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The Near Vacuum Hohlraum Campaign at the NIF: A New Approach

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Hohlraums filled with helium >1 mg/cc have been used with some success on the National Ignition Facility [1]. However challenges remain due to significant backscatter level, supra-thermal electron production and difficulties in modeling implosion symmetry via Cross Beam Energy Transfer (CBET) [2]. Near Vacuum Hohlraum (NVH, filled with <0.1 mg/cc of helium) may provide a viable alternative with negligible laser plasma instabilities and high laser-to-hohlraum coupling [3]. In this reduced laser-plasma interaction system, implosion symmetry is controlled through direct adjustment of the laser beam power balance rather than through CBET. A significant challenge in extending this platform to higher convergence designs is achieving adequate symmetry control of the drive throughout the pulse. This talk will summarize experimental campaigns exploring laser pulse duration and power limits in three hohlraum size scales and two capsule size scales. Experiments with small capsules have shown good symmetry control using laser cone fraction tuning at convergence ratio (CR) of 18x and 7ns pulses. Results from higher convergence (CR $\sim$ 25x) cryogenic DT layered capsule implosions with $\sim$ 9ns pulses will be presented and implications for achieving conditions required for robust alpha heating with NVH driven implosions will be discussed. *Work performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under contract DE-AC52-07NA27344.

[1] Hurricane, O. A., et al. "Fuel gain exceeding unity in an inertially confined fusion implosion." Nature 506.7488 (2014): 343-348.

[2] J.D. Moody et al., "The hohlraum Drive Campaign on the national Ignition facility," APS, DPP, 2013

[3] L. F. Berzak Hopkins et. al., "First high-convergence cryogenic implosion in a near-vacuum hohlraum," Phys. Rev. Lett. Phys. Rev. Lett. 114, 175001 (2015)