HIGH-FOOT NIF BERYLLIUM TARGETS WITH 6.72-MM CYLINDRICAL HOHLRAUMS WITH LOW GAS FILL[1]

A. N. Simakov[1], S. A. Yi[1], D. C. Wilson[1], J. L. Kline[1], D. E. Hinkel[2]
[1]Los Alamos National Laboratory, Los Alamos, New Mexico, USA
[2]Lawrence Livermore National Laboratory, Livermore, California, USA
simakov@lanl.gov

For indirect drive inertial confinement fusion, beryllium (Be) ablators offer a number of important advantages [1,2] as compared with other ablator materials, such as plastic and high-density carbon. Be ablator campaign on the National Ignition Facility (NIF) started in August of 2014 and has so far fielded six tuning shots and one cryogenic DT-layered shot (in June of 2015). The campaign is employing the standard 5.75-mm hohlraum with a high-density He gas fill ($\rho_f = 1.6$ mg/cm^3). The initial results are encouraging and demonstrate a somewhat better laser-capsule coupling than observed for similar plastic targets.

5.75-mm high-fill hohlraums generally exhibit a significant amount of the coupling degradation (between 40 and 50%) that manifests as laser energy backscatter and the so-called power multipliers between 0.5 and 0.9 that have to be invoked to match simulations with observations. The degradation is a consequence of nonlinear plasma processes that presently cannot be accurately modeled. In addition, due to relatively small hohlraum-to-capsule radii ratio, implosion symmetry tuning in such hohlraums must rely upon the cross-beam energy transfer (CBET), which also cannot be accurately modeled. Larger, 6.72-mm low-fill ($\rho_f \leq 0.6$ mg/cm^3) hohlraums present an attractive alternative: they have demonstrated for 7-ns laser pulses the coupling of about 90%; and may also be large enough to provide the implosion symmetry without CBET. We have designed a series of high-foot NIF Be targets for such low-fill hohlraums without CBET using HYDRA simulations. The shortest, ~9-ns pulse uses the fuel adiabat >2.5 but is still expected to yield about 10^{16} neutrons; while a ~13-ns pulse is predicted to ignite. This sequence of targets will be used on NIF starting FY16 to scope the hohlraum performance for varying pulse durations and gas fill densities; and the capsule performance for various adiabats in terms of capsule yield, stability and implosion symmetry.

[1] A. N. Simakov et al., "*Optimized beryllium target design for indirectly driven inertial confinement fusion experiments on the National Ignition Facility*", Phys. Plasmas **21**, 022701 (2014).
[2] S. A. Yi et al., "*Hydrodynamic instabilities in beryllium targets for the National Ignition Facility*", Phys. Plasmas **21**, 092701 (2014).

[1] This work was performed at LANL, operated by LANS, LLC for the U.S. DoE under Contract No. DE-AC52-06NA25396; and at LLNL, operated by LLNS, LLC for the U.S. DoE under Contract No. DE-AC52-07NA27344.