# Absolute Calibration of Space-Resolving Vacuum Ultraviolet 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] and SX (20-350 Å) [2] 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 efficiency of these spectrograph systems throughout their wavelength ranges. Previously we measured the absolute sensitivity of VUV spectrograph for wavelength range from 350 Å to 1050 Å [3]. In this report we show the absolute sensitivity of the VUV spectrograph system under both P and S polarization of incident light conditions for total wavelength range of this spectrograph (150-1050 Å).

## Experiments

In the space- and time-resolving VUV spectrograph, a concave grating ruled with varied spacing (Hitachi P/N001-0266) is used, which has a radius of curvature of 500 mm, a nominal groove density of 1200 g/mm and a ruled area of $48 \times 48$ mm$^2$. The incident angle is 51 ° and the effective braze wavelength is 60 nm. The entrance slit is a 6-mm in height and 100 μm in width. A MCP intensified detector having $50 \times 50$ mm$^2$ 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, $256 \times 256$ pixels, can be changed from 4 to 106 frame/s.

The calibration experiments have been carried out at the beam line 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 150 Å to 300 Å at the BL-12A with 25 Å interval under both P- and S-polarization of incident lights.

## Results

The absolute sensitivity of the VUV spectrograph as a function of wavelength under P- and S-polarization of lights for wavelength range from 150 Å to 1050 Å is shown in Fig. 1. This shows that this VUV spectrograph has sensitivity against the polarization of lights. The absolute sensitivity under S-polarization of light is higher than that under P-polarization of light in the wavelength range of 400-1050 Å. While in the wavelength range of 150-300 Å the absolute sensitivity under S-polarization of light is lower than that under P-polarization of light.

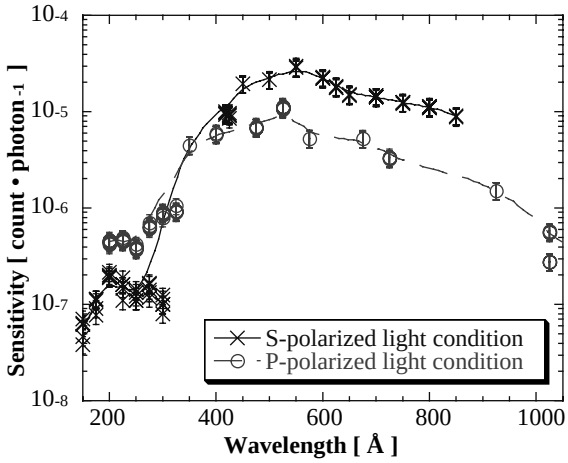


Fig. 1 Absolute sensitivity of the VUV spectrograph.

## References

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