GLAST The Gamma Ray Large Area Space Telescope

LAT Trigger Tests

ACD Timing Results

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List of Tests

- AEM hitmap parameters
- Veto and CNO channel uniformity
- Veto TREQ delay
- ACD TACK delay

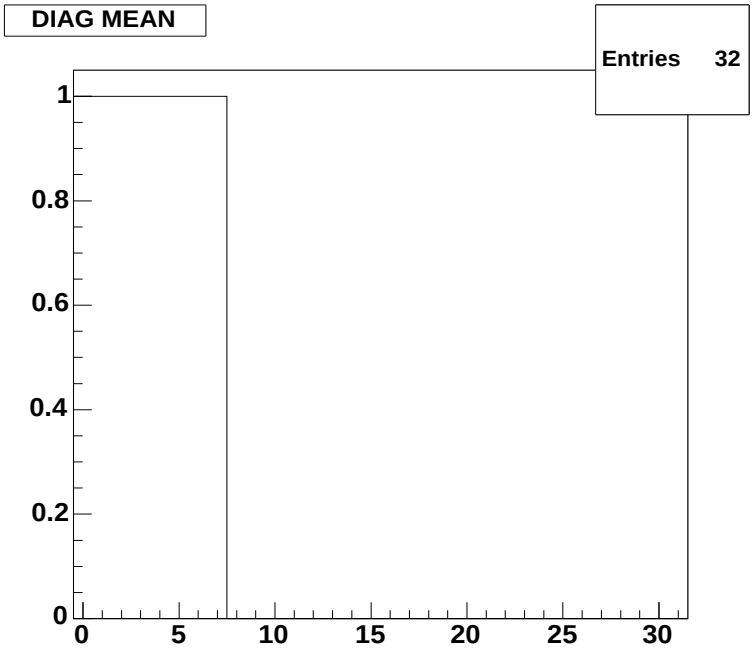
AEM Hitmap Timing Scan

- Basic method: Cause trigger in one channel (CI), look if the channel has an entry in the AEM hitmap.
- Scan pipeline length parameter “hitmap_delay” across edge of veto pulse to determine value for hitmap latching.
- Verify “hitmap_width” parameter functionality which stretches the hitmap signal to a minimum value.
- Verify “hitmap_deadtime” parameter functionality which stretches the hitmap signal by a fixed number of clock ticks.

hitmap_delay scan

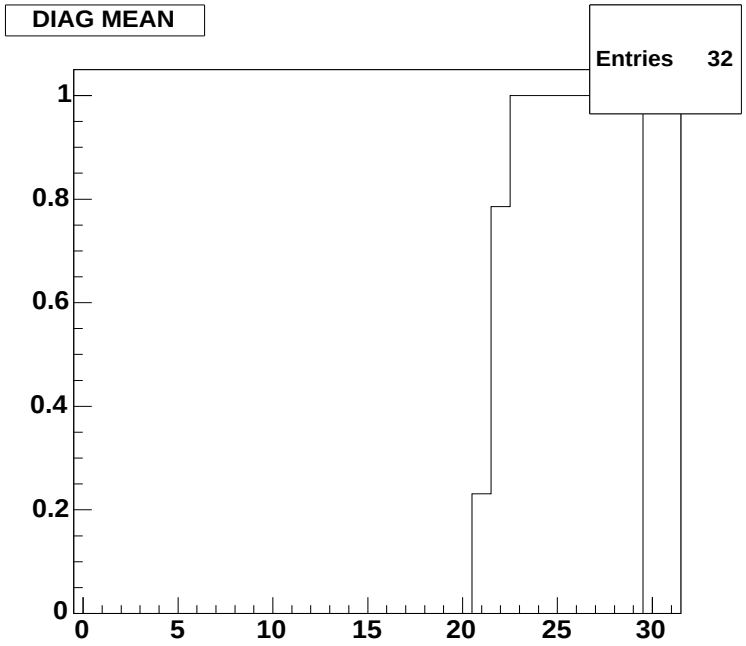
- Window width is set to 1
- TREQ delay is set to 0

