

Visualization

The MOLLER Project
Measurement Of a Lepton Lepton Electroweak Reaction

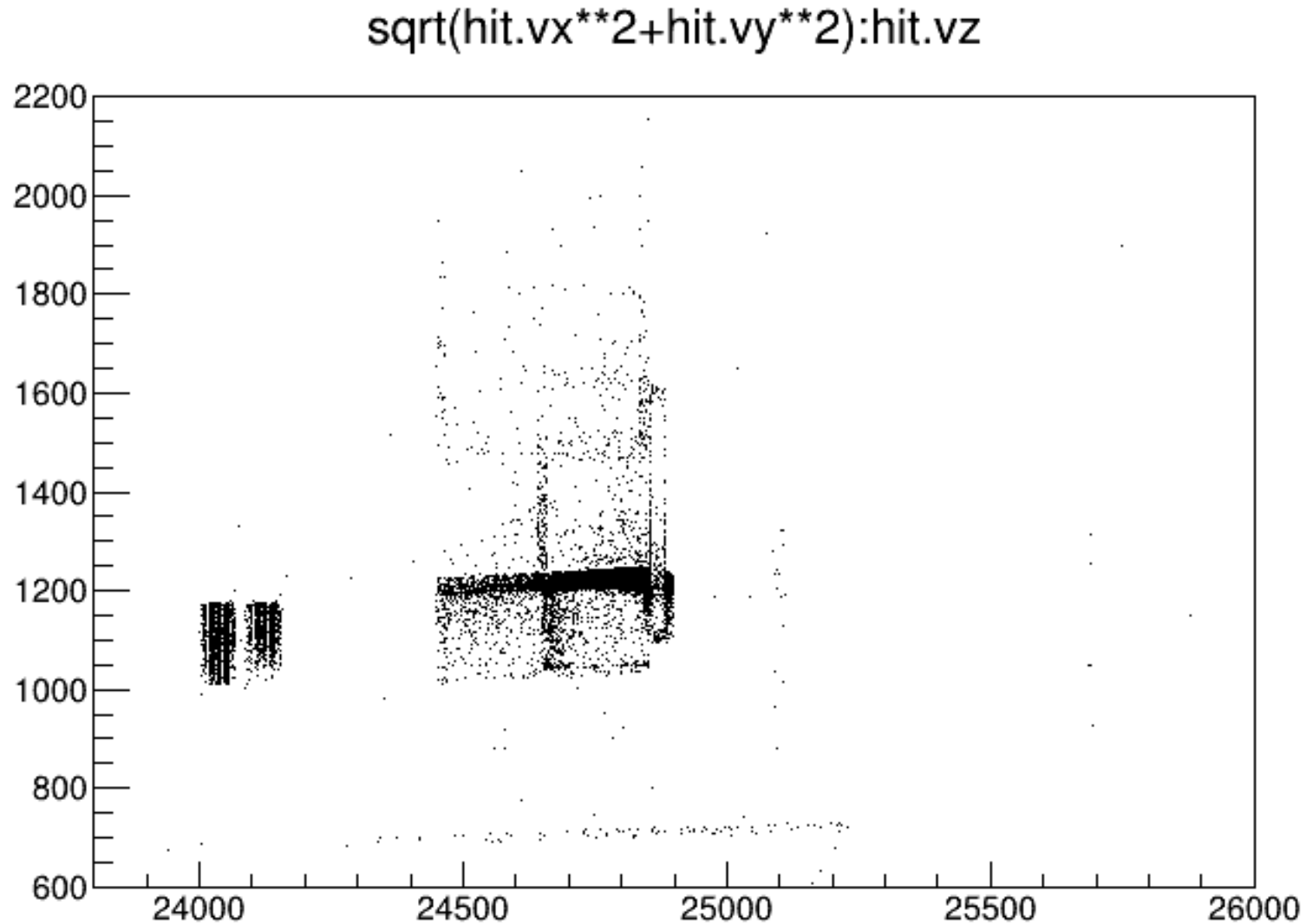
Elham Gorgannejad
Dr. Wouter Deconinck

April, 2021



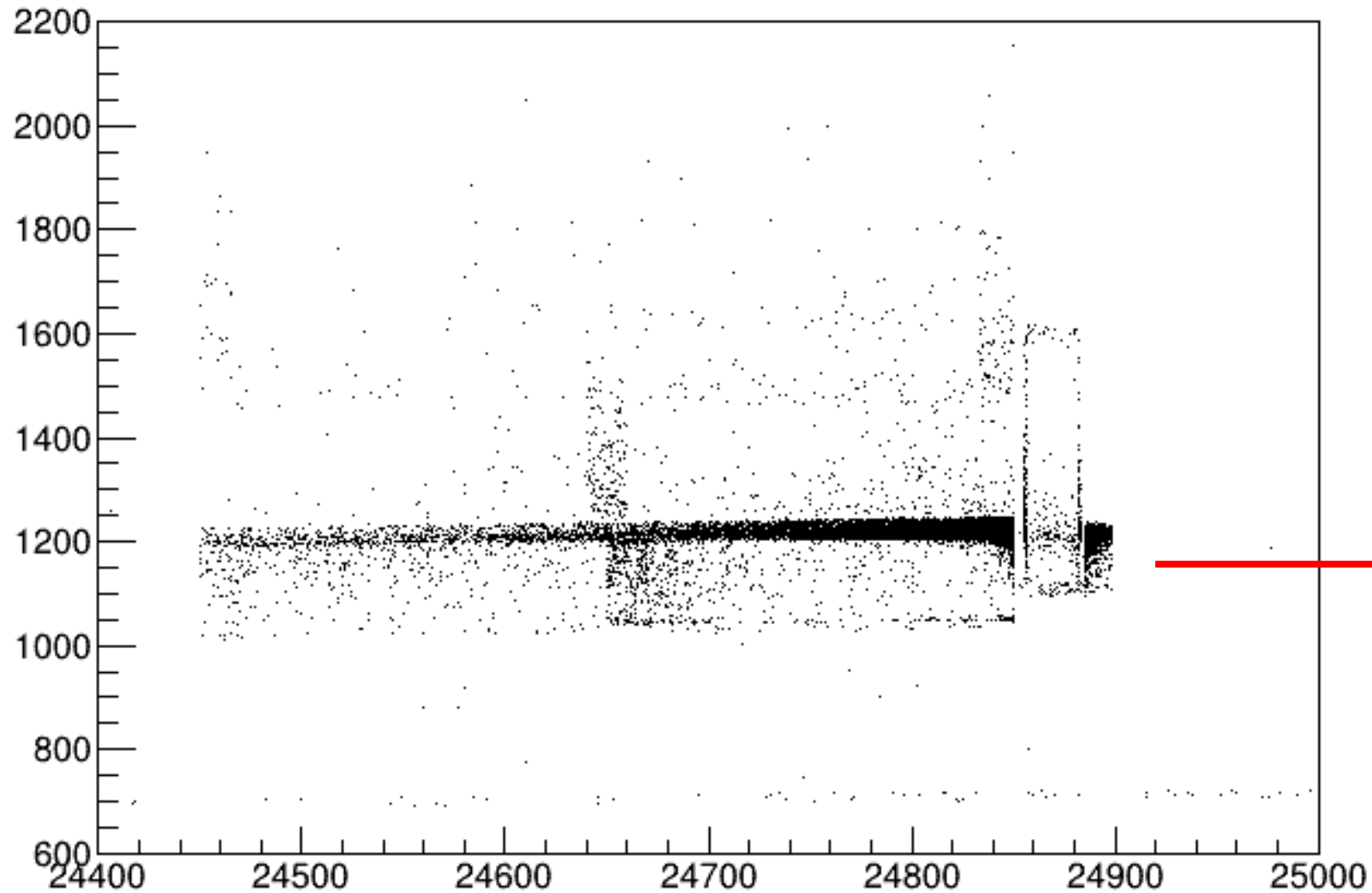
University
of Manitoba

**The origin location of all the secondaries anywhere for 5,000,000 events
(16 cm concrete and upstream Lead)**



`T->Draw("sqrt(hit.vx**2+hit.vy**2):hit.vz>>h1(100,23800,26000,100,600,2200)")`

`sqrt(hit.vx**2+hit.vy**2):hit.vz`

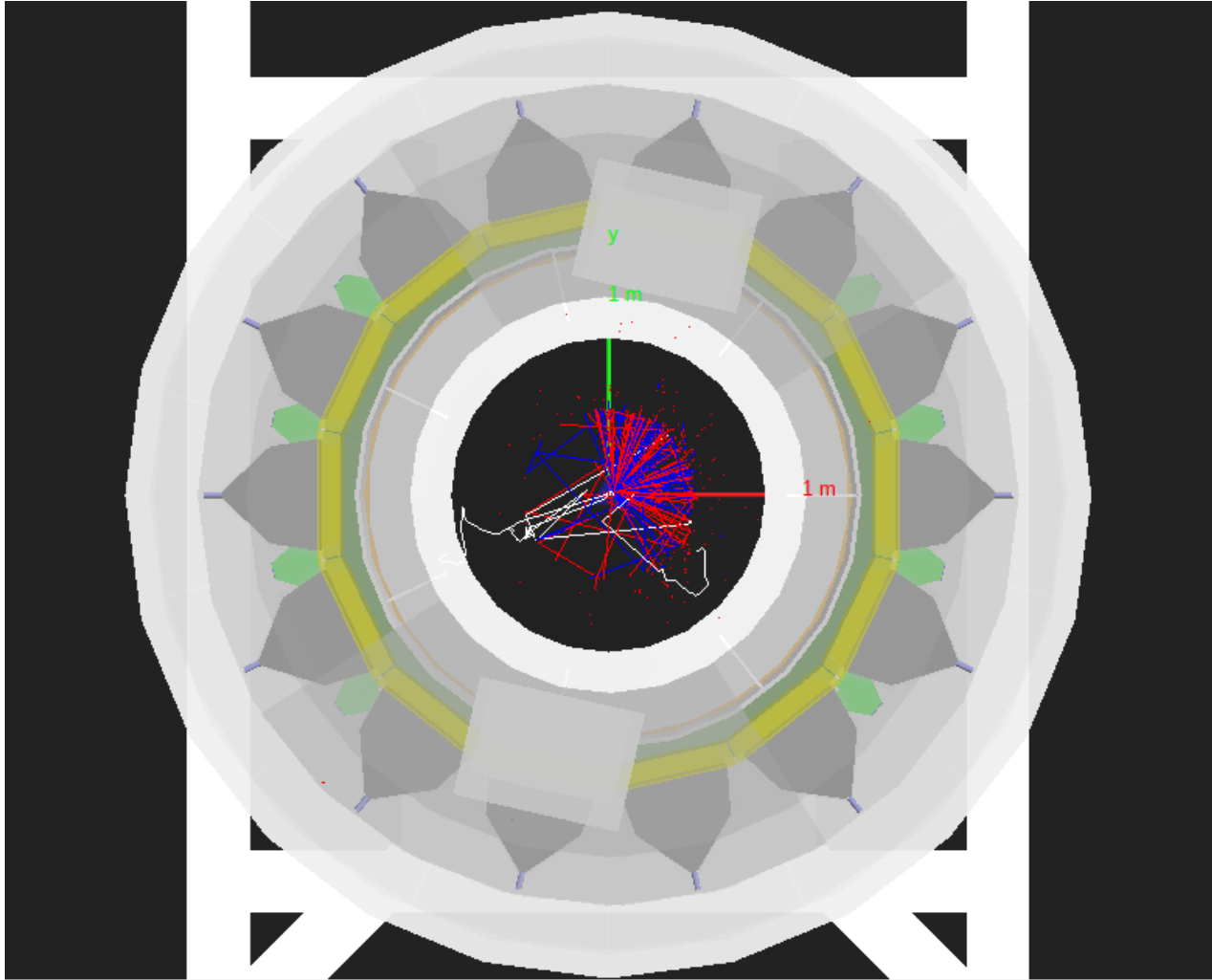


**Run visualization
for these events**

`T->Draw("sqrt(hit.vx**2+hit.vy**2):hit.vz>>h1(100,24400,25000,100,600,2200)")`

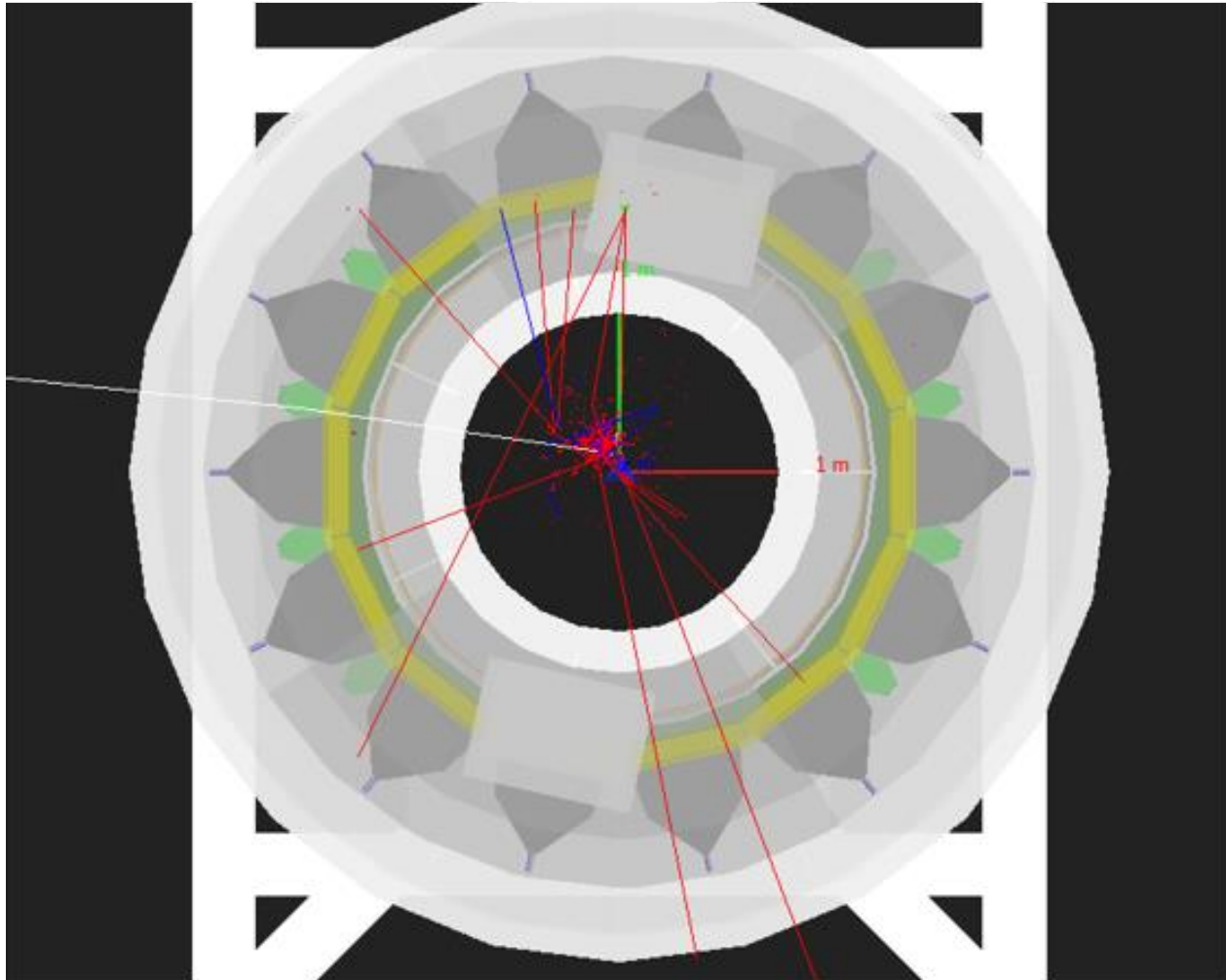
Different kinds of events

1- Events not creating electrons at PlaneWedge



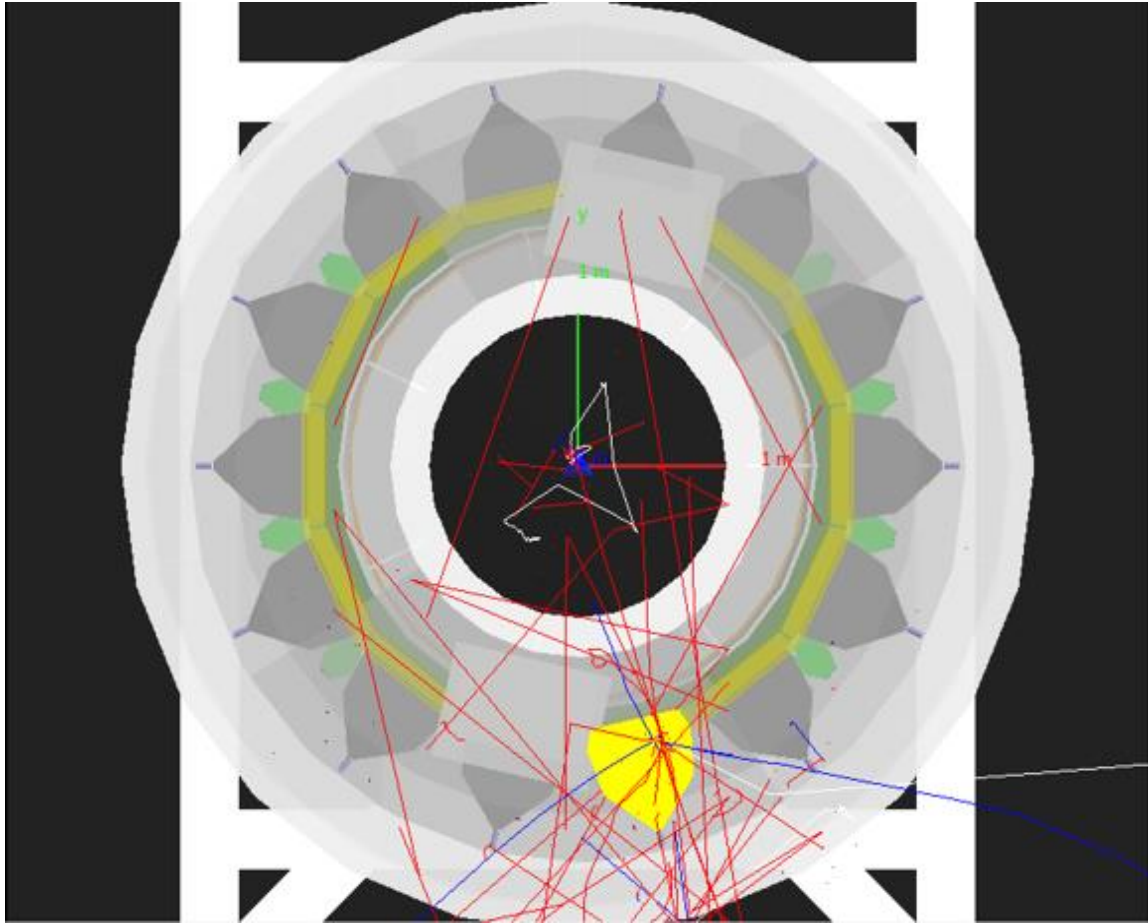
Different kinds of events

2- Events creating electrons at PlaneWedge but not creating optical photons at PlaneWedge



Different kinds of events

3- Events creating electrons at PlaneWedge and creating optical photons at PlaneWedge



Event #1 (not creating electrons at PlaneWedge)

	Particle type	Initial point	Initial energy (MeV)	Losing much energy	Energy difference (MeV)	Physical process	Final point	Final energy (MeV)	Final Physical process
1	Primary electron	h2Targ_PV	3.84e+03	tungsten_27_3	843	eBrem	cylwall	0	Scintillation
2	gamma	tungsten	44.3	donutLeadSleeveOuter_physical	44.3	conv	donutLeadSleeveOuter_physical	0	conv
