

# CMS DQM-DC operations and performance

**Speaker:**

Muhammad Ahmad

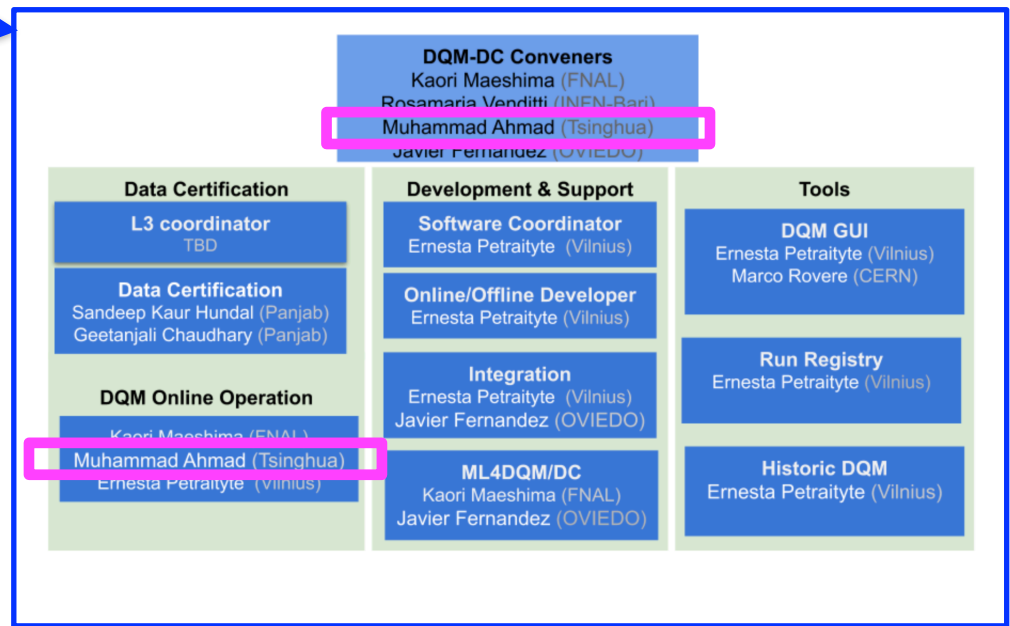
on behalf of DQM-DC group

Tsinghua University, Beijing, China

CLHCP2020 (Nov. 06-09)

# Outline

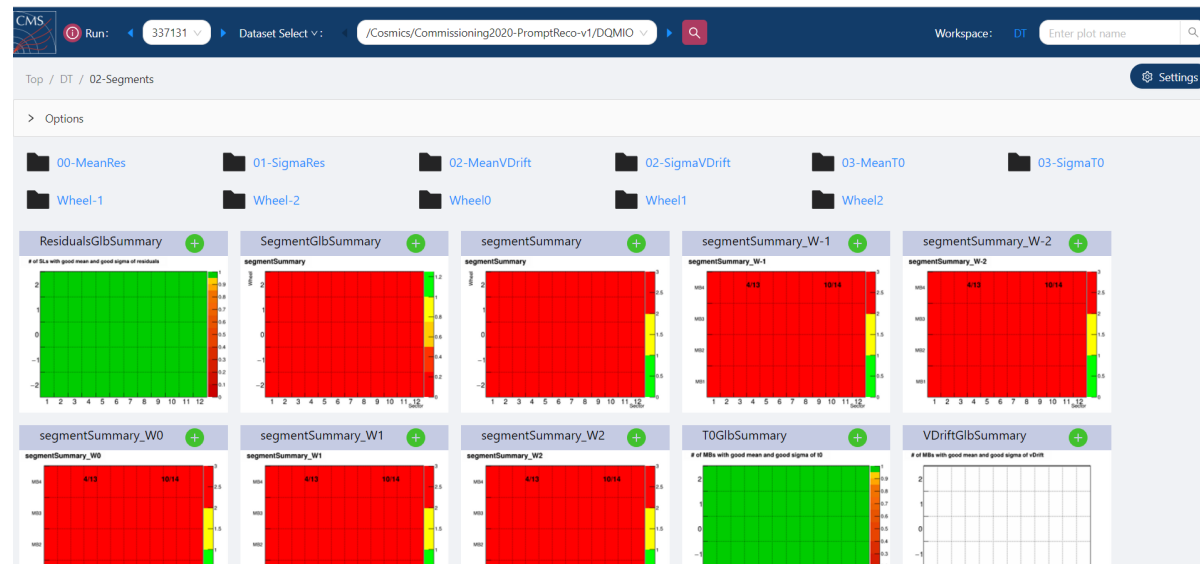
- Aim is to give an overview of extensive work done by CMS DQM-DC group
  - In progress on various fronts for coming Run3 will be also be covered
- DQM-DC group organization
- DQM code modernization and new/improved tools developed
  - ✓ New DQM GUI
  - ✓ Run Registry
  - ✓ Historic DQM
- Legacy data certification (2016, 2017 and 2018)
- Machine learning for DQM
- Operations 2020/2021
- Summary



