Online Track Summary

Volker Guelzow&Jiri Masik

General

- 23 posters, 28 talks, 5 Sessions:
- Very much supported by session chairs:

Wainer Vandelli (Atlas)

Pierre Vande Vyvre (Alice)

Gordon Watts (D0)

Rainer Mankel (CMS)

Clara Gaspar (LHCb)

- Sponsored by Aceole

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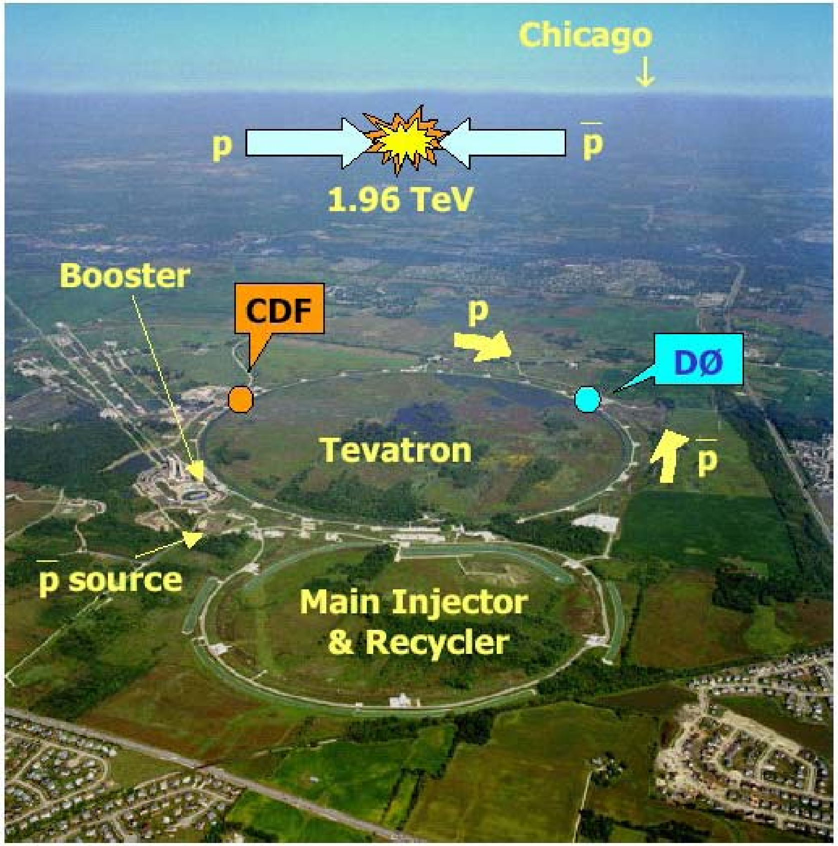
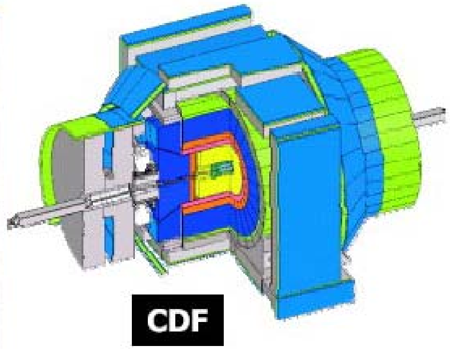
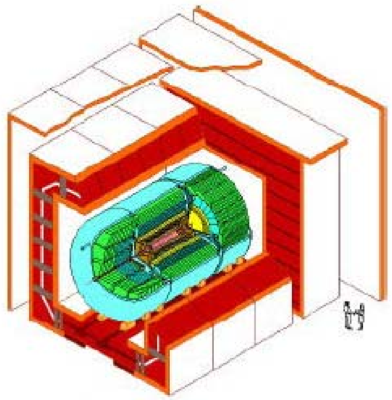
www.cern.ch/aceole

Tevatron Experiments







DØ

D0-L3 Trigger by Gordon Watts

- The COOR System is very stable
- Still up to date design
- Scales with increased Lumi
- Configures very fast (couple of seconds)
- Primary responsibility is carried out by 3 people (+ Fermi Comp.Div.)

The Gigafitter by Silvia Amerio

- The GigaFitter is a next generation **track fitter processor**.

→ Designed as a possible upgrade for CDF trigger system

→ Useful for future experiments

The GigaFitter

- Designed as a possible replacement of the current Track Fitter
- Can overcome the SVT limits and increase SVT performances at high luminosity

Thanks to Xilinx for kind donation!

Based on modern FPGA

Xilinx VIRTEX 5 : 65 nm – 550 MHz device

Provided with **640 DSP**

- 25 x 18 bit multipliers
- 48 bit adders

Can use full hit resolution → 18 x 18 multipliers, no need for precalculated terms stored in big memories

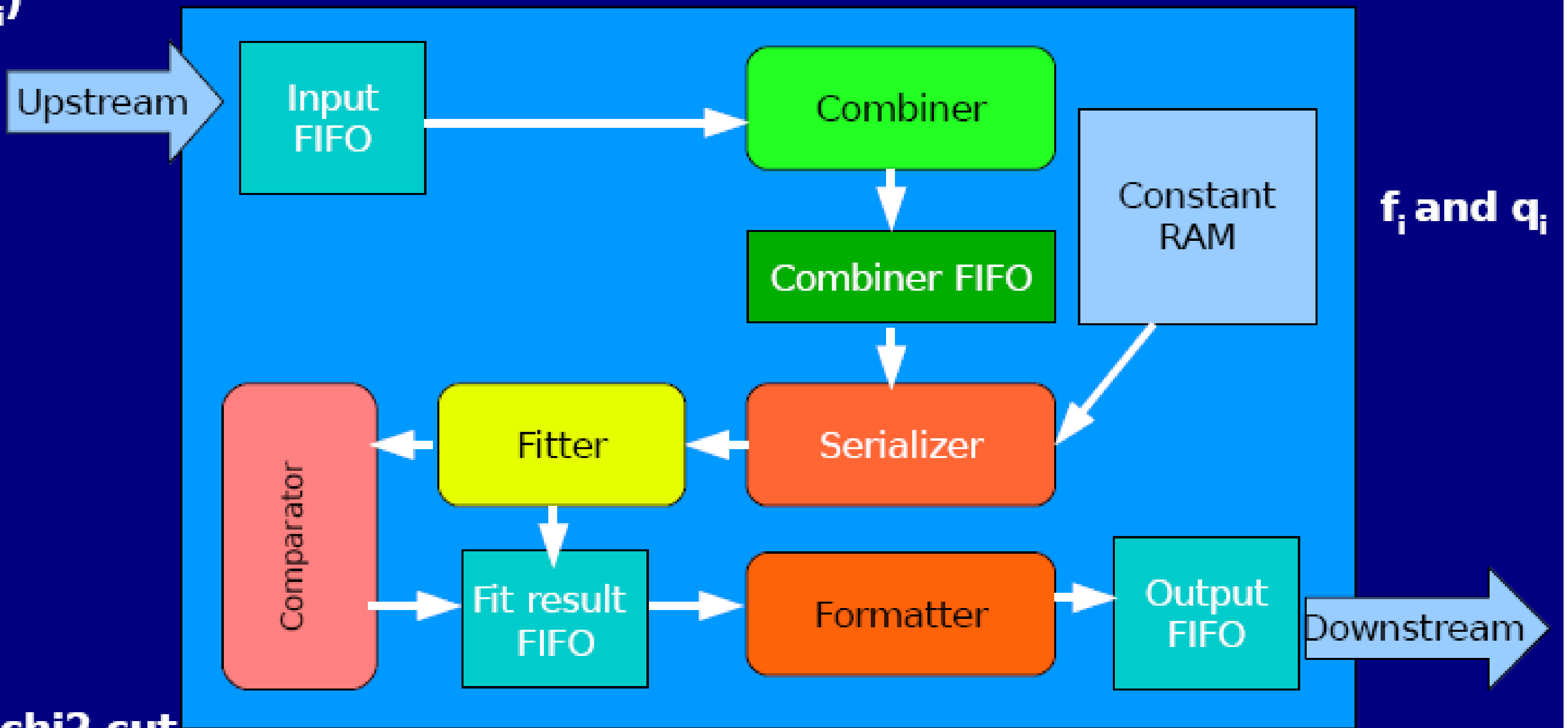
Memory available to store **more patterns and more constant sets!**

GF basic fit line

$$p_i = \vec{f}_i \cdot \vec{x} + q_i$$

SVX hits
+
XFT p_T and ϕ
(x_i)

