Simulation and Reconstruction of $K_L + p \rightarrow K_s + p$ and $K_L + p \rightarrow K^+ + n$ using GlueX tracker in KLF software (S. Dobbs)

Outlook

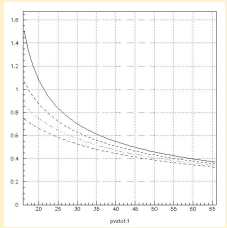
1. Simulated Detector performance: examples dE/dx vs momentum etc.
2. Reconstruction of $K_L + p$ final states

   $\rightarrow K_s + p$ at **low beam** momenta (Pentaquark region)

   $\rightarrow K_s + p$ at high beam momenta

   $\rightarrow K^+ + n$ at **low beam** momenta

   $\rightarrow K^+ + n$ at high beam momenta
3. Conclusion



Identification of final particles from $K_L + p \rightarrow K_s + p$ and $K_L + p \rightarrow K^+ + n$ using GlueX CDC tracker.

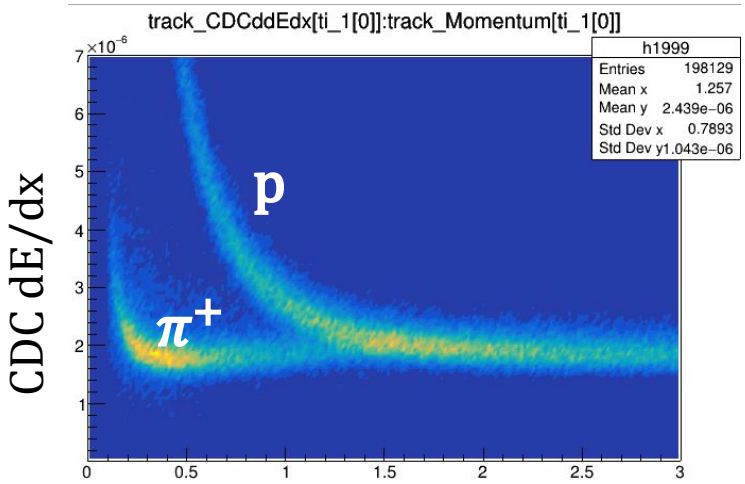
Hadronic decays, lifetimes and Target dimensions.

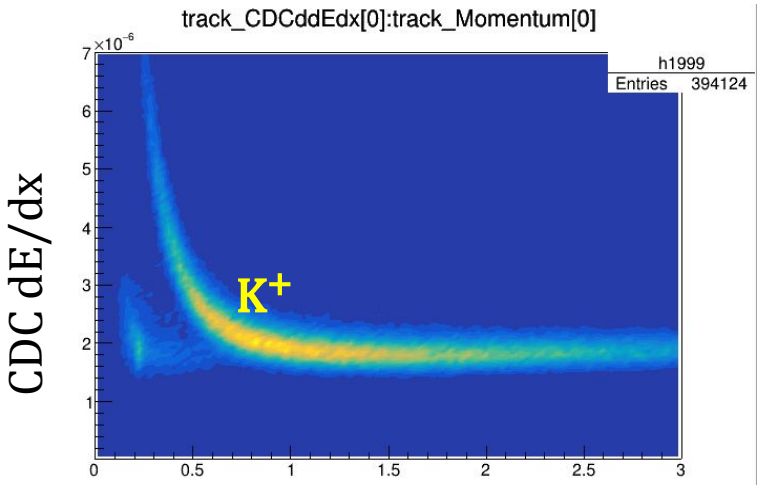
$K_s \rightarrow \pi^+\pi^-$ **69.2 %** $c\tau$ = 2.9 cm => decays mostly in LH2 target and close to it.
$\rightarrow \pi^0\pi^0$ 30.7 %

$K^+ \rightarrow \pi^+\pi^+\pi^-$ 5.6 % $c\tau$ =371.2 cm =>**K^+ almost "stable"** within the LH2 Target and CDC.
$\rightarrow \pi^+\pi^0$ 20.7 %

- K_s +p reconstruction: - via EM($\pi^+\pi^-$) to identify K_s and MM($\pi^+\pi^-$) for proton.
- K^++n reconstruction: - via dE/dx in CDC to identify K^+ and MM(K^+) for neutron.

