Update on PME Beam ND Data

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Outline

- Runs
- Data processing
- Preliminary Results :
  - Event characteristics
  - Track characteristics &
  - Shower characteristics
  - Some Numbers
- Summary

Neutrino Runs

- Took data from Friday till Today…
- Various runs with different intensities varying from :
  - 1 batch ~ (0.5-4 x 10^{13} POTs)
  - 5 batches ~ 1.2 x 10^{13} POTs
  - 6 batches ~ 2.5 x 10^{13} POTs !

Data processing

- Magnet off BUT (as before) residual magnetic field present (there was no proper degauss procedure, power supply died suddenly). Reconstructing assuming either zero or nominal magnetic field is not 100% correct…
- Processed events with :
  - Nominal field map for the reconstruction
  - R1.14 (Development was crashing I need to go back and look…)
  - ASAP slicer since it seems less sensitive to the fixed bug I discussed the previous time that however has not been back-ported to release 1.14
  - Processed nearly 70 % of the data.

CUTS USED :

- Event starting position 1m around beam center, z>1 && z<6.2

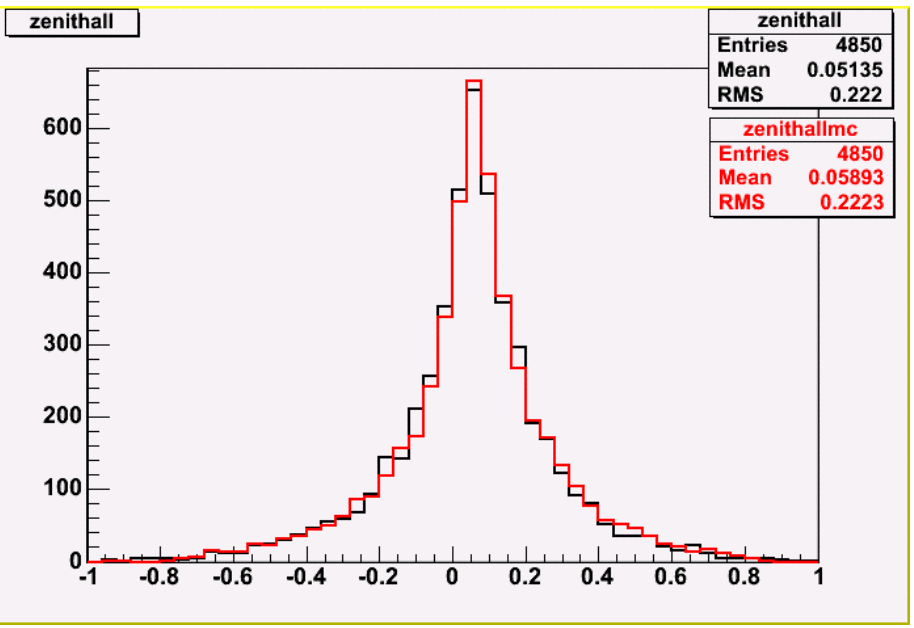
MC used

- Alysia Marino has produced various PME MC files with different intensities (2.5 x 10^{12} and 1 x 10^{13})

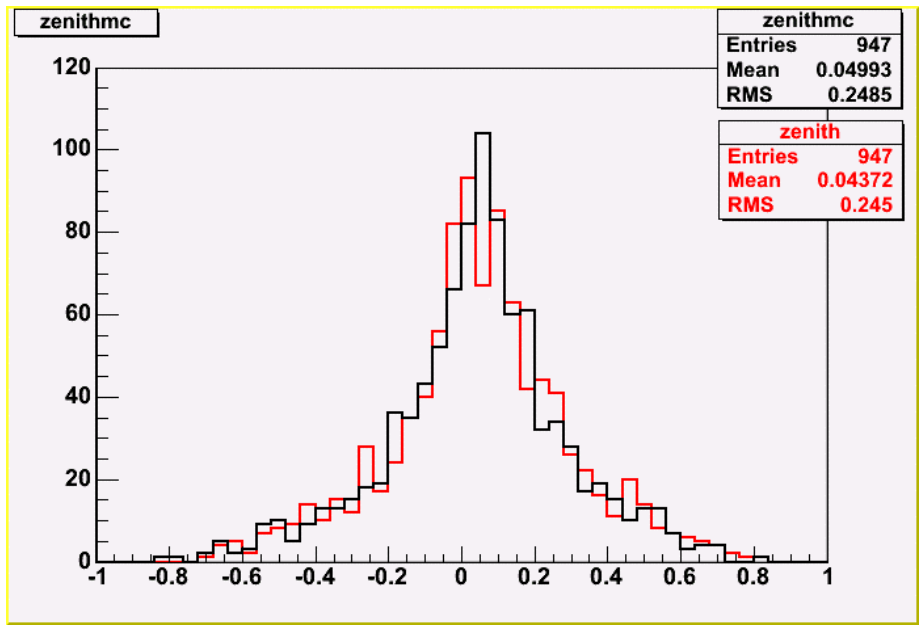
- I just used the ones with 2.5 x 10^{12} to perform event by event comparisons and not rate studies.

Event characteristics : Direction

Cosine zenith angle: All tracks



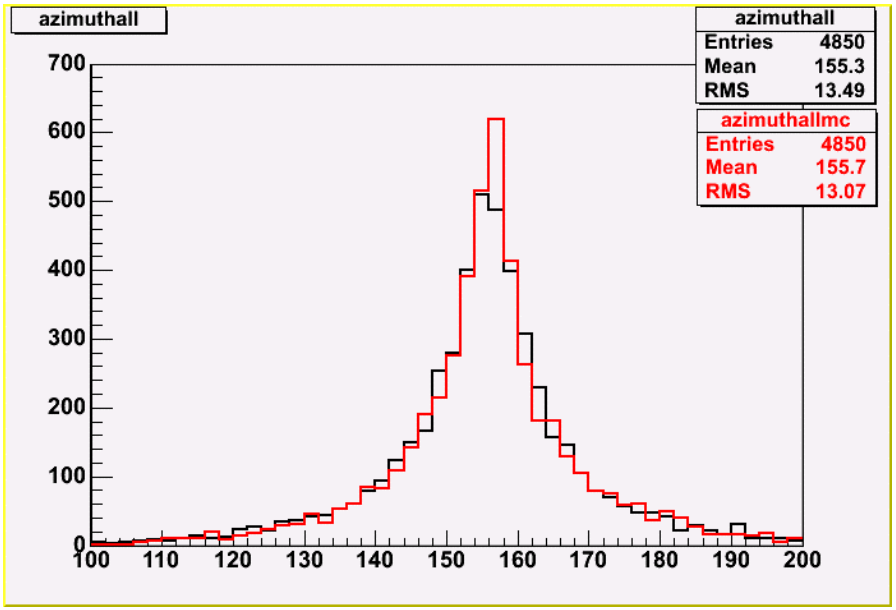
Cosine Zenith angle: tracks inside fiducial region



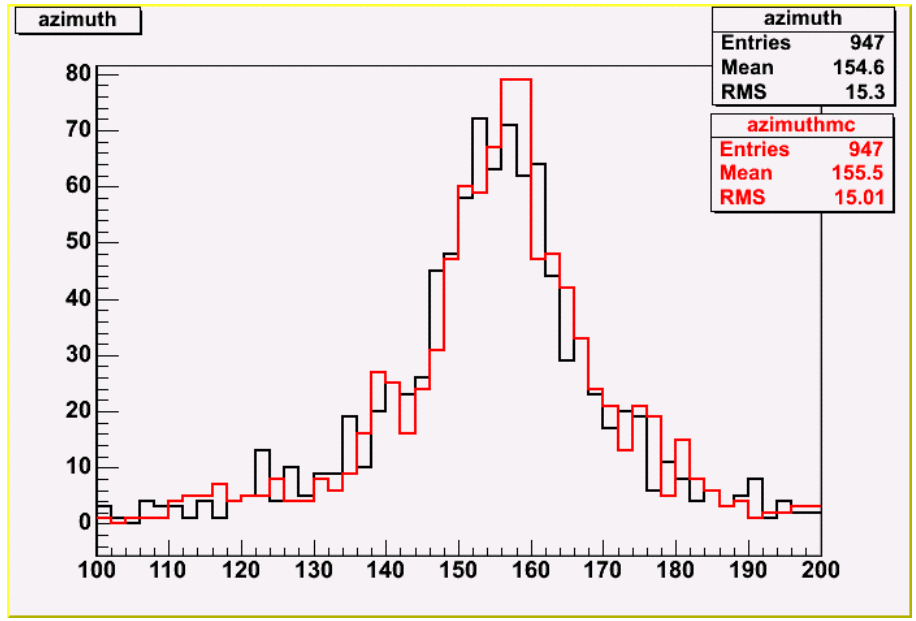
- Black data : Red MC .
- The look really similar… and coming from the beam

