



Meson Spectroscopy with Neutral Kaon Beam

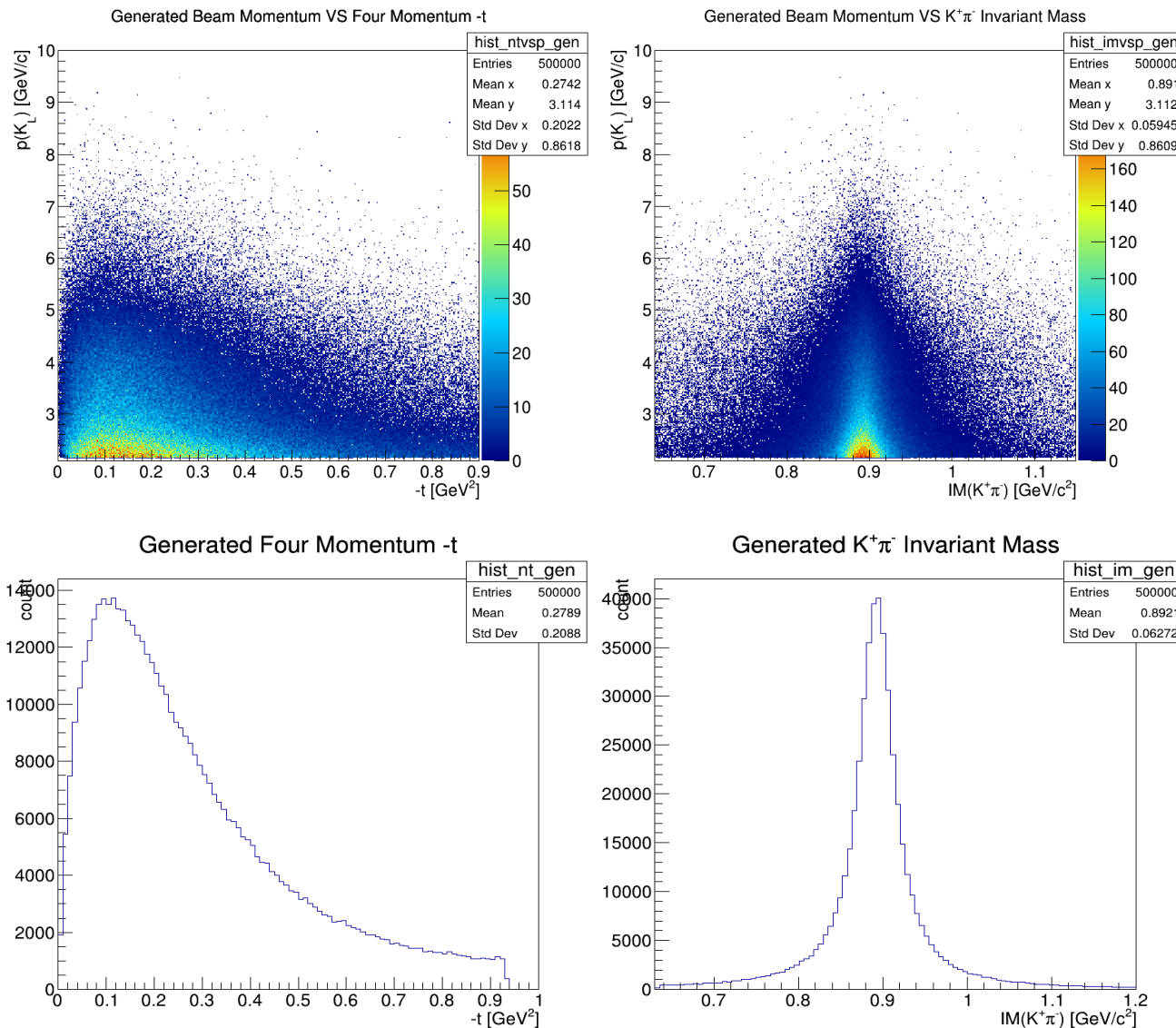
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$K\pi$ Production

