

Muon Collaboration

Neutrino Factory R&D

US & International Perspective

Steve Geer

NSF Visit.

7 January 2004

Neutrino Factory R&D is becoming increasingly international. “Grass-Roots” coordination is through annual NUFACT international workshops (rotates: US, Europe, Japan) and international steering groups.

NUFACT01: Launched a grass roots international steering group to initiate the international Muon Ionization Cooling Experiment (MICE) Collaboration.

NUFACT03: Launched a grass roots international steering group to co-ordinate the preparation for the “World Neutrino Factory Design Study” (there is a bid for EU funds to support the study).

Neutrino Factory R&D in the US is at the center of these international efforts.

MUCOOL already has European and Japanese participation. The MUCOOL goal is to develop & make engineering tests of all cooling channel components.

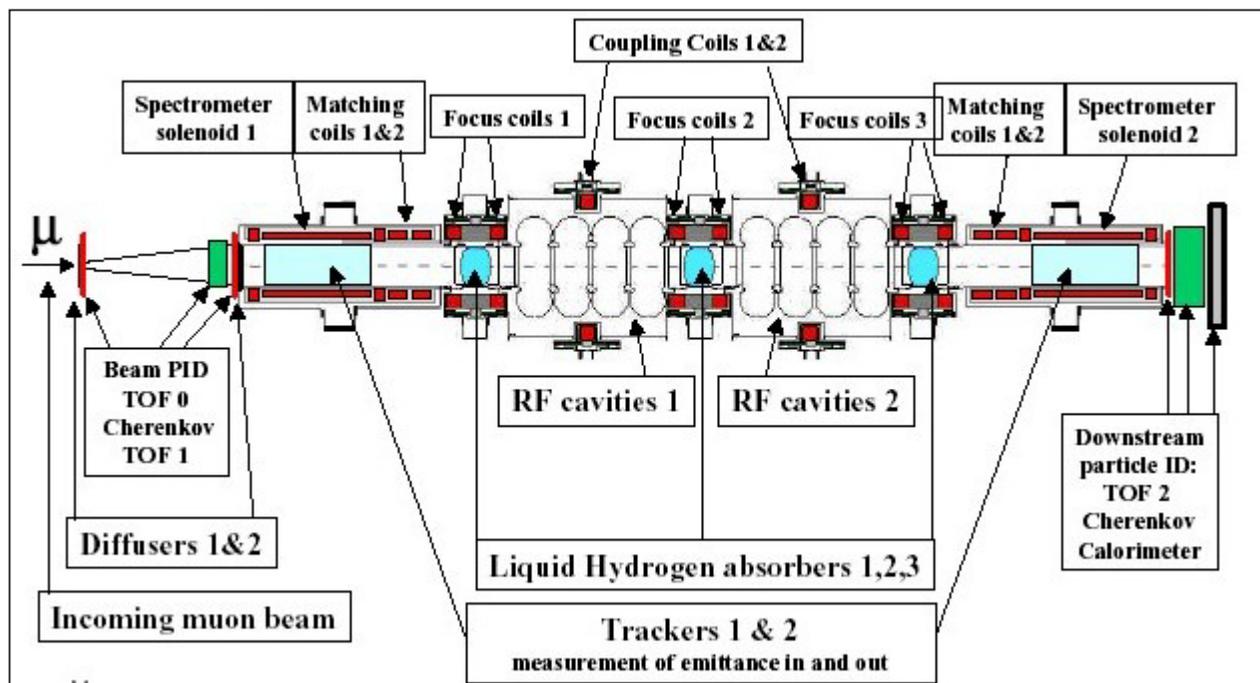
The international Muon Ionization Cooling Experiment (MICE) will use these MUCOOL components to demonstrate a short cooling section in a muon beam at the Rutherford Lab.

MUCOOL & MICE have been identified by our external technical review committee as providing “the critical systems test that must be made before a Neutrino Factory could be built”.

MICE has just received scientific approval. MUCOOL R&D is on the critical path for MICE, and MICE is on the critical path for a Neutrino Factory.

MICE Approval

130 Scientists from Europe, US, and Japan



The last few months have seen the international MICE project proposal peer reviewed at both a national and an international level. The scientific case, technical merits and timeliness of the proposal have been strongly endorsed in each case. CCLRC accepts the strong endorsement of the proposal by the Astbury panel and consequently considers the proposal to have full scientific approval.

World Context – Targetry R&D

The targetry R&D has from the beginning had important international contributions from Europe (CERN, Grenoble, Rutherford Lab.).

More recently there is interest from Japan ... and prospects for Support from US-Japan funds.

A grass-roots international (US-Europe-Japan) steering group is being put in place to help promote even stronger links in the future targetry R&D program.

World Context – The World Design Study

In the US there have been 2 Neutrino Factory Design studies, hosted by Fermilab and BNL respectively, each study with ~1M\$ engineering.

Studies 1 and 2 showed that a Neutrino Factory is feasible, and helped define the R&D program required before a Neutrino Factory can be built.

In the next couple of years we hope to launch a World Design Study (“Study 3”) with a focus on cost optimization. The Rutherford Lab is a candidate host laboratory.

A grass roots international steering group has just been put in place to help define and guide the study. European funding is being requested from the EU.

US Context – Preparing for the World Design Study

The Muon Collaboration has promising ideas for improving (making more cost effective) the Study 2 neutrino factory design.

The Muon Collaboration is fully participating in the APS sponsored neutrino workshop (Palmer is on the organizing committee, and Geer and Zisman are working group leaders).

In the context of the APS workshop we plan to update our baseline Design to include the new ideas, and make some progress towards an end-to-end simulation of the new design. This will be a very good preparatory step for the World Design Study.

