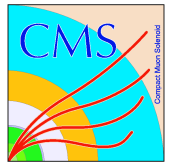


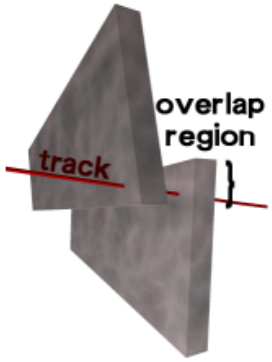
A Look at MuAlBeamHaloOverlaps Data

Jim Pivarski

Texas A&M University

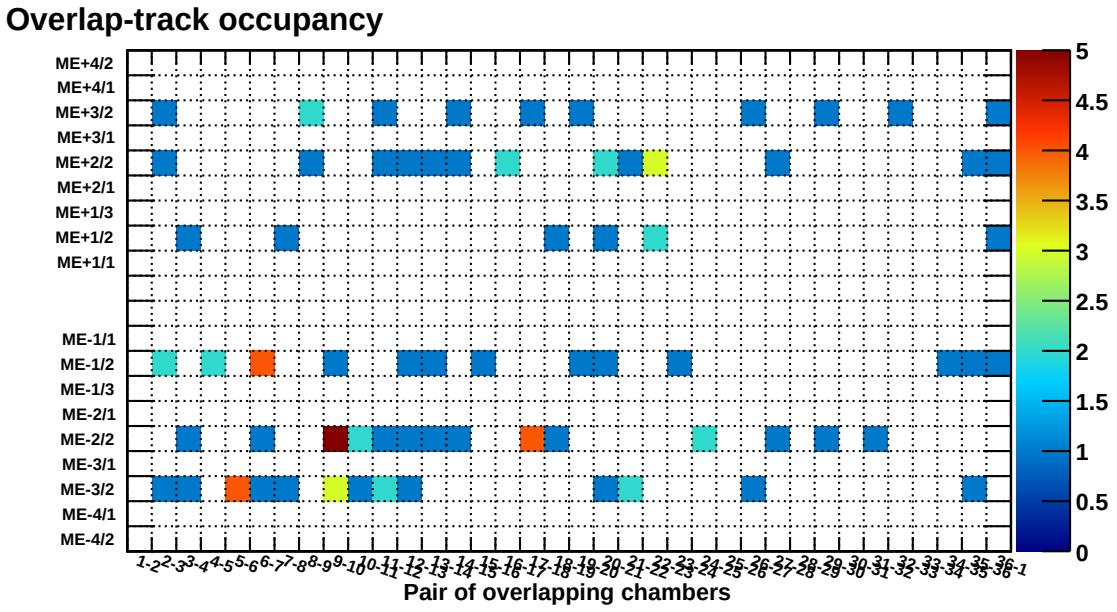
24 November, 2009

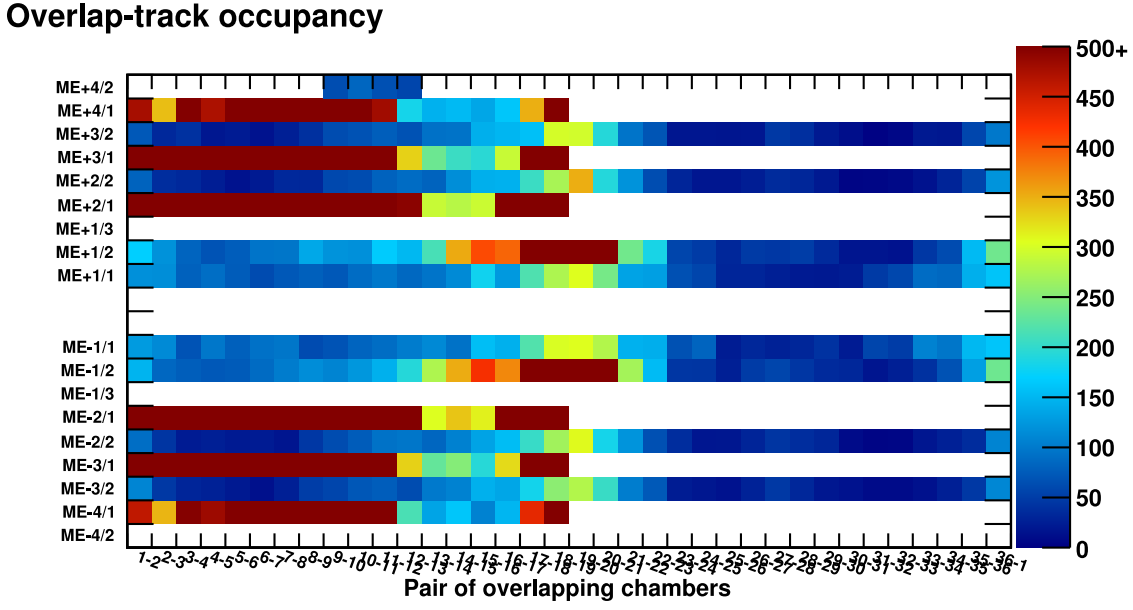
Event counts



- Reminder: we're looking for tracks that pass through the overlap region of pairs of CSC chambers—about 7% of the total beam-halo rate because of geometric acceptance
- MuAlBeamHaloOverlaps: about 170 events
  MuAlBeamHalo: about 2430 (as of yesterday)
  - prompt reco: includes data up to 122281 (Monday 9:30 GMT)
  - trigger configuration:
    - HLT_CSCBeamHalo* only until Monday morning
    - all muon triggers (including HLT_L1OpenMuon*) thereafter
  - almost all events are in three runs only:
    - 121964, 20 Nov 21:30, 72 events in MuAlBeamHaloOverlaps
    - 122269, 23 Nov 4:50, 61 events
    - 122270, 32 Nov 5:20, 35 events
- ExpressMuon/ExpressPhysics: the MuAlBeamHaloOverlaps selection algorithm (without HLT requirement) returns 20 events because most of them have zero "cosmicMuon" tracks
- ZeroBias: selection returns 1380, but nearly all are cosmic rays

