Preliminary Clean Air System For ET Cryostat

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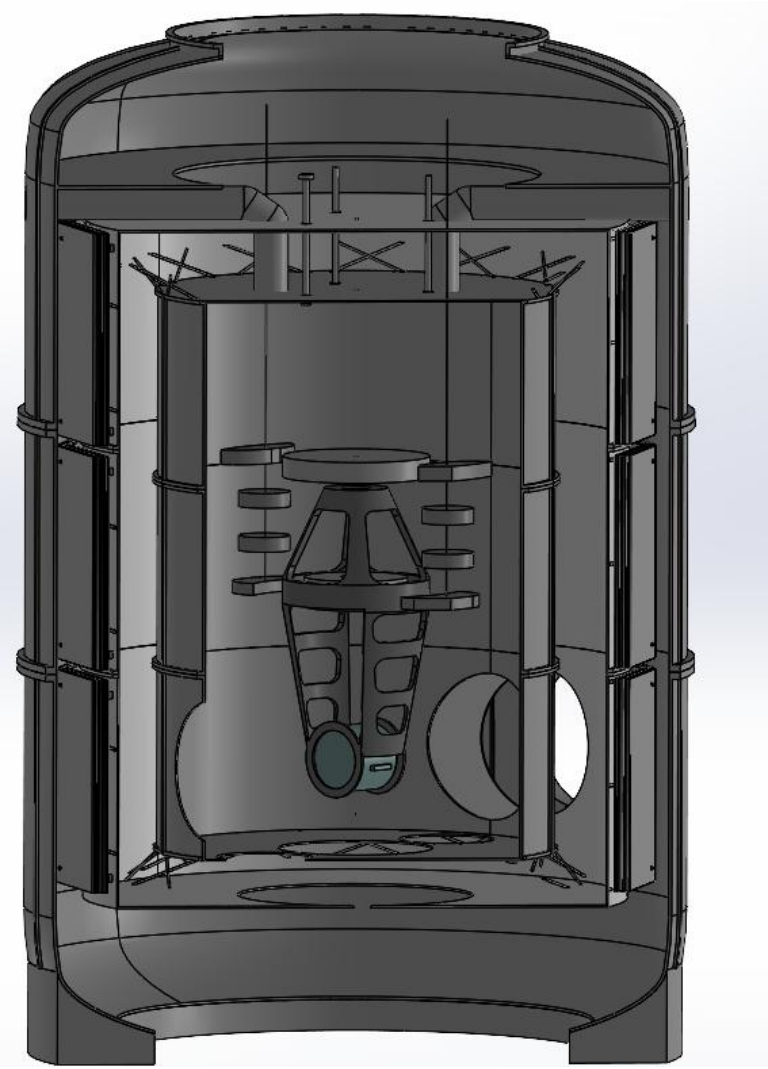
Cleanliness Air System – Requirements

- Cleanliness inside the tower is necessary to protect the optics of the payloads against hydrocarbons and dus
- The clean air circulation is arranged in order to have slightly increasing pressure
- Inside the IITS, where the payload will be installed, is necessary at least CLASS ISO 4, in absence of operator
- The established regime is not at all a laminar flow, due to the large dimension of the payload and operators

Cleanliness Air System – Data



The requirements standard ISO 4 are at least:

- 150 ACH
- 0.45 m/s (average)

