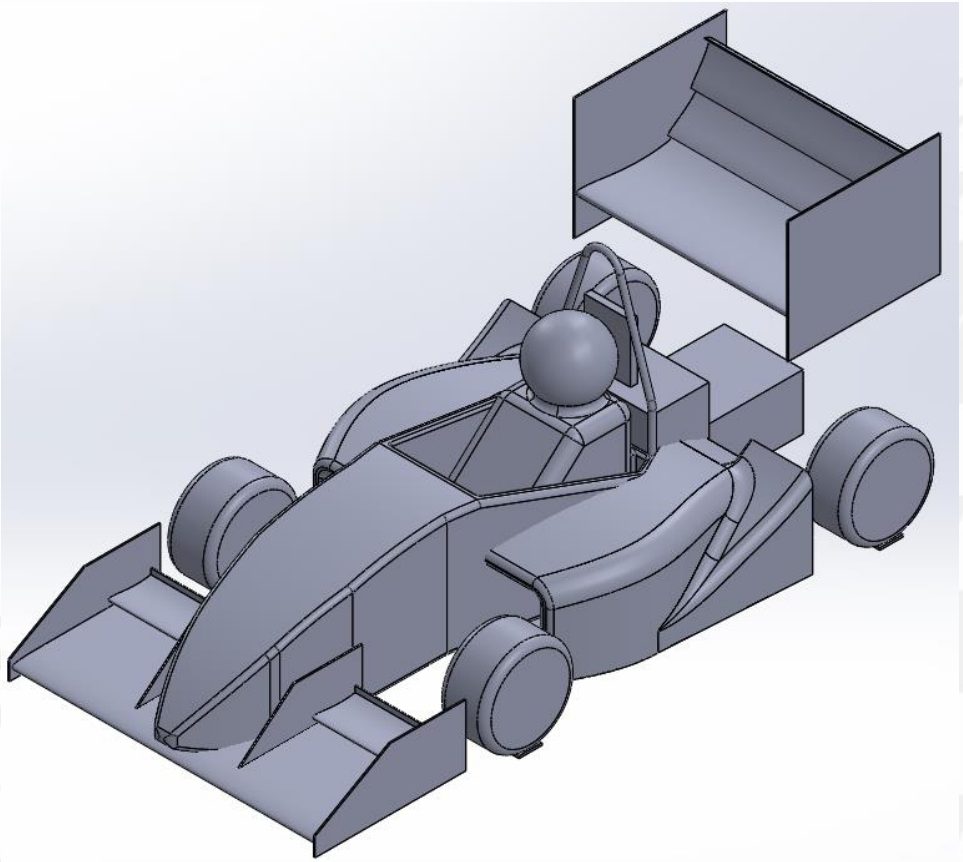
OPTIMISATION OF A WING IN GROUND CLEARANCE



Hashan Mendis s3449757

FRONT WING DESIGN

Current Design :

- Simple design

Problem Statement :

- Need more front downforce

Objective :

- Evaluate optimum ground clearance and flap angle
- Optimise design to produce more downforce

