PORSCHE 987.2 CAYMAN

PERFORMANCE OF VERUS ENGINEERING VENTUS 2 PACKAGE

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Rear Diffuser / Flat Underbody Panel:
The rear diffuser is 2x2 twill carbon with hard plastic strakes for longevity. The underbody panel is sheet aluminum. Both units bolt to chassis locations.

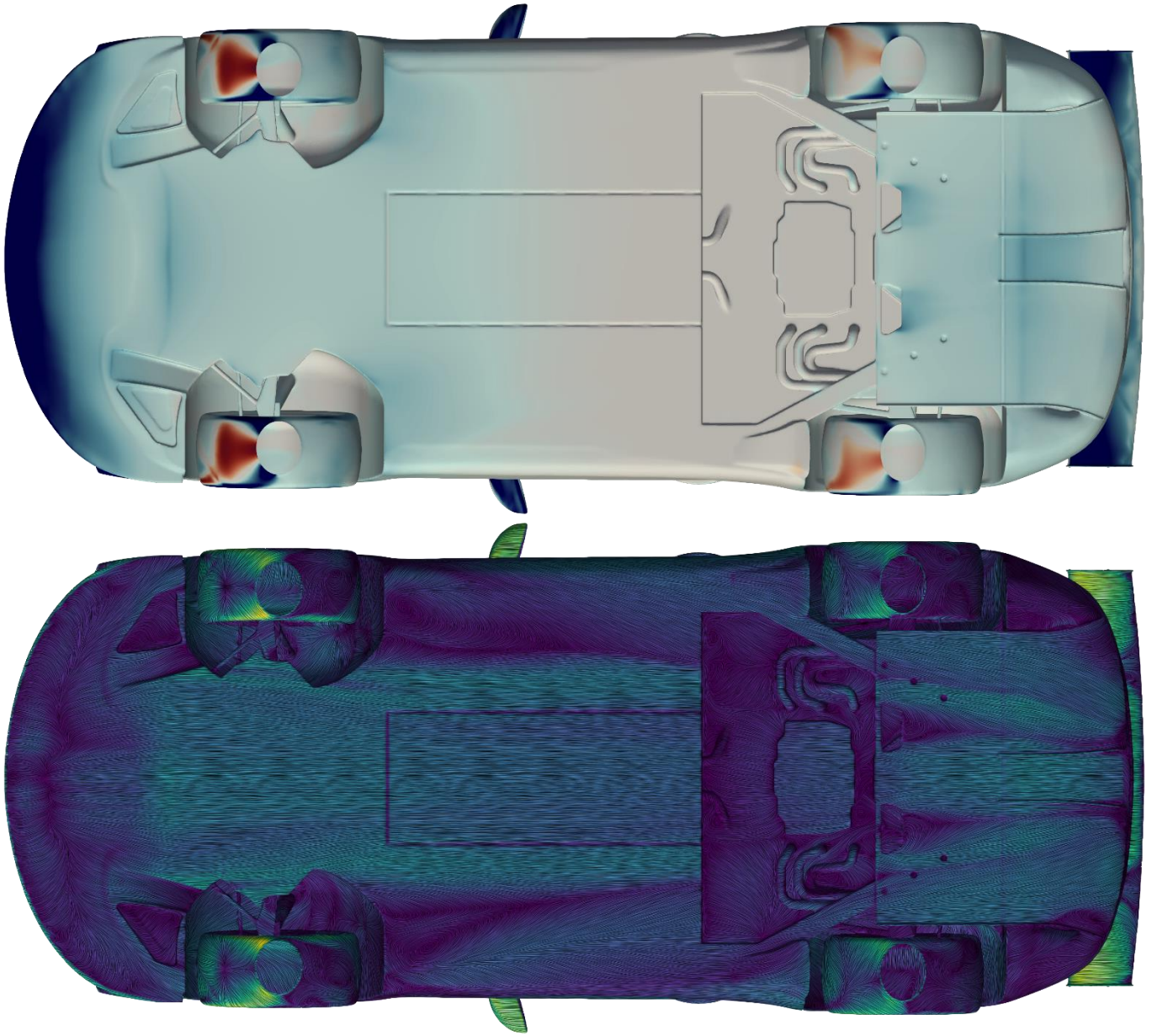
UCW Wing Assembly:
The wing is manufactured by 2x2 twill carbon fiber and is mounted to our carbon fiber duck tail spoiler that replaces the factory wing/spoiler.

