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KEYNOTE TALK

FEATURES OF A POINT DESIGN FOR FAST IGNITION

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Fast Ignition requires efficient assembly of high density fuel followed by efficient coupling of laser light energy to an ignition region. This talk will discuss the challenges in both of these areas together with approaches to overcome these challenges. We start with a simple model to illustrate system requirements. We review two alternate 1-D implosion pulse-shaping schemes for achieving high density and column density. As is frequently done, we use a cone to protect the short-pulse laser path from the coronal plasma in our designs. The use of the cone leads to two design challenges: hard photons produced in the coronal region or at the hohlraum wall can penetrate the implosion capsule and preheat and expand the cone ahead of the imploding fuel. This preheated matter can impede the implosion or possibly mix with the fuel and thereby increase the ignition energy requirement. Depending on the pulseshaping strategy employed this threat can be reduced by placing varying amounts of higher Z dopant in portions of the ablator, tamping the cone with low Z materials or even replacing the high-z cone with lower absorption high-density low Z materials.

The cone must survive the implosion. As the the fuel implodes. It applies pressure to the outside of the cone which can implode the cone. The second challenge comes from the fuel during its stagnation launching a jet of high pressure matter in the cone direction and causing a large separation between the critical surface and the compressed fuel. An asymmetric implosion may overcome this challenge.

After the fuel is assembled we must still couple the relativistic electrons produced in the short pulse laser-plasma interaction to the fuel. In plasmas with even nominal prepulse, laser absorption is high with much of the energy appearing as hot electrons. However, the spectrum is hard and produced with a large angular divergence. We suggest several ways to control the spectra. We also mention several approaches to control beam collimation and energy deposition given a particular spectrum. Finally, we present an integrated calculation tying together the hydrodynamic assembly, the laser-plasma coupling and the electron transport to the fuel.

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