2 vents cavity modelling

PIV measurements and LES simulations

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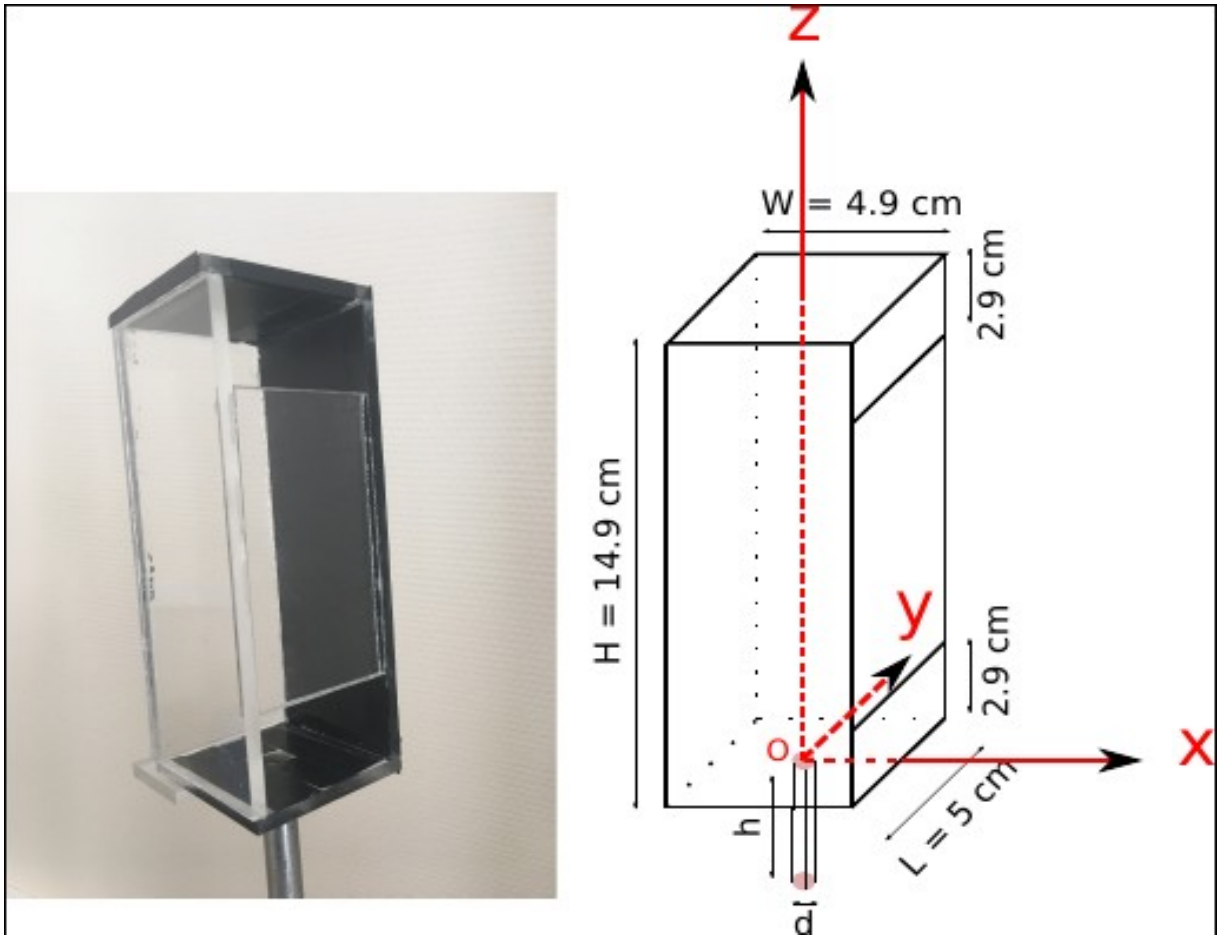
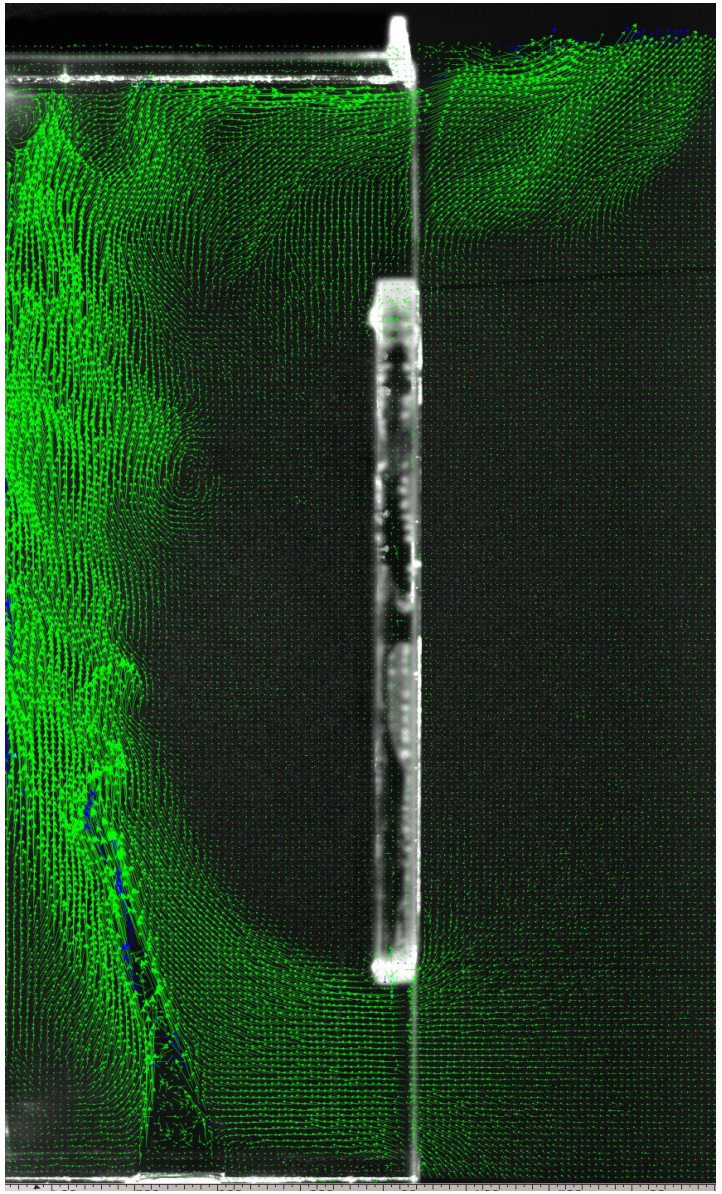
Experimental set-up



