

A new electronic readout for the Mini Drift Chambers in HADES experiment at GSI

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OUTLINE

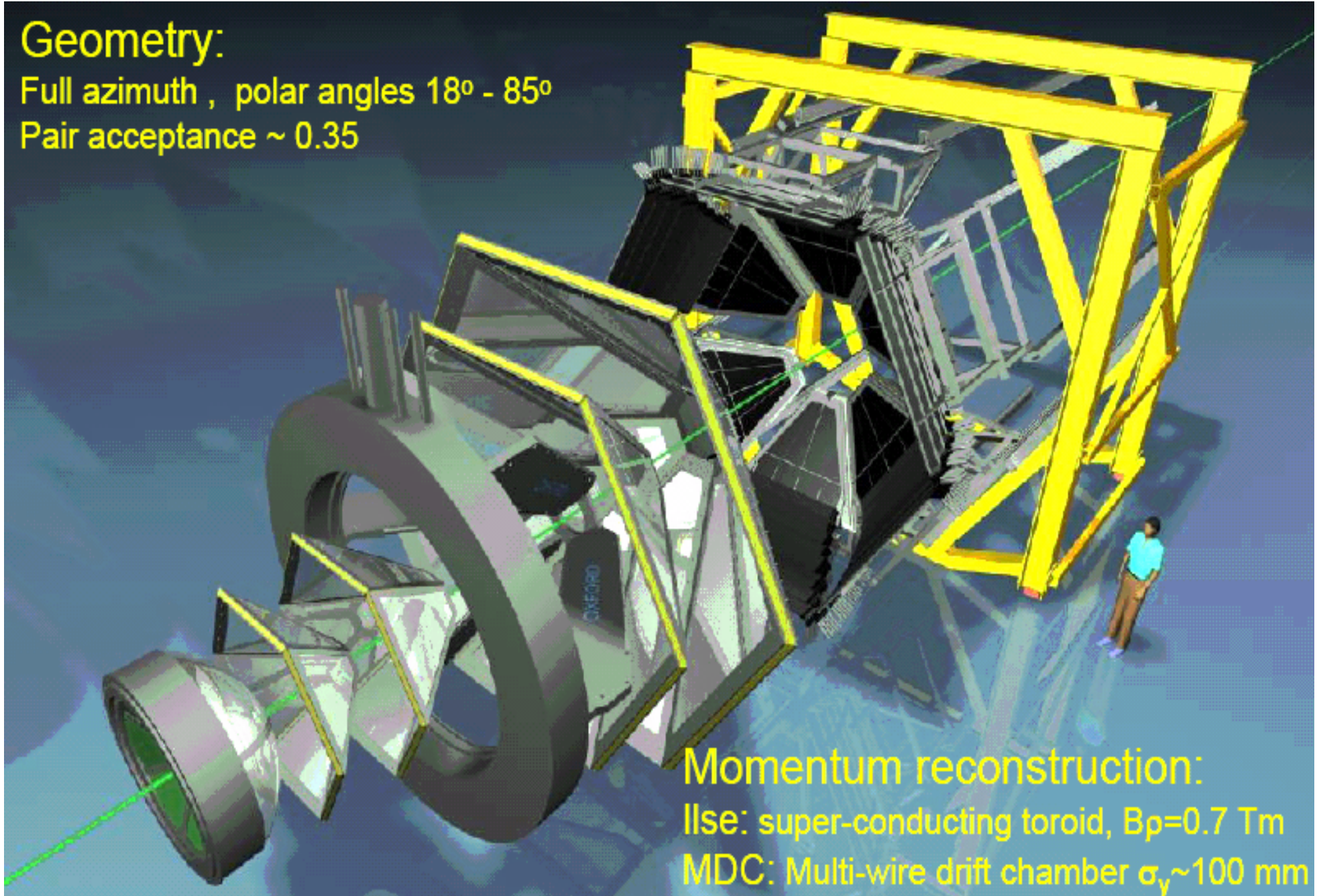
- HADES experiment: overview
- Reasons for the Data Acquisition (DAQ) upgrade
- The TDC Readout Board (TRB)
- The Mini Drift Chamber (MDC) electronics upgrade: MDC add on board

HADES experiment: overview

Geometry:

Full azimuth , polar angles $18^\circ - 85^\circ$

Pair acceptance ~ 0.35

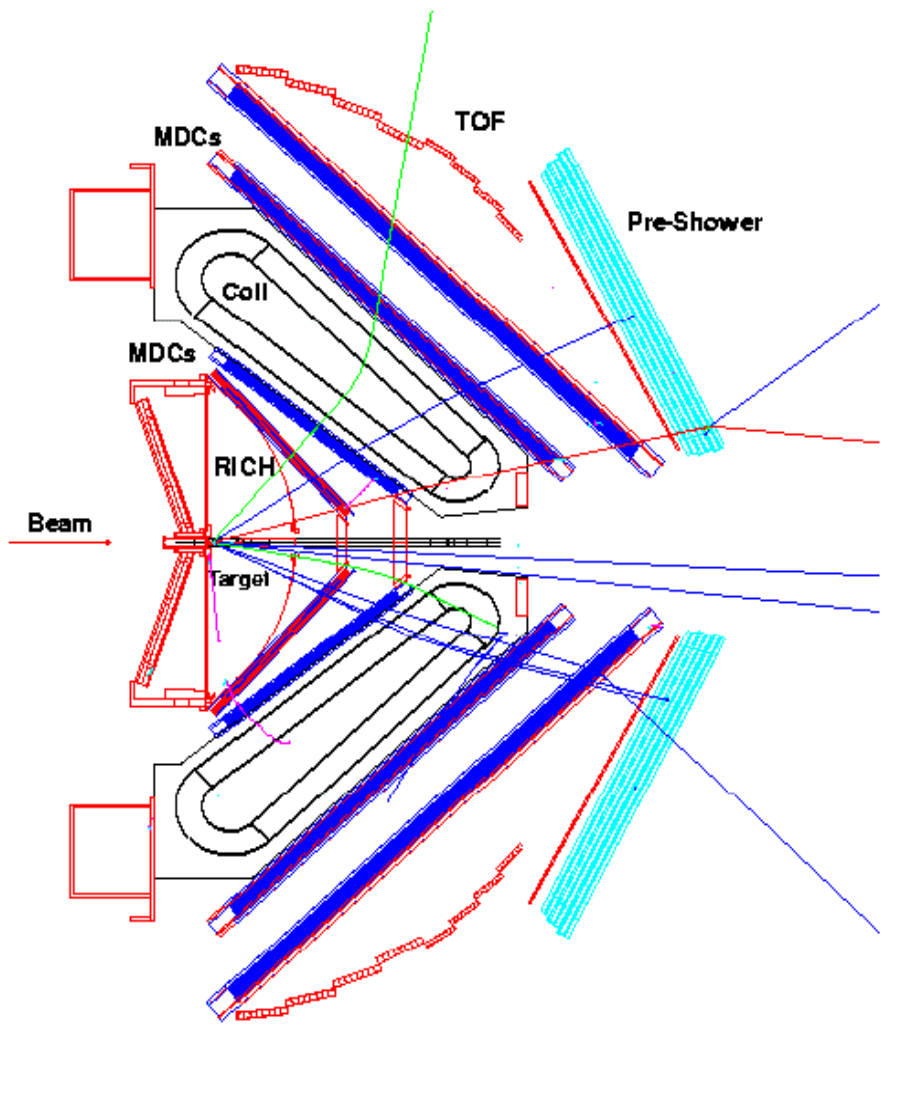


Momentum reconstruction:

Ilse: super-conducting toroid, $B_p = 0.7 \text{ Tm}$

MDC: Multi-wire drift chamber $\sigma_y \sim 100 \text{ mm}$

HADES experiment: overview



- *Lepton ID* \Rightarrow RICH and META(TOF+TOFINO+SHOWER)
- *Tracking* \Rightarrow Magnet + MDC
- Dielectron spectrometer for p+p up to Au+Au reactions (2nd part of my thesis: p+p at 3.5 GeV data analysis, data taken in april 07)
- In medium properties of light vector mesons ρ, ω, ϕ (rare decay) which produce penetrating probes

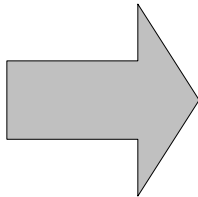
Reasons for the Data Acquisition (DAQ) upgrade

Current situation in beam:

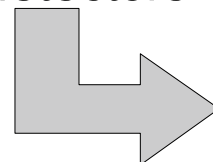
	<u>Max LvL1 rate</u>	<u>Max LvL2 rate</u>	
> elementary reactions	8 kHz	1-3 kHz	Data rate on tape: 4-14 MBytes/s
> heavy ion reactions	3-4 kHz	1-2kHz	

