Few changes in develop

F. Oliva on behalf of the PADME Lecce group

Few changes in develop - Outline

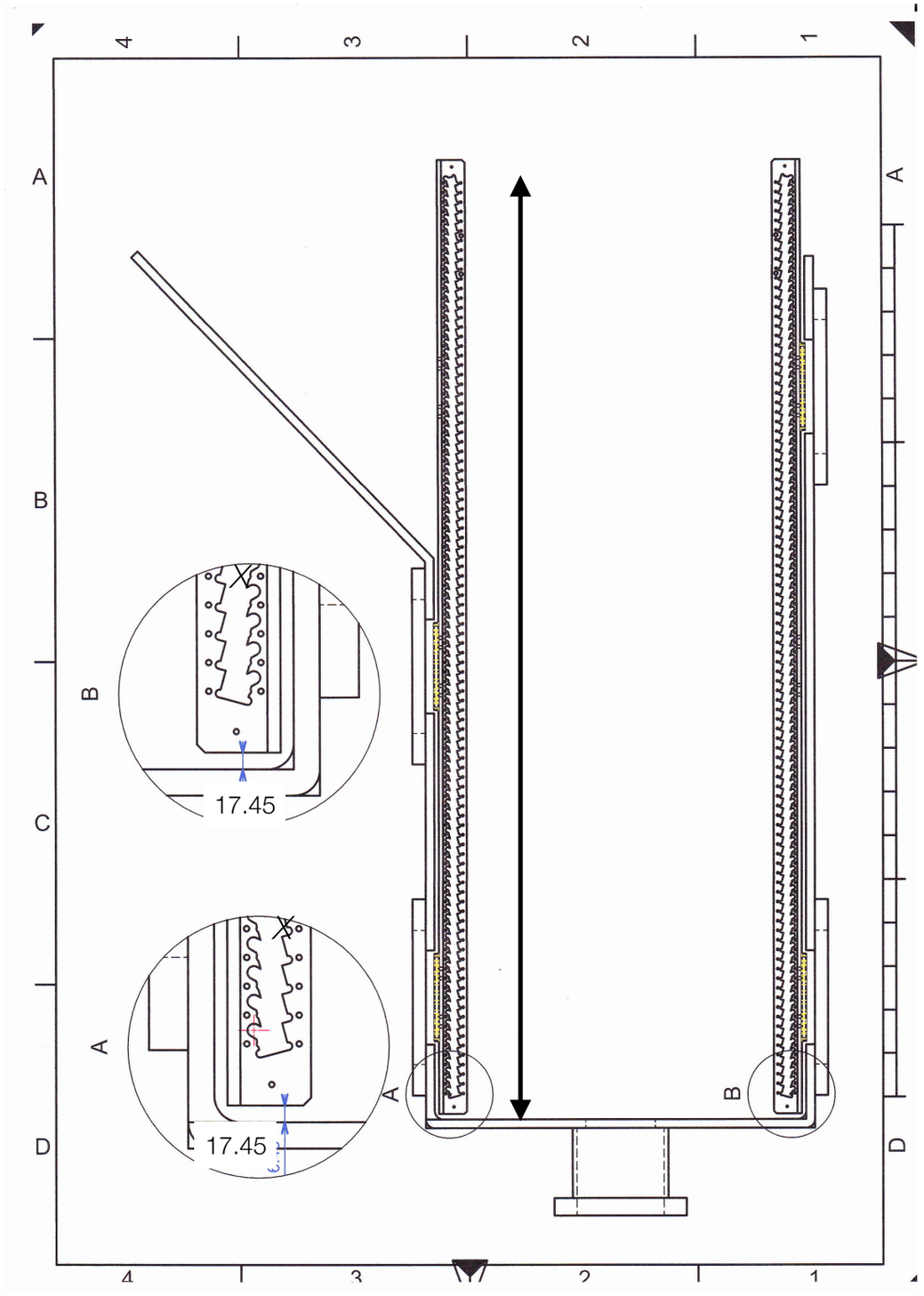
- PVeto geometry Check performed thanks to CAD measurements
- Hit Time alignment for MC
- Available Channel Id and TrigMask informations from base class

From Isabella

- Implementation of dead channels in ECal reconstruction
- Added new flag ClusterDeteriorateECal resolution to implement the data-like resolution in MC

Pull request to add this developments in develop branch ✓

Position PVeto From CAD measurements



Distance center of finger 0-VC

17.45 + 26 (d from rail)

Position VC -490 mm

Distance fing0 in PADME frame

-490 + 17.45 + 26 = 446.55 mm

Instead of 472.55 mm, in PADME geometry up to now

distance d from the rail wasn't considered
For the first implementation of PADME geometry

From MC geometry Z position

PVetoGeometry::GetFingerPosZ

fFingerDist0 = 26.*mm
fFingerPitch = 11.*mm;
fSupportSizeZ = 109.5*cm; // EL 2019/05/21 Technical drawings from Sofia

-0.5*fSupportSizeZ+fFingerDist0+idx*fFingerPitch;

Position of Each Channel Id

-547.5 +26 +Chld *11

If the rail is centered within the magnet

Shift of the rail to apply to finger position

GetPVetoPosZ() { return fPVetoFrontFacePosZ+0.5*GetPVetoSizeZ(); }
fPVetoFrontFacePosZ = -472.55*mm; // Start 56.45mm from inner face of vacuum chamber (wrong but real position M. Raggi)
fSupportSizeZ = 109.5*cm;

-472.55 + 547.5 = 74.95 mm

Pos Finger within PADME frame = -521.5 +Chld *11 + 74.95 = -446.55 + Chld*11

Finger 0 pos -446.55

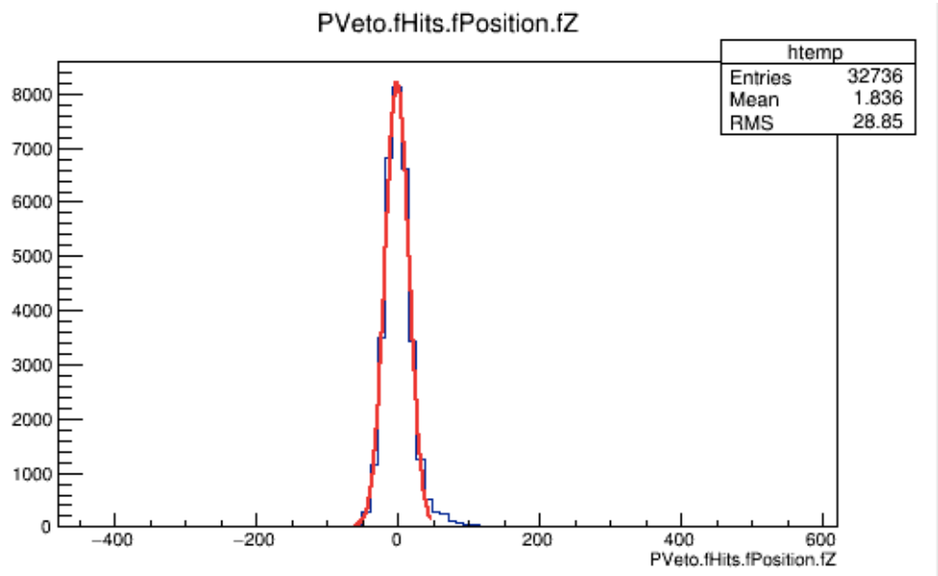
Z = 0 for Chld ~ 41 *Checked also with MC Single Positron*