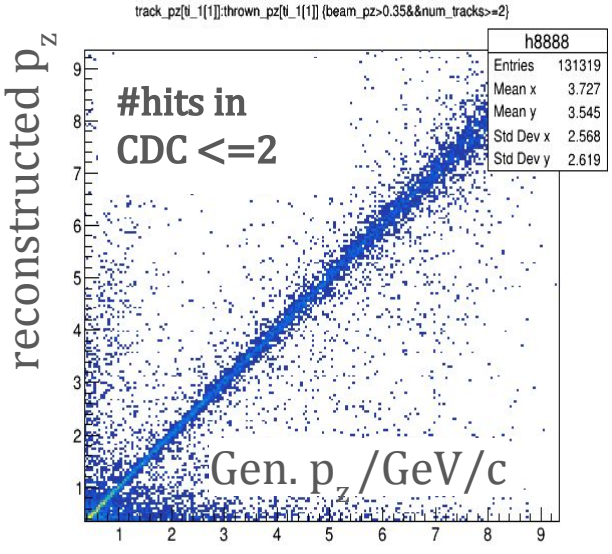
Example. dE/dx in CDC of Gluex Detector .vs. particle momentum for $K_L + p \rightarrow K_s + p$ and $K_L + p \rightarrow K^+ + n$. Beam momentum < 6 GeV/c

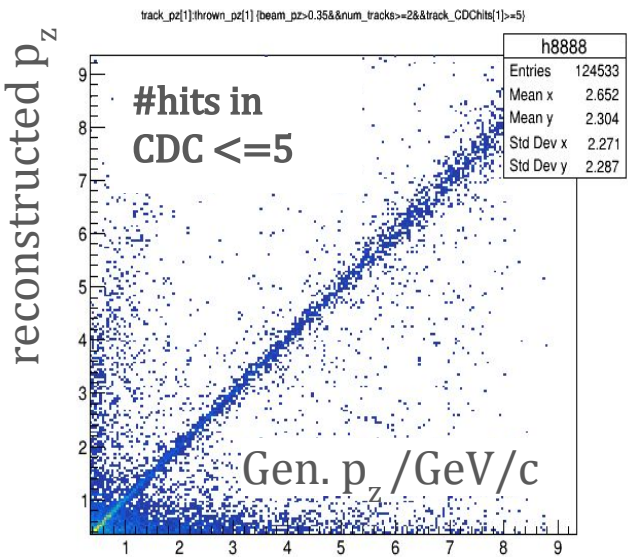


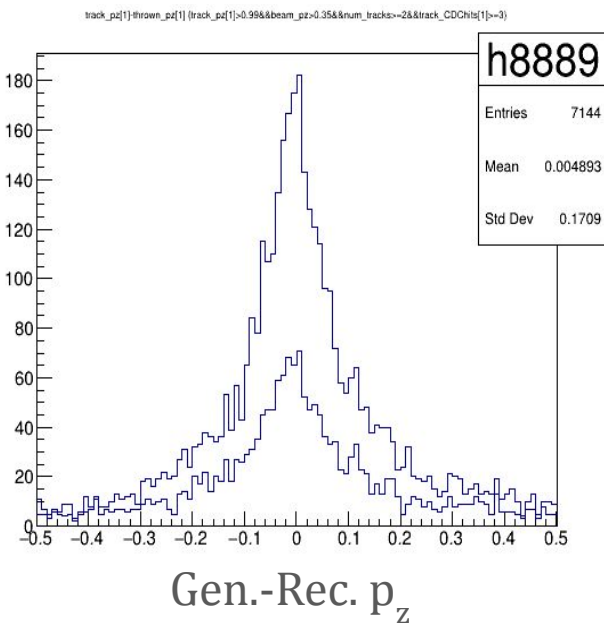


- Good separation of pions below ~1.4 GeV/c and ~0.7 GeV/c for K^+.

