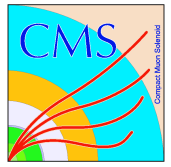

Prompt CRUZET-4 Alignment and AlCaRecos

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Muon cosmic-ray AlCaRecos

MuAlStandAloneCosmics

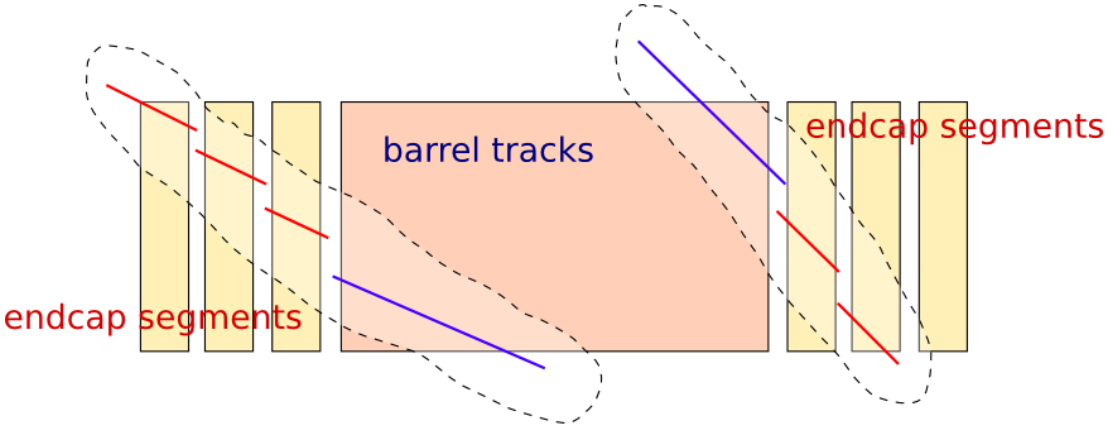
- Completed alignment of endcap disks to barrel (while they were moving)

MuAlGlobalCosmics, MuAlZeroFieldGlobalCosmics

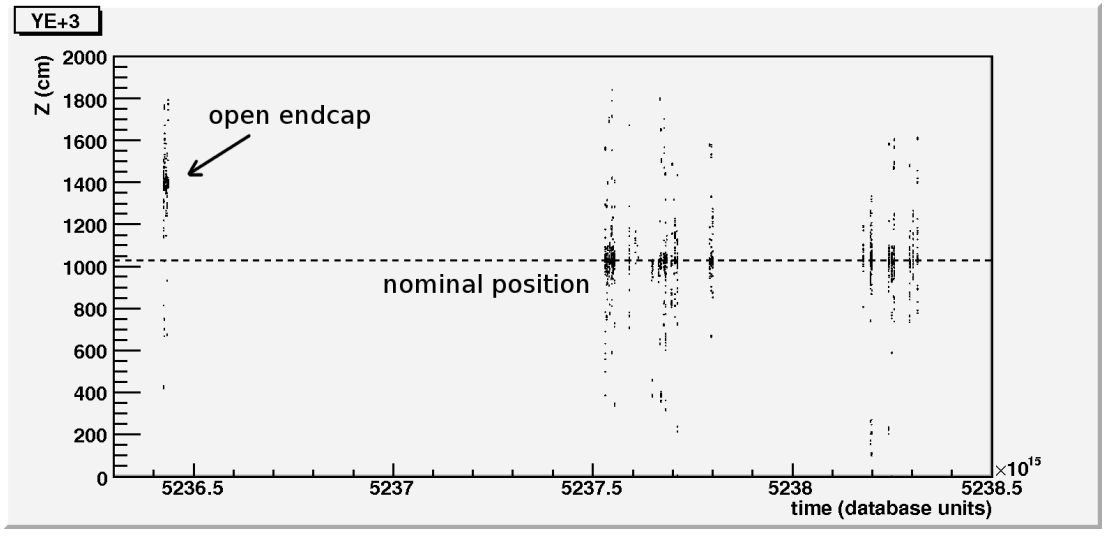
- Discovered a problem with handling of tracker hits

