Advanced Hohlraum Designs to Improve Capsule Coupling*

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Experiments conducted on the National Ignition Facility (NIF) have been limited to inferred capsule absorbed energies of less than ~200 kJ. The main reason for this limitation is that the capsule must be small enough to allow late-time passage for the inner beams to control drive symmetry. A related constraint is that the hohlraum wall "bubble" created by the outer beams can also impede propagation of the inner beams to the mid-plane of the hohlraum near the time of peak power. The strategy recently adopted is to use shorter pulses and lower hohlraum gas fills to reduce laser backscatter and unidentified drive losses [1]. Despite the improved hohlraum drive efficiency, the limiting factor in capsule coupling remains the loss of late-time drive symmetry from impaired propagation of the inner beams [2].

To overcome this constraint in capsule coupling, three research directions are being pursued: (1) shorten the path lengths of the inner beams with highly non-standard hohlraum geometries, (2) delay the interaction of the capsule and wall blow-off with the inner beams by varying the hohlraum shape and laser beam configurations, and (3) implement measures for reduced wall motion and laser-entrance-hole (LEH) closure. Non-standard hohlraum geometries include the "midraum" [3], where the inner beams enter the hohlraum through a set of auxiliary LEHs placed around the hohlraum mid-plane, and the "ballraum", which is a pair of nested spherical hohlraums having two annular LEHs. The benefit of the midraum is that the path lengths of the inner beams are severely shortened to reduce the risk of impaired propagation, but the challenge is keeping the mid-plane LEHs open for the duration of the laser pulse. The ballraum has the advantage of shielding the capsule from views of the LEHs and the laser spots, providing a preferred LTE radiation environment for the capsule. The drawback of the ballraum concept is that the transport of drive radiation around the edges of the two inner spherical shields is simulated to be inefficient unless perforations are strategically used. A promising approach to delaying the interaction of the inner beams with the capsule blow-off and hohlraum wall bubble includes the use of a large diameter (7 mm) super-ellipse hohlraum shape (Lame′ parameter = 2.5) with split quads and half-sized phase plates. The techniques for controlling wall motion and LEH closure respectively consist of the use of low-density annular foams and low-Z on-axis wires [4] that provide a back pressure to the ablating high-Z material for reduced wall motion. The overarching goal is to nearly double the absorbed capsule energy using a combination of optimized hohlraum geometry and techniques to delay hohlraum filling and LEH closure. The strategy is similar to a new campaign on the NIF with double-shell targets to demonstrate up to 700 kJ absorbed energy in the outer shell by using oversized targets and 4-5 ns reversed-ramp laser pulse shapes at 2 MJ with 3ω light.

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[2] S. Le Pape *et al*., *Physics of Plasmas* **23**, 056311 (2016).

[3] O.S. Jones *et al*., *Bull. Am. Phys. Soc.* **60**(19), 2015 (http://meetings.aps.org/link/BAPS.2015.DPP.UO7.1)

[4] M. Tabak, private communication (2016).

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