- Main twiki ([Link](#)) contains links to all of our activities and available documentations

# New DQM GUI

- New DQM GUI has been developed
  - Offline DQM GUI started development in Feb. and it already has beta version (still based on the **old back-end**)
    - <https://dqm-gui.web.cern.ch/>
  - Online version has been successfully tested during MWGR#3 for the first time (based on **new back-end**)
    - <https://cmsweb.cern.ch/dqm/online-new/>
- Commissioning of new (alpha/beta version) GUI (running along with old GUI)
- Received all the runs and few feedbacks from shifters
- Continuously improving and fixing issues



# New Run Registry

- Developed new run registry with new advanced & user-friendly features
- Online version is already in use @p5 (since end of 2018 data taking)
- Offline version is used for legacy DC 2018/2016 and synchronisation performed with old RR for legacy DC 2017 (official UL17 DC was done using old RR)
- Built-in and improved lumi loss statistics tool, any user can get the statistics much easier as compared to earlier
- Lumisection based book keeping, compatible to implement the future LS based ML certification
- Placeholder for GEM bits
- Placeholder for ML4DQM
- Old run registry is not being used at all now

# New Run Registry

**Authenticate via egroup**

**Keep track of history**

**ML4DQM**

**JSON creation**

**Filters**

**OMS DCS LS bits**

**Run Registry twiki ([Link](#))**

Run Registry

ONLINE OFFLINE ML JSON PORTAL LOG

Muhammad Ahmad Log out

WORKSPACES

GLOBAL

BTAG

CASTOR

CMS

CSC

CTPPS

DT

ECAL

EGAMMA

GEM

Online / Global

All runs (253799):

AND +Rule +Group

Finished	Run Number	Class	Manage / ...	Significant	State	Started	Hlt Key Descrip...	LS Duration	HLT Event Cou...	GUI	OMS	castor
✓	338072	Commissioning20	Manage / LS	Make significant	Non Significant(Open)	2020-10-15T1...	/minidag/2020/...	0	82	GUI	OMS	No Lumisec No
✓	338071	Commissioning20	Manage / LS	Make significant	Non Significant(Open)	2020-10-15T1...	/minidag/2020/...	0		GUI	OMS	No Lumisec No
✓	338070	Commissioning20	Manage / LS	Make significant	Non Significant(Open)	2020-10-15T1...	/minidag/2020/...	0	691	GUI	OMS	No Lumisec No
✓	338069	Commissioning20	Manage / LS	Make significant	Non Significant(Open)	2020-10-15T1...	/minidag/2020/...	0		GUI	OMS	No Lumisec No
✓	338068	Commissioning20	Manage / LS	Make significant	Non Significant(Open)	2020-10-15T1...	/minidag/2020/...	0	79	GUI	OMS	No Lumisec No

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Significant runs (35502):

