

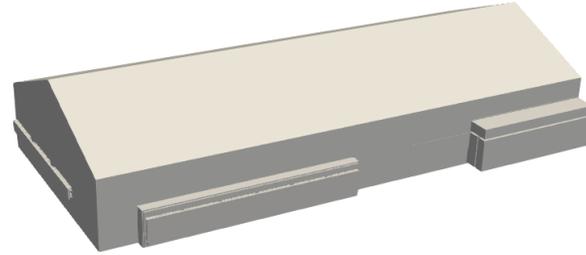
Report Progress Simulasi CFD

Performa ventilasi lapangan futsal

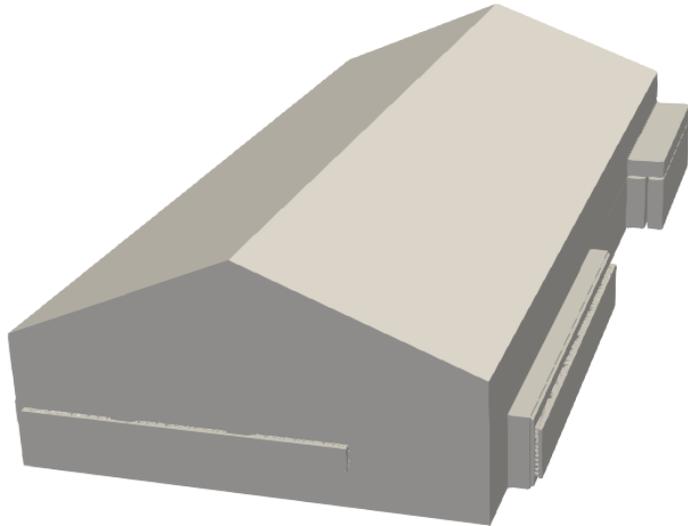
Konten

- Geometry
- Mesh
- Input (kecepatan, suhu dan ukuran partikel)
- Langkah – Langkah simulasi CFD (Flow chart dan penjelasan)
- Hasil Simulasi CFD
 - a. Kecepatan
 - b. Particle Tracking
 - c. Tekanan

