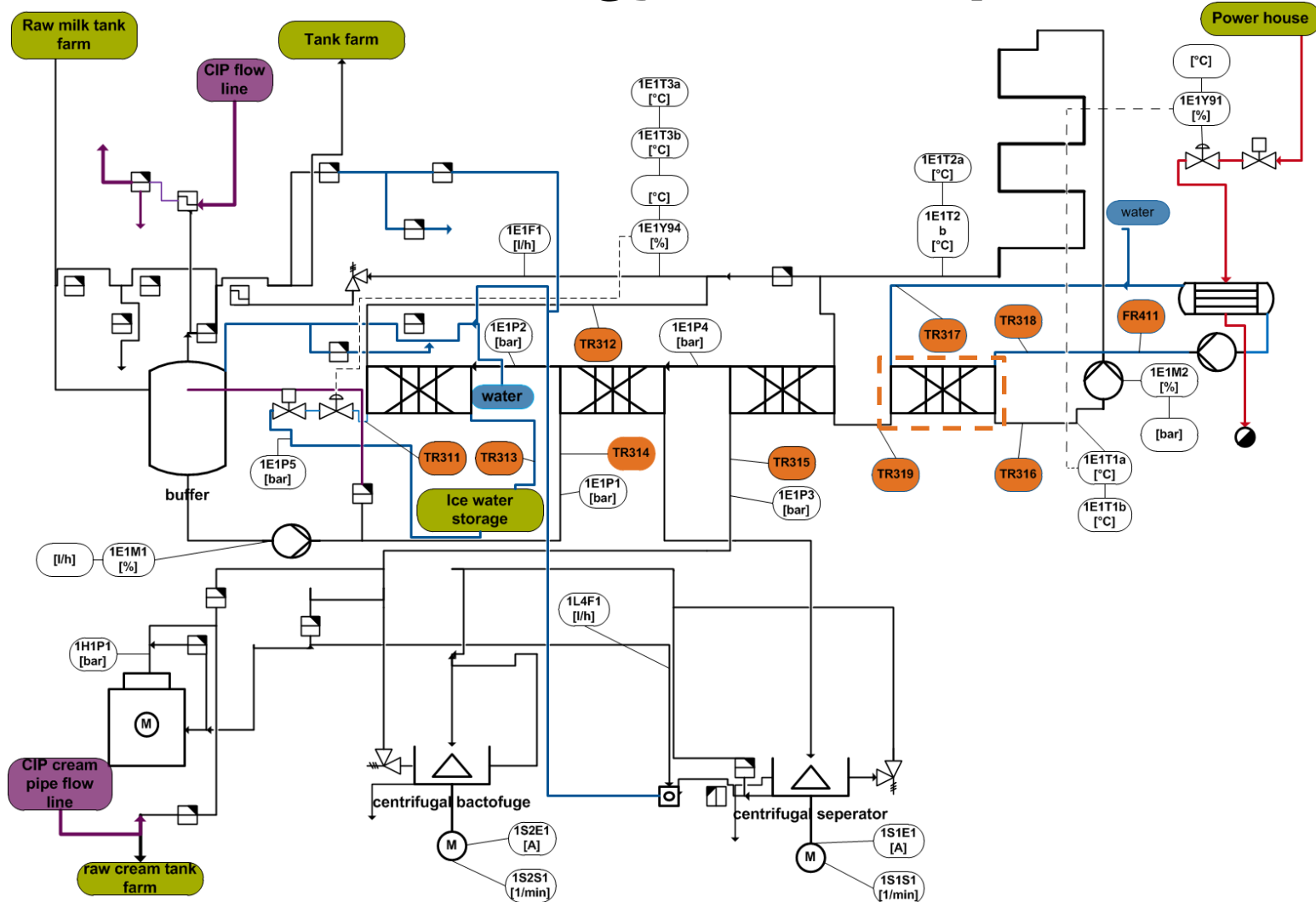
Methods of the production based energy management



