

# 2D PIV Wind Turbine Test

## Flow Analysis Using Particle Image Velocimetry

**Particle image velocimetry (PIV)** is a powerful optical technique used to visualize and quantify fluid flow. By tracking seeded particles within the flow, engineers can accurately measure displacement, velocity, and flow structures. This method is essential in industries such as aerospace and automotive, where understanding aerodynamics is critical for design optimization.

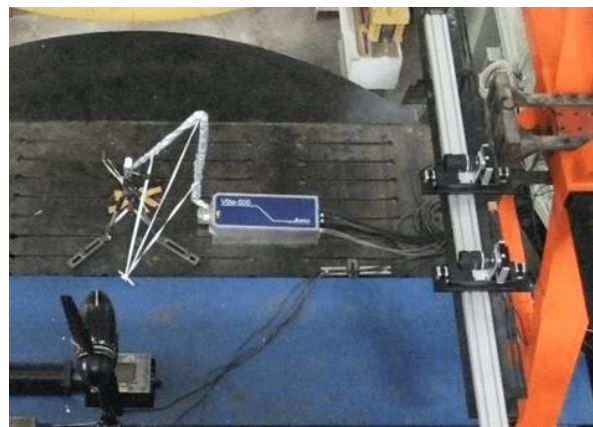
### Objective

The objective of this case study was to analyze the initiation and development of the tip vortex of a wind turbine, providing deeper insight into flow structure and aerodynamic behavior.

### Description of the Case Study

The experiment was conducted on a **1.5 MW wind turbine test platform**. A **500 mJ double-cavity pulse laser** was used to illuminate the seeded flow, while **two 11 MP cameras** captured high-resolution images of particle motion.

To achieve a comprehensive view, the results from both cameras were stitched together, creating a large field of view of **950 × 750 mm**. This setup enabled simultaneous full-field analysis of airflow around the turbine blade.