Event characteristics : Direction con't

Azimuth angle All tracks

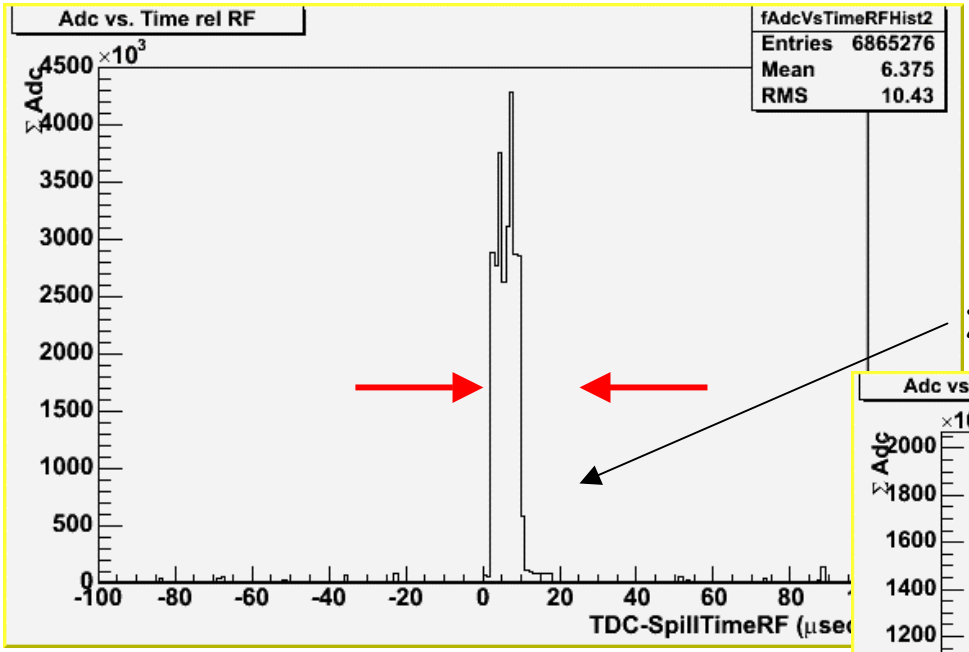


Azimuth angle tracks inside fiducial region



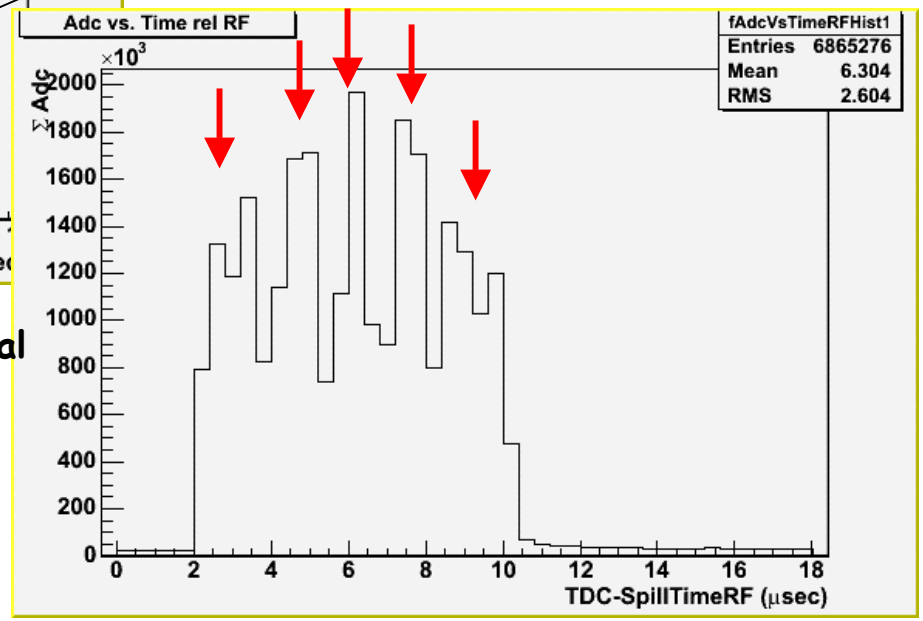
- Black data : Red MC .
- The look really similar… and coming from the beam

Event characteristics :TIMING



Sum of ADC in the DETECTOR

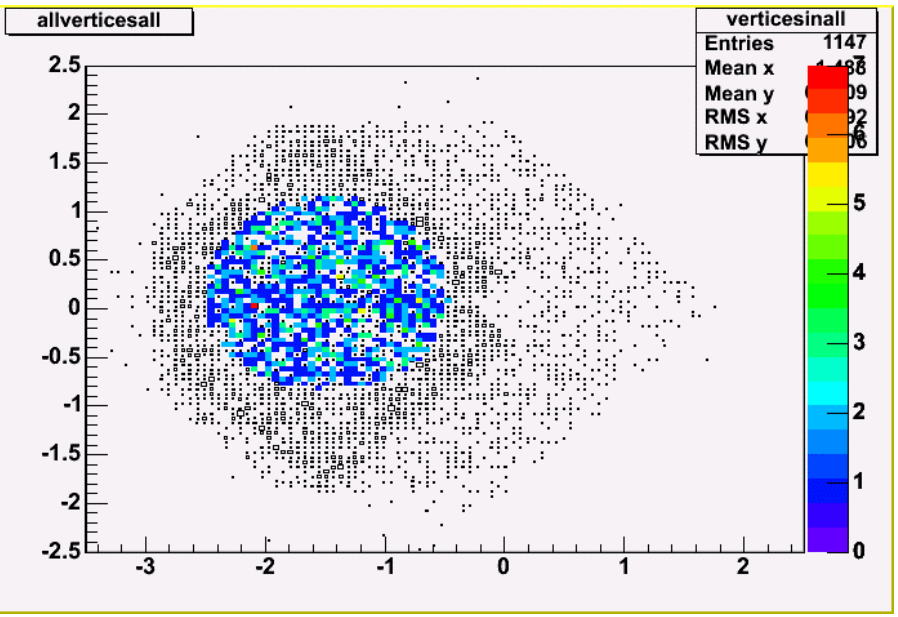
ZOOMED (see the 5 batch structure)

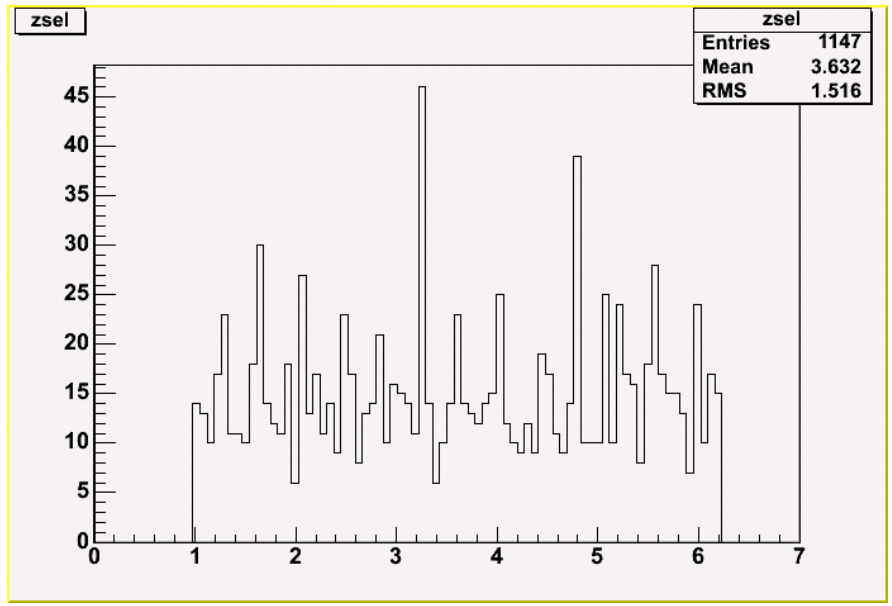


Time window +- 100 nsec from SGATE signal

- Robert H. wrote this very useful package (Filtration) that allowed us to look at the activity in the detector in a 200 nsec window around the sgate signal (running in a dynode mode) and properly tune the timing of the detector to make sure that we see everything that we are supposed to,.

