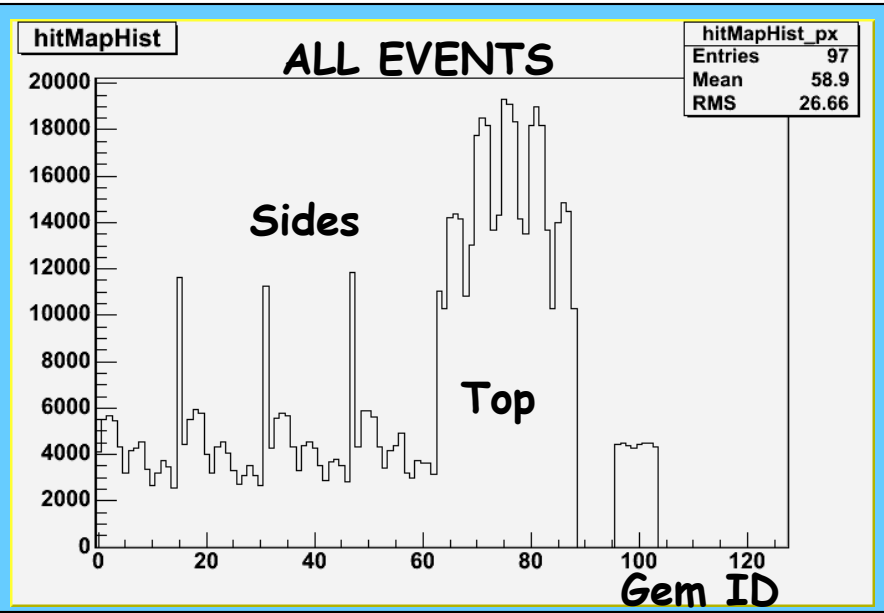
Acd Veto Latching

- The Acd front end electronics generate a veto primitive when a discriminator goes above threshold.
- But. The signal is split:
  - One path sends a signal with a small time constant to the GEM
  - The other path has a longer time constant and is associated with the hits.
    - The GEM ORs the bits from the to PMTs
- The creates some issues to worry about
  - Do the GEM and AEM veto maps agree?
  - Are the timing delays between the two set correctly?
  - How much of a difference can we expect?
  - What does this difference come from?

Differences between GEM and AEM



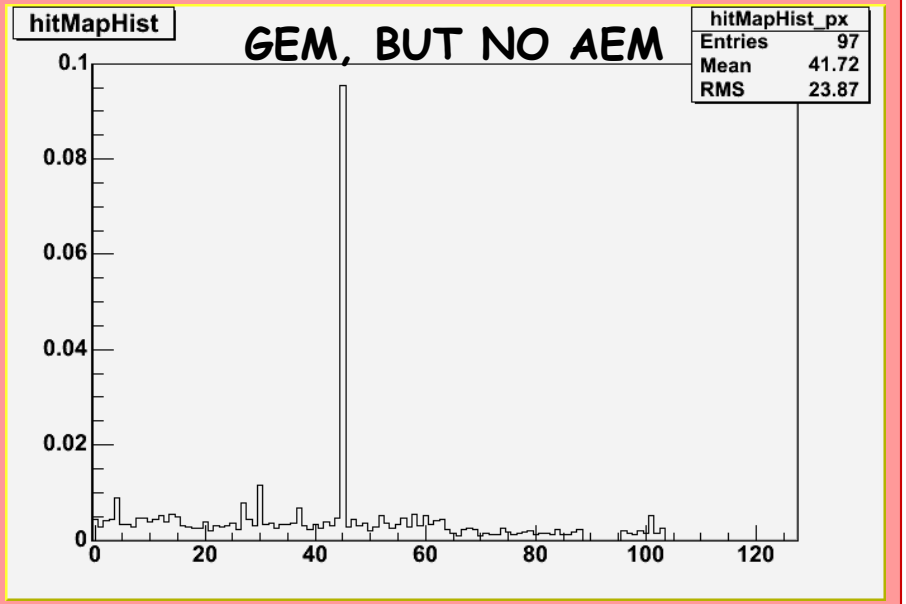
If we look at the distribution of Vetos in the GEM it is very Reasonable.

