Database utility and SiPM leakage current studies for sPHENIX physics data-taking

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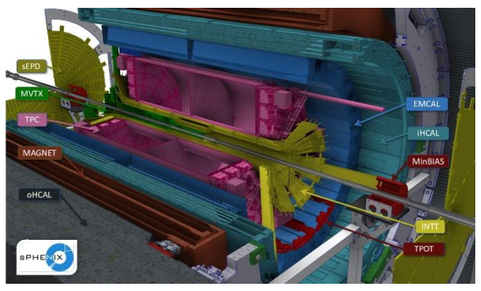
Abstract

The sPHENIX detector, at the Relativistic Heavy Ion Collider (RHIC), was designed to study hard probes of the quark-gluon plasma. To this end, sPHENIX handles data, in the hundred petabyte range, obtained from the collisions of high-energy nuclear matter annually. Storing, sorting, and processing this data is crucial to achieving the scientific goals of the sPHENIX program. We developed software, using databases in a number of ways, to track the conditions of the sPHENIX detectors sub-systems throughout the course of data-taking, and to provide a repository of physics-quality data for offline analysis. This poster presents the database tool we developed to maintain lists of good data runs for physics analysis. As one specific aspect of the detector conditions, we present our studies on SiPM leakage currents in the electromagnetic calorimeter to quantify the effect of radiation on the detector.

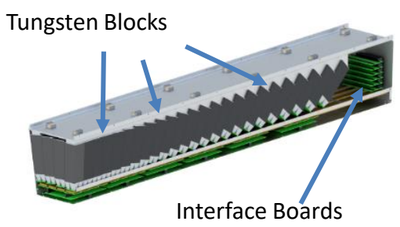
sPHENIX Electromagnetic Calorimeter Sector



EMCal consists of 64 sectors (32 azimuthal × 2 longitudinal)

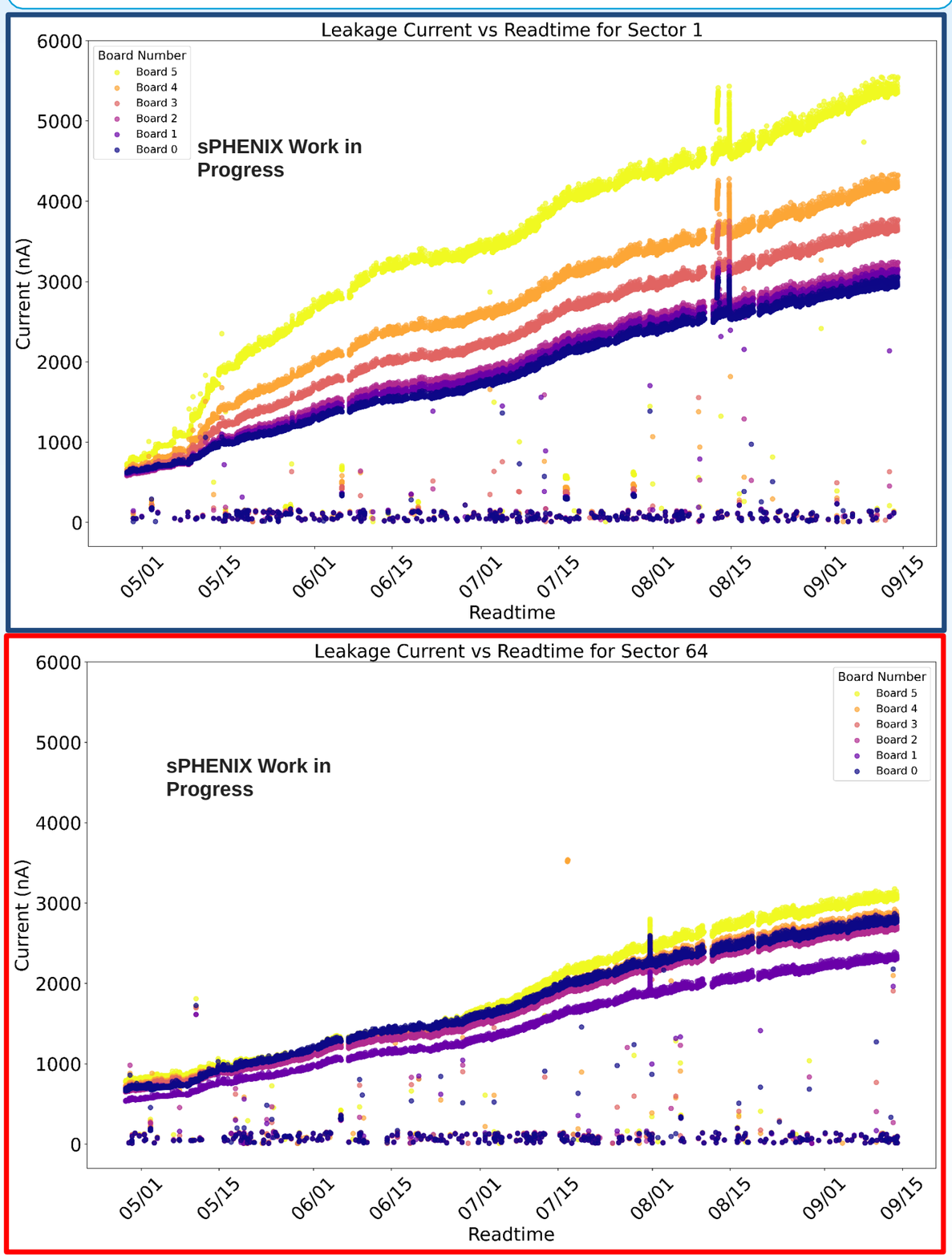
Each sector consists of 6 interface boards

