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High-Energy Ion Acceleration Mechanisms in a Dense Plasma Focus Z-Pinch D.P. HIGGINSON, A. LINK, A. SCHMIDT, LLNL, D. WELCH, Voss — The compression of a Z-pinch plasma, specifically in a dense plasma focus (DPF), is known to accelerate high-energy electrons, ions and, if using fusion-reactant ions (e.g. D, T), neutrons. The acceleration of particles is known to coincide with the peak constriction of the pinch, however, the exact physical mechanism responsible for the acceleration remains an area of debate and uncertainty. Recent work has suggested that this acceleration is linked to the growth of an m=0 (sausage) instability that evacuates a region of low-density, highly-magnetized plasma and creates a strong (>MV/cm) electric field. Using the fully kinetic particle-in-cell code LSP in 2D-3V, we simulate the compression of a 2 MA, 35 kV DPF plasma and investigate in detail the formation of the electric field. The electric field is found to be predominantly in the axial direction and driven via charge-separation effects related to the resistivity of the kinetic plasma. The strong electric and magnetic fields are shown to induce non-Maxwellian distributions in both the ions and electrons and lead to the acceleration of high-energy tails. We compare the results in the kinetic simulations to assumptions of magnetohydrodynamics (MHD). Prepared by LLNL under Contract DE-AC52-07NA27344.

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