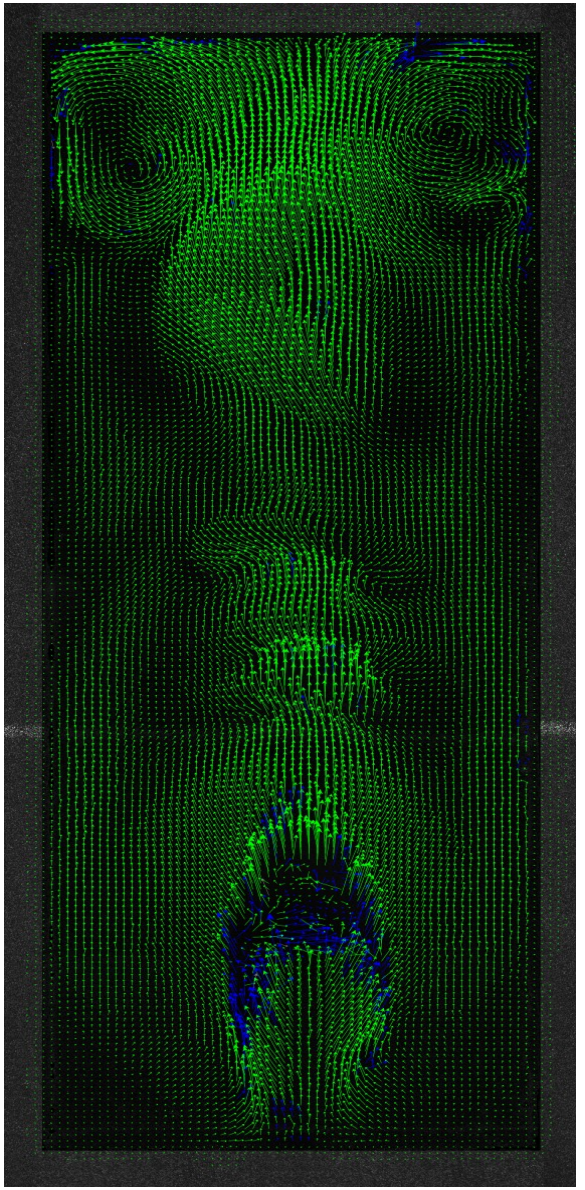
- Pulsed Yag laser
- Helium injection
- Injection diam 10mm
- 8Mpx PIV camera

