Abstract Submitted
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Staged Z-pinch Simulations for the UNR, Nevada Terawatt Zebra Facility[1] PAUL NEY, HAFIZ RAHMAN, FRANK WESSEL, Magneto-Inertial Fusion Technologies, Inc., JEFF NARKIS, JULIO VALENZUELA, FARHAT BEG, University of California, San Diego, RADU PRESURA, Voss Scientific, LLC, TIM DARLING, ERIK MCKEE, AARON COVINGTON, University of Nevada, Reno — We simulate a Staged Z-pinch[2] imploded on the 1 MA, 130 ns, 100 kJ, Nevada Terawatt Zebra Facility. The load is a magnetized, cylindrical, double gas-puff, plasma liner imploding onto a plasma target. Simulations use the 2-1/2 D, radiation-MHD code, MACH2. Three different liner gases are evaluated: Ar, Kr, and Xe and the target is either: DD, or DT, with a liner-plasma radius of: 1.0 cm and 2.0 cm, and a 5.0-mm thickness. Initial conditions are optimized to produce the highest neutron yield. Shocks propagate at different speeds in the liner and target, leading to a shock front at the interface. Magnetosonic shock waves pre-heat the target plasma and provide a stable implosion. The shock front provides a secondary conduction channel which builds up during implosion. The axial magnetic field controls the MRT instability and traps α-particles, leading to ignition. Magnetic flux is compressed, and at peak parameters the magnetic field and current density exceed, by an order of magnitude, values outside the pinch, providing a magneto-inertial confinement. A smaller radius provides $10^2 - 10^3\times$ higher neutron yield.

[1]Funded by the US Department of Energy, ARPA-E, Control Number 1184-1527
[2]H. U. Rahman, F. J. Wessel, and N. Rostoker. Staged Z-pinch. PRL, 74:714, 1995

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