

The Data Quality Monitoring System and Experiences

CMS Hamburg / DESY Meeting

Markus Marienfeld



Data acquisition (DAQ) at CMS

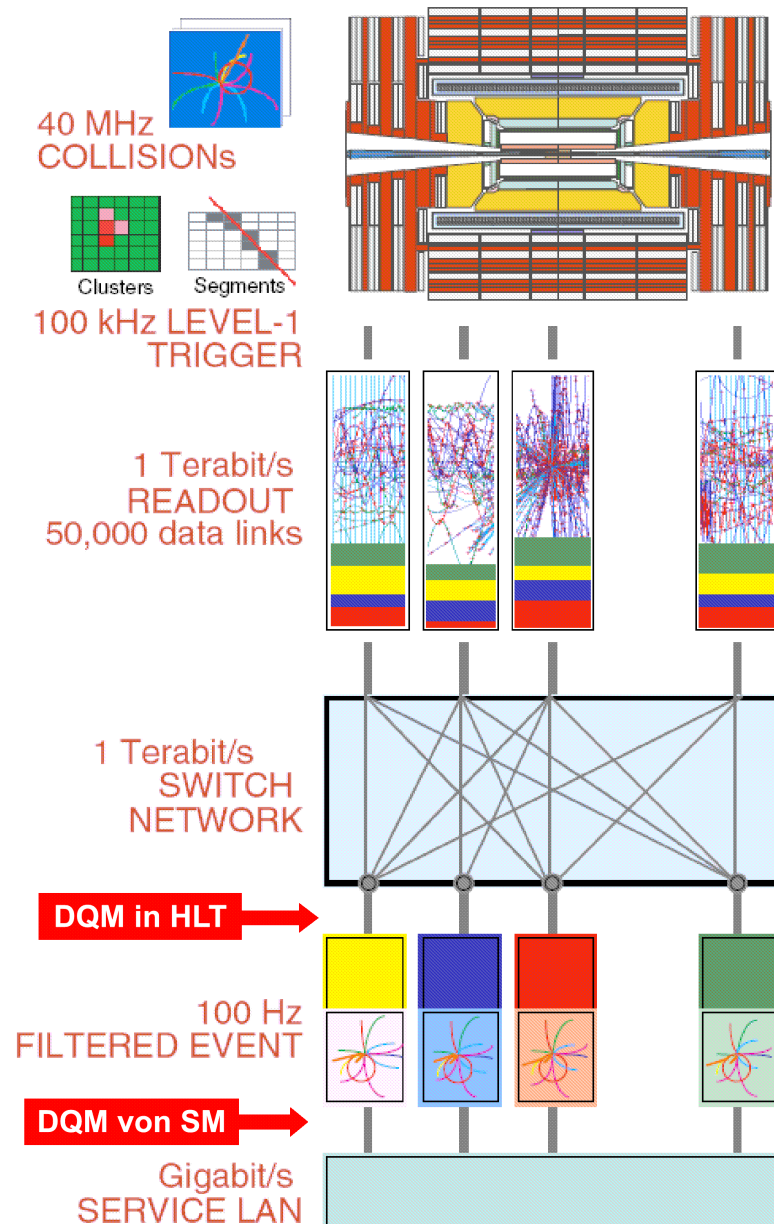


- (1) Collision rate: 40 MHz
- (2) Level-1-Trigger (L1T): 100 KHz
- (3) High-Level-Trigger (HLT): 100 Hz