Splitter Assembly:
Our splitter is a motorsports grade composite material. Carbon Polyweave is rigid while exhibiting excellent wear characteristics. The Airdam is manufactured with 2x2 twill carbon fiber and slides into the OE bumper slot.

Dive Planes:
The dive planes are manufactured with 2x2 twill carbon fiber and install with templates.

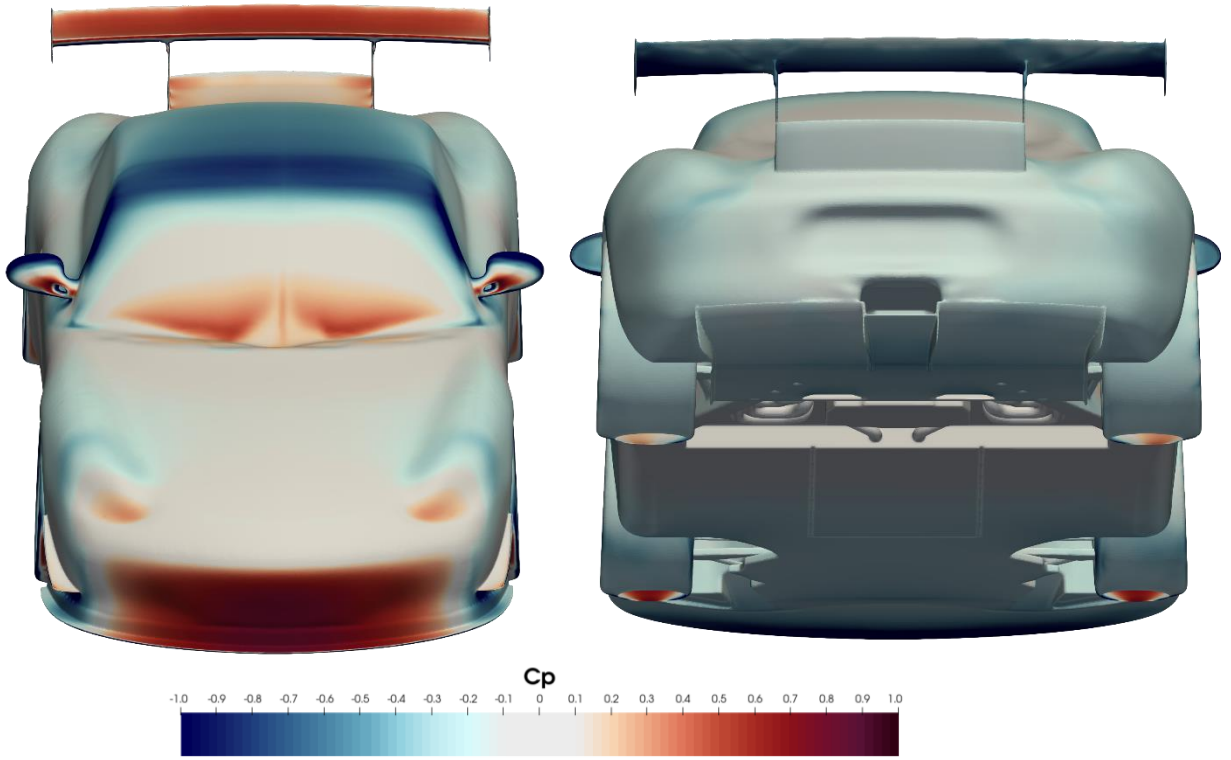
SPLITTER

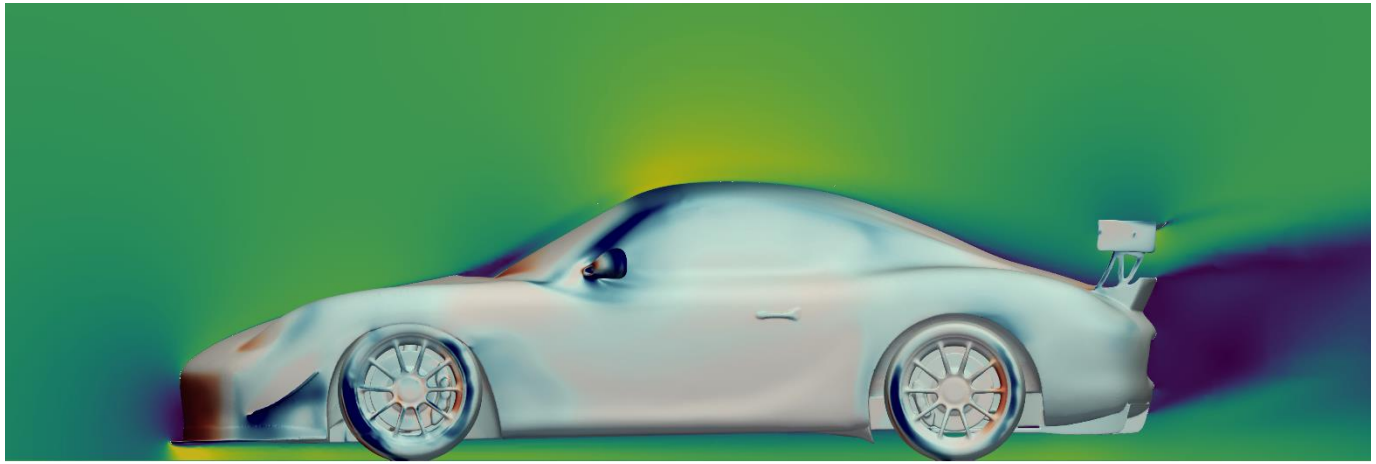
- The front splitter is ideal for increasing front-end downforce.
- The full splitter assembly is simulated which includes the splitter and airdam.
