

MULTIPHYSICAL SIMULATION OF HYDRODYNAMIC TRAPPING OF *S. cerevisiae*

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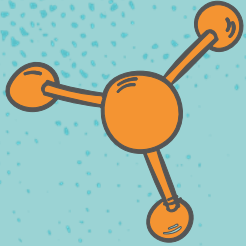
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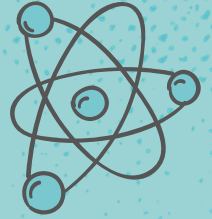




01

Introduction

Table of Contents



03

Result-Analysis

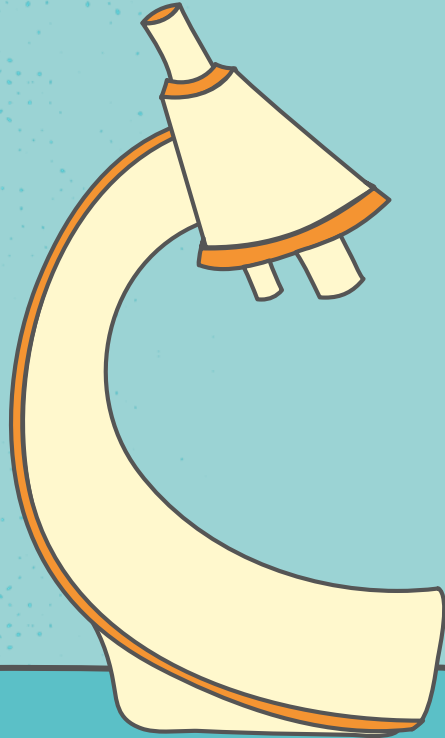
02

Methodology

Construction of
the channel

04

Conclusions

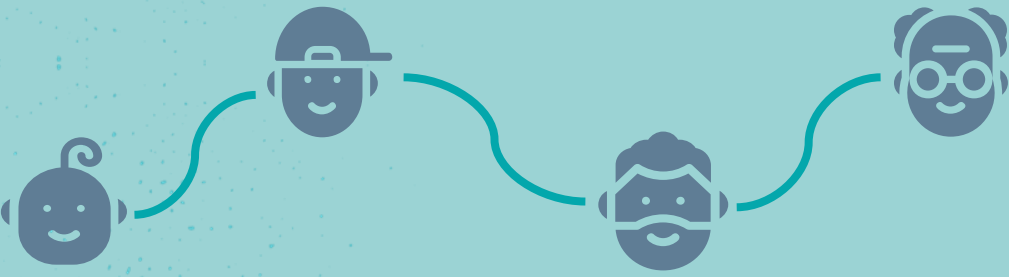


01

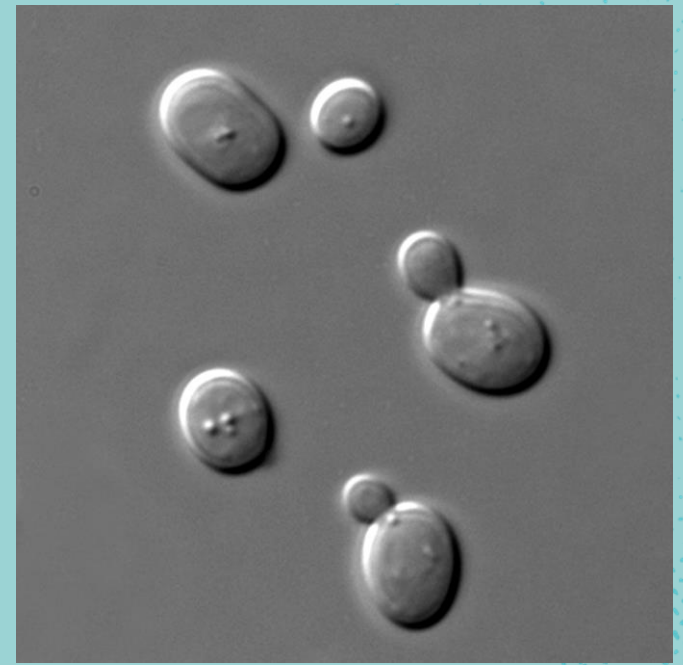


Introduction

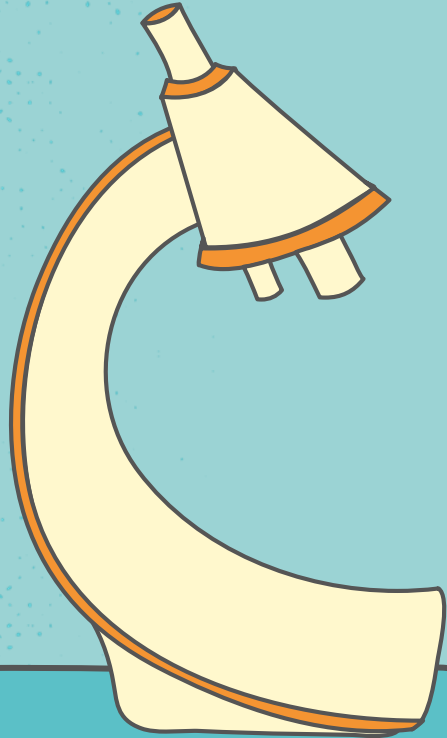
Aging



Yeast *S. cerevisiae*



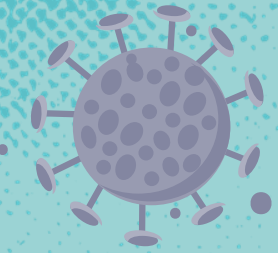
Yeast cell- *S. cerevisiae*.
https://es.wikipedia.org/wiki/Saccharomyces_cerevisiae



