



The ALICE data quality monitoring

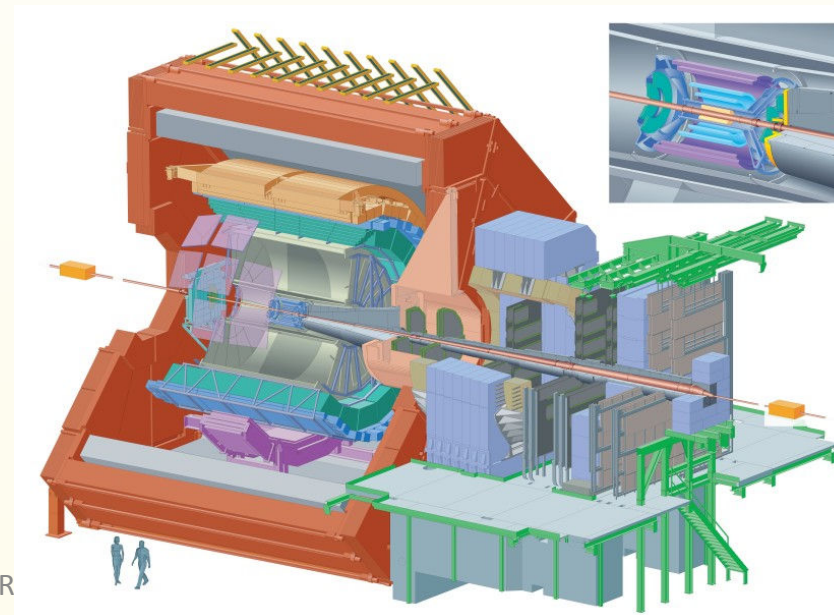
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CERN PH/AID
For the ALICE Collaboration



The ALICE experiment



- CERN : European Organisation for Nuclear Physics
- LHC : Large Hadron Collider
- ALICE : A Large Ion Collider Experiment
 - 18 detectors
 - Trigger rate : 10 KHz (max)
 - Bandwidth to mass storage : 1.25 GB/s





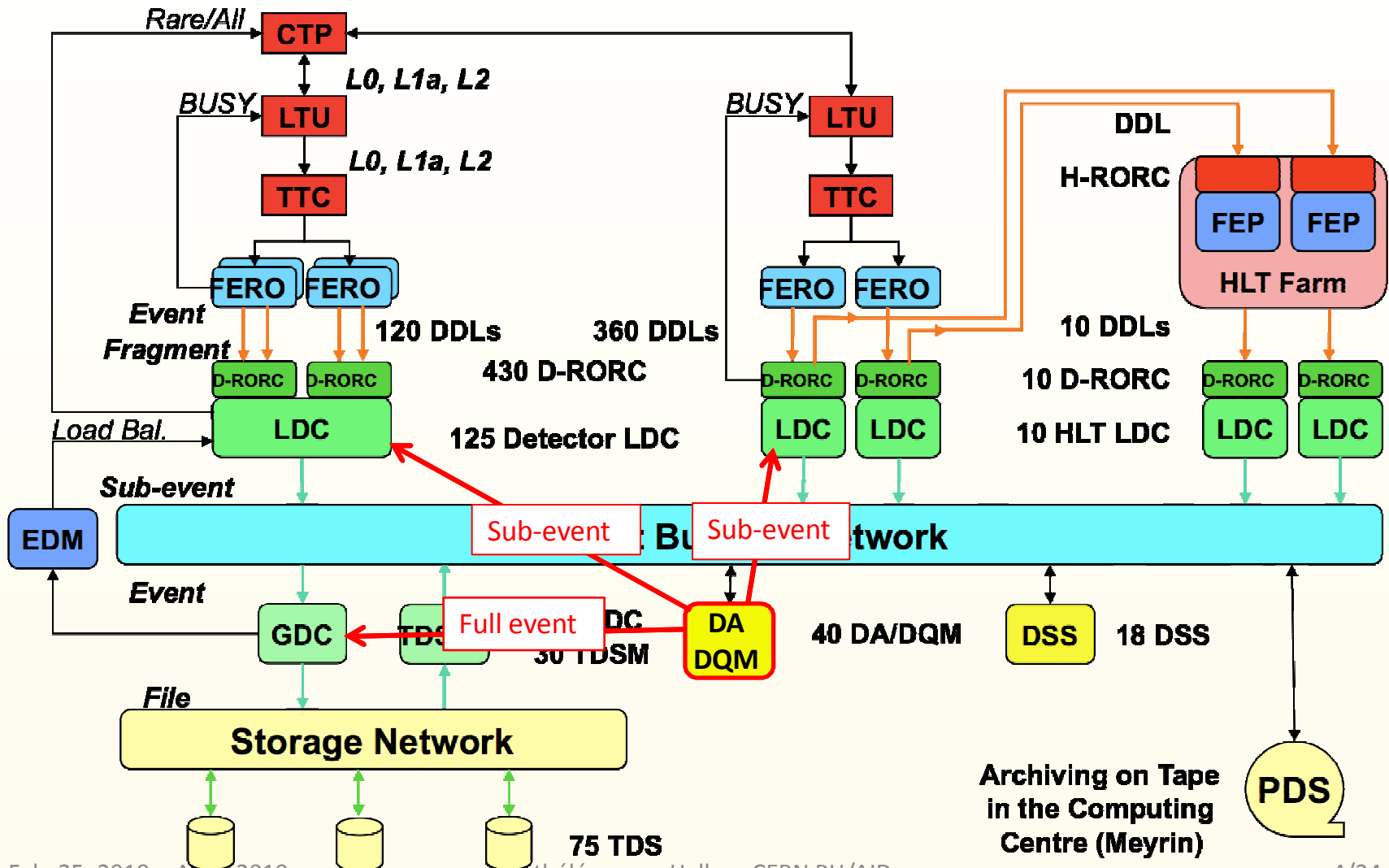
Data Quality Monitoring



- Online feedback on the quality of data
- Make sure to take and record high quality data
- Identify and solve problem(s) early
- Data Quality Monitoring (DQM) involves
 - Online gathering of data
 - Analysis by user-defined algorithm
 - Storage of monitoring data
 - Visualization



