Comparison of runs with Right and Left readout cables

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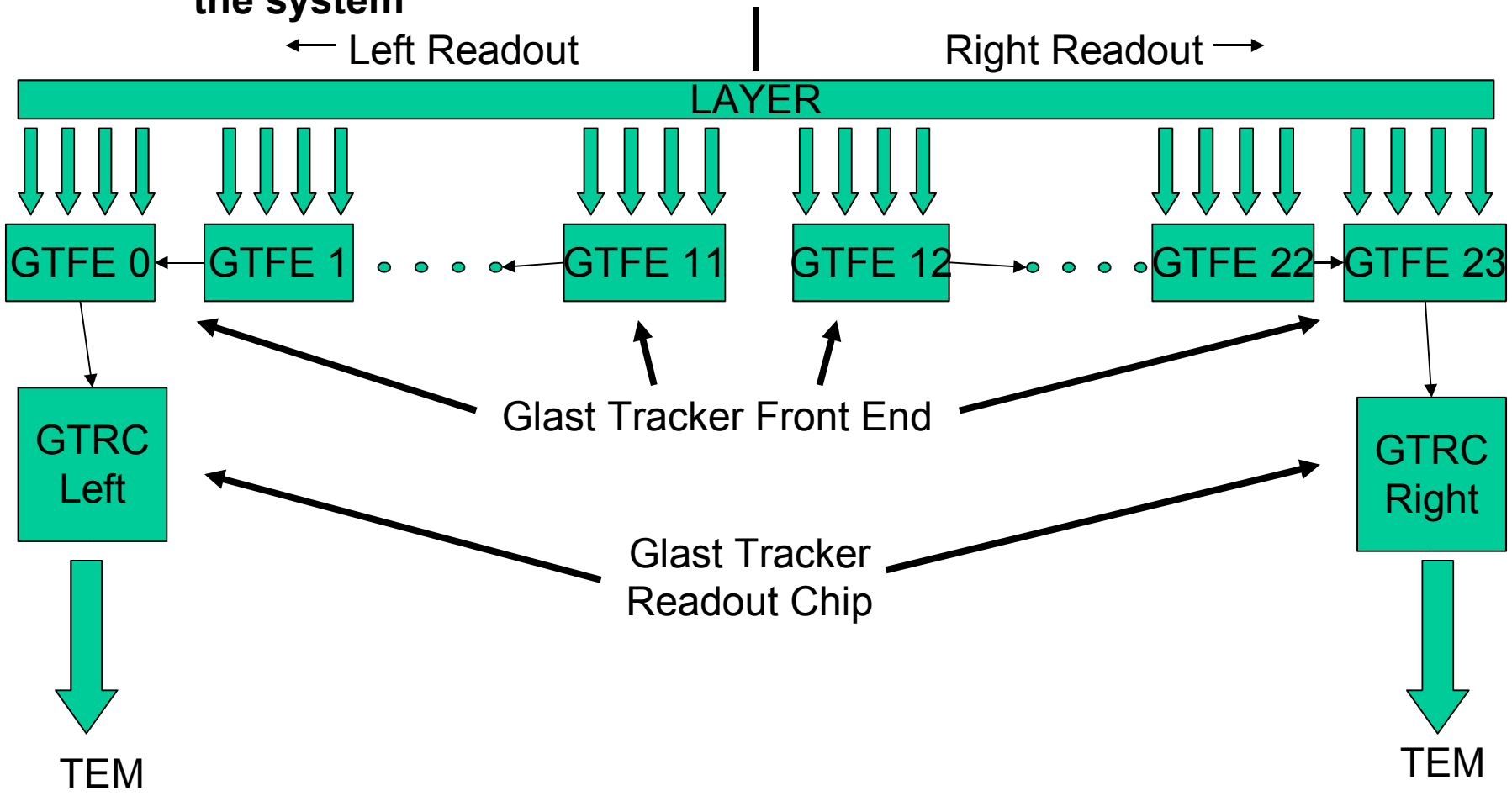
IA Workshop
SLAC, July 14,2005

Front End Scheme

- **Each Si-Layer is read by two readout chips that control usually half of Front End Chips**
- **This Configuration can change to test the redundancy of the system**

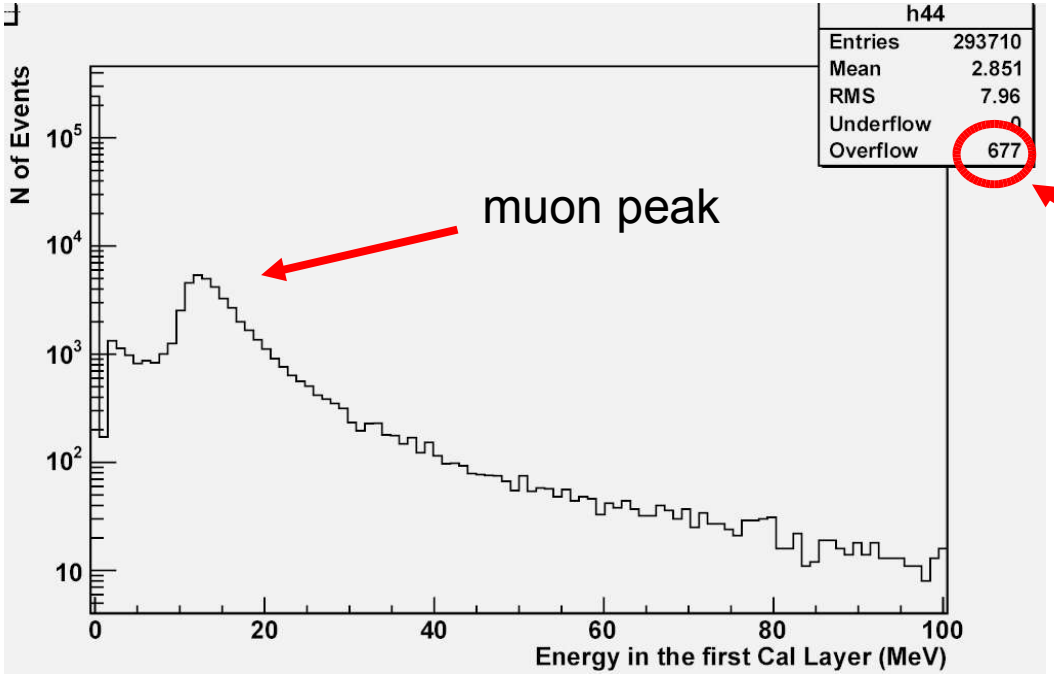


The Goal

- In Two tower tests, we have three runs at different configurations:
  - *135002052 (baseline run)*
  - *135002057 (right cable readout only)*
  - *135002103 (left cable readout only)*
- We select only one tower and
- Searched for differences between the three runs
  - Use Merit and SVAC ntuple

