



## CFD Analysis of RRS-MC500 Air Flow Analysis

## Objective and Scope - CFD

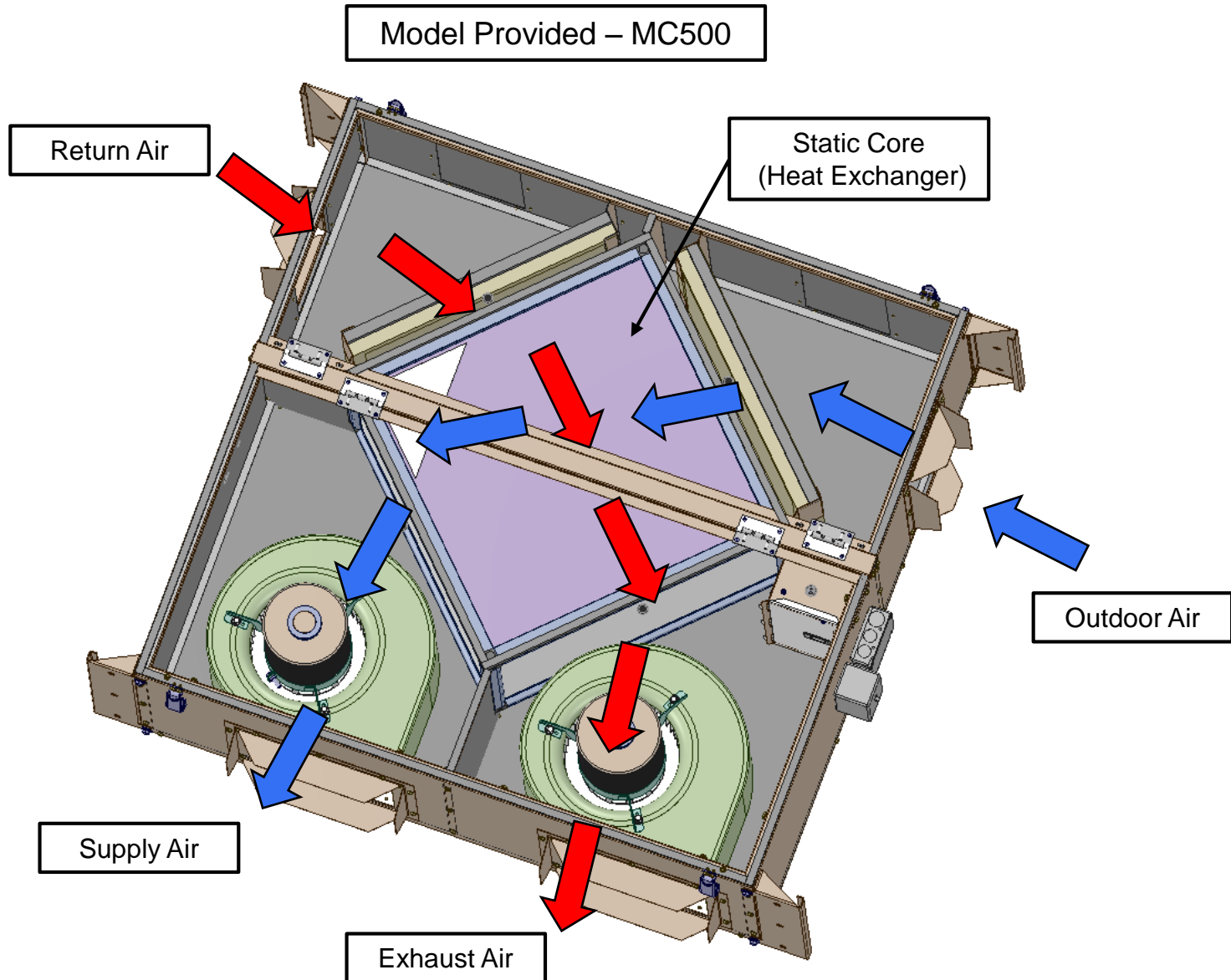
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### Objective:

- Run the CFD analysis to check the Airflow performance and identify turbulence region if any inside MC500 unit.

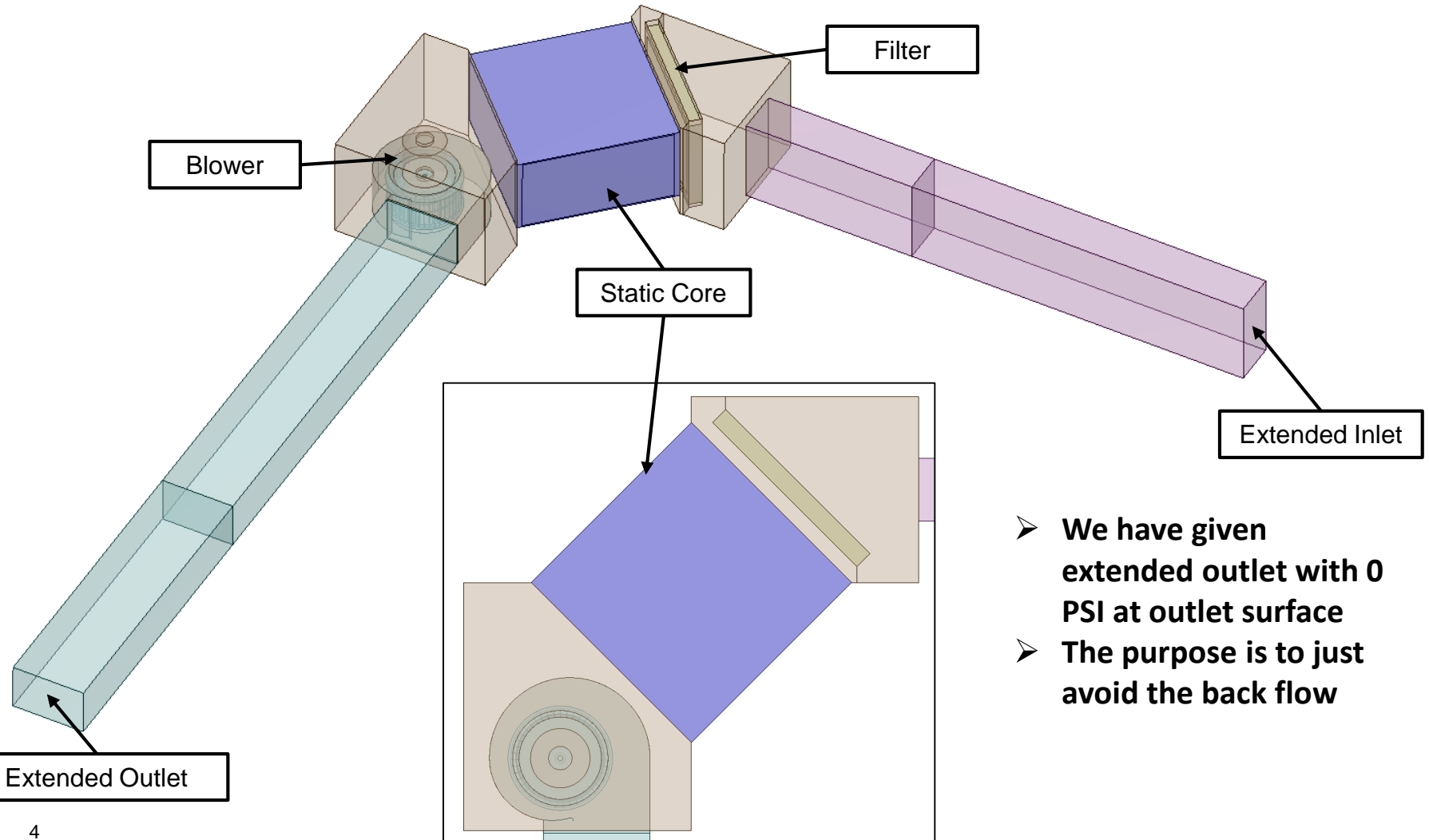
### Scope:

- To predict the Air Flow pattern inside the MC500 unit



# CFD Model – MC500 – Supply side

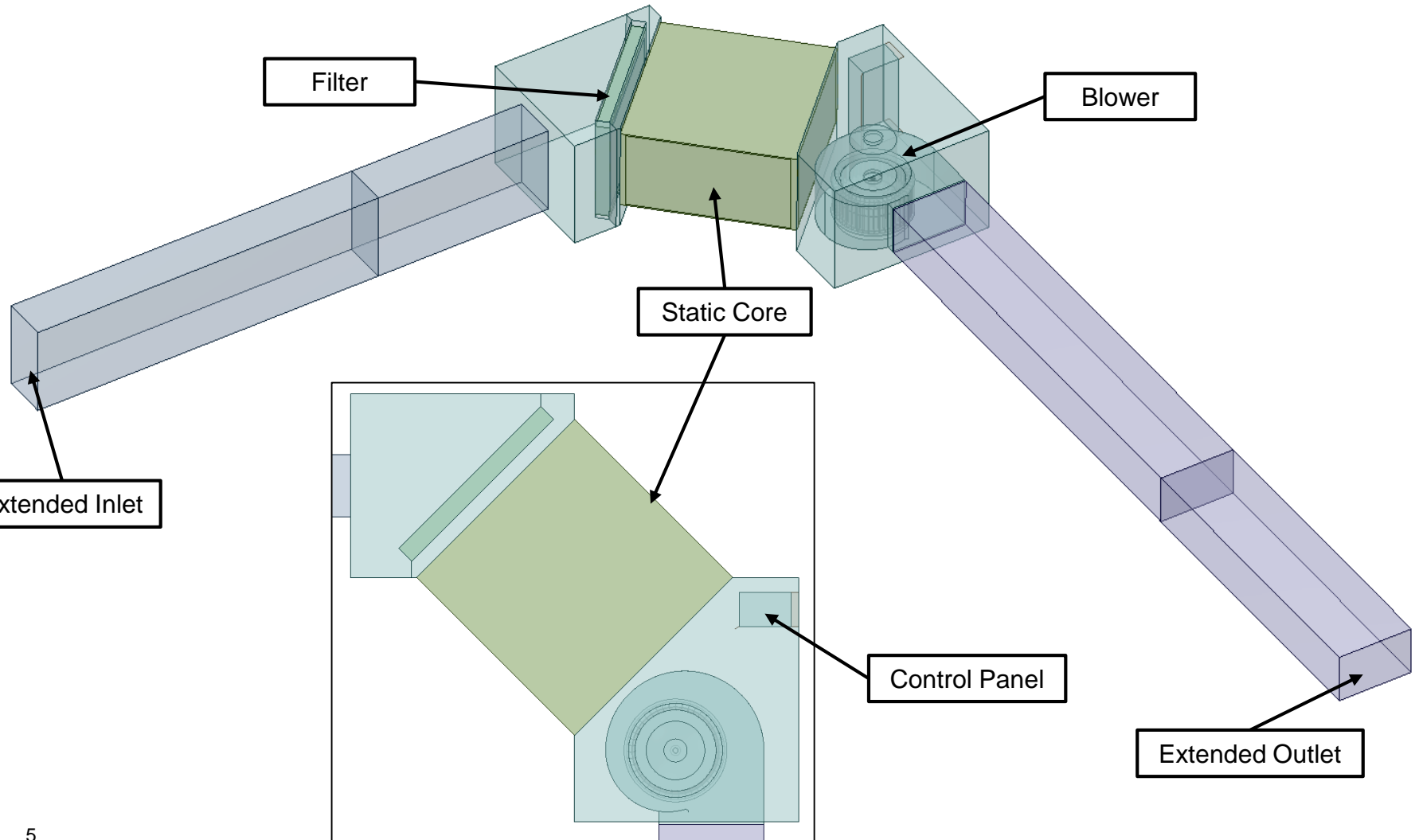
CFD Model – MC500 – Supply side



- We have given extended outlet with 0 PSI at outlet surface
- The purpose is to just avoid the back flow

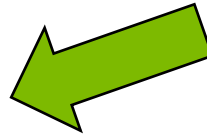
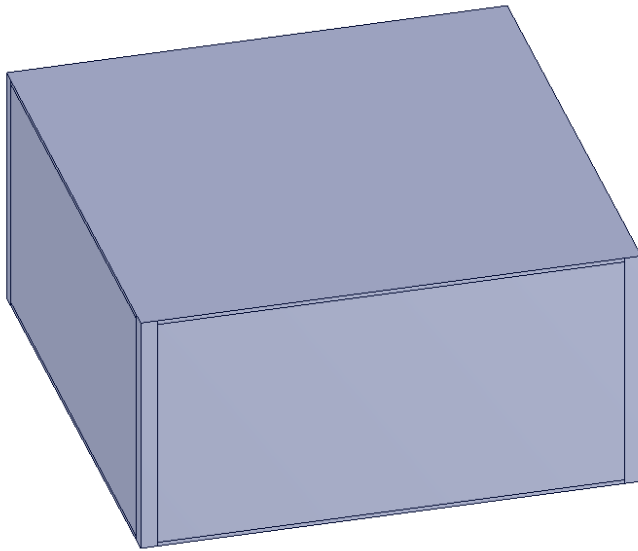
# CFD Model – MC500 – Return side

CFD Model – MC500 –Exhaust side



# Modeling Details – Static Core

CFD Model – MC500 – Supply side

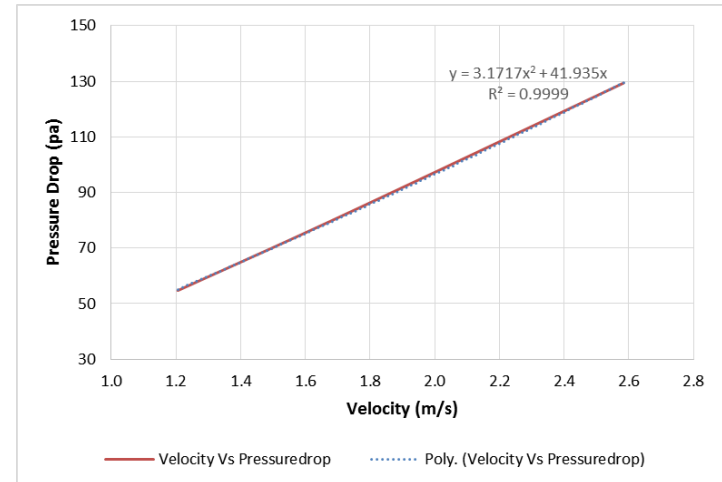


Airflow Direction

Static Core  
(21.65" X 10.86" X 21.65")

Static core modelled as block  
(porous media) in CFD

Static Pressure Drop Static core – MC500	
Volume Flowrate (CFM)	Pressure Drop (In Wg)
350	0.22
500	0.33
750	0.52

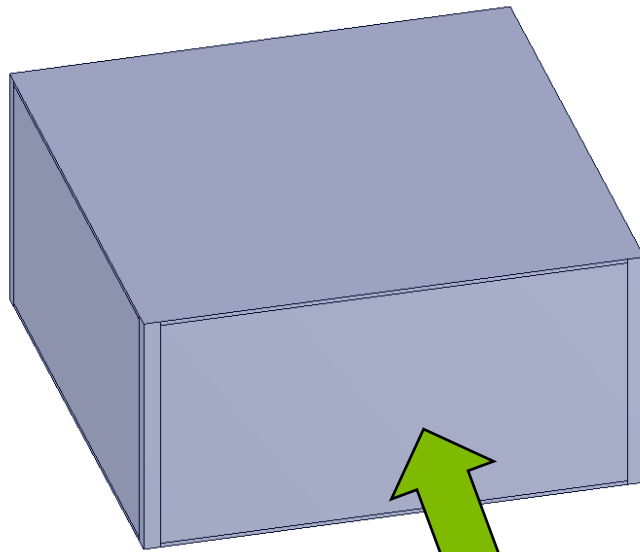


Y – Pressure Drop (pa)

X – Velocity (m/s)

