

Kaon Electroproduction Experiment (E12-09-011) SIMC Results

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In this report, the simulation (SIMC) results with regards to the real coincidence rate estimations for all the kinematic settings of the upcoming $p(e, e' K^+) \Lambda(\Sigma^0)$ measurements above the resonance region are presented. The report is divided into two parts – first part dealing with the fall 2018 kinematics settings and the latter dealing with the rest of the K^+ electroproduction settings. The kinematics settings are arranged according to their nominal virtuality of the incoming photon, Q^2 and invariant mass, W values. Each kinematics setting is further divided into 2 (for low ε) or 3 (for high ε) angular settings with respect to the \vec{q} , i.e., central angle is along the \vec{q} , $\phi_{Kq} = -3.00^\circ$ is 3° less than the central angle and $\phi_{Kq} = +3.00^\circ$ is 3° greater than the central angle and so on.

For each angular setting, three plots after applying cuts are shown in the report, namely, the so-called "diamond" plot of $W - Q^2$ distribution, charge normalized reconstructed missing mass for both Λ and Σ^0 final states as well as $|t| - \phi$ polar plot showing ϕ coverage at each angular settings¹. The diamonds shown in the report are for Λ final state, however the Σ^0 channel also covers roughly similar $W - Q^2$ regions. In addition to Λ (histogram with red pattern) and Σ^0 (filled blue histogram) missing mass distributions, the plots also contain sum of the two as represented by unfilled blue histogram. The cuts to select each channel are represented in the plots with black dotted lines while red and blue dotted lines represent PDG masses: $m_\Lambda = 1.1157$ GeV and $m_\Sigma = 1.1926$ GeV, respectively. Finally, in $|t| - \phi$ polar plots, the radial component represents four momentum transfer to the nucleon, $-t$ (in GeV^2) while ϕ_K is the polar component that progresses counter-clockwise, with $\phi_K = 0^\circ$ at the right. The plot is color coded to represent central (black), $+3.00^\circ$ (red) and $+3.00^\circ$ (blue) angular settings.

¹More information on coincidence rate estimation and cuts used can be found in the third chapter of [this thesis](#).

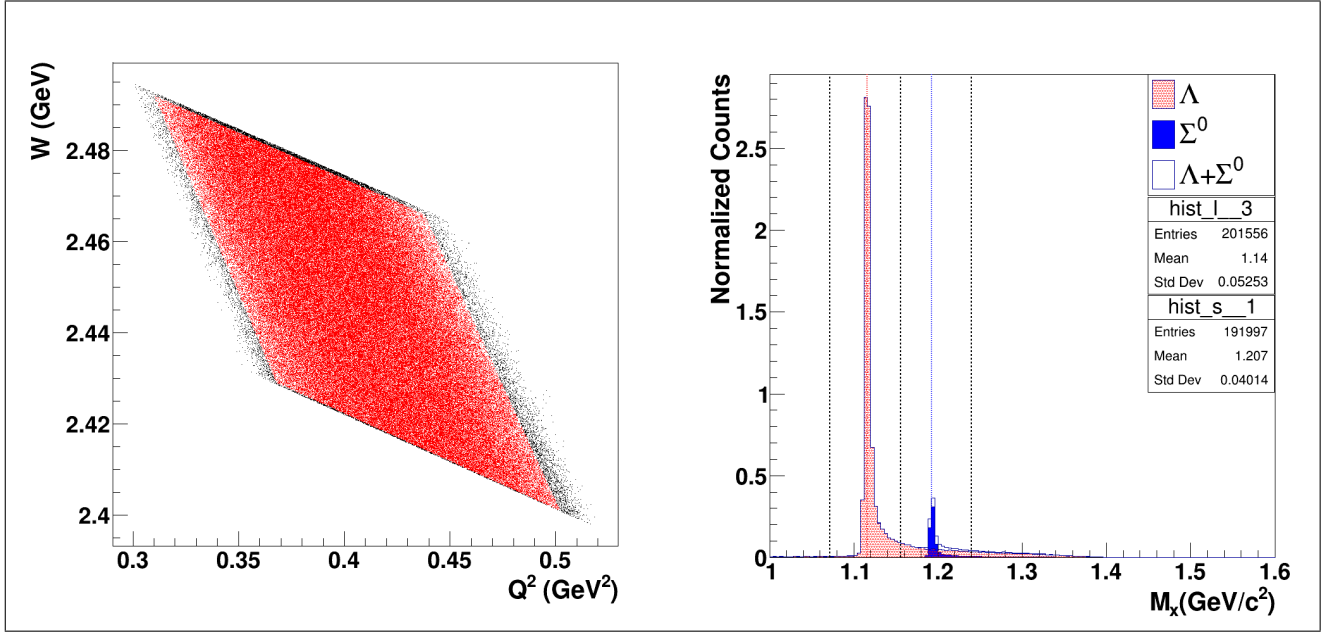
Part I

Fall 2018 Kinematic Settings

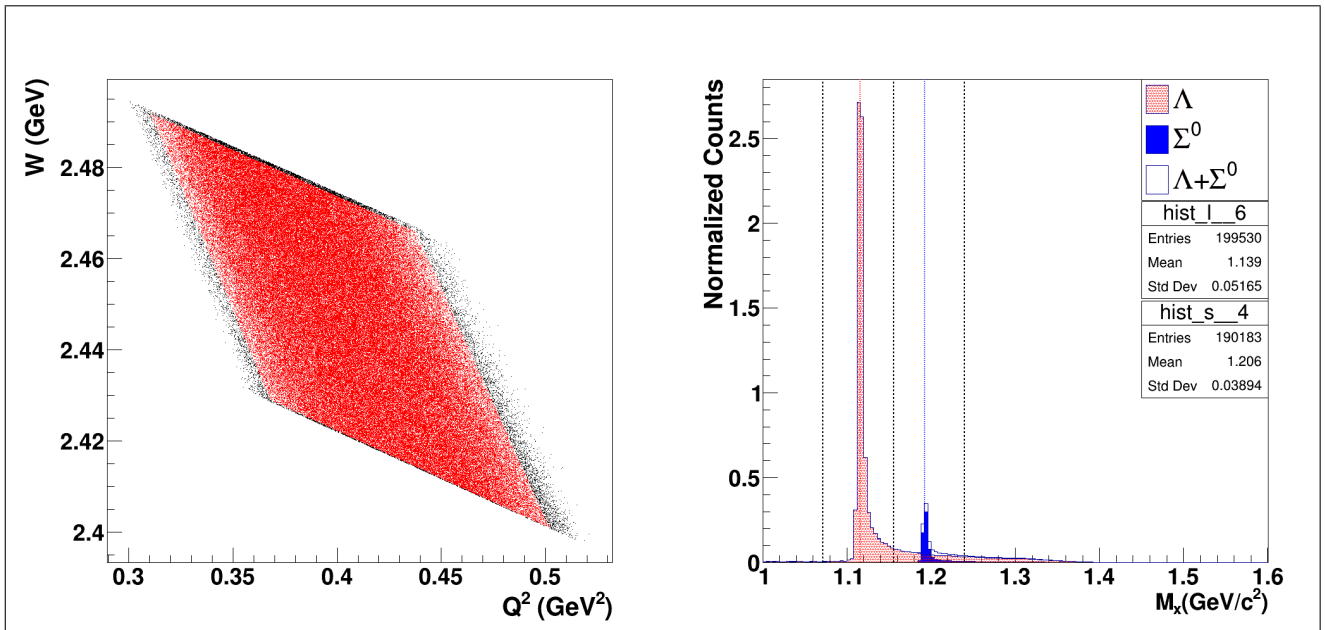
1 Setting: $Q^2 = 0.40 \text{ GeV}^2$, $W = 2.45 \text{ GeV}$

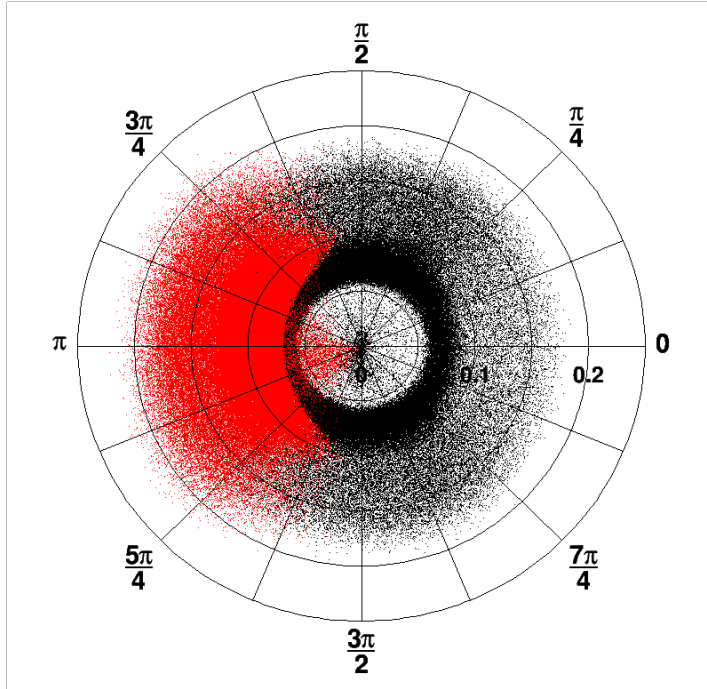
1.1 $E_{beam} = 3.799 \text{ GeV}$ (low ε)