Overview of energy consumption units

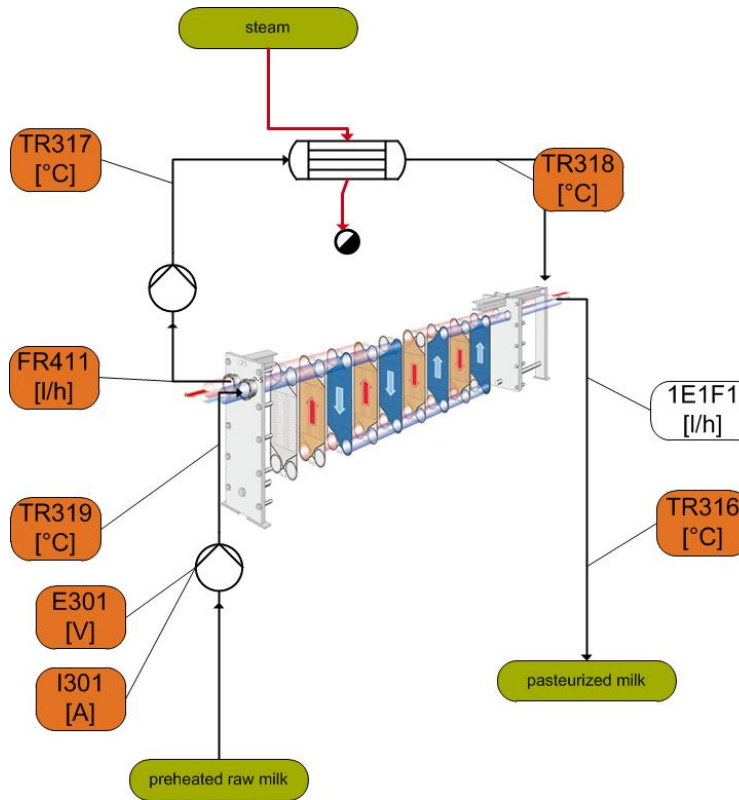


Overview of energy consumption units



Measurement methods

Temperature measurement:
 -PT 1000 surface temperature sensors
 -data logging system



Flow measurement:
 -Clamp-on ultrasonic sensor
 -data logging system

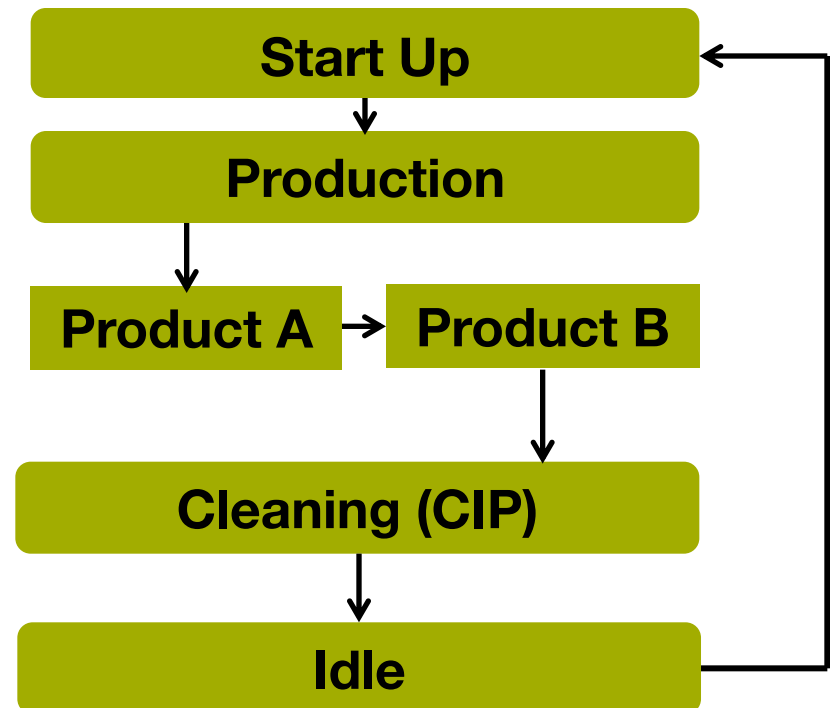
Electrical power:
 -Clamp ammeter
 -Measuring at the switching cabinet of each consumer

Process control system:
 -Using sensor values of the control system
 -SQL data base storage

