ECAL Background Rates using Hall D Generator

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Trigger Thresholds from DIS Gen.

- Cluster thresholds generated from electron signals (DIS weighted generator)
- The trigger threshold is the DIS threshold in the shower.
  - Radius bins: {110 -130 ,130 - 150 ,150 – 170, 170 – 190, 190 - 210 ,210 – 230, 230 - 250 ,250 - 270}
  - Shower 6+1 Thresholds : {617.9 ,531.0 ,460.0 ,389.8 , 331.0 ,287.6 ,271.9 ,272.0} MeV
  - Shower 2+1 Thresholds : {501.5 ,471.9 ,412.8 ,340.5 , 291.9 ,255.3 ,243.7 ,244.0} MeV
- No threshold is applied to Pre-Shower clusters

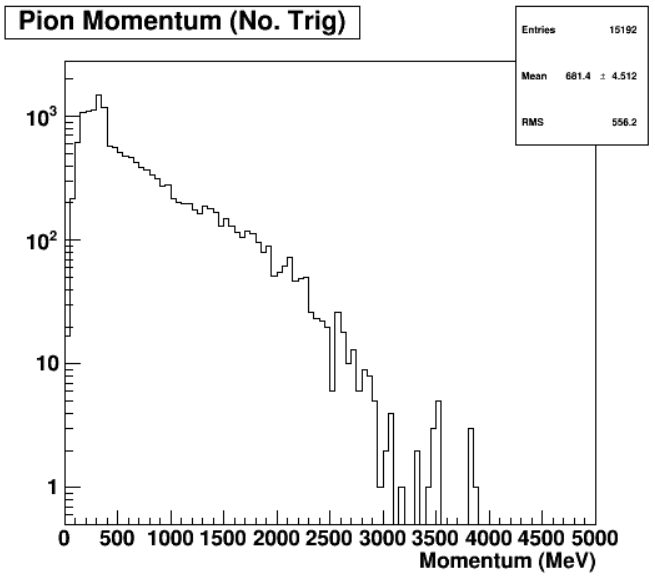
ECAL Analysis with Trigger Windows

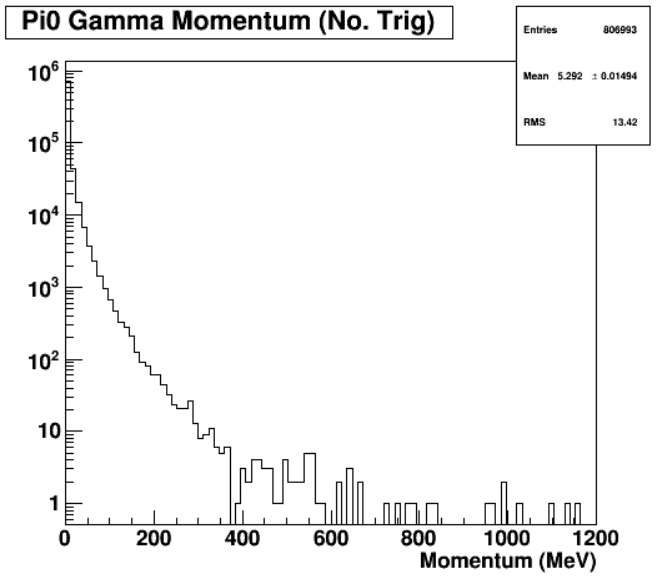
- Backgrounds are generated using cross section weighted events from hall D generator
- Combined Pions : π^- , π^+, π^0 and EM background
  - Events are uniformly separated in time according to the background rates
- Tracks incident on the ECAL can then be separated to 30 ns time windows (trigger window is 30 ns)
- Each sector (12 deg) of ECAL is treated independently
- Total time in simulation is 35070 ns or 1169 background trigger windows
- Photon blocker included in the simulation

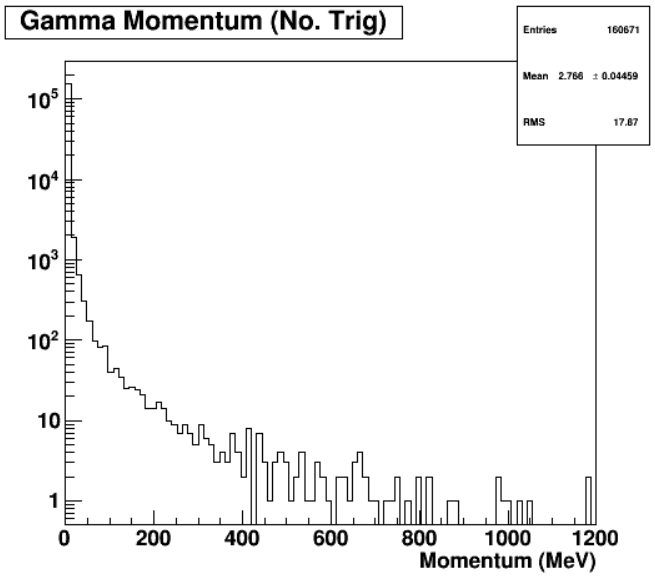
Trigger Definition

- Select 6+1 max energy cluster for each window in each sector
- If above the threshold, trigger the sector
- Trigger condition applied based on radial dependence cluster thresholds