$$ACH = \frac{Q}{V_{IITS}} = 150\ h^{-1}$$

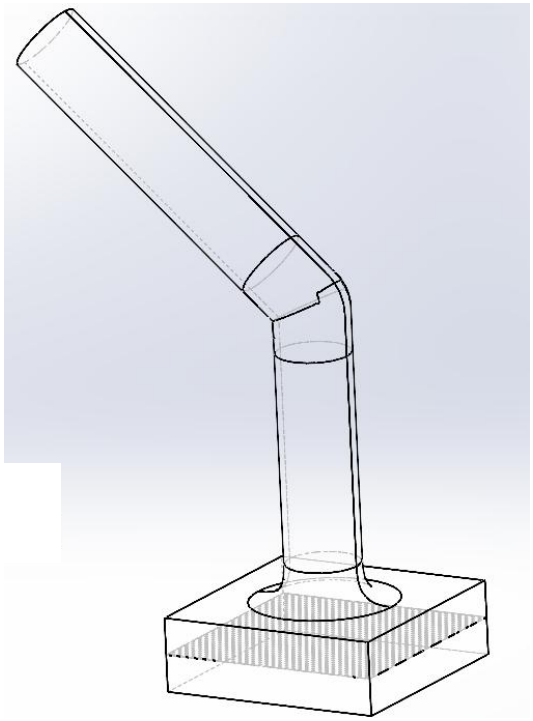
$$Q = 0.78\ \frac{m^3}{s}$$

IITS Data	
H (m)	3.28
D (m)	2.7
V (m^3)	18.77
Air Tube Data	
D(m)	0.20

Cleanliness Air System – First idea Design

The design Idea is a tube with a diameter of 200 mm with a plenum at the end with a dimension of 610x610 mm (square) and thickness of 200 mm

To reach the requirements ACH of 150 established by the ISO 4 with a velocity of 0.5 m/s is necessary to install 4 systems (tube+plenum) at the top of the IITS



- In this condition each part will have a flow rate of 0.195 m^3/s
  - Inlet zone $v = \frac{Q}{S_{tube}}$ = 6.22 m/s **High velocity**

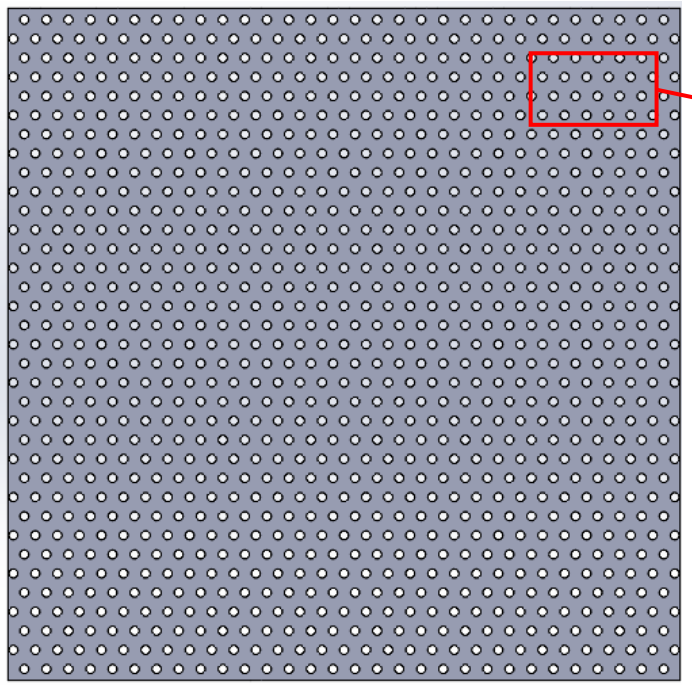
For this reason is necessary to use the plenum:

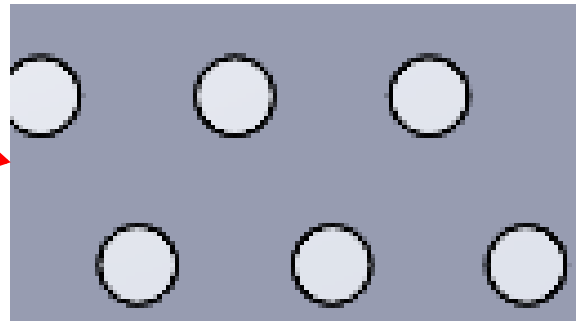
  - Outlet zone $v = \frac{Q}{S_{plenum}}$ = 0.523 m/s

ISO4 Range velocity:
0.3 m/s ≤ v ≤ 0.56 m/s

Cleanliness Air System – First idea Design

A perforated plate is inserted inside and in the middle of the plenum to simulate a real condition of the air passage through the plenum