Energy based phase tracking

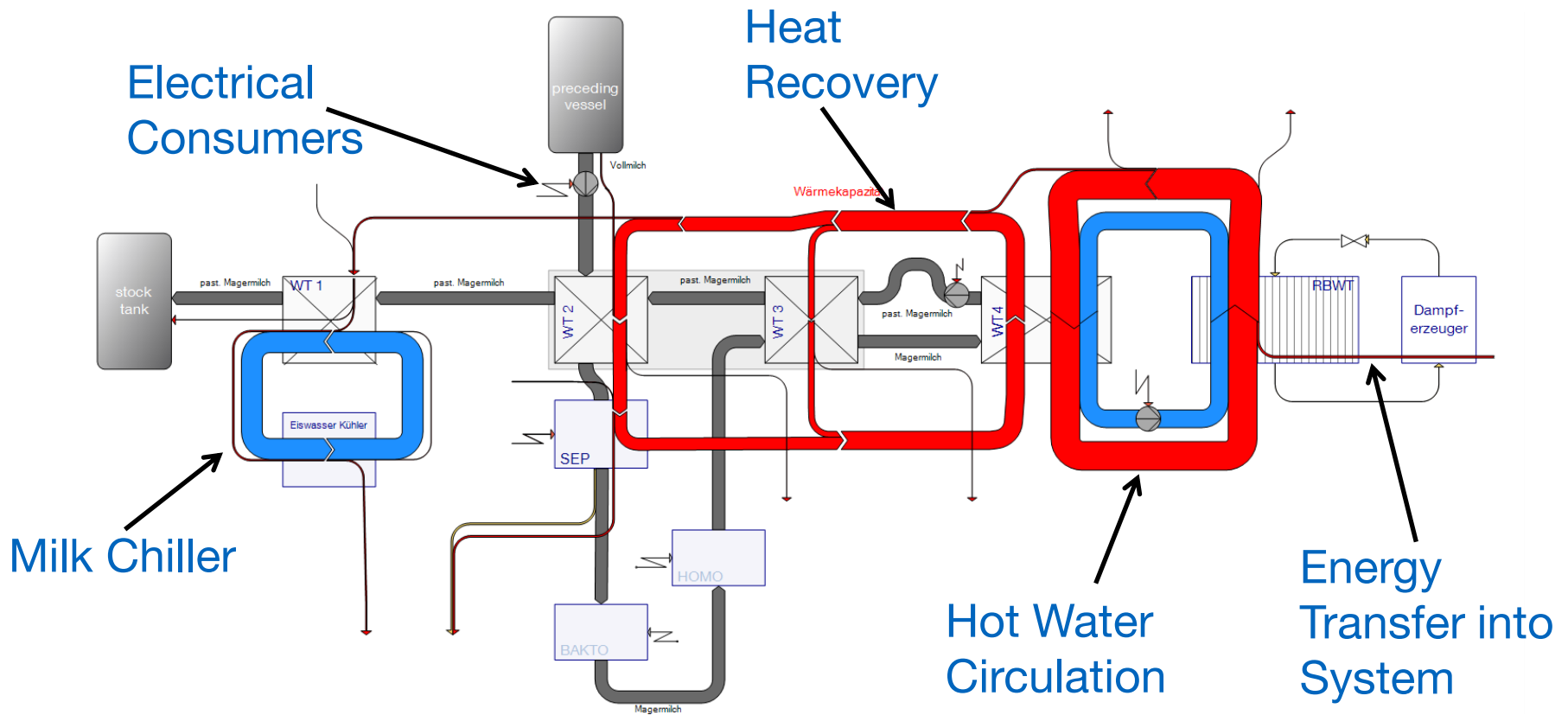
Classification of the plant status into phases

