

DØ Layer 0 Silicon Sensor Production Readiness Review

Response to Reviewers Recommendations

February 4, 2004

The Run II Layer 0 silicon group wishes to thank the review committee for their thorough review and their recommendations. The review and subsequent report have been beneficial to the group. Below we address each item brought forward in the report separately.

***Recommendation 1:** We believe it would be better to specify a desired value, possibly the largest one can hope for, and a modest band of allowed deviations referenced to the desired value.*

Response: We accept the recommendation by the committee and will revise our specifications. Based on our experience with the Run IIb Layer 1 sensors we anticipate a depletion voltage in the range of 140 V with a spread of 25 Volts. We will modify our specifications to read that the vendor is to specify a nominal sensor depletion voltage within the range of 120 to 240 V. All sensors must have a depletion voltage within +/- 30 volts of the nominal voltage.

***Recommendation 2:** A larger bias voltage should be accommodated by appropriate changes of the design of the bias voltage distribution system at an early stage, i.e. now!*

Response: Our radiation studies indicate that depletion voltages of 250 V are expected after a fluence of $4 \cdot 10^{13}$ 10 MeV protons per cm^2 , corresponding to an integrated luminosity of 9 pb^{-1} . A safety factor of 1.5 has been assumed in our calculations. We believe a safety factor of 50% to be adequate and we opt to retain our baseline design for 300 V operation. However, options will be explored to study the impact and feasibility to switch to operation allowing a detector bias in excess of 300 V.

***Recommendation 3:** The low signal to noise ratio for large angles of incidence and for high radiation dose is of some concern. We realize that sensible design choices were made and given the present six-fold azimuthal segmentation not much could be done. Nevertheless this low value underlines the need for radiation damage studies with all alacrity once the sensors are received.*

Response: Radiation tests of our silicon sensors are an integral part of our testing procedures and we plan on performing rigorous radiation testing on sensors and test structures.

Recommendation 4: *intermediate strip defects should indeed be included in the count towards defective strips- as was done in the case of the CDF sensors. What are the tests for these intermediate strips? A more comprehensive and detailed testing procedure should be developed.*

Response: We adopt the recommendation that defective intermediate strips be counted towards the overall defective strip count. As for developing a detailed testing procedure, we plan to incorporate the following testing into our QA program.

We will measure the capacitance between the DC pad of an intermediate strip and the DC pad of a neighboring readout strip. A break in the intermediate strip implant should show up as a low capacitance. We plan to explore the possibility of two different approaches:

- 1) Add a 5th stationary probe to touch the DC pad of an intermediate strip, during our normal scan. There is room for this probe in the current Stony Brook design of the matrix. Then the readout strip to intermediate strip capacitance could be measured for even pairs as part of the normal scan. This would only test half the intermediate strips. But only one extra touch of a DC pad on half the readout strips would be required to measure all intermediate strips.
- 2) Use the 4 existing stationary probes to measure the readout strip/intermediate strip capacitances of all strips in a separate scan, in addition to our normal scan.

We will also investigate the possibility of using a probe card, rather than needle probes to make the above measurements.

Recommendation 5: *the pitch adaptor design and its relationship to the sensors should be thoroughly reviewed before proceeding with sensor or pitch adaptor production.*

Response: We accept the recommendation of the committee and the pitch adapter will be included in the upcoming review of the hybrids and analogue cable. We will test some of the concepts with CDF pitch adapters which we have in hand. We expect to prototype the pitch adapters to determine bondability and appropriate thickness before the final order.

Recommendation 6: *Who approves the design of the sensors, and who approves the acceptance of the sensors. The approver (s) should be clearly identified.*

Response: The Level 3 managers for the sensors, R. McCarthy and M. Demarteau, approve the design and specifications of the sensors. Once they approve, they submit

their recommendation to the project manager, R. Lipton. Approval of the acceptance of the sensors also rests with the Level 3 managers.

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