Contribution ID: **1531** Contribution code: **MOPL163** Type: **Poster Presentation**

Thermodynamic characteristics of hydrogen in an ionization cooling channel for muon colliders

Monday, 8 May 2023 16:30 (2 hours)

Ionization cooling is the only suitable approach to reduce the phase space volume occupied by a muon beam on a timescale compatible with the muon lifetime. Small normalized transversal emittances can be achieved by using hydrogen (H) as an absorber and high solenoid fields at low beam energy. The strong focusing suppresses emittance growth due to scattering occurring from muon beam interaction with nuclei in the absorber's atoms. This leads to very small beam sizes and therefore the deposition of energy in small volumes causing a high peak energy density. Temperature changes in H can cause pressure rises that may damage the absorber's H containment windows. This work presents the acceptable temperature ranges in liquid H and discusses an alternative method with low density H-gases.

Funding Agency

Footnotes

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Yes

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Session Classification: Monday Poster Session

Track Classification: MC1: Colliders and other Particle Physics Accelerators: MC1.A09: Muon Accelerators and Neutrino Factories