

# Experimental And Numerical Studies Of Gaseous And Particulate Pollutants Backflow Through An Opening From A Depressurized Enclosure:

## Application To Nuclear Dismantling Operations

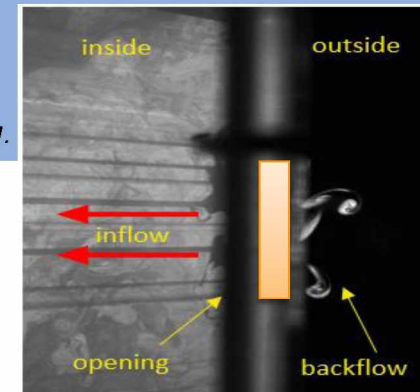
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Presented by **Zeinab RIDA**

*Keywords: dynamic confinement; backflow; flow at openings; hybrid turbulent modelling.*

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# Context and problematic

- **Context:** Safety of maintenance and dismantling sites.
- **Problematic:** Characterize the efficiency of the dynamic containment in flexible dismantling sites (SAS), by studying the backflow phenomenon of gaseous or particulate pollutants near the openings.

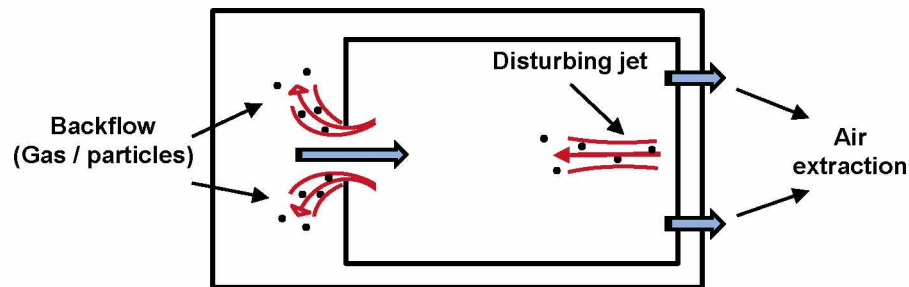


Examples of a flexible SAS

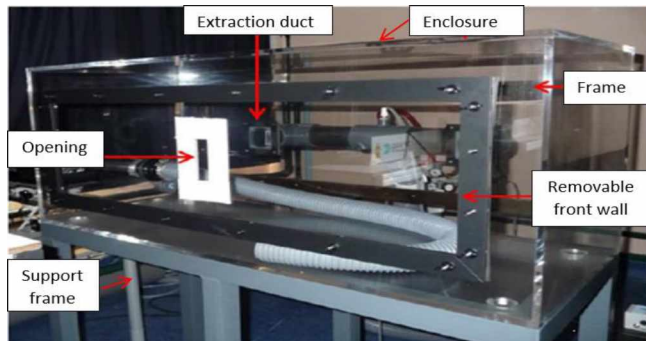
## Objectives

- **Experimental:** Local and global quantification of the pollutants emitted outside ventilated enclosure under the effect of an aerodynamic disturbance
- **Numerical:** Validation of the ability of the hybrid turbulence model DES to reconstitute and quantify these non-stationary phenomena

