§32. Study of Effect of Plasma Flow on Magnetic Island Dynamics in Helical Plasmas with Various Magnetic Configurations

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It is required to proceed with the study of magnetic island focusing on the correlation between the magnetic island and plasma flow in helical plasmas with various magnetic configurations because the common phenomenon that the magnetic island is healed after the increase in a poloidal flow has been observed among the Heliotron (LHD) and Heliac (TJ-II) [1]. In addition to those two devices, the study in the Heliotron-J (Helical-axis Heliotron) is expected to obtain the detailed experimental observation about the magnetic island. During several years, resonant magnetic perturbation (RMP) coil system, the charge exchange recombination spectroscopy (CXRS) system, and the magnetic diagnostic systems have been prepared in the Heliotron-J. The RMP coil system imposes the perturbation magnetic field with m/n = 2/1 Fourier mode as shown in fig. 1 (a), resulting the vacuum magnetic island with m/n = 2/1 mode (fig. 1 (b)) [2]. Varying the current flowing in the RMP coil, the width of the island can be changed (fig. 1 (c)). The CXRS system measuring a CVI line can obtain the poloidal flow velocity [3]. This CXRS system is a powerful tool to study the effect of plasma flow on magnetic island dynamics in helical plasmas with various magnetic configurations. To detect the perturbed field originating from the island dynamics the saddle loop coil system is also the powerful tool [2] (fig. 3). The saddle loop array is composed by 6 saddle loops and the poloidal mode number of the plasma response field can be obtained by the spatial Fourier decomposition of the poloidal profile of the perturbed field.

These preparations of the control and diagnostic systems will provide to us the beneficial experimental result to understand the effect of plasma flow on magnetic island dynamics in helical plasmas with various magnetic configurations.

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[1] Y. Narushima, et al., (2011) Nuclear Fusion **51** 083030
[2]S. Yamamoto et al., "Studies of Magnetic Island using RMP and Optimized Magnetic Measurement in Heliotron J Plasmas" ITC-22 Toki Japan
[3] T. Harada, *et. al.,* (2014) Plasma conference 19PB-083

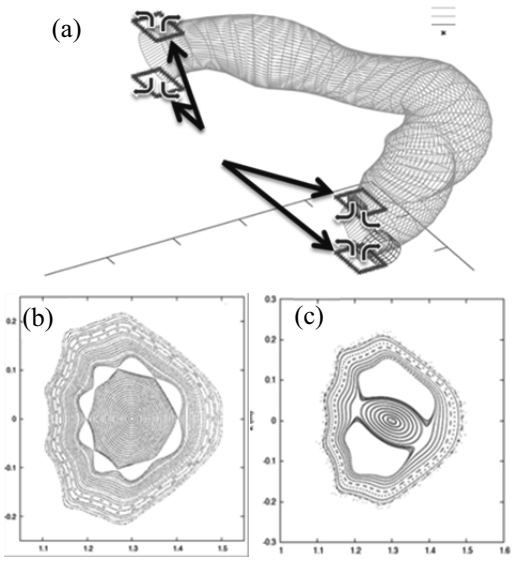

Fig. 1 RMP coil system in Heliotron-J (a). Poincaré plot without RMP (b) and vacuum island with RMP I_{RMP} = -20kA (c). [S. Yamamoto et al., "Studies of Magnetic Island using RMP and Optimized Magnetic Measurement in Heliotron J Plasmas" ITC-22 Toki Japan]

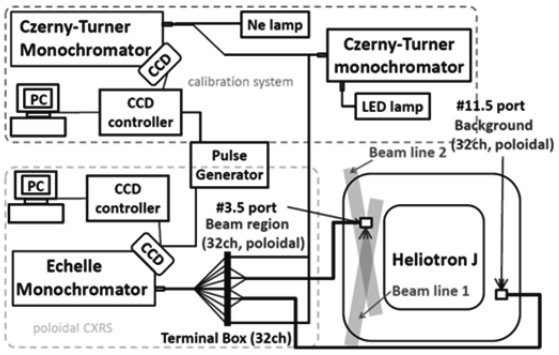

Fig.2 CXRS system in Heliotron-J. The poloidal flow velocity can be measured. [T. Harada, S. Kobayashi, et al., Plasma conference 19PB-083 (2014)]

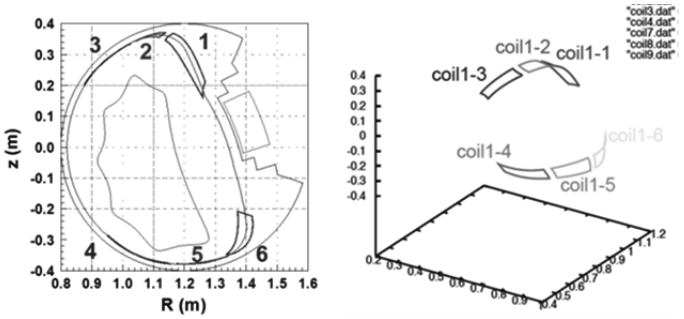

Fig.3 Saddle loop system in Heliotron-J. Plasma response magnetic field can be detected. From [S. Yamamoto et al., "Studies of Magnetic Island using RMP and Optimized Magnetic Measurement in Heliotron J Plasmas" ITC-22 Toki Japan]