RICH alignment and Tracking

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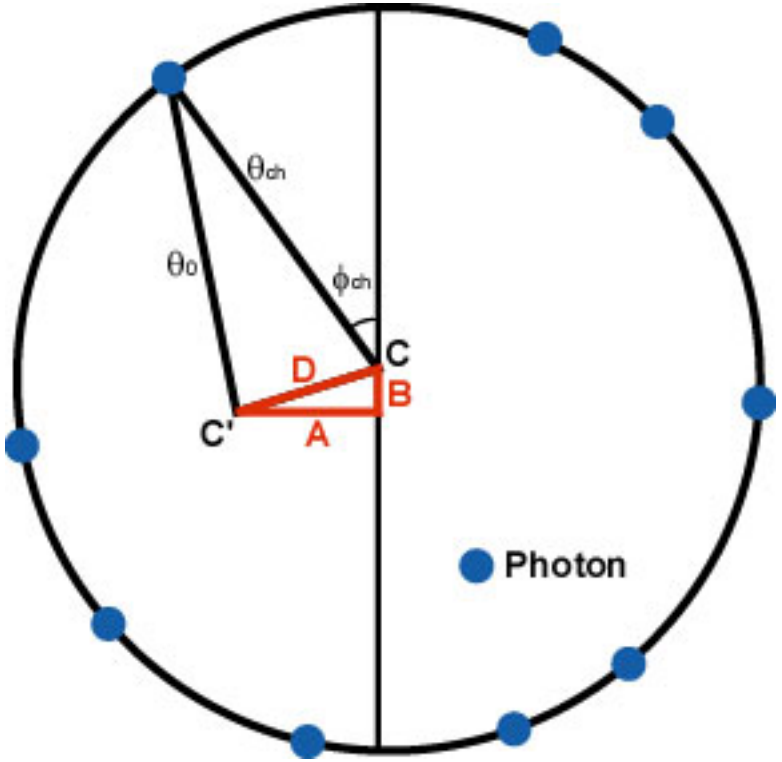
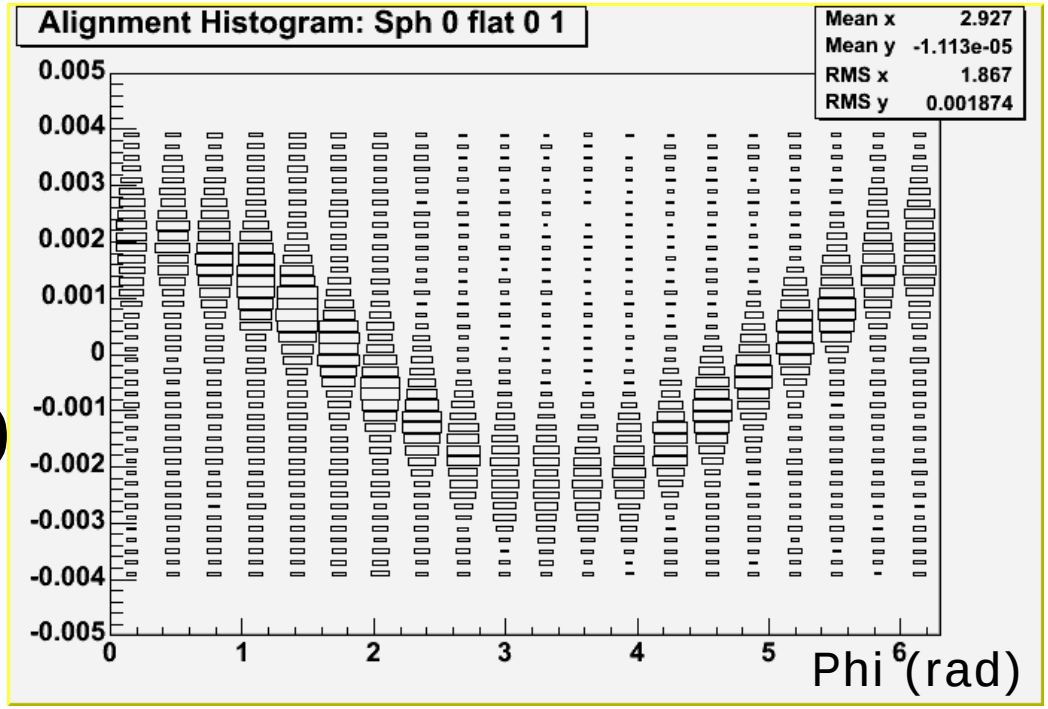
Misalignment in the RICH detectors



$$\Delta\vartheta = A\cos(\varphi_{ch}) + B\sin(\varphi_{ch})$$

- For fixed misalignment the bias per photon varies
- A plot of theta versus phi can be used to extract misalignment parameters
- Saturated tracks can be used to predict the Cherenkov angle



