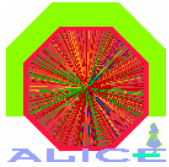




Status of the ALICE DAQ

T. Antičić



ALICE DAQ



Flexibility

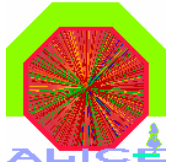
– **17 detectors**

– Pb-Pb

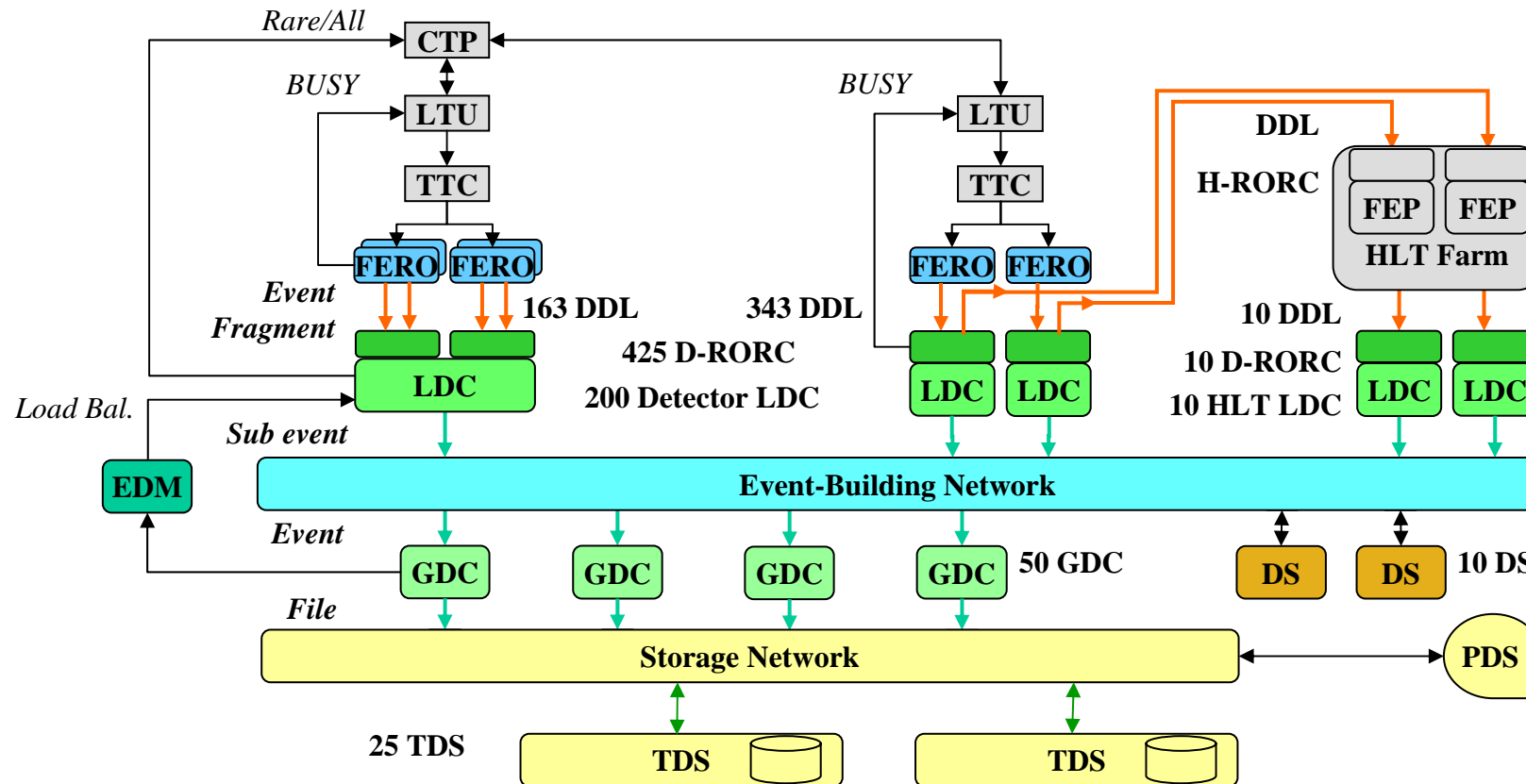
– pp and pA

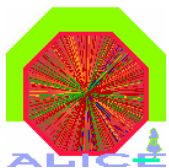
- *Synchronized / standalone tuning*
- *Big events (86.5 MB)*
- *Large bandwidth (1.25 GB/s to tape)*
- *Low interaction rate (10 KHz)*
- *Complex triggers*
- *Different sets of detectors*
- *Small events (2.5 MB)*
- *High interaction rate (200 KHz)*
- *Less bandwidth*
- *Simpler triggers*

