DQM in CR0T
Baseline and Goals

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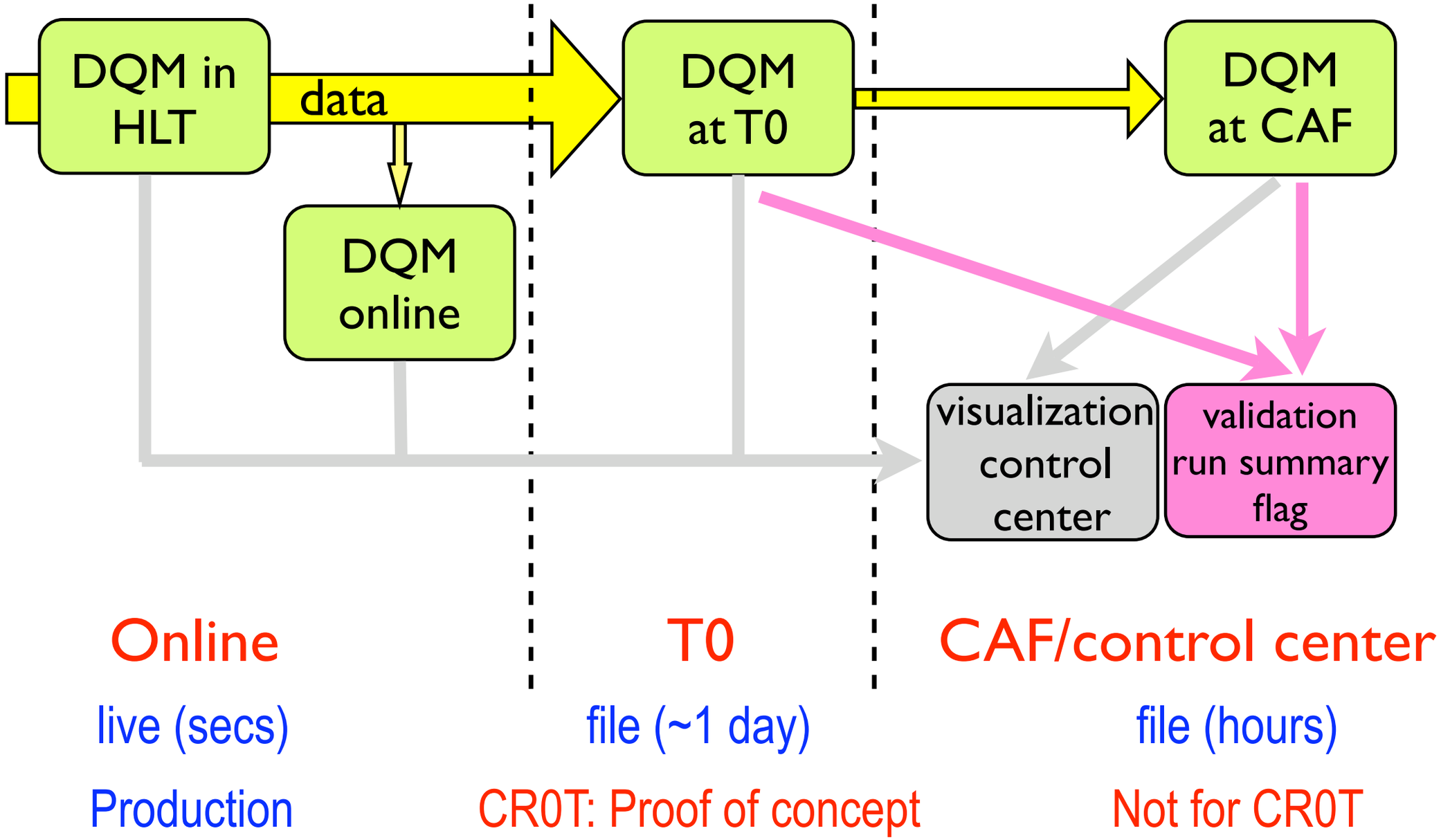
DPG Coordination Meeting
10 April 08

DQM Central Operation

Detector & Operation Efficiency → Physics Data Certification



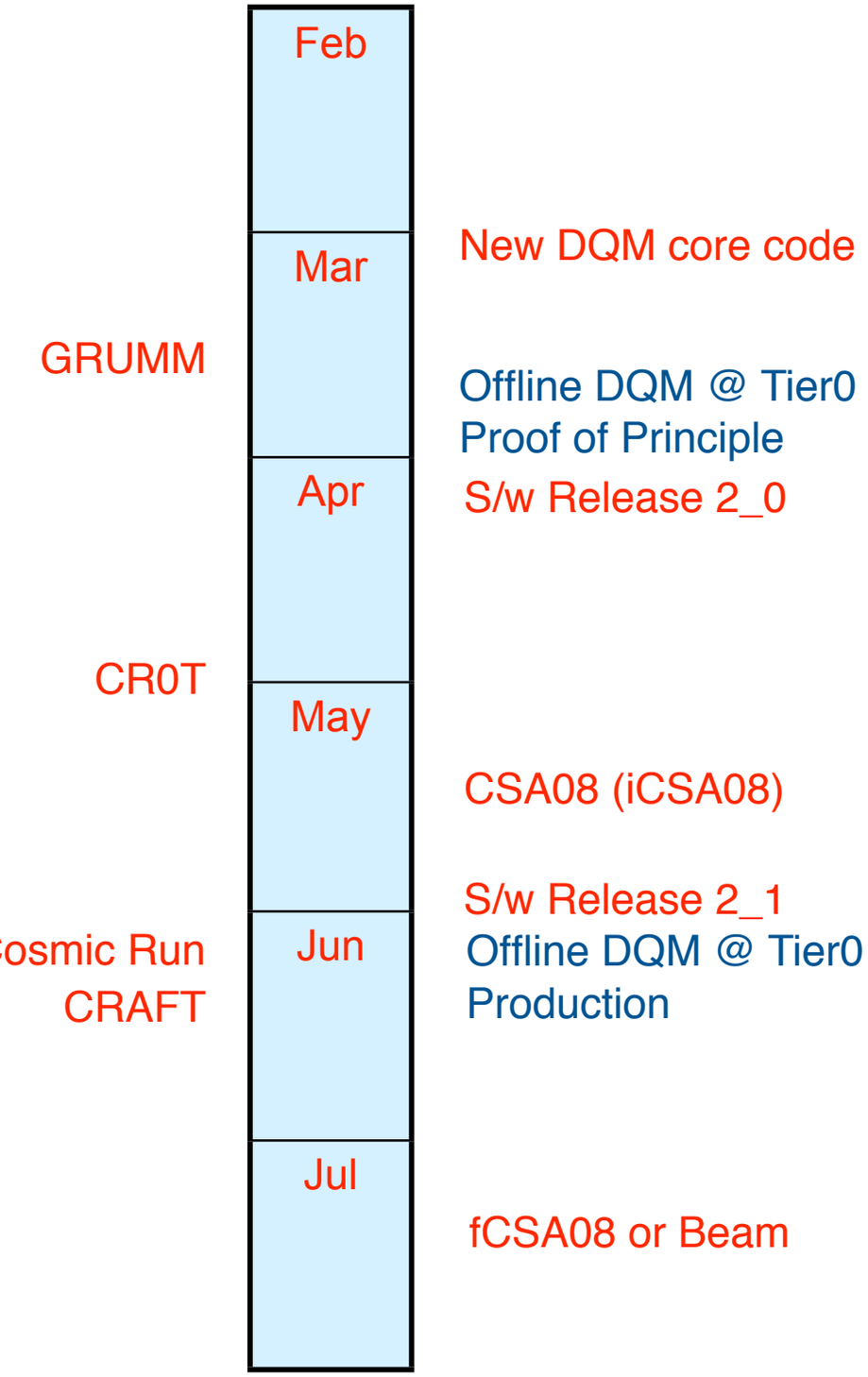
DQM core operation: focus on P5-online (24/7) and T0 (best effort)

Offline DQM Timeline

- Basic DQM software functionality in place
- Online DQM in (semi-automatic) production, still a lot to develop
- Offline DQM (Tier-0 webserver in cern.ch domain)

