

Remoll SoLID Simulation Update

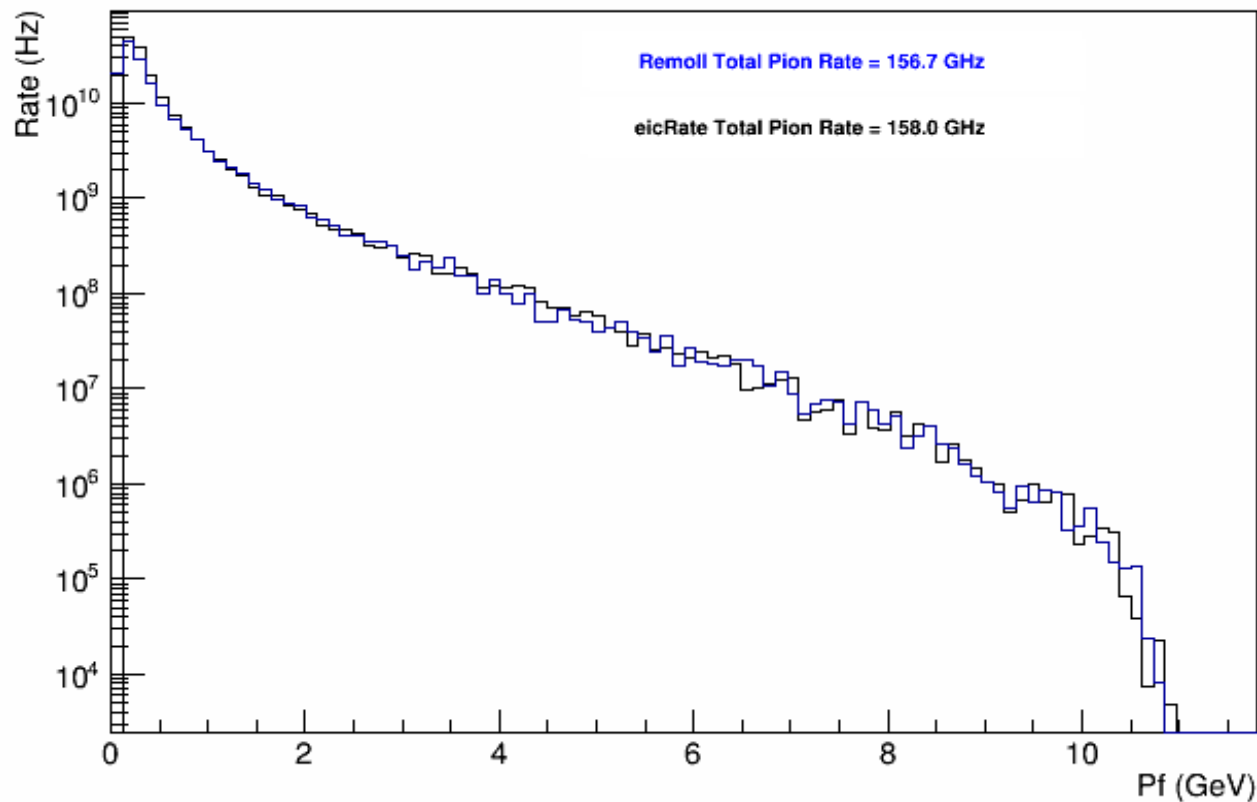
EM Calorimeter Update – 1

Pion Input Generators

	Pi+	Pi+	Pi-	Pi-
	Total Rate (GHz)	Rate from 0 to 60 deg (GHz)	Total Rate (GHz)	Rate from 0 to 60 deg (GHz)
Remoll	156.74	99.29	158.45	100.28
eicRate	158.03	100.18	157.57	99.70

Rates match within 1% and
Comparable no. of π^\pm are generated by both eicRate and Remoll

π^+ Input Generator Rate Comparison



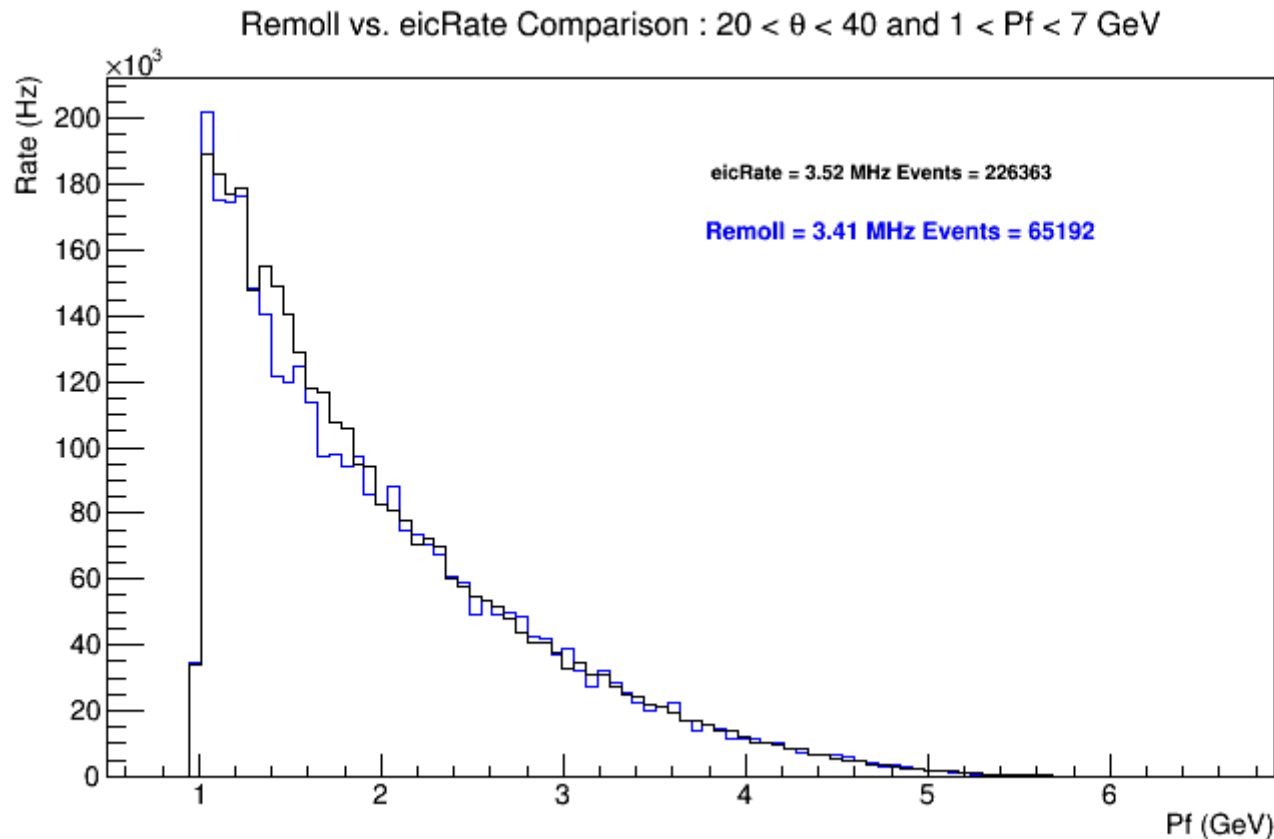
DIS Input Generator

In SoLID acceptance range ($20 < \theta < 40$ and $1 \text{ GeV} < P_f < 7 \text{ GeV}$),

Remoll Rate (MHz)	eicRate (MHz)
3.41	3.52

Rates matched within 3% after turning off following items,

- Multi-scattering correction after vertex
- Radiative loses in the target before vertex



Simulation Summary

- Used newly developed remoll simulation
 - First SoLID analysis using remoll simulation
- Baffles : babar_more1
 - Lead and Kryptonite
- Wiser DIS and Pions inputs
- Full EM calorimeter included

Calorimeter Geometry

- Hexagonal ecal blocks
 - Radius is 3.6 cm
- Each block has,
 - 0.05 cm Pb
 - 0.15 cm scintillator Material
 - 0.024 cm air gap
- There are 194 layers of these blocks along the z-directions
- In x-y plane, $R_{in} = 118$ cm $R_{out} = 261$ cm
- Energy deposited on scint. material and photons generated from the deposited energy are recorded for each block

Analysis Summary

- Only looked at events with primary tracks crossed the last GEM
 - Plotted momentum distribution of primary tracks and background electron and photon tracks at the last GEM
 - Plotted photons produced by the ecal block scintillator for these events
 - Plotted x-y distribution of the ecal block hits
- Analysis done for DIS e, pions (\pm) with lead baffles and making heavy materials kryptonite

Analysis Summary

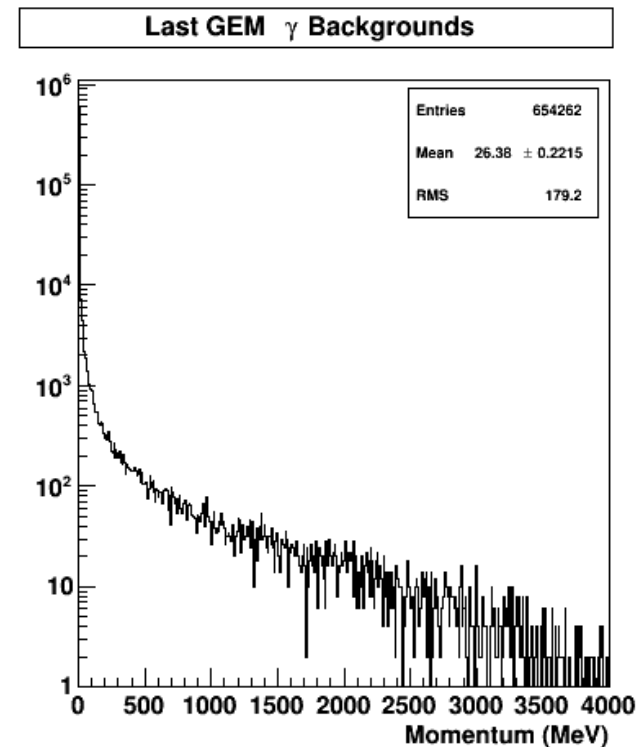
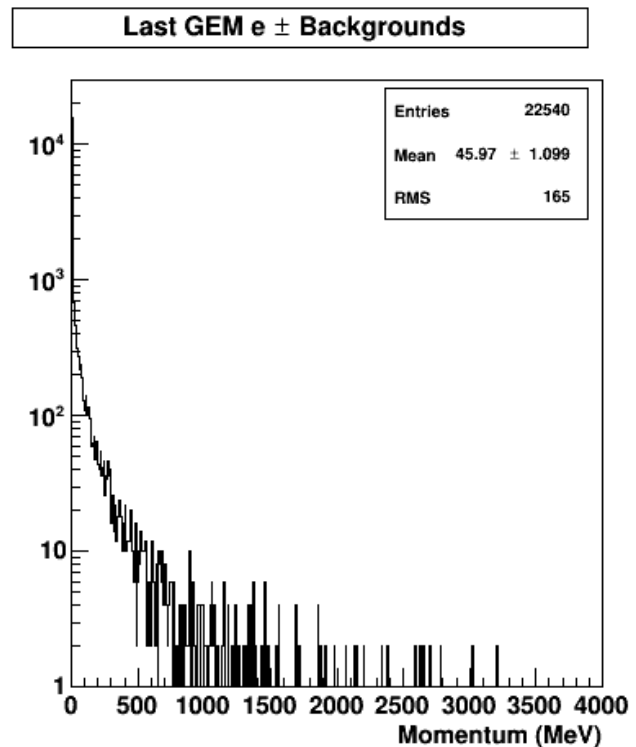
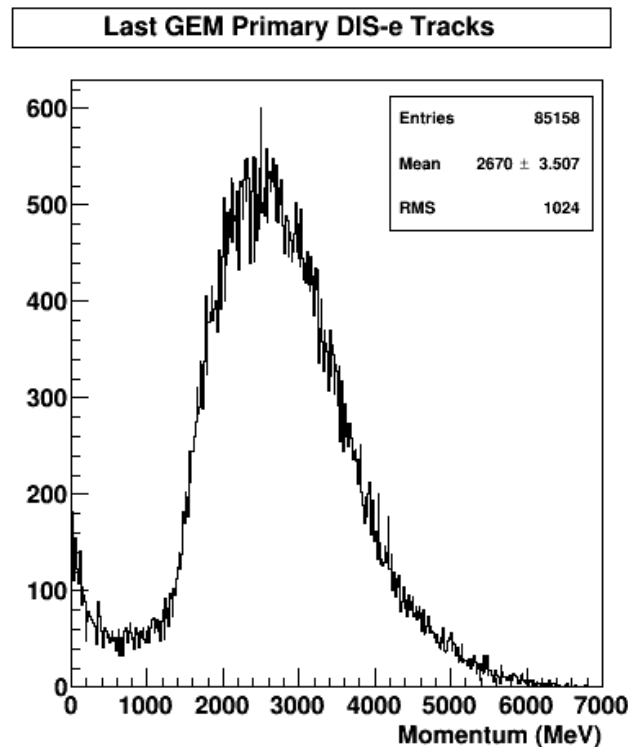
- Sample event

```
T->Scan("ev.evnum:hit.trid:hit.pid:(hit.det-40005)","(hit.p>0 && ((hit.det-40005)%100==0)
&& hit.det>40000 && hit.det<50000)","")
```

```
*****
* Row * Ins * evnum * hit.trid * hit.pid * hit.det *
*****
* 2 * 28 * 3 * 617 * 22 * 2000 *
* 2 * 32 * 3 * 1 * 11 * 2200 *
* 2 * 33 * 3 * 107 * 22 * 2200 *
* 2 * 34 * 3 * 1018 * 22 * 2200 *
* 2 * 35 * 3 * 2040 * 22 * 2200 *
```

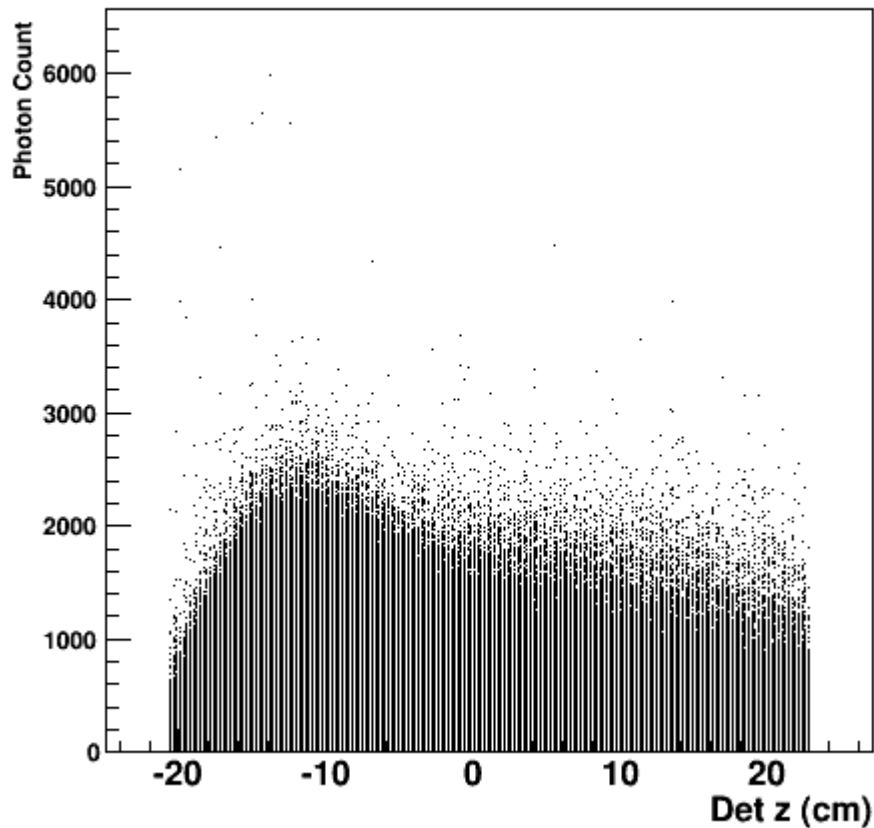
Note: trid=1 is primary track and trid>1 are secondaries

DIS-e Momentum distributions at last GEM with lead baffles (From all the events)

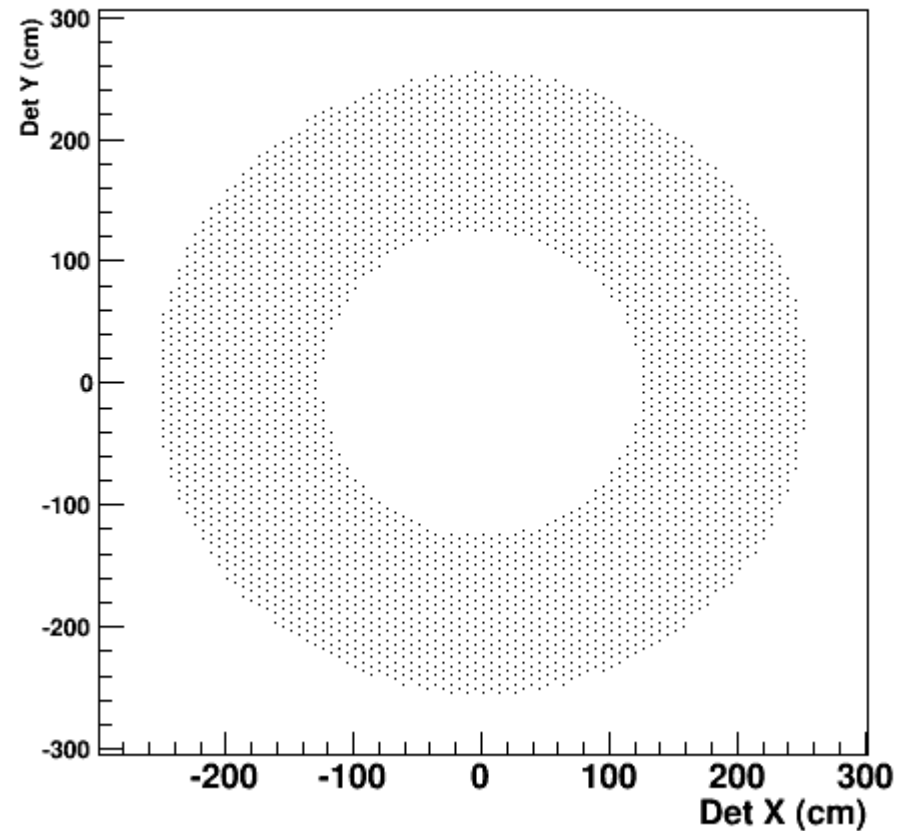


Photon production at scint. for events with primary DIS-e tracks with lead baffles (From all the events)

Total Photons Generated on Shower Scint. by Primary DIS-e Tracks



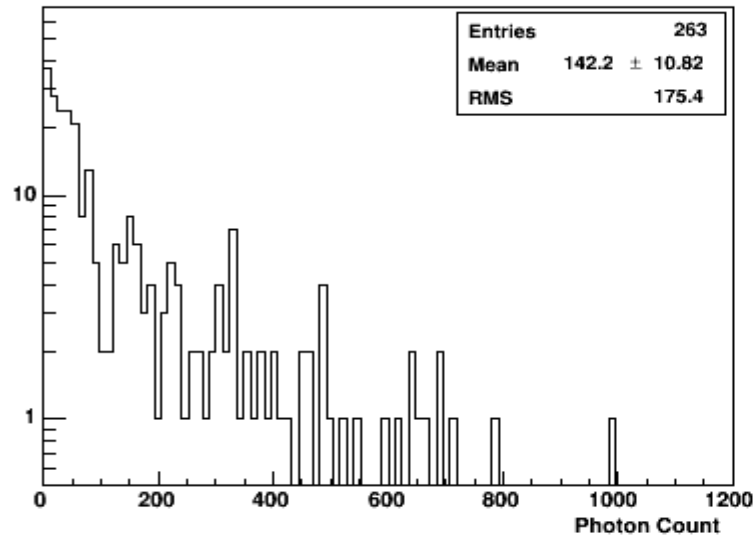
ECAL Blocks : Det Y vs Det X Pos. for Primary DIS-e Tracks



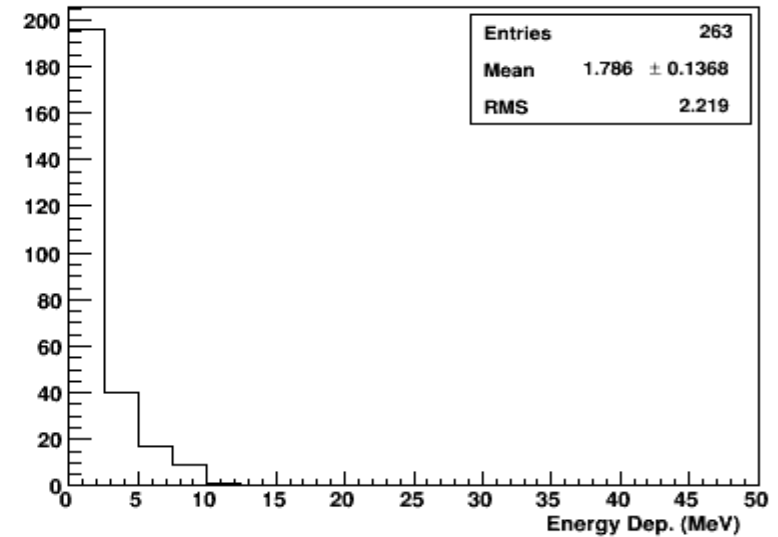
DIS-e Single Event

Energy deposition for a single event with Pb baffles

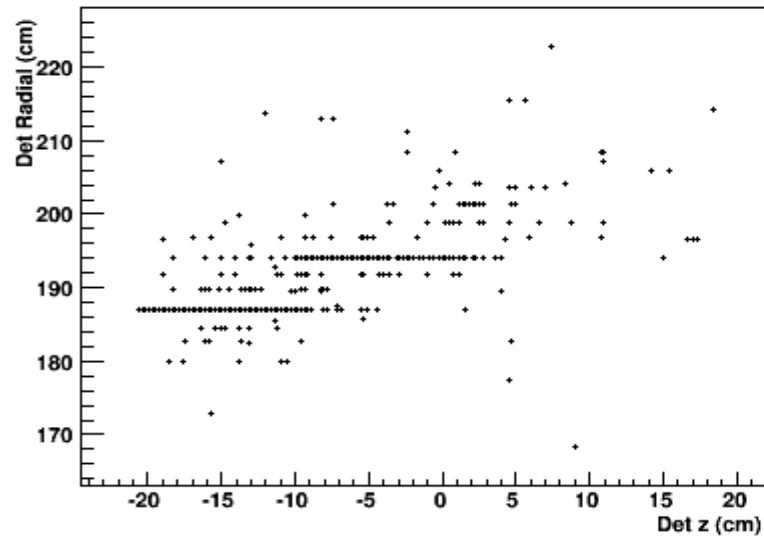
Generated Photon on Scint. from Single Primary DIS-e Track



