

Sensitivity calibration of vacuum ultraviolet spectroscopy in GAMMA 10

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Introduction

The plasma spectroscopy in the wavelength range from soft X-ray (SX) to visible is important for plasma particle confinement and impurity analysis. We have constructed the time- and spatial-resolved vacuum ultraviolet (VUV) and SX spectrographs with absolutely calibration experiments carried out by using the photon factory in KEK [1-3]. Another VUV spectrometer was installed for impurity diagnostics in the barrier cell of GAMMA 10. Then we had to carried out the calibration of the sensitivity of the spectrometer. We checked the sensitivity of the phosphor plate against the SX light. In this report we show the sensitivity experiment of phosphor plate of the VUV spectrometer.

Experimental apparatus

The VUV spectrometer (Shimazu, SGV-50) is the 50 cm Seya-Namioka type monochromator which can measure 50 to 350 nm. The incident and exit slit width are 100 mm at normal use. The concave grating of 1200 groove/mm and 30 × 50 mm² large is used. The phosphor plate for changing the SX and VUV lights to visible light is used with sodium salicylate coated silica glass. We used the photomultiplier tube (EMI, 6255B) for the time dependent spectrum measurement. For the multi-wavelength range measurement, we plan to use the high speed camera (Casio, EX-F1), which can measure 60 fps with 1920 × 1080 pixel and 1200 f/s with 336 × 96 pixel.

The experiments have been carried out at BL-12A. In these experiments, we wanted to check the sensitivity of SX wavelength range from 2 to 35 nm. We set the phosphor plate of VUV spectrometer to the output port of the beam line. The incident photon intensity was monitored by the gold mesh detector. The injected beam to the phosphor plate is monitored by using the high speed camera. The F-number and ISO sensitivity setting of the high speed camera are 2.7 and 1600. The captured images of the high speed camera are analyzed by using the Image-J software.

Experimental Results

In Fig. 1, we show the experimental setup of this calibration experiment. Measurements are repeated for wavelength range from 2 nm to 35 nm at the BL-12A with 2 nm intervals. The beam current measured by the gold mesh detector was about 0.8 nA at 20 nm.

Figure 2 shows the measured intensity on the phosphor plate measured by the high speed camera against wavelength. The sensitivities of phosphor plate are almost constant except at the wavelength of 2 nm.

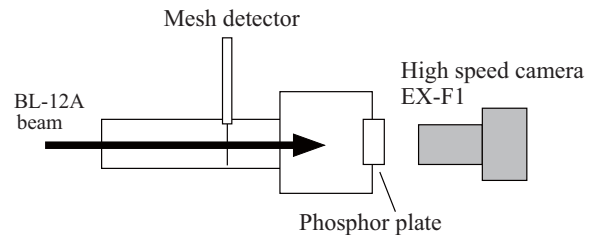


Fig. 1: Experimental setup.

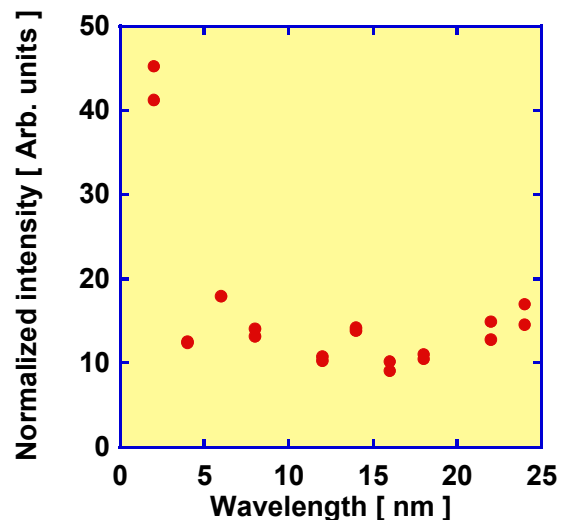


Fig. 2: Normalized intensity on the phosphor plate against incident beam wavelength.

References

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