



# Temporal development of showers in mcd00

Hans Wenzel

Fermilab 

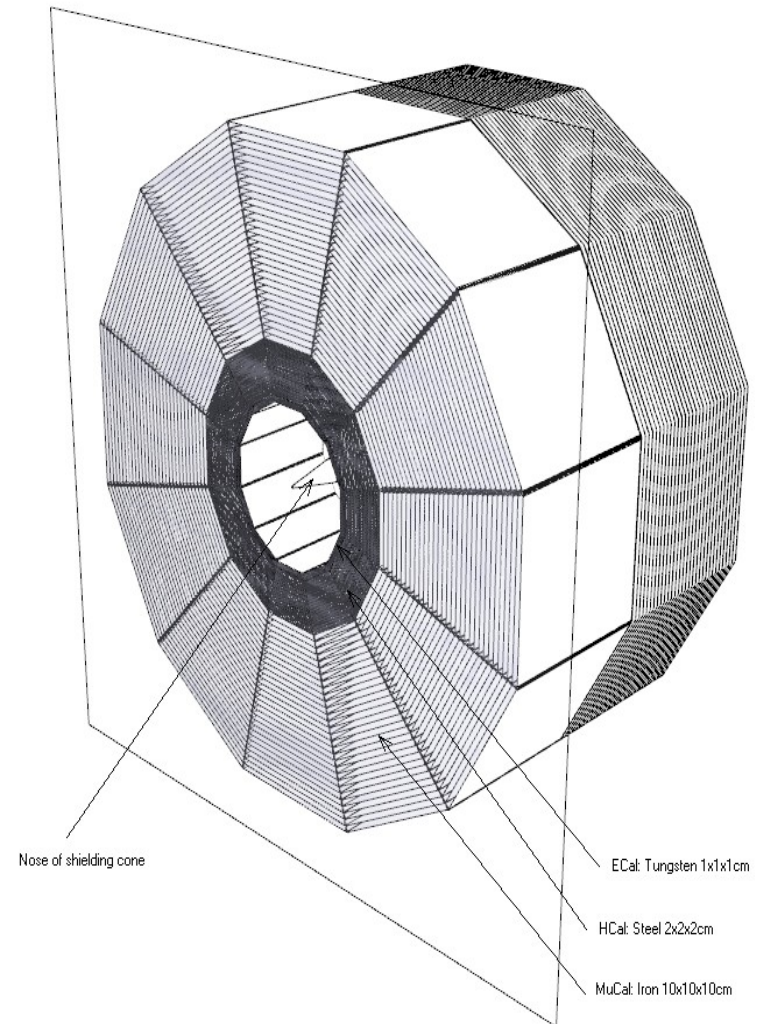
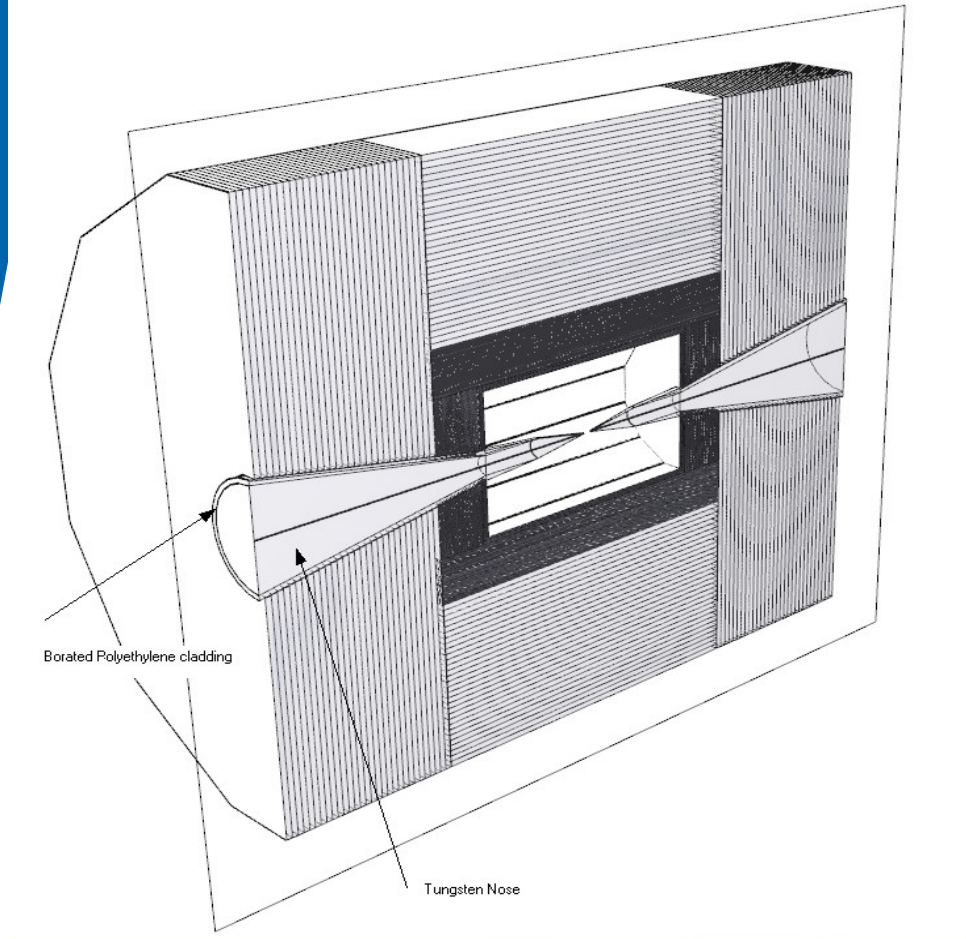
Muon Collider 2011

