



**BIONIC
SURFACE
TECHNOLOGIES**

**World
Leading
Riblet Expert**

bionic surface technologies

We are a globally active company, based in Austria. Our focus lies in developing engineering solutions. A company-owned HPC system with 1026 cores including a comprehensive license pool is supporting our customers.



2009
Founded



20+
Employees



Biggest CFD
Office in Austria



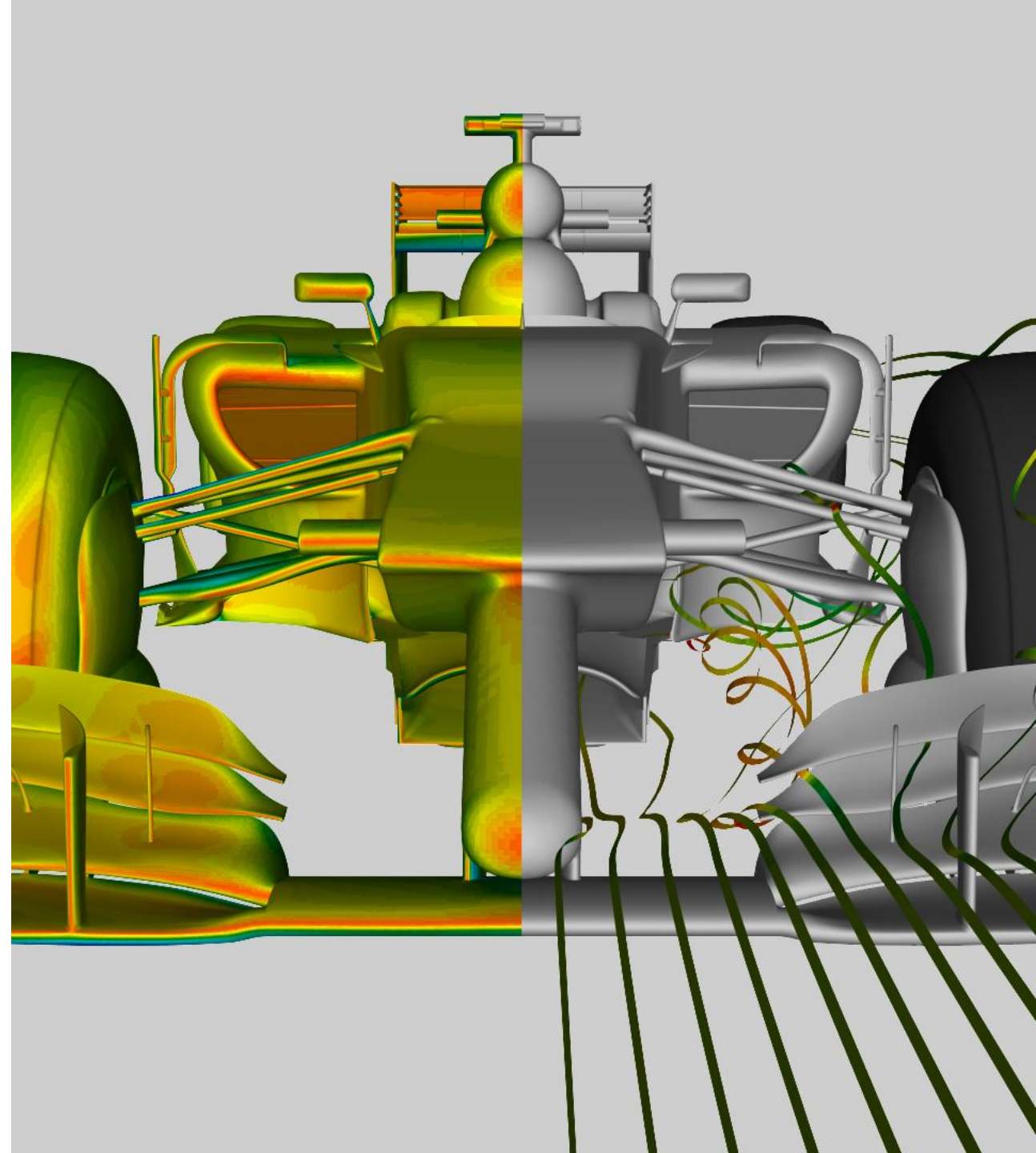
600+
Customers/Projects
worldwide



● Our Office

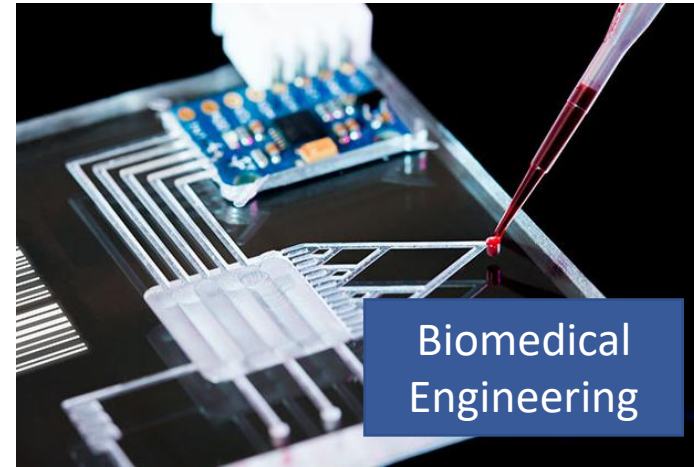
● Our Customers

Multiphysics Modeling



Modeling

Areas of special focus