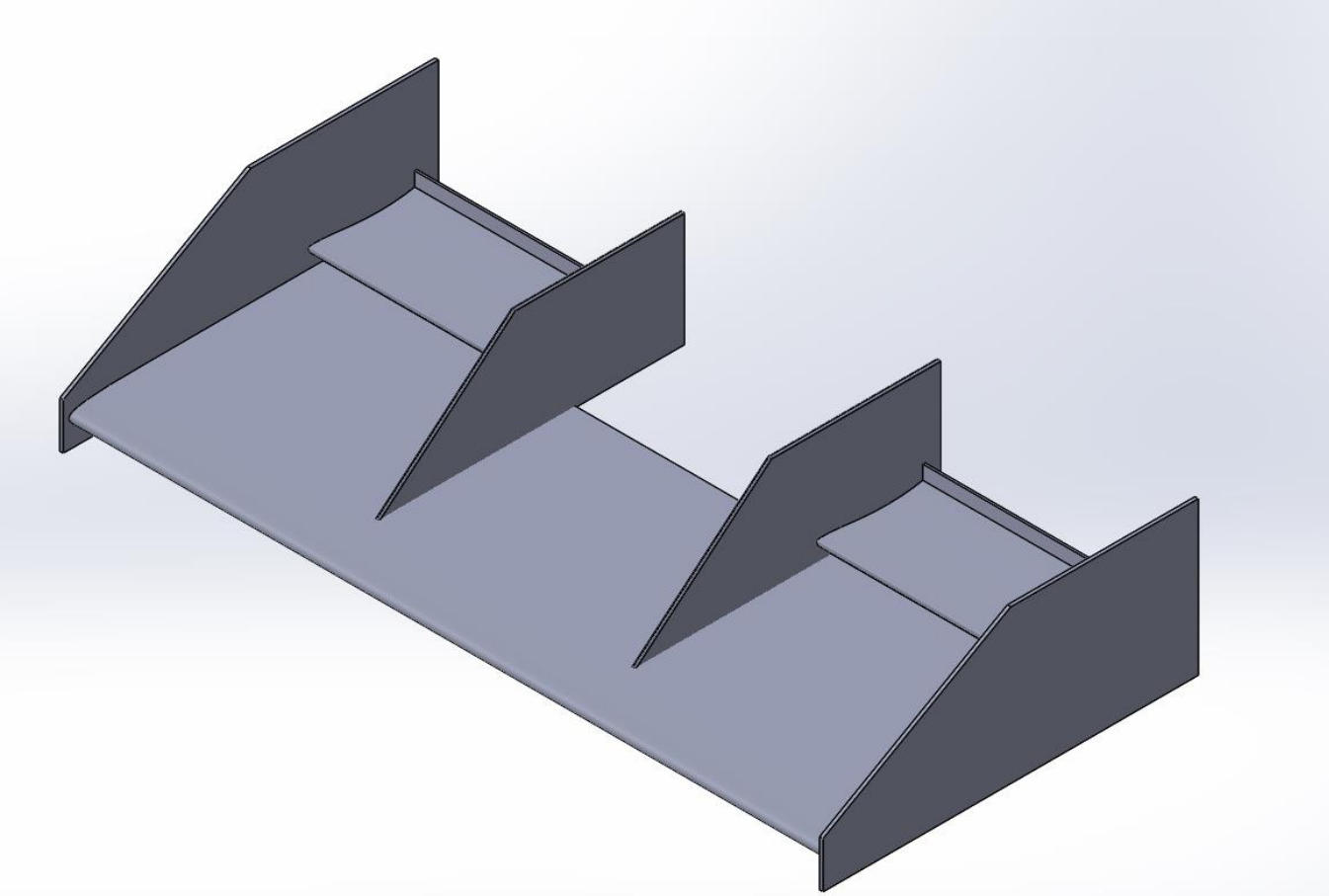


Figure 1 – Current design of the front wing

METHODOLOGY

Full Design of Experiments

- 2D CFD
- Quick run time (1 minute)
- 2D flow structure

Partial Design of Experiments

- 3D CFD
- Long run time (2 hours)
- 3D flow structure

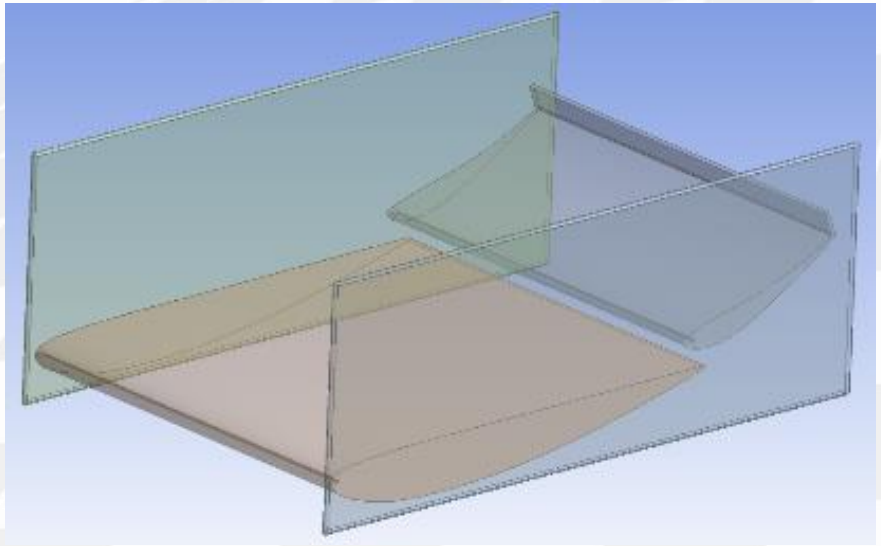
Optimisation

- 3D CFD
- Increase downforce

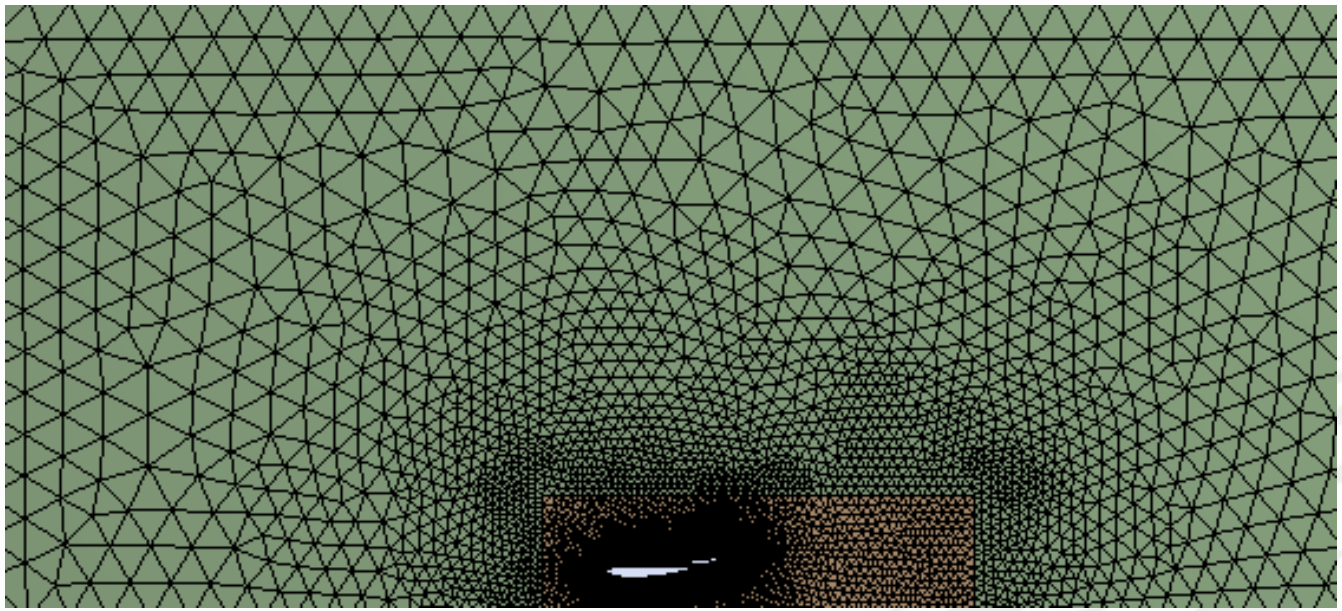
COMPUATIONAL FLUID DYNAMICS

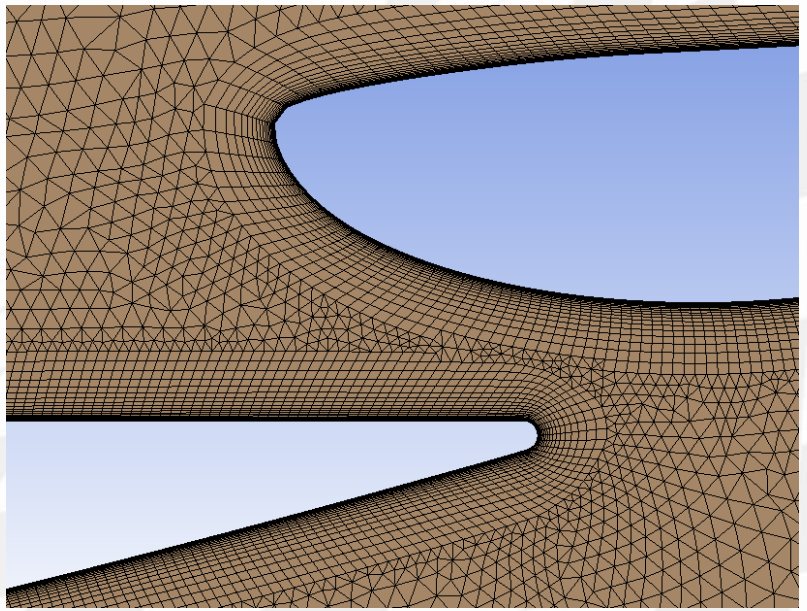
