Level 1 Trigger – DQM

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Status

- New L1T DQM tools for rate and synchronization monitoring now 2 month online

- Several improvements, comments and corrections being developed and will be deployed soon.

- New tool to monitor L1T Occupancy is now being developed (Summer Student: Thomas Schaefer).

# Level 1 Trigger Data Certification

- For L1T Data Certification we test:

  - Rates

  - Synchronization

  - Occupancy

  - Efficiency (between L1T and offline candidates)

- The lowest unprescale single object trigger for each object category in use to validate each object/sub-system that takes part in L1T

Status
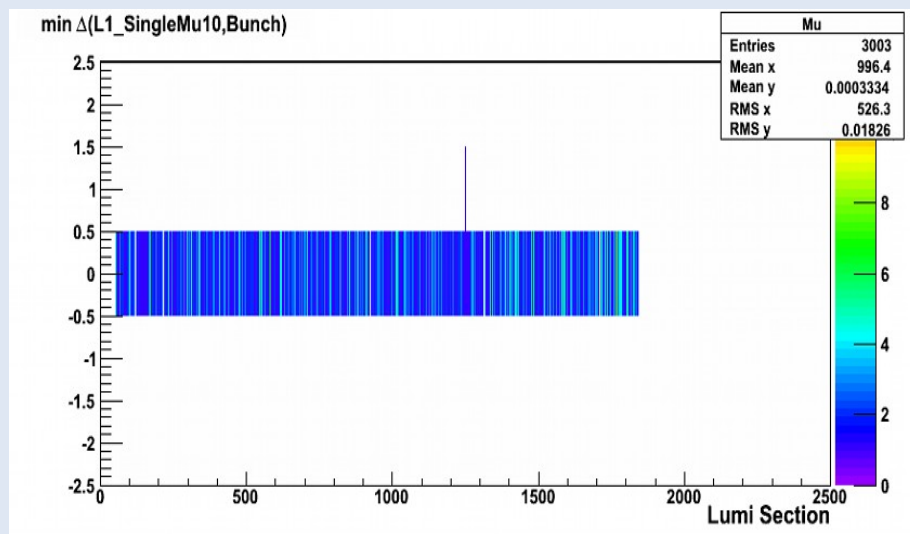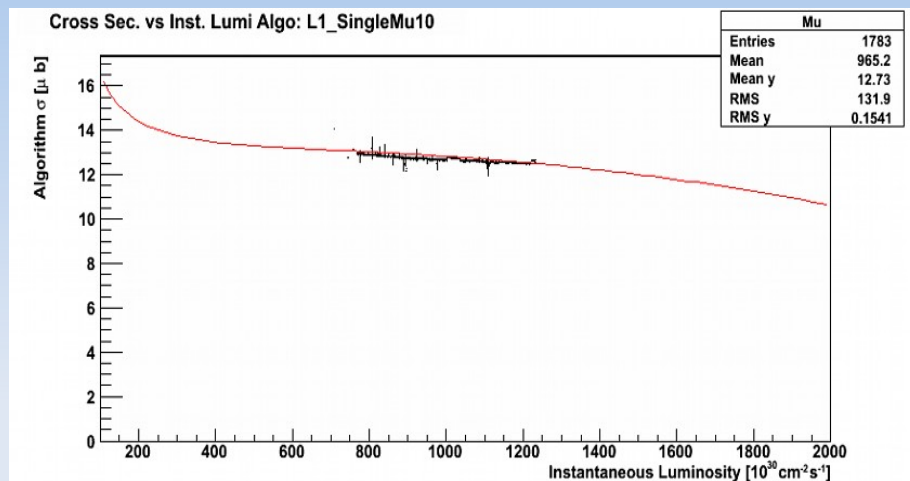
- Trigger shifters already using currently implemented tools for manual certification.

