Present status of NewSUBARU

NewSUBARU Synchrotron Radiation Facility

The synchrotron radiation facility NewSUBARU is a VUV and Soft X-Ray light source at the SPring-8 site. Laboratory of Advanced Science and Technology for Industry (LASTI), at the University of Hyogo is in charge of its operation, collaborating with SPring-8. At the present the main operation mode is the 1.0 GeV top-up mode, which occupies about 70% of the user time. The 30% is for the operation at 1.5 GeV. The main parameters of NewSUBARU are listed in Table 1.

The following progresses since the last operational is reported. 1) Double top-up mode operation, the time-sharing top-up injection to SPring-8 and NewSUBARU using same linac, is started. It was necessary to be confirmed that the energies of three accelerators are the same with each other. 2)The new beamline for the use of Compton-gamma ray was constructed and the user operation is started. 3)The injection was much stabilized by the orbit feedback system in the beam transport line from the linac. 4)In order to reduce the tune shift by the ion trapping, the ring adopts a special filling pattern. All buckets are filled with beam but different charges. It improved the injection efficiency at higher stored beam current more than 300 mA. 5)The improvement of vacuum pressure improved the beam lifetime. A the present, the lifetime for 330 mA is 8.8 hours and that for 145 mA is 17 hours at 1.5 GeV. 6)The real-time measurement system of the betatron tunes helped to adjust the B-Q tracking during the acceleration from 1 GeV to 1.5 GeV. 7)The improvement of the temperature control system for the air in the ring tunnel is schedules in 2006. The orbit drift of a few tens mm with a repetition time of about ten minutes, in horizontal and vertical directions are expected to disappear. 8)The continuous slow cod correction is in progress. The software needs special consideration on the rf frequency because of small momentum compaction factor, 0.0013. After the improvement of the air temperature control system, the continuous cod correction will be in operation. 9)The automatic correction system of the effect of the undulators to the ring is in progress. Because of the large tune shift by the undulators, the ring will have a local quadruple correction system for the short undulator and a global correction system for the long undulator. 10)The optimization of the beam orbit is scheduled in 2006. The beam will run the center of the multipole magnets. With the new orbit a horizontal octapole resonance is expected to be weaker. 11)Improvement of the orbit shift at the injection is in progress. The (small) horizontal shift was caused by the eddy current field of the pulse septum magnet. It is reduced by cutting the induced current path. For a further improvement, an air-core correction magnet with non-linear field will be installed.

There are 8 beamlines which are in operation.

Table 1. Main parameters of the NewSUBARU storage ring

Circumference	118.73 m
RF Frequency	499.955 MHz
Injection / Max	1.0 / 1.5 GeV
Natural Emittance (@1.0 GeV)	38 nm
Critical Photon (1.0 / 1.5 GeV)	0.67 / 2.3 keV
Maximum Current	500 mA
Number of beamlines	8

BL1 is a beamline for research and developing new light sources. The light source is an optical klystron (OK : undulator that has dispersion section at middle for FEL operation) which is installed at this straight section. Upstream side of this beamline (BL1B) is intended to be used for visible and infrared light generated from FEL or SR. Downstream side of this beamline (BL1A) will be used for VUV and gamma rays generated by laser-Compton source. BL3 is a beamline for the developing the next generation lithographic technology so called extreme ultraviolet lithography (EUVL). BL3B beamline branches to two beamlines. One is for the usage of the EUVL microscope for the EUVL finished mask inspection. And another is for the usage of EUV resist evaluation. BL6 has been mainly developed for irradiation experiments such as photochemical reaction, SR-CVD, photo-etching, surface modification. BL7 beamline was designed for the development of new materials by SR technology. This beamline consists of two branch lines, which are provided with an incident beam from a 3-m undulator by switching the first mirror. One of them is a high photon-flux beamline with a multilayered-mirror monochromator for the study of SR-process (BL-7A) and another is a high-resolution beamline with a varied line spacing grating monochromator for the evaluation of nano-structure characteristics by SR-spectroscopy (BL-7B). BL9B beamline branches from BL9 beamline propose for the usage of the advanced point diffraction interferometry for the test alignment of the EUVL imaging optics for practice use. A purpose of BL9 beamline is studies on a soft X-ray interferometry or a holographic exposure experiment with making use of highly brilliant and coherent photon beams radiated from 11 m long undulator in NewSUBARU. The characteristics of BL10 beamline and the result of the Mo/Si multiplayers measurement are carried out for the development of the EUVL mask techmology. BL2 and BL11 beamlines are constructed for exposure Hard X-ray Lithography (DXL) in the LIGA (German acronym for Lithographite Galvanoformung and Abformung) process. LIGA process, that utilizes a useful industrial application of SR, is one of the promising technologies for fabrication of extremely tall three-dimensional microstructures with a large aspect ratio.

Topics of our facility is reported in the poster.