- High pressure on the top side helps drive the splitter downward at speed.
- The bottom side, like the rear wing, produces more downforce than the top side.
- The bottom is designed to feed the factory splitter diffusers for improved performance.
- Our splitter is a motorsports grade composite material. Carbon polyweave is rigid while exhibiting excellent wear characteristics. Where traditional carbon fiber components may fail due to an impact, the carbon polyweave will not.



REAR WING : UCW

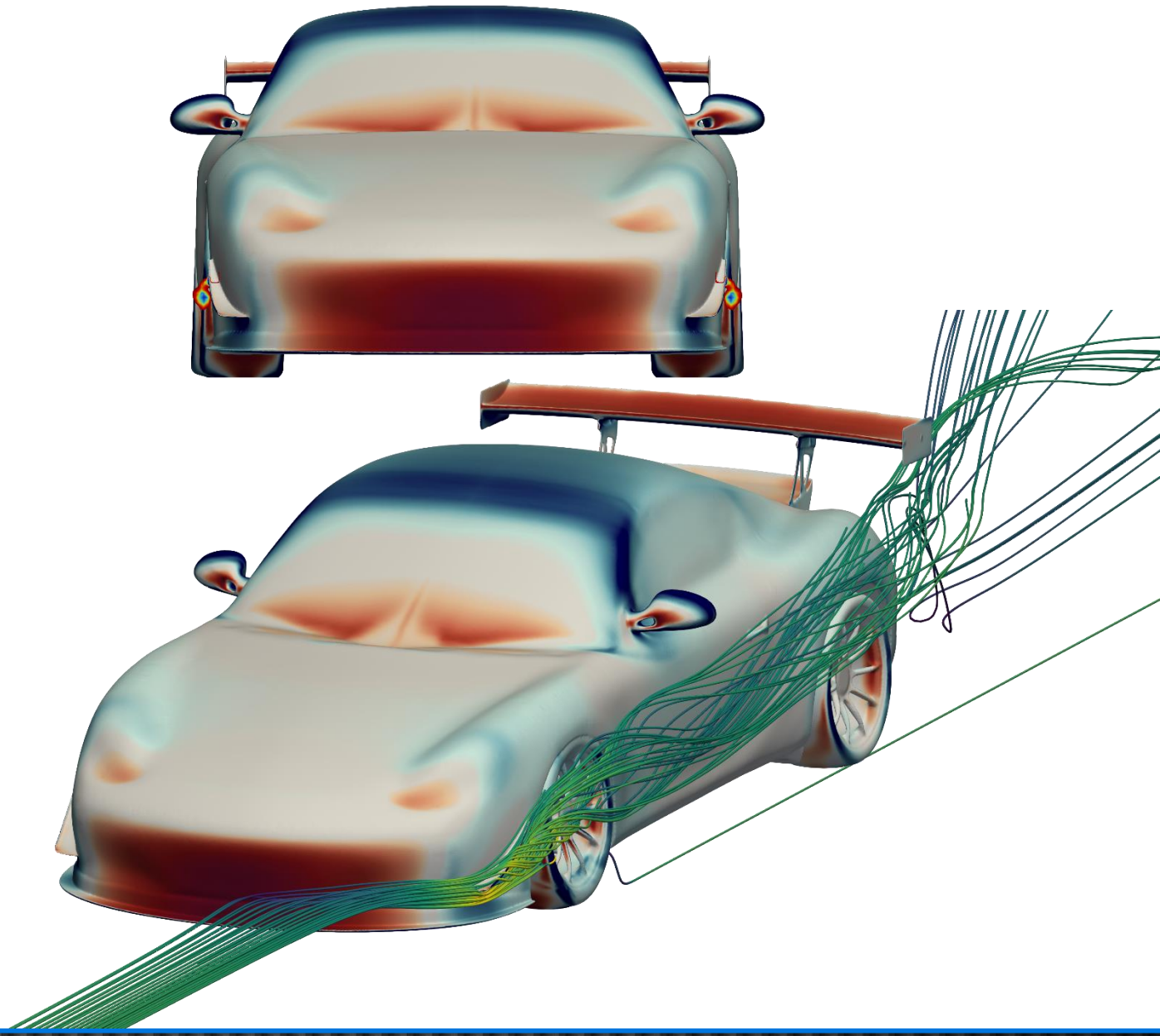
- The rear wing is great for customers looking for a large bump in rear downforce.
- The UCW wing profile was developed in CFD and refined in the wind tunnel.
- The airfoil produces efficient downforce on the 987 in combination with the ducktail spoiler.
- The bottom surface is where the majority of the downforce is generated. This low pressure pulls the car downward.
- The top surface still produces downforce, but not like the bottom surface.
- The Cp (coefficient of pressure) does not go above 0.7 on the top, but the bottom goes below -1. In other words, the bottom surface is working the wing harder.
- The wing and spoiler is produced from 2x2 twill, pre-preg carbon fiber.