Alignment of endcap disks

- Barrel-to-endcap procedure, no tracker involved (same as CRUZETs 1–3)
- We now build tracks in a way that is insensitive to z misalignment, so we no longer need an approximate pre-alignment
- Compute alignment corrections (e.g. z) from each hit residual
- Disks moved during data-taking: two validity intervals



identify disconnected tracks and segments if they are parallel



Results for early period

Only one run (57795)

	ME+1	ME+2	ME+3	ME+4
Δz (cm)	+3.1	+301	+301	+373

	ME−1	ME−2	ME−3	ME−4
Δz (cm)	−1000	−1011	−1011	−1048

Results for late period

	ME+1	ME+2	ME+3	ME+4	*(no minus-side)*
Δx (cm)	0	+0.3	+0.3	+0.5	
Δy (cm)	−0.5	0	0	−0.2	*±0.2 cm*
Δz (cm)	−1.8	−1.8	−1.8	−1.8	
$\Delta\phi_x$ (mrad)	+1.9	+1.1	+1.1	−0.8	*±1 mrad (not used)*
$\Delta\phi_y$ (mrad)	+2.0	+1.6	+1.6	+1.6	*±1 mrad (not used)*
$\Delta\phi_z$ (mrad)	−0.3	0	0	+0.6	*±0.25 mrad*

(ME2 = ME3 is now imposed as a constraint, used to gauge uncertainty)

$\Delta z = -1.8$ cm? (backup slide)

Can the endcap be *closer* to barrel than nominal? (a question for DPG)

Barrel to each station: *(nearly the same value in each)*

-1.80 cm (ME+1), -1.88 cm (ME+2), -1.85 cm (ME+3)

Relative between stations: *(no gaps between stations)*

-0.32 cm (ME+1→2), -0.03 cm (ME+2→3), 0.05 cm (ME+3→4)

Aligned barrel doesn't seem to be a displaced reference because repeating endcap alignment using nominal barrel yields:

-1.3 cm (ME+1), -1.6 cm (ME+2), -2.6 cm (ME+3)

Without hit weights, -1.8 cm → -1.3 cm *(still persistently "$-1.x$")*

Maybe nominal position includes a (rather large) gap?

Could be resolved by a conversation with the experts, but the track-based alignment results are unanimous

Global cosmic-ray AlCaRecos

- Select cosmics that pass through tracker and bulid globalMuon
  (two different ways, for robustness and cross-checks)
- Purpose: for aligning muon system relative to tracker
- Status: installed in system, produced all the data records we asked for, but 2_1_X introduced new requirements that weren't forseen (and weren't caught in validation)

New in 2_1_X:

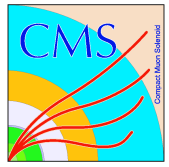
- Tracker RecHits don't store position, must recompute from clusters
- Muon AlCaReco selector does not store clusters-associated-to-tracks
  - Javier is implementing that, with help from Giovanni Petrucciani
- Cosmic-ray AlCaRecos include all tracker clusters
- But we don't know how to use them:

  globalMuon refitter module $\neq$ tracker refitter module (updated)

What we're doing about it

- Muon AlCaReco will store associated clusters, just like tracker AlCaReco
  - implementation is partly/nearly done
  - updating one C++ class corrects all muon AlCaRecos
  - will be queued as soon as it is (fully) validated
- Two options for globalMuon refitting:
  - teach current refitter (TracksToTrajectories) to deal with new tracker RecHits correctly
    - configuration file changes don't seem to be sufficient
    - contacting the author
  - teach tracker refitter (TrackRefitter) to deal with muon hits
    - would also be a C++ change
    - TrackRefitter would then provide a superset of TracksToTrajectories functionality
- Setting up a complete muon alignment validation "test-stand"
  - reproduce *full* alignment workflow
  - RelVals will soon include AlCaReco streams
  - more manpower required, might be fulfilled within A&M

Summary and outlook



Endcap disk alignment completed in CRUZETs 1, 2, and 4; CRUZET-3 dataset is now ready for the procedure

- constants sent to Luca and Pablo (both CRUZET-4 IOVs)

Discovered an inadequacy in our globalMuon AlCaRecos, but we can fix it for the future and maybe work with it now

Tracker-to-muon alignment will need to wait for solution