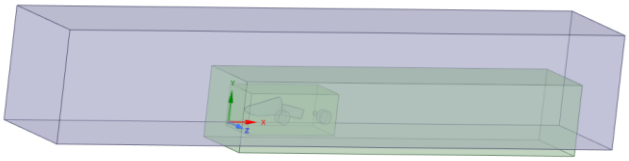
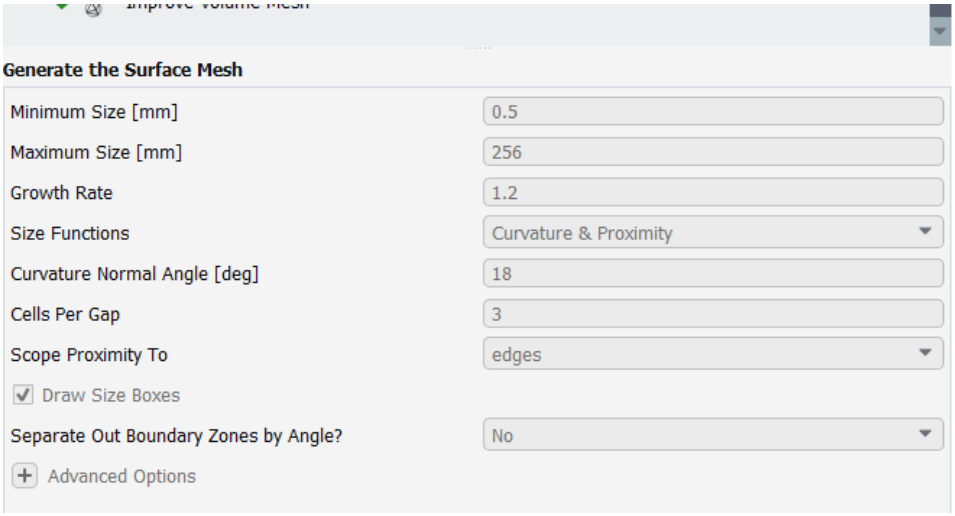
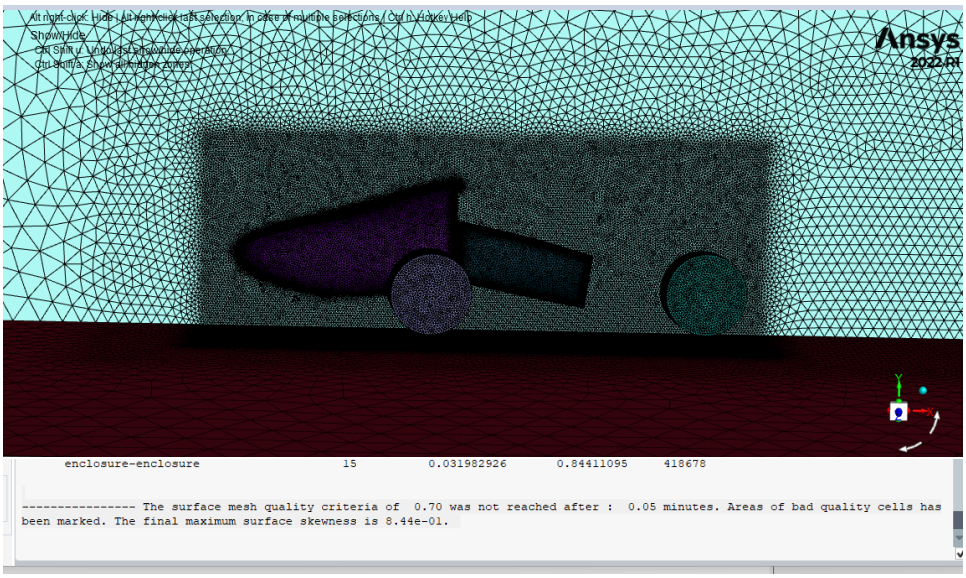
- Pre-Processing:

1) The unnecessary surfaces were eliminated, and a wind tunnel along with 2 bodies of influence were created. To reduce the amount of time, 2 planes were created, featuring the symmetric shape of the car and then the wind tunnel was slitted