Occupancy distributions

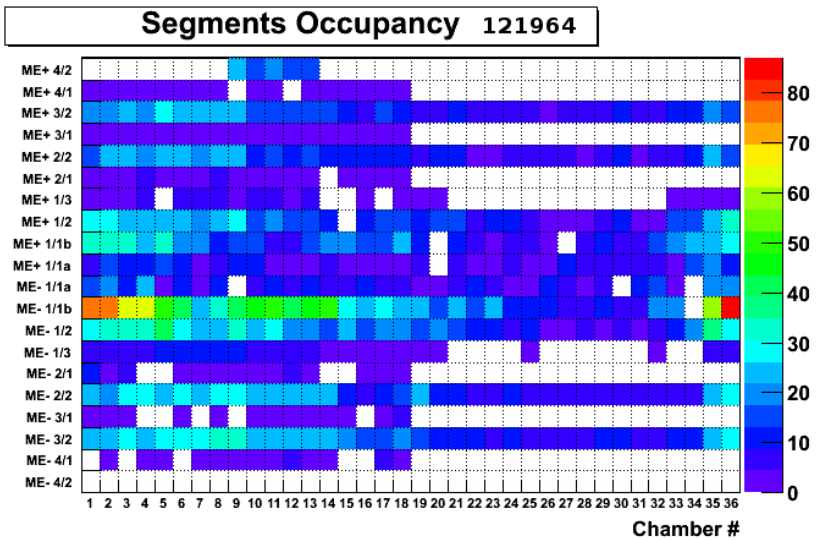


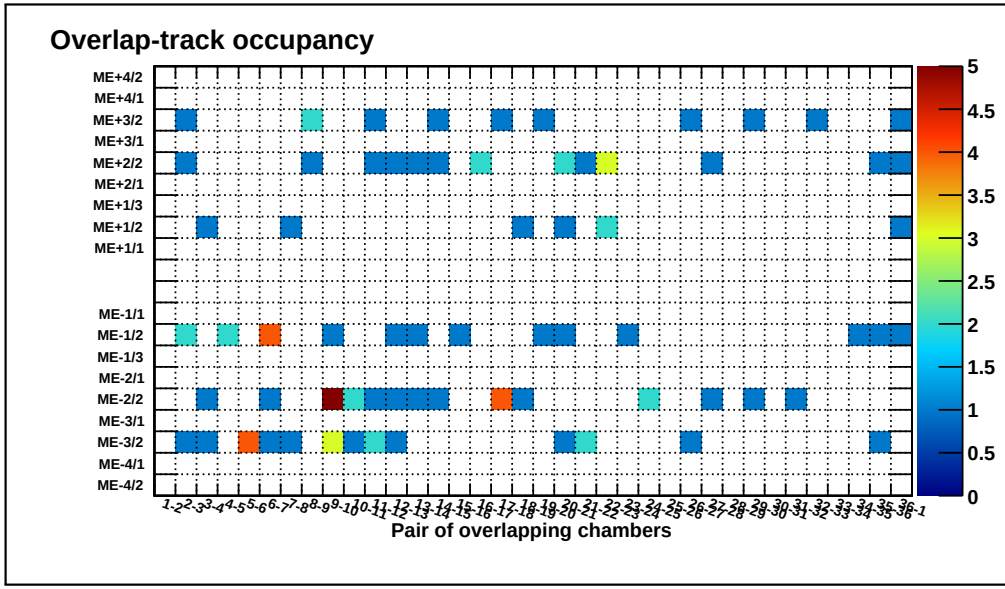


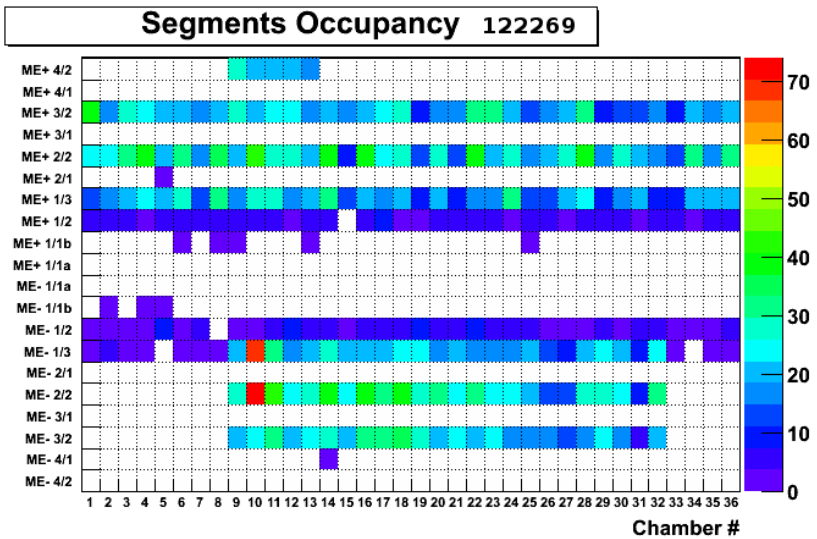
- Tracks crossing *pairs* of chambers (multiply by 2 for total segments)
- Top: data
  Bottom: MC
- ME1/3 has no overlaps and ME2/1, 3/1, 4/1 have only 18 chambers
- Only low-rate ring-2 collected because ring-1 was at low voltage (STANDBY) for safety

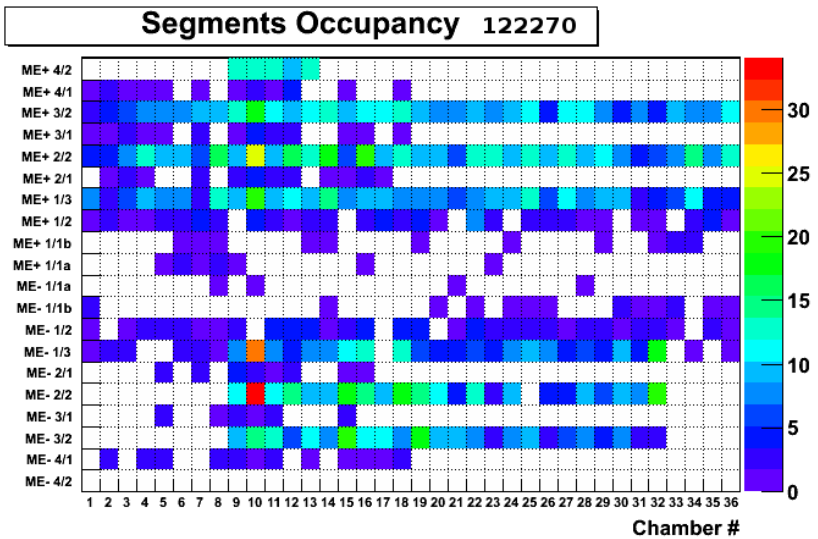
For comparision: CSCValidation

- CSCValidation segment occupancy plots for the three runs
- Confirms higher rate in ring-2

