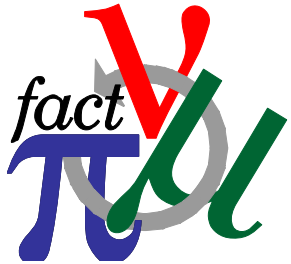


Muon Collaboration Spokespersons Report

1. Collaboration Goals
2. Organization
3. Key developments since the 2001 MUTAC review
4. Hopes for the future
5. Summary

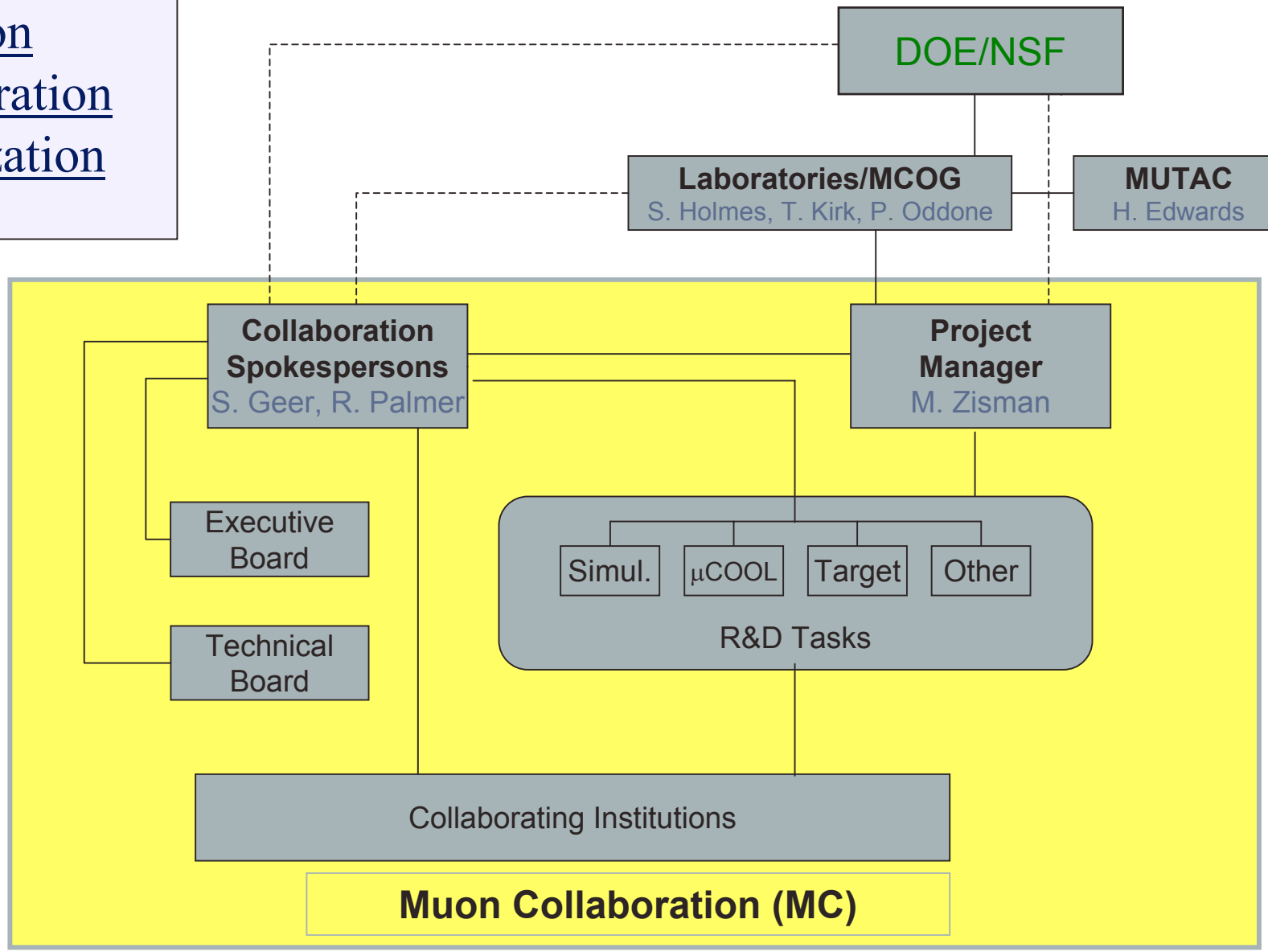
Muon Collaboration

Muon Collaboration Goals

The collaboration is governed by a charter which defines its goals and organization. The goals are defined :-