- The equivalent reaction of $K_L p \rightarrow K^*(892)^0 p$ with charged Kaons beam:
 - ➔ $K^+ p \rightarrow K^*(892)^+ p$
 - ➔ $K^- p \rightarrow K^*(892)^- p$
- Charge independence and Clebsch-Gordan-Coefficient consideration indicate that:
 - ➔ $\sigma(K^- p \rightarrow K^*(892)^0 n) > \sigma(K^- p \rightarrow K^*(892)^- p)$.
- The pheno study on neutral exchange production, with charged kaon beam, using Regge model showed a good agreement with the experimental results.
- The new simulation is based on Regge Model described by Nucl.Phys.B10(1969) 151-168.
- More details can be found in the updated proposal (ongoing).

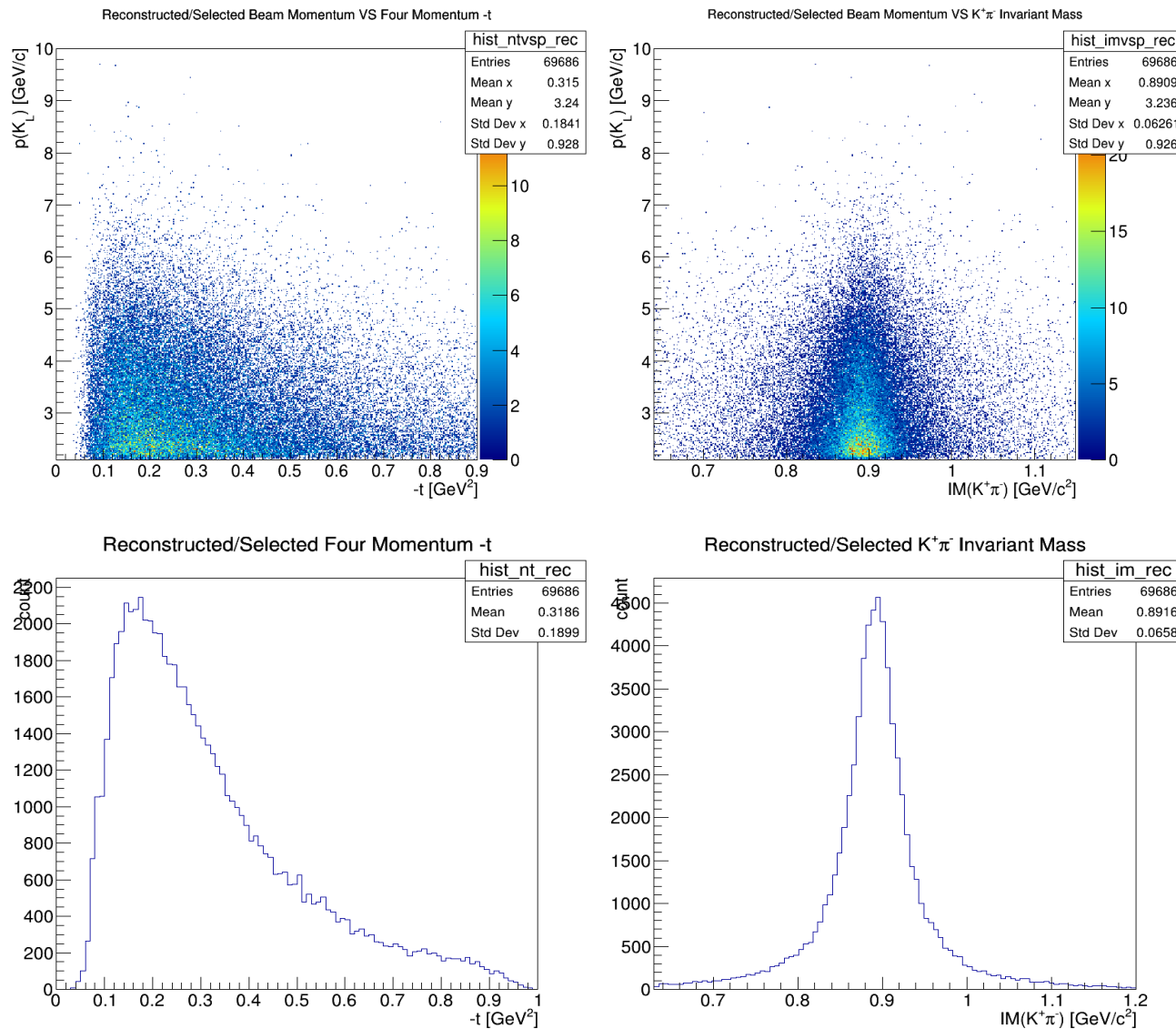
$K\pi$ Production

- Generated Monte-Carlo using Regge Model (500 kevents):



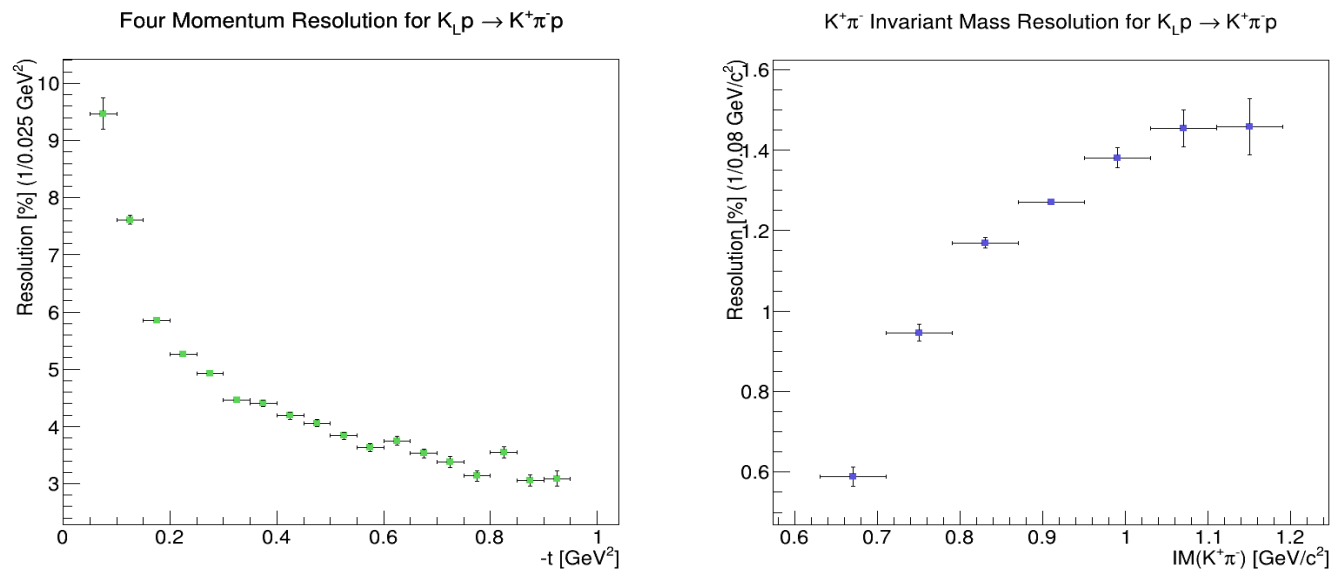
$K\pi$ Production

- Reconstructed+Selected MC (integrated efficiency = 13.7%):



