Nagoya University Photo-Science Nanofactory Project

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Nagoya University has a project to construct a new synchrotron light facility, called Photo-Science Nanofactory, for a wide range research from the basic science to the industrial applications, life science and environmental engineering in collaboration with universities, research institutes and industries. The key equipment of the facility is a compact electron storage ring, “Nagoya University Small Synchrotron Radiation facility (NSSR)”. Since users of synchrotron radiation in Nagoya University are dominantly aiming at technological applications, NSSR is planed to supply hard x-rays.

The layout of acceleraors and beam lines of NSSR is shown in Fig. 1, and parameters of the accelerators are given in Table 1. The circumference of the storage ring is 62.4 m and the harmonic number is 104 for 500 MHz of RF frequency. The energy of the stored electron beam is 1.2 GeV with the current of 300 mA and the natural emittance is about 53 nm-rad. The configuration of its magnetic lattice is the triple bend cell with twelve bending magnets. Eight of the magnets are normal conducting ones, whose field strength is 1.4 T and the bending angle is 39 degrees. Four of them are 5T superconducting magnets (superbends), whose bending angle is 12 degrees. From each super-bend, two or three hard x-ray beam lines can be extracted, so that more than 10 hard x-ray beam lines can be constructed in our facility. All bending magnets are separated function type.

The electron beam is injected from a booster synchrotron with the energy of 1.2 GeV as full energy injection because we avoid changing the current of the super-bends. The full energy injection also enables us to operate the storage ring in the “top-up” mode. A 50 MeV linac is used as an injector to the booster synchrotron. The booster synchrotron and the injector linac are constructed under the ground level in order to transport the electron beam to the storage ring under the ground and extract the synchrotron light beam lines from all the bending magnets without the interference of the electron beam transport line.

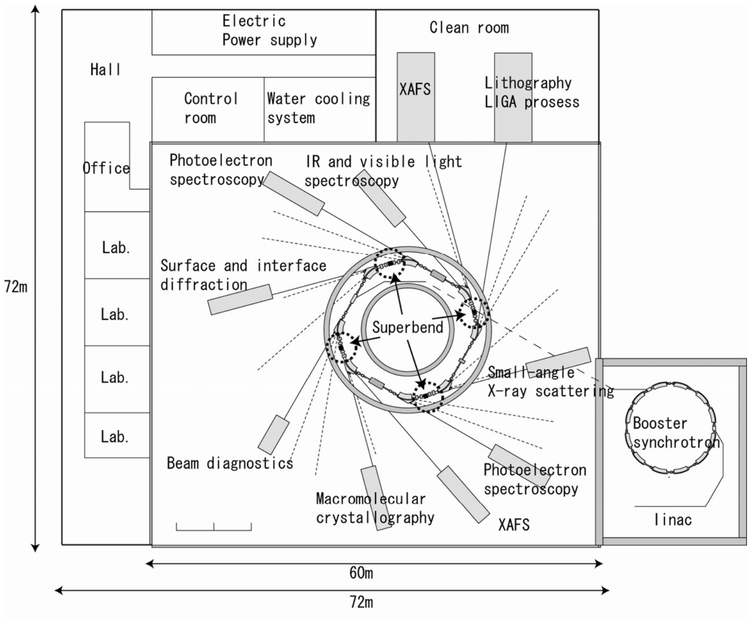

FIGURE 1. Layout of accelerators and beam lines of NSSR.

TABLE 1. Parameters of NSSR.

Storage ring	
Beam energy	1.2 GeV
Current	300 mA
Circumference	62.4 m
Normal conducting bending magnets	1.4 T, bending angle 39° × 8
Superconducting bending magnets	5 T, bending angle 12° × 4
RF frequency	500 MHz
Output power of Klystron	100 kW
Natural emittance	～60 nmrad
Magnetic lattice	Triple Bend Cell × 4
Straight section	4 m × 2
Booster synchrotron	
Maximum beam energy	1.2 GeV
Bending magnets	1.1 T
Circumference	37.2 m
RF frequency	500 MHz
Injector linac	
Beam energy	50 MeV
Current	10 mA
Repetition rate	1 Hz
RF frequency	2856 MHz