



MARSHALL B. C. SCOTT

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RXN : KL4

- KL4
 - $K^0_L + p \rightarrow \pi^+ + \Lambda$
 - π^+ lifetime $\sim 2.6e-8$ s
 - Λ lifetime $\sim 2.6e-10$ s
 - $\rightarrow p + \pi^-$ (63.9%)
 - $\rightarrow n + \pi^0$ (35.8%)
- Concentrating mainly on the charged decay at the moment

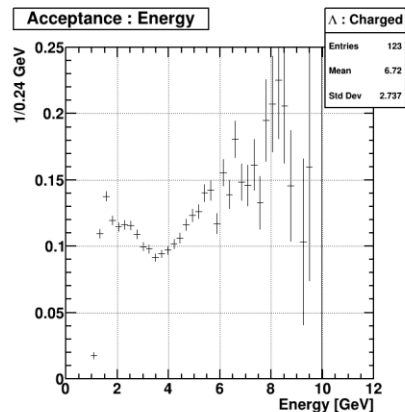
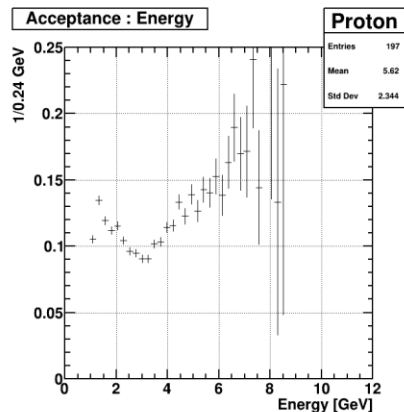
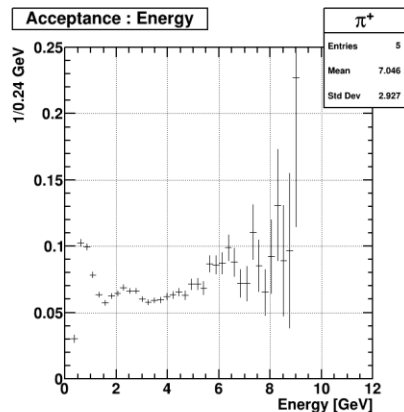
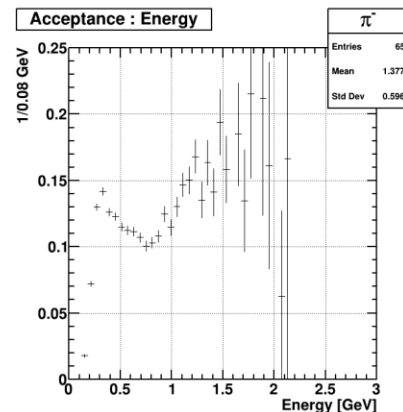
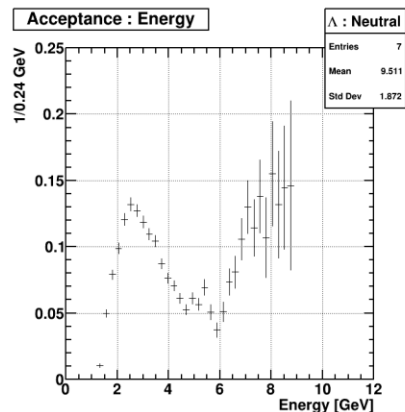
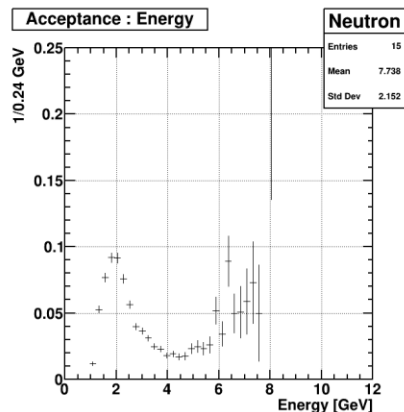
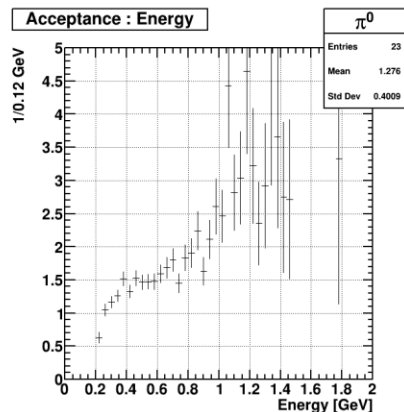


GENERATING STEPS

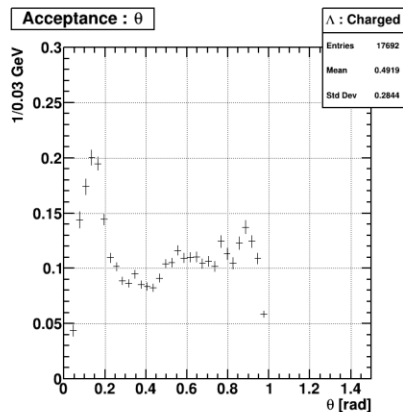
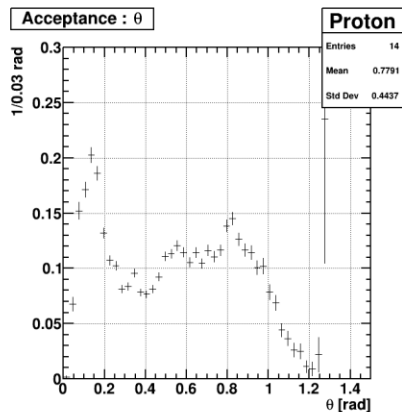
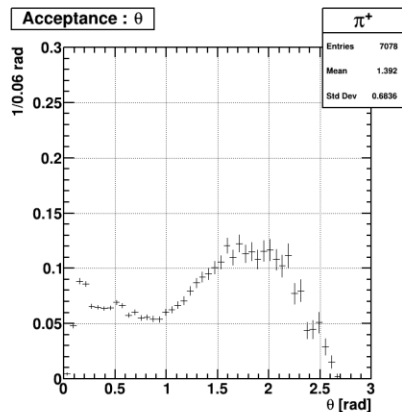
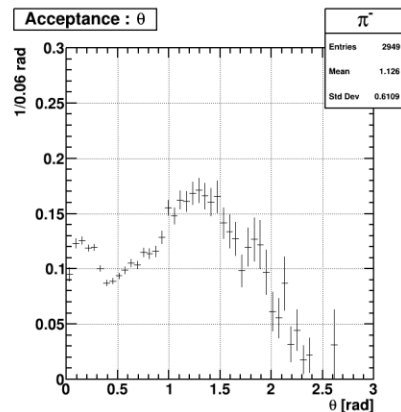
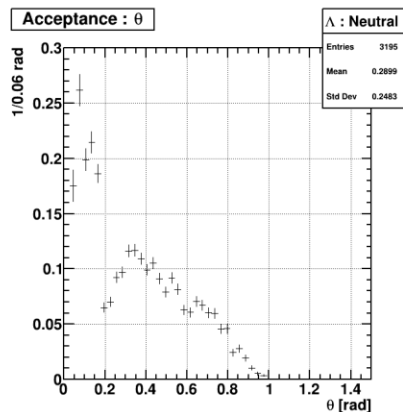
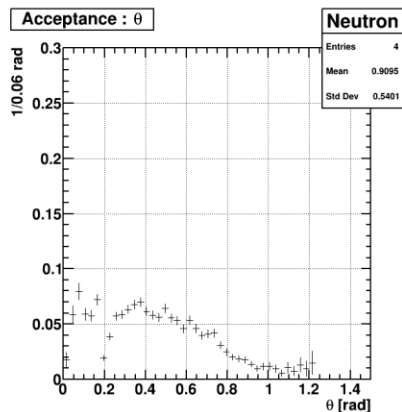
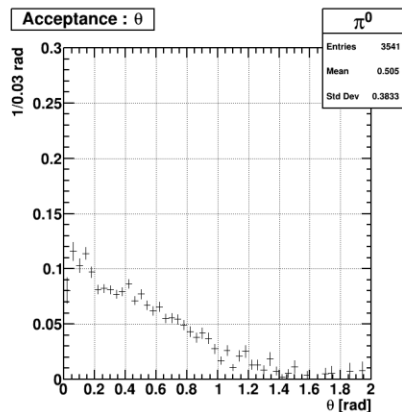
- Generated histograms/root files (Monitoring Histograms, ReactionFilter, fcal_tree, mcthrown_tree)
 - `hd_root --nthreads=8 -PPLUGINS=PEVENTRFBUNCH:USE_TAG=KLong -PVERTEX:USEWEIGHTEDAVERAGE=1 -PPLUGINS=monitoring_hists foo_smeared.hddm`
 - `hd_root --nthreads=8 -PPLUGINS=PEVENTRFBUNCH:USE_TAG=KLong -PVERTEX:USEWEIGHTEDAVERAGE=1 -PPLUGINS=ReactionFilter -PReaction1=10_14__8_18 foo_smeared.hddm`
 - Note the default ReactionFilter only produces the charged decay
 - Added `-PReaction1:Decay=18__7_13` for neutral decay
 - `hd_root --nthreads=8 -PPLUGINS=PEVENTRFBUNCH:USE_TAG=KLong -PVERTEX:USEWEIGHTEDAVERAGE=1 -PPLUGINS=fcal_tree foo_smeared.hddm`
 - `hd_root --nthreads=8 -PPLUGINS=PEVENTRFBUNCH:USE_TAG=KLong -PVERTEX:USEWEIGHTEDAVERAGE=1 -PPLUGINS=mcthrown_tree foo_smeared.hddm`



