Commissioning of the intermediate silicon tracker in sPHENIX

G. Nukazuka,[*1] Y. Akiba,[*1] J. Bertaux,[*2] D. Cacace,[*3] R. G. Cecato,[*4] A. Enokizono,[*1] K. Fujiki,[*1,*5] M. Fujiwara,[*6] T. Hachiya,[*1,*6] S. Hasegawa,[*1,*7] M. Hata,[*6] B. Hong,[*8] J. Hwang,[*8] M. Ikemoto,[*6] R. Kan,[*6] M. Kano,[*6] T. Kato,[*1,*5] T. Kikuchi,[*1,*5] T. Kondo,[*9] C. M. Kuo,[*10] R. S. Lu,[*11] N. Morimoto,[*6] I. Nakagawa,[*1] R. Nouicer,[*3] R. Pisani,[*3] C. W. Shih,[*10] M. Shimomura,[*6] R. Shishikura,[*1,*5] M. Stojanovic,[*2] Y. Sugiyama,[*6] W. C. Tang,[*10] Y. Terasaka,[*6] H. Tsujibata,[*6] M. Watanabe,[*6] and X. Wei[*2]

The sPHENIX collaboration[1)] studies Quark-Gluon Plasma and Cold-QCD at the Relativistic Heavy Ion Collider (RHIC) at Brookhaven National Laboratory. There are four trackers in the sPHENIX detector: a MAPS-based Vertex Detector (MVTX), Intermediate Silicon Tracker (INTT), Time Projection Chamber (TPC), and TPC Outer Tracker (TPOT).

The INTT is a two-layer barrel detector using silicon strip sensors, covering full azimuth angles and pseudo-rapidity within ±1.1. The barrel was constructed using 56 ladders equipped with silicon sensors with a sensitive area of approximately 40 cm × 2 cm. The strips are 78 µm × 320 µm × 16 mm or 20 mm in size, and a single FPHX chip[2)] reads 128 strips. The INTT is located between the MVTX and TPC, and is responsible for hit position and timing measurements for tracking. The detector was installed in March 2023, and the construction of the sPHENIX detector was completed in April 2023. The commissioning started in May and was conducted with Au-Au collisions with center-of-mass energy $\sqrt{s} = 200$ GeV triggered by a Minimum Bias Detector (MBD) located at the forward region. In order to measure particles in the collisions, the timing

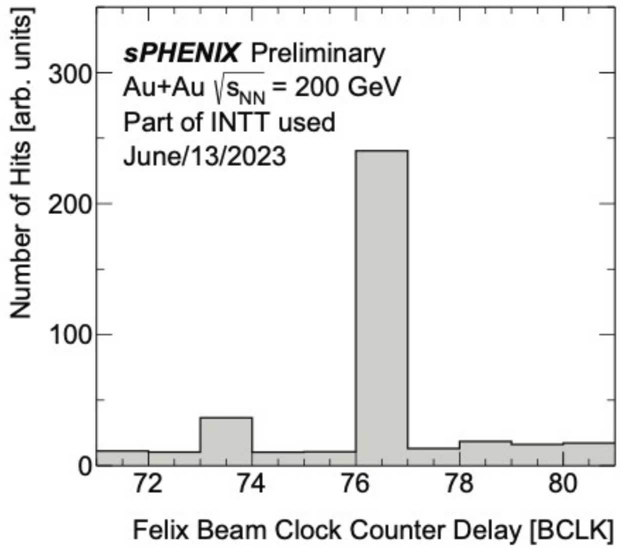
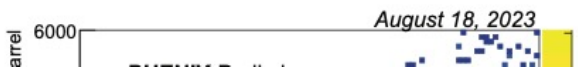


Fig. 1. Number of hits on the INTT barrel as a function of a delay parameter in the system.



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The sPHENIX experiment at RHIC and the INTT silicon detector

Y. Akiba,[*1] A. Enokizono,[*1] T. Kondo,[*2] C. M. Kuo,[*3] T. Hachiya,[*4] S. Hasegawa,[*5] B. Hong,[*6] R. S. Lu,[*7] I. Nakagawa,[*1,*8] R. Nouicer,[*9] G. Nukazuka,[*1] M. Shimomura,[*4] and X. Wei[*10]

The sPHENIX experiment is a new experiment and its new detector of Relativistic Heavy Ion Collider (RHIC). The construction of the sPHENIX detector was completed by April of 2023 and its new detector subsystems were commissioned using $\sqrt{s_{NN}}$ = 200 GeV Au + Au collision. The Japanese group of sPHENIX led by RIKEN is responsible for the construction and operation of a silicon tracker (INTT), which is one of three tracking detectors of the sPHENIX detector complex. The INTT detector successfully demonstrated its design performance from the commissioning data. The sPHENIX experiment will start taking physics data of polarized proton + proton and Au + Au collision data at $\sqrt{s_{NN}}$ = 200 GeV in 2024.

perature of the QGP

(3) Measurement of jet substructure and the study of parton–QGP interaction

(4) Study of the spin structure of the proton

High-energy partons (quarks or gluons) lose their energy as they pass through the QGP. The energetic partons then break up into a jet of many energetic hadrons concentrated in a narrow angular region. Therefore, measurements of hadron jets are very useful for elucidating the energy loss of partons in the QGP. The interaction of partons with the QGP medium can also be studied based on the measurement of jet substructures. For these purposes, the sPHENIX detector is designed to measure hadron jets, high transverse momentum (p_T) hadrons, and high-energy photons over