Monitoring of Alignment Triggers

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2 February, 2009

Status of alignment triggers (1/3)

As an overview, I'll summarize the status of all alignment-related triggers and their monitoring

- Muon triggers (HLT_Mu5, HLT_Mu9, HLT_Mu11, . . .)
  - primary triggers for long-term alignment (tracker and muon systems)
  - status: covered by muon physics groups

- Muon beam-halo (HLT_CSCBeamHalo, HLT_CSCBeamHaloRing2or3, HLT_CSCBeamHaloOverlapsRing1, HLT_CSCBeamHaloOverlapsRing2)
  - what it is: CSC trigger with a different η cut in L1, CSC RecHit pattern requirements in HLT
  - why we need it: align muon endcaps earlier and more quickly
  - status:
    - L1 hardware and emulator are working, HLT paths exist
    - L1 data are being monitored
    - need to expand monitoring to HLT paths and release validation
    - responsible: Joseph Gartner (U. Florida)

Status of alignment triggers (2/3)

- Tracker-pointing cosmics (HLT_TrackerCosmics)
  - what it is: RPC cosmics trigger in L1, standAloneMuon pointing to tracker in HLT
  - why we need it: reduce weak modes in tracker alignment and study tracker-related systematics in muon alignment
  - status:
    - L1 emulator needed
    - standAloneMuon pointing algorithm needed
    - monitoring package needed
    - responsible*: Yohann Tschudi (Lyon)

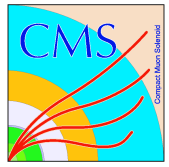
- Tracker beam-halo (HLT_ForwardBSC, HLT_BackwardBSC)
  - what it is: timing coincidence of two scintillator paddles, one on either side of the tracker (L1 passed directly through HLT)
  - why we need it: reduce weak modes in tracker alignment
  - status:
    - L1 emulator became available a few weeks ago, HLT exists
    - monitoring package needed
    - responsible*: Yohann Tschudi (Lyon)

*newly appointed

Status of alignment triggers (3/3)

- Minimum bias (HLT_MinBiasPixel, HLT_MinBiasECAL, HLT_MinBiasHCAL)
  - why we need it: align tracker earlier and more quickly
  - status: basic paths covered by physics groups; considering possibility of adding a new path with a high momentum cut, to lower prescale
- Tracker Laser Alignment System (LAS) abort gap events
  - what it is: monitors tracker alignment independently of tracks; data are transferred through the event stream between collisions
  - why we need it: cross-check, additional alignment constraint

