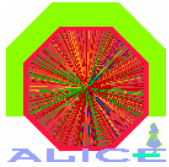# Status of the ALICE DAQ

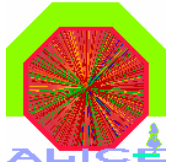T. Antičić

ALICE DAQ

Flexibility
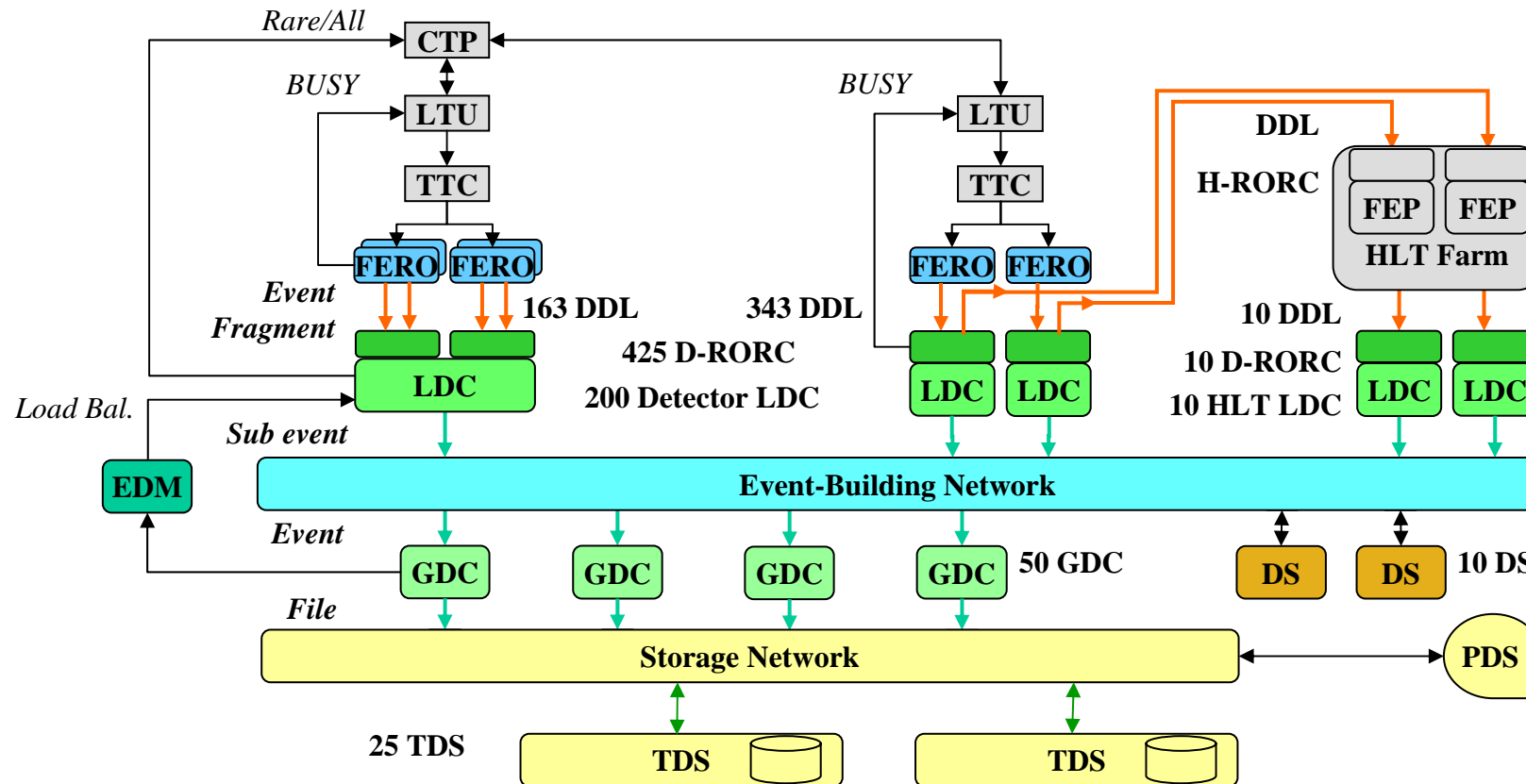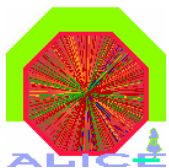
– **17 detectors**

– 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*

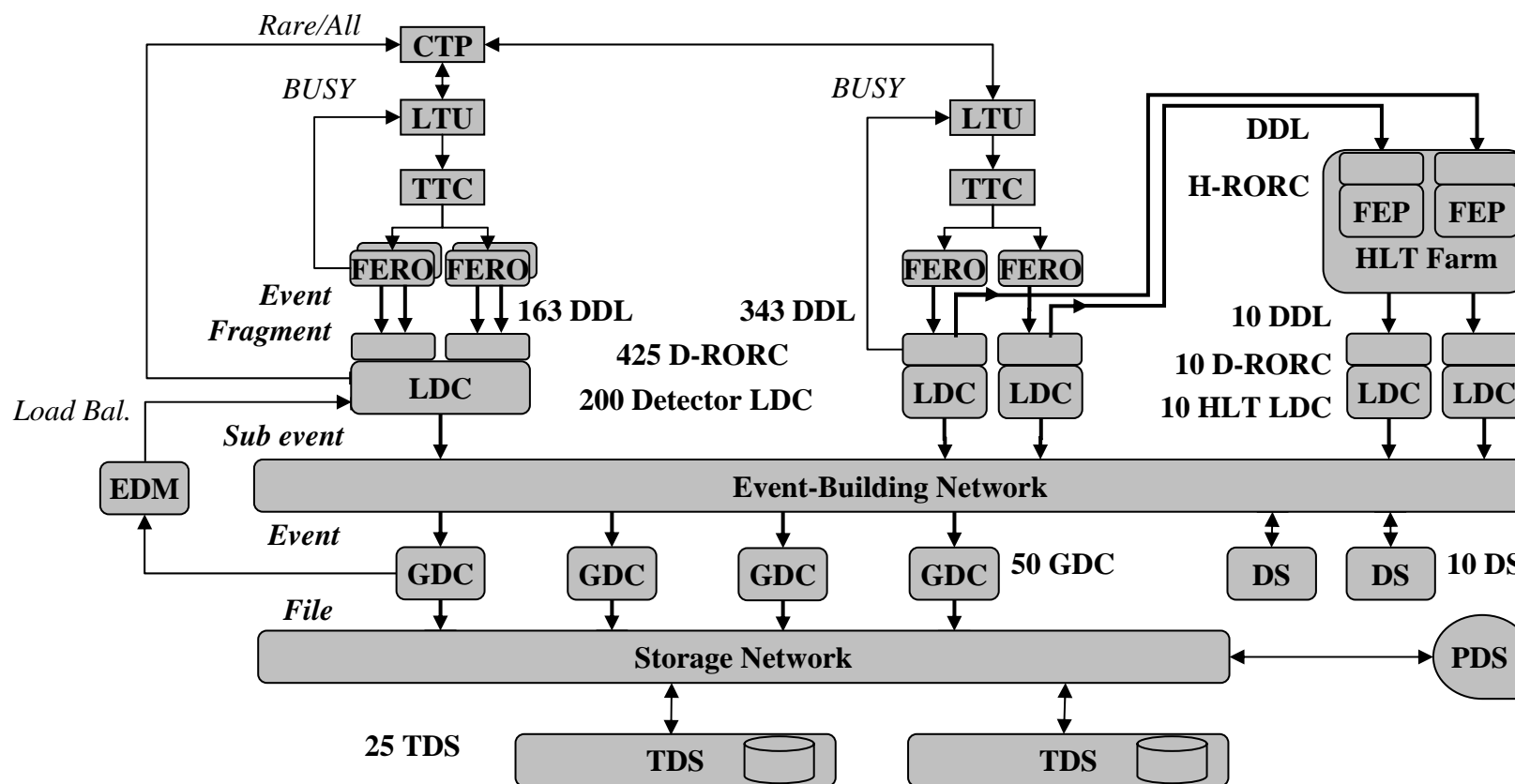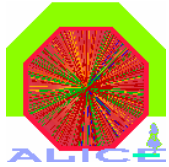**25 GB/s raw from the detectors => 1.25 GB/s data files**
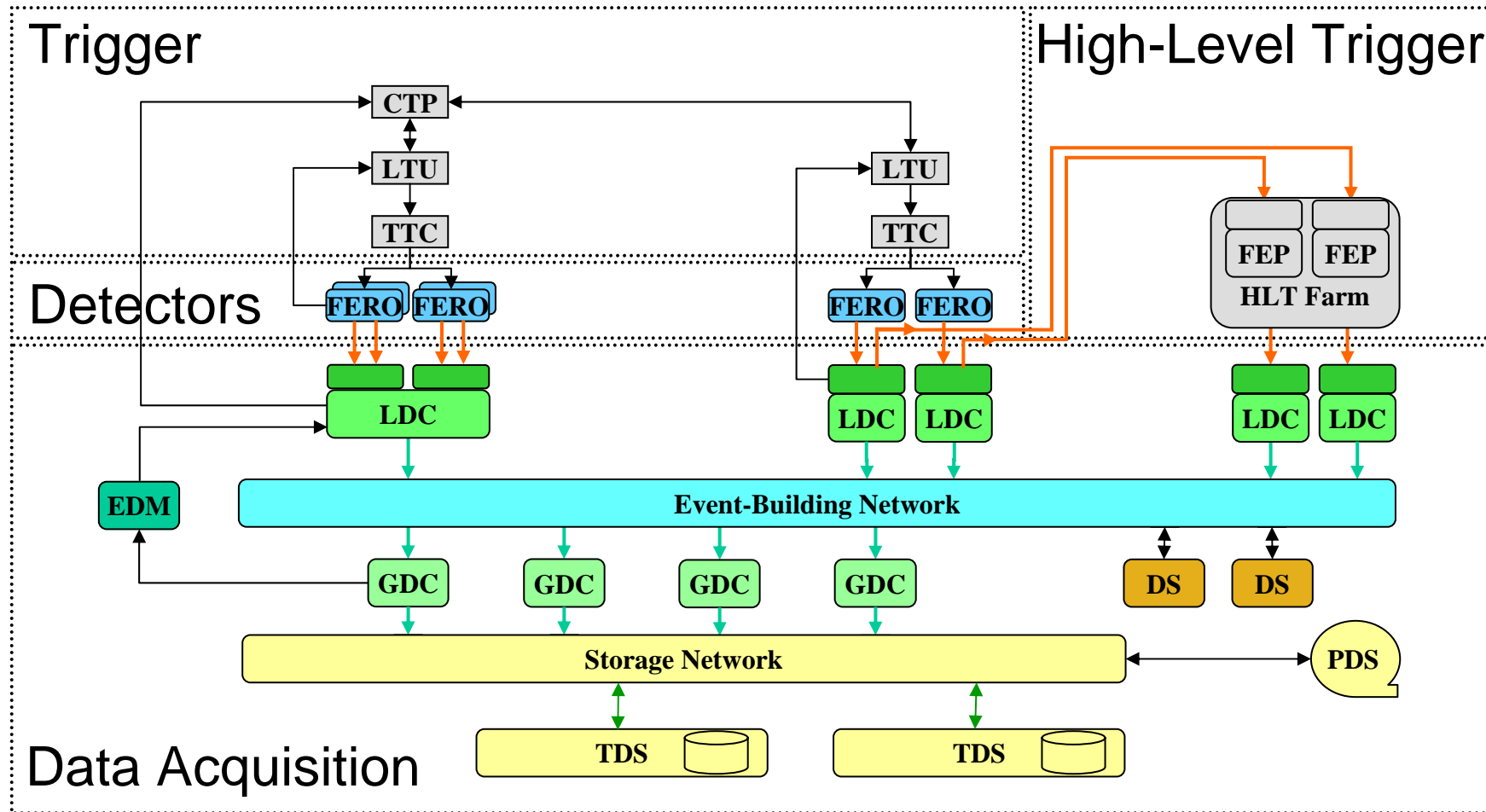
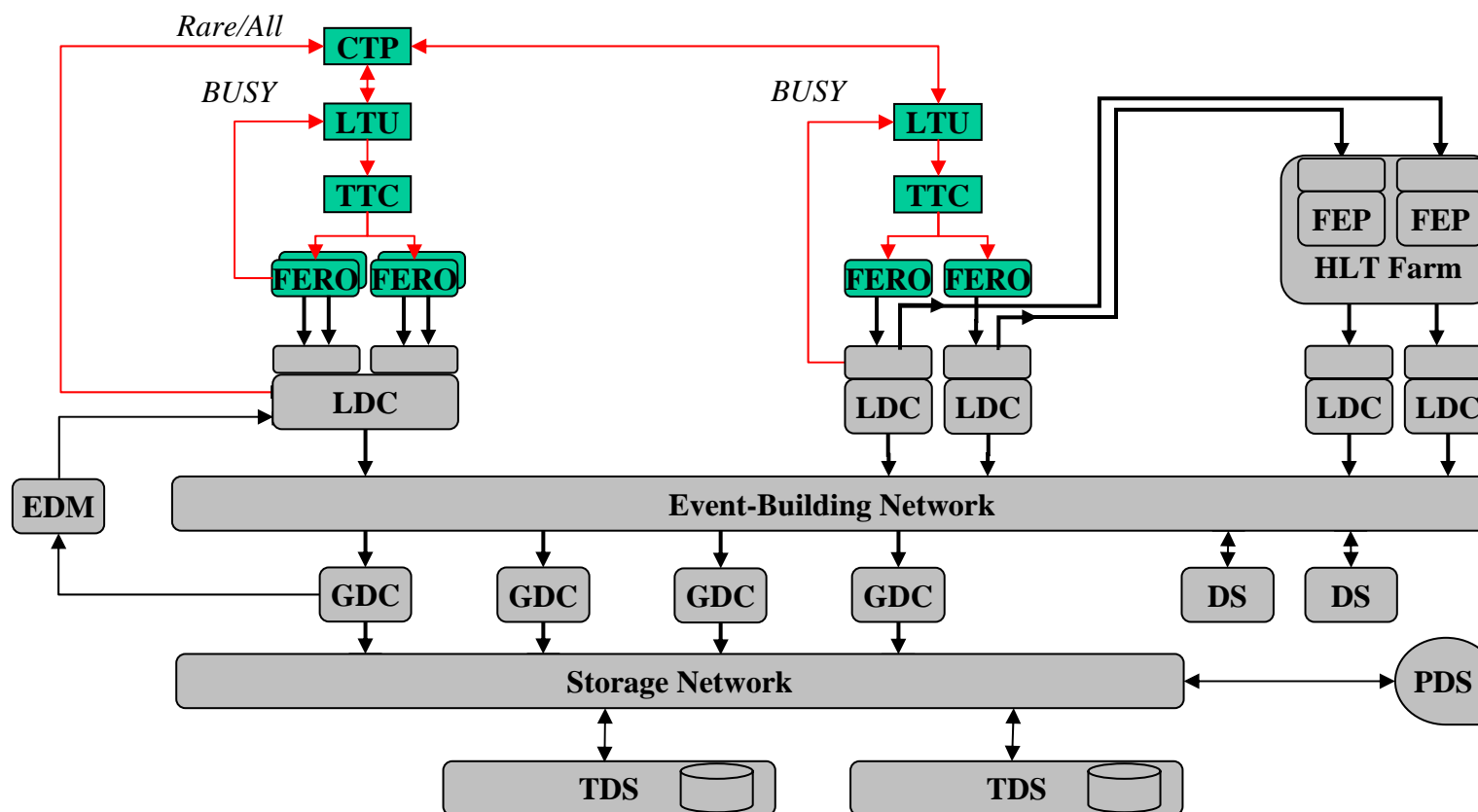# ALICE DAQ Architecture

