The Performance of an Advanced Elliptically Polarized Undulator at SRRC


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A four-meter-long Elliptically Polarizing Undulator (EPU5.6) device with Apple-II structure is completely and installed in the SRRC storage ring. It is the largest long EPU device of Apple-II structure in the world. The system control algorithm and the mechanical design structure will be described in this paper. The experiment involving magnet design and construction as well as field shimming highlights several crucial issues in the maximization of spectrum performance. They are as follows: (1) faultless uniformity of the magnetization in each block is required to reduce quadrupole field strength and optical phase errors. (2) The dimension of the magnetic block and block holder must be controlled within $\pm 0.025$ mm, particularly along the longitudinal axis. (3) Magnetic block assembly on the block keeper must be carefully controlled through the use of the assembly fixture, which minimizes the assembly error of tilt and twist. (4) A reference plane is required for the magnetic block assembly to maintain a constant interval along the longitudinal axis on each magnetic block array. (5) In the zero phase position, alignment among the four magnetic block arrays and module arrays should be located at the same longitudinal position (the position error must maintain within $\pm 0.025$ mm).

When the polarization mode is changed from horizontal linear polarization to right and left elliptical polarization, the intrinsic second-order focusing strength in the horizontal and vertical planes will be changed, thus producing the two-dimensional tune shift, beta beating, and the change in beam size. Therefore, the beam dynamic effect and magnetic field as well as photon spectrum performance will be described in this paper.

Meanwhile, the system control algorithm and the mechanical design structure will be described in this paper. In addition, the variation of the electron orbit and photon beam position in different polarization radiation modes is within 0.005 mm under the Global Feedback System (GFS) and a two-dimensional field correction table with fallow gap and phase. In this device, two groups of vertical and horizontal corrector magnets are required to control the position and angle deviation of the electron and photon beams.

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