Development of a High Rate Tracker for secondary Pion Beams*

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Field of application

After the successful upgrade of HADES and a planned extension with an electromagnetic calorimeter the set-up will be ready for data taking of pion induced reactions. A further important detector for the pion beam run is a beam tracking system called CERBEROS (**Ce**nt**r**al **Be**am T**r**acker for Pi**o**n**s**), installed 15m in front of HADES. This detector system will be necessary to determine the momentum of the secondary produced pions. It will consist of two silicon detectors placed at the dispersive plane of the two quadrupole magnets that follow the pion production target. For an exhaustive description see [1] and Fig. 1.

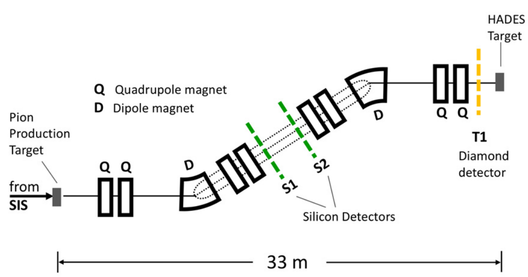

Figure 1: Beam line for the secondary Pion Beam

Silicon Detector

For the pion beam detection two double-sided silicon detectors with a thickness of 300μm and 2x128 channels will be installed inside the beam line. The large momentum spread of the pion beam ($\frac{\Delta p}{p}$ ≈10%) translates into a large position deviation at the dispersive plane where the two silicons are placed. As our aim is to cover the accepted momentum space completely the detectors have a large active area of 10x10 cm. Furthermore the detectors have to cope with large particle intensities up to 10 p/sec. This requires a rather high radiation hardness. The silicon detectors, delivered for this purpose by Micron Semiconductor, have already been tested in our lab (with α-particles) and the energy resolution is below 1%.

Readout

An n-XYTER-exploder [2] based readout, planned as front-end electronic for the silicon detectors, will be integrated into the HADES DAQ system. The readout was tested in a 3 GeV proton beam at the COSY facility in the FZ-Jülich. In this test the n-XYTERs [3] were connected to a smaller silicon detector (34.5x34.5 mm and 500μm thick). The p and n-side of the two detectors were read out each by one n-XYTER mounted on a FE-board. Between the detectors a 18x18 mm sized scintillator (2) was placed for triggering and another one (scintillator 1) was installed in front of the setup. The detector in front of the scintillator was read out by a SysCore-card and the one behind by an eXploder-card, see Fig. 2. A qualitative prove of the working principle is visible in Fig. 3. Here events which were time correlated with the scintillator 2 signal are shown as x-y hit distribution of the silicon detector which was read out by the eXploder setup. The shadow of the smaller scintillator is clearly visible. The analysis of the ADC spectra and the quantitative comparison with the data collected by the SysCore board is still ongoing.

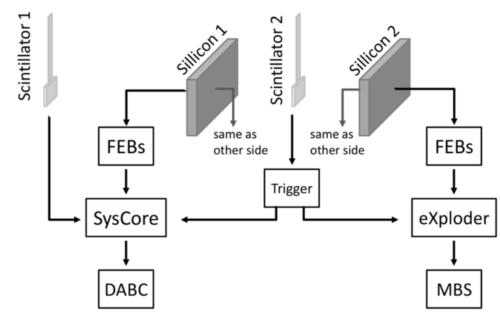

Figure 2: Read out scheme for the silicon detectors

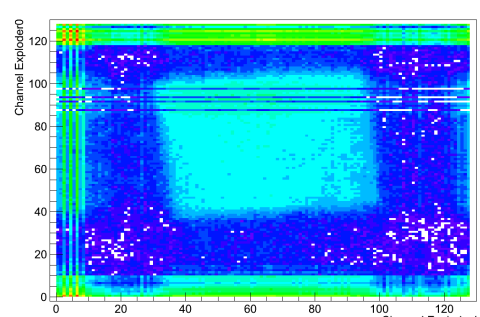

Figure 3: Hit distribution of trigger correlated events

* Work supported by F&E Project:TMFABI1012

References

[1] Daz, J. et al., Nucl. Instr. and Meth. A 478 (2002).
[2] P. Koczoń, GSI Jahresbericht (2011).
[3] A. Brogna et al. Nuc. Instr. and Meth. A 568 (2006).