§4. Development of Two Dimensional Thomson Scattering Measurement for Anisotropic Electron Temperature by Use of Multiple Reflection and Time of Flight of Laser Light

Ono, Y., Nakai, R., Ishida, S., Tanabe, H. (Univ. Tokyo, Dept. Advanced Energy), Yasuhara, R., Yamada, K., Nagayama, Y., Narihara, K. (National Instjtute for FS)

Thomson scattering measurements have been developed as the most reliable diagnostics for electron temperature measurement. We have been using its two dimensional (2-D) extension for magnetic reconnection experiment in TS-4 [1-4] and electron transport study in LHD experiment. We have developed a new 2-D Thomson scattering measurement system for anisotropic electron temperature using multi-reflection of a single laser light and its time-of-flight effect. A new characteristics for our system are as follows: (1) reflections of laser light to measure anisotropic electron temperature and (2) those to cover m x n (2-D) measuring points on r-z plane, (3) usage of time-of–flight of laser light to save the number of polychromators and detectors, and (4) flexible usage of laser path length to control the delay times of scattering signals from those measuring points. They enable us to develop a low-cost 2-D Thomson scattering system for anisotropic electron temperature measurements using a single Laser and polychromators equivalent to the 1-D system, because the scattered lights from n points are measured by a single polychromator.

In 2015, we tested the single filter spectromator by multi-angle injections of scattered light. Our spectromator has three pairs of optical fibers to inject the scattered light into a single filter with three different angles. As shown in bundle to take care of injection and collection of the scattered light [3,5]. Figure 2 shows the three components of scattered light signals decomposed by the single filter spectromator with three injection angles of scatterred light. Each scattered light signals were measured as time series signals with interval time of 30nsec because. The Gaussian fitting of those signals are used to calculate the electron temperature. Finally, 1D profiles of electron temperature were obtained. We can identify that the both way signals have almost equal amount of scattered lights because the measured plasma has uniform low temperature. We are going to use this technique for measuring electron temperature profile around the X-point as the laboratory study of magnetic reconnection [1,3].

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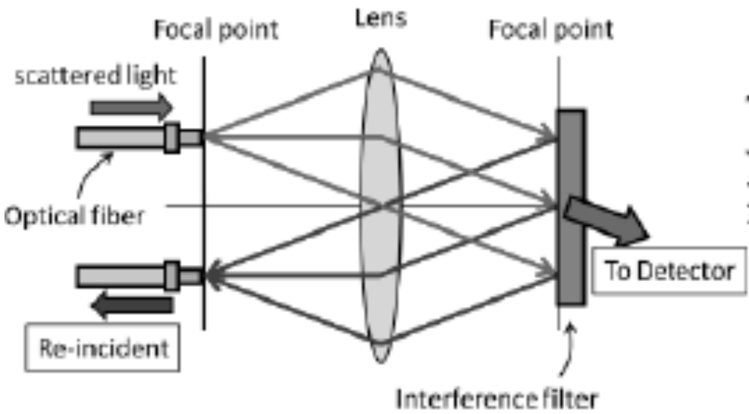

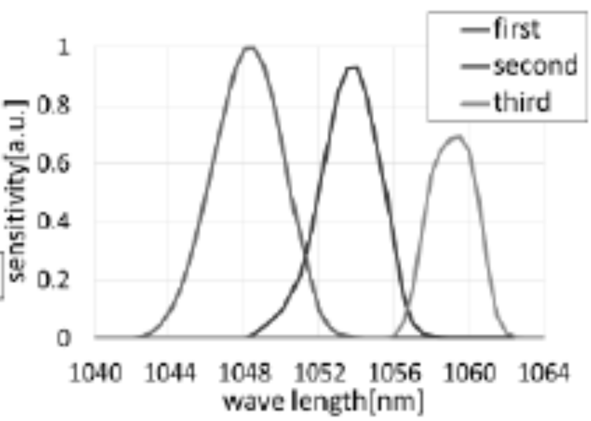

Fig. 1 Multiple injections of scattered light into filter-type spectrometer. Fig. 2 Scattered light signals for three injection angles to the filter