JetMET / HCAL / ECAL DQM and Data Certification

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Requirements / Assumptions

Provide data quality feedback to identify good data for analyses using *Jets and MET*

POG will monitor Jet and MET physics objects

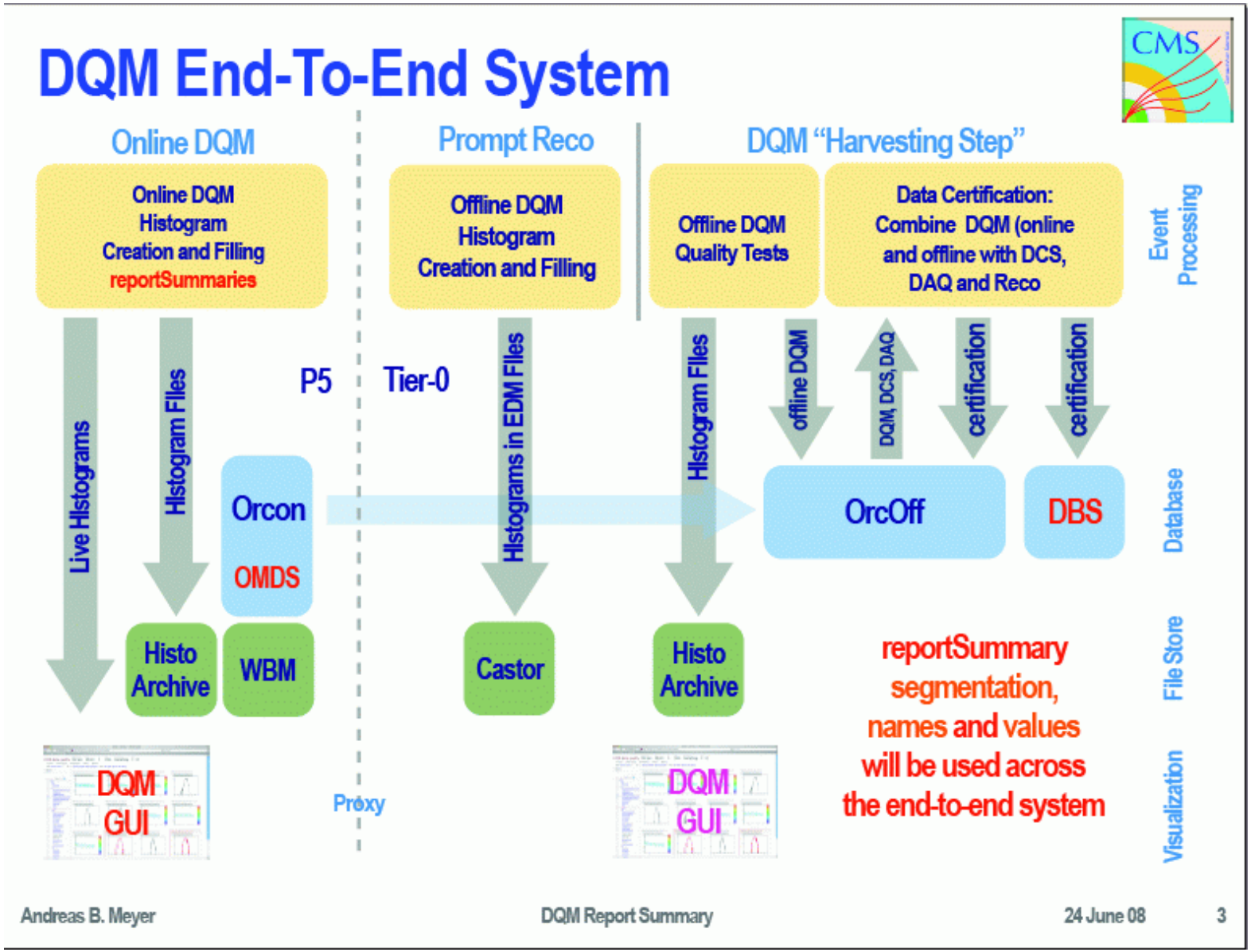
Jet and MET analyses rely on the
<u>DPG HCAL and ECAL monitoring</u>

Need quality for detector segmentation

Barrel, EndCap, Forward

Need data quality *per luminosity section*

Overview of CMS DQM



DQM and Data Certification

Online DQM

Limited statistics

→ ***Provide quick feedback to shifter***

Offline DQM (prompt analysis)

Runs over *all* of the data

Uses DCS, DAQ, (Online DQM information)

→ ***Output is used for Data Certification***

Data Certification

→ ***Result used to select good runs for analysis***

User Interface to Good Run Bits

User specifies subdetectors needed for analysis

For a basic jet analysis in the central region:

run start, run stop,
HB, EB, HO, Tracker, Luminosity,
(JET_Barrel)

