Trigger Studies

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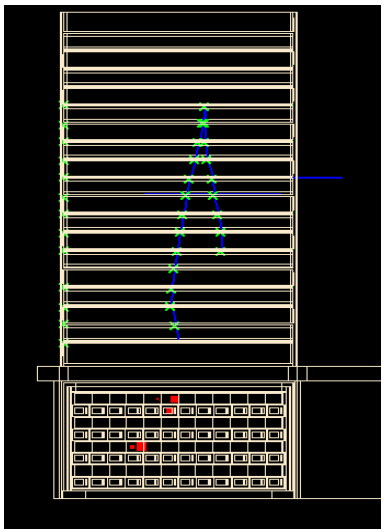
Instrument Analysis Workshop III

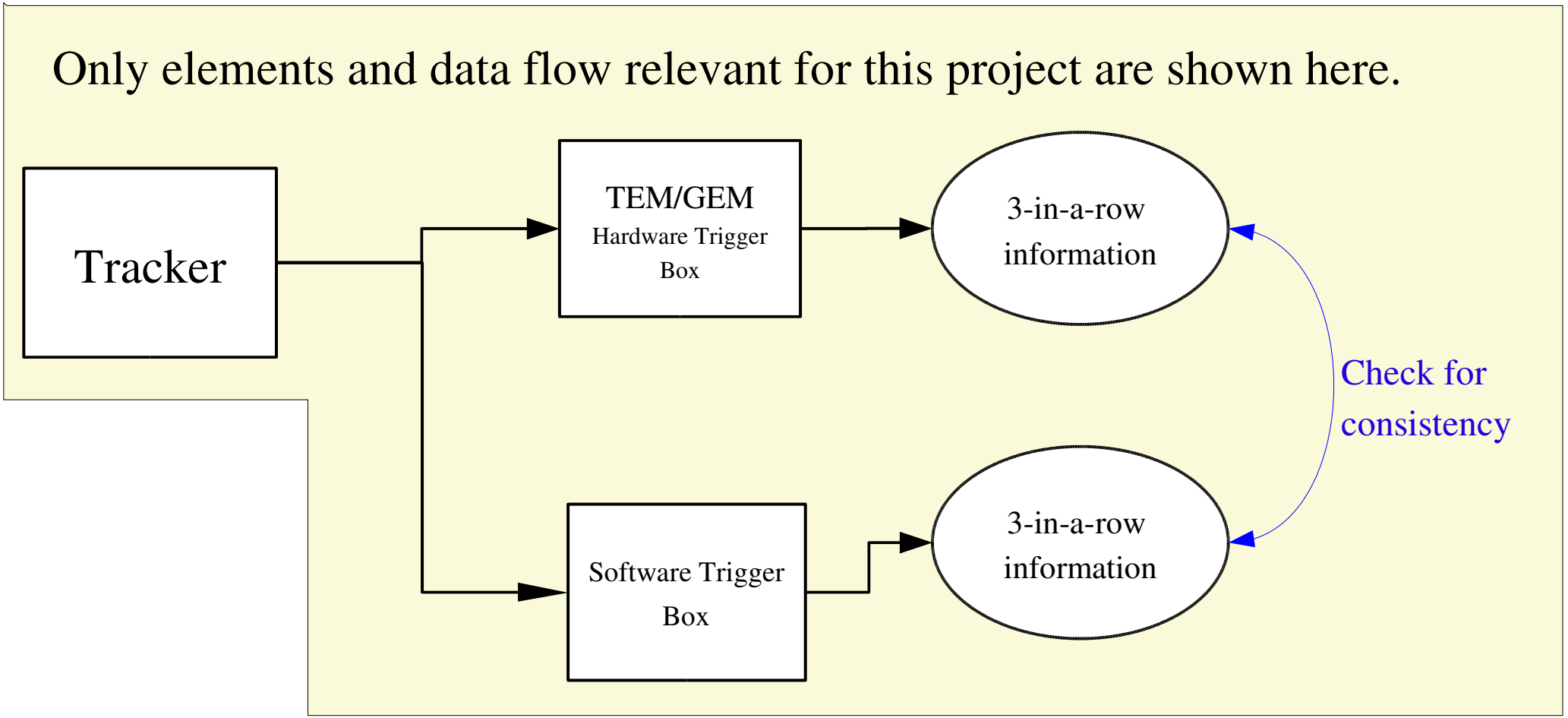


March 10th, 2005

Outline of I&T Project

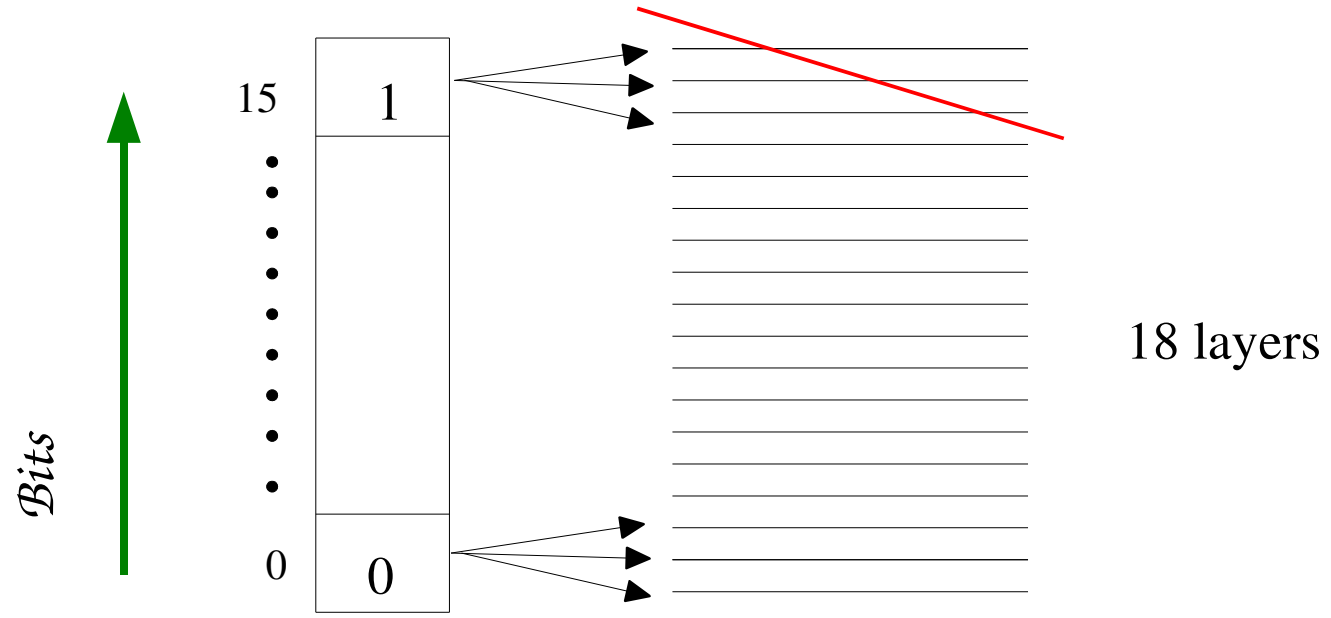
Data taking mode:

Only elements and data flow relevant for this project are shown here.