July 29





# Muon Collider Detector in Icsim



Norman Graf



- Uses Icio hits. (report only the time of the first energy deposition)
- No threshold cuts
- No clustering. We know there is only one particle and sum up all the energy of all the calorimeter cells.

Single particle Data sets using mcd00 detector found in:  
<ftp://ftp-lcd.slac.stanford.edu/ilc3/MUC/backgrounds/slci0/slic/>



# Wired Event display

JAS3

File Edit View Tuple Loop Window Help

pi\_Theta90\_10GeV\_SLIC-v2r9p8\_geant4-v9r3p2\_QGSP\_BERT\_mcd00.slcio

Welcome View 1

Interaction Picking Settings Cuts

Interaction

Types

- DetectorType
  - Barrel
  - Endcap
- EventType
  - EcalEndcapHits
  - HcalEndcapHits
  - VtxBarHits
  - MCDParticle

Instances

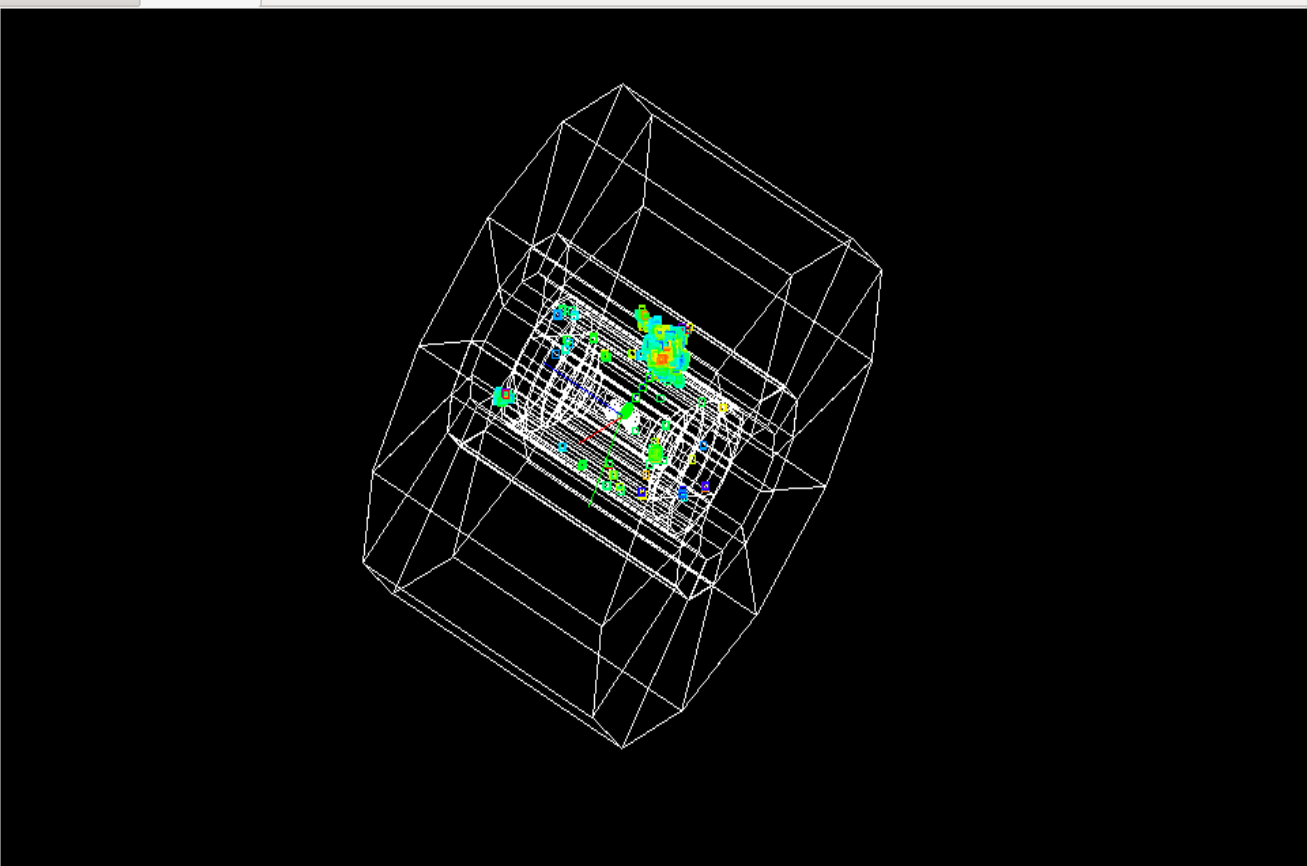
- Detector
- Event

Apply immediately Apply

Hide Types below level: 3

Hide Instances below level: 3

JAS3Tree WIRED W



Drag to rotate using virtual ball; Shift-drag to rotate over vertical axis; Ctrl-drag to rotate over horizontal axis.

53.9/78.4MB



# LCIO-Data Browser

JAS3

File Edit View Tuple Loop Window Help

pi\_Theta90\_10GeV\_SLIC-v2r9p8\_geant4-v9r3p2\_QGSP\_BERT\_mcd00.slcio

Settings Cuts Interaction Picking

Interaction

Types

Instances

Apply immediately Apply

Hide Types below level: 0

Hide Instances below level: 0

JAS3Tree WIRED

Welcome View 1 LCSim Event x

Run: 0 Event: 0

Event

- EcalBarrelHits
- EcalEndcapHits
- HcalBarrelHits
- HcalEndcapHits
- INPUT\_FILE
- MCParticle
- MCParticleEndPointEnergy
- MuonBarrelHits
- MuonEndcapHits
- TkrBarrHits
- TkrEndcapHits
- VtxBarrHits
- VtxEndcapHits
- MCParticleTree

Collection: HcalBarrelHits size:4820 flags:e0000000  
CellIDEncoding: system:0:6,barrel:6:3,module:9:4,layer:13:6,slice:19:5,x:32:-16,y:48:-16

