

Different designs for the new geometry with shielding in the electron and pion generator

The MOLLER Project
Measurement Of a Lepton Lepton Electroweak Reaction

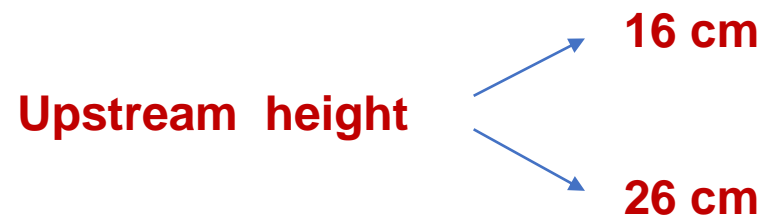
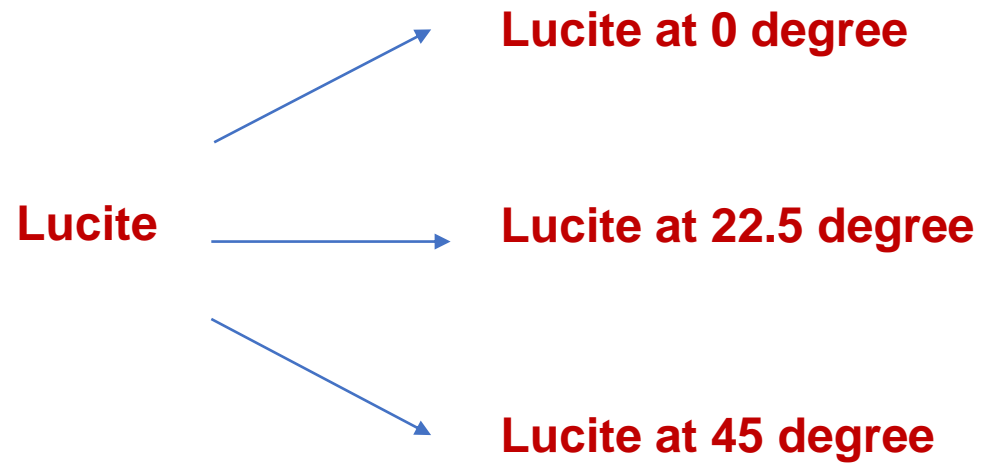
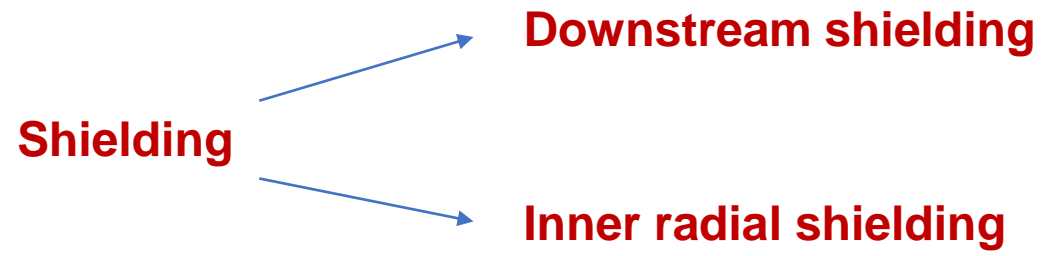
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February, 2021

