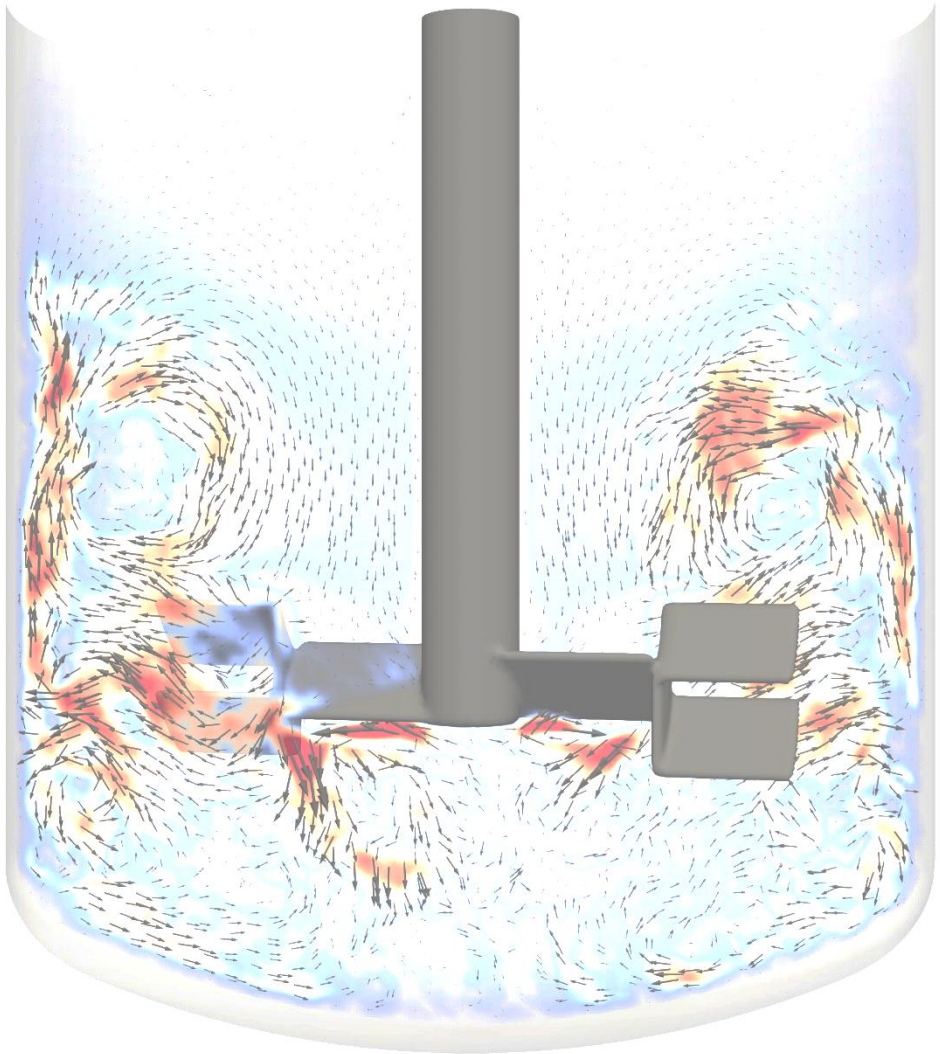
SIMVANTAGE

Dr. Christian Witz, CEO

christian.witz@simvantage.com
www.simvantage.com

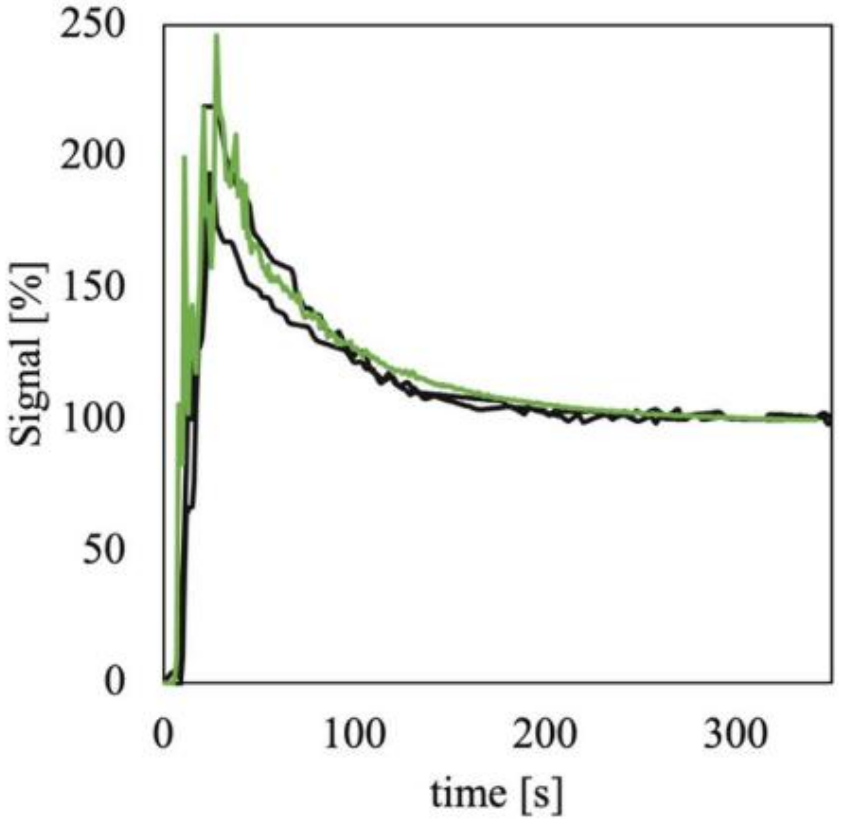


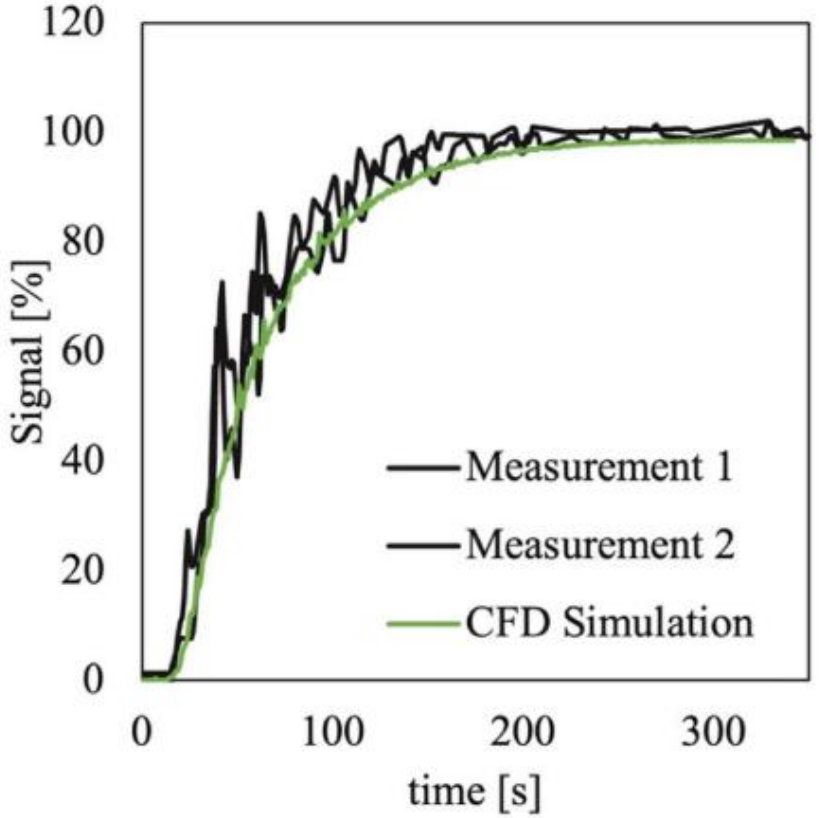
Use-Case Reactor Optimization

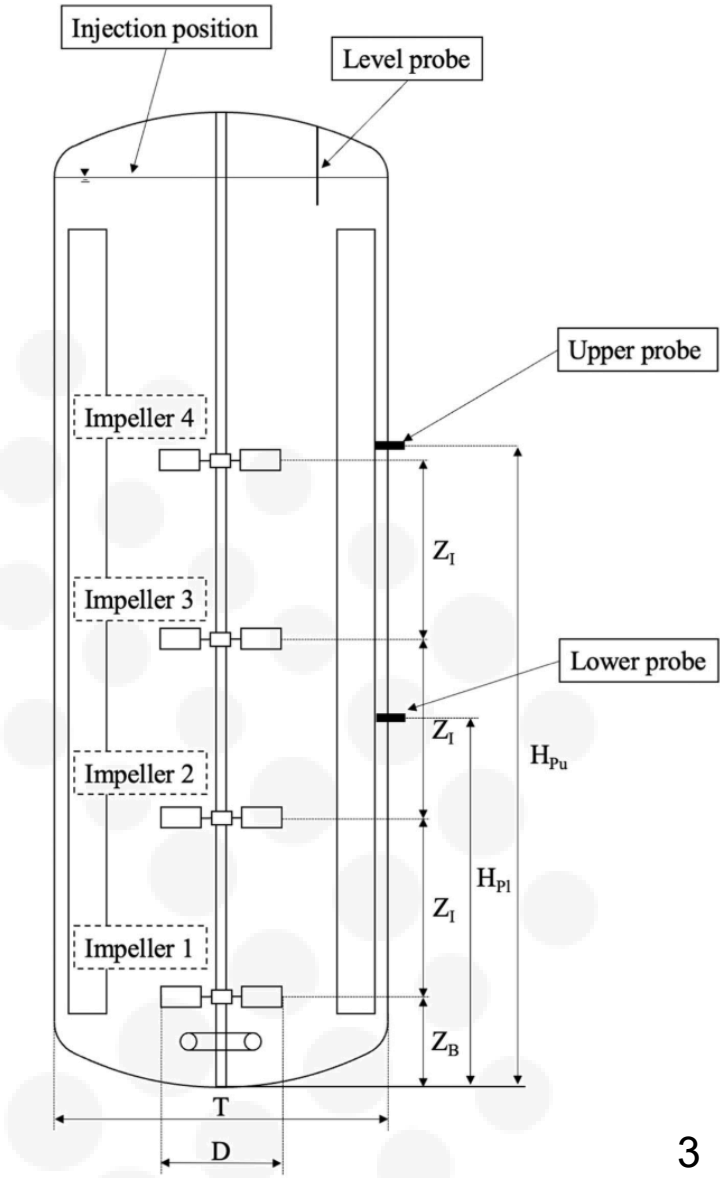
Validation and stirring system adaption
Collaboration with Sandoz Kundl