2D Geometry

3D Geometry



COMPUATIONAL FLUID DYNAMICS





2D - 43 000 elements

3D - 11 000 000 elements

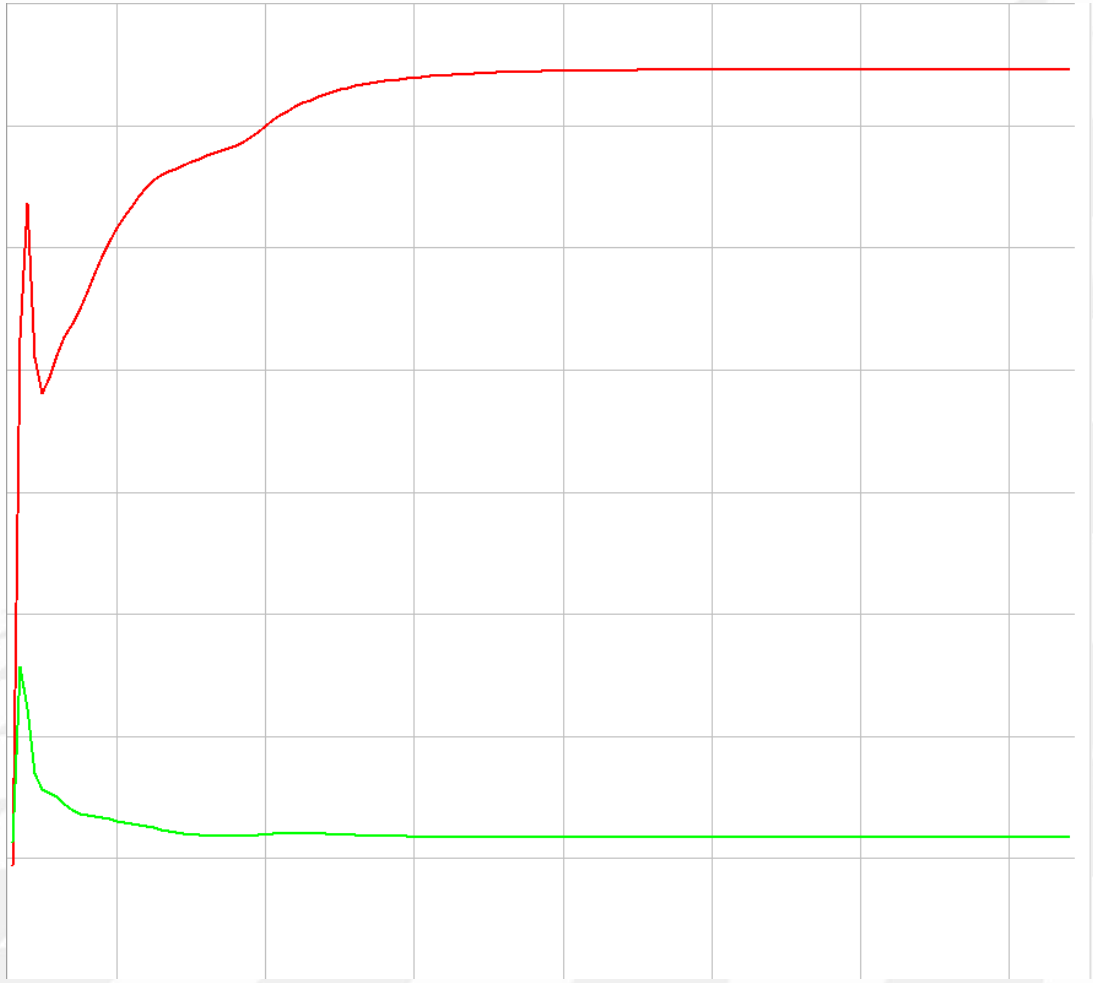
COMPUATIONAL FLUID DYNAMICS

Set up

- 60 km/hr wind speed
- Turbulence model – SST

Solution

- Ensure monitor points stable



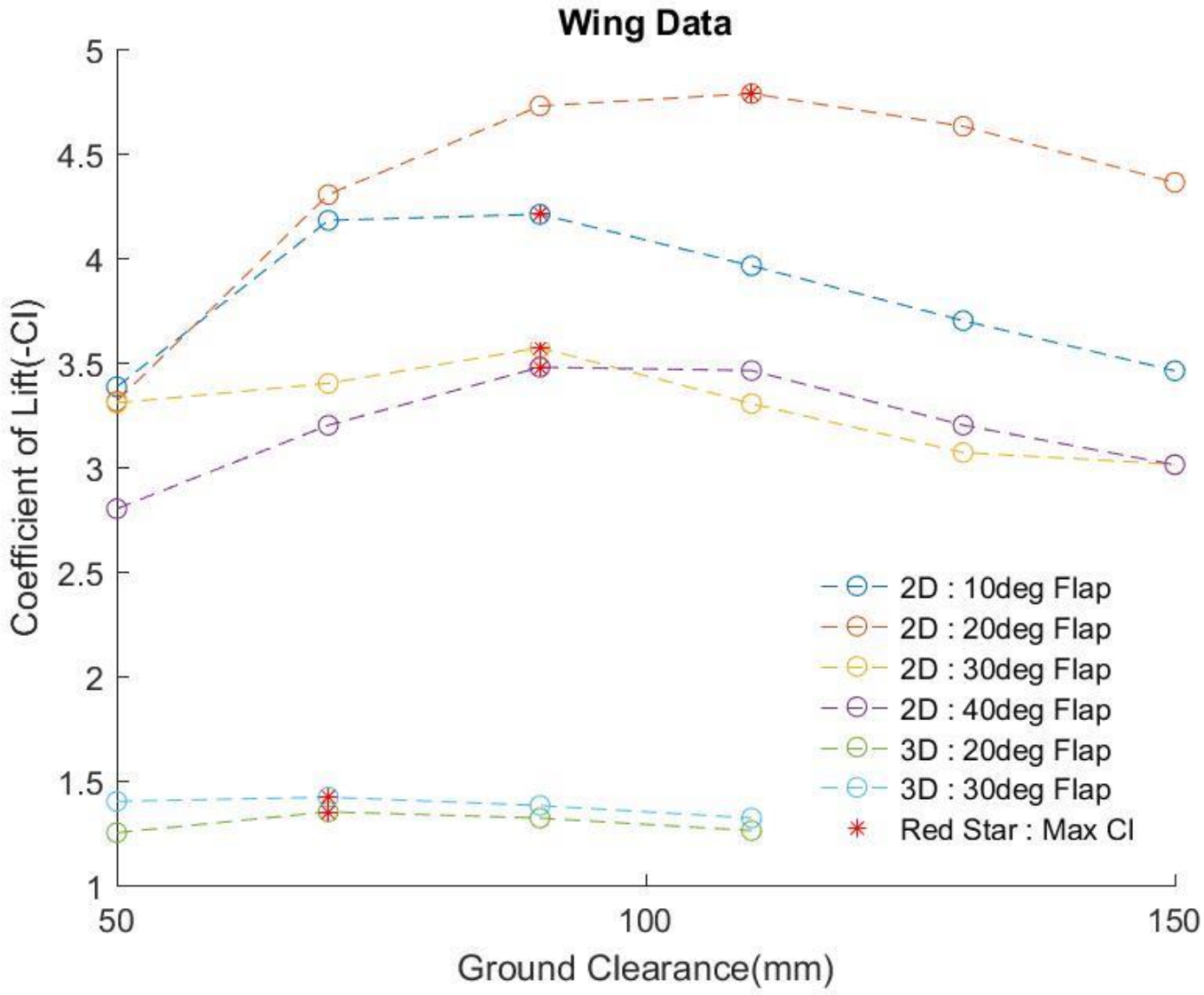
DESIGN OF EXPERIMENTS

2D Results

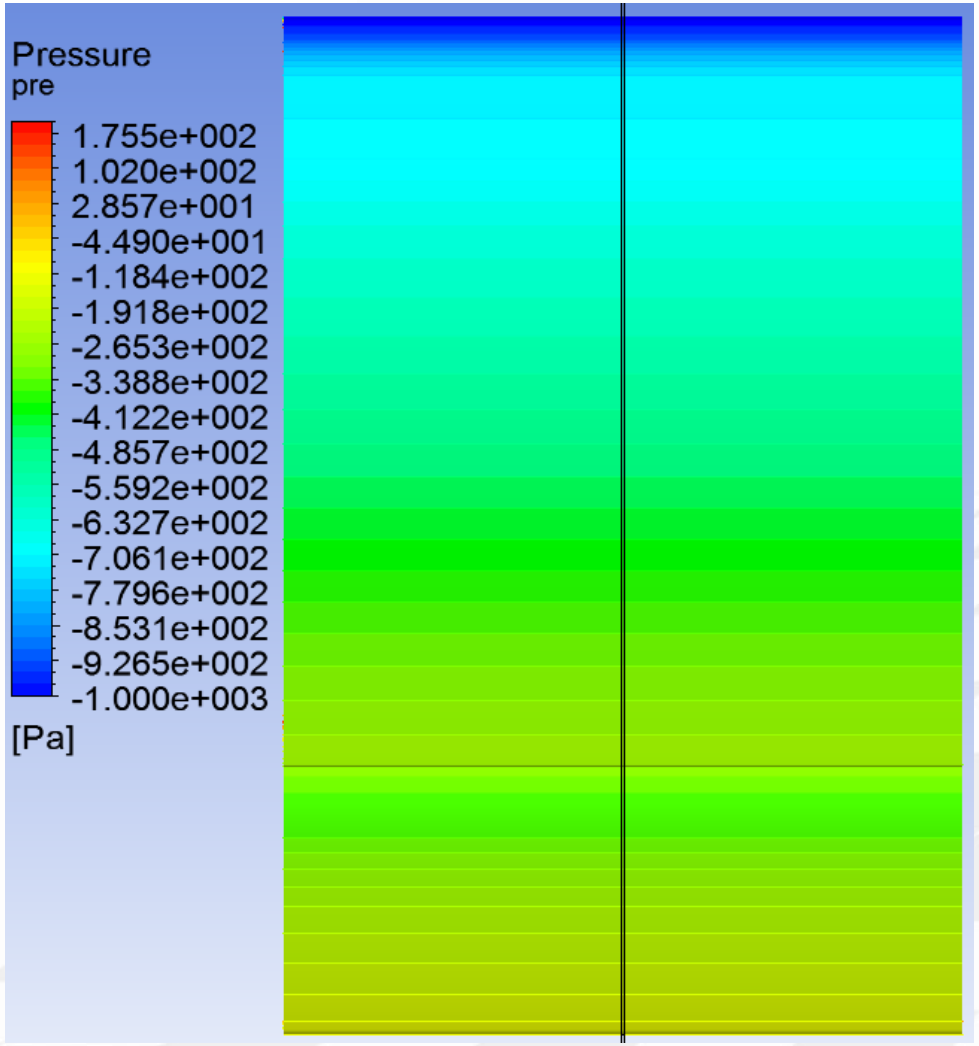
- 20° flap angle
- Ground Clearance 110 mm