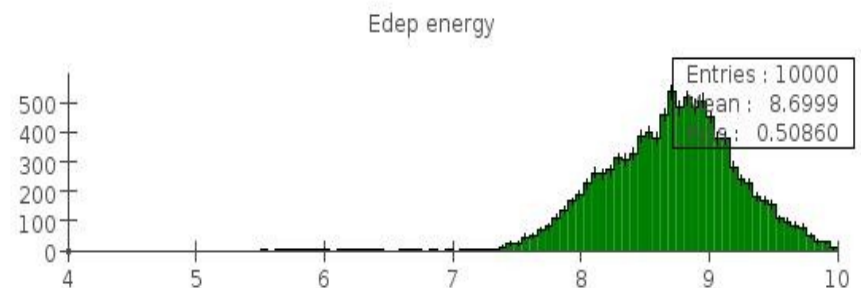
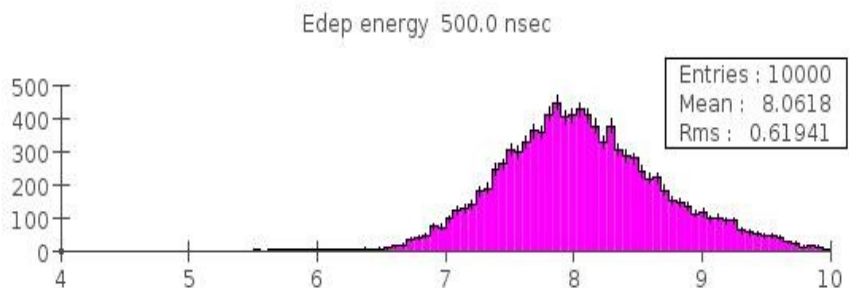
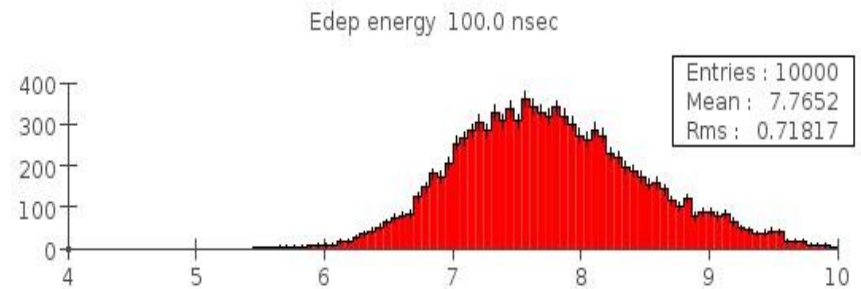
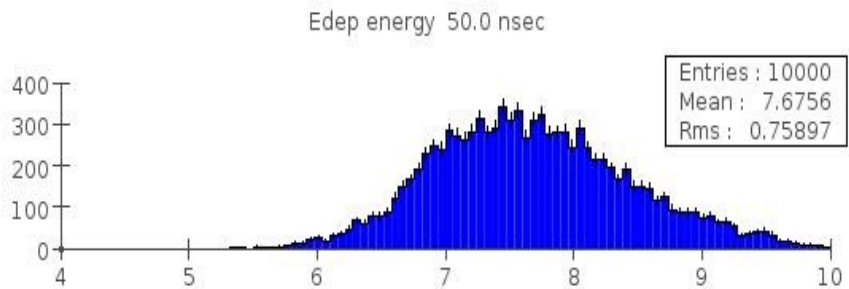
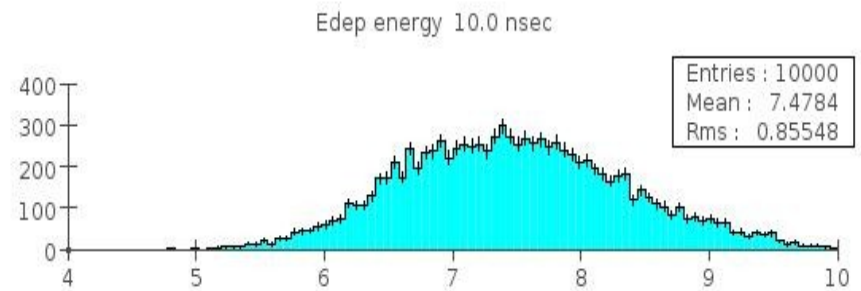
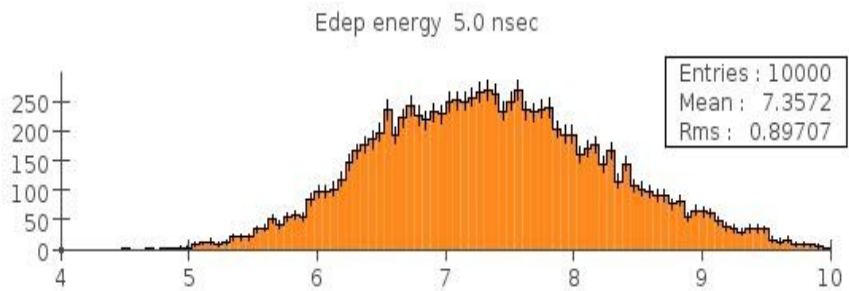
d: module	id: layer	id: slice	id: x	id: y	raw energy (GeV)	corrected energy (GeV)	X (mm)	Y (mm)	Z (mm)	time (ns)
0	0	-13	-1		.022463	.022463	-1057.1	-899.01	10.000	4.6757
1	0	-13	-1		.025812	.025812	-1074.4	-909.01	10.000	4.6908
2	0	-14	-1		.063353	.063353	-1081.8	-936.33	10.000	4.7686
4	0	-14	0		.038508	.038508	-1116.4	-956.33	-10.000	4.8799
3	0	-13	0		.059966	.059966	-1109.1	-929.01	-10.000	4.8308
4	0	-13	0		.088197	.088197	-1126.4	-939.01	-10.000	4.8791
3	0	-14	0		.10534	.10534	-1099.1	-946.33	-10.000	4.8200
4	0	-15	-1		.0016754	.0016754	-1106.4	-973.65	10.000	4.9638
4	0	-14	-1		.26900	.26900	-1116.4	-956.33	10.000	4.8863
4	0	-15	0		.0017762	.0017762	-1106.4	-973.65	-10.000	4.9635
5	0	-14	0		.072495	.072495	-1133.7	-966.33	-10.000	4.9558
