Introduction to DQ monitoring

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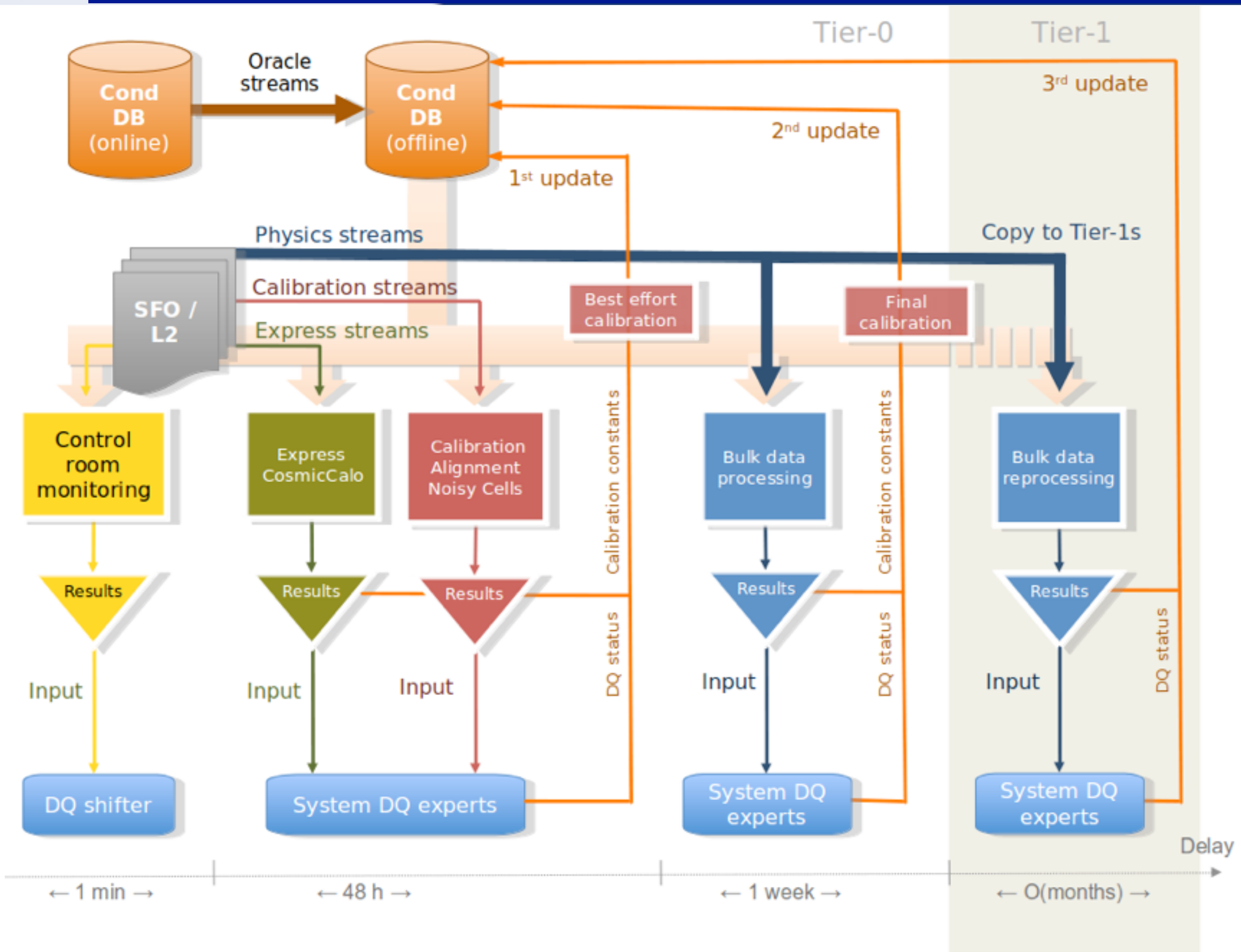
Outline

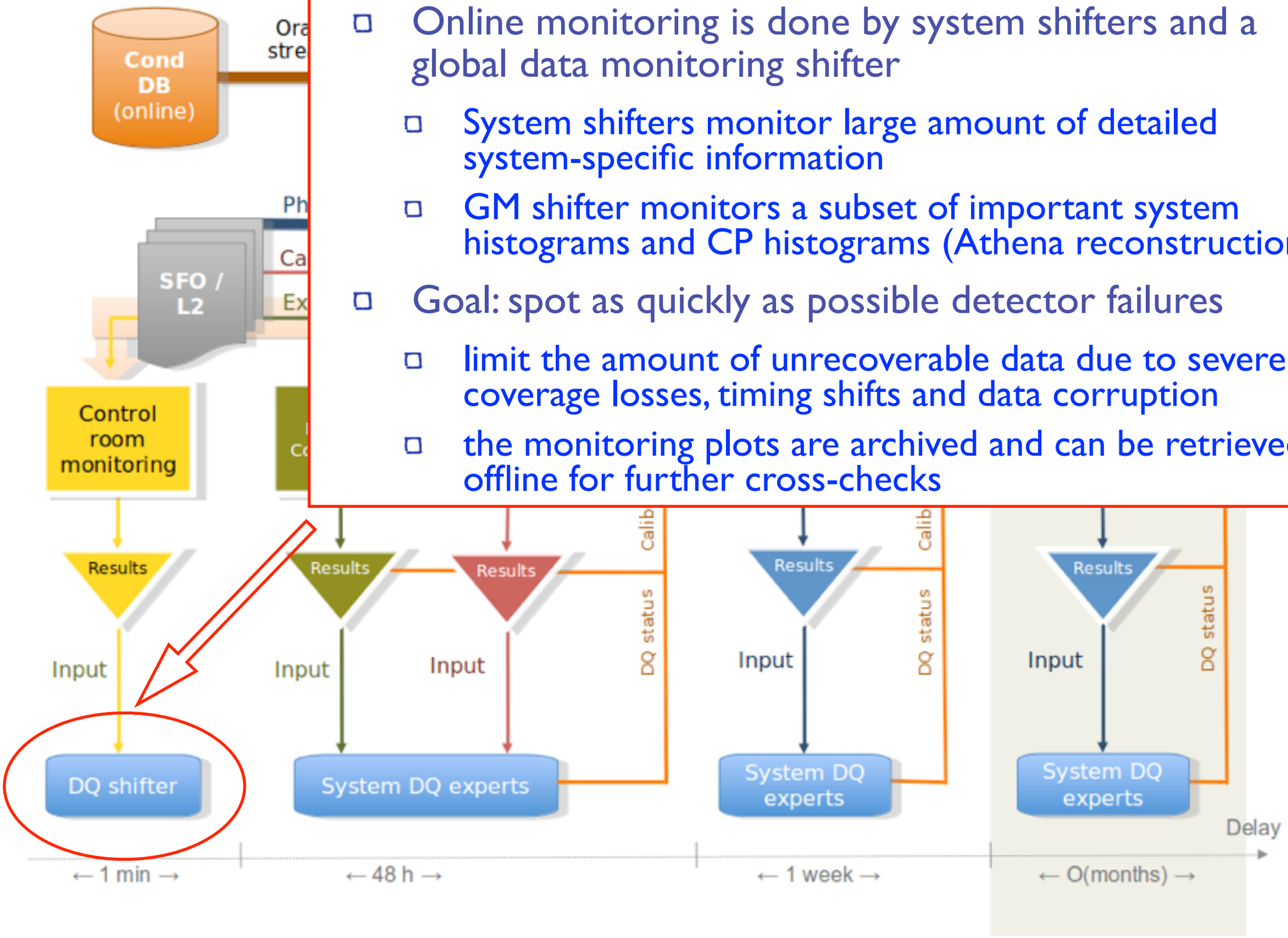
- Data quality assessment in ATLAS
- Main tasks of DQM in ACR
- DQM tools
  - OHP
  - DQMD
  - Trigger Presenter
  - Event displays
  - OH display
- Conclusions

Data quality operation scheme in run I



Data quality operation scheme in run I

- Online monitoring is done by system shifters and a global data monitoring shifter
  - System shifters monitor large amount of detailed system-specific information
  - GM shifter monitors a subset of important system histograms and CP histograms (Athena reconstruction)
- Goal: spot as quickly as possible detector failures
  - limit the amount of unrecoverable data due to severe coverage losses, timing shifts and data corruption
  - the monitoring plots are archived and can be retrieved offline for further cross-checks



Steps in DQ evaluation

Online histograms

Automatic checks: online DQMF

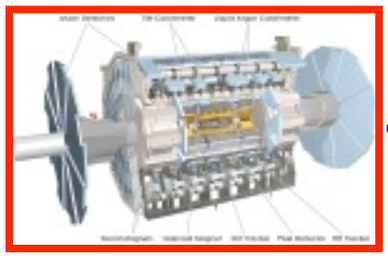
Online shifter

Detector Control System

DCS status calculator

Offline Shifter

Defects entry to DB



Atlantis

Event displays

VP1

Offline histograms

Automatic checks: offline DQMF

Data source

Program

Humans

DB entry

Steps in DQ evaluation

Online histograms

Automatic checks: online DQMF

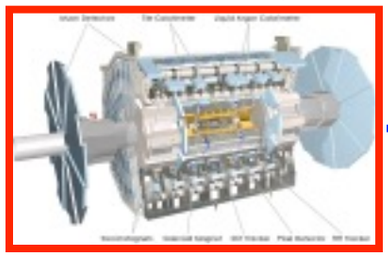
Online shifter

Detector Control System

DCS status calculator

Offline Shifter

Defects entry to DB



Atlantis

Event displays

VP1

Offline histograms

Data source

Each system enters defects in DB instead of assigning good/bad/questionable flags

- ✓ Information instead of decision
- ✓ Intolerable defects
  - data is useless for any analysis
- ✓ Tolerable defects
  - data have some flaws but can be used
  - should be checked at the object level
- ✓ Online-offline communication is critical
  - severe problems are often more visible online

Atlas DQ page

ATLAS Data Quality Monitoring

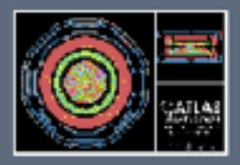
DQ Conveners

Sarah Demers
Anyes Taffard
Elizaveta Shabalina
James Frost

DQ Tools

Yuriy Ilchenko
Peter Onyisi

Latest Atlantis events



Runs to be considered for DQ checks

Wed Apr 29 2015 13:31:02 GMT+0200 (CEST)

Run	Tag & Period	Start/End	Evts	Tier0 Reco Status	Missing Sign-Off	Sign-Off Day	End of Calib Loop
263123	data15_cos data period C8	2015-04-25 17:47 CEST 2015-04-26 10:02 CEST	12048120	ES1: G G BLK: G G U G	TRIG PIXEL CALO ALFA LAR ID EGAMMA LUMI MBTS TAU ZDC LCD MCP BTAG SCT	2015-04-27	2015-04-28 10:06

News & Documentation

General Information
- DQ TWiki (people, shifts, links & tasks)
- DQ Meeting Agendas - Wedn 4-6pm
- ATLAS Run Meetings - Daily 9:30am
- Weekly Run Meetings - Weekly Tue 9:30am
- General Announcements Mailing list

Troubleshooting
- DQ Frequently Asked Questions
- DQ Help e-group
- DQ Developers e-group

Documentation
- RC Guidelines to Stop a Run
- Useful DQ Links

Shifts & OTP

DQ Shifts
- How to become DQ shifter in ACR
- How to become DQ shifter OFFLINE
- OTP Shift Booking

DQ Shifters Tools
- Online DQ Shift Instructions
- Online DQ Shift Instructions (P1)
- Offline DQ Shift Instructions
- DQ Crew Phonebook
- DQ Experts Phonebook

DQ Reports
- DQ Checks Morning Email
- DQ Signoff & Logbook
- DQ Offline Shifter Twiki

Data Quality Tools

DQ Web Displays
- Tier-0 Histograms
- Archived Histograms (MDA & CoCa)
- Web interface to Online Information Service
- DQ History Plots

DQ Jira Bugs
- DQ Infrastructure
- Central Services Operations
- Reconstruction
- ID & Tracking
- Jet/Etmiss

Atlas DQ page

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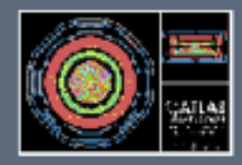