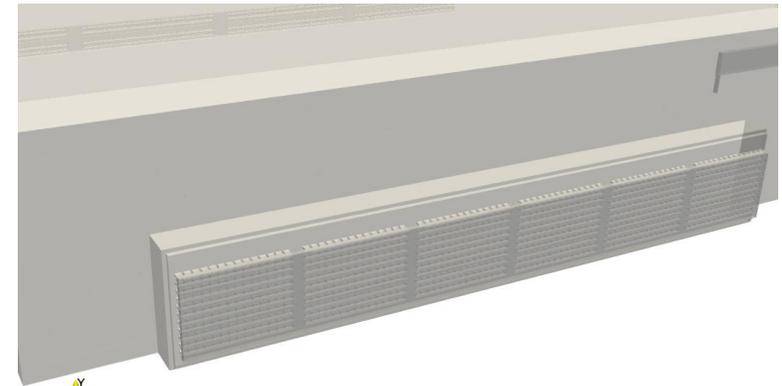
Geometry



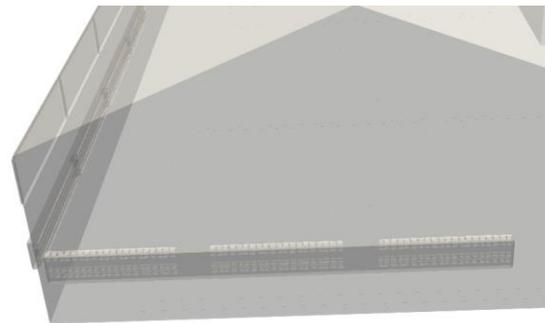
Gambar Nampak Iso



Gambar Nampak Iso

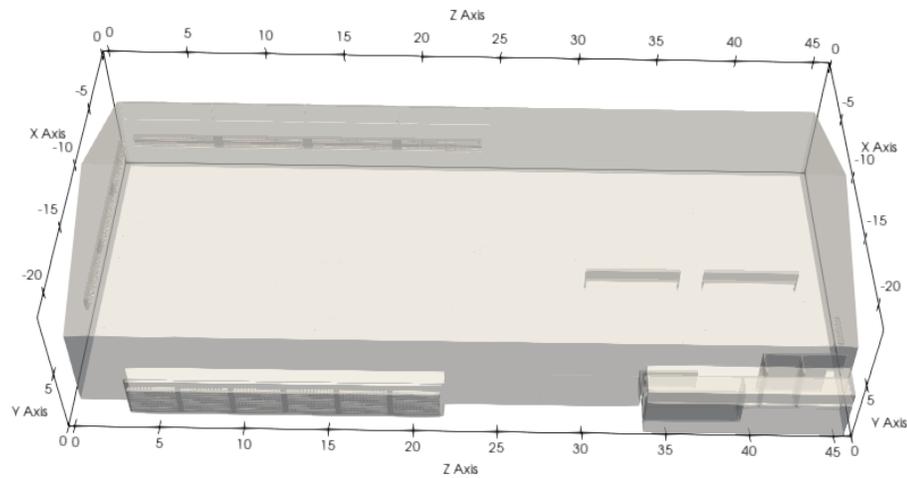


Detail ventilasi depan

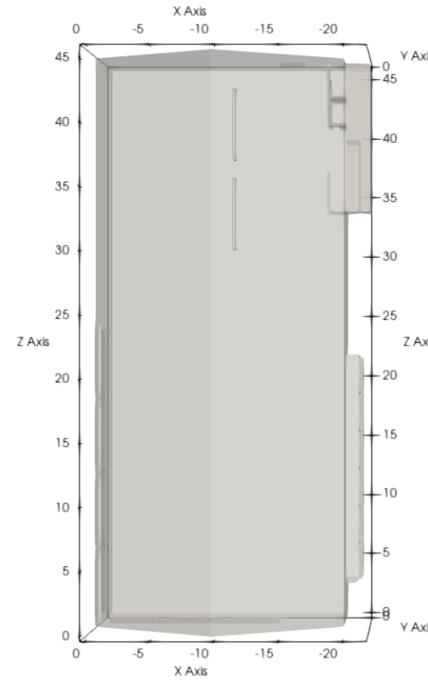


Detail ventilasi belakang

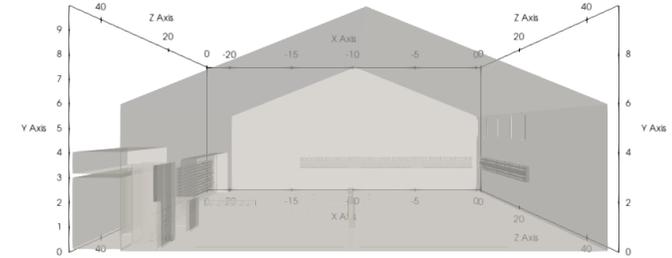
Geometry Dimensi



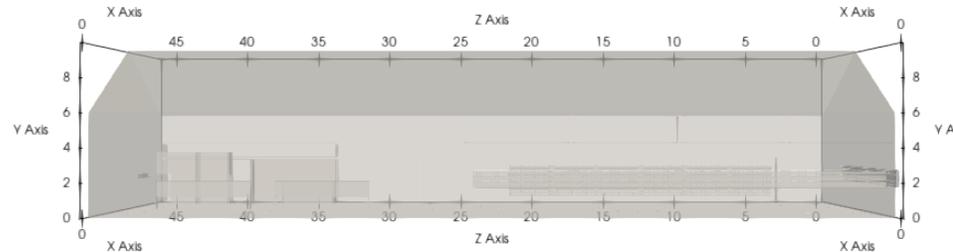
Gambar Nampak Iso



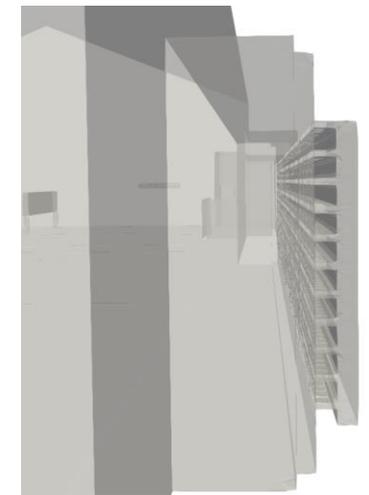
Gambar Nampak atas



Gambar Nampak depan

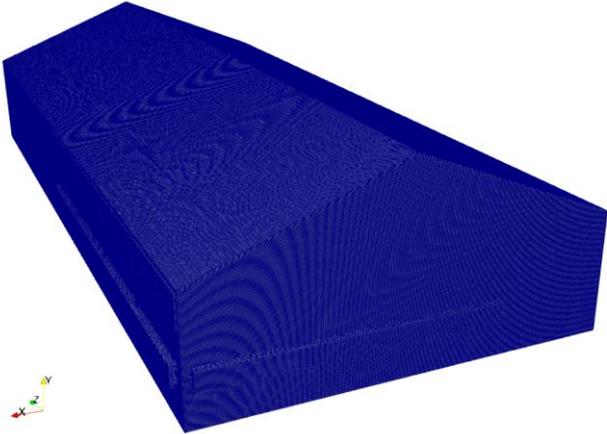


Gambar Nampak samping

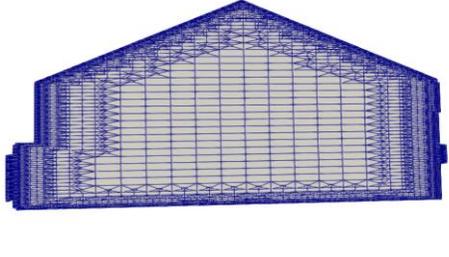


Detail ventilasi depan

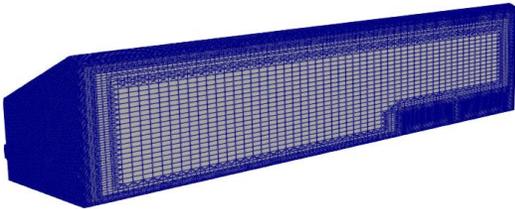
Mesh Information



Gambar Nampak Iso



Gambar Nampak Potongan Tegak



Gambar Nampak Potongan Memanjang

Type	Multi-block Dataset
# of Cells	11,155,566
# of Points	6,829,881 (float)
# of TimeSteps	93
Current Time	93 (range: [0.1, 9.7])
Memory:	558.662 GB
Bounds	-21.84 to 0.340521 (delta: 22.1805) 0.00349928 to 9.99464 (delta: 9.99114) -0.350177 to 46.03 (delta: 46.3802)

Detail statistic mesh

```

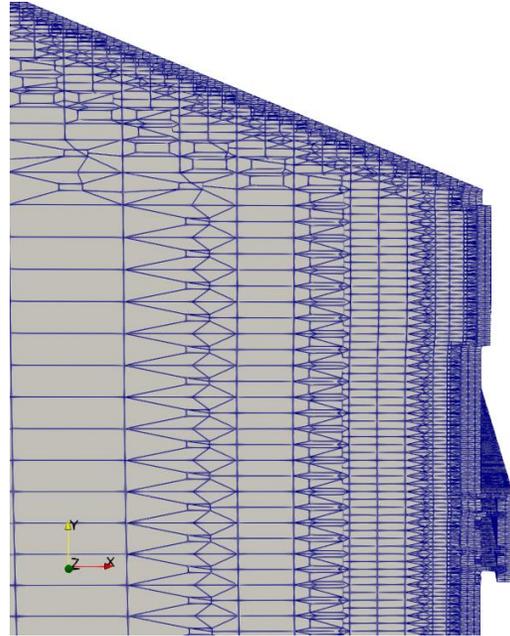
Checking geometry...
Overall domain bounding box (-21.840891 0.0034992797 -0.35017742) (0.34052087 9.9946416 46.03)
Mesh has 2 geometric (non-empty/wedge) directions (1 1)
Mesh has 3 solution (non-empty) directions (1 1 1)
Boundary openness (-1.8458315e-16 -2.1405201e-13 1.8889598e-15) OK.
Max cell openness = 8.1862566e-16 OK.
Max aspect ratio = 18.72556 OK.
Minimum face area = 1.818809e-05. Maximum face area = 1.0786696. Face area magnitudes OK.
Min volume = 3.7029636e-06. Max volume = 9.35158369. Total volume = 7398.7574. Cell volumes OK.
Mesh non-orthogonality Max: 66.989598 average: 30.448867
Non-orthogonality check OK.
Face pyramids OK.
***Max skewness = 12.762392, 3040 highly skew faces detected which may impair the quality of the results
<->Writing 3040 skew faces to set skewFaces
Coupled point location match (average 0) OK.
    
```

