# Report of Project Manager


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**NFMCC Meeting–Fermilab**
**March 18, 2008**

# Outline

- Introduction
- Advantages
- Challenges
- R&D management process
- R&D overview
- Funding status
- FY07 accounting
- Recent R&D accomplishments
- FY08 budget
- FY08 plans
- Issues
- Summary and outlook

# Introduction

- U.S. Neutrino Factory and Muon Collider Collaboration (NFMCC) explores techniques for producing, accelerating, and storing intense muon beams
  - near-term focus: muon storage ring to serve as source of well-characterized neutrinos ("Neutrino Factory") for long baseline experiments (~3000–7500 km)
  - longer-term focus: Muon Collider
    - Higgs Factory operating at few-hundred GeV or energy-frontier collider operating at several TeV
  - both types of machine will be difficult
    - but, both have high scientific potential
  - a common feature of these state-of-the-art machines is the need for a sustained R&D program
    - most modern projects (LHC, ILC, CLIC) share this need

# Muon Accelerator Advantages

- Muon-beam accelerators can address both of the outstanding accelerator-related particle physics questions
  - neutrino sector
    - Neutrino Factory beam properties

$$\mu^+ \to e^+ \nu_e \bar{\nu}_\mu \Rightarrow 50\% \nu_e + 50\% \bar{\nu}_\mu$$

$$\mu^- \to e^- \bar{\nu}_e \nu_\mu \Rightarrow 50\% \bar{\nu}_e + 50\% \nu_\mu$$

Produces high energy neutrinos

    - decay kinematics well known
      - minimal hadronic uncertainties in the spectrum and flux
    - $\nu_e \to \nu_\mu$ oscillations give easily detectable "wrong-sign" $\mu$
  - energy frontier
    - point particle makes full beam energy available for particle production
      - couples strongly to Higgs sector
    - Muon Collider has almost no synchrotron radiation
      - narrow energy spread
      - fits on existing Lab sites

# Muon Beam Challenges (1)

- Muons created as tertiary beam ($p \rightarrow \pi \rightarrow \mu$)
  - low production rate
    - need target that can tolerate multi-MW beam
  - large energy spread and transverse phase space
    - need solenoidal focusing for the low energy portions of the facility
      - solenoids focus in both planes simultaneously
    - need emittance cooling
    - high-acceptance acceleration system and decay ring
- Muons have short lifetime (2.2 μs at rest)
  - puts premium on rapid beam manipulations
    - high-gradient RF cavities (in magnetic field) for cooling
    - presently untested ionization cooling technique
    - fast acceleration system
- Decay electrons give rise to backgrounds in collider detector

# Muon Beam Challenges (2)

- Magnet challenges
  - 20 T magnet in high radiation environment (target)
  - large aperture solenoids (up to 1.5 m) in cooling channel
  - very strong solenoids (~50 T) for final collider cooling stages
  - low fringe fields in acceleration system
    - to accommodate SC RF cavities
  - high mid-plane heat load in decay or collider ring

If intense muon beams were easy to produce, we'd already have them!

# R&D Management Process

- Each year R&D groups propose annual program to TB
  - based on overall NFMCC budget guidance from DOE
- PM prepares budget based on this input
  - note: budget determined by R&D program, not "institutional commitments"
  - subsequently approved by TB, EB, and Co-Spokespersons
- After budget finalized, PM negotiates milestones with each institution based on R&D plan
  - milestones specify both dates and deliverables
    - "report card" generated at year's end to audit performance
- PM summarizes spending and accomplishments each year in detailed report
  - given to MCOG and DOE at annual MUTAC review

# R&D Overview (1)

- NFMCC R&D program has the following components:
  - simulation and theory effort
    - supports both Neutrino Factory and Muon Collider design
      - NF work presently done under aegis of IDS-NF
  - development of high-power target technology ("Targetry")
  - development of cooling channel components ("MuCool")

- We participate in system tests as an international partner
  - MERIT (high-power Hg-jet target)
  - MICE (ionization cooling demonstration)
  - EMMA (non-scaling FFAG electron model)

- Hardware development and system tests are major focus
  - simulation effort has led to cost-effective Neutrino factory design
    - and progress toward a complete Muon Collider scenario

# R&D Overview (2)

- NFMCC R&D program has already led to many innovative accelerator concepts and approaches
  - driven by our desire to solve challenging technical problems in support of the HEP experimental program
    - enhanced support will further such innovation

- Examples:

| |
|---|
| Solenoidal pion capture from target |
| RF phase rotation and bunching scheme |
| Non scaling FFAG concept |
| Muon cooling channels (linear, ring, helix) |
| Theory of breakdown and conditioning in RF cavities |
| High-pressure gas-filled cavities for cooling* |
| Linear 6D helical cooling channel* |
| Phase space manipulation techniques* |
| High-field HTSC solenoids for giving low emittance* |

*Muons, Inc.

# Funding Status

- Since FY03, NFMCC budget has been nearly "flat-flat"
  - we desire to restore it to FY01–02 levels

| Year | DOE-base ($M) | DOE-NFMCC ($M) | TOTAL ($M) |
|---|---|---|---|
| FY00 | 3.3 | 4.7 | 8.0 |
| FY01 | 3.0 | 3.2 | 6.2 |
| FY02 | 3.0 | 2.8 | 5.8 |
| FY03 | 2.1 | 1.4 | 3.5 |
| FY04 | 2.2 | 1.8[a)] | 4.0 |
| FY05 | 1.9 | 1.7 | 3.6 |
| FY06 | 1.8 | 2.1[b)] | 3.9 |
| FY07 | 1.8 | 2.5[c)] | 4.3 |
| FY08 | 2.1[d)] | 1.7 | 3.8 |

[a)] Includes $0.4M supplemental funds
[b)] Includes $0.3M supplemental funds
[c)] Includes $0.7M supplemental funds
[d)] Includes $0.25M funds at BNL previously designated as AARD

  - helped by NSF funding for MICE and DOE-SBIR funding for Muons, Inc.
    - NSF: $100K per year (FY05–07); $750K FY06 MRI grant (tracker electronics, spectrometer solenoid); $133K/year (FY08-10); FY08 MRI grant ($798K) (Coupling coils and MICE RF)

# FY07 Accounting

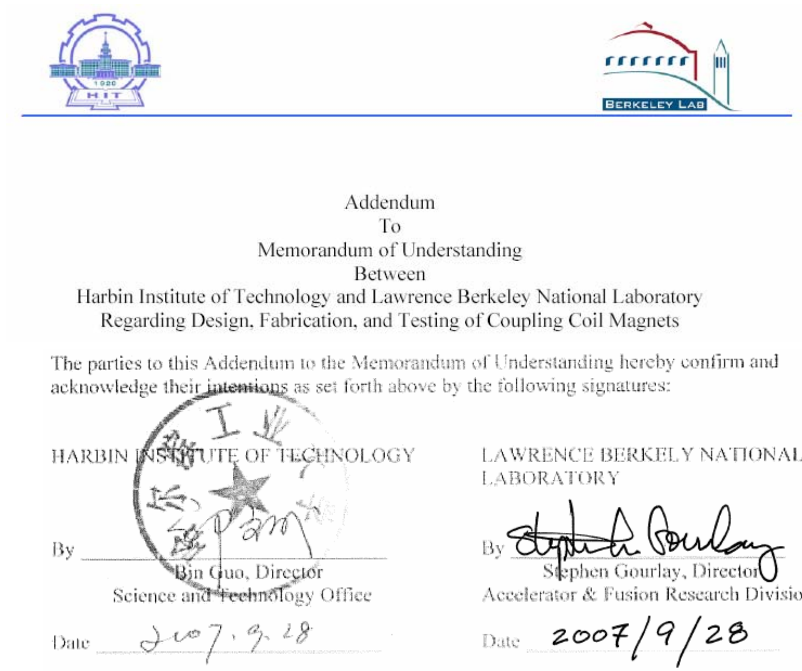
- FY07 budget finalized by Spokespersons and PM in December 2006
  - both MICE and MERIT were big-ticket items this year
    - finally getting a start on MuCool and MICE coupling coil fabrication
      - thanks to ICST collaboration (Jia, Li, Green) and NSF MRI (Summers)