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DQ Jira Bugs
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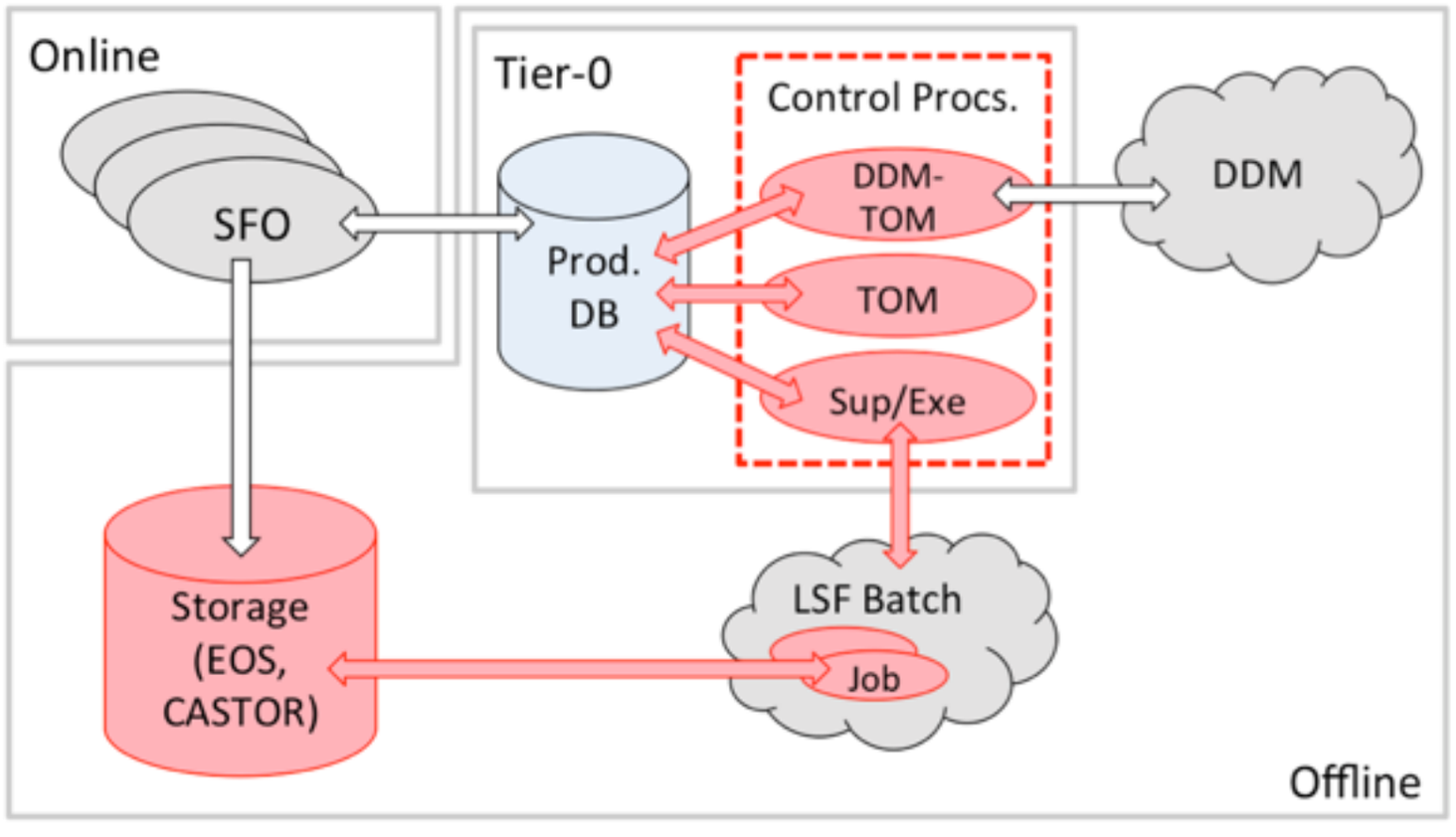
- Jet/Etmiss

Main tasks of DQ desk

- Watch the correct running of the (online) Data Quality infrastructure at Point 1
- Check the most relevant histograms of the systems and Combined Performance Groups and report any problems
- Operate the Event Displays on the projectors in the ACR
- Watch the DQMD (Data Quality Monitoring Display) showing the automatically assigned DQ status flags of all systems
- Watch the luminosity and beam conditions plots in the LHC FSM, and the corresponding DCS alarm panel
- Monitor offline computing (Tier0) (new task in Run 2)
- Check archiving of online histograms
- Document temporary issues, e.g. "application XYZ is frequently crashing and needs to be watched and restarted, bug fix underway" in the Data Quality White Board and log book

Offline computing monitoring

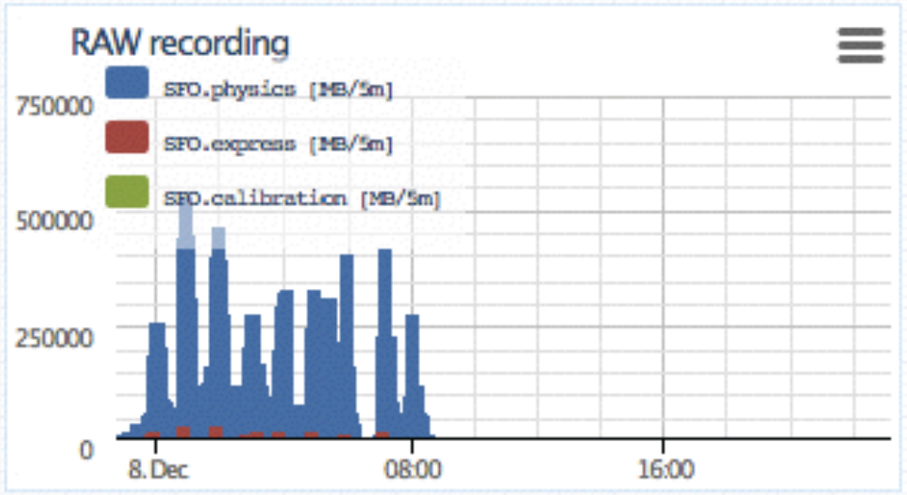


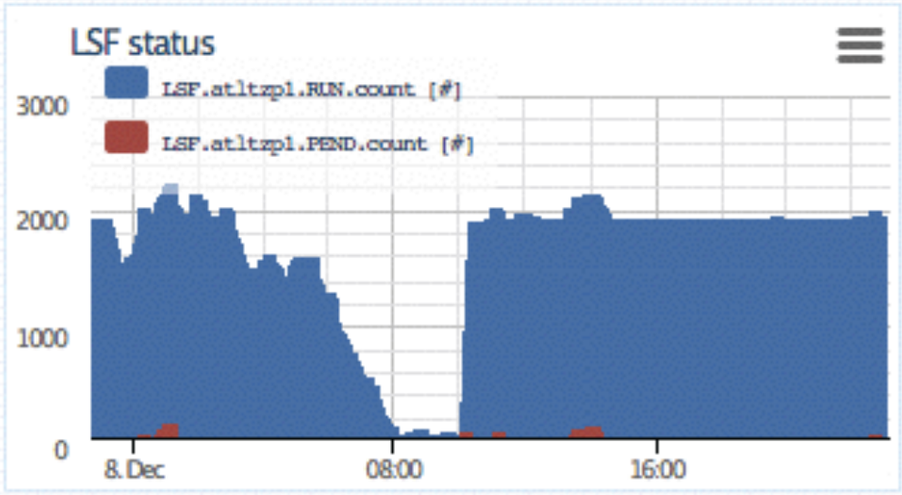
- Tier-0 responsibilities:
  - Archival of RAW data from the SFOs
  - Management, orchestration, execution of first-pass processing
  - Registration of all data products, preparation for export to Tier-1 centres

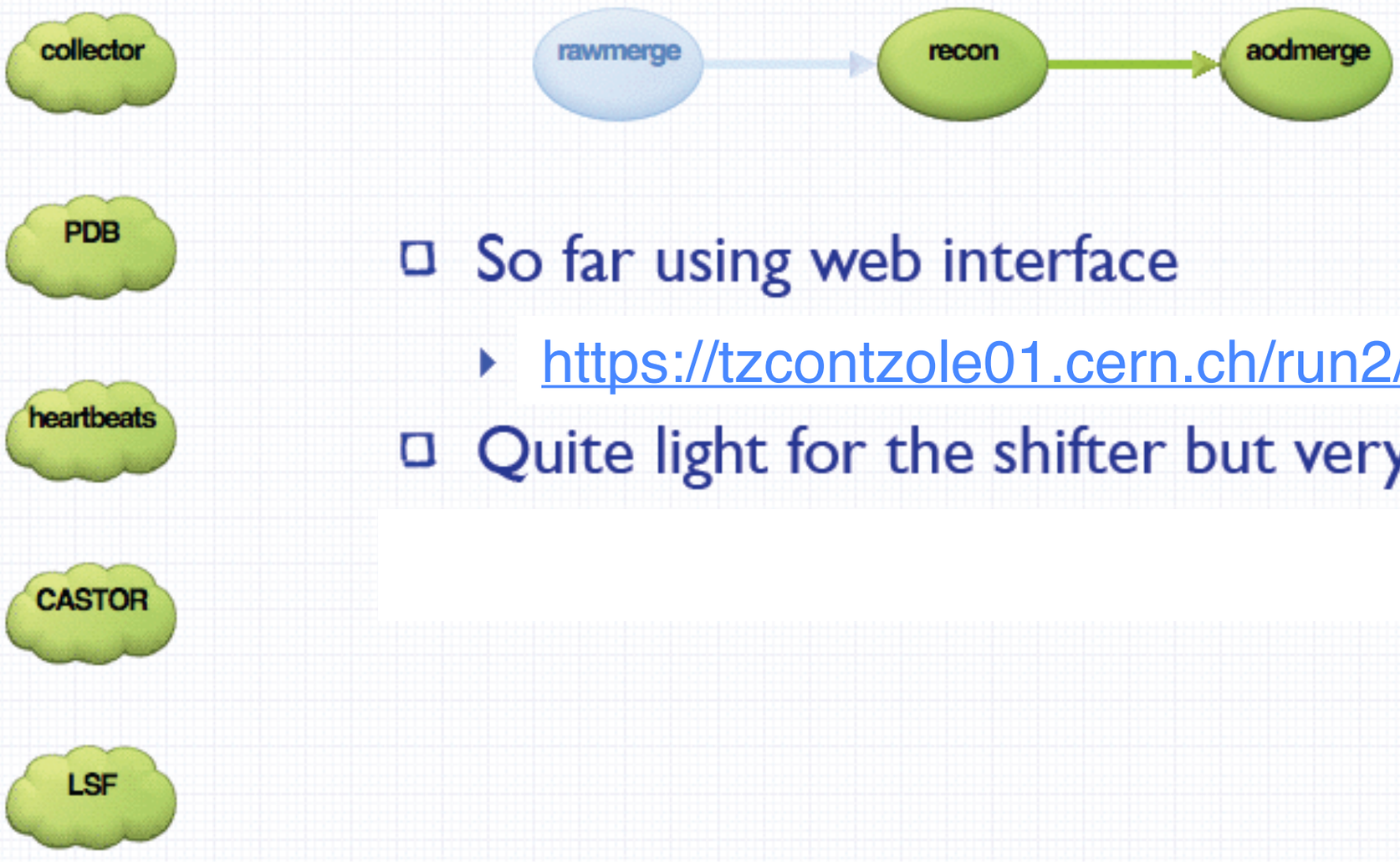
The DQ shifter monitors the basic functionality of the Tier-0 and offline infrastructure:

- Uptime ("heartbeat") of Tier-0 control processes
- Frequency of transfer failures (status of storage system, relevance for online/SFOs)
- Frequency of job failures

T0 monitoring



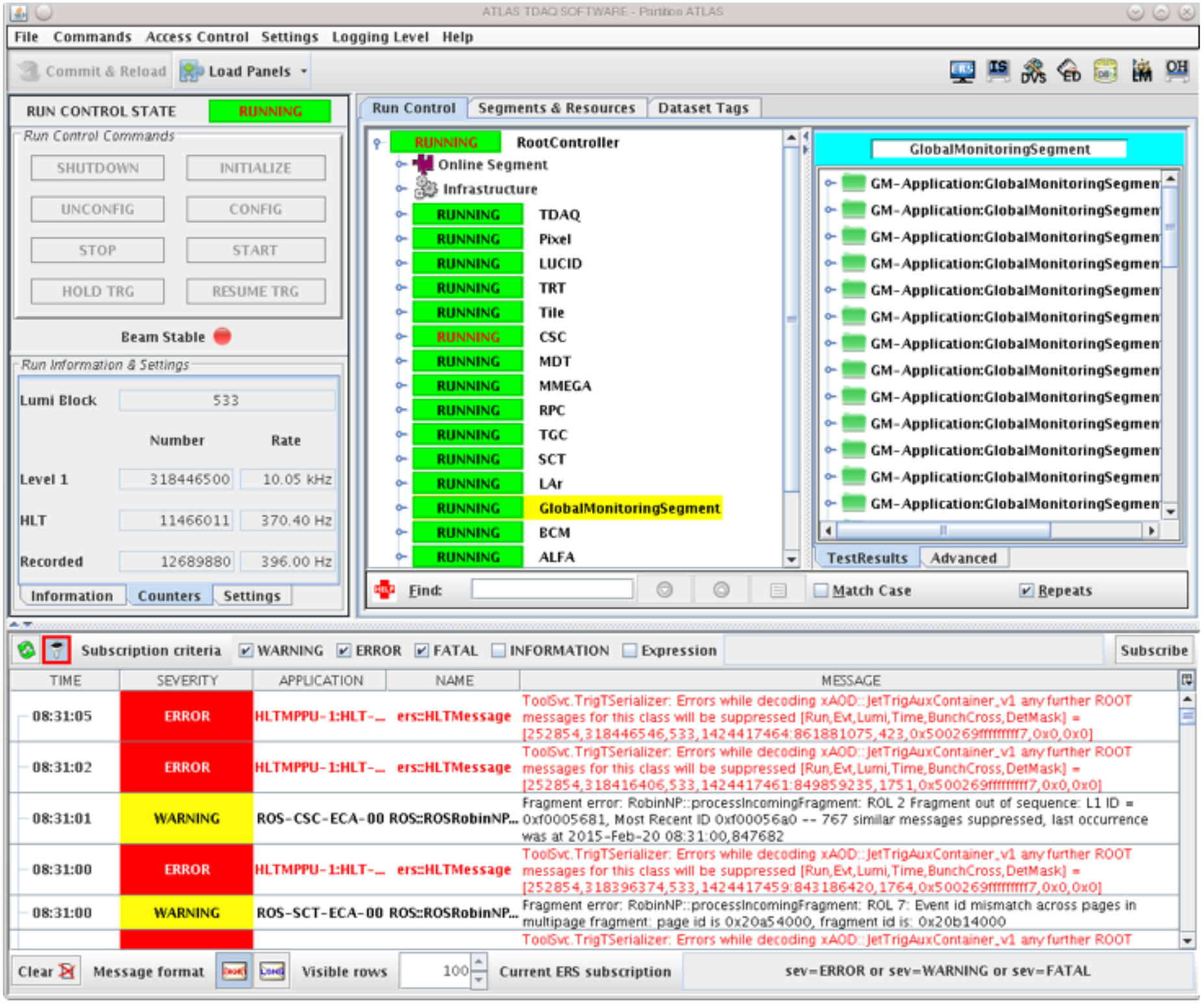




- So far using web interface
  - https://tzcontzole01.cern.ch/run2/monitor/
- Quite light for the shifter but very successful

