Online monitoring
CMS vs FVTX comparison

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Introduction

- Feedback from the sPHENIX software and simulations meeting meeting link:
  - Overall people were happy with our initial proposal (using FVTX model)
  - Now we have to work on details
  - Cross-subsystems monitoring will be needed
    - Not strictly responsibility of INTT

- Based on CMS experience on Silicon Strip Detector we made few comparisons for monitoring plots

- All CMS plots are artificially made for visualization purpose
  - NOT TRUE DATA histograms!

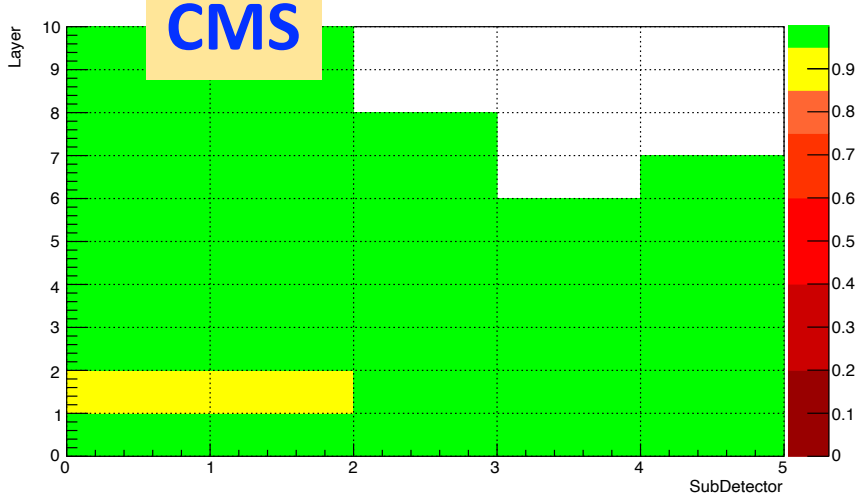
CMS Strip Tracker – Readout components

CMS

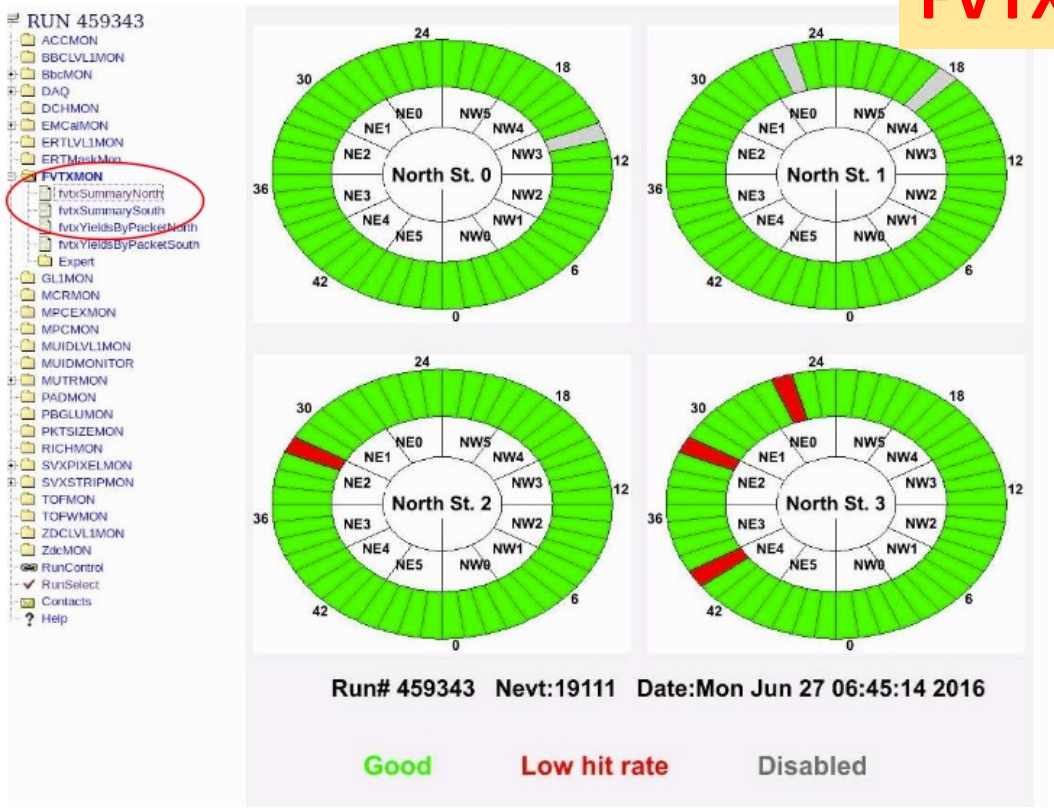
- Around 10M channels
- 128 channels/APV (Analog Pipeline Voltage chip)
- 6 APVs/module (very few cases has 4 APVs) -> 738 channels/module
- 192 APVs/FED (Front-End Driver) ~ 430 FEDs in total

