Tuning MC and DATA for VETO

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PADME internal Meeting, 21st March 2020

OUTLINE

A first try to calculate the yield of Bremsstrahlung was done but MC and DATA were not in agreement.

Maybe a step too far

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A step back was needed
to understand better MC for PVeto and consequently
the DATA to allow the tuning DATA/MC

Step 0

Understand energy release in Veto for MC

Single Positron simulations

Step 1

MC simulation from Target and from BeW

Step 2

DATA

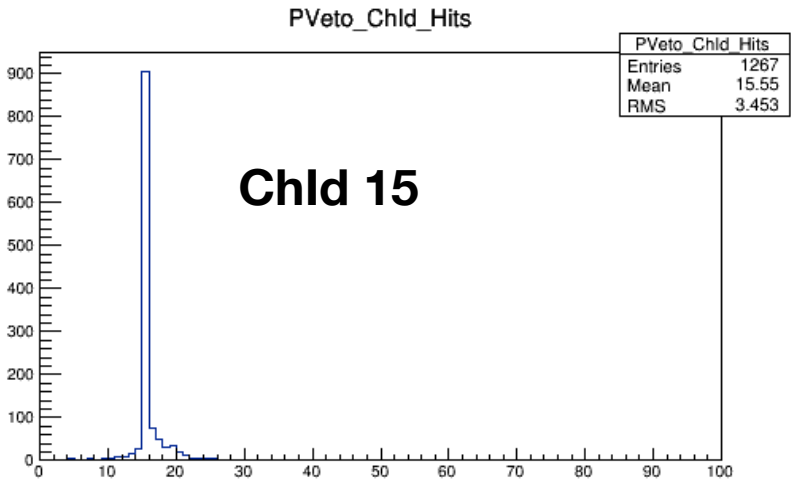
Step 3

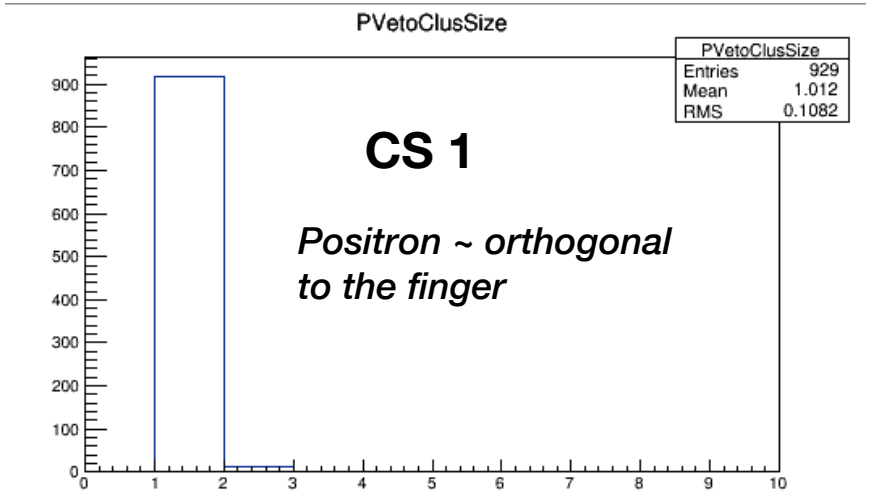
Comparison DATA/MC and tuning

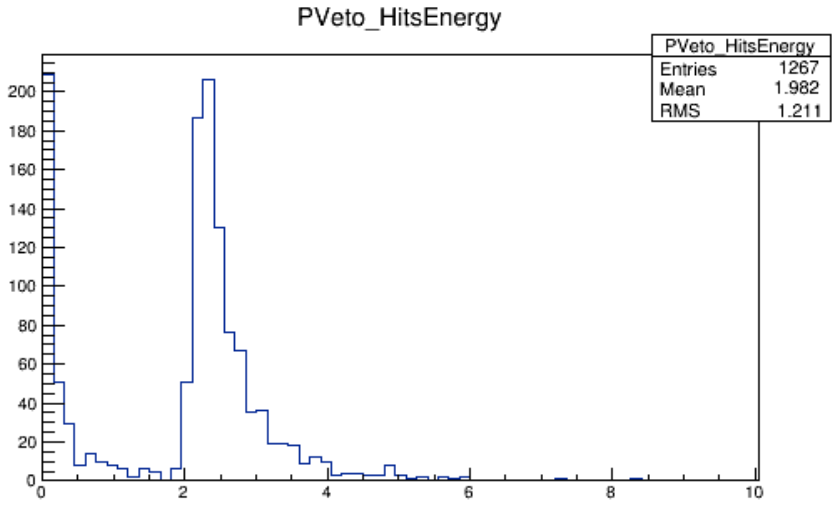
Step 0 - Single Positron MC

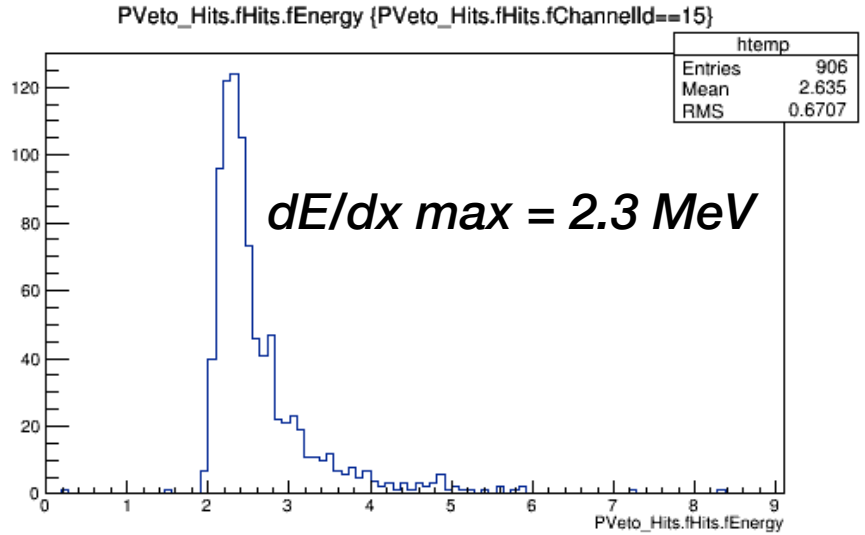
What is the energy release at most in Veto?