Flow structure – 5NL/min

XZ

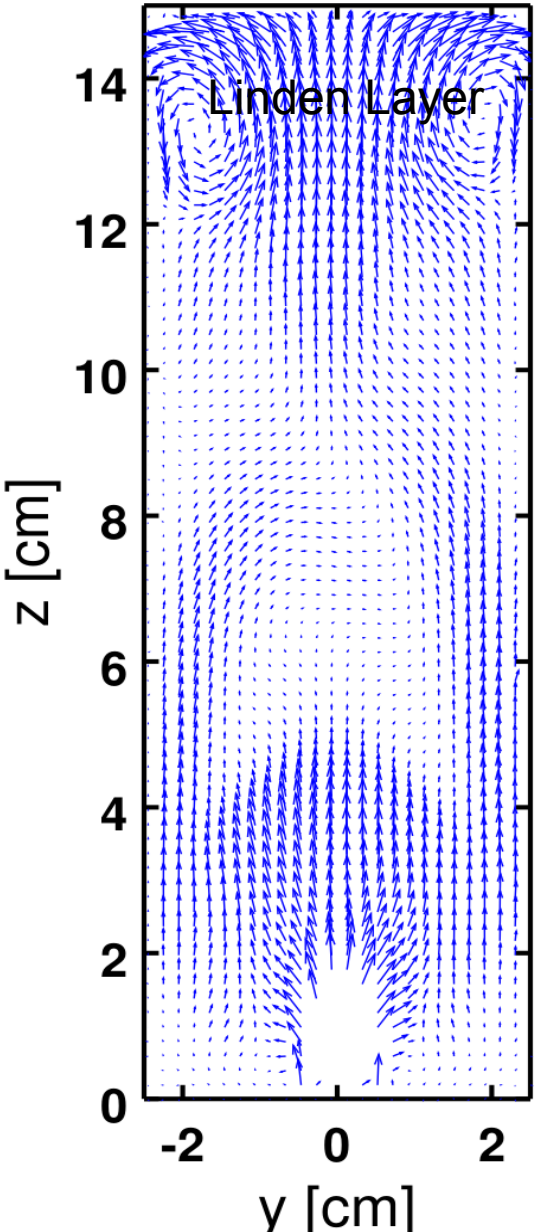


YZ

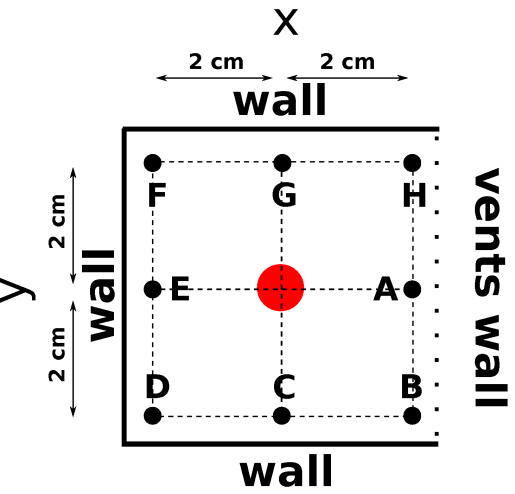


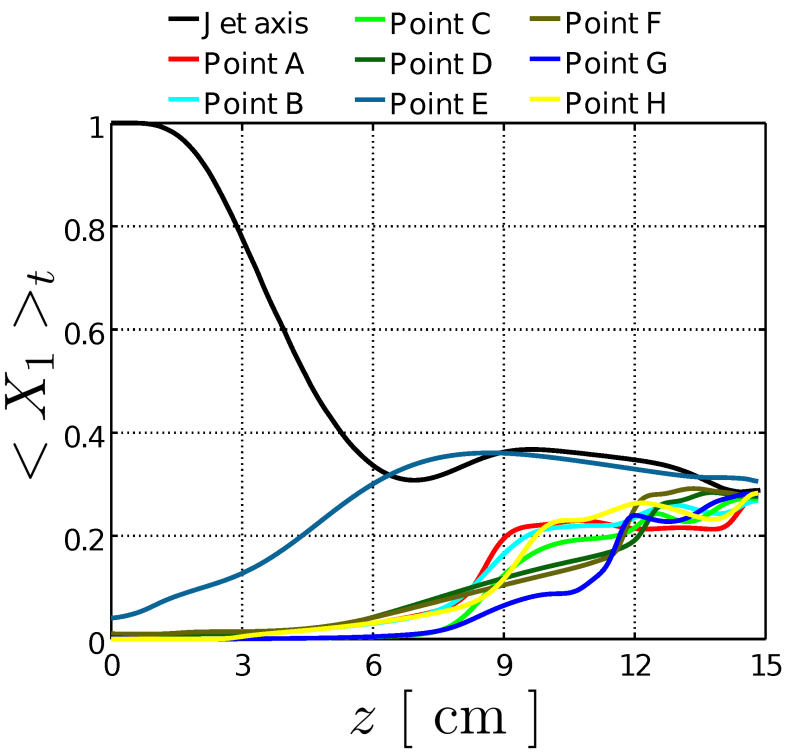
