ASDBLR01 Neutron Exposure October 2001

Nine ASDBLR01 chips were exposed to neutrons ($3.5X10^{14}N/cm^{2)}$ at Prospero. Bare chip were characterized on the IMS test setup and sent to prospero. Power was not applied. No channels or chips failed. The measured gain is lower by about 44% but the threshold deviations within each chip remain acceptable. It should be noted that the change in gain directly affects the threshold dispersion.

Power
Only a small change in current draw is observed.

Average Supply Current before and after exposure

Supply	Pre Rad (mA)	Post Rad (mA)
+3V	65	64
-3V	67	-64

Power Off Input resistance

The input of each preamp is connected to ground through the junction of the 20K feedback resistor with a 6K resistor to ground that supplies current to the output emitter follower. The input resistance of exposed chips was compared to that of other unexposed chips from the same batch. Differences are less than 5%, typical of the variation from chip to chip. (26.3 K)

Change in Gain
The absolute threshold for a constant input charge is a sensitive function of gain. After exposure to neutrons, the mean value for the threshold for a fixed input demonstrates a significant change in gain for both the low and high thresholds.

Average Threshold for all exposed chips Pre and Post Irradiation

Comparator	Pre Rad (mV)	Post rad (mV)
Track (Low) 3fC	491	289
Tr (High) 30fC	352	220

The gain pre and post exposure was calculated by subtracting the mean threshold at 5fC from the mean 3fC data for the low threshold and similarly the mean threshold from 50fC from the 30fC data. The resultant gain is given below:

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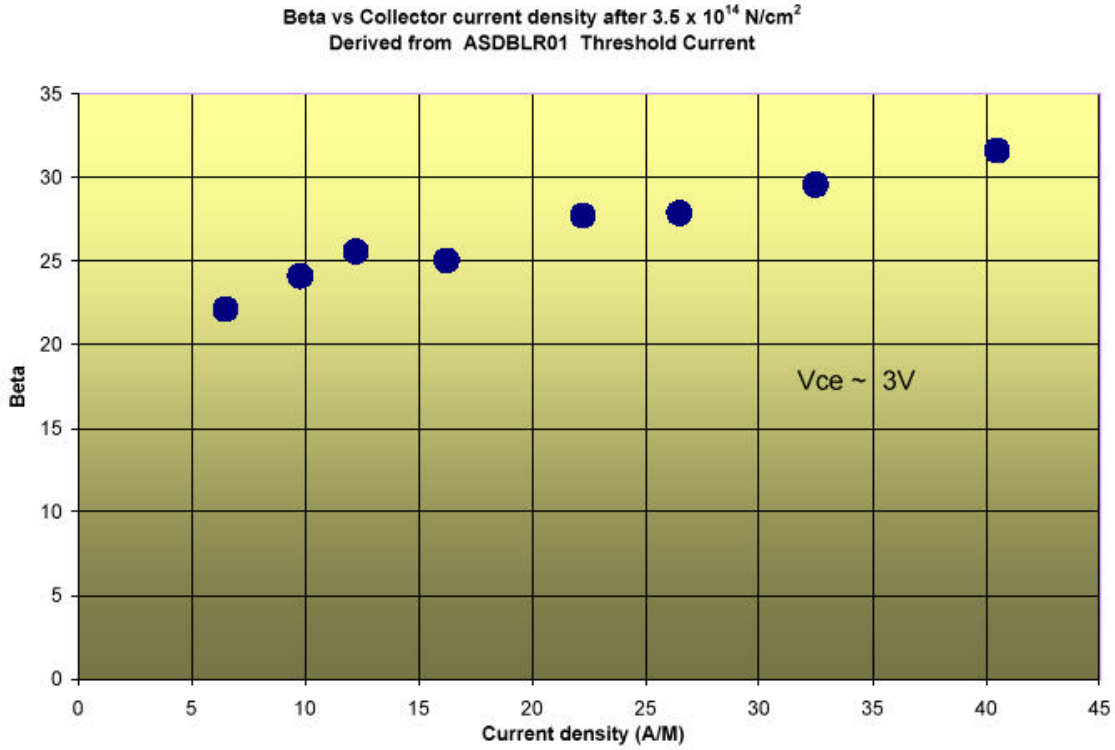
Average Threshold Gain for all exposed chips Pre and Post exposure to $3.5X10^{14}$ n/cm^2

Comparator	Pre Rad (mV/fC)	Post rad (mV/fC)
Track (Low) 3fC	110	62
Tr (High) 30fC	12.9	7.1

Gain change of the NPN transistors

The gain reduction can be directly linked to a significant change in the NPN transistor gain, or beta. The beta can be directly measured for a variety of collector currents by simply measuring the current into the threshold lines which directly drive the base of eight npn transistors. Since the collector current changes as a function of threshold, we can derive beta for a range of collector current densities.



This offers some insight into what the beta of the input transistor might be. The collector current is 540µA into a 100µA effective emitter length transistor. It shows that we are on the low end of the curve and probably somewhat worse since the collector emitter voltage for the threshold transistor is about 3V versus the .8V the input transistor operates at.

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Threshold Deviations

Since the comparator thresholds are common to all channels an important consideration for the ASDBLR is the deviation of the threshold from the chip wide average. The most critical being the Tracking threshold. The input referred deviations (gain adjusted) from chip average are shown below.