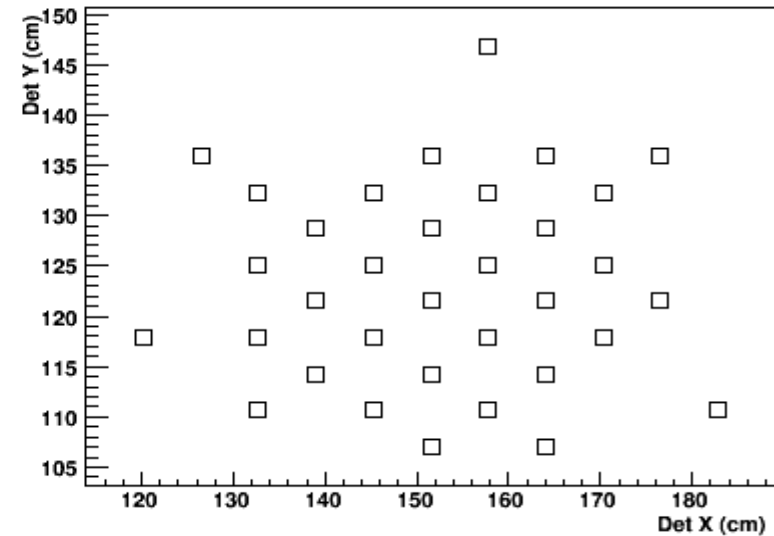
Energy Deposited on Scint. from Single Primary DIS-e Track



ECAL Blocks : Radial Pos. vs Z Pos. for Primary Single DIS-e Track



ECAL Blocks : Det Y vs Det X Pos. for Single Primary DIS-e Track

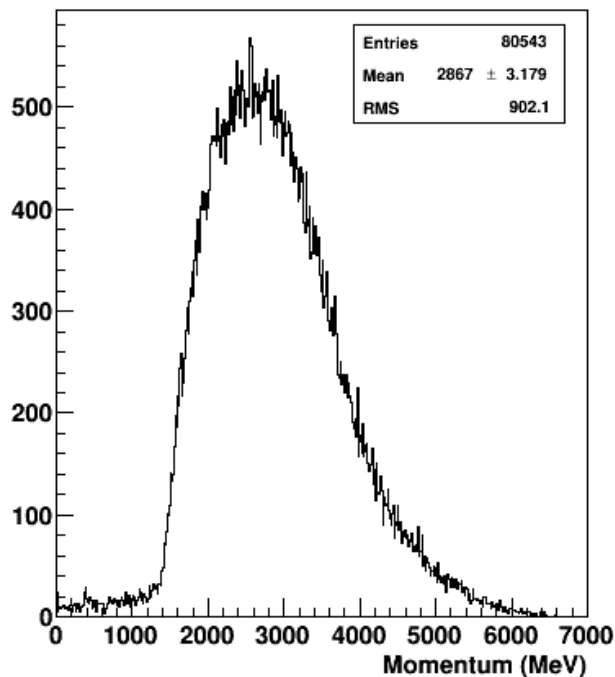


DIS-e Single Event

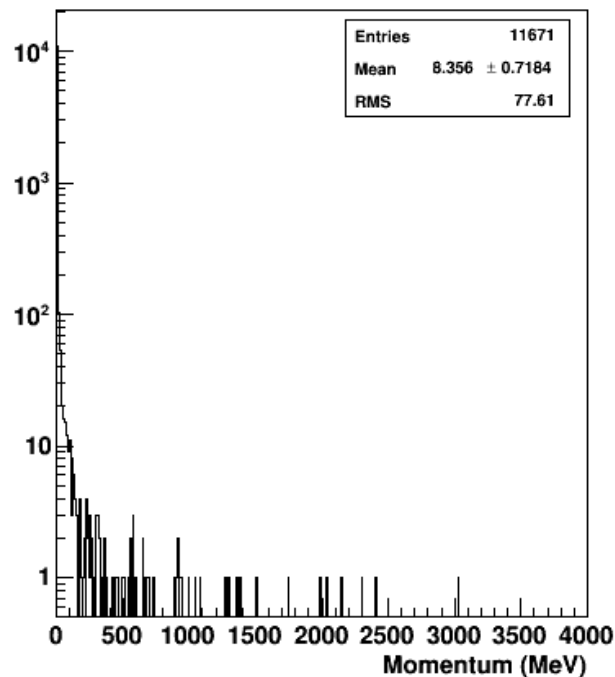
```
*****
* Row * Instance * hit.trid * hit.p * hit.x*100 * hit.y*100 * hit.pid * (hit.det- *
*****
* 15 * 19 * 1 * 1.5884668 * 137.87799 * 109.18470 * 11 * 2700 *
* 15 * 20 * 193 * 0.0029760 * 183.01808 * 118.12150 * 22 * 2700 *
* 15 * 21 * 22 * 0.2233527 * 137.86100 * 109.32652 * 22 * 2700 *
* 15 * 22 * 895 * 0.0011785 * 159.09273 * 132.96126 * 22 * 2700 *
* 15 * 23 * 893 * 0.0006715 * 147.04666 * 122.2924 * 22 * 2700 *
* 15 * 24 * 1760 * 0.0005109 * 149.38992 * 115.83917 * 22 * 2700 *
* 15 * 27 * 895 * 0.0001174 * -153.6115 * 159.42311 * 22 * 1900 *
* 15 * 53 * 193 * 0.0002048 * 146.61562 * 31.162612 * 22 * 2900 *
*****
```

DIS-e Momentum distributions at last GEM with Kryptonite heavy materials (From all the events)

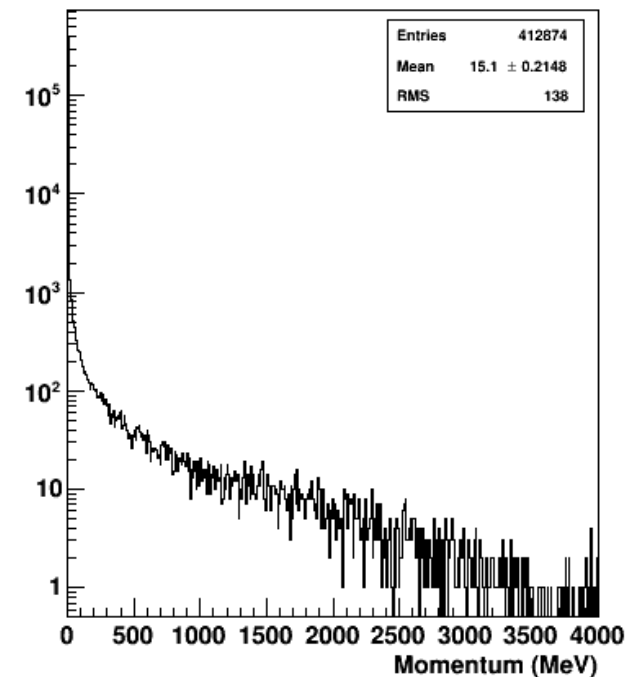
Last GEM Primary DIS-e Tracks



Last GEM e ± Backgrounds

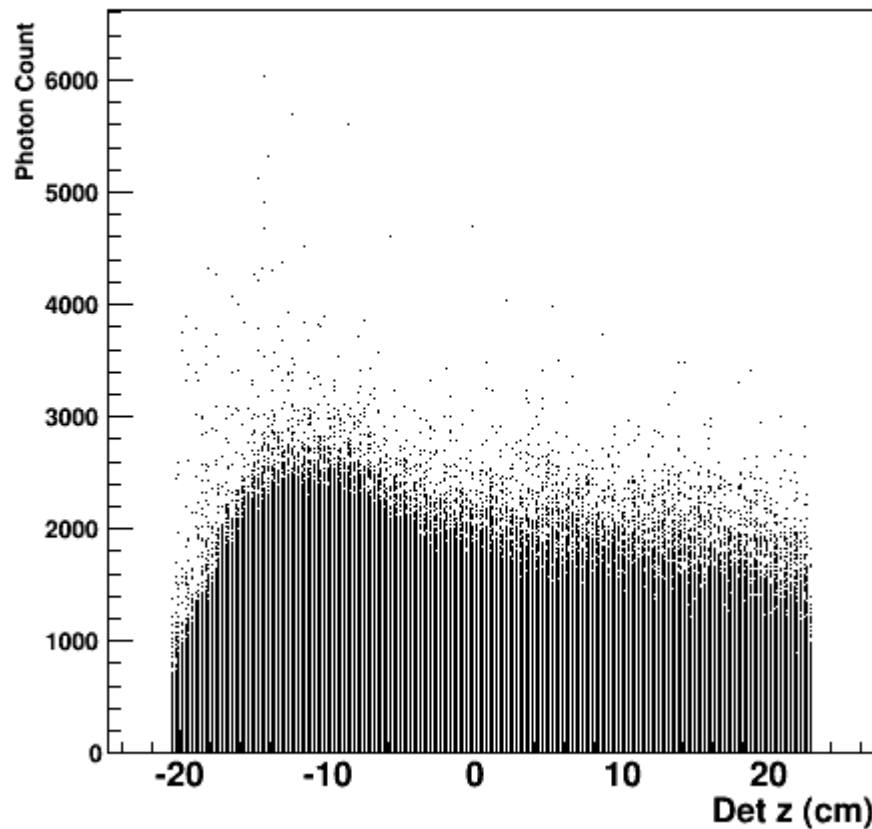


Last GEM γ Backgrounds

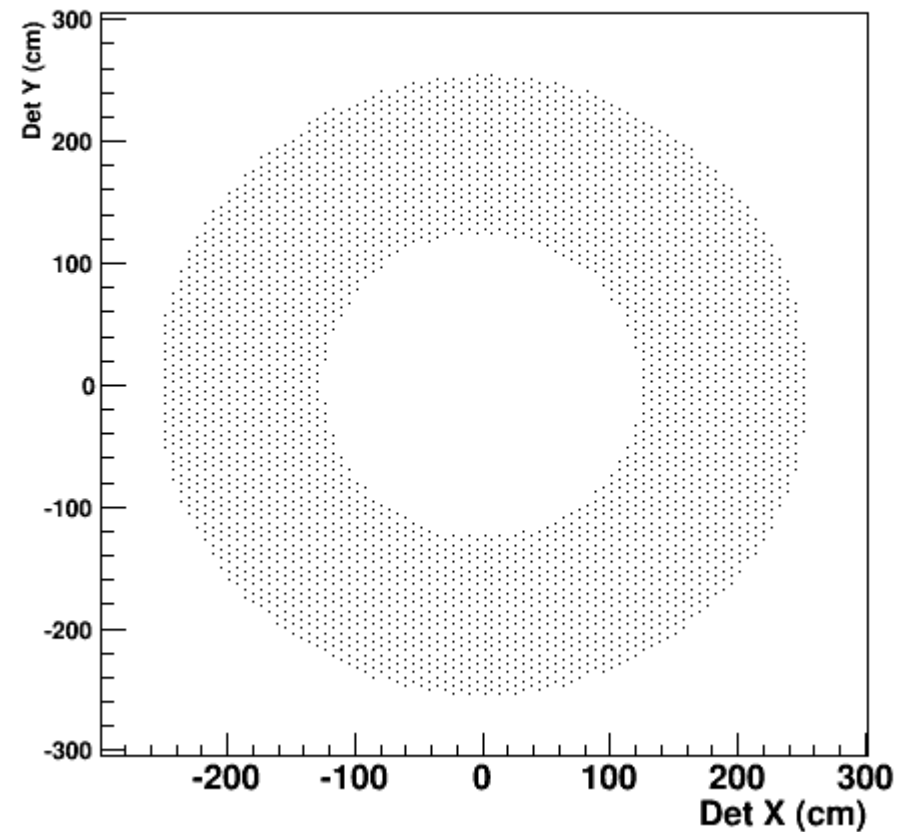


DIS-e Photon production at scint. for events with primary tracks with Kryptonite heavy materials (From all the events)

Total Photons Generated on Shower Scint. by Primary DIS-e Tracks



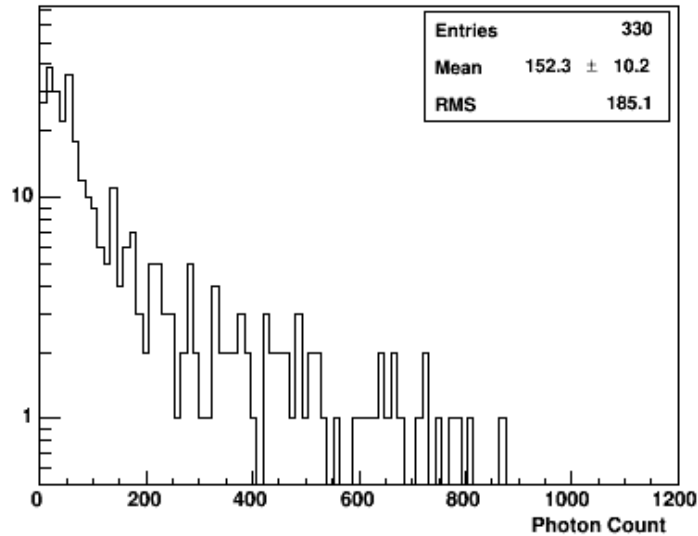
ECAL Blocks : Det Y vs Det X Pos. for Primary DIS-e Tracks



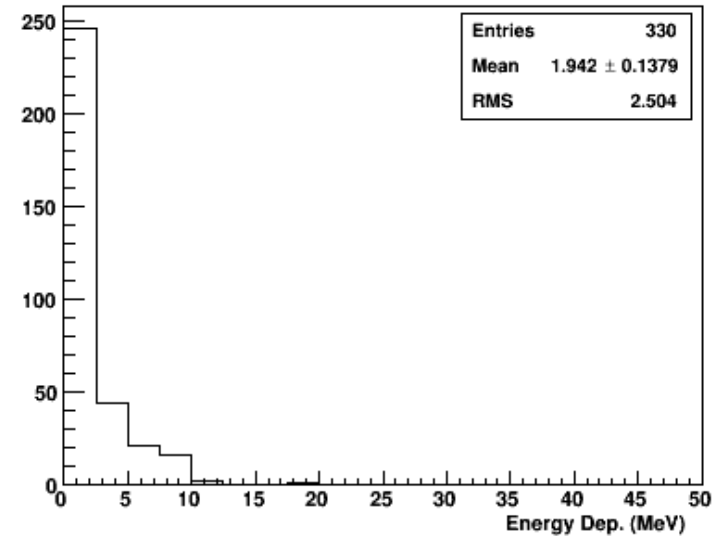
DIS-e Single Event

Energy deposition for a single event with Kryptonite heavy materials

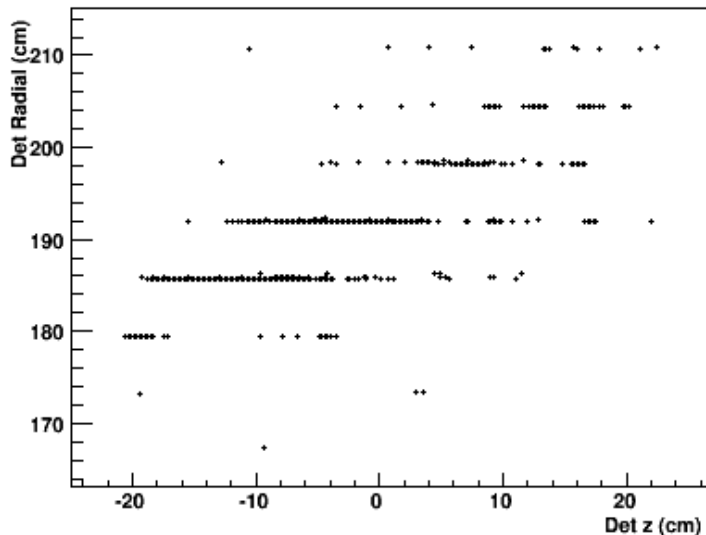
Generated Photon on Scint. from Single Primary DIS-e Track



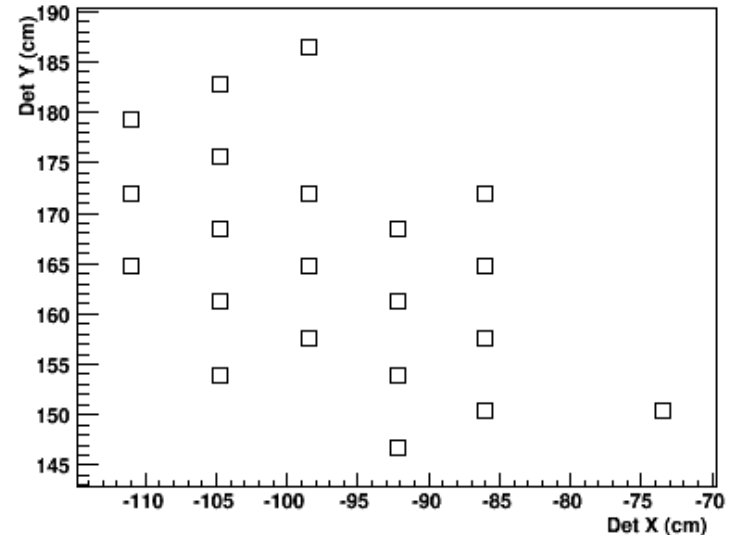
Energy Deposited on Scint. from Single Primary DIS-e Track



ECAL Blocks : Radial Pos. vs Z Pos. for Primary Single DIS-e Track



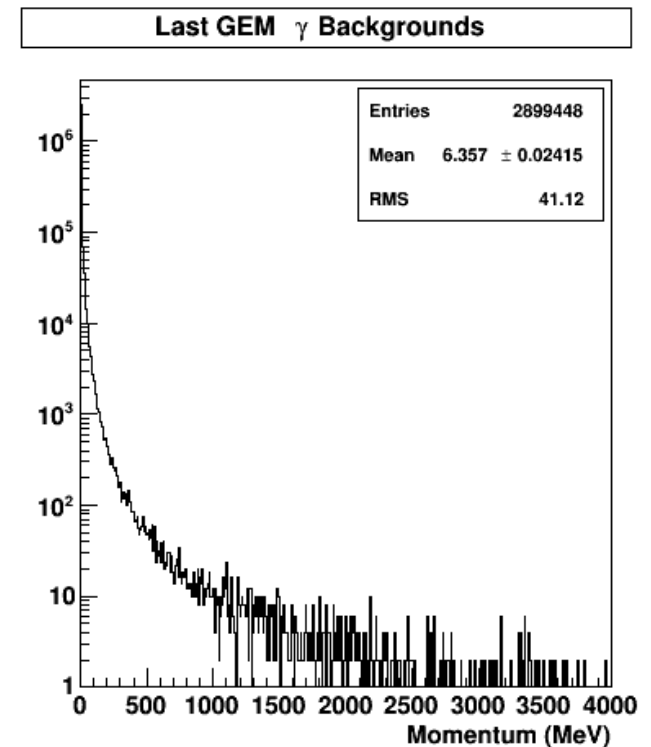
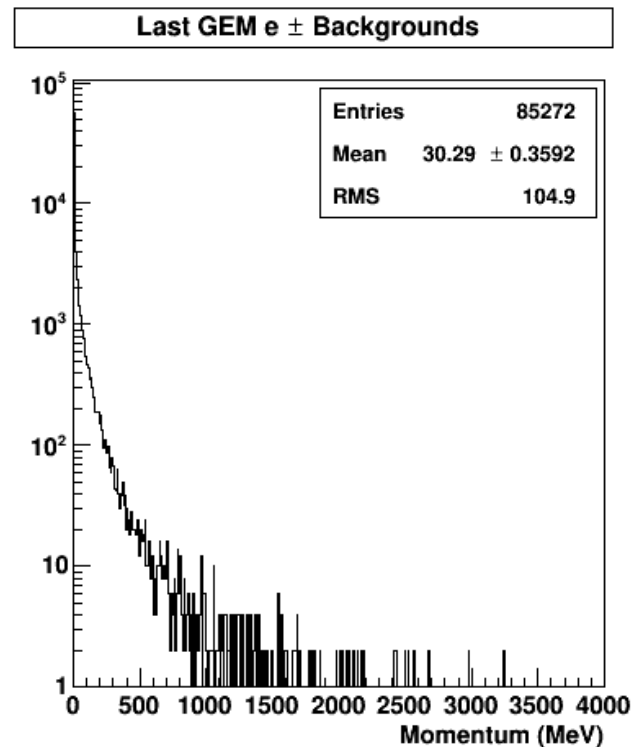
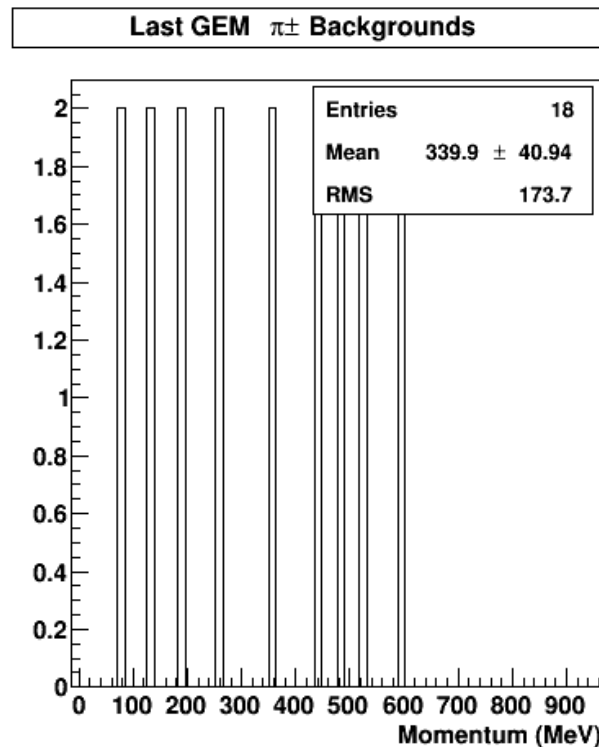
ECAL Blocks : Det Y vs Det X Pos. for Single Primary DIS-e Track