Fermentation Reaktors Sandoz Kundl

160 m³ Reactor, Ø 4.25 m, 100 rpm

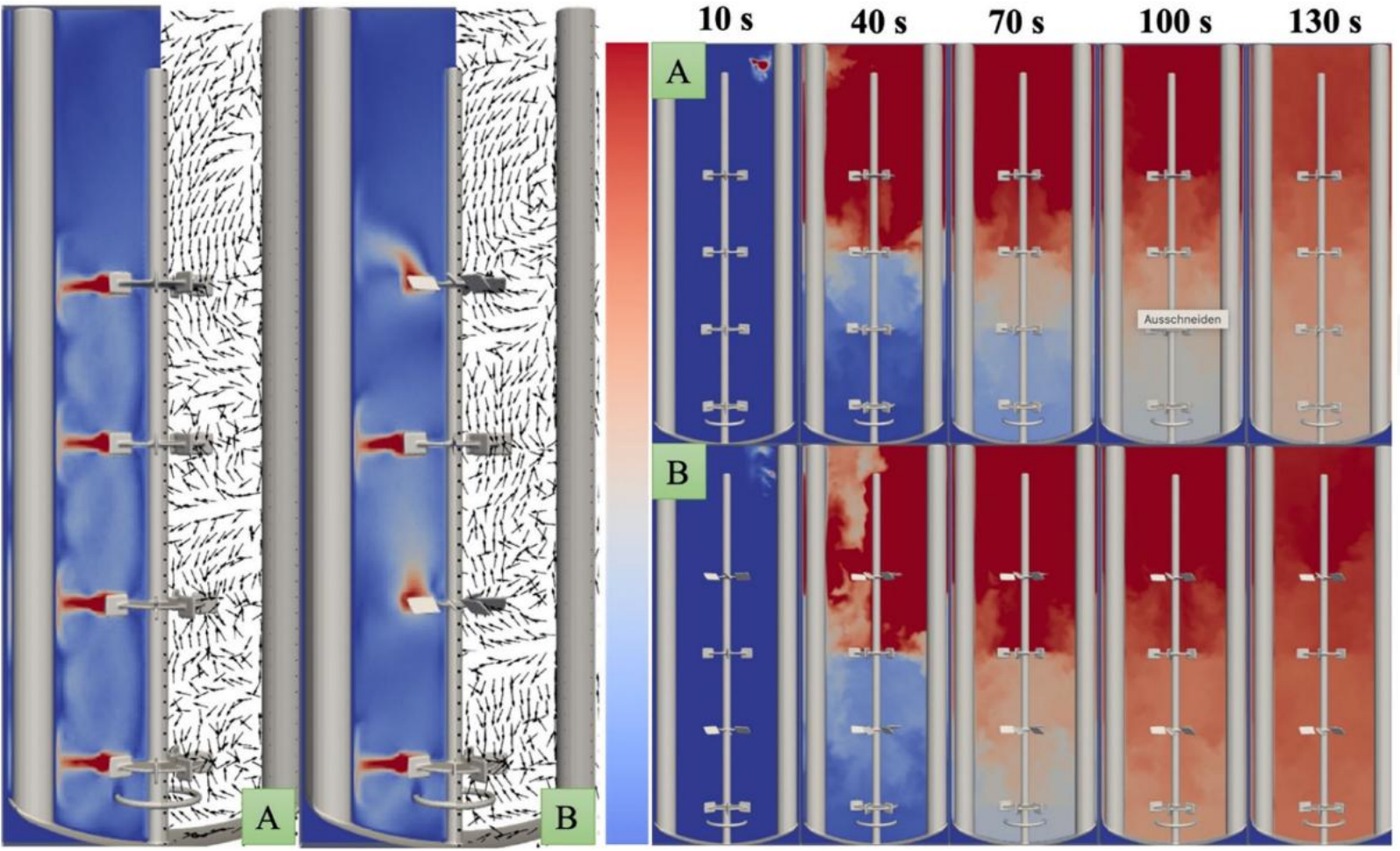






Fermentation Reaktors Sandoz Kundl

Single phase large-scale mixing time comparison with different impellers

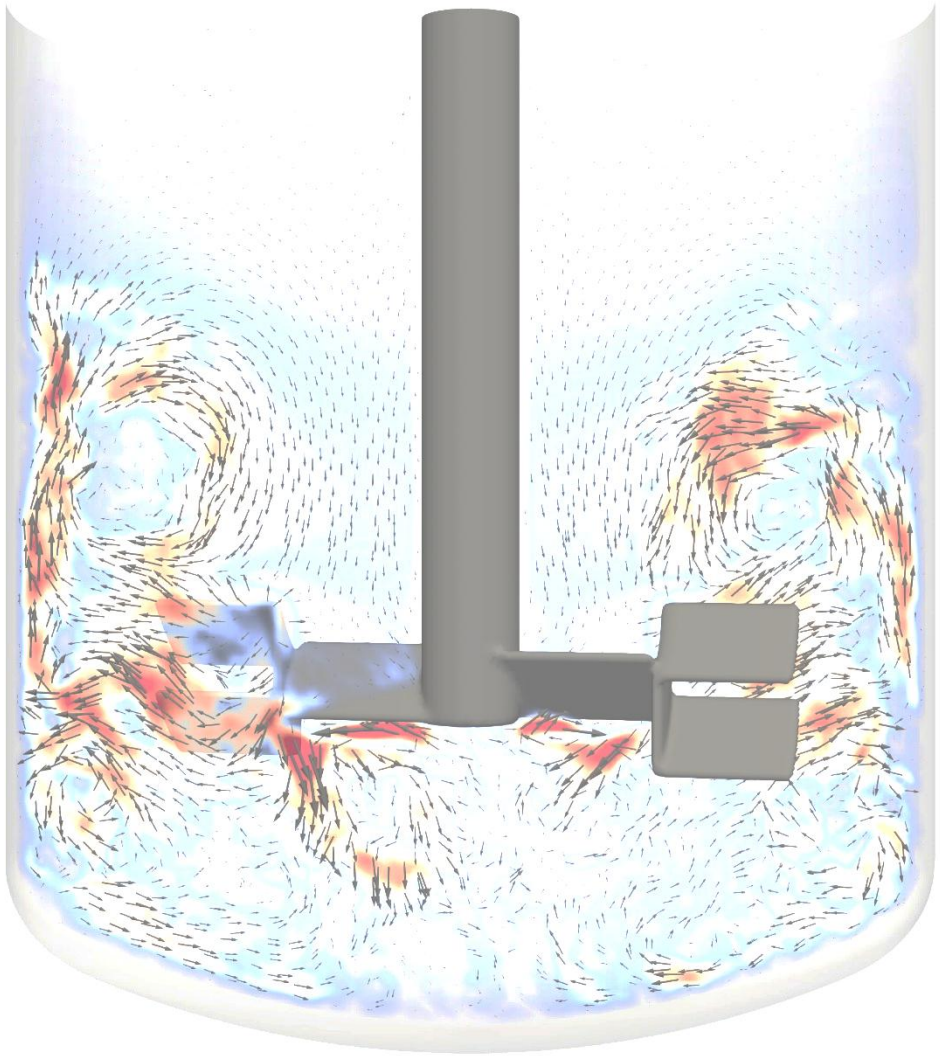


20% Reduced energy demand

Saving € 350.000 per reactor and year

30% Faster mixing

Bernauer, Eibl, Witz, Khinast, Hardiman (2022), “Analyzing the effect of using axial impellers in large-scale bioreactors”, B & B 119

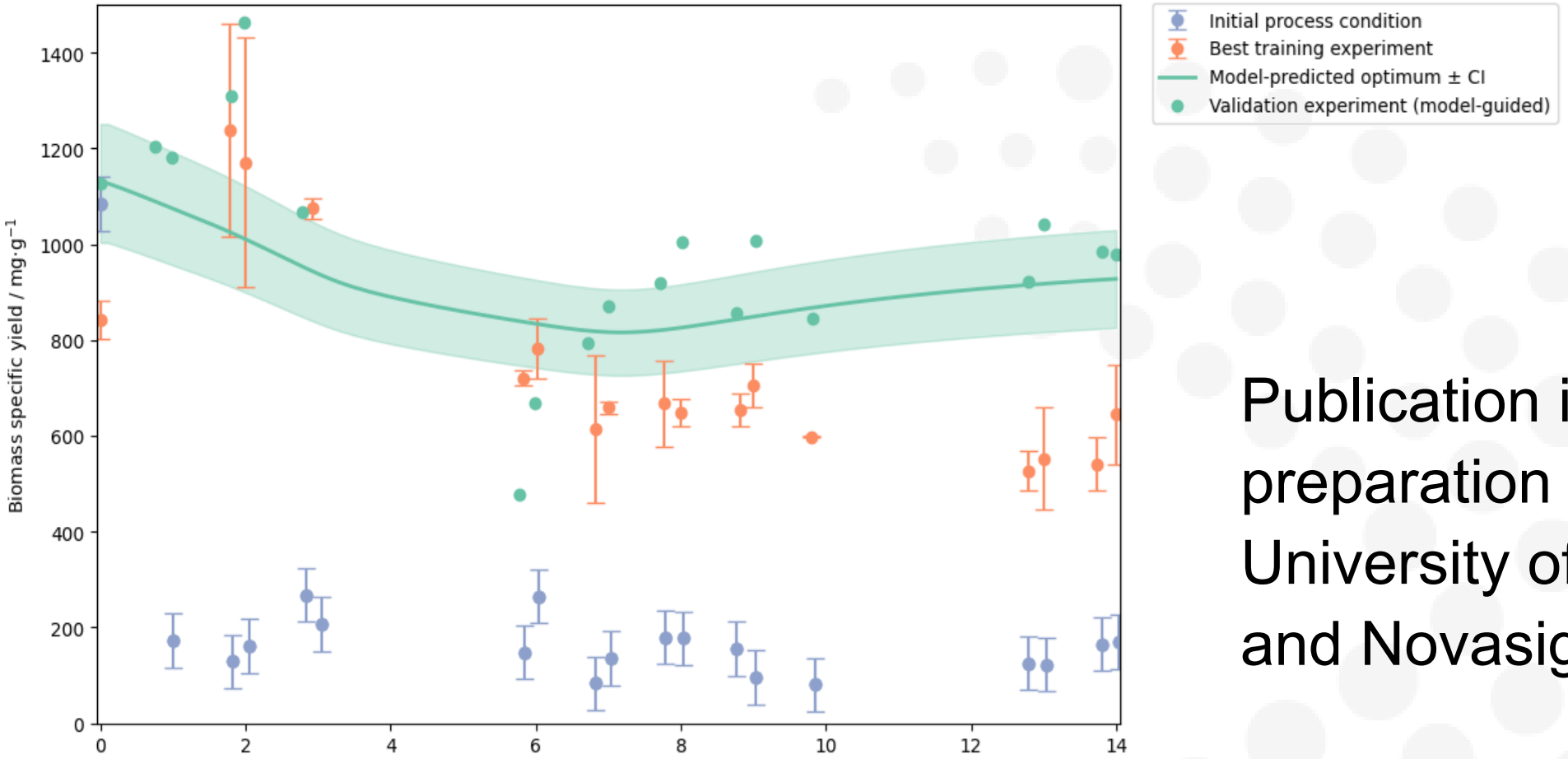


Use-Case Methanothermobacter

Optimization and Scale-Up of a *Methanothermobacter marburgensis* Fermentation

Case Study - Methanothermobacter

- Hybrid model-guided Optimization of a *Methanothermobacter marburgensis* Fermentation