Example. Generated .vs. Reconstructed momenta in $K_L + p \rightarrow K_s(\pi^+\pi^-) + p$.

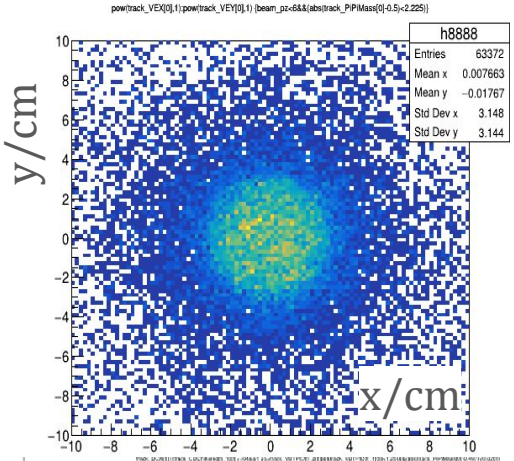


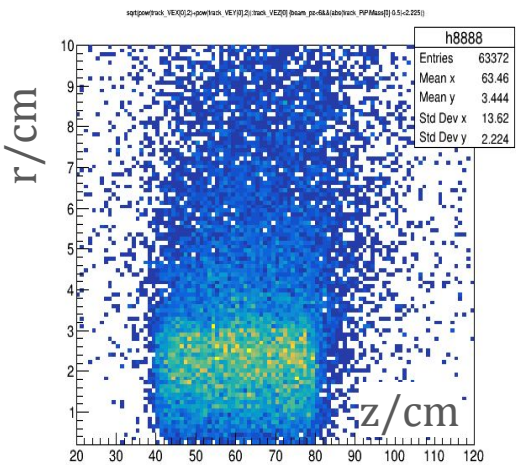


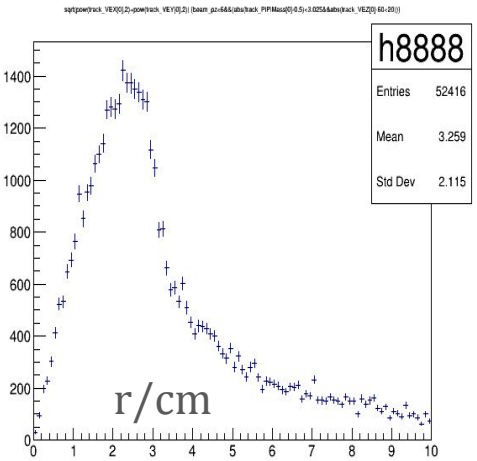


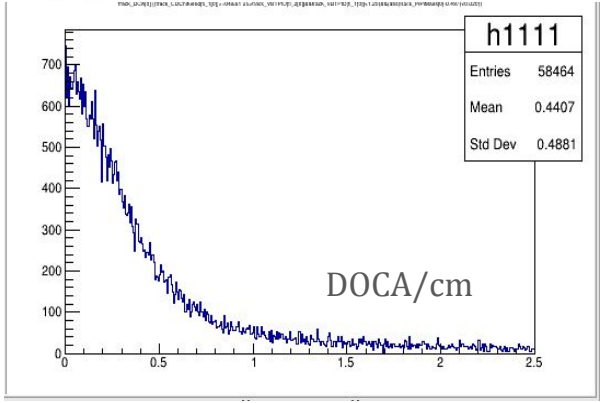
- Good reconstruction at all generated momenta.

Example. Reconstruction of $\pi^+\pi^-$ vertex for $K_L + p \rightarrow K_s(\pi^+\pi^-) + p$.