Pos Finger within PADME frame = -521.5 +ChId *11 + 74.95 = -446.55 + ChId*11

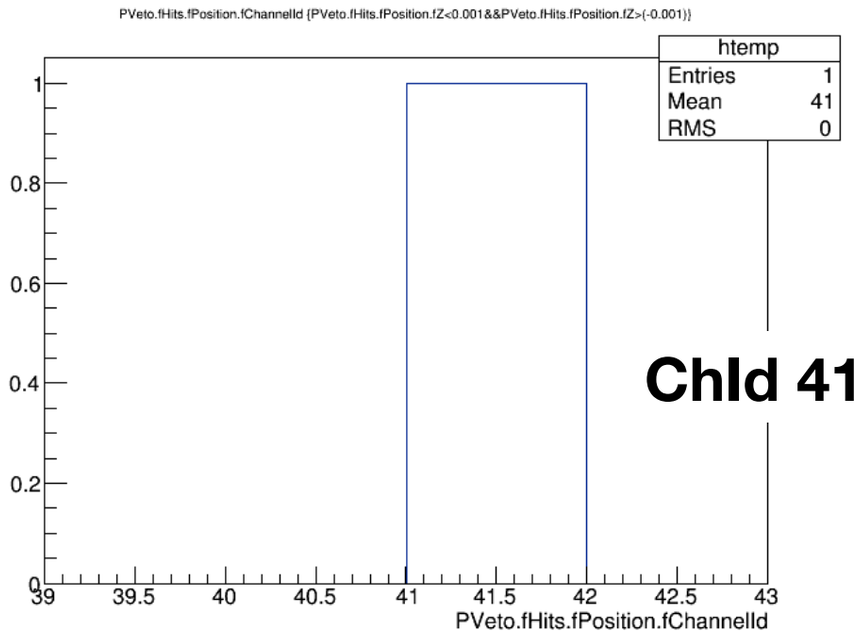
Finger 0 pos -446.55

Z = 0 for ChId ~ 41 *Checked also with MC Single Positron*

Positron Energy 135 MeV



Requiring -0.001<ZPosition<0.001



ChId 41 in (0, 0, 0)

From MC geometry X position

GetPVetoPosX() { return fPVetoInnerFacePosX+0.5*GetPVetoSizeX(); }

G4double GetPVetoSizeX() { return fSupportSizeX; }

193.5 mm

GetFingerPosX()

return -0.5*fSupportSizeX+fFingerCenterPosX;

PVetoSizeX 32 mm
fPVetoInnerFacePosX 177.5 mm
fFingerCenterPosX 15 mm

-1 mm

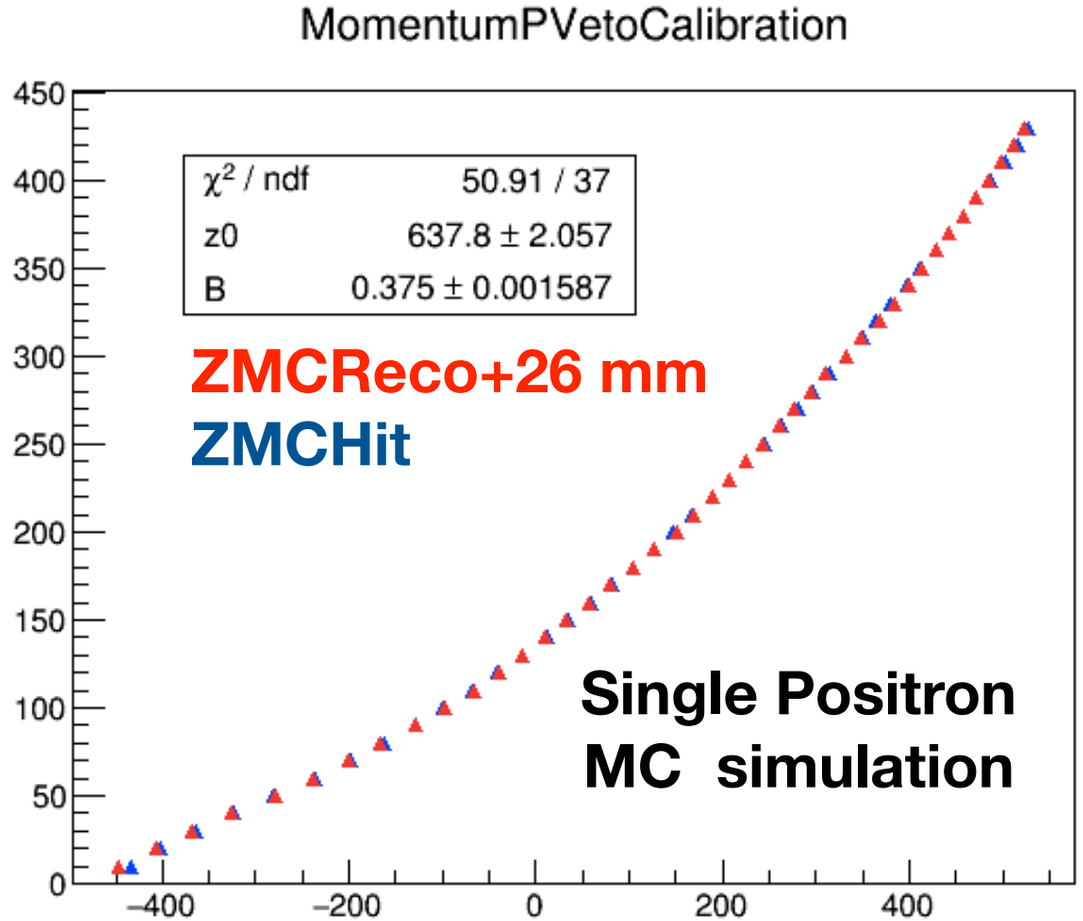
X Position Finger 193.5 -1 = 192.5 mm

PADME reco geometry changes

#LocalOrigineX 182.5
LocalOrigineX 192.5

#ChId@LocalZ0Offset -472.55
ChId@LocalZ0Offset -446.55

Now Reco Hit and MC Hit are in agreement



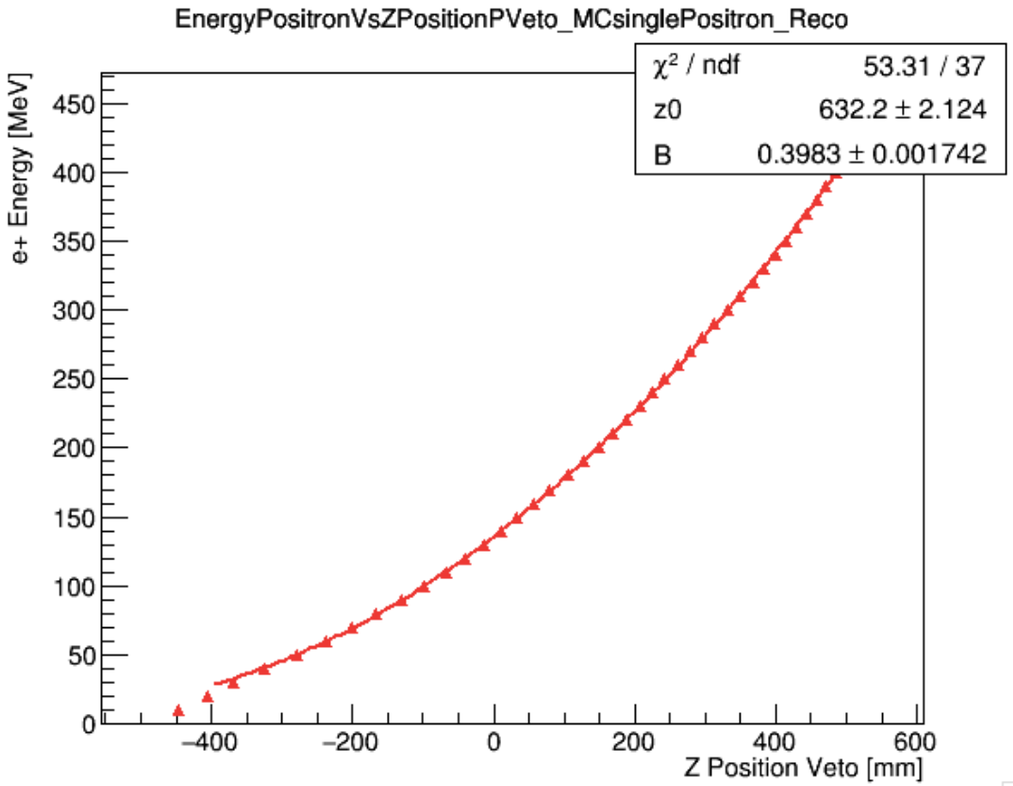
Analytic Fit function $p(z) = \frac{0.3\,B}{2\,x}\left[(z + z_0)^2 + x^2\right]$