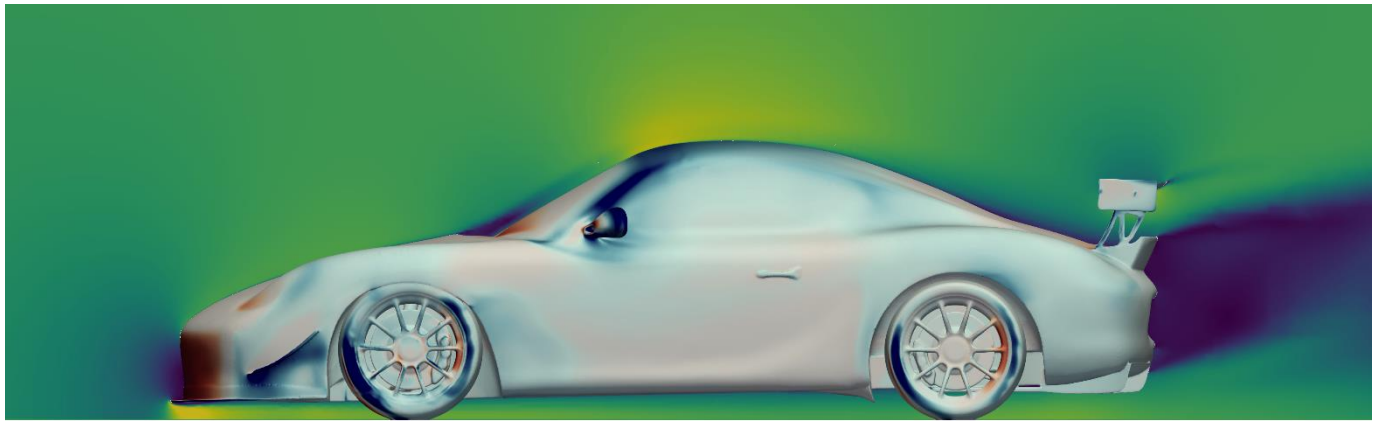


DIVE PLANES / CANARDS

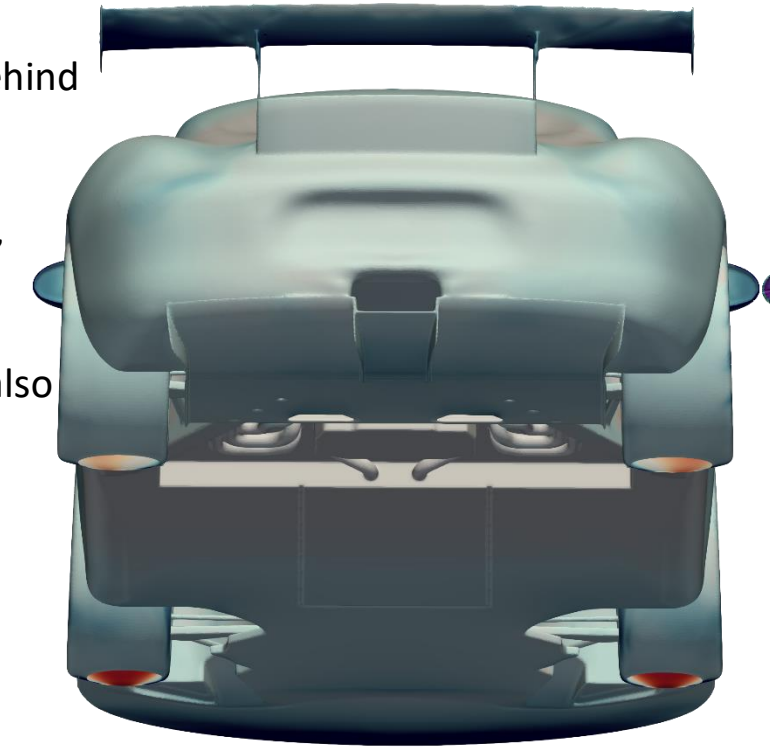
- Dive planes are great for customers looking for a slight bump in front downforce and no reduction in ground clearance.
- Verus Engineering develops dive planes to produce downforce by controlling the flow around the vehicle, not on the units themselves, improving efficacy.
- A small amount of downforce is produced on the units themselves, high pressure on top, low pressure on bottom.
- We develop the dive planes to create a beneficial vortex which helps evacuate the fenders.
- This evacuation reduces lift on the body, improving performance.
- The dive planes are produced from 2x2 twill carbon fiber finished in an automotive clear coat. Templates are supplied to ensure location of the units are correct.



