Elliptical and 45degrees Linear Polarization Obtained from Two Linear Polarizations Perpendicularly Intersecting each other.

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Introduction

The polarization-controlled soft X-ray undulator of BL07LSU emits elliptically and 45degrees linearly polarized radiation by superposing two type of radiation of which linear polarizations are perpendicular each other. In this article, we report the result of measurement of reflectivity of multilayer polarization analyzer for elliptically and 45degrees linearly polarized radiation, and of polarization analysis.

Experiment and Results

Figure1 shows the schematic view of the polarization-controlled soft X-ray undulator at BL07LSU. Initial alphabet of each notation "H", "V" and "PS" means Horizontally polarized undulator, Vertically polarized undulator and Phase Shifter, respectively. In this work, we use the H7, V8 and PS7. Monochromator and permanent magnet gaps of the H7 and V8 undulator are set to emit the photon of 300eV. The permanent magnet gap of the phase shifter PS7 varies from 60 to 31mm.

Figure 1: Schematic view of the polarization-controlled soft X-ray undulator

The black and red large outlined squares in Fig. 2 show the normalized reflectivity of multilayer analyzer measured for H7 and V8 undulators, separately. The small circles show that measured for superposed H7 and V8 with PS7 in the various gaps as shown in the figure. It is seen that reflectivity curves for the superposed undulator have peaks and bottoms at the azimuth angles of 45, 135, 225 and 315 degrees, except for almost flat curves. On the contrary, reflectivity curves for the H7 or V8 separately have peaks and bottoms at the azimuth angles of 0, 90, 180, 270, 360 degrees.

The intensities at the azimuth angles of 45 and 135 degrees are plotted in Fig.3 with a transverse axis of quantities of phase shift. The quantities of phase shift are obtained by theoretical formula [1] and offset of +0.375 which is determined so that peaks or bottoms are located at $n\pi(n=1,2,\cdots)$ radian. It is can be seen that phase shift of $(n+1/2)\pi$, $(2n)\pi$ and $(2n+1)\pi$ radian make elliptical, 45 degrees linear and 135 degrees linear polarization, respectively.

Discussion

The contrast factor obtained by fittings [2] are in -0.62 to 0.72. The degree of 45degrees linear polarization is estimated by SPECTRA [3] to be in -0.84 to +0.84. The reason of these differences is that the quantities of phase shifts at which the degree of linear polarization show the maximum or minimum values are not found in the present work.

The superposed undulator of this time consist of one horizontally and one vertically undulator. The degree of polarization will be improved by using eight undulators.

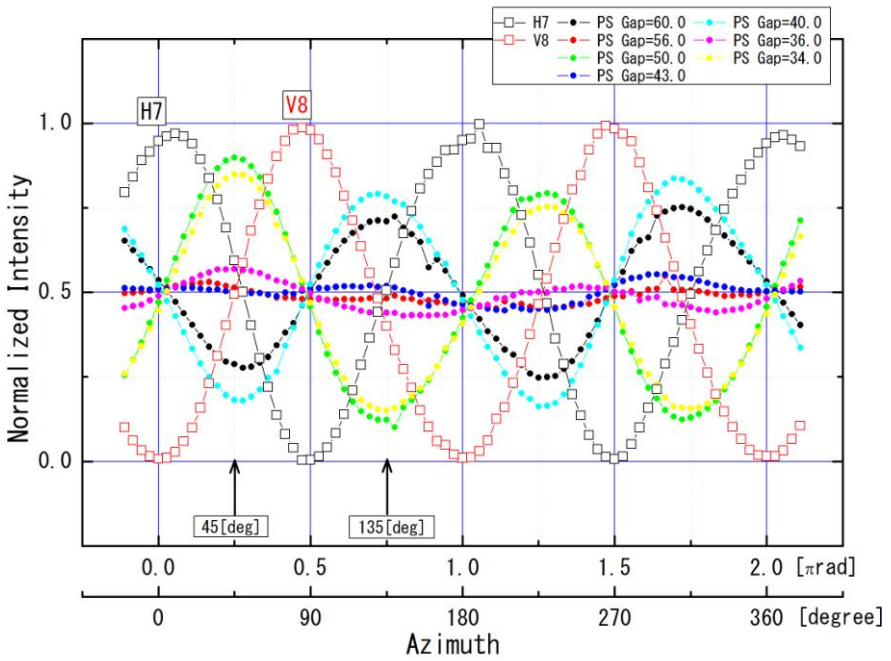

Figure2: Normalized reflectivity of multilayer analyzer

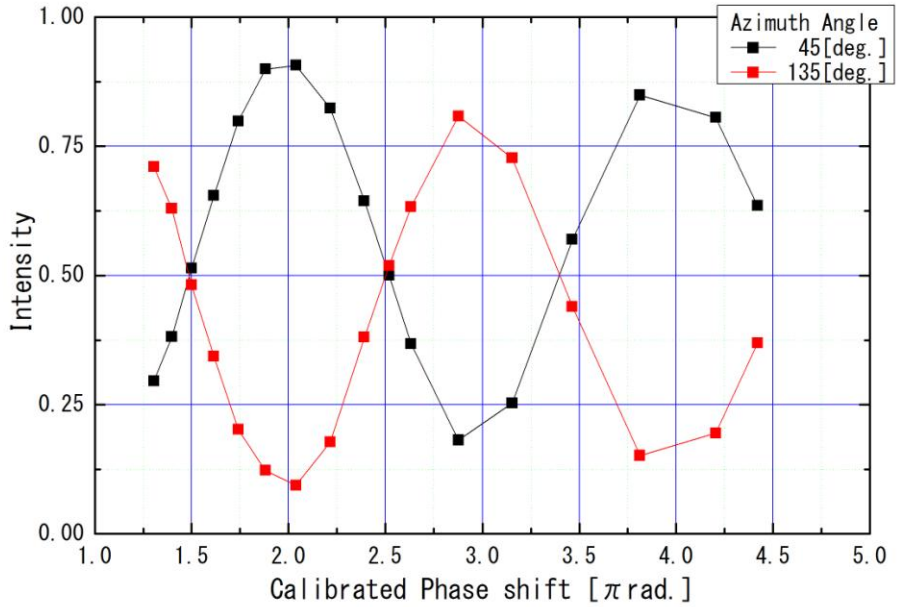

Figure 3: intensities at the azimuth of 45 and 135 degrees with a transverse axis of quantities of phase shift

References

[1] T. Tanaka, private communications.
[2] M. Fujisawa et al., Activity Report of Synchrotron Radiation Laboratory 2011.
[3] T. Tanaka and H. Kitamura, J. Synchrotron Radiation, 8(2001)1221.