Data-Acquisition architecture

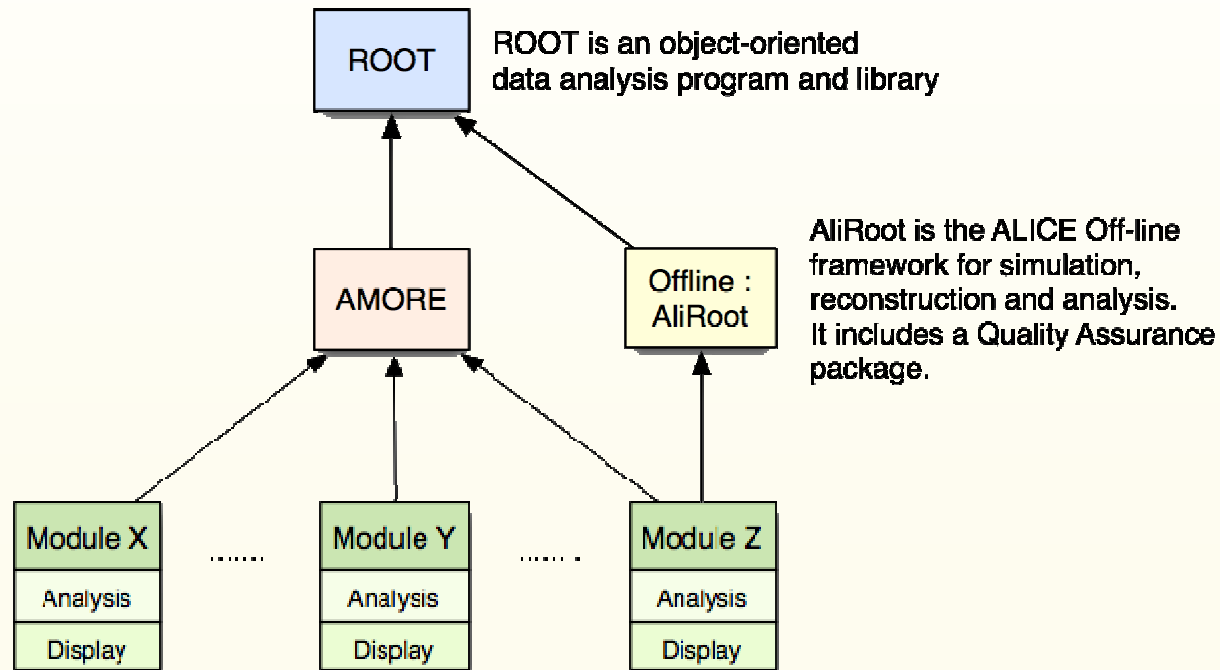




The AMORE framework



- AMORE : Automatic MOnitoring Environment
- A DQM framework for the ALICE experiment

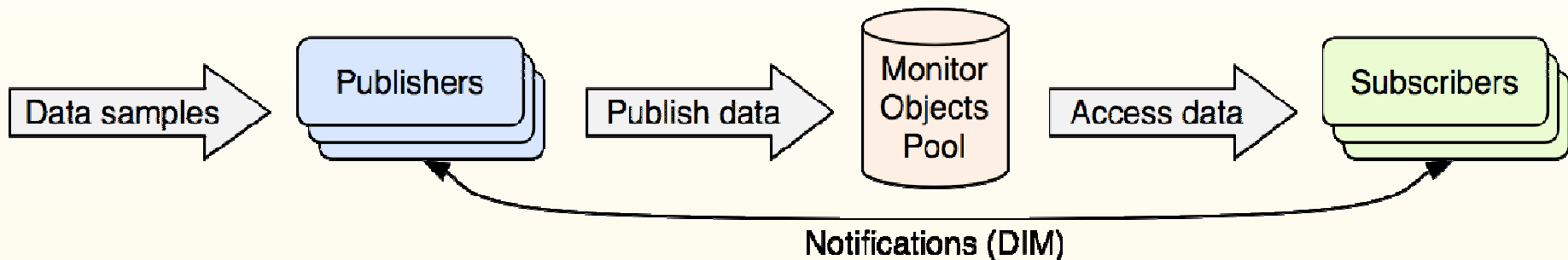




Design & Architecture



- Publisher – Subscriber paradigm
- Database used for the data pool
- Notification with DIM (Distributed Information Management System)

