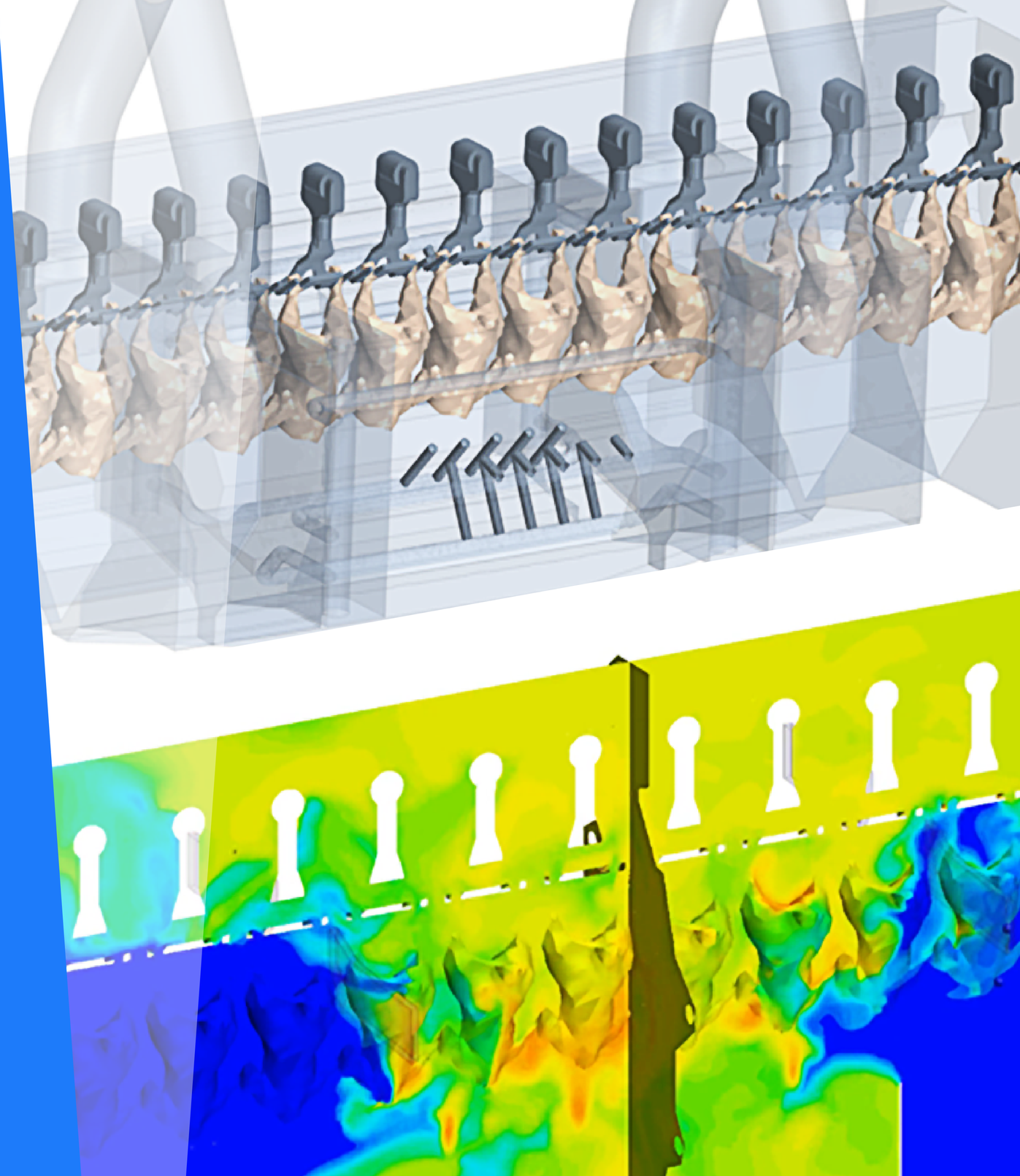
MINIGUIDE

Improvement of your food processing system - using CFD



Hygienic design & cleaning of equipment

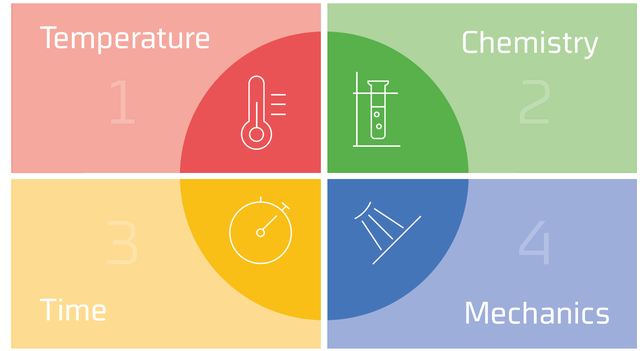
The food industry is ruled by strict regulations. Hygiene and safety play a key role during food processing and food processing companies must meet various strict requirements to comply with national and international standards.

According to Sinner’s circle, four factors have a massive impact on the cleaning of the process equipment. They are: Temperature, detergent, time and the mechanical force of the CIP process (cleaning in place).

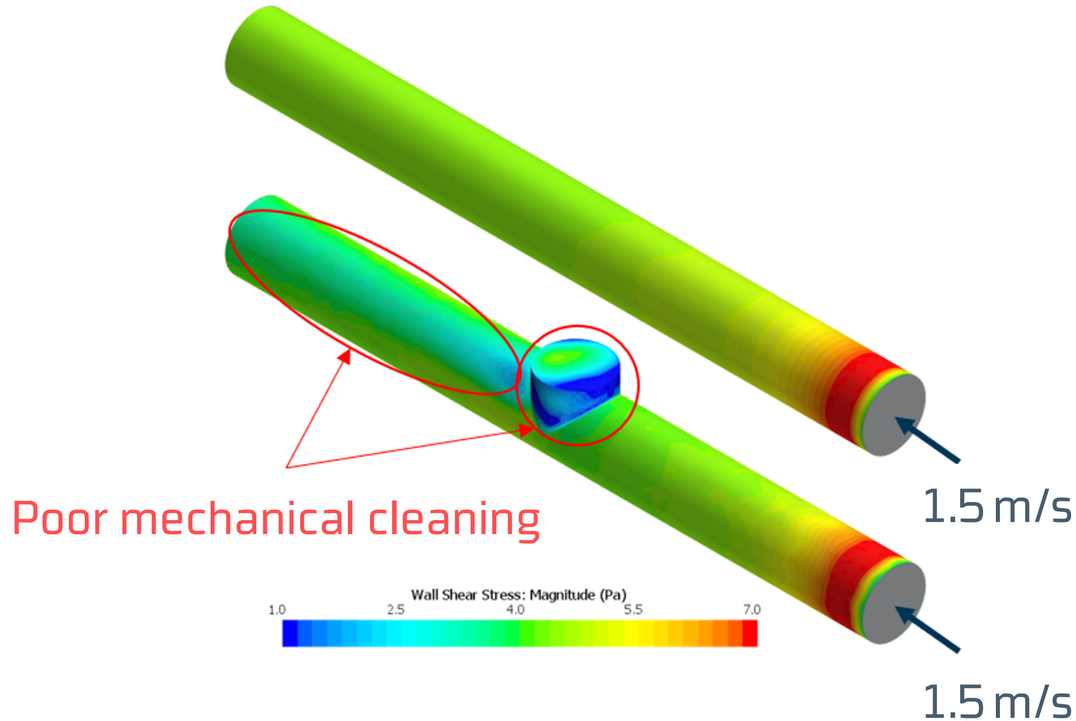
Applying computational fluid dynamics (CFD) when designing the production equipment ensures an optimised mechanical design which decreases the cost of the remaining three factors.

If the system is designed with few or no dead ends, the amount of necessary detergent, temperature and time to clean the equipment is decreased.

This leads to more available production time and lower operational costs.