> "*To study and develop the theoretical tools and the software simulation tools, and to carry out R&D on the unique hardware, required for the design of Neutrino Factories and Muon Colliders.*"

Muon Collaboration Organization



Muon Collaboration

Muon Collaboration Executive Board

S. Geer	FNAL	Co-Spokesperson
R. Palmer	BNL	Co-Spokesperson
A. Sessler	LBNL	Associate Spokesperson
M. Tigner	Cornell Univ.	Associate Spokesperson
J. Gallardo	BNL	Secretary
D. Cline	UCLA	
D. Errede	Univ. of Illinois	
D. Kaplan	IIT	
K. McDonald	Princeton Univ.	
A.N. Skrinsky	BINP	
D. Summers	Univ. Mississippi	
A. Tollestrup	FNAL	
J. Wurtele	LBNL/UC-Berkeley	
M. Zisman	LBNL	Project Manager

Muon Collaboration

Muon Collaboration Technical Board

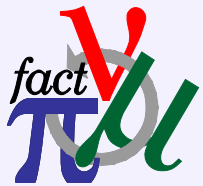
S. Geer	FNAL	Co-Spokesperson
R. Palmer	BNL	Co-Spokesperson
D. Hartill	Cornell Univ.	
H. Haseroth	CERN	
H. Kirk	BNL	
D. Kaplan	IIT	
K. McDonald	Princeton Univ.	
Y. Mori	KEK	
D. Neuffer	FNAL	
R. Raja	FNAL	
R. Rimmer	JLab	
T. Roser	BNL	
M. Zisman	LBNL	Project Manager

Muon Collaboration

Muon Collaboration Sub-Activity Leaders

Targetry	K. McDonald (Spokesperson) H. Kirk (Project Manager)
MUCOOL	D. Kaplan (Acting Spokesperson)
MICE	D. Kaplan (US Spokesperson)
Simulations/Theory	R. Raja (Chair, Simulation/Theory Committee)
Speakers Bureau	G. Hansen (Chair)

Muon Collaboration Institutions



130 Scientists & Engineers from 33 Institutions

6 US Labs
ANL
BNL
FNAL
LBNL
Oak Ridge Nat. Lab.
Thomas Jefferson Lab.

16 US Universities
Columbia Univ.
Cornell Univ.
IIT
Indiana Univ.
Michigan State Univ.
NIU
Northwestern Univ.
Princeton Univ.
UC-Berkeley
UC-Davis
UCLA
Univ. Chicago
U. Illinois, Urbana-Champaign
Univ. of Iowa
Univ. Mississippi
Univ. Wisconsin

11 Foreign Institutes
CERN
DESY
JINR, Dubna
Karlsruhe
KEK
Kernfysisch Versneller Instit.
Osaka Univ.
Oxford Univ.
Pohang Univ.
RAL
Tel Aviv Univ.

Muon Collaboration

Since the last MUTAC review …

1. The HEPAP report endorsed support for our R&D at the FY01 funding level (8M$ / year)

2. With results from SNO and KamLAND, the physics case for the Neutrino Factory has grown stronger (see Andre de Gouvea's talk)

3. Our DOE support has been severely cut twice (see Mike Zisman's talk)

4. Nevertheless, we feel we have continued to make good technical progress (→ subject of this review)

Muon Collaboration

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."

Muon Collaboration

Physics Evolution

1. At the time of the HEPAP sub-panel presentations the scenario yielding the weakest case for a Neutrino Factory was the one in which only the atmospheric ν deficit was due to flavor transitions → simple 2-flavor oscillations. The recent SNO results have have removed this scenario (since solar ν deficit is also due to flavor transitions) .

2. It is believed that the strongest case for a Neutrino Factory can be made for those scenarios in which the LMA solution describes the solar neutrino deficit → chance to observe CP violation in the lepton sector. The LMA solution has been confirmed by the recent KamLAND results !

3. Preference for the LMA solution has focused attention on theoretical (GUT) models that can tolerate LMA. There are now a handful of these models that make explicit predictions for the oscillation parameters, & illustrate the importance of measuring $\sin^2 2\theta_{13}$, δ_{CP}, $\mathrm{sgn}[\Delta m_{32}^2]$ … just the parameters that a Neutrino Factory can probe.