E=50 MeV









A mip releases in the finger ~2.3 MeV at most

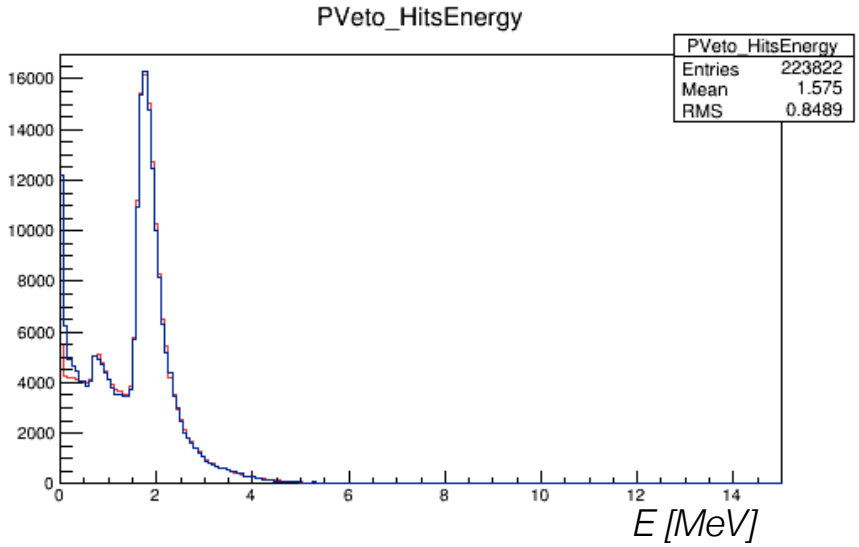
Single Positron MC

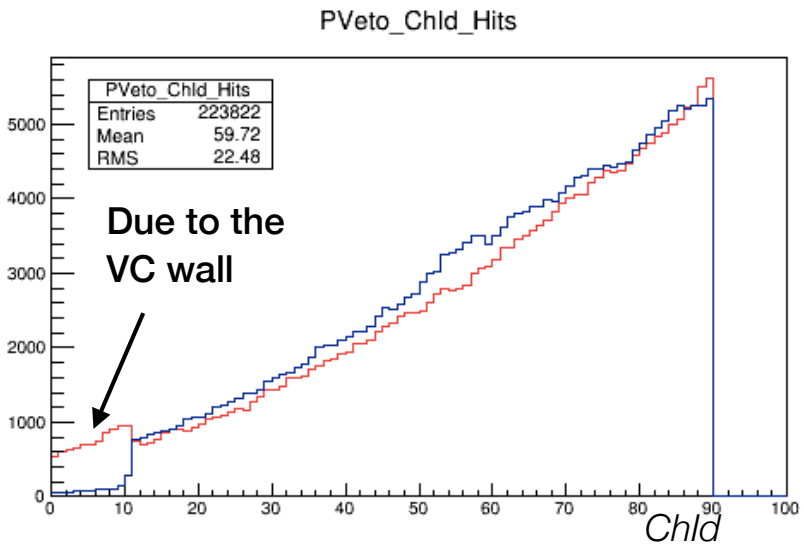
Single Positron Momentum 0.0001 MeV

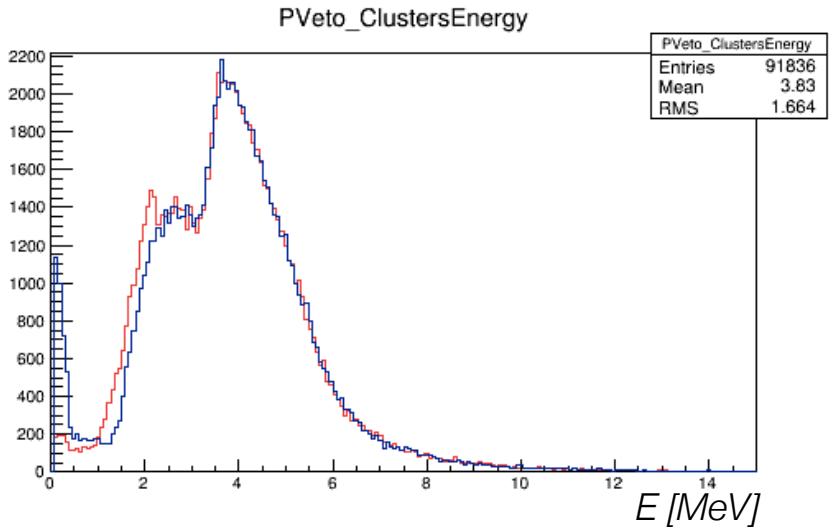
Momentum Spread Uniform distribution **[0, 500] MeV** ⟶ To hit every single finger in the PVeto with a unique simulation

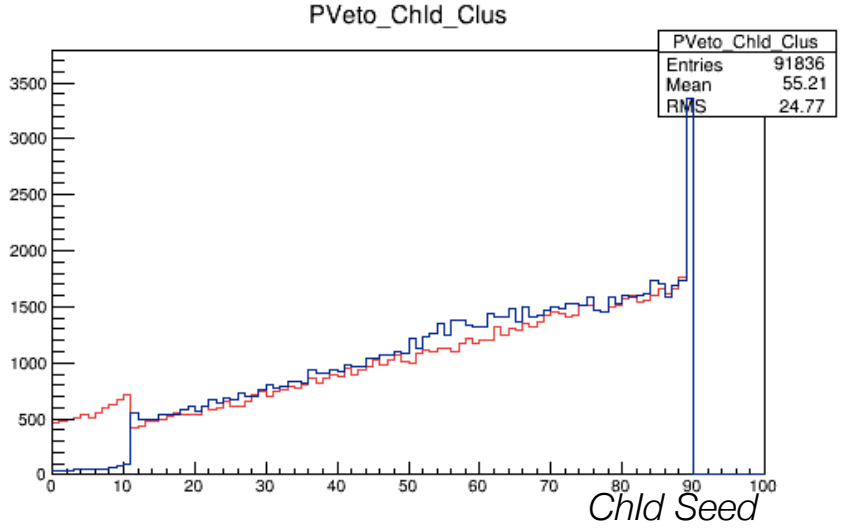
Low Clusterization Thrs Thr Seed 0.1/Hit 0.1, deltaTimeClusters 1ns **100 k events**

