

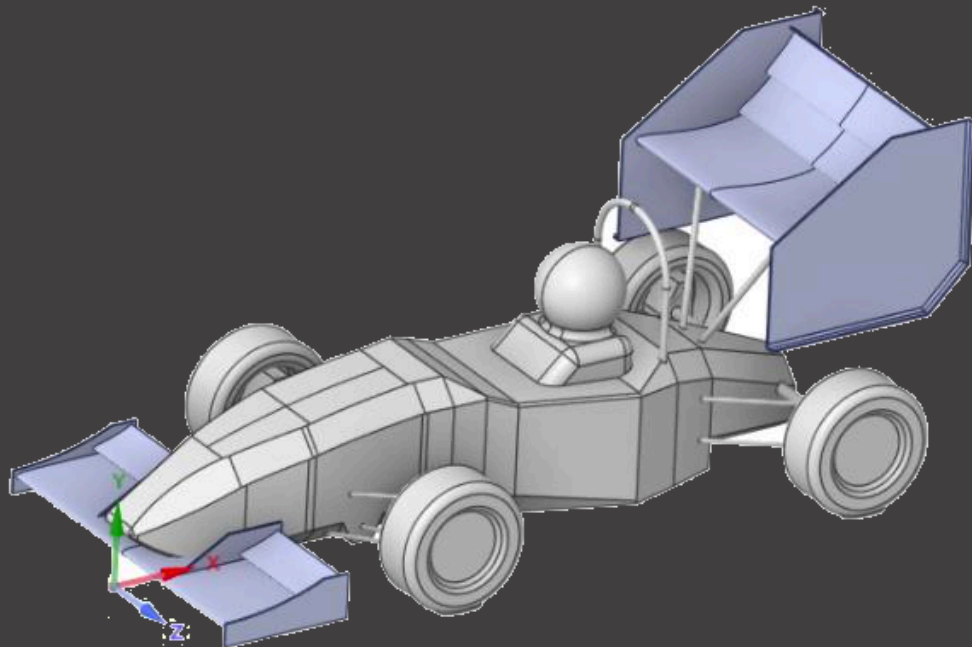


CASE STUDY · AUTOMOTIVE

FSAE AERO

EXTERNAL AERODYNAMICS CFD
WITH NEXUS & ANSYS FLUENT

Tools Nexus · ANSYS Fluent 2026 R1 · SpaceClaim
Outcome 50% time saved



WHAT'S INSIDE

A walk-through of how Nexus took an FSAE external-aero CFD study from ~12 hours of manual work down to ~6 — mesh, setup, results and design takeaways.

Summary

P. 03

The headline outcome — 50% time saved, Cd 1.145 / Cl -1.794.

Problem

P. 03

License-bound mesh cap, best-practice sizing and post-processing overhead.

Methodology

P. 04

Mesh convergence, case setup and design guidance with Nexus.

Results

P. 05

Agent-generated CFD results — streamlines, wall shear, velocity, wake.

Try Nexus

P. 06

How to bring the same workflow to your own CFD studies.

SUMMARY

A full external-aero CFD workflow, delivered in half the time.

A Formula Style (FSAE) open-wheel race car was simulated at 20 m/s in ANSYS Fluent, driven through Cosmon's Nexus AI agent. End-to-end engineering time dropped from **~12 hours to ~6 hours**, and the agent reduced the mesh to the minimum number of nodes needed to find convergence — from **5.44M cells down to 799,538** — without losing physical fidelity. Final: $C_d = 1.145$, $C_l = -1.794$ (downforce ~439 N).

50%

ENGINEERING TIME SAVED

85%

REDUCTION IN MESH SIZE ACHIEVED

1.57

L/D RATIO PREDICTED (DOWNFORCE/DRAG)

PROBLEM

Open-wheel aero is a high-cell-count problem, and these constraints compound for any team running on a constrained workstation.

01 Best-practice sizing

Hitting both the cell budget *and* a log-law y^+ band usually takes a senior CFD engineer several iterations.

02 Post-processing overhead

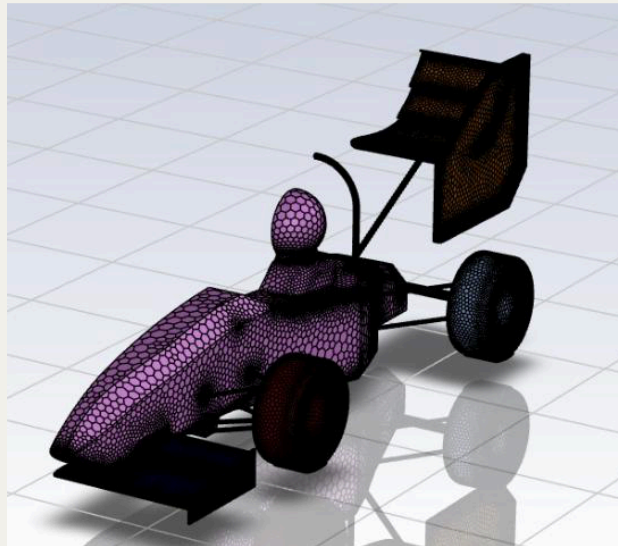
Building velocity, pressure, wall-shear, y^+ and wake contours manually is 4+ hours of GUI work per case.

+ Benefit to engineer

Minimum fidelity mesh without losing $k-\omega$ SST log-law physics · auto-generated contours with embedded flow-physics insight · design recommendations quantified by $\Delta C_d / \Delta C_l$ impact.

METHODOLOGY

Half-car FSAE geometry imported live from SpaceClaim. Nexus proposed mesh settings, predicted cell counts *before* running the mesher, iterated through mesh convergence and proposed targeted reductions — turning an open-ended blocker into a 5-step problem.