MEMORANDUM OF UNDERSTANDING
Between
HARBIN INSTITUTE OF TECHNOLOGY
and
LAWRENCE BERKELEY NATIONAL LABORATORY

The parties to this Memorandum of Understanding hereby confirm and acknowledge their agreement to be bound by its terms by the following signatures:

HARBIN INSTITUTE OF TECHNOLOGY
By ______
Shu-Guo Wang, President
Date ______

LAWRENCE BERKELEY NATIONAL LABORATORY
By ______
Steven Chu, Director
Date ______



Addendum
To
Memorandum of Understanding
Between
Harbin Institute of Technology and Lawrence Berkeley National Laboratory
Regarding Design, Fabrication, and Testing of Coupling Coil Magnets

The parties to this Addendum to the Memorandum of Understanding hereby confirm and acknowledge their intentions as set forth above by the following signatures:

HARBIN INSTITUTE OF TECHNOLOGY
By ______
Bin Guo, Director
Science and Technology Office
Date 2007.9.28

LAWRENCE BERKELEY NATIONAL LABORATORY
By ______
Stephen Gourlay, Director
Accelerator & Fusion Research Division
Date 2007/9/28

# FY07 Funding Distribution

- FY07 NFMCC budget (only DOE-NFMCC funds)†

  †Also: salary support from BNL, FNAL, LBNL; support from NSF of $1M ($750K MRI + $100K 3-yr grant); support of Muons, Inc. via SBIR grants

| Institution | COOLING /MICE | TARGETRY | ACCEL./ COLLIDER | RESERVE | TOTAL ($K) |
|---|---|---|---|---|---|
| BNL | | 440 | | | 440 |
| FNAL | 50 | | | | 50 |
| LBNL[a,b] | 1310 | | | | 1310 |
| ANL | 185 | | | | 185 |
| IIT | 85 | | | | 85 |
| Mississippi | 42 | | 18 | | 60 |
| Princeton | | 45 | | | 45 |
| UCLA | 25 | | 45 | | 70 |
| UC-Riverside | | | 95 | | 95 |
| ORNL | | 80 | | | 80 |
| Jlab | 5 | | 5 | | 10 |
| TOTAL ($K) | **1702** | **565** | **163** | | **2430** |

[a]Includes MICE funding of $680K.

[b]Includes supplemental funding of $630K for MUCOOL and MICE coupling coils.

# Incremental Funding

- Request this year was different than past years
  - DOE asked for scenarios for funding increase of 10% and 20%
  - submitted in October 2006
- For +20%, proposed fabricating MuCool coupling coil
  - if Harbin arrangement worked out, remaining funds would be put toward MICE RF cavities (8 needed)
- For +10%, proposed fabricating MuCool coupling coil if Harbin was collaborating with us
  - if not, we would advance the schedule by purchasing the superconducting cable and preparing bid package for the fabrication
- Actually got $695K, of which $50K went to BNL base and $15K to LBNL base
  - also awarded $798K NSF MRI to U.-Miss. (Summers)

# Budget Comments

- By juggling projects across fiscal year boundaries and careful prioritization, we continue to make progress
  - all our R&D efforts, including our international project commitments, have no contingency
    - only recourse for "contingent events" is delay (schedule slippage)
      - thus far, we've been fairly lucky
  - MICE schedule may be delayed 1 year due to inability to provide components in sufficiently timely way

- Emphasis on hardware development for international experiments comes at price of attrition in effort level
  - trying this year to augment post-docs
    - need growth in this area; many interesting problems to work on
  - BNL staff decreased by 1 FTE and budget remains severely strained
  - need common funds for MICE or we will not be co-authors on papers

# FY07 R&D Goals

- Main goals for FY07 included:
  - carry out MERIT experiment
  - continue development of MuCool Test Area (MTA)
    - needed enhanced vacuum system to accommodate RF tests in B field
    - continue implementation of cryogenic system
  - continue high-power tests of 805-MHz cavity
  - continue high-power tests of 201-MHz cavity
    - in particular, prepare for magnetic field tests
  - begin fabrication of MICE spectrometer solenoids
  - begin simulation effort in support of IDS-NF
  - continue exploring and optimizing 6D cooling performance
    - in conjunction with MCTF

# FY07 Milestones

- **Prior to distribution of funds, each institution provided milestones agreed upon by PM**
  - these (example below) reflect budget allocations for each institution, including base program funds

UCLA [Cline]

| Milestone | Date | Deliverable |
|---|---|---|
| Continue support of MICE 5-station fiber tracker construction, assembly, and testing | Sep-07 | MICE presentation |
| Design tabletop cooling ring with LiH absorbers | Jun-07 | PAC07 paper |
| Simulate curved Li lens ring configuration to understand emittance exchange process | Sep-07 | NFMCC note |
| Continue study of Li lens pion capture channel followed by Li lens cooling channel | Sep-07 | NFMCC note |
| Compare 6D cooling ring schemes and dipole cooler for muon collider development | Jun-07 | PAC07 paper |
| Continue study of scientific goals of muon collider | Sep-07 | NFMCC note |

U-Miss. [Summers]

| Milestone | Date | Deliverable |
|---|---|---|
| Provide fabrication support for MICE RF cavities | Sep-07 | Inspection |
| Manufacture and measure thin Al absorber windows for MICE | Sep-07 | Inspection |
| Manufacture MUCOOL coupling coil support | Sep-07 | Inspection |
| $n$ = 1.07, 1.12 aerogel studies for MICE Cherenkov | Jul-07 | Paper written |
| Participate in design of 50-T solenoid for 6D cooling studies | Mar-07 | Conference paper |
| Participate in design of 750 GeV muon acceleration in the Tevatron tunnel | Jul-07 | Conference paper |

IIT [Kaplan]

| Milestone | Date | Deliverable |
|---|---|---|
| Continue web support for MICE experiment | Sep-07 | Inspection |
| Carry out MTA radiation measurements with 805- and 201-MHz cavities | Feb-07 | NFMCC presentation |
| Document MTA phototube magnetic shielding and force analysis | Jan-07 | NFMCC note |
| Carry out MICE beam line optimization | Apr-07 | MICE note |
| Carry out MICE background analysis based on MTA data | Jun-07 | MICE presentation |
| Update MTA DAQ system documentation | Aug-07 | Inspection |
| Carry out RF cavity breakdown simulation | Jun-07 | PAC07 paper |

UC-Riverside [Hanson]

| Milestone | Date | Deliverable |
|---|---|---|
| Hire NFMCC simulation post-doctoral research associate | Sep-07 | Inspection |
| Continue simulations of 6D muon cooling | Sep-07 | NFMCC note |
| Participate in MICE tracker commissioning and simulations | Sep-07 | MICE note |
| Participate in muon cooling simulations for the International Design Study | Sep-07 | NFMCC note |

# FY07 Accounting

- **Summary of FY07 spending:**

| Institution | Collaboration Committed ($K) | Collaboration Uncommitted ($K) | Base Program Committed ($K) | Overall Total ($K) | Contact |
|---|---|---|---|---|---|
| ANL | 188 | 0 | 66 | 253 | J. Norem |
| BNL [1] | 564 | 136 | 1200 | 1764 | H. Kirk |
| FNAL [2] | 134 | 36 | 2616 | 2750 | A. Bross |
| LBNL [3] | 698 | 1698 | 346 | 1044 | M. Zisman |
| ORNL | 139 | 4 | 0 | 139 | T. Burgess |
| Princeton U. | 45 | 0 | 150 | 195 | K. McDonald |
| UCLA | 70 | 0 | 28 | 98 | D. Cline |
| UC-Riverside [4] | 1 | 94 | 373 | 374 | G. Hanson |
| Mississippi | 60 | 0 | 10 | 70 | D. Summers |
| IIT [5] | 64 | 30 | 0 | 64 | D. Kaplan |
| Jlab | 6 | 6 | 0 | 6 | R. Rimmer |
| *NSF MICE Support* [6] | *347* | *77* | *97* | *443* | *D. Kaplan* |
| **TOTALS** [7] | **1967** | **2004** | **4790** | **6757** | |
| | *2314* | *2081* | | *7104* | |

***NOTES:***

[1] Uncommitted funds for MERIT experiment.
[2] Uncommitted funds for MTA cryogenics and beam line.
[3] Includes $119K in uncommitted Project Reserve funds maintained by LBNL
[4] Base funds are UC-Riverside startup funds.
[5] Only DOE funds. NSF funding reported separately.
[6] Funds allocated to IIT as primary contractor.
[7] DOE totals in Roman type; *additional NSF funding shown in italics*.