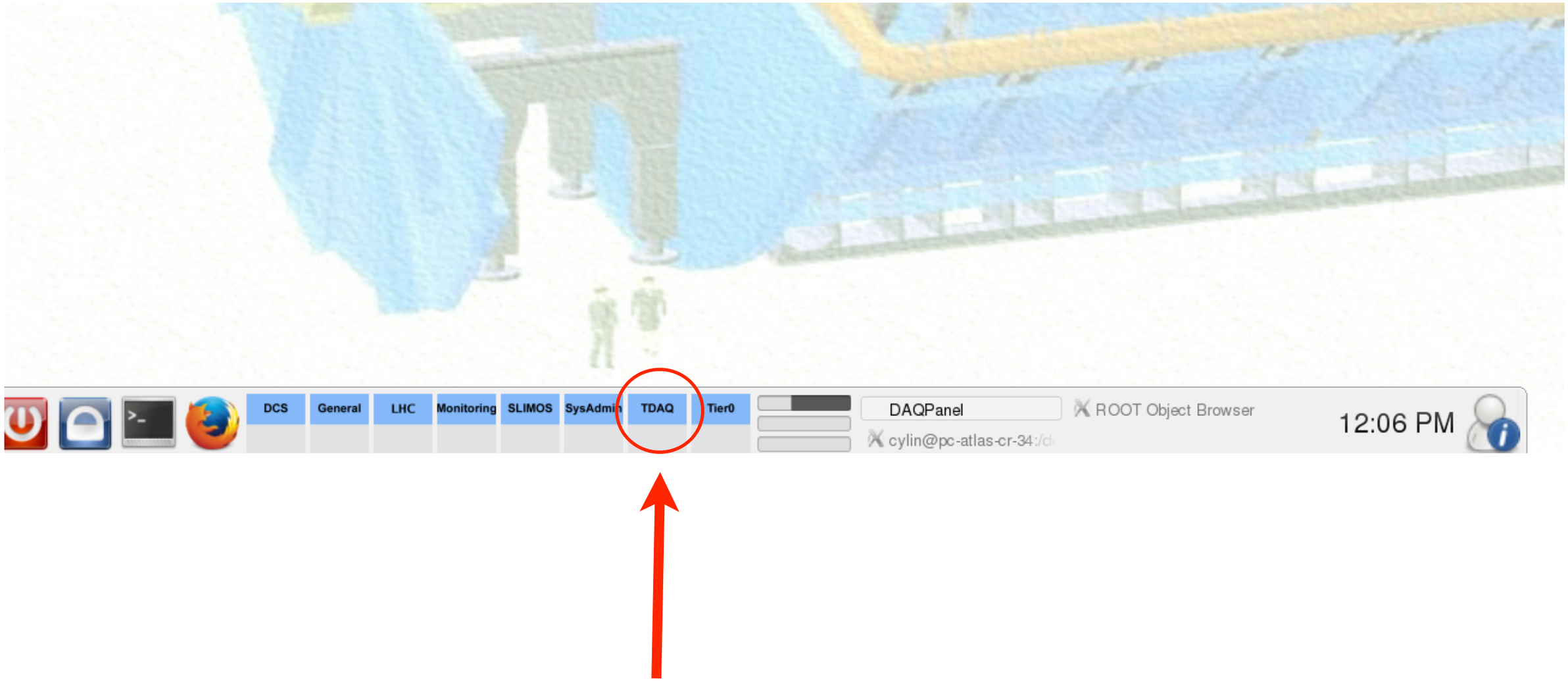
Monitoring applications

- DQ applications run automatically in ATLAS partition



DQM tools

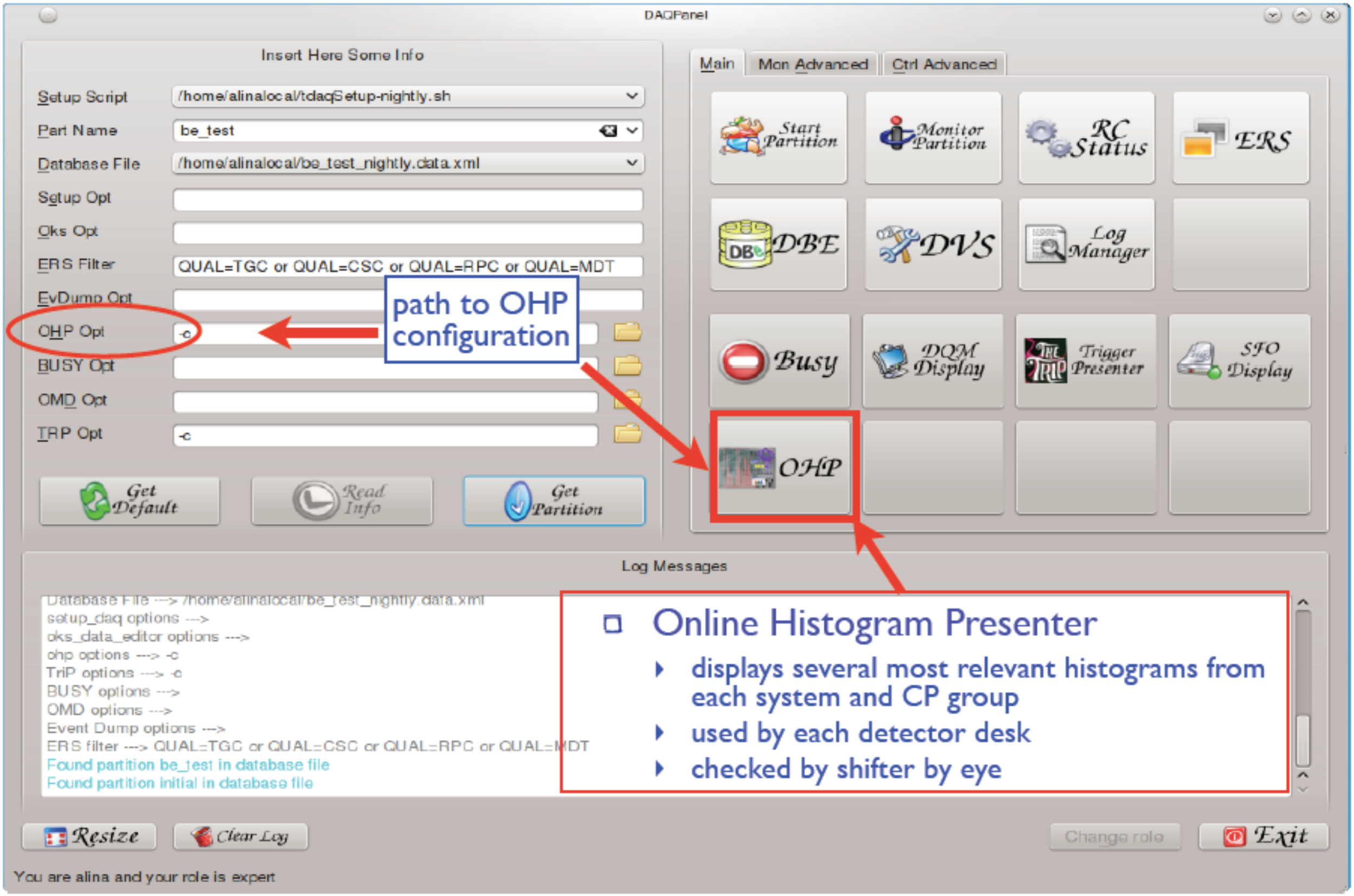
- DQM tools can be opened from DAQ panel: TDAQ→DAQ panel



DQM tools: OHP

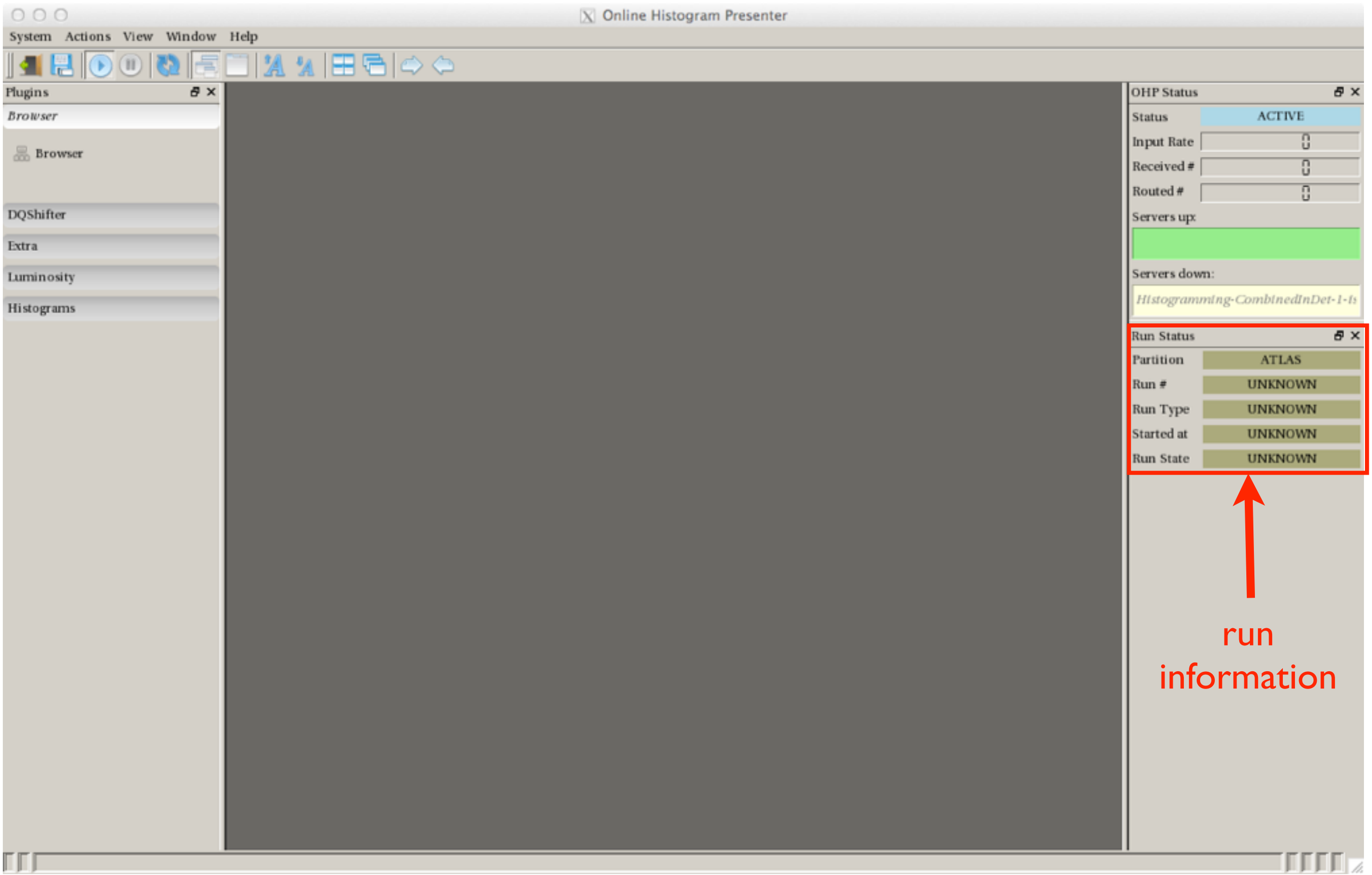
- Online Histogram Presenter
  - displays several most relevant histograms from each system and CP group
  - checked by shifter by eye

