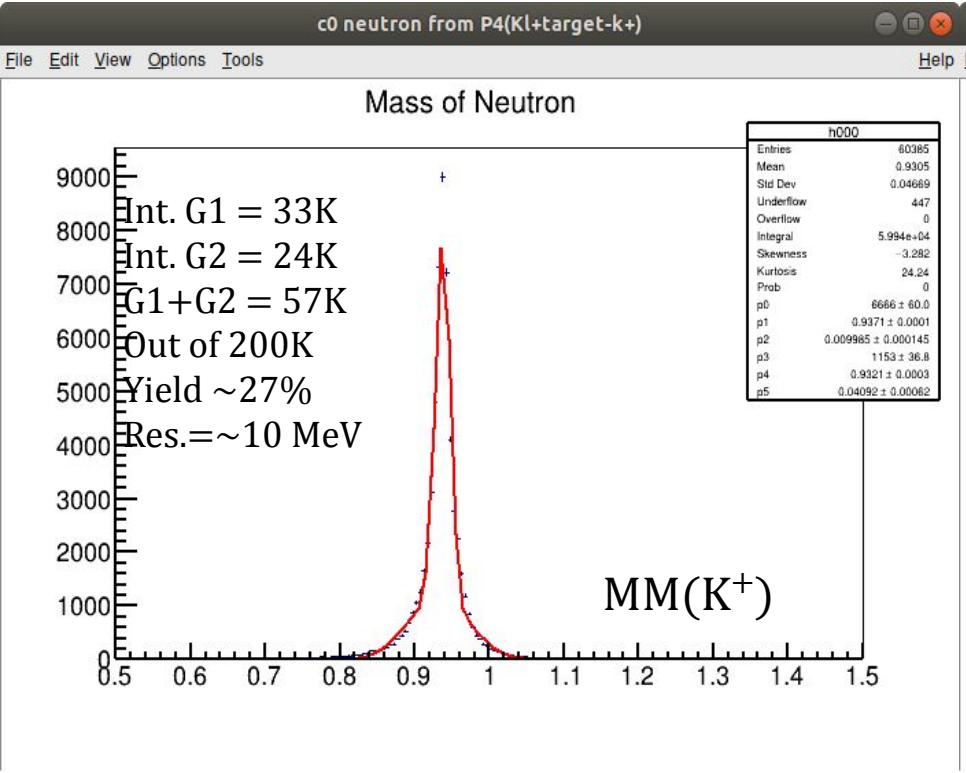
Reconstruction of neutron from $K_L + p \rightarrow K^+ + n$ with uniformly distributed beam momentum (0.23;0.65) GeV/c mixed with the background reaction $\gamma + n \rightarrow K^+ + \Lambda$

