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Precise Tracking of Cosmic Muons Using Time-over-Threshold Property of NINO ASICs

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Muon Scattering Tomography (MST) requires tracking detectors with fairly good spatial resolution in order to identify the material contents of the target object from its reconstructed image. A prototype MST set up is being fabricated at SINP using RPC as the muon trackers. Six Bakelite RPCs have been fabricated with pick-up panels equipped with copper strips of width 1 cm to populate the setup. NINO ASIC [1] has been opted for the front-end pre-amplification and discrimination of the RPC signal. A sample detector has been placed in a vertical cosmic-ray hodoscope of three plastic scintillators with an overlap that matches the strip width of the pick-up panel. The signal waveforms from the triggered strip along with three strips from both sides have been saved for analysis using a Tektronix MSO 4104-b oscilloscope. From the waveform, the widths of signals are measured. In the avalanche mode, the mean width of the signals obtained from the central strip was found to be 25 ns, whereas in streamer mode, it was found to be 60ns. The same technique is to be used for a pick-up panel with thinner strips (width ~ 1mm) in coincidence with more precise tracking detectors like GEM (resolution ~ 200 um). To take care of increment in the number of strips an Altera MAX-10 based developer board is being used instead of the oscilloscope. Exploiting the time-over-threshold property of NINO, the charge profile of the signal on the pick-up strips is obtained. The spatial resolution of the RPC will be estimated by comparing the center of the charge profile to the estimated hit as obtained from the track reconstructed using the GEM detectors.

Reference:
F. Anghinolfi, et.al, Nuclear Instruments and Methods in Physics Research A 533 (2004) 183–187.

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