The SAGA Light Source

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Saga prefecture, a local government in Kyushu district of Japan, operates a synchrotron light facility named Kyushu Synchrotron Light Research Center for regional industries to develop advanced industrial technologies as well as to promote fundamental material sciences. It is expected that the facility will play a role of an Asia-wide technology interchange center for light-related industries. Construction of the facility was started in the fall of 2001. The installation of light source equipments such as ring magnets, vacuum chambers and so on started in October 2003, and the commissioning started in August 2004. The tentative goal of 100 mA electron accumulation, acceleration and storage in the ring was attained in August 2005.

The light source, named SAGA-LS, consists of a 260 MeV injector linac with a length of 30 m and a 1.4 GeV synchrotron/storage ring with a circumstance of 75.6 m. Electrons emitted from an electron gun are accelerated up to 260 MeV while passing the traveling wave structure, and are injected in the storage ring. The synchrotron/storage ring is consisted of the eight magnetic cells. Each cell consists of two bending magnets, five quadrupole magnets, and four sextupole magnets. The 260 MeV electrons are accelerated up to 1.4 GeV in the ring and stored with this energy. Figure 1 shows the spectral brilliance of the SAGA-LS. The critical energy of the photon from the bending magnets is 1.9 keV. As of August 2006, the ring is operated for twelve hours a day with a maximum beam current of 100 mA. The beam lifetime of stored electron is 12 hours, and the injection interval is six hours.

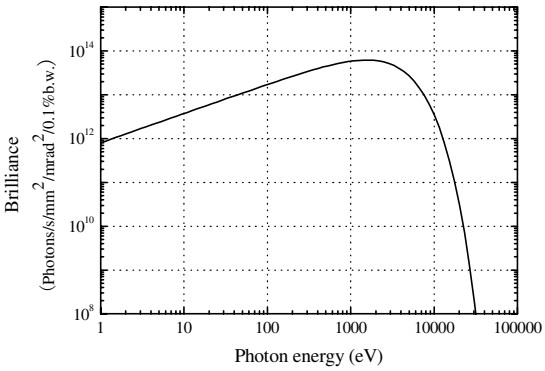

Fig. 1 Brilliance of SAGA-LS from bending magnet.

Twenty beamlines at maximum can be set up around the storage ring including those from the insertion devices. Saga prefectural government has prepared three beamlines, BL09, BL12, and BL15, for the present to be used in engineering science, and has a plan to construct another three beamlines in near future. Other beam ports are open for any application by institutes or companies. At present Saga University has completed a soft X-ray beamline, BL13, connecting to an undulator. These beamlines are under commissioning and partly opened for users. The outlines of these beamline are shown below.

BL09 has two branches, one of which derivers white light from a bending magnet directly to a clean room, and another branch transports extreme ultraviolet radiation from a monochromator of Seya-Namioka type. Research at end stations of these beamline aims at material processing and process development includes LIGA process, ablation, etching, surface improvement, etc. BL12 is a beamline for material analysis by photo-electron spectroscopy and X-ray absorption fine structure (XAFS) measurement. This beamline is equipped with a varied line-spacing plane-grating monochromator with three mirrors and one grating to change the deviation angle, and covers a wide energy range from 40 eV to 1000 eV. BL13 is a beamline constructed by Saga University. The synchrotron lights both from a bending magnet and from an undulator are used for nano-scale surface and interface dynamics studies. Monochromatic vacuum-ultraviolet radiation and soft X-rays are delivered from a monochromator with a total resolving power higher than 10,000 with a slit width of 10μm. BL15 is a hard X-ray bending magnet beamline designed for materials science researches. X-rays monochromatized at a Si(111) double crystal monochromator are focused by a cylindrical mirror into a sub-millimeter spot at a sample position. End stations are installed in a hutch, where basic experimental equipments for X-ray absorption measurement, high resolution diffractometry, topographic imaging and energy-dispersive four-circle diffractometry are prepared.