# Modeling Details – Static Core

CFD Model – MC500 – Exhaust side

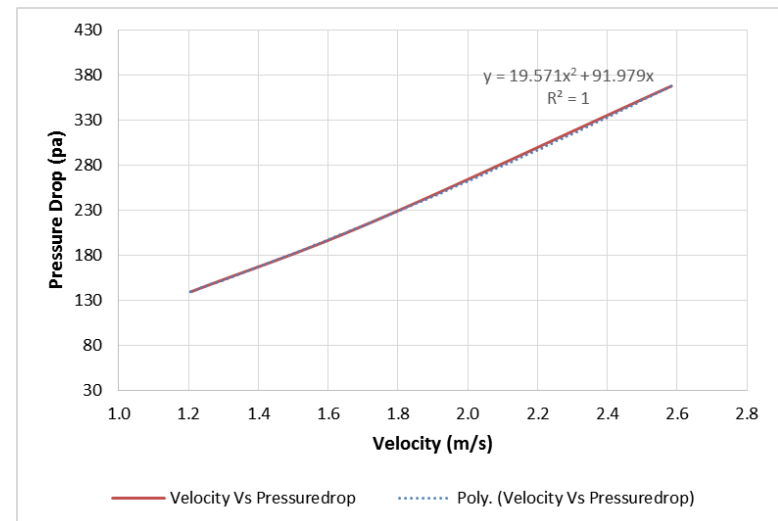


Airflow Direction

Static Core  
(21.65" X 10.86" X 21.65")

Static core modelled as block  
(porous media) in CFD

Static Pressure Drop Static core – MC500	
Volume Flowrate (CFM)	Pressure Drop (In Wg)
350	0.56
500	0.87
750	1.48

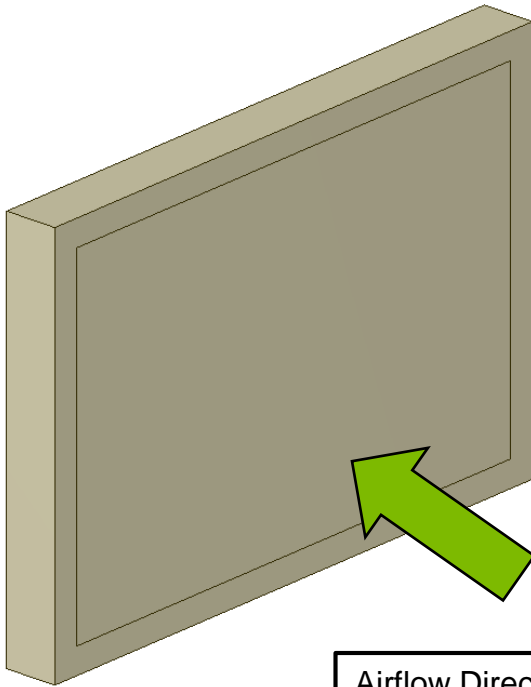


Y – Pressure Drop (pa)

X – Velocity (m/s)

# Modeling Details – Filter

CFD Model – MC500 – Filter

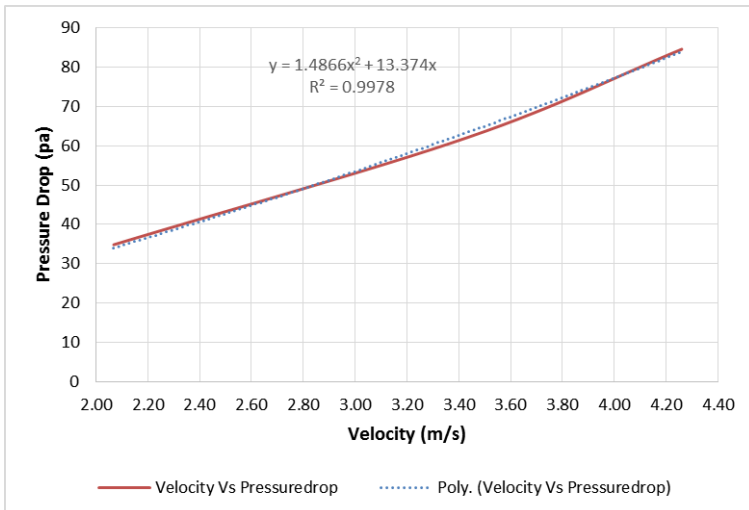


Airflow Direction

Filter  
(19.5" X 13.5" X 1.75")

Filter modelled as block  
(porous media) in CFD

Static Pressure Drop Filter – MC500	
Volume Flowrate (CFM)	Pressure Drop (In Wg)
590	0.14
980	0.25
1215	0.34



Y – Pressure Drop (pa)

X – Velocity (m/s)



# Boundary Conditions

## Boundary Conditions – MC500

Boundary Conditions (Supply & Exhaust)	
Extended Inlets	Pressure Inlet (0 PSI)
Extended Outlets	Pressure Outlet (0 PSI)
Fan Blades	Moving Reference Frame (1500 RPM)
Filters	Porous Medium
Static Core	Porous Medium

- Fan blades rotation are modelled by the Moving Reference Frame (MRF) method.

## CFD Results

- Pressure drop for MC 500 Filter and Static Core has been recorded in the table below

	Supply Air Unit	Exhaust Air Unit
Flowrate (CFM)	808	592.2

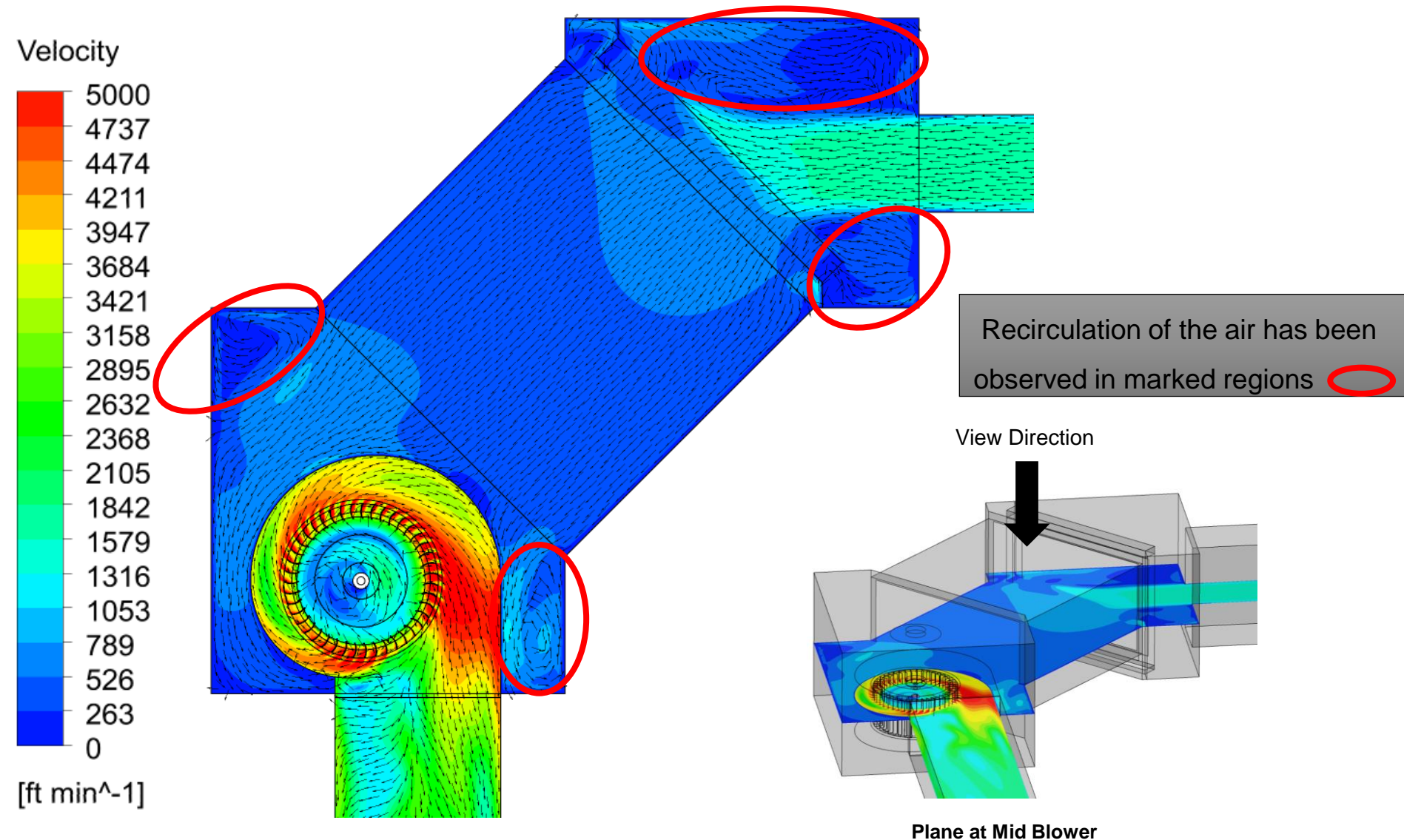
	Supply Air Unit $\Delta$ Ps (in.w.g.)	Exhaust Air Unit $\Delta$ Ps (in.w.g.)
Filter	0.151	0.107
Static Core	0.428	0.687



