

**Comments on Review of NuMI Absorber
November 20, 2001**

Summary of Design Changes & New Elements

Presenter: A. Wehmann

1. (Reviewer: D. Eartly) Operational issues of the electric forklift; safety on slopes and stalls, battery charging/changing, etc. A vendor visit is appropriate.

Done.

2. (Reviewer: D. Johnson) The many questions about the fork lift battery change, speed capability, mast height, etc could not be answered. This should be further investigated even if a trip to the local vendor is required.

Done

3. (Reviewer: T. Leveling) The lift truck (Lazer) which is to be battery powered and which is to have replacement batteries needs to be carefully reviewed. How does one know that battery needs to be replaced? What happens if the battery goes dead and there is a load on the lift truck or the lift truck is not conveniently ? Can battery changes be scheduled around natural breaks, e.g., lunch, end of shift, etc. Propane fueled trucks are supposed to be safe

Can't use propane underground. The fork truck operator needs to understand the equipment.

4. (Reviewer: T. Leveling) The project should have lift truck vendor demonstrate battery replacement on Lazer truck and demonstrate hauling capability up ramps like that to be used in the project.

We plan to use a winch to move the blocks up the tunnel.

5. (Reviewer: T. Leveling) There was some discussion of adequacy of dump in the event beam misses the target and hits the absorber. Is there a plan to provide a system interlock or beam inhibit for this?

An interlock is probably not operationally useful. The NuMI beam permit system could conceivably be used to prevent this occurrence. The MINOS shift crew is the first line of defense against this occurrence since the neutrino event rate would plummet. There is no immediate safety concern if the errant beam is not discovered promptly. The beam would strike one of the 10 T steel shield blocks that surround the absorber core, causing a temperature rise that would become a concern after several shifts duration.

6. (Reviewer: T. Leveling) Have the large vacuum window safety issues been addressed? I don't think this was mentioned today. It appears that the window is not accessible to people after the absorber is assembled.

Yes. An engineering note has been written and reviewed.

7. (Reviewer: J. Kilmer) I did the same calculation as Alan on the life of a battery charge for the Lazer forklift. It seems clear that from time to time they will have to change a battery in the middle of the day instead of just charging it at night. Much more attention needs to be paid to this operation after the fork truck is here. Typically these battery changes are much more than ½ hour jobs, and always are filled with extra hazards like the battery acid, and maneuvering the heavy batteries. Special rigging will probably have to be designed to facilitate this job.

The fork truck will not be used to rig blocks up the inclined tunnel.

Absorber Engineering

Presenter: E. Villegas

1. (Reviewer: D. Johnson) We had a number of metal plates fall over like dominos at TPL during decommissioning. That thought kept coming to mind when listening to the discussion on the core module assembly. I don't know the details of TPL, but is it valid?

No. The core modules are supported by a base plate and do not rely on any inter-module bracket to maintain stability.

2. (Reviewer: T. Leveling) Perhaps top shield block could have lift ears affixed to side of blocks so that hooks could be used to rig in the top layer. The plan we saw shows no clearance when rigged from the top.

The rigging scheme has been reviewed by task managers and found to be acceptable.

3. (Reviewer: T. Leveling) I suspect there is no reason to grout voids in steel blocks as long as the voids are staggered in the stacking arrangement.

OK

4. (Reviewer: M. Reichanadter) It was mentioned during the review that the gantry crane could not be used to place the top shielding block and that it would need to be 'rigged by hand'. Develop a plan to 'rig by hand' the upper concrete shielding block on the for the absorber shielding.

The top layer will be rigged into place with cribbing.

5. (Reviewer: J. Kilmer) I am nervous about the absorber welds in restricted space. I went to see Ernie's test. I thought that the test allowed the welder to unconsciously use vision space that is not available for real. Additionally he could weld this joint on the bench. In the field he may be on his back trying to do it. At least in the schedule ½ day per weld is allowed. If one of these welds leaked it could be very difficult to fix.

The absorber has been pre-assembled into 2 super-modules at MAB. This reduces the number of welds that must be done in place to 4. The core will be pressure tested before final assembly.

RAW System Update

Presenter: D. Pushka

1. (Reviewer: D. Eartly) While I agree that valve packings can lead to leaks, I am concerned that there is not a way to test one half of the RAW loops for leaks. This could be accomplished by a three way valve(or an injection valve in the Input manifolds) in each half loop for pressure testing etc. This could lead to an expedited shut off of the appropriate half loop and continued operation up to a normal maintenance period. Draining and cutting all the RAW lines, pressure testing, re-fill, and re-weld/test takes significant time.

The absorber core has been designed with redundant circuits in each module and will be tested before final assembly. There are no credible repair scenarios apart from identifying and disabling the defective circuit. The introduction of valves in the absorber manifold increases the likelihood of leaks.