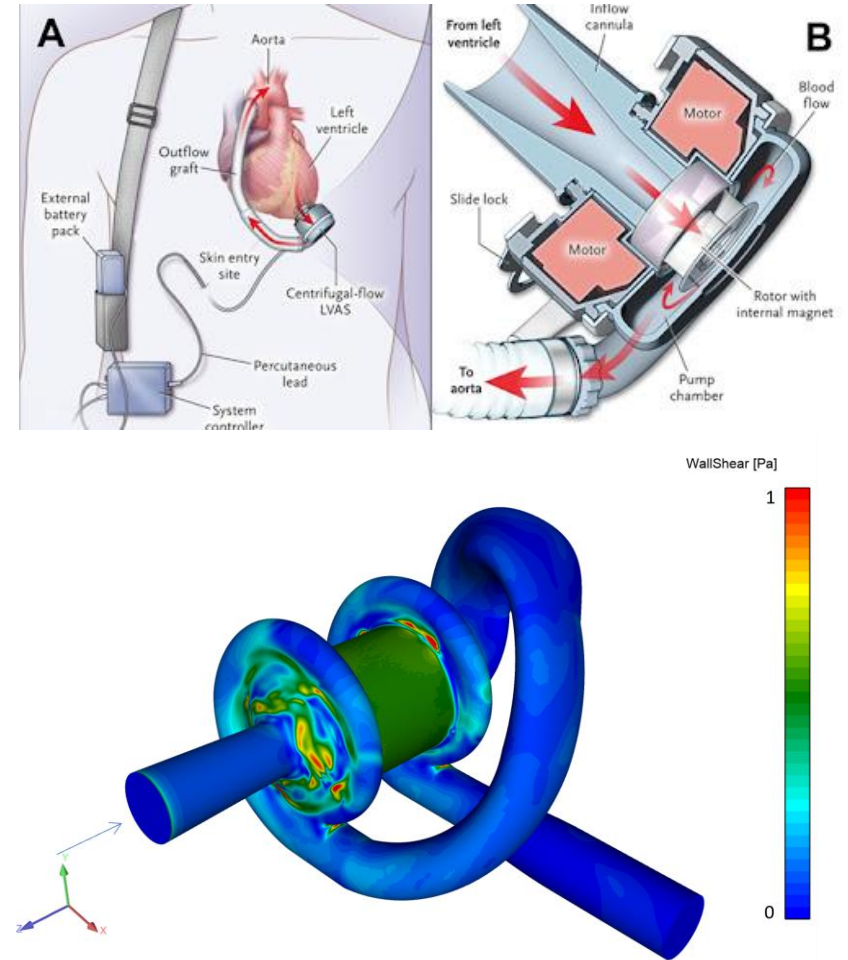


Process Engineering

Biomedical Engineering

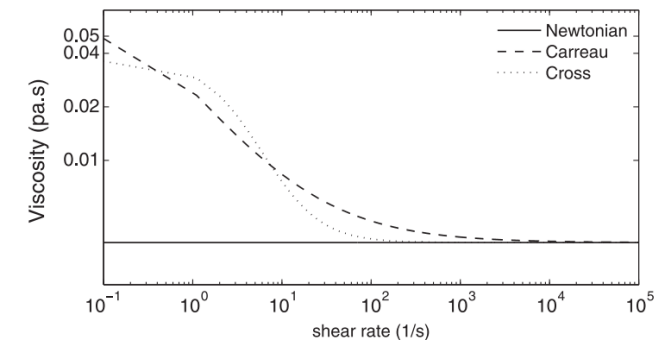
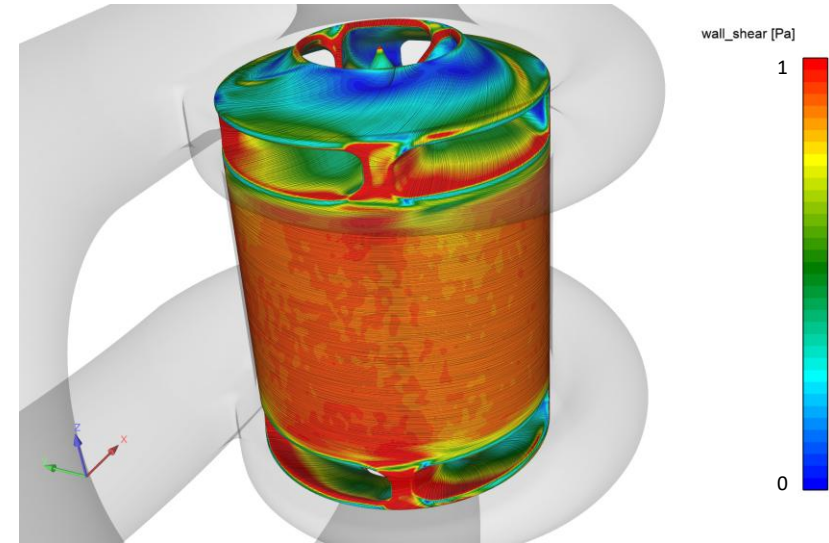
Blood pump

- Laminar – turbulent flow
- newtonian vs. non Newtonian
- Fahraeus-Lindqvist effect:
Newtonian near-wall behavior of blood
- 3D CFD simulations, validation and hydrodynamic optimization of micro/nano functionalization



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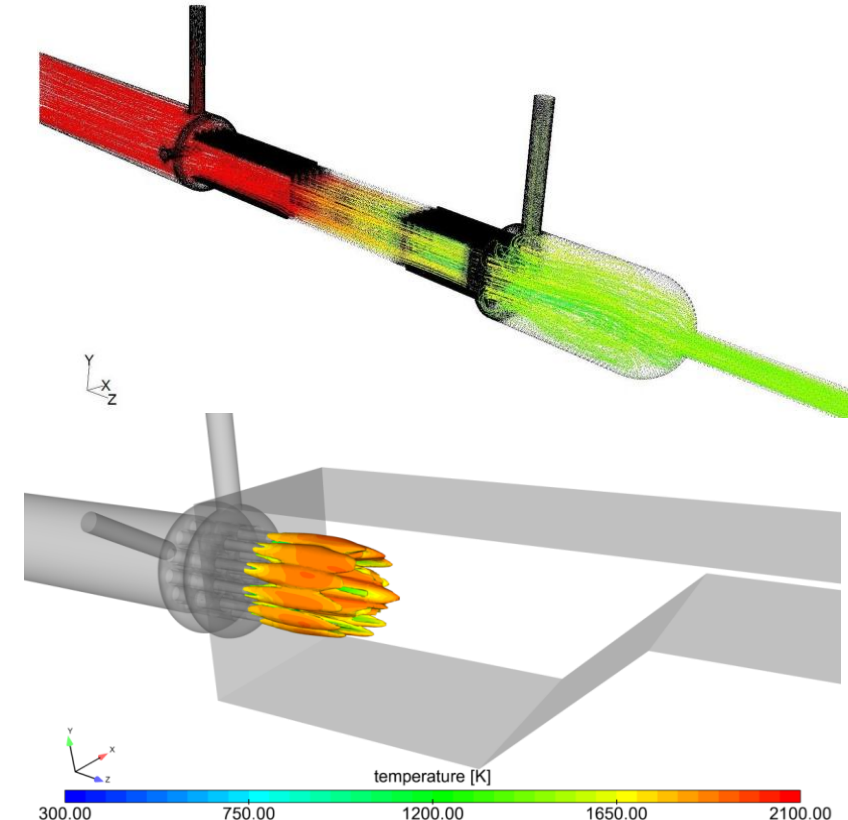


Viscosity of blood for Newtonian and non-Newtonian models versus strain rate.

