Modelling cross flow microfiltration:

an alternate design for the concentration and fractionation of suspensions

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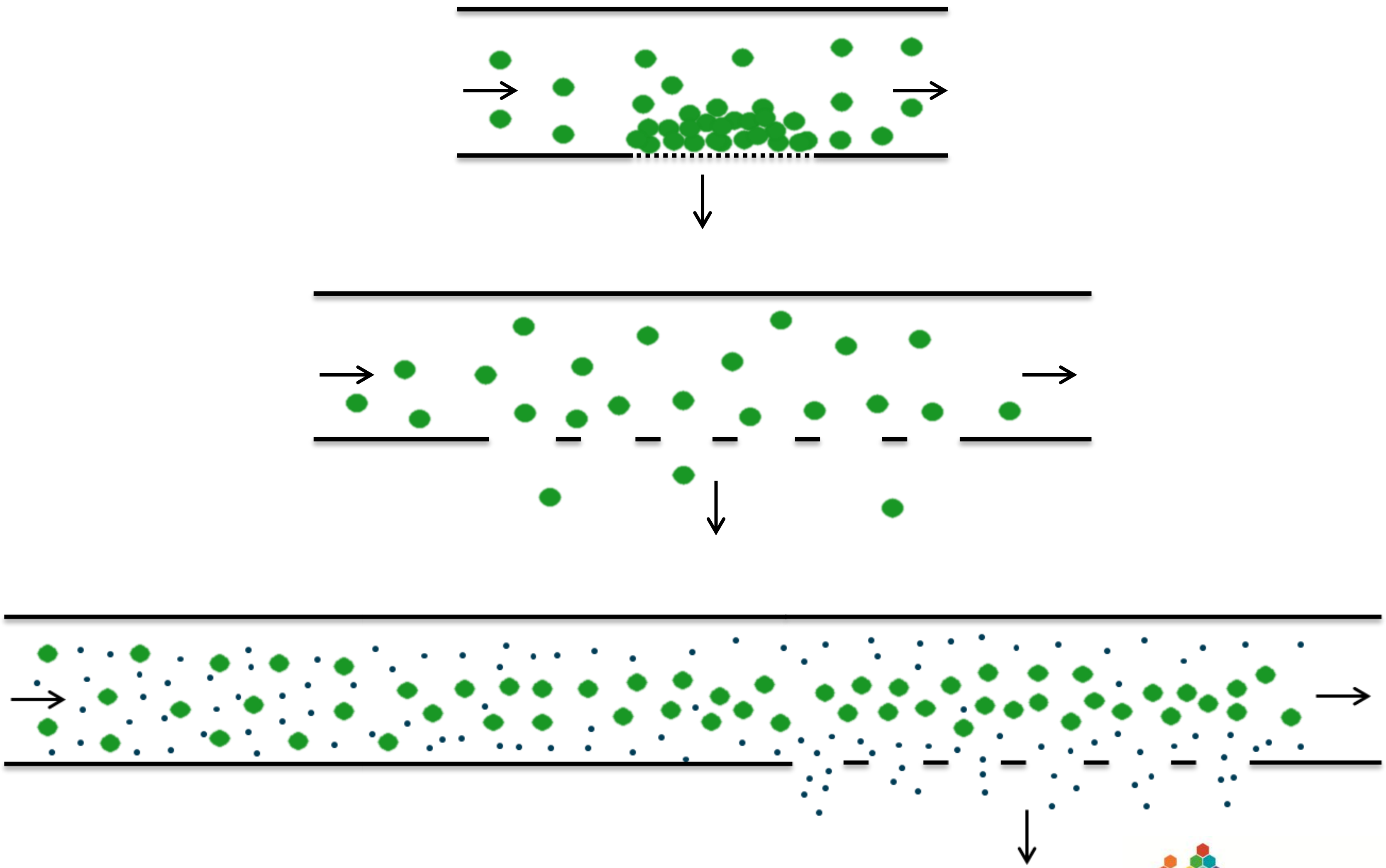
Membrane microfiltration