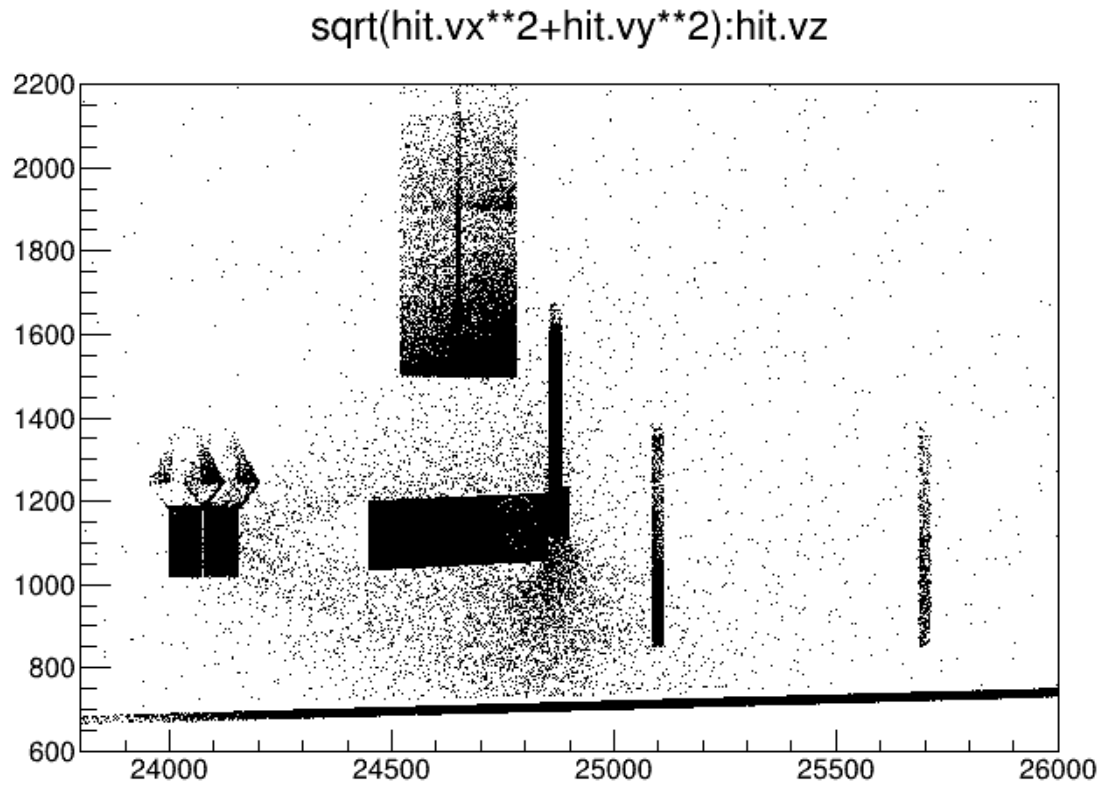


**University
of Manitoba**

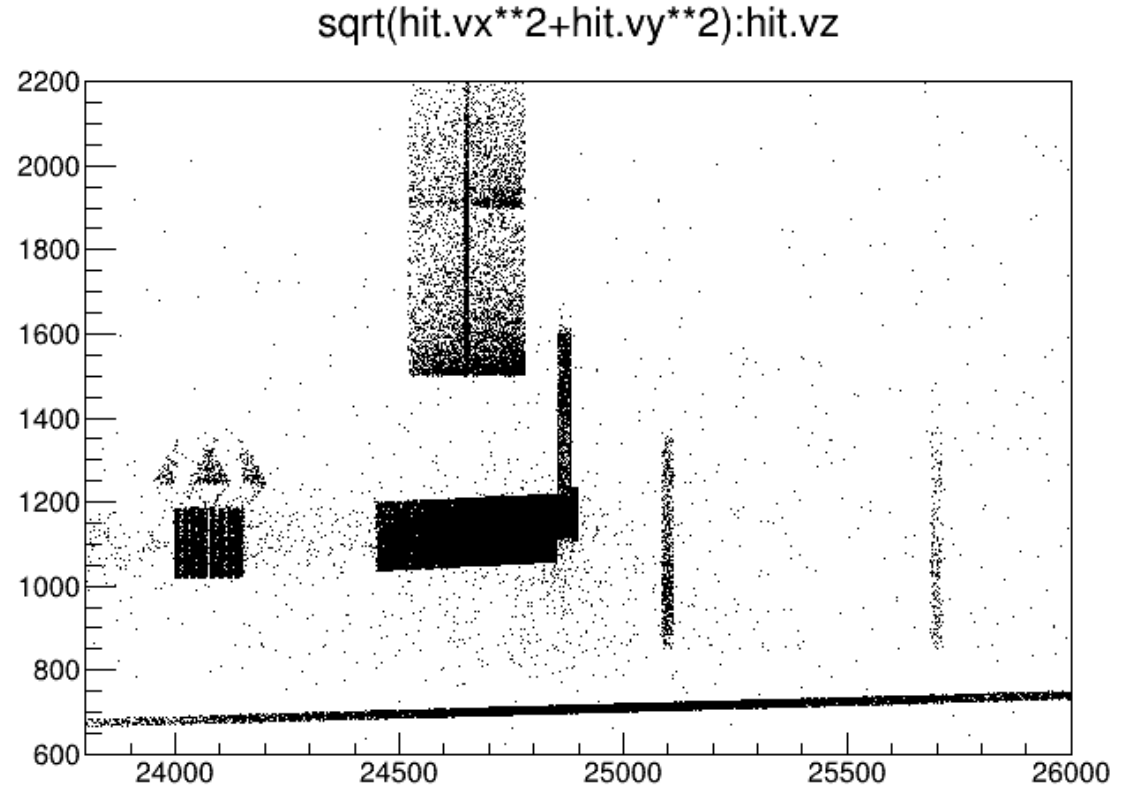


The origin location of all the secondaries anywhere for 5,000,000 events
(Lucite at 0 degree, 16 cm Upstream Lead)