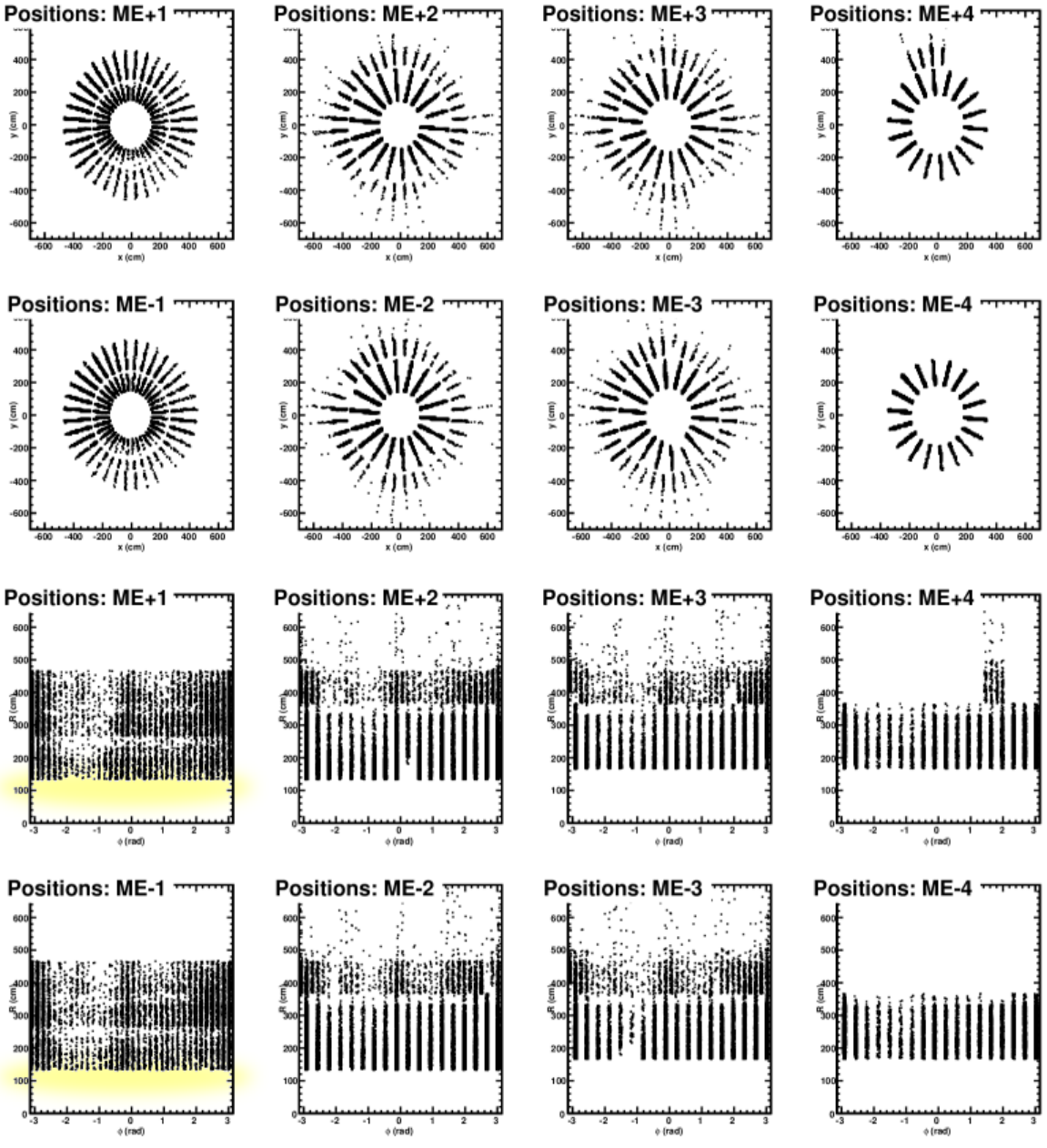




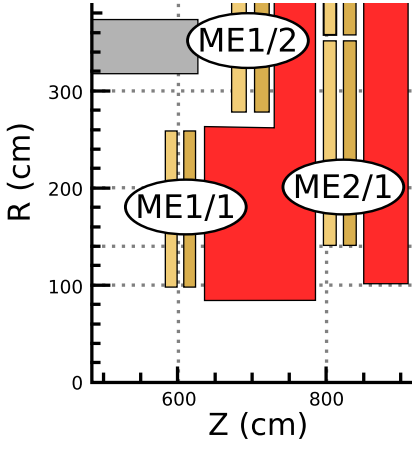




Hit distributions (MC)