Summary

CMS



FVTX

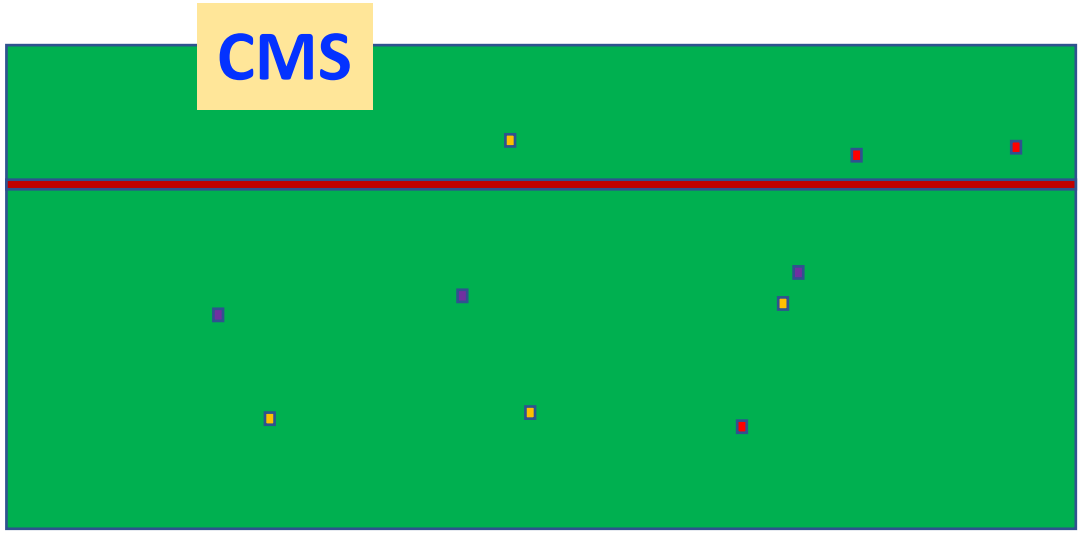


- The fraction of modules which do not pass the Quality Test

- Legend:
  - **green :** status = [95-100]% - GOOD
  - **yellow :** status = [85-95]% - (probably) BAD
  - **red :** status = [0-85]% - BAD
  - **white :** not read out

- Hit multiplicity per event for each ladder
  - **Condition: good, low, disabled**

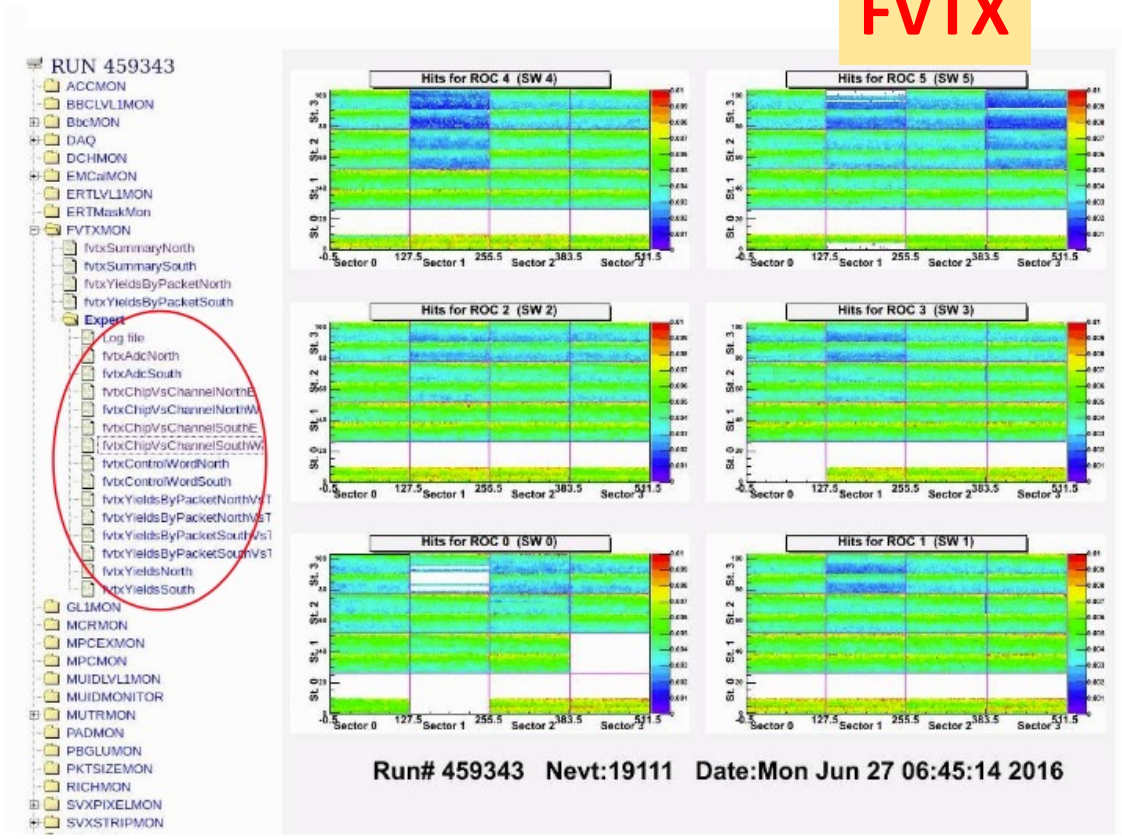
Chip/Channel monitoring



The Subdetector Map, filled with a color code depending on the outcome of Quality Tests.

- **Green** Good
- **White** Missing
- **Dark Red** FED Errors.
- **Pink** Too high (or too low) number of Clusters
- **Orange** Too high (or too low) number of Digis
- **Red** Both high (or low) #Digis and #Clusters
- **Purple** are modules with wrong Volt.