AND +Rule +Group

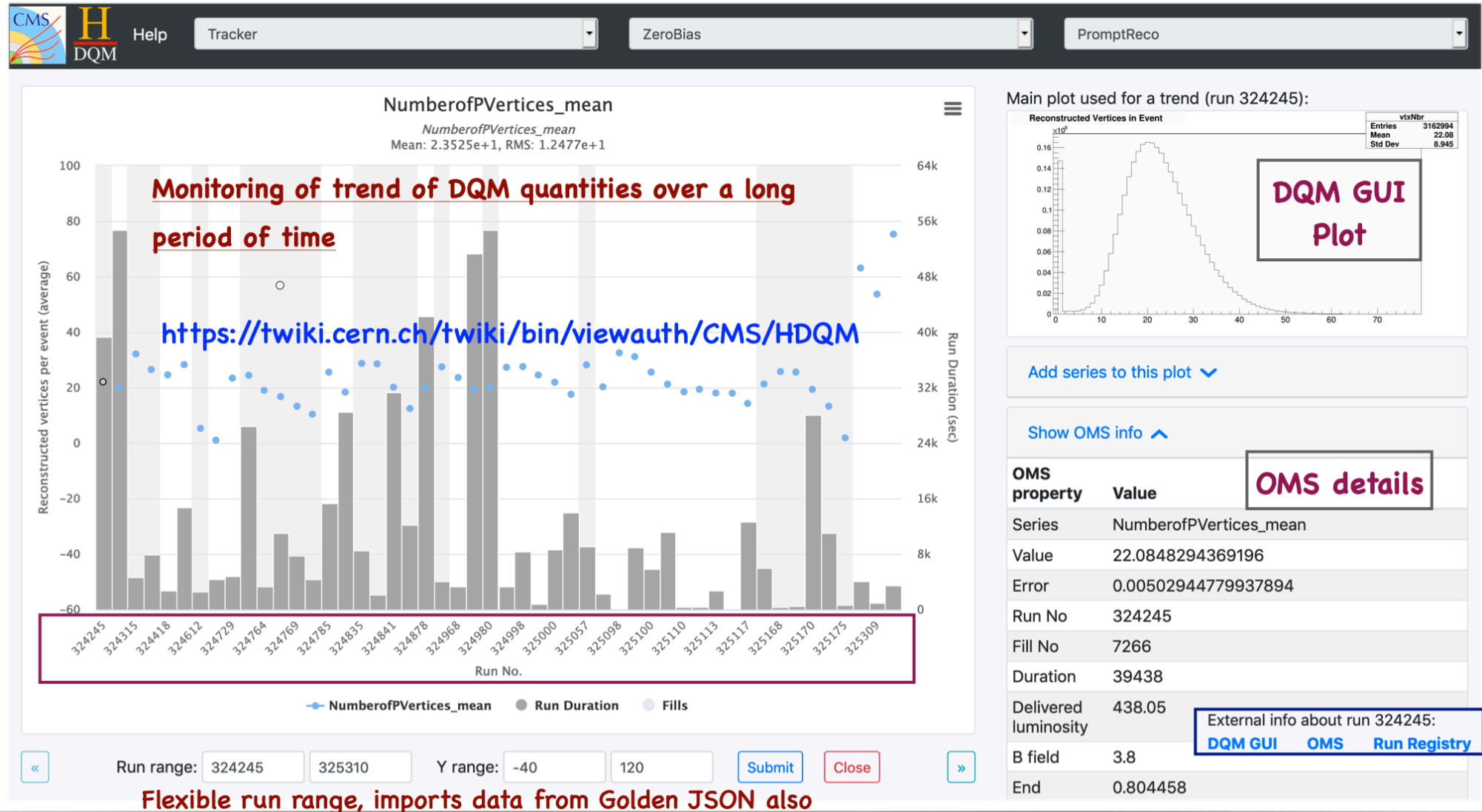
Finished	Run Number	Class	Manage / ...	Significant	State	Started	Hlt Key Descrip...	LS Duration	HLT Event Cou...	GUI	OMS	castor
✓	338015	Commissioning20	Manage / LS	✓	SIGNOFF / move	2020-10-09T1...	/cdaq/cosmic/c...	198	37285	GUI	OMS	EXCLUDED
✓	338012	Commissioning20	Manage / LS	✓	OPEN / move	2020-10-09T1...	/cdaq/special/2...	14	1669281	GUI	OMS	EXCLUDED
✓	338008	Commissioning20	Manage / LS	✓	OPEN / move	2020-10-09T1...	/cdaq/special/2...	31	114086	GUI	OMS	EXCLUDED
✓	337997	Commissioning20	Manage / LS	✓	SIGNOFF / move	2020-10-09T1...	/cdaq/cosmic/c...	246	35963	GUI	OMS	EXCLUDED
✓	337990	Commissioning20	Manage / LS	✓	SIGNOFF / move	2020-10-09T0...	/cdaq/cosmic/c...	28	20443665	GUI	OMS	EXCLUDED

