SUPPLEMENTARY MATERIAL RELATED TO:

Dreyer et al., Experiments in Fluids, 2014

STEREO PIV MEASUREMENTS DATA AND HIGH SPEED MOVIES

How to retrieve and cite the paper:

Dreyer, M., Decaix, J., Münch-Alligné, C., & Farhat, M. (2014). Mind the gap: a new insight into the tip leakage vortex using stereo-PIV. *Experiments in Fluids*, *55*(11), 1-13. DOI 10.1007/s00348-014-1849-7, http://link.springer.com/article/10.1007/s00348-014-1849-7

How to retrieve experimental data:

http://infoscience.epfl.ch/record/202752?ln=en

Authors' declaration:

The authors agree to grant free and open access to experimental data, involving SPIV velocity fields measured in a tip leakage vortex as well as high-speed visualization movies. Whenever these data are used in publications, reports and presentations, their authors are kindly asked to cite the paper mentioned above.

About the case study:

Detailed information about the case study and the experimental setup can be found in the original publication.

The tip leakage vortex is generated by a NACA 0009 hydrofoil with a blunt trailing edge in the test section of EPFL high-speed cavitation tunnel, as illustrated in Figure 1. The foil chord length is originally c_0=110 mm. It is blunt truncated at c=100 mm. The foil span is 150 mm and its maximum thickness is h=9.9 mm. Its thickness distribution y_b is defined as follows:

$$0 \le \frac{x}{c_0} \le 0.5 \qquad \frac{y_b}{c_0} = a_0\left(\frac{x}{c_0}\right)^{1/2} + a_1\left(\frac{x}{c_0}\right) + a_2\left(\frac{x}{c_0}\right)^2 + a_3\left(\frac{x}{c_0}\right)^3$$

$$0.5 < \frac{x}{c_0} \le 1.0 \qquad \frac{y_b}{c_0} = b_0 + b_1\left(1-\frac{x}{c_0}\right) + b_2\left(1-\frac{x}{c_0}\right)^2 + b_3\left(1-\frac{x}{c_0}\right)^3$$

$$\begin{cases} a_0 = +0.197933 \\ a_1 = -0.04785 \\ a_2 = -0.0082 \\ a_3 = -0.11188 \end{cases} \quad \begin{cases} b_0 = +0.002 \\ b_1 = +0.465 \\ b_2 = -0.684 \\ b_3 = +0.292 \end{cases}$$

The velocity field is measured using stereo PIV in a cavitation-free regime at three streamwise positions (z=100, 120 and 150 mm) as represented in Figure 2. At each position, different incidence angles (3°, 5°, 7°, 10°, 12°) are tested in combination with up to four inlet velocities (5, 10, 15 and 20 m/s). For each of these configurations, the tip clearance is varied between 0 and 20 mm. Measurements are performed both with and without turbulent boundary layer tripping using a strip of distributed roughness on the hydrofoil leading edge.

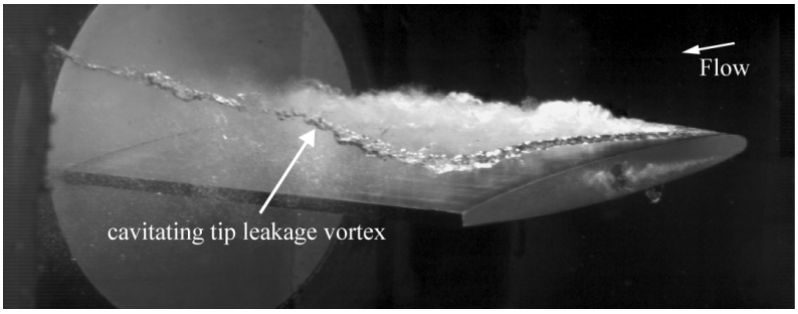

Figure 1. Cavitating tip leakage vortex generated by the NACA0009 in the EPFL high-speed cavitation tunnel

About the PIV data files:

The PIV data are stored in text format. Each file contains 93x81 velocity vectors covering an area of 52x55 mm around the tip leakage vortex. The data files are named after the test conditions as follows:

incidence angle — turbulent boundary layer tripping: rough=yes, smooth=no

v=10ms_incidence=10°_z=120mm_rough_gap=20mm.txt

inlet velocity — streamwise coordinate — tip clearance value

The results are represented in the Cartesian x, y, z coordinate system (the corresponding velocities are referred as u, v and w). The origin is located on the test section lateral wall, corresponding to the plane x=0, while the foil axis of rotation is on the intersection of the planes y=0 and z=0. The orientation of the coordinate system is illustrated in Figure 2.

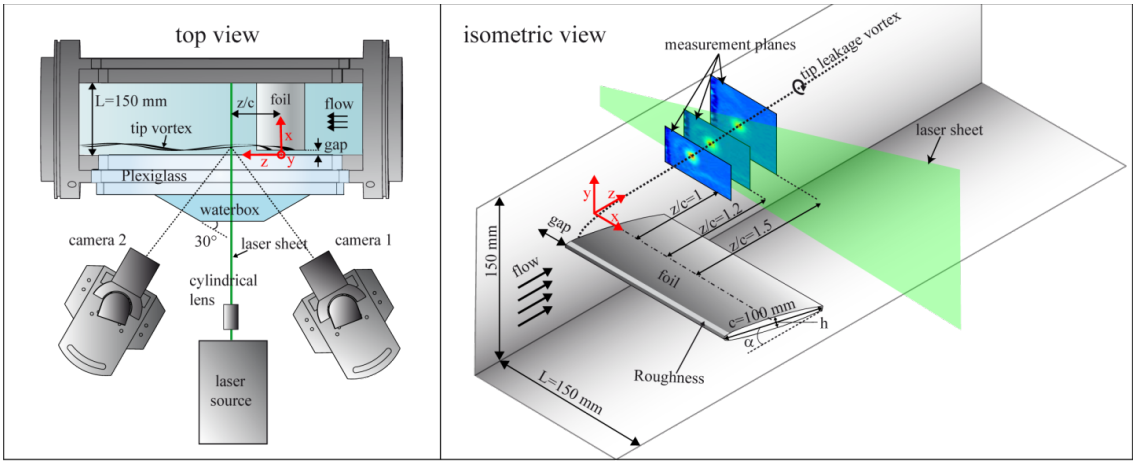

Figure 2 Sketch of the SPIV configuration used in the 3D measurement of the velocity field. Left: top view of the tunnel test section and optical instruments. Right: isometric view of the inlet test section with the three measurement planes.

Related publication:

J. Decaix, G. Balarac, M. Dreyer, M. Farhat, C. Münch. (2014). RANS and LES simulations of the tip leakage vortex for different gap widths, *Journal of turbulence*.