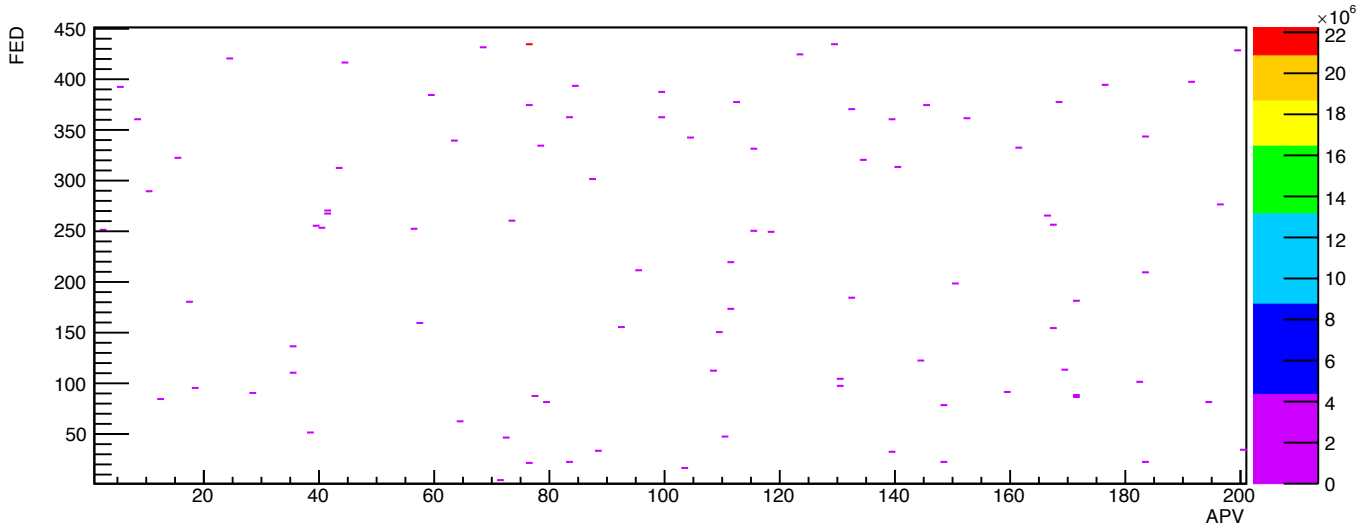
FVTX



- Hit multiplicity for each channel

APV errors

CMS

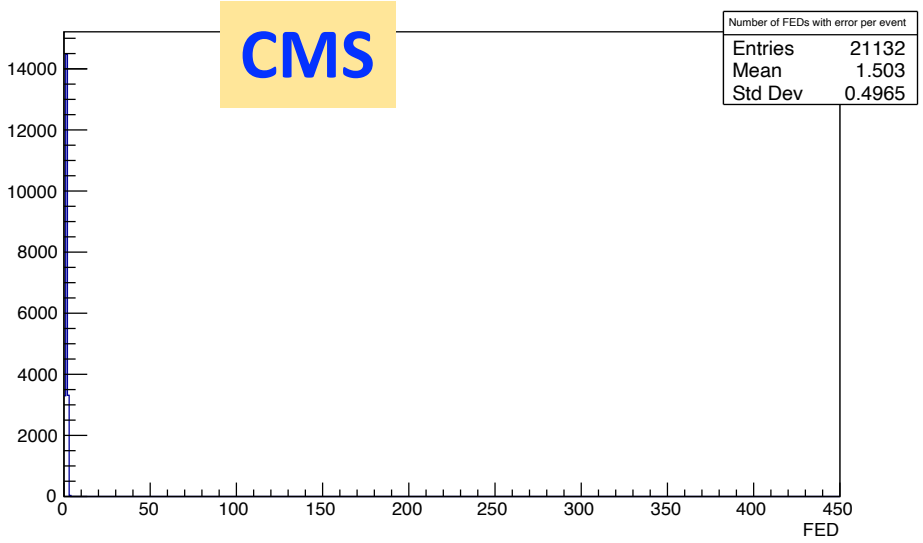


Number of any read-out error for each APV and each FED

More precise information about APV errors

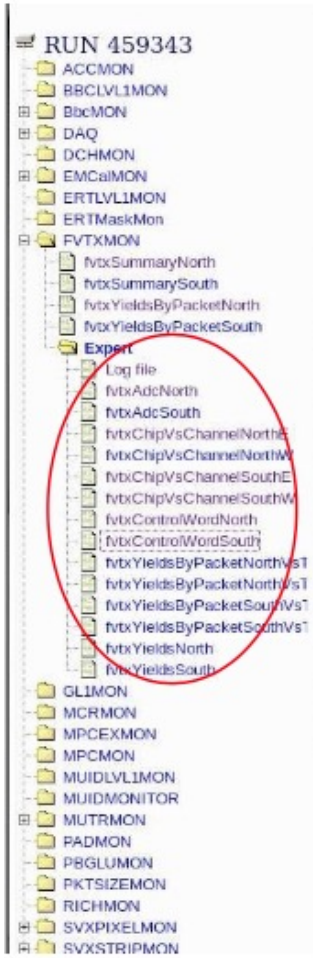
