Kaon Beam-Spin Asymmetry at Low Q^2 from KaonLT Data

Ivan Zhenchuk
KaonLT Experiment, Jefferson Lab Hall C
June 20, 2025

Introduction

Attempt to measure beam-spin asymmetry (BSA) of Kaon Λ at kinematic setting of Q^2=0.5 and W=2.40.

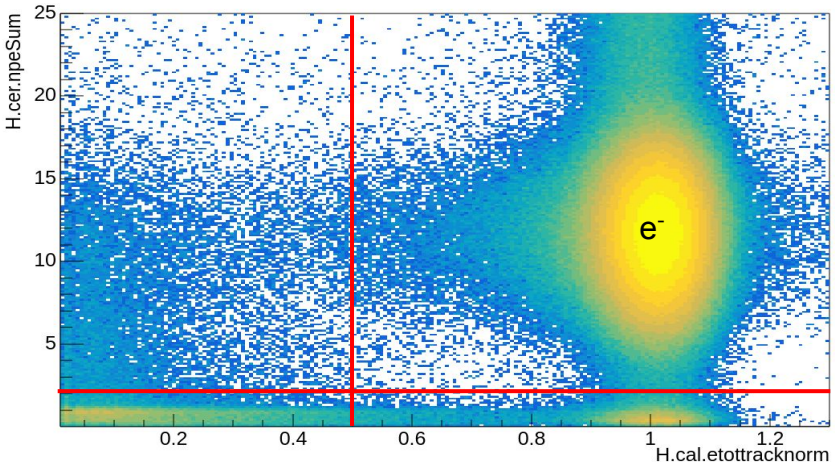
$$BSA = \frac{1}{P}\left(\frac{Y^+ - Y^-}{Y^+ + Y^-}\right) \propto \frac{\sigma_{LT'}}{\sigma_0}$$

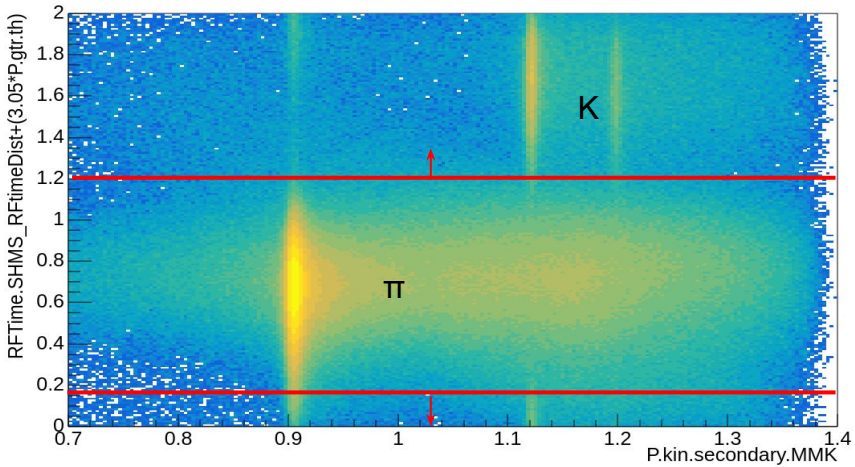
The process involves extracting clean Kaon Λ yield from missing mass histogram, finding asymmetry from BSA's **φ** dependance, and getting final results from **t** dependance

PID

Pair SHMS Hadron and HMS electron with HMS cuts

Use corrected RF distribution to select PID cut for Kaons and Pions.

