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sPHENIX machine learning on FPGAs for event selection

The sPHENIX experiment is a next-generation collider detector at RHIC designed for rare jet and heavy flavor probes of the Quark-Gluon Plasma. With ever-increasing collision rates producing larger data volumes and the search for rarer physics processes, it is becoming apparent that autonomic decision making can play a key role in tagging physics events of interest to specific groups or filtering data streams to manageable levels. A demonstrator for separating events with a heavy flavor decay from background events was deployed in a test setup of the vertex detector in 2024. The sPHENIX precision tracking system was capable of recording up to 30% of the minimum-bias collisions at RHIC using streaming readout, a significant improvement over the 10% design specification, in addition to its 15 kHz hardware calorimeter trigger for rare high-pT events. This demonstrator uses machine-learning algorithms on FPGAs with an aim to sample a large fraction of the collisions, determine the event topology and send a decision to the data acquisition system to record events of interest. The design of the demonstrator and its use at sPHENIX will additionally be refined for deployment at the EIC for the tagging of heavy flavor decays and DIS-electrons.

Category

Experiment

Collaboration (if applicable)

sPHENIX Collaboration

Authors: BOSSI, Hannah (Massachusetts Inst. of Technology (US)); COLLABORATION, sPHENIX

Presenter: BOSSI, Hannah (Massachusetts Inst. of Technology (US))

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