Resolution

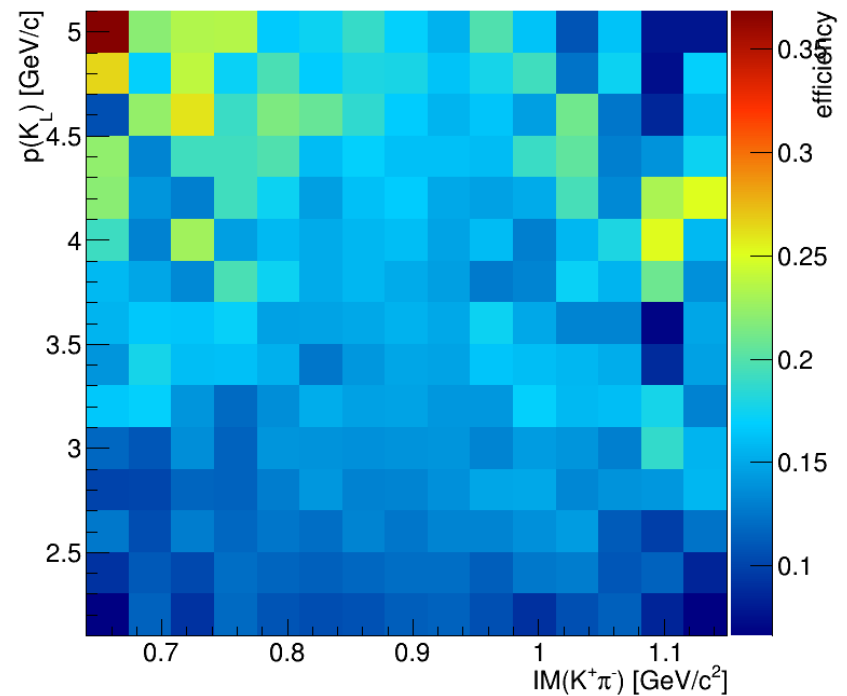
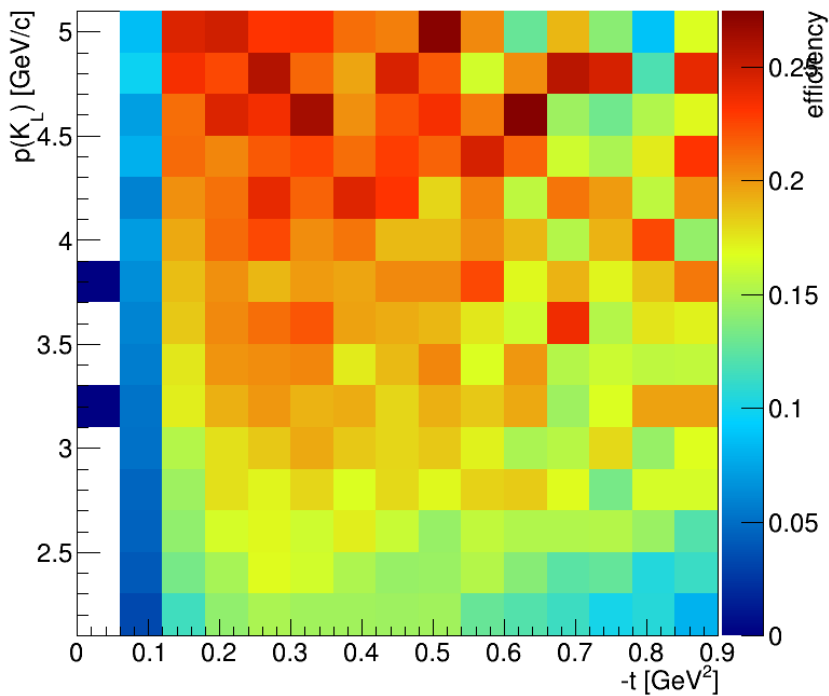
- Relative resolution ($\Delta x/x$) of the main variables used in the scattering study (4-momentum transfer & $K\pi$ invariant mass):



- The average resolution of $-t$ is $\sim 0.02 \text{ GeV}^2$ which is sufficient to improve the binning resolution of the previous experimental studies, where the binning varies between 0.02 and 0.05 GeV^2 (references can be found in the updated proposal).
- The average resolution of the invariant mass $\sim 10 \text{ MeV}/c^2$.