First Problem: cannot use CAL triggers

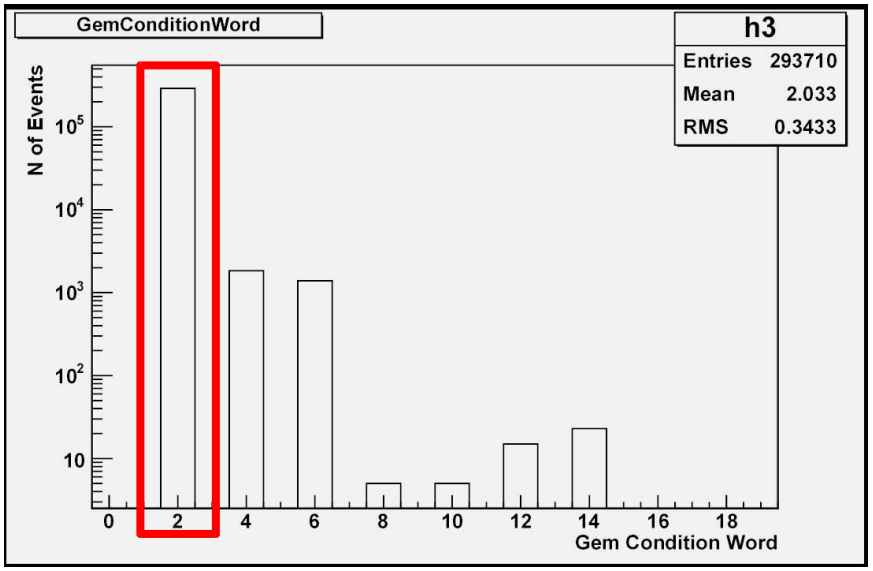
- We would like to play one system against the other
  - Use CAL variables for event selection and study TKR distributions
- We have types of 2 CAL Triggers but
  - threshold is too high for muons
    - CAL Low Energy: Energy > 100 MeV
    - CAL High Energy: Energy > 1 GeV



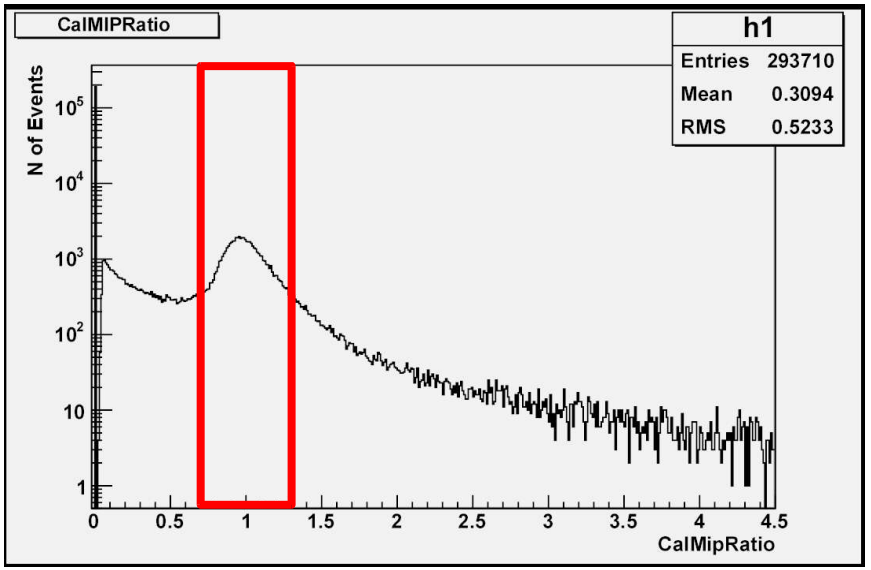
We have only about 0.2% of the events that could trigger the CAL

Use TKR trigger and cut on CAL variables

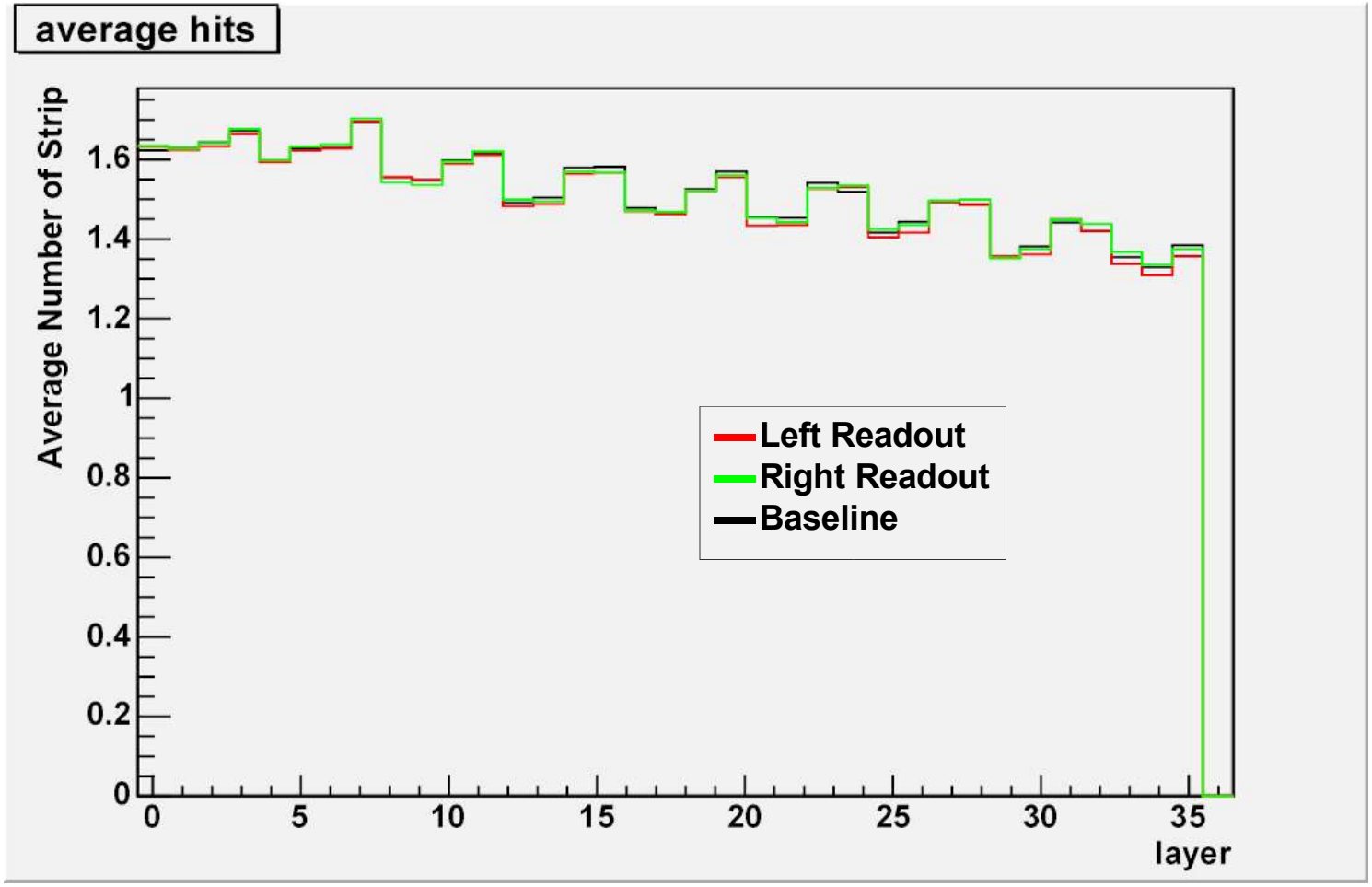
- **Next best things that we can do is:**
  - **Select triggers in Tower 4**
    - **GemTkrVector[4]==1**
  - **Require TKR triggers only**
    - **GemConditionsWord==2**