02

Methodology

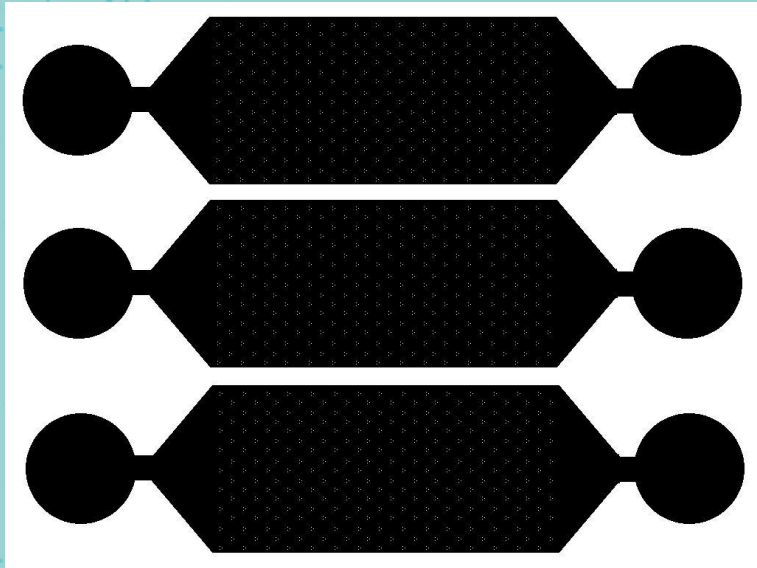




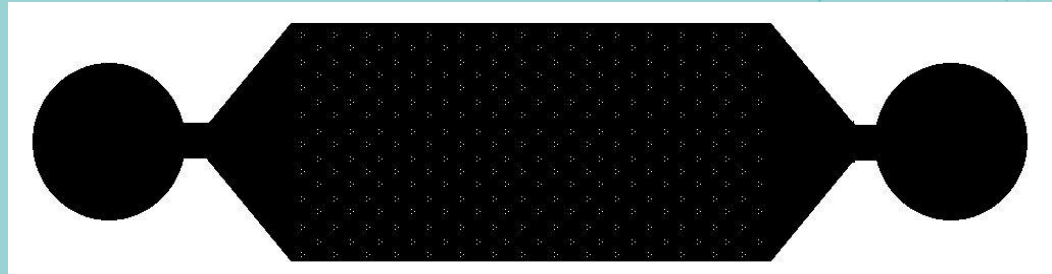
Construction of the channel



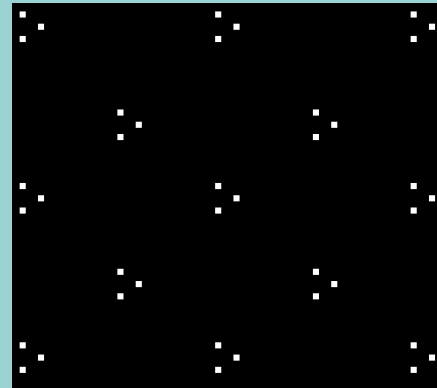
Mother Machine



Design of the mother machine.

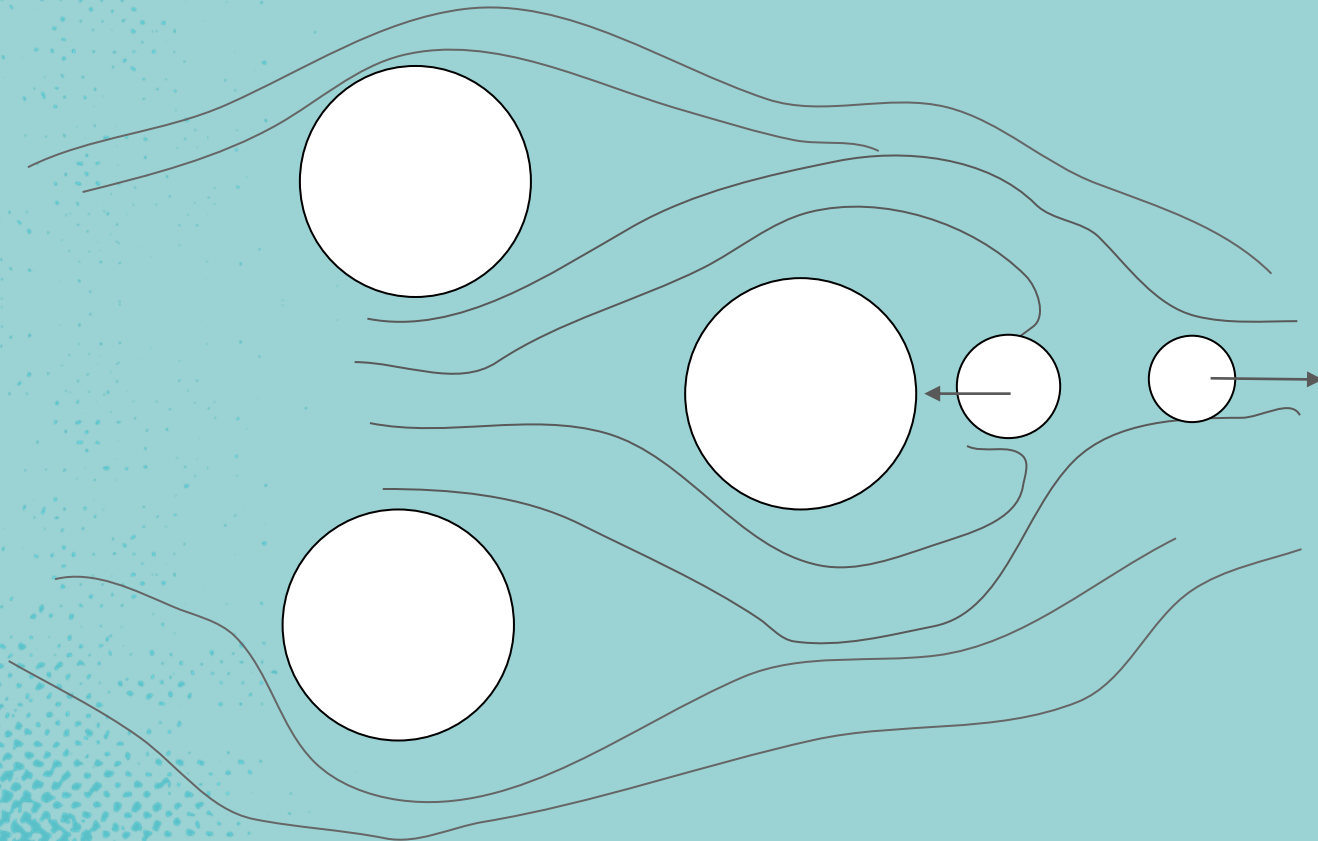
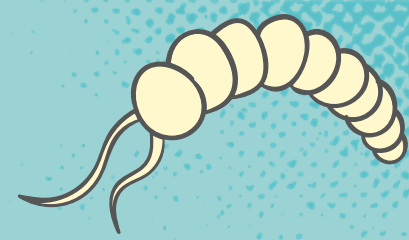


