2 vents cavity modelling

PIV measurements and LES simulations

Experimental set-up

- Pulsed Yag laser
- Helium injection
- Injection diam 10mm
- 8Mpx PIV camera
Flow structure – 5NL/min

Instantaneous

Time averaged

Linden Layer
Concentration – 5NL/min (LES)
Velocity profiles - top vent

Graph showing velocity profiles with "z [cm]" on the y-axis and "< u_1 >_t [m.s^{-1}]" on the x-axis. Different lines and markers represent CFD and PIV measurements at various x positions: CFD: x = 2.95 cm, CFD: x = 2.7 cm, CFD: x = 2.45 cm, PIV: x = 2.95 cm, PIV: x = 2.7 cm, PIV: x = 2.45 cm.
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 profiles

LES - XZ

LES - YZ
Second conclusions

With higher flow rates, flow is more symmetrical
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, momentum, 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.