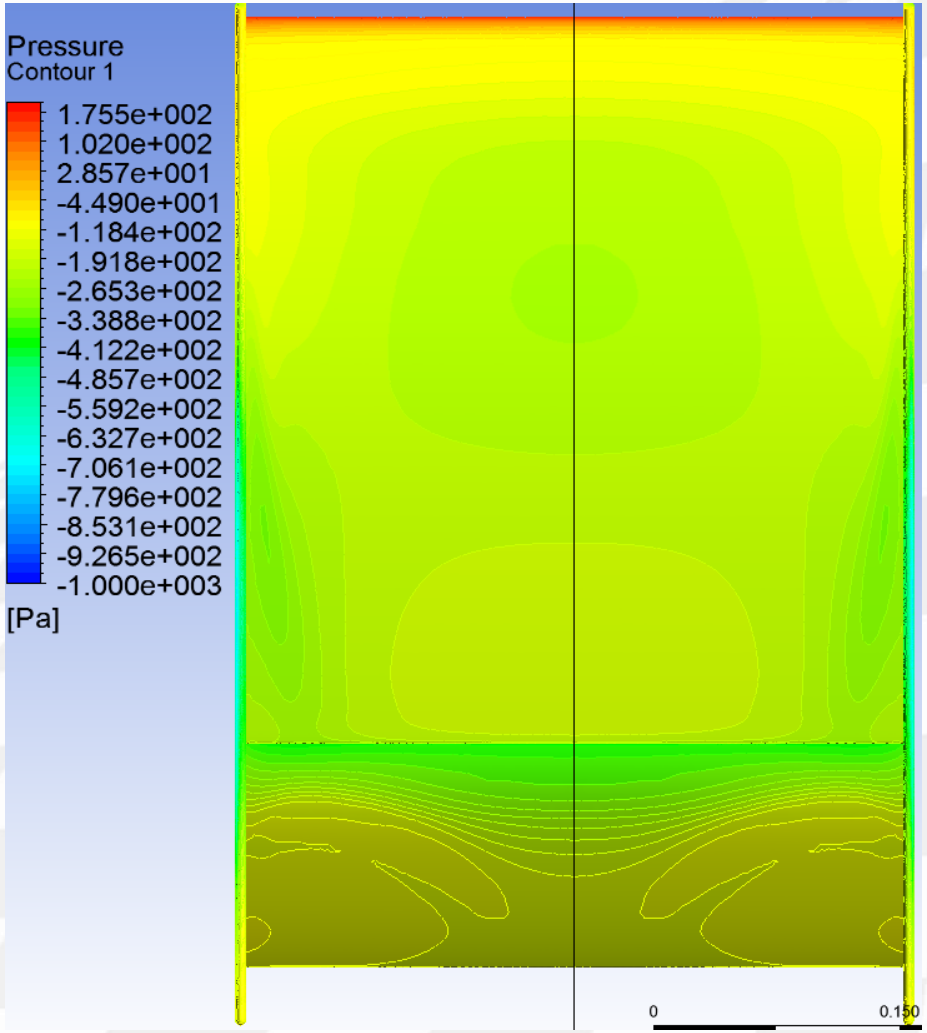
3D Results

- 30° flap angle
- Ground Clearance 70 mm

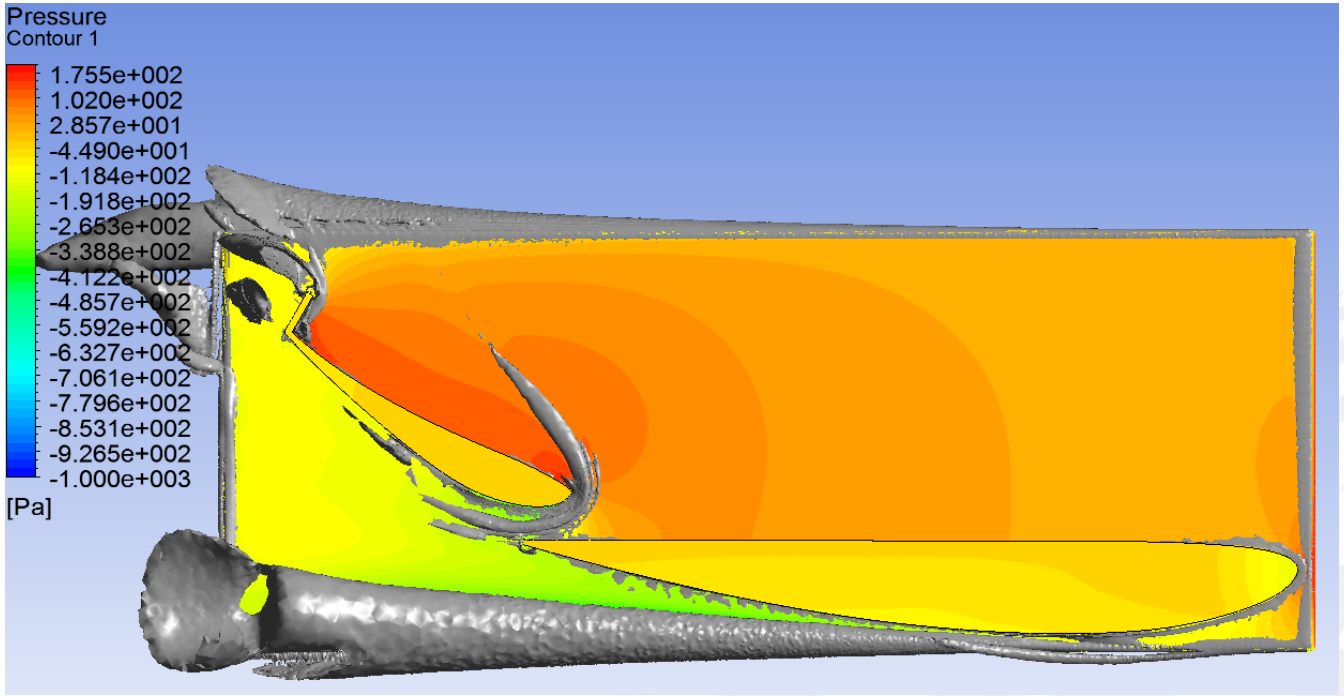


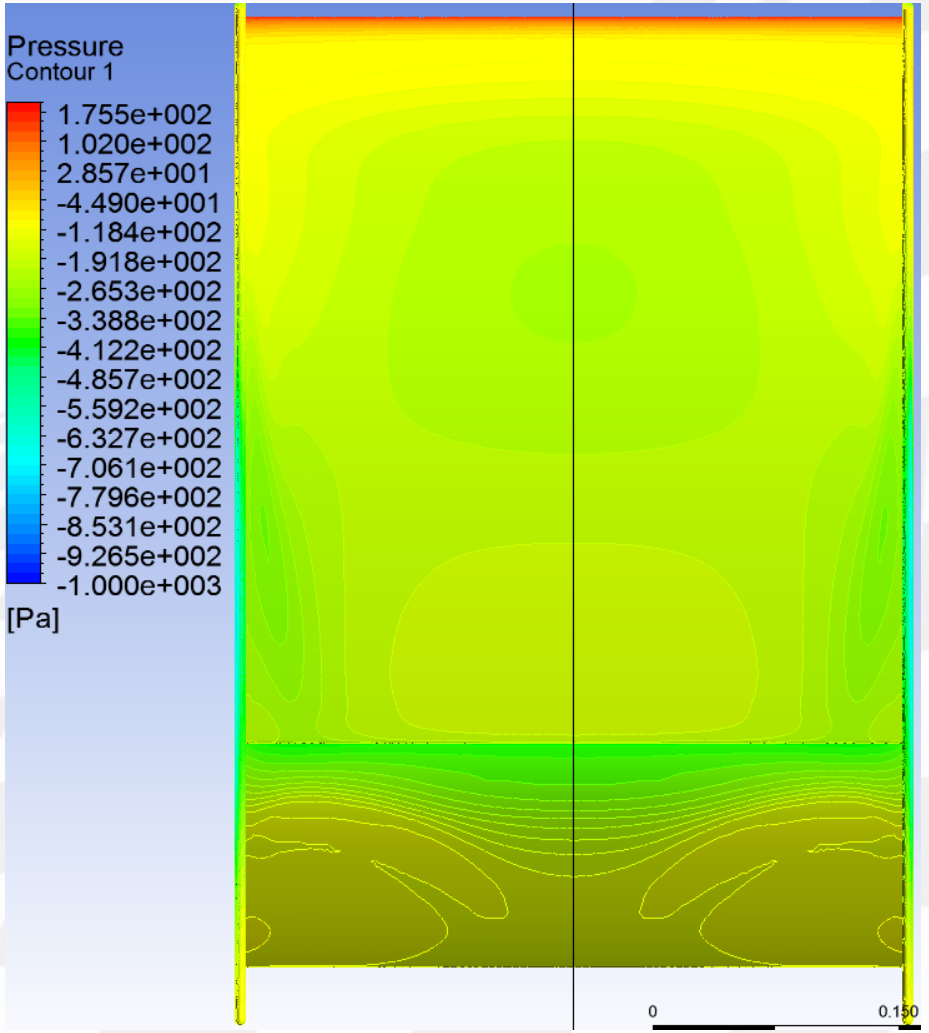
PRESSURE DISTRIBUTION