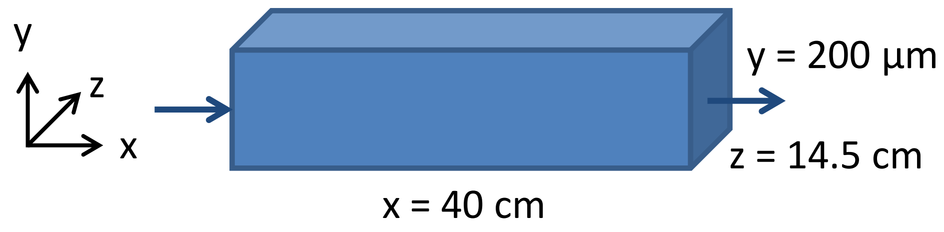


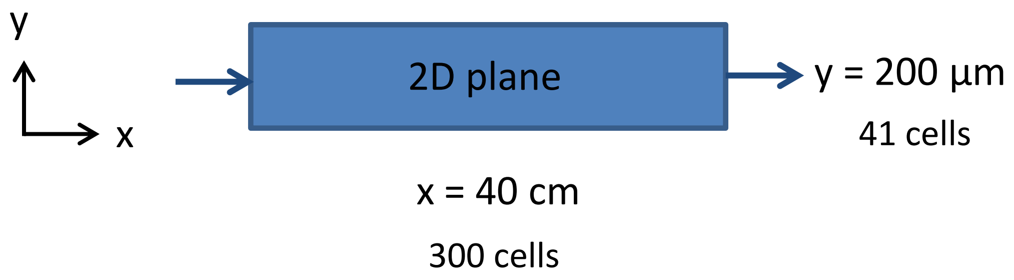
Software program: STAR-CCM+

Simulating multiphase flow:

1) Eulerian → Particle-particle interactions: SID
2) Lagrangian
3) Discrete element method