# Recent R&D Accomplishments

- R&D progress made on most fronts:
  - Simulations/ISS + IDS-NF
  - Targetry/MERIT
  - Cooling/MICE
- Acceleration work on hold due to lack of funding at Cornell

# Simulations

- NFMCC has been engaged in a number of recent efforts
  - Feasibility Study I (with FNAL)
  - Feasibility Study II (with BNL)
  - APS Multi-Divisional Neutrino Study ("Study IIa," see http://www.aps.org/policy/reports/multidivisional/neutrino/)
  - International Scoping Study (see http://www.hep.ph.ic.ac.uk/iss/)
    - Accelerator Working Group Report (finally!) completed (see http://www.cap.bnl.gov/mumu/project/ISS/iss-accel-report.pdf)
  - follow-on IDS-NF to develop engineered facility design and corresponding cost estimate is under way (see http://www.hep.ph.ic.ac.uk/ids/)
    - Berg playing a lead role in this enterprise
- Accomplishments
  - simplification of NF front-end design while maintaining performance
    - "simplification" $\Rightarrow$ cost savings of roughly 1/3 cf. study II
  - development of international consensus on NF design aspects
  - working with MCTF toward MC facility design (increasing interest here)

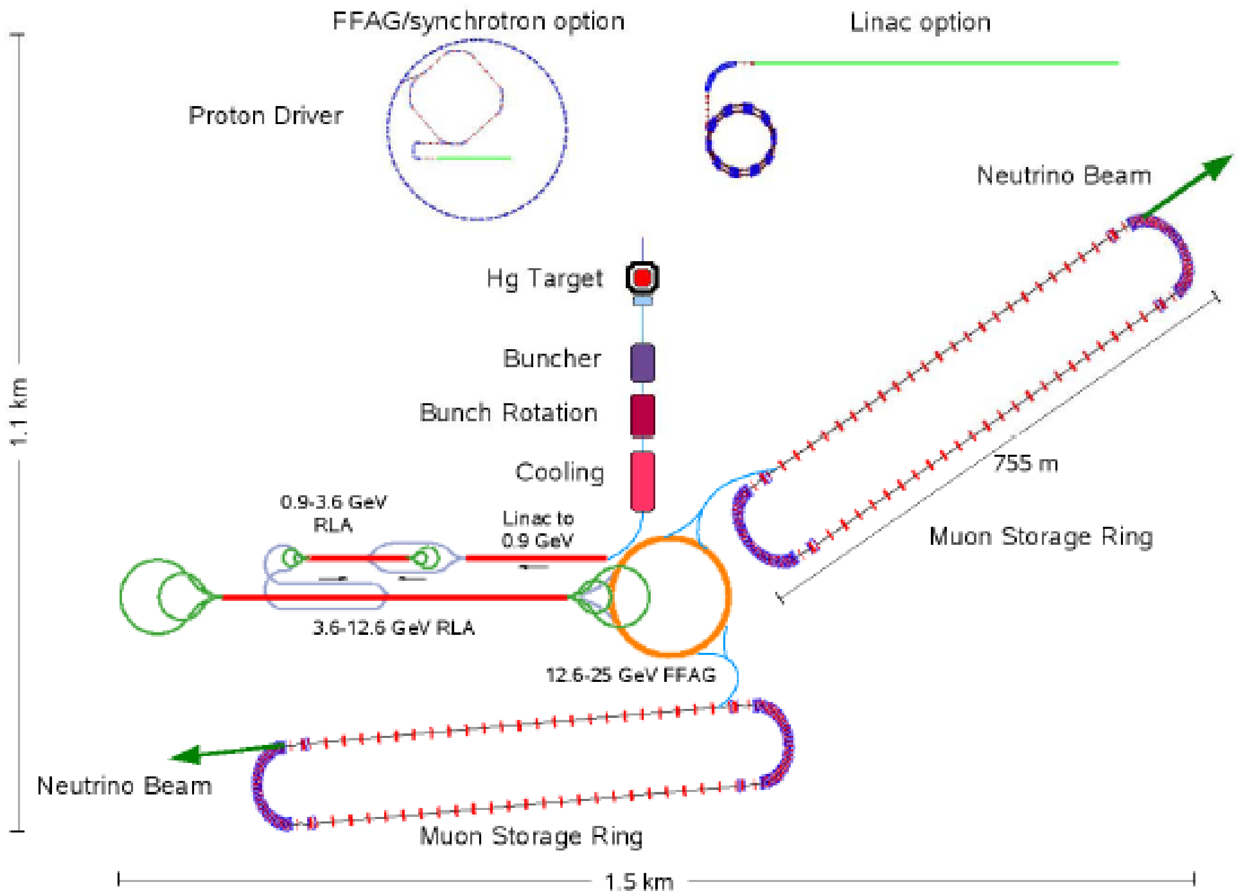
# ISS Main Findings

- ISS compared existing NF designs to identify the most promising approaches

- Findings:
  - optimum proton driver energy is 10 ± 5 GeV
  - Hg-jet target gives optimal muon production for protons in preferred energy range
  - Study IIa front end design is preferred, using simultaneous operation with both muon signs
  - non-scaling FFAG beam dynamics limits performance and preferred approach will use only one, or at most two, such systems
  - both racetrack and triangular rings possible (two rings needed in either case)
    - triangle more efficient if two suitable sites are operating simultaneously
    - racetrack better for a single detector site, and has no directional constraints

# IDS-NF Baseline

- A baseline configuration for the Neutrino Factory has been specified
  - based in large measure on the Study IIa design



# IDS-NF Baseline Parameters

**Proton Driver**

| | |
|---|---|
| Proton power | 4 MW |
| Proton kinetic energy | 5–15 GeV |
| Pulses per second | 50 |
| Bunches per pulse | 3 |
| Minimum time between bunches | 17 μs |
| Maximum time for all bunches | 40 μs |
| RMS proton bunch length | 1–3 ns |

**Target**

| | |
|---|---|
| Material | Hg |
| Type | Liquid jet |
| Jet diameter | 1 cm |
| Jet velocity | 20 m/s |
| Jet angle to axis | 100 mrad |
| Jet angle to proton beam | 33 mrad |
| Proton beam angle to axis | 67 mrad |

