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

  – 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 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
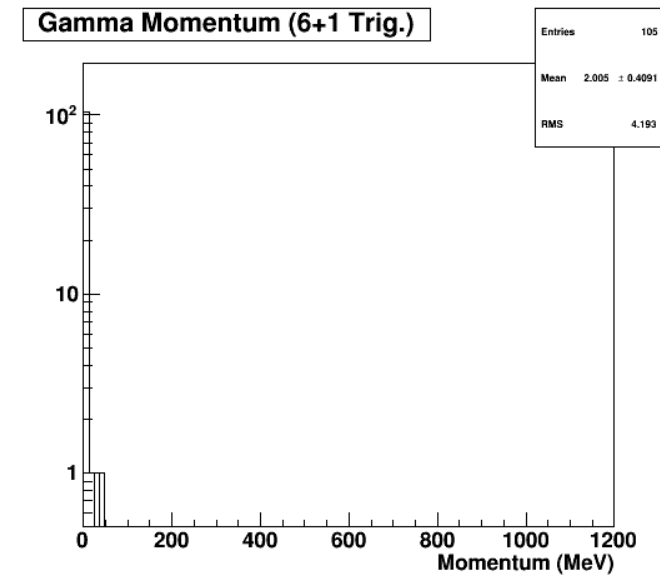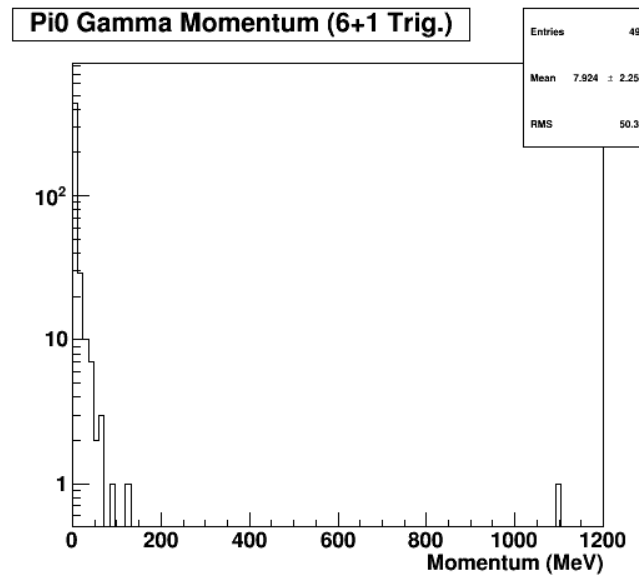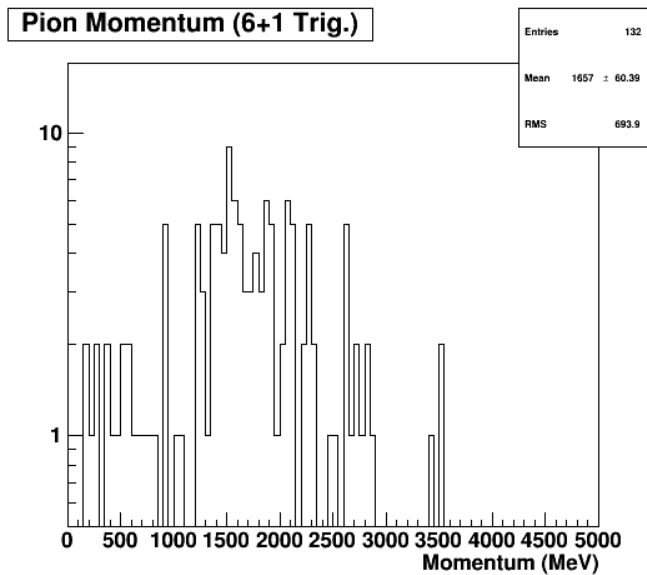
