

# Exclusive Kaon Electro- Production @ EIC

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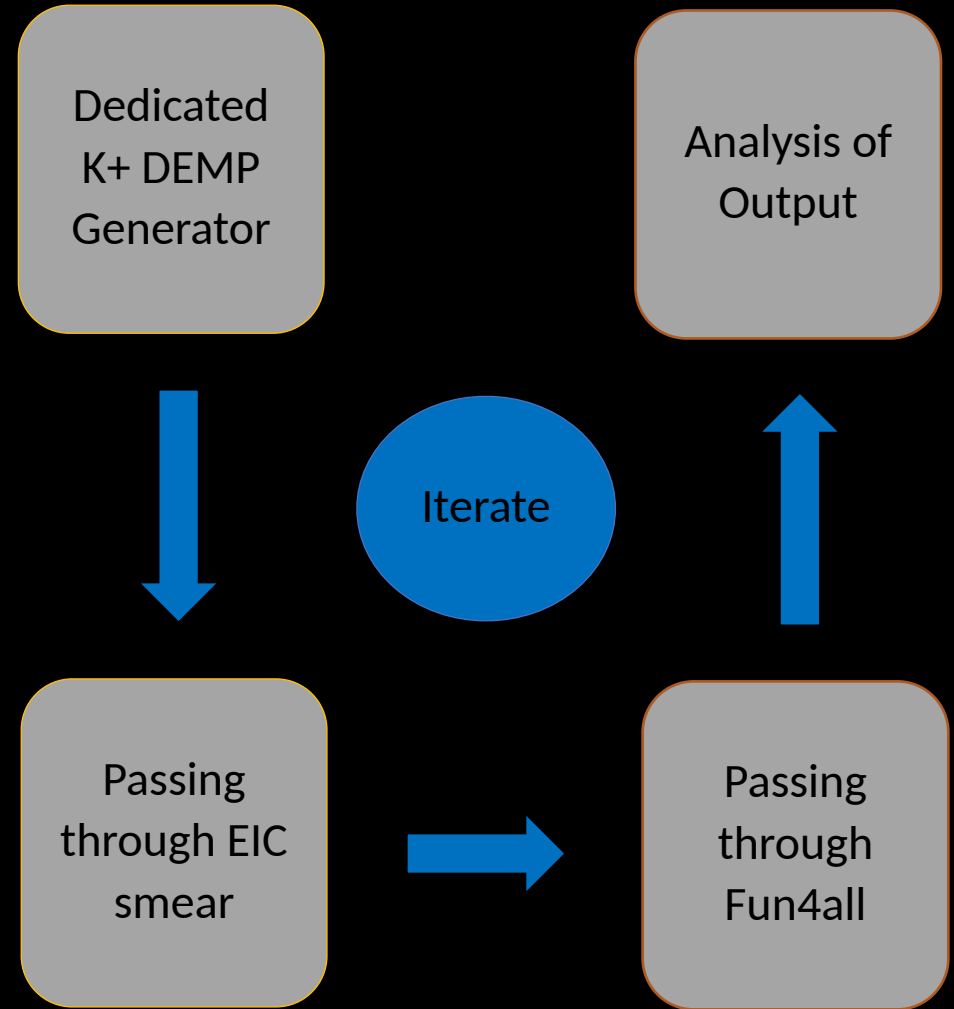
# Introduction

## Challenging Measurement

- A triple coincidence needed with reasonable precision
- Two unique channels ( $\Lambda$  and  $\Sigma^0$ )
- Critical to precisely separate  $\Lambda$  and  $\Sigma^0$  decays

## Specific Detector Requirements

- ZDC
- Tracking
- Hadron Endcap



# Objectives

- Produced some events using Kaon DEMP generator.
- Use 5on41 beam energy combination.
- Weighting transferred from event generator to Fun4All output.
- Primary Goal
  - ZDC Acceptance Efficiency
    - This requires all the daughters from lambda/sigma to be detected in ZDC.
    - Only possible for neutral decay channel (i.e neutron and 2/3 photons)
- Secondary Goal
  - $-t$  resolution from reconstructed lambda/sigma
  - Kaon Form Factor projections