5	0	-14	-1		.36851	.36851	-1133.7	-966.33	10.000	4.9463
11	0	-12	2		.0041166	.0041166	-1257.7	-991.69	-50.000	5.4058
8	0	-13	2		4.7690E-4	4.7690E-4	-1195.7	-979.01	-50.000	5.2143
7	0	-13	2		.0052083	.0052083	-1178.4	-969.01	-50.000	5.1486
6	0	-13	1		.026708	.026708	-1161.0	-959.01	-30.000	5.0455
5	0	-13	0		.070351	.070351	-1143.7	-949.01	-10.000	4.9593
0	0	-14	0		2.5901E-4	2.5901E-4	-1047.1	-916.33	-10.000	4.9089
0	0	-13	0		1.9779E-4	1.9779E-4	-1057.1	-899.01	-10.000	4.9048
1	0	-14	-1		5.0336E-4	5.0336E-4	-1064.4	-926.33	10.000	4.8222
3	0	-13	-1		.041011	.041011	-1109.1	-929.01	10.000	4.8197
3	0	-14	-1		.073434	.073434	-1099.1	-946.33	10.000	4.8352
4	0	-13	-1		.034026	.034026	-1126.4	-939.01	10.000	4.8874
1	0	-15	-1		5.0607E-4	5.0607E-4	-1054.4	-943.65	10.000	4.8875
3	0	-15	-1		.0025729	.0025729	-1089.1	-963.65	10.000	5.0816
2	0	-16	-2		1.6996E-5	1.6996E-5	-1061.8	-970.97	30.000	5.1060
1	0	-16	-3		9.3358E-4	9.3358E-4	-1044.4	-960.97	50.000	5.0011

