§7. Observation of Toroidal Alfvén Eigenmodes Induced Fast Ion Losses in LHD

Nishiura, M., Isobe, M., Yamamoto, S., Osakabe, M., Mutoh, T., Watanabe, F., Ido, T., Nagasaka, T., Hirouchi, T., Nishimura, H., Sasao, M. (Tohoku Univ.), Murakami, S. (Kyoto Univ.)

For understanding fast ion behaviors and their confinements, a scintillator type lost ion probe is newly developed and installed into 2.5U port of LHD. The lost ion probe has measured the loss signals of fast ions near the edge region throughout the 9th and 10th campaigns. During the 10th campaign, we have observed the fast ion losses, while the toroidal Alfvén eigenmodes (TAEs) for n=1, and/or 2 are observed by magnetic probe signals. As the density increases, as shown in Fig. 1, the observed TAE frequencies for n = 1 and 2 decrease from 100 to 40 kHz. At t > 1.2 s, the n = 2 mode disappears, when the co-going neutral beam with the beam energy of 160 keV stopped the injection. When the NB#3 injection stopped, the central electron temperature obtained from Thomson scattering measurements shifted to the inward central peak position. The inward shift is considered due to the change of the beam pressure profile. The fast ion loss signals are compared with two time windows between 1.0-1.1 and 1.3-1.4 seconds in Fig. 3. When only the n = 1 mode is observed, the bursts of fat ion losses appear clearly. The ratio of the burst amplitude to the base loss amplitude becomes roughly 0.6. When the n = 1 and 2 modes are observed simultaneously, the bursts of fast ion losses are not seen clearly. The apparent difference would be related to the locations of the TAE modes and the fast ion transport.

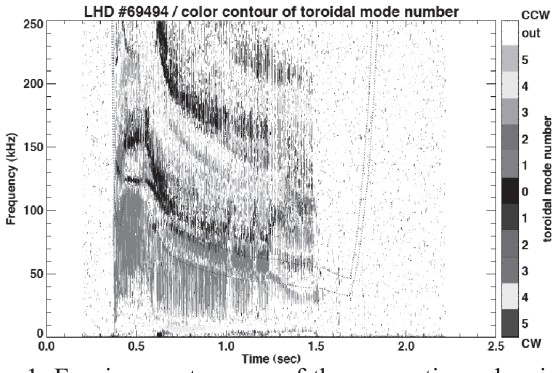

Fig. 1. Fourier spectrogram of the magnetic probe signals during the TAE modes.

From these experiments, the features during TAE excitation are described: in the case of low Bt~0.75T, the bursts of fast ion loss signals are clearly observed rather than Bt > 1.0T.

The ion loss signals during core and edge TAEs(n=1 and 2) are observed and are correlated with the magnetic fluctuation signals.

The TAE frequency range is from 50 to 100 kHz.

The rise time of ion loss signal for a single burst event is roughly less than 300 μs.

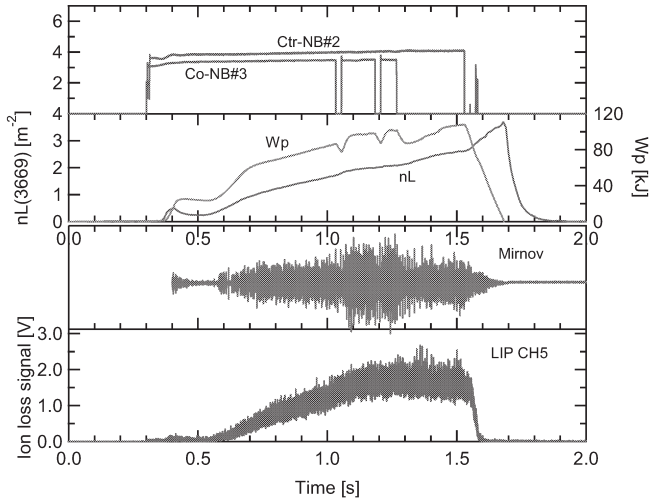

Fig. 2. Fast ion loss signal and magnetic probe signal. The fast ion loss corresponds to the pitch angle of around 130 degrees.

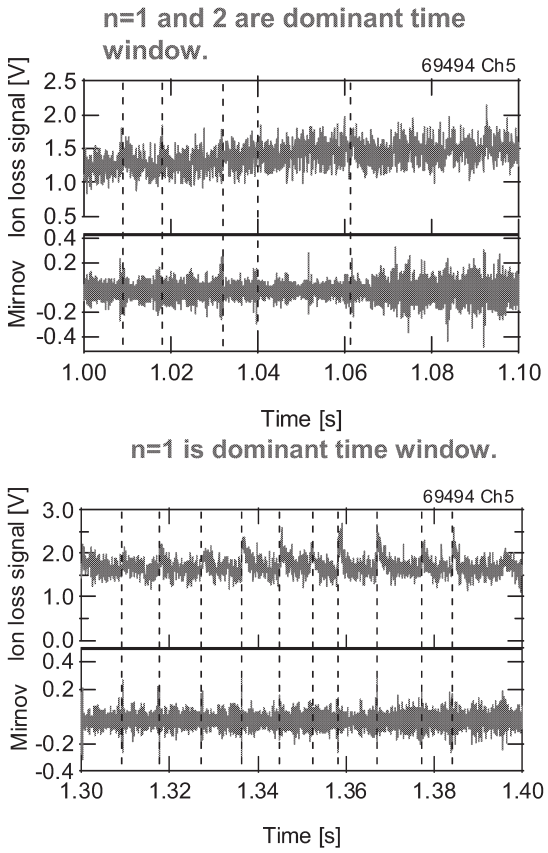

Fig. 3. Fast ion loss signals with unclear and clear bursts.

References

1) Nishiura, M., Isobe, M., et al. NIFS-PROC-63, (2006)194-198.
2) Nishiura, M. et al., Rev. Sci. Instrum. **77**(2006)10E720.