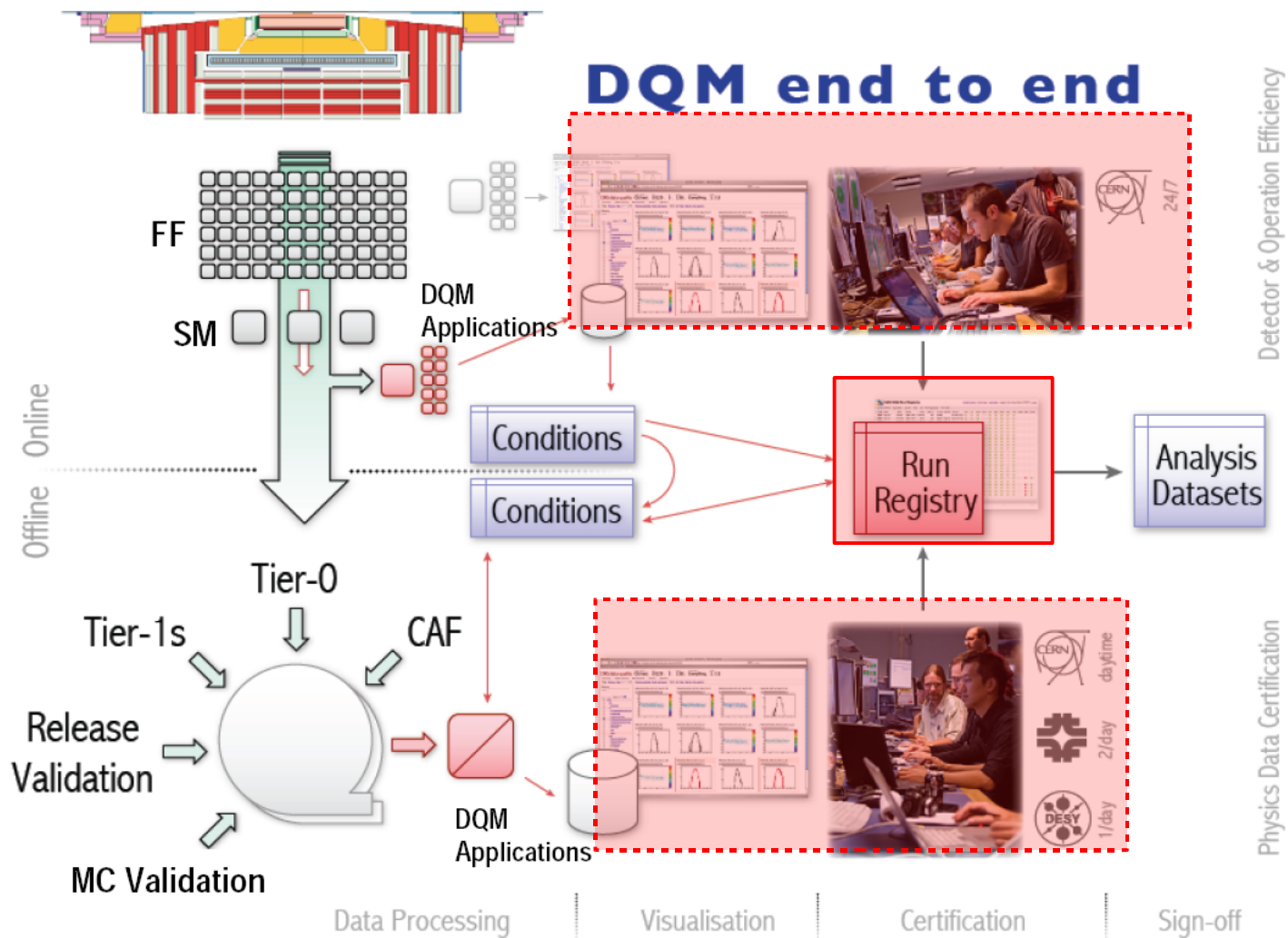
➤ Worldwide data processing:

- Tier-0 & CAF at CERN
- Tier-1 (7 computing centres)
- Tier-2 (ca. 40 analysis centres)



The DQM workflow

- **Online:** Real time detector control.
- **Offline:** Monitoring and certification of reconstruction and calibration.
- **Playback:** Environment for testing and software integration.



DQM Shifts Overview

➤ Online Shifts at P5 (3/day for 24 hours coverage)

0:00-7:00 | 7:00-15:30 | 15:30-0:00

- On the **first day** of global running, shifts start at **9:00h**.