Electron



Pion

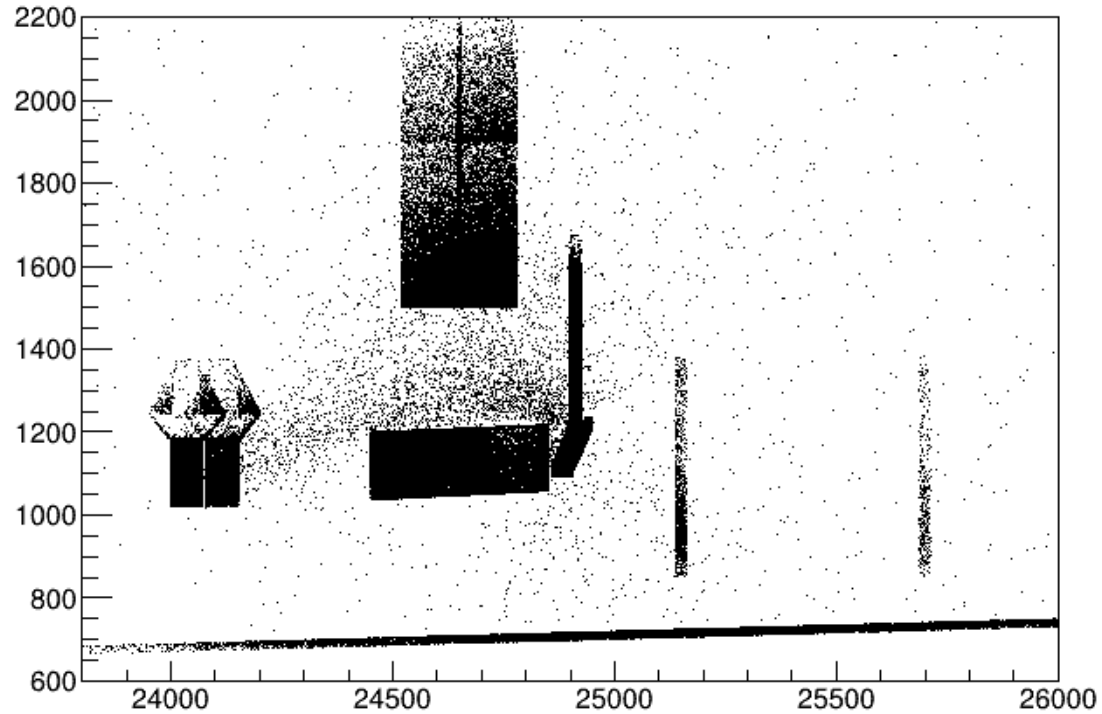


T->Draw("sqrt(hit.vx**2+hit.vy**2):hit.vz>>h1(125,23800,26000,100,600,2200)")

The origin location of all the secondaries anywhere for 5,000,000 events (Lucite at 22.5 degree, 16 cm Upstream Lead)

Electron

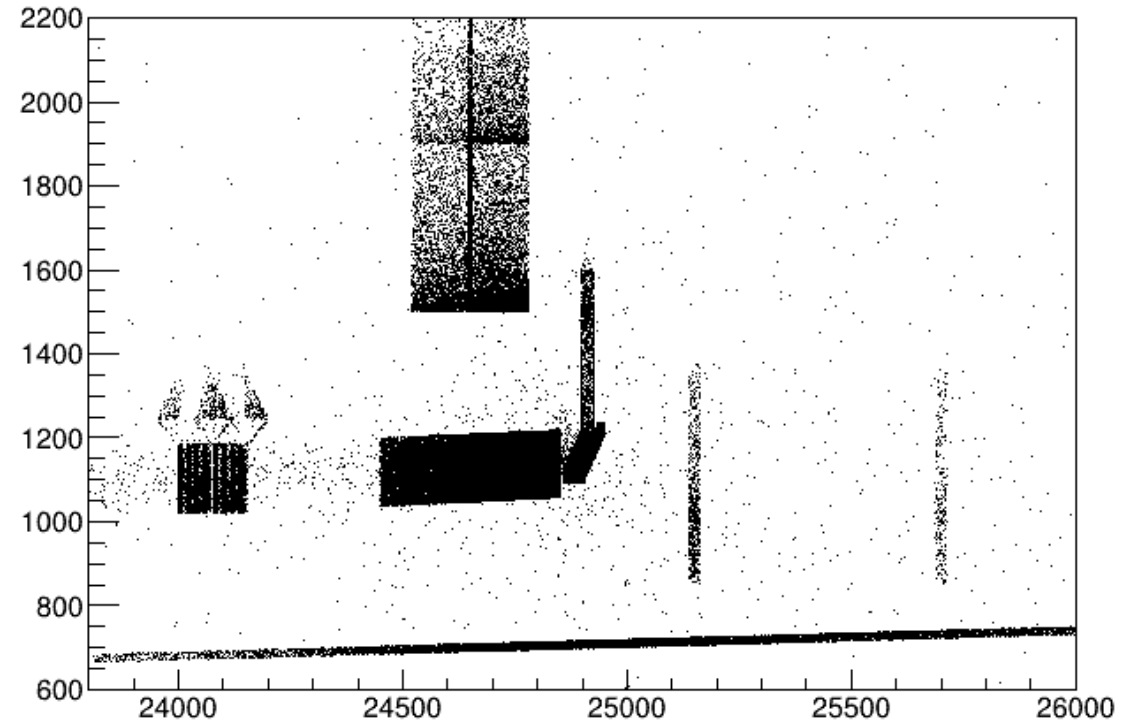
$\sqrt{\text{hit.vx}^2 + \text{hit.vy}^2} : \text{hit.vz}$



