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PIV measurements of the velocity field in counter-rotating cylindrical Couette flow RENE VAN HOUT, Technion - IIT, JOSEPH KATZ, The Johns Hopkins University — An experimental investigation using Particle Image Velocimetry (PIV) was carried out to study the latitudinal planar velocity field in air counter-rotating cylindrical Couette flow at high Reynolds numbers. The facility consisted of two concentric cylinders with a radius ratio of $\eta = r_i/r_o = 0.55$ and aspect ratio $\Gamma = L/(r_o - r_i) = 11.2$. Measurements were done at two outer cylinder Reynolds numbers, R_o = -25,196 and -52,042 while the inner cylinder Reynolds number varied between R_i = 2,635 to 40,446. At constant R_o with increasing R_i, the mean azimuthal velocity profile became increasingly flatter over most of the annulus with a strong shear layer near the cylinder wall. The radius at which U_θ changed sign moved away from the inner cylinder. Plotted against inner wall coordinates, the azimuthal velocity profile displayed log law behavior albeit with increased values of κ and B as R_i was increased. Normalized rms values of the azimuthal fluctuating velocity component and Reynolds stresses peak near to the wall. Magnitudes increase and become more significant over the whole width of the annulus as R_i increased. Higher moments display double peaks. Holding the inner cylinder rotation speed constant while increasing the outer cylinder speed strongly influenced the radial profiles of turbulent stresses.

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