Abstract Submitted
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Turbulent flow field in the viscous sublayer: statistics and structures.[1] SANTOSH KUMAR SANKAR, Dept of Mechanical Eng & Saint Anthony Falls Lab, Univ of Minnesota, JIARONG HONG, Department of Mechanical Engineering & Saint Anthony Falls Lab, University of Minnesota — The study of wall-bounded turbulence has largely focused on the buffer and logarithmic regions above the wall. However, the need to unravel the effects of sublayer roughness structures on turbulence (Evans *et al.* PNAS 2018, 115, 1210-1214) requires measurements that can fully resolve the sublayer flow, which are challenging with current state-of-art techniques. Specifically, the spatial averaging effects of hot-film probes (along probe length) as well as particle image velocimetry (PIV) based experiments (across light sheet thickness) lead to large uncertainties when approaching the wall. Using digital Fresnel reflection holography (DFRH) introduced in Kumar *et al.* [Opt. Express 2018, 26(10), 12779-12789] which records backscattered signal from tracers, we can measure 3D flow fields within the viscous sublayer at high resolution. Such measurements enable us to observe and quantify meandering particle trajectories below 1 wall unit which indicating strong spanwise acceleration and an instantaneously linear streamwise velocity profile with varying slopes. In addition, the streamwise velocity PDF shows a positive skewness decreasing with wall normal distance and the limiting value of the streamwise turbulence intensity is higher than the ones reported from prior studies.

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