hit.trid==1 6
hit.trid==2 4

Pion

$\sqrt{\text{hit.vx}^2 + \text{hit.vy}^2} : \text{hit.vz}$



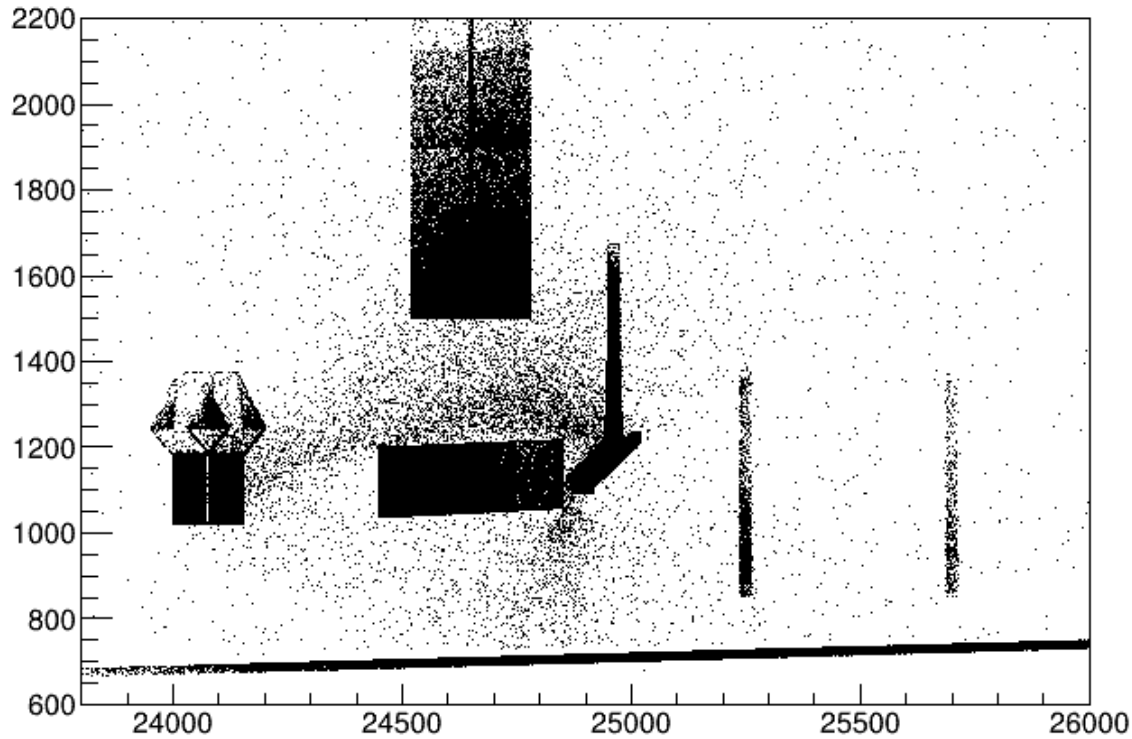
hit.trid==1 6930

T->Draw("sqrt(hit.vx**2+hit.vy**2):hit.vz>>h1(125,23800,26000,100,600,2200)")

The origin location of all the secondaries anywhere for 5,000,000 events
(Lucite at 45 degree, 16 cm Upstream Lead)

