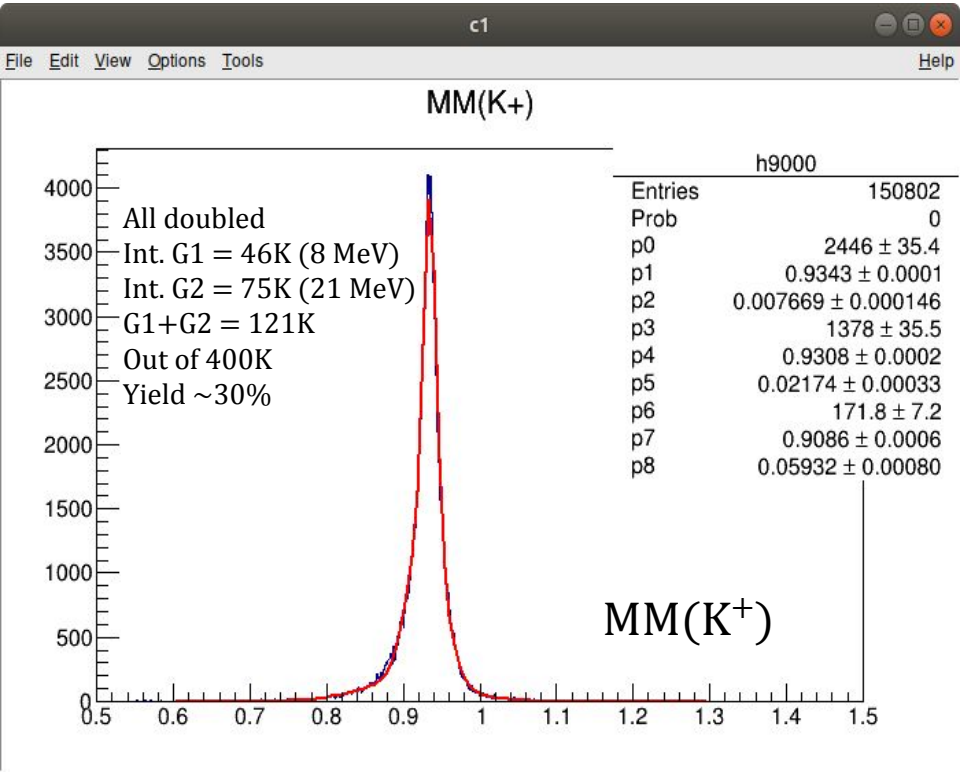
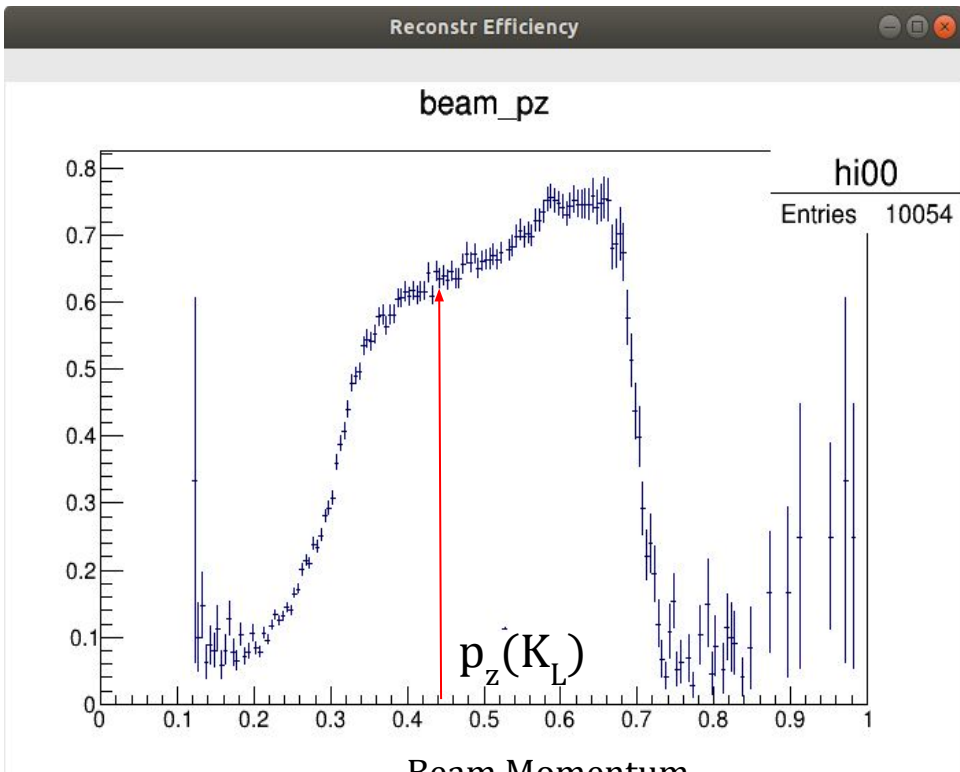
Reconstruction of neutron from $K_L + p \rightarrow K_+ + n$ with uniformly distributed beam momentum (0.23;0.65) GeV/c.
Plugin fcal_tree vs Reaction Filter.

```
$HALLD_MY/bin/KLGenerator_hddm_V3 -M200000 -FgeneratedRkl1FinalK++n0d24to2d64.root
-Ekaon:plain:0.05:0.32 -Rkl1

##12/02/24 No RF
hd_root --nthreads=8 --sodir=$HALLD_MY/Linux_Alma9-x86_64-gcc11.4.1/plugins -PPRINT_PLUGIN_PATHS=1
-PPLUGINS=EVENTRFBUNCH:USE_TAG=KLong -PVERTEX:USEWEIGHTEDAVERAGE=0
-PPLUGINS=monitoring_hists
-PPLUGINS=fcal_tree
hdgeant4_output_smeared.hddm

##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.hddm
```