See Andre de Gouvea's talk

Muon Collaboration

Support from the neutrino community

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

Muon Collaboration

Funding Levels

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$

The news is not all bad. We are now getting some support from NSF (~ 1M$/ year for 3 years -- we are in year 2).

However, the reduction in the DOE support is a serious blow … and has slowed progress in our hardware R&D program.

See Mike Zisman's talk.

Muon Collaboration

Neutrino Factories: General Status

1. Based on Studies 1 and 2 we believe that Neutrino Factories are feasible.

2. We have a workable Neutrino Factory design provide we can develop components that meet some aggressive performance requirements.

3. We have made significant progress with our target R&D program.

4. The simulated performance of the Study 2 Neutrino Factory design should be adequate for the physics, but the estimated cost is high.

5. Therefore, we believe the critical items for the Collaboration to focus on are (i) Component R&D, and (ii) Cost Reduction.

Muon Collaboration

Comments on Technical Progress: Cost Reduction

1. Our recent simulation activity has focused on reducing the cost of a Neutrino Factory.

2. The Neutrino Factory Study cost estimate was dominated by three roughly equally expensive sub-systems:
   (i) Phase Rotation, (ii) Cooling Channel, (iii) Acceleration.
   These accounted for ~3/4 of the total cost.

3. We are making good progress in studying potentially cheaper solutions for all three sub-systems.

See Palmer's talk, plus Neuffer, Raja, Berg, & Summers

Muon Collaboration

Comments on Technical Progress: RF R&D

Neutrino Factory RF performance requirements are demanding

Cooling Channel NCRF -- 16 MV/m at 201 MHz in multi-Tesla field

PROGRESS:

-- 5T solenoid for RF test built
-- Two 805 MHz cavities built
-- 34 MV/m achieved at 805 MHz
-- RF tests in magnetic field → large dark currents&breakdown

BUT WE NEED

-- Further 805 MHz studies (planned)
-- 201 MHz cavity (designed)
-- 201 MHz test facility (under construction)
-- magnet for 201 MHz test (funds ?)

Acceleration SCRF – 17 MV/m at 201 MHz

PROGRESS:

-- 201 MHz test cavity built
-- Test facility built at Cornell
-- First tests begun – achieved 8 MV/m

BUT WE NEED

-- Continued testing and development to achieve goals

See talks of Kaplan, Li, Torun, & Padamsee

Muon Collaboration

Comments on Technical Progress: Absorber R&D

Cooling channel absorber requirements are demanding:

-- Liq. H2 absorbers operating next to RF cavities with very thin low-Z windows

PROGRESS:

-- Absorbers designed (forced flow & convection driven)
-- Understanding of safety issues is maturing
-- Thin windows designed, fabricated, and burst tests (including at LN2 temp) made.
-- New (thinner/stronger) window design developed but not yet tested.
-- Non-linear FEA calculations developed → good description of measurements
-- Flow tests proceeding
-- Bolometer based instrumentation development proceeding

BUT WE NEED

-- Test area (under construction)
-- Filling test
-- Study alternative window materials

See talks of Kaplan, Cummings & Errede

Muon Collaboration

Comments on Technical Progress: MUCOOL Test Area

1. The MUCOOL NCRF and absorber R&D programs need a test area.

2. Expensive … but our experience with both the Lab G facility and the targetry experiment have taught us the value of having the right test facilities.

3. We decided, even with a reduced budget, to put the largest slice of the FY03 funds devoted to MUCOOL into pushing ahead with the new test area. This is now under construction !

4. This means that at the end of FY03 we will have an empty test area that, with flat funding, will enable either a 201 MHz test facility to be implemented in FY04, or an absorber filling facility. With a modest increase in funding both could be done in FY04 !

See Dan Kaplan's talk

Muon Collaboration

Comments on Technical Progress: Targetry

Need target that can handle 4 MW proton beam

PROGRESS

-- Carbon-rod & Hg-jet targets studied at BNL →
-- Hg jet preferred because:
x 2 pion yield
May survive 4 MW proton beam
-- Jet (2 m/s) remains intact for beam spill → Fragments have small velocities
-- Cost effective solution for target test magnet designed
-- Simulations of target behavior look promising

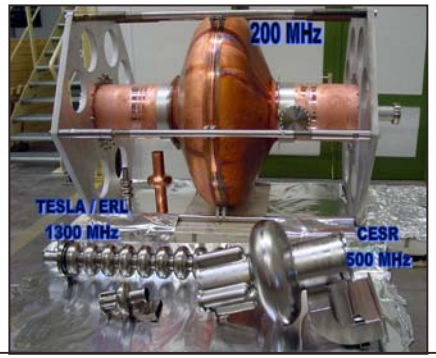
BUT WE NEED TO:

-- develop & test 20 m/s jet
-- test in higher intensity (x 4) AGS beam
(needs AGS running in 2004 (?) or move to another Lab)
-- test in high-field solenoid + beam.

