Frustraum 1050 campaign on the National Ignition Facility

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Abstract

The goal of the Frustraum 1050 campaign is to reduce hohlraum energy losses by approximately 10% compared to current cylindrical implosions, using a frustraum hohlraum design [1–4] to couple more energy into the capsule while maintaining symmetry control. Compared to previous frustraum designs, the frustraum geometry has been modified: its overall length and width near the LEH planes have each been increased by 5%. Increasing the diameter where the outer beams hit the wall increases the distance the gold bubble has to travel and increasing the time over which P2 control can be maintained. To address the lower overall surface area of earlier designs, the central portion of the frustraum has been replaced with a circular arc spanning -3.2 mm $< z < 3.2$ mm. Additionally, the capsule's inner radius has been reduced from 1.1 mm to 1.05 mm, making low-order mode control easier and decreasing areal density asymmetry in the shell, according to simulations. These improvements in hohlraum efficiency correspond to an equivalent increase in effective laser energy and power, enabling exploration of a parameter space that is currently inaccessible with the existing National Ignition Facility (NIF) laser, i.e. > 440TW and >1.9 MJ. The Frustraum 1050 campaign uses a HyE-like pulse shape [5].

We report on the experimental tuning campaign leading up to a Tritium-Hydrogen-Deuterium (THD) layered implosion on the NIF, demonstrating the campaign's enhanced efficiency and symmetry control. We discuss techniques employed to reduce P4 asymmetries through beam staggering in the foot and to minimize backscatter using quad splitting of the outers and 30-degree cones. Finally, we include a comparison to previous HyE experiments conducted at higher energies and powers.

References

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