Abstract Submitted for the DFD14 Meeting of The American Physical Society

The evolution of the very large scale motions in pipe flow¹ LEO HELLSTRÖM, Princeton University, BHARATHRAM GANAPATHISUBRA-MANI, University of Southampton, ALEXANDER SMITS, Princeton University, Monash University — We present a dual-plane snapshot POD analysis of turbulent pipe flow at a Reynolds number of 94,000. The high-speed PIV data were simultaneously acquired in two planes, a cross-stream plane (2D-3C) and a streamwise plane (2D-2C) on the pipe centerline. The two light sheets were orthogonally polarized, allowing particles situated in each plane to be distinguished. The dual-plane data were conditionally-averaged based on the occurrence/intensity of a given crossstream snapshot POD mode. The conditionally-averaged modes reveal the streamwise extent and evolution of that particular cross-stream snapshot POD mode. A complex structure consisting of both wall-attached and detached large-scale structures is associated with the most energetic modes. The temporal evolution of these large-scale structures is examined using the time-shifted correlation of the crossstream snapshot POD coefficients, identifying the low energy intermediate modes responsible for the transition between the large-scale modes.

¹Supported under ONR Grant N00014-13-1-0174 and ERC Grant No. 277472

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Date submitted: 01 Aug 2014

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