1.1.1 central angle



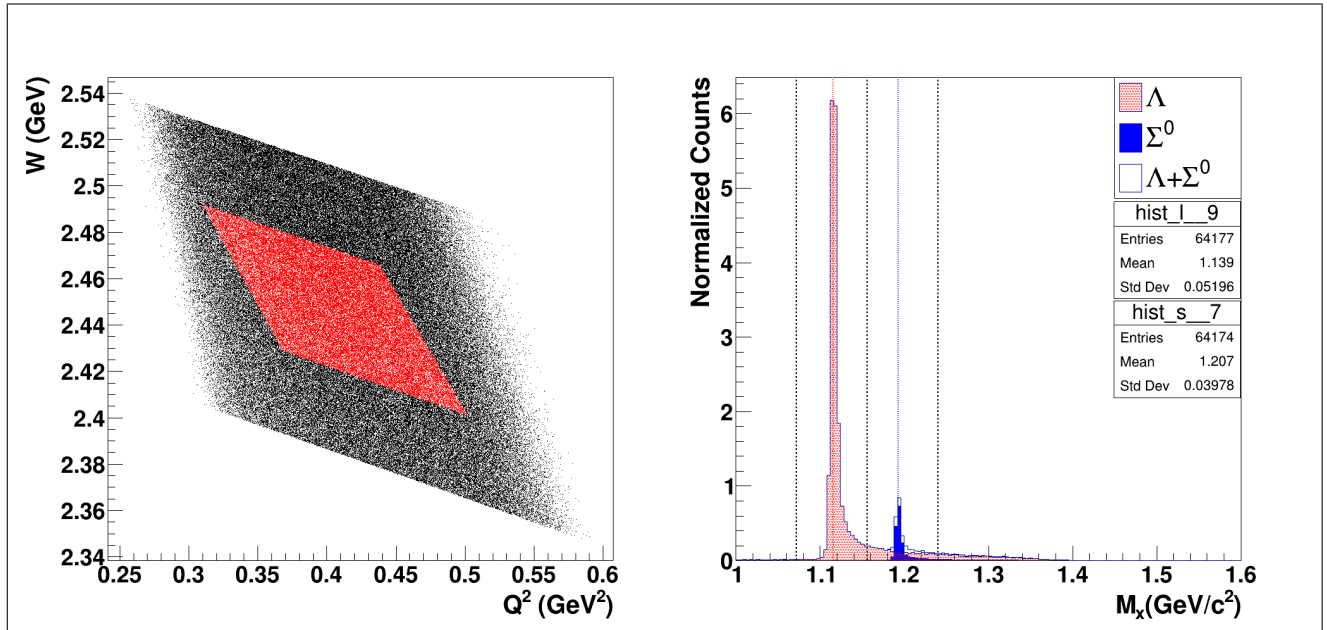
1.1.2 $+3.00^\circ$



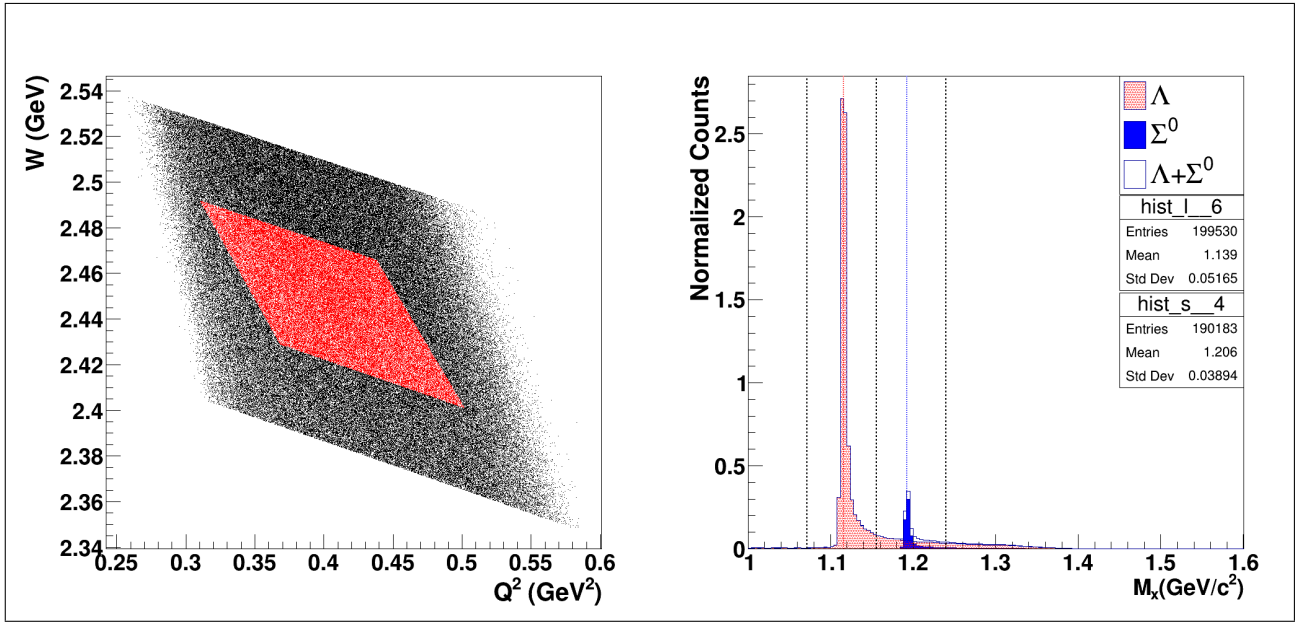


1.2 $E_{beam} = 4.951$ GeV (high ε)

