# Meson Spectroscopy with Neutral Kaon Beam

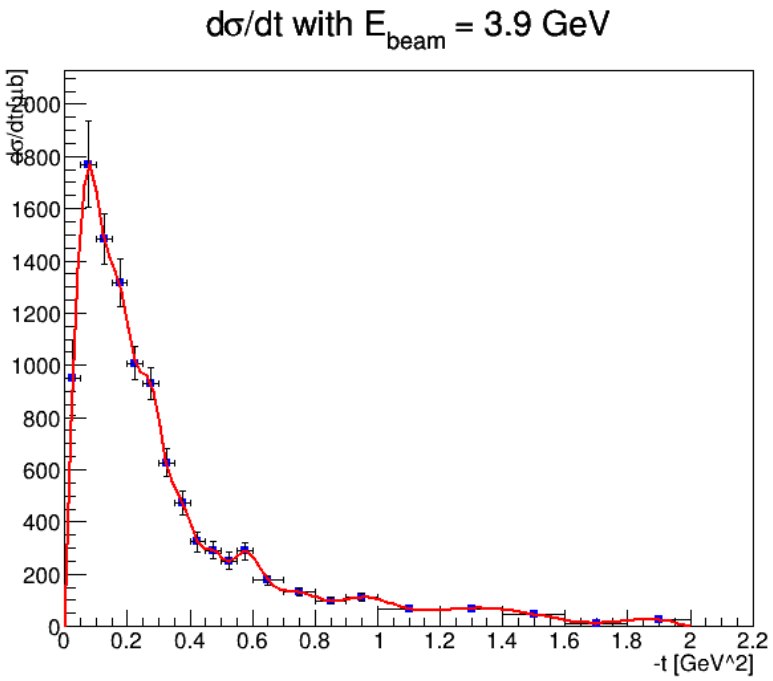
Marouen Baalouch
Old Dominion University/JLab

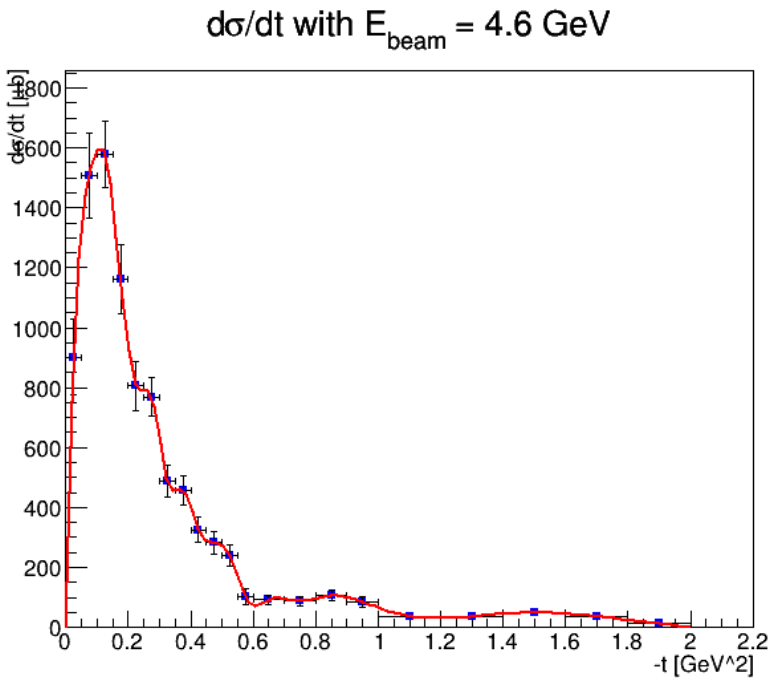
# $Kp$ Production

- The equivalent reaction of $K_L p \to K^*(892)^0 p$ with charged Kaons beam:
  - $K^+ p \to K^*(892)^+ p$
  - $K^- p \to K^*(892)^- p$
- Charge independence and Clebsch-Gordan-Coefficient consideration indicate that:
  - $\sigma(K^- p \to K^*(892)^0 n) > \sigma(K^- p \to K^*(892)^- p)$.
- A study of the reaction $K^- p \to K^*(892)^- p$ using a beam energy 3.9 GeV and 4.6 GeV has been made by BNL in 1971: *PhysRevD.4.2583* .
- The beam energy values used in this study close to what we expect with KLF, so the extracted differential xsec and the SDME coefficient will be used for our simulation of $K_L p \to K^*(892)^0 p$ and $K_L p \to K^*_0(1430)^0 p$ .