3	Electron	donutLeadSleeveOuter_physical	37.8	donutLeadSleeveOuter_physical	25.71	eBrem	donutLeadSleeveOuter_physical	0	Scintillation
4	gamma	donutLeadSleeveOuter_physical	21.1	dump	21.1	conv	dump	0	conv

Event #2 (creating electrons but not creating optical photons at PlaneWedge)

	Particle type	Initial point	Initial energy (MeV)	Losing much energy	Energy difference (MeV)	Physical process	Final point	Final energy (MeV)	Final Physical process
1	Primary electron	h2Targ_PV	6.08e+03	tungsten_20_3	1554	eBrem	tungsten_20_2	0	Scintillation
2	gamma	tungsten_20_3	232	donutLeadSleeveOuter_physical	232	conv	donutLeadSleeveOuter_physical	0	conv
3	positron	donutLeadSleeveOuter_physical	190	donutLeadSleeveOuter_physical	101.1	eBrem	donutLeadSleeveOuter_physical	0	Scintillation
4	gamma	donutLeadSleeveOuter_physical	100	donutLeadSleeveOuter_physical	100	conv	donutLeadSleeveOuter_physical	0	conv
5	positron	donutLeadSleeveOuter_physical	88.3	donutLeadSleeveOuter_physical	62.39	eBrem	donutLeadSleeveOuter_physical	0	Scintillation
6	gamma	donutLeadSleeveOuter_physical	58	donutLead_physical	58	conv	donutLead_physical	0	conv
7	electron	donutLead_physical	45.7	donutLead_physical	22.2	eBrem	pionDetectorLucitePlaneWedge_physical	0	Scintillation
8	gamma	pionDetectorLucitePlaneWedge_physical	0.00347	pionDetectorLucitePlaneWedge_physical	0.00347	compt	pionDetectorLucitePlaneWedge_physical	0	phot
