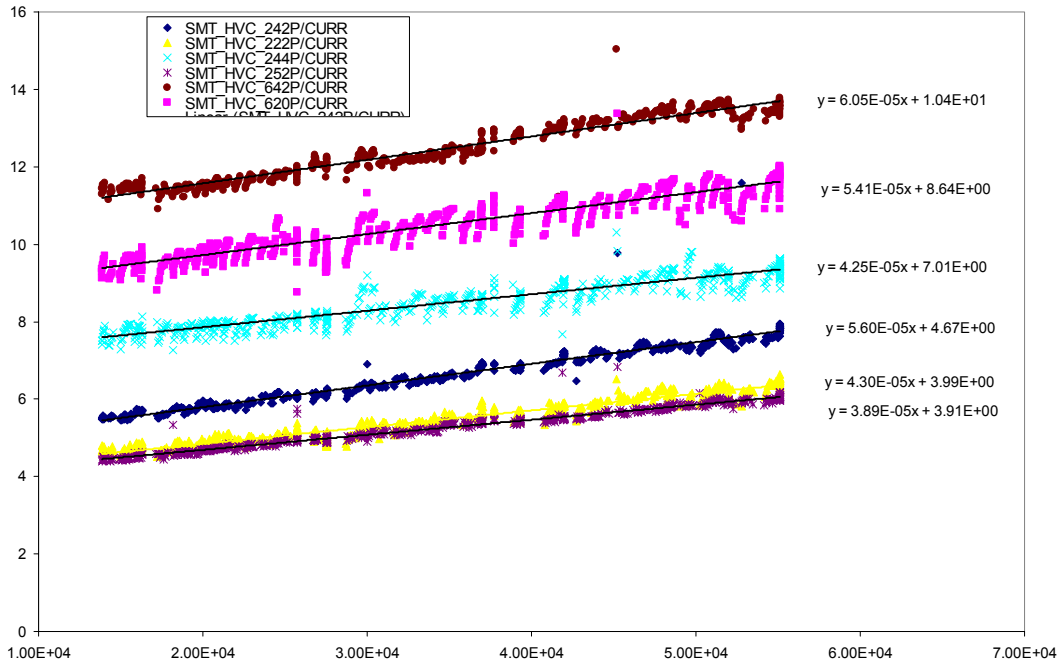
Radiation Exposure to the D0SMT

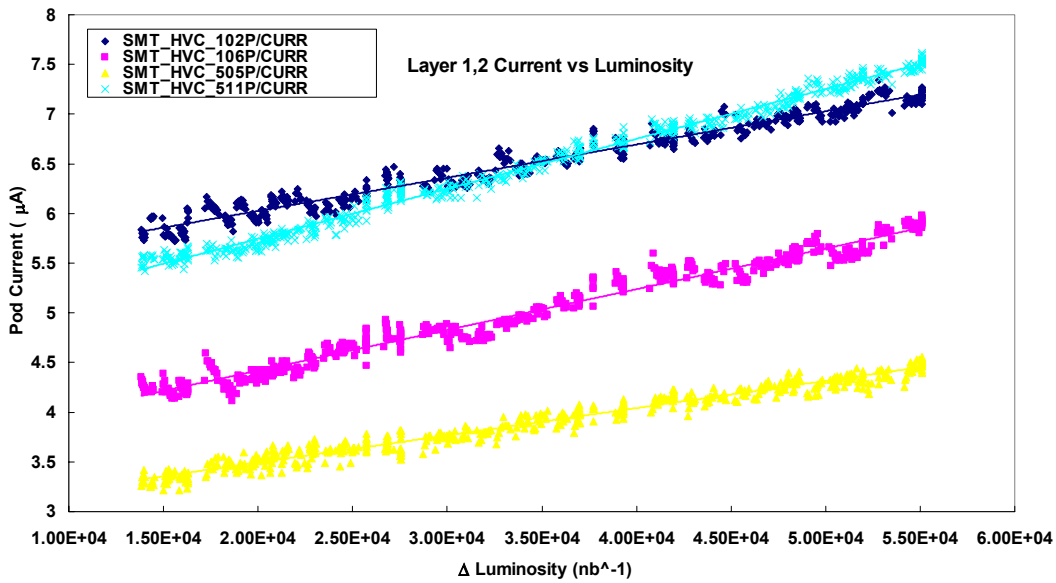
- **Purpose: Measure the dose in particles (1 MeV equivalent neutrons) per fb^{-1} to the D0SMT using leakage current**
  - **Use the formula:** $I=I_0\ \alpha\ \phi$ Amp/cm^3
  - Measure dI/dL for the last 2+ months to establish $d\phi/DL$