What is the 3-in-a-row information?

Combination	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Layers	0 1 2	1 2 3	2 3 4	3 4 5	4 5 6	5 6 7	6 7 8	7 8 9	8 9 10	9 10 11	10 11 12	11 12 13	12 13 14	13 14 15	14 15 16	15 16 17



16 bit word per every tower.

What is the 3-in-a-row information?

There are two sources of 3-in-a-row information:

Contribution from the Digis:

- A modified version of TriggerAlg calculates the 3-in-a-row bitword for every tower.
- This information is put in TDS and made available through the Svac tuple.

Contribution from the TEM:

- I&T provides a Traker Request variable (TkrReq) for every tower, layer, view and tray end.
- 3-in-a-row bitwords are formed from TkrReq.

Checking for Consistency

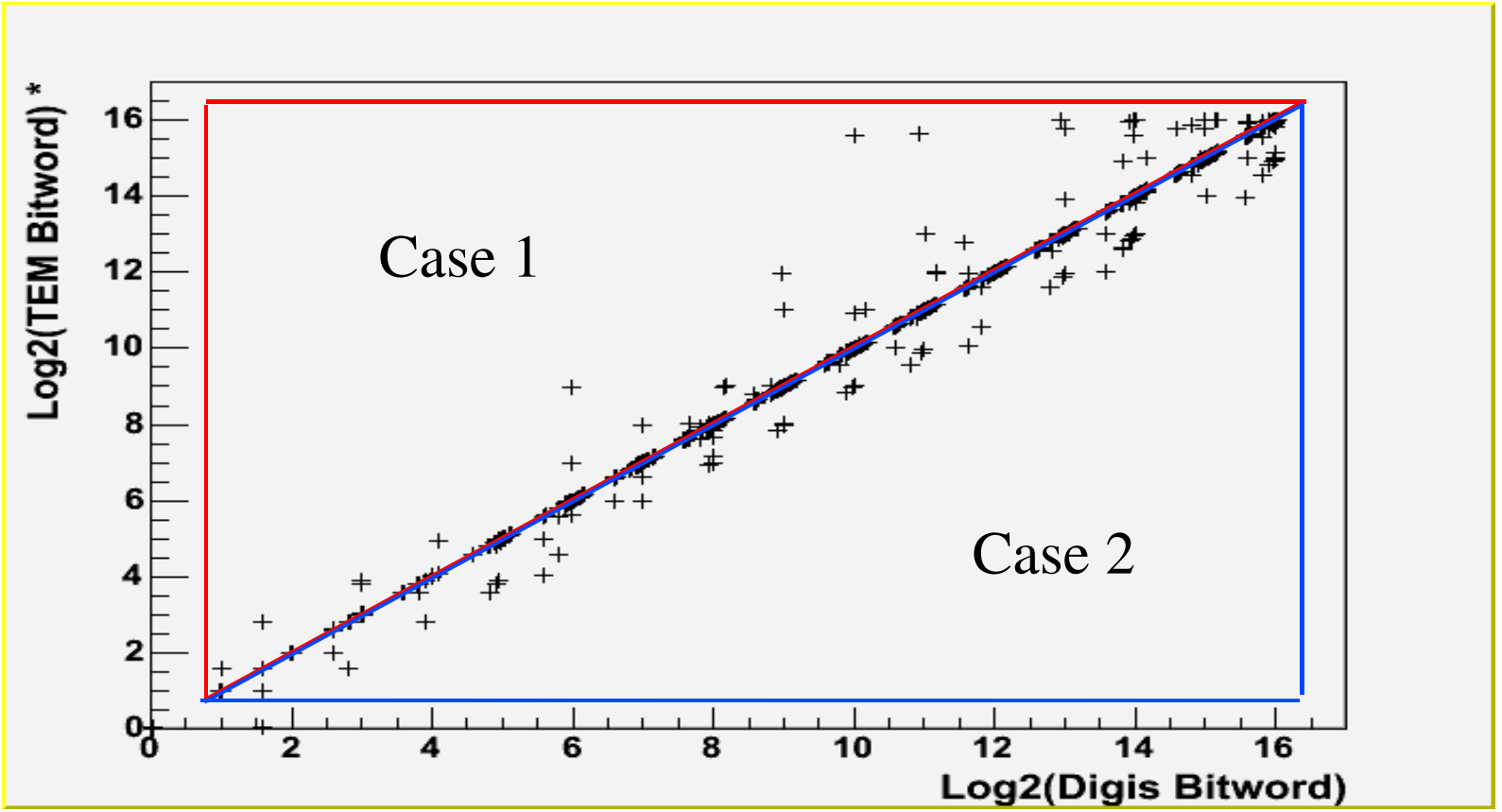
Case 0: Everything working as desired. Digi Bitword = TEM Bitword

(Digi Bitword = Readout / Tem Bitword = Trigger Request)

Case 1: A given hit (including noise) produces a trigger request, but its time over threshold is so low that by the time the readout takes place the hit has faded away (missed hit) Digi Bitword < TEM Bitword

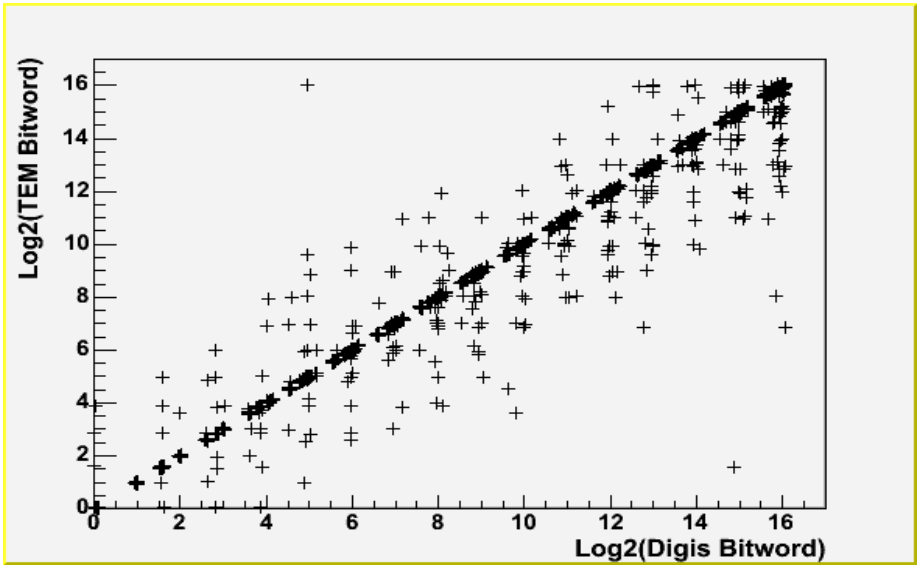
Case 2: A trigger request is issued. While waiting for the readout a noise hit takes place (Spurious hit).

