BL19LXU
(RIKEN SR Physics)

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. EH 4 was constructed in FY2001. The beamline has undergone the following updates: installation of a double mirror in the optics hutch to reject higher harmonic radiation (FY2004), installation of precision four-jaw slits (FY2010), renewal of the stages (FY2013), renewal of the cooling pipes in the double-crystal monochromator for better 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 ion pumps to keep the surface of the monochromator crystals and the mirrors clean (FY2017). Changing the minimum gap size of the undulator lowered the minimum photon energy from 7.270 keV to 7.092 keV, which is below the iron K-edge at 7.112 keV (FY2017). For micro- and nano-focusing, the Kirkpatrick-Baez (KB) mirror systems were permanently installed in EH 3 (FY2014) and EH 4 (FY2010). The dated laser system was updated (FY2016), and the repetition rate was increased from 1 kHz to 10 kHz for better efficiency in the 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 EH 1 and EH 3 were upgraded (FY2016), and the automatic doors of EH 1 and EH 3 were motorized (FY2017).

In FY2018, the interlock system is upgraded. With the new Inter-Lock system, users can select the active hutch without closing MBS, making beamline operations easier and enhancing thermal stability of the monochromator. The new interlock system runs in the remote mode, so that users can easily operate MBS, DSS, and SCM from a personal computer. By contrast, users had to change the mode of the former interlock system manually every time they close the hutch (Fig. 1). The X-ray chopper system was also upgraded, and is now vacuum compatible to avoid air attenuation. The vertical aperture of the chopper is wider than before, delivering more X-ray flux. The blade of the new chopper is made of titanium, which can be used at higher photon energies. A polarization controller is developed to convert the horizontal linear polarization of the incidence to the circular polarization and the linear polarization in arbitrary

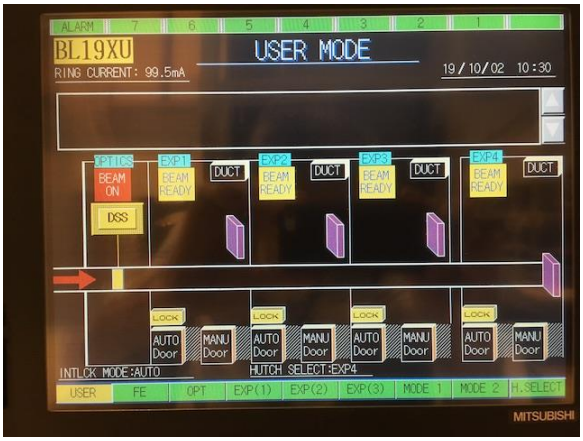

Fig. 1. Graphic panel of the new interlock system in the USER mode. MBS button is hidden to prevent users from closing MBS carelessly, and appears only when users can open it.

directions using two diamond phase retarders. The polarization controller is compatible with a high vacuum. A new goniometer with a precision encoder is installed, which can measure the absolute angle with a 0.1-arcsecond resolution. This combined with a standard silicon crystal and calibrated thermometers, the new goniometer can determine the absolute wavelength by the Bond method.

Various user experiments, which require brilliant X-rays, and R&D programs for X-ray free-electron laser experiments were performed at each experimental hutch. In FY2018, experiments carried out at EH 1 included a fundamental study on X-ray parametric down conversion, X-ray quantum imaging, nuclear resonance vibrational spectroscopy to study hydrogenase, and X-ray magnetic scattering. Various HAXPES experiments using circular and vertically polarized X-rays, laser system, time-resolved X-ray scattering experiments, and STM experiments with X-rays were conducted at EH 3. At EH 4, X-ray magnetic imaging was performed using the submicron beam from the KB mirror.

Kenji Tamasaku

SR Materials Science Instrumentation Team, Physical and Chemical Research Infrastructure Group, Advanced Photon Technology Division, RIKEN SPring-8 Center