Data Handling returns the dataset which satisfies the user's query…

Framework skips bad Luminosity sections

Input to Data Certification

Each subsystem is expected to provide DQM information *that will be stored in DBS* and used to identify "good runs"

```
Layer 1          Layer 2          Layer 3

HCAL_Global   -  HCAL_HB       -  HCAL_HB_Online
                 HCAL_HB_Val      HCAL_HB_Online_Val
                                  HCAL_HB_Offline
                                  HCAL_HB_Offline_Val
                                  HCAL_HB_DCS
                                  HCAL_HB_DAQ

              -  HCAL_EB
              -  HCAL_HO
              -  HCAL_HF

Flags  [0,1]
Vals   [0,1000]
```

Database information is organized in layers

Able to select subcomponent (HB,HO, HE, HF)

Data Certification

```
Run      |-------------1-------------
File     |---1---|---2---|---3---|---
LS       |-1-|-2-|-3-|-4-|-5-|-6-|-7-

DAQ      |-1-|-1-|-1-|-1-|-1-|-1-|-1-
DCS-HB   |-1-|-0-|-0-|-0-|-0-|-1-|-1-
HB       |-1-|-1-|-1-|-0-|-0-|-1-|-1-
DCS-EB   |-1-|-1-|-1-|-1-|-1-|-1-|-1-
EB       |-1-|-1-|-1-|-1-|-1-|-1-|-1-
```

Returns

```
File     |---1---|           |---3---|---
LS       |-1-|-0-|           |-0-|-6-|-7-
```

DPG HCAL and ECAL DQM

DCS will be used for DPG Data Certification

In particular HCAL and ECAL DPG

DCS provides fine time granularity

Some issues with DCS:

Data not organized per run

Only transitions are saved

Timestamps not Lumi Sections

Query is expensive (takes ~minutes)

Need to find the time of the run start and go back in the database to find the last change…

DCS Queries

We have several DCS queries which return HV/LV settings for the HCAL

wget -q -O file.txt "http://cmsmondev.cern.ch/cmsdb/servlet/TestSelectToFile ...

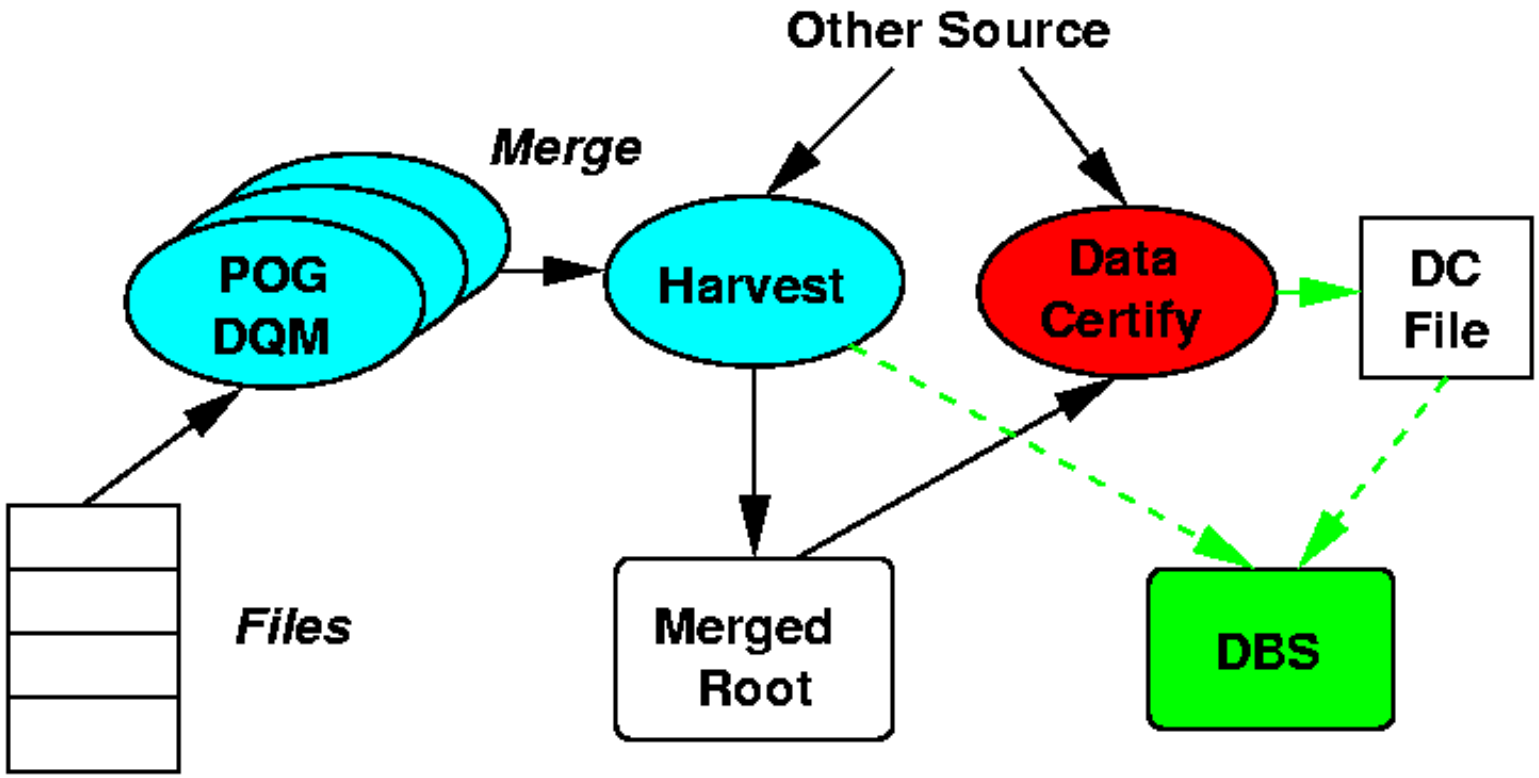
Example output:

```
2008.07.11_10:28:52 HFM_HV/M1 9 222.100006103516
2008.07.11_10:28:54 HFP_HV/M5 9 219.100006103516
2008.07.11_10:29:01 HFM_HV/M1 9 219.899993896484
2008.07.11_10:29:07 HFM_HV/M1 9 222.199996948242
2008.07.11_10:29:09 HFP_HV/M5 9 216.800003051758
2008.07.11_10:29:12 HFM_HV/M1 9 219.699996948242
2008.07.11_10:29:21 HFP_HV/M5 9 218.899993896484
```

