INERTIAL CONFINEMENT FUSION
Lawrence Livermore National Laboratory
Livermore, CA

Bimonthly Update

July-September 2005

UCRL-BR-144675-05-04

2010 Ignition Target Design Requirements Established by National Ignition Campaign

A formal set of requirements for the 2010 ignition target designs has been established and agreed to by the management of the National Ignition Campaign (NIC). To assure coordination across all elements of the Program, any future modifications to the target design will be made through a formal change control process.

For the 2010 ignition campaign, the target designs assume 1.0 MJ of laser energy. We have set specifications for a "point design" and several options for risk mitigation. Three capsule designs were specified: the point design using layered-doped Be(Cu); layered-doped CH(Ge); and uniformly doped Be(Cu). The latter is being defined by scientists at Los Alamos National Laboratory. Specifications have also been completed for three hohlraum designs: He or He/H gas-filled, which is the point design; SiO_2 foam-filled; and SiO_2 lined. The specifications have been tabulated in a set of spreadsheets, which form a complete, fully integrated, detailed description of the targets. The specifications are set so that any of the capsules, built to specification could be fielded in any of the hohlraums, with only the laser pulse being varied.

The new designs differ in some details from those previously published. Many details that were previously implicit are now explicitly set in the spreadsheets, so that the specifications can be complete.

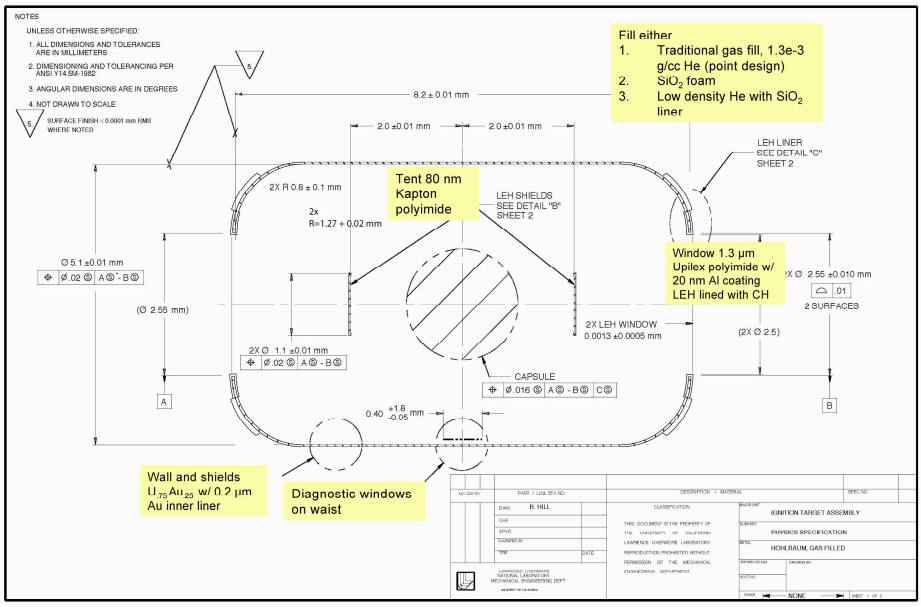


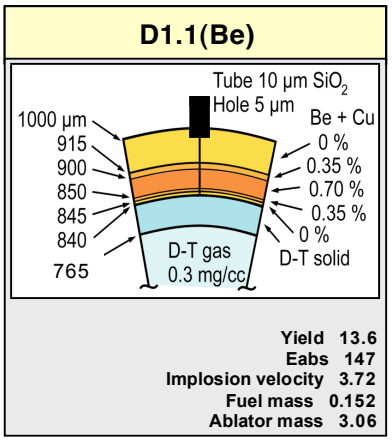
Figure 2. Engineering drawing of the point design hohlraum, with highlights overlaid in the text boxes.

Some details were updated in collaboration with target fabrication specialists. For example, the density of the Be in the layered design, which will likely be made by sputter deposition, was reduced to a density more representative of recent results from that fabrication method. The two capsule designs are shown in Figure 1.

The layered beryllium target is designated as the point design because it is the least sensitive to those aspects of the experiment over which we have the least control. Where possible, the specifications have been adjusted to accommodate the less robust performance of the other targets—for example, the surface roughness specification on the CH target is tighter than that for the Be target. In other cases, such as the roughness of the ice layer, all targets must realistically have the same specification. Then the more unstable targets experience more impact.

The gas-filled hohlraum has been chosen as the point design because it is less susceptible to uncertainty in the fill density, and in balance, seems to be easier to fabricate and to build a program around. There is only a small difference in the physics of the gas-filled and foam-filled hohlraums: with the foam fill, the x-rays driving the capsule have early-time Si features that produce more preheat in the capsule. This preheat reduces the growth of some hydrodynamic instabilities, but introduces possible issues with the expansion of the beryllium upon preheat. The gas-filled design is closer to the bulk of previous work, and we can have more confidence in its performance. A drawing of the gas-filled hohlraum is shown in Figure 2. The spreadsheet includes a number of detailed drawings specifying the targets in detail.

These requirements are now under configuration control and form the basis for planning all aspects of the ignition 2010 campaign.



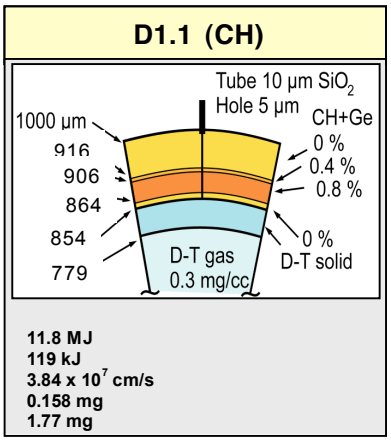


Figure 1. Designs for layered doped Be(Cu) and CH(Ge) targets. Detailed specifications for these two designs were put under configuration control as of 10/1/05.

For comments about content of the ***Bimonthly Update,*** contact Bruce A. Hammel (925) 422-3299.
To get on the mailing list of the *LLNL ICF Program Bimonthly Update and Annual Report* send a request to cassady1@llnl.gov
These reports and other LLNL ICF Program information are available on our Web site at http://www.llnl.gov/nif/icf/icf.html
This work was performed under the auspices of the U.S. Department of Energy by University of California Lawrence Livermore National Laboratory under Contract W-7405-Eng-48.