Detail mesh information

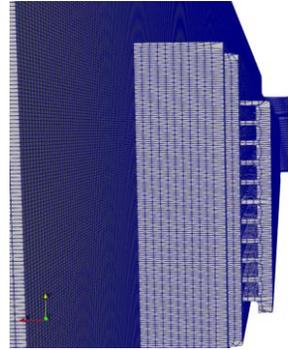
	Value	Remark
Node	6.829.881	
Cells	11.155.566	
Non-Ortho	14.4464	Excellent
Skewness	12.125	Acceptable

Mesh Information

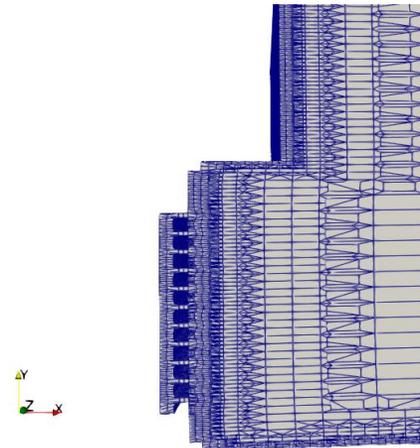
Mesh information



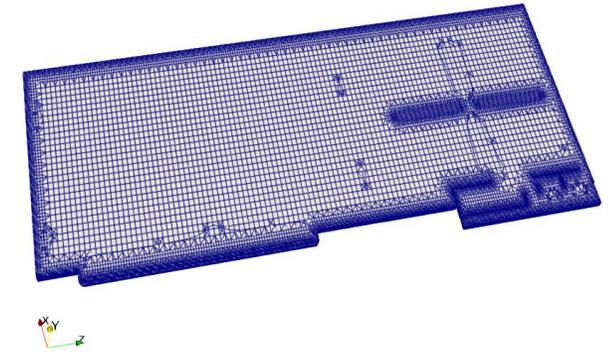
Gambar Nampak Dinding



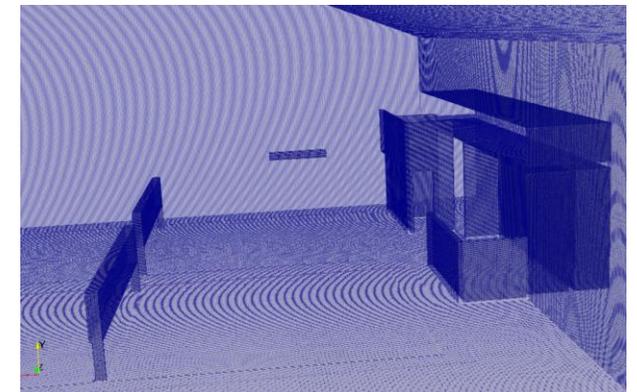
Gambar detail pada ventilasi



Gambar Detail ventilasi keluar



Gambar Nampak Potongan Melintang

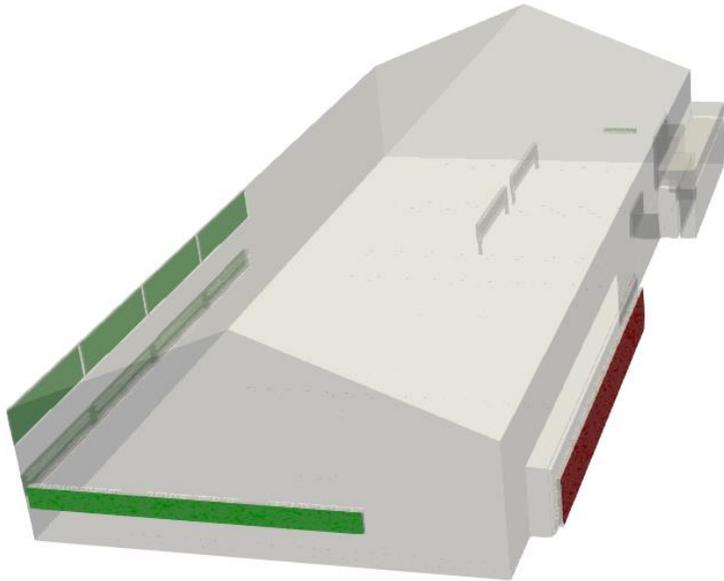


Gambar Nampak Dalam

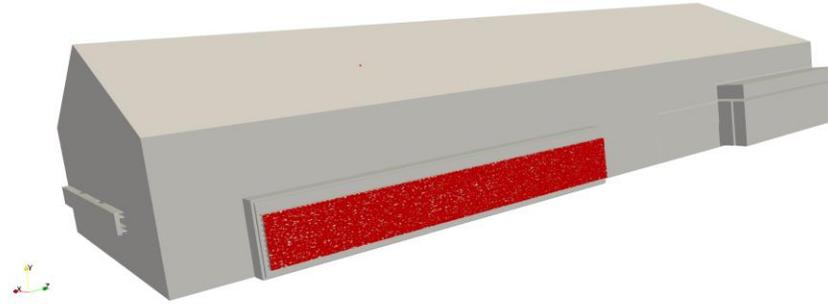
Input Model

Domain

- Inlet : masuknya udara
- Outlet : keluarnya udara
- Walls : objek pembatas

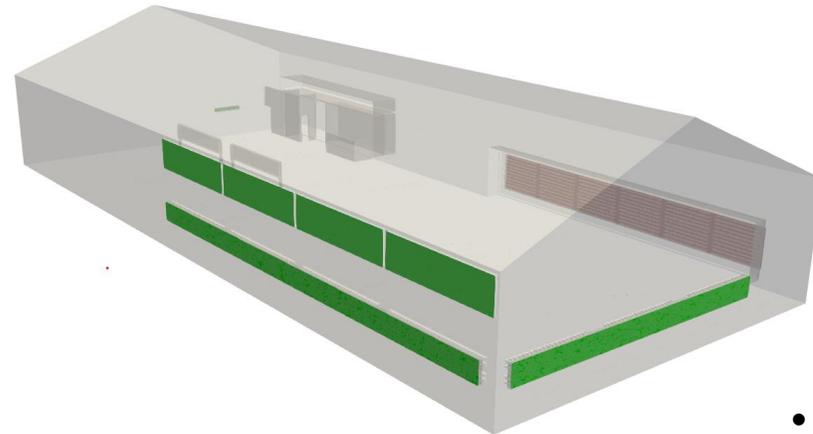


Domain Nampak ISO



Domain Nampak inlet (merah)