9	electron	pionDetectorLucitePlaneWedge_physical	0.00344	pionDetectorLucitePlaneWedge_physical	0.00344	eloni	pionDetectorLucitePlaneWedge_physical	0	Scintillation

Event #2 (creating electrons and optical photons at PlaneWedge (The first process))

	Particle type	Initial point	Initial energy (MeV)	Losing much energy	Energy difference (MeV)	Physical process	Final point	Final energy (MeV)	Final Physical process
1	Primary electron	h2Targ_PV	6.08e+03	tungsten_20_3	1554	eBrem	tungsten_20_2	0	Scintillation
2	gamma	tungsten_20_3	232	donutLeadSleeveOuter_physical	232	conv	donutLeadSleeveOuter_physical	0	conv
3	positron	donutLeadSleeveOuter_physical	190	donutLeadSleeveOuter_physical	101.1	eBrem	donutLeadSleeveOuter_physical	0	Scintillation
4	gamma	donutLeadSleeveOuter_physical	100	donutLeadSleeveOuter_physical	100	conv	donutLeadSleeveOuter_physical	0	conv
5	positron	donutLeadSleeveOuter_physical	88.3	donutLeadSleeveOuter_physical	62.39	eBrem	donutLeadSleeveOuter_physical	0	Scintillation
6	gamma	donutLeadSleeveOuter_physical	58	donutLead_physical	58	conv	donutLead_physical	0	conv
7	electron	donutLead_physical	45.7	donutLead_physical	22.2	eBrem	pionDetectorLucitePlaneWedge_physical	0	Scintillation
8	Optical photons	pionDetectorLucitePlaneWedge_physical	2.89e-06	-	0	-	pionDetectorLuciteMylar_physical	2.89e-06	CoupledTransportation

Event #2 (creating creating electrons and optical photons at PlaneWedge (The second process))