Electron

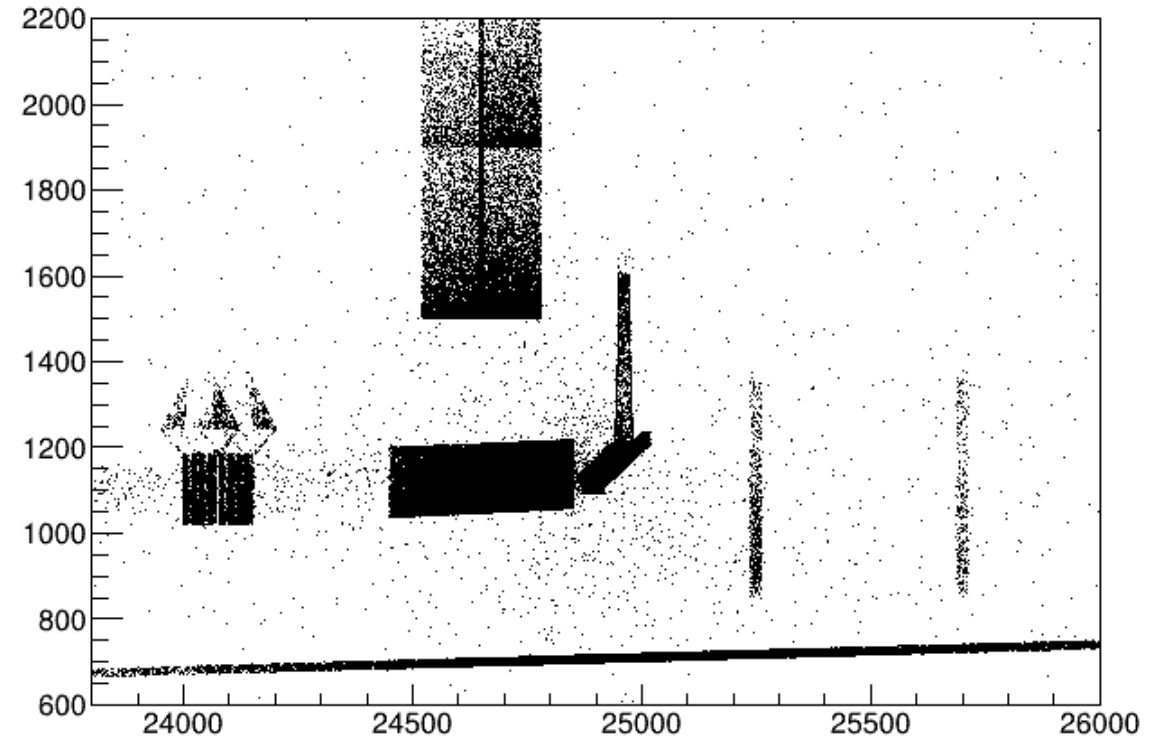
$\sqrt{\text{hit.vx}^2 + \text{hit.vy}^2} : \text{hit.vz}$