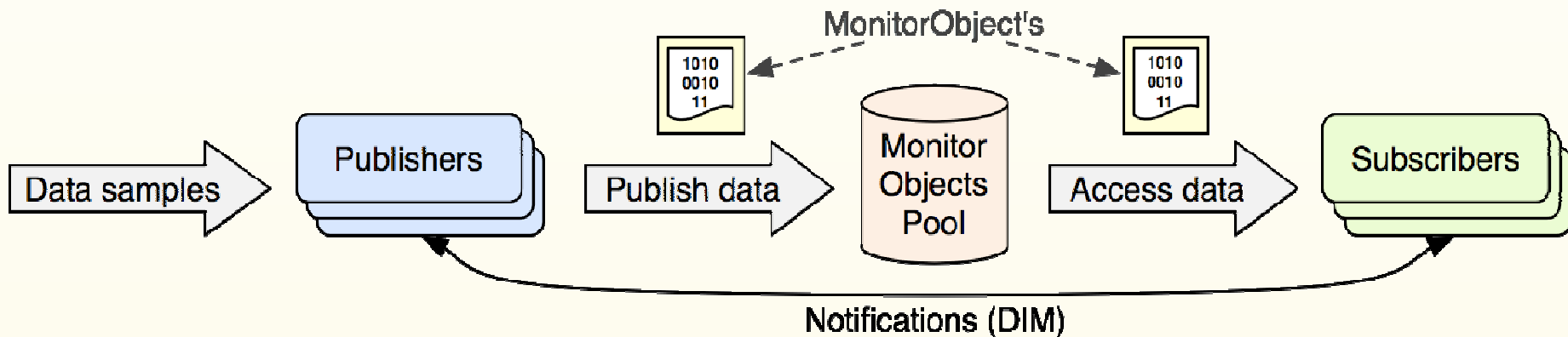




Design & Architecture

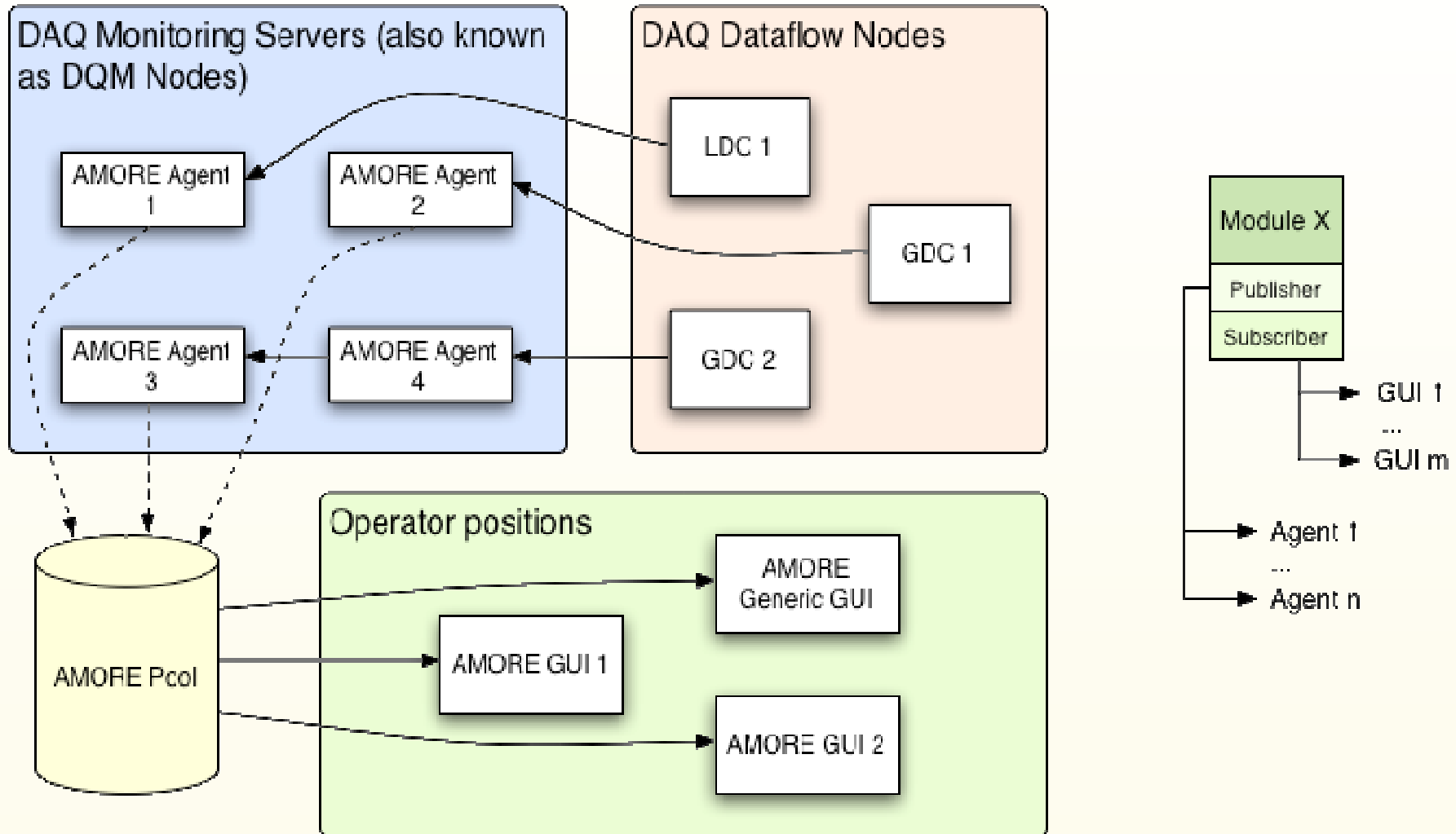


- Published objects are encapsulated into « MonitorObject » structure
- Plugin architecture using ROOT reflection
 - Modules are dynamic libraries loaded at runtime





