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Structures in the viscous sublayer and the prediction of wall shear stress.[1] SANTOSH KUMAR SANKAR, University of Minnesota, XINYI HUANG, XIANG YANG, Pennsylvania State University, JIARONG HONG, 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; Sirovich & Karlsson *Nature* 1997, 6644, 753-755) requires measurements that can fully resolve the flow within the viscous sublayer. Hot-film anemometry and particle image velocimetry, though widely used for such studies, introduce spatial averaging either along the length of probes for the former or the thickness of light sheet, for the latter. In contrast, by capturing holograms from backscattered light from tracer particles through Digital Fresnel Reflection Holography (DFRH), introduced in Kumar & Hong *Optics Express* 2018, 26(10), 12779-12789, we capture 3D flow within the viscous sublayer at high resolution. Our technique is able to resolve sub-viscous scale meandering motions which are typically not resolved by state-of-art direct numerical simulations (DNS). Furthermore, our experiment also measures a higher frequency of extreme wall shear stress events when compared to DNS, which can be traced to the limited spatial resolution in the streamwise and spanwise directions in the simulation.

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