Drag to rotate using virtual ball; Shift-drag to rotate over vertical axis; Ctrl-drag to rotate over horizontal axis.

34.3/74.9MB



# Pion energy response for single pions.

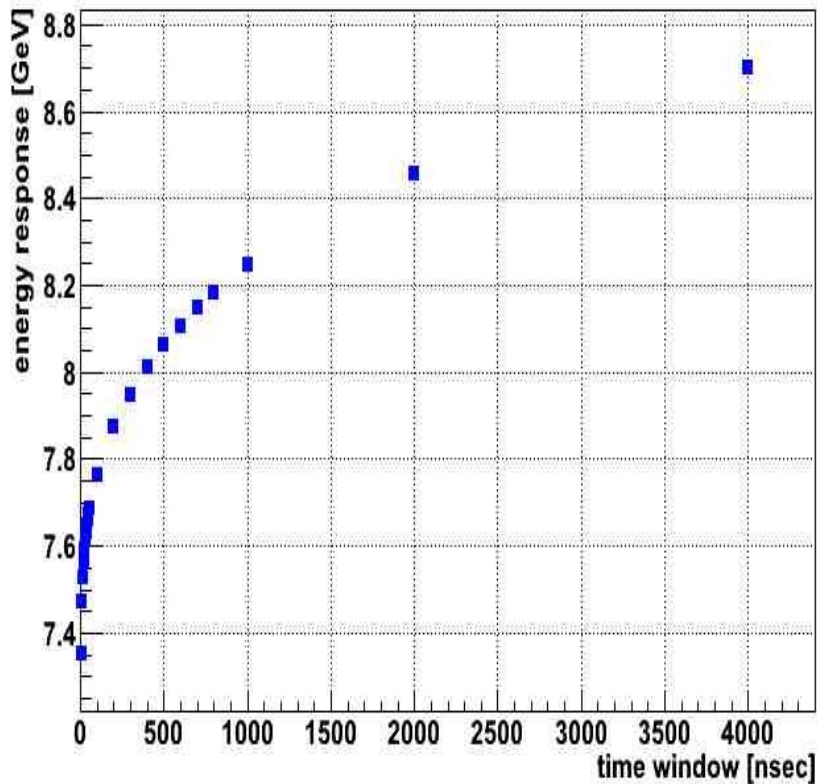