Fed/DAQ errors

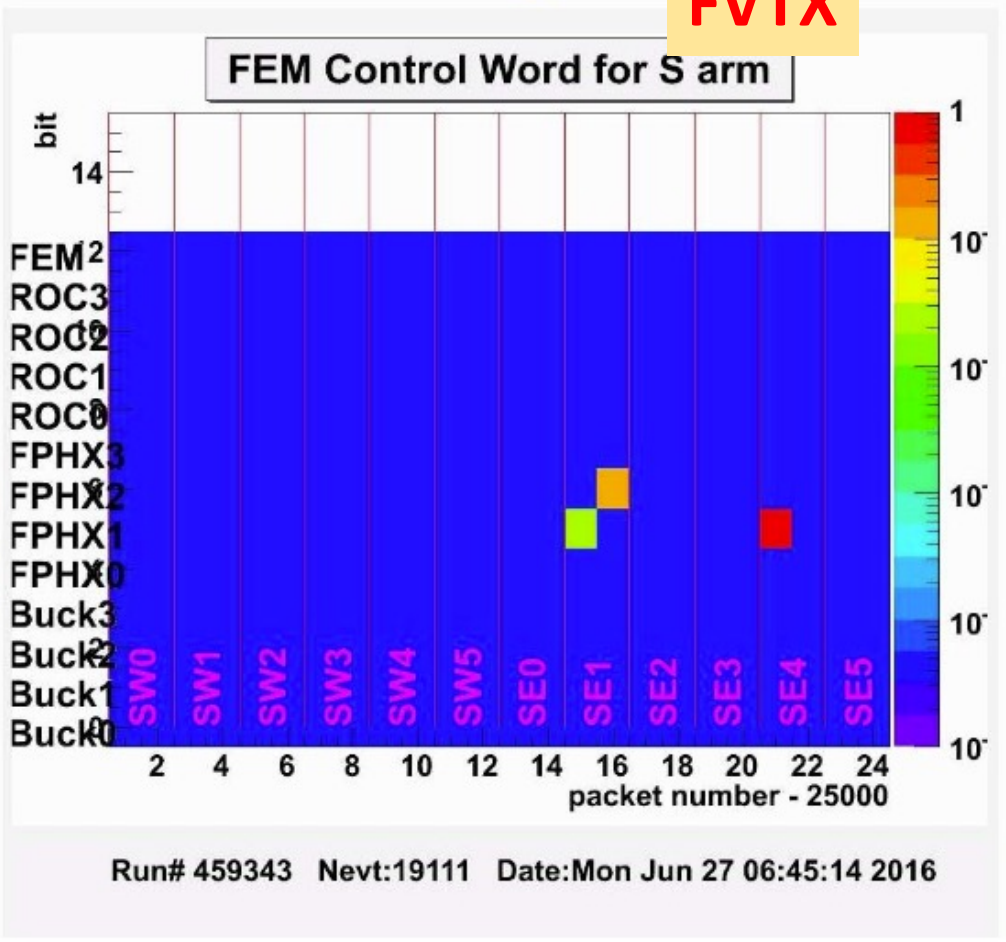
CMS



- The total number of FED showing any error per event
- It is OK to have few FEDs with errors
- If the mean is more than 5 (~1%) further investigation is needed
- Similar histogram with # of bad active channels per event