# $K\rho$ Production

- According to this paper, the total xsec for $K^*(892)^-$ using $K^-$ beam is:
  - 3.9 GeV: $\sigma = 575 \pm 19$ μb
  - 4.6 GeV: $\sigma = 509 \pm 23$ μb
- The differential xsec $d\sigma/dt$ (corrected by the acceptance):



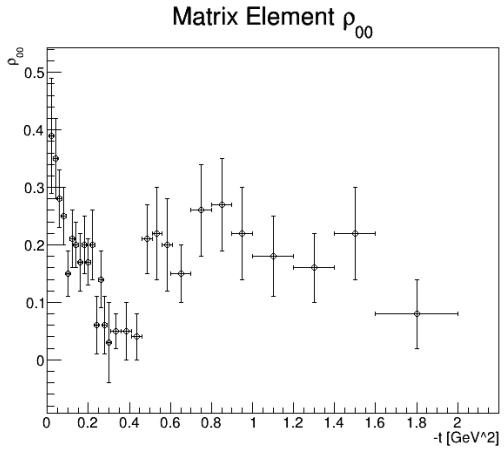



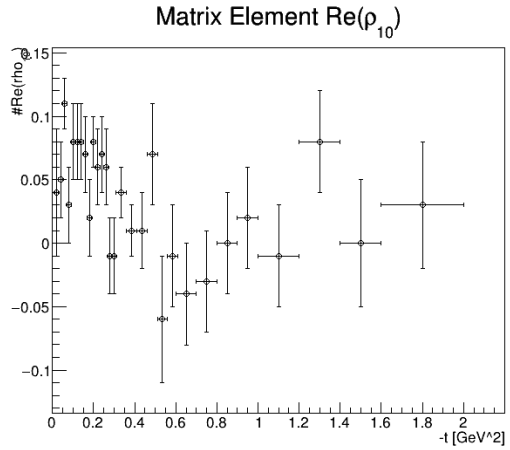
# $K\rho$ Production

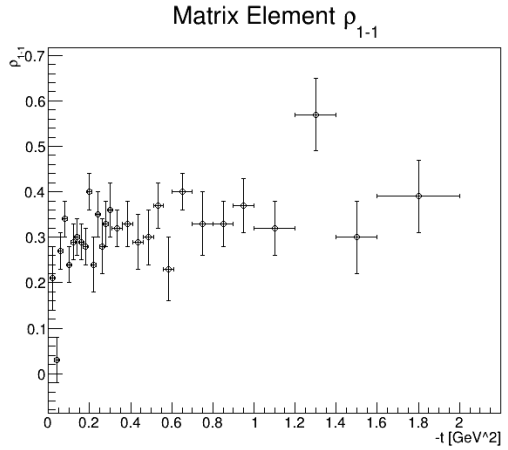
- The decay angular distribution for a $1^-$ particle decaying into two $0^-$ particles is:

$$W(\cos(\theta),\phi)=\frac{3}{4\pi}[\rho_{00}\cos^2(\theta)+\rho_{11}\sin^2(\theta)-\rho_{1-1}\sin^2(\theta)\cos(2\phi)-\sqrt{2}\Re(\rho_{10})\sin(2\theta)\cos(\phi)]$$

- The SDME in the BNL analysis are estimated using a fit to the data using the previous function in bins of -*t*.



