

# CALOL2 DQM - Diagnosing system performance with online DQM

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## Overview

1. Introduction to DQM
2. Overview of available functionality
3. Online DQM
4. Emulator DQM
5. Customisation
6. Conclusion



## Online DQM

1. <https://cmsweb.cern.ch/dqm/online/> (requires grid certificate)
2. Receives a subset ( $\approx 1\%$ ) of data-stream that comes out of DAQ
3. Intended for real-time diagnostics and quality monitoring of detector sub-systems
4. Comprised of CMSSW modules that process data each lumi-section (23 sec) as data becomes available
5. Generates a set of histograms which are processed by DQM GUI (data is accumulated)
6. DQM GUI offers limited interactive functionality for styling, documentation and automation of plots

## Offline DQM

1. Runs on full dataset after completion
2. Useful for performance studies (i.e. turn-ons, efficiencies)



## CALOL2 Specific DQM functionality

1. Distributions of object properties from data / emulator (jet position, energy, etc)
  - ▶ jets (central and forward):  $E_T$  (rank), position ( $\eta$ ,  $\phi$ )
  - ▶  $e/\gamma$  (iso and non-iso):  $E_T$  (rank), position ( $\eta$ ,  $\phi$ )
  - ▶  $\tau$  (iso and non-iso):  $E_T$  (rank), position ( $\eta$ ,  $\phi$ )
  - ▶ sums: scalar sums (ETT, HTT), vector sums (MET/MHT  $E_T$ ,  $\phi$ )
2. Diagnostic plots, i.e. timing and isolation
  - ▶ 2D occupancy
  - ▶ Bx occupancy (check of timing)
  - ▶ Quality bits
  - ▶ Isolation (for  $e/\gamma$ ,  $\tau$ )
3. Data-emulator comparisons (ratio plots useful for debugging firmware issues)
  - ▶ ratio is taken of object distributions
  - ▶ deviations suggest issues with either algorithm firmware/emulator
  - ▶ useful as a sanity check after a firmware upgrade



- WBM available at <https://cmswbm.cern.ch/>



## CMS Web Based Monitoring *online*



### Subdetectors WBM

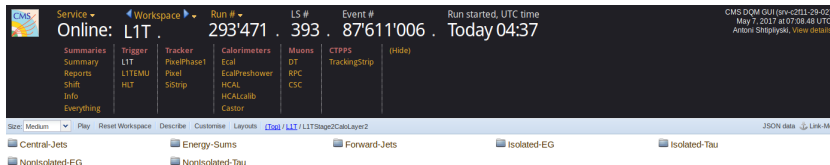
ECALSummary  
DTSummary  
RPCSummary  
HCALHome  
HGCALHome  
CSCSummary  
BCM1F Bunch Info  
TriggerModes  
TrackerTools  
PixelHome  
ScreenSnapShots

### Core Services

RunSummary [24h] [24h&1+trig]  
RunTimeSummary [LHC Fills] Dendtime  
FillReport [Latest Stable Fill] DataSummary  
LumiScalers | Automatic Fill eMails  
DQM Run Registry [Online][Offline][User]  
DQL [Online] [Offline  $\beta$ ]  
TriggerHistory | TriggerRunListing  
TriggerRates [Pre-DT L1] [Post-DT L1] [HLT]  
LastValue | ConditionBrowser [Plot]  
MagnetHistory | CurrentBunches | BunchFill  
LhcMonitor | LHCStatusDisplay | BLM | BPM | DIP  
LhcCollimators | AbortGaps  
ShiftAccountingTool  
wbm4lhc  
PageZero | CMS Page 1

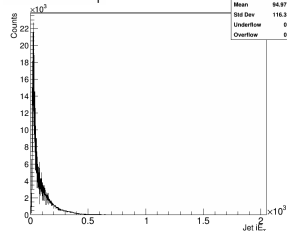
### Links

Online DQM GUI  
FNAL ROC  
Commissioning & Run Coordination  
CMS Twiki: OnlineWB TriDAS  
CMS Online  
Shift eLog  
Snappy eLogViewer  
LHC Page 1

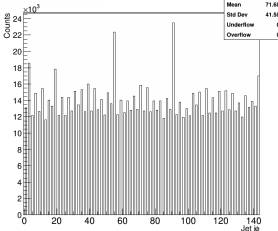


- Workspace → L1T → (Top) → L1TStage2CaloLayer2

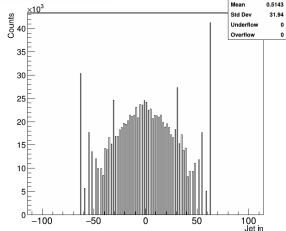
CENTRAL JET  $E_T$



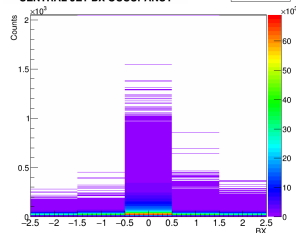
CENTRAL JET PHI



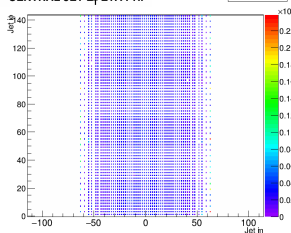
CENTRAL JET ETA



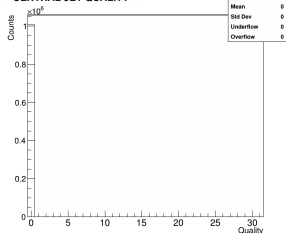
CENTRAL JET BX OCCUPANCY

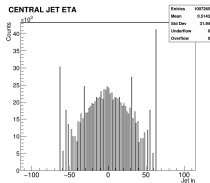
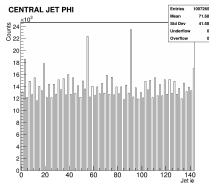