**Front End**

| | |
|---|---|
| ICOOL input files | for001.dat<br>for030.dat<br>for031.dat |

**Storage Ring**

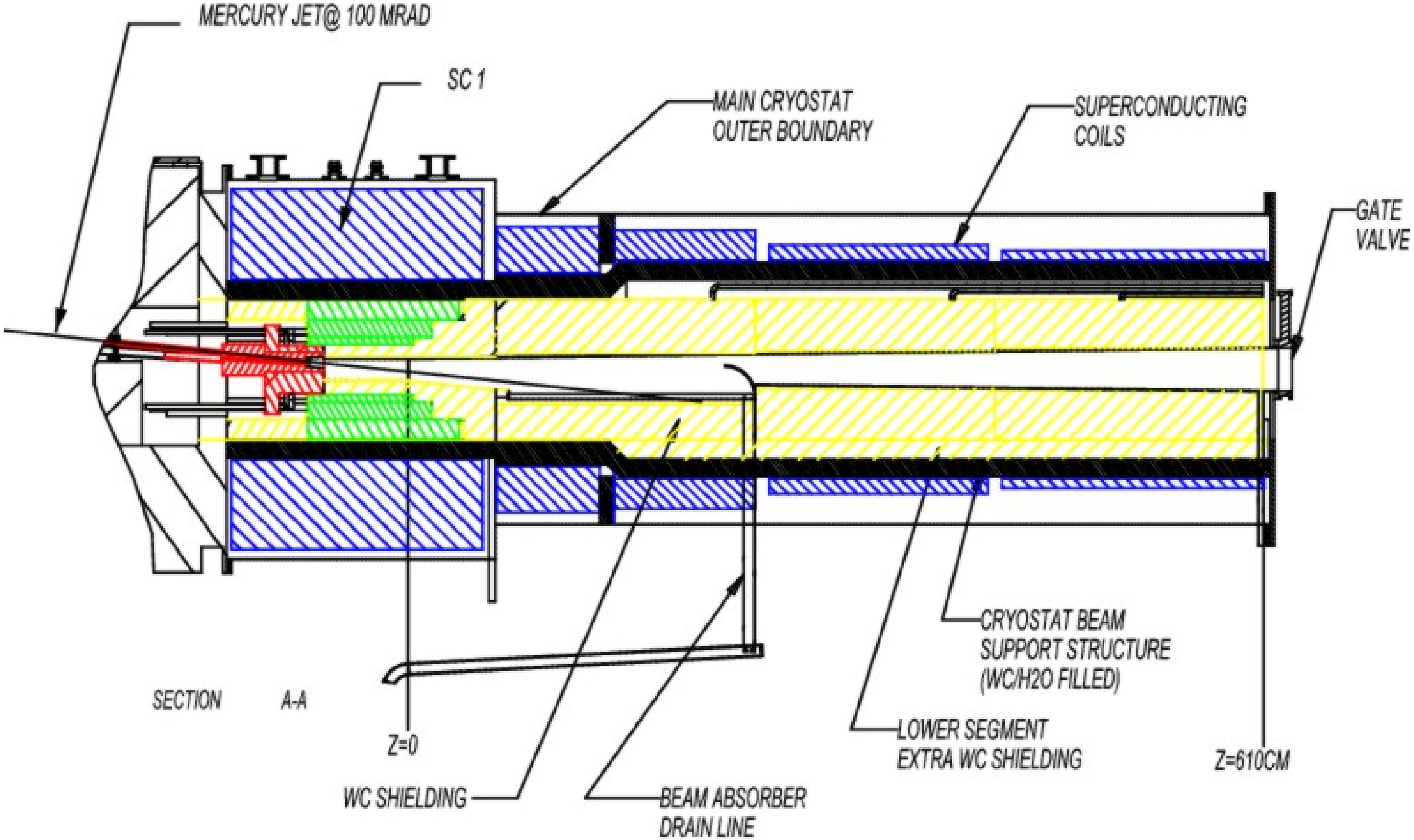
| | |
|---|---|
| Total muon energy | 25 GeV |
| Type | Racetrack |
| Number of rings | 2 |
| RMS angular divergence, production straight | $0.1/\gamma$ |
| Gap between bunch trains | 100 ns |
| Possible simultaneous signs per ring | 2 |
| Total production straight μ decays in $10^7$ s | $10^{21}$ |
| Short baseline | 3000–5000 km |
| Long baseline | 7000–8000 km |

**Acceleration**

| | |
|---|---|
| RF frequency | 201.25 MHz |
| RF type | Superconducting |
| Total energy at injection | 244 MeV |
| Transverse normalized acceptance at input | 30 mm |
| Longitudinal normalized acceptance at input | 150 mm |
| Stage 1, type | Linac |
| Stage 1, lattice cell | Solenoid FOFO |
| Stage 1, lattice files | linac_sol.opt<br>linac_sol.mad |
| Total energy, stage 1–2 transition | 0.9 GeV |
| Stage 2, type | Dogbone RLA |
| Stage 2, cavity aperture diameter | 30 cm |
| Stage 2, energy gain per cavity cell | 12.75 MV |
| Stage 2, lattice cell | FODO |
| Stage 2, linac passes | 4.5 |
| Total energy, stage 2–3 transition | 3.6 GeV |
| Stage 3, type | Dogbone RLA |
| Stage 3, cavity aperture diameter | 30 cm |
| Stage 3, energy gain per cavity cell | 12.75 MV |
| Total energy, stage 3–4 transition | 12.6 GeV |
| Stage 4, type | Linear non-scaling FFAG |
| Stage 4, cavity aperture diameter | 30 cm |
| Stage 4, energy gain per cavity cell | 12.75 MV |
| Stage 4, lattice cell | FODO |
| Stage 4, cavity cells per lattice cell | 2 |

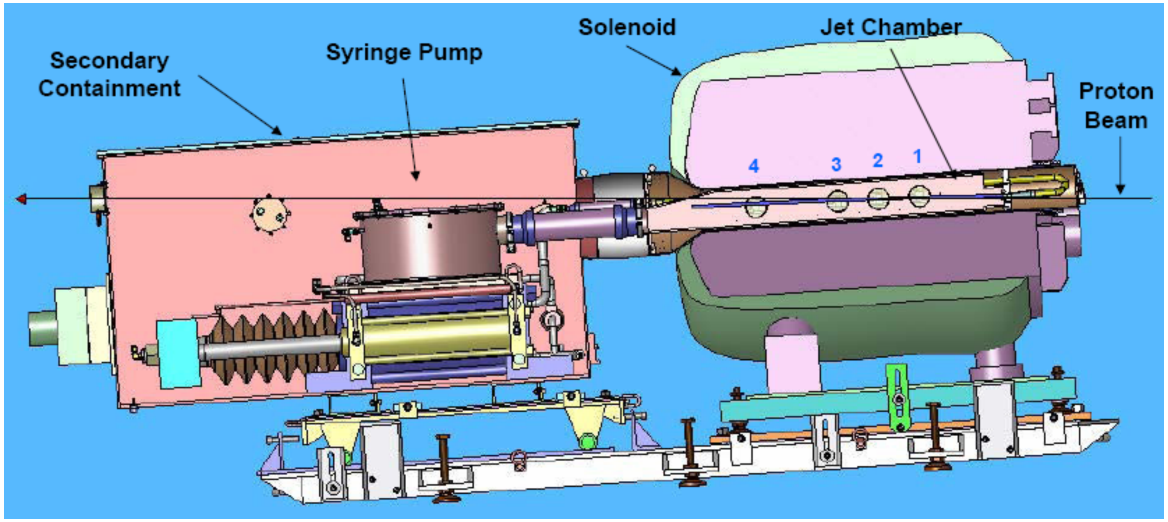
# Targetry R&D

- Target concept uses free Hg jet in 20-T solenoidal field
  - jet velocity of 20 m/s establishes "new" target for each beam pulse
  - this approach serves as basis of MERIT experiment

