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Long–Term MUCOOL Plans

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Introduction

MUCOOL MISSION

Design, prototype, bench–test all cooling channelcomponents, & eventually beam–test a cooling section

Short–Term Plan (~3 years)

Prototype and test all of the basic cooling channel components (RF Cavities, absorbers, beam instrumentation, solenoids) at the MUCOOL LINAC area test facility.

Long–Term Plan ... includes:

Further iterations to achieve RF performance goals
Choose cooling lattice
Build & bench–test real prototype cooling section
Build & test a "string"
Test the (reconfigured ?) string in a muon beam

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Preparing a Long–Term Plan

We need to make detailed long–term plans for all parts of our neutrino factory R&D, that take us from where we are to accelerator construction ...

Which items are really on the critical path ?
How do we allocated limited precious resources ?
How long is it really going to take ?
What resources do we really need ?

Having finished two design studies, now is the time to make a first detailed R&D plan.

In MUCOOL we have begun to work towards this. The process is :–

(i) Since a cooling channel is a new type of LINAC, define the R&D path & time lines by building a consensus amongst the appropriate experts within our collaboration.

(ii) Make a strawman plan (timelines, funding profile, who does what). We are in the middle of this step

(iii) Expose it to the collaboration, and iterate until we have a CREDIBLE streamline plan.

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Complications that must be faced – 1

1. The lattice of choice is not yet frozen, and will probably continue to evolve until the point at which we know we have components that achieve performance goals (~ 3 years).

2. We could be lucky & our cavities achieve the performance goals first time ... but this is not the most likely case. Any credible technologically driven R&D plan must have the capacity to absorb an additional RF iteration (~1–2 years) to arrive at satisfactory cavity performance.

3. We are not very far along with understanding the beam diagnostic requirements & options. We hope that beam diagnostic development will be no longer than the RF development ... but this is not obvious.

4. The string test will involve significant expense. Best current guess is that we will need 3 solenoid sections, and each is O($10M) –> few times $10M cost for string test.

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Complications that must be faced – 2

5. If the scale is such that we want to pursue cooling channel development and tests in collaboration with our European and Japanese colleagues, we need to have a decision process to choose the technology (the CERN design uses different components to ours)
   –> get involved in each others component development ?

6. Our resources so far have not been sufficient to complete our planning for the component development (next 3 years) :

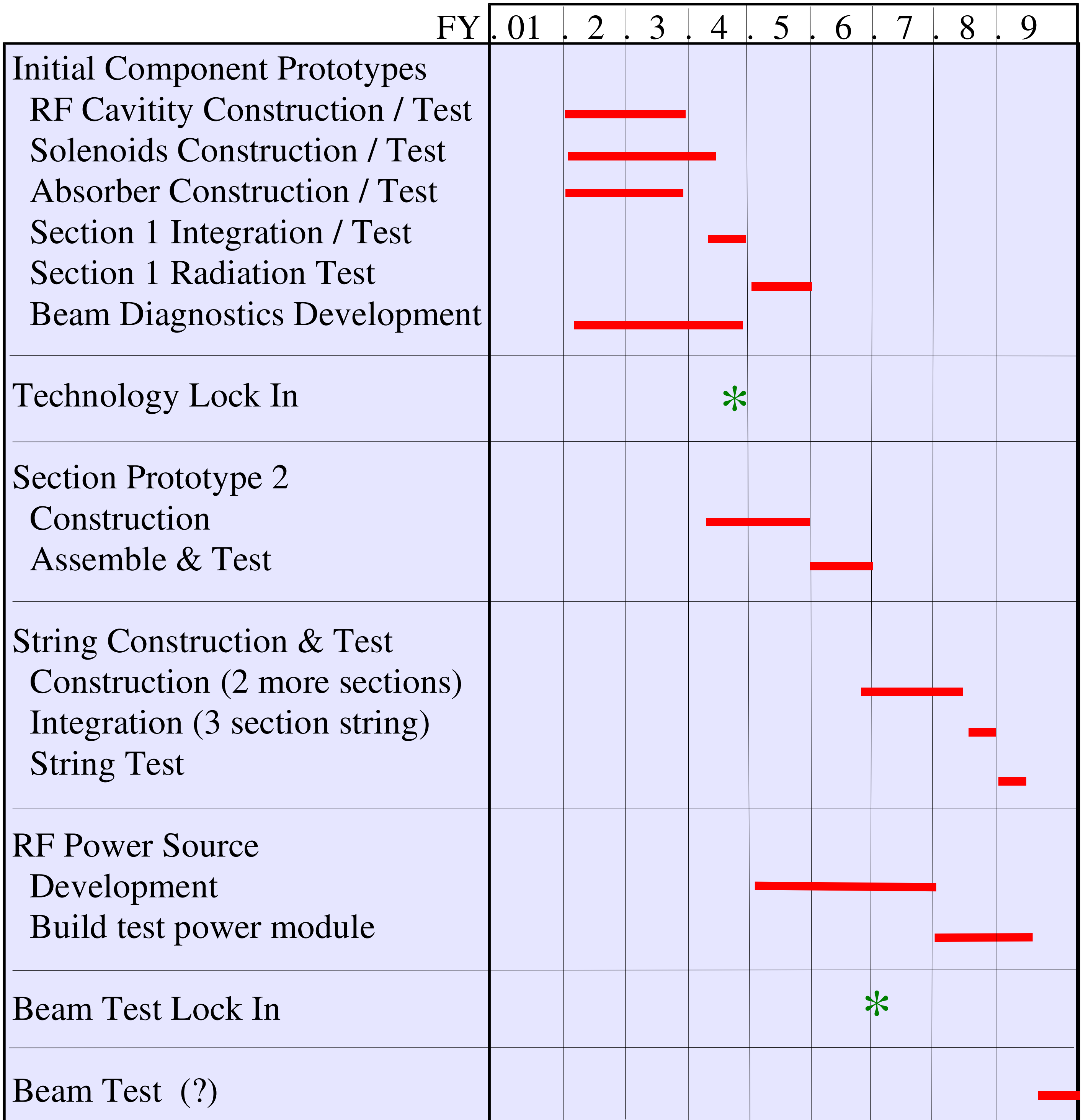
   Need more test cavity details.
   Who will manufacture the prototype cavity ?