TACK = 0



Rising edge at hitmap_delay=6

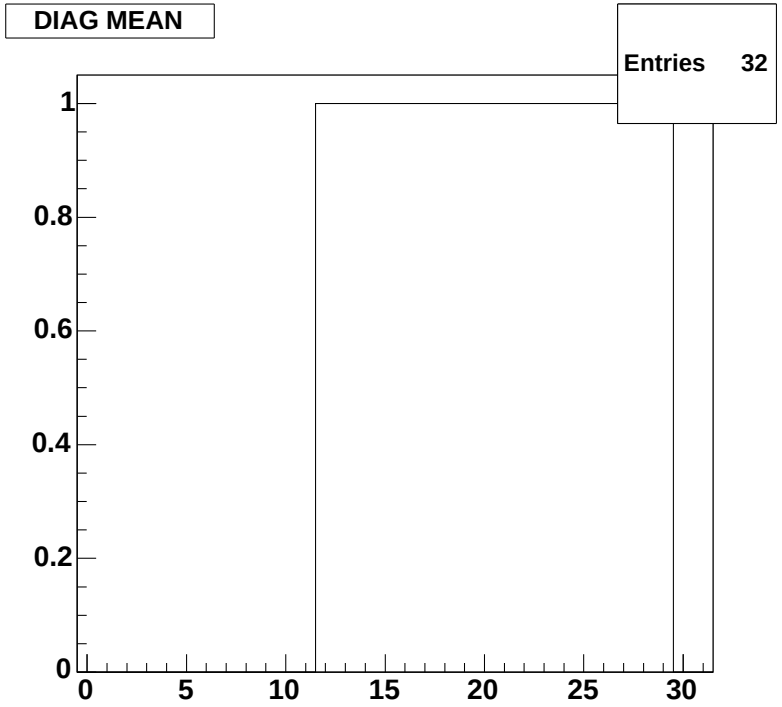
TACK = 22



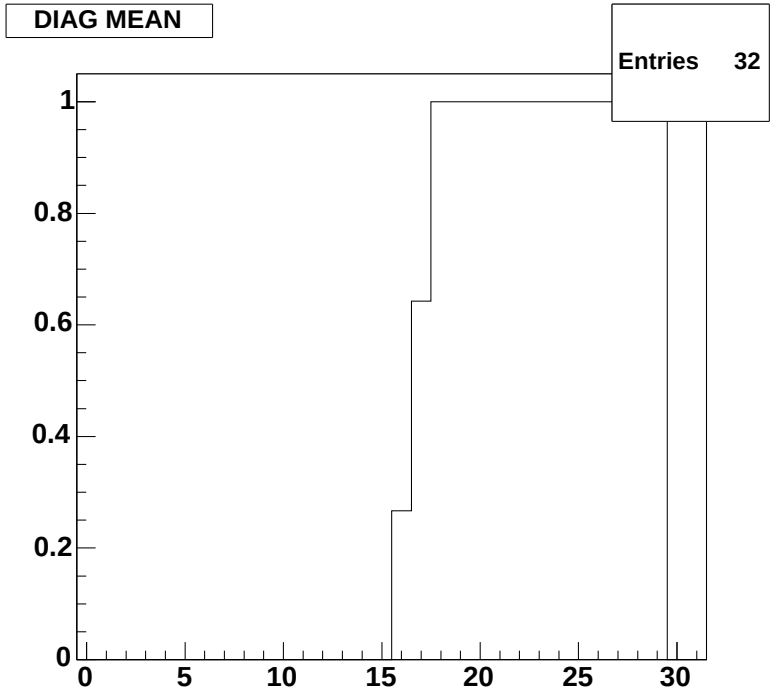
Increased delay to see full pulse

hitmap_width and hitmap_deadtime

- TREQ=0, TACK=22, window_width=1



hitmap_width=15



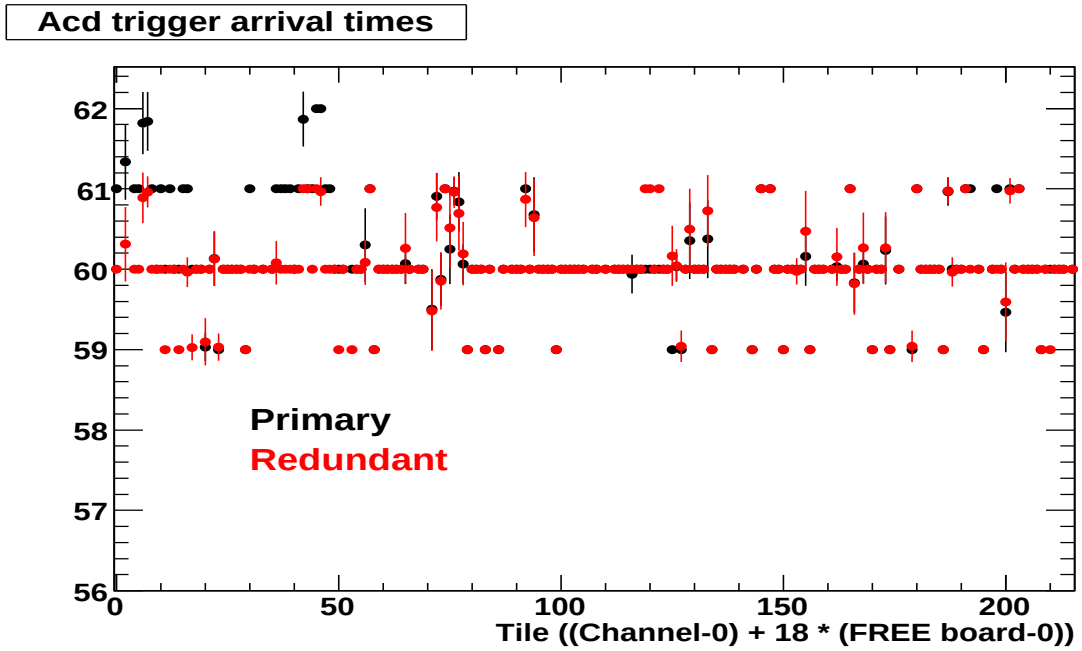
hitmap_deadtime=5

AEM Hitmap timing

- The results were plugged into the SVAC runs