Catalytic Processes – Reaction models

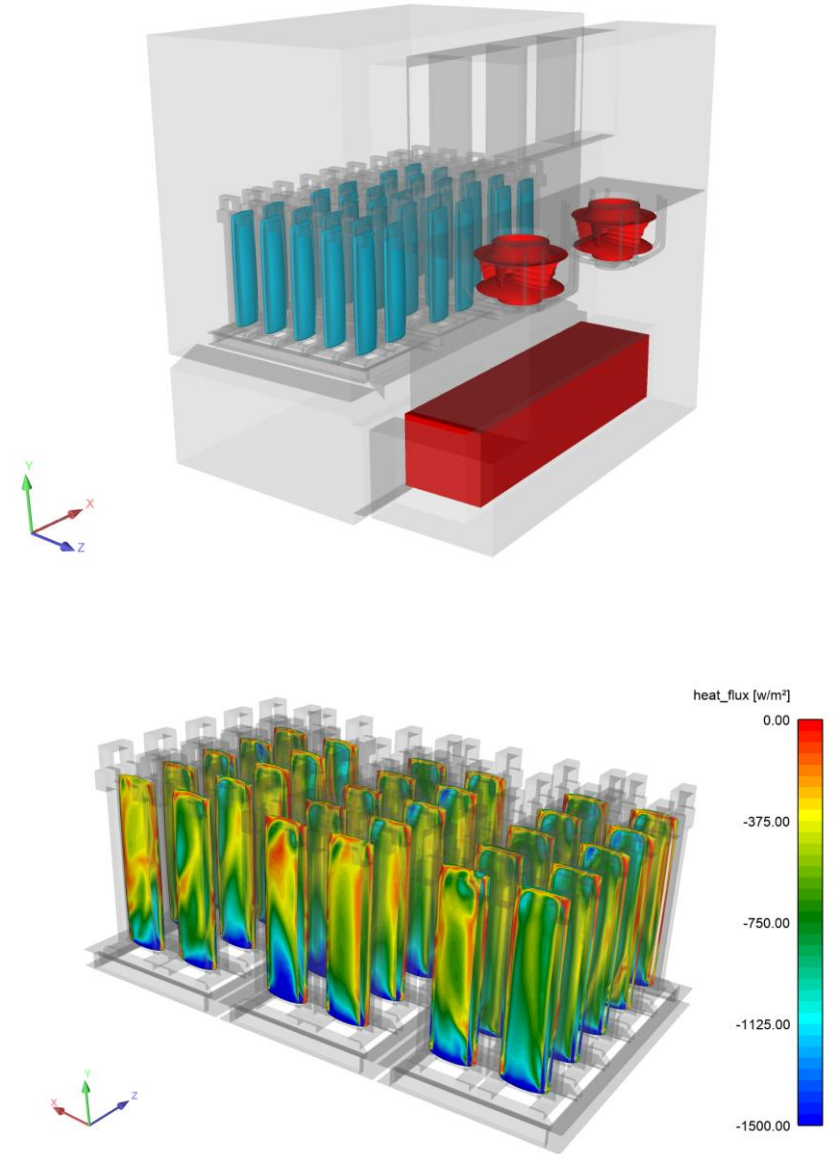
- Build up of digital twin models
- Chemical reactions
- Thermodynamic
- Heat Transfer, Radiation & Conduction
- Fluid Flow

```
! 12/8/08 CVN removed Ar, C3H8, C3H7
!
! GRI-Mech Version 3.0 7/30/99 CHEMKIN format
! See README30 file at anonymous FTP site unix.sri.com, directory gri;
! WorldWideWeb home page http://www.me.berkeley.edu/gri\_mech/ or
! through http://www.gri.org, under 'Basic Research',
! for additional information, contacts, and disclaimer
ELEMENTS
0 H C N
END
SPECIES
H2 H O O2 OH H2O HO2 H2O2
C CH CH2 CH2(S) CH3 CH4 CO CO2
HCO CH2O CH2OH CH3O CH3OH C2H C2H2 C2H3
C2H4 C2H5 C2H6 HCCO CH2CO HCCOH N NH
NH2 NH3 NNH NO NO2 N2O HNO CN
HCN H2CN HCCN HCN O HCN HNC NCO
!AR C3H7 C3H8
CH2CHO CH3CHO N2
END
!THERMO
! Insert GRI-Mech thermodynamics here or use in default file
!END
REACTIONS
2O+M<=>O2+M 1.200E+17 -1.000 .00
H2/ 2.40/ H2O/15.40/ CH4/ 2.00/ CO/ 1.75/ CO2/ 3.60/ C2H6/ 3.00/ !AR/ .83/
O+H+M<=>OH+M 5.000E+17 -1.000 .00
H2/2.00/ H2O/6.00/ CH4/2.00/ CO/1.50/ CO2/2.00/ C2H6/3.00/ !AR/ .70/
O+H2<=>H+OH 3.870E+04 2.700 6260.00
```



Defrosting equipment

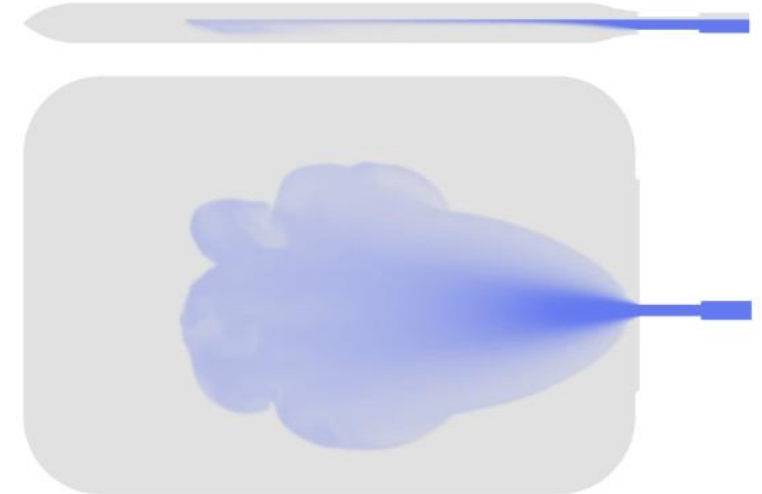
- Ice melting, Shaking of bags
- CHT Simulation
- 3D CFD simulations, validation and hydrodynamic optimization of micro/nano functionalization



Orbital shaker

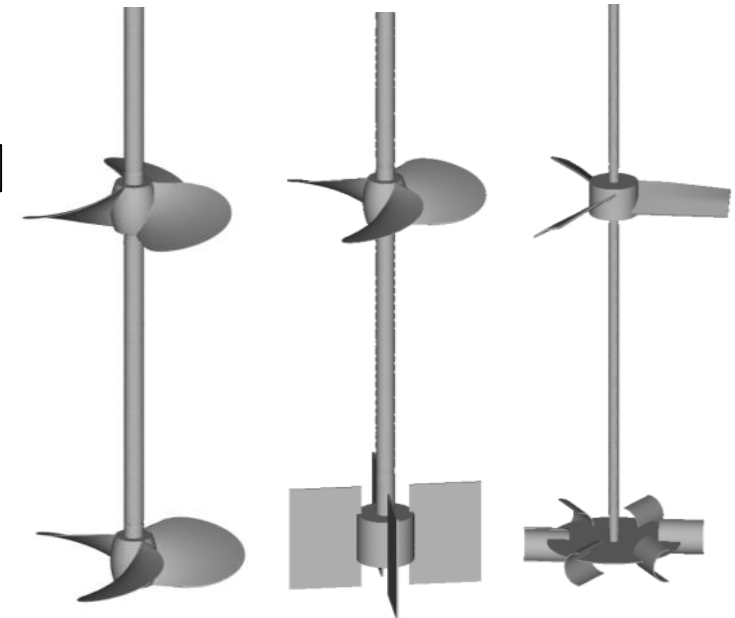
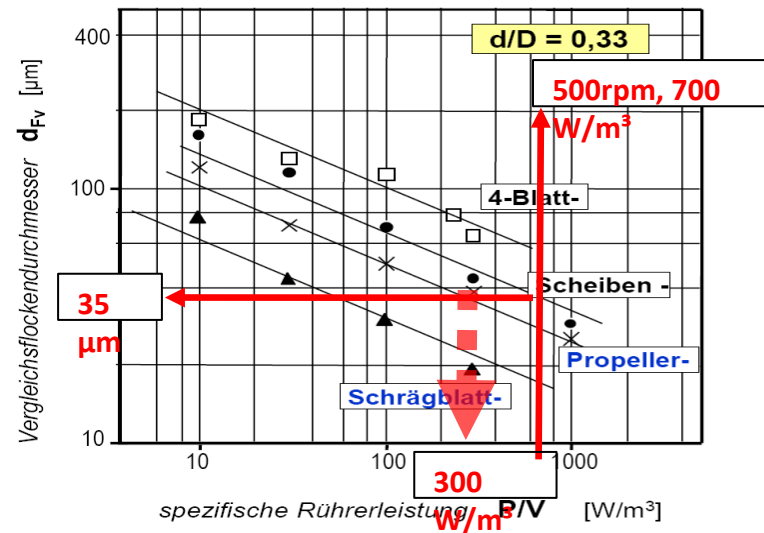
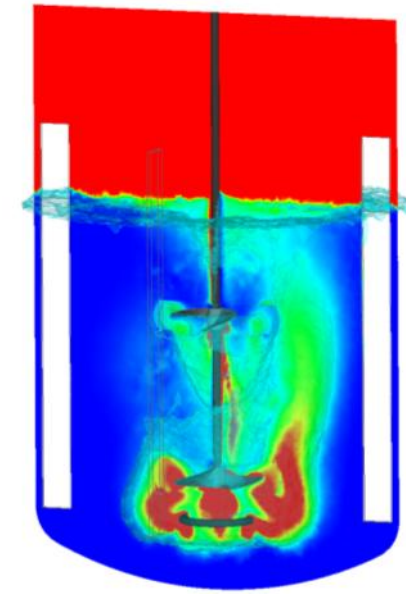
- Multiphase Modell
- Shaking process
- Mixing behavior, Diffusion process

