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First Detailed Diagnosis of Double Shell Collision under Realistic Implosion Conditions[1]

GEORGE KYRALA, Los Alamos National Laboratory

Double shell implosions provide a non-cryogenic path to inertial confinement fusion [ICF]. In the double shell target the laser energy is absorbed in an outer shell that is accelerated inward which then, after the laser is off, collides with an inner shell that implodes against the deuterium fuel. However the design of these ICF capsules depend on a many step process to achieve the ignition. One of these processes is the symmetric collision of the outer shell with an inner shell. This requires that the shells must be illuminated and built symmetrically. In reality the targets are complicated and the construction is not symmetric, due to the seam that our current assembly method requires. Furthermore, in order to diagnose the symmetry of the implosion and the hydrodynamics, radiography of the shells are required. This places a significant requirement on the x-ray energy in the backlighter. Using the OMEGA laser, we have designed an illumination strategy that uses 40 beams in an offset geometry, leaving 20 beams to perform radiography from two different directions. This places an artificially significant non-symmetric illumination that may not exist in final targets shot on the NIF. We will present the first measurement of the time history of a collision of two shells in a double shell capsule. We will briefly review the illumination geometry, give the results of the measurements of the trajectory of the outer and inner shells, and compare the results with calculations. We will also present data on the measured symmetry of the outer and inner shell implosions, and if time permits we will present some of the data on the development of the seam in the capsule and its effect on the inner shell implosion. This is the first measurement of such a collision in a spherical geometry and is of great interest to double shell implosions, and to the verification of the code we used.

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