- Use EPICs monitoring data from ~Sept 9
  - Average over 90 minutes
  - Reject points with low current (detector off) or sigma >0.05 microamps
  - Most pods have two sublayers – correct to inner sublayer using $r^{-1.68}$ radial dependence
  - Correct to 20 deg C using $I \sim I_0 T^2\ e^{(-1.23eV/kT)}$ using average temperature per type
  - Correct for detector area
  - Reject pods that are too noisy, have changes in conditions, have large in-store oscullations

Pod data

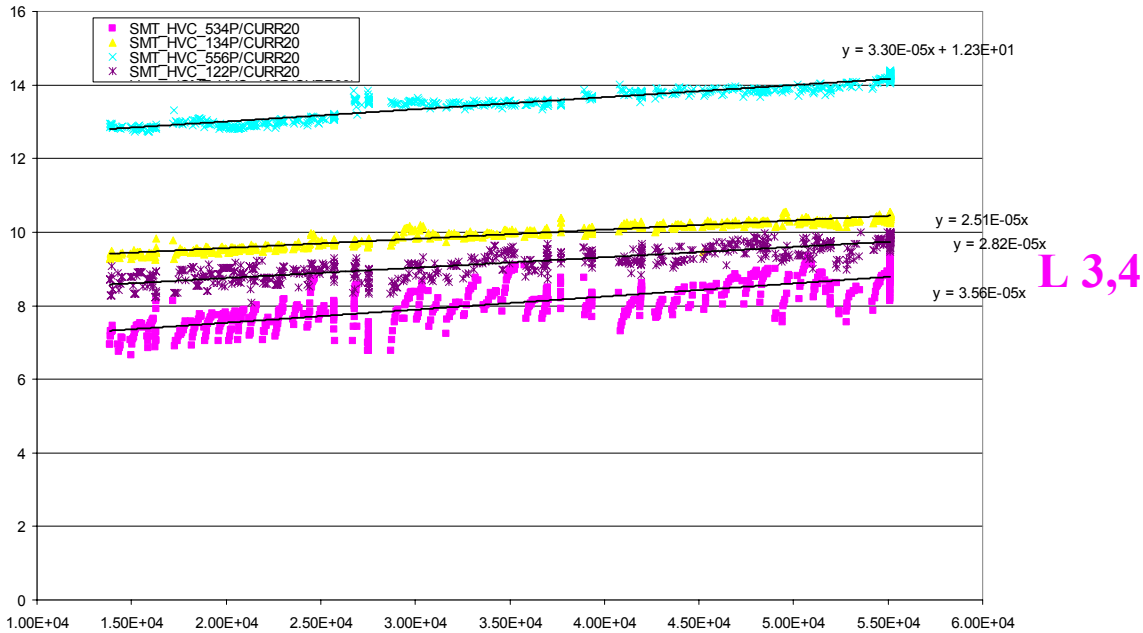


L12DS

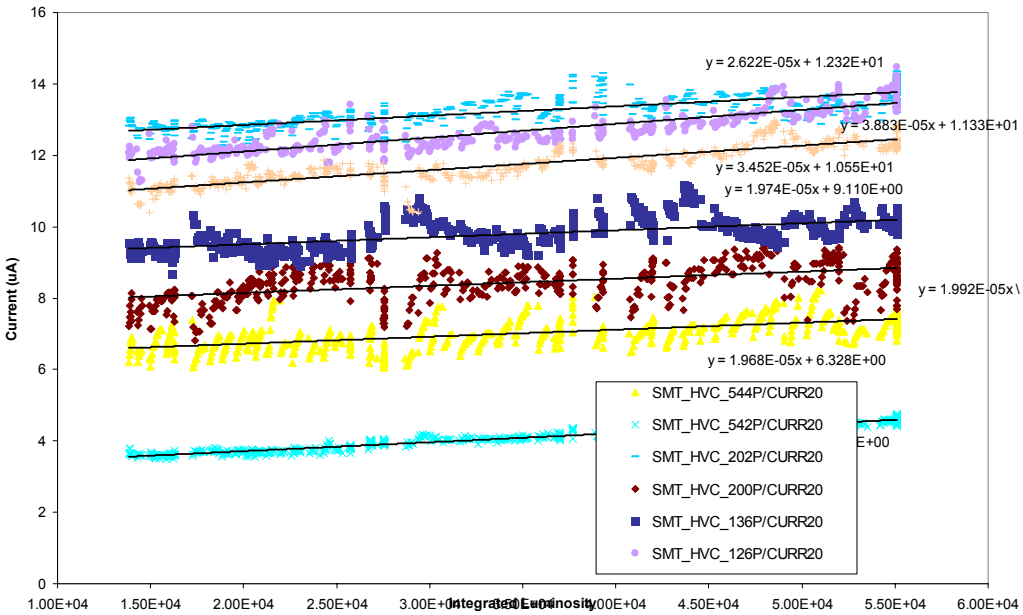


L12SS

Pod Data



L 3,4



L7,8

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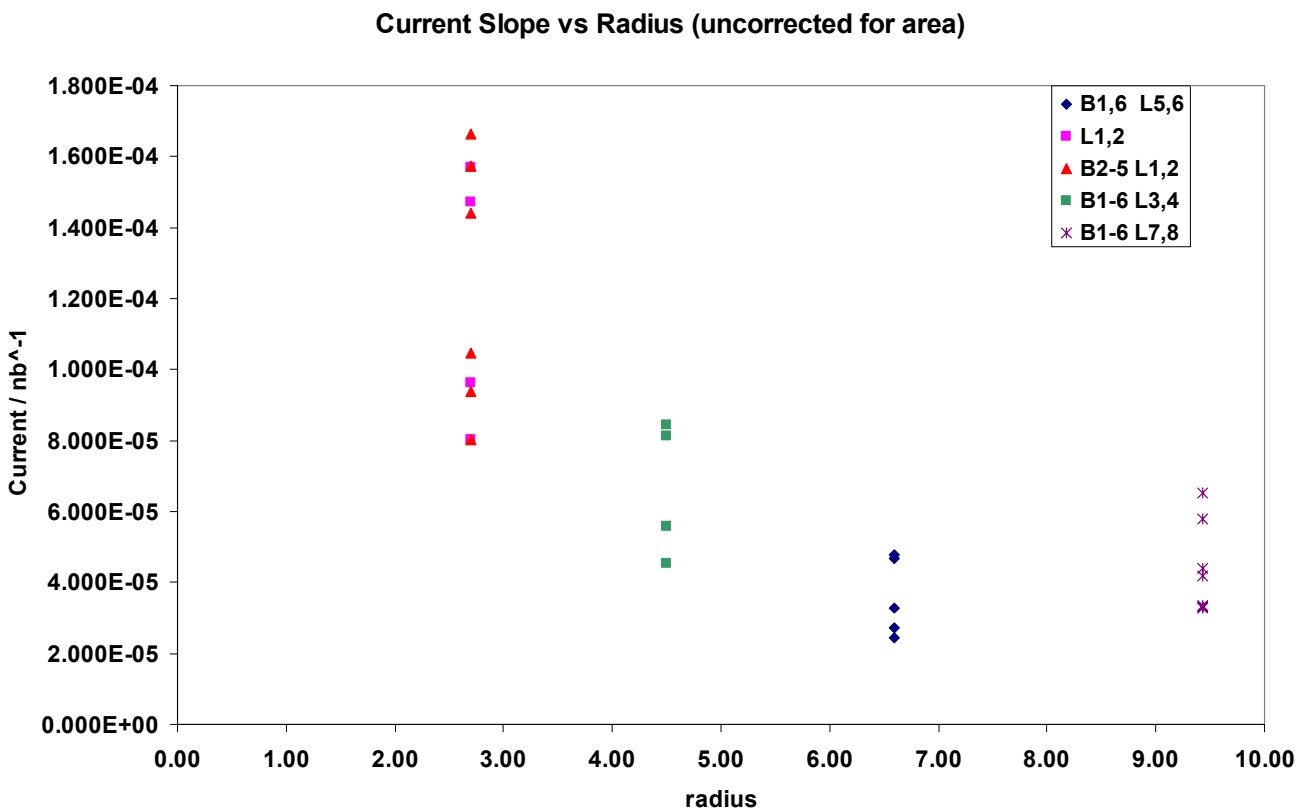
Currents



