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longitudinal phase space reconstruction in a electron strage ring

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This paper proposes a longitudinal phase space measurement and reconstruction technology of particle beam in a storage ring. The technology collects and analyzes the beam injection signals by a high-speed oscilloscope, so as to extract the phase and beam length information of the injected beam. The length of a single data collection covers several thousand circles, the measurement accuracy of the phase reaches 0.2ps, and the measurement accuracy of the beam length reaches 1ps. At the same time, we develop a single beam tracking software based on the mbtrack2 software package. The simulation software can record the phase space evolution of the beam after injection under different initial conditions. By matching with the simulation results, we can get various initial parameters of the experimental beam, including the initial phase, the initial beam length, the initial energy deviation, the initial energy dispersion, and the initial injection angle of the beam in the phase space. This technology enables us to understand the kinetic behavior of the particle beam deeply and to monitor and adjust the injection system in real-time. By obtaining the phase space distribution information of the particle beam in real-time, we can find and correct the deviation and instability in the injection system in time, so as to improve the injection efficiency and the quality of the particle beam.

Footnotes

Funding Agency

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Yes

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