Sinner’s Circle



CFD is helpful in various production processes

In order to produce products of high quality with a minimum amount of wasted food products many factors are in play. CFD can be of great advantage when it comes to:

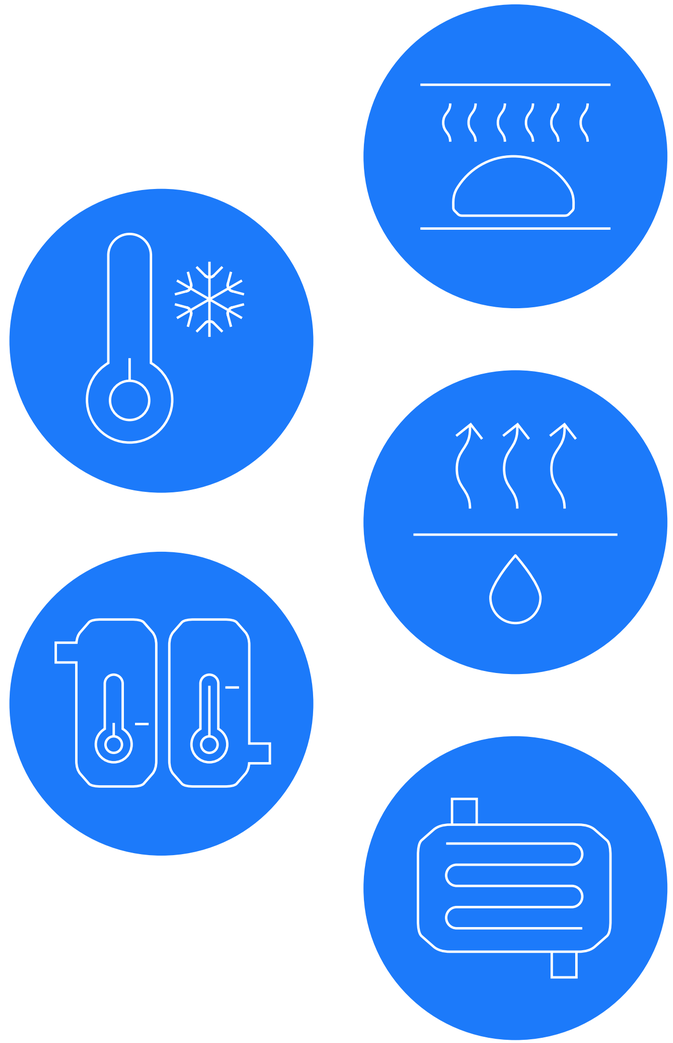
Baking: Model the heat transfer from the heating elements inside the oven to the food product as well as modelling the moisture transferred from the food until it is removed from the oven.

Refrigeration: Calculate and simulate the heat transfer in order to optimise the design of refrigerators and freezers.

Drying: The efficiency depends on the air flow and air velocity. CFD can optimise the nozzles of the spray dryers and calculate temperature and droplet velocity.

Pasteurization: CFD can predict the temperature distribution of the milk during thermal processing.

Heat Exchanger Design can also benefit from using CFD to ensure an optimised heat transfer.