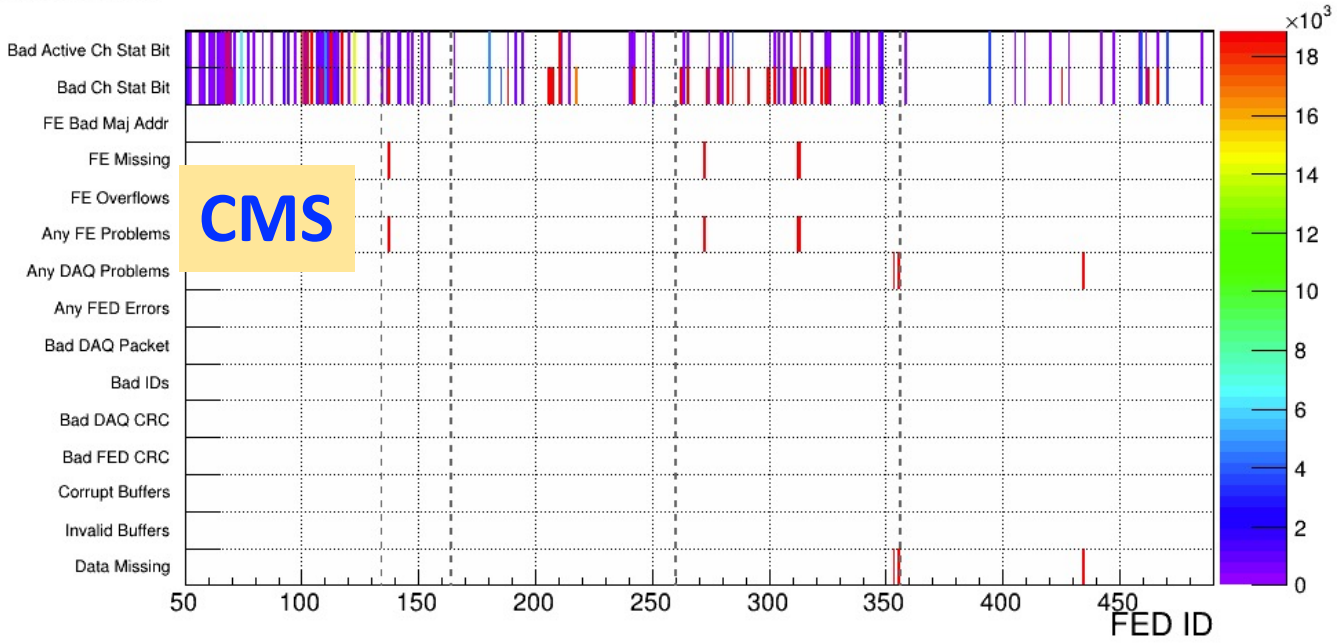
FVTX

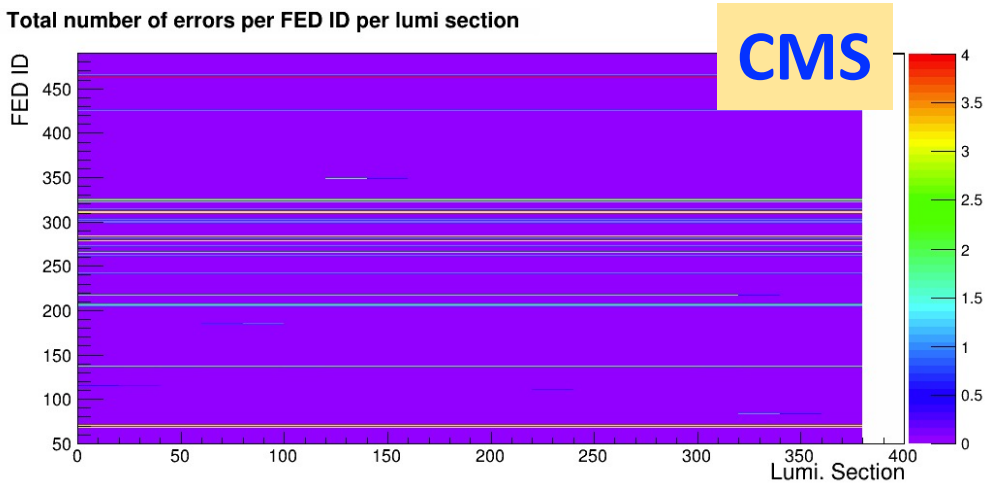




- DAQ errors (Z-axis) vs. packet ID

Fed/DAQ errors





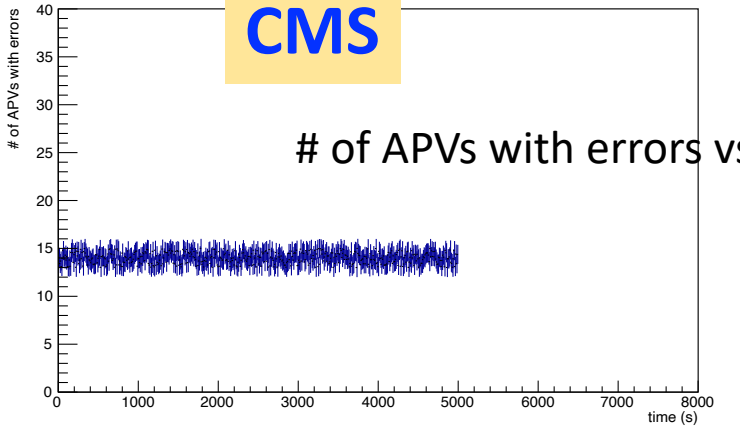
# of errors for FED ID vs lumi section (2D histogram

CMS also has more detailed histograms:

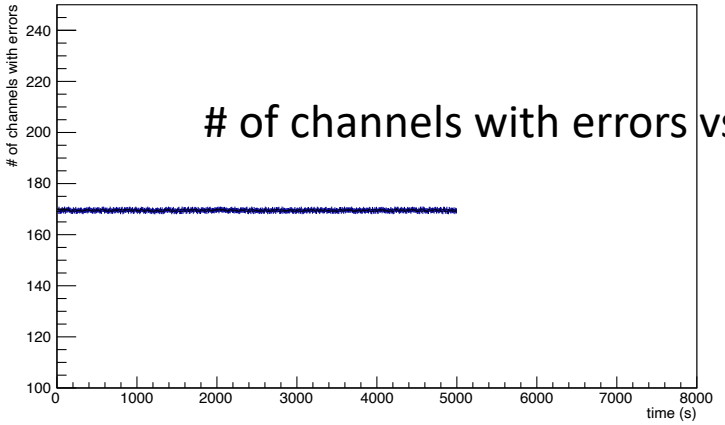
Type of FED errors vs FED ID

APV & Channel errors vs time

CMS



# of APVs with errors vs time.

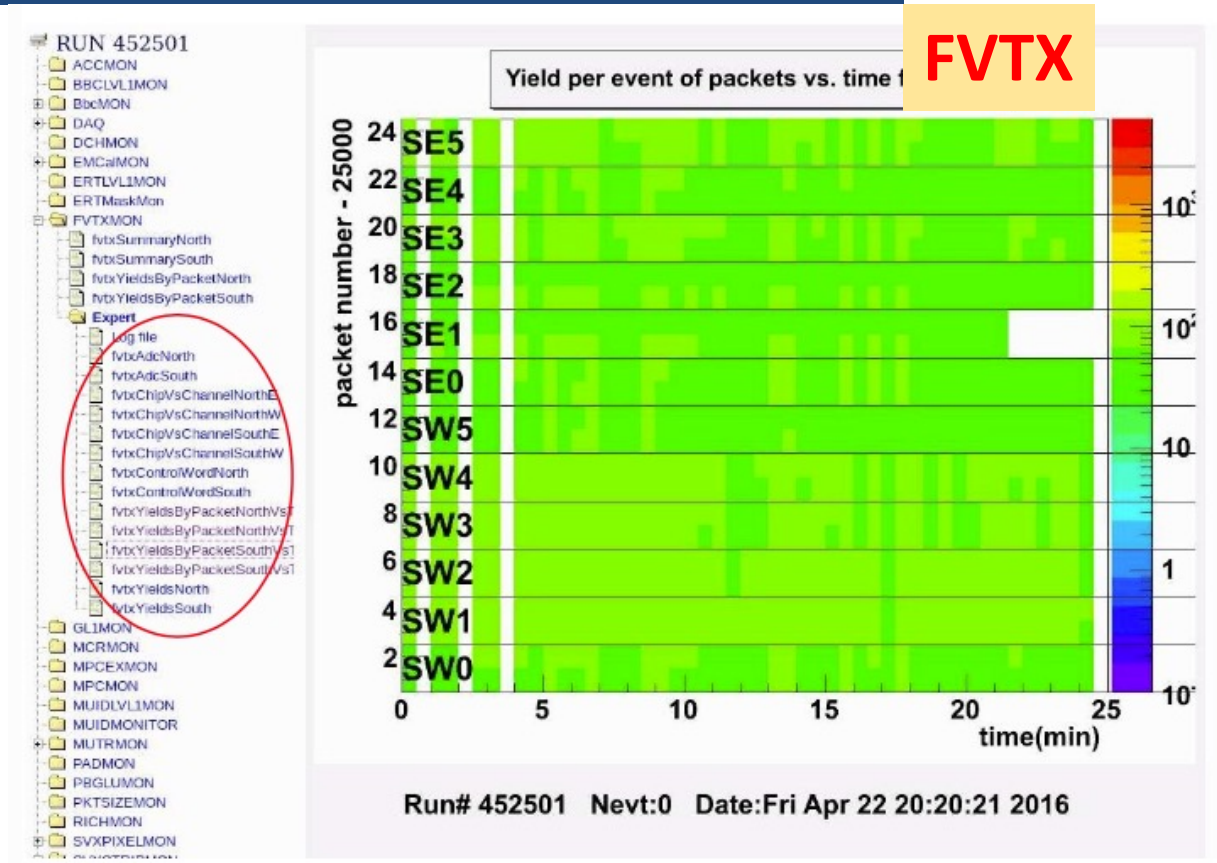


# of channels with errors vs time.

If everything is OK should be constant.

Also should be compared with previous runs.