Design & Architecture

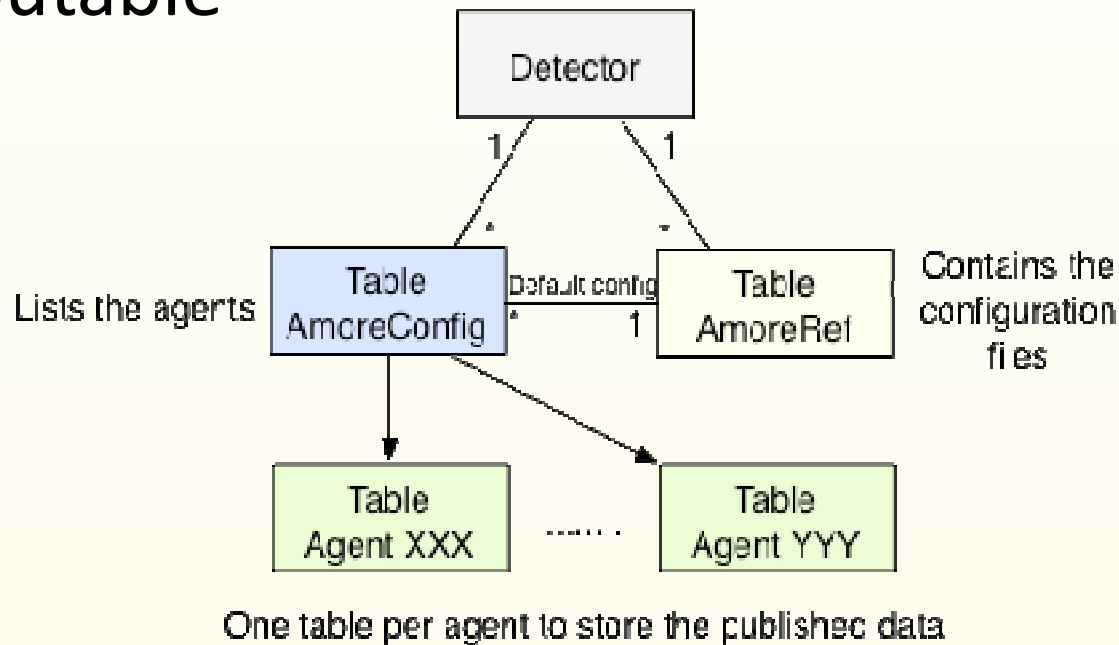




The Pool

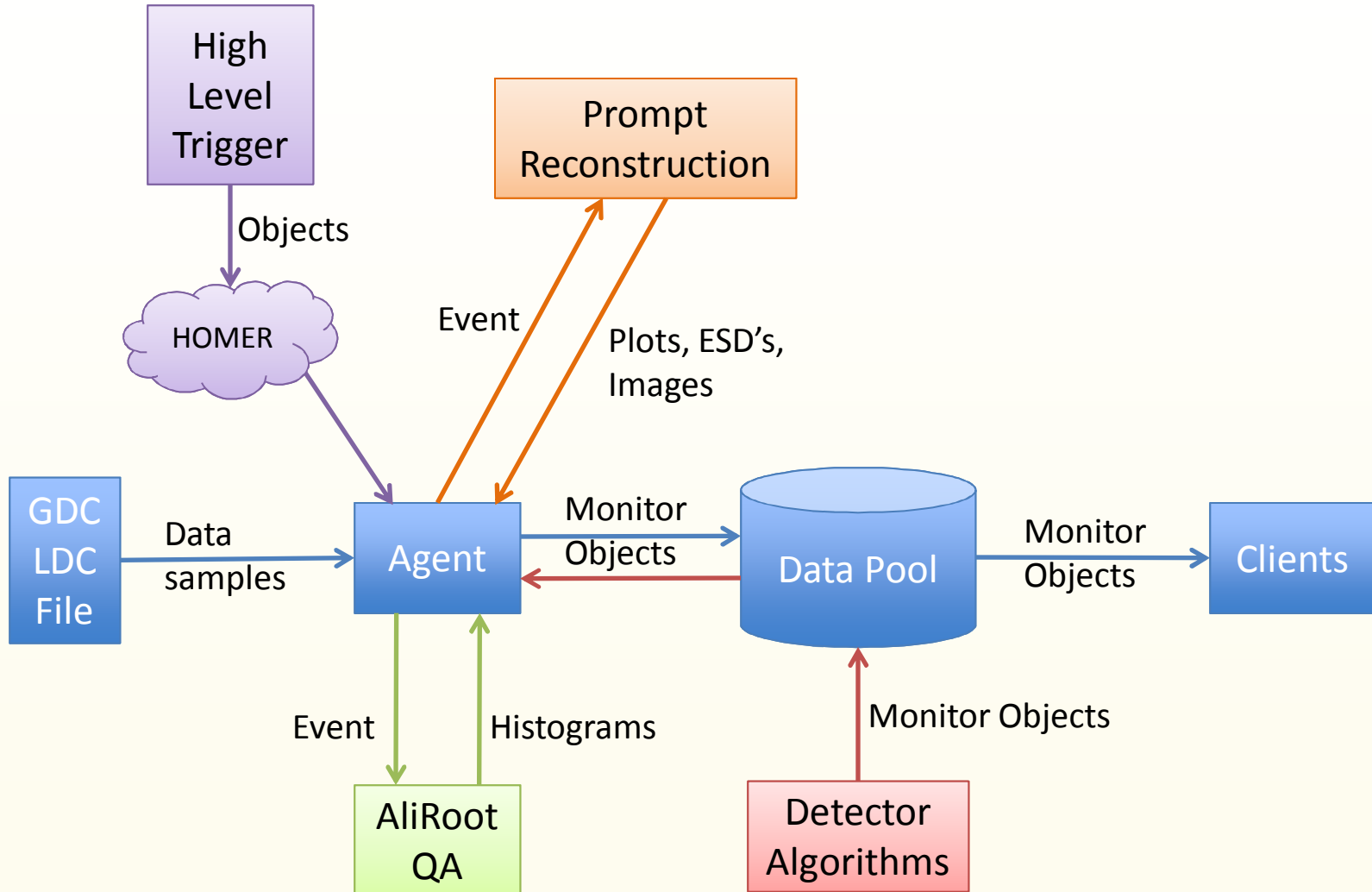


- Current implementation based on a database
- MySQL : light-weight, reliable, freely distributable