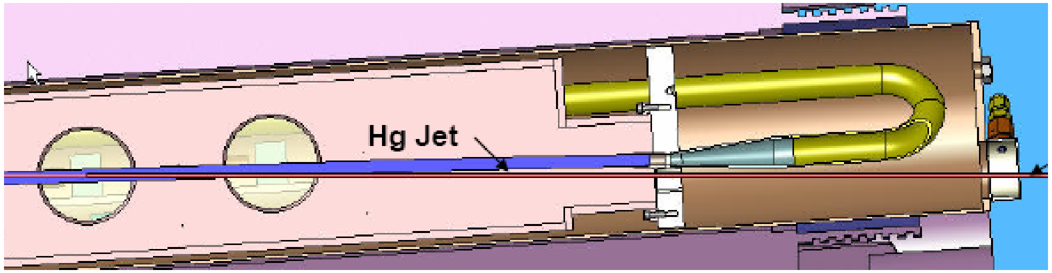


# MERIT Experiment

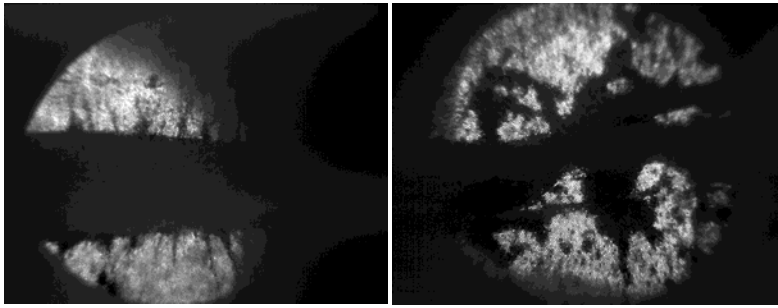
- MERIT recently carried out beam test of Hg-jet target in 15-T magnetic field using CERN PS




Installation at CERN



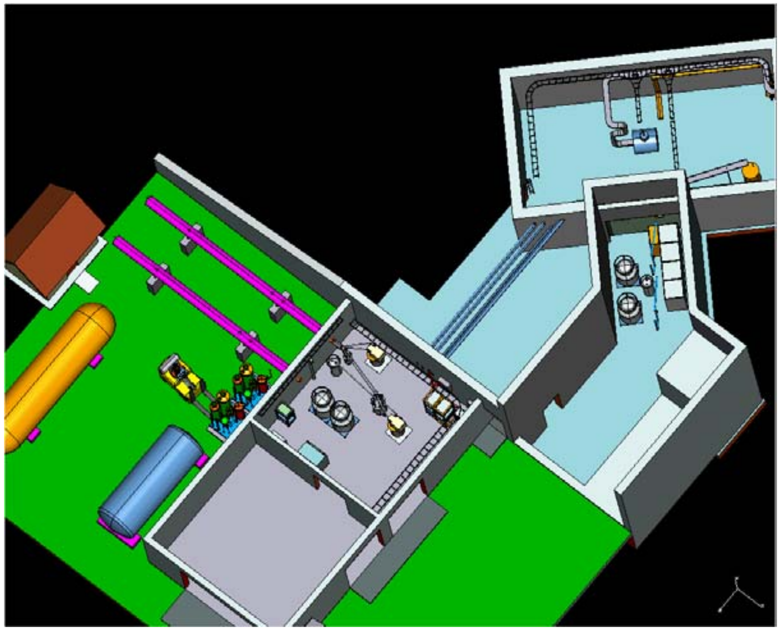

Schematic of MERIT experimental setup



Before After
10 Tp

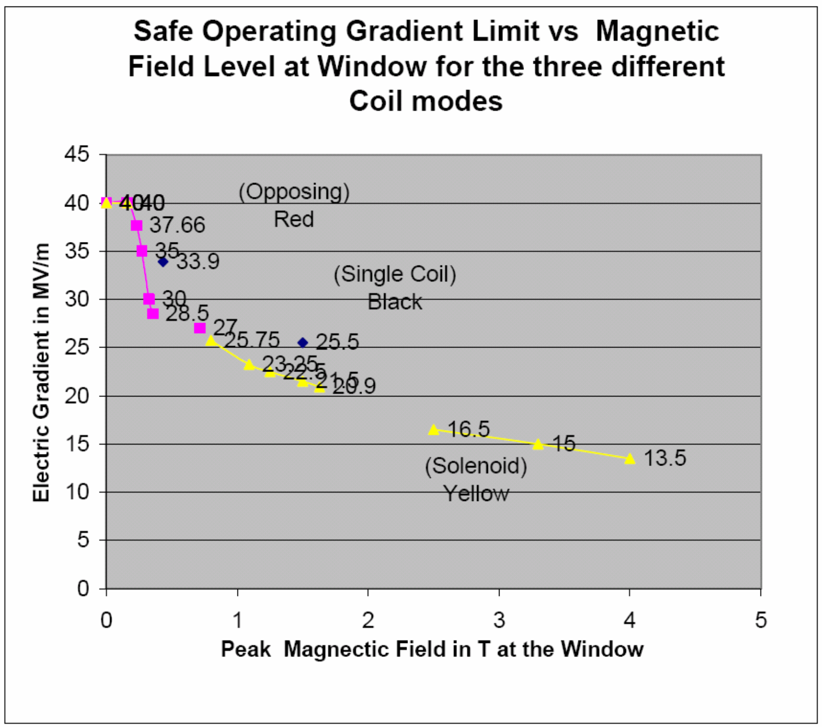
# MuCool R&D (1)

- MuCool program does R&D on cooling channel components
  - RF cavities, absorbers
- Carried out in newly constructed MuCool Test Area (MTA) at Fermilab (funded by NFMCC)
  - located at end of 400 MeV linac and shielded for eventual beam tests



# MuCool R&D (2)

- Motivation for cavity test program: observed degradation in cavity performance when strong magnetic field present
  - open-cell cavity did not show degradation, so problem seemingly not "fundamental"
  - 201 MHz cavity easily reached 19 MV/m without magnetic field



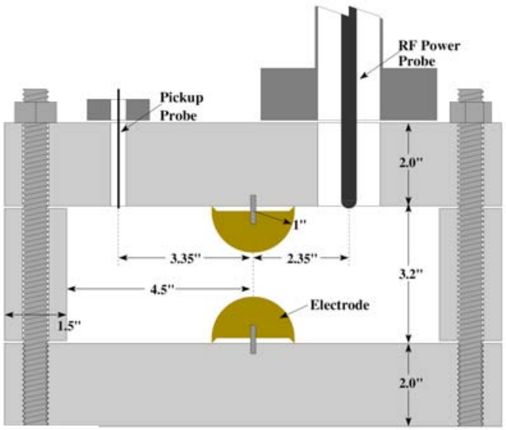

201 MHz cavity

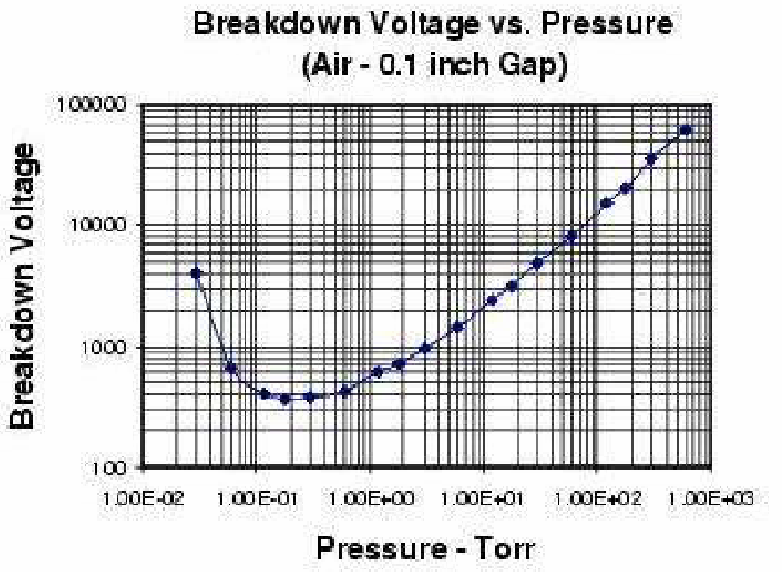
5-T solenoid + 805-MHz cavity

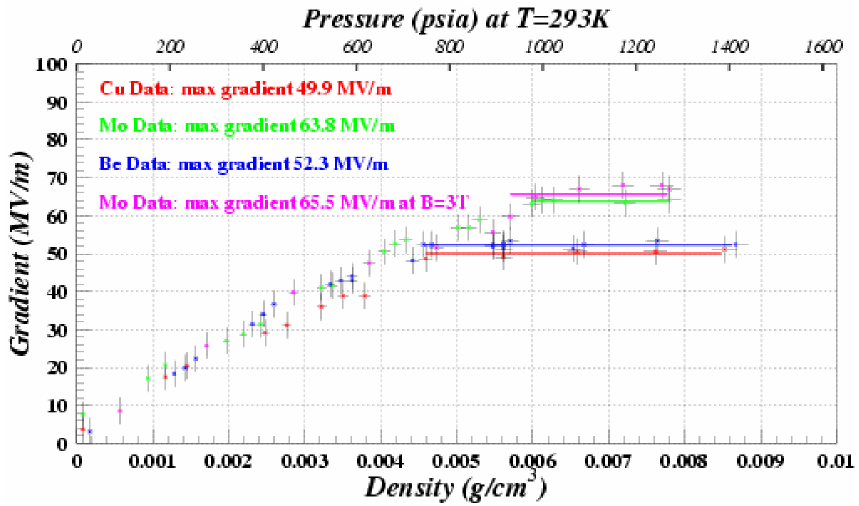
# MuCool R&D (3)