- **Cut on CAL variables:**
  - **Select MIPs:**
    - **0.6 < CalMIPRatio < 1.3**

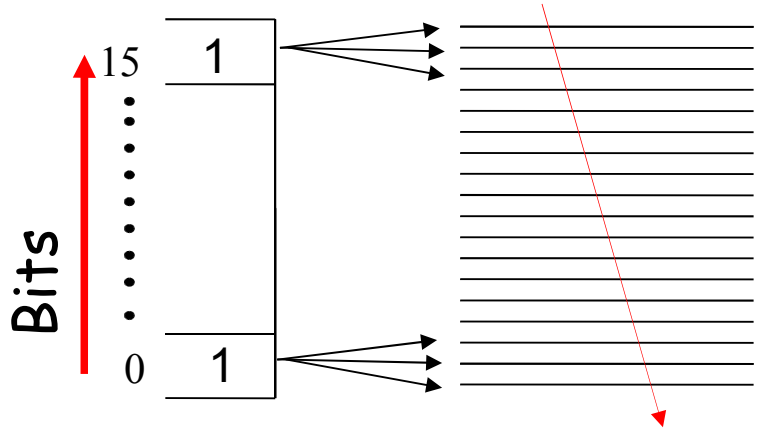


Average Hits per Layer



We don't have any difference between the runs!

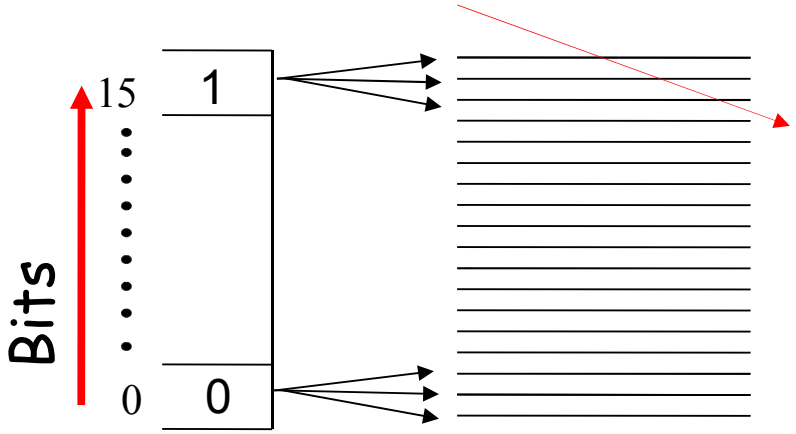
3-in-a-row TKR Trigger



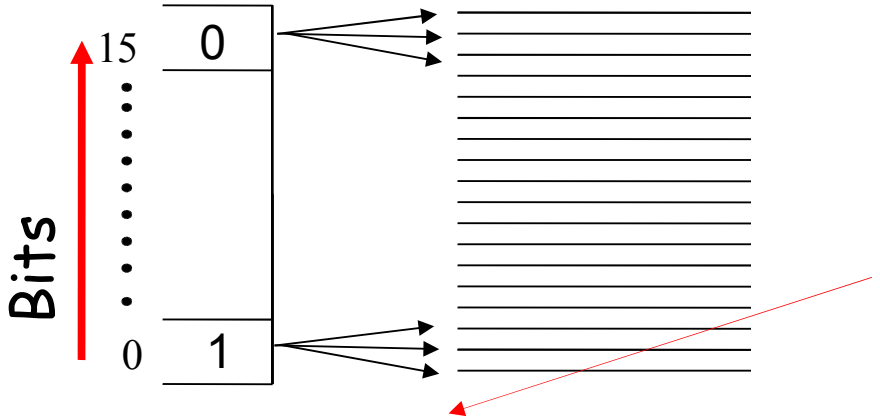
Muons usually produce trigger requests for all of the 16 allowed combinations of 3-in-a-row

There is no way to know which of the 16 3-in-a-row is responsible for the trigger