VC on / VC off

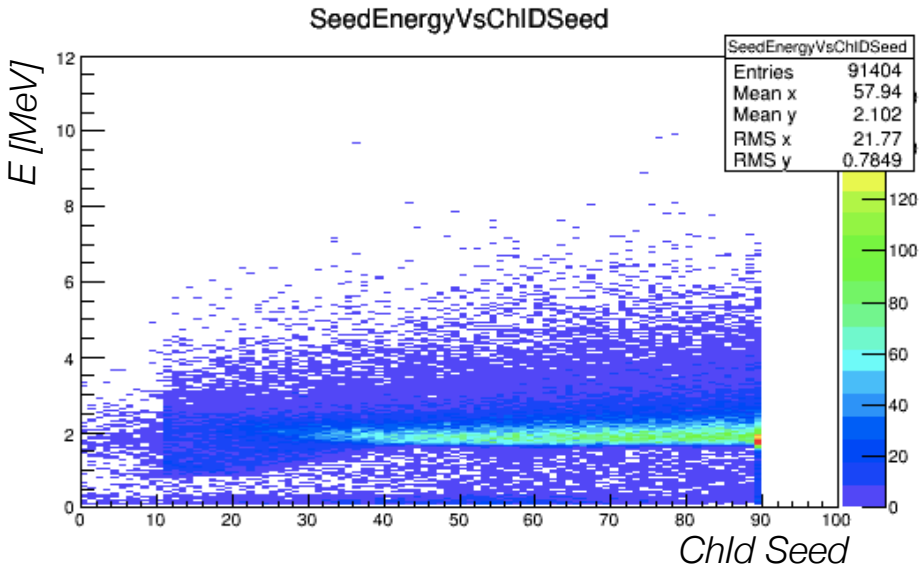


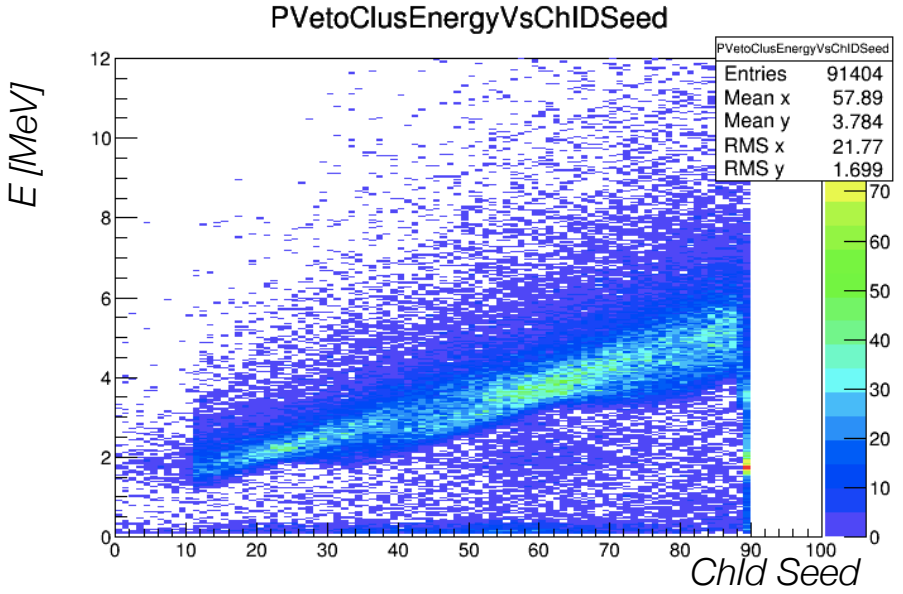


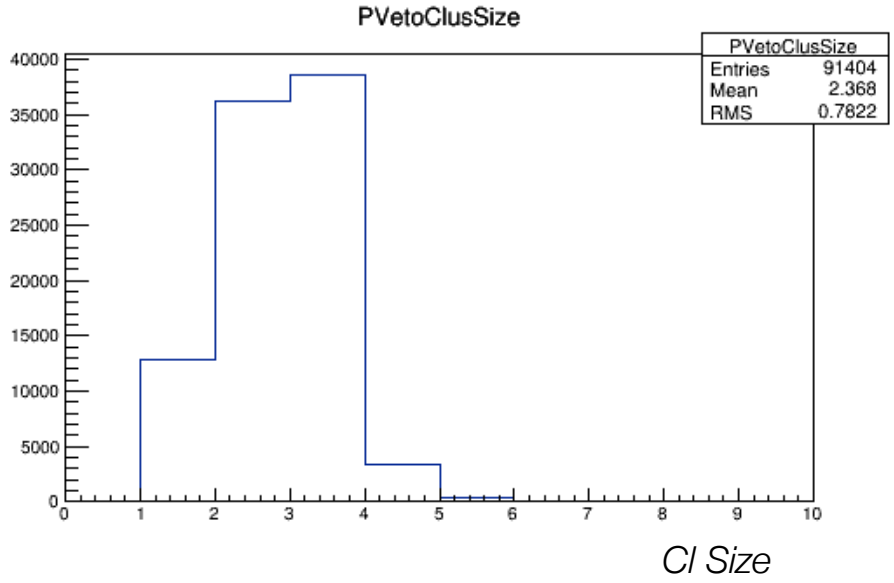


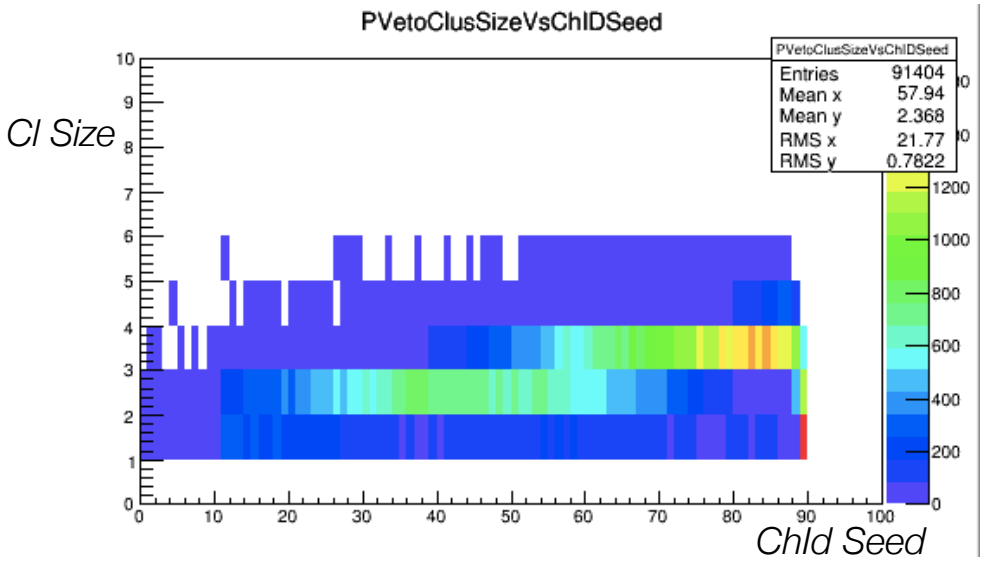


…focusing on Vacuum Chamber on









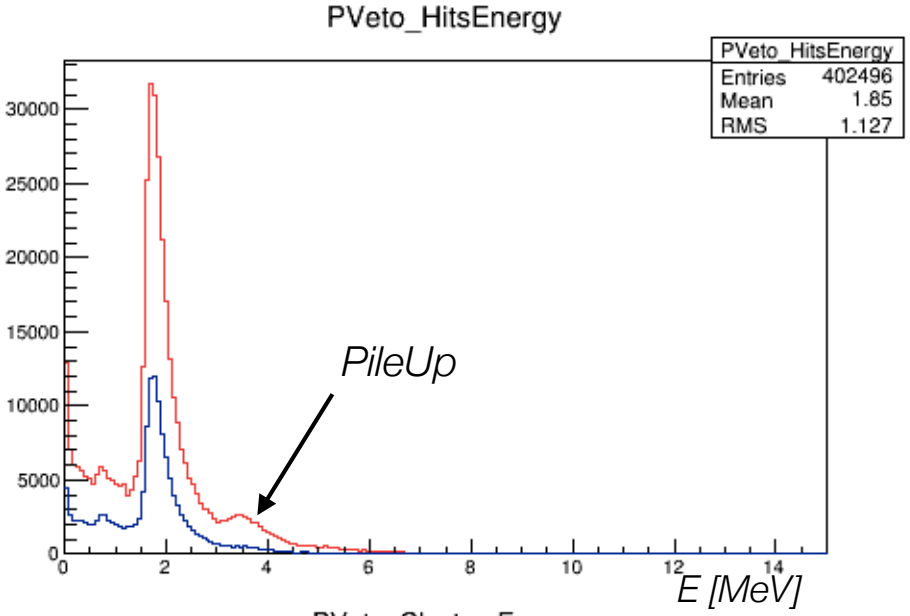
Step 1

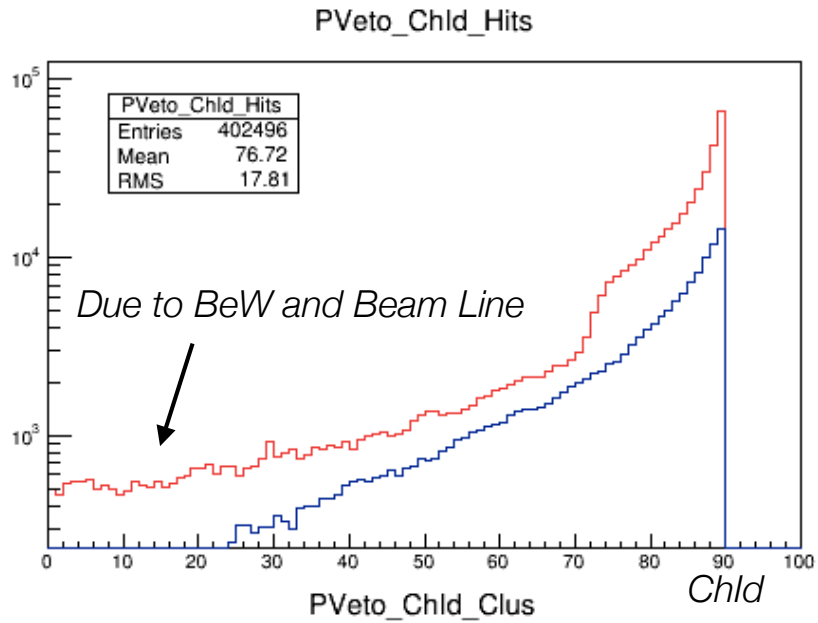
MCs comparison

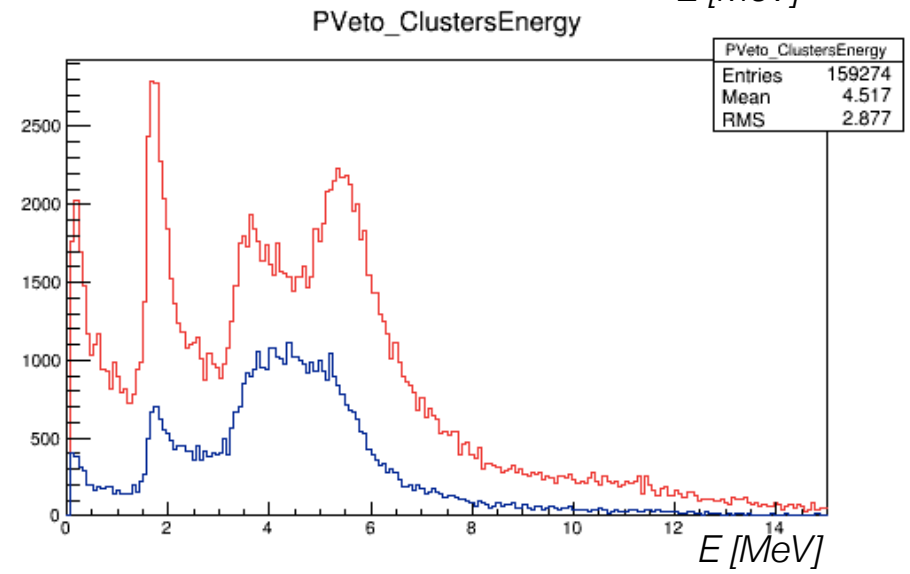