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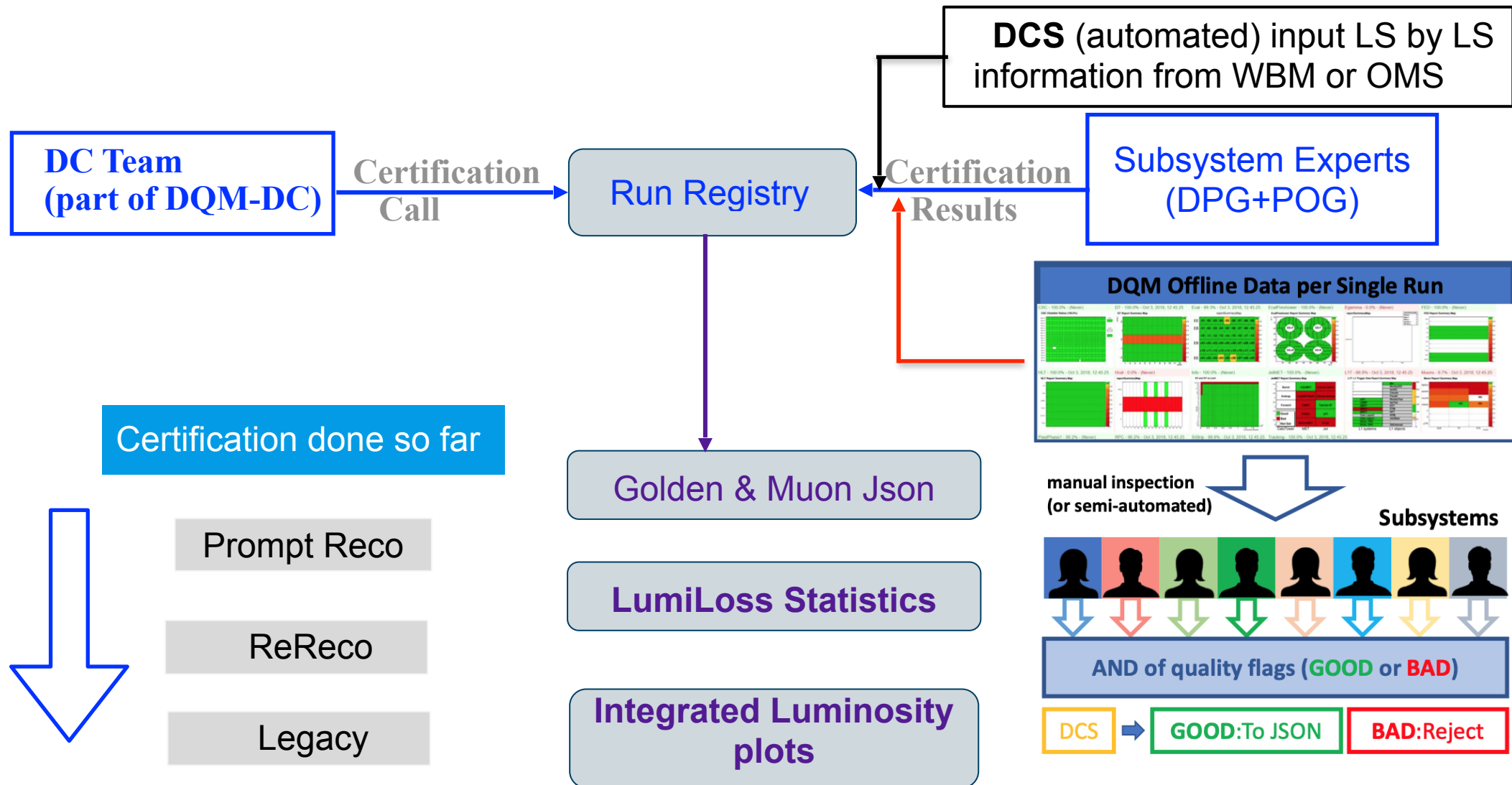
Tutorial during last PPD workshop ([Link](#))