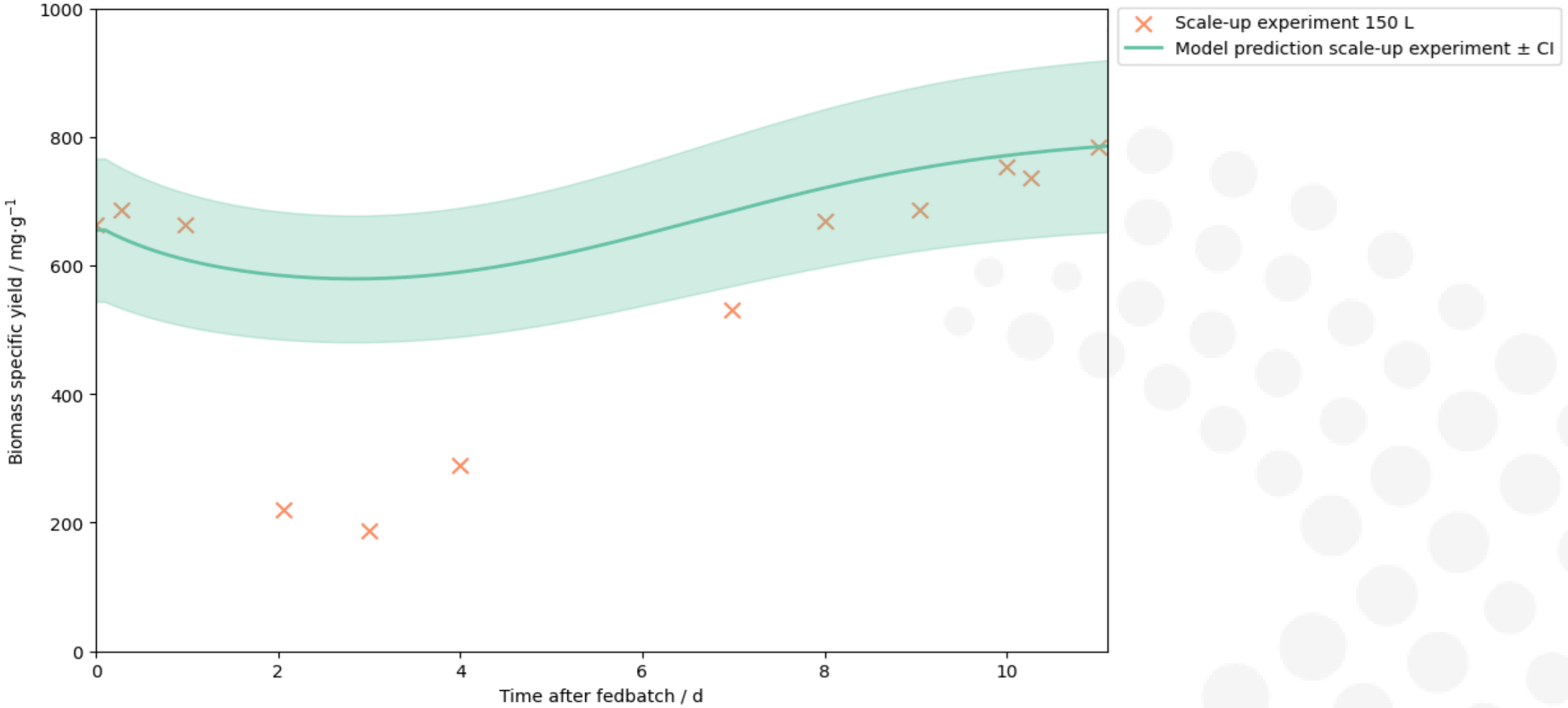


Publication in preparation with University of Vienna and Novasign

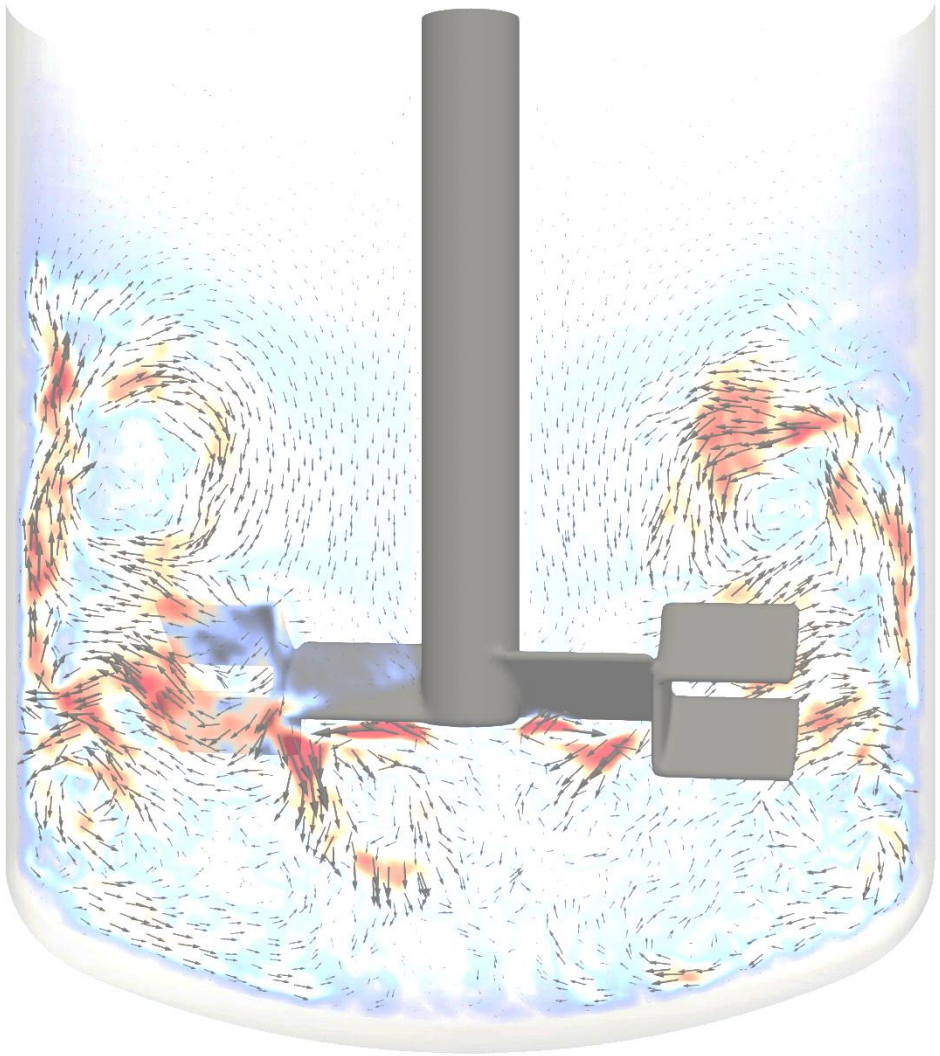
CONFIDENTIAL | © SimVantage 2025

Case Study - Methanothermobacter

- Scale Up to 150L guided by SimVantage and Novasign



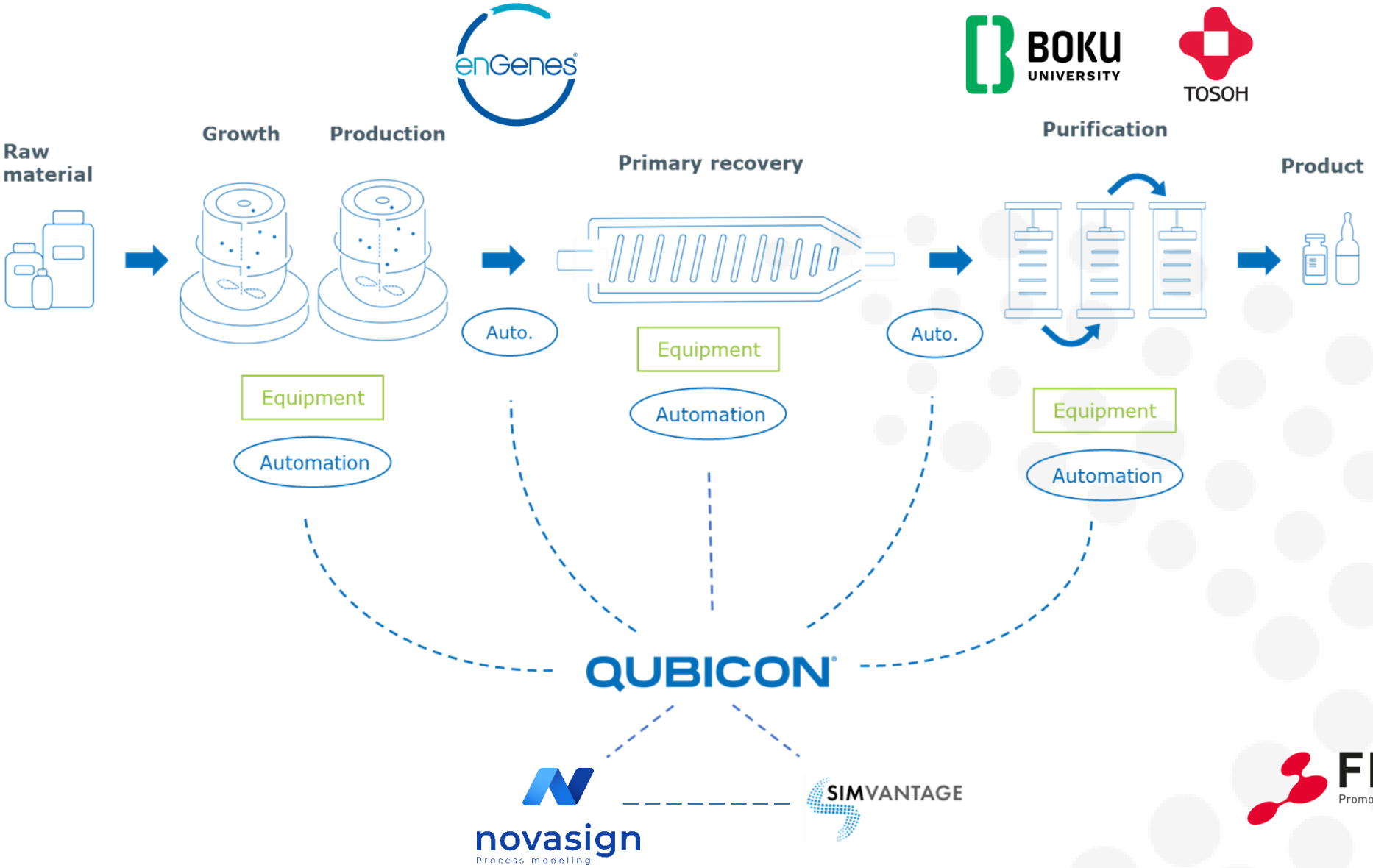
CONFIDENTIAL | © SimVantage 2025



Use-Case Econti