0.005 s



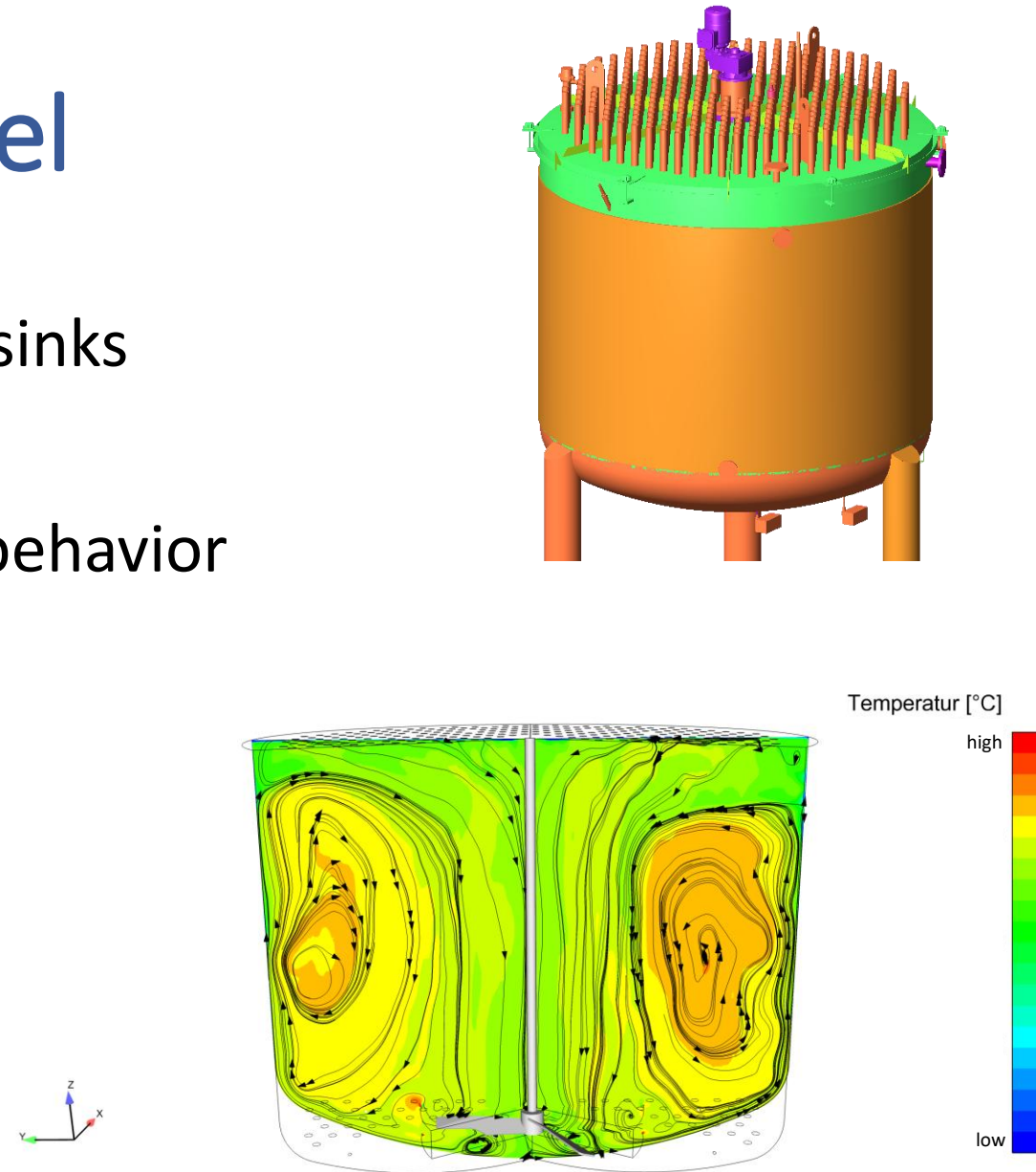
Fermenter analysis

- Multiphase Modell
- Mixing behavior
- Up- Downscaling behavior



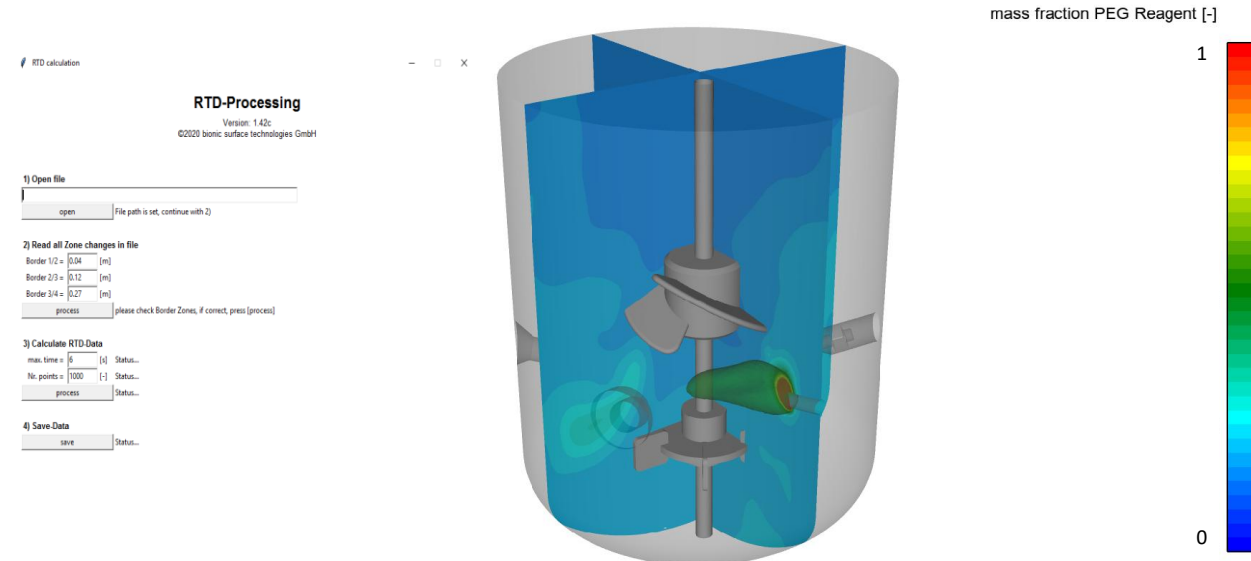
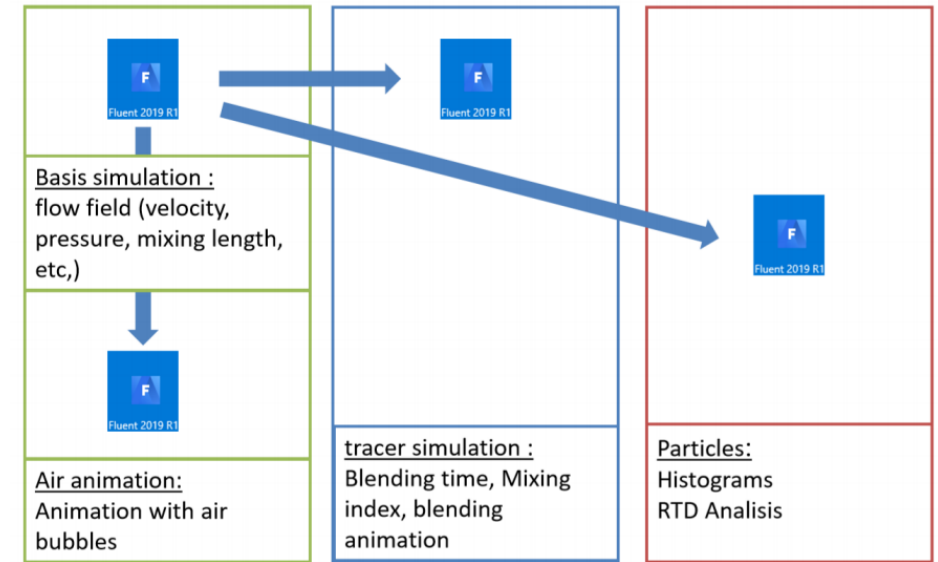
Agitator vessel

