BL08W
High Energy Inelastic Scattering

1. Introduction

BL08W is the beamline that can deliver the highest energy X-rays, the range of which is from 100 to 300 keV, emitted by the only wiggler source at SPring-8. This beamline is used in several research fields, including Compton scattering, high-energy X-ray diffraction, and high-energy X-ray fluorescence analysis. Three methods of Compton scattering can be performed in this beamline. The first method is magnetic Compton scattering for studying magnetic states. The second method is high-resolution Compton scattering with a high momentum resolution of 0.1 a.u. for studying electronic states and fermiology. The third method is Compton scattering imaging (CSI) using a CdTe two-dimensional detector (HEXITEC) having energy dispersive capability in each pixel. Also, structural studies of disordered materials by pair distribution function analysis using high-energy X-ray diffraction and studies on cultural properties by high-energy X-ray fluorescence analysis can be performed.

2. Improvement of slit system

Two methods of CSI, the point type and the plane type, are performed at BL08W. The point-type CSI method utilizes the nine-segment Ge-SSD with a collimator of 1 mm at a scattering angle of 90° to measure the Compton profile coming from a limited sample area with good momentum resolution. However, by this method, it is difficult to obtain 2D or 3D images such as CT images because of the large in-plane spatial resolution of 1 mm. Therefore, we have developed the plane-type CSI method to measure the 2D or 3D image with the in-plane spatial resolution of 0.07 mm. Plane-type CSI is a unique method used to visualize the cross-sectional image of materials with a combination of a pinhole and a two-dimensional X-ray detector. The advantage of this method is that it can directly visualize the cross-sectional image without sample rotation and reconstruction. However, because this method utilizes the CdTe two-dimensional detector, the momentum resolution of this method is worse than that of point-type CSI. Depending on what we want to measure, we need to choose between these two types of CSI method.

These two types of CSI method generally use X-rays with a small vertical beam size of 10 μm to achieve fine spatial resolution in the vertical direction. We make the small vertical beam size with the fore quadrant slit. Since the resolution of our slit is 1 μm, the vertical beam size might have a 10% error. Furthermore, since it takes much time to make a small beam size of 10 μm, we introduced the new slit system. Figure 1 shows the new slit. The slit size is fixed at 10×2000 μm (H×W) and the slit is set on the XZ and swivel stages. As a result, we can reduce the setup time of a slit to about 10 min.

3. Maintenance of superconducting magnet

Magnetic Compton scattering (MCS) can measure the spin-dependent momentum density of magnetic electrons and the spin-specific magnetization hysteresis loops. Experimentally, a magnetic substance is magnetized by the superconducting magnet with ±2.5 T and the spin-dependent Compton profiles of magnetically active electrons

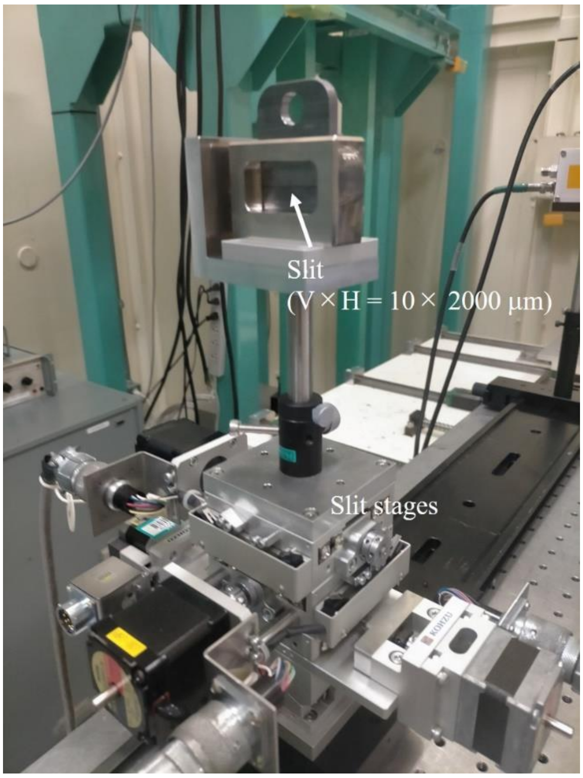

Fig. 1. New slit. The new slit blade is made of tantalum with a depth of 10 mm.

can be measured by irradiating a magnetized sample with circularly polarized X-rays. The coil of the superconducting magnet is made of NbTi with Tc = 9.5 K and is cooled by liquid helium. The liquid helium recondenser is utilized to reduce the operating cost and enable continuous use. Since it was making strange noises, we performed maintenance on it. Currently, the strange noises have disappeared and it is working stably. Moreover, since the sample temperature no longer reached the lowest temperature of about 7 K, we performed maintenance on the refrigerator for samples. As a result, the sample cools to about 6 K.

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