DIS-e Single Event

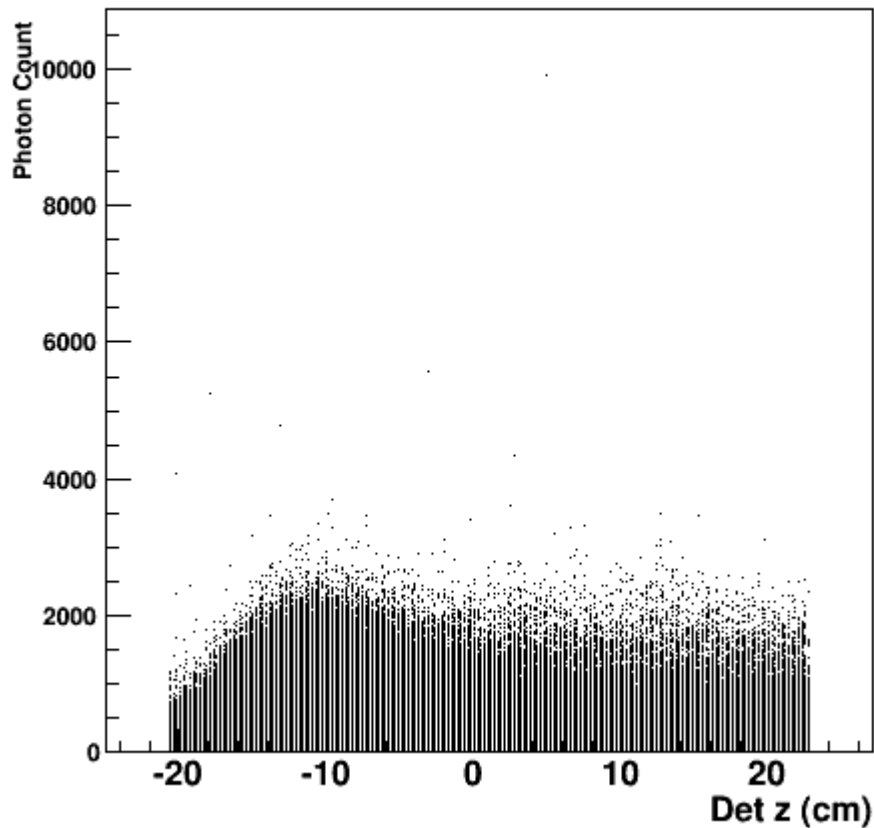
```
*****
* Row * Instance * hit.trid * hit.p * hit.x*100 * hit.y*100 * hit.pid * (hit.det- *
*****
* 0 * 8 * 1 * 2.339411 * -87.23703 * 150.27410 * 11 * 2000 *
* 0 * 9 * 58 * 0.0002302 * -99.12186 * 150.84926 * 22 * 2000 *
* 0 * 10 * 53 * 0.0018612 * -82.61341 * 146.26356 * 22 * 2000 *
* 0 * 11 * 9 * 0.0012601 * -87.51120 * 150.46847 * 22 * 2000 *
* 0 * 12 * 668 * 0.0004459 * -97.01855 * 154.63180 * 22 * 2000 *
* 0 * 13 * 1328 * 0.0011559 * -109.3782 * 172.01586 * 22 * 2000 *
* 0 * 27 * 152 * 0.0012338 * -137.5385 * 99.820989 * 22 * 1800 *
* 0 * 28 * 3073 * 0.0005436 * -132.3176 * 96.191272 * 22 * 1800 *
* 0 * 30 * 1409 * 0.0008445 * -115.4360 * 142.10788 * 22 * 1900 *
* 0 * 112 * 1328 * 0.0001346 * 162.36197 * 155.89261 * 22 * 2600 *
*****
```

DIS Generated Background tracks momentum distributions at last GEM with lead baffles (From all the events)

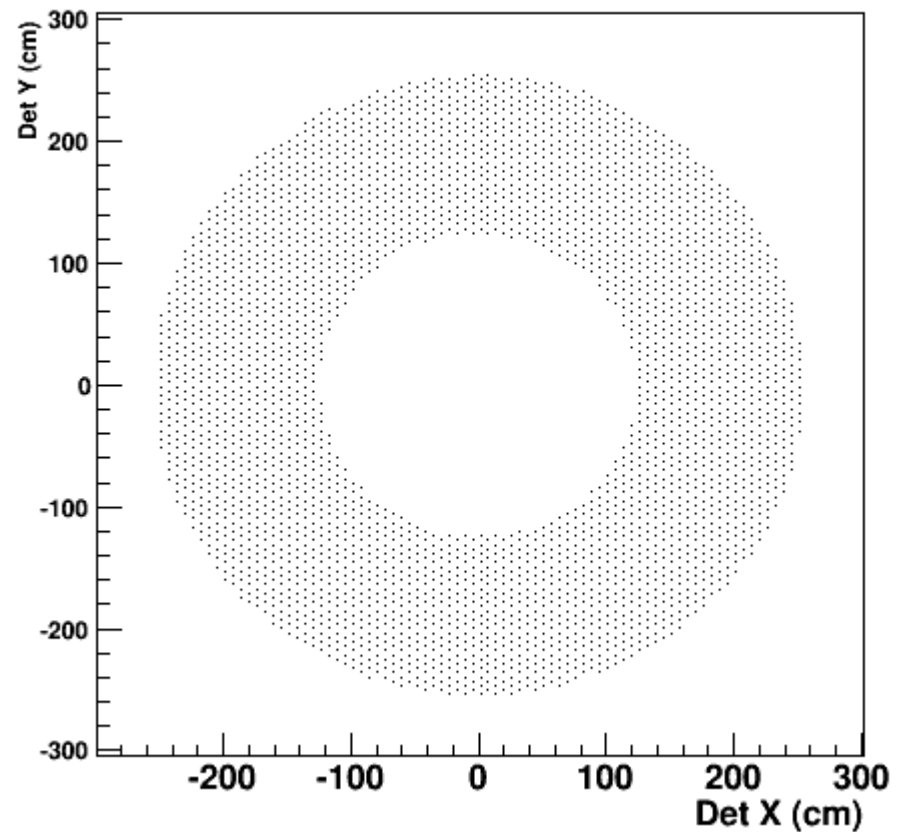


DIS Generated Background Photon production at scint. for events with no primary tracks with lead baffles (From all the events)

Total Photons Generated on Shower Scint. by Background Tracks



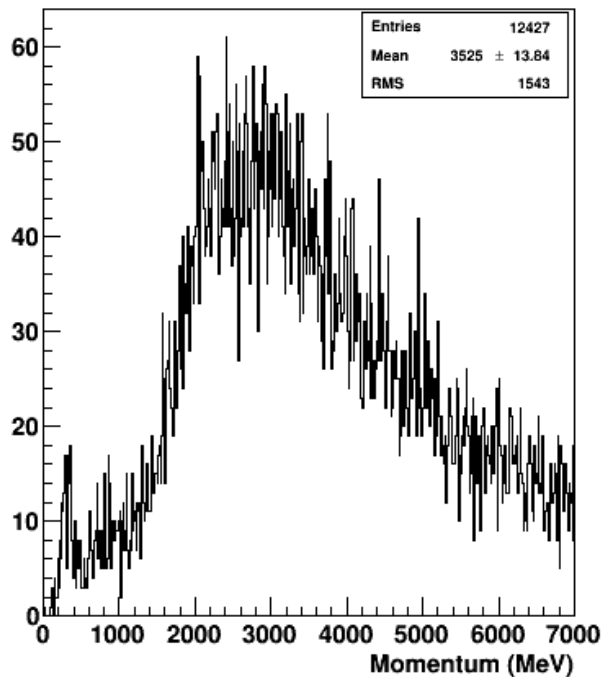
ECAL Blocks : Det Y vs Det X Pos. for Background Tracks



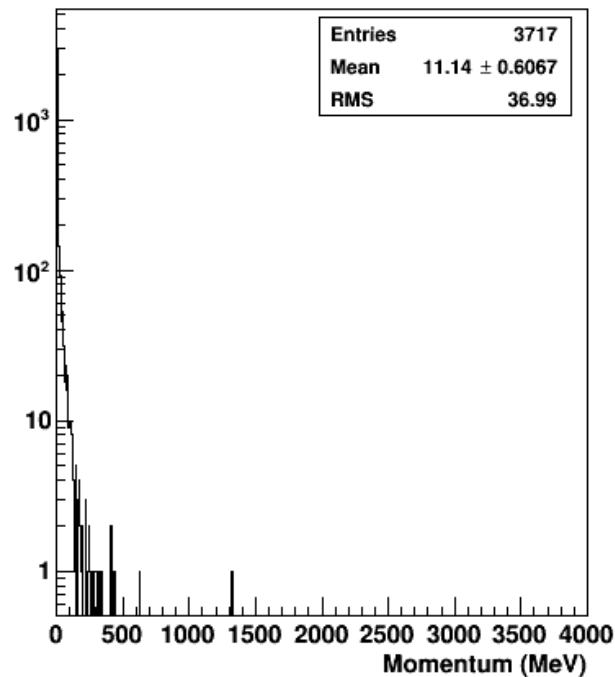
π^- Summary

π^- Momentum distributions at last GEM with lead baffles (From all the events)

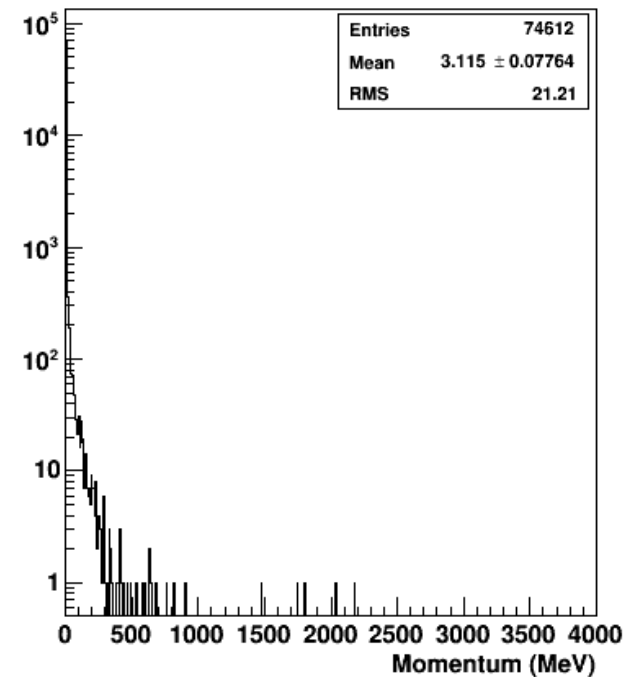
Last GEM Primary π^- Tracks



Last GEM e^\pm Backgrounds

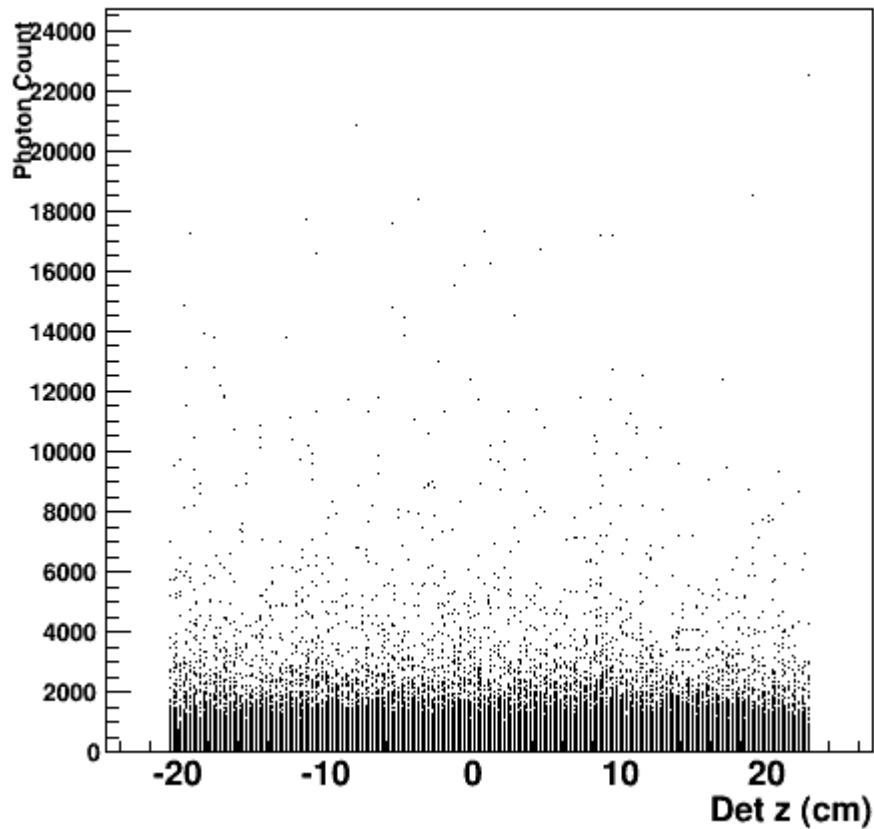


Last GEM γ Backgrounds

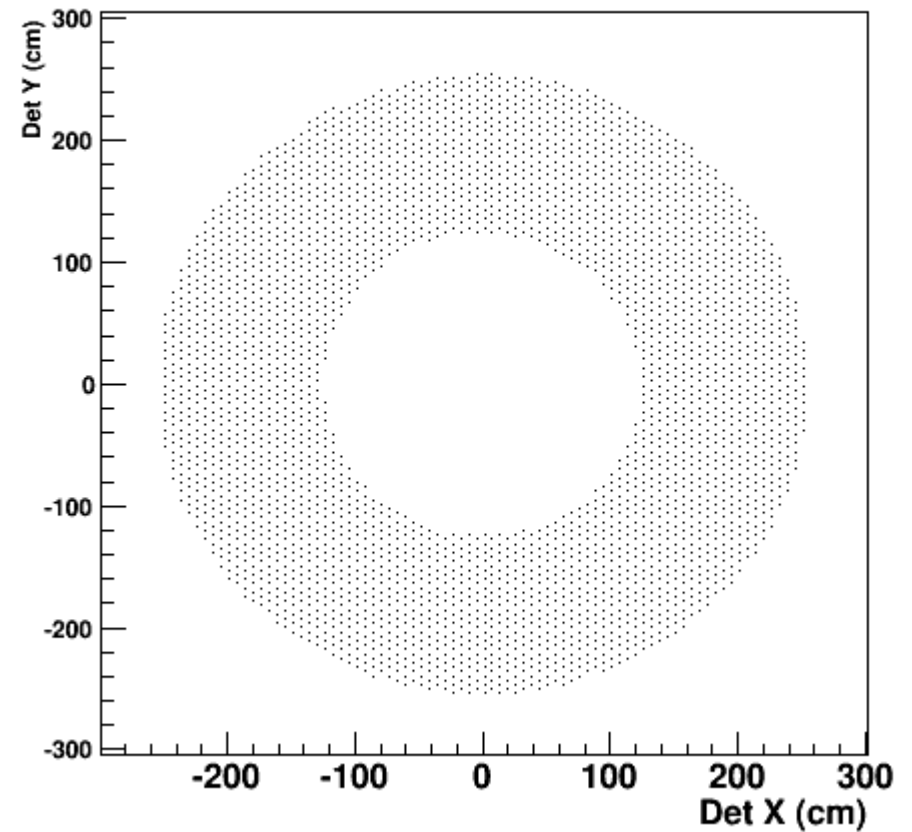


π^- Photon production at scint. for events with primary tracks with lead baffles (From all the events)

Total Photons Generated on Shower Scint. by Primary π^+ Tracks

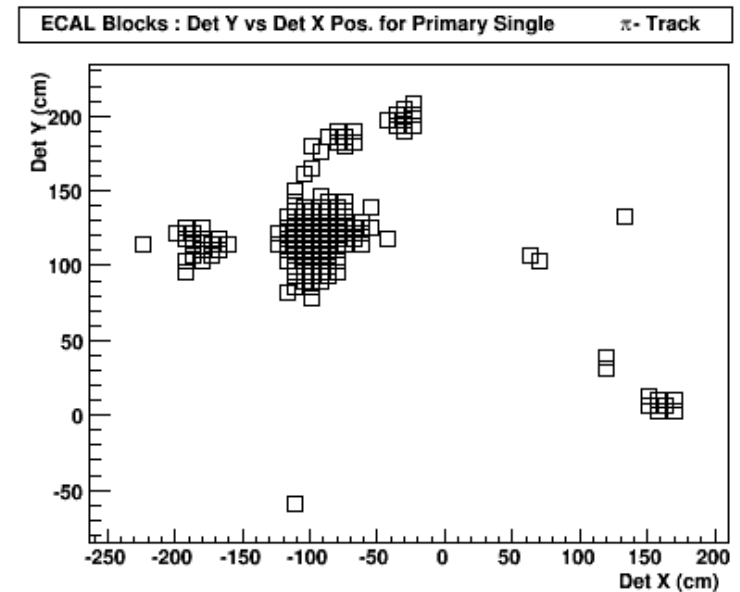
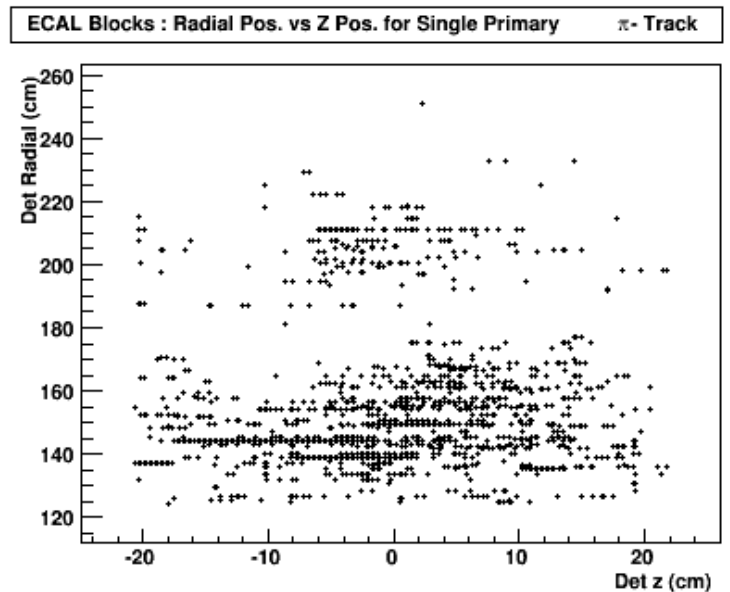
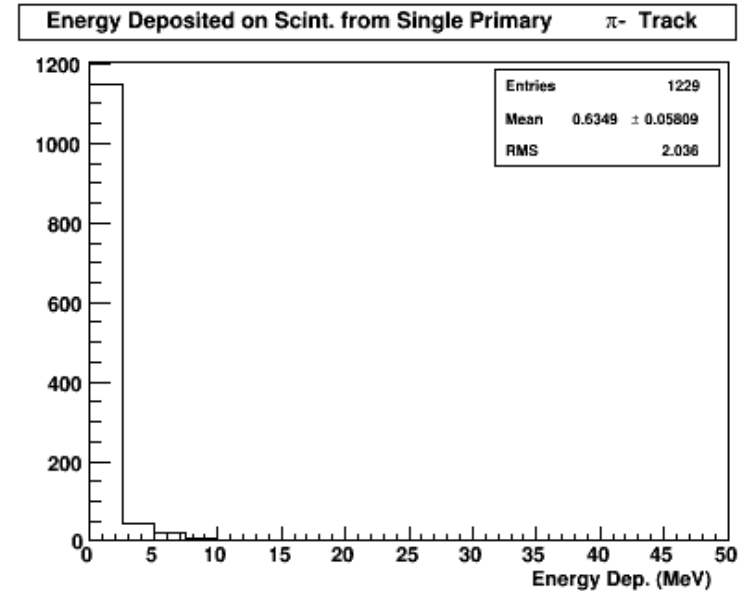
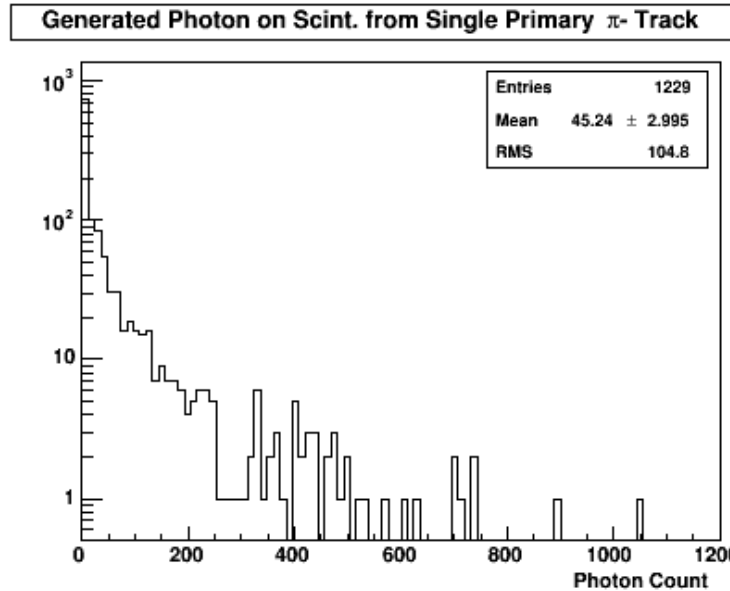


ECAL Blocks : Det Y vs Det X Pos. for Primary π^+ Tracks



π^- Single Event

Energy deposition for a single event with Pb baffles



π - Single Event

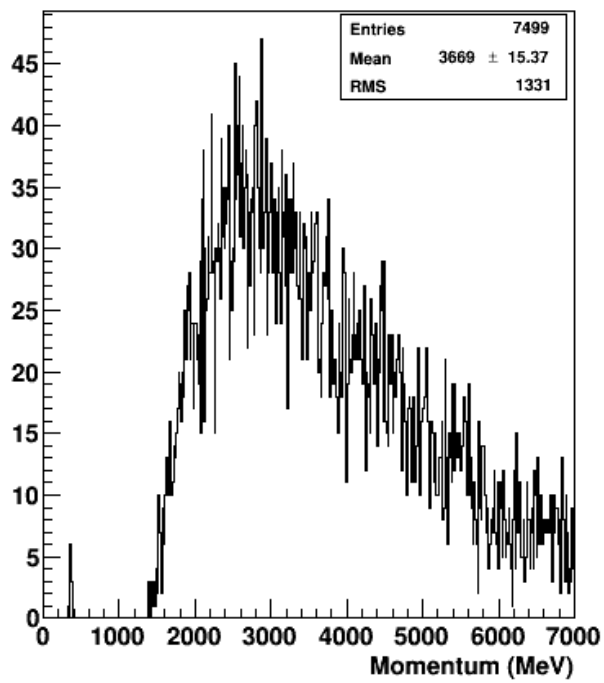
```

*****
*   Row   * Instance * hit.trid *   hit.p * hit.x*100 * hit.y*100 *   hit.pid * (hit.det- *
*****
*   127 *    58 *    153 * 0.0079920 * -33.64977 * 110.74904 *    2112 *    2100 *
*   127 *    75 *     1 * 4.1467536 * -84.76287 * 101.97990 *   -211 *    1900 *
*   127 *    76 *    127 * 0.0443087 * -101.6623 * 102.28511 *    -14 *    1900 *
*   127 *    77 *    172 * 0.2074613 * -106.0186 * 111.91799 *    2112 *    1900 *
*   127 *    78 *    100 * 0.0121847 * -111.4656 * 135.67444 *    2112 *    1900 *
*   127 *    79 *   2325 * 0.0062856 * -76.01569 * 93.267723 *     22 *    1900 *
*   127 *    82 *    195 * 0.0008582 * -88.16686 * 134.42973 *     22 *    2000 *
*   127 *    83 *    100 * 0.0100086 * -82.51184 * 153.52070 *    2112 *    2000 *
*   127 *    84 *     97 * 0.0018823 * -73.60232 * 121.50608 *    2112 *    2000 *
*   127 *    89 *   2794 * 0.0466050 * 160.77071 * 26.923999 *    2112 *    2900 *
*   127 *   102 *    588 * 0.0018347 * -148.7182 * 126.89231 *     22 *    1800 *
*   127 *   103 *    279 * 0.0062671 * -95.96768 * 72.546116 *     22 *    1800 *
*   127 *   104 *    242 * 0.0041978 * -144.5378 * 125.05734 *     22 *    1800 *
*   127 *   105 *   2724 * 0.0078468 * -165.6135 * 110.57593 *    2112 *    1800 *
*   127 *   106 *   3079 * 0.0005109 * -157.5736 * 112.40986 *     22 *    1800 *

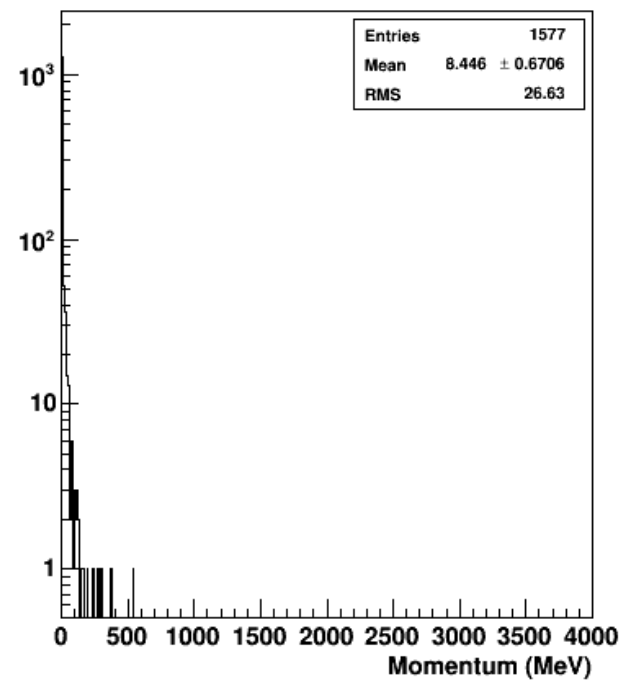
```

