Abstract for an Invited Paper
for the DPP06 Meeting of
The American Physical Society

Direct-drive laser target designs for sub-MJ energies[1]

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New direct-drive laser target designs with KrF laser light take advantage of the shorter wavelength by lowering the laser energy required for substantial gain (>20 -30) to sub-MJ levels. These low-energy pellets are useful in systems that form an intermediate step towards fusion energy, such as the proposed Fusion Test Facility [1]. Aside from the lower energy, these designs are similar to previous designs [2]. The short wavelength laser allows higher intensity (and higher pressure) without increasing the risk of laser-plasma instabilities. The higher pressure in turn allows higher velocities (of the order of 4×10^7 cm/s) to be achieved while keeping the low pellet aspect ratios required for hydrodynamic stability. The canonical laser energy has been chosen to be 500 kJ. Target designs will be presented and both 1D and 2D simulation results will be shown, and the customary trade-off of gain for stability will be analyzed. Recently developed strategies for improving both gain and stability [3] are combined with recently developed numerical techniques for minimizing noise in the multi-dimensional code [4], allowing full high-resolution simulations of the entire implosion. The sensitivity of these targets to both low- mode (e.g., beam geometry, power imbalance, surface finish) and high mode (pellet uniformity, laser imprint) perturbations will be examined. This paper will show that significant gain can be achieved for these targets even in the presence of hydrodynamic stabilities.

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[3] K.Anderson and R.Betti, Phys. Plasmas **10**, 4448 (2003); V.Goncharov et al, Phys. Plasmas **10**, 1906 (2003)
[4] S.Zalesak et al, Phys. Plasmas **12**,056311 (2005)

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[1]Work supported by USDOE.