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GAMMA10セントラル部プラズマの高温高密度化に向けた ICRF加熱方法の検討

ICRF heating experiment for high-temperature and high-density plasma production in the central cell on GAMMA10

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On the GAMMA10 tandem mirror, Ion Cyclotron Range of Frequency (ICRF) heating is the main method for production and stabilization of base plasmas. Besides, ICRF heating is also used for additional plasma heating. ICRF waves accelerate ions in the vertical direction of magnetic field line and the ion temperature reaches to several keV.

The divertor simulation experiment which is one of the main subjects on GAMMA10 utilizes the particle flux toward the end. The particle flux flowing from high-temperature and high-density plasmas to the divertor simulation device is needed. The particle flux toward the end tends to increase while ICRF waves produce high-density plasmas in the central cell which is located between both anchor cells and holds main plasmas. Therefore, the ICRF heating methods for promoting particle confinement are required in order to produce higher-temperature and higher-density plasmas in the central cell.

Figure 1 shows the experimental results of ICRF heating only in the east anchor cell and Fig. 2 shows those of simultaneous ICRF heating in both anchor cells. In each experiment, additional H_2 gas was puffed from ten milliseconds before ICRF heating. In Fig. 1, line-integrated plasma density with ICRF heating only in the east anchor cell increases more than 4×10^{18} m^{-2}. On the other hand, the effect on the plasma density in the central cell is very little in comparison with that in the east anchor cell. By contrast, in the case of simultaneous ICRF heating in both anchor cells, the effect on the line-integrated plasma density in the central cell is almost the same as that in each anchor cell as shown in Fig. 2. In addition, the line-integrated plasma densities reach to near 10^{18} m^{-2}. One of the interpretations for the results is the formation of electric potentials in both anchor cells by high-density plasmas which leads to the improvement of particle confinement along the magnetic field line.

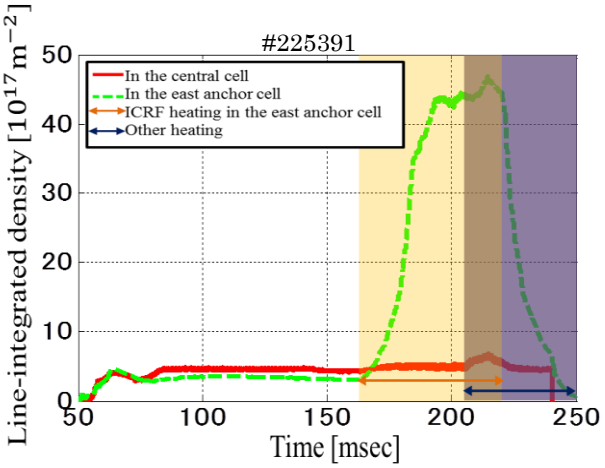

Fig. 1. Line-integreted densities with ICRF heating only in the east anchor cell between 160-220 msec and puffing of additional H_2 gas from 150 msec. Other heating was applied from 205 msec.

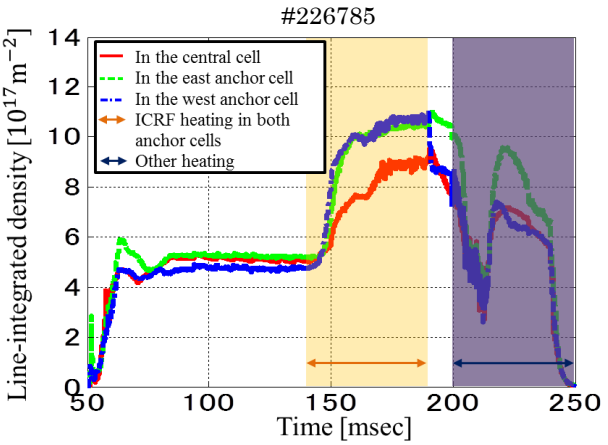

Fig. 2. Line-integreted densities with ICRF heating in both anchor cells between 140-190 msec and puffing of additional H_2 gas from 130 msec. Other heating was applied from 200 msec.