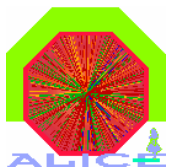# Architecture

ALICE DAQ Architecture

Trigger

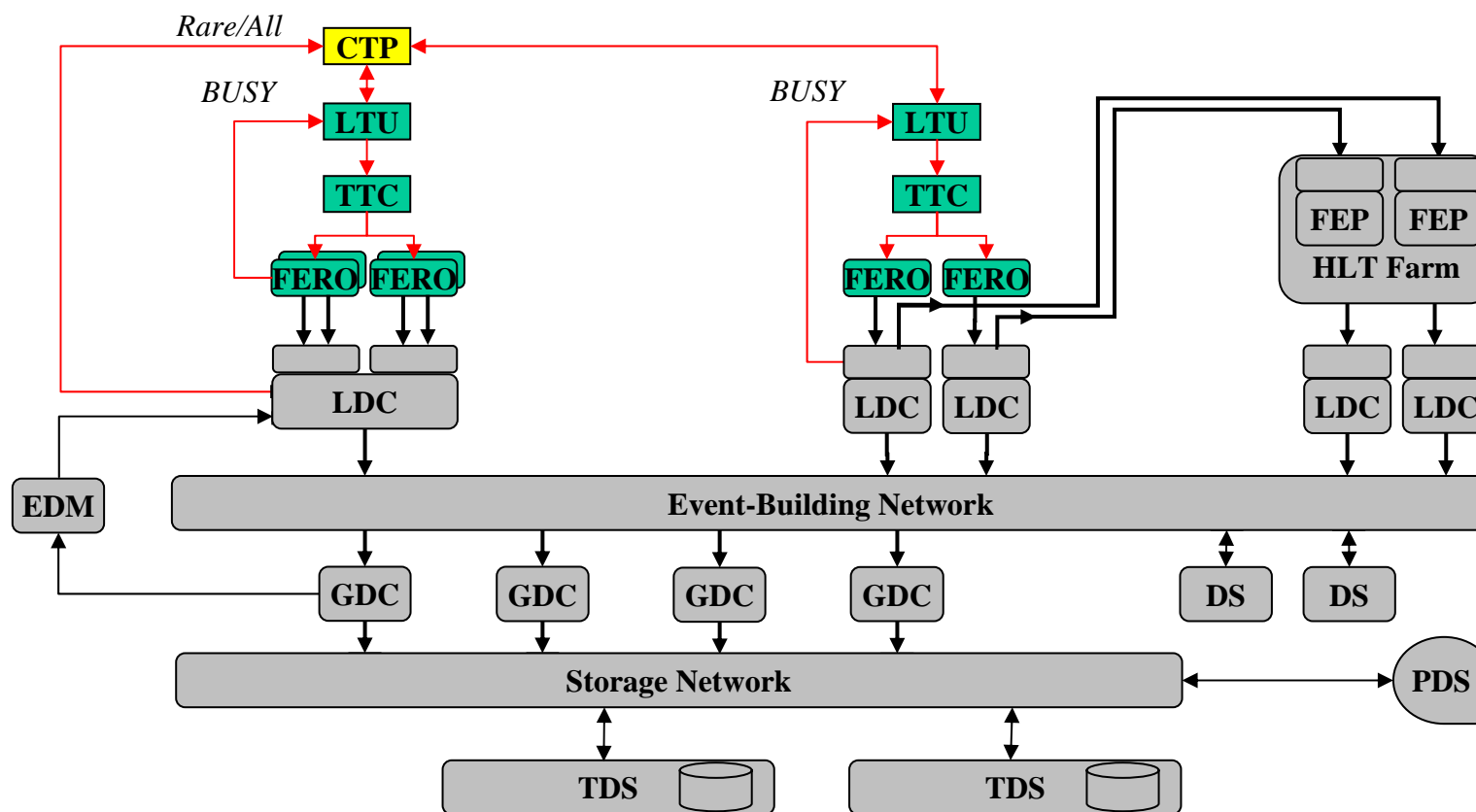*Initiates detector readout of selected events*

Trigger

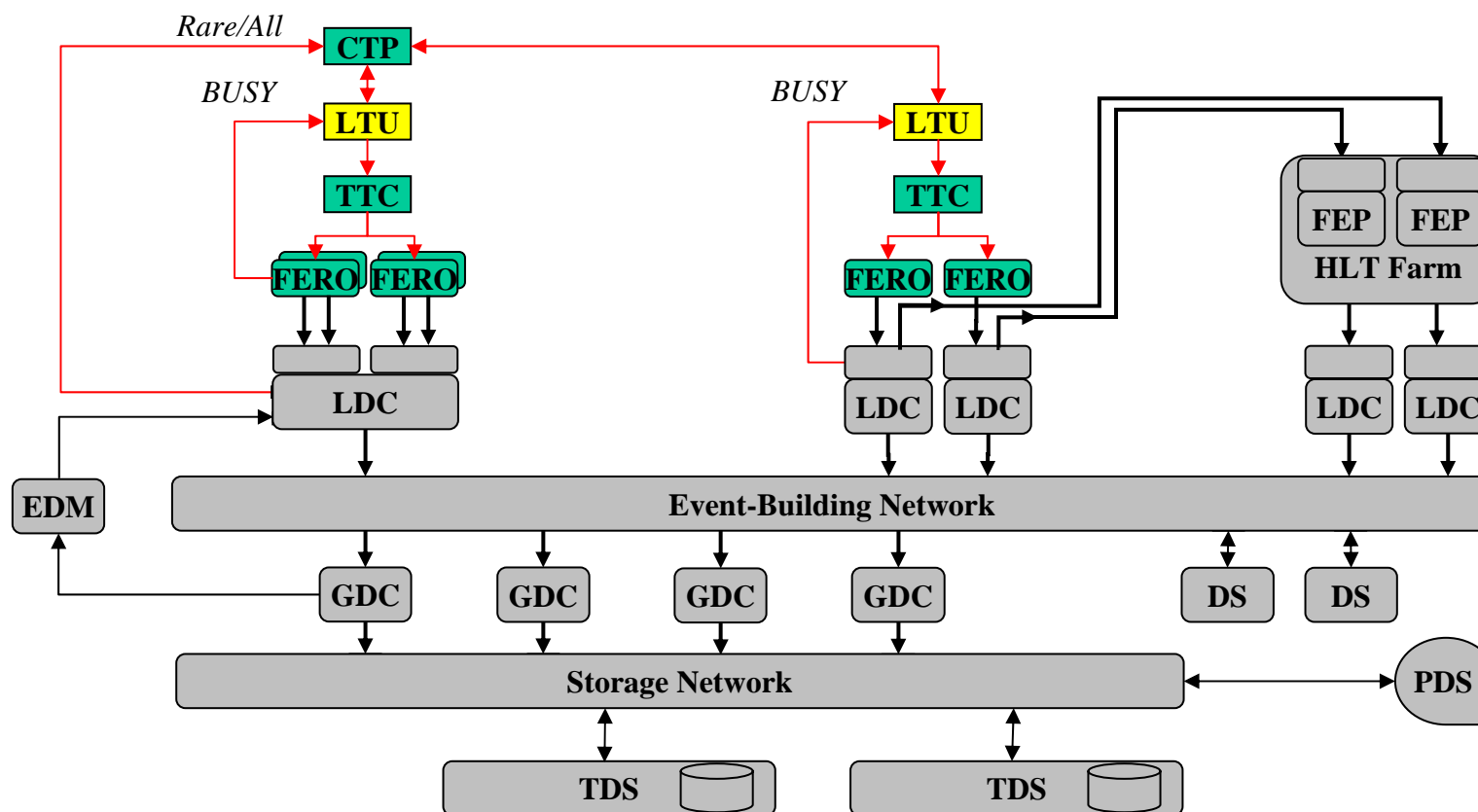## Central Trigger Processor: *decisions*

Trigger

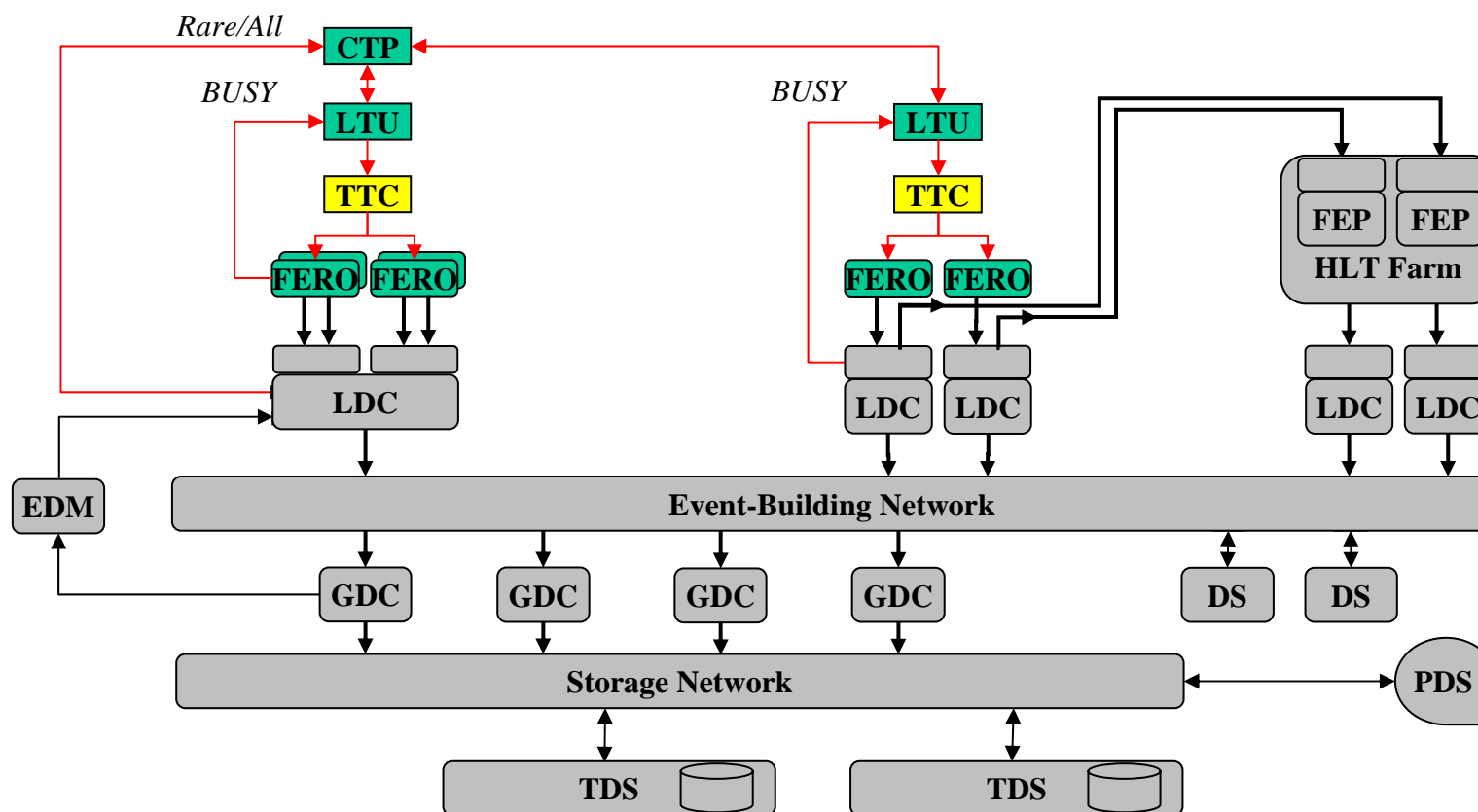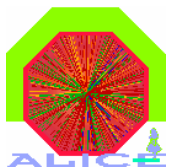Local Trigger Unit: *receives decisions for each detector*

Trigger

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

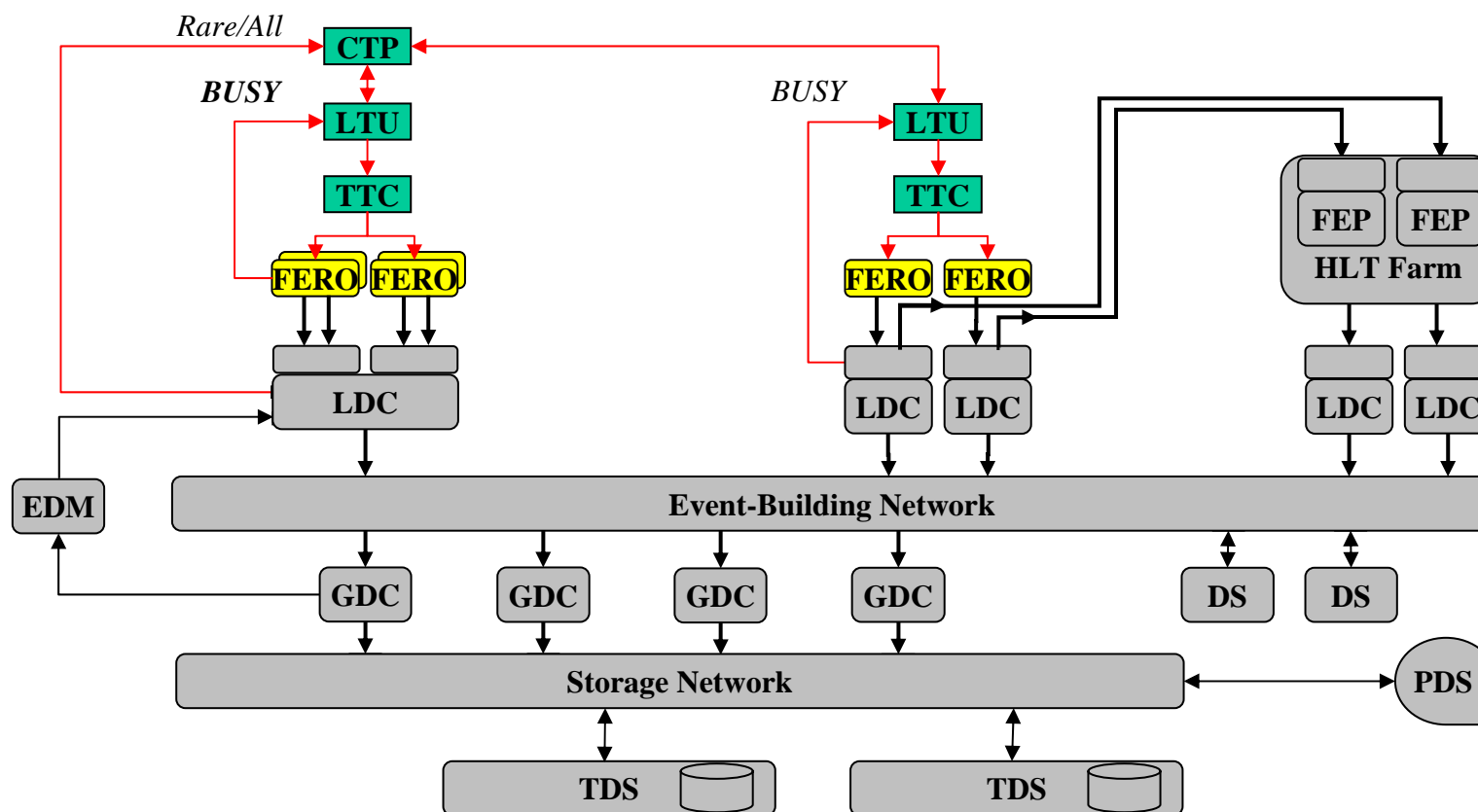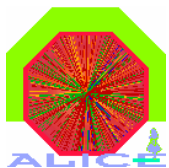# Trigger