Tracks Incident on ECAL
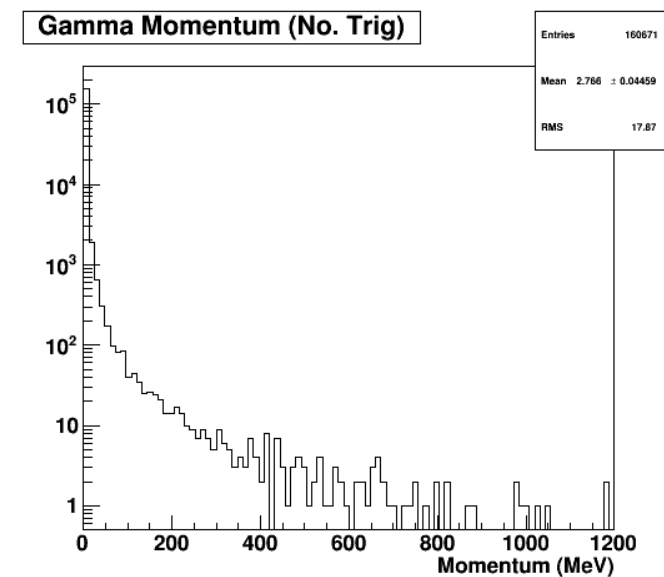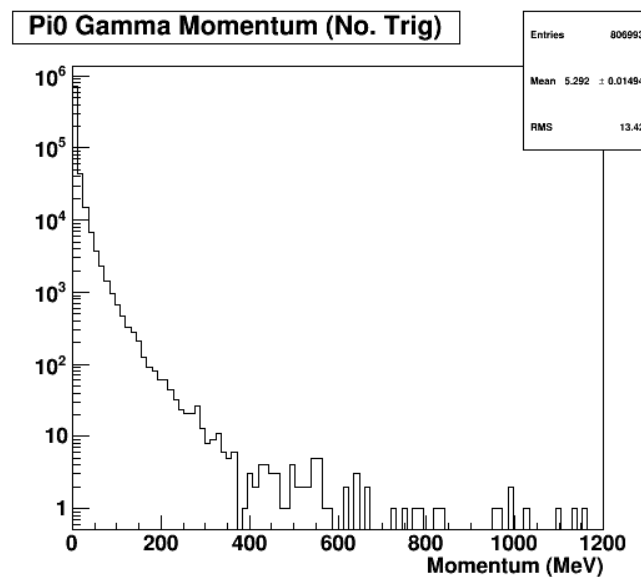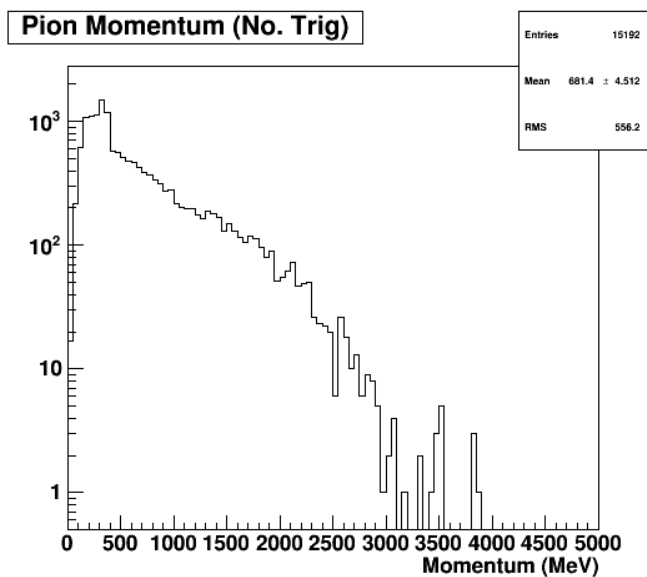
Total no.of tracks incident on the ECAL sector are categorized in to,
- Pions (+/-)
- Pi0 Photons
- All other photons