DQM tools: OHP

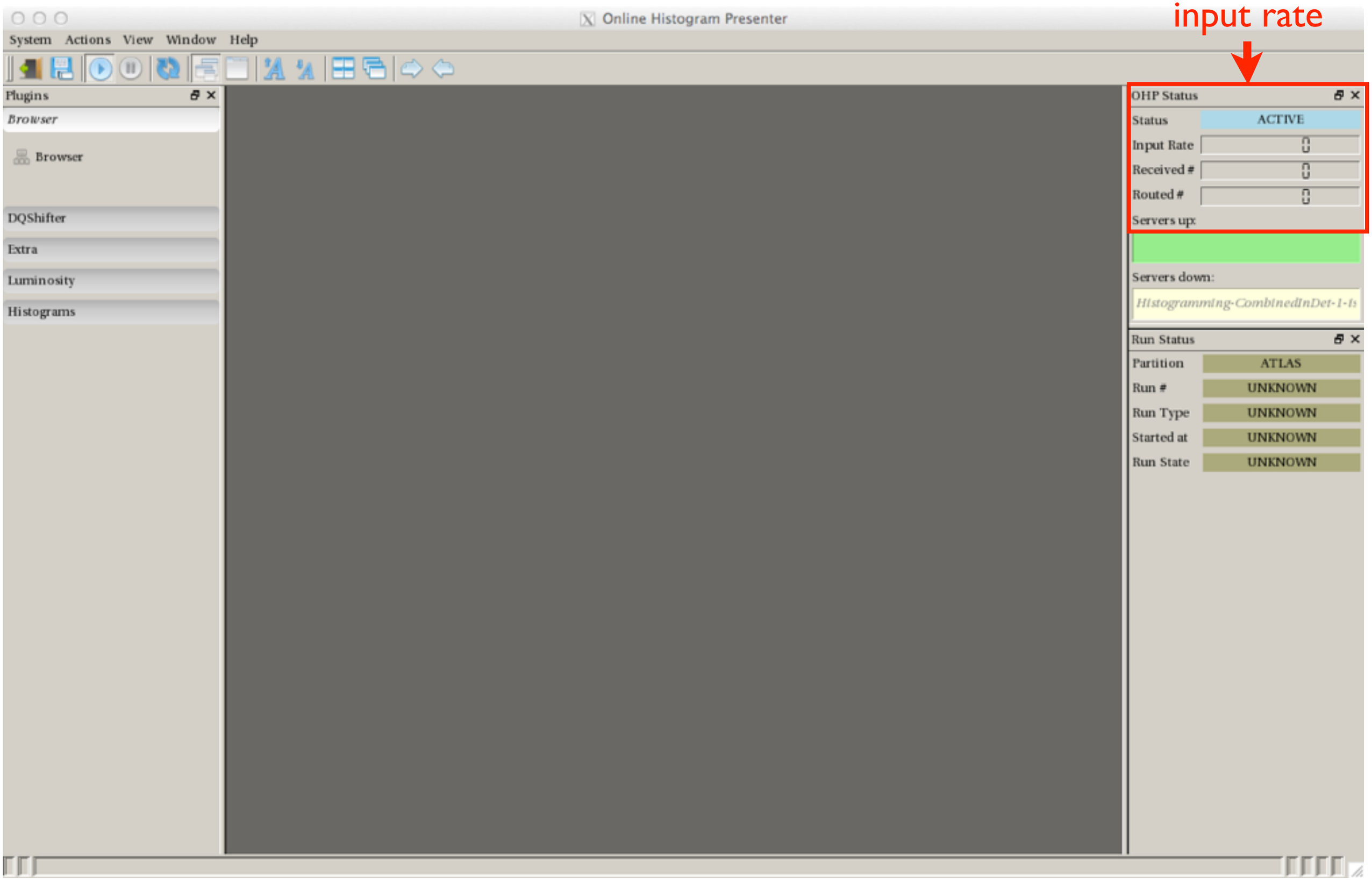


- Online Histogram Presenter
  - displays several most relevant histograms from each system and CP group
  - used by each detector desk
  - checked by shifter by eye

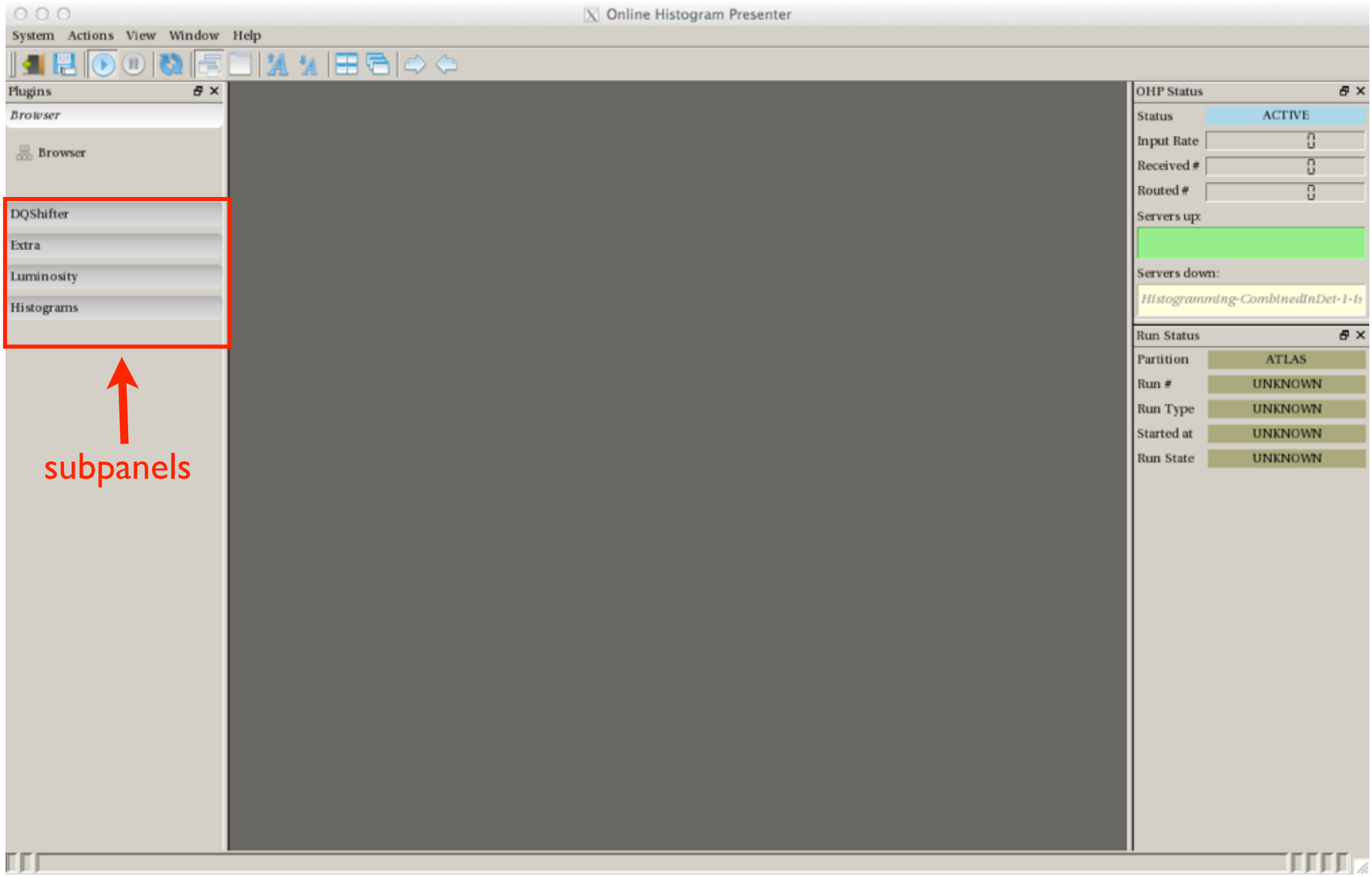
OHP main panel



OHP main panel

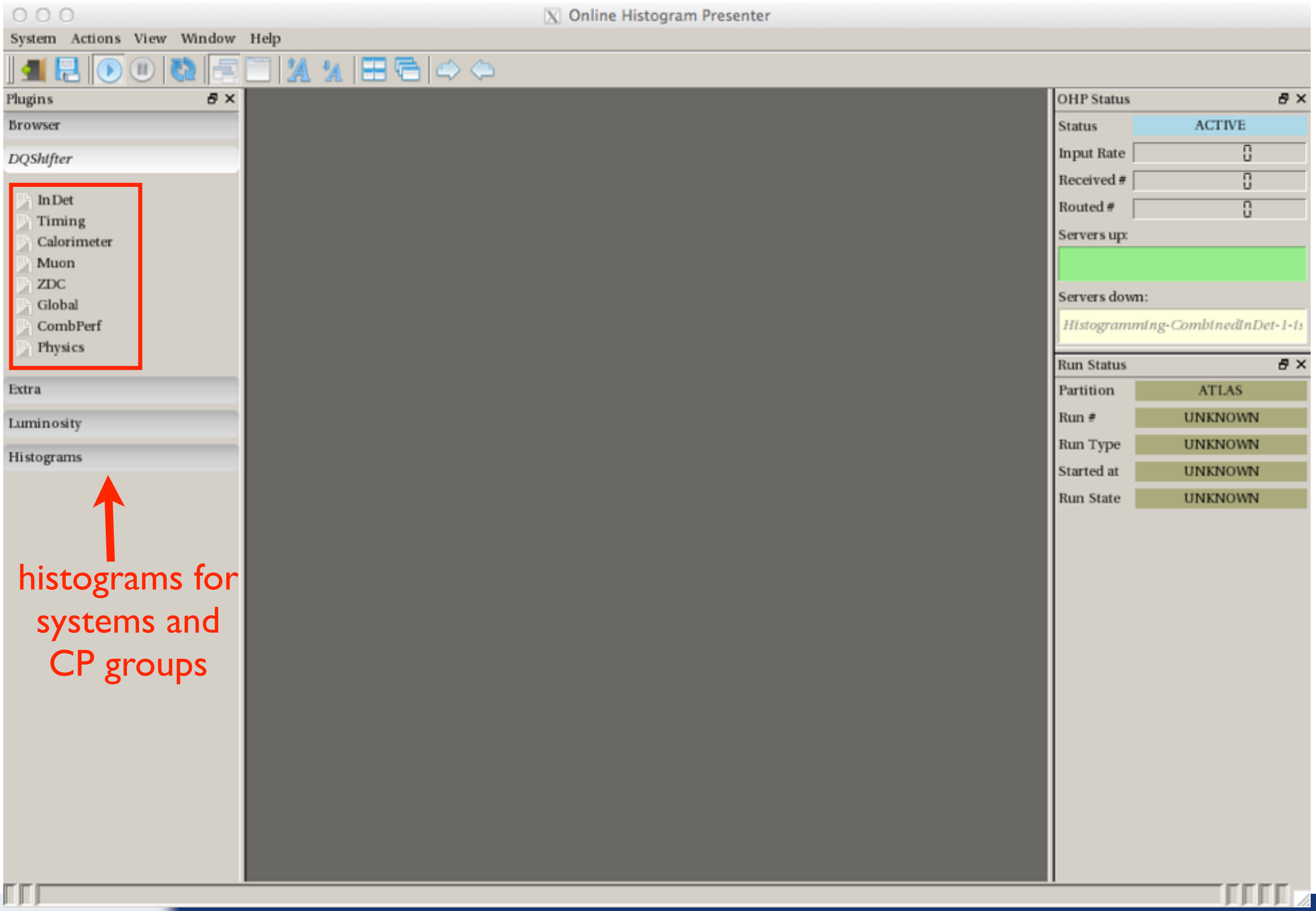


OHP main panel



subpanels

OHP DQ shifter panel



histograms for systems and CP groups

OHP DQ shifter panel

Online Histogram Presenter

System Actions View Window Help

Plugins

Browser

DQShifter

- InDet
- Timing
- Calorimeter
- Muon
- ZDC
- Global
- CombPerf
- Physics

Extra

Luminosity

Histograms

InDet

TRT-Timing | TRT-Hits | TRT-Tracking

Histogramming-CombinedInDet-1-ts/CombinedInDet_Merged/TRT/Shift/EndCap/ htRelation_C *is not found*

Histogramming-CombinedInDet-1-ts/CombinedInDet_Merged/TRT/Shift/Barrel/ htRelation *is not found*

Histogramming-CombinedInDet-1-ts/CombinedInDet_Merged/TRT/Shift/EndCap/ htRelation_A *is not found*

Histogramming-CombinedInDet-1-ts/CombinedInDet_Merged/TRT/Shift/EndCap/ hDriftTimeonTrkDist_C *is not found*

Histogramming-CombinedInDet-1-ts/CombinedInDet_Merged/TRT/Shift/Barrel/ hDriftTimeonTrkDist *is not found*

Histogramming-CombinedInDet-1-ts/CombinedInDet_Merged/TRT/Shift/EndCap/ hDriftTimeonTrkDist_A *is not found*

Histogramming-CombinedInDet-1-ts/CombinedInDet_Merged/TRT/Shift/EndCap/ hTronTDist_C *is not found*

Histogramming-CombinedInDet-1-ts/CombinedInDet_Merged/TRT/Shift/Barrel/ hTronTDist *is not found*

Histogramming-CombinedInDet-1-ts/CombinedInDet_Merged/TRT/Shift/EndCap/ hTronTDist_A *is not found*

OHP Status

Status	ACTIVE
Input Rate	
Received #	
Routed #	

Servers up:

Servers down:

Histogramming-CombinedInDet-1-ts

Run Status

Partition	ATLAS
Run #	UNKNOWN
Run Type	UNKNOWN
Started at	UNKNOWN
Run State	UNKNOWN

