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Large scale structures in a turbulent boundary layer and their imprint on wall shear stress[1] ROMMEL PABON, CASEY BARNARD, LAWRENCE UKEILEY, MARK SHEPLAK, University of Florida — Experiments were performed on a turbulent boundary layer developing on a flat plate model under zero pressure gradient flow. A MEMS differential capacitive shear stress sensor with a 1 mm $\times$ 1 mm floating element was used to capture the fluctuating wall shear stress simultaneously with streamwise velocity measurements from a hot-wire anemometer traversed in the wall normal direction. Near the wall, the peak in the cross correlation corresponds to an organized motion inclined 45° from the wall. In the outer region, the peak diminishes in value, but is still significant at a distance greater than half the boundary layer thickness, and corresponds to a structure inclined 14° from the wall. High coherence between the two signals was found for the low-frequency content, reinforcing the belief that large scale structures have a vital impact on wall shear stress. Thus, estimation of the wall shear stress from the low-frequency velocity signal will be performed, and is expected to be statistically significant in the outer boundary layer. Additionally, conditionally averaged mean velocity profiles will be presented to assess the effects of high and low shear stress.

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