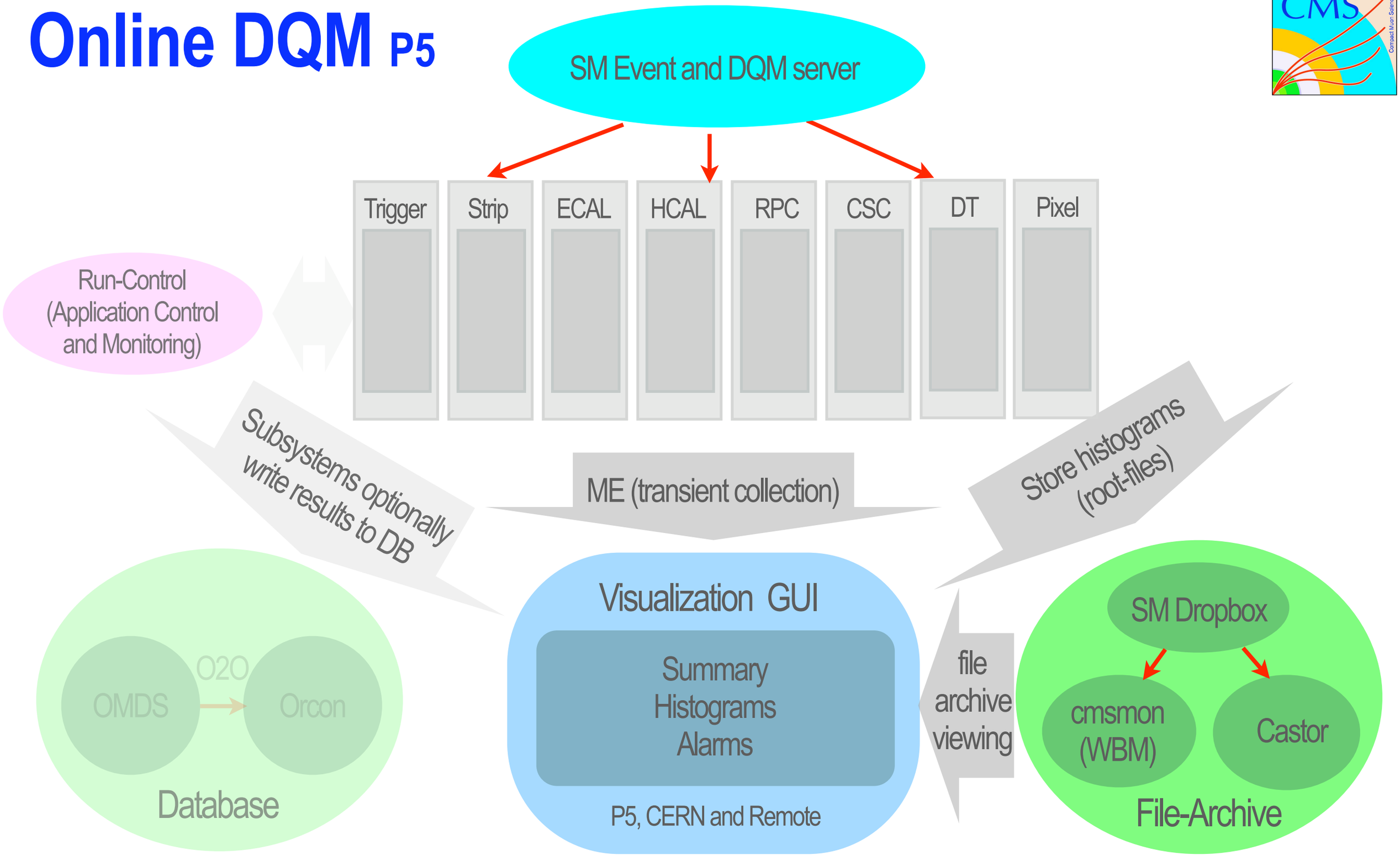
- DQM Integration in RunControl
- Histogram file transport, archive and viewing through DQM GUI
  - Tier-0: Establish regular production
  - CAF: Starting to define and implement workflows
- Create/visualize detector status and error summaries
- Manual version of Data Certification

- Consolidate production systems (full automation, scaling and robustness)
- Full set of required GUI navigation features (annotations, reference histograms, ...)
- GUI, history, trends, correlations with conditions



Need full production DQM for first pp-collisions

Online DQM P5



Baseline DQM production system in place since GREN
now use with CMSSW_2_0_0, latest GUI version, runcontrol for 24/7 operation

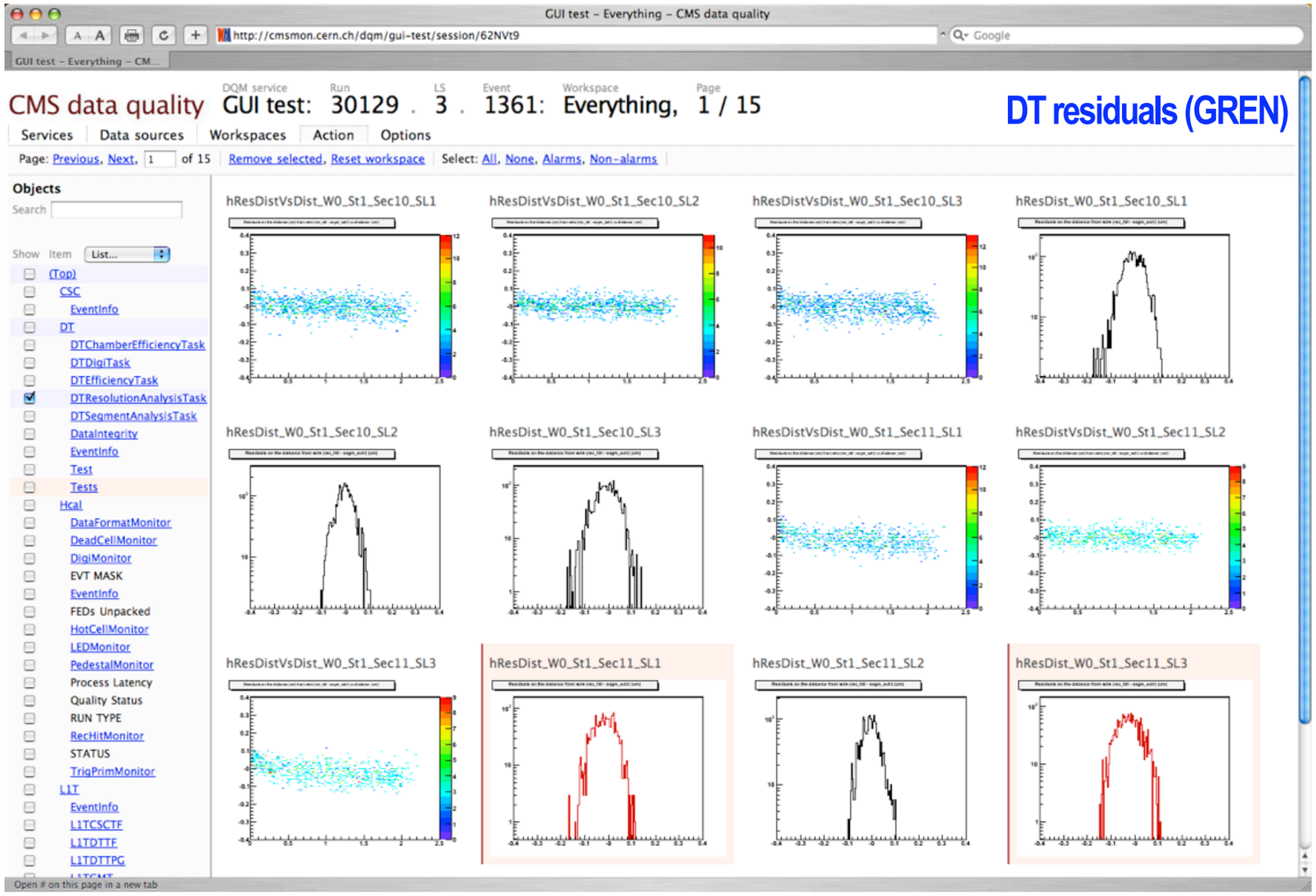
Baseline Operation

http://cmsmon.cern.ch/dqm/online live

http://cmsmon.cern.ch/dqm/online-playback playback

Lassi Tuura

- Web-based service
- no specific S/W installation on user side
- accessible from
  - P5, CERN
  - Remote
- access to histograms
  - Online (live)
  - Online (file-archive)
  - Offline Tier-0 (file-archive)
  - Offline CAF, Tier-X, ...

