Abstract Submitted
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Near-wall PTV measurements in a high-Reynolds-number flat-plate turbulent boundary layer[1] GHANEM F. OWEIS, American University of Beirut, ERIC S. WINKEL, MARC PERLIN, STEVEN L. CECCIO, DAVID R. DOWLING, University of Michigan — We report on near-wall particle-tracking velocimetry (PTV) measurements in the turbulent boundary layer that forms on a hydraulically smooth flat plate. The experiments were performed on a 13-m-long test model in the US Navy's W.B. Morgan Large Cavitation Channel at flow speeds up to 20 m/s for downstream-distance-based Reynolds numbers up to and exceeding 200 million. These measurements where made with three custom-built (hardware and software) PTV systems that nominally cover $0.1 < y+ < 200$ ($\sim$1 mm), and were deployed 1.96 m, 5.94 m, and 10.68 m from the test model's leading edge. The main design features of the PTV system are described including improved sensitivity to the vertical velocity component and accurate pinpointing of the wall's vertical location. Profiles of mean velocity and turbulence quantities are presented in addition to the wall shear stresses derived from the mean stream-wise velocity gradient near the wall, ($0.5 < y+ < 5.5$). These PTV results are compared with traditional velocimetry and shear stress measurements made with other instrumentation..

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