Complementary README file for the linked data

University of Southampton
Faculty of Engineering and the Environment
Aerodynamics and Flight Mechanics Group
Written by Angeliki Laskari

Data Manager: Prof. Bharathram Ganapathisubramani
G.Bharath@soton.ac.uk

October 8, 2017

1   General Comments

All the data attached is from time-resolved tomographic PIV experiments of a turbulent boundary layer. The experiments were performed in the recirculating water tunnel located at the Experimental Fluids Laboratory, which is part of the Aerodynamics and Flight Mechanics Research Group, in the Faculty of Engineering and the Environment of the University of Southampton. Further details on the experimental setup and processing parameters can be found in the linked PhD Thesis (Laskari, 2017).

The data includes the coordinates X, Y, and Z of the 3D velocity grid in the streamwise, wall-normal and spanwise direction respectively (unscaled, inner, and outer normalised in files `Grid_mm.mat`, `Grid_inner.mat` and `Grid_outer.mat`, respectively) and 3C-3D velocity vectors (under the folder Velocity for each of the 3310 consecutive snapshots). Estimated pressure values at the same grid points, based on the Taylor's hypothesis method (see Laskari et al., 2016; Laskari, 2017), are also included (under the folder Pressure for each of the 3310 consecutive snapshots).

2   Experimental details

For the data acquisition, the LaVision software DaVis 8.2 was used to acquire a set of $3,300$ particle images at 1.45 kHz, which was subsequently processed with the same software using an iterative volume correlation with a final interrogation volume of $64 \times 64 \times 64$ pixels with an overlap factor of 75%. The nominal flow conditions, based on the 3,300 evaluated

vector fields were: $U_\infty \approx 0.66$ m/s, $\delta_{99} \approx 0.10$ m, $Re_\tau \approx 2300$, while the resulting FOV was approximately $0.8\delta \times 2\delta \times 0.18\delta$ in the streamwise, wall-normal and spanwise direction respectively (Table 1). The friction velocity was calculated using the Clauser chart method (Clauser, 1954).

Friction velocity Re number	Re_τ	2370
Friction velocity	U_τ	0.0254 [m $\cdot$ s^{-1}]
Viscosity	ν	$1.16 \cdot 10^{-6}$ [m$^2 \cdot$ s^{-1}]
Domain length	$L_x \times L_y \times L_z$	$0.8\delta \times 2\delta \times 0.18\delta$ [m]
Interrogation volume size	$l_x^+ \times l_y^+ \times l_z^+$	$104 \times 104 \times 104$
Timestep	dt^+	0.38
Voxel size	l_v^+	1.62

Table 1: Nominal flow conditions and processing parameters.

References

Clauser, F. H. (1954). Turbulent boundary layers in adverse pressure gradients. *Journal of the Aeronautical Sciences*, 21(2):91–108.

Laskari, A. (2017). *Pressure and velocity fluctuations in wall-bounded turbulent flows*. PhD thesis, University of Southampton.

Laskari, A., de Kat, R., and Ganapathisubramani, B. (2016). Full-field pressure from snapshot and time-resolved volumetric PIV. *Experiments in Fluids*, 57(3):1–14.