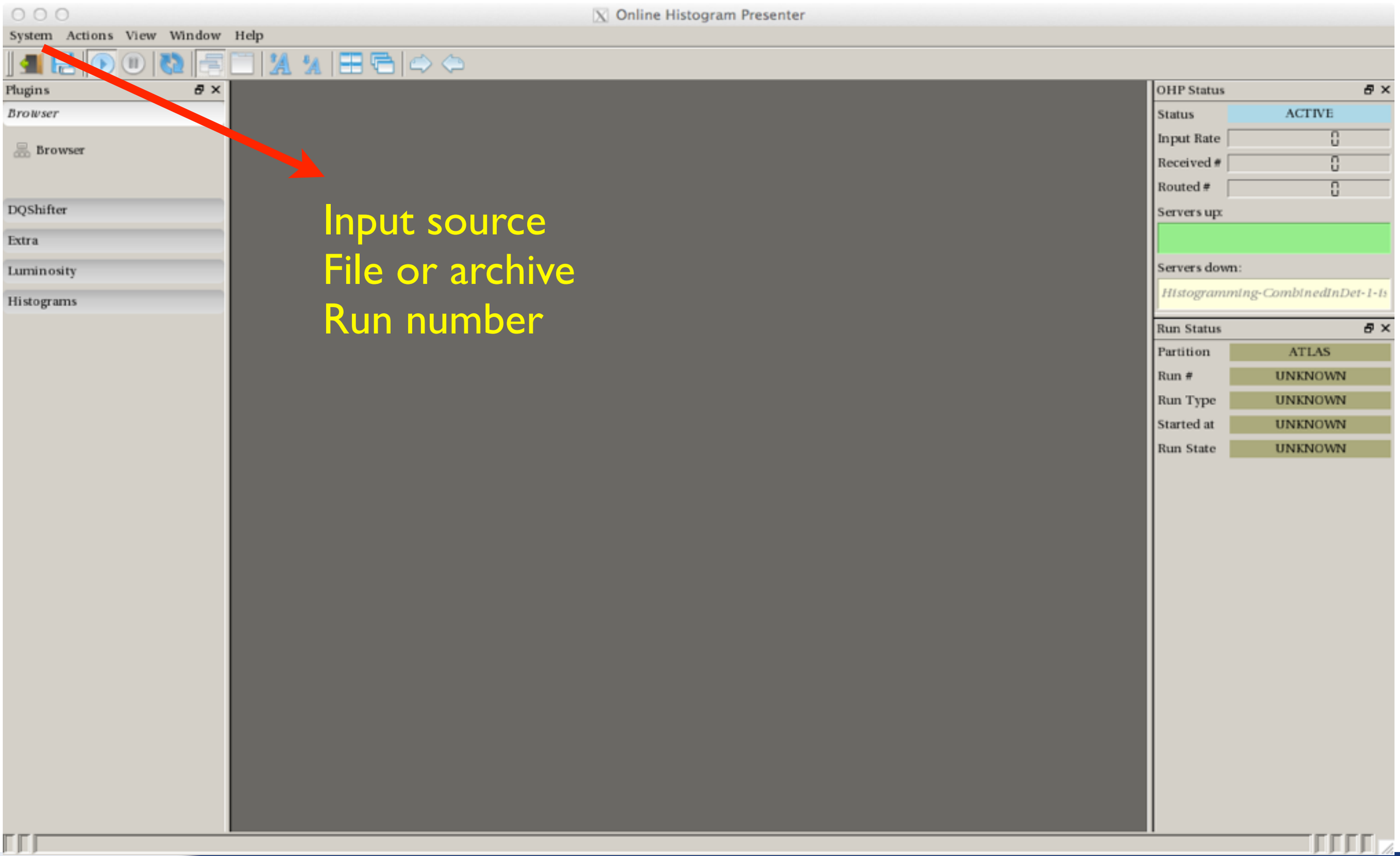
Histogram name

If configuration is correct no empty histograms should be seen

Report empty histograms in the logbook

OHP main panel

It is possible to look at the run information from the previous run



OHP on the web

https://atlasop.cern.ch/tdaq/web_is/ohp

OHP Web View

These pages have been automatically created from the OHP configuration files in Point 1.

General	ATLAS	Trigger	BPTX	DAQ	Timing
Inner Detector	Inner Detector	Beamspot			
Calorimeters	Calo/Forward	Tile			
Muon	Muon (Shifter)	MDT	RPC	TGC	CSC

If your system is not here or plots are missing, it's most likely that the XML from your configuration could not be parsed.

Inside Point 1 run this command

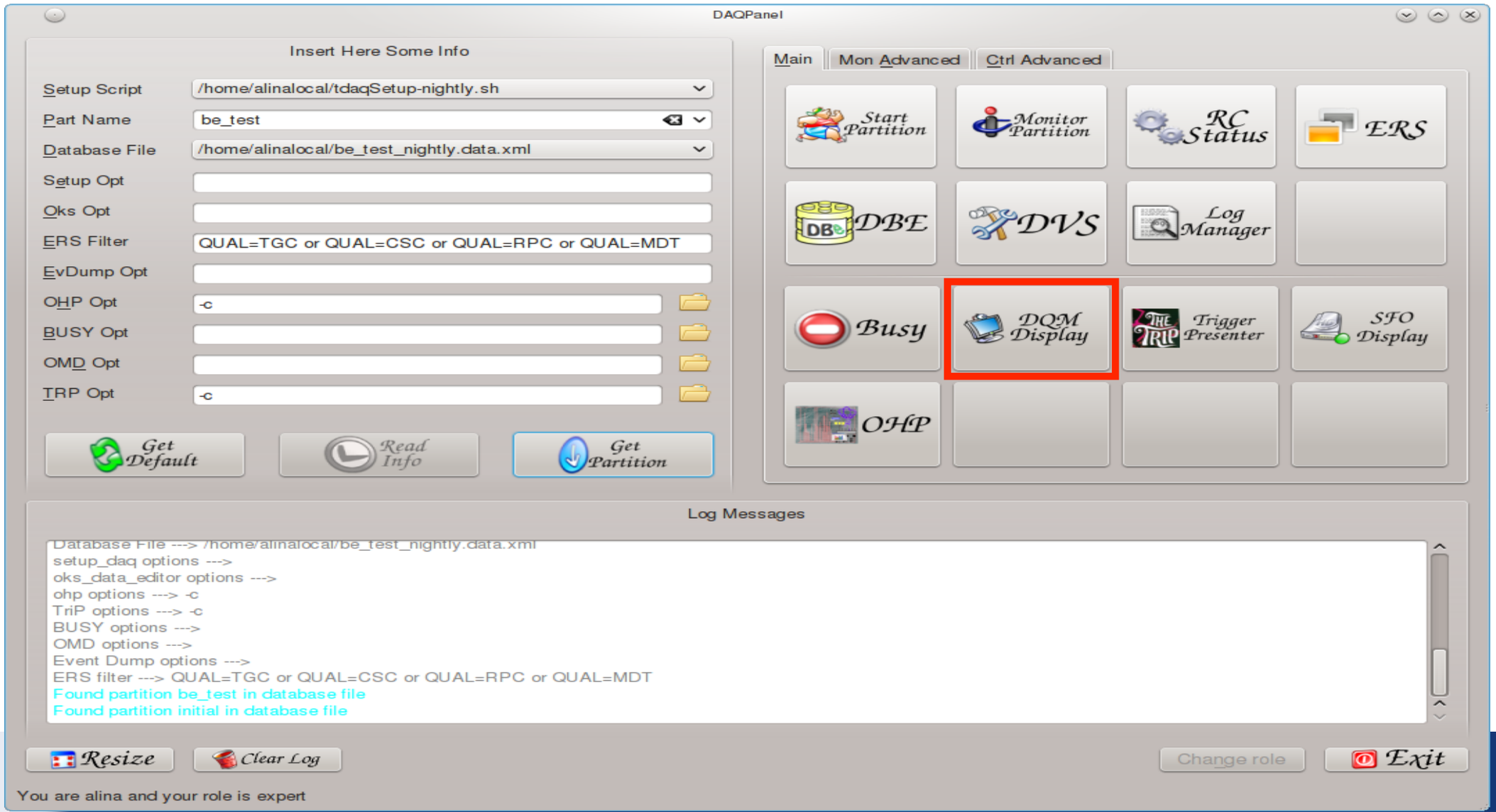
```
~rhauser/ohp/ohp2webis.py /path/to/your/ohp.xml YourDetector
```

and look at the errors you get.
Reiner.Hauser@cern.ch

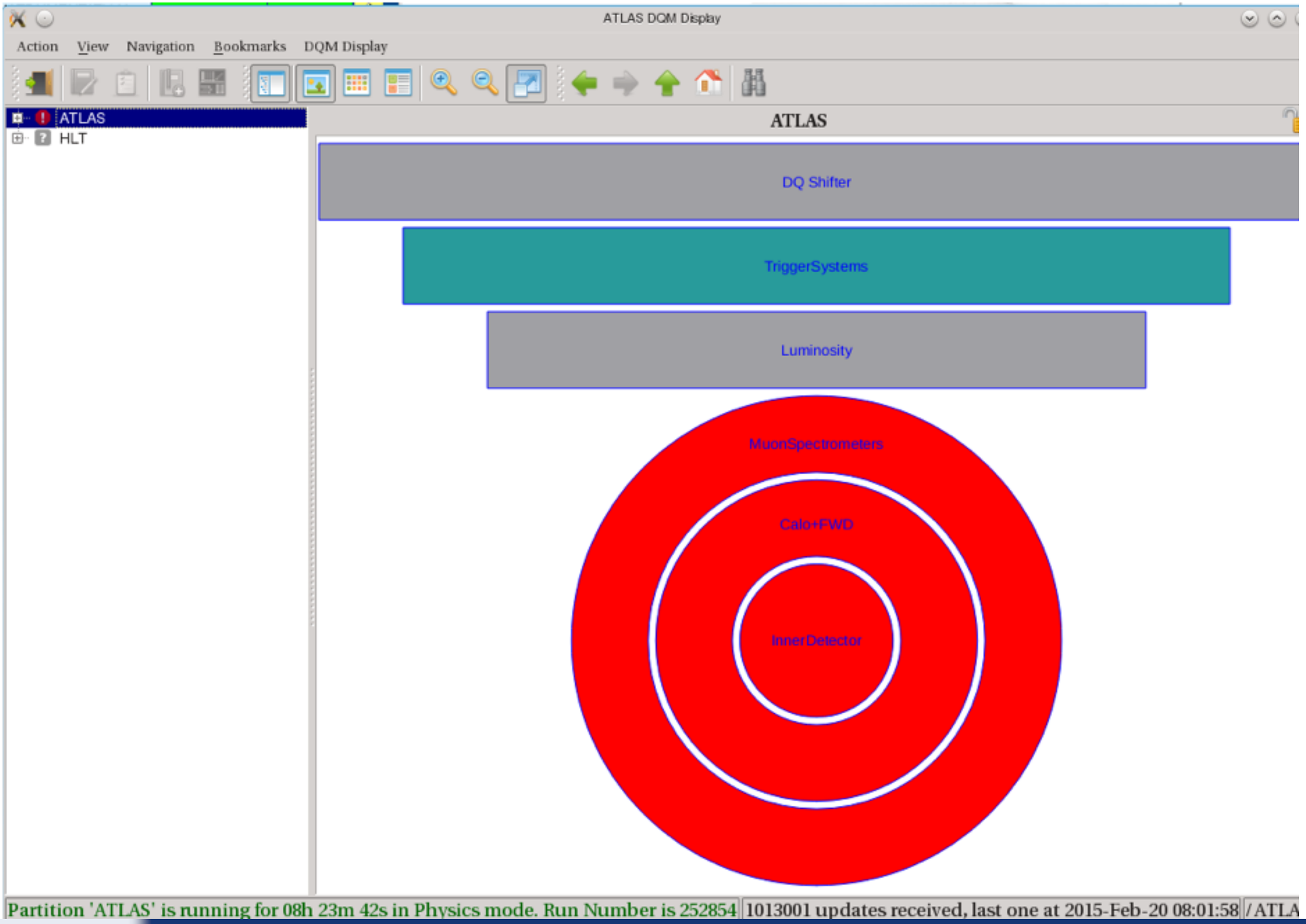
to be revived for collisions

DQM tools: DQMF

- Data Quality Monitoring Framework
  - 50'000 histograms are checked every few minutes
  - automatic DQ assessment is made per histogram (DQ result)
  - DQ result can be GREEN (all ok), YELLOW (flawed), RED (bad), GREY (unknown), BLUE (not enough statistics) or BLACK (detector/part not in run)
- To give meaningful results requires careful tuning of the algorithms