- Heat sources and sinks
- Mixing behavior
- Up- Downscaling behavior
- Shear rates



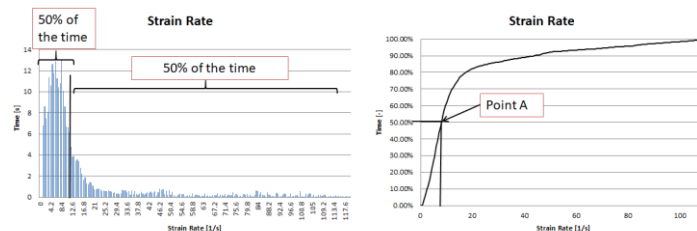
Bioreactor modeling

- Developing of new designs
- Troubleshooting
- Redesign
- Product development
- Evaluation tools with Modeling
- Software development (Particle residence time distribution)



Bioreactor modeling

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Numbers
Tip speed
Re Number
Torque
Power
Power Number
Froud Number
Total Power
Power/Volume
Average Strain Rate
Av Eddy Dissipation Rate
Av Kolmogorov Mixing Length
Av Micromixing Timescale
Av meso mixing Timescale

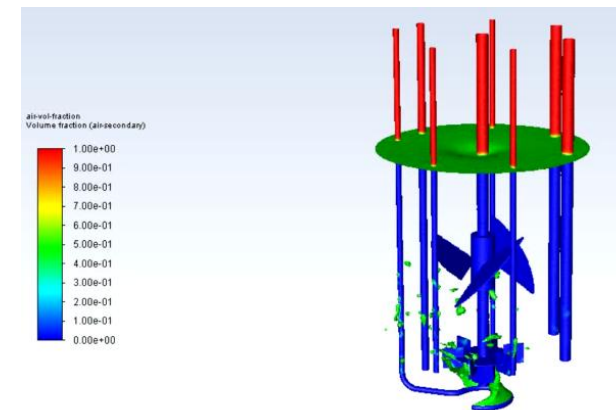
Air water
Water surface
Animation bubbles
Cell number increase
viscosity change
densitiy change

Contours
Velocity
Pressure
Hydrostatic Pressure
Velocity vectors
Meso mixing time
Micro mixing time
Strain rate
Turb eddy disipation
Kolmogorov mixing length

Histogramms
Mixing index vs time
Strain rate histogram
Kolmogorov mixing length histogram
Turb dissip hrate histogram
Dimensionless Z coord histogram
Zonal RTD histogram

Diagrams
Av Vel convergence
Av Moment convergence
Blending time monitors

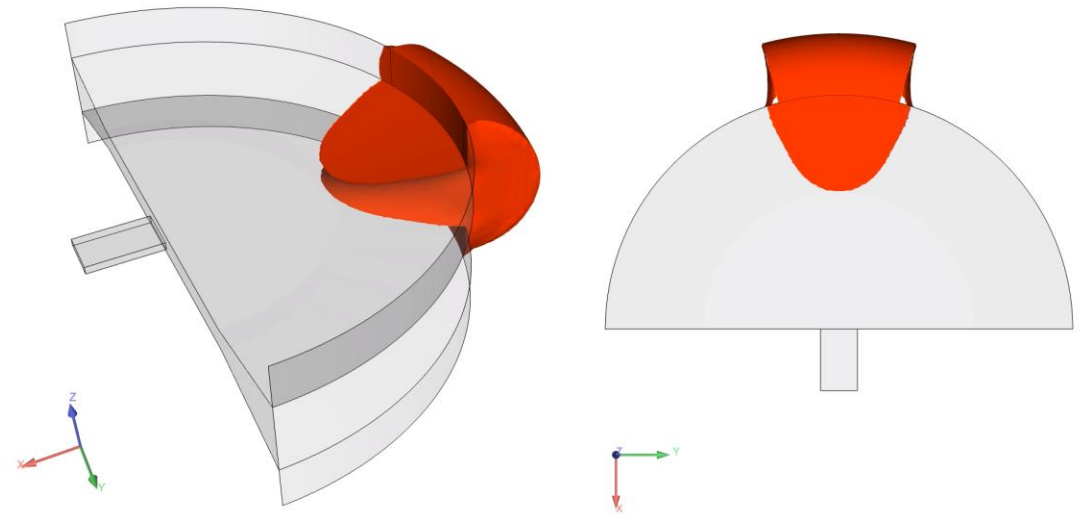
Animation
tracer blending



Microfluidic - Passive flow

- Capillary driven
- Is the meniscus moving?
- Is the test sample uptaken?
- Implementation of stop valves, crossings possible
- Mixing of samples