- L1TRate Monitor compares observed triggers cross section with predictions from previous runs (produced by WbM)

- L1TSync Monitor compares triggers bx against LHC filling scheme
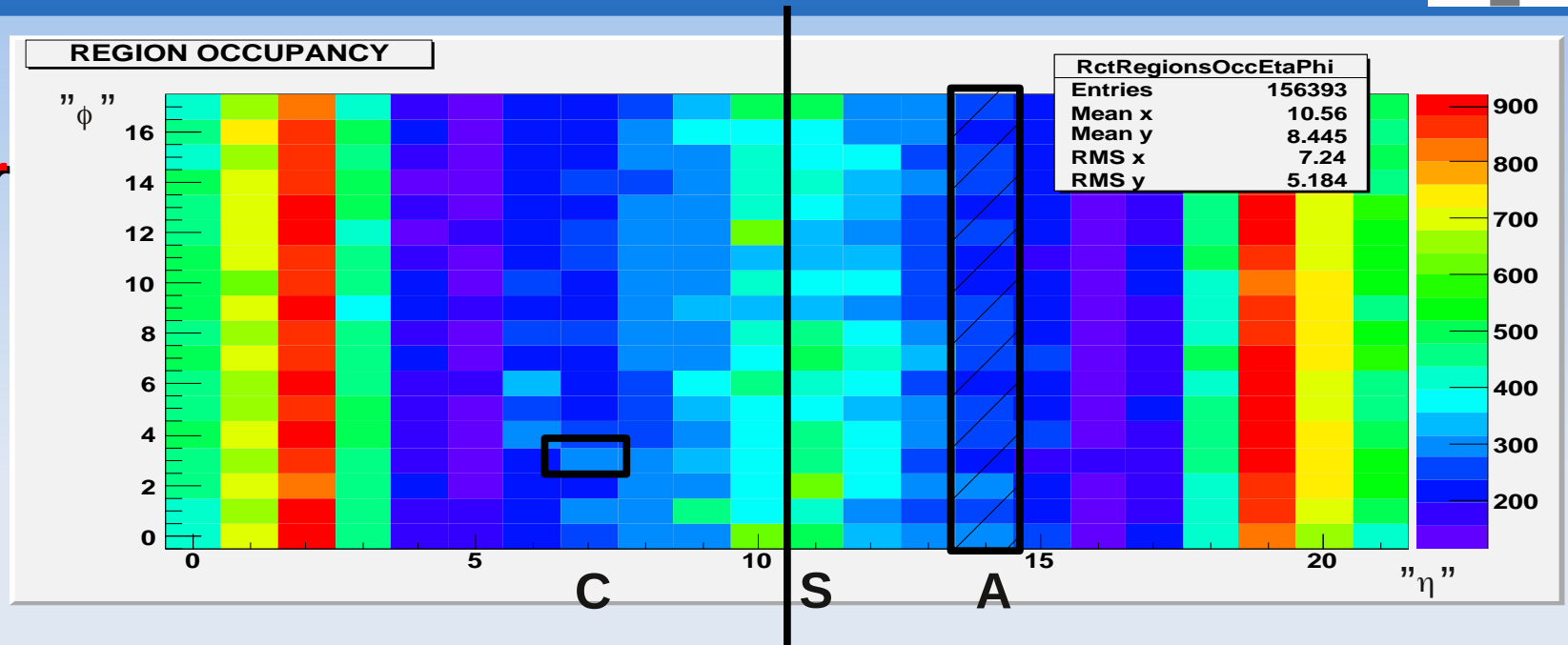
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Status
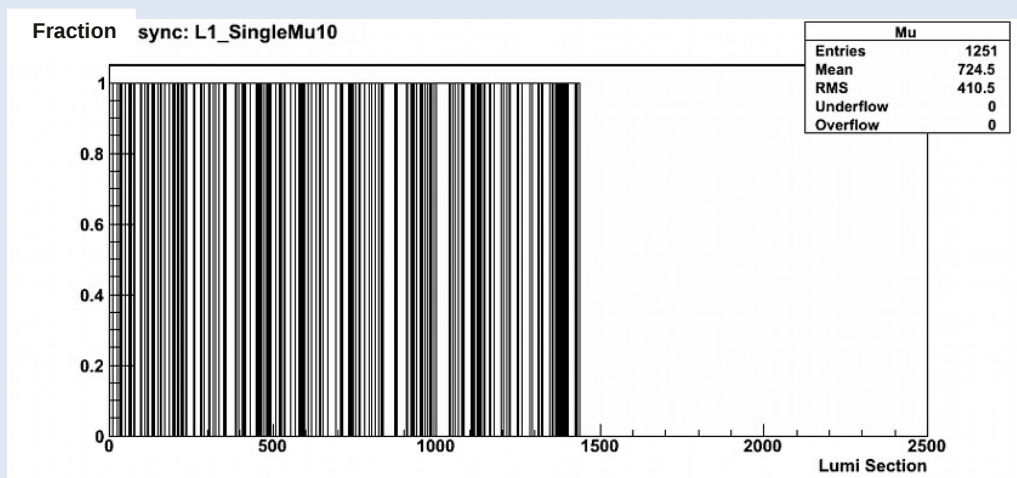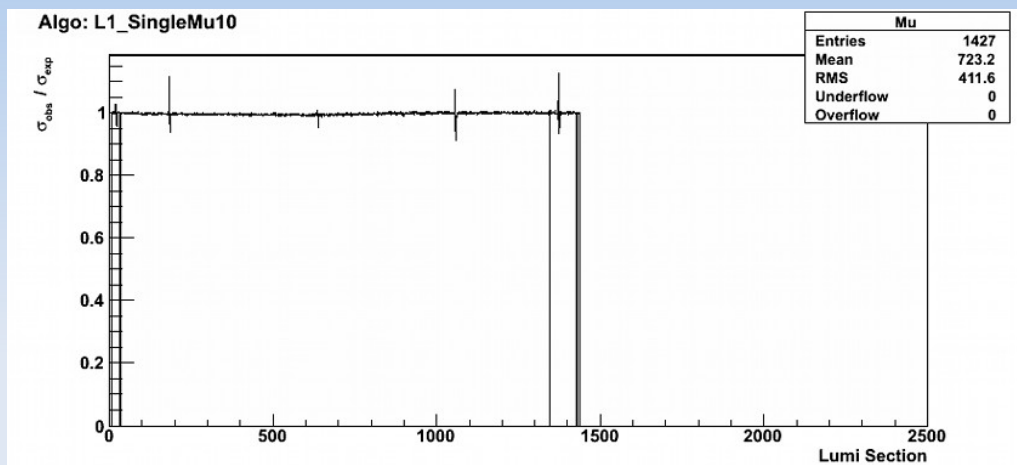
- A single number is produced per single object trigger per LS
- 1 being the correct value for the test
- Now stored in TH1, we will use floats with LS flag.