DQMD: general view



DQMD: calorimeter

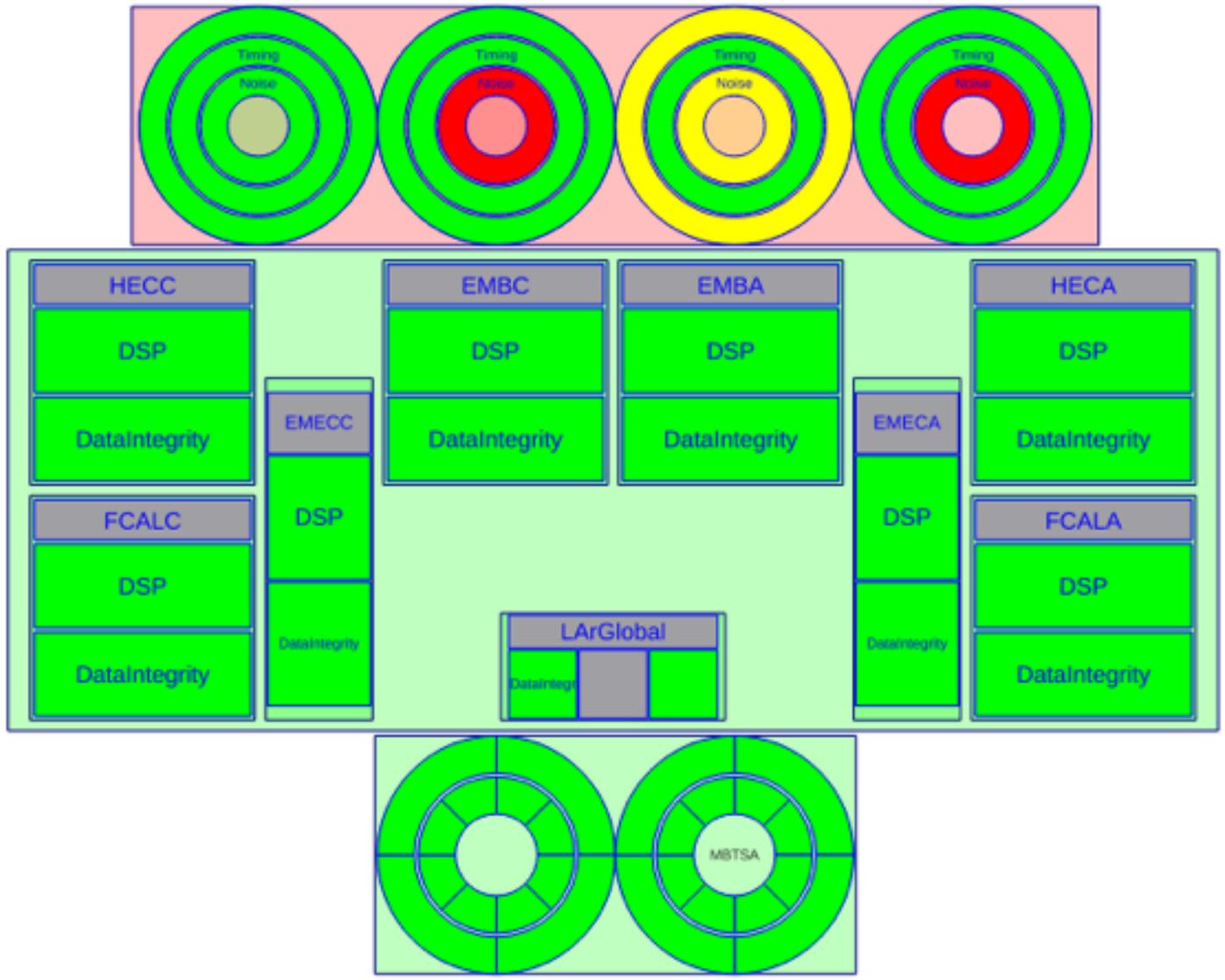
ATLAS DQM Display

Action View Navigation Bookmarks DQM Display

- ATLAS
  - Calib-Align
  - Calo+FWD
    - LArDQM
    - MBTS
    - Tile
  - DQ Shifter
  - InnerDetector
  - Luminosity
  - MuonSpectrometers
    - DQM::MDT
    - RPC
  - TriggerSystems
    - L1CAL
    - L1MU
- HLT

Calo+FWD

inputs from low level detector specific monitoring and Athena



Partition 'ATLAS' is running for 08h 28m 12s in Physics mode. Run Number is 252854 | 1287503 updates received, last one at 2015-Feb-20 08:06:24 | /ATLAS/

DQMD: pixel

ATLAS DQM Display

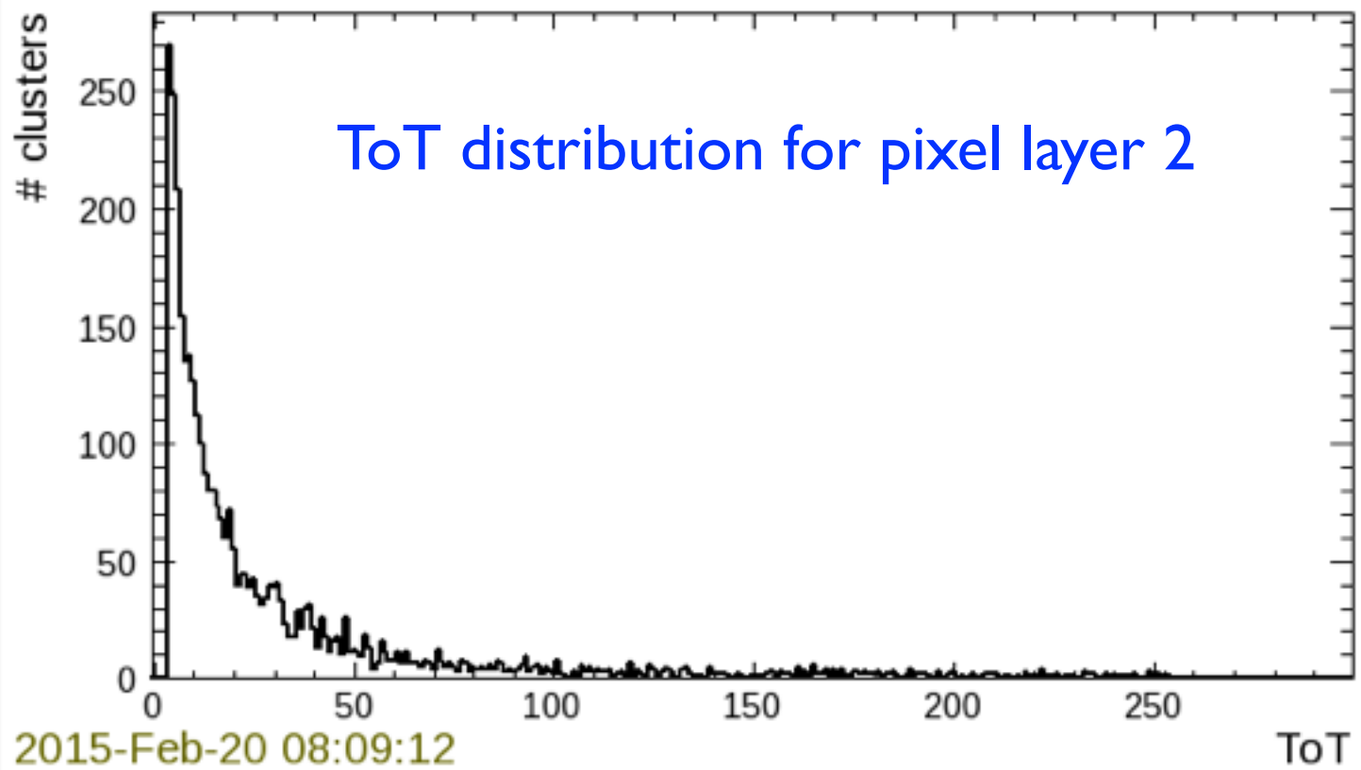
Action View Navigation Bookmarks DQM Display

- InnerDetector
  - PIXEL
    - AthenaPT
    - GNAM
    - OHP
      - ClusterOccupancySummary_GNAM
      - ClusterOccupancy_Athena
        - *PixelPT_Cluster_Occupancy_A*
        - *PixelPT_Cluster_Occupancy_B0*
        - *PixelPT_Cluster_Occupancy_B1*
        - *PixelPT_Cluster_Occupancy_B2*
        - *PixelPT_Cluster_Occupancy_C*
        - *PixelPT_Cluster_Occupancy_IBL2D*
        - *PixelPT_Cluster_Occupancy_IBL3D*
      - ClusterOccupancy_GNAM
      - Cluster_ToT_Athena
        - *PixelPT_Cluster_ToT_A*
        - *PixelPT_Cluster_ToT_B0*
        - *PixelPT_Cluster_ToT_B1*
        - *PixelPT_Cluster_ToT_B2*
        - *PixelPT_Cluster_ToT_C*
        - *PixelPT_Cluster_ToT_IBL2D*
        - *PixelPT_Cluster_ToT_IBL3D*
      - Cluster_groupsize_Athena
      - DisabledModule_GNAM
      - Errors
      - HitOccupancy_Athena
      - Hit_ToT_Athena
      - ModuleStatus_Athena
      - PixelTracks
      - Timing
  - SCT
    - SCT-Clusters
    - SCT-Disabled
      - SCT-Disabled-Summary
        - *SCT-Disabled-Summary-Histo*
        - *SCT-Masked-Summary-Histo*
      - SCT-Disabled-Tree
        - SCT-Disabled-B

PixelPT_Cluster_ToT_B2

Cluster ToT: barrel layer 2 (Run 252854)

Entries	3503
Mean	33.15
RMS	44.84
Underflow	0
Overflow	2



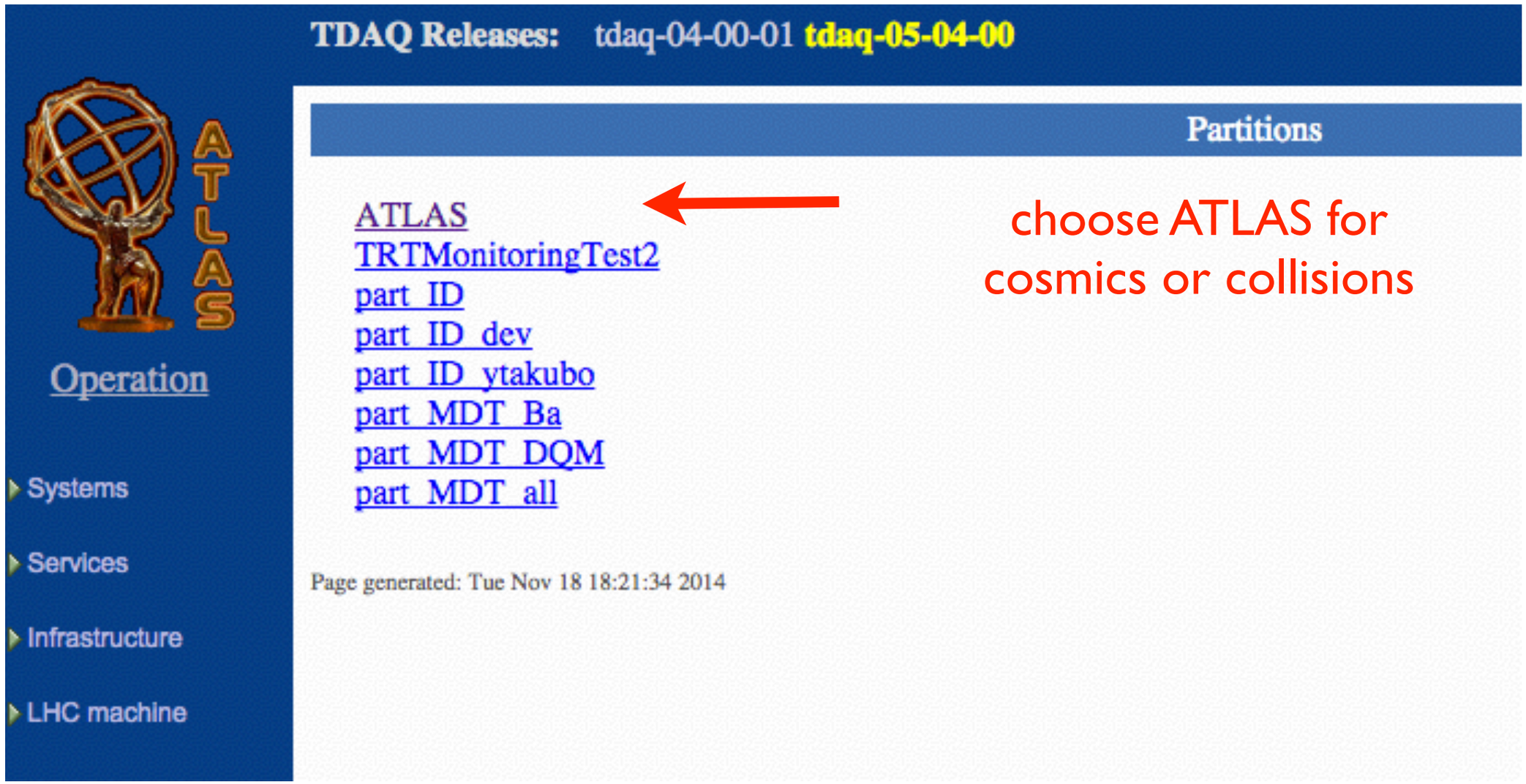
ToT distribution for pixel layer 2

Result	Configuration	Description	Troubleshooting
2015-Feb-20 08:09:12 NBins=221	**PixelPT_Cluster_ToT_B2** Histogram(s): Histogramming-CombinedInDet-1-iss.CombinedInDet_Merged./ Pixel/ Clusters/ Cluster_ToT_B2 Weight: 1 Algorithm: Bins_GreaterThan_Threshold Parameters: BinThreshold=0 Thresholds: 0<NBins<1000;		

Partition 'ATLAS' is running for 08h 35m 22s in Physics mode. Run Number is 252854 | 1761988 updates received, last one at 2015-Feb-20 08:13:40 | /ATLAS/

