3D PIV Car Model Test

Aerodynamic Flow Analysis Using PIV

Particle image velocimetry (PIV) is a powerful optical technique used to visualize and quantify fluid flow. By tracking seeded particles within the airflow, engineers can measure displacement, velocity, and complex flow structures. This method is widely used in automotive and aerospace industries, where aerodynamic performance plays a critical role in product design and optimization.

Objective

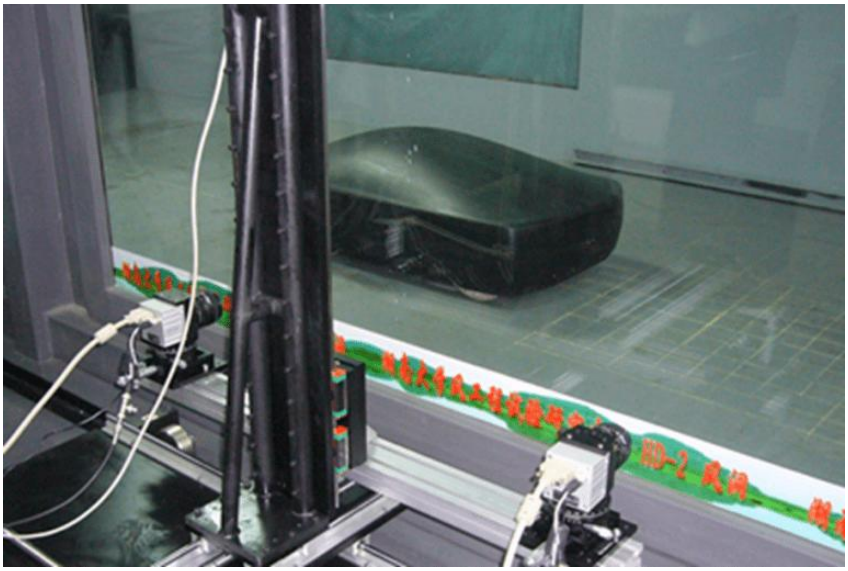
The objective of this study was to understand the aerodynamic flow around a large-scale car model in a wind tunnel, with a focus on obtaining accurate **3D flow velocity data**.

Description of the Case Study

The experiment was conducted in a **large wind tunnel** with airflow speeds of up to **30 m/s**. A **500 mJ double-cavity pulse laser** was used to illuminate the seeded airflow.

For image acquisition, **two 11 MP cameras** equipped with **Scheimpflug adapters** and **100 mm Nikon lenses** were arranged in a **Stereo PIV configuration**, enabling full **3D flow reconstruction**.

Due to the size of the model and limitations in illumination coverage, multiple measurements were performed and combined using the **Microvec stitching feature**, allowing analysis over a larger field of view.