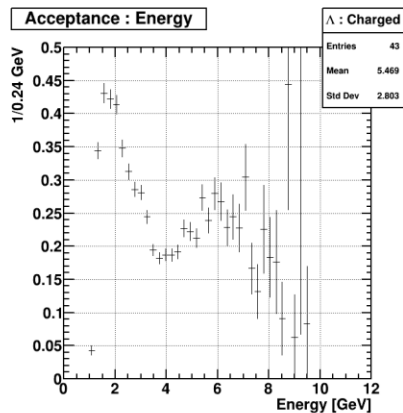
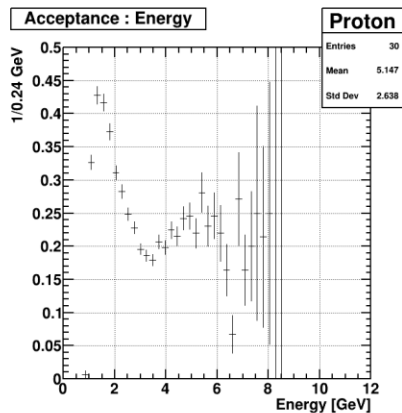
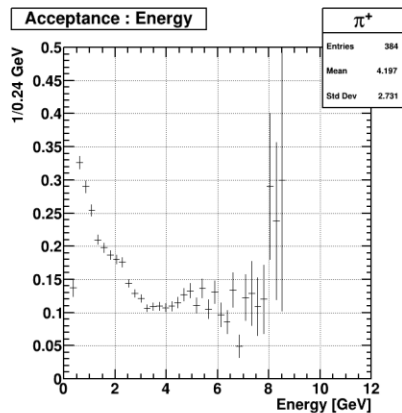
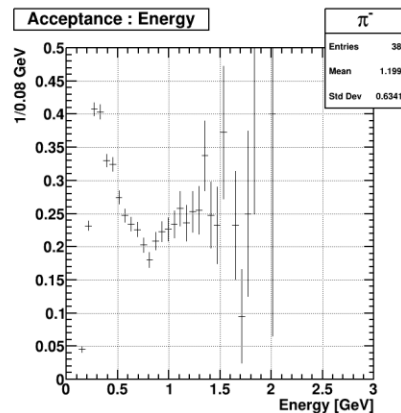
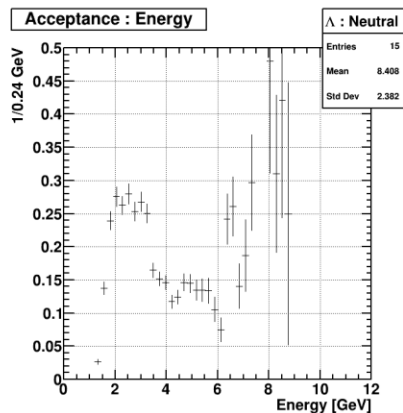
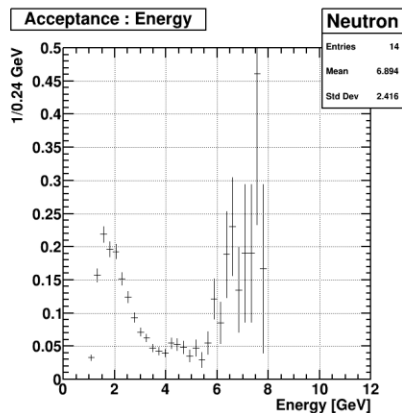
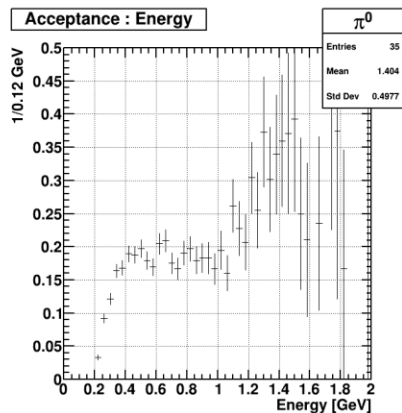
THROWN VS RECONSTRUCTED : ACCEPTANCE (ENERGY) OLD



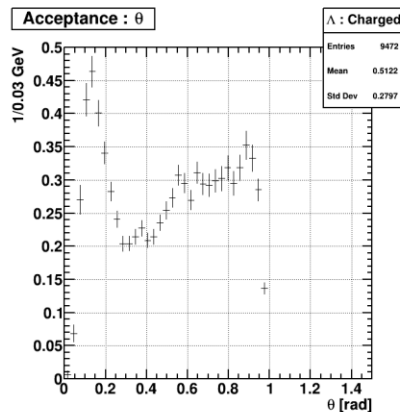
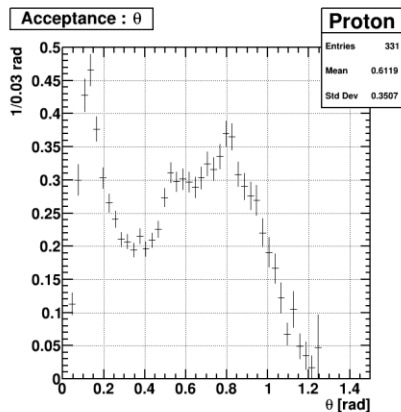
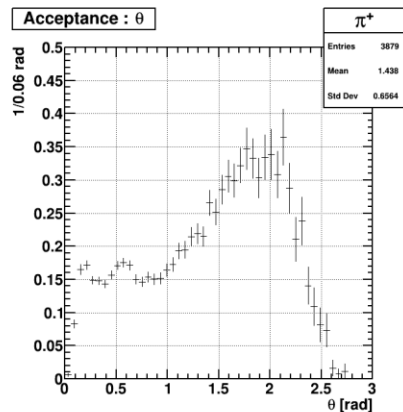
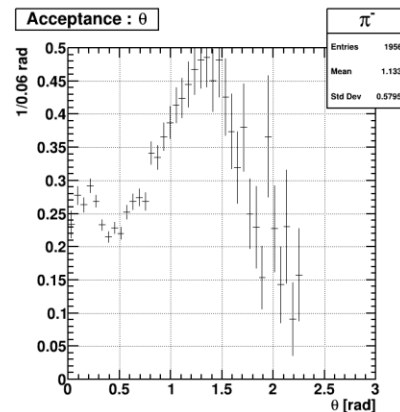
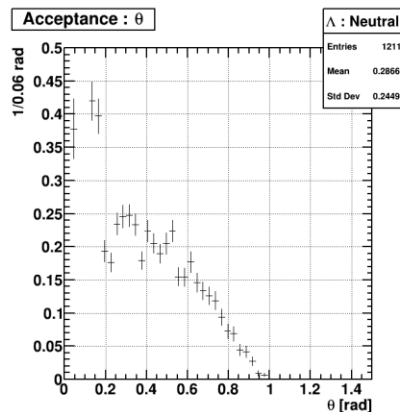
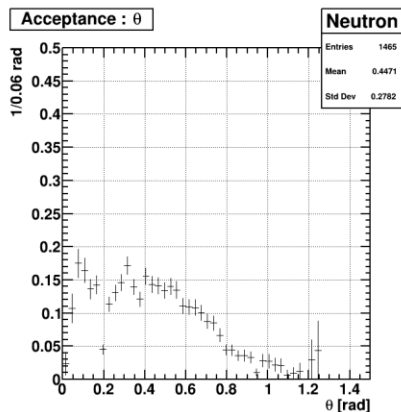
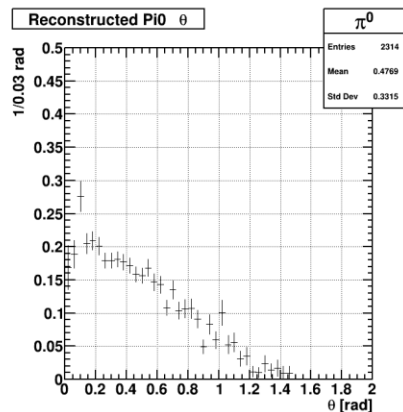
THROWN VS RECONSTRUCTED : ACCEPTANCE (THETA) OLD



THROWN VS RECONSTRUCTED : ACCEPTANCE (ENERGY) NEW



THROWN VS RECONSTRUCTED : ACCEPTANCE (THETA) NEW



ACCEPTANCE COMPARISON OLD VS NEW

New ~ 2.5X Old acceptance

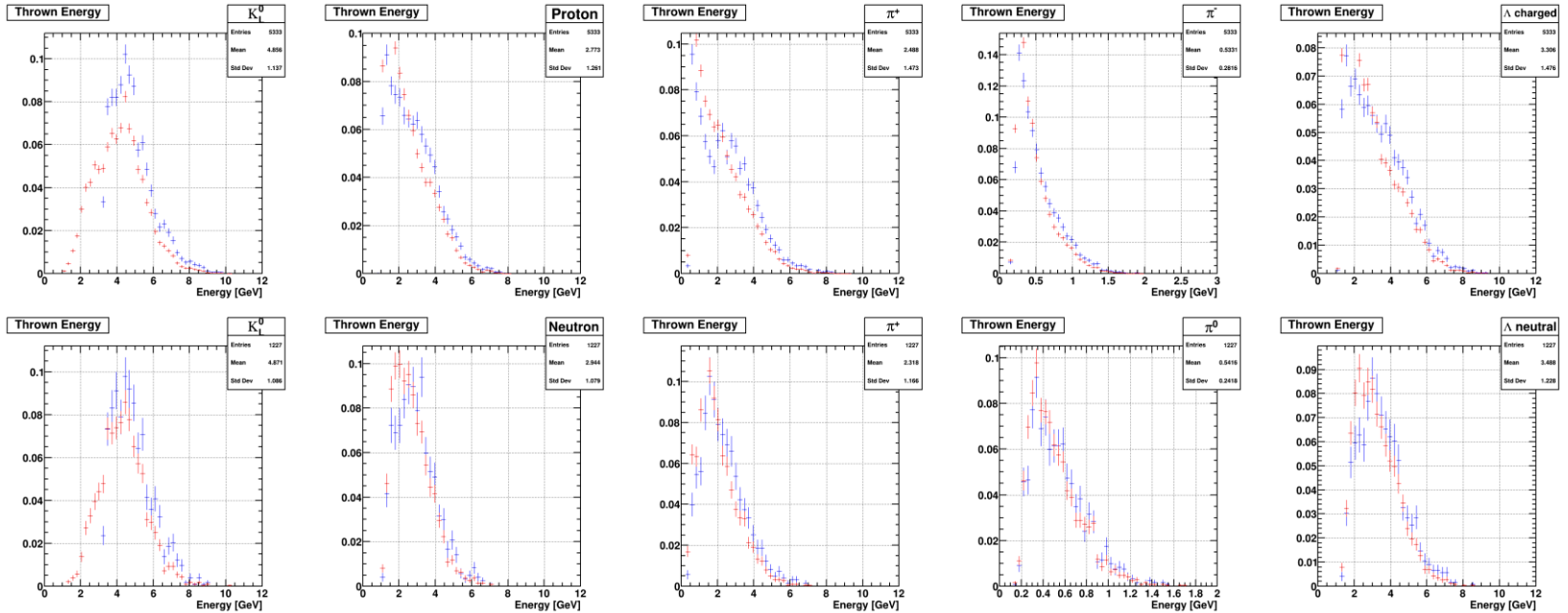
Particle	Old Acceptance	Particle	New Acceptance
Proton	0.1097	Proton	0.2731
Pi-	0.1116	Pi-	0.2778
Pi+	0.0690	Pi+	0.1713
Λ char. decay	0.1111	Λ char. decay	0.2768
Neutron	0.0471	Neutron	0.1077
Pi0	0.0667	Pi0	0.1457
Λ neut. decay	0.0862	Λ neut. decay	0.1895



OLD VS NEW : THROWN AND RECONSTRUCTED ENERGY

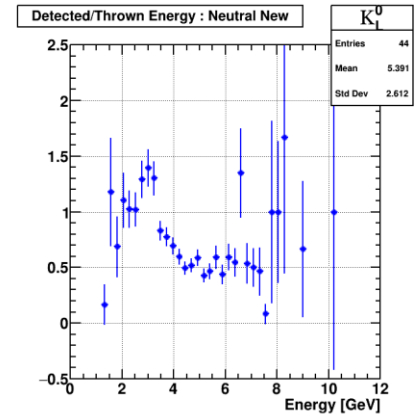
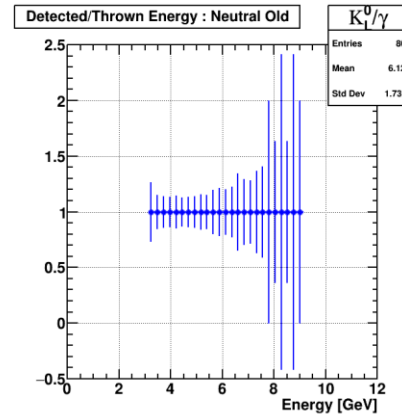
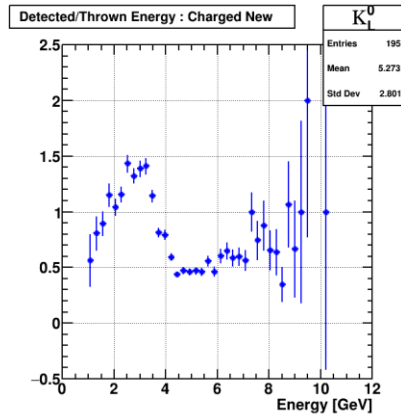
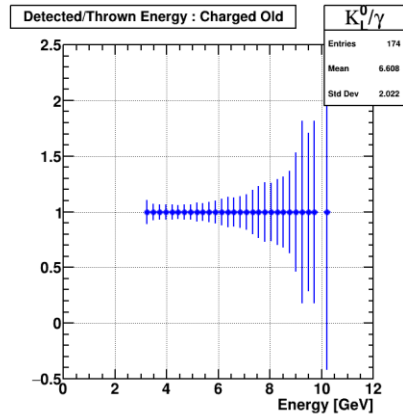
Top(Bottom) row is Thrown(Reconstructed); Old is in blue and New is in red