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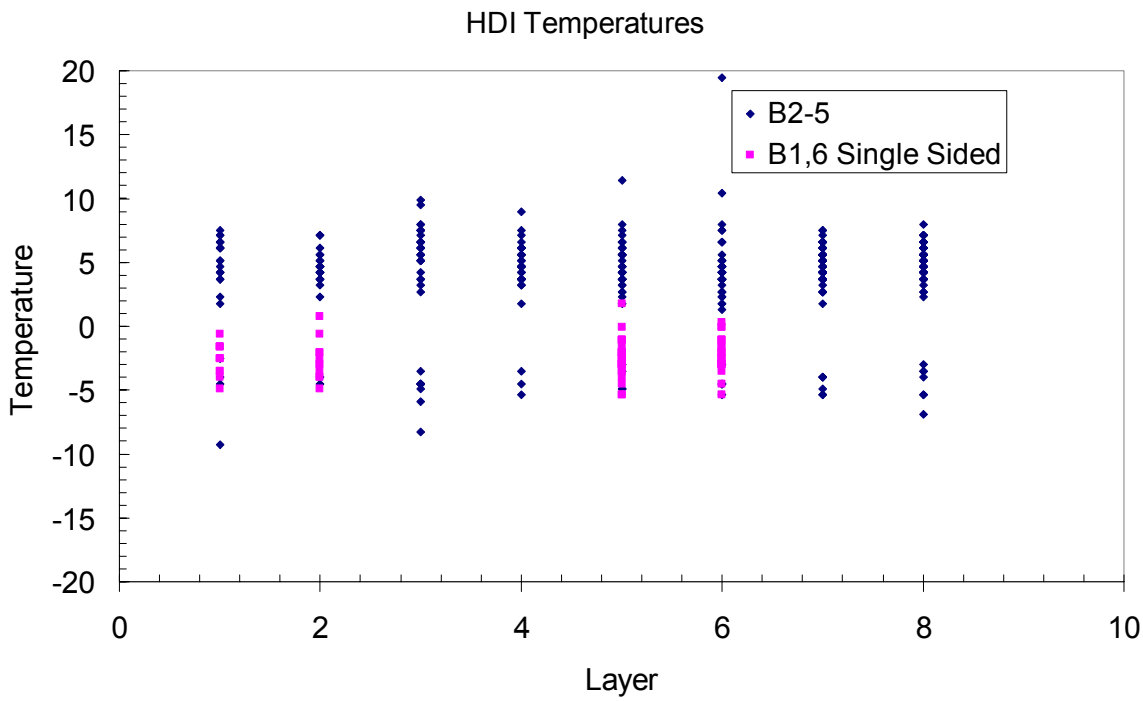
Temperature



Calculation of alpha:

–α ranges from 2.9×10^{-17} A/particle cm with full annealing to ~ 9 x 10^{-17} A/particle cm immediately after irradiation and is a complex function of temperature.

-For the moment – assume $T_{silicon} \sim T_{HDI}$

- Use June temperature scan to try to relate $T_{operating}$ to T_{HDI}.

- Use 5.7 x 10^{-17} A/particle cm for this study

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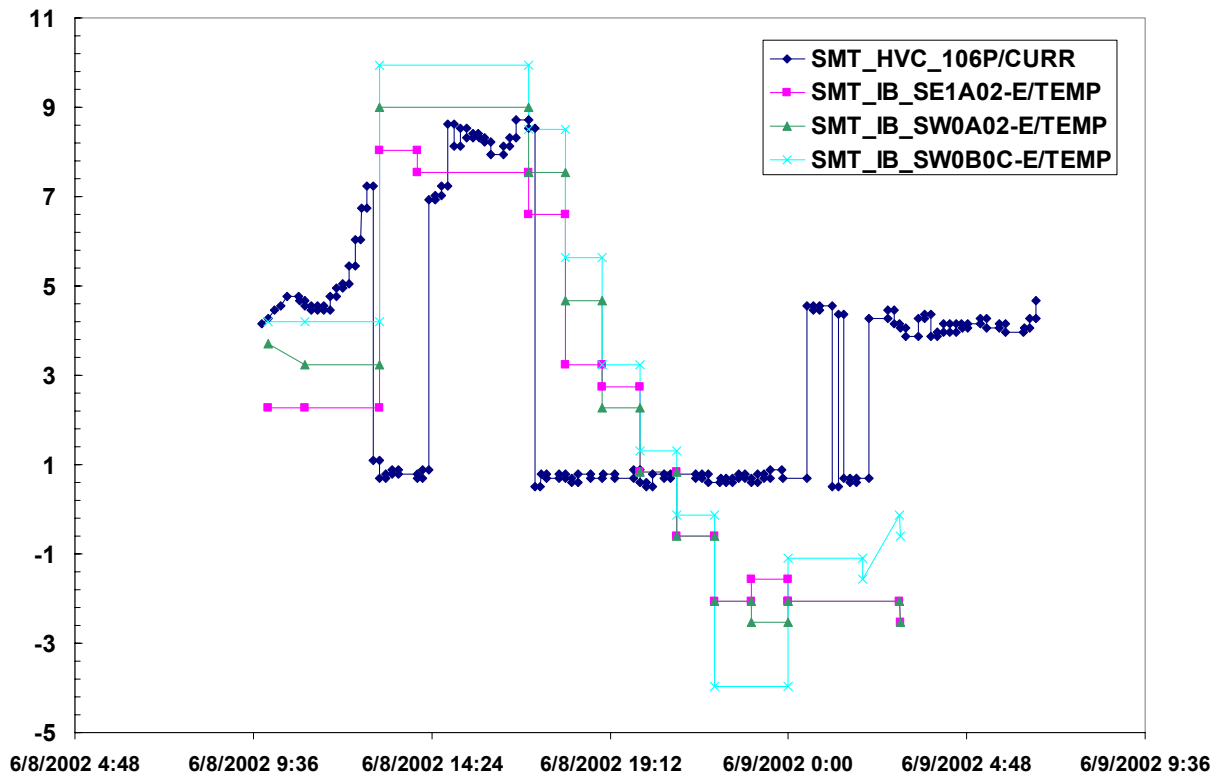
Temperature Scan

