

多孔型加速器における二次粒子の振る舞い Secondary particles in multi-aperture accelerator

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Negative-ion-based neutral beam injection (N-NBI) system is one of the promising candidates for plasma heating and steady state operation of magnetic fusion machines. In ITER, the neutral beam of 16 MW is required to be injected for 3600s. There are some issues to be resolved to fulfill the requirement. The beam power and the pulse length are limited by the heat loadings of the acceleration grids and the beamline components, which are mainly caused by secondary particles produced in the accelerator.

To understand the behavior of secondary particles in the accelerator, the intense studies are carried out in experiments and numerical simulations. In the previous studies, the secondary particle trajectory has been calculated in the single-aperture model, though negative ion sources for fusion researches have large-sized and multi-aperture grids. Then, the large discrepancy between the experiments and the simulations is observed [1]. In large negative ion sources, the negative ion is produced non-uniformly so that secondary particle trajectories are different between apertures and the extracted beamlets interact with each other.

The accelerator of the LHD-NBI was modeled as multi-aperture grids with OPERA-3d [2] to take into account the multi-aperture effect, that is, the non-uniformity in the H⁻ density and the beamlet-beamlet interaction. The grid heat loading was estimated with EAMCC, which is a monte carlo code to simulate collisions of particles with a residual gas and acceleration grids [3]. In this paper, affects of the multi-aperture effect on the secondary particle trajectories are discussed.

[1] P. Veltri, Ph.D. dissertation, University of Padova, Padova 2011.

[2] OPERA-3D, Vector Fields Co. Ltd.

[3] G. Fubiani *et al*, Phys. Rev. Special Top. Accelerators Beams **11** 014201.