Web Monitoring Interface

- An alternative option to display DQMF
- https://atlasop.cern.ch/operRef.php?subs=wmi/DQM.html



TDAQ Releases: tdaq-04-00-01 **tdaq-05-04-00**

Operation

- Systems
- Services
- Infrastructure
- LHC machine

ATLAS/PIXEL

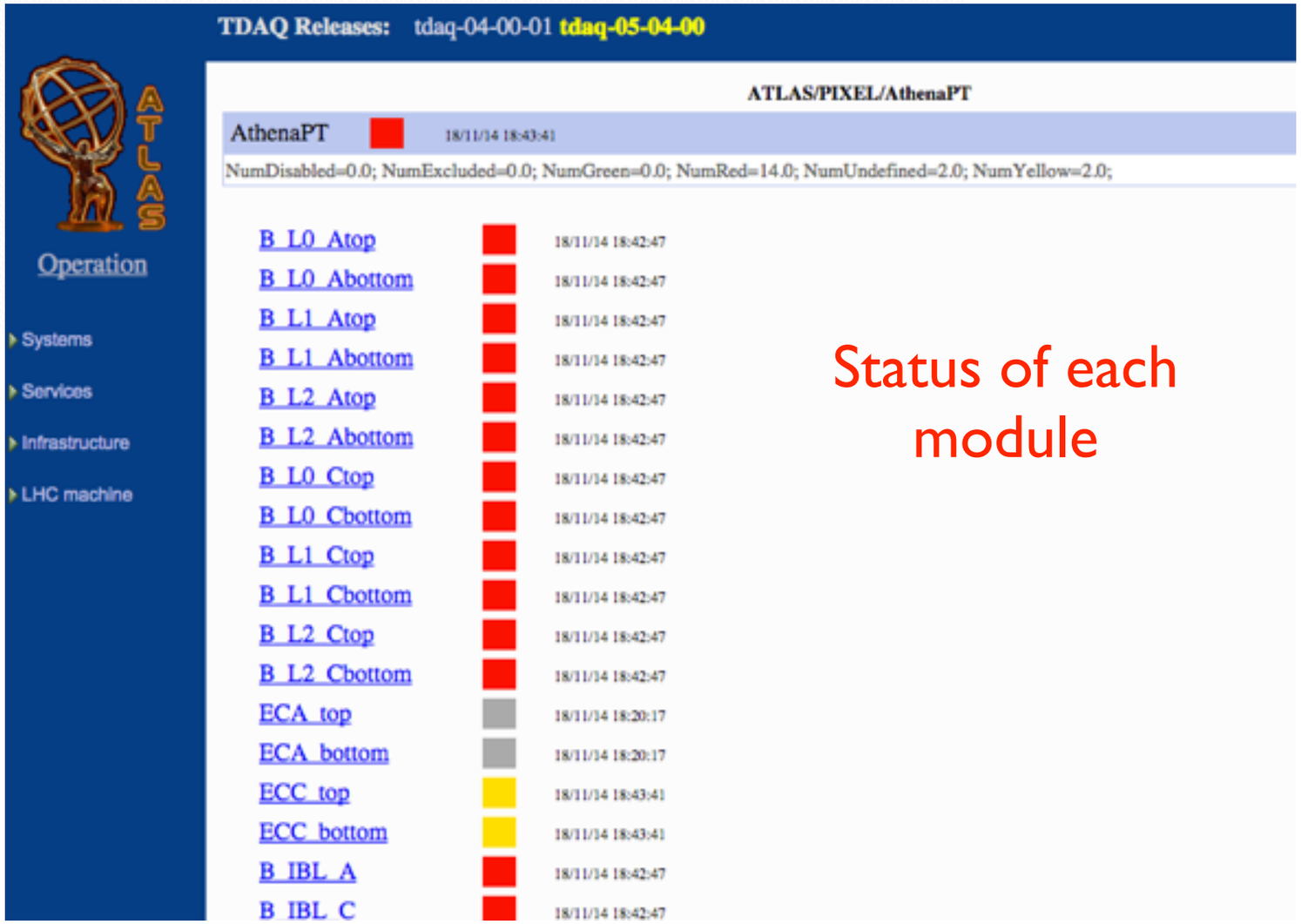
PIXEL 18/11/14 18:43:39

NumDisabled=0.0; NumExcluded=0.0; NumGreen=0.0; NumRed=1.0; NumUndefined=1.0; NumYellow=1.0;

OHP	18/11/14 18:20:18
GNAM	18/11/14 18:43:39
AthenaPT	18/11/14 18:43:41

Page generated: Tue Nov 18 18:21:19 2014

Pixel applications



Status of each module

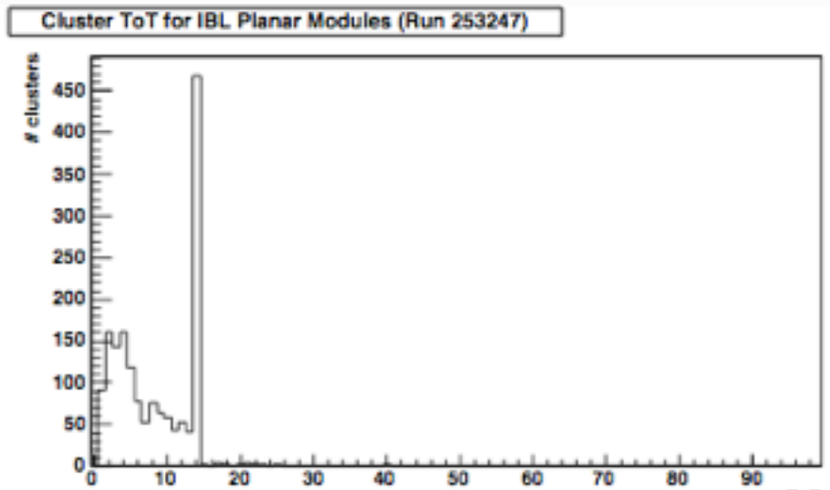
Web monitoring interface

TDAQ Releases: tdaq-04-00-01 **tdaq-05-05-00**

ATLAS/ATLAS/InnerDetector/PIXEL/OHP/Cluster_ToT_Athena

Cluster_ToT_Athena 25/2/15 01:06:22

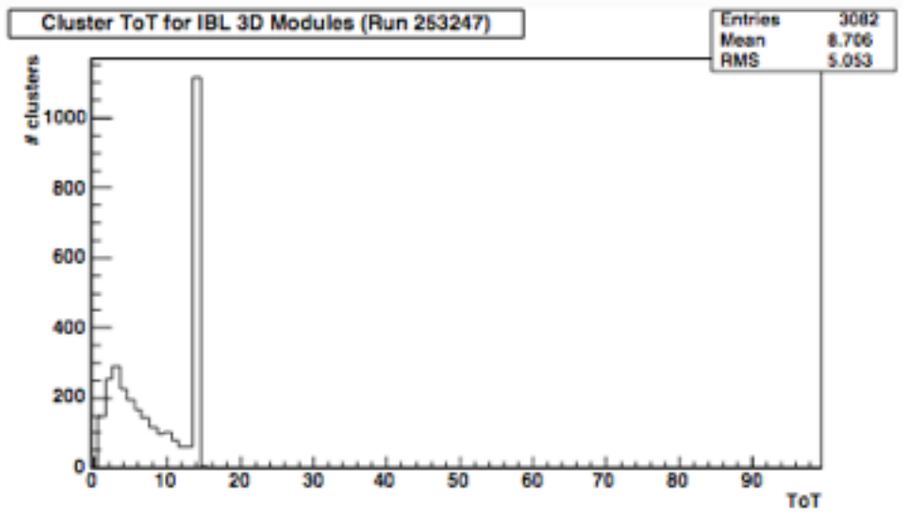
NumDisabled=0.0; NumExcluded=0.0; NumGreen=0.0; NumRed=0.0; NumUndefined=2.0; NumYellow=5.0;



PixelPT_Cluster_ToT_IBL2D 25/2/15 01:06:22

NBins=34.0;

Histograms	Histogramming-CombinedInDet-1-iss.CombinedInDet_Merged./Pixel/Clusters/Cluster_ToT_IBL2D
Reference	
Algorithm	Bins_GreaterThan_Threshold
Parameters	BinThreshold = 0;
Thresholds	0 < NBins < 1000



PixelPT_Cluster_ToT_IBL3D 25/2/15 01:06:22

NBins=25.0;

Histograms	Histogramming-CombinedInDet-1-iss.CombinedInDet_Merged./Pixel/Clusters/Cluster_ToT_IBL3D
Reference	
Algorithm	Bins_GreaterThan_Threshold
Parameters	BinThreshold = 0;
Thresholds	0 < NBins < 1000

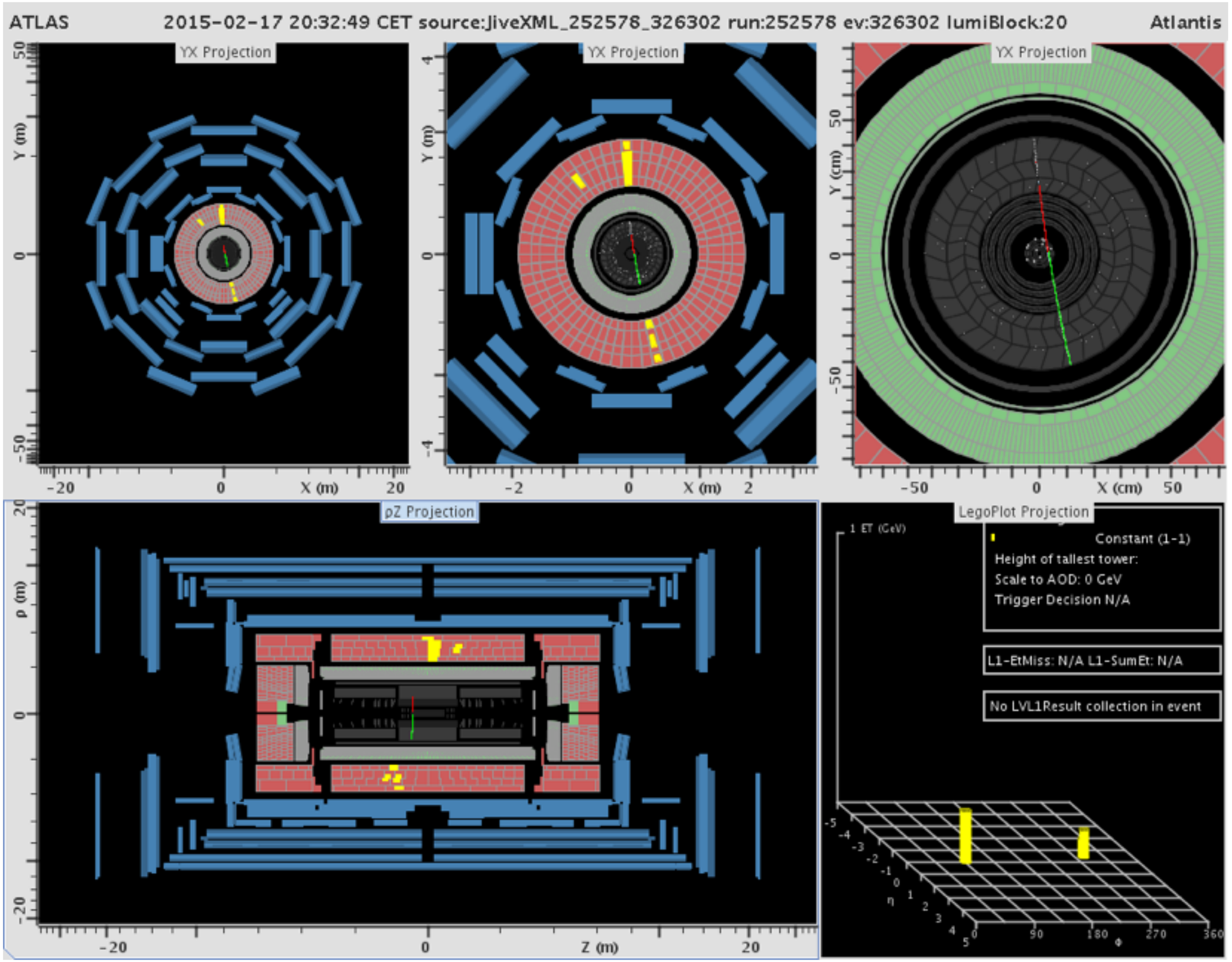
DQM tools: Trigger Presenter

- Monitoring the trigger performance in the control room is vital to make sure that ATLAS is maximising the data taken and it is a first opportunity to catch any problems
  - watch LVL1 and HLT trigger rates
  - notify Shift Leader about the jumps in trigger rate

DQM tools: event displays

- Atlantis
  - 2D event display
- VP1
  - 3D event display
- Both allow a selection of trigger mask and event stream
- Useful tool to see hits in the detectors participating in the run

Example: event in Atlantis



DQM tools: OH display

- Online Histogram display
  - expert rather than shifter tool
  - useful for trouble shooting
    - for example, if histograms don't appear in OHP

