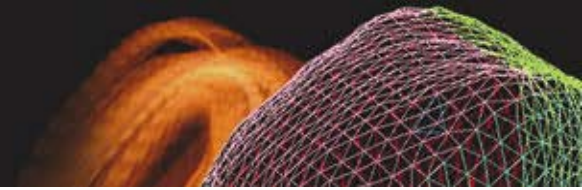

Optimizing Mesh Generation Study in Indoor Bio-aerosol Transmission

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Presentation Overview

- **Background**
- **Experimental Case Setup**
- **RANS Validation**
- **DPM or VoF**
- **RANS – DPM**
- **Adaptive Mesh Refinement (AMR)**
- **Scale-Resolving Simulation Options (SBES)**
- **DPM – VoF coupling with AMR so far**

Background

- Multiphase flows
- Clear interface even at the molecular level of breakup.
- Predicting particle and droplet transport.
- To simulate the movement of continuous air, the flow governing equations in Eulerian-form are solved:

$$\frac{\partial \Phi}{\partial t} + (\mathbf{V} \cdot \nabla)\Phi - \Gamma_\phi \nabla^2 \Phi = S_\phi$$

Background

- Software used - ANSYS fluent

- CFD – Eulerian-Lagrangian (DPM) application in fluent

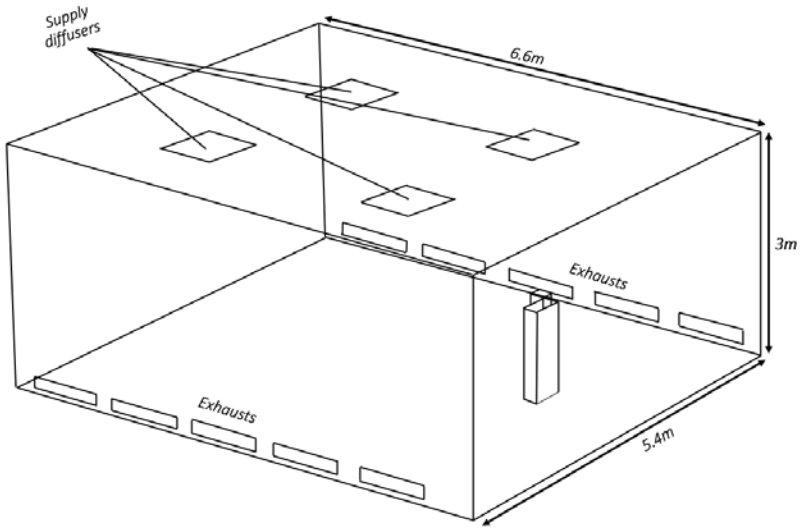
Two different phases are defined in the DPM model: A continuous and a particle/discrete phase.

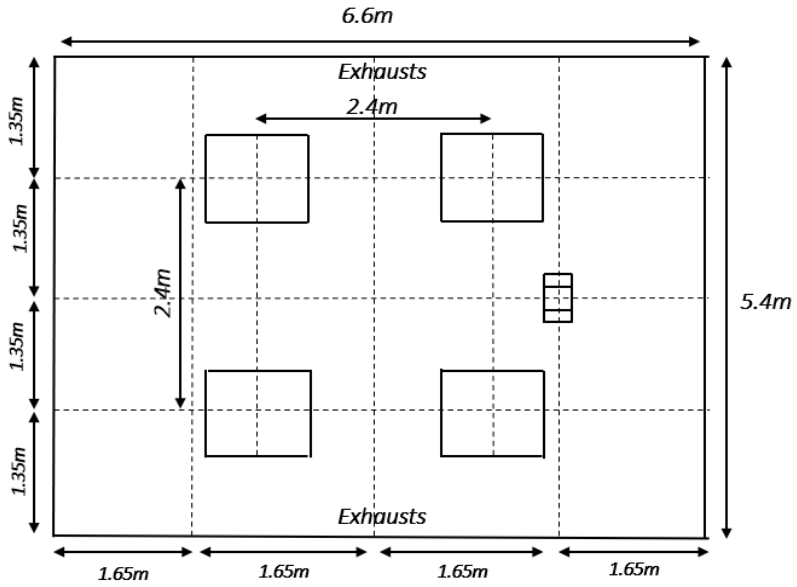
- CFD – Eulerian Eulerian (VoF) application in fluent