hit.trid==1 15
hit.trid==2 13

Pion

$\sqrt{\text{hit.vx}^2 + \text{hit.vy}^2} : \text{hit.vz}$



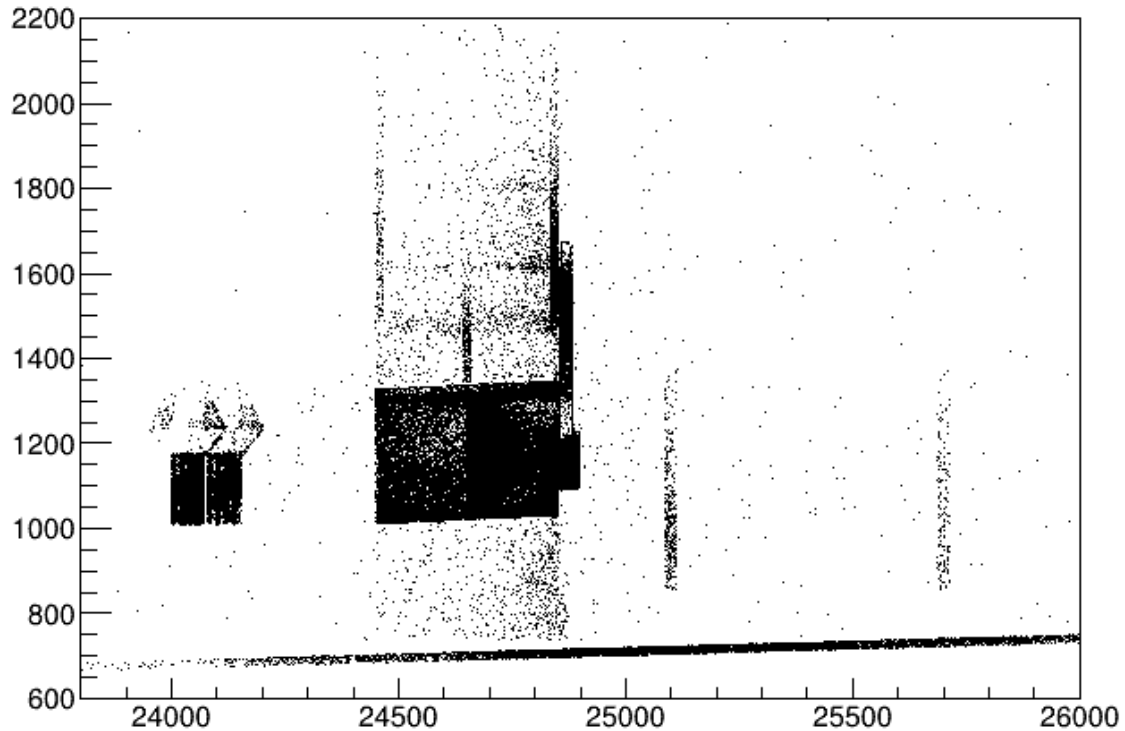
hit.trid==1 6753

T->Draw("sqrt(hit.vx**2+hit.vy**2):hit.vz>>h1(125,23800,26000,100,600,2200)")

The origin location of all the secondaries anywhere for 5,000,000 events
(Lucite at 0 degree, 26 cm Upstream Lead)

Electron

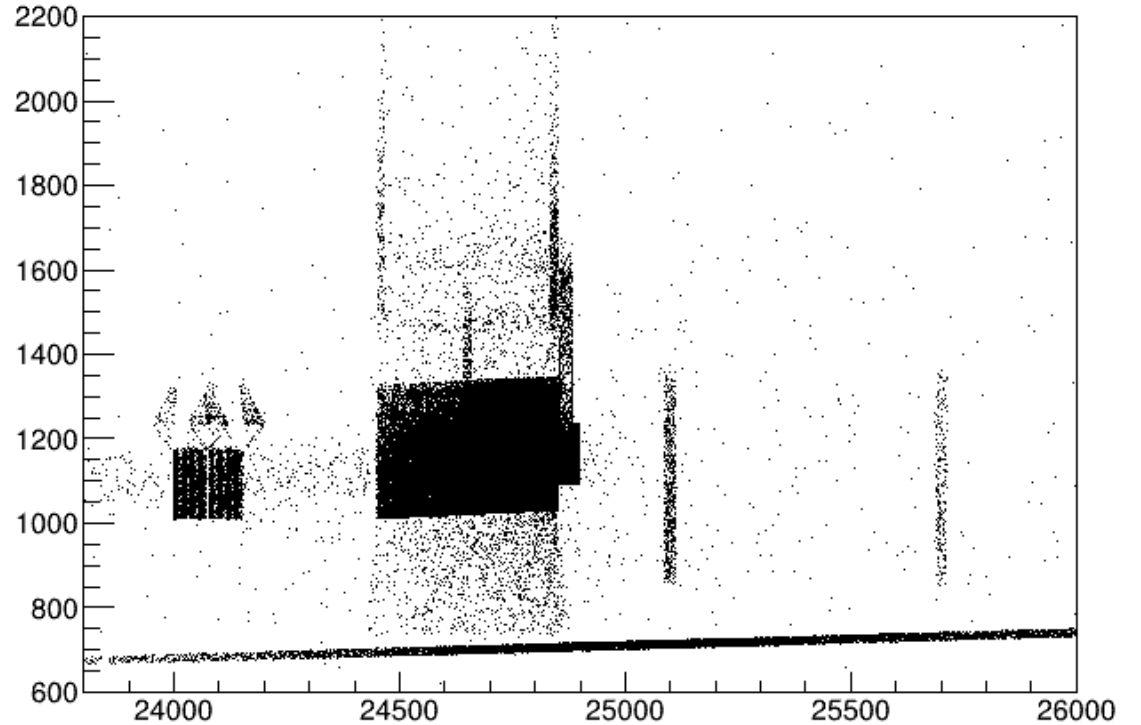
$\sqrt{\text{hit.vx}^2 + \text{hit.vy}^2} : \text{hit.vz}$