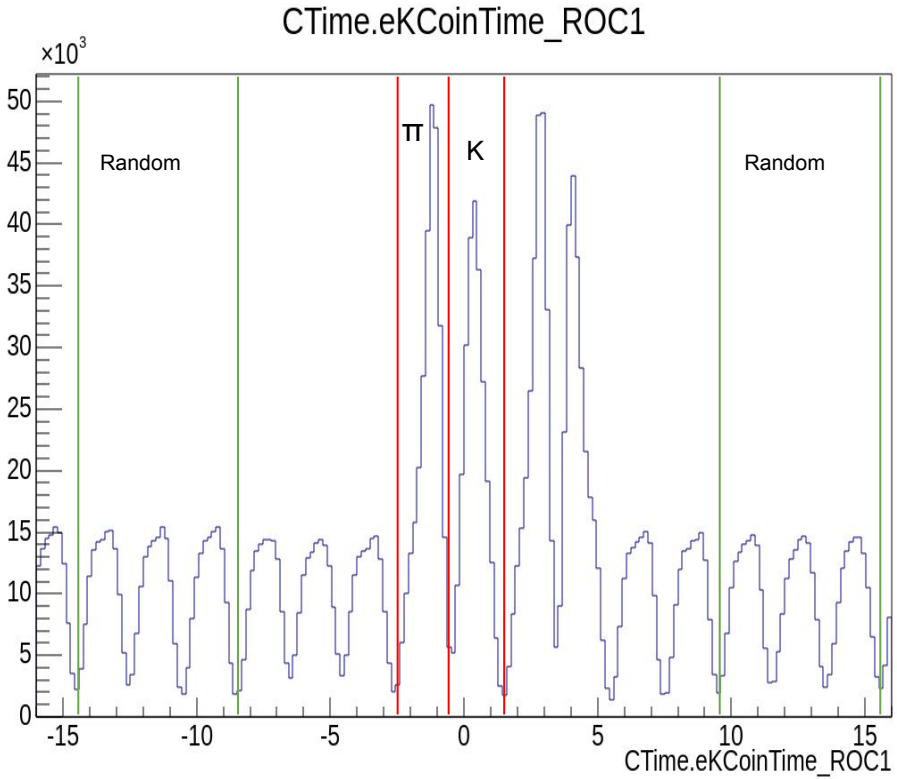




Cuts:
-0.5 < CTime.eKCoinTime_ROC1 < 1.5 (Kaon peak cut)

Setting: Q^2=0.5, W=2.40, Pol 38%, Center, +1 Hel.

CTime



Cuts:

0.5 < H.cal.etottracknorm

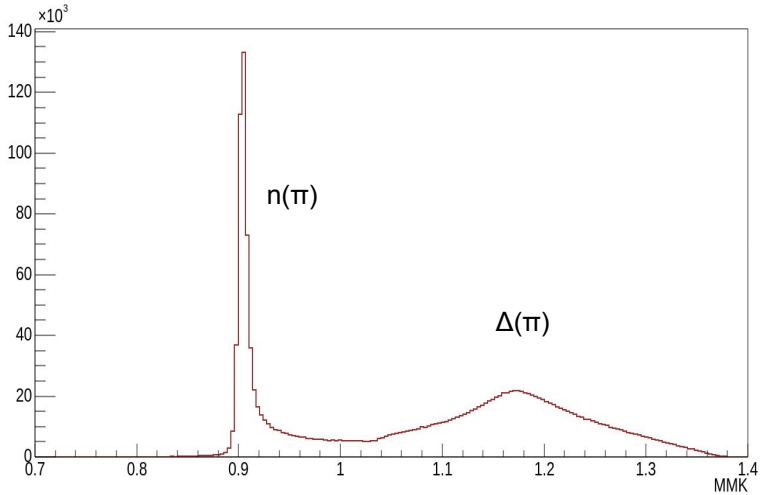
2.0 < H.cer.npeSum

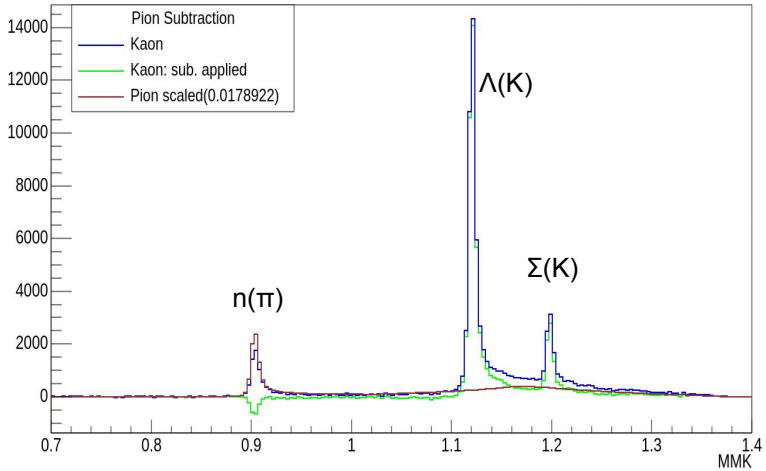
1.2 < RF corrected < 0.15 (Kaon selection)

Setting: Q^2=0.5, W=2.40, Pol 38%, Center, +1 Hel.