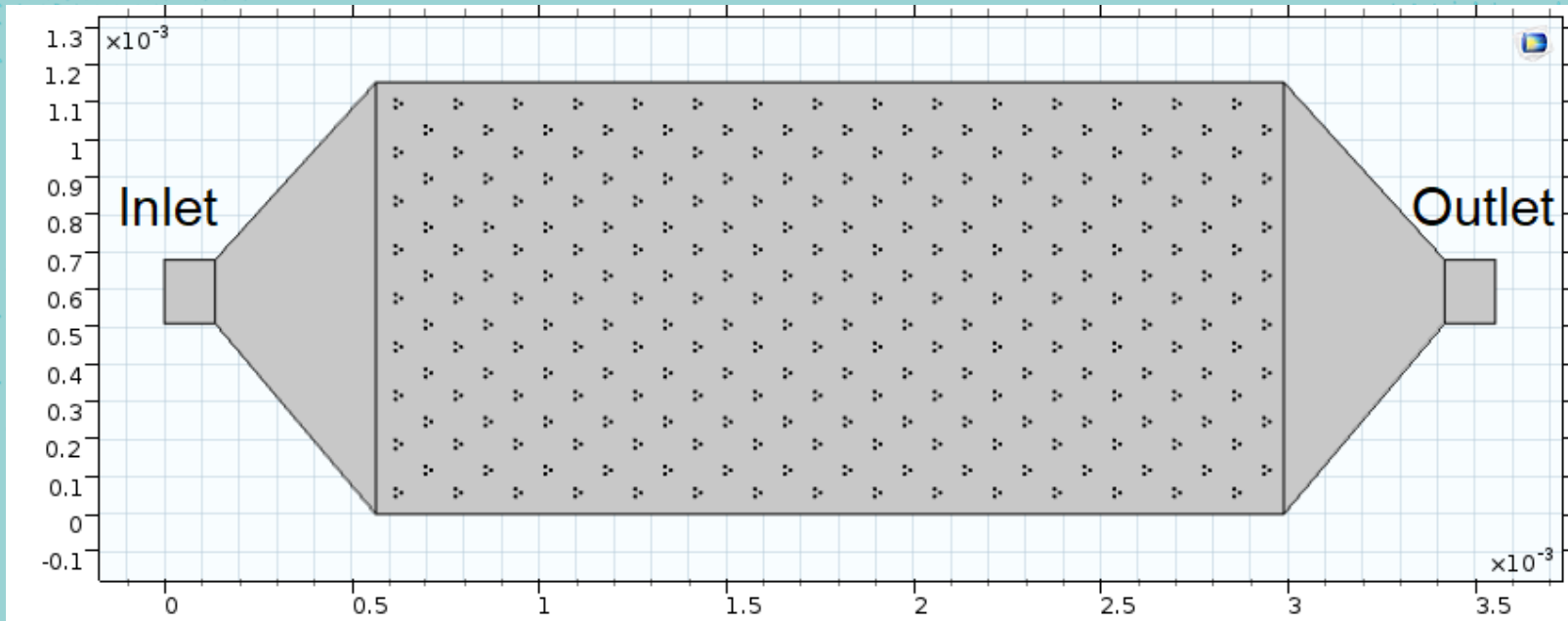
Design of a channel of the Mother machine.