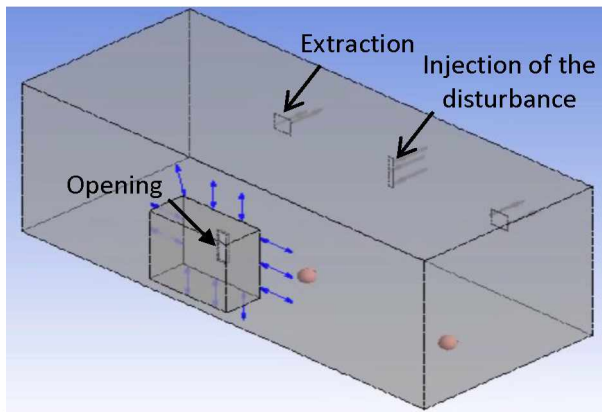
## Application to a real SAS



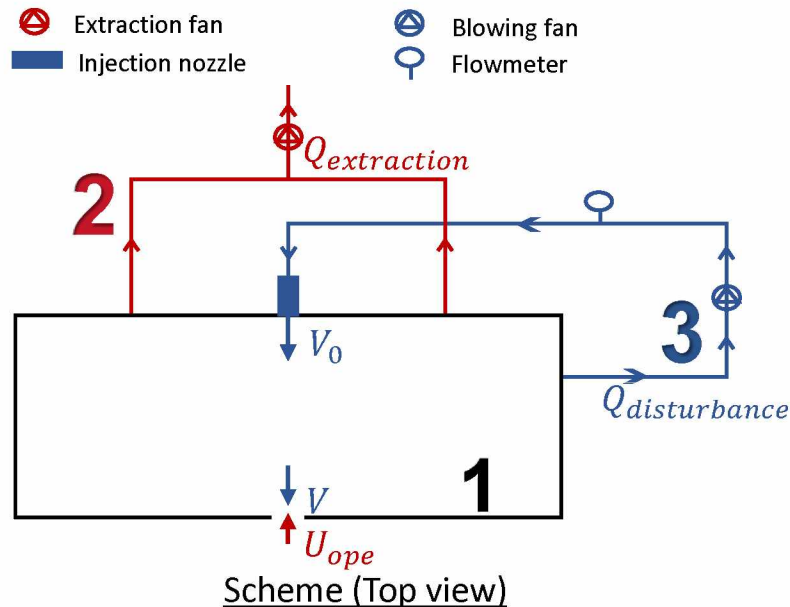
# Our study configuration



Experimental enclosure



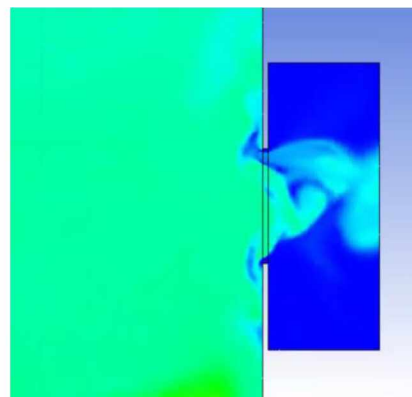
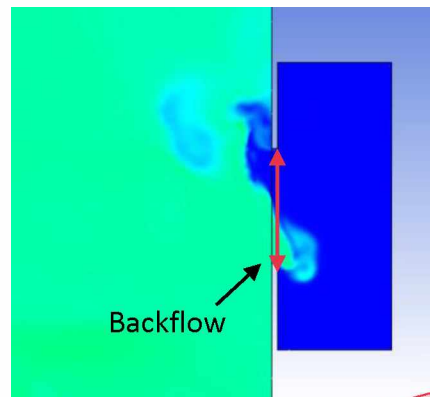
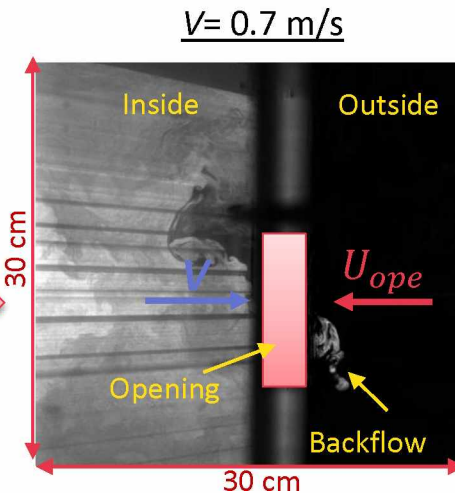
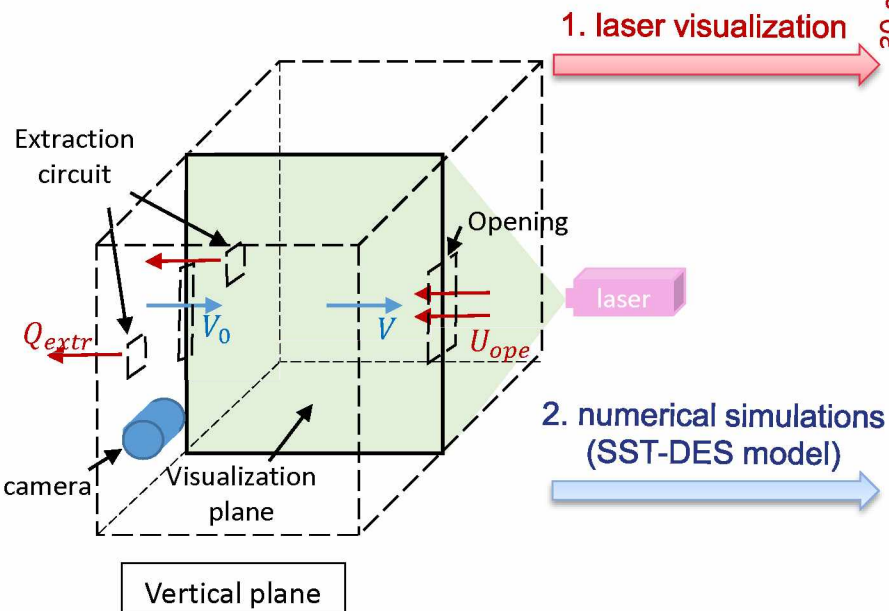
Numerical enclosure