Tracks Incident on ECAL no EM Background



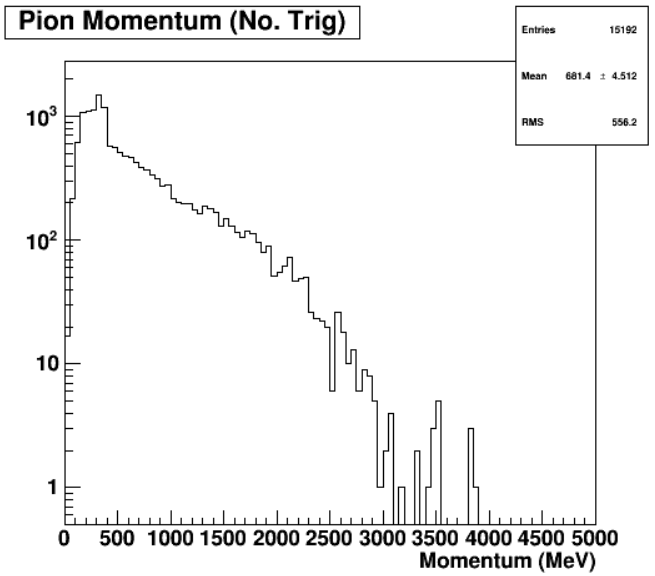


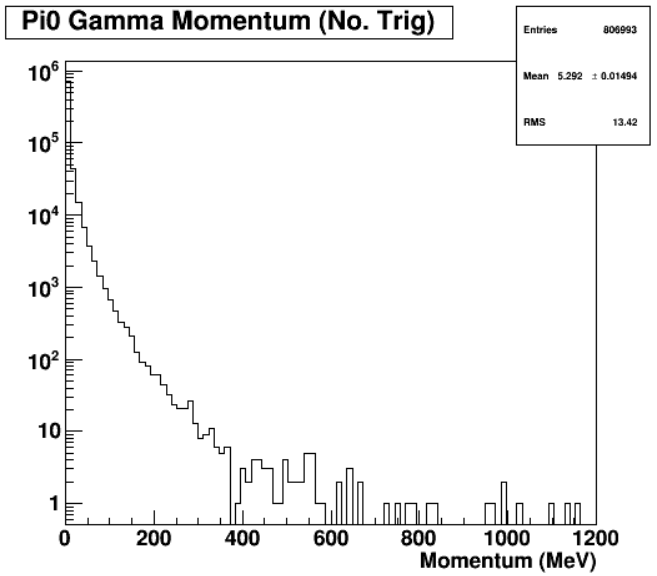


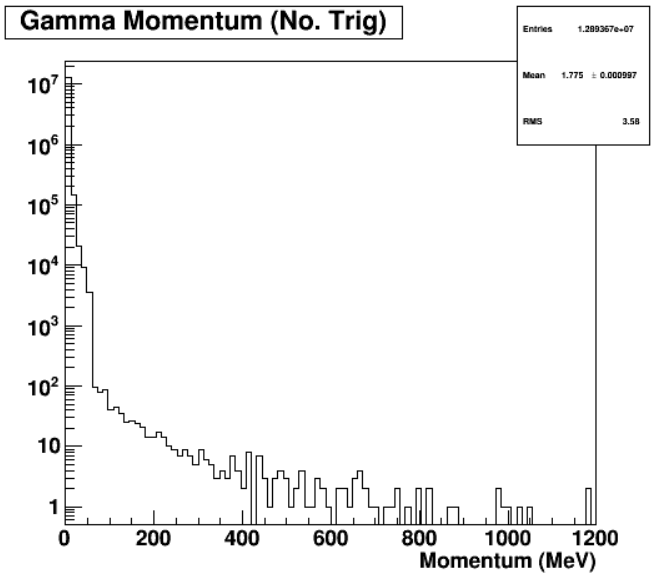
Total no.of tracks incident on the ECAL sector are categorized in to,

- Pions (+/-)
- Pi0 Photons
- All other photons

Tracks Incident on ECAL



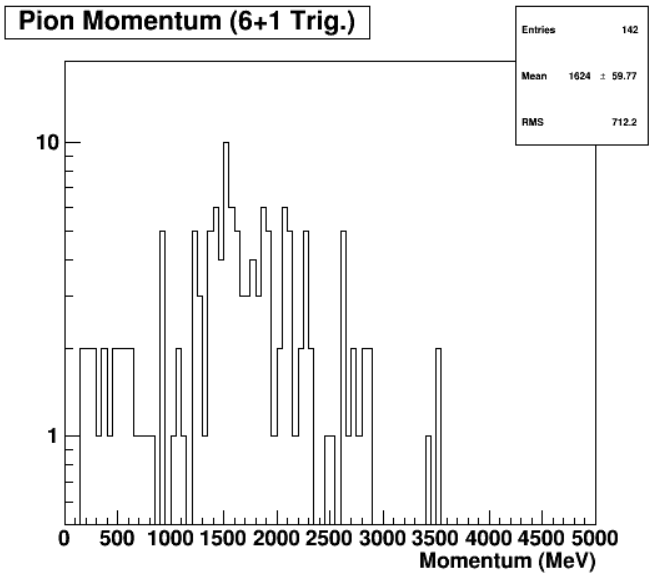


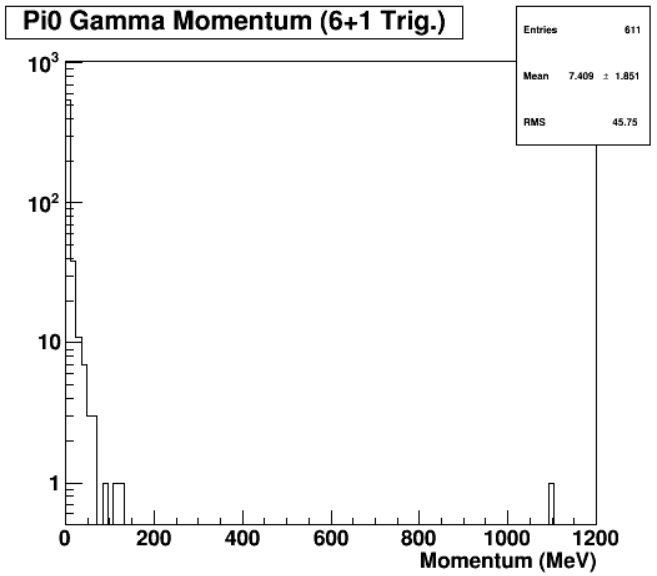


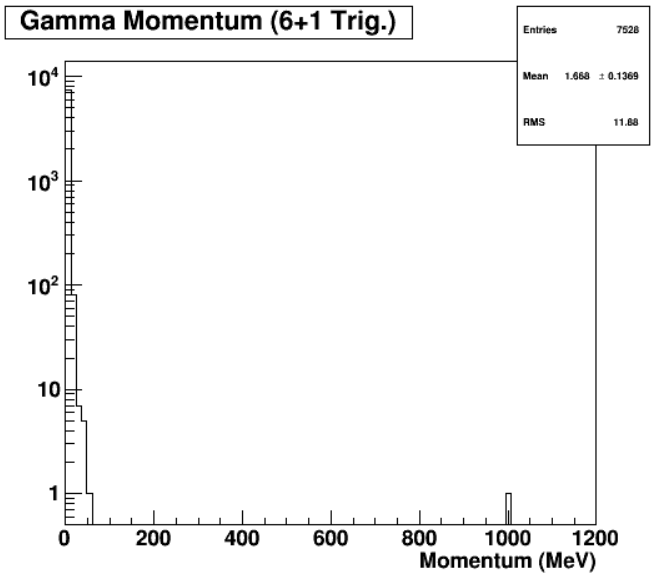
Total no.of tracks incident on the ECAL sector are categorized in to,

- Pions (+/-)
- Pi0 Photons
- All other photons

Tracks Incident on ECAL After 6+1 Trigger







Total no.of tracks incident on the ECAL sector are categorized in to,

- Pions (+/-)
- Pi0 Photons
- All other photons

ECAL : Wiser Background Rate

- Total background rates before and after applying the trigger
- With the photon blocker
- Photons are separated into two groups
  - From Pi0 and all other secondary photons
  - No high energy gammas after photon blocker
  - Photon rate is mostly dominated by very low energy tracks