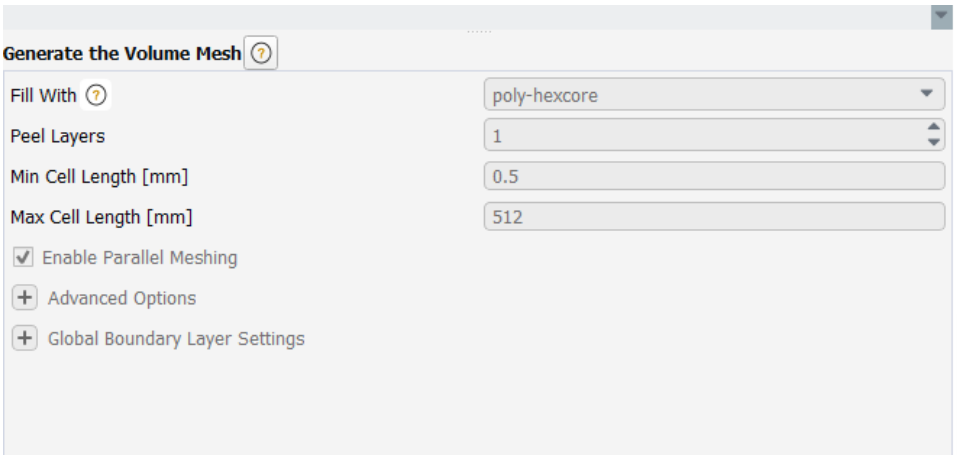


2) Surface Mesh





3) Volumetric Mesh



4) Check Quality Mesh

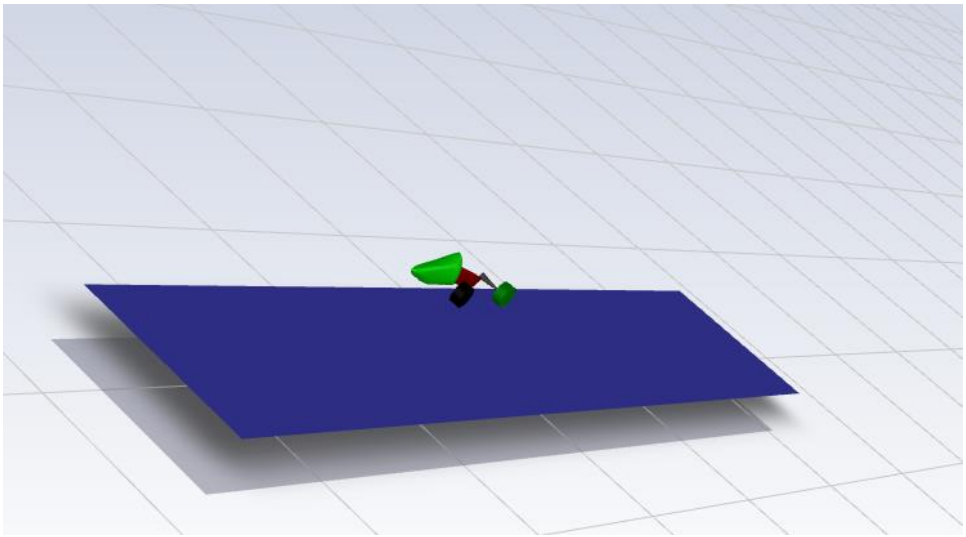
```
Mesh Quality:

Minimum Orthogonal Quality =  1.00154e-01 cell 448646 on zone 3754 (ID: 1170250 on partition: 1) at location ( 1.81738e+00,  4.11892e-01,  2.68951e-01)

Maximum Aspect Ratio =  6.15272e+02 cell 117729 on zone 3754 (ID: 271213 on partition: 0) at location ( 1.82014e+00,  4.32322e-01,  2.70841e-01)
```

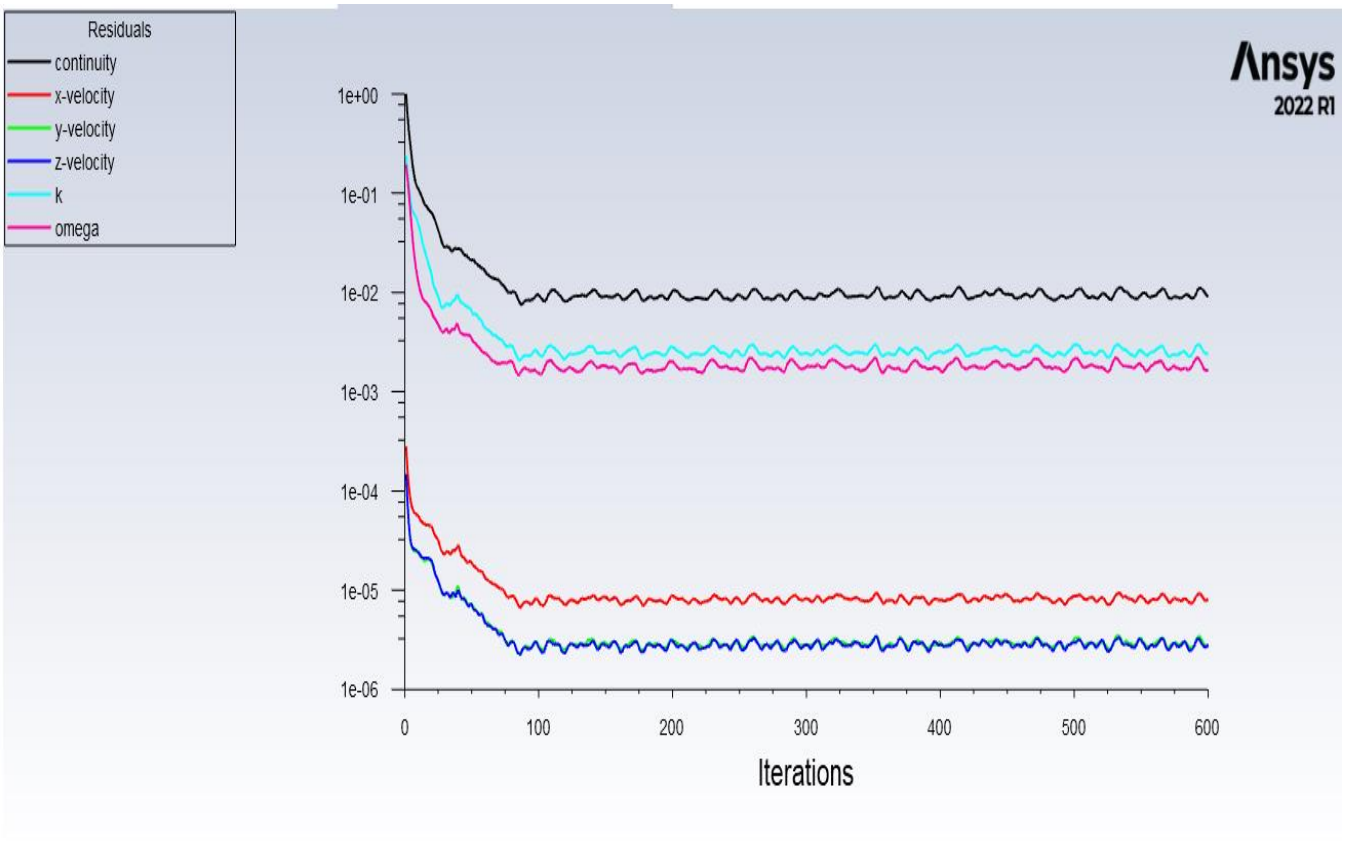
The orthogonal quality of this mesh was found to be greater than the recommended minimum threshold of 0.1, confirming that it is a good quality

