Abstract Submitted
for the DFD09 Meeting of
The American Physical Society

Turbulence Statistics Over 3D Roughness in a Turbulent Channel Flow[1] JIARONG HONG, JOSEPH KATZ, Johns Hopkins University, MICHAEL SCHULTZ, US Naval Academy — This study focuses on the near-wall flow field within a turbulent channel flow over a rough surface. Performing experiments in a facility containing a fluid with the same refractive index as the acrylic rough plate facilitates PIV measurements very near the wall. Presently, the flow in the vicinity of uniformly distributed 0.45mm high pyramids at Re_τ=3400-5418 is resolved at a vector spacing of 63um, ∼9 wall units. Data in a streamwise-wall-normal plane shows that below one roughness height, there is an upsurge of <u'u'>, and there are substantial spatial variations in <u'u'>, <u'v'> and <v'v'>, which rapidly diminish father from the wall. All Reynolds stress components peak above the forward face of roughness, with <v'v'> peaked slightly downstream of the others. The in-plane turbulent kinetic energy (TKE) production peaks deep in the roughness sublayer, especially near the pyramid crest. Both <u'u'> $\partial U/\partial x$ and -<u'v'> $\partial U/\partial y$ are significant contributors. Measurements in a streamwise-spanwise plane located within the roughness sublayer show spatial variability of <w'w'> and <u'w'>, and their contributions to TKE production.

[1]Sponsored by ONR

Jiarong Hong
Johns Hopkins University

Date submitted: 07 Aug 2009 Electronic form version 1.4