The structure in this plot is all from The ACD geometry and $\cos^2\Theta$ cosmic flux

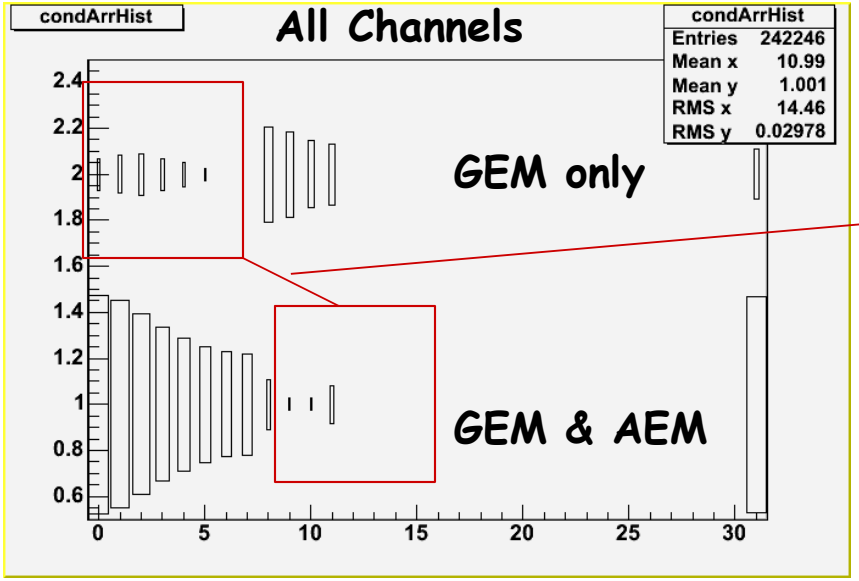
Here we see a massive peak For GemID 45 -> aka tile 123

Aside from this channel, the Difference between the GEM and the AEM is below 1 percent level

But for this channel it is at the 10% level



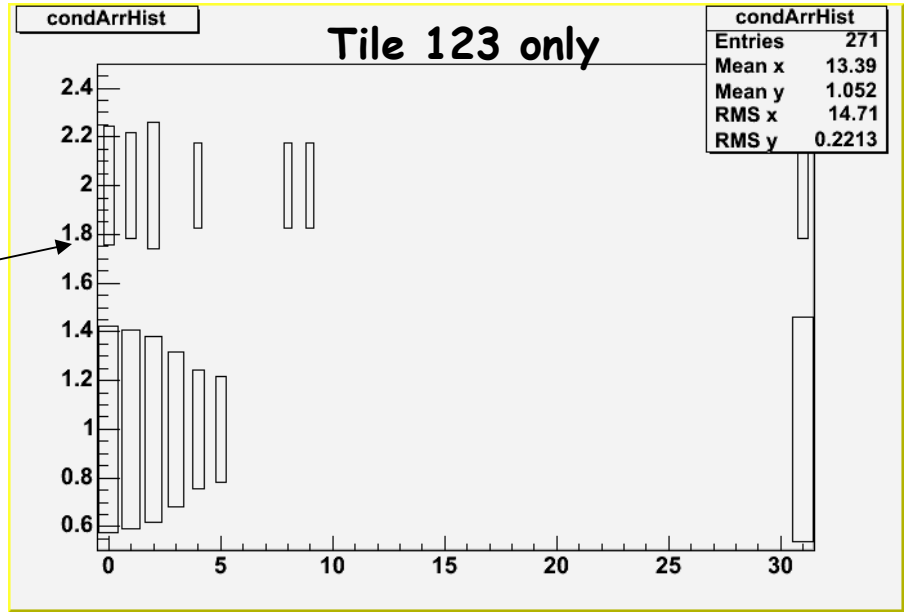
Could it be the timing?