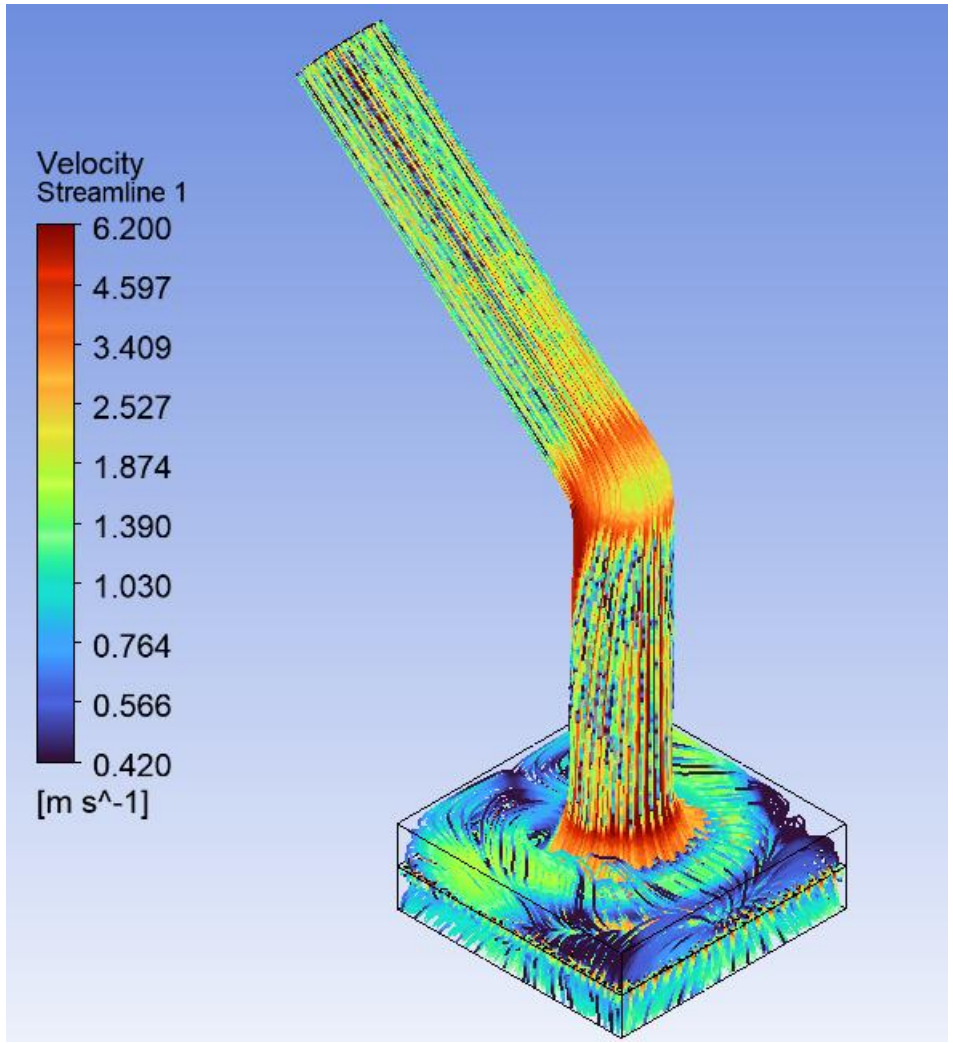




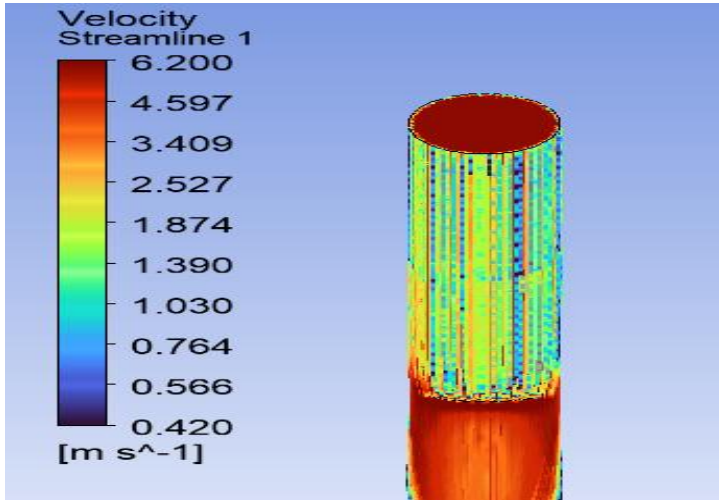
Holes distance 20 mm
Diameter hole 5 mm

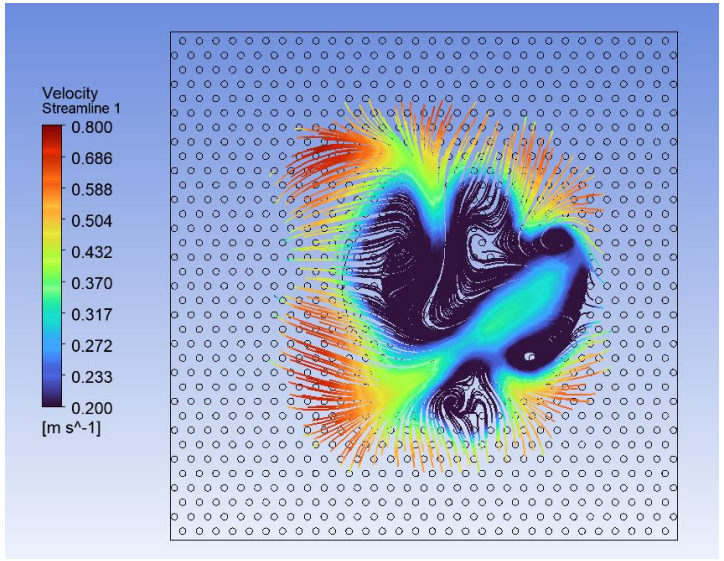
Perforated plate dimension= 610x610mm
Thickness 1mm

Cleanliness Air System – FEM Result (tube+plenum)