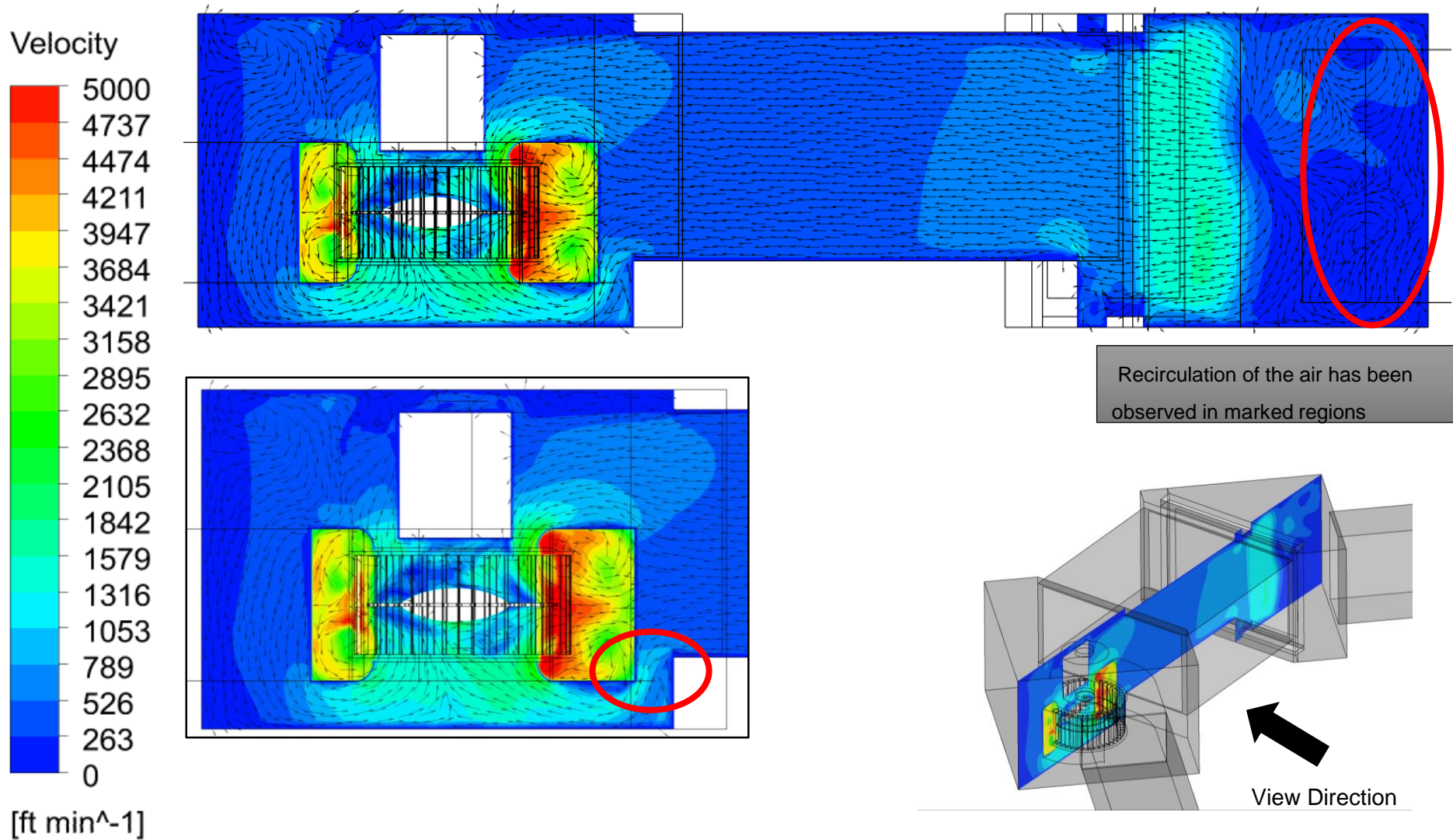
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## **CFD Results – MC500 Supply Side**