FINAL SURFACE MESH · 2 PRISM LAYERS · MAX SKEW 0.69

ITER	SURF MIN	BOI NEAR / FAR	BL	CELLS
1	0.5	16 / 64	10	~5.44 M
2	0.5	24 / 64	4	3.68 M
3	2	32 / 128	3	1.46 M
4	2	48 / 132	2	1.35 M
5	4	64 / 256	2	799 K

+ Nexus proposed setup with best-practices

Turbulence model (k- ω SST), inlet turbulence quantities (TI 5%, VR 2), reference frontal area (0.4997 m²) and rotating-wheel BCs all proposed by Nexus.

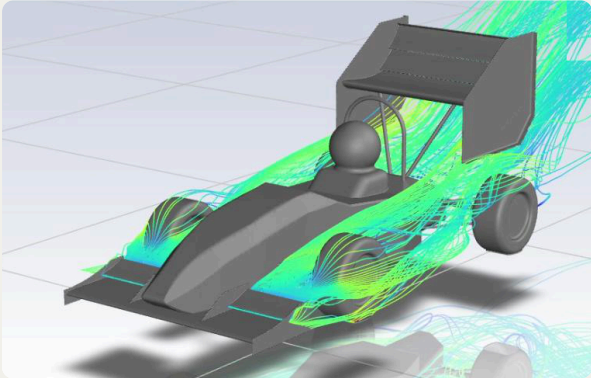
+ Quantified design guidance

Prioritized L/D wins with ΔC_d / ΔC_l estimates — aggressive diffuser ramp (ΔC_d -0.05, ΔC_l -0.30), wheel turning vanes (ΔC_d -0.05, low effort) — targeting C_d ~ 0.95 next iteration.

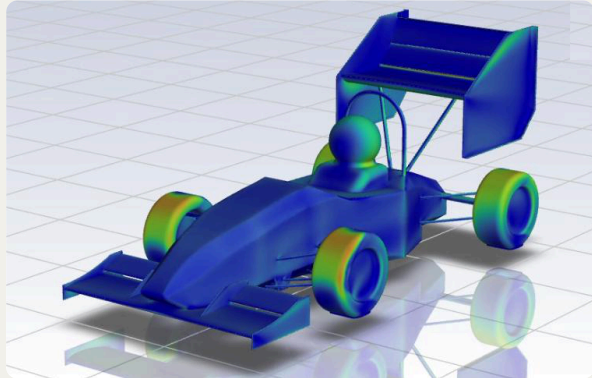
RESULTS

PHASE	MANUAL	WITH NEXUS	SAVINGS
Mesh generation	~6 h	~3 h	-50%
Case setup (BCs, turbulence, references)	~2 h	~1 h	-50%
Post-processing + report preparation	~4 h	~2 h	-50%
Total	~12 h	~6 h	-50%

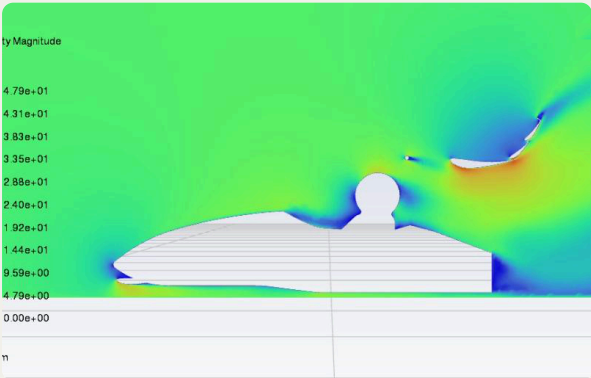
Every contour below was generated with Nexus — no manual scripting or clicking in Fluent. After constructing results, the engineer asked the agent for design recommendations, and it paired each visualization with flow-physics commentary that translated directly into design actions.



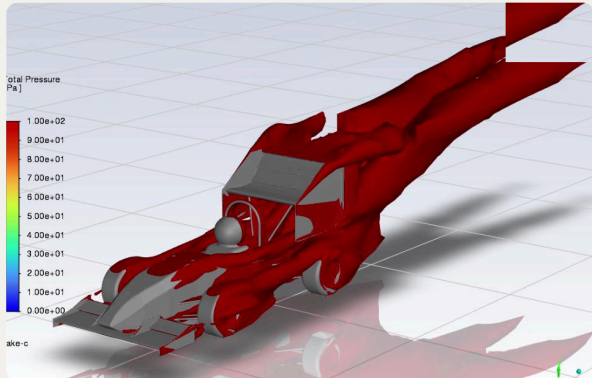
Streamlines · front-wing inlet
 Ground-effect speed-up at 24–32 m/s, strong upwash over chassis, coherent bundle through the wing channel — consistent with the negative Cl.



Wall shear stress
 Highest WSS on rotating tire shoulders (doubled effective slip velocity) — confirms rotating-wheel BCs active. Wheels dominate viscous drag.



Velocity, symmetry plane
 Bow-wave acceleration above the helmet (~30–35 m/s), wake deficit drops to ~10–18 m/s — ~3x car length downstream.



Wake envelope · total pressure
 Iso-surface at >60% P0 loss. Rear plume from wings, chassis and wheels is the dominant Cd driver. Underbody stays clean — attached, high-energy.



Think through > click through.
Let **Nexus** handle the rest.

YOUR AI AGENT FOR ENGINEERING WORKFLOWS

Want to try Nexus on your own workflow?
Visit www.cosmon.com to start a trial.

WWW.COSMON.COM