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Real-Time Betatron Tune Correction with the Precise Measurement of Magnet Current

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The betatron tune, which is defined as the number of transverse oscillations in one turn of a ring accelerator, must be precisely controlled. This is because particular betatron tunes drastically increase the amplitudes of the oscillations so that many particles are lost from the ring sooner than designed. Since the betatron tune is controlled by the magnetic fields in the ring, the ripple of magnet current regulators directly displaces the betatron tune from its designated value.
We have developed a system which corrects the betatron tune displacement using precisely measured magnet current at the J-PARC Main Ring. Although it is possible to directly measure the betatron tune, the measurement involves the excitation of the betatron oscillation which is not allowed for the user operation. This is the reason that we plan to use magnet current to obtain the betatron tune during the user operation. The current ripple is generally not predictable so that the conversion from the current to the betatron tune must be done in real-time. In the system, the analog measured currents are converted to digital signals at each current regulator. The digitized signals are sent to the current regulator of correction magnets (corrector). At the corrector regulator, a FPGA board are used for the conversion from the current to the betatron tune. We will report the details of the system and some experimental results using the beam.

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Yes

Description

tuning algo

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