Indirect-drive double shell implosion experiments at the National Ignition Facility: Progress and Plans

S. Palaniyappan, D. Stark, J. Sauppe, N. Christiansen, I. Sagert, S. Goodarzi, H. Robey, P. Donovan, D. Schmidt, E. Loomis.

[1]*Los Alamos National Laboratory, Los Alamos, NM 87544*

Recent results from high-yield ICF implosions on the National Ignition Facility (NIF) have reinvigorated interest in the study of burning plasmas. At Los Alamos National Laboratory (LANL), ICF research is focused on double-shell implosions, which provide a complementary path toward the study of thermonuclear burning plasmas. Enabled by enhanced radiation trapping of the higher-Z inner shell, double shells operate in volume ignition mode as opposed to central hot-spot ignition mode, implode at lower convergence ratios, and potentially ignite at reduced fuel temperatures than single shells.

Double shell experiments at NIF are focused on understanding the many factors affecting performance during the implosion and stagnation phases. Experiments have been conducted to measure the radial trajectory and low-mode shape distortion of both the inner and outer shells, quantify the impact of engineering features, and assess the impact of high-energy Au L-shell preheat from the hohlraum. Recently, we have demonstrated control over the symmetry of a tungsten inner shell to P2 of 3% and, for the first time, maintained a closed outer shell assembly gap using a thin gold coating placed between the outer hemi-shells.

The first double-shell implosion at the NIF with 200 mg/cc liquid DT fill is scheduled for April this year. In this talk, we will discuss the progress of double shell implosion at the NIF including engineering feature-driven hydro instability growth mitigation and first nuclear measurements. We will also discuss our plans for achieving ignition in double-shell implosion.

*This work conducted under the auspices of the U.S. DOE by LANL under contract 89233218CNA000001.