

Date: 09/22/2023
To: Nance Ericson
From: Marcel Demarteau (ORNL)

Subject: Review of the Nab Electronics

The Nab experiment has successfully taken commissioning data before the long shutdown of the SNS, that started mid-August 2023. This highly successful run has revealed some issues with the detectors and readout electronics that need to be addressed if the experiment is to meet its intended precision. The time for corrective action, which potentially includes designing and producing new boards, is short, about nine months, before the SNS is starting up again. To address these issues we kindly ask you to chair a review of the Nab electronics on Thursday, October 26, 2023. The purpose of the review is to investigate the source of the issues and provide a set of specific, actionable recommendations that will ensure high efficiency of the detector and its data acquisition system to ensure that the experiment meets its targeted sensitivity before the startup of the SNS.

Specifically, the review committee is requested to address the following questions:

1. **Weaknesses of current detector system:** Identify the primary weaknesses of the system, with particular emphasis on:
 - a. Failure of the detector and electronics readout chain to report signals from individual pixels and recommend prevention, mitigation, and hardening strategies;
 - b. Detection system stability and resilience to oscillations: investigate at least grounding and noise as contributing factors. Recommend mitigating actions.
 - c. Investigation of the hypothesis of ice formation on the detector versus contamination and recommendation of a remediation strategy as is feasible at the time of the review.
2. **HV discharges:** Evaluate to the best extent possible the HV configuration to identify the origin of the discharges and strategies to protect the electronics.
3. **DAQ system:** Evaluate the full data acquisition system to ensure its robustness.
4. **Silicon detectors:**
 - a. Evaluate the mechanical robustness of the silicon detectors;
 - b. Evaluate calibration of electron energy and proton time-of-flight response.
 - c. Detector bias issues, depletion depth and charge collection across the detector: Propose a diagnostics and remediation measures
5. **Risks:** Summarize the risks identified in achieving the physics goals.

I would appreciate receiving a detailed set of prioritized recommendations in the form of a powerpoint presentation at the end of the review. If you have any questions, please contact Stefan Baeßler, experiment manager (434-243-1024) or Leah Broussard, on-site experiment manager (865-574-4497).