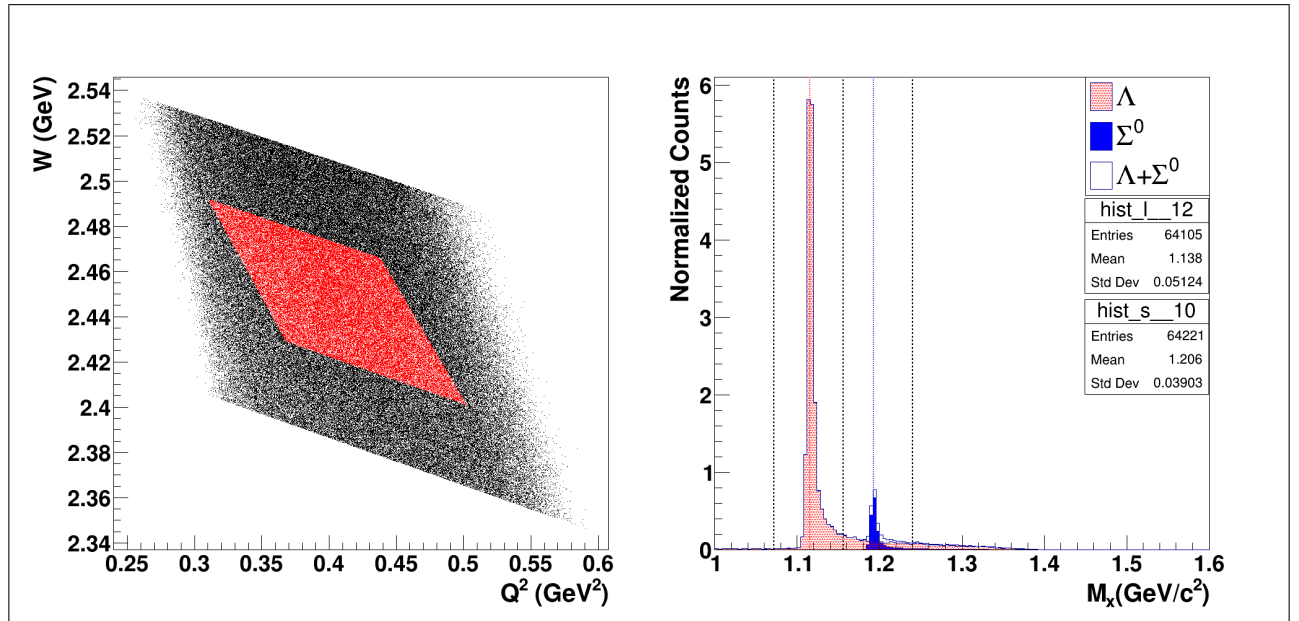
1.2.1 central angle

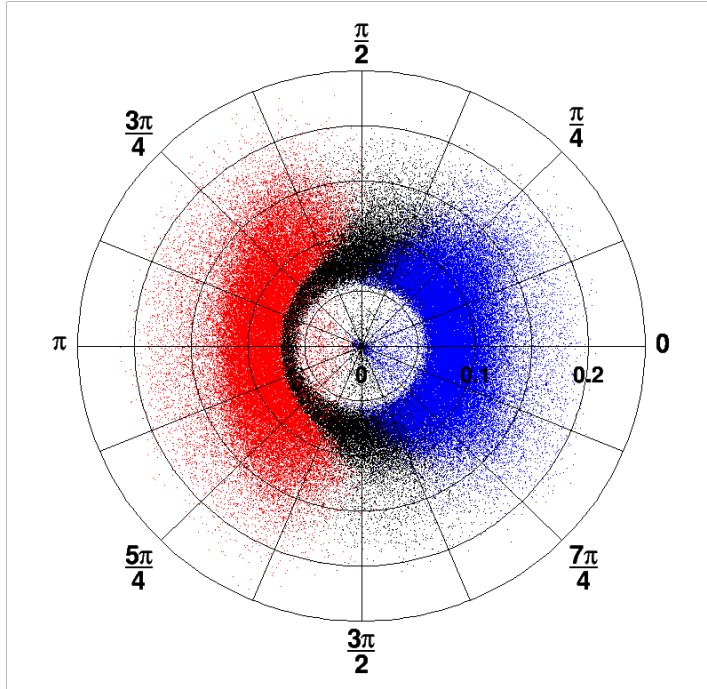


1.2.2 $+3.00^\circ$



1.2.3 -1.90°

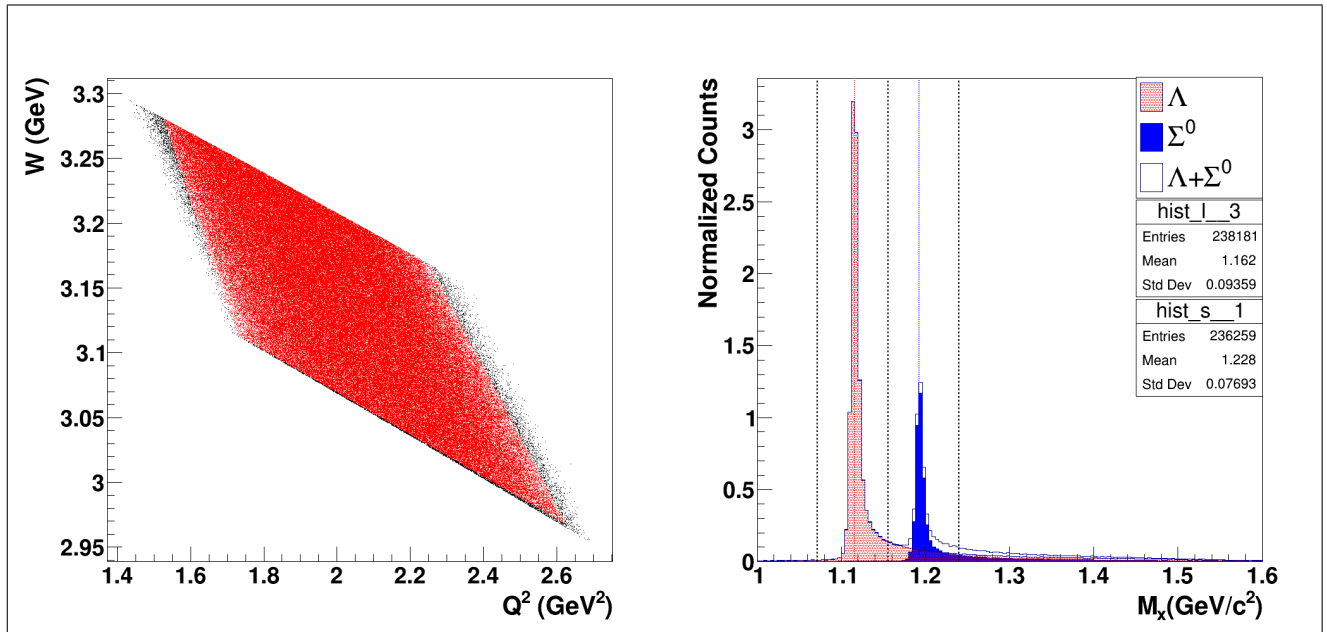




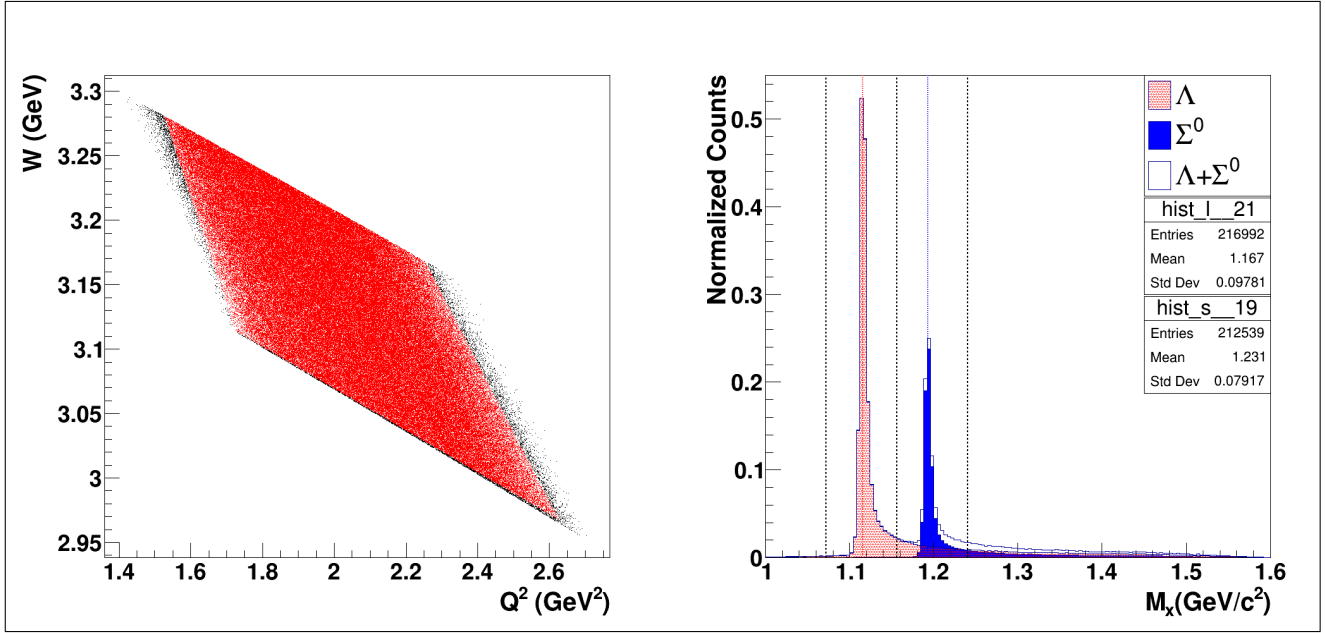
2 Setting: $Q^2 = 2.00 \text{ GeV}^2$, $W = 3.14 \text{ GeV}$

2.1 $E_{beam} = 8.761 \text{ GeV}$ (mid ε)

