Applications of the TRB3 and Associated Front End Electronics in Recent Beam Times*

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The TRB3 platform [1] with its associated Front-End-Electronics has been proven in the recent years to be very useful for many applications and has been successfully used by several experiments/groups in 2014.

The HADES collaboration performed a pion test beam experiment in May 2014 and two production pion beam runs in July and August/September 2014, where the TRB3 was used by several detector systems. The HADES pion tracker (see [2]) located in the NE5 area in front of the HADES experiment was used to determine the momentum of each pion. The FEE, based on the n-XYTER ASIC, was read out by the TRB3 and seamlessly integrated in the HADES DAQ, where the TRB3 had a pure digital task.

The pion hodoscope used the Padiwa-AMPS FEE board together with the TRB3 (see [3]) for precise TDC and QDC measurements. The diamond start detector employed the TRB3 for the precise T0 time determination.

The CBM-TOF collaboration used a large setup of 7 TRB3 boards together with 14 TOF-FEE (detector specific strip-down of the TRB3) modules to perform RPC-detector test beam times in April and October 2014. The PADI-FEE delivered the LVDS signals to the TRB3 based system for digitisation. The desired time precision as well as the required DAQ-event rates have been reached during the second beam time.

The PANDA-Barrel-DIRC group set up a system of 20 MCP-PMTs (each 64-channel) with PADIWAs as FEE and 24 TRB3s for test beams in April and July/September 2014 to test the DIRC optics in beam together with the readout electronics.

The CBM-RICH group set up a RICH-detector prototype at CERN with 16 64-channel MA-PMTs with a Padiwa + TRB3 (18 were used) based readout. An online display of the RICH rings is shown in fig. 1. Preliminary analysis results show good efficiency for RICH rings.

Additional to these experiments and test beams the TRB3 has been used in other production experiments like the DIRC-Detector in the WASA experiment in Jülich.

Furthermore, a larger number of test setups of various groups exists, who used the TRB3 platform in 2014 to read out their detectors and plan to use the TRB3 in their final setups. Just to have some of these groups mentioned: PANDA STT, CBM-MVD, HADES-ECAL, MUSE collaboration, A1 Neutron detector, Coimbra-PET, Cracow-PET,

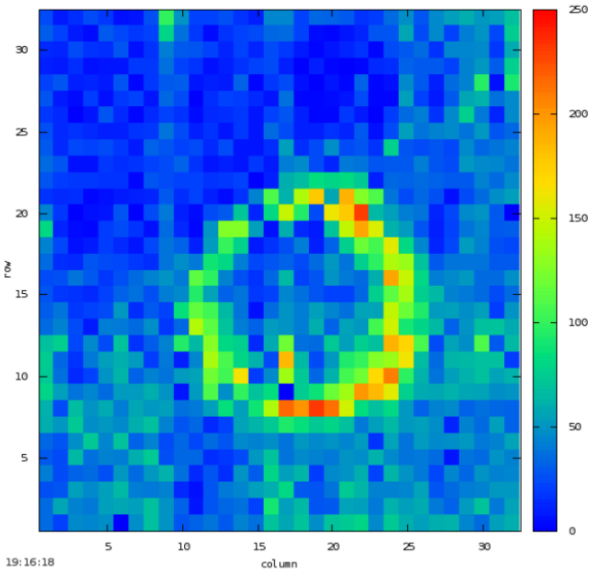

Figure 1: Online heat map of hits measured in the the array of 1024 MA-PMT channels of the CBM-RICH detector. The ring is visible during spills from the SPS beam.

etc.

All these experiences, together with the users, improved the platform substantially. The lessons learned jointly with new developments on the TDC side (see [4] will also lead to developments like a crate based TRB3 system "TRB3SC" and the joint effort for an optimized FEE+TDC+DAQ electronics "DIRICH" for PANDA-DIRC, CBM-RICH and HADES-RICH.

References

[1] All information about the TRB3 can be found here: http://trb.gsi.de

[2] L. Fabbietti et al., "Integration of the Pion-Beam Tracker into the HADES DAQ", GSI-SR2013-NQM-HADES-10, GSI Scientific Report 2013

[3] M. Traxler et al., "A Precise Multi-Channel QDC FEE utilizing FPGAs as Discriminators and Delay Elements Based on the TRB3 as TDC and Readout Platform", GSI-SR2013-NQM-HADES-13, GSI Scientific Report 2013

[4] C. Ugur et al., "FPGA Based Multi-Channel TDC Development", GSI Scientific Report 2014

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