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Target design for high fusion yield with the double Z-pinch-driven hohlraum.[1]

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A key demonstration on the path to inertial fusion energy is the achievement of high fusion yield (hundreds of MJ) and high target gain. An indirect-drive high-yield inertial confinement fusion (ICF) target involving two z-pinch x-ray sources heating a central secondary hohlraum is described by Hammer, Tabak, Wilks, et al. [*Phys. Plasmas* **6**, 2129 (1999)]. In subsequent research at Sandia National Laboratories, we have developed theoretical/computational models and performed an extensive series of validation experiments to study hohlraum energetics, capsule coupling, and capsule implosion symmetry. We are using these models to design a 0.5 GJ yield z-pinch-driven ICF target that incorporates the latest experience in capsule design, hohlraum symmetry control, and x-ray production by z-pinches. An x-ray energy output of 8-9 MJ per pinch, suitably pulse-shaped, is sufficient for this concept to drive 0.3-0.5 GJ capsules. Integrated 2D hohlraum/capsule LASNEX radiation-hydrodynamics simulations have demonstrated adequate hohlraum coupling, radiation symmetry control, and the successful implosion, ignition and burn of a 0.5 GJ ICF capsule. An important new feature of this target design is mode-selective symmetry control: the use of burnthrough shields offset from the capsule that selectively tune certain low-order asymmetry modes (P_2, P_4) without significantly perturbing higher-order modes. This talk will describe the capsule and hohlraum design that have produced 0.5 GJ yields in 2D simulations, as well as provide a preliminary design of the z-pinch load and accelerator requirements necessary to drive the system. In collaboration with M. C. Herrmann, R. W. Lemke, G. R. Bennett, R. B. Campbell, P. J. Christenson, M. E. Cuneo, M. P. Desjarlais, T. A. Mehlhorn, J. L. Porter, D. B. Sinars, S. A. Slutz, W. A. Stygar, E. P. Yu, and J. H. Hammer (LLNL).

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