# Improved Historic DQM

- Reads data directly from EOS rather than DQM GUI
- Simplified and well documented configuration



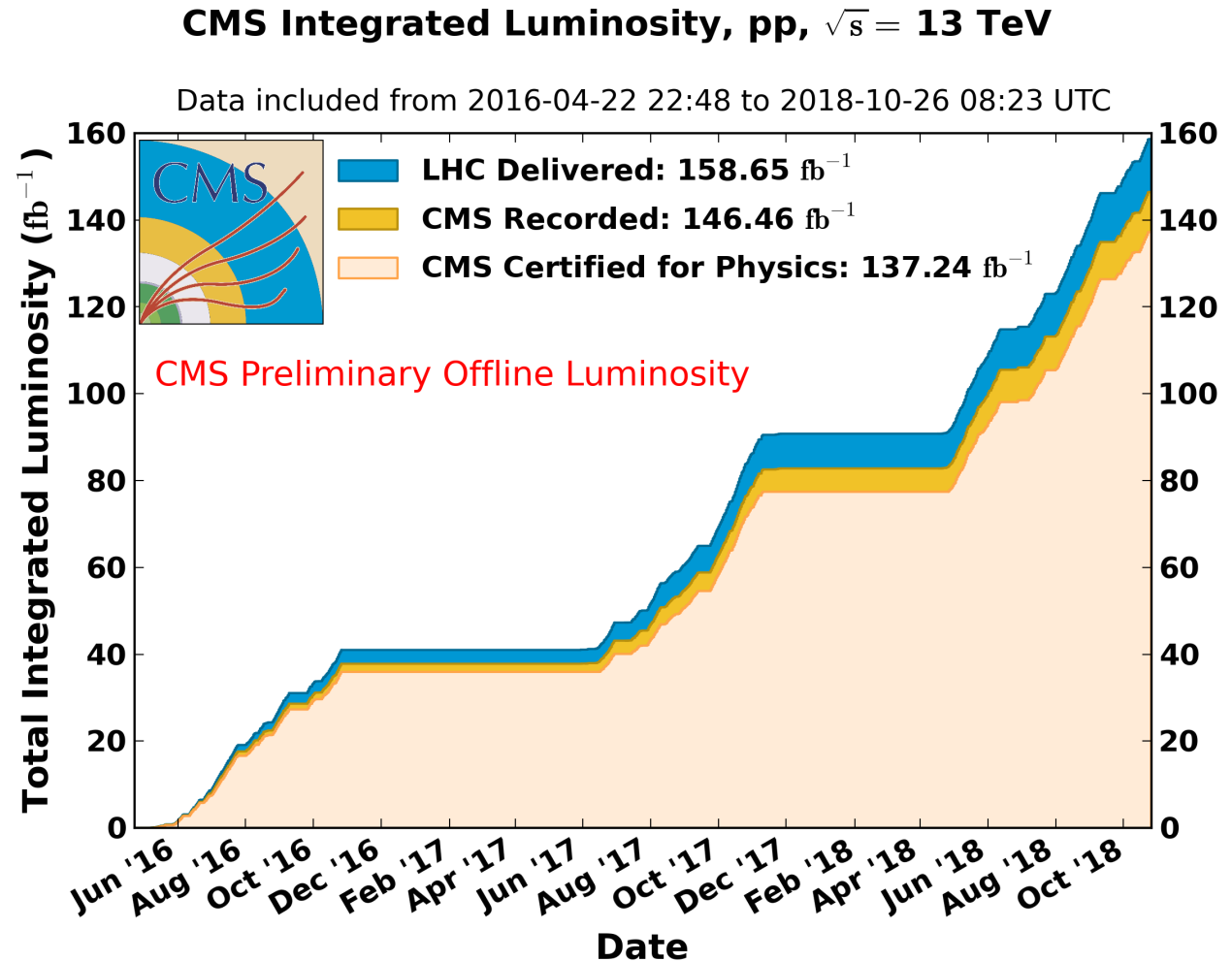
# Current Central Data Certification Procedure