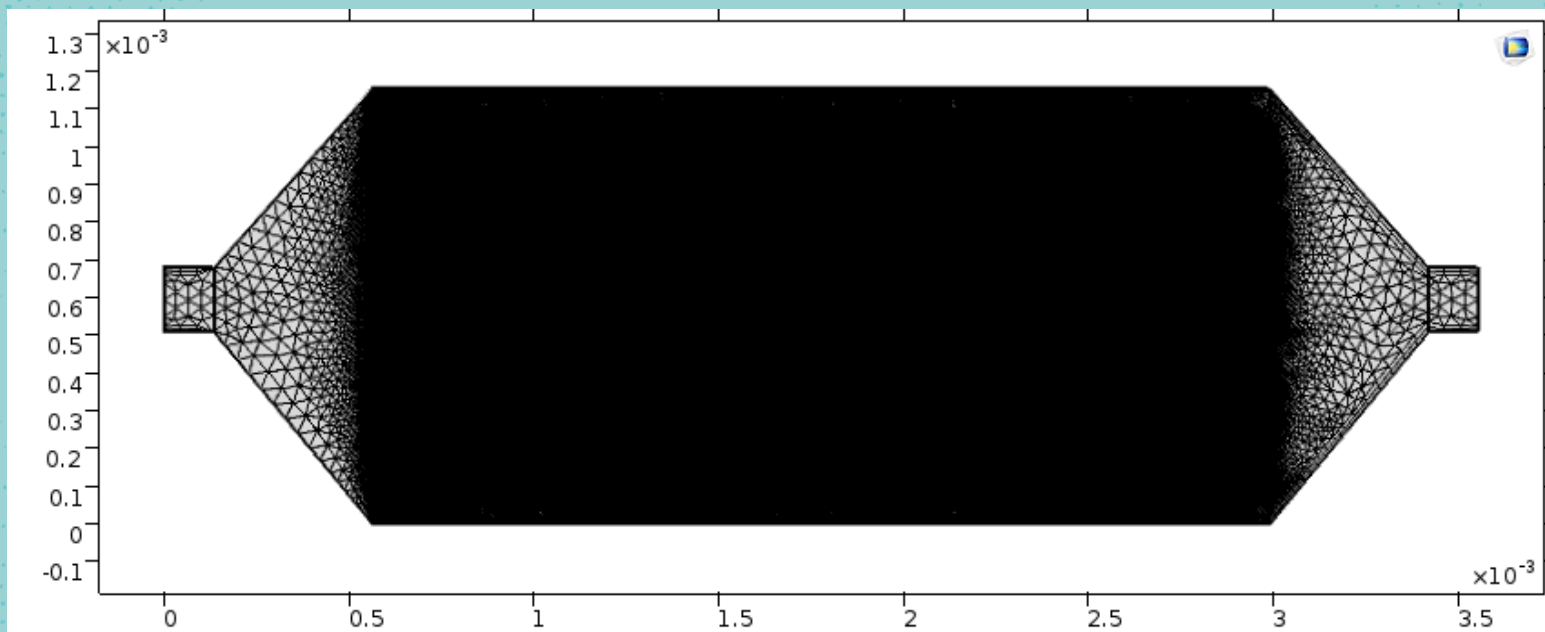
Shape of the traps

Slipstreaming Effect





geometry of the Mother machine channel.

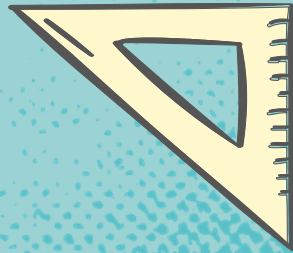


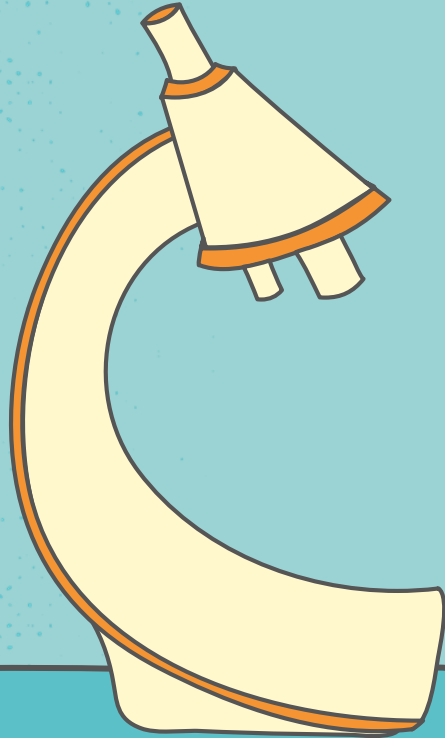
Normal mesh. where it becomes thinner when there are traps present, while it is thicker where there are none.

Finite Element Method

$$\rho(u \cdot \nabla)u = \nabla \cdot [-pI + \mu(\nabla u + (\nabla u)^T)] + F \rho \nabla \cdot (u) = 0$$