Instantaneous

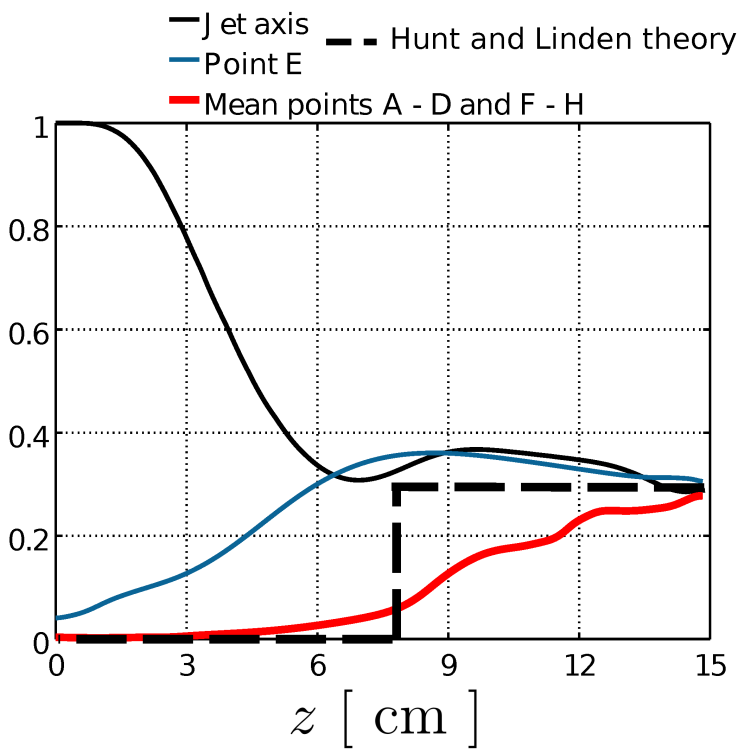
Time averaged



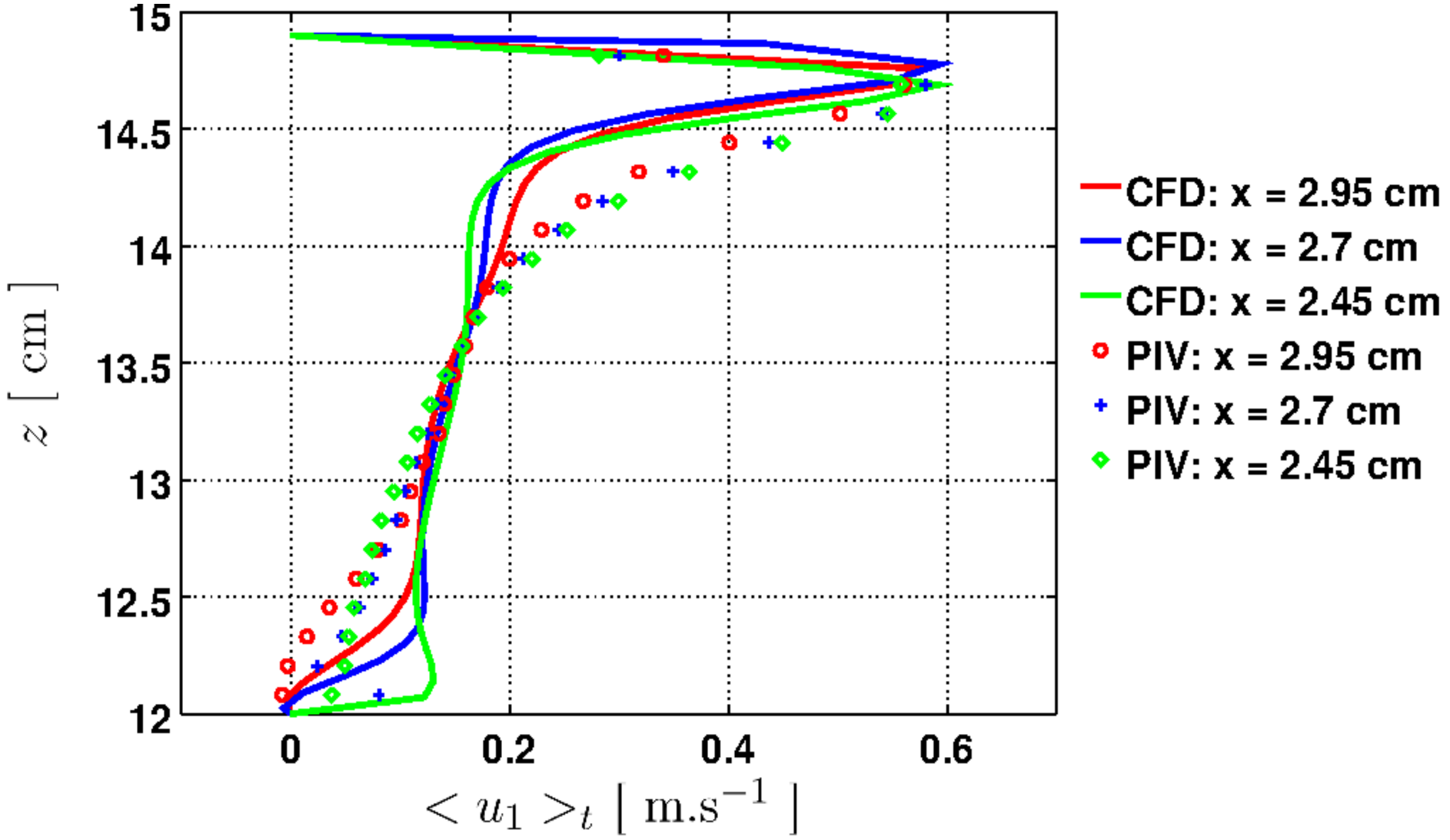
Concentration – 5NL/min (LES)