Gem Arrival time

Martin Kocian set up the timing so that the AEM should latch the hit if the GEM arrival time is less that about 7 (give or take a tick) The entries in the red boxes are suprising

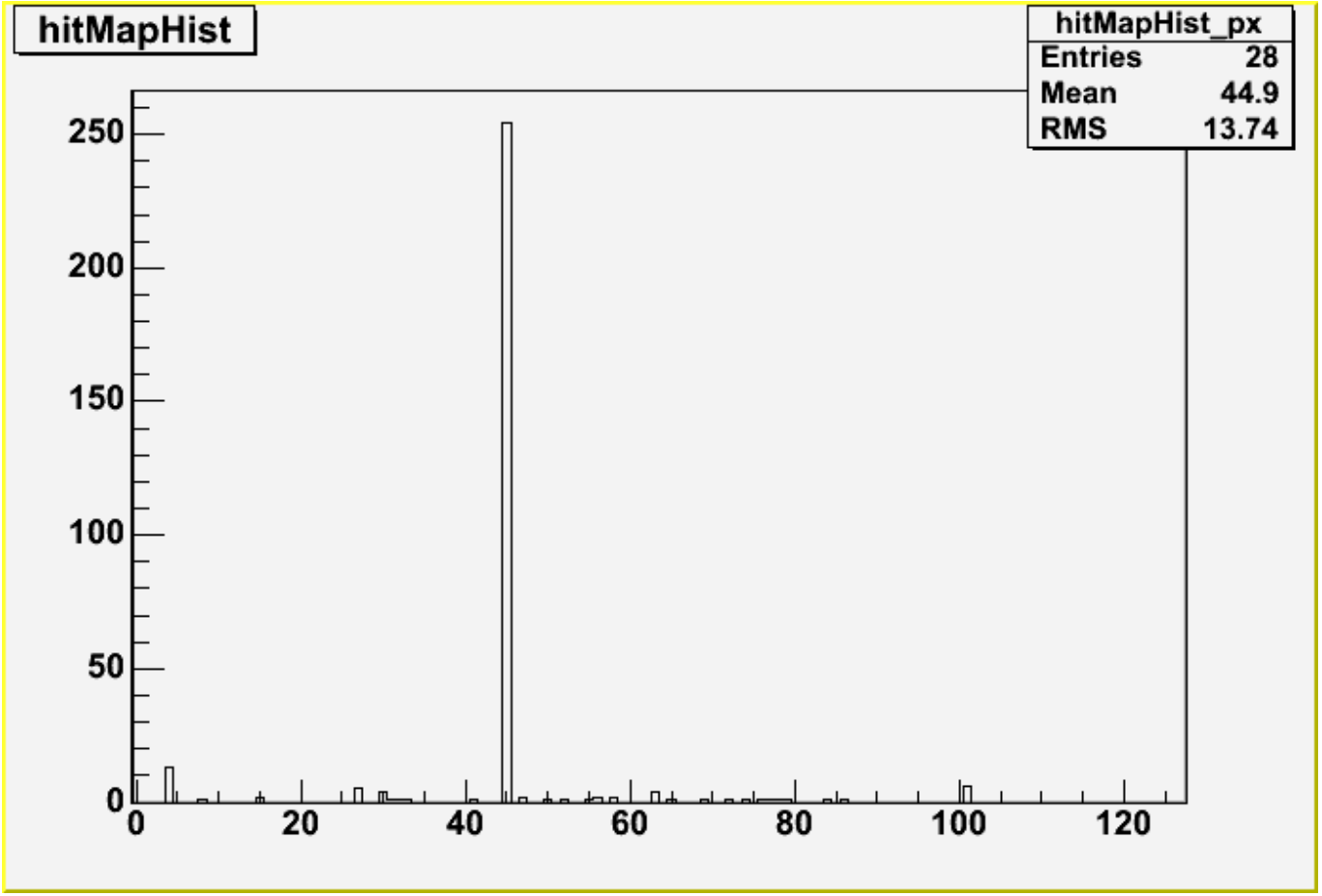
It looks like the mismatched events in tile 123 should have been latched by the AEM.