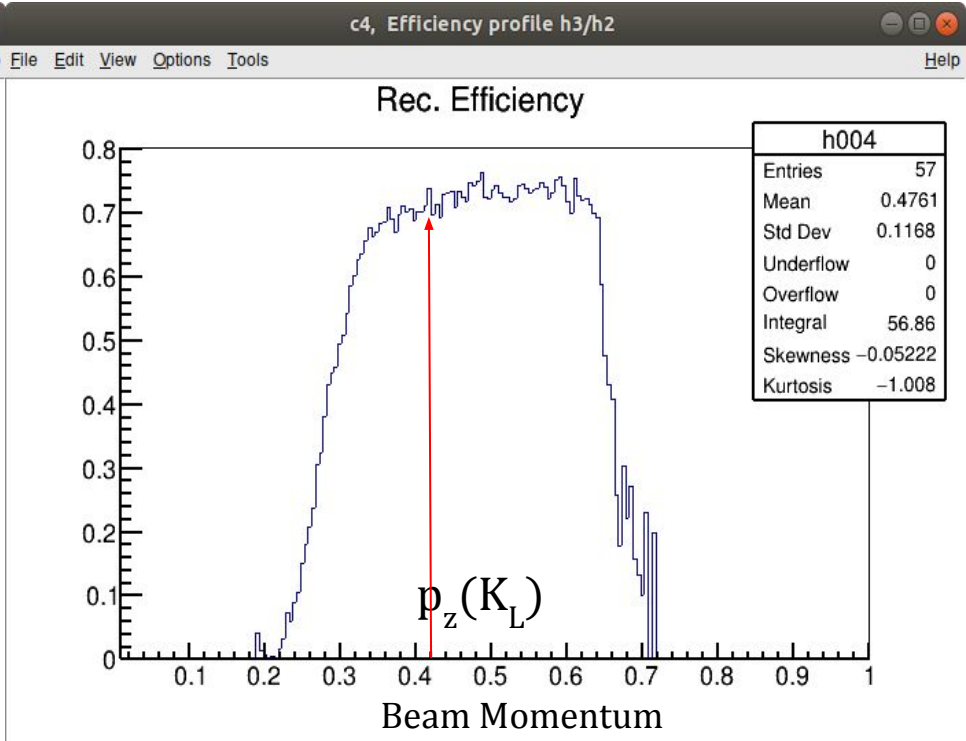
```
$HALLD_MY/bin/KLGenerator_hddm_V3 -M200000 -Fgenerated.root -Ekaon:plain:0.05:0.32 -Rkl1

$HALLD_MY/bin/KLGenerator_hddm_V3 -M200000 -Fgenerated.root -Ephoton:plain:0.05:5.32 -Rg1

$HALLD_MY/bin/KLGenerator_hddm_V3 -M200000 -Fgenerated.root -Eneutron:plain:0.05:5.32 -Rn1
```

```
##12/02/24 Yes RF
hd_root --nthreads=8 -PTRIG:BYPASS=1
-PEVENTRFBUNCH:USE_TAG=KLong -PVERTEX:USEWEIGHTEDAVERAGE=1
-PVERTEX:USE_KLONG_VERTEX=1 -PPLUGINS=monitoring_hists,
ReactionFilter -PReaction1=10_14__11_m13
-PReaction1:Flags=B0_F0 hdgeant4_output_smeared_kl1.hddm  hdgeant4_output_smeared_g1.hddm
hdgeant4_output_smeared_n1.hddm
```

Reaction $K_L + p \rightarrow \mathbf{K^+} + n$: mass of neutron via $P4(n) = P4(K_L) + P4(\text{Target}) - P4(K^+)$.

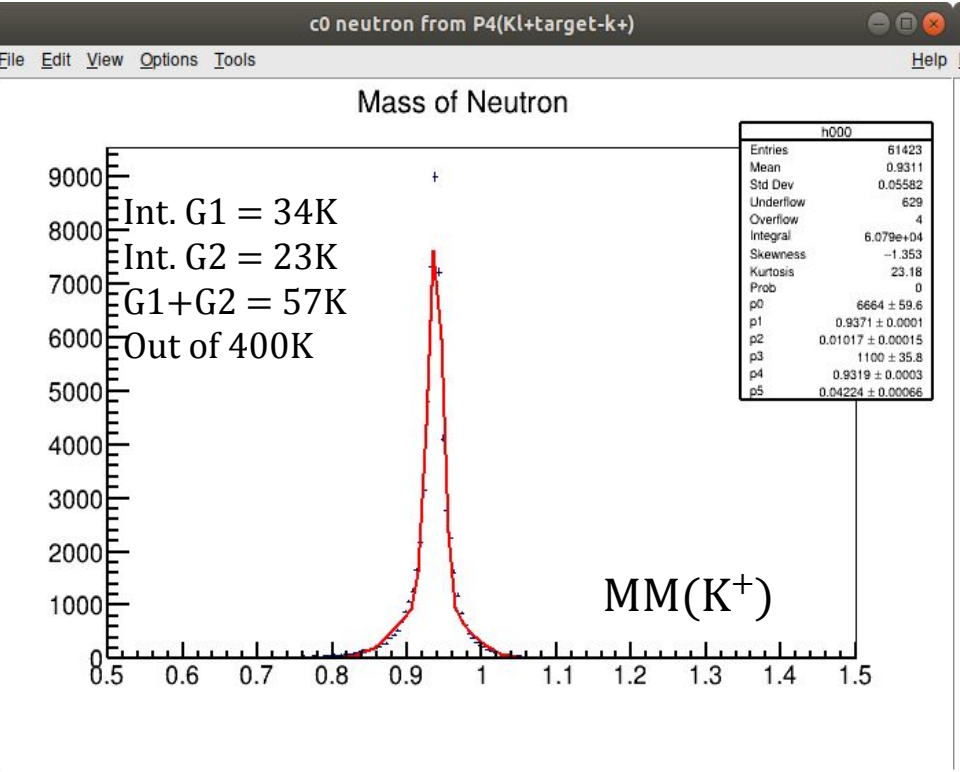
Reaction Filter. NO background. Yield of neutrons and Reconstruction Efficiency

