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The Role of the Driver Circuit in the Neutron Yield of the Plasma Focus[1] JASON SEARS, ANDREA SCHMIDT, ANTHONY LINK, Lawrence Livermore National Laboratory, DALE WELCH, Voss Scientific — Emperical observations have suggested that dense plasma focus (DPF) neutron yield increases with driver impedance. Using the particle-in-cell code LSP [1], we reproduce this trend in a kJ DPF [2], and demonstrate in detail how driver impedance is coupled to neutron output. We implement a 2-D model of the plasma focus including self-consistent circuit-driven boundary conditions. We show that m=0 growth is central to beam formation and is a chaotic, non-deterministic process. Neutrons are produced when high, short-lived electric fields in the low-density cavity of an m=0 mode accelerate a beam of ions into the dense downstream pinch region. Neutron yield is highest when the ion beam is generated within 50 ns of the pinch formation on axis, because at that time the pinch (target) density is highest. High driver impedance contributes to prompt beam formation in two ways. First, the high impedance driver, losing less energy to run-down, has a faster run-in velocity and hence larger Rayleigh-Taylor features that more readily seed the m=0 instability. Second, the shorter anode of the high-impedance driver retains less trailing mass in the run-down region and thus exhibits fewer and less parasitic restrikes.

[1] A. Schmidt, V. Tang, D. Welch, PRL, 2012
[2] J. Ellsworth, RSI, 2014

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