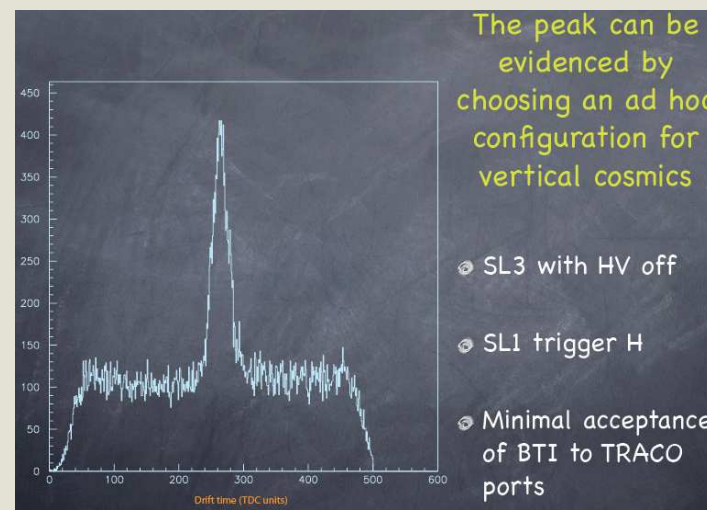
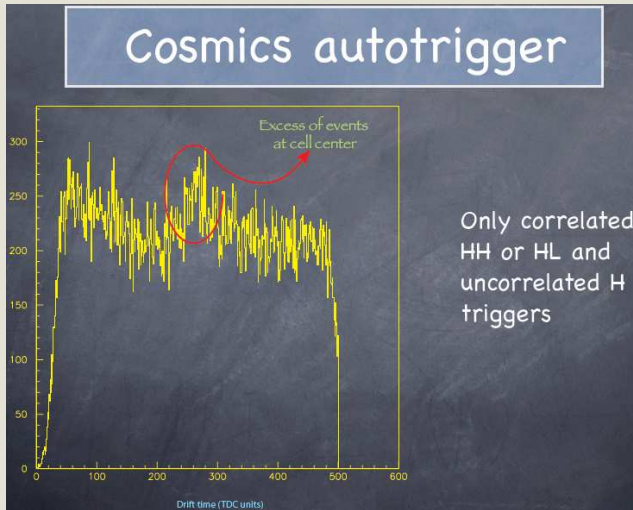


Synchronous trigger noise

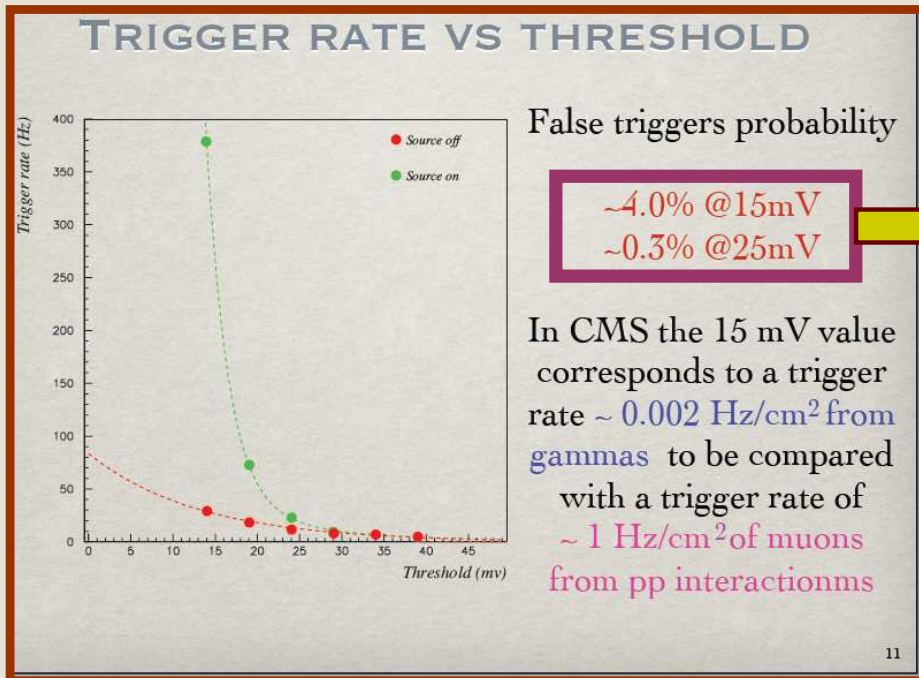
Synchronous noise given fake triggers are observed at the commissioning data. It looks like a crosstalk effect but the origin is not understood.



Detailed studies were presented by Pierluigi Zotto last Muon Week (Feb' 06)

Some data taken with:

- Co⁶⁰ Source
- L1 Phi1 & L1 Phi2 OFF
- Uncorrelated H



It was wrong!!! By a factor 200
The false trigger probability is:

0.02% @ 15mV
0.0015% @ 25mV

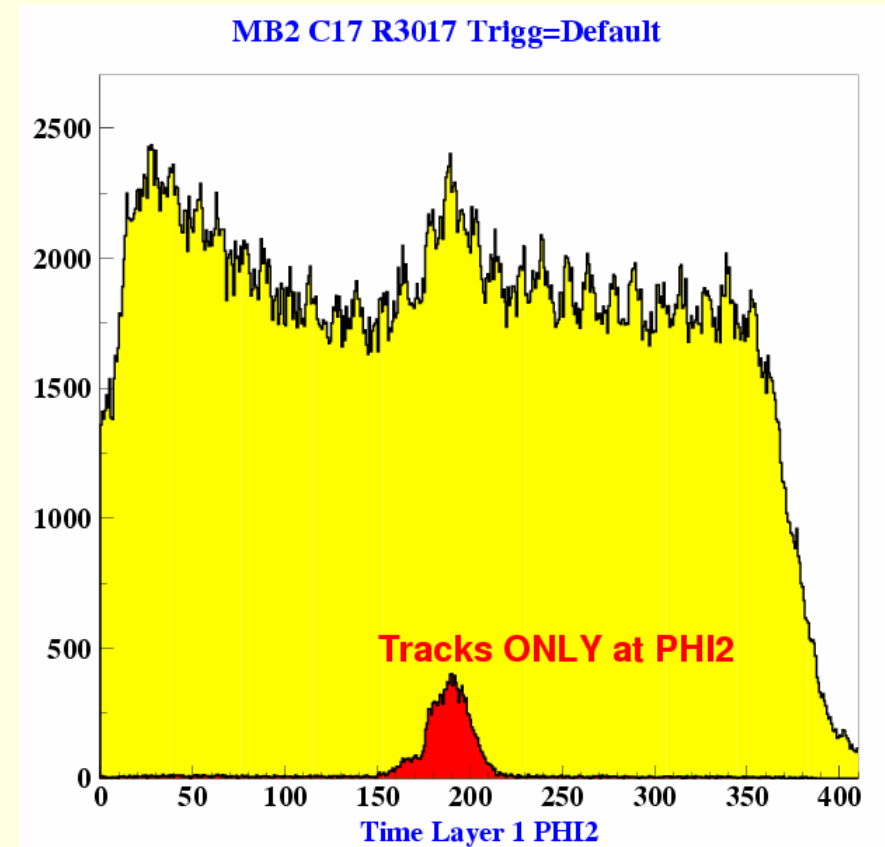
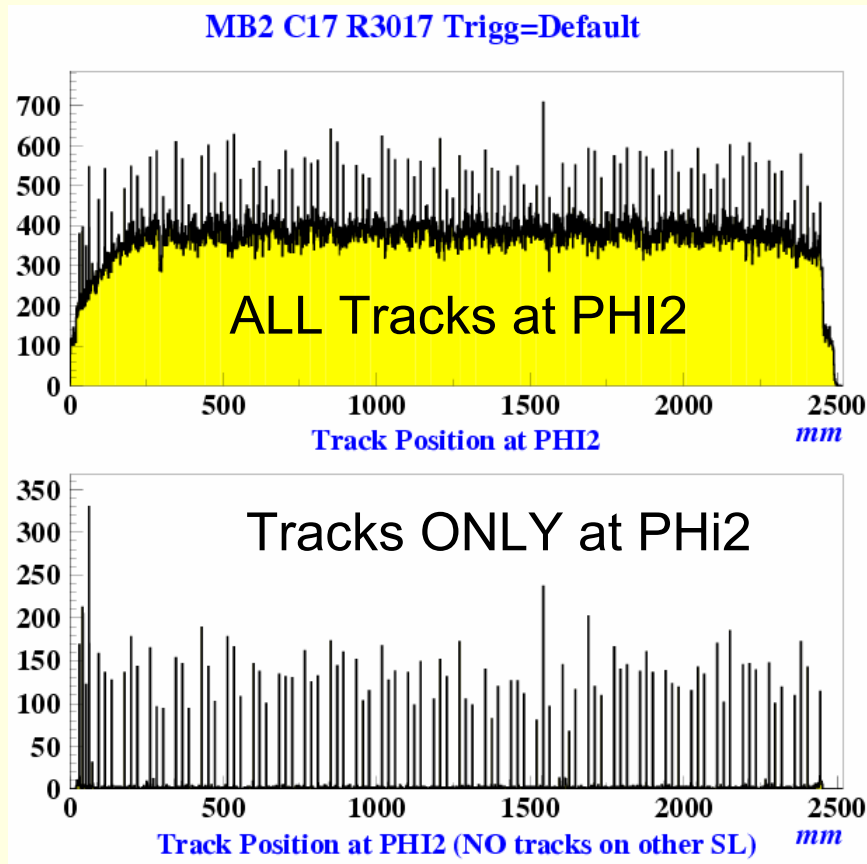
NEW

