



First look at CRUZET track-based CSC alignment

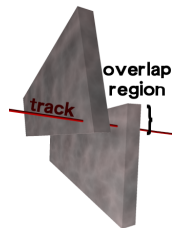
Károly Banicz, Jim Pivarski*, Alexei Safonov*

US-CMS, *Texas A&M University

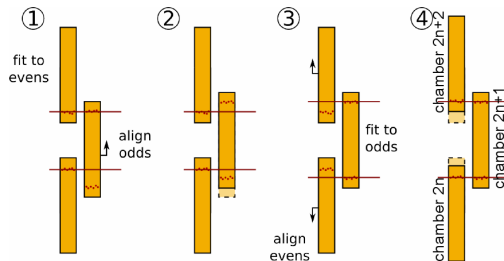
18 June, 2008



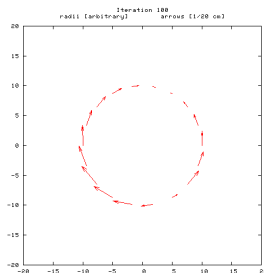
- ▶ Different track-based alignment procedure from the one we propose for high-luminosity samples
- ▶ CSC-Overlaps procedure: look for tracks (tracklets?) passing through two CSC chambers in the same ring
- ▶ Two modes:
 - ▶ move all chambers until track fits are consistent
 - ▶ propagate alignment from a known measurement (SLM-measured chambers) to the chambers in between
- ▶ Can be used
 - ▶ without a working silicon tracker
 - ▶ without fully-reconstructed tracks (just segments)
 - ▶ without modification for \vec{B} =on and \vec{B} =off
- ▶ Independent development effort, largely by Karoly Banicz



Method:



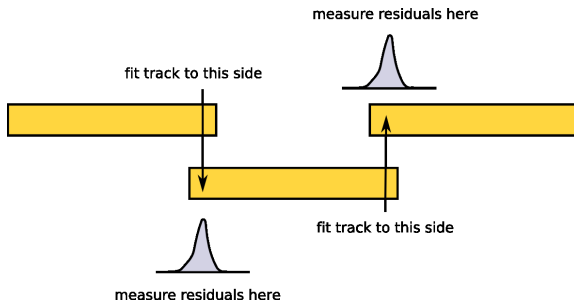
Problem with convergence



- ▶ Starting from a perfectly-aligned detector, global distortion grows (iteration 100 shown on left)
- ▶ Due to the fact that HIP minimizes *mean* of residual distribution, and this global distortion introduces symmetric double-peaks which preserve the mean



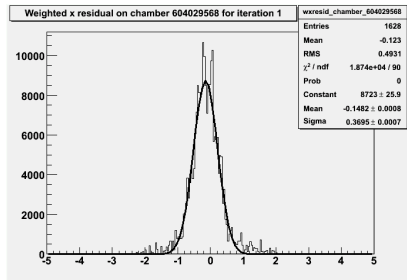
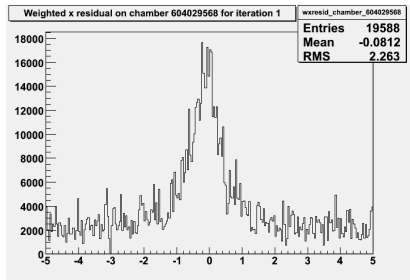
- ▶ Don't want left-residuals and right-residuals to balance
- ▶ Make sure that each chamber sees only one kind of residual
- ▶ Align evens and odds at the same time, using left-sides and right-sides differently:

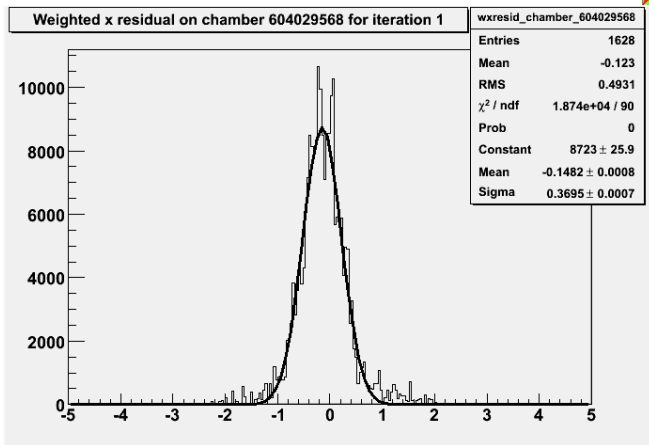


- ▶ Implemented but untried (start with the same MC sample)



- ▶ Track-based/hardware comparison possible in ME+4
- ▶ CRUZET-I data available for skimming
- ▶ Too few tracks in the (narrow) overlap regions
- ▶ Tracking may be too restrictive, e.g. requiring coincidence between stations
- ▶ Built tracks out of pairs of segments in neighboring chambers
- ▶ Quality cuts: (a) only one pair allowed, (b) segment-pair must be fitable to a single line with $\chi^2/\text{ndf} < 10$



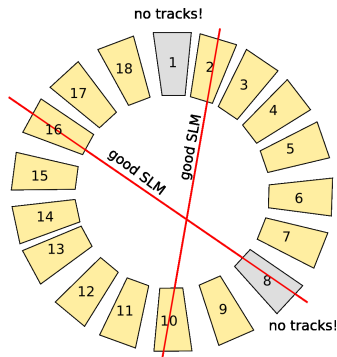


Comments:

- ▶ This pair has a ~ 1.3 mm relative misalignment
- ▶ 1.23 mm or 1.48 mm? Alignment algorithm uses the mean
- ▶ This is the biggest mean–Gaussian fit discrepancy we could find



- ▶ Even without a convergent procedure, we can propagate from one reference measurement and compare against another
- ▶ CRUZET-I: two good SLM lines, no tracks in chambers 1 and 8 (PG comparison only: chamber targets 2–7, SLM endpoints 10–16)



- ▶ CRUZET-II: all three SLM lines, unknown situation with tracks (maybe full comparison?)



In addition, we can do a simple check against PG in all stations by

- ▶ look at residuals with ideal geometry
- ▶ look at residuals with PG geometry: should be closer to zero
- ▶ doesn't depend on convergence of algorithm

Oleg is filling an Excel spreadsheet that I can convert to an AlignmentRcd in the database

We can attempt new global fit afterward on rings without empty chambers

Inclusion of CRUZET-II

We should attempt a skim of the prompt RECO

Maybe we can even merge track-based statistics? ME+4 is not moved as often as the other disks (need to ask Armando)



- ▶ Trigger issues (not discussed here) are basically solved
- ▶ CSA08 MC event sample was very useful for vetting algorithm
- ▶ No global convergence of an entire ring yet, but we understand what went wrong and have an idea to fix it
- ▶ Residuals in data are usable, but full-ring fit is impossible if any chamber is missing or has low statistics
- ▶ Basic comparison with PG possible in CRUZET-I
- ▶ Comparison with PG+SLMs might be possible in CRUZET-II, depending on occupancy