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Final Activities for NLUF grant:

Examination of the cone in shell target compression concept for Asymmetric Fast Ignition

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This is the end of the second year of a program of studies of the hydrodynamics of compression of targets suitable for implementing the fast ignition concept. Our experimental run earlier this year showed that the indirect drive geometry causes problems: non-thermal, high-energy gold m-line radiation from the hohlraum (~2.5 keV) vaporizes material from the surface of the reentrant cone. This material intrudes into the space between the cone and the fuel where it may interfere with efficient hot electron transport. There is also some evidence that it mixes into the assembled fuel. This problem is solved by fabricating the hohlraum with an element whose fluorescence emissions can be stopped by the shell wall. The major components of efficient hohlraum cocktails (Au, Pb, Ta, Bi, Gd, W, La, Nd, …) have fluorescence lines at similar energy (2-10 keV), so it might prove difficult to eliminate this radiation and will probably be necessary to build the shells with a keV x-ray shine-through barrier.
An easier alternative is to switch to a direct-drive configuration. A shine through barrier is still needed, but in this case 0.1 μm of Al will suffice. With the last of the NLUF funding, we have designed direct drive FI reentrant cone shells for experiments on Omega with the additional collaboration of Christian Stoeckl and David Meyerhofer. This first experiment will use an empty reentrant cone shell and simple backlighting as a diagnostic to verify that our modeling is correct. The next set of experiments (to be done outside the NLUF program, using our individual resources) will use gas filled targets and more sophisticated diagnostics to look at the density and angular uniformity of the imploded reentrant cone shells.

A detailed presentation of these results were made at the APS-DPP meeting in 2002 (see report DOE/SF/22229-2). A write up of the results of all the work done under this grant appears in R.B. Stephens, S.P. Hatchett, R.E. Turner, K.A. Tanaka, and R. Kodama, "Implosion of indirectly driven reentrant cone shell target," *Phys. Rev. Lett.* **91**, 185001 (2003) (see report DOE/SF/22229-3).