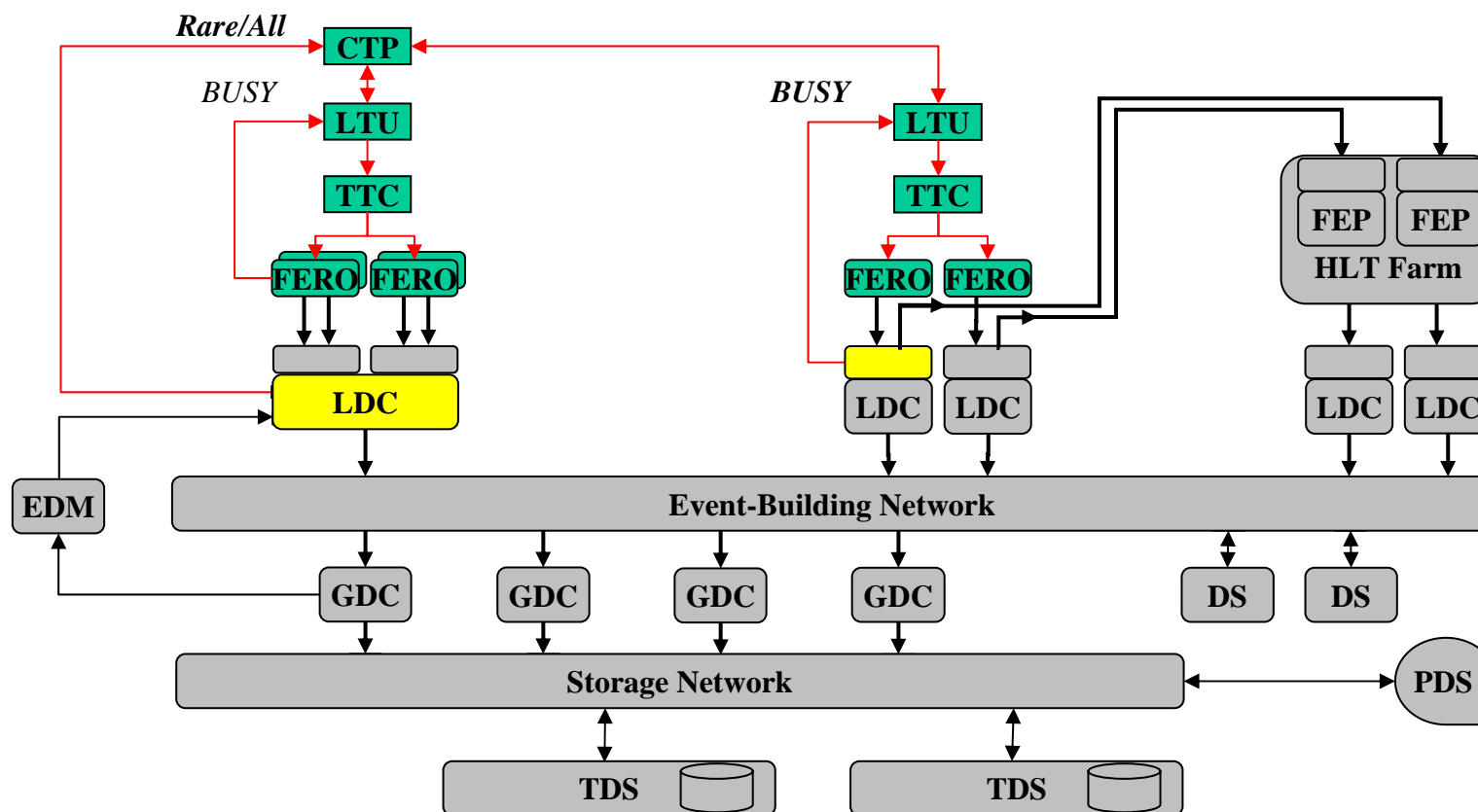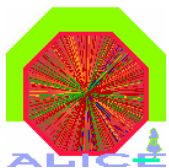## Front-End Readout Electronics: *use triggers, signal BUSY*

Trigger

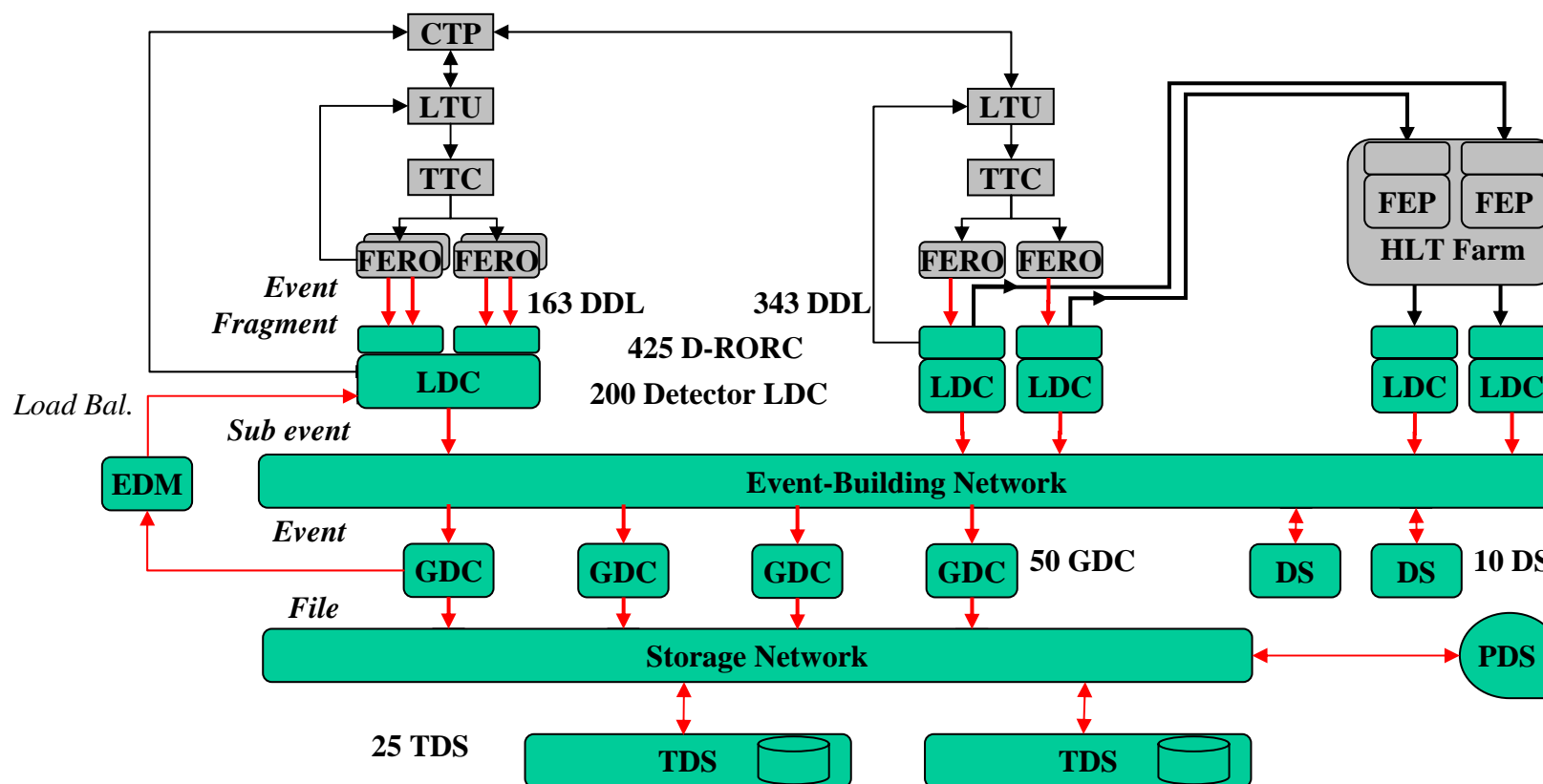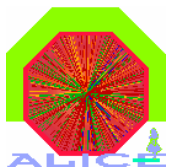Some DAQ components can feed back information

Data Acquisition

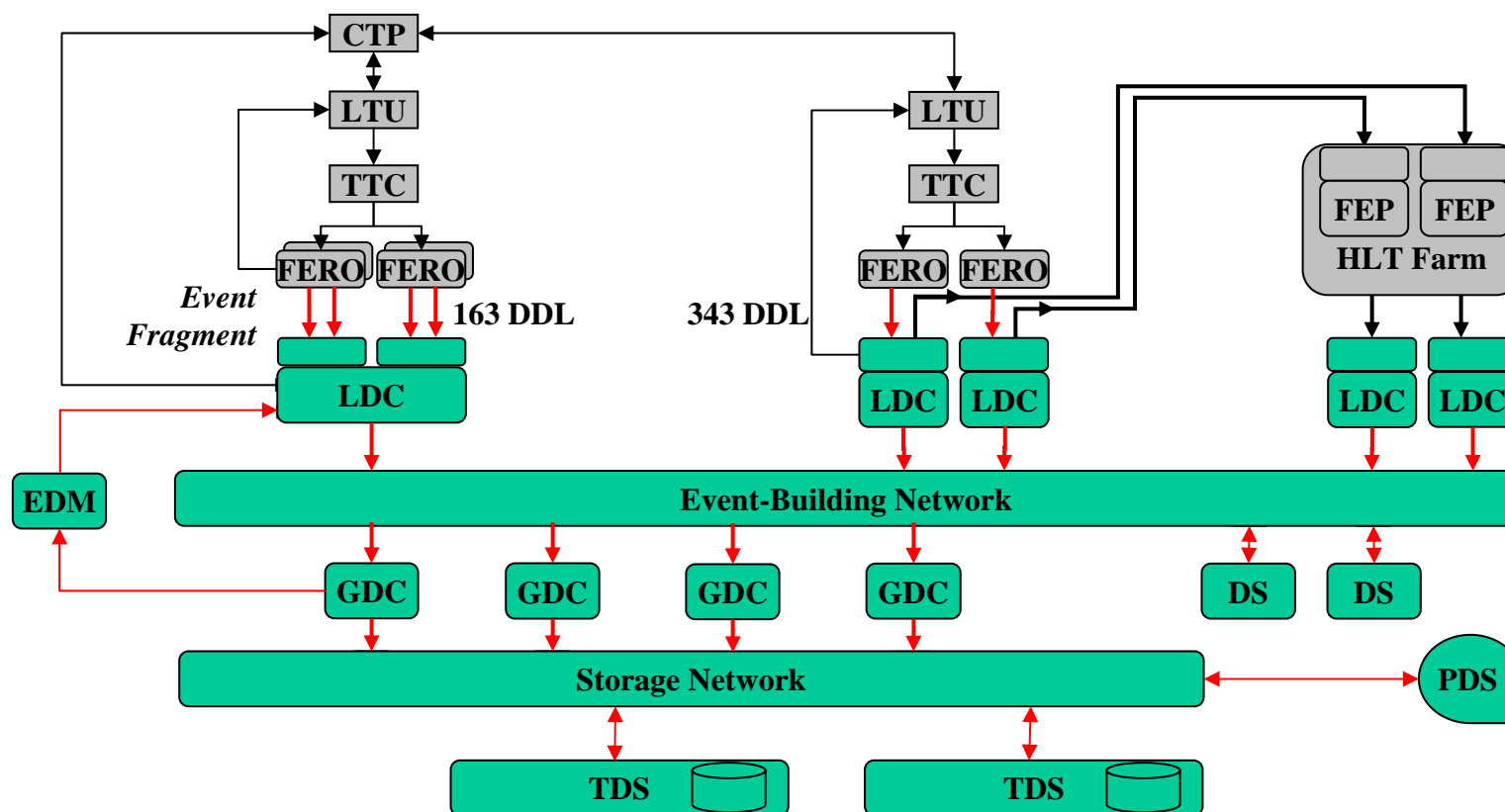*Data-flow from electronics to permanent storage*

Data Acquisition

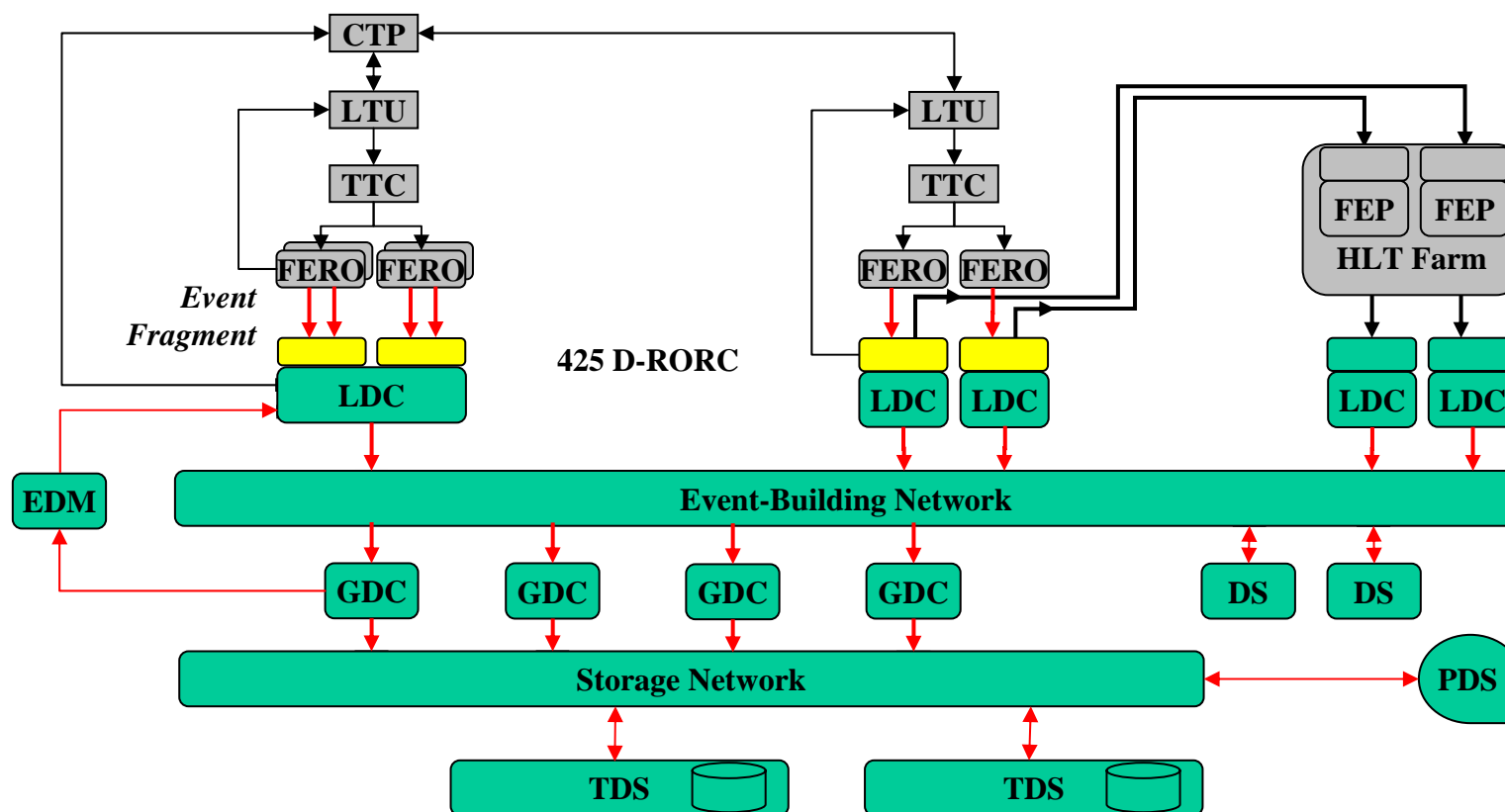## Detector Data Links: *optical transmission*