- The plots below show the normalized thrown and reconstructed energy distributions.
- The majority of the difference stems from the increase in low energy KLongs



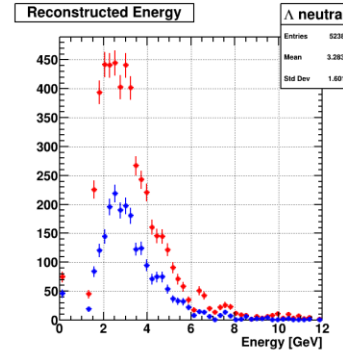
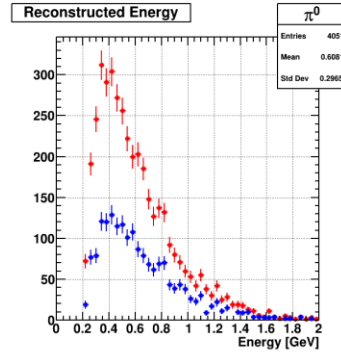
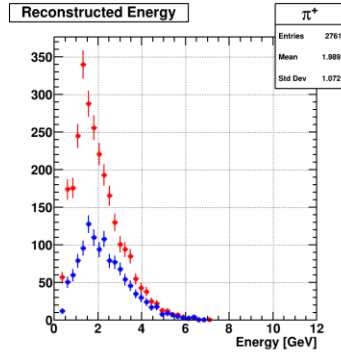
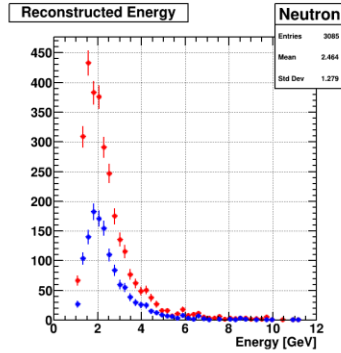
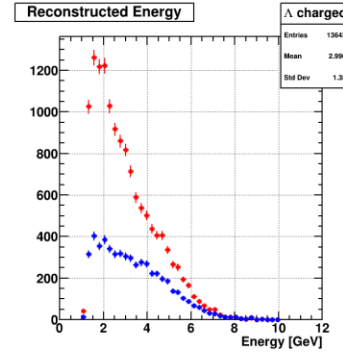
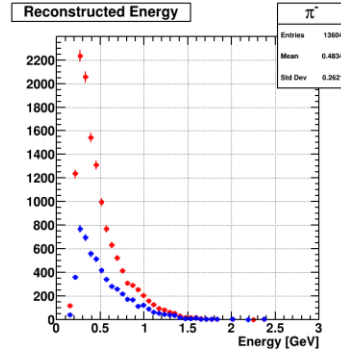
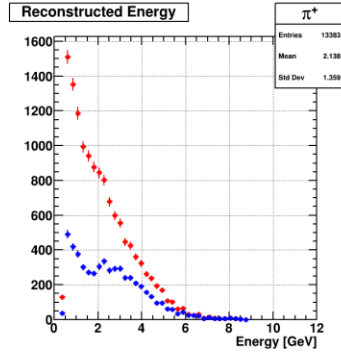
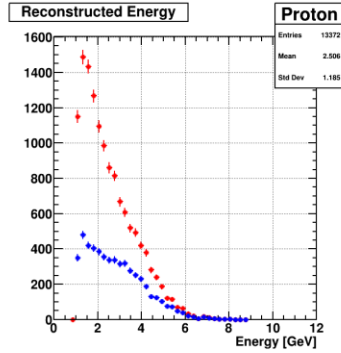
OLD VS NEW : THROWN AND RECONSTRUCTED ENERGY

- As mentioned in the previous slide, there is a significant difference in the beam energy distributions between the distributions.
- Below are ratio plots of the detected/thrown old and new beam energy distributions.



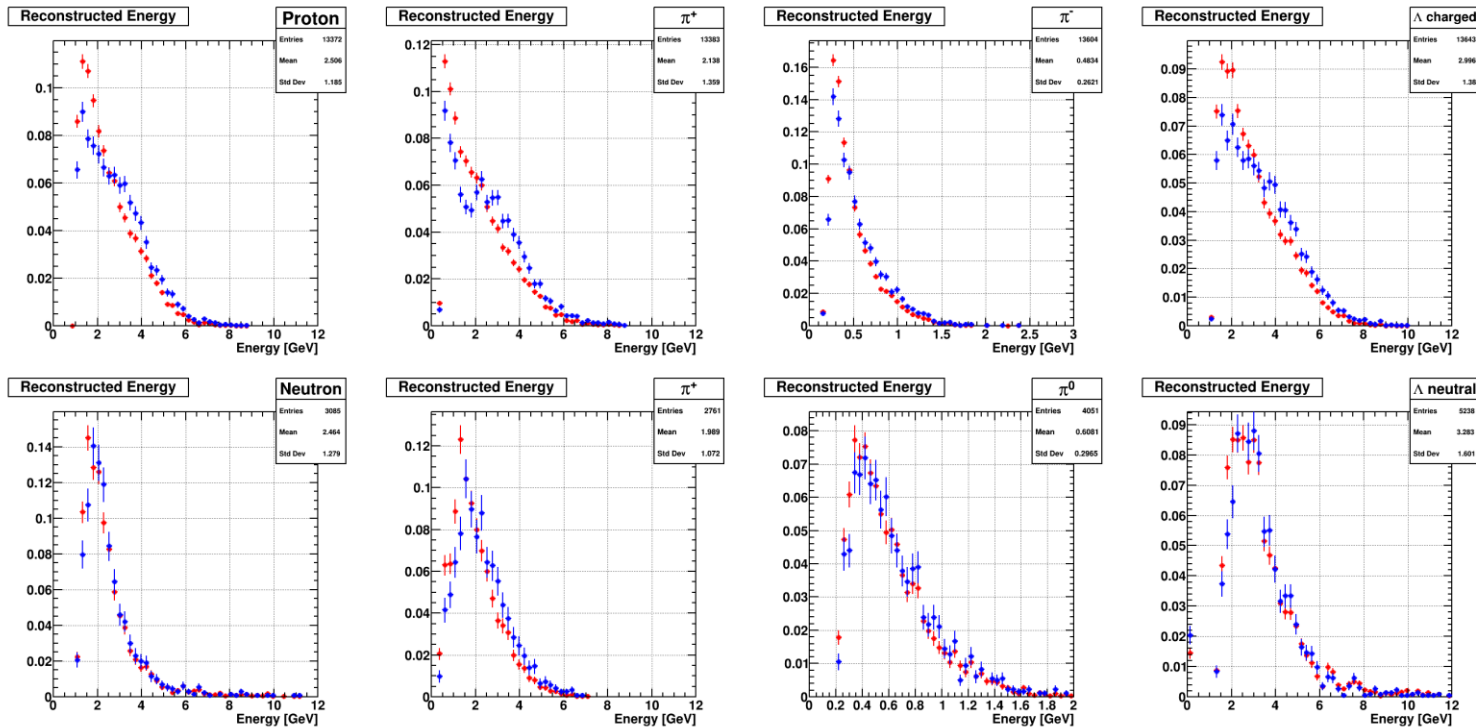
OLD VS NEW : RECONSTRUCTED ENERGY

Old is in **blue** and New is in **red**



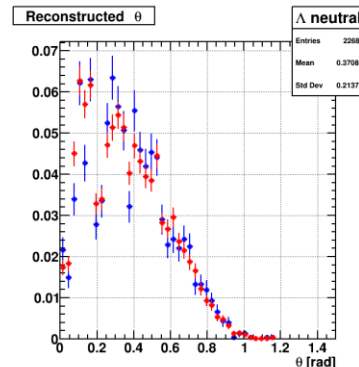
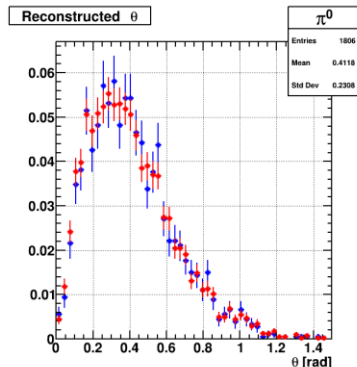
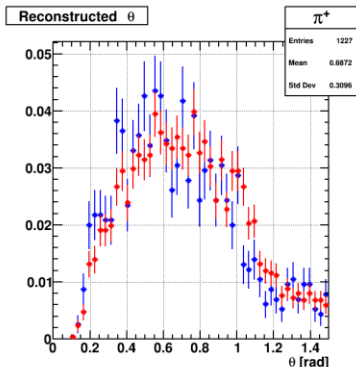
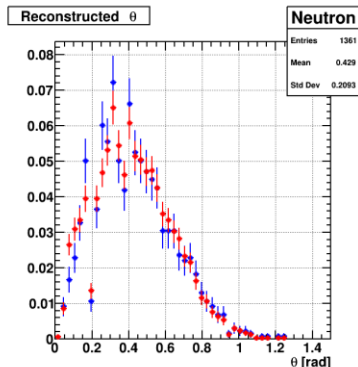
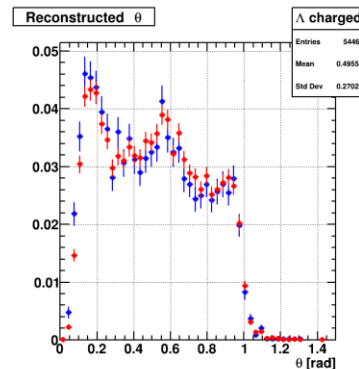
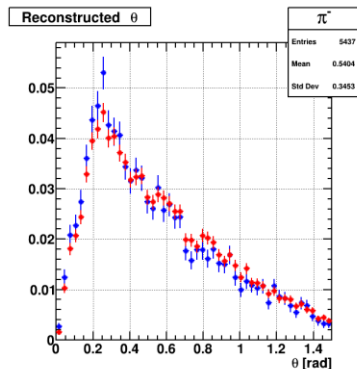
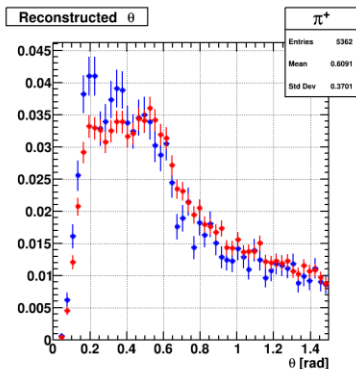
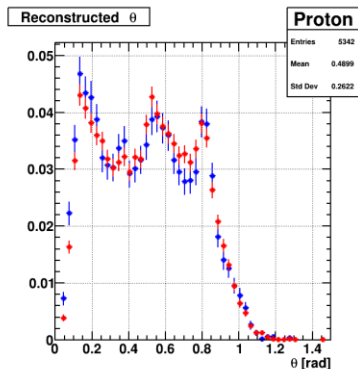
OLD VS NEW : NORMALIZED RECONSTRUCTED ENERGY

