§ 13. Study of Fast Ion Confinement Using Diagnostic Neutral Beam in CHS

Matsushita, H. (Grad Univ.), Ida, K., Okamura, S., Akiyama, R.

The confinement of fast ion is investigated in the CHS by using Diagnostic Neutral Beam (DNB) which can inject high energy neutral hydrogen atom ($E_b \leq 40\text{keV}$). DNB has a smaller divergence angle (0.75 degree at 30keV beam energy) than that of heating NBI (HNB). The injection angle can be scanned horizontally by 0.1 degree using pulse motor. A extracted beam current of DNB is about 2.5A at 32keV beam energy. The fast ion injected by DNB is detected with Neutral Particle Analyzer (NPA) located at 180 degree apart from DNB (Fig.1). The energy distribution of the fast ion is measured with 16-channel microchannel plate using electrostatic deflection plate.

Fig.2 shows the typical energy distribution of high energy particles injected by DNB ($E_b \cong 30\text{keV}$) for the plasma with electron density of $0.6 \times 10^{19}\text{m}^{-3}$. Each energy component (full energy of DNB E, one-half energy component E/2 and one-third energy component E/3) is clearly obserbed. DNB injection angle is scanned from 68 to 74 degree (more perpendicular) in order to investigate the pitch angle of loss corn region boundary. These experiments were performed ECRH plasmas without HNB in order to avoid the overlapping due to the high energy particle from HNB. A line of sight of NPA was fixed 70 degree at magnetic axis. When the DNB is injected more perpendicular from 68 degree to 74 degree at magnetic axis, the significant reduction of fast neutral flux was observed. The reduction of flux at the full energy of DNB, E, is larger compared with the reduction of flux at E/3 component (Fig.3). These observations are consistent with the single particle full orbit calculation in which a larger loss cone region at E energy than that at E/3 is expected.
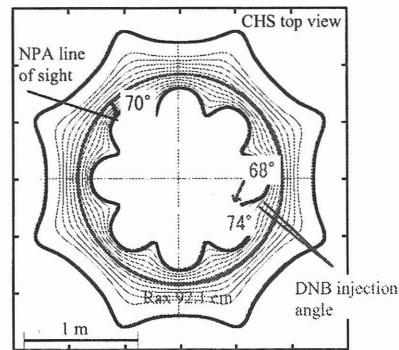

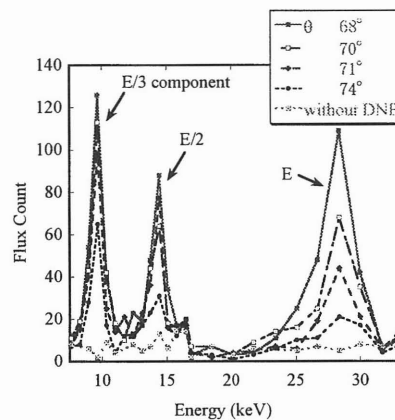Fig.1: DNB injection angle and NPA line of sight

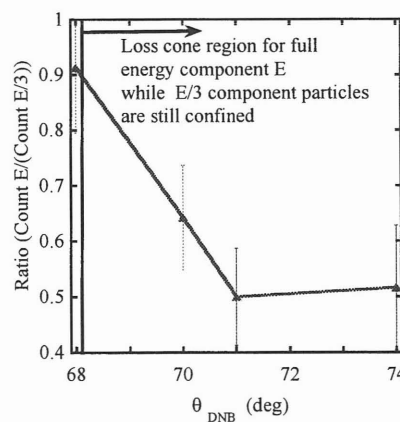Fig.2: Distribution of high energy particle injected by DNB in ECH plasma

Fig.3: DNB injection angle dependence of the ratio of E component flux to E/3

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