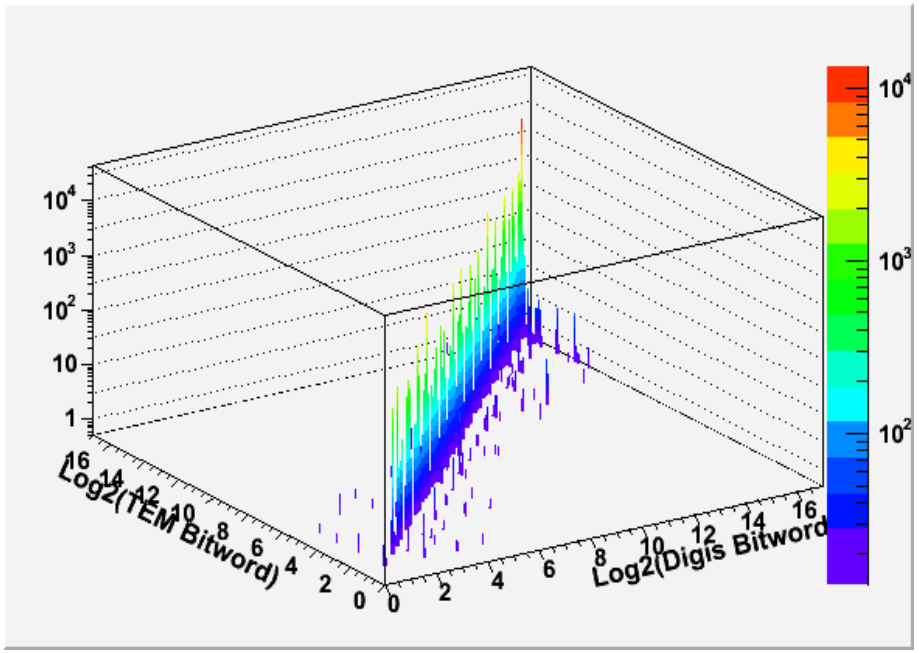
Digi Bitword > TEM Bitword



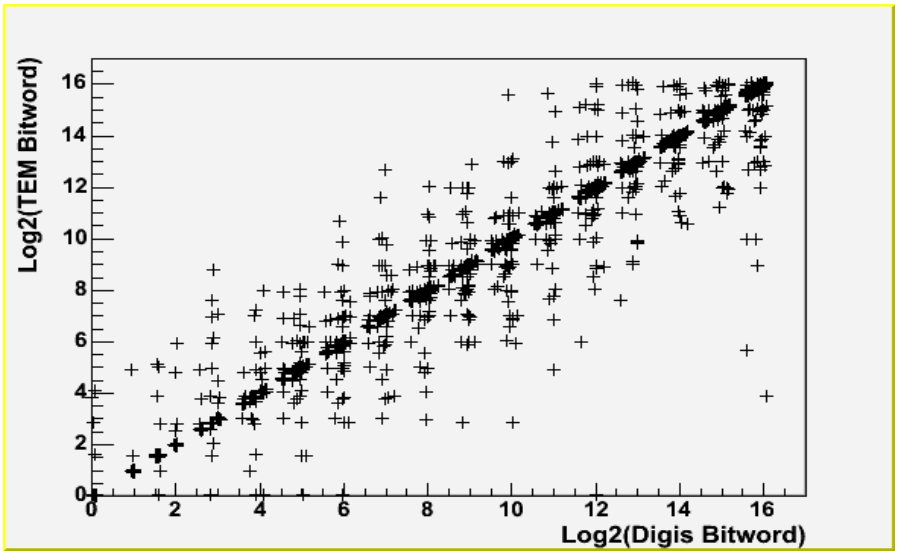
Consistency vs DAC

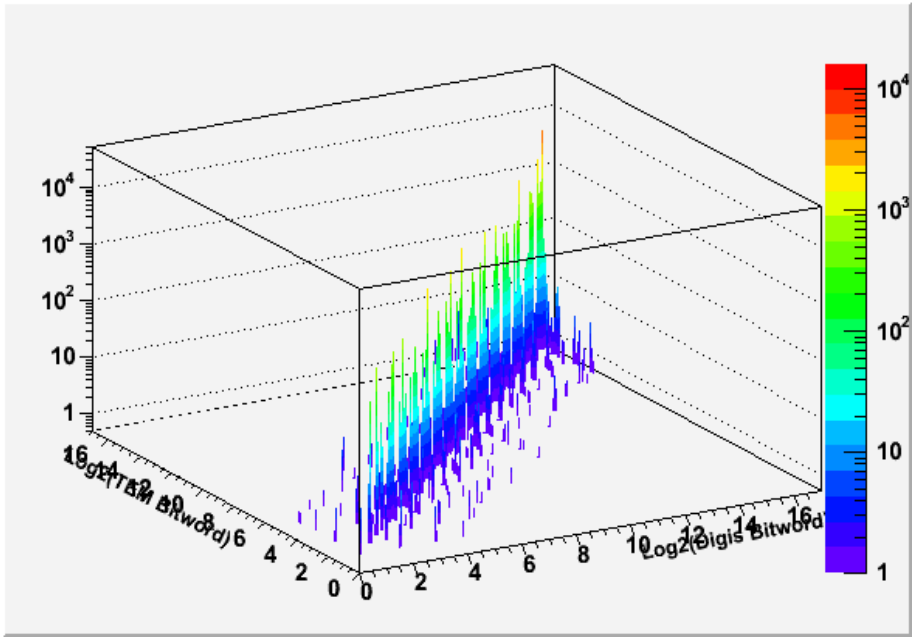
Tower B (DAC = 40) - Run 398000750



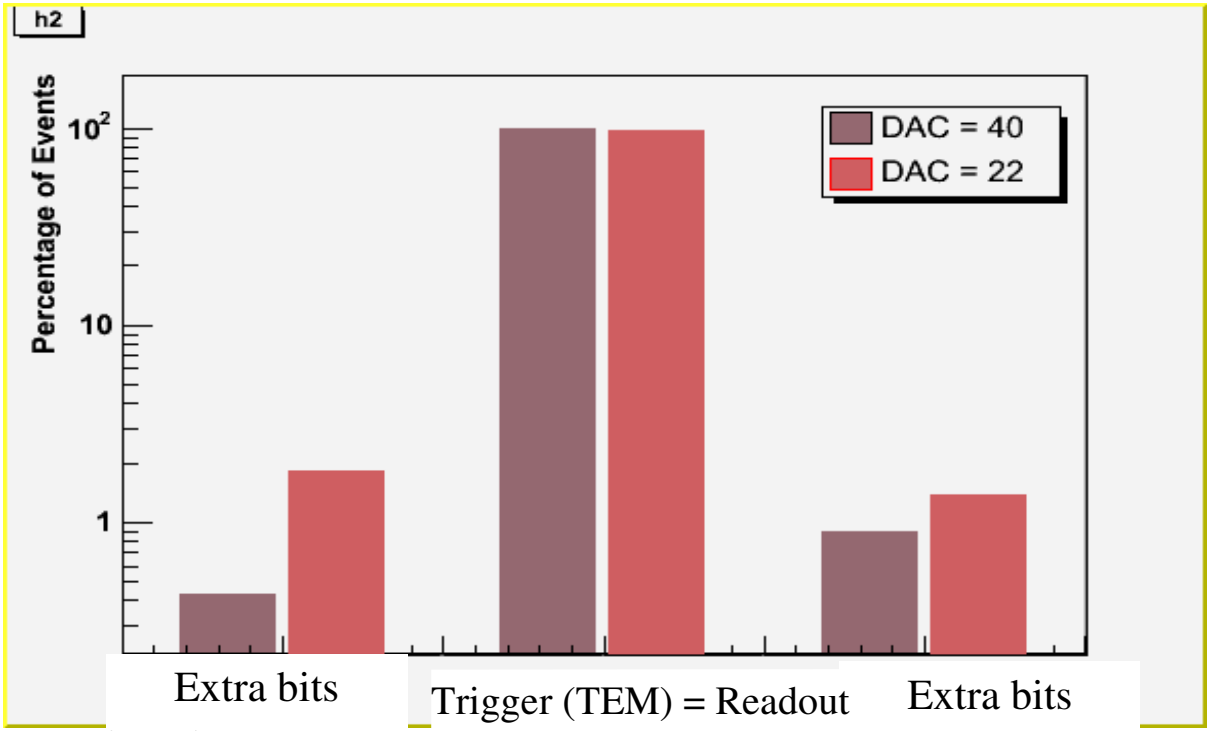


Tower B (DAC = 22) – Run 398000801





Consistency vs DAC



Run 398000750 ~100K events