Old is in blue and New is in red



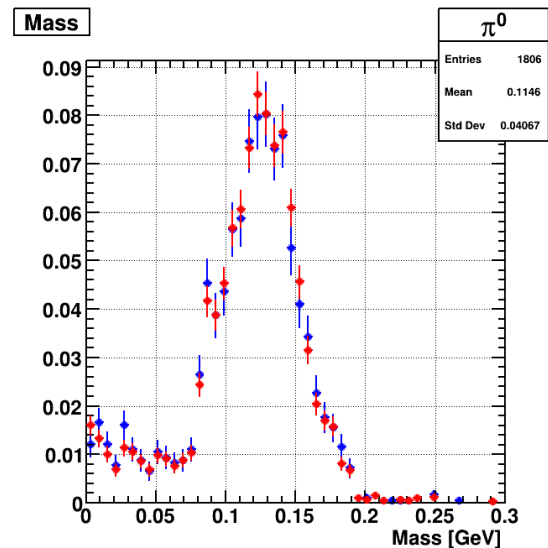
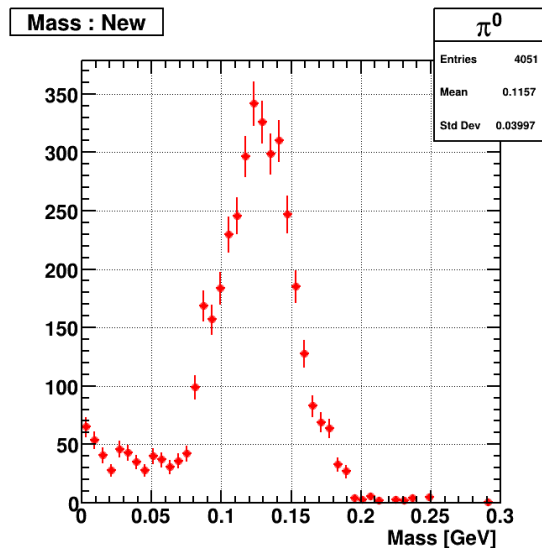
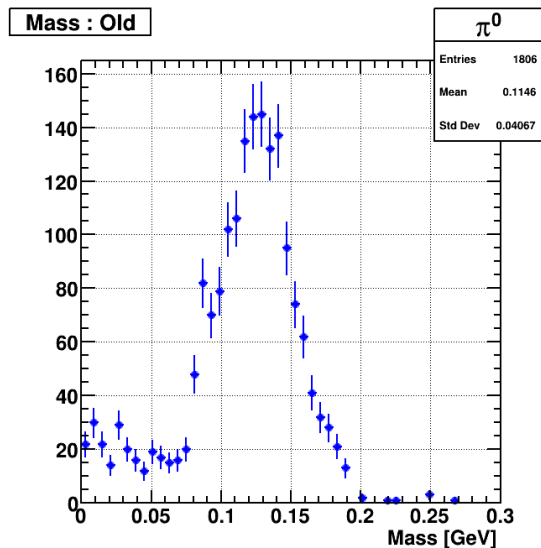
OLD VS NEW : NORMALIZED RECONSTRUCTED THETA

Old is in blue and New is in red



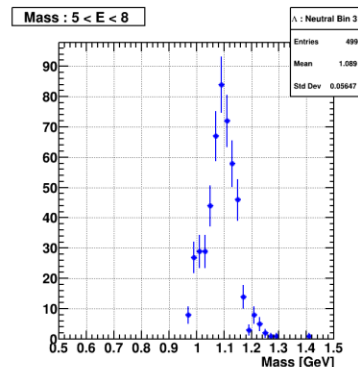
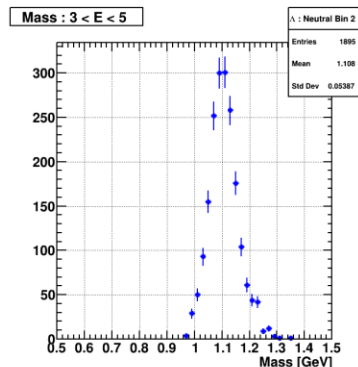
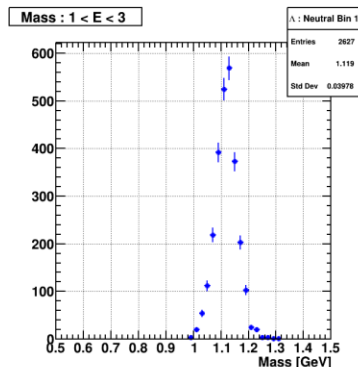
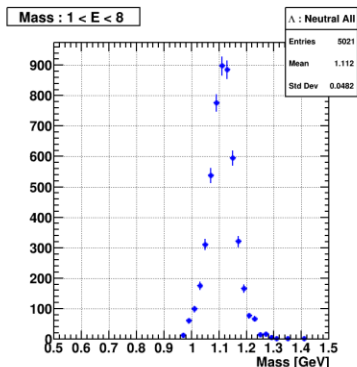
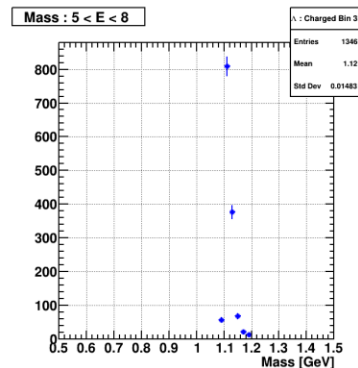
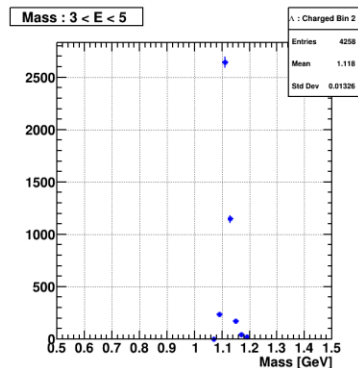
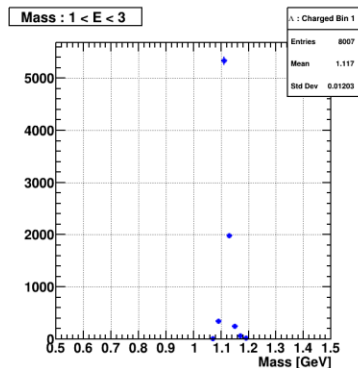
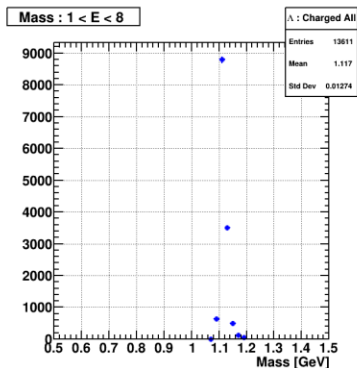
OLD VS NEW : NEUTRAL PION MASS

Old is in **blue** and New is in **red**



Λ MASS DISTRIBUTIONS AS A FUNCTION OF ENERGY

Top(Bottom) row is charged(neutral) decay

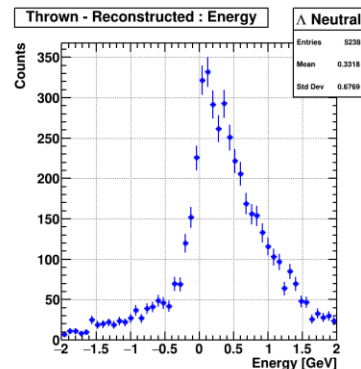
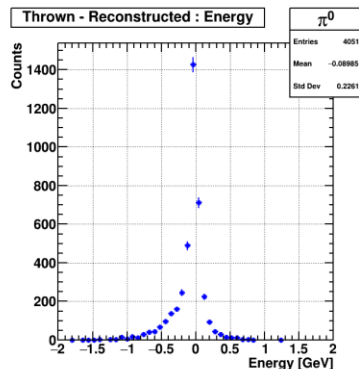
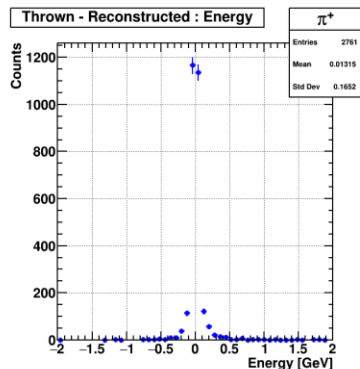
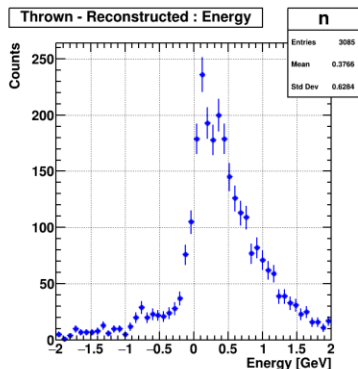
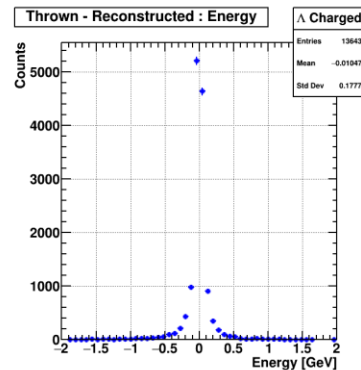
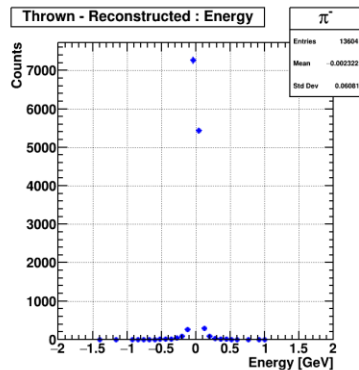
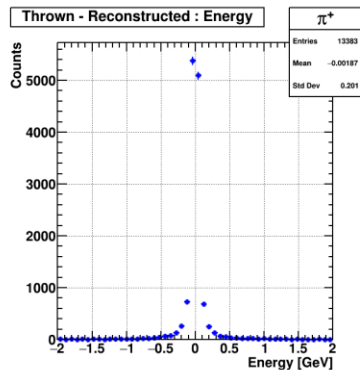
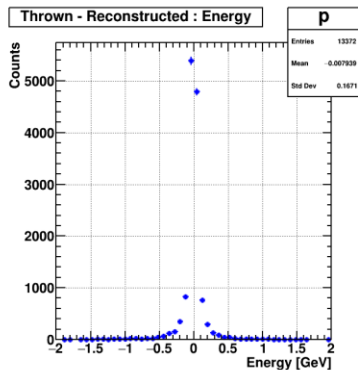