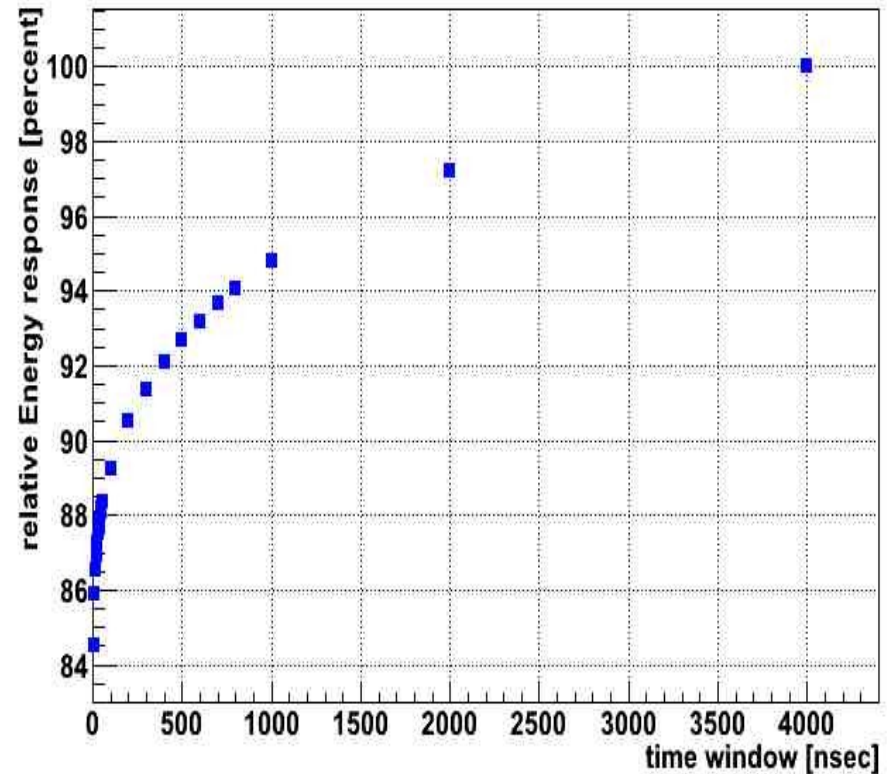


# Temporal development of hadronic (pion) showers

10 GeV Pions



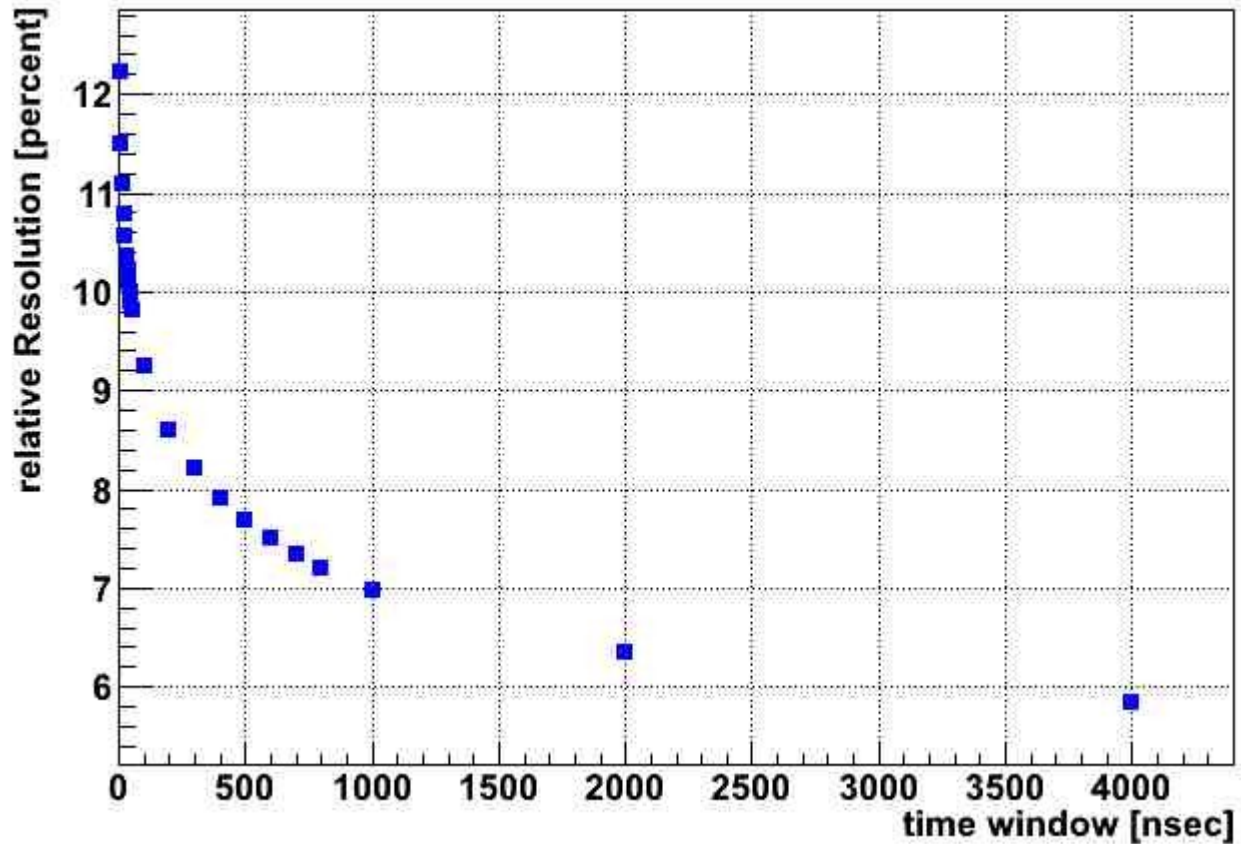
10 GeV Pions





# Energy resolution

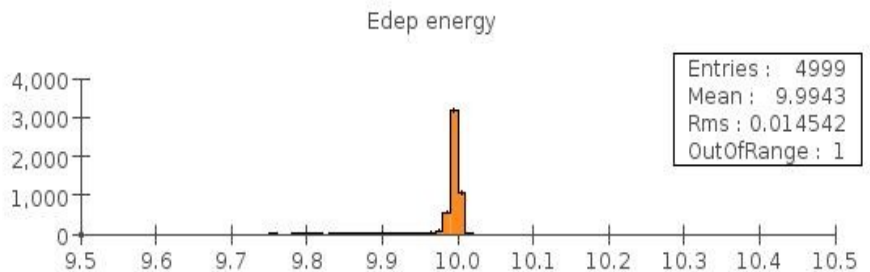