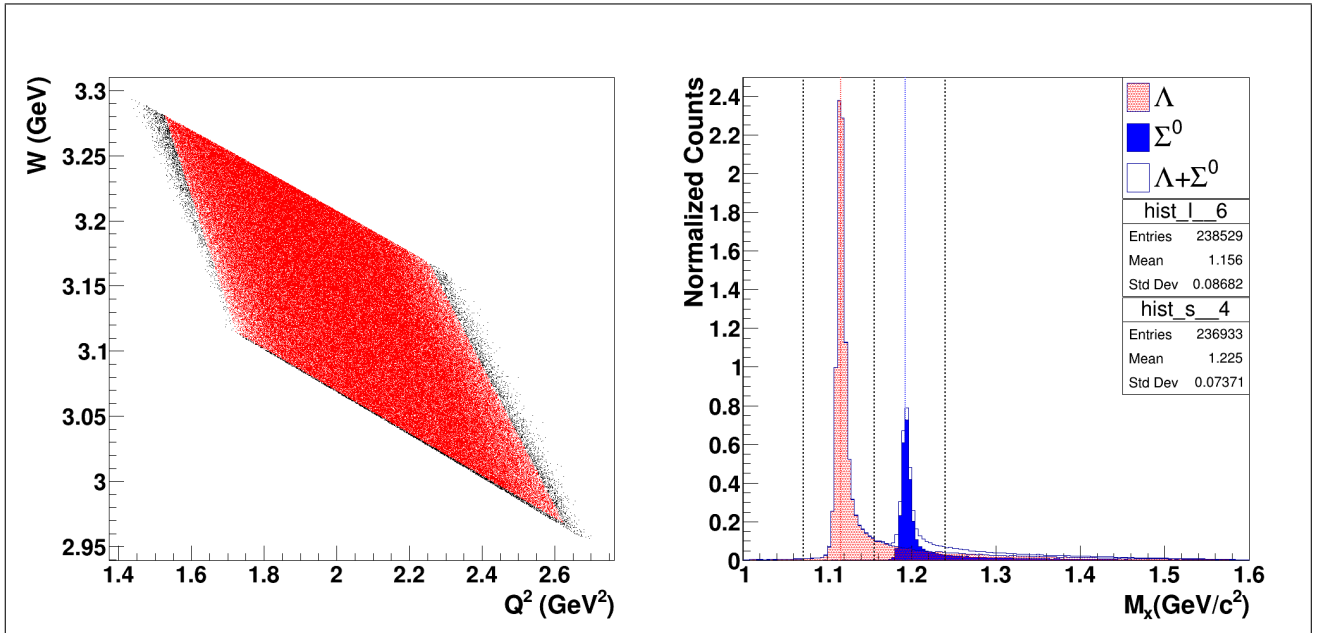
2.1.1 central angle

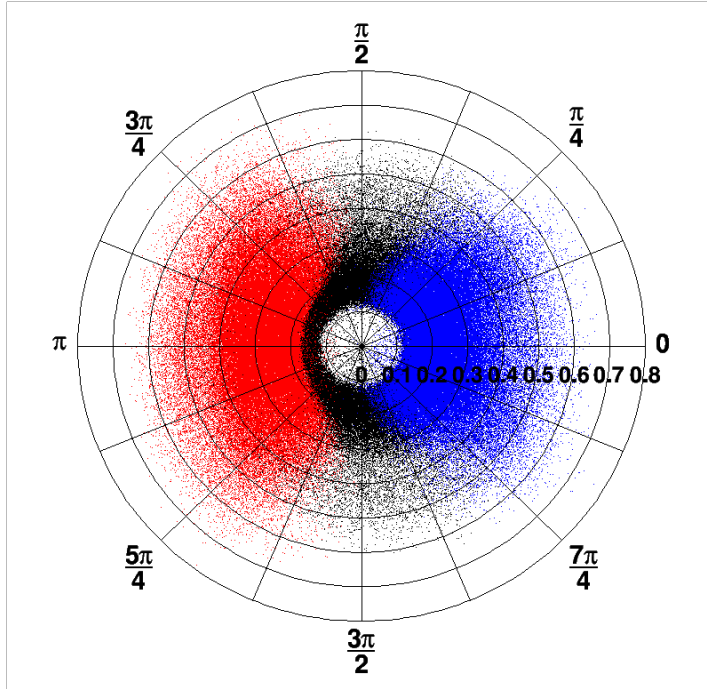


2.1.2 $+3.00^\circ$



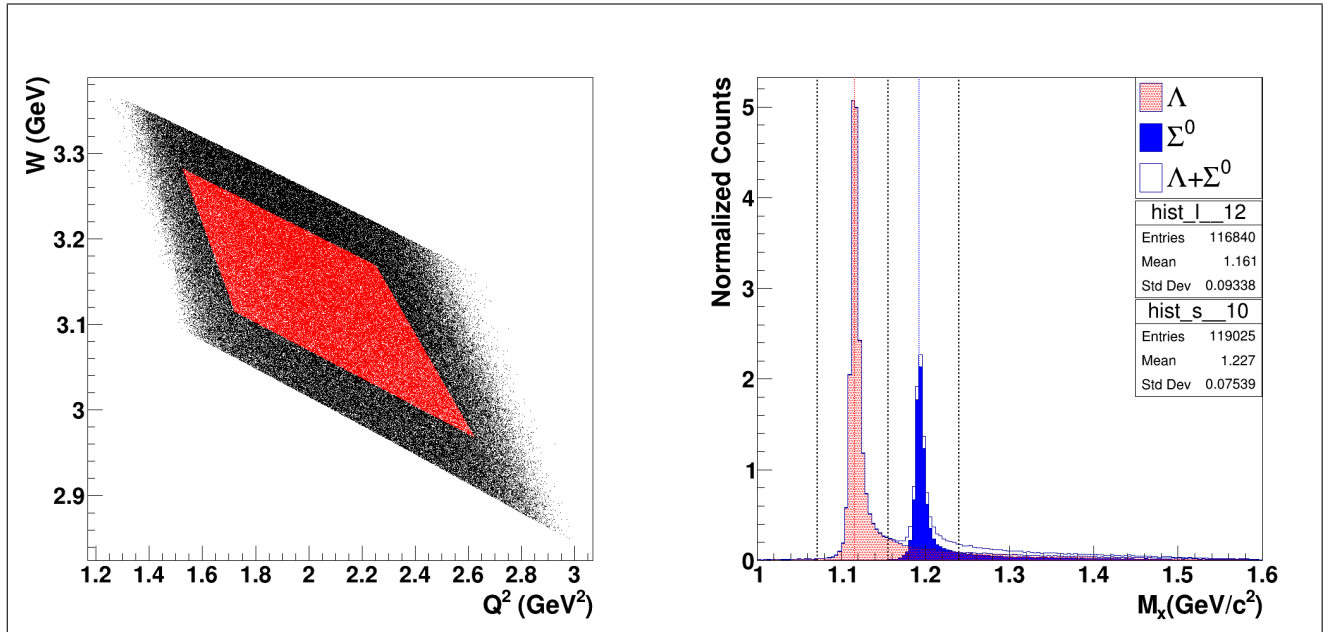
2.1.3 -2.20°



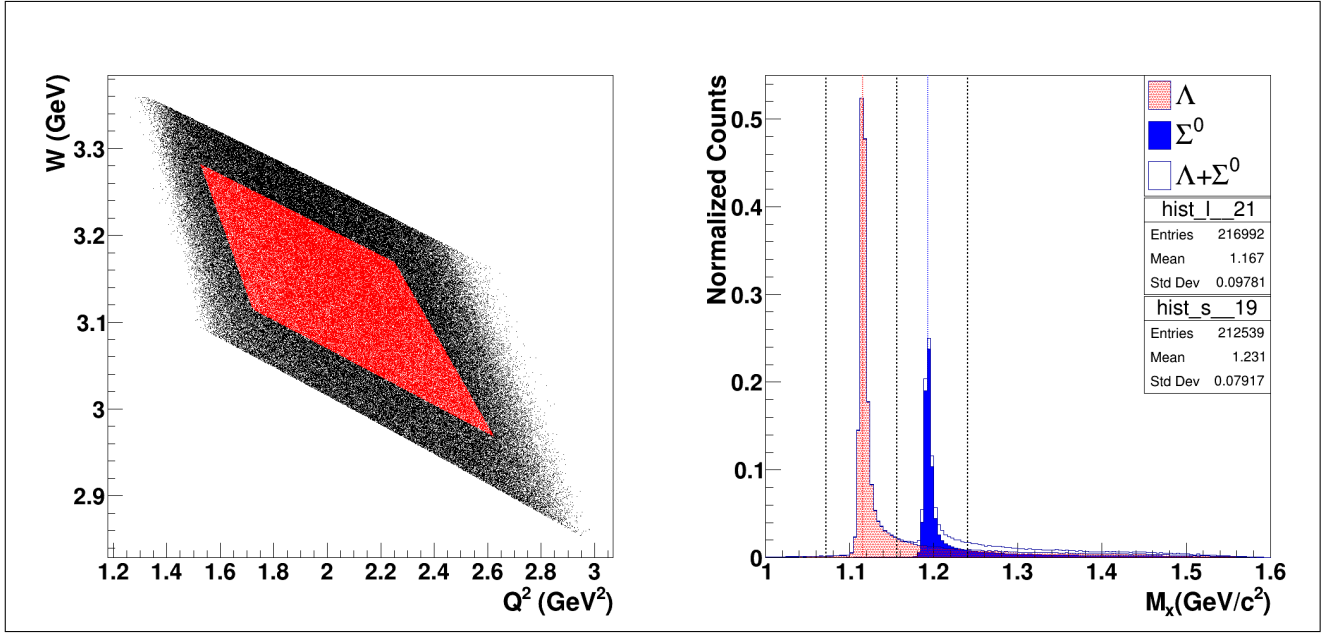


2.2 $E_{beam} = 10.921$ GeV (high ε)

