

Status & Requirements for MUCOOL
(after the 6 month study)

Ongoing activities

Cooling channel design

RF development

Absorber development

Longer term plan

Component development

"String test"

How to proceed

Cooling channel pic – Ed Black

Ongoing MUCOOL Activities

1. Cooling channel design

Simulation

Engineering studies

2. Component development

RF

Absorbers

3. Developing plan for "string test"

Potential future MUCOOL activities

1. Cooling channel instrumentation & controls development needs simulation studies to establish specs.
2. Cooling channel beam test(s) ... needs feedback from simulation studies to establish what needs to be measured. Also needs (I believe) the "big picture" (staging strategy) to understand how/when cooling tests needed

Cooling channel design

Non-trivial: needs simulation people, simulation tools, lattice expertise, RF design people, absorber (liq. H) design people ... and experience.

We have a local team providing **all of the above** plus some momentum and an activity well intergrated into the collaboration

Need to keep the pace going :

Deeper level of simualtion and engineering studies.

Optimization needed to achieve cooling goals.

Need to explore some alternative (potentially much better) cooling lattices.

Must not forget emittance exchange.

This activity crucial to enable us to define and cost a "string test"

Liquid hydrogen absorbers

In all the cooling channel designs under consideration we need liquid hydrogen absorbers with thin (as possible) windows that can tolerate dEdx heating up to a fraction of a kW.

- **Two-year R&D Plan:**

1. Prototype window tests.
2. Prototype several absorbers (different dimensions, windows) and bench test.
3. Engineering test of absorber in proton or electron beam with appropriate energy deposition.

- **Groups:** IIT, NIU, FNAL ... we have attracted University groups into this R&D, & are trying to bring in State funds to support this, and also some US/Japan funds.

- **Immediate needs:**

Prototype window tests (few thousand \$)
Find location at FNAL for absorber bench tests
Set up safety committee
Make plan to prepare bench test area

High gradient RF & RF Power source

● Lab G: First real collaboration facility

Short term: Complete test setup.
Complete 805 MHz model cavity.
Construct open cell copper cavity.
HP open cell test in 5T solenoid.
Later: HP test with Be window cavity from LBNL.

Long term: Prepare Lab G for 200 MHz tests.
HP test of 200 MHz cavity.

● 200 MHz cavity design: crucial for overall cooling channel design.

Immediate needs: Push alternative designs (open cell, grid, window (LBNL) and preliminary tests of window support) to the point where we can make a choice.

● 200 MHz power source:

Need to develop a plan for development of source.

Immediate priorities

The immediate things we want to vigorously pursue for the remainder of the FY:

- 1. Continue the vigorous ongoing activity on cooling channel design ... exploit momentum, tools, expertise.**
- 2. Complete the Lab G RF facility and start HP testing of 805 MHz cavity.**
- 3. Push hard on 200 MHz cavity design so that we can choose which sort of cavity to pursue further.**
- 4. Push hard on liquid hydrogen absorber design and window tests.**
- 5. Make a more detailed plan for a "string test" in the longer term.**

Longer term plan based on what we know

Sub-program	Year					Scale (M\$)	
	1	2	3	4	5	M&S	Sal
200 MHz Cavity R&D	████████████████████					~3	~3
Absorber R&D	████████████					~2	~2
Construct short sectn -> string test			████████████████			?	?

RF power source: Need to make plan and make a case to MUTAC.

At the end of this part of the R&D we would have a short cooling section constructed with its operational parameters measured "on the bench", and the corresponding cooling channel simulated in detail.

How to proceed ?

1. Get design study and physics study reports finished.
2. Identify a staging scenario that appeals to the directorate

Example:

Stage 1: Proton source upgrade + target station + decay channel → Stopped muon source + proton source physics.

Stage 2: First neutrino factory .. 20 GeV with 10^{19} decays.

Stage 3: Upgraded neutrino factory .. 20 GeV with 10^{20} decays.

Stage 4: Muon collider (???)

3. Get the design study AND the staging scenario reviewed (MUTAC, AAC, PAC) along with the R&D plan.
4. While the staging scenario + R&D plan are being formulated/reviewed continue momentum on design work/component R&D → charge for addendum to design study.