L1 DQM and certification tools

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Purpose of the L1T DQM

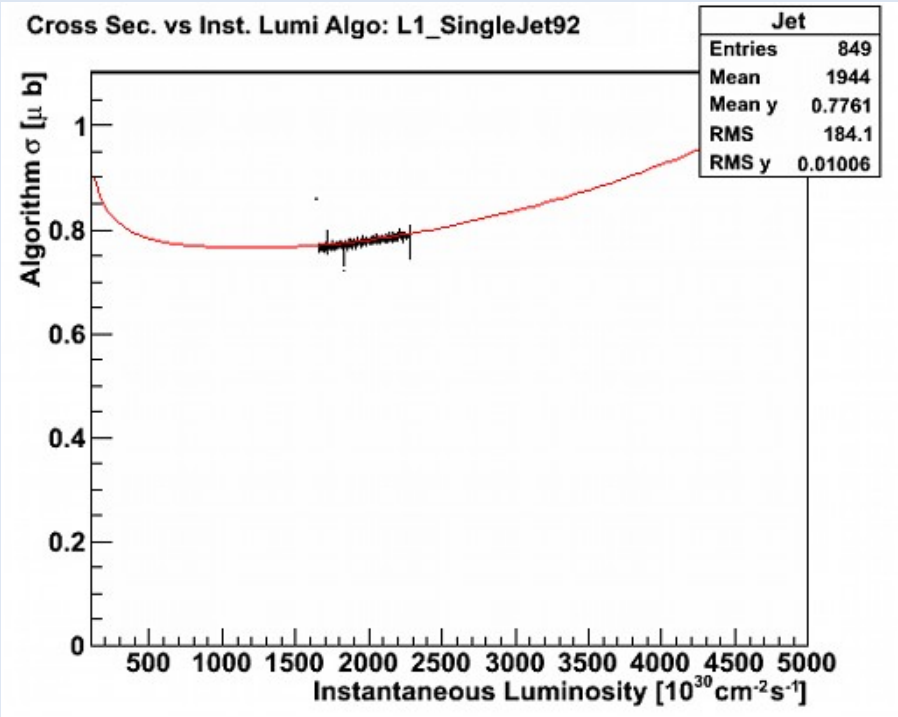
- Provide **online/offline monitoring** of the Level 1 trigger:
  - Spot possible problems.
  - Help diagnose reasons for them.
  - Ensure quality of the L1T operation.
- **Data certification:**
  - Use L1T DQM information to assess quality of data.
  - Ultimate goal: provide a *global flag* reflecting the data quality LS-by-LS for the L1T.