Pion and Kaon samples

No dummy subtraction





Cuts:
HMS, RF(pion), CTime(pion)
Subtractions:
Random with pion PID

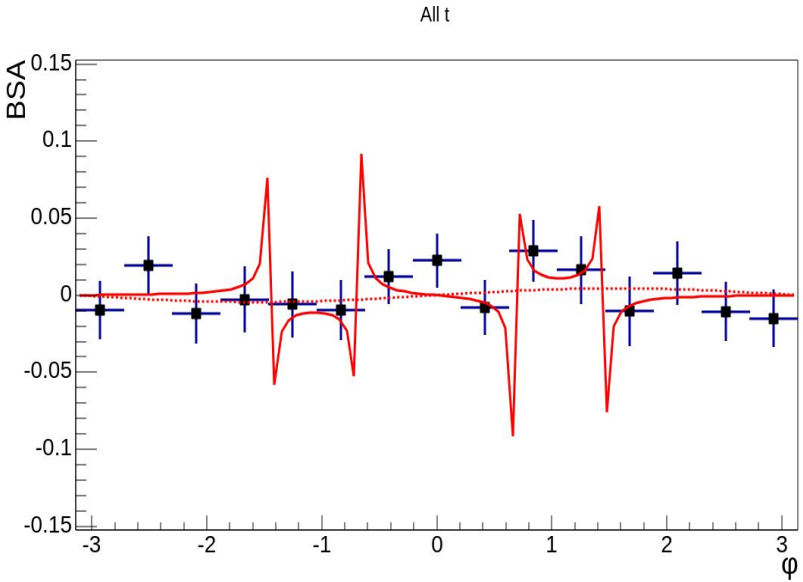
Cuts:
HMS, RF(kaon), CTime(kaon)
Subtractions:
Random with kaon PID

Setting: Q^2=0.5, W=2.40, Pol 38%, Center, +1 Hel.

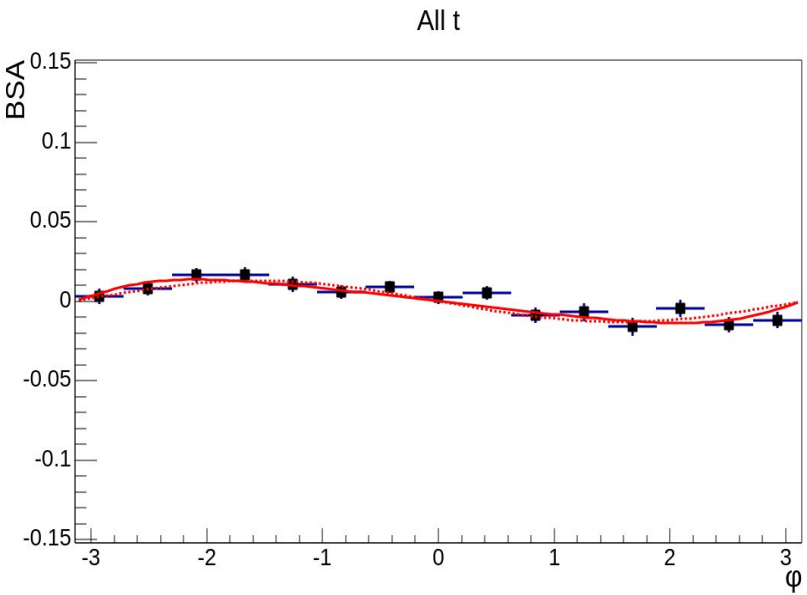
Preliminary Asymmetry (all t)