This number is now compatible with the rejection factor for cross-talk inside a FE board as measured by Matteo and Enrico (~ 10⁻⁵) in LNL.

Position of “fake” tracks on the SL (I)

Track position reconstructed at PHI2

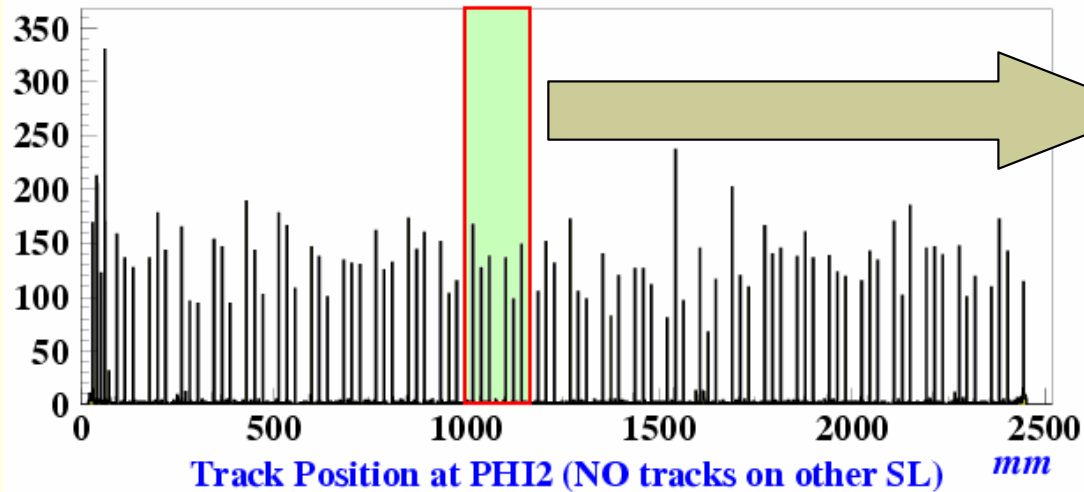
Time at L1 of PHI2



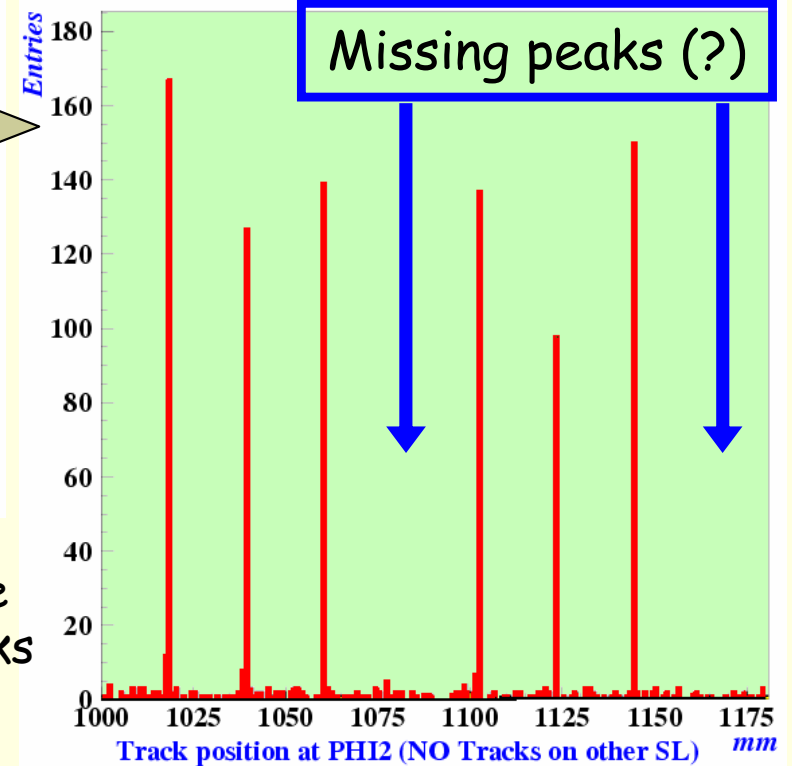
Synchronous noise can give triggers corresponding to “fake” vertical tracks at a distance ~ 10.5 mm from the wires positions (because of similar hit times for the four layers)

Position of “fake” tracks on the SL (II)

MB2 C17 R3017 Trigg=Default



MB2 C17 R3017 Trigg=Default



Since the “fake” tracks are produced at a distance ~ 10.5 mm from the wires positions, we expect peaks every 21 mm

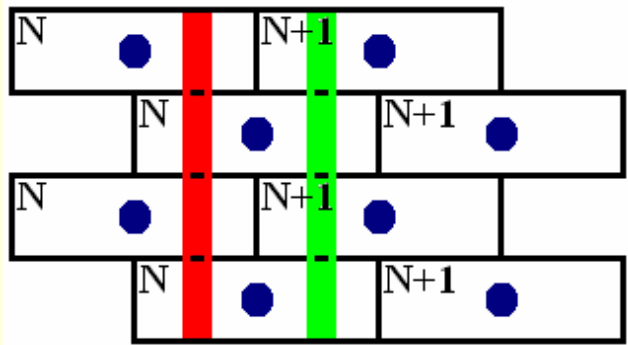
BUT

By looking to the peak positions we observe a peculiar arrangement in groups of 3 peaks as:

GROUP X:	Peak N	Pos_n	Peak $N+1$	$Pos_n + 1 \times 21$	Peak $N+2$	$Pos_n + 2 \times 21$
GROUP X+1:	Peak $N+3$	$Pos_n + 4 \times 21$	Peak $N+4$	$Pos_n + 5 \times 21$	Peak $N+5$	$Pos_n + 6 \times 21$
GROUP X+2					

Peak at $Pos_n + 3 \times 21$ is missing !!! Is there any logic in this “cell pattern”?

