

Development of the intermediate silicon tracker for sPHENIX experiment at RHIC

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The development of the next generation experiment, called sPHENIX,¹⁾ at RHIC has been firmly proceeded and have passed the critical decision 1 and 3a approval in August 2018. The R&D of the intermediate silicon tracker for sPHENIX is almost in the final stage of the development. The silicon strip sensor design and the high density interconnect (HDI)²⁾ had been finalized by the 2nd generation prototyping in early 2018. The 3 layers of INTT telescope ladder modules based on these 2nd generation prototypes were assembled for the beam test at Fermi Laboratory. Shown in the Fig. 1 is the telescope array used for the beam test in March 2018.

The resulting spectra of the 120 GeV primary proton beam measured by a corresponding cell of each ladder layer are shown in Fig. 2. The observed position and the width of the Gaussian shapes are well consistent between the three layers and matches with the expected beam profile which is also measured by the beam profile monitor originally implemented at the test beam facility of Fermi Lab. The noise performance was also quite satisfactory.

The next round beam tests is scheduled in May, 2019 with a full readout chain including a 1.2 meter bus extender^{3,4)} and the air cooling stave support structure, which were substituted by temporary solutions in the last beam test because they were still in the middle of development stages and not ready for the beam test. The stave (Fig. 3 is the support structure of the INTT module which consisted of silicon sensors and HDI as

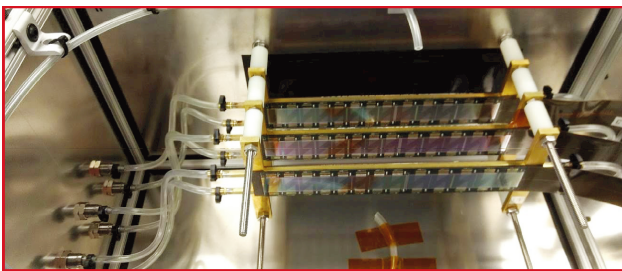


Fig. 1. The telescope of the INTT half ladder detectors assembled for the beam test at Fermi Lab.

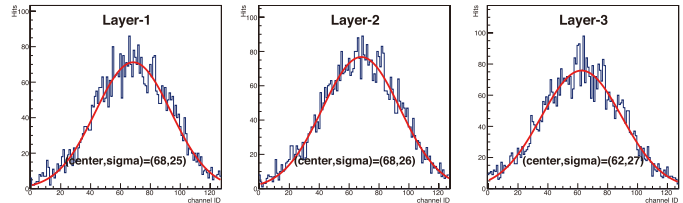


Fig. 2. The telescope of the INTT half ladder detectors assembled for the beam test at Fermi Lab.



Fig. 3. The auto-CAD drawing of the stave support structure with the air cooling tubes.

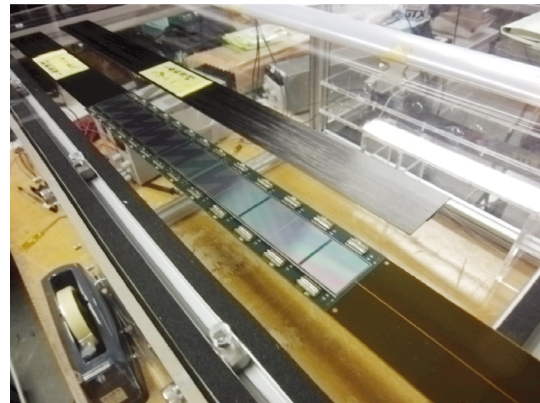


Fig. 4. The HDI module mounted on the prototype stave.

shown in the Fig. 4. It requires not only the stiffness, but also high thermal conductivity in order to remove heat generated from the read out chips mounted on the HDI. The stave is made of a carbon fiber reinforced plastic (CFRP) and its prototyping has been in progress both in Asuka Co. in Japan and Lawrence Berkley National Laboratory in parallel. As well as the measurement of thermal conductivity performance of the prototype staves, the stiffness is also tested before the finalization.

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