- Over 99 % of events have both GEM and AEM hits.
- Are the remaining hits noise that is out of time?

Veto Channel Uniformity

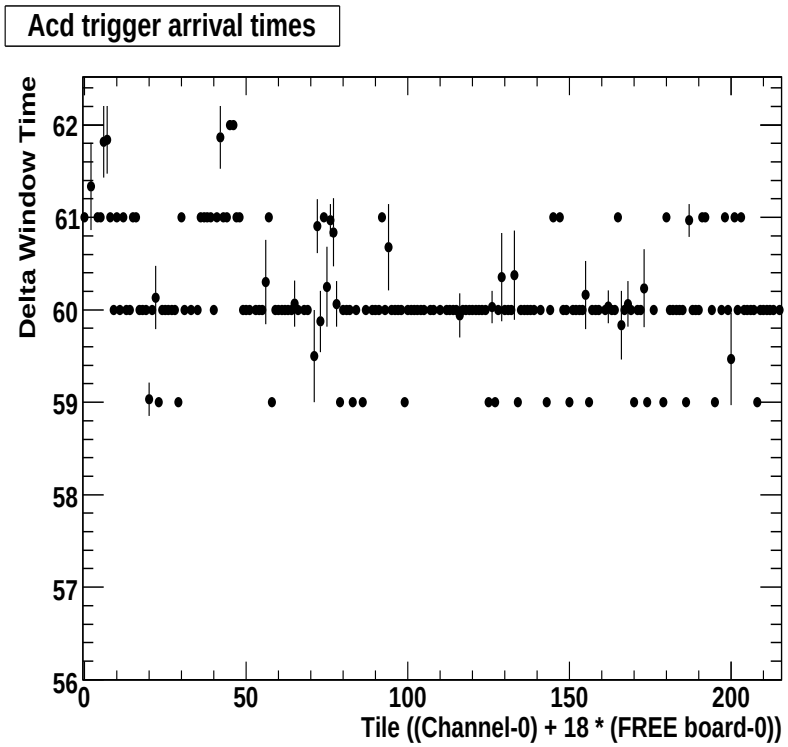
- Method: Inject charge into each channel separately. Measure time until a trigger arrives.
- Test was performed on both the primary and the redundant side
- In addition, the GEM veto map is cross-checked against the GARC/GAFE channel number as a verification.