L1TOccupancyClient: test method

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REGION OCCUPANCY

RctRegionsOccEtaPhi	
Entries	156393
Mean x	10.56
Mean y	8.445
RMS x	7.24
RMS y	5.184

- We want to test L1T occupancy by exploiting **phi-symmetry/eta-"parity"-symmetry** in the test

- We use the information of a whole phi-strip (A) to test each cell on the opposite side (C) of the symmetry axis (S)

- If the tested bin is above a given threshold -> "Bad" cell

Statistical test

- Assumption: **Poissonian distribution** of number of counts $P(x;\mu_i)$

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  - around μ_0 for bins without error (e.g. $\mu_0=10$)

  - around μ_1 for bins with error (e.g. $\mu_1=0.5\mu_0=5$)

- Define **Chi²-like measure** for deviation (per bin):

$$\chi_j^2(\mu_1,\mu_0)=\ln\left(\frac{P(x_j;\mu_1)}{P(x_j;\mu_0)}\right)$$

- Define fixed confidence level for finding hot or dead channels ("efficiency")

- Determine bin statistics such that the "fake rate" is below threshold

- We tested **several efficiencies** (0.95/0.99), **fake rates** (0.05/0.01) an **histogram sizes** (from 72 to 9216)

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L1TOccupancyClient: Current Status

