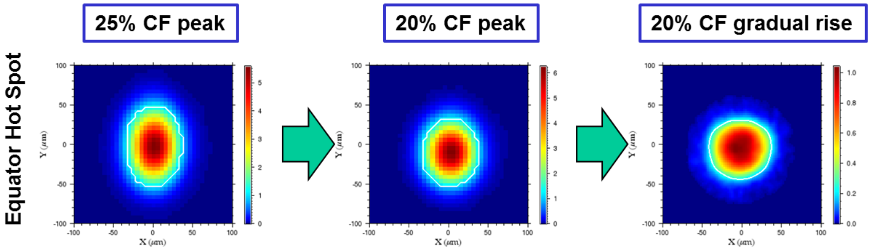
DEVELOPMENT OF A PREDICTIVE AND SYMMETRIC IMPLOSION PLATFORM USING A 2-SHOCK 1MJ PULSE IN A NEAR VACUUM HOHLRAUM

S. F. Khan[1] S. A. MacLaren[1], J. D. Salmonson[1], T. Ma[1], J. R. Rygg[1], J. E. Field[1], G. A. Kyrala[2], R. Tommasini[1], J. E. Ralph[1], D. P. Turnbull[1], J. E. Pino[1], A. J. Mackinnon[1], L. R. Benedetti[1], D. K. Bradley[1], E. Dewald[1],T. R. Dittrich[1], L. B. Hopkins[1], N. Izumi[1], M. L. Kervin[1], J. Kline[2], S. R. Nagel[1], A. Pak[1], H. G. Rinderknecht[3], H. W. Sio[3], A. B. Zylstra[3]

[1]Lawrence Livermore National Laboratory, Livermore, CA, USA
[2]Los Alamos National Laboratory, Los Alamos, NM, USA
[2]Massachussets Institute of Technology, Cambridge, MA, USA
Khan9@llnl.gov

We describe a novel platform at the National Ignition Facility that delivers a predictive and symmetric inertial confinement fusion implosion. Experiments using this platform are providing valuable implosion code validation as well as a well-behaved experimental platform for studies of the sensitivity of ablator-fuel mix to symmetry, convergence ratio and shock timing. The platform features a 2-shock laser pulse with 1MJ total energy and a subscale (1.35mm OD) capsule with a plastic shell uniformly doped with 1% Si inside a nominal scale (5.75mm ID) Au Hohlraum with a near vacuum interior.

Utilizing a series of experiments and subsequently making small changes in the laser pulse shape and shock timing[1], a nearly round hot core was achieved as shown in the x-ray images below. The shape of the shell of the imploding capsule inflight towards stagnation was tracked using backlit radiography experiments[2] and was found to closely match the hot core shape. The principal shape tuning mechanism is the adjustment of the laser beam by cone. The power of the laser beams in the inner cones, which heat the central region of the hohlraum was reduced while the power of the outer cones were increased to maintain the laser total energy of 1 MJ. The cone fraction (CF) of the inner beams to the total power was reduced until a symmetric hot core was produced. Scaled simulations have predicted the neutron yield, bang time and shell opacity well but are systematically generating a more prolate shape than experiments.



[1] H. F. Robey *et al.* Precision Shock Tuning on the NIF. PRL 108 (2012)
[2] J. R. Rygg *et al.* 2D X-Ray Radiography of Imploding Capsules at the NIF. PRL 112 (2014)

This work performed under the auspices of the U.S. Department of Energy by LLNL under Contract DE-AC52-07NA27344. LLNL-ABS-669831