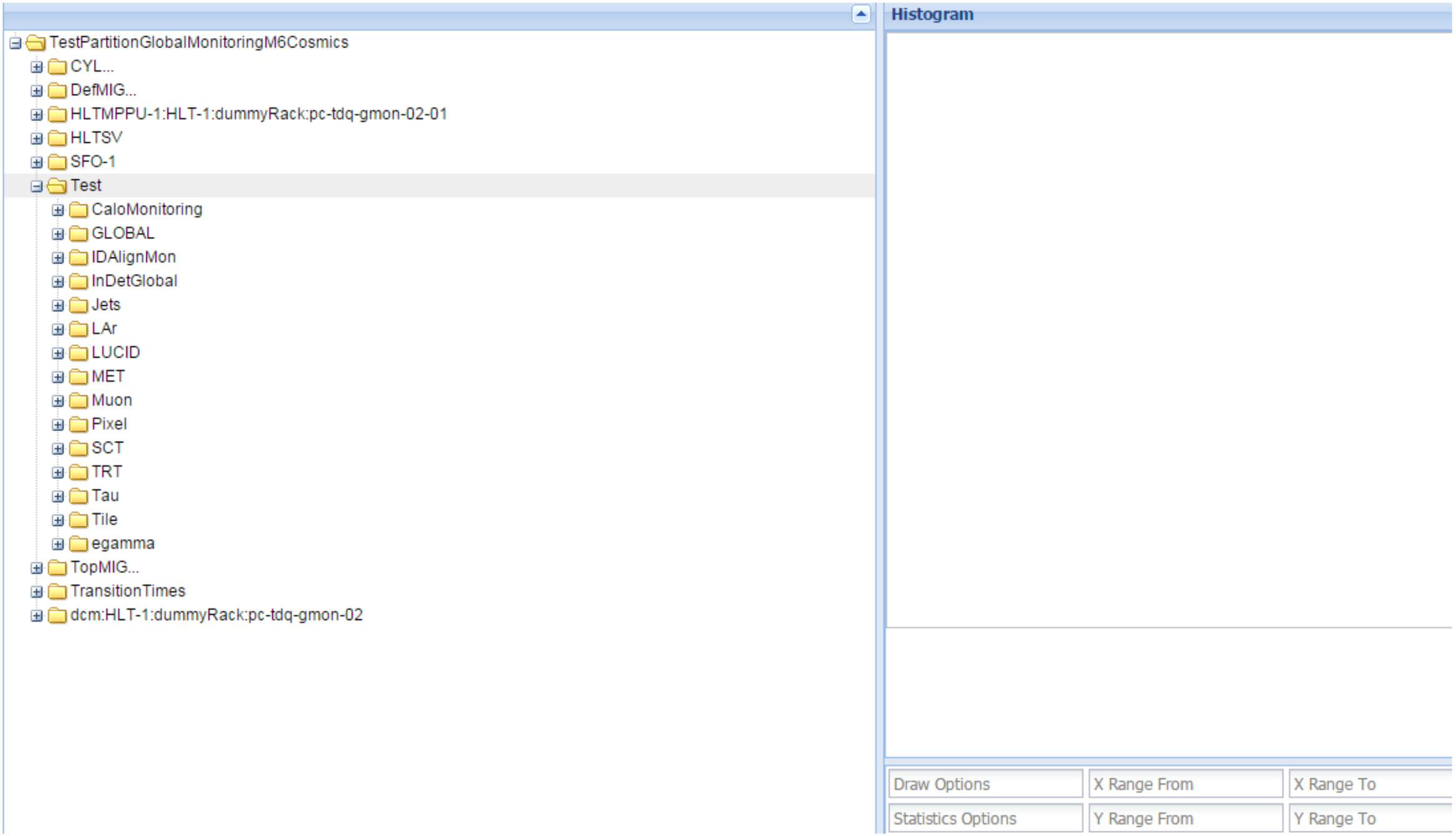
https://atlasop.cern.ch/tdaq/web_is/daq/runstatus.html

Atlas Partition Status

Partition	Services	Run Number	Run Type	State	Recording	Start	End	Time
part_ID_ytakubo	IS OH OKS PMG	246043	Physics	RUNNING	0	18/11/14 17:10:57	1/1/70 01:00:00	59892
part_TGC_FillTest	IS OH OKS PMG	246085	Emulated	NONE	0	18/11/14 20:02:44	18/11/14 20:09:17	392
initialL1CT	IS OH OKS PMG	243103	Physics	CONNECTED	0	20/10/14 13:07:46	20/10/14 15:14:45	7619
part_RPC	IS OH OKS PMG	242969	Physics	NONE	0	17/10/14 15:51:13	17/10/14 16:11:25	1212
part_MDT_all	IS OH OKS PMG	244768	Noise	???	0	6/11/14 19:23:43	6/11/14 19:24:19	35
part_TGC	IS OH OKS PMG	0	Emulated	NONE	0	1/1/70 01:00:00	1/1/70 01:00:00	???
PixelInfr	IS OH OKS PMG	246076	Physics	RUNNING	0	18/11/14 19:24:24	1/1/70 01:00:00	51882
part_ID_dev	IS OH OKS PMG	245968	Physics	RUNNING	0	18/11/14 12:04:14	1/1/70 01:00:00	78292
part_ID	IS OH OKS PMG	246093	Physics	RUNNING	0	19/11/14 09:28:23	1/1/70 01:00:00	1250
TDAQ-Tommaso	IS OH OKS PMG	245897	Physics	RUNNING	0	17/11/14 18:30:13	1/1/70 01:00:00	141536
PixelInfr_IBL	IS OH OKS PMG	246057	Physics	RUNNING	0	18/11/14 18:14:39	1/1/70 01:00:00	56072
TestPartitionGlobalMonitoringM6Cosmics	IS OH OKS PMG	245980	Physics	RUNNING	0	18/11/14 14:40:46	1/1/70 01:00:00	68902
ATLAS	IS OH OKS PMG	246060	Physics	RUNNING	1	18/11/14 18:20:14	1/1/70 01:00:00	55733
TRTMonitoringTest2	IS OH OKS PMG	245984	Physics	RUNNING	0	18/11/14 14:55:13	1/1/70 01:00:00	68032
part_MDT_Ba	IS OH OKS PMG	246095	Noise	RUNNING	0	19/11/14 09:48:51	1/1/70 01:00:00	20
TDAQROS	IS OH OKS PMG	245322	Physics	NONE	0	13/11/14 12:59:36	13/11/14 13:59:52	3616
part_MDT_DQM	IS OH OKS PMG	246002	Noise	RUNNING	0	18/11/14 15:38:22	1/1/70 01:00:00	65452
initial	IS OH OKS PMG	244954	Physics	???	0	10/11/14 12:09:32	1/1/70 01:00:00	769183

DQM tools: OH display

- Contains all monitoring histograms
  - appear under ATLAS partition for data taking
- Not user friendly



DQM tools: OH display

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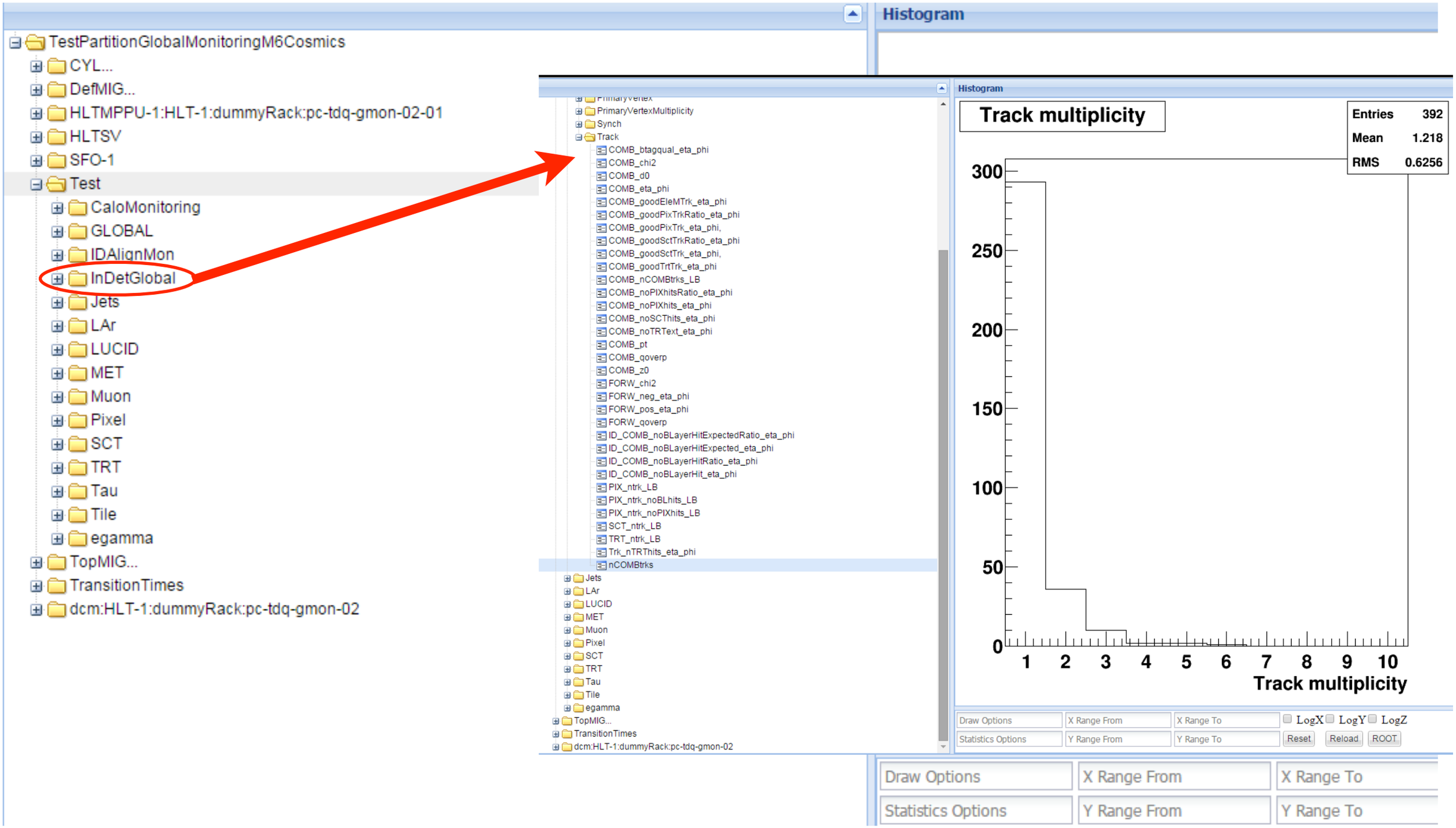

Histogram archiving

Online histograms are archived in CoCa: https://atlasdaq.cern.ch/info/mda/coca

CoCa Datasets

= Collection and Cache service

Dataset name Search

- BCM-Lumi
- CSCGnam
- DQM-Archive
- Gatherer
- HLT-BeamSpot
- Histogramming-DQM
- Histogramming-HLT
- L1CT
- L1Calo
- Lucid-Lumi
- MDA-GlobalMonitoring
- MDA-ID
- MDA-LAr-All
- MDA-LAr-Cosmic
- MDA-LAr-PT-1
- MDA-Pixel
- MDA-RPC
- MDA-SCT
- MDA-TRT
- MDA-ZDC
- MDAStressTest
- MDATest
- MDTCalibGnam
- MDTGnam
- MonaIsa
- TGCGnam
- TRP-Rates
- Tile-MDAMon

CoCa files for dataset "Histogramming-DQM"

[Datasets]

File name Search	Size, MB	Archive, relative to /eos/atlas/atlascerngroupdisk/tdaq-mon/coca/
r0000246047_lEoR_ATLAS_MDA-Histogramming-DQM_Histogramming-DQM.root	9	2014/Histogramming-DQM/r0000246047_lEoR_ATLAS_MDA-Histogramming-DQM_Histogramming-DQM.root
r0000246036_l0006_ATLAS_MDA-Histogramming-DQM_Histogramming-DQM.root	9	2014/Histogramming-DQM/r0000246036_l0006_ATLAS_MDA-Histogramming-DQM_Histogramming-DQM.root
r0000246027_lEoR_ATLAS_MDA-Histogramming-DQM_Histogramming-DQM.root	9	2014/Histogramming-DQM/r0000246027_lEoR_ATLAS_MDA-Histogramming-DQM_Histogramming-DQM.root
r0000245998_lEoR_ATLAS_MDA-Histogramming-DQM_Histogramming-DQM.root	9	2014/Histogramming-DQM/r0000245998_lEoR_ATLAS_MDA-Histogramming-DQM_Histogramming-DQM.root
r0000245993_lEoR_ATLAS_MDA-Histogramming-DQM_Histogramming-DQM.root	9	2014/Histogramming-DQM/r0000245993_lEoR_ATLAS_MDA-Histogramming-DQM_Histogramming-DQM.root
r0000245978_lEoR_ATLAS_MDA-Histogramming-DQM_Histogramming-DQM.root	9	2014/Histogramming-DQM/r0000245978_lEoR_ATLAS_MDA-Histogramming-DQM_Histogramming-DQM.root

Conclusions

- Data Quality monitoring is essential for a successful detector operation
- It is a key ingredient for producing outstanding physics results
- DQM in ACR is critical to minimize the amount of unrecoverable data by spotting detector failures
- Many DQ tools are available
  - they should provide enough information to take decision to stop the run
  - the role of DQ desk is expected to be enhanced in Run 2 operation model

Backup