25 GB/s raw from the detectors => 1.25 GB/s data files

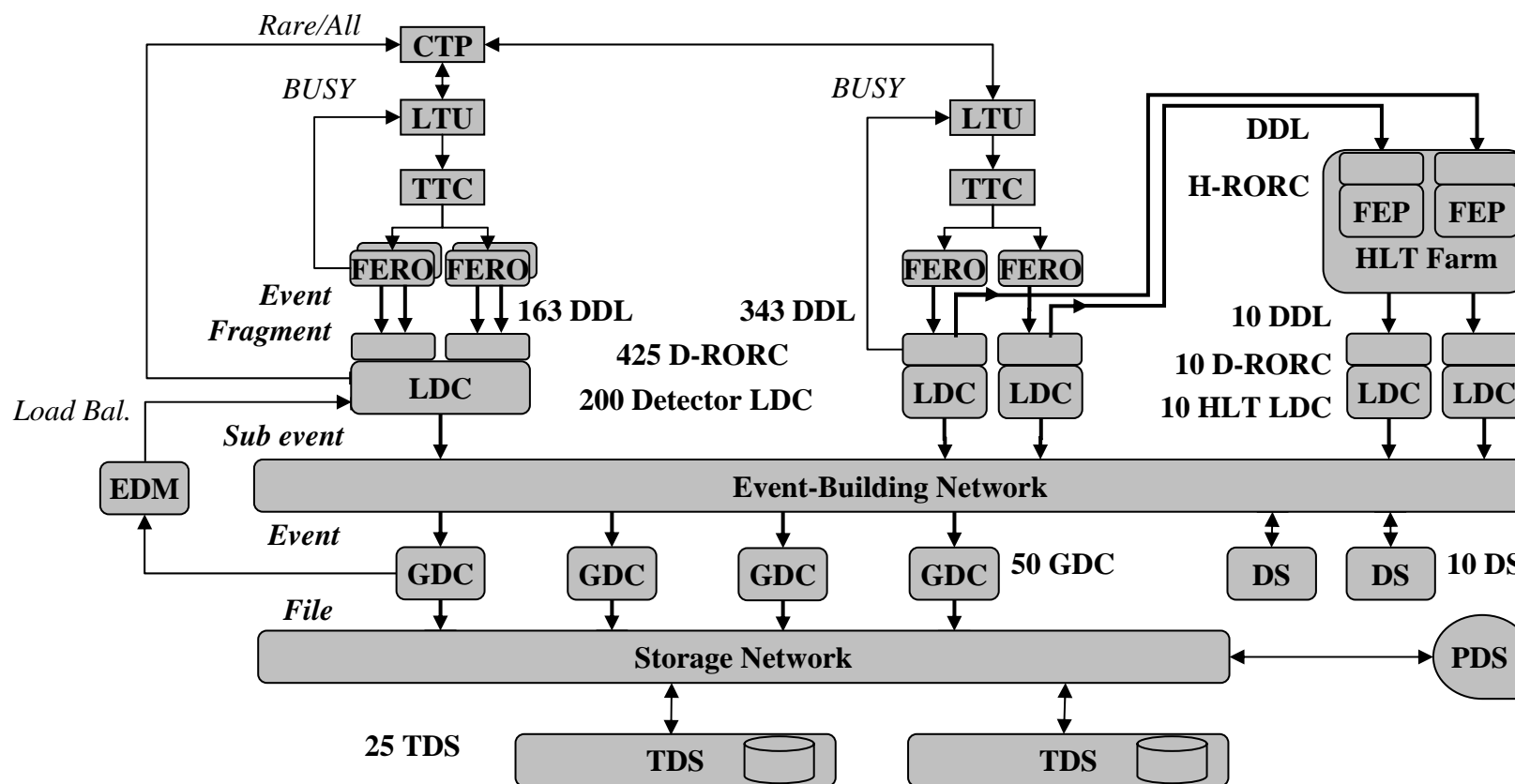


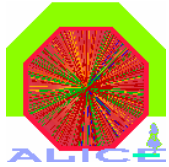
ALICE DAQ Architecture



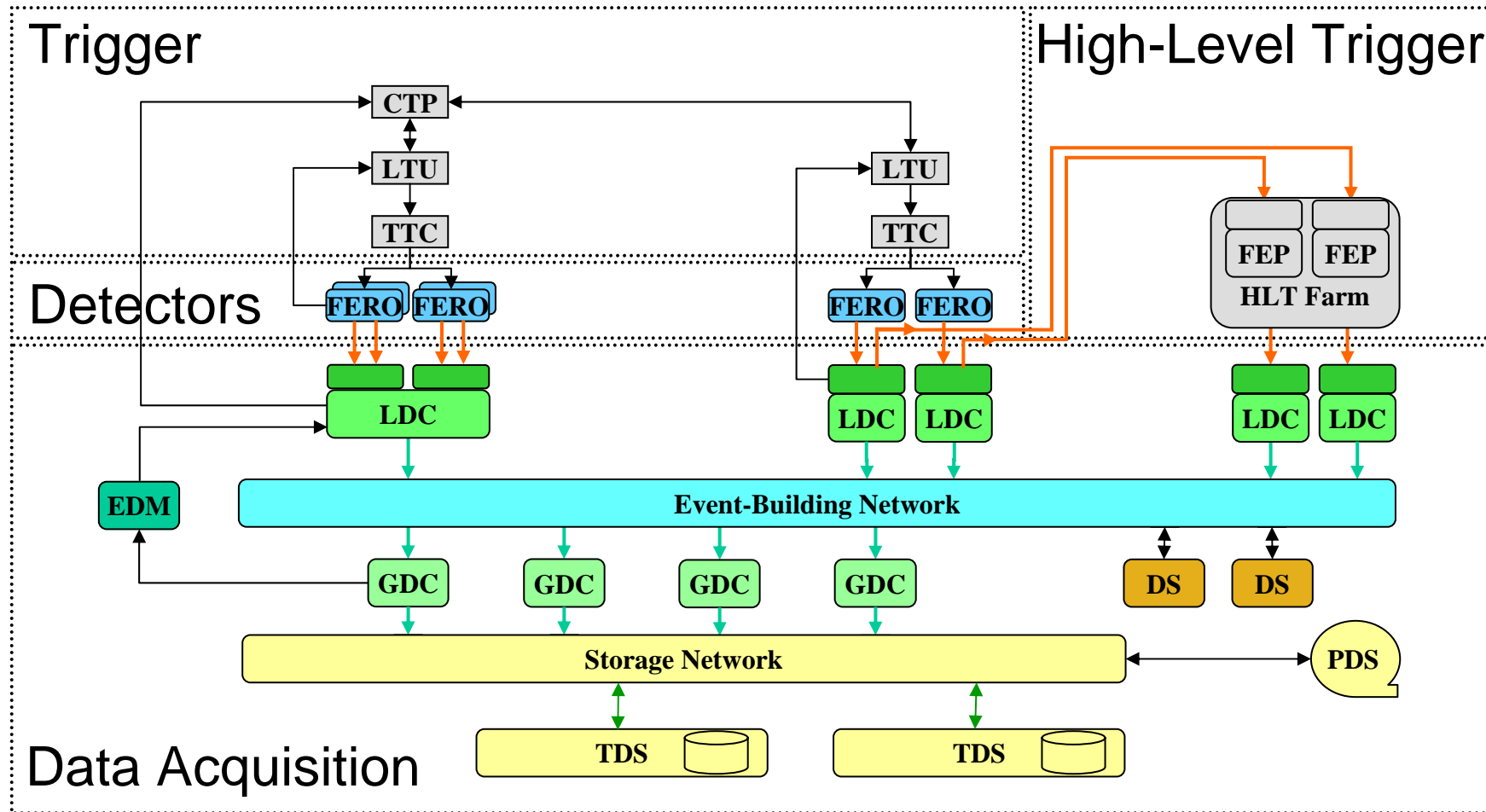


Architecture





ALICE DAQ Architecture

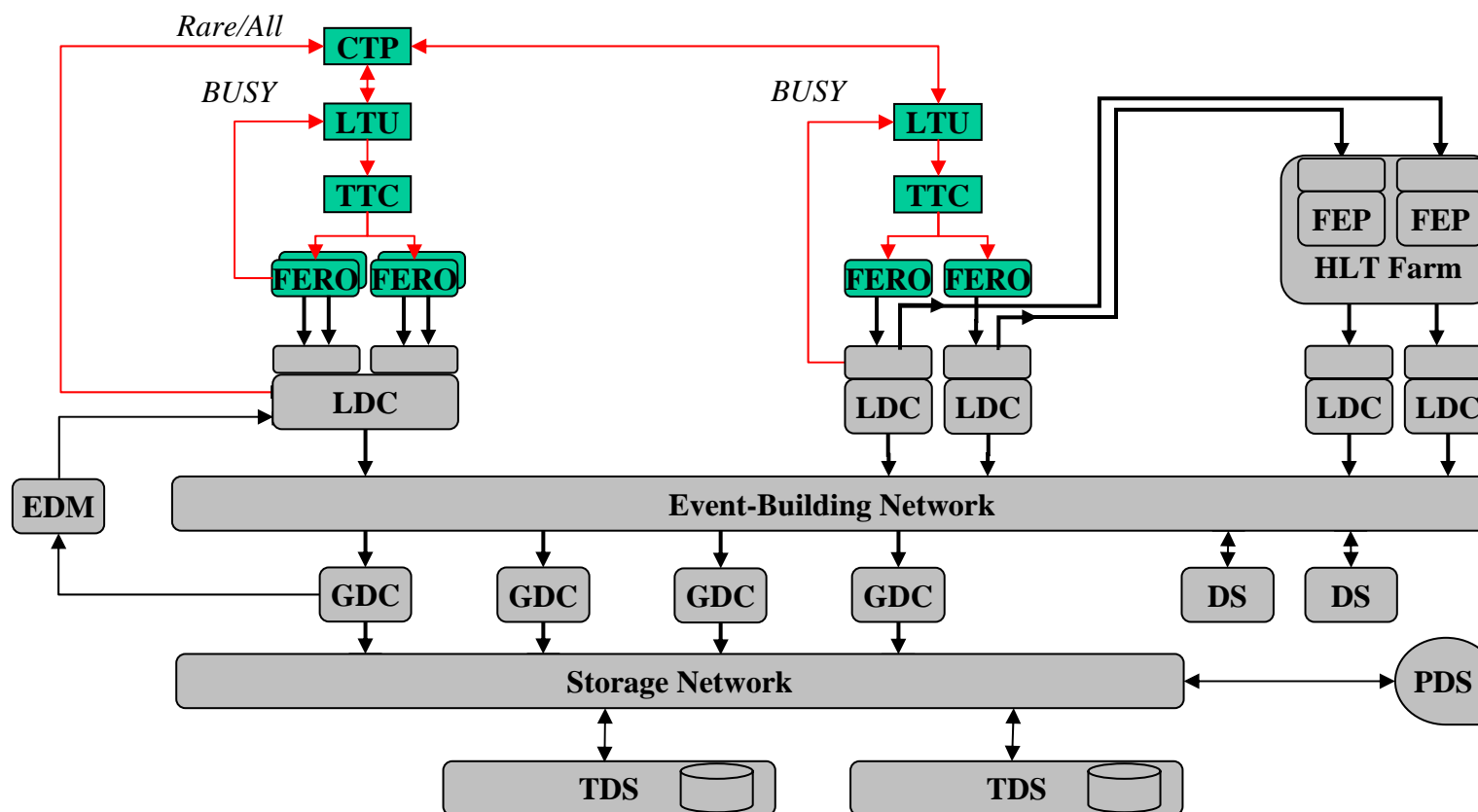


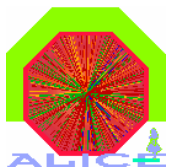


Trigger



Initiates detector readout of selected events

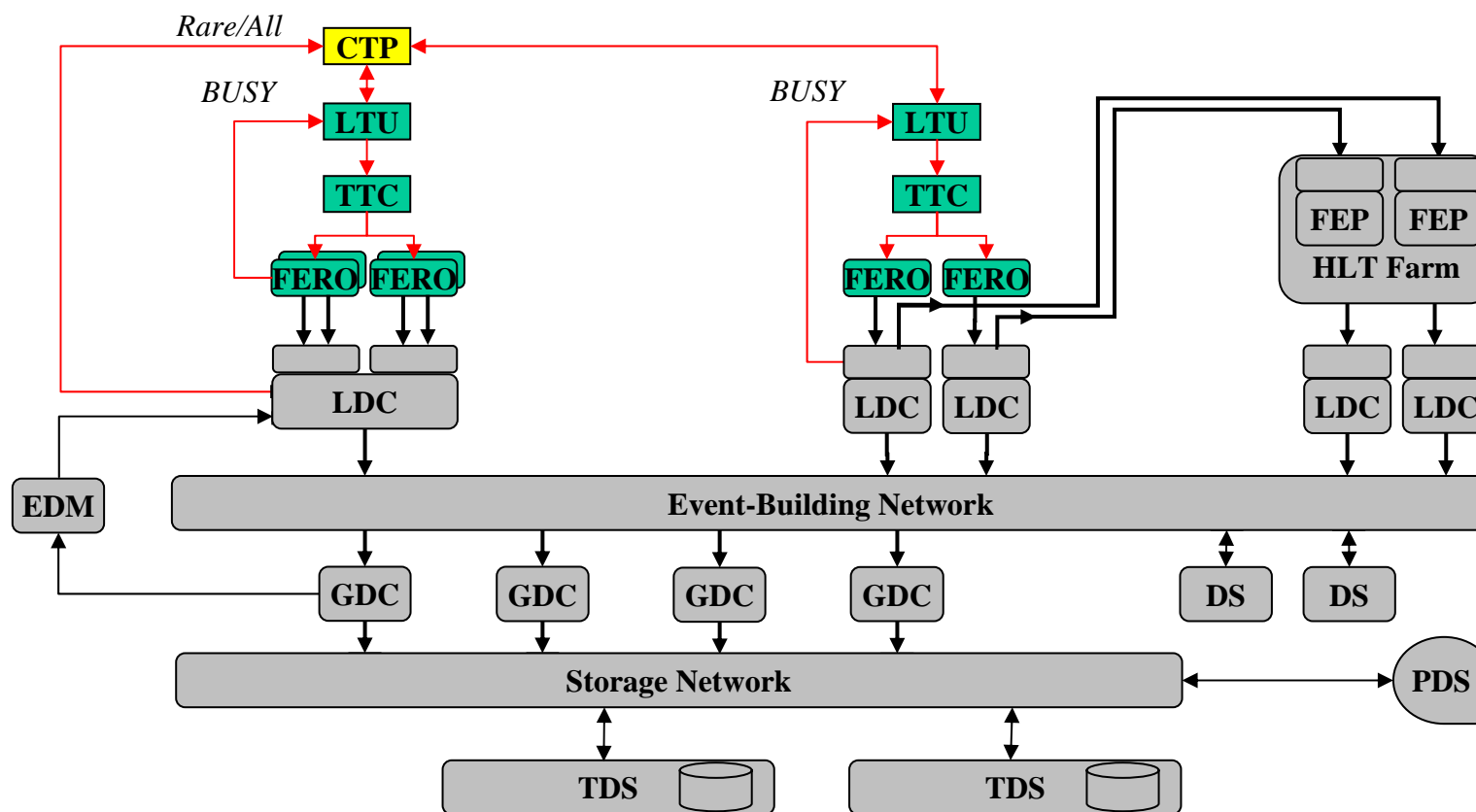




Trigger



Central Trigger Processor: *decisions*

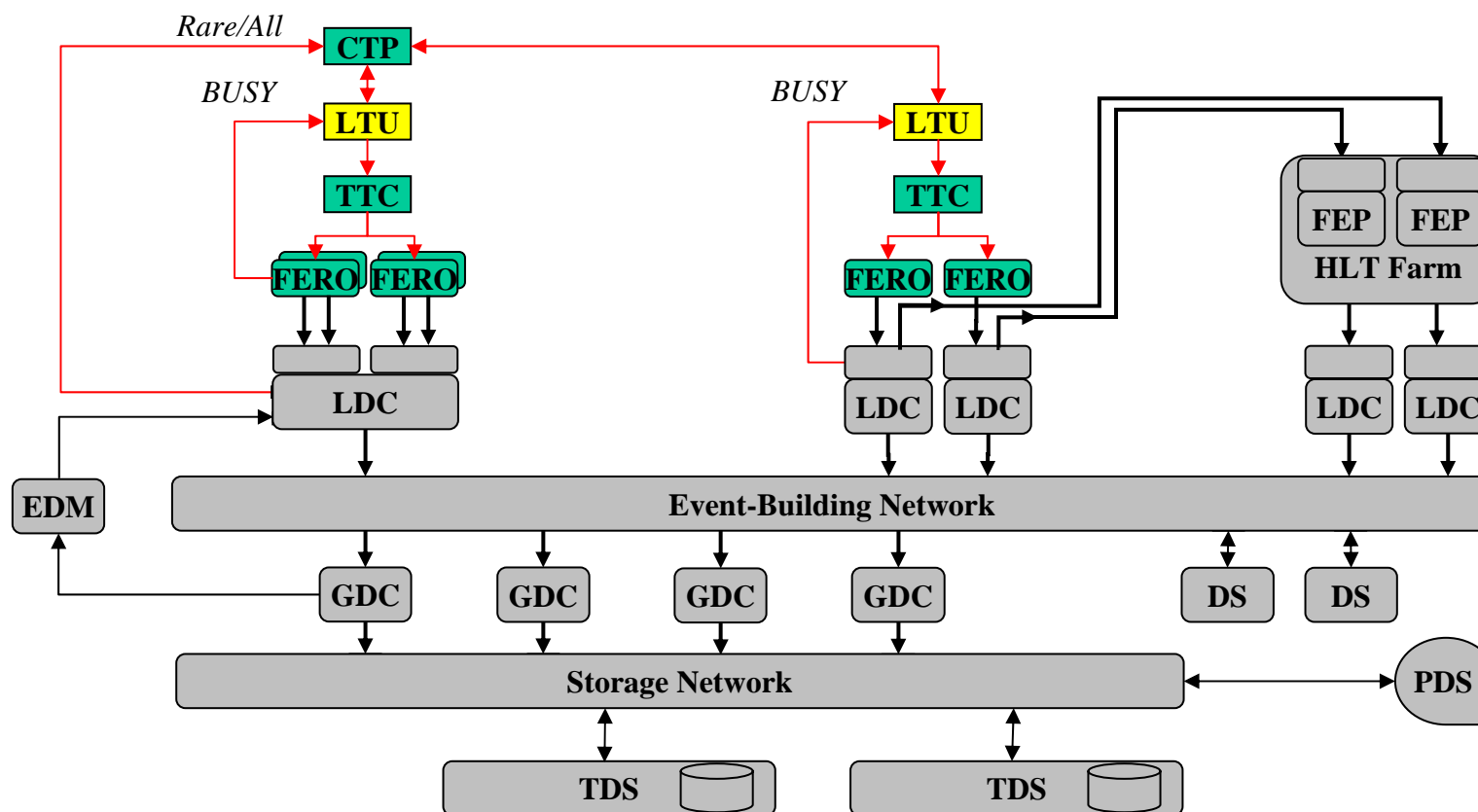




Trigger



Local Trigger Unit: *receives decisions for each detector*

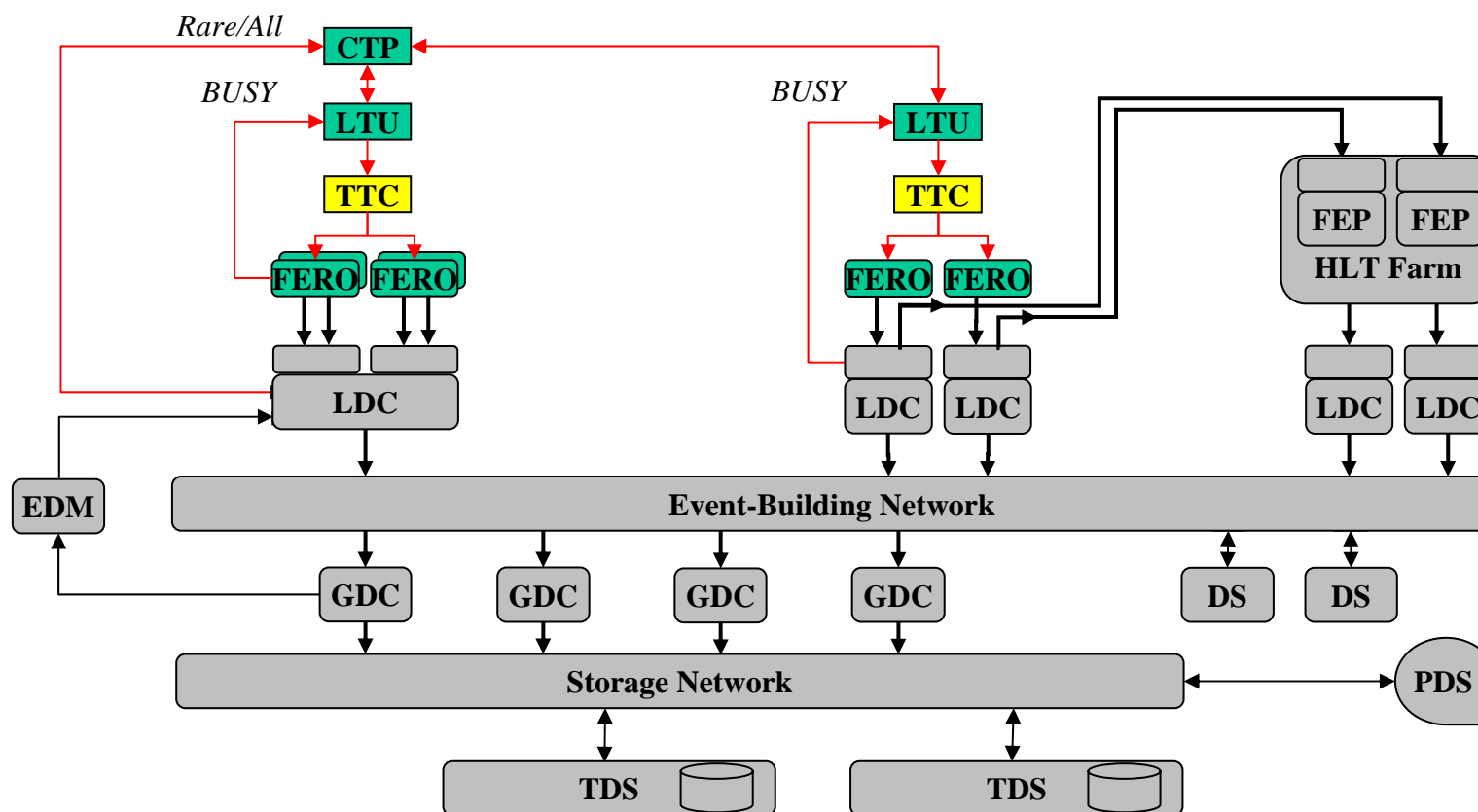


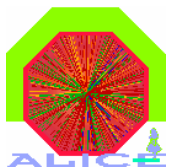