➤ Offline Shifts (CRAFT09: 2/day)

9:00-16:00 | 14:00-21:00

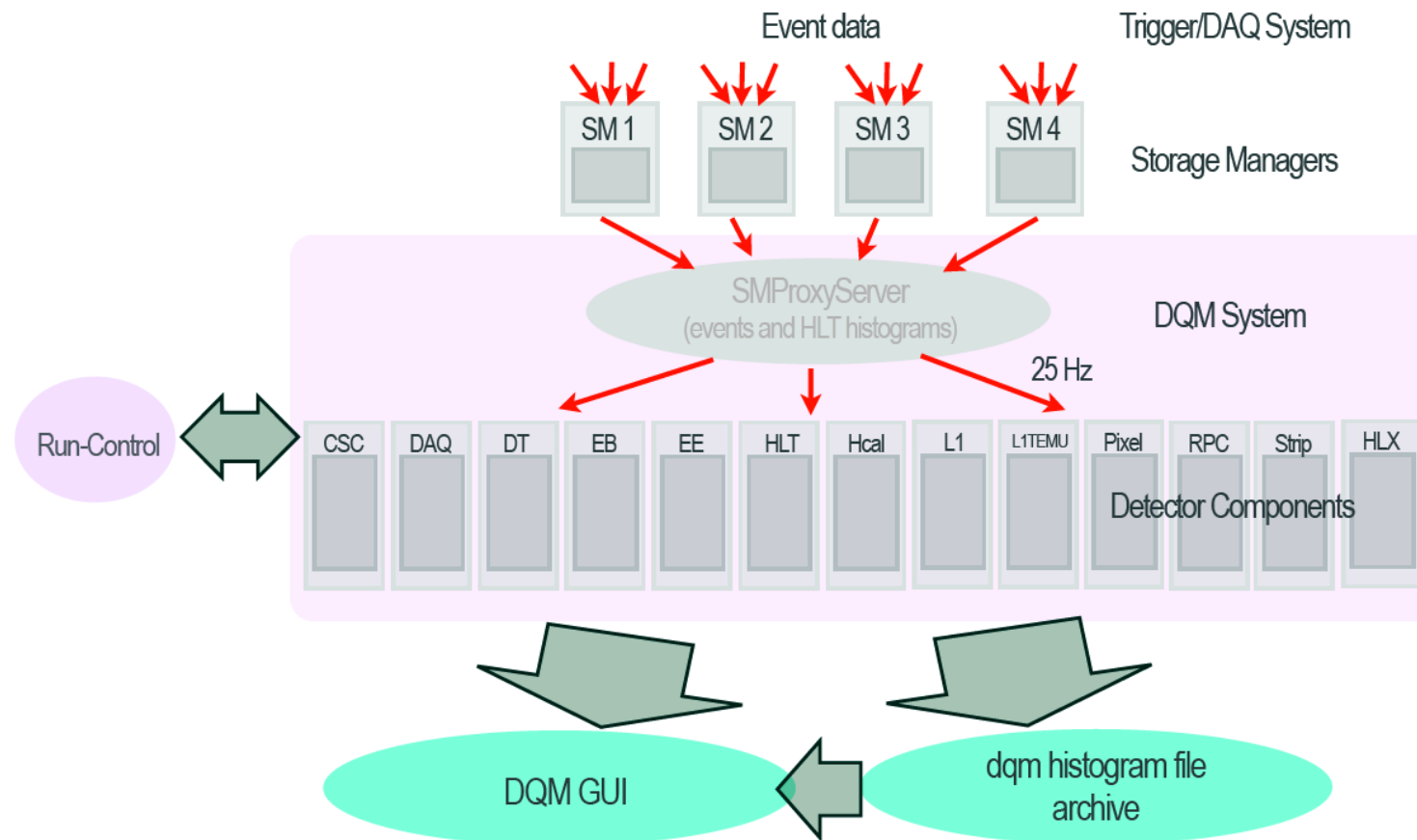
- Run at **Meyrin CC** with a **delay of ~24 hours**.