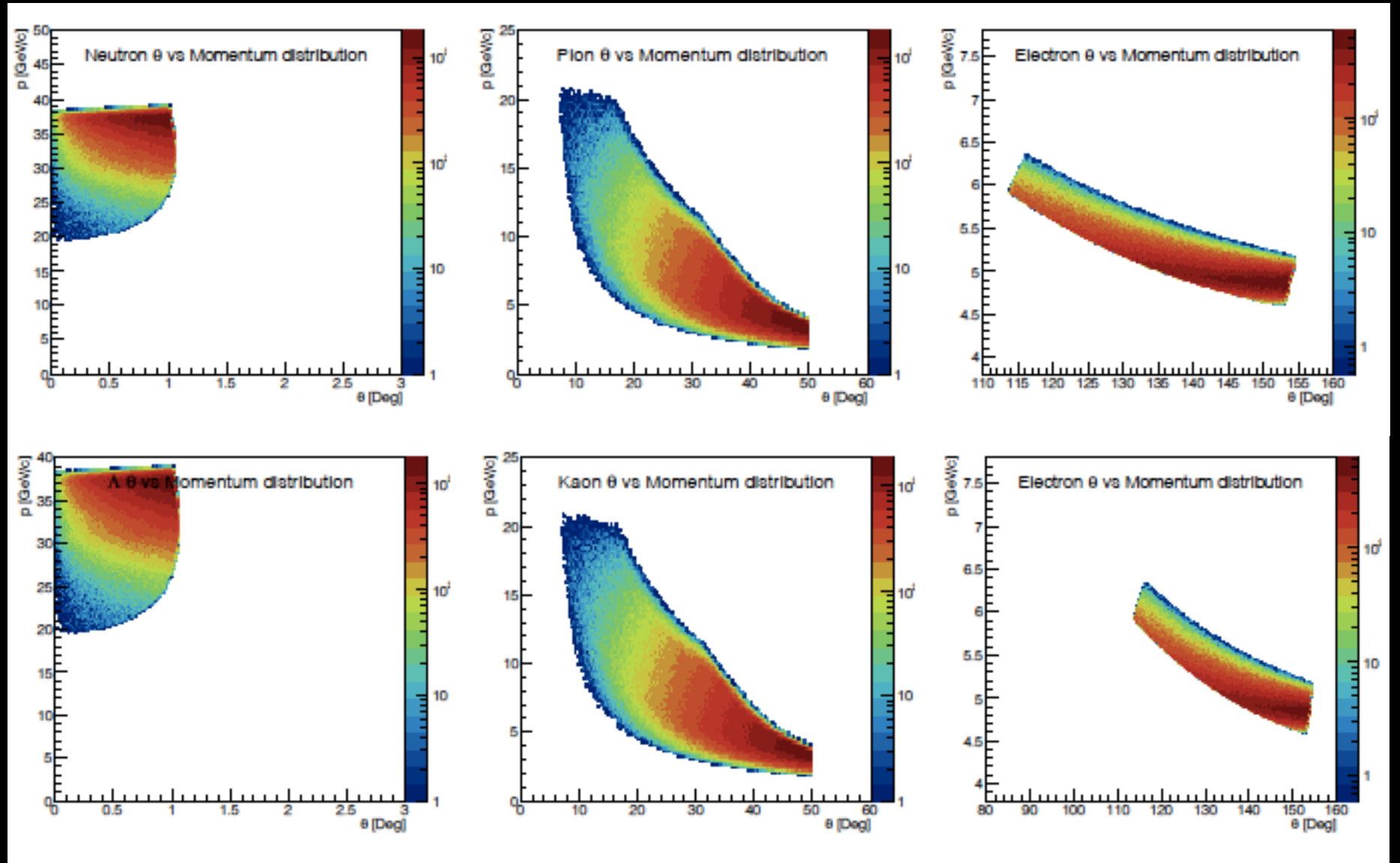
# Kaon DEMP Generator

# $\pi^+ \nu/s K^+$

➤  $Q^2 \geq 5$

➤  $-t < 0.5$

Pion



Kaon

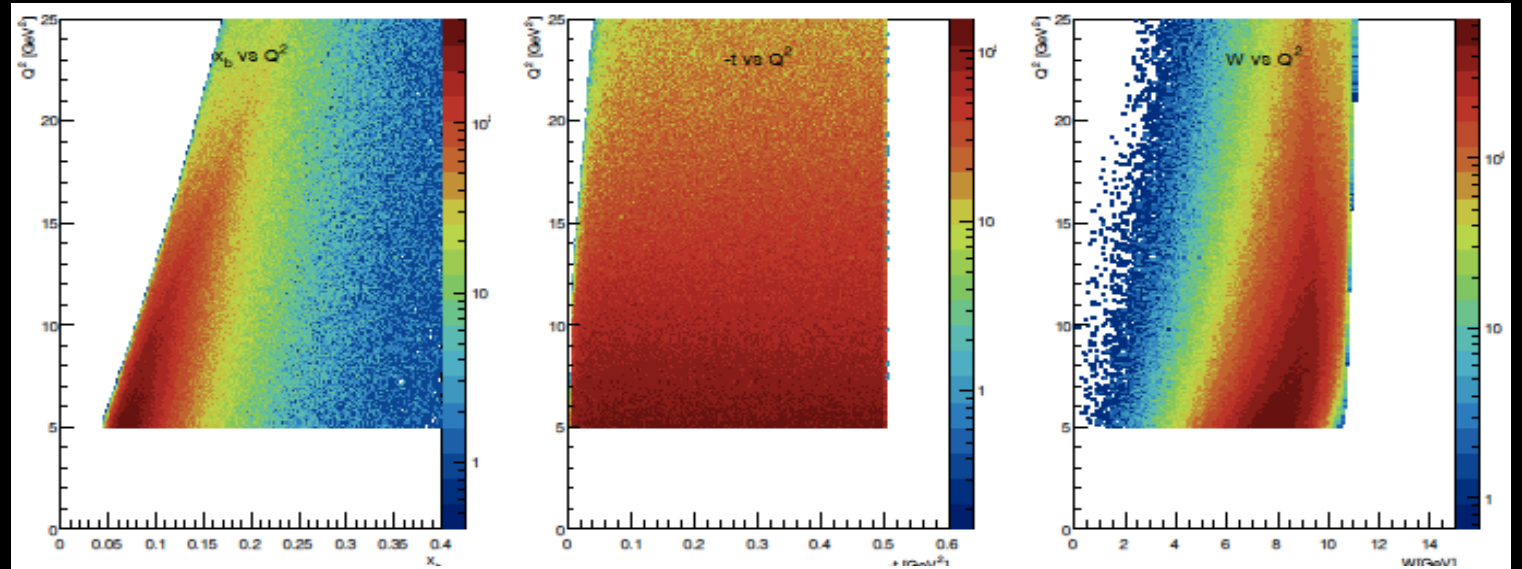


# $\pi^+ u/s K^+$

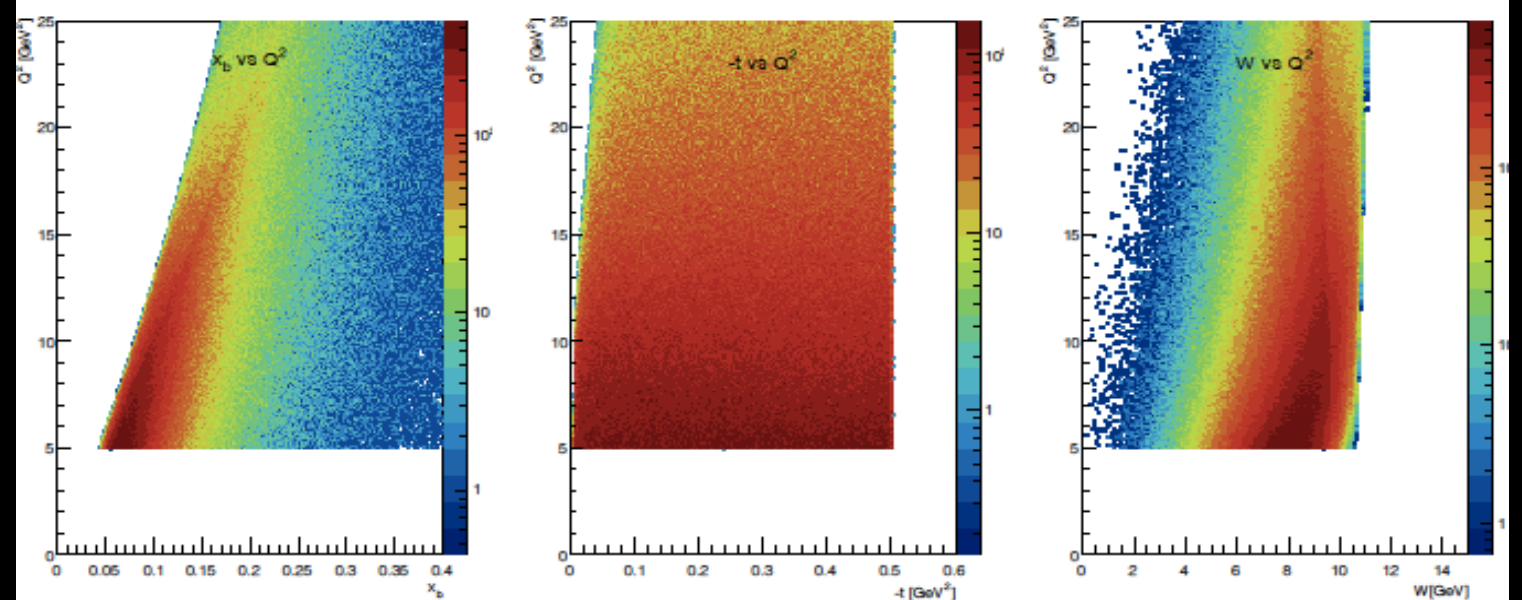
➤  $Q^2 \geq 5$

➤  $-t < 0.5$

Pion



