Associate Professorship of Bioseparation Engineering
TUM School of Engineering and Design
Technical University of Munich

Bachelor's/ Master's/ Semester Thesis

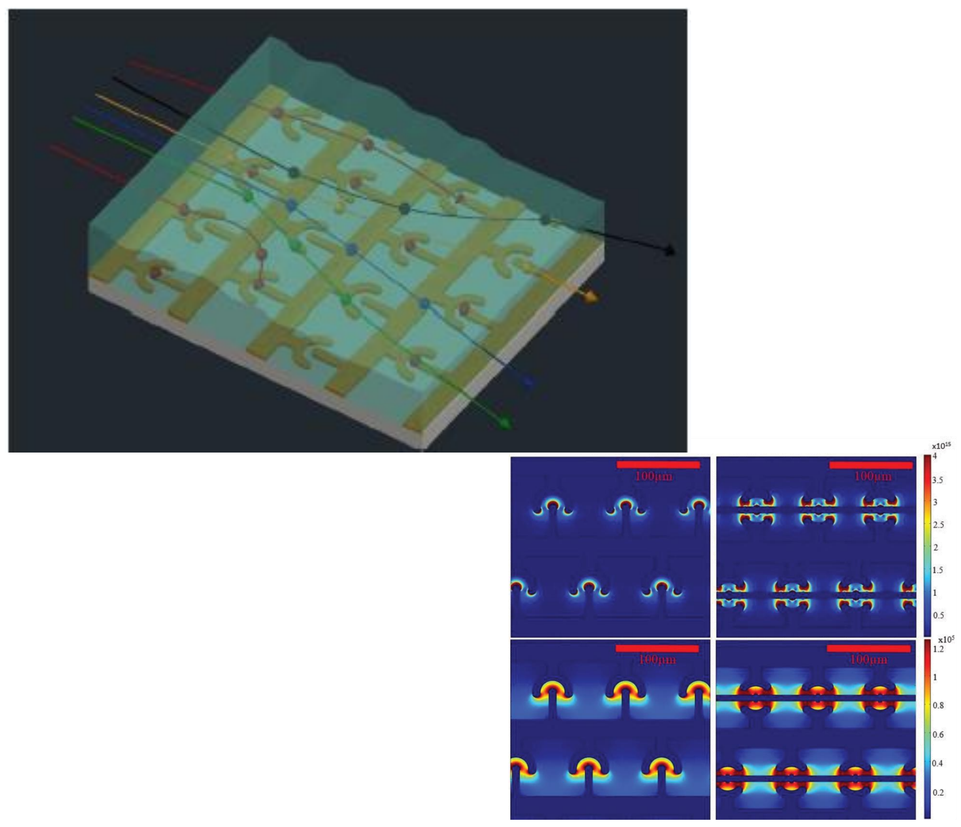
Simulative Design and Experimental Validation of a Millifluidic Separation Chamber

Keywords: CFD-Simulation, Dielectrophoretic Separation, Laminar Flow, Charged Particle Tracing, Microfluidics, Pathogen Detection

Project Description

Early and accessible detection of pathogens is crucial to prevent the spread of infectious diseases. A novel Point-of-Care detection system promises to deliver results about the level of contamination in minutes, compared to days or weeks of competing concepts. Therefore it needs a far higher-than-natural pathogen concentration, which will be achieved with a semi-automatic millifluidic enrichment chamber.

Suitable designs for the chamber will be developed based on the results of a CFD simulation. Suitable chamber candidates are then printed out and tested regarding separation and enrichment performance.



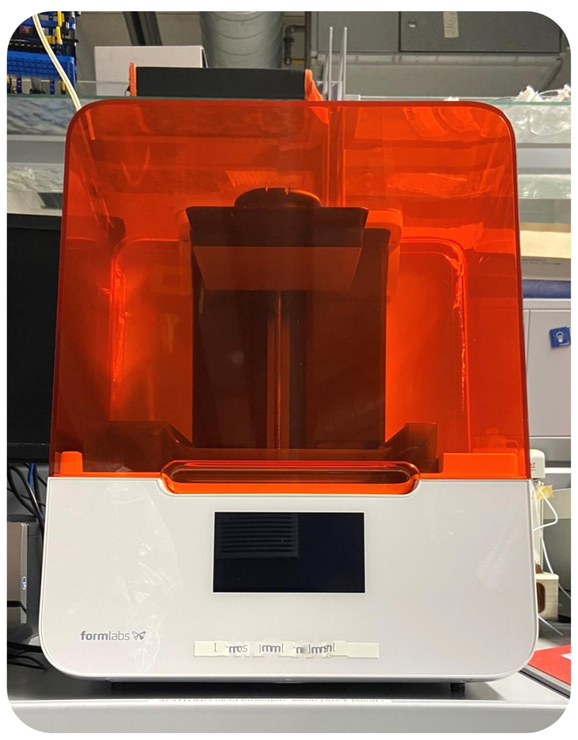
Top: Conceptual view of a Dielectrophoretic Cell Trap
Bottom: Calculated $\nabla|E|^2$ through different cutplanes
As seen in Velmanickam, Nawarathna (2016)

Profile

- Independent and structured work
- Enjoyment of simulative and experimental work
- Mechanical engineering, electrical engineering, chemical engineering, bioprocess engineering, or similar

Ideal, but not required:

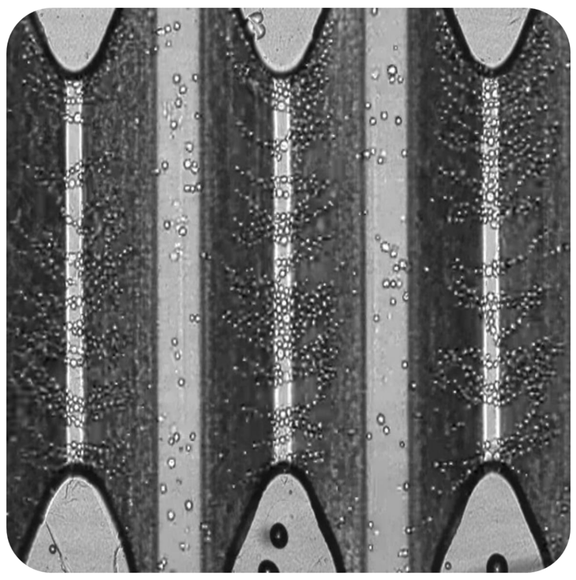
- Experience with CFD and particle simulations



FormLabs 3B+
Available SLA printer to validate the simulation parameters and results

Tasks

1. CFD-Simulation to design initial fluid chamber design candidates
2. Experimental validation and refinement of simulative results with millifluidic chambers
3. Iterative Improvement



Dielectrophoresis
Beer, Kupalu et al. (2017)
https://doi.org/10.1038/s41598-017-01256-8

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