- **we want to find topology to maximize timing effects in TKR distributions**



Trigger on top only



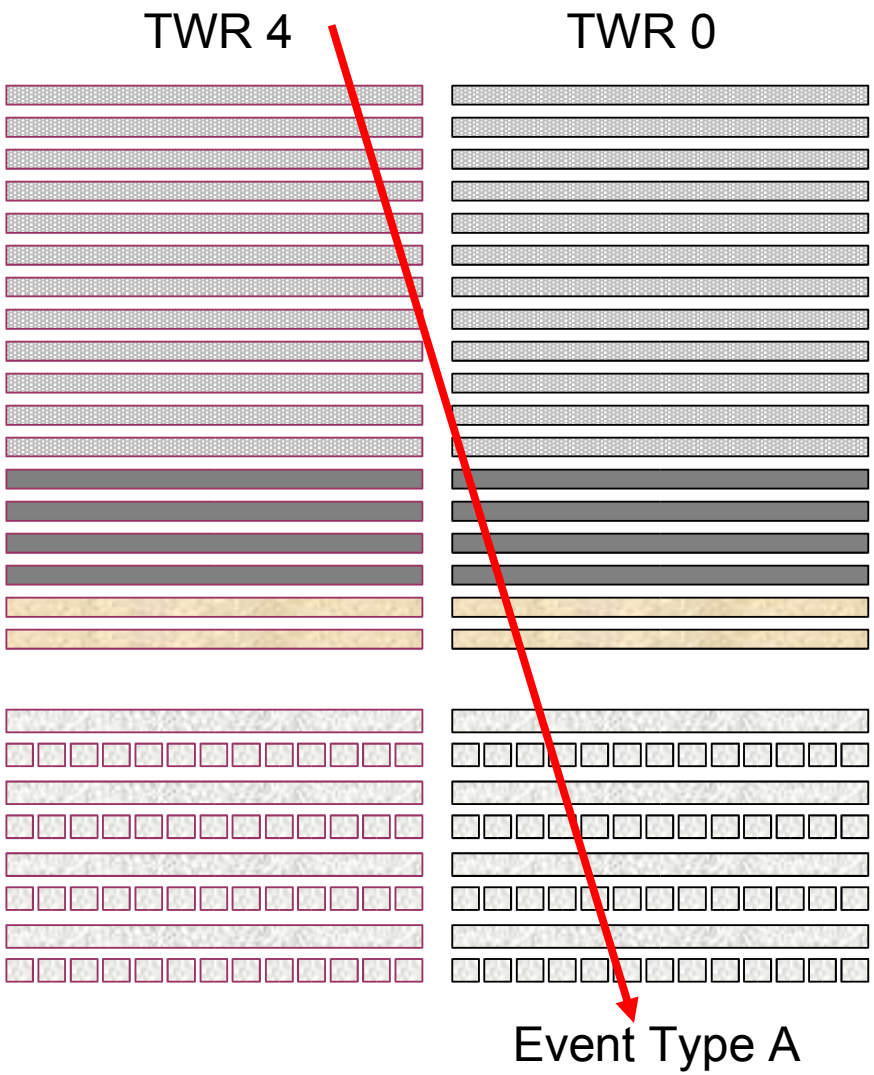
Trigger on bottom only

Use triggers from different towers

- To compare events that trigger on the top only with those that triggered on the bottom only
  - We will not have the CAL variable to play against the TKR
    - Not enough geometrical acceptance
- As an alternative we can
  - study distributions in tower 4 by selecting triggers from different towers
- Event Type A
  - triggered by tower 0
- Event Type B
  - triggered by tower 4

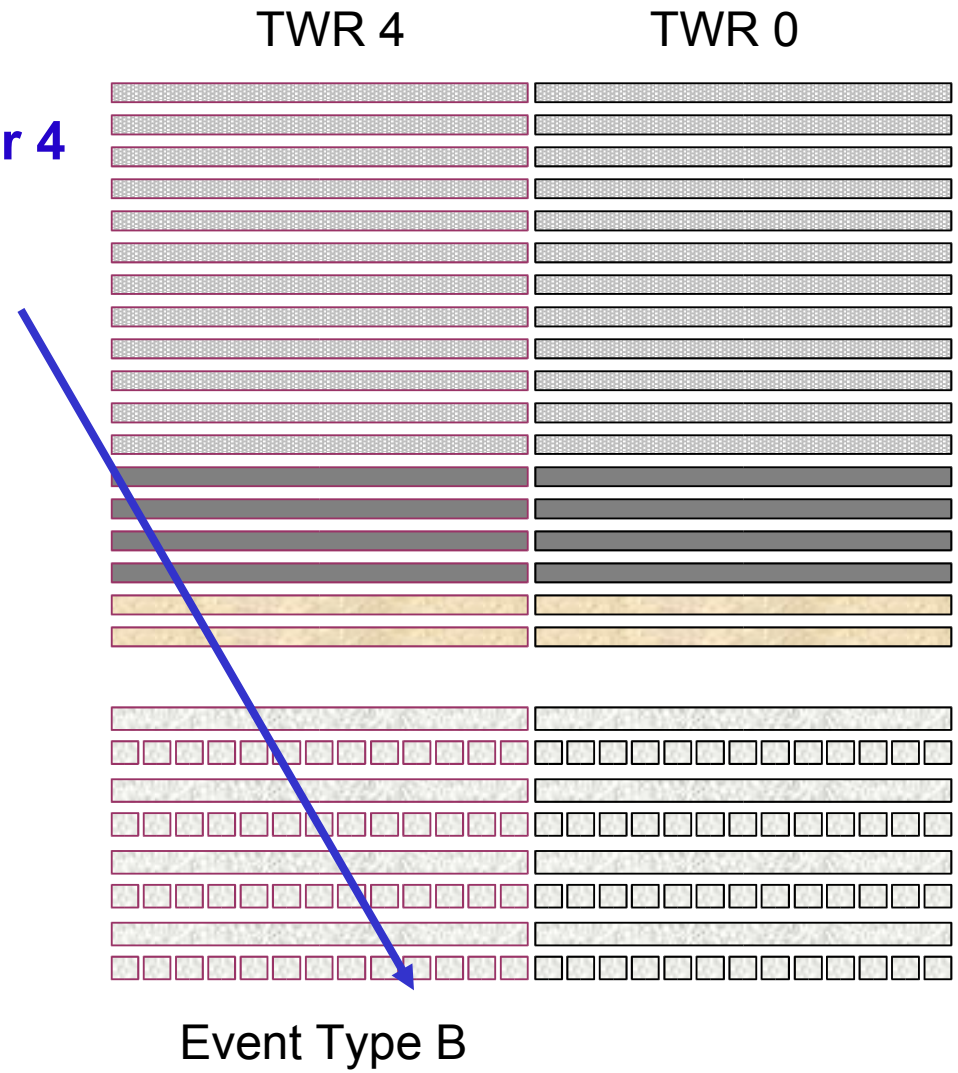
Event Type A

- Trigger on bottom of Tower 0
  - Look at distributions on tower 4
- To select these kind of event we use the following cuts:
  - 0.6 < CalMIPRatio < 1.3
  - GemConditionWord = 2
  - GemTkrVector[0] = 1
    - Only Tower 0 Triggered
  - CalNumHit[4] = 0
    - No CAL hits in Tower 4
  - TkrTotalHits[0] < 25
  - TkrY0 > - 370 mm



Event Type B

- Trigger on bottom of tower 4
  - Look at distributions on tower 4
- We use the following cuts:
  - 0.6 < CalMIPRatio < 1.3
  - GemConditionWord = 2
  - GemTkrVector[4] = 1
    - Only Tower 4 Triggered
  - CalNumHit[0] = 0
    - No CAL hits in Tower 0
  - TkrTotalHits[4] < 25
  - TkrY0 > - 370 mm

