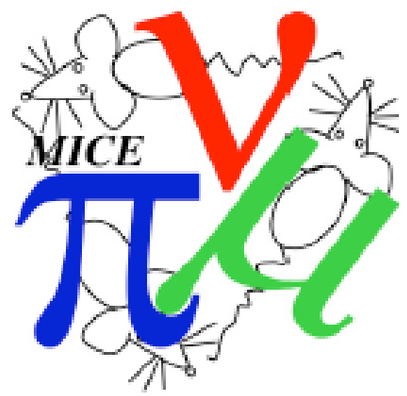
MICE Overview & Outlook

Daniel M. Kaplan



MAP Meeting
Jefferson Lab
4 Mar. 2011

Outline

- Progress against milestones
- MICE magnets
- Conclusions

MICE MAP Milestones

Table 2. System test task milestones and deliverables.

Date	Milestone	Designation	Deliverables[a)]
FY10	Study possible minor extensions to MICE	ST10.1	DR
FY11	Deliver Spectrometer Solenoids to RAL	ST11.1	DR
FY12	Deliver first RFCC module to RAL	ST12.1	DR, MR
FY13	Initial specification of 6D cooling bench test	ST13.1	DR, MR
FY14	Finalize 6D cooling bench test specification	ST14.1	DR, MR
FY15	Initial component specifications for 6D cooling experiment	ST15.1	MR
FY16	Install 6D cooling bench test section in MTA	ST16.1	MR
	Prepare proposal for 6D cooling experiment	ST16.2	FR, ER

a) DR: design report (MAP technical note); ER: external review; FR: formal report; MR: MAP (internal) review.

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Schedule to be developed by ≈4/11

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MICE MAP Milestones

2010-05-13 MICE Note 290

WEDGE ABSORBER DESIGN FOR THE MUON IONISATION COOLING EXPERIMENT

C. T. Rogers*
P. Snopok, L. Coney
A. Jansson

Abstract

In the Muon Ionisation Cooling Experiment (MICE), muons are cooled by ionisation cooling. Muons are passed through material, reducing the total momentum of the beam. This results in a decrease in transverse emittance and a slight increase in longitudinal emittance, but overall reduction of 6d beam emittance.

In emittance exchange, a dispersive beam is passed through wedge-shaped absorbers. Muons with higher energy pass through more material, resulting in a reduction in longitudinal emittance as well as transverse emittance. Emittance exchange is a vital technology for a Muon Collider and may be of use for a Neutrino Factory. Emittance exchange has also been proposed as a technique to be used in the production of neutrons for Hadronic cancer therapy and in the manufacture of unstable rare isotopes for neutrino beam creation in the Betabeam scenario.

In this note, we study the cooling performance of different wedge materials and geometries and propose a set of measurements that would be made in MICE. We outline the resources these measurements would require and detail some of the engineering considerations and constraints that guide the choice of wedge parameters.

EMITTANCE EXCHANGE IN THE MUON IONISATION COOLING EXPERIMENT

Collider and has been considered as an upgrade option to the Neutrino Factory. Ring coolers [2], Helical coolers [3] and Guggenheim coolers [4] have been proposed to perform emittance exchange and longitudinal cooling using a simple wedge or a truncated wedge. Emittance exchange has been proposed as a technique for cooling beams in muon accelerators,

The proposed Guggenheim or RFoFo tilted solenoid ring system is closest to the system proposed in this note. In the Guggenheim lattice proposed for the muon collider, a beam with a dispersion of 80 mm is passed through liquid Hydrogen wedges with on-axis thickness of 280 mm and opening angle of 110°.

The measurement of longitudinal emittance reduction in MICE would:

- Demonstrate the accuracy of MICE's physics models for an absorber in a different geometry.
- Demonstrate that the physics of emittance exchange is well understood.
- Demonstrate emittance exchange in a real magnetic lattice.

It would be desirable to demonstrate emittance exchange and also energy replacement in a naturally dispersive lattice (i.e. with RF and dipoles), but that would be the subject of future work

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- Question what emittance definition to use (Snopok)...

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MICE Magnets

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- But the analysis by the LBNL group is in progress and can't be rushed
  - most important thing is to get it right!
- *Hope* is to deliver Spectrometer Solenoids this year and Coupling Coil(s) next year

Other MICE Progress

- Electron–Muon Ranger (EMR, non-sampling calorimeter) construction proceeding...
- Target & beam-bump development proceeding...
- AFC construction proceeding...
- RFCC construction proceeding...
- RF power infrastructure (UMiss MRI)...
- LH_2-system installation...
- Software improvement...

Conclusions

- MAP providing essential, critical-path MICE magnets (and more besides)
- Development of magnet completion plan nearly complete
- Aim at complete (Step VI) study of transverse cooling within next few years
  - as well as demo of emittance exchange at Step IV