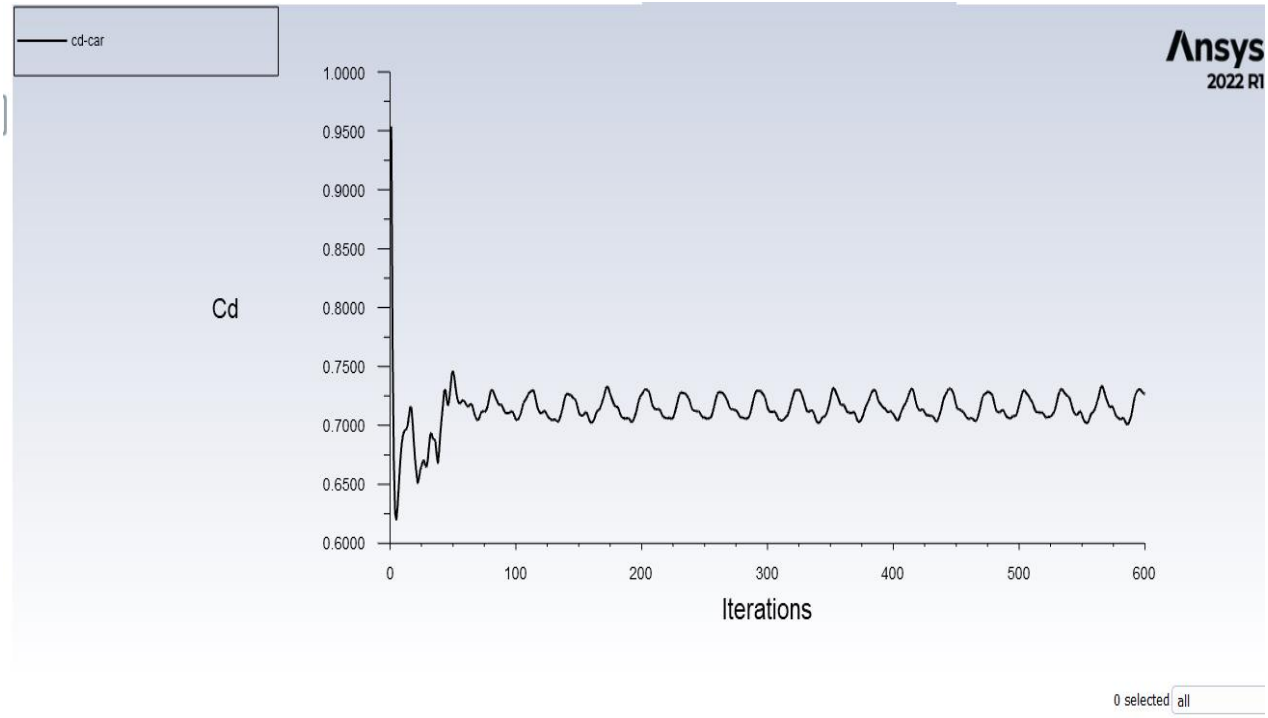
Ready for simulation & post-processing

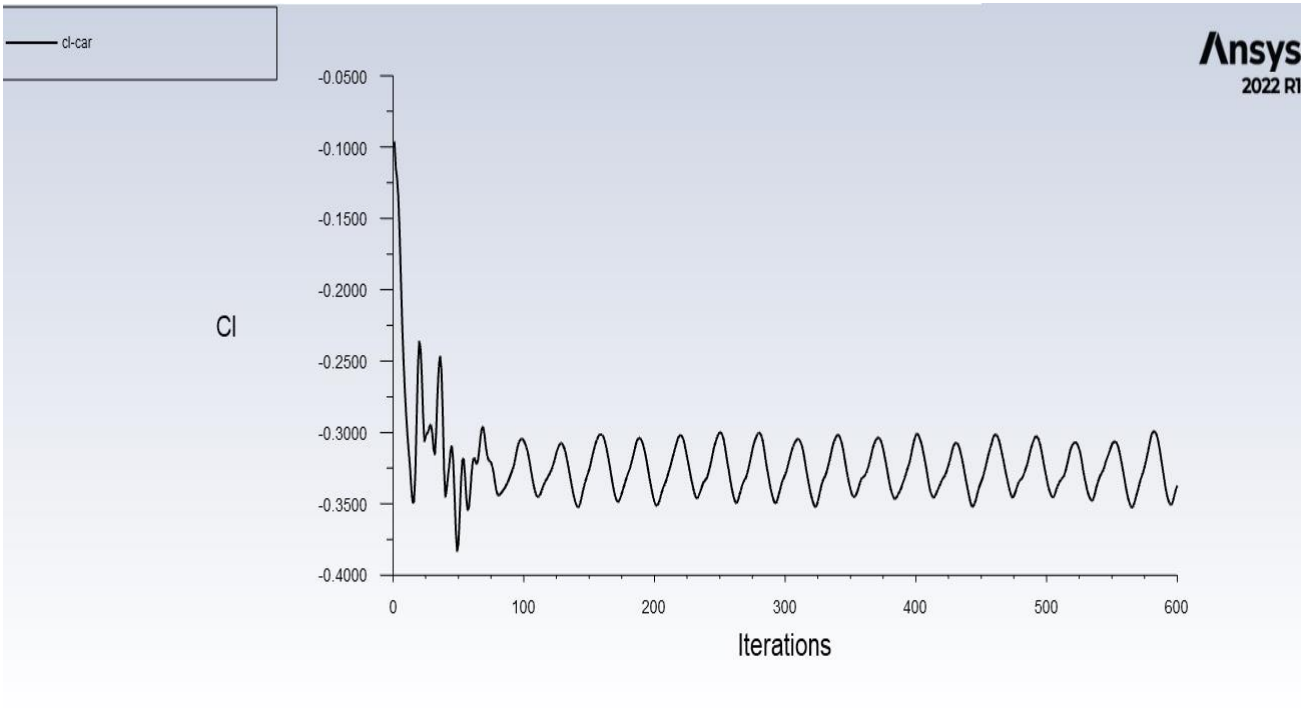


- Simulation & Post-Processing:

1) Global Results:







1) Estimated total and local drag force:

Forces - Direction Vector (1 0 0)

	Forces [N]			Coefficients		
Zone	Pressure	Viscous	Total	Pressure	Viscous	Total
axel	4.6360396	0.098210822	4.7342504	0.065250383	0.0013822776	0.066632661
