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Performance of the DAQ system of the PANDA Micro-Vertex Detector

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The data acquisition system of the Micro-Vertex Detector in the PANDA experiment, including the recent advancements in the design of the data concentrator (MDC) ASIC, will be presented. The MDC is a local digital controller on the detector module. The contribution describes the entire readout chain, encompassing the double-side microstrip sensors, the ToASt front-end ASICs, the MDC, the lpGBT links and the off-detector electronics. Recent performance results of the beam test at the Marburg Ion therapy facility are presented.

Summary (500 words)

The Micro-Vertex Detector (MVD) is the innermost subdetector of the PANDA (Proton Antiproton Annihilation in Darmstadt) detector at FAIR. The sensors are read out by custom front-end electronics called ToASt (Torino ASic for Strip readout). The ToASt ASICs are managed by a Module Data Concentrator (MDC), which is an ASIC currently under development at KIT in collaboration with INFN Turin. The MDC processes the incoming event data streams before sending them to an Advanced Mezzanine Card (AMC) module also under development at KIT. The initial prototype of the complete readout chain, containing a double-sided microstrip sensors readout by ToASt ASIC and the MDC functionality implemented in an FPGA, was successfully tested at a beam test at COSY (Forschungszentrum Jülich) in 2023. Following the successful proof-of-concept of the MDC-logic, the ASIC version of the MDC will be submitted in June 2024. Moreover, the performance of the current readout chain has been characterized, where several MDCs are linked to the Versatile Link+ Demo Board (VLDB+), which is then connected to the AMD-Xilinx ZCU102 evaluation card that mimics the AMC off-detector card. Recent beam tests were conducted at Marburg Ion Therapy Center in April 2024 to characterize the entire readout system for PANDA. This contribution presents the MDC-ASIC design, the test setup of the readout chain, and the beam test results. The status of the back-end electronics hardware design and possible future medical applications are outlined.

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