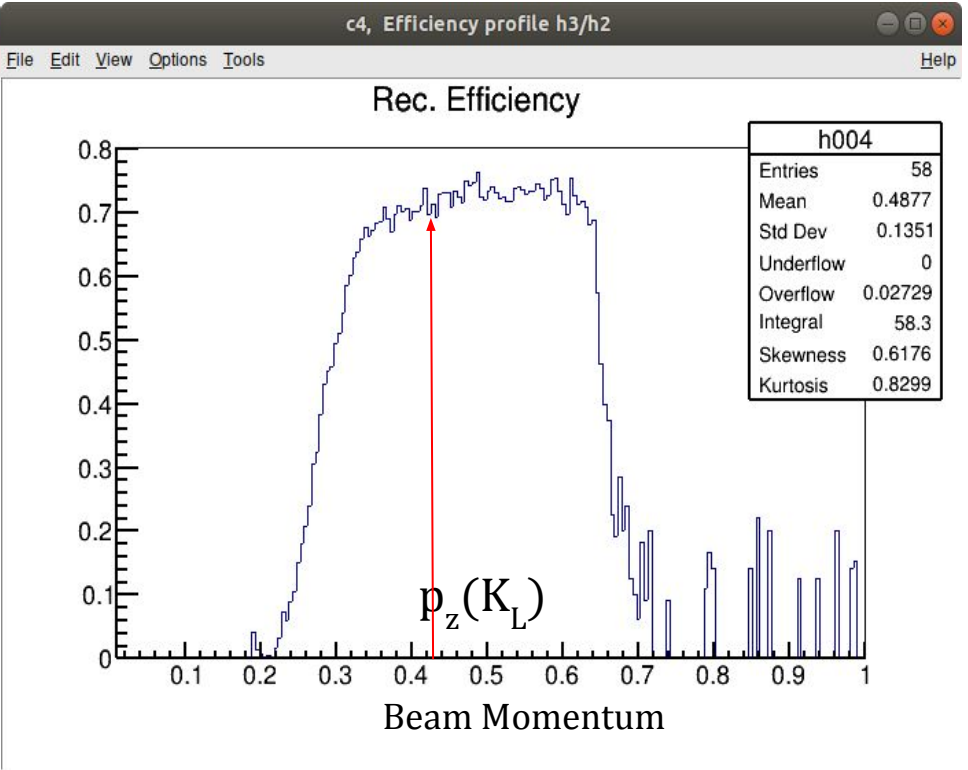




- #Events in the Tree = ~80,000.
- The yield of neutrons (under 2 gaussians) = 27% (17% for narrow G1)
- At p_z=0.44 Rec. Efficiency =~70% for |(MM(K^+)-0.938)| < 0.04 GeV.

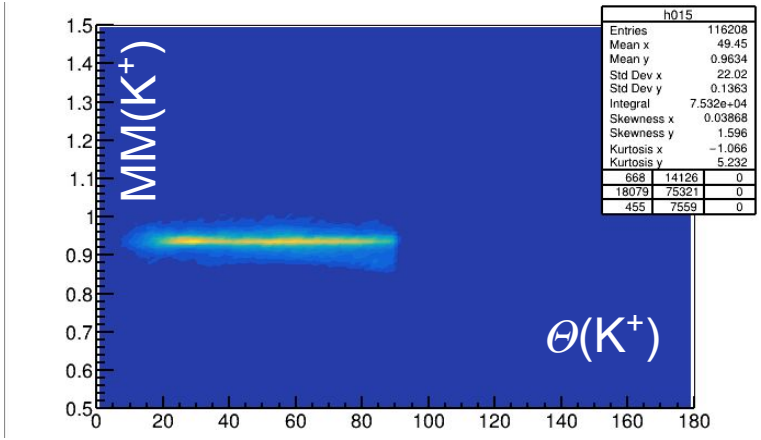
Reaction Filter. YES background. Yield of neutrons and Reconstruction Efficiency