- Increase LVL1 capability (MDC in trigger system) up to 20 kHz
- Improve LVL2 algorithm (MDC cluster finding, RICH correlation)
- Data rate on tape 150 MBytes/s

HEAVY ION REACTIONS



- Needs a common readout for all detectors \Rightarrow stable system, easier to debug
- Easy to maintain (no VME crate)
- Possible platform to readout detectors of other experiments (CBM,PANDA, PET readout,...): Add on boards provide connectivity with other detectors



TRB project
(started in 2004)

The TDC Readout Board (TRB)

GLOSSARY:

TTL: Transistor-transistor logic

LVDS: Low Voltage Differential Signaling

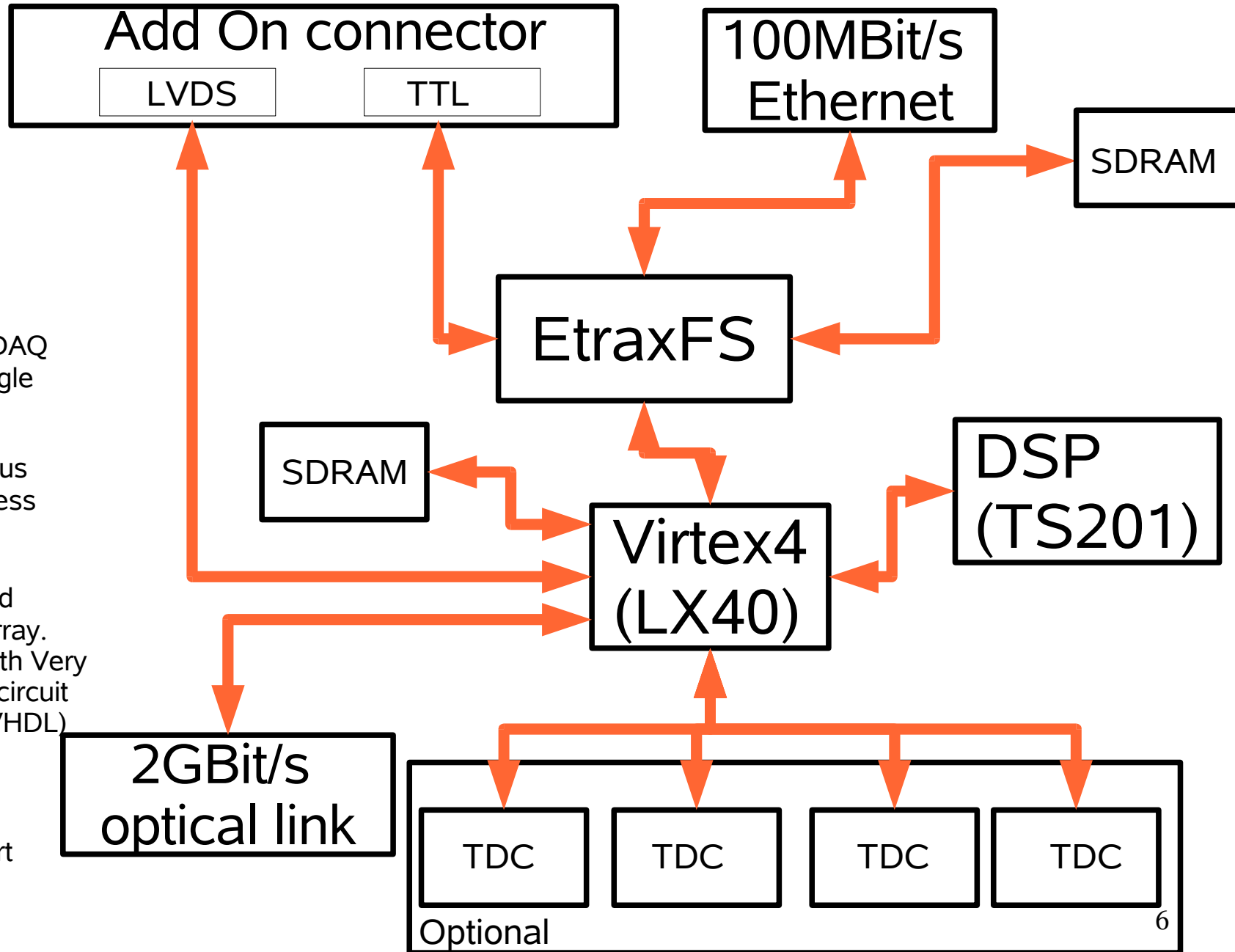
DSP: Digital Signal Processor for on-line data processing