Track patterns compatible with the “fake” triggers



For a given cell (n) at Layer 1
Two possible cell patterns

Pattern A: C_nL1 C_nL2 C_nL3 C_nL4

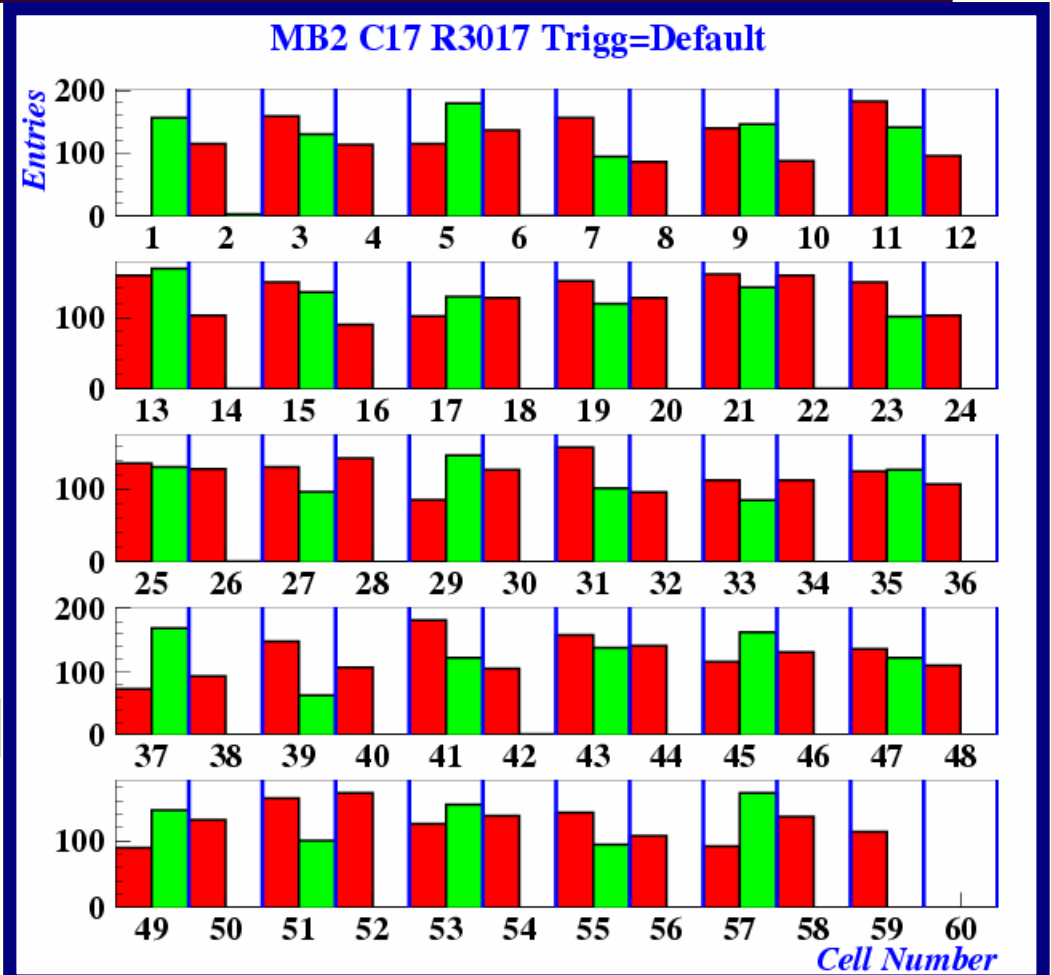
Pattern B: C_nL1 $C_{n+1}L2$ C_nL3 $C_{n+1}L4$

By plotting the cell number on L1 PHI2
when there is only track at PHI2 for

Pattern A

Pattern B

(tracks in the indicated regions of the cells)

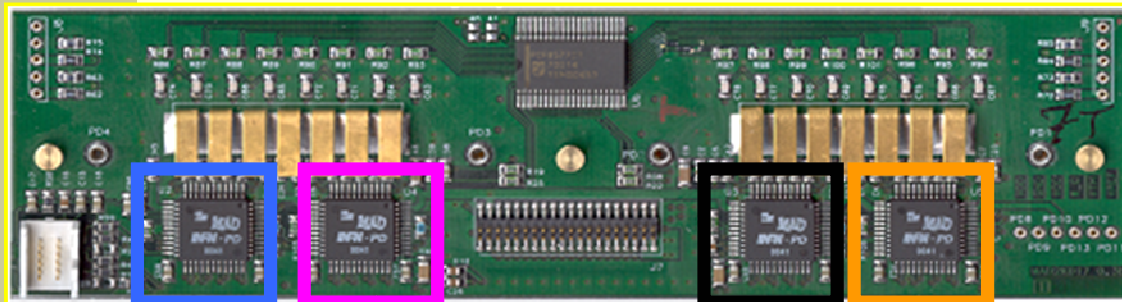


ALL Cells have entries corresponding to Pattern A (forget chamber edges)
ONLY 1 every 2 Cells have entries corresponding to Pattern B

This effect could be associated to the FEBoard Channels (→ Next Slide)

Patterns vs FE MAD channels

The 16 channel FE Board has 4 MAD Chips.
Each Chip is connected to 4 cells (as shown in the figure)



Let's call
MAD0, **MAD1**, **MAD2**, **MAD3**

If we consider again the previous defined patterns:

Pattern A: C_nL1 C_nL2 C_nL3 C_nL4

Pattern B: C_nL1 $C_{n+1}L2$ C_nL3 $C_{n+1}L4$

In terms of "MAD" this patterns will correspond to:

Pattern A:

All the cells belong to the same MAD

Pattern B:

Cells L1&L3 belong to the MAD_N

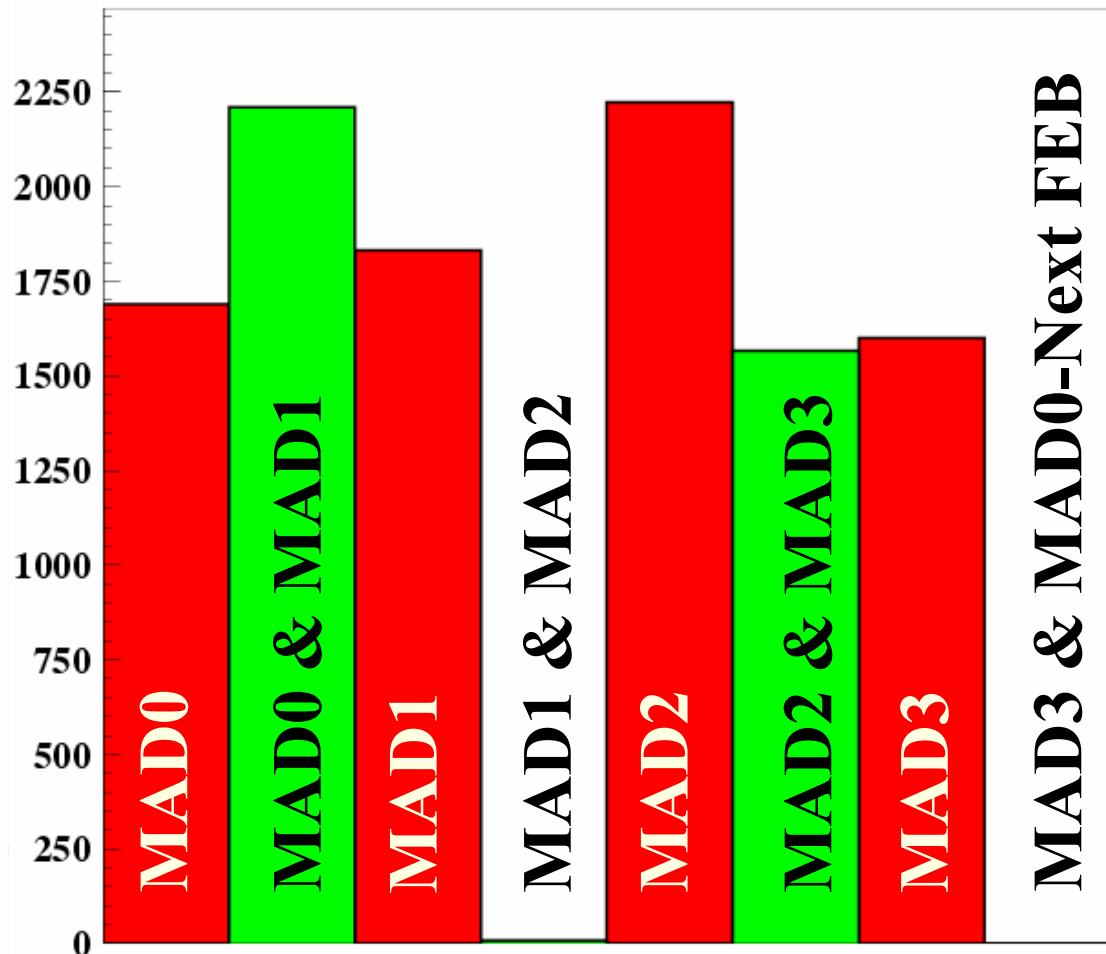
Cells L2&L4 belong to the MAD_{N+1}

Therefore considering FE Board we can distinguish 2x4 possibilities according to these patterns:

- | | | | |
|---------|----------------|---------|-------------------------|
| 1) MAD0 | 2) MAD0 & MAD1 | 3) MAD1 | 4) MAD1 & MAD2 |
| 5) MAD2 | 6) MAD2 & MAD3 | 7) MAD3 | 8) MAD3 & MAD0-NEXT FEB |

Patterns vs FE MAD channels (II)

MB2 C17 R3017 Trigg=Default

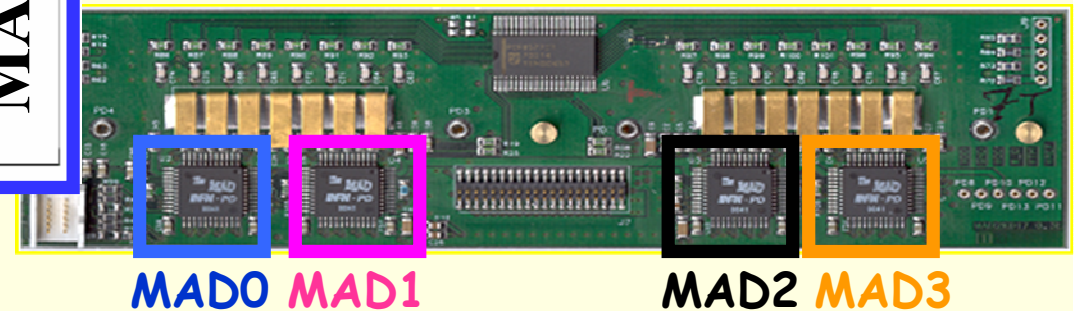


By plotting the cell on L1 PHI2 as MAD number when there is only track at PHI2 we have the 2x4 possibilities listed on the previous slide

We found NO Entries for two cases:

- MAD3 & MAD0 Next FEB
→ No Crosstalk between different FEBs
- MAD1 & MAD2

Conclusion



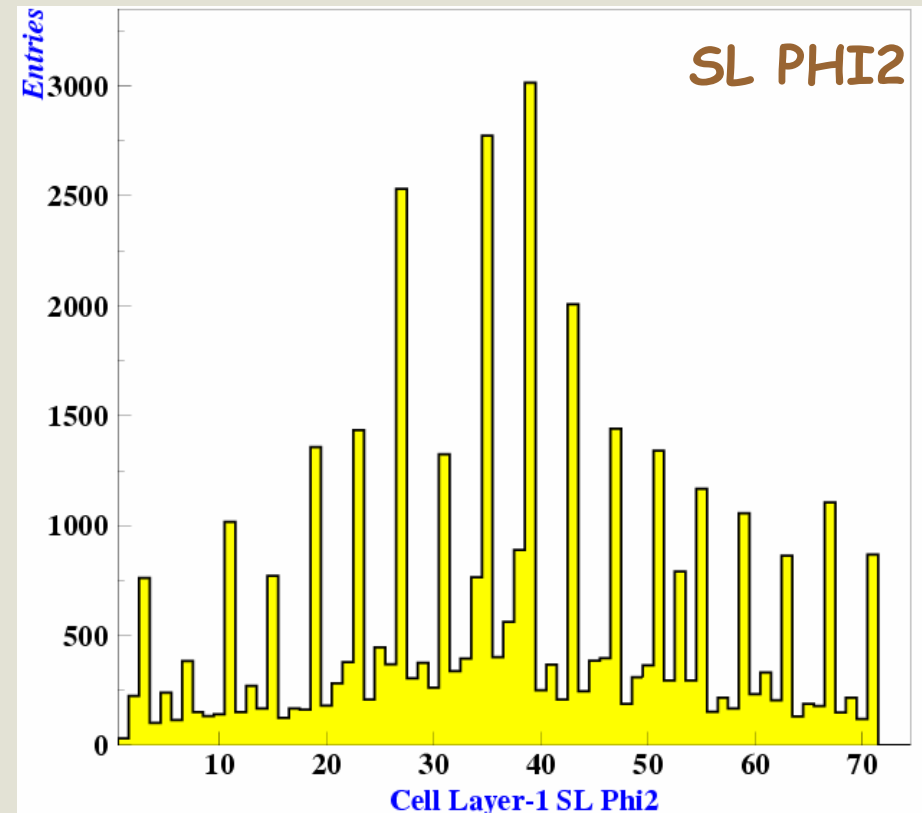
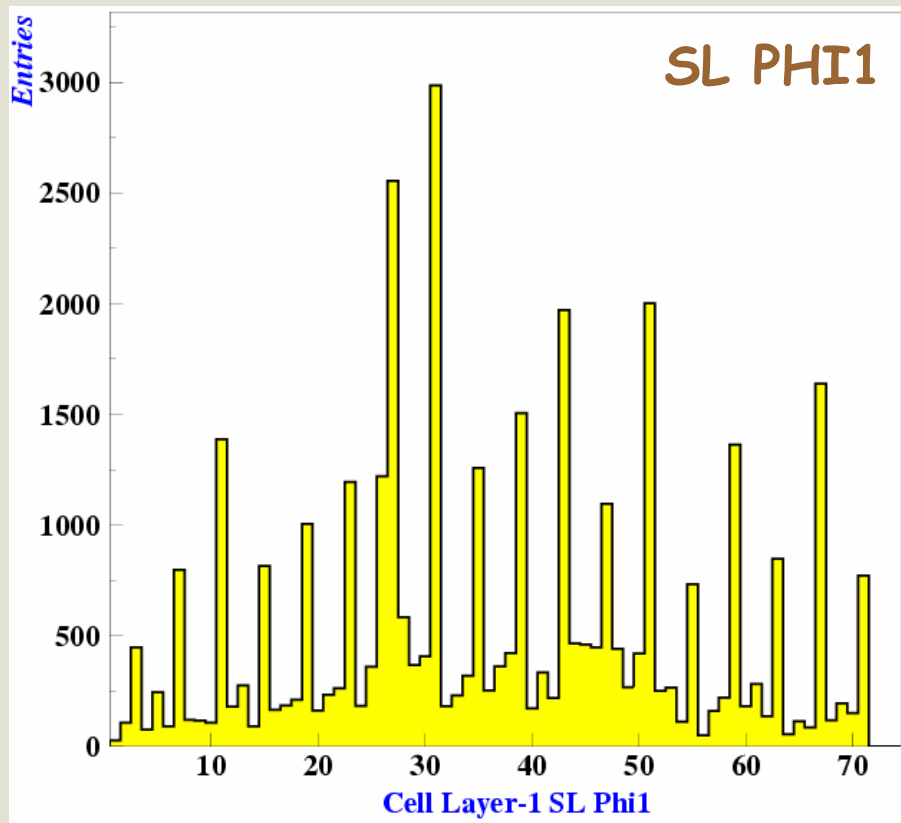
The crosstalk seems to appear between channels belonging either to the same MAD or to 2 MADs close together (MAD0 and MAD1, or MAD2 and MAD3) BUT never between channels in MAD1 and MAD2