All Mom.		Before Trigger	After 6+1 Trigger	After 2+1 Trigger
		(MHz)	(MHz)	(MHz)
	Bkg. e±	1308.2	0.9	0.4
	π±	842.5	5.3	2.0
	γ(π0)	55346.5	49.9	14.3
	all other γ	9104.3	11.4	3.7
P > 1 GeV				
	Bkg. e±	0.0	0.0	0.0
	π±	140.1	4.3	1.0
	γ(π0)	0.3	0.0	0.0
	all other γ	0.0	0.0	0.0
P < 1 GeV				
	Bkg. e±	1308.2	0.9	0.4
	π±	702.4	1.0	1.0
	γ(π0)	55346.2	49.9	14.3
	all other γ	9104.3	11.4	3.7

ECAL : Hall D Gen. Background Rate no EM Background

- Total background rates before and after applying the trigger
- With the photon blocker
- Photons are separated into two groups
  - From Pi0 and all other secondary photons
  - No high energy gammas after photon blocker
  - Photon rate is mostly dominated by very low energy tracks

All Mom.		Before Trigger	After 6+1 Trigger	After 2+1 Trigger
		(MHz)	(MHz)	(MHz)
	Bkg. e±	396.9	0.3	0.0
	π±	433.2	3.8	0.5
	γ(π0)	23010.9	14.2	2.5
	all other γ	4581.4	3.0	0.7
P > 1 GeV				
	Bkg. e±	0.1	0.0	0.0
	π±	97.3	3.1	0.5
	γ(π0)	0.2	0.03	0.0
	all other γ	0.2	0.0	0.0
P < 1 GeV				
	Bkg. e±	396.7	0.3	0.0
	π±	335.8	0.7	0.1
	γ(π0)	23010.7	14.1	2.5
	all other γ	4581.2	3.0	0.7

ECAL : Hall D Gen. Background Rate

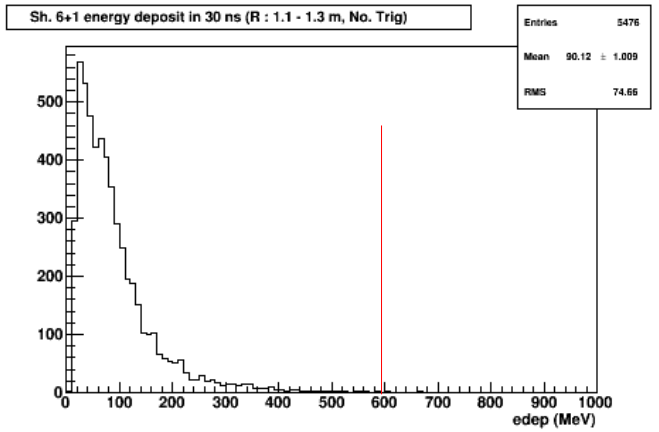
- Total background rates before and after applying the trigger
- With the photon blocker
- Photons are separated into two groups
  - From Pi0 and all other secondary photons
  - No high energy gammas after photon blocker
  - Photon rate is mostly dominated by very low energy tracks

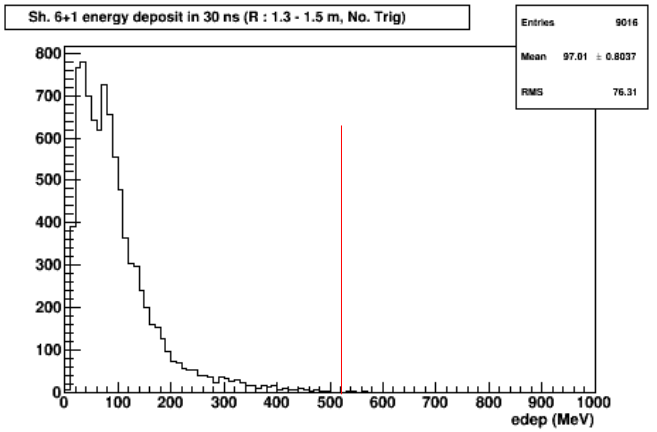
All Mom.		Before Trigger	After 6+1 Trigger	After 2+1 Trigger
		(MHz)	(MHz)	(MHz)
	Bkg. e±	3907.4	2.1	0.2
	π±	433.2	4.0	0.6
	γ(π0)	23010.9	17.4	2.9
	all other γ	367655.3	214.7	48.2
P > 1 GeV				
	Bkg. e±	0.1	0.0	0.0
	π±	97.3	3.3	0.5
	γ(π0)	0.2	0.03	0.0
	all other γ	0.2	0.0	0.0
P < 1 GeV				
	Bkg. e±	3907.2	2.1	0.2
	π±	335.8	0.8	0.1
	γ(π0)	23010.7	17.4	2.9
	all other γ	367655.1	214.6	48.2

