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Velocimetry Analysis of 2D Turbulence Imaging Data from Beam Emission Spectroscopy[1] G.R. MCKEE, R.J. FONCK, Z. YAN, University of Wisconsin-Madison, C. HOLLAND, University of California San Diego — The time-resolved velocity field of density fluctuations contains pertinent dynamics on critical features of plasma turbulence, including zonal flow and geodesic acoustic mode behavior, and the $E \times B$ motion from underlying electrostatic potential fluctuations. This velocity field may be used to infer the Reynolds stress ($d < v_r^* v_\theta > /dr$), thought to drive zonal flows, and the radial turbulent particle flux. The beam emission spectroscopy (BES) system on DIII-D obtains radially and poloidally resolved images (up to 8x8) of density fluctuations at $\sim$1 cm resolution. The orthogonal dynamic programming method, developed in fluid dynamics, is used to extract the 2D flow field, $v(r, z, t)$ from the fluctuating densities. A vector-matching method determines structure motion from one frame to another. The technique will also be applied to density data from nonlinear GYRO simulations of turbulence, using an appropriate BES synthetic diagnostic. The inferred 2D density fluctuation velocity field will be compared with the $E \times B$ fluctuations also calculated from GYRO to discern their relationship and wavenumber sensitivity.

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