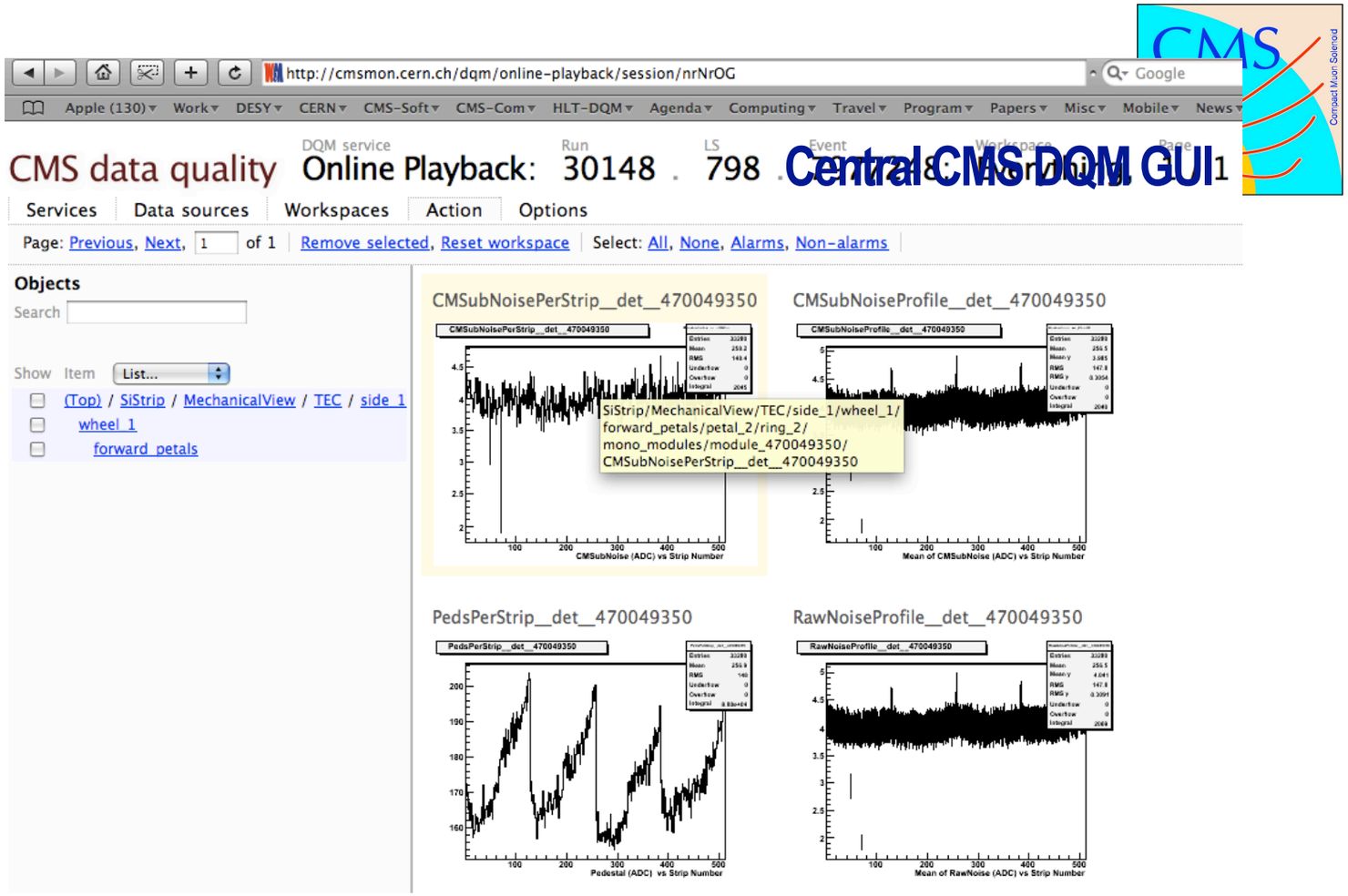


Highest Priority: Online Live Monitoring in P5

DQM project page at https://twiki.cern.ch/twiki/bin/view/CMS/DQMInfrastructure

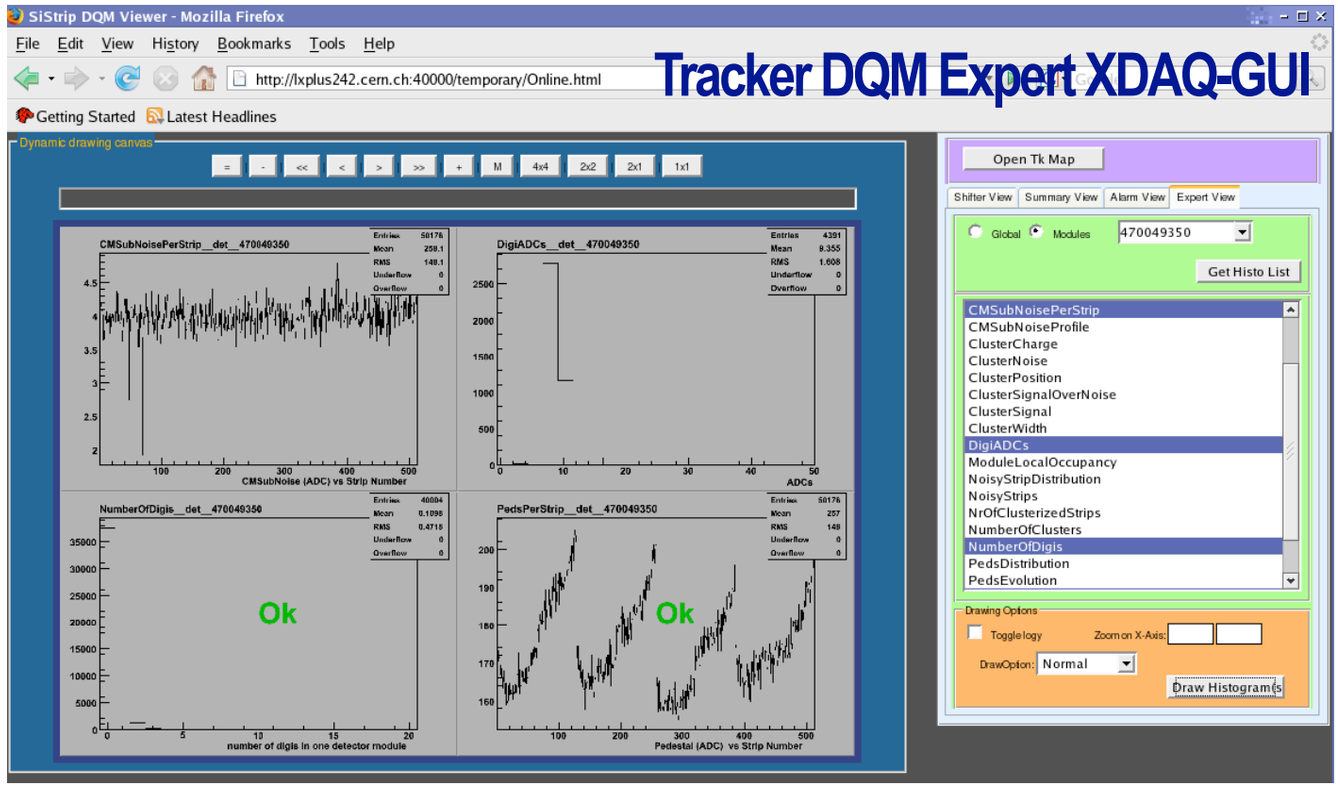
SiStrip DQM

- Sistrip DQM has been integrated in central CMS DQM GUI



- Central DQM GUI and XDAQ-based tracker expert DQM GUI can run in parallel (using histograms from same source)

- Planned for CR0T: Operate DQM from Runcontrol in order to support automated operation of XDAQ-based tracker expert DQM GUI



DQM Online File Archive through WBM

http://cmsmon.cern.ch/cmsdb/servlet/RunSummary

All times are in UTC

Rows: 1 **Data:** root | text | xml | html | query

RUN	SEQUENCE	BOOKINGTIME	KEY	START_TIME	STOP_TIME	TRIGGERS	EVEN
30129	NOV-GLOBAL-RUN toppro	2007.12.03 17:48:28	/GLOBAL_CONFIGURATION_MAP/CMS/COSMICS/GLOBAL_RUN	2007.12.03 18:36:04	2007.12.03 19:29:04	32677	326

Components: DAQ DQM DT HCAL RPC TRACKER TRG **Links:** Files DCS eLog DQMBrowser Online [169] | Remote

Partition	FEDs	Percent
DT	1 / 5	20%
GT	2 / 2	100%
HBHEa	6 / 6	100%
HBHEb	6 / 6	100%
HBHEc	6 / 6	100%
HO	7 / 8	87%
RPC	1 / 6	16%