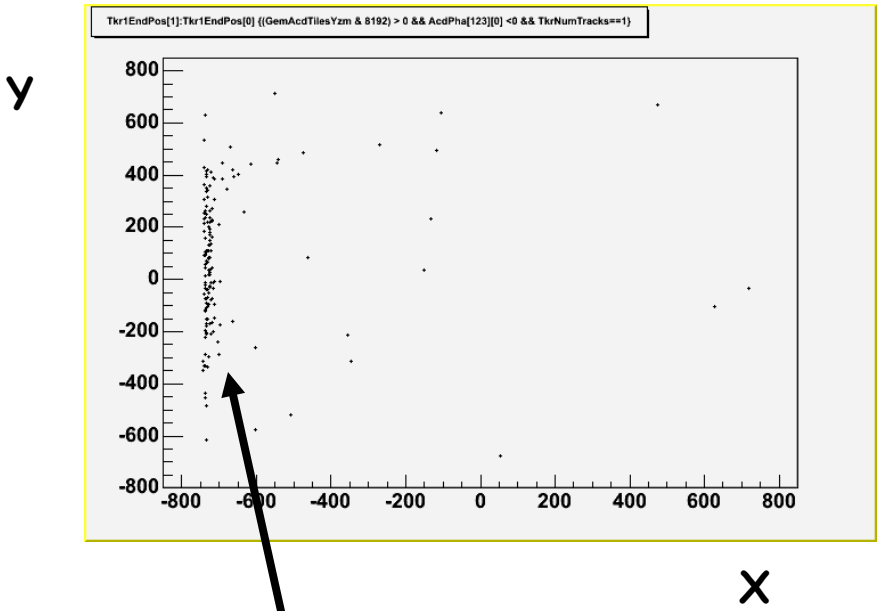
Not just missing vetos, missing PHAs (aka digis)

About 6% of the Gem triggers in this channel have no digi

This is the only channel where we see more that a few such events



The missing hits are not noise



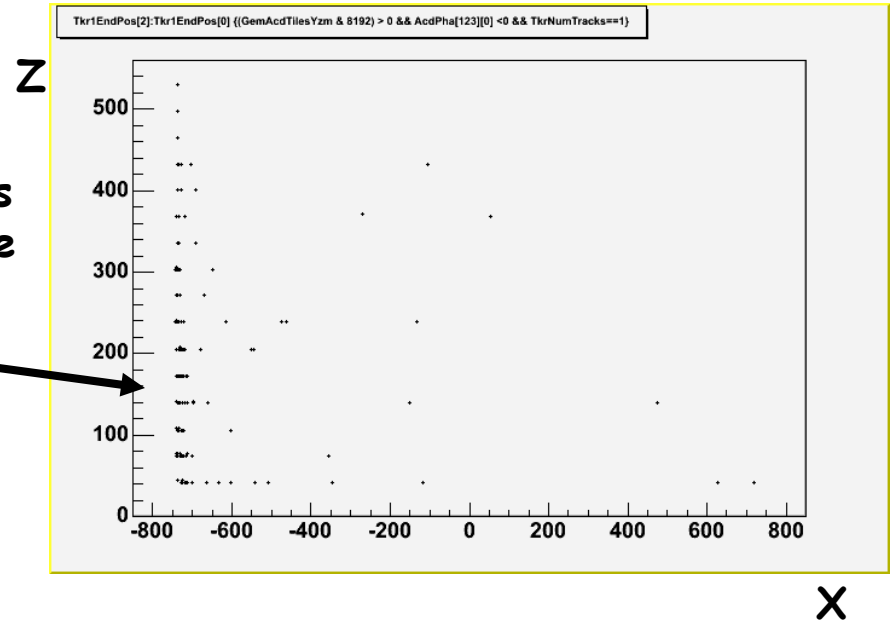
This tile (123) is on the 3rd row on The –x side of the LAT.

Almost no tracks extrapolate UP to this tile, most of the hits in our events are from tracks on the way out of the LAT

(Tkr triggered events)

For the events where we seem to be missing data in tile 123, the tracks tend to leave the tracker near the tile in question. –x side, y ~ 100mm, Z ~ 200 mm

These are NOT noise hits.