Event characteristics : x y z position of selected events



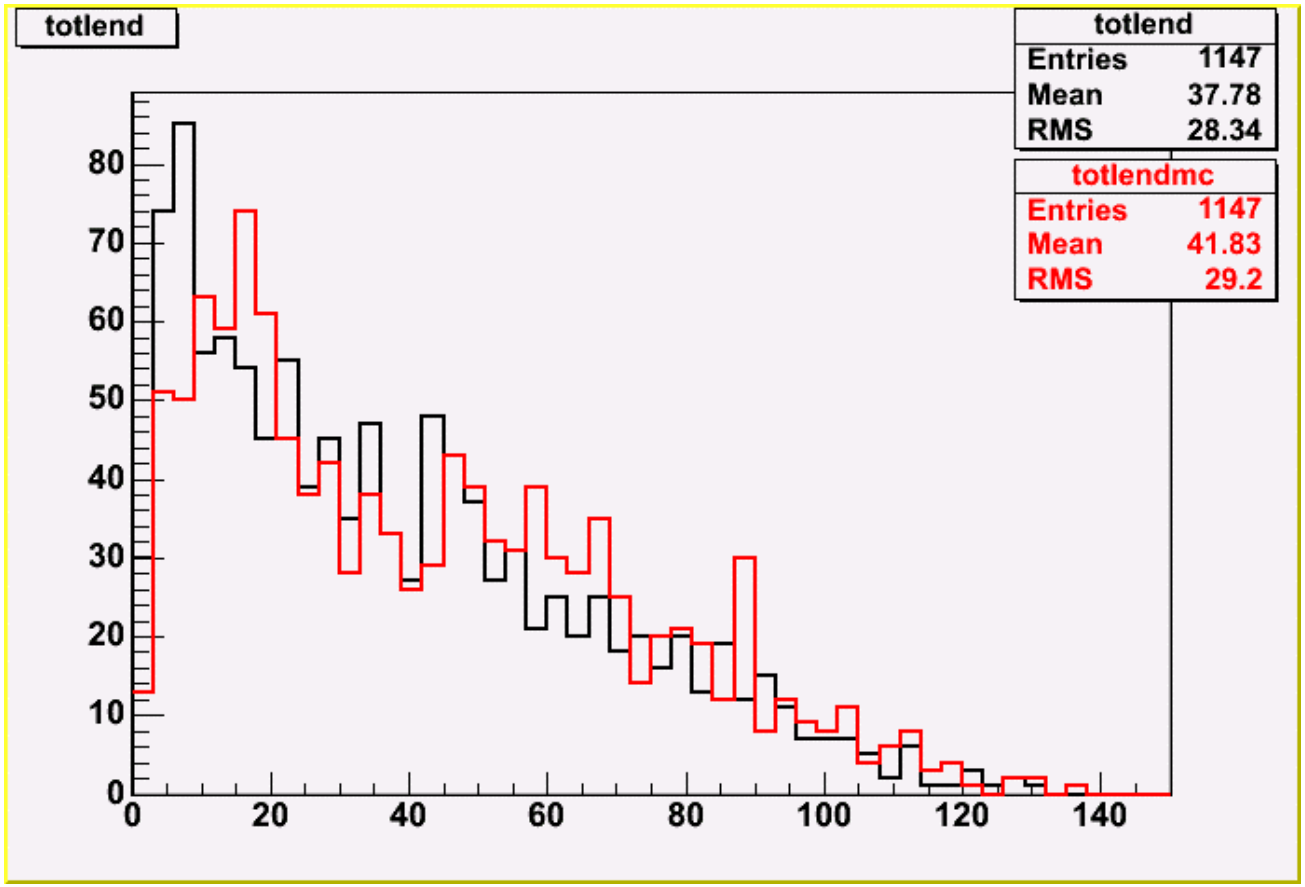


Y vs X position of all tracks (box) and the ones in the fiducial region (color)

Z position of all events in the fiducal region

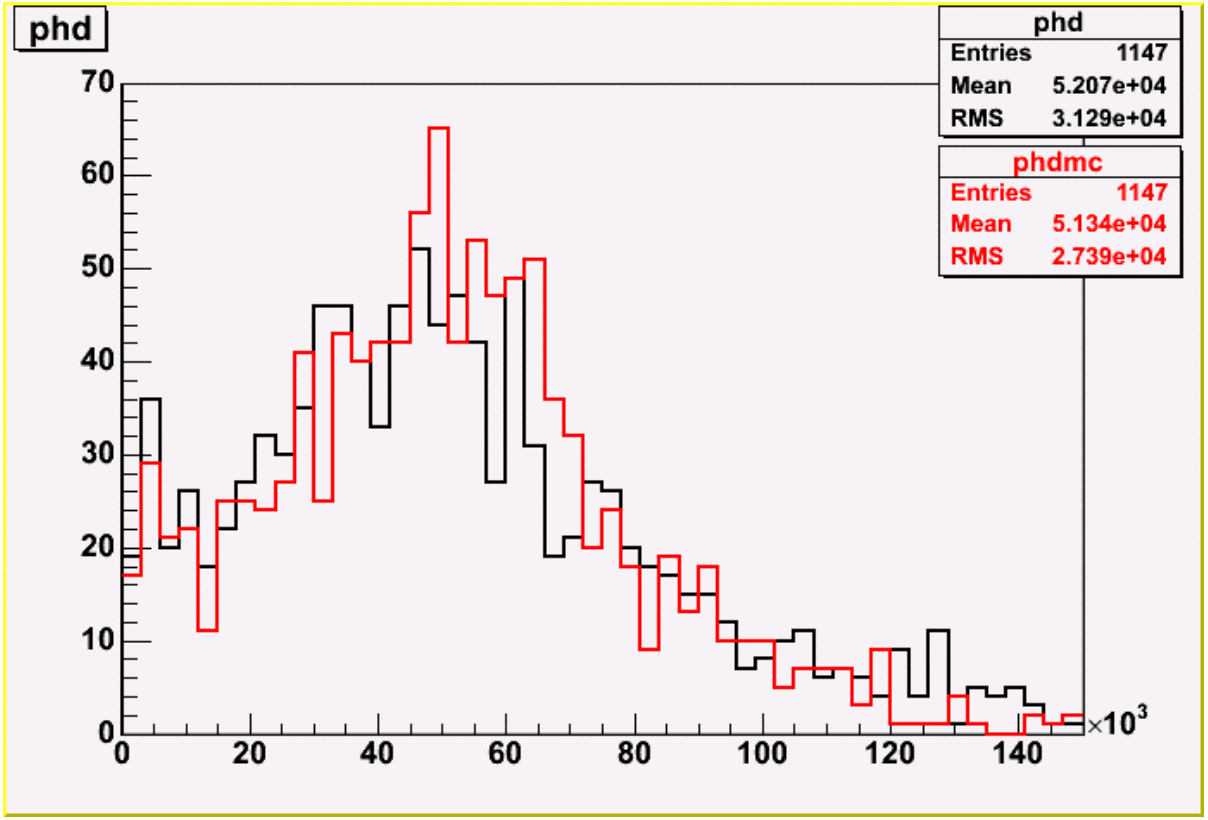
- No physics in these plots. It is just nice that we start to see the details of the detector with the data we have (partial, full region, coil e.t.c)

Event characteristics : Length (events in fiducial region)



- **MC events have a slightly large number of planes. Need to re-examine with proper slicing and if it persists study where it is coming from.**

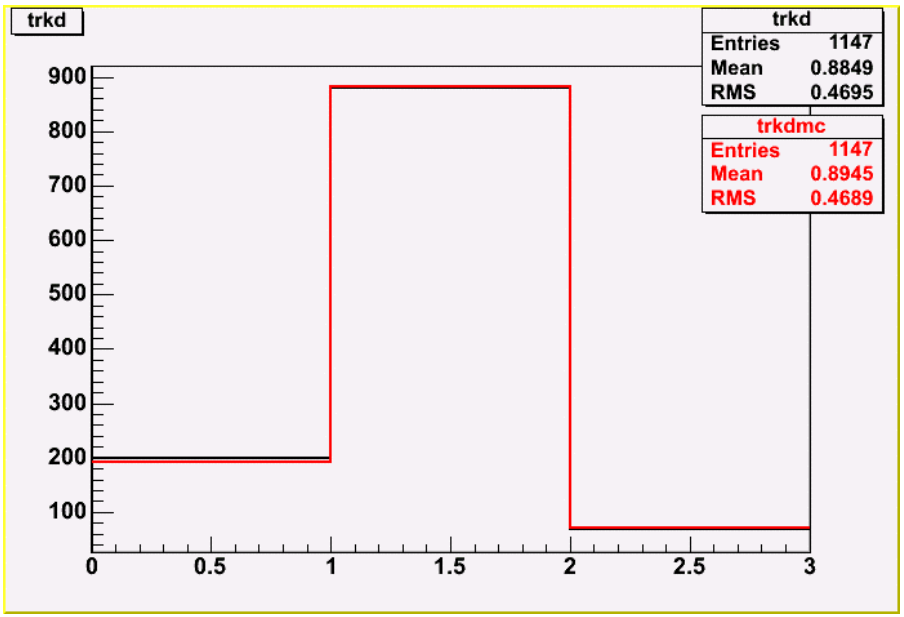
Event characteristics : Total PH (events in fiducial region)



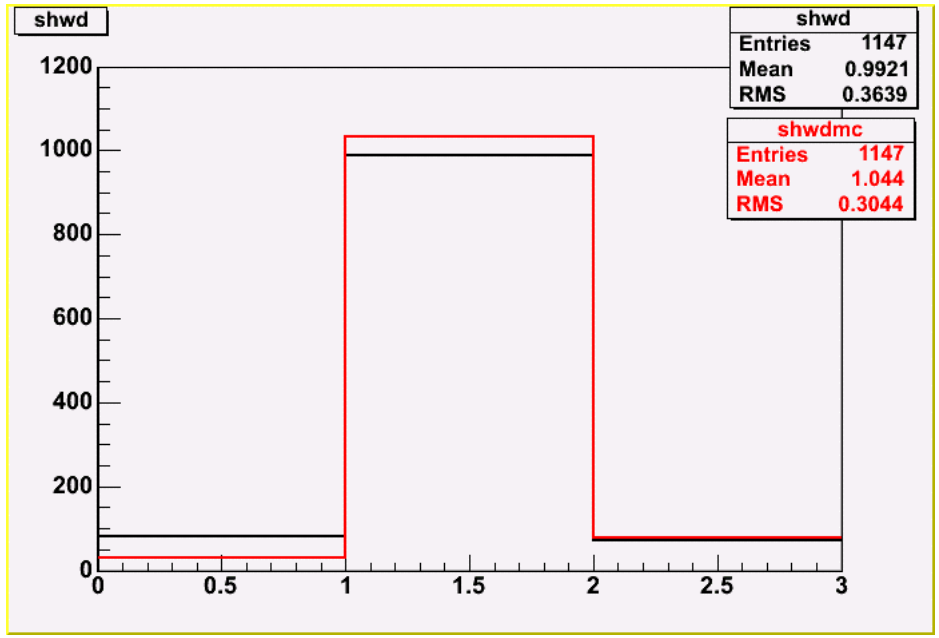
- **Module lack of calibration & slicing (and ADC threshold effects) the PH distributions look quite similar between data and MC. (MC is slightly higher than data).**

Event characteristics : # tracks & showers (events in fiducial region)