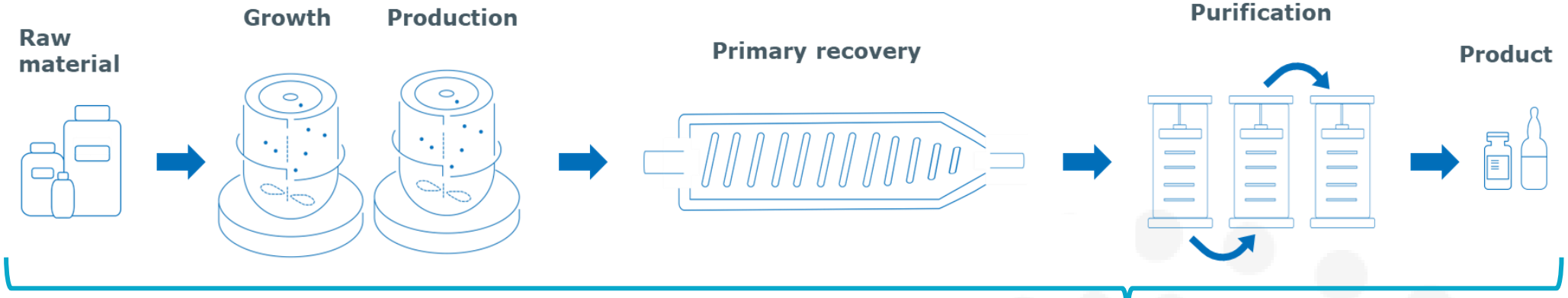
Digital Twin for a Continuous Bioproduction with E.Coli

Use Case: ECOnti

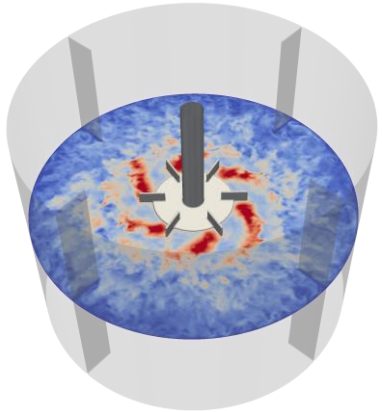


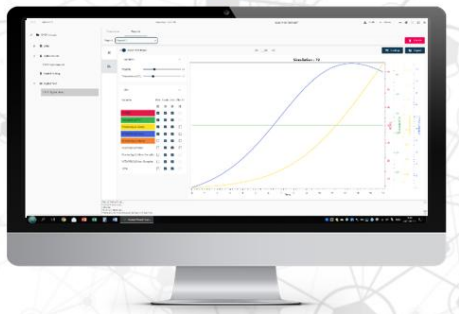
Video Link

ECOnti – Model Responses



Scale-up





Model Predictive Control

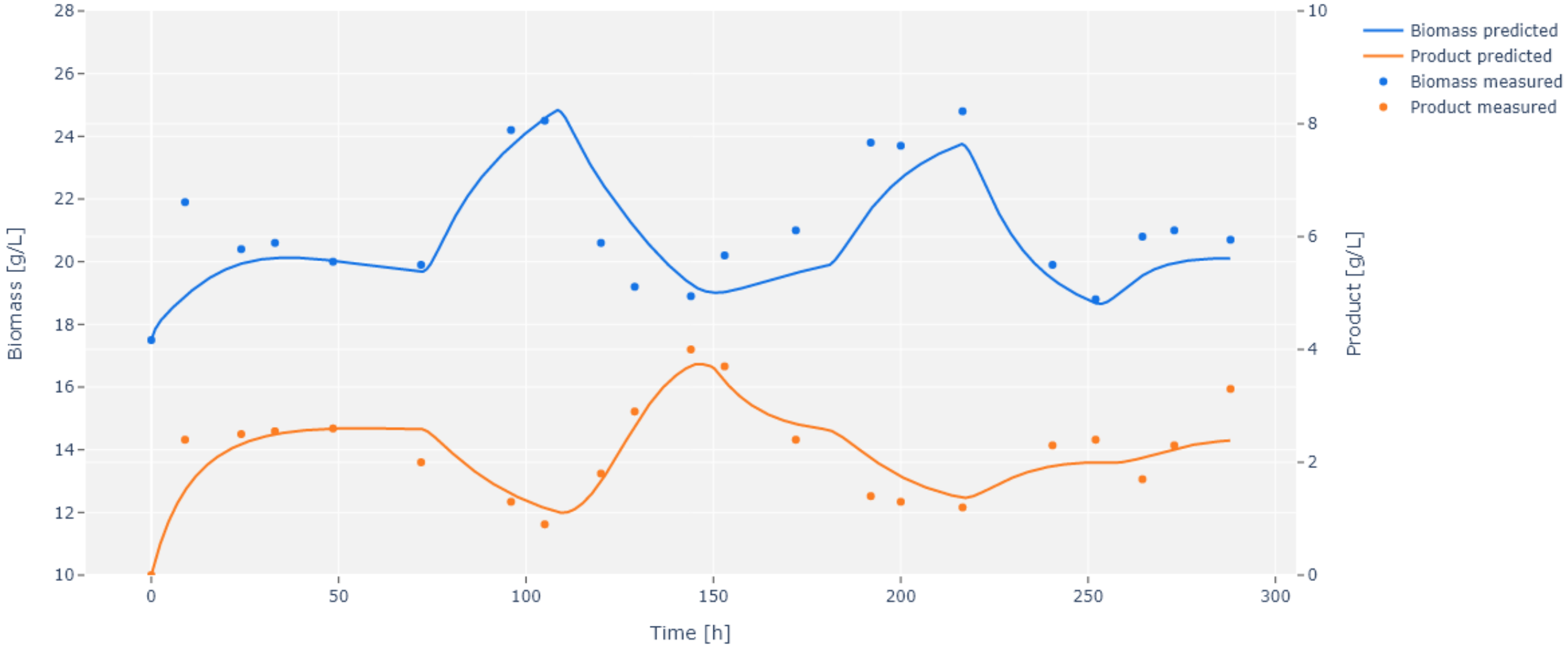
Digital Twin (process representation)