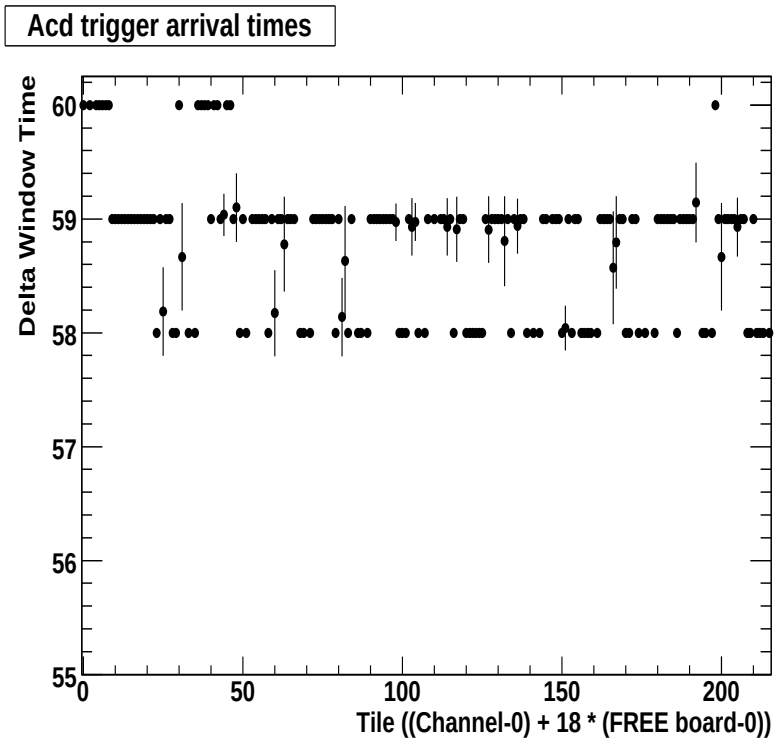
Veto Channel Uniformity

- Spread is somewhat larger than expected. Repeated at higher charge.