Kaon

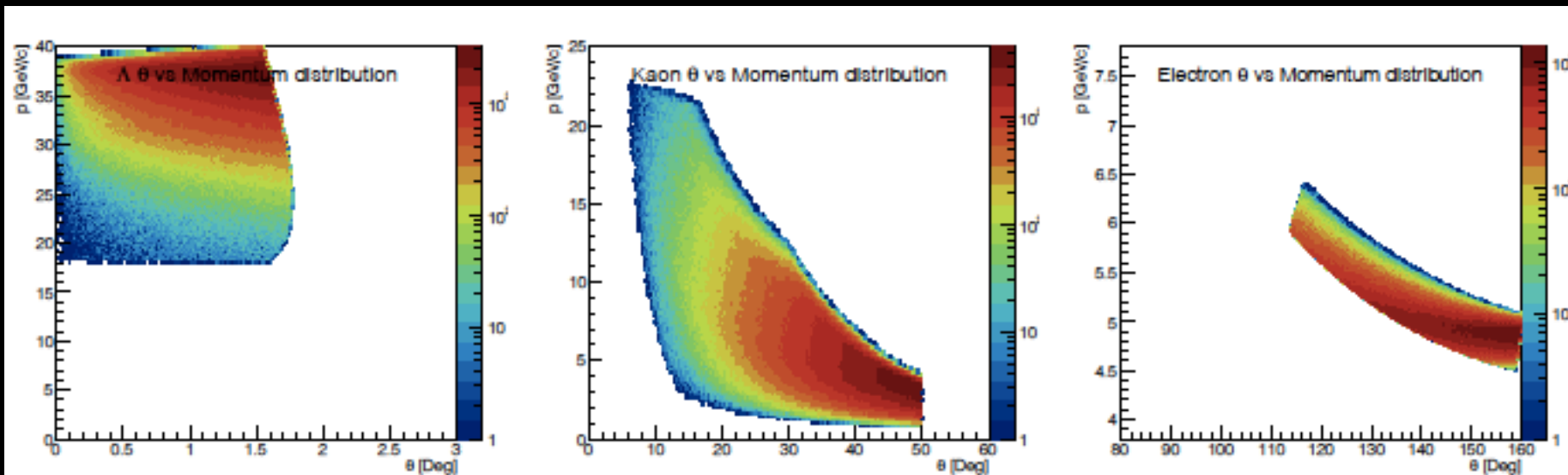


# $\Lambda$ $\nu/s$ $\Sigma^0$

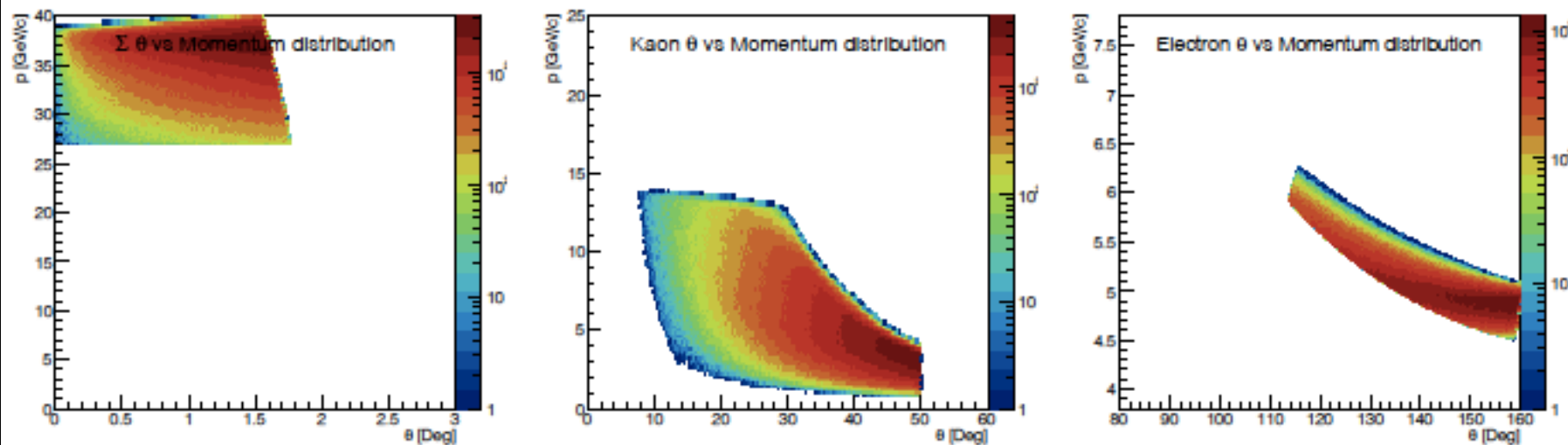
$\triangleright Q^2 \geq 3$

$\triangleright -t < 1.2$

$\Lambda$



$\Sigma^0$

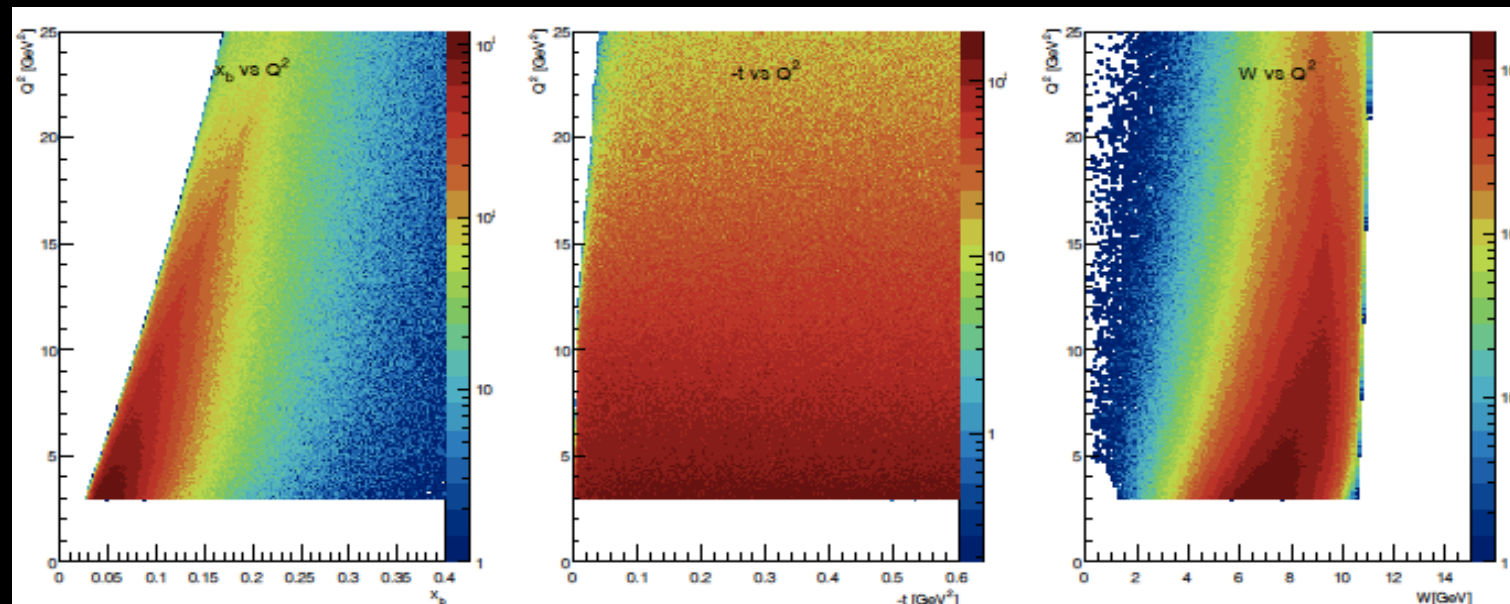