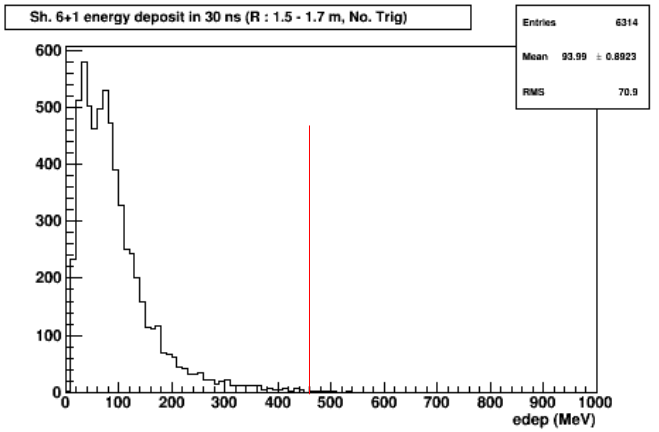
Trigger Rate Estimation

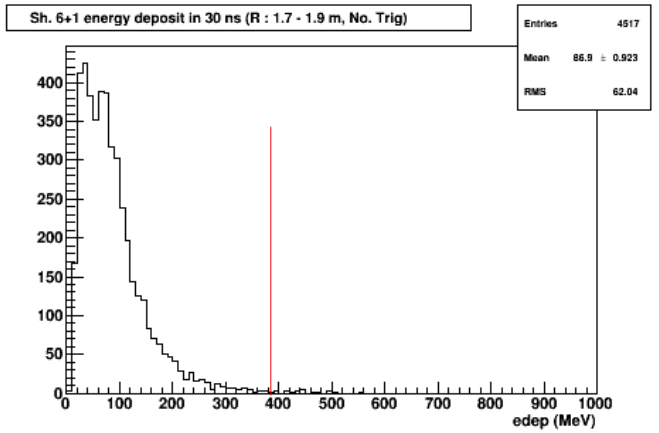
ECAL Shower Energy Deposit No EM

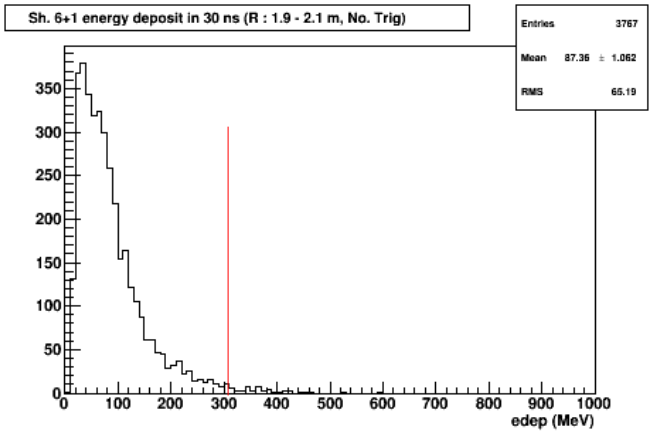
Trigger threshold

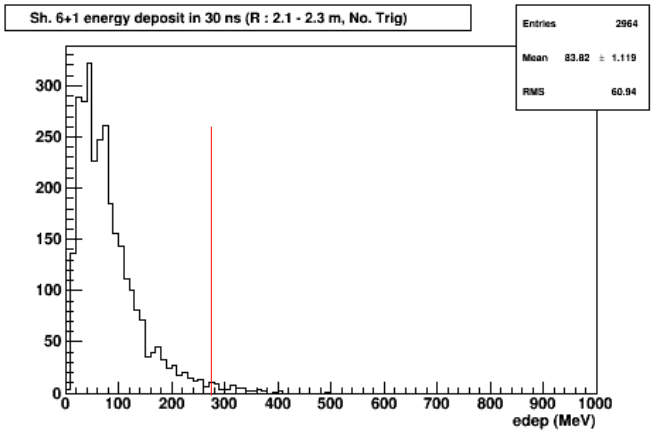


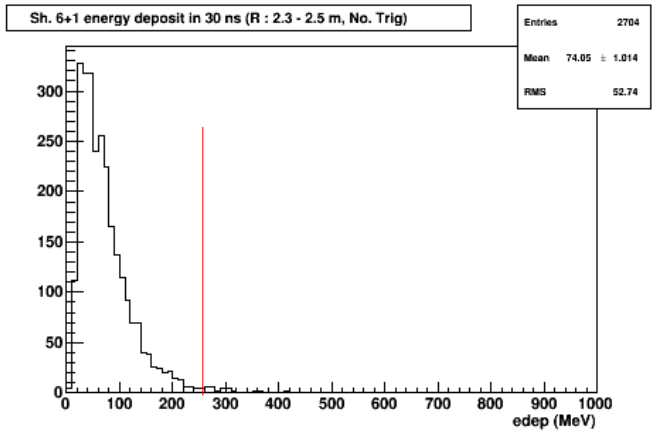


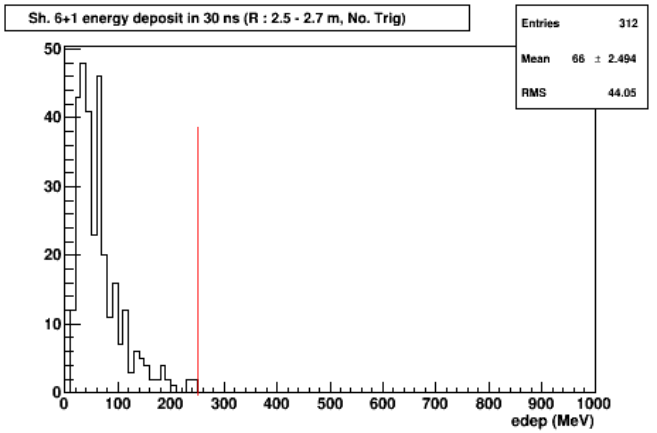