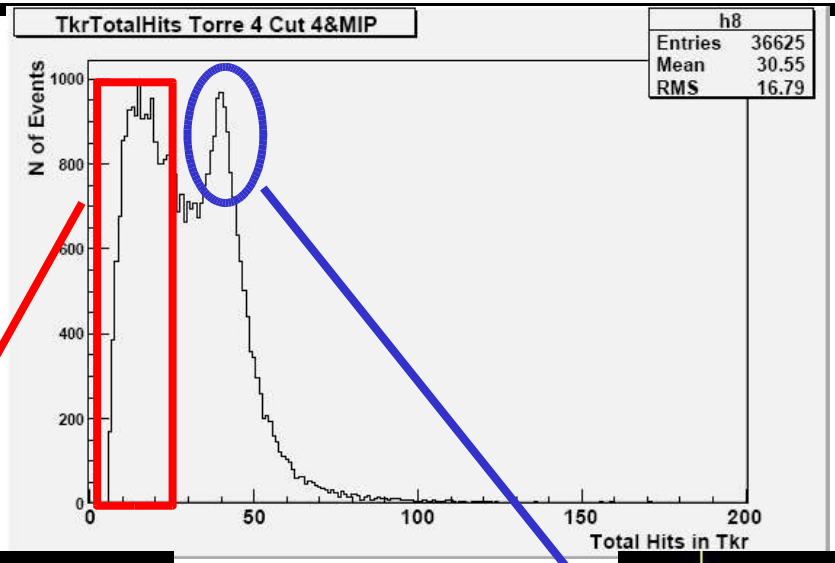


Cuts Explanation

This one is what we want to keep

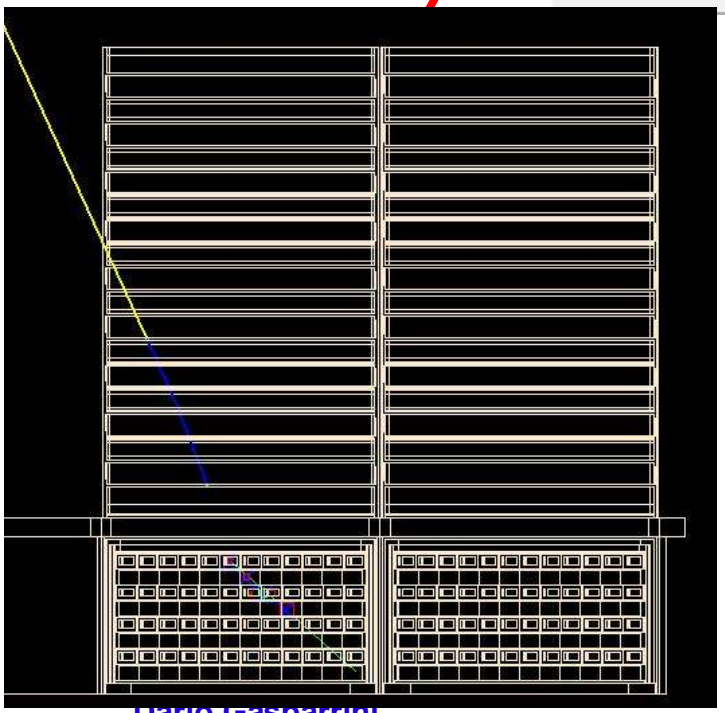
We select

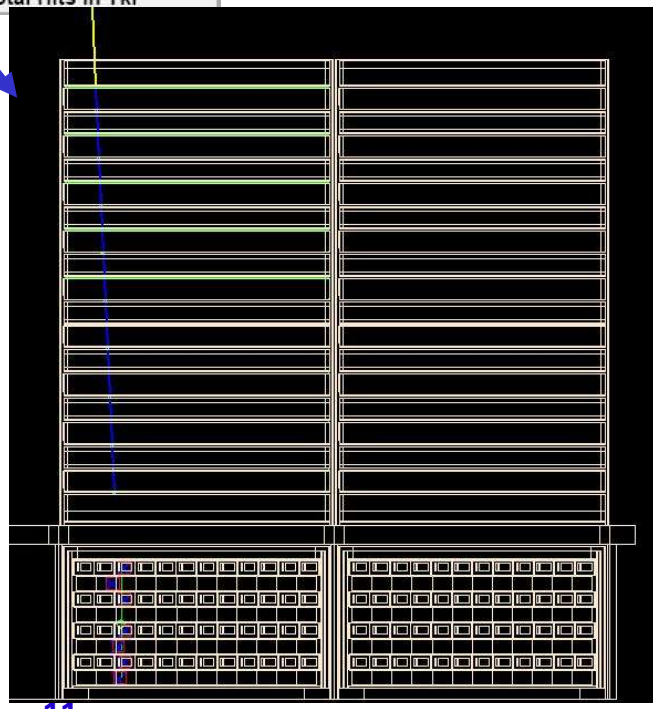
TkrTotalHits < 25



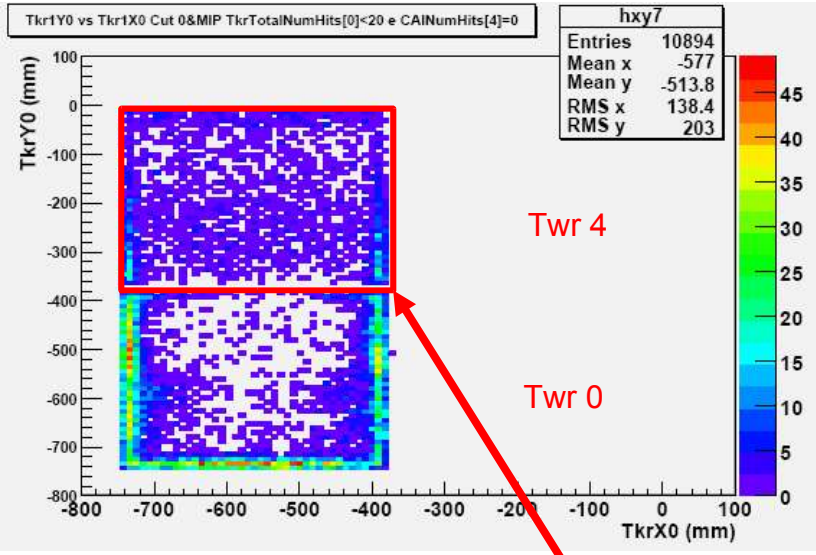