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

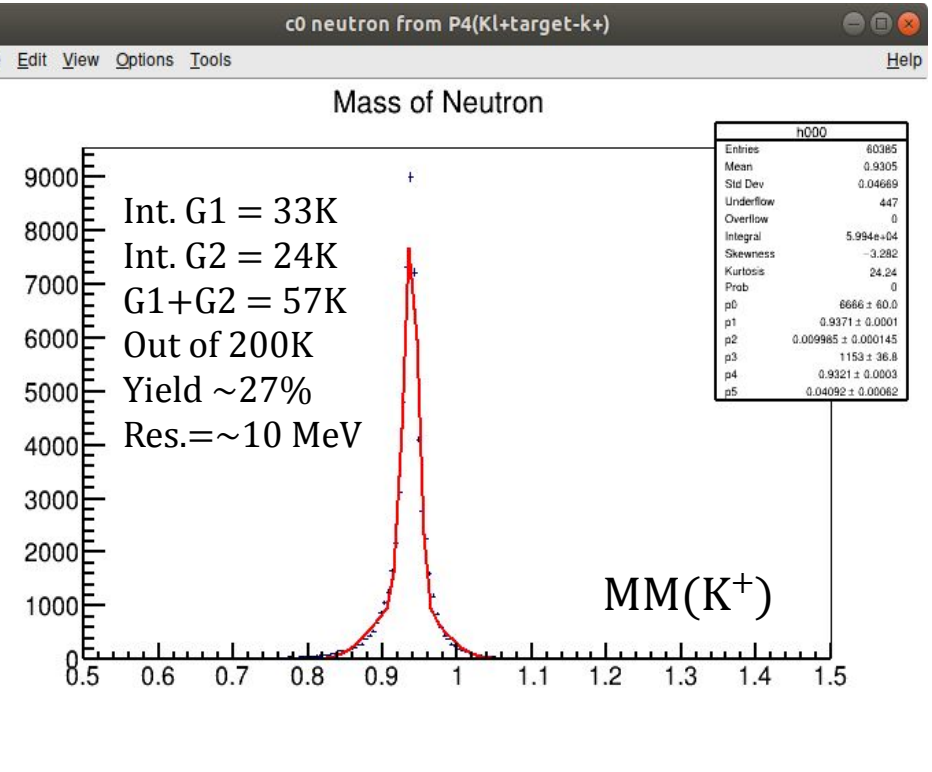
No Reaction Filter. Yield of neutrons and Reconstruction Efficiency.

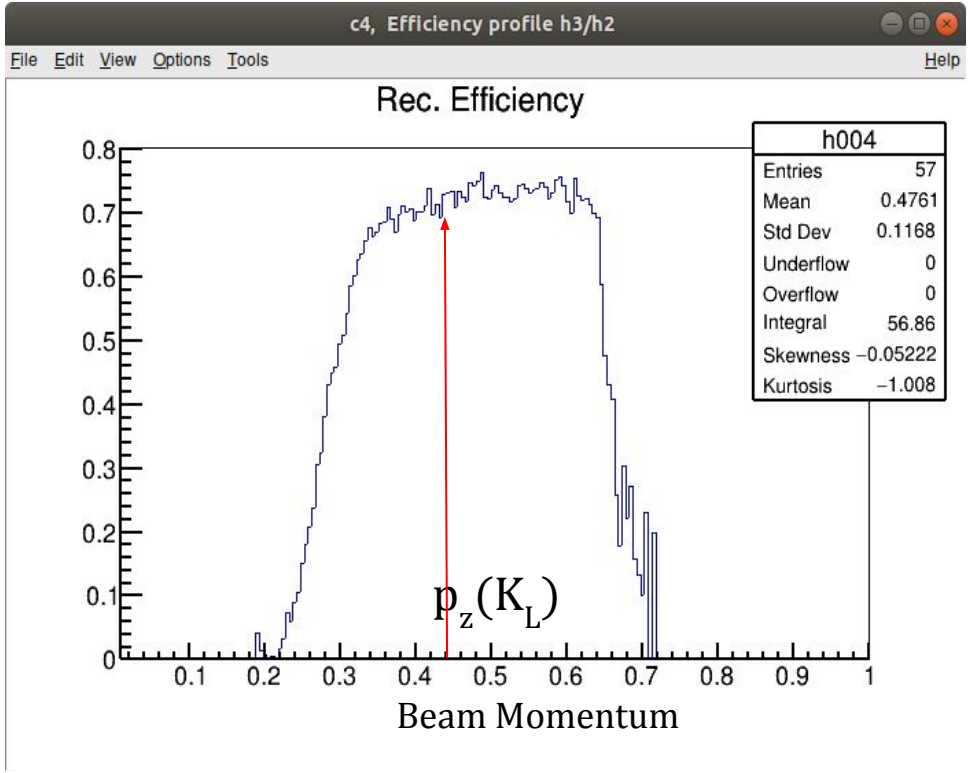




- Actual #Events in Tree 200,000
- The yield of neutrons ~60K (under 2 gaussians) = ~31% (12% for G1; 19% for G2)
- Rec. Efficiency =~63% for $|(MM(K^+)-0.938)| < 0.04$ GeV.

Reaction Filter. 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.

Conclusion

- Two methods render close neutron yields -37% v 27%(RF)- and reconstruction efficiencies 0.63 v 0.7(RF).
- Note that RF for K^++n final state can not use Kin. Fit if neutron is not detected.
- Reaction filter has more uniform reconstruction efficiency.
- Seems agreement improves with time.
- Next step will be to compare two methods for Kaon MM in $K_{S,L}$ +p final state.