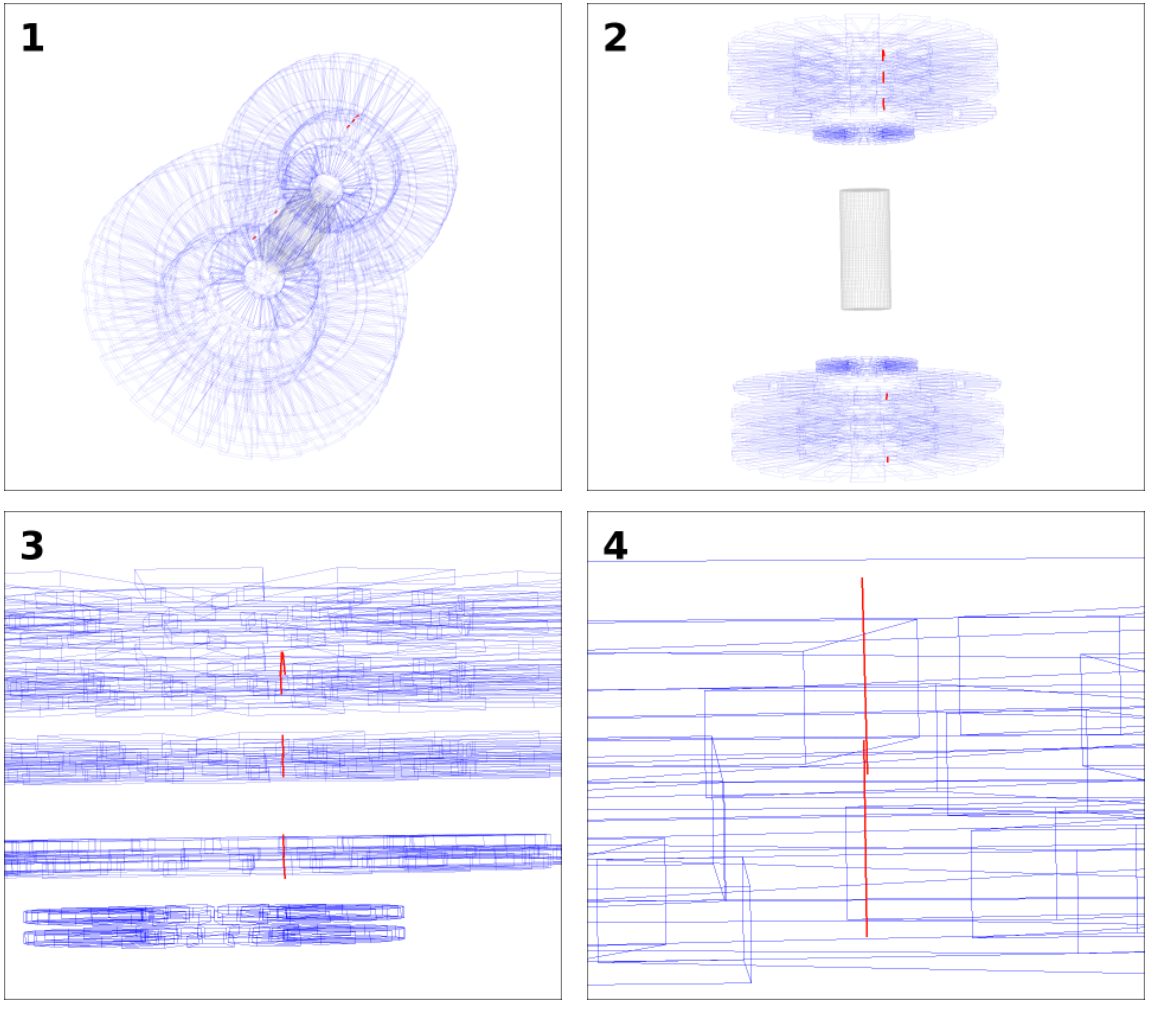


- Top: Y vs. X
  Bottom: R vs. ϕ
- Both are MC
- Radial spokes along CSC edges indicate that overlap selection works
- ME1 $R < 140$ cm missing due to beam-halo trigger requirements



Event display pictures (data)

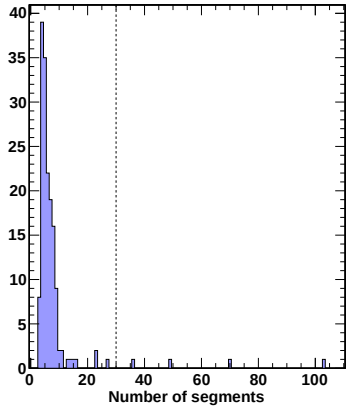
- ∼90 beam-halo/gas, ∼10 beam-splashes, and ∼70 cosmics
- Zooming into a nice beam-halo event:

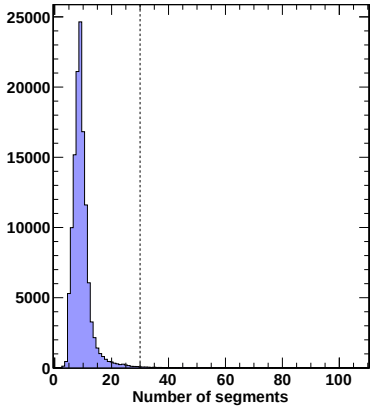


Offline cuts

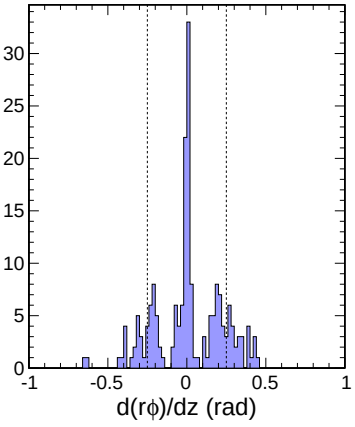
- Top plots: data, bottom plots: pure beam-halo Monte Carlo

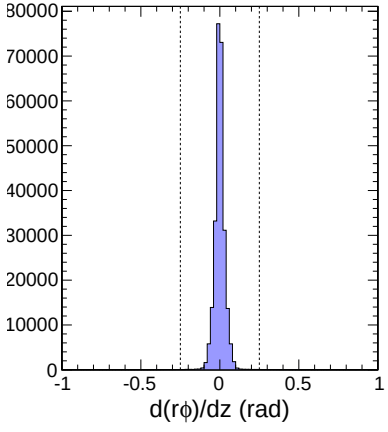
Anti-beam-splash: # segments < 30



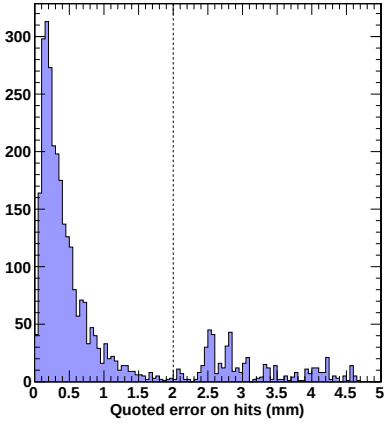


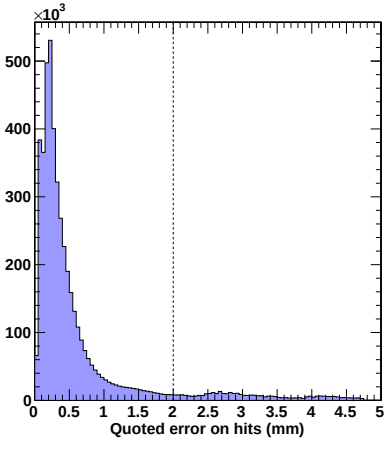
Anti-cosmic: point to beamline (± 2.5 mrad)