	Particle type	Initial point	Initial energy (MeV)	Losing much energy	Energy difference (MeV)	Physical process	Final point	Final energy (MeV)	Final Physical process
1	Primary electron	h2Targ_PV	6.08e+03	tungsten_20_3	1554	eBrem	tungsten_20_2	0	Scintillation
2	gamma	tungsten_20_3	232	donutLeadSleeveOuter_physical	232	conv	donutLeadSleeveOuter_physical	0	conv
3	positron	donutLeadSleeveOuter_physical	190	donutLeadSleeveOuter_physical	101.1	eBrem	donutLeadSleeveOuter_physical	0	Scintillation
4	gamma	donutLeadSleeveOuter_physical	100	donutLeadSleeveOuter_physical	100	conv	donutLeadSleeveOuter_physical	0	conv
5	positron	donutLeadSleeveOuter_physical	88.3	donutLeadSleeveOuter_physical	62.39	eBrem	donutLeadSleeveOuter_physical	0	Scintillation
6	gamma	donutLeadSleeveOuter_physical	58	donutLead_physical	58	conv	donutLead_physical	0	conv
7	electron	donutLead_physical	45.7	donutLead_physical	22.2	eBrem	pionDetectorLucitePlaneWedge_physical	0	Scintillation
8	gamma	donutLeadVirtualDetectorDS_physical	2.2	pionDetectorLucitePlaneWedge_physical	0.39	compt	pionDetectorLuciteShieldDS_physical	0	phot
9	electron	pionDetectorLucitePlaneWedge_physical	0.227	pionDetectorLucitePlaneWedge_physical	0.097	Cerenkov	pionDetectorLucitePlaneWedge_physical	0	Scintillation
10	Optical photons	pionDetectorLucitePlaneWedge_physical	1.58e-06	-	0	-	pionDetectorLuciteMylar_physical	1.58e-06	CoupledTransportation

•From the last meeting:

For the beam generator

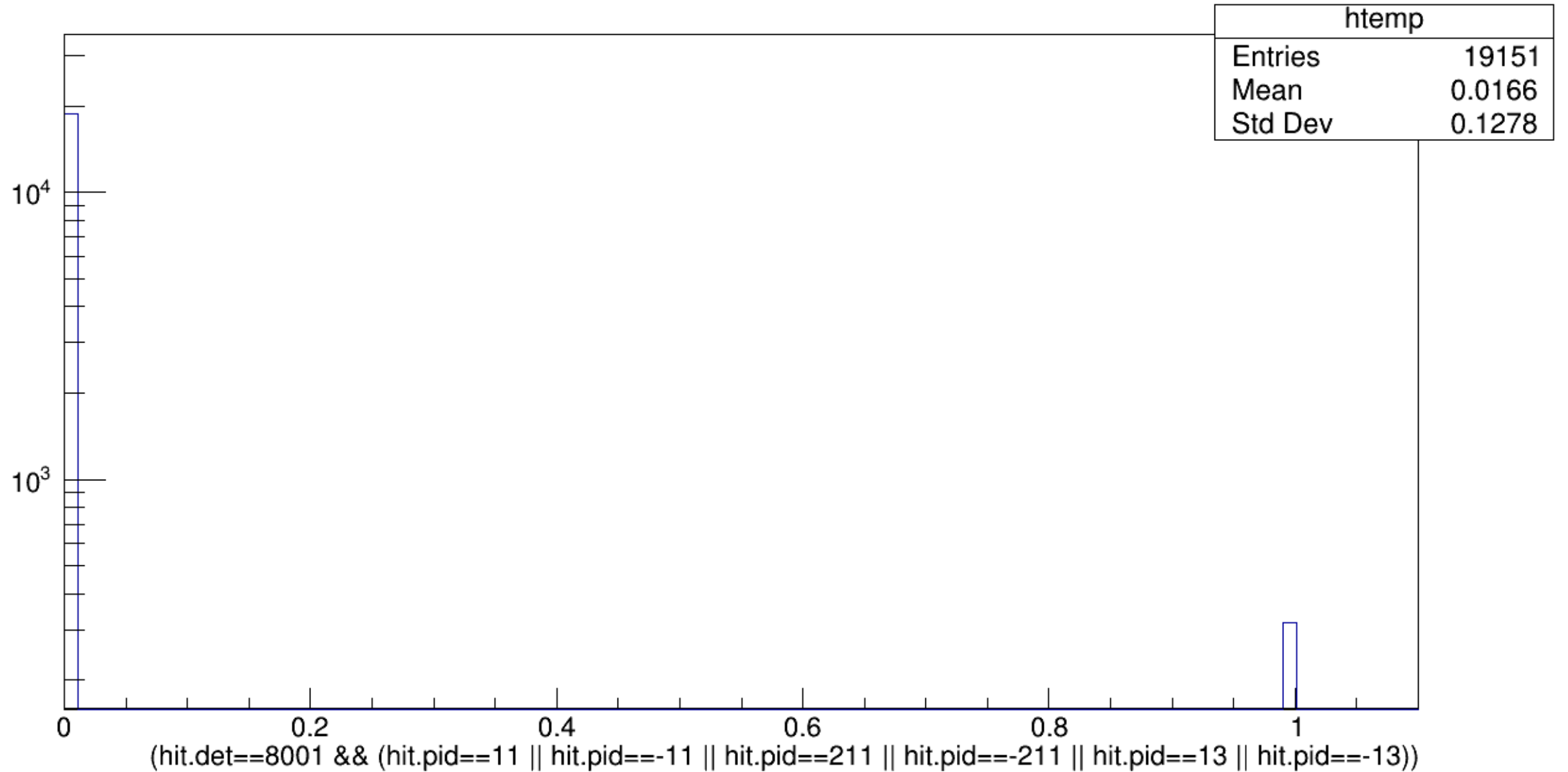
- look at number of events before scaling into rates
- Are there pions that reach the lucite in the beam generator?
 - TODO: Only look at electrons/positrons, not the other types.

For the moller generator:

Create histogram of rate to find high rate events

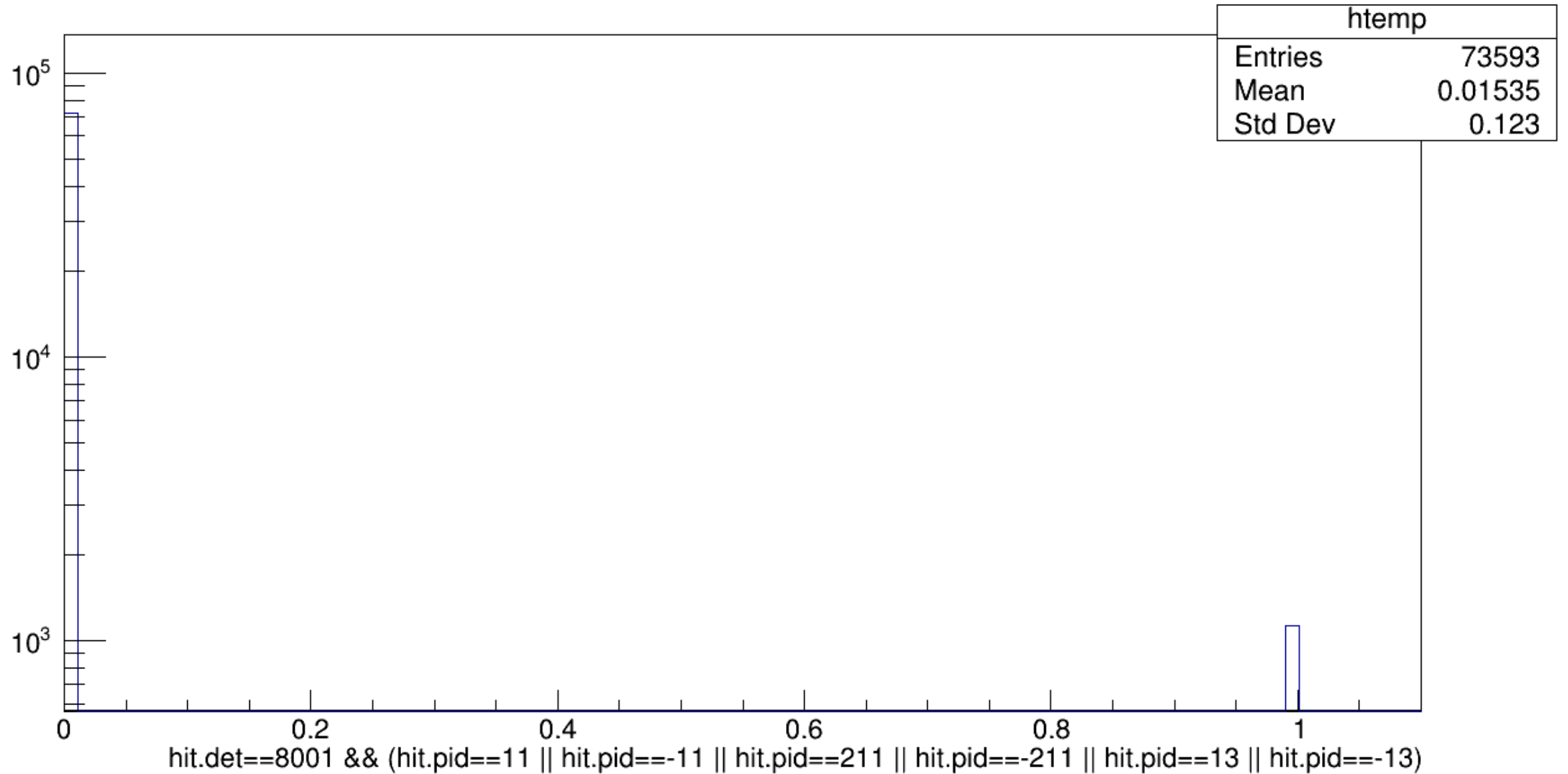
Number of events before scaling into rates (50M events)

