# Trigger Studies

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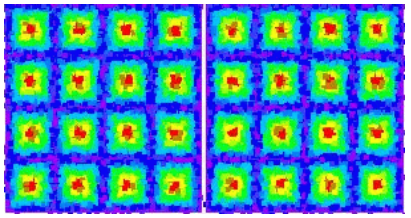
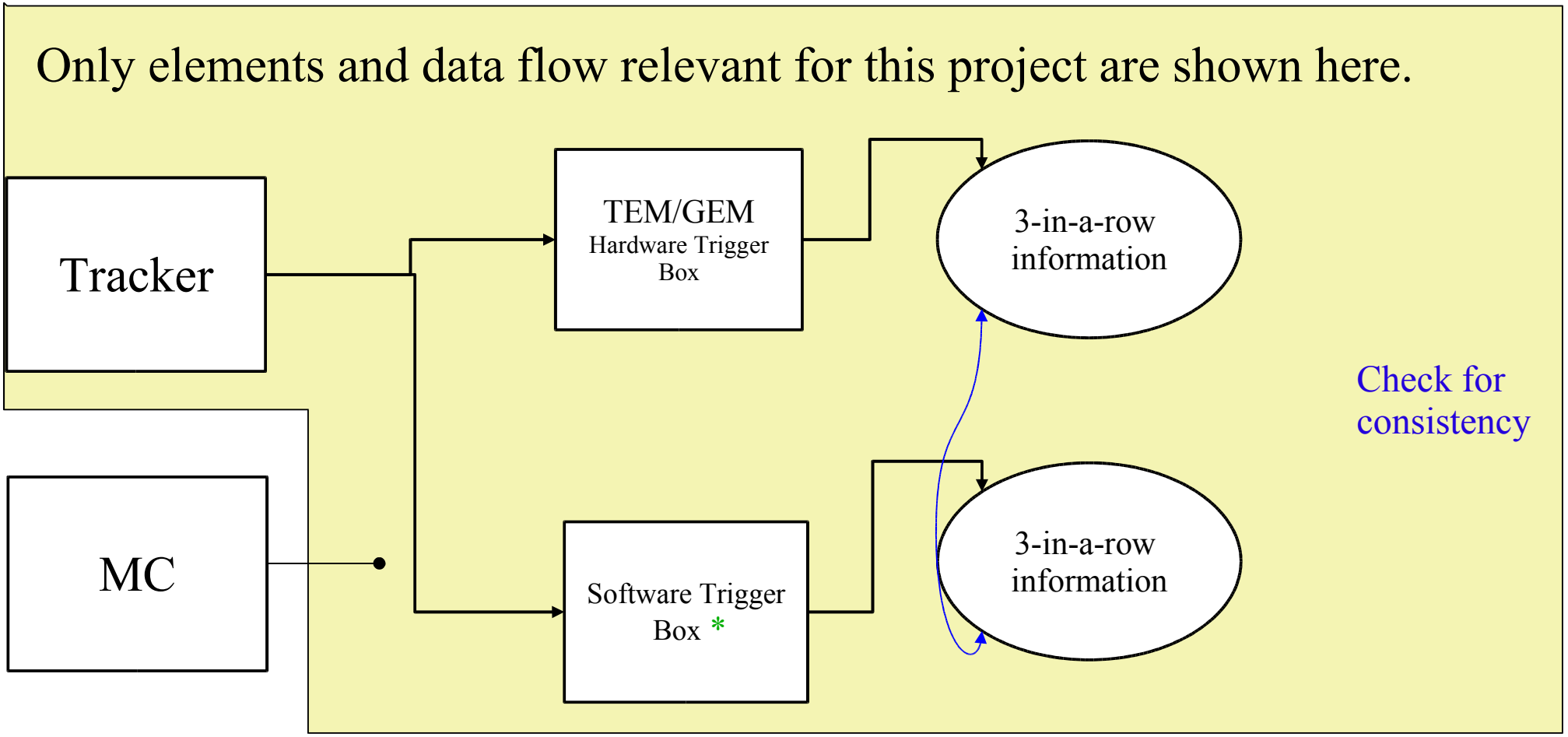
## Instrument Analysis Workshop II