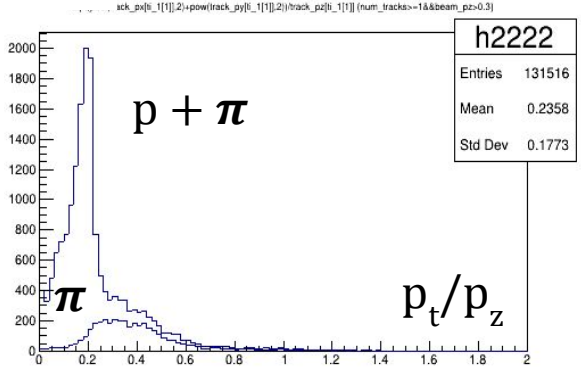


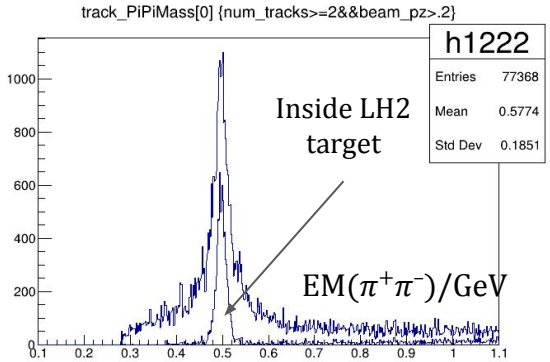


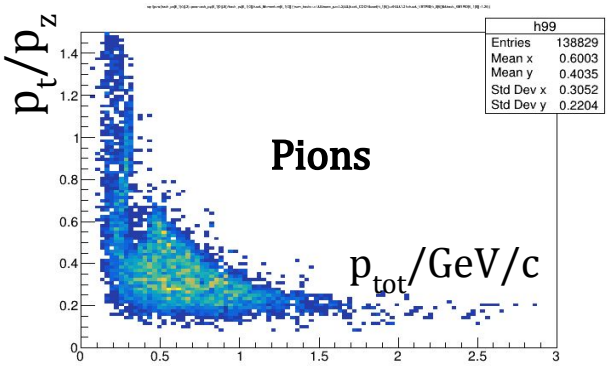


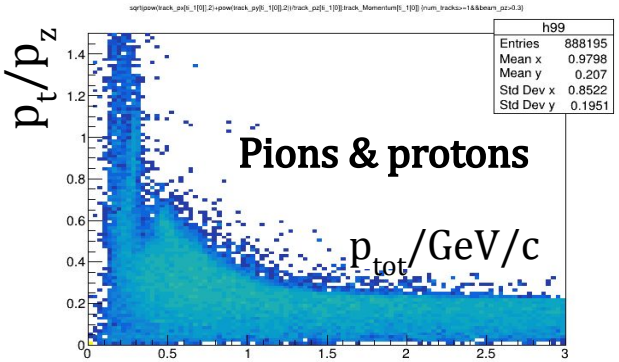
- LH2 target sized in cm as r×z = 3 cm ×40 cm.
- LH2 target is well reproduced by the $\pi^+\pi^-$ vertex coordinates.
- Diffuse area around r=3 cm is of 1 cm (=>sigma ~0.25 cm).
- Long exponential r-tail is due to K_s lifetime ($c\tau$=2.9 cm)

Example. Angular distribution of π^+,π^- , and p.
Effect of LH2 Target Cut for $K_L + p \rightarrow K_s(\pi^+\pi^-) + p$.

