Abstract Submitted
for the DPP05 Meeting of
The American Physical Society

High-Density and High-ρR Fuel Assembly for Fast-Ignition Inertial Confinement Fusion R. BETTI, C. ZHOU, Fusion Science Center for Extreme States of Matter and Fast Ignition Physics and Laboratory for Laser Energetics, U. of Rochester — Scaling relations to optimize implosion parameters for fast-ignition inertial confinement fusion are derived and used to design fast-ignition targets relevant to direct-drive inertial fusion energy (IFE). A method to assemble thermonuclear fuel at high densities, at high ρR, and with a small-size hot spot is presented. Massive cryogenic shells can be imploded with a low implosion velocity V_I on a low adiabat α using the relaxation-pulse technique.[1] While the low V_I yields a small hot spot, the low α leads to large peak values for the density and areal density. It is shown that a 750-kJ laser can assemble fuel with $V_I \approx 1.7 \times 10^7$ cm/s, $\alpha \approx 0.7$, $\rho \approx 400$ g/cc, $\rho R \approx 3$ g/cm^2, and a hot-spot volume less than 10% of the compressed core. If fully ignited, this fuel assembly can produce yields of ~150, of interest to IFE applications. This target can also be shock-ignited with a 250-kJ laser-driven spherically convergent shock yielding a gain exceeding 120. This work has been supported by the U.S. Department of Energy under Cooperative Agreement ER54789 and DE-FC52-92SF19460.

[1]R. Betti *et al.*, Phys. Plasmas **9**, 2277 (2002).

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Date submitted: 21 Jul 2005 Electronic form version 1.4