The previous studies have been extended to the data taken a Legnaro

- Co⁶⁰ Source
- L1 Phi1 & L1 Phi2 OFF
- Trigger = Uncorrelated H

Cell occupancy - Layer 1

Distributions ONLY for hits on fitted tracks

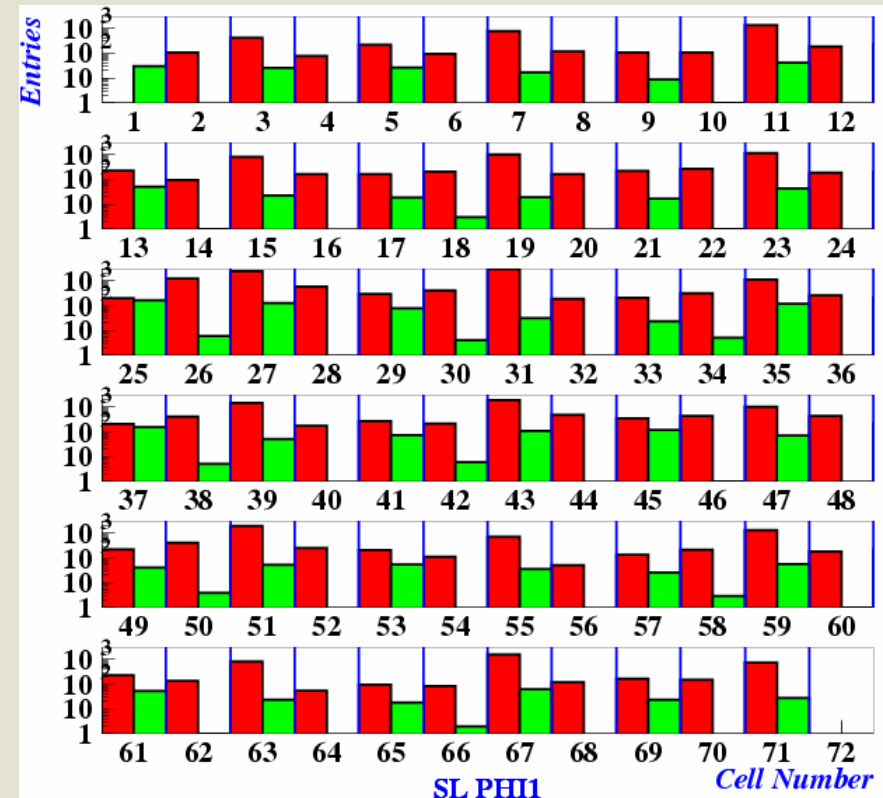
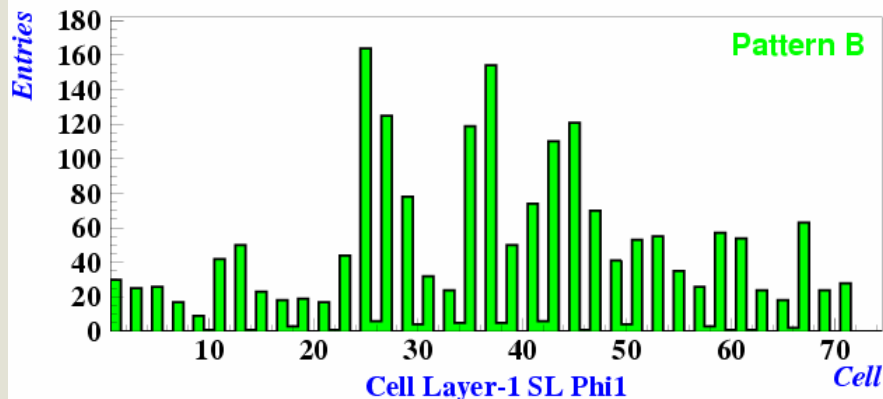
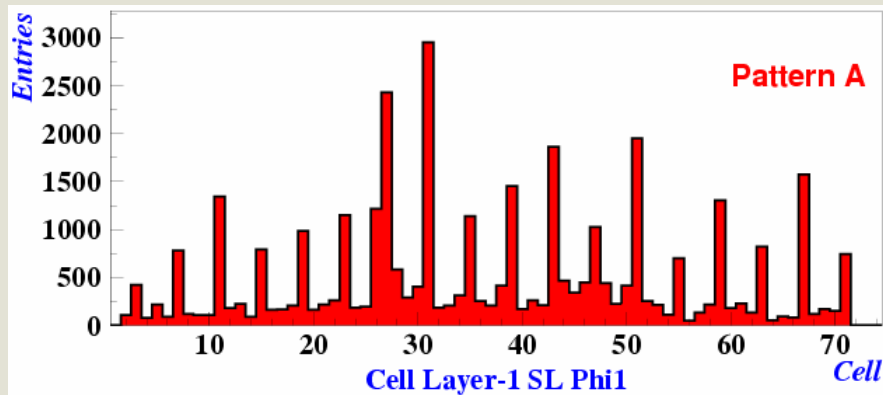
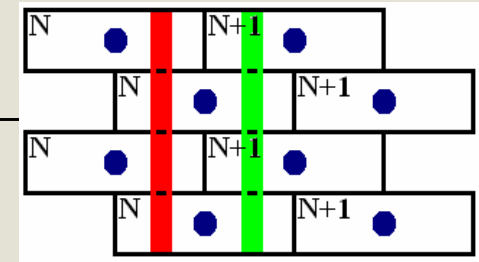