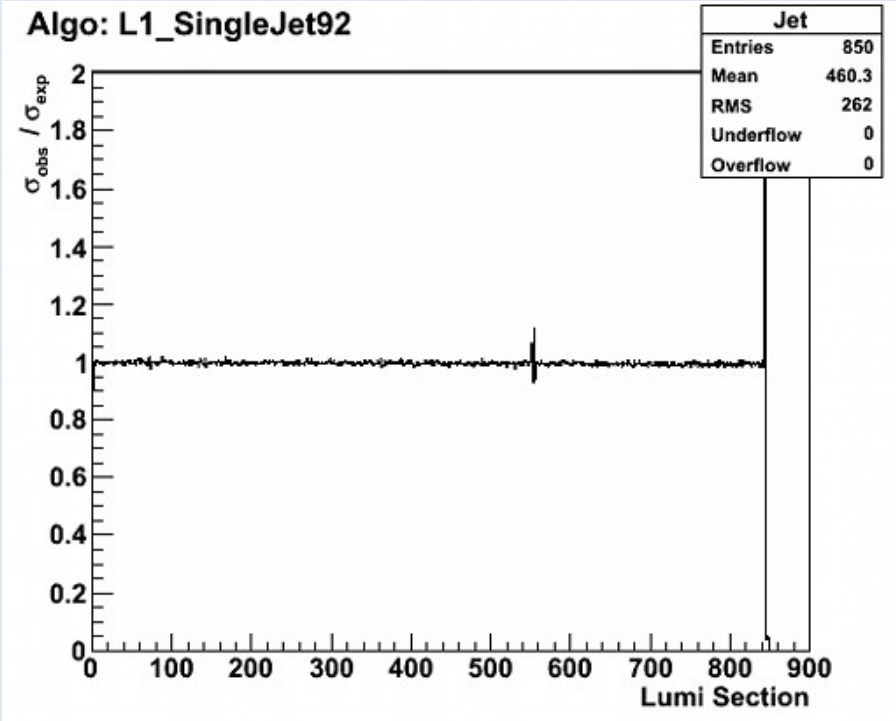
Structure

- **Online L1T DQM:**
  - Online tests using the *DQM Stream.*
  - Monitor trigger rates, synchronization and occupancy.
- **Offline L1T DQM:**
  - Online tests and additional object efficiency test.
  - Both data and MC validation.
  - Runs at every RECO of data/MC.
- This presentation focuses on the tools to be used for *automatic certification.*
  - Most of the tools have been developed in 2011.

Rate Monitoring

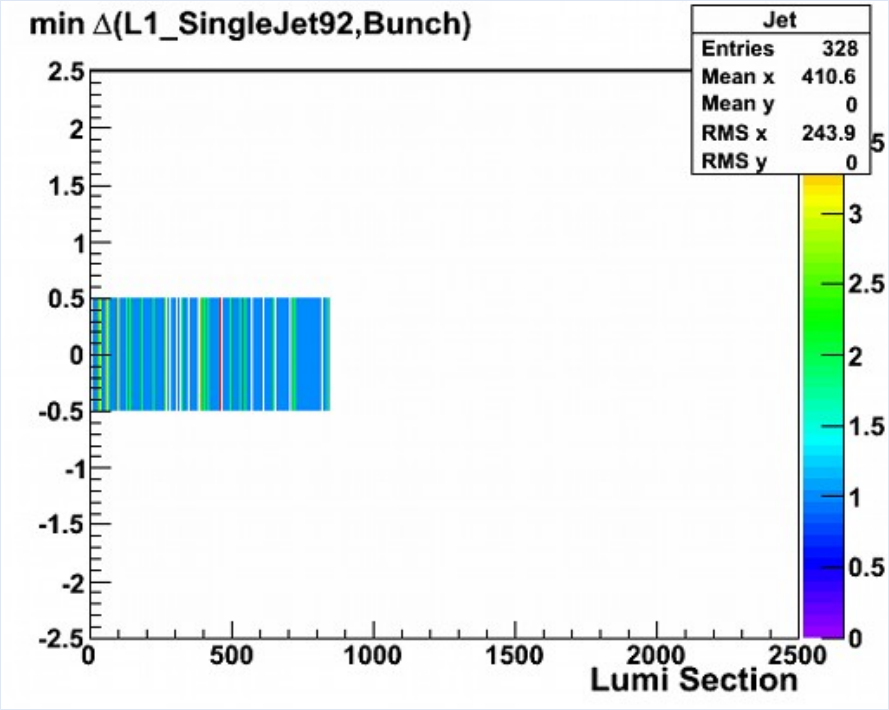
- Comparison between observed and expected rates.
  - Expected rates from WBM fits of trigger cross sections in previous runs:
    - **Online:** Retrieve from parametrization stored in OMDS
    - **Offline:** Needs O2O of information. To be done.
- Test all *L1 Single Object Lowest Prescale Triggers*.

