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 (EHs) 1, 2, and 3 have been in operation since FY2000 and 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), the installation of precision four-jaw slits (FY2010), the renewal of the stages (FY2013), the installation of the cooling pipes in the double-crystal monochromator for enhanced stability (FY2015), the installation of an in-line beam monitor made of a diamond thin film (FY2015), and the replacement of the vacuum system from a turbomolecular pump 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 EH3 (FY2014) and EH4 (FY2010). The outdated laser system was updated (FY2016), and the repetition rate was increased from 1 kHz to 10 kHz, which improved efficiency in time-resolved experiments.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 in the hutch (FY2019). A heavy-load Z stage was installed in EH2. The Z stage mounts the X-ray chopper, a four-jaw slit, and the diamond thin-film beam monitor, and can easily adjust these components to the beam axis.

2. Recent activities

In FY2021, current amplifiers were renewed with new high-speed ones, which were developed in FY2019. The amplifiers were located in each hutch to suppress noise. A dedicated GUI program was developed to control the amplifiers via a network. The gain and base level can be adjusted remotely, which enables automated measurements over a wide signal range.

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 FY2021, 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 the X-ray pumping of the thorium-229m isomeric state, high-

energy X-ray diffraction for the stress–strain analysis of iron materials, linear dichroism in HAXPES, time-resolved experiments with the synchronized Ti:S laser system, 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. Current amplifiers installed in EH1 (left) and EH3 (right). The amplifiers can be controlled via a beamline network.

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