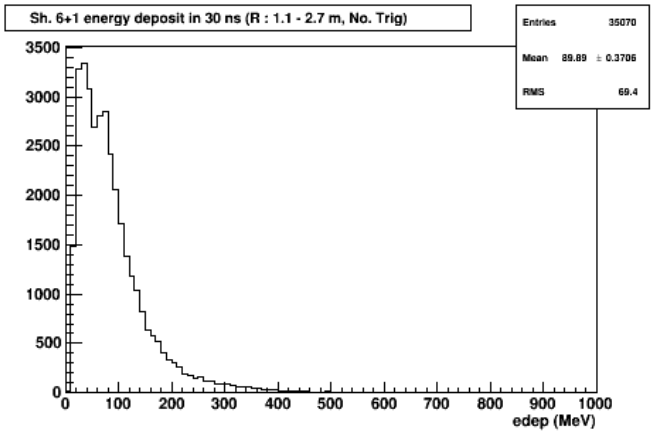






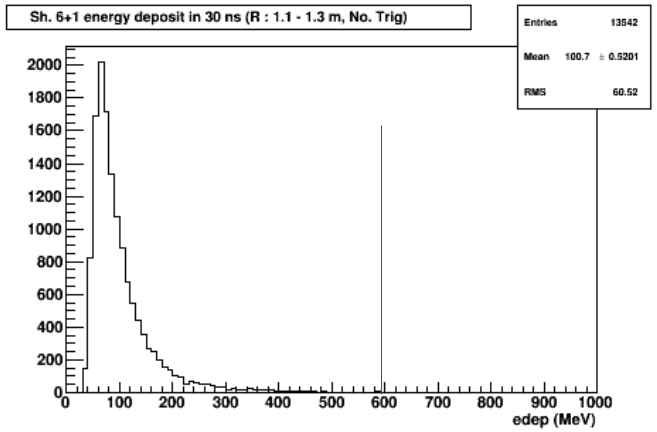


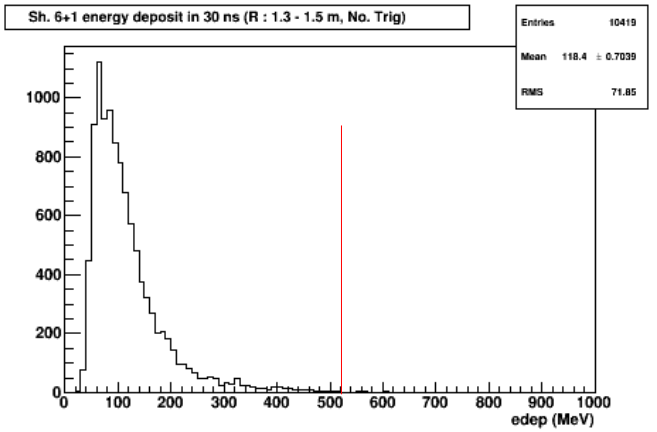


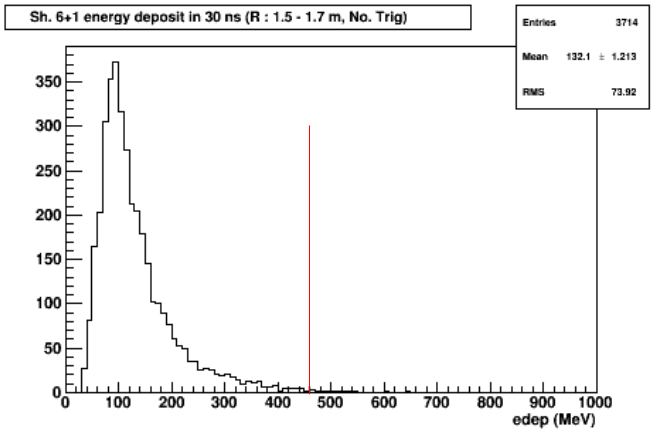


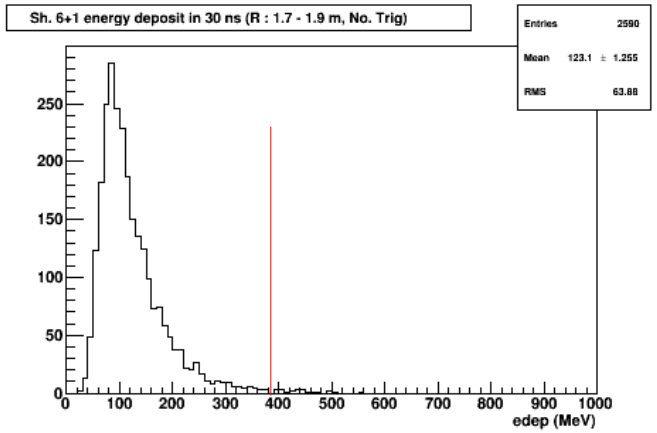
ECAL Shower Energy Deposit

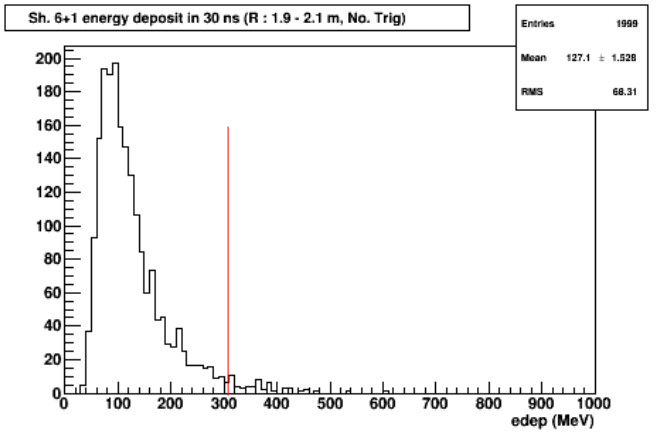
Trigger threshold

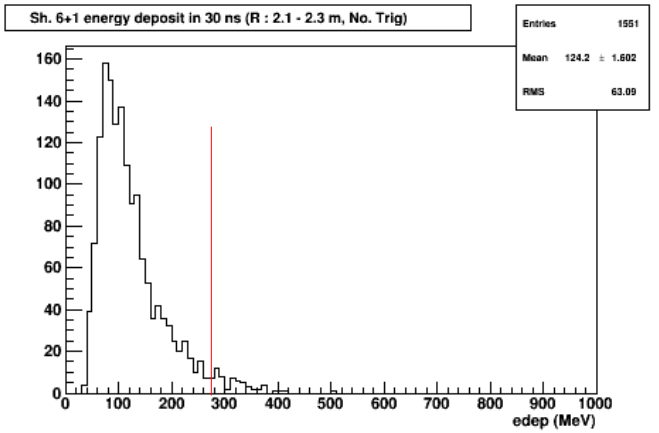