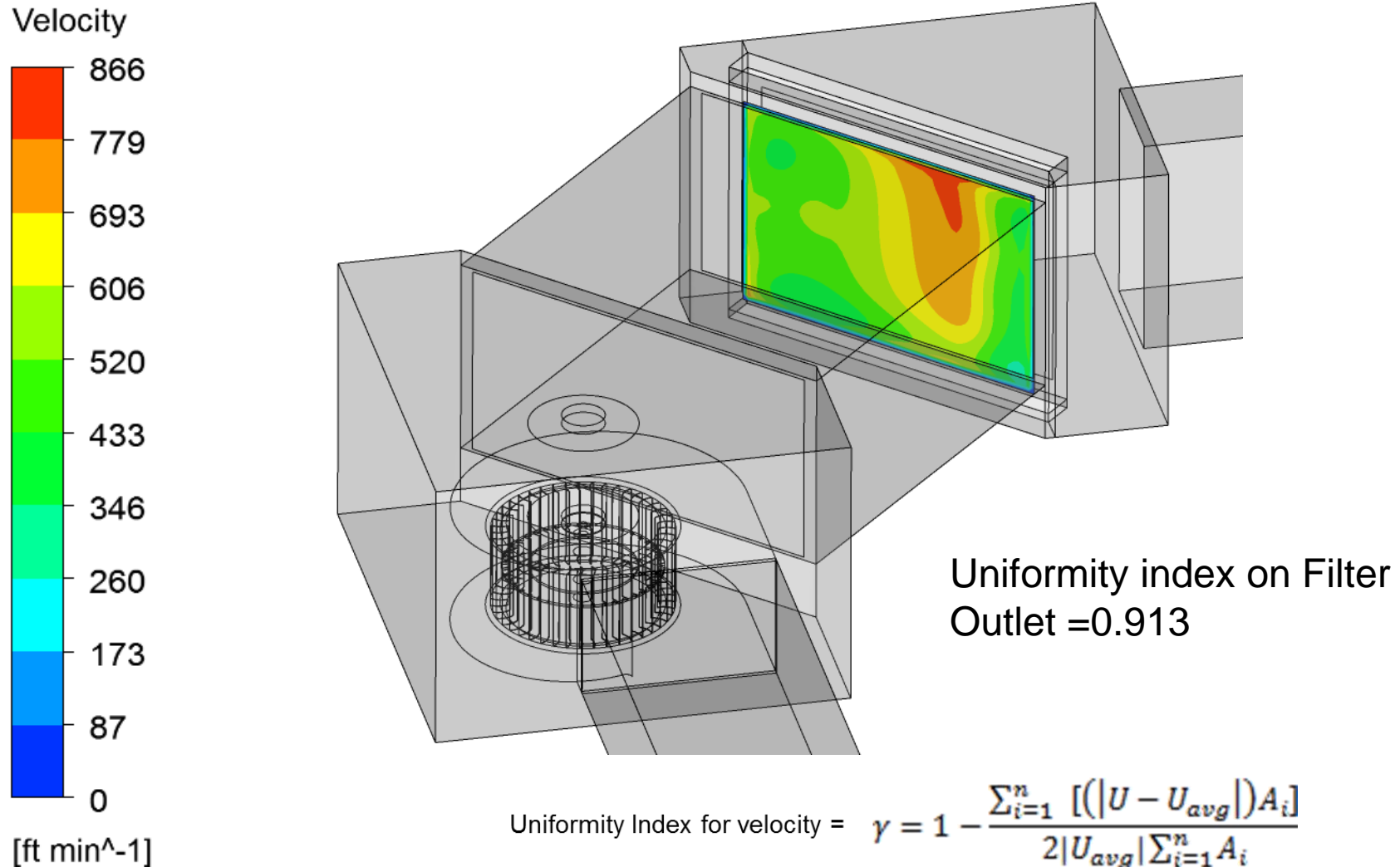
## Results : Velocity Contour



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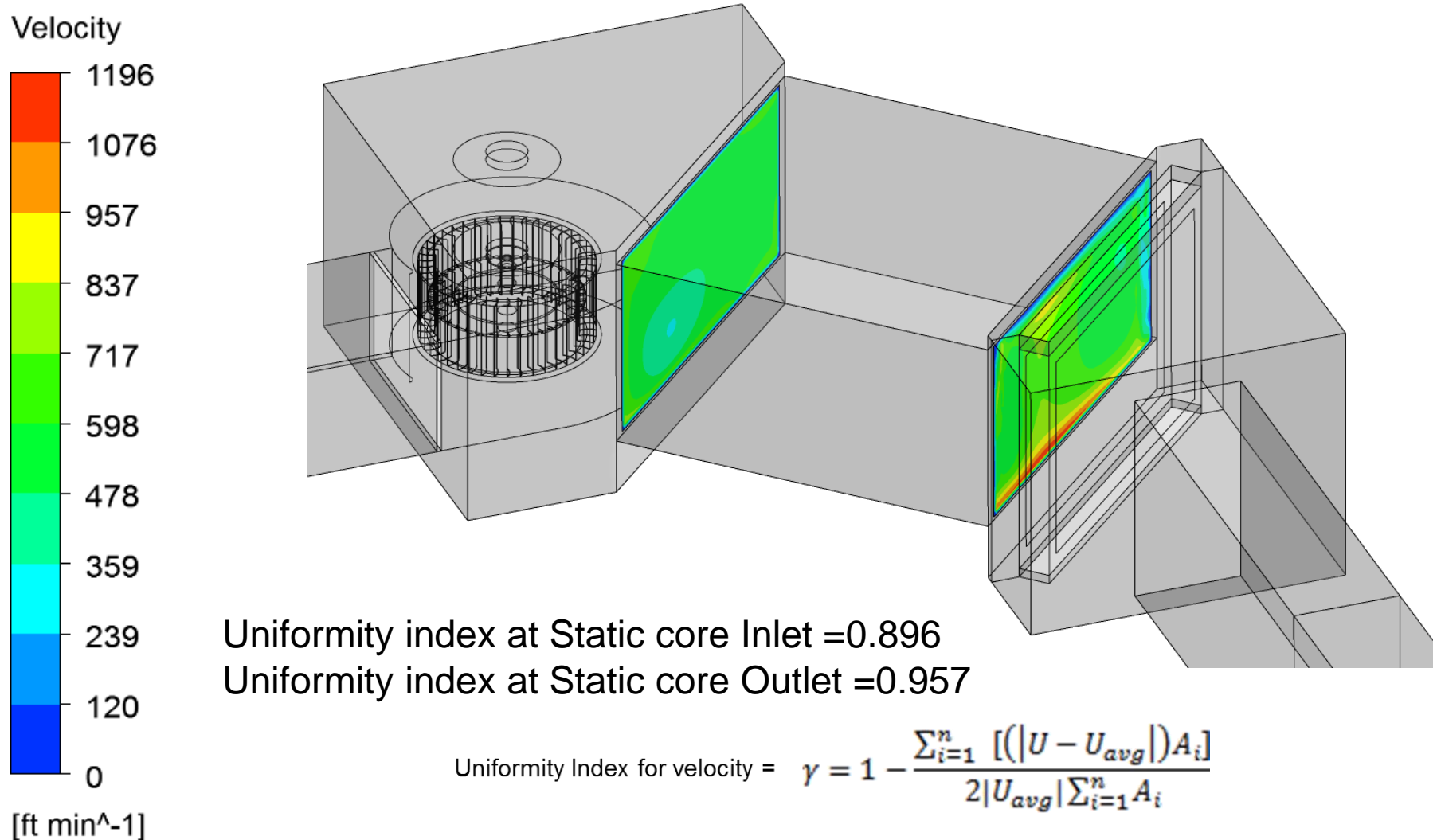


## Results : Velocity Contour at Filter Outlet



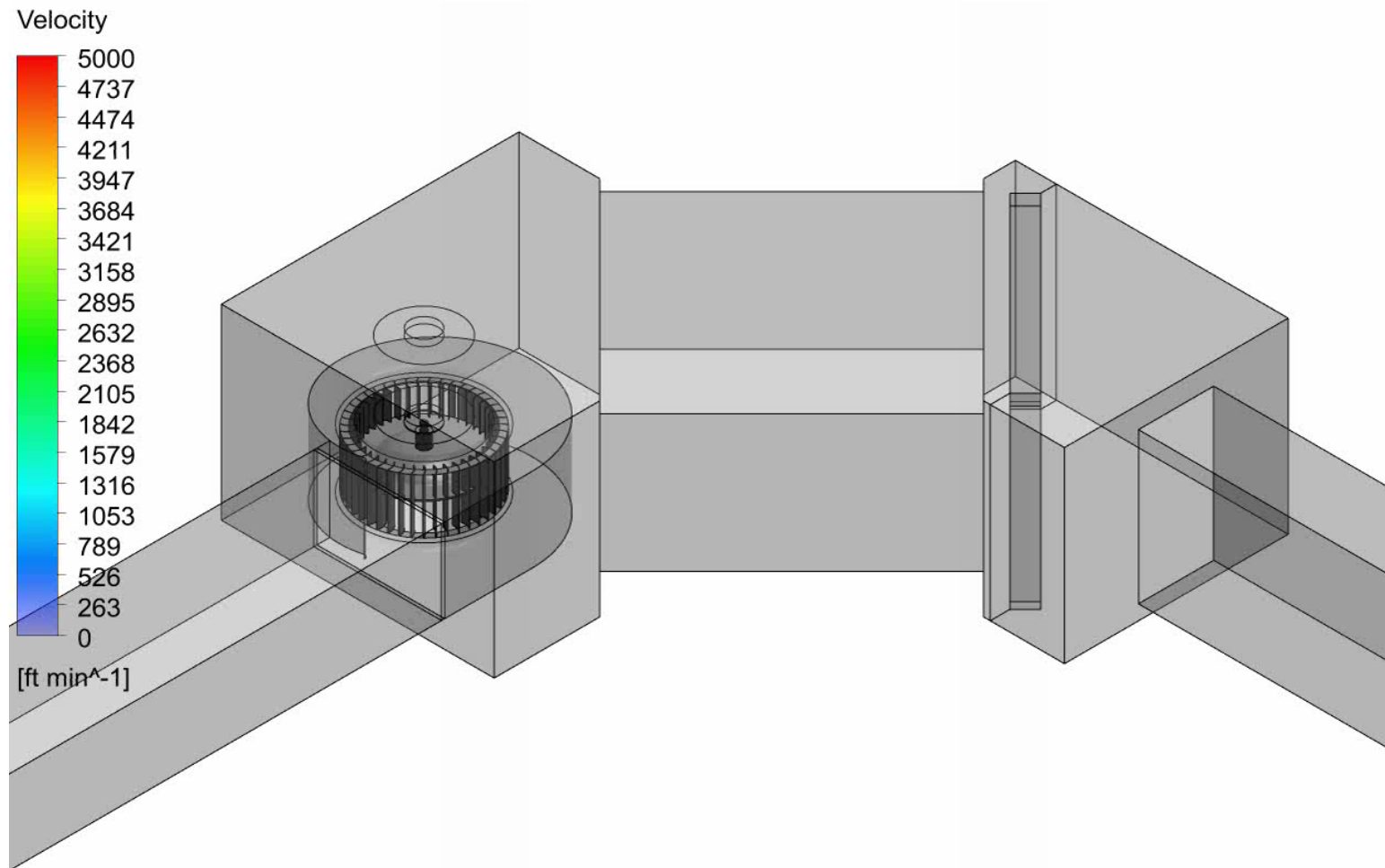
Uniformity index close to 1 which indicates uniform air-flow