- Kecepatan 1.23 m/s
- Suhu 30.13 °C
- Tekanan 1 atm

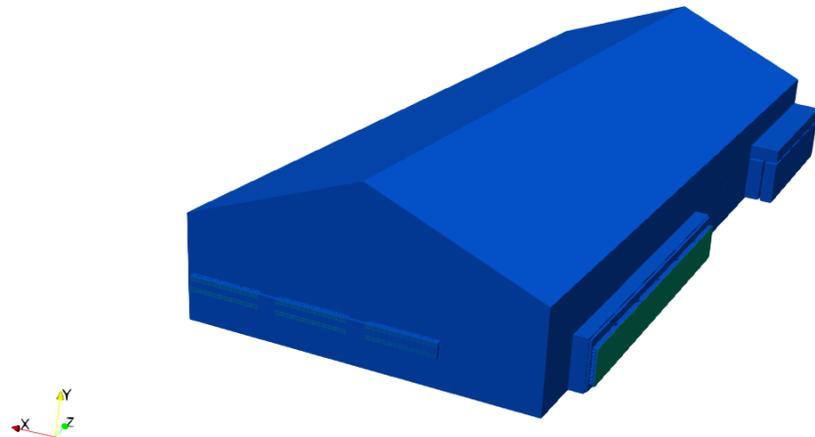
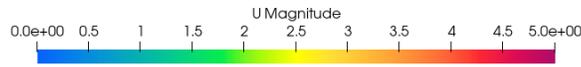


Domain Nampak Outlet (hijau)

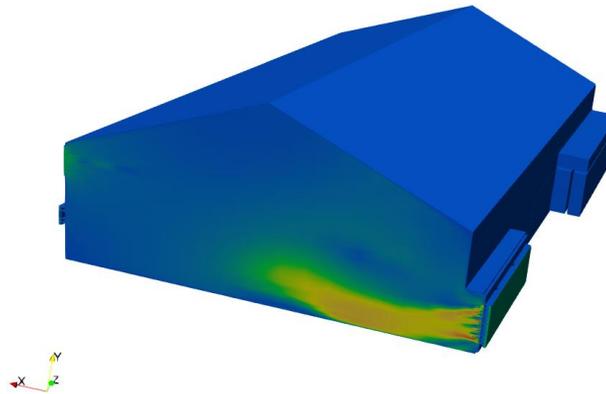
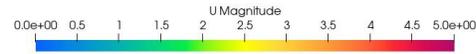
- Tekanan 1 atm
- Suhu 30 °C

Hasil Simulasi CFD

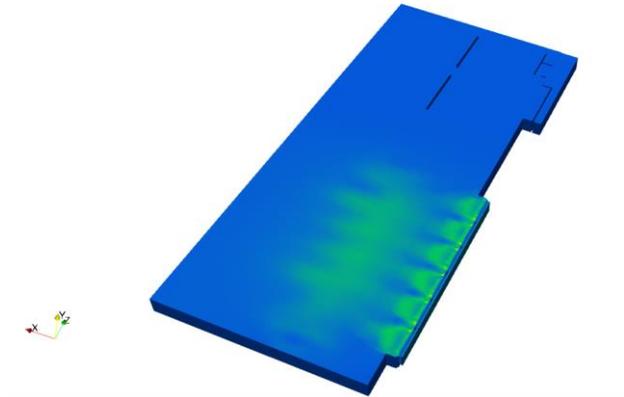
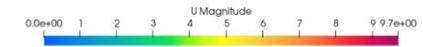
Hasil Simulasi CFD Kecepatan



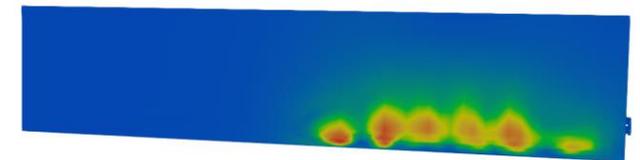
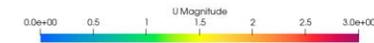
Gambar Nampak Luar



