Airflow Modelling through Portalwall System

Prepared by Dr. Cristina Paduano and Dr. Arman Safdari

CFD Modelling Specialists

B-Fluid Ltd. | Buildings Fluid Dynamics Consultants

B-Fluid
Buildings Fluid Dynamics

Issued: 12 Septemebr, 2025

For: Yonatan Margalit

Portalwall®

WATER VAPOR ALOFT
PortalWall®

CFD Methodology

- At intake side of the portalwall, velocity is defined and the standard air properties at temperature 20 ˚C were applied.

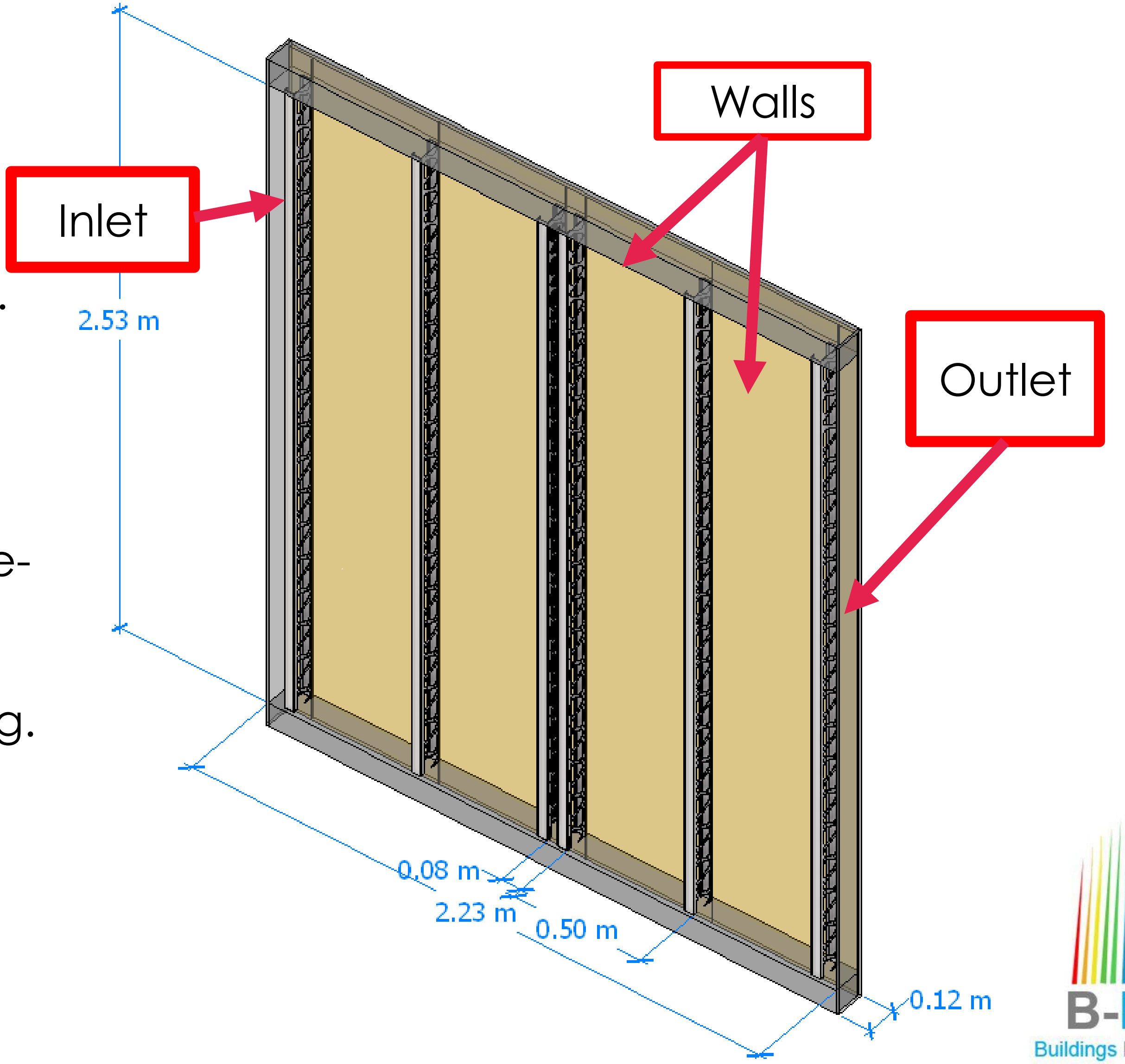
- At outlet side of the portalwall, zero gradient of velocity of air is assumed.

- The walls were modelled to be adiabatic and air is isothermal. The no slip condition was applied and zero velocity in the tree direction (Ux=Uy=Uz=0) was used for walls.

- Three dimensional steady CFD Analysis Was performed for solving the momentum, continuity. The RANS SST turbulence model was used to solve turbulence transport equations, with the both standard wall function model for near wall treatment. Finite Volume Discretization (FVM) is employed to approximate the governing equation. Interpolation scheme is employed for solution of governing equation.

Boundary Condition and Dimensions Model A

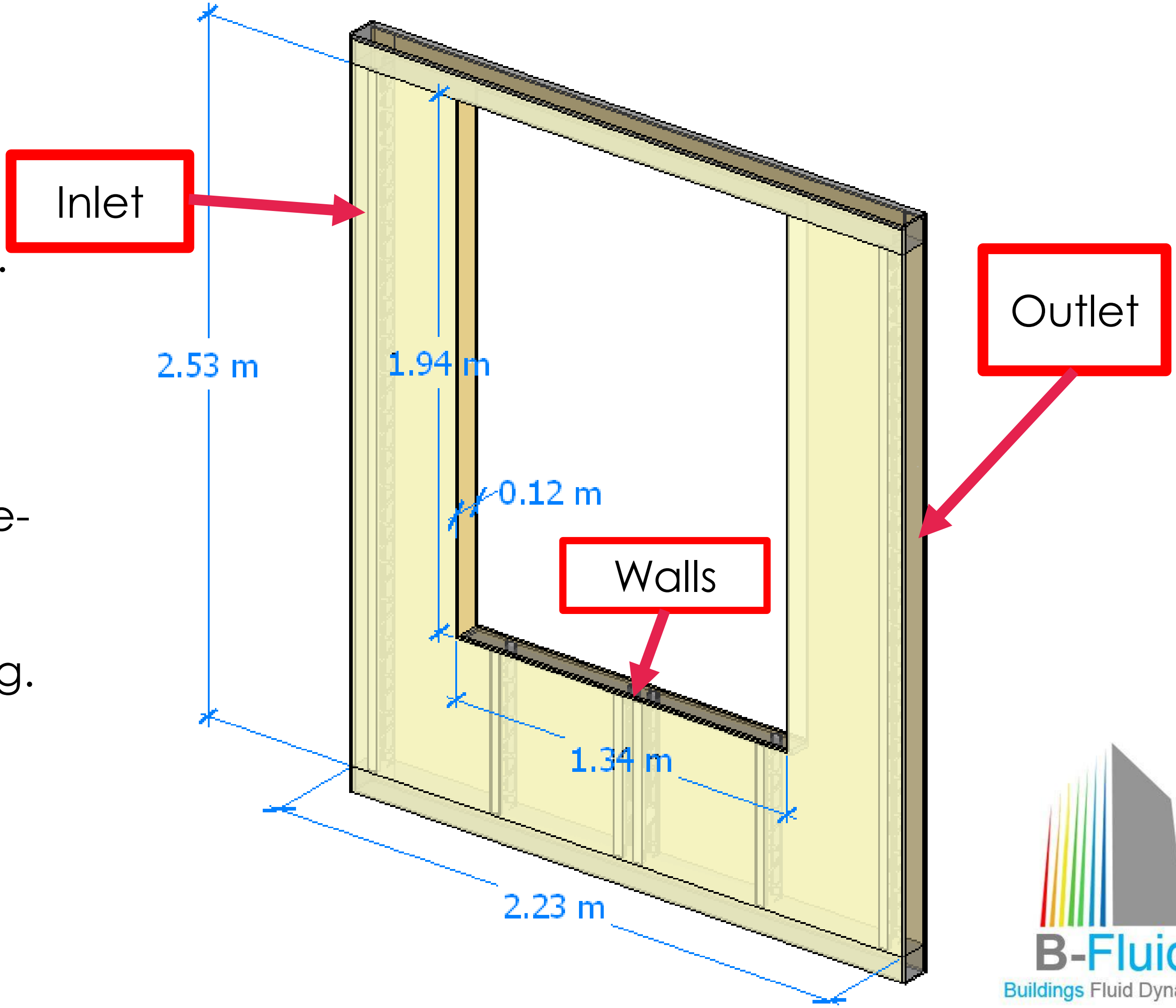
- Fluid is considered to be incompressible.
- Default initial conditions implemented in the computer code are used for the simulations.
- OpenFoam software is applied for solving Navier-Stokes equations.
- SketchUp and OpenFoam are utilized for pre-processing and mesh generation.
- Paraview software is used for post-processing.