Num ber of tracks

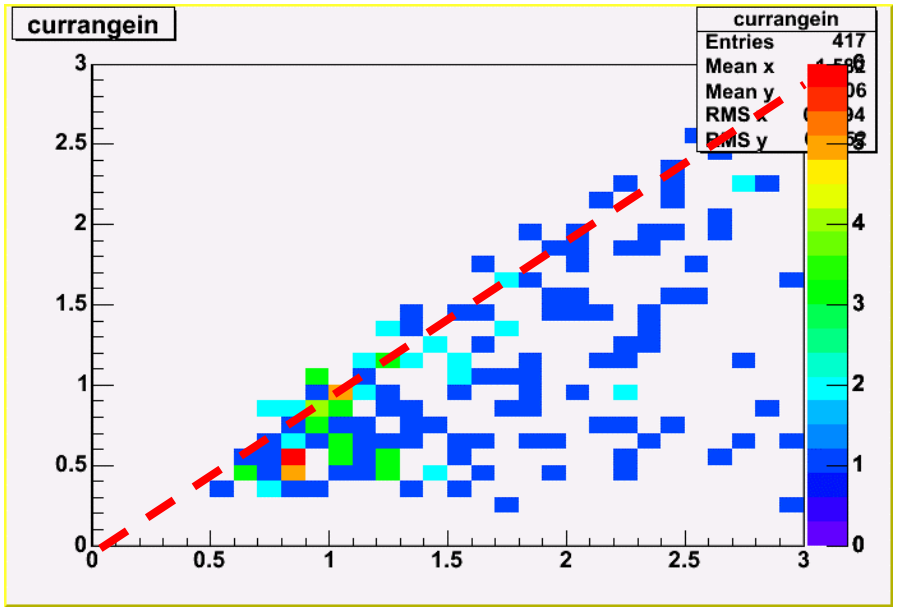


Number of showers

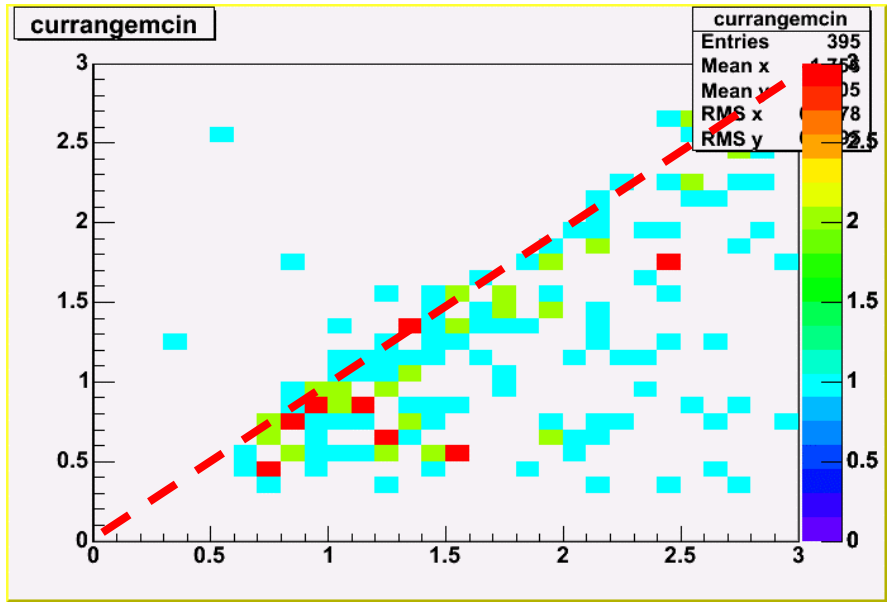


- Number of tracks and showers look suspiciously similar between data and MC…(!)
- The MC seems to have a slightly larger number of showers…
- Need to check again with more correct slicing.

Event characteristics : Track momentum



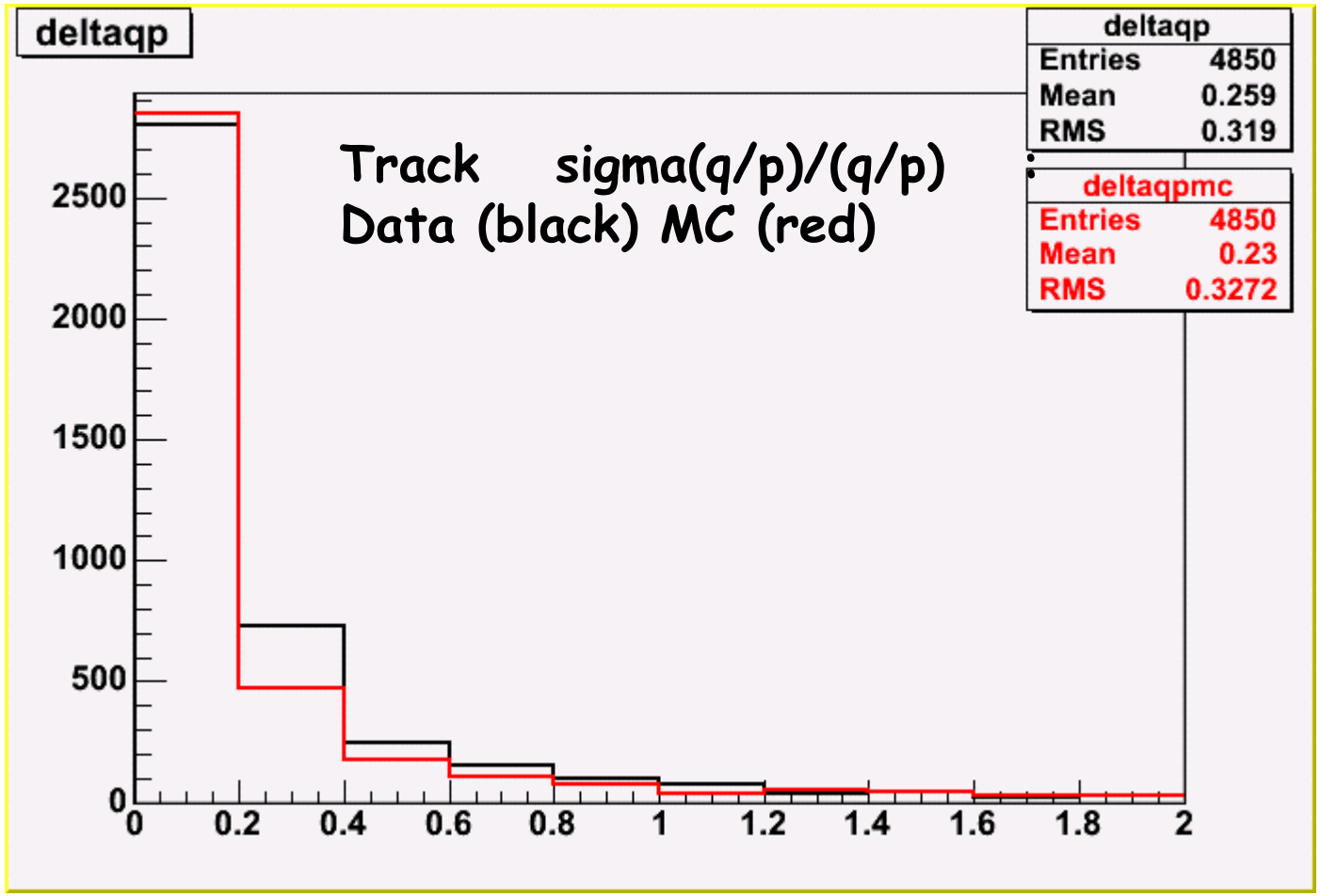
Range vs curvature Data



Range vs curvature MC

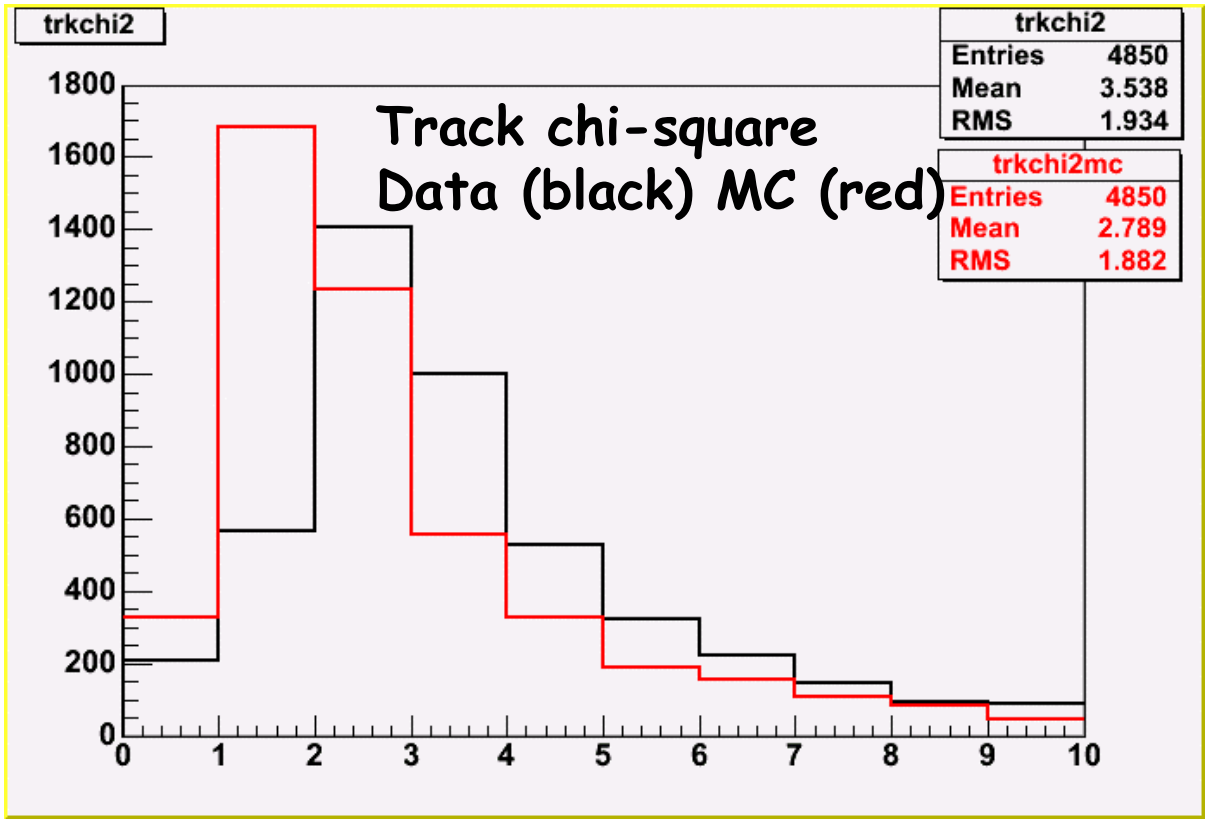
- We know momentum from curvature is not right.
- Apparently the behavior of data and mc are quite close…
- I want to check again using Sergei's fitter that DOES not use range measurement in the momentum from curvature calculation to see (now with more statistics) how that fit momentum behaves…

