

A New Electronic Readout for the Multiwire Drift Chambers in the HADES Experiment at GSI

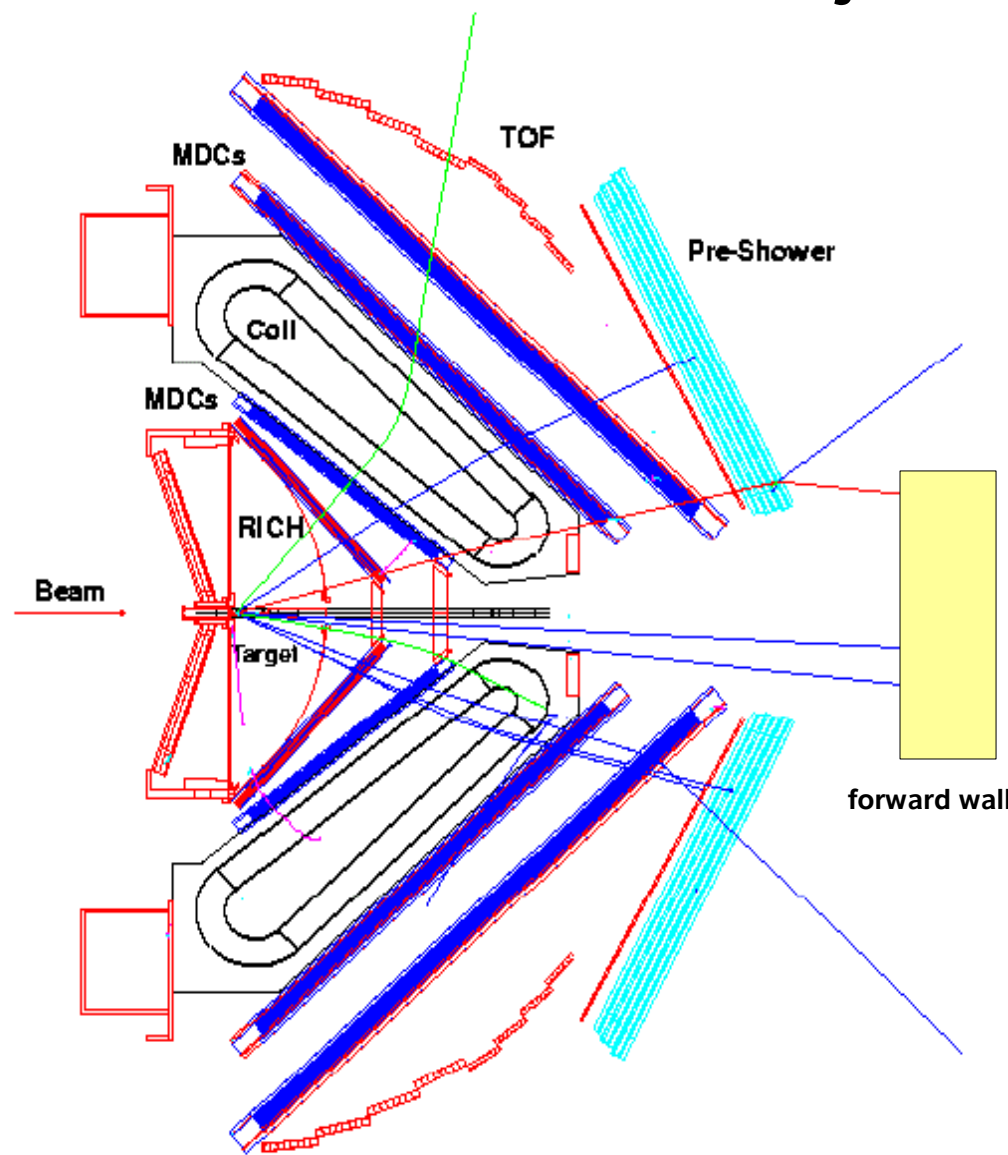
Attilio Tarantola



OUTLINE

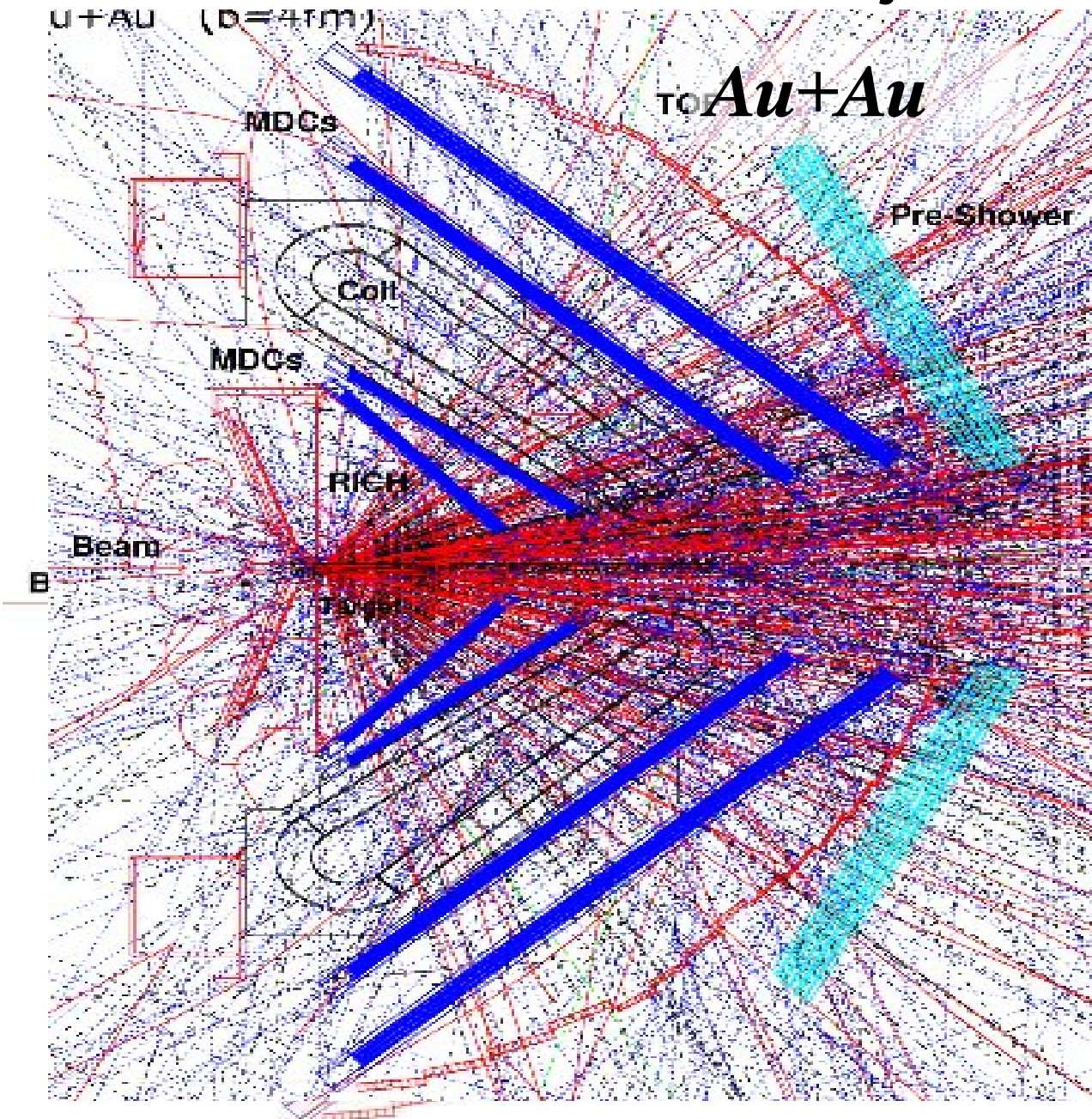
- The HADES Experiment, Motivation for the Upgrade Project.
- The Multiwire Drift Chamber (MDC) Electronics Upgrade:
 - The Common Readout Platform: *TDC Readout Board* (TRB).
 - MDC Add On Board.
 - Further Improvement: Data Transmission over *Plastic* Optical Fiber (POF).
- Summary.