- What is meshing and why is it so important in grid discretization

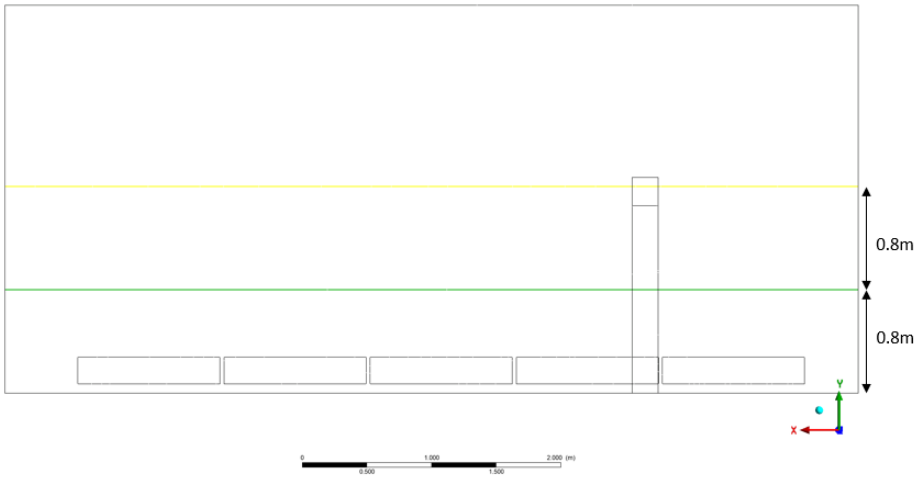
Experimental Case Setup

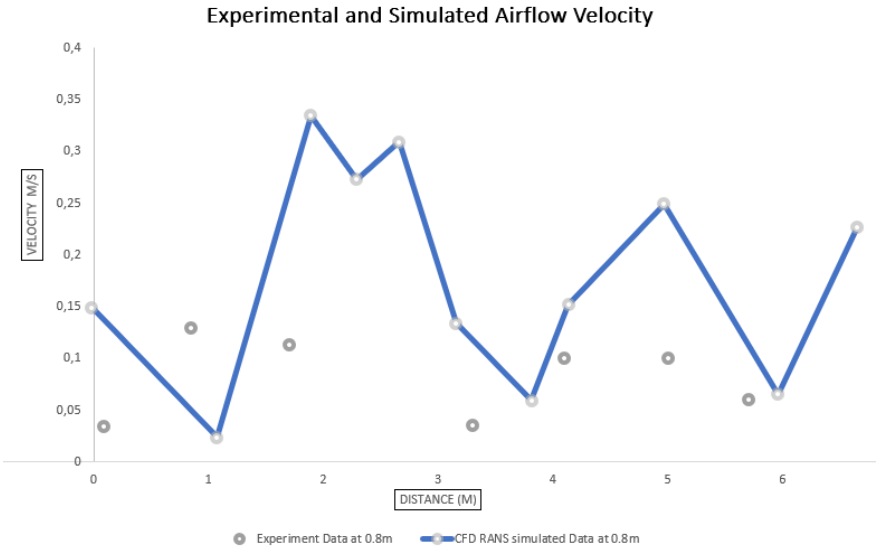
Liu, Z., Zhu, H., Song, Y., & Cao, G. (2022, May). Quantitative distribution of human exhaled particles in a ventilation room. In Building Simulation (Vol. 15, No. 5, pp. 859-870). Tsinghua University Press.