Portalwall®

Boundary Condition and Dimensions Model B

- Fluid is considered to be incompressible.
- Default initial conditions implemented in the computer code are used for the simulations.
- OpenFoam software is applied for solving Navier-Stokes equations.
- SketchUp and OpenFoam are utilized for pre-processing and mesh generation.
- Paraview software is used for post-processing.



B-Fluid
Buildings Fluid Dynamics

Portalwall®

Model A
(air flow: 0.046 l/s)

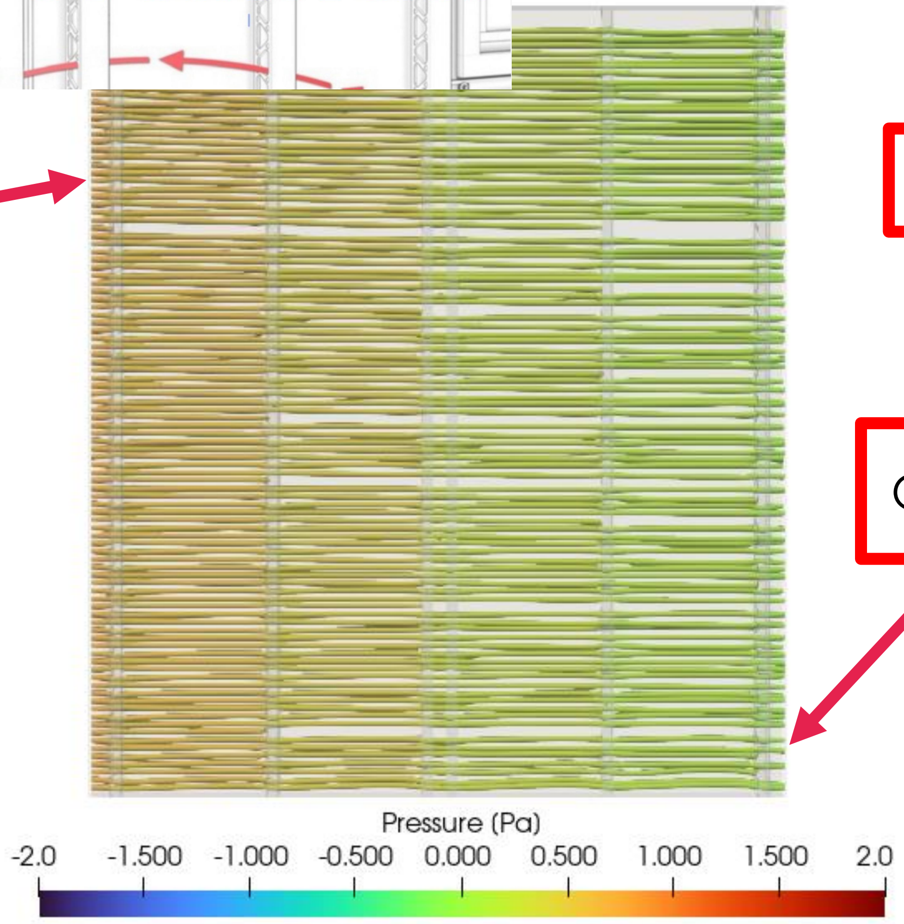
Please note that for the results images the following scales have been used:

- Velocity Range: 0 – 0.3 m/s
- Pressure Range: -2 – 2 Pa

B-Fluid
Buildings Fluid Dynamics

CFD Results – Model A

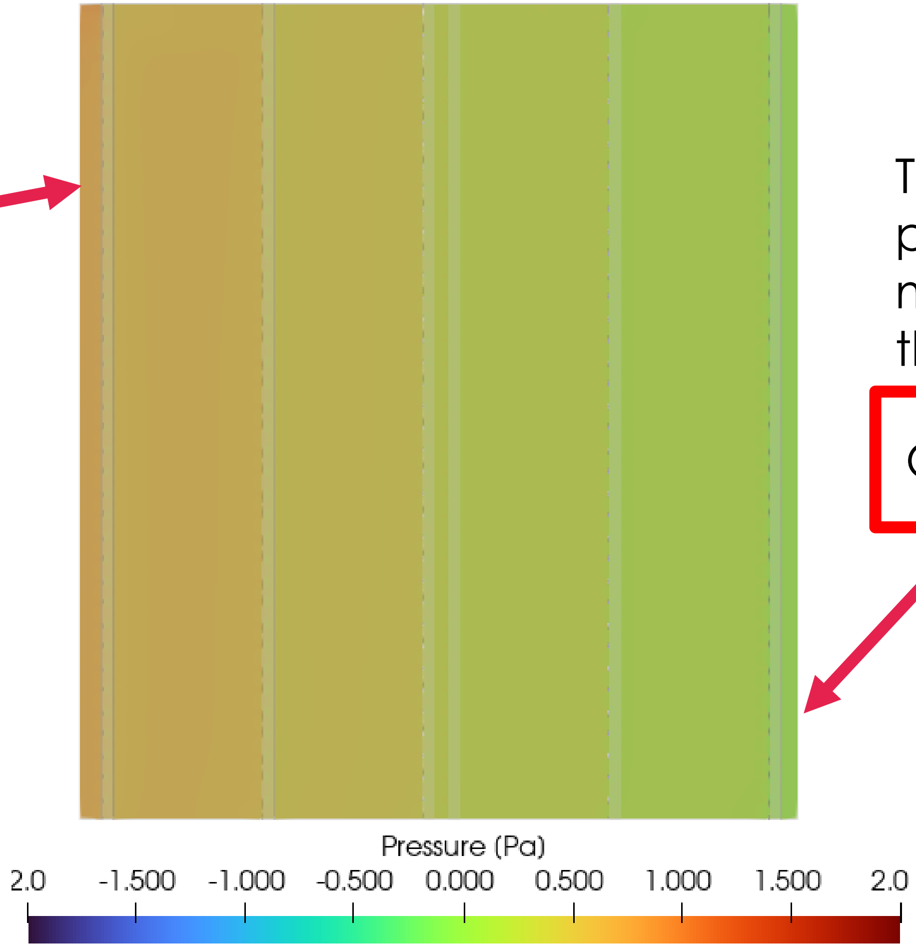
Inlet



Outlet

Air flow direction

Inlet



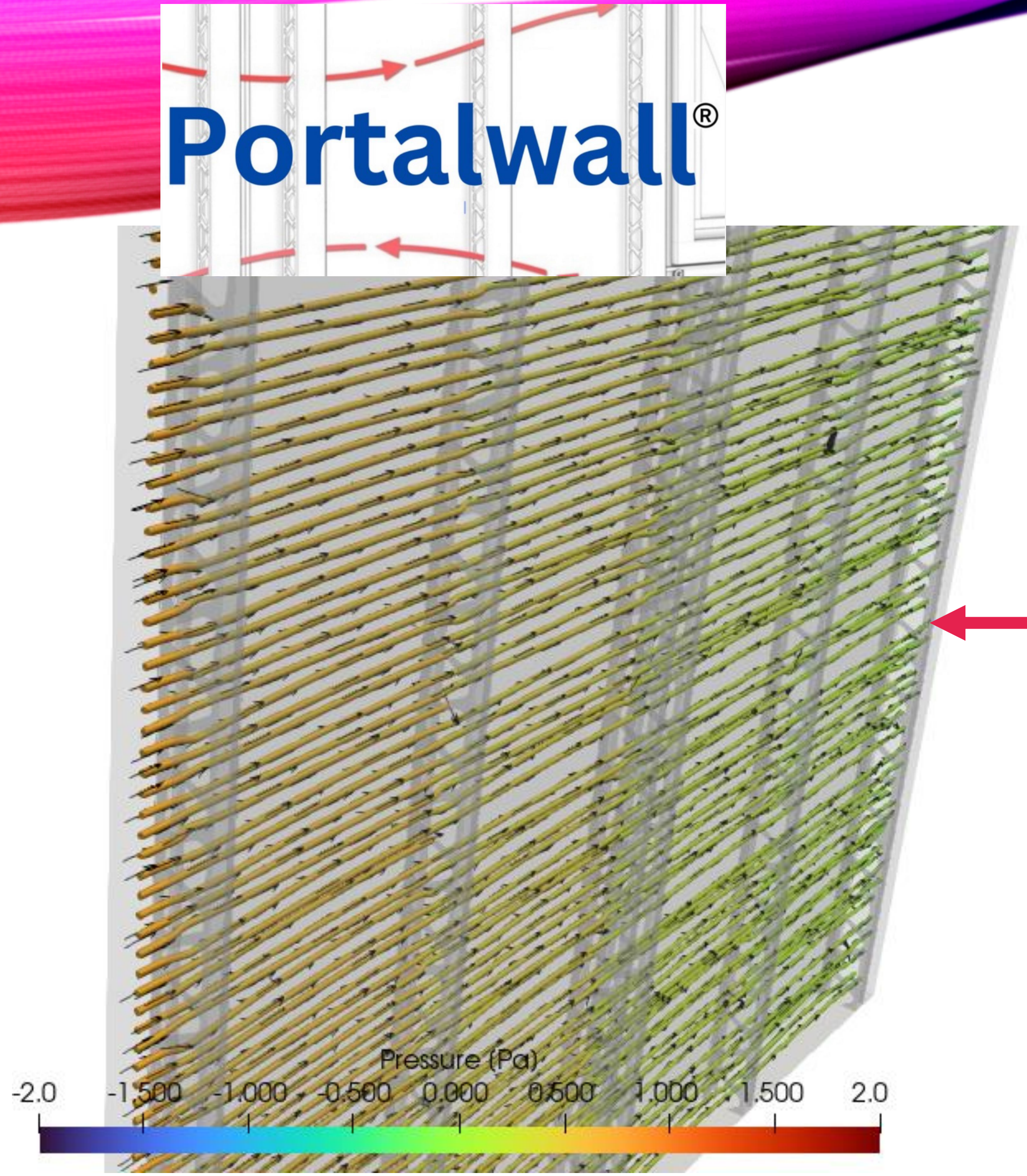
The loss of pressure is minimal in this model

