Response to Referees for ZU8005

Referee A

We have changed the sign of Equation 29 1st part and also the overall sign in Equation 31.

Referee B

Title:-- Changed to “Recent Progress in Neutrino Factory and Muon Collider Research within the Muon Collaboration” in accordance with requests made by the referee to a)be different from “Status Report” and be “specific about the origin of the research”.

Abstract:- Changes made as requested

Introduction:-

Added the phrase “Also known as the Muon Collaboration” after “Neutrino Factory and Muon Collider Collaboration” in second paragraph to clarify the title.

The second paragraph starting “This document indicates our progress” now reads correctly as the referee wants, since the title explicitly states “within the Muon Collaboration”. So no further changes have been implemented.

We have added references to NUFACT 01, 02 and 03 and also to the recently submitted MICE proposal at the end of paragraph 2 on Page 7 as per referee’s suggestion. In addition references have been added to the Neutrino Factory efforts at CERN and Japan.

We have added the sentence on “Neutrino Factory vs the Muon Collider cooling as suggested by referee on Page 6 , in the paragraph starting “While the Neutrino Factory..”.

LH_2 has been replaced by liquid hydrogen.

III Neutrino Factory
All the Referee’s suggestions followed except

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F. The rep rate is described in the proton driver section; it is not
simply quantified as a single frequency.
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IV Muon Colliders

Page 65, line 6 Spelling of enegies corrected.

Text added after Line 17 as asked to refer to cooling and accelerator stages.

Page 66 Higgs Factory being the 0.1TeV collider is made clearer along the lines asked.

Page 68 “added three types of” before ring coolers.

Fig 29 Changed SS to “straight Section”

p.71 Line 19 Changed posibility to possibility

p.72 lines 7-8 Added sentence “We still need to
engineering studies to ensure that these coils are buildable”

P.73 line 4 corrected grammar.

P73 lines 14,15,18 and p77 line 9 RF changed to rf

P75, Fig34 “Circonf” changed to “circumf”

P76 line 4,6 H_2 changed to hydrogen

P76 line 8, p77 Fig 37.

mm-rad are the units used by the people working on this cooler. We see no need to change these at this point. The x equilibrium emittance for the figure quoted should read 3mm-rad.
We have changed the text to read
“The equilibrium normalized emittances are about 1 mm-rad in y, 3 mm-rad in x, and around 10 mm in z. The modest heating in x emittance seen in this plot is due to the particular choice of wedge angle.
Changing the wedge angle can induce cooling in x but at the expense of the cooling in z.

P77. Fig38. s changed to “arc length”

P78. Sentence added to Section C to explain RCS and RLA.
Beam time in table X changed to Beam transit time.

VI. INTERNATIONAL MUON IONIZATION COOLING EXPERIMENT

P92,p93 "RF" -> "rf" everywhere (2 places)

p93 Line 3 "embedded" -> "located" (first place, Sec. C para 1 sentence 4, not noticed by the referee) and "immersed" (2nd place, Sec. D sentence 1,

the one s/he noticed)

P93 lines 4-6, p94 and revised caption for Fig. 43: Distribution of ratios of output to input six-dimensional emittance for 1000 simulated experiments, each with 1000 accepted muons. The top figure shows the distribution of this ratio for the emittances as generated by simulation; the bottom figure, as ``measured'' in the simulated experiments. The curves are Gaussian fits to the points.

REFERENCES

All referees' comments on references have been implemented.

Referee C

III Neutrino Factory

The modifications requested by this referee was extensive in the sections related to accelerator physics. We have tried very hard to honor the requests and extensive rewriting was done in some sections. All suggested changes were incorporated (including the addition and replacement of several figures), with the following exceptions:

Discussing dispersion and chromaticity in a skew lattice is more detailed than is appropriate for this paper.

Discussion of the details of analyzing TPC tracks in this context is beyond the scope of this paper.

We have chosen to continue to use "we." The use of "we" is accepted (in fact somewhat encouraged) in the AIP style manual.

IV Muon Colliders

The first sentence "The lure of the muon colliders" changed along the lines the referee suggests. The paragraph is restructured as per the referee's suggestions.

Added "Cryogenics" to sentence in second paragraph beginning "Muon decay.."

Added a table of emittances to explain the colling needed to get to a muon collider better.

P.66 Explains emittance exchange better , with sentences,
"However, due to straggling, the longitudinal energy spread of the beam increases, even if the average longitudinal energy of the beam is kept constant. The longitudinal emittance thus grows in a linear cooling channel. In order to cool longitudinally, one needs to create dispersion in the system and have wedge absorbers at the point of maximum dispersion so that the faster

particles go through the thicker parts of the wedge. This results in a reduction in longitudinal emittance accompanied by an increase in transverse emittance and is thus called emittance exchange."

P69. We have added a figure of a focusing dipole and its field components as per referees' request.

P69. "on the edges" changed to "at the end regions"

Sentence starting "Symmetric field flip…" changed to explain zero dispersion at long absorber.

P72. Sentence added on Magnet and Maxwell to satisfy both referees B and C

P73 Sentence starting "The RF cavities had.." modified as per referee's wishes.
Referee is incorrect in asking for a figure of "a wedge magnet" on this page. What is being described is a wedge absorber.
Reference to ICOOL put in.
Reference to Study II put in.

P74: Exchange of emittance has been better explained earlier.

P75: Spiral tapering explained better.

Quadrupole cooler section has been completely updated to reflect more recent work.

P77. There is a reference [137] to the "alternate injection scheme" . We do not think it is worthwhile to explain it more in this report, since the note referred to does so for people really interested in the topic.

P78. 1st sentence in the section "Higher energy muon colliders" rewritten.
Sentence beginning "One may attempt to solve" removed.

RLA and RCS explained as per referee B.

In section "Muon Collider Detectors",Tungsten cones explained further.
A sentence added to talk about Bethe Heitler Muons.

Figures

We have modified figures as requested and added new figures as requested. We have not added zeroes as requested to Figures 7,8 since it would have made them too cluttered.