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Investigation of turbulent boundary layer structures using Tomographic PIV[1] NEELAKANTAN SAIKRISHNAN, ELLEN LONGMIRE, University of Minnesota, Twin Cities, BERND WIENEKE, LaVision Inc. — Tomographic particle image velocimetry (TPIV) data were acquired in the logarithmic region of a zero pressure gradient turbulent boundary layer flow at friction Reynolds number $Re_\tau = 1160$. Experiments were conducted in a suction type wind tunnel seeded with olive oil particles of diameter $\sim 1\mu$m. The volume of interest was illuminated by two Nd:YAG laser beams expanded with appropriate optics into sheets of 8mm thickness in the wall-normal direction (z). Images were acquired by four $2k$ x $2k$ pixel cameras, and correlation of reconstructed fields provided the full velocity gradient tensor in a volume of 0.7δ x 0.7δ x 0.07δ, which resolved the region $z^+ =$ 70-150 in the log layer. Various vortex identification techniques, such as Galilean decomposition and iso-surfaces of two- and three-dimensional swirl, were utilized to visualize and analyze the eddy structures present in instantaneous fields. The results of the present study will be compared to results from earlier experimental studies that relied on planar PIV data only to identify vortices and vortex packets as well as from a direct numerical simulation of fully developed channel flow at comparable Re_τ.

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