ARIES Inertial Fusion Chamber Assessment

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Nearly 10 years have passed since the US DOE commissioned two large, multi-institutional IFE power plant design studies: Prometheus [1] and OSIRIS/SOMBRERO [2]. Since that time, several major factors – both scientific and programmatic – have changed the landscape of IFE research. Increased confidence in the physics feasibility of inertial fusion has led to the construction of NIF, with its expected demonstration of ignition and gain. Declassification and increased international effort on unclassified target physics now enables us to include target design in system optimizations. In addition, significant achievements in key enabling technologies have been made over the past decade, such as advances in our understanding of ion beam propagation and ion-material interactions, increased efficiency of high-power lasers, demonstration of effective laser beam smoothing techniques for direct drive targets, and advances in target physics, including innovative concepts such as close-coupled indirect drive and fast ignition. Arguably, inertial fusion looks significantly more credible and more attractive than it did only ten years ago.

The ARIES Team recently initiated a new activity to assess the current state of inertial fusion energy research and to help motivate and guide R&D programs. The Team includes participation from several of the major national laboratories and Universities engaged in IFE research. The first phase of the program is focused on a broad-based assessment of chamber options and related technologies relevant for both laser and heavy ion drivers. Utilizing the progress in the last decade, detailed analysis of more traditional IFE chamber concepts as well as newer concepts will be performed to ensure self-consistency. This analysis also will highlight shortcomings in the present data base and high-leverage areas for R&D. Key issues and design trade-offs will be discussed for the major technologies, including target fabrication; target injection, tracking and transport; driver/chamber interface components (*i.e.*, final optics, final focus magnets), chamber physics (particle and radiation transport, gas-dynamics); and chamber materials response. These technologies will be assessed using an integrated system-wide approach with economics, safety and environmental attributes, and credibility as principal metrics.

[1] L. M. WAGANER, *et al*., "Inertial Fusion Energy Reactor Design Studies: Prometheus Final Report," MDC 92E0008 (DOE/ER-54101) March 1992.

[2] W. R. MEIER, *et al*., "OSIRIS and SOMBRERO Inertial Fusion Power Plant Designs: Final Report," WJSA-92-01 (DOE/ER/54100-1) March 1992.