Abstract Submitted
for the DFD14 Meeting of
The American Physical Society

Resolved measurements of the near-wall coherent structures GERRIT E. ELSINGA, Delft University of Technology, YOSHIFUMI JODAI, Kagawa National College of Technology, Japan — The 3D coherent structures in the near-wall region of a turbulent boundary layer have been measured by time-resolved tomographic PIV. The Reynolds number based on the friction velocity was 814. The measurement volume extended from the wall up to a y+ of 170, and it spanned 680x620 wall units in the streamwise and spanwise direction respectively. The spatial resolution was 16 wall units, which corresponds to 5-6 Kolmogorov length scales. This is considered sufficiently resolved as to infer the nature of the vortical structures, which is still the subject of some debate. Compared to earlier 3D experiments this new data offers much improved spatial resolution within a relatively large flow domain and allows to follow the structures as they develop in time. Visualizations of vortical motions reveal quasi-streamwise vortices near the low speed streaks consistent with some of the proposed models for the near wall region. However, we also find clear evidence of hairpins in this region. Moreover, a new hairpin is observed to develop upstream of one of the pre-existing hairpins creating what may be considered a hairpin packet. This suggests auto-generation mechanisms to be present in the fully turbulent boundary layer.

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Date submitted: 01 Aug 2014 Electronic form version 1.4