Multiple hits in the same SVX layer → do all the combinations



f_i and q_i

- **apply chi2 cut**
- **select the *best* track**

7 DSP used
1 fit every 6 clock cycles

Real time framework for SuperKEKB &Hyper Suprime Cam by Soohyung Lee

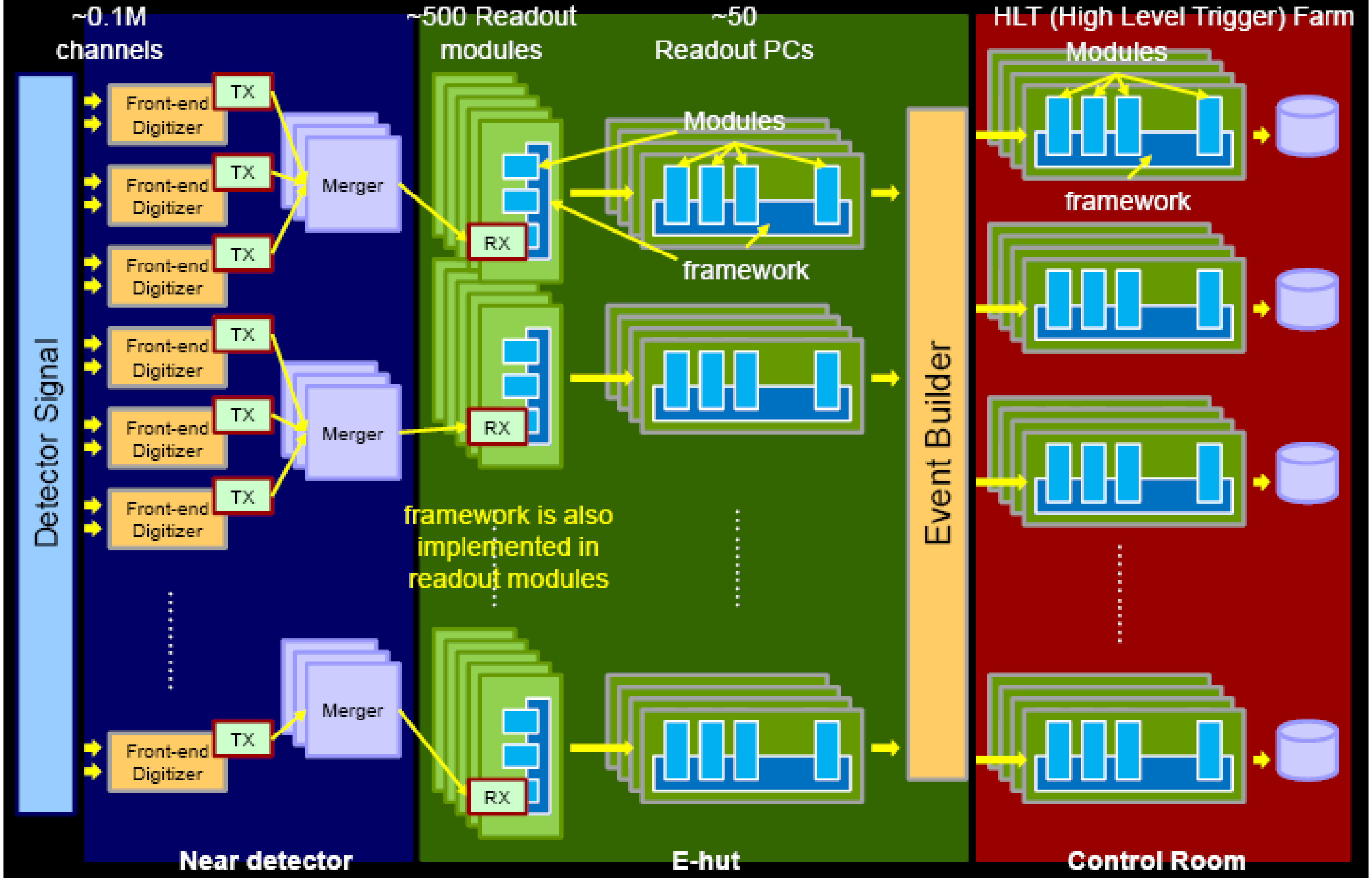
Introduction

- SuperKEKB
  - In KEK, Tsukuba, Japan
  - Observation of CPV in B-meson decay in e^+e^- collision
  - Better understanding of CPV phenomena
  - Upgrade Belle experiment
    - Much larger data than Belle
      - Luminosity: $\sim 10^{36} cm^{-2} s^{-1}$
      - 50 billion BB-bar pair ($50 ab^{-1}$)
      - ~250KB / event, 2GB / sec.

- HSC (Hyper Suprime-Cam)
  - Subaru telescope, Hawaii, USA
  - Search for Dark energy
  - Next generation CCD camera for Subaru telescope
  - Take the place of SC (Suprime-Cam) in 2011
  - 110 CCDs arranged in grid
  - 1 shot / 5 min. (including exposure time), 1.5GB / shot (880M pixels)
    - 1.5GB data for every 5 minutes
    - Data should be processed in 20 seconds to determine next exposure

R. Itoh (KEK), N. Katayama (KEK)
S. Lee (Korea University), S. Mineo (University of Tokyo)

Real-time Pipelining in SuperKEKB



Development of DAQ Middleware by Yoshiji Yasu

- DAQ-Middleware is a software framework of network network-distributed DAQ system based on Robot Technology (RT) Middleware
- RT-Middleware is an international standard of Object Management Group (OMG) not only for Robotics but also embedded system
- The software package of RT-Middleware was developed by National Institute of Advanced Industrial Science and Technology (AIST),Tsukuba, Japan
- XML, Phython, C++
- Cooperation with J-PARC

Context of Fair (Facility for antiproton and Ion Research)

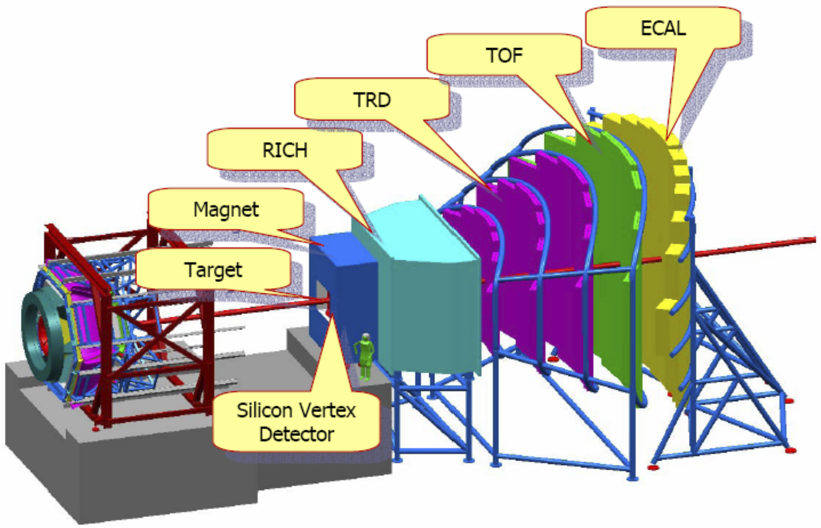
Data Acquisition Backbone Core library by Hans G. Essel

- DAQ-Framework and Dataflow engine

First level Event selection packages by Ivan Kisel

- Track reconstruction in STS/MVD displaced vertex search required first trigger level
- -> requires fast Kalman Filter

CBM-Experiment



LHC Experiments general observations

- Use frameworks and Software from offline
- High amount of resources in the trigger farms -> implications to run control
- Multicore architecture: Can the data come in fast enough? Multithreaded or parallel? (see Wiedenmann (Atlas))
- Cosmics for testing

Alice online/offline

Progress reports by

Chiara Zampolli: Alice online/offline cond. DB

Vasco Barroso: Detector Algorithm

Barthelemy von Haller: The ALICE data quality monitoring

Alice online/offline cond. data
by Chiara Zampolli

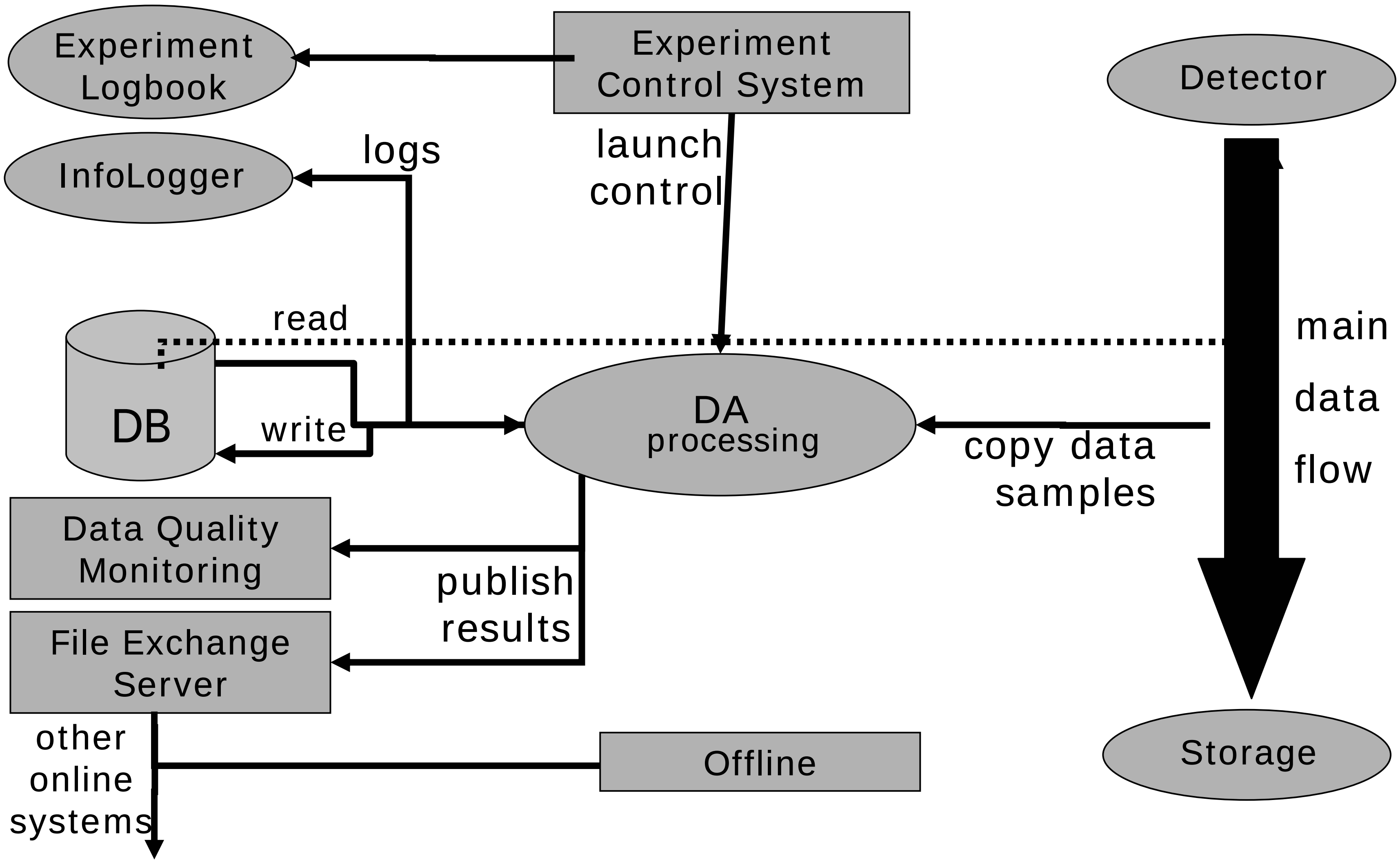
- *The **Shuttle** is the ALICE Online-Offline software framework dedicated to the extraction of conditions data – calibration and alignment – during data taking, running detector specific procedures called **preprocessors***
- During data-taking, the **18 ALICE detectors** interact with five online systems – **DAQ** (Data Acquisition), **DCS** (Detector Control System), **ECS** (Experiment Control System), **HLT** (High Level Trigger), **Trigger**
- **Monitored with MonAlisa**

Alice online/offline cond. data
by Chiara Zampolli

What Shuttle does:

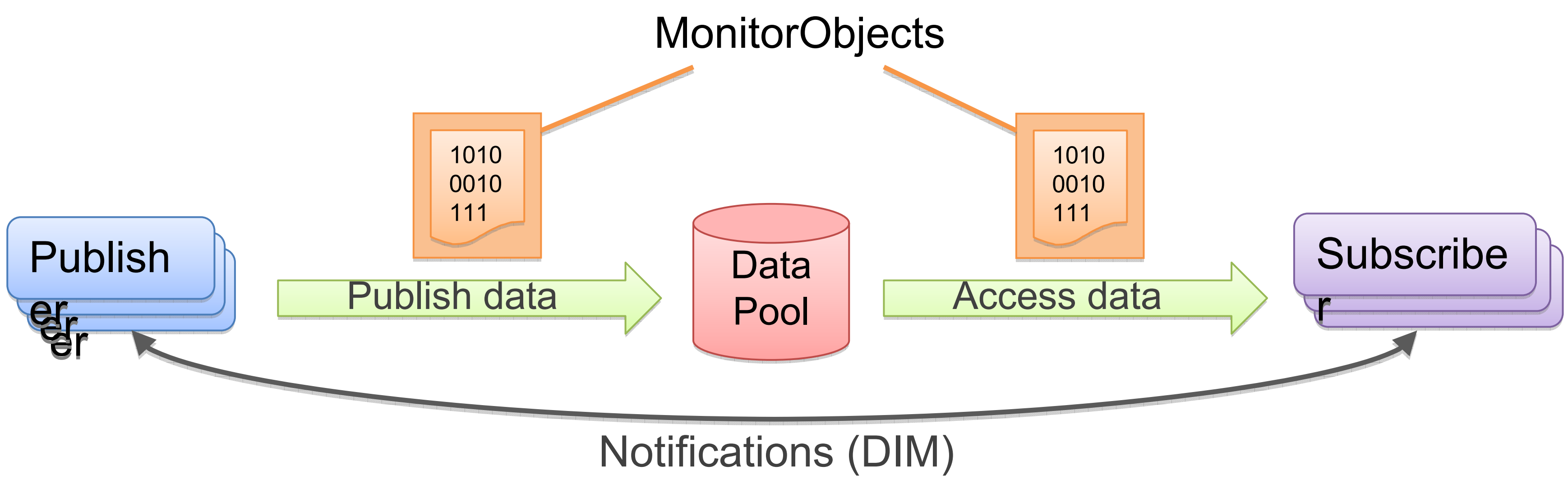
- **Copying** of data in any format produced by the online systems DAQ, DCS and HLT for each subdetector;
- **Preprocessing** of the data, e.g. consolidation, fitting;
- **Reformatting** to ROOT format;
- **Storing** in the Offline Conditions DataBase (OCDB);
  - Not a relational database, but a set of AliEn entries pointing to ROOT files stored in various SE of the Grid
- Indicating that a given **run** has been **processed**, which is a precondition to starting the reconstruction.

