

§7. Analysis of Edge Plasma Turbulence and Neutral Particle Transport in Open Magnetic Field Configuration Plasmas

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Investigation of edge plasma behavior and neutral particle transport is important subject for open magnetic field configuration plasmas. Particularly in tandem mirror plasmas, penetration of neutrals into the core plasma region plays an important role in formation of the neutral density profile. Recently a CCD camera with a speed of 400 frame per second was installed on the central-cell midplane and used for the measurement of plasma shape and response to the application of plasma heating pulses. The objective this research is to investigate the optimization of plasma production and sustainment for achieving better plasma confinement in tandem mirror plasmas.

Figure 1 shows the schematic view of the vacuum chamber wall and the magnetic-flux tube from the central-cell to the east anchor-cell. In the central-cell, three limiters are installed to control the plasma boundary in this region. One is installed near the midplane ($z = +30$ cm; CC-limiter). Another limiters have a structure of iris and is installed at 1.5 m away to the east ($z = -155$ cm) from the midplane (Iris-limiter(E)). The same type limiter is installed at 1 m away to the west ($z = +100$ cm; Iris-limiter(W)). These two limiters can be changed in the diameter. As shown in Fig. 1, many $H\alpha$ line-emission detectors have been installed in the central-cell and three of them are mounted close to the CC-limiter and Iris-limiters, respectively.

Figure 2 shows the two types of time behavior of plasma parameters measured in the GAMMA 10 central-cell. One is "sustained shot" that the plasma is continued for a period of time after the start of the ECH pulse (#205260) and the other is "collapsed shot" that the plasma is quickly decays together with the ECH pulse (#205261). In the case of sustained shot, both line-density of the plasma (NLcc) and diamagnetism (DMcc) start increasing with ECH. However, DMcc begins to decrease in the course of the ECH pulse and NLcc also strongly decreases just before the end of the ECH pulse. In the case of collapsed shot, on the other hand, both DMcc and NLcc begin to decrease at the same time of the ECH injection. It is noted that the rapid increase of $H\alpha$ intensity is recognized just after the onset of ECH especially located at Iris-limiter(W). In the case of sustained shot, it is observed that the signals of $H\alpha$ intensity in every position strongly increases at the plasma collapse in the end of ECH pulse.

Figure 3 shows the visible image of the plasma near the CC-limiter taken by the CCD camera at the time just before the ECH pulse ($t = 157.5$ ms). In the case of the sustained shot (Fig. 3(a)), the light emission from the whole inner surface area of the CC-limiter is observed. In the collapsed shot, on the other hand, a strong radiation from the upper edge of the limiter is observed and the light emission from the lower part of the plasma column is diminished.

From the above results, it is found that position control of the plasma and the limiter is important for plasma optimization.

1. Y. Nakashima, *et al.*, 7th Int. Conf. on Open Magnetic System for Plasma Confinement (July 15-18, Daejeon, Korea) O-11.
2. Y. Nakashima, *et al.*, *ibid.*, O-20.
3. Y. Nakashima, *et al.*, 14th Int. Congress on Plasma Phys. (September 8-12, Fukuoka, Japan) FI-P3-229.

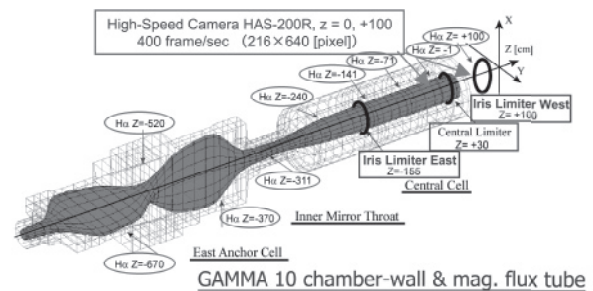


Fig. 1. Schematic view of the vacuum chamber wall, the magnetic-flux tube and the location of diagnostics used for this experiment.

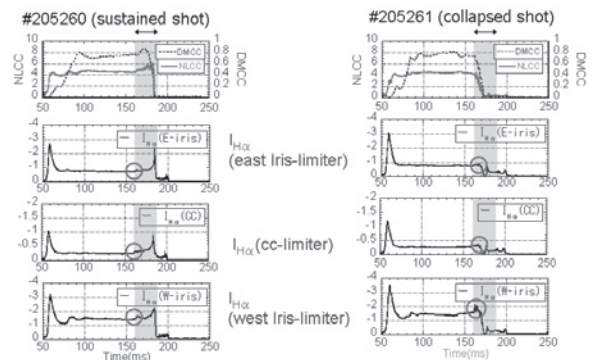


Fig. 2. Time behavior of plasma parameters measured in the GAMMA 10 central-cell. (a) "sustained shot" (b) "collapsed shot"

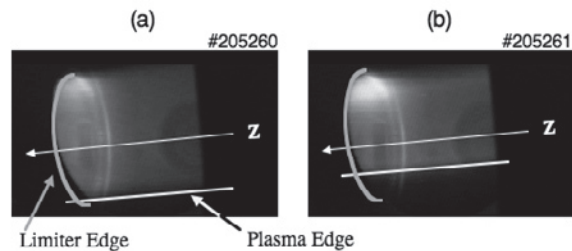


Fig. 3. 2-D image of the plasma near the CC-limiter taken by the CCD camera at the time just before the ECH pulse ($t = 157.5$ ms). (a) "sustained shot", (b) "collapsed shot"