This is a typical straight muon event

TkrTotalHits peaks around 45





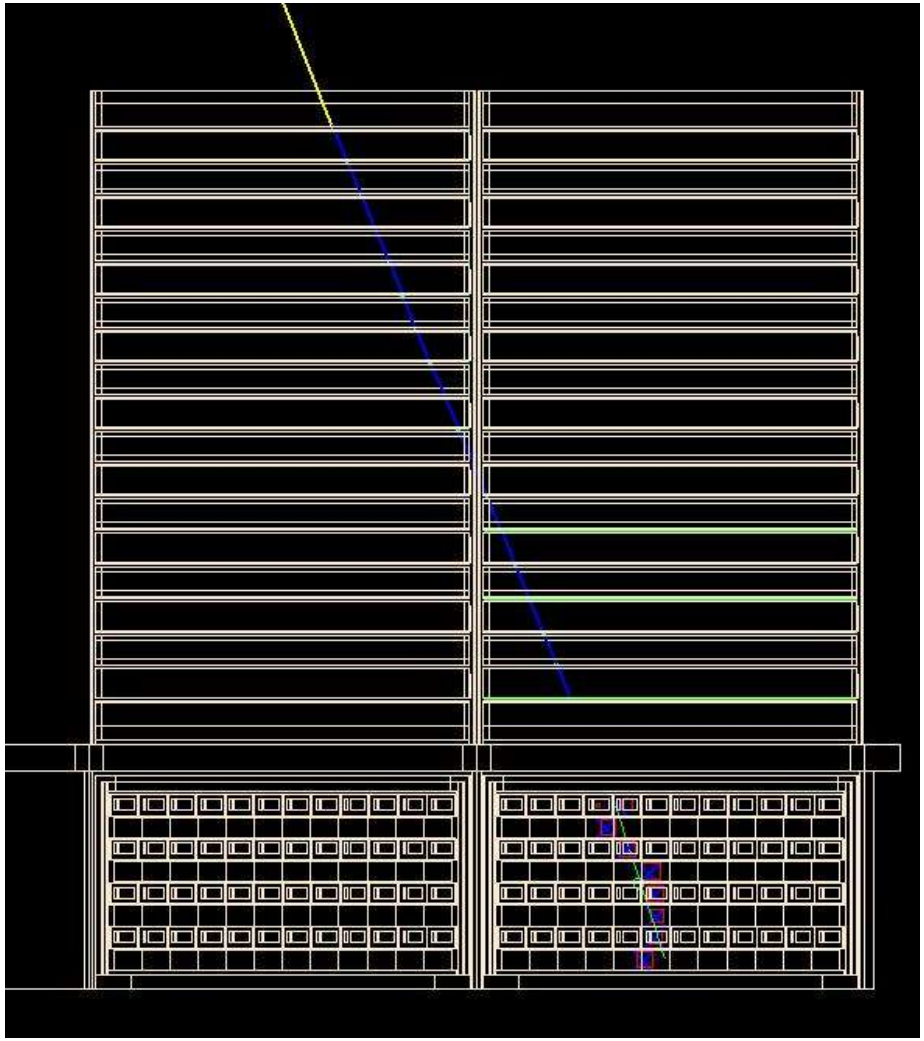
Cuts Explanation (II)



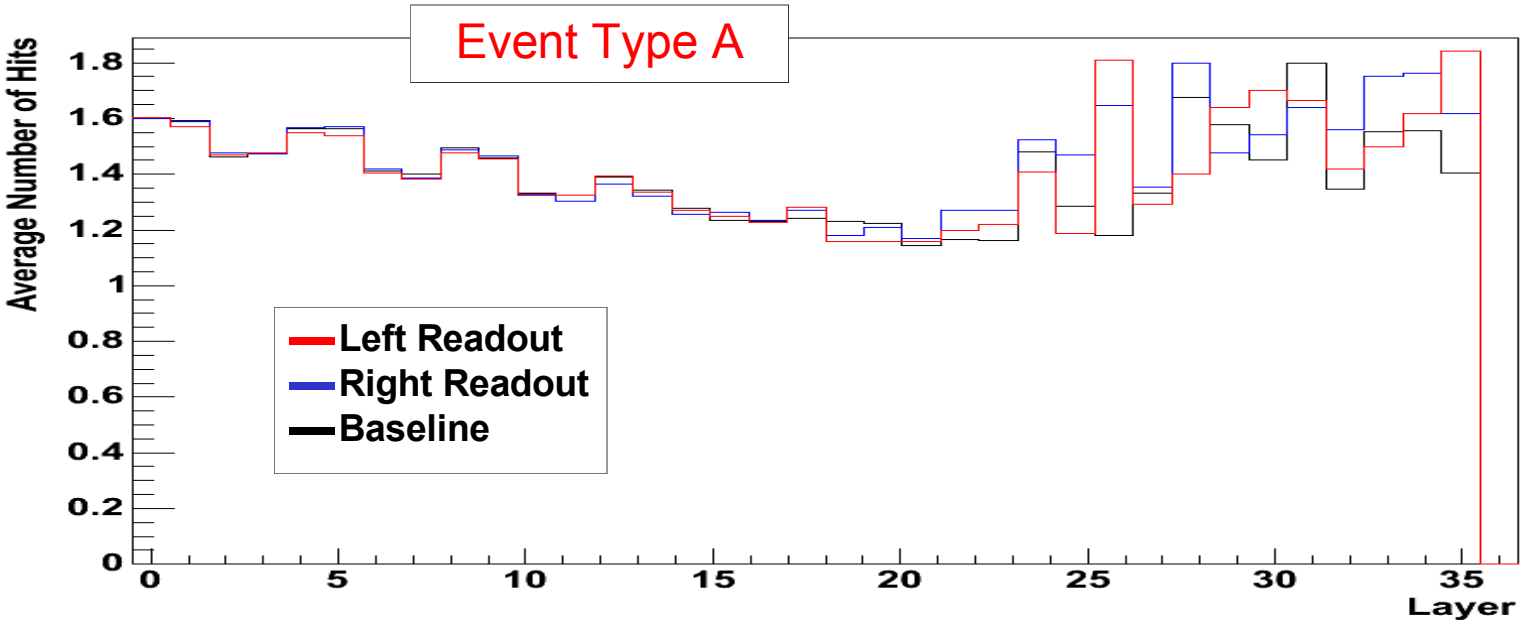
Then we select on the TkrY0 (coordinate of first hit) to find out in which tower the events enter