Objects Producers





Subscriber & User Interface

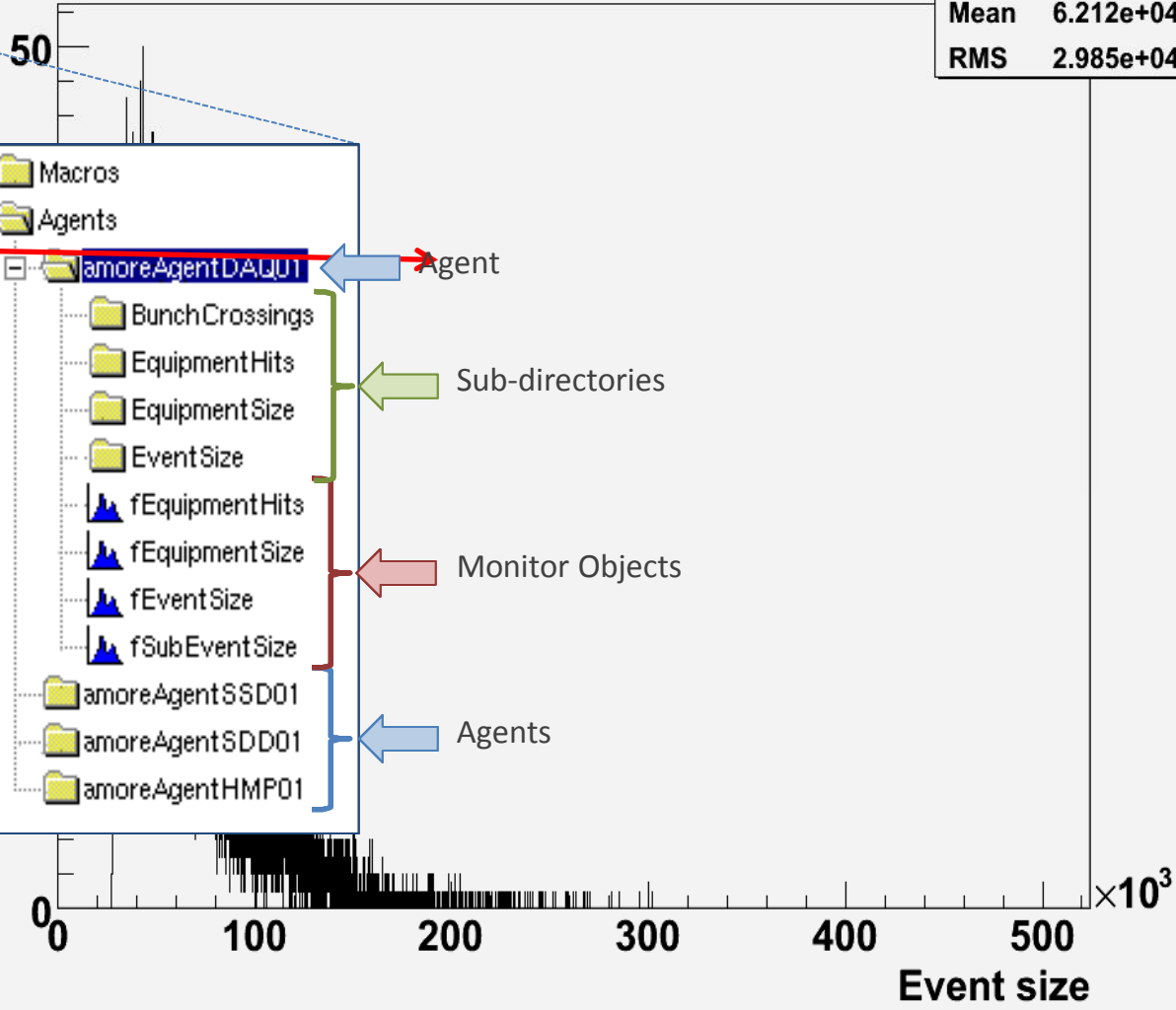


- Generic GUI
 - Display any object of any running agent
 - Possibility of handling automatically the layout
 - Layout can be saved for future reuse
 - Fit the basic needs of the users to check what is published by the agents
- For more complex needs, users can develop their own GUI

- Macros
- Agents
 - amore.AgentDAQ01
 - BunchCrossings
 - EquipmentHits
 - EquipmentSize
 - EventSize
 - fEquipmentHits
 - fEquipmentSize
 - fEventSize**
 - fSubEventSize
 - amore.AgentSSD01
 - amore.AgentSDD01
 - amore.AgentHMP01

Event size per detector

EventSize/TPC	
Entries	27763
Mean	6.212e+04
RMS	2.985e+04



Command

Command (local): [dropdown]



Web access



- Another type of client : web application
- ALICE eLogbook
- Possibility to access monitoring information in real time world-wide :
 - Images
 - Raw monitoring objects
 - Statistics

Run Details - 106876

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No active filters

Quick Access ▶

Print tab

Print all

- Run Conditions
- Run Statistics
- Trigger Clusters Info
- Run Quality
- LDCs Statistics
- GDCs Statistics**
- Shuttle Info
- File Info
- Log Entries
- InfoLogger Messages
- DQM

Data Quality Monitoring Info - agent 'amoreAgentDAQ_TEST_1'

- Overview
- Permanently Archived MOs (0)
- Temporarily Archived MOs (591)**
- Online MOs (2)

MO Name	Size (KB)	Update Time	Image	Object	
BunchCrossingsClusters/cluster_1	14.7	26/01/2010 16:59:49	 	Yes	
EventSize/FMD/class_CTRUE-ABCE-NOPF-CENT	39.8	26/01/2010 16:59:49	 	Yes	
EquipmentSize/FMD/DDLs/3073	4.6	26/01/2010 16:59:49	 	Yes	



Multithreading

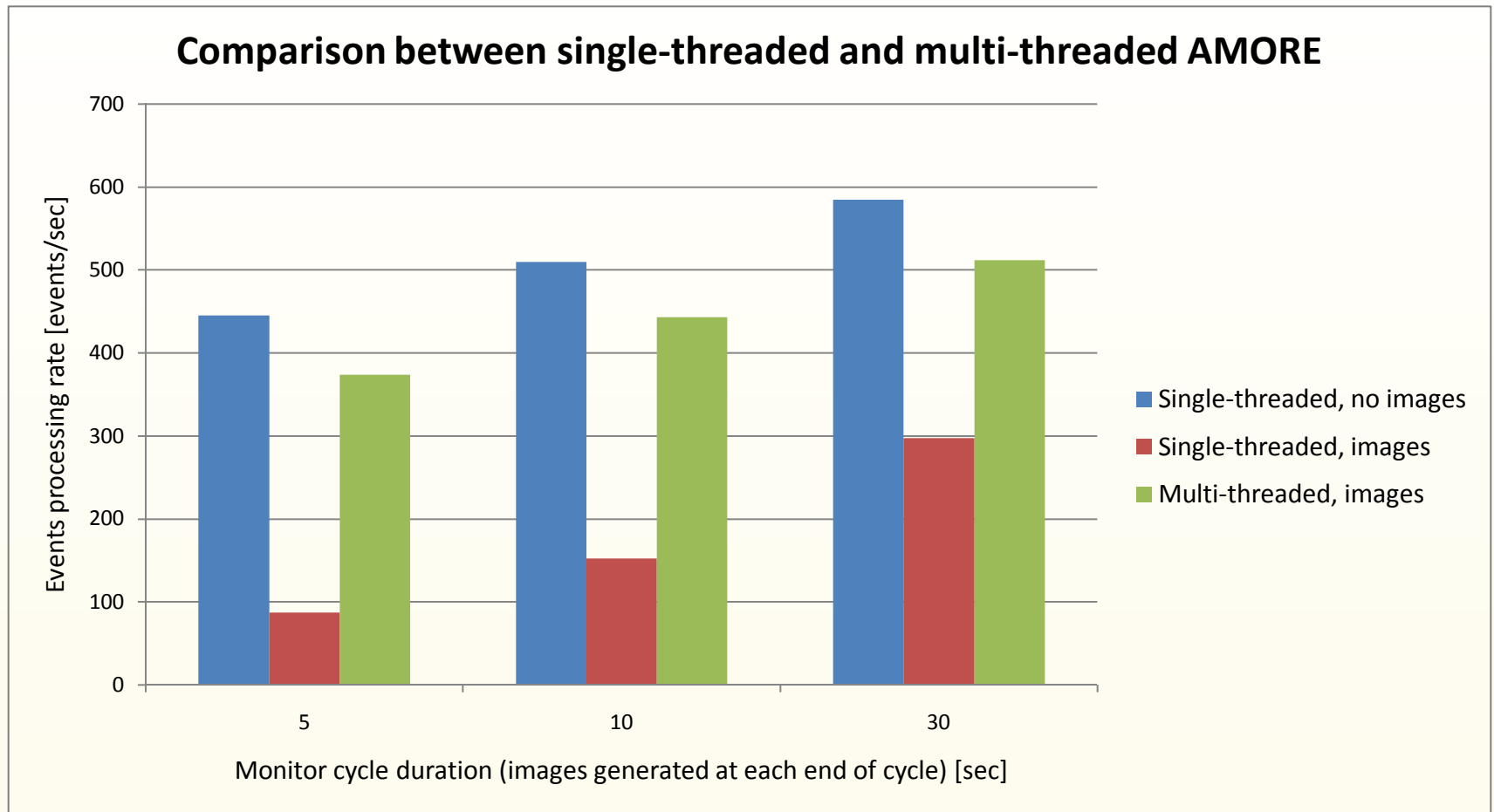


- Motivation : to take advantage of multi-core architectures
- First step :
 - One thread for the analysis (user's code) => go as fast as possible and therefore monitor as much events as possible
 - One thread for the images production (heavy process)