Troubleshooting in existing setups

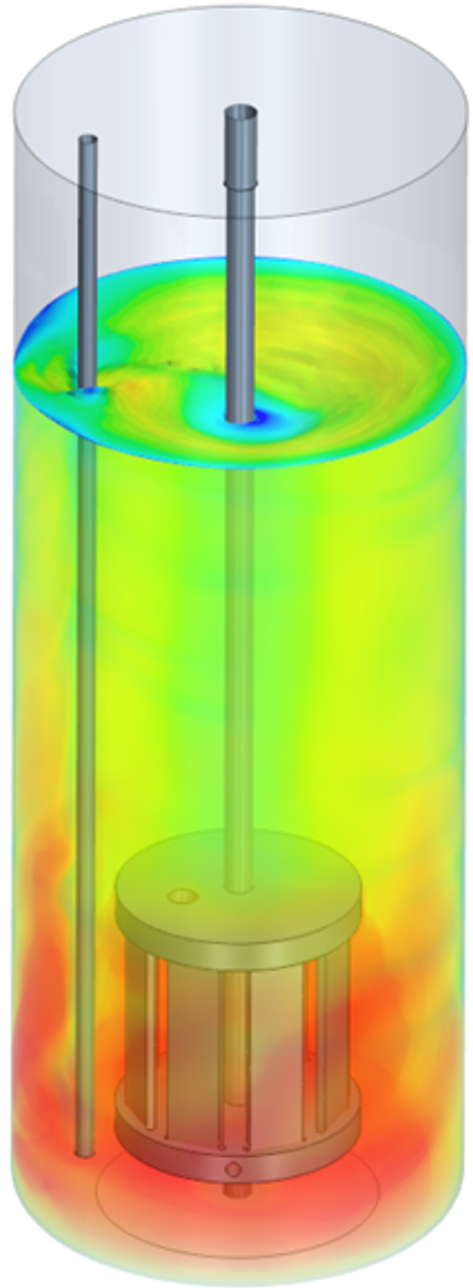
CFD simulations can optimise processes, not only in the design phase, but also in an existing setup.

Using CFD for troubleshooting is a powerful tool to e.g., determine whether two phases or two interacting liquids are mixed properly, including both heat and mass transfer between phases and components.

The mixing tank to the right is used for mixing various fluids. CFD is here used to show the time before the fluids are mixed at a certain level. It is further used to simulate the wall shear stress in the entire volume which can predict areas with high level of corrosion.

Vibration is another common problem, which during operation can lead to failure of components. Vibrations can be induced by problematic flow conditions. This can be examined with a CFD simulation interacting with a FEM (Finite Element Method) simulation. This is called Fluid-Structure Interaction (FSI).

These are only examples of the many possibilities that CFD provides in the pursuit of optimisation of an existing food processing system.



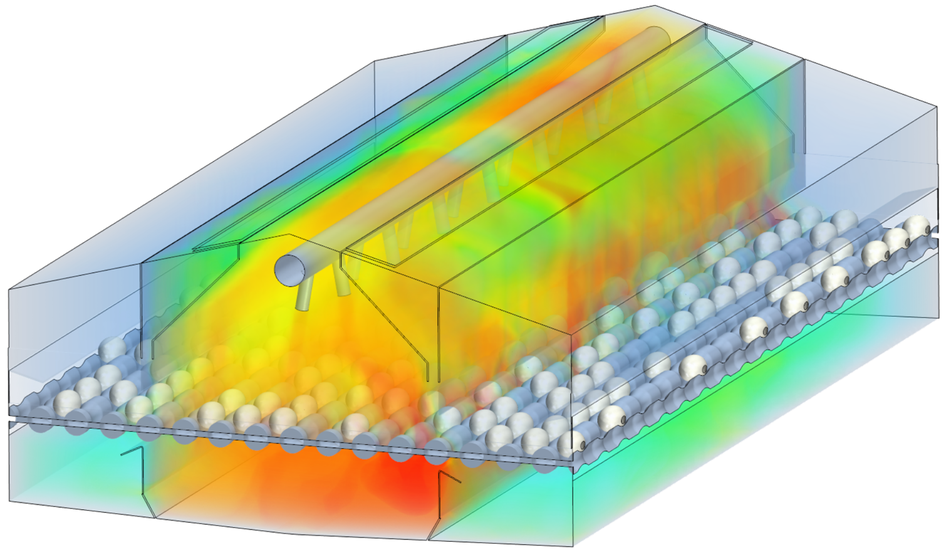
Optimising disinfection systems with CFD

