



VORTEX DYNAMICS IN THE NEAR-WAKE OF TABS WITH VARIOUS GEOMETRIES

APPLICATION NOTE V3V-FLEX-010 (A4)

Introduction

A study was recently conducted by Hamed et al. (2016 JFM) at the University of Illinois – Urbana Champaign using the V3V-PCM-CS to measure the mean and instantaneous velocity fields around wall-mounted tabs of various geometries in order to determine the effects of tab shape on the ensuing downstream wake.

Experimental Setup

The size and shape of the tab geometries that were examined can be seen in Figure 1.

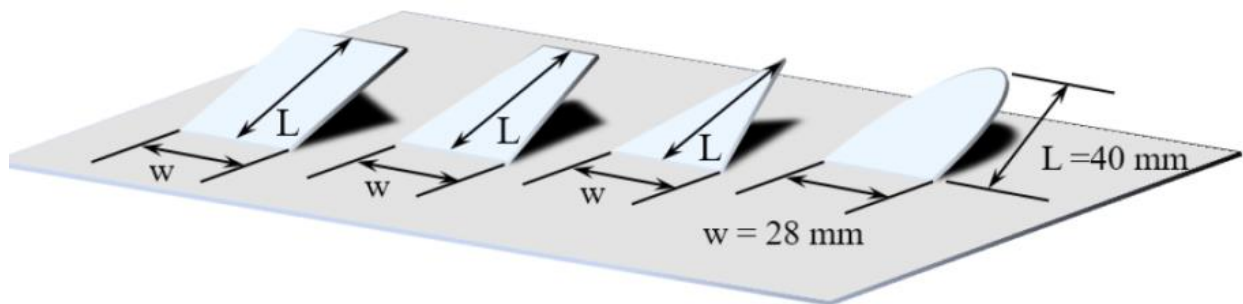


Figure 1. The size and geometry of the tabs examined.

The tabs under study were constructed from PMMA which was transparent and thin enough that data could be acquired underneath the tab, in the region between the tab and the wall. The measurement volume was illuminated by a pulsed dual-head Nd:YAG laser, and the V3V-PCM-CS system with three 8 MP cameras was focused on the region downstream and including the tab. The interrogation volume was 140 mm × 100 mm × 50 mm. The flow was seeded with 50 μm silver-coated hollow glass spheres. Images were captured and processed using the TSI INSIGHTV3V 4G™ software package.



A schematic of the experimental setup is shown in Figure 2.

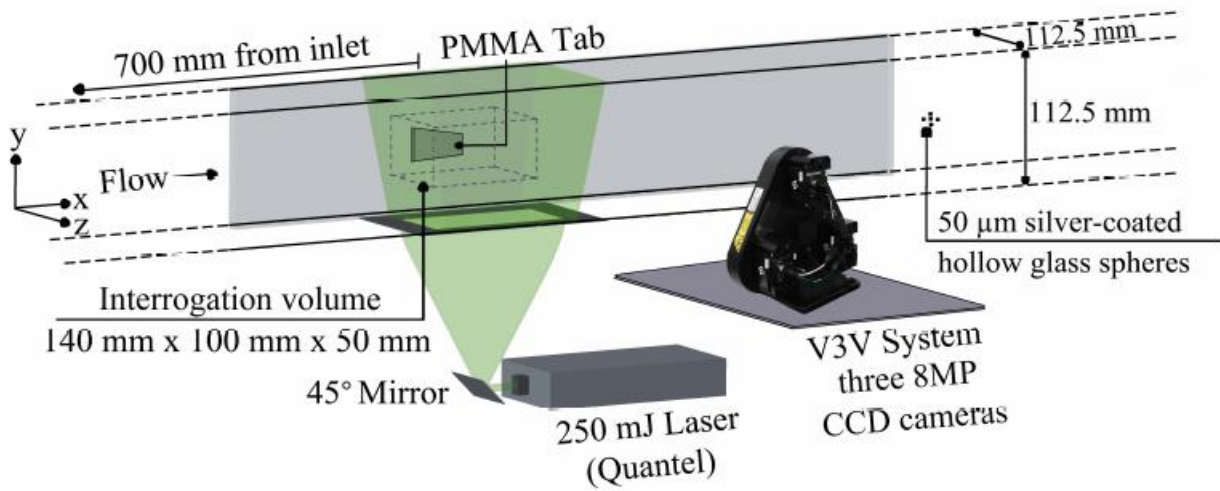


Figure 2. Experimental setup.

Results

Figure 3 shows the mean results for the flow around and downstream of the trapezoidal tab. Streamwise (*left*) and spanwise (*right*) velocity fields are shown in orthogonal slices. The plots clearly show the pair of counter-rotating vortices that are formed from the tab tips and extend into the downstream wake.