The HADES Experiment, Motivation for the Upgrade Project

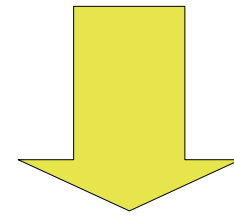


- Lepton ID
RICH+TOF+SHOWER
- Tracking
MDC+MAGNET
- *Dielectron spectrometer
(C + C up to Au + Au)*
- *Detector and electronic upgrade is needed to cope with high multiplicities in heavy collisions system*

The HADES Experiment, Motivation for the Upgrade Project



Electronics Upgrade



- ***TRB***: fast data readout for all detectors.
- ***AddOn boards***: interface between Detectors Front End and TRB.

The MDC AddOn Board

CONNECTORS
to MDC Front
End Electronics
(TDCs)

VIRTEX FPGA
PROCESSOR
(data processing)

POWER
SUPPLY
(DC/DC
converter)

Connectors to TRB.
(TRB and Add On
connected back to
back)

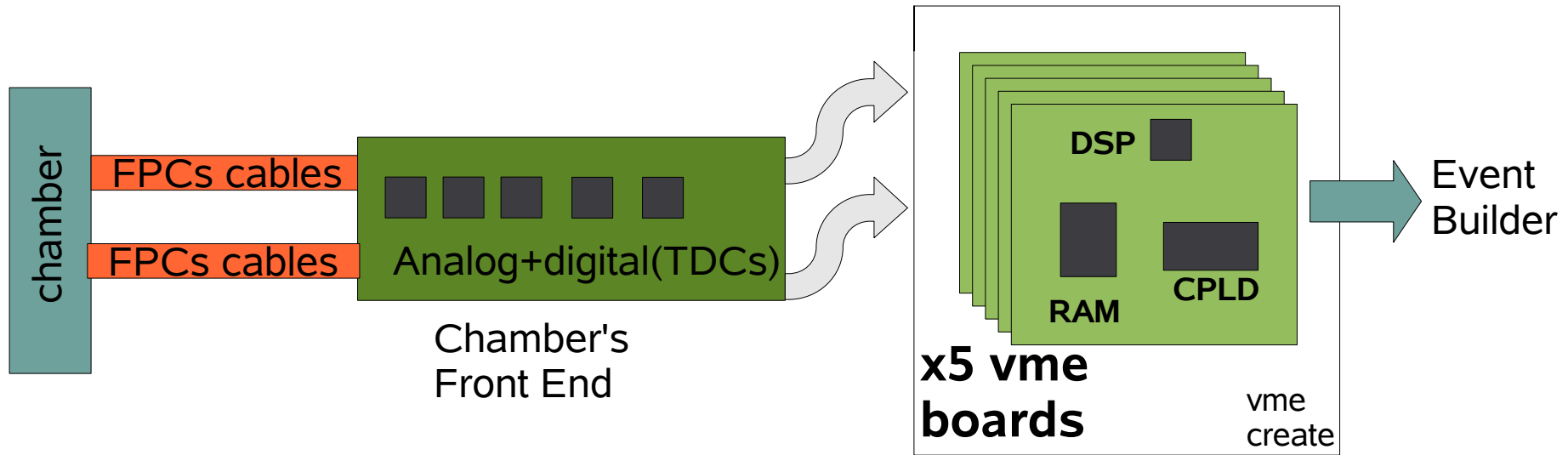
TRB size: 20.0 cm x 23.0 cm

TRB
board

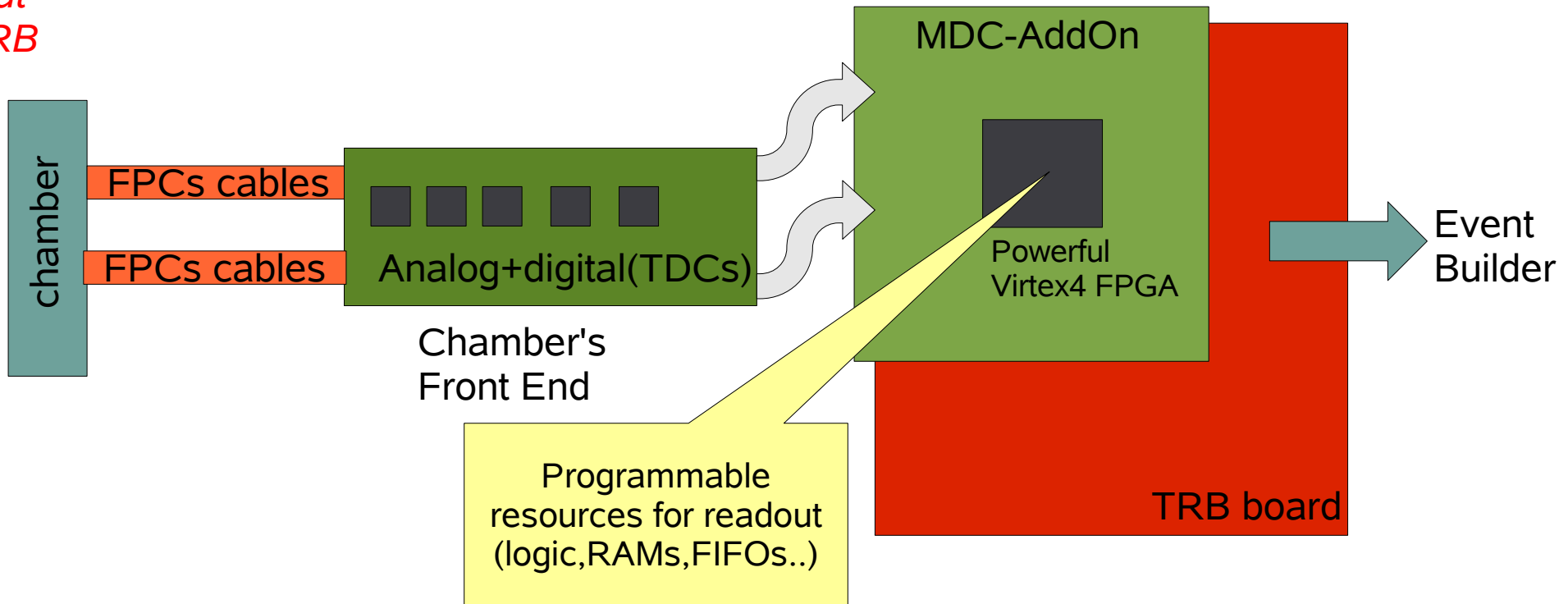
- 24 Boards will read out all HADES Chambers
- ~30.000 TDC channels
- Parallel readout of ten buses within one Processor
- Possible platform to implement “on line” tracking or RICH ring/MDC segment correlation
- The Processor code is highly reusable!
- The TRB (not equipped with TDCs) is used for data readout. See M.Palka talk.

