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The Effect of Driver Rise-Time on Pinch Current and its Impact on Plasma Focus Performance and Neutron Yield[1] JASON SEARS, ANDREA SCHMIDT, ANTHONY LINK, Lawrence Livermore National Laboratory, DALE WELCH, Voss Scientific — Experiments have suggested that dense plasma focus (DPF) neutron yield increases with faster drivers [Decker NIMP 1986]. Using the particle-in-cell code LSP [Schmidt PRL 2012], we reproduce this trend in a kJ DPF [Ellsworth 2014], and demonstrate how driver rise time is coupled to neutron output. We implement a 2-D model of the plasma focus including self-consistent circuit-driven boundary conditions. Driver capacitance and voltage are varied to modify the current rise time, and anode length is adjusted so that run-in coincides with the peak current. We observe during run down that magnetohydrodynamic (MHD) instabilities of the sheath shed blobs of plasma that remain in the inter-electrode gap during run in. This trailing plasma later acts as a low-inductance restrike path that shunts current from the pinch during maximum compression. While the MHD growth rate increases slightly with driver speed, the shorter anode of the fast driver allows fewer e-foldings and hence reduces the trailing mass between electrodes. As a result, the fast driver postpones parasitic restrikes and maintains peak current through the pinch during maximum compression. The fast driver pinch therefore achieves best simultaneity between its ion beam and peak target density, which maximizes neutron production.

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