

BL19LXU

RIKEN SR Physics

1. Introduction

BL19LXU is a hard X-ray beamline equipped with a 27m 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 turbomolecular 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 nanofocusing, 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 The outdated laser system was updated (FY2016), and the repetition rate was raised from 1 kHz to 10 kHz, which improved efficiency in time-resolved experiments.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). 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 into the hutch (FY2019).

2. Recent activities

In FY2020, a heavy-load Z stage was introduced in EH2. The Z stage mounts the X-ray chopper, a 4-jaw slit, and the diamond thin-film beam monitor (Fig. 1), and adjusts the height of these components to that of the X-ray beam. Before introduction of the Z stage, the X-ray chopper and slit were independently adjusted when the beam height was changed by the cut-off mirror and/or a channel-cut monochromator inserted upstream. This adjustment procedure took time, and sometimes they were misaligned. Now, the three components move together, making the alignment procedure much easier and faster than before.

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 FY2020, experiments performed in EH1 included a fundamental study on X-ray parametric down-conversion and nuclear resonance vibrational spectroscopy to study hydrogenase. In EH3, research on X-ray pumping

of the thorium-229m isomeric state, high-energy X-ray diffraction, linear dichroism in HAXPES, X-ray magnetic scattering, and X-ray-excited STM experiments were performed. X-ray magnetic scattering using a superconducting magnet and X-ray magnetic nano-imaging with the KB mirror were performed in EH4.

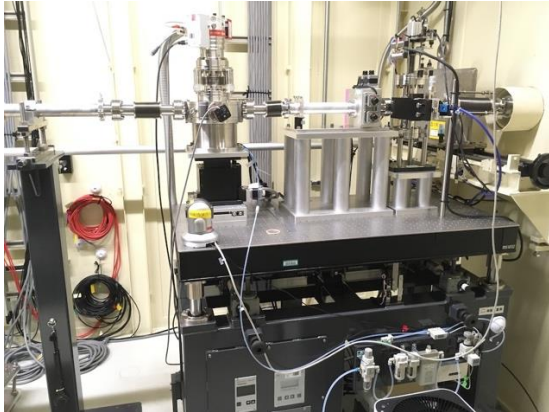


Fig. 1. Heavy-load Z stage in EH2.

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