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ヘリオトロンJにおけるNd:YAGトムソン散乱計測装置の高精度散乱分光装置の開発

Development of high precision polychromator for scattering light of Nd:YAG Thomson scattering measurement for Heliotron J

荒井翔平[1], 南貴司[2], 釼持尚輝[1], 高橋千尋[2], 小林進二[2], 水内亨[2], 大島慎介[2], 山本聡[2], 岡田浩之[2], 長崎百伸[2], 李炫庸[1], 臧臨閣[1], 沙夢雨[1], 杉本幸薫[1], 永榮蓉子[1], 中村雄一[1], 橋本紘平[1], 福島浩文[1], 安田圭祐[1], 和多田泰士[1], 中村祐司[2], 木島滋[2], 佐野史道[2]

Shohei Arai[1], Takashi Minami[2], Naoki Kenmochi[1], Chihiro Takahashi[2], Shinji Kobayashi[2], Tohru Mizuuchi[2], Shinsuke Ohshima[2], Satoshi Yamamoto[2], Hiroyuki Okada[2], Kazunobu Nagasaki[2], Hyunyong Lee[1], Linge Zang[1], Yukishige Sugimoto[1], Yoko Nagae[1], Yuuichi Nakamura[1], Kohei Hashimoto[1], Hirofumi Fukushima[1], Keisuke Yasuda[1], Hiroto Watada[1], Yuji Nakamura[2], Shigeru Konoshima[2], Fumimichi Sano[2]

1*Graduate School of Energy Science, Kyoto University, Gokasho, Uji 611-0001, Japan*
京都大学エネルギー科学研究科　〒611-0001 宇治市五ヶ庄
2*Institute of Advanced Energy Science, Kyoto University, Gokasho, Uji 611-0001, Japan*
京都大学エネルギー理工学研究所　〒611-0001 宇治市五ヶ庄

To investigate the plasma transport phenomena which change quickly, it is important to measure the time evolution of plasma profile with high accuracy. Therefore we are designing and developing a new Nd:YAG Thomson scattering measurement system for Heliotron J, which can measure the time evolution of electron temperature and density profiles. The Nd:YAG Thomson scattering measurement system consists of a laser and transmission system, a collecting system of scattering light, a polychromator system and a data acquisition system. In this paper, we focus on the results of the performance tests of the polychromator and the data acquisition systems.

The polychromator is a device to disperse the scattering light. One polychromator consists of 6Ch. detectors; 5Ch. are used for measuring scattering light intensity, and 1Ch. is used for density calibration. It outputs the scattering light intensity by dispersing specific wavelength using the interference filters. Furthermore, we designed and manufactured a pre-amplifier which amplifies the output signal and eliminates the background light. It was found that the polychromator has an enough performance to measure the electron temperature.

The data acquisition system is a system which can process the rapid scattering light signal under the condition that the laser pulse width is 10ns. This system acquires analog signal from the polychromator and it digitizes the analog signal with the charge integral type AD/C. The acquired data are transferred to the data acquisition computer, which is called CINOS. Finally, these data are analyzed by transferring to the analyzing computer.

The wavelength of polychromator was calibrated to measure the plasma profile with high precision using a data acquisition system and a variable wavelength light source. The calibration method is to inject a varying wavelength light which comes from the light source to the polychromator by changing the wavelength of the monochromator. Next, the injected light is converted to the signal by the polychromator and transferred to the acquisition system. The Figure 1 shows the spectrum obtained by polychromator as an initial result. The green, lime green, blue, magenta and red line show Ch.1, Ch.2, Ch.3, Ch.4 and Ch.5, respectively. The minimum wavelength step size of the monochromator is 0.028nm, therefore we can calibrate polychromator with very high precision.

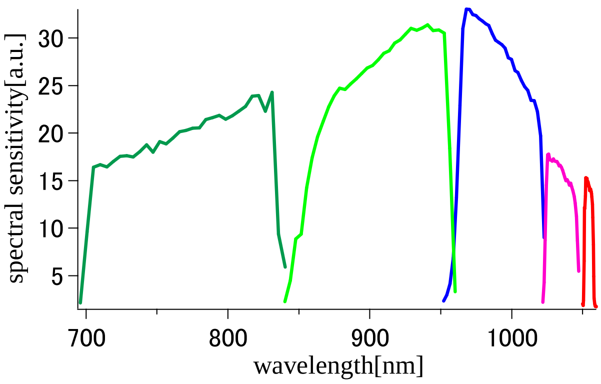

Fig.1 Initial result of the spectrum of a polychromator

Our next work is to measure the plasma profile of the electron temperature and density with more high precision and to investigate the plasma transport phenomena.