Run 398000802 ~120K events

DAC	40	22
Digi = Tem	98.68%	96.81%
Extra TEM	0.43%	1.81%
Extra Digi	0.89%	1.38%

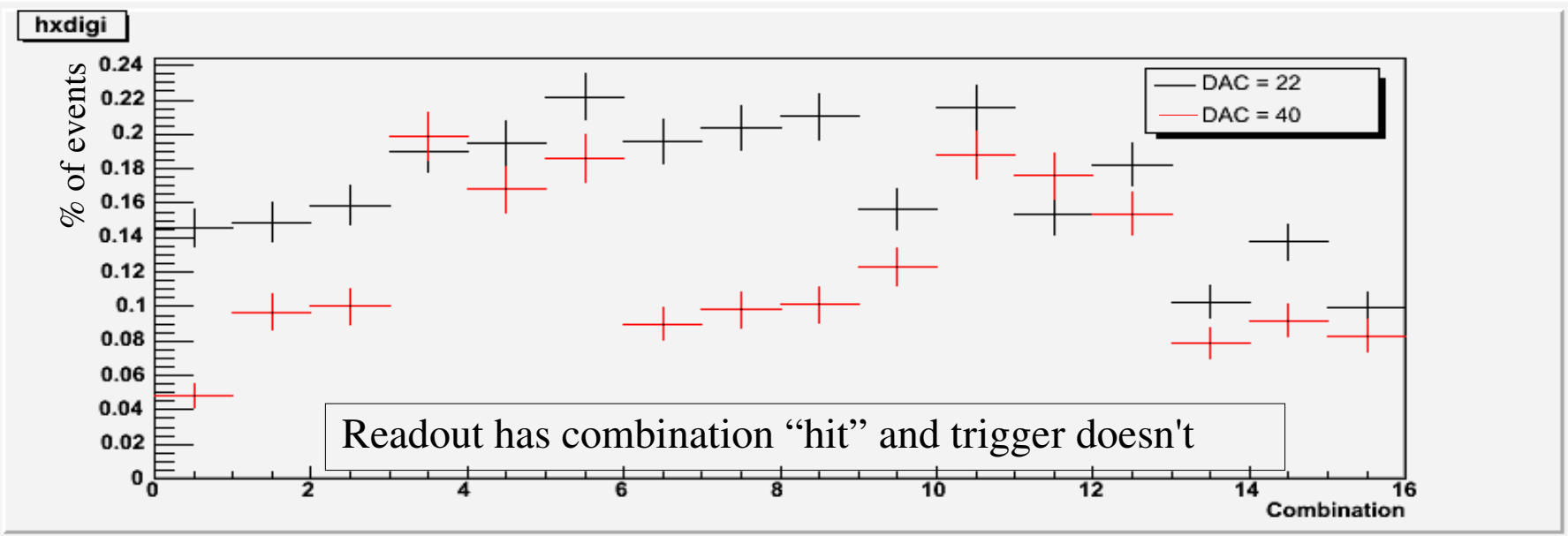
Extra Trigger Hits (TEM): Due to noise hits and losses due to trigger delay

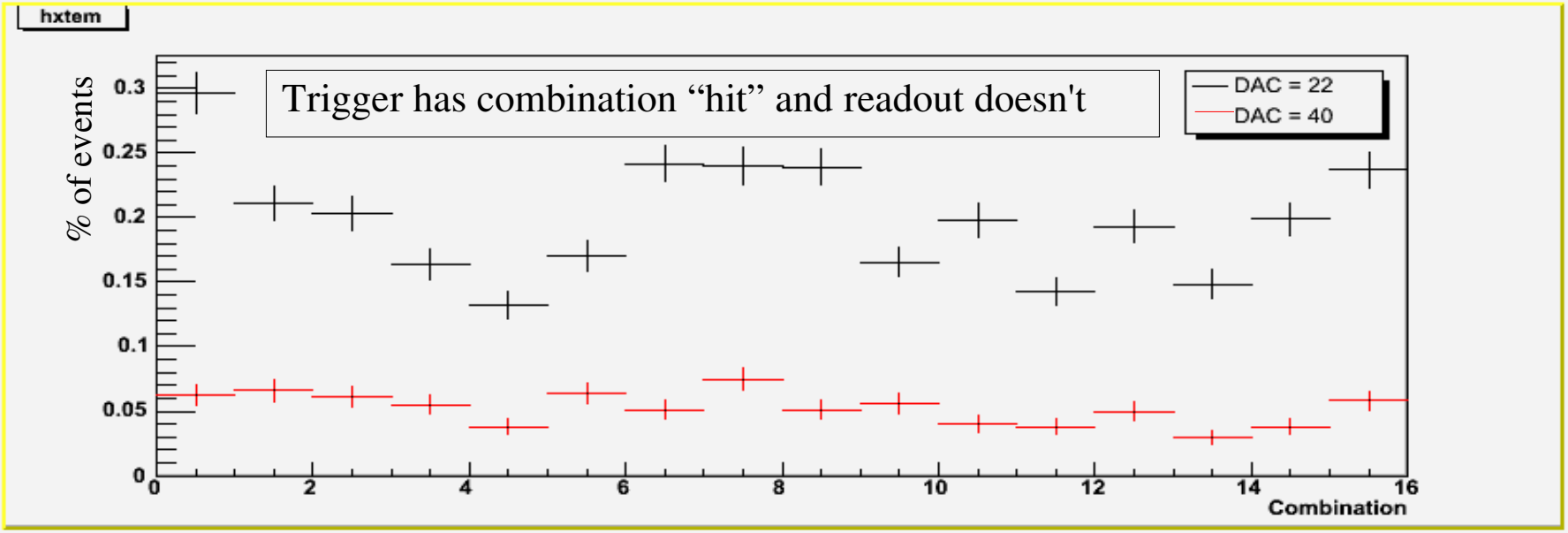
Extra Readout Hits (Digis): Due to noise occupancy.