THROWN-RECONSTRUCTED DISTRIBUTIONS

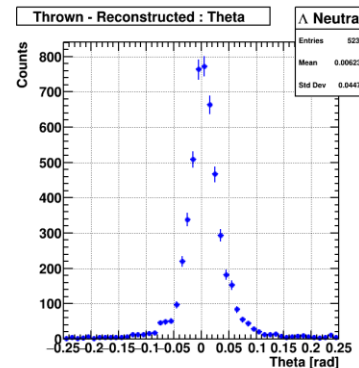
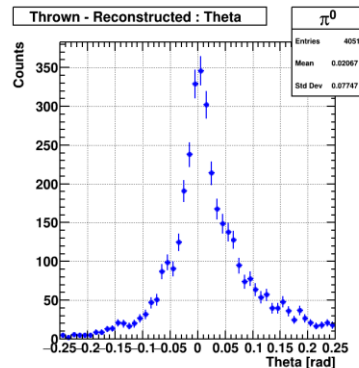
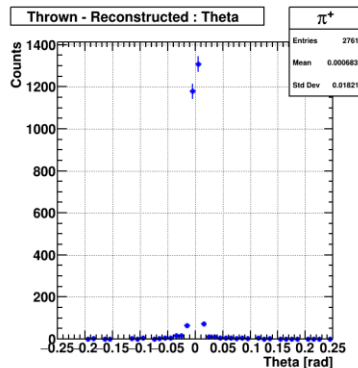
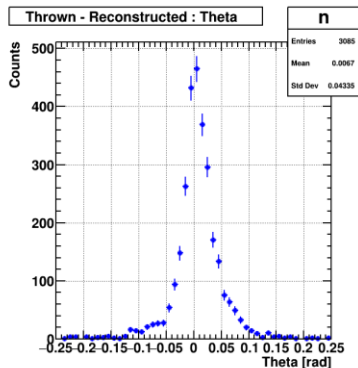
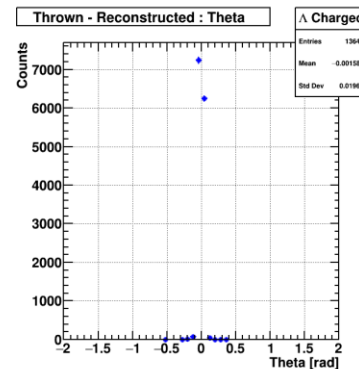
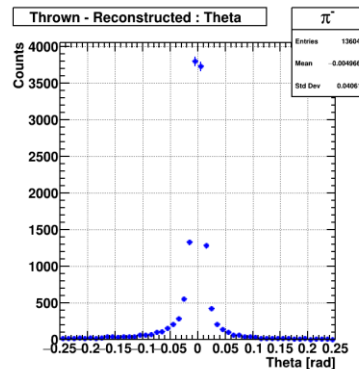
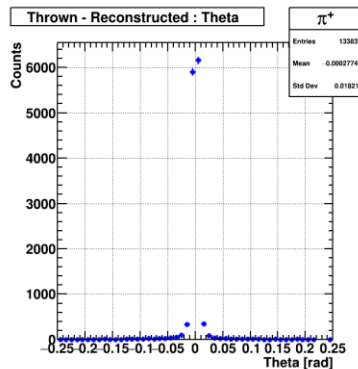
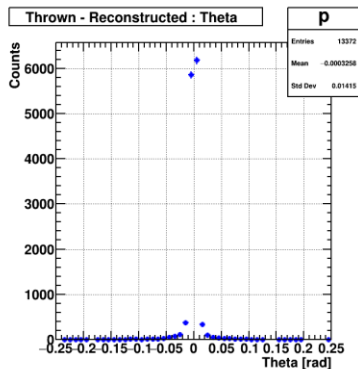
- The following 2 slides show the energy and theta distributions of thrown – reconstructed distributions.
- In general, the differences are small, however the neutral particles, neutron and pi0s, see the greatest differences.



THROWN-RECONSTRUCTED ENERGY DISTRIBUTIONS



THROWN-RECONSTRUCTED THETA DISTRIBUTIONS



Back up slides



MONITORING HISTOGRAMS

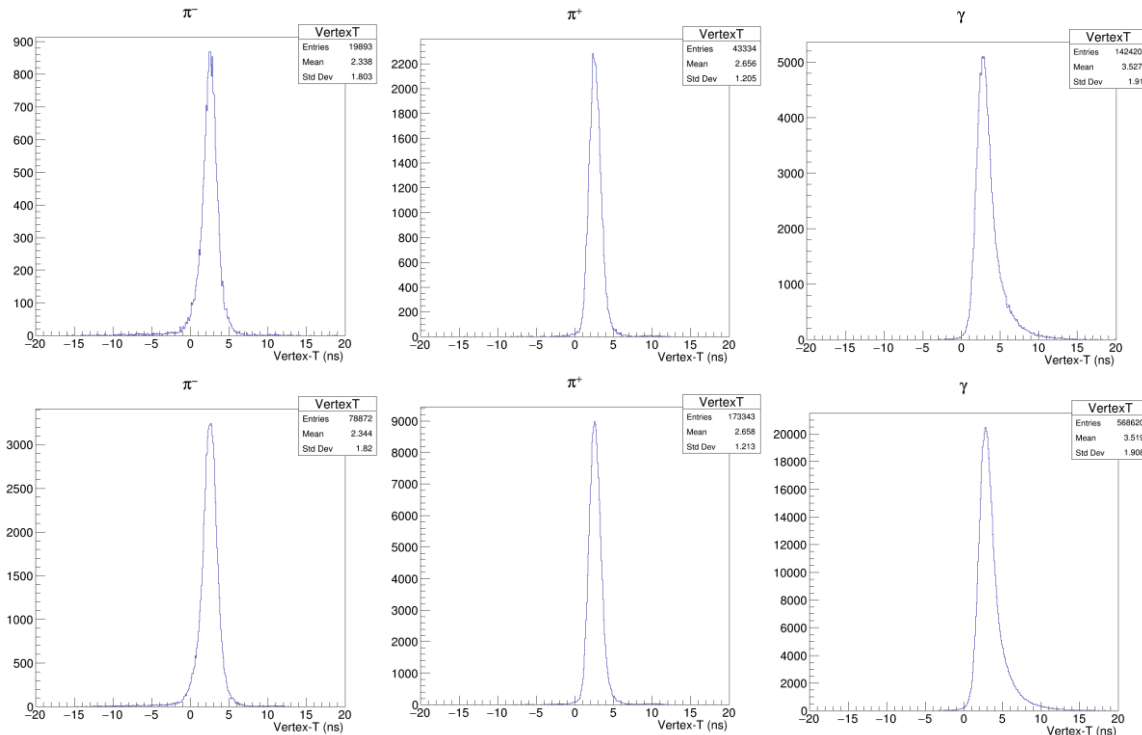
- There was no difference seen in the monitoring histograms.
- The next several slides bear this out.
- Note that in a meeting with Sean, on 6/24/2024, he stated that the monitoring histograms have not been updated.



DETECTED KINEMATICS : VERTEX-T

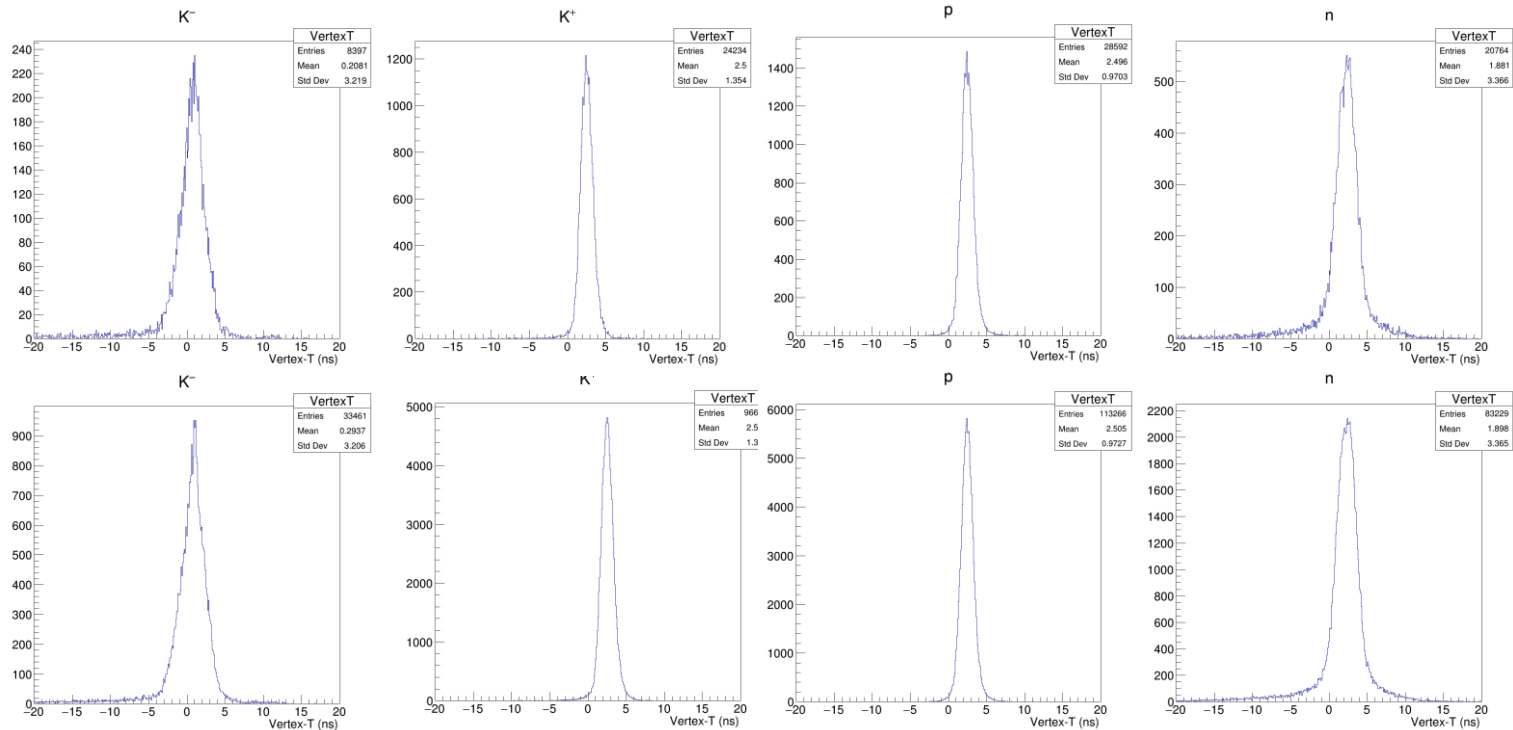
Top(Bottom) row is old(new)

