

SLAC MEMORANDUM

4 October 2000

To: K. Jobe
 From: S. Roesler, J. Liu, and W. R. Nelson

Topic: Results of Radiation Survey on Top of NLCTA Roof Penetrations

A radiation survey was performed by J. Liu and S. Roesler on Friday, Sep 22, 2000, on top of the downbeam roof penetration. The aim of the measurements was to determine whether local shielding which so far covered the top of the penetrations during operation is indeed necessary.

The survey was performed with the following beam parameters:

- Energy: 65 MeV
- Repetition Rate: 10 Hz
- Bunch Intensity: 1×10^9 electrons/pulse

These parameters result in an average beam power of 0.1 ^{kw} W.

Neutrons were measured with a moderated BF₃-detector and a ³He-detector. A Victoreen 450P ion chamber and a G-M counter were used to measure photons and ionizing radiation.

Data were taken for normal running conditions and for a mis-steering situation which was created by steering the beam into a quadrupole magnet located close to the penetration. The detectors were placed at a height of 2 feet above the roof. A first set of measurements was performed on top of the penetration and a second set at a distance from the penetration of about 3 feet, i.e. at a vertical location above the beamline.

Results obtained after subtracting the background are summarized in Table 1. The last column gives the total dose rate using the values from the devices giving the largest numbers for neutrons and photons. Dose equivalent response factors of 1.29×10^6 , 1×10^6 , and 3×10^4 counts/mrem were applied to the G-M, BF₃, and ³He readings, respectively. The values carry large uncertainties because the background was as high as 50% of the signal for some of the readings.

In addition, a SHIELD11 calculation was performed assuming the beam hitting a "standard" target (iron cylinder, 12" long, 4" diameter) at the magnet location. The dose rate was calculated for

Table 1: Summary of survey results. "Top" and "3' " refer to the measurement locations (see text).

Condition	Location	BF ₃ μrem/h	³ He μrem/h	G-M μrem/h	Victoreen μrem/h	Total μrem/h	Total mrem/kWh
normal loss	top	6.0	6.8	34	80	87	870
mis-steering	top	6.5	5.8	59	96	103	1030
mis-steering	3'	1.0	2.0	—	17	19	190

the top of the roof, vertically above the beamline, which corresponds to the measurement condition in Table 1 labelled "mis-steering, 3' ". For a loss of 0.1 kW SHIELD11 gives 0.73 μrem/h and 12.7 μrem/h for the contributions from neutrons and photons, respectively. These values are in fairly good agreement with the measurements taking into account the uncertainties originating from the fact that the actual "target" (i.e., the magnet) had different dimensions than the "standard" target and also taking into account the statistical uncertainties of the measurements.

The Protection Ion Chamber (PIC) readings were also recorded during the measurements. The largest value during beam mis-steering was found to be 4.8 nA detected by PIC-1450 which is the PIC downbeam closest to the penetration. During normal operation the readings of the PICs close to the measurement locations were 2.5 nA. Since the trip level of PICs is set at 50 nA the radiation level above the penetration at which the PIC would trip the beam is nominally 1 to 2 mrem/h, with the level outside of the penetration about 5 times lower.

Based on these measurements we conclude that shielding on top of the three cable penetrations is not needed for a beam energy of 65 MeV.

- cc. Bill Baumgartner
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- Marc Ross