VOLUMETRIC VELOCITY MEASUREMENTS USING V3V-FLEX

APPLICATION NOTE V3V-FLEX-003 (A4)

Introduction

The V3V-Flex system uses multiple cameras, a light source, and segmented triangulation in order to determine the positions and velocity tracks of particles within a volume with very high spatial resolution. V3V-Flex was recently applied to measuring the wake downstream of a cylinder with Re = 20,000.

Experimental Setup

A cylinder was mounted vertically in the TSI water channel and imaged with four of the Phantom V641 cameras arranged in a rectangular configuration with Scheimpflug mounts and 135-mm lenses. The measurement volume was centered on a location 6-cylinder diameters downstream of the cylinder axis. A photograph of the experimental setup can be seen in fig. 1.

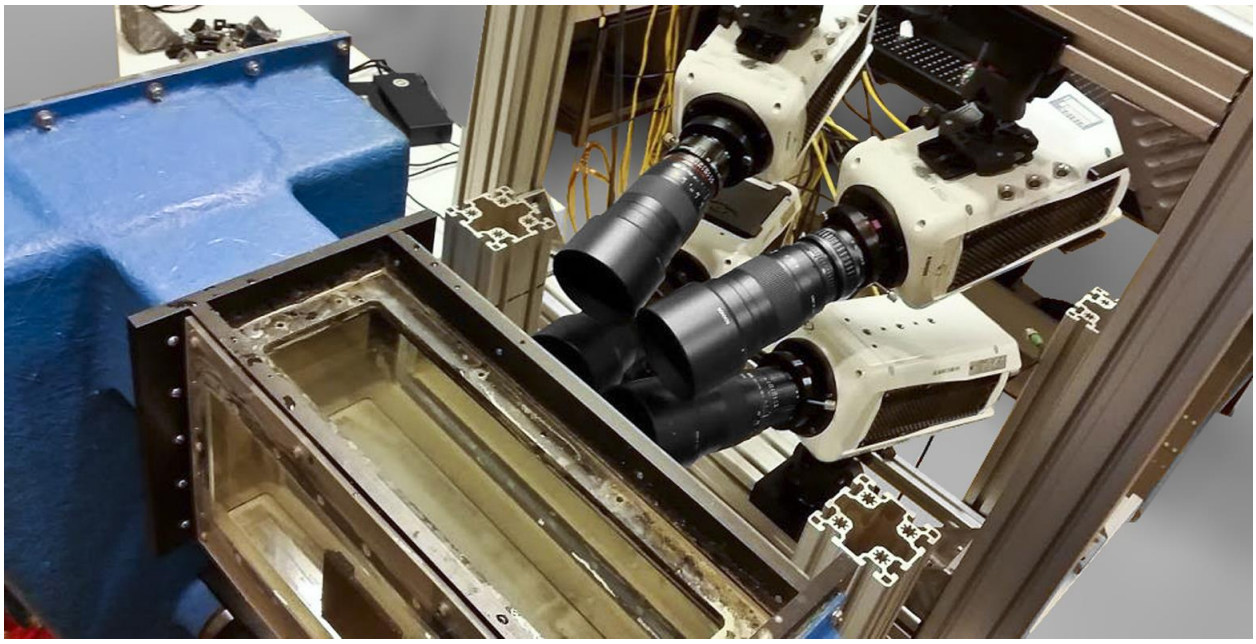

Fig. 1. Experimental Setup showing the water channel and the viewing arrangement of the four cameras.

The measurement volume was 50 × 30 × 10 mm^3, and the spatial resolution was less than 0.5 mm. Volumetric velocity fields were captured at a rate of 500 Hz, providing very highly temporally resolved data, allowing structures to be tracked in time.

Results

Plots of five instantaneous snapshots of the results can be seen in fig. 2. The isosurface is the Q-criteria and the slices are colored with the streamwise velocity and overlaid with velocity vectors. The Karman vortex street can be seen clearly in the near wake of the cylinder, and further downstream the presence of secondary lambda vortex structures more aligned with the streamwise direction are visible.

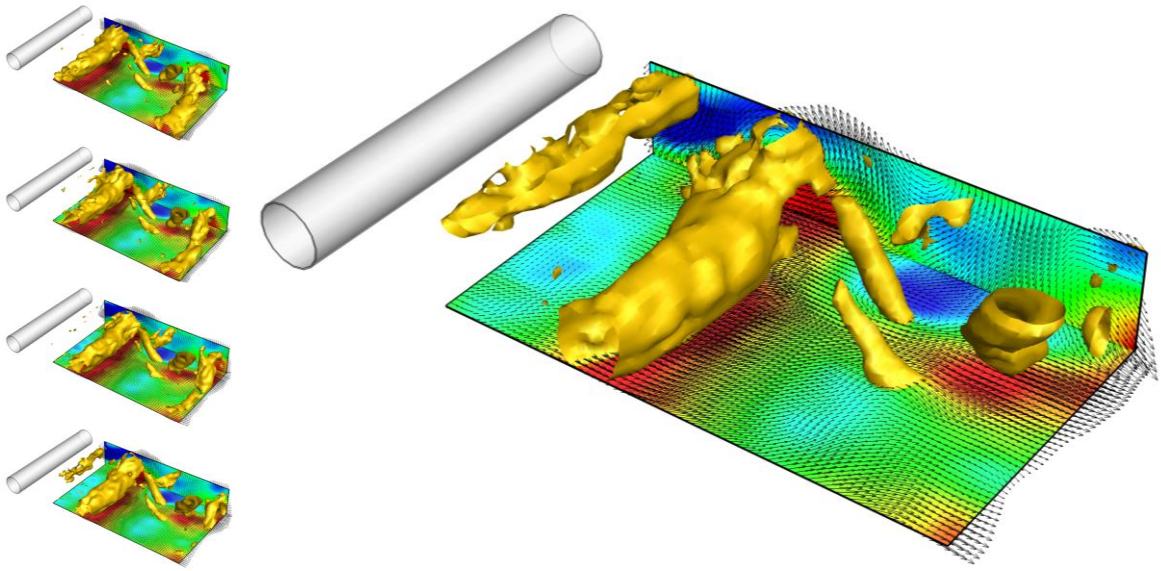

Fig. 2. Vortex shedding downstream of a cylinder at Re = 20,000. Plots on the left (from top to bottom) indicate time-steps leading up to the large instantaneous snapshot on the right. Isosurface is the Q-criteria, and the slices are colored by streamwise velocity. Flow is from left to right.

Conclusion

The V3V-Flex was used to perform volumetric velocity measurements with very high spatial and temporal resolution.

UNDERSTANDING, ACCELERATED

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