Track patterns & “fake” triggers

For a given cell (n) at Layer 1 two possible cell patterns

Pattern A: CnL1 CnL2 CnL3 CnL4

Pattern B: CnL1 Cn+1L2 CnL3 Cn+1L4



ALL Cells have entries corresponding to Pattern A

ALL ODD cells BUT also SOME EVEN cells have entries corresponding to Pattern B

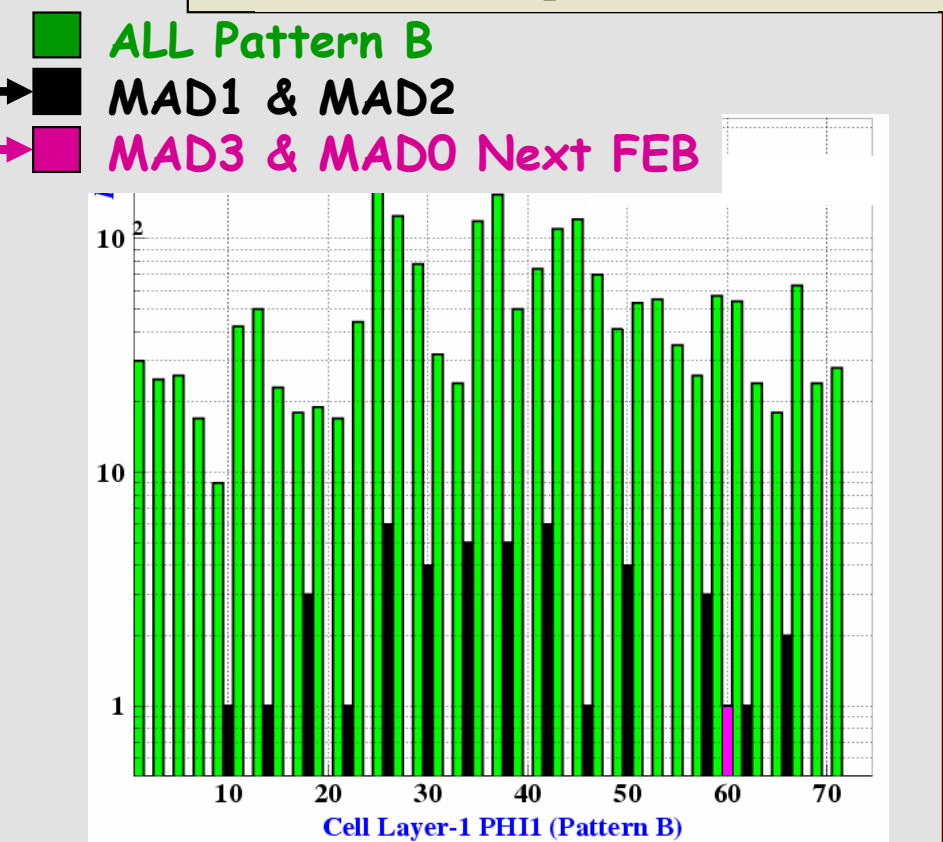
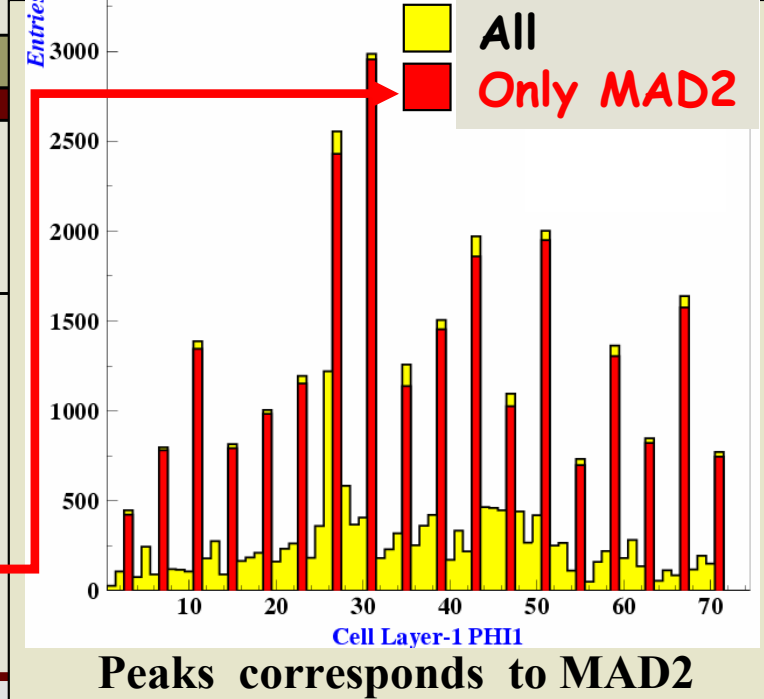
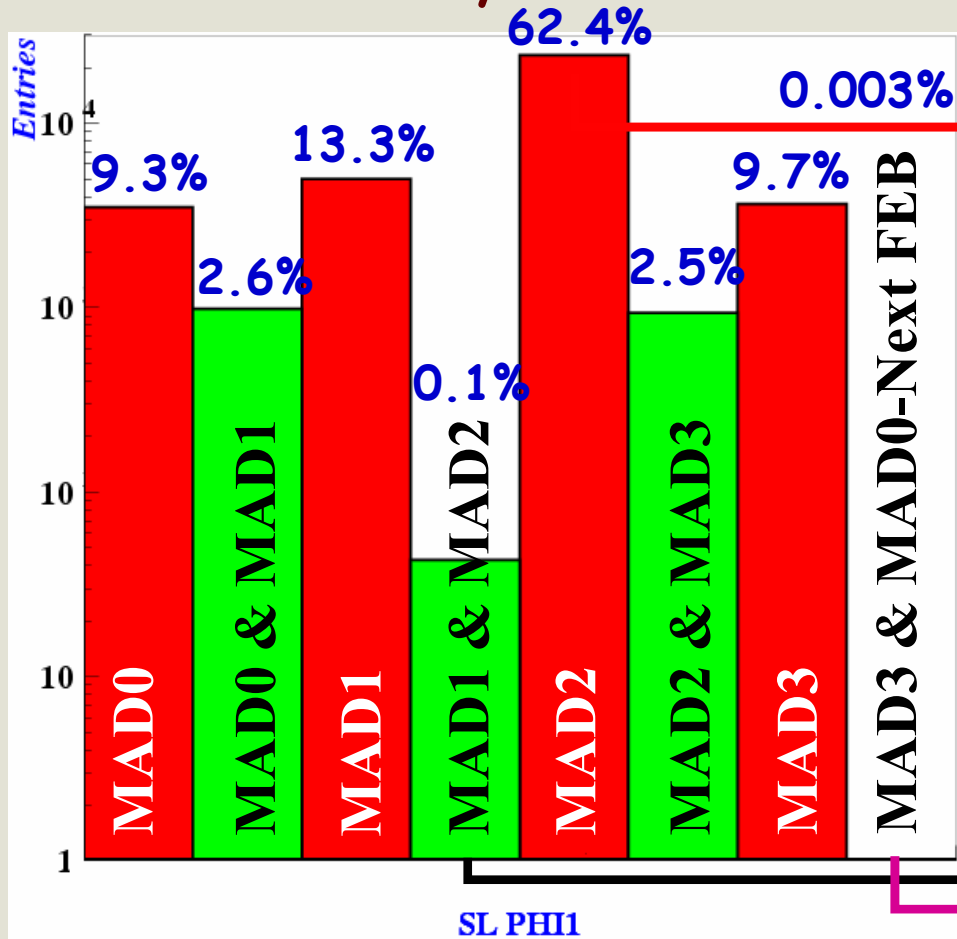
Pattern B represents only the ~5% of all events

For a given cell, Pattern B represents ~10-20% of all events

(notice the logarithmic scale on the right plot)

Patterns vs FE MAD channels (II)