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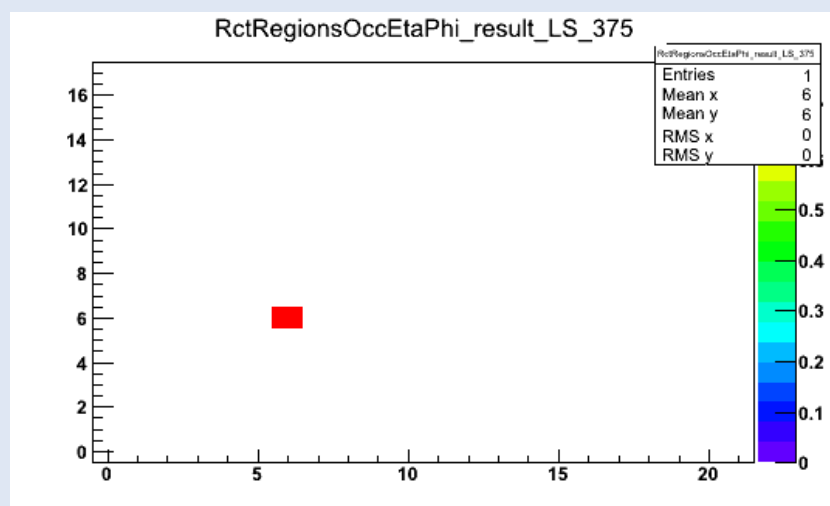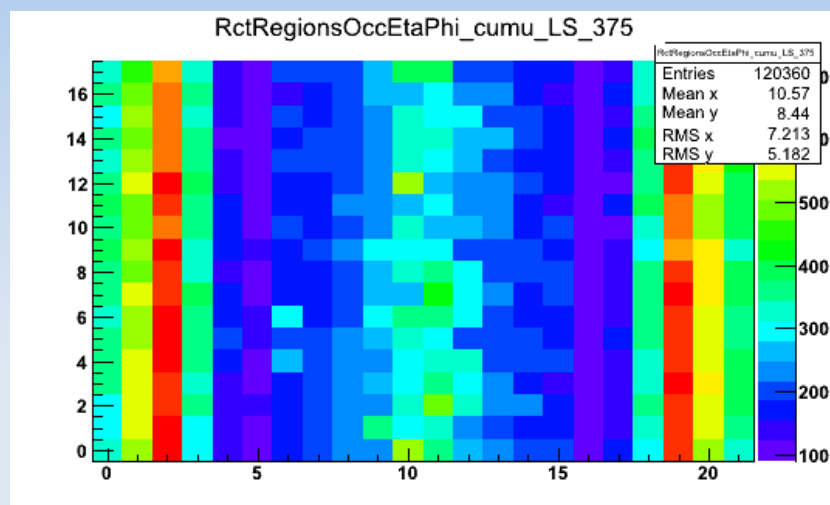
- Systematically tested on run 166950 changing the occupancy by hand.

- Looking for problematic channels in the 2011 dataset.

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Block Certification

- Some tests are statistically limited. To produce a significant result we need to integrate several LS (Block Certification)

- L1T Synchronization already uses this method. Block sizes are determined by integrated statistics.

- Issues:

  - Some cases need O(100) LS to produce test results.

  - For consistency blocks need to be of consecutive LS and have same conditions (ex. beam status)