1 MIP



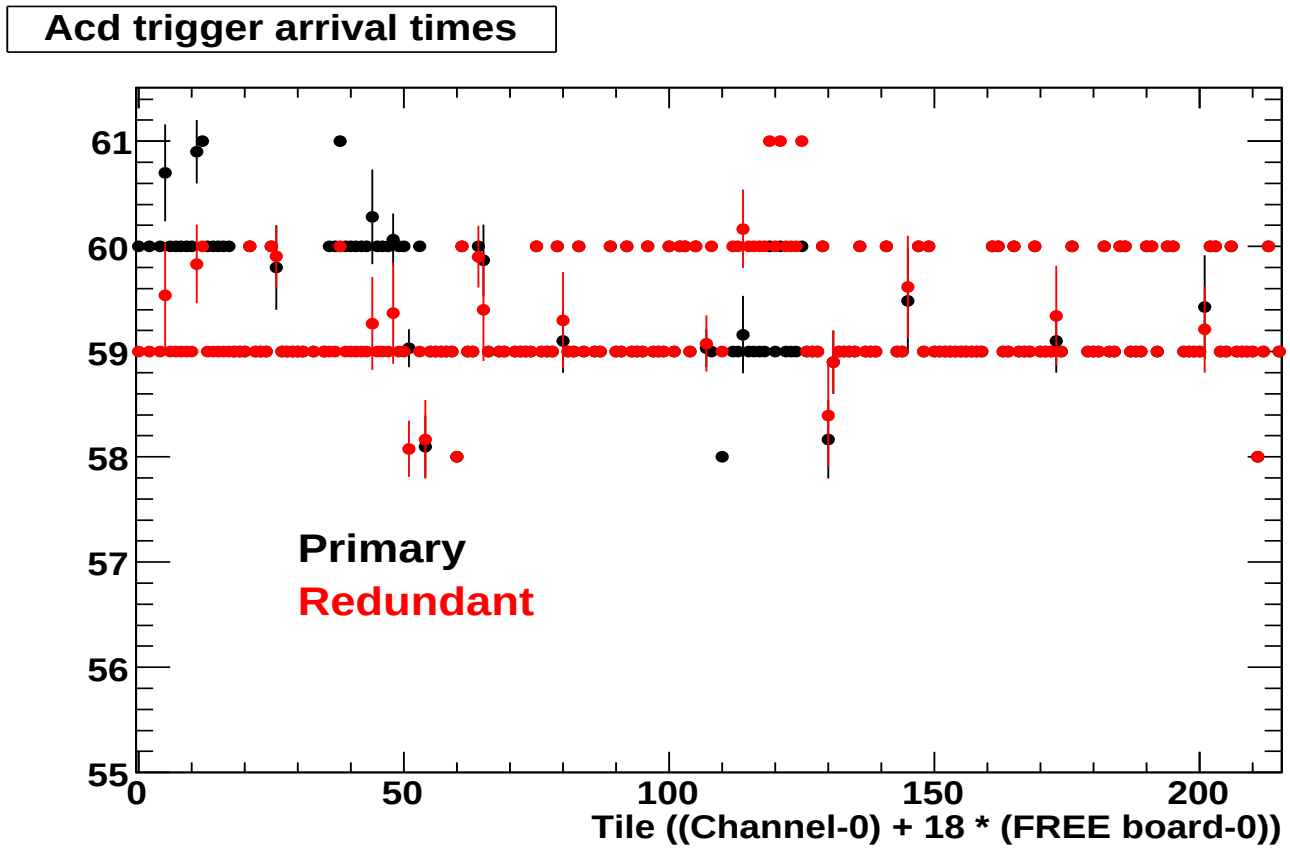
10 MIPs



Is the spread due to charge injection?

CNO Channel Uniformity

- The same test was applied to CNO.

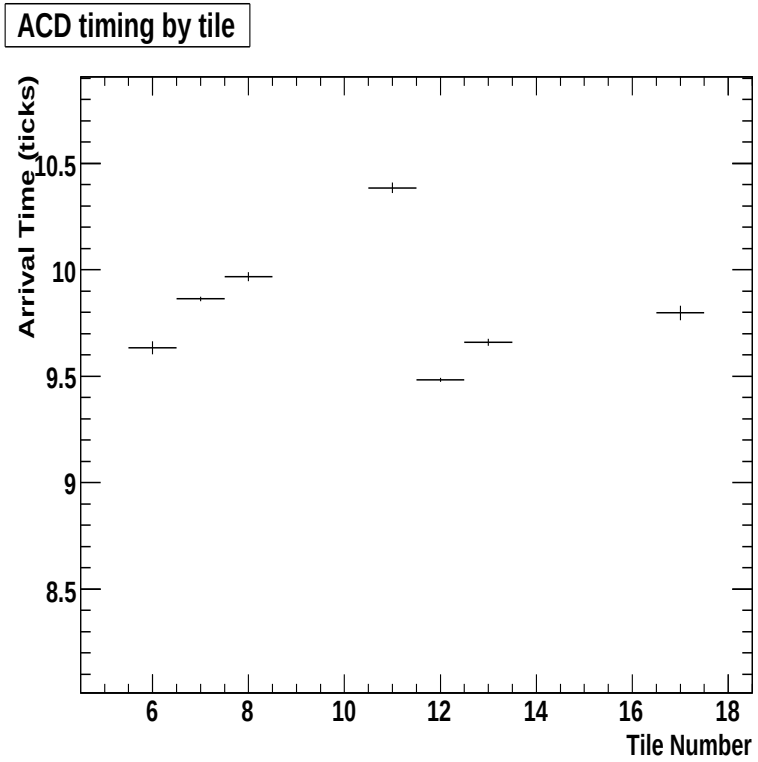


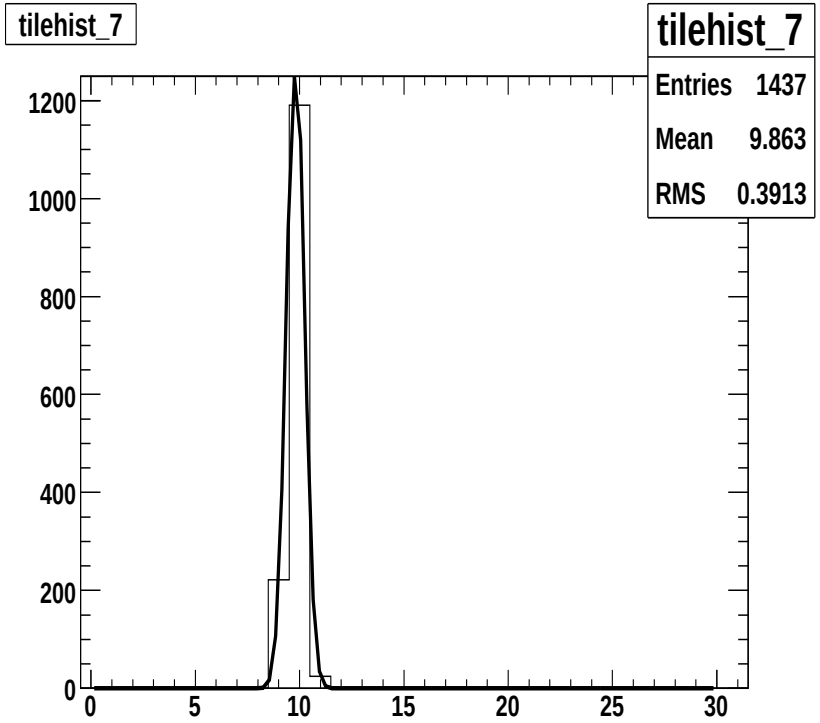
TREQ measurement

- Trigger on cosmics
- Measure conditions arrival time for events with exactly one tile in GEM veto list
- Reference source can be the muon telescope or the tracker.
- The muon telescope has less jitter and is an independent reference, but its rate is low and it is not large enough to cover the whole LAT
- Muon telescope was only used for cross-reference on a number of channels.