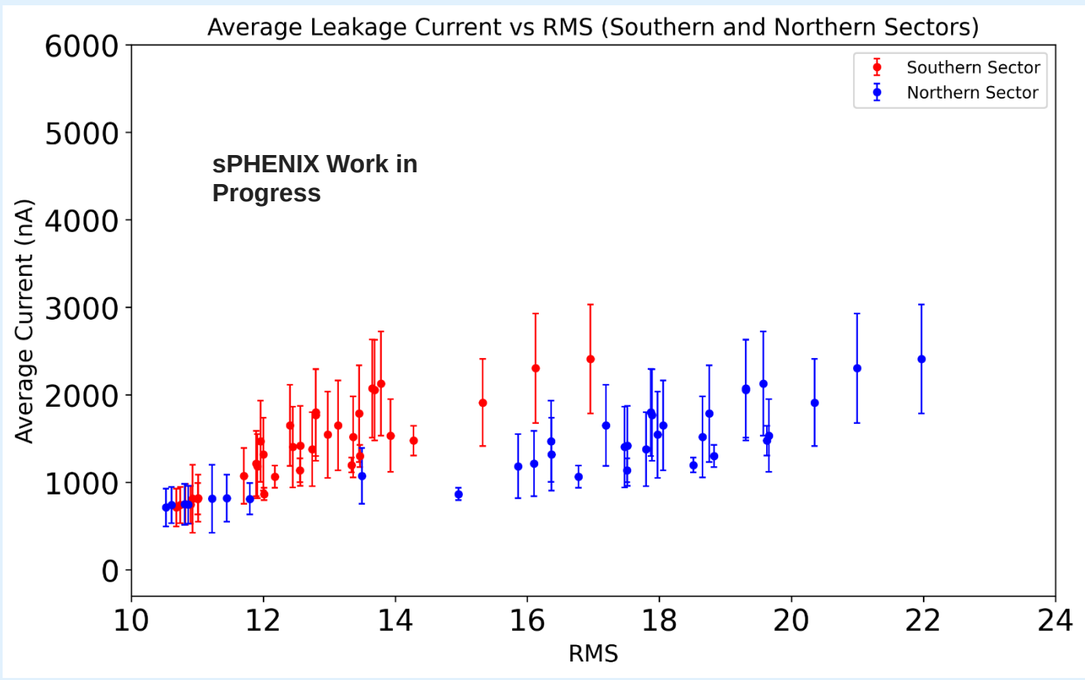
It is important to understand how radiation from collisions affects the SiPMs, interface boards, and sector electronics



EMCal SiPM Leakage Current vs. Time

Leakage current increases as a function of time, suggesting leakage current is commensurable to time under radiation damage. Increasing leakage currents lead to noisier measurements. Leakage current also shows strong board dependence for **northern** sectors (1-32) and **southern** sectors (33-64)





sPHENIX Run Triage System

A database management system was developed to assist in quickly communicating to collaborators not present at sPHENIX which collision-run data was best to use for calibrations and early analysis

- We create a custom composite data type called a triage data type consisting of two strings referring to the run class and run notes respectively
- A PostgreSQL database consisting of a table with columns corresponding to each sPHENIX subsystem is created with run number as a primary key and a triage type as the default element for each subsystem column
- The database is linked with scripts and programs to assist QA work
- Lastly, we construct a website atop the database and interfacing software for use by detector experts

EMCAL - Run Triage

EMCal OHCal IHCal MBD SEPD TPOT TPC INTT MVTX ZDC SPIN -HOMEPAGE-

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Run Number	emcal Notes	emcal_auto Notes
51175	GOLDEN QUESTIONABLE BAD GoodRun Update	GOLDEN QUESTIONABLE BAD GoodRun Update
51174	GOLDEN QUESTIONABLE BAD GoodRun Update	GOLDEN QUESTIONABLE BAD GoodRun Update
51173	GOLDEN QUESTIONABLE BAD GoodRun Update	GOLDEN QUESTIONABLE BAD GoodRun Update
51172	GOLDEN QUESTIONABLE BAD GoodRun Update	GOLDEN QUESTIONABLE BAD GoodRun Update
51171	GOLDEN QUESTIONABLE BAD GoodRun Update	GOLDEN QUESTIONABLE BAD GoodRun Update
51170	GOLDEN QUESTIONABLE BAD NotEnoughEventsBadTower: Update	GOLDEN QUESTIONABLE BAD NotEnoughEventsBadTower: Update

Conclusions

We developed a collision-run data management system to track the conditions of the sPHENIX sub-systems throughout data-taking. We also applied our database methods to study the evolution of the EMCal as a function of time under radiation exposure due to normal collision conditions. We found differences in leakage currents between the northern and southern sectors, likely due to asymmetric backgrounds. We also found leakage current dependence on interface boards. We aim to extend our studies to the HCal and investigate leakage current reliance on other factors such as beam luminosity.

Acknowledgments

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