  - Current method works online (with output to histograms), but requires careful implementation for flags associated with each LS and offline (where several jobs are done in parallel, blocks must be done in the end)
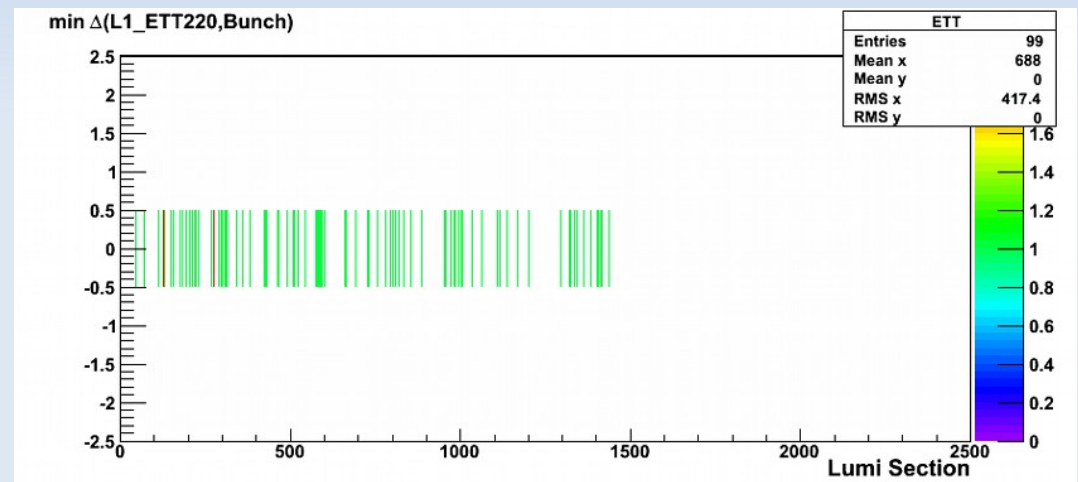
Questions from central DQM

- Performance (memory, cpu usages, etc.):
  - Nothing to report

- Improvements and Feature requests:
  - Support for block certification

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Reason L1T is marked bad

- Big chunks of runs due to detector issues (eg ECAL HV going down, etc) [most of lumi loss, but it's not "L1T" issue!]

- Few lumi-sections within
several runs due to specific trigger issues (usually very high rate spikes due to links between trigger primitives and regional triggers or hot towers showing up in calorimeters) [small lumi loss]

- Very few times it happened a wrong configuration was set and we had to declare BAD [very small lumi loss]
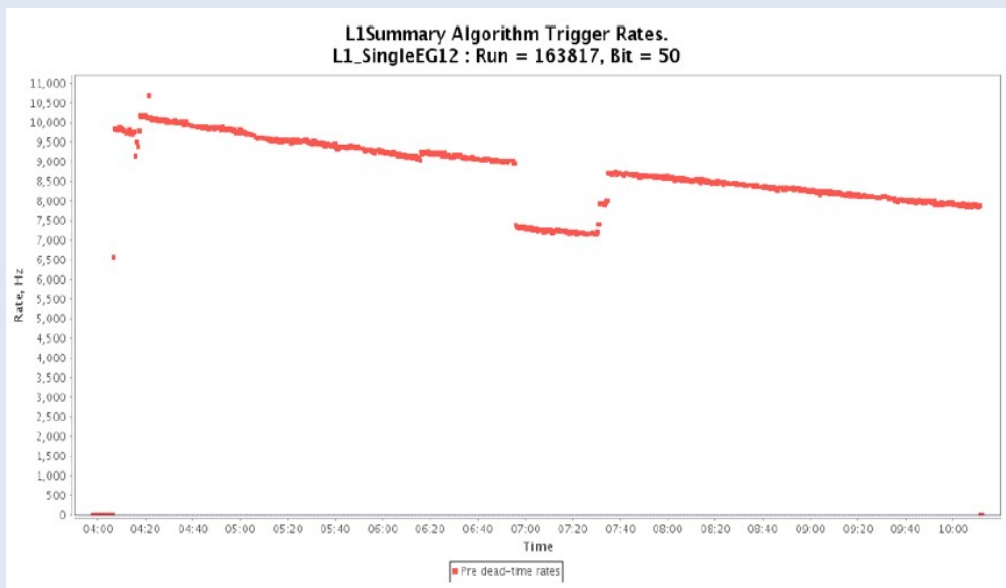
EE HV problem lead to rate problems and consequentially made some LS to be marked bad

Conclusions

- New L1T tools now in production and being used for certification.

- Further upgrades to current tools will be deployed soon.

- Significant development in occupancy tests which soon will put into production.

- L1T normally is not a direct cause for big data losses at certification.