September 27th, 2004

# Outline of I&T Project

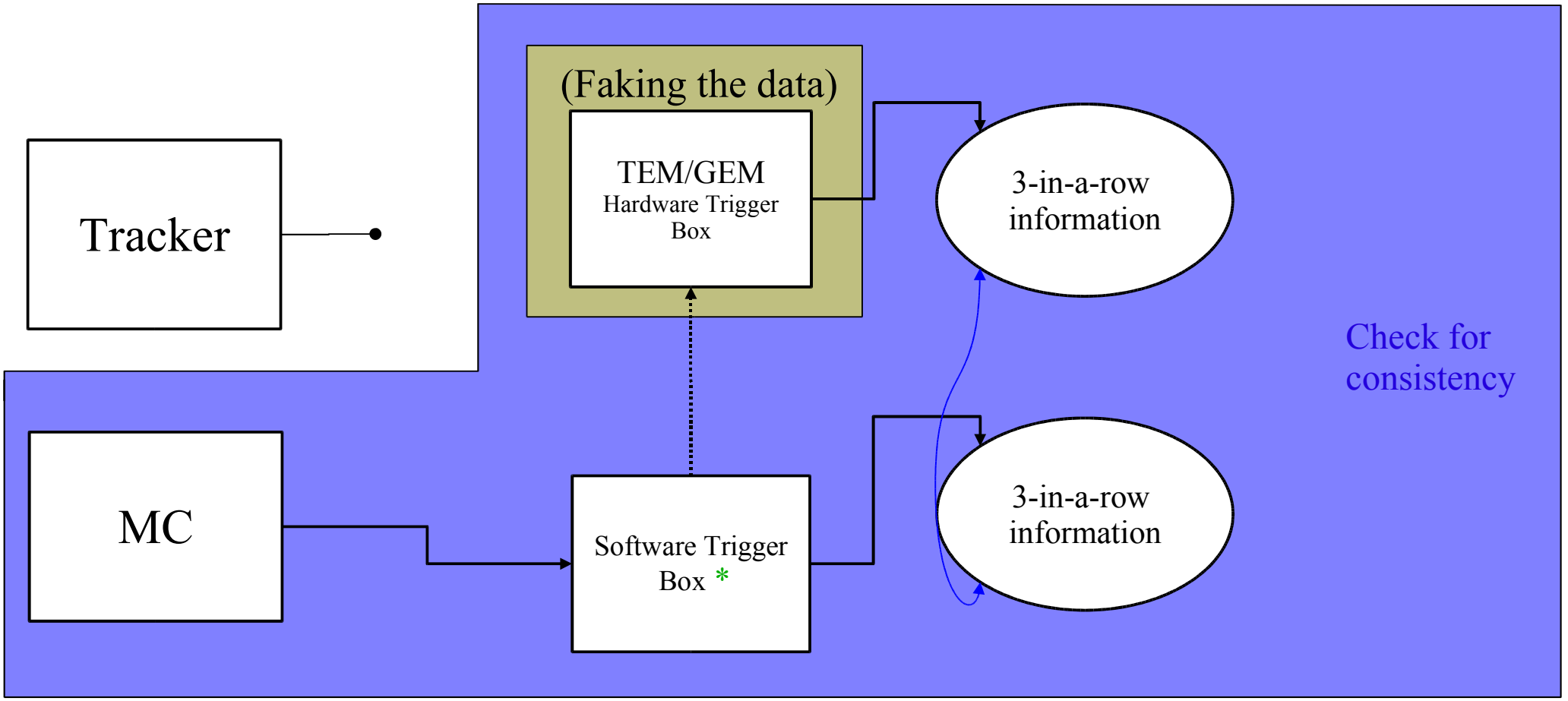
Data taking mode:




*TriggerAlg does this job but some information has to be made available/explicit for this project.