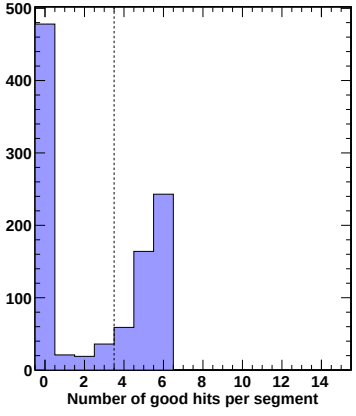


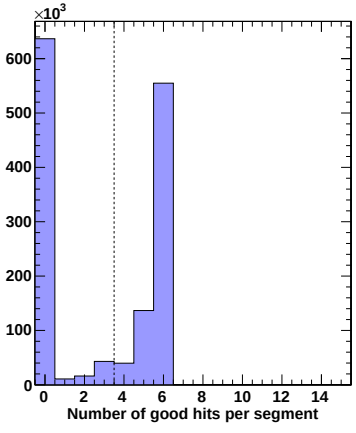
Exclude last cathode strip: hit error < 2 mm



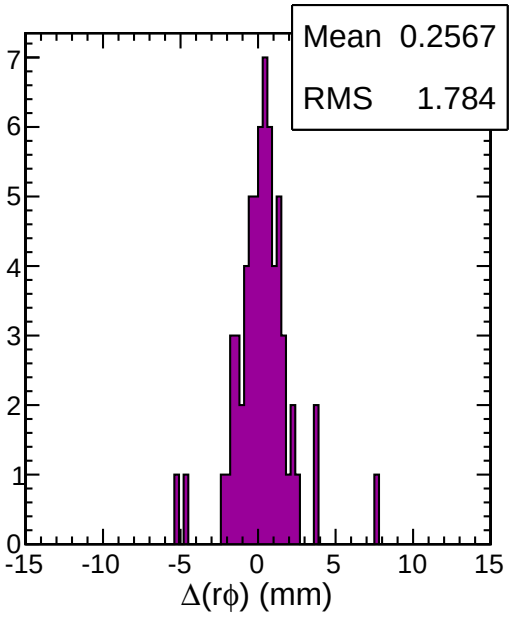


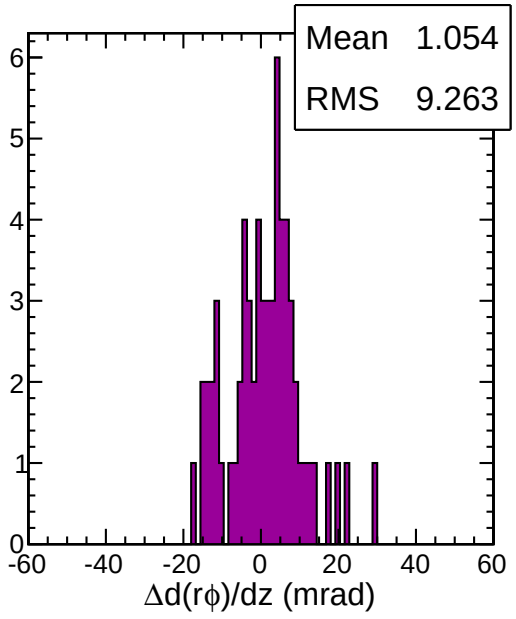
Fiducial segments: #hits/segment ≥ 4 (usually require 6)