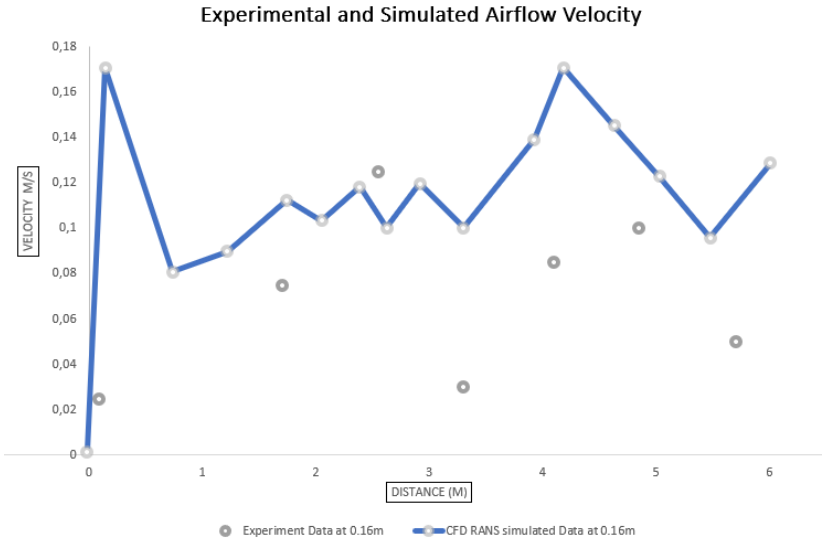


Validation



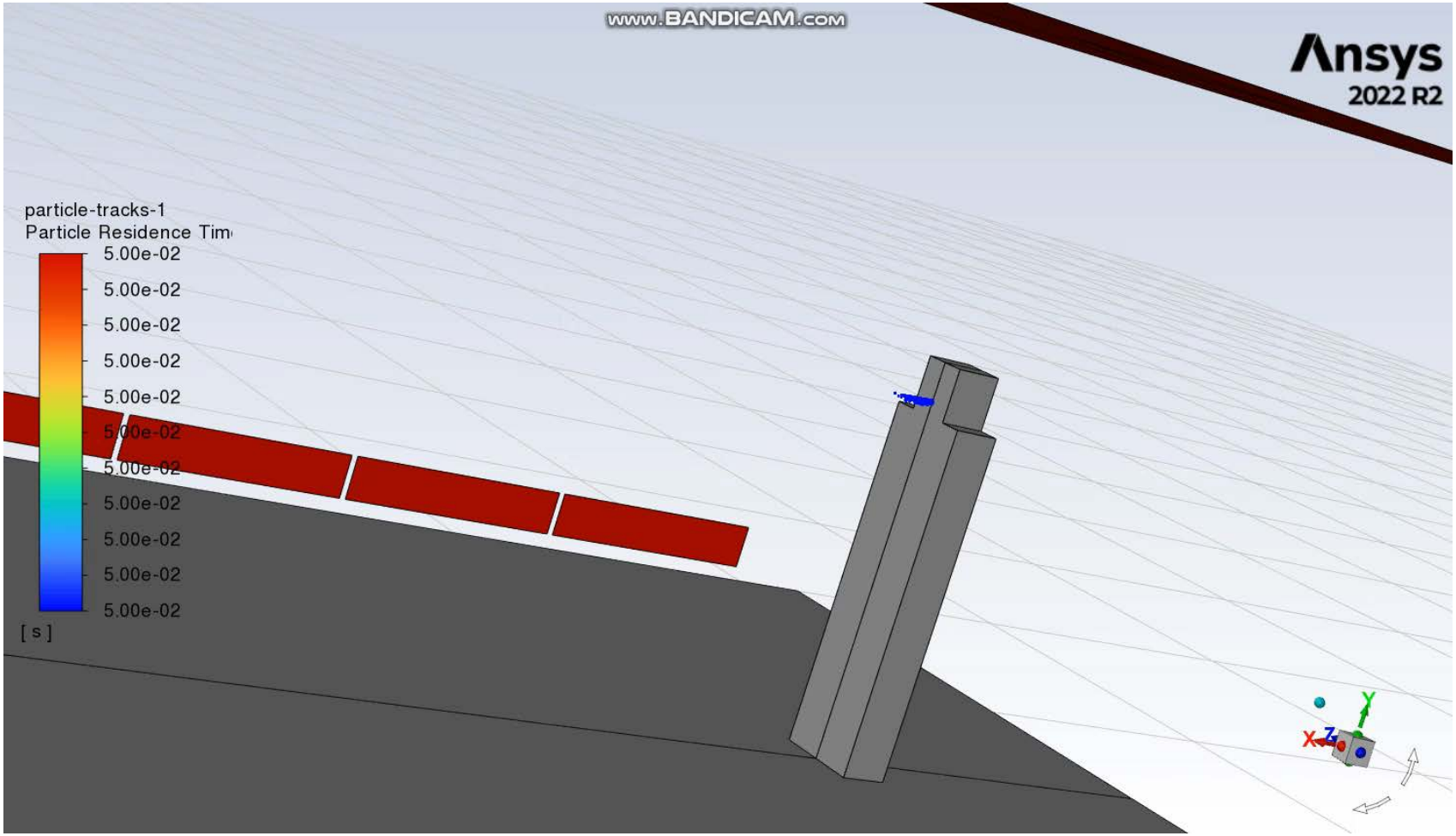


Cross sectional area at the center of the computational domain displaying heights at 0.8m and 0.16m from ground level.



