SIMULATIONS OF SYMCAP AND LAYERED NIF EXPERIMENTS WITH TOP/BOTTOM LASER ASYMMETRY TO IMPOSE P1 DRIVE ON CAPSULES

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We discuss integrated hohlraum/capsule post-shot simulations of a sub-scale cryogenic DT-filled symcap experiment and a full-scale cryogenic layered-DT experiment with top/bottom laser asymmetries. This drive asymmetry (of 16% in the symcap case, and 8% in the cryogenic layered-DT case), resulted in an imposed P1 drive on the capsules to give downward velocities of order 50 km/s as measured by neutron time of flight (NTOF) diagnostics and x-ray imagers. The symcap experiment used an adiabat-shaped laser pulse and the layered experiment used a HiFoot-shaped laser pulse. Compared to a control shot the symcap with drive asymmetry had a DT yield reduction of approximately 5%. In contrast, the layered experiment had a 30% reduction in DT yield compared to the average of two comparable shots without drive asymmetry. In addition to yield, the neutron activation diagnostics (NADs) measure implosion areal density variations. They show a clear indication of higher areal density in the direction of the north pole compared to other directions for both shots with drive asymmetry. The layer experiment had a significantly smaller down scatter ratio (DSR) with a value of 2.6% compared to the two comparable shots without drive asymmetry with DSRs of 4.1 and 4.0% as well as having a different angular distribution. This drop and change in angular distribution was consistent with expectation.

The integrated hohlraum/capsule post-shot simulations use measured laser powers for all quads. Backscatter data is only available on a subset of inner and outer beams in the bottom half of the NIF chamber. We assume that the backscatter power scales with laser power to estimate the backscatter for the top beams. Separate plasma conditions at the upper and lower hohlraum laser entrance holes (LEHs) are used to calculate the crossbeam energy transfer between the outer and inner beams. The same saturation model for crossbeam transfer and laser-drive multipliers that give good agreement with data on x-ray emission shape and bang times on the control shots were used for the corresponding shots with drive asymmetry.

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