

GEM DPG Activities

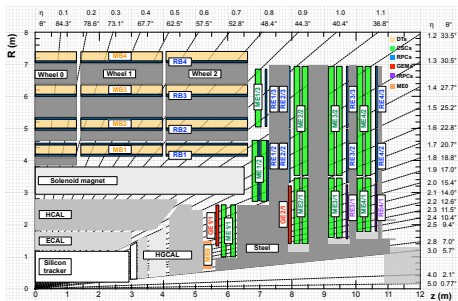
Ian J. Watson

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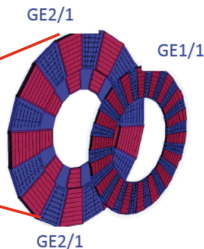
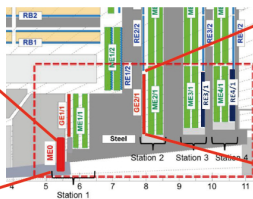
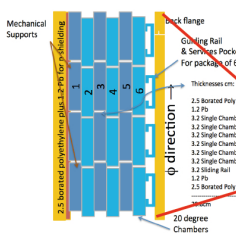
KSHEP Fall Conference
November 28-30, 2024



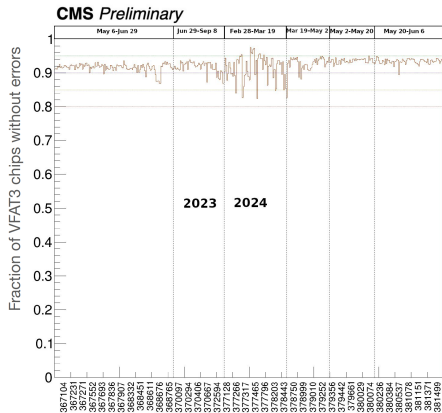
GEM System



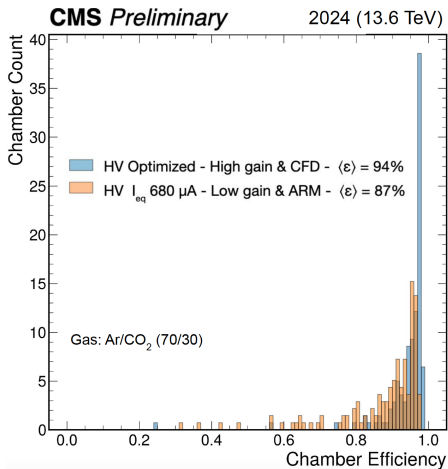
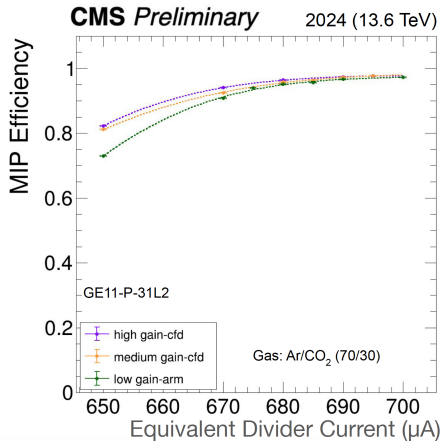
- GE1/1 has been in for Run 3
- ME0+GE2/1 for Phase-II
 - GE2/1: $1.6 < |\eta| < 2.4$
 - GE1/1: $1.55 < |\eta| < 2.18$
 - ME0: $2.0 < |\eta| < 2.8$
- ME0 consists of 6 layers
- At $|\eta| > 2.4$, ME0 alone has coverage in the muon endcaps



VFAT Fraction

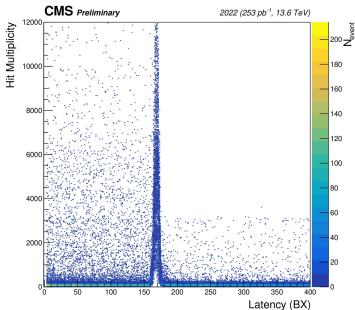
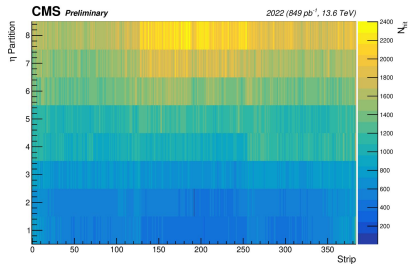
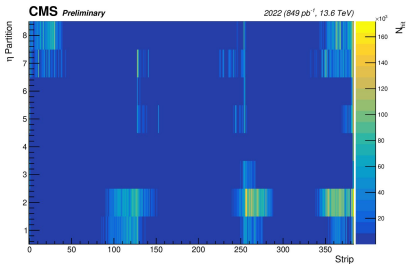


Fraction of VFAT3 front-end chips without readout errors during stable pp collision or cosmic ray runs in 2023 and 2024. Each data point is the fraction per run. Vertical lines are to show periods of constant data taking conditions. During the data taking, the chips might get progressively masked from the readout for a communication instability related to the VTRx [<https://indico.cern.ch/event/1099169>] outgassing issue. To minimize the impact of this unreliability on data taking various developments were done over time. The GEM DAQ software and firmware were progressively modified to handle seamlessly the loss of communication and improve the communication stability. The dip in June 2023 is due to some chambers (4) being shut down by the safety system for high temperature readouts (affected runs are 368672 – 368678).



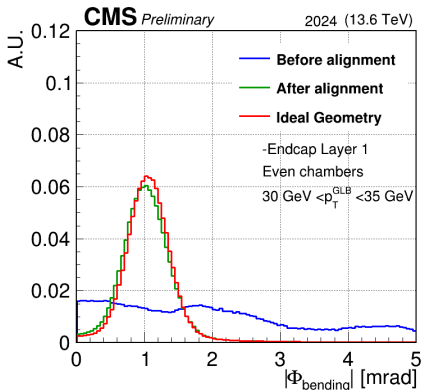
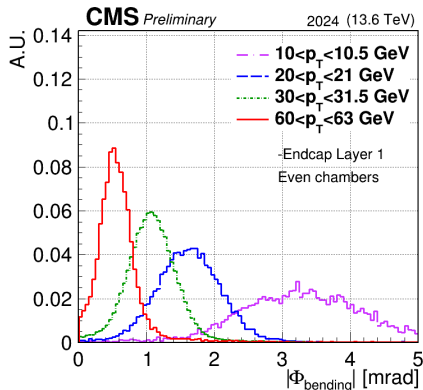
- HV scan performed during 2024 running period
- VFAT settings and HV settings optimized per chamber
- Increase overall efficiency of the GE1/1 detector

Flower Events



- CMS level 1 trigger system sends a L1A signal to read out the detector when an event passes
- "Flower events" happen when a noise signal generated by the L1A signal is higher than the threshold set in the VFAT3 chip for the acquisition of data
- Can see that ~ 160 BX after L1A flower events are generated, with noise clustered near the edge of the detectors
- Can be removed, if needed, by excluding events where L1As occurred 150-200 BX before the read out BX

Bending Angle



- The main purpose of GEM is to improve the trigger efficiency during HL-LHC
- The GEM adds additional measurements in front of CSC, from which the bending angle can be measured, improving the p_T measurement at L1
- We see before and after alignment between GEM and CSC, and clear separation of p_T ranges after alignment
- GEM has this year been included in the CSC triggering system during running

- GEM DPG has been working on checking the GEM system
 - GE1/1 throughout run 3
 - GE2/1 production chambers installed this year
- We have several studies showing the performance
 - Update of settings with HV scan
 - Fraction of good VFAT stability check
 - Flower events
 - Bending angles