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Simulation and design study of cryogenic cone shell target for fast ignition FIREX project[1]

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The fast ignition (FI) scheme is attractive approach for the IFE, and many researches were conducted to understand its physics. In ILE Osaka Univ., FIREX (Fast Ignition Realization Experiment) project is in progress. Implosion experiments of the cryogenic target are scheduled in near future. In comparison with the central-hot-spot (CHS) approach, there are more unknown physics and variable parameters, which must be studied and determined to achieve the project's final goal of neutron yield 10ˆ14. Sophisticated target designs are required, in which not only the target structure and laser pulse shape but also the detail specifications of the high density fuel core plasma, trigger timing of the heating core by the peta-watt laser, heating mechanism, and so on, must be optimized. Fast Ignition Integrated Interconnecting code (FI^3) where radiation-hydro code, PIC code, and Fokker-Planck code are linked each others has been applied to the integrated simulation of FI. In the results, concerning the cone-guided implosion, we have learned that the uniformity of the implosion is not so critical issue as that in the CHS approach. Also, we have realized that heating efficiency strongly depend on the scale length of the pre-plasma in the conical target, and the density gap at the rear surface of the laser plasma interaction which locates the edge of the main fuel compressed by the implosion. That is, heating the core plasma with the peta-watt laser is not independent problem of laser plasma interaction. A desired fuel mass density profile of the core plasma is necessary. Recent design work of the cryogenic target is in progress for FIREX-I. Here, those important physics behind the FI are explained and some typical designs will be presented.

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