## Results : Velocity Contour at Static Core



Uniformity index close to 1 which indicates uniform air-flow

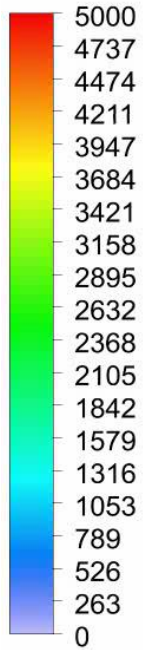
## Results :Streamlines



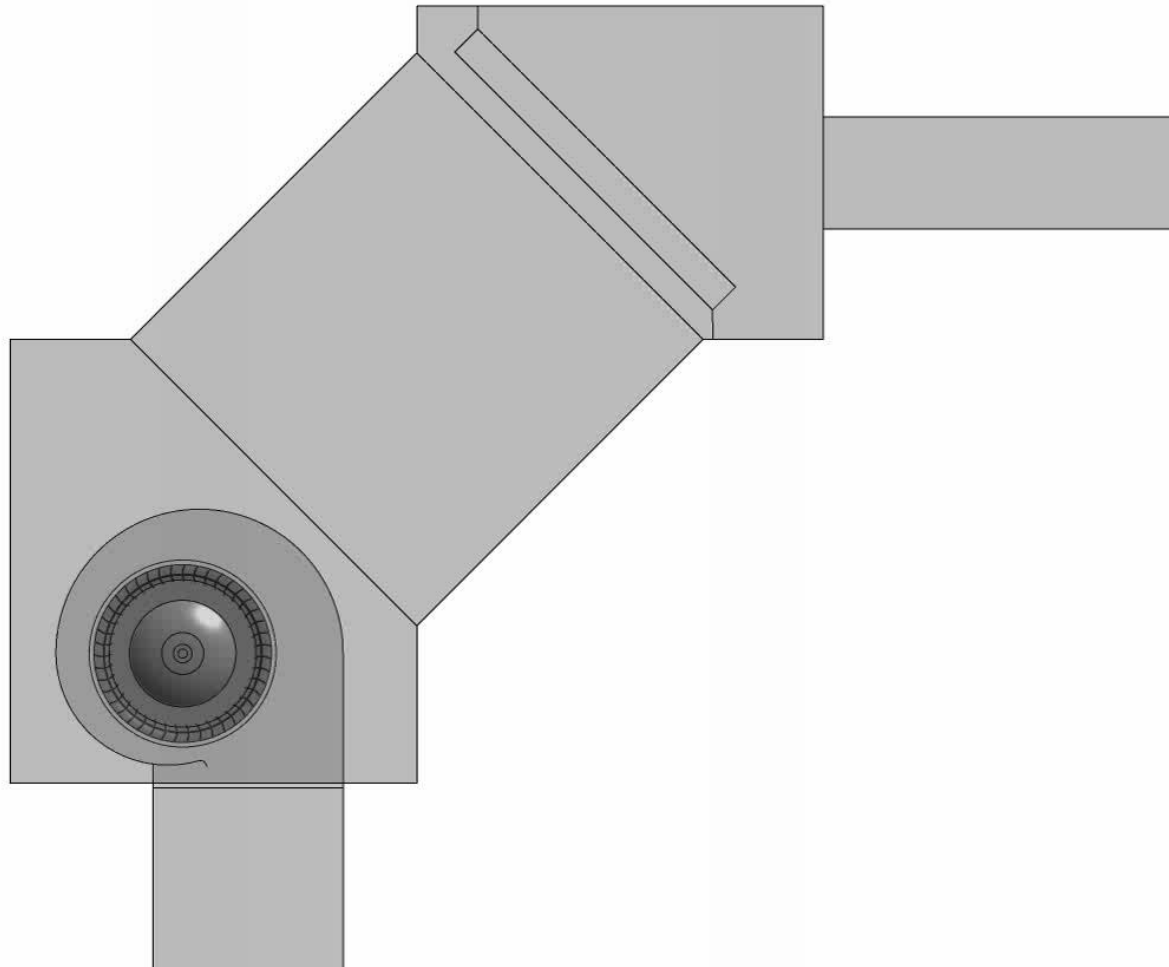


## Results :Streamlines

Velocity



[ft min<sup>-1</sup>]

