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Stopping Muon Beams

Cooperative Research and Development Agreement Final Report

CRADA Number: FRA-2007-0003

Fermilab Technical Contact: Charles Ankenbrandt

Summary Report
June 2007

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CRADA number: FRA-2007-0003

CRADA Title: Stopping Muon Beams

Parties to the Agreement: MUONS, Inc and Fermi Research Alliance, LLC

Abstract of CRADA work:

The study of rare processes using stopping muon beams provides access to new physics that cannot be addressed at energy frontier machines. The flux of muons into a small stopping target is limited by the production process and by stochastic processes in the material used to slow the particles. Innovative muon beam cooling techniques are being applied to the design of stopping muon beams in order to increase the event rates in such experiments. Intense stopping muon beams will also aid the development of applications such as muon spin resonance and muon-catalyzed fusion.

In Phase I, we will show that beam cooling can be used to improve the design of stopping muon beams. As an example, a stopping muon beam design using a helical cooling channel (HCC) will be developed and optimized to provide improved sensitivity with reduced costs for a particular experiment to search for direct conversion of muons to electrons. Funded in part by SBIR grant DE-FG02-03ER83722.

Summary of Research Results:

The flux of stopping muons for the study of rare processes such as muon-to-electron conversion can be improved by the use of innovative muon cooling concepts originally developed for muon colliders and neutrino factories. This first study shows the muon/proton ratio of muons stopping in a 50 mm Al target is 1.2%, almost 5 times larger than in the baseline MECO design. This is encouraging, and further study of transverse distributions, backgrounds, and the use of a stronger capture solenoid should yield additional improvements.

Related Reports, Publications, and Presentations:

PAC07, Albuquerque, NM, June 2007, IEEE, APS, LANL, "Stopping Muon Beams" (THPMN096)

Subject Inventions listing:

None

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