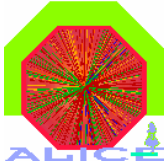# Data Acquisition

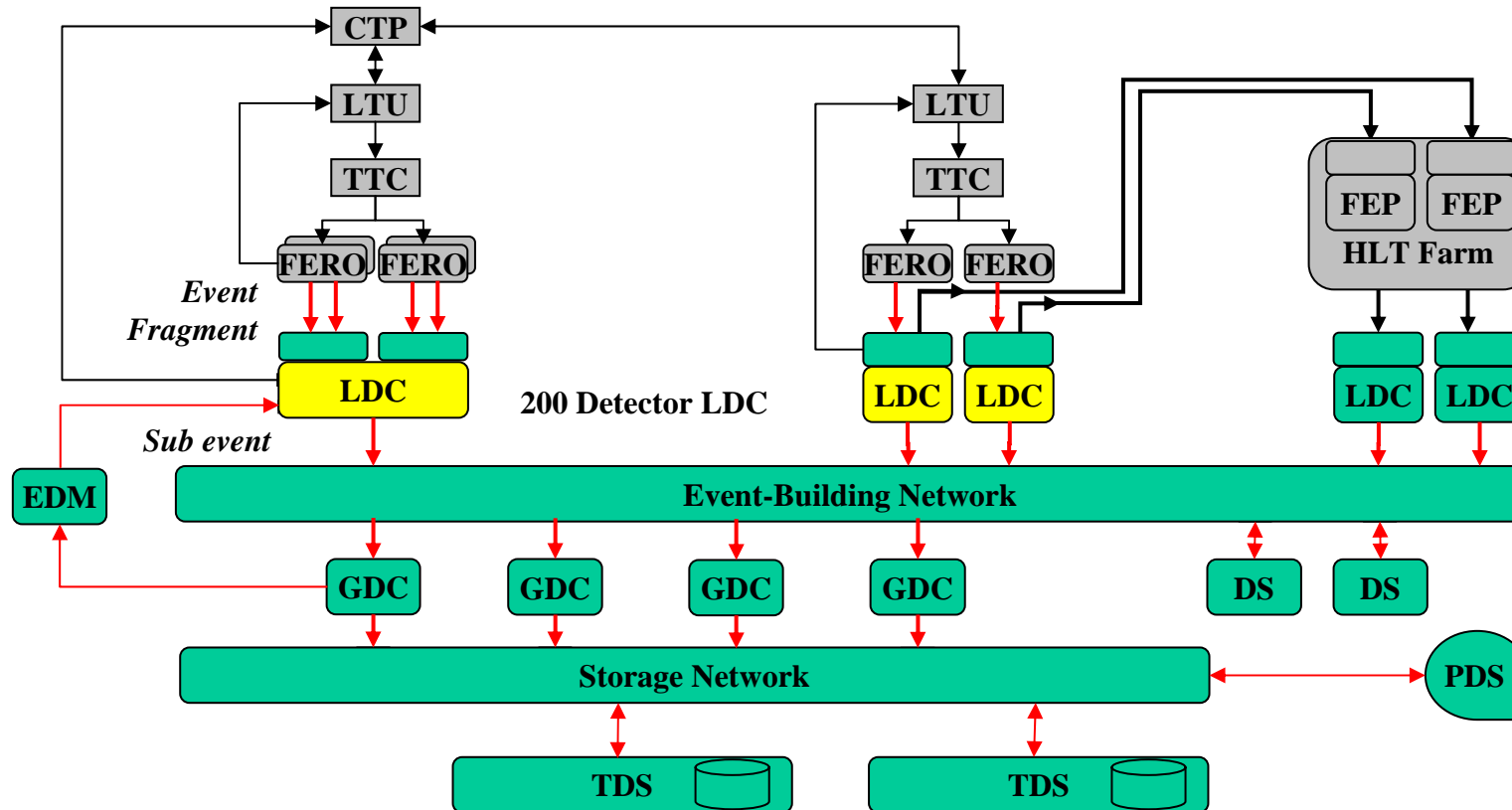## DAQ Read-Out Receiver Card: *PCI interface*

Data Acquisition

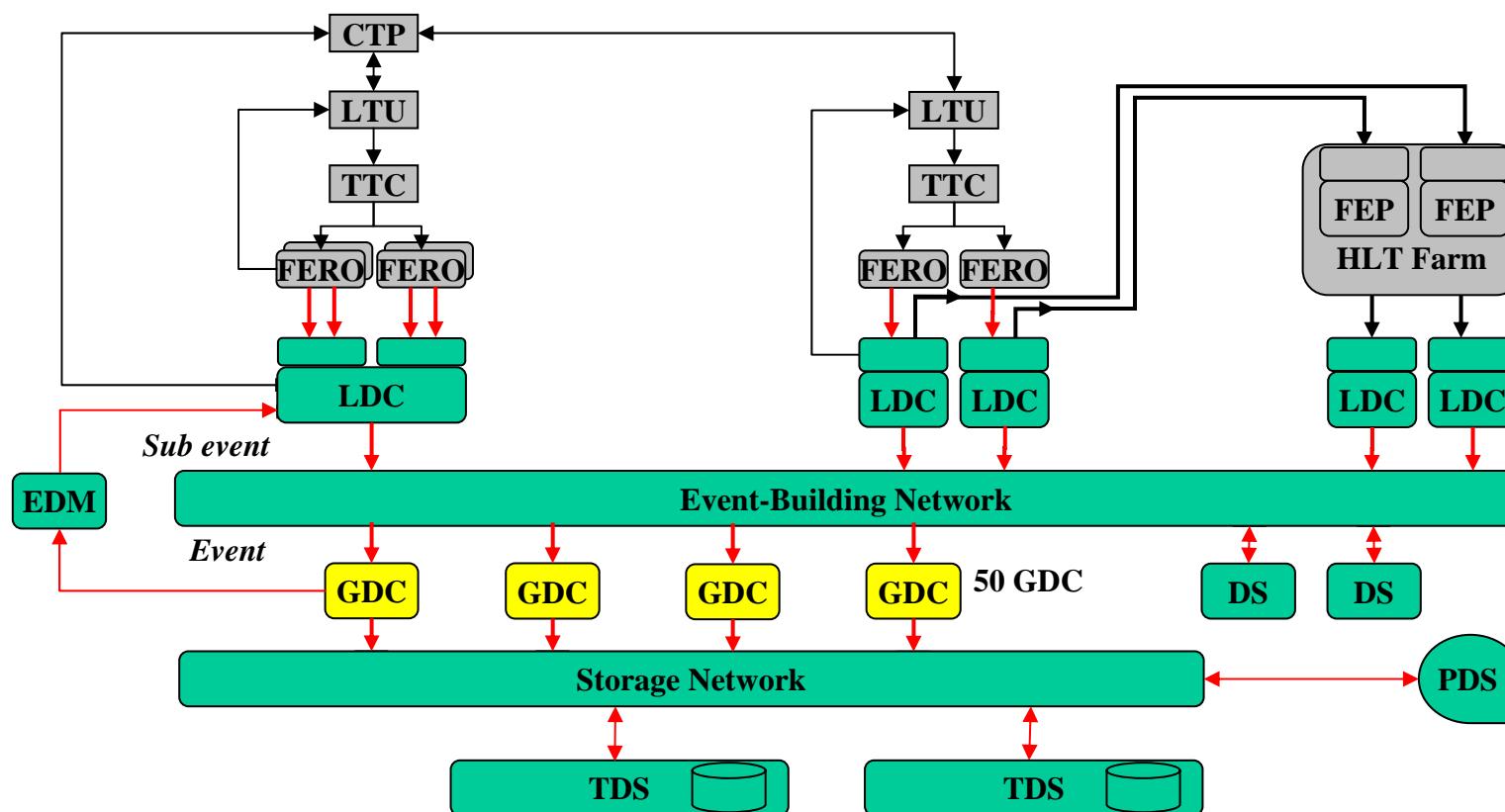## Local Data Concentrators: *ship sub-events*

Data Acquisition
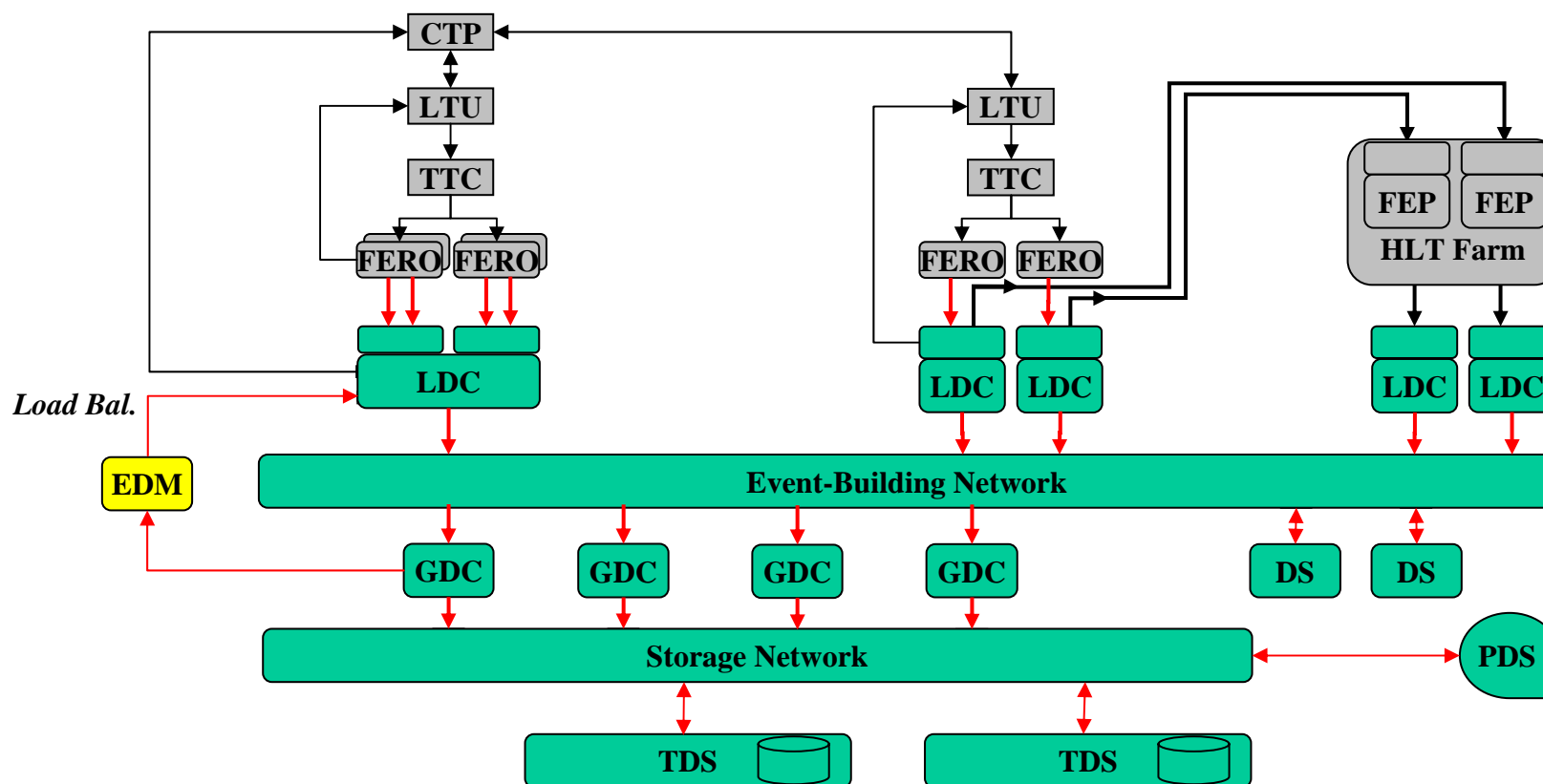
Global Data Collectors: *build events*

Data Acquisition

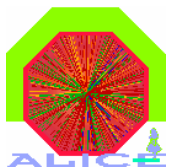## Event Distribution Manager: *load balancing*

