BL19LXU
RIKEN SR Physics

1. Introduction

BL19LXU is a hard X-ray beamline equipped with a 27-m in-vacuum undulator in one of the four long straight sections of the SPring-8 storage ring. Experimental hutches (EH) 1, 2, and 3 have been in operation since FY2000. EH4 was constructed in FY2001. The beamline has been continuously updated as follows. Major updates in the optics hutch include the installation of a double-mirror system to reject higher harmonic radiation (FY2004), installation of precision four-jaw slits (FY2010), renewal of the stages (FY2013), installation of the cooling pipes in the double-crystal monochromator for enhanced stability (FY2015), installation of an in-line beam monitor made of a diamond thin film (FY2015), and replacement of the vacuum system from turbo-molecular pumps to an ion pump (FY2017) to keep the surfaces of the monochromator crystals and the mirrors clean. In FY2017, the minimum photon energy was lowered from 7.270 keV to 7.092 keV, which is below the iron K edge at 7.112 keV, by changing the minimum gap size of the undulator. For micro- and nano-focusing, Kirkpatrick-Baez (KB) mirror systems were permanently installed in EH 3 (FY2014) and EH4 (FY2010). The outdated laser system was updated (FY2016), and the repetition rate was raised from 1 kHz to 10 kHz, which improved efficiency in time-resolved experiments. In accordance with the 10-kHz system, the X-ray chopper was also upgraded to select a single bunch at 9.49 kHz (FY2016). To improve the experimental environment, the lighting in the hutches was changed from fluorescent tubes to LEDs (FY2015), the precision air-conditioning systems in EH1 and EH3 were upgraded (FY2016), and the doors of EH1 and EH3 were motorized (FY2017). The PLC system was upgraded to allow users to select the active hutch, and to operate in a remote mode at all times for users' convenience (FY2018).

2. Recent activities

In FY2019, X-ray optics was developed for high-energy X-ray diffraction experiments at 100 keV. Combined with a monochromator stabilizer (MOSTAB) unit, the intensity and the photon energy is stable for more than a week. The environment of the nano-focusing system in EH4 was improved to provide more stable focusing. An X-ray beam monitor used for aligning mirrors is now set on an isolated post away from the bench for the KB mirror system, reducing the mechanical vibration due to the fan of the beam monitor. The mirror surfaces are cleaned using ozone gas, and the KB mirror system recovers the designed focus size. The regles of the doors of EH1 and EH3 were backfilled to seamlessly join the floors inside and outside the hutch, which makes it much easier for users to carry heavy apparatuses in the hutch.

Various user experiments, which require brilliant X-rays, and R&D programs for X-ray free-electron laser experiments are performed at each experimental hutch. In FY2019, experiments performed in EH1 included a fundamental study on X-ray parametric down-conversion, nuclear resonance vibrational spectroscopy to study hydrogenase, and X-ray magnetic scattering. In

EH3, research on X-ray pumping of the thorium-229m isomeric state, high-energy X-ray diffraction, linear dichroism in HAXPES, and X-ray–excited STM experiments were performed, and X-ray scattering experiment and X-ray magnetic imaging were performed using the sub-micron beam from the KB mirror in EH4.

Fig. 1. Door regles of EH1 and EH3 are backfilled.

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