October 26, 2011

Leo Greiner

DRAFT

# Response to BNL HFT PXL detector safety review requests

A safety review for the STAR HFT PXL detector was held at BNL on September 26, 2011. The minutes from the review indicated that there were some additional materials that the committee would like to see from the PXL detector subsystem. Specifically;

* **Provide a summary of the latch tests (Greiner/ Beavis Nov 1, 2011)**
* **The mass termination board is in a prototype stage, provide a schematic or potential changes for the final product. (Greiner / Beavis Dec 1, 2011)**

This document is intended to respond to these requested items.

## Summary of Latch-up tests

The basis of this inquiry was to evaluate the effectiveness of the latch-up protected power regulation circuit that was developed to power and protect the sensors in the event of a latch-up event. A schematic of this circuit may be found at <http://rnc.lbl.gov/hft/hardware/docs/latchup/LU_POWER_PCB.pdf>.

As can be expected, the PXL subsystem engineers are also very interested in the circuit performance. To this end, we have integrated the use of these latch-up protected power regulators in our latch-up testing program. This program was used to measure the latch-up (LU) and single event upset (SEU) onset Linear Energy Transfer (LET) level and cross-section. The measurements made using these LU protected regulator circuits were carried out at the LBNL 88” cyclotron BASE facility. These tests included testing of prototype and pre-production sensors as well as all of the components used on the sensor ladders and the Mass-termination Boards. A document giving a detailed description of the test plan and the components and equipment involved may be found at <http://rnc.lbl.gov/hft/hardware/docs/latchup/Latchup_plans_2010_(draft2).doc>. In this set of tests we used 10 dual channel PU protected power regulator modules of the design linked above to supply and interrupt power when a LU event was detected. This prevented over-current and probable destruction of the devices under test.

We did 2 beam runs at the BASE facility. The schematic of the boards used for this test may be found at <http://rnc.lbl.gov/hft/hardware/docs/latchup/LATCHUP_2010_schematic.pdf>. During these runs we counted and reset many thousands (~11k) of LU events using these regulator modules. None of the devices that were used in the testing experienced any damage from the induced LU events. From this we conclude that these LU regulator modules are working reliably and as designed. Some measured LU and SEU results may be seen at <http://rnc.lbl.gov/hft/hardware/docs/latchup/latchup_for_IPHC_LBL_phone_meeting.ppt>, <http://rnc.lbl.gov/hft/hardware/docs/latchup/Latchup_in_PXL_DRAFT.doc>.

## Mass Termination Board (MTB) changes

The current prototype MTB has been used successfully in testing of prototype sensor ladders showing that the existing functionality is mostly in place. We anticipate making a few design changes when moving to the preproduction version. The existing MTB schematic may be found here <http://rnc.lbl.gov/hft/hardware/docs/Phase1/PIXEL_RDO_MASS_TERM_V1.1.pdf>.

The anticipated changes include:

* The integration of the LU protected power supplies (schematic and description shown in the first section) onto this board.
* The addition of an additional LVDS buffer (FIN1108) to allow for the distribution of the sensor START signals.
* The output connectors will change from SAMTEC TOLC\_25x4 connectors to dual stacked VHDCI connectors.
* A change in the form factor to allow the boards to fit into the space allocated on the cart.

The schematic for the new board should be available within 1-2 months and we can provide it when it is complete.