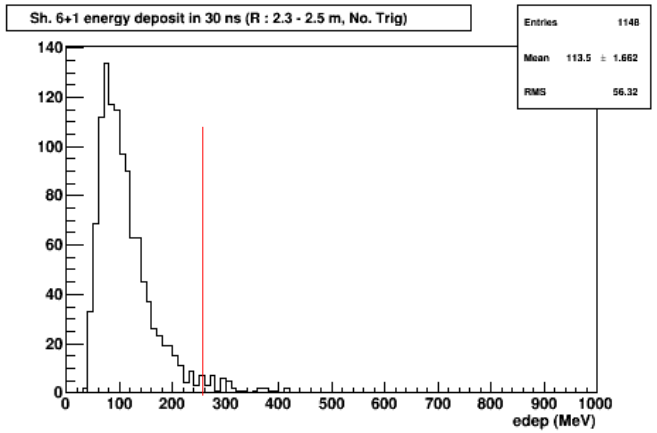


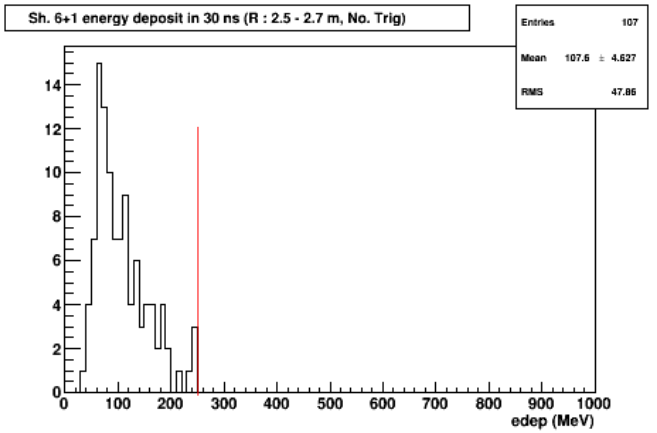


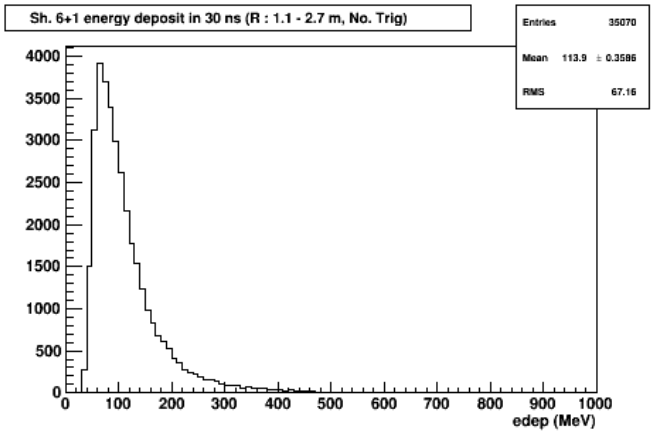






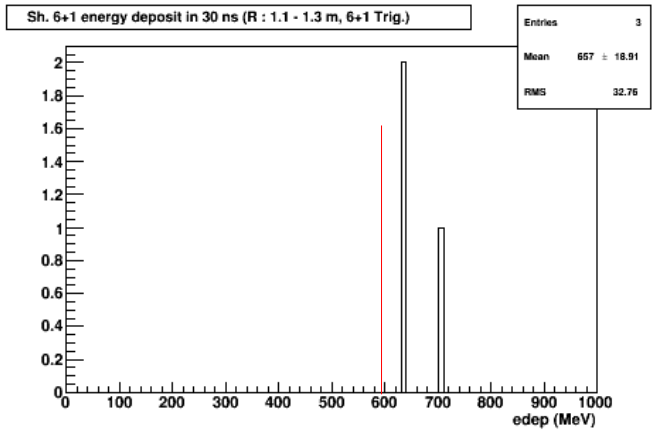


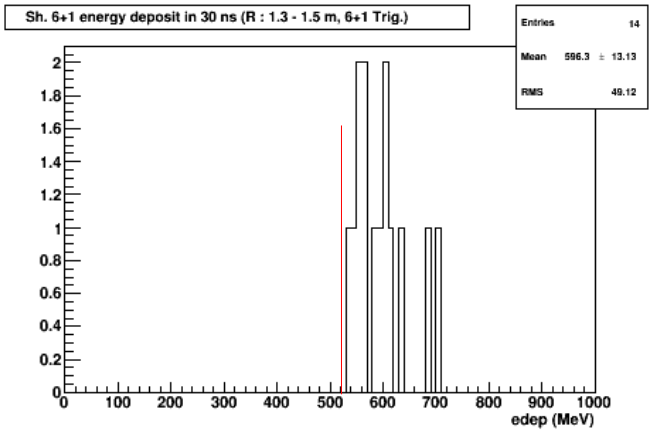


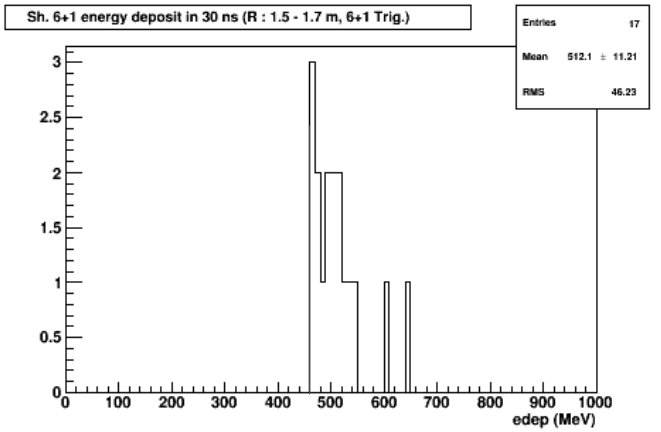


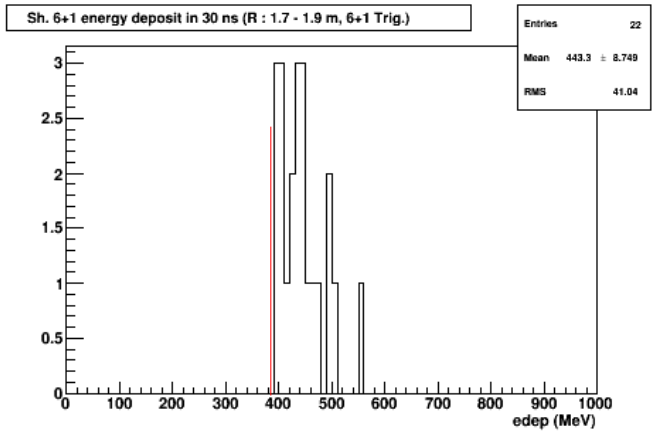
ECAL Shower Energy Deposit after Trigger