- A lower threshold (DAC) results in an increase of noise and events with digi bitword != tem bitword
- A large increase (~400%) is observed for (trigger > Readout) events. These are events for which low pulse noise hits present at the trigger time disappear before readout takes place.
- More quantitative analysis are on the “to do list”

Inconsistent bits per Combination – DAC Comparison

Combination	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Layers	0 1 2	1 2 3	2 3 4	3 4 5	4 5 6	5 6 7	6 7 8	7 8 9	8 9 10	9 10 11	10 11 12	11 12 13	12 13 14	13 14 15	14 15 16	15 16 17





Inconsistent bits per Combination – Tower comparison

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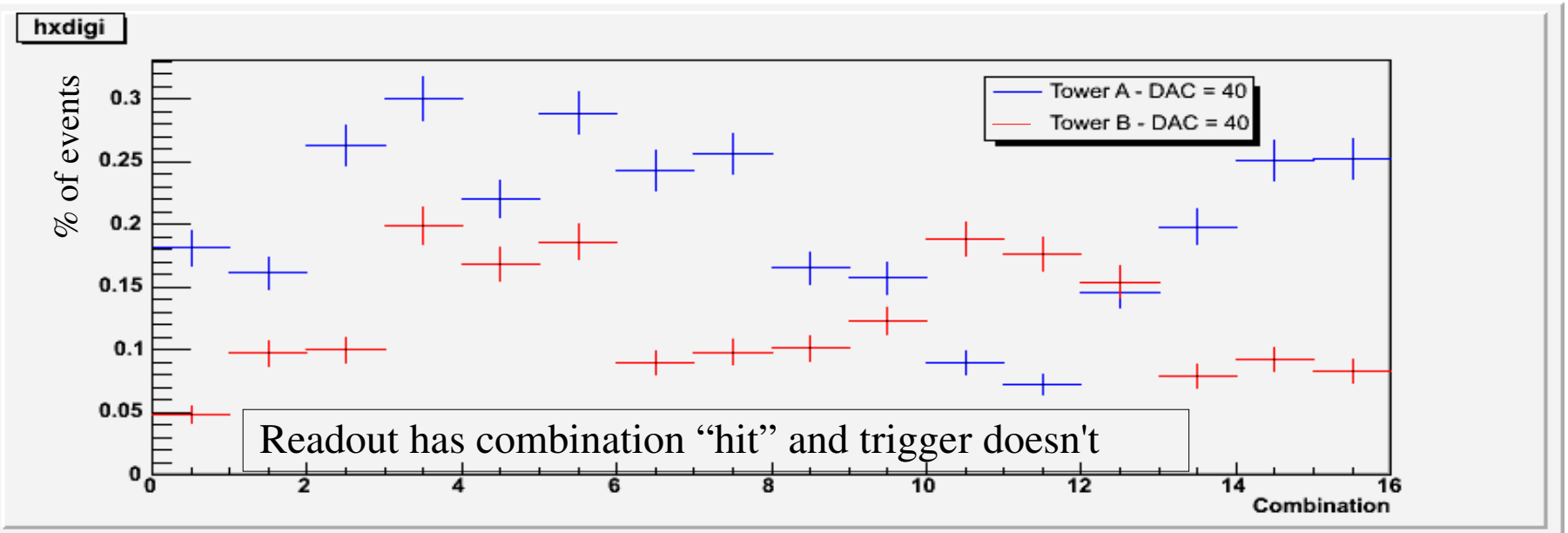
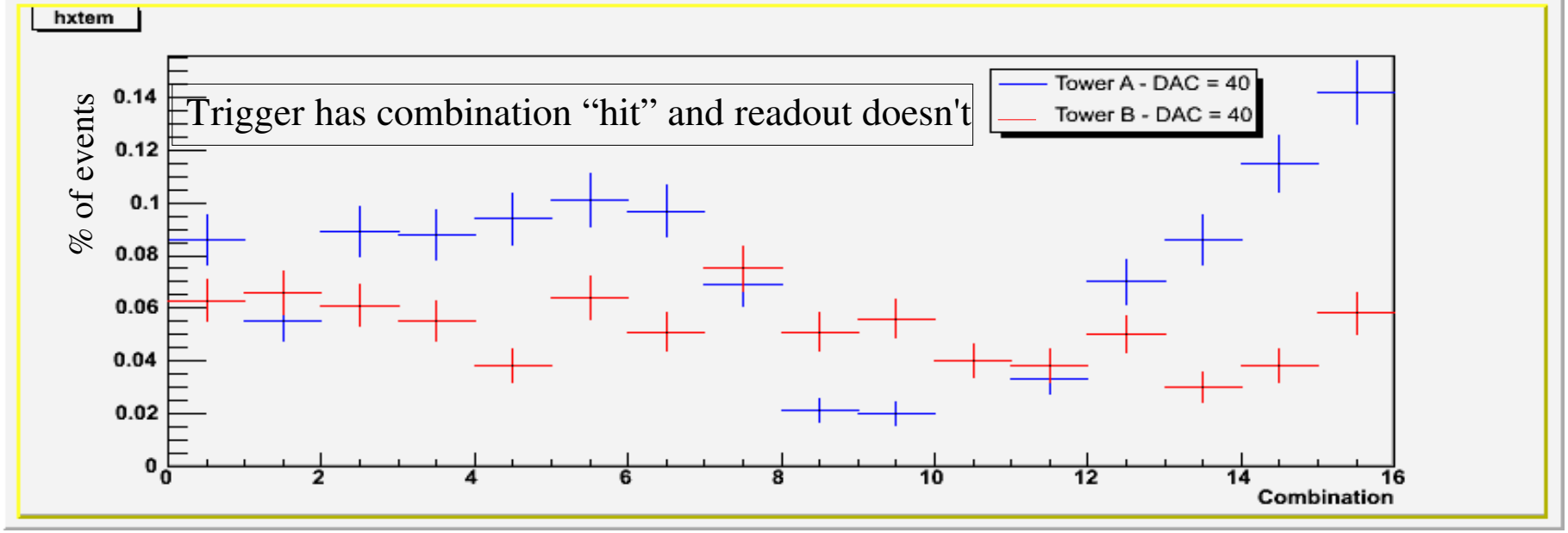
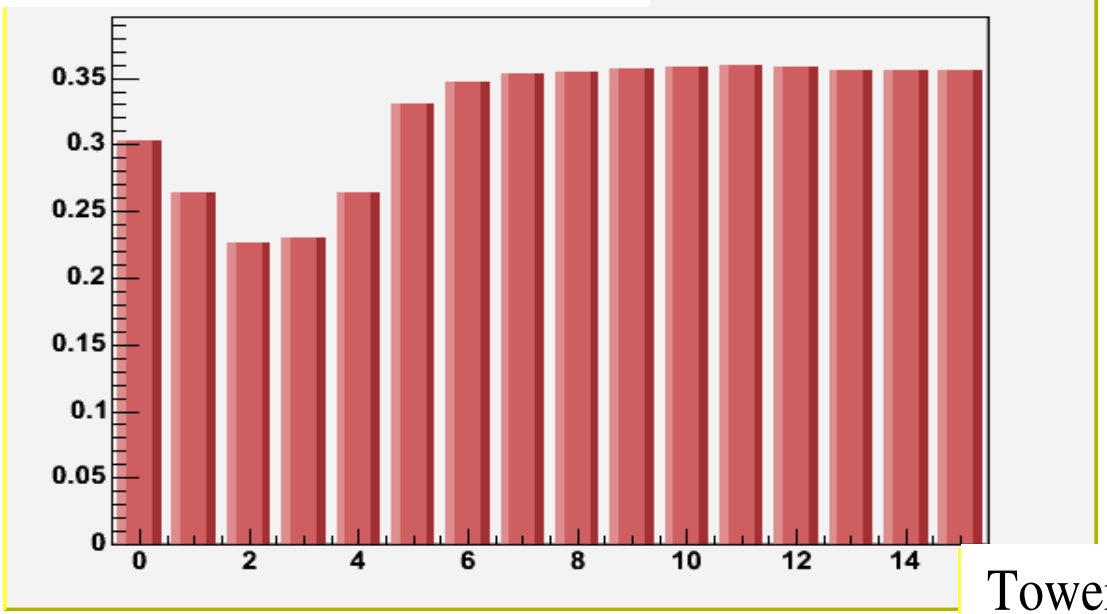