Event characteristics : Track sigma(q/p)/(q/p) (All tracks)



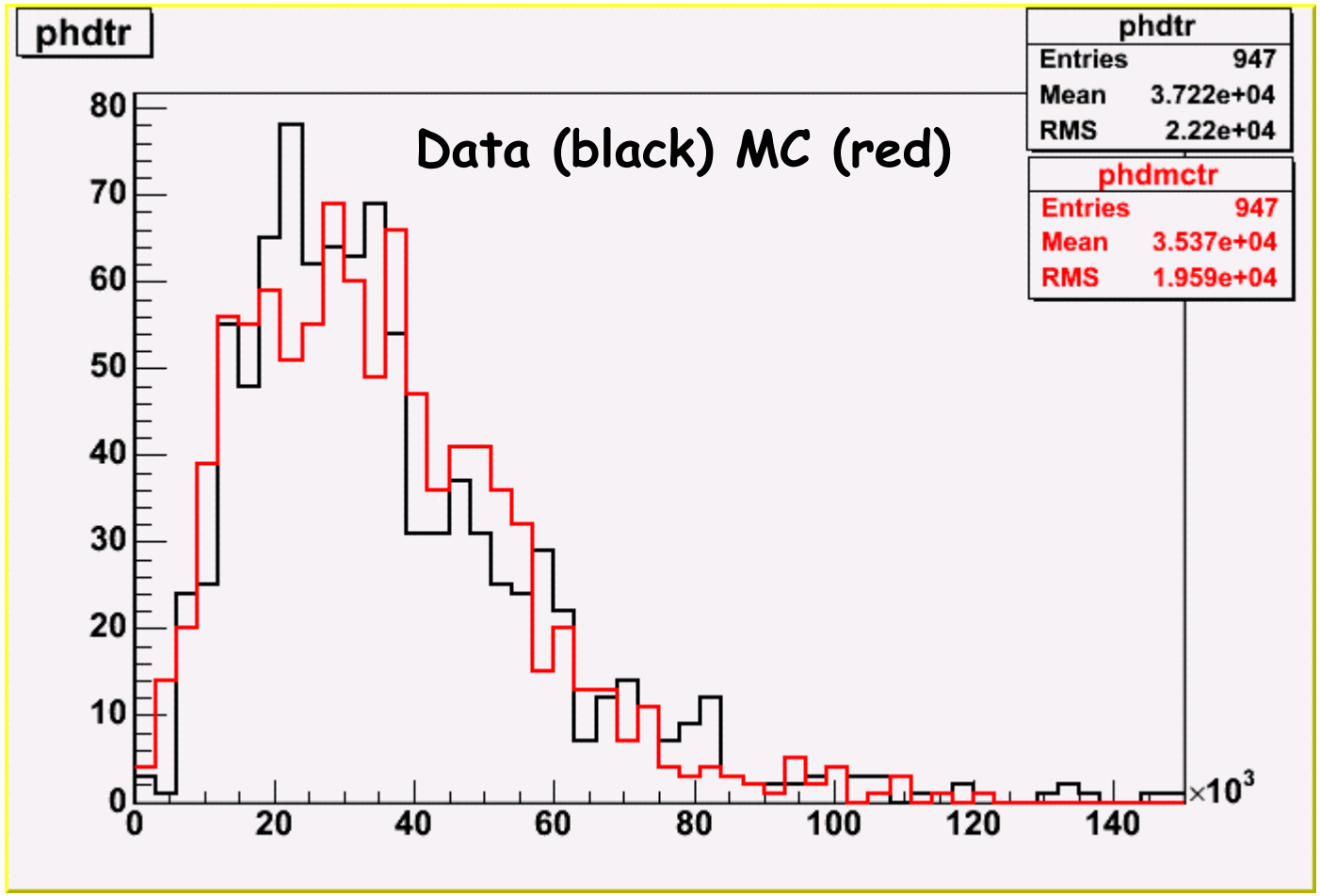
- **Track sigma(q/p)/(q/p)** starts to show differences between data and MC that could reflect the fact that we are using the wrong field map.
- Interesting thing to check again when Magnet ON.

Event characteristics : Track Chi-square (All tracks)



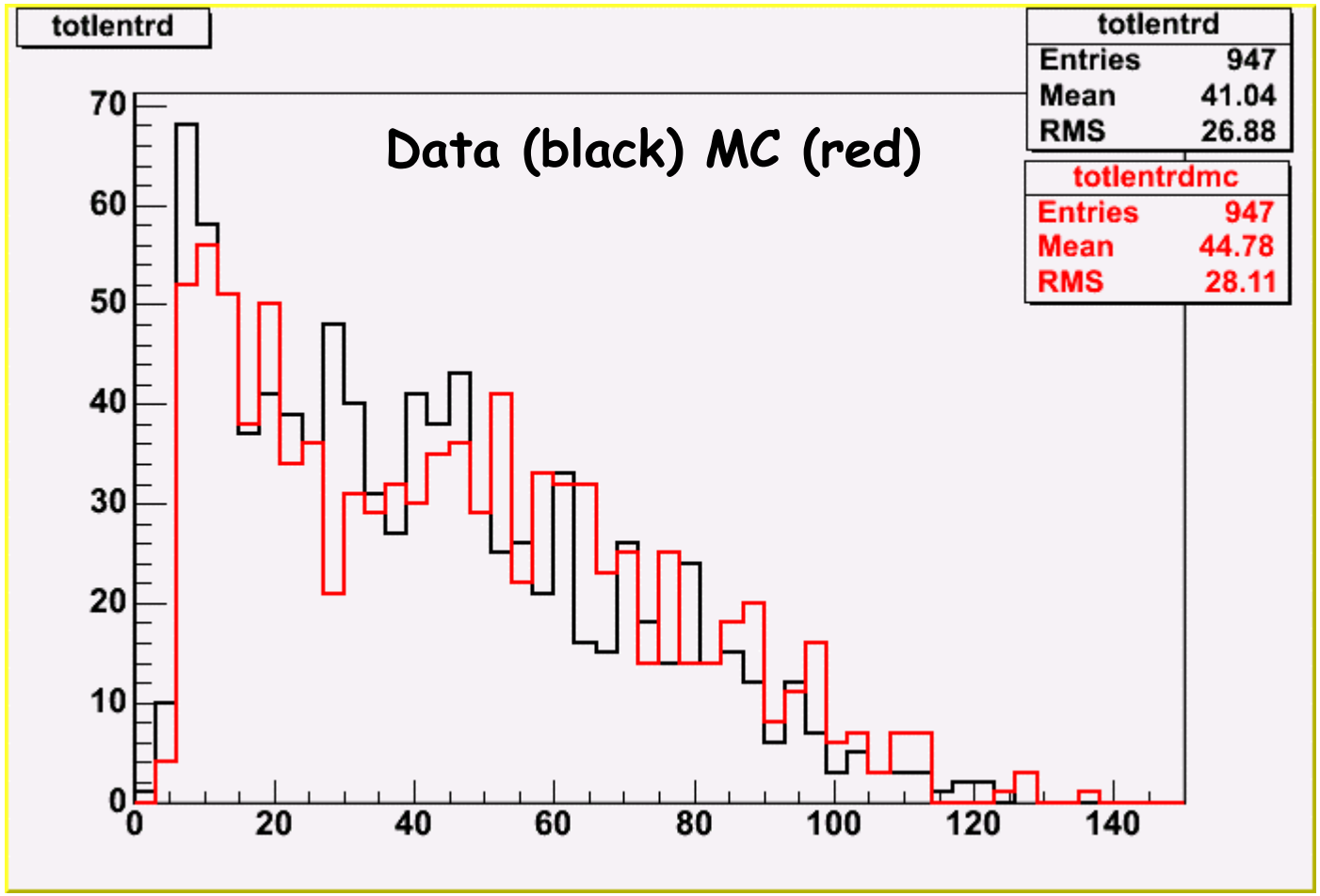
- Track chi-square for DATA larger than MC as expected.