- **Tested pressurized button cavity at MTA (Muons, Inc.)**
  - *use high-pressure $H_2$ gas to limit breakdown ($\Rightarrow$ no magnetic field effect)*

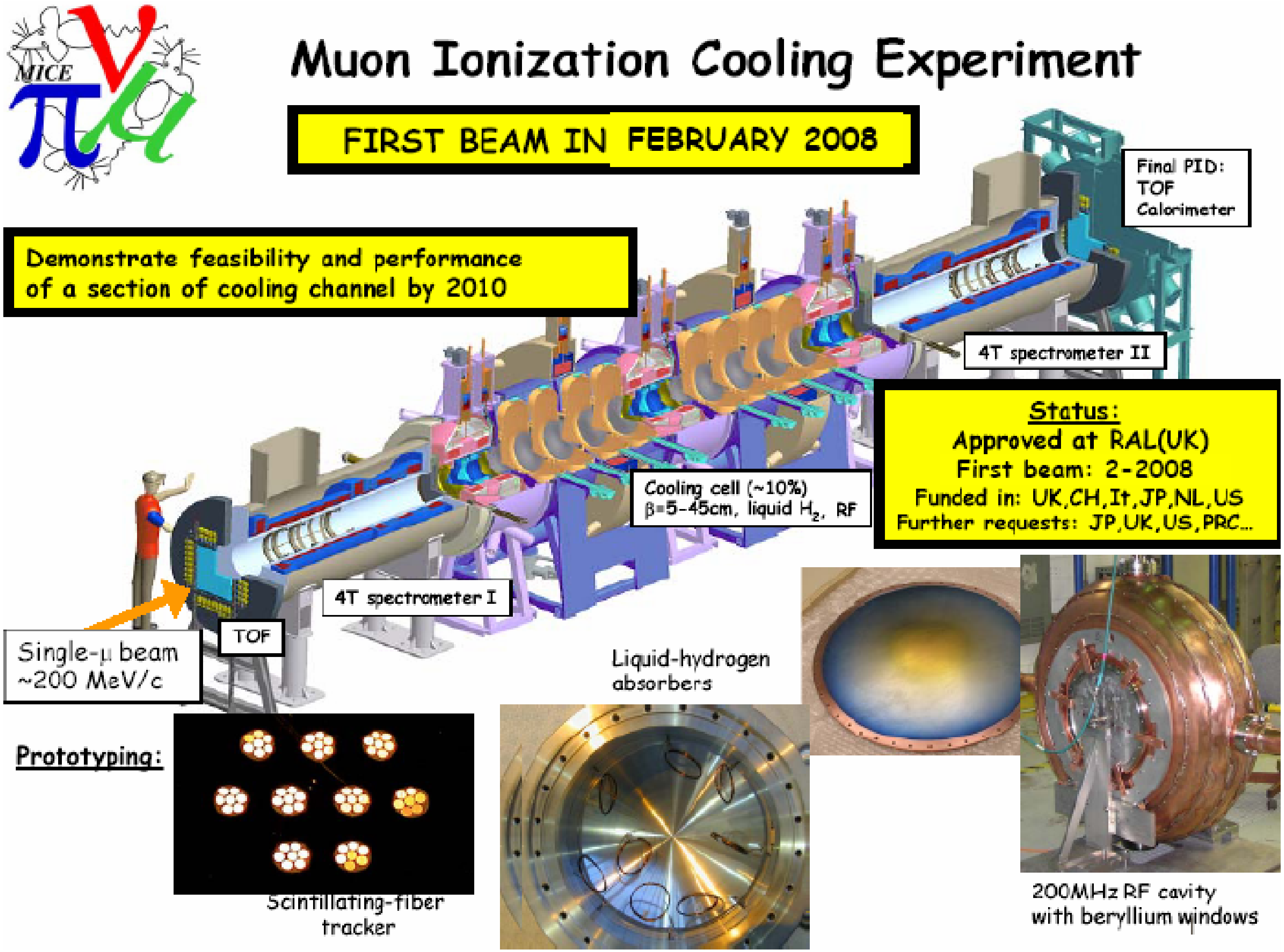
Remaining issue:
What happens when high intensity beam traverses gas?



# MICE Schematic

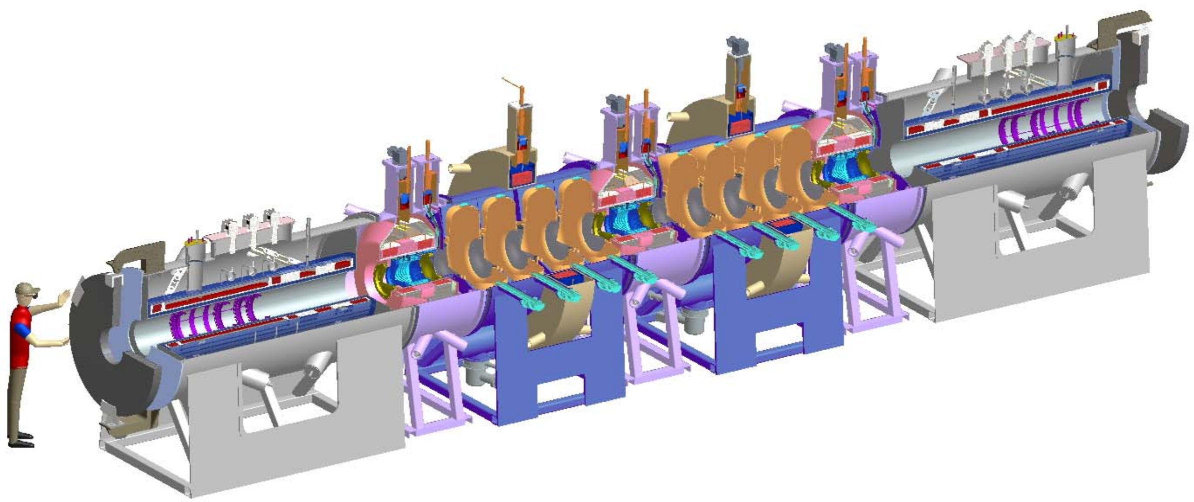


# MICE Goals

- To design, engineer and build a section of cooling channel capable of giving the desired performance for a Neutrino Factory
- To place this in a muon beam and measure its performance in various modes of operation and beam conditions
  - and reproduce the results with a simulation code!
- Challenges
  - operating high-gradient RF cavities in solenoidal field
  - operating $LH_2$ absorbers with thin windows in accord with safety needs
  - integrating cooling channel components while maintaining operational functionality
  - measuring small emittance reduction (~10%) to level of $10^{-3}$