Written to a file/run which can be parsed by the data certification algo

How do we integrate this into CMS DQM?

Data Certification Step



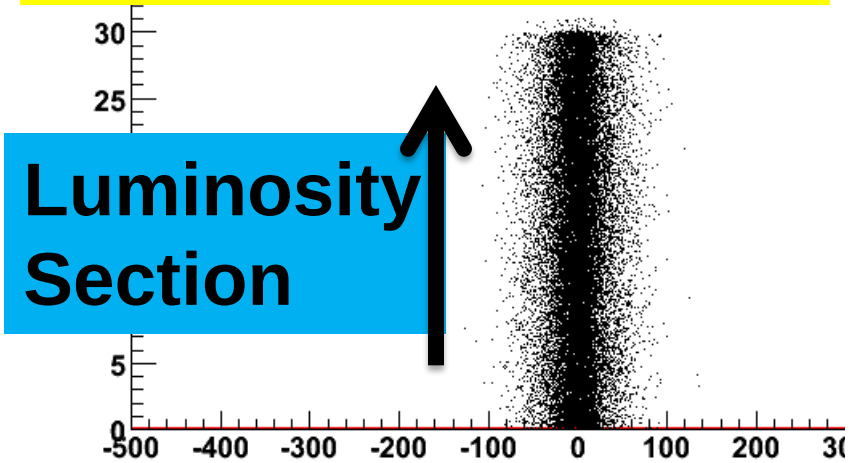
Data Certification algorithm runs as a root script over the "Merged Root" file (can move into harvest)

Writes results to a "Data Certification File"

