High Energy Density Simulations for Inertial Fusion Energy Reactor Design

Gregory A. Moses

Fusion Technology Institute
University of Wisconsin-Madison
moses@engr.wisc.edu

The promise of inertial fusion as an energy source for electric power generation is elucidated in conceptual reactor design studies. These studies use the best available experimental information to predict the fusion performance and performance of the other reactor components such as materials strength and radiation damage, tritium breeding heat transfer, etc. For those properties where experimental evidence is not available, computer simulations are often used. One aspect where computer simulations are predominantly relied upon are the high energy density radiation hydrodynamics simulations of target burn and expansion and the reactor cavity and first wall response to the energetic target constituents (x-rays, ions, and neutrons).

Simulations of target implosion and ignition are of course a well developed discipline and are a cornerstone of the U.S.D.O.E. inertial confinement fusion program and other programs worldwide. The post-ignition target performance and subsequent target expansion are less well studied and are the subject of this presentation. The starting point is the same radiation hydrodynamics model used to simulate target implosion and burn. We will explore the possibility that this fluid-based model is inadequate to simulate target expansion in a vacuum. We will report on the implications for reactor design and performance of an imprecise estimate of the nature of the energetic target constituents.