



Contribution ID: 181 Contribution code: MOLCA03

Type: Plenary Presentation

The Challenges of Instabilities and Impedances on High Intensity Hadron Machines

Monday, October 20, 2025 3:00 PM (30 minutes)

High-intensity hadron machines stand at the forefront of applied and fundamental research. Pulsed spallation neutron sources harness intense proton beams to drive advances in fields ranging from quantum materials to cultural heritage. Meanwhile, high-energy particle physics colliders are revolutionizing our understanding of the universe's structure. The performance of these accelerators has improved by at least three orders of magnitude since the 1980s, which has been made possible by innovations in mitigating the effects of coherent beam instabilities. Today, these innovations have become fundamental to the design and operation of high intensity hadron accelerators.

This talk will survey some principal tools and techniques: impedance optimisation, chromatic control, Landau damping, feedback systems and optical techniques; illustrate their application today, and reflect on their possible limits for next-generation facilities. A case study from the ISIS Neutron and Muon Source will be presented, where recently discovered transverse resonator impedances on this 40-year-old machine have been found to have implications for some of the most recently constructed RCS accelerators.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

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Session Classification: MOLCA WGs Plenary presentations

Track Classification: WGs:Plenary presentations WGs A-E