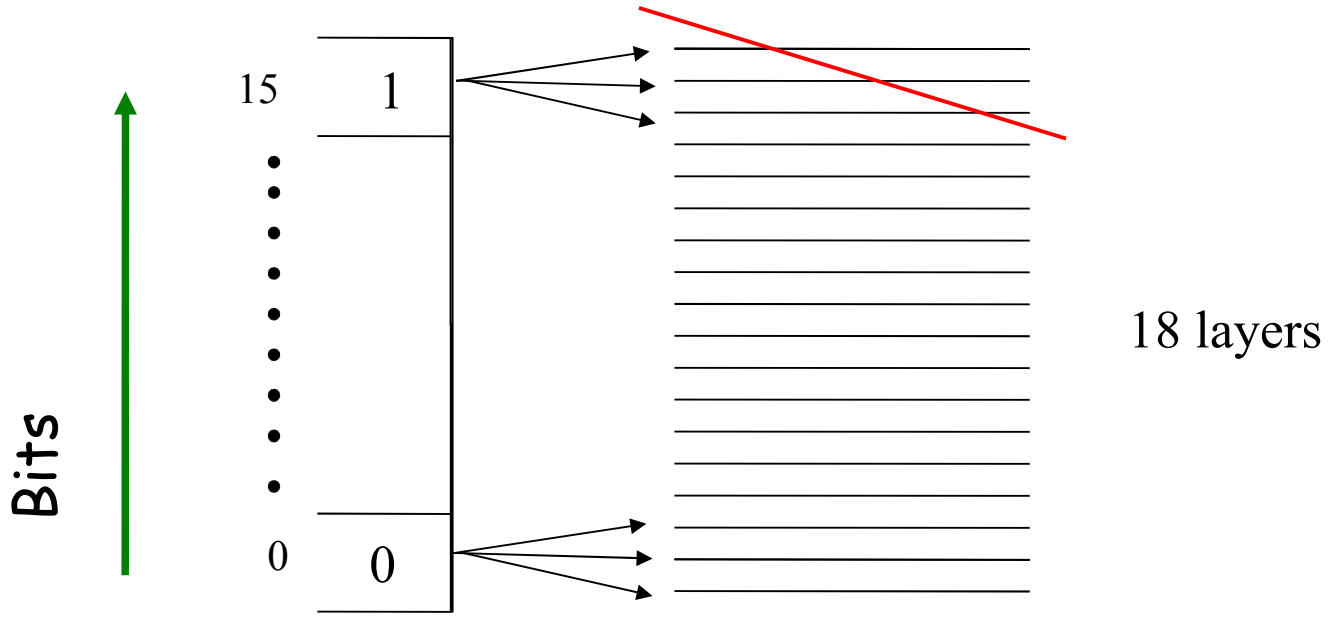
# Outline of I&T Project
## (without Real Data)

MC mode:




*TriggerAlg does this job but some information has to be made available/explicit for this project.

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




16 bit word per every tower.

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

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

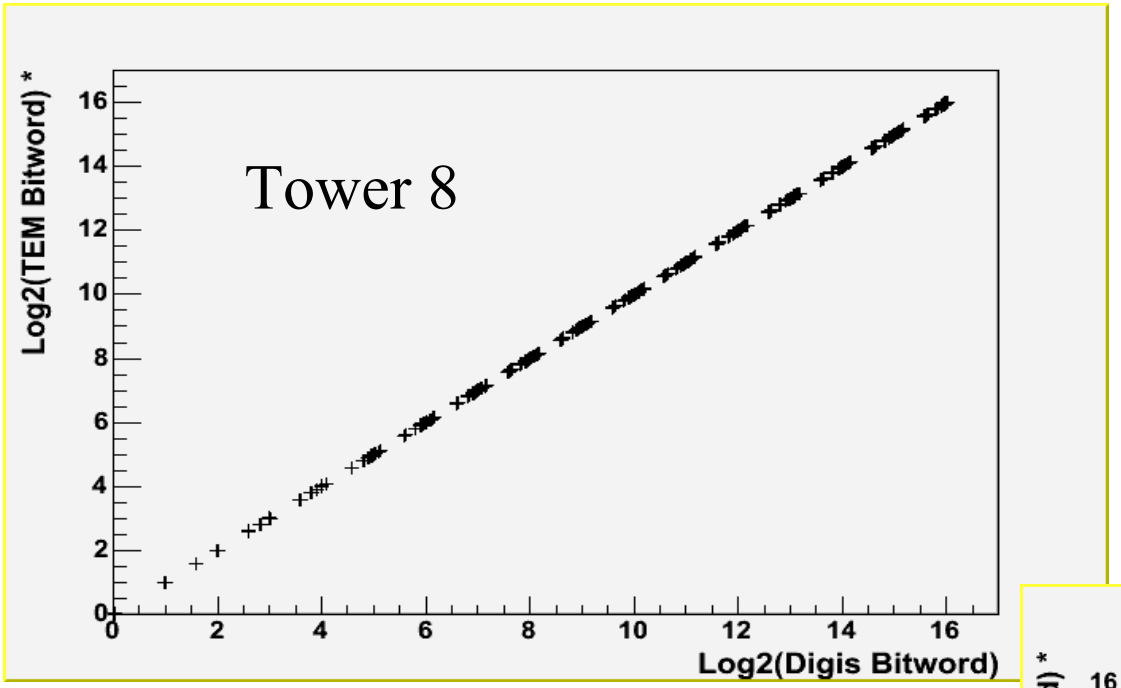
## Contribution from the Digis:

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

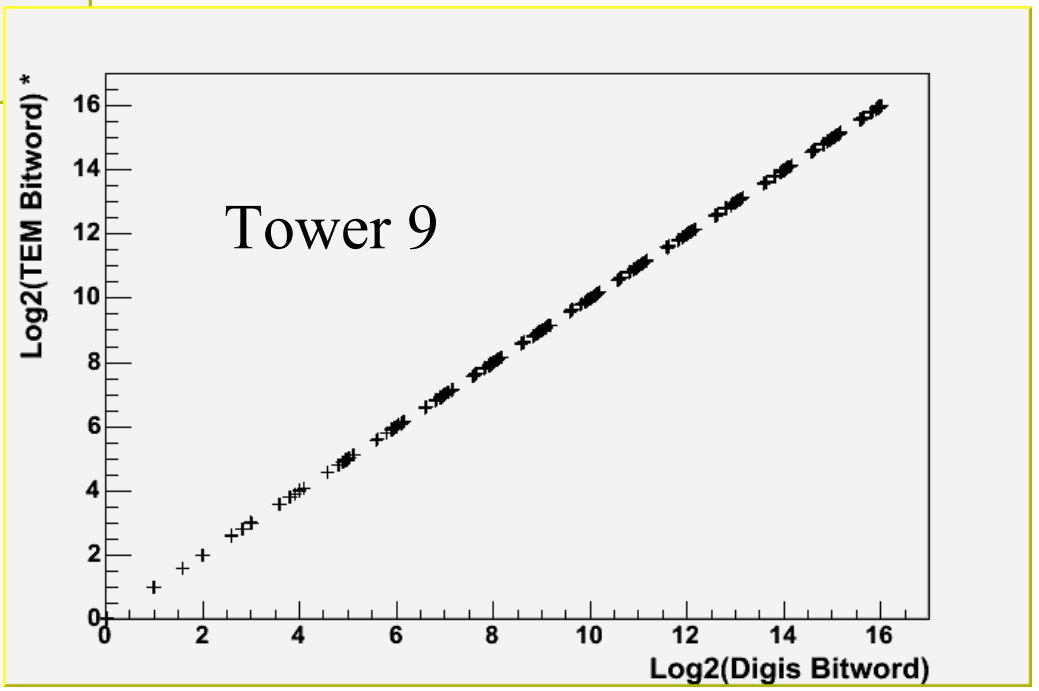
# Analysis of 2 towers Data




TEM Bitword vs
Digis Bitword

* Simulated Hardware Data

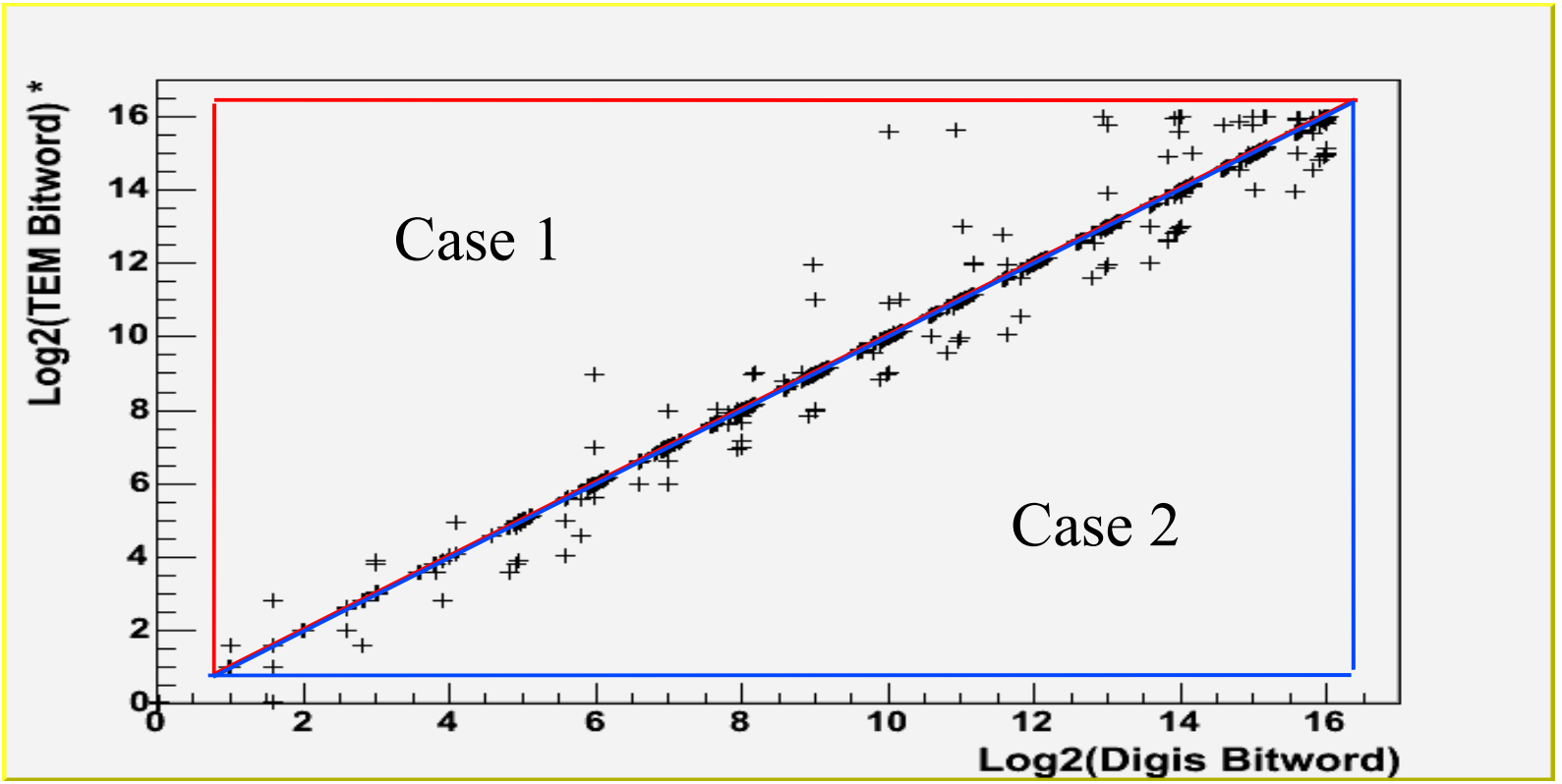
As expected the agreement is perfect for MC data. Any inconsistency will appear as an off-diagonal element. In case the disagreement is to small to be "seen" the analysis tool (root macro) reports such inconsistency.



