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The 3D flow structure of puffs in transitional pipe flow JERRY WESTERWEEL, Delft University of Technology, CASIMIR VAN DOORNE, DIRK-JAN KUIK — Time-resolved stereo-PIV measurements were used to study the 3D flow structure of a puff in a pipe. At the trailing edge of the puff, where the laminar flow undergoes a transition to turbulence, pairs of counter rotating streamwise vortices result in large mushroom-like structures as seen in the LIF flow visualizations. The stereo-PIV system is used to take time- resolved measurements over the entire cross-section of the pipe. When time is converted to a spatial coordinate (assuming Taylor's hypothesis of 'frozen turbulence') we obtain the quasi- instantaneous flow structure of a turbulent puff. At the upstream end of the puff a quasi-periodic regeneration of streamwise vortices takes place. Initially the vortex structure resembles a travelling wave solution, but as the vortices propagate further into the turbulent region of the puff they continue to develop into strong hairpin vortices. The structure suggests a mechanism for the long persistence of these puffs.

Jerry Westerweel Delft University of Technology

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