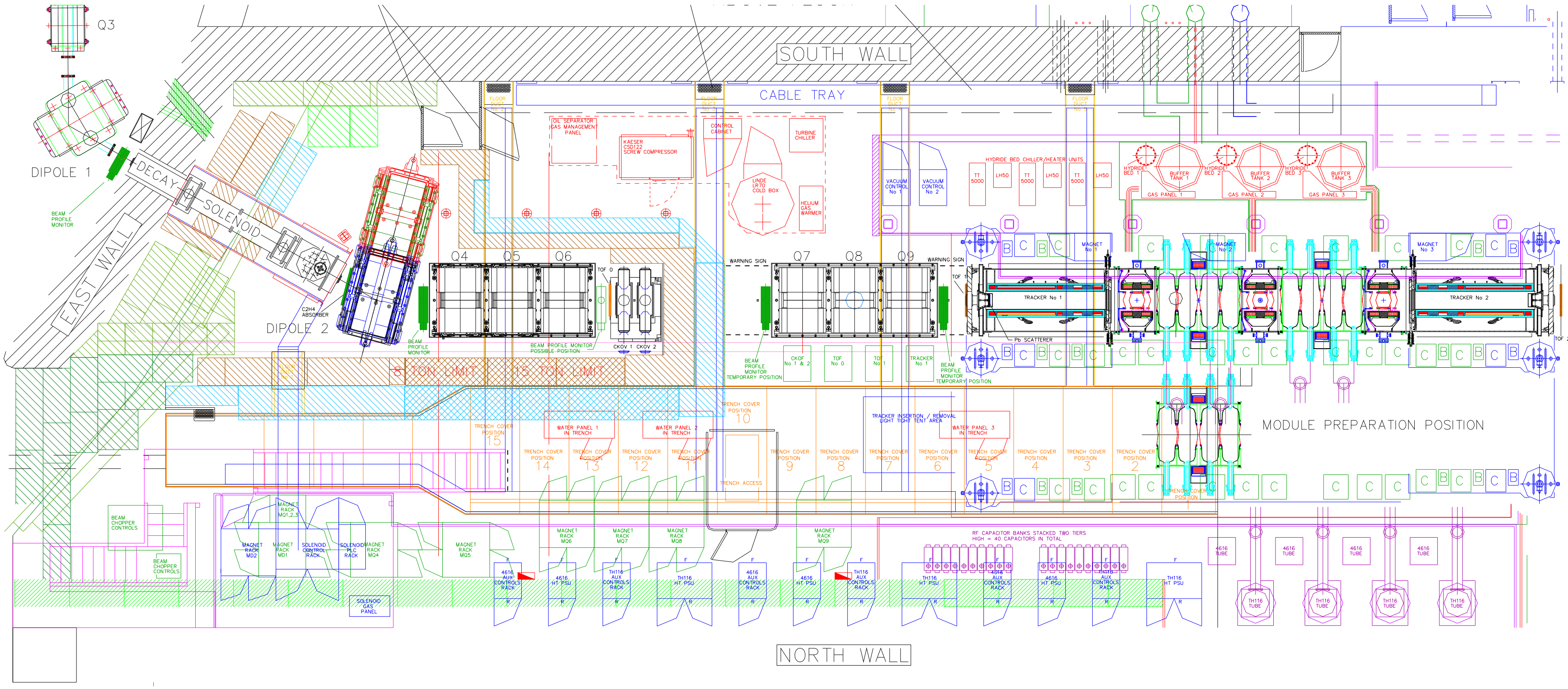
# MICE Description

- MICE includes one cell of the FS2 cooling channel
  - three Focus Coil modules with absorbers ($LH_2$ or solid)
  - two RF-Coupling Coil modules (4 cavities per module)
- Along with two Spectrometer Solenoids with scintillating fiber tracking detectors
  - plus other detectors for confirming particle ID and timing (determining phase wrt RF and measuring longitudinal emittance)
    - TOF, Cherenkov, Calorimeter



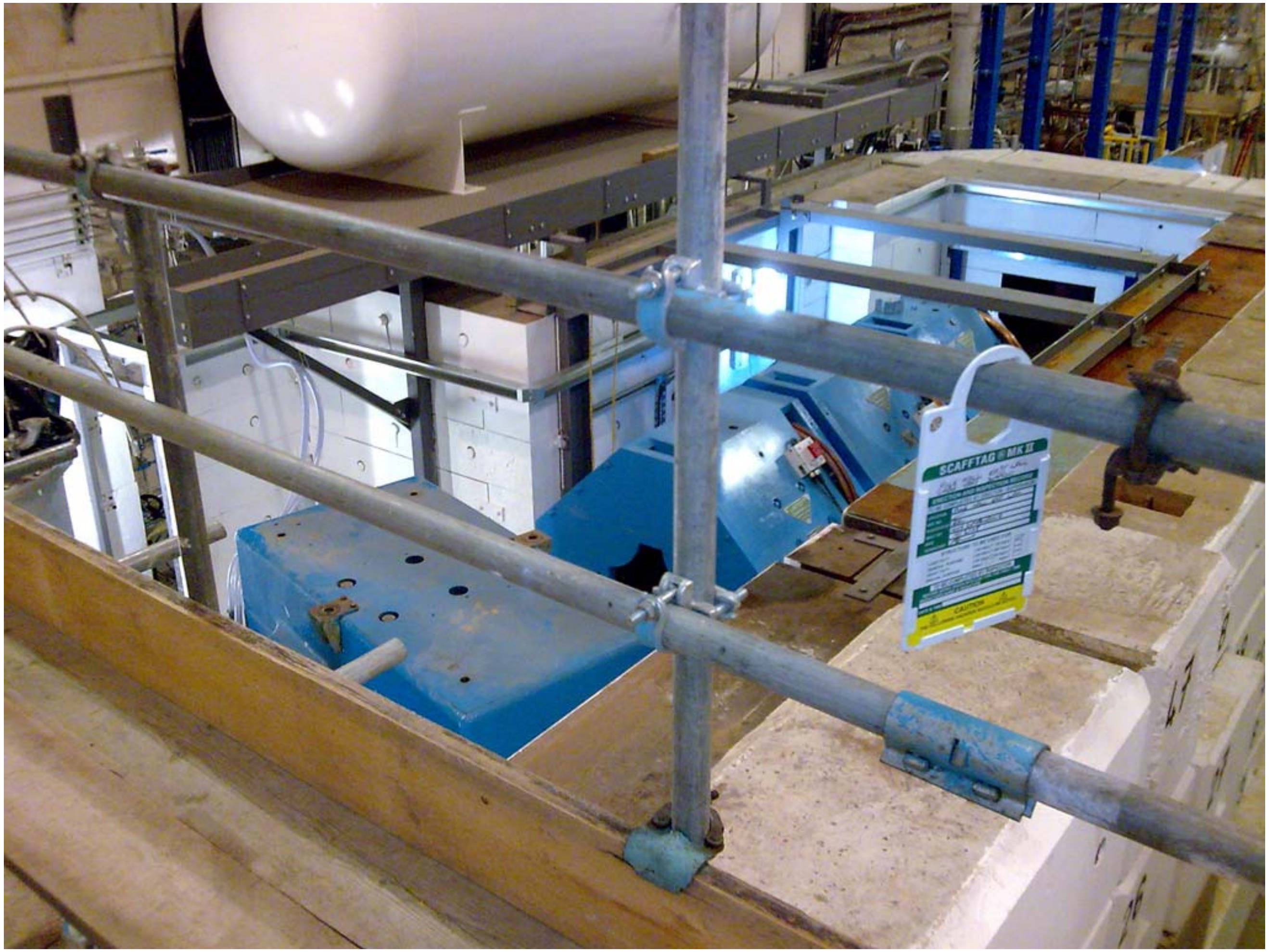
# MICE Hall (1)