TREQ with Muon Telescope

- ACD is almost 1 clock tick faster than the muon telescope, ACD was delayed by 10 ticks for measurement
- Jitter is very small, but there is some channel variation

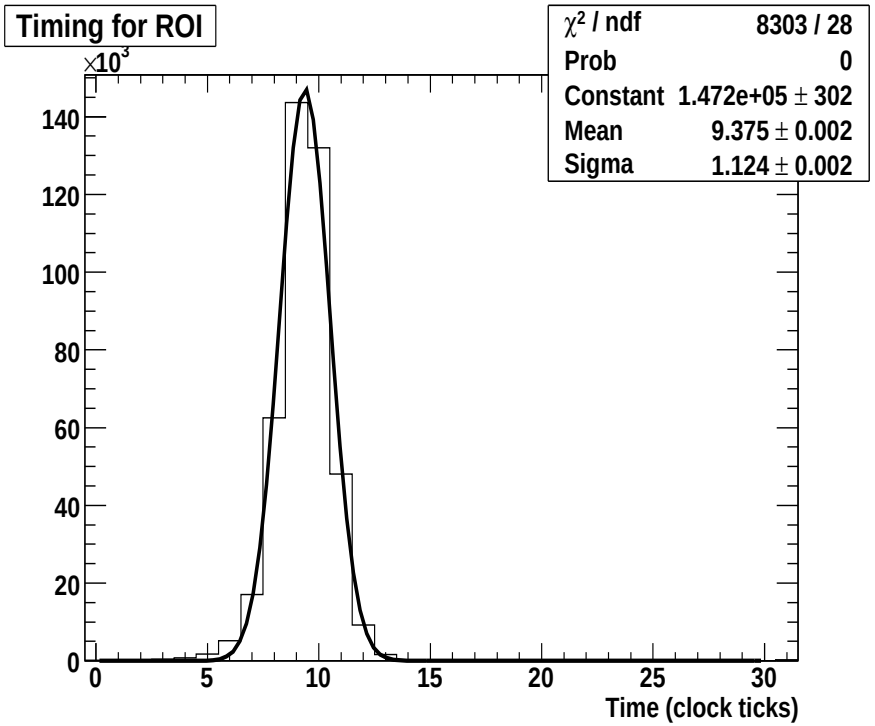




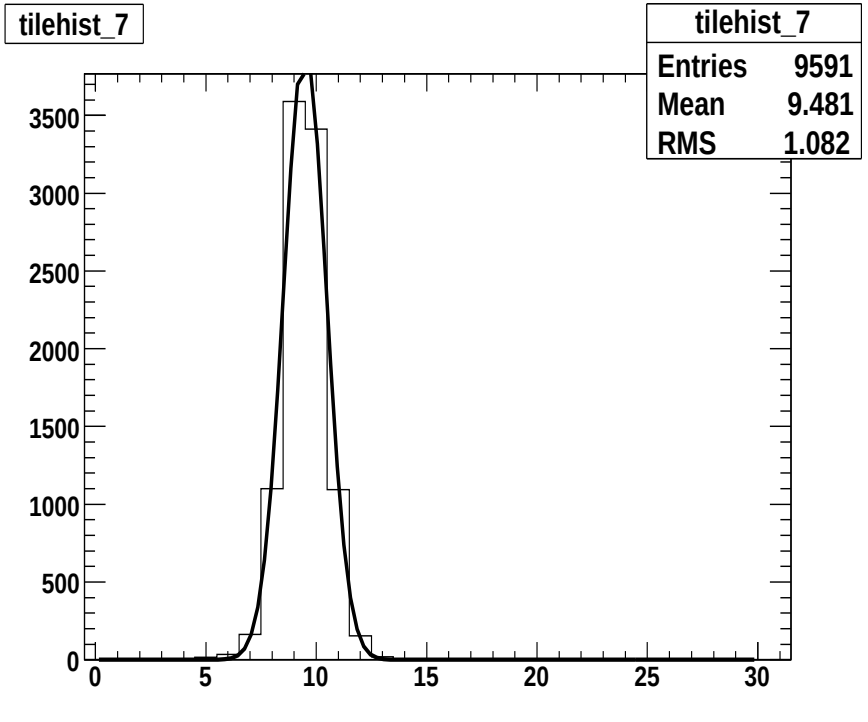
TREQ using the Tracker

