

## Absolute calibration of space-resolving soft X-ray spectrograph for plasma diagnostics

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### Introduction

Measurements of spatial and temporal variation of spectra in the wavelength range from vacuum ultraviolet (VUV) to soft x-ray (SX) are necessary to determine radiation power losses and ion density profiles which directly relate to the impurity transport, confinement and sources in magnetically confined plasmas. We developed space- and time-resolving VUV (150-1050 Å) [1, 2] and SX (20-350 Å) [3, 4] spectrographs and applied for impurity diagnostics in the tandem mirror GAMMA 10.

For quantitative analyses of emission lines, it is important to characterize the absolute sensitivity of these spectrograph systems throughout their wavelength ranges. Previously we measured the absolute sensitivities of VUV spectrograph under incident polarized light conditions for wavelength range from 150 Å to 1050 Å [2]. In this report, we show the absolute sensitivity of the diffracting position on the concave grating in the SX spectrograph system (50-250 Å).

### Experiments

In the space- and time-resolving SX spectrograph, a concave grating ruled with varied spacing (Hitachi P/N001-0266) is used, which has a nominal groove density of 1200 g/mm and a ruled area of 50 × 30 mm<sup>2</sup>. The incident angle is 87° and the effective blaze wavelength is 100 Å. The entrance slit is a 6-mm in height and 100 μm in width. A MCP intensified detector (Hamamatsu F2814-23P) having 50 × 50 mm<sup>2</sup> active area is set on the flat field output plane. The recording system of spectral image is a high-speed solid state camera (Reticon MC9256) with a fast scanning controller. The resolution of video image is eight bit. The frame rate with full image size, 256 × 256 pixels, can be changed from 4 to 106 frame/s.

The experiments have been carried out at the beam line 12A (BL-12A). The incident photon intensity was monitored just behind the entrance slit by using an absolutely calibrated XUV silicon photodiode (IRD AXUV-100G) and then the output spectral image was recorded by a high-speed camera. Measurements are repeated for wavelength range from 20 Å to 250 Å at the BL-12A with 20 Å intervals. We changed the incident light position on the grating at the three points, center (0mm), up (+3 mm) and down (-3mm).

### Results

The absolute sensitivity of the SX spectrograph as a function of wavelength under the three diffracting positions on the grating for wavelength range from 50 Å to 250 Å is shown in Fig. 1. This shows that the SX spectrograph has not so clear sensitivity against the diffracting position on the grating. Then we plan to carry out the more experiments for sensitivity of diffracting efficiency against the incident angle of the SX spectrograph.

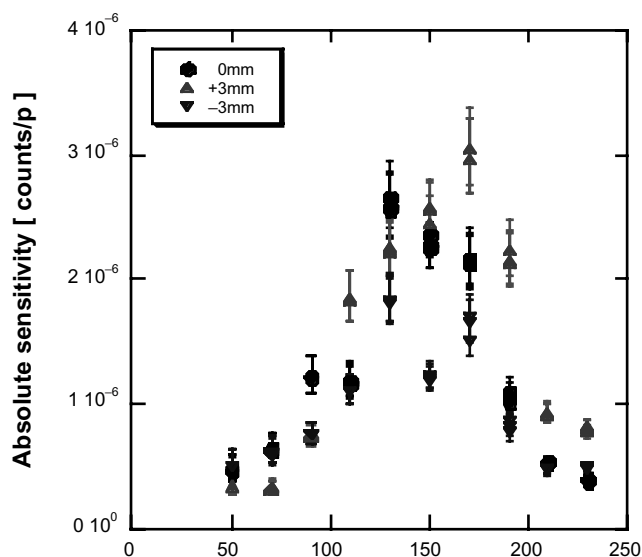


Fig. 1 Absolute sensitivity of the SX spectrograph.

### References

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