➤ Remote Shifts (3/day for 24 hours coverage)

- Run at **FNAL** and **DESY ROC's in parallel** with P5 shifts.

Online DQM

- Event data is processed in parallel by independent **DQM applications**.
- Creation of ROOT histograms **in real time** with an own type (→ “*monitor elements*”).
- Visualization by one centralized, web-based **Graphical User Interface (GUI)**.



The Graphical User Interface (GUI)

- **Summary page:** Compact overview about subsystems status.
- Monitoring of **live histograms** as well as archived runs.
- **Shift histograms:** DQM shift person watches a **selected subset** of a **great number of histograms** per subsystem.

Global summary values
by subsystems:

Good: $\geq 95\%$

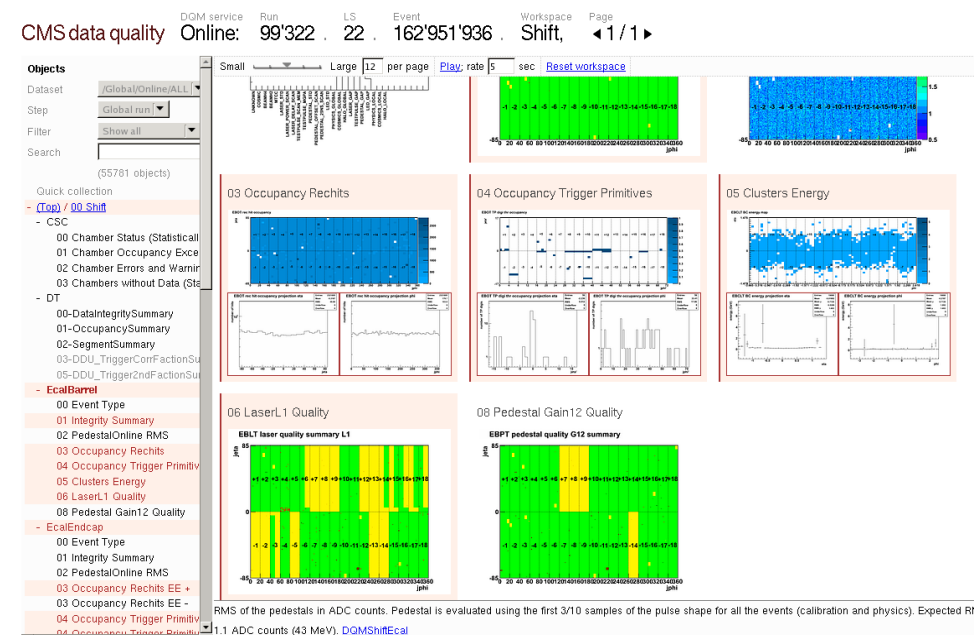
Warning: $< 95\%$

ERROR: $< 85\%$

No DAQ: not in readout



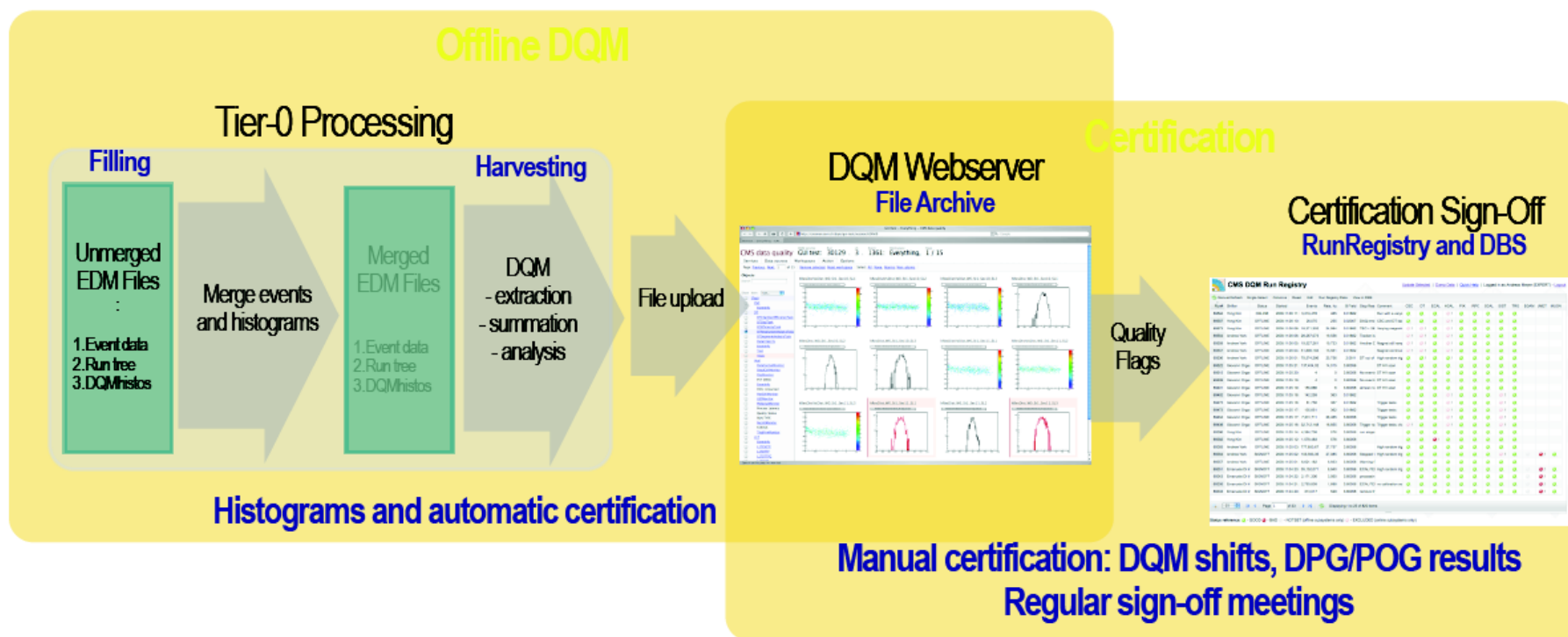
Please file any feature requests and any bugs you find in [Savannah](#). Find [shift instructions here](#).
IGUANA DQM GUI @ srv-C2D05-19; Jun 29, 2009 at 09:50:42 UTC; session is modifiable



Please file any feature requests and any bugs you find in [Savannah](#). Find [shift instructions here](#).
IGUANA DQM GUI @ srv-C2D05-18; Jul 1, 2009 at 15:45:18 UTC; session is modifiable