π^- Momentum distributions at last GEM with Kryptonite heavy materials (From all the events)

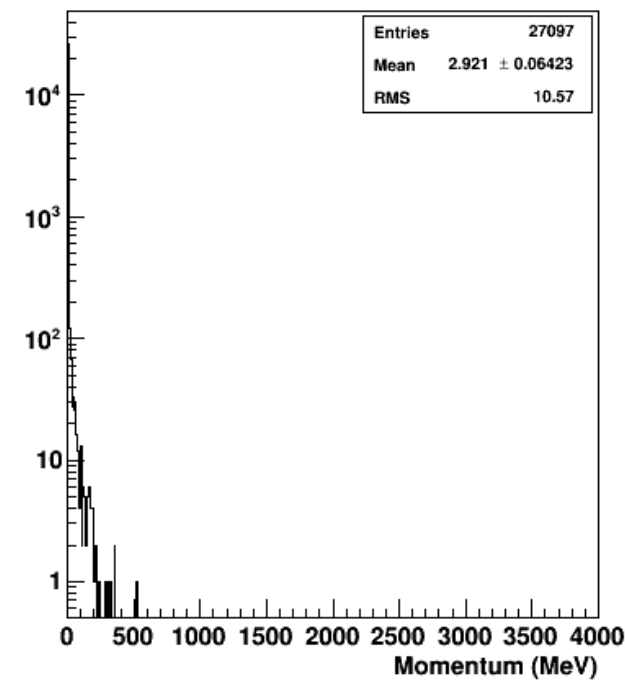
Last GEM Primary π^- Tracks



Last GEM e^\pm Backgrounds

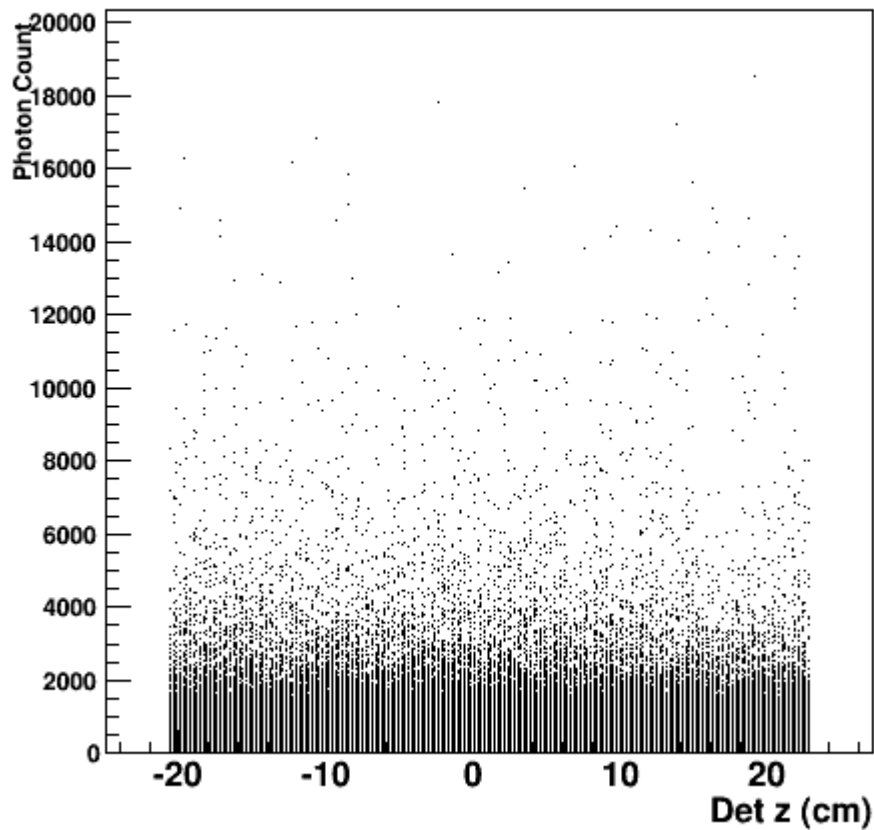


Last GEM γ Backgrounds

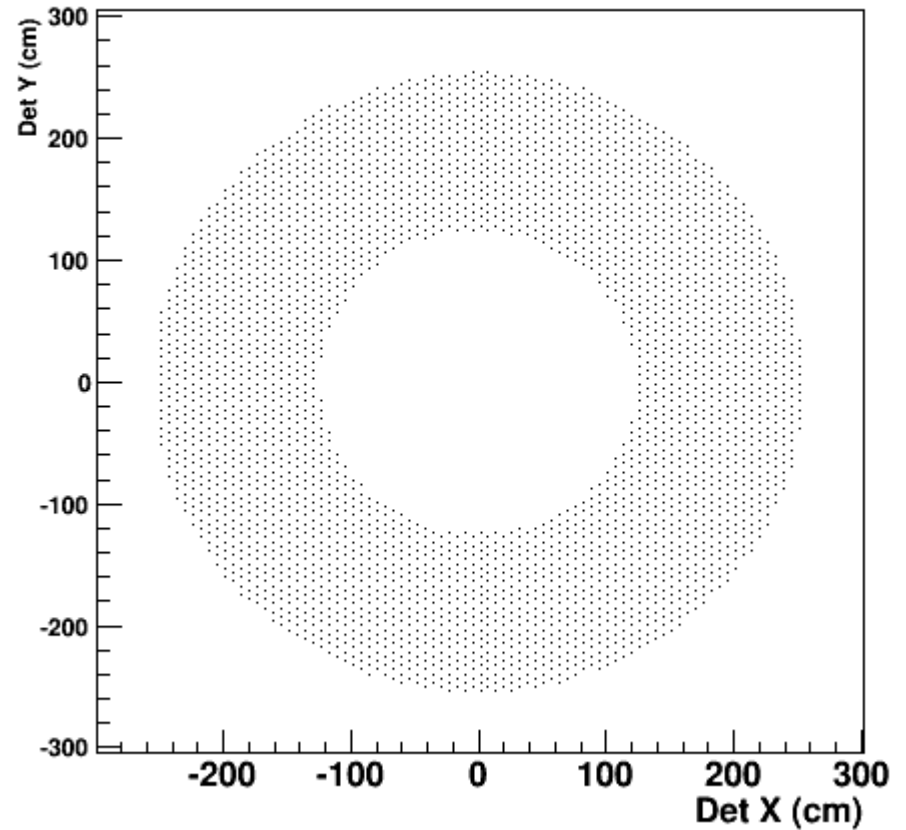


π^- Photon production at scint. for events with primary tracks with Kryptonite heavy materials (From all the events)

Total Photons Generated on Shower Scint. by Primary π^- Tracks



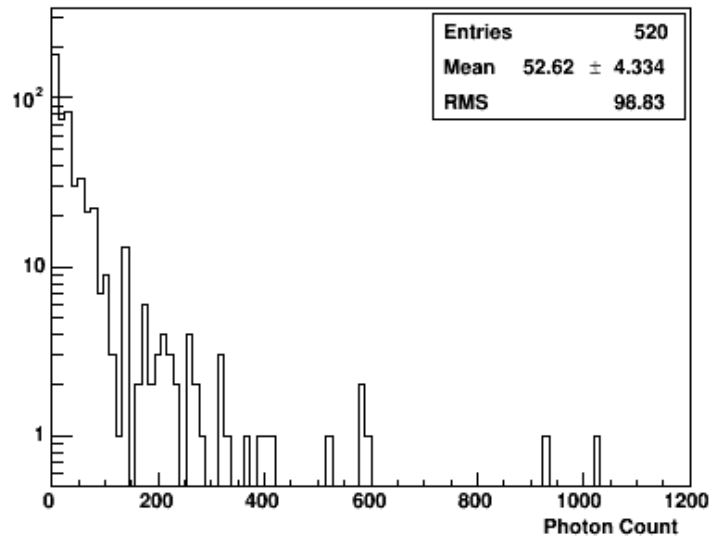
ECAL Blocks : Det Y vs Det X Pos. for Primary π^- Tracks



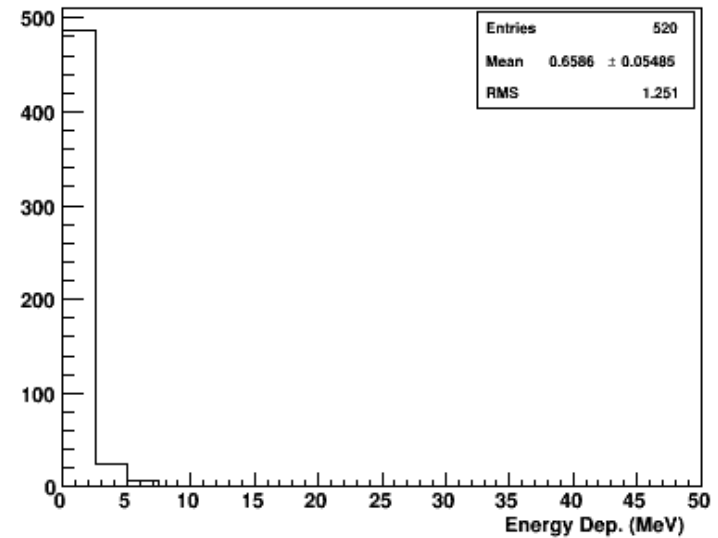
π^- Single Event

Energy deposition for a single event with Kryptonite heavy materials

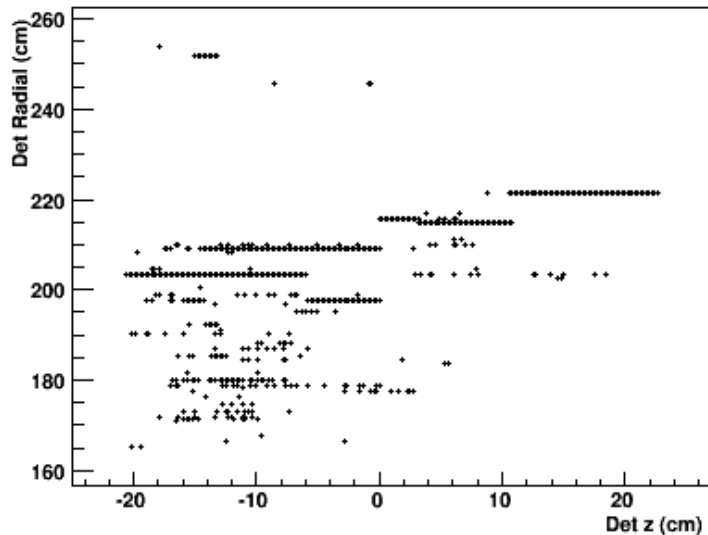
Generated Photon on Scint. from Single Primary π^- Track



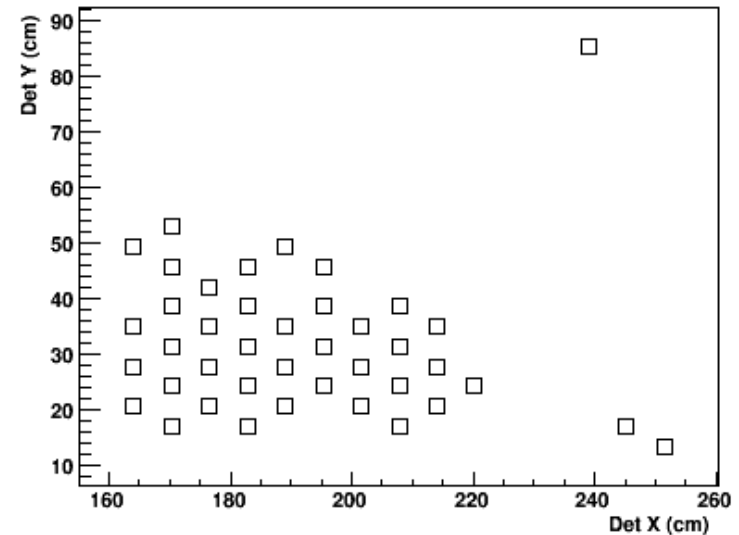
Energy Deposited on Scint. from Single Primary π^- Track



ECAL Blocks : Radial Pos. vs Z Pos. for Single Primary π^- Track



ECAL Blocks : Det Y vs Det X Pos. for Primary Single π^- Track



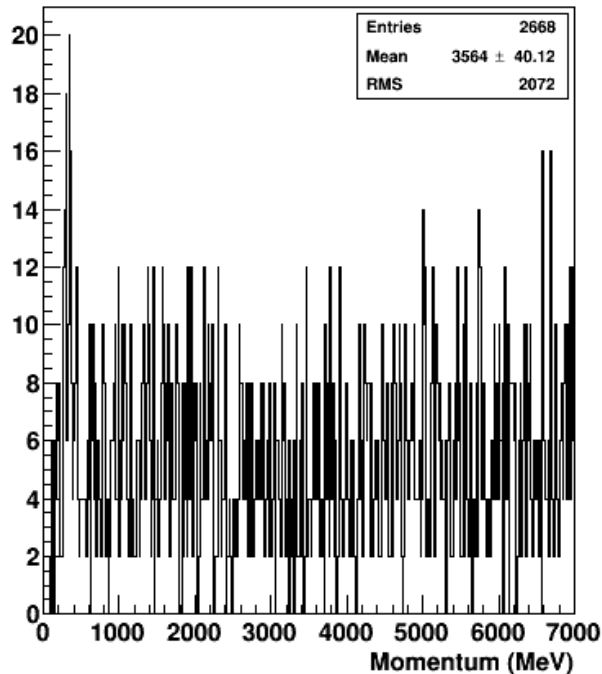
π - Single Event

```
*****
*   Row   * Instance * hit.trid *   hit.p * hit.x*100 * hit.y*100 *   hit.pid * (hit.det- *
*****
*   64   *   33   *   112 * 0.0026086 * 185.46513 * 69.828831 *   22 *   2800 *
*   64   *   40   *    1 * 3.5829595 * 193.60763 * 25.637231 *  -211 *   2900 *
*   64   *   41   *   19 * 0.0011276 * 185.90694 * 33.202450 *   22 *   2900 *
*   64   *   42   *   16 * 0.0017258 * 200.7867 * 36.980421 *   22 *   2900 *
*   64   *   43   *   32 * 0.0457995 * 175.15516 * 26.923779 *  2112 *   2900 *
*   64   *   44   *  173 * 0.0057859 * 193.787 * 53.294239 *   22 *   2900 *
*   64   *   45   *  136 * 0.0060923 * 162.16234 * 32.224649 *   22 *   2900 *
*   64   *   93   *   31 * 0.0623445 * 202.4846 * 15.173736 *  2112 *    0 *
*   64   *   94   *   17 * 0.0525160 * 203.47242 * 11.824153 *  2112 *    0 *
*   64   *   95   *  161 * 0.0016158 * 211.57524 * 17.005389 *   22 *    0 *
*****
```

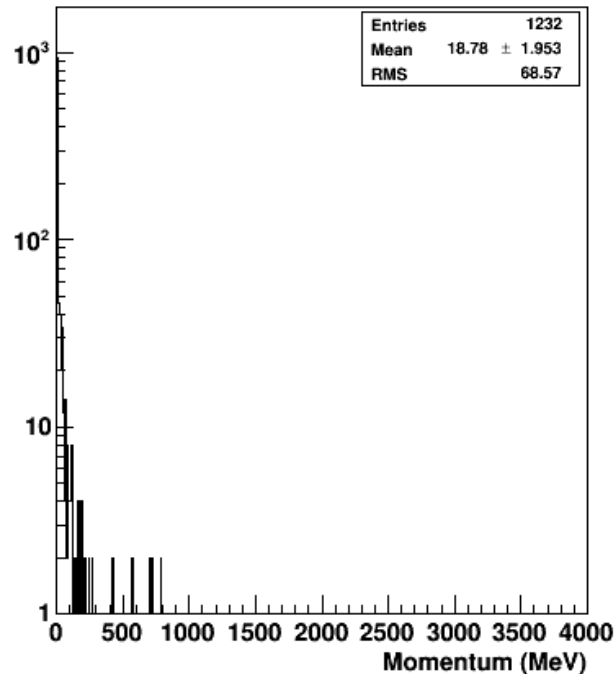
π^+ Summary

π^+ Momentum distributions at last GEM with lead baffles (From all the events)

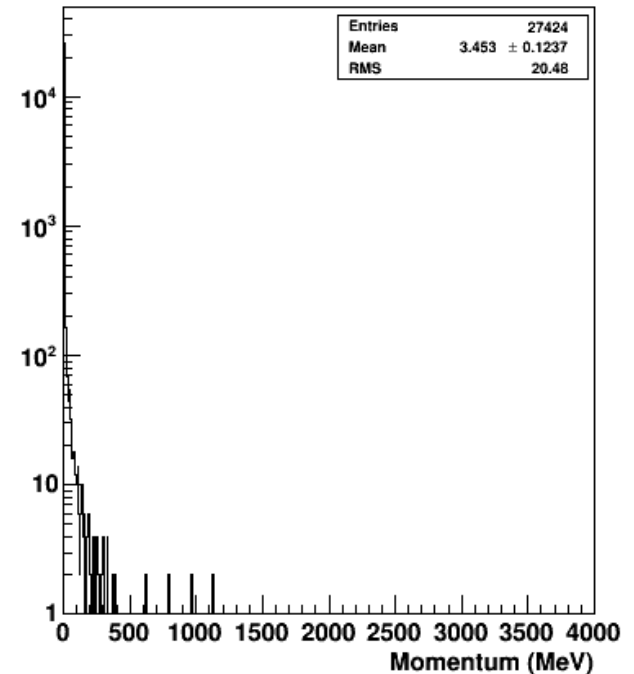
Last GEM Primary π^+ Tracks



Last GEM e^\pm Backgrounds

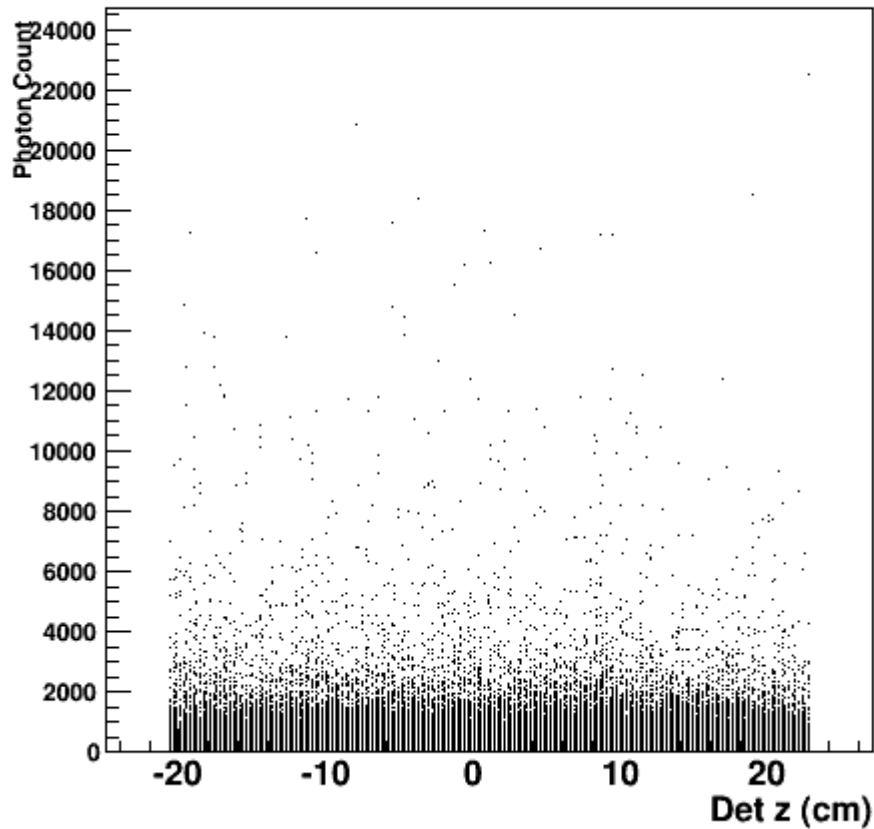


Last GEM γ Backgrounds

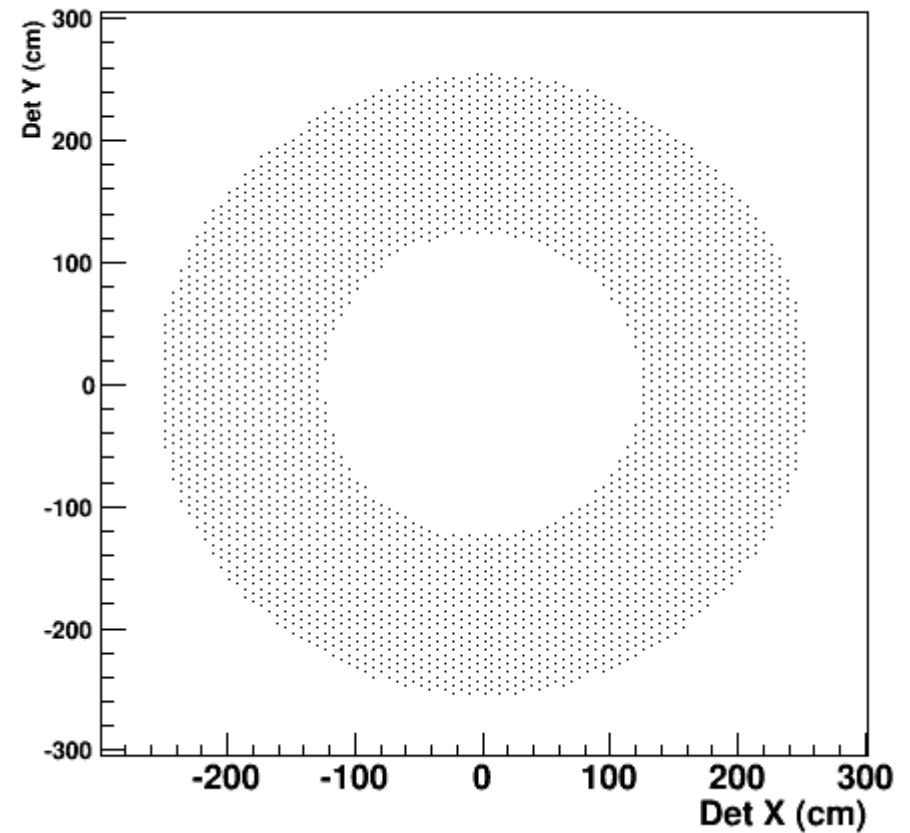


π^+ Photon production at scint. for events with primary tracks with lead baffles (From all the events)