Event characteristics : Track PH (events in fiducial region)



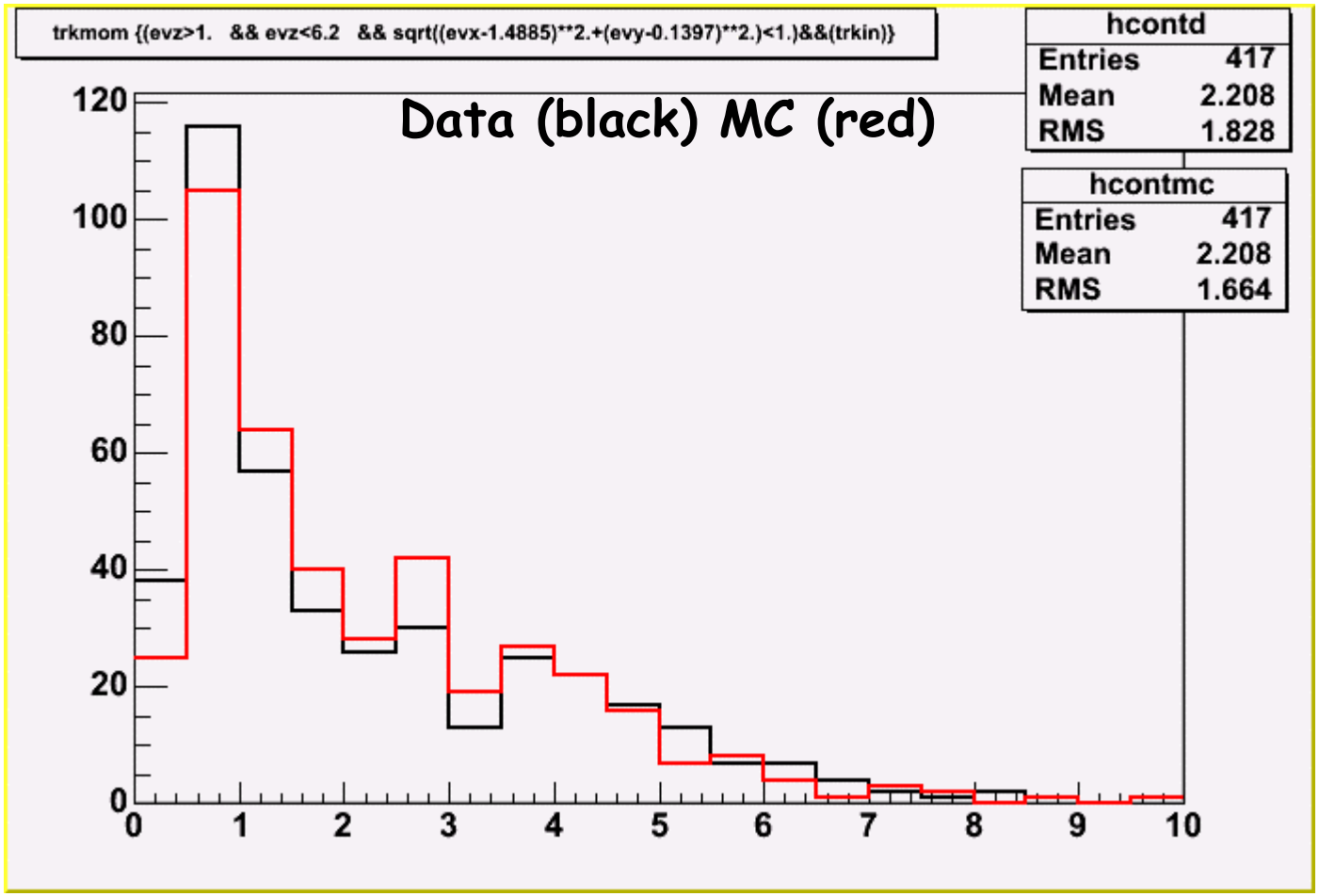
- No big differences in track PH…

Event characteristics : Track Length (events in fiducial region)



- Slightly longer MC events…but overall OK
- Redo with proper slicing & also with an MC with higher intensity from Alysia.

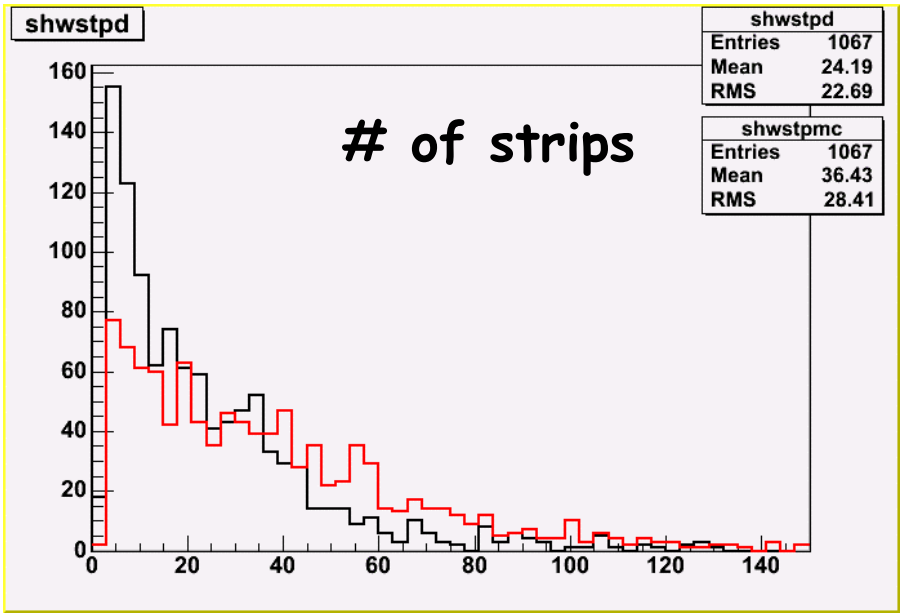
Event characteristics : Track momentum from range (stopping tracks)

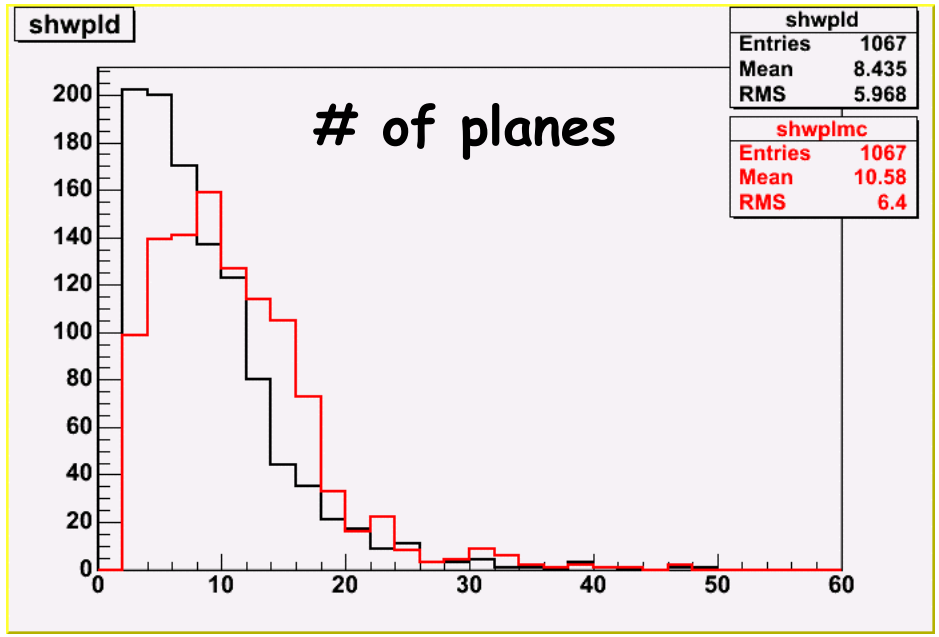


•Lower number of data in the first bin and higher in the second which gives the same average.

• Check were this is coming from (It is in agreement with slightly shorter tracks in data…)