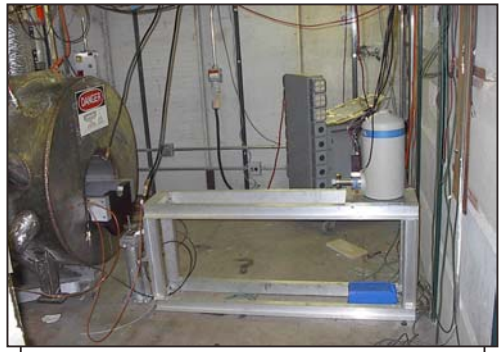
See talks of McDonald, Kirk, & Samulyak

Muon Collaboration

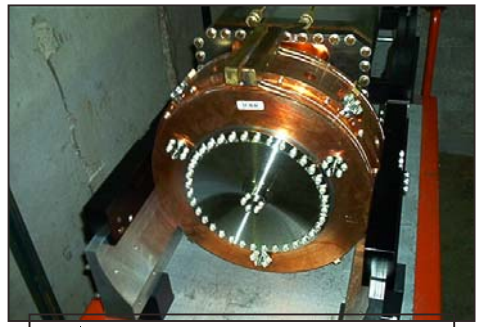
Hardware Activities - 1



201 MHz SCRF Cavity for Acceleration – Cornell



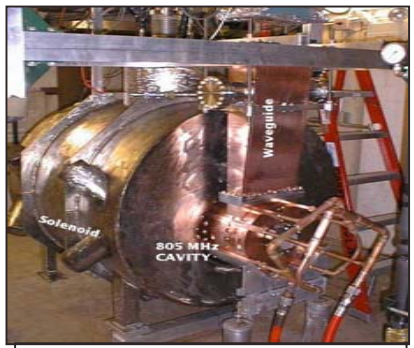
Studied dark current & X-rays from cavity with various detectors



Single cell cavity with Be windows - LBNL

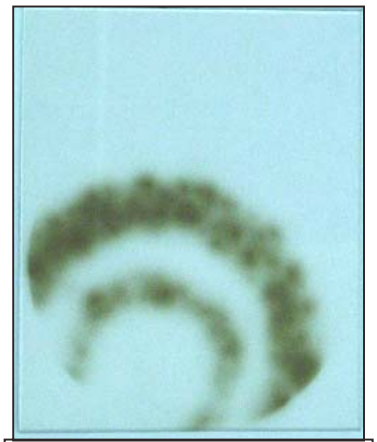
Tested Be-Windows for RF Cavities – LBNL

High-Gradient RF Tests in High Magnetic Field – FNAL



5T Cooling Channel Solenoid – LBNL & Open Cell NCRF Cavity operated at Lab G – FNAL

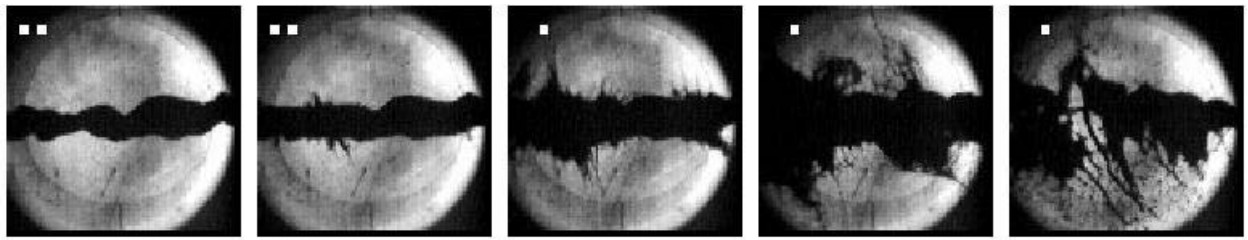
High pressure seal test for high-pressure RF studies – Muons Inc