Navier-Stokes equation

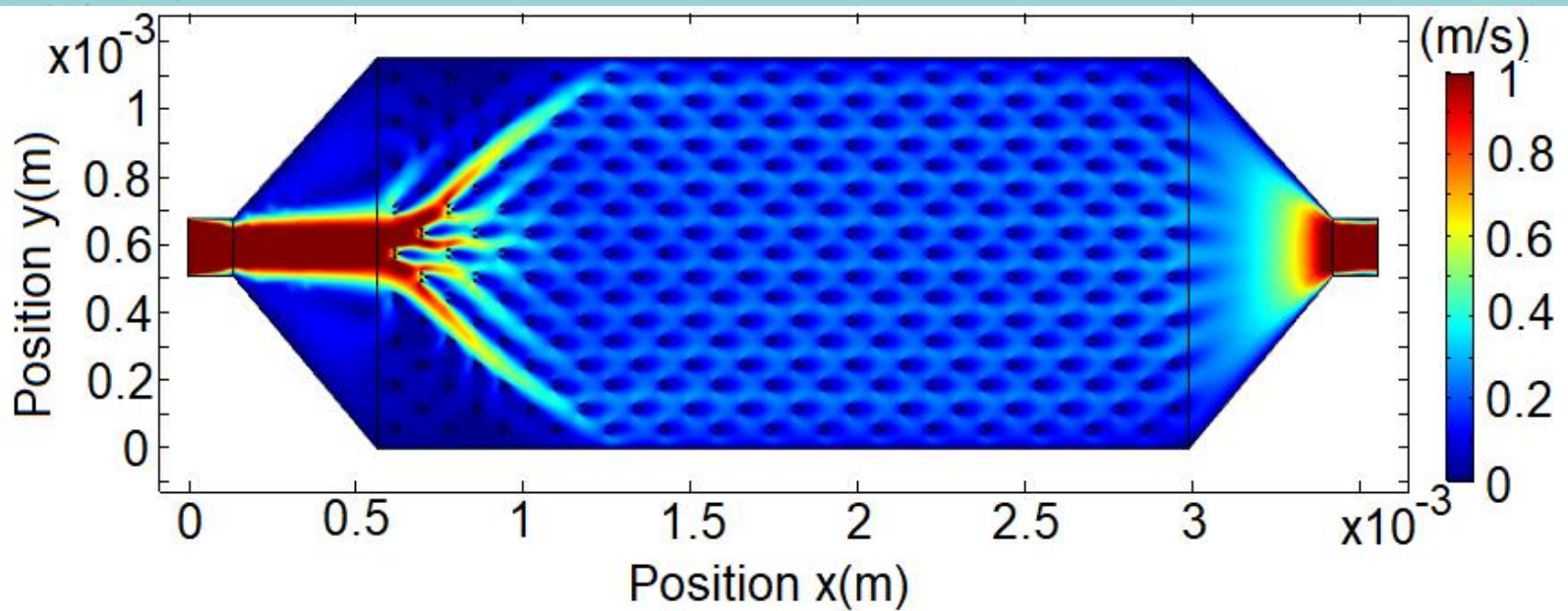




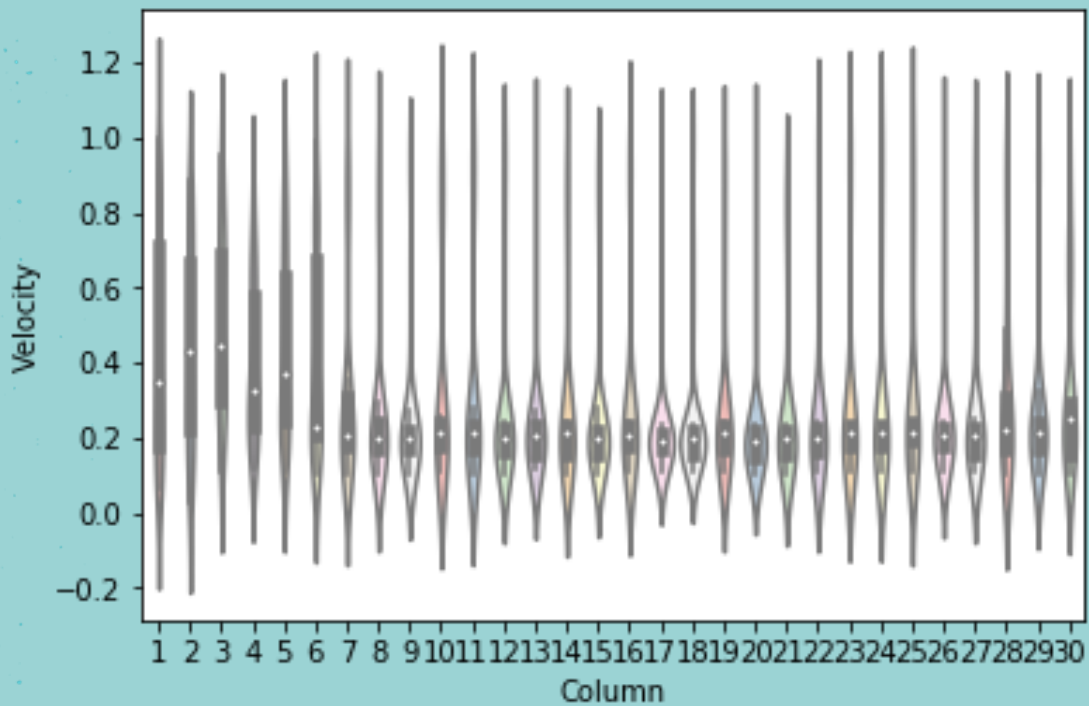
03



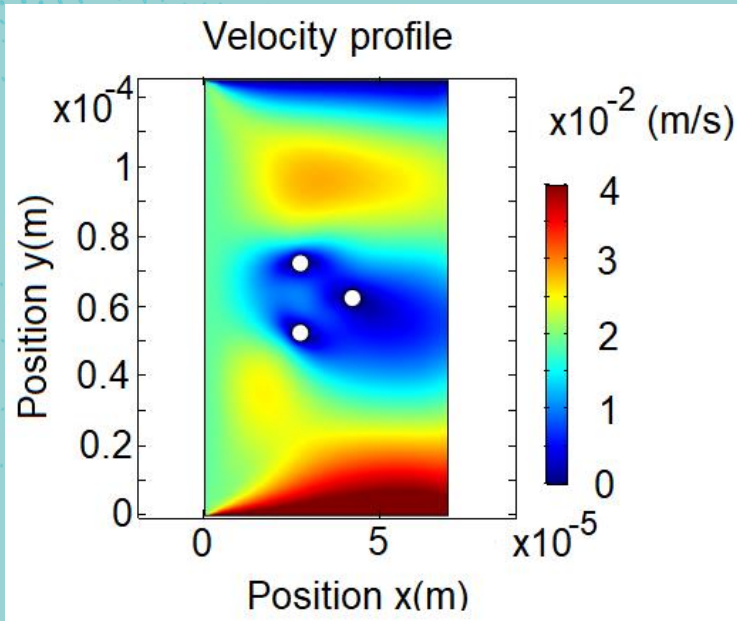
Result-Analysis



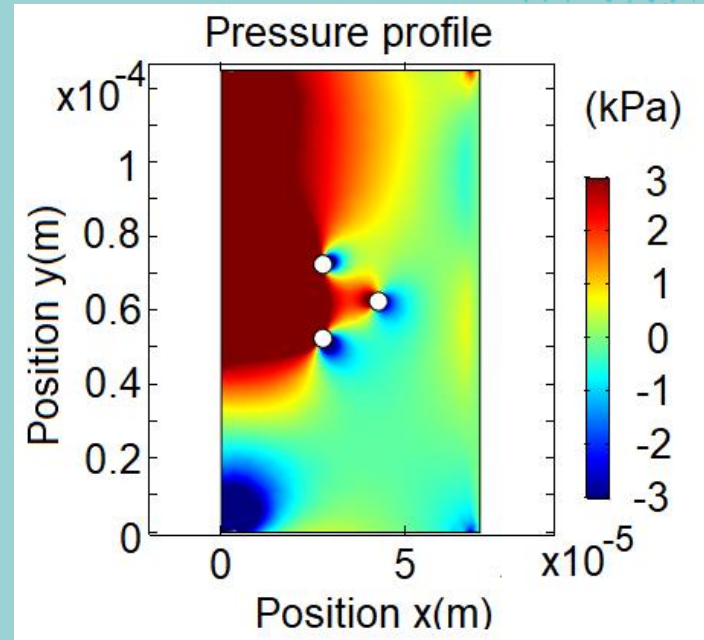
Channel velocity profile.



Columns and average channel velocity.