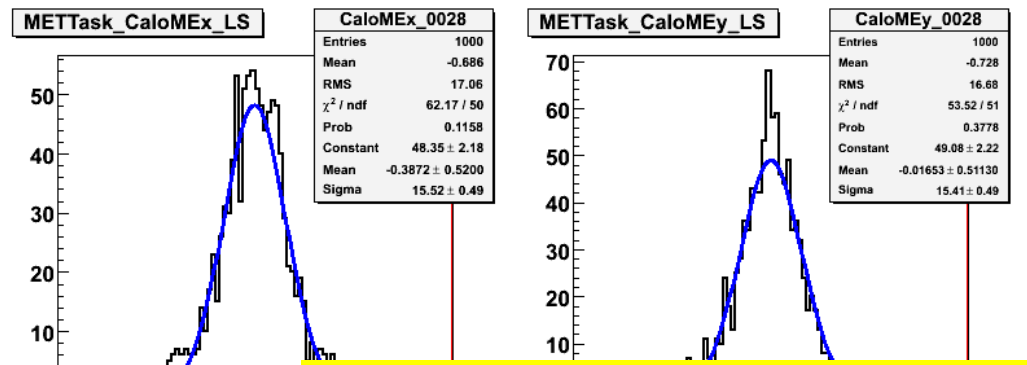
Determining Data Quality in a LS

METTask_CaloMEyNoHF_LS

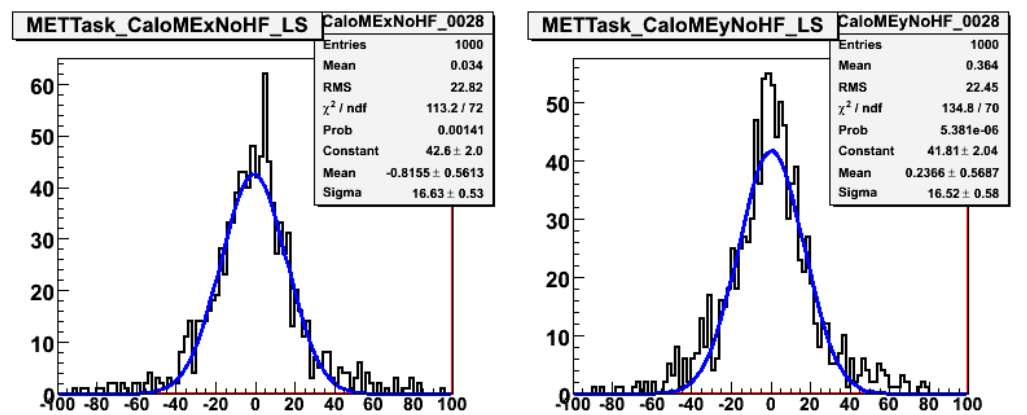
Filled in POG Monitor



Luminosity Section



Fit by DC Algorithm



Fill a 2d histogram

Take projection and fit to get mean and chi2

Determining Data Quality in a LS

JetMET_MET_XXX = JetMET_MET_MEx_XXX * JetMET_MET_MEy_XXX

run,	lumi-sec,	tag name,	output
1	0	JetMET_MET	1
1	0	JetMET_MET_All	1
1	0	JetMET_MET_NoHF	1
1	1	JetMET_MET	1
1	1	JetMET_MET_All	1
1	1	JetMET_MET_NoHF	1
1	2	JetMET_MET	1
1	2	JetMET_MET_All	1
1	2	JetMET_MET_NoHF	1
1	3	JetMET_MET	1
1	3	JetMET_MET_All	1
1	3	JetMET_MET_NoHF	1
1	4	JetMET_MET	1
1	4	JetMET_MET_All	1
1	4	JetMET_MET_NoHF	1
1	5	JetMET_MET	1
1	5	JetMET_MET_All	1
1	5	JetMET_MET_NoHF	1
1	6	JetMET_MET	1
1	6	JetMET_MET_All	1

JetMET_MET_MEx_XXX

XXX = All, NoHF

Distribution fit with a double Gaussian

If mean and chi2 are within tolerance then set = 1

Actual output of Data Certification Algo (using MC)

Data Certification File

Agree on format of the Data Certification File

Initial conditions written out for LumiSection=0
Write out condition whenever there is a change

Run	LumiSection	TagName	TagValue
1	0	JetMET_Global	1
1	0	JetMET_Jet	1
…			
1	56	JetMET_Jet	0
1	108	JetMET_Jet	1

Format is similar to how the data is saved in DBS

Approach can be used by other components…

Questions

The goal of DQM is to provide (semi)-automated quality feedback → *make use of DQM Framework*

Can HCAL/ECAL monitoring fit into CMS DQM?
Is CMS DQM too restrictive?

Identify requirements

- ***CPU***
- ***Memory (histogram sizes)***

Other Needs

- ***Trend plotting***

Goals

Define Quality Flags to be saved in DBS

Specify how they are derived

Retrieve DCS information and fill DBS with related quality flag / luminosity section

Run HCAL/ECAL code in Offline DQM framework

Reuse online DQM code

Develop Data Certification algorithm

Run in the "harvesting" step

HCAL DQM Inputs

Have the pieces and now need to fit them together

Information is being collected at:

http://ncdf76.fnal.gov/~chlebana/CMS/DQM/HCAL/

Quality values are determined from the results of the Hot, Dead, and Digi monitors.

```
HCAL_HB_Online_Val = HCAL_HB_Online_HotCell_Val  / 3 +
                     HCAL_HB_Online_DeadCell_Val / 3 +
                     HCAL_HB_Online_DigiMon_Val  / 3


if (HCAL_HB_Online_Val > 950) HCAL_HB_Online = 1
```

Musings…

Does not have to be a perfect system from day1

Should be able to catch *most* of the obvious problems

Lightweight monitor

Part of CMS Data certification

More resource intensive monitor

Provide updates to Data Certification

Start by specifying the functional requirements…