Dark current ring measurements on glass plate – ANL/FNAL/IIT

Hardware Activities - 2

Muon Collaboration

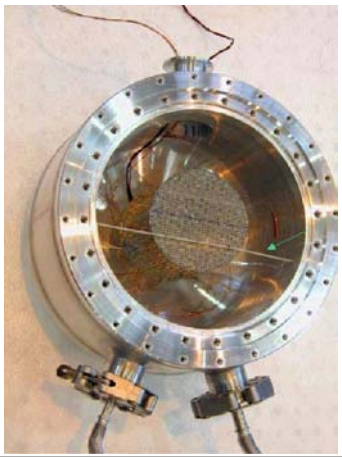


t = 0 | 0.75 ms | 2 ms | 7 ms | 18 ms

Hg jet beam tests – Target experiment

Bolometer detectors for Window Beam profile – cryogenic setup– U. Chicago

Thin absorber windows Tested – new technique – ICAR Universities



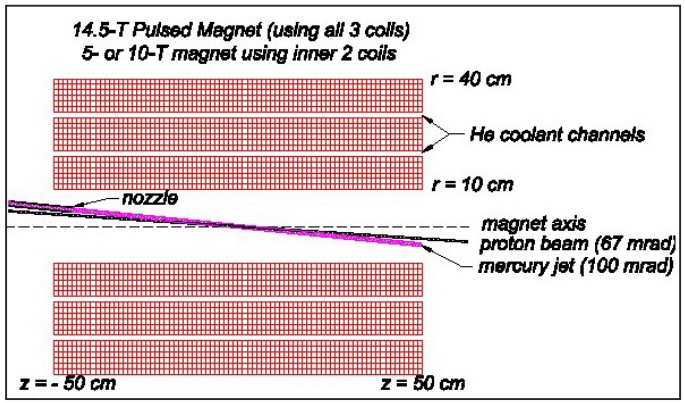
Liq.H Absorber with central heater– KEK

Liq.H Absorber – KEK To be tested at FNAL

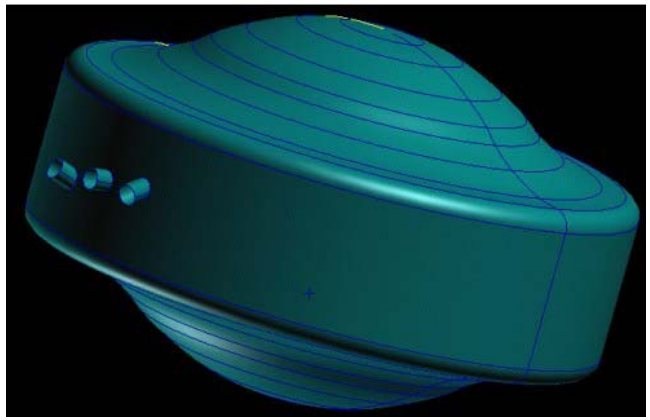
Window burst tests – ICAR Universties

Muon Collaboration

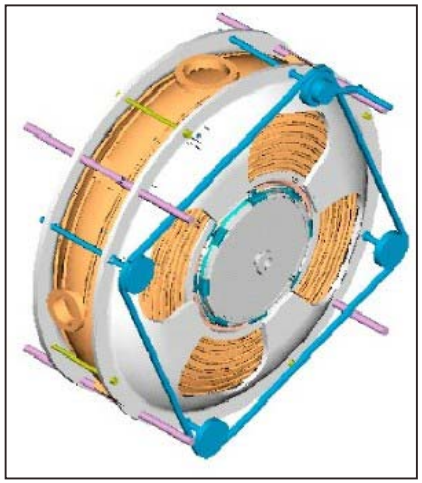
Design Activities



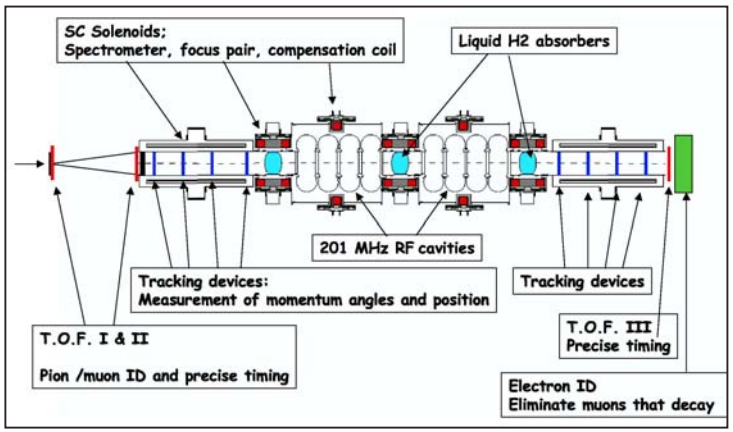
Desin for pulsed target test magnet - BNL