Total Photons Generated on Shower Scint. by Primary π^+ Tracks

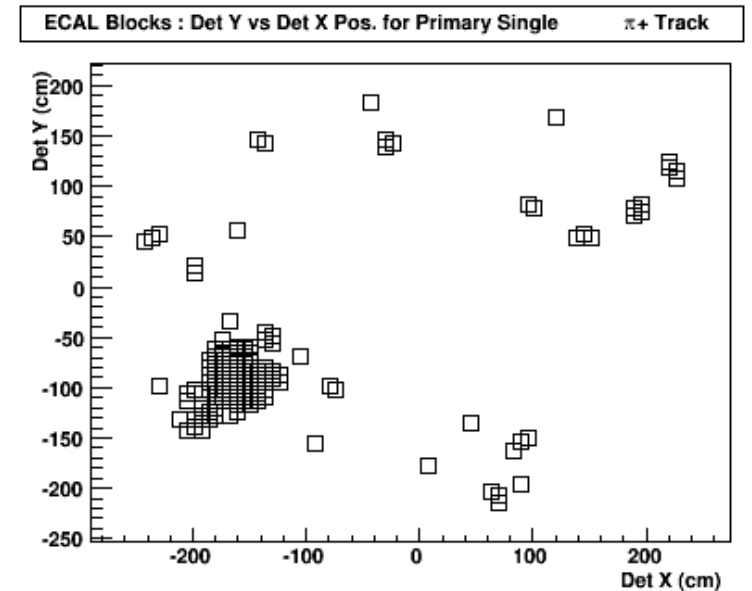
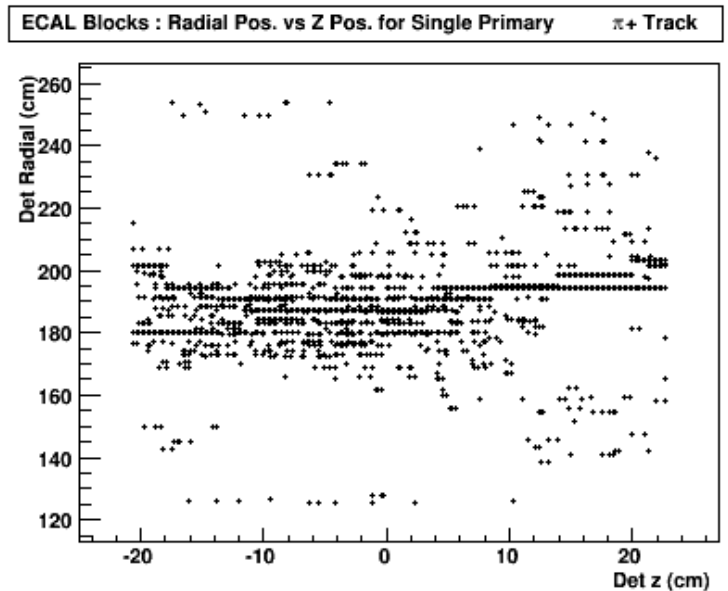
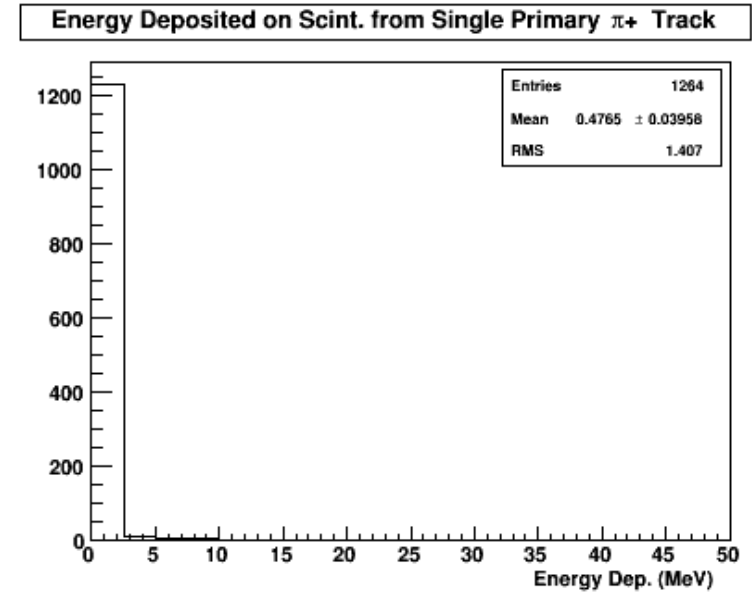
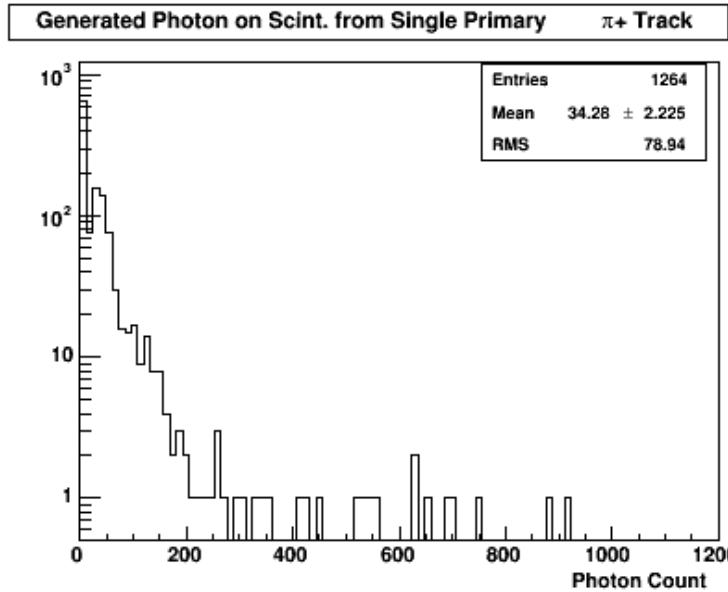


ECAL Blocks : Det Y vs Det X Pos. for Primary π^+ Tracks



π^+ Single Event

Energy deposition for a single event with Pb baffles



π^+ Single Event

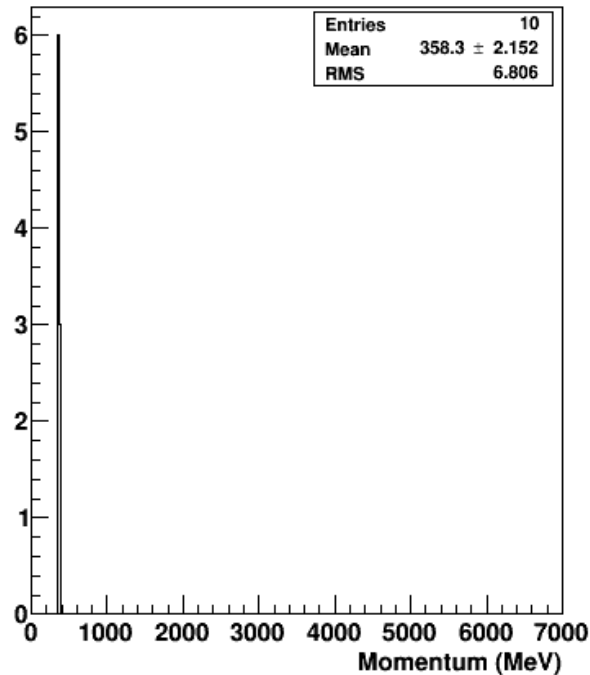
```

*****
* Row * Instance * hit.trid * hit.p * hit.x*100 * hit.y*100 * hit.pid * (hit.det- *
*****
* 6767 * 0 * 6824 * 0.0130594 * -20.88965 * 135.88294 * 2112 * 2200 *
* 6767 * 2 * 3493 * 0.0059014 * 30.521203 * 183.51619 * 2112 * 2300 *
* 6767 * 11 * 6235 * 0.0306979 * 86.831322 * -149.0769 * 2112 * 500 *
* 6767 * 12 * 6235 * 0.0042960 * 74.831083 * -129.6452 * 2112 * 500 *
* 6767 * 13 * 6244 * 0.0045943 * 84.425296 * -157.3142 * 2112 * 500 *
* 6767 * 14 * 6249 * 0.0083532 * 105.23187 * -201.3441 * 2112 * 500 *
* 6767 * 15 * 6249 * 0.0007050 * 103.57041 * -193.3621 * 2112 * 500 *
* 6767 * 18 * 6297 * 0.0382185 * -49.63071 * 171.54609 * 2112 * 2100 *
* 6767 * 27 * 3556 * 0.0448389 * 157.06555 * -60.34644 * 2112 * 200 *
* 6767 * 30 * 6235 * 0.0042155 * 71.149432 * -82.62722 * 2112 * 400 *
* 6767 * 57 * 6249 * 0.0115178 * -42.54884 * -136.8203 * 2112 * 900 *
* 6767 * 58 * 3682 * 0.0163632 * -70.79964 * -130.9113 * 2112 * 1000 *
* 6767 * 89 * 3493 * 0.0025831 * 122.97211 * 159.91662 * 2112 * 2600 *
* 6767 * 255 * 6866 * 0.0003356 * -206.8955 * 26.232887 * 2112 * 1600 *
* 6767 * 370 * 362 * 0.3833259 * -175.4846 * -114.8393 * -211 * 1200 *
* 6767 * 371 * 721 * 0.0041029 * -161.3917 * -99.34885 * 22 * 1200 *
* 6767 * 372 * 5385 * 0.0659892 * -169.6064 * -110.8206 * 2112 * 1200 *
* 6767 * 373 * 5425 * 0.0001346 * -145.6473 * -97.72180 * 22 * 1200 *
* 6767 * 376 * 6856 * 0.0184124 * 112.98136 * 177.40379 * 2112 * 2500 *
* 6767 * 431 * 1 * 7.0647125 * -151.9920 * -79.04959 * 211 * 1300 *
* 6767 * 432 * 281 * 0.0002895 * -144.4353 * -76.63308 * 22 * 1300 *
* 6767 * 433 * 582 * 0.0029374 * -171.0803 * -89.34838 * 22 * 1300 *
* 6767 * 434 * 3668 * 0.0259723 * -175.4377 * -81.83530 * 2112 * 1300 *
* 6767 * 435 * 649 * 0.1023602 * -178.6571 * -80.59416 * 2112 * 1300 *
* 6767 * 436 * 3778 * 0.0011203 * -207.1114 * -79.55424 * 22 * 1300 *
* 6767 * 437 * 3737 * 0.0012425 * -162.6459 * -60.24097 * 22 * 1300 *
* 6767 * 438 * 3696 * 0.0022000 * -178.3935 * -64.20807 * 22 * 1300 *
* 6767 * 439 * 5304 * 0.0006002 * -173.5080 * -90.47959 * 2112 * 1300 *
* 6767 * 443 * 3682 * 0.0229747 * -149.5960 * -41.16321 * 2112 * 1400 *
* 6767 * 444 * 3682 * 0.0196889 * -120.9855 * -36.46474 * 2112 * 1400 *
* 6767 * 445 * 5419 * 0.0011339 * -209.7113 * -36.42329 * 22 * 1400 *
* 6767 * 446 * 6777 * 0.0175169 * -139.1111 * -19.00043 * 2112 * 1400 *
* 6767 * 447 * 6777 * 0.0064968 * -152.0275 * -36.84741 * 2112 * 1400 *
* 6767 * 448 * 6777 * 0.0048776 * -218.7945 * -61.39082 * 2112 * 1400 *
* 6767 * 452 * 6235 * 0.0024625 * 149.50071 * -7.853912 * 2112 * 0 *
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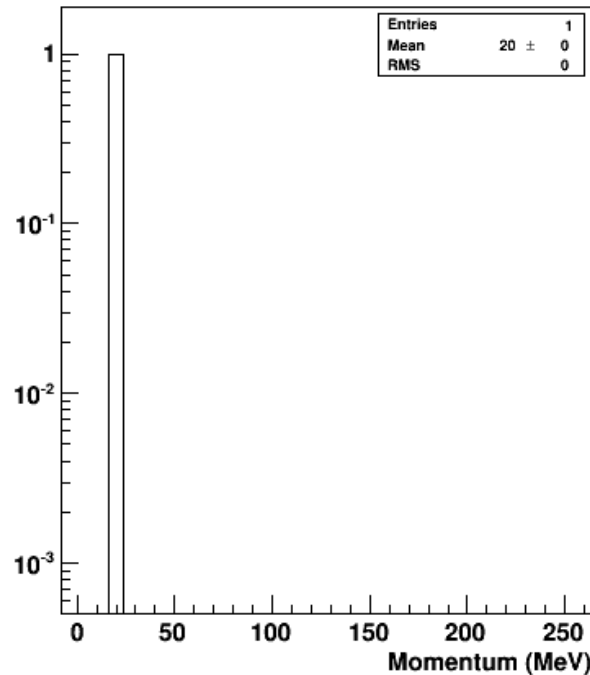
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π^+ Momentum distributions at last GEM with Kryptonite heavy materials (From all the events)

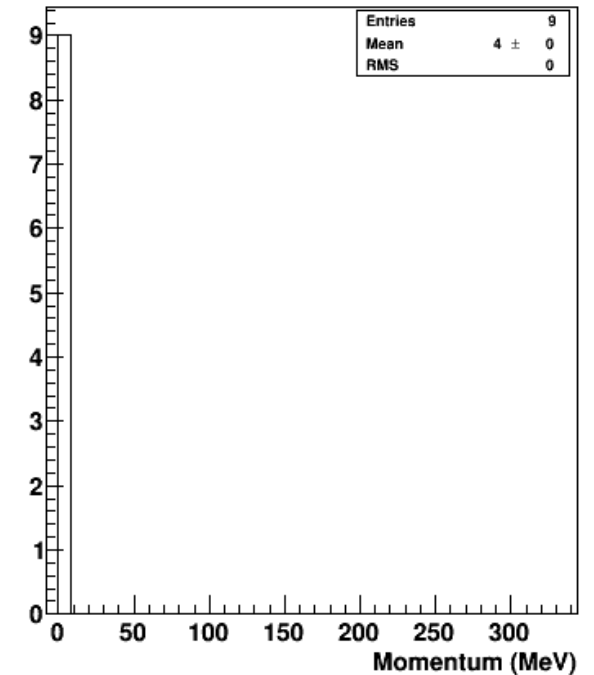
Last GEM Primary π^+ Tracks



Last GEM e^\pm Backgrounds

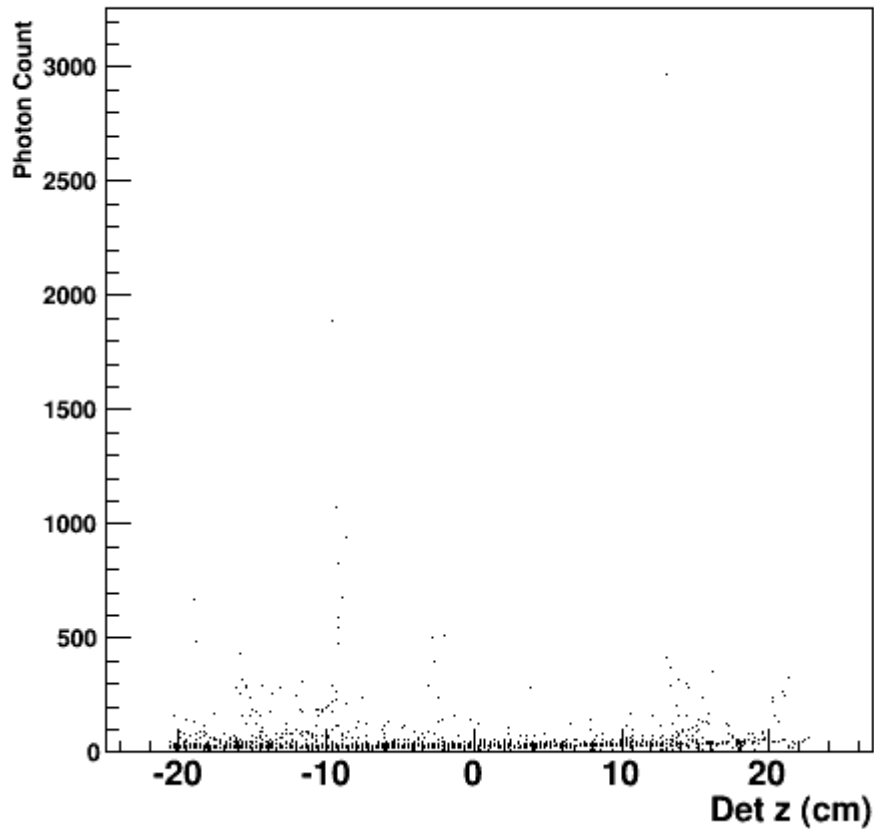


Last GEM γ Backgrounds

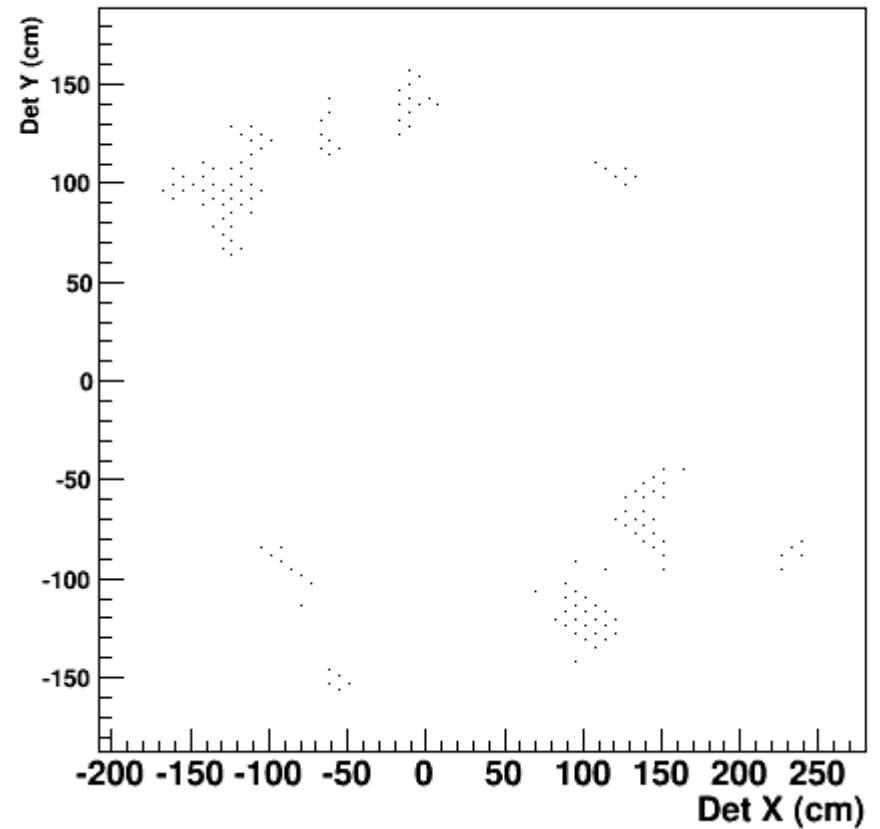


π^+ Photon production at scint. for events with primary tracks with Kryptonite heavy materials (From all the events)

Total Photons Generated on Shower Scint. by Primary π^+ Tracks



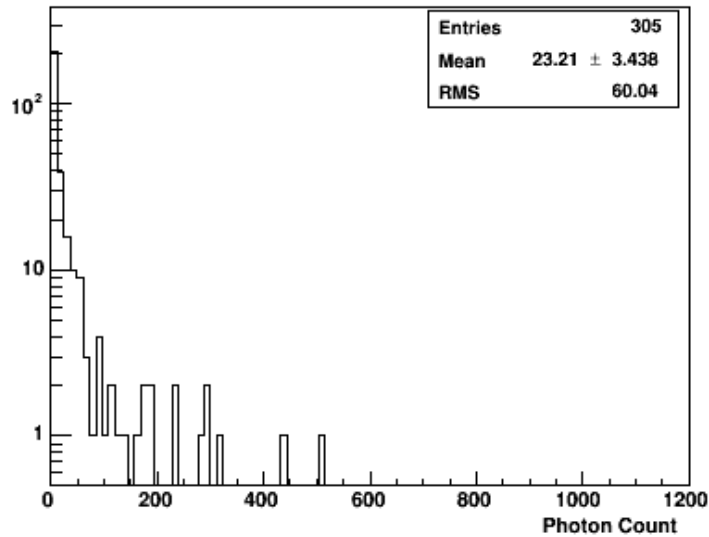
ECAL Blocks : Det Y vs Det X Pos. for Primary π^+ Tracks



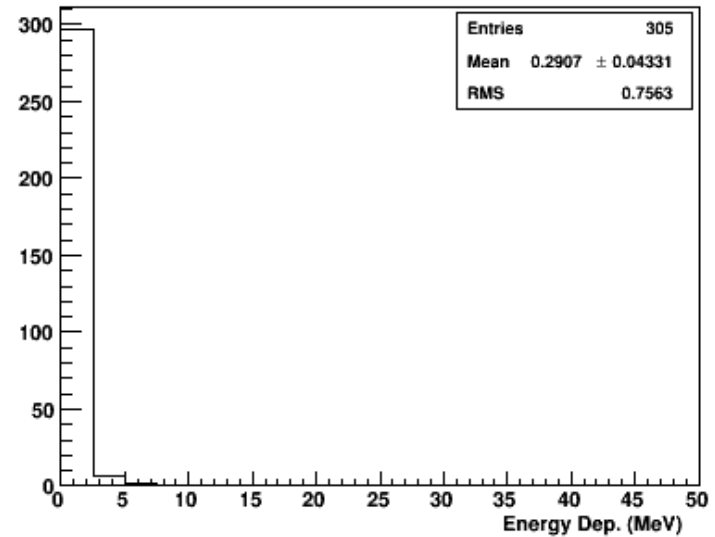
π^+ Single Event

Energy deposition for a single event with Kryptonite heavy materials

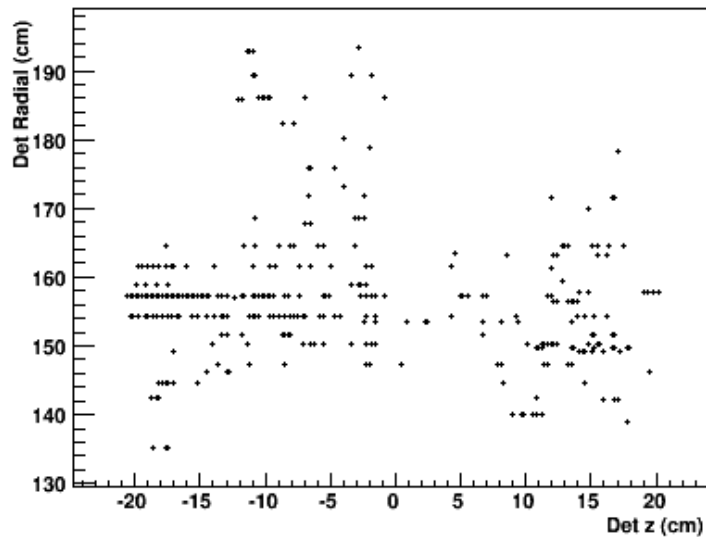
Generated Photon on Scint. from Single Primary π^+ Track



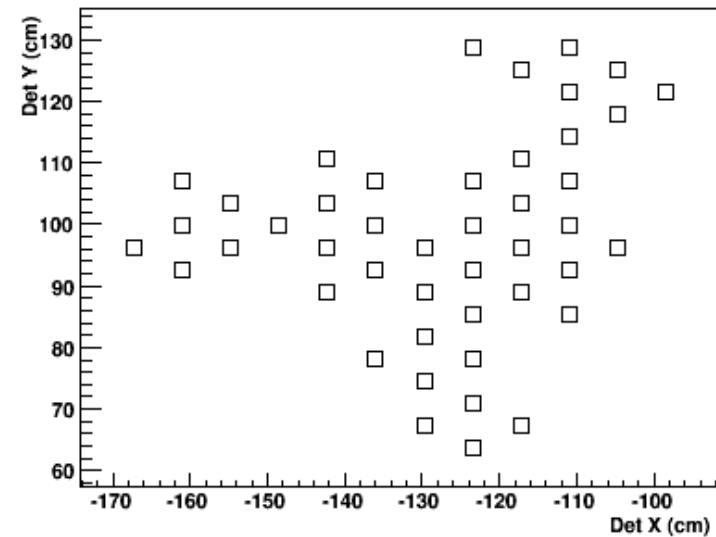
Energy Deposited on Scint. from Single Primary π^+ Track



ECAL Blocks : Radial Pos. vs Z Pos. for Single Primary π^+ Track



ECAL Blocks : Det Y vs Det X Pos. for Primary Single π^+ Track



π^+ Single Event