Multithreading

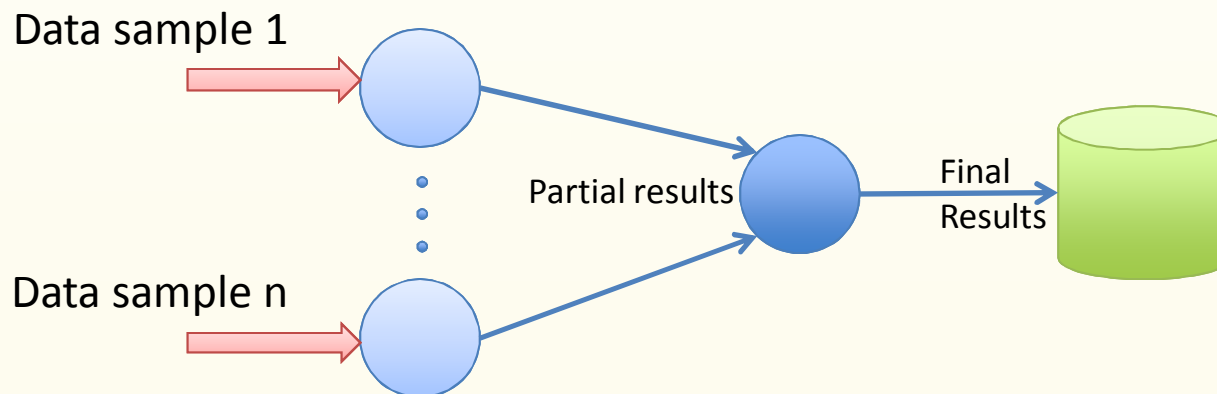




Parallelization : future



- Add yet another thread for the database operations
- Allow users to transparently run a given agent in n processes to collect more data





LHC start-up's experience



- November 2009 : LHC restarts
- AMORE intensively used in a real world and production environment
- Up to
 - 35 agents running
 - 3400 objects published per second in average
 - 115 MB published per second in average



Draw Option:

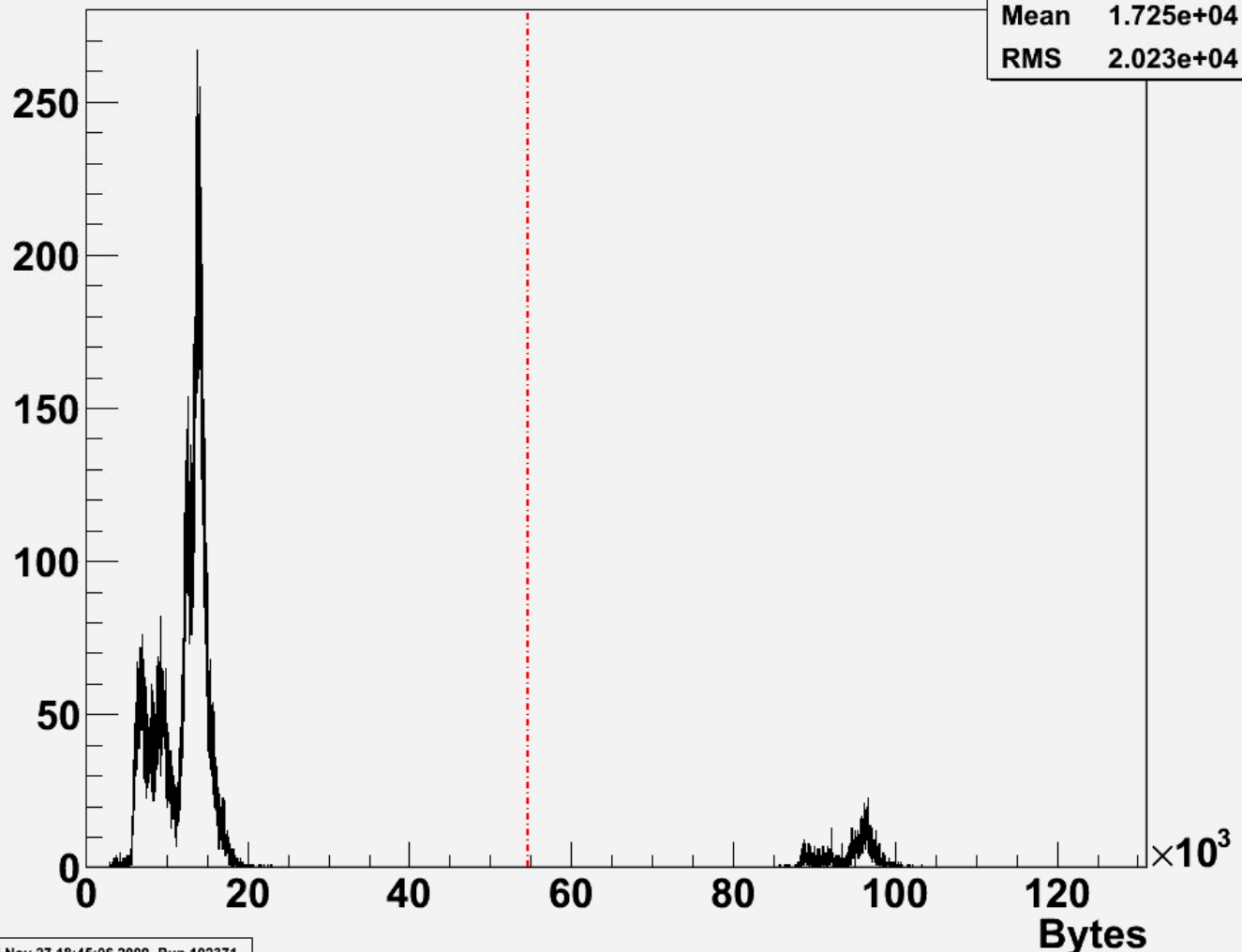
Filter:

Auto Layout

- Macros
- Agents
 - amoreAgentPHSQAshifter
 - amoreAgentTPCQAshifter
 - amoreAgentTOF99
 - amoreAgentT00QAshifter
 - amoreAgentV00QAshifter
 - amoreAgentTOFQAshifter
 - amoreAgentSSDQAshifter
 - amoreAgentDAQ_TEST_1
 - amoreAgentV00Cosmic
 - amoreAgentACDQAshifter
 - amoreAgentV00CosmicLocal
 - amoreAgentDAQTime_PHYSICS_2
 - amoreAgentDAQ_TEST_2
 - amoreAgentDAQ04
 - amoreAgentMTRQAshifter
 - amoreAgentT00QA
 - amoreAgentPMDQAshifter
 - amoreAgentTRDQAshifter
 - amoreAgentSPDQAshifter
 - amoreAgentZDCAshifter
 - amoreAgentHMPQAshifter
 - amoreAgentDAQ_PHYSICS_2
 - amoreAgentMCHQAshifter
 - amoreAgentFMDQAshifter
 - amoreAgentDAQ_PHYSICS_1
 - BunchCrossingsClusters
 - EquipmentHits
 - EquipmentSize
 - EventSize
 - ACORDE
 - CPV
 - DAQ_TEST
 - EMCAL
 - FMD
 - HLT
 - HMPID
 - ITSSDD
 - ITSSPD
 - ITSSD ←
 - MUONTRG
 - MUONTRK
 - PHOS
 - PMD

Event size for detector ITSSSD

EventSize/ITSSSD	
Entries	57162
Mean	1.725e+04
RMS	2.023e+04



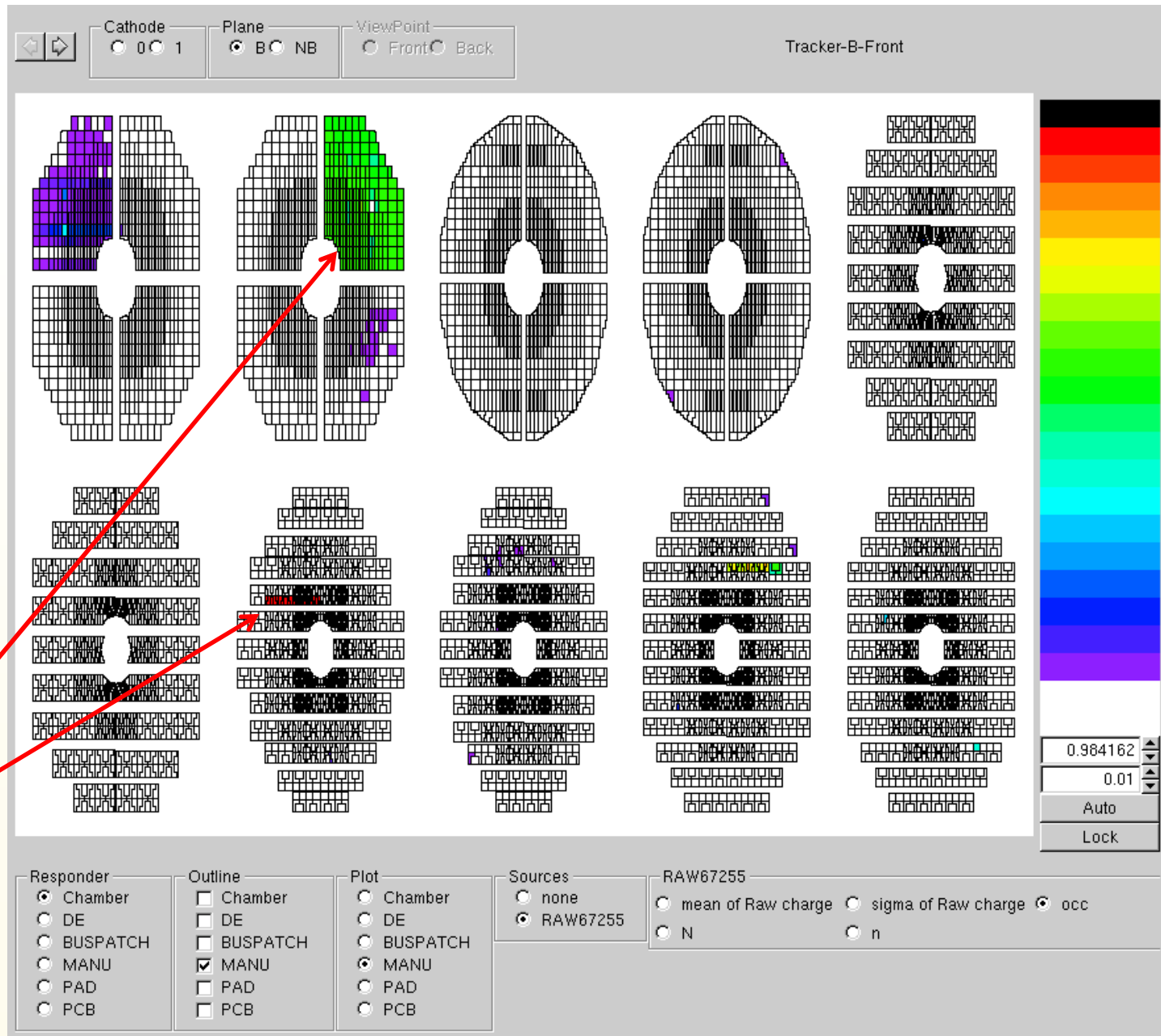
Fri Nov 27 18:45:06 2009, Run 102371

Command

Command (local):