3-in-a-row Combination Efficiency

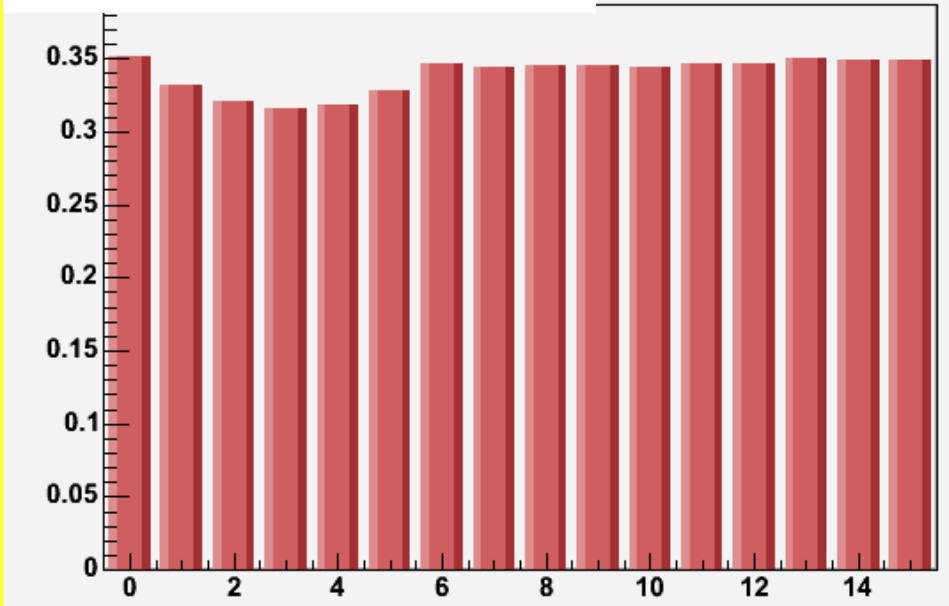
Combination	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Layers	0 1 2	1 2 3	2 3 4	3 4 5	4 5 6	5 6 7	6 7 8	7 8 9	8 9 10	9 10 11	10 11 12	11 12 13	12 13 14	13 14 15	14 15 16	15 16 17

Tower A – Run 398000750



- Both runs are from SLAC
- A minimum is observed for the heavy converter layers in both towers
- Tower A has additional suppression of those layers because of the known wirebond problems

Tower B – Run 398000801



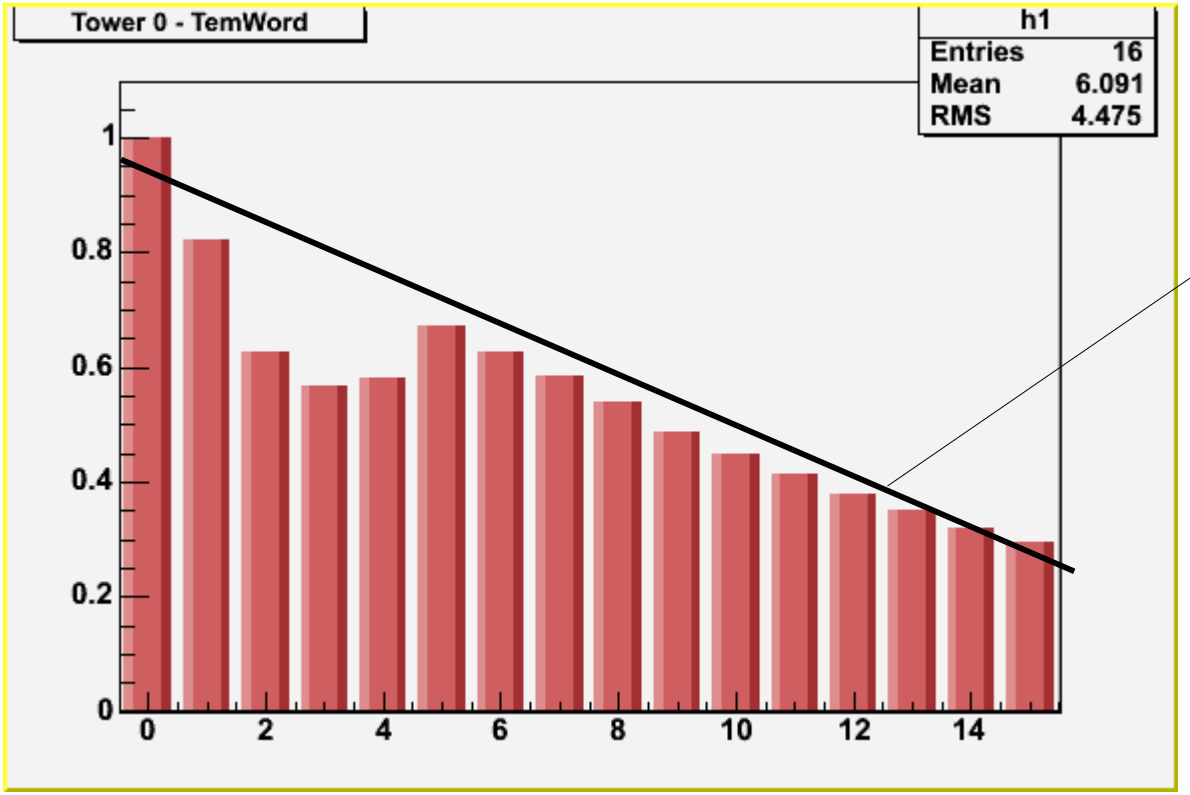
The results from Tower B reinforces hypothesis that muons are ranging out at the bottom layers

