

Performance of the PANDA barrel DIRC prototype in a pion beam at GSI*

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The PANDA[1] detector at FAIR will measure the decay products of antiproton-proton annihilations in the energy domain of charmed quark production. A Barrel DIRC counter, inspired by the successful BaBar DIRC [2], will perform charged particle identification (PID) in a polar angle range between 22° and 140° . Several test experiments with beams at GSI, CERN, and MAMI-C have been performed to evaluate a series of increasingly complex Barrel DIRC prototypes.

In the summer of 2014 a pion beam at GSI was shared with the HADES experiment during several beam times. Pions with a momentum of 1.7 GeV/c were produced by a primary 2 AGeV N-beam from the heavy ion synchrotron SIS18 and transported to Cave-C with the help of the beam transport calculation MIRKO [3]. A scintillating trigger counter with 5 cm diameter selected about 1000 pions/s.

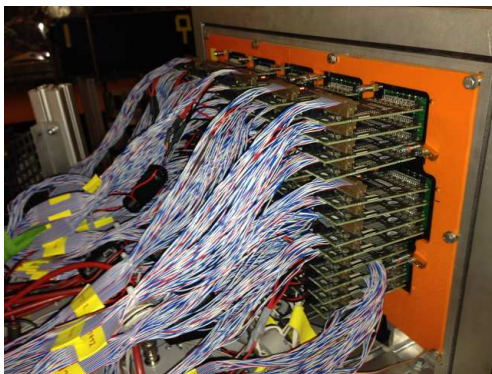


Figure 1: The array of 15 PHOTONIS PLANACON MCP-PMTs and 60 PADIWA3 discriminator boards with the cables towards the TRB3 TDCs.

The beam hits the radiator plate ($17 \text{ mm} \times 160 \text{ mm} \times 1250 \text{ mm}$), coupled to a 30 cm-deep expansion prism, both made from synthetic fused silica. The produced Cherenkov cone is reflected within the plate by total internal reflection. Due to high-quality optical surfaces the opening angle of the cone is preserved. The expansion prism converts the directions of the photons at the radiator end into position information on the detection plane, which is equipped with a 3×5 array of XP85012 [4] Microchannel-Plate PMTs (MCP-PMTs). A total of 960 pixels were read out by 60 PADIWA3 discriminator cards, shown in Fig. 1. The photon time of arrival and the time-over-threshold were mea-

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sured by TDCs on a total of 24 trigger and readout boards (TRB3) [5]. An example for the observed Cherenkov images is shown in Fig. 2. The top three rows show the prediction from simulation, which agrees well with the experimentally observed pattern, shown in the bottom three rows.

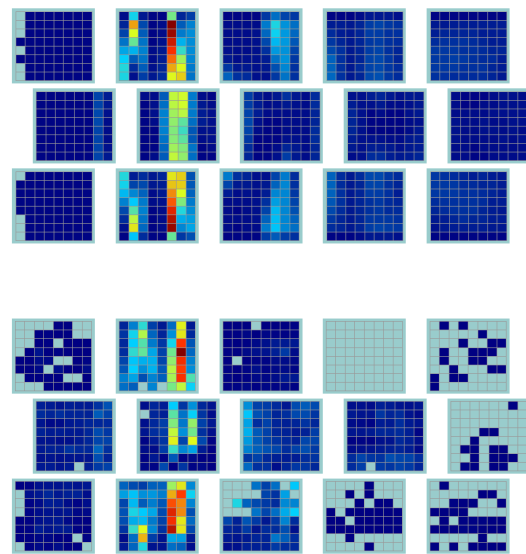


Figure 2: Top: Simulated Cherenkov image measured with 3×5 pixelised MCP-PMTs. Bottom: The measured image. The particle track hits the radiator plate with an angle of 120° degree.

More detailed studies, in particular of the wide radiator plates in combination with focusing optics, and direct measurements of the PID performance, are scheduled for the summer of 2015 during two test beam campaigns at CERN. The results will form the basis for the Technical Design Report, expected to be completed by mid-2016.

References

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