Case Study

Driving F1 aerodynamic performance

This case study highlights that in the discipline of motorsport aerodynamics, especially in Formula One, precision is critical. Imetrum's 3D measurement system, Mobius, provides target identification techniques and rich data collection for the wind tunnel testing environment.

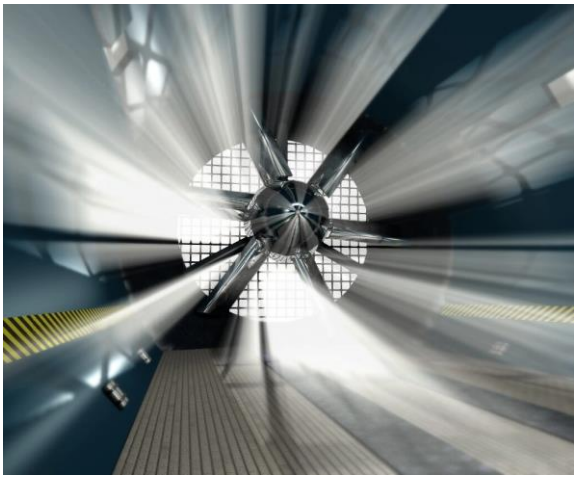
Published September 2023

Challenge

Aerodynamicists and engineers constantly innovate to minimise the impact of ever-changing rules governing development within Motorsport. With wind tunnel time now limited based on prior season performance, it is imperative that engineers maximise their run time efficiency and data collection.

Solution

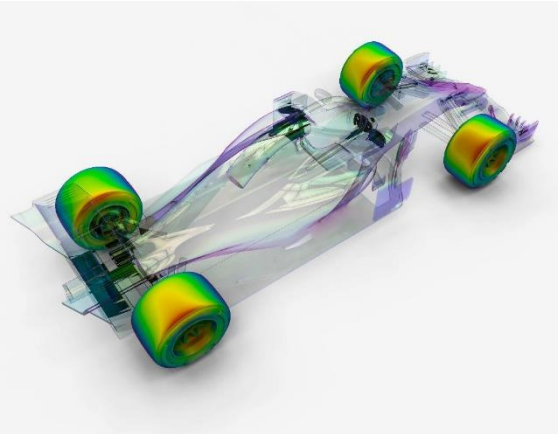
For aerodynamicists, understanding the behaviour of a car's aero surfaces is critical, such as the deflection of a wing, how one aerodynamic device affects another or how elements move relative to the whole car. The knowledge gained from the wind tunnel validates Finite Element Analysis models and Computational Fluid Dynamics simulations. Digital model to wind tunnel correlation is critical to extracting performance from CFD techniques.



Over several seasons, the use of Imetrum measurement solutions has become widely adopted within Formula One. This widespread adoption of Imetrum technology is the result of the performance advantages gained by each team.

Imetrum's flagship 3D measurement solution Mobius comprises multiple measurement heads, each focusing on a section of the car. Using the Unified Coordinate System functionality, all measurements regardless of source, are gathered relative to a single set of Cartesian coordinates.

The Rigid Body Motion correction feature allows the movements of the desired target to be isolated from global movements of the rigid body itself e.g. measuring complex displacements of an aircraft winglet in relation to the fuselage, even when the entire aircraft is also changing pitch, roll and yaw within the 3D measurement volume.



Results

Target identification techniques, unique to Mobius, reduce setup time to minutes whilst removing disruptions to the airflow. The computational architecture and wide range of embedded tools deliver live, information rich data. Communications protocols facilitate data transmission and measurement system control direct from the wind tunnel's own operating system.

Post Processing features allow test reconstruction and measurement modification at any time following the live test.

Visit the website page: https://www.imetrum.com/case-studies/driving-f1-aerodynamic-performance/