fronwheels	16.98452	0.23724363	17.221763	0.23905025	0.0033391082	0.24238935
nosecone	14.163105	1.077286	15.240391	0.19933998	0.015162365	0.21450234
rearwheels	13.051493	0.28833111	13.339824	0.18369449	0.0040581438	0.18775263
sidepanel	0.92102945	0.18615813	1.1071876	0.012963117	0.0026201004	0.015583218
Net	49.756187	1.8872297	51.643416	0.70029821	0.026561995	0.72686021

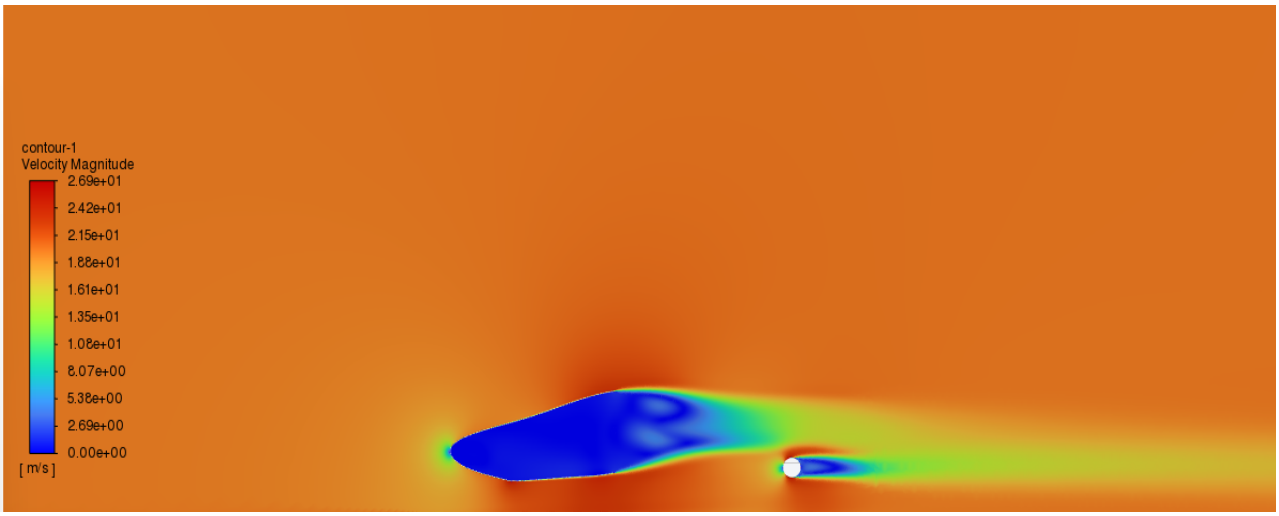
2) Estimated total and local down force:

Forces - Direction Vector (0 1 0)

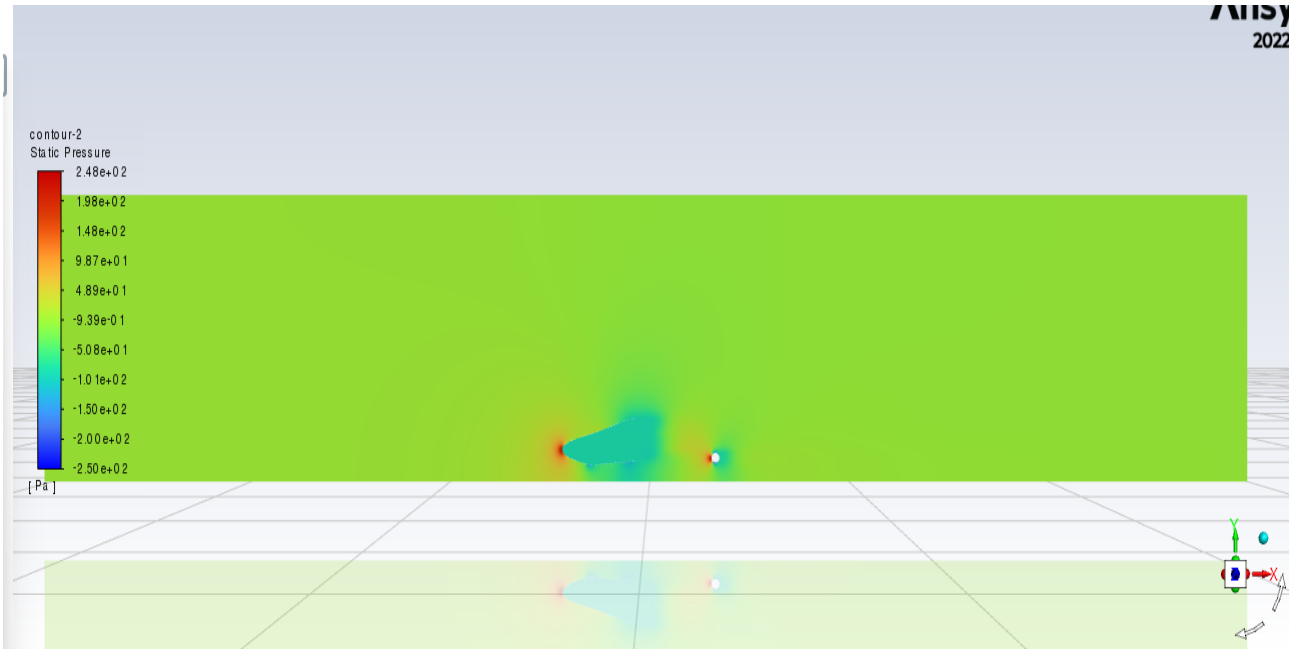
	Forces [N]			Coefficients		
Zone	Pressure	Viscous	Total	Pressure	Viscous	Total
axel	0.36730028	0.0057341523	0.37303443	0.005169603	8.0705875e-05	0.0052503088
fronwheels	-7.398639	0.097045059	-7.3015939	-0.10413285	0.00136587	-0.10276698
nosecone	-7.7295948	0.033200508	-7.6963943	-0.10879092	0.00046728373	-0.10832364
rearwheels	-9.644392	0.093966698	-9.5504253	-0.13574092	0.0013225433	-0.13441838
sidepanel	0.23954021	-0.03444548	0.20509473	0.0033714316	-0.00048480621	0.0028866254
Net	-24.165785	0.19550094	-23.970284	-0.34012366	0.0027515967	-0.33737206

The current aero kit is 46% efficient without the undertray. Note that front and rear wheels generate an important amount of drag, thus a diffuser extended from the side panel would solve the problem for the rear wheels, and a front wing would allow a much smoother flow of air around the front wheels

