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Symmetry Tuning for Ignition Capsules via the Symcap Technique[1]

GEORGE KYRALA, Los Alamos National Laboratory

Achieving ignition requires control over many parameters for an imploding capsule symmetry being a key parameter to control. The primary technique used to determine the implosion symmetry at the peak of an ignition pulse on the National Ignition Facility (NIF) is the symcap. A symcap is a surrogate capsule that replaces the DT fuel layer by an equivalent mass of ablator to mimic the hydrodynamic behavior of the capsule. The x-ray self-emission signature from the implosion correlates well with an ignition capsule's core shape. Experiments at Omega and NIF demonstrate the ability of this technique to tune capsules' symmetry in ignition relevant conditions. At Omega we used CH and Be symcaps in ignition scale hohlraum to demonstrate tuning at parameters matching the foot of an ignition pulse. These experiments are the first to demonstrate tuning of the capsule by beam phasing in which symmetry control is achieved by varying the relative power between an inner and an outer cone of laser beams having the same basic geometry as the NIF. Experiments at NIF also demonstrate symmetry control using beam phasing with symcaps in full-scale ignition targets with shaped laser pulse having ignition relevant energies, $\sim$840 kJ. The current plans is to extend this technique to cryogenically filled Tritium-Hydrogen-Deuterium (THD) capsule implosions, where deuterium is replace by mostly tritium to reduce the neutron yield. THDs make better emulators for ignition capsules since they have the same convergence and some variable fusion burn.

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