Trigger



Timing, Trigger and Control system: *broadcast to electronics*

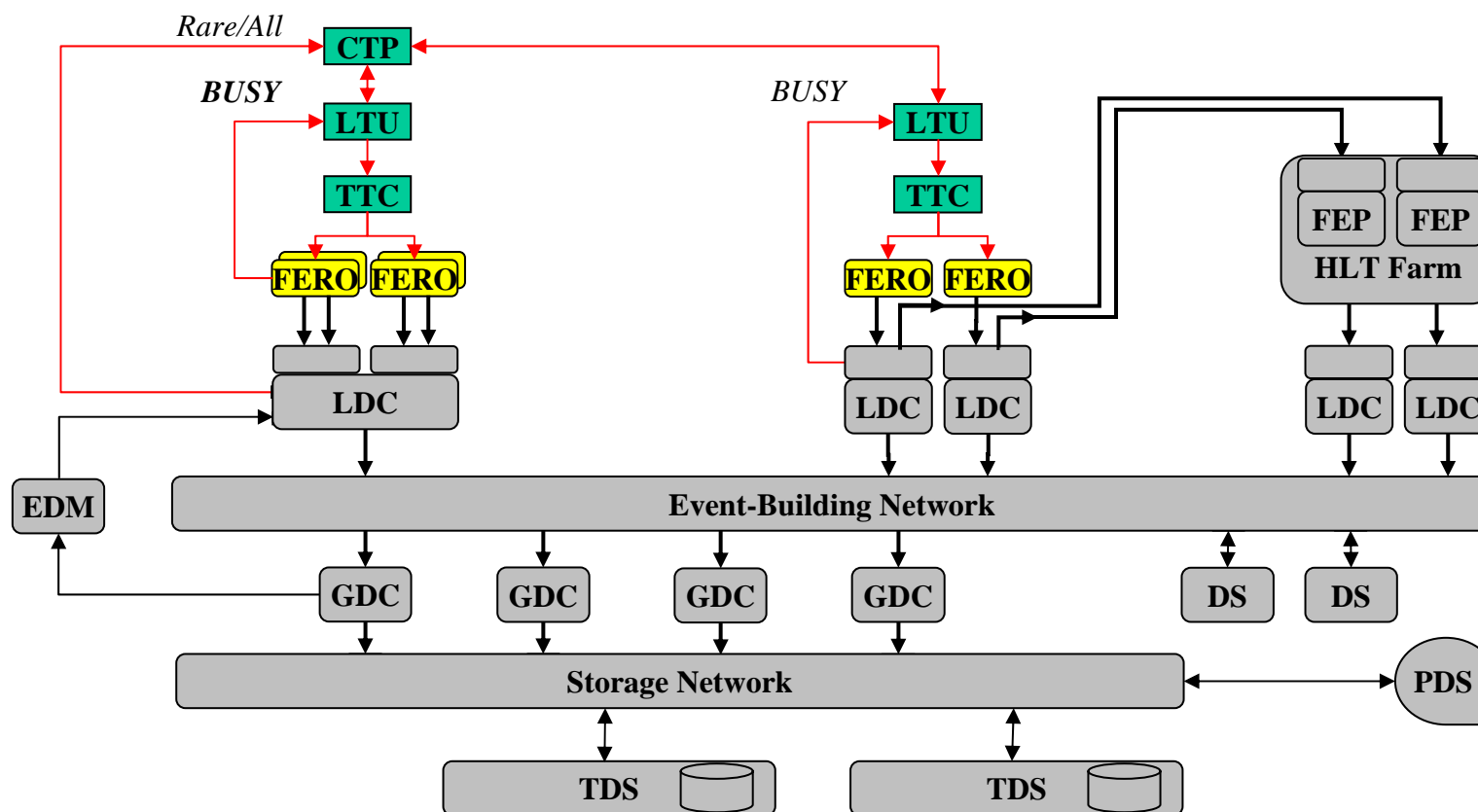


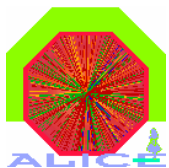


Trigger



Front-End Readout Electronics: *use triggers, signal BUSY*

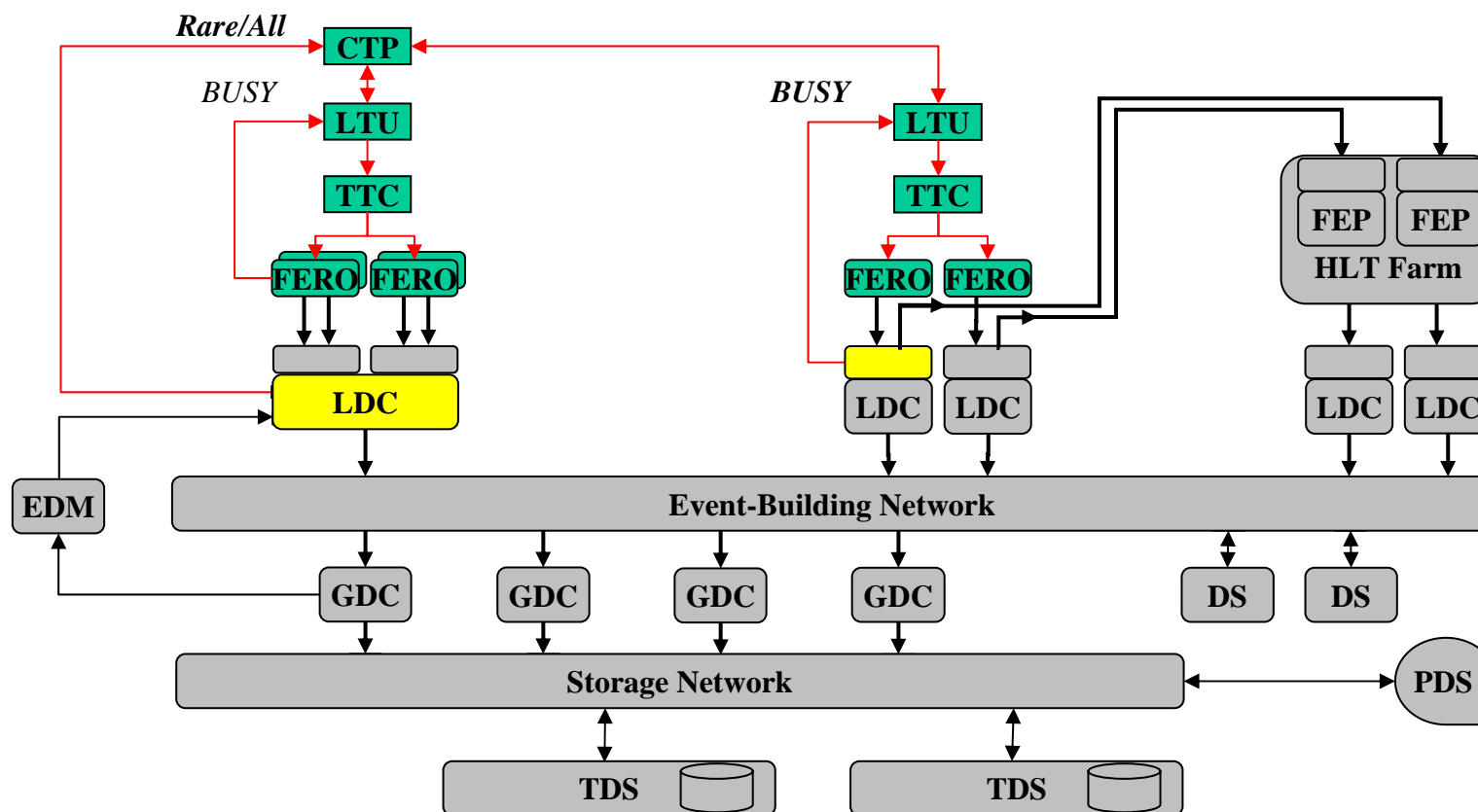


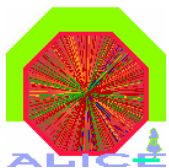


Trigger



Some DAQ components can feed back information

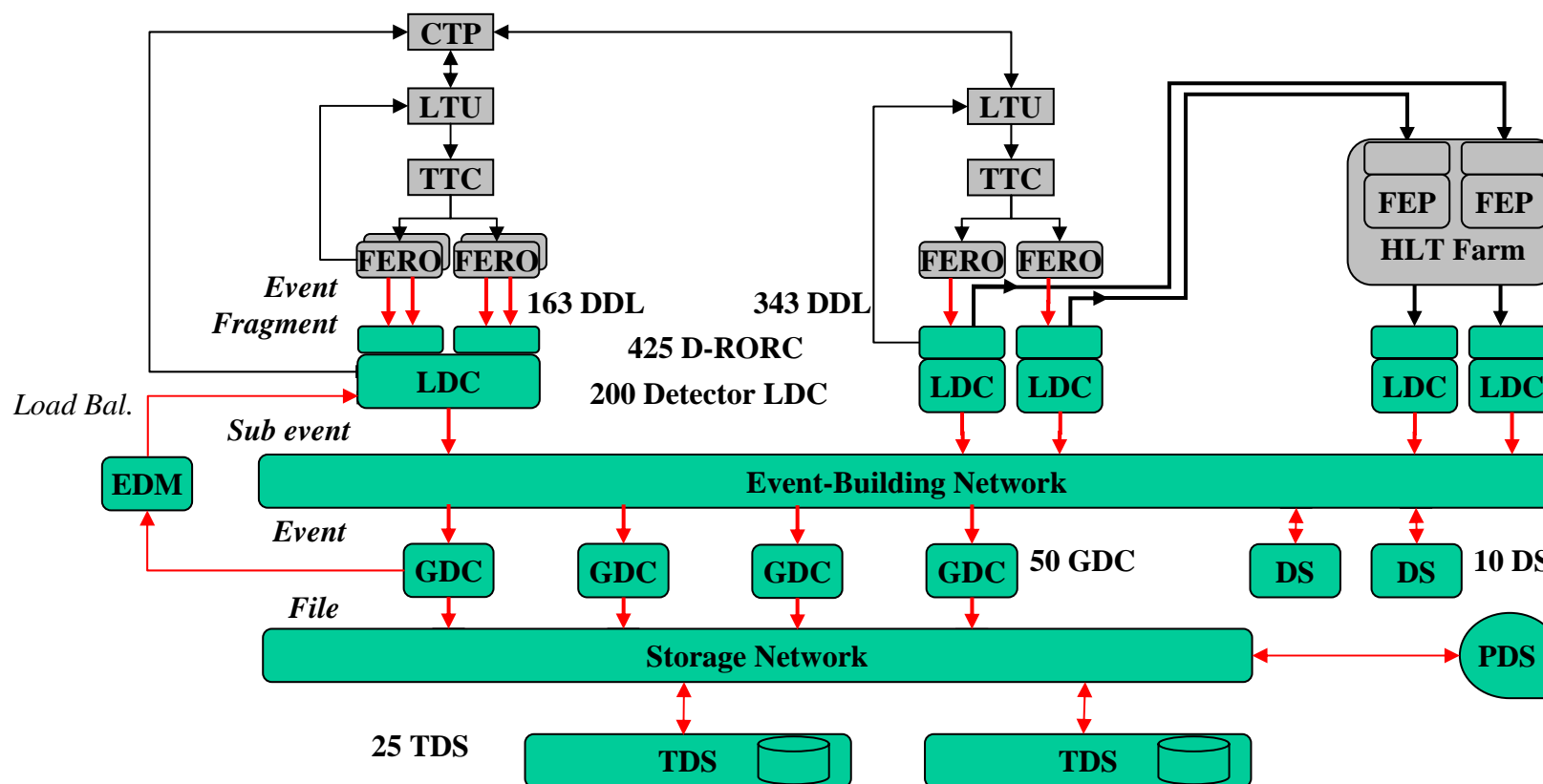


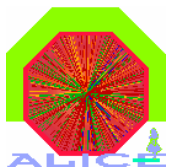


Data Acquisition



Data-flow from electronics to permanent storage

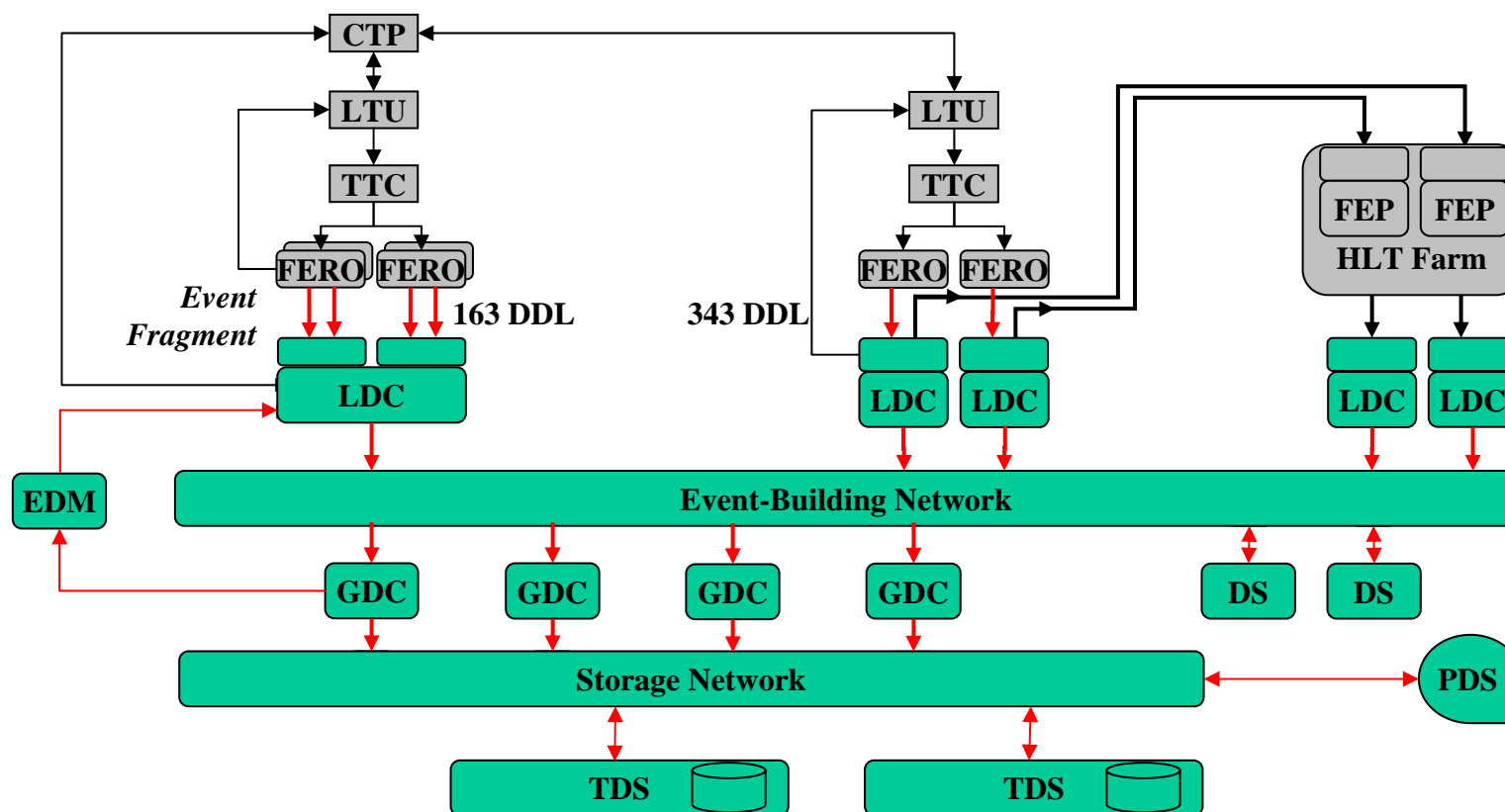




Data Acquisition



Detector Data Links: *optical transmission*