   Need more test solenoid details.
   Who will build the test solenoid(s) ?

   So we are trying to make a plan before all the actors are identified.

Towards a Long–Term Plan
First Iteration

(i) First prototype components –> prototype section 1 test
(ii) Build/test second prototype section
(iii) Build two further sections –> 3 (4) section string test.



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Milestones

These strawman milestones need a lot more discussion within MUCOOL. But they are based on our current evolving long–term plan.

Technology (& Lattice) Lock–In

Assumed to be at the time we have a prototype of each of the components (or at least the RF cavities) meeting our performance goals.

Estimated to be during FY04 if the cavity development goes exceedingly well.

Could be FY05/06 if we need an iteration on the cavity.

Beam Experiment Lock–In

Assumed to be at the time the first ~2m section is successfully tested.

Estimated to be FY06/07

Allows 2.5 years to prepare beamline & experiment.

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Groups Involved (so far)

RF Cavity Development :

FNAL, LBNL, Mississippi, exploring IIT

Absorber Development :

FNAL, IIT, KEK, Mississippi, NIU, NW, Osaka, UIUC

Beam Diagnostics :

ANL, IIT, U. Chicago

Solenoids :

LBNL, exploring Saclay

Test Facilities :

FNAL, NW

Beam Experiment Concepts

ANL, BNL, FNAL, Indiana, Mississippi, Princeton, UCLA, UIUC

Towards a funding profile – Input

Preliminary input based on study 1 information
plus partial study 2 information.

Needs to be updated in detail with study 2 results.

Needs the next level of design/optimization work
if we want to pin down the costs to better than 50% (?)

Cost estimates for one (~2m long) prototype section :

Solenoids	2200
RF Power	4000
Cavity	1500
Other	3000
Total	10700

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Towards a String Test funding profile : First Attempt

Estimated costs to:
(i) build and test the first prototype ~2m section, & then
(ii) build an additional two sections –> string test.

	FY04	FY05	FY06	FY07
Solenoids	1100	1100	2200	2200
Cavities	750	900	1500	1500
RF Power	0	1000	1500	1500
Other	1500	1500	3000	3000
Contingency (30%)	1005	1350	2460	2460
Total	4355	5850	10660	10660

Notes:
(1) This is only the start of a plan. Needs a lot more work, including working towards defining & costing individual tasks (work package elements), taking care of overheads, identifying the critical paths, looking at the R&D risks, etc.
(2) There are other MUCOOL activities needing funding during the FY04–07 period: RF power source development, beam experiment and beamline construction.

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Summary & Next Steps

Now that study 2 is done, we have more information on which to base our long–term plans.

Have started to make a detailed plan that takes us beyond the first prototype components, and through a string test phase of MUCOOL.

A good goal is to have the string test plan fleshed out by Snowmass, together with a good understanding of the associated milestones.

Next steps:

1. Absorb all the study 2 cost information into the plan, identify the additional design work needed to make plan solid, & start reviewing the details.
2. If we want to explore the possibility of an inter–regional cooling test, we need to start discussing the basics. There is a decision process that must be built into the plan.
3. More discussion of plan within MUCOOL –> iterate.