Fit 1
x=182.5 mm
z0 and B free pars

Old set X from reco geometry

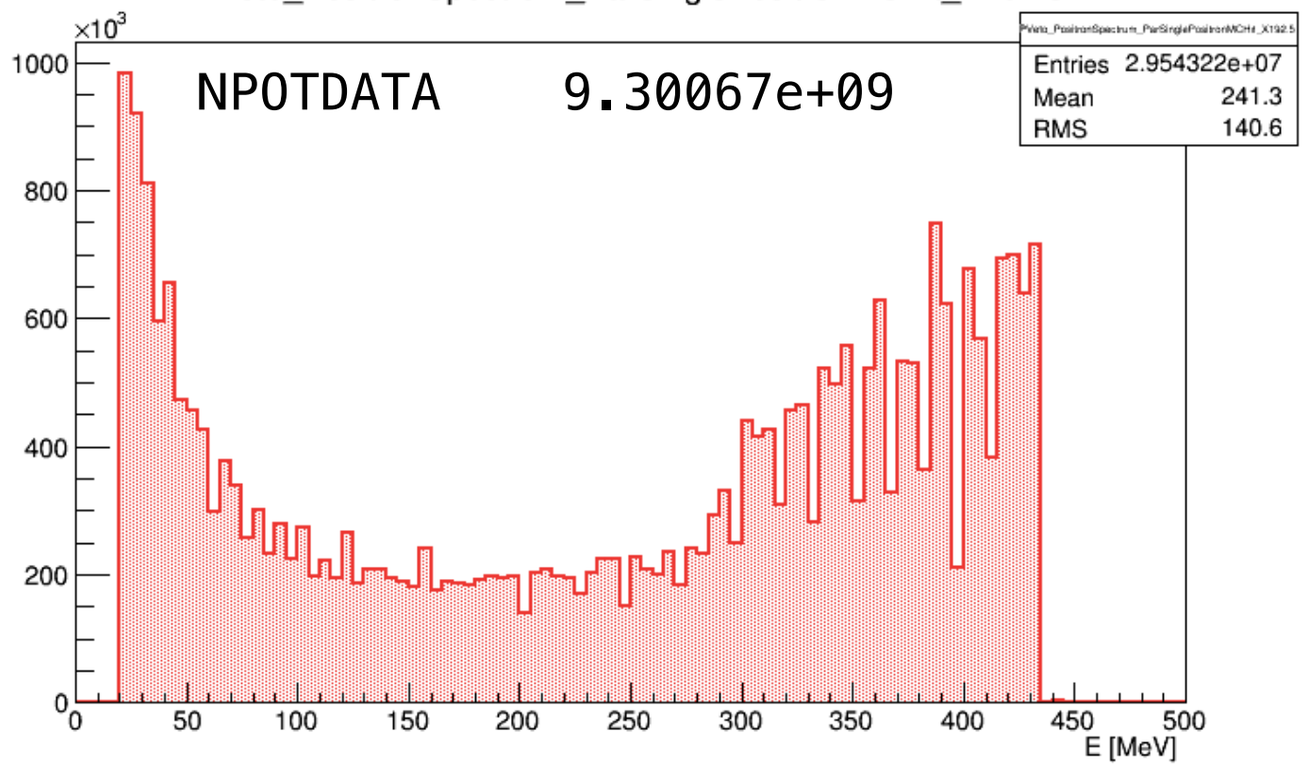
Fit 2 *Final Choice*
x=192.5 mm
z0 and B free pars

Possible Positron spectrum



Energy cut at 440 MeV, same of MC Single Positron

Data run_0000000_20190724_152634



Time Calibration for MC ***With MC Chamber off***

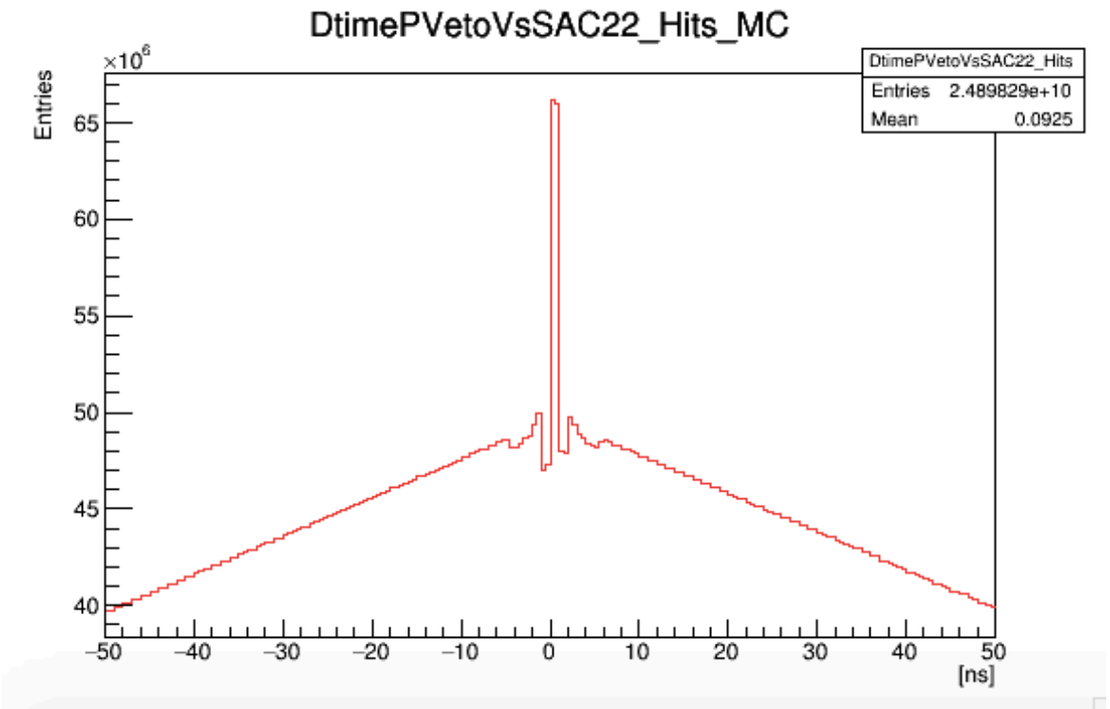
Similar implementation of the DATA
Inserted Method PerformMCCalibration

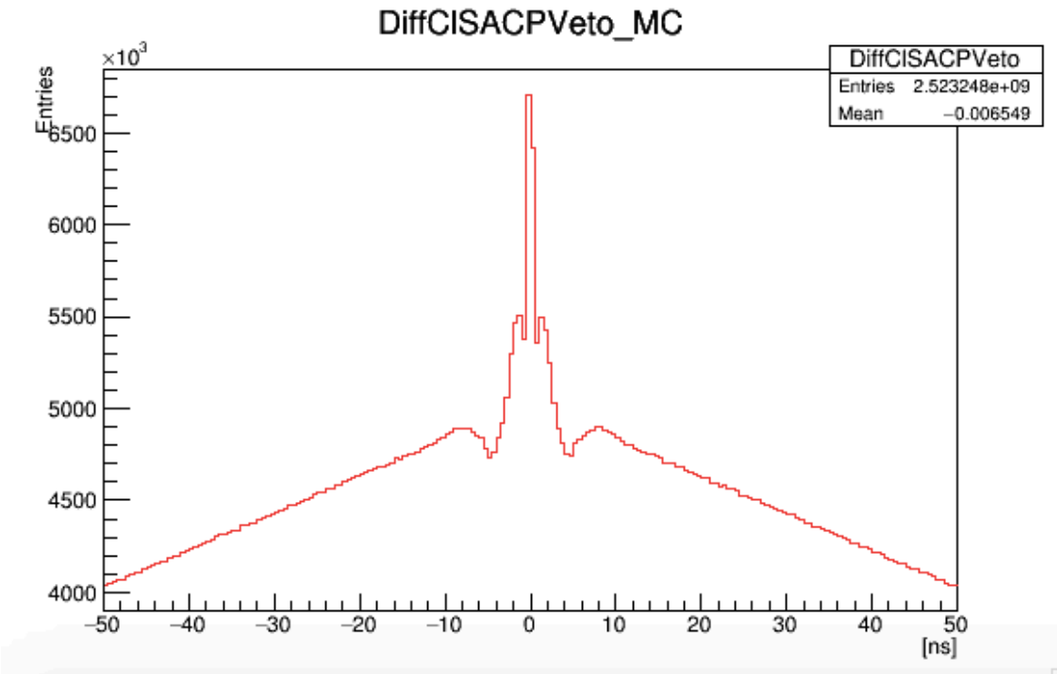
		ConfigFiles	
PVeto	*Hit Time Alignment for each channel*	***t0MC_x***	***(Ref ChId22 SAC)***
EVeto, ECal, HEPVeto	*Global Time Alignment*	***Common_t0MC***	