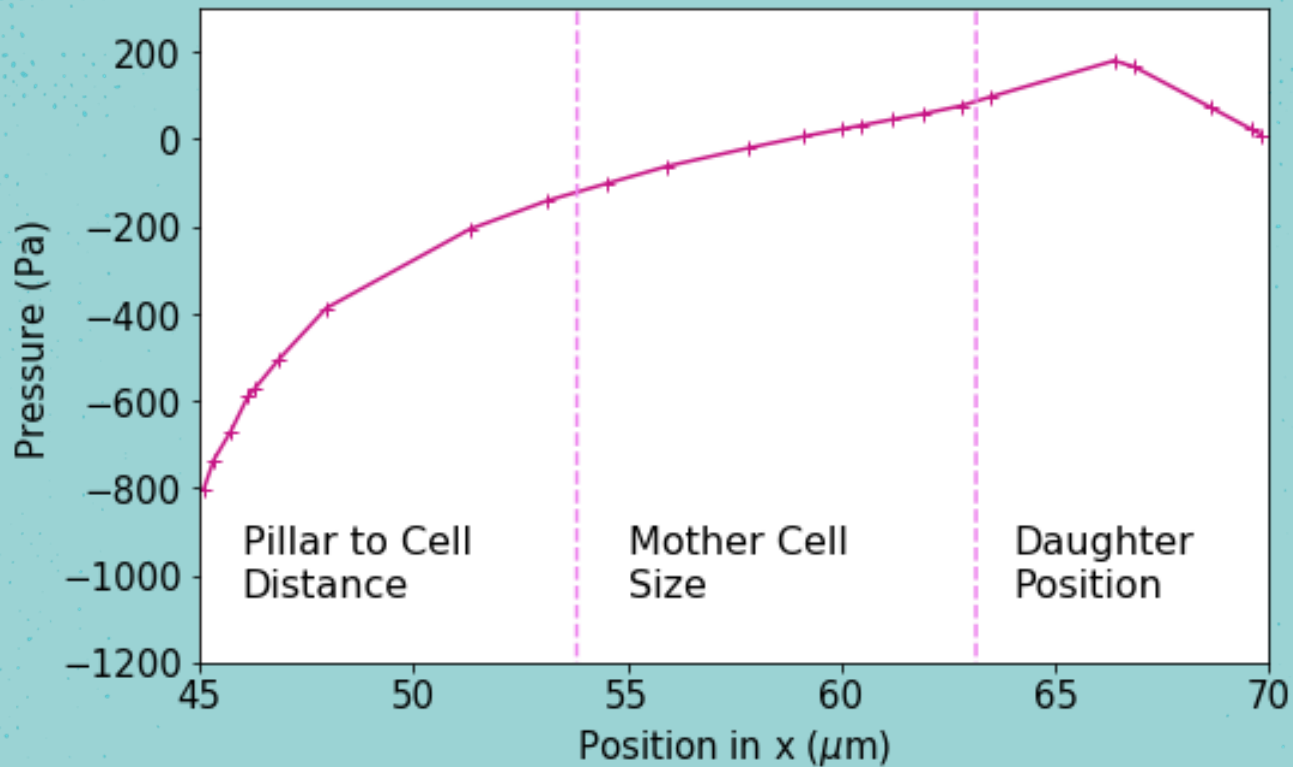


velocity profile of a channel trap.



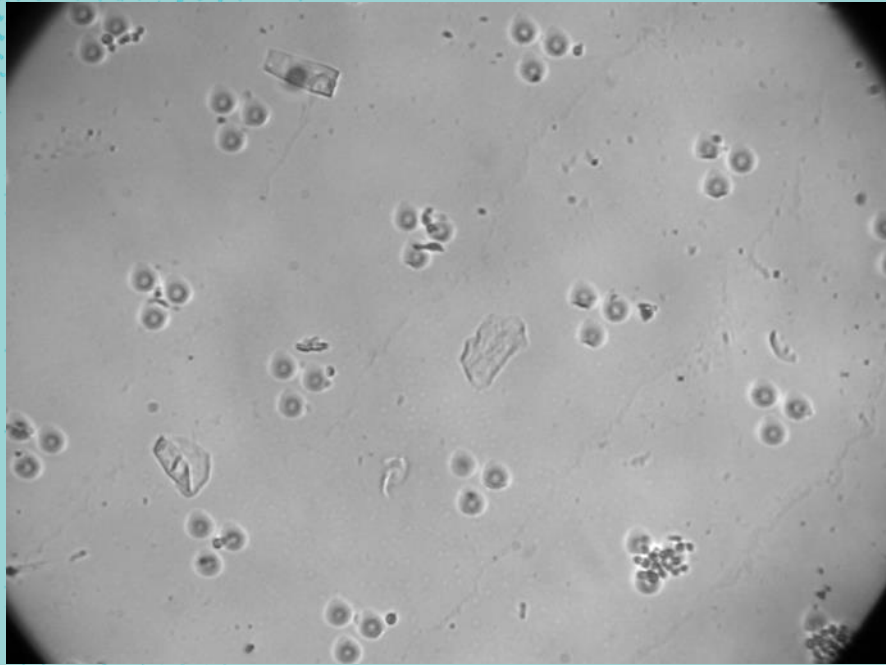
Pressure profile of a channel trap.



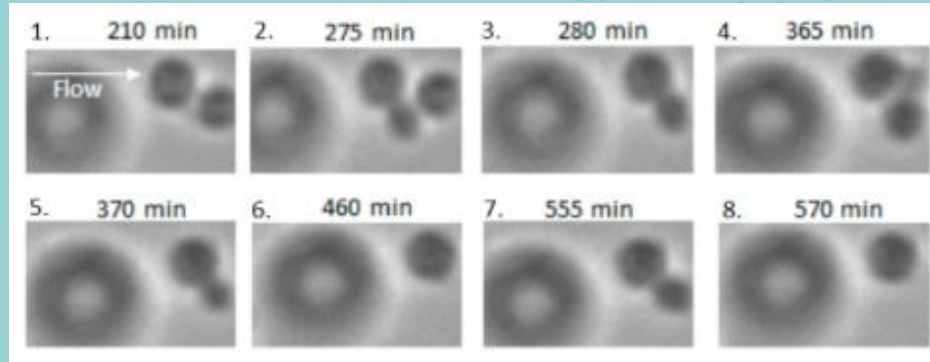


Pressure profile for a trap.