# $\Lambda$ $\nu/s$ $\Sigma^0$

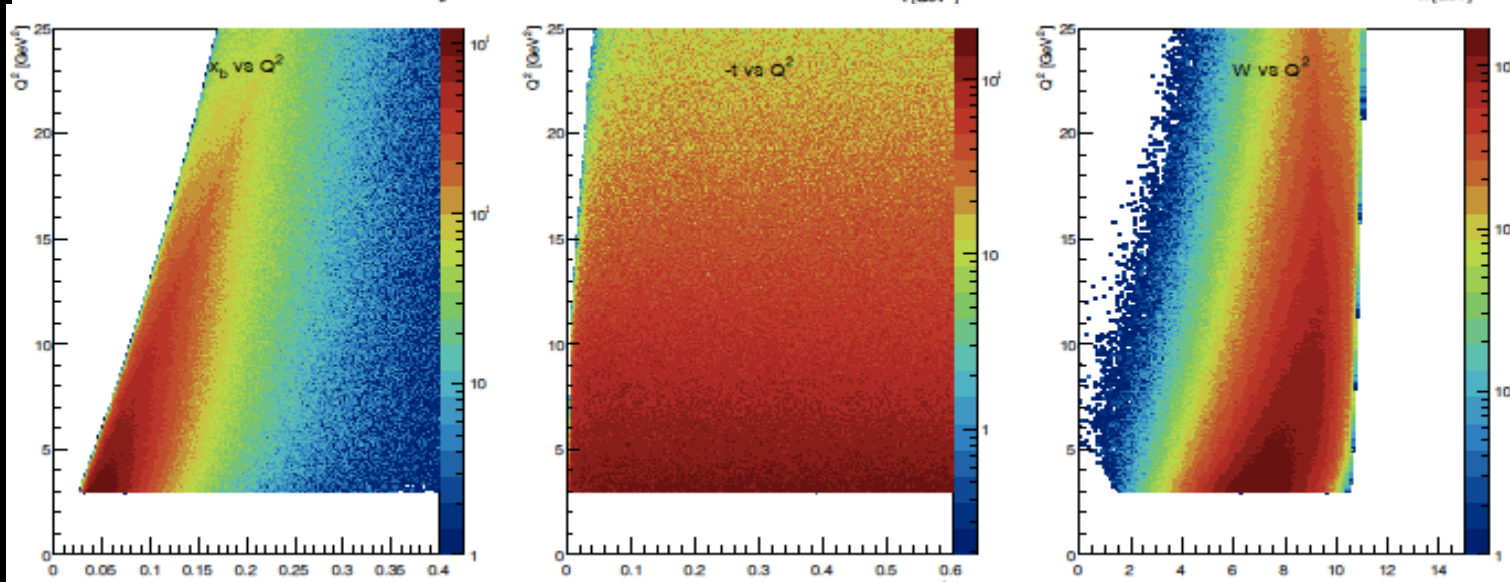
➤  $Q^2 \geq 3$

➤  $-t < 1.2$

$\Lambda$



$\Sigma^0$



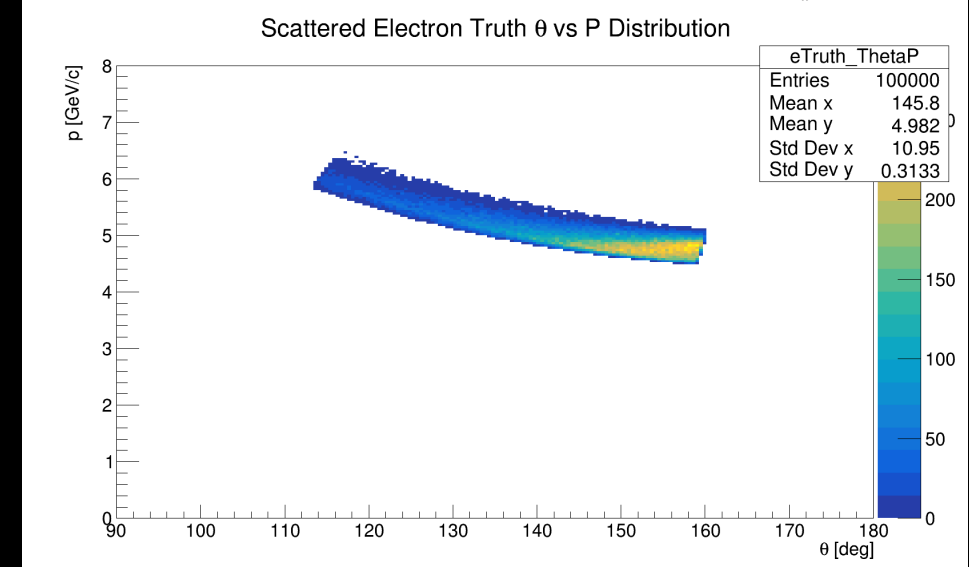
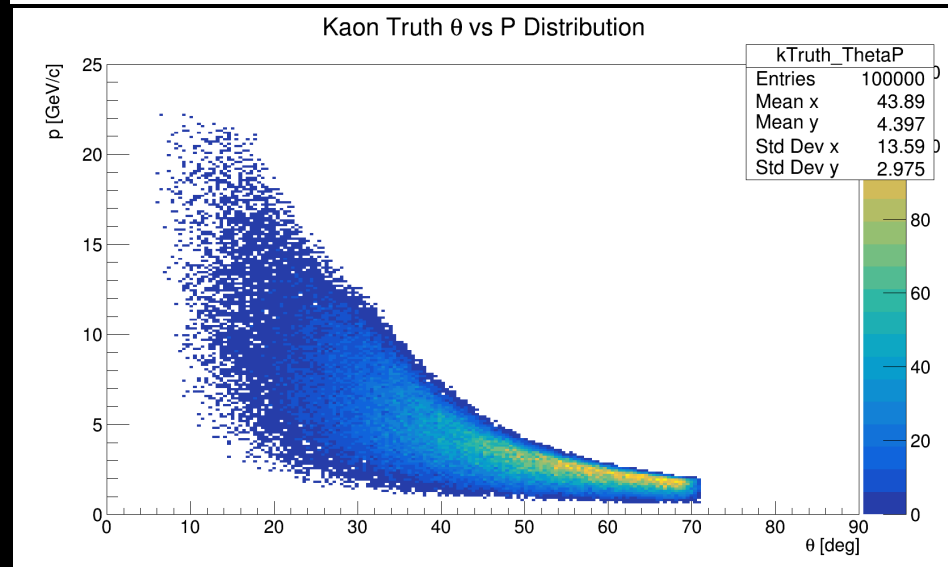
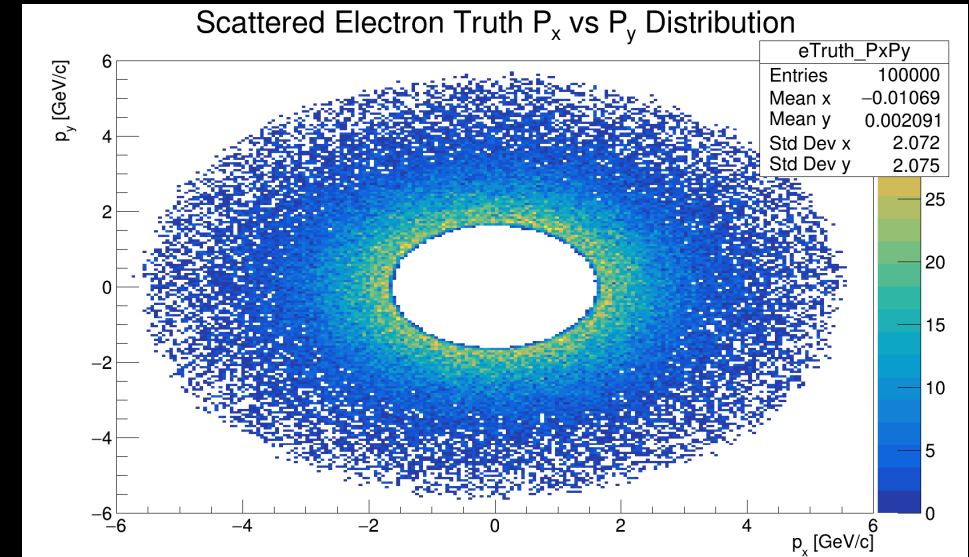
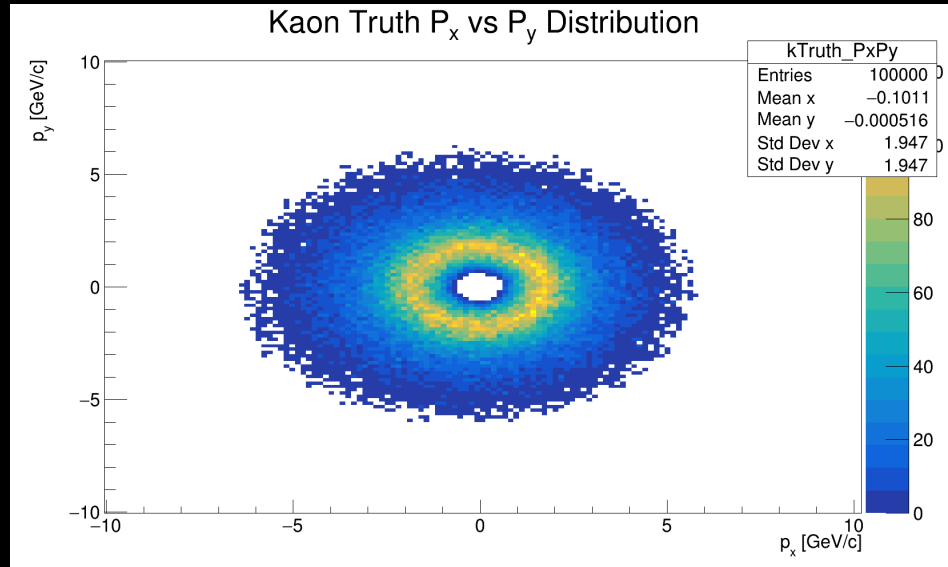


