# §8. Measurement of Transmission of Electron Heating Wave through the Fundamental Resonance region at the Plug of GAMMA 10

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## I. Objectives

An experiment of generation of a high ion confining potential is now under progress by introducing new 500 GHz gyrotrons. In the fiscal year 2005, a record value of the confining potential substantially exceeding 2.5 kV was achieved. The next issues are formation of a further larger potential and improvement of the radial confinement with a radial electric field and /or a shear of the radial electric field. Development of an improved antenna for control of the radiation pattern of the electron-heating microwave is now under way. To realize improved confinement, however, information and control of absorption of the heating wave are necessary. In this study, we evaluate the absorption profile through the measurement of the profile of transmission of the heating wave. Then, we contribute to effective formation of the confining potential and control of the radial potential distribution.

## II. Method and procedure

A detector array for measurement of the transmitted microwave had been installed at the plug of GAMMA 10. Number of detectors was built up to twelve from six at the end of the fiscal year 2005. Now, the radial distribution of the transmitted microwave can be measured. The transmission coefficient is determined as the ratio of the transmitted power detected by each channel in a plasma shot to that without plasma. This method has been established and carried out with a proper shot interval. We can obtain the information for control of the potential distribution by combining the data of the microwave transmission and the radial potential distribution.

In addition to a FDTD full Maxwell code, a numerical code has been developed to theoretically calculate the transmission rate of the heating wave through a magnetic beach geometry. This code evaluates the absorption rate by path-integration of the local absorption coefficient derived from direct calculation of the warm dispersion relation at each position along the wave path.

## III. Results

The transmission rate $T$ of the heating wave was derived for each channel from the detected powers with and without plasma. The absorption rate is evaluated as $A = 1 - T$. The radial distribution of the absorption rate has a maximum value on axis. The density dependence of $A$ was experimentally obtained. This data indicated that the ratio of the R wave is about 80 % of the total power radiated from the antenna.

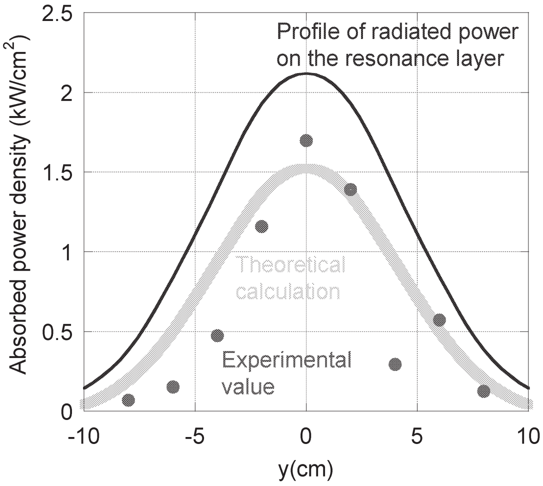

Fig.1 Distribution of the absorbed power density on the resonance layer

Figure 1 plots the radial distribution of the power density of the heating wave by the thin solid line. The radial profile of the absorbed power was evaluated by multiplying the radial power distribution of the heating wave at the plug by the radial distribution of the absorption rate. The radial power distribution of the heating wave was determined from the radiation pattern of the antenna. Spread of the rays was taken into account in this evaluation. It was also assumed that absorption occurred at only the plug region. The closed circles in Fig. 1 show the experimentally evaluated radial profile of the absorbed power density. It is peaked on the axis. The absorbed power density was calculated by setting the radial distribution of the electron density and the electron temperature. The dispersion relation was solved for the beach geometry for this calculation. The thick solid line stands for the calculated absorption power density. This well agrees with the experimentally evaluated data.

We have first measured the radial profile of the absorbed power. Fifty through sixty percent of the radiated power was absorbed at the plug.

## References

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