By plotting the cell on L1 PHI1 as MAD number when there is only track at PHI1



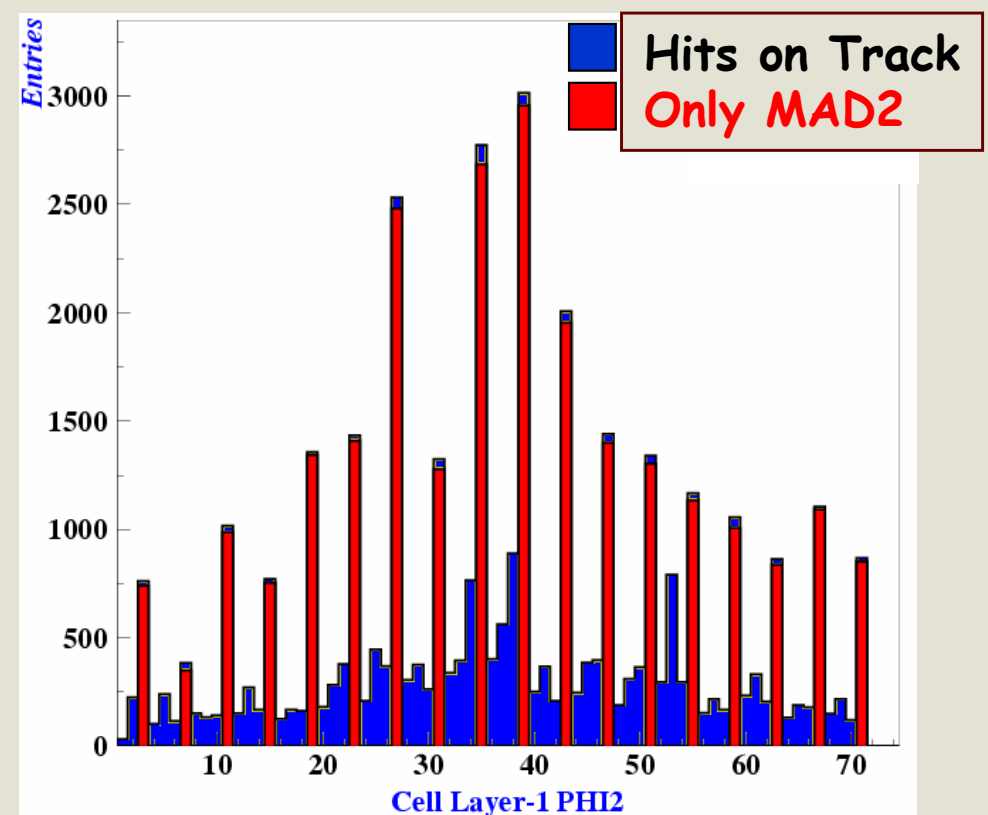
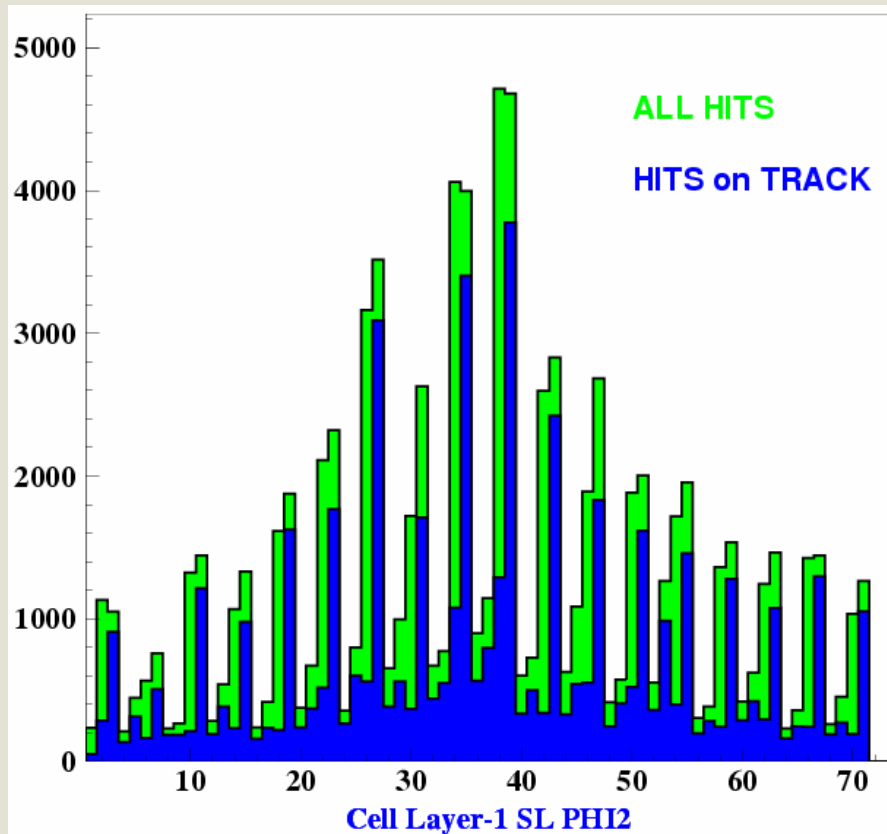
There are **some few** entries for **MAD1 & MAD2**
 There is **1 entries** corresponding to **crossstalk**
 between different FEBs

Fitted hits vs all hits

If we compare the total number of hits for cells at layer 1 with the distribution for hits on fitted tracks we observe that:

For hits on track there are peaks corresponding to the configuration of **ONLY MAD2**

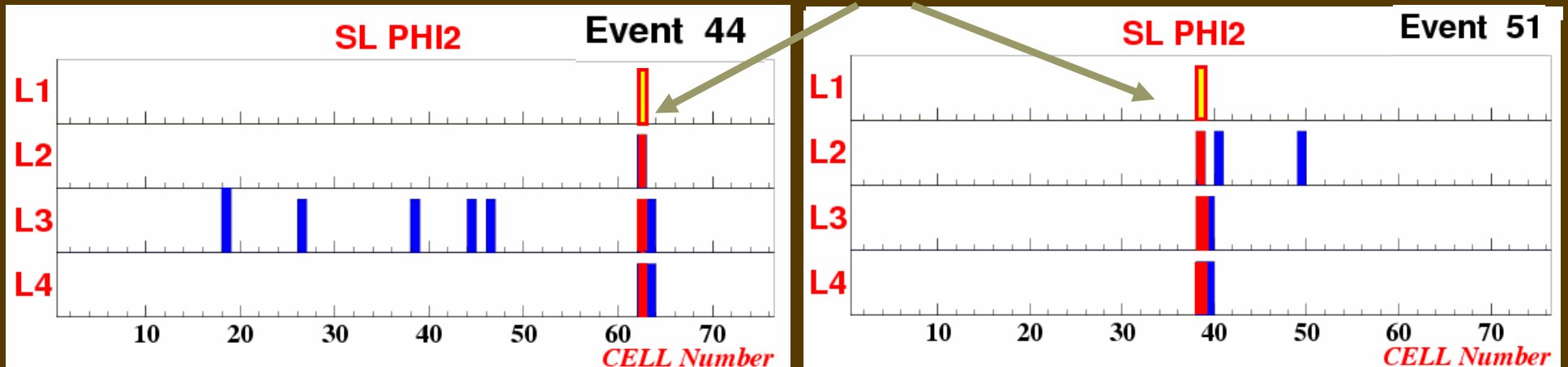
For ALL hits there are peaks on cells of MAD1 that do not correspond to fitted tracks



Hits at L1 on MAD1 (I)

