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The high velocity, high adiabat, "Bigfoot" campaign and tests of indirect-drive implosion scaling

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To achieve hotspot ignition, inertial confinement fusion (ICF) implosions must achieve high hotspot internal energy that is inertially confined by a dense shell of DT fuel. To accomplish this, implosions are designed to achieve high peak implosion velocity, good energy coupling between the hotspot and imploding shell, and high areal-density at stagnation. However, experiments have shown that achieving these simultaneously is extremely challenging, partly because of inherent tradeoffs between these three interrelated requirements. The Bigfoot approach is to intentionally trade off high convergence, and therefore areal-density, in favor of high implosion velocity and good coupling between the hotspot and shell. This is done by intentionally colliding the shocks in the DT ice layer. This results in a short laser pulse which improves hohlraum symmetry and predictability while the reduced compression improves hydrodynamic stability. The results of this campaign will be reviewed and include demonstrated low-mode symmetry control at two different hohlraum geometries (5.75 mm and 5.4 mm diameters) and at two different target scales (5.4 mm and 6.0 mm hohlraum diameters) spanning 300-430 TW in laser power and 0.8-1.7 MJ in laser energy. Results of the ˜10% scaling between these designs for the hohlraum and capsule will be presented. Hydrodynamic instability growth from engineering features like the capsule fill tube are currently thought to be a significant perturbation to the target performance and a major factor in reducing its performance compared to calculations. Evidence supporting this hypothesis as well as plans going forward will be presented. Ongoing experiments are attempting to measure the impact on target performance from increase in target scale, and the preliminary results will also be discussed.
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