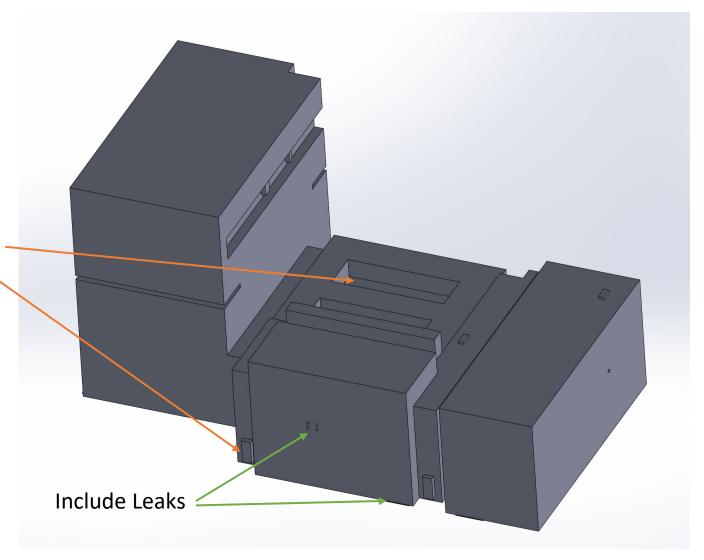
How To Model Your Lab's Airflow

(Total Simulation Time ~2 hours)

Create a 3D CAD model of lab internal volume

Insert extrusions for both Inlets and Outlets

If you don't know how to do this, follow this video on using Inventor (Free CAD Software for students) https://youtu.be/GIN87pw9jV0



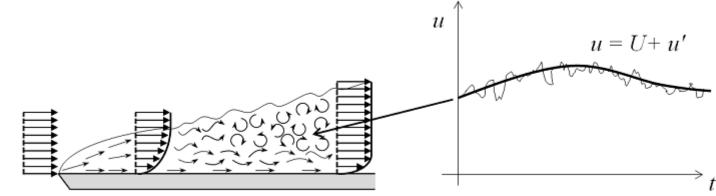
Verify airflow from each outlet/inlet



- Inlet flow rate dependent on return conductance.
- Include any high flow rate devices, such as HEPA flow hoods, laminar flow hoods, fans, chillers.

CFD Simulation assumptions used

- Isothermal ideal air
 - (For low airflow rooms with high heat loads this is not valid)
 - Segregated flow (Due to low speed flows)
- Steady state flow assumed
- Reynolds-Averaged Navier-Stokes
 - K-epsilon turbulence model



CFD Software Options

Shown Here

• Ansys Fluent – Free Student Version Available

https://www.ansys.com/academic/free-student-products

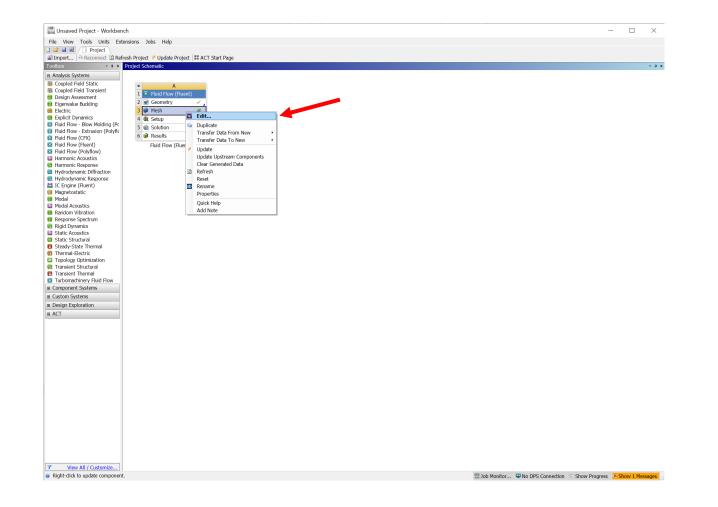
Other Options:

