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Using a Z-pinch precursor plasma to produce a cylindrical, hotspot ignition, ICF JEREMY CHITTENDEN, PETER VINCENT, CHRISTOPHER JENNINGS, ANDREA CIARDI, Imperial College — We show that if the same precursor plasma that exists in metal wire arrays can be generated with a Deuterium-Tritium plasma then this precursor provides an ideal target for a cylindrical magneto-inertial ICF scheme. The precursor is generated from a fraction of the mass of the array which arrives on the axis early in time and remains confined at high density by the inertia of further material bombarding the axis. Later on, the main implosion of the DT Z-pinch produces a dense, low temperature shell which compressively heats the precursor target to high temperatures and tamps its expansion. The azimuthal magnetic field in the hotspot is sufficient to reduce the Larmor radius for the alpha particles to much less than the hotspot size, which dramatically reduces the ρR required for ignition. A computational analysis of this approach is presented, including a study of the thermonuclear burn wave propagation. The robustness of the scheme with respect to instabilities, confinement time and drive parameters is examined. The results indicate that a high energy gain can be achieved using Z-pinches with 50-100 MA currents and a few hundred nanosecond rise-times. This work was partially supported by the U.S. Department of Energy through cooperative agreement DE-FC03-02NA00057.

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