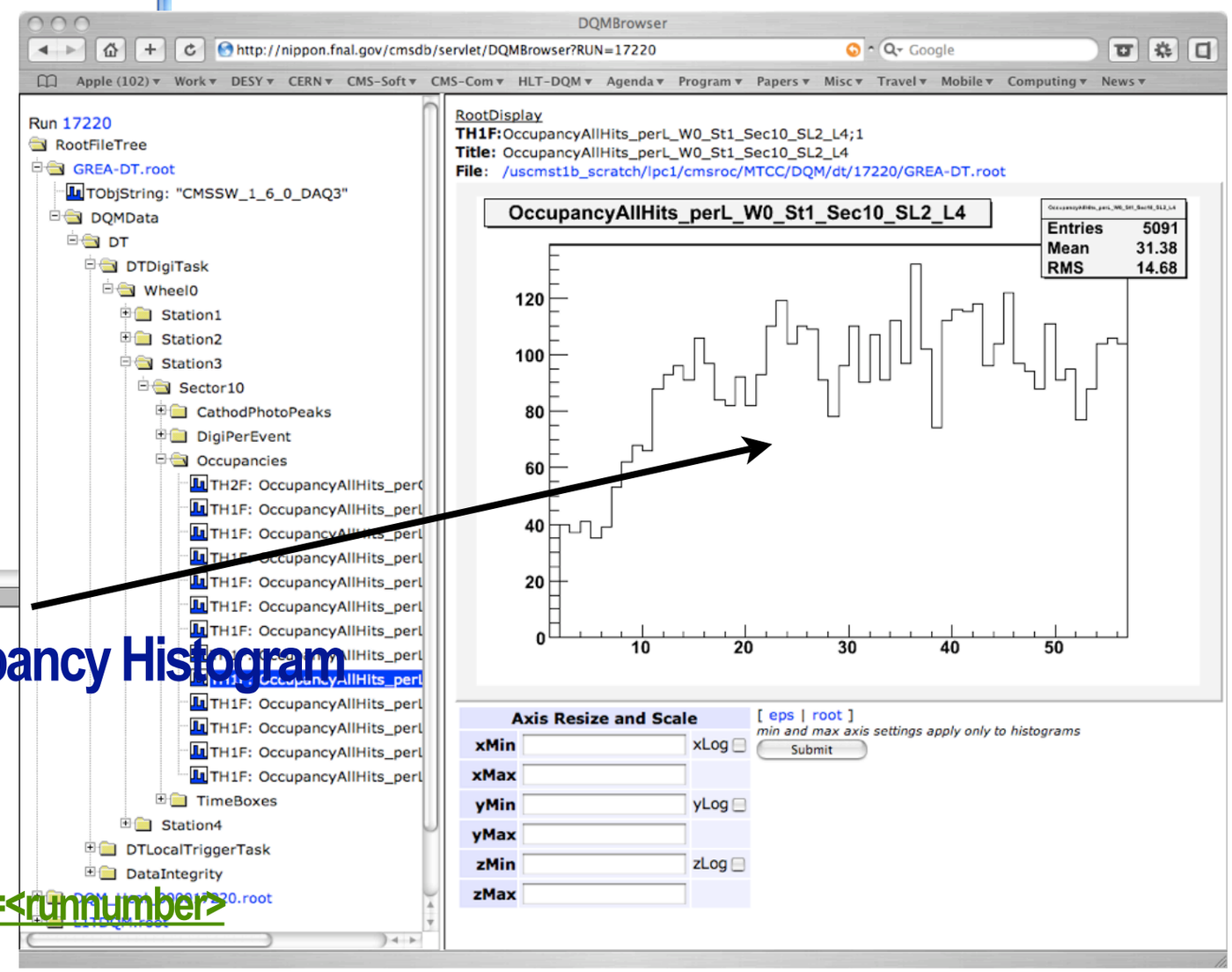
L1 Key	TSC_GREN07_GTmuon_GMTdt_DTTF
HLT Key	n/a
L1 Rate	10.965
HLT Rate	n/a
L1 Triggers	32677
HLT Triggers	n/a
LHC Fill	n/a
Initial Lumi	n/a
Ending Lumi	n/a
Run Lumi	n/a
Run Live Lumi	n/a

MagnetStatus

All CMS_RUNINFO.RUNSESSION_PARAMETER Entries

Name	Value	Time
CMS.LVL0:RC_STATE	Initializing	2007.12.03 17:48:28
CMS.LVL0:HCAL_STATE	Initializing	2007.12.03 17:48:32
CMS.LVL0:RPC_STATE	Initializing	2007.12.03 17:48:32
CMS.LVL0:DT_STATE	Initializing	2007.12.03 17:48:32
CMS.LVL0:DQM_STATE	Initializing	2007.12.03 17:48:32
CMS.LVL0:DAQ_STATE	Initializing	2007.12.03 17:48:32
CMS.LVL0:TRG_STATE	Initializing	2007.12.03 17:48:32
CMS.LVL0:TRG_STATE	Halted	2007.12.03 17:48:32

Link to DQM files



Example DT Occupancy Histogram

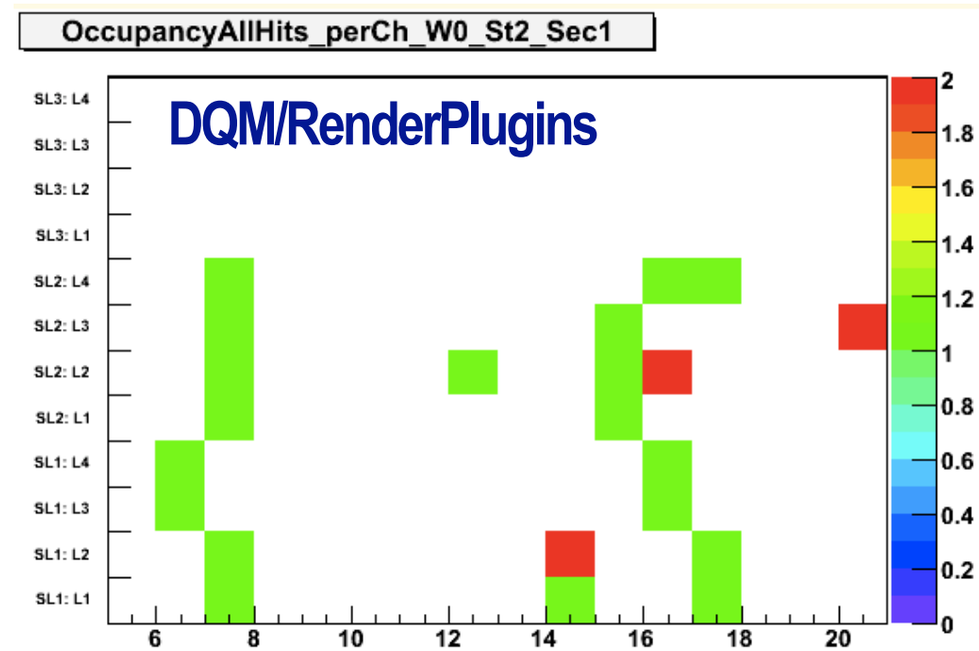
http://cmsmon.cern.ch/cmsdb/servlet/DQMBrowser?RUN=<runnumber>

Goal: CMS DQM GUI supersedes WBM GUI

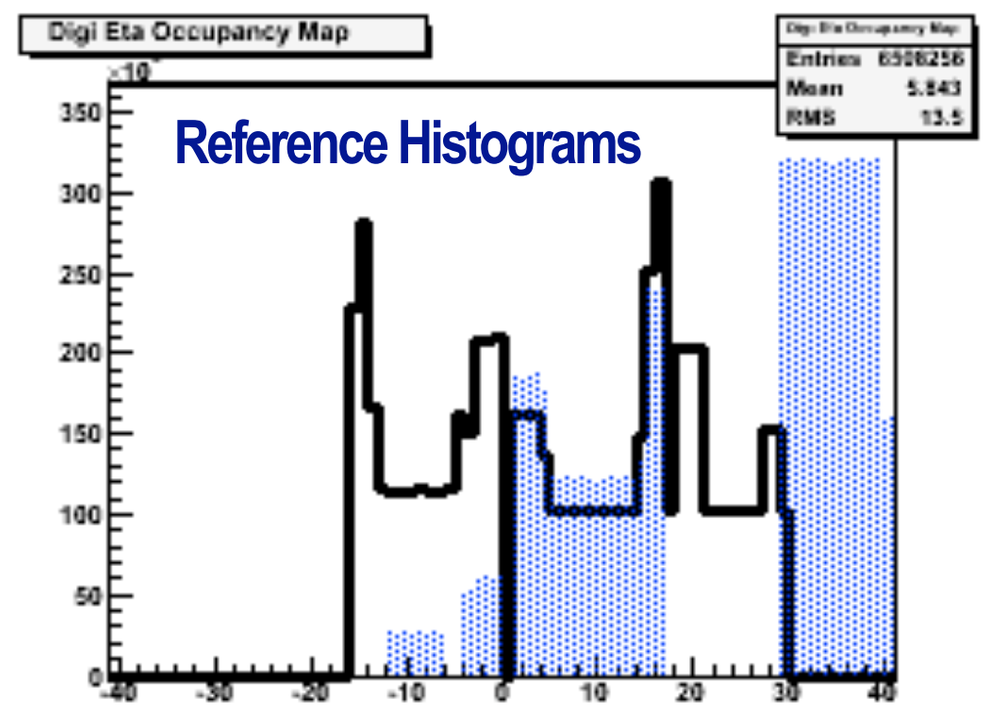
Subsystem Configuration

Subsystems define individually:

- Histogram Layouts:
  - define important (summary) histograms
  - Package: DQM/Integration/config
- Drawing options (RenderPlugins)
  - e.g. colour coding
  - Package: DQM/RenderPlugins
- Reference histogram files
  - DQM output files from previous runs containing histograms for overlay
  - specified in process cfg
  - Package: DQM/Integration/test



Digi Eta Occupancy Map



Detector Status & Alarm Summary Views

Subsystems have been asked to implement:

- EventInfo/errorSummary [0,1]
  one floating point number per DQM source application

Subsystem	Error summary	Run	Lumi section	Event	Last update	Last event	Processed events	Event rate	Monitor elements
CSC	-1	30129	4	918	30 secs in future	30 secs in future	1286225	2.45	16
EcalBarrel	-1	30129	4	921	30 secs in future	30 secs in future	1046380	1.77	853
Hcal	0.696	30129	4	977	30 secs in future	30 secs in future	1286650	2.48	189
L1T	-1	30129	4	921	30 secs in future	30 secs in future	1284325	2.42	189
RPC	-1	30129	4	942	30 secs in future	30 secs in future	1125321	2.35	145
SiStrip	1	30129	4	936	30 secs in future	30 secs in future	511625	2.45	216