The MDC AddOn Board

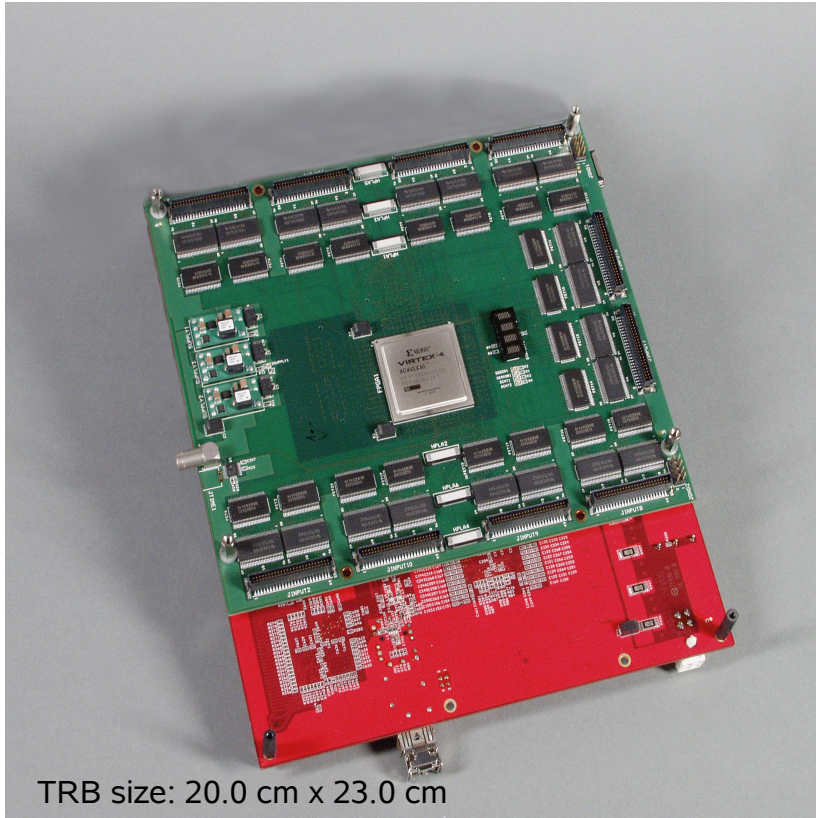
*Current
MDC
Readout*



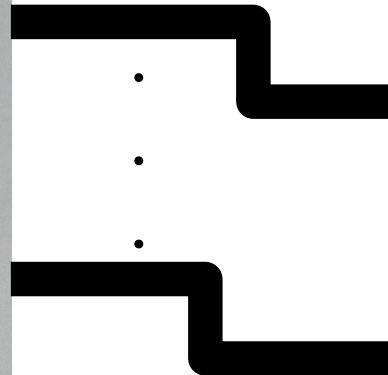
*MDC
Readout
with TRB
and
AddOn*



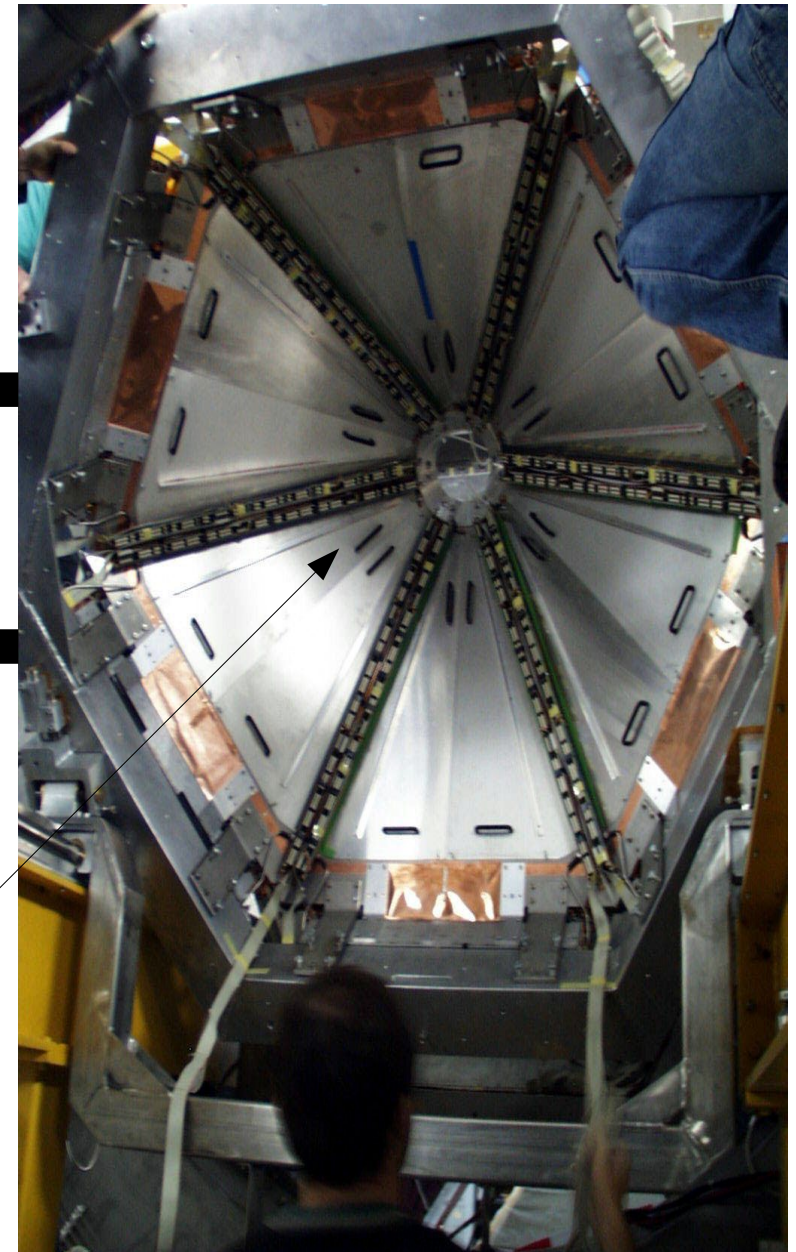
The MDC AddOn Board



TRB size: 20.0 cm x 23.0 cm