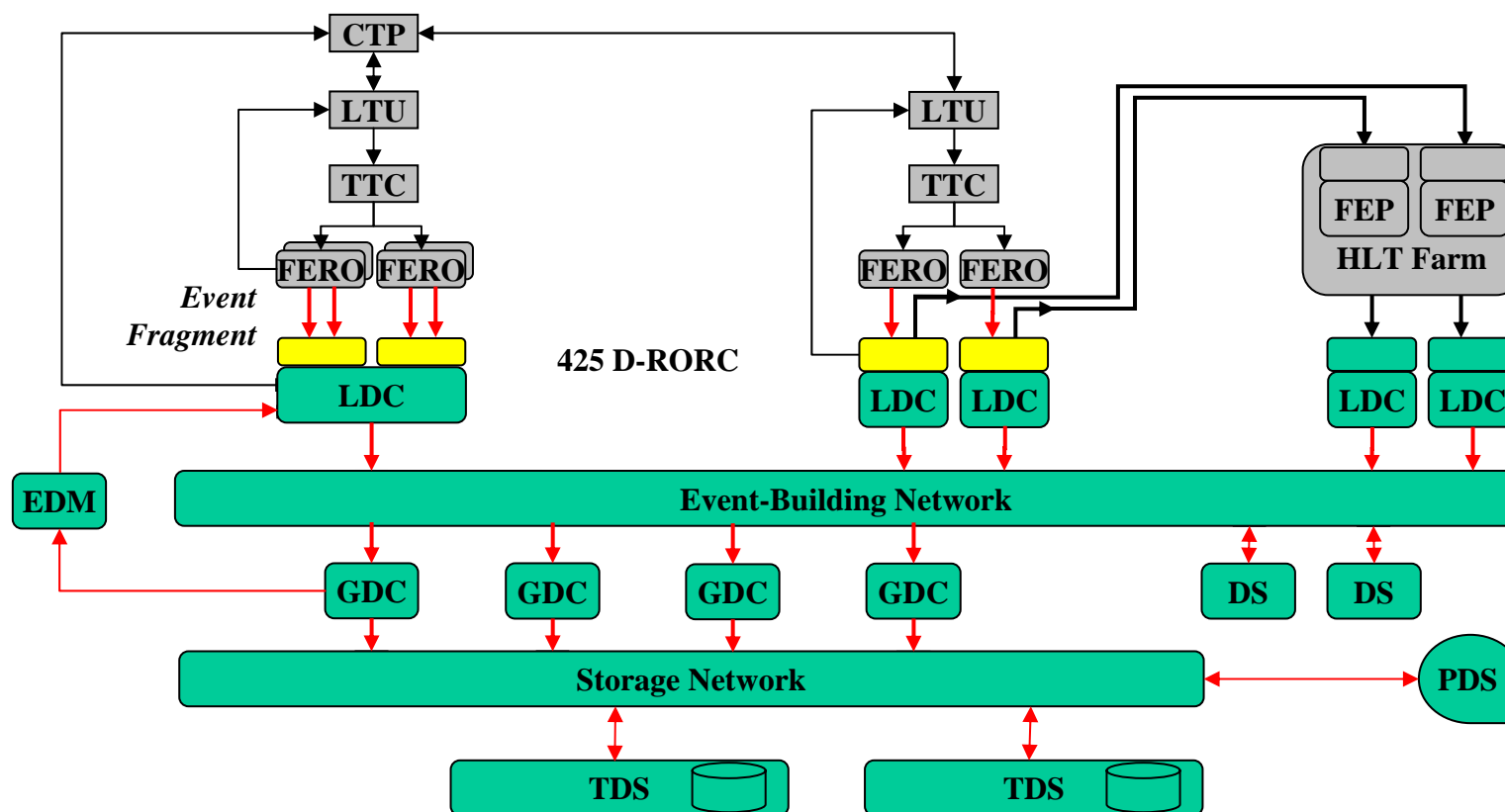


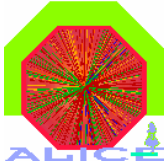


Data Acquisition



DAQ Read-Out Receiver Card: *PCI* interface

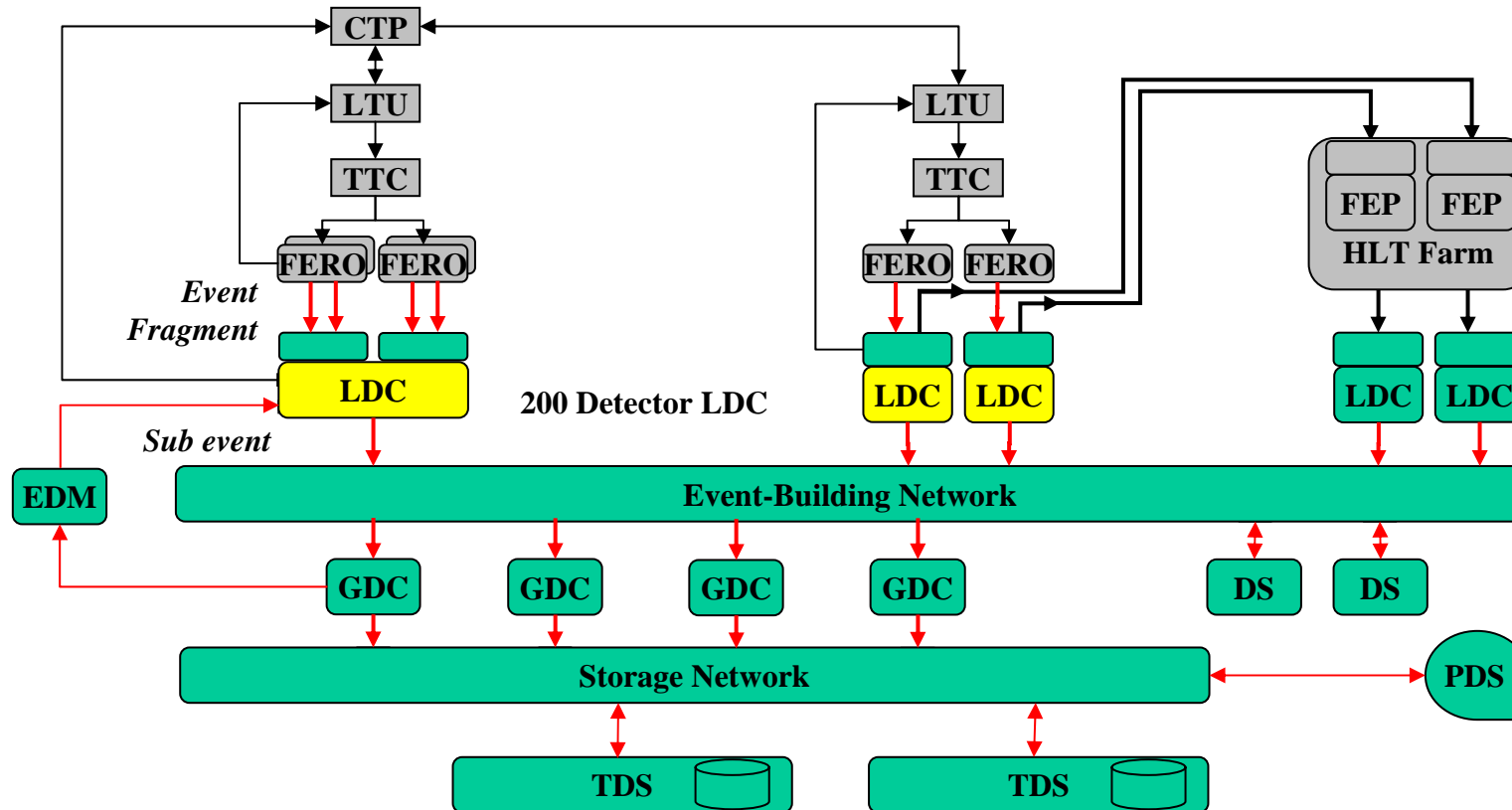




Data Acquisition



Local Data Concentrators: *ship sub-events*

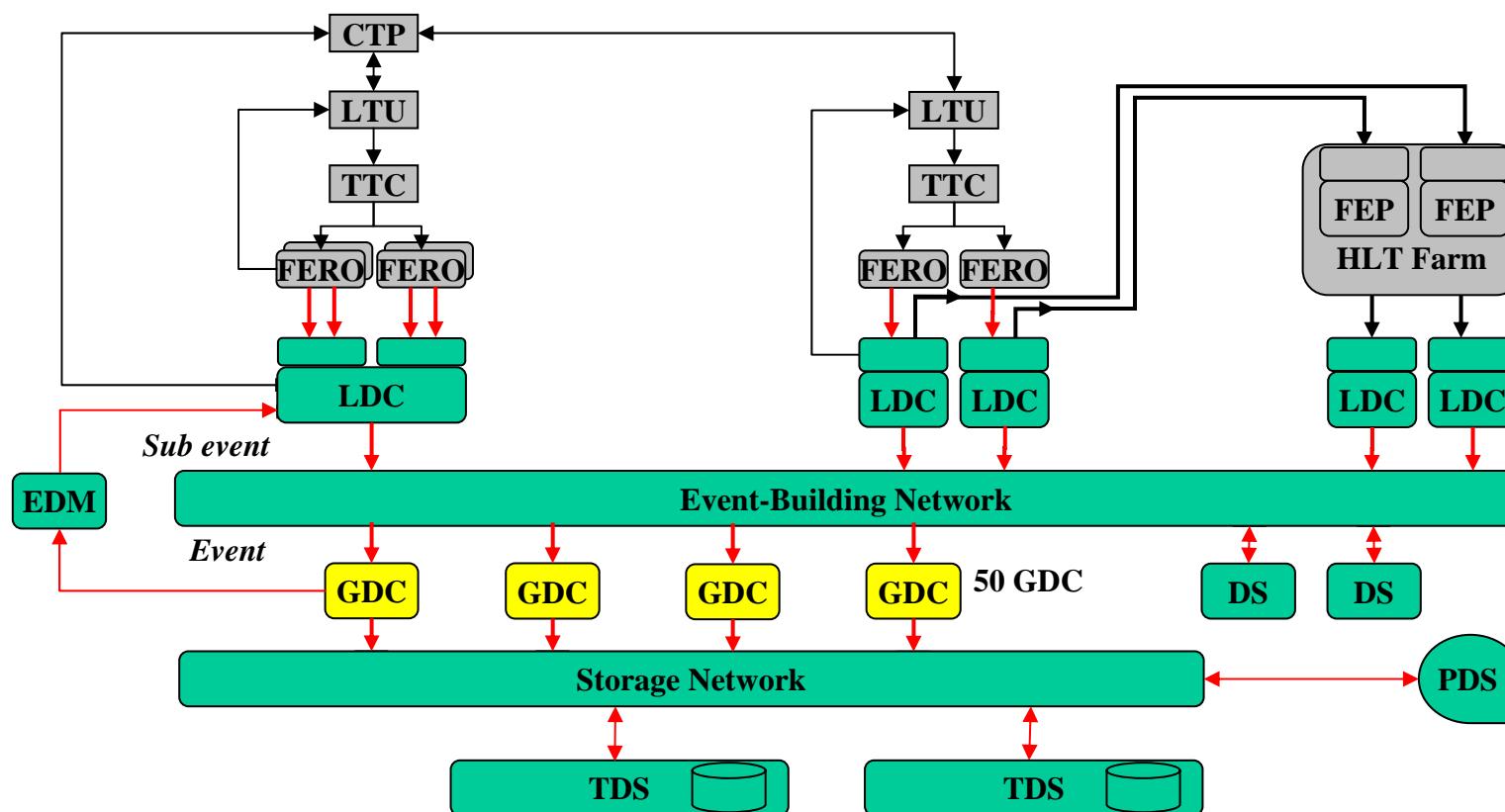




Data Acquisition



Global Data Collectors: *build events*

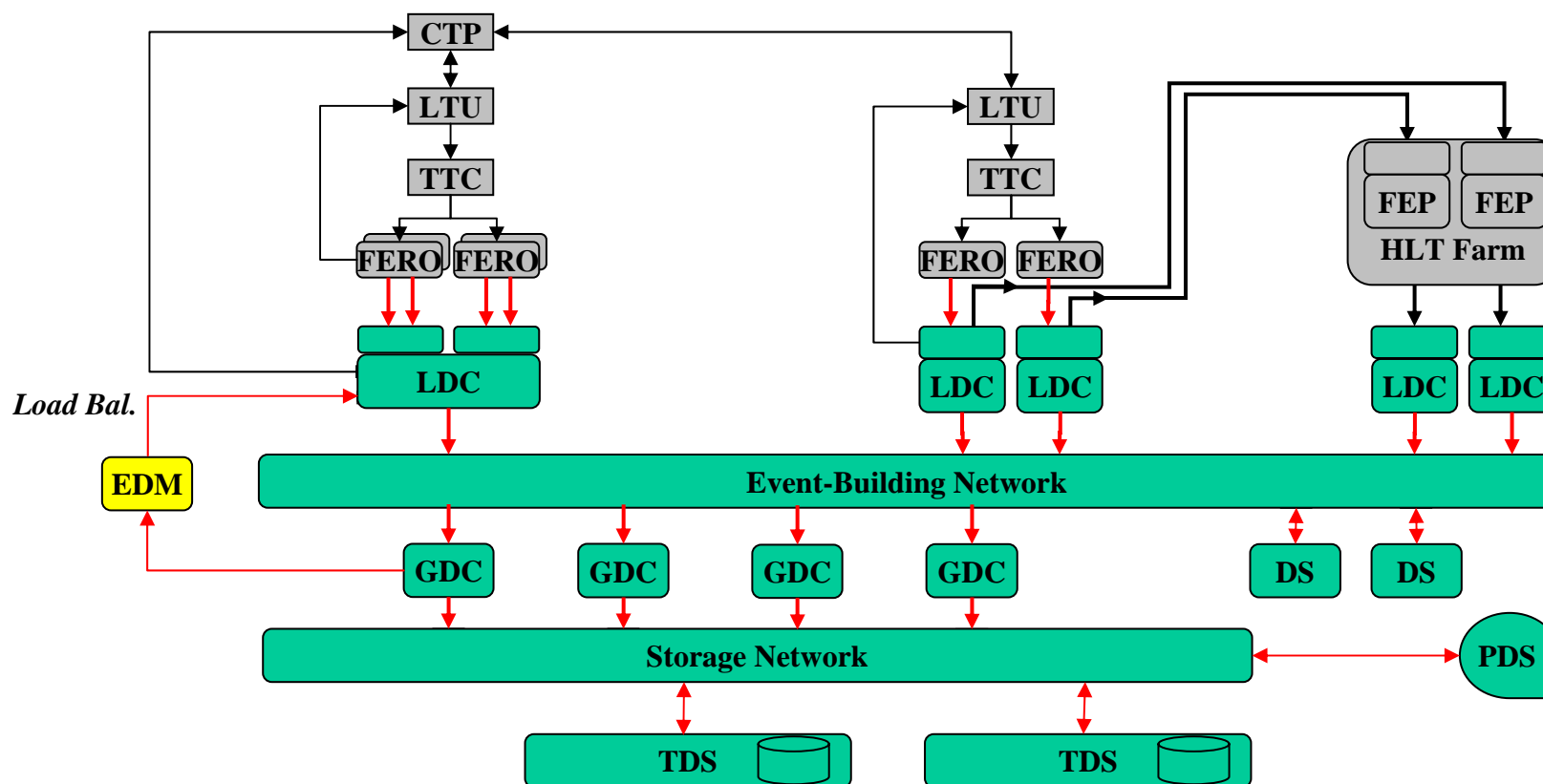


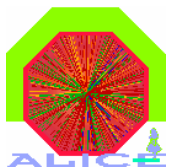


Data Acquisition



Event Distribution Manager: *load balancing*

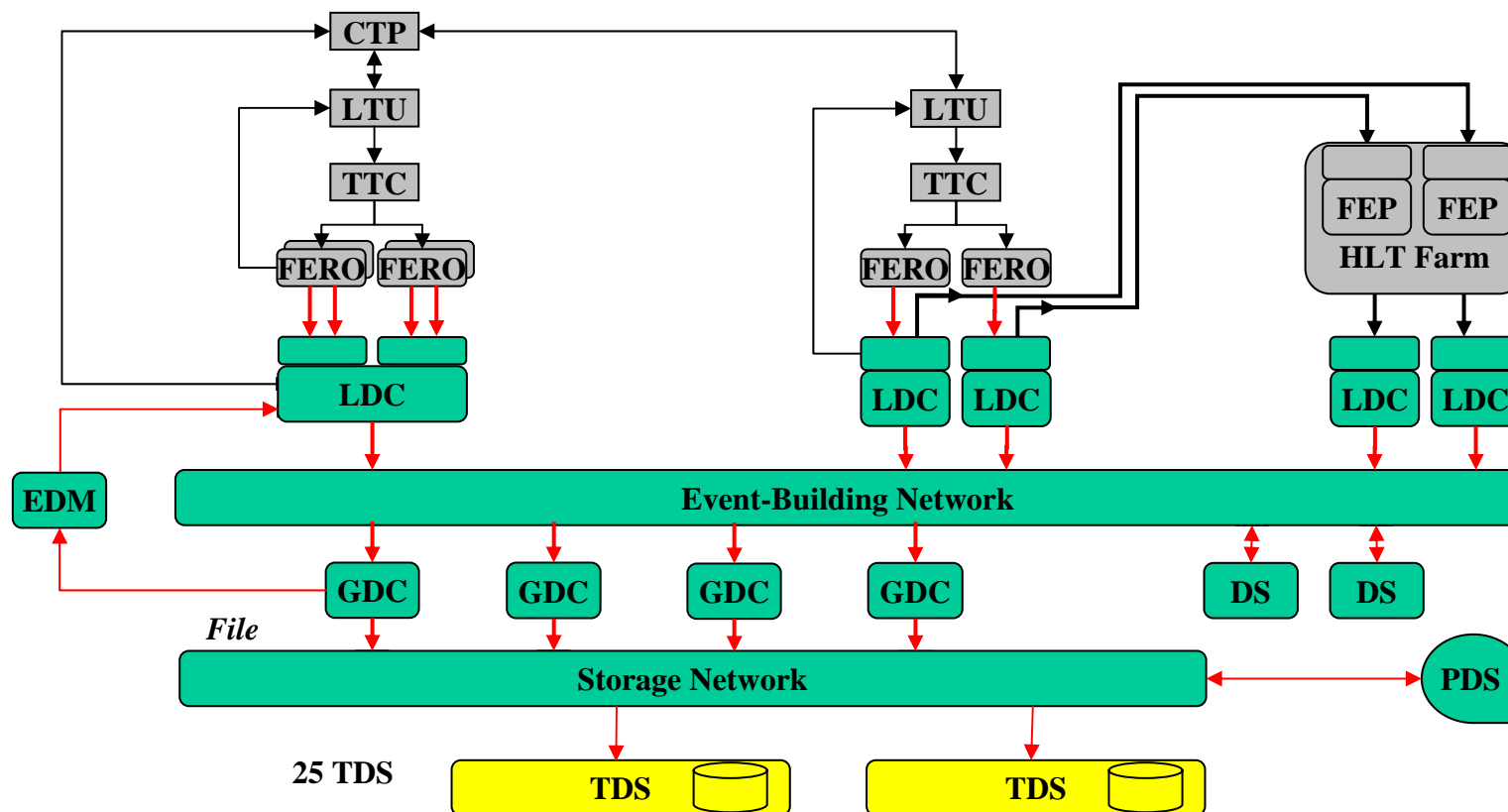


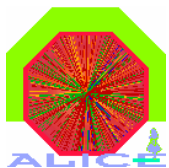


Data Acquisition



Transient Data Storage: *local storage before migration*