(hit.det==8001 && (hit.pid==11 || hit.pid==-11 || hit.pid==211 || hit.pid==-211 || hit.pid==13 || hit.pid==-13))



Number of events before scaling into rates (Raj's data, 500M events)

hit.det==8001 && (hit.pid==11 || hit.pid==-11 || hit.pid==211 || hit.pid==-211 || hit.pid==13 || hit.pid==-13)



Beam generator

50M events (Low energy particles, hit.p<2*MeV)

Concrete and Lead at 26cm	$(1.89 \pm 0.13) \times 10^{-3}$			$(1.023 \pm 0.001) \times 10^{-1}$		
				$(1.023 \pm 0.001) \times 10^{-1}$		

Only e- & e+ inclusion

Concrete and Lead at 26cm	$(1.89 \pm 0.13) \times 10^{-3}$			$(1.023 \pm 0.001) \times 10^{-1}$		
				$(1.023 \pm 0.001) \times 10^{-1}$		

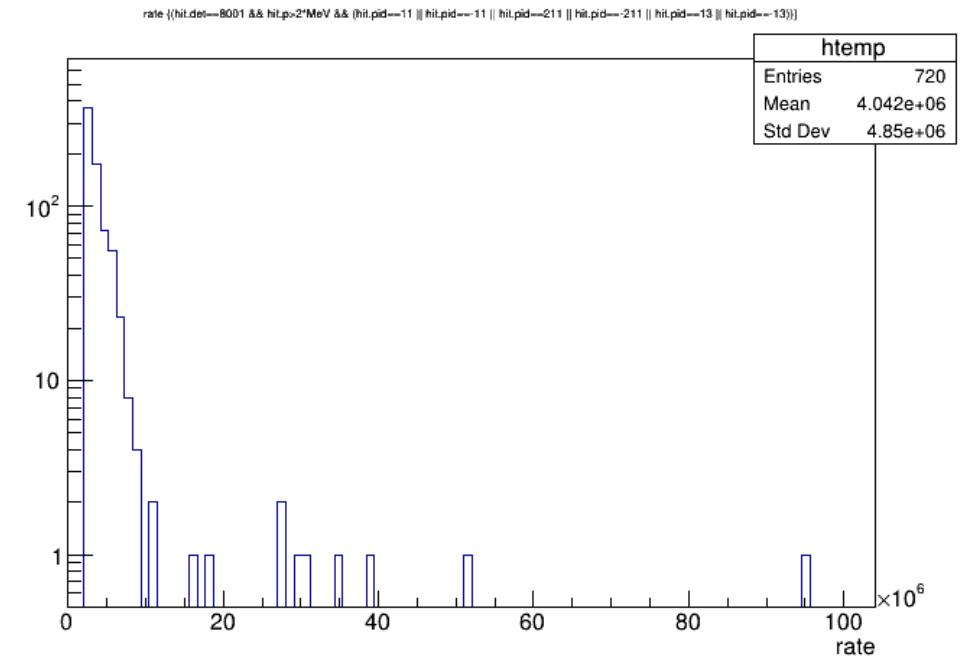
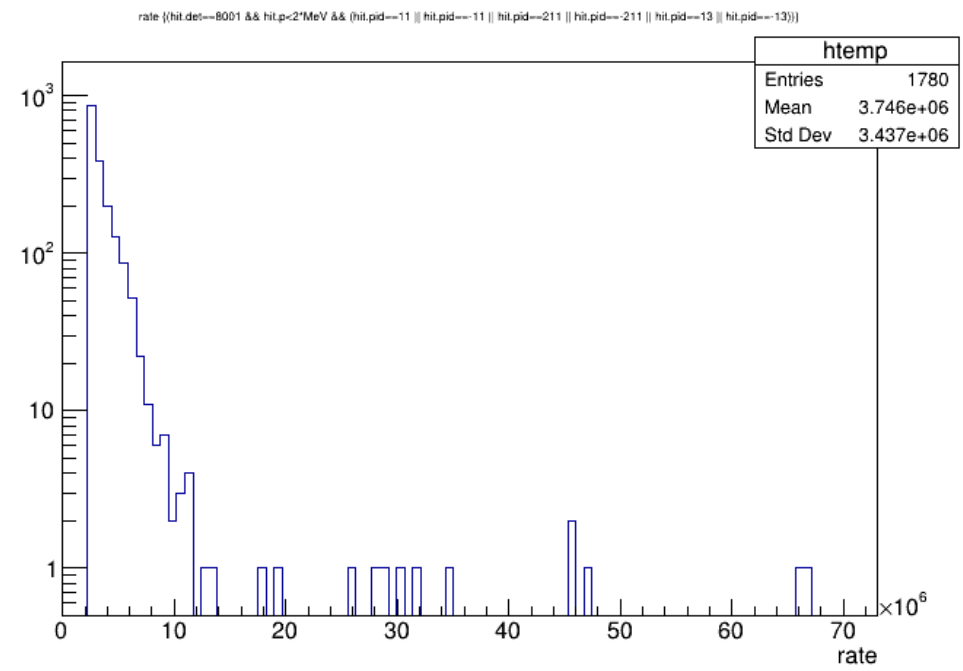
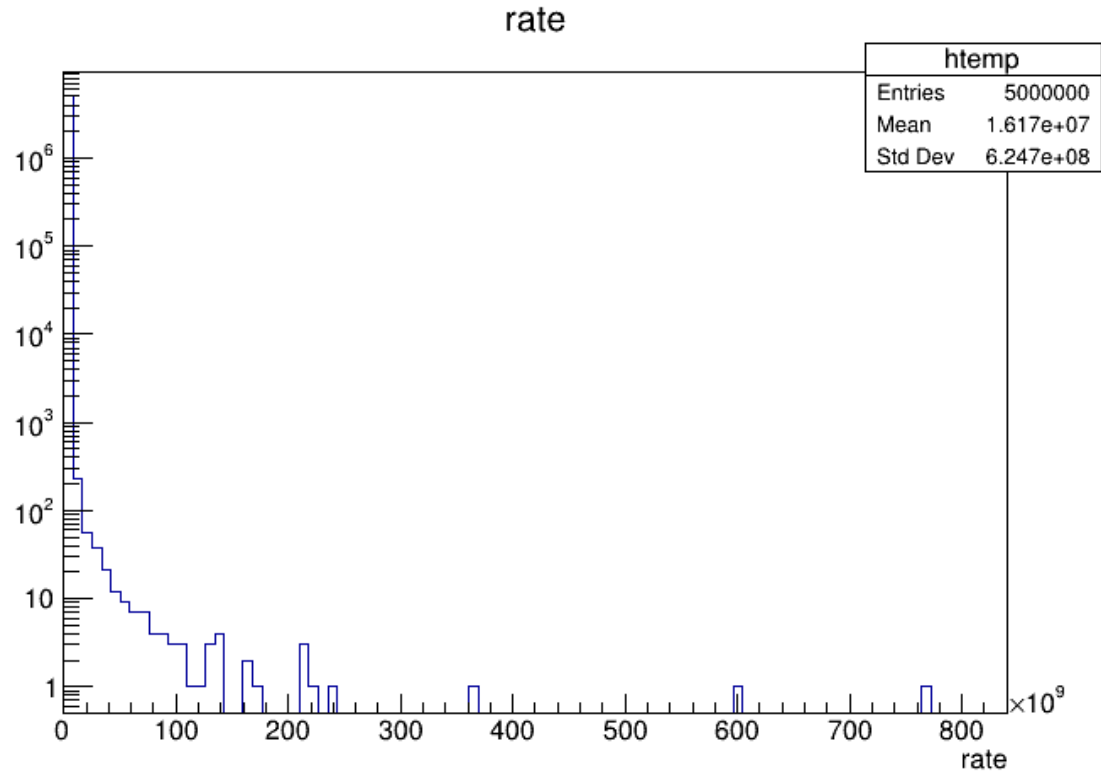
50M events (High energy particles, hit.p>2*MeV)

