

The Database Driven ATLAS Trigger Configuration System

Carlos Chavez, Michele Giannelli, Alex Martyniuk,

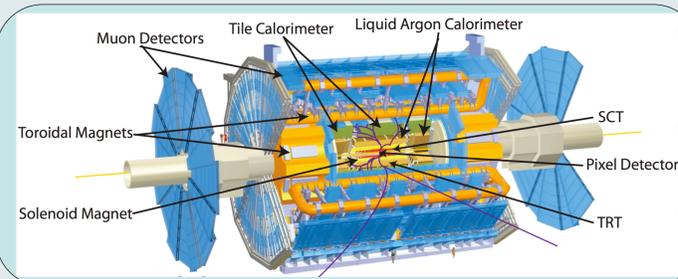
Joerg Stelzer, Mark Stockton, Will Vazquez

UCL Physics and Astronomy Department

Tel: +44 (0)20 7679 3498



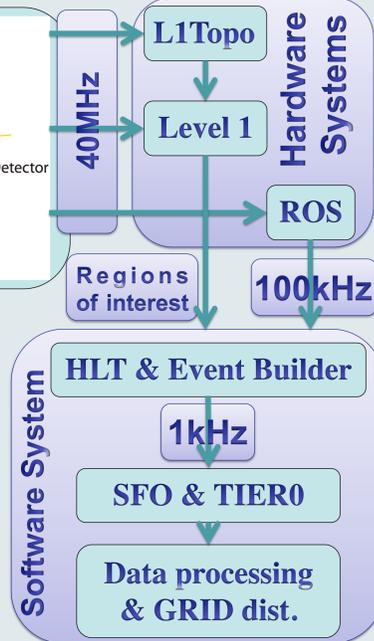
ATLAS Detector



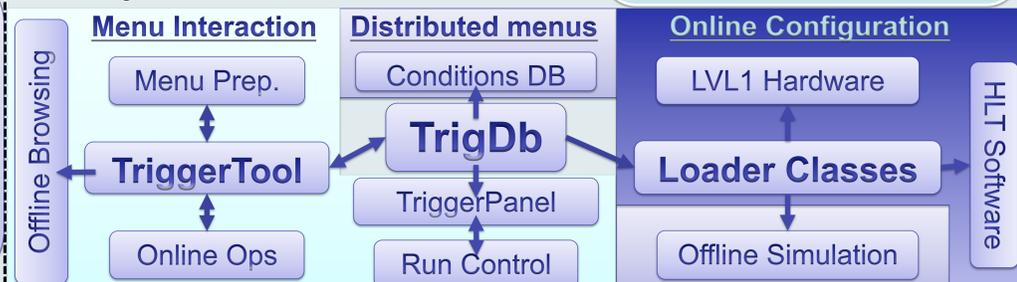
The ATLAS detector is a cylindrical general purpose detector at the LHC. Its trigger system reduces the rate of events from the 40MHz bunch crossing rate to 1kHz, the data storage rate. A hardware based trigger selects events based on information from the calorimeters and muon system. In addition to simple counting, the L1Topo system has been added for run-2 providing selection based on the topological relations between trigger objects. The Level 1 system outputs regions of interest (ROI) to the HLT at 100kHz. The HLT receives the ROI's and the full detector information from the read out system (ROS) and makes a software based decision using close to offline algorithms. These events are then reprocessed and distributed to GRID sites.