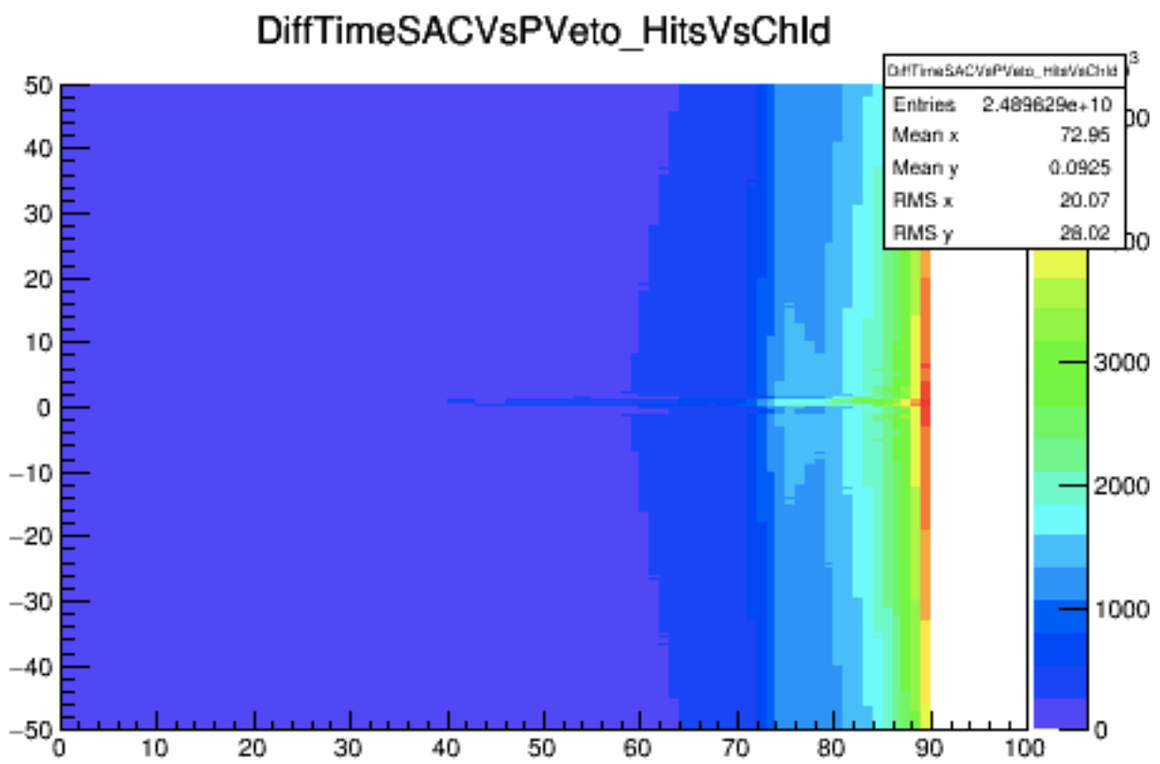
ECal Ref to central finger of PVeto, ChId41