Inlet zone

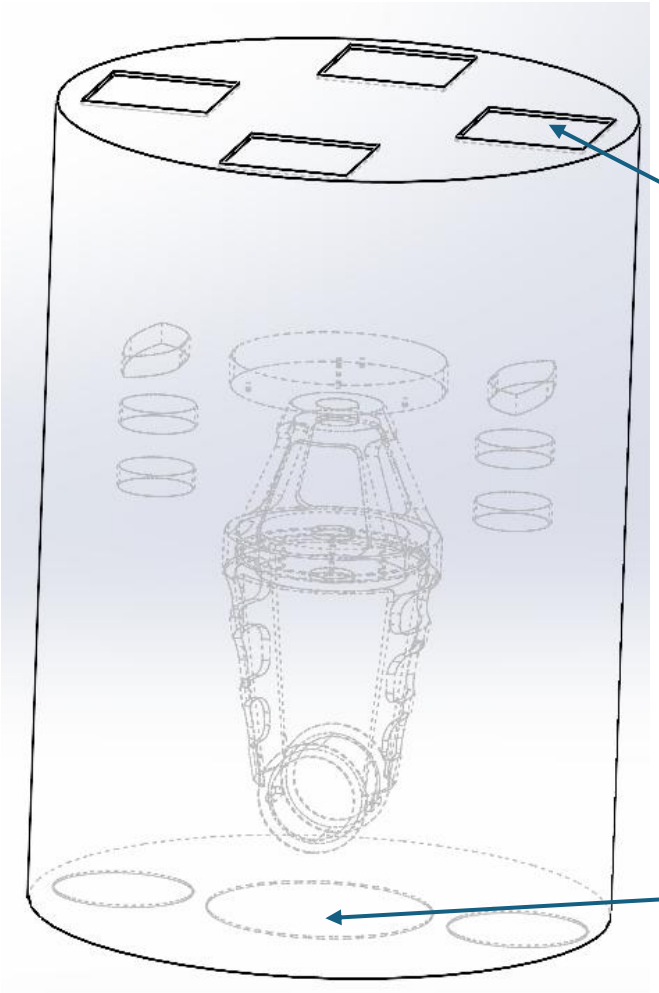


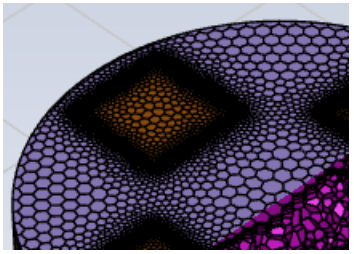


Outlet zone

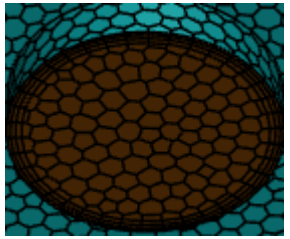
