Level 1 Trigger Monitoring

Murrough Landon – 9 November 2004

`http://www.hep.ph.qmul.ac.uk/~landon/talks`

Contents

- Requirements

- Tools

- Testbeam experience

- Future plans

Brief overview based on L1Calo with some input from CTP and MuCTPI

Purpose of Monitoring

- Provide details to help understand whats going on

- Check everything is (still) working correctly

- Detect where and when problems appear and help diagnose them

- Keep history of trends for later analysis and correlation

Are the requirements understood?

- Level 1 monitoring requirements have been considered several times

- Document(s) exist (some in EDMS)

- Input to Monitoring working group for the DAQ/DCS/HLT TDR

- Still room for new ideas... especially when we see real data

Requirements (2)

Types of monitoring

- Two broad categories: event based monitoring and continuous non-event based hardware and operational monitoring

- Events from ROD/ROS for detailed subdetector and subcomponent monitoring

- Events from SFI/EF for cross detector correlation, trigger performance

- Other monitoring via DCS and VME from trigger processor modules

Monitoring outputs

- Mostly histograms, some primitive quantities or objects?

- Many kinds of histogram: accumulated during run, current snapshots, history

- Presented to local and remote experts, ATLAS and LHC shift crew (eg beam background and luminosity)

- Selection stored in Conditions DB

Requirements (3)

What to monitor?

- Beam quality and timing (beam pickups, background rates, clock stability)

- Luminosity (dedicated detector)

- Trigger hardware: crates, modules, links

- Trigger configuration: internal timing, connectivity, thresholds

- Trigger inputs: dead/hot cells, calibration

- Trigger operation: cross check algorithm with event samples

- Dead time and BUSY frequency per subdetector

- Trigger rates: overall and detailed (eg subtrigger vs bunch)

- Trigger performance: maps of RoIs, correlations with calo/muon detectors

- Trigger efficiency: rejection rates at LVL2/EF

Tools (1)

Hardware/firmware support

- Error counters for all links

- Counters for ROD_BUSY (CTP)

- TDCs for phase measurements (CTP, MuCTPI)

- Histograms for all trigger rates (CTP)

- "Level 0" rate meter and energy histogramming for each tower (L1Calo)

- Read via VME (ROD crate DAQ), publish in IS, combine data from several crates, display in IGUI panels, standalone displays and/or histogram presenter, periodically save history in Conditions DB

Tools (2)

Requirements for online event monitoring

- Online monitoring: more robust (ROS/SFI issue?), flexible event selection

- IS/OH: performance? (Some history plots need rapid update, eg few Hz)

- Presenter: robust full feature histogram presenter needed, also access to histograms via web for remote access

- Standard framework for monitoring programs (as part of TDAQ release)

Tools needed for higher level questions

- Show the Sub-Trigger 77 rate over the beam lifetime for runs where the threshold on trigger condition XYZ was xyz and its rate exceeded abc

- Show the beam pickup clock phase as a function of the high pt muon rate

- Correlate new hot/dead cell with anything else at the same (eg in DCS)

Testbeam Experience

Hardware monitoring

- Internal checks (eg link errors) displayed via IGUI (L1Calo)

- Dataflow/monitoring statistics useful

- DCS used extensively by L1Muons

Event monitoring

- L1Calo: simple online monitoring task taking data from the ROS (some stability issues)

- L1Calo: presenter for histograms published in IS

- L1Muon: monitoring at EF via ATHENA (and standard display tools?)

- RecExTB and combined NTuple (L1Calo: only after TB)

Future Plans

A bit vague

- L1Calo: finish testing prototypes, final production and installation

- Improve monitoring tools as a background activity

- Theres a lot to do...