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 (MHz)	After 6+1 Trigger (MHz)	After 2+1 Trigger (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

- 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 (MHz)	After 6+1 Trigger (MHz)	After 2+1 Trigger (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 y	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	0.0	0.0
		all other y	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 y	4581.2	3.0	0.7

Trigger Rate Estimation

ECAL Shower Energy Deposit

Trigger threshold ⎯⎯⎯
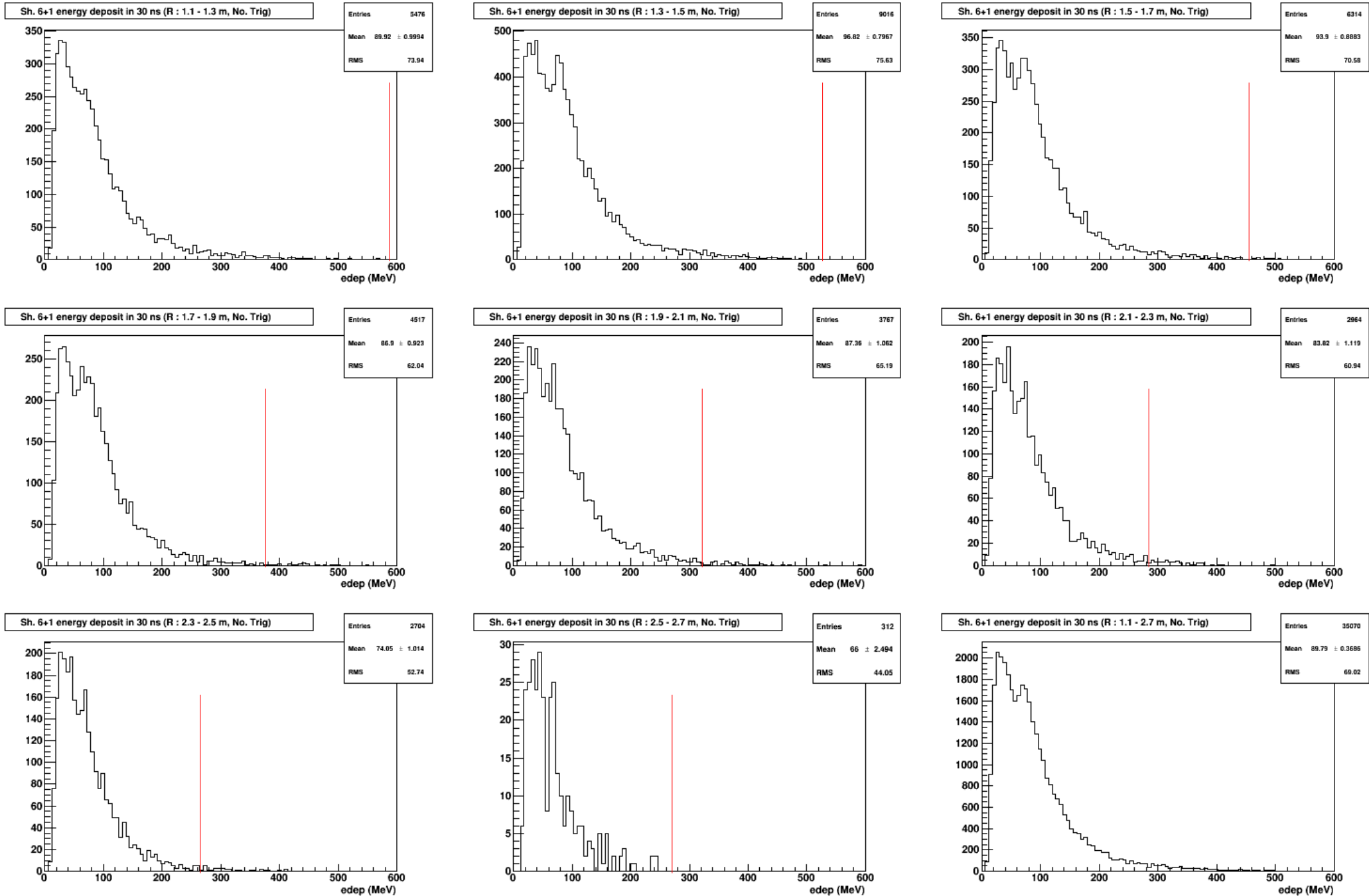
ECAL Shower Energy Deposit after Trigger

