

## §7. Visualization of Leakage EM Field around RF Oscillators for Ion Cyclotron Resonance Heating

Kamimura, Y. (Grad. School of Engin., Utsunomiya Univ.), Tanaka, M.

### i) Introduction

The purpose of this study is to investigate the time varying (random and intermittent) properties of the leakage electromagnetic field that has specific broadband characteristics in the fusion study facilities, and to establish worker's safety management method for particular leakage electromagnetic field (EMF) exposure. This study paid attention to the power supply room of coils and the surround of power amplifiers for LHD ion cyclotron resonance heating where workers may approach comparatively easily and the leakage EMF are generated. The visualization of the leakage EMF (i.e. EMF distribution measurement) has been performed using a position tracking system with IR camera of Wii-remote.

### ii) Methods

In the surrounding of the power amplifier for the ion cyclotron resonance heating, the visualization system for time varying leakage EMF distribution that had been developed last year was used.<sup>1)</sup> Concretely, two EMF dosimeters (Radman) were used. One dosimeter adhered an IR marker measured the EMF strength distribution.<sup>2)</sup> Another was fixed to a comparatively strong position of EMF strength for obtaining the time variance. The EMF strength distribution corresponding to the peak of the time-variance is obtained based on the measurement results of both dosimeters.

In the experiment in the coil power supply room, the compliance of the protection guideline in the passage between power supply units was visualized and was evaluated by the visualization system for low frequency leakage magnetic field distribution with magnetic field meter (ELT-400).<sup>2)</sup>

### iii) Results

The visualization measurement of the time varying EMF with Radman was tried again because it had been expected that the heating experiment by ICRF in 2013 was performed in the previous year by a high power. However, leakage EMF strength did not reach the sensitivity of Radman still. It was confirmed that we have to change the instrument to obtain EMF distribution. Therefore, the leakage electromagnetic field is so weak, and we can say that it hardly has potential hazard.

In experiment on the low frequency leakage magnetic field distribution visualization in the coil power supply room, though the results of the instrument in accordance with the ICNIRP guideline in 1998 exceeded the reference level at the passage entrance between power supply units (Fig.1), the results by the instrument in accordance with the

ICNIRP guideline in 2010 did not exceed it except entering the interior of the passage (Fig. 2).

### iv) Conclusion

At present, the leakage EMF that exceeded the protection guideline has not been observed around the ICRF device. It is confirmed that the visualization system for the low frequency magnetic field distribution can easily distinguish the compliance of protection guideline of the leakage magnetic field in the power supply room of coils.



Fig. 1. Compliance distribution of protection guideline in the vicinity of entrance of passage (ICNIRP 1998).



Fig. 2. Compliance distribution of protection guideline in the vicinity of entrance of passage (ICNIRP 2010).

- 1) Sato, K., Nakayama, S., and Kamimura, Y.: "A Measuring Method for Time-Varying EM Field Distributions," AP-RASC'13, Taipei, Taiwan, EK-2 (2013-09).
- 2) Sato, K. and Kamimura, Y.: "Measurement and Visualization of EMF Distributions", J. Plasma Fusion Res., Vol.88, No.8 (2012) 432-436.