Abstract Submitted
for the DFD16 Meeting of
The American Physical Society

Investigation of inner-outer interactions in a rough-wall turbulent boundary layer using time-resolved PIV[1] GOKUL PATHIKONDA, University of Illinois, Urbana-Champaign, KENNETH T. CHRISTENSEN, University of Notre Dame, Notre Dame — A turbulent boundary layer over hexagonally packed hemispherical roughness is investigated using time resolved PIV in a Refractive Index Matched (RIM) facility. Two cameras, with different fields of view and spatial resolutions, have been used to view the streamwise – wall normal plane. Matching the refractive index of the working fluid with that of the roughness model eliminates near-wall reflections of the light sheet, and enables measurements very close to the wall. The high-sampling rate ($dt \approx 3t^*$) and near-wall spatial resolution of first camera ($dx \times dy \approx 10^2 y^*$) capture small scales within the roughness sublayer. The large field of view ($X \times Y \approx 2\delta \times 1.2\delta$) of the second camera simultaneously captures the large scales away from the wall. The modulation influences of the outer large scales on the small scales within the roughness sublayer is explored, and compared with the literature investigating the same using hot-wire measurements. The rich spatio-temporal data available provides a new perspective of the inner-outer interactions, and provides a more direct way of observing the existing hypotheses (for e.g., Baars et al., 2015, Exp. Fluids, 56 : p188).

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Date submitted: 28 Jul 2016 Electronic form version 1.4