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Reexamination of the Classical View of how Drag-Reducing Polymer Solutions Modify the Mean Velocity Profile: Baseline Results¹ YASAMAN FARSIANI, JACQUELYNE BAADE, BRIAN ELBING, Oklahoma State University — Recent numerical and experimental data have shown that the classical view of how drag-reducing polymer solutions modify the mean turbulent velocity profile is incorrect. The classical view is that the log-region is unmodified from the traditional law-of-the-wall for Newtonian fluids, though shifted outward. Thus the current study reexamines the modified velocity distribution and its dependence on flow and polymer properties. Based on previous work it is expected that the behavior will depend on the Reynolds number, Weissenberg number, ratio of solvent viscosity to the zero-shear viscosity, and the ratio between the coiled and fully extended polymer chain lengths. The long-term objective for this study includes a parametric study to assess the velocity profile sensitivity to each of these parameters. This study will be performed using a custom design water tunnel, which has a test section that is 1 m long with a 15.2 cm square cross section and a nominal speed range of 1 to 10 m/s. The current presentation focuses on baseline (non-polymeric) measurements of the velocity distribution using PIV, which will be used for comparison of the polymer modified results. Preliminary polymeric results will also be presented.

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