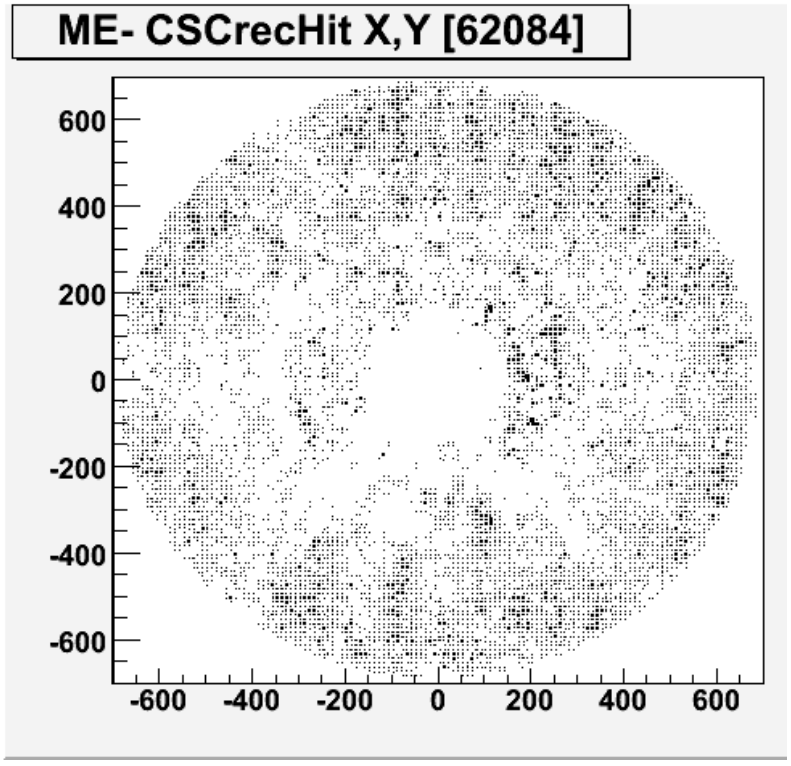
Outline for this talk

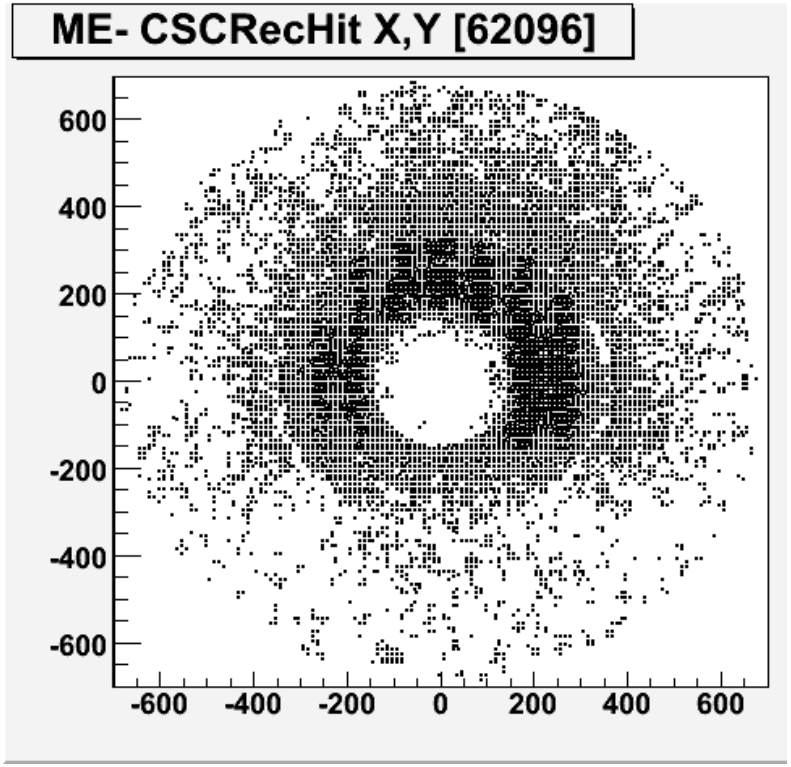


- Since the muon beam-halo monitoring is the most developed, that's what I'll be focusing on in this talk
  - reacting to beam conditions
  - alignment reach as a function of rate
  - example of monitoring plot, future plans
- Plan for tracker-pointing cosmics and tracker beam-halo triggers

Beam-halo in the muon system

- Generally peaks at low radius (near the beamline), but very unpredictable, depends on day-to-day LHC conditions
- Two x-y distributions from September 2008, different runs:

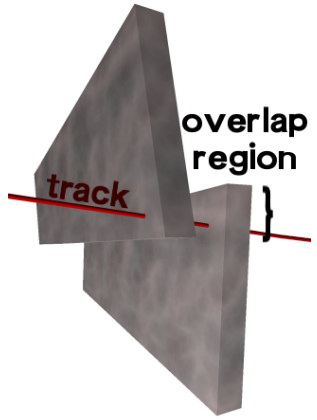


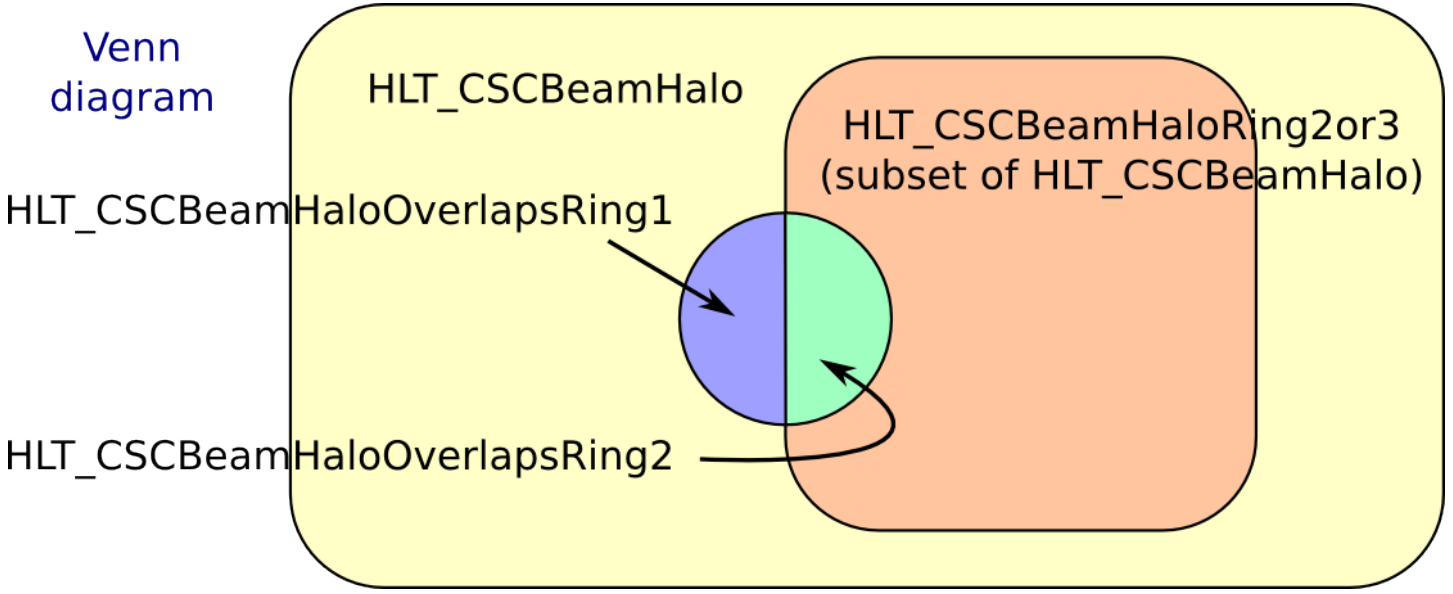


- For alignment and other detector studies, we want to make sure we have enough ring 2 (outer radius) events, without flooding the trigger with ring 1 events

CSC beam-halo paths

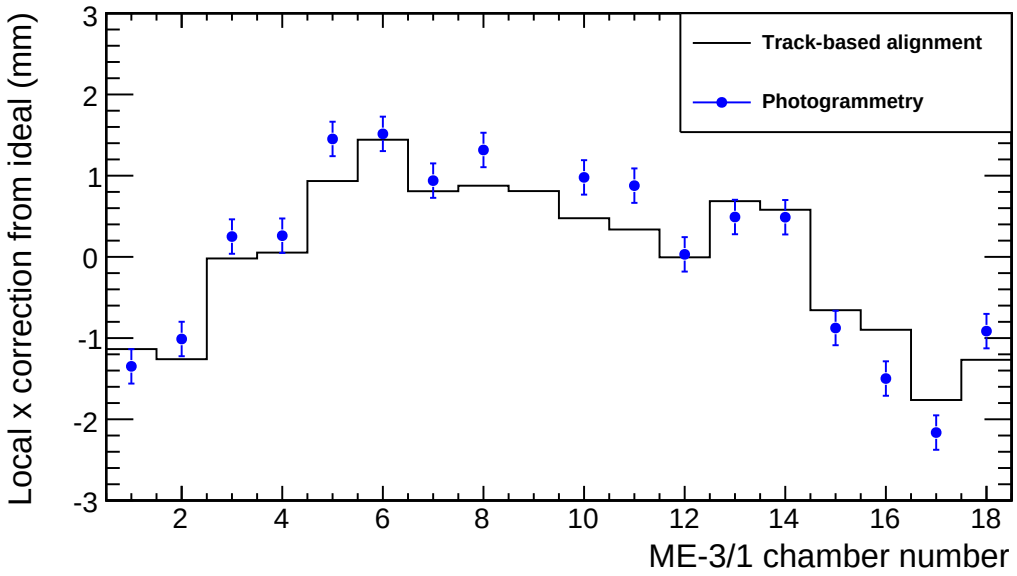
- HLT_CSCBeamHalo only passes the L1 bit: can be prescaled if necessary
- HLT_CSCBeamHaloRing2or3: for general studies of outer detectors, less prescaled
- HLT_CSCBeamHaloOverlapsRing1, Ring2: special events for alignment where track passes through pair of neighboring chambers
  (rate is about 1/50th of general beam-halo: even less prescaled)