- There was no difference seen in the monitoring histograms



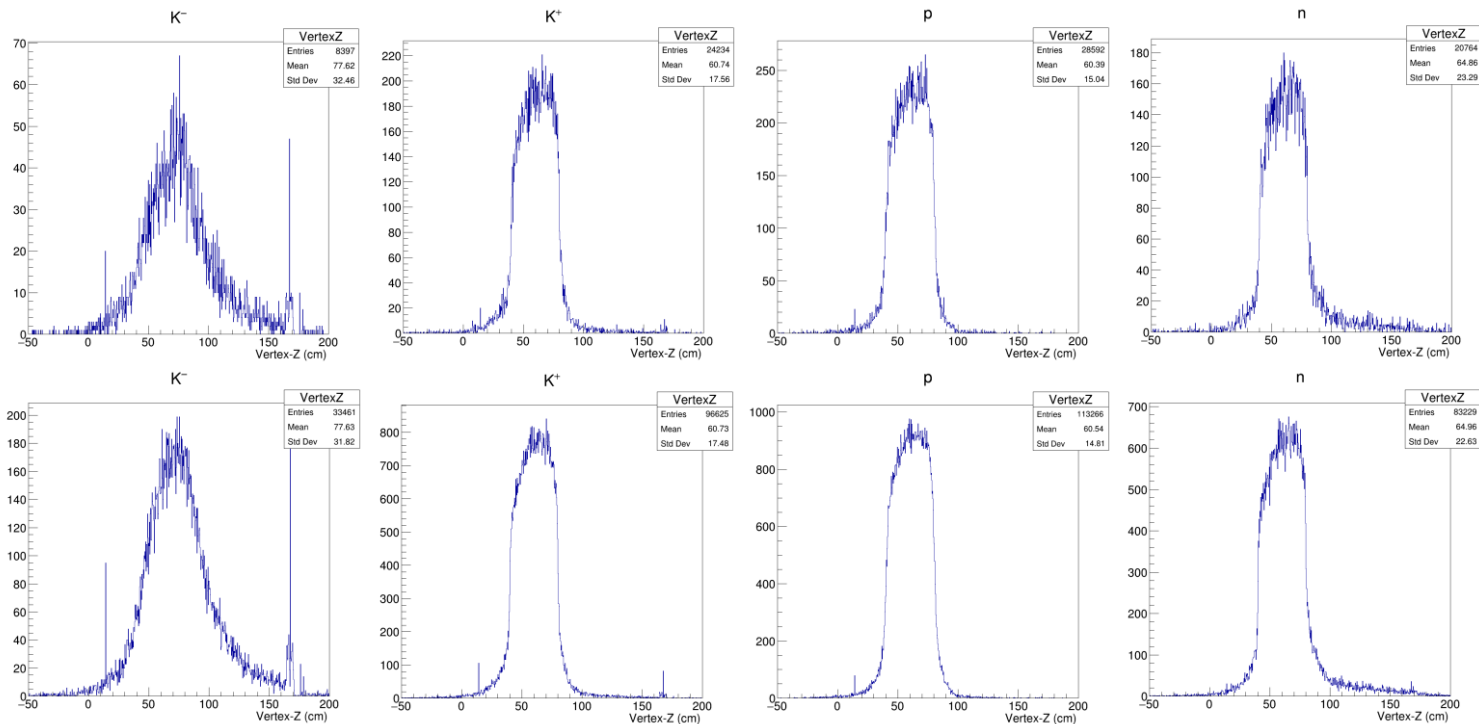
DETECTED KINEMATICS : VERTEX-T

Top(Bottom) row is old(new)



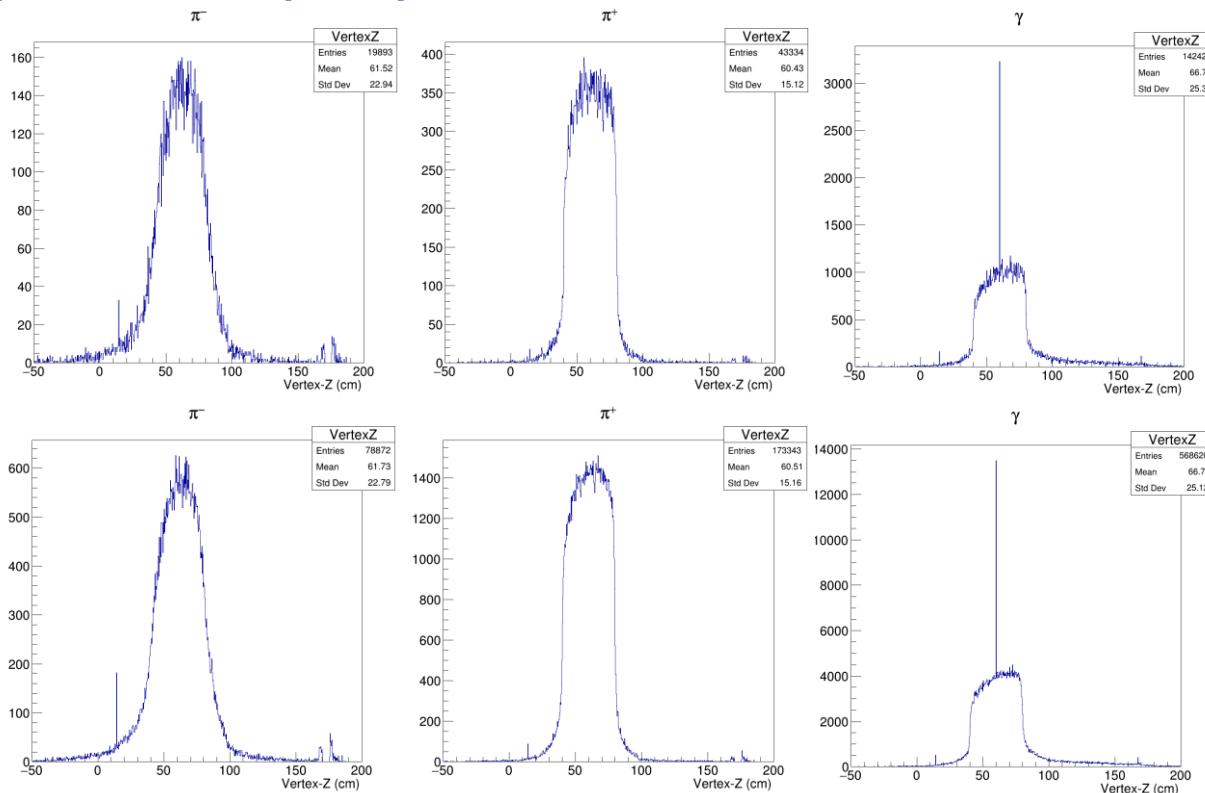
DETECTED KINEMATICS : VERTEX-Z

Top(Bottom) row is old(new)



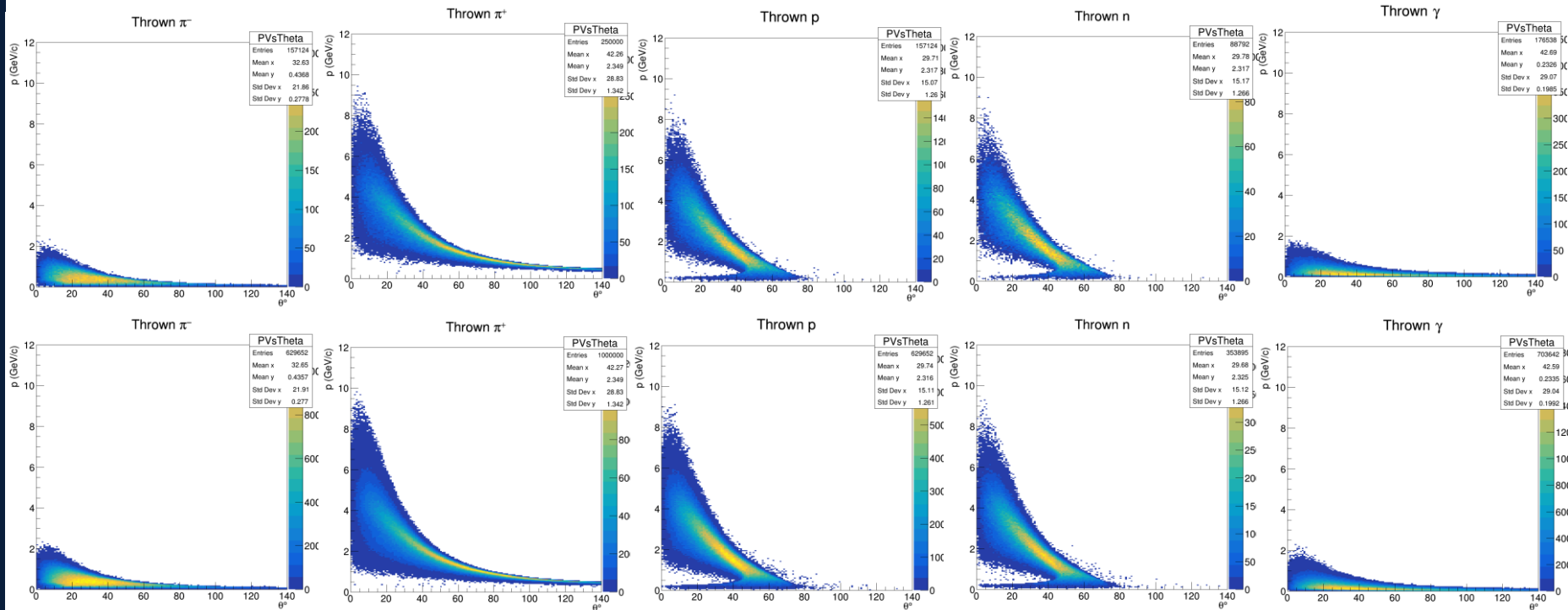
DETECTED KINEMATICS : VERTEX-Z

Top(Bottom) row is old(new)



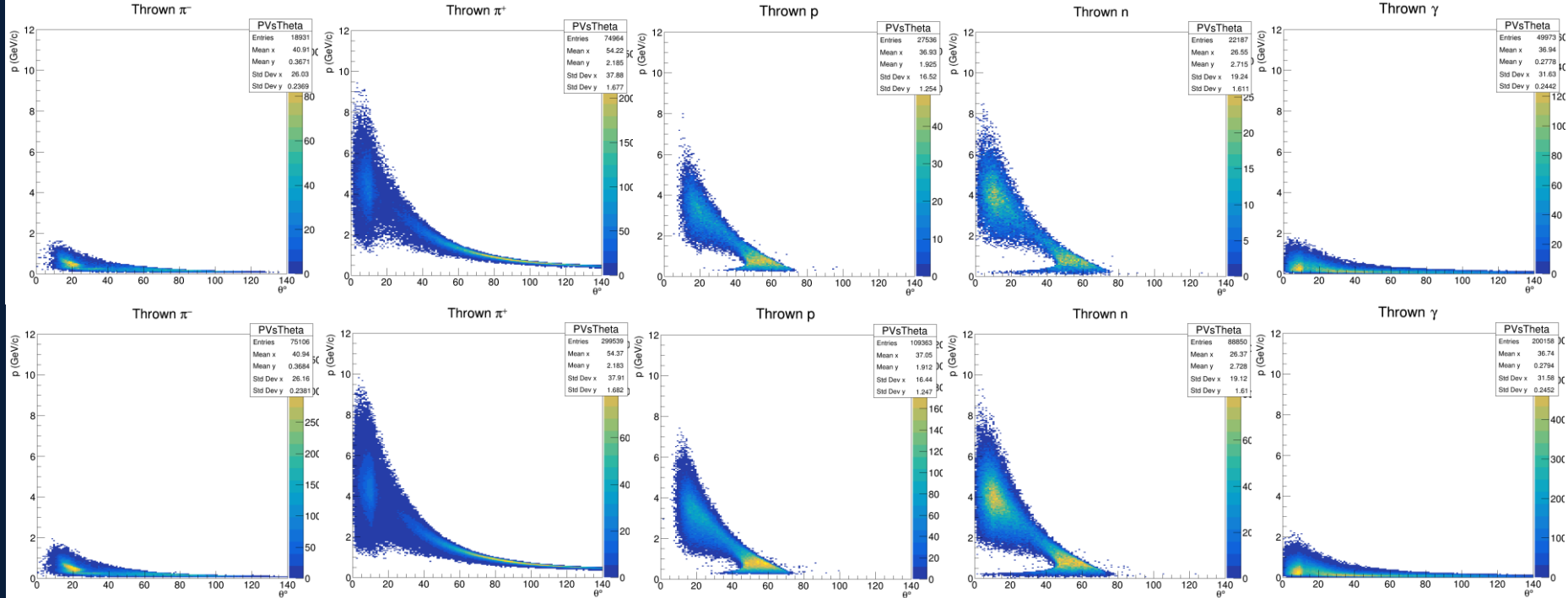
THROWN : MOMENTUM VS. THETA

Top(Bottom) row is old(new)