# Fun4All (or Fun4None) Output

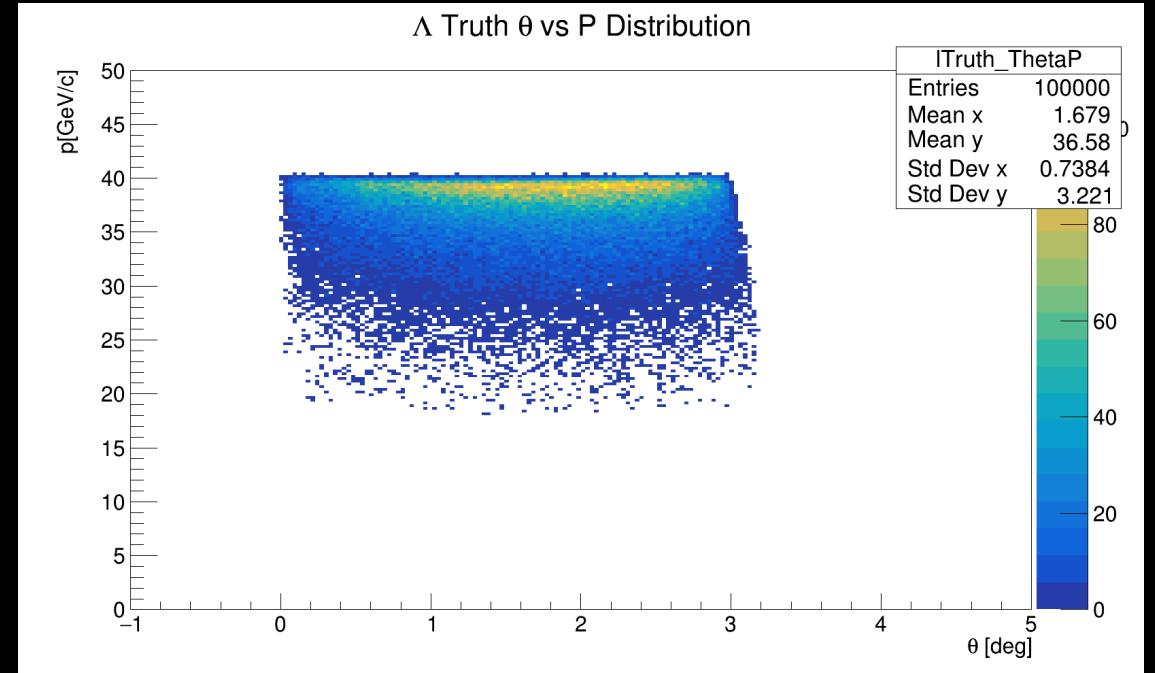
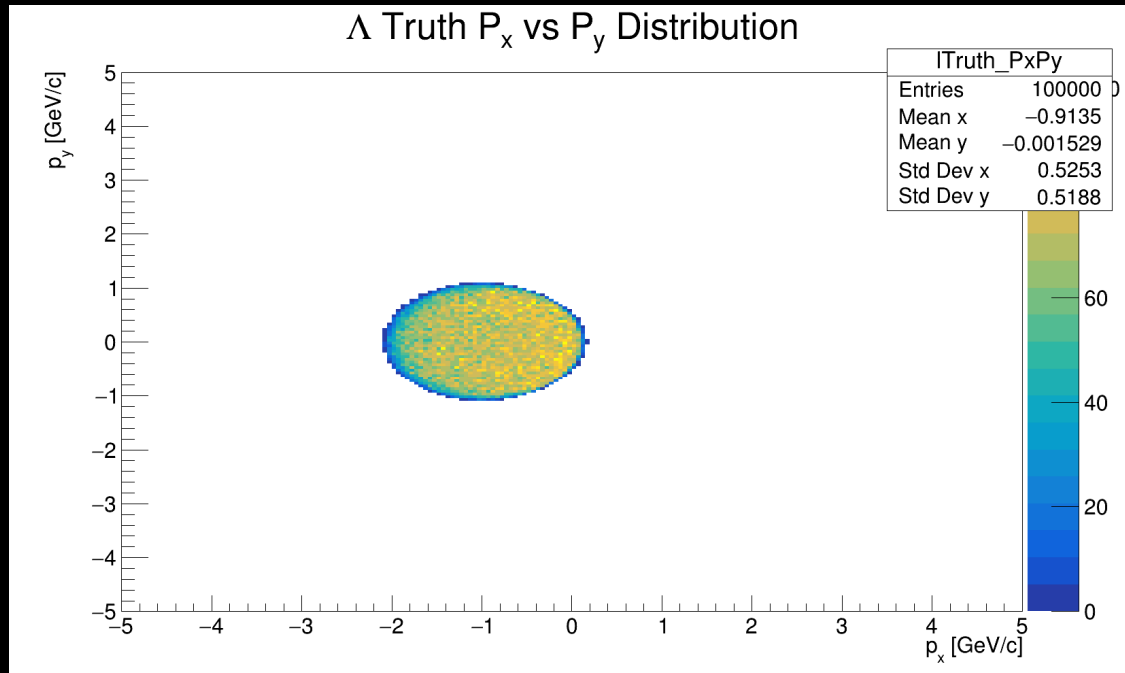
# Key Points

- The decay of the baryon (Lambda or Sigma) are not done in DEMP generator instead they are supposed to be handled in Fun4All.
- Looking at K/Lambda channel first since it has on two decay steps whereas K/Sigma has 3 decay steps which is more challenging.
- For both neutral and charge decay, using an energy cut of  $>3$  GeV on the stable baryon.
- Only looking at truth information for now.