Cleanliness Air System – FEM Model IITS

Solidworks Model for CFD Analisys



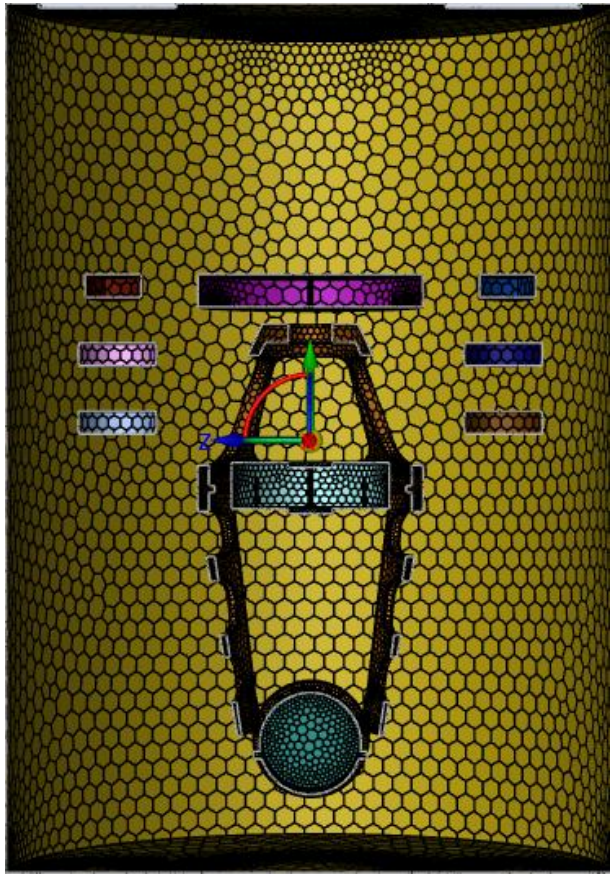


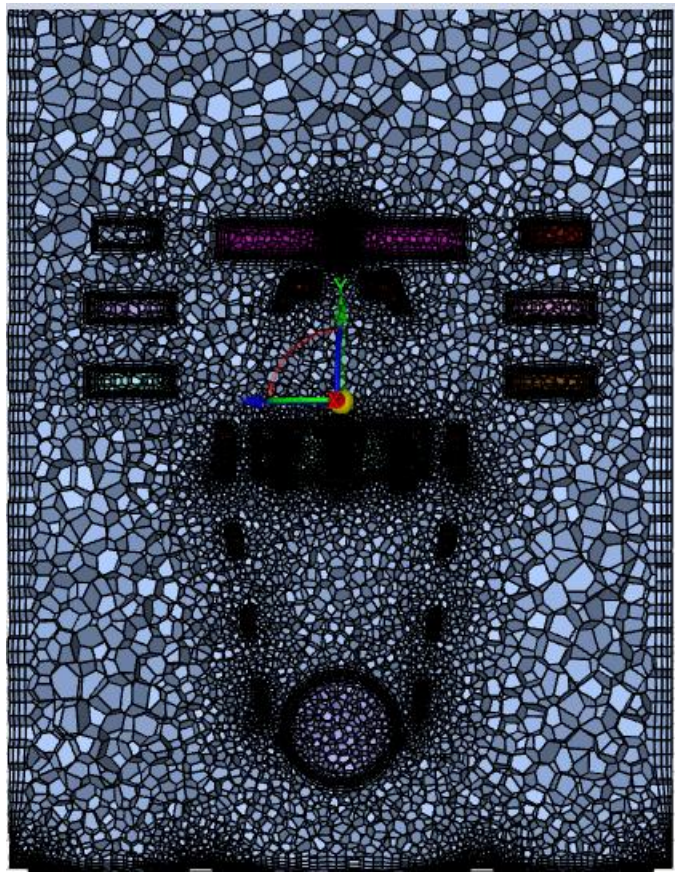
4 Inlet Zone