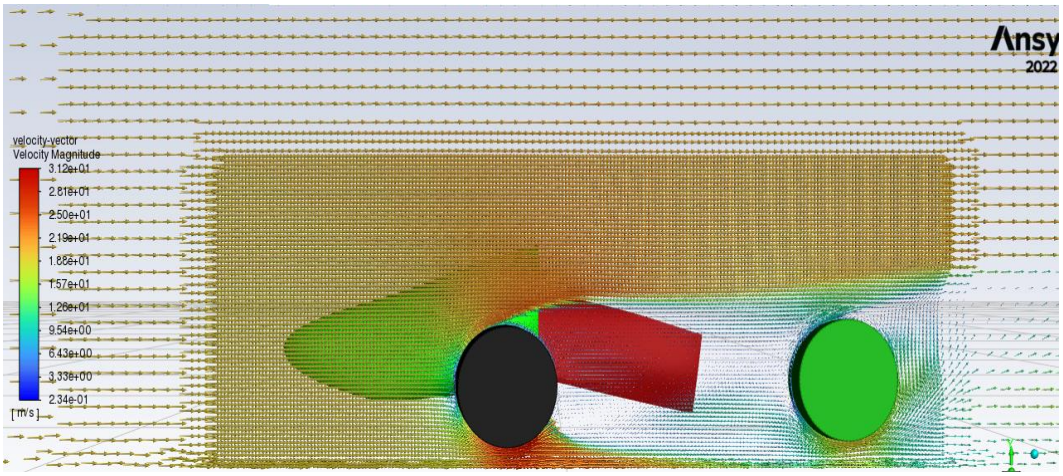
3) Velocity Distribution

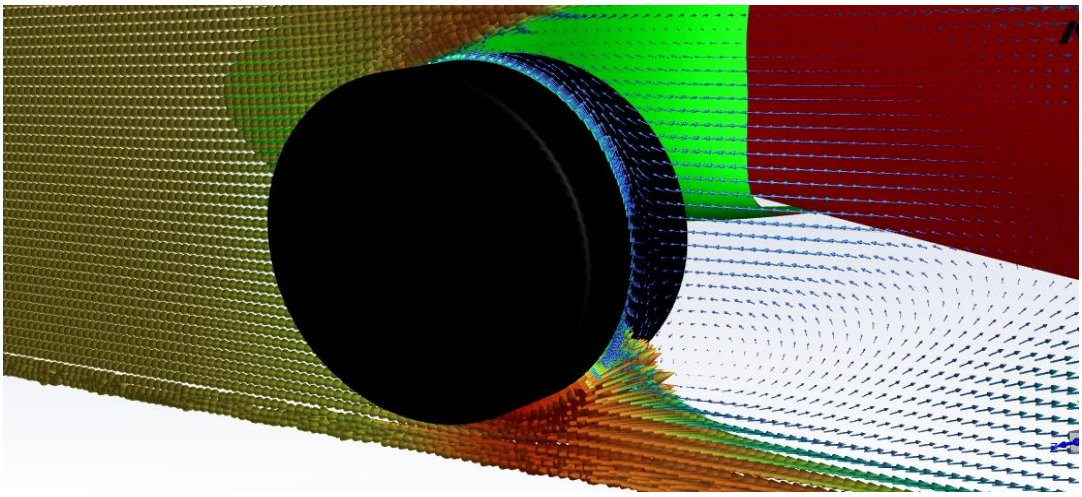


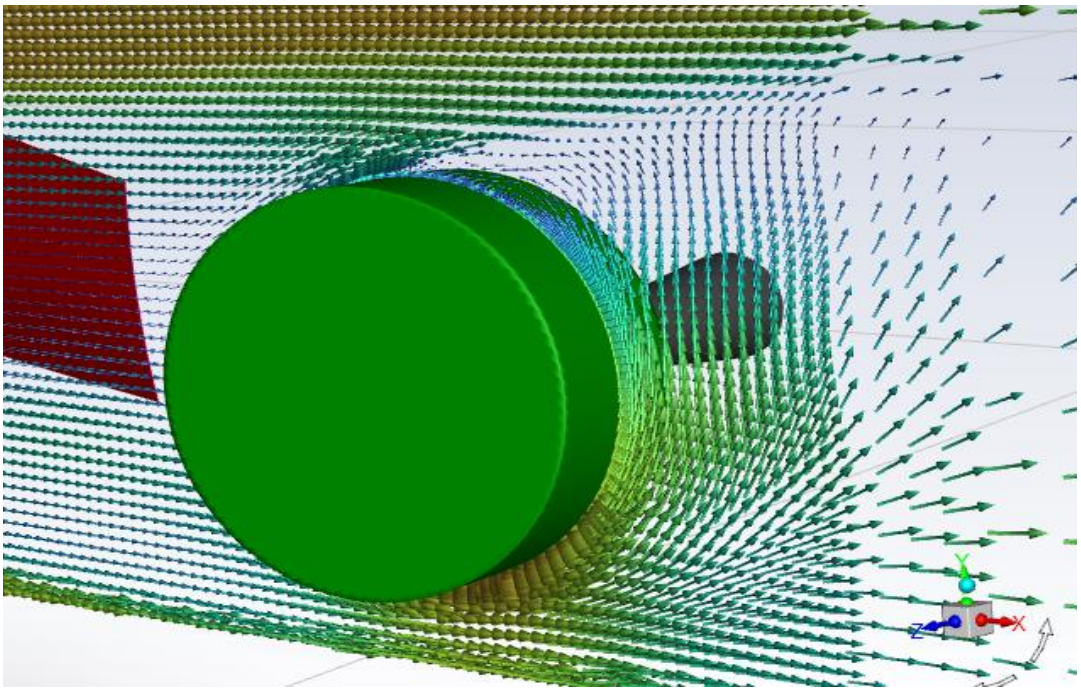
4) Pressure Distribution



5) Flow Field Behavior around the wheels

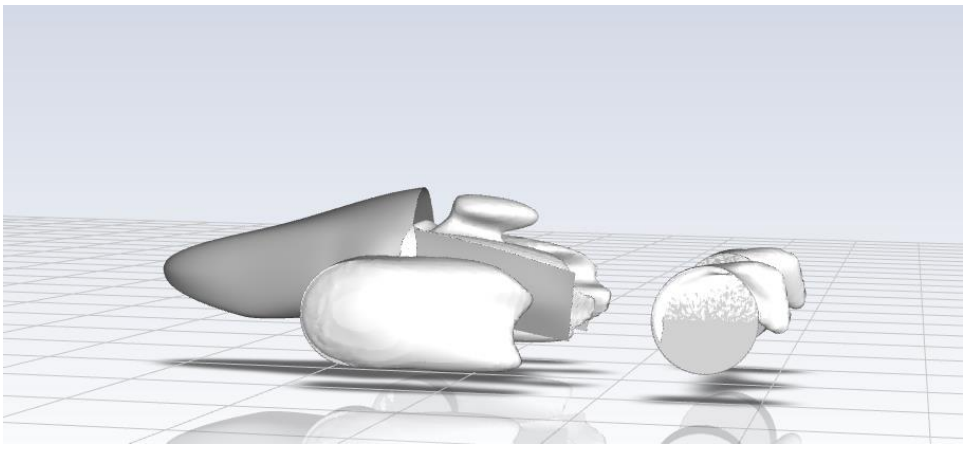




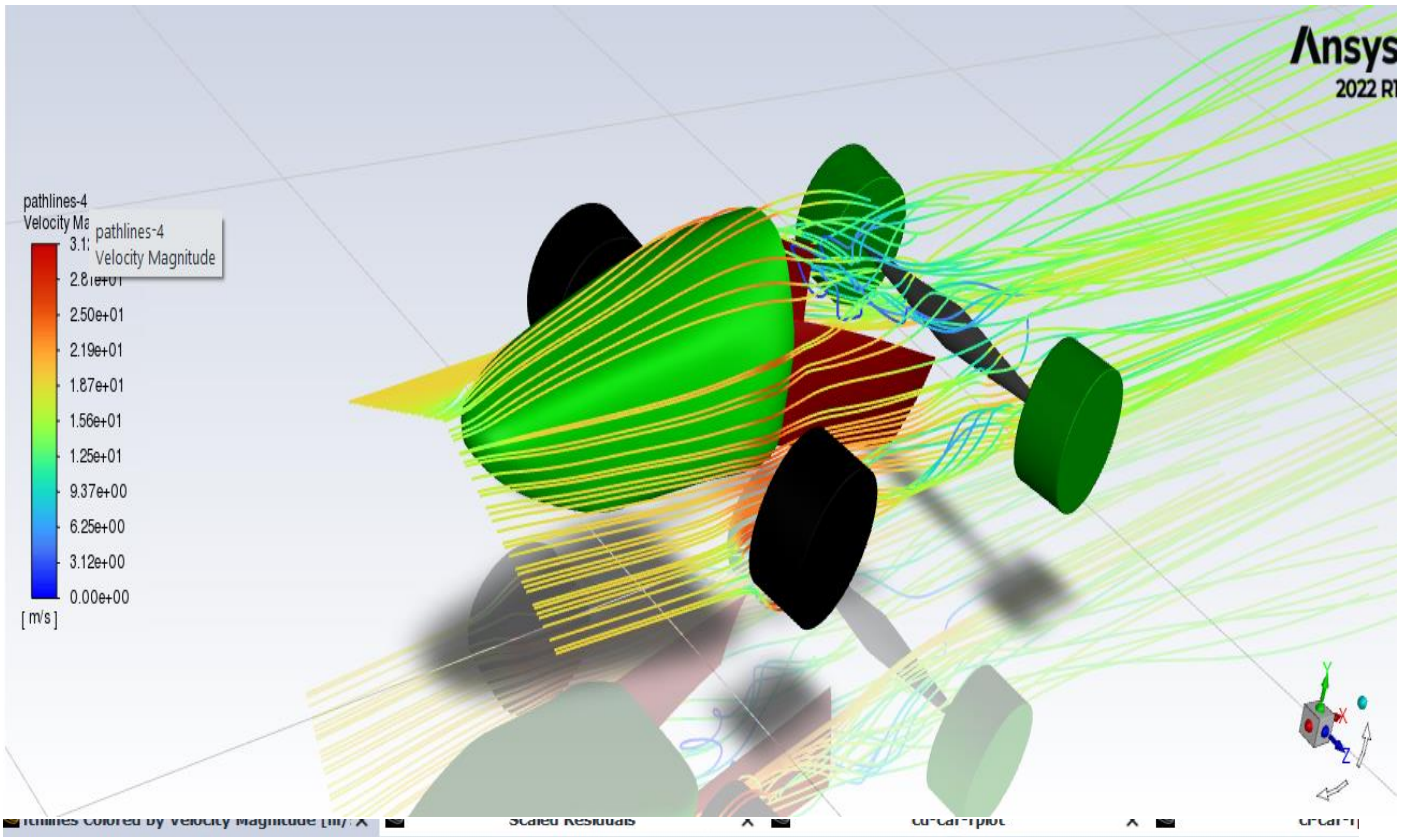


