Contribution ID: **52** Contribution code: **FRA3** Type: **Contributed Oral Presentation**

A Charge-Agnostic Design for 6D Muon Ionization Cooling

Friday 31 October 2025 10:00 (30 minutes)

A muon collider presents a compelling path forward for high-energy physics, offering both energy reach and precision. The notable challenge in realizing the target luminosities for a muon collider is in the development of a sufficiently fast cooling scheme – one capable of several orders of magnitude in emittance reduction with minimal decay losses. Ionization cooling is presently considered the only scheme to fit this criterion. Traditional ionization cooling channels are characterized by a solenoid-based lattice for beam focusing and a low-Z absorbing material to facilitate emittance exchange. Dipole fields are used to generate dispersion such that higher-momentum muons pass through more absorbing material, enabling longitudinal cooling. The problem with this approach is the charge-specificity of the dispersion function, necessitating separate channels for μ^+ and μ^-. Here, the Helical FOFO Snake (HFOFO) is presented as an alternative approach to 6D cooling that agnostically treats both signs of muon, enabling a single cooling channel for both.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

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Session Classification: Coolers Designs and Proposals

Track Classification: COOL'25