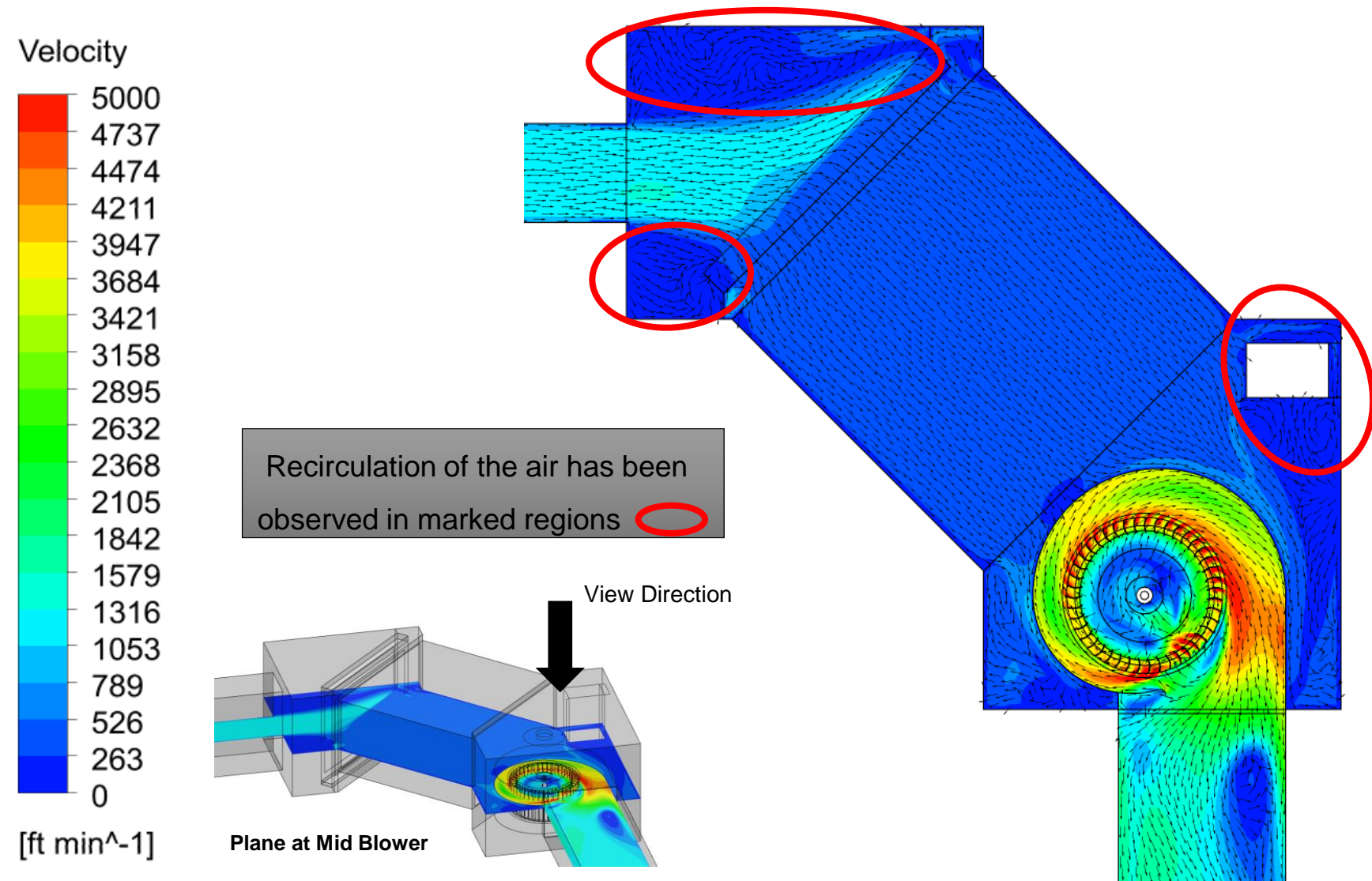




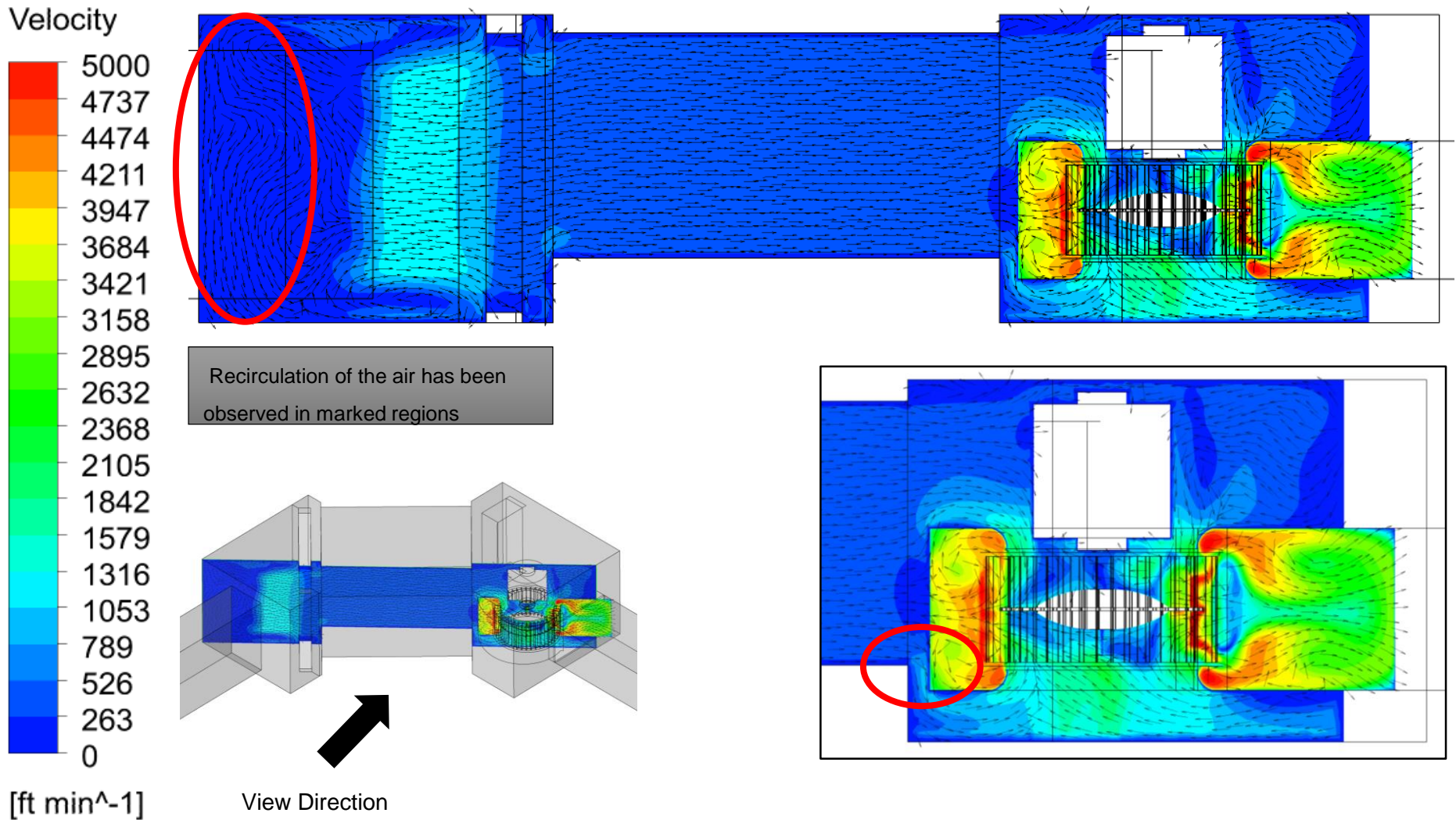
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## **CFD Results –MC500 Exhaust Side**