* Entries are not individual events. An event that has a hit in every layer will contribute with an entry in every bin. Histograms are normalized to total number of events in the run (~100K)

New idea on how to calculate the Efficiency – On Progress

Combination	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Layers	0 1 2	1 2 3	2 3 4	3 4 5	4 5 6	5 6 7	6 7 8	7 8 9	8 9 10	9 10 11	10 11 12	11 12 13	12 13 14	13 14 15	14 15 16	15 16 17

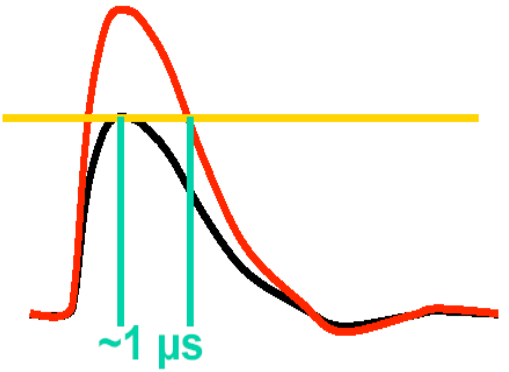
- Require some deposition in Cal (>5 MeV)
- From the data, get the Tkr1ZDir distribution for those events
- MC calculate the expected number of combination "hits" from a pure geometrical perspective assuming ideal layers.
-Calculate the efficiency with respect to that benchmark



Future calculation...
getting precise geometry information

What next?

- Expand the analysis of the inconsistent combinations to include both DAC and TACK delay information.



(Hiro's talk)

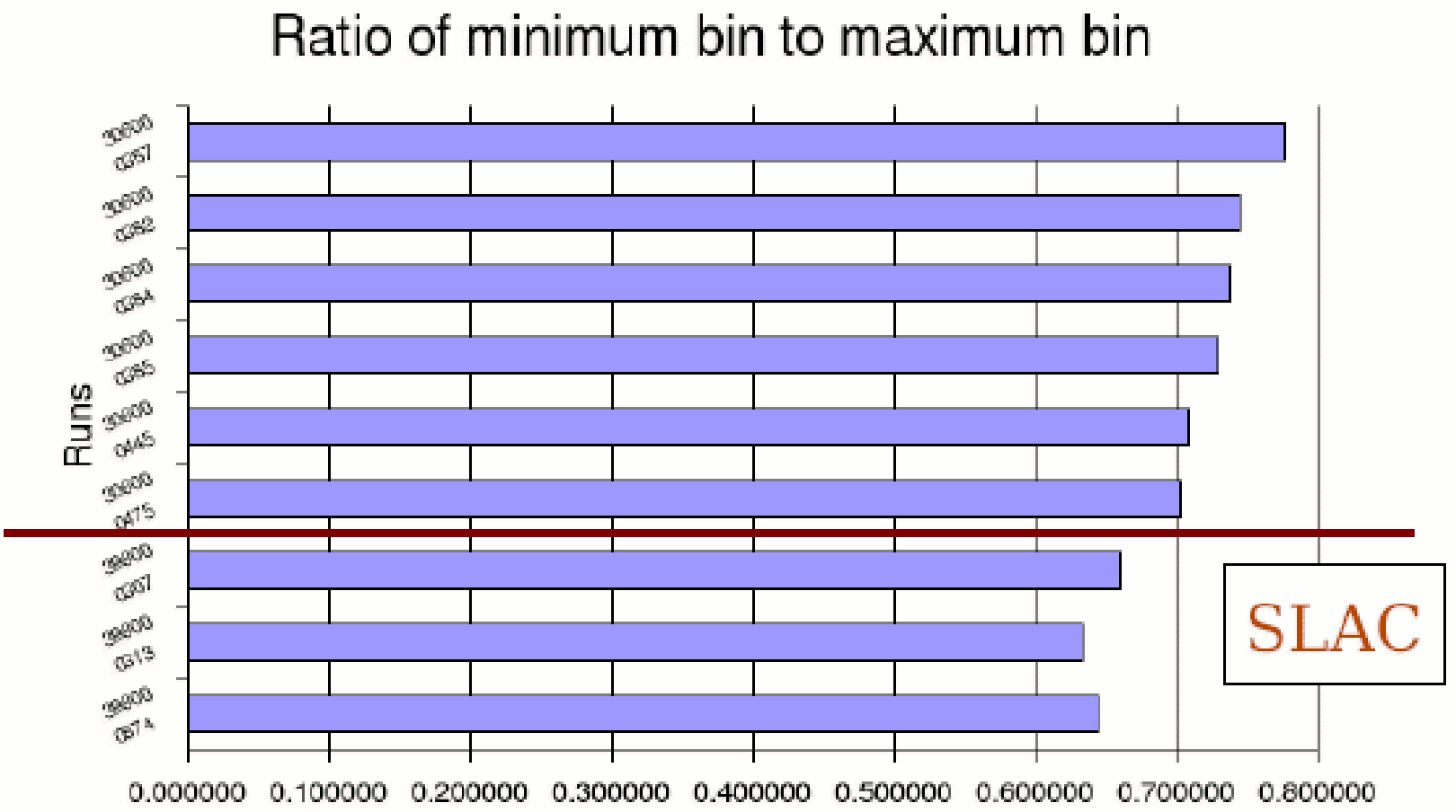
- Get quantitative in the analysis by using (calculating) known information as noise occupancy, and noisy strips.