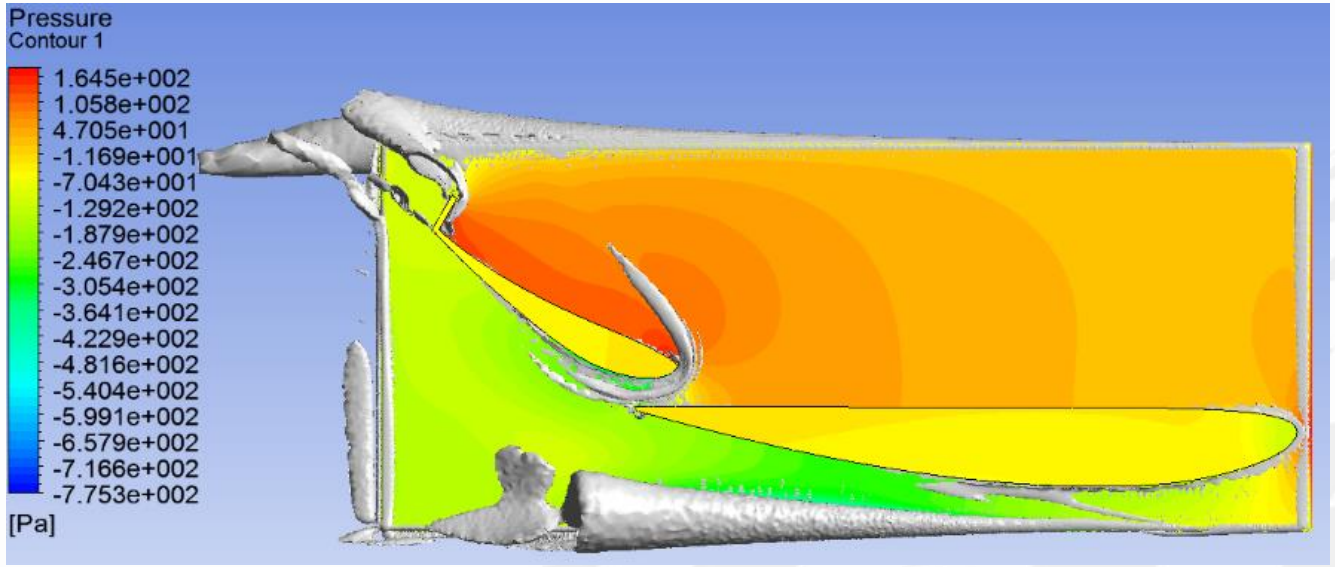
INITIAL WING DESIGN

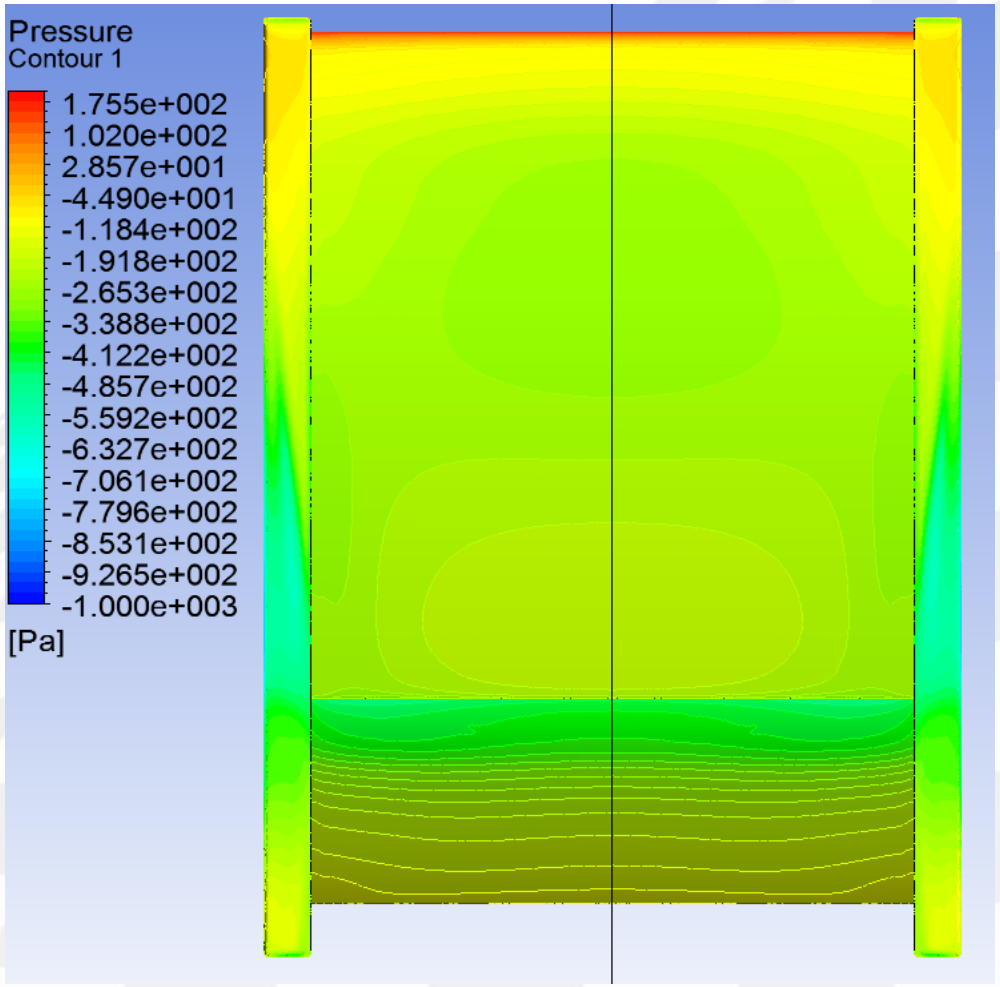




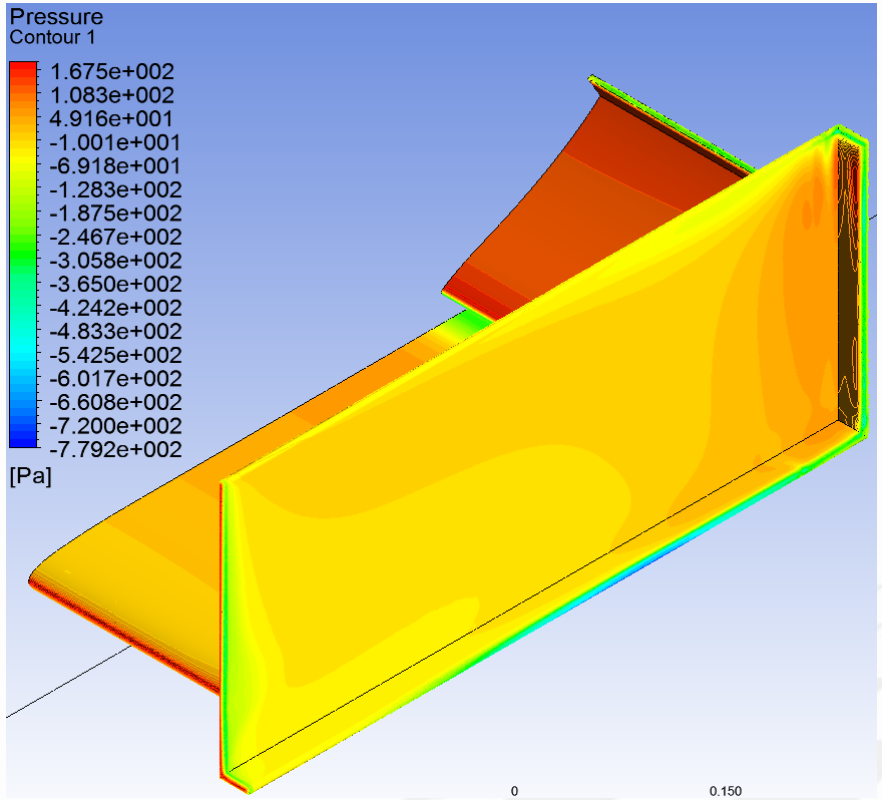
ITTERATION 1

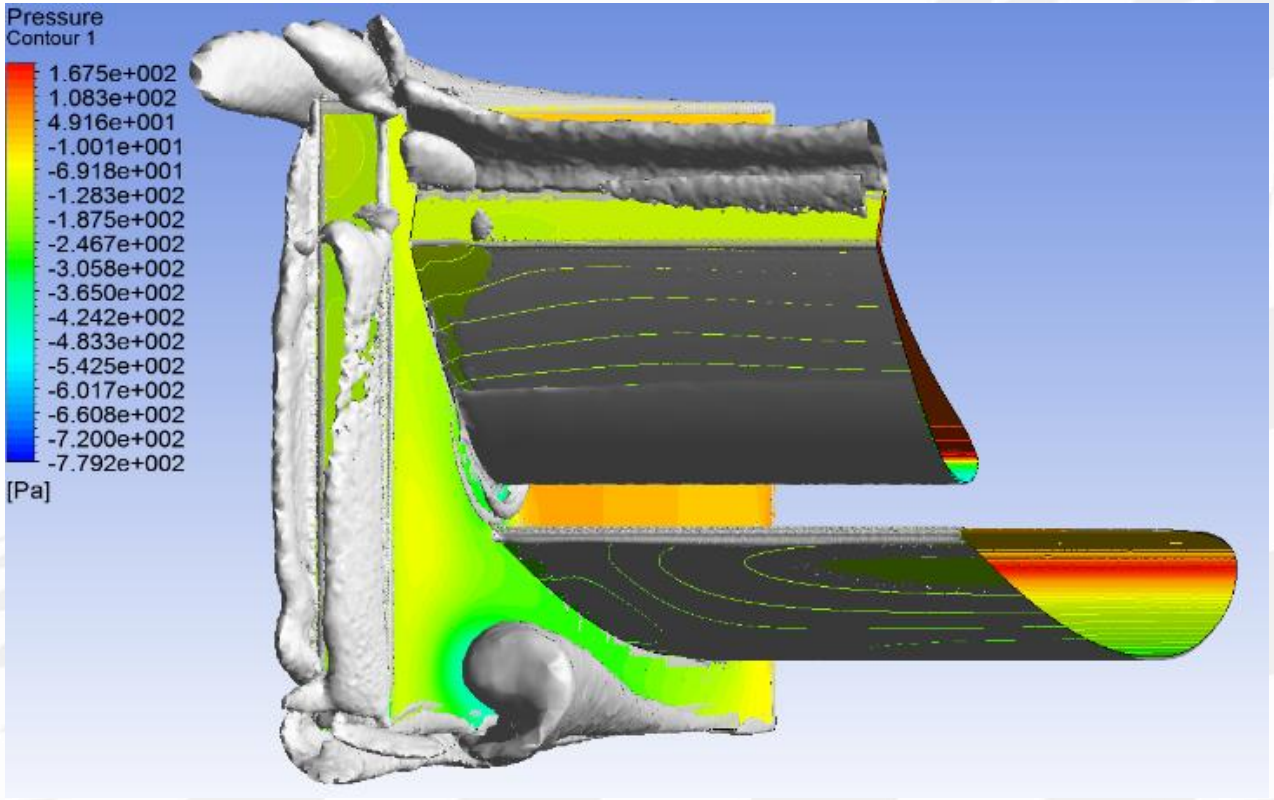
Improvement : 8%





