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Large-scale coherent motion in turbulent pipe flow JERRY WESTERWEEL, TU Delft, SEBASTIAN GROSSE — Fully-developed turbulent pipe flow at bulk Reynolds numbers ranging from Re = 10 000 to 44 000 has been investigated experimentally using high-speed PIV in a plane perpendicular to the mean flow. A stereoscopic setup was used to enable the reconstruction of all three components of the entire azimuthal velocity field. The application of Taylor's hypothesis allowed to reconstruct the quasi-instantaneous streamwise extension of the flow field. Individual recording sequences cover more than 150 bulk scales based on the bulk velocity and the pipe radius such that even the largest expected streamwise extends of the flow structures are captured. The azimuthal flow field scaling was found to be consistent with results reported in previous studies. A steep decrease of azimuthal width towards values found in turbulent boundary layers could be observed at low Reynolds number indicating the near-wall region to be unaffected by the confinement of the pipe geometry. At wall distances $0.5 < y/R < 0.8$ azimuthal growth nearly stagnates. The large-scale coherent flow field at different wall-normal positions exhibits a very high instantaneous similarity. Streak-width distributions exhibit a flattening of the present azimuthal streak extensions throughout the logarithmic and wake region.

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