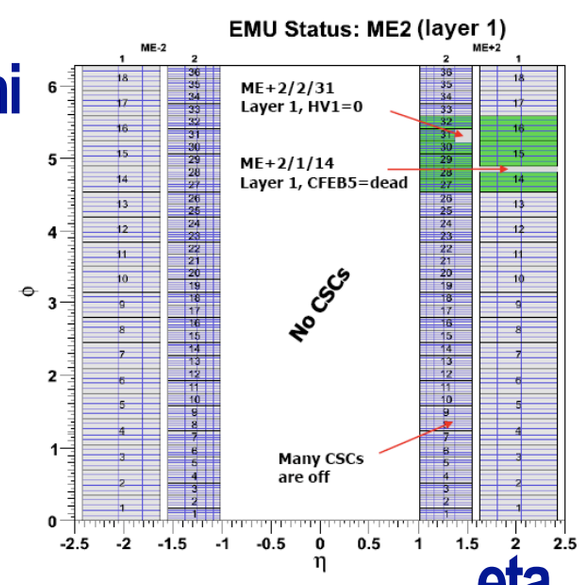
- EventInfo/errorMap [0,1]
  segmentation according to detector geometry

increasing level of detail

Tracking	99%	Pix	95%
		TIB	99%
		TID	97%
		TOB	100%
		TEC	100%
EM	99%	EB	100%
		EE	98%
		SE	50%
Hadron	85%	HB	100%
		HE	50%
		HF	95%
Muon	98%	DT	100%
		RB	95%
		CSC	97%
		RE	50%

- EventInfo/etaphiMap [0,1]
  2D histogram with fine binning

phi



eta

Discuss future refinements based on experience with proposed scheme

Example from CSC (A.Korytov)

Subsystem DQM Code for P5

Towards the most useful online histograms

- **Implement distributions that are really sensitive to detector problems**
  Online DQM is not for determination of calibration constants etc.

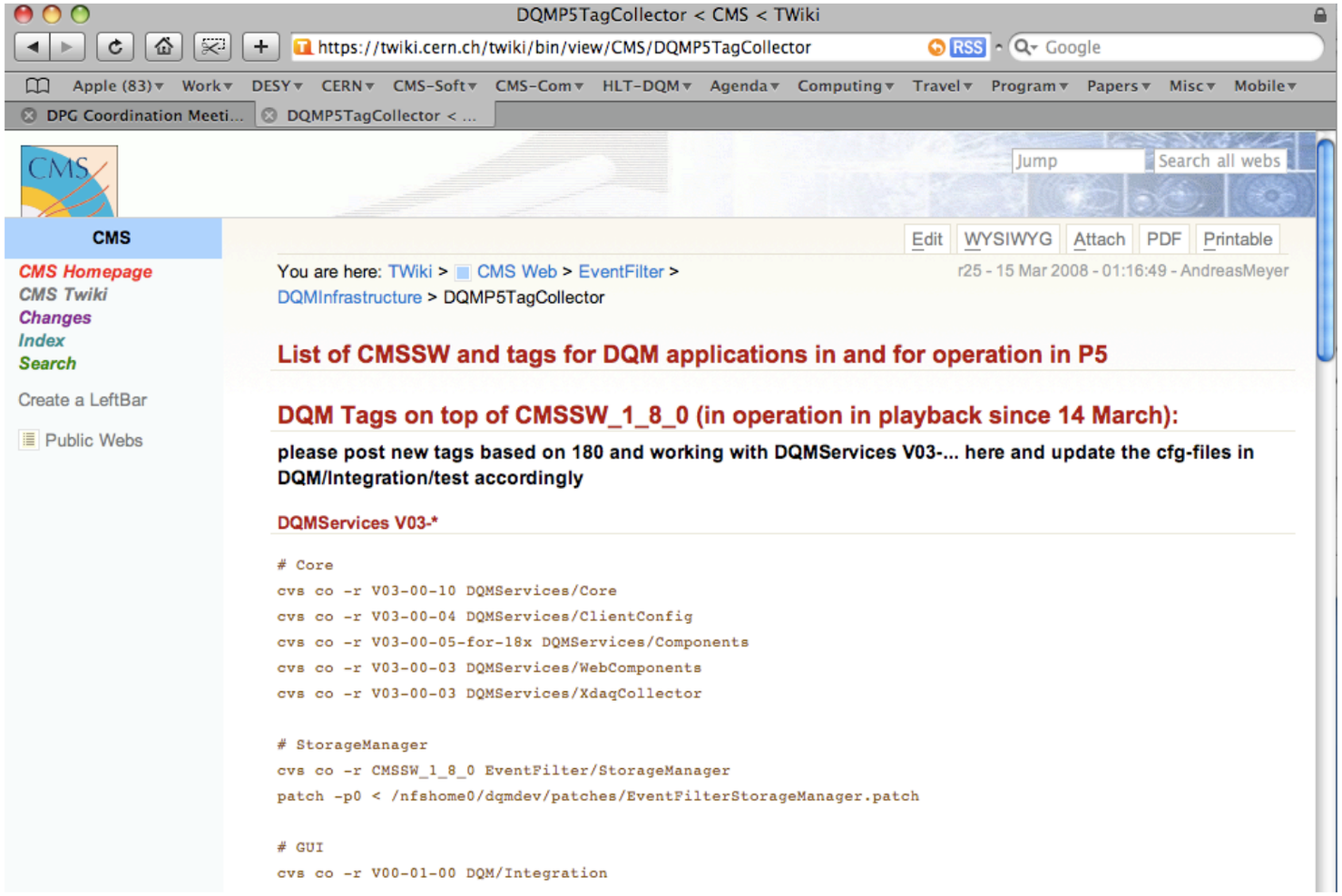
- **Minimize number of histograms as much as possible.**
  Online DQM is not detector commissioning

- **Stick to simple (1d) distributions where ever possible**
  Online DQM displays should be easy to understand

- **Make DQM shifters life as simple and straightforward as possible**
  - define a few, most relevant, simple-to-understand, summary histograms as top-level layout
  - define reference histograms and keep them up-to-date
  - provide individual subsystem instructions and keep them up-to-date
    will launch wiki-page based campaign shortly

Subsystem Code Development / Updates

- DQM code updates are accepted and integrated once per 1-2 day DQMPATCH:xx versioning
- Provide tags at "DQMTagCollector wiki page and per email https://twiki.cern.ch/twiki/bin/view/CMS/DQMP5TagCollector
- Make sure tags are tested in P5 (!)

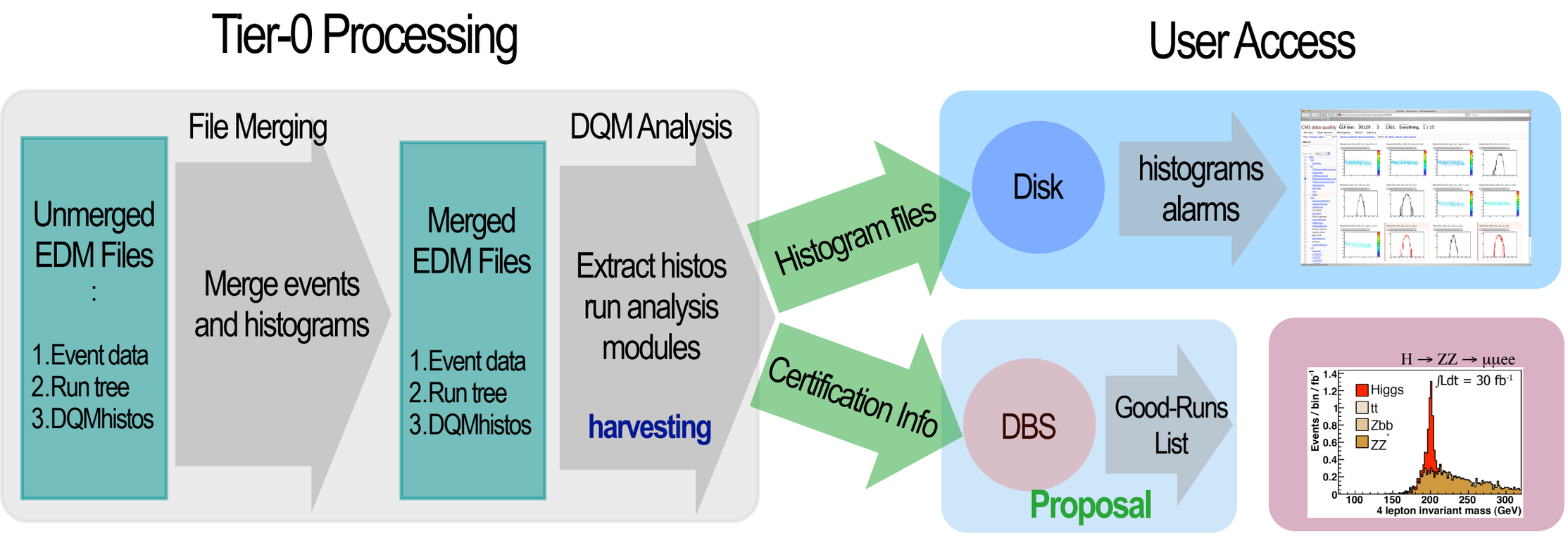


- Three DQM systems are in operation at P5:
  - Test system: GUI srv-c2d05-16 http://cmsmon.cern.ch/dqm/online-test
  - Playback system: Full set of applications + GUI srv-c2d05-18 http://cmsmon.cern.ch/dqm/online-playback
  - Production system: Full set of applications + GUI srv-c2d05-19 http://cmsmon.cern.ch/dqm/online