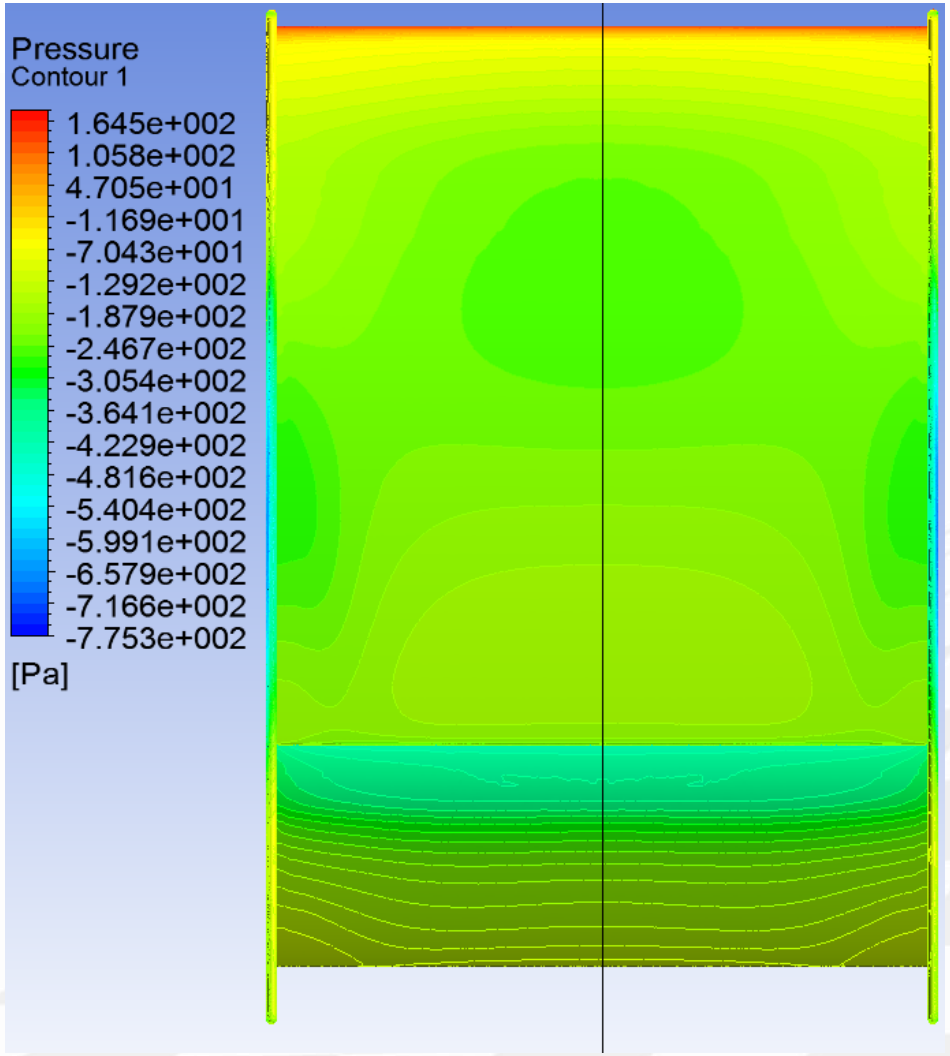
ITTERATION 2

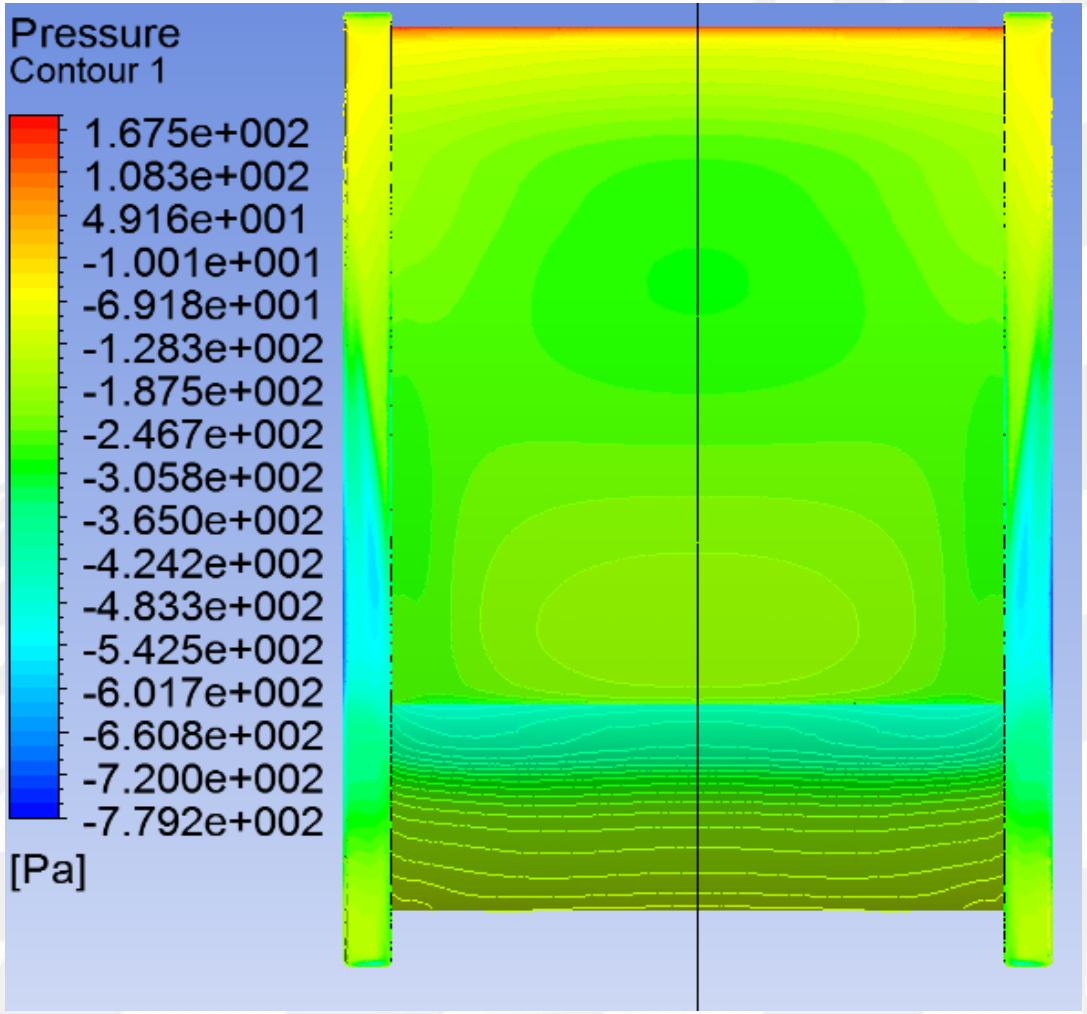




ITTERATION 2

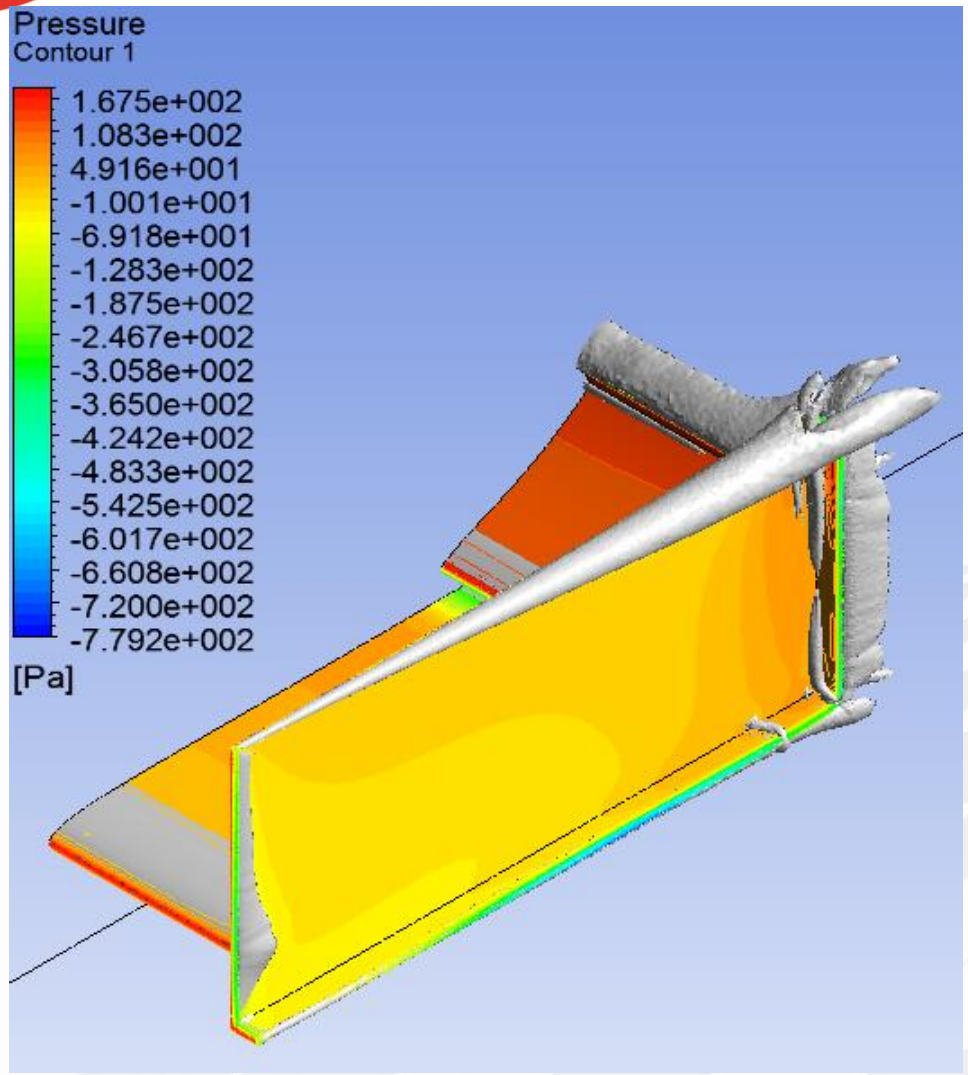
Improvement : 9%

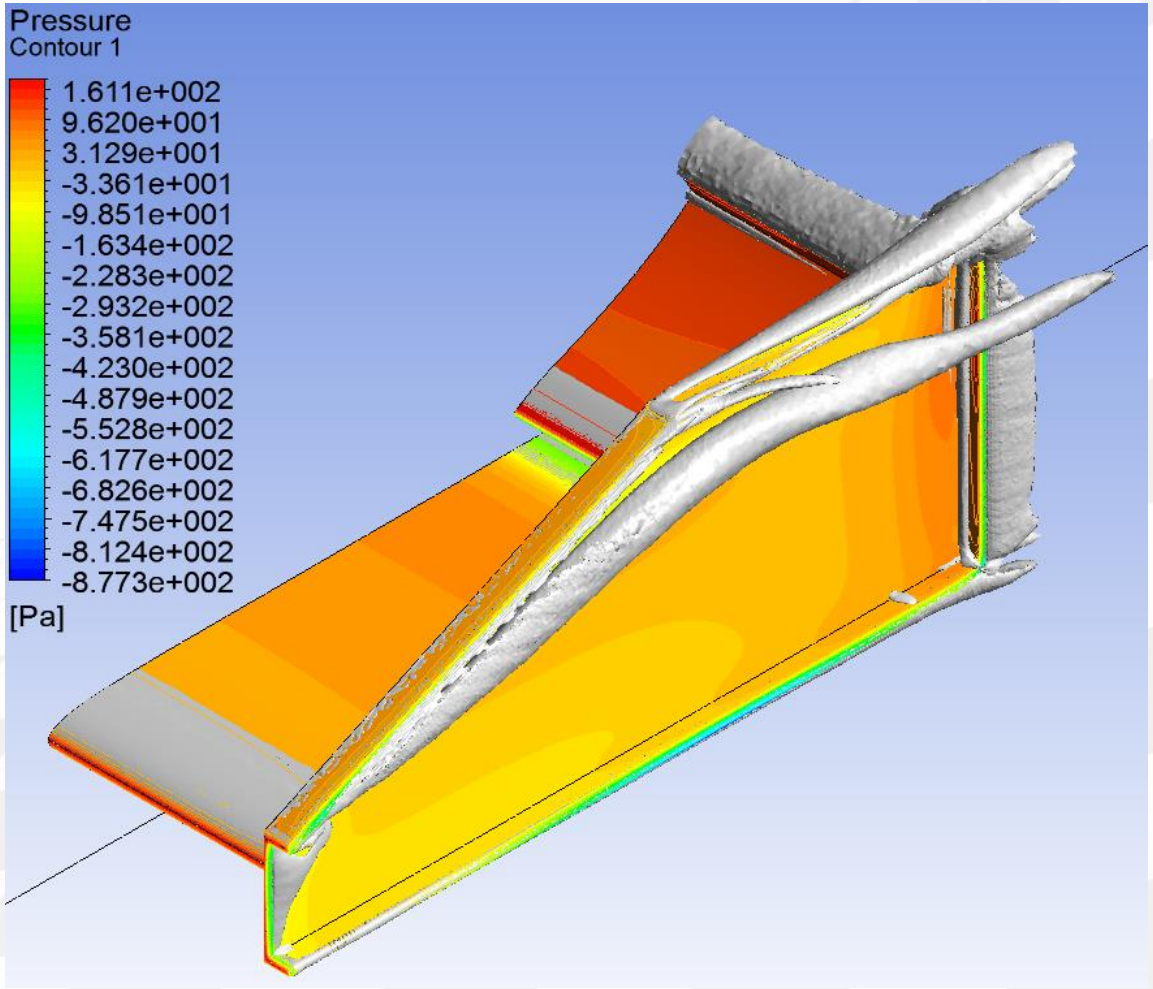




