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Coping with the Data Rates and Volumes of the PHENIX Experiment

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The PHENIX detector system at the Relativistic Heavy Ion Collider (RHIC) was one of the first experiments getting to “LHC-era” data rates in excess of 500 MB/s of compressed data in 2004. In step with new detectors and increasing event sizes and rates, the data logging capability has grown to about 1500MB/s since then.

We will explain the strategies we employ to cope with the data volumes in the online system and at the analysis stage. We will detail and discuss in the role of our data format, and the success of our concept of managed access to the DST data by way of “analysis taxis”.

We will outline the upgrades currently in progress and envisioned on our way to the “sPHENIX” project, expected to begin in 2015, and their impact on our current computing paradigms.

Summary

The PHENIX Experiment has started to exceed its originally designed data rates in 2004, when we switched to a compressed data format on disk and upgraded to a maximum data rate of 600 MB/s. This was made possible with a distributed compression system, which uses a large number of CPUs in the event builder to compress the data, rather than the logger machines. The switch, which has allowed us to run our Level-2 trigger is “tag-only”, rather than in filter mode, has given us access to physics signals which one can not normally trigger on due to the high multiplicity in heavy-ion collisions.

With the increased data rate, we had to implement a managed access to the data. Compared to a traditional staging model, we have achieved an throughput increase for the data analysis by an estimated factor 30.

We will explain the technologies involved in the DAQ and analysis procedures, and give an overview of the strategies we will use to maintain our event rate in spite of the increasing event sizes after a future upgrade.

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