Intermediate Silicon Strip Tracker for sPHENIX Experiment

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After 16 years of continuous operation, the PHENIX experiment completes its original mission and was decommissioned at the end of Run16. In combination with other RHIC experiments, results from PHENIX show that the quarks and gluons are liberated from protons and neutrons in nucleus forming Quark Gluon Plasma (QGP). These strong interactions make the plasma flow like a nearly “perfect” liquid. On the other hand, the understanding exactly how the QGP’s perfect fluidity and other collective properties emerge from its point-like constituent particles remains a compelling mystery.

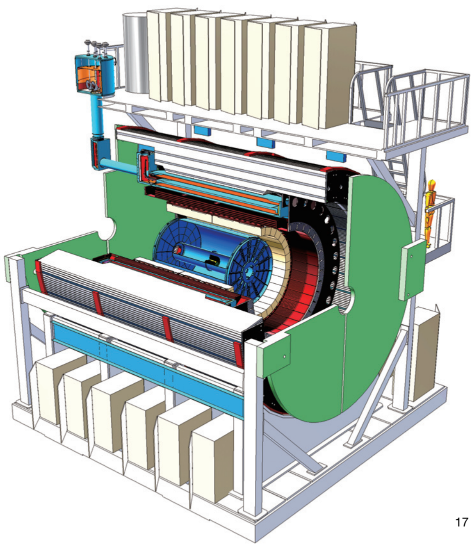

Fig. 1. Latest design of sPHENIX detector complex.

Alternative QGP studies in the large hadron collider experiments which launched a decade later than RHIC experiments indicated the direct observing potential of QGP using jets as a probe. To address remaining open questions of QGP[1)], a new scientific collaboration was formed to upgrade the PHENIX detector, i.e. building a brand new detector called super-PHENIX (sPHENIX)[2)] in the same experimental hall at RHIC after disassembling the PHENIX. The latest design of sPHENIX detector complex is shown in Fig. 1. This central arm detector is designed to cover the rapidity range of $|\eta| < 1.1$ with full azimuthal coverage.

The sPHENIX tracker reference design consists of MAPS (monolithic active pixel sensors) and a time projection chamber (TPC) for the inner- and outer-tracking system, respectively, with an intermediate silicon strip tracker (INTT). The momentum of a charged particle is primarily measured by TPC detector, whereas the inner most MAPS detector measures the decay vertex of heavy flavor mesons. The INTT interconnects the tracks between MAPS and TPC independently observed as illustrated in Fig. 2. The present time resolution of 4∼10 beam clocks prevents us from connecting track candidates between MAPS and TPC under the high multiplicity circumstances. The INTT is to be built by the well established technology, i.e. silicon strip sensors which gives better than 1 beam clock timing resolution.

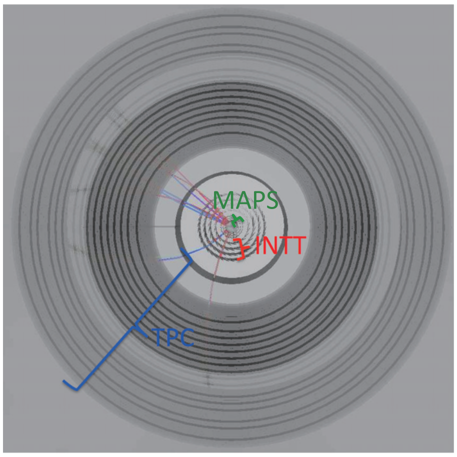

Fig. 2. Cross section of the sPHENIX tracking system.

The radius of the each detector layers are tabulated in the Table. The MAPS and INTT detectors consist of 3 and 4 layers, respectively. The TPC detector tracking volume runs about 58 cm to the radial direction.

Table 1. Radius of each detector layers.

Detector	layer	radius [cm]
MAPS	0	2.3
MAPS	1	3.1
MAPS	2	3.9
INTT	0	6
INTT	1	8
INTT	2	10
INTT	3	12
TPC	-	20∼78

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References
1) I. Nakagawa, Accelerator Progress Report vol.48 (2015).
2) sPHENIX pre-Conceptual Dsign Report (2015).