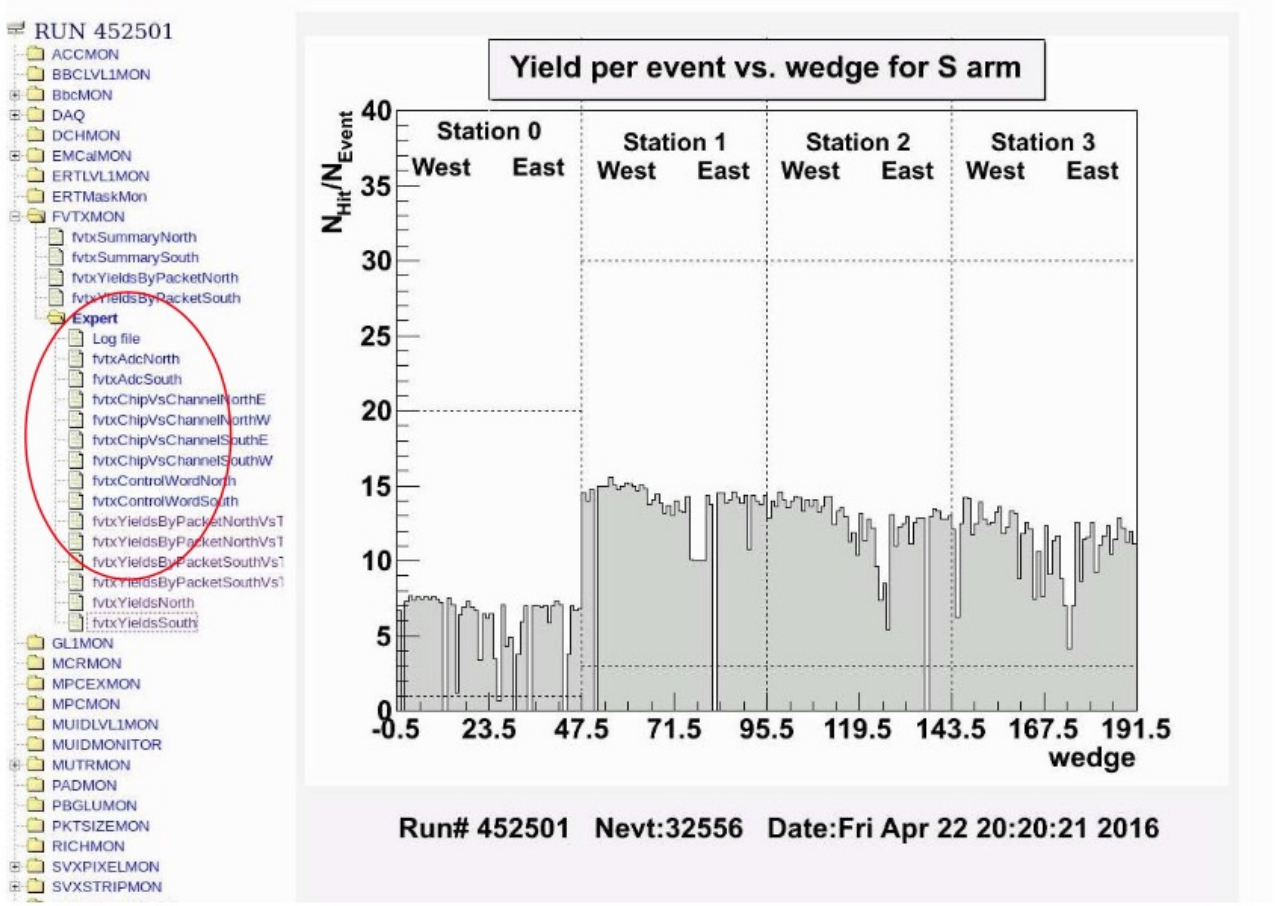
FVTX



Hit multiplicity per packets per event vs. time.

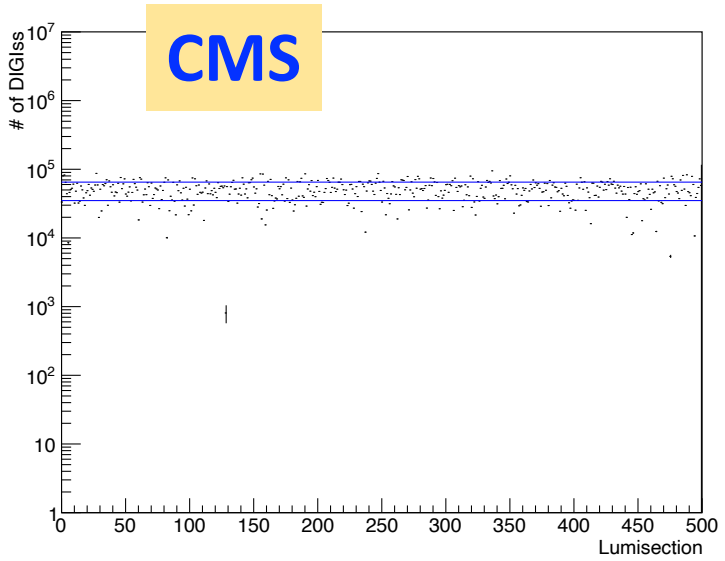
Hit Multiplicity per event vs Wedge

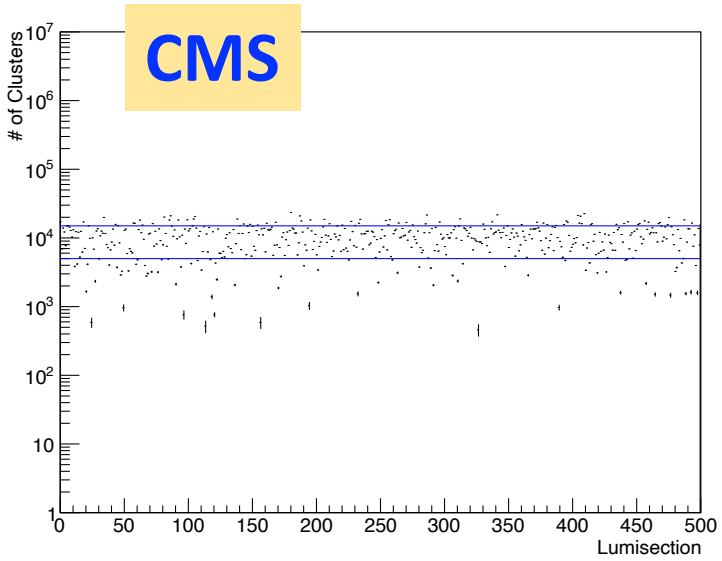
FVTX



- Hit Multiplicity per event vs. Wedge
  - Used to produce the first shift crew plot.