US Context : HEPAP Subpanel Recommendation

Accelerator R&D

*“We give such **high priority** to accelerator R&D because it is **absolutely critical** to the future of our field. ... As particle physics becomes increasingly international, it is **imperative that the United States participates broadly in the global R&D program.**”*

Neutrino Factory & Muon Collider R&D

*“We support the decision to concentrate on intense neutrino sources, and **recommend continued R&D near the present level of 8M\$ per year.** This level of support is well below what is required to make an aggressive attack on all of the technological problems on the path to a neutrino factory.”*

US Context :Funding History

The Collaboration is supported by direct DOE & NSF funds & by support through the BNL, FNAL, & LBNL base programs.

Since the HEPAP sub-panel presentations the direct DOE support has been cut by a factor of 3.4. The total annual DOE support has been reduced from 8 M\$ to 3.5 M\$

Year	DOE-base (\$M)	DOE-MC (\$M)	TOTAL (\$M)
FY99	2.8	2.2	5.0
FY00	3.3	4.7	8.0
FY01	3.0	3.2	6.2
FY02	3.0	2.8	5.8
FY03 ^a	2.1	1.4	3.5

Also support from NSF
at ~ 1M\$/ year for 3 years
(we are in year 3).

The NSF support has been VERY important for us ... it has enabled very effective University participation in in our R&D program

Support from the neutrino community

10

6 January, 2003

To: John O'Fallon

From: J. Conrad
W. Louis
D. Michael
M. Shaevitz
S. Wojcicki

Dear John,

We would like to encourage you to increase support for Neutrino Factory R&D in FY04.

Neutrino oscillation physics has entered a very exciting period. In the not-too-distant future we expect that results from MiniBooNE and MINOS will add to the excitement. No matter what the results are from these experiments it is already clear that more ambitious long-baseline experiments will be needed in the future. It also seems increasingly likely that we will ultimately need the full power of a Neutrino Factory to unambiguously determine all of the parameters that describe neutrino oscillations. This will be particularly true if the LMA solution to the solar neutrino problem is confirmed (which initial KamLAND results suggest is the case), or if MiniBooNE and/or MINOS make discoveries that indicate there is more going on than just three-flavor mixing.

The HEPAP subpanel recommended a funding level for Neutrino Factory R&D at the FY01 level of 8M\$ per year. We understand that since that recommendation support for the all important R&D has been significantly reduced. We believe it is important to maintain an investment in the long-term future. Since the HEPAP subpanel presentations the R&D seems to have made good progress, and the physics case for an eventual Neutrino Factory has, if anything, grown stronger. We would therefore like to encourage a restoration of the support for Neutrino Factory R&D to the level that the subpanel recommended.

cc: Steve Geer
Bob Palmer

MUTAC Review – October 2001

Every year the Muon Collaborations R&D is reviewed by an external technical committee (MUTAC: H. Edwards (chair), M. Breidenbach, G. Dugan, M. Harrison, J. Hastings, Y.-K. Kim, J. Lykken, A. McInturff, R. Ruth, K. Yokoya), who report to a multi-laboratory directorate level oversight group (MCOG).

The MUTAC report was very positive. The MUTAC report received a strong letter of transmittal from our oversight group (MCOG = representatives from BNL, LBNL & FNAL Directorates):

*“ The impressive record of progress is epitomized by the summary judgment of the report, namely, that
The committee finds the progress since last year excellent. ”*

MUTAC Review – January 2003

The review this year was in January, and resulted once again in a very positive report. In their transmittal letter to the laboratory directors, MCOG say:

The successful record of progress is epitomized by the summary judgment in the report, namely that “Overall, MUTAC was impressed by the accomplishments since the last meeting, particularly given the strained financial situation. MUTAC can enthusiastically assure MCOG that the limited funding is being well and carefully utilized.”

MCOG has concluded that it is imperative that DOE seek to provide enhanced R&D funding for this work if it is to meet either the intent or the recommendations of the Long Range Plan laid out in the 2002 Gilman Report of HEPAP.

MCOG Recommendations

(Spring 2003)

1. In the area of experimental work, the highest priority should continue to be accorded to the 800 MHz and 200 MHz RF work, especially the testing of the 800 MHz cavity in a magnetic field. This work is critical to the advancement and eventual success of the MUCOOL and MICE projects. High power target R&D is important to a number of future high energy accelerator projects under consideration in the U.S. program and this work should be continued.
2. MCOG supports participation by the U.S. in the Muon Ionization Cooling Experiment (MICE) and urges support of this valuable international activity.
3. The creative conceptual advances made by the Muon Collaboration are strengthening the notion that a muon-storage-ring-based neutrino factory is feasible and will offer opportunities for a future facility. As such, we recommend continued support for conceptual development activities in parallel with the strengthened experimental and engineering R&D activities described above.

NEXT MUTAC REVIEW

This years MUTAC Review is at BNL
18-19 February

An NSF person coming to the review
would be both welcome and valuable.

1. We believe the Muon Collaboration (MC) is making excellent use of the resources it has. The MC is a new way to conduct accelerator R&D with many University & Laboratory institutions, particle & accelerator physicists and engineers. We are succeeding.
2. The HEPAP sub-panel recommendation was for stronger support than we are now getting. Increased support is also recommended by MUTAC and MCOG, and encouraged by the neutrino community.
3. Neutrino Factory R&D has become increasingly international. The flagship international experiment for us is MICE ... which has scientific approval, and now needs funding.
4. Lead time for R&D on big projects is very long. The technical ground work needed before a future neutrino factory decision can be made must be pursued vigorously now.