- All tiles and ribbons have enough entries to analyze their timing.
- The tracker has a slightly higher jitter and is not as uniform.
- The ACD was delayed by 15 ticks to fire long after TKR.

Timing for all channels

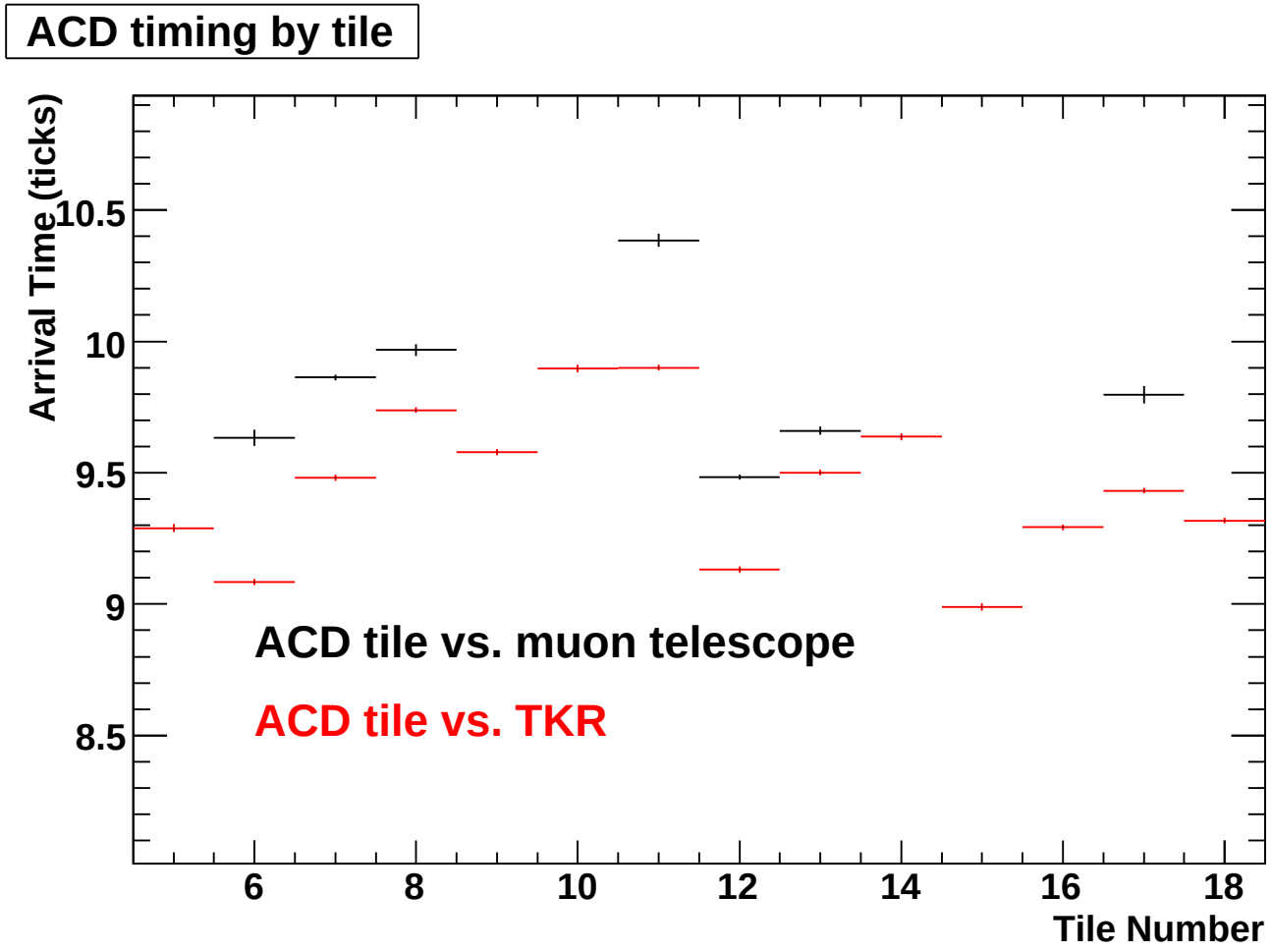


Timing for 1 channel (tile 7)