MC 23 k POT, beamFromBeW 250 ns bunch length digi 1ns

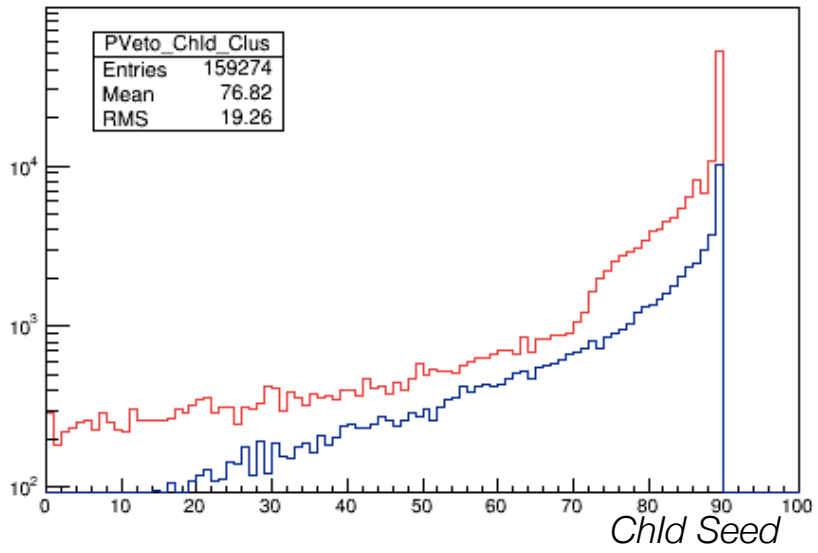
MC 23 k POT, beamFromTarget 250 ns bunch length digi 1ns

1 k events



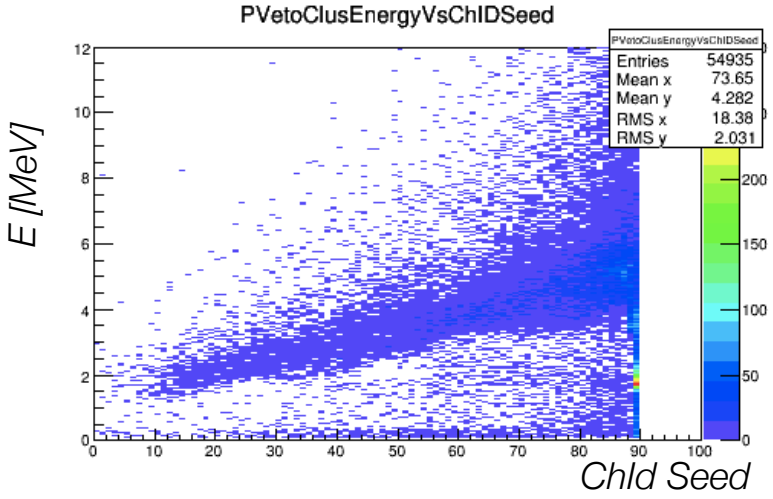


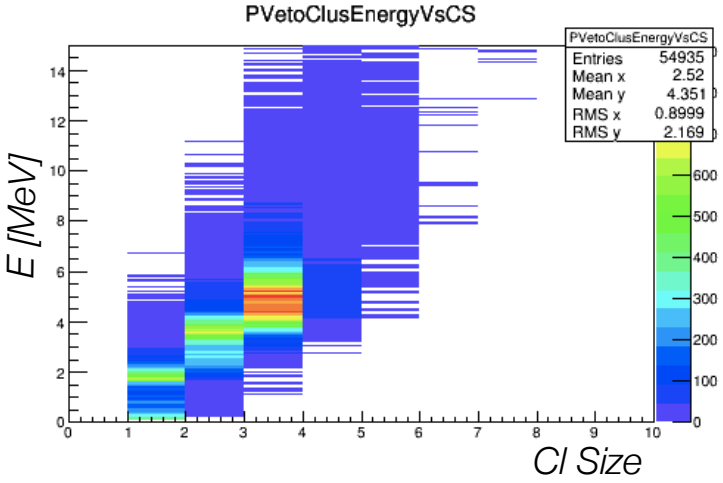




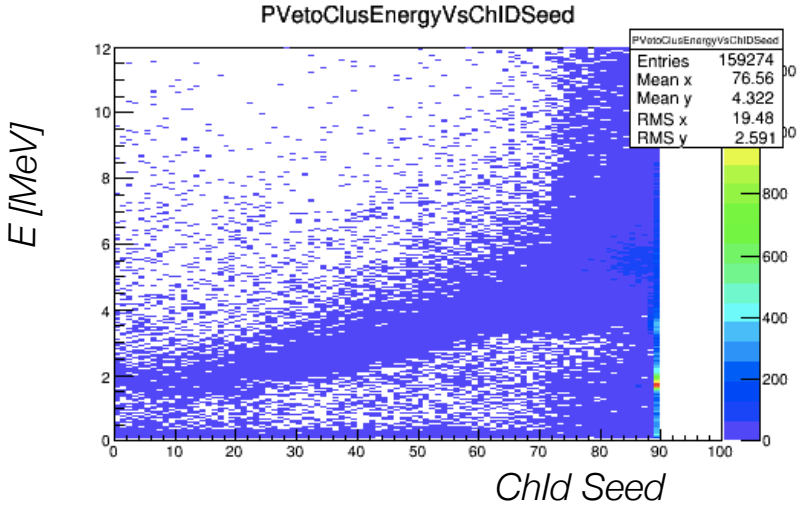
Low Clusterization Thrs Thr Seed 0.1/Hit 0.1, deltaTimeClusters 1ns