Data Acquisition

Transient Data Storage: *local storage before migration*
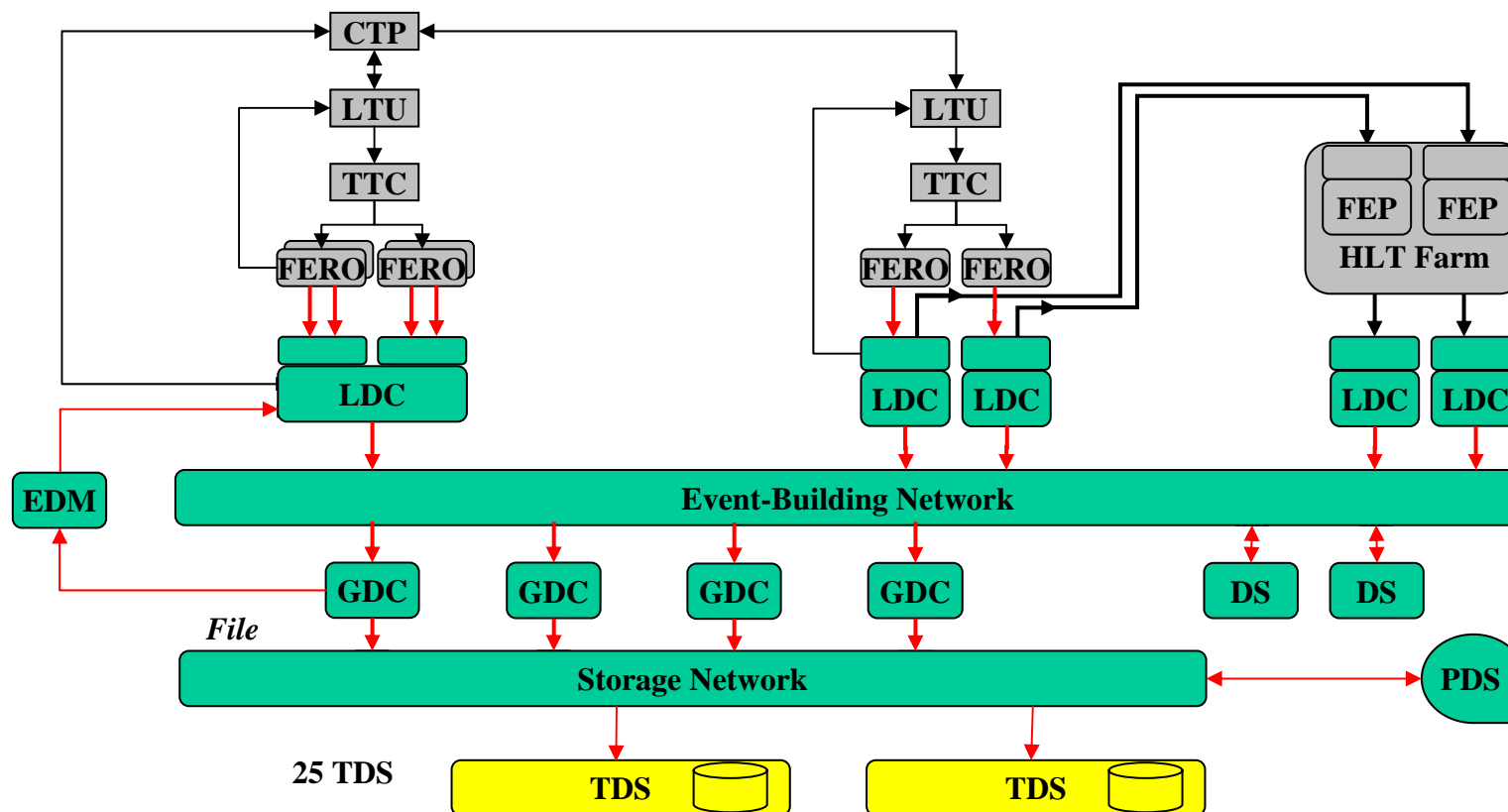
Data Acquisition

Permanent Data Storage: *file archive*
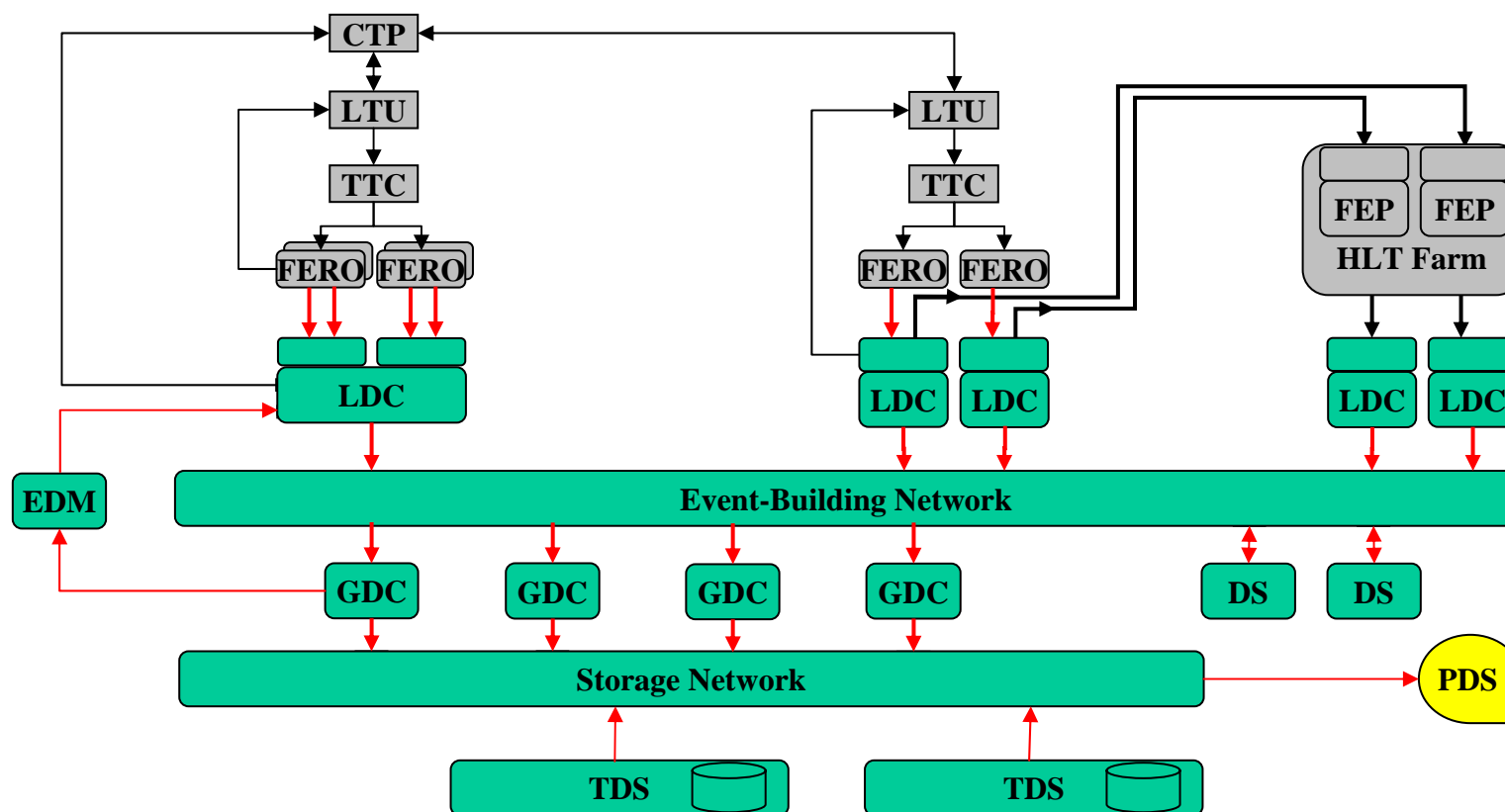
Data Acquisition

DAQ Services: *database and central facilities*
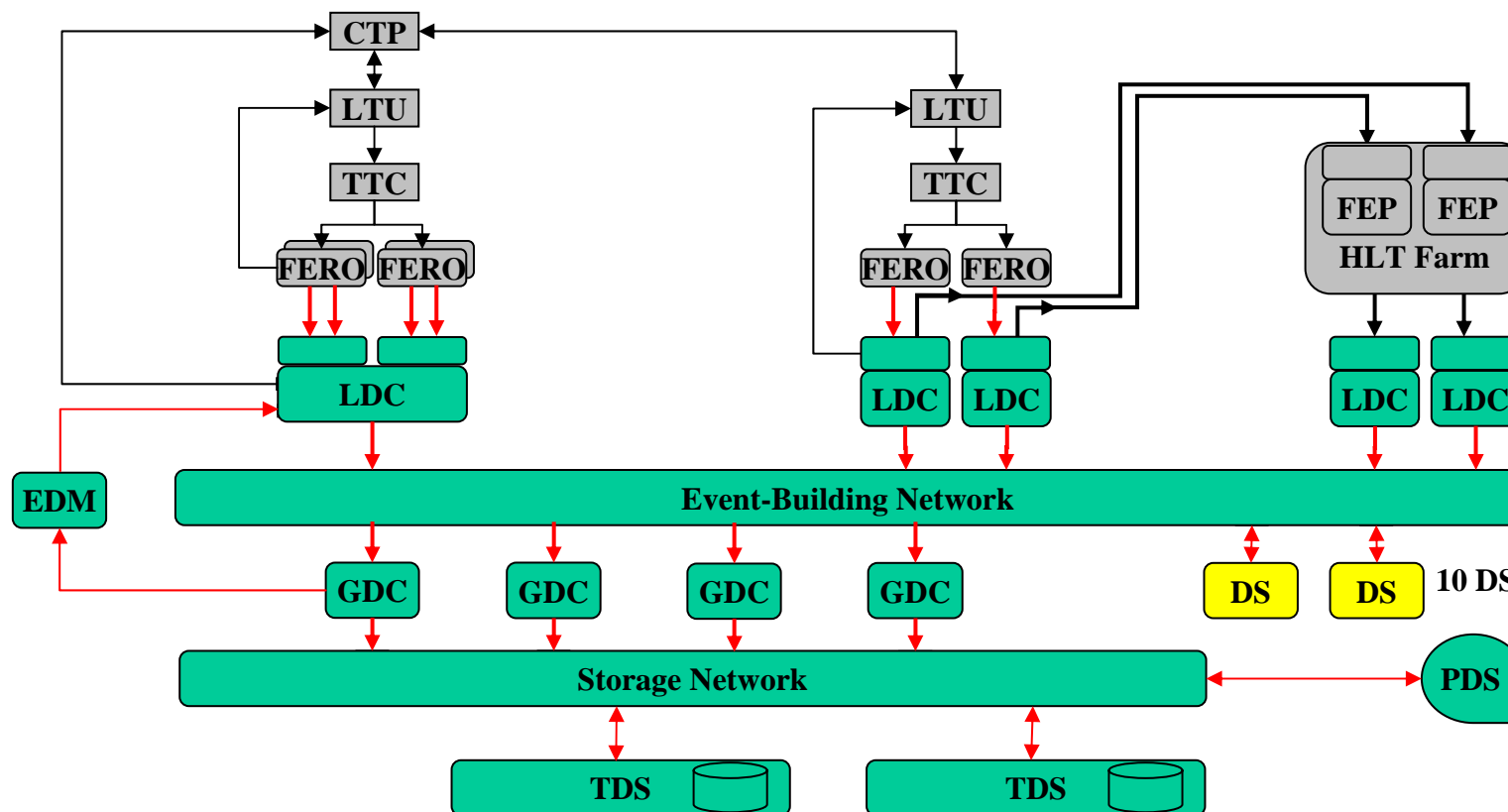
High-Level Trigger

Filter events to optimize amount of valuable data
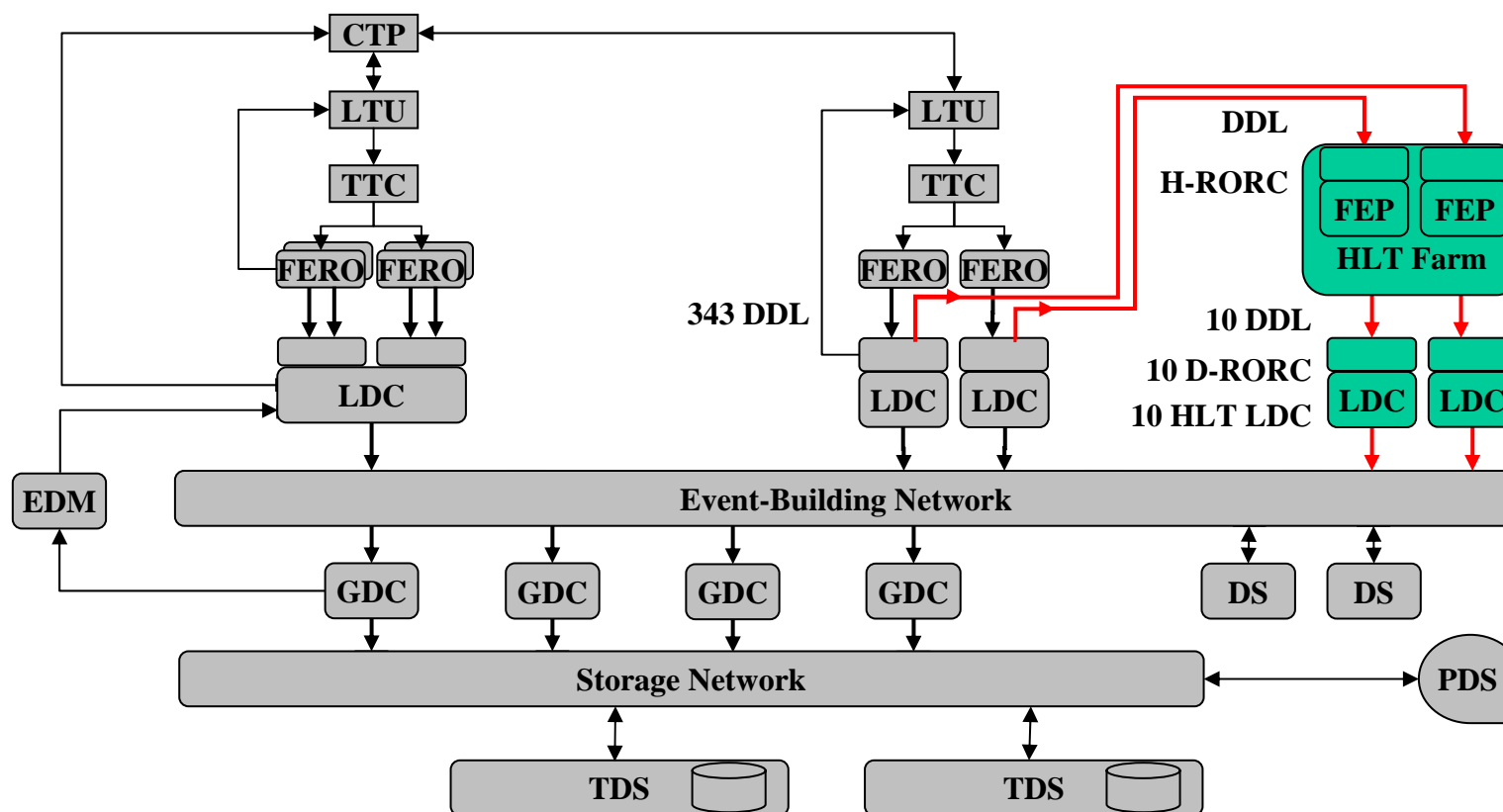
High-Level Trigger