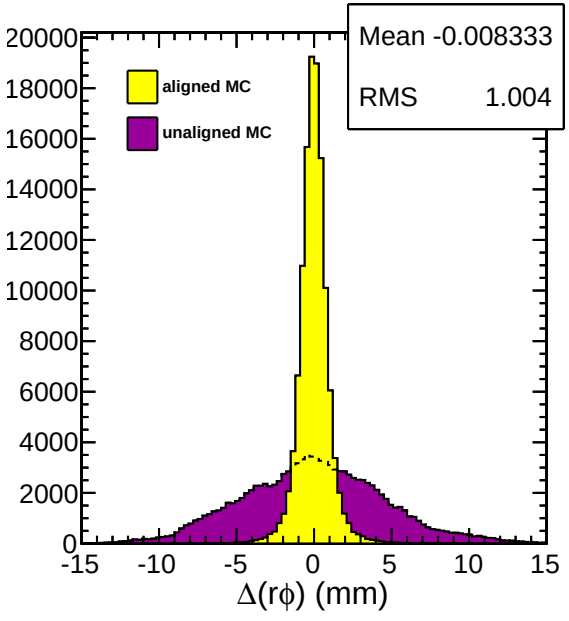


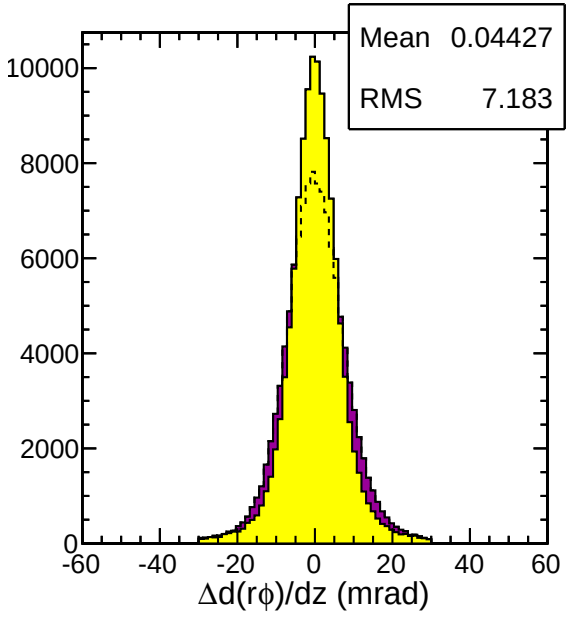


Residuals

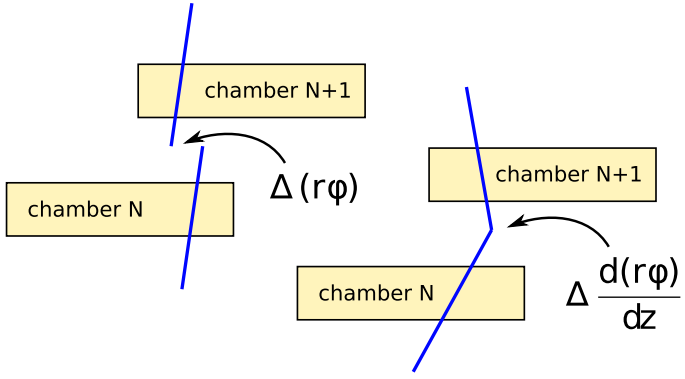






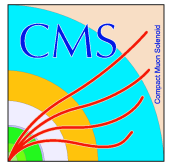


- Top: data, bottom: MC
- $\Delta(r\phi)$ and $\Delta\frac{d(r\phi)}{dz}$:



- Error in $\Delta(r\phi)$ dominated by $\Delta\frac{d(r\phi)}{dz}$ resolution
- If #hits/segment $= 6$ (all segments must be fiducial), MC resolutions improve by 20%

Conclusions

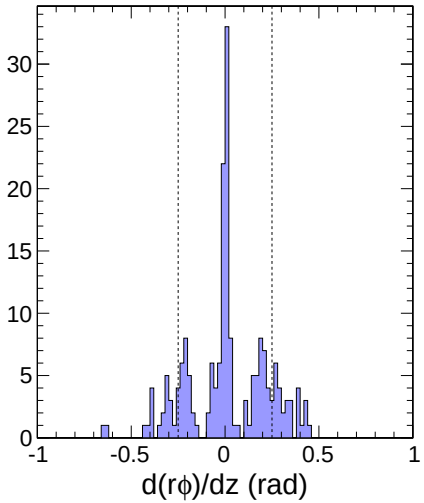


- Beam-halo overlaps sample still has too low statistics for alignment
  - tried to find the events in ExpressMuon, ExpressPhysics, and ZeroBias, but they aren't supersets of MuAlBeamHaloOverlaps
- The events we have make sense
  - most events in ring-2 because ring-1 CSCs not at high voltage
  - individual event displays look like the overlap events we want
  - plots differ by beam-splash and cosmic ray backgrounds
  - fewer hits per segment than MC: inefficiency due to lower voltage?
  - residuals consistent with $\sim$1 mm misalignment relative to ideal
- The alignment machinery will work when needed
  - tested in MC, including new features

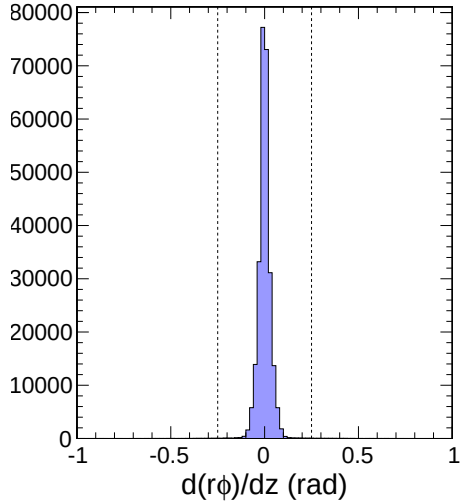
The ZeroBias sample

- The ZeroBias sample is ∼all cosmic rays:
- MuAlBeamHaloOverlaps and beam-halo MC shown on page 7

