Au + Au commissioning of RHIC-sPHENIX in Run2024

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sPHENIX at the BNL-RHIC facility is a cutting-edge detector substantially upgraded from the prior PHENIX, aiming at studying the properties of the quark-gluon plasma and spin structure of nucleons in further detail through measuring Au + Au and polarized $p + p$ collisions at a center-of-mass energy of 200 GeV per nucleon pair.[1)] sPHENIX started collecting data in Run2023 with the commissioning of the Au + Au experiment, which was aborted halfway through due to the RHIC Cryo issue. As such, another Au + Au commissioning was performed for 3 weeks in October 2024, after successfully finishing an experiment with polarized $p + p$ collisions.[2)]

The intermediate silicon tracker (INTT), which was mainly developed by RIKEN, has performed well in the Run2023 Au + Au commissioing,[3)] and the performance of INTT using the Run2024 Au + Au data are reported elsewhere in this progress report.[4–6)]

Most of the Run2024 Au + Au commissioning time was dedicated to investigating beam backgrounds at the most inner tracker (MVTX). Splash-like beam backgrounds continuously place tha status of many of the MVTX readout chips into halt and then recovery; no signal can be read out during that time. RHIC uses two beams, blue (clockwise) and yellow (counter-clockwise), and a collaborative study between the sPHENIX and RHIC teams determined that the MVTX beam backgrounds mostly originate from the yellow beam.

New devices for monitoring background counts around the beam pipe at sPHENIX interaction region are currently being installed and tested. Figure 1 illustrates the location of the new beam monitors, called inner and outer donut counters, which provide detailed beam background information for RHIC group to steer the beam to mitigate the background in the MVTX.

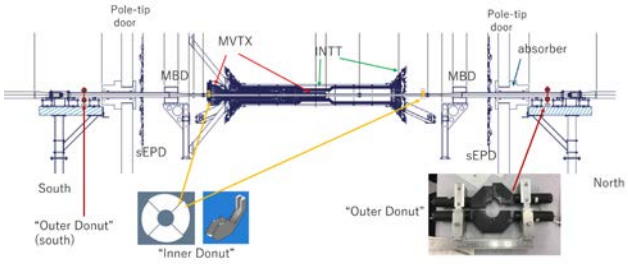

Fig. 1. Inner and outer donut counters that monitor background rate around the beam pipe.

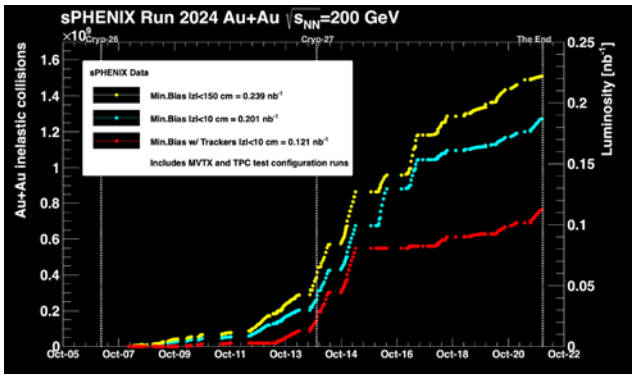

Fig. 2. Integrated luminosities of Au + Au collisions with different trigger conditions in Run2024 commissioning.

A total of 0.24 nb^{-1} minimum-biased data including INTT have been obtained during the Au + Au commissioning in Run2024 even with the limited beam time and the required MVTX beam background study. Approximately one-half of the data (0.12 nb^{-1}) contain all subsystems, such as the MVTX and TPC, as summarized in Fig. 2. The statistics enable the study of the performance of all the sPHENIX subsystems and provide some physics-related results. The Run2025 Au + Au experiment will start in spring 2025, aiming at ∼7 nb^{-1} minimum-biased collision data.

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References

1) I. Nakagawa *et al.*, RIKEN Accel. Prog. Rep. **57**, S1 (2024).
2) G. Nukazuka *et al.*, in this report.
3) G. Nukazuka *et al.*, RIKEN Accel. Prog. Rep. **57**, S39 (2024).
4) T. Kato *et al.*, in this report.
5) M. Fujiwara *et al.*, in this report.
6) N. Morimoto *et al.*, in this report.

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