# Simulating Inconsistencies

Case 1: A given hit 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

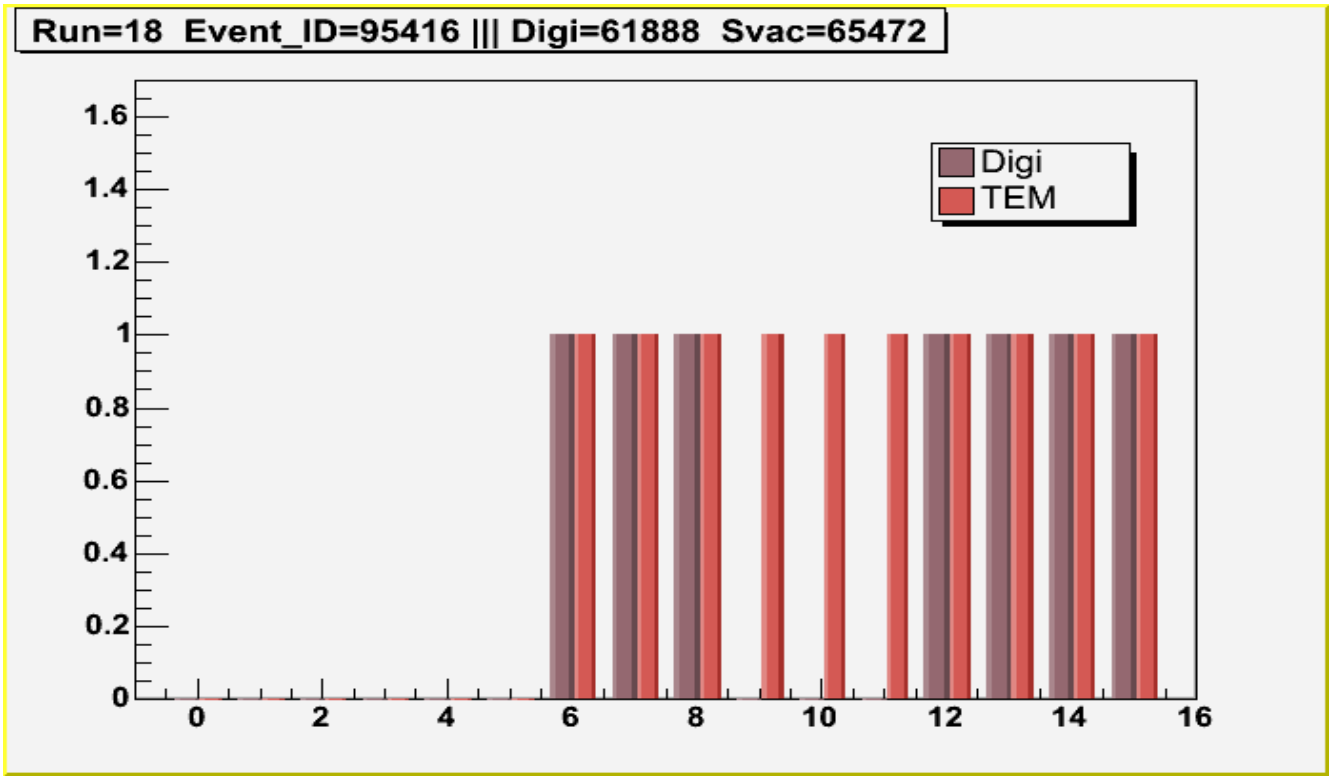
Case 2: A trigger request is issued. While waiting for the readout a noise hit takes place (Spurious hit). Digi Bitword > TEM Bitword




* The inconsistent events shown here were simulated with made up rates, actual rates should be different from this.

# Studying Inconsistent Events

Lets take as an example Run=18 and Event_ID=95416, that was found to be inconsistent in the present simulation:




Bins 0,...,15 are the possible combinations of 3-in-a-row. There are two possible values for each bin:

0 = inactive combination

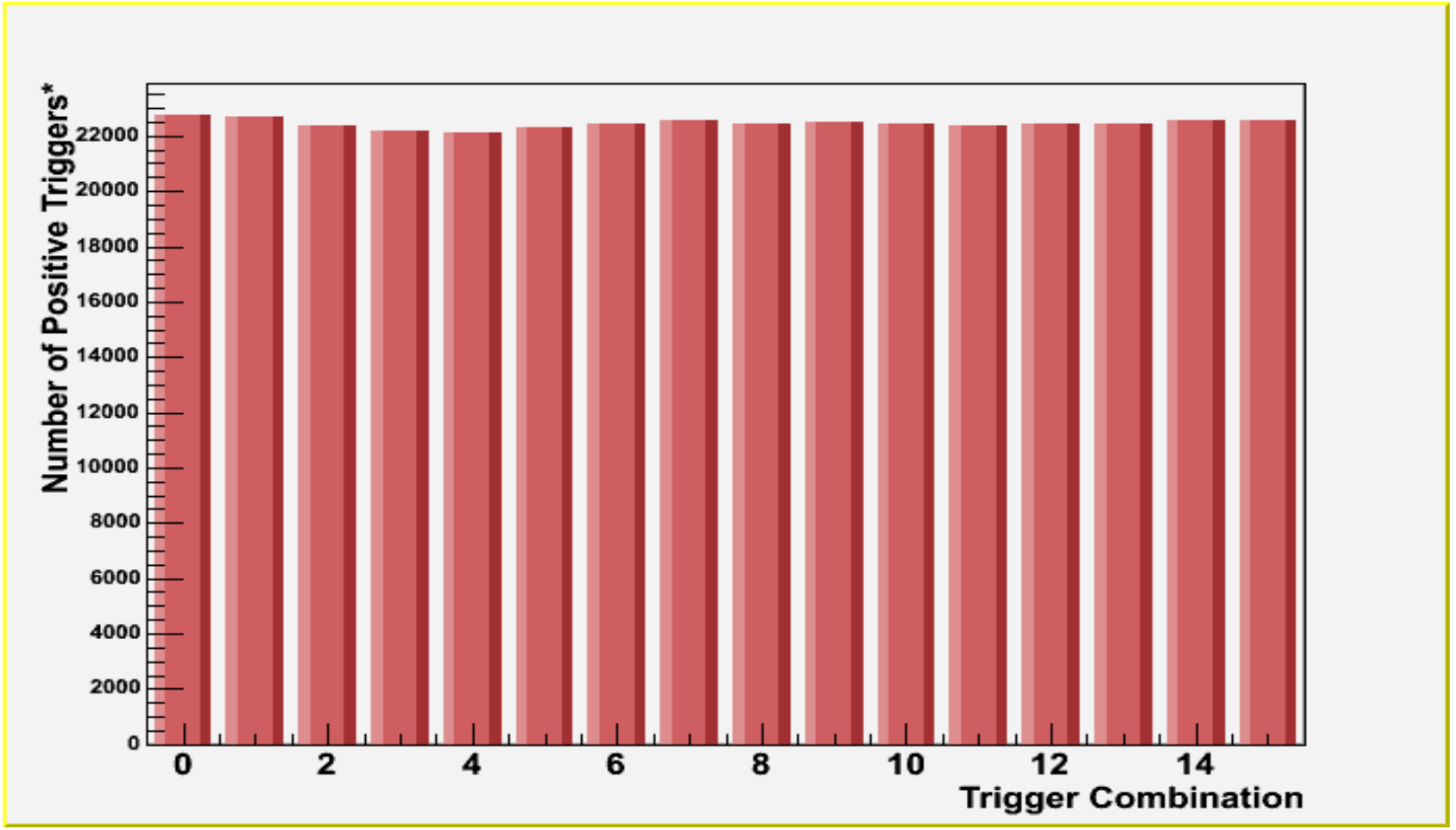
1 = active combination

Combinations 9, 10 and 11 are inactive according to the digis, but 8 and 12 are active, thinking in terms of layers this means that layer 11 has no hits. Svac reports a trigger request in every of those layers.

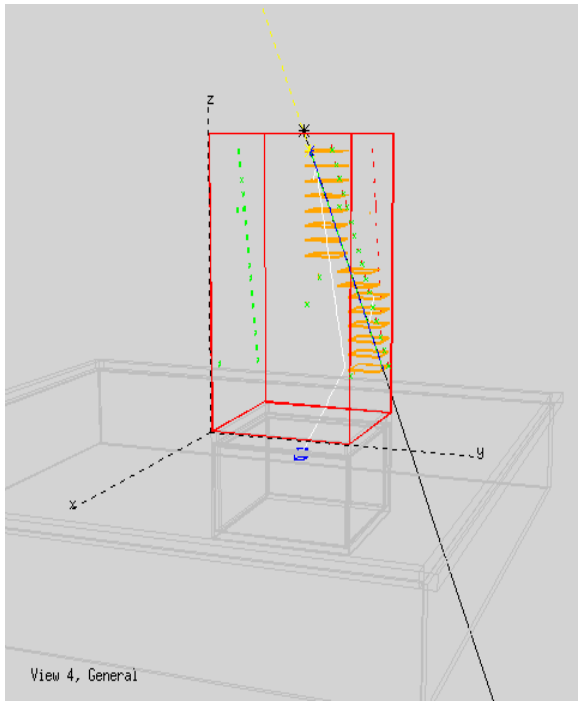
Conclusion: Most likely there was a hit in layer 11 that was gone when the readout took place.

# Are all 3-in-a-row combinations equally efficient?

Assuming an homogeneous flux and identical layers, one expects every combination to trigger the same number of times:




* Entries are not individual events. An event that has a hit in every layer will contribute with an entry in every bin.