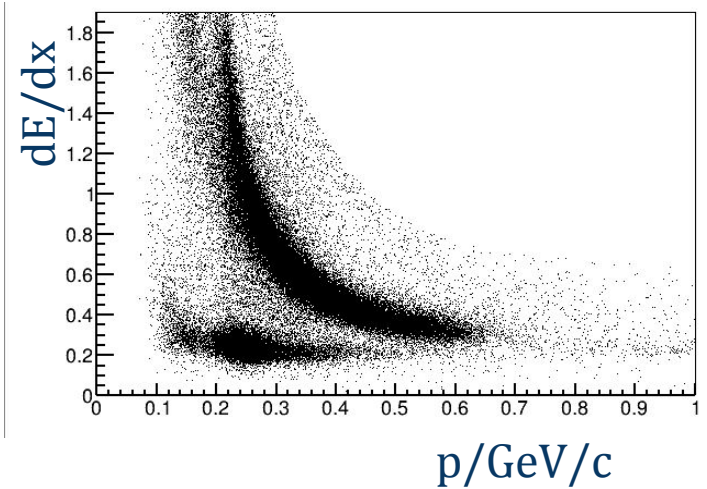


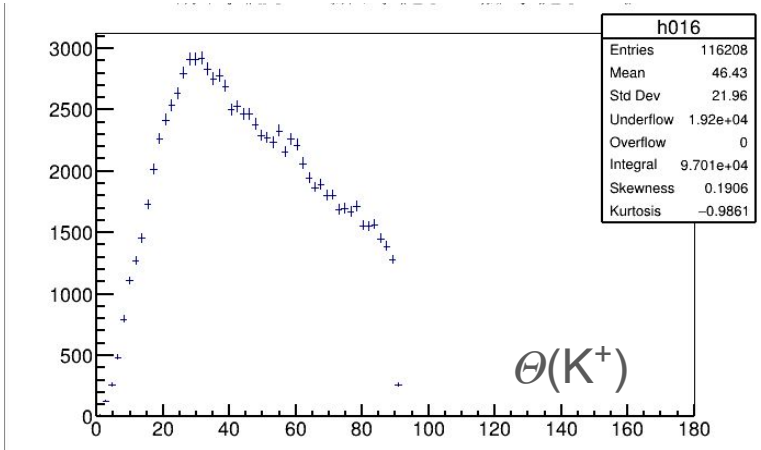


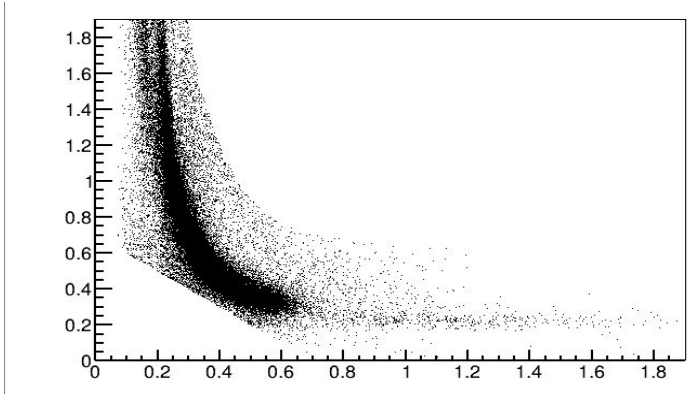
- #Events in the Tree = ~110,000. (170,000 with n-background)
- The yield of neutrons same (under 2 gaussians) = 27% (17% for narrow G1)
- At p_z=0.44 Same Rec. Efficiency =~70% for |(MM(K^+)-0.938)| < 0.04 GeV.