DPM or VoF

Reynolds Average Navier Stokes (RANS) – Discrete Phase Method (DPM)



Scale-Resolving Simulation Options (SBES)

- Subgrid-Scale Model – WMLES S-Omega

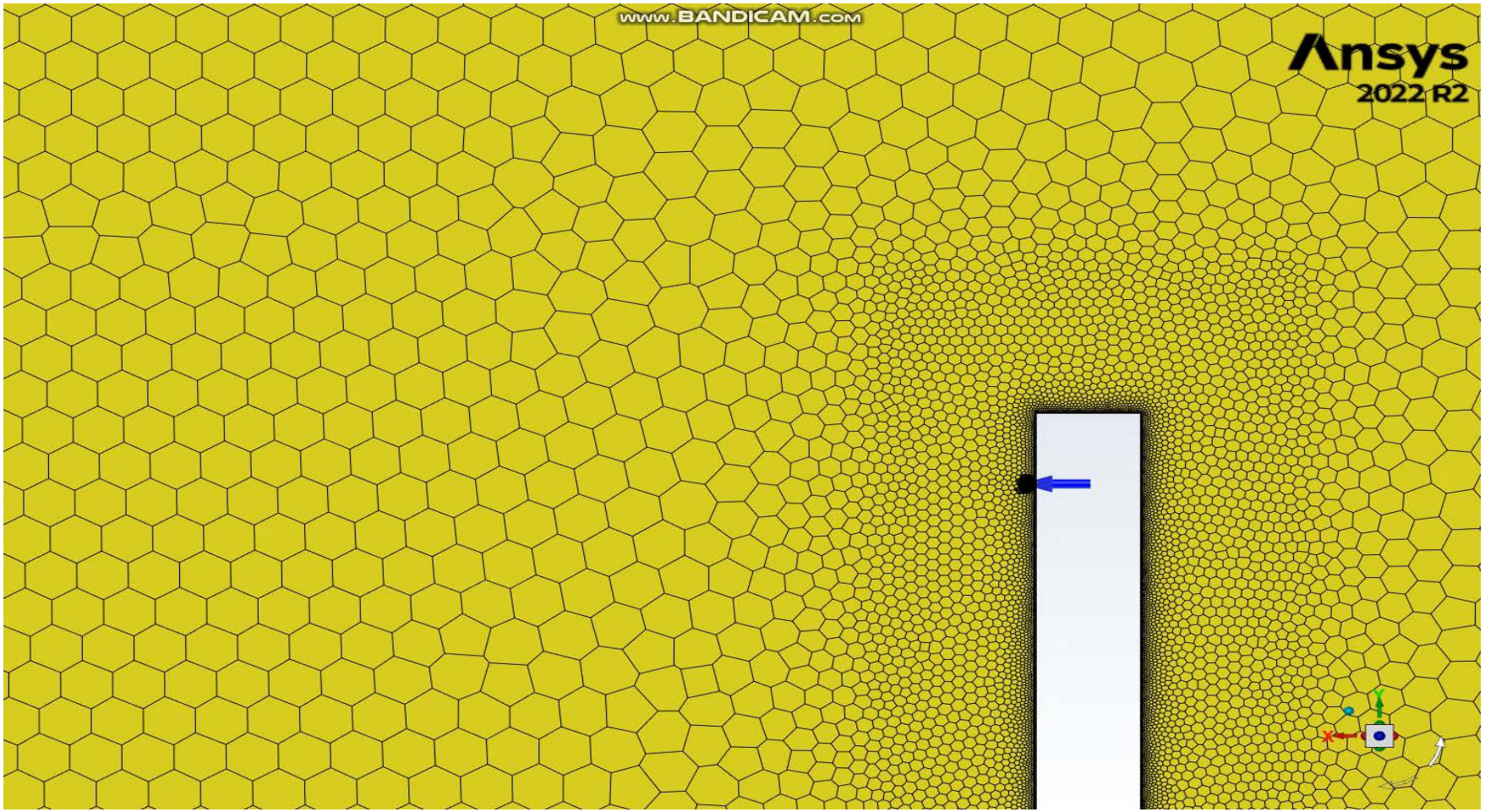
Utilize subgrid WMLES in areas of interest and RANS turbulence modeling in the coarse regions

- VoF phase transition – Water to air

Adaptive Mesh Refinement

- What is AMR and why this technique
- A method of adapting the accuracy of a solution within certain regions of simulation, dynamically and during the time the solution is being calculated.
- Adaptive mesh refinement (AMR) changes the spacing of grid points, to change how accurately the solution is known in that region.

DPM – VoF coupling with AMR so far



Thank you for your attention