Outlet

Air flow direction

B-Fluid Buildings Fluid Dynamics

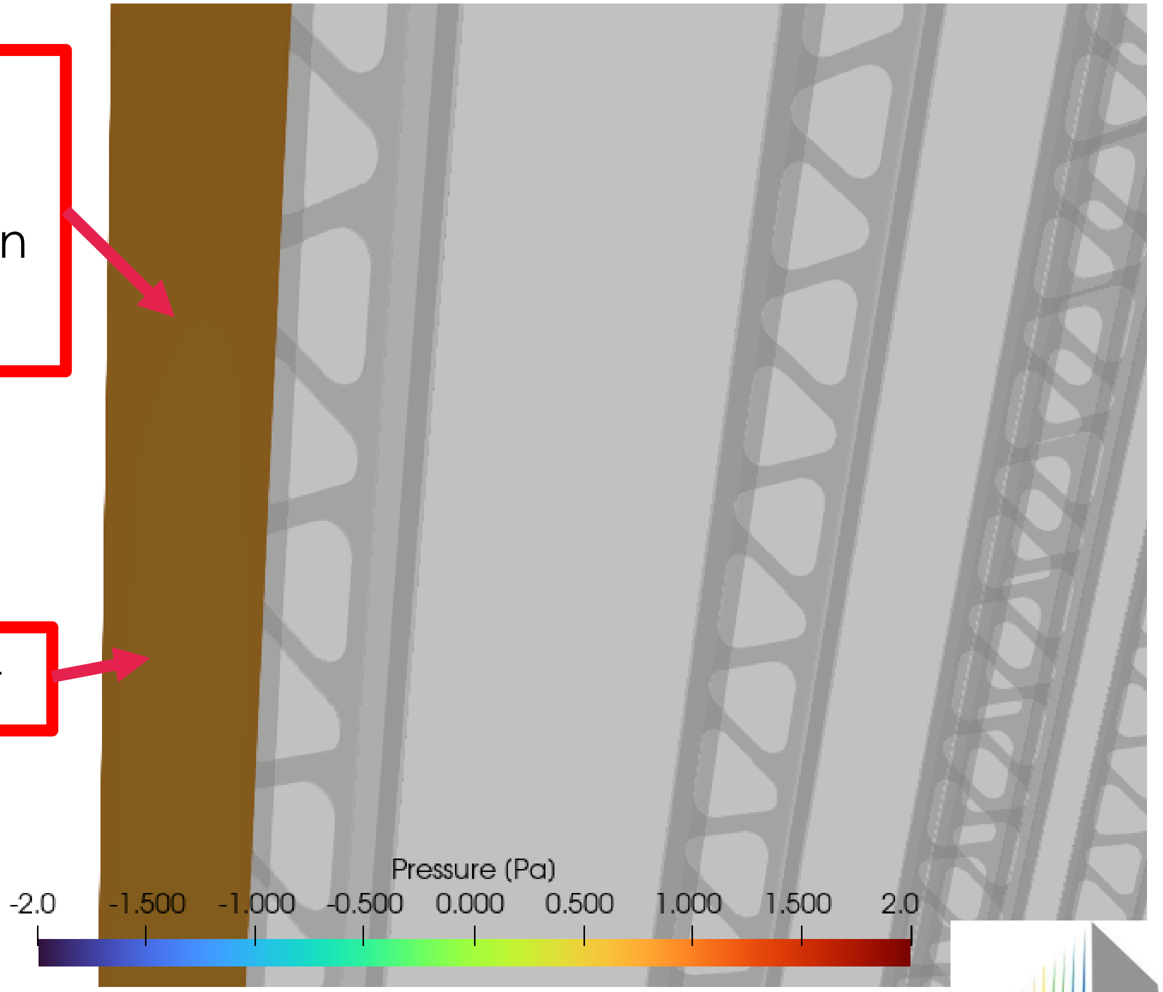
CFD Results – Model A



Uniform pressure distribution at Inlet

Outlet

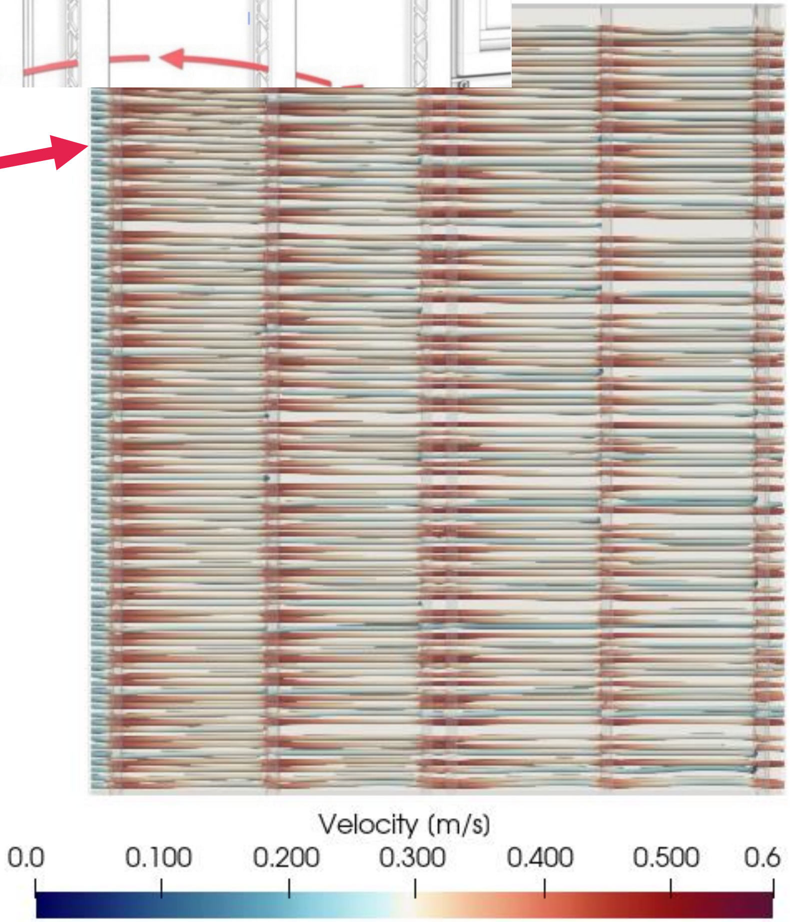
Inlet

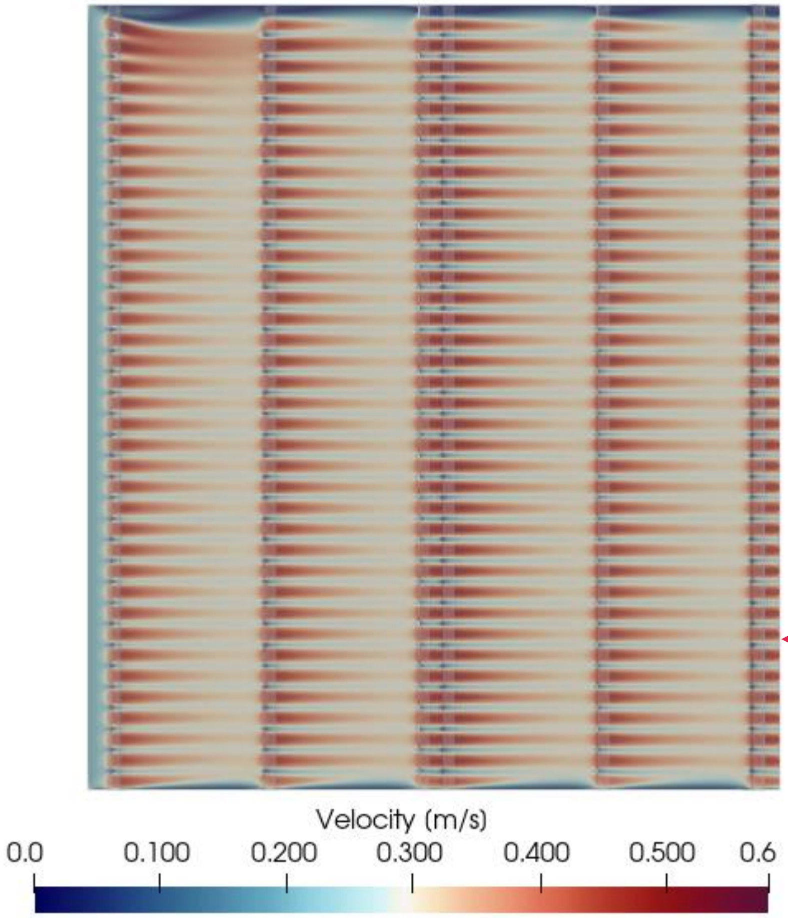


B-Fluid Buildings Fluid Dynamics

CFD Results – Model A

Inlet





A uniform distribution of air flow results a consistent air age throughout, allowing for optimal replacement of stale air with fresh air.