Concrete and Lead at 26cm	$(9.43 \pm 0.92) \times 10^{-4}$			$(1.023 \pm 0.001) \times 10^{-1}$		

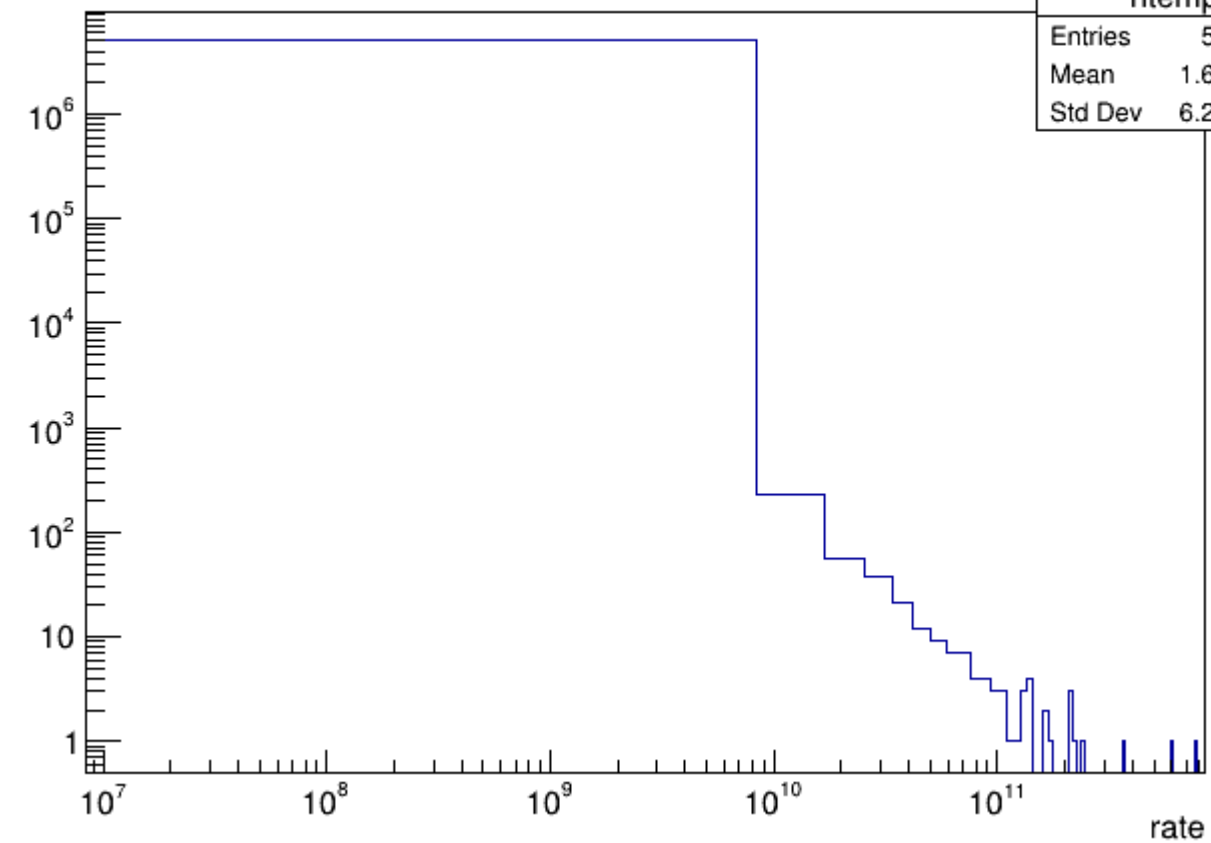
Only e- & e+ inclusion

Concrete and Lead at 26cm	$(8.99 \pm 0.89) \times 10^{-4}$			$(1.023 \pm 0.001) \times 10^{-1}$		

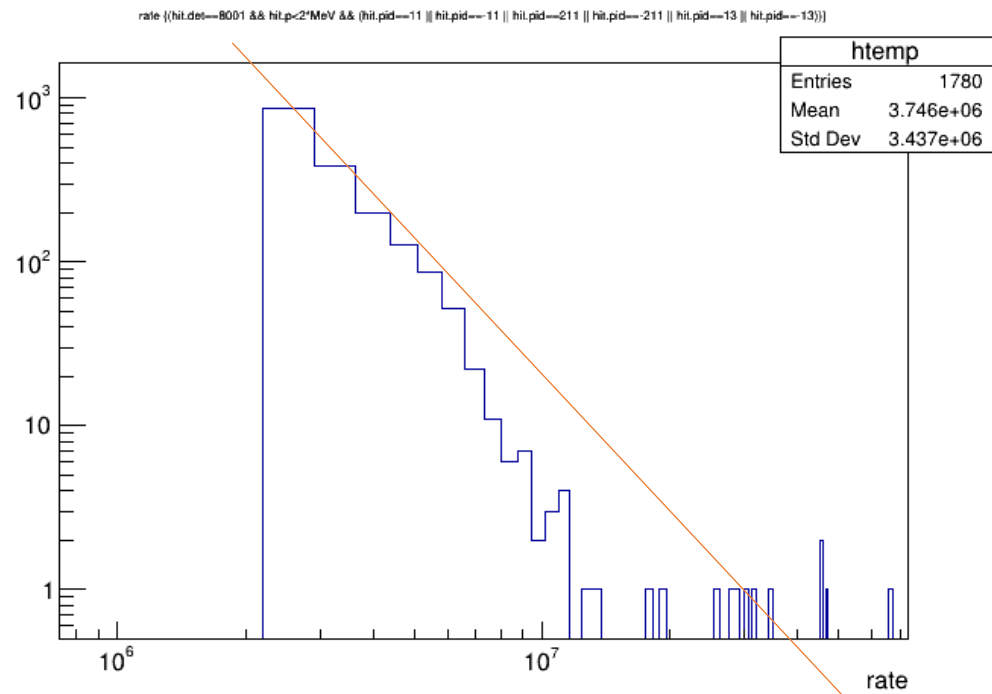
Histogram of rate for the moller generator