Gambar Nampak Potongan



Gambar Nampak Potongan Melintang

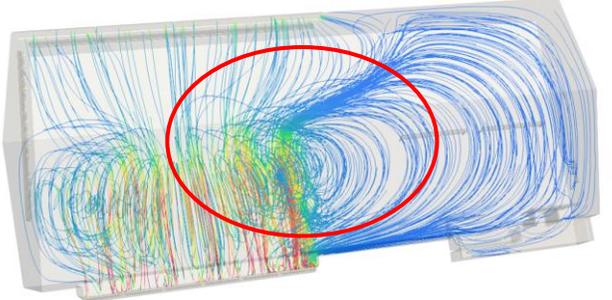
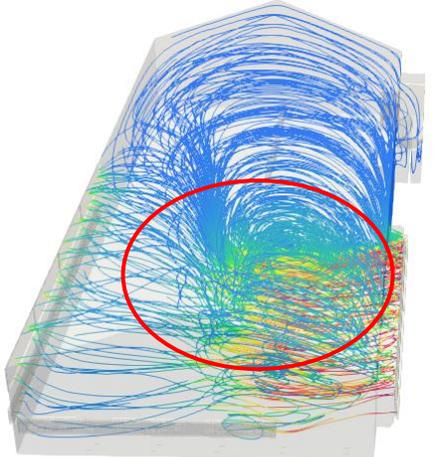
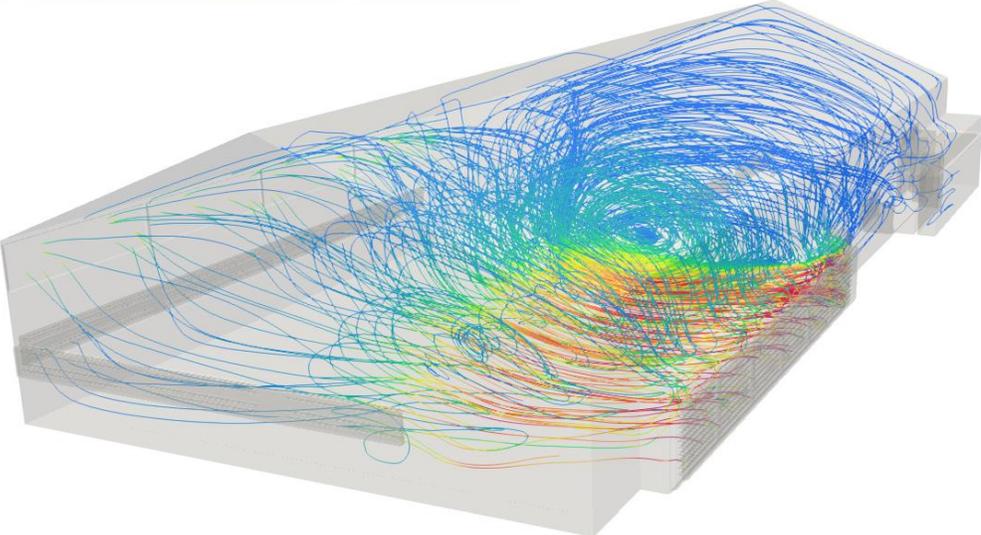
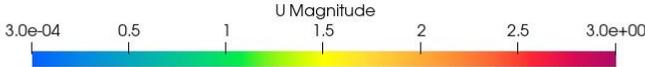


Gambar Nampak Potongan Memanjang



Gambar grafik kondisi kecepatan inlet ke outlet, terjadi trend penurunan kecepatan dari intake 1.23 m/s menuju kecepatan pada ventilasi keluar 0.6 m/s

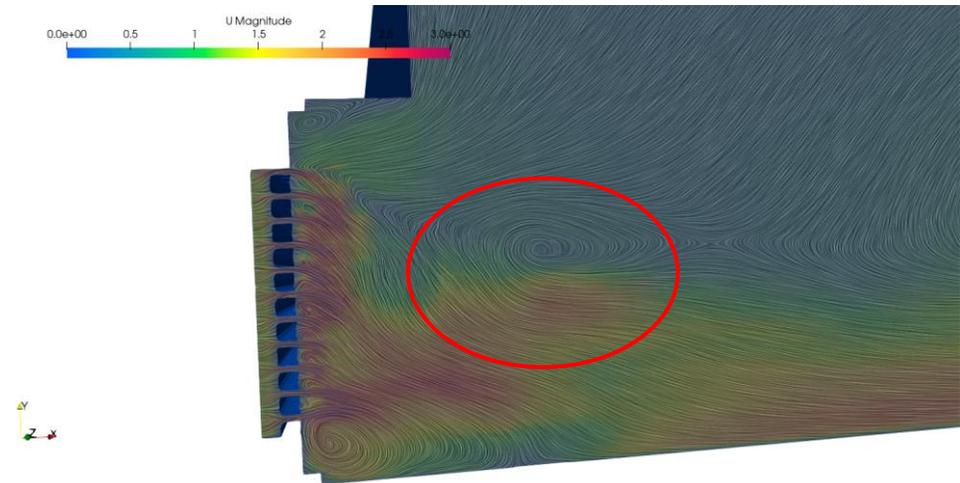
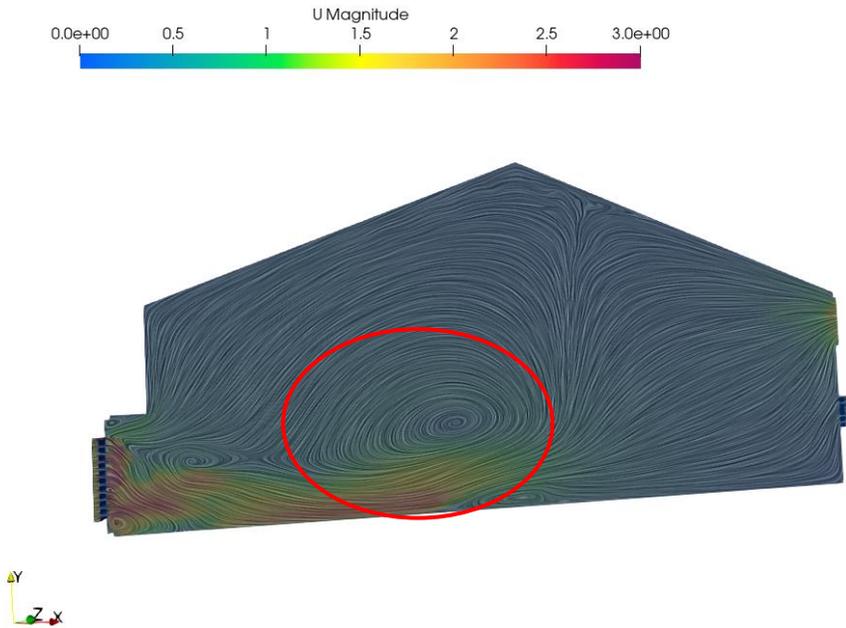
Hasil Gambar Streamline



Berdasarkan hasil dari streamline menunjukkan bahwa fluida mengalami vortekes atau interaksi antar fluida yang menyebabkan pusaran fluida pada posisi Tengah, tepatnya pada posisi diantara lapangan futsal dan lapangan badminton

