

Velocity profiles inside concentrated particle suspensions flows

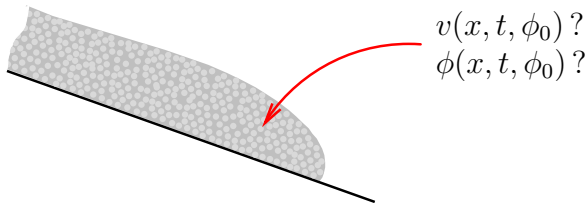
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Laboratoire d'Hydraulique Environnementale
Ecole Polytechnique Fédérale de Lausanne

October 13th, 2008

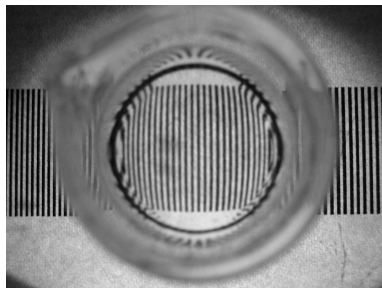
Goal

Measure velocity and concentration profiles in a free-surface flow of concentrated particle suspension (solid fraction $\geq 50\%$)



↳ region of special interest : the front


Suspensions



2 fluids \rightarrow control refraction index

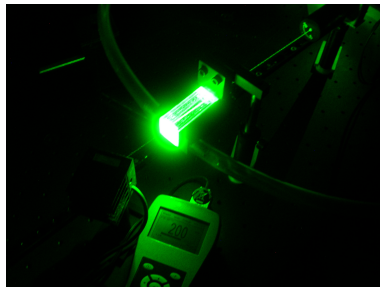
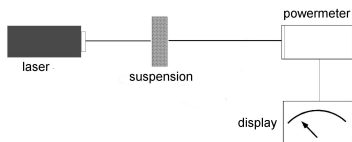
3 fluids \rightarrow control refraction index + $\Delta\rho$

4 fluids \rightarrow control refraction index + $\Delta\rho + \mu$

 work at constant temperature (± 0.2 °C)

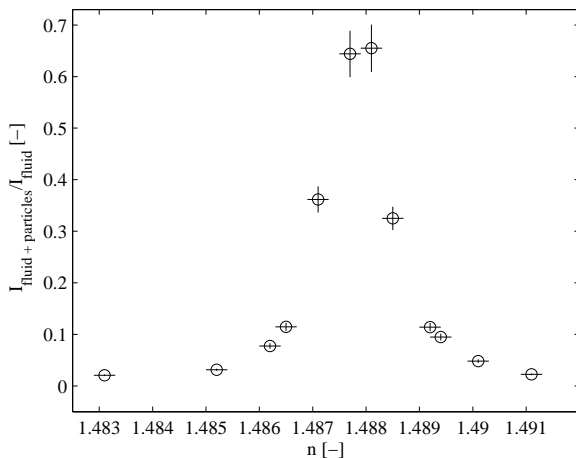
Optimization of the suspensions

- optimization of the fluid refraction index :

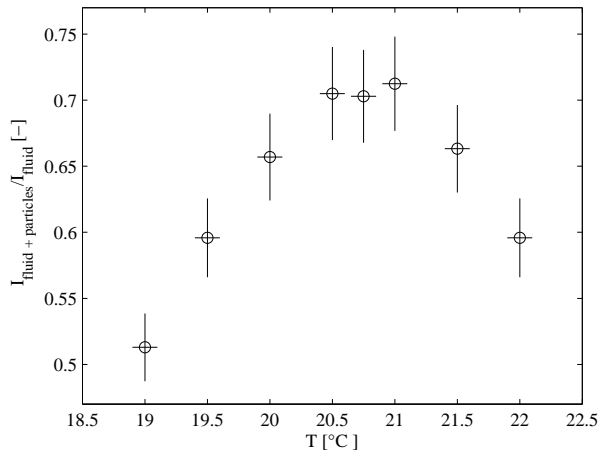


- optimization of the fluid density :
→ sedimentation test at constant temperature

Transmission in the suspension vs fluid refractive index

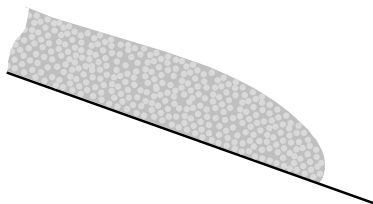


Transmission in the suspension vs temperature



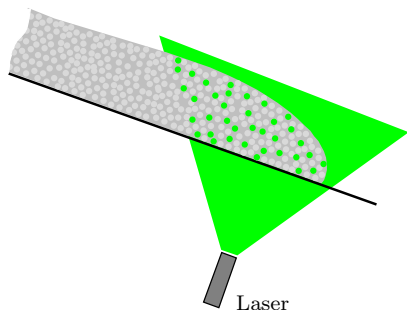
Fluorescent Particle Tracking Velocimetry (FPTV)

- tag a fraction of the particles with fluorescent molecules
- laser pulse
- the tagged particles emit light
- take a picture
- wait Δt
- repeat the process
- $v = \frac{\Delta x}{\Delta t}$