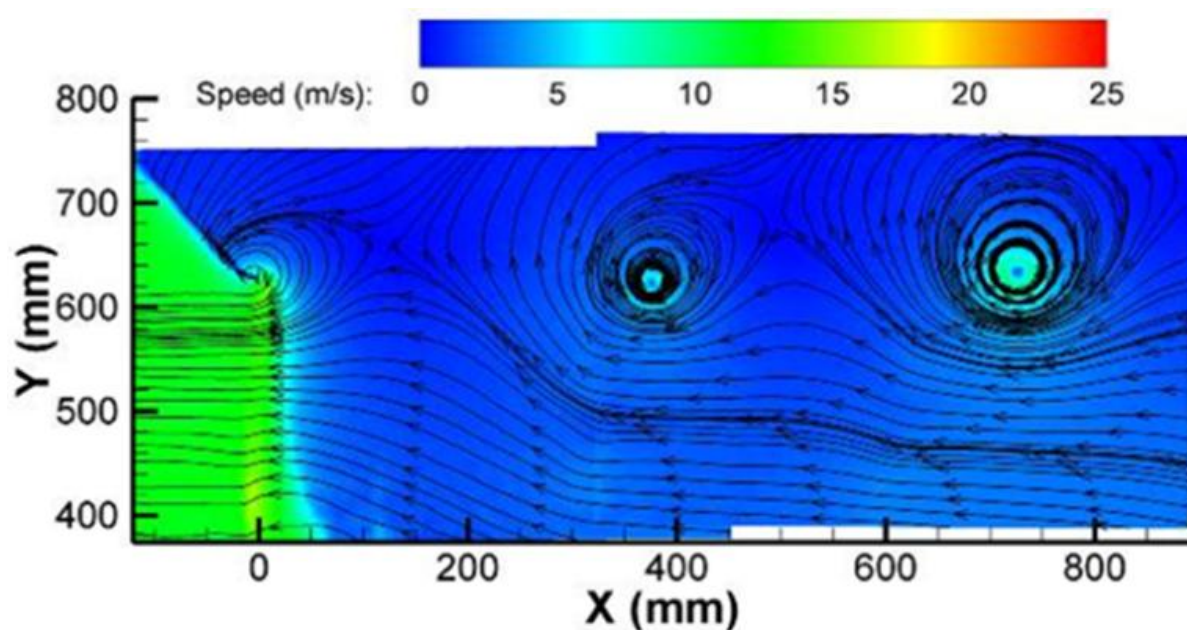


# MicroVec

## Results obtained with Microvec 2D PIV software

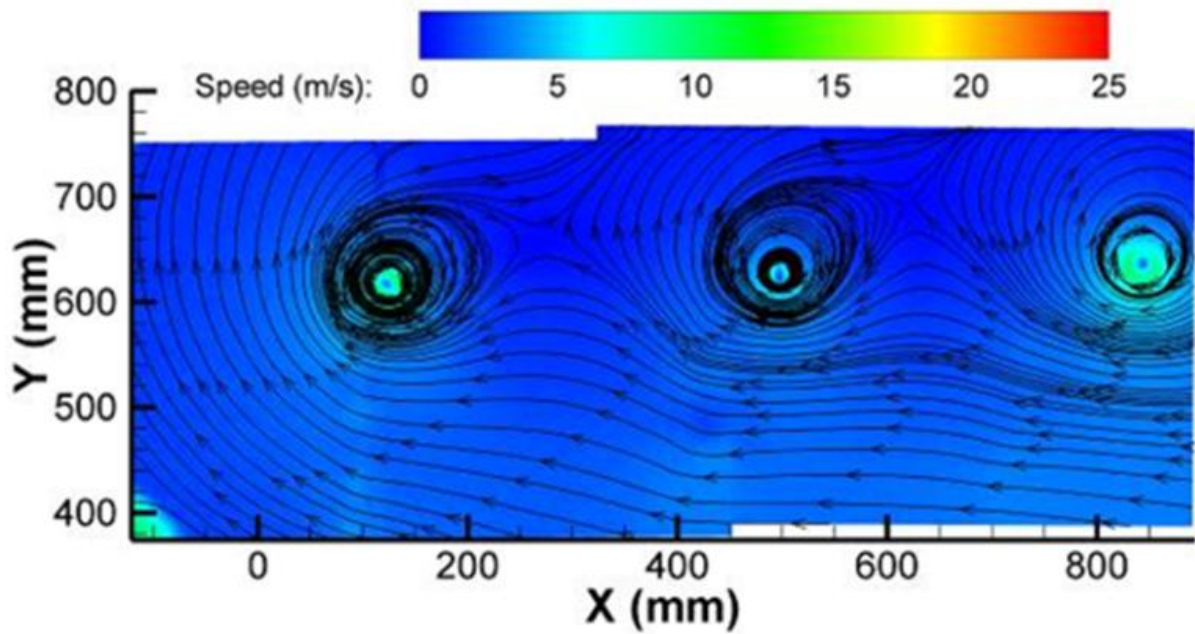
Using **Microvec 2D PIV software**, the flow behavior was evaluated under different conditions:

❖ **Wake at 0° angle** – capturing the baseline flow structure behind the turbine blade



❖ **Wake at an angle of 60°** – revealing changes in vortex formation and flow dynamics





The **particle image velocimetry analysis** provided detailed insight into flow vorticity and vortex development. These findings are crucial for understanding aerodynamic performance and preventing long-term damage caused by turbulent flow conditions.

## Advantages of Using Particle Image Velocimetry

- ❖ **Full-field flow** visualization – capture complete velocity fields across large areas
- ❖ **Non-intrusive measurement** – no disturbance to the flow being analyzed
- ❖ **High spatial resolution** – detect detailed flow structures such as vortices
- ❖ **Scalable setup** – suitable for both small-scale and large-scale experiments

