Design Studies of Ultra-High Hohlraum-Capsule Coupling Efficiency Experiments for the NIF*

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In indirect-drive inertial confinement fusion a high-*Z* cylindrical enclosure (or "hohlraum") surrounds a low-Z capsule containing DT fuel. Laser beams irradiate the interior of the hohlraum through a pair of laser entrance holes, creating an x-ray radiation bath that compresses the fuel to ignition conditions. The coupling of laser light to the capsule is typically ~10%, resulting in ~200 kJ absorbed energy for the ~2 MJ-scale laser at the National Ignition Facility (NIF). A new hohlraum design has been found that can accommodate ~50% larger capsules for up to 3× more capsule absorbed energy and ~30% coupling efficiency. This new design uses two truncated, conically-shaped hohlraum halves that join above the capsule equator to provide a large volume for fitting a larger (1.5 mm radius) capsule and facilitating laser beam propagation over the entire laser pulse duration. Integrated hohlraum simulations in 2-D show good control of x-ray drive asymmetry with peak radiation temperatures reaching 295 eV at 1.8 MJ of laser energy. The potential for nearly tripling the capsule absorbed energy translates into a similar increase in performance margin, thereby improving the prospects for achieving ignition on the NIF. Backscatter of the laser light at late time when the laser is at peak intensity and the hohlraum has filled with plasma is a common risk with indirect drive, but a simulation post-processor (LIP) used to estimate linear instability growth rates predicts benign levels. Further analysis of the potential for laser-plasma interactions in the nonlinear regime will be reported using particle-in-cell simulations with the OSIRIS [1] code, the laser beam propagation code PF3d [2] and the 2D Vlasov Fokker-Planck code K2 for modelling hot electron transport.

[1] R.A. Fonseca, Plasma Phys. Cont. Fus., **50**, 124034 (2008).

[2] R.L. Berger *et al*., Phys. Rev. Lett. **75** (6), 1078 (1995).

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