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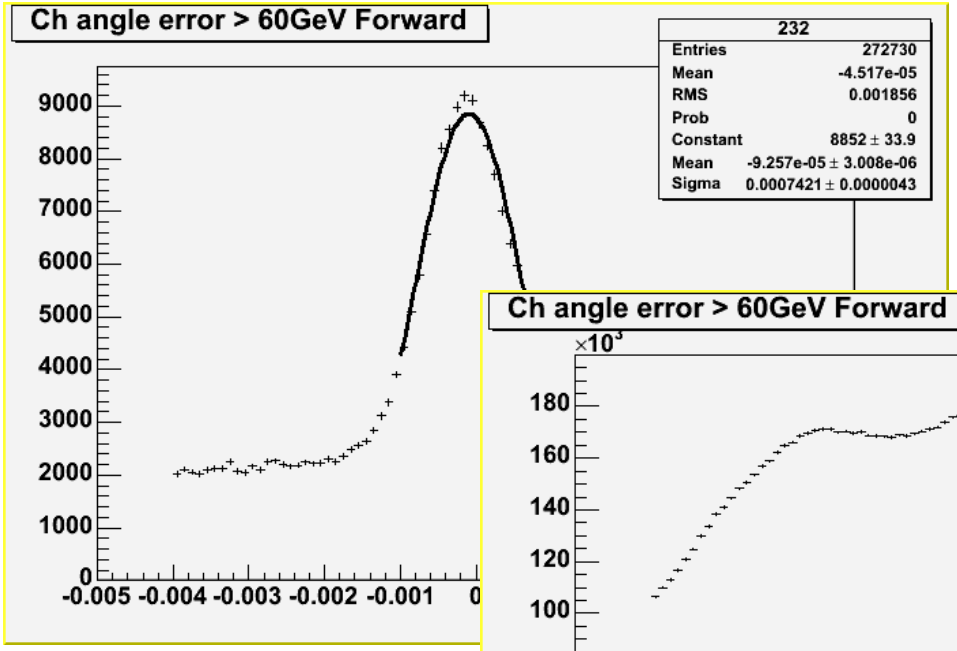
Misalignment components

- Possible misaligned components:
  - Whole RICH detector (with respect to tracking).
  - Individual mirror segments (96 in Rich2).
  - HPD panel.
  - Individual HPDs.
- Data must be selected to include only one misalignment component.
- Accuracy of histogram fitting ~0.1 mrad.
- HPDs will be (relatively) aligned using light pattern (used also for magnetic distortions).

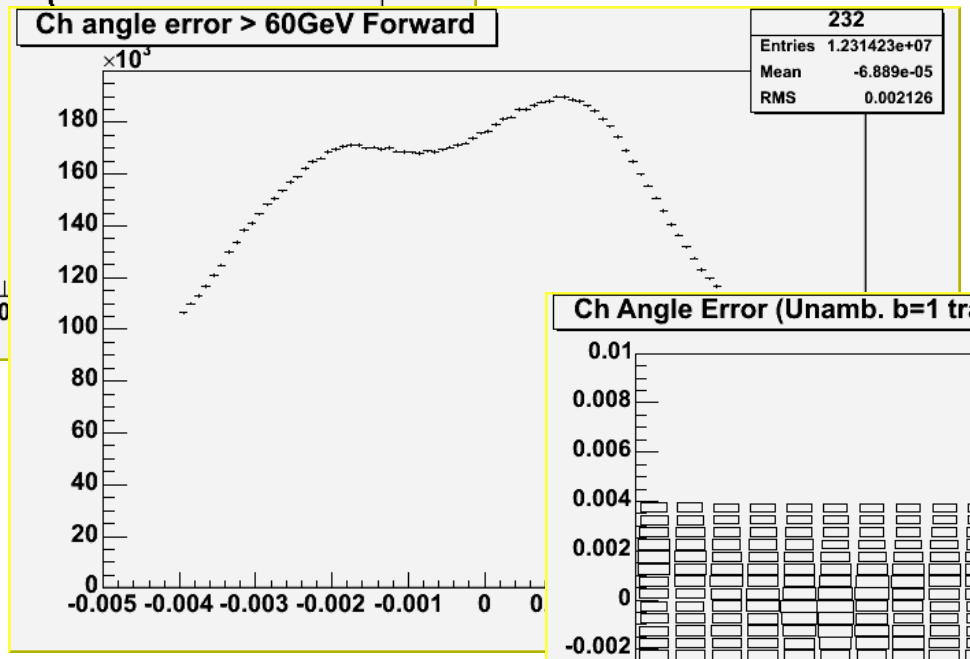
Resolutions

- Cherenkov angle resolution per photon:
  - Rich2 ~ 0.7 mrad
  - Rich1 ~ 1.7 mrad
- Cherenkov rings have potential for better resolution, but:
  - Not easy to identify relevant photons
  - Part of a ring could come from an optical component with different alignment (eg mirror segment)

