Trigger Diagnostic Studies
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Feb 18, 2005
In order to understand the instrument better, we need to investigate potential instrumental problems in the data.

- **Missing digis: (see Eduardo’s talk last week)**
  - The TKR tower triggered (need 6 planes hit = 6 digis), but when we latched the data, there were events with less than 6 silicon planes with hits.

- **Missing trigger requests: (today’s presentation)**
  - The TKR tower triggered and some planes have strip hits. However, the diagnostic data indicates that the plane did not fire a trigger request.
Background Information

- A Si plane has 2 cable controllers (GTCC)
  - A plane can be read out by each end or by both ends
  - When the TKR readout split for a plane is in the middle (nominal)
    - one cable controller will collect data from strip 0-767
    - the other will collect data from strip 768-1535

- Diagnostic information is stored in the TEM
  - describes from which cable controller the trigger request signal was sent.
    - It tells us exactly which end of a particular plane sent the trigger request.

- Units used in the following plots:
  - Position = plane*2 + end
    - Plane 0 is at bottom,
    - end 0 refers to read out starting from strip 0 (TKR jargon = LO or Left side)
    - end 1 refers to read out starting from strip 1535 (TKR jargon = HI or Right side)
    - Example
      - Position 3 = 1*2 + 1 means the trigger request was sent from the high end of the plane 1
Missing Digis

- The instrument was triggered by the TKR with 6 planes hit but latched data had with less than 6 silicon planes with hits.

  - **How?**
    - A noisy strip can send a trigger request which eventually participates in the 3 in a row trigger. However, when the GASU issues a signal (TACK) to latch the data, the signal from the noisy strip is no longer there because it remained above the threshold for a short amount of time.

  - **Run 398000570,**
    - TKR DAC setting 30 (~0.28 MIP)
    - 100007 events

  - **Run 398000307**
    - TKR DAC setting 26
    - 100007 events
No. of trigger requests for the missing digi events

Run 398000570,
TKR DAC setting 30 (~ 0.28 MIP)
100007 events

Run 398000307
TKR DAC setting 26
100007 events
“Missing” Planes

$16 = 8 \times 2 + 0$ means the trigger request was sent from the low end of the plane 8 (4Y)

- Y0, high end
- Y4, low end
- Y15, low end

Position = plane*2+end
Hit Occupancy for the planes

No. of events

Strip id

Y0, high end

Y4, low end

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Missing Trigger Requests

• Take a plane that has strip hits. Has this plane fired a trigger request?

• If there are inefficiencies they may be caused by time delays…
  – Run 398000570
    – TKR DAC setting 30 (~ 0.28 MIP)
    – 100007 events
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Missing Trigger Requests (1)

Position = plane*2+end

No. of events

Run 398000570

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**Missing Trigger Requests (2)**

Fraction is normalized to the number of events that have hits in the plane.

Position = plane*2+end

- Y0, high end
- Y3, low end

Is this the expected level?

Run 398000570
Conclusion

• Missing digi events happens at \( \sim 10^{-3} \) level, there seems to be certain planes worse then others.
  – Partially could be explained by noisy hits in the event. This is also consistent with the fact that when lowering the TKR threshold, the number of missing digi events increased.

• Missing trigger request events happens at less then \( 2 \times 10^{-3} \) level although there seems to be certain planes much worse then others.

• It is interesting to see Y0 high end seems to be consistently bad in terms of both “missing digi” and “missing trigger request”
  – Needs further investigation