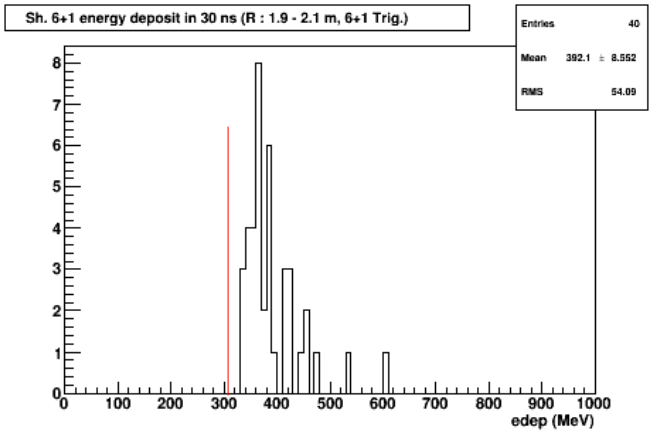
Trigger threshold

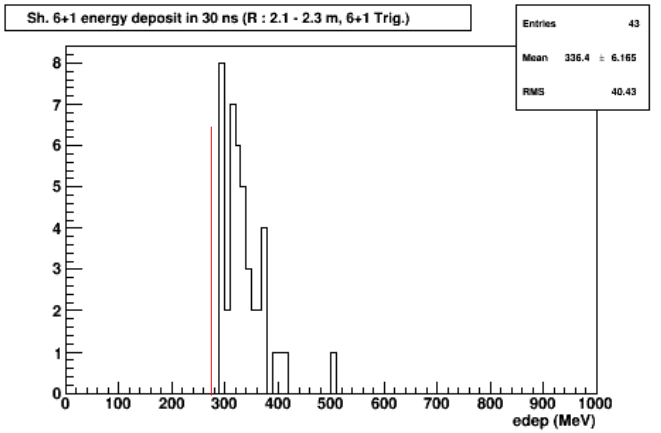


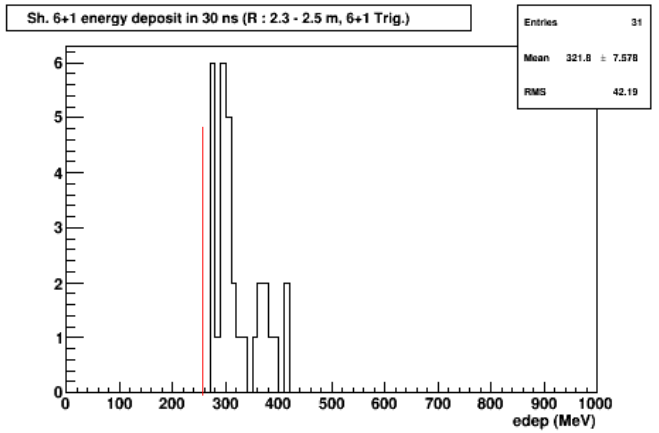


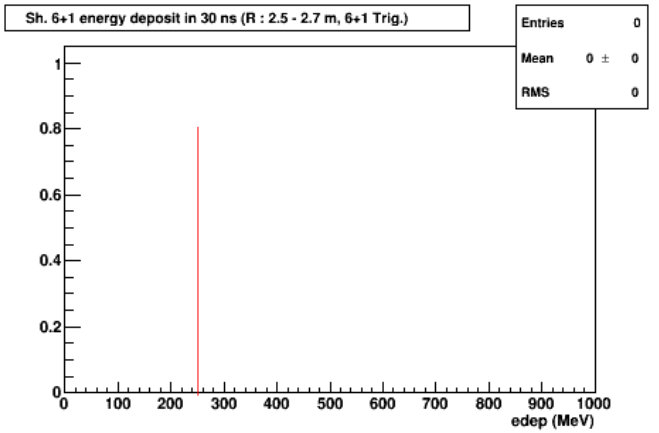


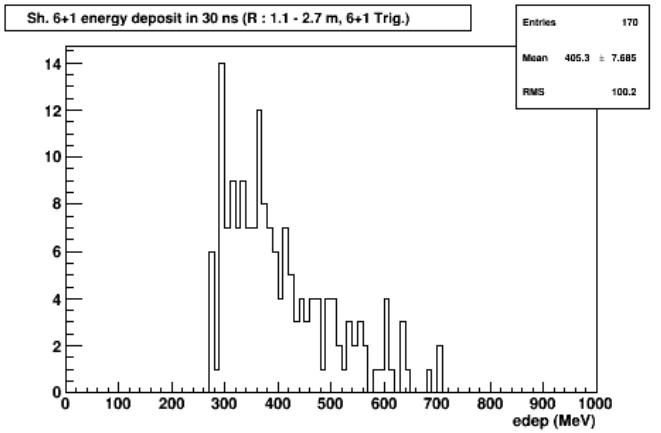




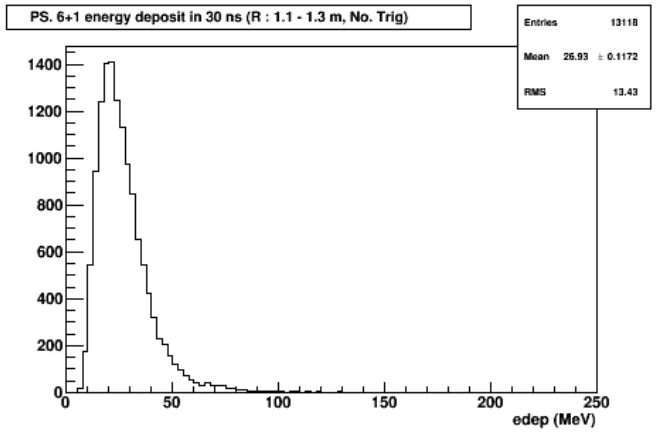


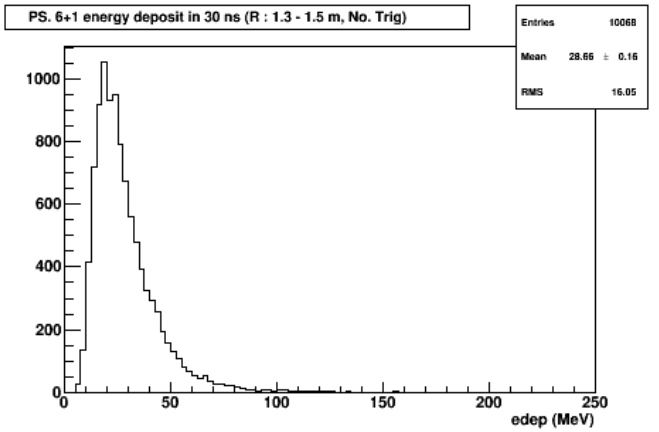


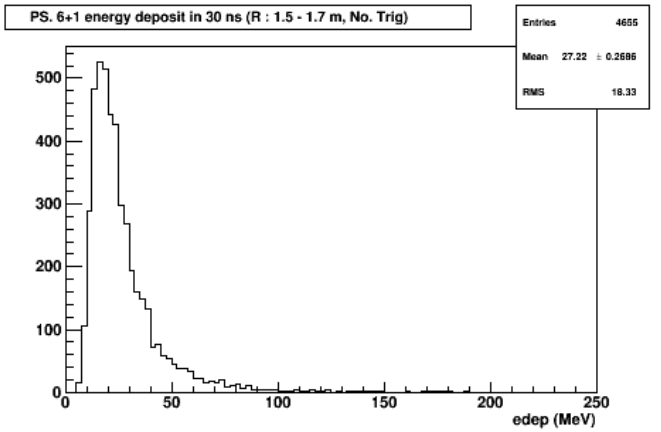


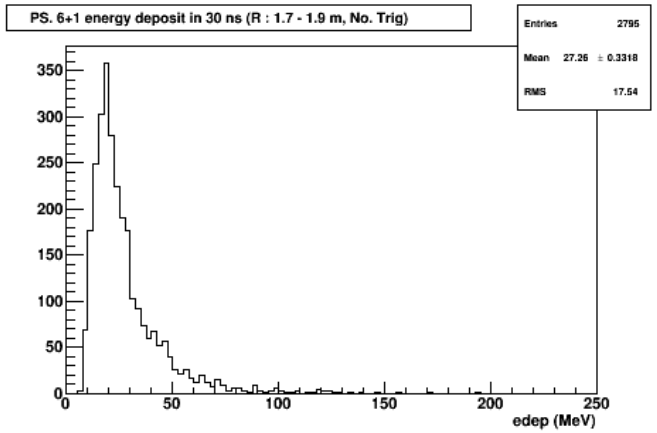


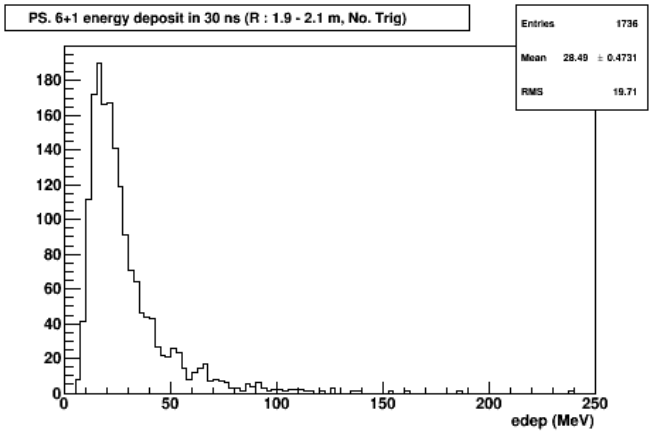
ECAL Pre-Shower Energy Deposit

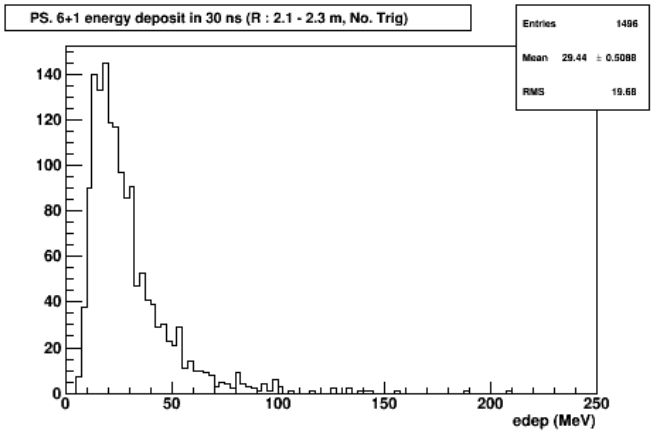


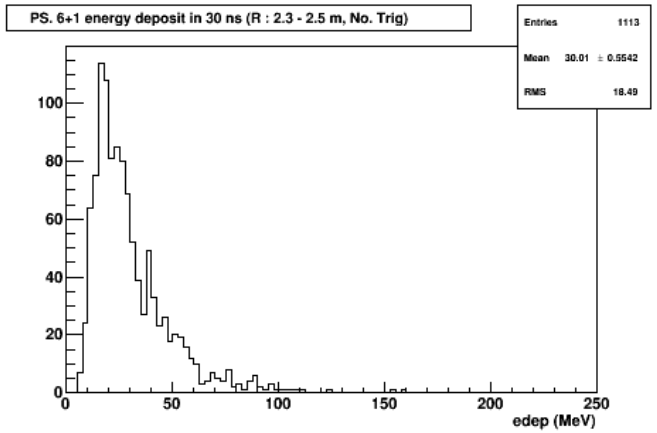


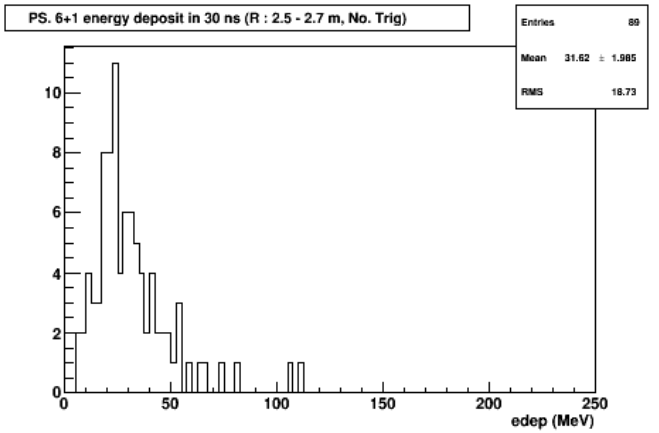


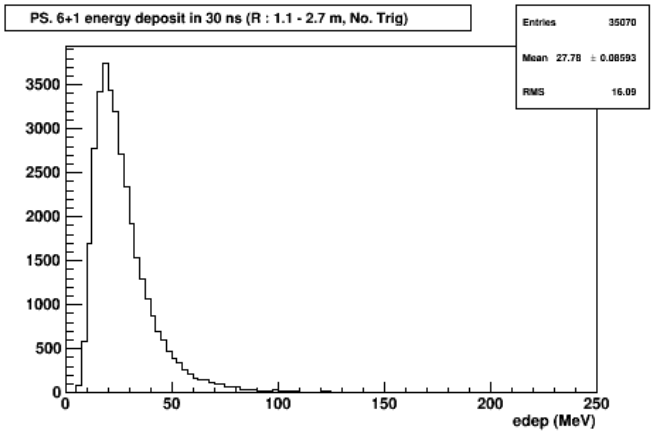












Trigger Rate Estimation with EM Background

- Total time windows 1169
  - In each window there are 30 individual sectors → 1169*30
- Maximum trigger rate is 1/30 ns → 33.33 MHz
  - This is when all time windows are triggered
- Total trigger rate is 4.85 MHz or 162 kHz per sector
    - Total time windows after applying the trigger 170
- Total trigger rate only from pion bkg. 4.612 MHz or 154 kHz per sector

Trigger Rate Sector wise summary			
Sector	Total Windows	Triggered Windows	Trig. Rate (kHz)
1	1169	9	256.6
2	1169	6	171.1
3	1169	1	28.5
4	1169	7	199.6