# Golden JSON - Integrated Luminosity (Legacy 2016-2018)

Data taking eff. = 92%  
DC eff. = 95%

Consistent with the high  
fraction of good data in  
each year



Luminosity (Data certification page):  
<https://twiki.cern.ch/twiki/bin/viewauth/CMSPublic/DataQuality>

Details: DC talk in CMS week(Sept. 14-24): [Link](#)

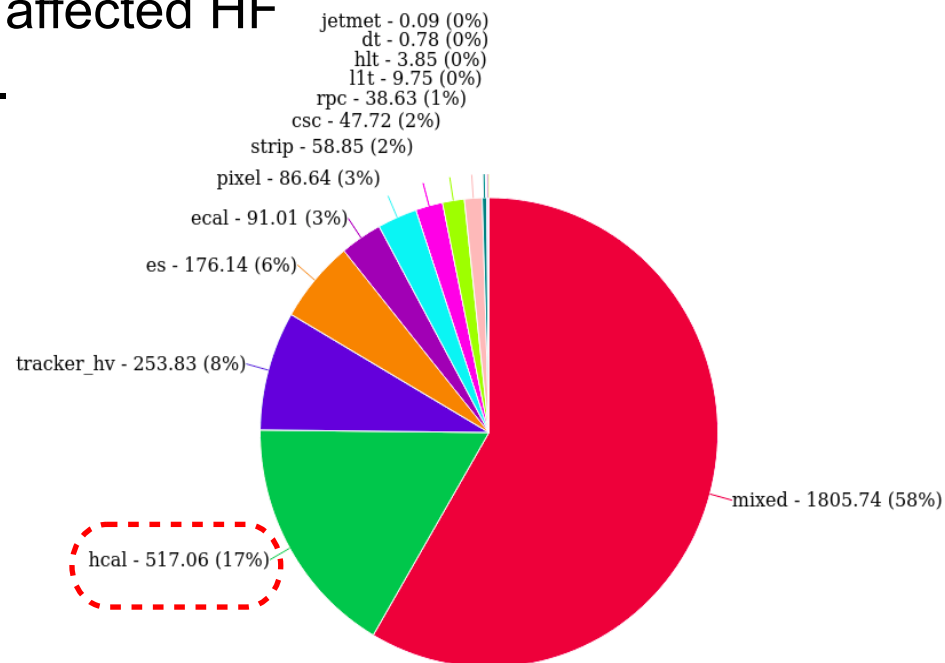
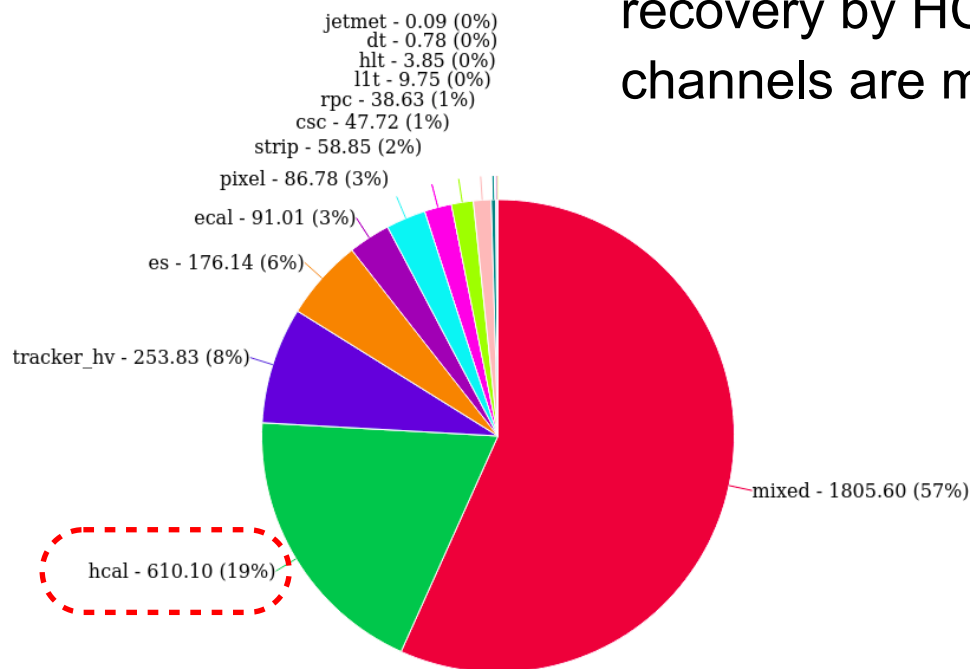
# Total (DQM+DCS) Lumi Losses Comparison(2018)