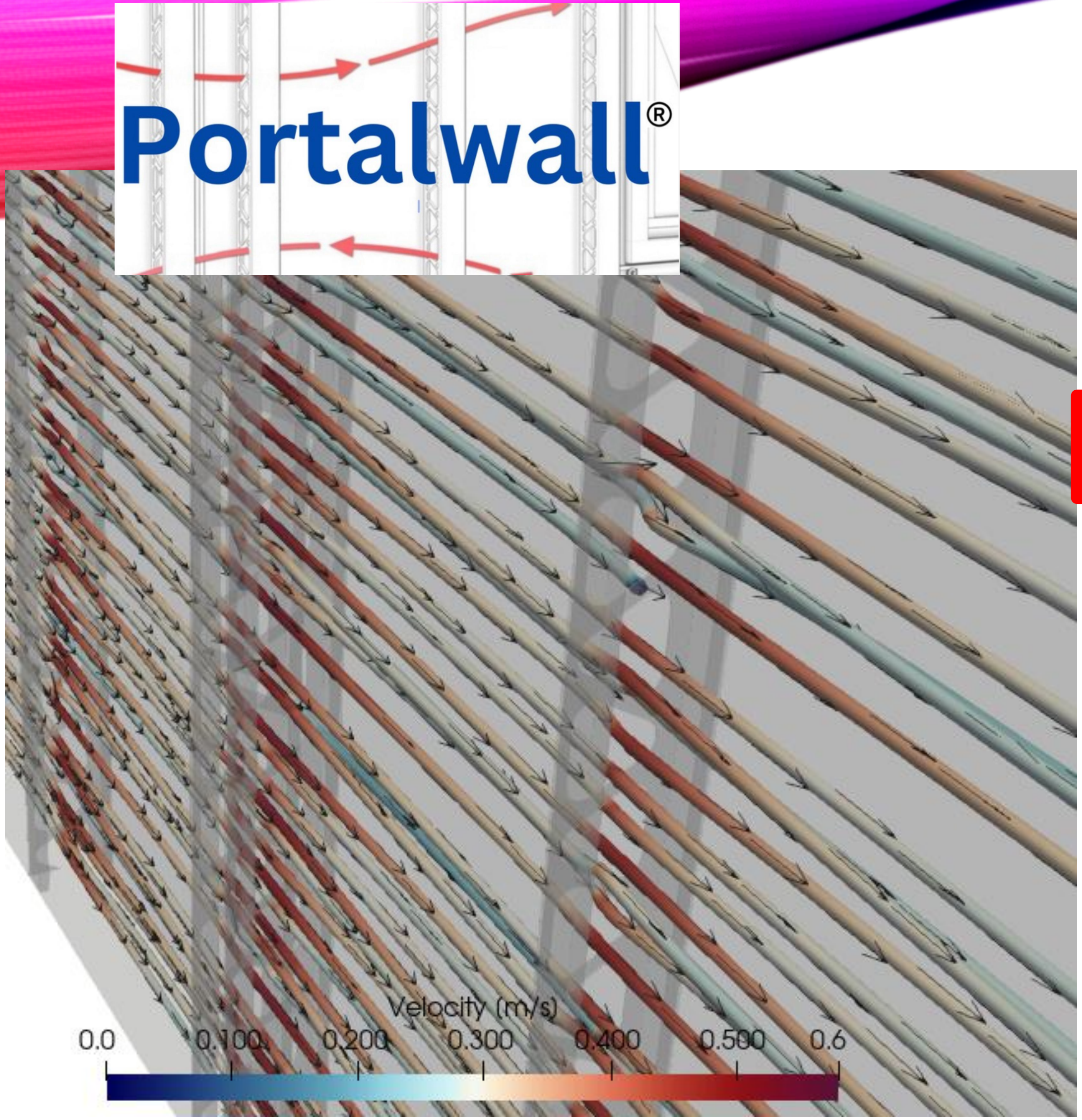
Outlet

Air flow direction

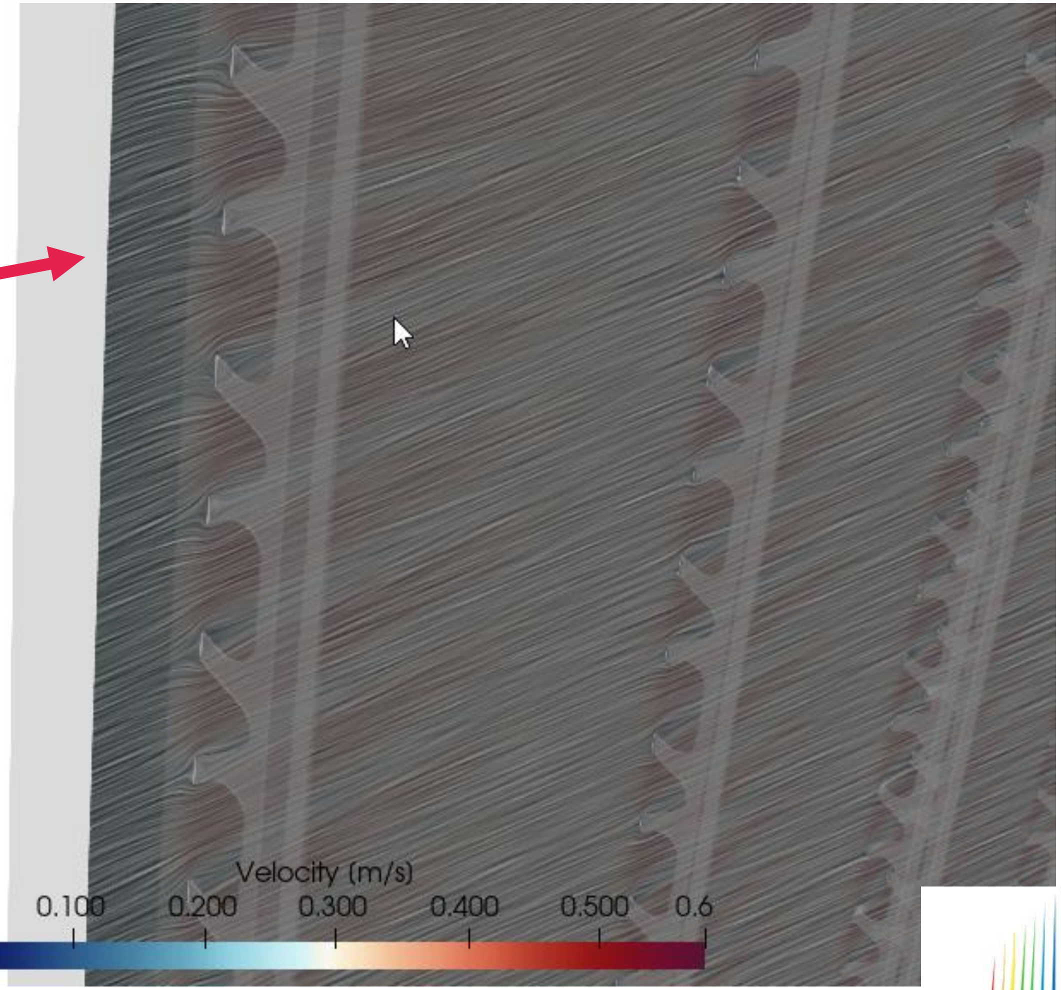
Air flow direction

B-Fluid
Buildings Fluid Dynamics

CFD Results – Model A



Inlet



Model B
(air flow: 0.046 l/s)

Please note that for the results images the following scales have been used:

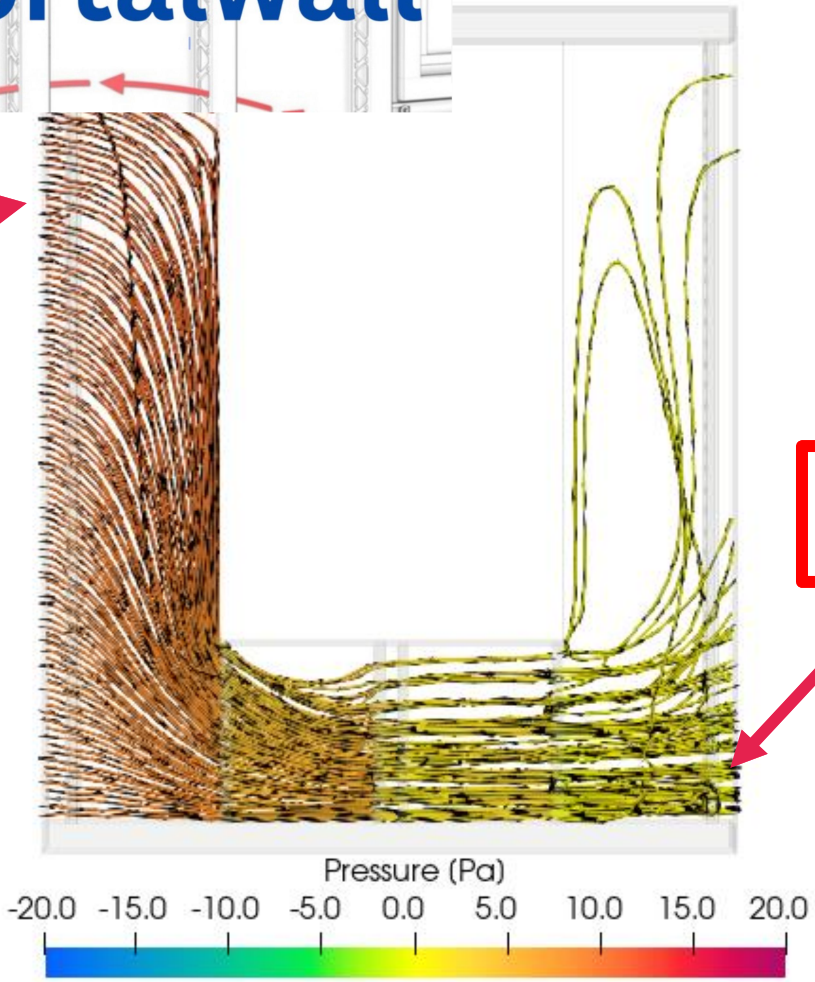
- Velocity Range: 0 – 2.7 m/s
- Pressure Range: -20 – 20 Pa