Production Process



➔ Calculation of production based green indicators

Visualisation of the stationary energy flow by a Sankey diagram

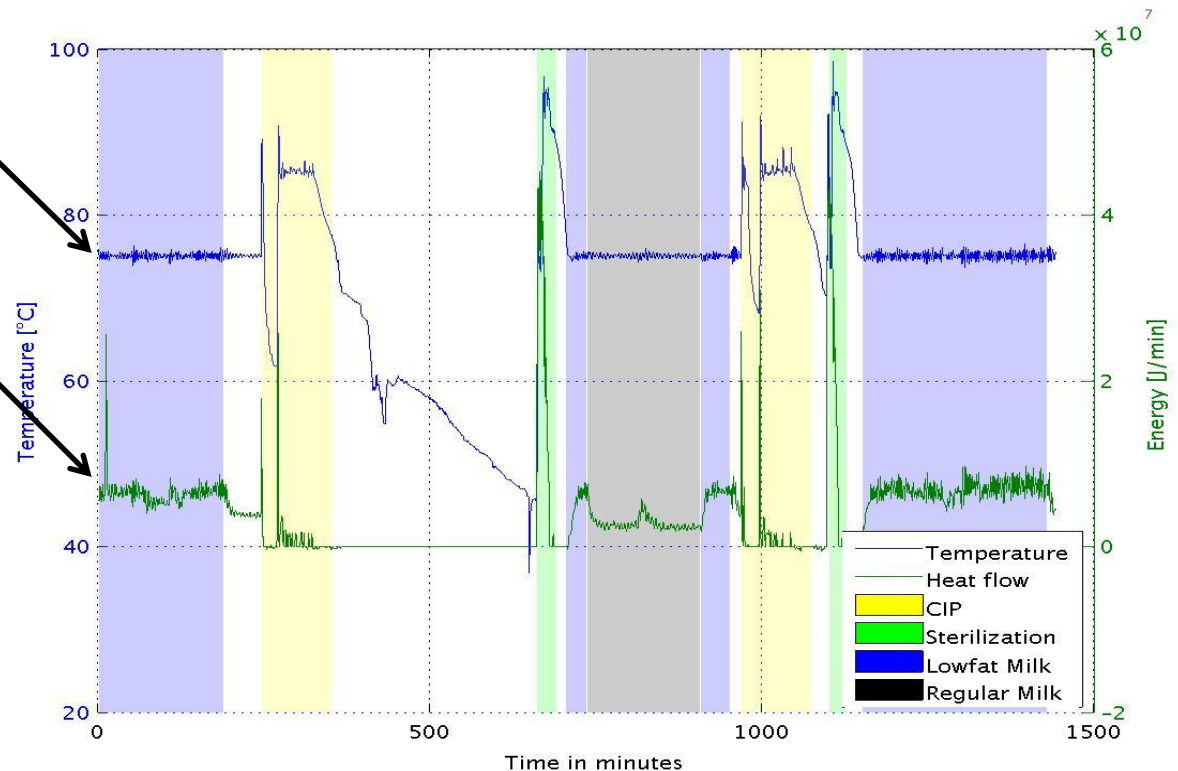


Production based as-is analysis: graphical approach, time series

Pasteurization
Temperature