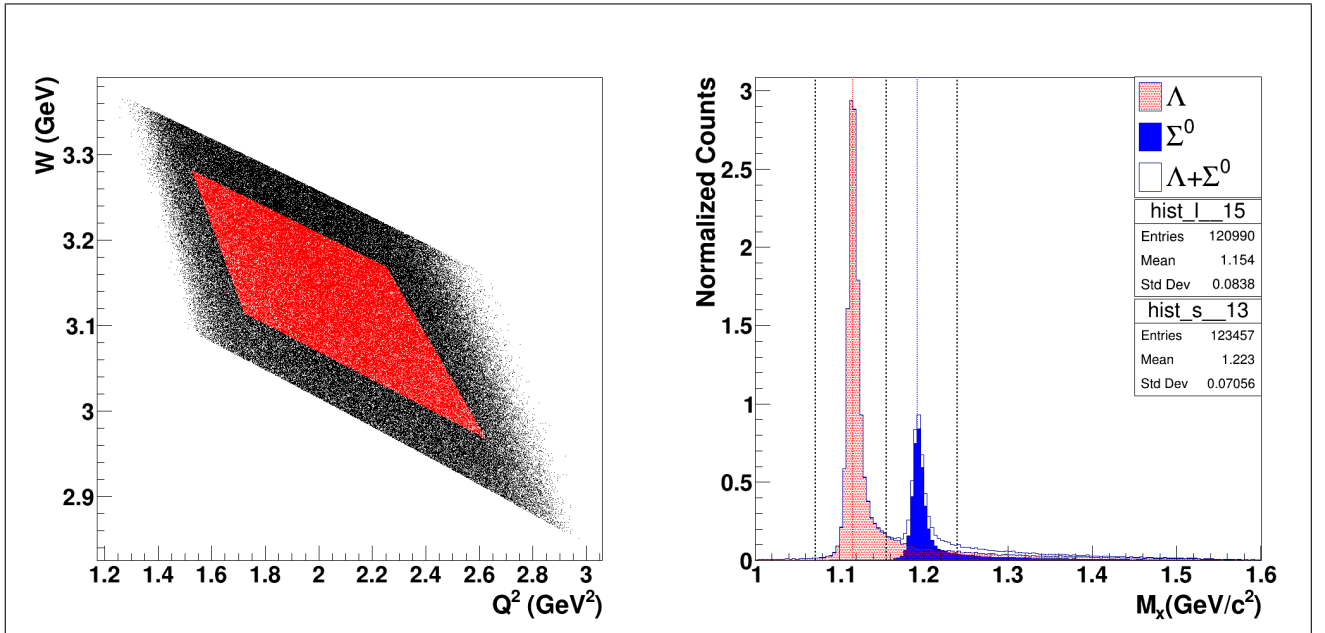
2.2.1 central angle

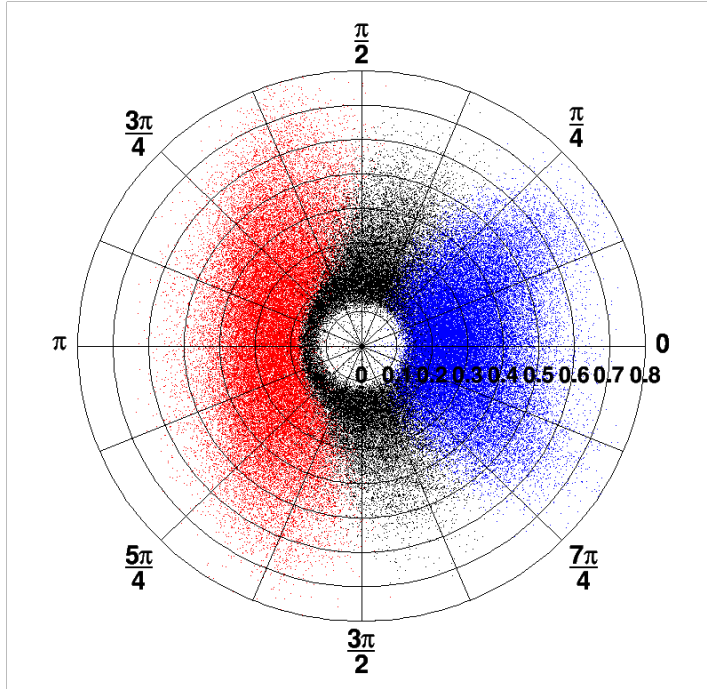


2.2.2 $+3.00^\circ$



2.2.3 -3.00°

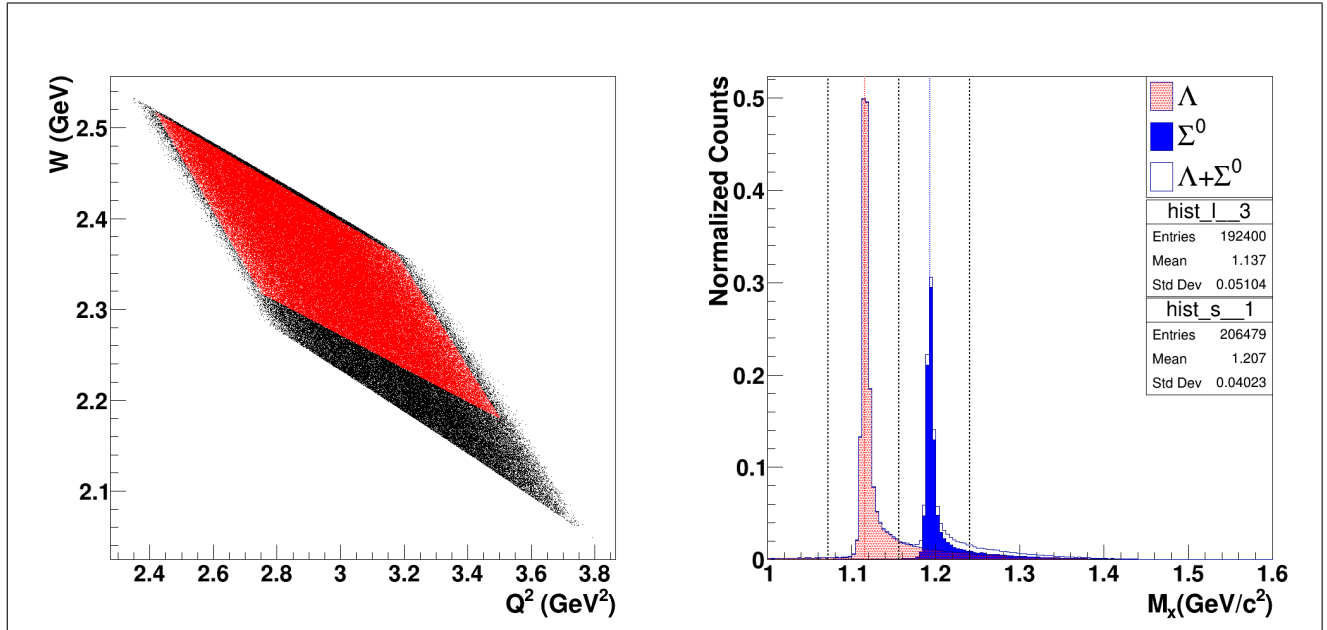




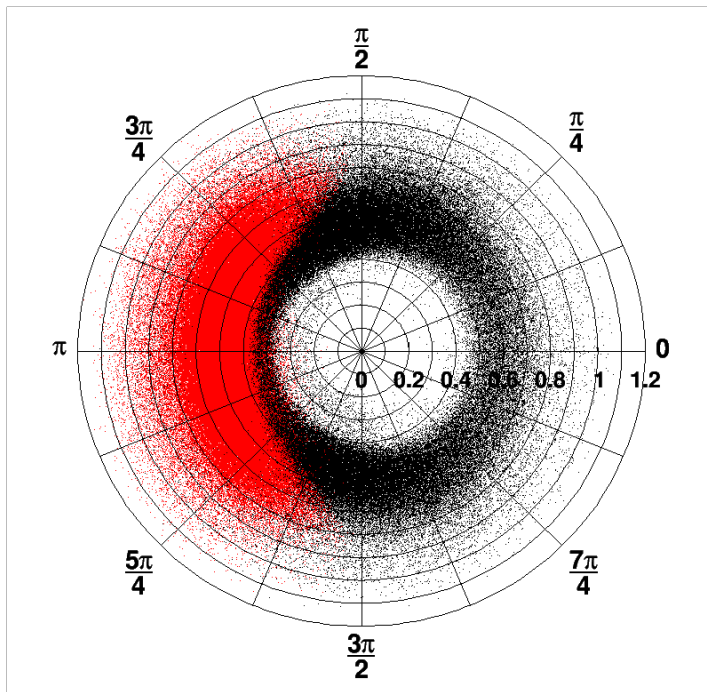
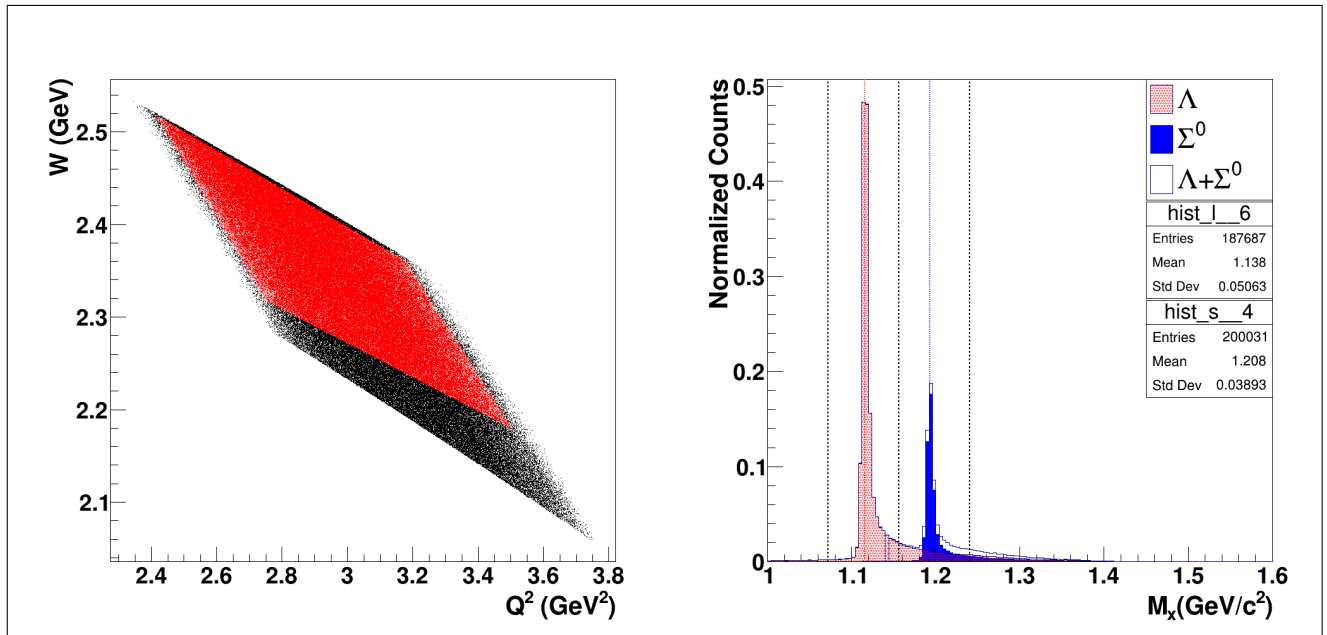
3 Setting: $Q^2 = 3.00 \text{ GeV}^2$, $W = 2.32 \text{ GeV}$