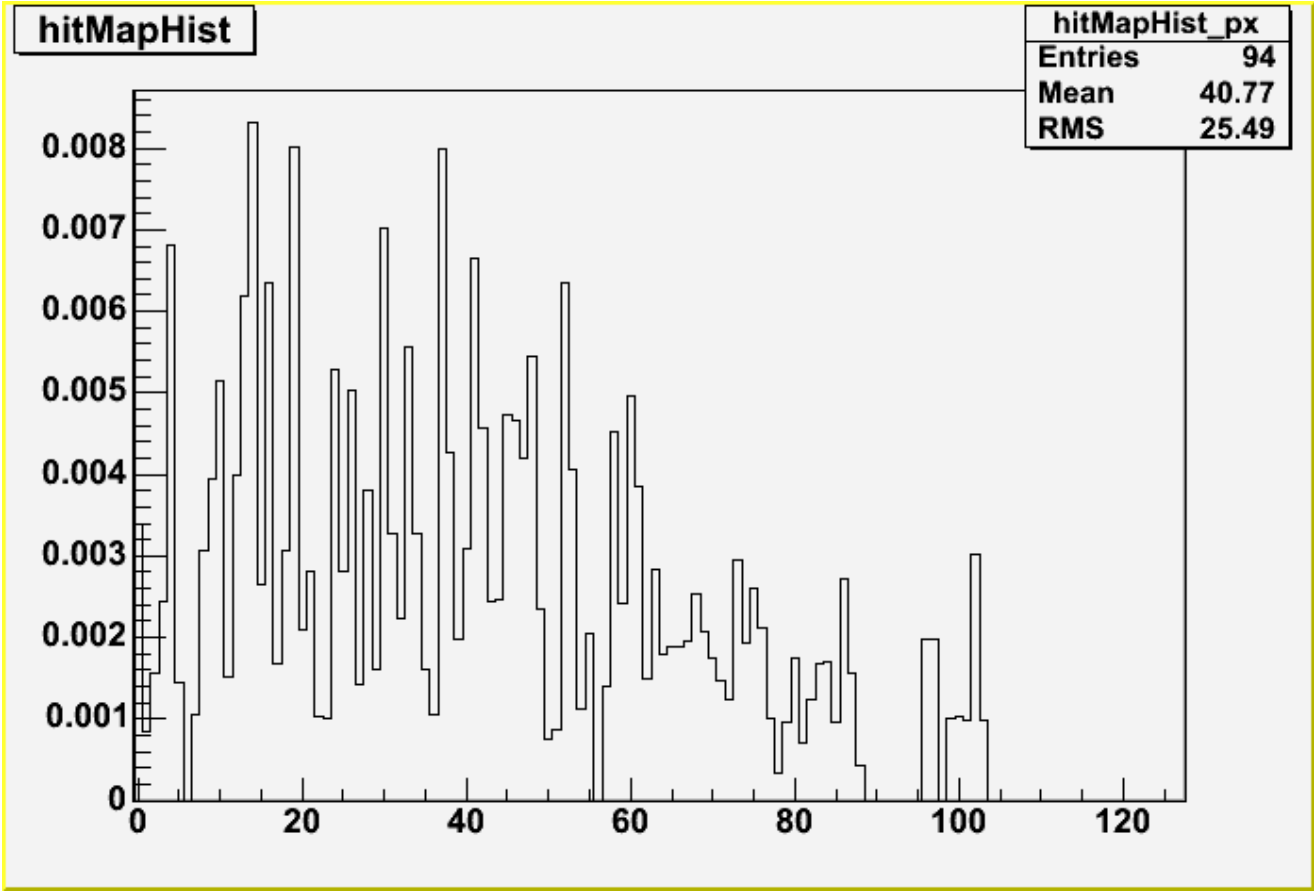
Issue with zero suppression threshold in tile 123

- PMT 123_B is one of two "sick" channels in the ACD
- The veto threshold doesn't go below 0.25 mips.
  - Most other channels go down to the noise floor
- The zero suppression threshold for PMT 123_B was set to 387 counts
  - This should have been 236, but we used the nominal veto value instead of the zero suppression value
    - The zero suppression value was about equal to the veto value
- However, the PMT 123_A is working fine
  - We will need to understand why it doesn't look right in there data

B/13 (No Zero suppression) runs look OK

The difference between the GEM and AEM veto maps is below 1% for all channels

Looks like zero-suppression is the culprit here.



In summary

- When we look at the processed data, we seem to be missing some of the Acd digis, in particular for tile 123.
- Hypothesis:
  - If a channel has a veto in the AEM, but is below zero-suppression threshold the hit is lost.
    - This maybe a "feature" of the Ldf2Digi process
  - Looks like this also kills the PHA in the other PMT on the same tile.
    - This is maybe another "feature" of the Ldf2Digi process.
- To do:
  - Test hypothesis.
  - Make sure that we don't use such bad zero-suppression values in the future.