The examined production scheduling problem

Given
- Operational data, e.g. available equipment, processing rates, changeovers
- A weekly demand

Considering
- Full demand satisfaction
- Tight operating and design constraints

Scheduling solution strategy consists of:
- A batching algorithm
  - Translates product orders into batches and lots to be scheduled
- A novel MILP model
  - In order to extract optimal scheduling decisions
  - Plant-specific constraints (e.g. foodstuff quality) clearly integrated
- An order-based decomposition strategy
  - Break initial problem into tractable subproblems

Reduction of problem size
An aggregated approach is employed to reduce the computational complexity of the scheduling problem
- Thawing stage omitted, since it is overdesigned compared to the rest of the stages.
- Sterilizers are viewed as a renewable resource and are not explicitly modelled.

Objective: To develop a mathematical model describing relevant variables (microbial lethality, foodstuff color, energy consumption, process time) in the sterilization process.

Three coupled units are considered: plate heat exchangers (PHEs); sterilizers; foodstuff+containers.
- Model obtained from energy balances.
- Increase efficiency: reduced order models for PDEs.

Results on Industrial Study Cases

Scheduling Case Study
- Proposed mathematical framework employed on a real weekly demand.
- Real operational data were used as provided by the plant's Manufacturing Execution System.
- Solution strategy implemented in GAMS 25.1.1 utilizing the CPLEX 12.0 solver.
- 123 final products are to be scheduled.
- Decomposition strategy employed: 20 products optimized at each iteration.
- Scheduling problem solved in just 10 minutes.
- Makespan of proposed solution: 133.1 hours
- Generated optimal schedules have been validated by the industrial partner.

Conclusions & Future Work
- The RTO solution allows it to be included in the MES system to help the operators daily operation.
- It can adapt to unexpected failures in the production lines quickly.
- Thanks to the overall schedule previously obtained it can have a reliable prediction of the arrival of carts.
- The objective function can focus either on the productivity or maximizing the quality among other options.