CENTRAL JET  $E_T$  ETA PHI



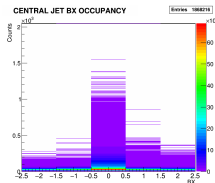
CENTRAL JET QUALITY





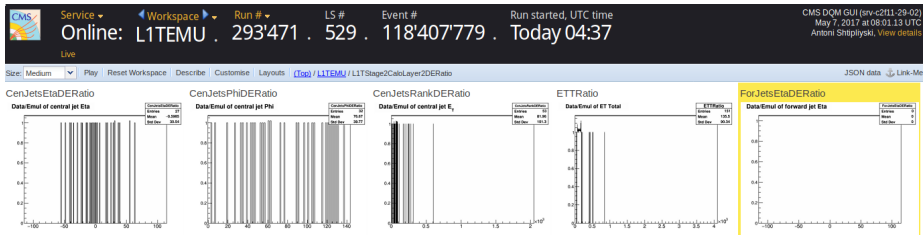
## Position

- Distribution should not be necessarily flat but should see symmetry in  $\phi$  and mirror symmetry in  $\eta$ .
- Spikes are often an indication of a hot tower



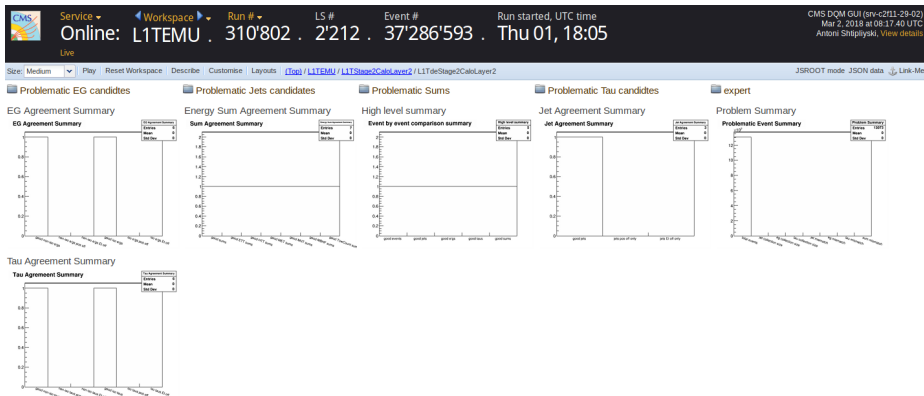
## Timing

- During collisions we expect to see a peak at Bx 0
- For cosmics, distribution may vary

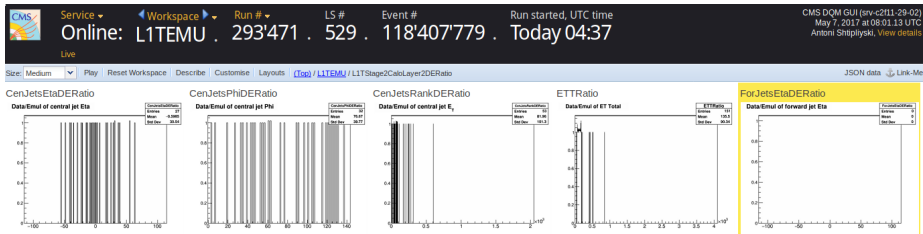


- ▶ Ratios for each object property (jets,  $e/\gamma$ ,  $\tau$ , sums)
- ▶ Useful for a check after the deployment of new firmware
- ▶ Currently waiting for a PR for automatic configuration of the emulator (expected in the next couple of weeks)

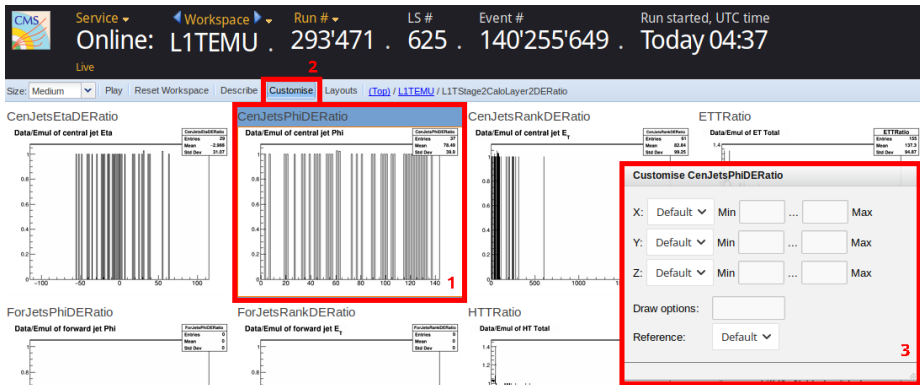




- ▶ Data-emulator agreement now summarised in a set of high-level plots
- ▶ Comparisons performed on event-by-event basis and more accurate than ratio plots
- ▶ Plots are organised in progressively greater detail to allow finding source of problems quickly



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In any given view one can “customise” the plots seen:

1. Identify plot that you want to customise and click on it. Once selected you will see blue border.
2. Click “Customise” button from top menu.
3. Use the Customise panel to change the axes ranges, scale (log/linear) or change the Draw options (a la ROOT)