Operation and Performance of the ATLAS Muon Spectrometer Databases during 2011-12 Data Taking

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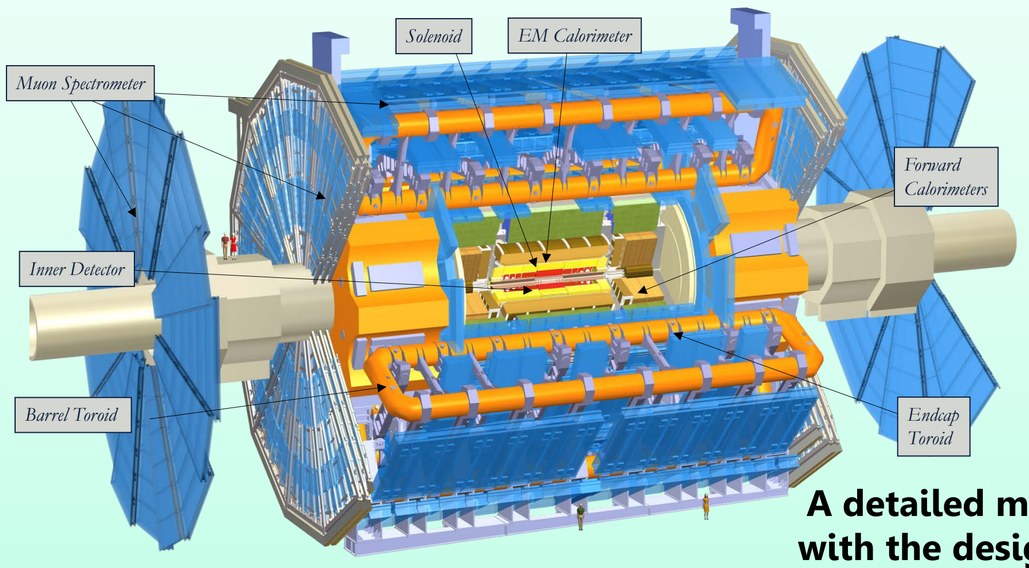
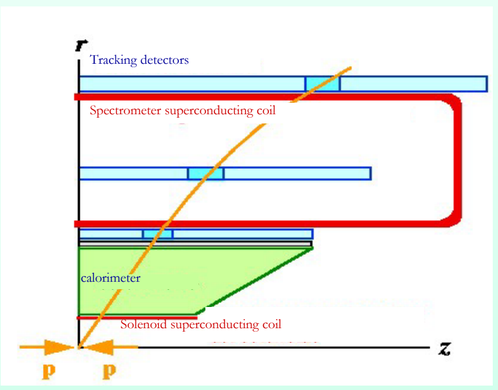
ATLAS Muon Spectrometer



Muon Spectrometer Requirements:

- Solid angle coverage
- 3 measurement stations
- Trigger capability for different muon momenta
- Operation in high rate and high background
- Good momentum resolution in the range 6GeV-1TeV
- Single point resolution <50 μm



A detailed monitoring and analysis of the detector operational parameters are required to cope with the design performance. These data are organized into different databases and data model. The data model defines not only the structure but also which operations can be performed on.

ATLAS Muon Databases

Configuration Database

Data needed at the start of the run to configure Sub-Detector hardware and software

- Data defining the configuration of the TDAQ/DCS/subdetector hardware and software to be used for the following run
- Different configurations can be available (cosmics, physics,...)
- Configuration data can evolve into conditions