2. (Reviewer: D. Johnson) As mentioned in the meeting, the intermediate water system can be used to fill the raw system. This should be considered for other water systems too.

OK

3. (Reviewer: T. Leveling) It seems feasible that a separate makeup water line could be installed between the mid-level cooling system and the absorber cooling system by simply running another line between the two spaces. Failing that, a simple modification to the absorber and middle cooling system could allow one to fill the absorber cooling system from the middle cooling system. A change to the P&ID drawings could be made to reflect this. The reason the first approach is better is that the absorber cooling system could have makeup water added without interfering with operation of the middle system. If the absorber cooling system is filled from the middle system, the middle system would need to first be shutdown to avoid the middle system shutdown due to possibility of the reservoir tank level going low. Hauling blue drums of DI water down 300+ feet to the absorber cooling water skid sounds like a bad idea.

OK

4. (Reviewer: T. Leveling) There is a reference in the project documentation on the water cooling system to ACNET. The document assumes that because there are muon counters nearby, that ACNET must be available for the absorber water systems as well. It's not obvious that muon counters would be connected to ACNET, especially because this sounds like a function of the experiment. Has the Beams Division Controls Department been made aware that NUMI would like to connect the absorber and middle cooling systems to ACNET? Is so, no problem. If not, I suggest that department should be formally notified of this intent.

Yes.

5. (Reviewer: T. Leveling) Details regarding the cooling systems alarms, interlocks, and controls should be worked out in advance to ensure resources are made available or so alternate arrangements can be made.

OK

6. (Reviewer: T. Leveling) I agree that flow turbines are not reliable indications of flow; i.e., they can fail when water flow is perfectly adequate. There is another type of device, a paddle switch, which seems to work very reliably on APO water systems. These are go/no go switches that close when water flow is sensed.

These are also prone to failure.

7. (Reviewer: T. Leveling) The cooling pond water temperature is quite variable depending on the season and a lot of other factors. Unless there is some flow control for pond water through the heat exchanger (NOT suggesting it's needed), the dump cooling water system, dump core, and middle cooling system will have an extremely wide operating range of operating temperatures. All sorts of scenarios seem possible: dump heating by cooling system or dump cooling by heating system both with various beam intensity and without beam. It seems possible that sweating in the dump stack could be possible depending on how well the dump is either sealed or ventilated.

The temperature of the absorber core will be maintained within reasonable limits. The dump will be sealed as well as we can.

8. (Reviewer: M. Reichanadter) On the RAW system, there are a few comments. I was not involved in the RAW review so please forgive any repetition that may have been addressed at that review.
 - a. The present design calls for full flow return through the makeup tank, which may cause excessive turbulence and add entrained air into the

system. Currently the system has 86gpm returning through a 30 gallon expansion tank. Assuming the tank is ~75% filled with fluid, this will result in a turnover of the full around every 16 seconds, much too high. Consider taking off only a small portion of the return flow through a tee to the expansion tank to allow the entrained air to settle out. Suggest bringing the return line into the expansion tank tangentially to minimize turbulence. The Pbar target (or lithium lens?) system is designed with this feature and it works well.

OK

- b. Consider adding a connection line from the secondary cooling to the primary cooling to be used for makeup water for the primary loop. This should be a simple way to add the water. Since the makeup water is not DI, some time will be needed to polish the water. However, the DI is not necessary for any high potential requirements, so it should be fine to allow periodic degradations in the DI quality when adding makeup.

OK

- c. Consider individual valves for the supply and return to each module. Although this is slightly more expensive, and does add the potential for valve leakage, valves allow remote isolation and troubleshooting of any minor leaks on the modules. Additionally, current valve technology can turn out a high quality product that is designed to last longer than the 10-year lifetime of the experiment, and cutting and welding pipes can be quite messy in a RAW system, particularly if you have a small leak on an undetermined module

OK

9. (Reviewer: J. Kilmer) Dave mentioned that a leaking pipe to a module would not be repaired but abandoned in place. To do this the pipes would be cut loose from the headers and plugged. Drain valves in each of the headers might facilitate this job by having a graceful way to remove the (mildly?) radioactive water from headers and modules only and not have to drain the entire system.

We have avoided using valves, as they are a potential leak source.

Schedule, Installation Planning

Presenter: A. Wehmann

1. (Reviewer: M. Reichenadter) The Lazer forklift will be a key during the installation phase. Consider spare parts and a priority maintenance contract to ensure the schedule.

The forklift was re-conditioned by the manufacturer prior to use. The absorber installation schedule is several months away from the critical path.

2. (Reviewer: J. Kilmer) If any extra money becomes available, I would suggest buying the Mini-lift crane and setting it up early so people can get familiar with it.s operation.

We will not use the mini-lift. The rigging contractor is supplying a gantry crane.

[Note: Some comments that have already been addressed are not included in this document. They may be found on the website.]