Status of the n-XYTER readout for the HADES Pion-Beam Tracker*

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The n-XYTER chip is currently being employed to develop a fast read-out of the pion beam tracker (CERBEROS – **Cen**ral **Be**am T**r**acker for Pi**o**n**s**) for the HADES experiment. Indeed this self-triggering system should enable the on-line tracking of each particle in pion secondary beams at SIS18.

In order to perform exclusive measurements with the HADES spectrometer and a pion beam, due to the large momentum spread (≈ 8 %) of the secondary particle, fast tracking detectors along the pion chicane are necessary to measure on-line the beam momentum.

Differently to past approaches [1] based on scintillator detectors, in CERBEROS two large-area silicon detectors are employed to measure the pion momentum and and pion impact angle on target.

The detector system that has been developed so far, has been first tested in the laboratory with radioactive sources and then with deutron and Ni beams at 1.9 and 1.7 GeV kinetic energy respectively at GSI in November 2012. Two Pb targets corresponding to an interaction probability of 2% and 10% respectively were used. The primary beam intensity was varied between 10^6 and $3 \cdot 10^7$ part./s. This corresponds to a reaction rate of 10^2 and $5 \cdot 10^5$ part./s (dependently on projectile kind) on the scintillator detectors placed in front of the CERBEROS system, that have been used as triggers.

Fig. 1 presents the experimental setup consisted of two double sided silicon detectors of 10×10 cm^2 dimension and 128 channels on each side, readout by n-XYTER modules connected to SysCore readout boards. The trigger was provided by two scintillators placed one in front and the other after the silicons. Coincidence of both or each separately can be used as a trigger source.

Detectors have been located around 10 m upstream the target and 30 cm from the beam axis to avoid direct heavy fragments hits. The distance between the detectors was 7 cm.

* Supported by VH-NG-330 and TMFABI1012

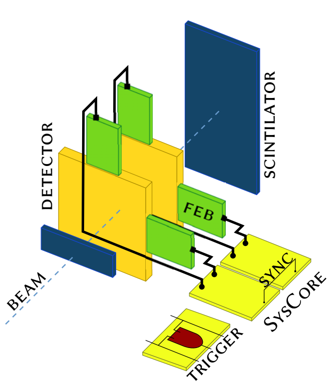

Figure 1: Experimental setup based on CBM readout.

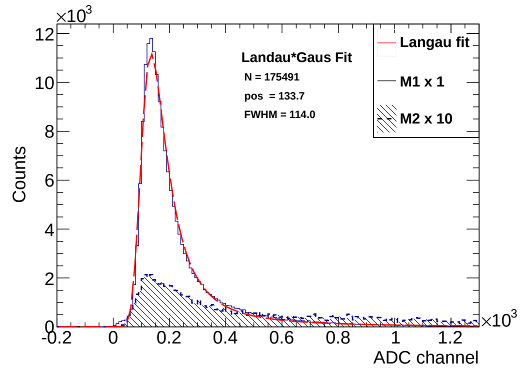

Figure 2: ADC spectrum of MIP signal (M1). Fitted is convolution of Gauss and Landau distribution to describe properly energy deposition in silicon.

Our goal was to the performance of the tracking system under realistic beam conditions, electronics stability and possibility of internal n-XYTER MIPs triggering.

Fig. 2 shows the ADC spectrum of measured signals after pedestal suppression and cluster reconstruction, integrated over all channels of one n-XYTER. The dominating part of the spectrum (M1) belongs to events with only one fired strip which corresponds to pure MIP signals without charge sharing. The average signal to background ratio obtained with a deuteron beam of 300 Hz intensity is ≈ 14 while the measured detector efficiency is higher than 95%.

We proved that with proper shielding of the detector and electronics together with careful settings of internal n-XYTER threshold it is possible to separate the MIP signal from the noise. The detector efficiency measured with the beam is consistent with laboratory tests. We are currently preparing the TRB3-based native HADES readout which will allow us to test the n-XYTER performance for high rate beams. The maximal data rate of n-XYTER is 32 MHz and average rate per channel is 160 kHz with 10% deadtime which will allow to cope with the maximal rate of 10^8 particle/sec expected along the pion chicane in the region close to the production target.

References

[1] J. Dıaz et al. Design and commissioning of the GSI pion beam *Nuclear Instruments and Methods in Physics Research Section A: Accelerators, Spectrometers, Detectors and Associated Equipment, 478(3):511–526, 2002*