Offline DQM Tier-0 Validation / Physics Data Certification

- DQM core software components in place, workflows being tested
  - Histogram creation, filling and merging
  - Histogram harvesting, DQM analysis, transport to webserver
- DQM GUI web server:
  - machine with large disk for histogram file cache set up
  - Software being developed / deployed
- Data Certification, input to Good-Runs-List, schema proposed, no code

Baseline:
Proof of concept mode
"Best effort" operation



Data Certification Proposal

- Detailed proposal at https://twiki.cern.ch/twiki/bin/view/CMS/DataCertProposal

- Workflow:
  - Automated data certification will be done in Tier-0 as part of DQM harvesting step
  - Input from
    - DCS
    - DAQ
    - Online DQM
    - Offline DQM
    - what else?
  - Output will be written to conditions DB (for access during analysis) and to DBS (for run selection)

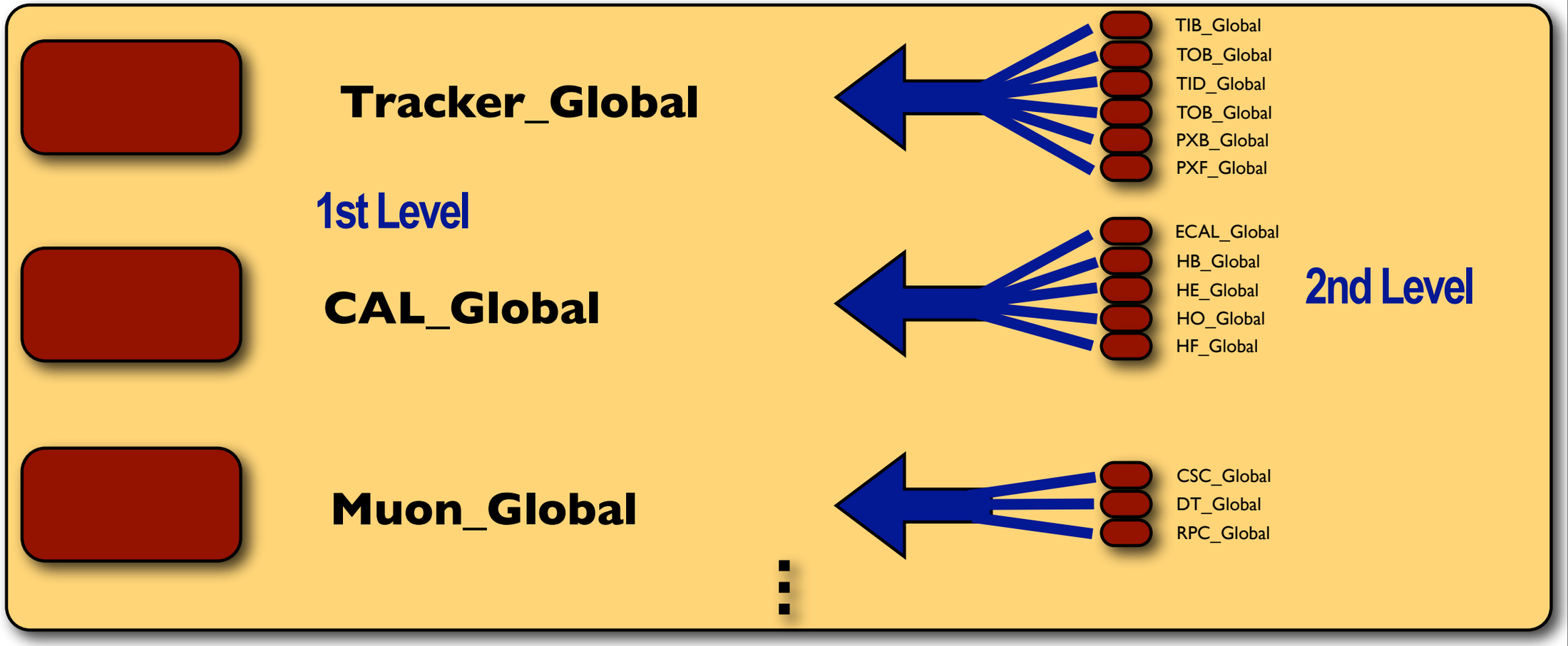
- Output Formats:
  - Global bits per subdetector (good/bad/unknown)
  - Local percentages per subdetector segment (floats) to be implemented
  - Proposed granularity at https://twiki.cern.ch/twiki/bin/view/CMS/DataCertQIM

Your input required on granularity and relevant information

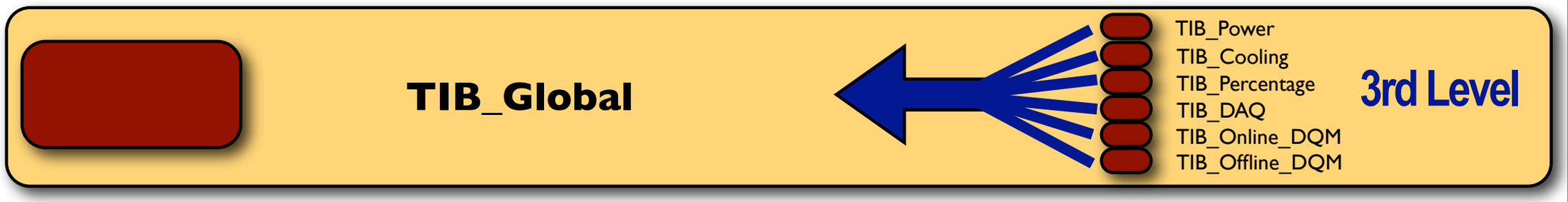
DBS Schema

QIM: Quality Information Mask

Exemplary QIM



- More detailed information on third level



- Selection can be made using all three levels

DQM Shift Planning

- 24/7 DQM and EVD Shift coverage (P5)

- P5 Online DQM shift person:
  - before shifts:
    - safety training & P5 access permissions
    - grid-certificate
    - read DQM shift instructions prior to arrival at P5
    - minimal ideas of operation at P5
    - try out DQM GUI in advance
  - during shifts:
    - keep DQM GUI up and running in Browser
    - look at histograms and note down problems
    - keep the histogram views readily available for interested experts
    - manually fill DBS with detector status bits per run (script provided)

- Plan to do DQM shift tutorial session on April 25 (morning) - shift list ready in advance (?)

Summary

- Baseline Operation
  - Online: Production mode, 24/7 operation
    - Live Histogramming using latest version of CMS DQM GUI
    - XDAQ (Run-control) based operation (for xdaq-based tracker DQM GUI)
    - Archival of histogram files on cmsmon (publication on WBM)
  - Offline (Tier-0): Proof of Concept, best effort operation
    - Establish routine production of histograms
    - Perform harvesting step (semi-manual)
    - Archival of histogram files on castor
- Goals
  - Deploy DQM GUI file backend (first in P5, then in Tier-0)
  - Expect subsystem code updates:
    - Individual histogramming configuration (layouts, renderplugins)
    - Detector status information
  - Manual generation of data certification info, input to DBS (DQM shifts)

Backup

Backup: DQM Links

- **Project wiki-page**
  https://twiki.cern.ch/twiki/bin/view/CMS/DQMInfrastructure
- **Online DQM Planning Document (DQM Workshop 27 August 07)**
  http://indico.cern.ch/getFile.py/access?resId=0&materialId=1&confId=19909

- **DQM GUI (on GR playback data)**
  http://cmsmon.cern.ch/dqm/online-playback
- **Web Based Monitoring and DQM Archive Browser**
  http://cmsmon.cern.ch/

- **Weekly EvF/DQM Meeting (Thursdays 16-18)**
  http://cmsevf.web.cern.ch/cmsevf/DQMMeetings.html
- **Hypernews forum on DQM development**
  https://hypernews.cern.ch/HyperNews/CMS/get/dqmDevel.html

