Study of tangentially beam-injected ion behavior in LHD using natural diamond detectors

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Fast ion behaviour in future fusion reactor is of great importance for its design. Due to ripple structure, q profile and topology of fast ions trajectories the issue of fast ion confinement is more crucial in fusion reactor based on stellarator configuration. Experiments on Large Helical Device (LHD) with neutral beam injection (NBI) are providing the possibility to study some aspects of fast ion behaviour in largest for today stellarator plasma configuration. Both energy spectra and dynamic of flux of fast ions originally tangentially injected into Large Helical Device plasma with energy 150 keV was studied using tangentially and perpendicular viewing charge exchange (CX) atom spectrometers [1-3] based on natural diamond detectors. Measurements were performed in plasma configurations with magnetic axis at R_{ax} = 3.75 m,.3.6 and 3.53m for axial magnetic field .B_t = +2.5, -2.5, 1.5 and 0.75 T. The degradation of energy distribution and diminishing of decay times of fast CX atom flux were measured at B_t=0.75 T. Sharp increases of fast (E > 29 keV) co-CX atom fluxes were measured in experiments with 200ms co-beam blip injection in R_{ax} = 3.53m and 3.6m configurations during the second part of the beam time when 50-60 kHz MHD instabilities appeared in plasma. Increase of fast co-moving ion transport from plasma center to periphery by 50-60 kHz energetic particle modes in R_{ax} = 3.53 and 3.6m configurations could be discussed as the reason of measured increase of fast CX atom flux.

[1] M.Sasao, et.al. 2001 Proc.18th Int. Conf. on Fusion Energy 2000 (Sorrento, 2000), (Vienna, IAEA) CD-ROM file EX 9/1 and http://www.iaea.org/programmes/ripc/physics/fec2000/ html/ node1.htm

[2] M.Isobe, et.al., Rev. Sci. Instrum., 72, 611-614 (2001).

[3] A.V.Krasilnikov, et.al., Nuclear Fusion, 42, 759-767 (2002).