§11. Low Frequency Fluctuation Analysis Using Azimuthally Aligned Probes in GAMMA 10 Tandem Mirror

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Studies of low frequency instabilities are significant for not only open systems but also toroidal systems. The authors have been continuing studies of instability in the central cell of GAMMA 10 tandem mirror[1]. Following to the previous work, the observations of instabilities on ECH application and those just after ICRF pulse are performed, and the results are presented in this report.

The authors also performed observations of instabilities in HANBIT device[2]. The same scheme of analysis is applied for GAMMA 10 plasma. In the central cell of GAMMA 10, azimuthally aligned probes are installed. Four of them, which are aligned with 90 degree intervals at the same axial position, are used in the experiment. Using probe signals of ion saturation currents, f_i, where $i = 1, 2, 3, 4$ is a probe number (numbered in clockwise order), displacement of plasma column can be expressed by $Y_c = (f_4 - f_2)/(f_4 + f_2)$ and $X_c = (f_3 - f_1)/(f_3 + f_1)$, where Y_c and X_c correspond to directions from 2 to 4 and from 1 to 3, respectively. By evaluating time variation of Y_c and X_c, we can obtain a direction of rotation of instability.

In Fig. 1, time evolution of probe signals are presented, where ch3, ch4, ch7, ch8 correspond to probe 1, 2, 3, 4, respectively. The analyzed period is during ECH application. The displacement of plasma column is evaluated by the above scheme. The orbit of the displacement is expressed as Fig. 2. According to Fig. 2, the rotation of the instability is found to be left-hand, which means a flute mode.

The same kind of measurements were performed just after ICRF pulse. The results are presented in Figs. 3 and 4. According to Fig. 4, the rotation of the instability is also left-hand, and a flute mode. This mode may be excited because of reduction of anchor pressure. Comparing Figs. 1 and 3, and Figs. 2 and 4, the frequency of the instability after ICRF pulse is lower than that during ECH application. This may be because enhancement of plasma potential due to ECH induces high $E \times B$ drift, and results in higher frequency instability.

The authors acknowledge cooperations with Prof. T. Cho. of University of Tsukuba.

1) Takeno, H., *et al.*: Ann. Rep. NIFS (2006-2007) 485.
2) Sugimoto, N., *et al.*: The 24th Annual Meeting of JSPF (2007) 30aA09P.

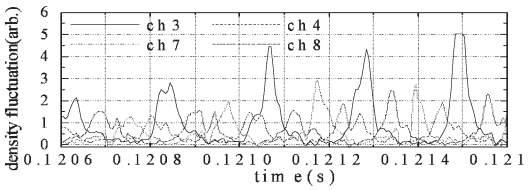

Fig. 1. Time evolution of density fluctuation during ECH.

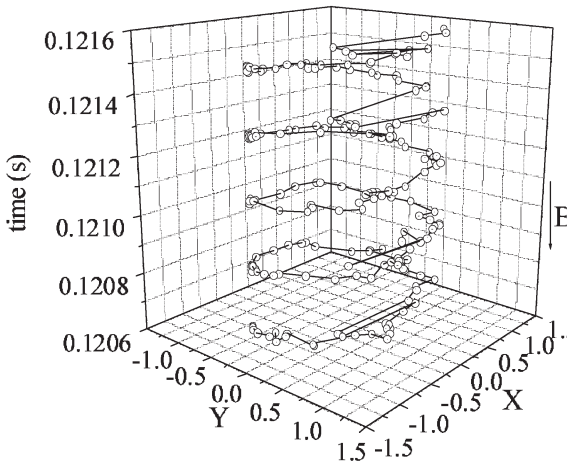

Fig. 2. Orbit of displacement in the cross section during ECH.

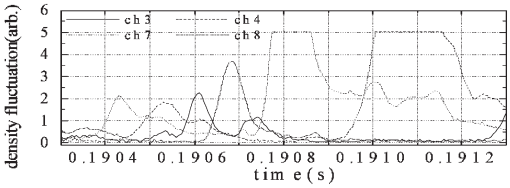

Fig. 3. Time evolution of density fluctuation after ICRF pulse.

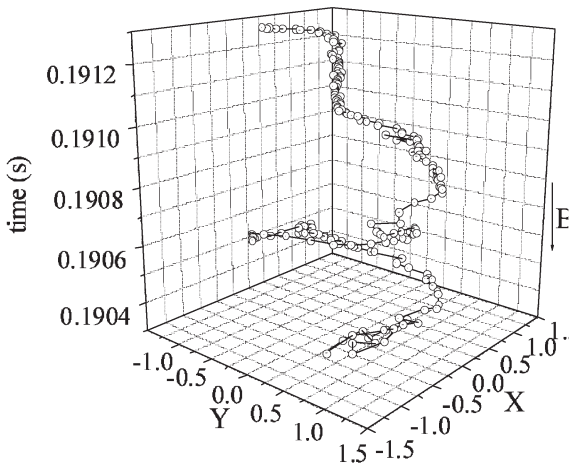

Fig. 4. Orbit of displacement in the cross section after ICRF pulse.