ITTERATION 3

Improvement : 2%





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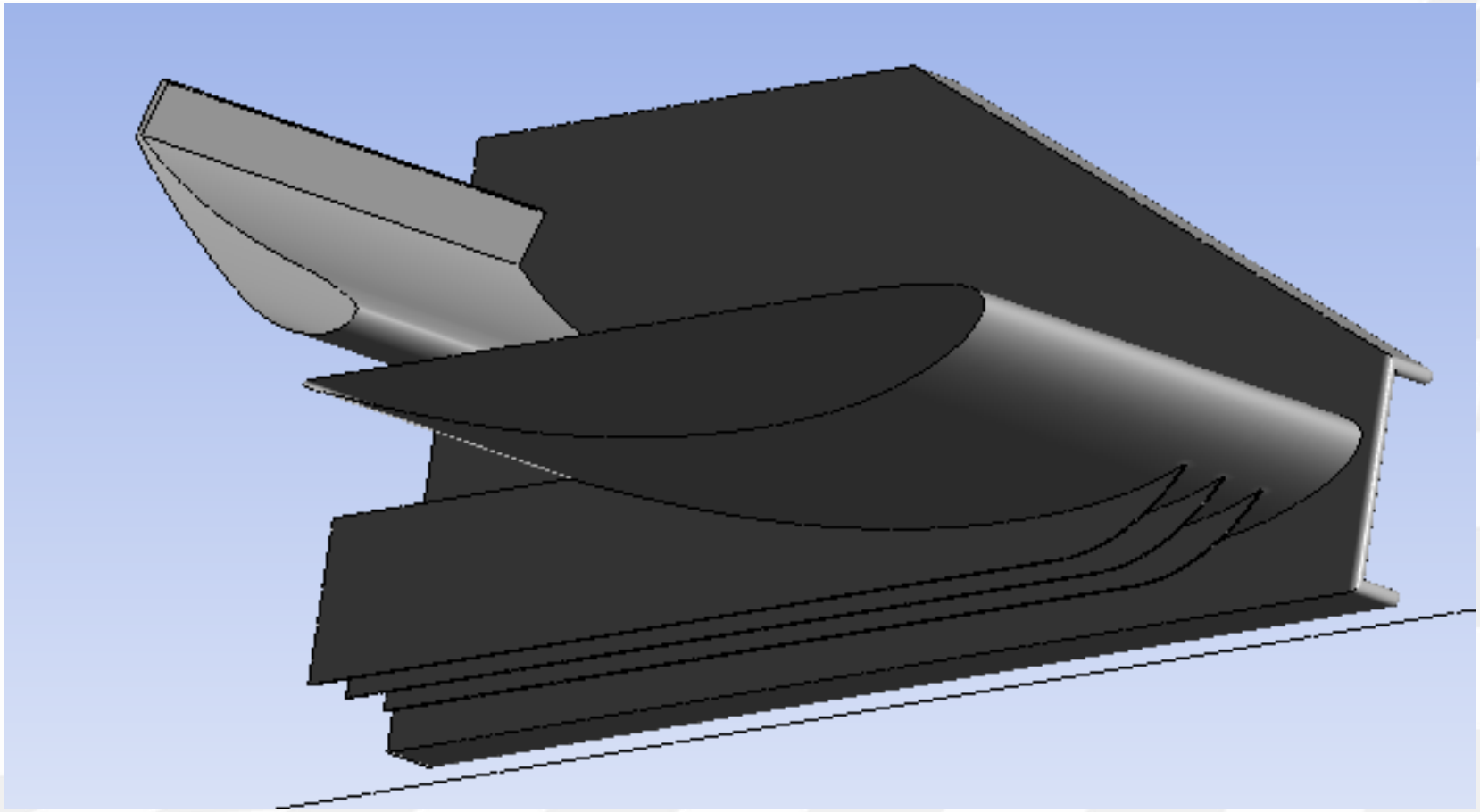
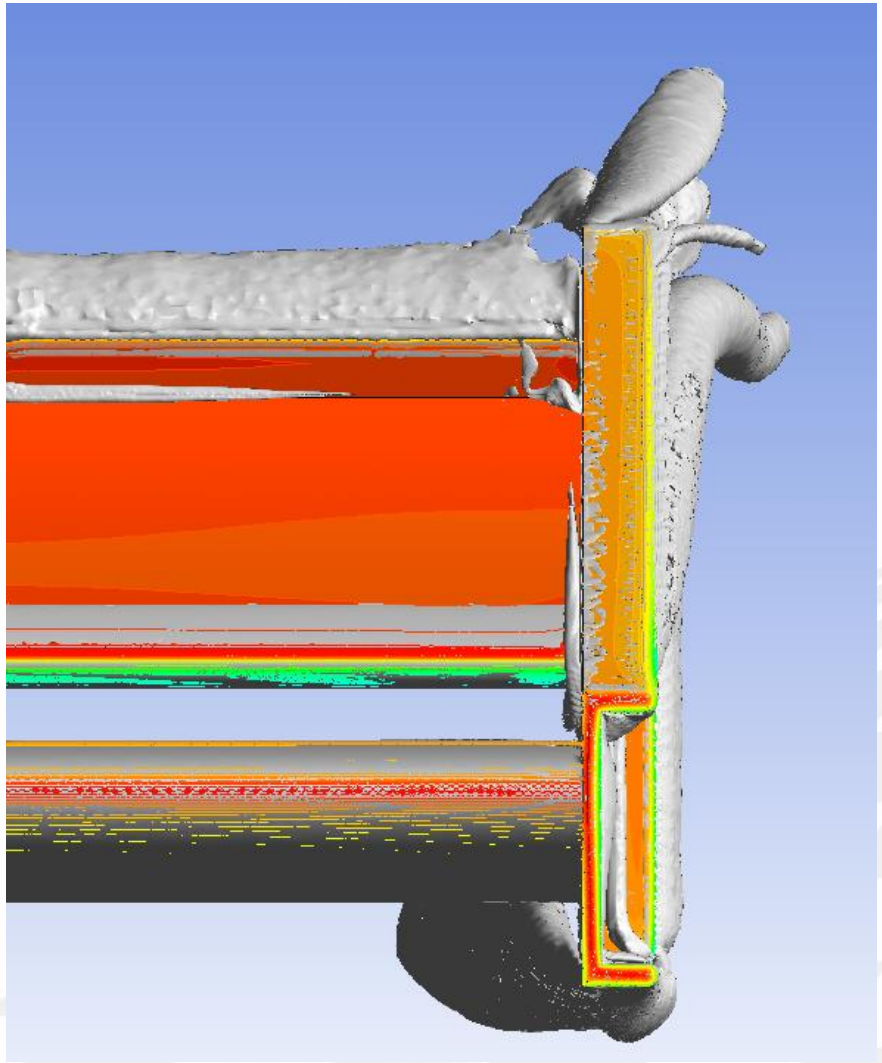
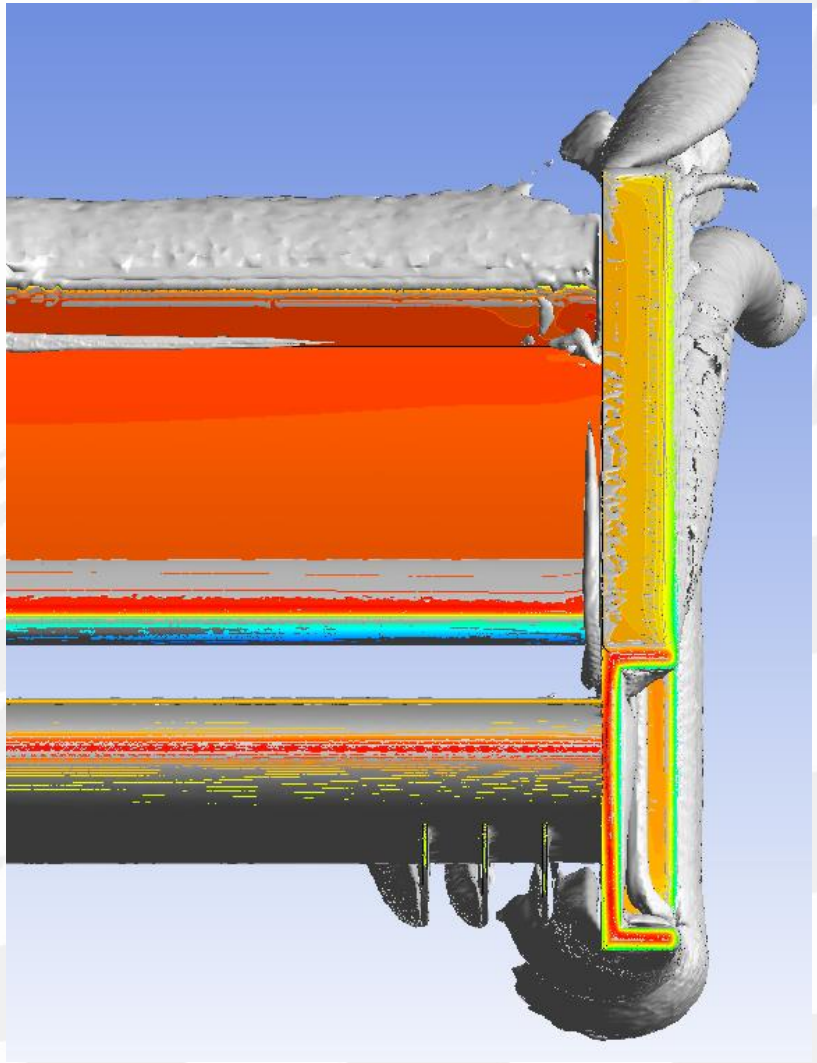