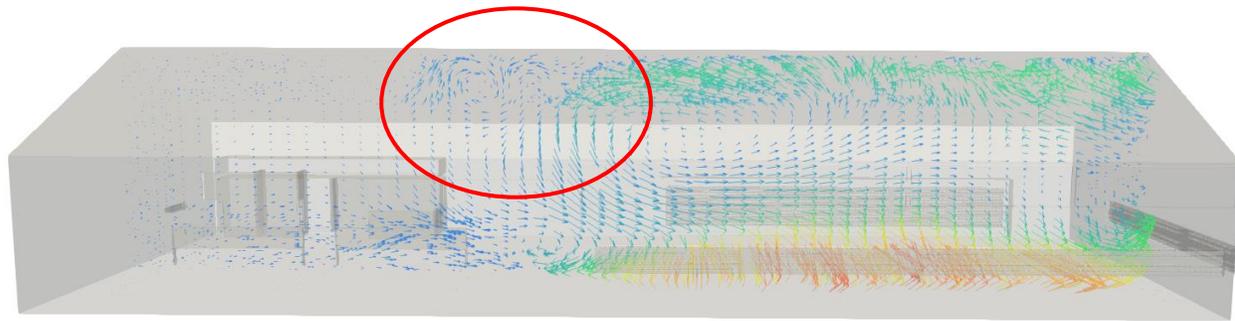
Cek lingkaran merah

Hasil Gambar Streamline

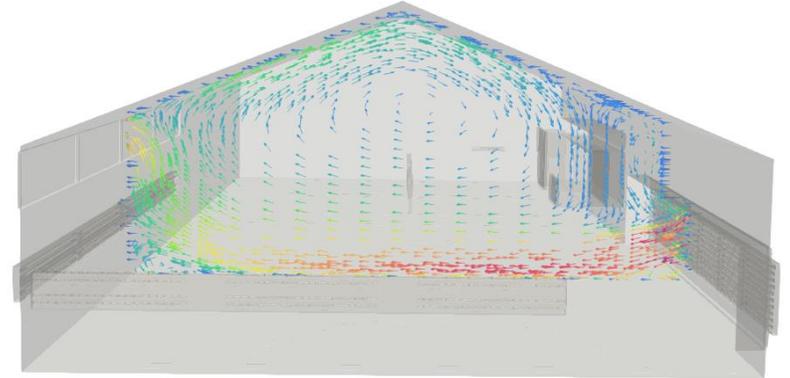
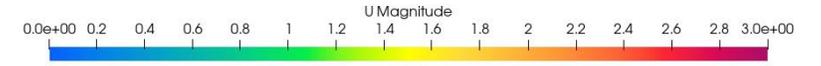


Detail vortex dan posisi dalam bentuk potongan

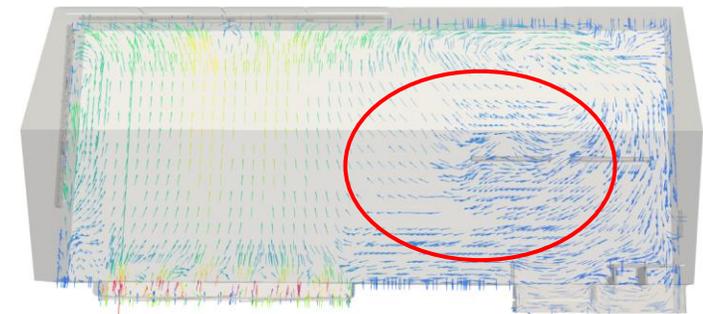
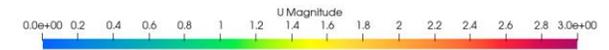
Hasil Vektor Kecepatan



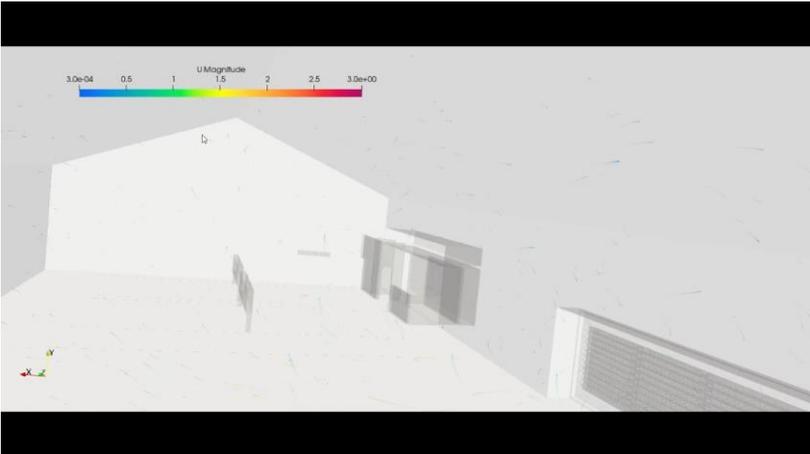
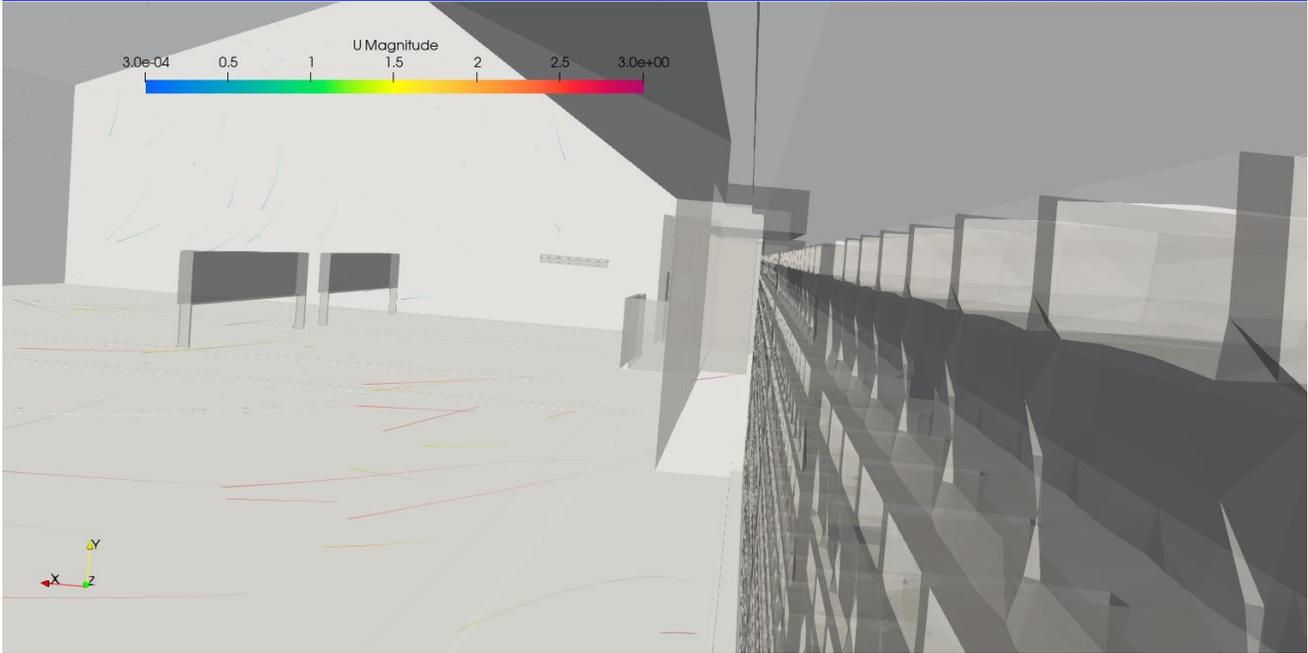
Dari Hasil analisis vector menunjukkan ada back flow udara yang didominasi di puncak atau bagian atas, selain itu di sebagian daerah lapangan badminton juga terindikasi backflow, seperti pada lingkaran