DQM Core Infrastructure

- Code:
  - Histograms (aka MonitorElements) are registered in service DQMStore
  - MonitorElements (ME) are generalized Histograms
    The types TH1F, TH2F,TH3F, TProfile, TProfile2D, float, int, string are supported
  - DQM histogramming software is implemented in EDAnalyzer modules
  - Production execution of modules is defined in Configuration/StandardSequences/
- Functionality:
  - ME Transport: IP-sockets (online), file transfer (offline)
  - ME Persistency: Plain root-objects in root-files (TFile)
    (Tier-x only: intermediately write ME to EDMfiles and extract them back out)
  - ME Archival: files on disk (backup and long term storage on castor)
  - ME Visualization: DQM GUI
- Conventions:
  - ME Names: Use 'source name', e.g. EcalBarrel, RPC, ..., as histogram tree top level folder.
    - To be booked: /<source name>/<individual subsystem histograms>
  - File Structure: Use DQMFileSaver module for histogram file output
    - Output tree: /Run<number>/<source name>/RunSummary/<individual subsystem histograms>
  - Other conventions, e.g. those specific to Relval, CSA08, etc., being worked out

DQM Code Organization

- DQM group:
  - Core code in DQMServices
  - DQM Webserver GUI in VisMonitoring/DQMServer

- DPG, ALCA, POG, PAG:
  - DQM (online DQM - optionally re-run in offline)
    - part of online release for use in P5
  - DQMOffline (offline DQM data)
    - independent of MC (truth and Geant)
    - not in online release
  - Validation (offline DQM simulation)
    - not in online release

DQM dependent code is managed in one of 3 CVS subsystems

Packages outside these subsystems should NOT depend on DQM

List of packages in CVS:

DQM (DPG code, use in P5 and offline):

CSCMonitorClient/ CSCMonitorModule/ Calibration/ DTMonitorClient/ DTMonitorDisplayPlugins/ DTMonitorModule/ DTMonitorTasks/ EcalBarrelMonitorClient/ EcalBarrelMonitorDbModule/ EcalBarrelMonitorDisplayPlugins/ EcalBarrelMonitorModule/ EcalBarrelMonitorTasks/ EcalCommon/ EcalEndcapMonitorClient/ EcalEndcapMonitorDbModule/ EcalEndcapMonitorDisplayPlugins/ EcalEndcapMonitorModule/ EcalEndcapMonitorTasks/ EcalHcalBarrelMonitorModule/ EcalHcalBarrelMonitorTasks/ EcalPreshowerMonitorClient/ EcalPreshowerMonitorModule/ FEDMonitor/ GCTMonitor/ HLTEvF/ HLTObjects/ HLTPhysics/ HcalMonitorClient/ HcalMonitorModule/ HcalMonitorTasks/ Integration/ L1TMonitor/ L1TMonitorClient/ PhysicsObjectsMonitoring/ Pi0CalibMonitor/ RCTMonitor/ RPCMonitorClient/ RPCMonitorDigi/RPCMonitorModule/ RenderPlugins/ RootDBInterface/ SiPixelCommon/ SiPixelHistoricInfoClient/ SiPixelMonitorClient/ SiPixelMonitorCluster/ SiPixelMonitorDigi/ SiPixelMonitorRawData/ SiPixelMonitorRecHit/ SiPixelMonitorRecHits/ SiPixelMonitorTrack/ SiStripCommissioningAnalysis/ SiStripCommissioningClients/ SiStripCommissioningDbClients/ SiStripCommissioningSources/ SiStripCommissioningSummary/ SiStripCommon/ SiStripHistoricInfoClient/ SiStripMonitorClient/ SiStripMonitorCluster/ SiStripMonitorDigi/ SiStripMonitorDisplayPlugins/ SiStripMonitorHardware/ SiStripMonitorPedestals/ SiStripMonitorSummary/ SiStripMonitorTrack/ TrackerCommon/ TrackerMonitorTrack/ TrackingMonitor/ TrigXMonitor/ TrigXMonitorClient/ TrigXMonitorFitter/

DQMOffline (POG, PAG, ALCA)

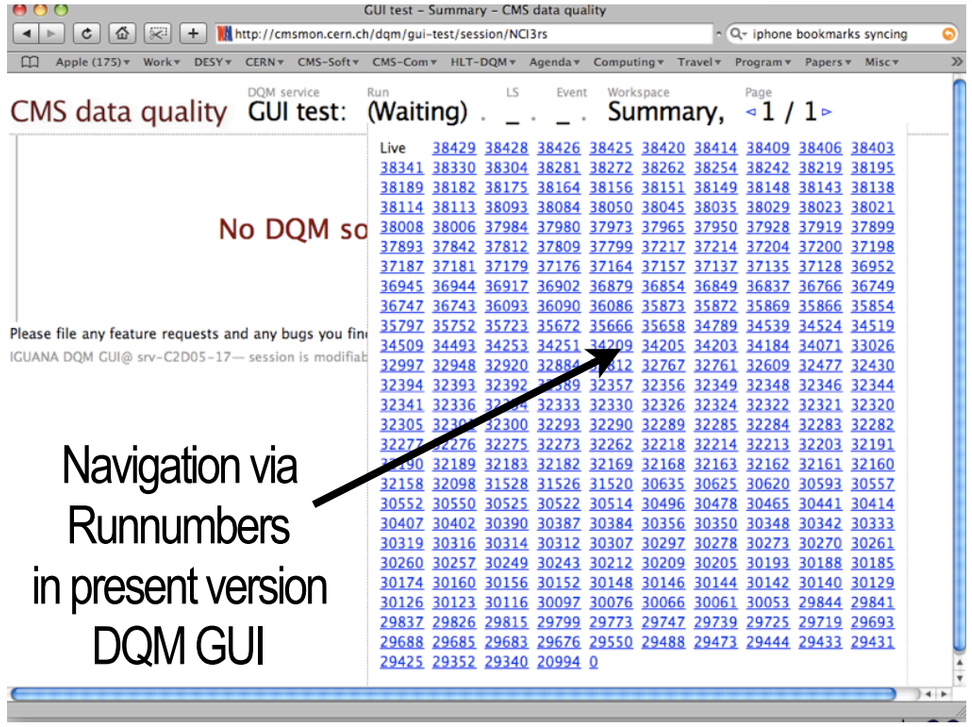
Configuration/ Ecal/ Integration/ Muon/

Validation (Relval, Simulation):

CSCRecHits/ CaloTowers/ CheckOverlap/ DTRecHits/ EcalClusters/ EcalDigis/ EcalHits/ EcalRecHits/ EcalTriggerPrimitives/ Geant4Releases/ Generator/ Geometry/ GlobalDigis/ GlobalHits/ GlobalRecHits/ HcalDigis/ HcalHits/ HcalRecHits/ MagField/ Mixing/ MuonCSCDigis/ MuonDTDigis/ MuonDigis/ MuonHits/ MuonIdentification/ MuonIsolationMuonRPCDigis/ MuonRPCGeometry/ Performance/ RPCRecHits/ RecoB/ RecoEgamma/ RecoJets/ RecoMET/ RecoMuon/ RecoParticleFlow/ RecoPixelVertexing/ RecoTau/ RecoTrack/ RecoVertex/ Tools/ TrackerConfiguration/ TrackerDigis/ TrackerHits/ TrackerRecHits/ TrackingMCTruth/ VertexReco/ VstConvertStdHep/ VstFewKDE/ VstMathUtils/ VstMcfio/ VstNtuple2txt/ VstOptimalBinning/ VstQuaero/ VstQuaeroUtils/ VstStdHep/ VstTurboSim/

Conventions / Data Segmentation CAF and Tier-0

- **Presently foresee 4 DQM file categories:**
  - (1) **Online DQM for real data**
  - (2) **Offline DQM for real data (Tier-0,1,2 and CAF)**
  - (3) **Offline DQM for MC data (e.g. CSA08)**
  - (4) **Offline DQM for RelVal**



- **Envisaged DQM file naming convention for real data (2):**

  $producer/$step/$stream/$runnr[1:3]/$runnr[4:6]/$runnr[7:9]/DQM_R$runnr_V$version__$workflow.root

  E.g.:

  Tracker/CAF1/Global-A/000/038/415/DQM_R0000038415_V1__Global-A__Online-CMSSW_2_0_0__RECO.root