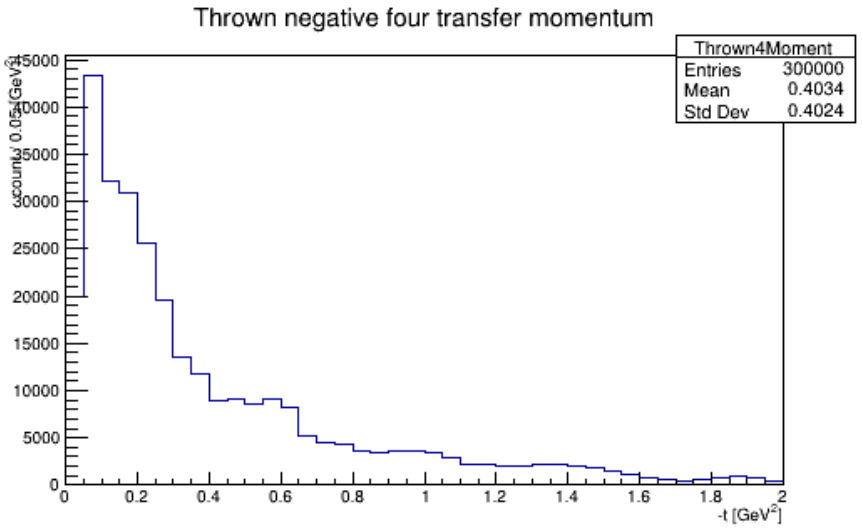
# $Kp$ Production

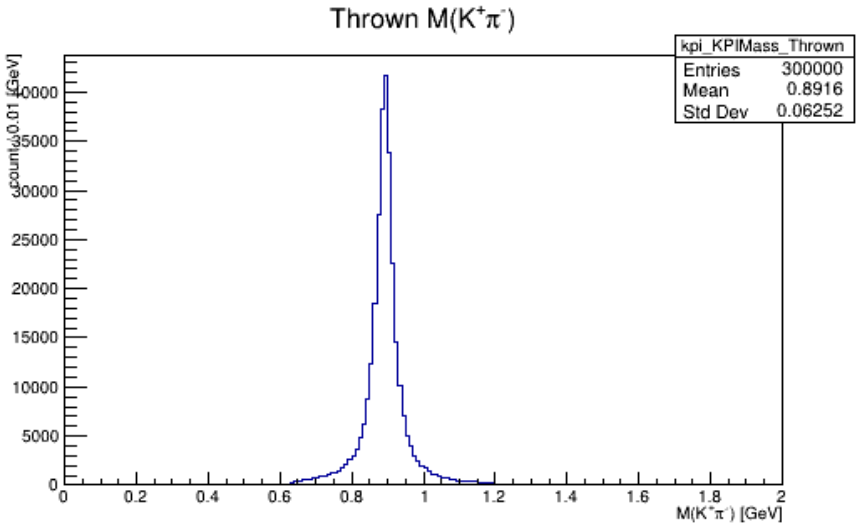
Very preliminary simulation study:

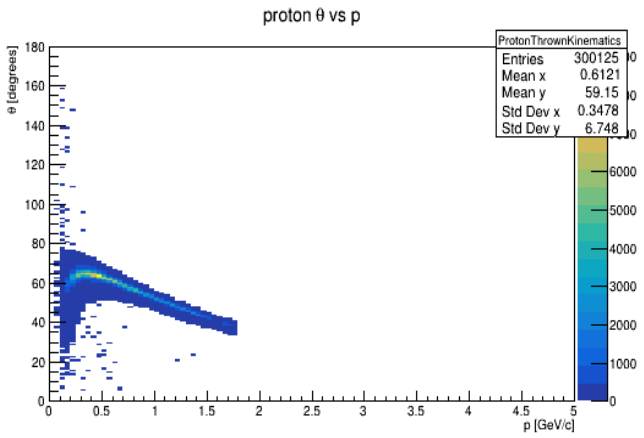
- Generate (300 kevent) the reaction $K_l p \rightarrow K^*(892)^0 p$ based on the BNL 1971 results with beam energy equal to 3.9 .
- Simulate the reaction throw GlueX using hdgeant (calibration constant: variation = mc).
- Reconstruct the events using JANA with a related plugin called “kpi_klong” using high level JANA classes (not the analysis library).
- Preliminary selection using basic cuts: dE/dx and the time difference from BCAL and TOF.

