BL14B2
XAFS II

1. Introduction

BL14B2 is a bending magnet beamline at SPring-8 dedicated to research by industrial and academic users conducting X-ray absorption spectroscopy (XAS) and X-ray imaging measurements. Various measurement systems have been developed to realize easy and high-throughput operations of XAS and X-ray imaging measurements. In FY2024, we introduced a variable cut-off frequency filter to improve the signal-to-noise ratio for XAFS measurements.

2. Introducing variable cut-off frequency filter for XAFS measurements

In FY2022, we introduced V–F converters with higher output frequency for XAFS measurements [1]. However, it was found that the S/N ratio of the XAFS spectrum was often low when the gain of the current amplifier was set to 10^9 V/A. To solve this problem, we introduced the variable cut-off frequency filter, 3625 (NF Corporation), in FY2024. We evaluated the effectiveness of the variable cut-off frequency filter in improving the quality of the measured spectra.

First, we evaluated the dark current of the ion chamber. Figure 1 shows the variation of the dark current with the gain of the current amplifier. The dark current was measured 100 times with a dwell time of 1 s using a counter (NCT08-01E (TSUJICON)). The standard deviation of the dark current without the filter increased rapidly with the gain of the current amplifier. However, the dark current count with the filter was stable. This indicates that the S/N of the dark current was improved by the addition of the variable cut-off frequency filter.

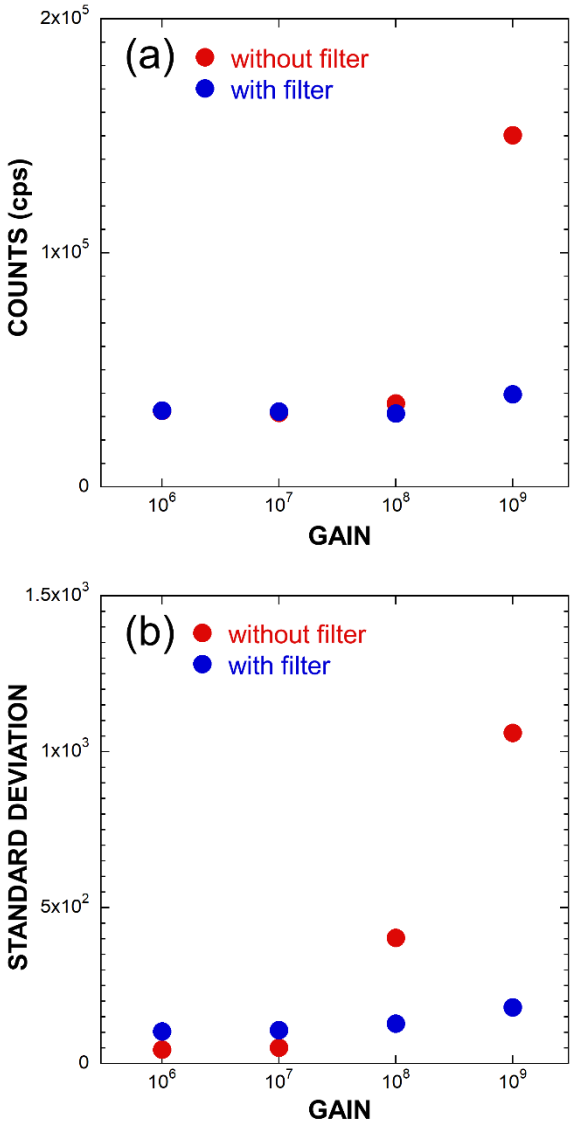

Fig. 1. Evaluation of dark current for the gain of the current amplifier: (a) average and (b) standard deviation of dark current.

Figures 2(a) and 2(b) show XANES and EXAFS spectra for Zn foil stacked with an Al plate without the filter (red line) and with the filter (blue lines). The thickness of the Zn foil was 25 μm

($\Delta\mu t \sim 4$). The Al plate with a thickness of 800 μm was used to attenuate transmitted X-rays. Each spectrum was measured under the same measurement time and the same gain of the current amplifier. The XANES and EXAFS spectra without the filter were noisy. In contrast, those with the filter were smoother. This result indicates that the noisy spectra measured for samples with large total μt were improved by introducing the variable cut-off frequency filter.

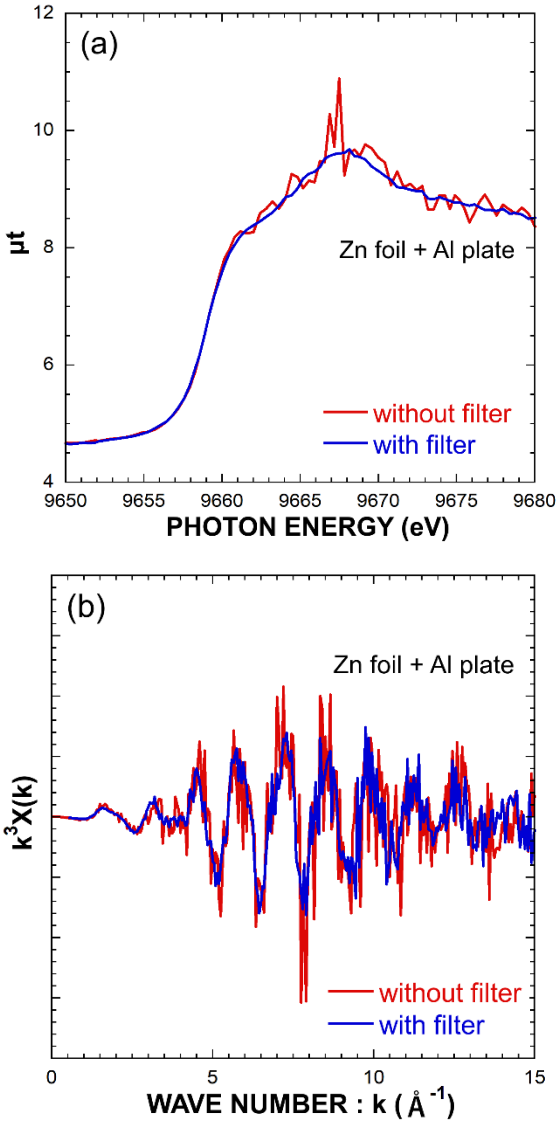

Fig. 2 (a) XANES and (b) EXAFS spectra for Zn foil stacked with Al plate.

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Reference:

[1] Ofuchi, H. & Honma, T. (2022). *SPring-8/SACLA Annual Report FY2022*, 45–46.