5	1169	7	199.6
6	1169	5	142.6
7	1169	2	57.0
8	1169	4	114.0
9	1169	5	142.6
10	1169	6	171.1
11	1169	4	114.0
12	1169	5	142.6
13	1169	9	256.6
14	1169	6	171.1
15	1169	3	85.5
16	1169	5	142.6
17	1169	5	142.6
18	1169	7	199.6
19	1169	7	199.6
20	1169	5	142.6
21	1169	5	142.6
22	1169	4	114.0
23	1169	8	228.1
24	1169	8	228.1
25	1169	6	171.1
26	1169	3	85.5
27	1169	10	285.1
28	1169	6	171.1
29	1169	6	171.1
30	1169	6	171.1
Total per Sector	35070	170	161.6

Trigger Rate Estimation in preCDR

region	full	high	low
rate entering the EC (kHz)			
e^-	413	148	265
π^-	5.1×10^5	2.7×10^5	2.4×10^5
π^+	2.1×10^5	1.0×10^5	1.2×10^5
$\gamma(\pi^0)$	8.4×10^7	4.2×10^7	4.3×10^7
p	5.5×10^4	2.4×10^4	3.1×10^4
sum	8.5×10^7	4.2×10^7	4.3×10^7
trigger rate for $p > 1$ GeV (kHz)			
e^-	321	80	231
π^-	4.8×10^3	3.4×10^3	1.4×10^3
π^+	0.28×10^3	0.11×10^3	0.17×10^3
$\gamma(\pi^0)$	4	4	0
p	0.18×10^3	0.10×10^3	0.08×10^3
sum	5.6×10^3	3.7×10^3	1.9×10^3
trigger rate for $p < 1$ GeV (kHz)			
sum	$(3.1 \pm 0.7) \times 10^3$	$(1.6 \pm 0.4) \times 10^3$	$(1.5 \pm 0.4) \times 10^3$
Total trigger rate (kHz)			
total	$(8.7 \pm 0.7) \times 10^3$	$(5.3 \pm 0.4) \times 10^3$	$(3.4 \pm 0.4) \times 10^3$

- Total trigger rate from Wiser + EM is 8.7 MHz
  - 290 kHz per sector