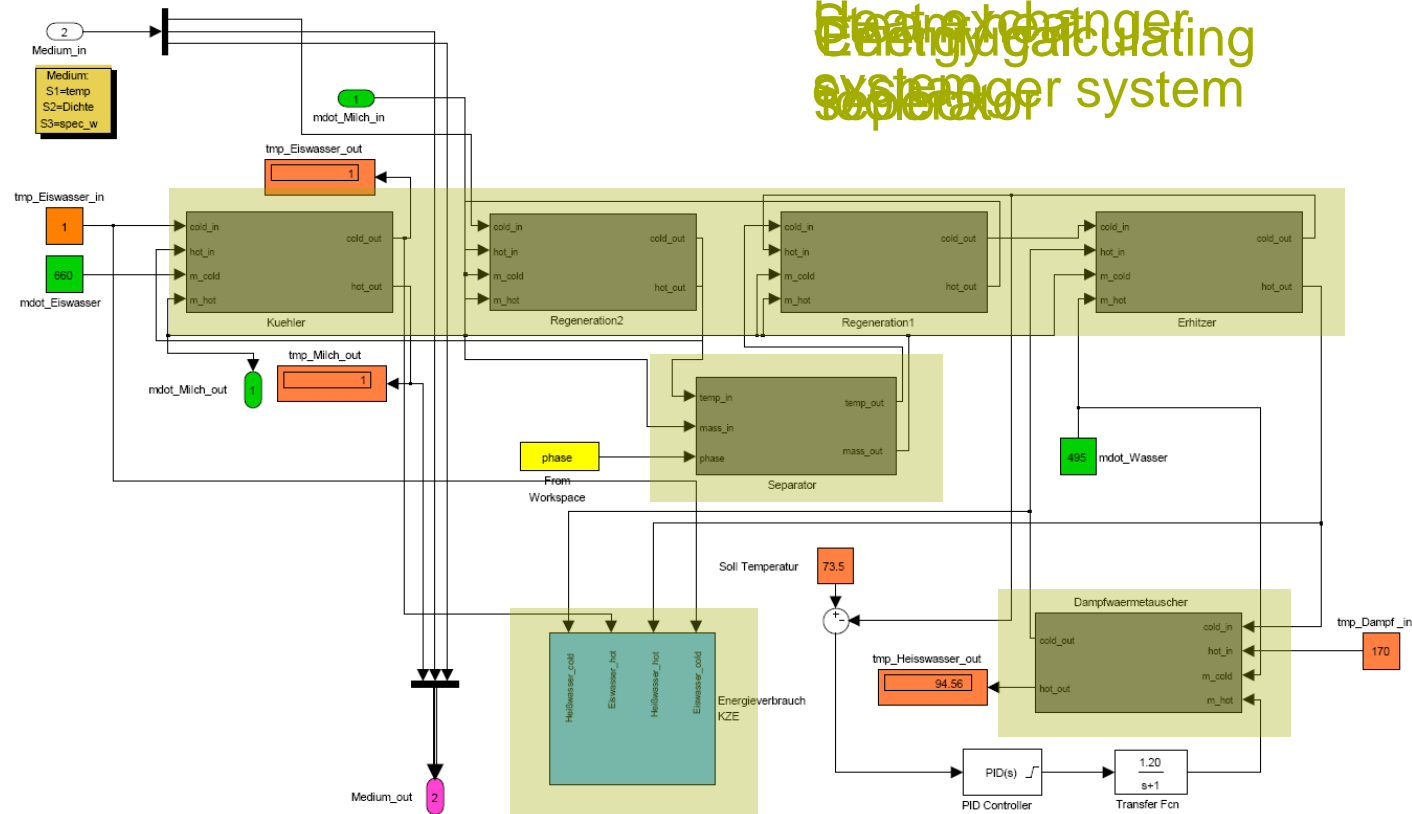
Heat Transfer
Hot Water
Circulation

- Diagnostic function for historical data
- Time behaviour of the process
- Calculation of phase based energy key indicators



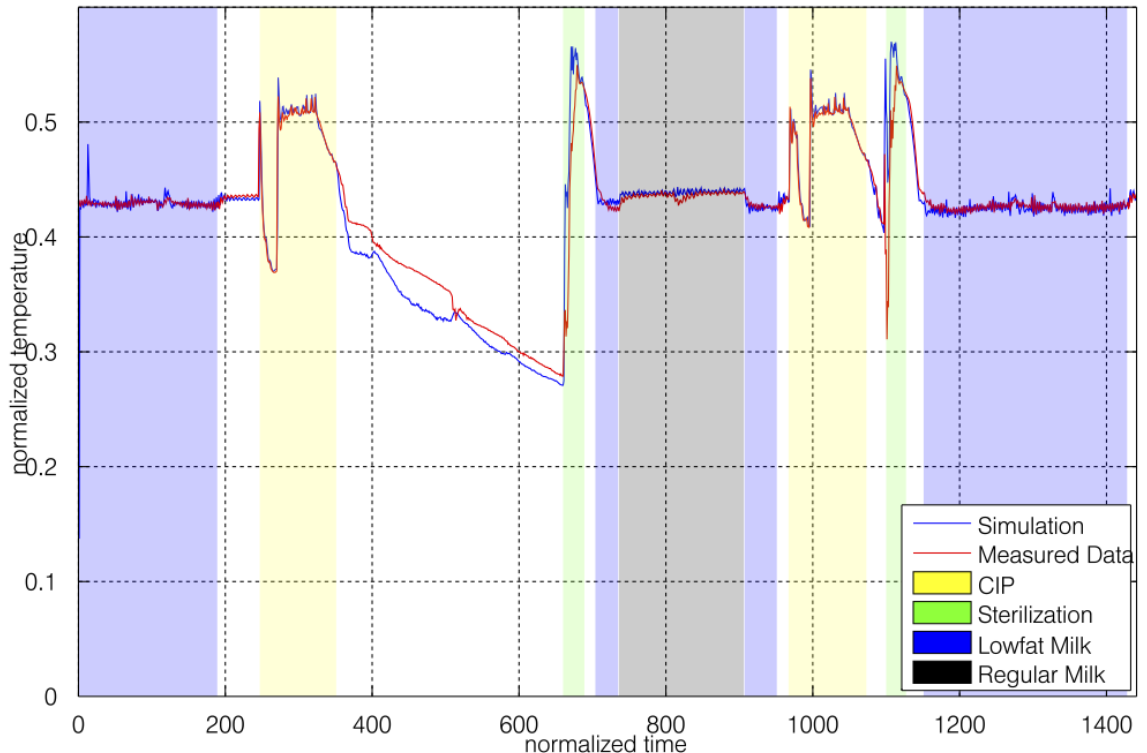
Energy based process simulation – component library