Detector Algorithm framework: Architecture by Vasco Barroso



Design & Architecture

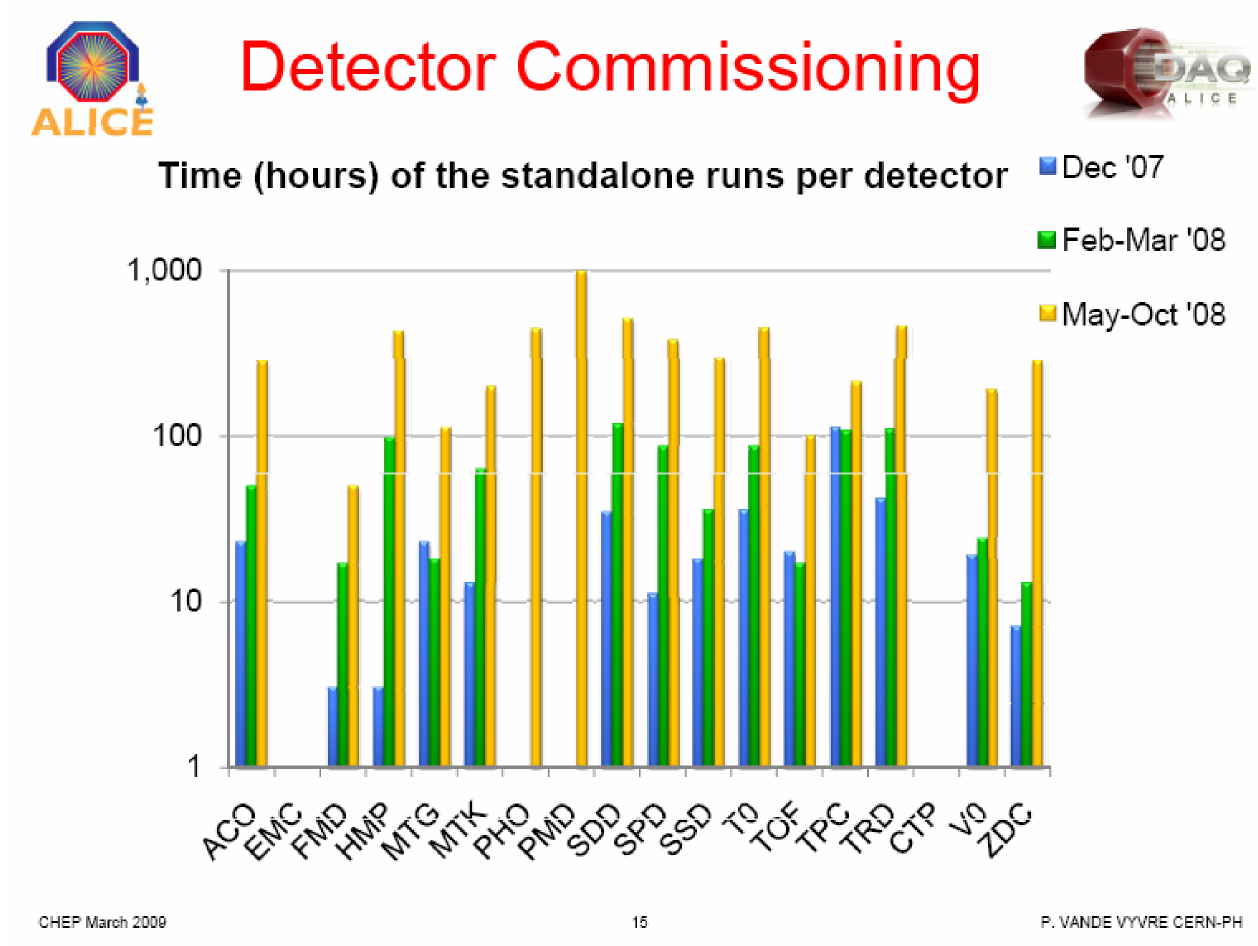
- Automatic DQ-monitoring environment (Amore)
- Published objects are encapsulated into « MonitorObject » structure
- Plugin architecture using ROOT reflection
  - Modules are dynamic libraries loaded at runtime



Commiss.& initial Exp. with Alice online by Pierre vande Vyvre

DQM

eLogbook

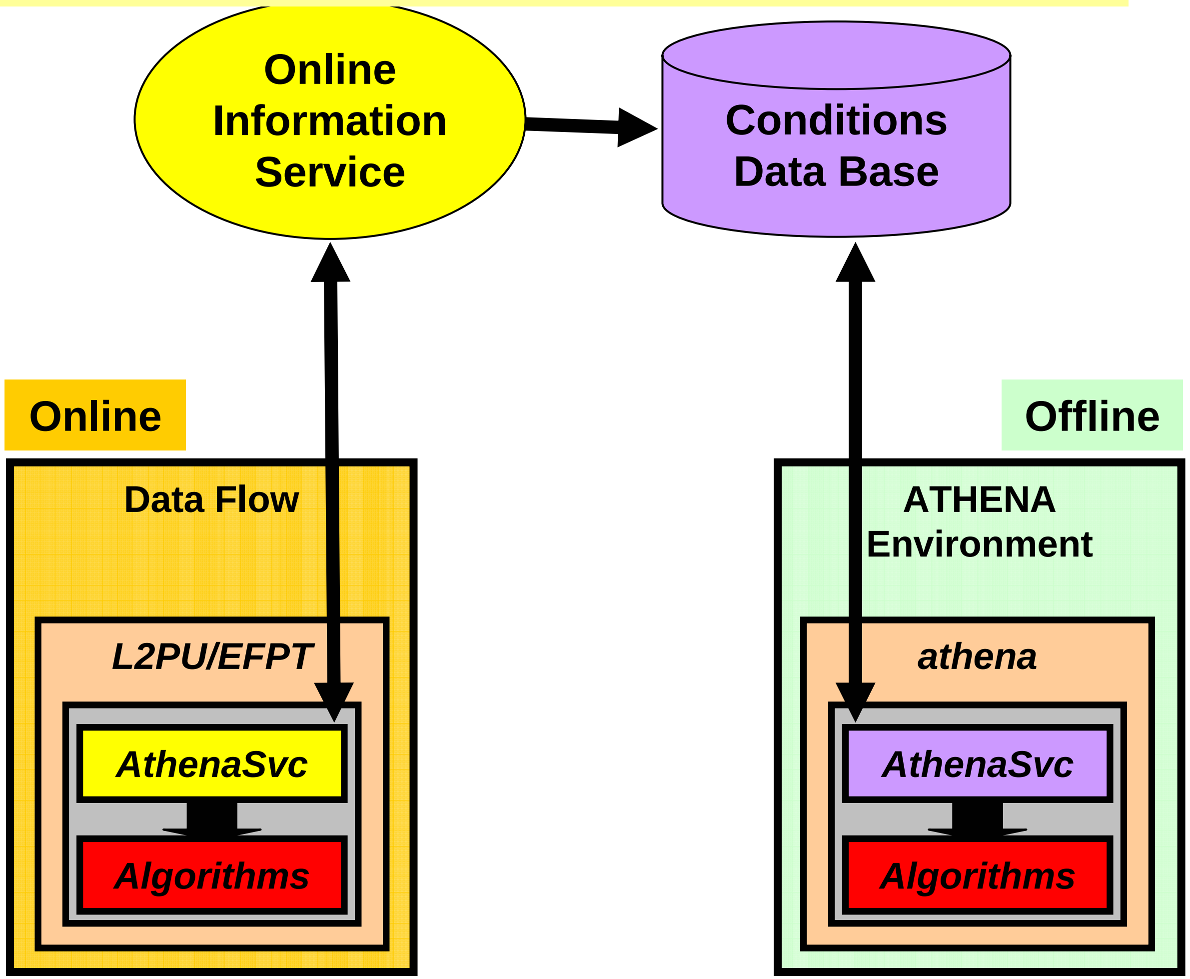


Atlas

HLT Framework by Werner Wiedenmann

Provides special Athena services when necessary to allow algorithms a transparent running in online / offline. Whenever possible the offline infrastructure services are reused. Athena services with a special "online" backend are used e.g. for

- ***Interfacing to online run control, state machine and the online configuration database***
  - e.g. for the readout buffer configuration
- ***Interfacing the algorithm configuration to the Trigger Database***
  - Holds menu configuration
- ***Interfacing to online conditions data***
- ***Forwarding of data requests to data flow in Level 2***
- ***…***



Commissioning of the HLT
by Alessandro di Matia

HLT system fully exercised
All the HLT infrastructure (steering, monitoring, data streaming, L2 & EF algorithms) tested to work under actual data taking conditions. Physics menu run in parallel to the cosmic slice.