Difference plots in backup slides

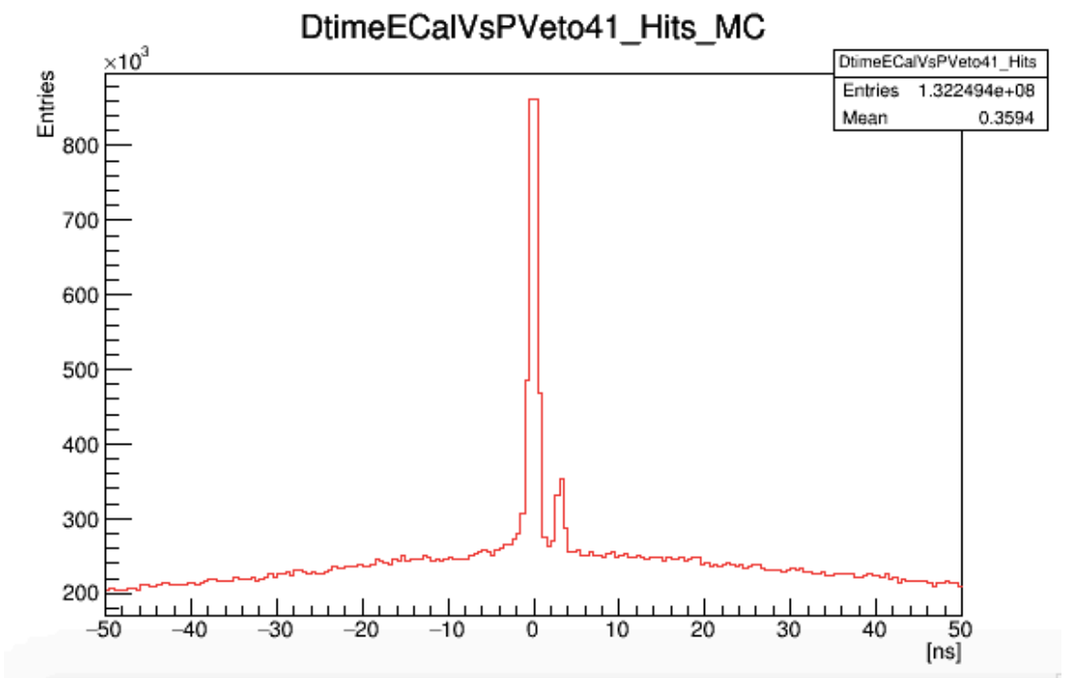
MC Time difference SAC

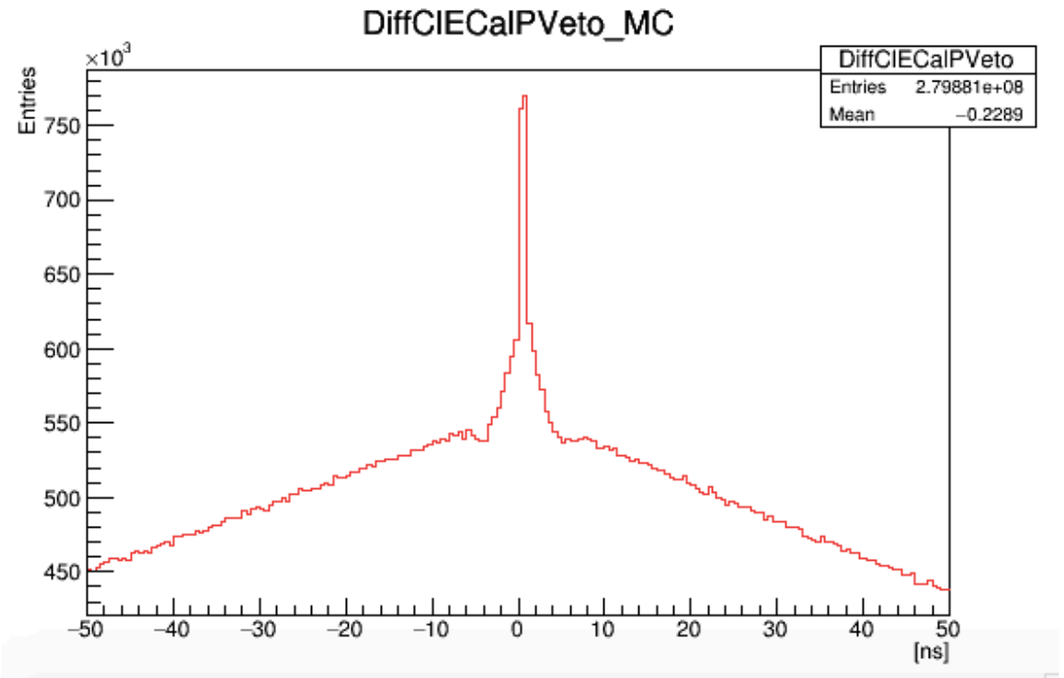


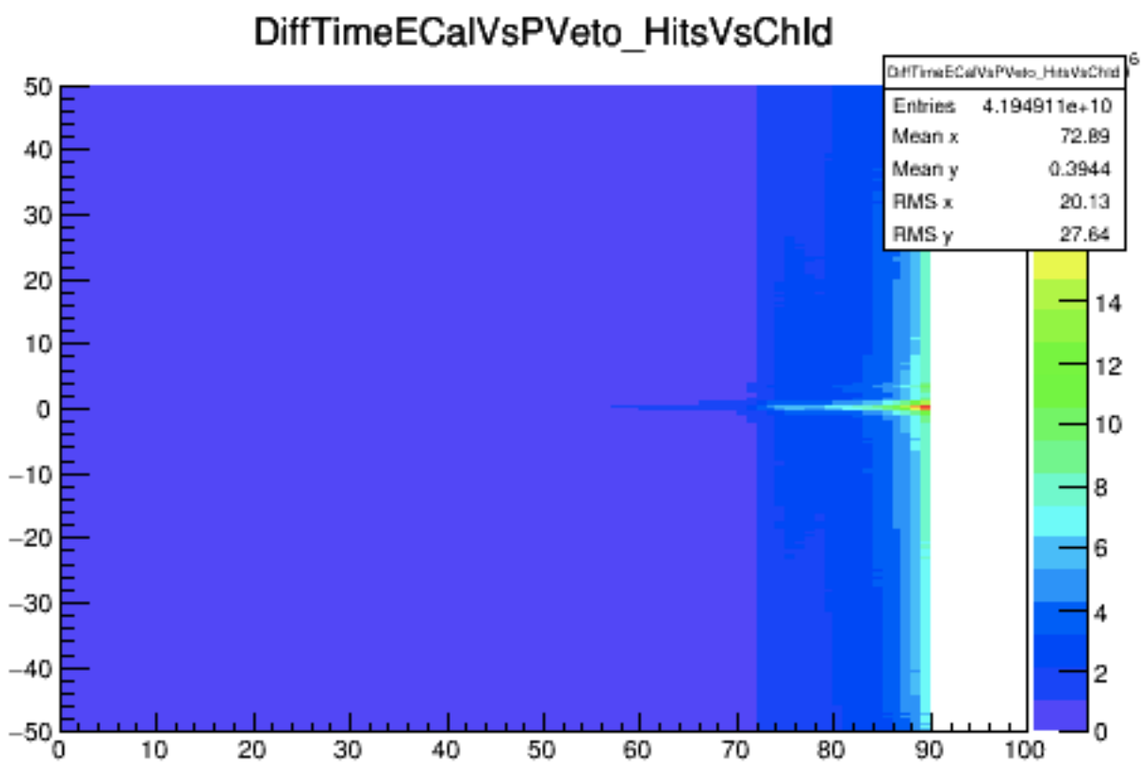




MC Time difference ECal

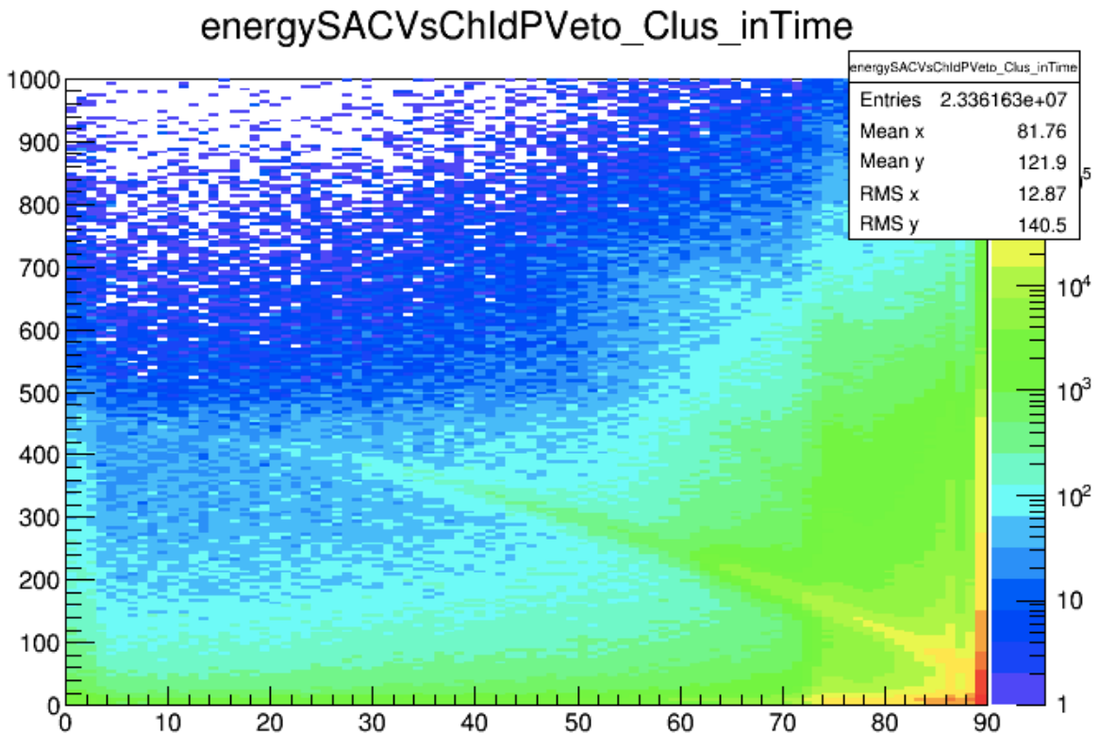






Before MC Time Calibration channel by channel

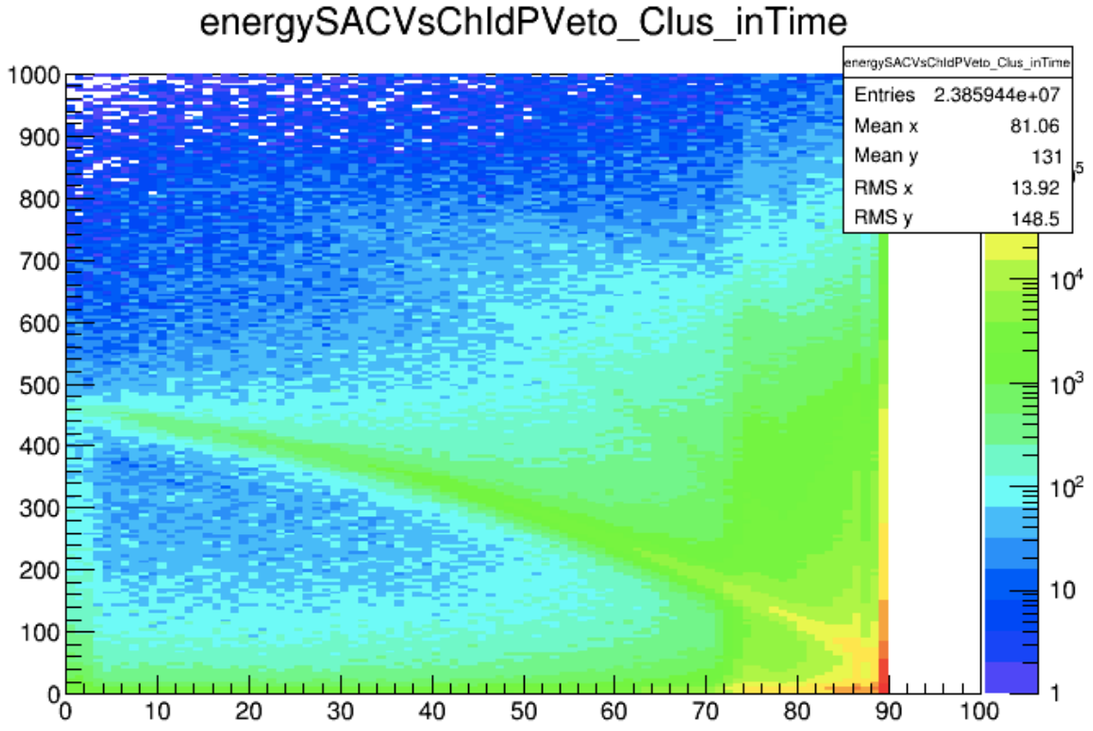
Time alignment Cluster from time shift in analysis