Detector Data-Links: *transfer of event fragments*
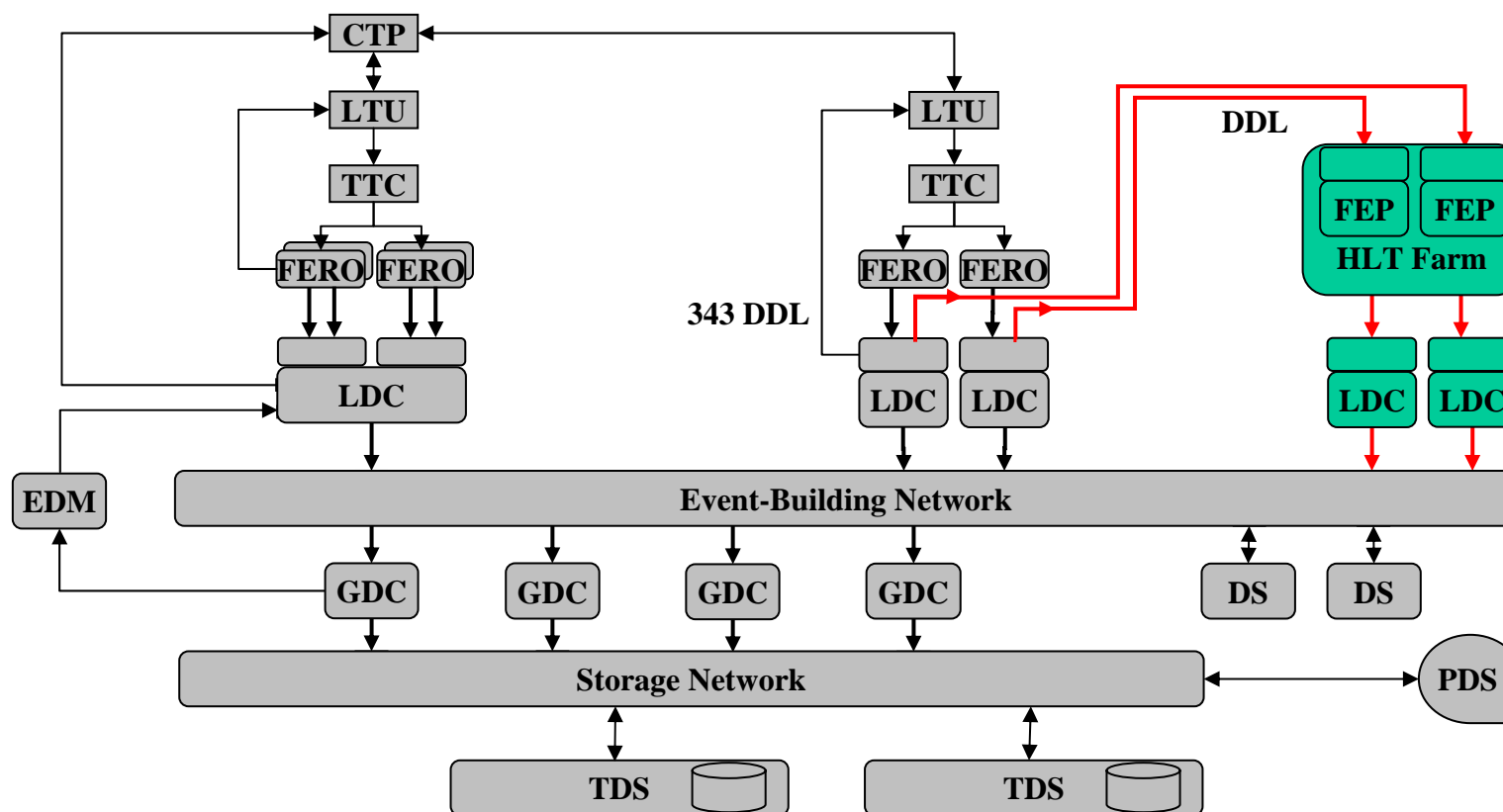
High-Level Trigger

HLT Read-Out Receiver Card: *data reception*
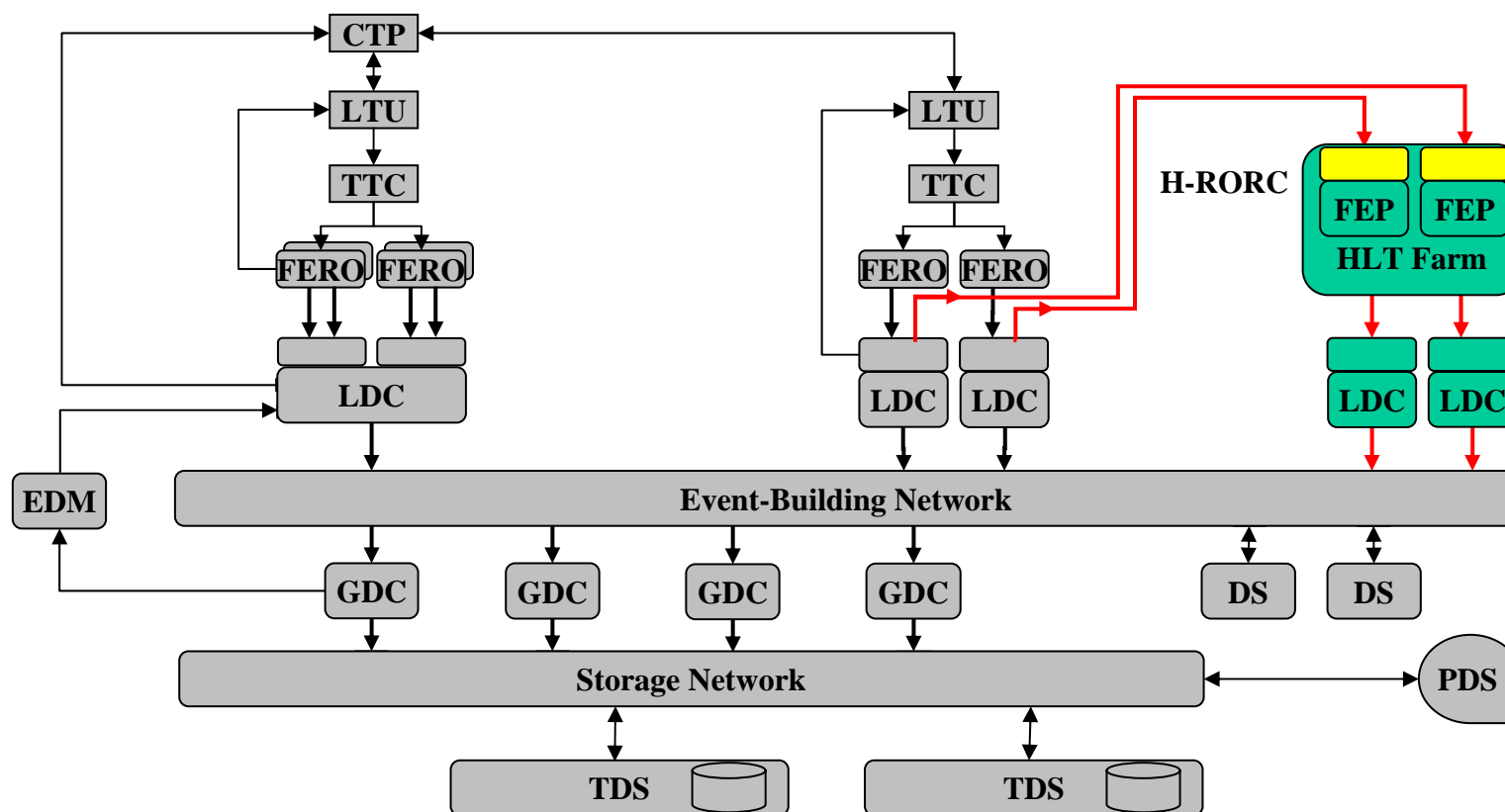
High-Level Trigger

Front-End Processors: *data analyzing and decision*
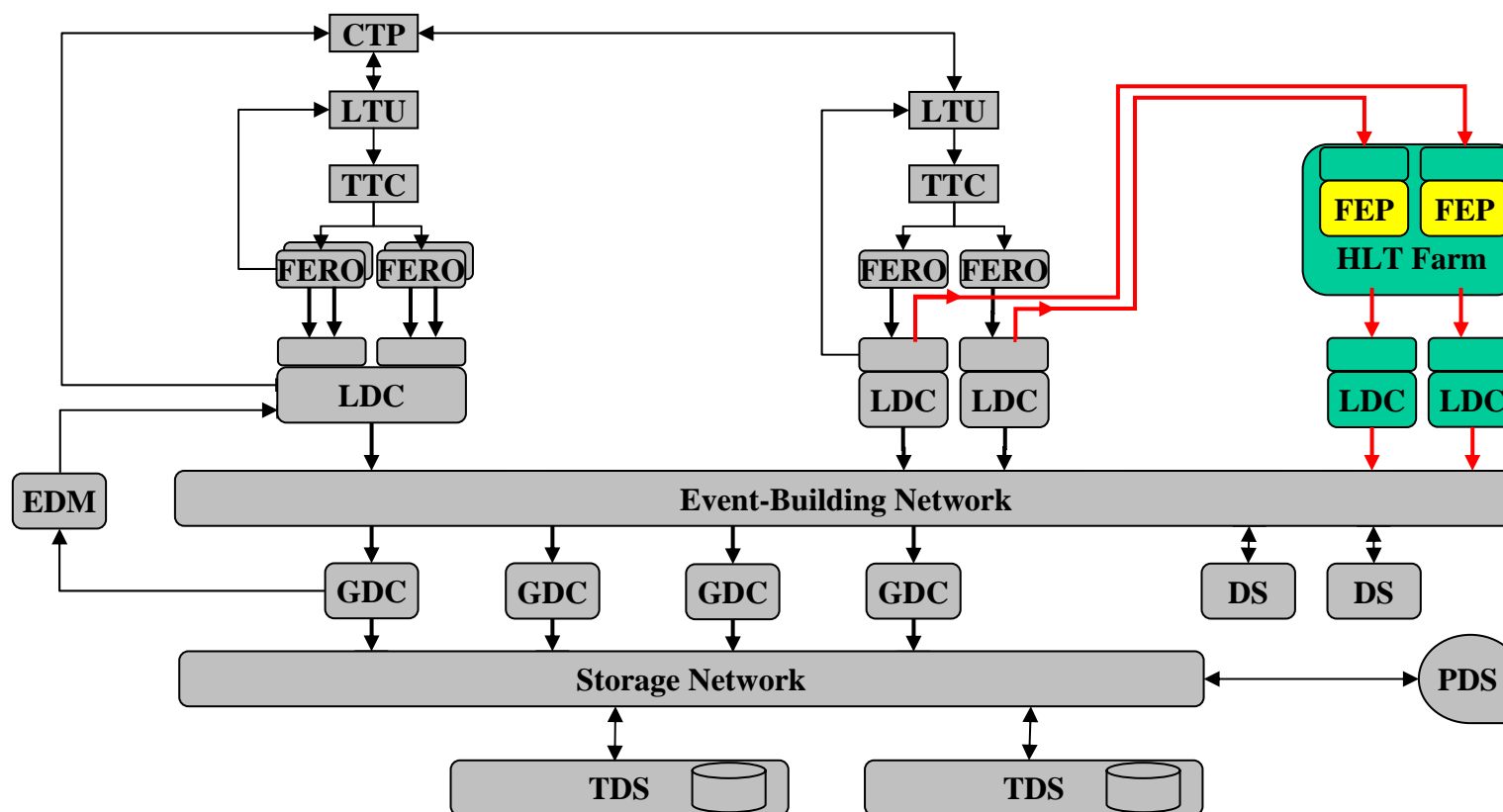
High-Level Trigger

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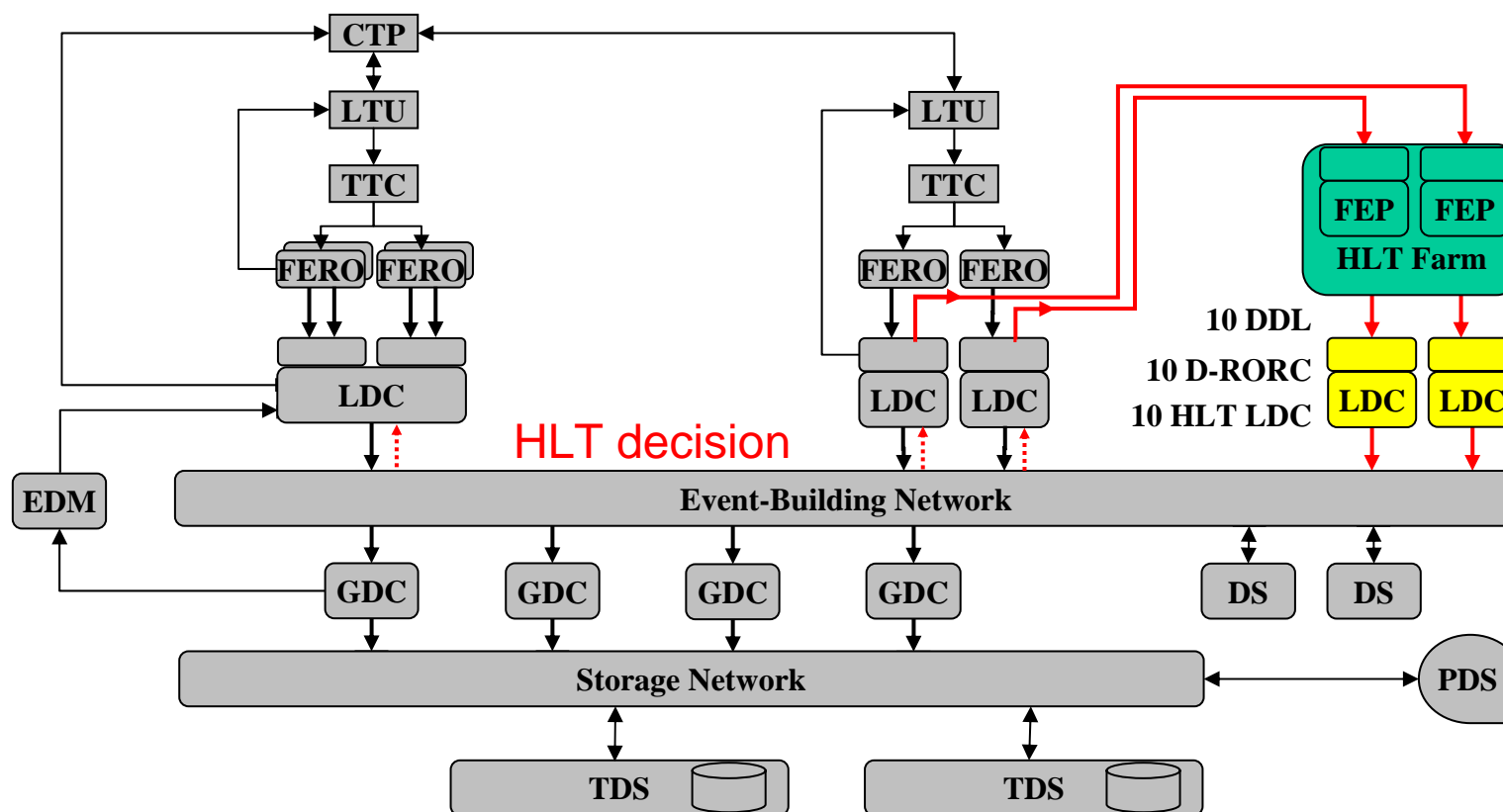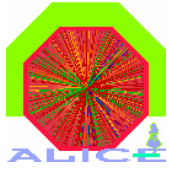
Implementation

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

Detector Data Link
Transfer of data to the DAQ

- Radiation tolerant SIU
  (**S**ource **I**nterface **U**nit)