Efficiency

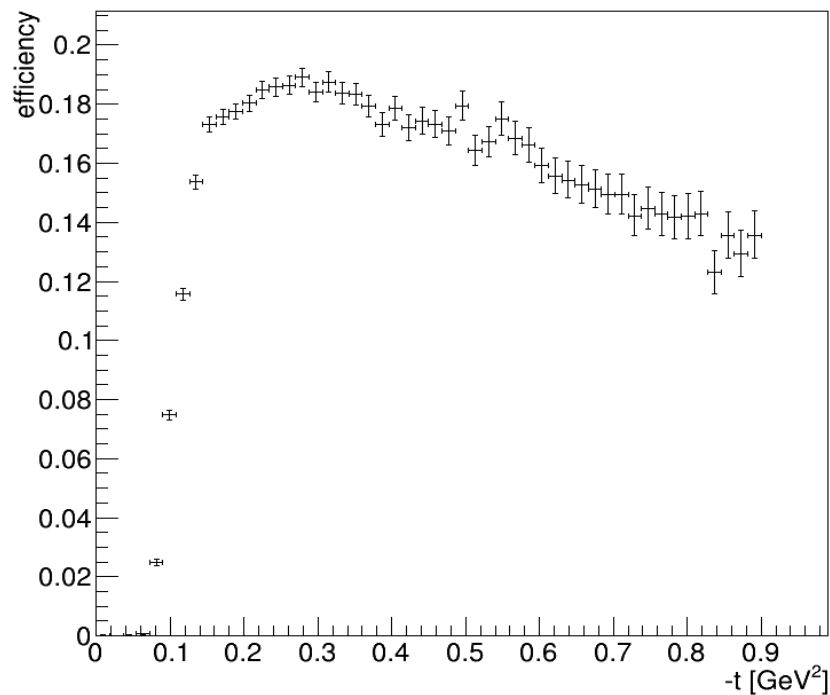
- Reconstruction + selection efficiency:



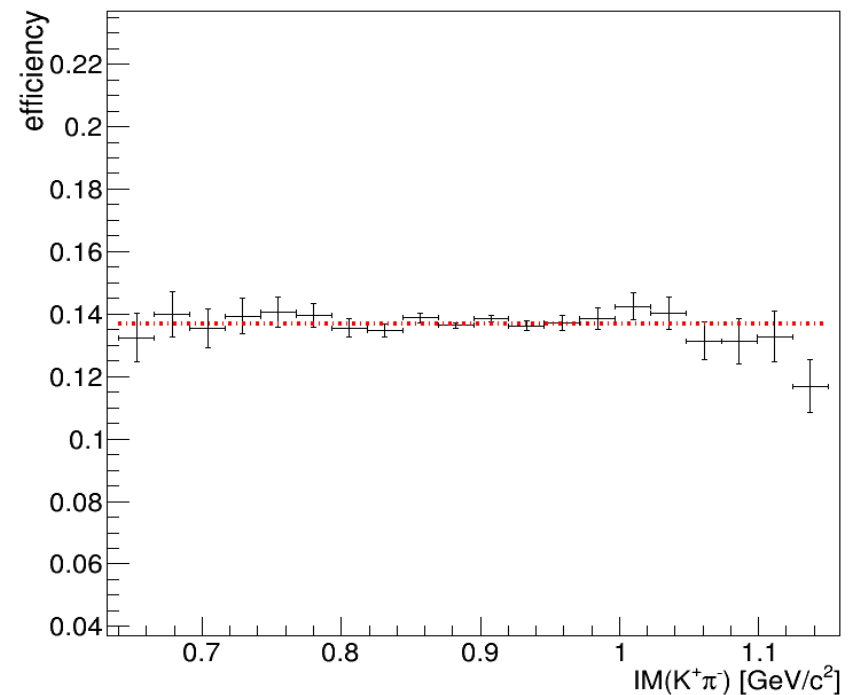
Efficiency

- Reconstruction + selection efficiency (integrated over beam momentum):

Transfer Four Momentum Efficiency



$K^+\pi^-$ Invariant Mass Efficiency



Event Estimation

- The two main studies that are expected to be performed on $K\pi$ system:
 - ➔ Scattering study of $K\pi \rightarrow K\pi$ interaction (Form factor measurement, kappa investigation ...): require $-t < 0.2$ to ensure pion exchange.
 - ➔ Production mechanism study and PWA: require beam momentum binning.