Event characteristics : Shower # of strips and # of planes

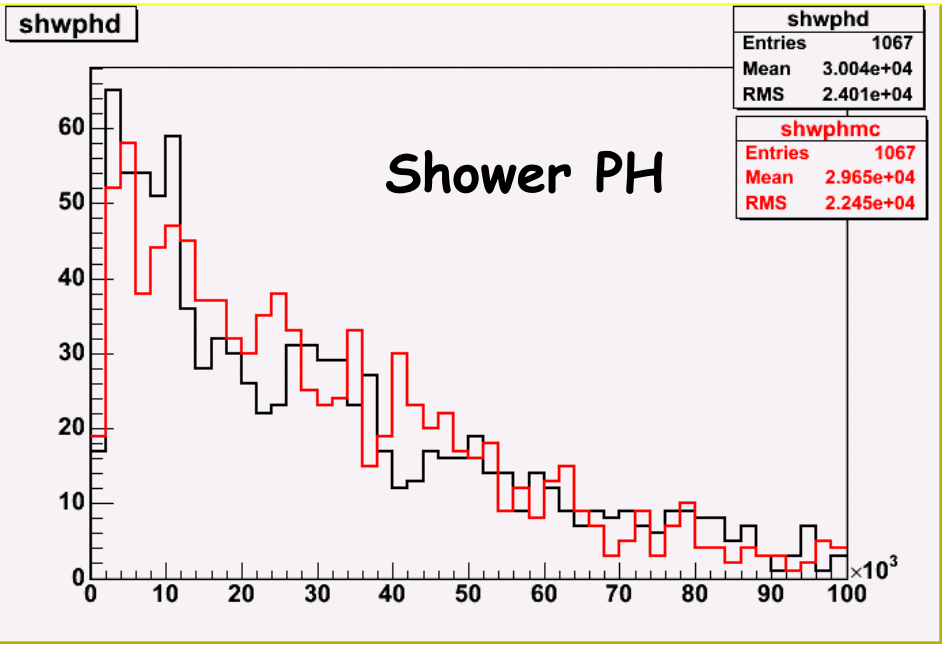


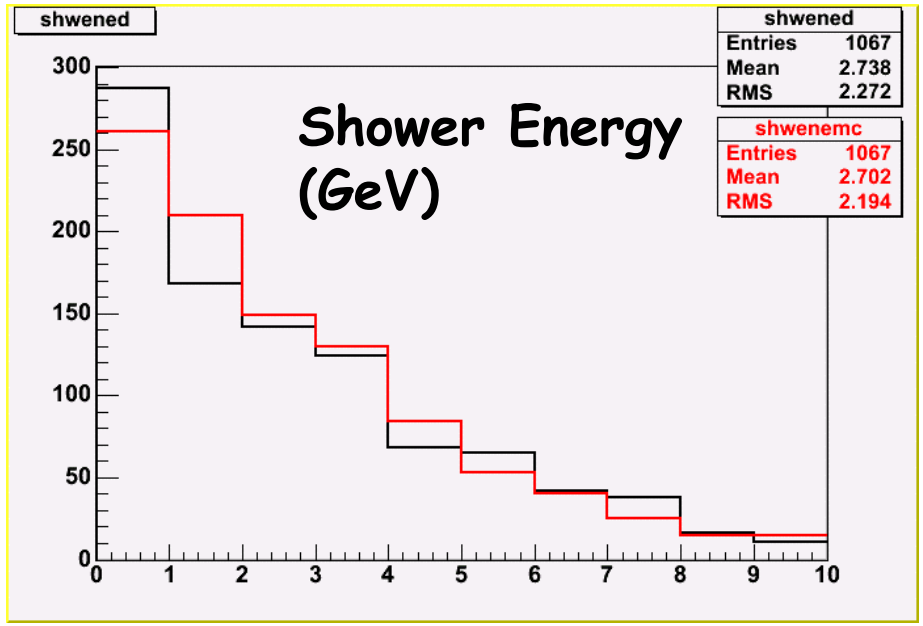


Data (black) MC (red)

- Clearly smaller shower in data both in number of strips and number of planes (length).
- Need to check…(slicer could be affecting that)

Event characteristics : Shower PH and Energy (GeV)

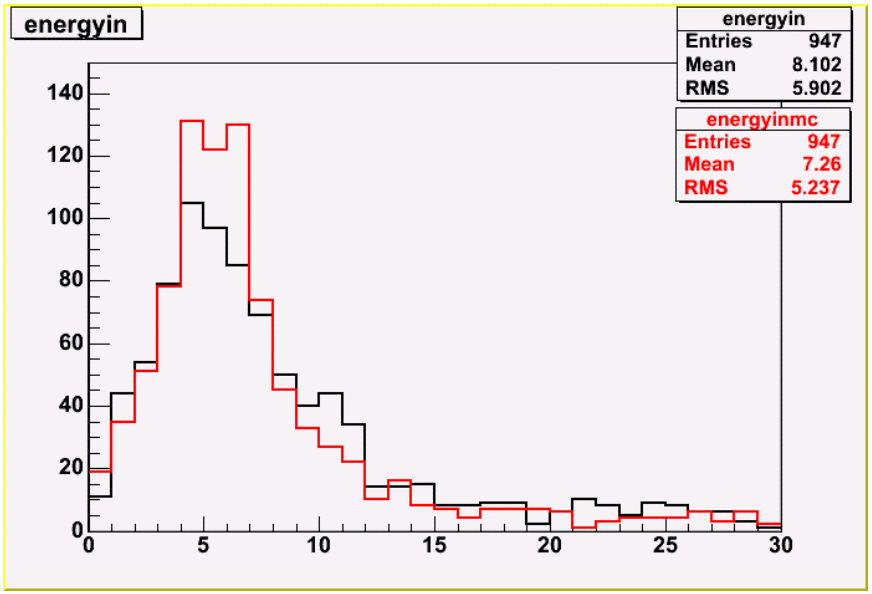


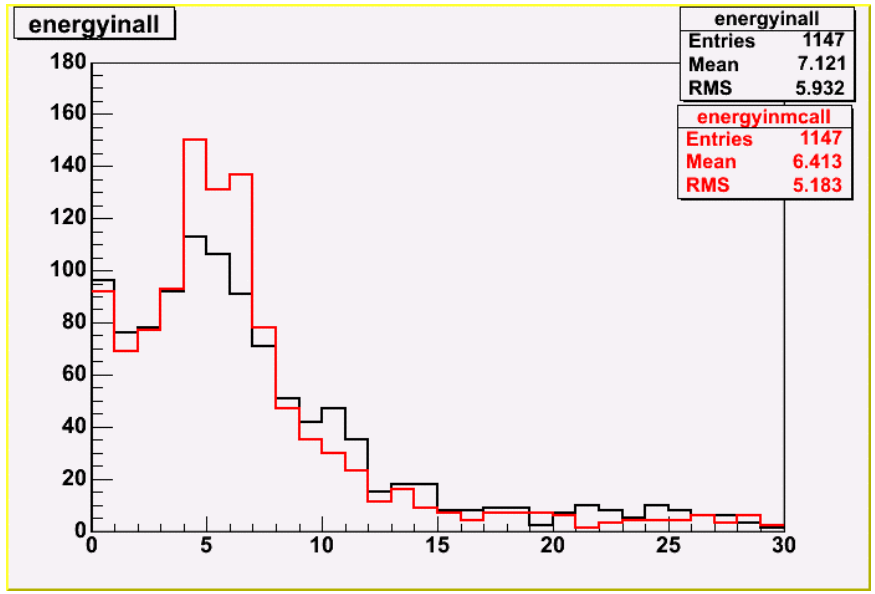


Data (black) MC (red)

- MC Slightly higher PH distribution than data (larger MC showers) which is reflected in the higher Shower energy estimation in GeV.
- No big differences observed overall..

Event characteristics : Neutrino energy **(VERY PRELIMINARY**



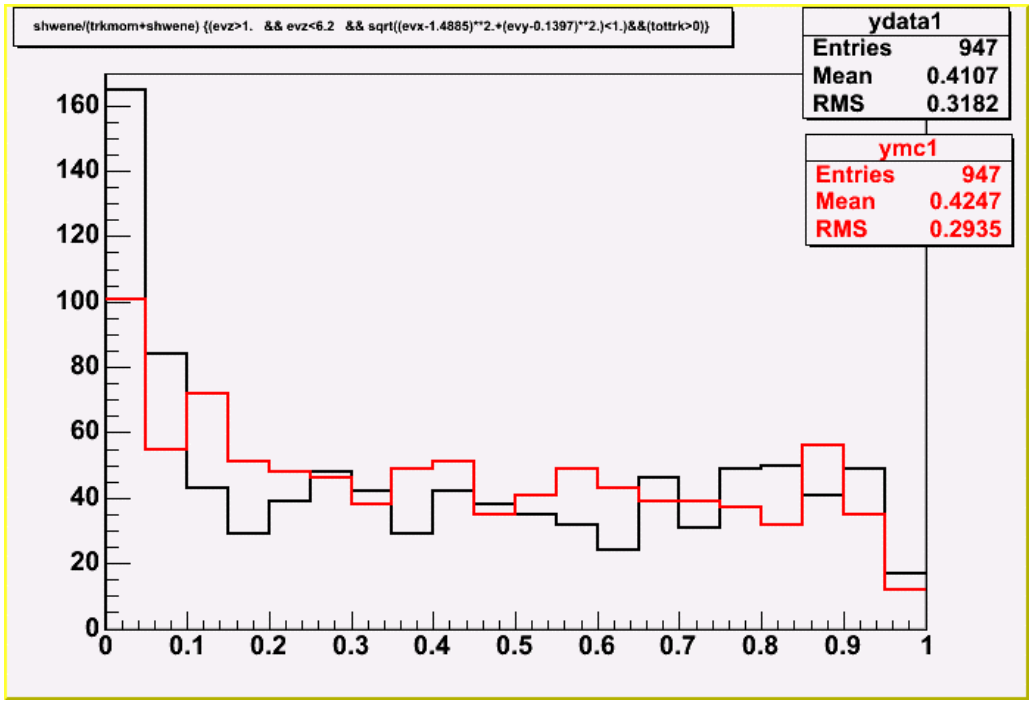


Events with tracks (in fiducial region) **Al Events (in fiducial region)**

- We know muon momentum estimation from curvature is wrong. Most of these events do not having stopping muons so I don't know how much to believe the above distributions.

