FINAL BEAM TRANSPORT AND TARGET ILLUMINATION*

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Key issues in heavy ion beam (HIB) inertial confinement fusion (ICF) include an accelerator design for an intense HIB, an efficient HIB transport, a HIB-target interaction, a reactor design and so on. At the final transport region in HIF the HIB space charge should be neutralized and several effective methods for the HIB space charge neutralization have been already proposed. In our study, an insulator annular tube guide has been proposed at the final transport part, through which a HIB is transported, in order to neutralize the HIB space charge [1]. After the HIB final transport, HIBs enter the fusion reactor and should illuminate a fuel target. Therefore, in our study three-dimensional computer simulations are performed for a HIB irradiation onto a direct-driven spherical fuel pellet in HIB ICF in order to clarify a dependence of multi-HIB illumination non-uniformity on parameter values of HIB illumination. If HIBs are not well neutralized, the HIB energy may not be used effectively and the present-designed fuel pellet may not lead a high gain. Therefore we employ this reasonable assumption that HIBs are neutralized well in our calculation of HIB irradiation. For various beam parameters and reactor chamber radii we investigate the energy deposition non-uniformity using 12, 20, 32, 60, 92 and 120-beam irradiation systems. In this study, effects of HIB temperature, HIB illumination systems, HIB emittance and pellet temperature on the HIB illumination non-uniformity are also evaluated. In addition, the non-uniformity growth due to a little pellet displacement from a reactor chamber center is investigated. The calculation results demonstrate that we can realize a rather low non-uniform energy deposition: for example, less than 2.0 % even for a 32-beam irradiation system.

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1. T.Someya, S.Kawata, T.Nakamura, A.I.Ogoyki, K.Shimizu, J.Sasaki, “Beam Final Transport and Direct-Drive Pellet Implosion in Heavy-Ion Fusion”, Fusion Science and Tech. 43 (2003) 282-289.