



Contribution ID: 68 Contribution code: WECDB01

Type: Contributed Oral Presentation

Bunch Compression Methodologies in the ISIS Rapid-Cycling Synchrotron

Wednesday, October 22, 2025 5:00 PM (20 minutes)

The ISIS rapid-cycling synchrotron accelerates a high-intensity beam of protons from 70 MeV to 800 MeV at 50 Hz, facilitated by ferrite-loaded RF cavities at harmonics $h = 2$ and $h = 4$. The extracted proton beam is delivered along separate transfer lines to two tungsten spallation neutron targets, TS1 and TS2, at rates of 40 Hz and 10 Hz respectively. An intermediate carbon target on the TS1 line exploits ~ 4% of the full TS1 beam intensity for muon production. Compression of the extracted proton pulse helps to provide good temporal resolution for muon spin spectroscopy, speeding up measurements and widening the range of possible experiments. A bunch rotation method has been successfully employed at ISIS for several years, though it is sensitive to variations in extraction timing. A new method using the phase offset between the fundamental and 2nd harmonics of the ISIS ring RF has been developed as an alternative compression method without the same timing sensitivity. This work presents both compression approaches with experimental data, tomographic reconstructions, and supporting longitudinal beam dynamics simulations.

Footnotes

Funding Agency

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Yes

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Session Classification: WECDB WGA contributed oral

Track Classification: WGA:Beam Dynamics in Rings