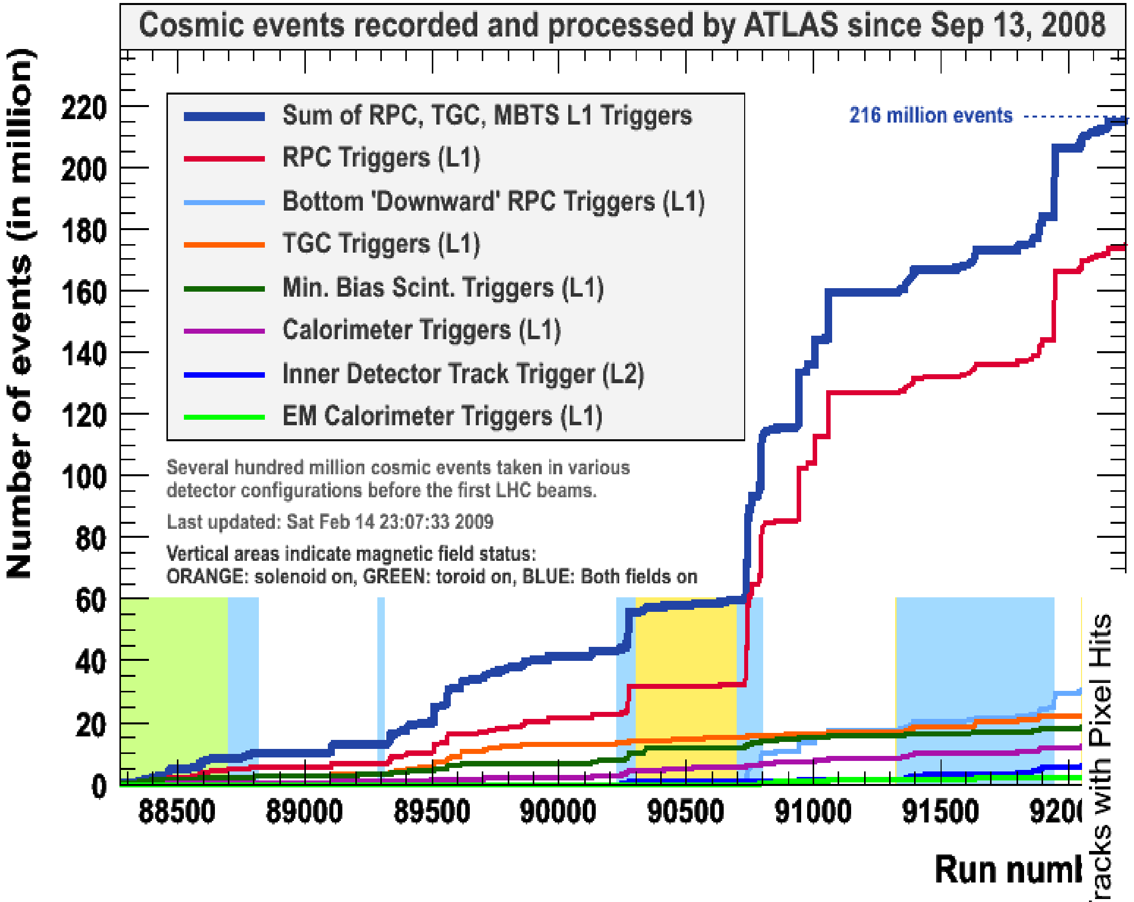
HLT performed event selection
L2 ID tracking provided the data for detector alignment, L2 muon served data for online detector Data Quality and Monitoring.

Dedicated alignment data stream were discussed by Belmiro Pinto

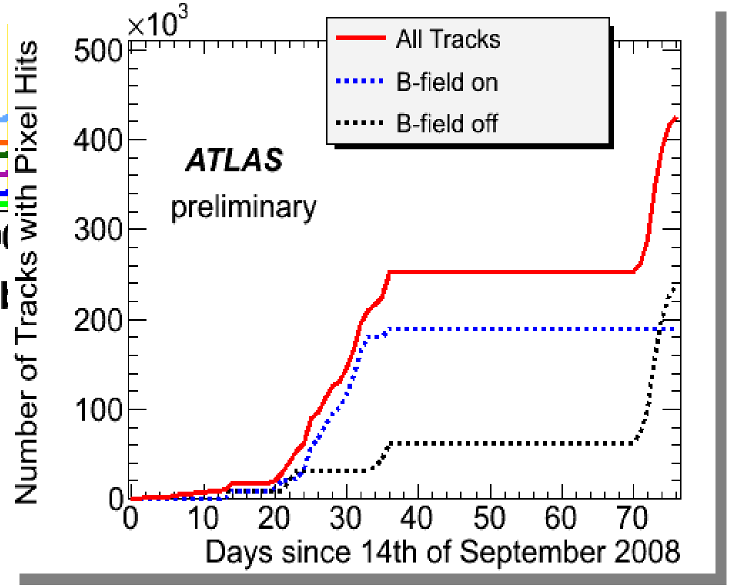
HLT operation was robust
HLT commissioning performed while serving the subsystems. Provided a good balance between stability and responsiveness to detector condition / request.

Lot of understanding driving further the commissioning work

Collected Cosmic Data (from Mark Sutton)



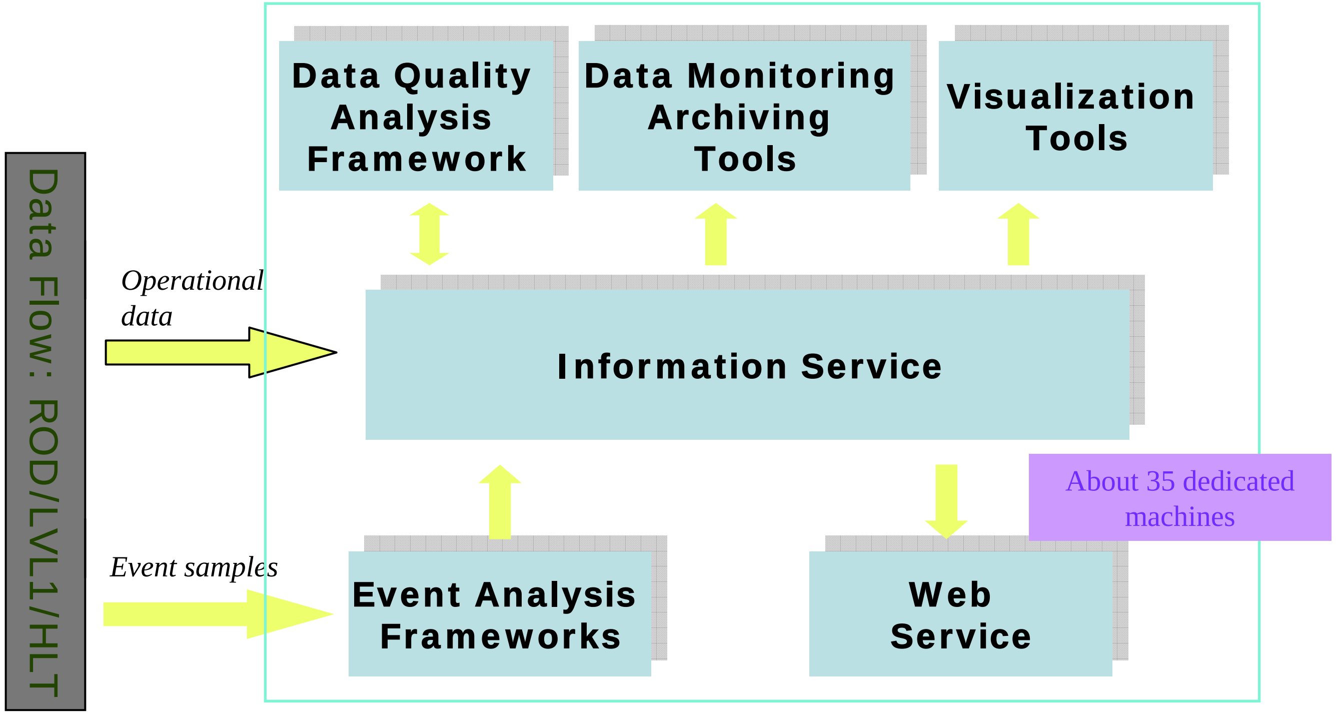
HLT-ID tracking SW used to select cosmic tracks passing through the inner detector, large statistics collected for alignment of the detector



Online monitoring framework

by ***Alina Corso-Radu***

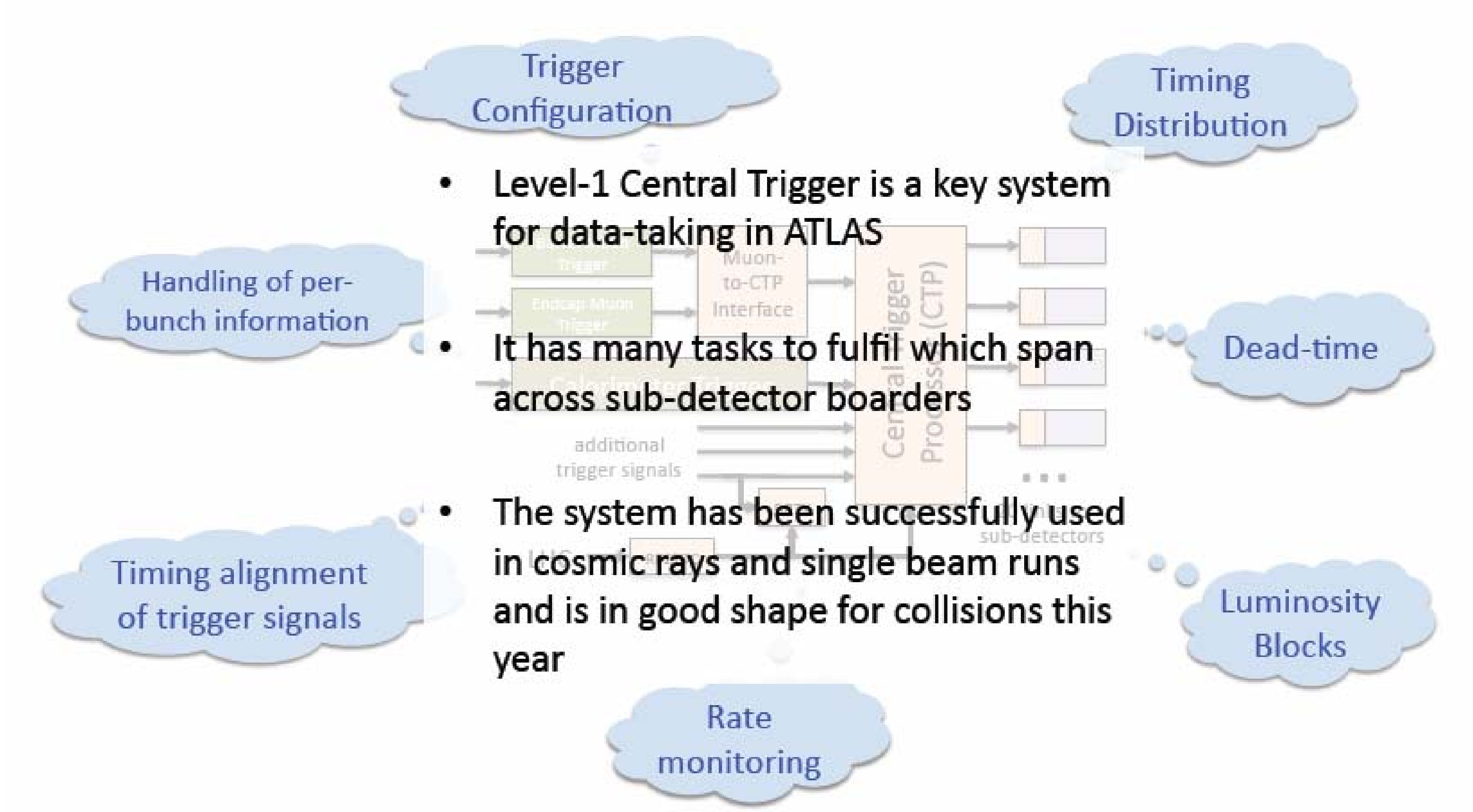
- Complexity and diversity in terms of monitoring needs of the sub-systems



- Analyze events content and produce histograms
- Analyze operational conditions of hardware and software detector elements, trigger and data acquisition systems.

