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3-D Flow Visualization of a Turbulent Boundary Layer[1] BRIAN THUROW, STEVEN WILLIAMS, KYLE LYNCH, Auburn University — A recently developed 3-D flow visualization technique is used to visualize large-scale structures in a turbulent boundary layer. The technique is based on the scanning of a laser light sheet through the flow field similar to that of Delo and Smits (1997). High-speeds are possible using a recently developed MHz rate pulse burst laser system, an ultra-high-speed camera capable of 500,000 fps and a galvanometric scanning mirror yielding a total acquisition time of 136 microseconds for a 220 x 220 x 68 voxel image. In these experiments, smoke is seeded into the boundary layer formed on the wall of a low-speed wind tunnel. The boundary layer is approximately 1.5" thick at the imaging location with a free stream velocity of 24 ft/s yielding a Reynolds number of 18,000 based on boundary layer thickness. The 3-D image volume is approximately 4" x 4" x 4". Preliminary results using 3-D iso-surface visualizations show a collection of elongated large-scale structures inclined in the streamwise direction. The spanwise width of the structures, which are located in the outer region, is on the order of 25 – 50% of the boundary layer thickness.

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