Abstract Submitted
for the DFD14 Meeting of
The American Physical Society

Comparison of the coherent structure of rough and smooth wall turbulent boundary layers at high Reynolds number DOUGAL SQUIRE, CHARITHA DE SILVA, University of Melbourne, MICHAEL SCHULTZ, United States Naval Academy, NICHOLAS HUTCHINS, IVAN MARUSIC, University of Melbourne — A comparison of structural aspects of the log- and wake-regions of smooth and rough wall zero pressure gradient turbulent boundary layers is presented at a friction Reynolds number of approximately 12,000. The roughness consists of P36 sandpaper, installed over the 54 m^2 working section in a continuous sheet. The results from four measurements are discussed, consisting of two eight-camera PIV arrangements above each surface. The field of view of both arrangements captures the full wall-normal extent of the boundary layer, but differs in the streamwise direction; one camera array captures a streamwise domain that spans approximately twice the boundary layer thickness; the other has a narrower streamwise extent in order to obtain an enhanced spatial resolution in the order of the Kolmogorov microscale. Combined, the two arrangements enable investigation of structural features with reasonably large streamwise dimension—using the large field of view data—and provide well resolved information on the wall-normal structure of the boundary layer—using the narrow field of view data. Generally, the data in the inertial dominated region confirm that the studied smooth and rough wall bounded flows are structurally similar, providing support for the outer-layer similarity hypothesis.

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Date submitted: 01 Aug 2014 Electronic form version 1.4