Design Study on HiSOR-II

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HiSOR is a compact racetrack-type light source in Hiroshima university, which has been operated stably from 1996 [1]. Although the energy is 700 MeV, HiSOR can provide synchrotron radiation from vacuum ultraviolet (VUV) to soft X-ray, which is due to the strong magnetic field (2.7 T) of the bending magnets. On the other hand, the brilliance is limited because of the large emittance, which is owning to the simple lattice configuration with two 18 degree bending magnets. To satisfy the demands of users for high brilliance undulator radiation, a new storage ring HiSOR-II is being designed.

Currently, two accelerator lattice designs shown in Figure 1 are under consideration. The parameters of two designs are summarized in Table 1. The emittance are both around 10 nm, and the brilliance of the synchrotron radiation can reach to 1×10^{17} ph/sec/mm^2/mrad^2/0.1%b.w which is 100 times higher than that of the present HiSOR. The first lattice (Design A) is compact and has a relatively small number of magnet elements. Therefore, a combined function magnet is required in this design for a chromaticity compensation. As for the second lattice (Design B), it is a double-bend achromat (DBA) lattice modified from the optics of ASTRID2 [2, 3]. Although the circumference is larger and the number of magnet elements is more than that of Design A, Design B is more general and has a better performance.

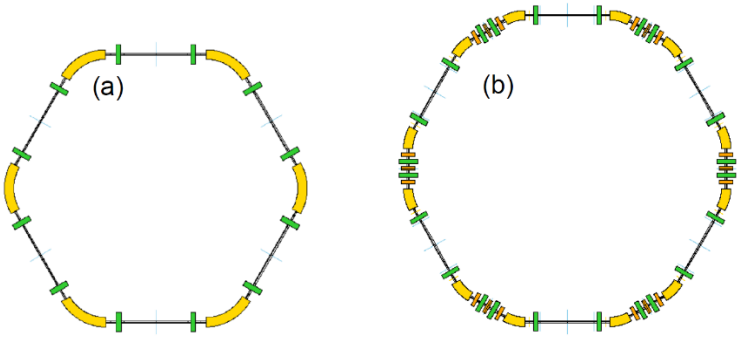

FIGURE 1. Schematic view of the magnet layout (a) Design A and (b) Design B.

TABLE 1. Storage ring parameters

	Design A	**Design B**
Energy [GeV]	0.5	
Circumference [m]	31.38	40.78
Emittance [nm]	17.43	8.92
Beam current [mA]	300	
RF frequency [MHz]	191	
Tunes: ν_x, ν_y	2.75/2.46	5.12/1.67
Number of undulators	4	

In this study, the dynamic Aperture (DA) survey and beam injection simulation are also performed. We have shown that the DA is relatively wide with simple sextupole correction scheme. For the beam injection, there are two schemes, pulsed multipole magnet injection [4, 5] and bump injection. A pulsed sextupole magnet can be installed in the Design A-ring, which injects the beam successfully by a three-turn kick. The

beam injection only needs one magnet and can save space for the injection system. For Design B, a bump orbit can be adjusted freely by three dipole kickers. The possibility of a pulsed multipole injection will be surveyed by a tune adjustment in the future.

A top-up operation is preferred for users' experiments. Therefore, a booster ring is necessary for a full energy beam injection. Figure 2 shows a one accelerator layout of HiSOR-II based on the building of the facility. A new experimental hall and Beam Transport (BT) line are needed for the main ring.

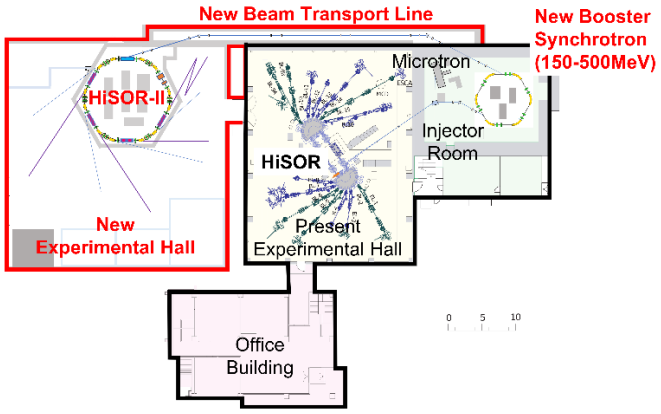

FIGURE 2. One accelerator layout of HiSOR-II.

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