CFD Results – Model B

Portalwall®

Inlet

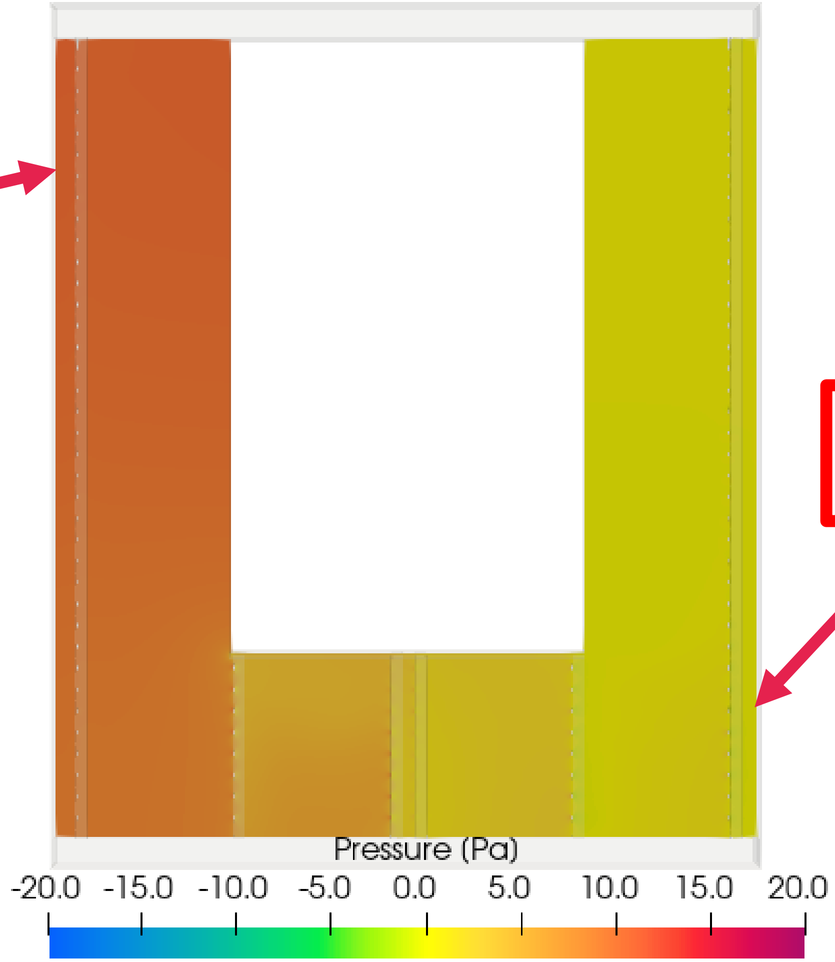
Outlet



Air flow direction

Inlet

Outlet



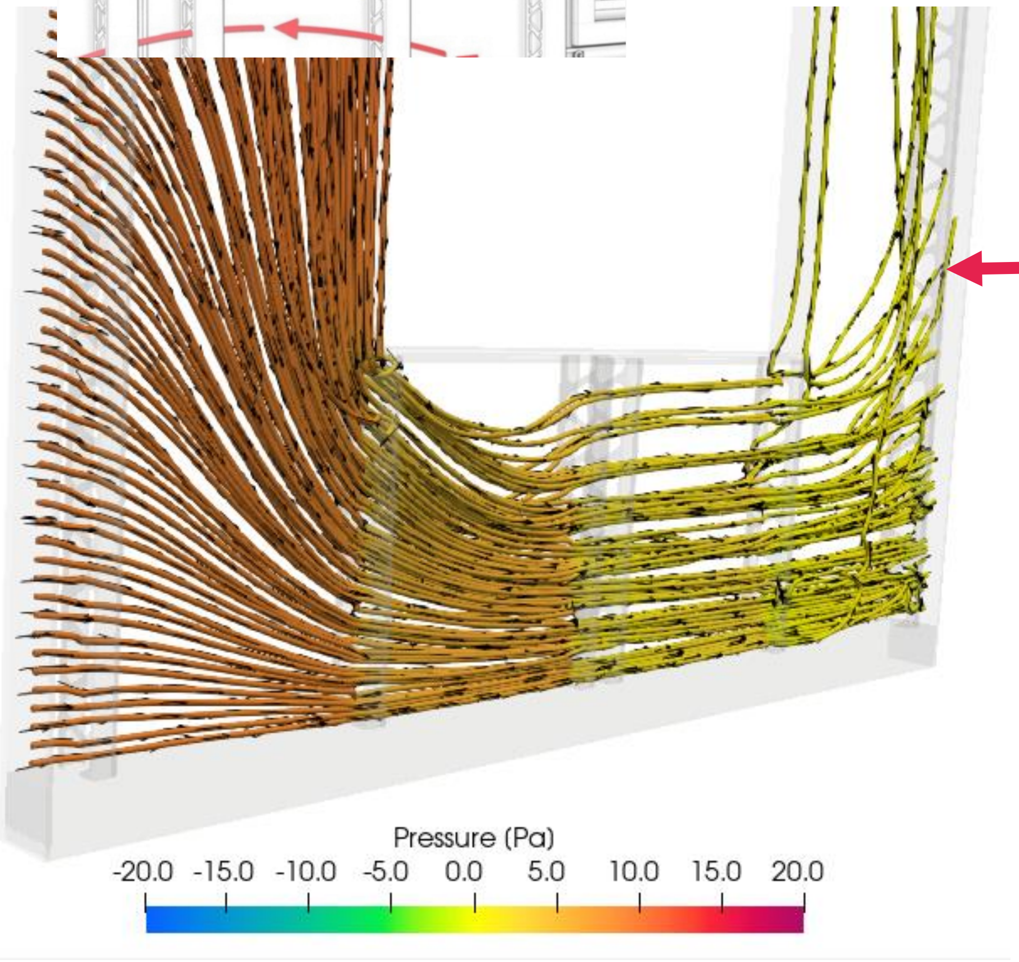
The loss of pressure is minimal in this model