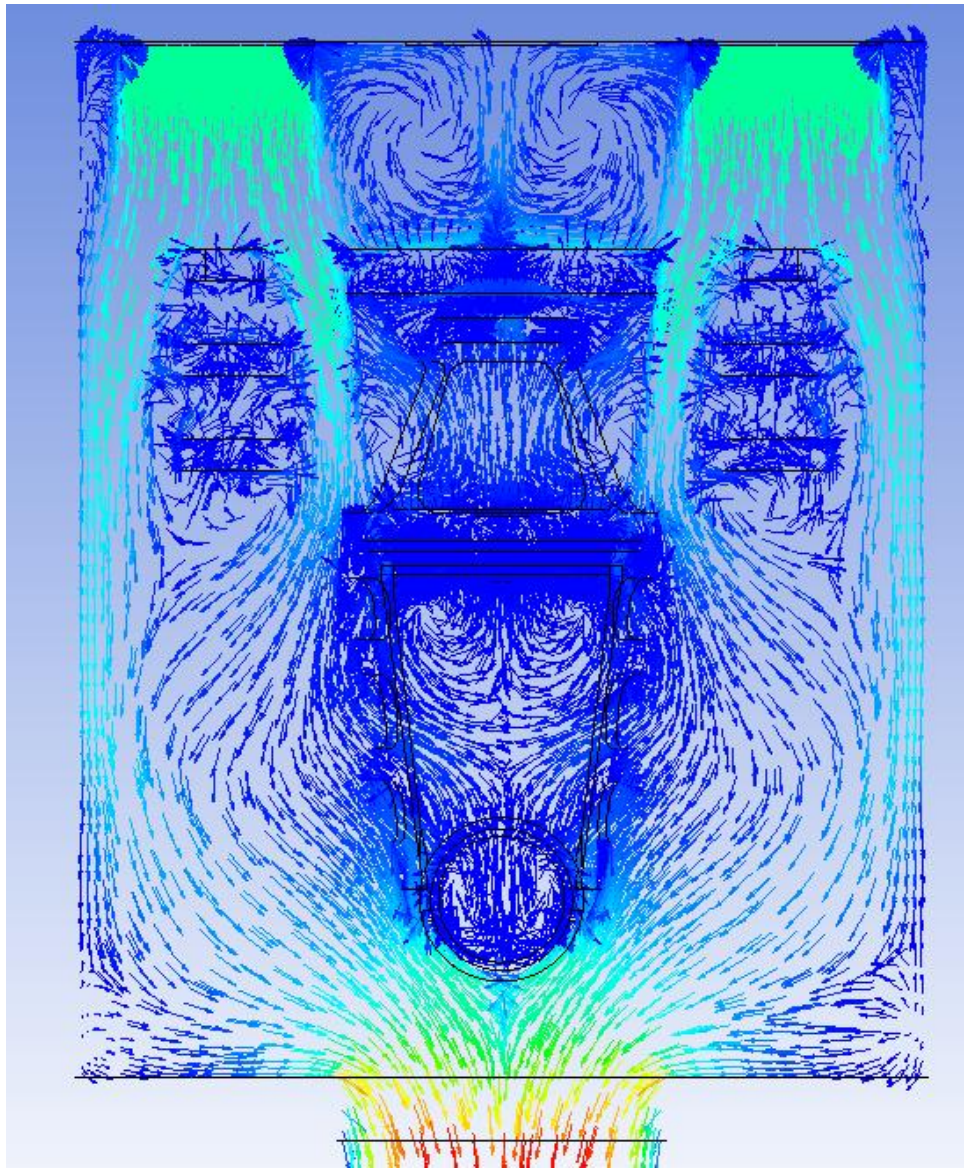
Outlet Zone

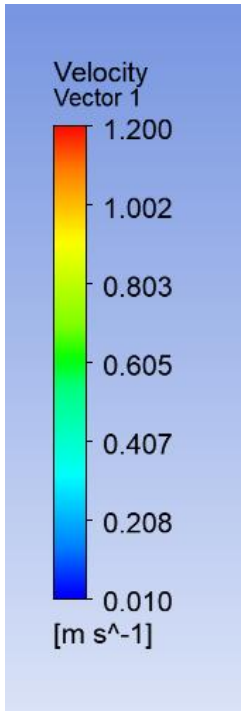
Surface mesh & Volume Mesh
Performed by a Polyheadra Mesh

