Observation of CX Neutral Particle Flux injected by Diagnostic Neutral Beam in CHS

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Abstract

A horizontally scannable diagnostic neutral beam (DNB) has been installed on the compact helical system (CHS) in order to study confinement of energetic ions with different pitch angle by varying injection angle. The DNB has been designed to have small divergence angle to provide energetic ions as a test particle source without heating the background plasma. The observation angle of charge-exchange (CX) neutral particle analyzer (NPA) in CHS is also designed to be scannable on the equatorial plane to measure energetic ions injected by the DNB. Combination of horizontally scannable DNB and NPA provides the information on the pitch angle of the energetic ions that should be confined in the plasma.

In CHS, confinement of collisionless trapped ions depends on the magnetic field configuration. In the configuration with the large inward shift, the distortion of $|B_{min}|$ contours from the magnetic flux surfaces is minimized. In this configuration, the drift motion of the helically trapped ions does not deviate significantly from the magnetic flux surfaces and good confinement of fast ions are expected. In contrast, in the outward shifted magnetic field configuration, the distortion of $|B_{min}|$ contours from the magnetic flux surfaces is large enough to cause helically trapped ions crossing the magnetic flux surfaces to be lost.

In order to investigate the dependence of trapped ion confinement on magnetic axis in CHS, the DNB was perpendicularly injected into plasma sustained by electron cyclotron resonance heating (ECRH) with magnetic axis position, R_{ax} of 88.8 cm (inward shifted configuration) and 99.5 cm (outward shifted configuration). Injected energetic ions are observed with the NPA. Experimental result indicates that inward shifted configuration has better confinement of perpendicularly injected energetic ions compared with that of outward shifted configuration.