Trigger threshold ——————
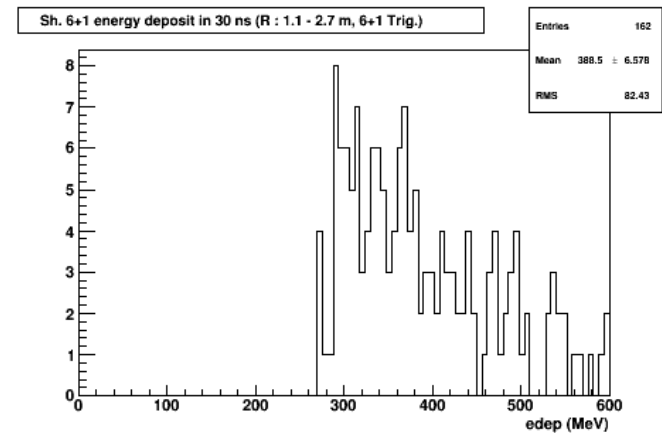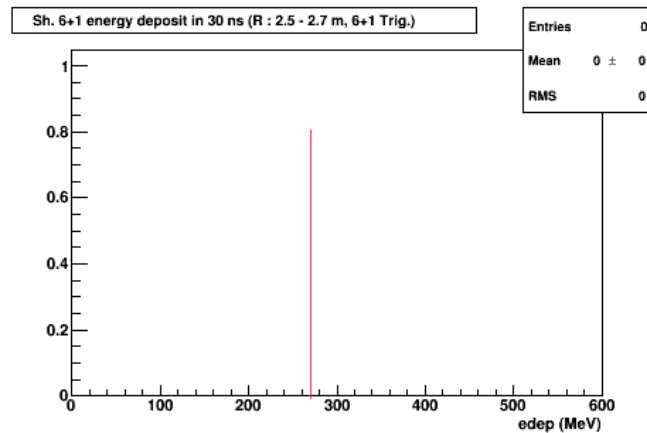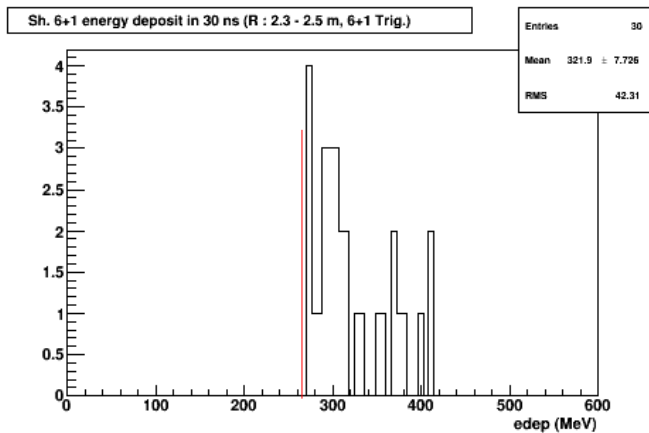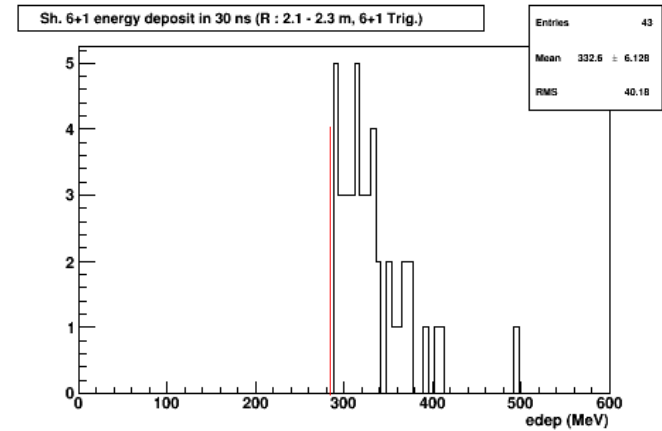