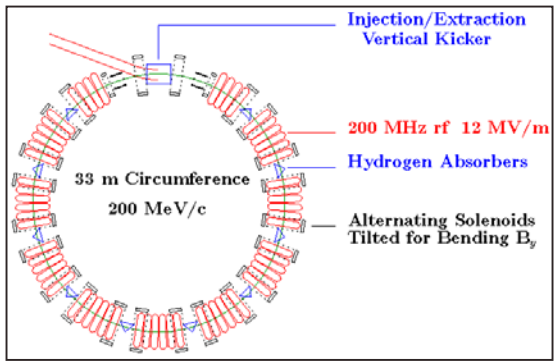
Improved absorber window design -- U. Oxford



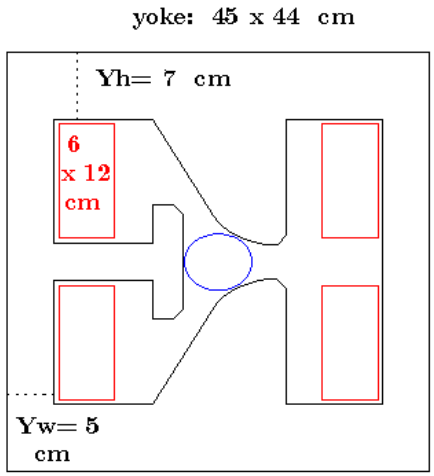
200 MHz NCRF Cavity design -- LBNL



Cooling experiment design (MICE)



Ring cooler design work



Rapid cycling magnet design – U. Mississippi

Muon Collaboration

Comments on Technical Progress: International Cooling Experiment

The MUTAC report from last year said that:
"The cooling demonstration is the key systems test for a Neutrino Factory "

We have now assembled a strong international collaboration to propose a muon cooling experiment.

An LoI submitted to RAL early 2002 had a favorable review, & we were invited to submit a full proposal, which has now been prepared.

RAL has assembled a project team to help.

We have a strong international team, a good experimental design, & a laboratory interested in hosting the experiment. Now is the time to move ahead.

See talks of Blondel and Drumm

Muon Collaboration

Rutherford is a good choice to host MICE

The Select Committee on Science and Technology (UK Parliament) has agreed to the following Particle Physics and Astronomy Research Council Report (17 Dec 2002) :

"Item 25: ……. Hosting a global facility like the Neutrino Factory would bring substantial scientific and commercial benefits to the UK. While we acknowledge the uncertainty of international decisions many years ahead, we recommend that the Government or PPARC consider developing a long-term strategy for bringing this facility to the UK."

Comments on Muon Collider R&D

Although nearly all of the Muon Collaborations present hardware activities are focused specifically on Neutrino Factories:

i) The work in large part is also of direct relevance to muon colliders.

ii) The simulation work on ring coolers will not only help realize a cost-effective neutrino factory, but also will help us understand how to implement the emittance exchange needed for muon colliders.

Muon Collaboration

Hopes for the Future

Funding is a concern, but the support for our R&D from the ν community, the exciting developments in ν physics, the enthusiasm within the Collaboration & continued progress towards our goals, give us hope for the future.

We would hope that:

1. We get adequate support from the funding agencies to pursue our current hardware R&D program (FY01 funding level)

2. We get support for MICE so that within a few years the critical cooling demonstration can be made

3. In one or two years we participate in a "study 3" which will be focused on a cost-optimized Neutrino Factory design.

Muon Collaboration

Summary

1. We believe that, with limited funds, we have made good progress on:

   i) Hardware development
   ii) Preparing for longer-term hardware development (test area & MICE Proposal)
   iii) Design studies aimed at cost reduction

2. We think that the Muon Collaboration is well organized and provides a model for doing accelerator R&D that is succeeding.

3. We hope that the committee will support restoring the funding for the collaboration to the level recommended by the HEPAP sub-panel, and agree this is desirable and justified.