Event selection methods & First look at new PCB test

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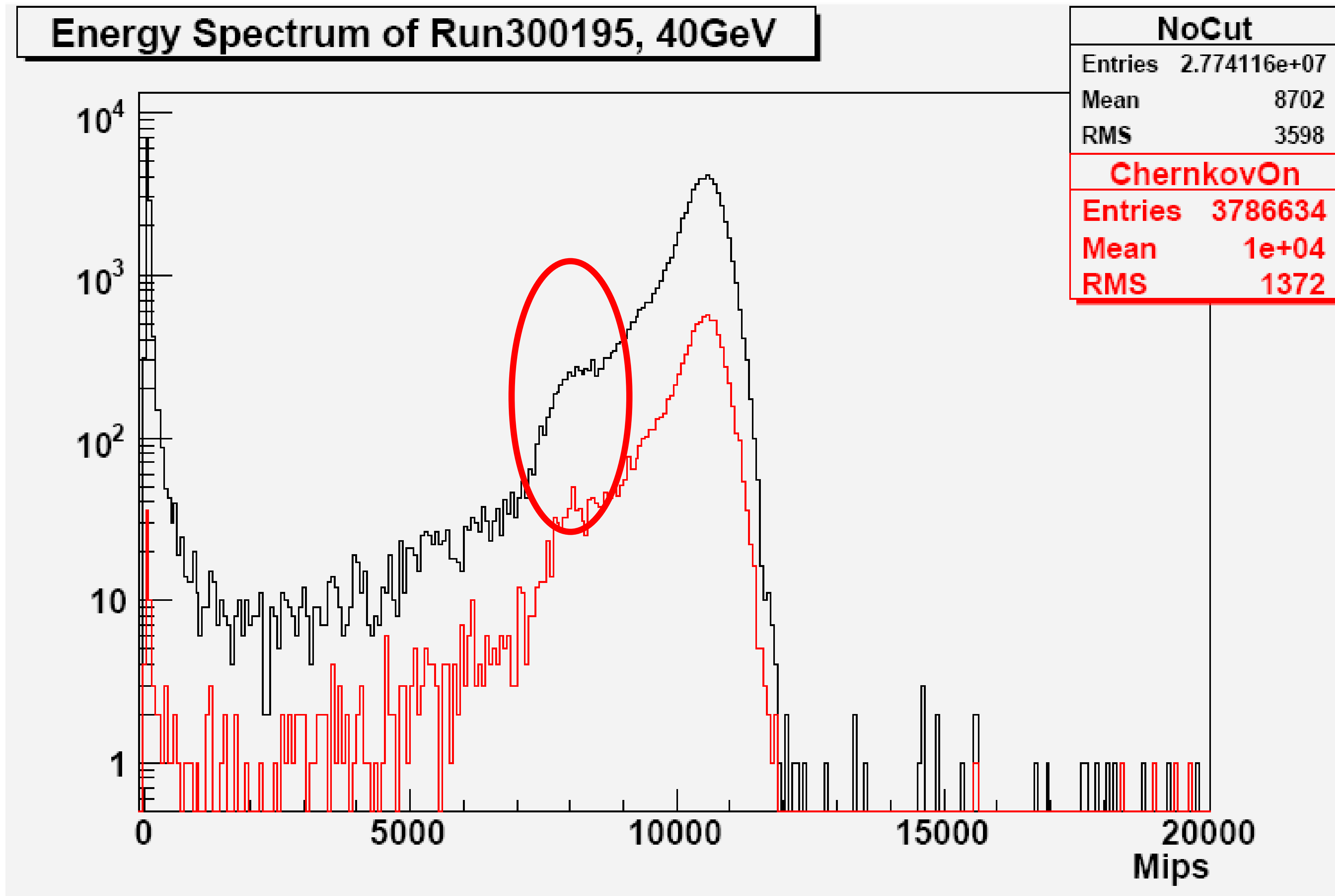
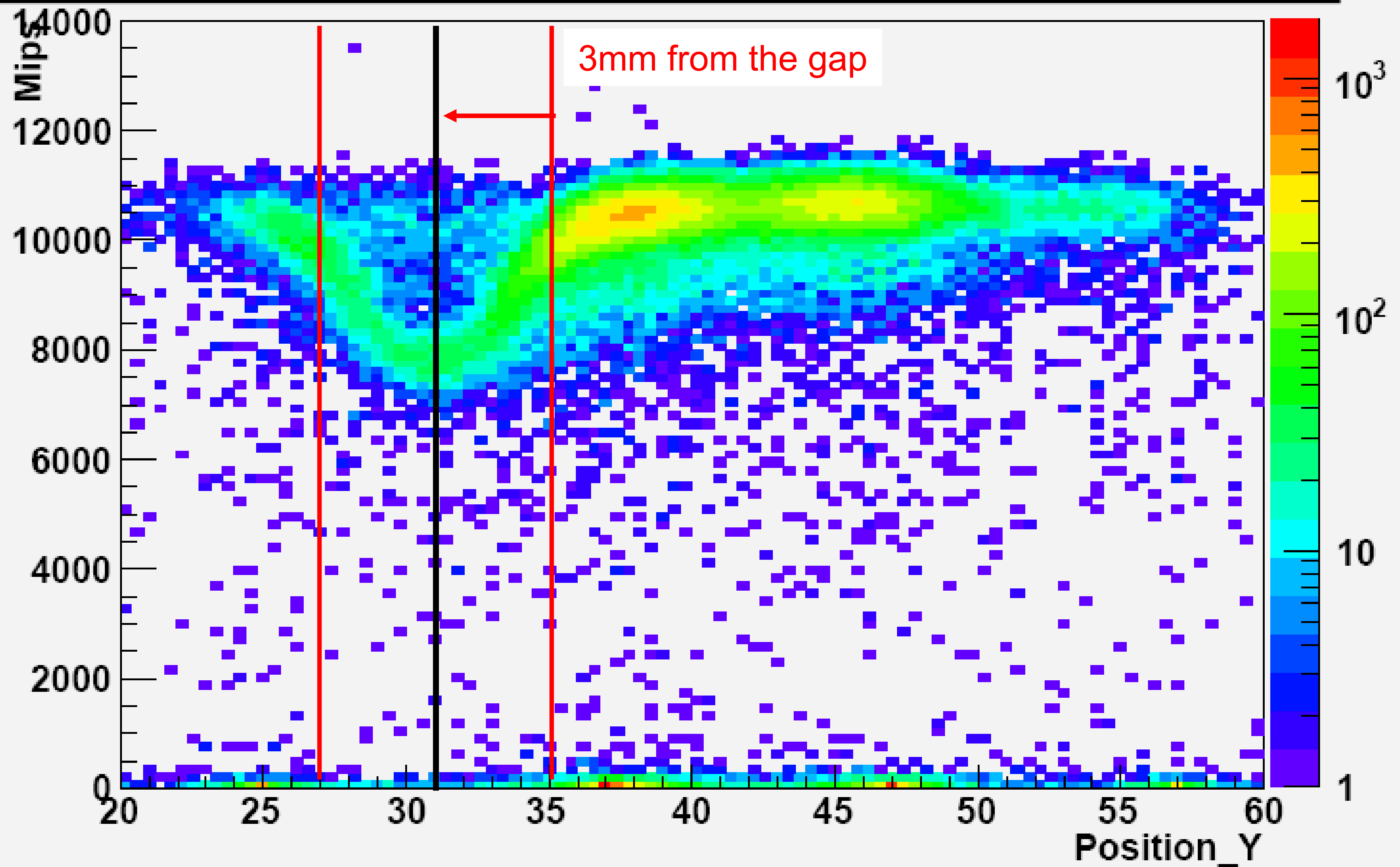
Outline

- Understanding of the bump in energy spectrum & fiducial cut used for event selection
- Using 3-by-3 trigger for event selection
- A first look at the new PCB test data
- Summary

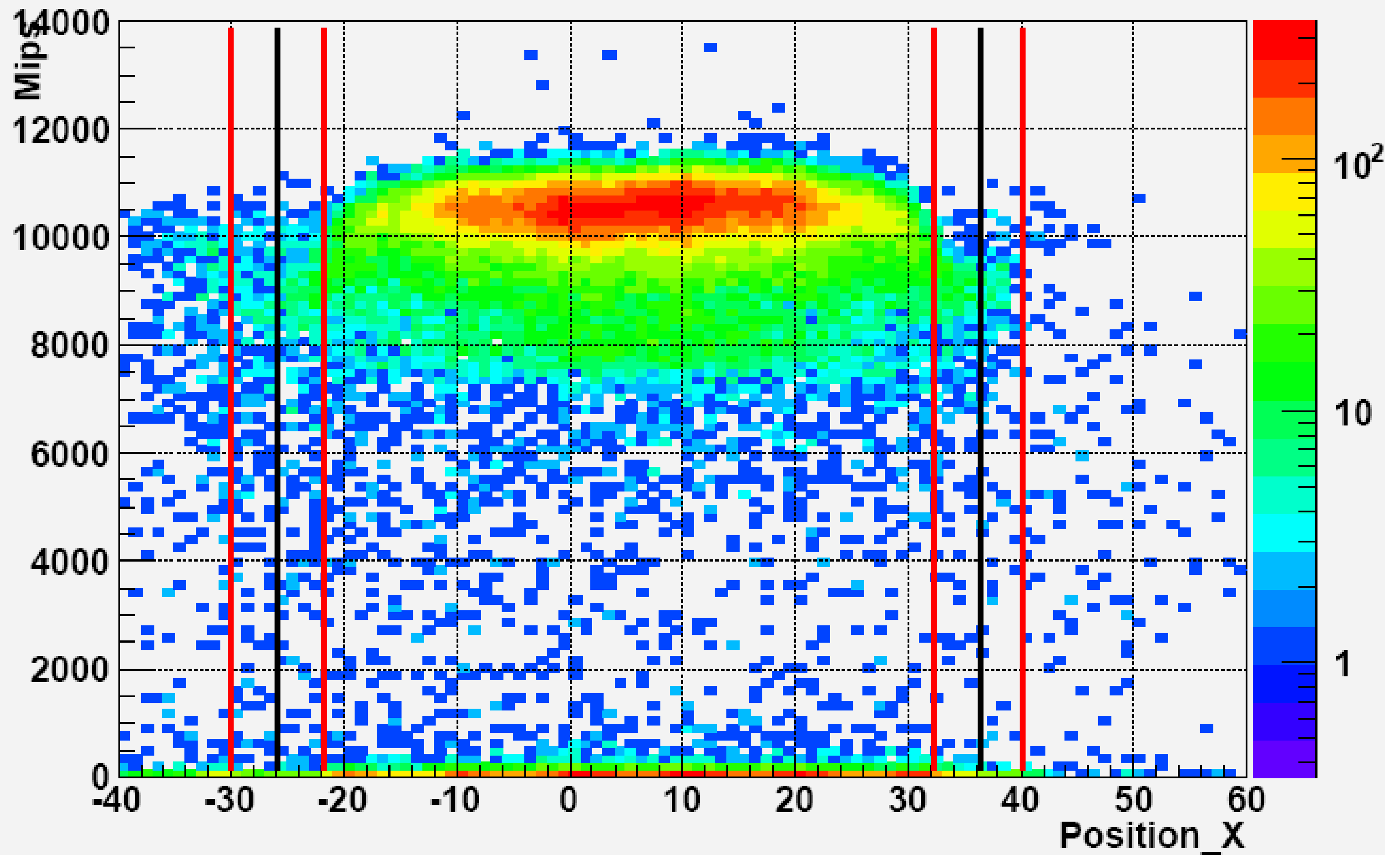
Run300195 : 40GeV run with significant bump pattern



