

## Performance evaluation for sPHENIX-INTT ladder with a beta source

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The INTermediate Tracker (INTT) is one of the three tracking detectors for the sPHENIX experiment which will be started in 2023 at the Relativistic Heavy Ion Collider in Brookhaven National Laboratory (BNL). It comprises 56 ladders, and each is composed of two silicon strip sensor modules. One module is divided into 26 cells, and each cell contains 128 readout strips. One readout chip reads the signals from one cell, 128 strips. The quality of all ladders need to be evaluated to be ready for detector construction scheduled for Spring 2022. Dead strips are one of the critical parameters. We developed the test procedure using a beta ray source <sup>90</sup>Sr to check for dead strips in a reasonable time scale.

All the strips need to be exposed by beta ray to locate the dead strips. For that purpose, we developed the source test fixture shown in Fig. 1. In the fixture, an INTT ladder was placed with the sensor side down. The source was placed on a movable stage in the fixture and moved from left to right during the measurement. Its moving speed and movable range are adjustable.

Using the fixture, we measured hit counts in each strip, both with and without the source. The hit

counts without the source provide background hits. In these measurements, the trigger was provided by the sensor module and it is called “self-trigger mode.” Figure 2 depicts the hit counts, the red (light blue) histogram corresponds to that with (without) the source. In these measurements, one can distinguish the hit by the source from the background even though the background is also visible since data was acquired by the self-trigger with relatively low hit threshold. The hit counts are statistically subtracted and shown as the blue histogram in Fig. 2 to show the signal. If the difference is consistent with zero, the strip can be regarded as “dead strip.” Accordingly measured the dead strips for a ladder in September 2021 and found no dead strips. The result is better than the requirement of less than 1% dead strips rate in a ladder.

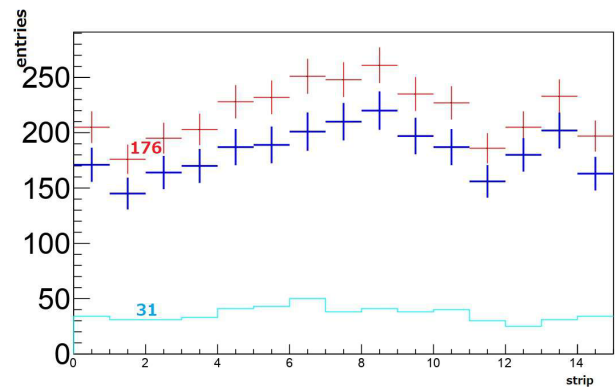


Fig. 2. Number of hit distributions with and without the beta ray source (red or light blue) and their differences (blue).

The measurements took eight hours for one sensor module, therefore an INTT ladder needs 16 h two modules, approximately one day. It is planned that 80 and 40 ladders will be produced at BNL and National Taiwan University, respectively. Therefore, we can complete the quality evaluation within 80 days at most for all ladders evaluation.

In summary, we developed a procedure to evaluate the dead strips using a beta source. The ladder production is in progress and the evaluation with this procedure will commence soon.

### Reference

- 1) I. Nakagawa *et al.*, in this report.

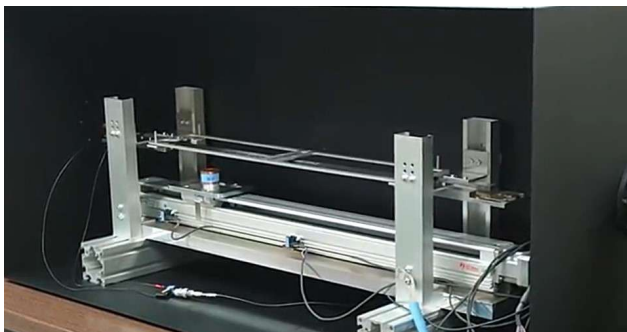


Fig. 1. Source test fixture.

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