REAR DIFFUSER

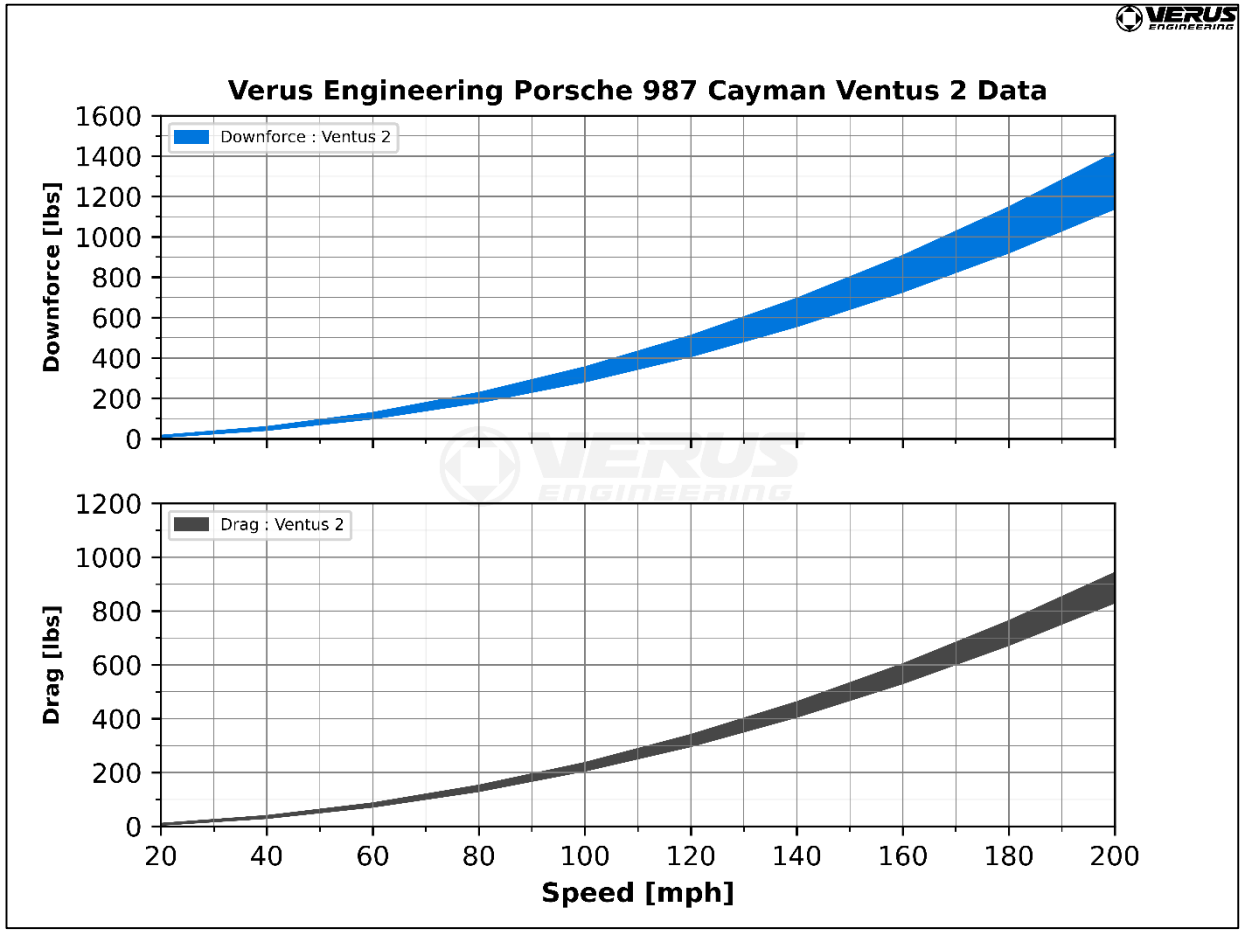


- The rear diffuser is a key component in creating efficient vehicle downforce.
- The diffuser is perfect for street cars as it will add stability (downforce) and reduce drag, when designed properly.
- The diffuser functions by creating low pressure on the bottom surface and reduces drag by filling in the void behind the vehicle.
- A large portion of drag on road vehicles is pressure drag, which is the low pressure region behind the car.
- This low pressure wants to pull the car rearward and is also known as the wake region.
- Using CFD and good design practices, we developed a solution that creates downforce and reduces drag.
- The rear diffuser is carbon fiber, with replaceable plastic diffuser strakes, and mounts to various chassis points.