Setting: Q^2=0.5, W=2.40, Pol 38%

Kaon Λ



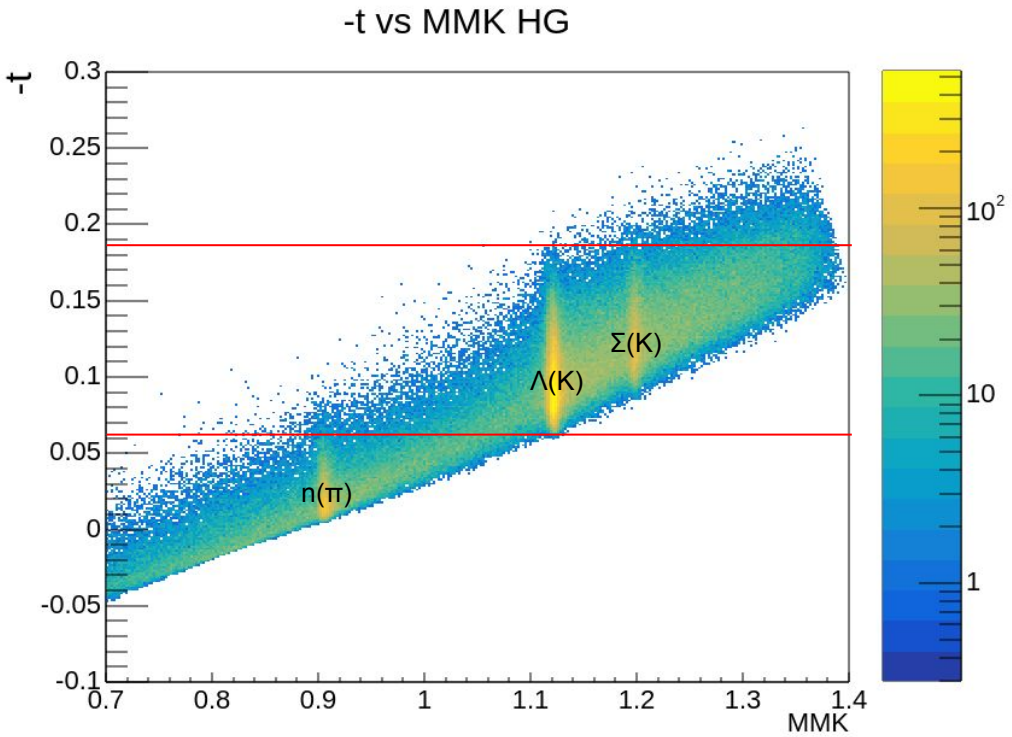
Pion n



Particle yield t bin dependance

Cuts:
Kaon PID, Kaon CTime, HMS

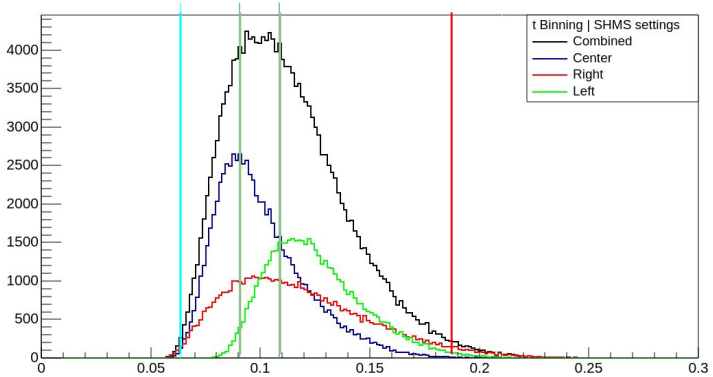
t binning separates kaons and pions very cleanly



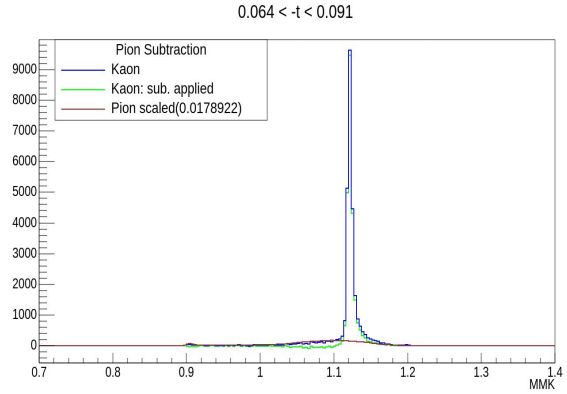
Setting: Q^2=0.5, W=2.40, Pol 38%, center, +1 Hel.

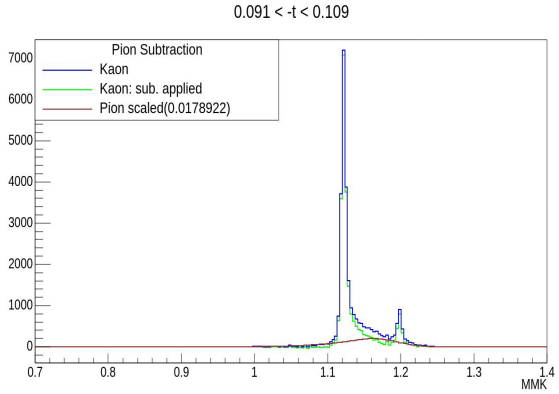
T-bining

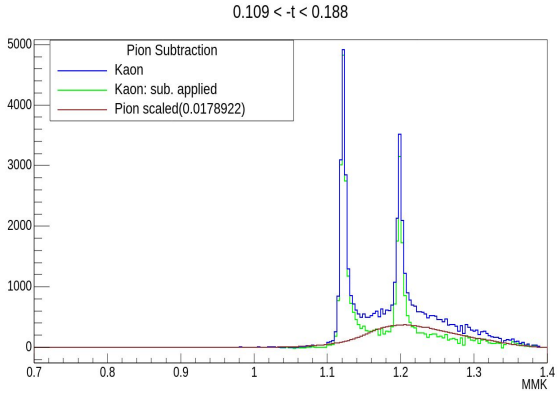
t bin (center)	N counts
0.064 - 0.091	42838
0.091 - 0.109	49430
0.109 - 0.188	87830



Cuts (t bins):
Kaon PID,
1.1 < MMK < 1.15







Setting: Q^2=0.5, W=2.40, Pol 38%, center, +1 Hel.

Preliminary Asymmetry (t binned)

Setting: Q^2=0.5, W=2.40, Pol 38%

Approximated BSA $A \cdot Sin(\phi)$

Complete BSA $$\frac{A \cdot Sin(\phi)}{1 + B \cdot Cos(\phi) + C \cdot Cos(2\phi)}$$