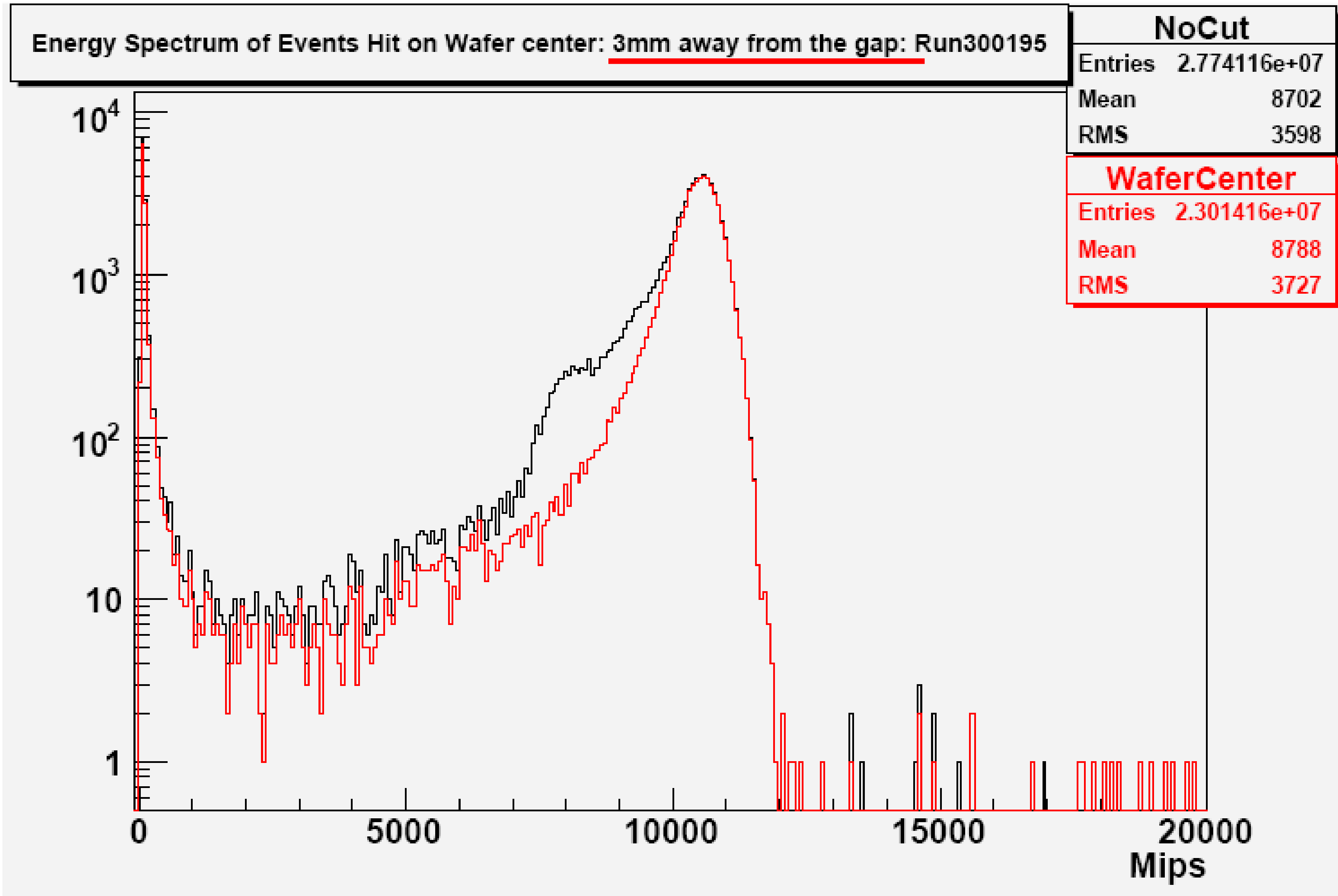
Cherenkov On/Off cut is not applied to save statistics



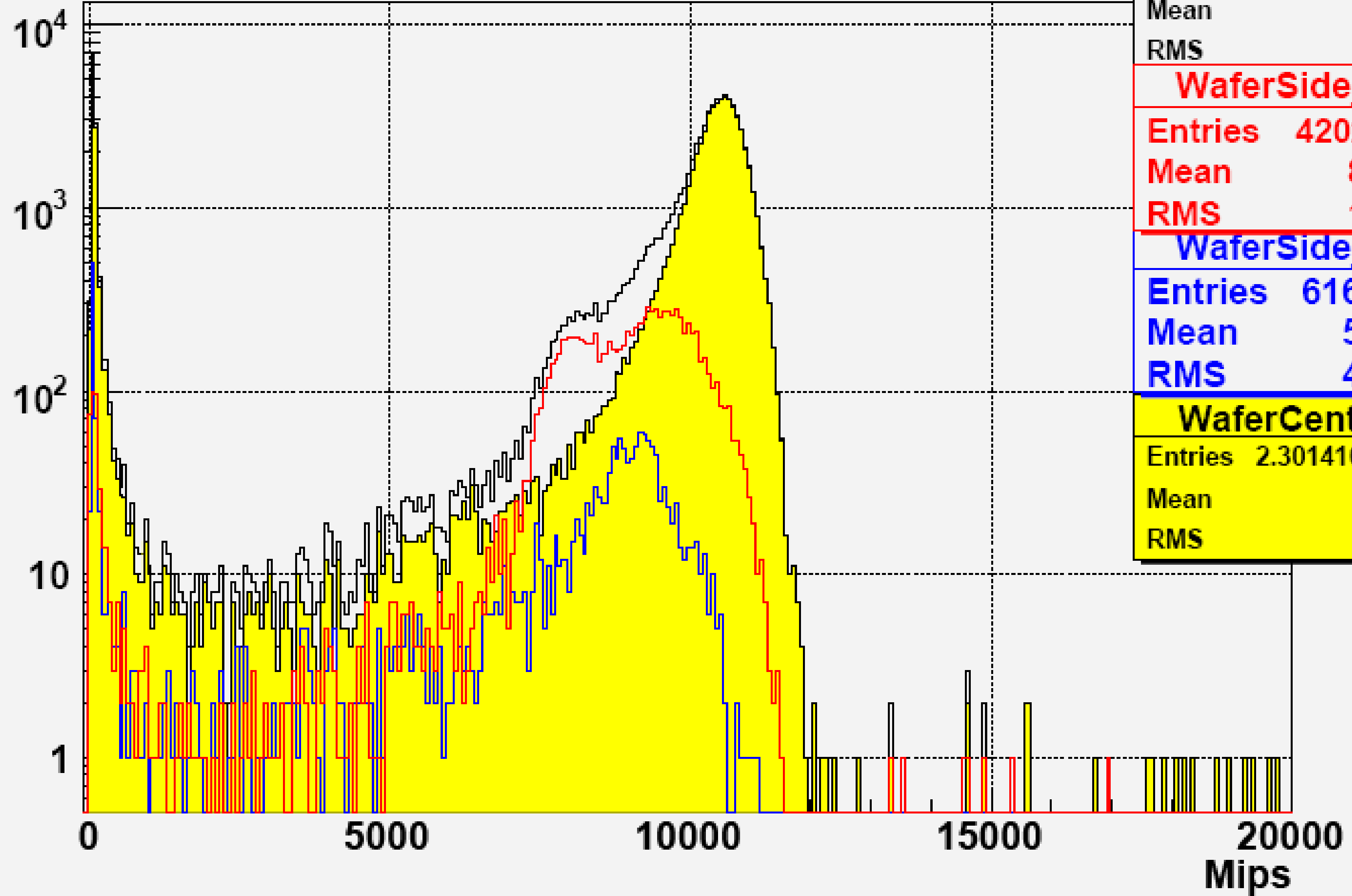
Energy measurement deficit for events hitting near the wafer gap in y direction:
Corresponding to bump in energy spectrum



Beam aim at center of wafer in X direction. So X direction contribution in bump is small

