

Local Measurement of Energetic Particles in a Core Plasma by a Directional Probe Method

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Energetic Particle behavior is one of the most important problems for control of burning plasmas in magnetically confinement fusion devices, for example, international thermonuclear experimental reactor. In particular, loss of energetic particles due to MHD activities is serious problem and it has been experimentally and theoretically studied in many experimental devices. So far, the local observations (not line-integrated observation) of energetic particles have been performed only outside the last closed flux surface. Thus, we will propose the local measurement of energetic particles in a core plasma by a directional probe method.

A directional probe method is generally used for plasma flow measurement, because the difference of ion current collected by probe surface facing two different directions is sensitive to the unbalance of ion distribution function. However, the beam component is considered to be dominant for the difference of the two probe currents collected by probe surface facing two toroidal directions in a plasma sustained by tangentially injected NBI. The two demonstrations of energetic particles (beam component) injected by NBI have been performed in the compact helical system (CHS). One is NBI modulation experiment, the other is observation of energetic particle loss synchronized with MHD burst, and the results well agree with neutral particle analyzer (NPA) observations. These show that energetic particle can be measured by a directional probe in core plasma and this method enables us to investigate the structure of energetic particle transport due to MHD activities.