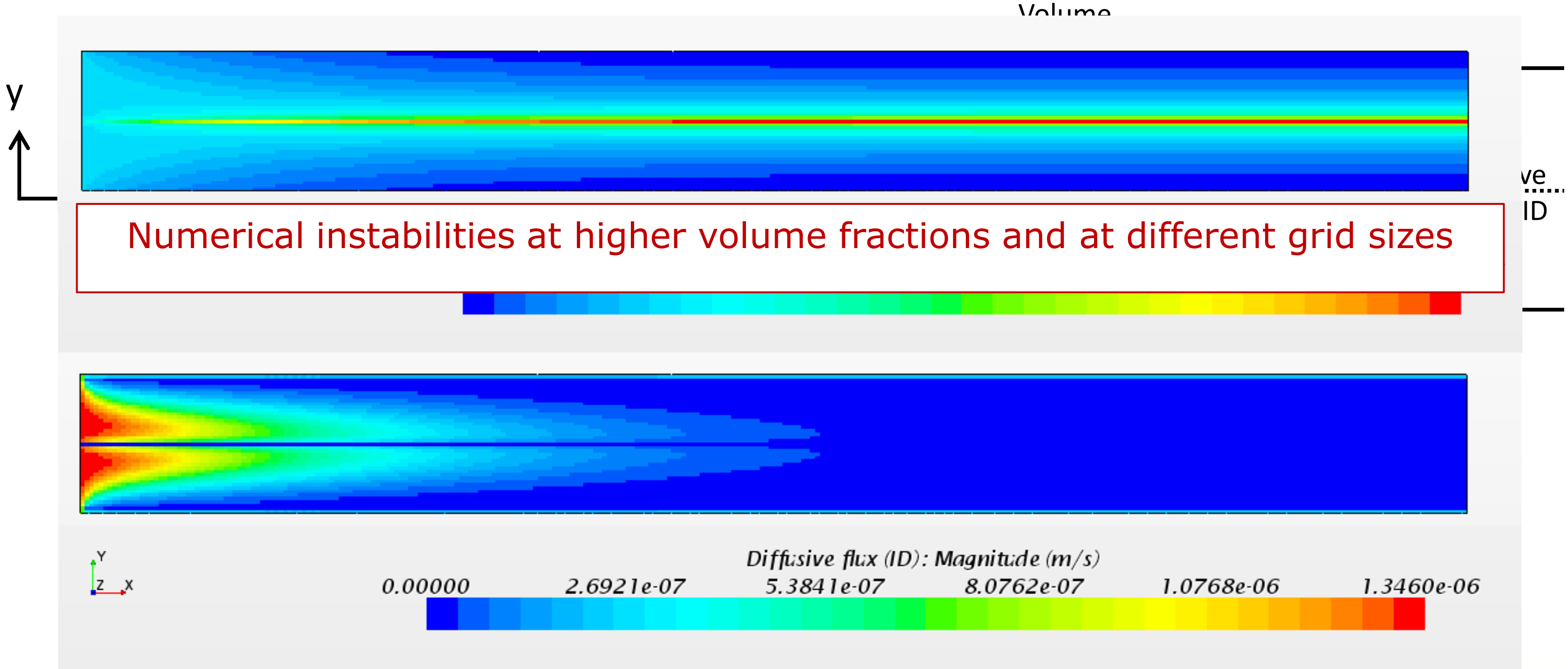
Current work





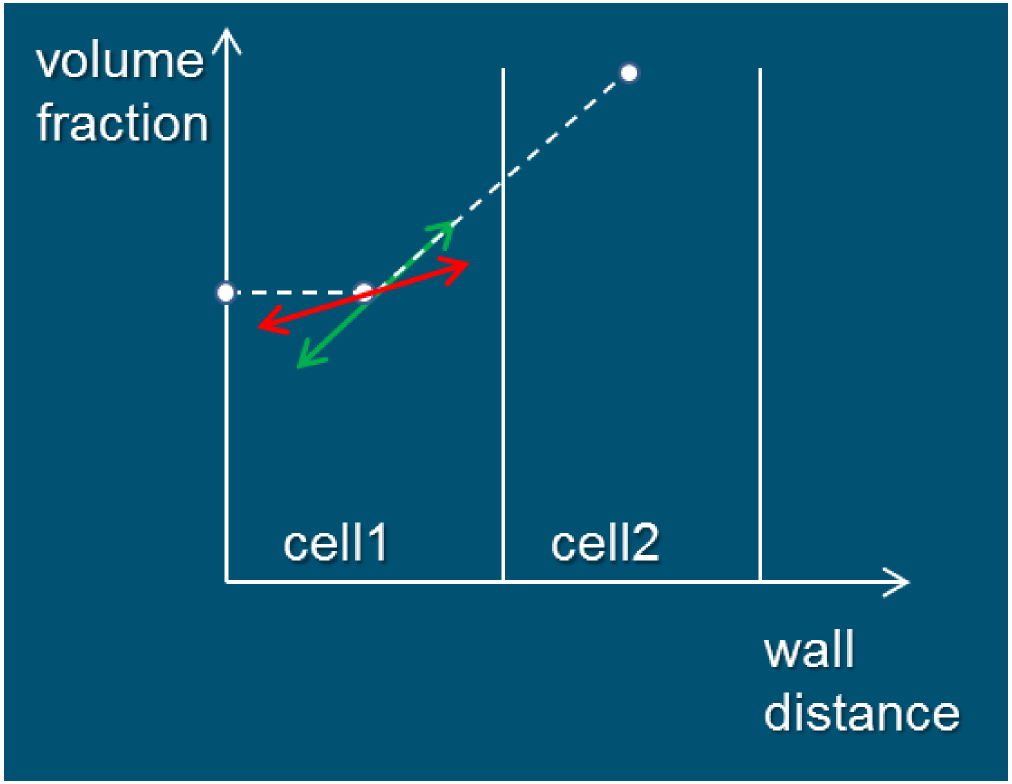
Previous work

monodisperse suspension in closed channel



Numerical instabilities at higher volume fractions and at different grid sizes

Numerical instabilities



Michael Descamps, CD-adapco

Assume a total flux of zero near the wall:

Diffusive flux = shear rate flux + volume fraction flux =0

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Results

Zero flux boundary condition at wall

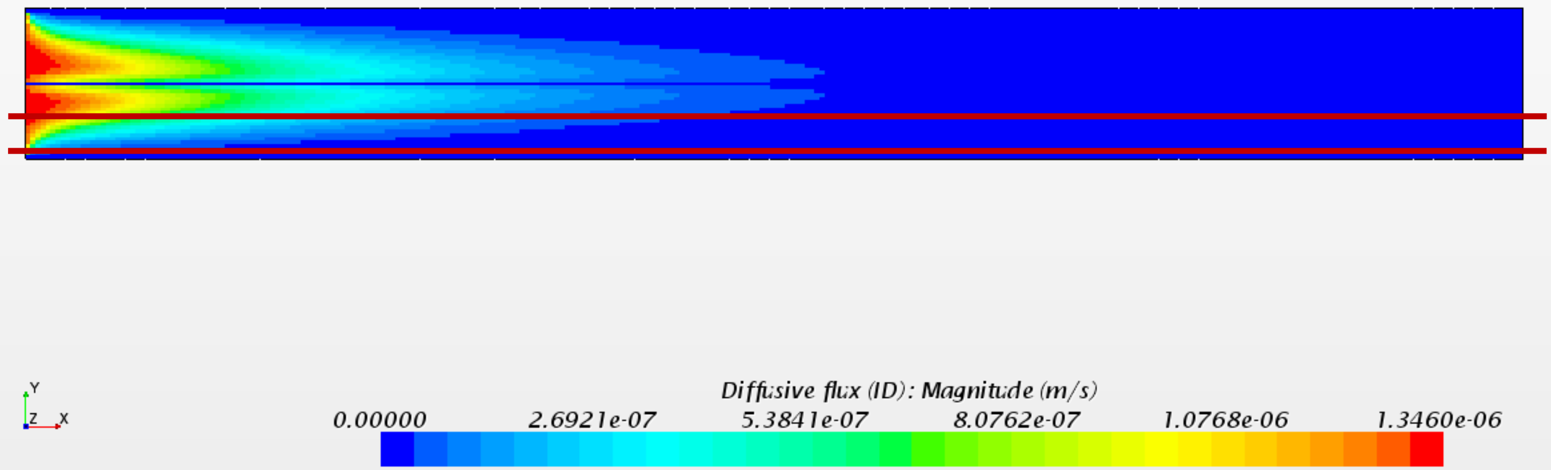
	“Stable” diffusive flux at 20 cm								
			Number of grid cells in y-direction						
			41	51	61	71	81	91	111
Volume fraction	Water/particles	90/10							
		80/20							
		70/30							
		60/40							
		50/50							

	“Stable” diffusive flux at 40 cm								
			Number of grid cells in y-direction						
			41	51	61	71	81	91	111
Volume fraction	Water/particles	90/10	10%/41						
		80/20							
		70/30				30%/71			
		60/40							
		50/50							

