Abstract Submitted
for the DPP19 Meeting of
The American Physical Society

Establishing the physics design basis for dynamic screw pinch implosions on the Z Facility[1] GABRIEL SHIPLEY, CHRISTOPHER JENNINGS, PAUL SCHMIT, DAVID YAGER-ELORRIAGA, MATTHEW WEIS, Sandia National Laboratories — Magnetically imploding cylindrical metallic shells (liners) containing preheated, premagnetized fusion fuel has proven effective at producing thermonuclear plasma conditions [1] but suffers from magneto-Rayleigh-Taylor instabilities (MRTI) that limit the attainable density, temperature, and pressure in the fuel. A novel method proposed by Schmit et al. [2] uses a helical magnetic drive field that dynamically rotates during implosion, reducing (linear) MRTI growth via a solid liner dynamic screw pinch (SLDSP) effect. Our work explores the design features necessary for successful experimental implementation of this concept. SLDSP uses a helical drive field at the liner outer surface generated via helical return-current posts, resulting in enhanced average magnetic pressure per unit drive current, mild spatial non-uniformities in the magnetic drive pressure, and augmented static initial inductance in the pulsed-power drive circuit. These topics have been investigated using transient magnetic and magnetohydrodynamic simulations and the results have led to a credible design space for dynamic screw pinch experiments on the Z Facility. [1] Gomez et al., Phys. Rev. Lett. 113, 155003 (2014). [2] Schmit et al. Phys. Rev. Lett. 117, 205001 (2016).

[1]Funded by the NNSA, Grant No. DE-NA0003864 and by the Sandia National Laboratories LDRD program, Project Nos. 195306 and 200269

Gabriel Shipley
Sandia National Laboratories

Date submitted: 29 Jun 2019 Electronic form version 1.4