3.1 $E_{beam} = 6.601$ (low ε)

3.1.1 central angle

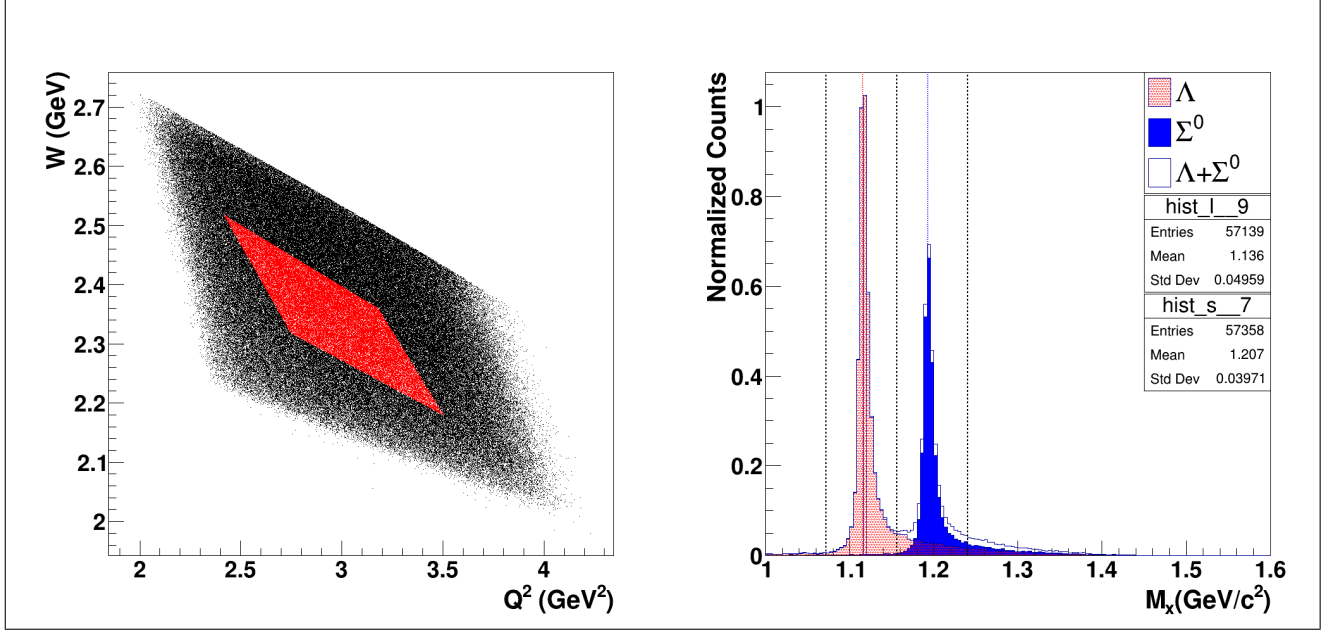


3.1.2 $+3.00^\circ$

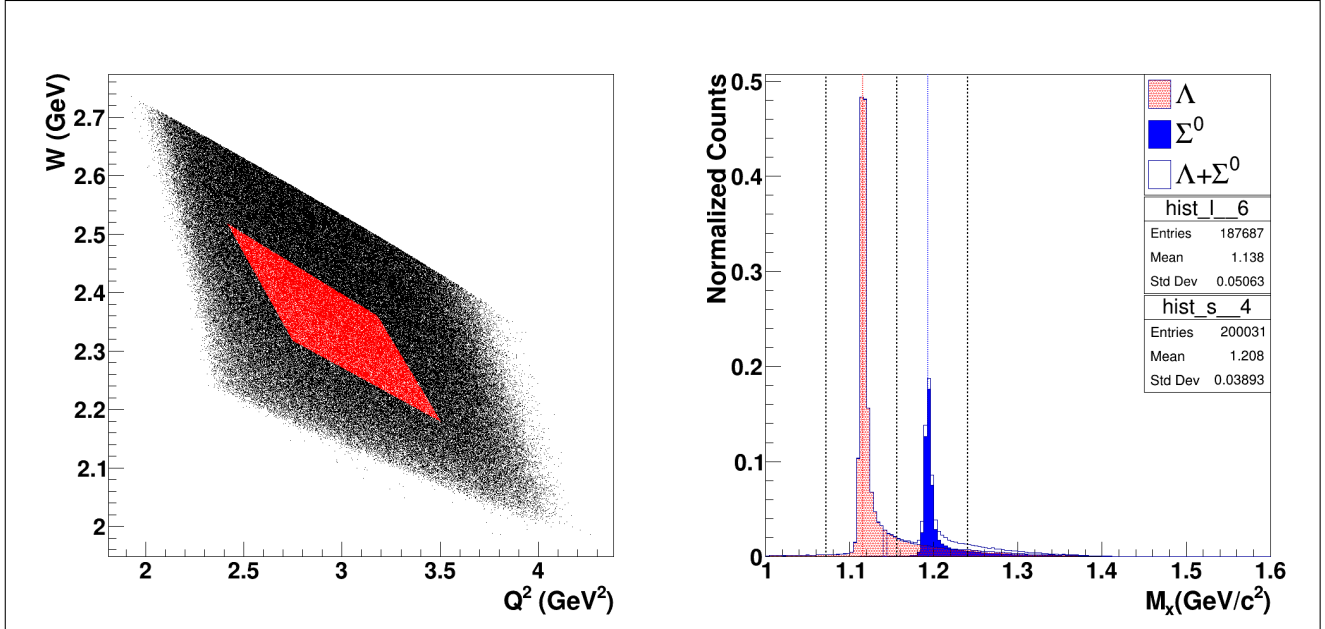


3.2 $E_{beam} = 10.921$ GeV (high ε)

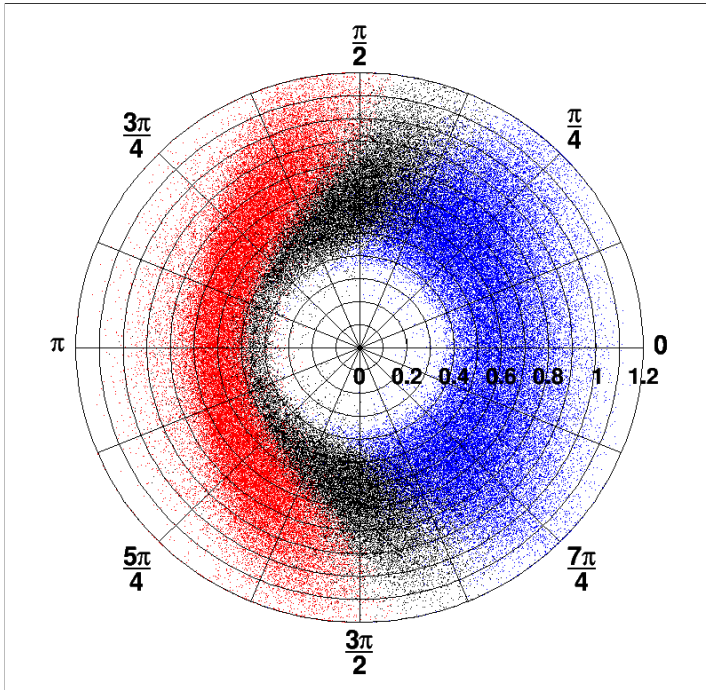
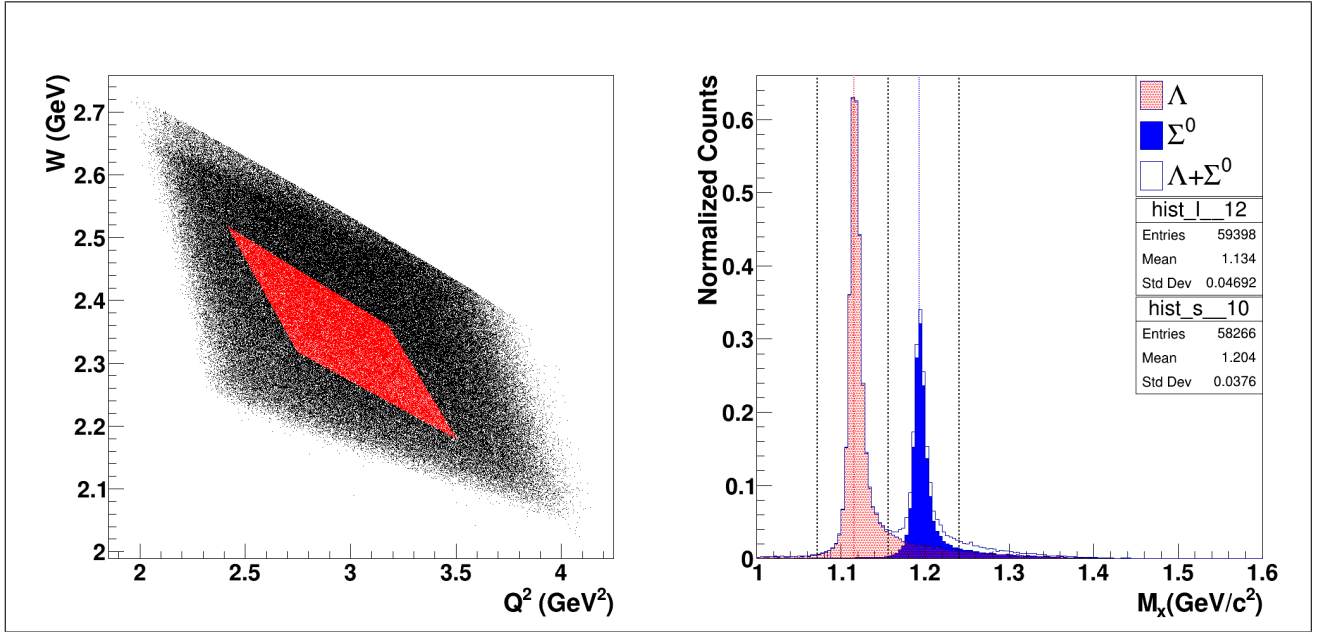
3.2.1 central angle



