§5. Observation of Resonant Loss Cone in FNA Spectrum

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Fast neutral particle measurement in CHS (FNA) usually gives clear Maxwellian spectrum for the low density NBI plasmas. It is because the injected beam from NBI.#1 passes through the plasma in front of FNA measurement which supplies sufficient neutral density in the plasma for the charge exchange process. The ion temperature derived from FNA spectrum is very close to the TVCXS for most of discharges in CHS.

During the experiments for getting high ion temperature, FNA ion temperature gave significantly low value of T_i compared with TVCXS measurement. It may happen for FNA measurements when the spectrum range used for getting slope is low energy part in which the contribution of boundary plasma is large. But the spectrum range used for getting T_i was around several times T_i for this measurement. In addition, if the spectrum range close to T_i was taken which is the energy range used for the doppler shift analysis of TVCXS, the result was very close to the TVCXS measurement. The shape of spectrum was convex which is very rare for usual FNA spectrum. The time variation of ion temperature is shown in Fig. 1 for two different ranges of spectrum used to obtain the slope.

Figure 2 shows the full spectrum for the perpendicular particles. The tail component appears which is supplied by the pitch angle scattering of slowed down beam particles. The slope fitting is made for the bulk component in the range of 0.5 keV < E < 2 keV indicated by small triangles. Figure 3 shows the spectrum in the low energy range. The fitting is made for 0.2 keV < E < 1 keV which clearly shows the loss of particles in the energy range above 1 keV.

This energy range corresponds to the resonant loss cone of trapped ions caused by the positive electric field. A preliminary measurement of energy distribution of parallel particles does not show such convex shape of spectrum.

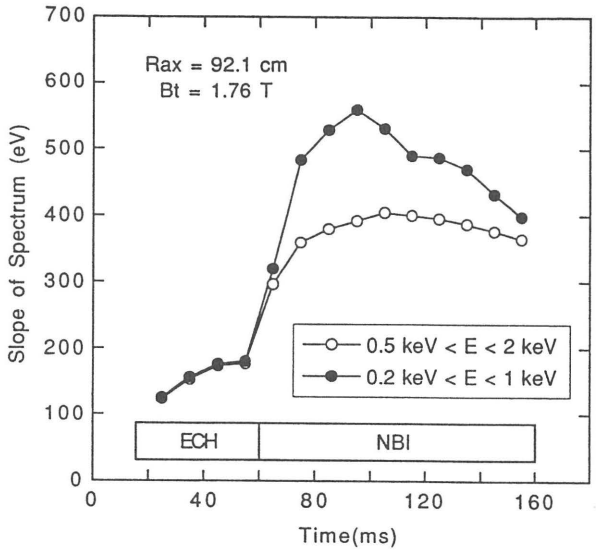

Fig. 1 Time variation of spectrum slope

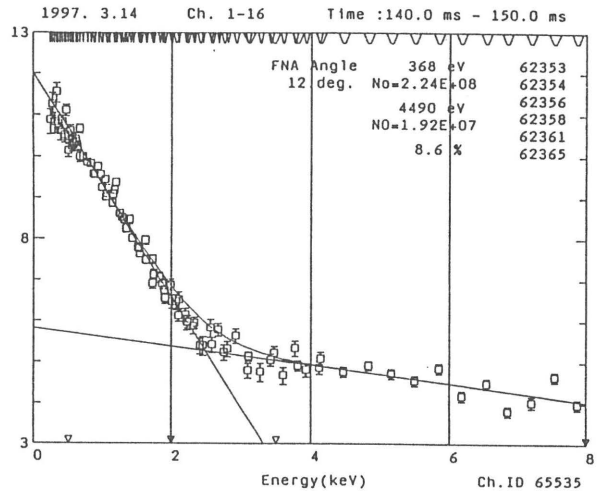

Fig. 2 Full spectrum of perpendicular particles

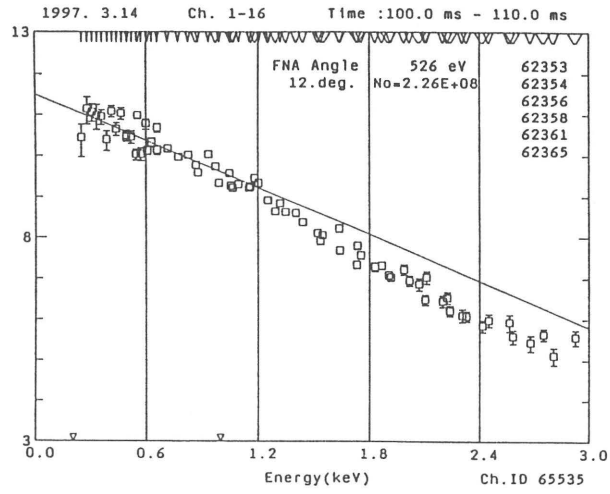

Fig. 3 Low energy spectrum