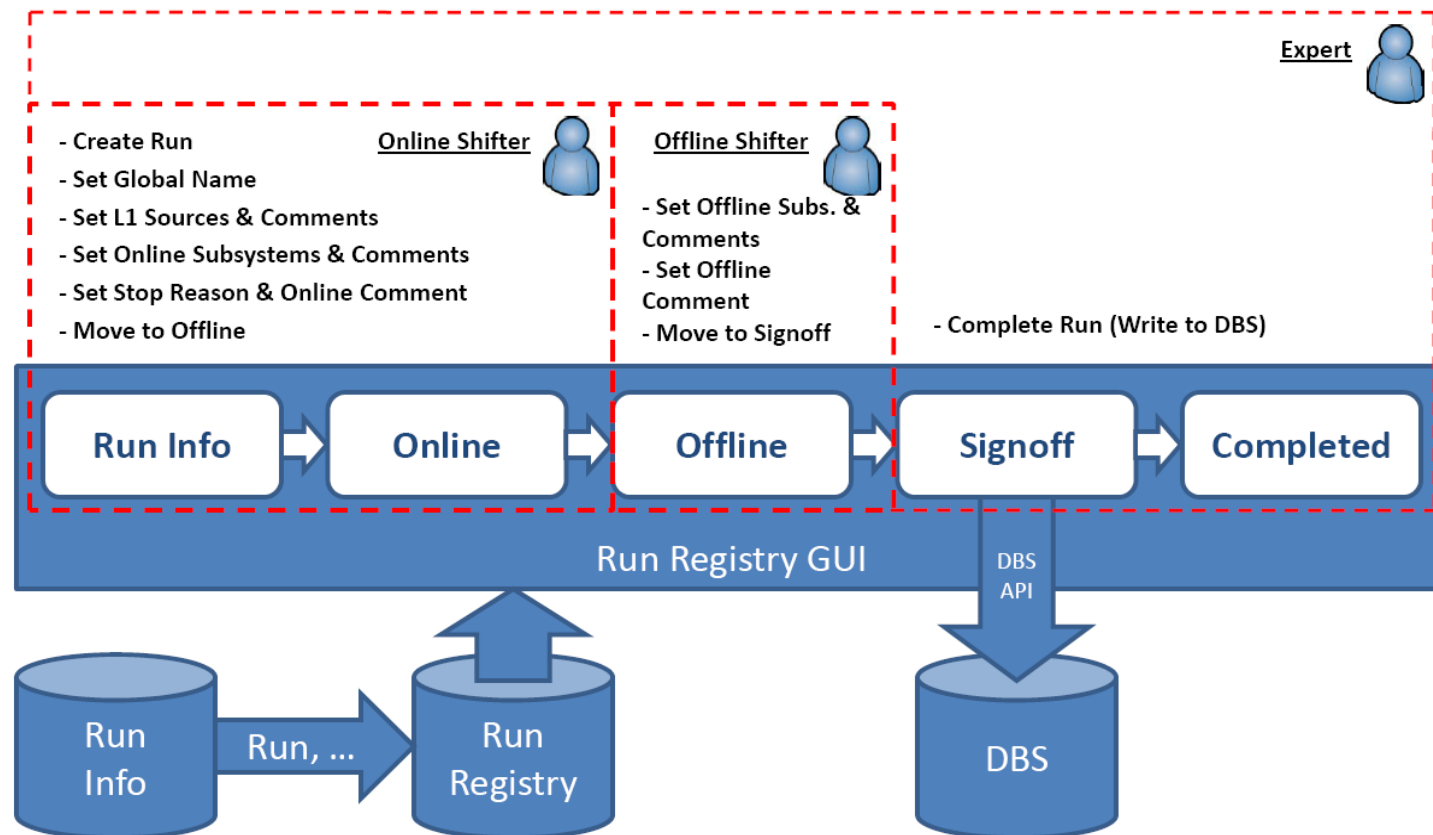
Data reconstruction at Tier-0 & Offline DQM

- Monitoring of **reconstructed physic objects**: muons, photons, jets...
- Anew evaluation of detector components with **full event statistics**.
- Collecting and summation of histograms from event data into **one single run** (→ “*harvesting*”).



Data certification & sign-off

- Determination of **detector and reconstruction quality** (online & offline) by DQM shift person and automatic certification (quality tests by algorithms).
- The certification result is send to sign-off and stored in the **Run Registry**.
- Final storage of the quality flags in DBS → availability for data analysis.



The Run Registry page

- DQM shift person registers **significant runs** to the Run Registry.
- Adding **quality flags** marking runs as **GOOD** or **BAD** for online and offline.
- Summarizing **detector subsystem conditions (DPG)** and **quality of reconstruction step (POG)**.

CMS DQM Run Registry - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://pccmsdqm04.cern.ch/runregistry/

DQM News & Infos Online Tools TWiki CMS online iCMS Indico [Home] Welcome [LCG Savann...