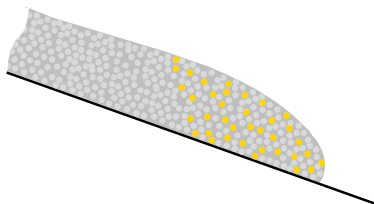
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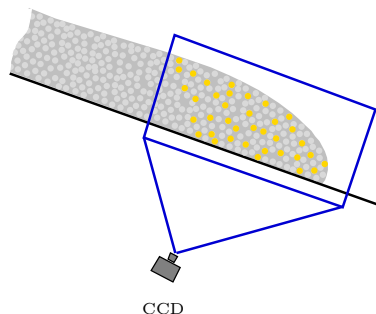
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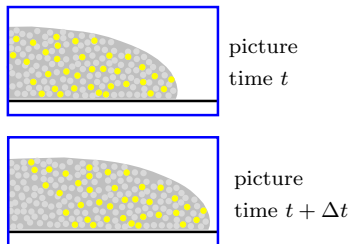


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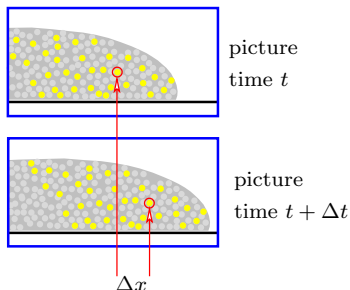
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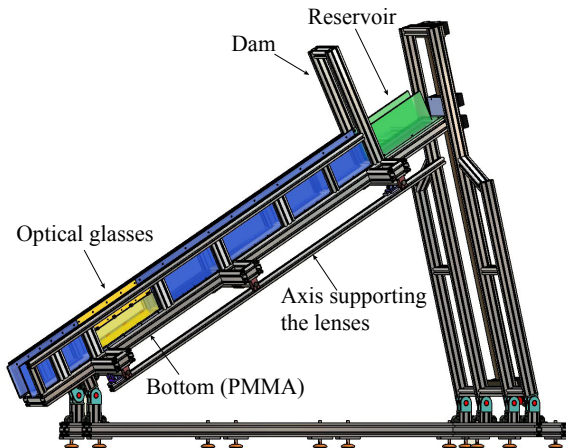


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Facility (under construction)

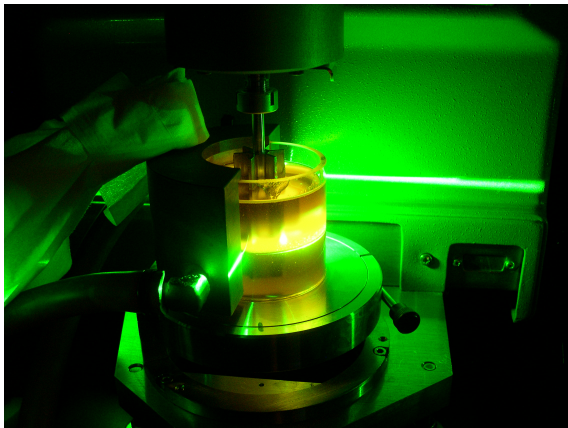


length 3.5 m, width 0.1 m, 10l of suspension released

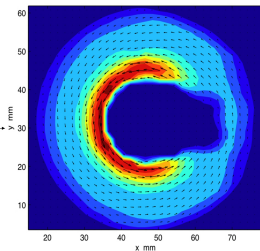
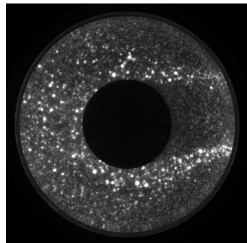
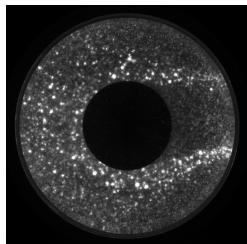
Facility (under construction)



Experiments in Couette cell

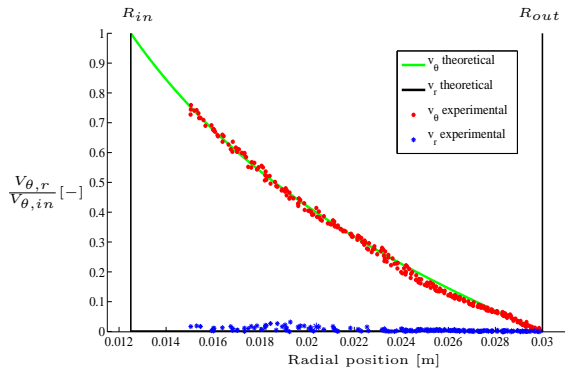


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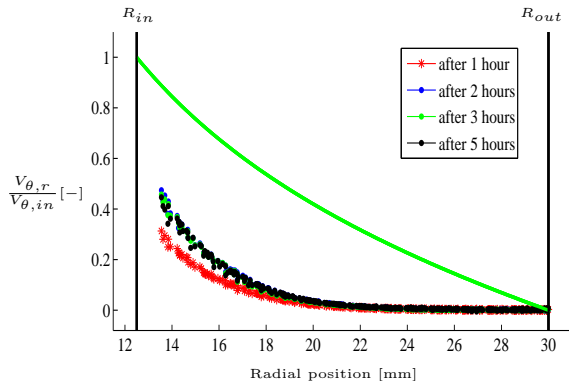


15 velocity maps/s

Results in Couette cell - newtonian fluid



Results in Couette cell - suspension $\phi = 50\%$



Conclusion

- suspension preparation and handling → OK
- velocity measurements → OK
- channel setup → ready for test at the end of the year
- concentration measurements → still working on