§2. Electron Temperature and Density Measurements by Using the Thomson Scattering System in GAMMA 10

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An yttrium-aluminum-garnet (YAG) Thomson scattering (TS) system was constructed and applied to the tandem mirror GAMMA 10 device to measure the electron temperature and density. A large solid-angle TS light-collection system was achieved by use of a spherical mirror system and large numerical aperture of bundled optical fiber. We constructed two five-channel polychromators with new avalanche silicon photo diodes. We carried out the Rayleigh and Raman scattering experiments for system settings and calibrations, and applied the YAG-TS system to the GAMMA 10 plasma. We applied the new charge to digital converter (QDC) system (CAEN, V792) for multi-channel and multi-period TS signal measurements with 50-channel high-speed amplifier system.

The YAG-TS system is constructed with the laser, the incident optics, the light collection optics, the signal detection electronics, and the data recording system. Details of the system is shown in elsewhere. We prepared the new polychromator systems (TS-030 and TS-136) with new APDs (Perkin Elmer, C30659-1060-3A). Moreover, we made an improvement of preamplifier circuit for Hamamatsu APD (S8890-30) in the polychromator TS-143. Then we can obtain the Thomson scattering signals by TS-143. The signals are recorded by using the high speed oscilloscopes, a DPO 4034 (Tektronix) and two DS5524 (IWATSU). We can measure three radial positions' electron temperatures and densities in a single plasma shot (Fig. 1). Fig. 1 (a) and (b) show the radial electron temperature and density, respectively. The linearity of both QDC system and 50-channel amplifier system were checked and their linearities were confirmed. We applied them to measure the electron temperature. Figure 2 shows the TS spectrum measured by using QDC system. We successfully obtained the electron temperature (15±2 eV) by using this QDC system.

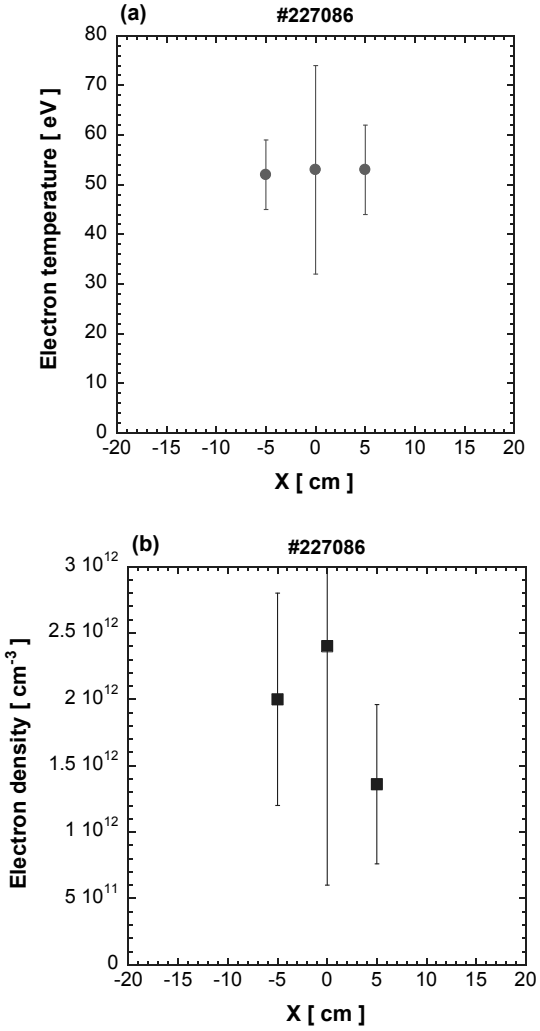

Fig. 1: (a) and (b) show the radial profiles of the electron temperature and density, respectively.

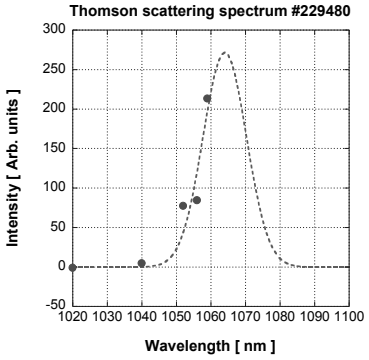

Fig. 2: TS spectrum obtained by using QDC system.