§2. Development of the KSTAR Thomson Scattering System

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A Thomson scattering system has been developed for the measurements of electron temperature and density profiles of KSTAR plasmas under the Japan-Korea fusion collaboration program.[1,2] Figure 1 shows the schematic diagram of the KSATR Thomson scattering system. The KSTAR Thomson scattering system consists of,

1) Yttrium-aluminum-garnet (YAG) lasers [JA: NIFS],
2) Laser beam transport and control systems [KO: NFRI],
3) Light collection optics [KO: NFRI],
4) Polychromators [JA: NIFS]
5) Data acquisition and analysis system [KO: NFRI].

We use a 2 J/10 Hz YAG laser, which is the same model as that is used in the LHD Thomson scattering system.[3] Sampling frequency is determined by the laser repetition frequency. The laser beam transport and alignment control systems have been developed at NFRI. The laser beam is tangentially injected into KSTAR plasmas. The scattering angle is ~90 degree, as shown in Fig.2. The light collection optics was also designed and developed at NFRI. There are two individual light collection systems for core and edge regions. The number of observation points, spatial resolution and *f*-number are five, 120 mm and 2.26, respectively for the core lens system. Those are twelve, 20 mm and 2.74, respectively for the edge lens systems. Collected Thomson scattered light is transported to polychromators through optical fibers. We used optical fibers with the core diameter of 0.91 mm in 2010. They will be replaced with new fibers for obtaining more photos in 2011. The new fibers have a wider entrance cross section of 3.5 mm x 1.8 mm, and the corresponding scattering length is ~8mm. The polychromators are developed at NIFS and optimized for KSTAR plasmas. There are two types: core and edge polychromators. The core and edge polychromators have been optimized to the temperature range of 500 eV-20 keV and 10 eV-1.5 keV, respectively. A charge integrated analog-to-digital converter system is used for data acquisition (CAEN VME-V792). To evaluate the electron density, we absolutely calibrated the KSTAR Thomson scattering system by using Rayleigh scattering in gaseous nitrogen. The Rayleigh scattering signal intensity was clearly proportional to the N_2 density, as expected. Relative calibration to determine spectral response of polychromators has been carried out by using tungsten lamp-monochromator system.

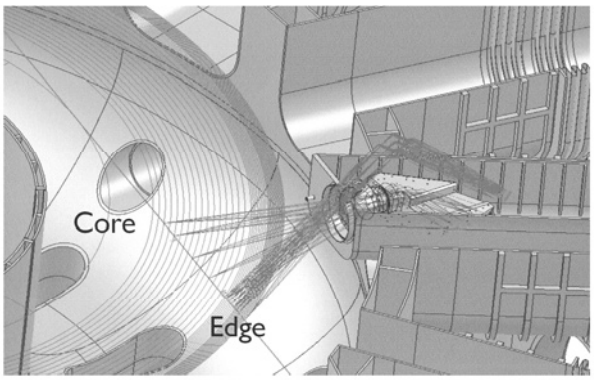

Fig.2. Observation point of the KSTAR Thomson scattering system.

We will try to measure electron temperature and density profiles by using the tangential Thomson scattering system in the 4th KSTAR experiment campaign (2011).

1) Lee, J. H. *et al.*, Rev. Sci. Instrum, **81**, 10D528 (2010).
2) Oh, S. T. *et al.*, Rev. Sci. Instrum., **81**, 10D504 (2010).
3) I. Yamada *et al.*, Fusion Sci. Tech., **55**, 345 (2010).

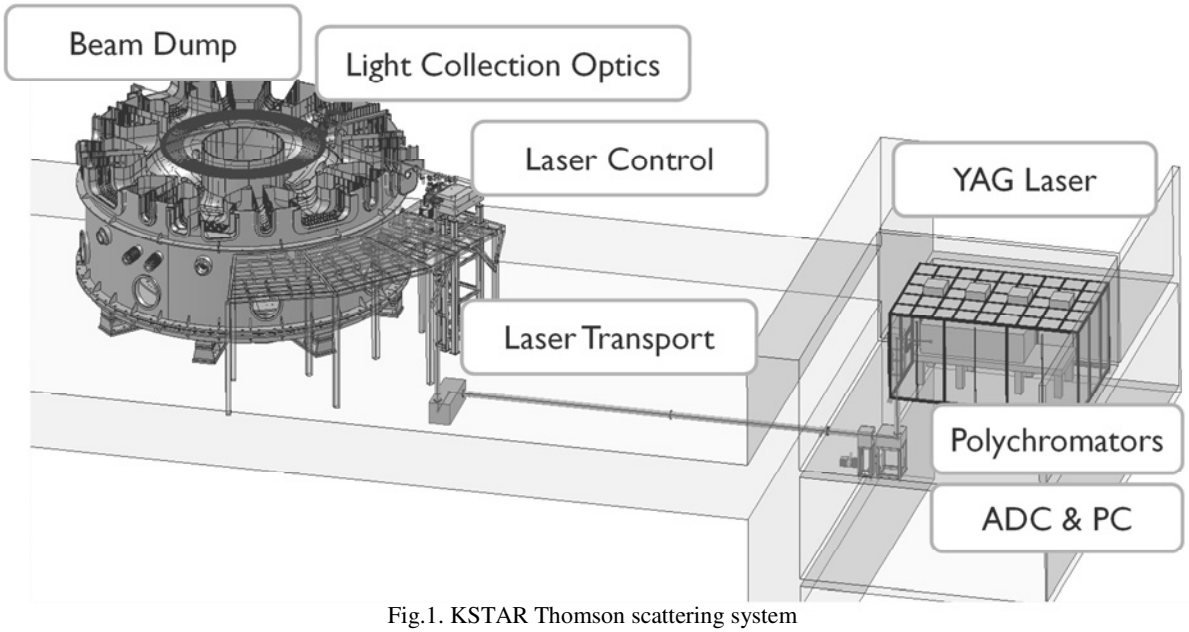

Fig.1. KSTAR Thomson scattering system