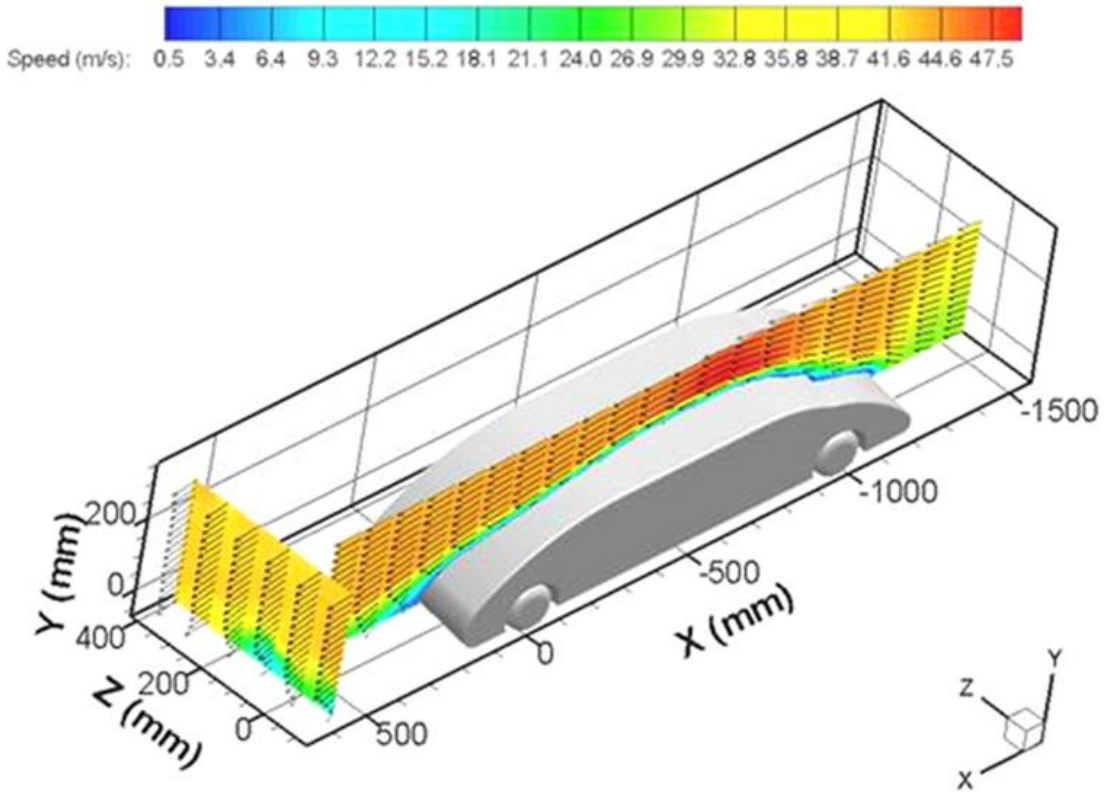


MicroVec

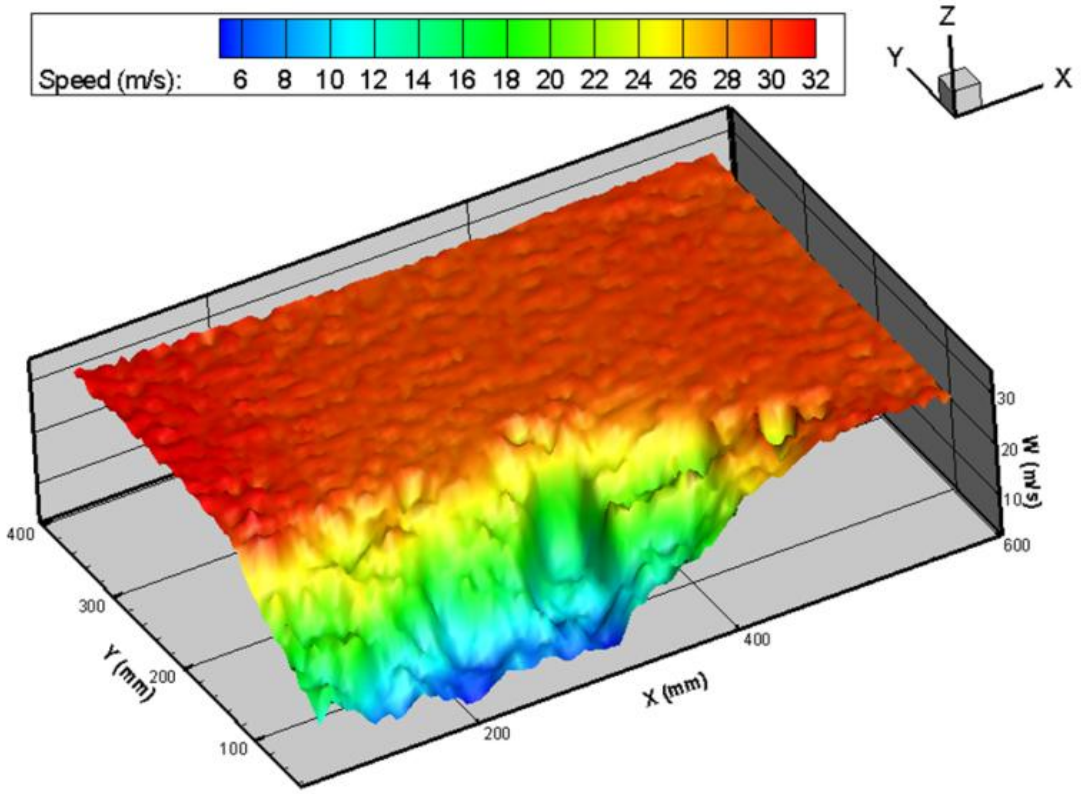
Results obtained with KRYTEN's Stereo PIV software

The **particle image velocimetry analysis** provided detailed insight into the airflow behavior around the car model:

- **3D flow velocity fields** capturing aerodynamic behavior
- **Visualization of flow structures** around the vehicle body
- **Identification of critical flow** regions influencing drag and performance



❖ Flow velocity



These results contributed to improved understanding of aerodynamic performance and supported **design optimization** of the vehicle body.

Advantages of Using Particle Image Velocimetry

- **Full-field flow** visualization – capture complete velocity fields across large areas
- **3D flow visualization** – analyze complex aerodynamic structures
- **Non-intrusive measurement** – no disturbance to the flow being analyzed
- **Scalable setup** – suitable for both small-scale and large-scale experiments