Abstract Submitted
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Design and optimization of a gas-puff nozzle for staged Z-pinch experiments using computational fluid dynamics simulations[1] J.C. VALENZUELA, I. KRASHENINNIKOV, F.N. BEG, University of California, San Diego, F. WESSEL, H. RAHMAN, P. NEY, Magneto-Inertial Fusion Technologies, Inc, R. PRESURA, Voss Scientific, LLC, E. MCKEE, T. DARLING, A. COVINGTON, University of Nevada, Reno — Previous experimental work on staged Z-pinches demonstrated that gas liners can efficiently couple energy and implode uniformly a target-plasma. A 1.5 MA, 1 μs current driver was used to implode a magnetized, Kr liner onto a D+ target, producing 10^{10} neutrons per shot and providing clear evidence of enhanced pinch stability. Time-of-flight data suggest that primary and secondary neutrons were produced. MHD simulations show that in Zebra, a 1.5MA and 100ns rise-time current driver, high fusion gain can be attained when the optimum liner and plasma target conditions are used. In this work we present the design and optimization of a liner-on-target nozzle to be fielded in Zebra and demonstrate high fusion gain at 1 MA current level. The nozzle is composed of an annular high atomic number gas-puff and an on-axis plasma gun that will deliver the ionized deuterium target. The nozzle optimization was carried out using the computational fluid dynamics (CFD) code fluent and the MHD code Mach2. The CFD simulation produces density and temperature profiles, as a function of the nozzle shapes and gas conditions, which are then used in Mach2 to find the optimum plasma liner implosion-pinch conditions.

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Julio C. Valenzuela
University of California, San Diego

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