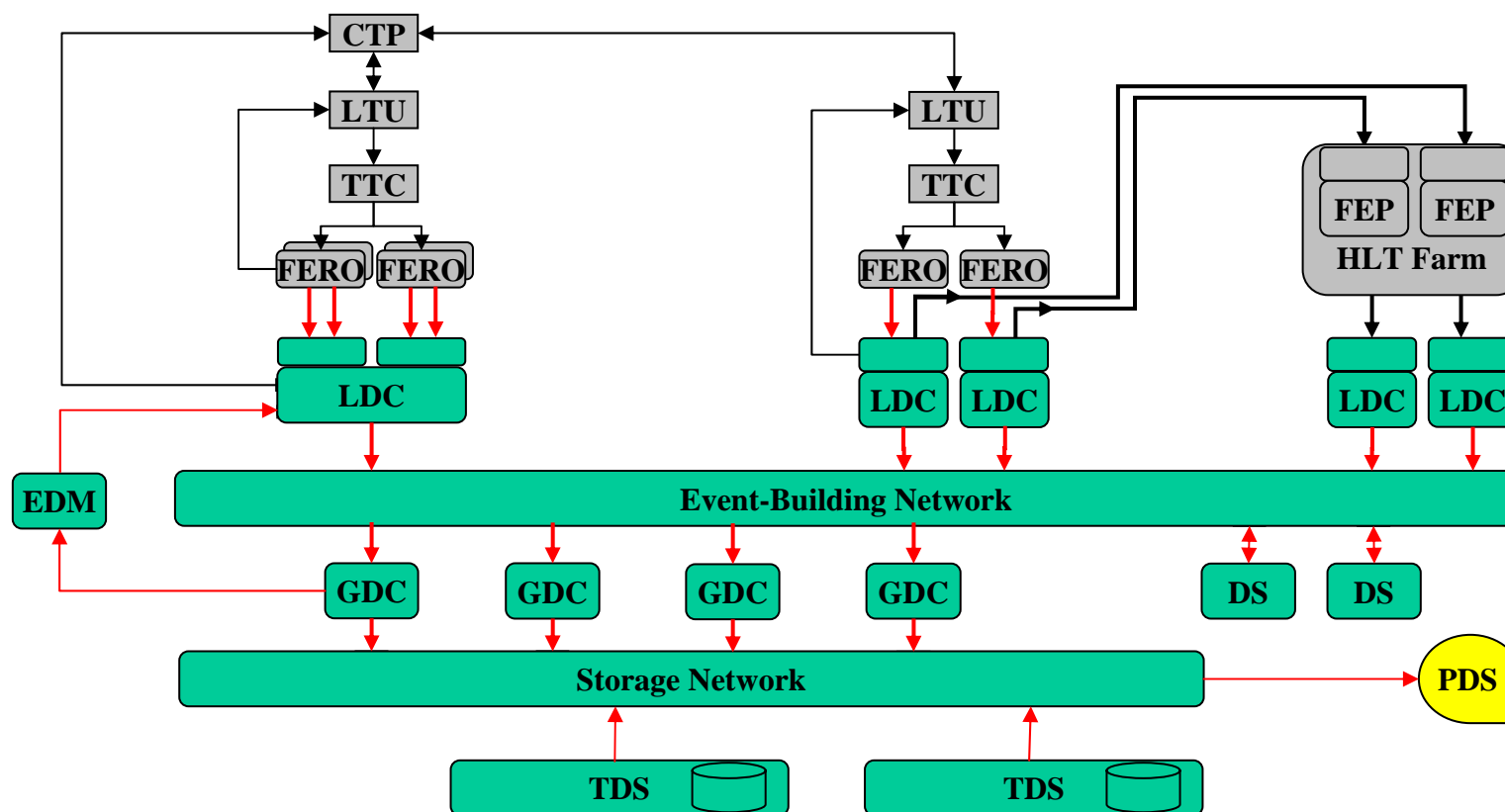


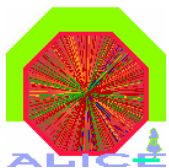


Data Acquisition



Permanent Data Storage: *file archive*

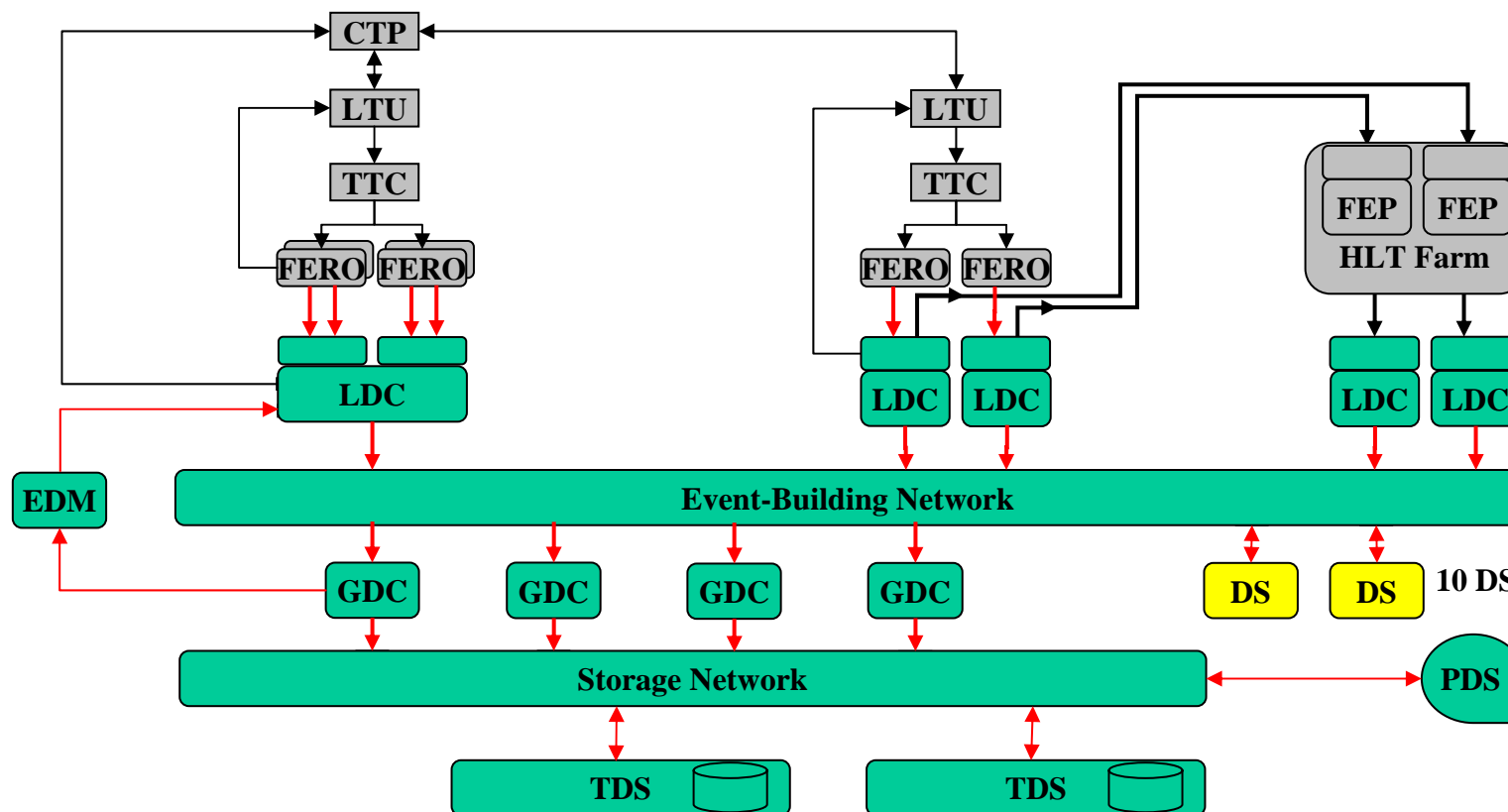


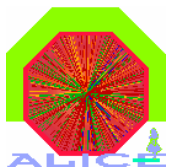


Data Acquisition



DAQ Services: *database and central facilities*

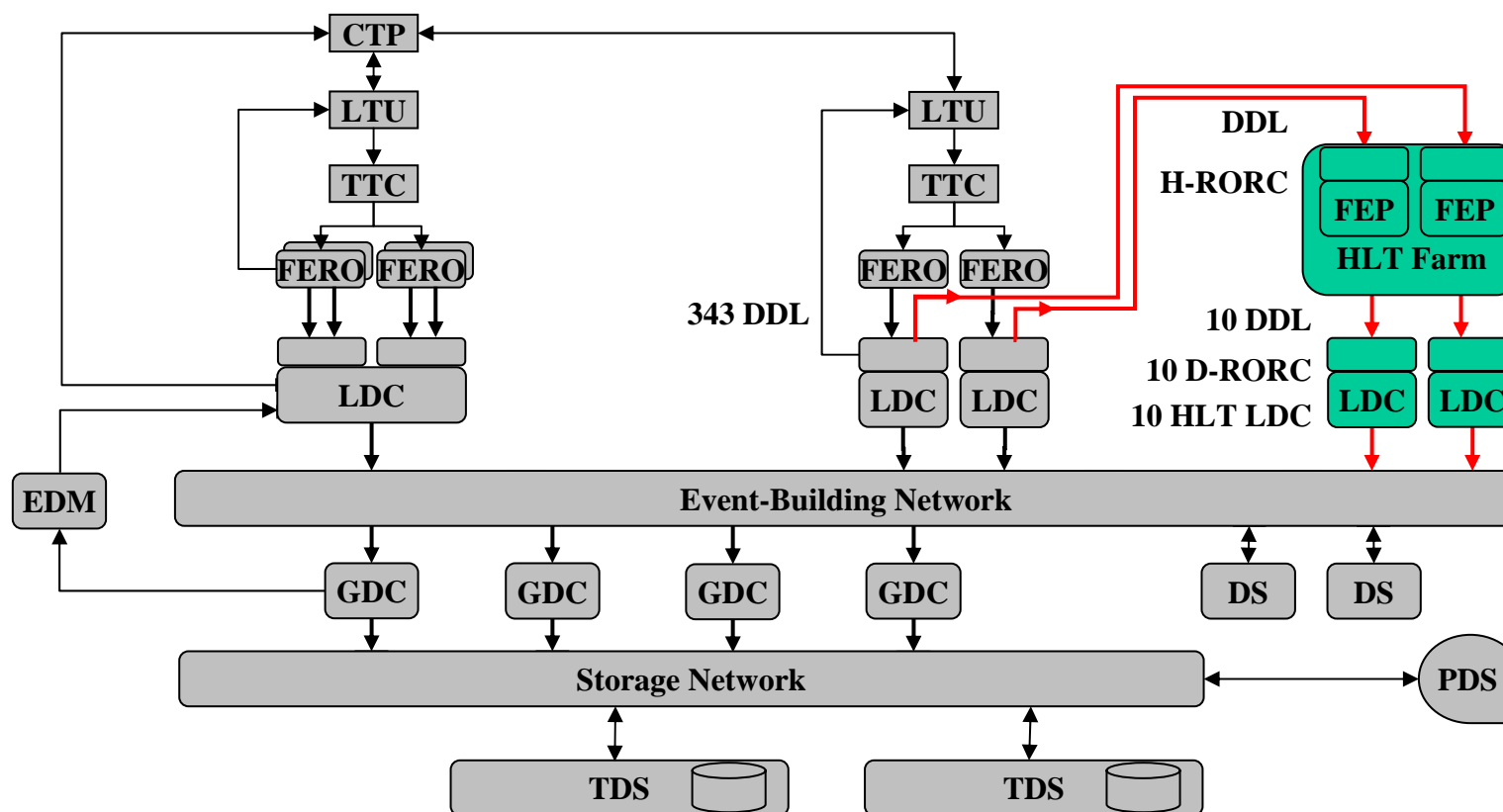




High-Level Trigger



Filter events to optimize amount of valuable data

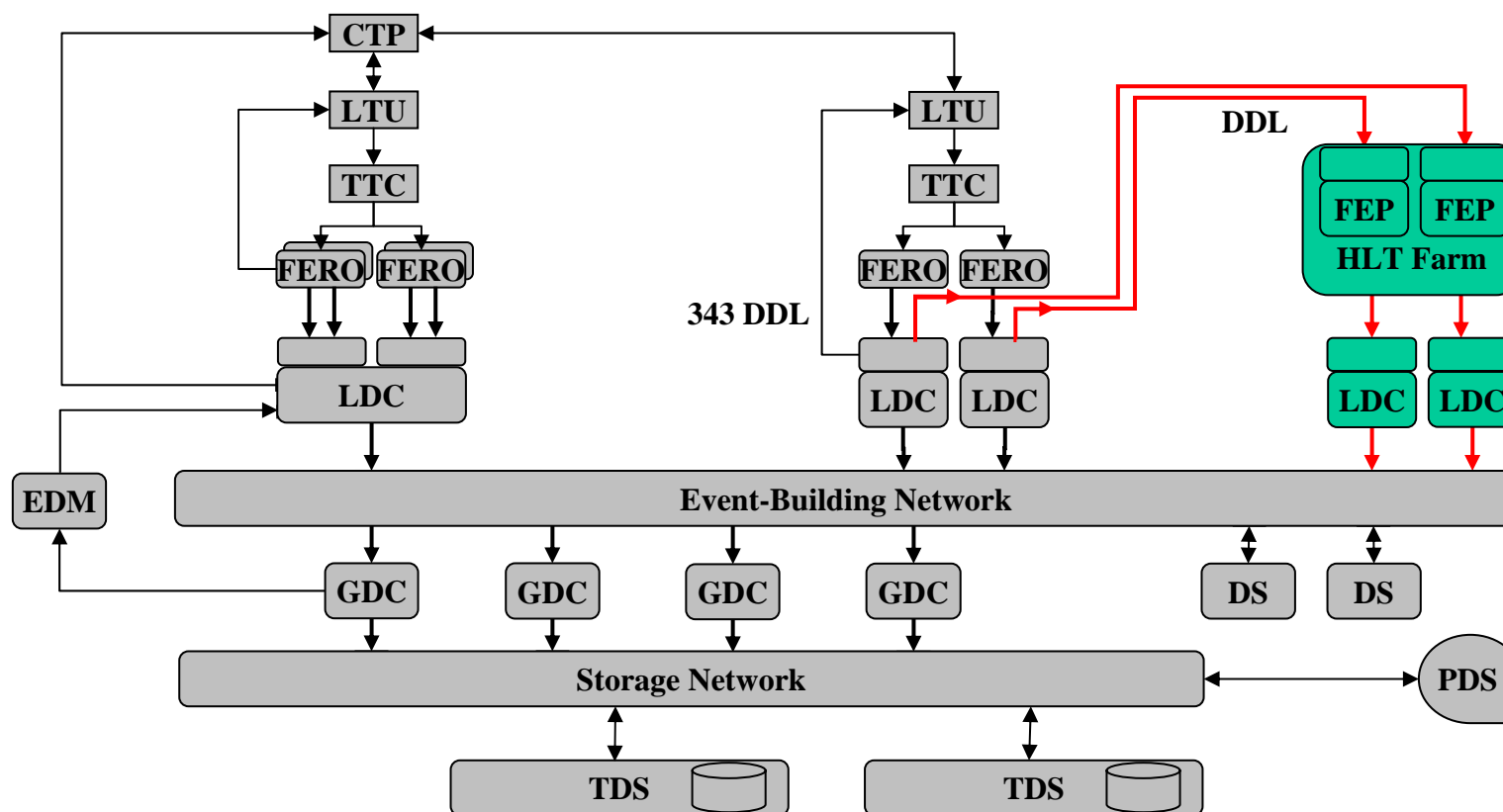


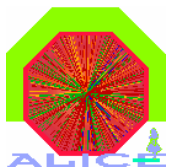


High-Level Trigger



Detector Data-Links: *transfer of event fragments*

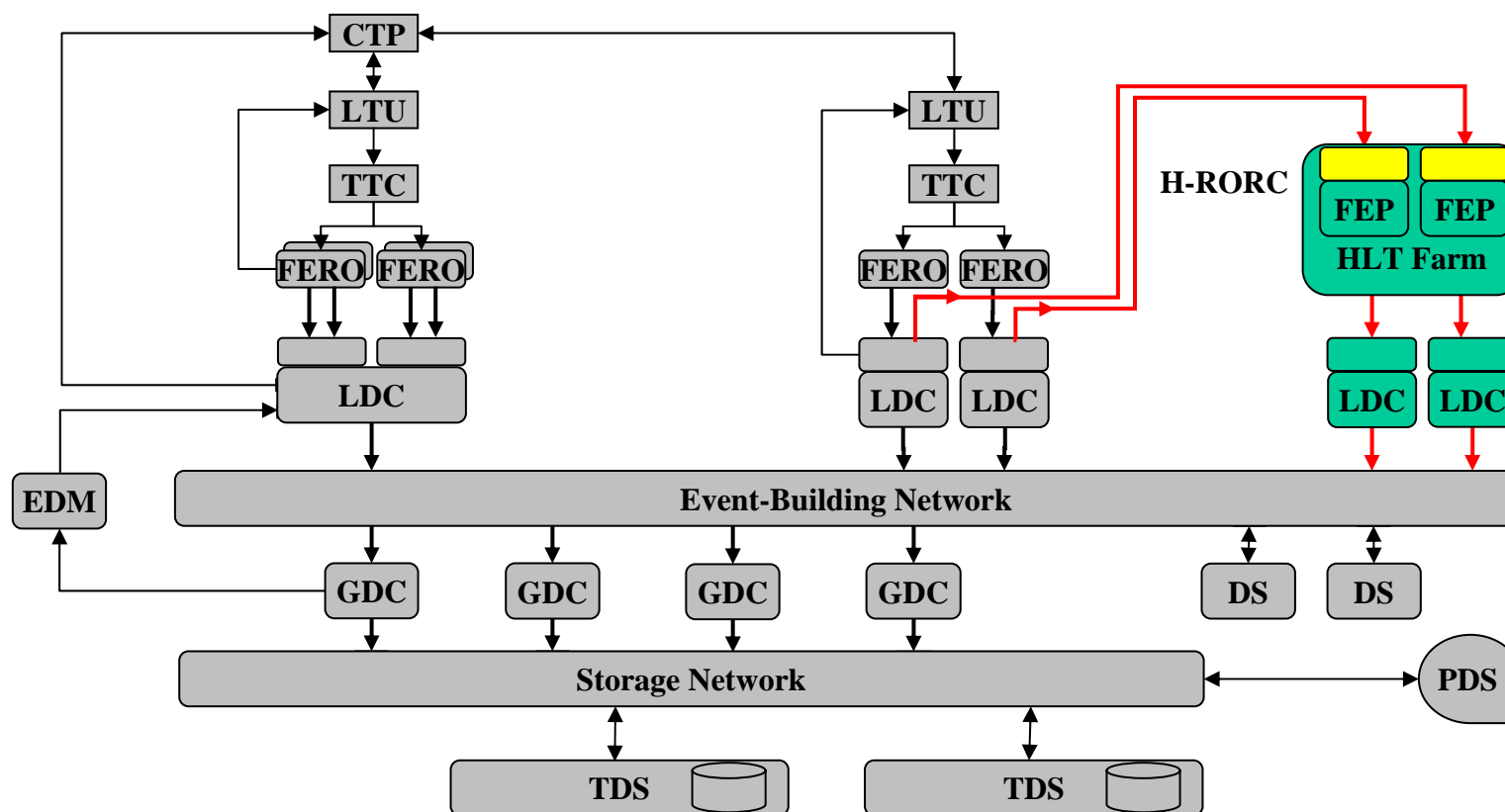




High-Level Trigger



HLT Read-Out Receiver Card: *data reception*