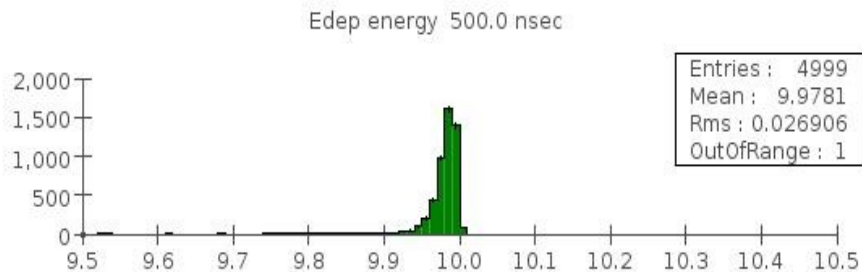
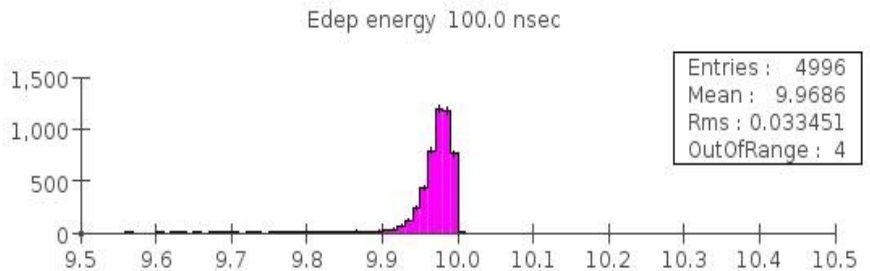
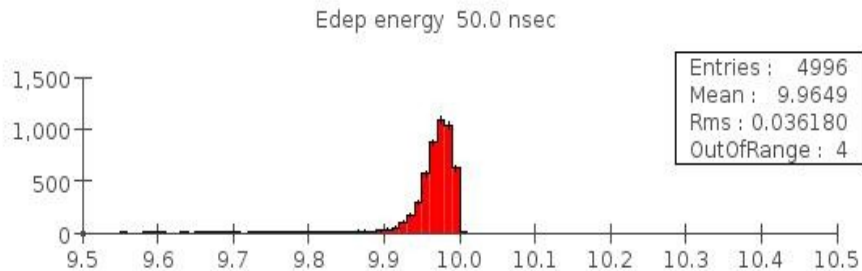
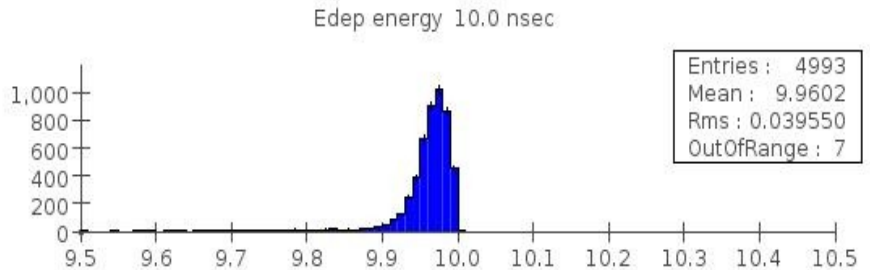
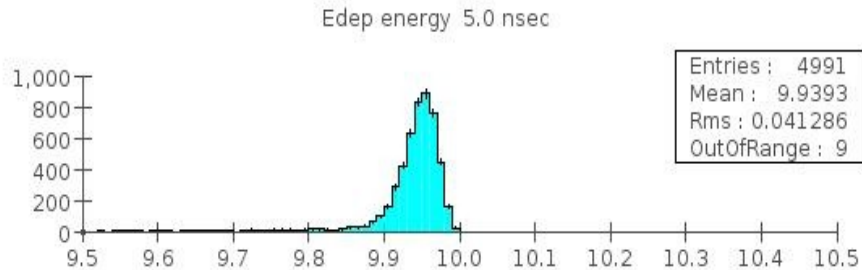
10 GeV Pions







