**Radiation Dose Estimate Based on Leakage Currents**
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## I. Introduction

One of the most well understood indications of total radiation dose is the increase of leakage current as a function of flux. The leakage current damage is characterized by a damage constant, $I = I_0 \ \alpha \ \phi$ [1] where $\alpha = 3.3 \times 10^{-17}$ A/ particle cm$^2$ at 20 deg C. The particle flux is characterized as equivalent flux of 1 MeV neutrons. Corrections must be made for annealing effects and temperature dependence, $I \sim T^2 \ e^{(-E/kT)}$ [2] where E = 1.23 Ev.
Measurement of the slope of leakage current vs luminosity allows us to check the effective flux integrated by the detectors.

## II. Monitoring Data

Typically, four ladders are powered by a single bias current channel, archived at 1 minute intervals. These ladders are usually split between two of the eight sublayers. Data from this slow archiver for dates since Sept 4 are available online. In this note we only consider data from single sided ladders. This is for several reasons. First, the single sided ladders have only one heat source which is directly above the cooling pipe and therefore their temperature can be more reliably estimated. Second, double sided ladders tend to have currents which rise slowly during the store, which makes fitting the slope a bit more unreliable.

Data was read from the archive into text files with a 1 microamp cut to eliminate beam off periods and averaging over 15 minutes for each point. Only data subsamples with $\sigma < 0.05$ μA were included. Data for each HV pod is then plotted against the interpolated integrated luminosity for that period and fit to a straight line (figure 1). A similar procedure was followed for layer 1,2 (figure 1) and layer 5,6 (figure 2) detectors. The current is then corrected to 20 deg C (equation [1]) and the flux/pb-1 is calculated. The result is $f = 2.9 \times 10^{12} + 0.7$ particles/cm$^2$ fb$^{-1}$. We know that the rate of curlers is roughly constant between 1.5 and 2 Tesla (D0 note 4038) so we can compare our measurement with value from CDF note 3937 scaled to the same radius. This value, of $3.14 \times 10^{12}$ , is consistent with our measurement and indicates that our radiation damage calculations, which are based on this value should be reliable.

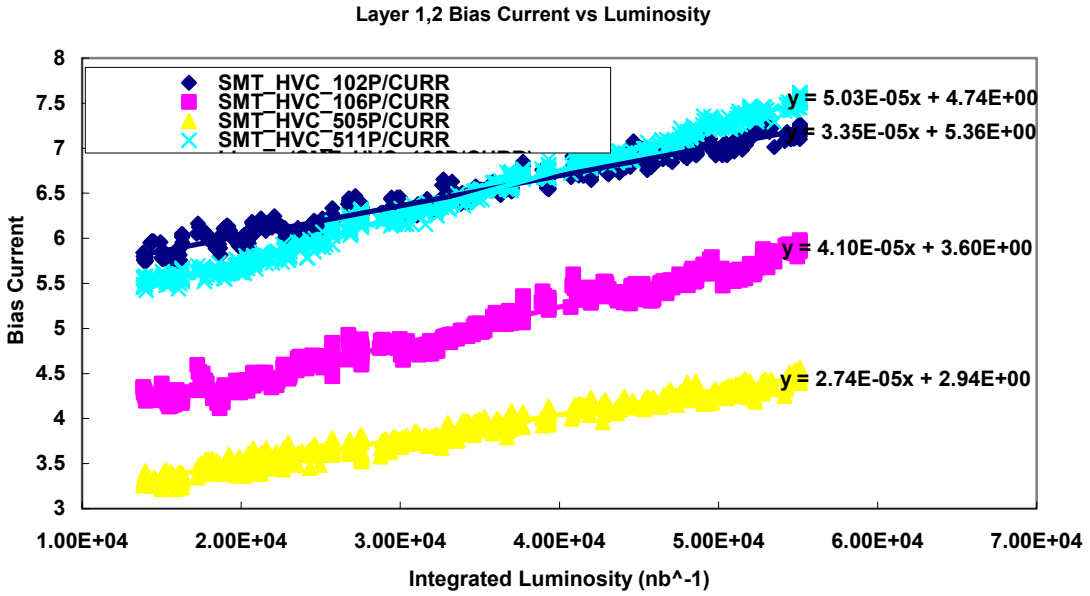


Figure 1. Current vs luminosity for inner layer single sided detectors.

