

§12. Modulated ICRF Experiment in CHS

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The incident power amplitude modulation experiment of ICRF heating was carried out in CHS in order to investigate the heating mechanism and the confinement properties of the heated plasma. The intensity of the second harmonic electron cyclotron emission (ECE) was measured at five frequencies which correspond to the electron temperatures at five different spatial points along the horizontal line of sight. The radiometer for ECE measurement consists of two different systems; one is 4 channel filter bank system with fixed different frequencies and the other is super heterodyne system with a local oscillator as shown in Fig.1. In this experiment, fast wave energy was absorbed by electrons following mode conversion. It is important to understand the mechanism of electron heating by the injected ICRF power. ECE signals can be analyzed to deduce the power deposition profile of electrons in ICRF heating experiment.

During the modulation experiment, the central electron temperature and density were 150 eV and $0.80 \times 10^{13} \text{ cm}^{-3}$, respectively. The magnetic field at the center of the vacuum vessel was 1.70 T, where the hybrid resonance (hydrogen minority in deuterium plasma) was located on axis with applied frequency of 26MHz. The 2nd harmonic electron cyclotron frequency is about 70 (at edge) \sim 105 (on axis) GHz. The amplitude modulation was applied to the U and/or P antenna. The modulation frequency of ICRF heating was about 62.5 Hz. The modulated ICRF heating power was injected at 50kW during/after ECRH pulse.

An example of ECE signal during the modulation experiment is shown in Fig.2. Here, power applied to P antenna was modulated after ECH was turned off at $t = 93 \text{ ms}$. Each ECE channel apparently responds to the applied power modulation, but sophisticated analysis is required

to derive local temperature and to get the power deposition profile from these data because the optical depth τ of each channel is rather thin ($\tau(r/a=0) = 0.31$ in this case)¹⁾. Several trials for deriving the power deposition profile are under way.

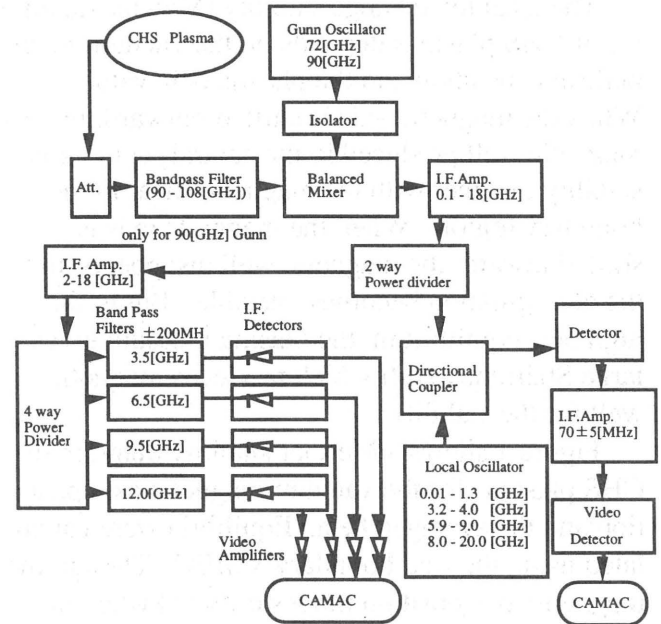


Fig.1 The 5 channel heterodyne radiometer system for ECE diagnostics. 4 channels of the filter bank system are adjusted at fixed frequency. The other channel can be varied almost over whole region of the plasma by changing local frequency.

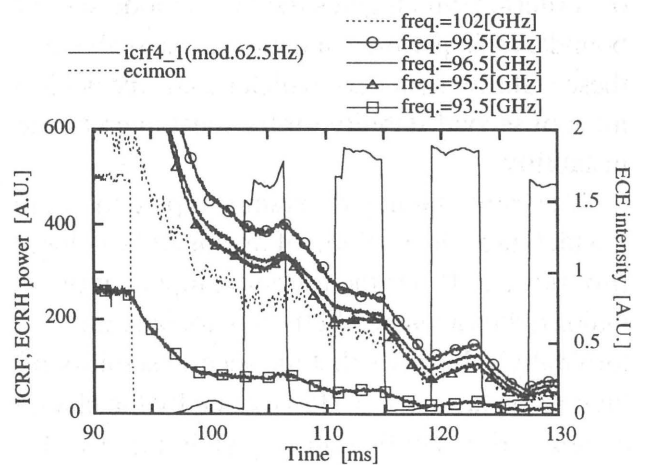


Fig.2 ECE signals in ICRF power modulation experiment.

References

- 1) Janicki.C., Nuclear Fusion, **33** (1993) III 513