

# Commissioning status of the sPHENIX INTT with cosmic rays

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The intermediate silicon tracker (INTT) is one of the tracking detectors of the sPHENIX detector.<sup>1)</sup> INTT is a two-layer barrel strip tracker with a clamshell structure and is read out by eight FELIX servers covering different acceptances of INTT.<sup>2)</sup> INTT strips are 78  $\mu\text{m}$  in width and 20 or 16 mm in length, which result in measuring hit positions precisely in  $\phi$  angle and coarsely along the Z axis.

Following the completion of the detector construction in April 2023, sPHENIX started commissioning with beams and cosmic rays from May 2023. To confirm the performance of the INTT, observing cosmic rays is essential. The geometry of the INTT allows a cosmic ray to be detected up to seven times as it passes through. Straight tracks formed by INTT hits in a given clock tag can ensure that INTT servers are synchronized and the INTT can detect charged particles.

In this study, INTT operated without a magnetic field, and used the triggered readout mode for data collection. The trigger signal was given by a coincidence of the center region of the top and bottom of the outer hadronic calorimeter. In the analysis, clustering was performed to group hits in adjacent strips. The position of the cluster was calculated using the energy-weighted method. In addition, relative geometrical offsets between the two INTT clamshell halves were considered as surveyed, and the known hot channels were masked. To select single-track events, the number of clusters in one event was required to be less than eight, and tracking was performed by fitting all the combinations of cluster groups with linear functions in the X-Y and Z-radius planes. The INTT strip lengths were considered in the fitting procedure. The optimal combination of cluster groups with reduced  $\chi^2$  values of  $<5$  in both planes was considered as a track candidate.

A straight track observed using the INTT (Fig. 1) indicated that the INTT was in good condition. Moreover, the INTT is the first sPHENIX tracking detector that finds clear cosmic tracks. The INTT cosmic-track clusters served as the references for the cosmic-track search in other tracking detectors. Figure 2 illustrates a cosmic track observed using the sPHENIX tracking system. It ensures that the tracking detectors are functional and can operate together, drawing a huge milestone for the sPHENIX collaboration.

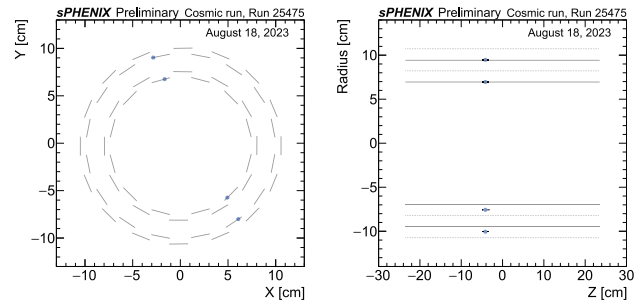


Fig. 1. Event display of one cosmic track in the X-Y (left) and Z-radius (right) planes observed by the INTT. The negative radius represents clusters with azimuthal angles  $\phi = [-\pi, 0]$ . The strip lengths of the INTT are indicated by the error bars in the right figure.

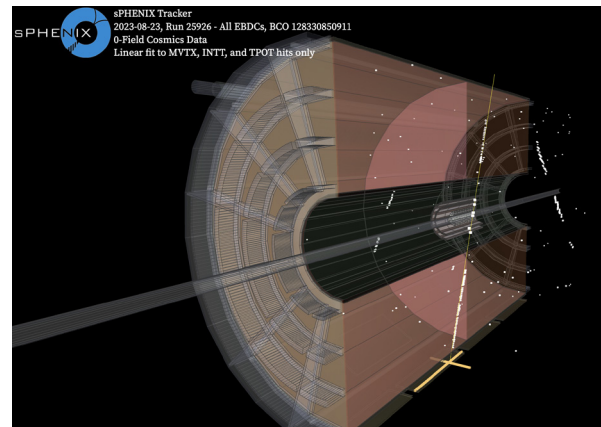


Fig. 2. Cosmic track observed using the sPHENIX tracking system.

## References

- 1) The sPHENIX Collaboration, sPHENIX Technical Design Report (2019).
- 2) S. Ryu on behalf of the ATLAS TDAQ Collaboration, J. Phys. Conf. Ser. **898**, 032057 (2017).

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