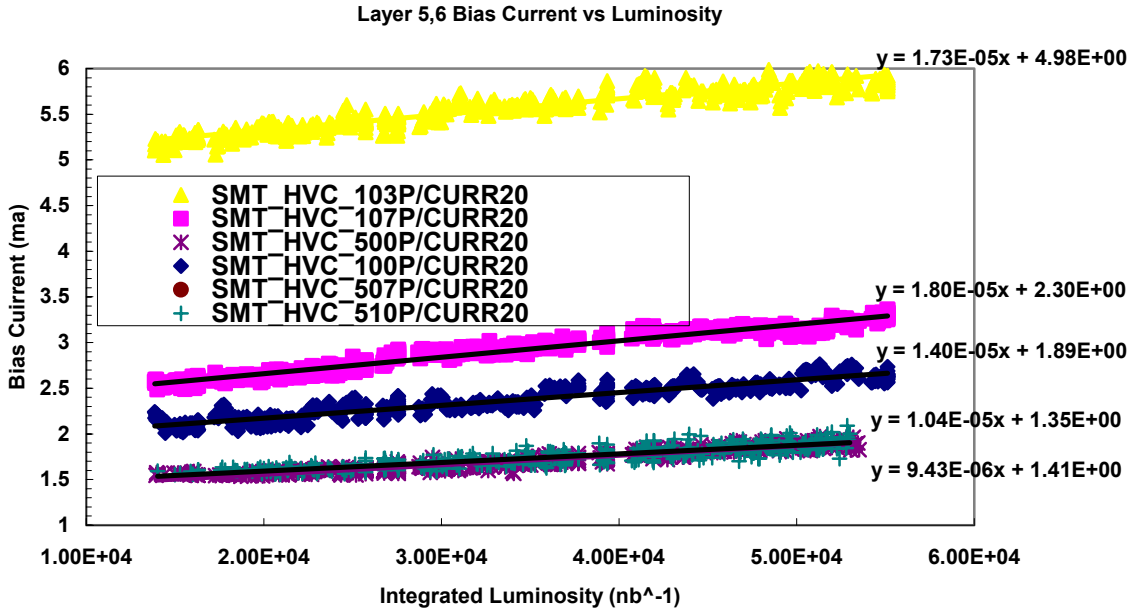


Figure 2. Current vs luminosity for layer 5,6 single sided detectors.

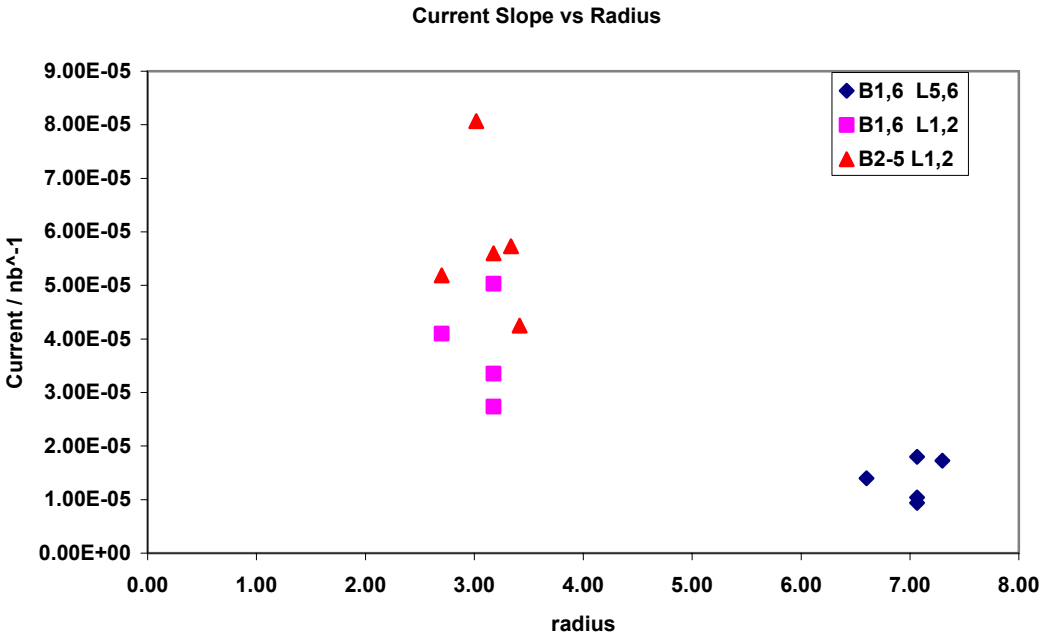
Current Slope vs Radius
9.00E-05
8.00E-05
7.00E-05
6.00E-05
5.00E-05
4.00E-05
3.00E-05
2.00E-05
1.00E-05
0.00E+00
Current / nb^-1
0.00
1.00
2.00
3.00
4.00
5.00
6.00
7.00
8.00
radius
B1,6 L5,6
B1,6 L1,2
B2-5 L1,2

Figure 3.