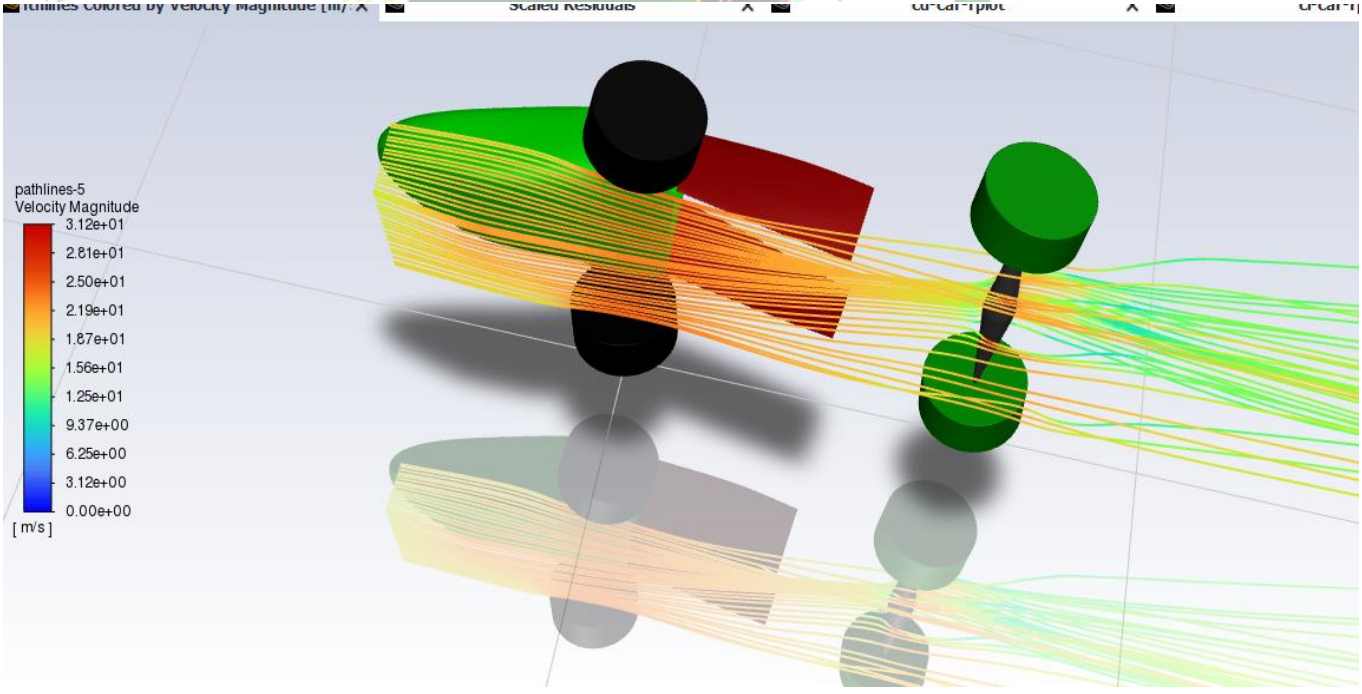
Note the rotational velocity component and vortices around the wheels, having a front wing would minimize this effect

6) Demonstration of recirculation region:



7) Path lines of the air flow around the FSAE car


Ansys
2022 R
pathlines-4
Velocity Ma
pathlines-4
Velocity Magnitude
3.1
2.81e+01
2.50e+01
2.19e+01
1.87e+01
1.56e+01
1.25e+01
9.37e+00
6.25e+00
3.12e+00
0.00e+00
[m/s]


pathlines-5
Velocity Magnitude
3.12e+01
2.81e+01
2.50e+01
2.19e+01
1.87e+01
1.56e+01
1.25e+01
9.37e+00
6.25e+00
3.12e+00
0.00e+00
[m/s]