SAC PVeto
Time coincidence 1ns

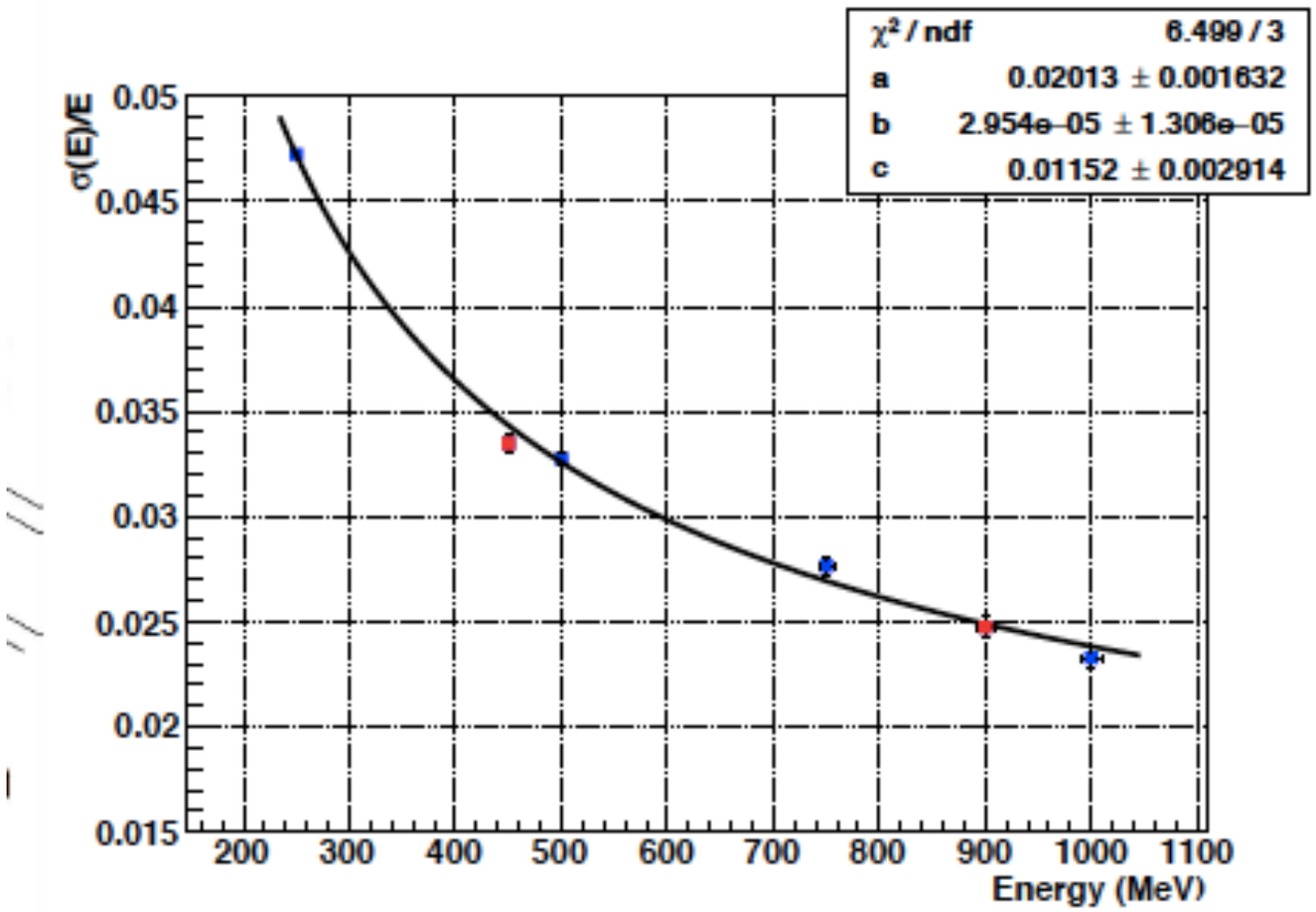
After MC Time Calibration channel by channel

Time alignment Hits in the reco



From Isabella

Added new flag ClusterDeteriorateECal resolution to implement the data-like resolution in MC



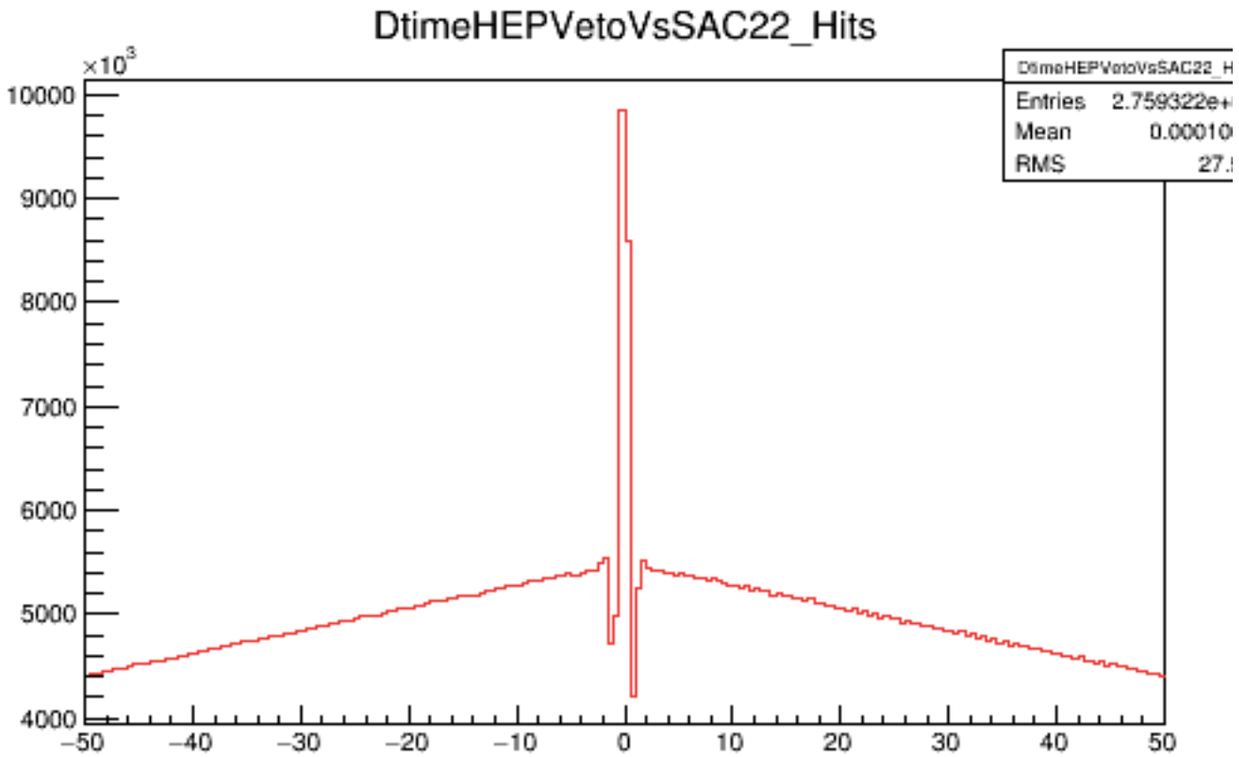
$$\sigma_E/E = \frac{\text{a(\%)}}{\sqrt{E}} \oplus \frac{\text{b(\%)}}{E} \oplus \text{c(\%)}$$

