Investigation of Plasma Behavior during ECRH Injection in the GAMMA 10 SMBI Experiments

M. M. Islam, Y. Nakashima, S. Kobayashi[1], N. Nishino[2], K. Hosoi, K. Ichimura[3], M. S. Islam, K. Fukui, M. Ohuchi, T. Yokodo, G. Lee, S. Yamashita, T. Yoshimoto, M. Yoshikawa, J. Kohagura, M. Hirata, R. Ikezoe, M. Ichimura, M. Sakamoto and T. Imai

Plasma Research Center, University of Tsukuba, Tsukuba, Ibaraki 305-8577, Japan
[1]Institute of Advanced Energy, Kyoto University, Gokasho, Uji 611-0011, Japan
[2]Graduate School of Engineering, Hiroshima University, Higashi-Hiroshima, Japan
[3]Dept. of Electrical and Electronic Engineering, Kobe University, Kobe-657-8501, Japan

GAMMA 10 tandem mirror is an open magnetic plasma-confining device [1], which consists of the central-cell, anchor-cells, plug/barrier cells and end cells as shown in Fig. 1(a). In a gas fueling experiment, supersonic molecular beam injection (SMBI) has been carried out in the central-cell of GAMMA 10 [2, 3, 4]. The SMBI experiment with Laval nozzle has been applied only ICRF heated plasma. It inputs a large amount of gas within a short period of time. The increase in the amount of gas in the central-cell increases the electron line density (NLcc). Therefore, more ions flow into the end-cells, and the end-loss ion current increased during SMBI. Electron cyclotron resonance heating (ECRH) is used for the formation of the axial confining potential by plug/barrier-ECRH (P/B-ECRH) in GAMMA 10.

The pulse of ECRH and SMBI were applied during 145ms-165ms and 150ms-150.5ms, respectively. The plenum pressure was varied from 0.5 MPa to 2.0 MPa in the experiments. The electron-line density was increased during SMBI and ECRH injection as shown in Fig. 1(b). Figure 2 shows the variation of NLcc with the plenum pressure of SMBI. The line density increases with the increase of plenum pressure in both cases. However, the line-density is higher in the case of ECRH injection. The ECRH produces a confining potential in the plug/barrier cell. Therefore, the particles are plugged to escape from central-cell to end-cell. In the conference, we will report the detailed results of SMBI experiments during ECRH injection.

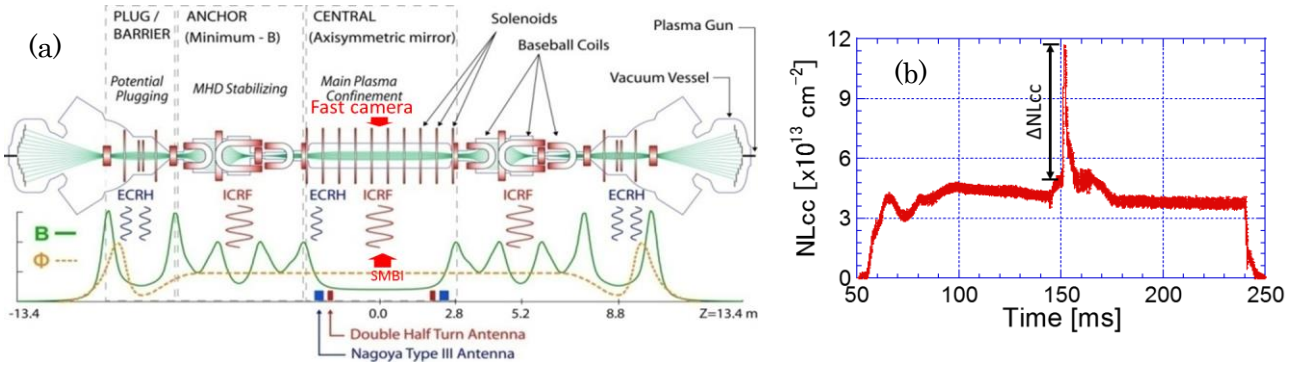

Fig.1 (a) Schematic view of the experimental setup, (b) temporal evolutions of electron line density in the central-cell.

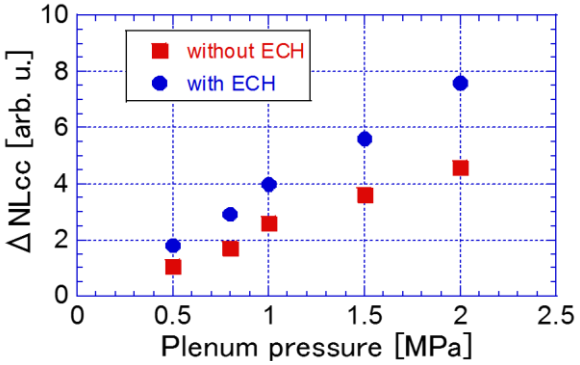

Fig.2 Plenum pressure dependence of NLcc.

[1] Y. Nakashima et al., J. Nucl. Mater. **415**, S996 (2011).
[2] M. M. Islam et al., Plasma Fusion Res, **11**, 2402053 (2016).
[3] K. Hosoi et al., Fusion Sci. Techno. **63**, 244 (2013)
[4] M. M. Islam et al., AIP Conf. Proc. **1771**, 030018 (2016)