

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

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Introduction

The purpose of this study is to investigate the time-variant (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 exposure. This study paid attention to oscillator for LHD ion cyclotron resonance heating where being able to approach comparatively easily by the worker and the leakage electromagnetic field were generated. The visualization of the leakage electromagnetic field (i.e. electromagnetic-field distribution measurement) was tried with a positional sensing system using the IR camera of a Wii-remote¹⁾.

Methods

First of all, the visualization measurement system of the leakage electromagnetic field distribution with time-variance has been constructed. Concretely, two electromagnetic field dosimeters (Radman) were used. One measures the electromagnetic field strength distribution as mounting IR marker like conventional¹⁾. To obtain the time-variance, another was fixed to a comparatively strong position of electromagnetic field strength. The electromagnetic field strength distribution corresponding to the peak of the time-variance is obtained based on the measurement results of both dosimeters. The effectiveness of the system was verified by using the leakage electromagnetic field when fluorescent lamp of the light bulb type was made to change with the slide transformer in the preliminary experiment.

Results

In the case with time-variance (Fig.2), the level has become small in parts than the case without time-variance (Fig.1). However, when the level was corrected according to the value of the fixed measuring instrument, the distribution approached that without time-variance (Fig.3).

Discussions

Since the intensity of the leakage electromagnetic field around IC RF system is not so high compared with the sensitivity of the electromagnetic field dosimeter when the preliminary measurement was tried in the heating experiment by ICRF in the fusion study facilities, the electromagnetic field distribution was not obtained.

There is necessary of experiment being performed by using another measuring instrument to obtain the electromagnetic field distribution.

Conclusion

At present, the leakage electromagnetic field that exceeds the protection guideline is not observed around IC RF system. It is necessary to be going to examine the visualization of the very low frequency magnetic field in the coil power supply room where the place where it seems to exceed the protection guideline in the future.

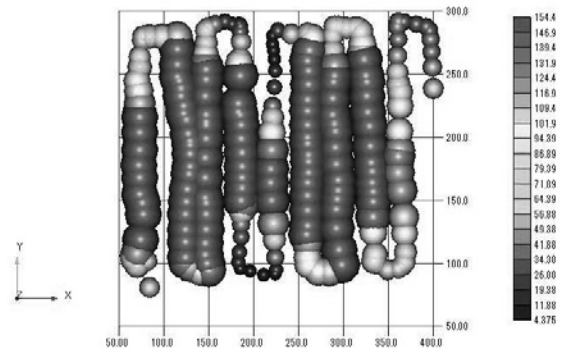


Fig. 1. E-field distribution without time-variance.

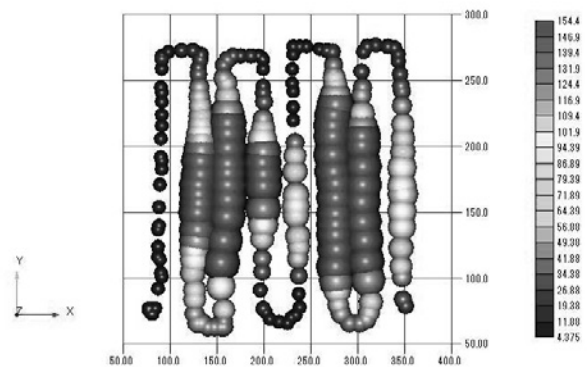


Fig. 2. E-field distribution with time-variance.

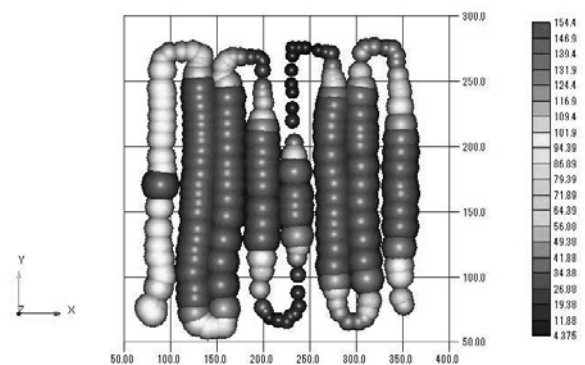


Fig. 3. Distribution corrected by values at a fixed point.

1) Sato, K. and Kamimura, Y.: "Measurement and Visualization of EMF Distributions", J. Plasma Fusion Res., Vol.88, No.8 (2012) 432-436.