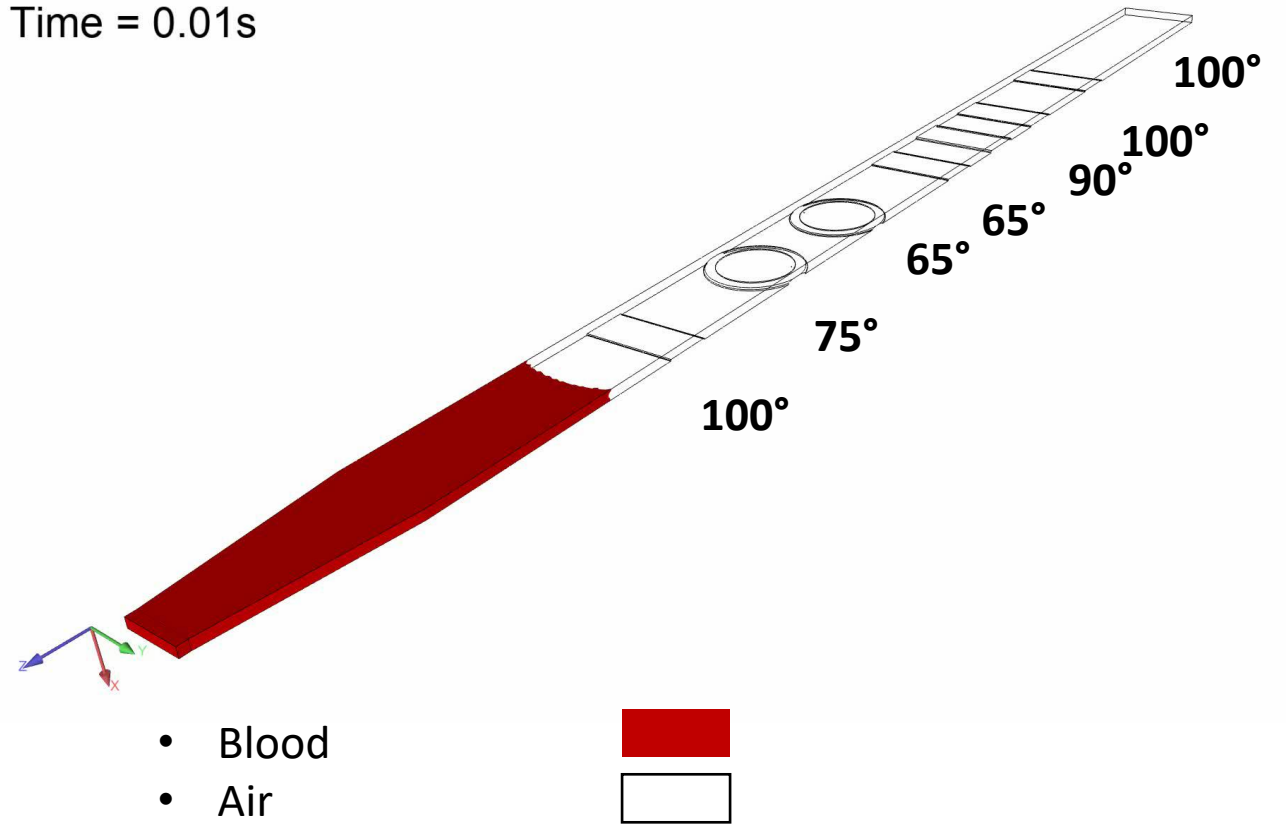
Blood uptake for sensing device



Microfluidic - Passive flow

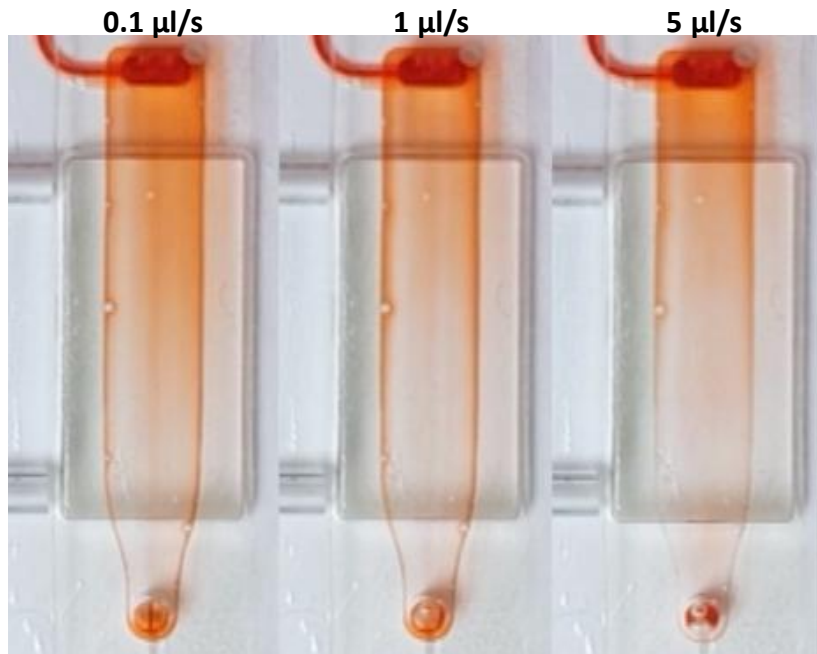
- Capillary driven
- Is the meniscus moving?
- Is the test sample uptaken?
- Obstacles due to sensor areas

