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Experimental investigation of turbulent sink flow boundary layers[1] PRANAV JOSHI, JOSEPH KATZ, Johns Hopkins University — Our objective is to study near wall structures in turbulent boundary layers on smooth walls under favorable pressure gradient. A sink flow is generated in a refractive index matched facility by means of an inclined upper wall. 2D-PIV measurements have been performed, initially at a coarse resolution of 320 μm, to characterize the mean flow and Reynolds stresses, for a constant acceleration parameter, $K=\nu dU/dx/U^2$, of 0.5 X10^{-6}. Re_θ drops from 5300 to 2600 over the 260 mm long accelerating range. Consistent with prior studies, acceleration thins the boundary layer. Trends of Reynolds stress vary in the literature. In our data, acceleration increases the magnitude of Reynolds stresses in outer parts of the boundary layer and decreases it in inner parts. An upsurge in all stresses occurs below 200 wall units in later stages of acceleration. When non-dimensionalized with local free-stream or friction velocity, the Reynolds stresses drop everywhere, except for an increase in <v'v'> and -<u'v'> below 200 wall units. We are following with higher resolution near wall measurements, and plan to acquire 3D data using holography in the near future.

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