Research of Spectroscopic Method by means of photo-absorption in metals

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1 Introduction
In plasma sciences it is necessary to use high dynamic-range-imaging detectors, since the intensity is strong. For the purpose the application of photo-absorption technique is proposed for the spectroscopy¹). In the present research an assembly of CCD camera is calibrated to measure the x-ray spectral images.

2 Experiment
Figure 1 shows the schematic view of the assembly equipped with an aluminum filter. The x-ray detector is a 1-mm-thickness-CsI implemented CCD. The dynamic range is 16 bit. The experiment is carried out at the BL-14C of photon factory in KEK. In the experiment the rotation velocity of the filter is set to 1 rpm. The exposure time of the CCD is set to 1 s. The gray scale images obtained with the CCD are depending on the thickness of the filter.

In the present experiment it is monitored whether the optical axis is highly stable as shown in FIG.2. The secondary diffracted beam can go through the pin hole, since the horizontal width of the beam is approximately 0.3 mm.

Figure 3 shows the total intensities of the images presented in FIG.2. The time-evolution of the transmitted intensity is consistent with the calculation predicted from the motion of the filter and the absorption coefficient. The spectrum, intensity, and optical axis of the x-ray beam are proved to be enough stable in order to obtain the calibration data.

3 Results, Discussion, and Future Prospect
It is the advantage of BL-14C for the present calibration of an assembly of CCD camera that the optical axis is enough stable. The calibration is carried out in an energy range from 20 keV to 40 keV. The energy step is 1 keV. From the calibration data, the energy resolution depending on photon energy will be estimated. The energy resolution is predicted to be proportional to the detected intensity in bits. The coefficient will be also estimated from the data.

In the next experiment, the intensity profiles of the fundamental and secondary diffractions from the monochrometer is precisely investigated to prepare two-color-image diagnostics at BL-14C.

References