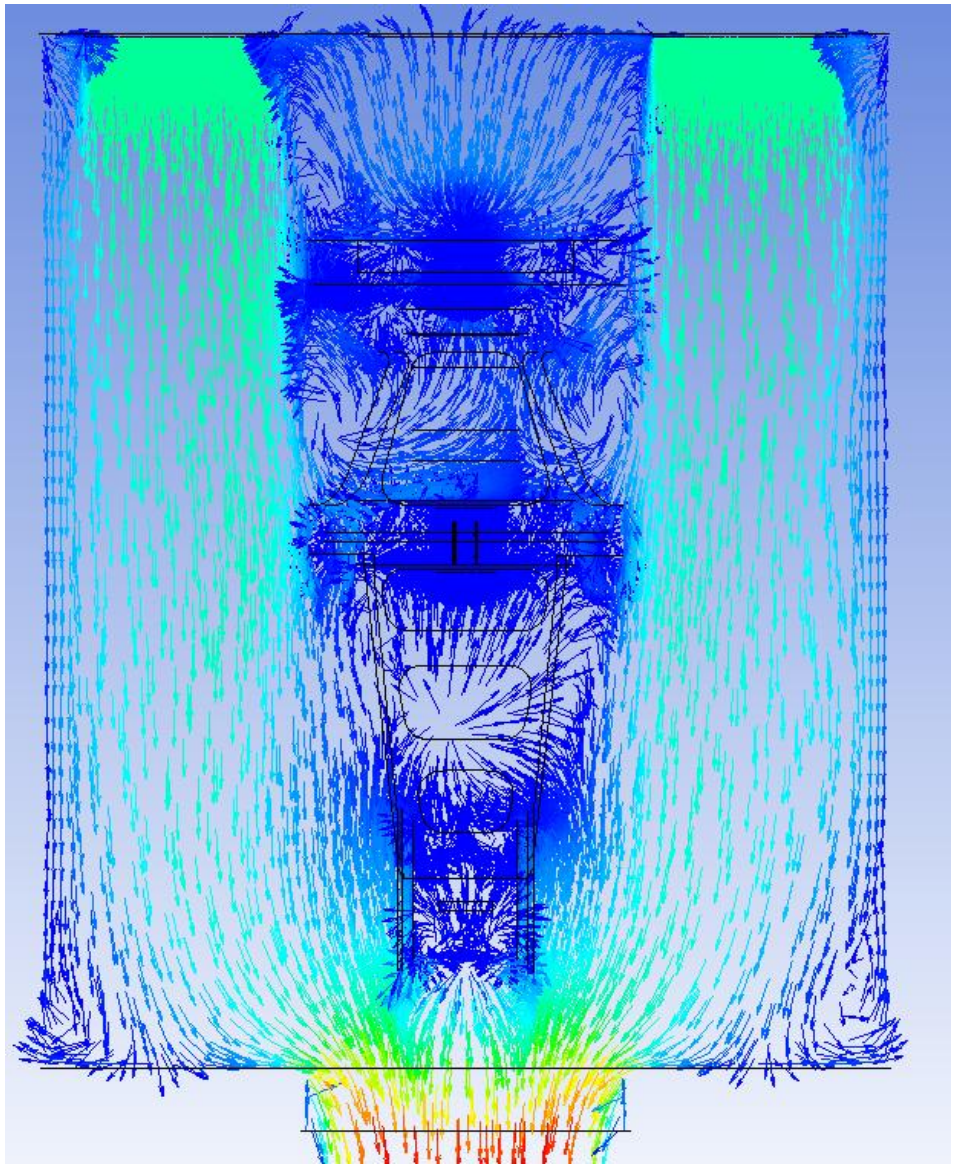




Cleanliness Air System – FEM Results







Cleanliness Air System – FEM Results