Energetic ion confinement and lost ion distribution in heliotrons

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There exists significant number of energetic ion, which is generated by the plasma heating (NBH and ICH) and by the fusion reaction (α−particle), in a fusion reactor. A good confinement of the energetic ion is required to sustain the high temperature plasma. Also there is a possibility that the lost energetic ion damages the first wall. Thus the confinement of energetic ions is one of key issues in the fusion reactor design. Particularly, the detail analyses of the energetic ion confinement and their losses are necessary in the development of a reactor based on a helical system, because of the complicated behaviour of trapped particles in the three dimensional magnetic configuration.

In this paper the energetic ion confinement and lost ion distribution are studied in the LHD and the heliotron reactors based on the LHD configurations, and the characteristics of energetic ion confinement in heliotrons are discussed. First, the energetic ion behaviour in the NBI and ICRF heatd LHD plasma is investigated using GNET code, and the simulation results are compared with the experimental ones. The lost ion distributions are also analyzed and the configuration dependencies are shown. Next, the α−particle (3.5MeV) confinement is investigated extending the LHD configuration to the reactor size ($1000m^3$). The α−particle confinement and the lost ion distribution are investigated and their configuration dependencies are discussed.