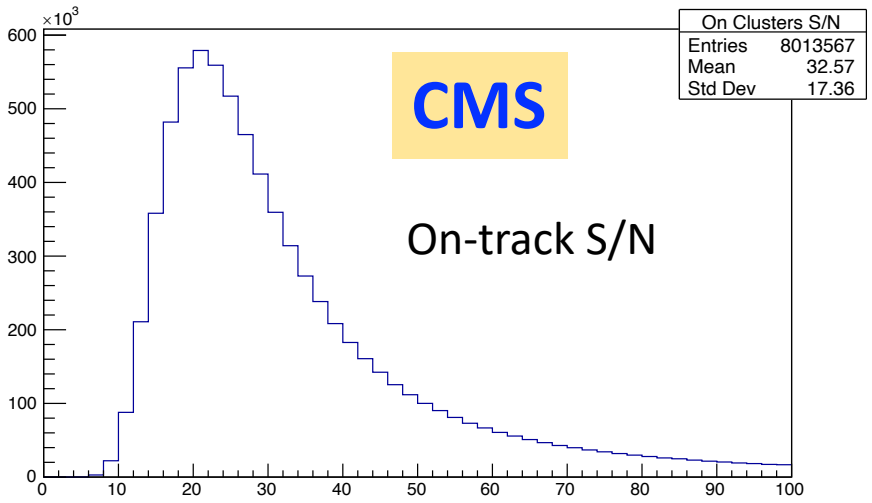
DIGI & Cluster number

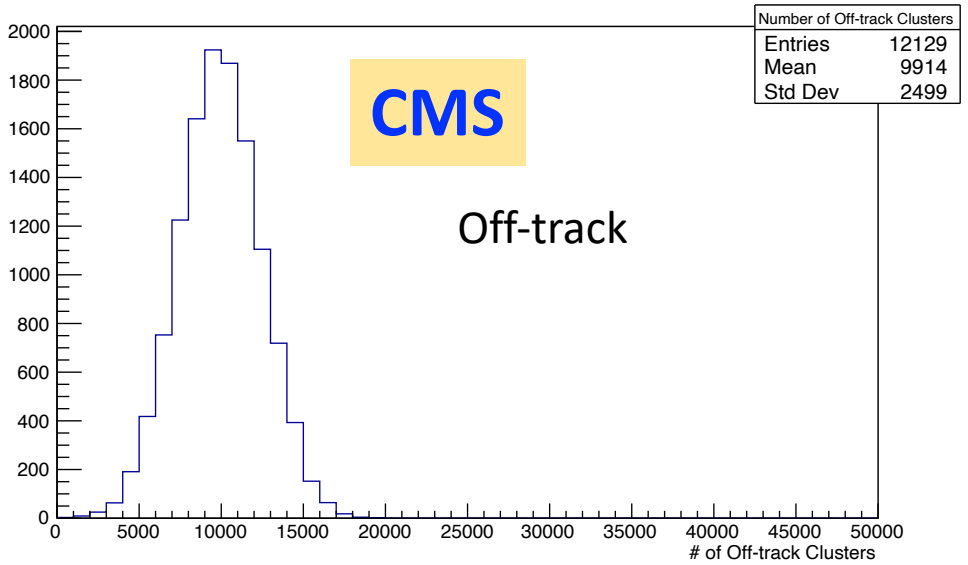




- The total number of clusters as a function of Lumisection
  - Lumisection – a time period in data taking, appr 24 seconds
- The blue lines represent safe limits where the trend should lie (although strongly depends on beam conditions)
- Trend should be uniform
- If is well beyond blue line should be investigated, but not BAD neccesserly

CMC cluster distributions





- The Signal-to-Noise (S/N) distribution from the clusters associated with tracks (on-track clusters)
- The shape is expected to be very close to a Landau distribution
- The peak should be greater than 20

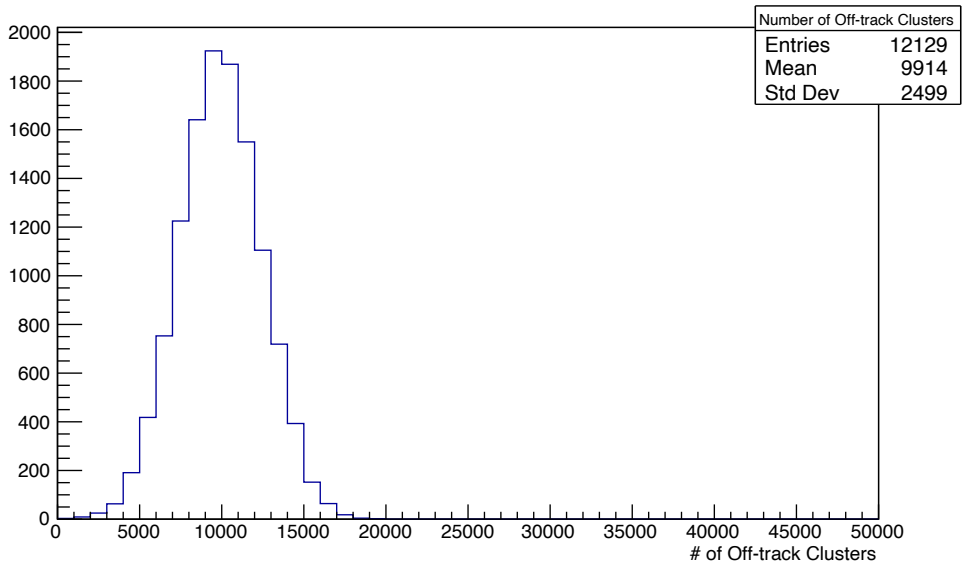
The distribution of total number of clusters not associated with tracks (off-track clusters)

Cannot give definitive check whether Run good or bad.

If the shape of the distributions show a significant changes with respect to previous runs should be investigated.

Off-track Clusters

CMS



The distribution of total number of clusters not associated with tracks (off-track clusters)

Cannot give definitive check whether Run good or bad.

If the shape of the distributions show a significant changes with respect to previous runs should be investigated.

Tracking monitoring

CMS

CMS SiStrip also has tracking performance histograms

And pile-up monitoring

Summary

- Similar ideas behind CMS Silicon Strip Tracker and PHENIX FVTX detector
- CMS goes in more details
- CMS uses also more advanced reco objects (clusters, tracks)

Backup

Module Quality Test

- **DCS Error**: bad if volt is off or not at the proper level.
- **Excluded FED channel**: bad if module is masked
- **Number of DIGIs[1]**: If number of DIGIs is significantly beyond expectation
- **Number of Clusters[2]**: If number of clusters is significantly beyond expectation
- **FED bad channel**: if the mean fraction of bad channels per module is above 20%

- [1]**DIGI** – Signal made when charged particle hits a strip
- The signals from a single charged particle form a [2]**Cluster**