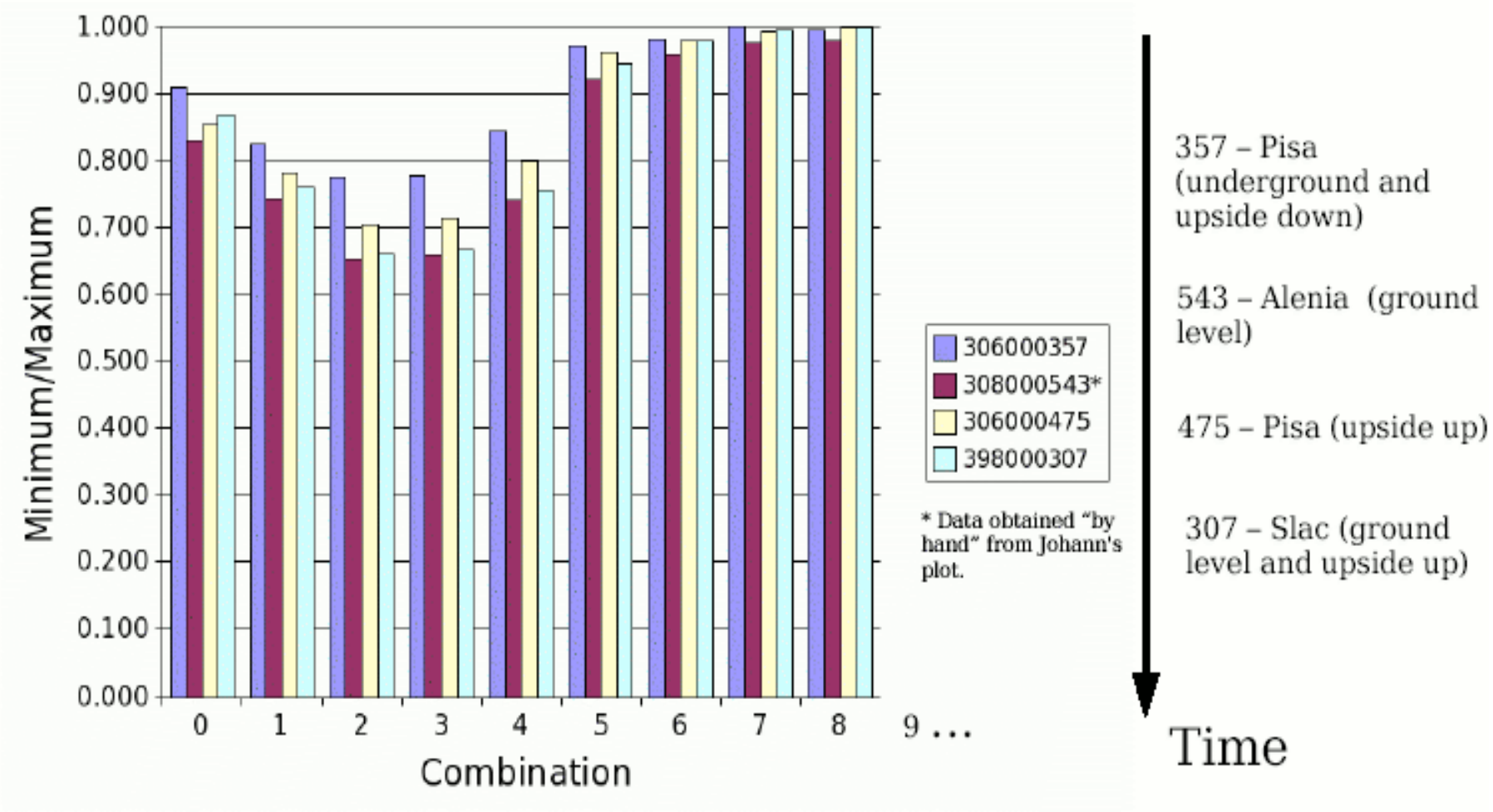
- Decoupling the combination efficiency from the issue of muons ranging out is still worth some effort, just enough to get some closure.

- All of these will get a lot more interesting with 1+ towers. This is a good analysis to catch problems but not the best one for diagnosing.

BACKUP SLIDES

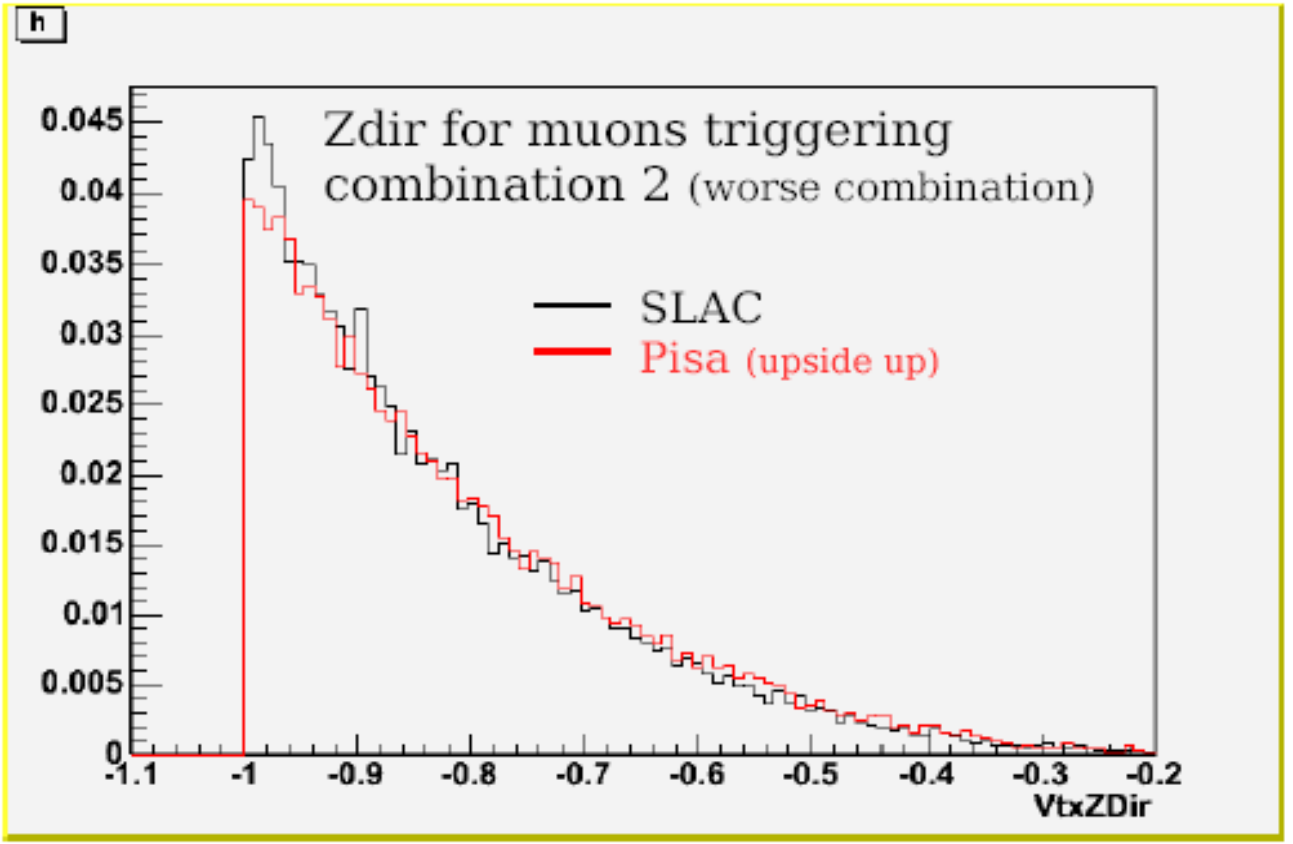
Before considering the location and orientation of the tower...





There is no degradation of the efficiency over time

Measurements at similar locations (ground level, underground) seem consistent



Tower at SLAC gets more vertical muons

Low energy vertical muons get stopped before reaching combination 2, therefore less entries for combination 2 and more for combinations at the front.

Ratio of less active combinations to ratio of more active combinations is worse in Slac than in Pisa.