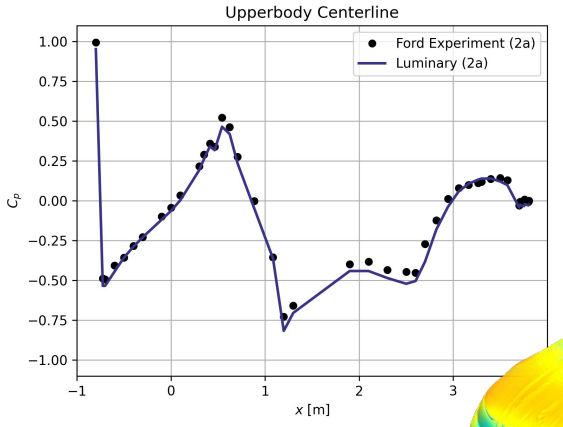
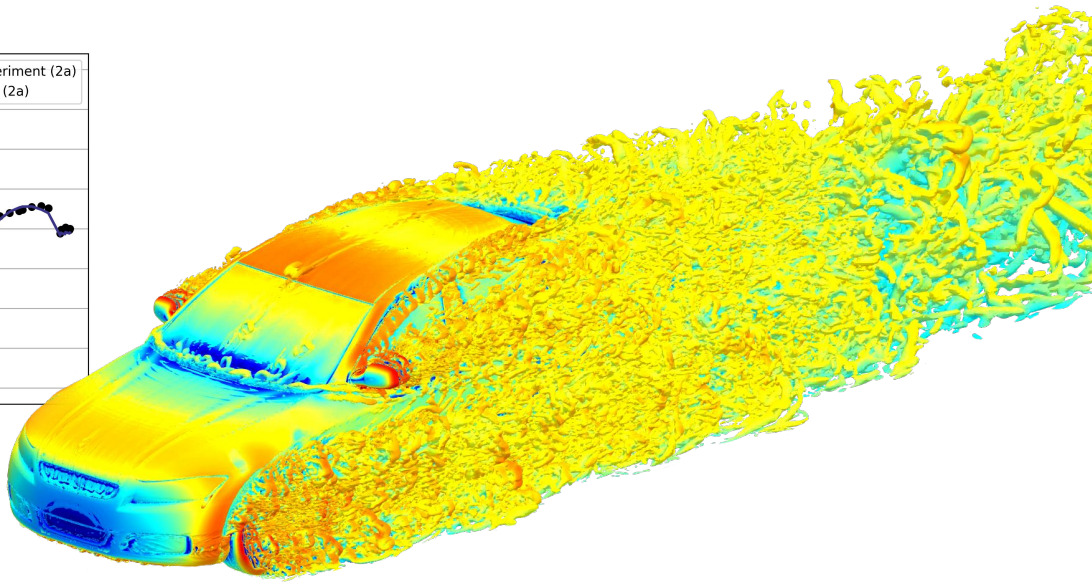
luminary

Accelerating Innovation in **Automotive**

DrivAer: 4th Automotive CFD Prediction Workshop (2024)





BACKGROUND

The 4th Automotive CFD Prediction Workshop (AutoCFD4) focused on assessing the predictive capability of CFD for standardized automotive geometries, highlighting transient, turbulence-resolving simulations. Case 2 compared predicted aerodynamic coefficients and flow profiles computed by different CFD solvers against wind-tunnel tests for the DrivAer Notchback geometry.

In this particular V&V study, the differences, or Δ's, in time-averaged force coefficients and flow fields for a baseline configuration (Case 2a) and a configuration with an added front wheel deflector (Case 2b) were investigated.

VERIFICATION & VALIDATION

CFD Solver	C_D (Case 2a)	ΔC_D
Luminary	**0.2768**	**-0.0099**
Competition	0.2546 - 0.312	-0.0225 - 0.0025
Experiment	0.255	-0.013

The chart above shows a comparison between Luminary's delayed detached-eddy simulation (DDES) results and experimental data for the time-averaged coefficient of pressure (Cp) along the centerline of the upper body surface. Luminary's DDES employs the Spalart-Allmaras turbulence model. Isosurfaces of Q-criterion colored by velocity magnitude are shown for an instantaneous solution within Luminary's complete transient simulation for Case 2a, revealing the structure of the turbulent flow around the vehicle.

LUMINARY: THE FASTEST GPU NATIVE SOLVER AT AUTOCFD4 WITH BEST-IN-CLASS ACCURACY

Luminary's predictions of Cp, sampled at hundreds of probe points on the surface, closely match the wind-tunnel data. In addition, velocity profiles extracted at many locations surrounding the car geometry show excellent agreement when compared to the wind-tunnel data.

The mesh used was provided by the workshop organizers and consists of 157 million control volumes. The DDES took 93 minutes to simulate 6.25s of physical time on 48 NVIDIA A100 GPUs. Using 64 NVIDIA H100 GPUs, the execution wall-clock time can be reduced to only 44 minutes.

Luminary's solver accuracy is on par or better than all other CFD solvers used by participants in the workshop. Luminary predicts the change in the drag coefficient between Cases 2a and 2b due to the addition of a wheel deflector to a close approximation of experimental data. While the presented results leverage the workshop-provided mesh, Luminary's own mesh generation technology can be used instead to achieve equal or better accuracy in a fully integrated, end-to-end framework.

For full detail on this V&V case, see Luminary's presentation at AutoCFD4.