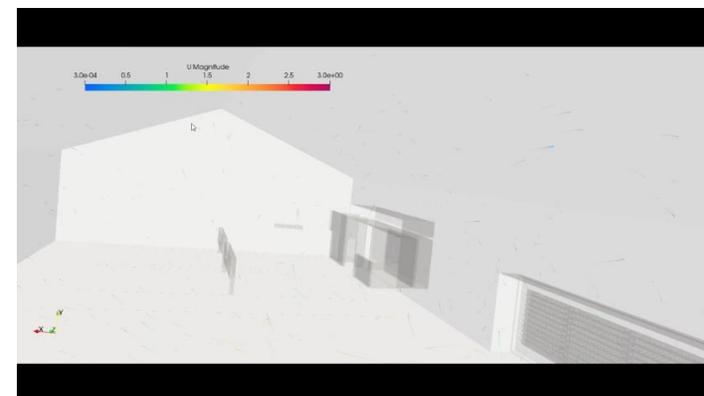
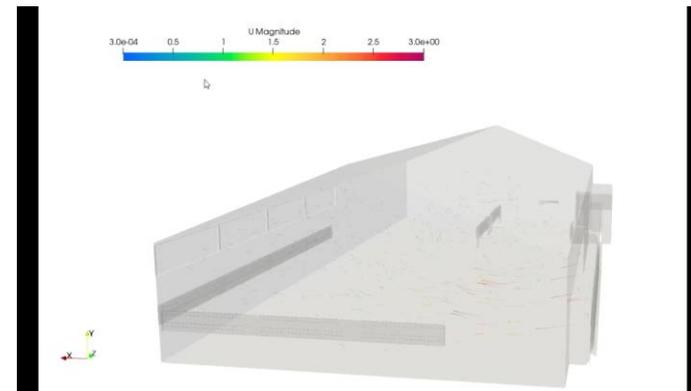
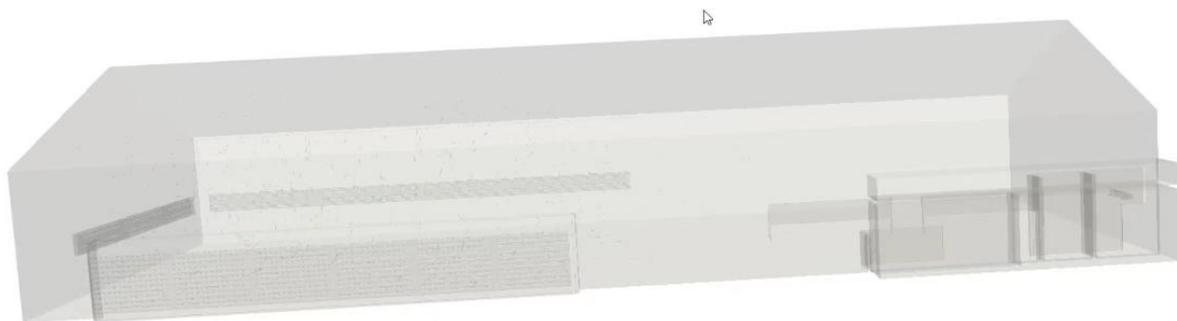
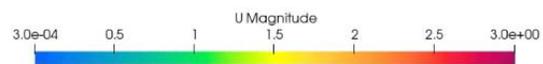
Time: 93.000000 detik



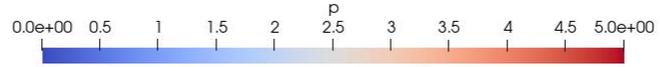
Animasi Partikel Tracking



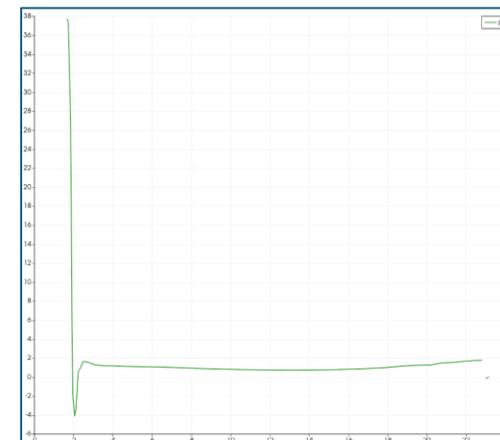
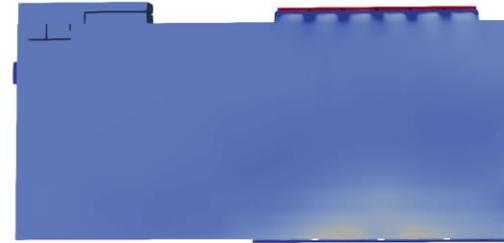
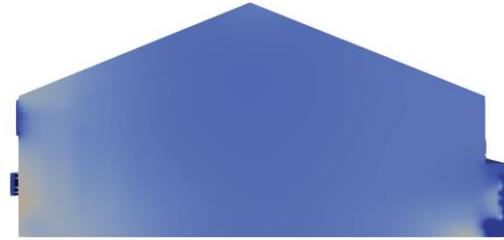
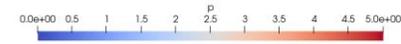
Animasi Partikel Tracking



