



# REQUEST FOR ACTION (RFA) RESPONSE

## GLAST LAT Project Calorimeter Peer Review

17 – 18 March 2003

<b>Action Item:</b>	CAL – 021
<b>Presentation Section:</b>	Detector Elements
<b>Submitted by:</b>	Bill Wisniewski

**Request:** Diode Performance - Investigate impact of leakage current rise on irradiation over the expected life of GLAST. Measure effect and understand consequences to noise budget and calorimeter performance.

**Reason / Comment:** BaBar has observed factor of 4 to 12 increase in leakage currents, depending on location (hence dose), during the last three years.

### **Response: 4 April 2003**

The calorimeter noise budget and energy resolution are not dominated by photodiode leakage current. For our shaping time of  $\sim 2.5$   $\mu$ s, the typical diode dark current of  $\sim 2.5$  nA contributes  $\sim 250$  electrons (rms) of noise. This scales with the square root of the dark current, hence yielding  $\sim 500$  e (rms) at 10 nA dark current. This is to be added in quadrature to the preamp noise ( $\sim 800$  e). It would take an increase in dark current of greater than a factor of 10 to be comparable to the preamp noise and a factor of  $\sim 50$  to cause failure to meet the overall requirement of  $< 2000$  e (rms) noise in the low energy channels.

Our measurements to date with  $^{60}\text{Co}$  hot cell irradiation indicates that after 23 kRad the dark current from two test units was less than 10 nA ( $\sim 4$  nA at 10 kRad). While the two units started with different dark currents ( $\sim \times 2$ ), they tracked approximately the same absolute current with radiation dose. Additional radiation testing will be performed on the flight PIN diode lot as part of the qualification testing.

On April 7 – 8, we exposed two diodes to proton irradiation along with CsI crystals in Sweden. These results are being analyzed at this time – a report shall follow.

We are investigating the possibility of neutron irradiation tests as suggested in RFA CAL019.

The reference to the  $^{60}\text{Co}$  irradiation test report is

<http://hese.nrl.navy.mil/glast/CM/rpt/EMDPDIrradiation-LAT-TD-00787-01.pdf>