CMS DQM Run Registry Message Board | Plot Chart | Advanced search | Dump Data | Options | Help | Login

gs	Run#	Global Name	Online Shifter	Status	Started	Events	Rate, Hz	Stop Reason	DPG										POG		
									CSC	DT	ECAL	HCAL	HLT	L1T	PIX	RPC	SCAL	STRIP	EGAM	JMET	MUON
	108526	CRAFT09	Andrew Godshalk	OFFLINE	2009.07.25 00:30:46	45,248,110	1,376		GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD			
	108521	CRAFT09	Andrew Godshalk	SIGNOFF	2009.07.24 22:36:56	5,366,500	1,372	allow RPCs to mask out hot	GOOD	GOOD	GOOD	BAD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	BAD
	108498	CRAFT09	Alan Hahn	SIGNOFF	2009.07.24 21:12:19	2,425,503	1,057	Stopping to bring in HCAL	GOOD	GOOD	BAD	GOOD	GOOD	GOOD	EXCL	EXCL	GOOD	GOOD	GOOD		BAD
	108483	CRAFT09	Alan Hahn	SIGNOFF	2009.07.24 19:54:02	879,016	973	Stopped to allow Pixels to d	GOOD	GOOD	EXCL	EXCL	GOOD	GOOD	GOOD	EXCL	GOOD	GOOD	GOOD	GOOD	BAD
	108478	CRAFT09	Alan Hahn	SIGNOFF	2009.07.24 19:04:12	2,151,919	1,093	Stop to reconfigure CSC	GOOD	GOOD	GOOD	EXCL	GOOD	GOOD	GOOD	EXCL	GOOD	GOOD	GOOD	GOOD	BAD
	108462	CRAFT09	Alan Hahn	SIGNOFF	2009.07.24 17:02:44	4,116,315	759	Stopped to allow Pixels to d	GOOD	GOOD	GOOD	EXCL	GOOD	GOOD	EXCL	EXCL	GOOD	EXCL	GOOD	GOOD	BAD
	108461	CRAFT09	Alan Hahn	SIGNOFF	2009.07.24 16:48:10	331,490	760	make changes	GOOD	EXCL	EXCL	EXCL	GOOD	GOOD	GOOD	EXCL	GOOD	GOOD	GOOD	GOOD	BAD
	108459	CRAFT09	Alan Hahn	SIGNOFF	2009.07.24 16:28:18	322,039	668	HLT change	GOOD	EXCL	EXCL	EXCL	GOOD	GOOD	GOOD	EXCL	GOOD	EXCL	GOOD	GOOD	BAD
	108449	CRAFT09	Alan Hahn	SIGNOFF	2009.07.24 15:55:20	639,739	761	Trying to add SCAL (lumi sc	GOOD	EXCL	EXCL	EXCL	GOOD	GOOD	GOOD	EXCL	EXCL	GOOD	GOOD	GOOD	BAD
	108343	CRAFT09	Erik Nesvold	SIGNOFF	2009.07.24 10:47:11	2,103,213	1,118	The ramping up of the magn	GOOD	GOOD	EXCL	GOOD	GOOD	GOOD	GOOD	GOOD	EXCL	EXCL	GOOD	GOOD	BAD
	108315	CRAFT09	Erik Nesvold	SIGNOFF	2009.07.24 09:11:55	2,010,389	1,165	Stopped to take out ECAL P	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	EXCL	GOOD	GOOD	GOOD	BAD
	108298	CRAFT09	Steven Won	OFFLINE	2009.07.24 03:28:45	20,449,299	1,307		GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	EXCL	GOOD			
	108290	CRAFT09	Steven Won	SIGNOFF	2009.07.24 01:04:19	4,886,746	1,316	Problem with DTs	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	EXCL	GOOD	GOOD	GOOD	BAD
	108265	CRAFT09	Alan Hahn	SIGNOFF	2009.07.23 21:22:24	2,748,081	885		GOOD	GOOD	BAD	EXCL	GOOD	GOOD	GOOD	GOOD	EXCL	GOOD	GOOD	GOOD	BAD
	108239	CRAFT09	Alan Hahn	SIGNOFF	2009.07.23 18:08:40	4,978,437	1,231	Stopping to include ECAL	GOOD	GOOD	EXCL	GOOD	GOOD	GOOD	GOOD	GOOD	EXCL	GOOD	GOOD	GOOD	BAD
	108219	CRAFT09	Alan Hahn	SIGNOFF	2009.07.23 16:23:06	1,271,768	1,100	Stopping to reconfigure (whi	GOOD	GOOD	EXCL	GOOD	GOOD	GOOD	GOOD	EXCL	GOOD	EXCL	GOOD	GOOD	BAD
	108168	CRAFT09	Alan Hahn	SIGNOFF	2009.07.23 14:11:21	1,947,049	1,899	Halted to reconfigure RPC t	GOOD	GOOD	EXCL	GOOD	GOOD	GOOD	EXCL	GOOD	EXCL	EXCL	GOOD	GOOD	BAD
	108151	CRAFT09	Alan Hahn	SIGNOFF	2009.07.23 13:33:20	1,553,664	939	Stopping to add CSC and R	GOOD	GOOD	EXCL	GOOD	GOOD	GOOD	EXCL	GOOD	EXCL	EXCL			
	108117	CRAFT09	Alan Hahn	SIGNOFF	2009.07.23 12:13:45	1,376,917	939	DT only Detector in run--but	EXCL	BAD	EXCL	EXCL	GOOD	GOOD	EXCL	EXCL	EXCL	EXCL	BAD	BAD	BAD
	106019	MWGR29	Mikko Antero Vou	COMPLETED	2009.07.16 18:59:04	14,698,325	1,362	Full three hours and midnigh	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	BAD	GOOD

