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Turbulent flow in a partially filled pipe HENRY NG, HOPE CREGAN, University of Liverpool, JONATHAN DODDS, National Nuclear Laboratory, ROBERT POOLE, DAVID DENNIS, University of Liverpool — Turbulent flow in a pressure driven pipe running partially full has been investigated using high-speed 2D-3C Stereoscopic Particle Imaging Velocimetry. With the field-of-view spanning the entire pipe cross section we are able to reconstruct the full three dimensional quasi-instantaneous flow field by invoking Taylor's hypothesis. The measurements were carried out over a range of flow depths at a constant Reynolds number based on hydraulic diameter and bulk velocity of $Re = 32,000$. In agreement with previous studies, the "velocity dip" phenomenon, whereby the location of the maximum streamwise velocity occurs below the free surface was observed. A mean flow secondary current is observed near the free surface with each of the counter-rotating rollers filling the half-width of the pipe. Unlike fully turbulent flow in a rectangular open channel or pressurized square duct flow where the secondary flow cells appear in pairs about a corner bisector, the mean secondary motion observed here manifests only as a single pair of vortices mirrored about the pipe vertical centreline.

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