- 1. Experimental enclosure:**  $(1,2 \times 0,5 \times 0,5) m^3$ , opening  $(0,1 \times 0,03) m^2$
- 2. Extraction circuit:**  $U_{ope}$  at the opening
- 3. Disturbance circuit:**  $V$  near the opening

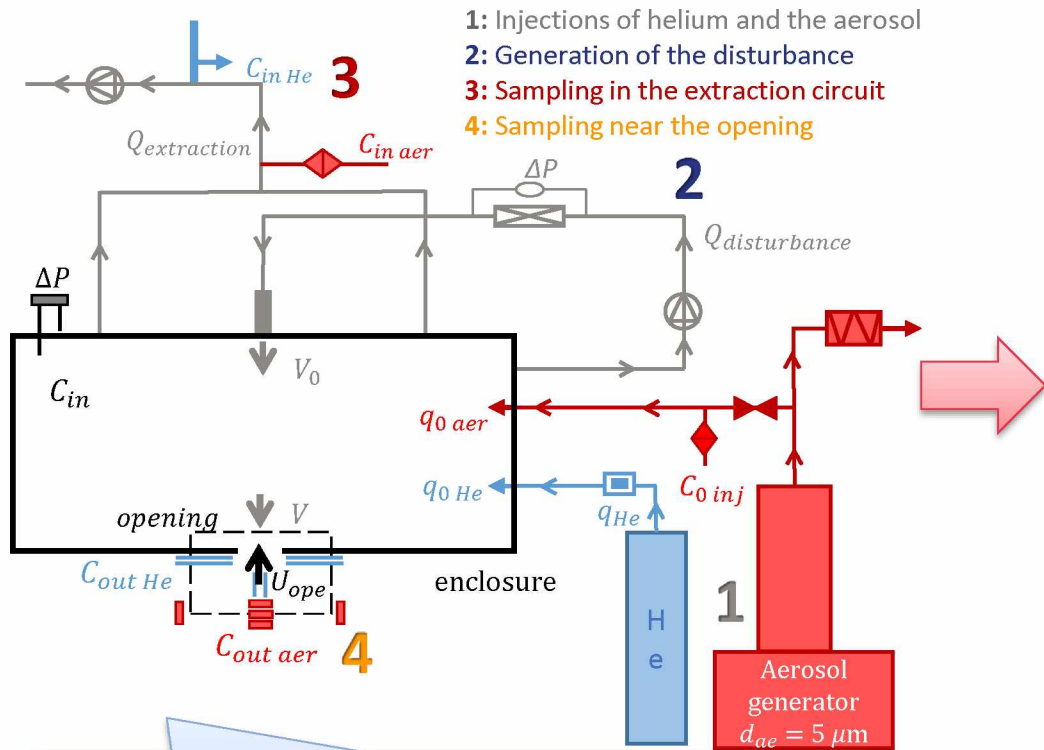
# Visualization of the backflow

- Dynamic containment:  $U_{ope} = 1$  m/s
- Counter-current internal jet:  $V = 0.7$  and  $1.3$  m/s