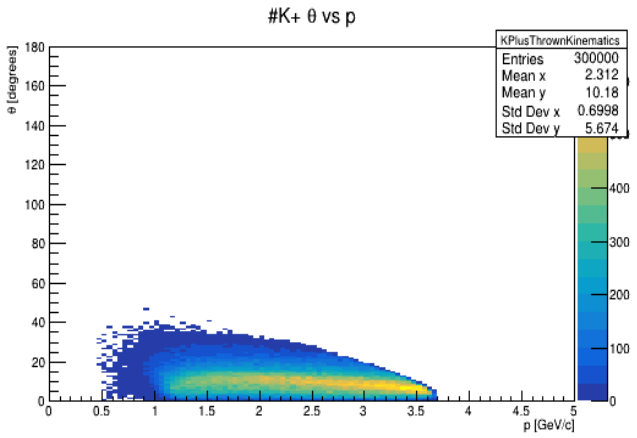
# $K\rho$ Production

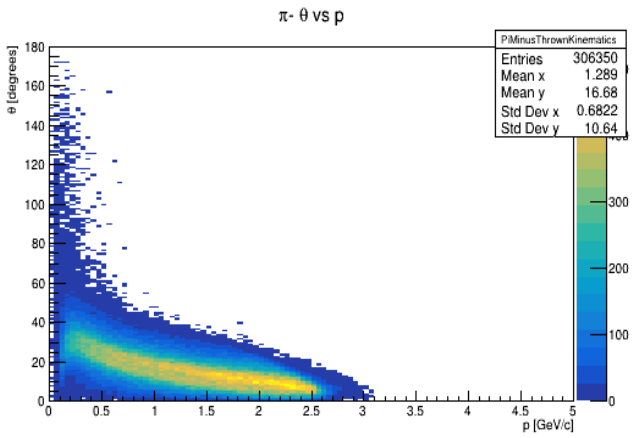
- Generated Events:



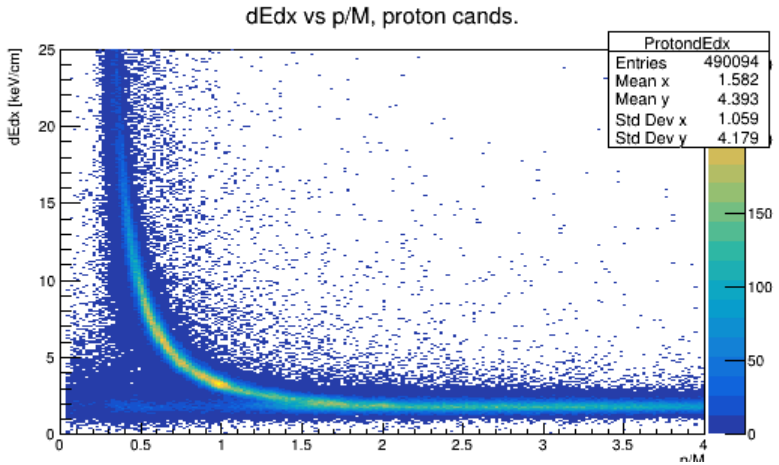



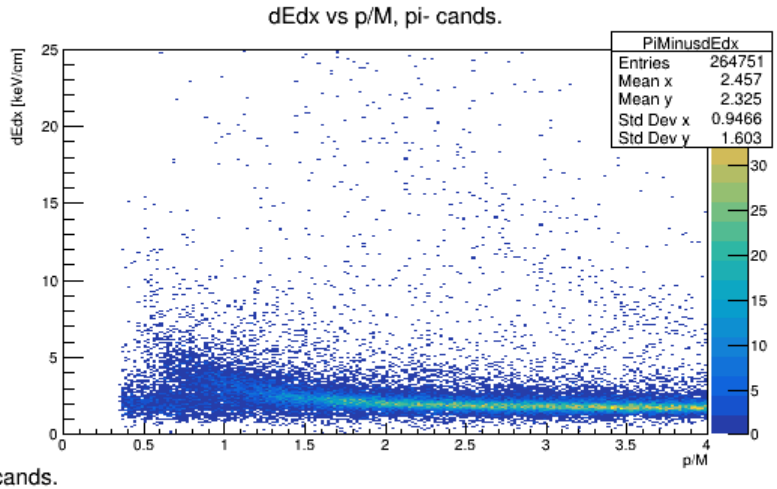



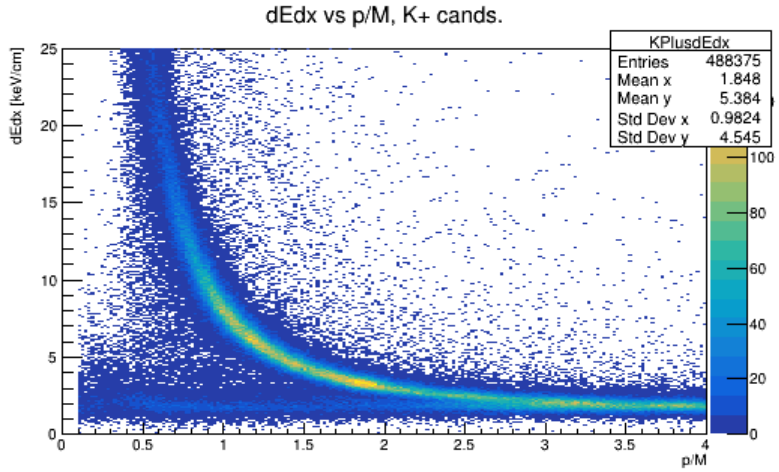



# *Kp* Production

- Variables used for the selection (dE/dx):

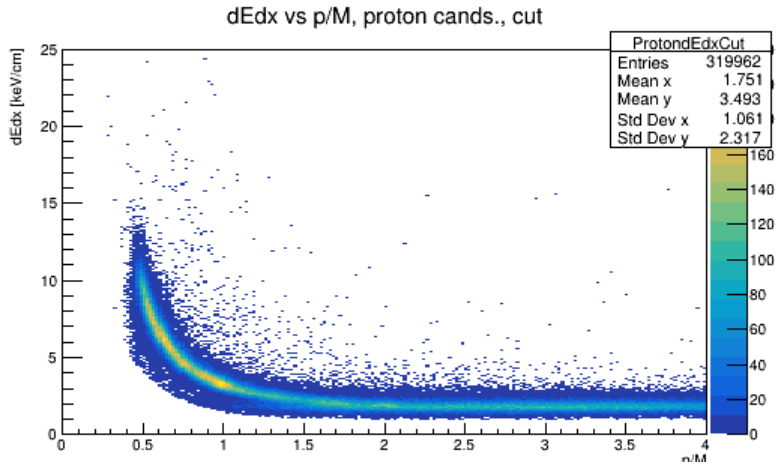


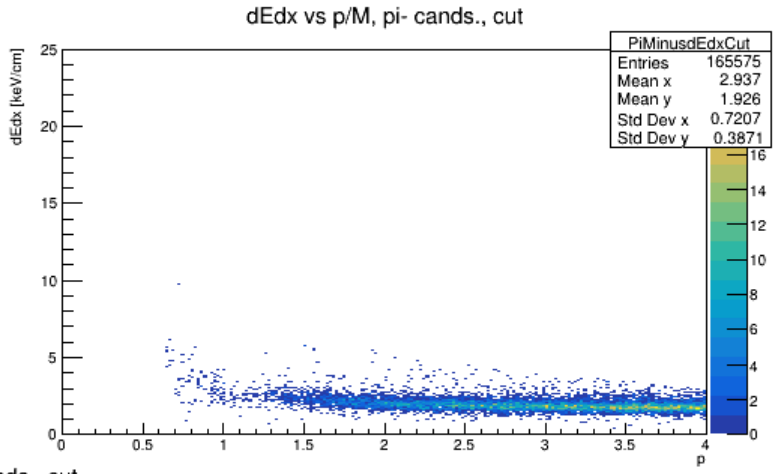



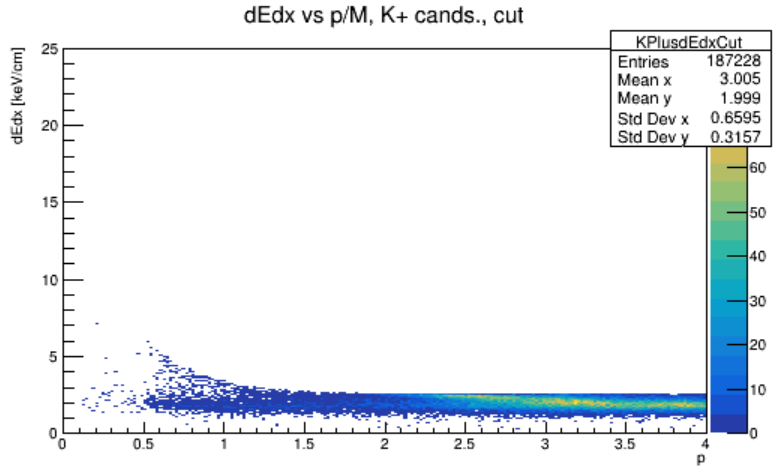



# *Kp* Production

- Variables used for the selection (dE/dx):