- Siemens Star CCM+
- COMSOL Multiphysics

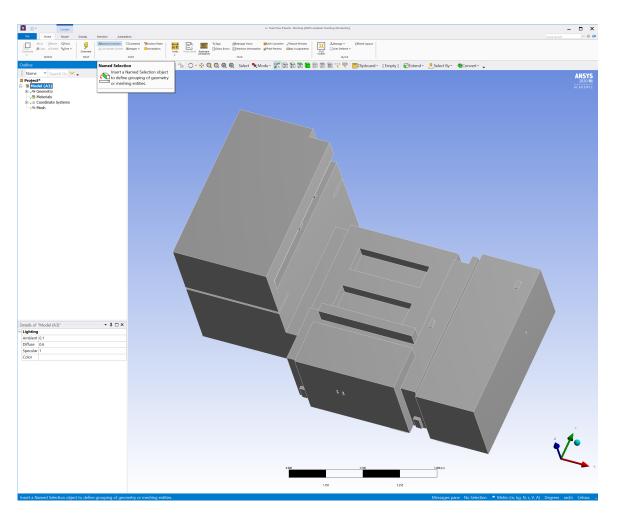
Click Fluid Flow (Fluent), Import Geometry

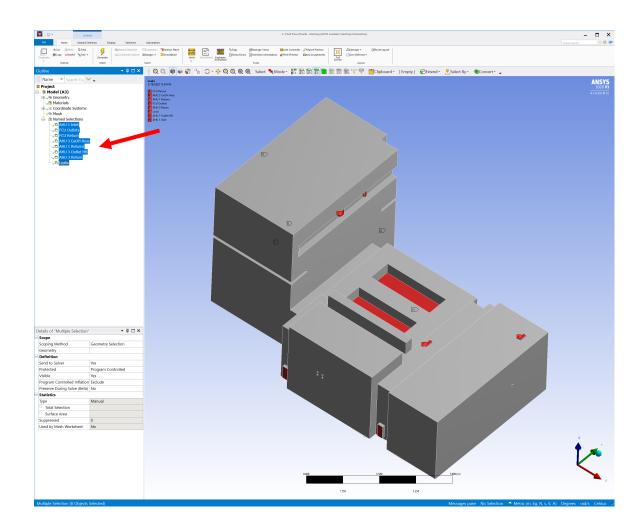
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Open Mesh Editor

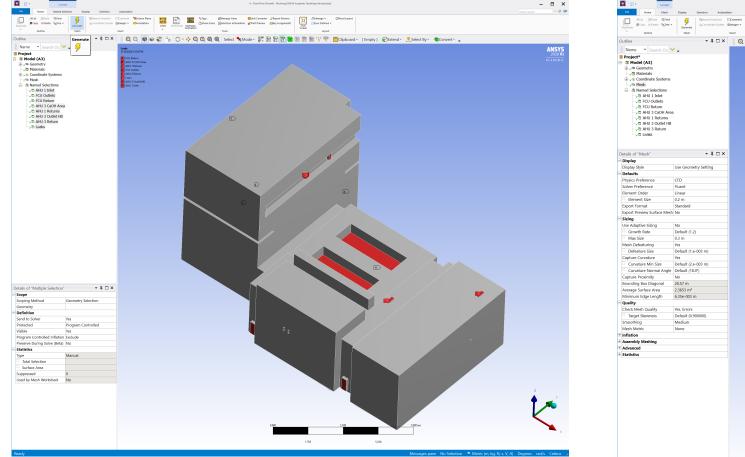


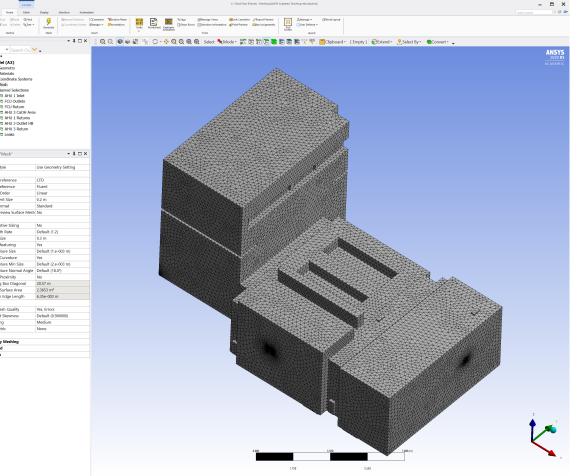
Add named selections to each inlet/outlet





