§36. Development of Scattering Measurement System Using a Gyrotron as a Power Source and its Application to CHS

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Gyrotrons are well suited sources for scattering measurement because of their capacity for high powers at submillimeter wavelengths [1] . The gyrotron used in the present work delivers long pulses (τ=0.6 s) of suitably high power (p~110 W) at submillimeter wavelengths (f=354 GHz, λ=0.847 mm) [2] . Its application enables us to improve the S/N ratio of the measurements and to observe density fluctuations with a lower level.

We are designing a new transmisssion line which is suitable for producing a high quality beam. The transmission line consists of a quasi-optical antenna, mirrors and polarizer [3] . The application of the high quality beam to scattering measurement enables us to improve the spatial resolution of measurement.

As first trial, we installed the scattering measrement system in CHS device. The gyrotron output is transmitted to a quasi-optical antenna by using the convensional waveguide and is converted into two-dimensionally focused beam. Scattered wave from plasma is received by horn antennae installed in plasma vessel and is converted into low frequency signal by homodyne detection system.

The scattering measurement with scattering angles of 4.4° and 8.8° is carried out in ICRF heated plasmas (t=40~90 ms). Target plasmas are produced by electron cyclotron resonance heating. Figure 1 shows time evolutions of scattered wave power for respective frequency intervals. This scattering angle of 8.8° corresponds to wavenumber of 11.4 cm^{-1}. The increase in scattered wave power is followed by the ICRF heating. But, no significant increase in scattered power is obseved in high frequency range (f>50 kHz). Reflectmetry with frequency of 39 GHz gives similar results (Fig.2).

Because we are to replace homodyne detection system with heterodyne system in this year, informations on propagation direction will be available to understanding density fluctuations. In the near futur, we will try the detail measurements on plasma parameter dependences.

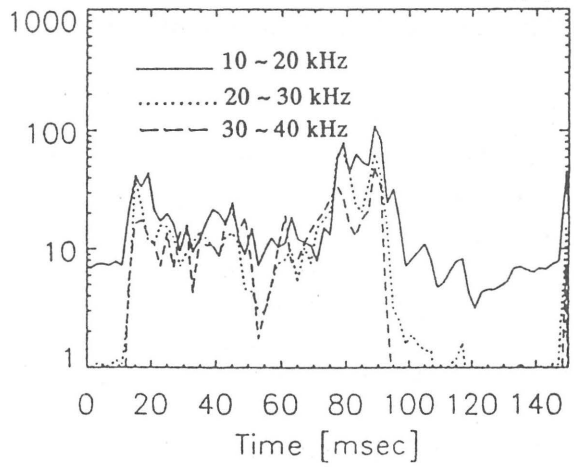

Fig.1 Time evolution of scattered wave power which is obtained by scattering measurement with scattering angle of 8.8°

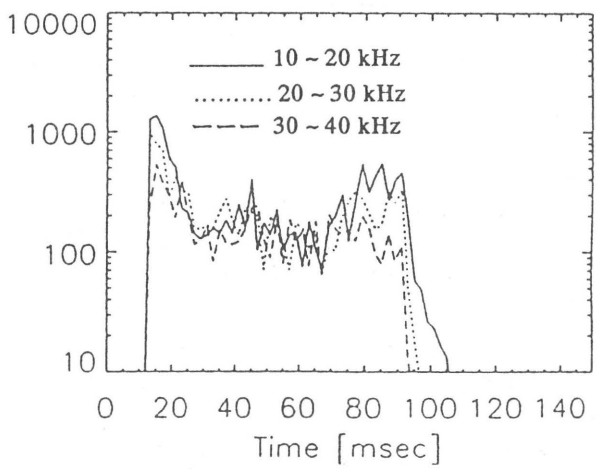

Fig.2 Time evolution of scattered wave power which is obtained by Reflectmetery with frequency of 39 GHz.

References

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