10 flat copper cables

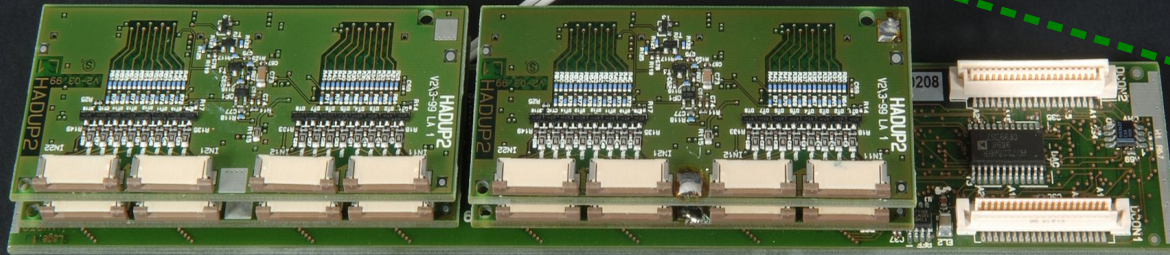


MDC AddOn reads out 1 Chamber
(10 FEE modules)

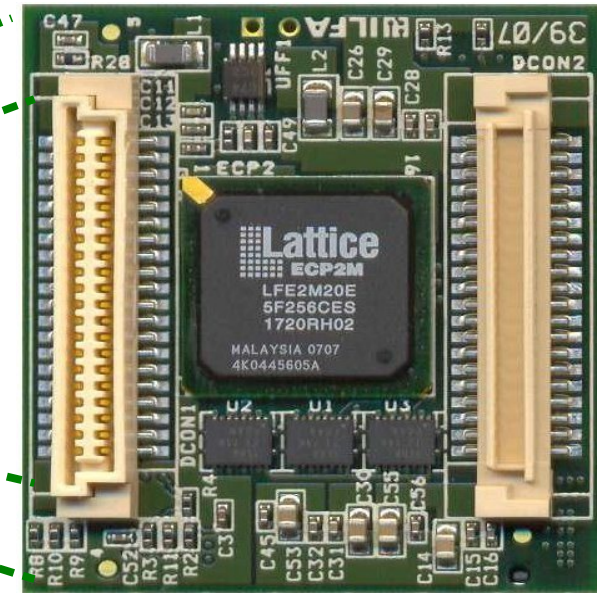
The Front End Electronic (FEE) is
squeezed between MDCs!
=> induces noise!

