§23. High Power ECH Experiment in CHS

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Electron cyclotron heating (ECH) experiment using high power (400 kW and/or 200kW) gyrotrons and quasi-optical transmission/antenna system have been carried out in CHS. Main purpose of this experiment is to investigate plasma confinement properties in the low collisionality regime. One of the attractive features of using ECH is that the power deposition region can be localized and controlled. This feature is a powerful tool for the local transport investigation. The antenna and transmission system is optimized for this purpose. Resultant microwave beam injected in CHS by this antenna is almost pure elliptic Gaussian whose waist size is about 15 mm in radial direction and 50 mm in toroidal one on the mid-plane of the CHS[1]. This focused beam can be directed to any radial position on a poloidal cross section. This feature has been checked by placing a thermal paper on the mid plane of CHS and to see the burn pattern made by short pulse microwave.

Figure 1 shows the typical radial profile of the electron a) temperature and b) density profile measured by YAG laser Thomson scattering during fundamental ECH with almost 500kW input. Here, ECH is injected from t = 12 ms to 42 ms. The electron temperature rises rather fast and peaked profile is formed with the central temperature exceeding 1.5 keV about 10 ms after the ECH power is turned on, while the electron density has almost flattened or hollow profile in the range of 5 to 7 x 10^{18} m^{-3}.

Attained diamagnetic energy at maximum was 1 kJ at t=20 ms. The power deposition profile is now tried to deduce from the combination of the multi-channel electron cyclotron emission measurement and fast modulation of the ECH power. This power deposition profile is one of the most important parameters in performing the transport analysis.

The drastic effect of the polarization on to the plasma initiation, in particular the case of second harmonic resonance, has also been observed by changing the polarization angle.

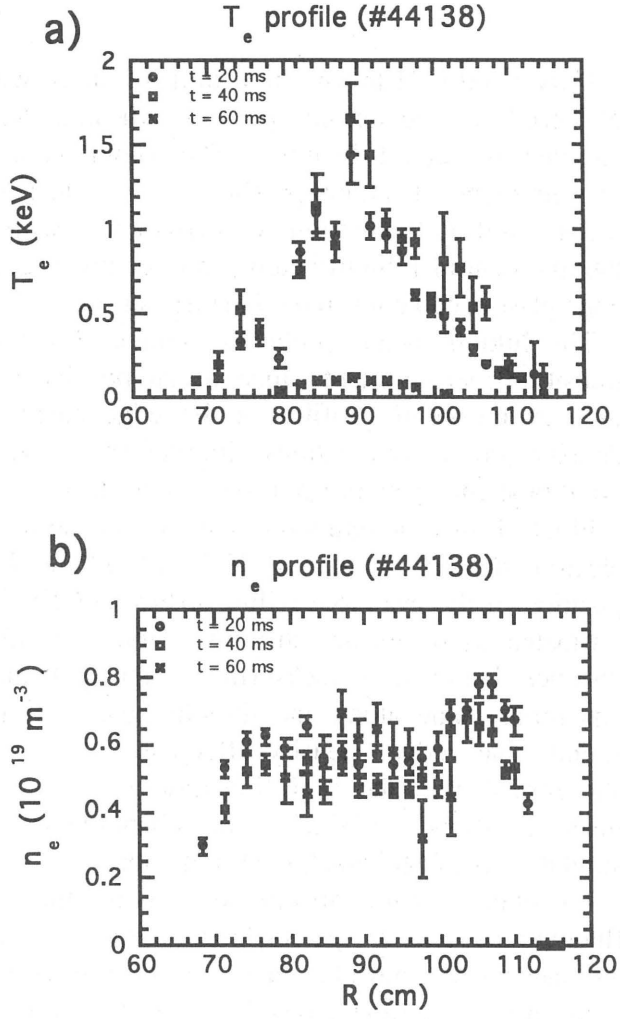

Fig.1. Electron a) temperature and b) density profile measured by YAG laser Thomson scattering. Open circle, open square and cross indicate the data at t = 20 ,40 and 60 ms, respectively. ECH is injected from 12 to 42 ms.

Reference
1)Kubo, S., et al.,Fusion Engineering and Design 26 (1995)319.