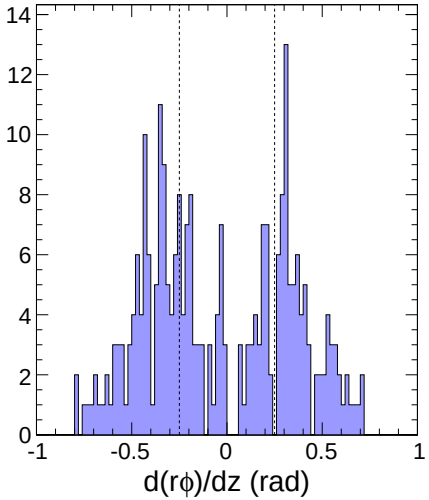
MuAlBeamHaloOverlaps



Pure beam-halo MC

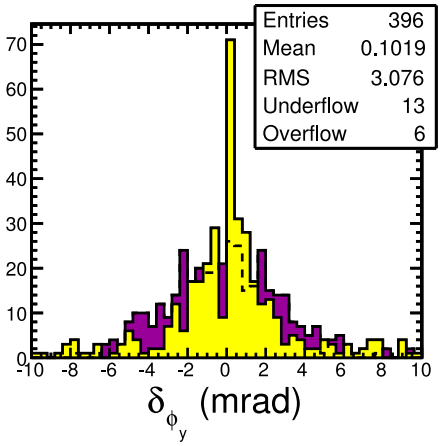


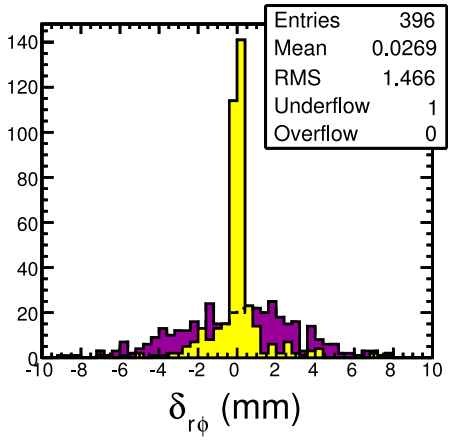
ZeroBias sample

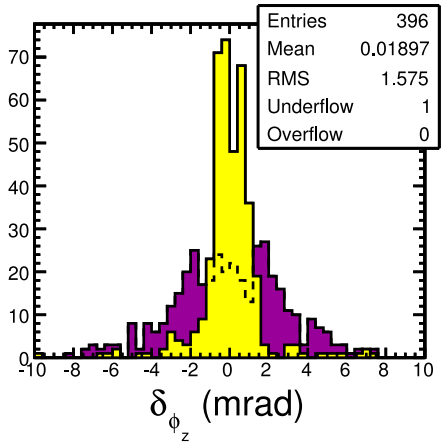


MC alignment accuracy

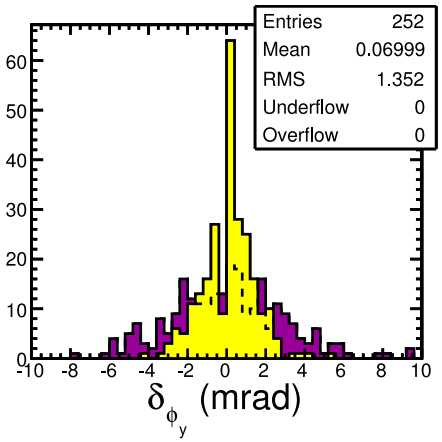
All rings:

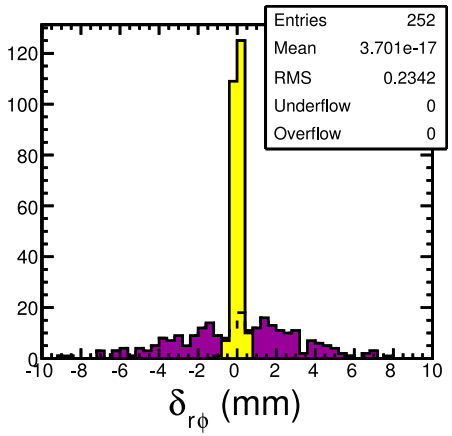


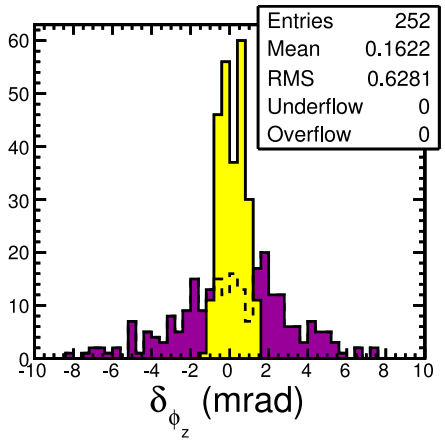




ME2/1, ME3/1, ME4/1







- Grain of salt needed: MC ϕ and R distributions are unrealistic
- Bottleneck seems to be ϕ_y (mean of $\Delta \frac{d(r\phi)}{dz}$ residuals), which can be determined better with tracker tracks from cosmics or collisions