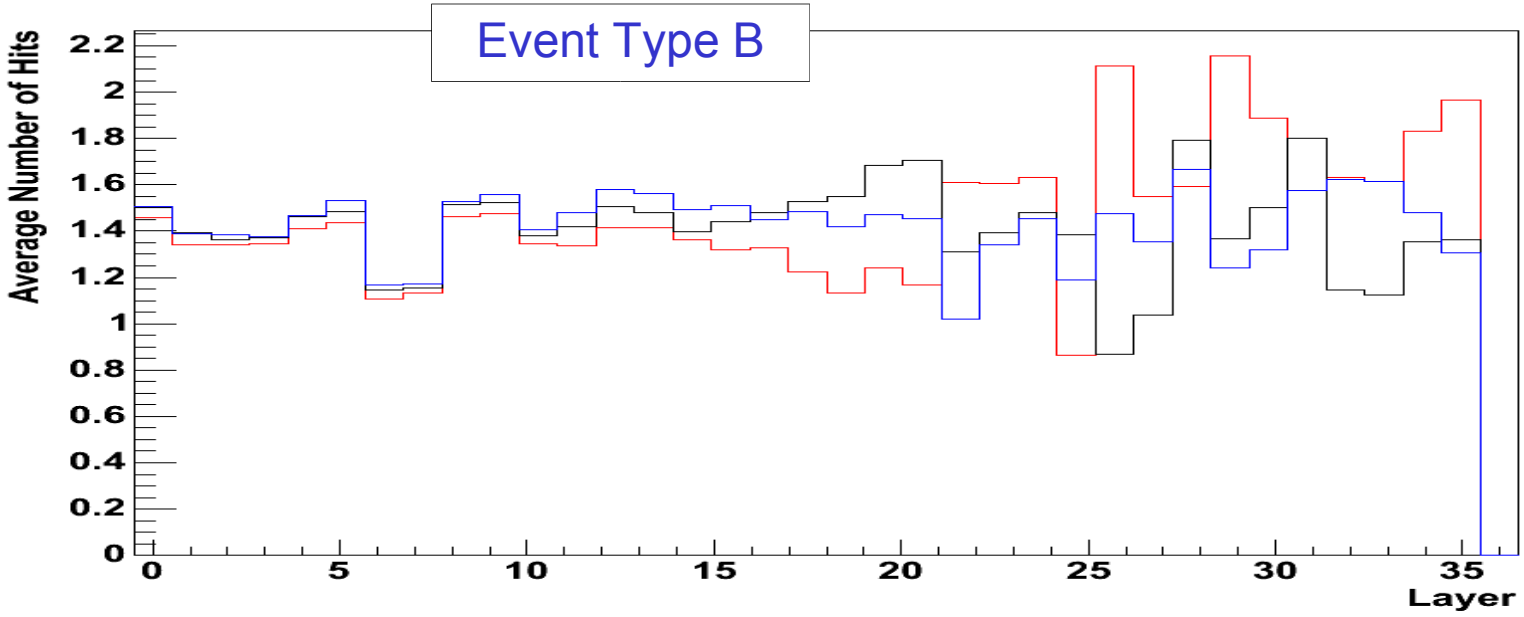
(i.e. We want tower 4 Events Type A)

TkrY0 > -370 mm



Average Hits per Layer





Bug found in SVAC Ntuple

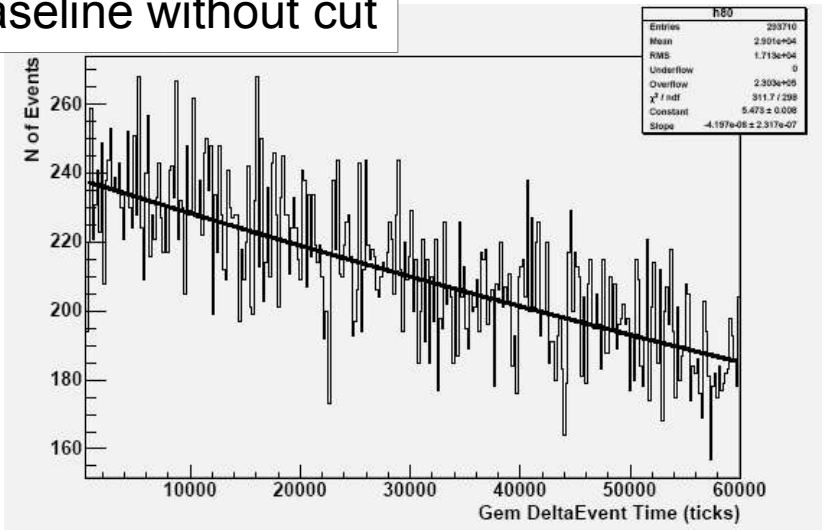
We tried these cuts because we found a bug:

- TkrNumCluster[tower][layer][view] was wrongly filled
  - All information from tower 4 was stored by mistake in tower 0
    - TkrNumCluster[0] wrongly filled
    - TkrNumCluster[4] is empty
- <beware> It happens in 2 towers and 4 towers runs !
- But Anders has corrected the error for 6 Towers runs.

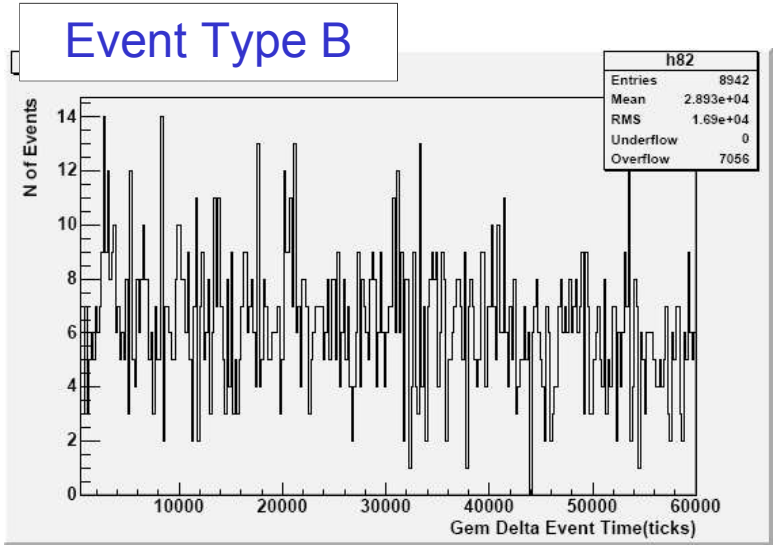
Time Distributions

We try to look at GemDeltaEventTime to look if we have some differences on the dead time