Results

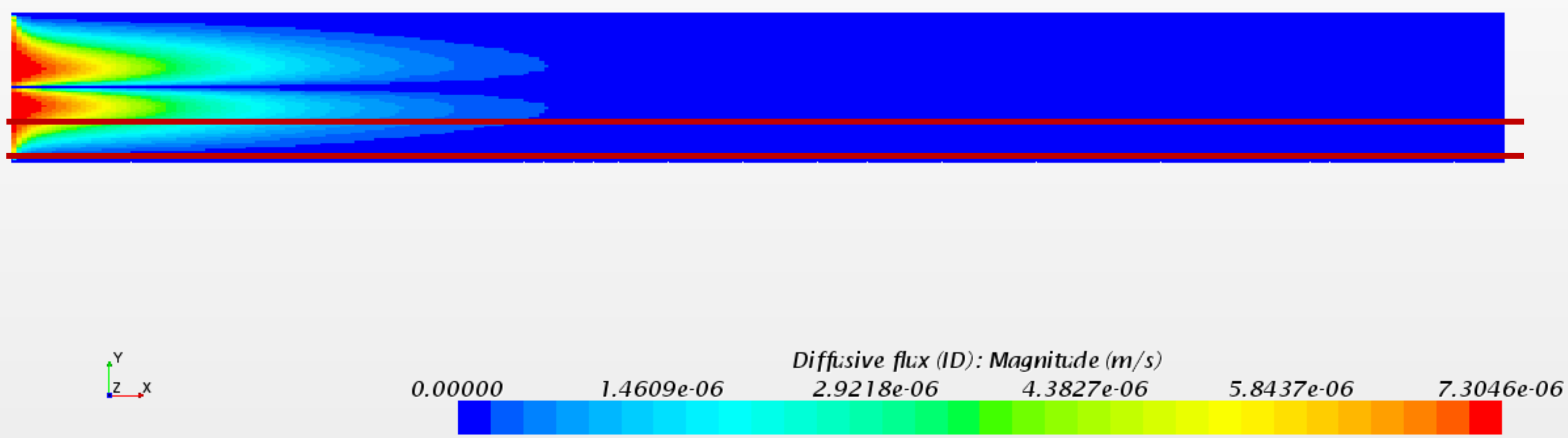
Zero flux boundary condition at wall

50 µm
10 µm



10%/41

50 µm
10 µm



30%/71