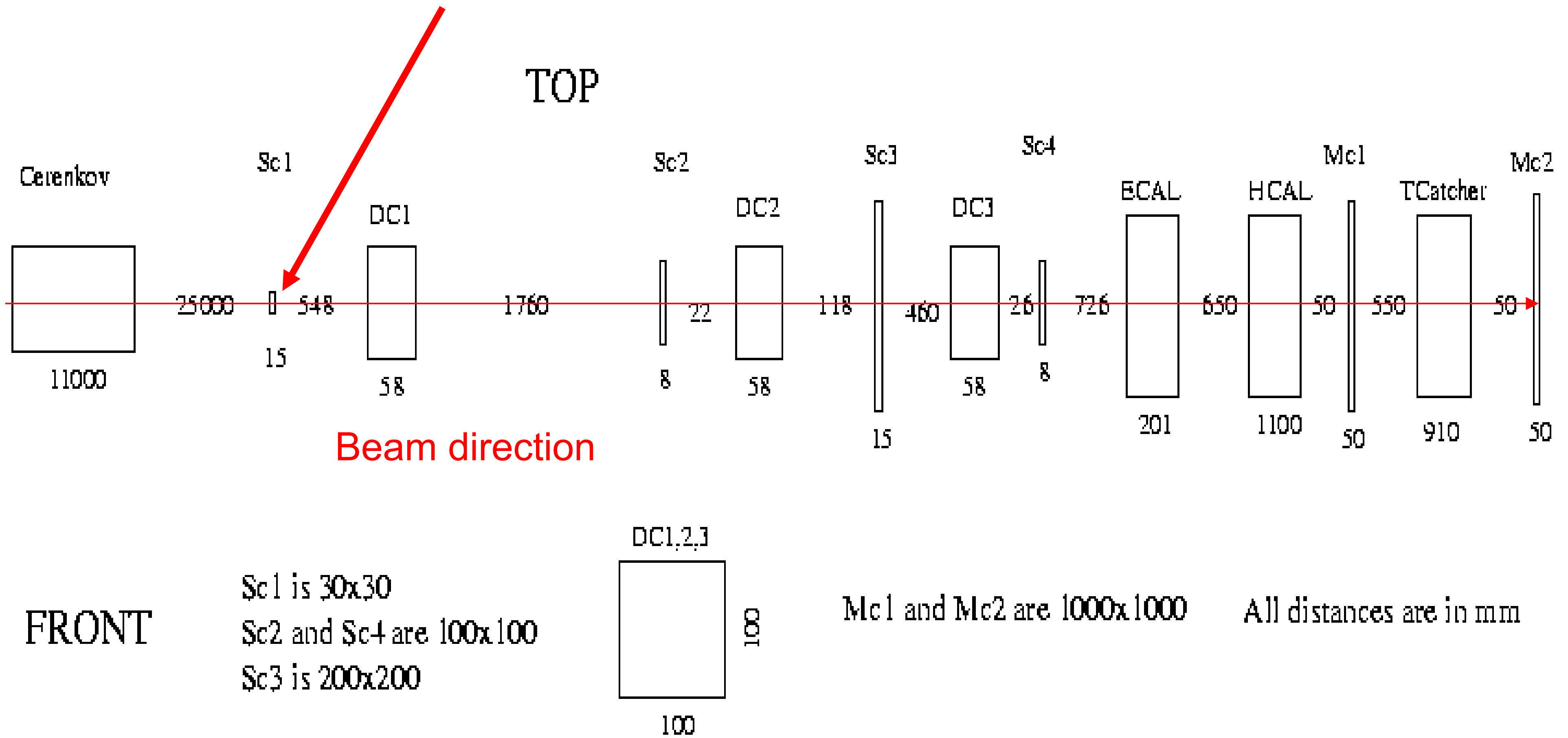


Energy measurement improved by excluding the wafer gap

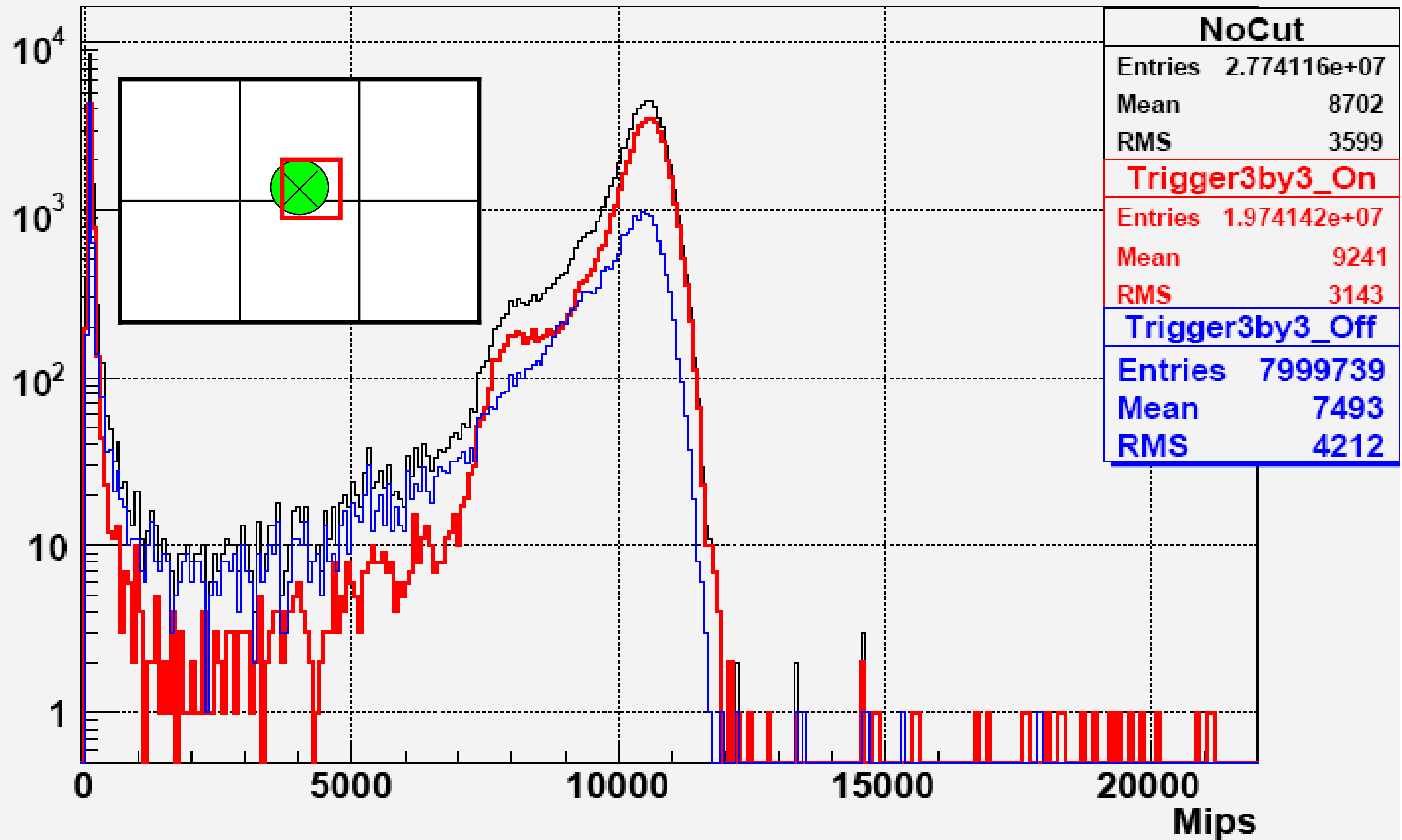


Bump is caused by events hit at wafer side: especially in Y direction

Using 3-by-3 trigger for event selection

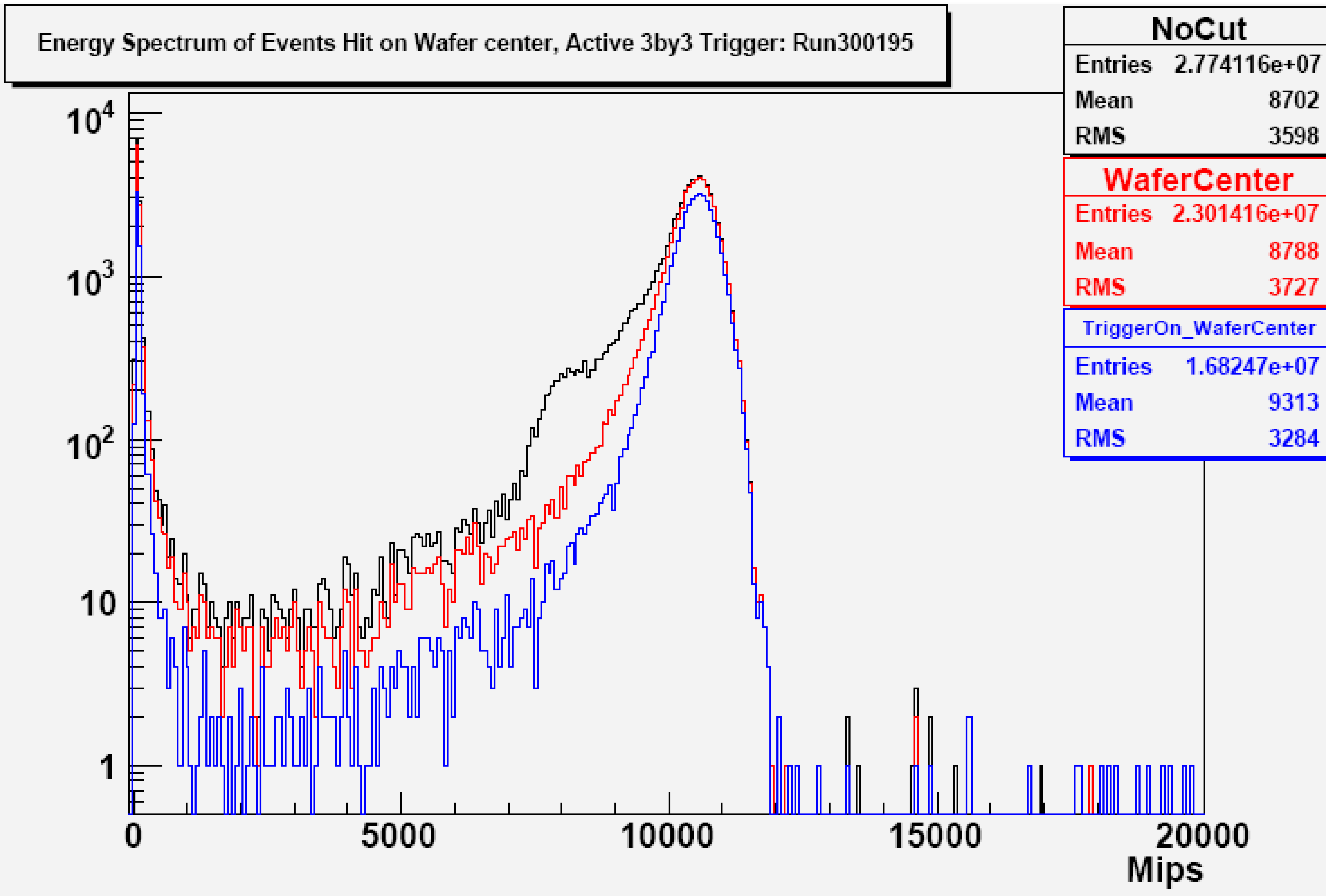


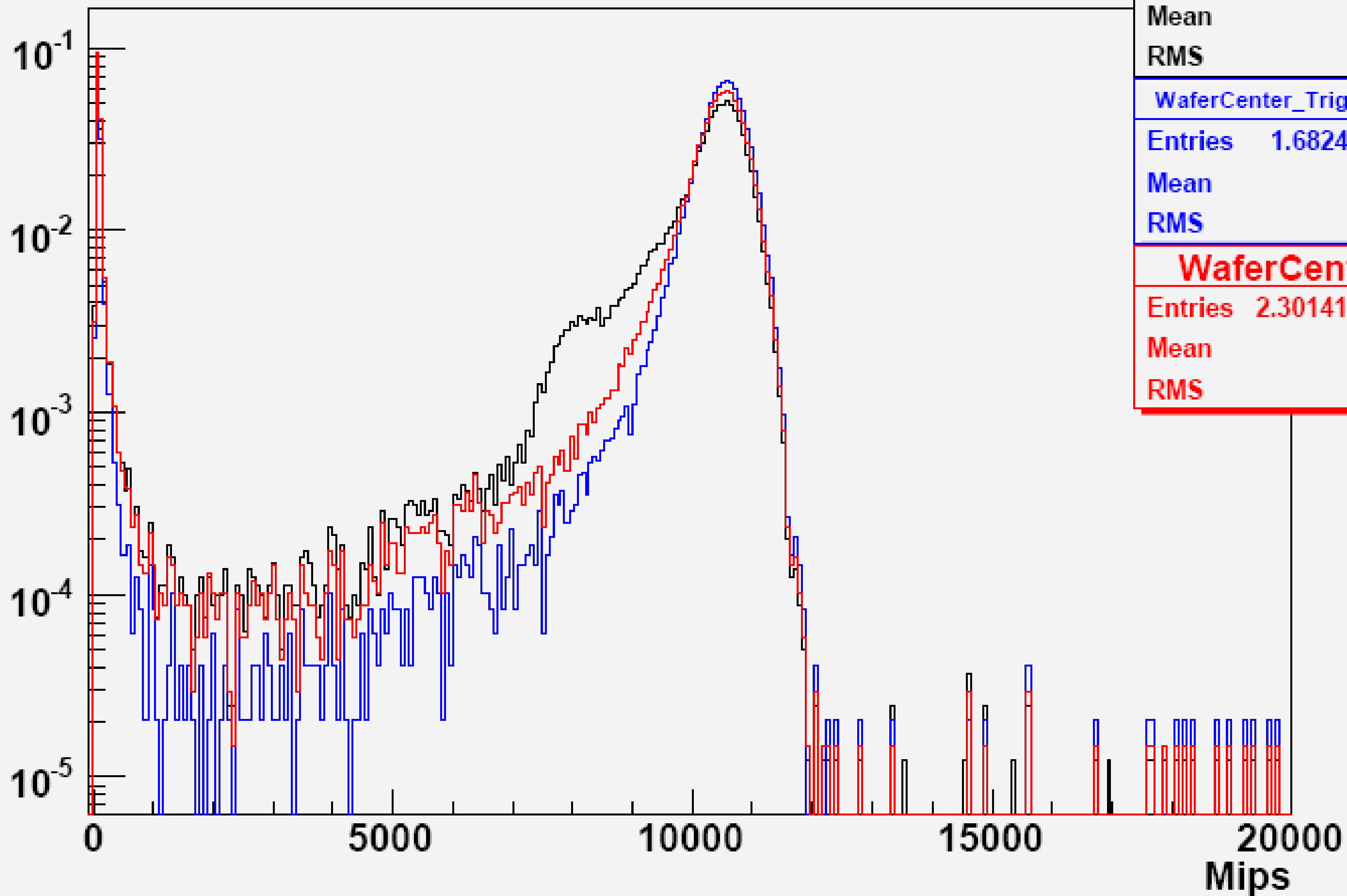
CERN 2006 test beam set up



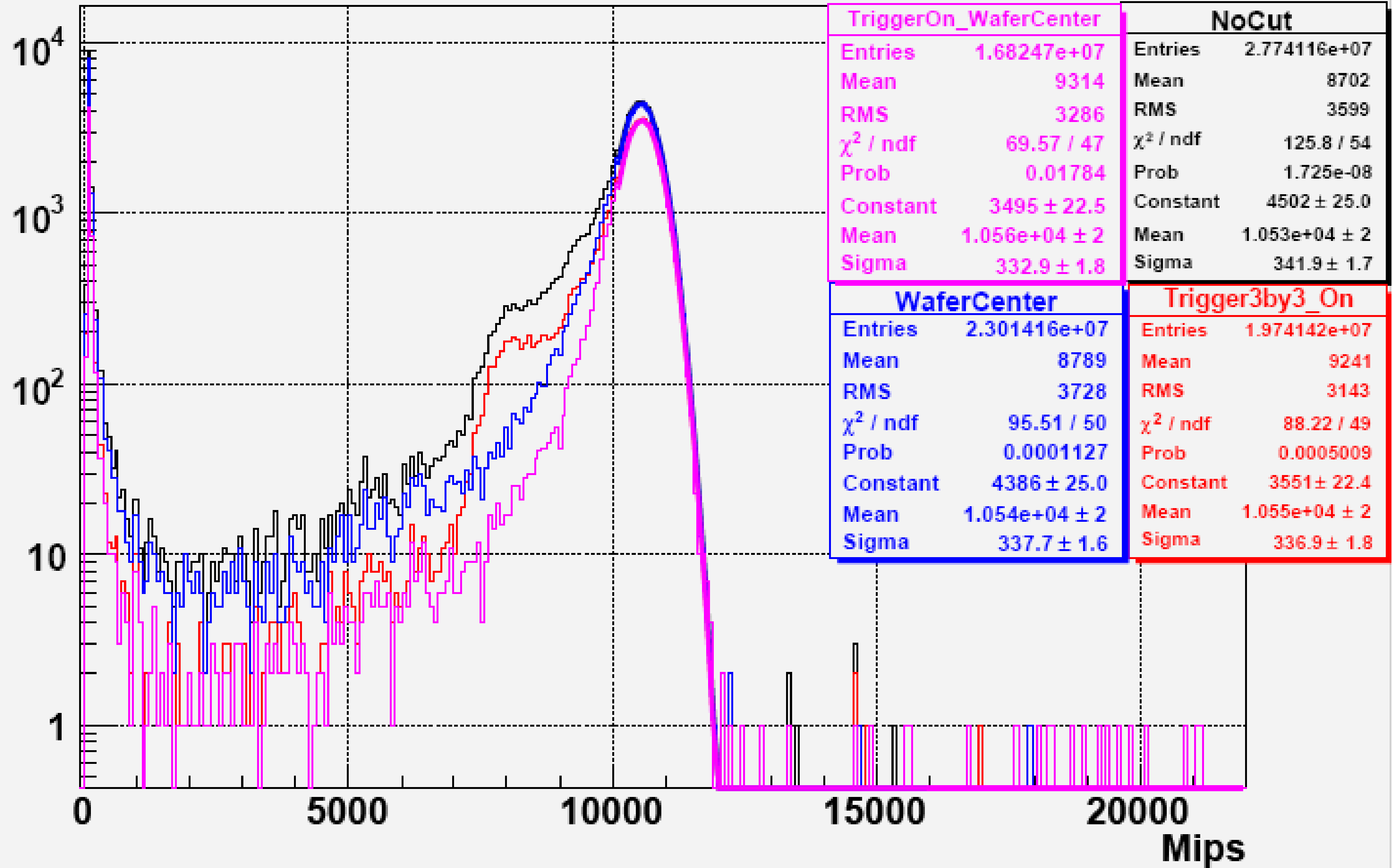
Events active the 3 by 3 trigger have relatively narrow energy distribution;
Bump pattern is more significant with events active 3 by 3 Trigger

If select events hit the wafer center and active the 3-by-3 Trigger:





Better energy resolution with both cuts applied



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Fit Region: > 10000mips (-1.5σ, 20σ).

Fit result for different event selection: Run300195

Cleaning option	Select all	3by3 trigger	Wafer Center	Wafer Center & 3by3 trigger
Peak Position (mips)	10530±2	10550±2	10540±2	10560±2
Peak Width (σ) (mips)	341.9±1.7	336.9±1.8	337.7±1.6	332.9±1.6
χ^2/ndf	2.33	1.80	1.91	1.48

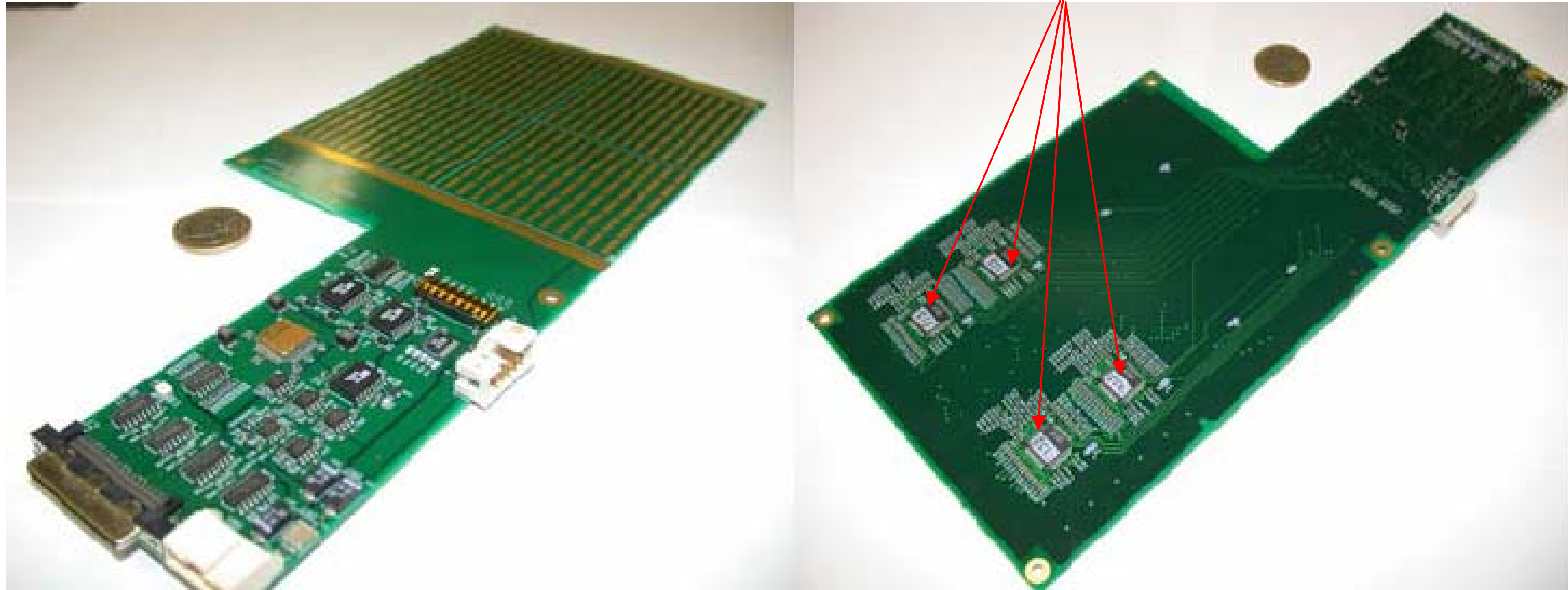
Peak position increases & better energy resolution and χ^2/ndf achieved with more strict event selection