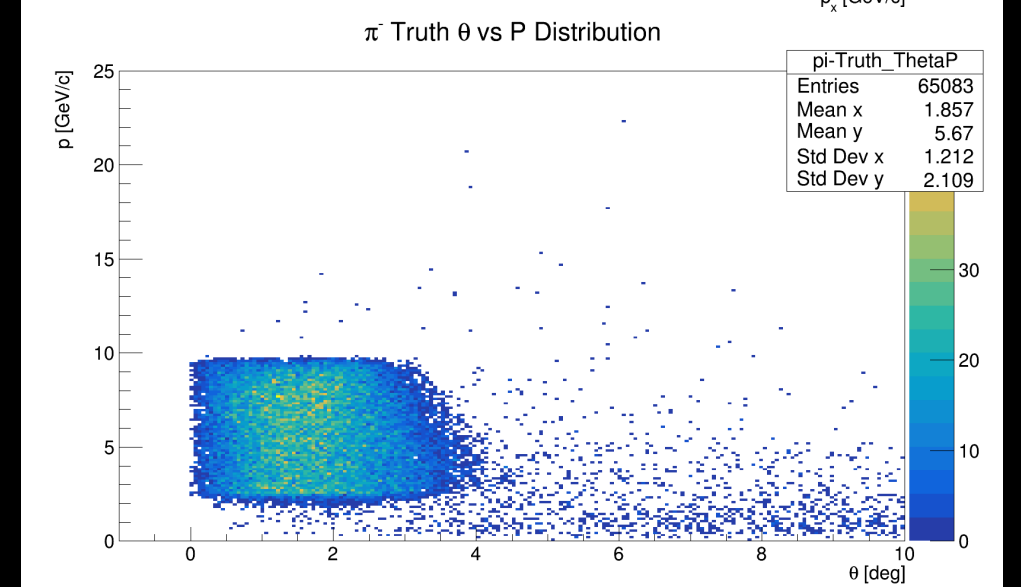
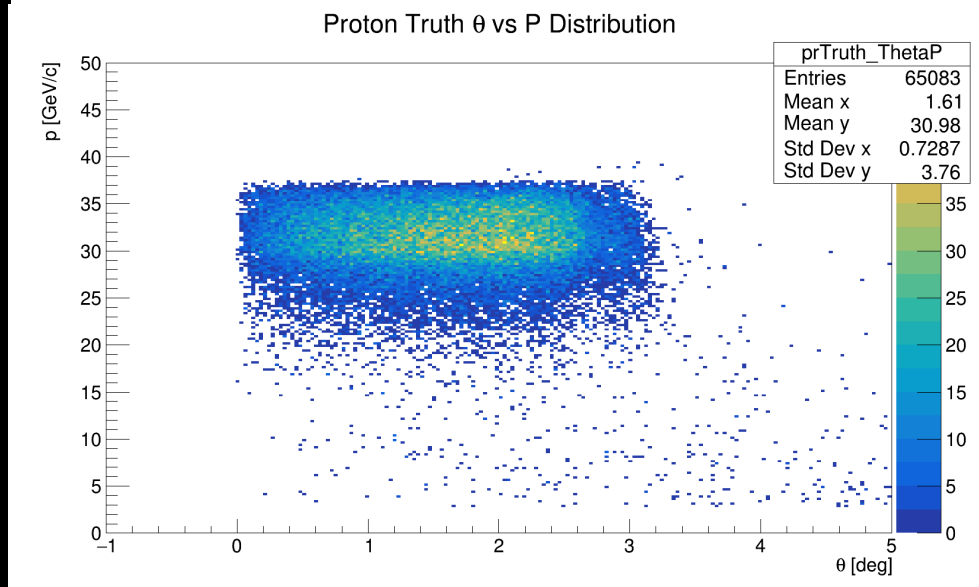
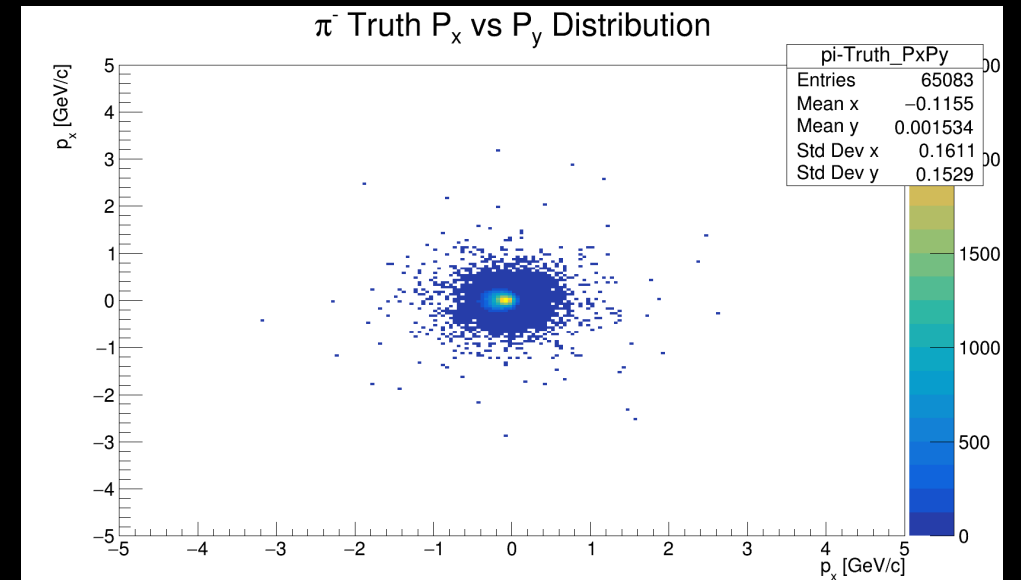
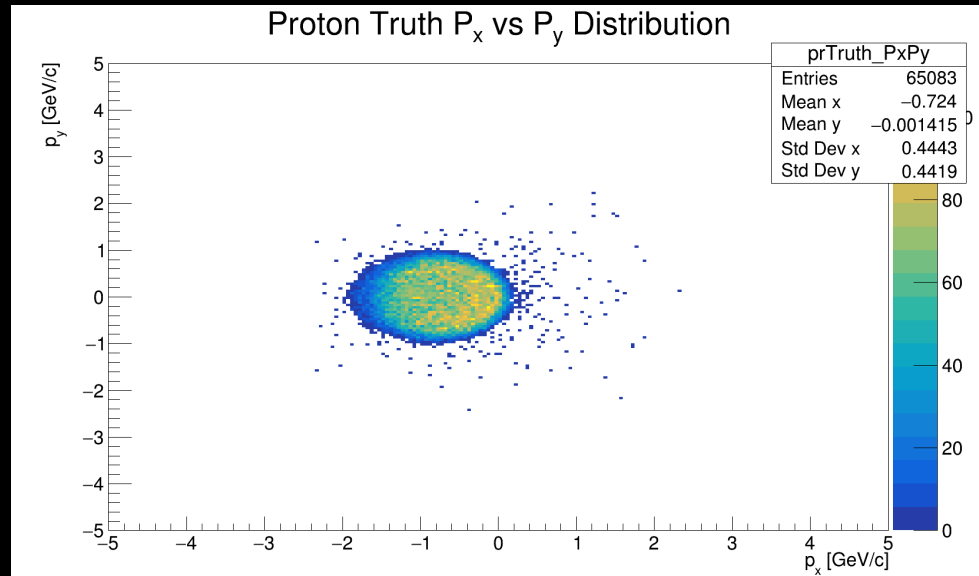
# Scattered Electron & Kaon



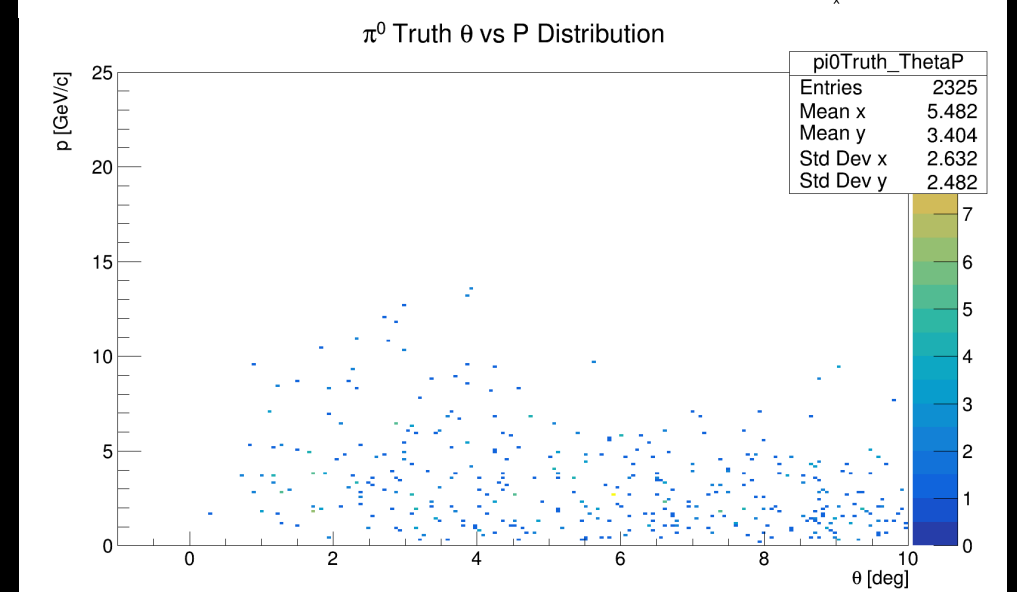
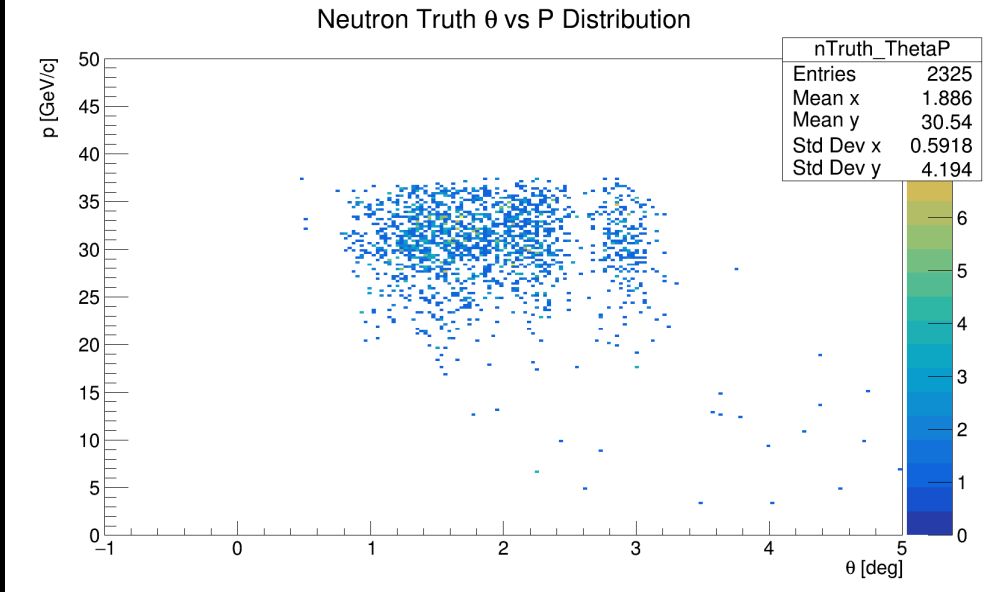
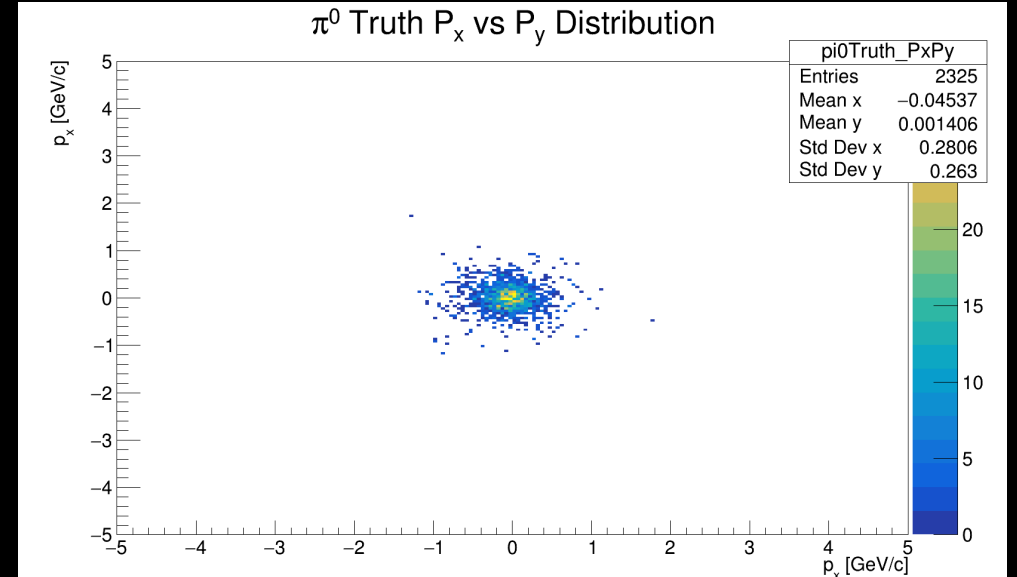
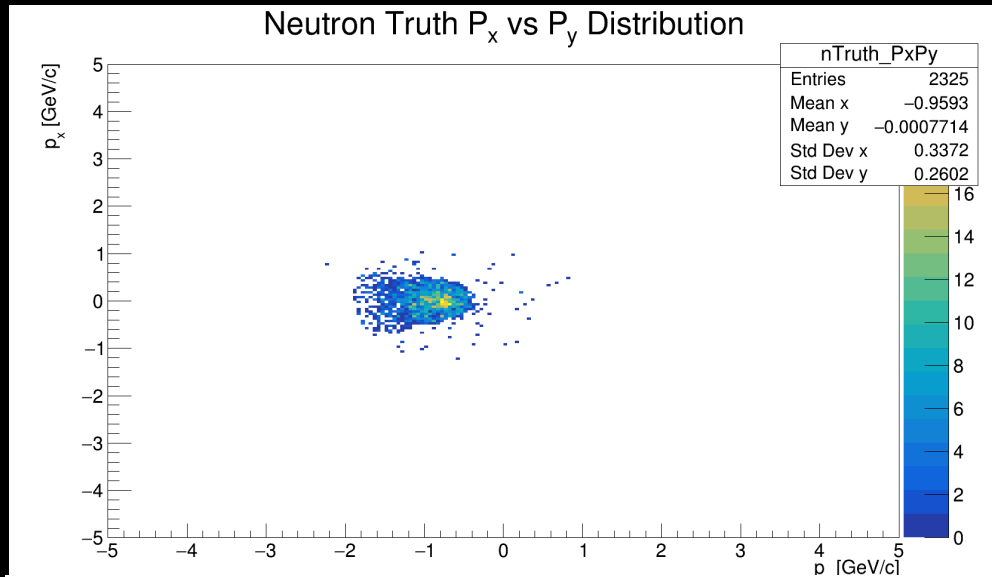
# $\Lambda$ Distributions