```
*****
*   Row   * Instance * hit.trid *   hit.p * hit.x*100 * hit.y*100 *   hit.pid * (hit.det- *
*****
*  969386 *     6 *     1 * 0.3622103 * -131.8072 * 83.425321 *   211 *   1800 *
*  969386 *     7 *    43 * 0.0333111 * -132.8072 * 89.243502 *  2112 *   1800 *
*  969386 *     8 *   129 * 0.0018993 * -117.7948 * 97.407753 *  2112 *   1800 *
*  969386 *     9 *   137 * 0.0022001 * -123.6277 * 100.84959 *   22 *   1800 *
*  969386 *    10 *    29 * 0.0020854 * -144.5226 * 97.330962 *   22 *   1800 *
*  969386 *    12 *    45 * 0.0018869 * -117.7001 * 116.71599 *  2112 *   1900 *
*****
```

Summary

- Only looked at primary tracks and so far very simple analysis
- Can look at background only events to see ecal background only signal
- Still a time stamp is missing on ecal and GEM hits
 - Work on progress
 - Once we have that we can start overlapping background signals with primary signals
- Ecal signals are summed over all the hits within an event
 - Currently it is not possible to separate background signal from primary signal within an event
- Goal is to help understand PVDIS triggering with full ecal

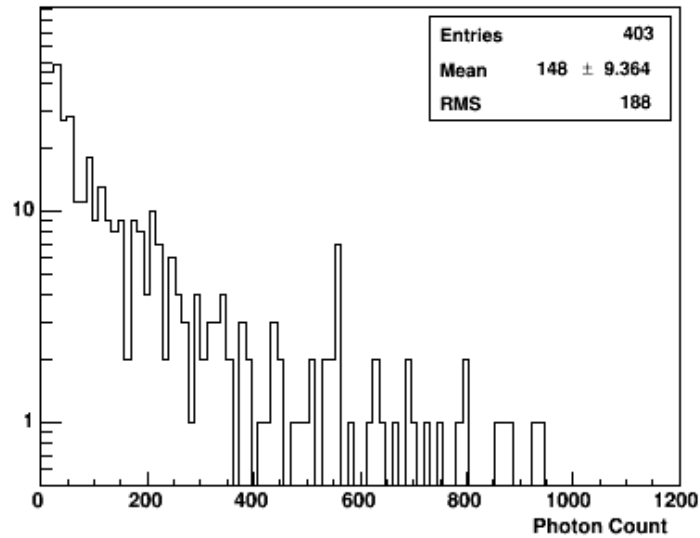
Supplementary

Single Events

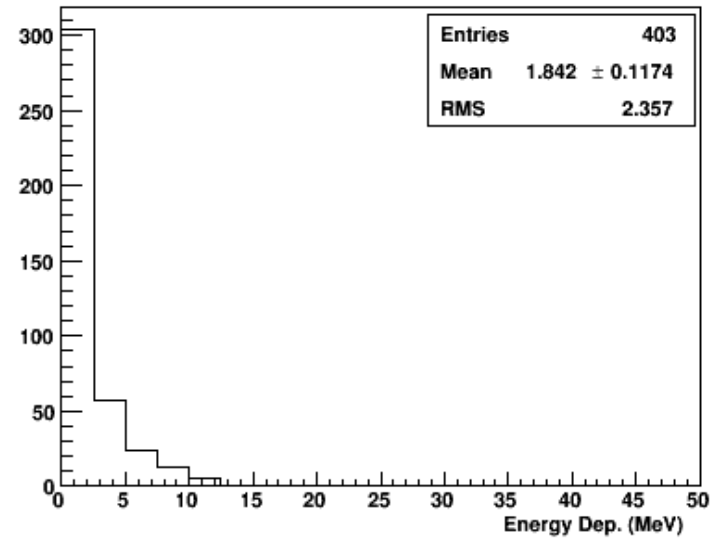
DIS-e Single Event

Energy deposition for a single event with Pb baffles

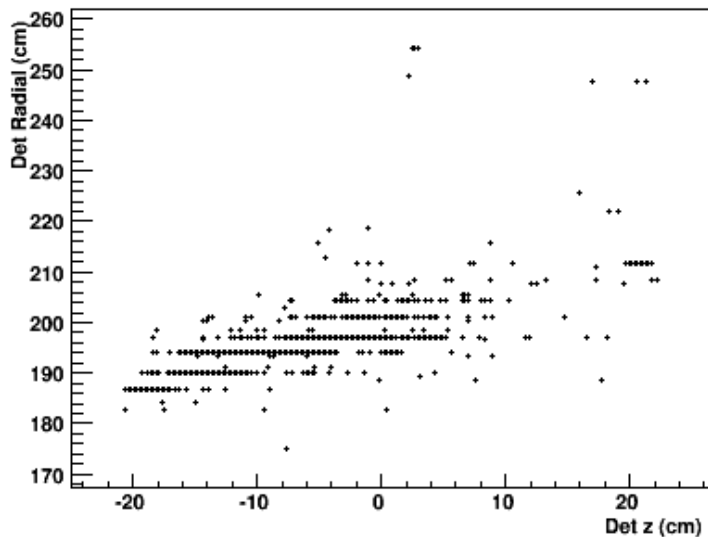
Generated Photon on Scint. from Single Primary DIS-e Track



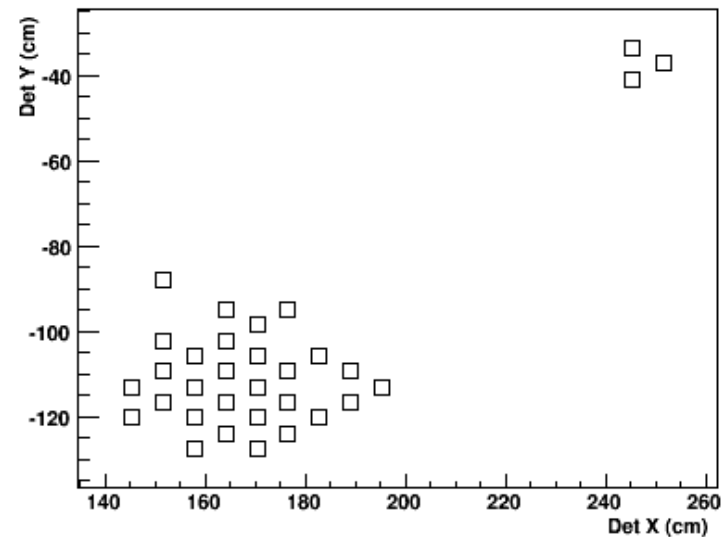
Energy Deposited on Scint. from Single Primary DIS-e Track



ECAL Blocks : Radial Pos. vs Z Pos. for Primary Single DIS-e Track



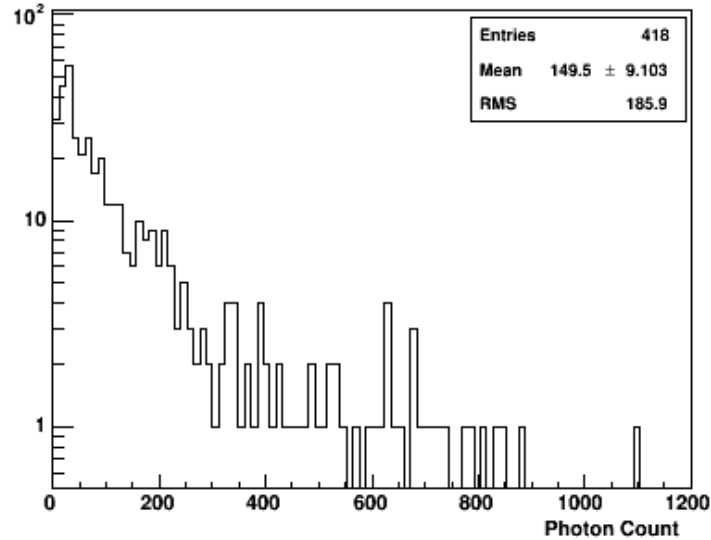
ECAL Blocks : Det Y vs Det X Pos. for Single Primary DIS-e Track



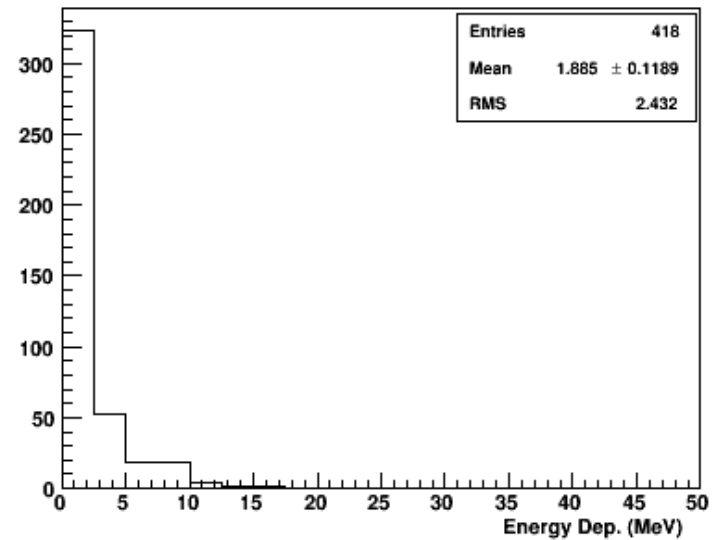
DIS-e Single Event

Energy deposition for a single event with Pb baffles

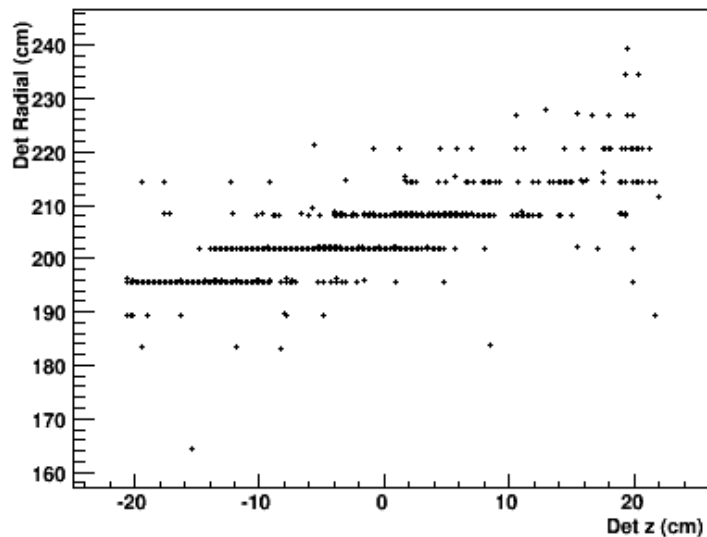
Generated Photon on Scint. from Single Primary DIS-e Track



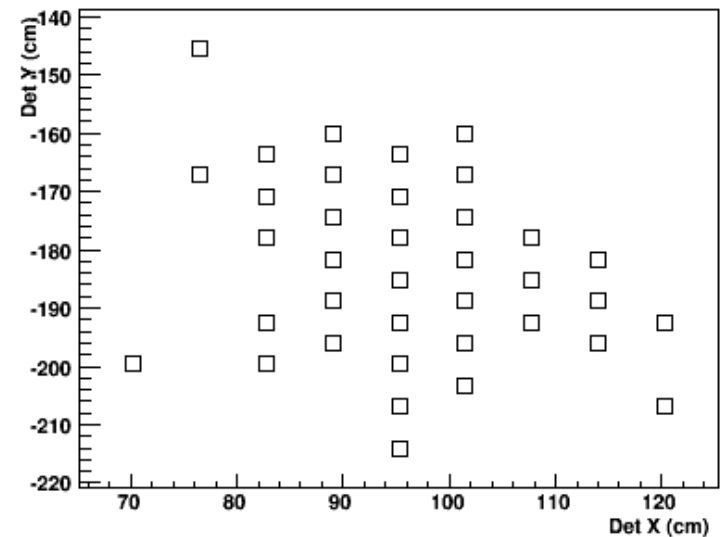