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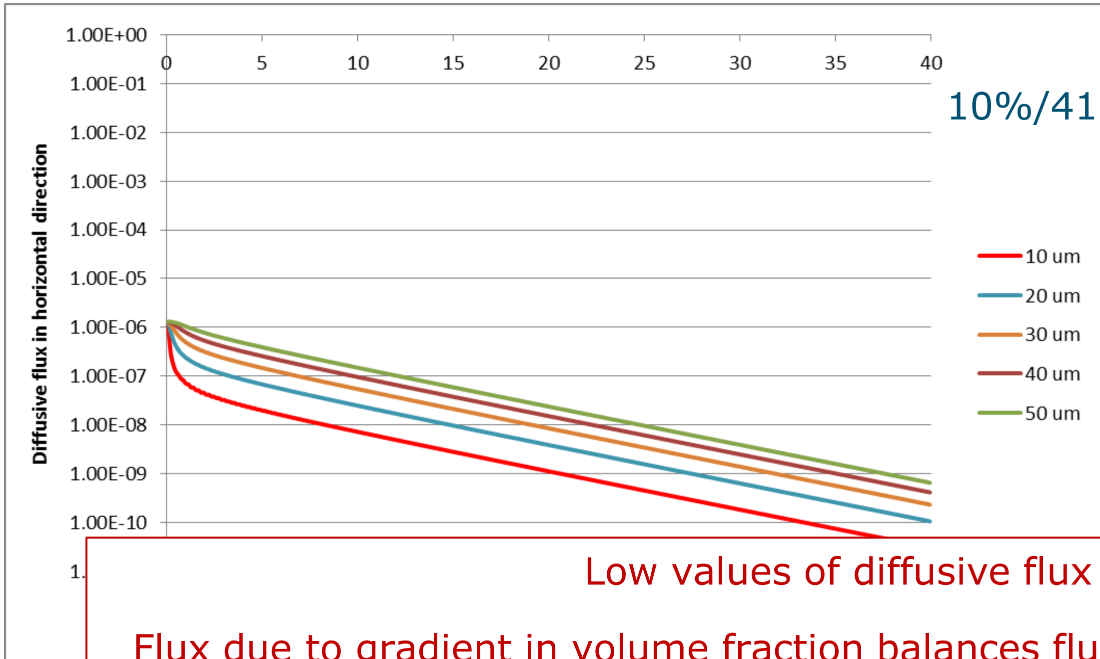
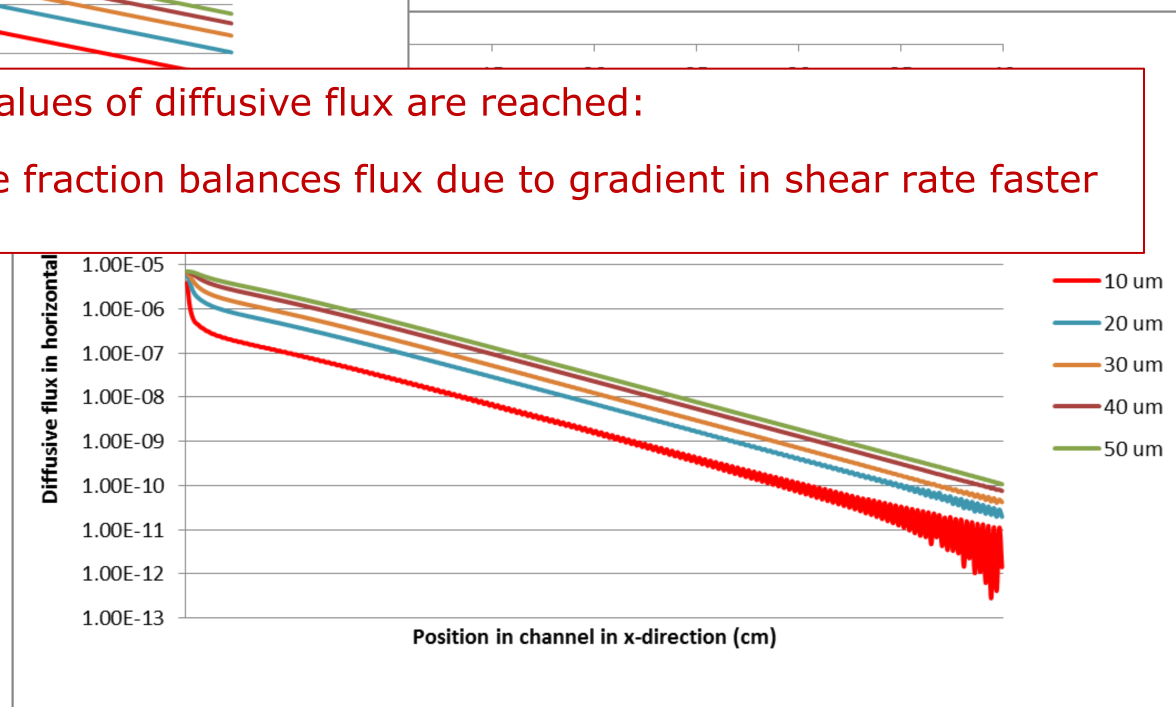
Zero flux boundary condition at wall