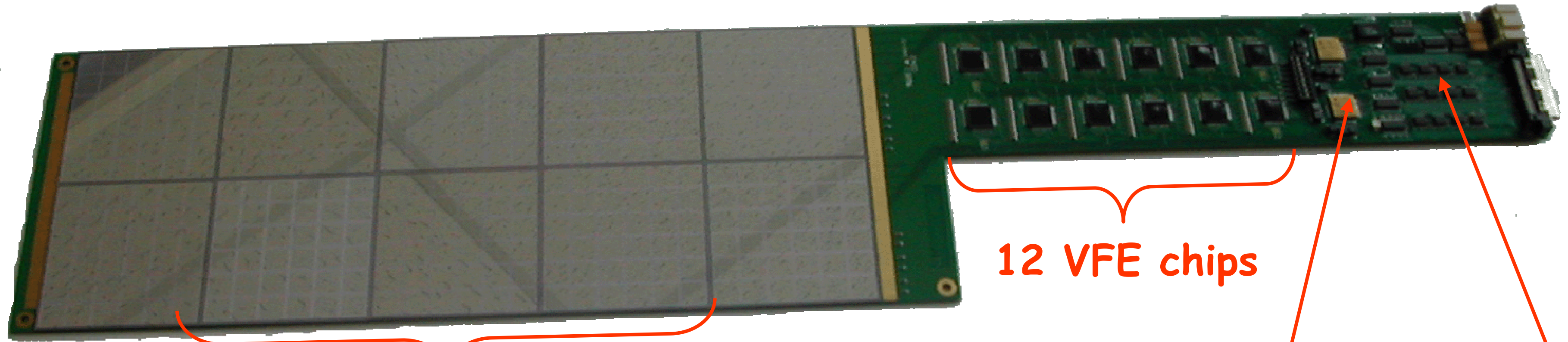
A first look at new PCB test:

will the shower electron create signals
when passing through the electronic chips?

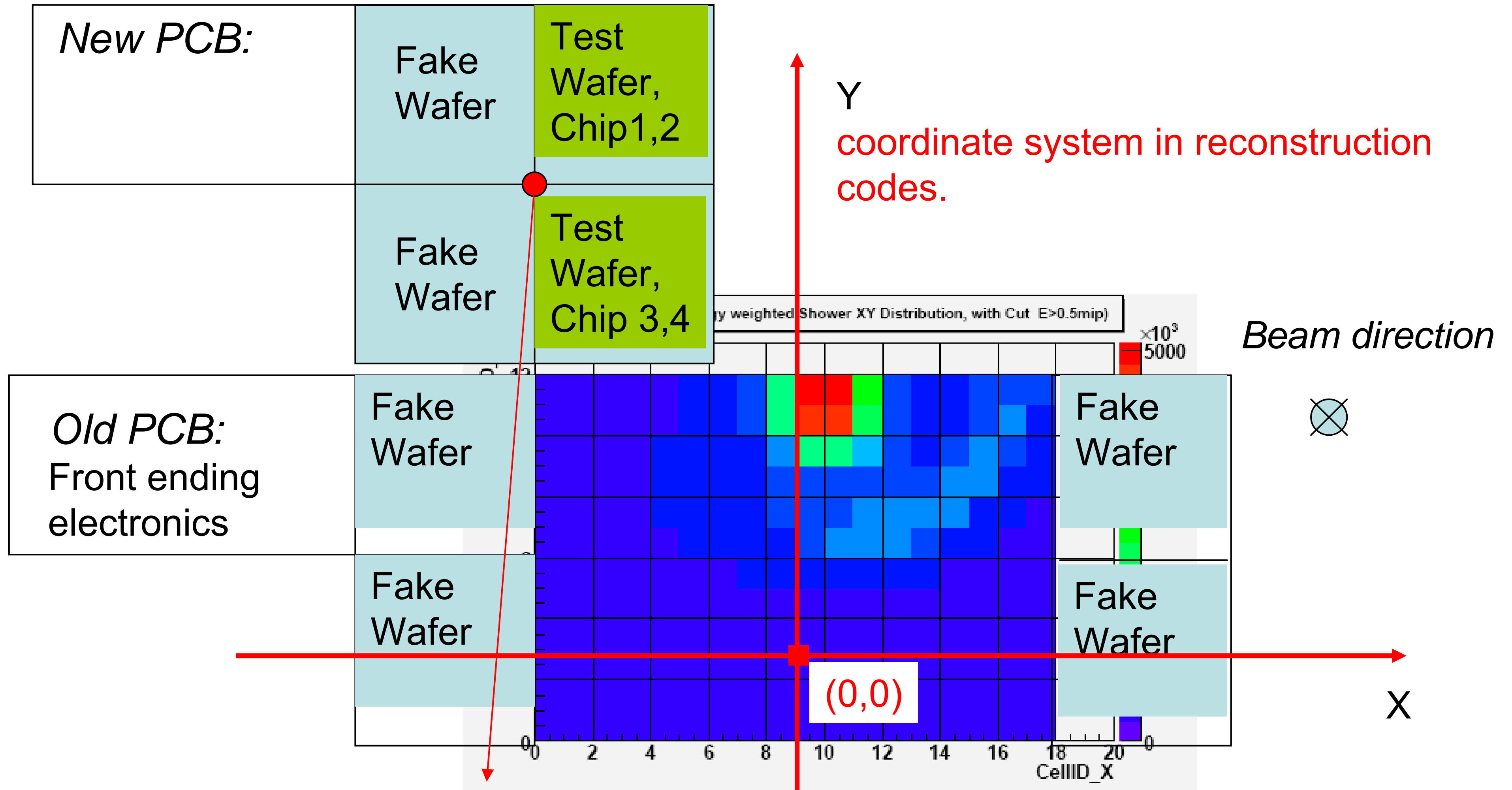
- In original design of ILC ECAL, the VFE chips will be installed inside the wafers to save space; we have one new PCB follow this design, while the old PCBs we used in test beam have VFE chips installed outside the wafers
- The new PCB is not equipped with silicon sensors: the ideal signal from new PCB will be nothing more than pure electronic noise

New PCB vs Old PCB:



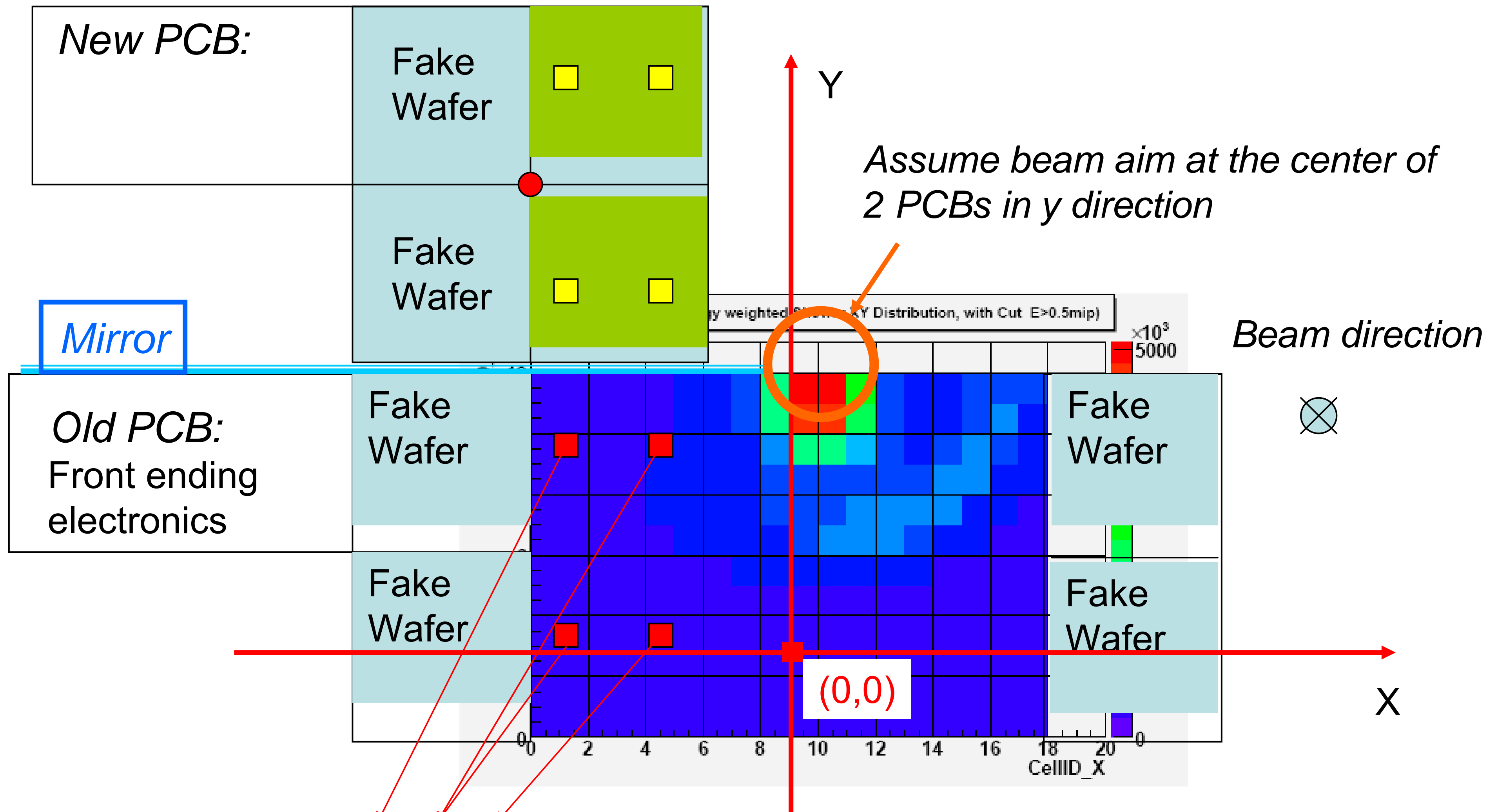


Experimental Setting Up: 100GeV beam

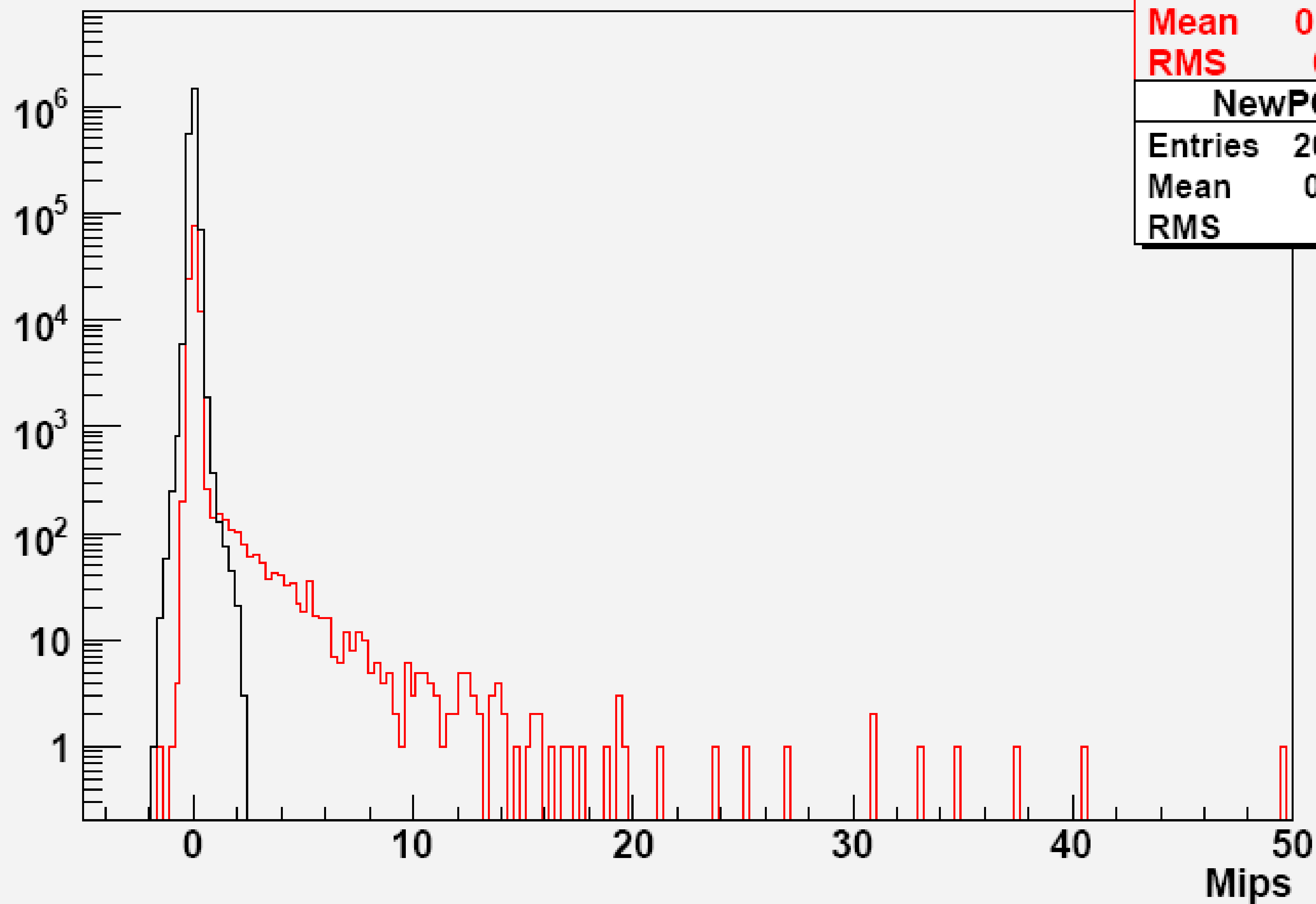


Y coordinate: Above the Normal PCBs.
X coordinate: Not Fixed. Uncertainty in X not excluded.
Z coordinate: layer 20 according to the shower maximal.

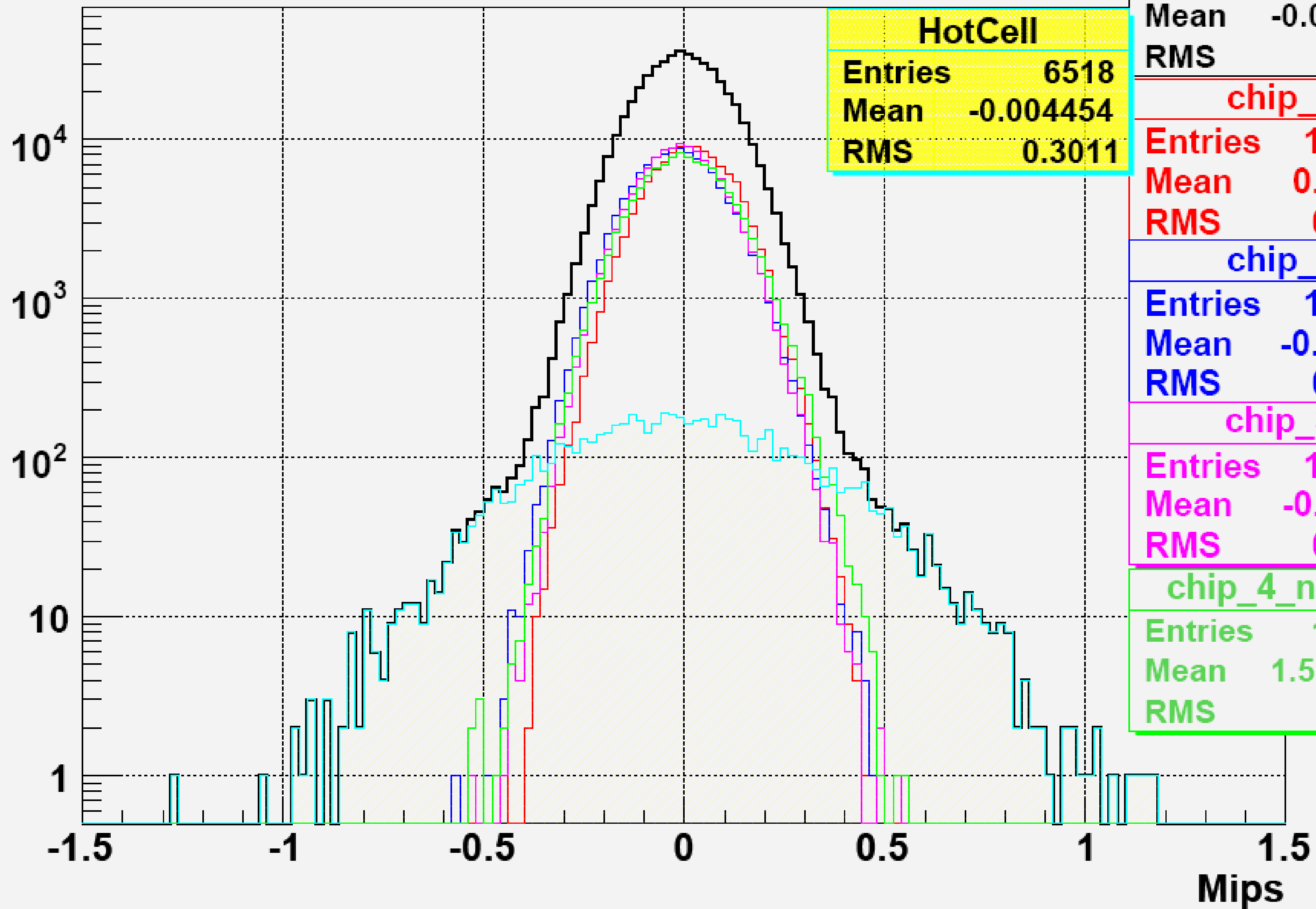
Mirror position of chips on new PCB:



Mirror Position of The chips (in form of (CellID_X, CellID_Y)):
(0,2) (4,2) (0,9) (4,9)



The signals in new PCB is purely electronic noise only



No chip dependence in Energy Spectrum

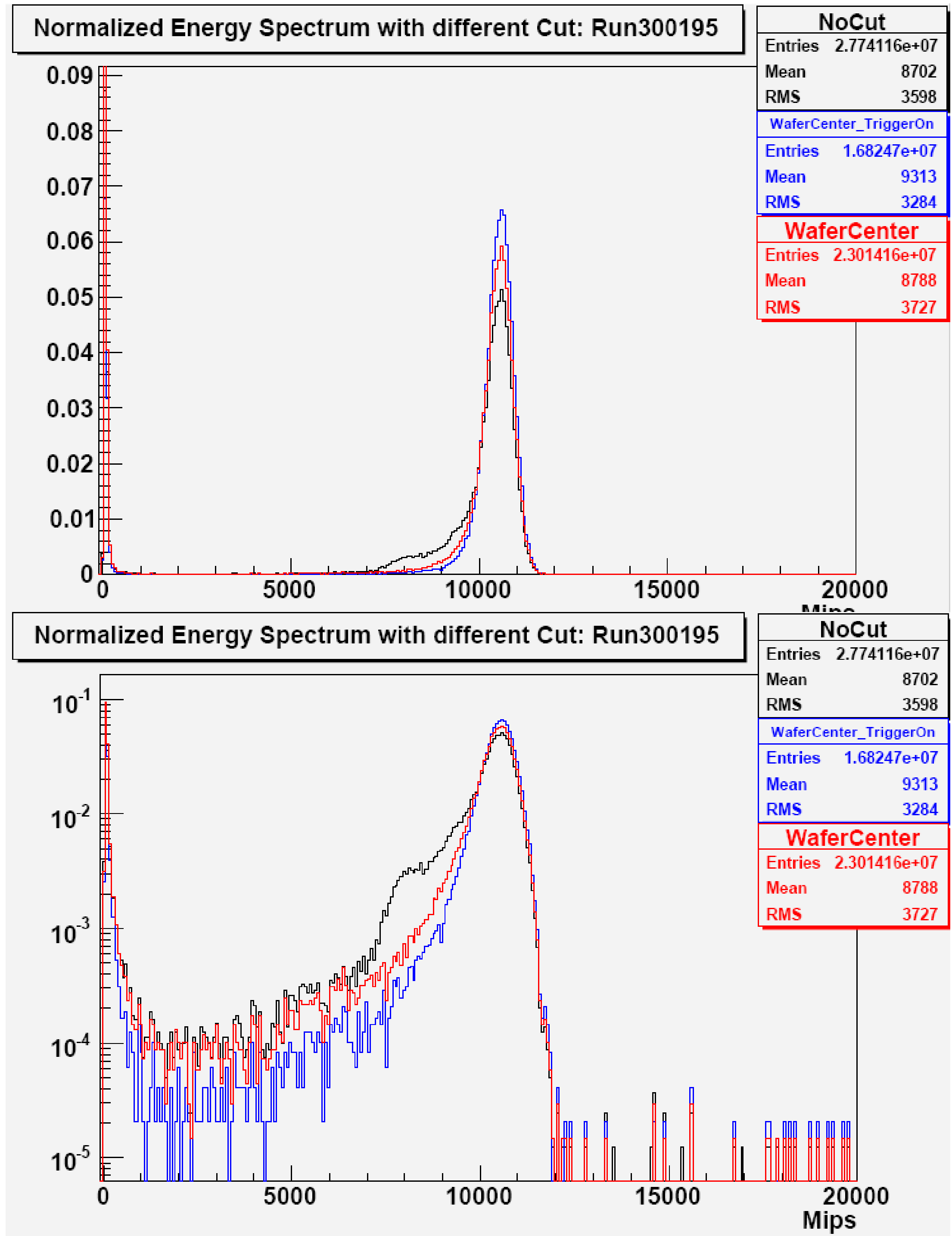
Summary

- The bump in energy distributions is due to energy deficit at gaps between wafers
- The 3-by-3 trigger may be further used for a clean event selection. (*But may lose quite an amount statistic for low energy beam*)
- For new PCB, no additional signal than electronic noise is observed. *If the new PCB sets at the expected position in x, It may be too far away from the beam position. → Further tests is needed in future beam tests.*