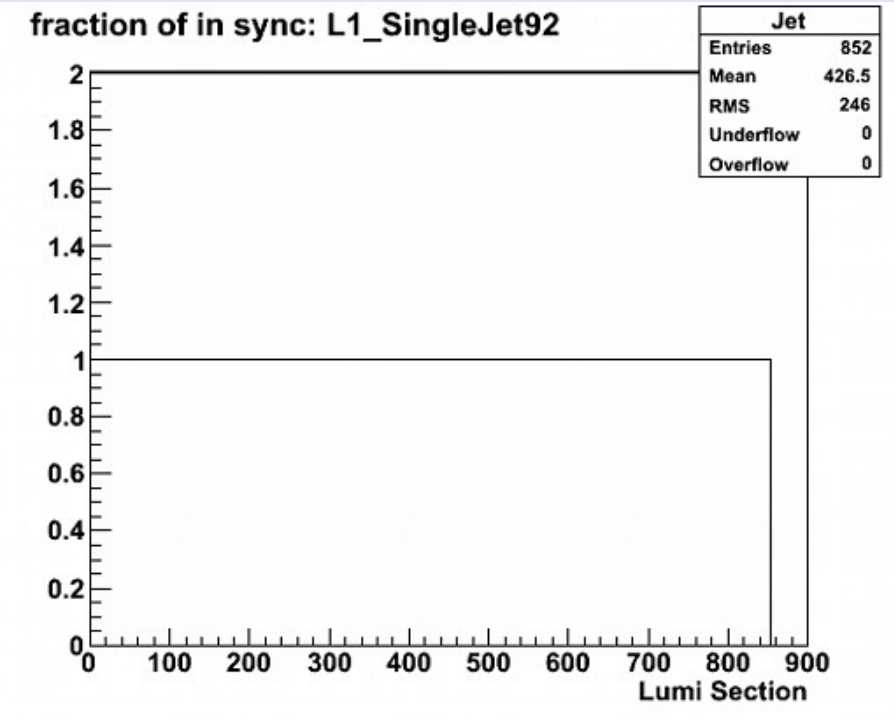




Synchronization Monitoring

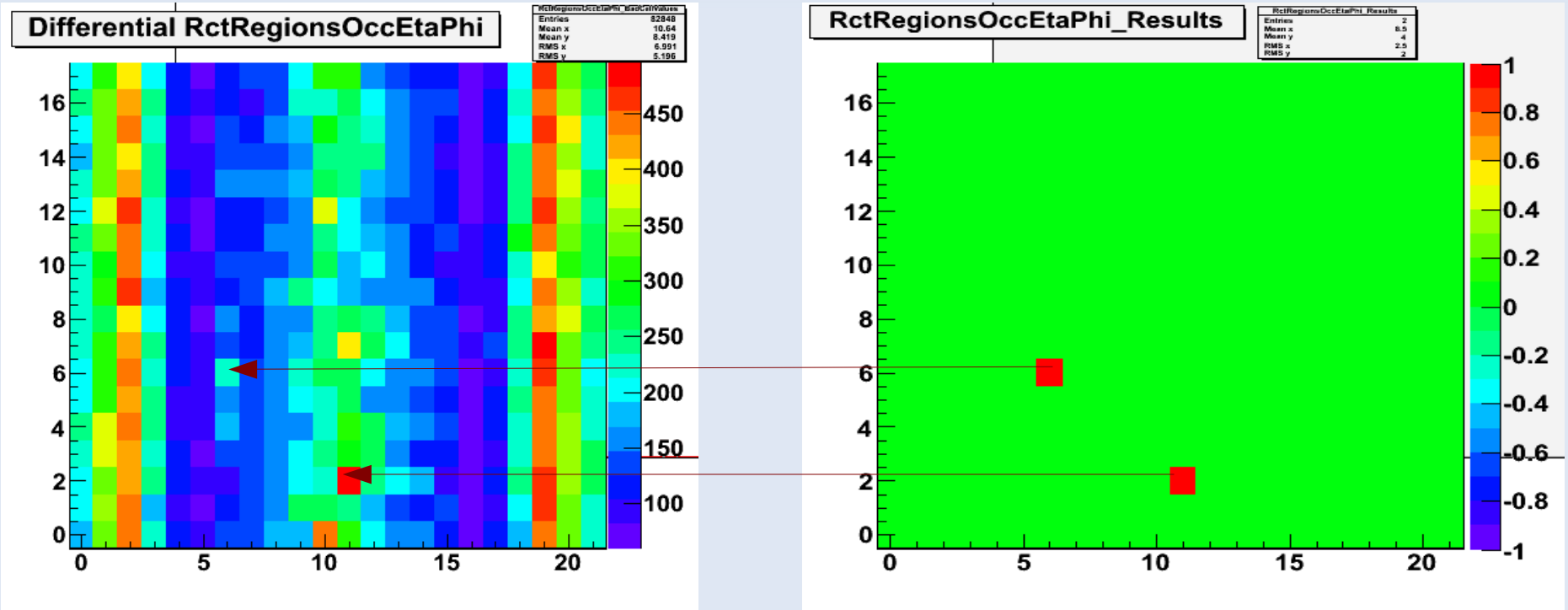
- Comparison between bx where triggers fired and *LHC Bunch Structure*.
- Test all *L1 Single Object Lowest Prescale Triggers*.
- *"LS Block certification"*
  - Test for a single LS is statistically limited
  - To reduce fluctuation we need to integrate (in some triggers) several LS





