Beam-Halo Alignment Status Update

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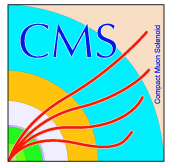
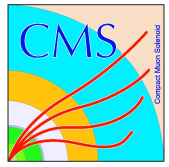
What this talk is about



- Aligning incomplete rings
- Oleg's correction to the closure problem
- The big picture: alignment for ICHEP data

Aligning incomplete rings



- CSC-Overlaps alignment procedure considered so far is a solution of equations relating neighboring chambers (chamber i and $i+1$)
- Requires complete rings to be a well-defined system of equations
- We have seen that photogrammetry still describes chamber positions well in $r\phi$: want to combine on an equal footing

Aligning incomplete rings

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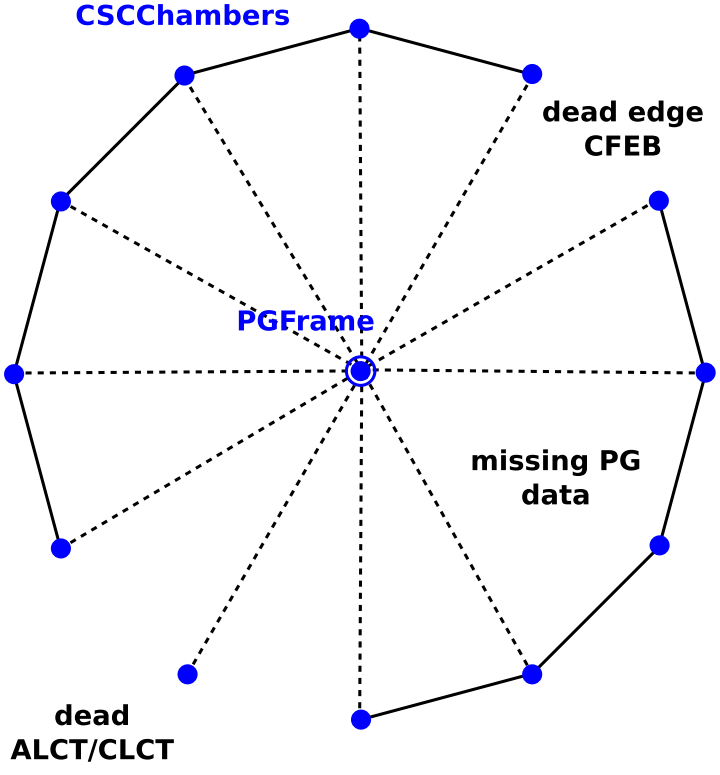
- Requires complete rings to be a well-defined system of equations
- We have seen that photogrammetry still describes chamber positions well in $r\phi$: want to combine on an equal footing
- Extension of method to equations relating arbitrary i and j:



relative positions measured by beam-halo tracks

relative positions measured by photogrammetry (PG)

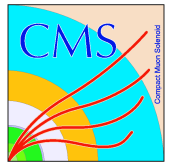
chamber position

frame position

Schematic diagram of alignment constraints: dots are alignable elements and lines are measurements relating pairs. PG and track-based data are treated the same way. Must be a connected graph to be meaningful (for existence of a solution).

"PGFrame" is an alignable element but not a physical chamber; it is included to allow for possible difference in PG and track-based coordinate frames.

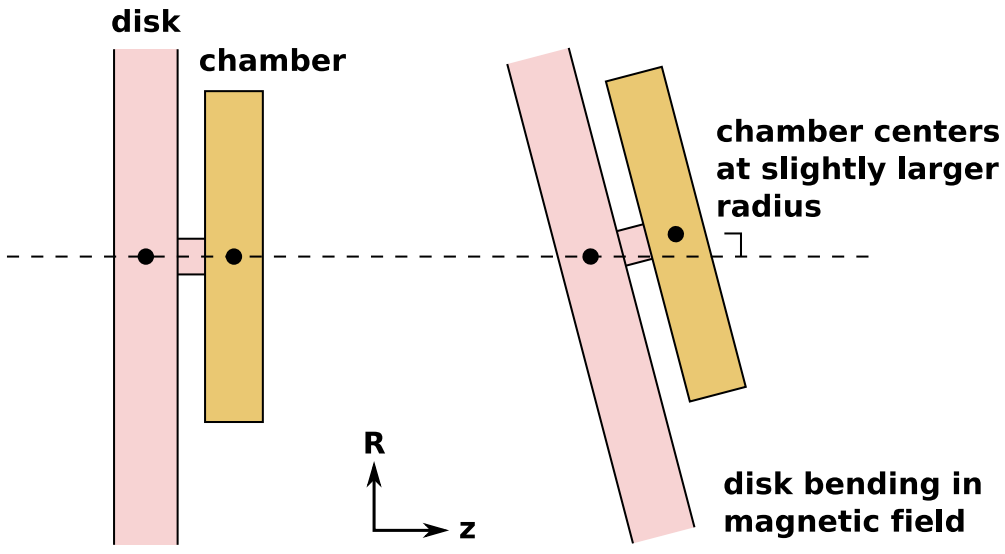
Status



- Major re-write of beam-halo alignment software completed
  - 16 new files, 2500 lines, 1.5 months
- All of the pieces tested independently and in-situ (especially checking signs and response to test-misalignments)
  - works in small-scale MC tests
- Currently back to having a complete push-button procedure and testing with the 2010 beam-halo dataset
- Goal: provide combined beam-halo/photogrammetry alignment for ICHEP sign-off next week

Oleg's closure correction

- Closure per chamber $= \frac{1}{N}\sum_{i}^{N} \Delta(r\phi)_i - \Delta(r\phi)_{i+1}$ $\quad N = 18$ or 36
  - should be zero for complete rings, independent of $r\phi$ alignment
  - zero in 2008 $\vec{B} = 0$ run, but not in 2010
  - equivalent to a change in chamber width or ring radius
- Oleg's idea: disk bending introduces a change in radius because z of chamber centers are not in the disks
  - predicted that this should account for half of the effect



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  - it does (in old framework (below) and new framework)

	2008 (no $\vec{B}$)	2010 (full $\vec{B}$)	corrected 2010
ME+3/1		$+298$	$+100 \pm 9$ μm
ME−2/1	-40 ± 23 μm		
ME−3/1	-20 ± 28 μm	$+486$	$+278 \pm 9$ μm
ME−3/2		$+572$	$+446 \pm 27$ μm
ME−4/1		$+440$	$+267 \pm 10$ μm

Big picture (for track-based alignment)

- Endcap alignment:
  - chambers relative to one another: beam-halo plus photogrammetry (this talk)
  - aligned rings relative to tracker: globalMuons from 2010 cosmics; Vadim Khotilovich is implementing it as an official script based on the CRAFT-09 method
- Barrel alignment:
  - chambers relative to tracker: globalMuons from 2010 cosmics, using same method as CRAFT-09
  - performed by Aysen Tatarinov (with his improvements)
  - rigorous uncertainties for selecting best chambers to align
- ICHEP reprocessing schedule:
  - final muon alignment PVT sign-off: May 14
  - final GlobalTag: May 19
  - reprocessing of all collisions data starts late May
  - all summer 7 TeV results would be based on this