- Automatic checks of histogram and operational data
  - Visualize and save results
  - Produce visual alerts
- Set of tools to visualize information aimed for the shifters
- Automatic archiving of histograms
- Monitoring data available remotely

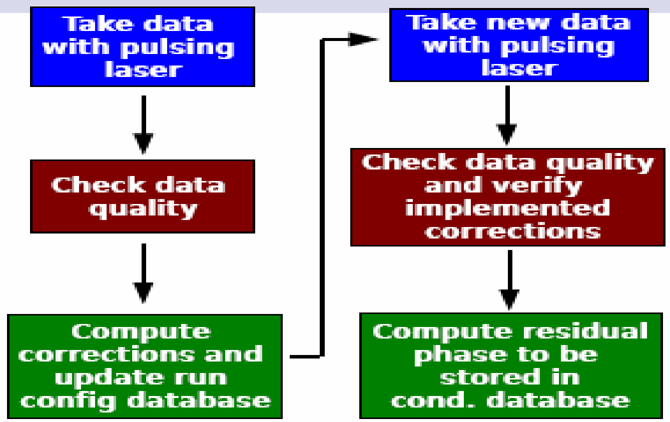
Atlas Level 1 Central Trigger by Thilo Pauly



- Level-1 Central Trigger is a key system for data-taking in ATLAS
- It has many tasks to fulfil which span across sub-detector boarders
- The system has been successfully used in cosmic rays and single beam runs and is in good shape for collisions this year

Time Calibration of the Atlas Tile Calorimeter by Bjoern Nordkvist

Laser Timing Work Flow



Convenient to have as much of the corrections as possible online. Six channel granularity sets the limit.

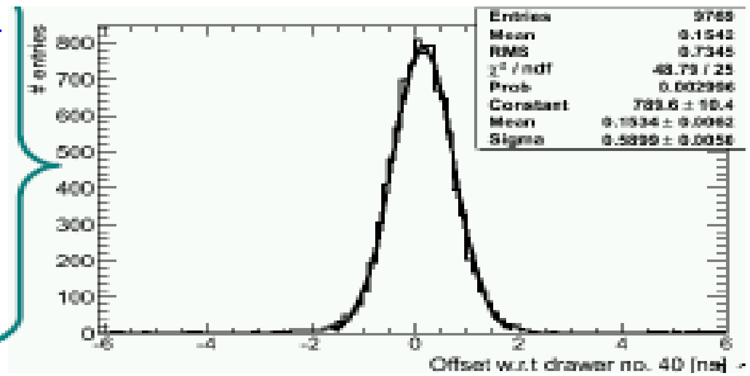
Data quality check: Verification of pulse shapes, amplitudes and convergence of fits (not yet automatized).

Plan is to integrate timing algorithms as part of automatic laser data reconstruction.

Distribution of all TileCal channels after implementing online timing corrections. All sections overlaid.

Sigma (~0.6 ns) of the Gaussian gives a lower limit resolution of the method.

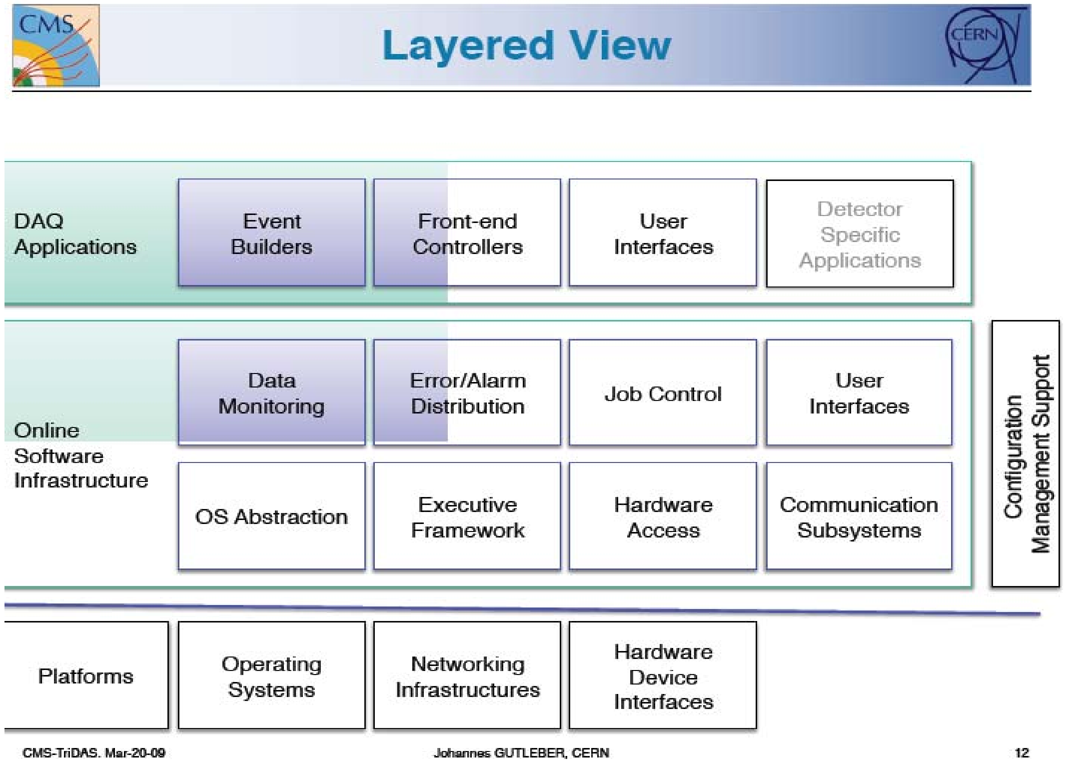
Result well within the timing goals.



CMS

CMS DAQ Syst. SW
by Johannes Gutleber

- Getting the pieces in a scalable, portable, manageable way together



XDAQ

- Coretools
- Powerpack
- Work Suite

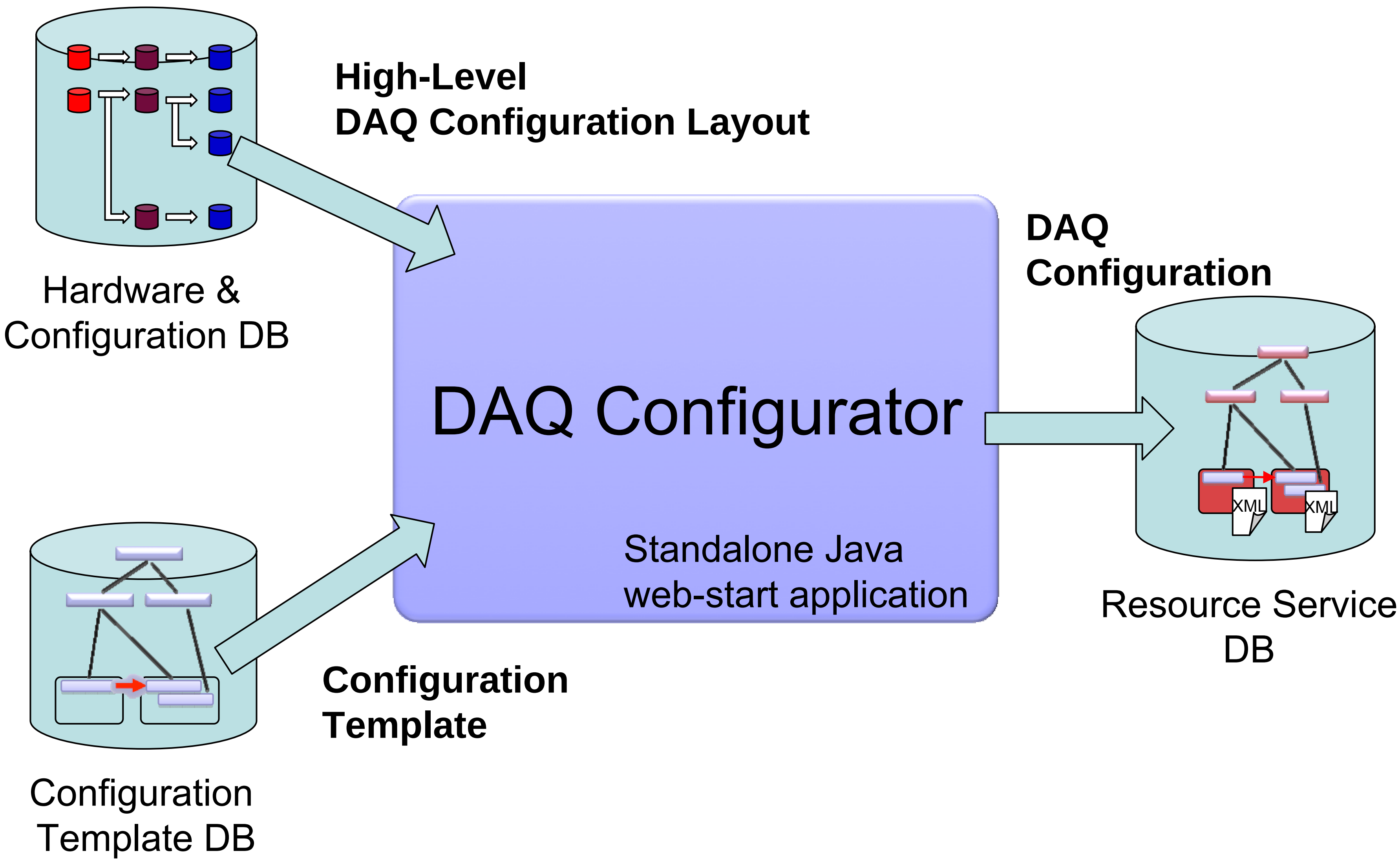
The CMS RPC Detector Control System by Giovanni Polese

- **The main functionalities (part of XDAQ):**
- Final state machine architecture,
- the graphical user interface,
- the alarm handler and
- the ORACLE database interface, for storing the data in the CMS online database and the loading of the hardware configuration from the CMS configuration database.