Trigger Configuration

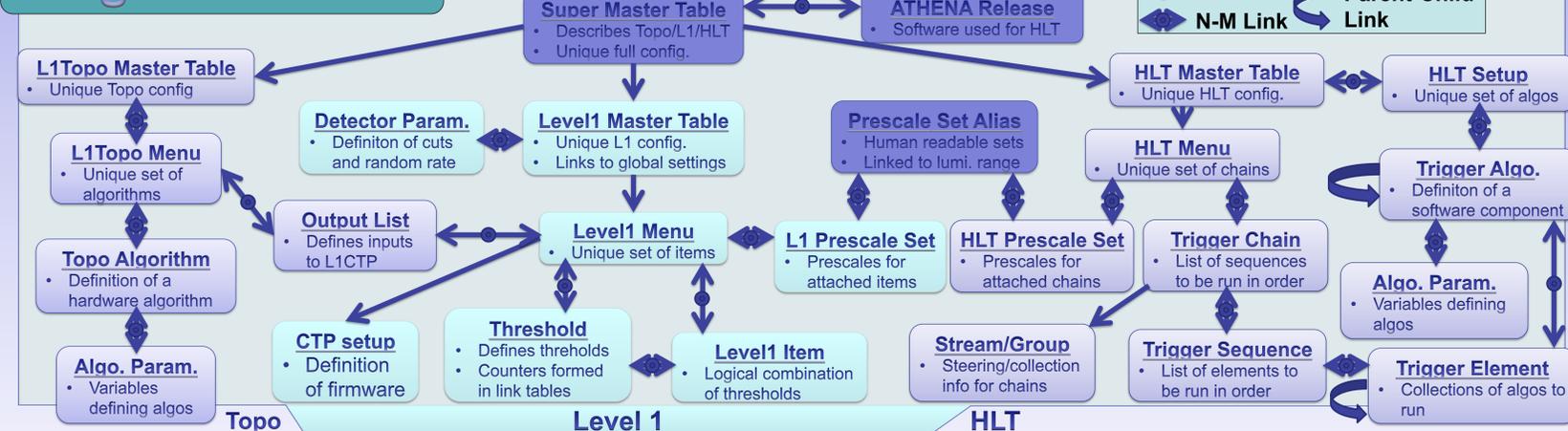
The ATLAS trigger configuration system provides a complete description of the trigger for online data-taking, offline reprocessing and Monte Carlo production. The TrigDb is pivotal to the system storing the full history of all configurations, for both hardware and software, to allow full understanding and reproduction of trigger behaviour. The structure of the whole system has to be flexible to allow configurations to be modified in response to changing beam and detector conditions during data taking. The TriggerTool is a JAVA based GUI allowing the creation and manipulation of the configurations stored in any instance of the TrigDb. Various tools can then access these configurations for use on or offline.



- ### Hardware Configuration
- Full description of L1 trigger items, i.e. conditions on detector objects
 - Prescale conditions to mask items
 - Firmware definition (VHDL, SVF, etc.)
 - Global settings, i.e. random rates, thresholds, windows etc.
- ### Software Configuration
- Full description of HLT trigger chains, i.e. sequence of algorithms to execute
 - Algorithm definition and parameters
 - Prescale conditions to mask chains
 - Description of trigger groups & streams
 - The ATLAS software release



TrigDb Schema

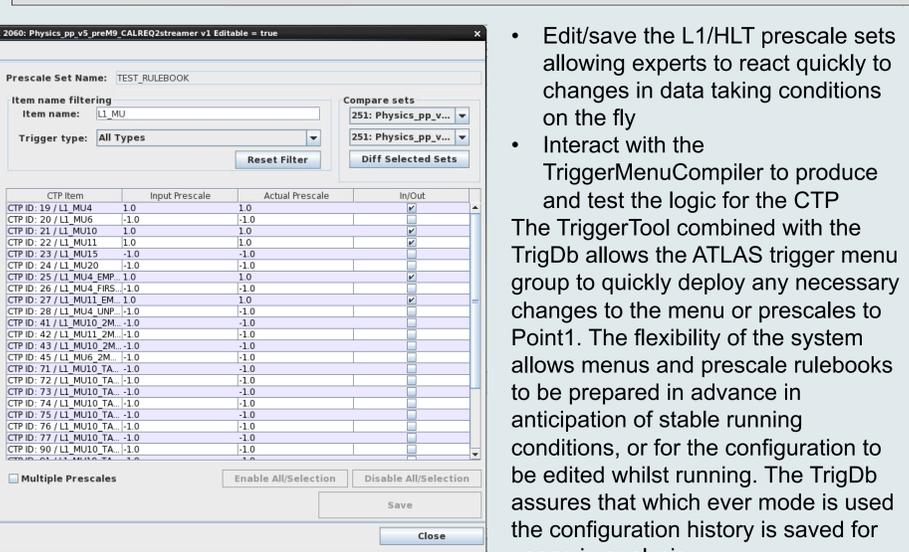
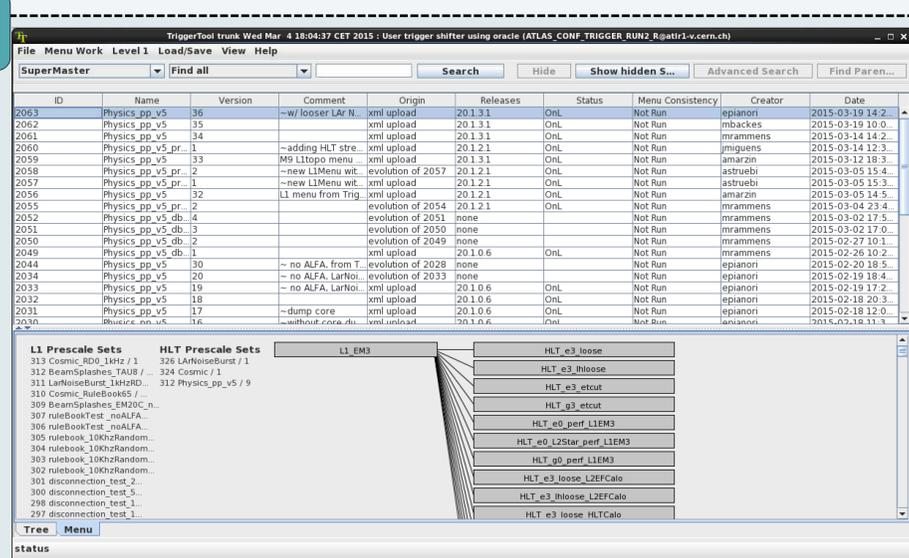


