Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

On the dynamics in the vicinity of a shear layer of a recirculation bubble past a canopy patch WING LAI, DAN TROOLIN, TSI Incorporated Fluid Mechanics Research Instruments, JIN-TAE KIM, YAQING JIN, HONG LIU, LEONARDO CHAMORRO, Department of Mechanical Science and Engineering, University of Illinois, Urbana, IL, USA, DEPARTMENT OF MECHANICAL SCIENCE AND ENGINEERING, UNIVERSITY OF ILLINOIS, URBANA, IL, USA COLLABORATION, TSI COLLABORATION — The 3D dynamics of the flow around the shear layer above the recirculation bubble past a canopy patch was explored with time-resolved volumetric PIV in a refractive-index-matching channel. The tunnel was operated in a free surface mode with a flow depth 0.4 m. The canopy had a width 0.12 m and a spanned the cross section of the flume; it consisted of rectangular elements with square cross section of side 6.4 mm side and 37.5 mm height, placed in a staggered layout. The measurements were made using a volumetric system, assembled with three high-speed 4MP cameras. The region of interest (50ˆ3 mm3) was illuminated with a high-speed laser. Results revealed distinctive patterns characterized by periods of low, developing and intense mixing. These three types of motions modulated the coherence, and distribution of the energetic vortices. Each type is defined in terms of the spatial distribution of the stagnation points. In the low mixing, those were mostly located in a plane; conversely, the points were spatially distributed in the high mixing state. Velocity spectra revealed intense turbulence energy around the shear layer at a frequency consistent with a Strouhal number St=0.2, with the canopy height as length scale.

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Date submitted: 31 Jul 2017 Electronic form version 1.4