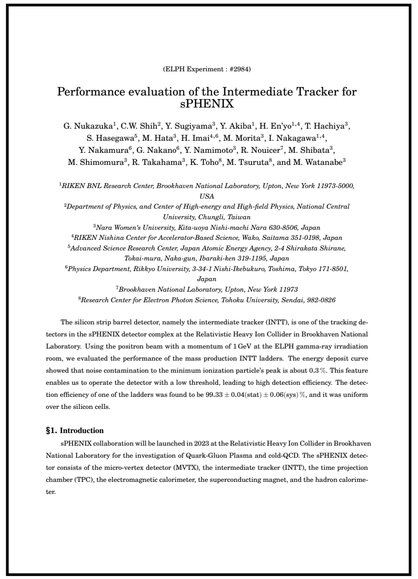
ELPH annual report: submitted on Jan/10

Our manuscript was successfully submitted 🎉 to ELPH on Jan/10, as announced by e-mail.

The manuscript and figures are in the sPHENIX wiki.



(ELPH Experiment : #2984)

Performance evaluation of the Intermediate Tracker for sPHENIX

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The silicon strip barrel detector, namely the intermediate tracker (INTT), is one of the tracking detectors in the sPHENIX detector complex at the Relativistic Heavy Ion Collider in Brookhaven National Laboratory. Using the positron beam with a momentum of 1 GeV at the ELPH gamma-ray irradiation room, we evaluated the performance of the mass production INTT ladders. The energy deposit curve showed that noise contamination to the minimum ionization particle's peak is about 0.3 %. This feature enables us to operate the detector with a low threshold, leading to high detection efficiency. The detection efficiency of one of the ladders was found to be 99.33 ± 0.04(stat) ± 0.06(sys) %, and it was uniform over the silicon cells.

§1. Introduction

sPHENIX collaboration will be launched in 2023 at the Relativistic Heavy Ion Collider in Brookhaven National Laboratory for the investigation of Quark-Gluon Plasma and cold-QCD. The sPHENIX detector consists of the micro-vertex detector (MVTX), the intermediate tracker (INTT), the time projection chamber (TPC), the electromagnetic calorimeter, the superconducting magnet, and the hadron calorimeter.

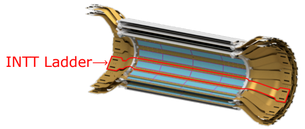

Fig.1. A half part of the INTT barrel. The inner and the outer barrels consist of 24 and 32 INTT ladders, respectively. The red box indicates an INTT ladder.

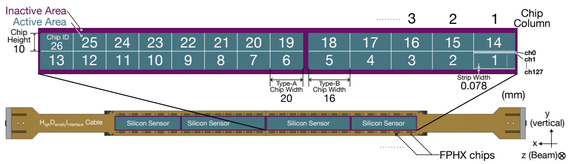

Fig.2. The INTT ladder consists of two types of silicon sensors, FPHX chips, High-Density Interconnect cable, and CFC stave. The sensors are divided into 10 or 16 cells. The silicon cells have 128 strips with 78 µm width and 320 µm thickness. The x-, y-, and z-axes in the test beam experiment are also shown.

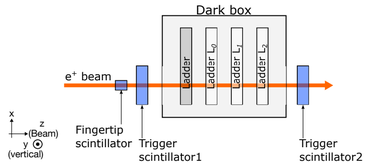

Fig.3. The setup for the test beam experiment at ELPH. The dark box, which contained the INTT ladders inside, was installed on the positron beam line. Two trigger scintillators and a fingertip scintillator were set upstream and downstream of the dark box. The x-, y-, and z-axes are also shown.

Introduction, etc. by Genki

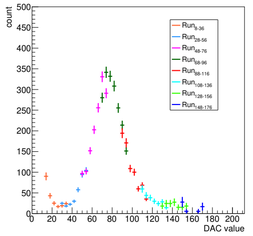

Fig.4. The ADC distribution of the eight runs after normalization. The legend indicates the scanning region of the runs.

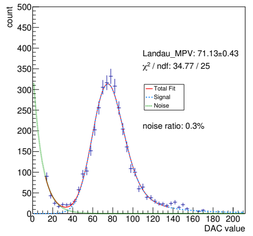

Fig.5. The energy deposit curve as a function of DAC value. Fitting to the distribution with the sum (red) of a Landau-Gaussian convolution function (dotted blue) and an exponential function (dashed green) is also shown.

DAC scan by Yuka

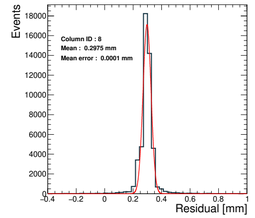

Fig.6. The residual distribution of column eight in ladder L1 before alignment correction.

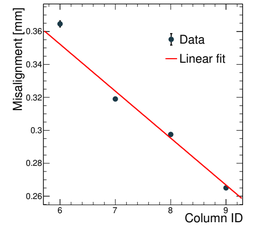

Fig.7. The amount of misalignment correction as a function of column ID. The error bars indicate the mean errors.

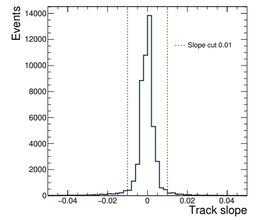

Fig.8. The slope distribution of track candidates. Tracks within slope ±0.01 were used in the analysis.

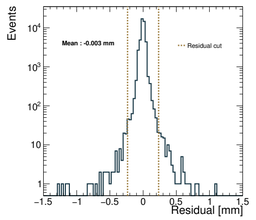

Fig.9. The residual distribution of column 8 in ladder L1.

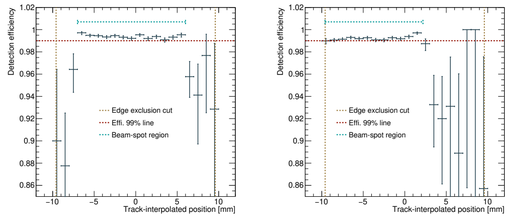

Fig.10. The detection efficiency as a function of the track position. (Left) The beam spot is in the middle. (Right) The beam spot aligns with the edge. The error bars indicate the statistic uncertainties.

Detection efficiency by Cheng-Wei

Thank you for your help!