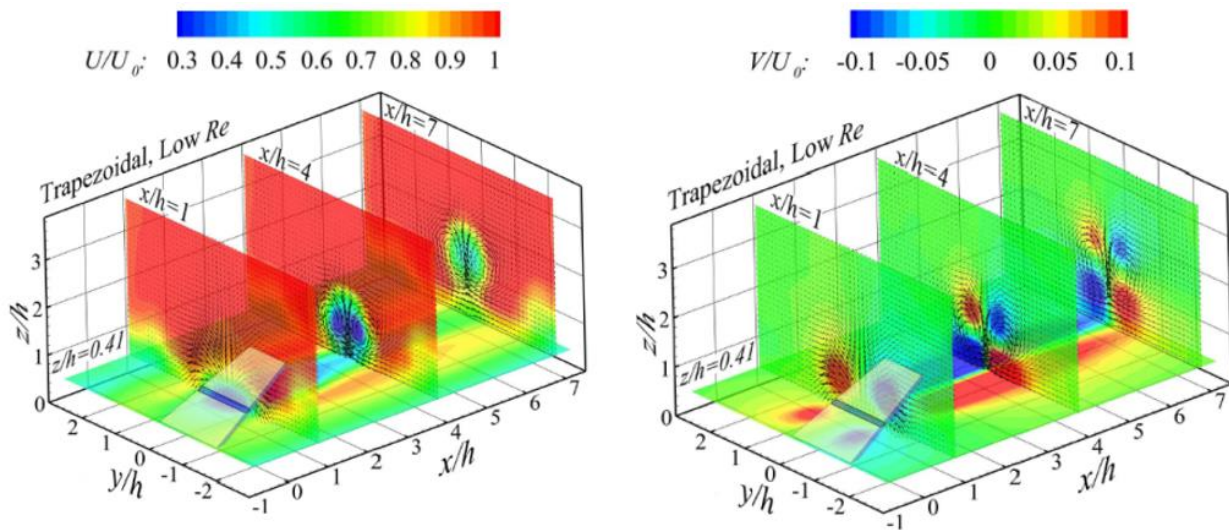


Figure 3. Mean results for the trapezoidal tab. Streamwise velocity is shown on the left, and span wise velocity is shown on the right. Flow is from left to right and into the page.

Figure 4 shows an instantaneous velocity field for the rounded tab. The slice shows streamwise velocity and the isosurfaces represent vorticity magnitude. A packet of vortex structures can be seen clearly shedding from the tab and convecting downstream.

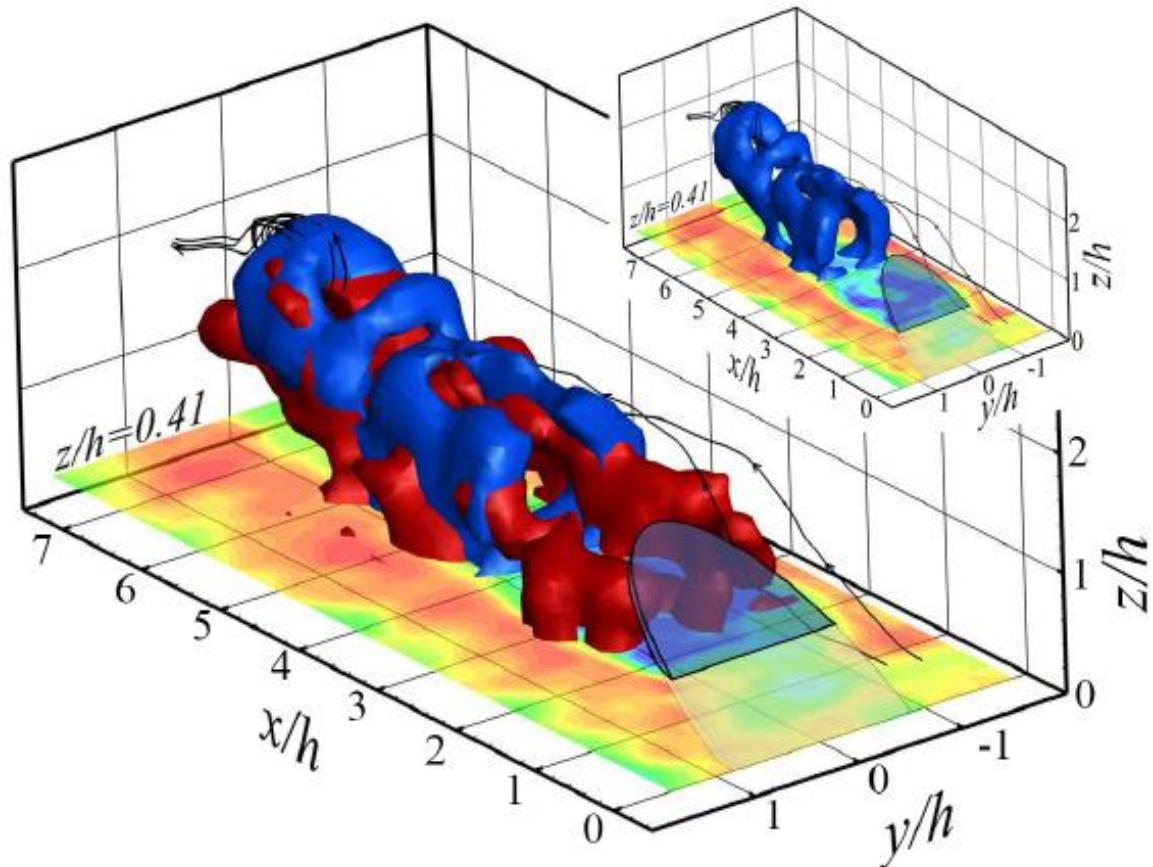


Figure 4. An instantaneous result for the rounded tab. The slice shows the streamwise velocity contour, and the isosurfaces show the vorticity. Streamlines are also shown. Flow is from right to left and into the page.

For more details on the specifics of this experiment, as well as the full results, please see the paper by Hamed et al. (2016) shown in the references section.

All figures courtesy of Prof. Chamorro, University of Illinois – Urbana Champaign.

References

Hamed, Pagan, Khovalyg, Marsh, Chamorro (2016) "Vortex dynamics in the near-wake of tabs with various geometries," *Journal of Fluid Mechanics*.

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