Low values of diffusive flux are reached:

Flux due to gradient in volume fraction balances flux due to gradient in shear rate faster



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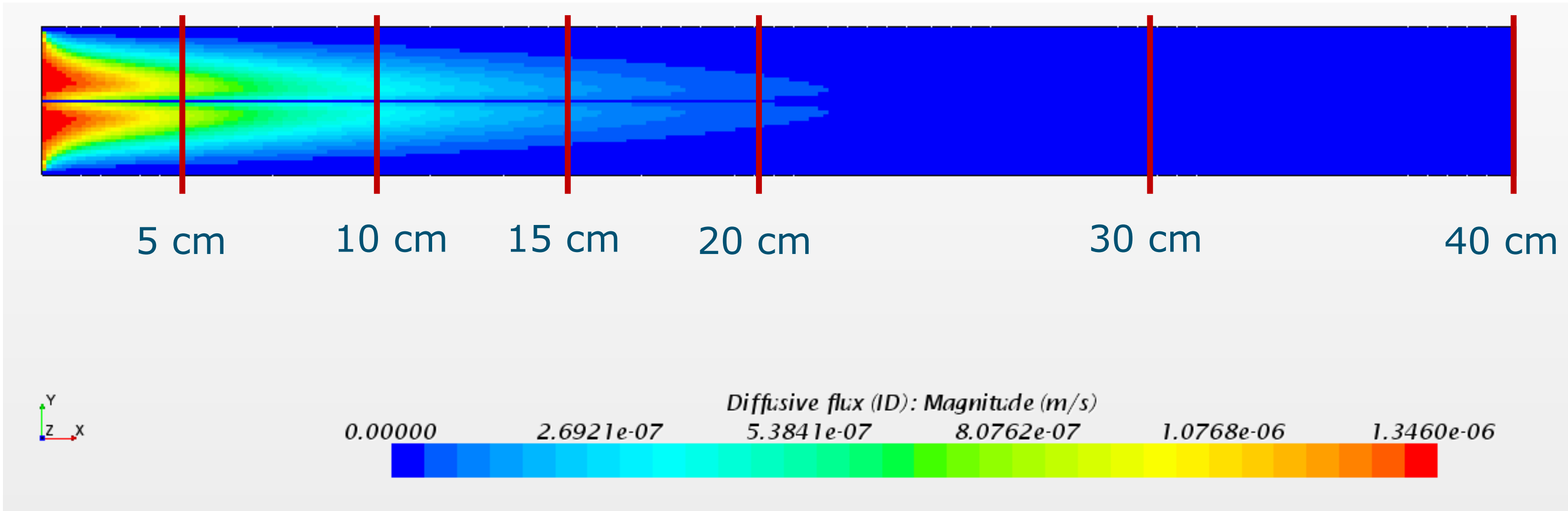
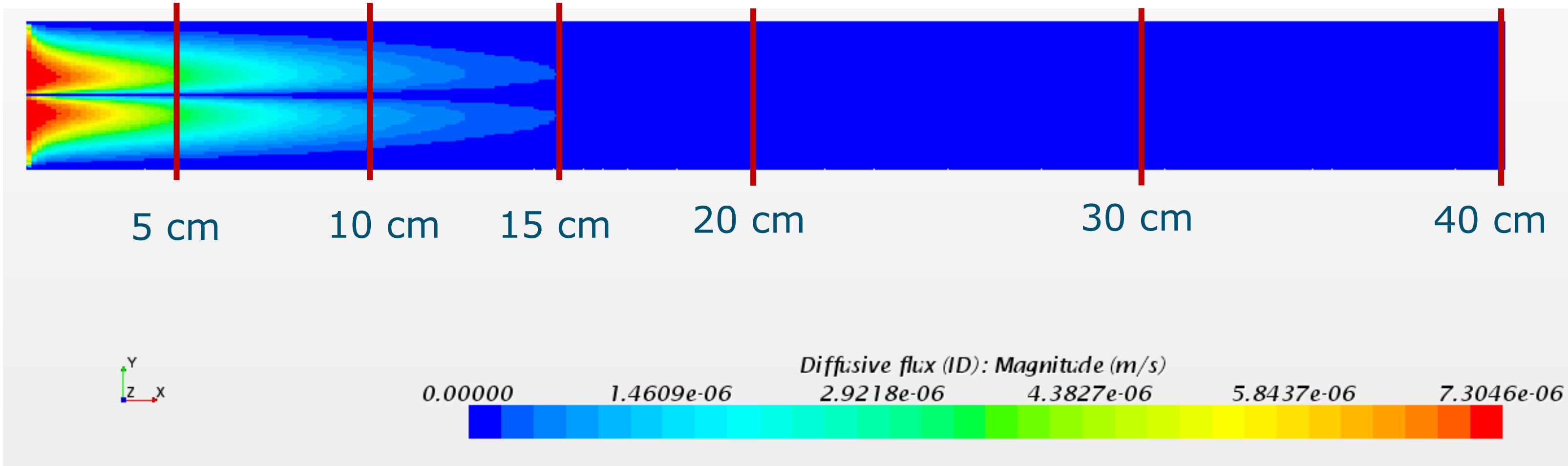
Zero flux boundary condition at wall