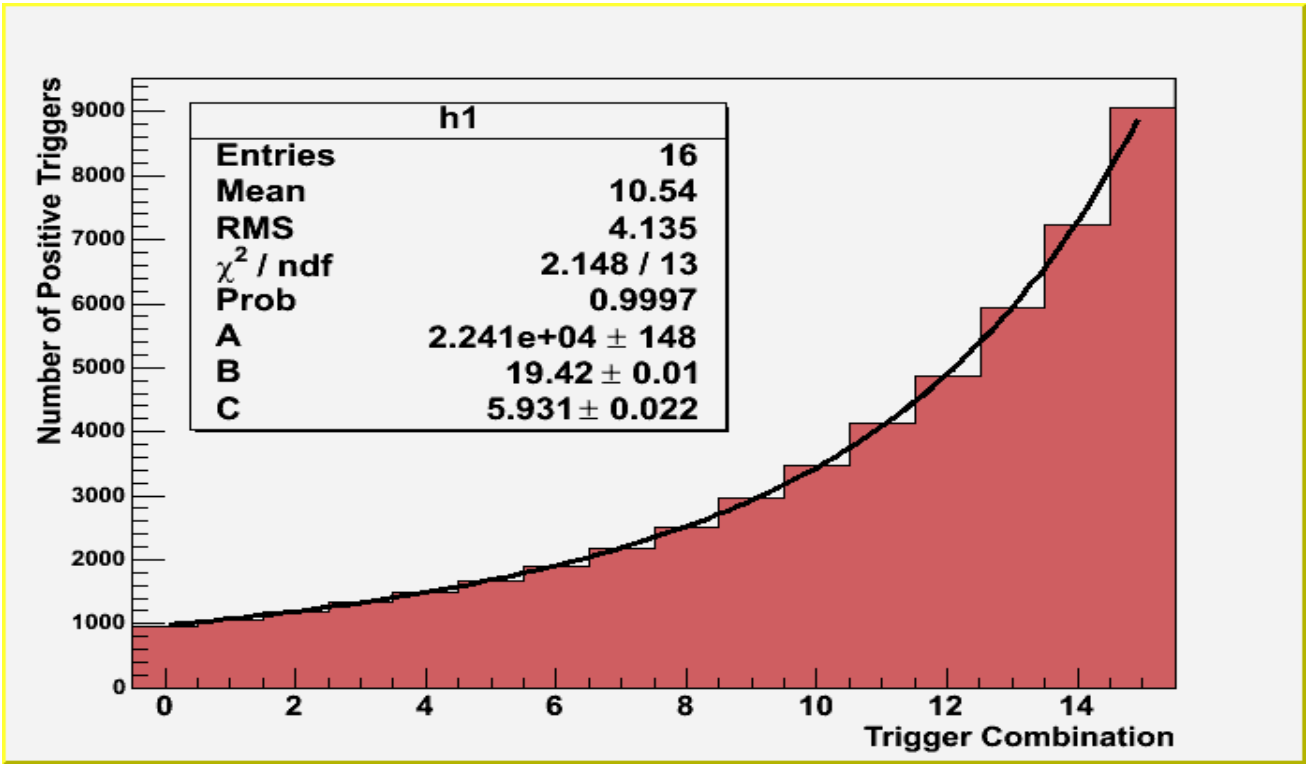

# Are all 3-in-a-row combinations equally efficient?
# A nonphysical model...
## that might be physical with enough data

- Muon source at the top of the tower
- Isotropic
- Monoenergetic (10 Gev)
- 20K events

*For such an ideal model the number of triggers can be calculated for each combination n:*

$$f(n) = A\left(1 - \frac{(B-n)}{\sqrt{C^2 + (B-n)^2}}\right)$$

B=Distance from the source to the bottom layer in units of tray thickness ≈ 18
C=half width of tower divided by tray thickness ≈ 5.2




*Seems like all combinations are equally efficient...*

# Summary

- The concept and the implementation of the project are clear.
  Thanks to Steve, Eduardo, Heather and Anders.

- Root Macros for analysis are ready for real data. What about
  a common place to put this kind of tools?

- Detailed statistics on how the instrument is triggering are
  intrinsically interesting. Several side studies can derive from this
  project (energy and direction dependence, trigger “extrapolation”
  between towers, etc).

- Looking forward to start working with real data...