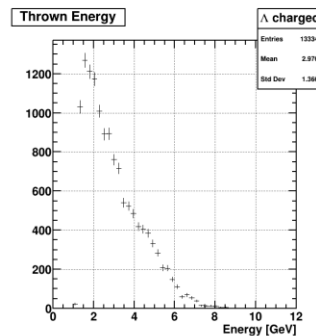
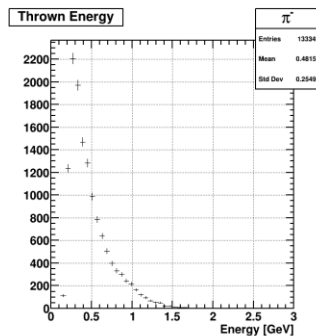
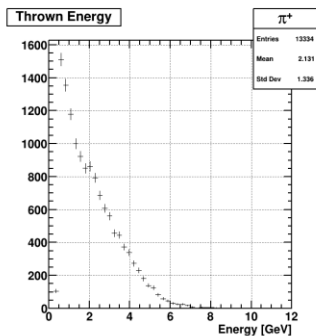
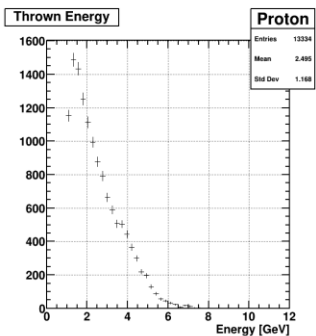
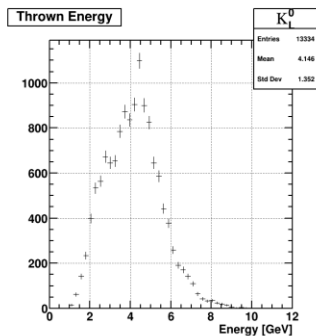
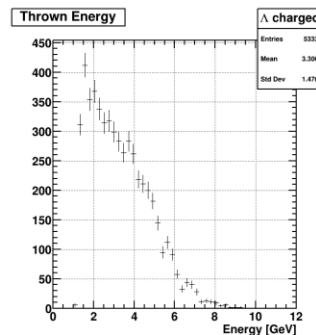
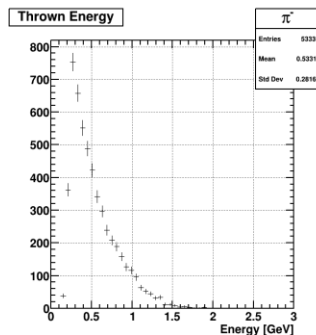
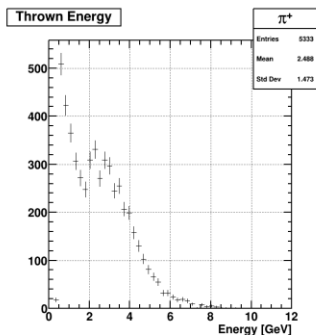
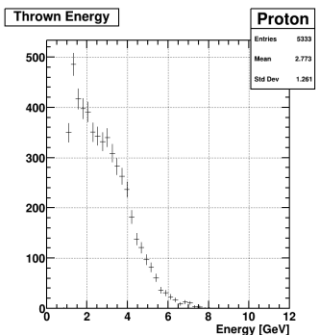
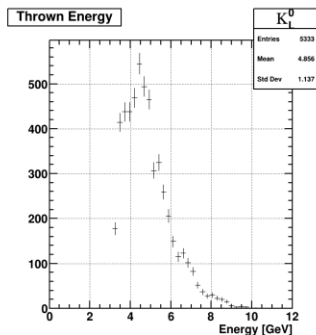
RECONSTRUCTED : MOMENTUM VS. THETA

Top(Bottom) row is old(new)



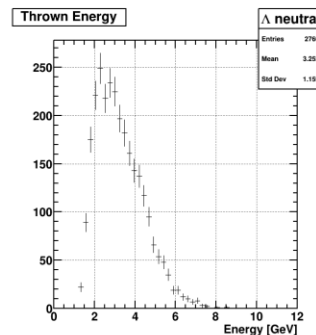
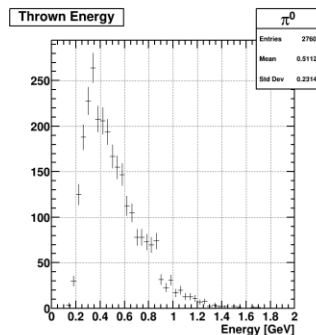
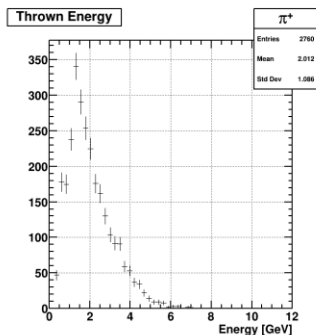
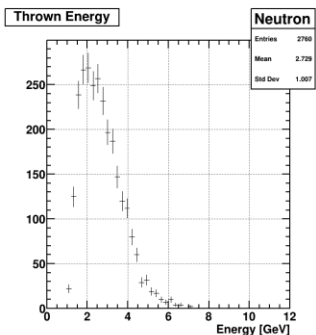
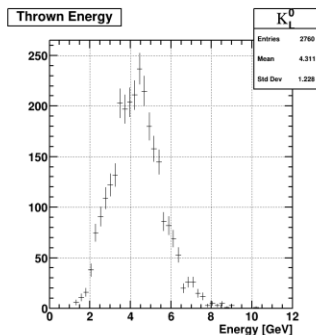
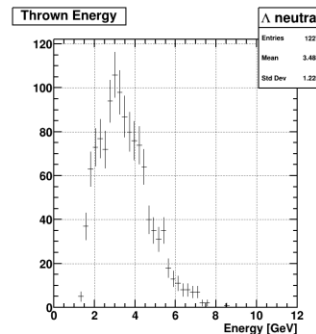
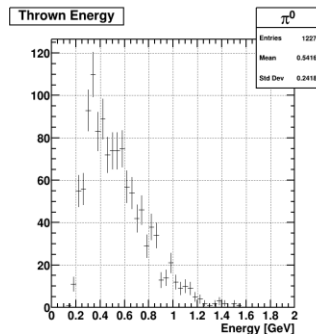
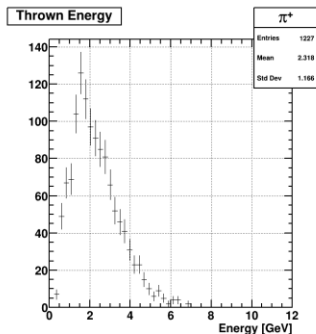
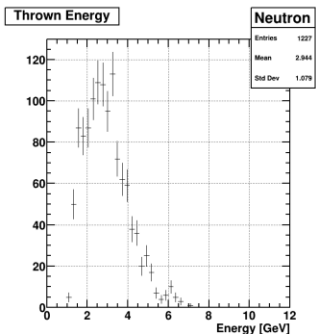
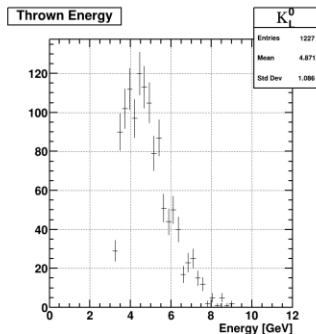
OLD VS NEW : THROWN ENERGY

Top(Bottom) row is old(new)



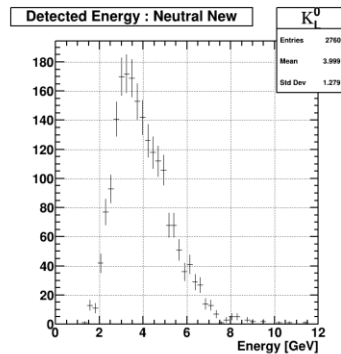
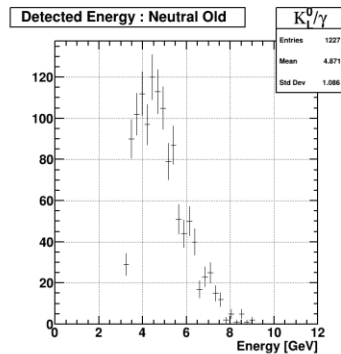
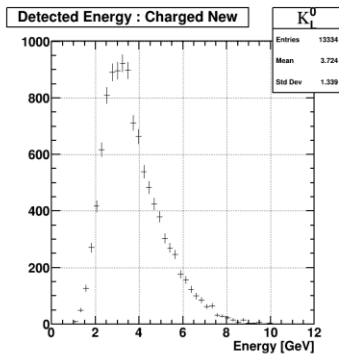
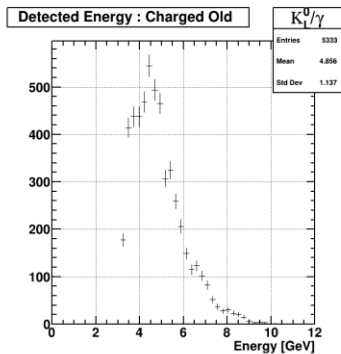
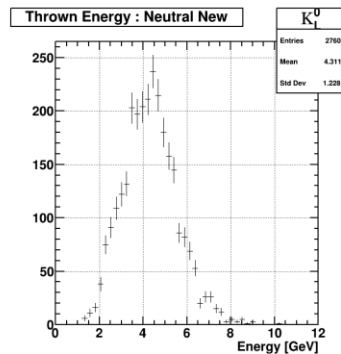
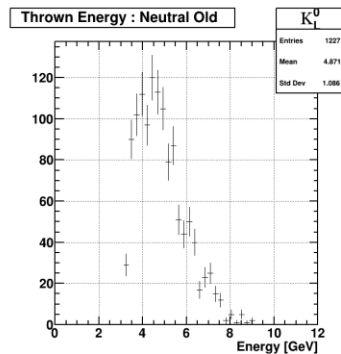
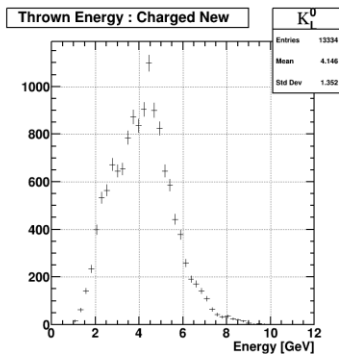
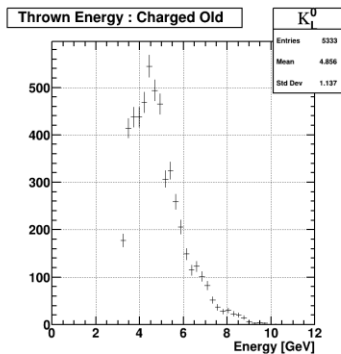
OLD VS NEW : RECONSTRUCTED ENERGY