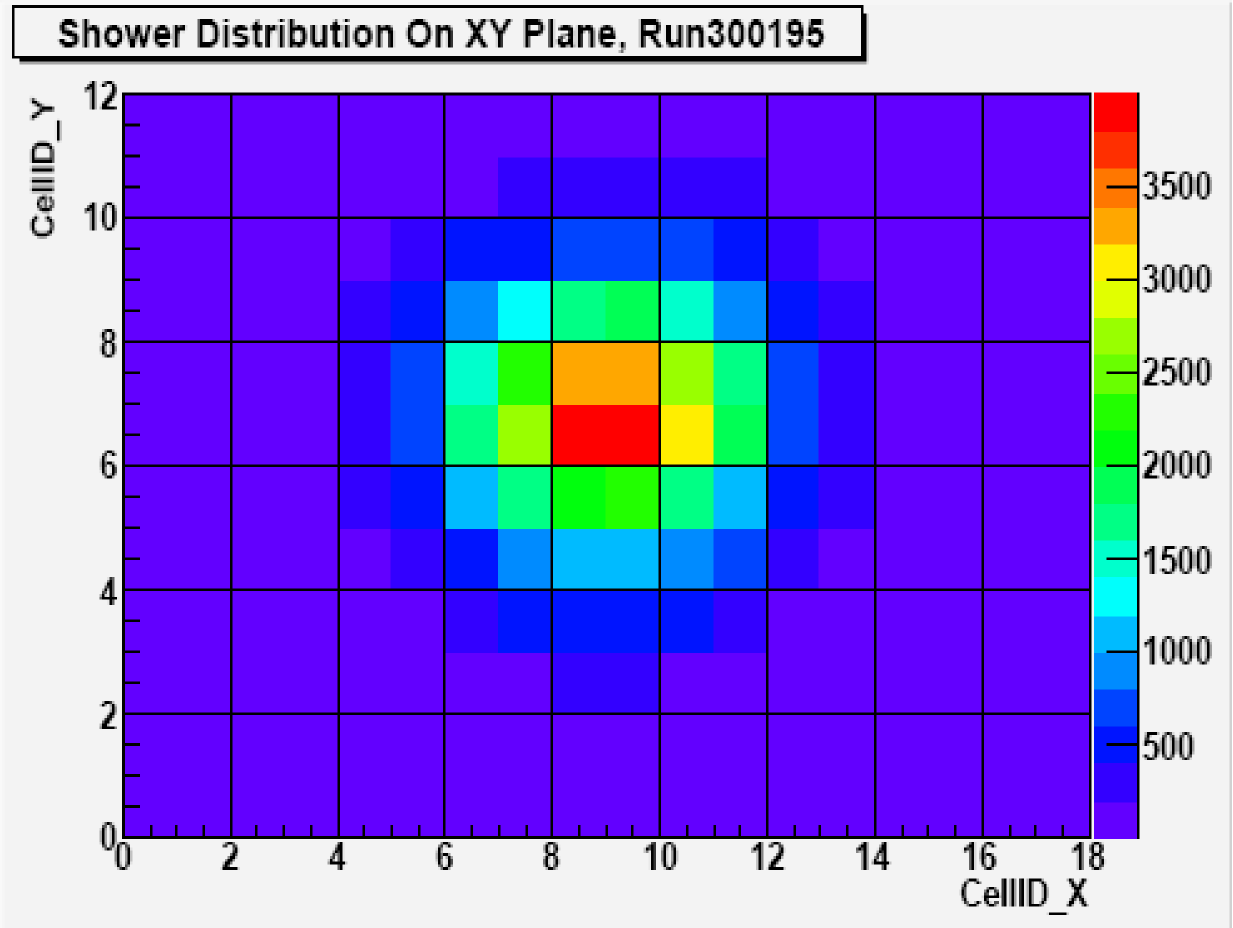
Spare plots

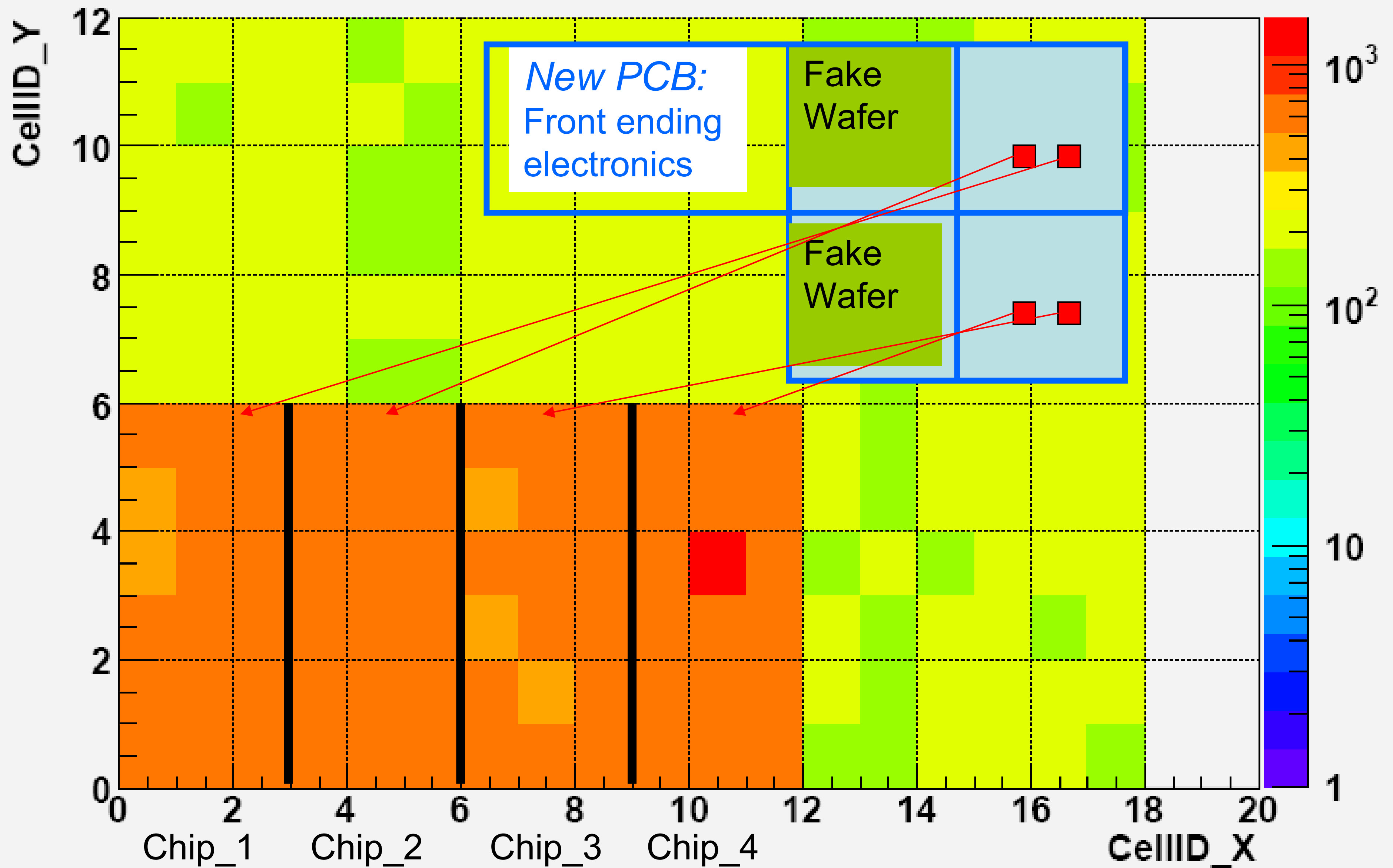
Normalized Energy Spectrum

Better energy resolution
with both cuts:



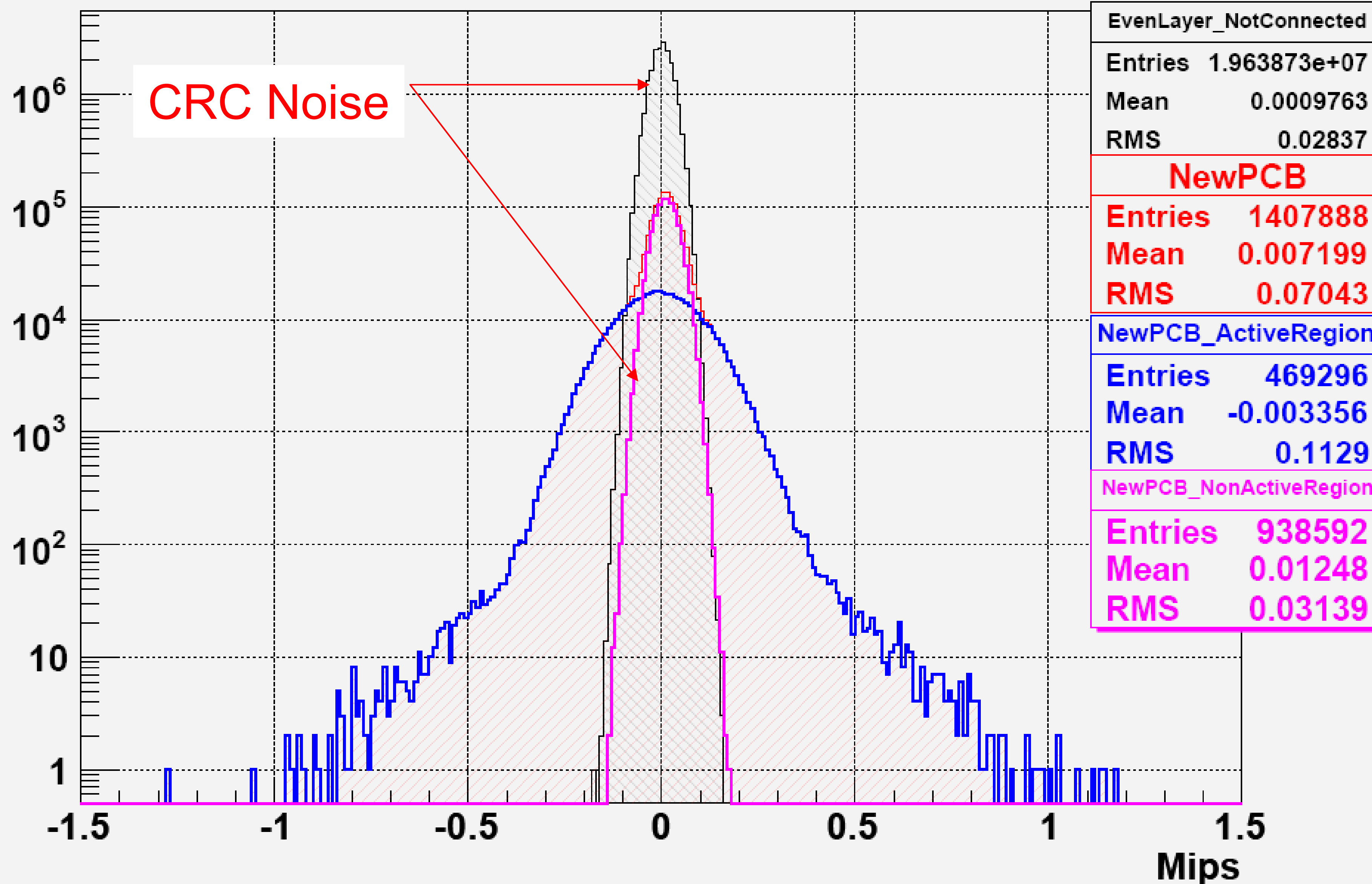
Beam position for run300195: cross the y gap, while aim at the center of wafer in X-direction