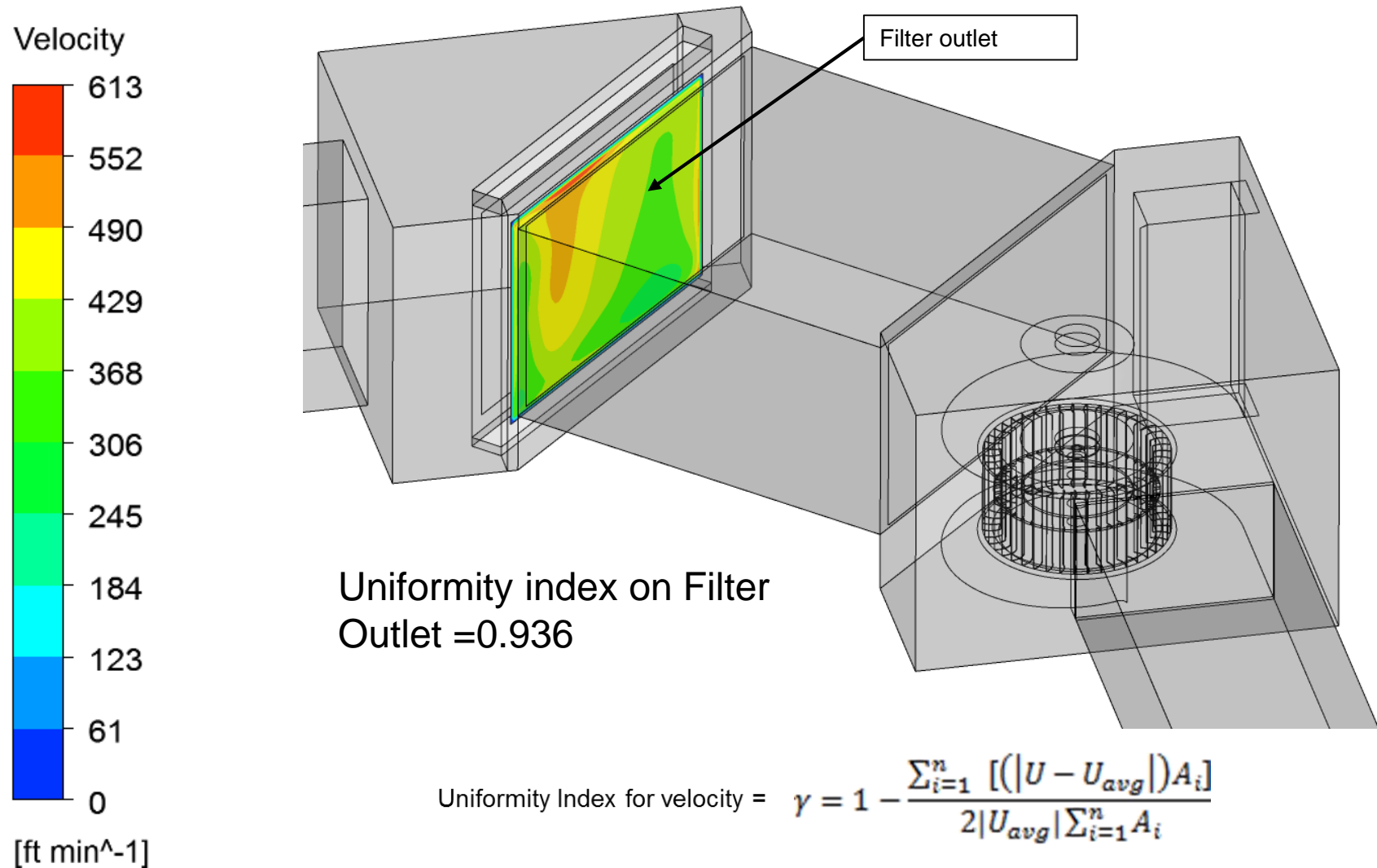
## Results : Velocity Contour



# Results : Velocity Contour

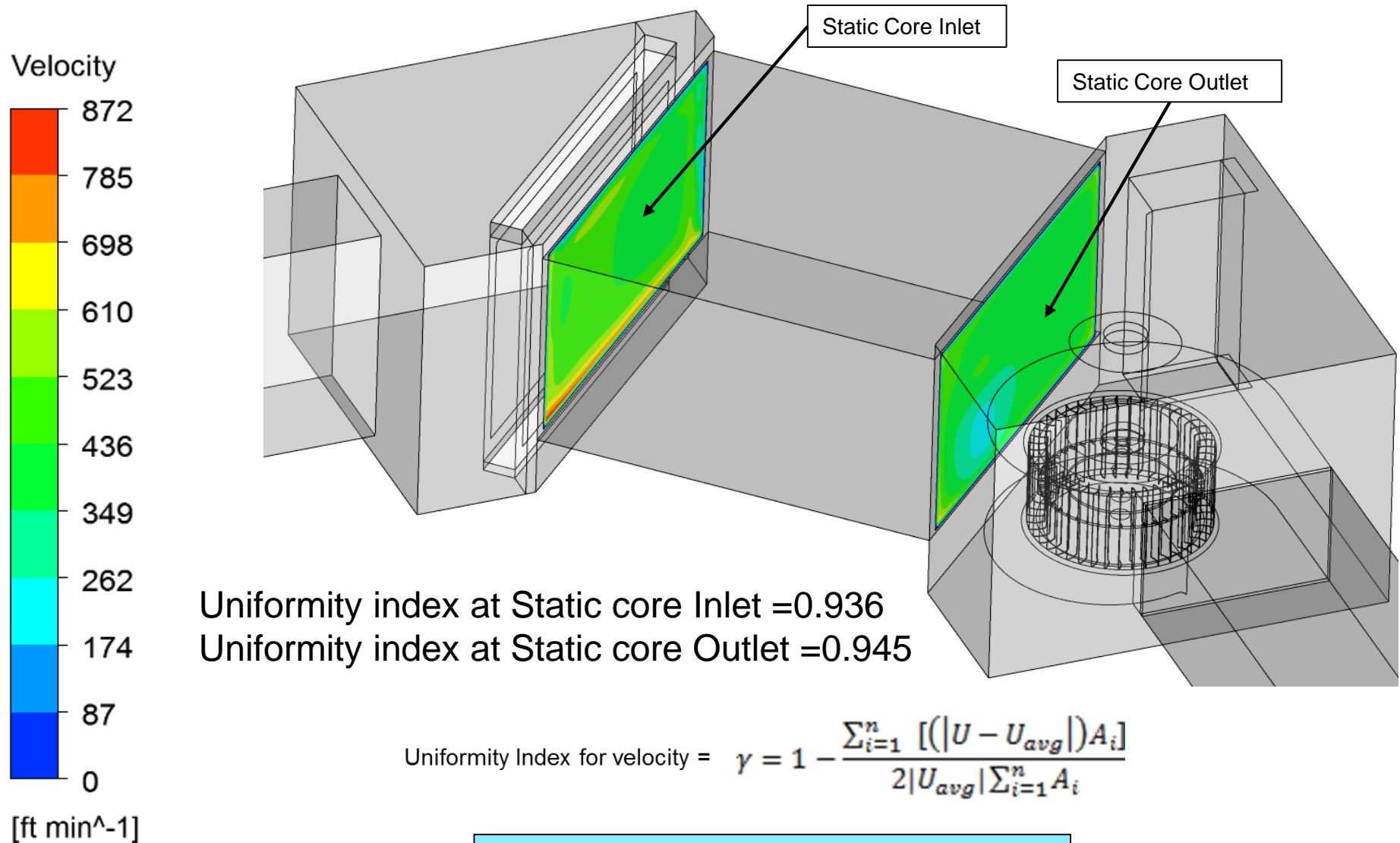


## Results : Velocity Contour at Filter Outlet



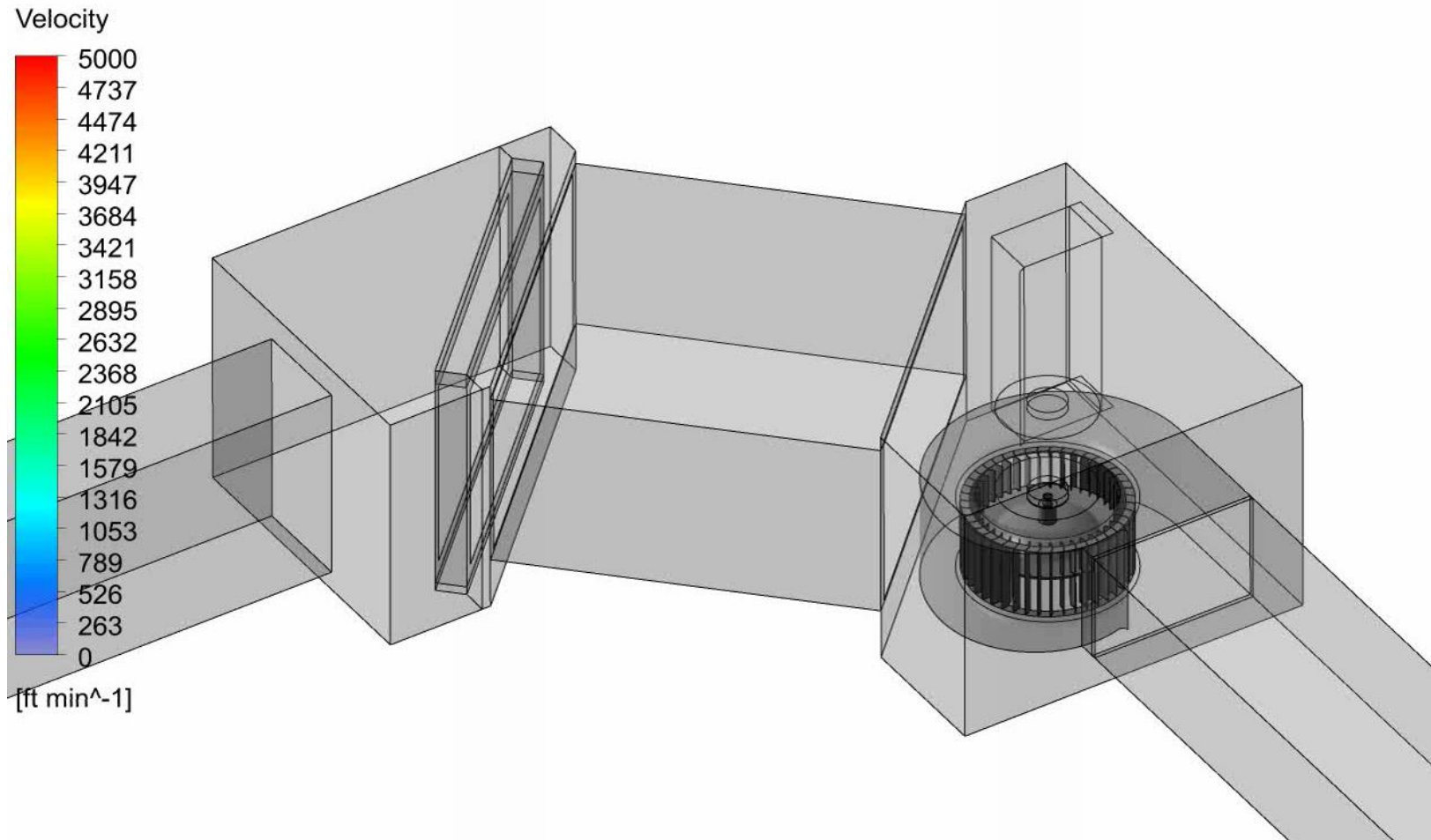
Uniformity index close to 1 which indicates uniform air-flow

## Results : Velocity Contour at Static Core



Uniformity index close to 1 which indicates uniform air-flow

## Results :Streamlines





## Results :Streamlines