## Exclusive Lumi Loss

### Latest ReReco

~90 pb<sup>-1</sup> recovered as a result of recovery by HCAL as affected HF channels are masked.

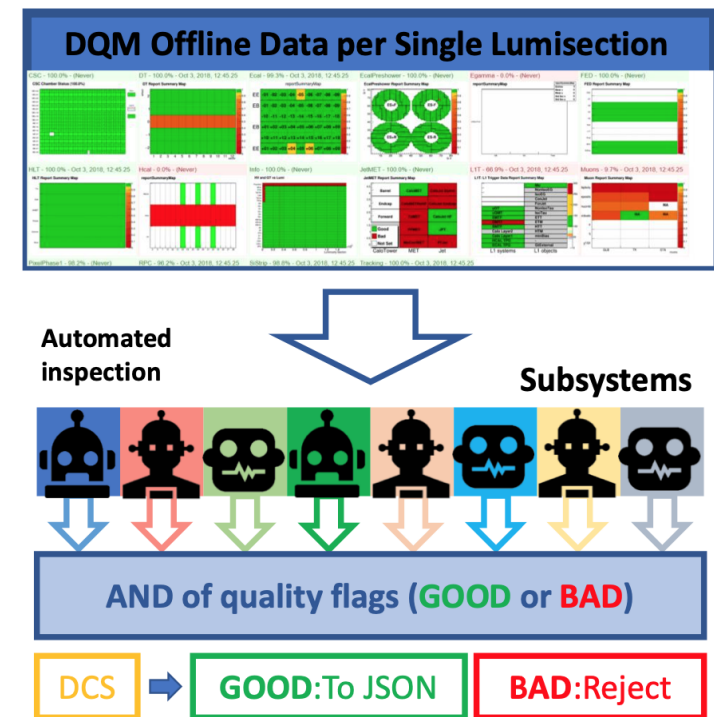
### Legacy



Note : Plots created using the new Run Registry interface

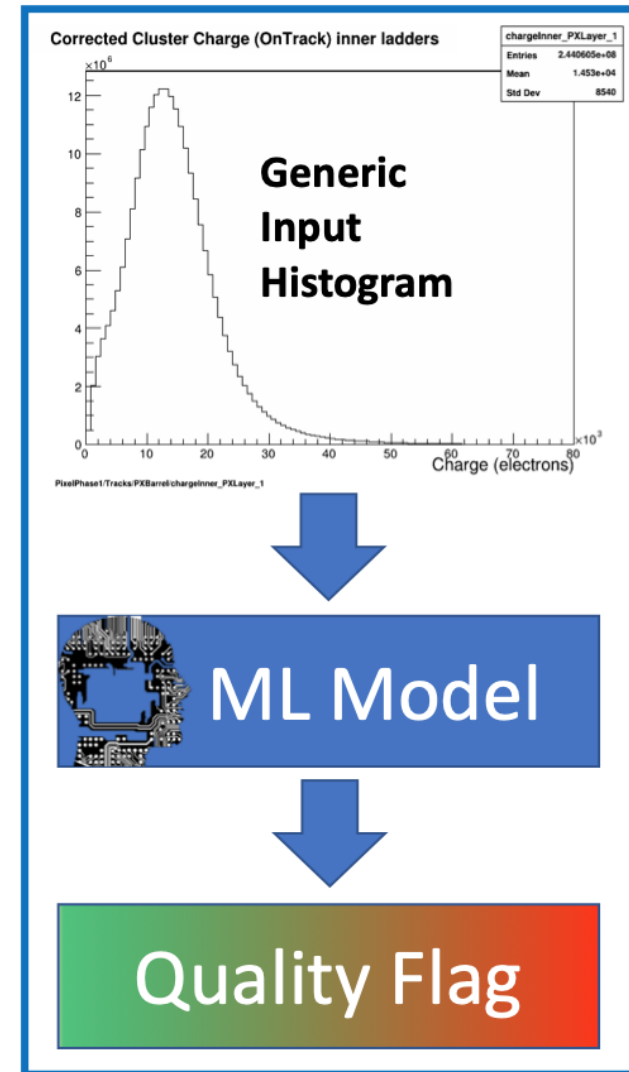
# DC: More automation towards Run3

- Currently CMS Data Certification is done from the two kinds of inputs:
  - DCS, beam condition : already checked automatically, LS by LS (Working well)
  - Data Quality information : checked by subsystem people run by run, mostly
- Data Quality information : requires high level of human-power (Around 50-70 people involved in full process)
- Various ML studies for DQM-DC are ongoing to automatically detect the data quality abnormalities not only in the run level but also LS by LS level (Single LS is data taking in ~23 seconds)
- In addition, there are also semi-automated systems developed to aid the DC process by subsystems



# DC using ML

- Current strategy: investigate single histogram discriminator of each type individually and then combine the outcomes (LS granularity)
- Train autoencoder on GOOD data (golden json) to identify BAD data (anomalies)
- Current main issue: Lack of labelled data. Developed a way to create labelled training data ourselves by re-sampling
- So far, through the DQM-DC ML meetings, mainly only the tracker related histograms were studied. Some activities are also on-going in subsystem group (need some coordination with CMS ML forum and subsystem)