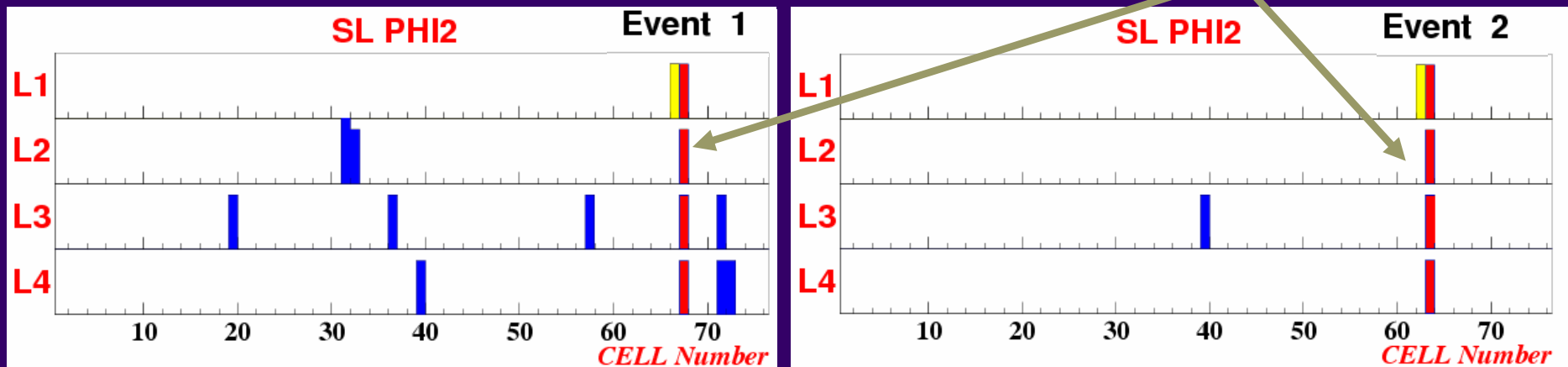
By looking for events having hits at **L1 on MAD1**

In few cases the hit is associated to a track passing through this cell



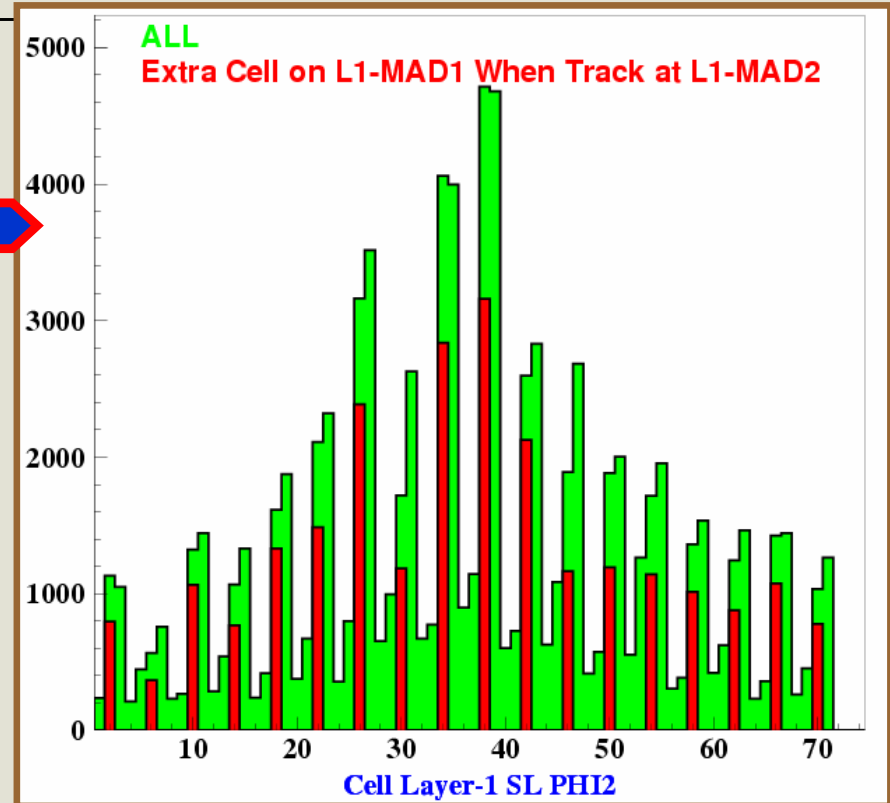
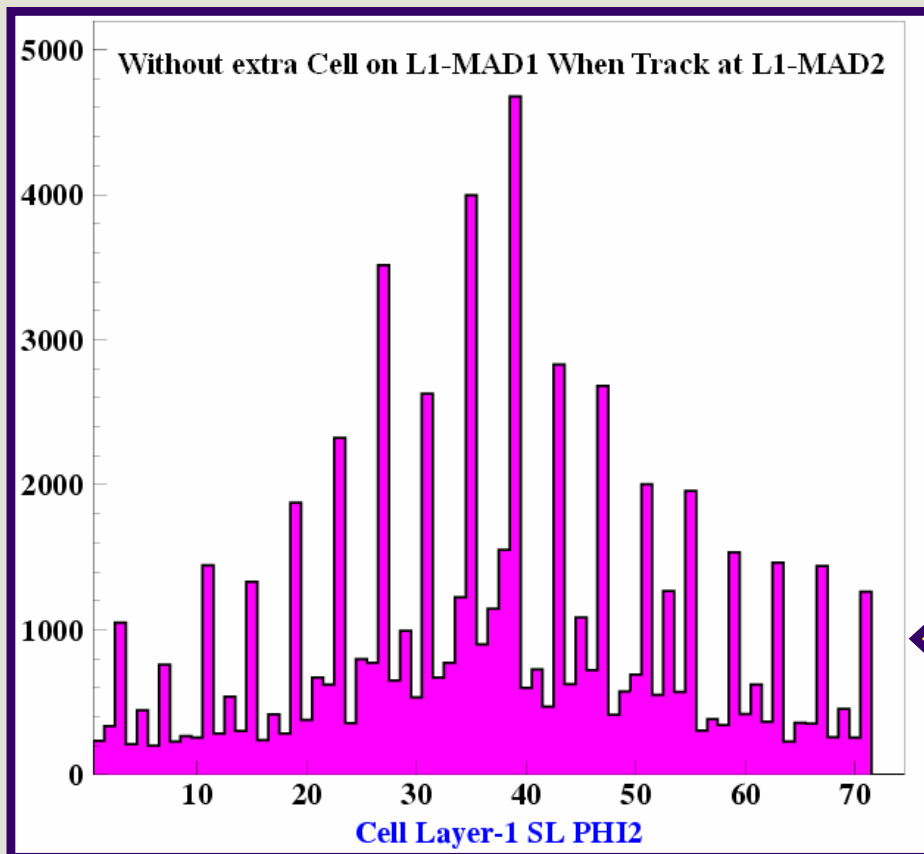
BUT

In most of events the track is passing through cells of MAD2



Hits at L1 on MAD1 (II)

If we plot the cell of L1-MAD1 having hits for events where the track is passing through cell L1-MAD2 the red peaks are obtained



By subtracting both plots (*green-red*) we obtain a distribution similar to the distribution obtained for the hits on fitted tracks.

There are peaks only at cells of MAD2, the peaks at MAD1 disappear.

Summary

❑ Studies performed on cosmic data shows a “pattern behavior” of the noise trigger that could be related with crosstalk on the MAD Chips.

❑ The analysis performed with the “special” data taken at Legnaro shows some differences:

- The fraction of events on PATTERN B is much smaller than for PATTERN A
- A big fraction of the tracks are produced at MAD2

In addition:

- When a track is produced at MAD2 most of the times it also appears an extra hit on L1MAD1

(This was not previously studied, because in normal cosmic data we had not observed this kind of effects in MAD2)

❑ The probability of having false triggers was found compatible with rejection factor for cross-talk inside a FE board.

Maybe it is something inside the FE board.