EtraxFS: chip with DAQ functionality (Linux single chip computer)

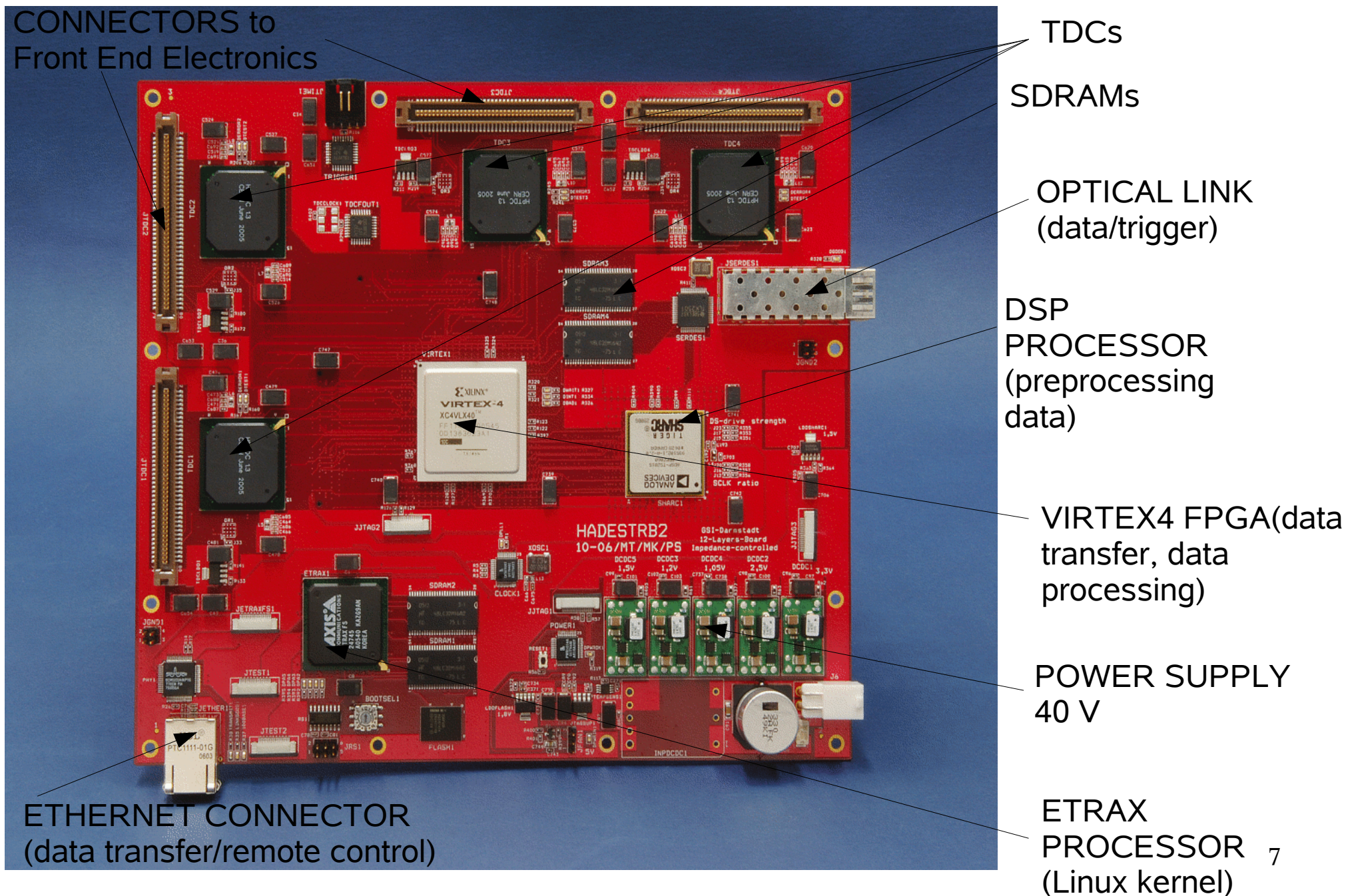
SDRAM: Synchronous Dynamic Random Access Memory