- D-RORC

- DDG: DDL Data Generator
  (for tests)
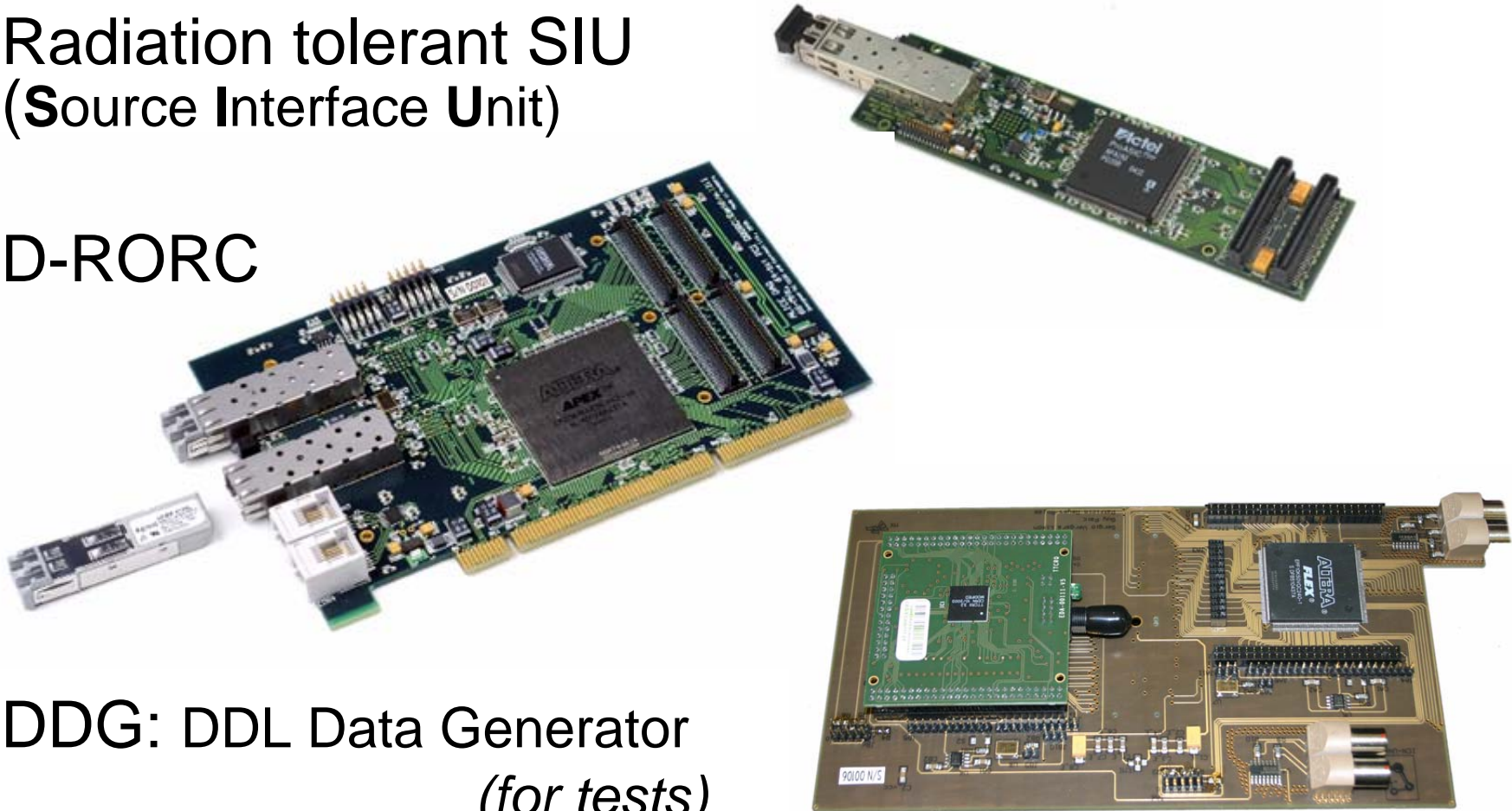
Installation

Pre-installation of optical fibres finished in the backframe
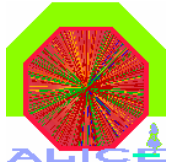
Test setup

DDL, DDG, Trigger
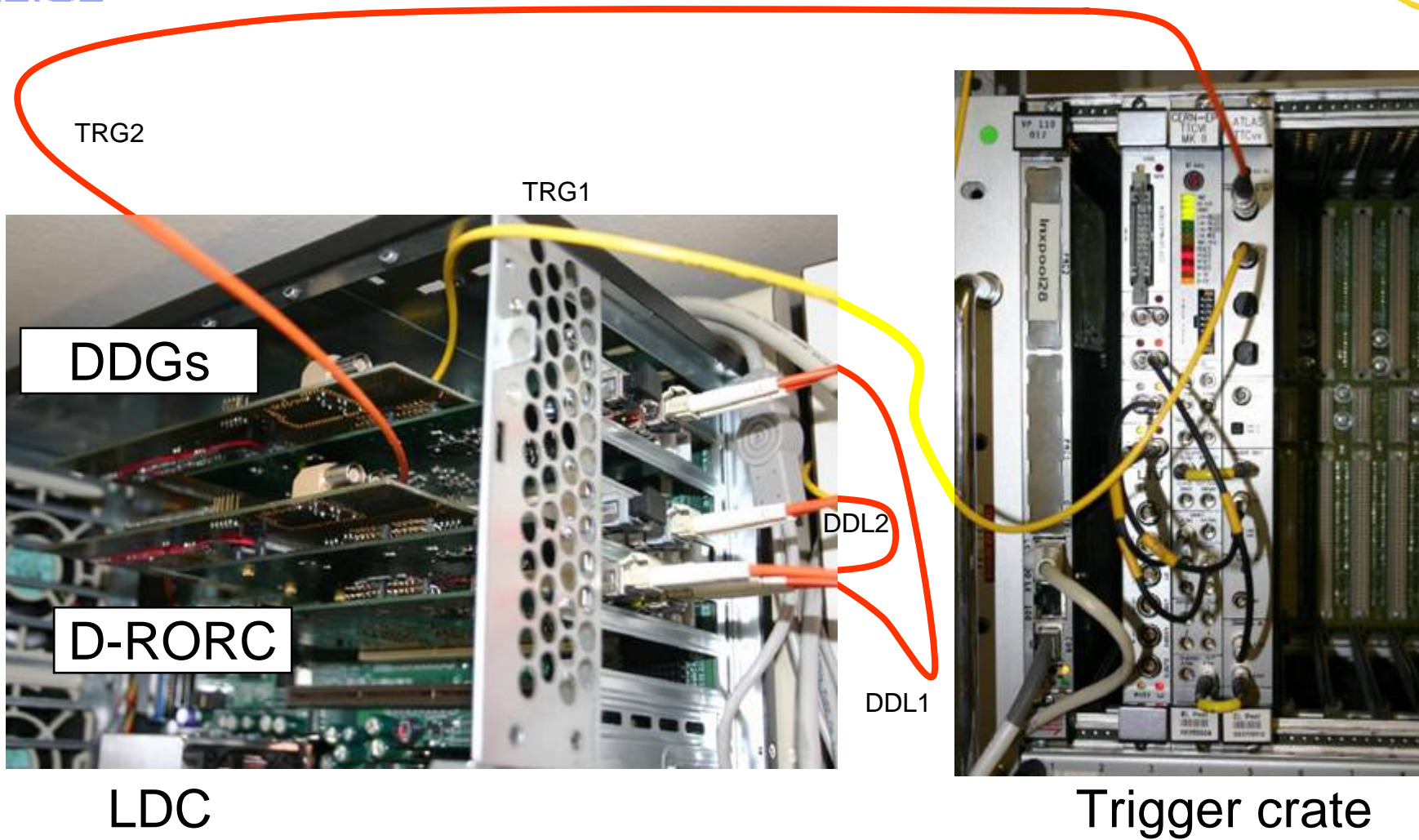
Computer choices

- 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
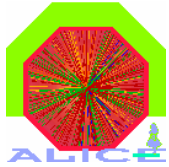
Event Building Switch

- 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
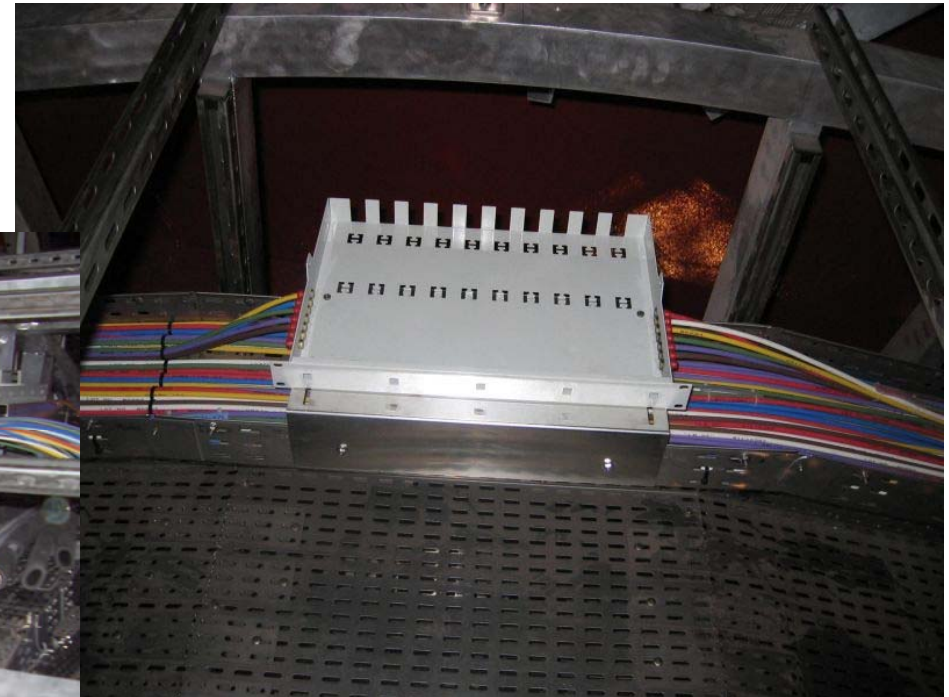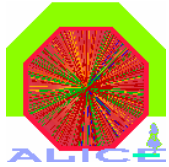 - Special set-up (IT): 60 PCs
  - DATE software used for benchmarking
  - <u>Switch selected: Force 10 Model 1200</u>
    Delivered and installed

Throughput by # of GDCs

27   28   29   30   31

Experimental area

Computing Center

10Gb Ethernet

DAQ

DDLs

Counting rooms

Cavern
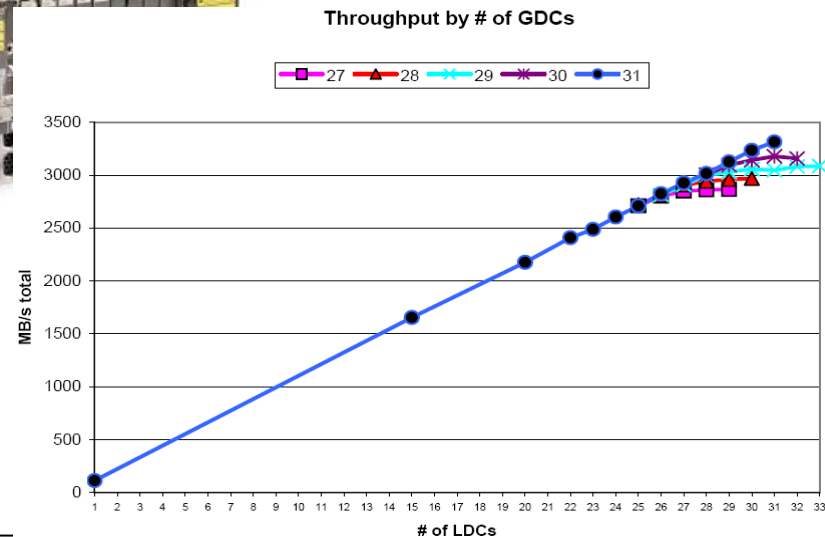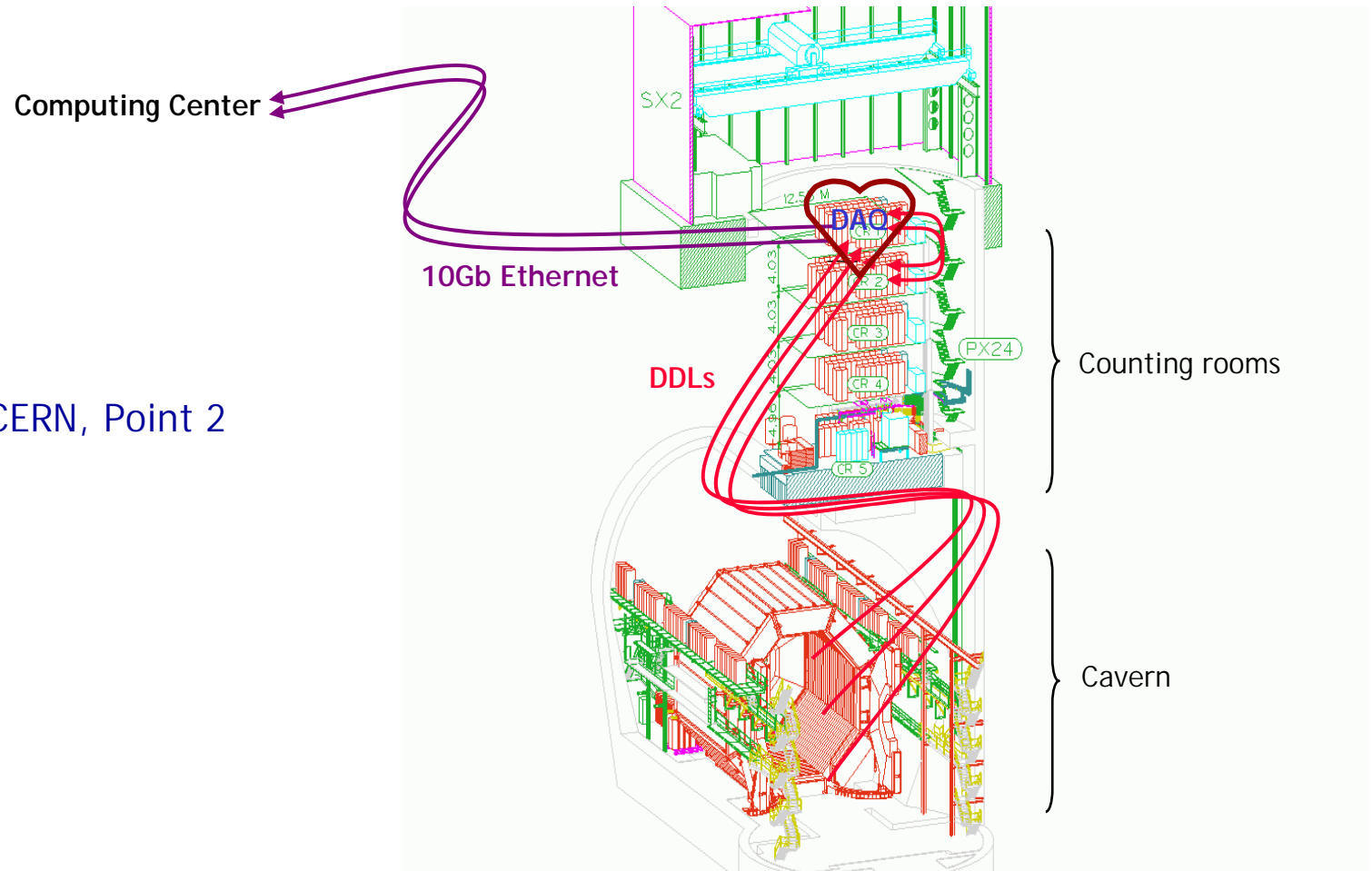
Machine: LHC @ CERN, Point 2
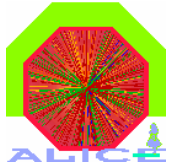
DAQ Counting Room