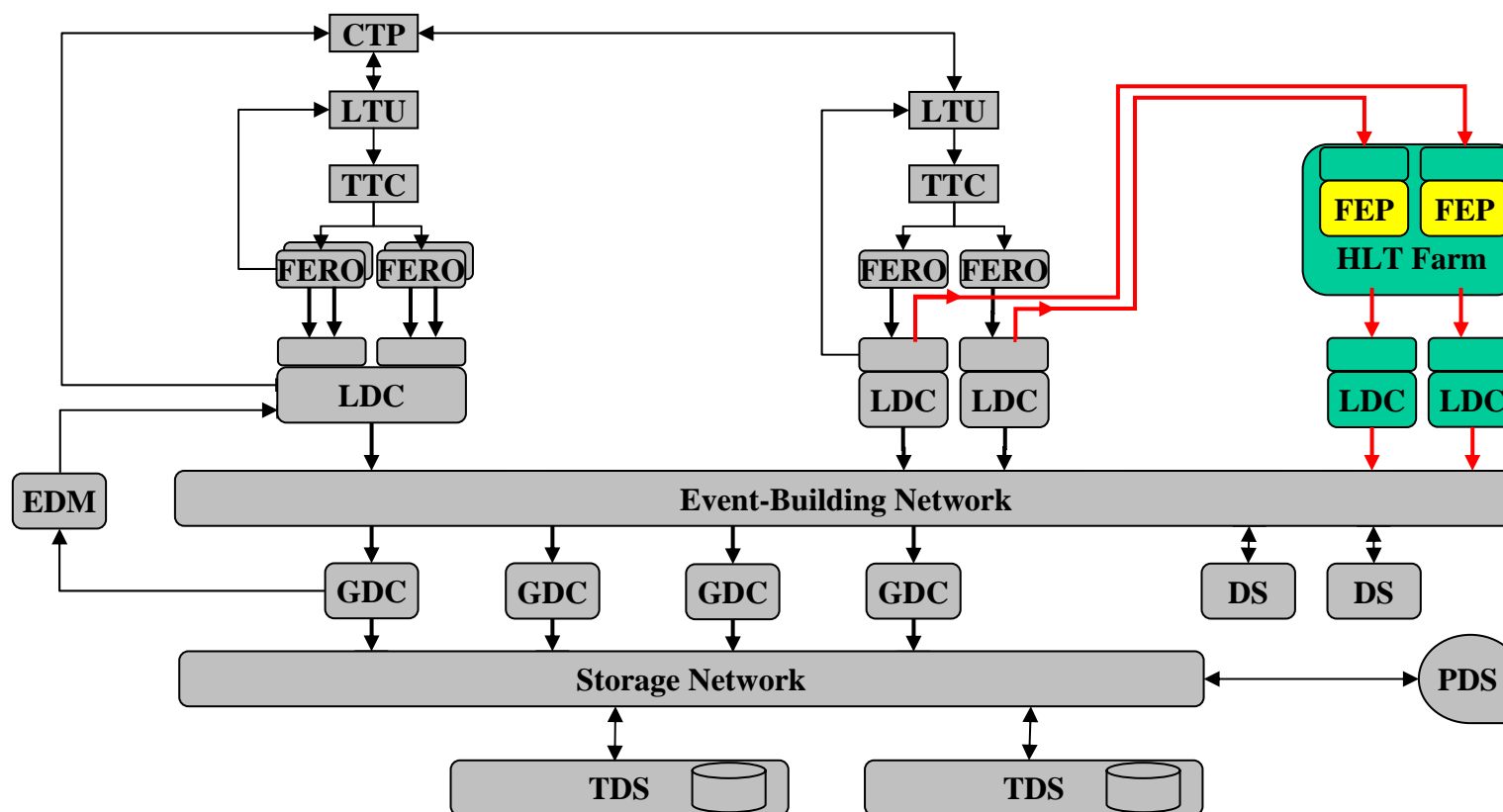




High-Level Trigger



Front-End Processors: *data analyzing and decision*

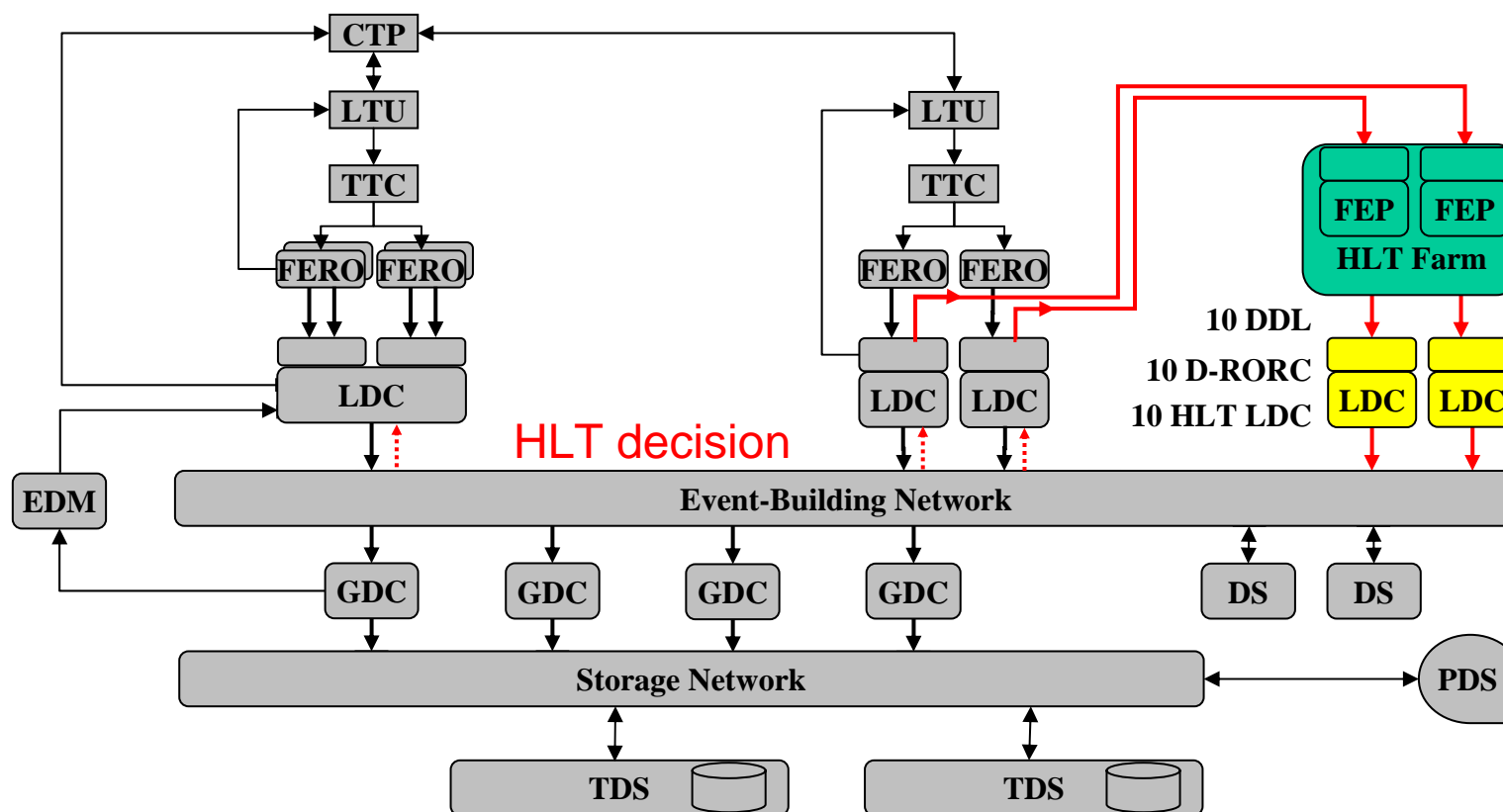


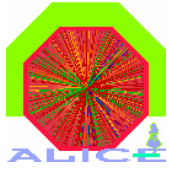


High-Level Trigger



DDLs, D-RORCs & LDCs: *injection of results in DAQ*

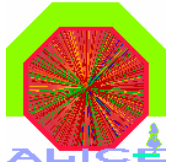




Implementation



- Transfer of data to the DAQ
- Computers
- Network
- Infrastructure
- Software

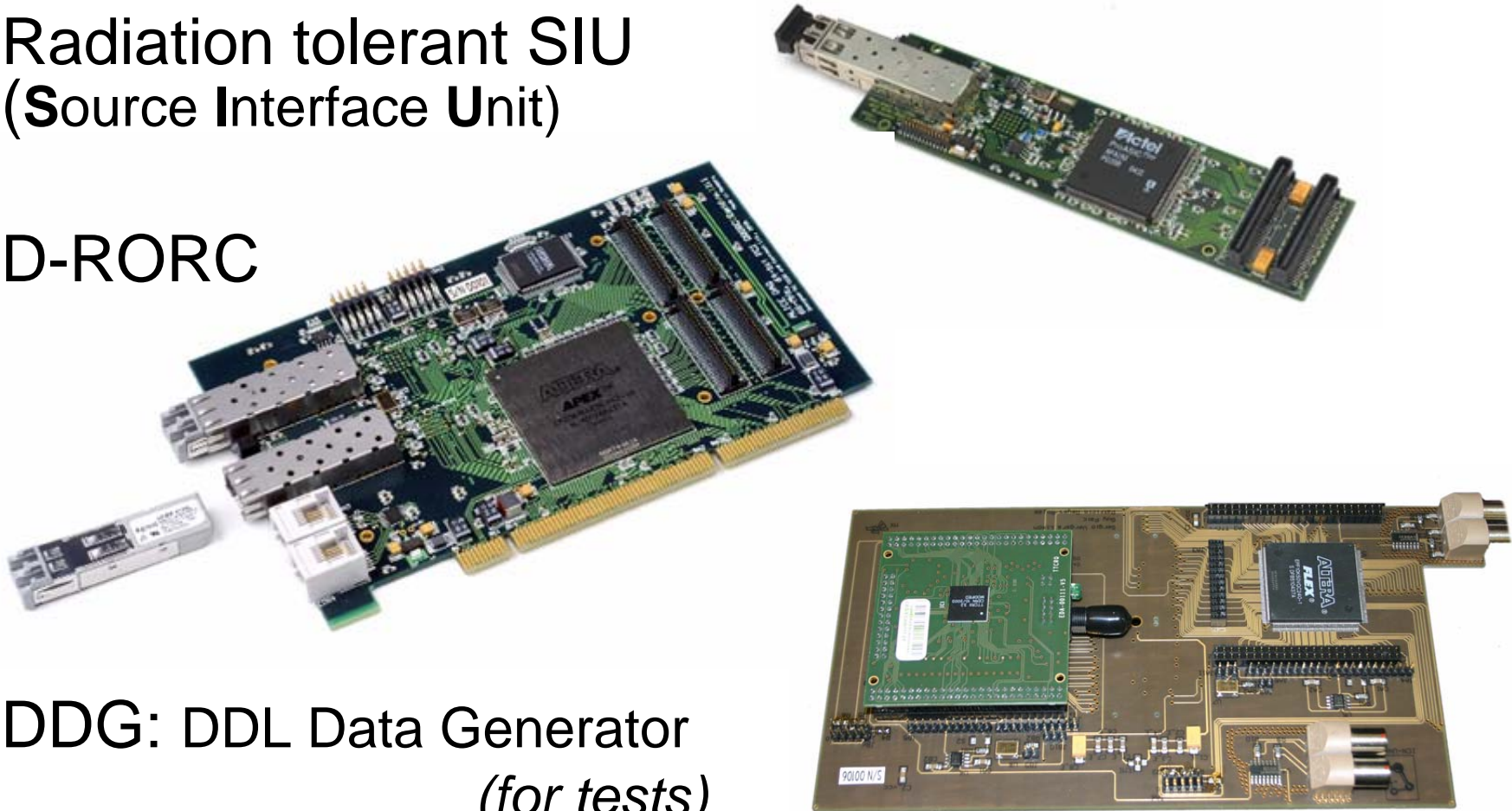


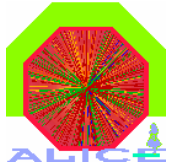
Detector Data Link



Transfer of data to the DAQ

- Radiation tolerant SIU (Source Interface Unit)
- D-RORC
- DDG: DDL Data Generator (for tests)

