# §19. Design of a New Lost Fast Ion Probe on Compact Helical System

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The confinement property of energetic ions, especially helically trapped ions is of concern in Compact Helical System (CHS) because their orbits significantly deviate from magnetic flux surfaces. To make argument clear, we show Mod-$B_{min}$ contours of standard configuration ($R_{ax}$ = 92.1 cm) of CHS in Figure 1. It can be seen that Mod-$B_{min}$ contours are not well aligned with the flux surfaces. This suggests trapped fast ions are not well confined in CHS.

We have so far measured escaping co-going transit beam ions and transitional ions with a scintillator type probe [1,2]. It has provided clear experimental evidences for beam ion loss via collisional processes and MHD-induced losses [3-5]. In order to understand beam ion behavior in further detail from experimental approach, a new type of lost fast ion probe has been designed. It is installed at a small major radius side of CHS and detects lost helically trapped fast ions. A three dimensional schematic drawing of this probe is shown in Fig. 2. Because the CHS plasma touches the vacuum chamber wall at the small major radius side, the space for the sake of probe installation is limited. Therefore, the choice of detection position and design of the probe are carefully carried out. We choose a smaller ZnS(Ag) scintillator of 1.6cm x 1.6 cm than that of previous probe because in addition to limited space, somewhat slowed down, deflected fast ions are thought to be detected. The two dimensional scintillation image due to fast ion impact is guided from detection point to a viewing window mounted on diagnostic port by the use of a rod-type image transferring tube. This image is again transferred to be recorded to an imageintensified-CCD camera via a fiber scope. Fig. 3 shows an example of escaping helically trapped fast ions($H^+$, 17 keV) reaching the probe. By the use of both lost fast ion probes for passing, and helically trapped ions, we are going to study not only ripple transport of neutral beam-injected fast ions but also MHD effect on beam ion confinement in CHS more comprehensively.

References

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4) Kondo, T. *et al.*, Nuclear Fusion **40**, (2000)1575.

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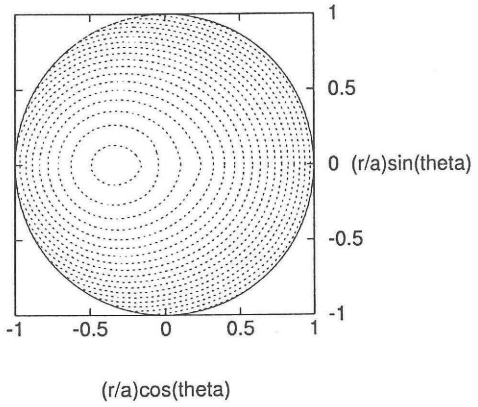


Fig. 1. Mod-$B_{min}$ contours of standard configuration ($R_{ax}$ =92.1 cm) of CHS.

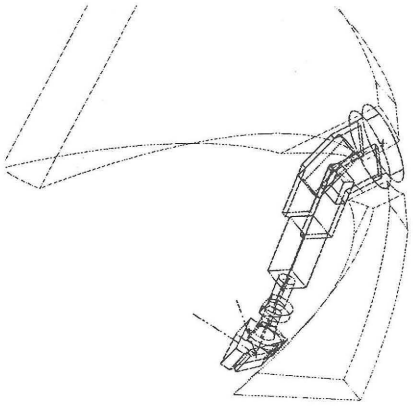

Fig. 2. Three dimensional schematic drawing of a new lost fast ion probe detecting helically trapped ions.

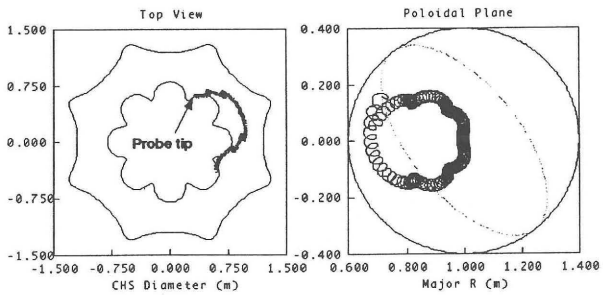


Fig. 3. An example of lost helically trapped fast ions ($H^+$, 17 keV) reaching the probe.