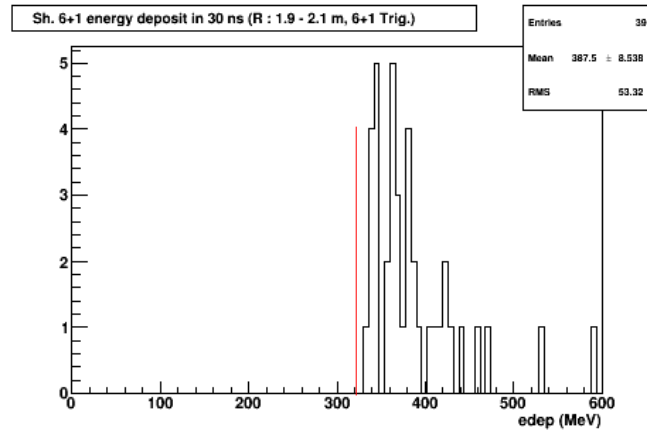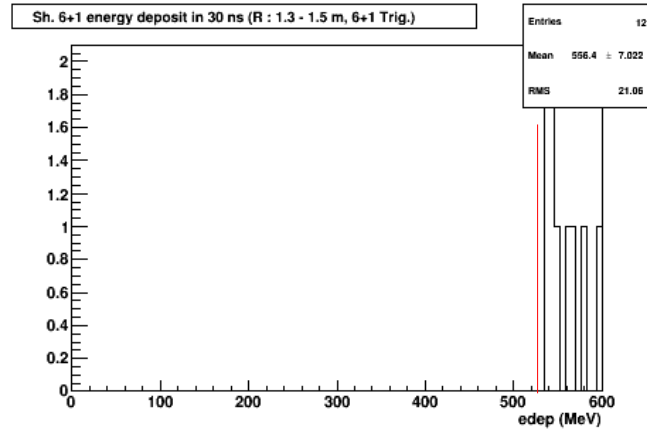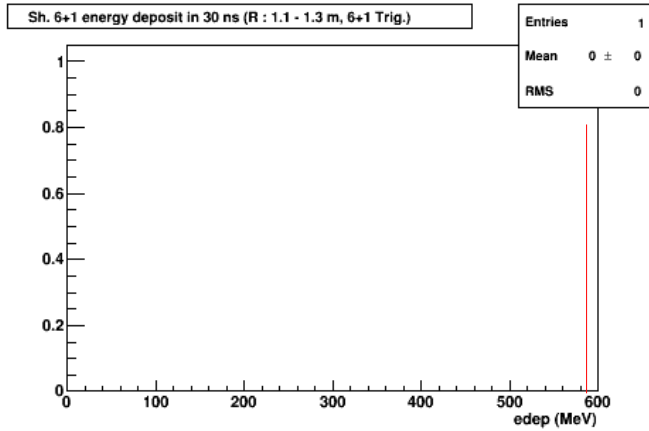
ECAL Pre-Shower Energy Deposit
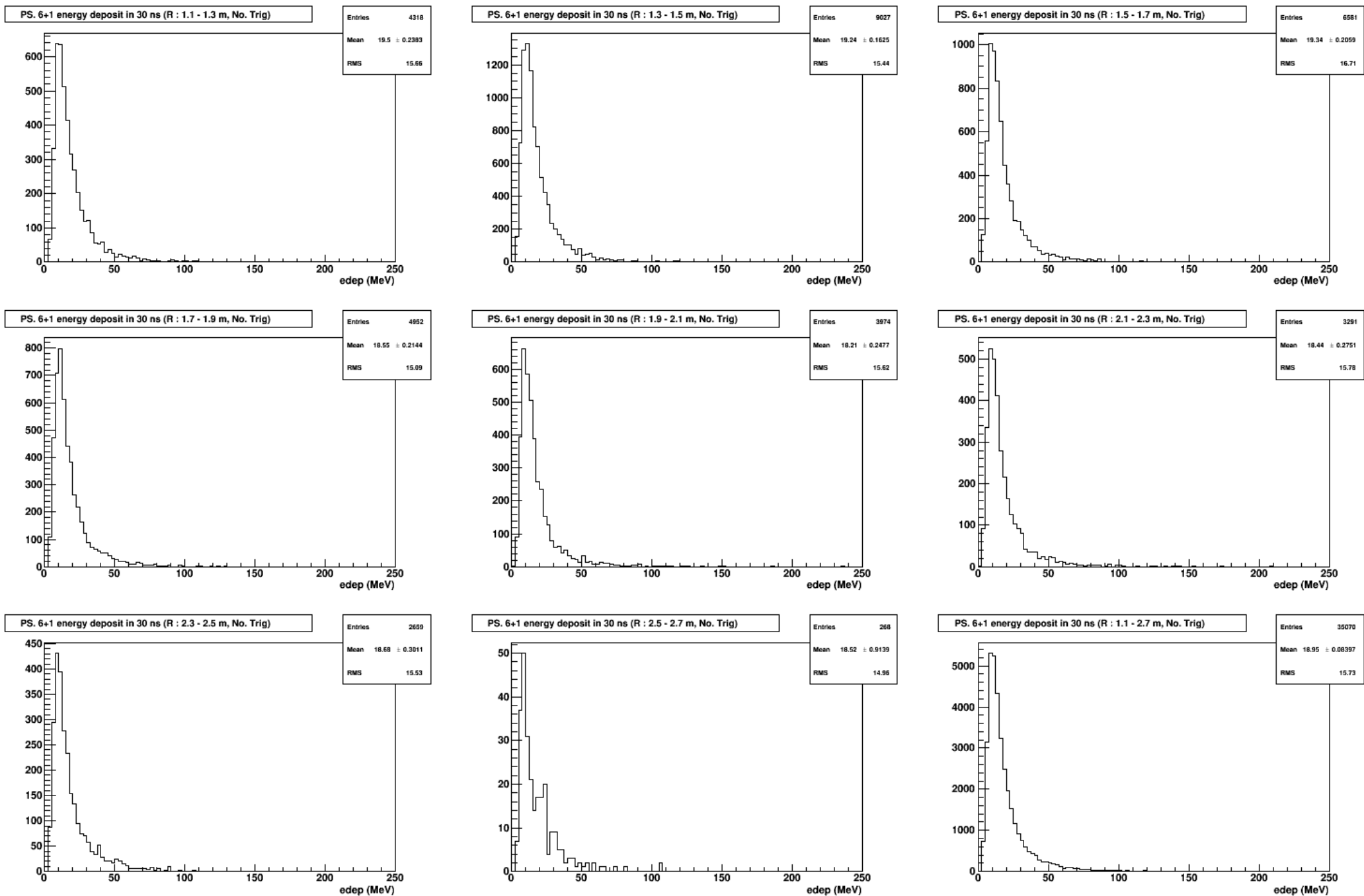
Trigger Rate Estimation