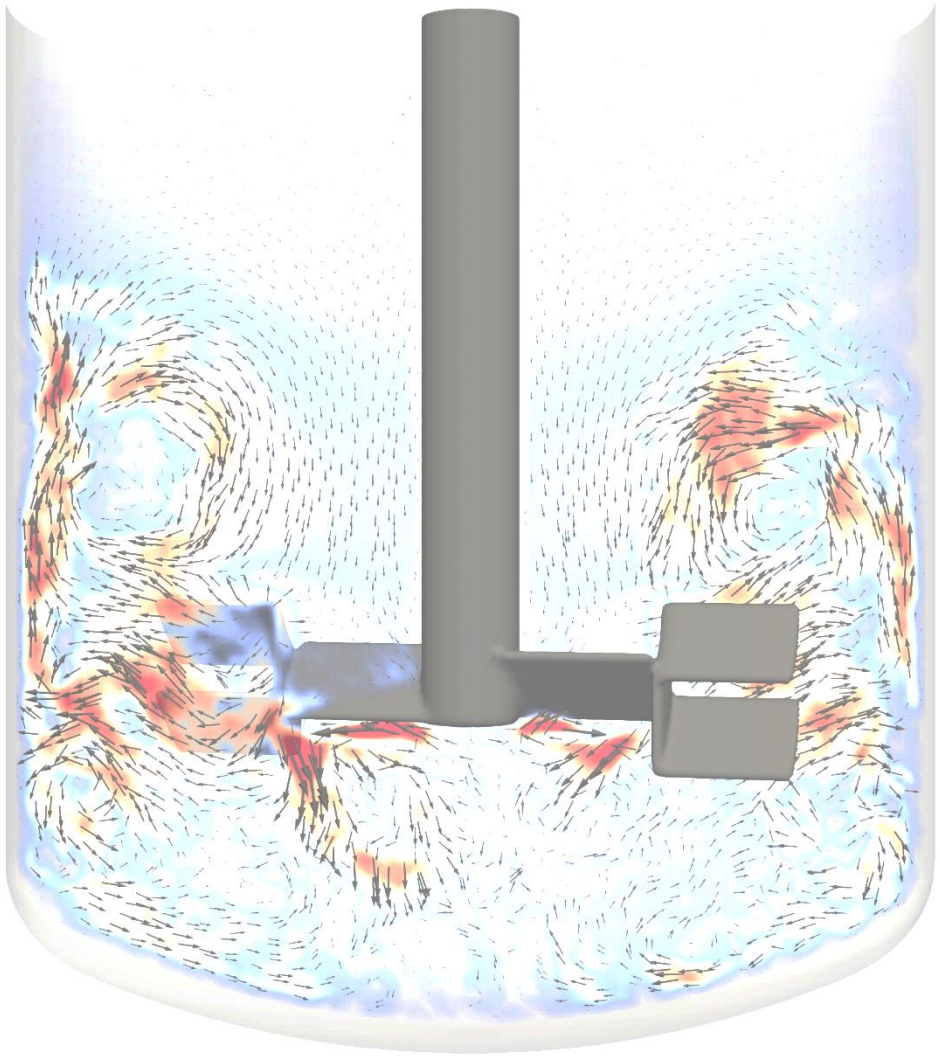
Integration of mechanistic CFD Knowledge into process twin to enable scale-up

Building digital process twin for each unit operation and for full process chain (end-to-end)

CONFIDENTIAL | © SimVantage 2025

Digital Twin Results vs. Offline Sampling





Use-Case Scale-up

A combination of first-principle
and data driven models

Combination with Hybrid Models

Any Lab-scale DoE

Process parameters

Physical parameters

Geometry

Conversion with CFD

SIMVANTAGE

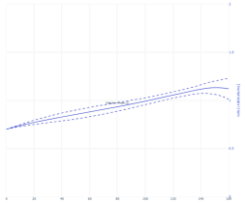
Microclimate of the cell

Shear rate

Concentrations (dO_2, dCO_2)

