

§50. ECE Diagnostics on LHD

Nagayama, Y., Inagaki, S.
 Sasao, H. (Grad. Univ. Advanced Studies)

Electron cyclotron emission (ECE) diagnostics is useful to measure the electron temperature profile continuously. In LHD, working ECE spectrometers are as follows: the 70 GHz heterodyne radiometer, the fast scanning Michelson interferometer and the grating polychromator (GPC). The Michelson takes the whole spectrum of ECE every 25 ms. The radiometer has 32 channels and each channel has one GHz bandwidth. The frequency of the local oscillator is the 70 GHz, and upper half (71 - 87 GHz) and the lower half (52 - 69 GHz) are divided by 16 channels, respectively. Corrugated waveguide system on LHD contains two notch filters (82.5 and 84 GHz) and the radiometer contains two notch filters (82.5 and 84 GHz) in the rectangular waveguide in order to protect the ECE spectrometers from the leaked electron cyclotron heating (ECH) power. So, three channels (82 - 86 GHz) are blind. Michelson and GPC are disturbed by the leaked ECH but the radiometer works during ECH.

Figure 1 shows time evolution of ECE electron temperature of LHD plasma with NBI. The build up of the temperature in the outer region delays from the central region. This shows that initial plasma is small and spread to outer region due to NBI heating. ECH produces a small target plasma first, and the NBI makes the plasma much larger and much hotter. In the outer region, once build up of the temperature starts, it exponentially grows for 150 ms. This time constant is similar to the energy confinement time.

Figure 2 shows time evolution of ECE electron temperature of LHD plasma with/without ICH. In this experiment, electrons were heated due to the mode conversion of ICH. The central electron temperature increased from 330 eV to 440 eV due to the ICH, but a significant increment of the electron temperature is observed in the outer region. The heating in the outer region starts earlier than that in the central region. These phenomena can be explained as the electron is

heated in the mode conversion layer, which is in the outer region.

In Fig. 1, small sawteeth like oscillation is seen. However, this is a signal modulation due to the Michelson system. The back and forth motion of the scanning mirror of the Michelson oscillates the grid of a beam splitter in front of the Michelson. The reflection from the beam splitter comes into the radiometer and modulates the radiometer signals. This problem was solved after the second cycle LHD experiment, as making a 10 cm air gap between the Michelson and the beam splitter.

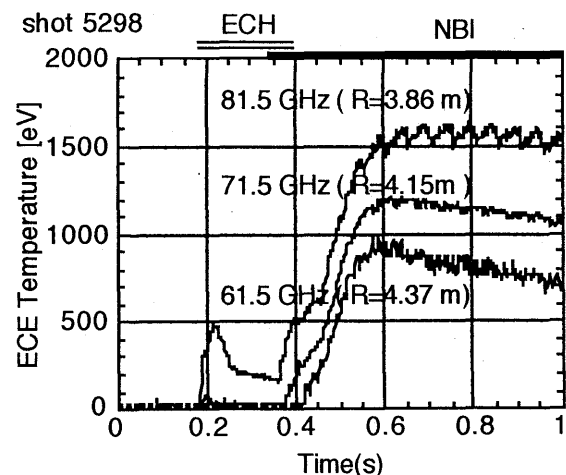


Fig. 1 Time evolution of ECE electron temperature of LHD plasma with NBI.

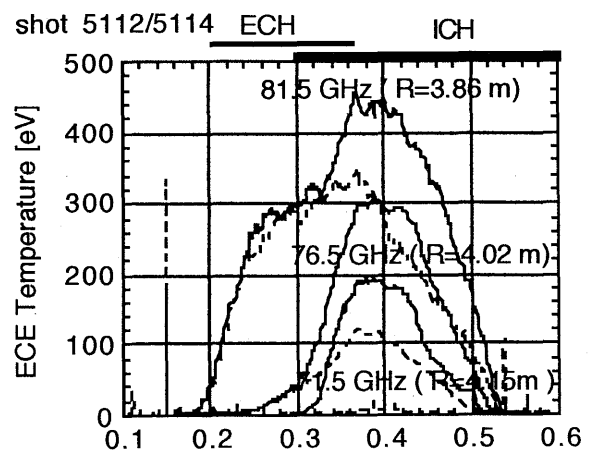


Fig. 2 Time evolution of ECE electron temperature with/without ICH.