Gaseous Hydrogen Energy Absorber For Muon Ionization Cooling

R. E. Hartline, R. P. Johnson

Muons, Inc., Batavia, IL 60510

C. M. Ankenbrandt, M. Kuchnir, A. Moretti, M. Popovic

Fermi National Accelerator Lab., Batavia, IL 60510

E. L. Black, K. Cassel, D. M. Kaplan, A. V. Obabko

Illinois Institute of Technology, Chicago, IL 60616

Abstract. Ionization cooling, a method for shrinking the size of a particle beam, is an essential technique for future particle accelerators that use muons. In this technique, muons lose energy in all three directions by passing through an absorber while only the longitudinal energy is regenerated by RF cavities. Thus the beam phase space area decreases down to the limit of multiple scattering in the energy absorber. Hydrogen is the material of choice for ionization cooling because of its long radiation length relative to its energy loss. In the application discussed here, dense gaseous hydrogen also suppresses RF breakdown by virtue of the Paschen effect, thereby allowing higher accelerating gradients and a shorter and less expensive cooling channel. As described in this paper, a channel of RF cavities pressurized with about 3 tons of cold hydrogen gas could provide muon cooling for a Muon Collider or Neutrino Factory. The present status of this research effort and several issues related to the use of hydrogen in this application are described.

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