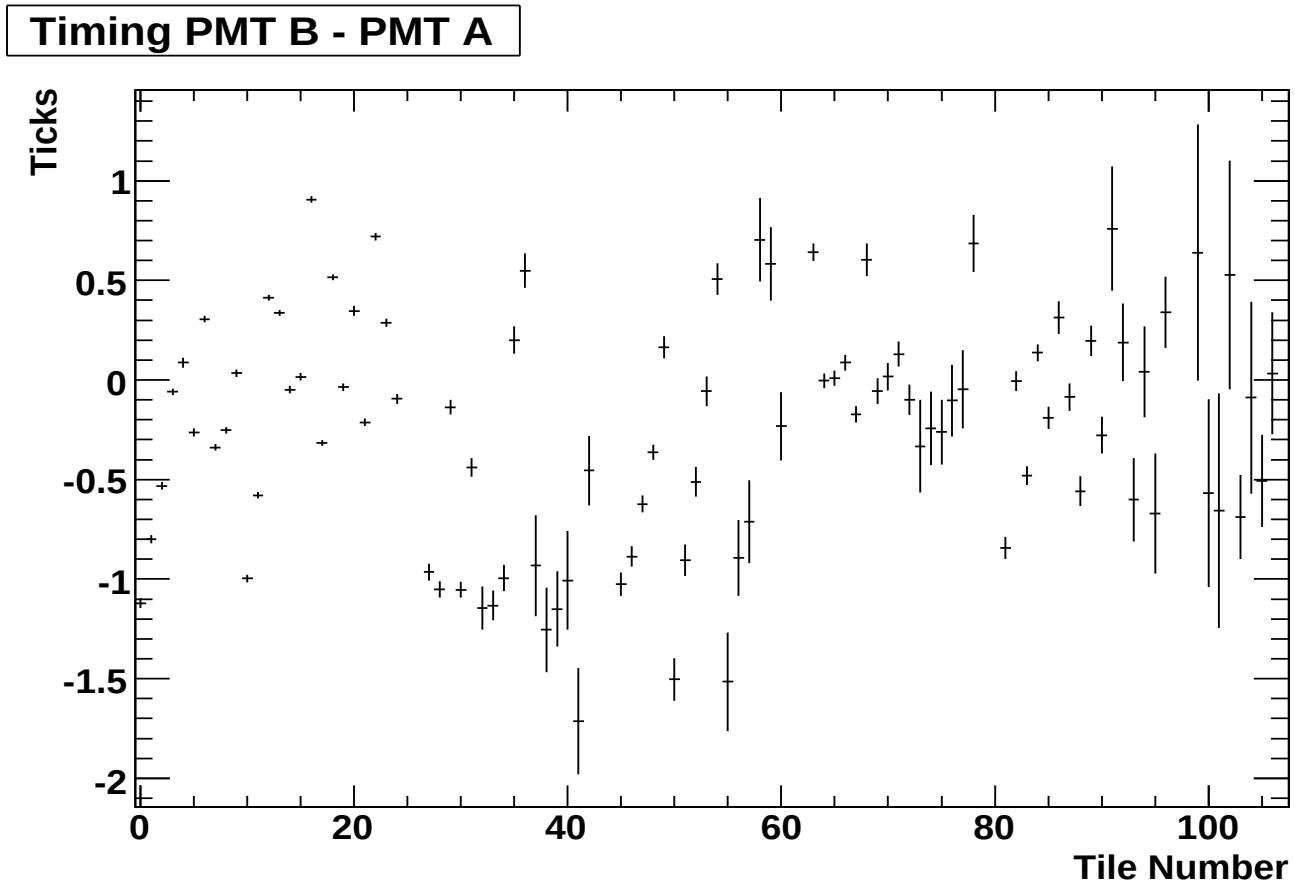
TREQ using TKR

- Cross-check results with TKR reference against muon telescope reference (Absolute value is not relevant, just the correlation).



TREQ PMT A/B

- Each tile is read out through two independent electronics chains
- Plot the difference in timing between the 2 channels of each tile



TREQ PMT A/B

- There seem to be systematic differences in one region.
- Plot timing A/B vs. GARC/GAFE.