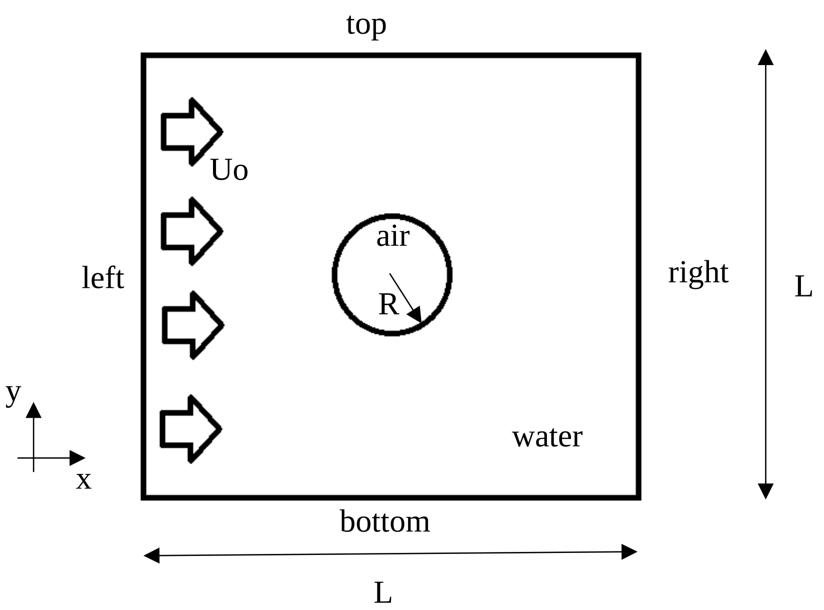
Project: Bubble transport

This project concerns the transport of an air bubble on a water flow. The case setup is presented on the next figure, with the geometry and boundary conditions.



Geometry

L (m)	0.1
R (m)	0.01

Boundary conditions

Top	Fixed velocity (1, 0, 0)
bottom	Fixed velocity (1, 0, 0)
Right	cyclic
left	cyclic

The solver employed for this purpose is **interFoam** or **interIsoFoam**. The problem assumes a gravity of 0 and, thus, the movement of our bubble it is only produced by the flow velocity. An initial condition for the velocity internal field is set to Uo = (1 , 0 , 0) in the entire domain.

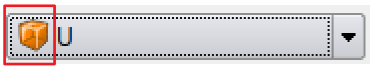
The physical properties for water are a density of 1000kg/m³ and a kinematic viscosity of 1e-06. For air a density of 1 kg/m³ and a kinematic viscosity of 1.48e-05. The surface tension coefficient sigma 0.07.

The simulation will run for 3s. The bubble has trespassed the domain 30 times, then.

Please produce a .pdf presentation with the requested information in English.

Pay attention at the attached images quality. Do not use screenshots unless it is necessary (use ParaView screenshots) and customization of figures will be appreciated (colours, background, …).

Always use the cell data fields representation, not the interpolation.
Cell data fields:



1. Present the mesh employed and give the total number of cells. Test at least 3 different mesh resolutions and compare the results in terms of alpha values at t=1, 2 and 3s. (A maximum number of cells is set to 40.000)

Select your best mesh and explain why is it the best one:

2. Present a two graph with the time evolution of the bubble area (values of alpha < 0.5) and the thickness (0.1<alpha<0.9) of the interface.
3. Use 2 different schemes for the convection term, as first and second order, and compare your results.
4. Test two different interface methods as MULES (interFoam) and isoAdvector (interIsoFoam) and compare your results.
5. Explain what does the Courant number states for. Test 3 maximum courant numbers and compare the results. Now impose a fixed time-step of 0.0005s and compare.
6. Improve your simulation as much as possible (nAlphaSubCycles, nCorrectors, time derivative schemes, …), without refining the mesh limit of 40.000 cells. Explain your decisions and why you choose them. The best solution will be evaluated in terms of: shape, area, interface thickness at the last time step, and execution time.
    1. What is the execution time for your simulation? What are the residuals?

Prepare a .zip file with:

1. Your best clean case (only 0/, constant/ and system/ folder)
2. The presentation in .pdf
3. A .csv file with the coordinates of your final (t=3s) contour for alpha=0.5.