ATLAS MDT remote calibration centers – CHEP2009

The ATLAS MDT Remote Calibration Centers

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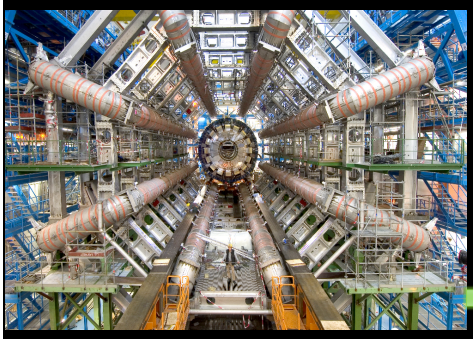
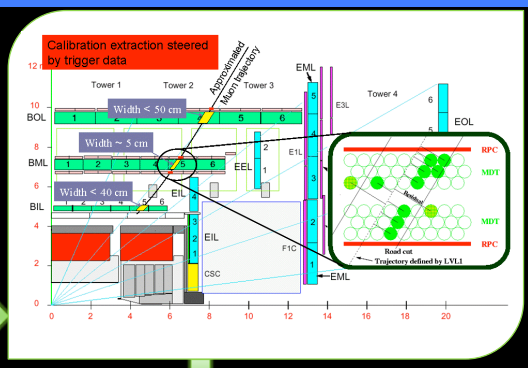
The precision chambers of the ATLAS Muon Spectrometer are built with Monitored Drift Tubes (MDT). The requirement of high accuracy and low systematic error, to achieve a transverse momentum resolution of 10% at 1 TeV, can only be accomplished if the calibrations are known with an accuracy of 20 μm. The relation between the drift path and the measured time (the so-called r-t relation) depends on many parameters (temperature T, hit rate, gas composition, thresholds,...) subject to time variations. The r-t relation has to be measured from the data without the use of an external detector, using the autocalibration technique. This method relies on an iterative procedure applied to the same data sample, starting from a preliminary set of constants. The required precision can be achieved using a large (few thousand) number of non-parallel tracks crossing a region, called calibration region, i.e. the region of the MDT chamber sharing the same r-t relation.



The maximum expected rate of muon triggered events on tape is 40 Hz. In order to obtain enough statistics to be able to follow the possible time variations of the MDT calibrations, a dedicated procedure, allowing the extraction of muon triggered events at a higher rate, has been designed. We aim at collecting enough statistics to allow a calibration per day with a sample of 3×10^7 muon tracks. Accounting for data taking efficiency we require an acquisition rate of at least 1 kHz.