hit.trid==1 48
hit.trid==2 0

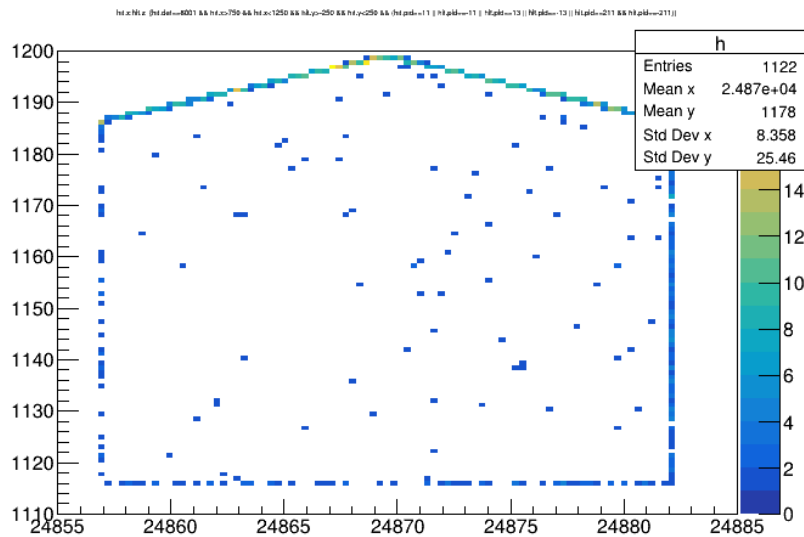
Pion

$\sqrt{\text{hit.vx}^2 + \text{hit.vy}^2} : \text{hit.vz}$

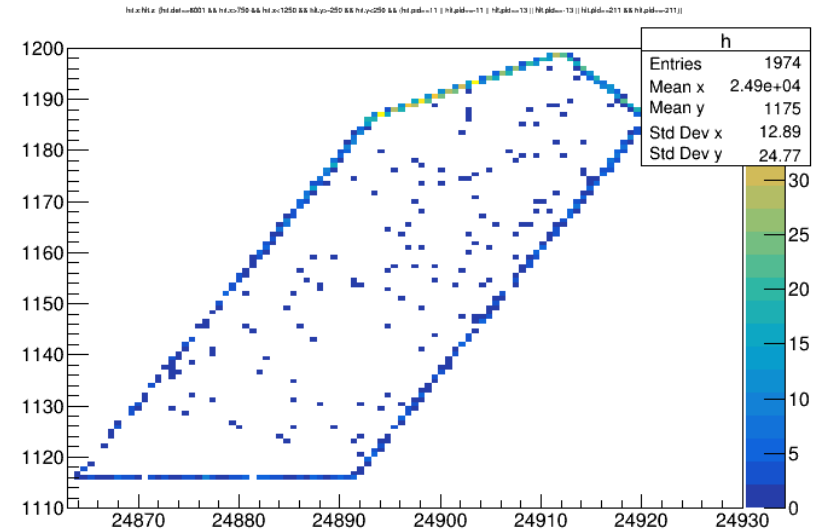


hit.trid==1 150426

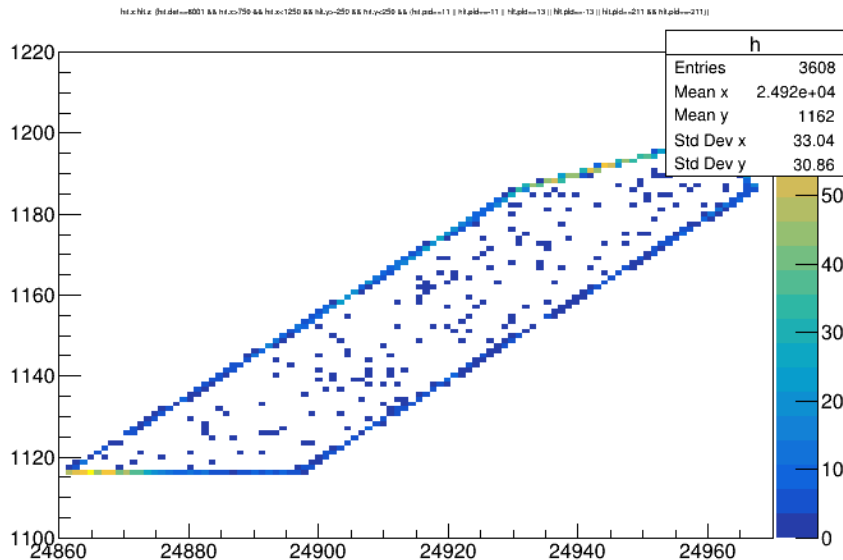
T->Draw("sqrt(hit.vx**2+hit.vy**2):hit.vz>>h1(100,23800,26000,100,600,2200)")