The CMS online Cluster by J.A. Coarasa

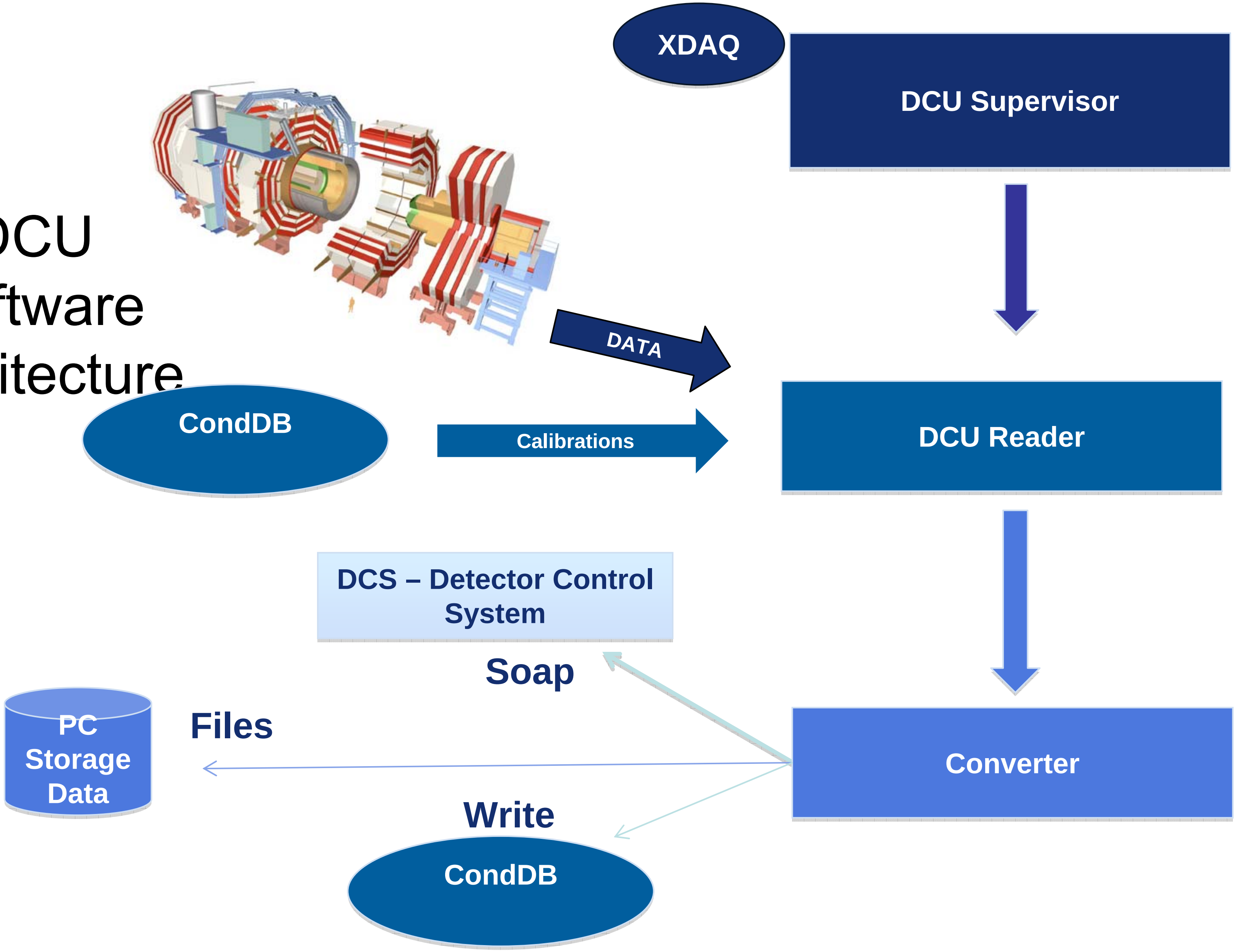
- About 2000 Systems
- Myrinet, Force10 switches, netApp storage
- Automatic procedures, nagios
- 5 FTE

Dyn. Config of DAQ Cluster by Hannes Sakulin
The solution: DAQ Configurator



Ecal FE-Monitoring by Matteo Marone

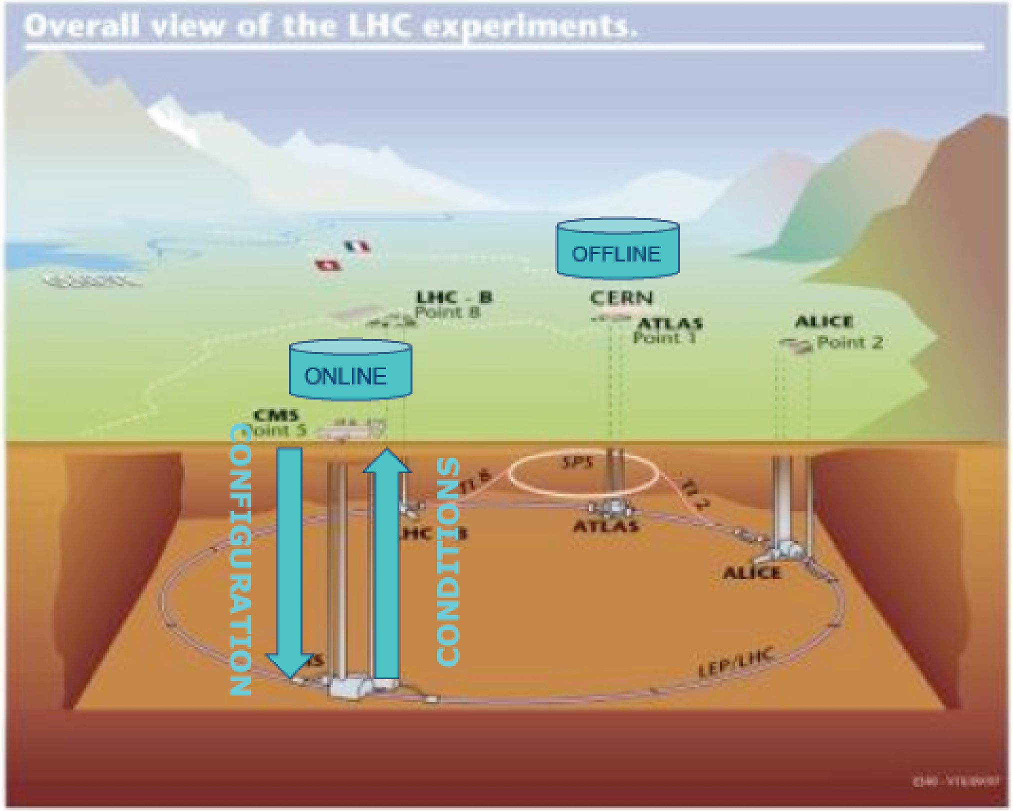
DCU Software Architecture



The CMS ECAL DatabaseServices for Detector Control and Monitoring by Giovanni Organtini

Data flow

Conditions measured during runs (non event data) or in local runs are stored on the online DB