- Tight space: $70m^2$

- 33 racks

- ~300 computers

ALICE DAQ @ P2

PX24/CR1

DDL
patch panels

PDU

LDCs

GDC

Storage

Network
Switch

Server

Network
Gateway

Clean room
SXL2

tome.anticic@cern.ch

LHC days in Split

ALICE Control Room
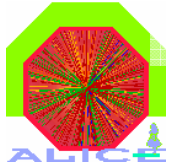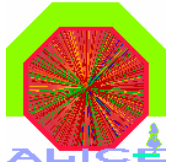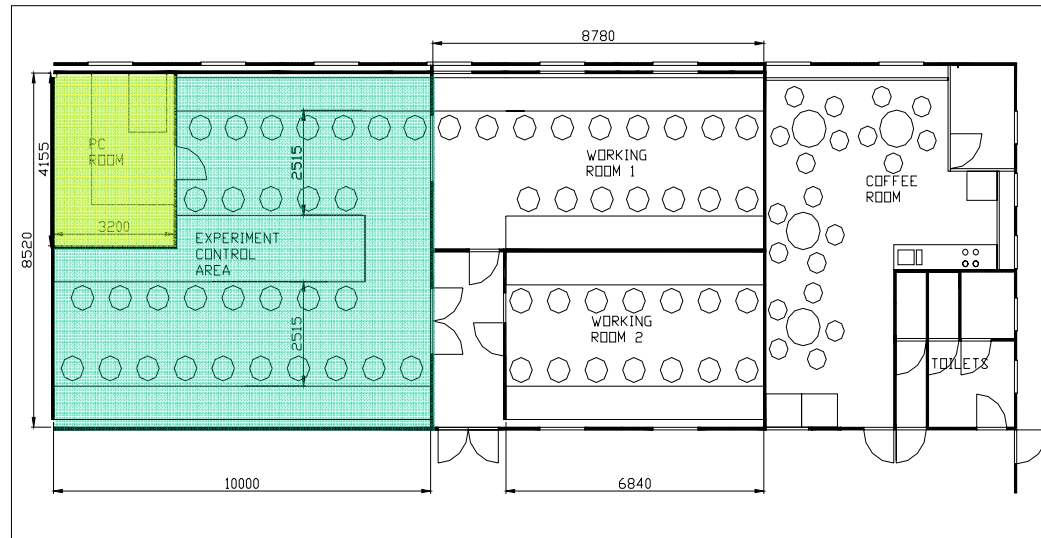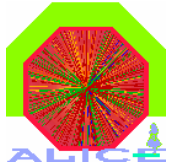

- 30 workstations
- separate room for PCs

- 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**
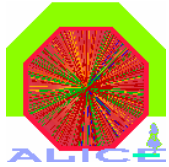
Information dissemination

- **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

DATE Configuration Database

- Database content
  - DATE Roles
    Actors of DATE system: LDCs, GDCs…
  - Trigger
    Trigger masks
  - Detectors
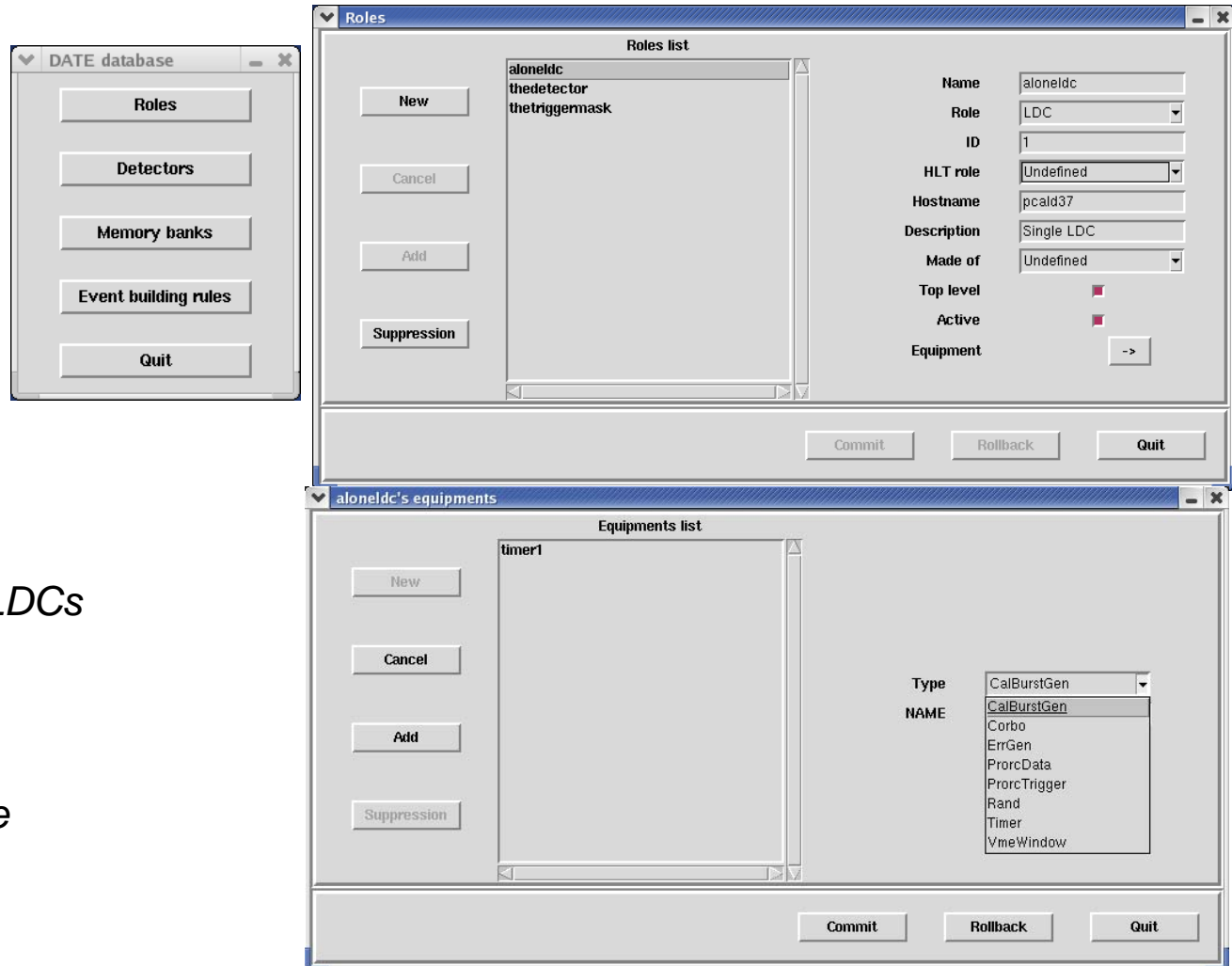   *Front-end equipment of LDCs*
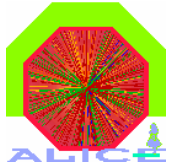 - Event building control
    Event building *rules*
  - Banks
    Memory banks to operate DATE
- Released in DATE V5

DATE Infologger

- 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

Performance monitoring: AFFAIR
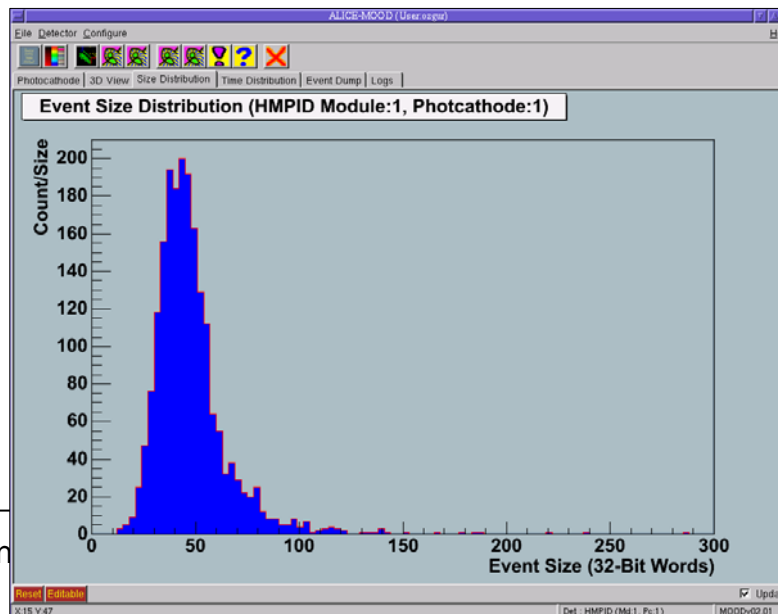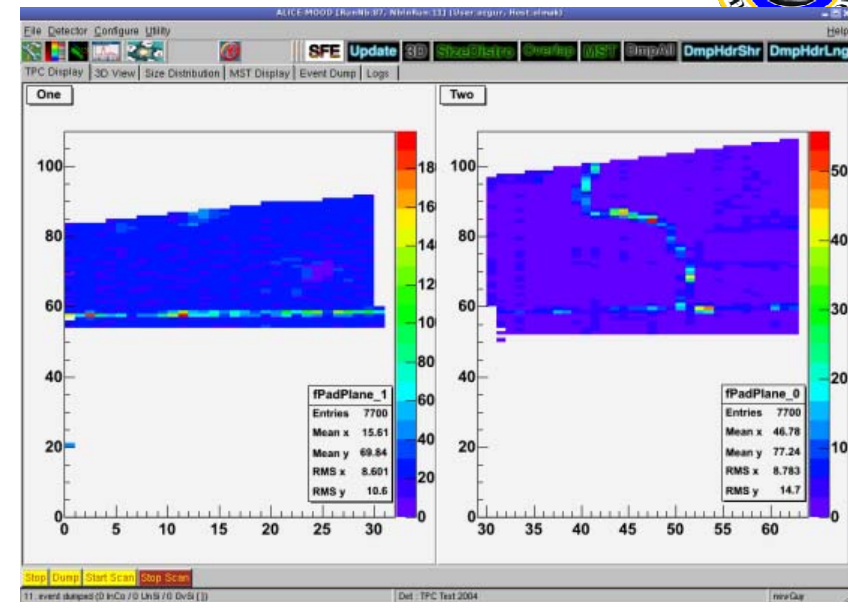
- Individual nodes view
  - CPU usage
  - Input/Ouput
  - Node status

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

Conclusion

- **Data transfer**
  - DDL and D-RORC being produced
- **DAQ software ready**
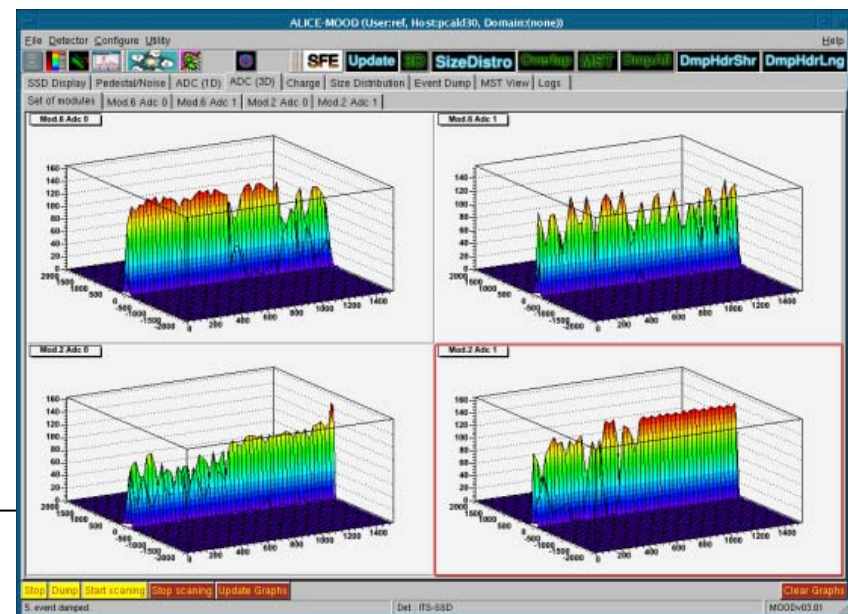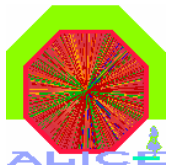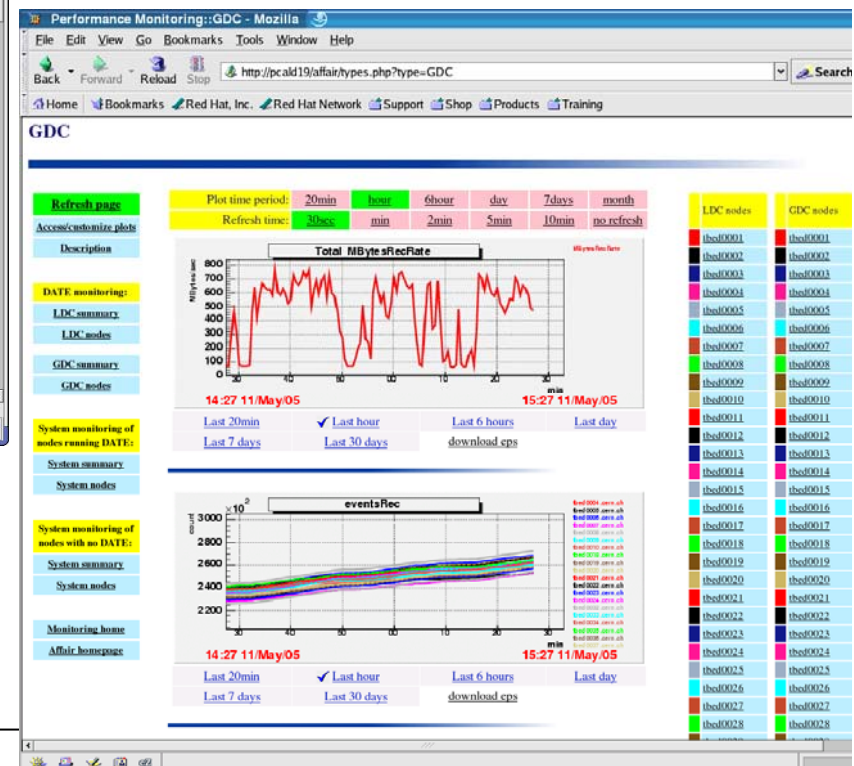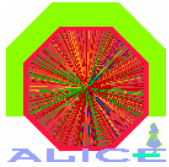 - Software (DDL sw, DATE, AFFAIR, MOOD) released (rpm) and documented.
  - satisfies the functional + performance requirements
  - runs on single machine and large-scale setups
  - Linux SLC3 now. Transition to SLC4 scheduled before end '06.
  - is tested at reference system, data challenges, test beams
  - 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