Generate Mesh – Adjust mesh to desired level



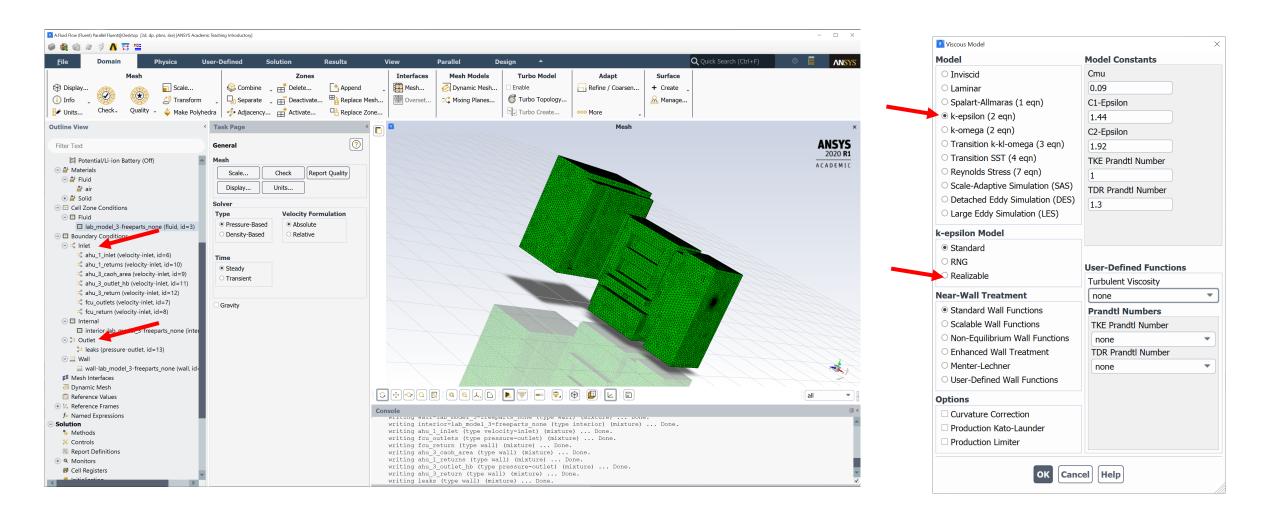


Update Mesh and Launch Fluent

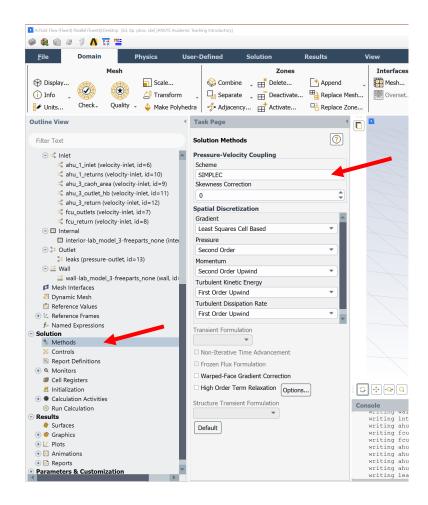
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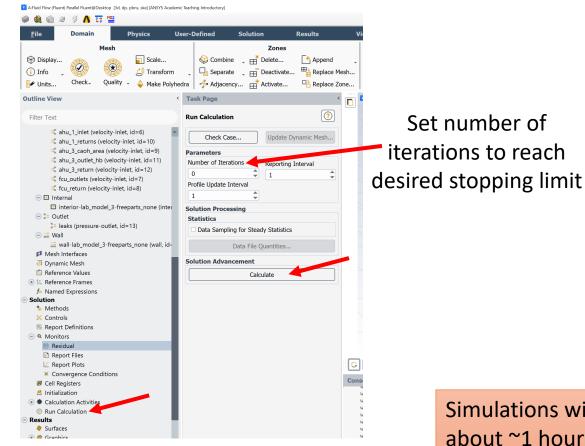
Select velocity inlets for both inlets and outlets and set velocities Leaks are left as pressure outlets

Select the k-epsilon turbulence model in the viscous model settings



Set segregated flow and Run





Simulations will take about ~1 hour to run on a desktop

General notes about attaining convergence

- Ensure mesh resolution is fine enough in "high" velocity areas (>0.5m/s)
- Ensure mass conservation is attained
- Residuals <~0.001 usually indicate reasonable convergence
- If non converging, stop and plot results. Use areas of unphysical results as indications of possible problems with the model

Once Convergence Reached, Plot Results

