§5. Evaluation of Fast-ion Confinement Property Using Si-FNA

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In order to measure high energy particles, a fast ion measurement system using the silicon-diode-based fast neutral analyzer (Si-FNA) was developed in the Large Helical Device (LHD) [1]. This system can measure the high energy particle one by one because the detection efficiency is approximately 100%, and pulse height analysis (PHA) technique is adopted. Using this system, the slowing-down energy spectra were obtained for neutral beam (NB) injected fast particles.

For the 17th cycle of LHD experiments, the fast ion measurement system was upgraded in order to be attached to the 6-O tangential port on the LHD for evaluating the high energy particle confinement during the decay process. For quantitative evaluation, the high energy local ions of the charge exchanged high energy neutral particle should be measured by active measurement using NB#4. Absolute value can be obtained by the observed particle density on the lines of sight and the solid angle of the measurement lines of sight. By the obtained local information using this developed system, evaluation of the charge exchange loss and comparison with the calculation by FIFPC (TASK3D) or FICXS are expected. This comparison is important for the neutron generation rate evaluation in the Deuterium experiments. The detector sensitivity was observed by the X-ray source of ^{57}Co and ^{241}Am, and the calibration factor was obtained using NB#2 without plasma.

Figure 2 shows the experimental conditions and results. (a) Two NBs, #4 (red) and #5 (blue), were used alternately for plasma sustain. The short pulse NB#2 was injected in red and blue timing for supply high energy test particles, and (b) the flux was observed. Figure 3 shows the observed particle energy by Si-FNA. The calculation and comparison with the calculation codes are future works.

1) Osakabe, M.: Rev. Sci. Instrum. **72** (2001) 788-791.

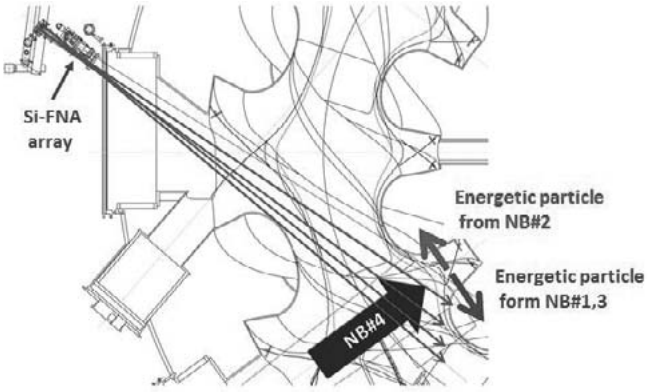

Fig. 1. Schematic view of the developed Si-FNA high energy particle measurement system.

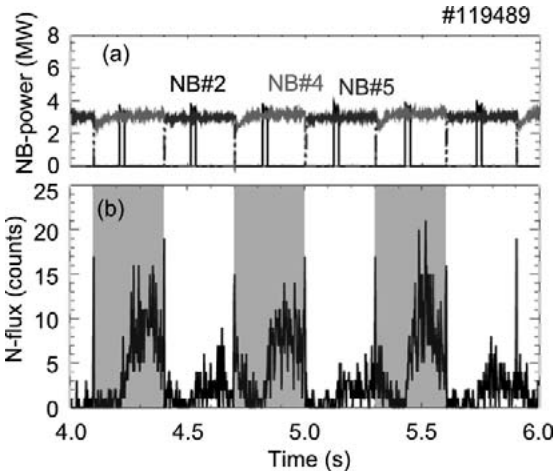

Fig. 2. Time evolution of the (a) NB-power and (b) N-flux. (a) Two NBs #4 (red) and #5 (blue) were used alternately for plasma sustain. The short pulse NB#2 was injected in red and blue timing in order to supply high energy test particles, (b) the flux was observed.

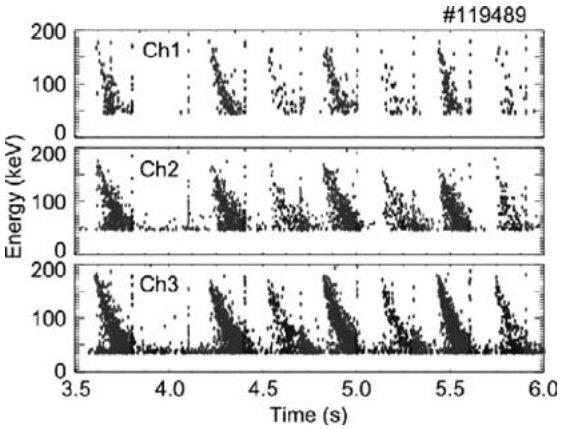

Fig. 3. The time evolution of the observed particle energy. The local energy decay process was observed.