3.2.2 $+3.00^\circ$



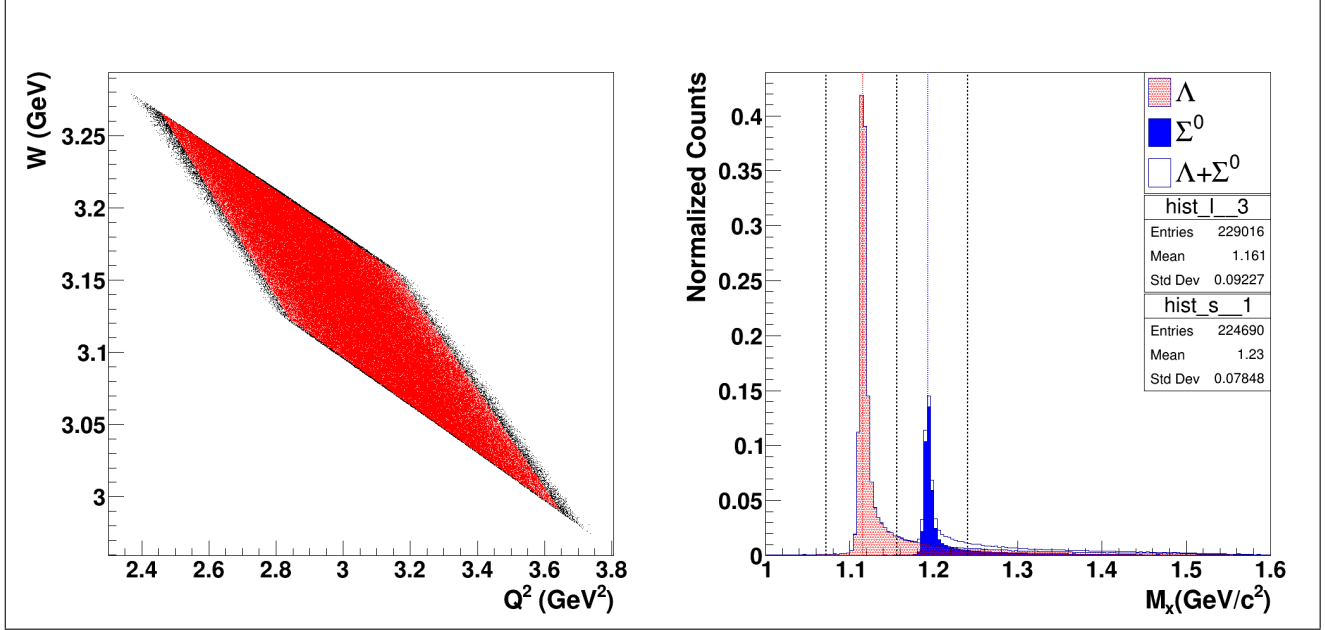
3.2.3 -3.00°



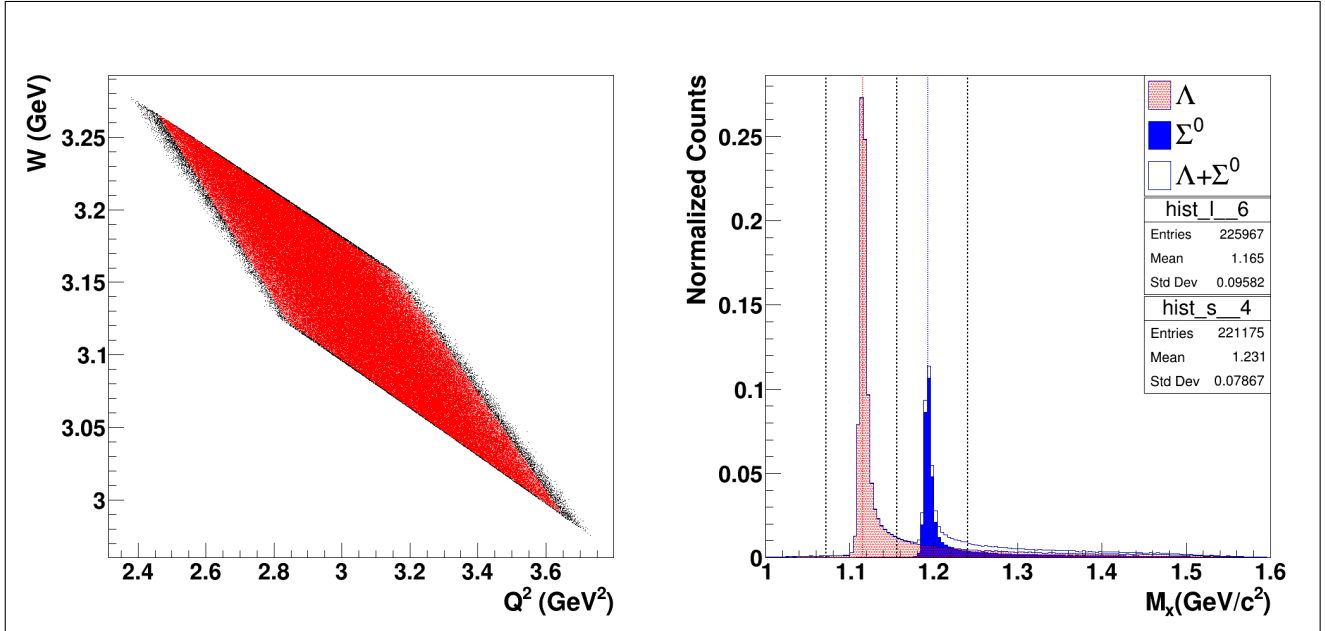
4 Setting: $Q^2 = 3.00 \text{ GeV}^2$, $W = 3.14 \text{ GeV}$

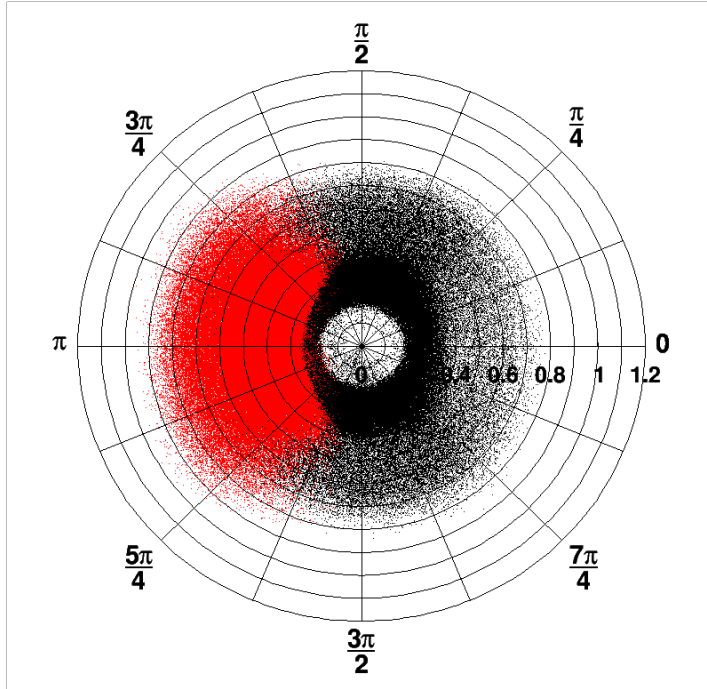
4.1 $E_{beam} = 8.191 \text{ GeV}$ (low ε)