Energy Deposited on Scint. from Single Primary DIS-e Track



ECAL Blocks : Radial Pos. vs Z Pos. for Primary Single DIS-e Track



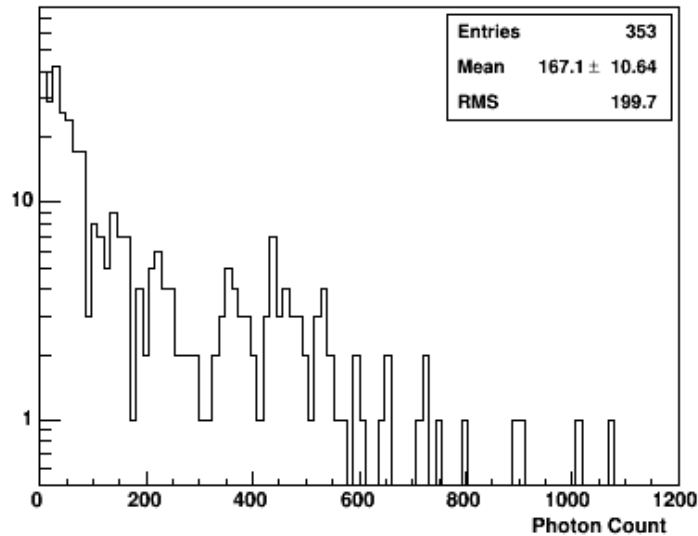
ECAL Blocks : Det Y vs Det X Pos. for Single Primary DIS-e Track



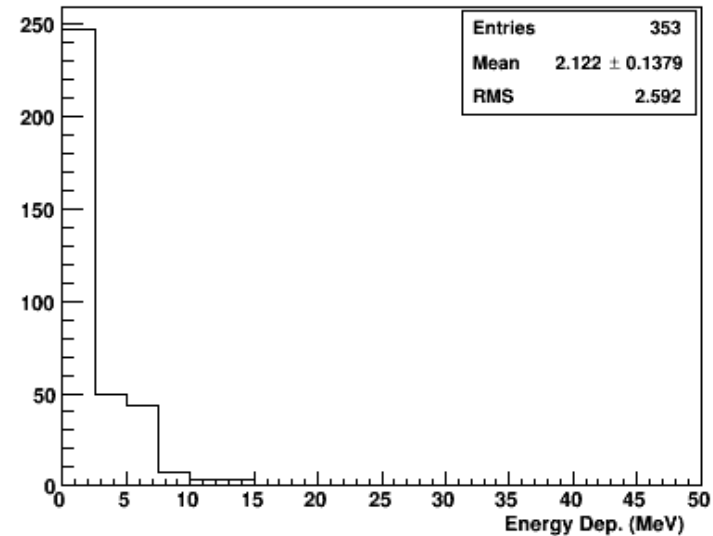
DIS-e Single Event

Energy deposition for a single event with Kryptonite heavy materials

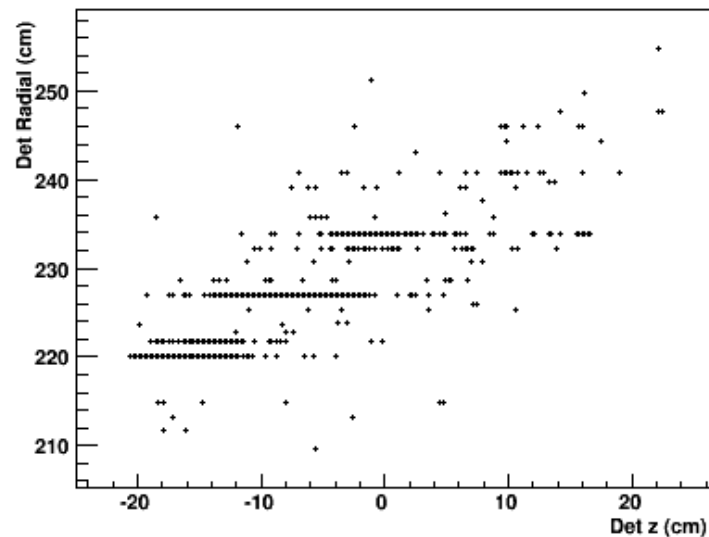
Generated Photon on Scint. from Single Primary DIS-e Track



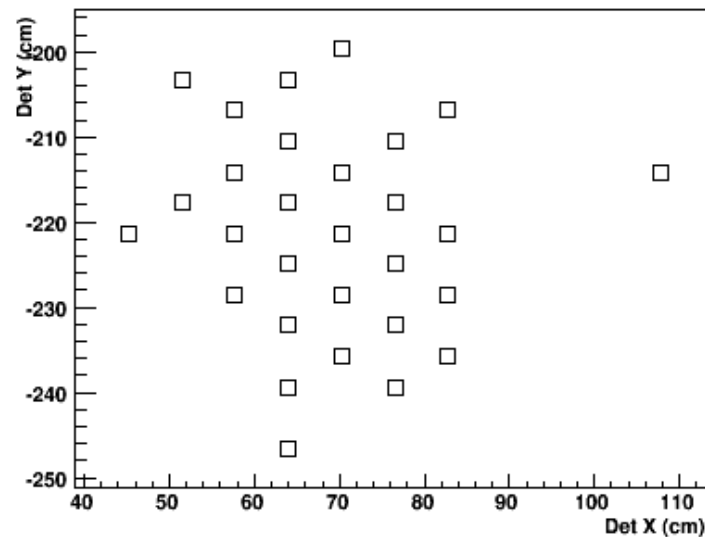
Energy Deposited on Scint. from Single Primary DIS-e Track



ECAL Blocks : Radial Pos. vs Z Pos. for Primary Single DIS-e Track

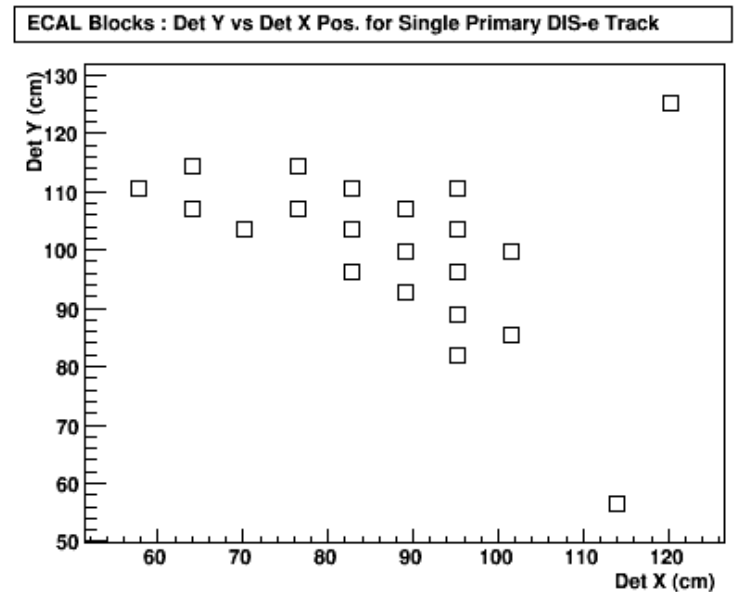
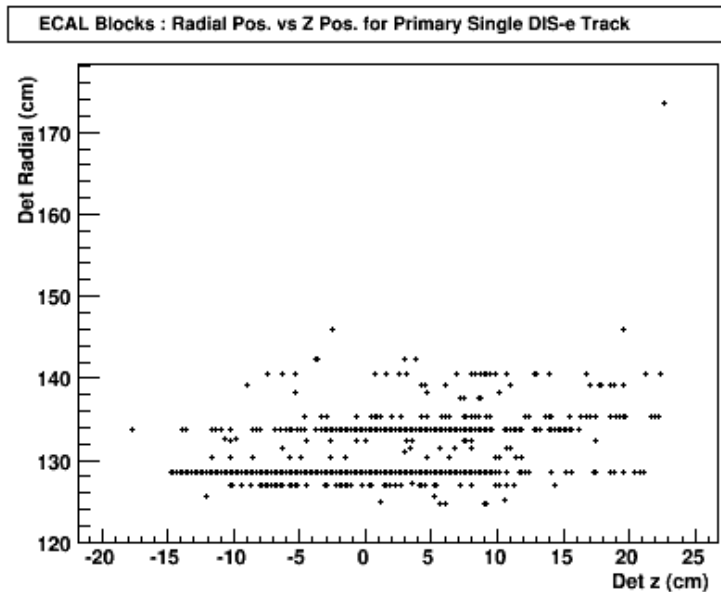
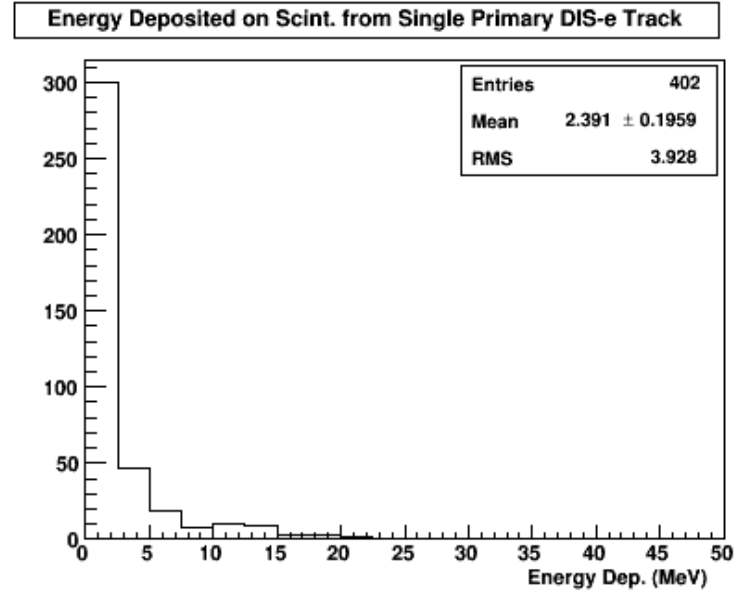
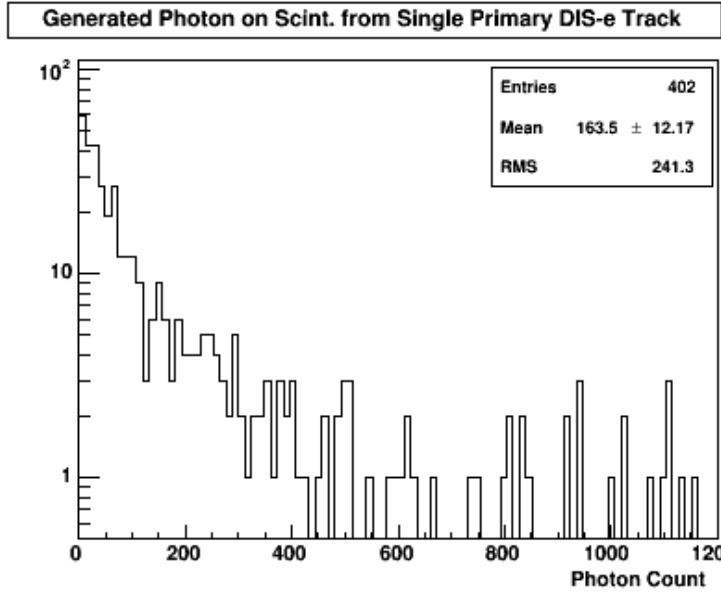


ECAL Blocks : Det Y vs Det X Pos. for Single Primary DIS-e Track



DIS-e Single Event

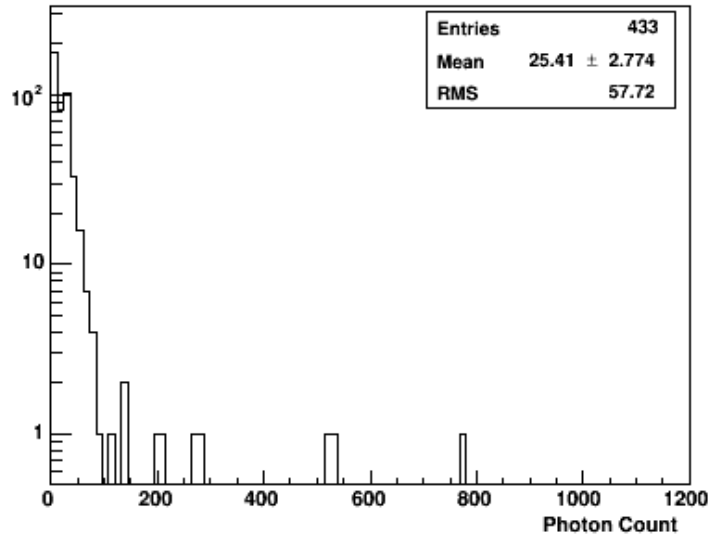
Energy deposition for a single event with Kryptonite heavy materials



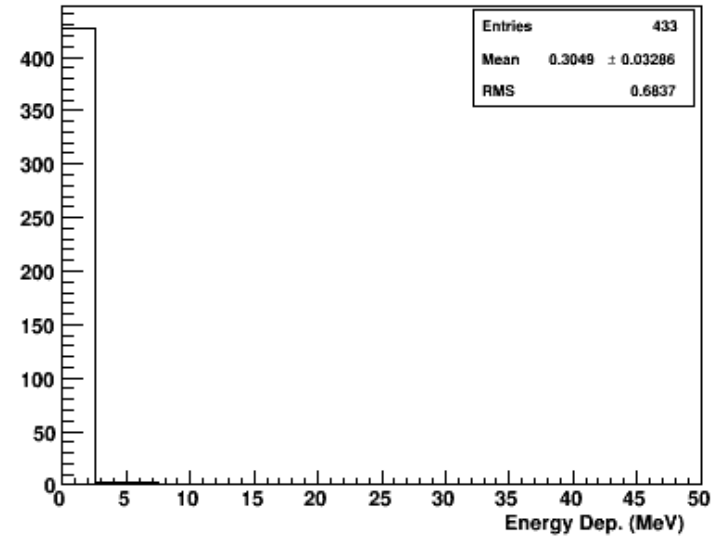
π^- Single Event

Energy deposition for a single event with Pb baffles

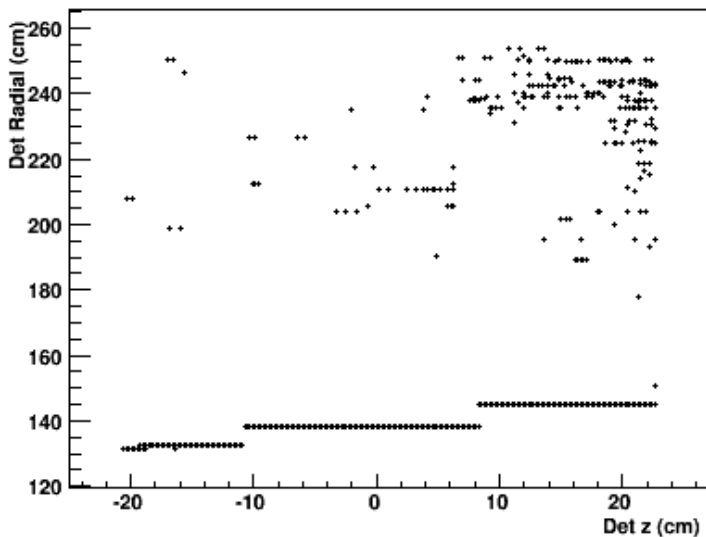
Generated Photon on Scint. from Single Primary π^- Track



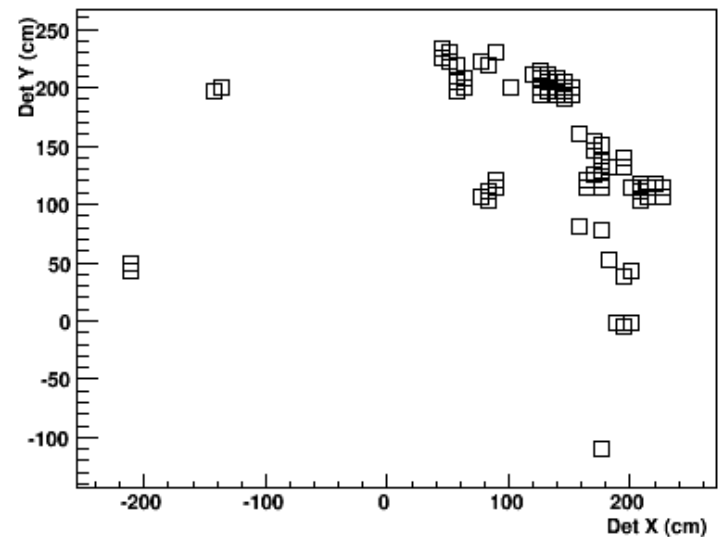
Energy Deposited on Scint. from Single Primary π^- Track



ECAL Blocks : Radial Pos. vs Z Pos. for Single Primary π^- Track

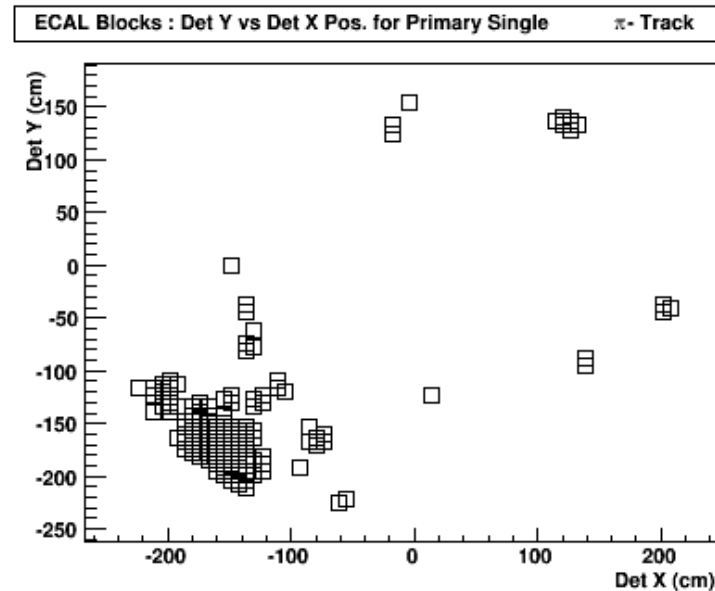
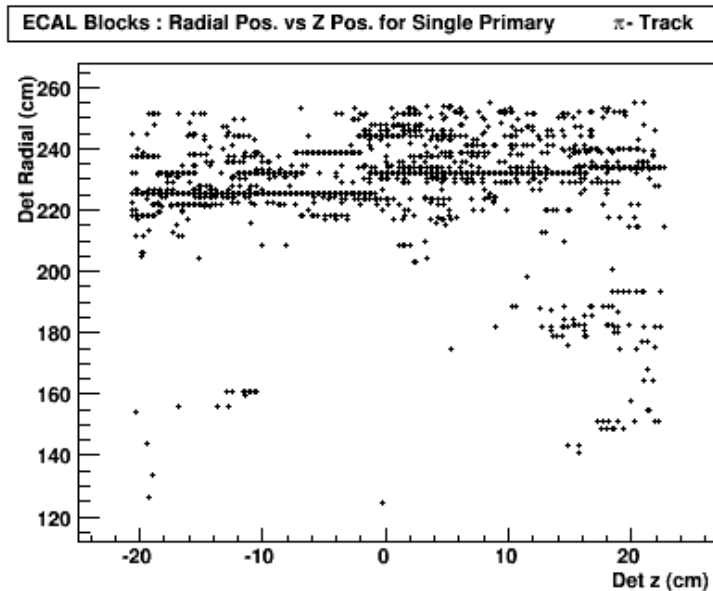
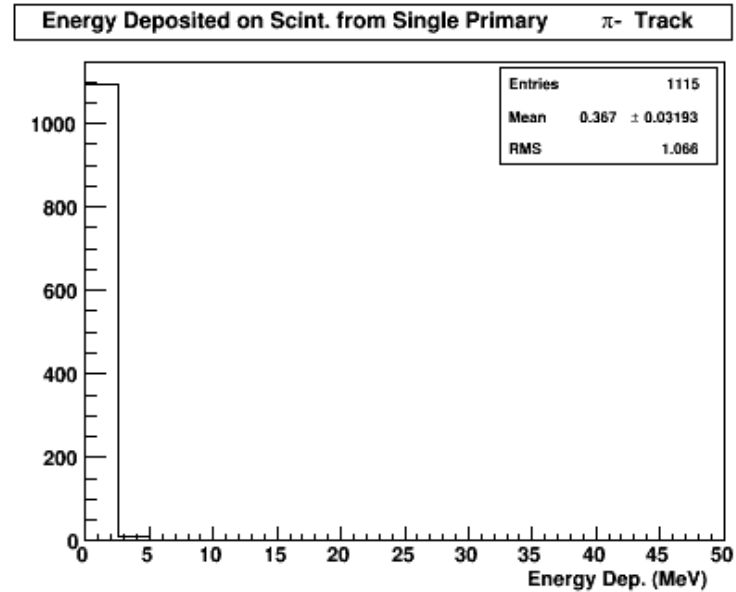
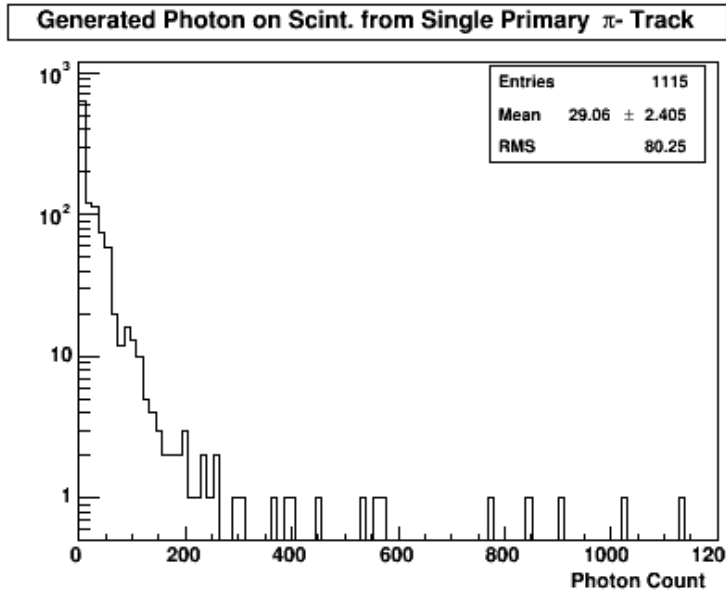


ECAL Blocks : Det Y vs Det X Pos. for Primary Single π^- Track



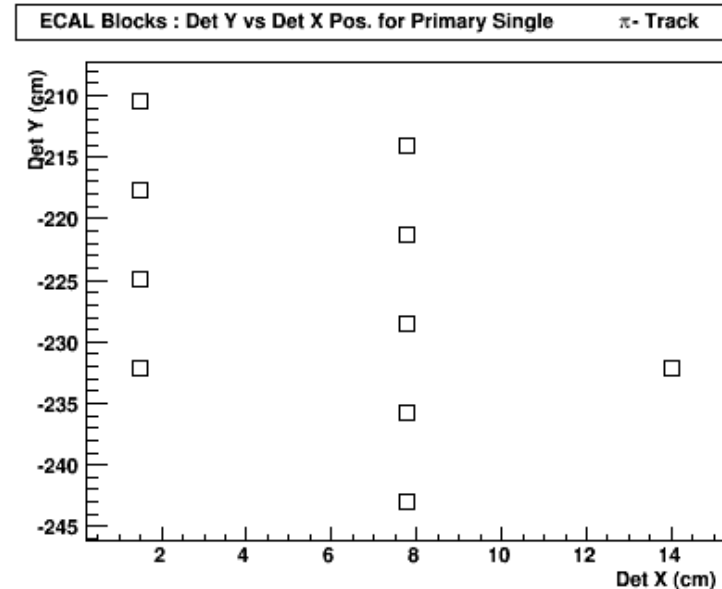
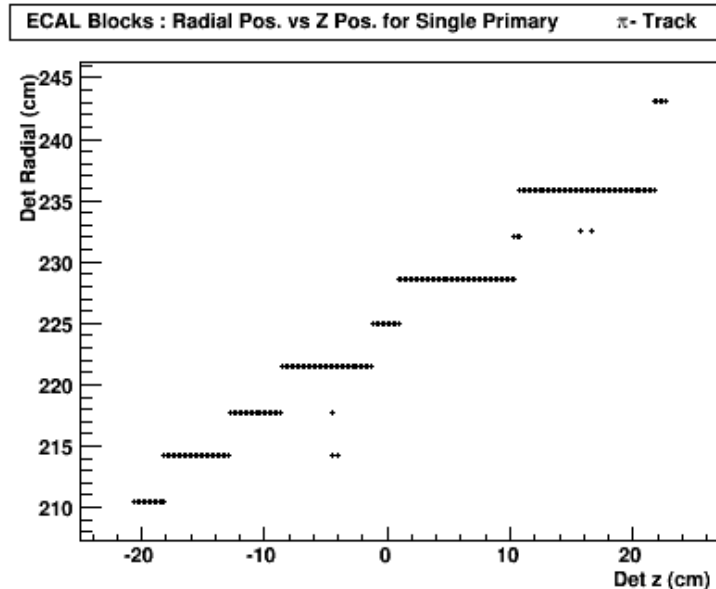
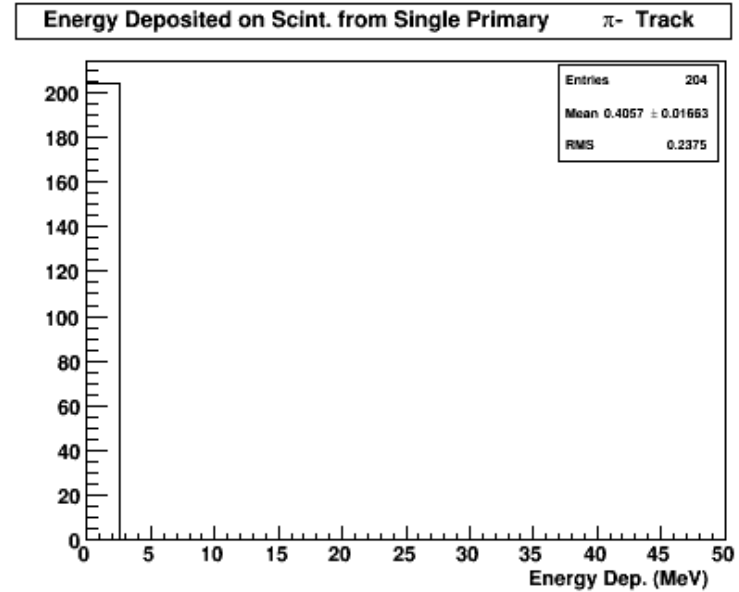
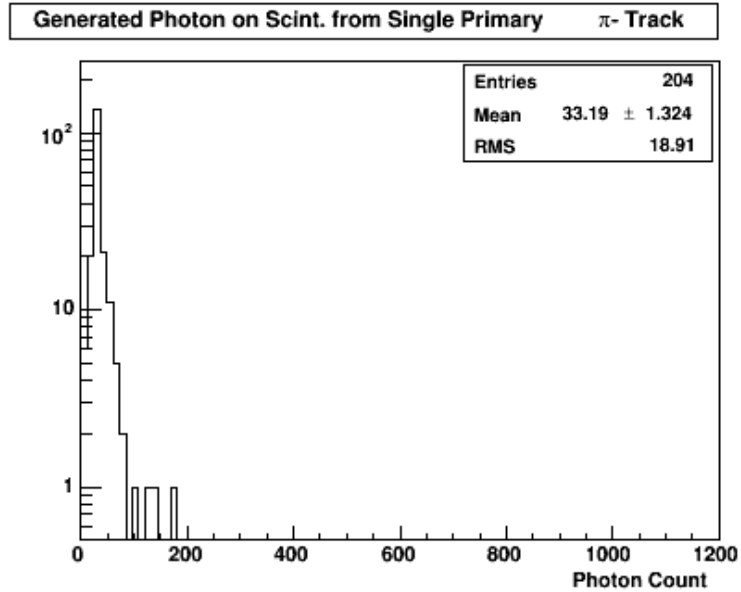
π^- Single Event

Energy deposition for a single event with Pb baffles



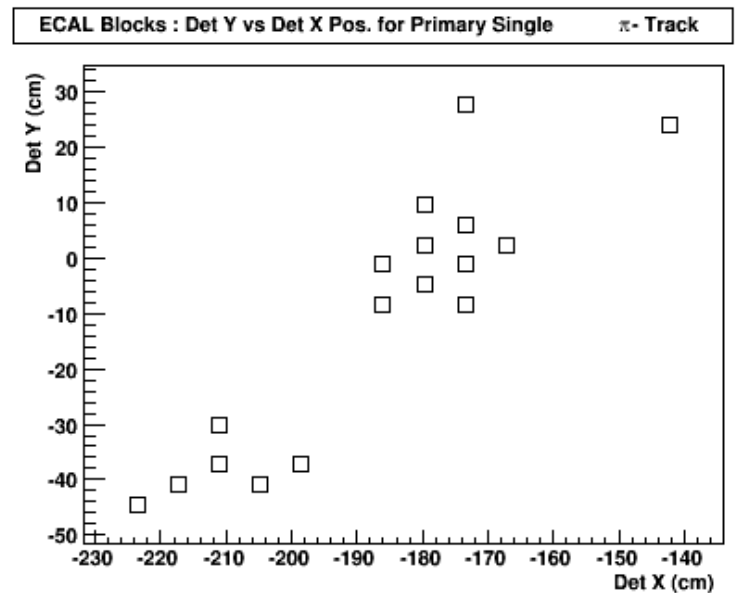
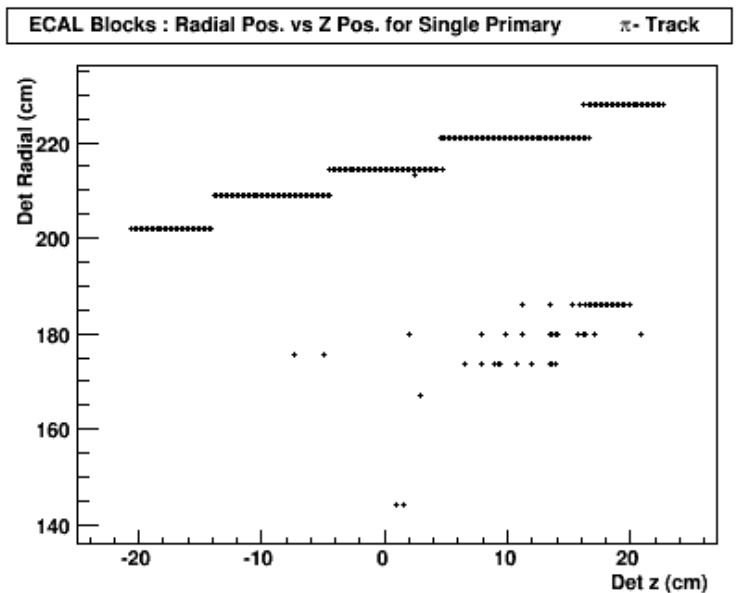