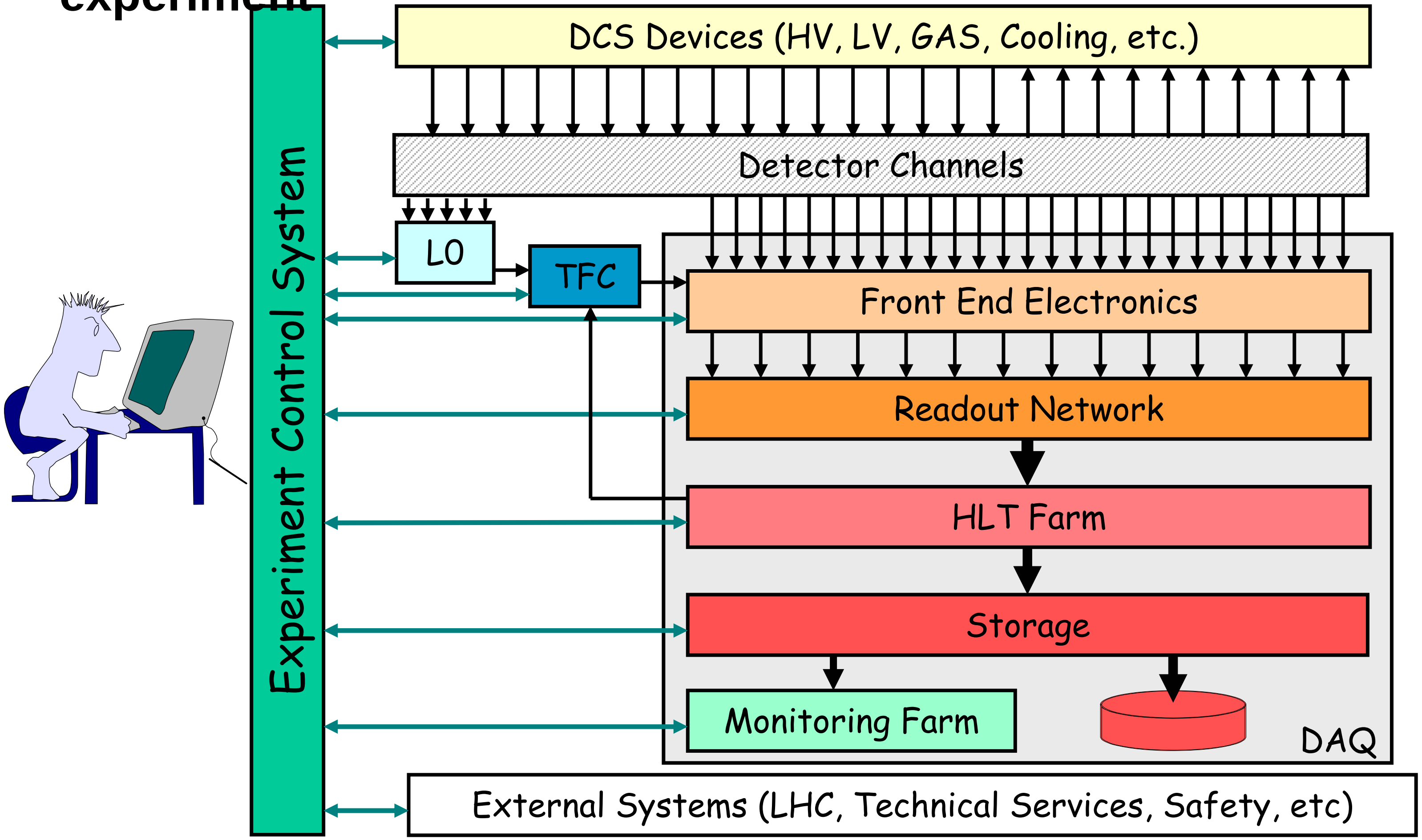


LHCb

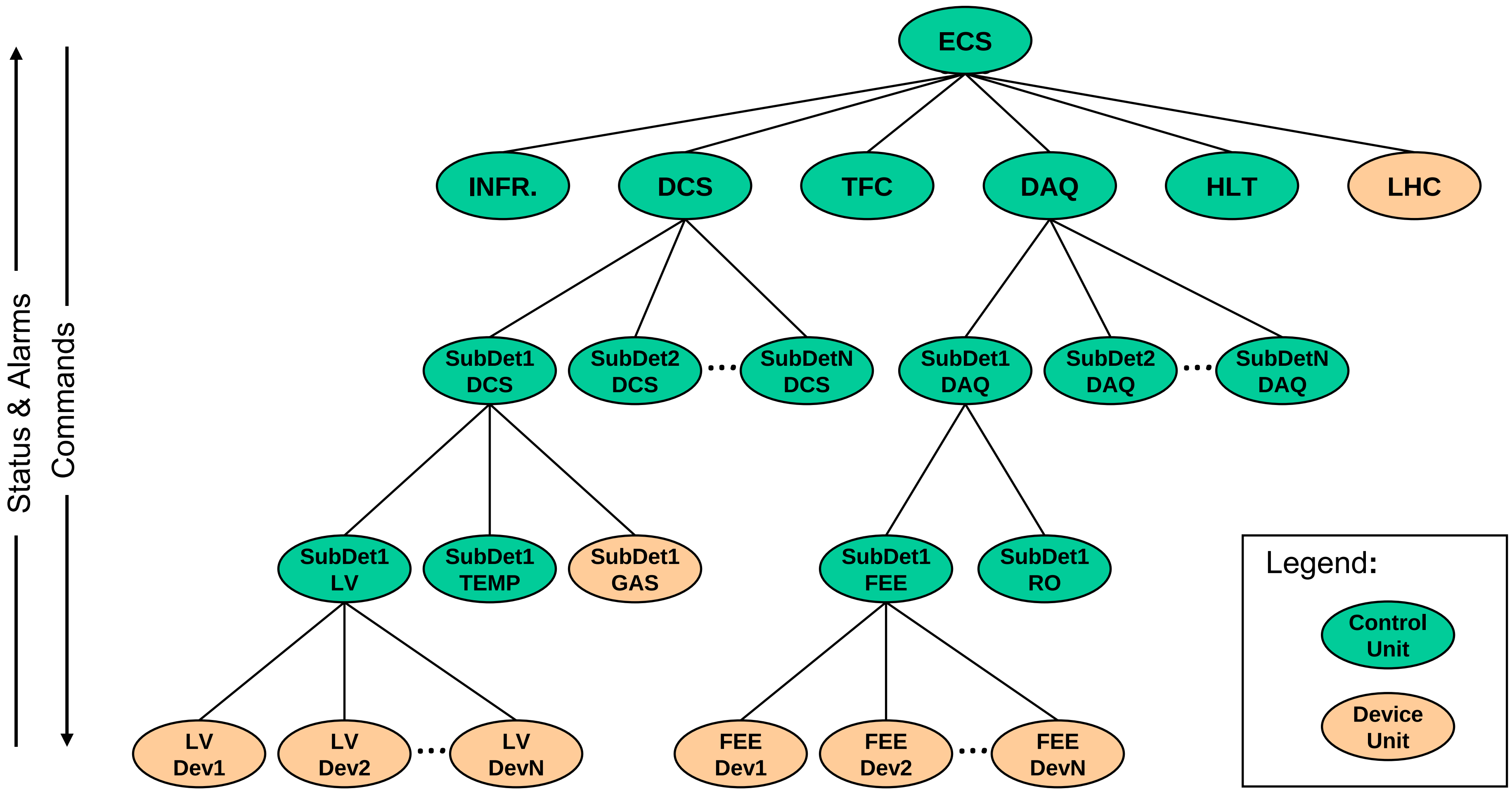
The LHCb Run Control by Clara Gaspar

The Experiment Control System

- Is in charge of the Control and Monitoring of all parts of the experiment



Generic SW Architecture



The Control Framework

- The JCOP* Framework is based on:
  - SCADA System - PVSSII for:
    - » Device Description (Run-time Database)
    - » Device Access (OPC, Profibus, drivers)
    - » Alarm Handling (Generation, Filtering, Masking, etc)
    - » Archiving, Logging, Scripting, Trending
    - » User Interface Builder
    - » Alarm Display, Access Control, etc.
  - SMI++ providing:
    - » Abstract behavior modeling (Finite State Machines)
    - » Automation & Error Recovery (Rule based system)

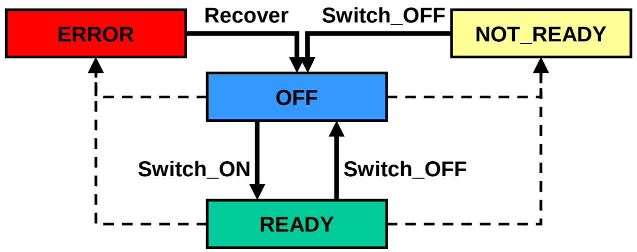
Device Units

Control Units

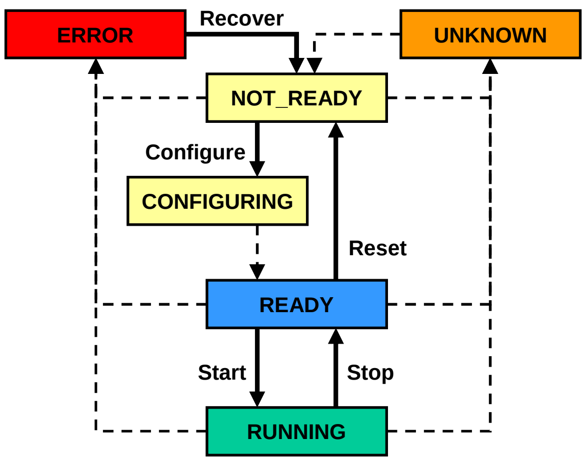
– The Joint COntrols Project (between the 4 LHC exp. and the CERN Control Group)

FSM Templates

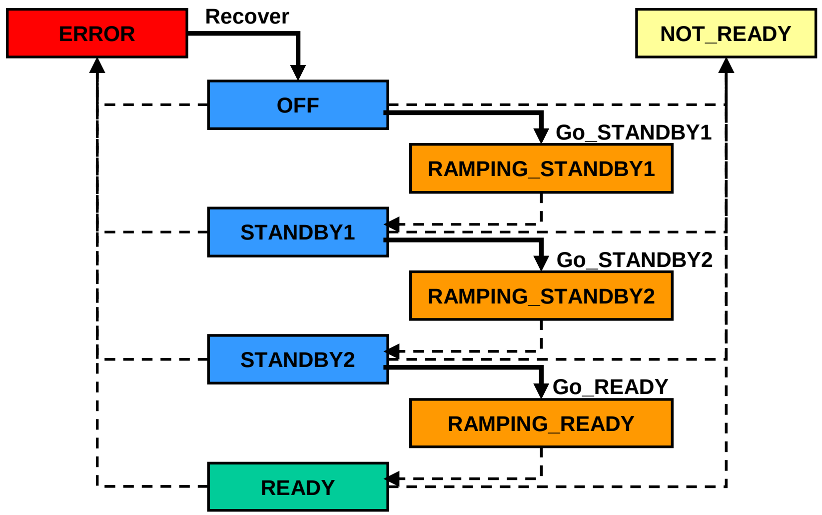
- DCS Domain



- DAQ Domain



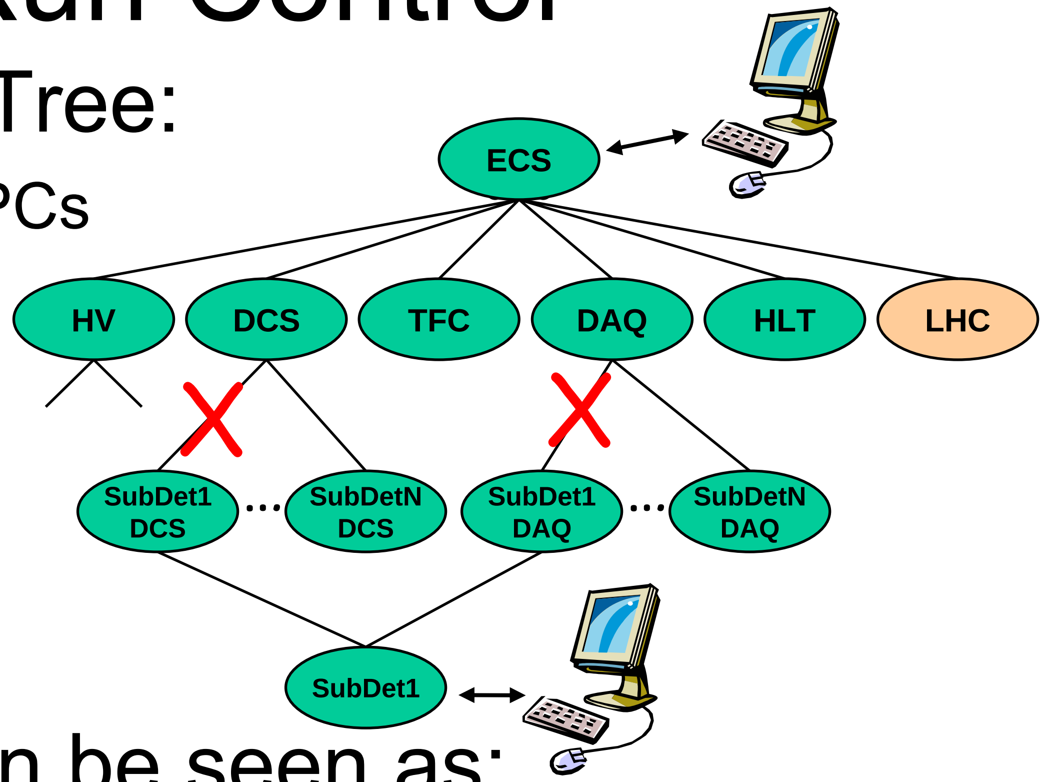
- HV Domain



- All Devices and Sub-Systems have been implemented using one of these templates

ECS: Run Control

- Size of the Control Tree:
  - Distributed over ~150 PCs
    - ~100 Linux (50 for the HLT)
    - ~ 50 Windows
  - >2000 Control Units
  - >30000 Device Units



- The Run Control can be seen as:
  - The Root node of the tree
  - ➡ If the tree is partitioned there can be several Run Controls.

Event reconstruction in the LHCb online Farm by Albert Navarro

Motivation:

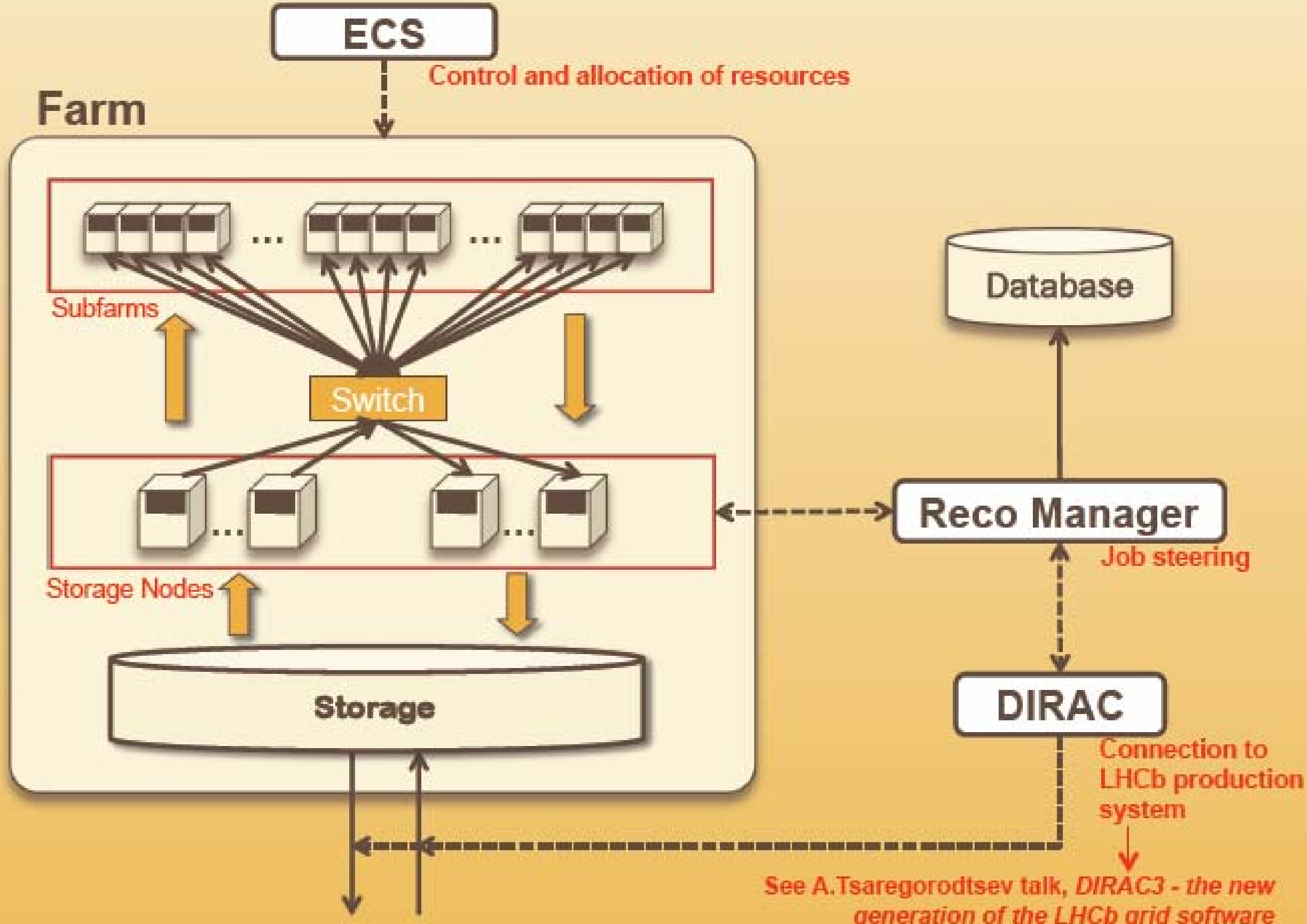
- compute power (~16 000 cores) of size of allt LHCb Tier 1‘s
- Significant idle times during shutdown etc.

