Multi-scale simulations for Fast Ignition and related laser plasma physics

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The fast ignition (FI) scheme is one of the most fascinating and feasible ignition schemes for the inertial fusion energy [1]. The numerical simulation plays an important role in studying detail mechanism of fast ignition, demonstrating the performance, designing the targets, and optimizing laser pulse shapes for the scheme. In our previous work,"Fast Ignition Integrated Interconnecting code" (FI^3) was developed [2]. In FI^3 system, radiation hydrodynamic code, PINOCO which is based on 2-D ALE hydrodynamic code [3] simulates implosion. Particle-in-Cell code, FISCOF [4] calculates relativistic laser plasma interaction in micro region. Relativistic Fokker-Planck hydrodynamic code FIBMET simulates the hot electron transport and depositing electron energy in the core plasma in meso-scale region [5]. The boundaries conditions and initial conditions for them are imported/exported to each other by way of DCCP, a simple and compact communication tool which enable these codes to communicate each others in different machines.

In the previous work, we have demonstrated the full integrated simulation of fast ignition, where computational condition was similar to experimental condition which was operated at ILE, Osaka University [6].

In this presentation, we introduce the overview of FI^3 system and some latest results of integrated simulation, and these element physics which relate to the FI. Especially, we have designed an advance target for FI to optimize implosion efficiency and heating efficiency using the multi-scale simulations. A schematic view of the advanced target is shown in Fig. 1.

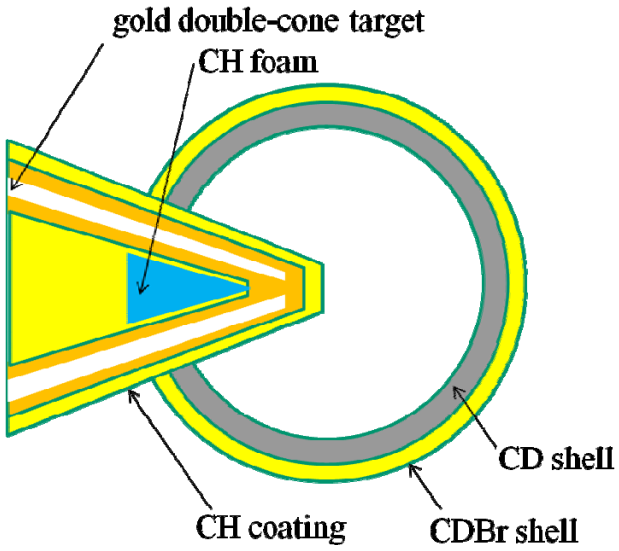

Figure 1: Schematic view of advanced target for Fast Ignition

References
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