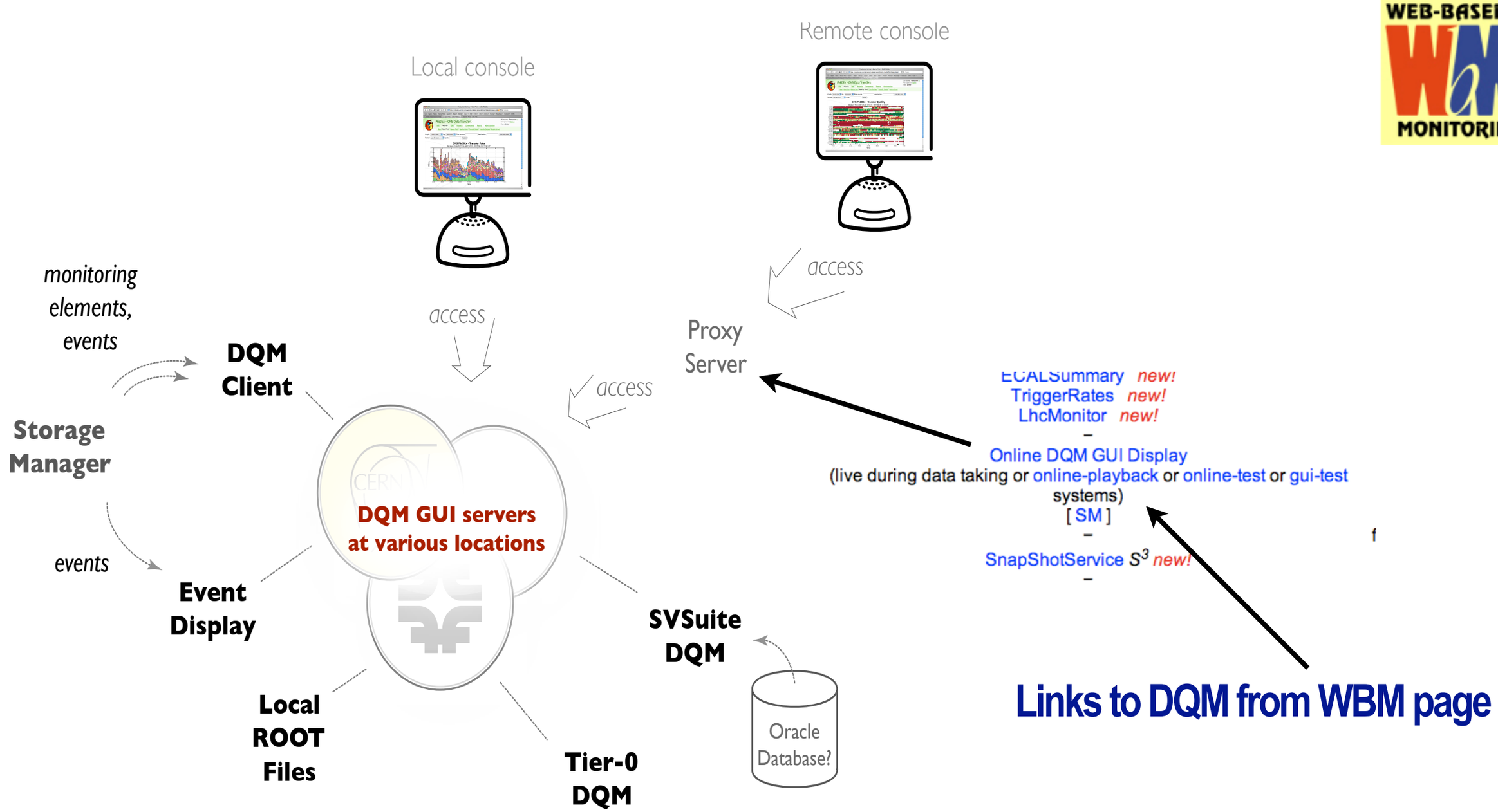
- **Internal file directory structure:**

  Run $runnr/$subsystem/Run summary/$monitor_element_name

- **For MC (e.g. Relval, CSA08): Replace** $stream **by** $dataset

This is a draft based on first discussions with WM/DM, Tier-0, CSA08, ALCA, Relval
Need complete picture → your input !

DQM GUI

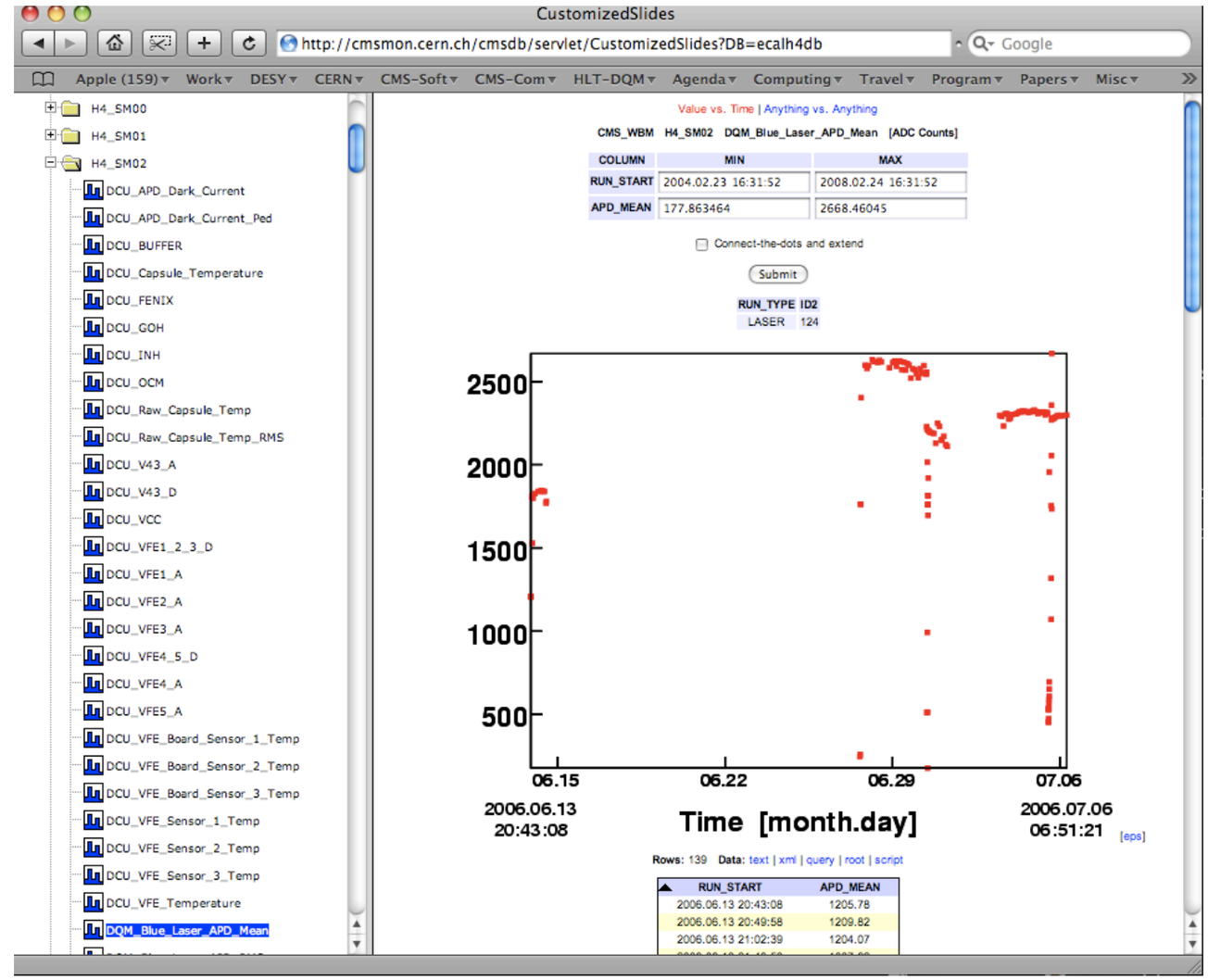


cmsmon is set up as a proxyserver to the DQM webservers installed in P5

History and Trending Plots

Planned

- Two methods are planned
  - History from GUI (file)
    - full flexibility
    - potentially long latency
  - History from DB
    - can only plot what was previously stored
    - reuse standard DB access interface, e.g. WBM
- History from DB:
  - run extraction job on selected histograms in DQM file and fill information into DB
  - Looking for help in implementation



Example: ECAL DQM

Automated Data Quality Tests

Existing / Upgrade soon

- Code for automated quality testing exists and is centrally supported
- Upgraded code including comparisons with reference histograms will become available in the next weeks
- Please use the QualityTester module in DQMServices/Components for any quality tests (no calls from C++)

	QUALITY TEST:	Usage in DQM package:	Parsable ?
1	Comp2RefChi2	NO	NO
2	Comp2RefKolmogorov	NO	NO
3	Comp2RefEqualString	NO	NO
4	Comp2RefEqualInt	NO	NO
5	Comp2RefEqualFloat	NO	NO
6	Comp2RefEqualH1	NO	NO
7	Comp2RefEqualH2	YES: HcalMonitorClient	NO
8	Comp2RefEqualH3	NO	NO
9	ContentsXRange	YES: CSC/RPC/Hcal/L1T/SiPixel/ SiStrip/MonitorClient	YES
10	ContentsYRange	YES: CSC/DT/RPC/Hcal/L1T/SiPixel/ SiStrip/MonitorClient	YES
11	DeadChannel	YES: DT/RPC/L1T/SiPixel/ MonitorClient	YES
12	NoisyChannel	YES: DT/RPC/L1T/ MonitorClient	YES
13	ContentsTH2FWithinRange	YES: HcalMonitorClient	YES
14	ContentsProfWithinRange	YES: DTMonitorClient	YES
15	ContentsProf2DWithinRange	NO	YES
16	MeanWithinExpected	YES: RPC/FED/Hcal/L1T/SiPixel/ SiStrip/MonitorClient	YES
17	MostProbableLandau	NO	YES
18	AllContentWithinFixedRange	NO	NO
19	AllContentWithinFloatingRange	NO	NO
20	FlatOccupancy1d	NO	NO
21	FixedFlatOccupancy1d	NO	NO
22	CSC01	NO	NO
23	AllContentAlongDiagonal	NO	NO