Velocity profiles -top vent



First conclusions

Bended jet due to interactions between bottom vent and injection

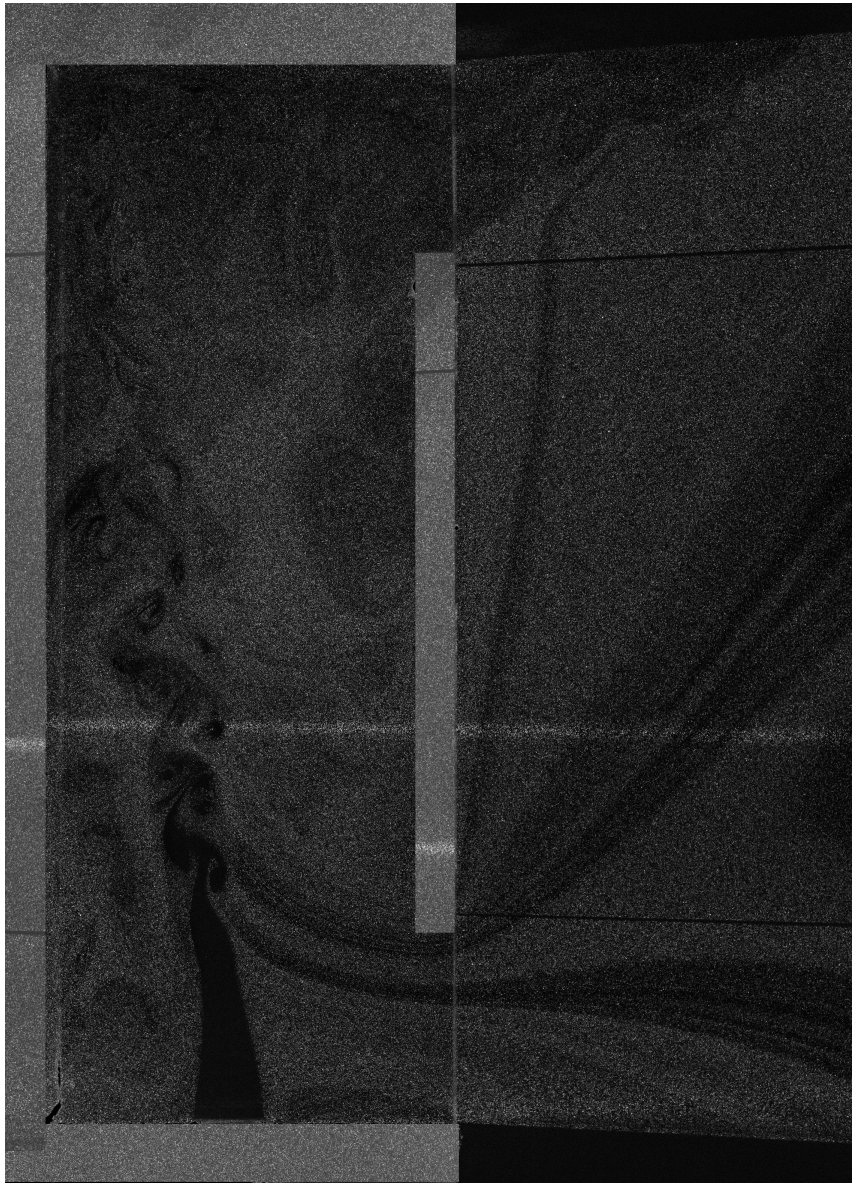
Interaction between jet and back wall facing the vents