Further Improvement: the New Driver Card

FEE module on MDC frame
(analog + digital TDC electronics)
10 module per chamber



One FEE module: 24.0 cm x 4.0 cm

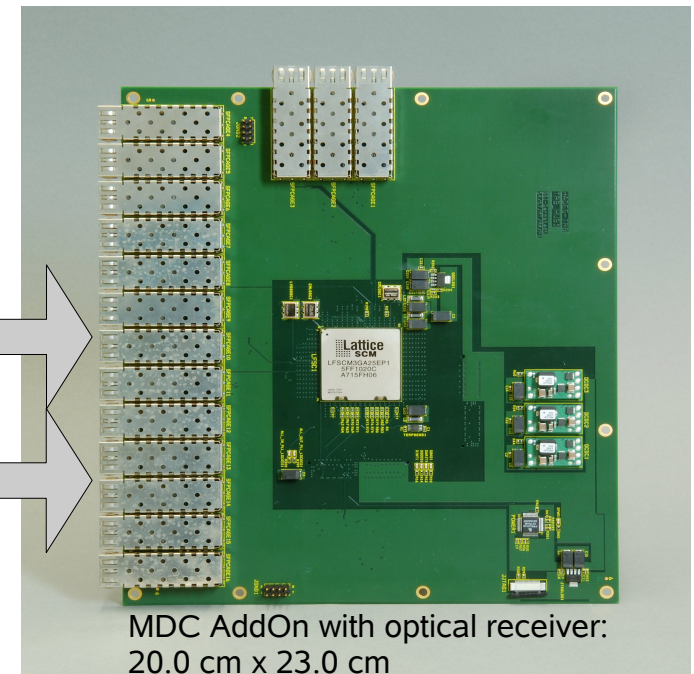


Driver Card size: 4.0 cm x 4.5 cm

Advantages:

- **Plastic** Optical Fiber (POF) are easy to maintain and do not induce noise conducted or irradiated!
- Fast data transmission: 250 Mbits/sec
- Cheap **plastic** optical fiber and transmitter

I/O: 16 plastic optical fibers



MDC AddOn with optical receiver:
20.0 cm x 23.0 cm

Summary

- ★ Success of the TRB concept: flexible system, usable by many detectors and different experiment!
- ★ MDC AddOn, as “an example of a *TRB-detector interface*” is working as designed.
- ★ “*A big project in a small board*”: Data AcQuisition functionalities as close as possible to the FEE:
 - ★ Optical transmission: small, cheap and fast devices are now on the market (not available few years ago!)
 - ★ All this integrated to the TRB

Literature

- *A General Purpose Trigger and Readout Board (TRB), for HADES and FAIR-Experiments, GSI Scientific report GSI 2006.*

M. Traxler, I. Froehlich, M. Kajetanowicz, K. Korcyl, W. Krzemien, M. Palka, P. Salabura, C. Schrader, H. Stroebele, J. Stroth, P. Skott, A. Tarantola, R. Trebacz.

- *128 channel high resolution TDC with integrated DAQ-system, GSI Scientific report GSI 2005.*

M. Traxler, D. Gil, M. Kajetanowicz, K. Korcyl, M. Palka, P. Salabura, P. Skott, R. Trebacz.

- *A General Purpose Trigger and Readout Board for HADES and FAIR Experiments* IEEE Transactions on Nuclear Science, 2008, in print.