Temperature

Digital Twin of Bioprocess



novasign
Process modeling

Prediction

of ideal process parameters at large scale

other DoE parameters

Large-scale production

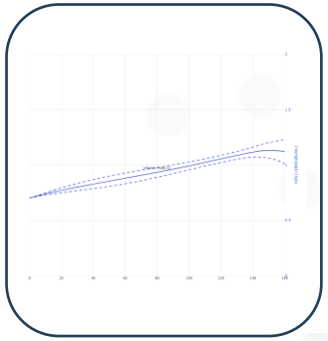
Combination with Hybrid Models

Experimental Plan

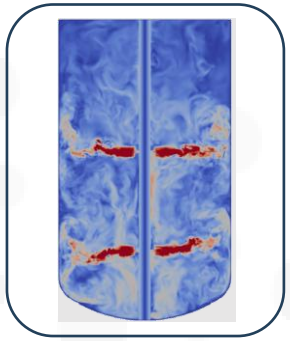
Small-Scale Experiments

CFD Characterization Small scale

Digital Process Twin



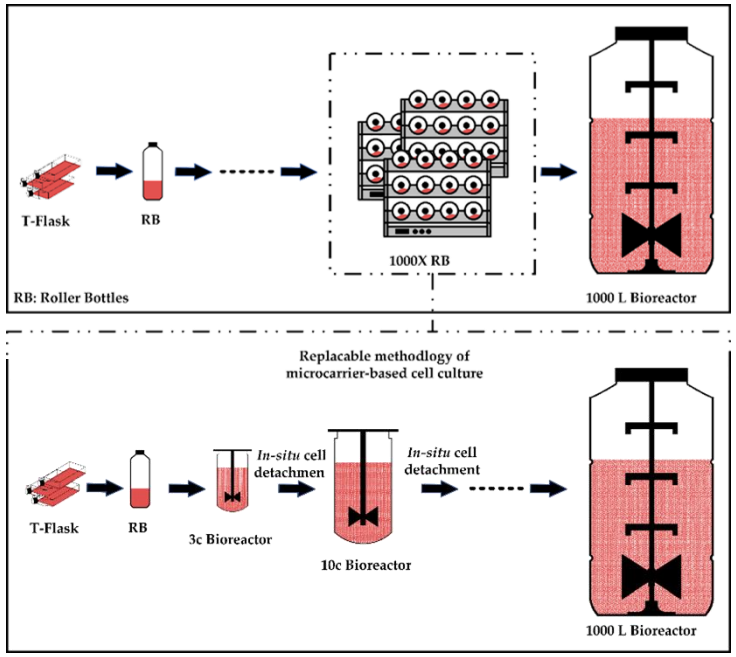
CFD Characterization Large Scale

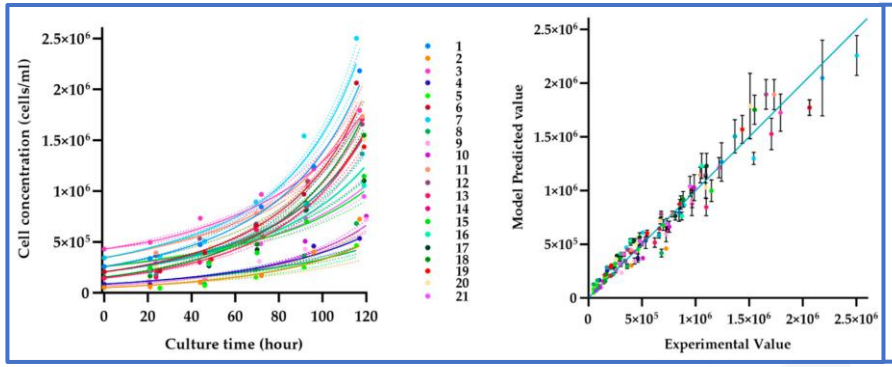


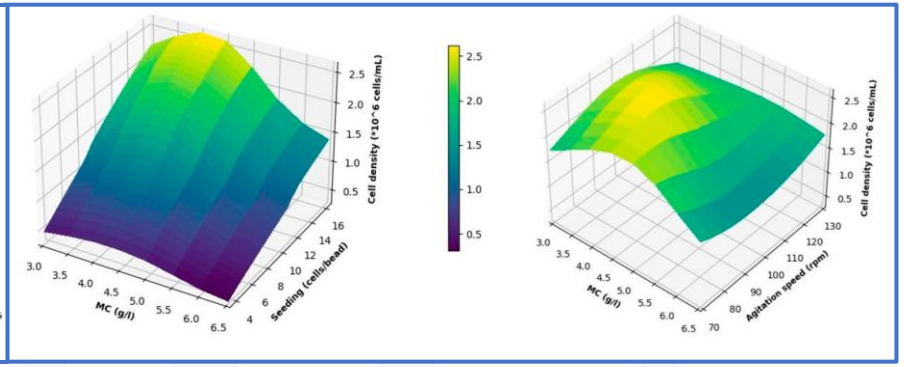
Ideal process conditions

Application for Viral Production

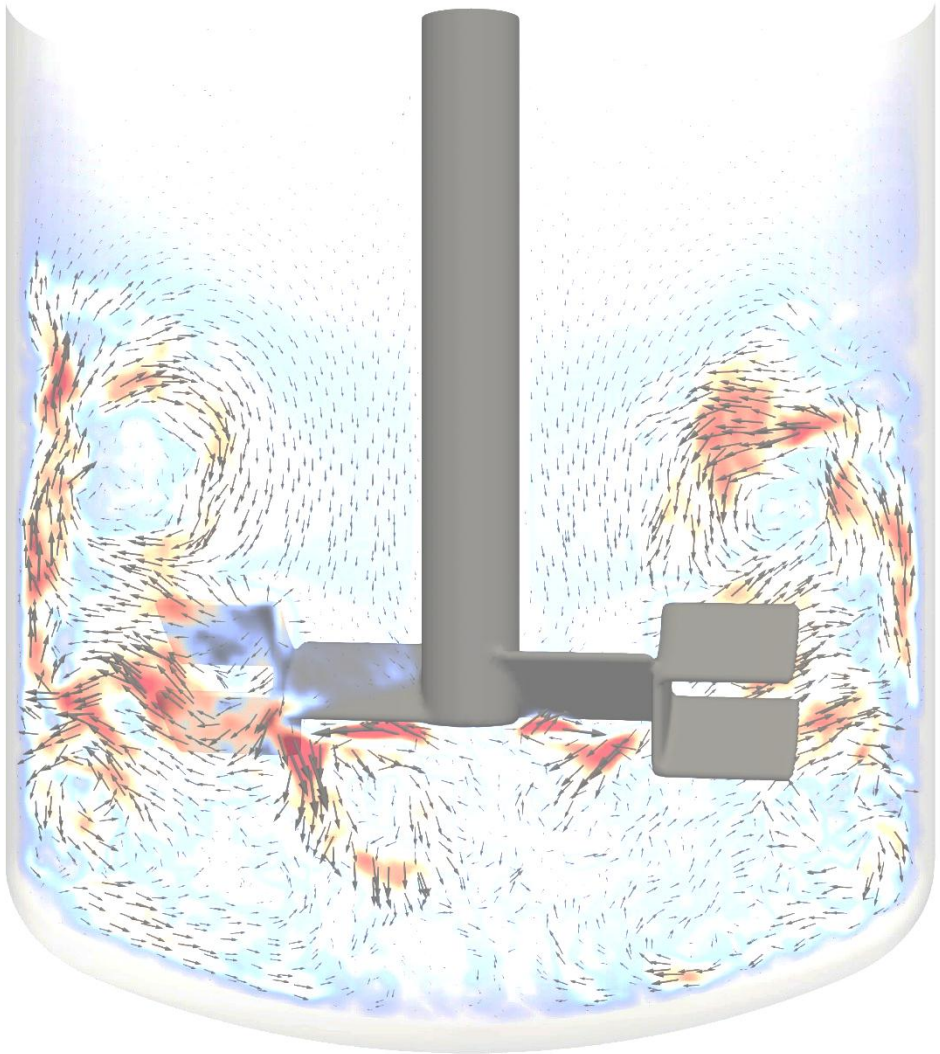
- Seed Train optimization to increase space-time yield while reducing costs and contamination risk







- Allowed optimized upstream from Spinner to 1000L SUB
- 42% higher Space-Time yield compared to gold standard seed train
- Lower contamination risks