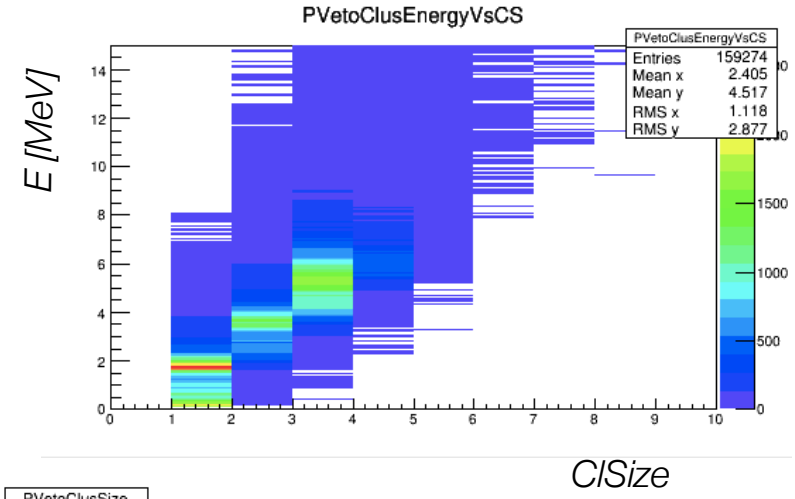
Positron beam in front of TARGET

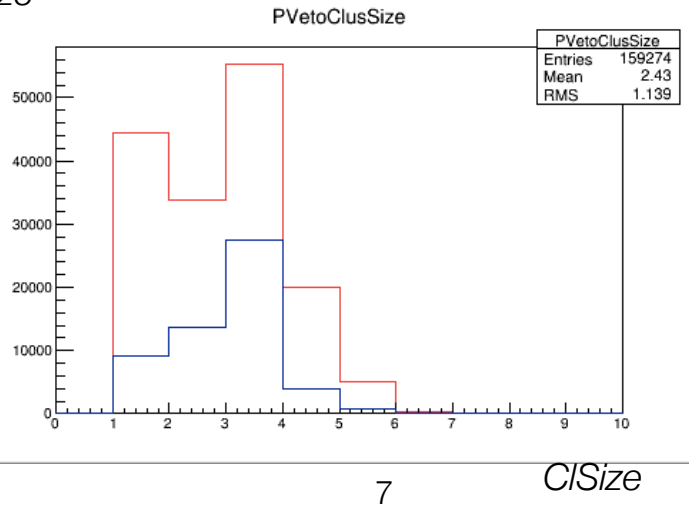




Positron beam in front of BeW

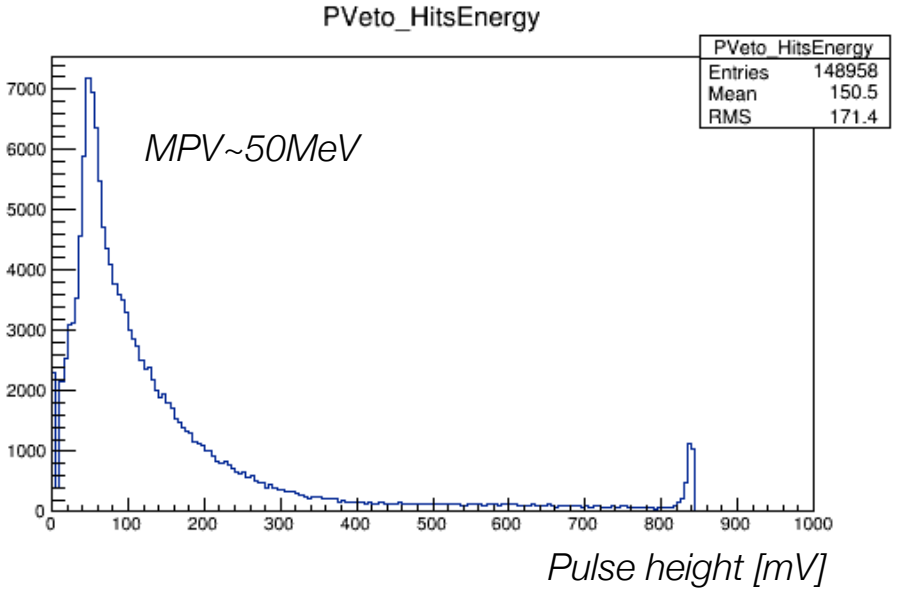






Step 2 *DATA run_0000000_20190724_152634_reco_00_009* 1 k events

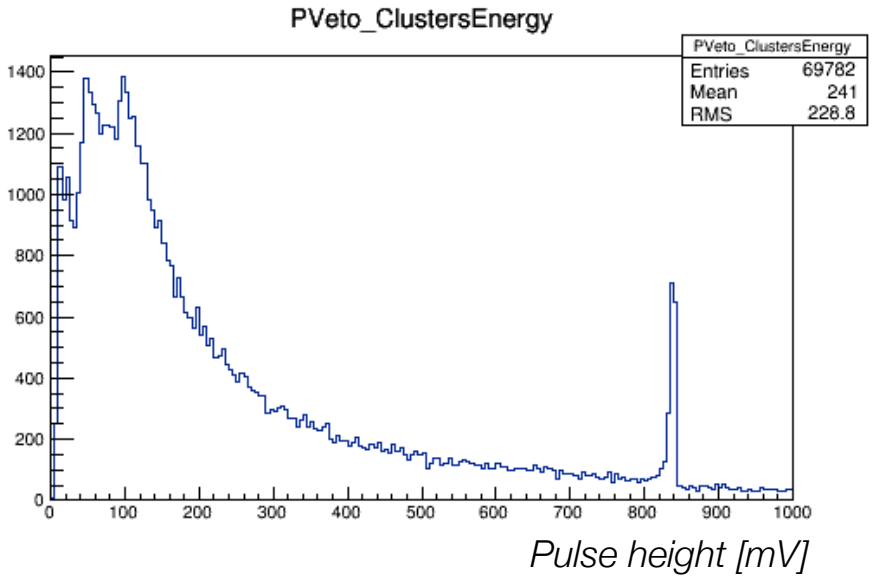
Thr Hit 2.5mV / Thr Seed 2.5 mV *DeltaTimeClusters 5ns*