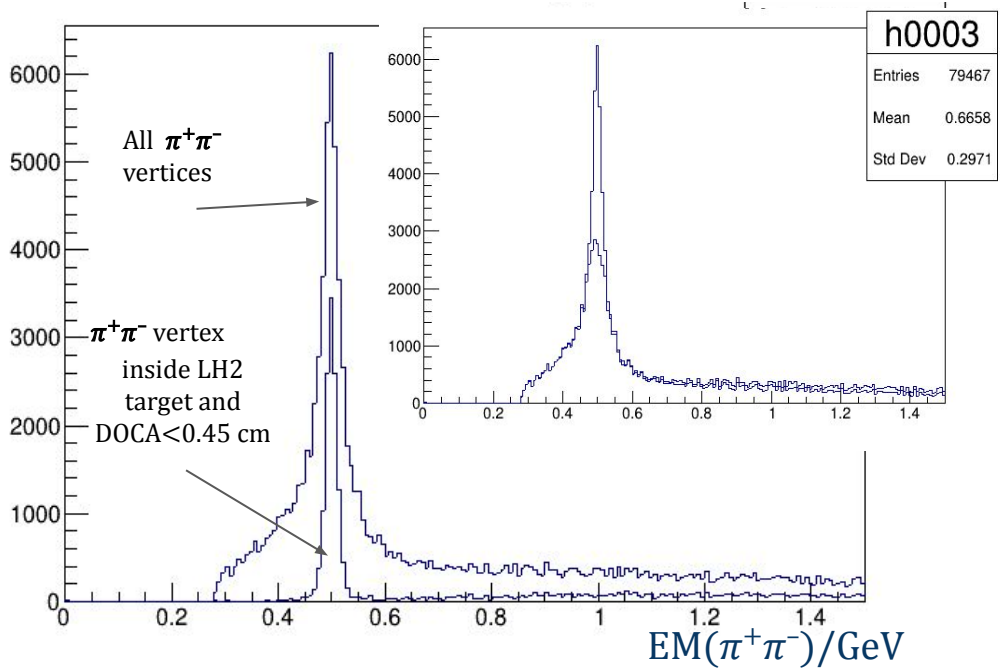


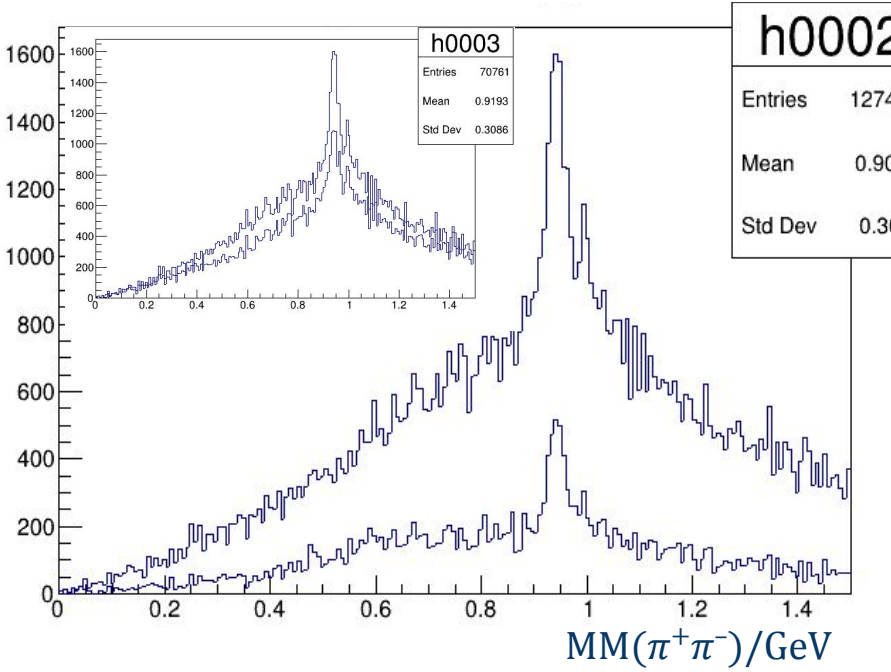






Example. Reconstruction of $\pi^+\pi^-$ vertex for $K_L + p \rightarrow K_s(\pi^+\pi^-) + p$. MM($\pi^+\pi^-$) and EM($\pi^+\pi^-$) inside LH2 target.





- EM($\pi^+\pi^-$) resolution is obviously better inside the LH2 target while the background is significantly lower.