Typical data:



Not enough precision to get a sensible answer other than $T_{sensor} \sim T_{HDI}$

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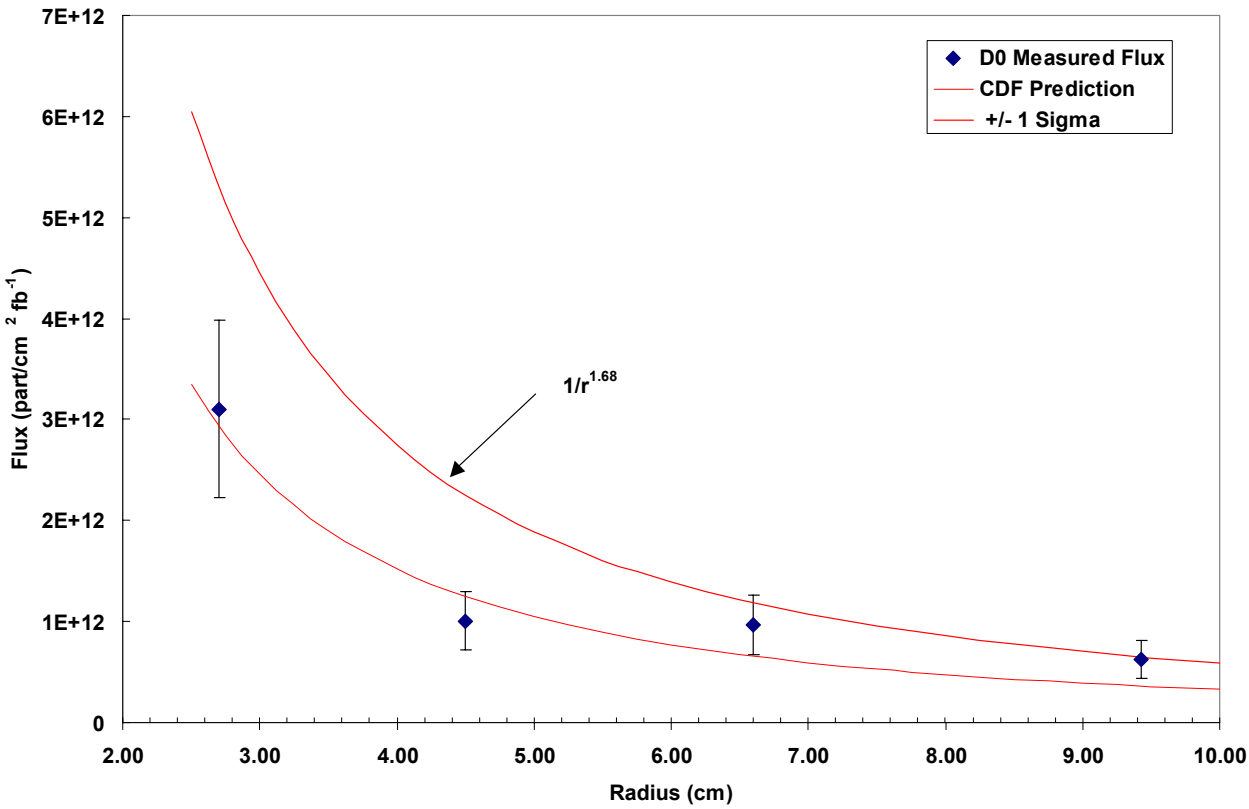
Results



Flux factor = 3.1 x 10^{12} particles cm^{-2}/fb^{-1}
1.8 x 10^{12} 1 MeV neutrons/Mrad
-> 0.58 Mrad/ fb^{-1}
We are now at about 150 pb^{-1} delivered or about 87 krad

This should be confirmed when the TLDs are removed in January