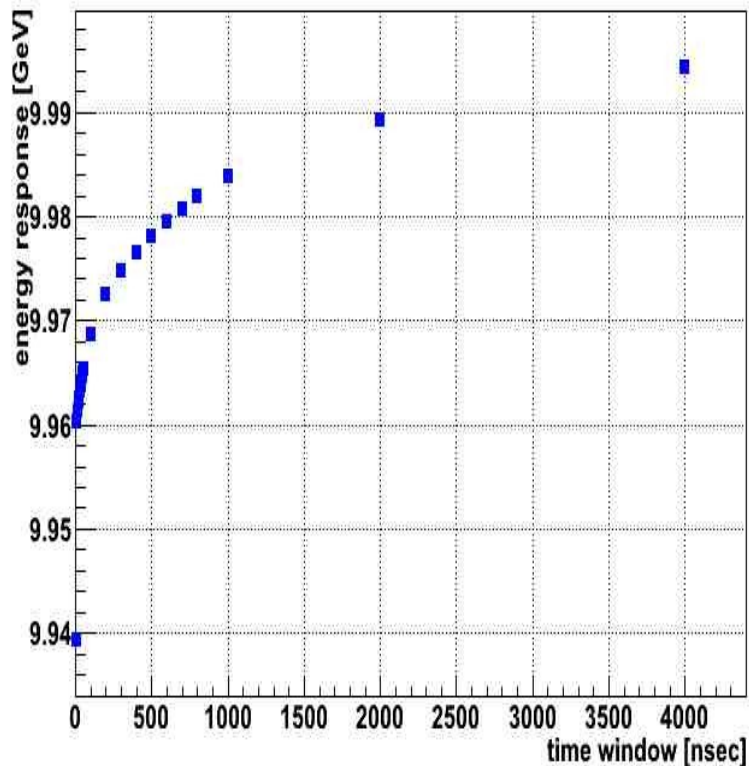
# Energy response for single electrons



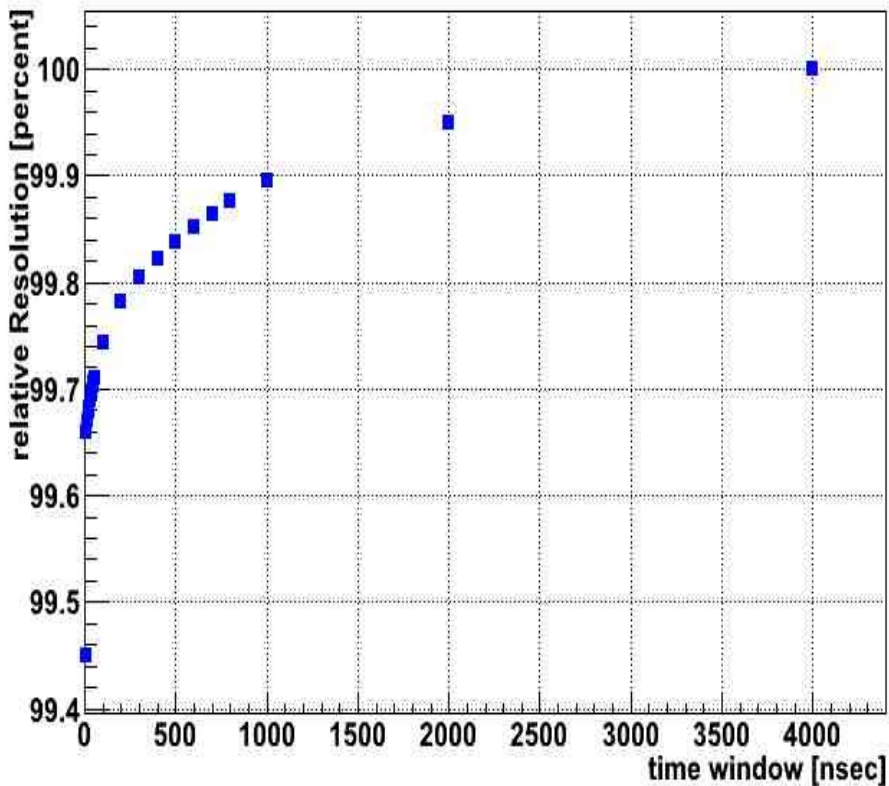


# Energy response electrons

10 GeV electrons



10 GeV electrons





# Energy resolution

10 GeV electrons