Time = 0.01s



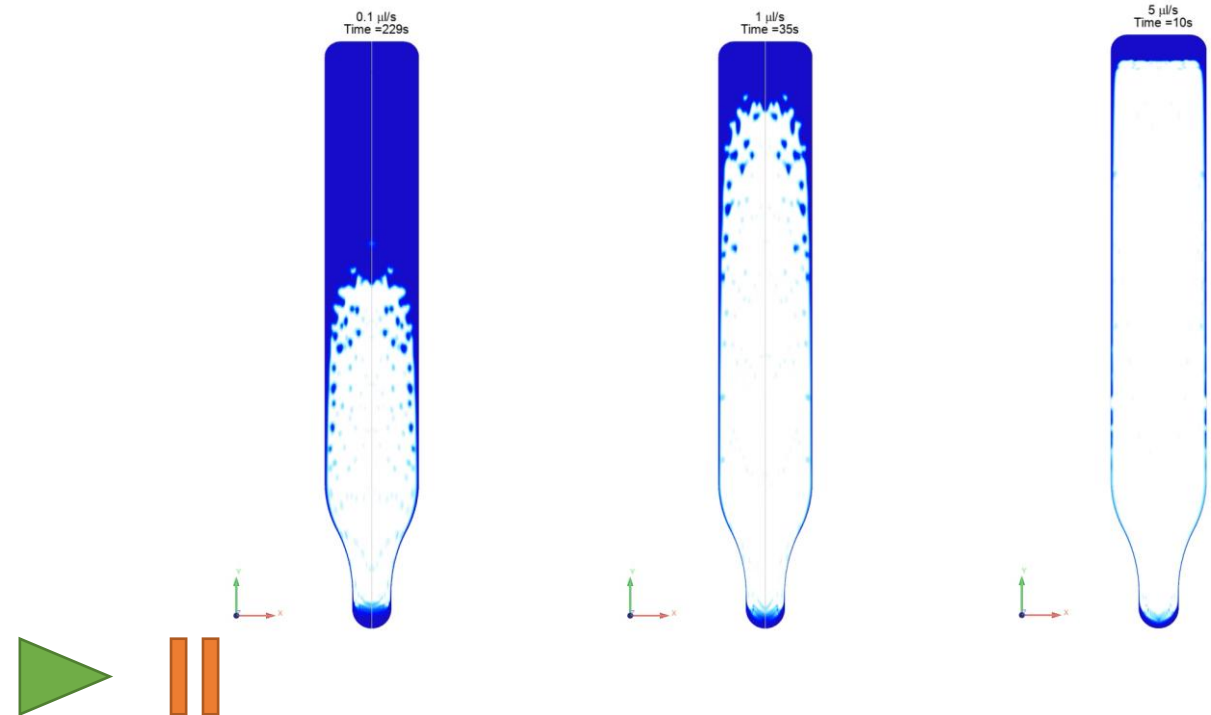
Microfluidic - Active flow - Rinsing

Testdesign 1



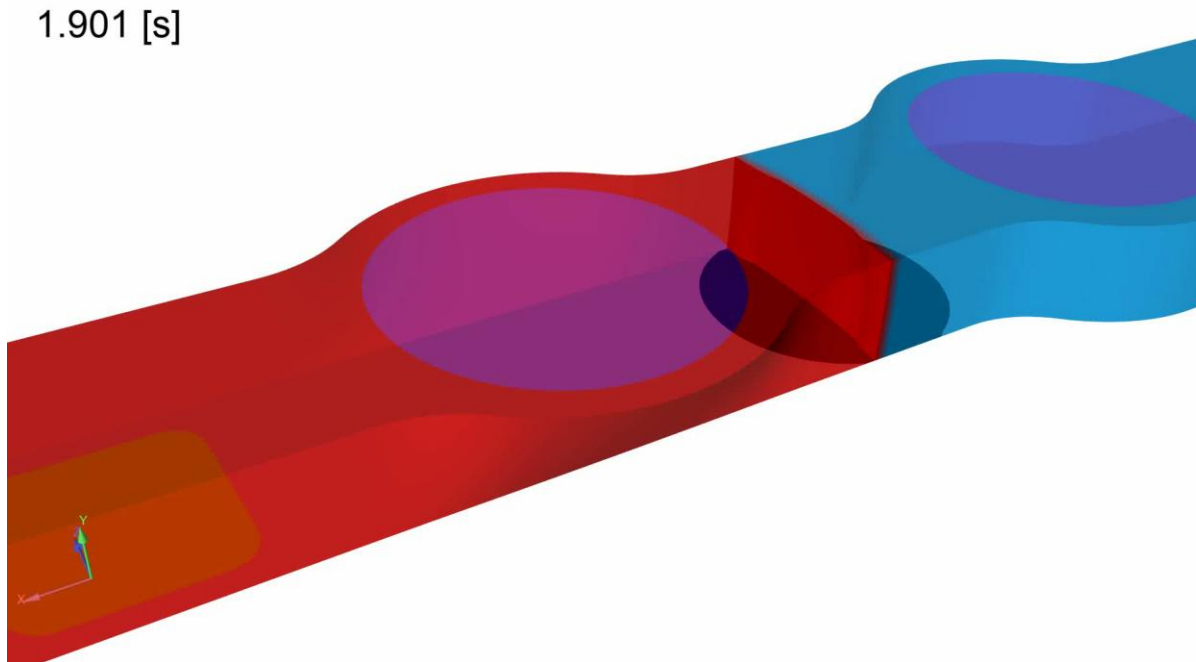
Simulation

■ - Water ink □ - Water pure

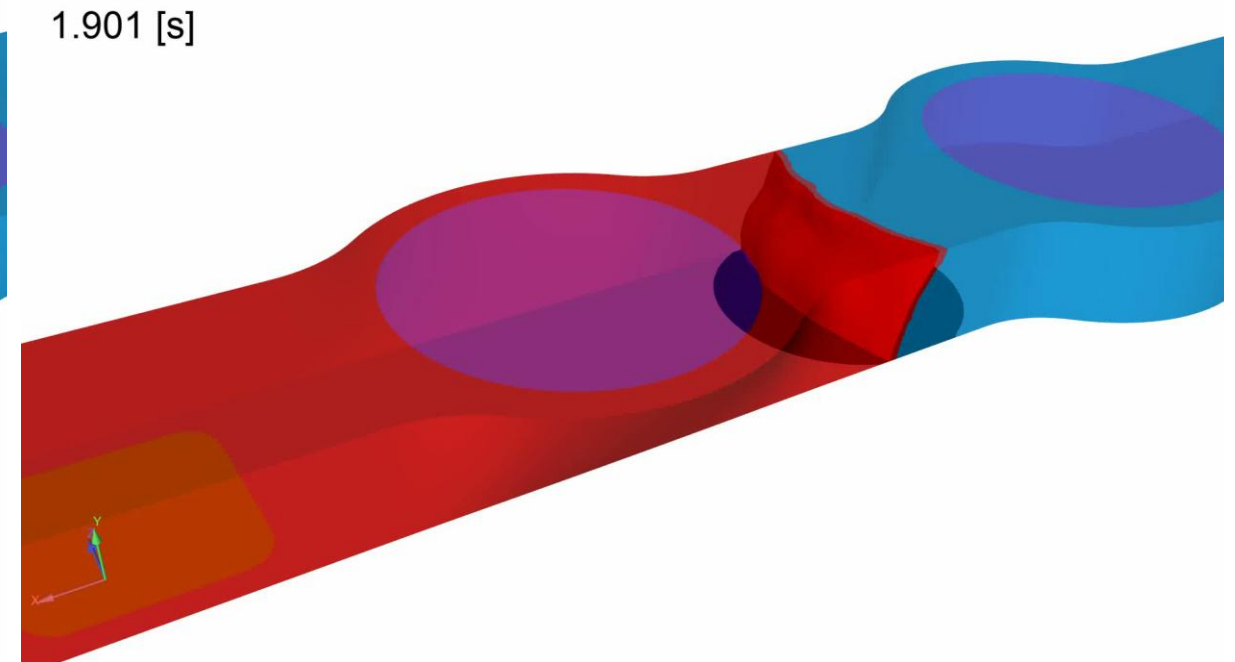


Microfluidic - Active flow - Emptying

- Static CA



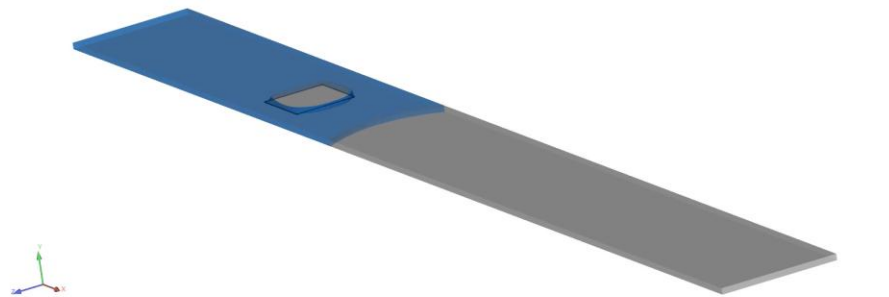
- Receding CA



Microfluidic - Bubble formation

Case A

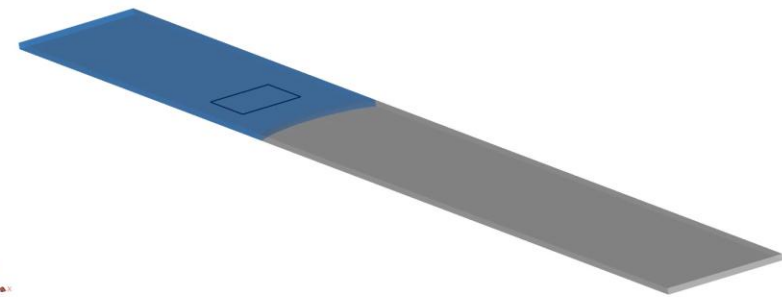
Bubble formation



Wall CA	Defect Area CA
55 deg	160 deg

Case B

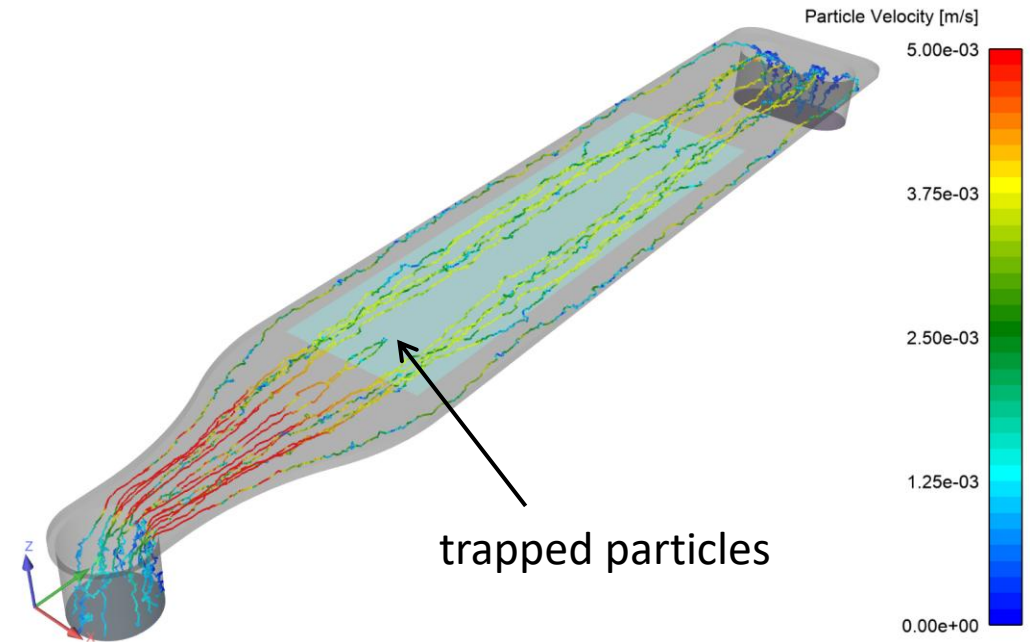
No bubble formation



Wall CA	Defect Area CA
55 deg	80 deg