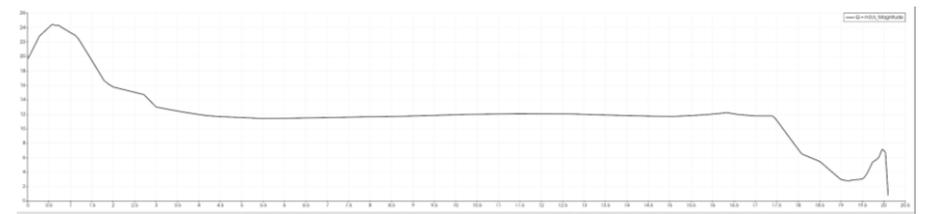
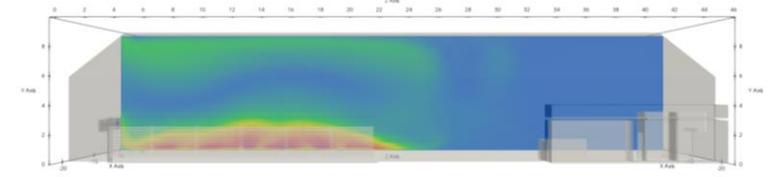
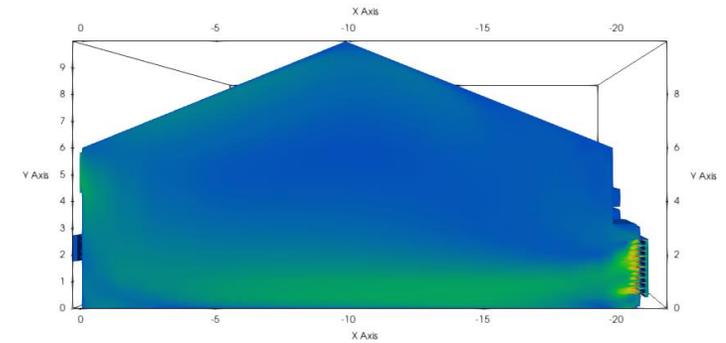
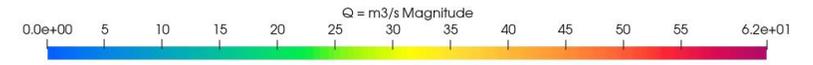
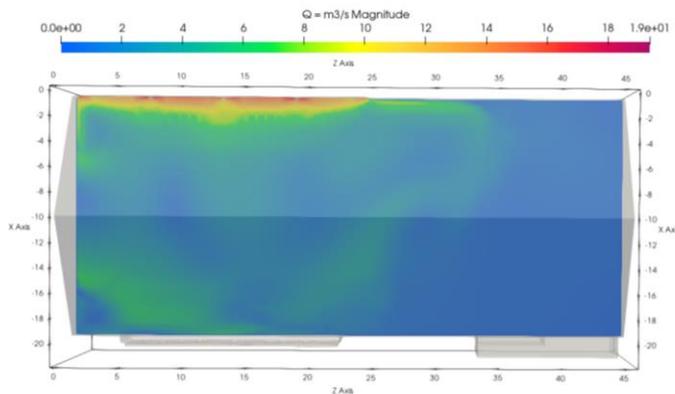
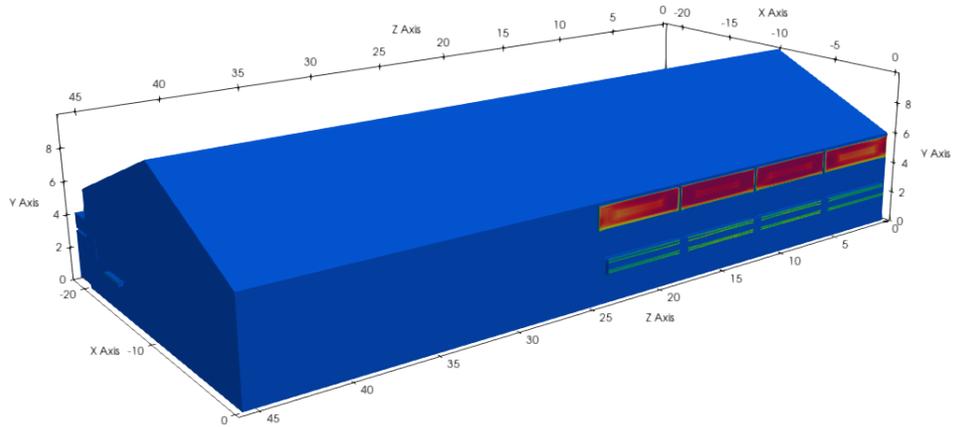
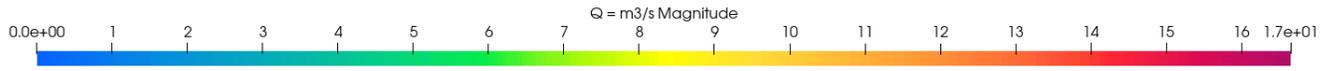
Hasil Tekanan



Kondisi tekanan pada desain bangunan meunjukkan adanya pressure drop dari inlet menuju ke outlet, namun ada beberapa tumpukan tekanan udara Ketika udara telah mendekati di ventilasi outlet



Hasil Simulasi Flow Rate



Nilai Rata-rata flowrate pada aliran udara dengan 100 detik pertama sebesar $12.100425\text{m}^3/\text{s}$

Kesimpulan Sementara

- Running dilakukan dengan waktu 93 detik
- Kondisi aliran dengan desain ventilasi
 1. Kecepatan terjadi penurunan kecepatan dari inlet menuju outlet dengan penurunan kecepatan 0.635 m/s
 2. Terjadi vortex di area bulutangkis dengan kecepatan rendah 0.235 m/s
 3. Terjadi pressure drop dari inlet menuju ke outlet sebesar 15 Pa
 4. Di bagian atap bangunan terjadi back flow akibat suplay udara dari satu sisi (dari penampang potongan melintang)
 5. Debit pada 100 detik pertama rata-rata sebesar 12.1 m³/s