SPring-8 Beam Performance

Recent update on accelerators

Orbit fluctuations excited by pulsed kicker magnets at ID23 and ID25 have been observed for years. At the beamlines, there are twin helical undulators and pulsed kickers so that the optical helicity can be switched at the repetition rates of 0.1 – 1 Hz (or 10 Hz in some cases) by making orbit bumps between kickers. Ideally, an orbit bump is supposed to be closed within the kickers without orbit fluctuations out of the kickers (Fig. 1). However, owing to hardware imperfections, the orbit bump is not perfectly closed, which results in orbit fluctuations at other beamlines. Our basic strategy to suppress such orbit fluctuations is to use correction magnets in ID sections that are composed of iron- and air-core magnets, and drive them based on feedforward tables. Nevertheless, it has been observed for years that the orbit fluctuations become gradually larger, i.e., the feedforward correction gradually deteriorates, as time elapses even after the feedforward tables are optimized. Typically, users start to see the fluctuations in a couple of weeks after the optimization. For this reason, we have developed the so-called adaptive feedforward orbit correction system. The new system monitors orbit distortions every hour, for instance, so that the feedforward tables are updated before users detect the fluctuation. In fiscal year 2019, the new system was operated manually and the reliability was verified. We plan to start user operations with the new feedforward system presumably in spring of the year 2020.

A full-energy direct beam injection from the SACLA linac to the SPring-8 storage ring has been developed. This new injection setup is beneficial in that (i) the 1 GeV linac and the 8 GeV booster synchrotron that are currently used for the injection to the storage ring can be shut down, (ii) the new injection setup with the low-emittance beam will eventually be inevitable after the major upgrade of the storage ring, and (iii) an experience with the new setup is invaluable when next-generation light sources become available, such as the new 3 GeV light source in Tohoku where a full energy injection from a linac is employed. For a year or so, we have developed a new timing system that can smoothly switch between the direct injection from the SACLA linac and the conventional injection from the booster, and simultaneously modified the beam transport hardware configurations. After several test runs in beam study times, we finally started user time operations with the new set up for full-energy direct injection from SACLA in February 2020. It worked as expected without a significant problem; stable lights were delivered to users without any deterioration of beam quality. Unfortunately, the injection with this new set up needed to be stopped just after 24 hours of user operation because of an independent problem with the electron gun of the SACLA linac. We aim to restart the new injection set up early in fiscal year 2020.

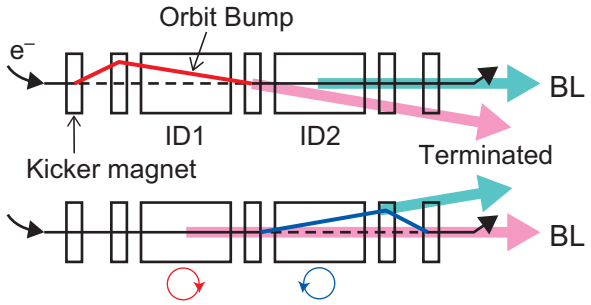

Fig. 1. The twin helical undulators at BL25SU. It consists of two helical undulators and five kicker magnets. The kicker magnets are used to generate bumped electron orbits at the undulators.

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