Comments from Baffle and Target/Baffle Carrier Review
Aug 1, 2002

Baffle Carrier
Presenter: E. Villegas

1. (Reviewer: P. Hurh) It seems that using administrative controls to ensure that the baffle is in place before high intensity running is not enough for the risk involved (destroying a horn). The carrier position should be interlocked to high intensity beam permit.

2. (Reviewer: P. Hurh) The number of moving mechanisms under the module seems to be high. There are two right angle gear boxes, a ball screw assembly, a telescoping drive shaft, a guide shaft with mating rollers, and cam followers. In my experience at AP-0 it is hard to ensure that these un-lubricated moving mechanisms in such a harsh environment do not bind, seize, or otherwise cause problems. It is my advice to reduce the number of these mechanisms, and assume the worst in efficiency when calculating needed loads. I'm especially leery of using a ball-screw for this application (see next comment).

3. (Reviewer: P. Hurh) In my limited experience, the close fitting ball screw mechanism is prone to binding and galling. I'm not comfortable with using a mechanism of this type to drive the carrier. Also mis-alignments between the ball screw and the guide rods could be a cause of binding and/or wear without lubrication. I would seriously suggest a different method of driving the carrier be investigated. Or at least conducting tests of the proposed ball screw mechanism in a suitably dirty environment (without lubication of course) to give us some confidence in the reliability. Perhaps some sort of wipers can be fashioned for the ball screw shaft to ensure that debris does not interfere with operation. A cable drive system may be utilized with the ends of the cable actually passing through the module to the top might be one possibility. The drives could be placed at the top of the module where they are accessible. They could be spring-loaded so driving force only has to be in one direction.

4. (Reviewer: P. Hurh) I have not used limit switches below the modules at AP-0. Perhaps some testing should be done to ensure proper operation at high dose and a possibly humid environment.

5. (Reviewer: P. Hurh) Wipers on the guide shafts and surfaces should be used to help avoid debris from binding operation.

6. (Reviewer: P. Hurh) Perhaps the AP-0 environment is much more corrosive than that of the NuMI chase (with its high speed ventilation), but I have seen cam followers seize many times. One should probably assume that the cam followers and rollers on the guide shaft are frozen and must slide rather than roll.

7. (Reviewer: P. Hurh) I would suggest that multiple limit switches be considered to help monitor actual target/baffle position. If the RVDT fails or loses its zero and the carrier binds up, the position of the target/baffle may be unknown. Or at least add some sort of allowance to remove a T-Block and sight down to the target/baffle in the case of an emergency.

8. (Reviewer: P. Hurh) Thermal expansions of the carrier frame may affect the alignment of the guide shafts and thus change the position of the target. If this occurs in the low energy position, damage to the horn or the target could occur. Analysis should be performed to ensure that thermal gradients are small enough in the low energy mode to avoid such deflections.

9. (Reviewer: P. Hurh) Sometimes moving relatively light objects is harder than moving heavy objects. Lighter objects tend to bind, flex, and move more in response to relatively small perturbations. I would not assume that because the object is light, that it is easy to overcome binding by brute force.

10. (Reviewer: P. Hurh) I'm concerned that 'running blind' during the insertion of the target into the horn is not a good idea. Providing feedback is essential to making sure such a crucial operation is performed properly. Adding at least the electrical 'short circuit' feedback would, in my mind, add a great deal of protection. Also, perhaps 'feelers' or 'whiskers' could be used? At the very, very least of course several dry runs should be performed before first beam on target to ensure the alignment procedure.

Baffle Mechanical Design
Presenters: V. Garkusha/V. Zarucheiski

1. (Reviewer: P. Hurh) Heating in the Be windows was not shown. This should be checked if it hasn't already… or at least compared to other, higher stressed windows.

2. (Reviewer: P. Hurh) The stress results of the baffle seem to depend on the initial compressive stress (pre-load) from the aluminum jacket. I would suggest a sensitivity study be performed to see how sensitive the stress results are to the amount of preload. Since the pre-load can vary by up to +/- 30%, it would be good to check the baffle at lower pre-loads. The principle stresses should be compared to allowable stresses via the coulomb-mohr theory (or other suitable brittle failure theory). This looks at the case where the most positive and most negative principal stresses are opposite in sign (fourth quadrant) and the limiting sigma 3 can be calculated. Contact me for details if necessary.

3. (Reviewer: A. Stefanik) Check the tie rods between the target and the baffle to make sure they and the connections are adequate for the case where the baffle is stuck and the target is driven towards it.

4. (Reviewer: A. Stefanik) What is the target vacuum requirement? Can the required vacuum be achieved with the small diameter, long, coiled run of tubing?

5. (Reviewer: A. Stefanik) On page 9 of "Baffle and Target/Baffle Carrier Design", maximum stress on the coiled water line is reported as 20 ksi. It is then compared to the tensile yield stress of 35 ksi. But it should be compared to the yield strength in shear, which is roughly 0.577 * 35 ksi = 20 ksi.

Beam Scraping on Baffle
Presenter: J. Hylen

1. (Reviewer: A. Stefanik) Make sure fail-safe operating procedures or interlocks are in effect to prevent full intensity beam from entering the target hall with the baffle and target lowered off the particle beam axis.