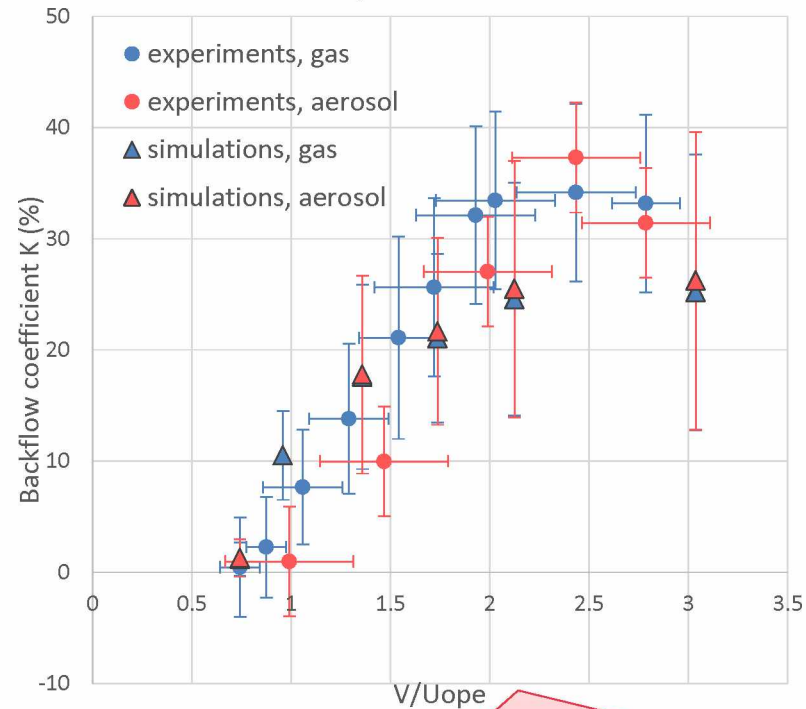


Validation of SST-DES model

# Quantification of the backflow



$U_{ope} = 0.5 \text{ m/s}$



→ Gaseous and particulate backflow coefficients:

$$K_{He} (\%) = \frac{C_{out He}}{C_{in He}} ; K_{aer} (\%) = \frac{C_{out aer}}{C_{in aer}}$$

The experimental/numerical and gaseous/particulate backflow coefficients are at the same order of magnitude

# Conclusions and perspectives

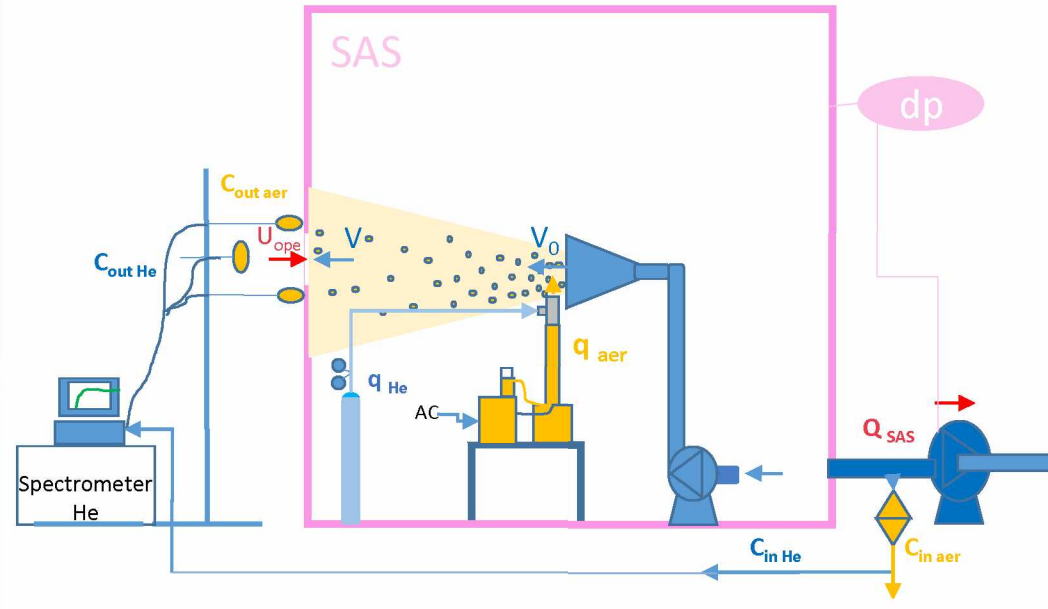
## Conclusions:

1. The **SST-DES model** is validated to reconstitute the **qualitative** and the **quantitative** aspects of the backflow in our conditions.
2. The **gas** and the **aerosol of  $5\ \mu\text{m}^*$**  have a similar behavior in our conditions.

\* : aerodynamic diameter

## Perspectives:

1. Perform **experiments** on a **real depressurized airlock**, while varying the disturbance type.
2. Test the ability of **numerical simulations** to predict the backflow phenomenon at this scale.



Real scale depressurized airlock (SAS)