Use-Case Shake-Flask

Scale-up of NK-cells from shake flasks to stirred tanks

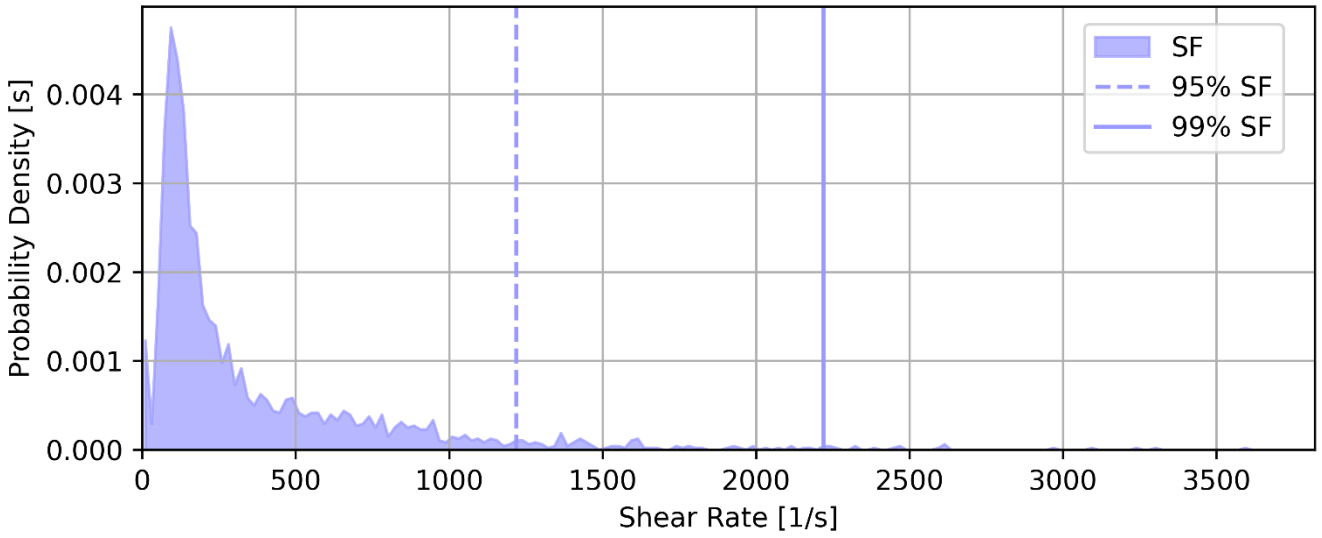
In collaboration with TU Vienna

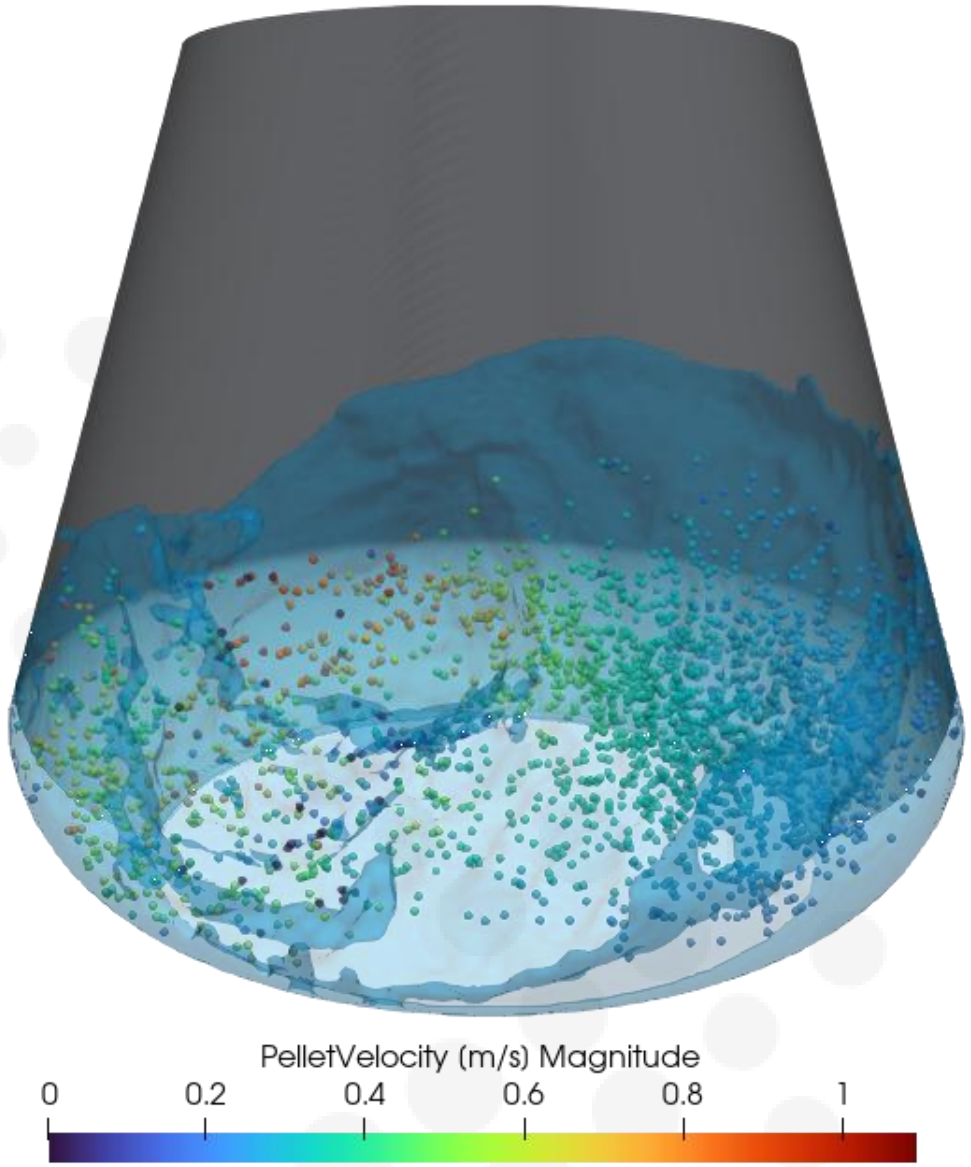
Preliminary Results – Cell Lifelines

25mm orbital diameter

250ml flask

100rpm speed





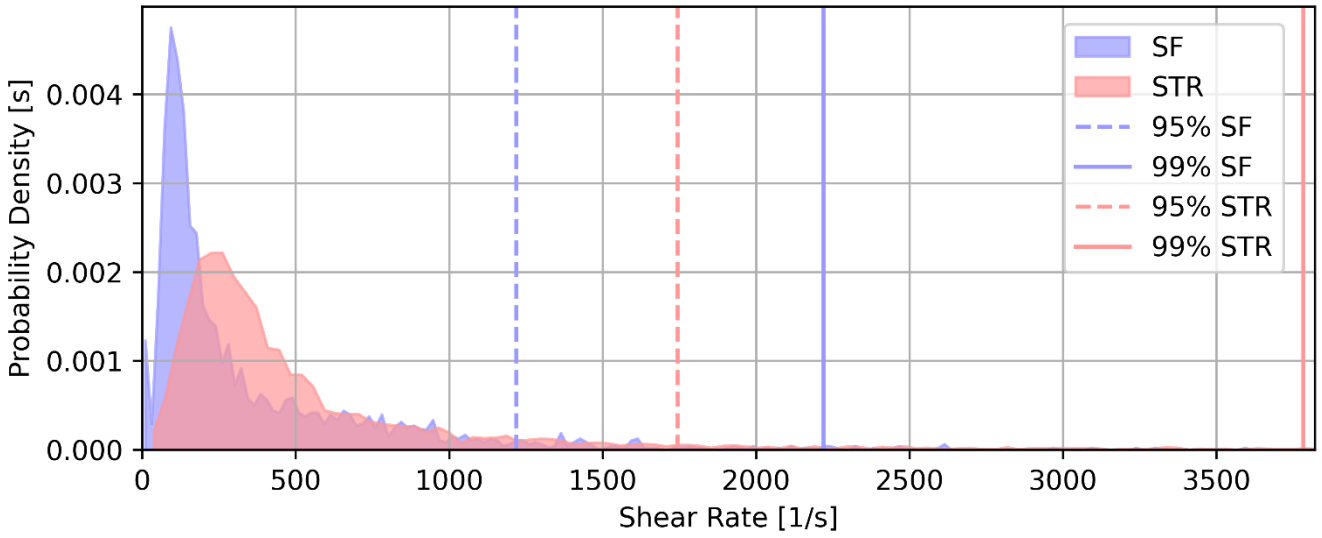
CONFIDENTIAL | © SimVantage 2025

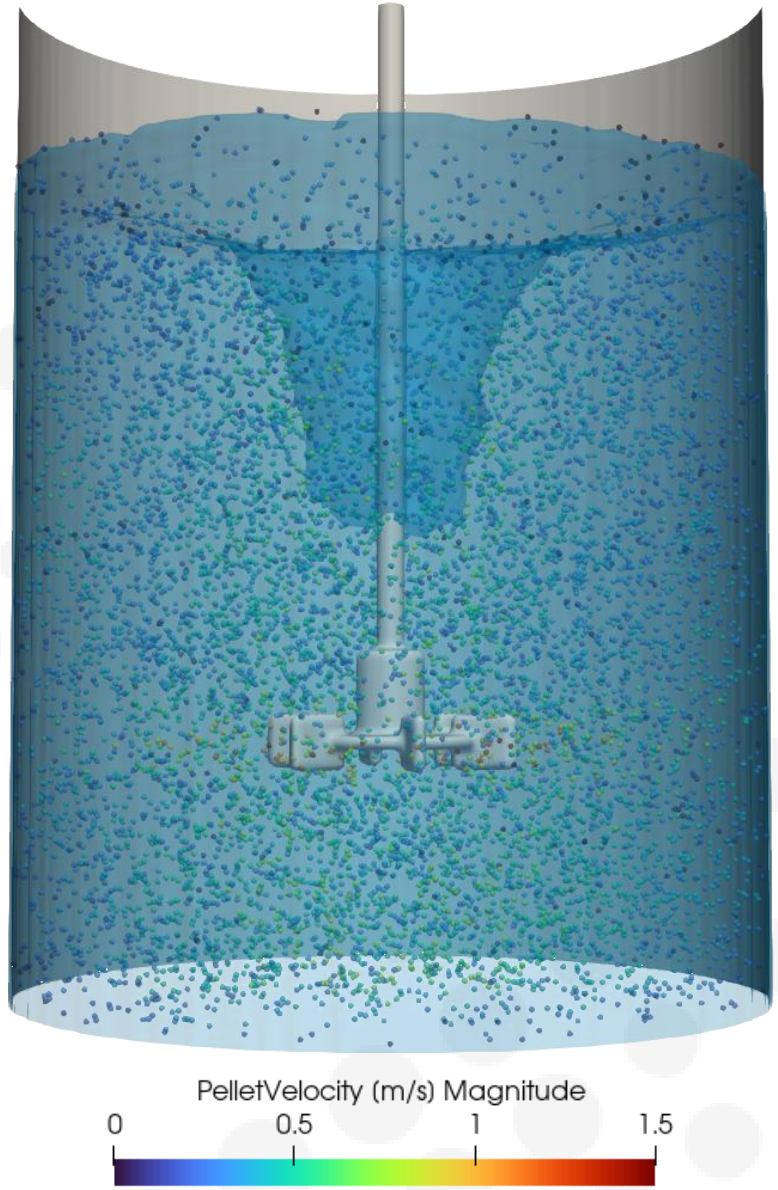
Preliminary Results – Cell Lifelines

Standard tank geometry

0.1m^3 broth volume

300rpm speed

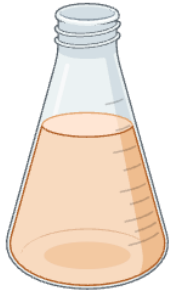




CONFIDENTIAL | © SimVantage 2025

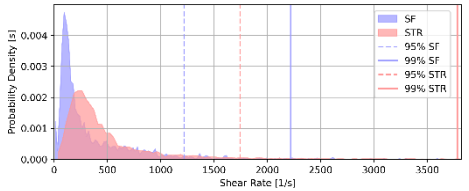
Scale-Up Framework

Shake flask
Laboratory scale
cell expansion

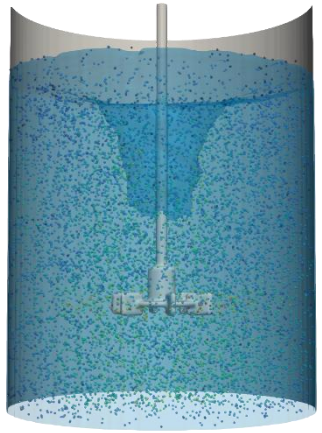


Experiments to determine the ideal microenvironment

Simulation of the shake flask to descripe the hydrodynamic conditions



IN-SILICO
SCALE-UP



Find the ideal operating point to mimic the hydrodynamic conditions of the shaking flask

Bioreactor
Industrial scale
cell expansion

Experiments to confirm ideal operating conditions

Oliver Spadiut
Bence Kozma
Valentin Moritz Ferdinand

CONFIDENTIAL | © SimVantage 2025

SIMVANTAGE

SimVantage GmbH
Dr. Christian Witz
Inffeldgasse 13
8010 Graz
Austria
+43 681 207 931 73
christian.witz@simvantage.com