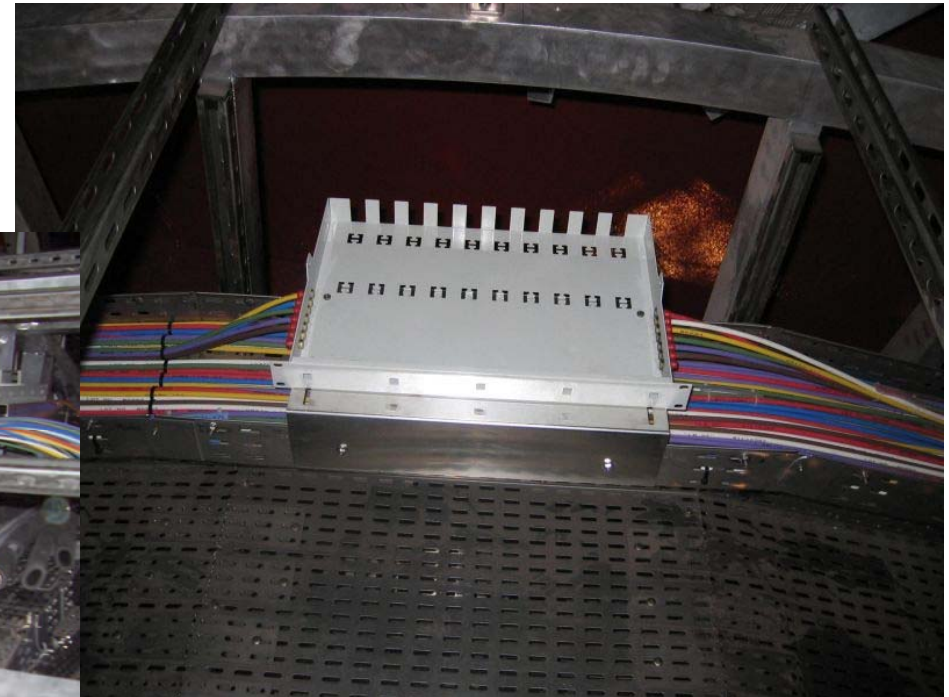


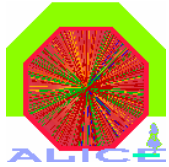


Installation



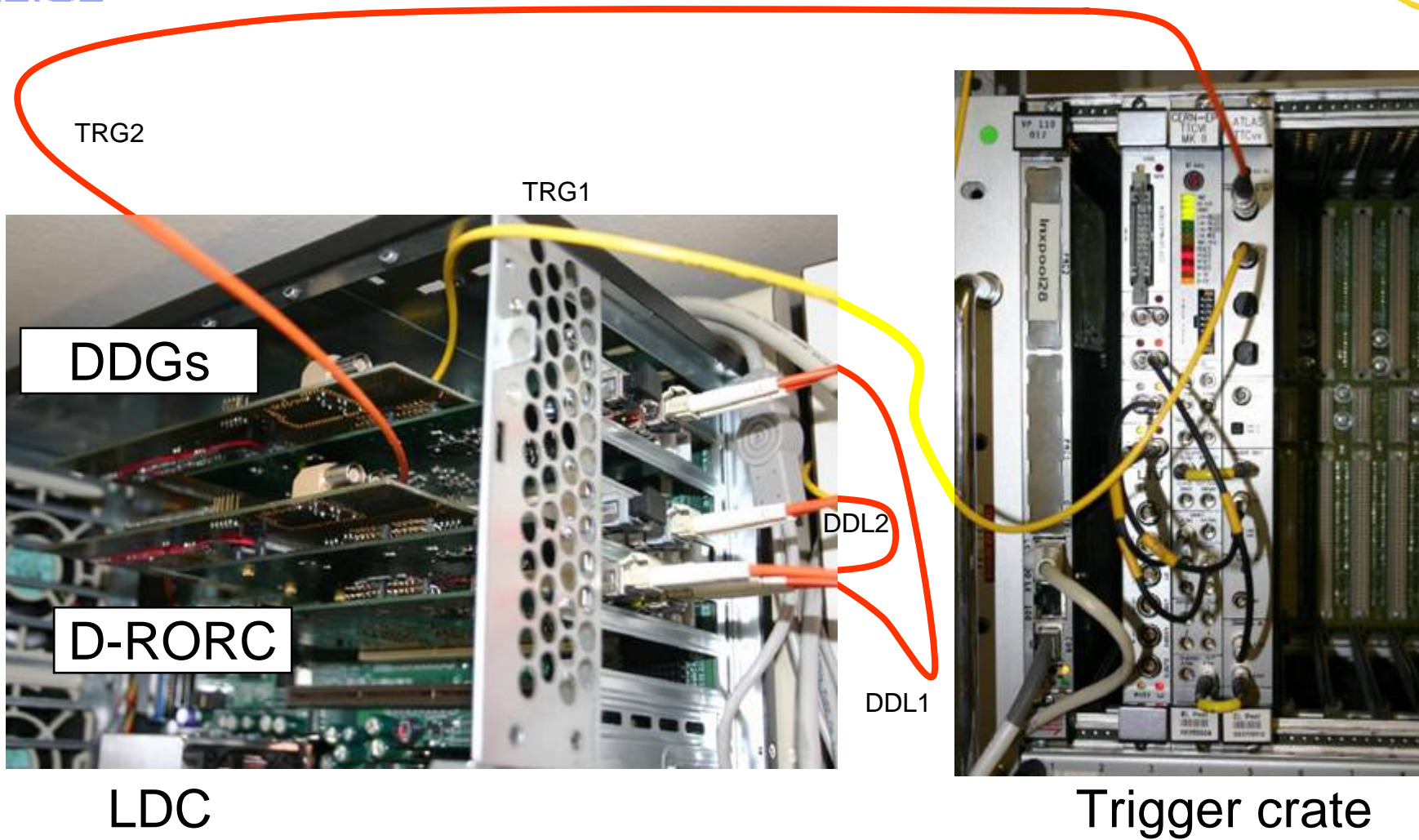
Pre-installation of optical fibres
finished in the backframe

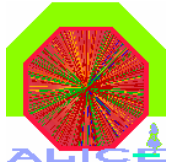




Test setup

DDL, DDG, Trigger





Computer choices



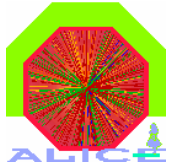
- Intel 32 (LDC,GDC)
- AMD 64 (DS)



- Scientific Linux CERN – SLC3
SLC4 when certified



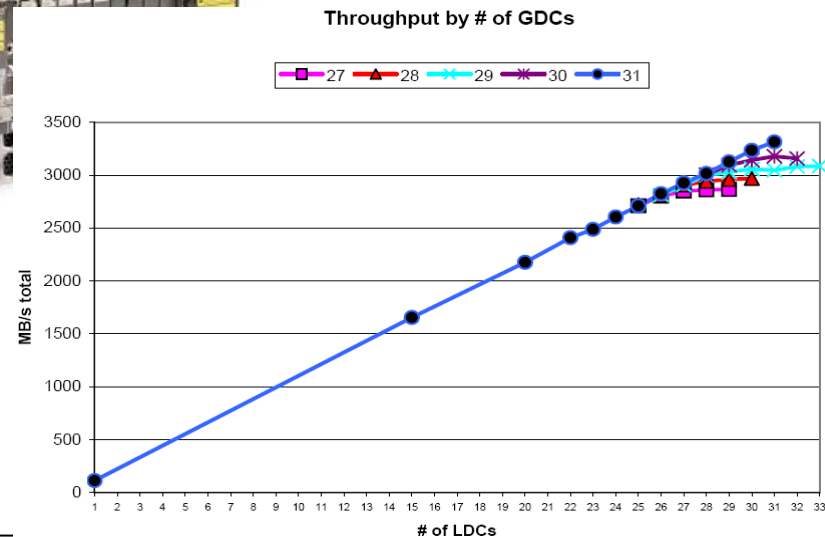
- GDC: CPU/memory performance
- LDC: number / architecture of PCI slots
- DS: database, multithreading performance

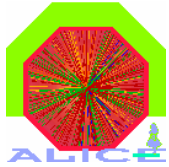


Event Building Switch

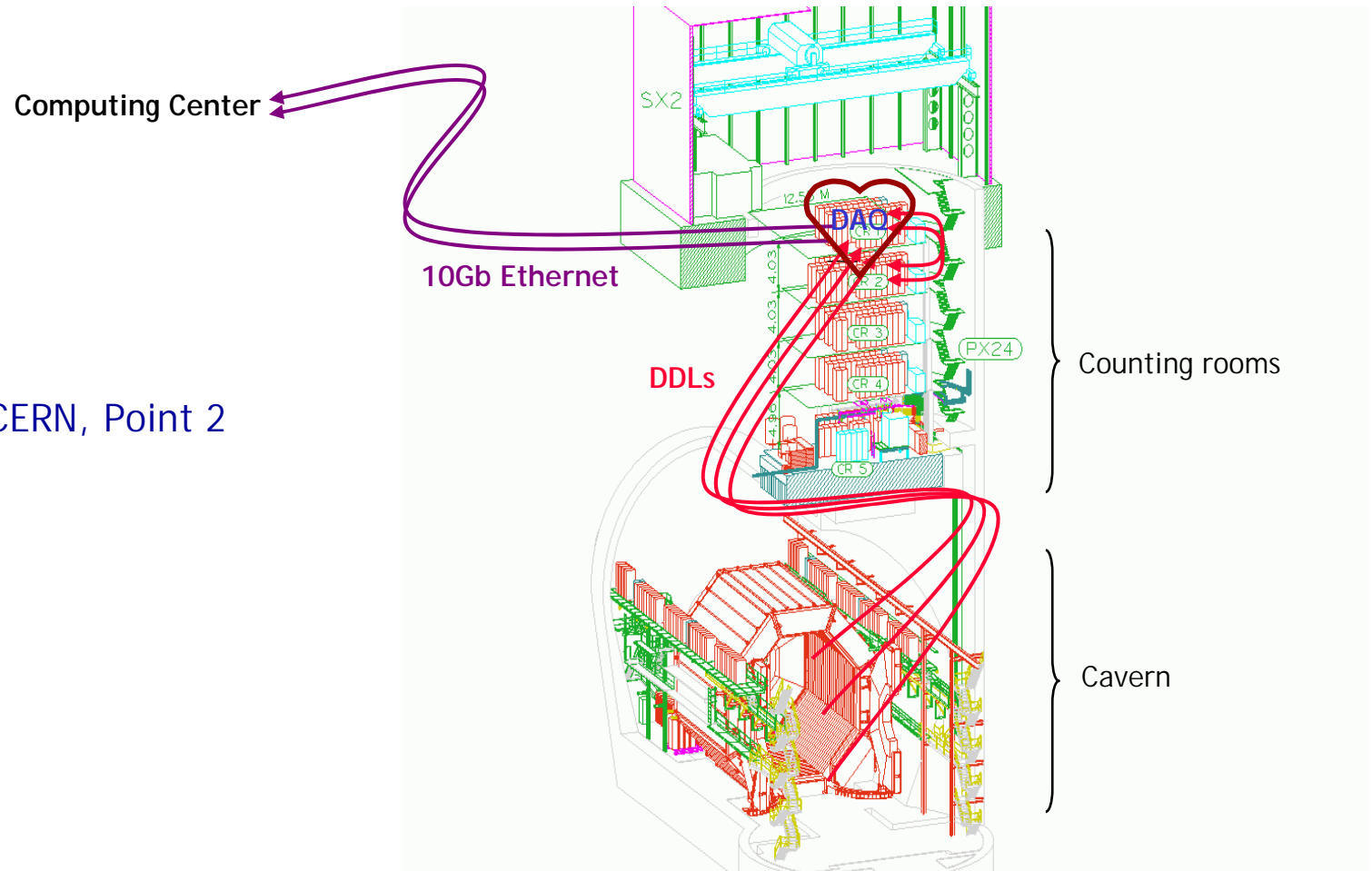


- ALICE baseline:
 - TCP/IP over switched Ethernet
- Event-Building Switch
 - CERN frame contracts
 - Needs of IT and experiments
 - Good prices
 - On site maintenance (company+IT)
- Switch qualification test
 - Special set-up (IT): 60 PCs
 - DATE software used for benchmarking
 - Switch selected: Force 10 Model 1200
 - Delivered and installed

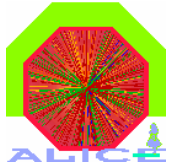




Experimental area



Machine: LHC @ CERN, Point 2

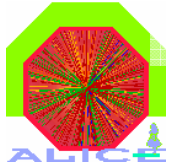


DAQ Counting Room



- Tight space: 70m²
- 33 racks
- ~300 computers





ALICE DAQ @ P2

PX24/CR1

DDL
patch panels

PDU

LDCs

GDC

Storage

Network
Gateway

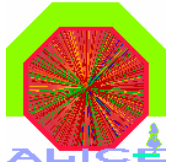
Network
Switch

Server

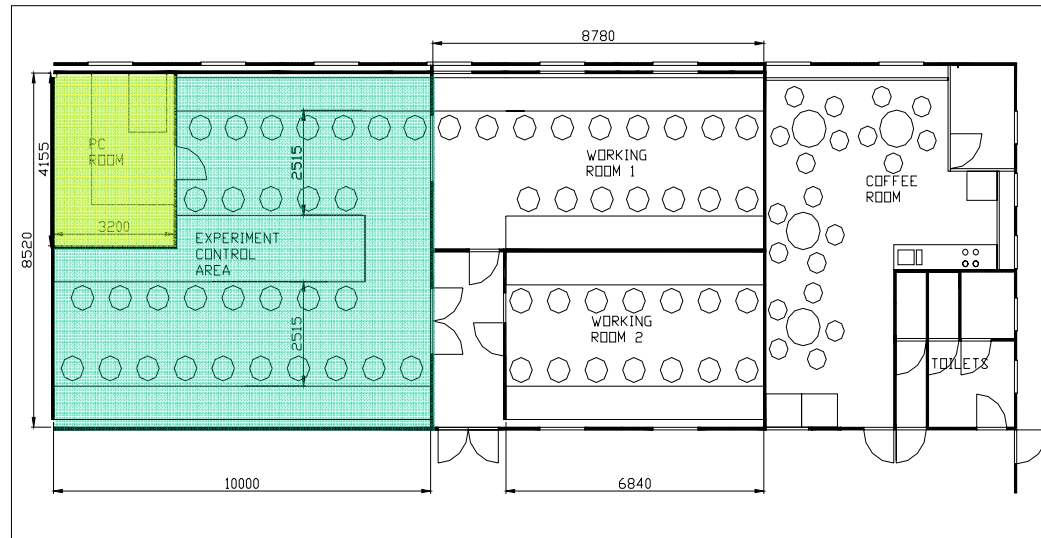


Clean room SXL2





ALICE Control Room

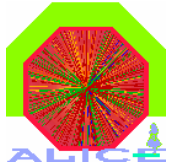


- 30 workstations
- separate room for PCs
- console access to machines in all counting rooms

- Multiscreen PCs

Nvidia NVS 280
Linux Xinerama





DAQ Software



DAQ software

- DDL software
- DAQ framework (DATE V5)
- Performance Monitoring (AFFAIR)
- Data quality monitoring (MOOD)

Auxiliary Software:

- DIM, SMI, MySQL, Tcl/Tk, libshift, ROOT, VMEbus driver

Information dissemination

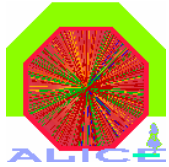
- Documentation: 4 DAQ sw packages + ECS: fully documented. User's guide released and printed
- Regular DAQ trainings (70 people in last 3 years)

Linux

- Linux SLC3 now.
- ALICE DAQ contributing to Linux SLC4 certification. Transition to SLC4 scheduled before end '06.

