Abstract Submitted
for the DFD16 Meeting of
The American Physical Society

Distance-from-the-wall scaling in turbulent boundary layers RIO BAIDYA, JIMMY PHILIP, NICHOLAS HUTCHINS, JASON MONTY, IVAN MARUSIC, The University of Melbourne — An assessment of self-similarity in the inertial sublayer of turbulent boundary layers (TBL) is presented by simultaneously considering the streamwise and wall-normal velocities. Here, we utilise carefully conducted subminiature $\times$-probe experiments at high Reynolds number. Moreover, the turbulent stresses are compared against results from a synthetic flow where the distance-from-the wall (z-) scaling is strictly enforced, following the Attached Eddy Hypothesis. We show that not all stresses approach the asymptotic solution at an equal rate as the friction Reynolds number (Re_τ) is increased. Specifically, the motions which contribute to the wall-normal variance and Reynolds shear stress are found to follow the asymptotic solution at a relatively lower Re_τ even when the streamwise variance does not, and this trend is attributed to the contribution from attached eddies. Based on these findings, the Reynolds shear stress cospectra, through its z-scaling, are used to assess the wall-normal limits where self-similarity applies within the TBL. The limits are found to be consistent with the recent observations that the self-similar region starts and ends at viscous scaled wall-distances of $\mathcal{O}(\sqrt{Re_\tau})$ and $\mathcal{O}(Re_\tau)$ respectively.

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Date submitted: 02 Aug 2016 Electronic form version 1.4