Air flow direction

B-Fluid
Buildings Fluid Dynamics

Portalwall®

CFD Results – Model B



Outlet

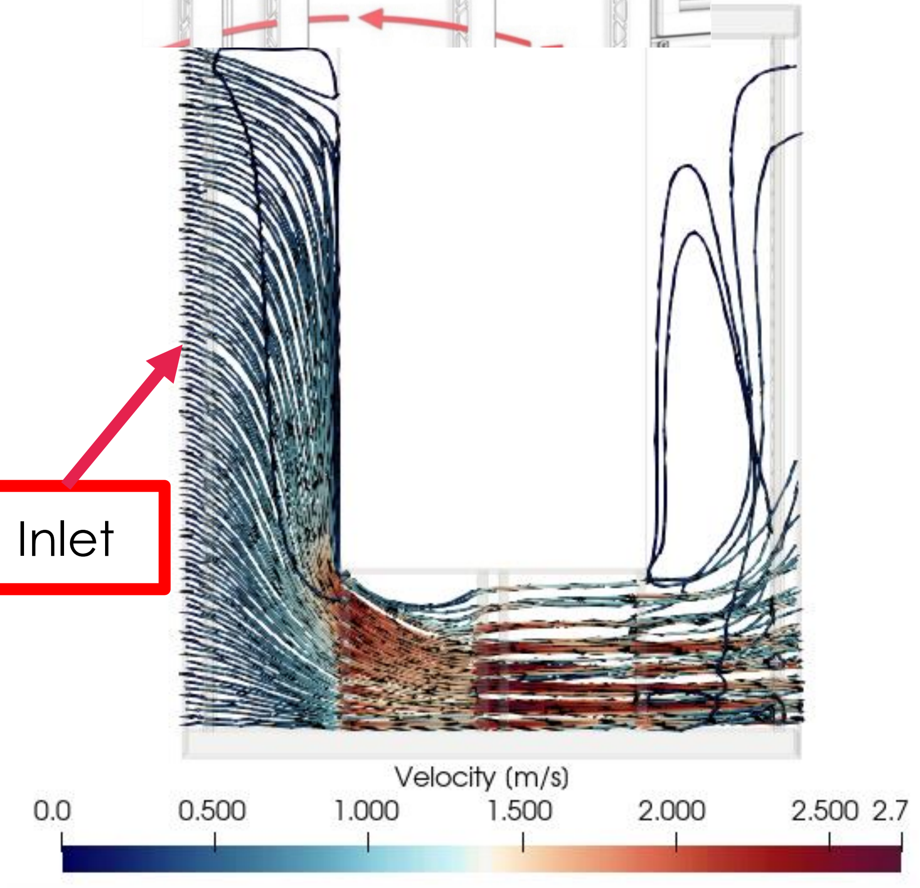
Inlet

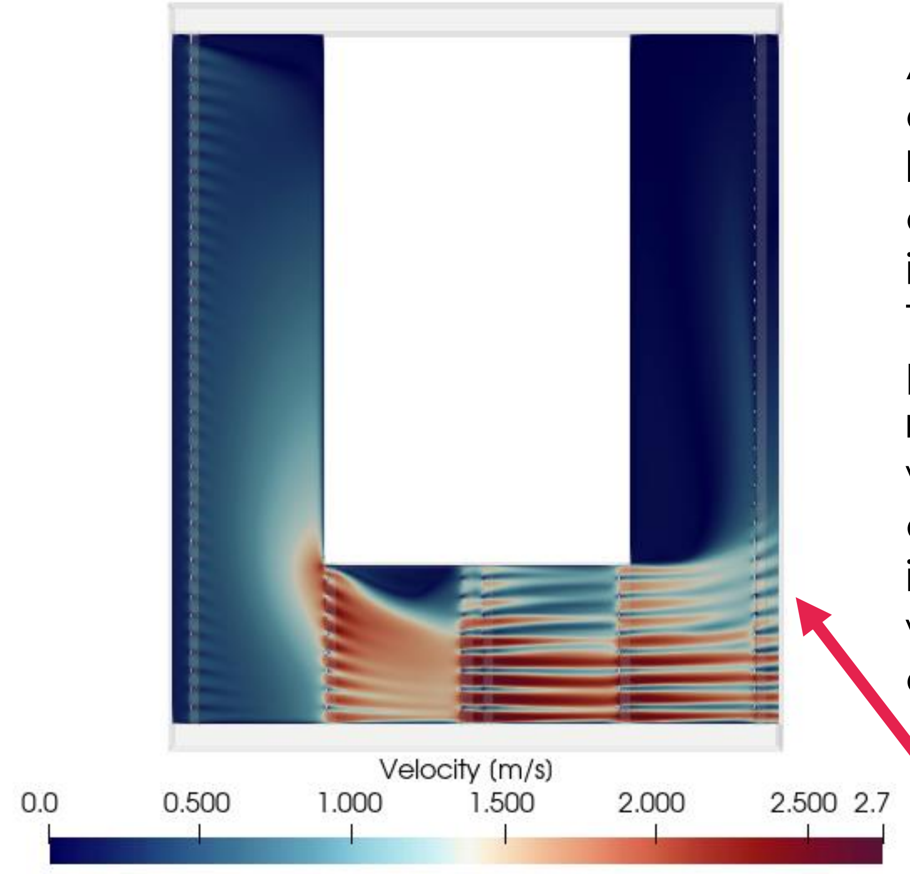
B-Fluid
Buildings Fluid Dynamics

Portalwall®

CFD Results – Model B

Inlet





Outlet

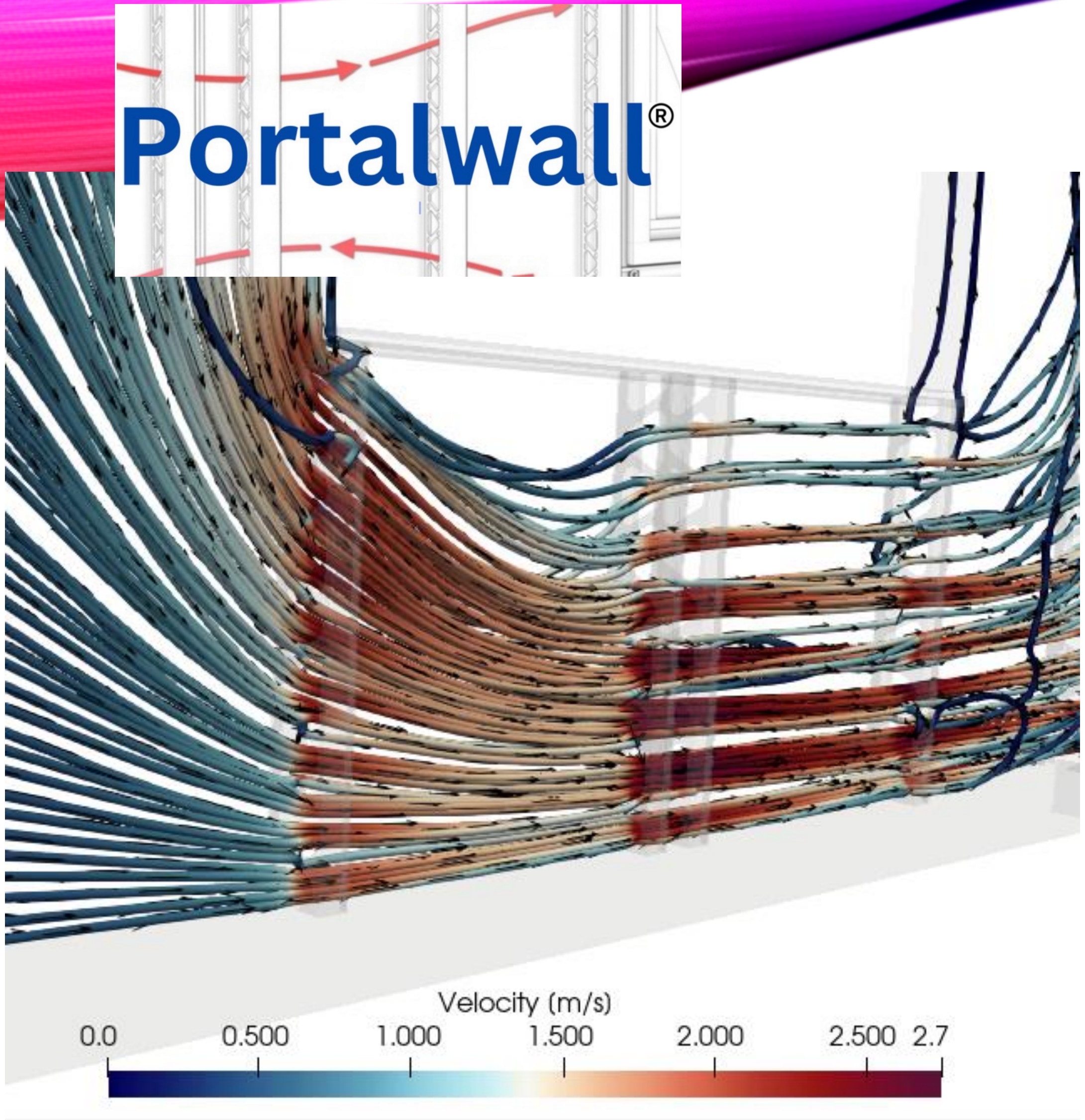
Air flow direction

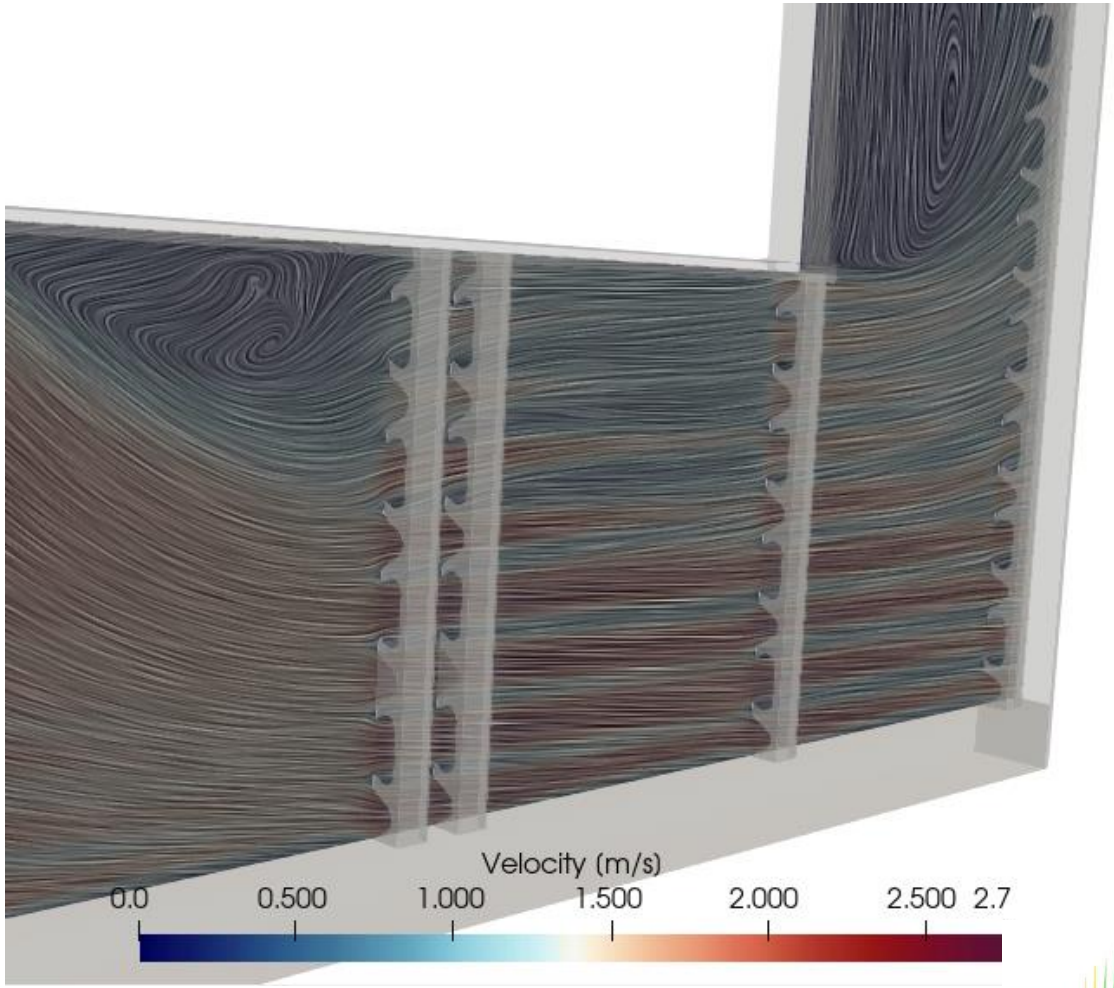
Air flow direction

An uneven distribution of airflow within a space leads to an inconsistent air age, resulting in inefficient ventilation. This inconsistency prevents the uniform replacement of stale air with fresh air, as some areas may experience inadequate airflow while others receive an overabundance.

B-Fluid
Buildings Fluid Dynamics

CFD Results – Model B





B-Fluid
Buildings Fluid Dynamics

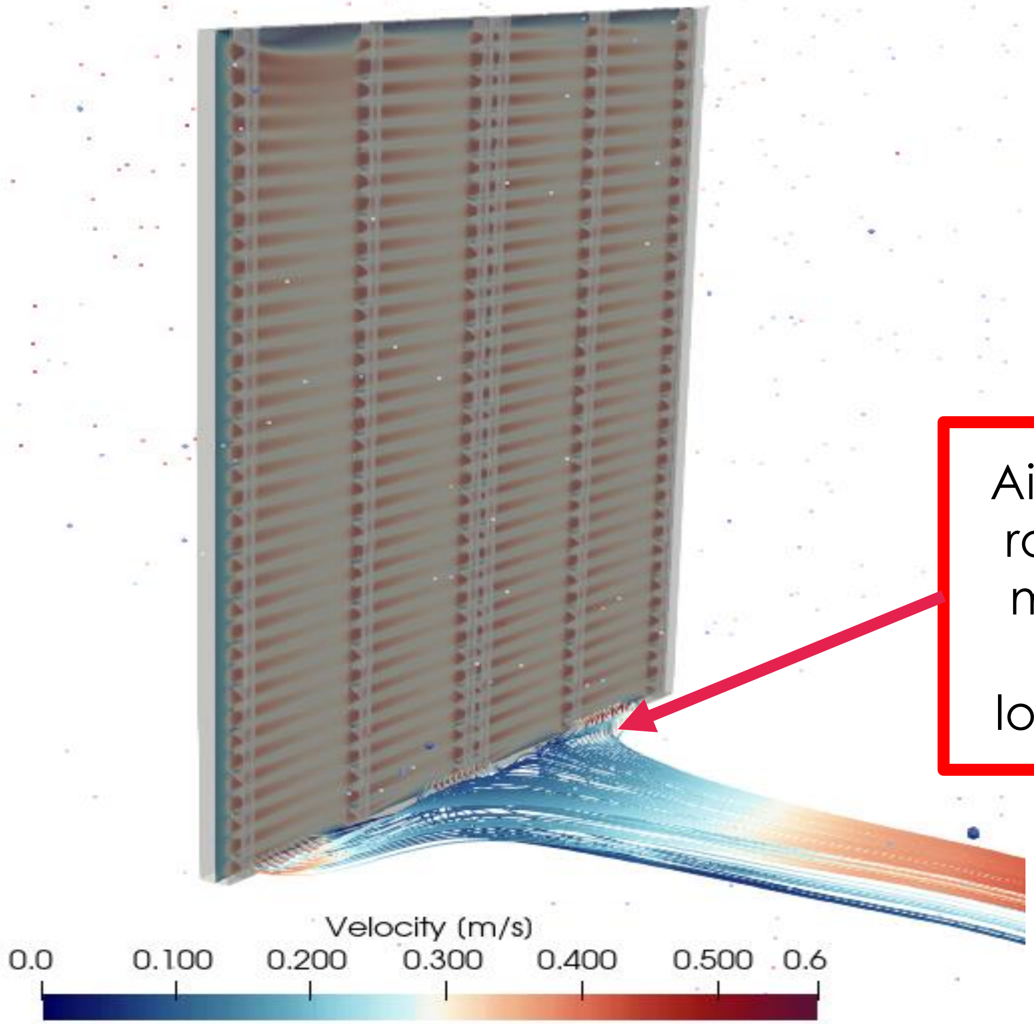
Model C
Portal Wall Exposure to Rain

Please note that for the results images the following scales have been used:

- Velocity Range: 0 – 0.6 m/s

Portalwall®

CFD Results – Model C



Airflow carrying rain droplets is moving inside through the lower opening.

B-Fluid Buildings Fluid Dynamics

Summary of Conclusions

Case	Pressure drop (Pa)	Average Air speed at inlet (m/s)*
Air flow 0.046 l/s – Model A	2	0.2
Air flow 0.046 l/s – Model B	11	0.2

Aeroacoustics Testing

Wind Tunnel Tests

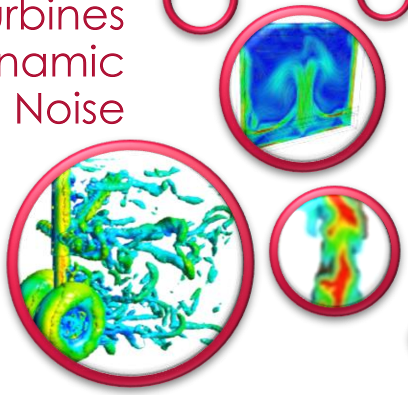
On Site Smoke Testing

CFD and Multi-Physics Modelling

Aircraft and Wind Turbines Aerodynamic Noise

Façade Thermal Analysis

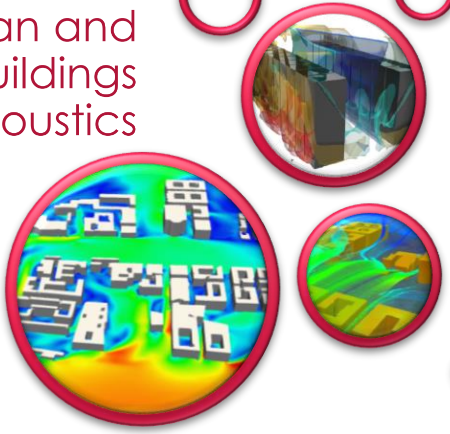
Fire and Smoke Modelling



Urban and Buildings Aeroacoustics

CFD & HVAC Analysis

Wind Impact study



B-Fluid Ltd | Buildings Fluid Dynamics Consultants

Ireland: The Studio, 55 C Maple Avenue, Stillorgan, Dublin
T: +353 (0) 1 506 5671 M:+353 (0)85 71 36 352

Email: info@b-fluid.com Web: www.b-fluid.com **LinkedIn:** linkedin.com/company/bfluid-ltd