

Memo

date: July 6, 2009
to: RSC
from: D. Beavis 
subject: Chipmunk NMON86 and NMON81 for E972/3 Operations

This note is intended to provide guidance in the placement and interlock setting for Chipmunk NMON86. This chipmunk is presently located at the junction of UGE3 labyrinth and the U line tunnel. For the two experiments the beam will be transported down the U line tunnel and not into the W line. A simple estimate of the dose at possible locations will be given.

The tunnel has air along the beam path at the labyrinth into the tunnel. The tunnel is 12 feet wide and it will be assumed that 2% of the beam will interact near the tunnel opening. A conservative estimate (thick target) for 5 GeV protons¹ is 3×10^{-12} rem/interaction at the entrance. The dose at the back of the first leg will be obtained by $1/(r^2)$ scaling. The dose after the next leg of the labyrinth will be obtained using the first-leg formula of Goebel². Subsequent doses at other legs will be calculated with the universal formula of Goebel². For a pulse of 10^{12} protons passing through the air column the chipmunk is expected to register a dose of

| Location | Dose for 10^{12} protons mrem | Response to pulse assuming 1 second mrem/hr |
|-------------------|------------------------------------|--|
| present | 60 | 216,000 |
| Back of first leg | 3.1 | 11,000 |
| After second leg | 0.5 | 1800 |
| After third leg | 0.011 | 40 |
| At gate | 0.0013 | 5 |
| Through shielding | 0.0031 | 11 |

The mrem/hr can be misleading since we do not intend to 3600 pulses per hour but it sets the scale for the chipmunk response. Since the experiment wants to operate at about 10^{11} protons per pulse it would seem that a likely location for the chipmunk would be outside the shielding with a 2.5 mrem/hr trip threshold. The location inside the gate would probably be okay, but closer would likely prevent the experiment from operating.

The UGE2 chipmunk, NMON081, may have similar issues. A crude estimate for the interactions in the air in front of the labyrinth produces 0.08 mrem per 10^{12} protons at NMON81. Depending on the actual integration time for the interlock function this could also be a problem. This should be examined during the setup.

References

1. A.J. Stevens, 5 GeV calculation on thick target at 5 feet, RSC files
2. Goebel labyrinth paper.

CC: RSC U line
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