TOWARDS A MORE UNIVERSAL UNDERSTANDING OF RADIATION DRIVE IN GAS-FILLED HOHLRAUMS*

O.S. Jones[1], C.A. Thomas[1], P.A. Amendt[1], G.N. Hall[1], N. Izumi[1], M.A. Barrios Garcia[1], E.L. Dewald[1], S.P Regan[2], D.E. Hinkel[1], L.F. Berzak Hopkins[1], A.L. Kritcher[1], M.M. Marinak[1], N.B. Meezan[1], J.L. Milovich[1], J.D. Moody[1], A.S. Moore[1], M.V. Patel[1], J.E. Ralph[1], M.D. Rosen[1], M.B. Schneider[1], S. M. Sepke[1], D.J. Strozzi[1], D.P. Turnbull[1]
[1]Lawrence Livermore National Laboratory, Livermore, CA, USA
[2]Laboratory for Laser Energetics, Rochester, NY, USA
oggie@llnl.gov

Recently there has been interest in using hohlraums with little or no gas fill. This has primarily been driven by the success of implosions with HDC ablators using relatively short laser pulses (6-9 ns) to heat near vacuum hohlraums (NVHs) with a hohlraum fill of 0.03 mg/cc He [1]. These experiments have demonstrated low backscatter, good propagation of the inner beams to the wall, and effective radiation drives that are much closer to high flux model [2] predictions. In contrast, experiments using HDC or CH capsules driven by hohlraums filled with 1-1.6 mg/cc of He have shown large amounts of inner cone backscatter, poor inner cone propagation, and 20-30% "missing energy" relative to radiation hydrodynamic (RH) codes using the high flux model. It is not currently known what causes this deviation in measured drive from predicted drive for longer pulse, gas-filled hohlraums, but ultimately we wish to have a predictive capability over a broad range of hohlraum conditions. To that end we have begun an effort to create a more predictive hohlraum model that does not require ad hoc fixes. An important first step is to understand exactly how the current hohlraum RH calculations deviate from measured quantities and how this deviation varies with experimental parameters. This should provide insight into what is missing from current modeling.

In the past two years a number of experiments have been done that provide new types of data in different regimes that we can use to benchmark against predictions from RH codes. These experiments include scans of hohlraum gas fill density, measurements of drive in open-ended viewfactor hohlraums, and spectroscopy-based measurements of the plasma temperature. We have calculated these experiments using highly temporally and spatially resolved RH calculations. By examining this data set as a whole, we aim to quantify the deviation in predicted radiation drive, plasma temperature, and other parameters as a function of gas fill, pulse length, and hohlraum case/capsule ratio, for example. The temperature measurements are particularly important, because it is possible that more energy is trapped in the coronal plasma than is predicted by current RH models, resulting in lower measured x-ray conversion and drive. We will compare the observed changes in drive deviation, temperature, backscatter, etc. to those predicted by competing models.

[1] L. F. Berzak Hopkins, N. B. Meezan,S. Le Pape, et al., accepted PRL
[2] M. D. Rosen, H. A. Scott, D. A Hinkel, et al., High Energy Density Physics 7, 180 (2011)

*Prepared by LLNL under Contract DE-AC52-07NA27344.

LLNL-ABS-669699