Existing thin impinging layer at the ceiling toward the vent

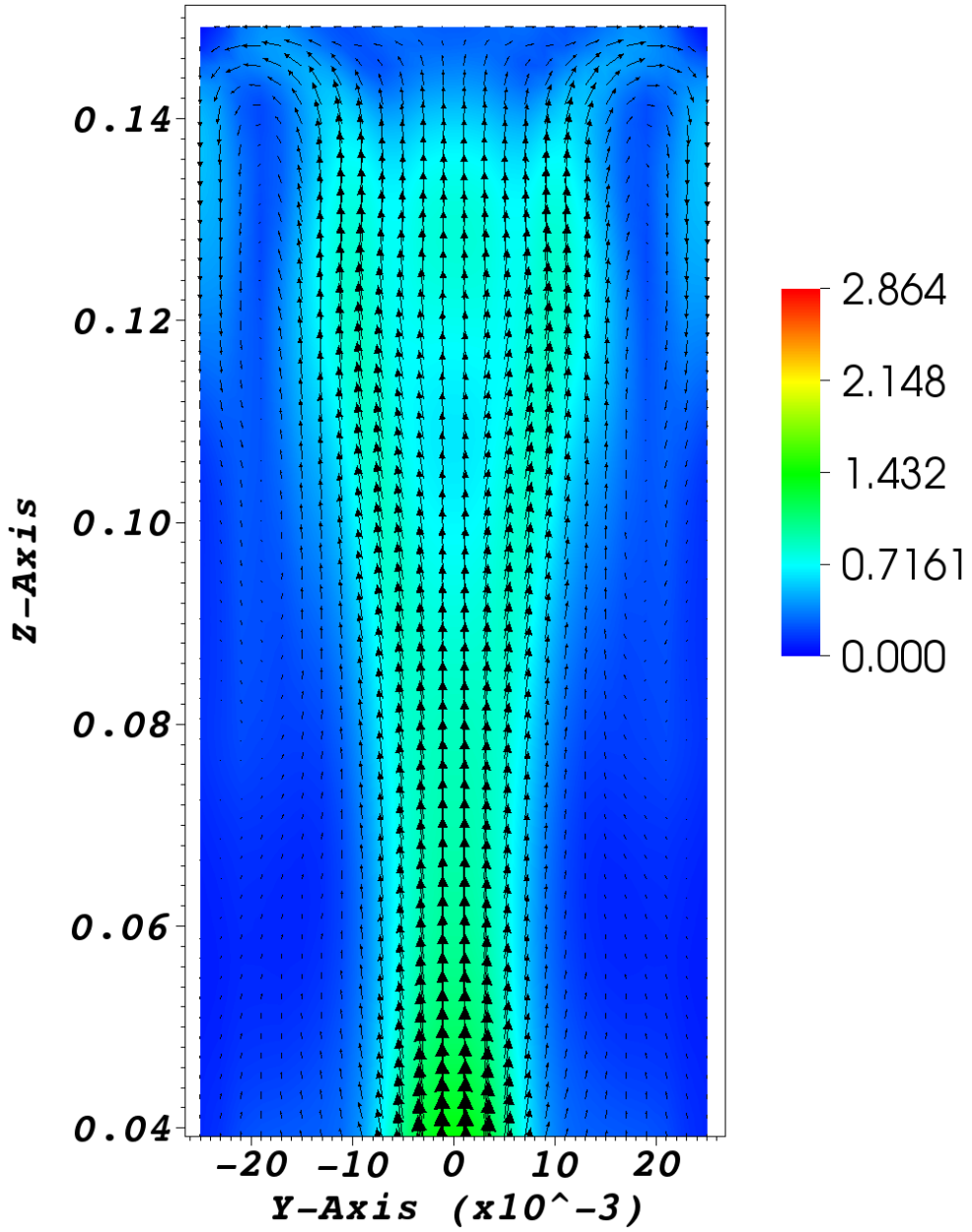
Second thicker “Linden” layer due to recirculating eddy in the y direction parallel to the vent wall
=> larger box or flow rate required to be in “Linden” configuration