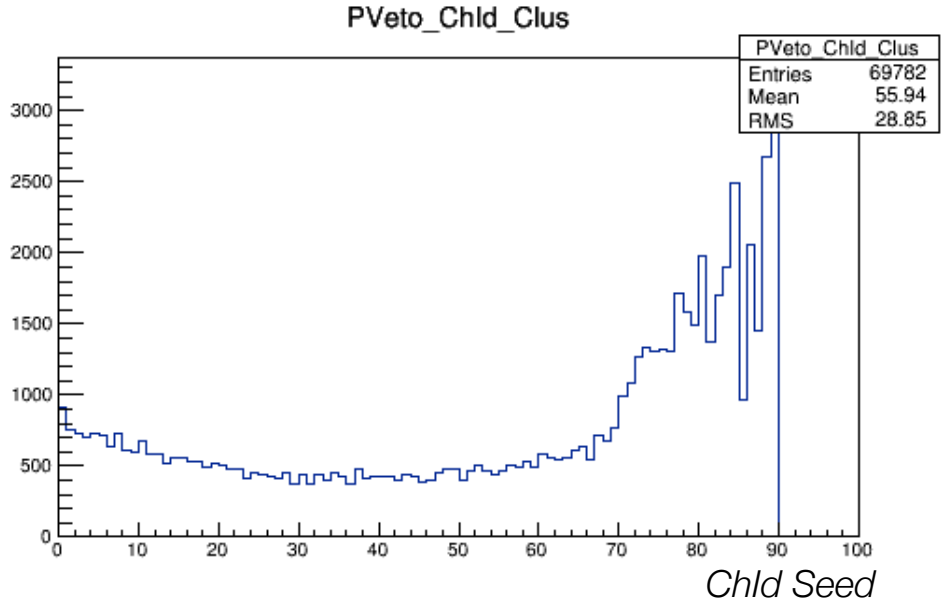


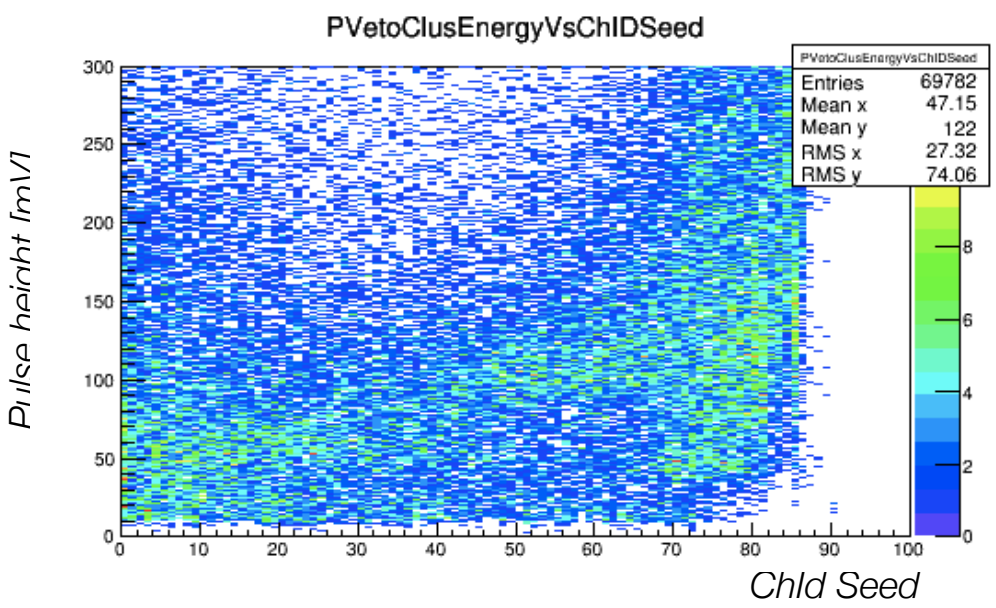
The energy associated to the hit for DATA corresponds to the pulse height of the signal. For the comparison with the MC a conversion factor is needed.

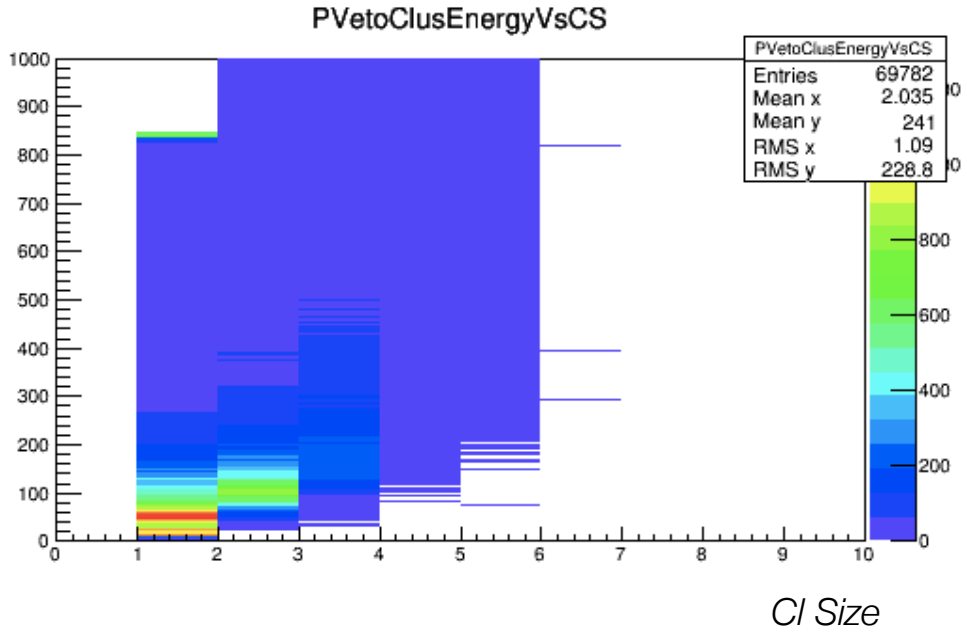
A mip in MC releases ~2 MeV in mC that corresponds to the MPV value of ~50 mV for DATA :

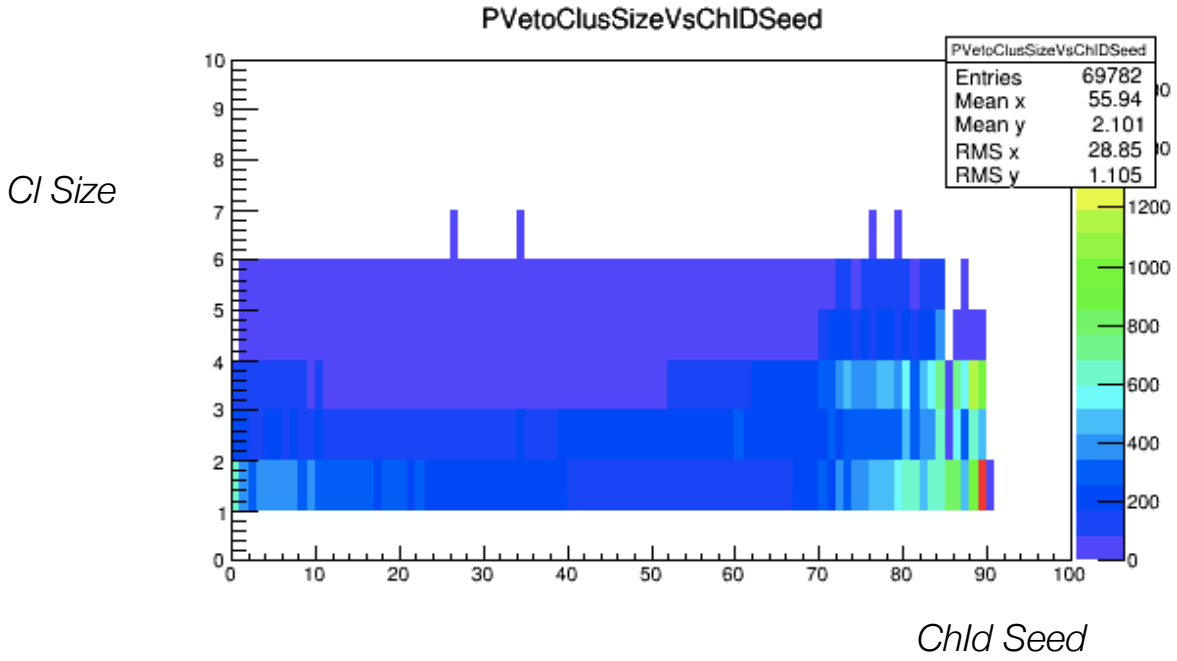
DATA Energy [MeV]=Pulse Height /(25mV/MeV)