- Total time windows 1169
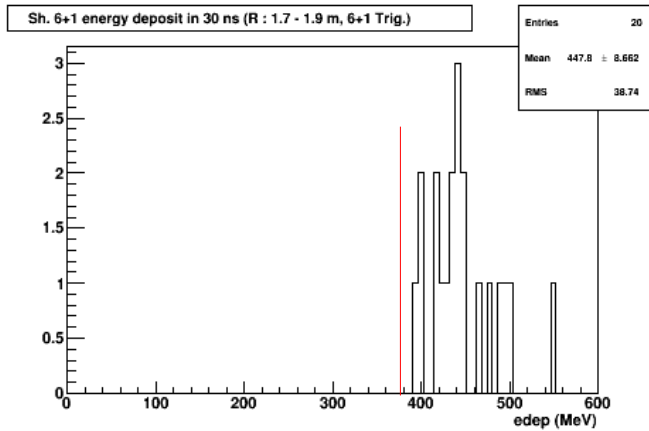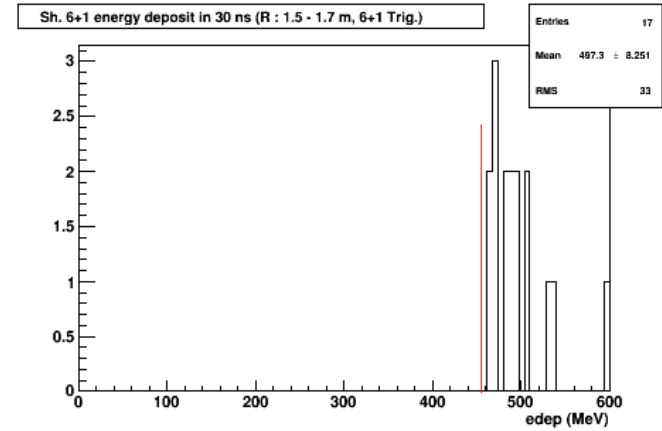
  – In each window there are 30 individual sectors → 1169*30

- Maximum trigger rate is 1/30 ns → 33.33 MHz

  – This is when all time windows are triggered

- Total time windows after applying the trigger 162

- Total trigger rate only from pion bkg. 4.612 MHz

  – 154 kHz per sector

- This estimation does not include EM background

Trigger Rate Estimation with Wiser

- Total time windows 233

    - In each window there are 30 individual sectors → 233*30

- Maximum trigger rate is 1/30 ns → 33.33 MHz

    - This is when all time windows are triggered

- Total time windows after applying the trigger 53

- Total trigger rate only from pion bkg. 7.58 MHz

    - 253 kHz per sector

- This estimation does not include EM background

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 8.7 MHz
  - 290 kHz per sector