

Comparison of neutral particle flux decay times on the NBI plasmas in Large Helical Device

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The compact neutral particle analyzer (CNPA) has been installed at the perpendicular position against the magnetic field on the mid-plane in Large Helical Device. We compare the decay times of charge exchange neutral particle fluxes in various NBI plasmas after switch-off of NBI by using CNPA. Here the decay times at co-, counter and perpendicular injections are observed at the magnetic axis of $R_{ax}=3.65$ m because the minimum particle loss in the chaotic orbit region and the maximum particle confinement can be expected at $R_{ax}=3.65$ m according to the simulation. The flux decay time of a certain energy particle is determined by the energy reduction due to the electron/ion, the charge exchange loss, the pitch angle scattering at the low energy region and the particle loss at the chaotic orbit region or the loss cone [1]. Former three effects are independent from the direction of beam injection. Therefore if the large discrepancy of the decay times by the beam injection direction is found, the orbit loss should be the main candidate of the particle loss. The decay time at co-injection is almost similar to that at the counter-injection in the experiment. The value is correspondent with the energy loss time by the electron. This fact means the decay times are determined by the electron drag. Those decay times decrease by the weak magnetic field same as the simulation. The decay time at the perpendicular beam NBI is several – ten ms, which is less than one tens of that at the tangential injections. The decay time determined by the ion-ion collision, which is the main process of the energy loss and the pitch angle scattering at the injection energy of 40 keV, is about 100 ms. The observed decay time is still ten times smaller than this value. On the other hand, the decay time is not constraint by the classical loss cone because the escaping time through the plasma radius is about several μ s. The particle from the perpendicular NBI may be lost from the chaotic orbit region with the decay time of several – ten ms.

[1] T.Watanabe, *et al.*, Nucl. Fusion, **46** (2006) 291-305.