HIB ILLUMINATION ON A TARGET IN HIF*

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In direct-driven pellet implosion, HIB illuminates a spherical target and deposits its energy on a target after a HIB final transport. In our study, we develop a three-dimensional HIB illumination code for direct-driven pellet in HIF [1]. We calculate the deposition energy on the spherical target according to a stopping power. The main object of our study is to clarify a dependence of multi-HIB illumination non-uniformity on parameter values of HIB illumination in HIF. The HIB ions impinge the target surface, penetrate relatively deep into the deposition layer and deposit their energy in a rather wide region in the deposition layer: this HIB deposition feature influences the beam illumination non-uniformity. The HIB temperature and emittance effects are also evaluated. During the HIB illumination the temperature of the energy deposition layer increases to a few hundred eV. We also investigate the pellet temperature effect on the HIB illumination non-uniformity. We also investigate the relationship between a chamber radius and the HIB illumination non-uniformity, and study the effect of the total HIB number on the HIB illumination non-uniformity. In an ICF power plant, a position of fuel pellet may shift from a reactor center, because a pellet may be injected from a pellet injection port at a reactor wall. The HIB illumination non-uniformity may be influenced by a little pellet displacement from the chamber center. In our study we also investigate the relation between the pellet displacement and the HIB illumination non-uniformity. For the evaluations of the illumination non-uniformity on the target, we compute the root mean square (RMS) non-uniformity on the spherical target. In addition, we also perform mode analyses of the HIB deposition energy on the spherical fuel target using the Legendre polynomial and the Fast Fourier Transfer (FFT). The calculation results demonstrate that we can realize a rather low energy deposition non-uniformity. Moreover from the investigation of the non-uniformity growth due to the little pellet displacement, we confirm that the pellet displacement is a serious problem in HIF.

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1. A.I.Ogoyki, T.Someya, S.Kawata, “Code OK1 – Simulation of multi-beam irradiation in heavy ion fusion”, accepted by Computer Phys. Communications (2004).