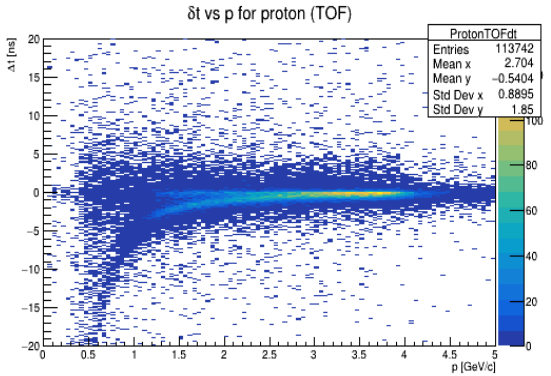



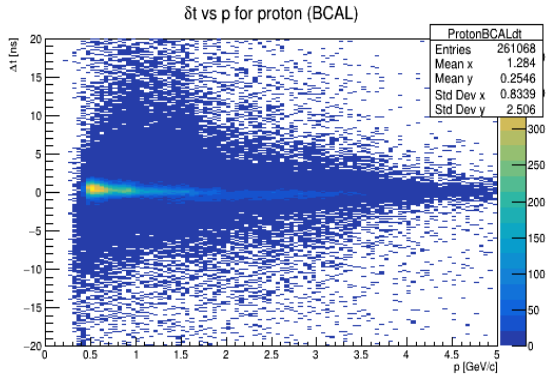



# $Kp$ Production

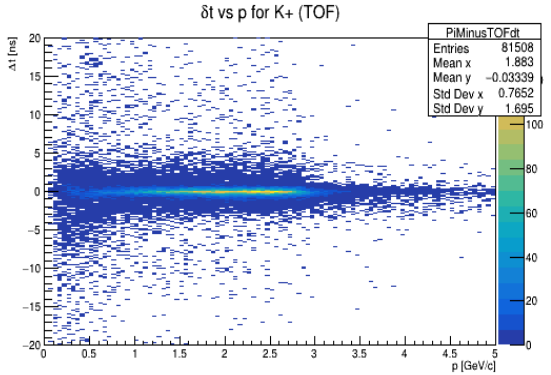
- Variables used for the selection (time difference):

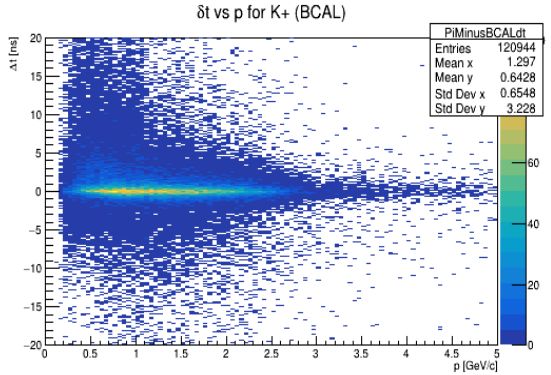
Proton:



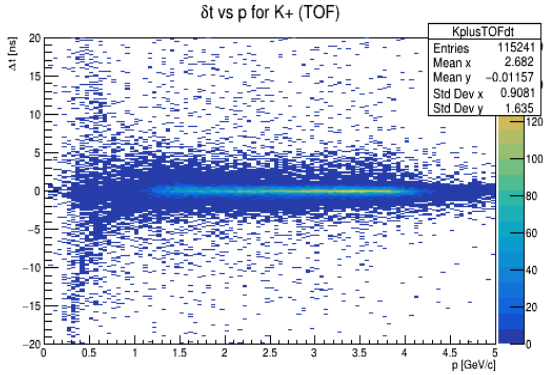



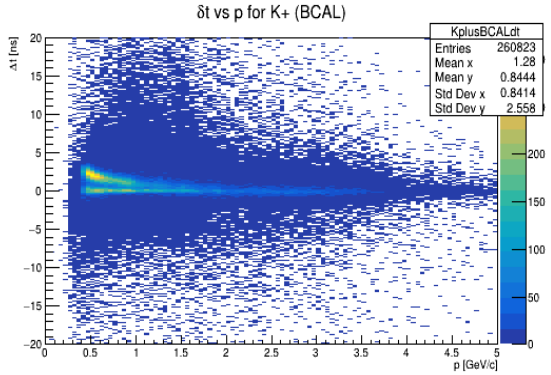

Pion:



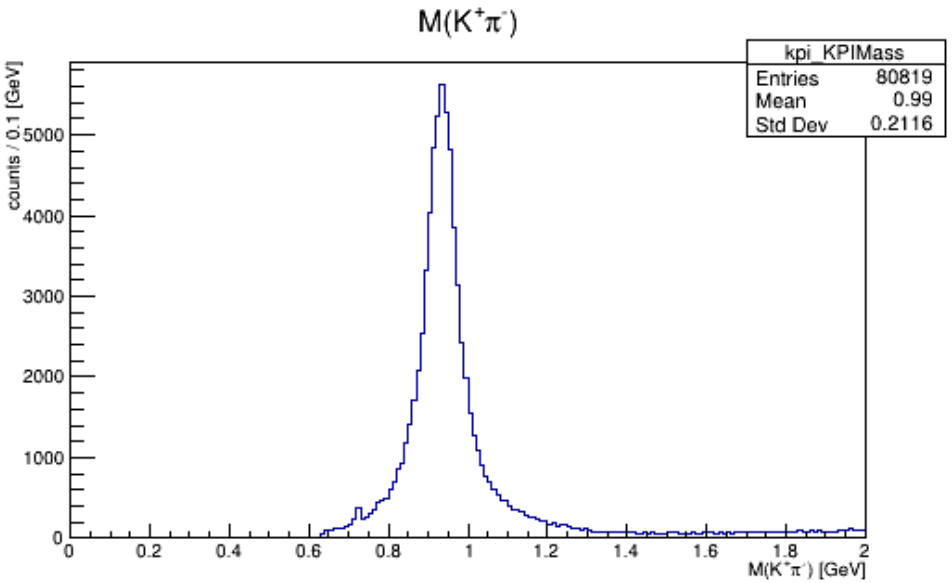

Kaon:

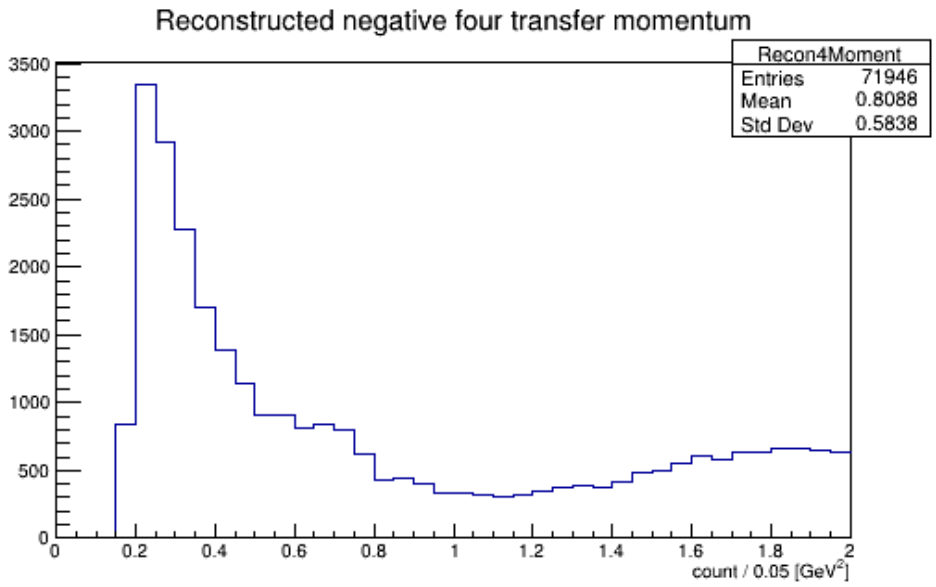


# $K\rho$ Production

- Reconstructed variables (after selection):




Total efficiency (acceptance) < 27%

# Outlook

- Short term outlook (one week):
  - Improve the selection.
  - Include the kinematic fitter in the plugin.
  - Broaden the energy range.
  - Estimate the resolution/efficiency.

- Long term outlook (2 weeks):
  - Simulate the other kpi reactions with isospin exchange (generator already build).
  - Estimate the resolution/efficiency.