I. Froehlich et al.

- *ETRAX, Axis www.axis.com*

Backup slide

The Common Readout Board: TDC Readout Board (TRB)

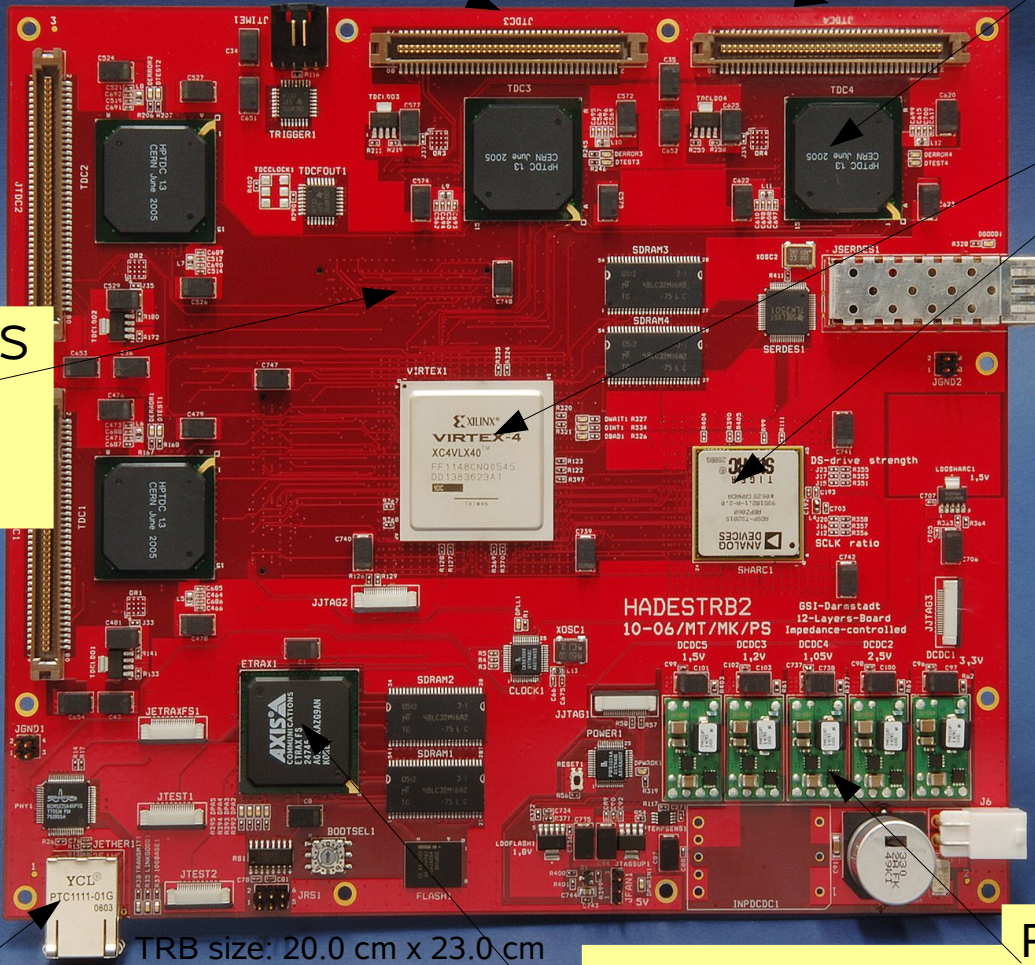
CONNECTORS to Front End Electronics

x 4 TDCs

PROCESSORS (preprocessing data)

CONNECTORS to Add On (back side)

Successfully used in two beam times in 2007!
Readout of
- hodoscope/RPC
- forward wall
- scintillation detector
- diamond detector



TRB size: 20.0 cm x 23.0 cm

ETHERNET CONNECTOR (data transfer/remote control)

ETRAX PROCESSOR (Linux kernel)

POWER SUPPLY 48 V

The Common Readout Board: TDC Readout Board (TRB)

