Abstract Submitted
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Turbulence in Favorable pressure gradient (FPG) boundary layers[1] PRANAV JOSHI, JOSEPH KATZ, Johns Hopkins University — Our objective is to study the effect of favorable pressure gradient on near wall structures in a sink flow turbulent boundary layer over a smooth wall. 2D PIV measurements have been performed upstream of and within the region of constant acceleration parameter, $K{=}\nu dU/dx/U^2$, of $0.575\text{X}10^{-6}$. In the initial range, where K increases to its asymptotic value, all the Reynolds stresses and skin friction coefficient, c_f, decay. In the region of constant K, the stresses continue to decay in the outer layer, but c_f and all the Reynolds stress components increase close to the wall ($y/\delta{<}0.2$). The stresses collapse when scaled with the local freestream velocity, $U_0(\text{x})$. TKE production and wall normal transport of turbulence also scale with $U_0(\text{x})^3/\delta(\text{x})$ close to the wall. PIV data obtained in wall-parallel planes show the expected low speed streaks (LSS) bounded by large structures in the zero pressure gradient range. Narrower LSS persist also in the constant K area, but the signatures of large structures diminish. In both regions, small-scale structures, with signatures suggesting inclined quasi-streamwise vortex pairs, appear predominantly in the LSS areas, suggesting that they are preferred sites of turbulence production.

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