Abstract Submitted
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Identification of the Viscous Superlayer on the Low-Speed Side of a Single-Stream Shear Layer[1] JOHN FOSS, JASON PEABODY, Michigan State University — Image pairs (elevation/plan views) have been acquired of a smoke streakline originating in the irrotational region on the low-speed side of a high Re single-stream shear layer of Morris and Foss (2003). The viscous superlayer (VSL) is identified as the terminus of the streak; 1800 such images provide VSL position statistics. Hot-wire data acquired concurrently at the shear layer edge and interior are used to investigate the relationship between these velocity magnitudes and the large-scale motions. Distinctive features (plumes) along the streakline are tracked between images to provide discrete irrotational region velocity magnitudes and material trajectories. A non-diffusive marker, introduced in the separating (high speed) boundary layer and imaged at $x/\theta_o = 352$, has revealed an unexpected bias in the streak-defined VSL locations. The interpretation of this bias clarifies the induced flow patterns in the entrainment region. The observations are consistent with a conception of the large-scale shear layer motions as "billows" of vortical fluid separated by re-entrant "wedges" of irrotational fluid, per Phillips (1972). Morris, S.C. and Foss, J.F. (2003). "Turbulent Boundary Layer to Single Stream Shear Layer: The Transition Region." Journal of Fluid Mechanics. Vol. 494, pp. 187-221. Phillips, O. M. (1972). "The Entrainment Interface." Journal of Fluid Mechanics. Vol. 51, pp. 97-118.

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