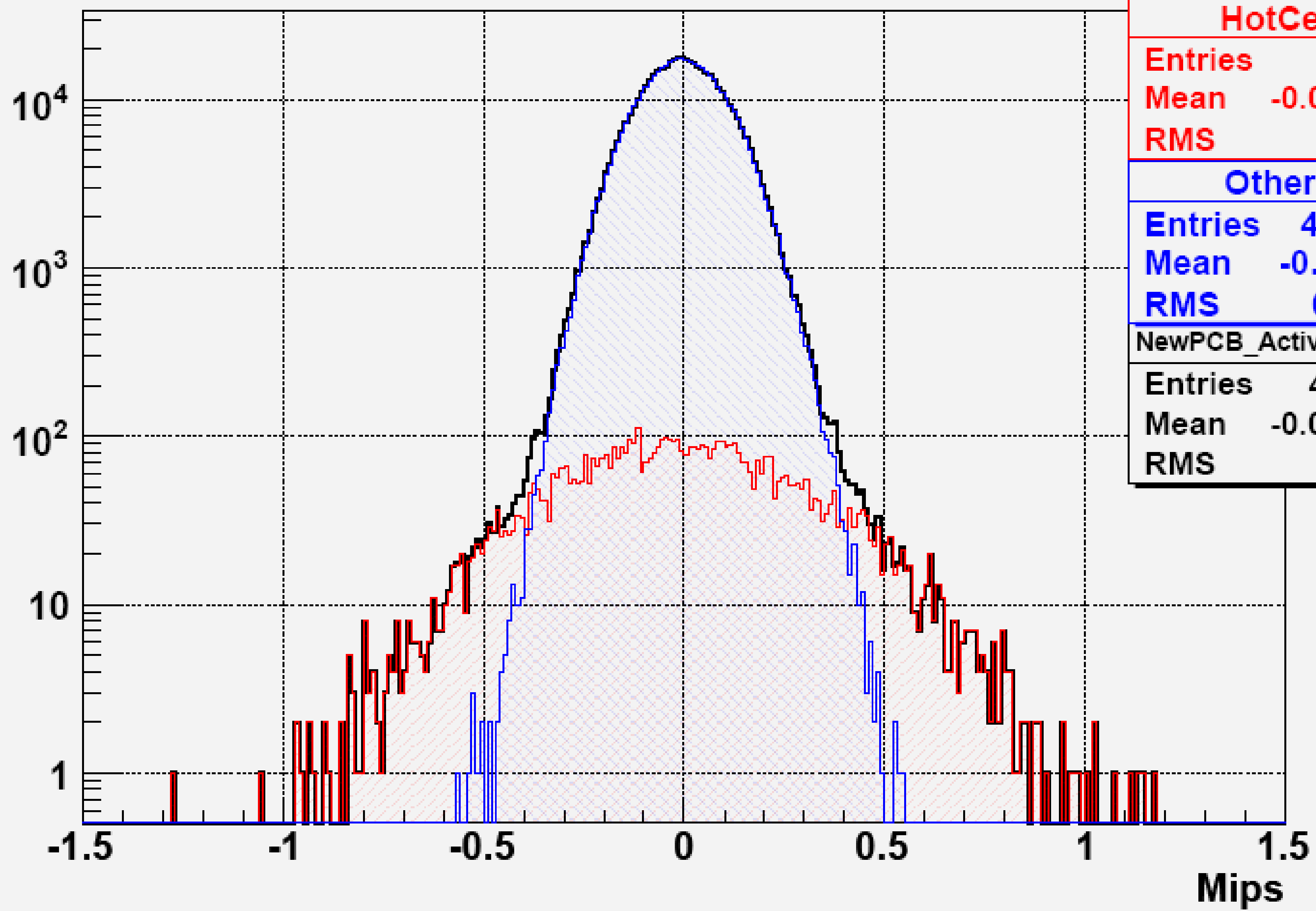


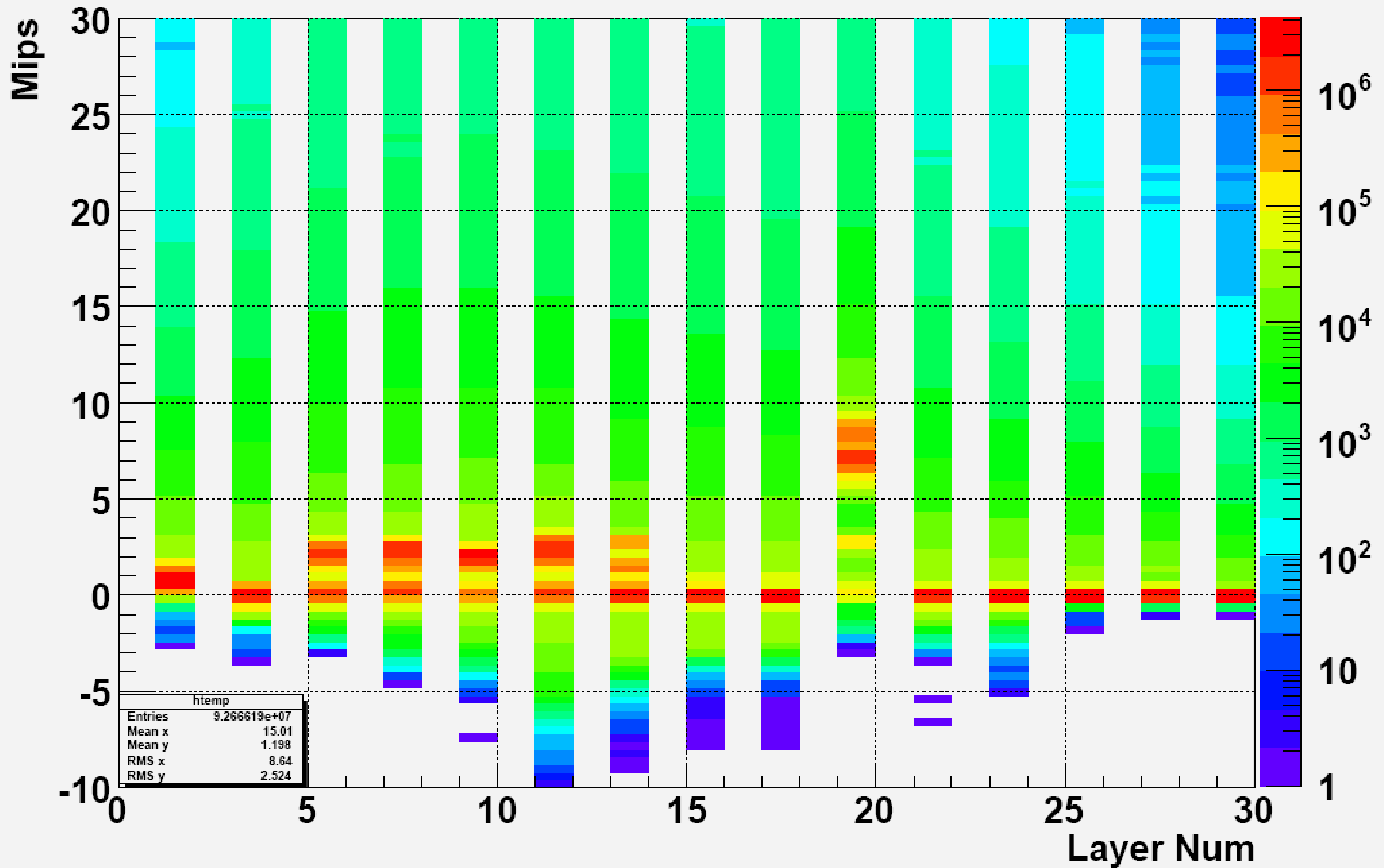


Signal reconstructed from the channel connect to NewPCB: Geometry here is fake.
4 chips on New PCB, corresponding to 2 wafers. One Hot Cell (10,3,14) Run300500

Run300502




NewPCB: Hot Cell's Contribution in Large Noise Tail
HotCell
Entries 6518
Mean -0.004454
RMS 0.3011
Others
Entries 462778
Mean -0.00334
RMS 0.1079
NewPCB_ActiveRegion
Entries 469296
Mean -0.003356
RMS 0.1129
10^4
10^3
10^2
10
1
-1.5
-1
-0.5
0
0.5
1
1.5
Mips



Layer Dependent Noise of Run300502 : why use layer 21 signal as the mirror

Data quality check statistic & Dead Cell List *(23 Cells of 6480)*

- In form of (CellID_X,Y,Z):

  (1,8,0), (16,2,0), (10,9,1), (6,3,2), (8,4,2), (15,4,2), (16,4,2), (0,1,5), (1,1,5), (13,7,5), (13,8,5),(13,9,5), (15,7,6), (17,6,6), (0,7,20), (0,11,20), (0,11,22), (1,6,25), (2,6,25), (1,12,25), (2,12,25), (10,5,29), (17,0,29)

- Totally I have scanned 339 runs in CERN test beam data and 201 runs in DESY data → refer to detailed information that I have sent around