20 Page 2 of 68 Displaying 21 to 40 of 1345 items

MESSAGE BOARD

Done

Physics DQM (PAG): Top quark

➤ Tentative plans for prompt data validation:

- **Online DQM:** Monitoring and checks of **lepton trigger efficiencies** from dileptonic events (tag & probe approach) at HLT level.
- **Offline DQM:** Monitoring of **dilepton reconstruction and efficiencies**, simple physics feedback, e.g. **dilepton mass spectrum**.
- Need $O(0.1 \text{ pb}^{-1})$ for visible J/ψ peak (900 GeV or 10 TeV) or Z peak (10 TeV).



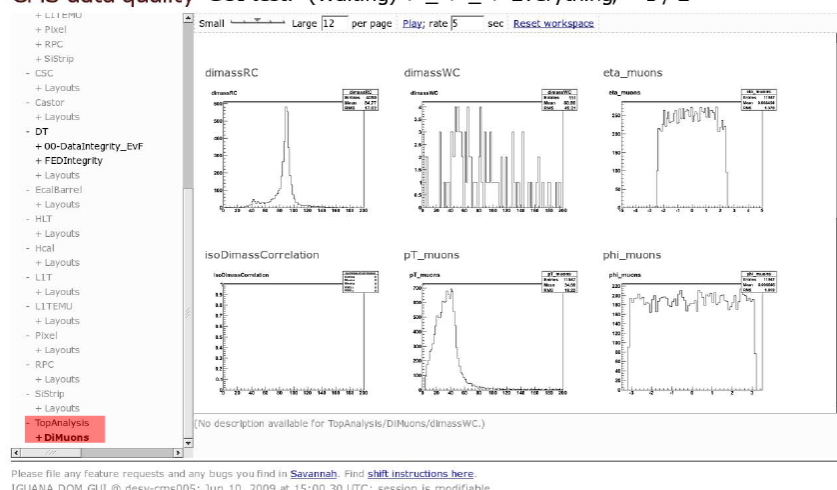
1. Prompt Data Validation for Dimuon Events

- Source code from top analysis PAT-based dimuon analyzer translated to and built into RECO-based offline DQM sequence.

- Runs on MC data as well as on CRAFT data.

tentative test
implementation
(M. Mariefeld, D. Dammann)

CMS data quality GUI test: (Waiting) . . . Everything, <1 / 2>



- ✓ First version of [TopDiLeptonDQM](#) ready and submitted.
- ✓ Test implementation of monitoring at HLT level.

Summary

- Real time detector control during data taking.
- Fully web-based technology from online data taking to certification within one framework!
- **Ca. 300 million cosmic events successfully taken** during cosmic runs in 2008 and presently running CRUZET/CRAFT09.
- Items not covered: Release Validation, MC Validation, DQM at Tier-1's and CAF.

