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BigFoot, a program to reduce risk for indirect drive laser fusion*

CLIFF THOMAS, Lawrence Livermore National Laboratory

The conventional approach to inertial confinement fusion (ICF) is to maximize compressibility, or, total areal density. To achieve high convergence (40), the laser pulse is shaped to launch a weak first shock, which is followed in turn by 2-3 stronger shocks. Importantly, this has an outsized effect on integrated target physics, as the time it takes the shocks to transit the shell is related to hohlraum wall motion and filling, and can contribute to difficulties achieving an implosion that is fast, tunable, and/or predictable. At its outset, this approach attempts to predict the tradeoff in capsule and hohlraum physics in a case that is challenging, and assumes the hotspot can still reach the temperature and density necessary to self-heat (4-5 keV and 0.1-0.2 g/cm^2, respectively). Here, we consider an alternate route to fusion ignition, for which the benefits of predictability, control, and coupling could exceed the benefits of convergence. In this approach we avoid uncertainty, and instead, seek a target that is predictable. To simplify hohlraum physics and limit wall motion we keep the implosion time short (6-7 ns), and design the target to avoid laser-plasma instabilities. Whereas the previous focus was on density, it is now on making a 1D hotspot at low convergence (20) that is robust with respect to alpha heating (5-6 keV, and 0.2-0.3 g/cm^2). At present, we estimate the tradeoff between convergence and control is relatively flat, and advantages in coupling enable high velocity (450-500 um/ns) and high yield (1E17). Were the approach successful, we believe it could reduce barriers to progress, as further improvements could be made with small, incremental increases in areal density. Details regarding the "BigFoot" platform and pulse are reported, as well as initial experiments. Work that could enable additional improvements in laser power, laser control, and capsule stability will also be discussed. *This work was performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under Contract DE-AC52-07NA27344.