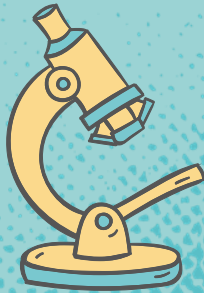




Capture of a section of the traps.

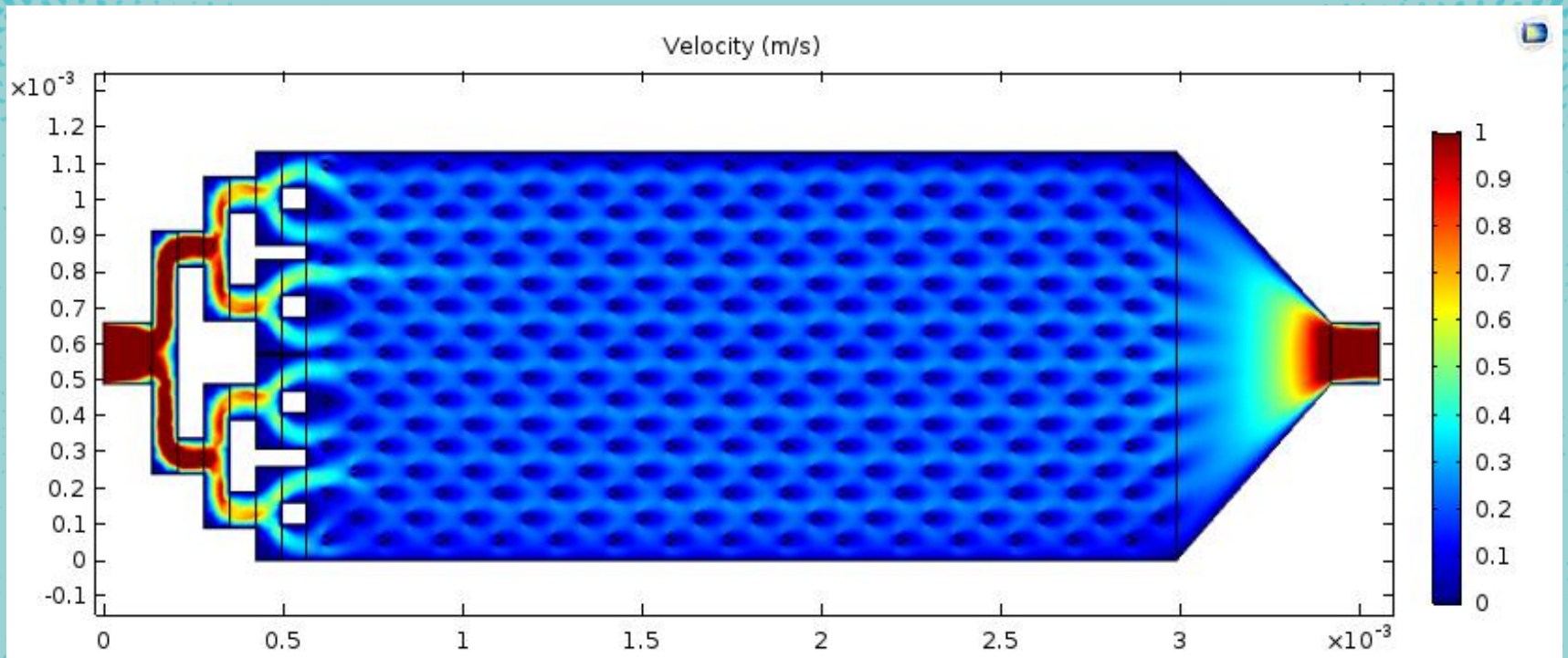


RLS measurements at different time intervals.