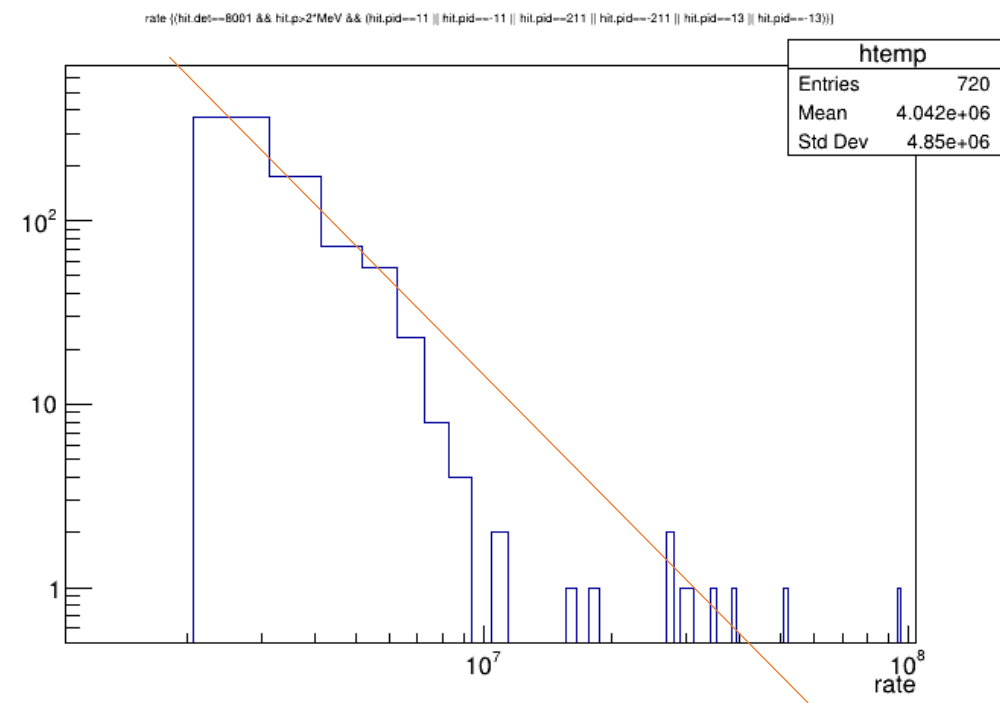
rate



htemp	
Entries	5000000
Mean	1.617e+07
Std Dev	6.247e+08



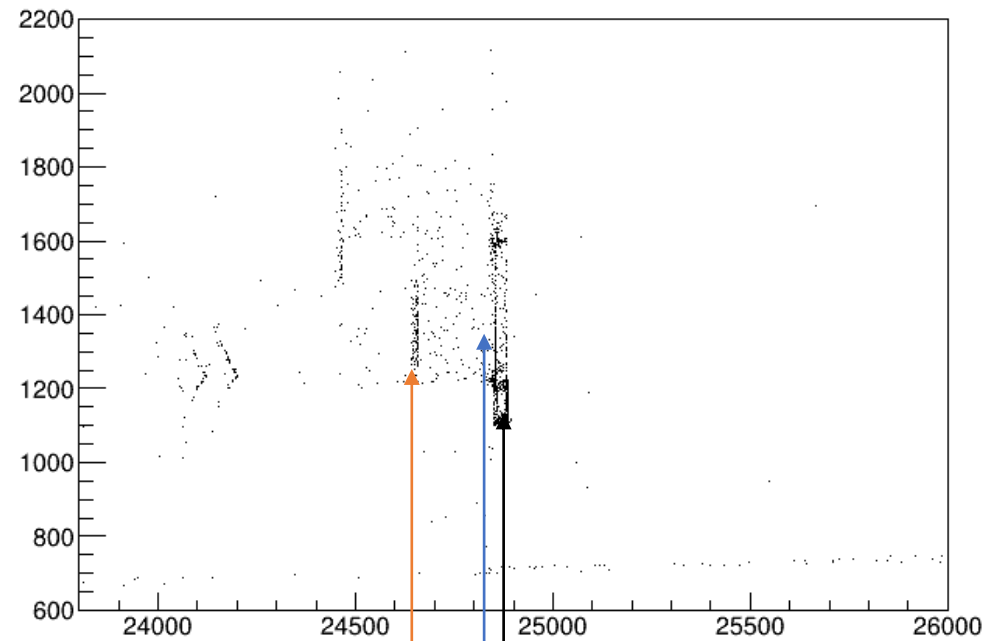
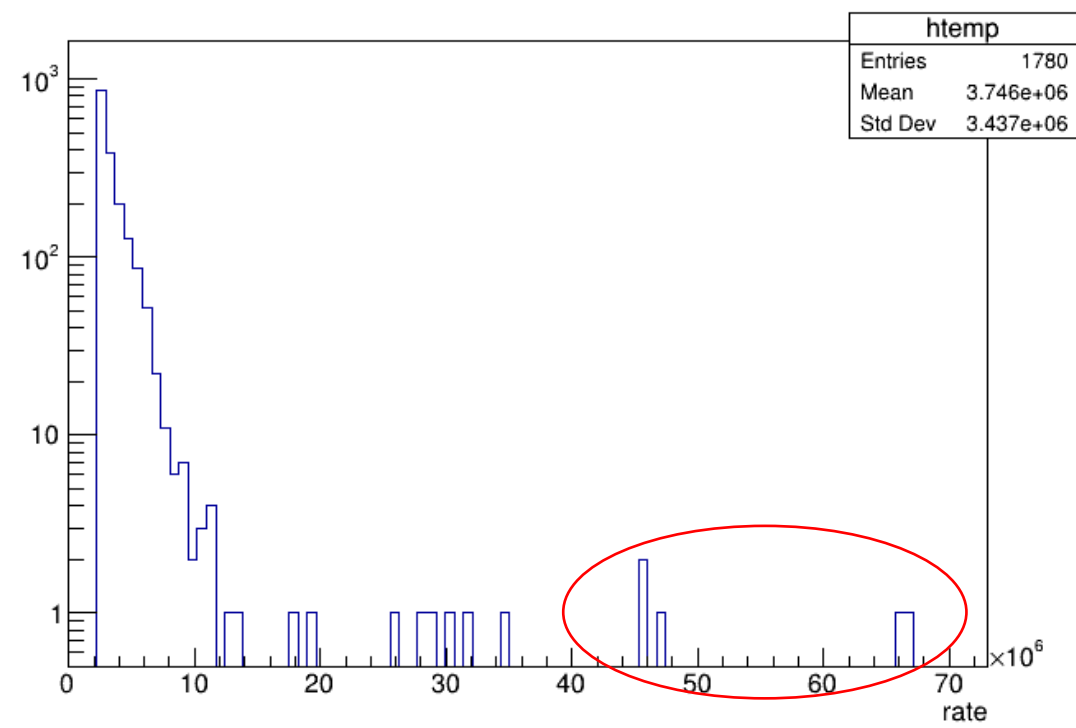
htemp	
Entries	1780
Mean	3.746e+06
Std Dev	3.437e+06



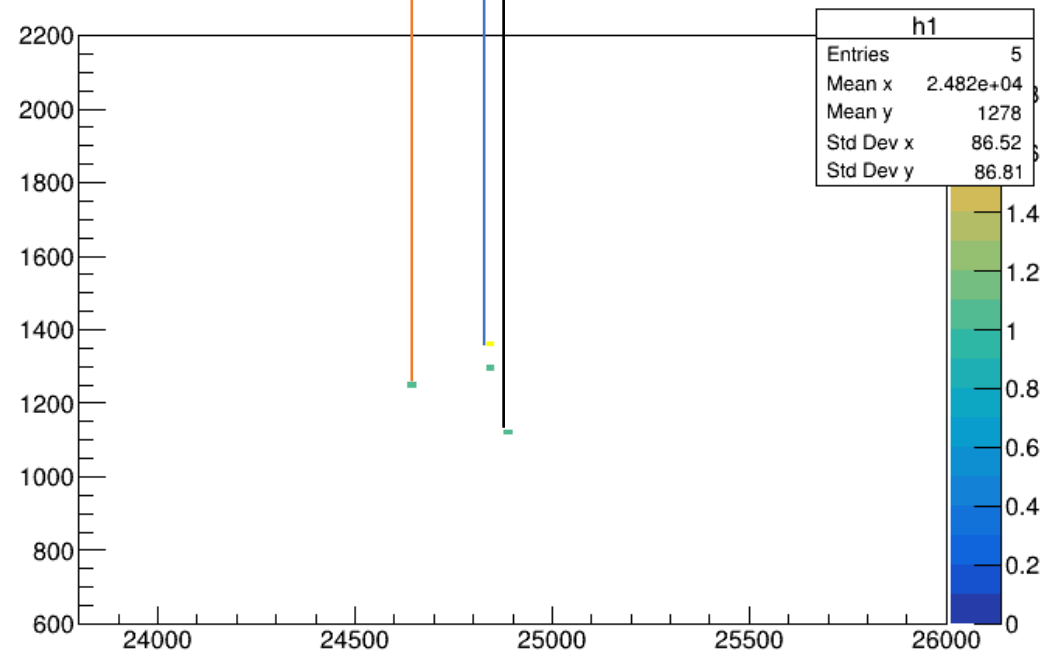
htemp	
Entries	720
Mean	4.042e+06
Std Dev	4.85e+06

sqrt((hit.vx**2+hit.vy**2):hit.vz (hit.p<2*MeV && (hit.pid==11 || hit.pid==11 || hit.pid==211 || hit.pid==211 || hit.pid==13 || hit.pid==13))