Top(Bottom) row is old(new)

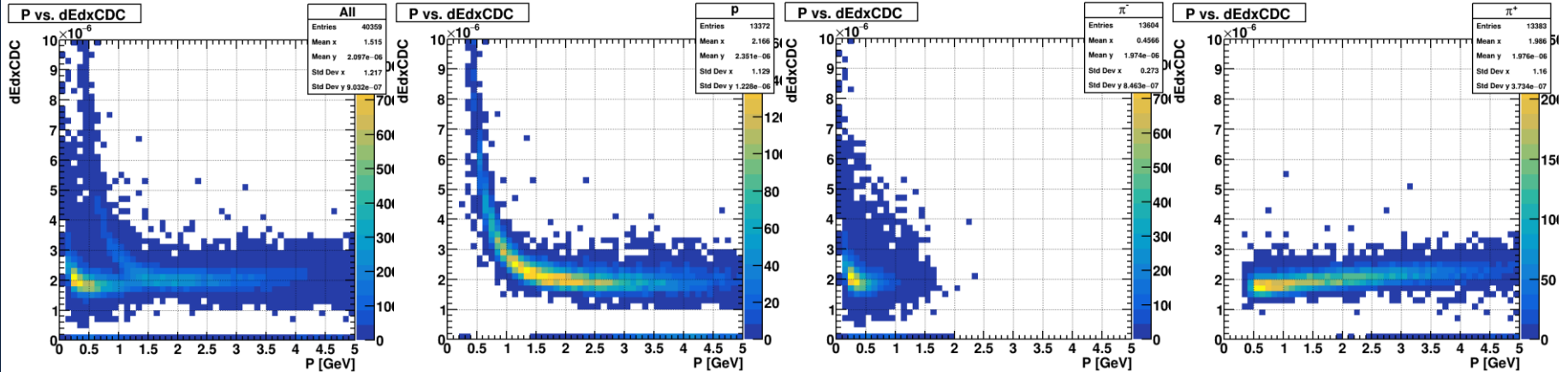


OLD VS. NEW : Λ ENERGY DISTRIBUTIONS

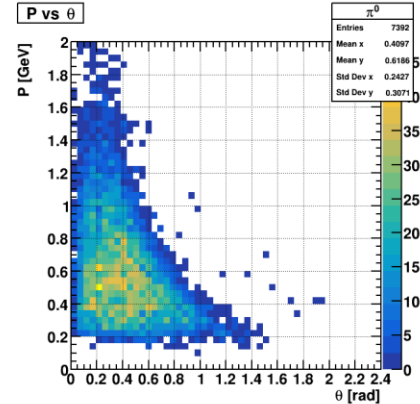
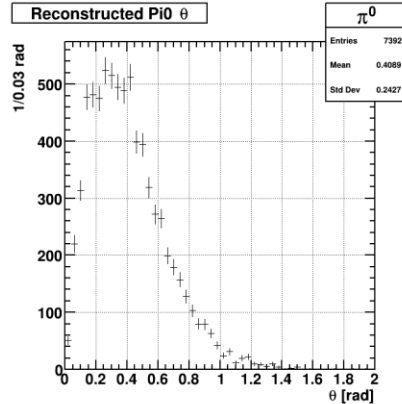
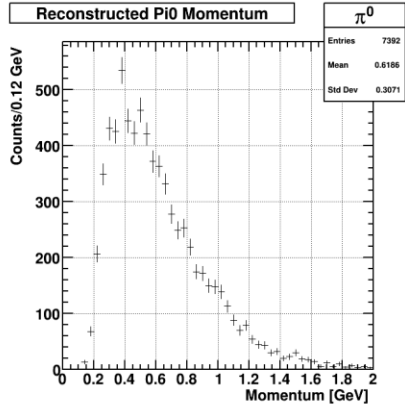
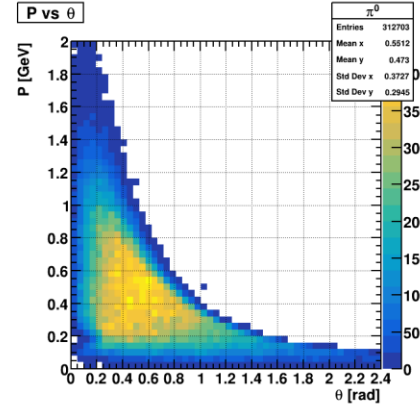
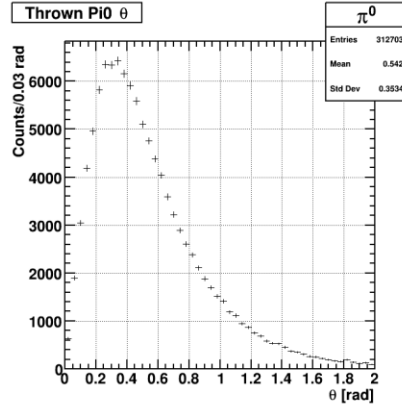
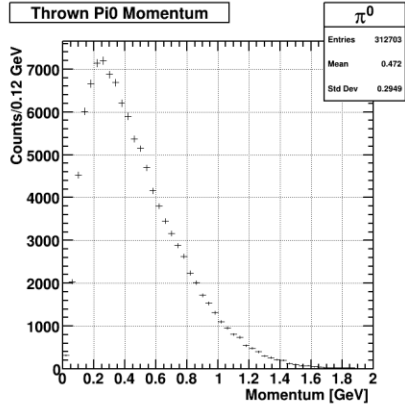
Top(Bottom) row is old(new)



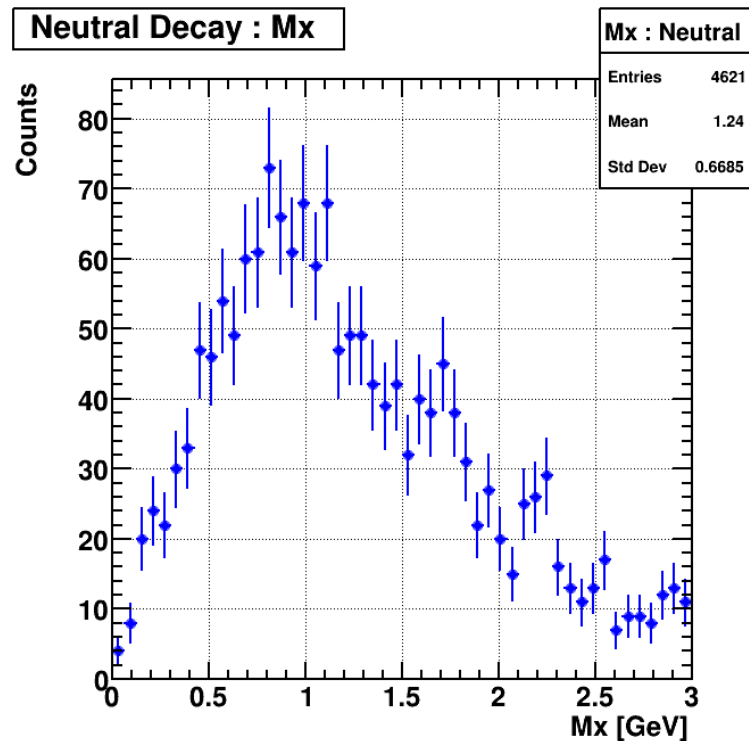
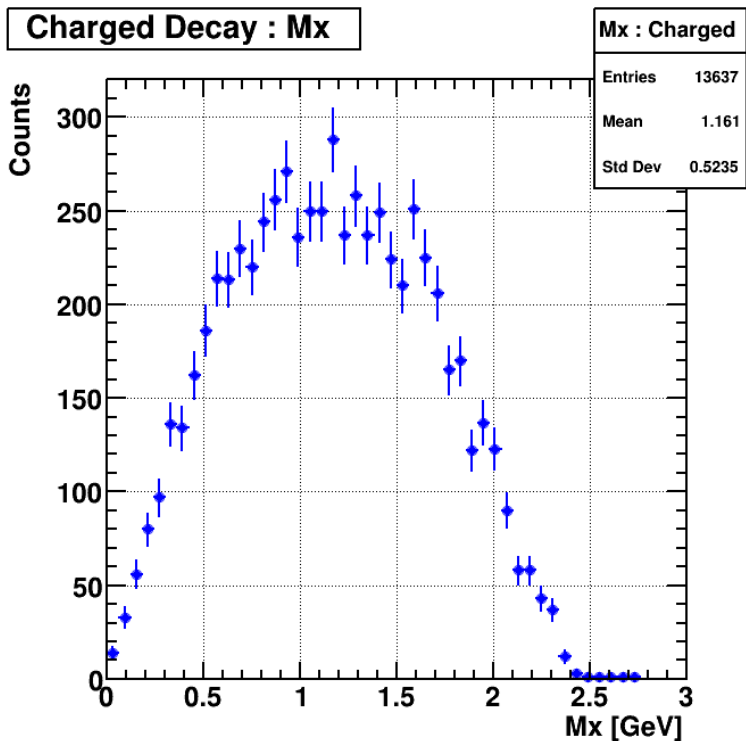
MOMENTUM VS. dE/DX CDC



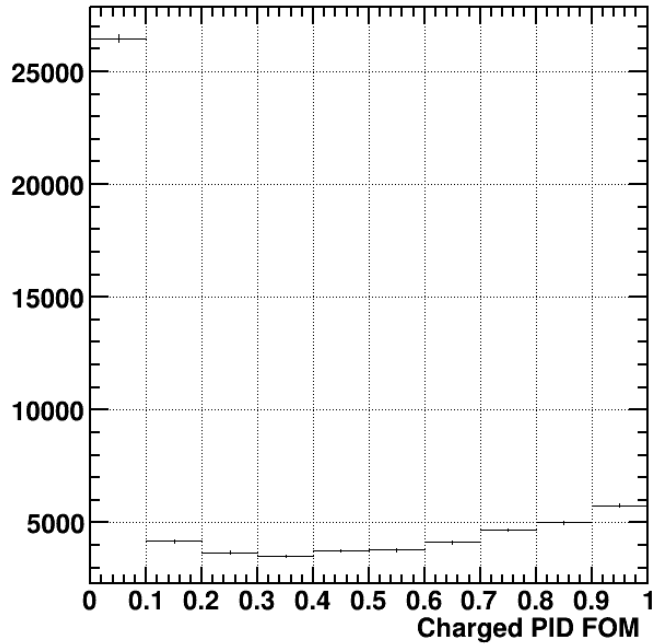
PI0 : THROWN VS RECONSTRUCTED MOMENTUM AND THETA



MISSING MASS FROM CHARGED AND NEUTRAL Λ DECAYS



Charged PID FOM



Charged PID FOM vs PID