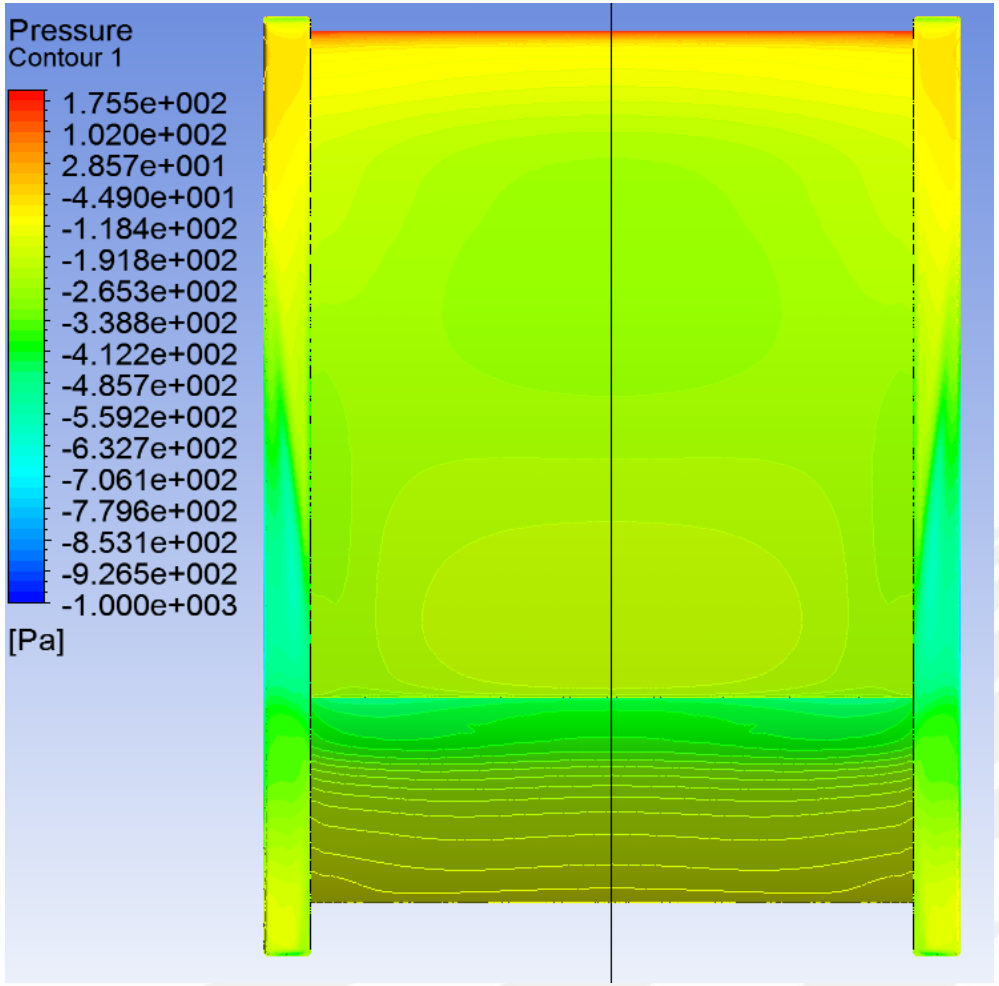
ITTERATION 4

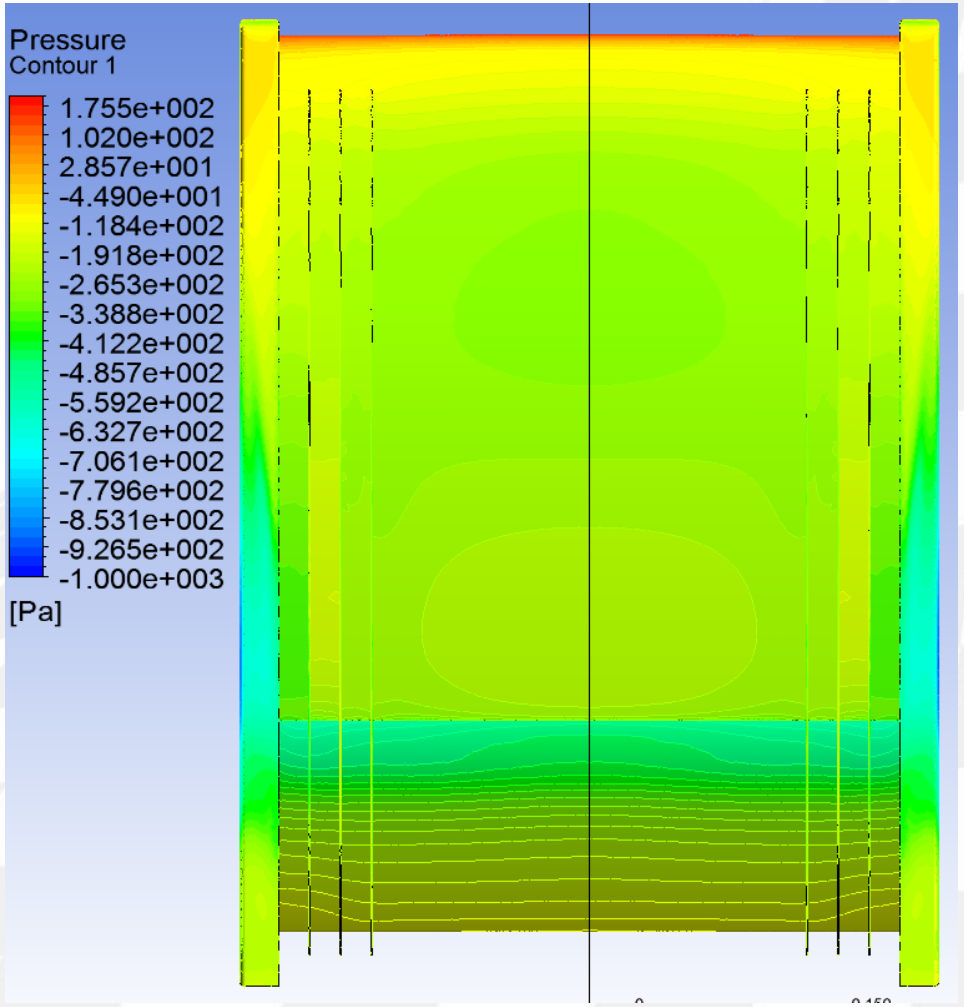




ITTERATION 4

Improvement : 9%





FINAL DESIGN

Improvement : 30%