- Hall will contain a *lot* of equipment



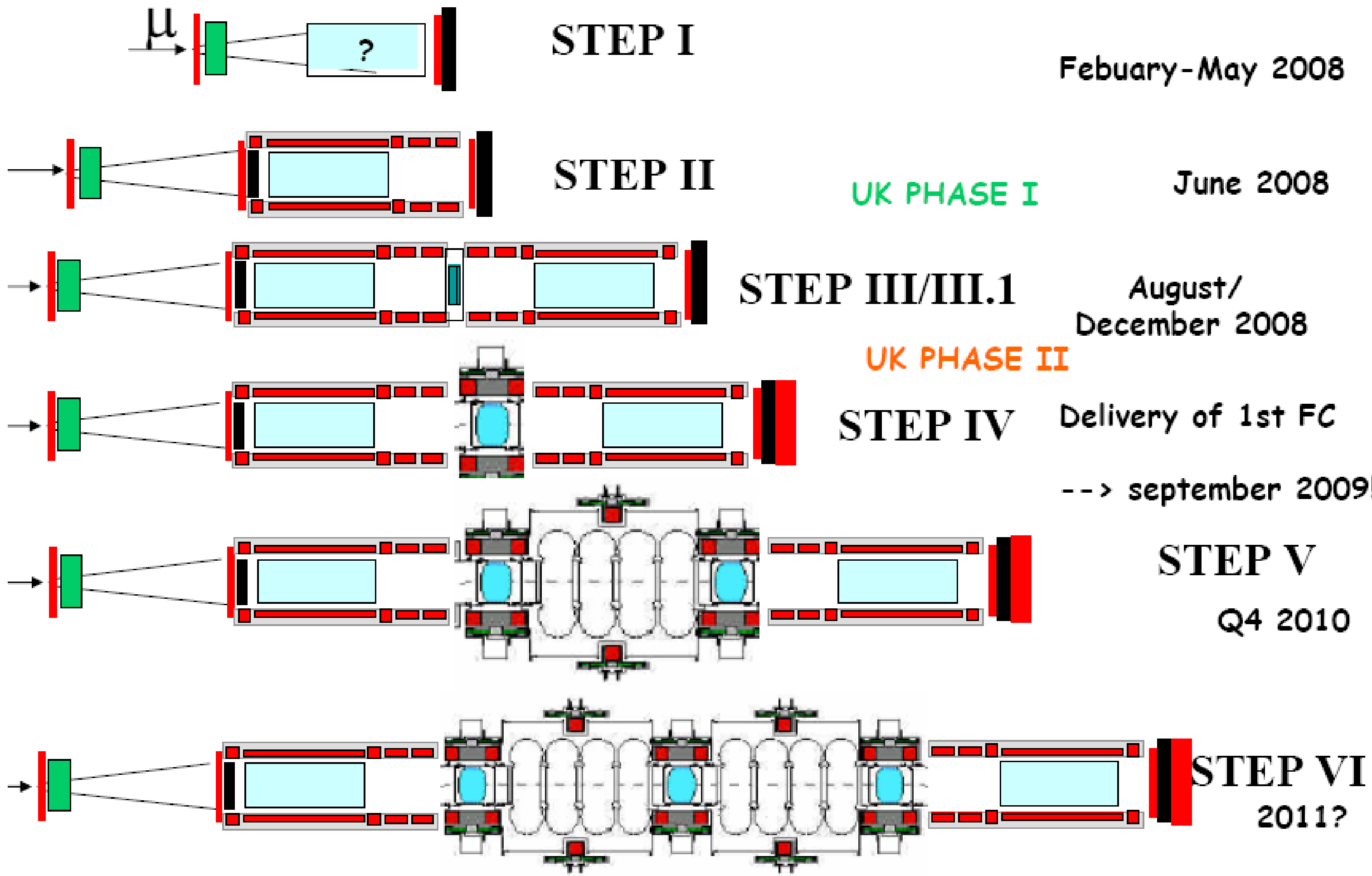
# MICE Hall (2)

- **Some of which is now in place and ready to commission**



# MICE Stages

- Present staging plan (some delays have occurred)



# MICE Collaborators

- **Collaborating institutions**

**Europe**
Bari
Brunel
CERN
Daresbury Lab
Edinburgh
Genève
Genova
Glasgow
Imperial College
Legnaro
Liverpool
LNF Frascati
Louvain la Neuve
Milano
Napoli
NIKHEF
Novosibirsk
Oxford
Padova
PSI
RAL
Roma III
Sheffield
Sophia
Trieste

**Japan**
KEK
Osaka

**U.S.**
ANL
BNL
Chicago-Enrico Fermi Institute
FNAL
Illinois Institute of Technology
TJNAF
LBNL
Mississippi
Muons, Inc.
UCLA
UC-Riverside

Shows broad international support for muon cooling study

# International Perspective

- International community holds annual “NuFact” workshops
  - provides opportunity for physics, detector, and accelerator groups to plan and coordinate R&D efforts at “grass roots” level
  - venue rotates among geographical regions (Europe, Japan, U.S.)

| Year | Venue |
|---|---|
| 1999 | Lyon, France |
| 2000 | Monterey, CA |
| 2001 | Tsukuba, Japan |
| 2002 | London, England |
| 2003 | New York, NY |
| 2004 | Osaka, Japan |
| 2005 | Frascati, Italy |
| 2006 | Irvine, CA |
| 2007 | Okayama, Japan |
| 2008 | Valencia, Spain |

# FY08 Budget

- Prepared initial budget for FY08 based on (usual) guidance of flat-flat funding
  - from there it went downhill, but not drastically
- Discussed and approved by TB, EB, and MCOG
- Goal: keep university programs viable while making some progress on key fabrication activities
- R&D obligations
  - proceed with MICE RFCC module fabrication
  - complete and decommission MERIT experiment
  - participate in IDS-NF and MICE (⇒ common fund payment)
  - continue RF test program at MTA
  - enhance effort on collider design

# FY08 Funding Distribution

- FY08 NFMCC budget (only DOE-NFMCC funds)[†]

  [†]Also: salary support from BNL, FNAL, LBNL; support from NSF of $1M ($798K MRI + $133K 3-yr grant); support of Muons, Inc. via SBIR grants

| Institution | COOLING /MICE | TARGETRY | ACCEL./ COLLIDER | RESERVE | TOTAL ($K) |
|---|---|---|---|---|---|
| BNL | | 145 | 90 | | 235 |
| FNAL | 55 | | | | 55 |
| LBNL[a] | 810 | | | 22 | 832 |
| ANL | 190 | | | | 190 |
| IIT | 80 | | | | 80 |
| Mississippi | 30 | | | | 30 |
| Princeton | | 40 | | | 40 |
| UCLA | | | 55 | | 55 |
| UC-Riverside | | | 95 | | 95 |
| ORNL | | 85 | | | 85 |
| Jlab | 3 | | 10 | | 13 |
| TOTAL ($K) | **1168** | **270** | **250** | **22** | **1710** |

[a]Includes MICE funding of $575K.

# FY08 Plans

- Targetry
  - decommission MERIT and publish results
- Cooling/MICE
  - continue testing 805- and 201-MHz cavities
    - with magnetic field
    - test gas-filled cavity with beam at MTA
  - begin MICE beam line commissioning
- Acceleration
  - continue system optimization for performance and cost
  - participate in EMMA design
- Simulations
  - participate in IDS-NF
  - continue collider studies with MCTF
    - aim for feasibility study in FY11-FY12

# Issues

- Three categories where additional support is needed:
  - completing our hardware commitments to international experiments
    - MICE hardware commitments will be honored at present budget levels, but may be 1 year late
      - any substantial need for contingency would risk further delays
  - restoring the health of our simulations and theory effort
    - manpower has eroded away after years of flat budgets
      - need effort for IDS-NF, MICE analysis, EMMA design, and MCTF work
  - providing common funds for the MICE experiment

- Hope for strong endorsement from P5 to help improve our fortunes

# Summary

- Despite limited funding, NFMCC continues to make excellent progress on carrying out its R&D program
  - 201 MHz test cavity tested to 19 MV/m
  - MICE spectrometer solenoid fabrication nearly completed
  - completed ISS; write-up posted
    - launched IDS-NF
  - completed MERIT beam run
    - data analysis under way

- Our work provides potential choices for HEP community
  - muon-based accelerators/colliders offer advantages over other approaches
    - they also provide an intense source for low-energy muon physics

- We have been disciplined and effective in carrying out our R&D tasks continue to make good use of our funding