Occupancy Monitoring

- Exploits Eta-Phi symmetry to find *problematic spots*
  - Based on statistical test assuming Poisson Statistics. Therefore need absolute counts per bin.
- Differential analysis LS-by-LS of a given plot.
  - Plots should not be reset during the run.
- Block Certification (like defined for L1TSync)
- **NOTE:** Currently only Calorimeter based histograms fulfill the described requirements.



L1T DQM Offline

- **L1ExtraDQM (L1Extra monitor)**
  - It is currently running (Vasile); several tools to be reused
- **L1ExtraRecoDQM (L1 vs Reco)**
  - Run on prompt reco, re-reco, data RelVals
  - DQMOffline/L1Trigger
- **L1ExtraGenDQM (L1 vs MC generated)**
  - Run on RelVals and MC production
  - Validation/L1Trigger
- **L1RecoGenDQM (Reco vs Gen)**
  - To check Reco with L1 choices of collections and binning

- The complete set useful to:
  - Online monitoring of trigger objects
  - Efficiencies with Express and PromptReco DQM
  - Release Validation

Status

- Both Rate and Synchronization Monitor are online since several months.
  - Monitored online and used for certification.
- New tag deployed recently (Oct 4)
  - Error monitoring.
  - **Rate Monitoring:** bug fixes and updated.
  - **Synchronization Monitoring:**
    Now fully functional (LS Block Certification).
- **Occupancy Monitoring**
  - Currently in final testing phase.

Plans

- **Online**
  - Provide a single data quality flag per L1 object.
    - Summarize all tests for each LS.
- **Offline DQM**
  - Develop O2O of necessary data form DB to event.
  - Adapt online code for the offline workflow:
    - Multiple jobs, merging, flag assignment.
  - Efficiency Monitoring using L1TExtra
    (first version to be ready by the end of the year).

Data Certification

- Monitoring tools currently used by humans (shifters/experts) doing data certification.
  - Gained operational experience.
  - Debugged data certification inputs.
- We would like to have automatic certification where possible.
  - Time-scale: 2012.
- Few developments are still needed.
  - Support for block certification in DQM framework.
  - Existing tools should be adapted to offline DQM.

Summary

- L1T DQM provides tools to monitor the performance of L1 Trigger.
- In the Online DQM, a set of tools aimed at data certification was developed in 2011.
  - Part of them are being routinely used since long time online (Rate/Synchronization).
  - Few more are currently being developed (Occupancy).
- The development of new tools in Offline DQM is starting.
- Final goal is to automatize the data certification procedure.
  - Good operational experience gained already.
  - Some more work is needed to make the automation technically possible.