Electrolytischer
Energieerzeugendes
systemer system
separator



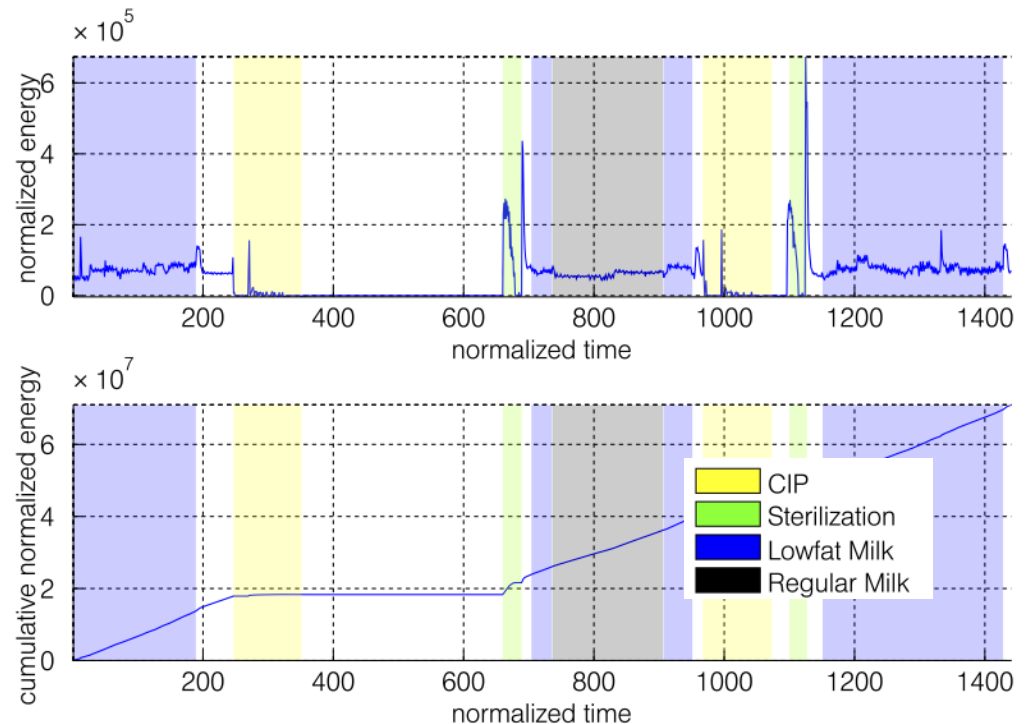
Energy based process simulation – model validation

- Blue curve: simulation data
- Red curve: measured data
- Validation results show a good accordance
- Simulation recognizes the different process phases
- Simulation of the time response



Energy based process simulation – energy plot with forecasting function

- Calculated energy by the toolbox
- Energy consumption of the simulation process
- Identifying energy key indicators of each phase
- Simulation helps to forecast the energy demand for a production process
- Testing new production schedules



Next steps

- Simulation of technical optimization
- Analyzing the manufacturing schedules
- Modeling an optimization approach for production scheduling
- Validate the optimized schedules with the process simulation
- Integration of green production indicators into an MES

Thank you for your attention

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