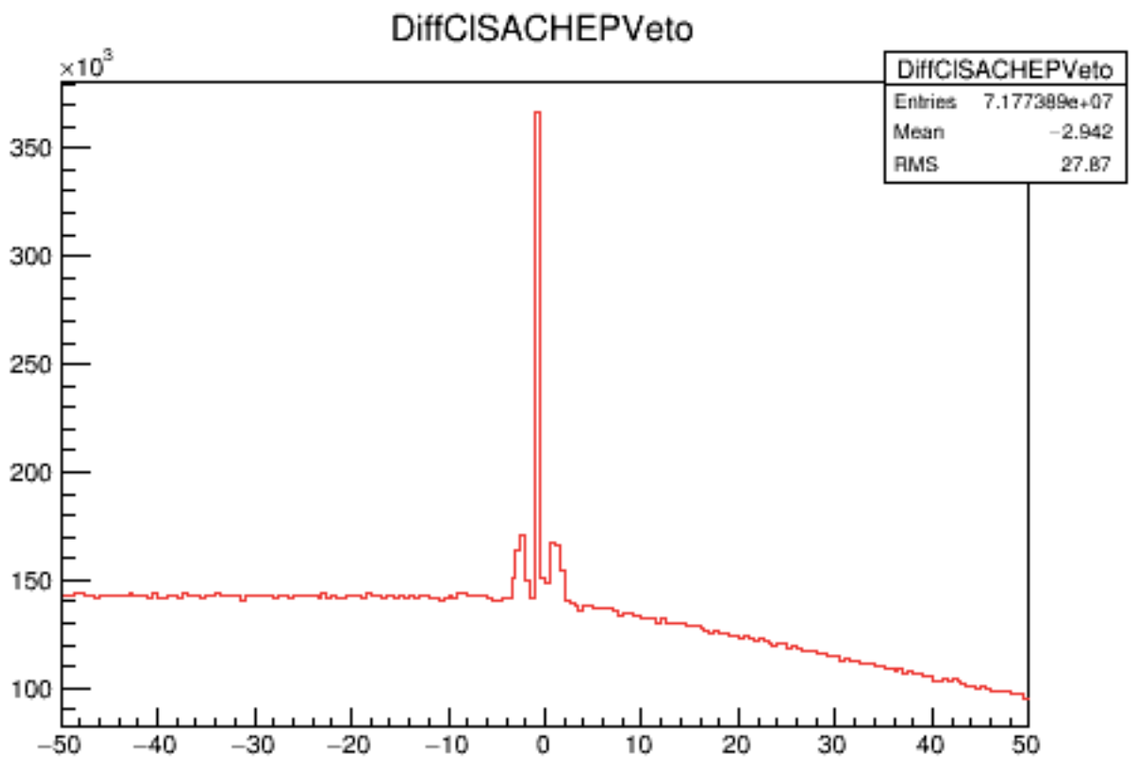
a = 2%

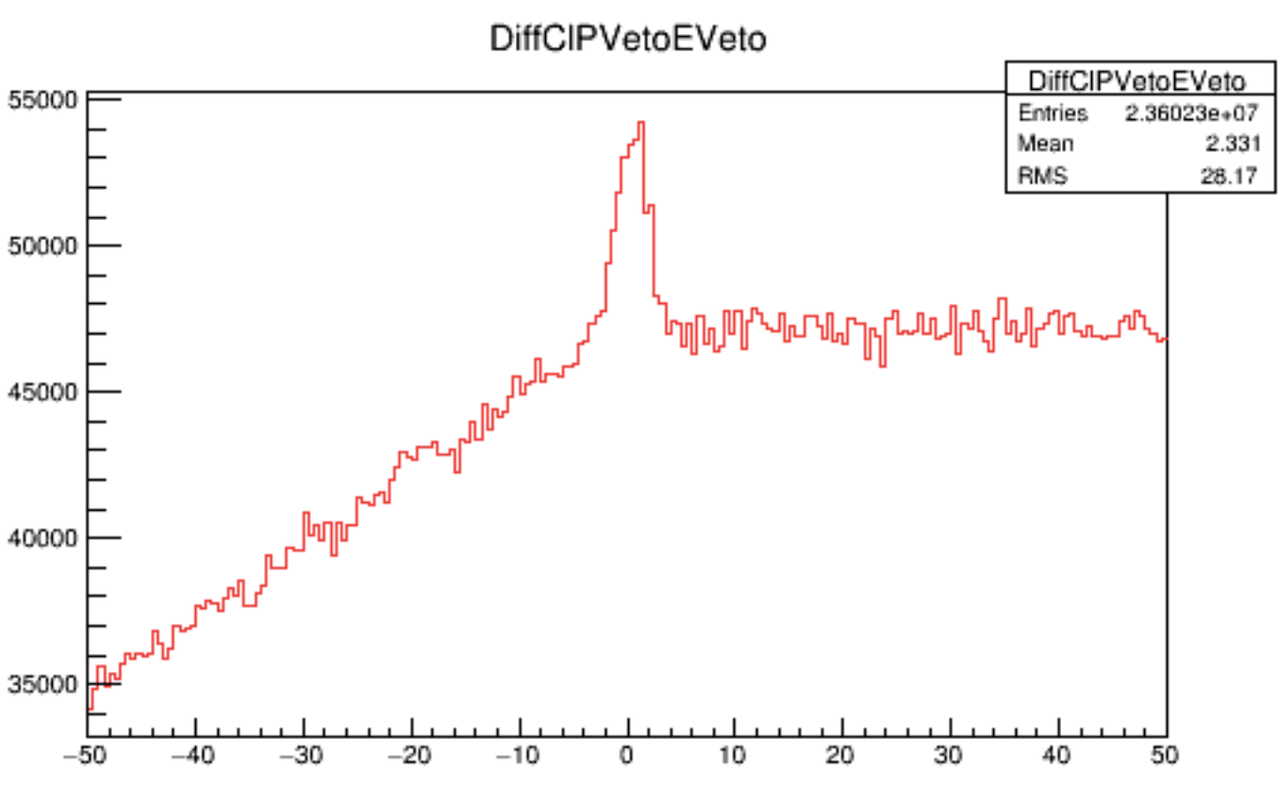
b = 0.003 %

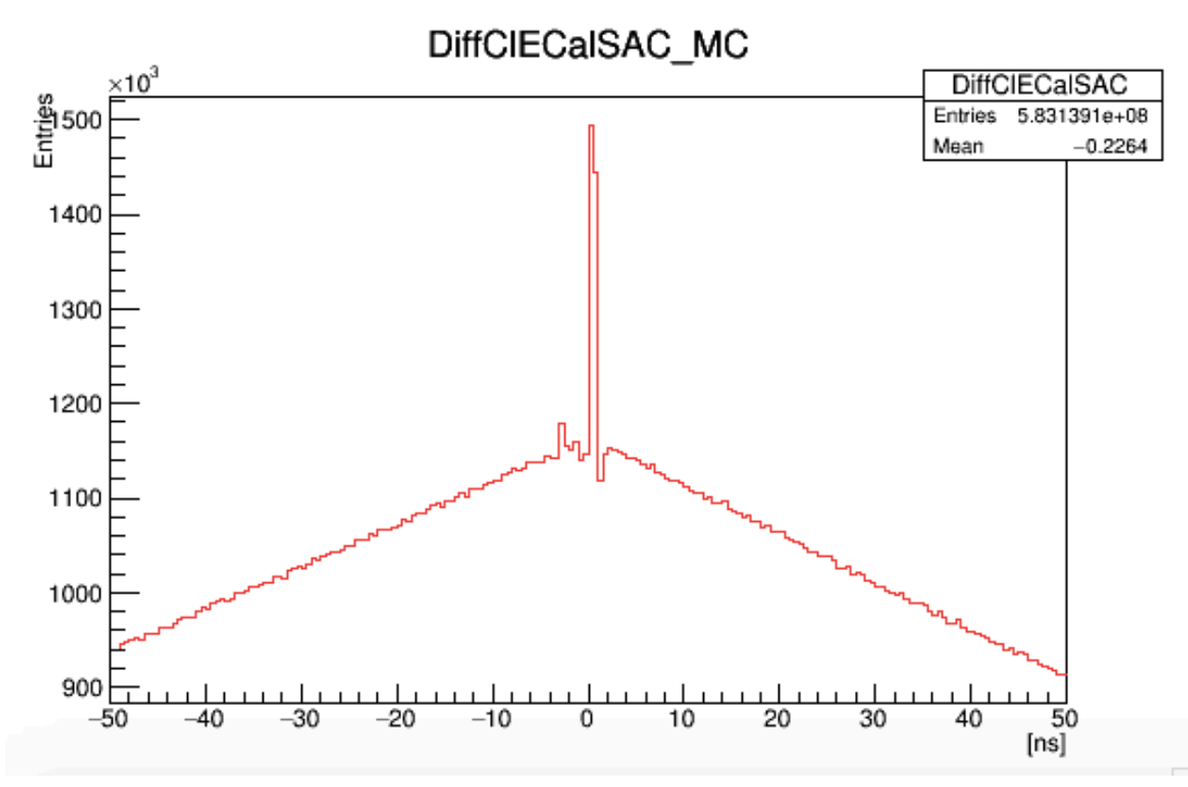
c=1.2 %

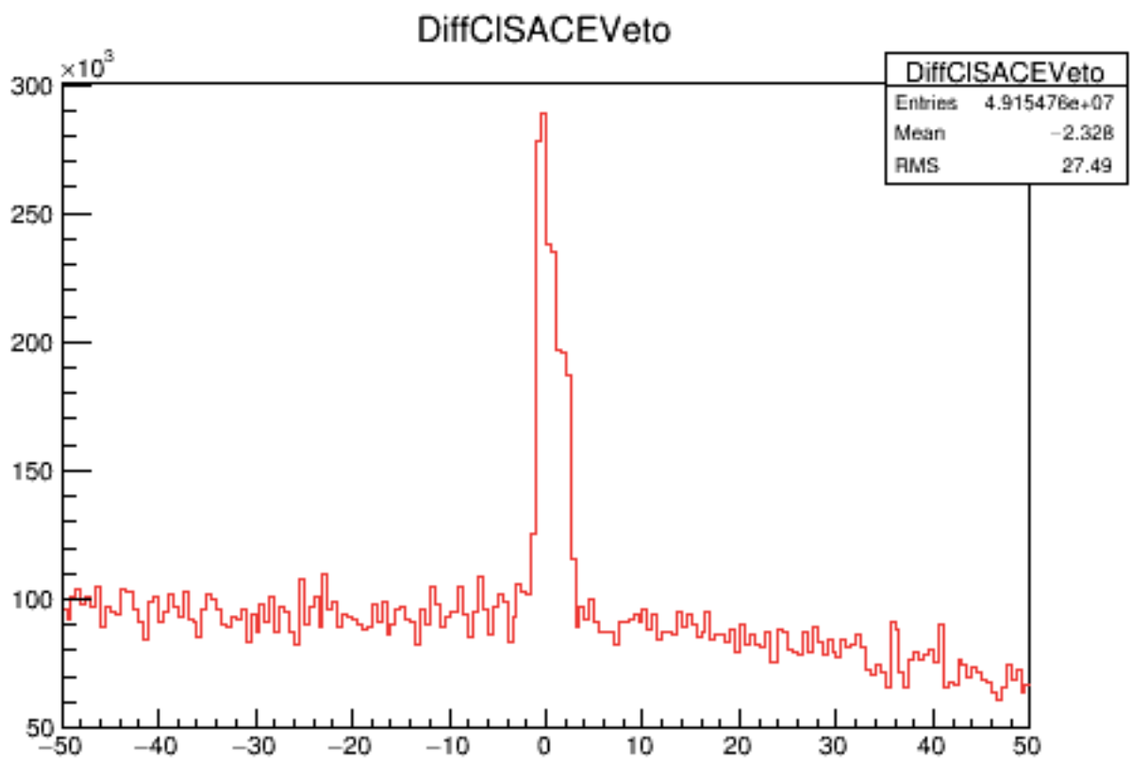
BACKUP SLIDES

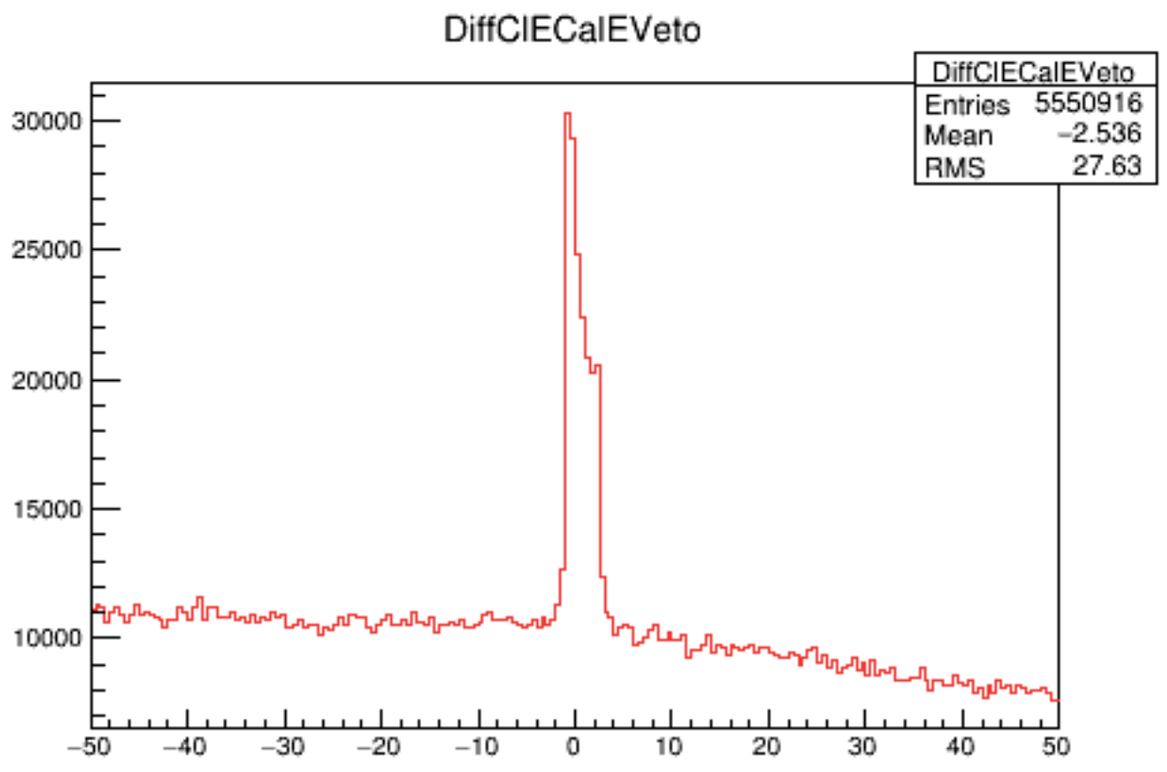

DtimeHEPVetoVsSAC22_Hits
DtimeHEPVetoVsSAC22_H
Entries 2.759322e+
Mean 0.00010
RMS 27.


DiffClSACHEPVeto
DiffClSACHEPVeto
Entries 7.177389e+07
Mean −2.942
RMS 27.87


DiffClPVetoEVeto
DiffClPVetoEVeto
Entries 2.36023e+07
Mean 2.331
RMS 28.17


DiffClECalSAC_MC
DiffClECalSAC
Entries 5.831391e+08
Mean −0.2264
Entries
[ns]


DiffClSACEVeto
DiffClSACEVeto
Entries 4.915476e+07
Mean −2.328
RMS 27.49
×10^3
300
250
200
150
100
50
−50 −40 −30 −20 −10 0 10 20 30 40 50


DiffClECalEVeto
DiffClECalEVeto
Entries 5550916
Mean −2.536
RMS 27.63
30000
25000
20000
15000
10000
−50 −40 −30 −20 −10 0 10 20 30 40 50