Virtex4 FPGA: Field Programmable Gate Array. Device programmed with Very High speed integrated circuit Hardware Language (VHDL)

TDC: Time to Digital Converter (it makes difference between start and stop signals, the output is a bit stream)



The TDC Readout Board (TRB)



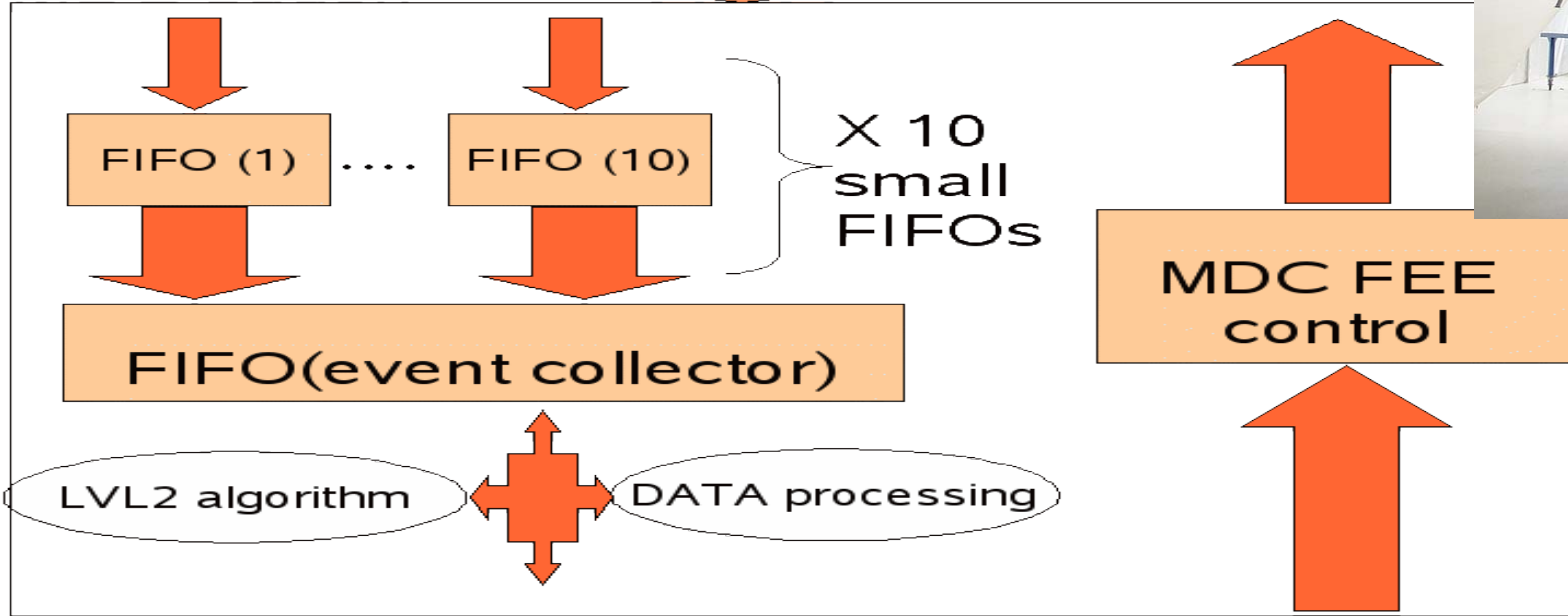
The Mini Drift Chamber (MDC) electronics upgrade

MDC add on board



MDC FEE: 16 CPLDs, 136 TDCs(1088 channels)

MDC addon



FIFO: first in first out

MDC FEE: MDC Front End Electronics (TDCs) placed on the chamber frame

CPLD: Complex Programmable Logic Device

data transfer MDC-Addon to TRB 500 Mbits/s

TRBv2 board (not equipped with TDCs)

The Mini Drift Chamber (MDC) electronics upgrade: MDC add on board

CONNECTORS
to MDC Front
End Electronics
(TDCs)

VIRTEX FPGA
(data processing)

POWER
SUPPLY (DC/DC
converter)

Connectors to TRB.
(TRB and add on
connected back to back)

- 24 Boards will read out all HADES Chambers
- ~30.000 TDCs channels
- Good platform to implement “on line” tracking or RICH ring/MDC segment correlation
- Easy configuration for all TDCs parameters (channel enable, threshold, spike suppression...)

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

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

- ETRAX, Axis www.axis.com