10%/41



30%/71



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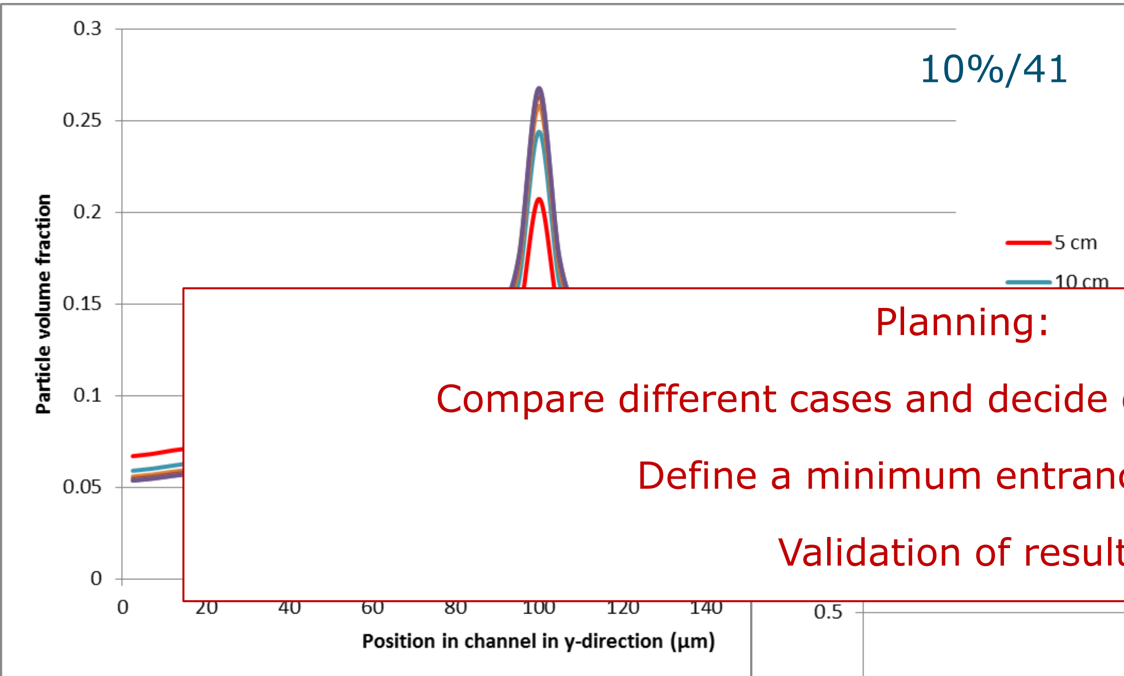

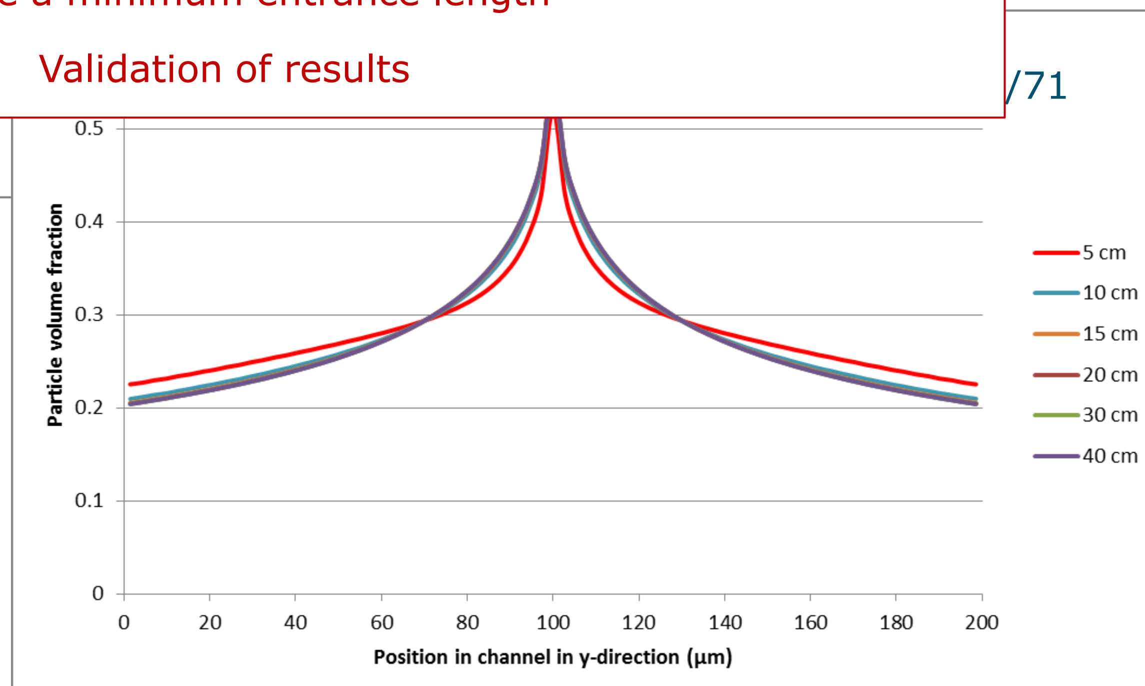

Planning:

Compare different cases and decide on optimal grid size

Define a minimum entrance length

Validation of results

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Questions or suggestions?

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