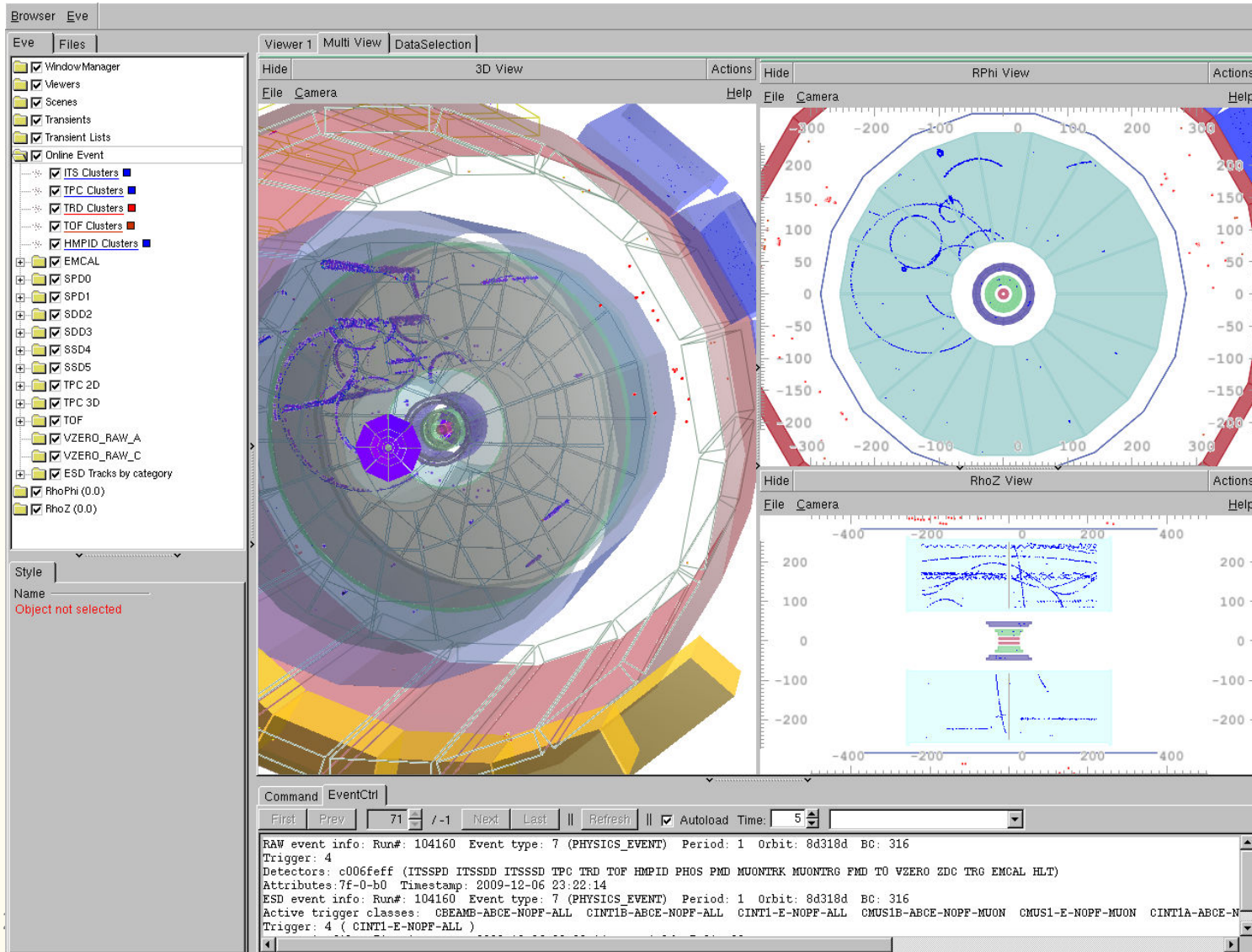
MCH example :
(Muon chambers)



Too high occupancy
-> electronic problem



LHC start-up's experience





Plans



- Fully automatize the process : comparisons to reference data, identification of problems, notification, actions taken
- Add features to take full advantage of multi-cores architecture
 - Multiple threads
 - Multiple processes



Conclusion



- AMORE has been successfully used during the LHC restart and proved to be very useful
- Wide range of usages
- Capable of handling very large number of agents, clients and objects
 - The architecture is adequate



Questions



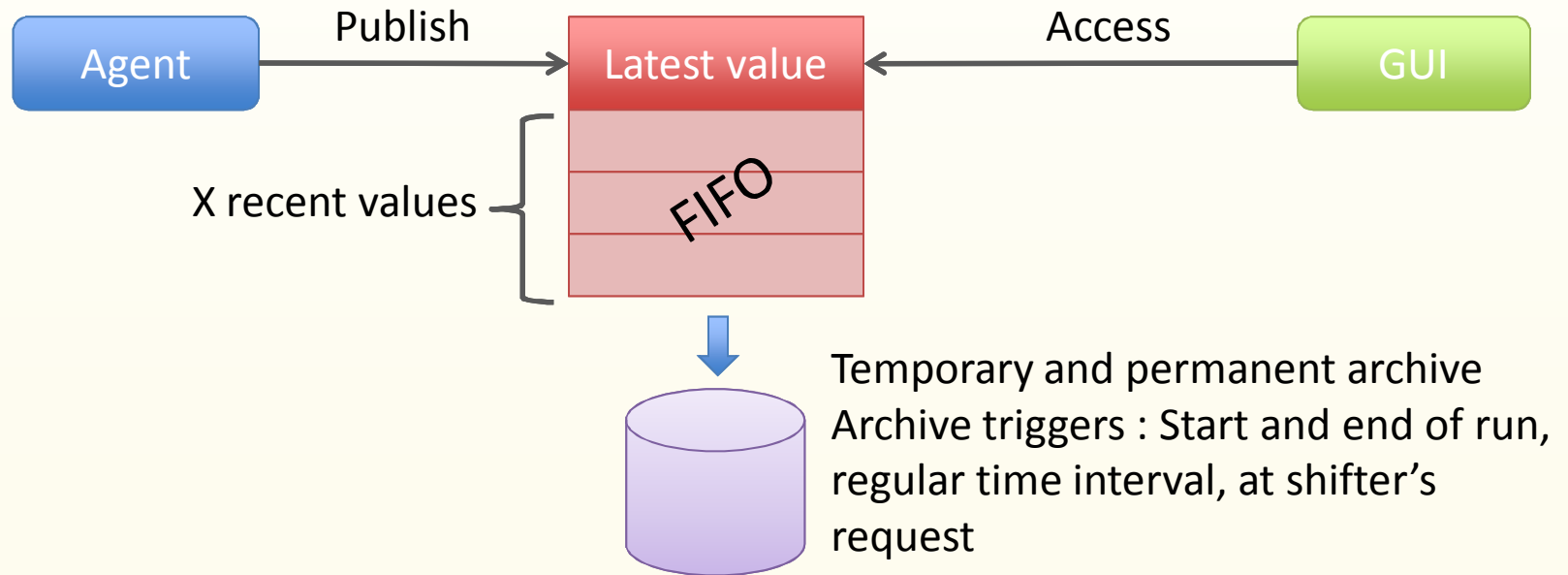




Archiving



- Short-term history : First-In First-Out (FIFO)
- Long-term archives : At end of run, regular intervals, and users' request





LHC start-up's experience



- TPC : event display in the detector