- The expected number of events for beam momentum p is estimated as:

$$N(p) = \sigma_{K^*}(p) \times BR(K^* \rightarrow K^+ \pi^-) \times n_K n_t T \times \epsilon_{tot}(p) \times \epsilon_\pi(p)$$

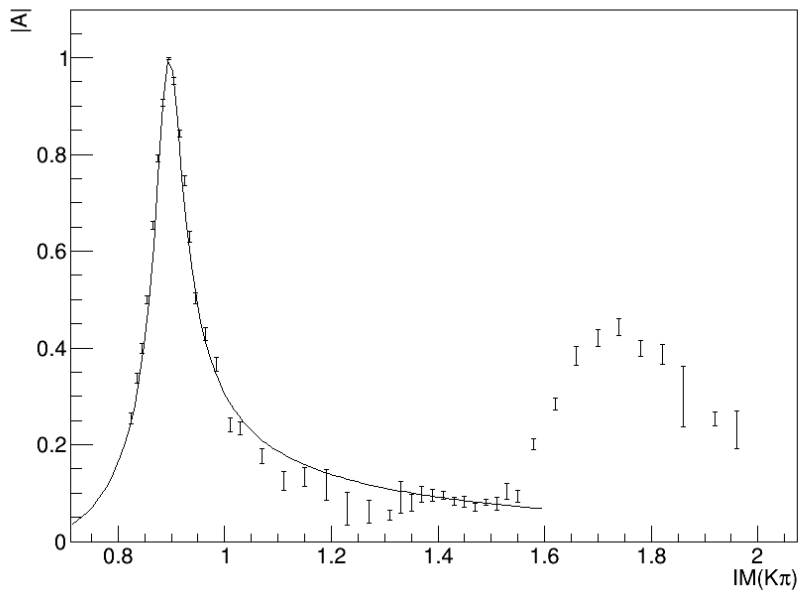
- ϵ_π : low $-t$ range selection efficiency.
- *e.g.*: For $0.14 < -t < 0.2 \text{ GeV}^2$, $2.20 < p < 2.25 \text{ GeV}/c$ and $T=100$ days the number of expected events is $N(p = 2.225) = 143 \cdot 10^3$ events, which is \sim # LASS events (all resonance).
($\sigma(2,225) \sim 1.2\text{mb}$, $BR \sim 1$, $n_k = 10^4$, $n_t = 1.68$, $\epsilon_\pi = 0.179$)

- $N_{tot} = 2 \cdot 10^6$ event of $K_L p \rightarrow K^*(892)^0 p$.

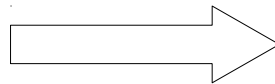
Impact on P-wave study

- Use Lass fit results to generate toy MC according to the expected number of event and fit the MC to extract the mass/width/amplitude/phase-shift and compare the results (work ongoing):

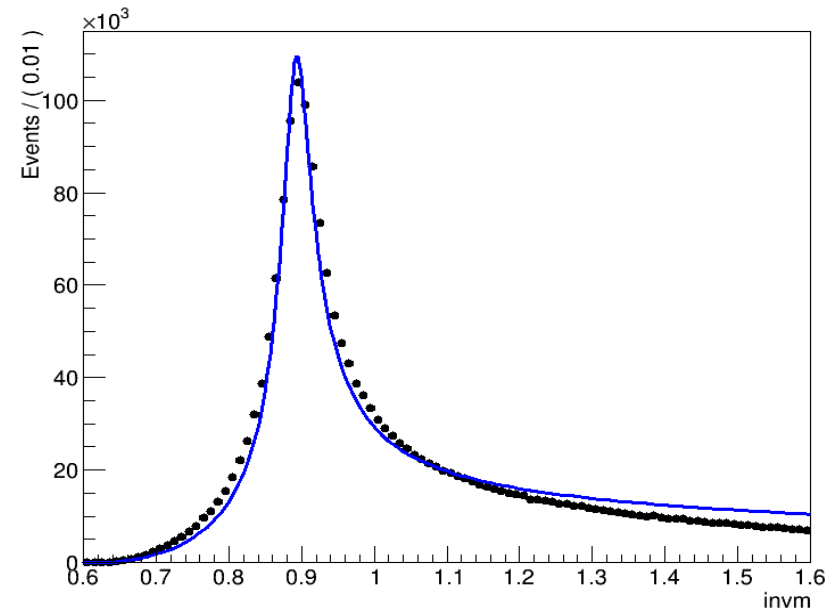
Lass Result



Toy MC



A RooPlot of "invm"