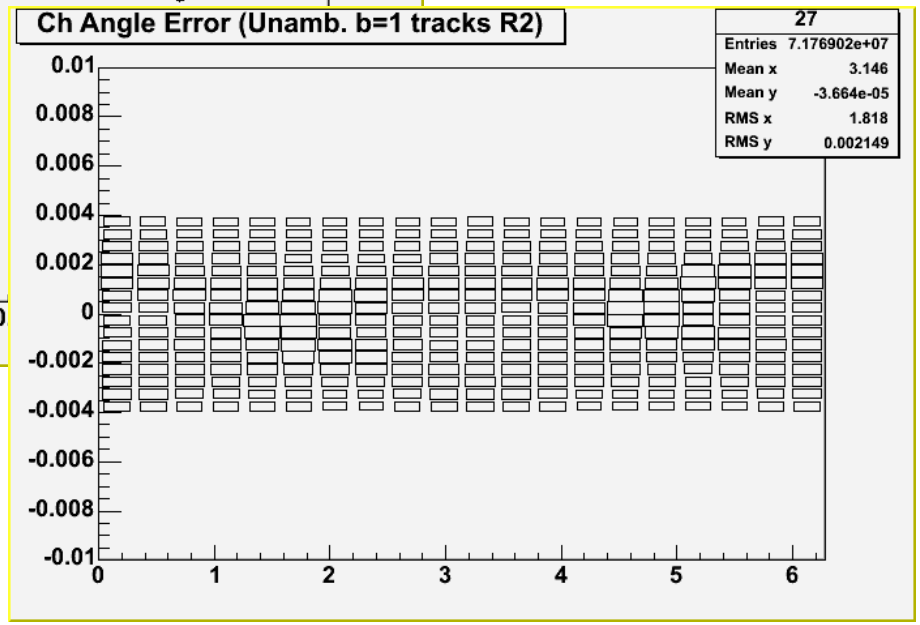
Using saturated tracks



Resolution without misalignment



Delta Theta v phi for all mirrors



Resolution with ~1 mrad random mirror misalignment (all mirrors)

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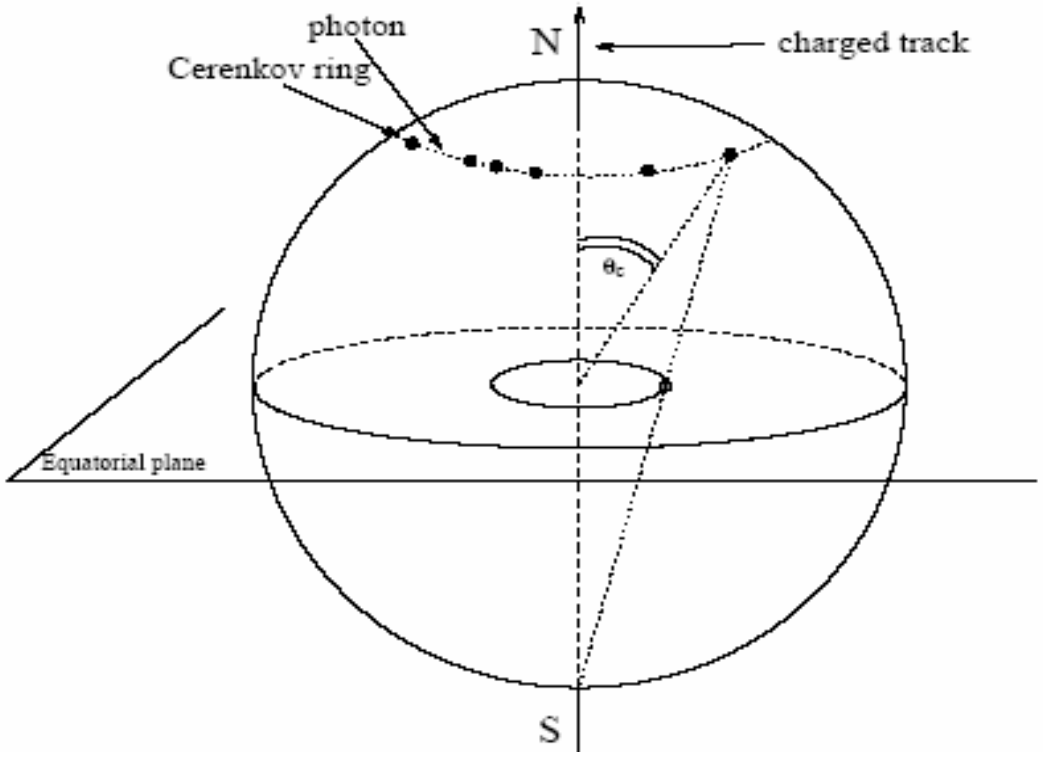
Tracking misalignment and the RICH detectors

- There is a “tracking” component in the Cherenkov angle resolution, currently about 0.2 mrad.
- If tracking is misaligned (poor), this contribution will increase.
- If tracking is misaligned with respect to the RICH it should be possible to correct at the level of 0.1 mrad.
  - Sensitivity depends on the internal RICH alignment.

Other methods

Stereo-graphical projection



- Use the track to define ring search area.
- Apply ring isolation criteria.
- Fit ring and find centre.

Method very sensitive to angles
Requires clean samples