Testing:

- reference system, on-line data challenges, test beams



DATE Run Control



- Control
 - Configuration
 - Main parameters
- Display
 - SMI State of all nodes
 - Main counters of all nodes
- Compatible with ECS

ALLALICE DAQ - Run Control
 HI running on pcald21 with PID 24842
 RC running on pcald21 with PID 24790

Disconnected Configuration | Connected Run Parameters | Ready to start | Data Taking

Start processes | Start | Stop | Abort

HLT mode A: DAQ only

Recording disabled

RUN NUMBER : 11 Run Control Status : RUNNING

Trace
 Mon 08 17:10:40 (RC) Starting Data Taking for run 11
 Clear
 Mon 08 17:10:37 (HI) Current RC options loaded from : JCM_20
 Mon 08 17:10:37 (HI) Start processes time : 7 seconds
 Debug
 Mon 08 17:10:30 (RC) Starting run 11
 Pause
 Mon 08 17:10:30 (RC) Get and update run number from database
 Mon 08 17:10:30 (RC) New Run options loaded from : Database JCM_20
 Bigger
 Mon 08 17:10:24 (HI) Stop processes time : 6 seconds
 Smaller
 Mon 08 17:10:18 (ldc20) End of run requested from LDC20

LDC status display

LDC name	ldc20	ldc21
Number of equipments	1	1
Number of triggers	488	381
Trigger rate	50	50
Number of sub-events	488	381

GDC status display

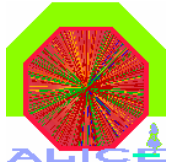
GDC name	gdc20
Number of sub-events	635
Sub-event rate	100

GDC (1)

NOT_RUNNING
 STARTING
 STARTING_PDSREC
 STARTING_EVB
 RUNNING
 RUNNING_ERR
 STOPPING_EVB
 STOPPING_PDSREC
 WAIT_STOPPED
 STOPPED

LDC (2)

NOT_RUNNING
 SYNCHRONOUS
 STARTING
 STARTING_EDMC
 STARTING_RECORDER
 STARTING_HLTAGENT
 STARTING_EDMAGENT
 STARTING_READOUT
 WAITING_START_OF_DATA
 RUNNING
 STOPPING_READOUT
 STOPPING_EDMAGENT
 STOPPING_HLTAGENT
 STOPPING_RECORDER
 STOPPING_EDMC
 STOPPED



DATE Configuration Database



- Database content

- DATE Roles

- Actors of DATE system:
LDCs, GDCs...*

- Trigger

- Trigger masks*

- Detectors

- Front-end equipment of LDCs*

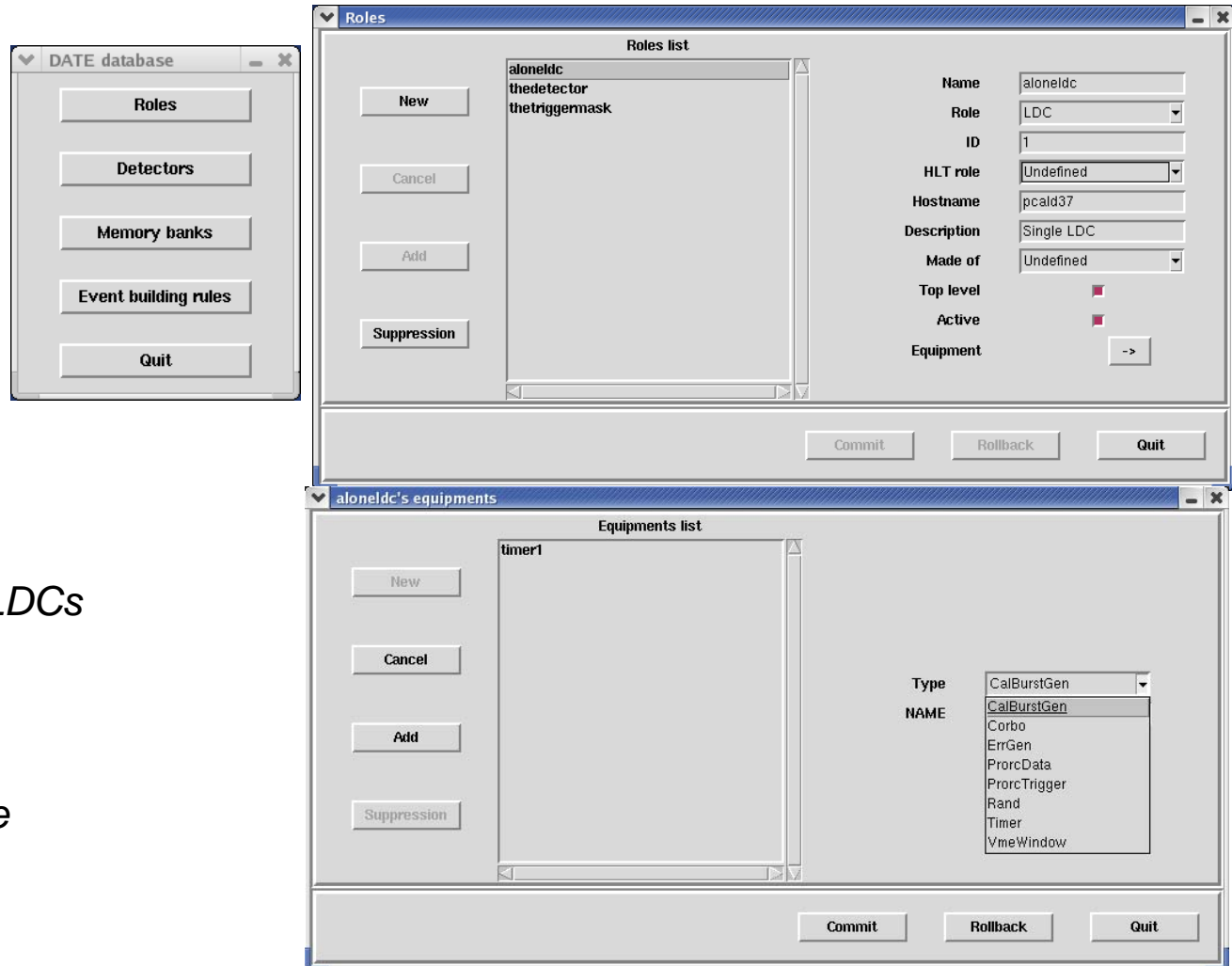
- Event building control

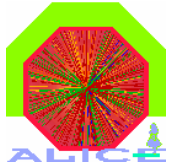
- Event building rules*

- Banks

- Memory banks to operate
DATE*

- Released in DATE V5





DATE Infologger



infoBrowser - DATE_SITE = /local/datedev/dateSite

Level Date Time decimals Host Pid Username Facility Destination Run Message

Level	Time	Host	Facility	Message
Info	14:52:19	pcald37.cern.ch	runControl	Connecting to aloneldc
Info	14:52:19	pcald37.cern.ch	runControl	Starting Logic Engines at 20 May 2005 14:52:19 (Wait...)
Info	14:52:20	pcald37.cern.ch	runControl	Connected to remote hosts
Info	14:52:22	pcald37.cern.ch	runControl	New Run options loaded from : Database DATE
Info	14:52:22	pcald37.cern.ch	runControl	Starting run 10
Info	14:52:22	pcald37.cern.ch	runControl	Run starting

Archive: Select Create Delete
Filters: Clear Save Load

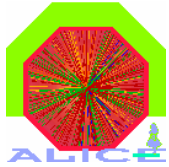
min. Time match Level (I,E,F) Hostname Username Facility Destination Run Message
max. Time exclude

runControl

Query
Export
 Online

Status : Connected
Query : Online data
6 messages

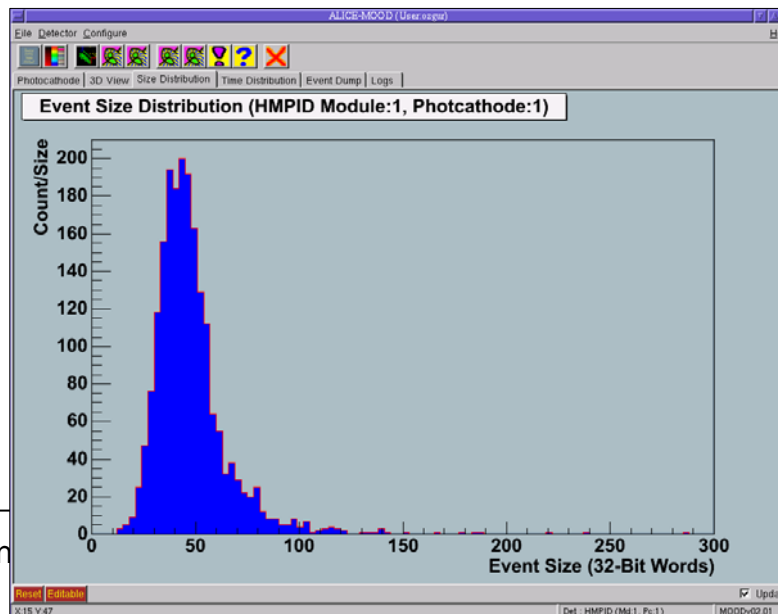
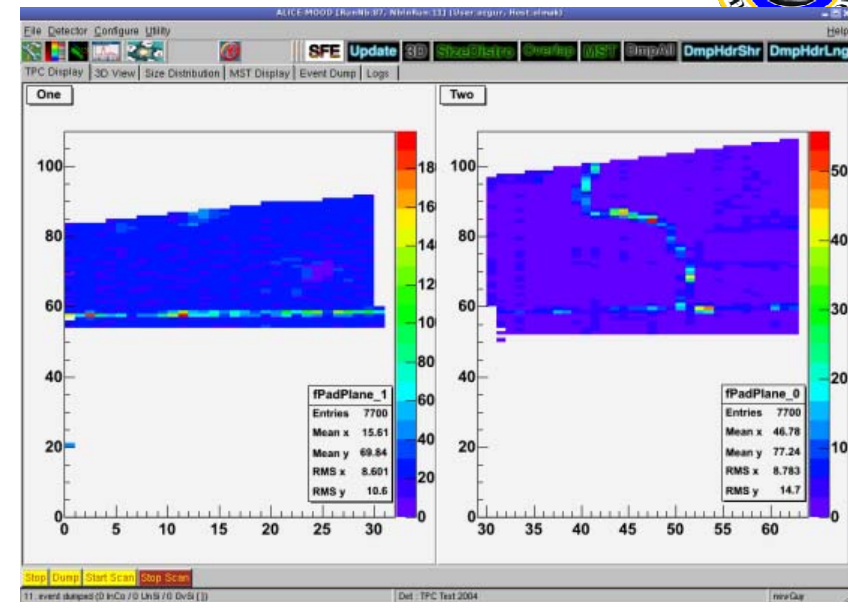
- Online view
 - Online selection of visible fields
 - Online selection of message displayed



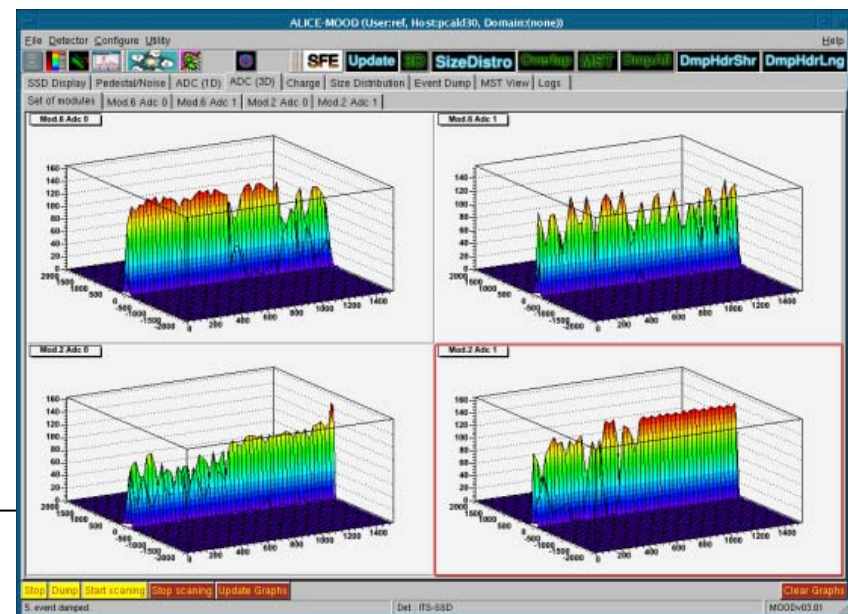
Data quality monitoring: MOOD

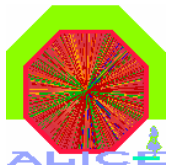


- MOOD: Monitoring Of Online Data
- DATE + ROOT environments
- MOOD framework
 - Interfaces to detector code
- Applications:
 - Raw data integrity
 - Detector performance



to me an



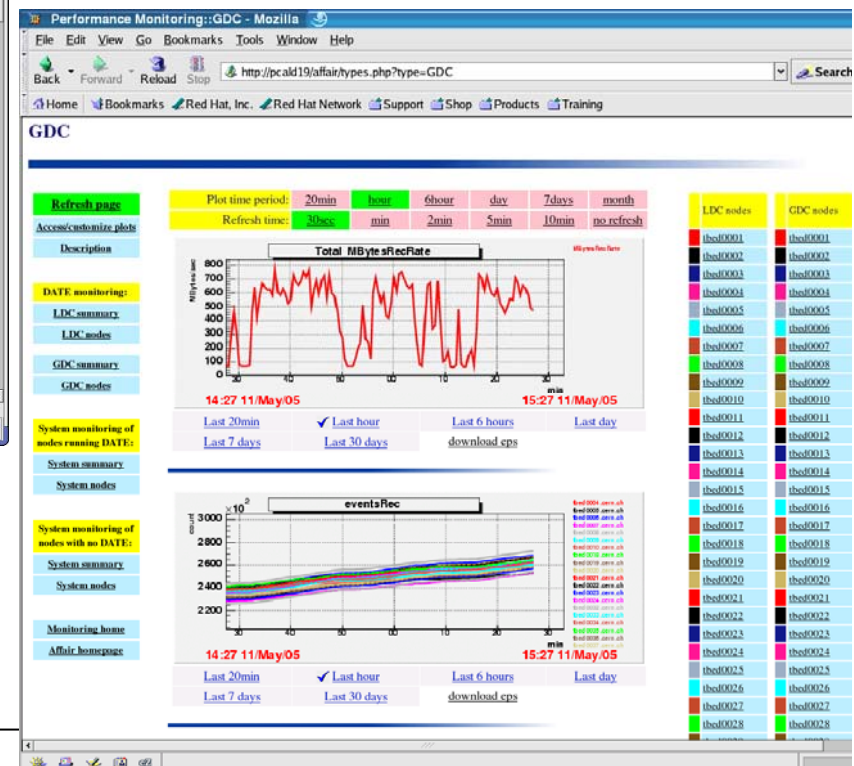


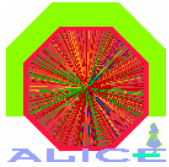
Performance monitoring: AFFAIR



- System view / Aggregated performances
 - Event building bandwidth
 - Event numbers

- Individual nodes view
 - CPU usage
 - Input/Output
 - Node status





Conclusion



- **Data transfer**
 - DDL and D-RORC being produced
- **DAQ software ready**
 - Software (DDL sw, DATE, AFFAIR, MOOD) released (rpm) and documented.
 - satisfies the functional + performance requirements
 - runs on single machine and large-scale setups
 - Linux SLC3 now. Transition to SLC4 scheduled before end '06.
 - is tested at reference system, data challenges, test beams
 - is ready for the test and commissioning phase
- **DAQ fabric hardware**
 - Event building switch qualified and being installed
 - PCs and storage selected. Tenders include most recent equipment.
- **Installation**
 - Services for DAQ finished
 - Optical fibres progressing with detector installation