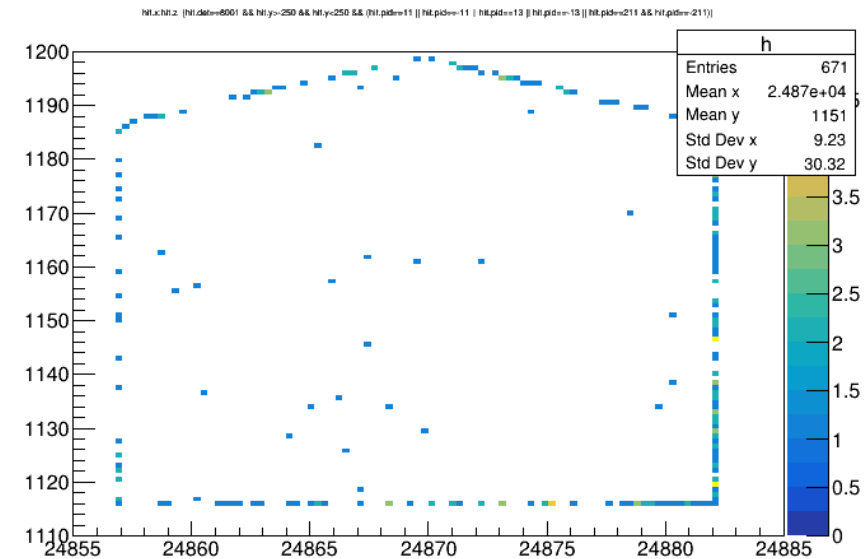
Lucite at 0 degree, 16 cm Upstream Lead



Lucite at 22.5 degree, 16 cm Upstream Lead



Lucite at 22.5 degree, 16 cm Upstream Lead



Lucite at 0 degree, 26 cm Upstream Lead

Comparison of rates at the Lucite for 5,000,000 events

Rates <i>GH z/μ A</i> <i>/Detector</i>	Rate of electrons	Rate of pions	Pi/e	Rate of photons from electrons	Rate of photons from pions	Pi/e
With Lucite at 0deg, 16cm Lead	$(8.21 \pm 0.09) \times 10^{-4}$	$(5.10 \pm 0.08) \times 10^{-6}$	0.62%	$(1.235 \pm 0.003) \times 10^{-2}$	$(5.743 \pm 0.008) \times 10^{-4}$	4.65%
With Lucite at 22.5deg, 16cm Lead	$(1.23 \pm 0.01) \times 10^{-3}$	$(4.78 \pm 0.07) \times 10^{-6}$	0.38%	$(1.633 \pm 0.003) \times 10^{-2}$	$(7.06 \pm 0.01) \times 10^{-4}$	4.32%
With Lucite at 45deg, 16cm Lead	$(2.08 \pm 0.01) \times 10^{-3}$	$(5.40 \pm 0.08) \times 10^{-6}$	0.26%	$(2.161 \pm 0.004) \times 10^{-2}$	$(7.50 \pm 0.01) \times 10^{-4}$	3.47%
With Lucite at 0deg, 26cm Lead	$(2.34 \pm 0.05) \times 10^{-4}$	$(6.13 \pm 0.08) \times 10^{-6}$	2.62%	$(6.18 \pm 0.02) \times 10^{-3}$	$(5.059 \pm 0.008) \times 10^{-4}$	8.18%

T->Draw("1", "(rate/5.95e13)*(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))")

T->Draw("1", "(rate/5.95e13)*(hit.det==8000)")

Note: 5.95e13 comes from $85 \times 14 \times 10^9 \times 50$ to be in the unit of *GH z/μ A/Detector/simulation*

Comparison of rates at the Lucite for 5,000,000 events

Rates $GH\ z/\mu A$ /Detector	Rate of electrons	Rate of pions	Pi/e	Rate of photons from electrons	Rate of photons from pions	Pi/e
With Lucite at 0deg, 16cm Lead	$(1.66 \pm 0.04) \times 10^{-4}$	$(2.79 \pm 0.02) \times 10^{-5}$	16.8%	$(1.235 \pm 0.003) \times 10^{-2}$	$(5.743 \pm 0.008) \times 10^{-4}$	4.65%
With Lucite at 22.5deg, 16cm Lead	$(2.97 \pm 0.05) \times 10^{-4}$	$(2.66 \pm 0.02) \times 10^{-5}$	8.96%	$(1.633 \pm 0.003) \times 10^{-2}$	$(7.06 \pm 0.01) \times 10^{-4}$	4.32%
With Lucite at 45deg, 16cm Lead	$(5.88 \pm 0.66) \times 10^{-4}$	$(2.63 \pm 0.02) \times 10^{-5}$	4.47%	$(2.161 \pm 0.004) \times 10^{-2}$	$(7.503 \pm 0.01) \times 10^{-4}$	3.47%
With Lucite at 0deg, 26cm Lead	$(6.22 \pm 0.28) \times 10^{-5}$	$(1.626 \pm 0.005) \times 10^{-4}$	261%	$(6.18 \pm 0.02) \times 10^{-3}$	$(5.059 \pm 0.008) \times 10^{-4}$	8.1%

T->Draw("1", "(rate/5.95e13)*(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))")

T->Draw("1", "(rate/5.95e13)*(hit.det==8000)")

Note: 5.95e13 comes from $85 \cdot 14 \cdot 10^9 \cdot 50$ to be in the unit of $GH\ z/\mu A/Detector/simulation$

Thank you