10 NL/min injection

PIV

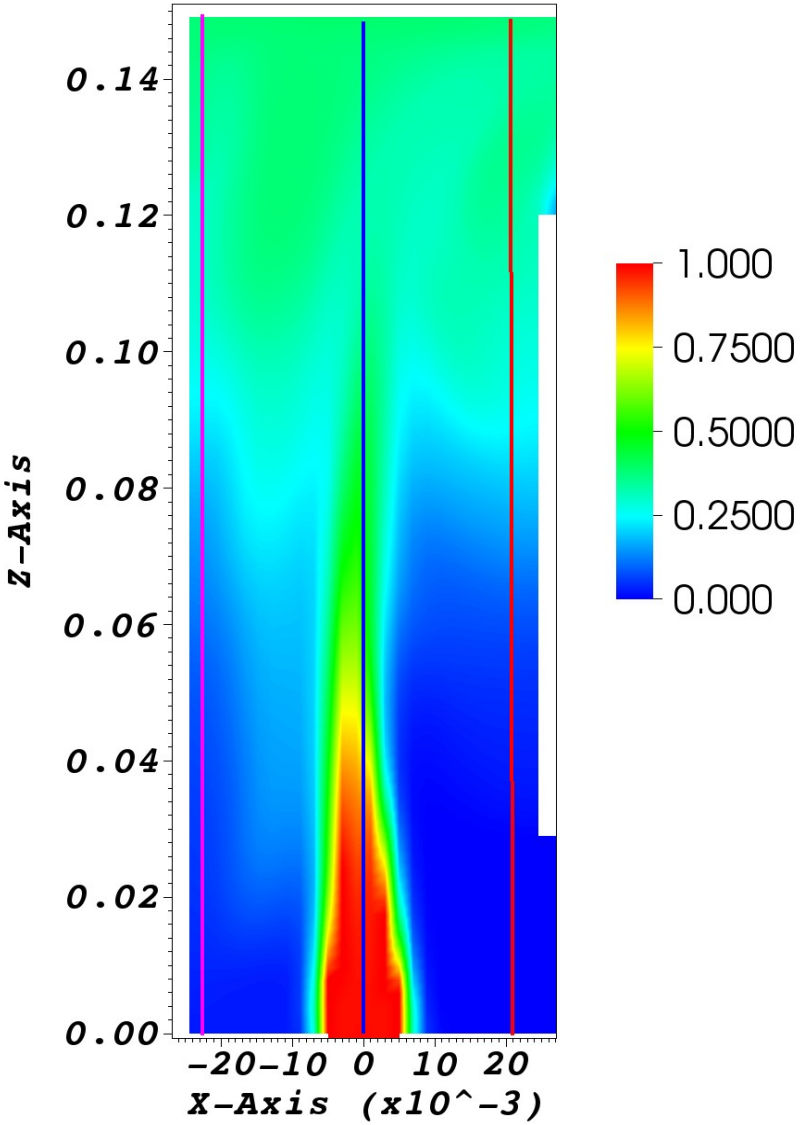


LES

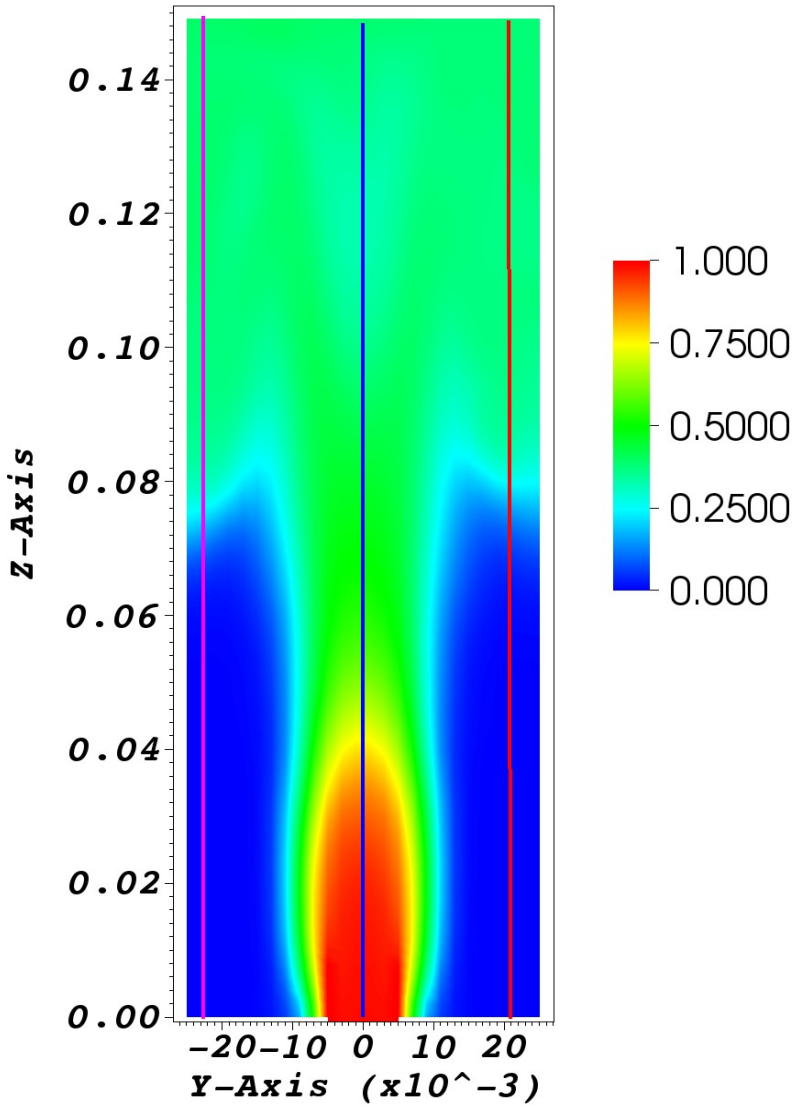


Concentration

LES - XZ

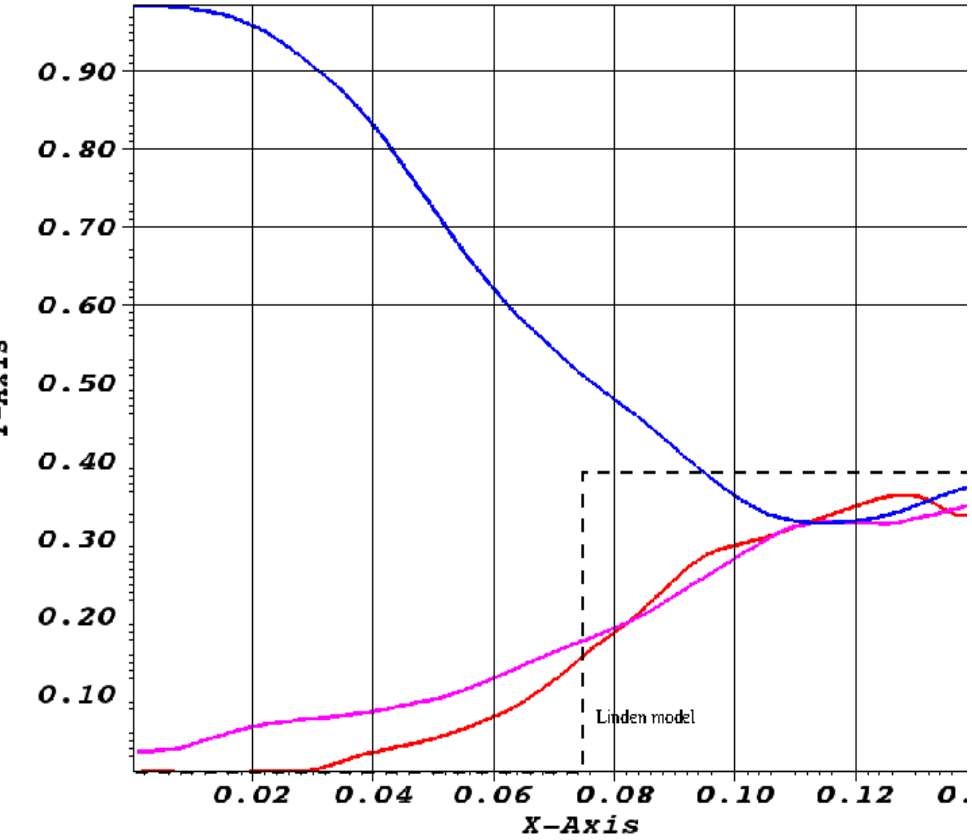


LES - YZ

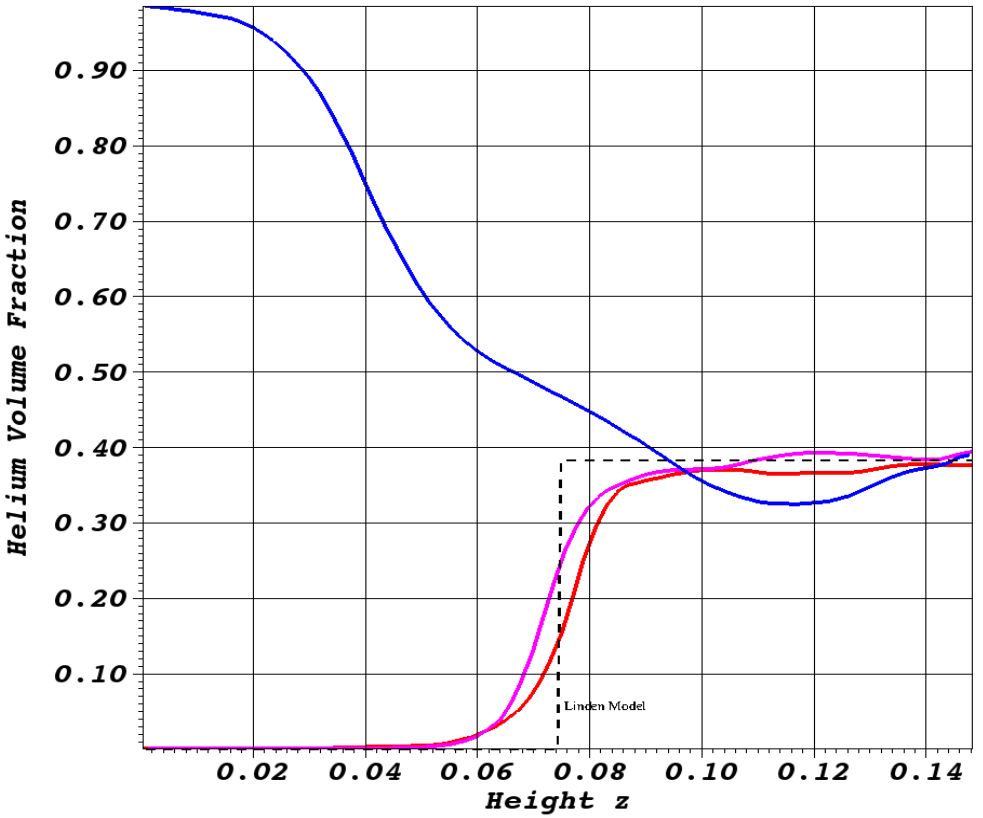


Concentration profiles

LES - XZ



LES - YZ



Second conclusions

With higher flow rates, flow is more symetrical
Structures become “1D”

Linden layer becomes dominant

=> good agreement between improved Linden model and simulations/experiments

Lindel model improvements

Pressure is varying across the vents, Bernoulli law is integrated

Entrainment coefficient is not chosen constant, Carazzo et al. Model is used:

- Mass, momemtum, species 1D equations are solved
- Equation for the entrainment coefficient connected to local Ri is solved
- Parameters suggested by Carazzo and Kaminski are modified for z/d < 10 based on our database.

CONCLUSIONS

- We dispose of validated experimental facility as well as numerical tools to have a better understanding at the formation of the Linden layers
- We dispose of an improved Linden model which is validated against a large database (experiments and CFD simulations)

YET

- We need to improve the model for jet/plume transition prediction (Papanicolaou) which proves to be inaccurate at low/high Mach flows.
- We need to build a model predicting when Linden model is valid/invalid.