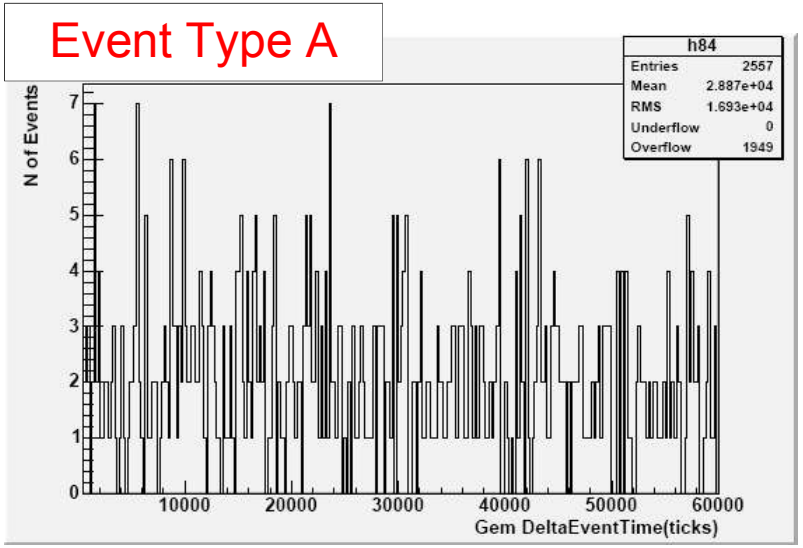
Baseline without cut



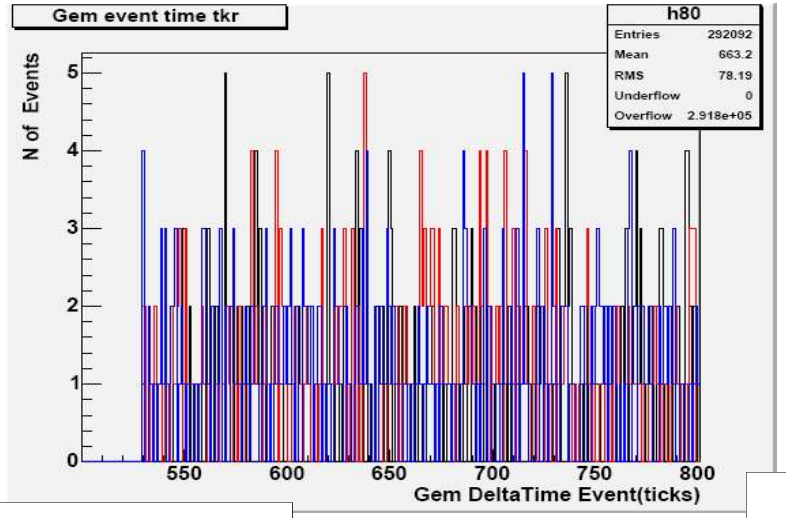
Event Type B



Event Type A



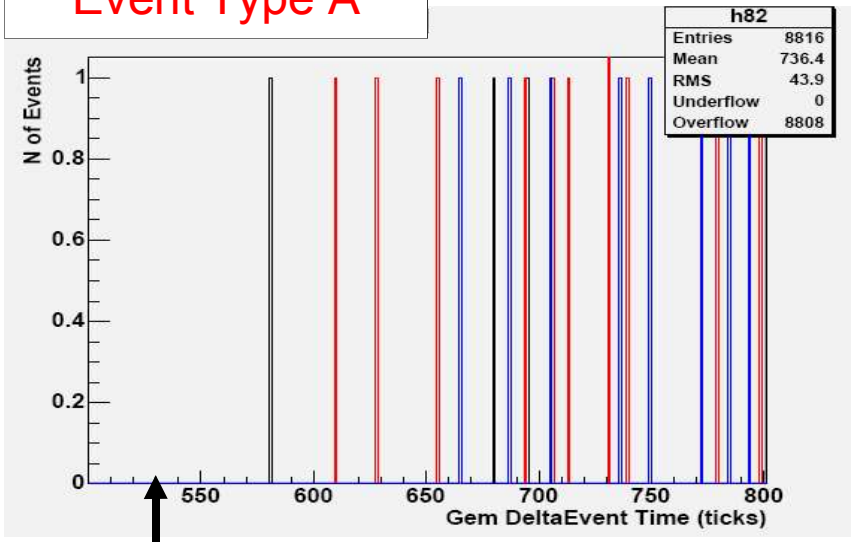
Time Distributions (II)



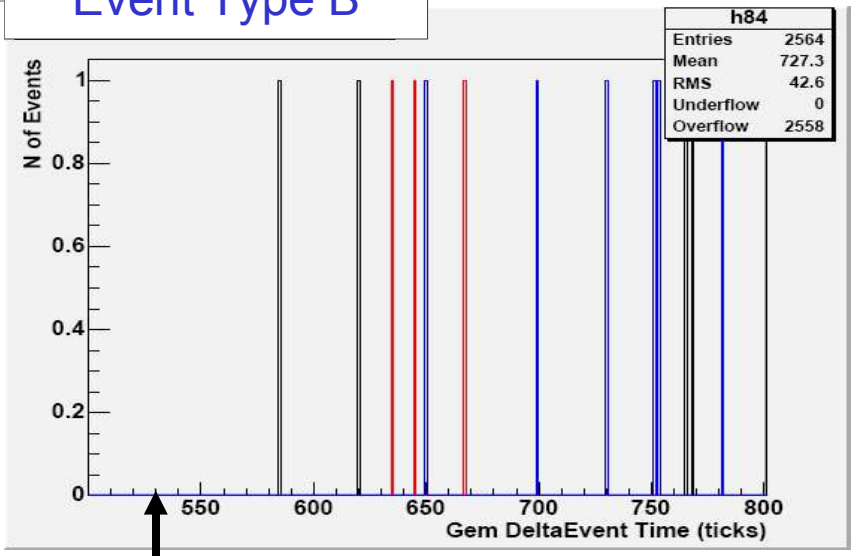
Left Readout
Right Readout
Baseline

1 tick = 50 ns

Event Type A



Event Type B



Expected Dead Time (530 ticks)

Conclusions

- We could not easily compare triggers that occurred on the top with those that occurred on the bottom
  - This information is NOT available in the hardware
- The next best thing is to
  - study distributions in one tower by selecting triggers generated only in one of the two towers
    - We may say we don't see any differences between three runs
    - But…
      - » we have a small and biased sample of events
      - » It is hard to conclude something based on that
- What we would like to do:
  - To ask for runs that allow only trigger on top or bottom of TKR
    - Read out by one side only and by both sides
      - » Total of 6 configurations
  - Comments and suggestions are welcome!

Backup Slides

Number of events history

Baseline 135002052 without cut								
				293710				
GemConditionWord==2								
GemTkrVector[4]==1						GemTkrVector[0]==1		
	160729					154287		
0.6 < CalMipRatio < 1.3								
	36625					35028		
TkrTotalHits[4] <25 && CalNumHits[0]==0					TkrTotalHits[0] <25 && CalNumHits[4]==0			
	11378					10894		
TkrY0>-370 (tower 4)					TkrY0<-370 (tower 0)			
	8942					2557		

Rejected Events