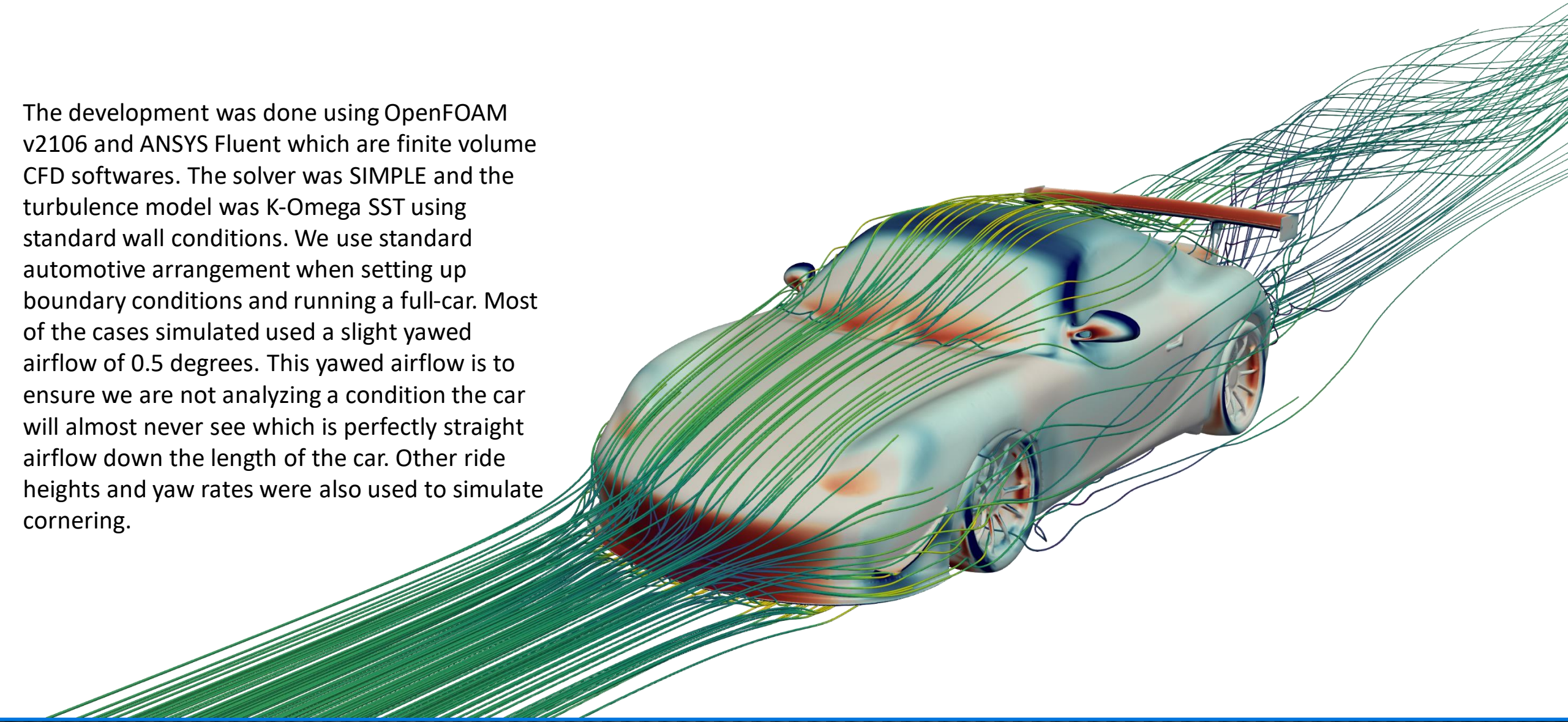
SUMMARY : AERODYNAMIC FORCES

- Aerodynamic forces change with the square of the vehicle speed, which is why we use a graph.
- The Ventus 2 package increases downforce over stock with minimal impact to drag.
- The lower value is with the UCW rear wing at 2 degrees, while the higher value is with the wing at 12 degrees AOA (angle of attack).
- AOA adjustment allows the driver to fine tune aerodynamic balance to his or her preference.
- The Ventus kit is designed and tested to make your 987 Cayman faster around the track.



THE SCIENCE

The development was done using OpenFOAM v2106 and ANSYS Fluent which are finite volume CFD softwares. The solver was SIMPLE and the turbulence model was K-Omega SST using standard wall conditions. We use standard automotive arrangement when setting up boundary conditions and running a full-car. Most of the cases simulated used a slight yawed airflow of 0.5 degrees. This yawed airflow is to ensure we are not analyzing a condition the car will almost never see which is perfectly straight airflow down the length of the car. Other ride heights and yaw rates were also used to simulate cornering.



DEFINITIONS

1. **Coefficient of Pressure (Cp)** = This is a dimensionless number which describes relative pressure to atmospheric pressure. A Cp of 0 equates to atmospheric pressure while a number below 0 represents low pressure and a number above 0 represents high pressure.
2. **CpX** = This is a dimensionless number which describes Cp normal to the x-direction. This helps us visualize locations which create drag. Red represents locations which are creating drag, while blue represents locations where thrust is created.
3. **CpZ** = This is a dimensionless number which describes Cp normal to the z-direction. This helps us visualize location which create downforce or lift. Red represents locations which are creating lift, while blue represents locations where downforce is created.
4. **Total Pressure Coefficient (CpT)** = This is a dimensionless number which describes total energy of the airstream. It is the sum of static pressure and dynamic pressure.
5. **Wall Shear** = This is a force per unit area due to fluid friction on the wall. This is used to visualize areas of separation and rapid changes on the surface.
6. **LIC Plot** = Line integral convolution (LIC) is used to visualize “oil” flow on the surface. It is a great way to correlate to flow vis testing and to study the flow on the surface of the vehicle.
7. **Streamline** = These are fluid tracers which are used to visualize where the air is going or coming from. These are normally colored as velocity where red is high-velocity and blue is low-velocity.
8. **Points** = One point is considered 0.001 of a coefficient. This is used in coefficient of drag (Cd) and coefficient of lift (Cl).

TOOLBOX