The TrigDb is a relational Oracle SQL database describing the full hardware and software configuration for the ATLAS trigger. Many-to-many link tables allow tables to be used in multiple configurations without duplicating information. Any configuration can be described by three keys; a supermaster key describing the configuration and two prescale keys describing the prescale sets. By recording the keys describing the setup at a lumi-block level granularity the setup used at any point can be recovered and used in the analysis of the data.

TriggerTool

The TriggerTool allows users, with sufficient privileges to connect to an instance of the TrigDb and perform many tasks, for example;

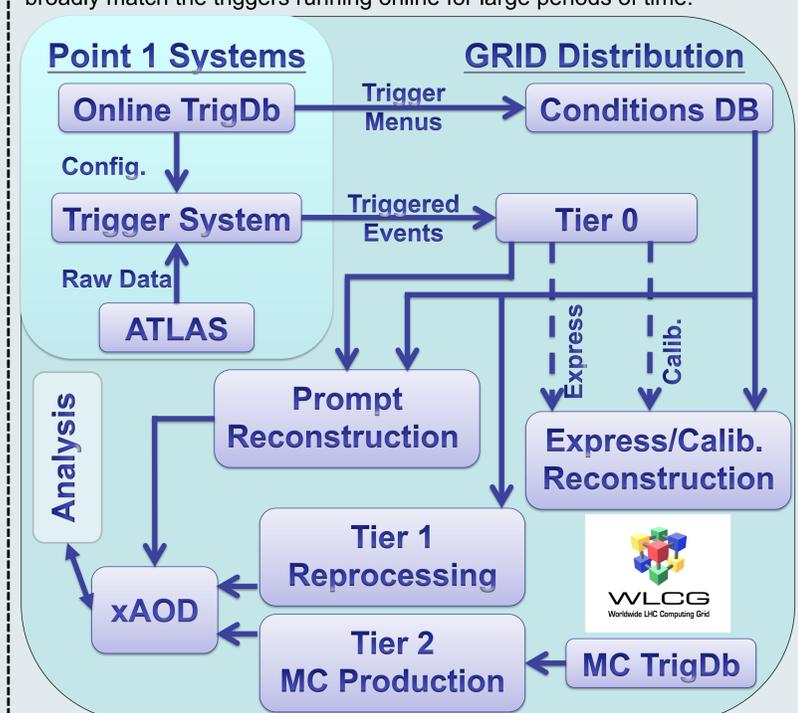
- Upload/download menus into the DB from/to external sources
- View the contents of those menus in tabular or relational form
- Edit and save any aspect of the menu
- Compare the contents of two configurations to see exactly what changed between them



- Edit/save the L1/HLT prescale sets allowing experts to react quickly to changes in data taking conditions on the fly
 - Interact with the TriggerMenuCompiler to produce and test the logic for the CTP
- The TriggerTool combined with the TrigDb allows the ATLAS trigger menu group to quickly deploy any necessary changes to the menu or prescales to Point1. The flexibility of the system allows menus and prescale rulebooks to be prepared in advance in anticipation of stable running conditions, or for the configuration to be edited whilst running. The TrigDb assures that which ever mode is used the configuration history is saved for usage in analysis.

Distribution

The history of the online trigger configurations are replicated to the GRID via the distributed ATLAS online conditions database (COOL). The reconstruction systems embed the trigger configuration as run-wise metadata, alongside the reconstructed event information, into the final xAOD files for usage in analysis. A small percentage of triggers are streamed to the express/calibration streams for fast reconstruction. These events can then be used to rapidly alter online calibrations at point one, rather than wait for longer scale reconstructions. A separate MC TrigDb instance is also filled by the TriggerTool and distributed on the GRID. It contains configurations of the trigger MC simulation. These configuration represent a stable configuration that broadly match the triggers running online for large periods of time.



Summary

The ATLAS trigger system filters the collision events taking place in ATLAS from 40MHz to the lower rate of 1kHz for recording to tape. The trigger configuration system defines how the ATLAS trigger achieves this task. It is centred around the TrigDb which stores the full history of all configurations used in data taking. The TriggerTool provides a direct access point to the TrigDb for viewing, manipulating and saving configurations. The trigger configurations are then distributed alongside the recorded events to allow trigger aware analyses to be performed.