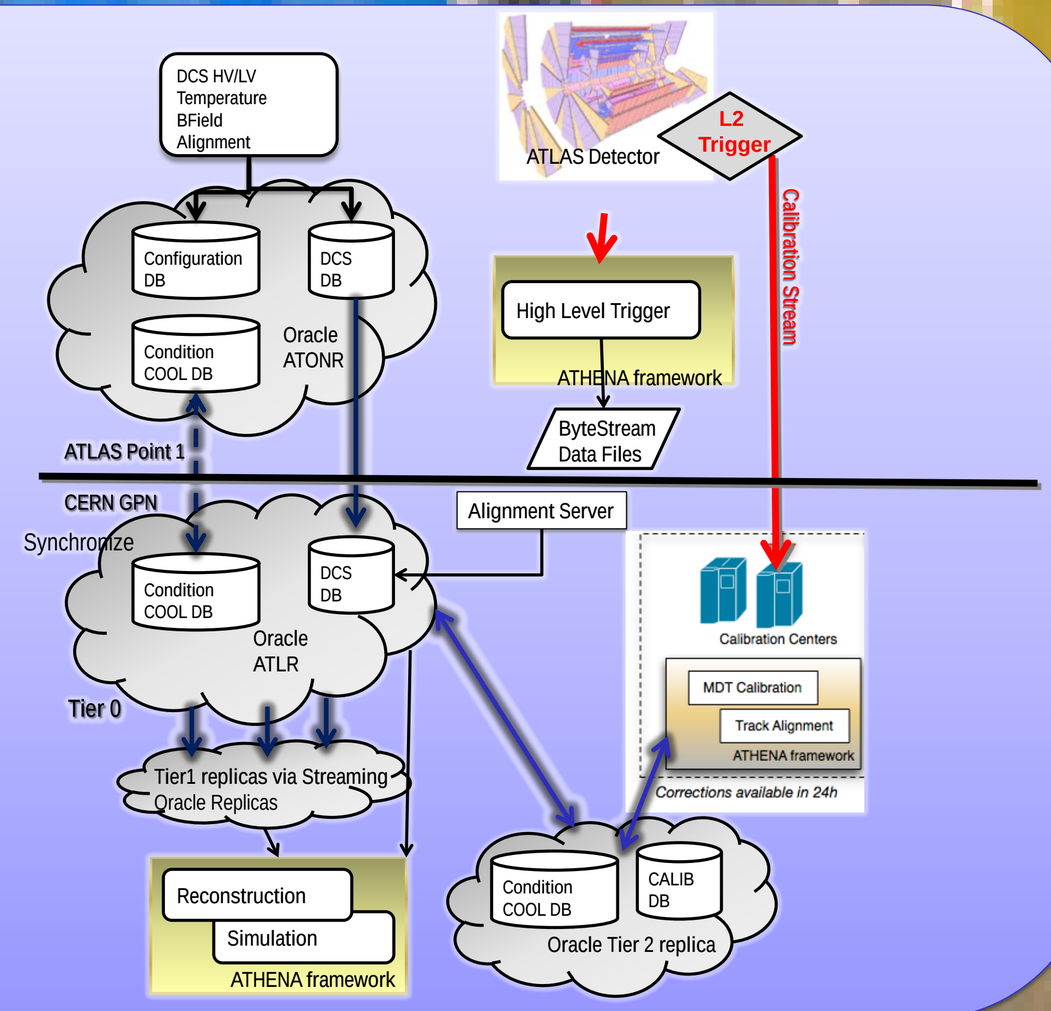
Conditions Database:

Non-event detector data: vary with time and exist in different versions.

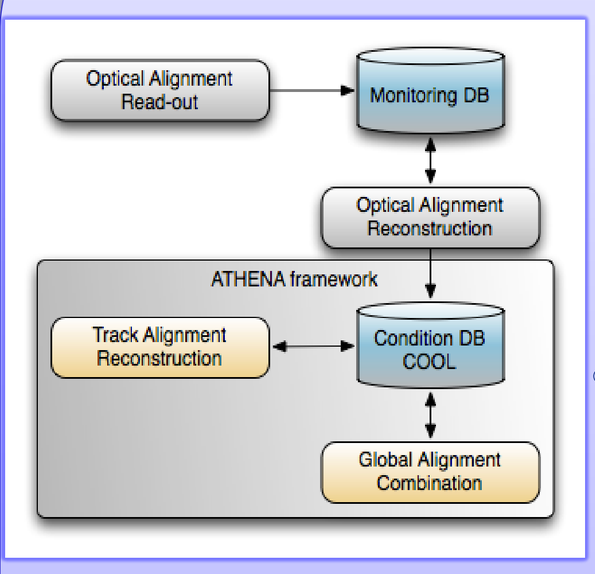
- Data coming from both offline and online
- Used for Diagnostic by detector experts
- Calibrations and Alignment
- Event Reconstruction and analysis
- Conditions data
- Geometry, DCS, alignment, calibration