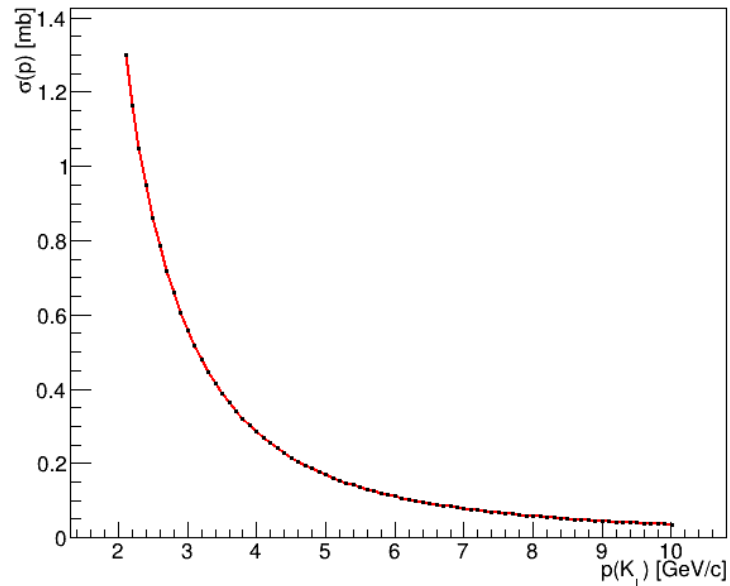


Non converged fit, model need to be updated

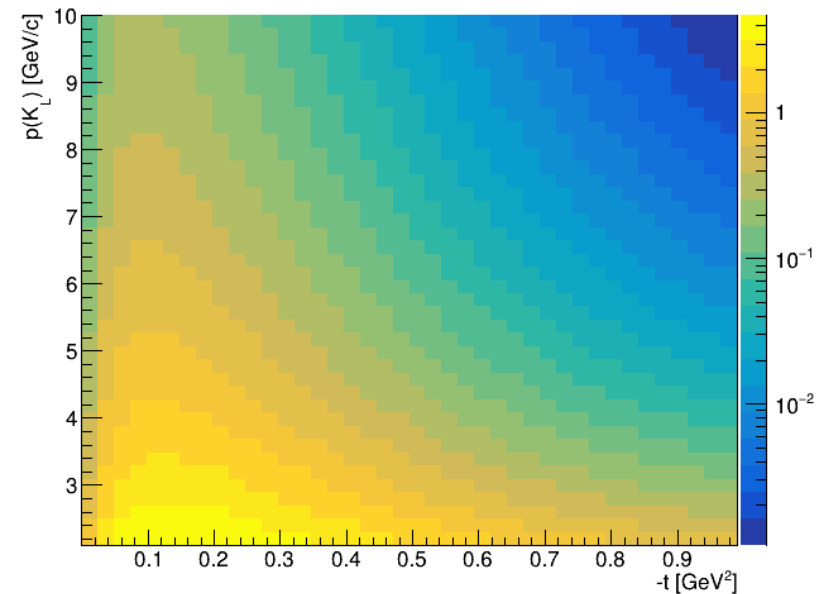
Backup

Regge Model (Backup)

Cross-section of $K_L p \rightarrow K^+ \pi^- p$ function of K_L momentum



Differential cross section $d\sigma/dt$ of $K_L p \rightarrow K^+ \pi^- p$ VS $p(K_L)$



Differential cross section $d\sigma/dt$ of $K_L p \rightarrow K^+ \pi^- p$ for $p(K_L) = 5.5$ GeV/c

