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Spark protection system for sPHENIX TPC GEMs

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sPHENIX is a new detector experiment currently under commissioning at the Relativistic Heavy Ion Collider (RHIC) at Brookhaven National Lab (BNL). The Time Projection Chamber (TPC) uses stacks of 4 Gas Electron Multipliers (GEMs) as a gain stage in its 72 modules. Under certain conditions the high voltage across a GEM can cause an uncontrolled discharge. To study and mitigate the effects of sparks in the TPC GEMs, an online spark monitoring system was created. If the spark monitoring system detects a spark, voltages will be adjusted to allow the gas to settle and prevent further sparks. GEM modules use a capacitor between the bottom GEM and ground to remove charges which are collected on the bottom of the GEM. A resistor was placed between a capacitor and the ground, the voltage across this resistor is monitored for spark signals. Various resistor and capacitor values were tested to optimise this pick off. To get the signal into a form that can reliably be digitised, electronics were developed to take an absolute value of the signal and then integrate. This results in a mono-polar pulse with a length of a few microseconds. The spark monitoring system has 72 channels with 10MSPS ADC per channel, uses two thresholds, one for hardware trigger and one for triggering the system to lower the HV. Machine learning methods are used to understand the nature of the background and the sparks.

Early Career

No

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