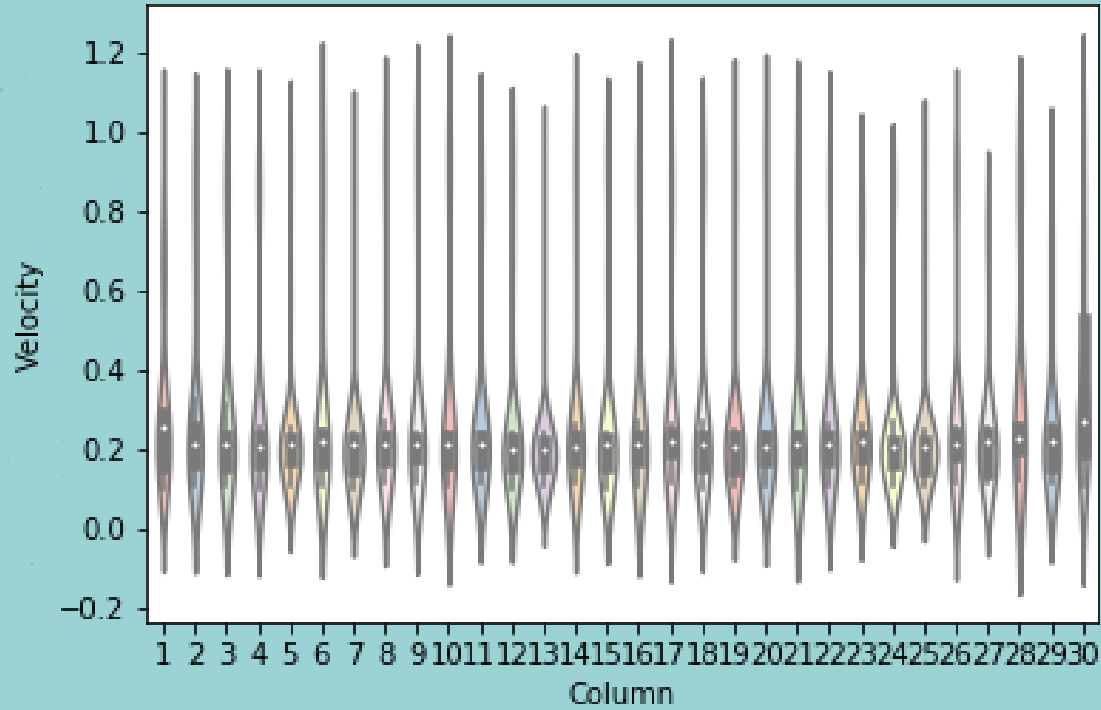


Channel improvements

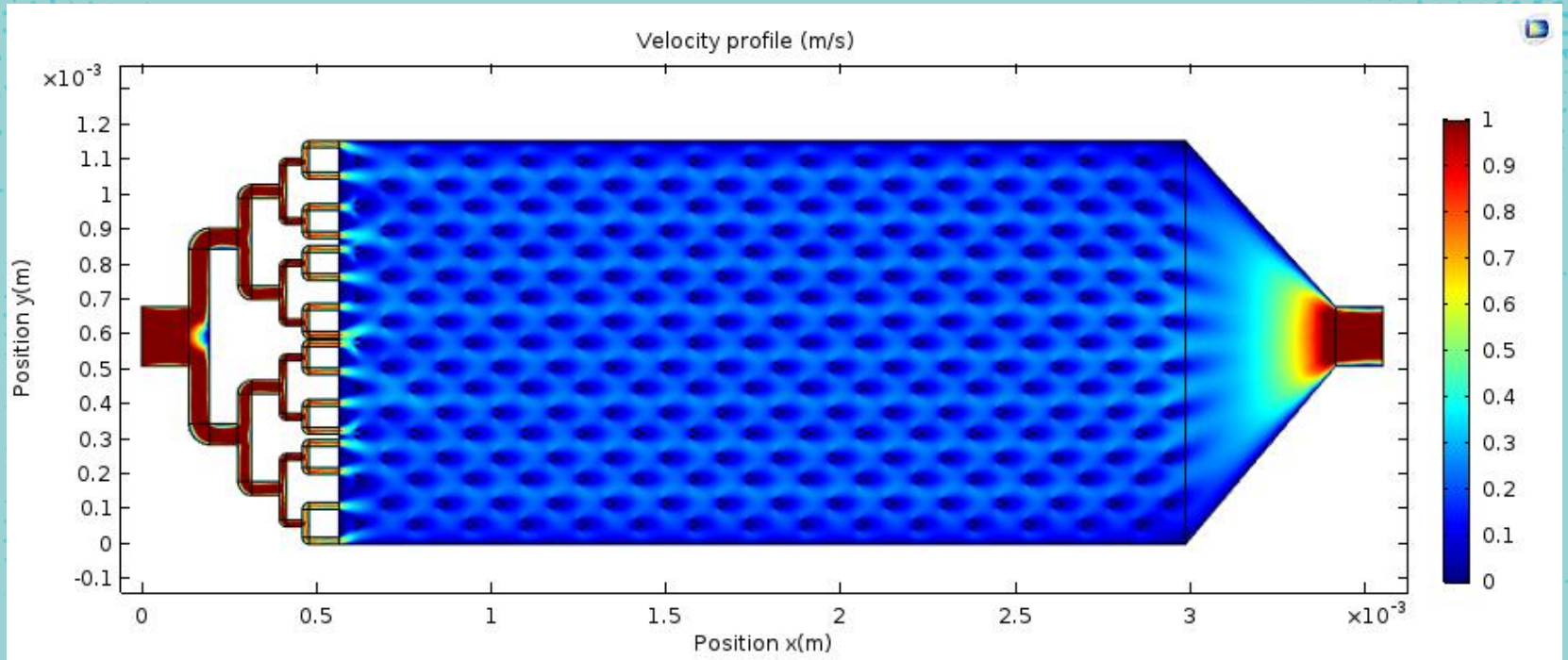


velocity profile of the branched channel.



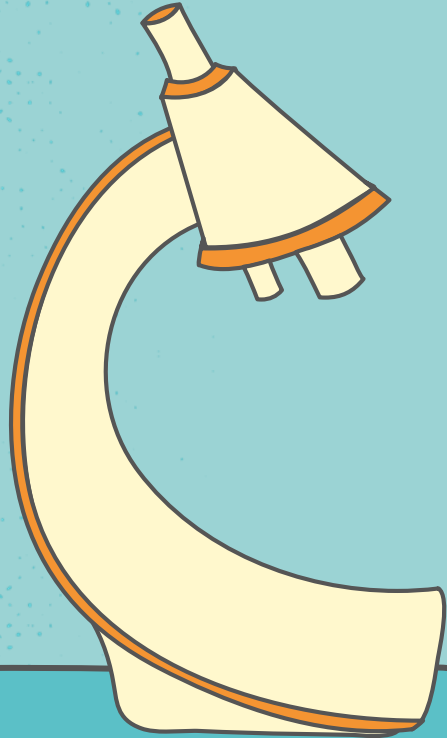


Columns vs average velocity of the branched channel.



velocity profile of the branched channel, final version # 12.





04



Conclusions

- The flow profile in the complete channel was obtained, which was very useful since it allowed obtaining the average velocity data for a more detailed analysis in each individual trap.
- It was observed that in the traps there is a pressure profile that allows to trap the mother cell and separate the daughter cell, taking advantage of its shape and its arrangement in the channel, in addition to the slipstreaming effect generated by the direction of flow and the same.
- The results obtained from the simulation conform to the experiment carried out. Evidence of the effectiveness and usefulness of this type of simulation, since they allow anticipating the behavior of the real experiment, being safer the course that it will take, in addition to avoiding problems in its development and unnecessary losses of the budget.



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Durán, D.C., López, O. (2010). Computational Modeling of Synthetic Jets. COMSOL 2010.