



Contribution ID: 209 Contribution code: THBC4

Type: Contributed Oral Presentation

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

Thursday, 12 September 2024 12:10 (20 minutes)

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

Primary author: AN, Yuwen (Institute of High Energy Physics)

Co-authors: HUANG, Liangsheng (Institute of High Energy Physics); HUANG, Ming-Yang (Institute of High Energy Physics); XU, Shouyan (Dongguan Neutron Science Center); LU, Xiaohan (Institute of High Energy Physics); YUAN, Yaoshuo (Institute of High Energy Physics); LI, Yong (Dongguan Neutron Science Center); YUAN, Yue (Institute of High Energy Physics); LI, Zhiping (Dongguan Neutron Science Center)

Presenter: AN, Yuwen (Institute of High Energy Physics)

Session Classification: THB: Machine Parameter Measurements

Track Classification: MC8: Machine Parameter Measurements