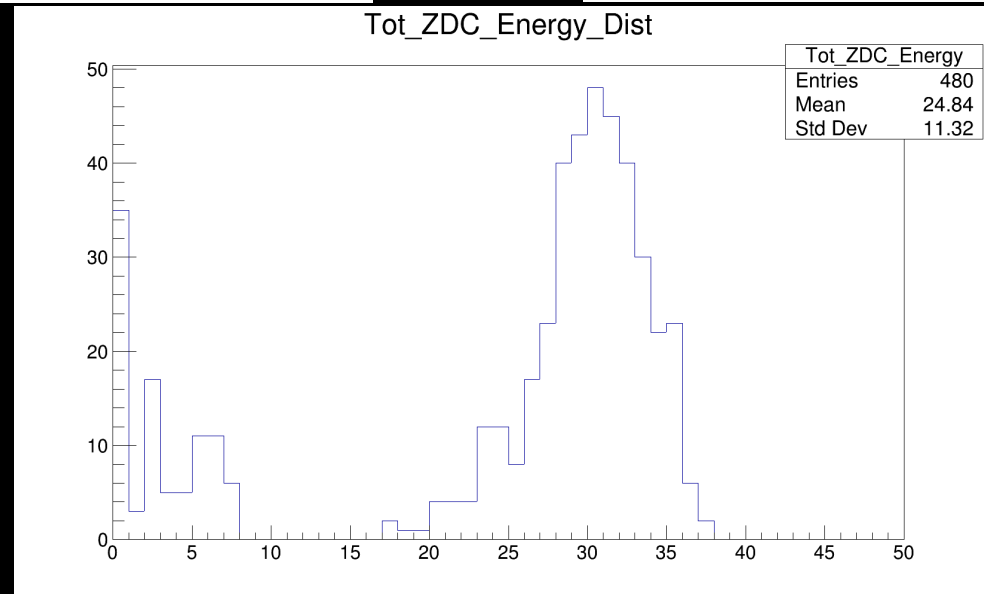
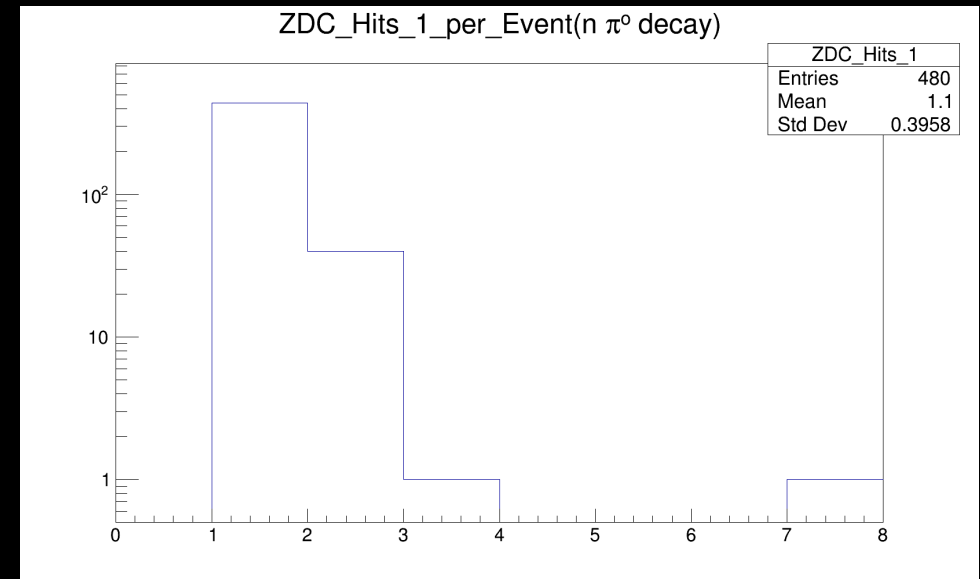
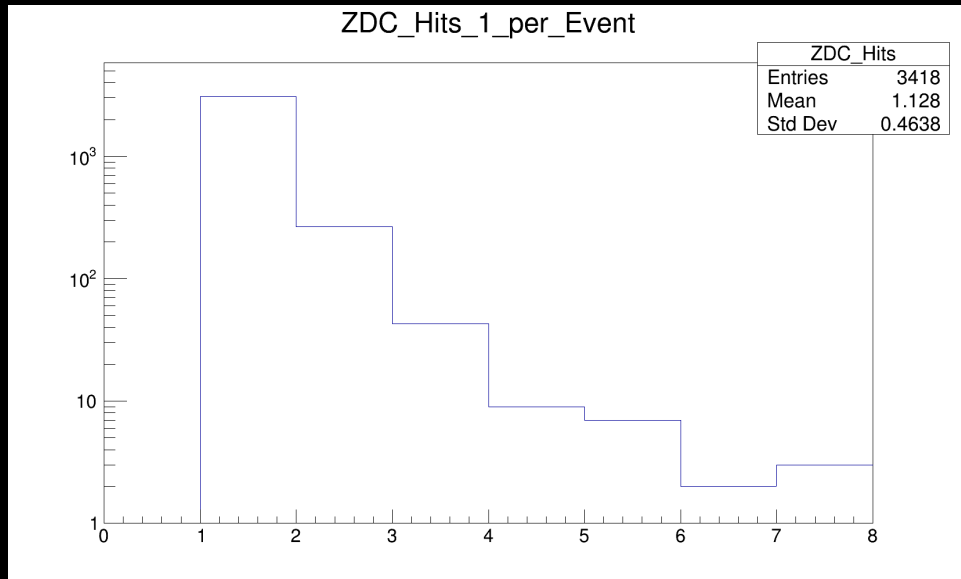
# Charged Decay (Proton-Pi-)