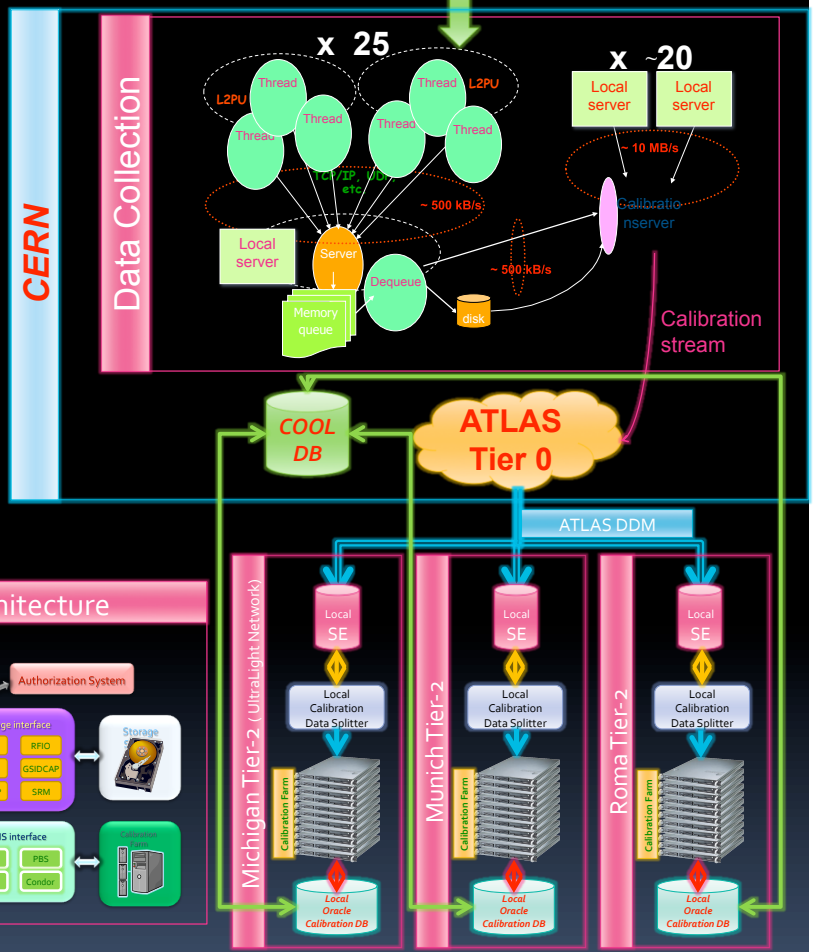


The muon calibration stream consists of pseudo-events, one for each muon track candidate seen by the level-1 muon trigger (LVL1), collecting both the trigger chamber data accessed by the level-2 trigger algorithm μFast and the MDT hits within the second level pattern recognition road. The pseudo-event header also includes the estimated p_T and the direction of flight.

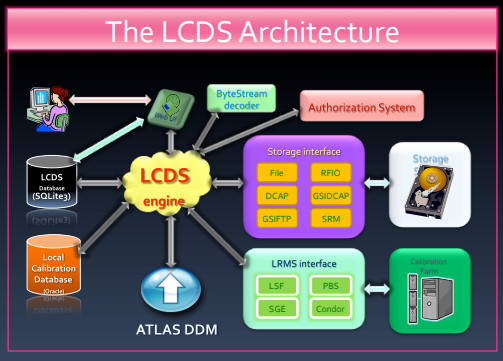
The extracted data size is about 800 bytes per pseudo-event. Data extracted from the level-2 nodes (L2PU) is then concentrated in a Calibration Server and made available to be distributed to calibration farms. Data concentration happens in two steps, sending data to the local file/boot servers in the level-2 racks and, in a second step, to the calibration server.

The Calibration Server collects all the pseudo-events coming from all the instances of the level 2 trigger processes. It also takes care of interfacing the data collection system to the ATLAS Tier-0 Computing Center, implementing the same handshaking protocol used for the other streams and allowing automatic registration of data sets to the data distribution system.

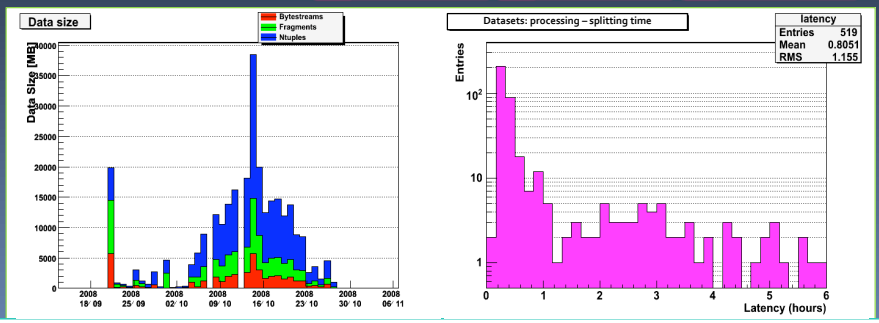
The calibration datasets collected in the ATLAS Tier-0 is then sent to the three remote calibration Tier-2 centers, in order to be analyzed. The calibration datasets are shipped through the standard ATLAS Distributed Data Management system (DDM)



The Local Calibration Data Splitter (LCDS) is in charge at each Calibration Center of spotting the arrival of new data, splitting them in "fragments" accordingly to some configurable criteria and generate for each fragment the ntuples used eventually in the analysis stage. The ntuples are processed to produce the calibration constants which are saved in a local ORACLE calibration database and then copied to the CERN database (COOL DB) via ORACLE Streams.



The remote calibration centers have been tested with the cosmic data in 2008. The right plot shows the dataset splitting latency, i.e. the latency beween the data taking and when the data has been split and is available in the remote calibration centers. The latency is peaked at about 1h, meaning that most of the dataset splitting is completed in the calibration centers about 1h after the data taking. The calibration ntuples are created a few minutes after the data fragments are available in the local Storage Elements (SE).



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