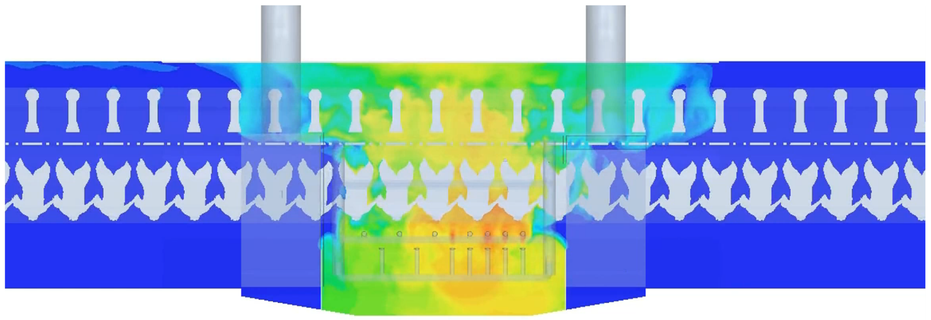
Temperature plays a significant role in assuring that food products are not harmful to the health of the consumer. The temperature must be high enough to kill the microorganisms but not so high that it affects or destroys the quality of the product. CFD can be used to predict the right temperature.

A CFD simulation of the egg disinfection process shows the distribution of steam/heat. Simulating the process makes it possible to see and address areas of concern in the design phase before the actual process is started.

To ensure a proper level of disinfection of chickens, a certain temperature during a specific time duration must be achieved. Moreover, the nozzles for disinfection must be optimally designed as overheating or too little heat is a no go.

CFD simulations of the above processes resulted in optimal disinfection of the food products and minimised wasted products considerably.





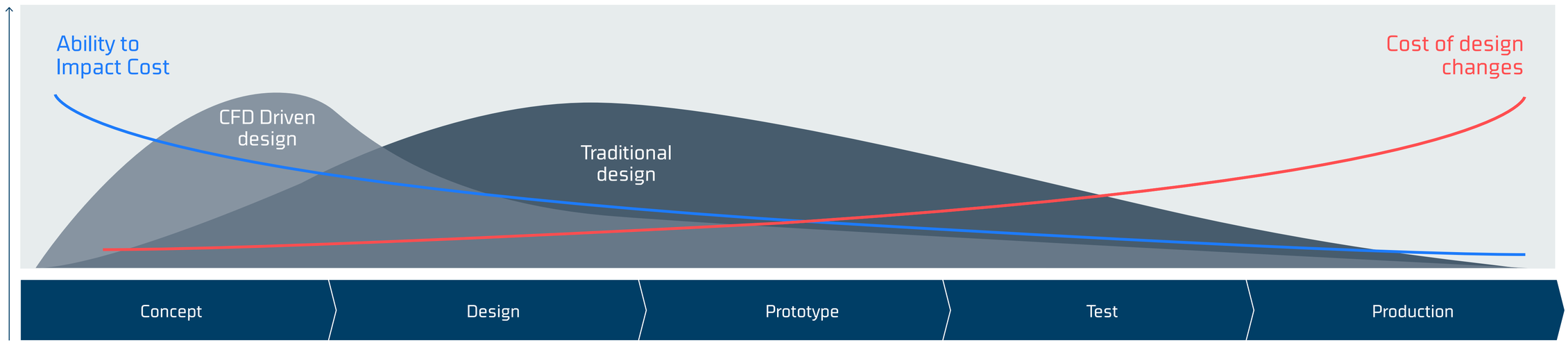
Benefit from designing your food processing system with a virtual prototype

CFD is a tool that allows deep understanding of flow and thermal behavior of a complicated process confined by a specific geometry. This understanding makes it easy to identify problems that are causing poor efficiency leading to wasted food products and high operating costs.

As opposed to manufacture and testing of prototypes, CFD simulations:

- Provide detailed information that is not limited to a few measurement points in specific locations
- Offer the opportunity to simulate scenarios that are unsafe or too expensive to carry out in real life testing.
- Allow testing many different setups, in a quick and affordable manner.

A virtual prototype provides a high degree of understanding before making, or even completely avoiding, a physical prototype. This ensures a much more straight-forward design process, reducing the expenses and long timeframes related to prototype manufacture and testing of equipment.



Further information you can benefit from

Case: Optimisation of disinfection system using CFD

Webinar: CFD simulations of processing systems

Service: Design and validation of efficient food and pharma processing systems using CFD

Facility: Centre for hygienic design

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