# Neutral Decay (Neutron-Pi0)

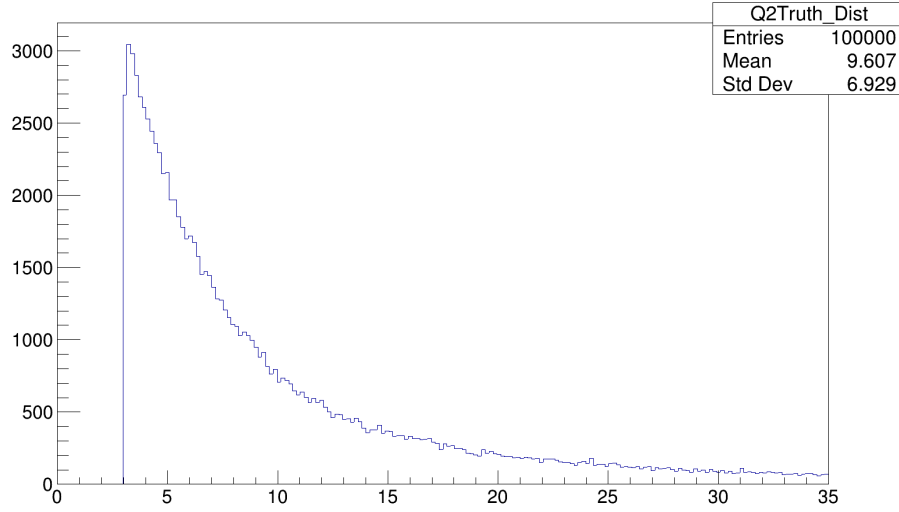


# ZDC Distributions

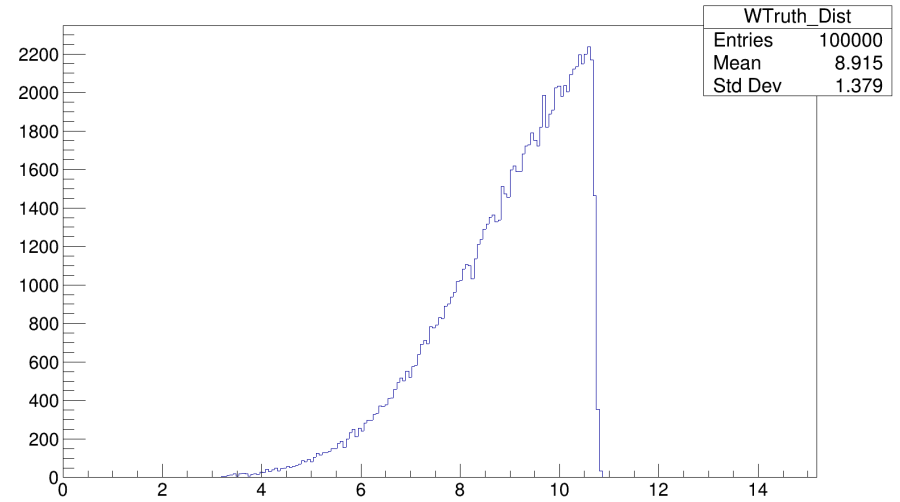


# Kinematics

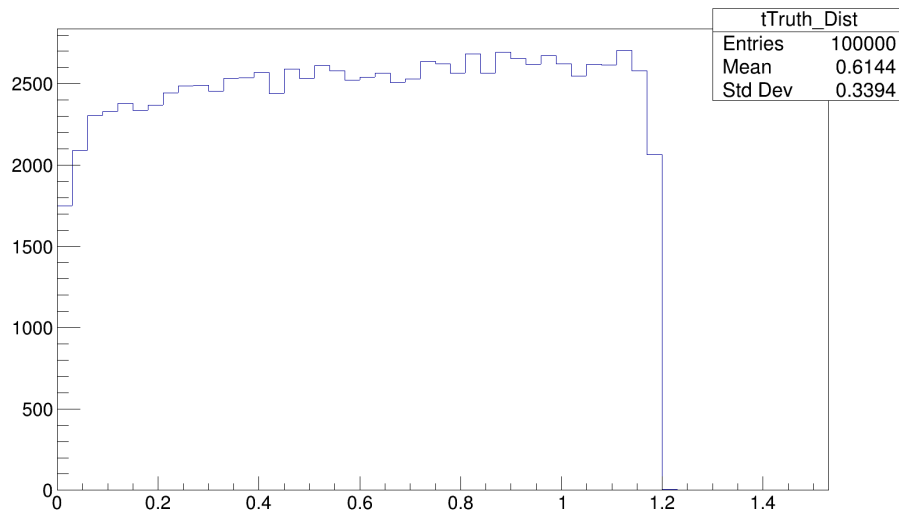
$Q^2$  Truth Distribution



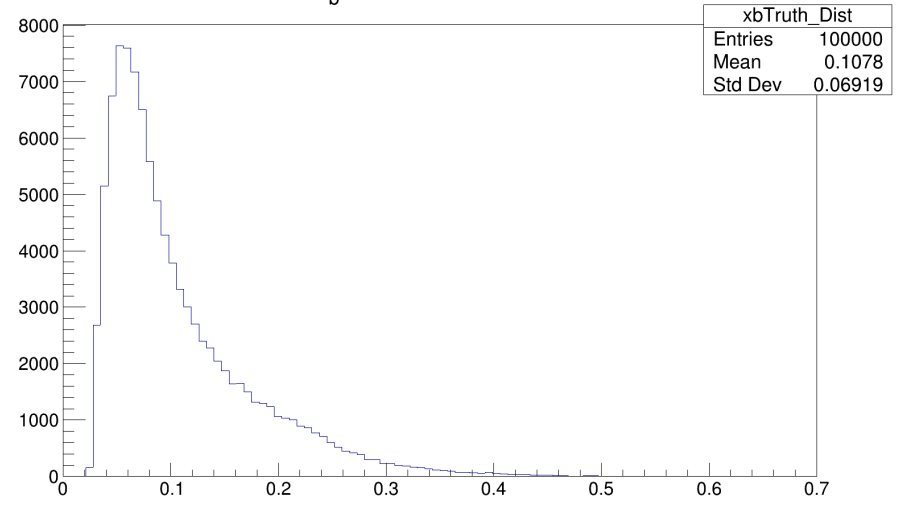
W Truth Distribution



t Truth Distribution



$x_b$  Truth Distribution





# Summary

- The DEMP event generator is working reasonably well and can be easily modified to look at the beam energy combinations.
- The weights are being transferred from event generator to the Fun4All output as well (although not shown in these slides).
- Primary particle truth distributions look reasonable close to the expectation.
- Neutral decay daughters and ZDC are not looking good so far.
  - Still inactive regions between interaction point and ZDC (needs fixing).

# Outlook

- The Kaon form Factor measurement at EIC is very challenging due to multiple decay steps.
- A realistic ZDC acceptance efficiency is only possible if we have full branching ratio of the neutral decay available.
- Improvements to the Kaon model in DEMP generator are required as well.
- Work on this will be continued at University of Regina in the coming months/years.