# DQM operations 2020

MWGR#2 (15-17 July) CMSSW_11_1_0_patch2	MWGR#3 (02-04 Sept.) CMSSW_11_1_3	MWGR#4 (07-09 Oct.) CMSSW_11_1_4	MWGR#5 (18-20 Nov.)
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- Significant effort made to make remote ONLINE DQM shifts
- Shifts formate: **primary shift** (8h shift as usual), **backup shift**, **DOCs** ( from core-DQM team )
- **Primary shifters**: were experienced (taken a lot of shifts at p5 in past)
- **Backup shifters**: to ensure the solid DQM operation (considering possible internet, power interruptions, DQM tool issues, etc.)
- Communication channels used: ZOOM (RC & DQM), Mattermost (RC), Mattermost/Skype (within DQM), elog, email, ...)
- The new DQM GUI continued to run in parallel with the old GUI for testing/commissioning (starting from MWGR#3)
- Upgrade of DQM software in CMSSW

# Summary

- Extensive work done ( & in progress) on various fronts for coming Run3 preparations
- Support online DQM operation- MWGRs shift operations and the DQM online system
- DC for Legacy 2016, 2017 & 2018 is completed
- Significant upgrades (nearly) done: DQM code upgraded and development of new tools (GUI, RR, HDQM)
- Upgrade of DQM software in CMSSW (Major clear up to reduce the number of Monitoring elements to reduce running memory)
- Continue DQM shifts operations
  - MWGR (~ one every month from Feb - June, 2021)
  - CRUZET/CRAFT comics data taking (24/7, starting from June 2021 till beam)
  - LHC beam comes in (Oct., 2021)