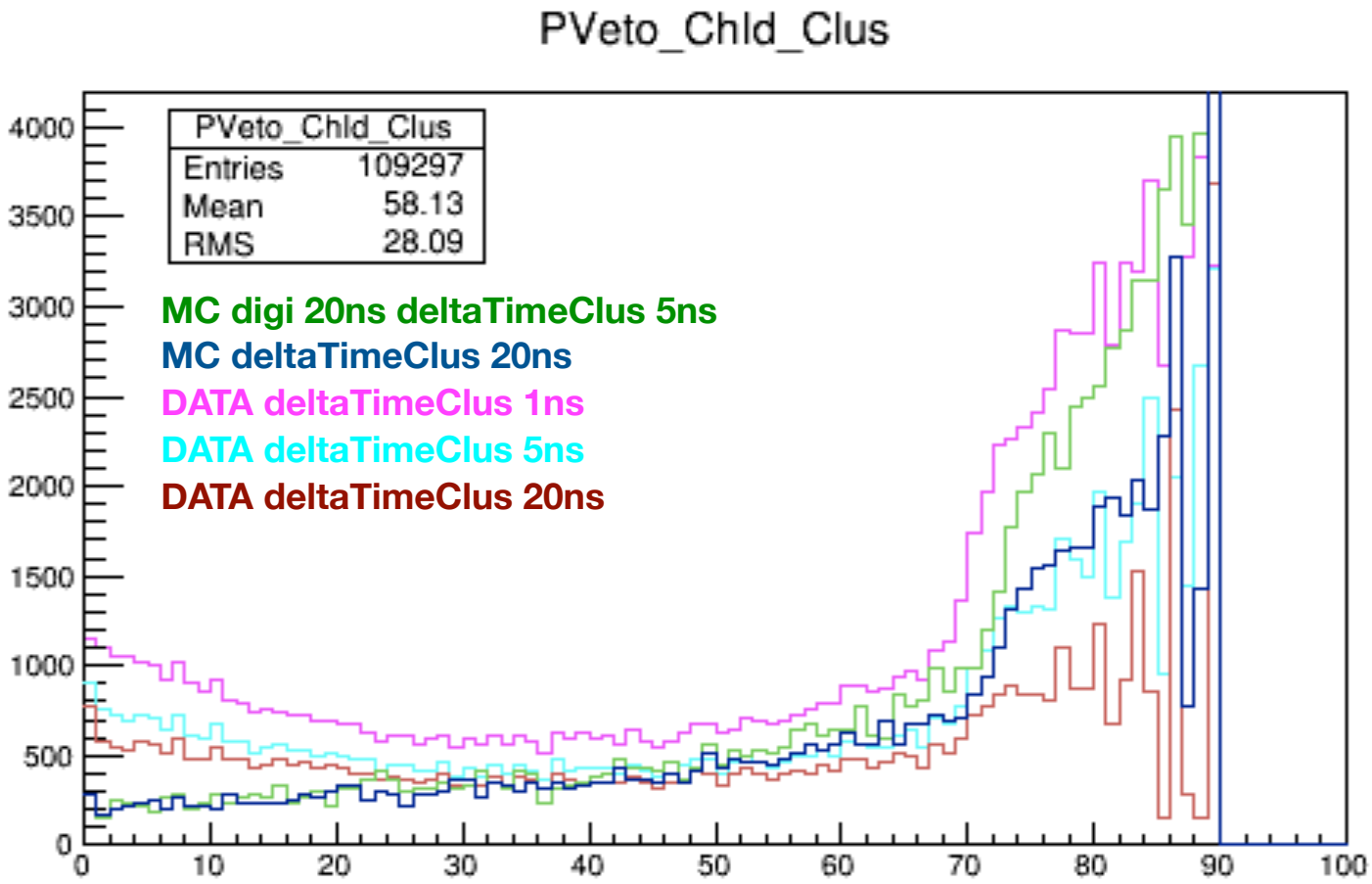

PVetoClusEnergyVsChIDSeed
PVetoClusEnergyVsChIDSeed
Entries 69782
Mean x 47.15
Mean y 122
RMS x 27.32
RMS y 74.06
Pulse height [mV]
ChId Seed


PVetoClusEnergyVsCS
PVetoClusEnergyVsCS
Entries 69782
Mean x 2.035
Mean y 241
RMS x 1.09
RMS y 228.8
Cl Size


PVetoClusSizeVsChIDSeed
PVetoClusSizeVsChIDSeed
Entries 69782
Mean x 55.94
Mean y 2.101
RMS x 28.85
RMS y 1.105
Cl Size
ChId Seed

Occupancy varying deltaTime Clusters for MC and DATA

The delta time cluster was enlarged for MC to emulate the time integration of the Veto front-end response.



A change in the MC digi time is maybe needed to compare MC and DATA. At the moment the digi time for MC is set at 5 ns in the develop.

