The Upgrade of the Multiwire Drift Chamber (MDC) Readout of the HADES Experiment at GSI

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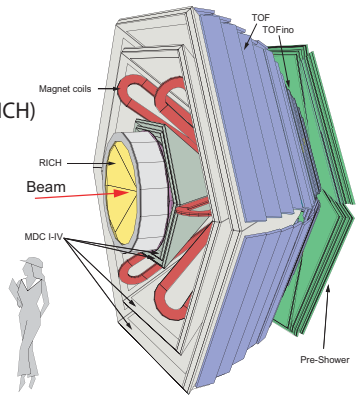
HADES Experiment: Motivation

HADES (High Acceptance Di-Electron Spectrometer) is a second generation spectrometer designed to study hadronic matter under extreme conditions.

Detectors:

- Time Of Flight (TOF)
- Multiwire Drift Chamber (MDC)
- Ring Imaging Cherenkov detector (RICH)
- Pre-Shower: electromagnetic calorimeter



Detector Upgrade and New Detector Integration:

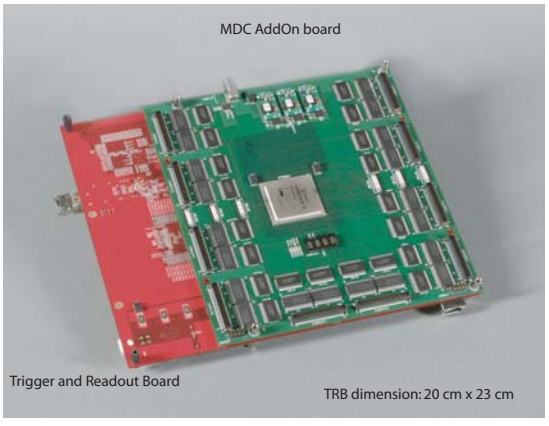
- Forward Wall
- RPC TOF Wall

DAQ Upgrade:

- Increase primary DAQ rate to 20kHz
- Detector interface: dedicated AddOn boards
- Implementation of selective algorithm

MDC DAQ Upgrade: Integration to TRB Concept

The HADES DAQ upgrade is based on the Trigger and Readout Board (TRB) [1][2]. The TRB will be the common readout platform for all HADES detectors. Extremely flexible AddOn boards are the interface to the existing detector Front End Electronic (FEE).
The first prototype of MDC AddOn [3]:



- Equipped with 10 connectors, 50 pins each and 20 RS485 transceivers (SN75976A2DL)
- From each connector a standard RS485 bus is driven to the existing front end transceiver cards, which are placed on the MDC
- A large FPGA (Xilinx Virtex4 XC4VLX-10FF1148) in the center of the AddOn card has been used to test the DAQ functionalities: FEE configuration and the data readout
- MDC AddOn tested and currently used as stand-alone readout system

MDC DAQ Upgrade: Optical Transmission

- Change data transmission from standard copper cable to Plastic Optical Fiber (POF); this leads to noise reduction and higher data transport bandwidth
- Keep VHDL design already implemented in the MDC AddOn: configuration and TDC readout
- Implementation of a dedicated TRB Network IP core for data transmission [4]

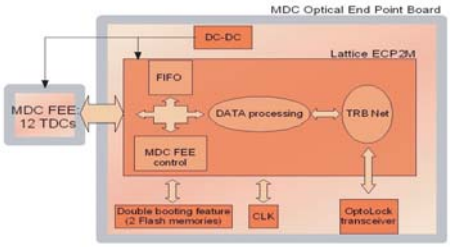
Optical End Point Board (OEPB):

- Compact, robust and cheap board placed directly onto FEE
- Lattice FPGA (ECP2/M) chip performs the configuration and the readout of the Chamber's TDCs
- 2 FLASH memories for Lattice double booting (in field reprogrammable)
- POF transceiver [5]: very small, simple, robust high speed interface (250Mbits/sec)
- DC/DC converters: the OEPB distributes power to FEE

MDC Optical AddOn (20 cm x 23 cm) connected to OEPB and MDC FEE

Optical End Point: back view
Board: (4.0 cm x 4.5 cm)

OEPB Block Diagram:



Radiation Tolerance Test

- Single Event Upsets (SEUs) have been detected with the Lattice FPGA ECP2/M dedicated features [6] with high intensity hadron beam (10^6 hadrons/cm^2 sec).
- POF is not affected by errors induced by ionizing radiation.

Acknowledgements

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References

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