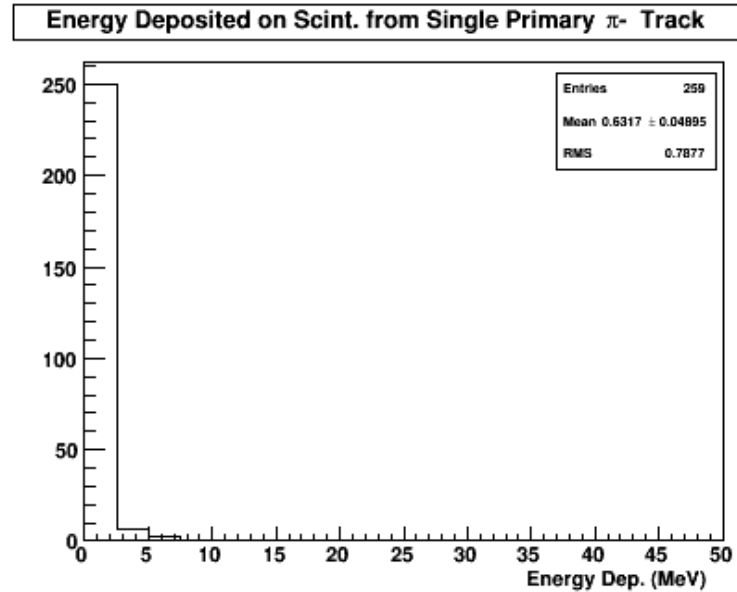
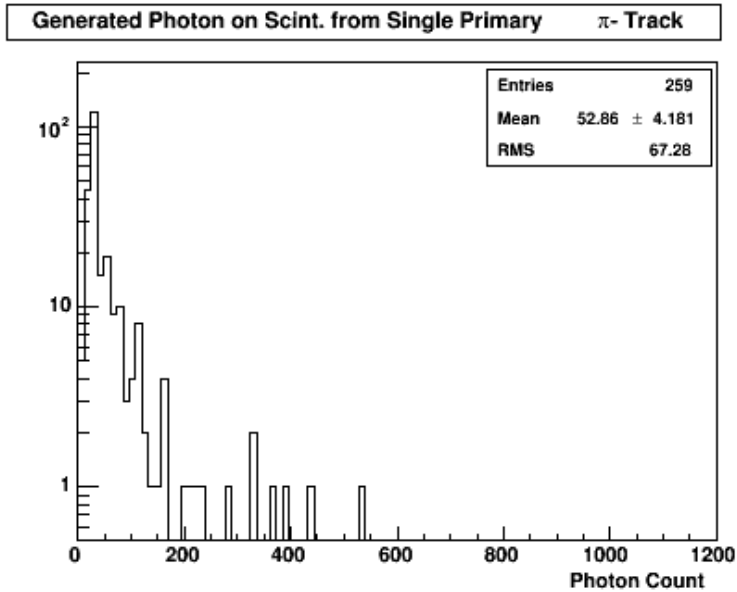
π^- Single Event

Energy deposition for a single event with Kryptonite heavy materials



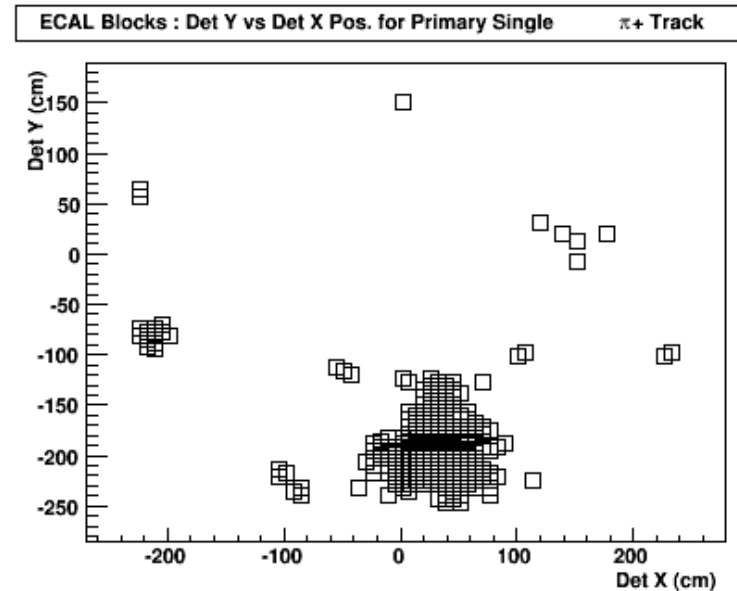
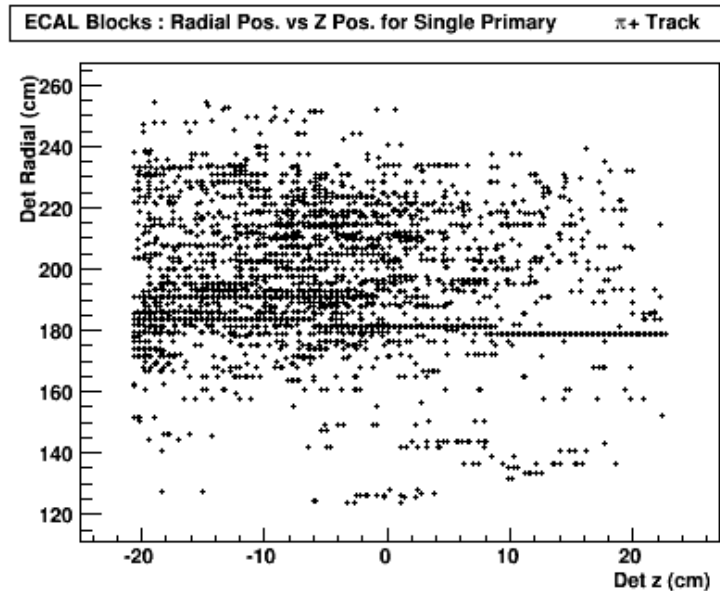
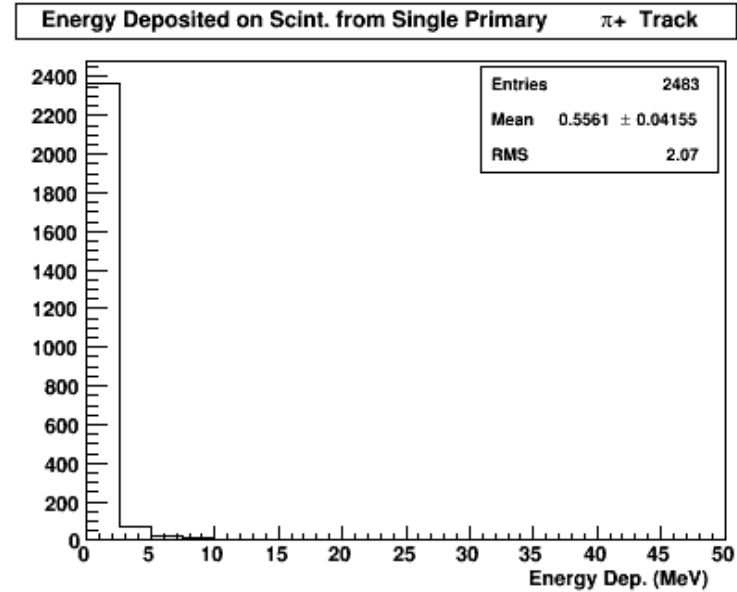
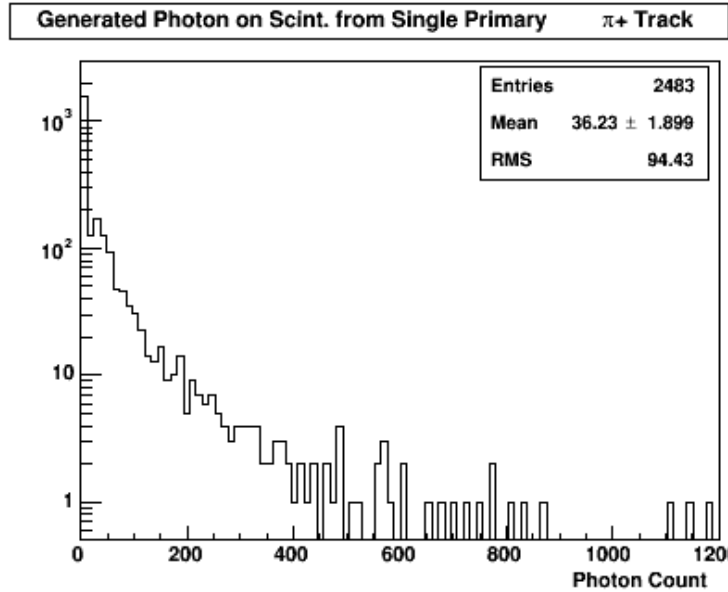
π^- Single Event

Energy deposition for a single event with Kryptonite heavy materials



π^+ Single Event

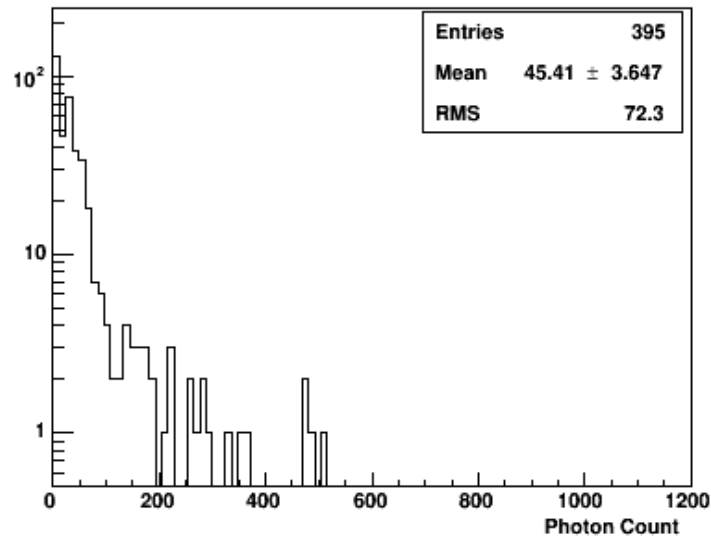
Energy deposition for a single event with Pb baffles



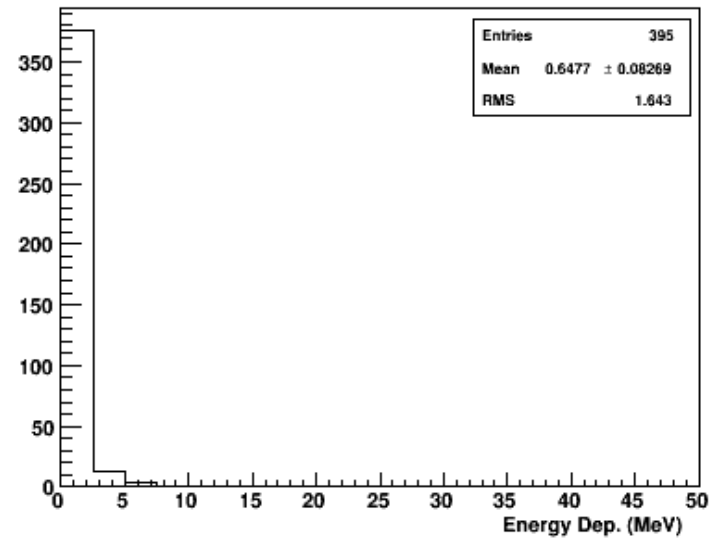
π^+ Single Event

Energy deposition for a single event with Pb baffles

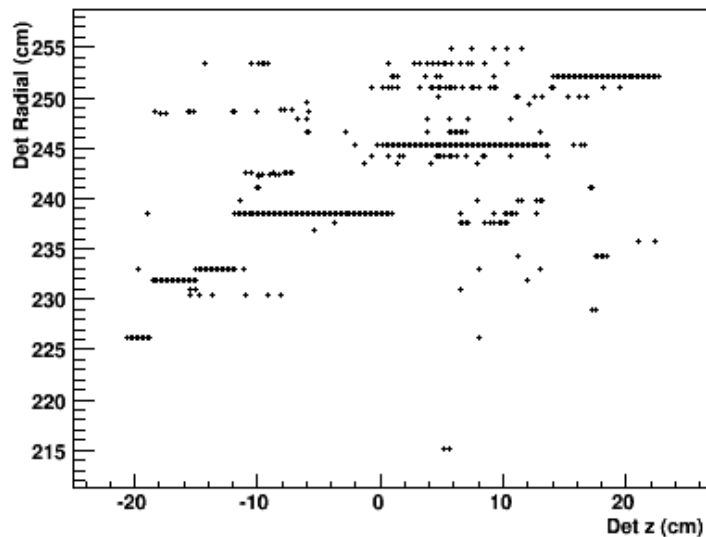
Generated Photon on Scint. from Single Primary π^+ Track



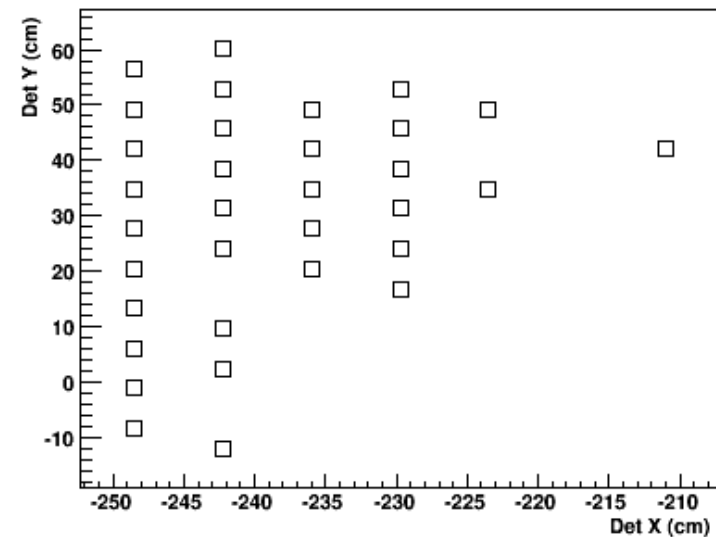
Energy Deposited on Scint. from Single Primary π^+ Track



ECAL Blocks : Radial Pos. vs Z Pos. for Single Primary π^+ Track



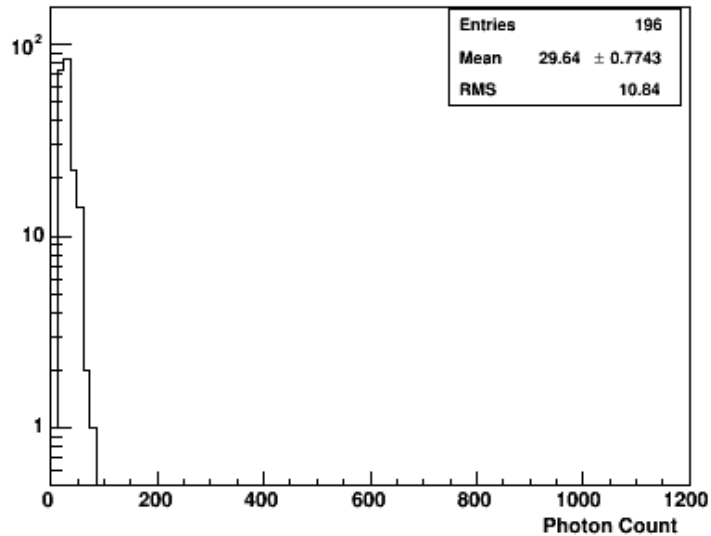
ECAL Blocks : Det Y vs Det X Pos. for Primary Single π^+ Track



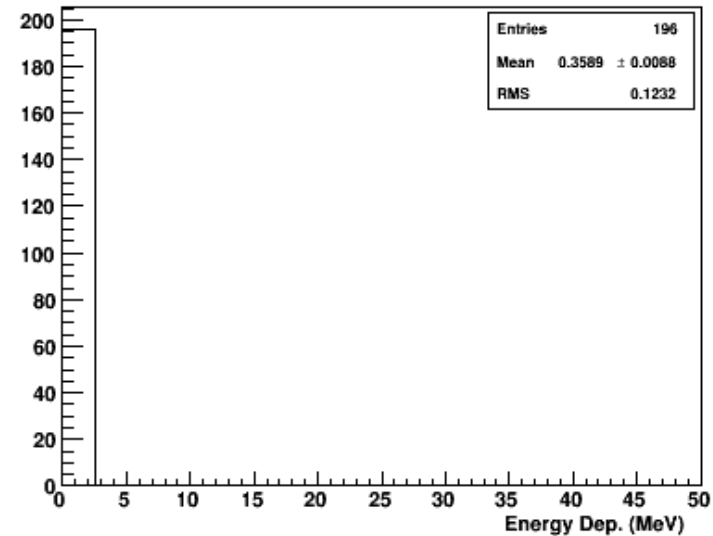
π^+ Single Event

Energy deposition for a single event with Kryptonite heavy materials

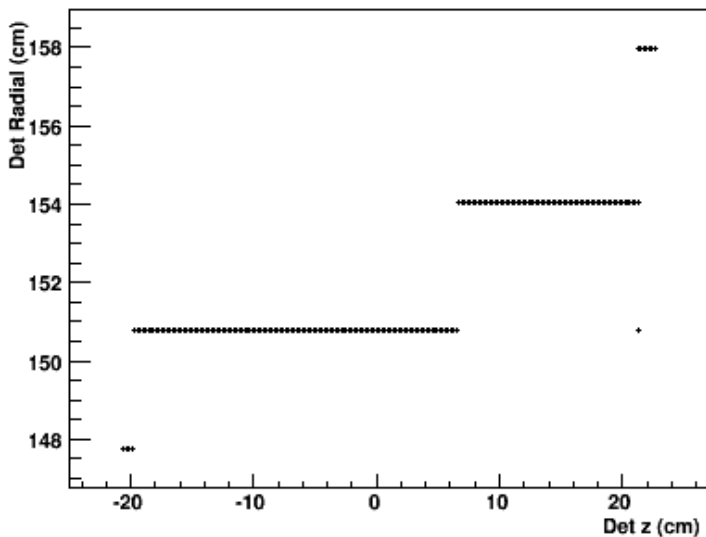
Generated Photon on Scint. from Single Primary π^+ Track



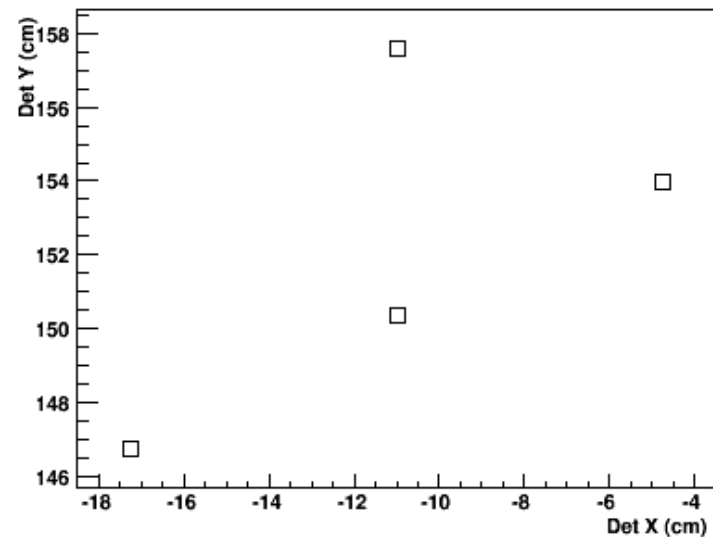
Energy Deposited on Scint. from Single Primary π^+ Track



ECAL Blocks : Radial Pos. vs Z Pos. for Single Primary π^+ Track



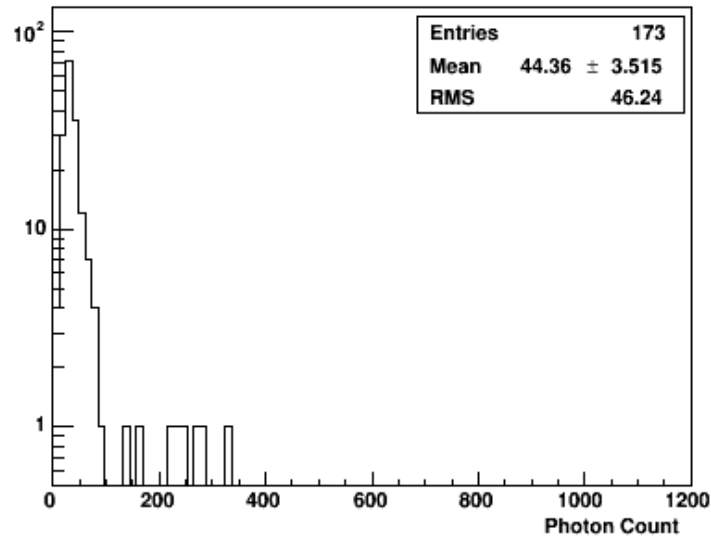
ECAL Blocks : Det Y vs Det X Pos. for Primary Single π^+ Track



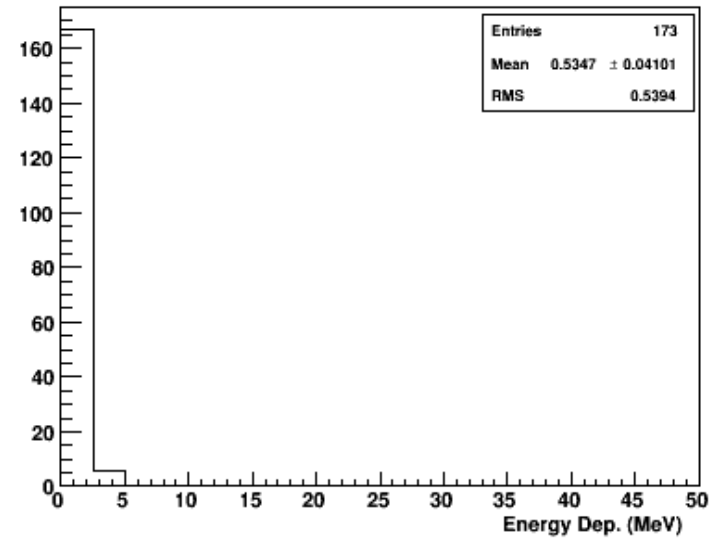
π^+ Single Event

Energy deposition for a single event with Kryptonite heavy materials

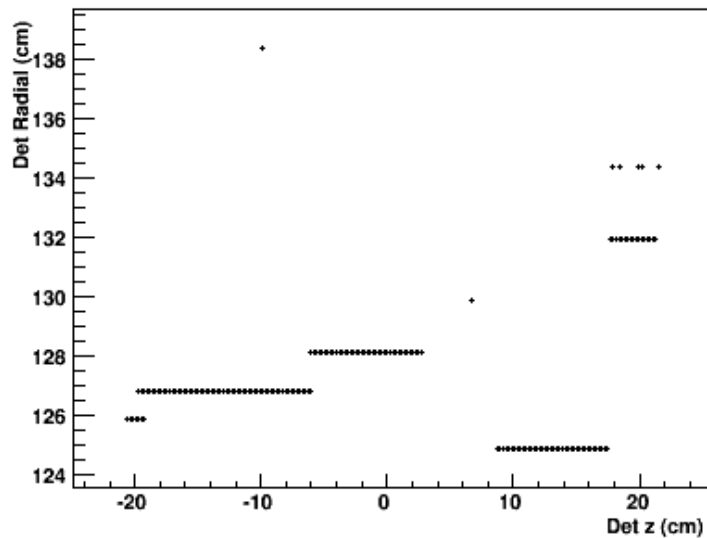
Generated Photon on Scint. from Single Primary π^+ Track



Energy Deposited on Scint. from Single Primary π^+ Track



ECAL Blocks : Radial Pos. vs Z Pos. for Single Primary π^+ Track



ECAL Blocks : Det Y vs Det X Pos. for Primary Single π^+ Track

