Validation of the Fokker-Planck analysis for NB Blip experiment on LHD

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Achieving high performance of the energetic particle confinement is one of the most important issues for fusion devices. Although the self-sustained plasma by fusion-born fast alpha particles is necessary to realize fusion reactors, the confinement performance of energetic particles is often degraded by several phenomena. Therefore the confinement property of energetic particles have been investigated in several devices and simulations.

On the Large Helical Device (LHD), a series of experiments with short pulse of tangential neutral beam injection (NB-blip) have been performed[1] to examine the confinement property of energetic particles during their slowing down processes. In the present research, to analyze the data of the blip experiments, we develop three-dimensional (2D in momentum space and 1D in radial direction) Fokker-Planck simulation code TASK/FP[2], which is a Fokker-Planck component of the integrated code TASK and TASK3D-a[3]. Although Fokker-Planck codes have a difficulty to include the finite orbit effect rather than particle codes, it requires less computational resources and it is suitable for the analysis of a lot of experiment data.

![Figure 1: Energy distribution of the half value of peak $f_{beam}$. (a): Observed particle energy and (b): calculation of the slowing down process.](image)

Figure 1-(a) shows that the observed particle energy by silicon-diode-based fast neutron analyzer (Si-FNA). Figure 1-(b) shows the example of the calculation of the beam slowing down process. Red curves denote the energy distribution of the half value of $f_{beam}$. It denotes that most of beam particles exist within the region surrounded by red curves. The results of F-P analyses of NB slowing processes and D-D fusion reaction will be reported.

References