Development of coordinate offset online calibration system at RHIC-PHENIX

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The PHENIX experiment in the Relativistic Heavy Ion Collider (RHIC) at Brookhaven National Laboratory has been upgraded by installing a silicon vertex tracker (VTX)[1]. The VTX has been developed for heavy-flavor (charm and bottom) measurements and is dedicated to precise tracking for finding primary and secondary vertices. The first set of physics data including the VTX was recorded for the Au+Au collisions in RUN 11 (RHIC experiment performed in 2011).

The first and second layers of the VTX are comprised of pixel detectors, and the third and the fourth layers of VTX are comprised of stripixel detectors[2], as shown in Fig. 1. Geometrical calibration is important because precise alignment is required in the VTX to identify primary and secondary vertices. To analyze the distance of closest approach (DCA) of tracks to the primary vertex, we require a drift chamber (DC) track is associated with the clusters on the VTX, as shown in Fig. 2.

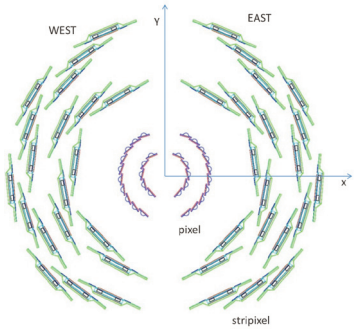

Fig. 1. Cross section of the VTX. The VTX is separated into a west half barrel and an east half barrel.

In the PHENIX apparatus, the west and east half barrels of VTX and DC in the east and west arms are mechanically separated, and their relative positions may shift. After each time we open up the apparatus to access the detectors, we need to calibrate the relative positions of the detectors. We developed an online and automated system to calibrate the coordinate offset between each of the west and east half barrels of VTX and DC in the east and west arms. Once we access the detectors, we always take zero-magnetic-field data in which all tracks from the collision point are assumed to be straight. The online calibration system calculates the beam center position with respect to DC west/east and VTX west/east coordinate system. Once the zero-field data are taken, the online calibration system runs immediately, and its result is submitted to a database. This result is used in the tracking analysis. This module outputs QA plots so that we can confirm that the result is reasonable.

In summary, we developed a coordinate offset online calibration system for RHIC-PHENIX. The system outputs calibration parameters of the coordinate offset of VTX and DC for the tracking analysis with VTX and DC data.

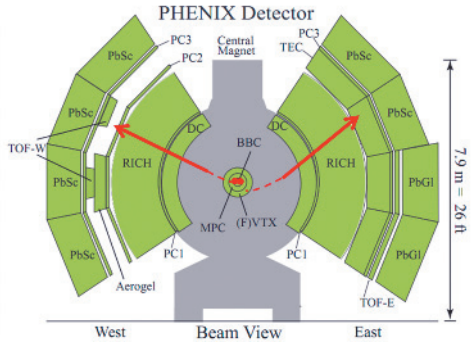

Fig. 2. Cross section of the PHENIX detector. The relative position of VTX west/east and DC west/east can be moved during the experiment.

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References

1) M Baker et al, Proposal for a Silicon Vertex Tracker (VTX) for PHENIX Experiment, 2004 BNL72204-2004, Physics Dept. BNL
2) A. Taketani et al., Nucl. Instr. and Meth. A 623 (2010) 374