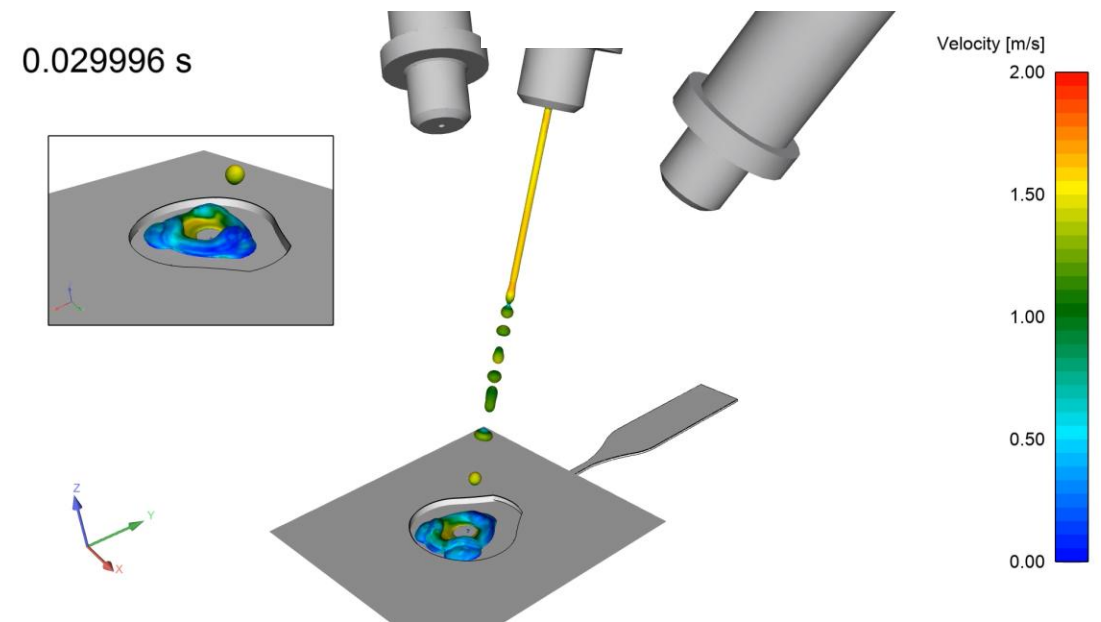
Microfluidic - Particle simulation

- **Particles:** equivalent diameter of $D = 1000\text{e-}8 \text{ cm}^2/\text{s}$
- 16 Particles injected :
 - 10 escaped
 - 6 trapped
- Brownian Motion can be seen in **fluctuating particle trajectories**
→ Amplitude = $f(T)$



Dispensing Simulation of Droplets

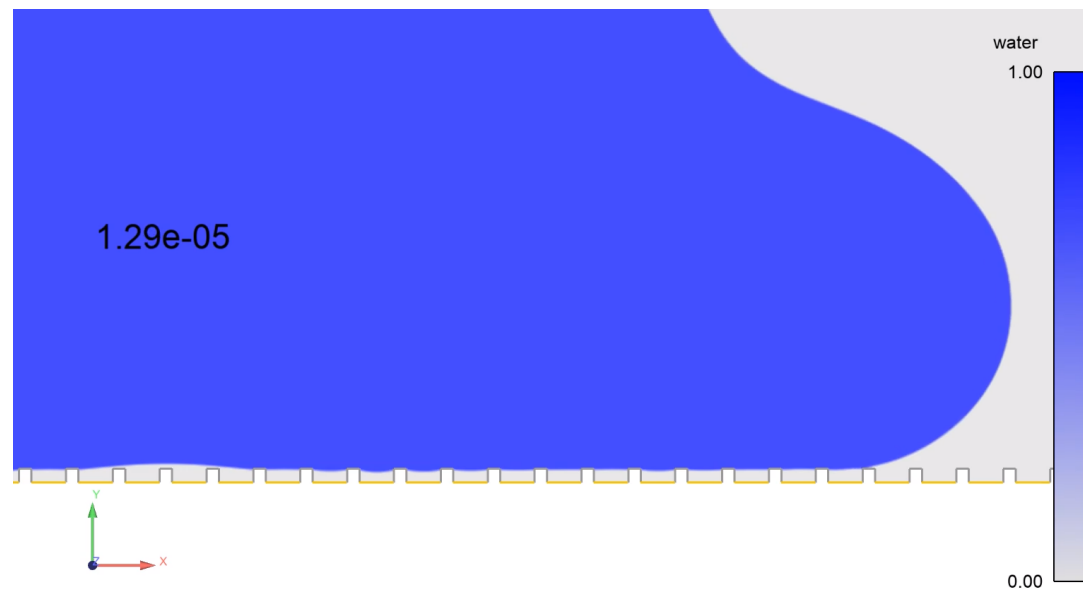
- External Flow
- Droplet Formation



Coating of microwells with dispensed droplet

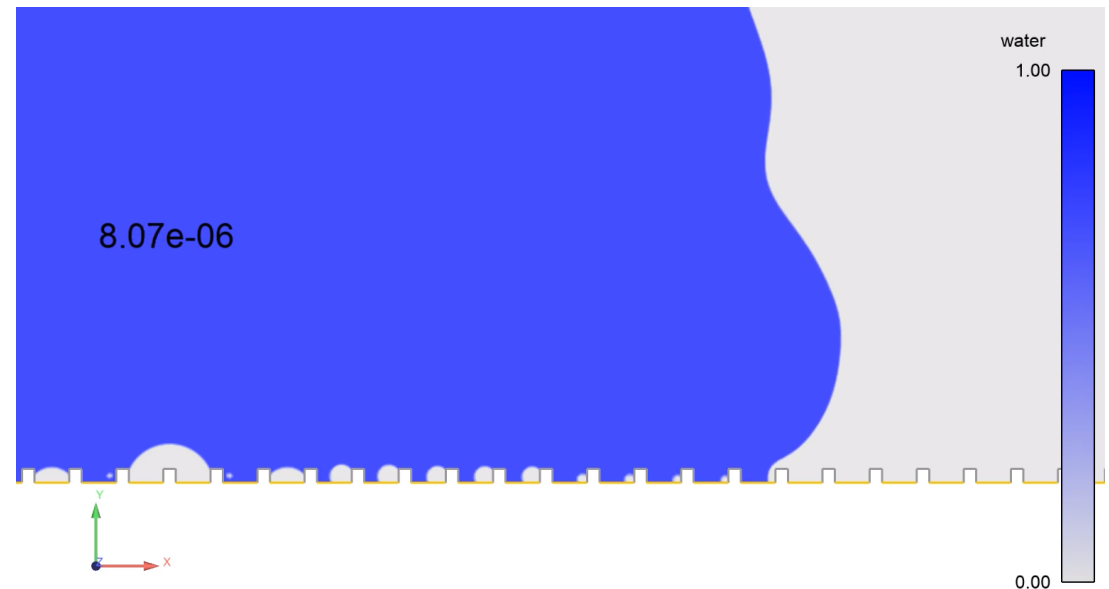
Untreated surface

CA $\sim 100^\circ$



Plasmatreated surface

CA $\sim 50^\circ$





www.bionicsurface.com