→

Comparison between DATA and MC production with digi time = 20 ns

Step 3

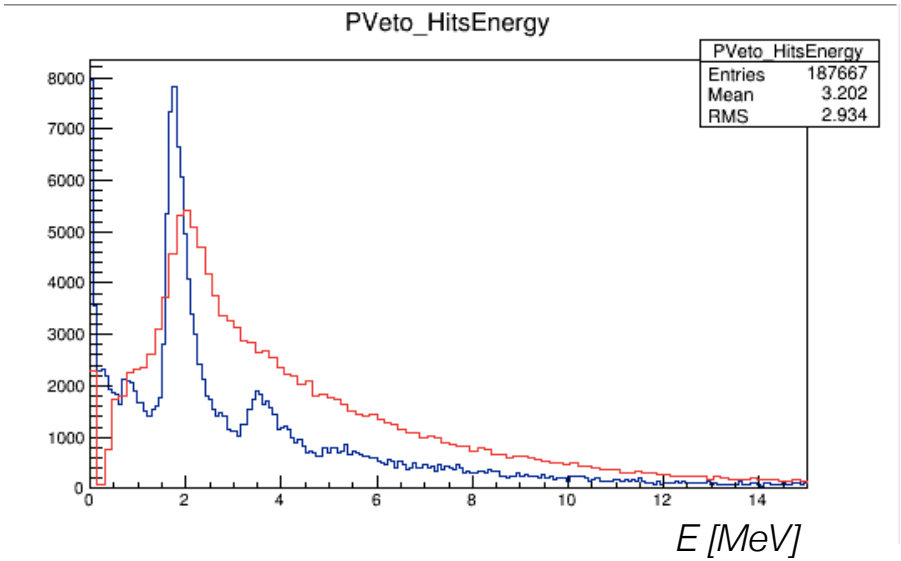
MC DATA comparison

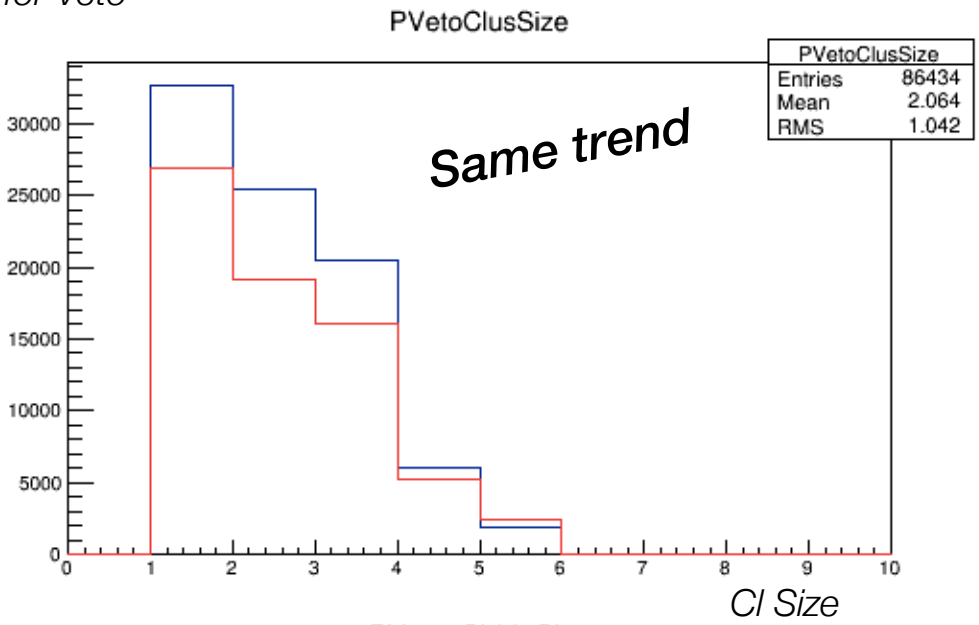
MC digi 20 ns delta cluster time 5ns / DATA delta cluster time 5ns

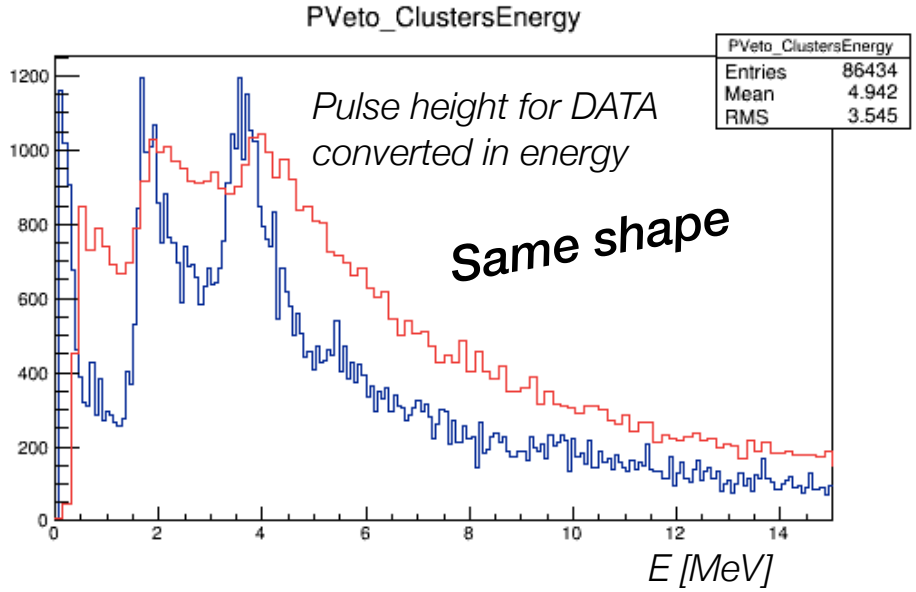
First try

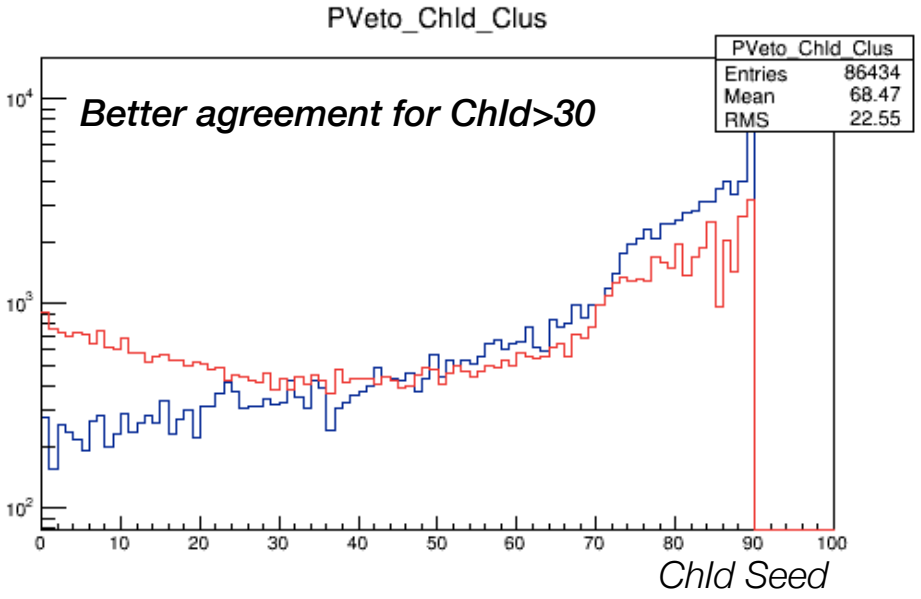
1 k events

Emulating the rising time of the signal for Veto









Conclusion

- *A comparison between MC vs DATA for veto at hits and clusters level is underway in order to understand occupancy and rate of beam background and bremsstrahlung.*

- *Simulated single positrons with flat energy distributions from 0-500 MeV allowed to understand hit and cluster energy spectrum and cluster size along z:*
  - *linear increase of energy peak and cluster size with z*
  - *a positron shadow for Veto from chId 1 to 10 is clearly visible for low energy single positrons due to fringe filed and vacuum chamber wall.*

- *Simulated sample of 23000 positrons per bunch without and with the beamline+BeW clearly show that the positron rate on the Veto is dominated by the beam-line+BeW material and not from bremsstrahlung from target.*

  -The simulation of the beamline+BeW show a positron shadow for Veto from chId 1 to 10 with significant rate and flat energy spectrum
  -The simulation of the beamline+BeW show a sharp increase of rate for chId 70

- *July data showed an energy spectrum, a cluster size and an occupancy semi-qualitative similar to MC only after hit digitization and clusterization parameters tuning.*

- *Tuning between MC and DATA is still underway.*