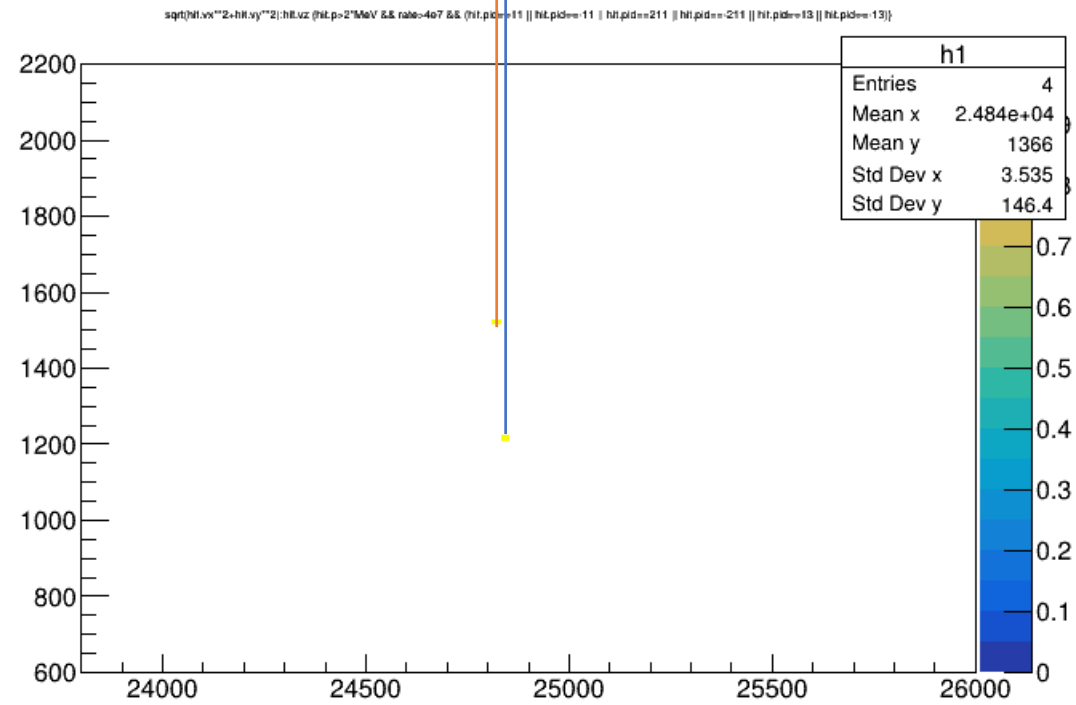
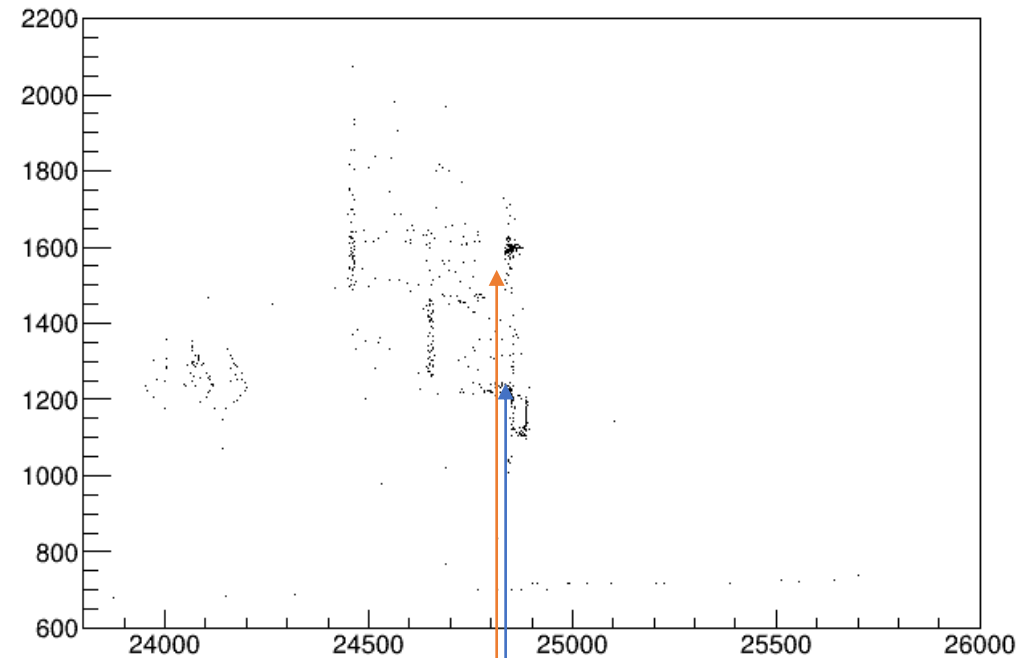
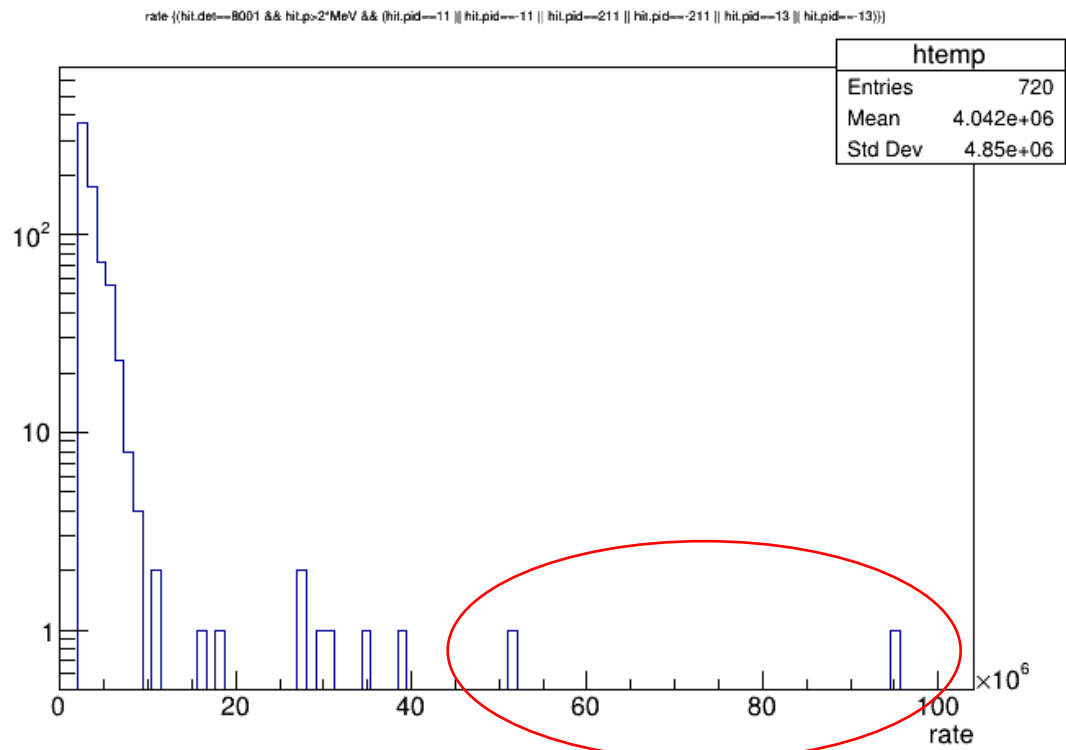
rate (hit.det==8001 && hit.p<2*MeV && (hit.pid==11 || hit.pid==11 || hit.pid==211 || hit.pid==211 || hit.pid==13 || hit.pid==13))



sqrt((hit.vx**2+hit.vy**2):hit.vz (hit.p<2*MeV && rate>47 && (hit.pid==11 || hit.pid==11 || hit.pid==211 || hit.pid==211 || hit.pid==13 || hit.pid==13))



sqrt(hit.vx**2+hit.vy**2);hit.vz (hit.p>2*MeV && (hit.pid==11 || hit.pid==11 || hit.pid==211 || hit.pid==211 || hit.pid==13 || hit.pid==13))



Thank you