Photon background

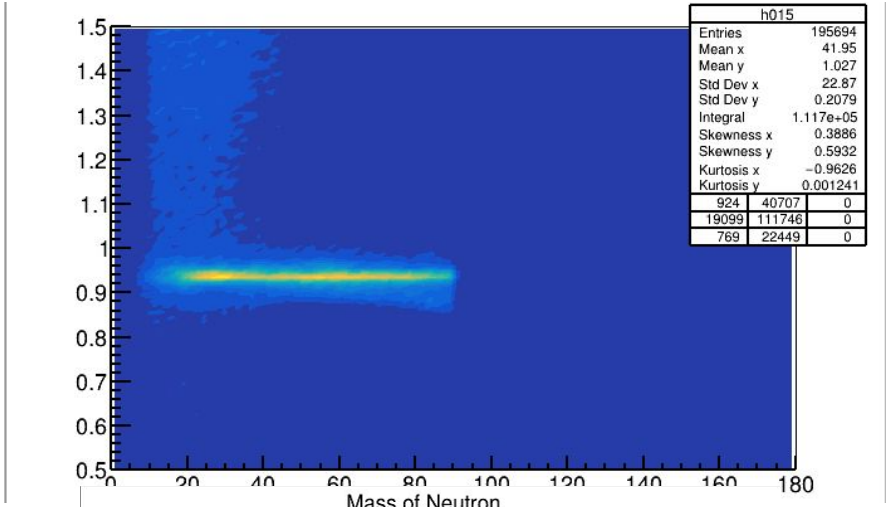


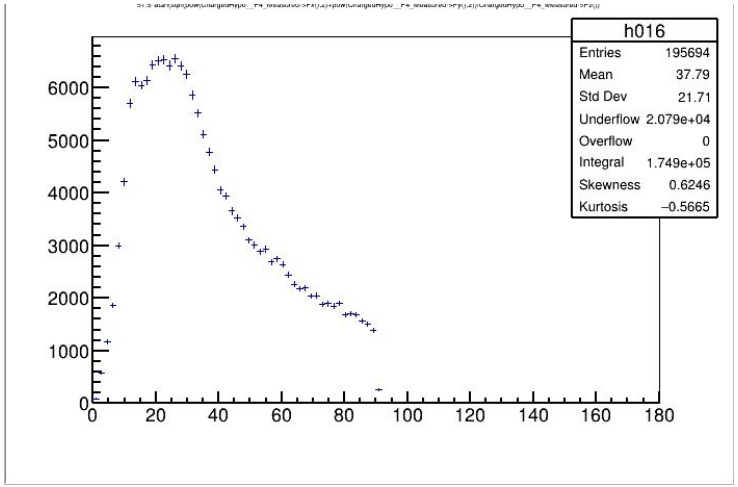


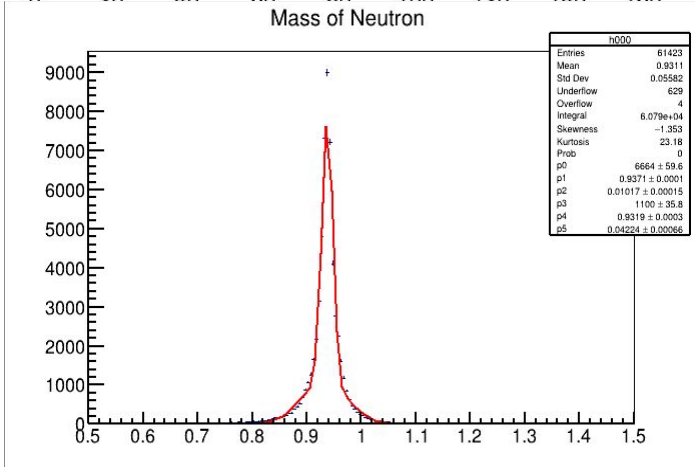


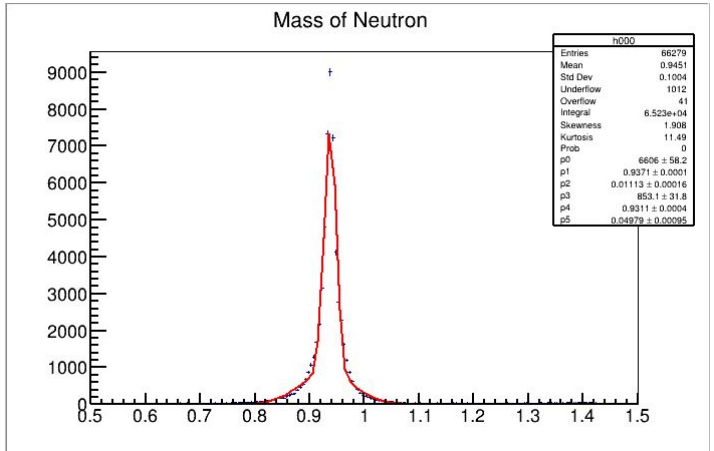


Photon and neutron backgrounds









Conclusion

- Equal number of $K^+ + \Lambda$ and $K^+ + \Lambda + n$ final states mixed with the main $K^+ + n$ does not changes neutron peak value/quality.
- We plan try more background channels to mix with higher background/effect ratio.