§6. Evaluation of the TASK3D by the High Energy Particle Measurement

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In the 17th cycle, a fast ion measurement system using the silicon-diode-based fast neutral analyzer (Si-FNA) was developed in the Large Helical Device (LHD) [1] in order to measure high energy particles. 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. In 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 as shown in Fig. 1 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 the experimental results. Two NBs, #4 and #5 were used alternately for plasma sustain, and the local flux was observed during the NBI#4 injected. The local information of the high energy particle at the cross-point of the sight line and the #4 beam line can be obtained by the comparison of the measured flux during the NBI#4 and #5 injecting time. Figure 3 shows the observed particle energy by Si-FNA. The calculation and comparison with the calculation codes are future works. Figure 3 shows the experimental conditions of this research during the 18th LHD experiment campaign. The energetic particles were measured in three kind of toroidal magnetic field and various electron density for comparison with the results of the calculation by TASK3D. The comparison and the evaluation are the future works.

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

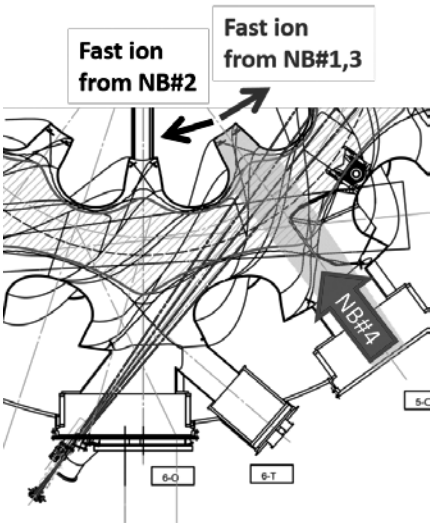

Fig. 1. Schematic view of the developed Si-FNA high energy particle measurement system.

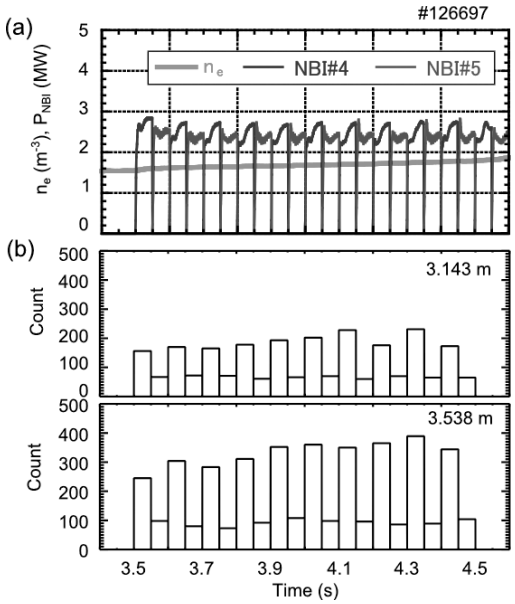

Fig. 2. Time evolution of (a) the electron density and NB-power, and (b) the count of the neutron flux. Two NBs #4 and #5 were used alternately for plasma sustain, and the local flux was observed during the NBI#4 injected.

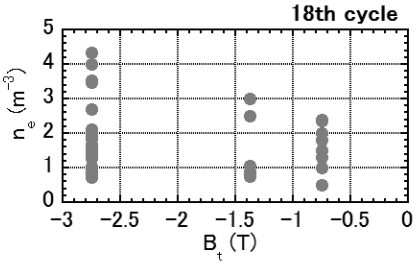

Fig. 3. The experimental conditions of this research during the 18th LHD experiment campaign.