Target Physics Scaling for Z-Pinch Inertial Fusion Energy

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Recent improvements in the technology of fast pulsed electrical power and load design have led to a growing interest in the use of fast z-pinches as x-ray sources for inertial confinement fusion (ICF) energy applications[1]. Fast z-pinch implosions of a high-Z plasma can efficiently convert the stored electrical energy in a pulsed power accelerator into high temperature dense plasmas that radiate as soft x-ray sources. In *dynamic hohlraum* x-ray sources, cylindrical arrays of tungsten wires are used to form a z-pinch imploding plasma shell[2], which generates and traps x-rays as it as it stagnates on a low opacity cylindrical target centered on the z-pinch axis. The trapped radiation can be either directed out of the *dynamic hohlraum* and into a *static-walled hohlraum* (as has been demonstrated in the experiments described in Ref. 3), or can be used to directly implode an ICF capsule located within the *dynamic hohlraum* (as has been demonstrated in the experiments described in Ref. 4). In recent experiments, ~ 10^{10}-10^{11} D-D neutrons have been produced via the implosion of a capsule located directly within a *dynamic hohlraum*[4]. In the present paper, we will provide descriptions of the ongoing ICF experiments, concepts for future ignition and high yield target designs, and an evaluation of the ICF target physics and z-pinch scalings required for the eventual development of a high gain Z-pinch IFE target.

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