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Cinematic Characterization of Convected Coherent Structures Within an Continuous Flow Z-Pinch[1] THOMAS UNDERWOOD, JESSE RODRIGUEZ, KEITH LOEBNER, MARK CAPPELLI, Stanford University — In this study, two separate diagnostics are applied to a plasma jet produced from a coaxial accelerator with characteristic velocities exceeding 10^5 m/s and timescales of ~ 10 μs. In the first of these, an ultra-high frame rate CMOS camera coupled to a Z-type laser Schlieren apparatus is used to obtain flow-field refractometry data for the continuous flow Z-pinch formed within the plasma deflagration jet. The 10 MHz frame rate for 256 consecutive frames provides high temporal resolution, enabling turbulent fluctuations and plasma instabilities to be visualized over the course of a single pulse. The unique advantage of this diagnostic is its ability to simultaneously resolve both structural and temporal evolution of instabilities and density gradients within the flow. To allow for a more meaningful statistical analysis of the resulting wave motion, a multiple B-dot probe array was constructed and calibrated to operate over a broadband frequency range up to 100 MHz. The resulting probe measurements are incorporated into a wavelet analysis to uncover the dispersion relation of recorded wave motion and furthermore uncover instability growth rates. Finally these results are compared with theoretical growth rate estimates to identify underlying physics.

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