Calibration Database:

- All the calibration constants produced by calibration jobs within the ATHENA framework.
  - Single muon tracks from the second level trigger, are streamed to Tier2 farms, where the new calibration constants are produced and written to a local Calibration Database



Muon Alignment System



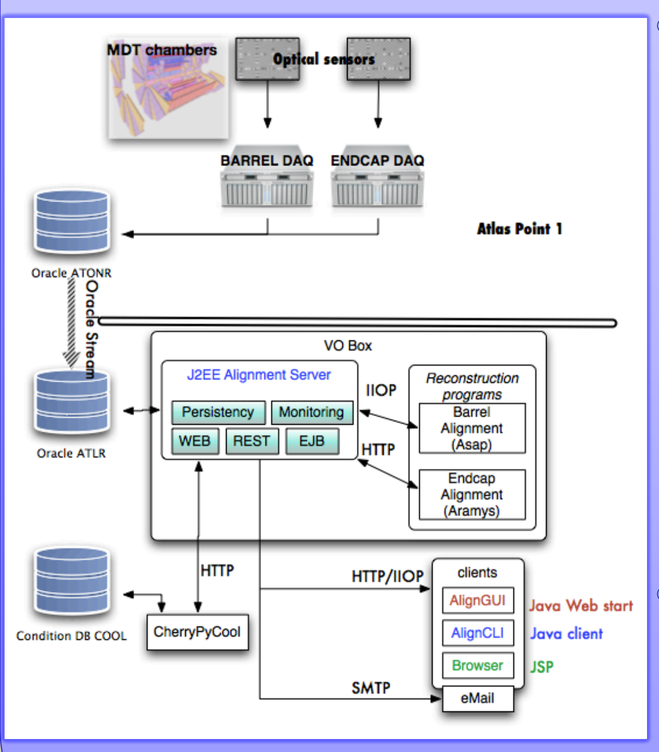
Muon internal Alignment

- based on optical sensors, plus muon tracks for overlapping regions
- 3 large subsystems (Barrel + 2 Endcaps)
- ~1200 MDT precision chambers each described by 6 positional parameters giving ~7000 DoFs
- Adding 11 chamber internal deformation parameters gives a total of ~21000 DoFs

MS-ID Alignment

- Muon Spectrometer should be aligned respect to ID at the level of few 100 microns

alignment tolerances μm	30 in R-z plane



ATLAS CERN GPN

- Barrel & Endcap Alignment (*voatlas*)
  - Conversion from optical sensors measurements taken from ATLR into chamber position and deformation parameters (via a fit) : results stored to Oracle (ATLR).
  - All input/output with the DB is performed via a Java application deployed in a J2EE Application Server
  - The Java server controls the Barrel Alignment algorithm library via CORBA.
  - The same server is used by the EndCap alignment program to store corrections in the monitoring DB.

Migration to Condition DB:

- Alignment corrections are migrated to Condition DB (COOL) in ATLR for usage by track reconstruction programs (via a COOL-aware CherryPy server, using HTTP methods)
- Data volume in COOL (Barrel+EC) : ~2 GBy / year

Muon Calibration System

The fast calibration of the 350k drift tubes of the muon spectrometer.

To obtain high statistics for the calibrations we extract single muon tracks from the second level trigger, where the preselection of data by the first level trigger allows the selection of only hits from isolated muon tracks.

- Collected data is then streamed using ATLAS grid data transfer to remote Tier 2 farms dedicated to detector calibration. The calibration stream event rate is about 10X the rate of single muons in regular ATLAS data and is processed in 36 hours.
- The calibration centers process the data with a program called the Local Calibration Data Splitter ("Splitter") which divides the data into 204 regions for processing a computer farm.
- New calibration constants are written to a local calibration database which is used to fill the main ATLAS reconstruction database ("COOL DB"). The entire loop from the close of datataking to the loading of new calibration constants in the COOL DB is completed in under 36 hours
- This system has run very well for three years on the ATLAS experiment at the Large Hadron Collider.