# Characterization of a 300 keV Monochromator for High Energy Synchrotron Radiation

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As the first experiment of the beam time at BL08W beamline, the characterization of a 300 keV monochromator was performed. This monochromator is mainly dedicated to magnetic Compton scattering experiments [1]. In addition it is designed for a single crystal arrangement [2]. The crystal is set to focus a vertically-diverged beam. The 300 keV beam is introduced to the monochromatic beam hutch A. For the 300 keV monochromator, asymmetric Johann-type Si 771 reflection is employed with an asymmetry angle of about one degree. The crystal size is about 800x60x30 $mm^3$. The system within the vacuum vessel consists of Bragg rotation, crystal up and down, and horizontal translation. The whole system is on a thick base plate which acts as a kinematic mount within the vessel. All motions are decoupled from the vacuum vessel. A set of filters is inserted and results in an incident power less than 1 kW. The crystal block is indirectly water-cooled from both sides through the thin In-Ga layer.

Results from finite element analyses indicate that the thermal problem is not serious [3]. The bender design we proposed is based on a 4-point bending system operated at either end of the crystal or the crystal holder using two stepper motors each in a sine-bar configuration. This bender has the following advantages. First, we can give the bending force through linear motion and it is easy to achieve. Second, the bender is not affected by temperature changes in the shafts. A small change in the incident angle produces a big change in the reflection energy because the incidence angle is very small. If the shafts of the bender are connected to the crystal holder vertically, a small temperature increase of the columns can have a significant effect on the change in the incident angle.

Experiments were performed (1) to measure the beam energy spread, (2) to characterize the beam focusing by using the bender, and (3) to measure the absolute photon energy and photon flux. For the measurement of the diffracted beam energy, we used a SSD (Ge) detector which was energy-calibrated by standard RI sources. The energy spread, $dE/E$, of the monocnoromator was estimated to be about 1,5 x $10^{-3}$ at 294 keV for the conditions of $I$=20 mA and an ID gap width of 30 mm. The total energy spread including the detector was about 3 x $10^{-3}$. The photon flux was measured to be about 1 x $10^{-9}$ photons/s for the same conditions by setting the detector to the directly-diffracted beam position.

Figure 1 shows examples of unfocused and focused beams. Note that the scale of the x-axis is different for both figures. The focused beam spot size at the sample position was about 1-2 mm (width) x 3 mm (height) at 274 keV. The lowest side of the scannable-energy range was limited to about 274 keV geometrically.

## References

[1] H. Yamaoka et al., SPring-8 Annual Report 1995, p. 195.
[2] H. Yamaoka, K. Ohtomo and T. Ishikawa, J. Synchro. Radiation (1998) **5** to be published.
[3] H. Yamaoka, T. Mochizuki, Y. Sakurai and H. Kawata, J. Synchro. Radiation (1998) **5** to be published.

Fig. 1 Unfocused (upper panel) and focused (lower panel) beams at 274 keV.