§ 60. Study of Ripple-trapped Proton Behavior on LHD by 2-line-of-sight Measurement of Fast Neutrals

Saida, T., Sasao, M. (Tohoku Univ.)
Isobe, M., Matsuoka, K., Nishiura, M., Kumazawa, R., Mutoh, T., Watari, T., Seki, T., Saito, K., Murakami, S. (Kyoto Univ.)
Krasilnikov, A.V. (TRINITI)

In LHD, ICRF experiments have been done under a variety of experimental conditions to investigate the heating efficiency and formation of high-energy ion tail. The topics that are related to high-energy ions have been discussed so far as follows: 1) the optimum configuration of resonance layer giving the highest plasma stored energy, bulk ion temperature and high-energy ion tail temperature, 2) the saturation in a high-energy tail temperature and that in the decay time of the bulk temperature, 3) confinement of minority protons in terms of effective temperature [1], and 4) behavior of high-energy ion in plasmas simultaneously heated with NBI and ICRF [2].

In this report, on the basis of previous ICRF experiments, confinement of minority ions in an ICRF heated plasma is investigated for two different resonance configuration, i.e. on-axis (2.5T) or saddle-shape (2.75T) resonance at R_{ax} of 3.6m. By taking advantage of compactness of Natural Diamond Detector (NDD), new information obtained simultaneously from two lines-of-sight is fully utilized [3] (see Fig.1).

The cofinement time of the particles obtained from the tail temperature properties has the best performance on center NDD in saddle-shape resonance (see Fig.2). The tail temperature increases linearly to certain extent as Stix-temperature is increased, then saturation follows. In the linear region, high-energy particles still do not gain enough energy so that the radial excursion of the particle orbit is not extended to a peripheral region. As the result the tail is easy to increase if the line-of-sight looks at the larger resonance area. In the saturation region, it is concluded from analysis using the Lorentz orbit code that the loss processes result from the ripple-induced loss enhanced by broadening of ICRF resonance layer due to the Doppler effect.

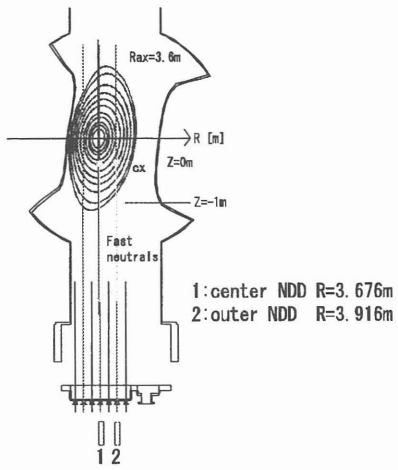

Fig.1 The schematic drawing on installation of NDDs in LHD. Two NDDs look at R=3.676m(1:center NDD) and 3.916m(2:outer NDD) perpendicularly.

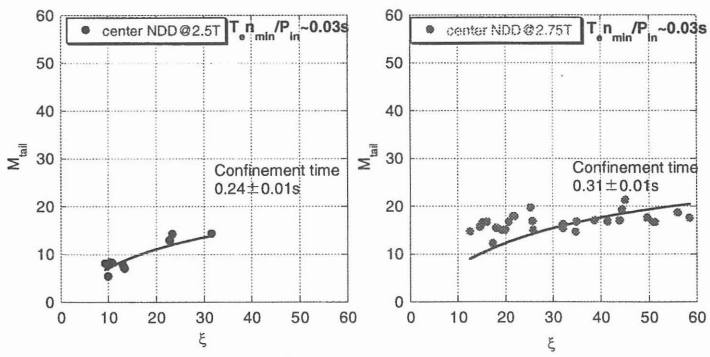

Fig2. Confinement time of high-energy particles for 2 line-of-sight NDD and resonance shape. The tail temperature is a function of slowing down time because of $T_e n_{\min} / P_{in}$ ~0.03s. (left) center NDD, on-axis resonance. (right) center NDD, saddle-shape resonance.

Reference

1) R.Kumazawa et al., Phys.Plasma 8 (2001) 2139
2) A.V.Krasilnikov et al., Nucl. Fusion 42(2002)759
3) T.Saida et al., Nucl.Fusion. To be submitted