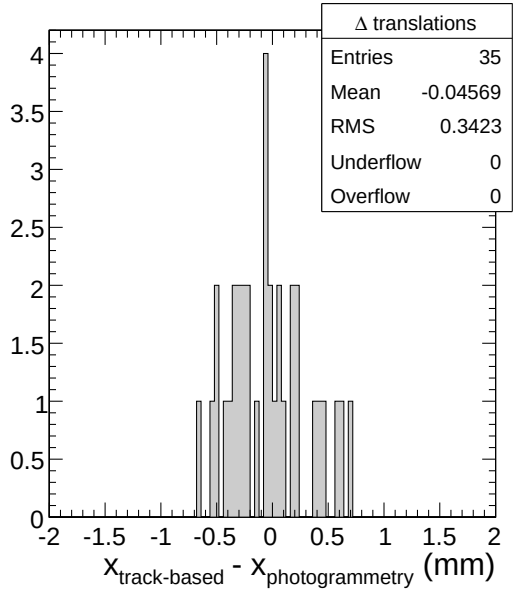




Rate needed for alignment

- Track-based alignment performed with 33,000 ring 1 overlaps events reaches desired accuracy (270 μm in the local x direction) when compared with photogrammetry (an independent method)



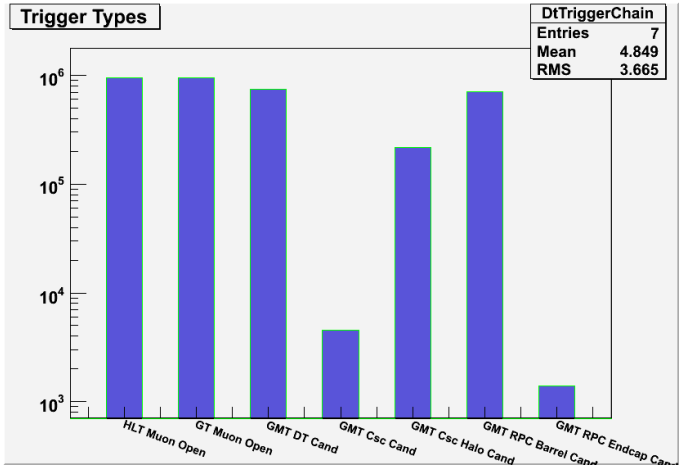


- One complete alignment per day: 0.4 Hz in HLT_CSCBeamHaloOverlapsRing1
- Ring 2 has twice as many chambers: needs 0.8 Hz
- The above was actually collected in 9 minutes (60 Hz, no prescale)
- Modest requirements: monitoring will mostly be important for keeping the rate low and well-distributed

CSC beam-halo monitoring

Present:

- L1 trigger rates and efficiencies in data
- only HLT_CSCBeamHalo path studied
- version exists for release validation, but not regularly used

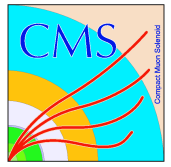


http://tier2.ihepa.ufl.edu/~gartner/plots/Cosmics/

Future:

- should track all four HLT paths
- monitor continuous distributions, such as x-y of CSC RecHits, to understand why the rate changes when it does
- should be a routine part of RelVal, probably in DQM

Tracker-pointing cosmics plan

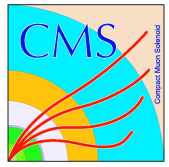


- Needs trigger development before monitoring project begins
  - no L1 emulator for RPC cosmics trigger yet (issue will be raised in Trigger Review on Wednesday)
  - current HLT implementation does full silicon tracking, but a standAloneMuon should be sufficient to determine if an RPC cosmic points to the tracker
- Tracker DPG has named a responsible person and institution
- Plan: keep all 1–2 Hz of tracker-pointing cosmics, or if prescale is needed, make it ϕ-dependent to reach sides of the detector

Tracker beam-halo plan

- Seen as part of the same project/responsibility
- Now that L1 emulator exists (recent development), only needs monitoring

Summary



- Status of all alignment-related triggers given on pages 2–4
- Reminder: most important events for alignment come from standard physics triggers— single muon and minimum bias
- Of the "special" triggers, brief status is
  - CSC beam-halo: monitoring should be expanded
  - tracker cosmics: trigger development needed, monitoring will be a part of that
  - tracker beam-halo: only monitoring needed now
  - tracker considering extensions to minimum bias triggers
  - LAS planning to transfer data through the abort gap
- Tracker DPG has named a person/institution responsible for cosmics and beam-halo (Yohann Tschudi, Lyon)