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Observation and study of space charge effect frequency shifts in high-intensity accelerators

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The China Spallation Neutron Source Rapid Cycling Synchrotron (CSNS-RCS) is the first high-intensity pulsed proton accelerator in China and the fourth in the world. The space charge effect is a key factor limiting power enhancement. Measuring the frequency shift induced by the space charge effect is an important method for studying this phenomenon. In our experiments, we varied the beam current by adjusting the injection pulse length and chopping rate. Using a combination of narrow-band filtering and Fast Fourier Transform (FFT) techniques, we successfully observed a tune shift of approximately 0.02 induced by a beam power of 140 kW. These experimental results were compared with simulation outcomes, showing good agreement.

Footnotes

Funding Agency

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Yes

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