Basic facts:

60 k ev/2GB File, 1-2 s CPU time/ev-reco

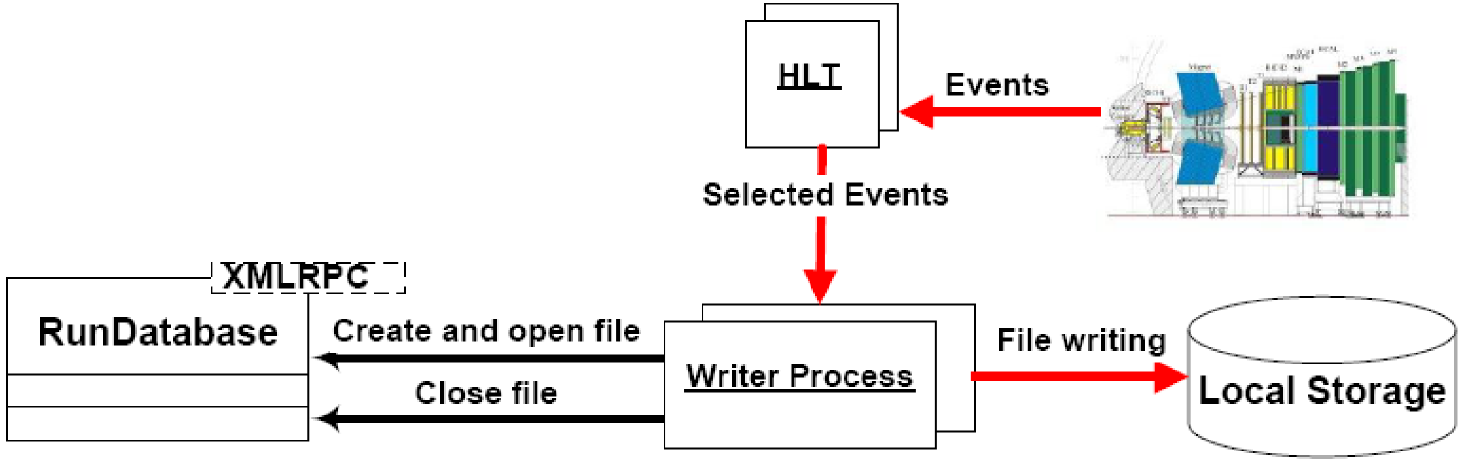
-> new approach: split farm into slices and do a parallel reconstruction

Implementation

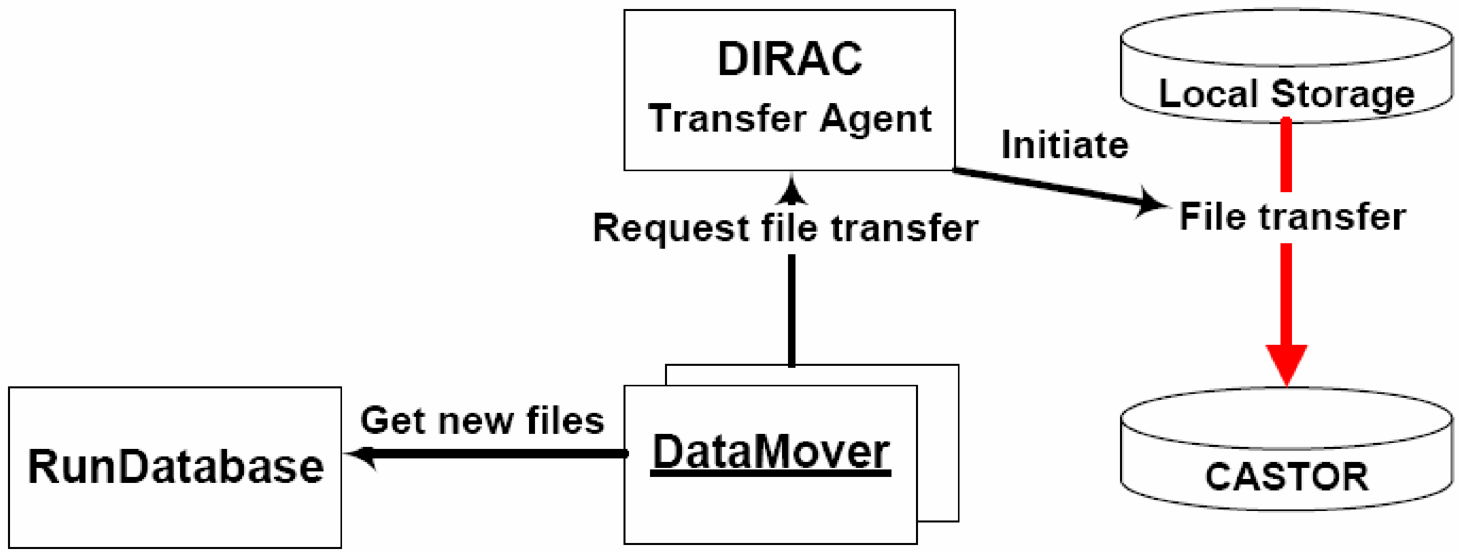


LHCb ONLINE

Storage System: File Writing

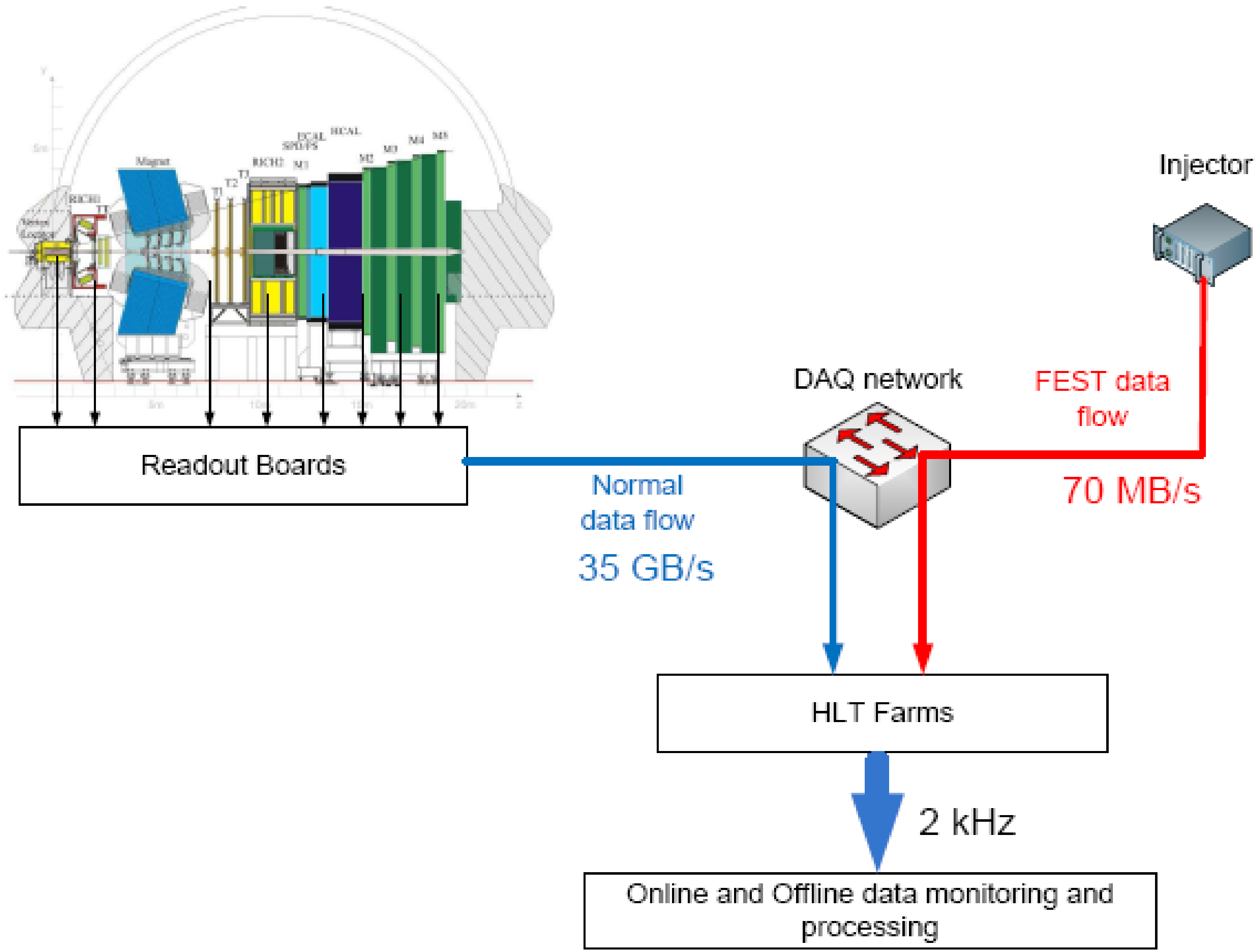


Storage System: File Transfer



Reliable Online Data Replication by Daniel Sonnick

Purpose of FEST



Summary

- Excellent presentations and posters
- Huge amount of computing in the online field
- All have set up Frameworks
- Huge SW-development in the online field
- Cosmics proofed online systems are working
- The way how to use multicore usage is open
- Modern software technology is in place

Cosmic Run III (May-Oct ‘08)

- Global runs in 23 weeks
- 16 detectors participating
- 60-1250 hours of data taking – 5-3500 x 10^6 triggers