- Given the above they look similar (with the MC being more peak than the MC…

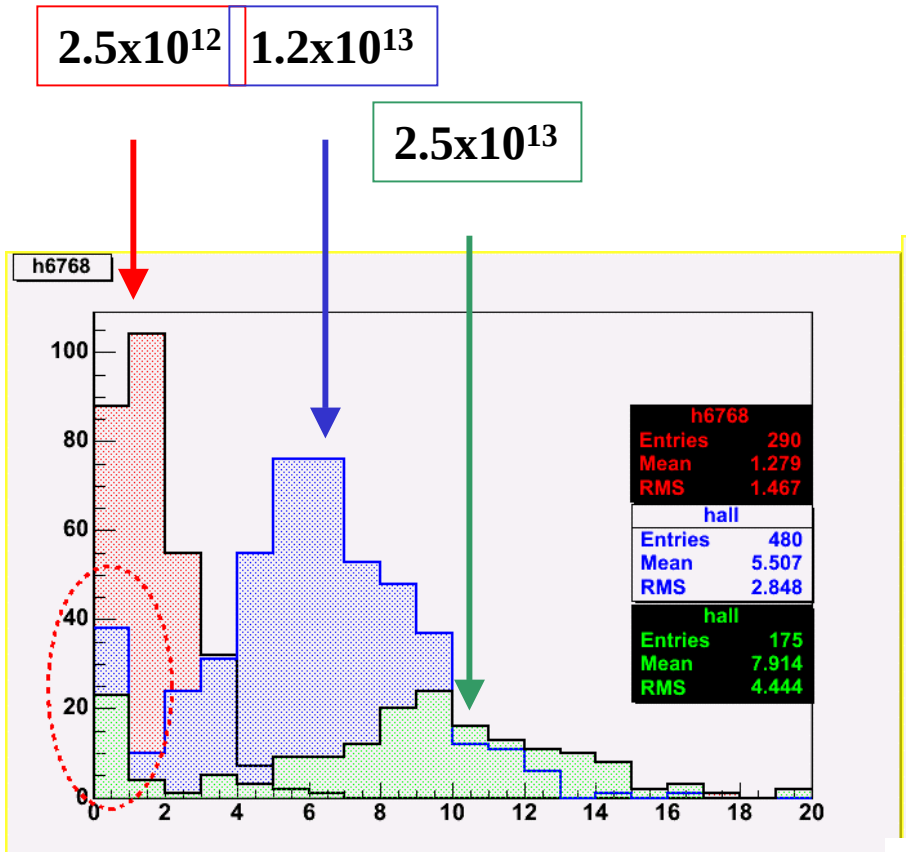
Event characteristics : Y (VERY PRELIMINARY



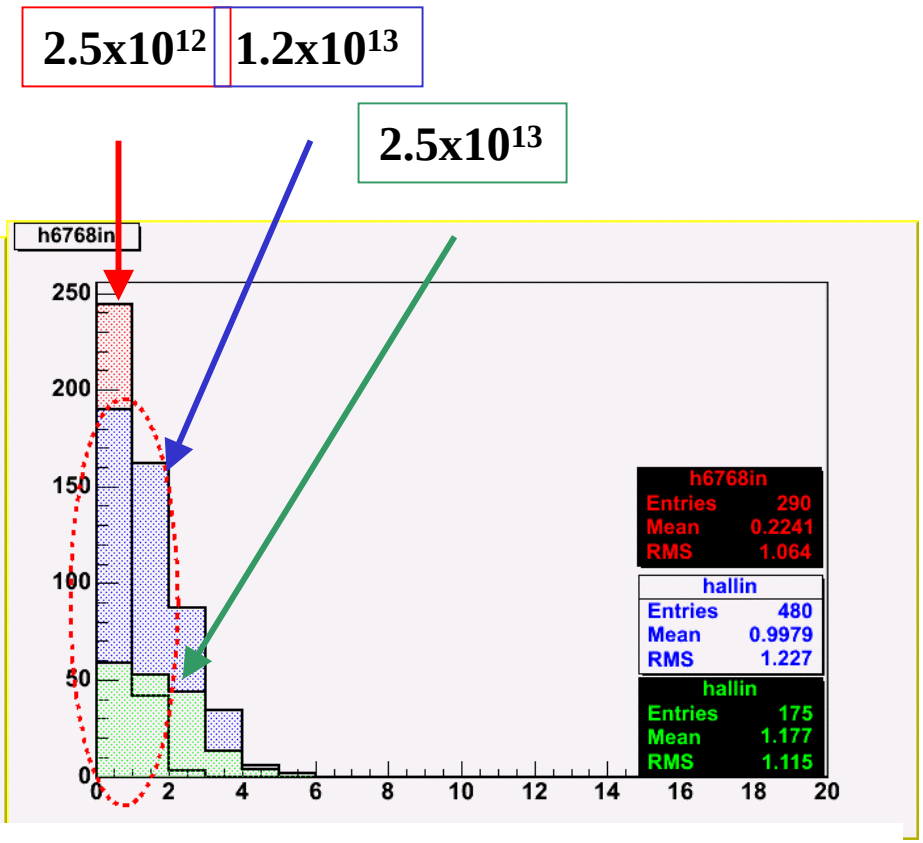
Events with track in fiducial region

- Y distribution is not suspiciously clustered in any region.
- It has the MC trend.
- It shows a higher peak at lower Y due to lower shower energy estimation?
- Need to check with proper muon momentum estimation

Events per Snarl (spill)



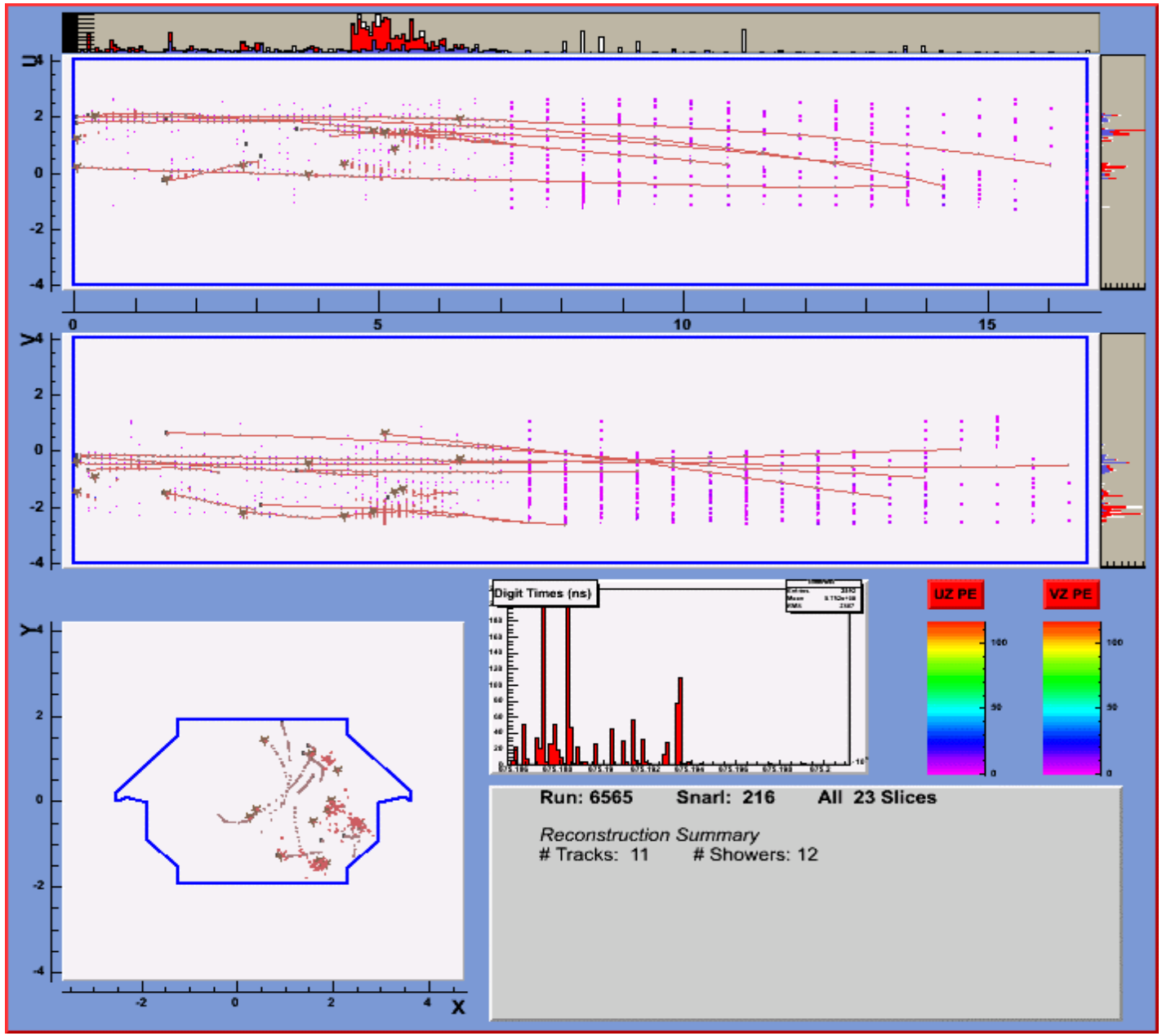
total number of events per spill



total number of events per spill in fiducial region

- From previous calculations (for the 2.5x10^12 running) things event rates were very close to what expected.
- Now things seem to be scaling nicely (given the not very stable running conditions I.e spill with no beam, varying intensity e.t.c)
- I guess Mark D. will expand on that issue.

What we were looking @ nearly all weekend(!!) :



Summary / On going work

- The reconstruction seems to be performing on data similar to MC..
- What we expect and what we see from this second neutrino running are in quite good agreement (either MC & reco are perfect or both data and MC wrong in a similar way…)
- I plan to look again at all these distributions with all available data processed with the correct slicer.
- After that I am going to start examining very carefully to determine where they are coming from.
- More next time…