4.1.1 central angle



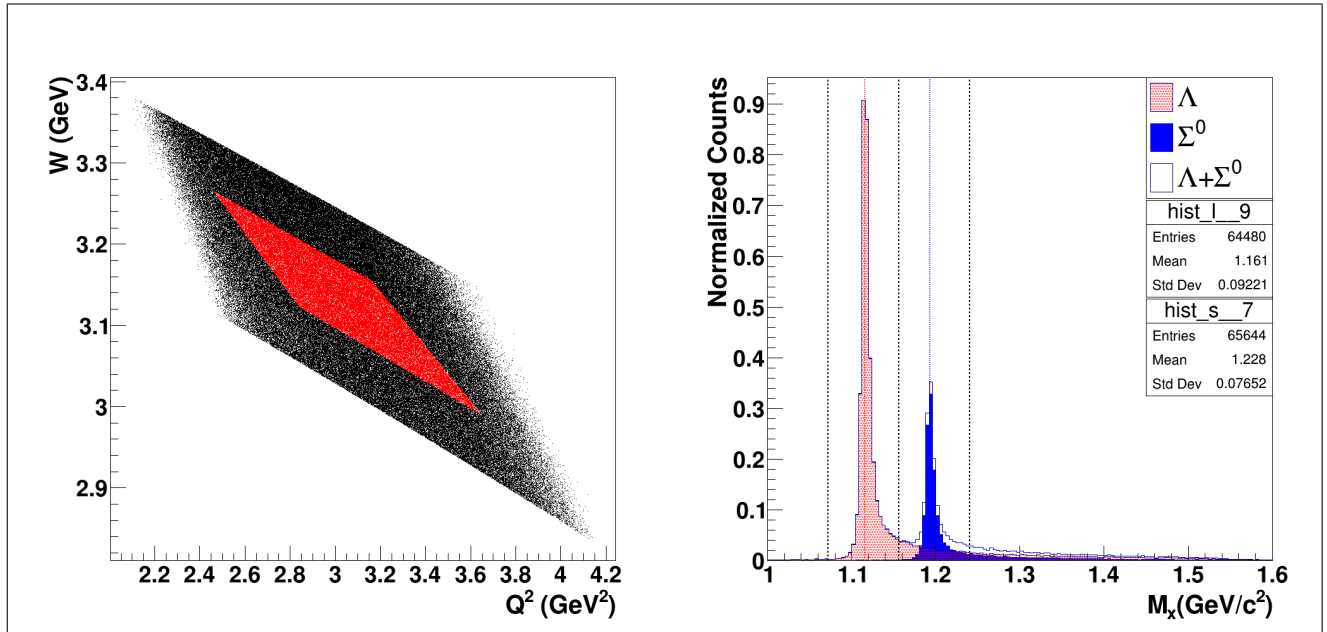
4.1.2 $+3.00^\circ$



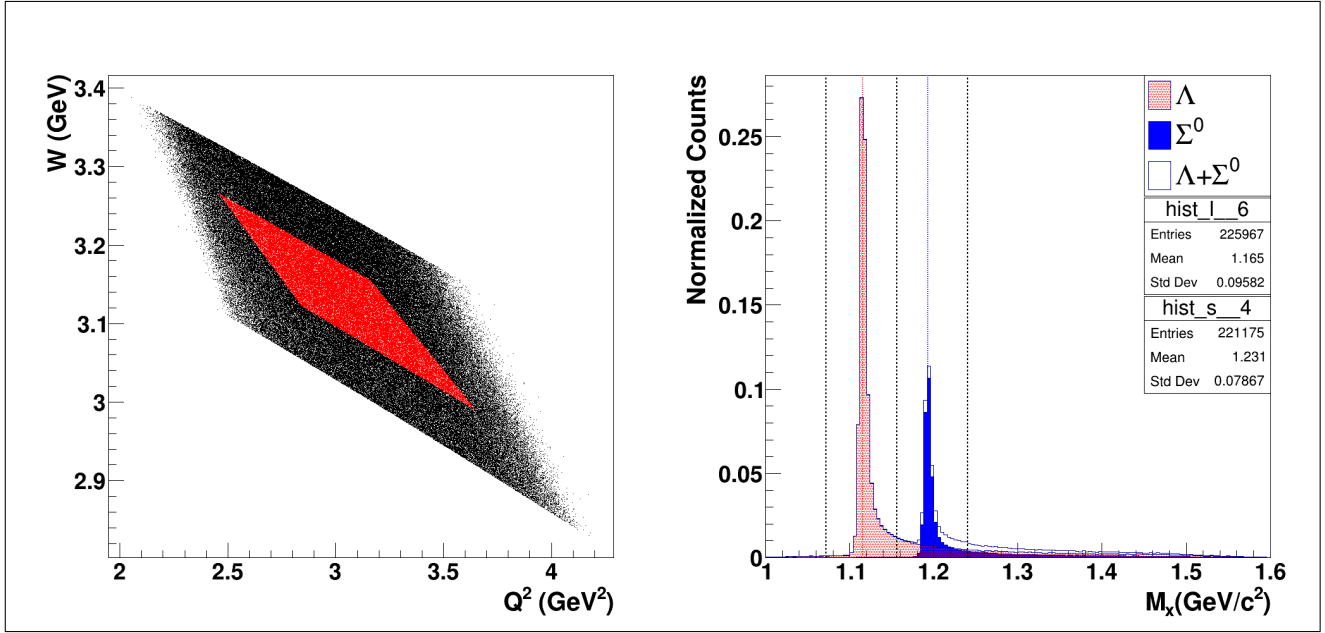


4.2 $E_{beam} = 10.921$ GeV (high ε)

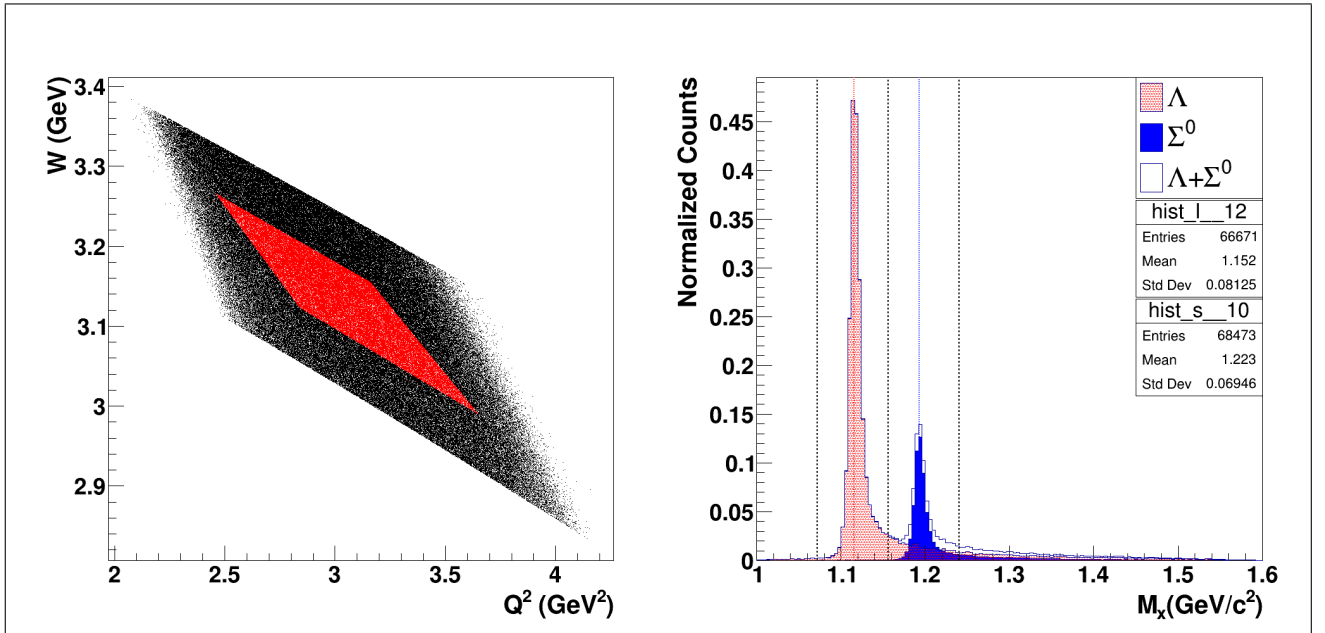
4.2.1 central angle

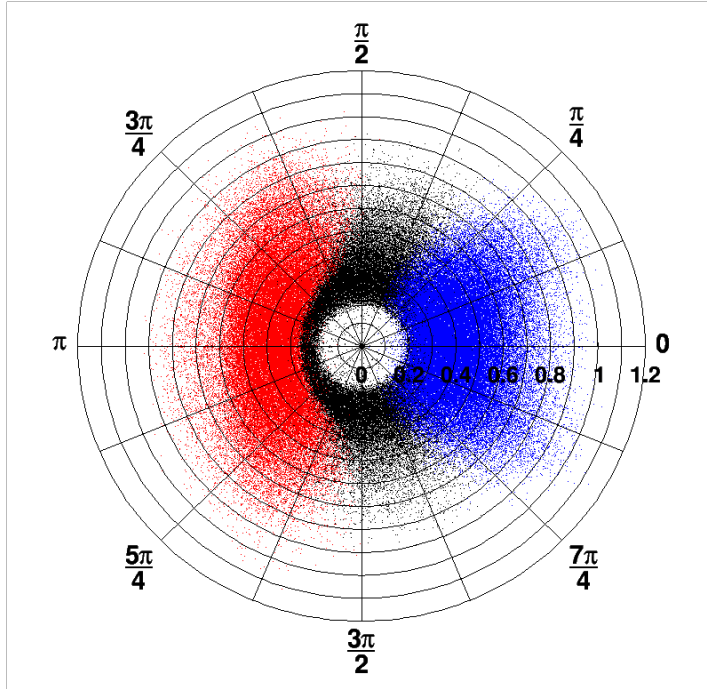


4.2.2 $+3.00^\circ$



4.2.3 -3.00°

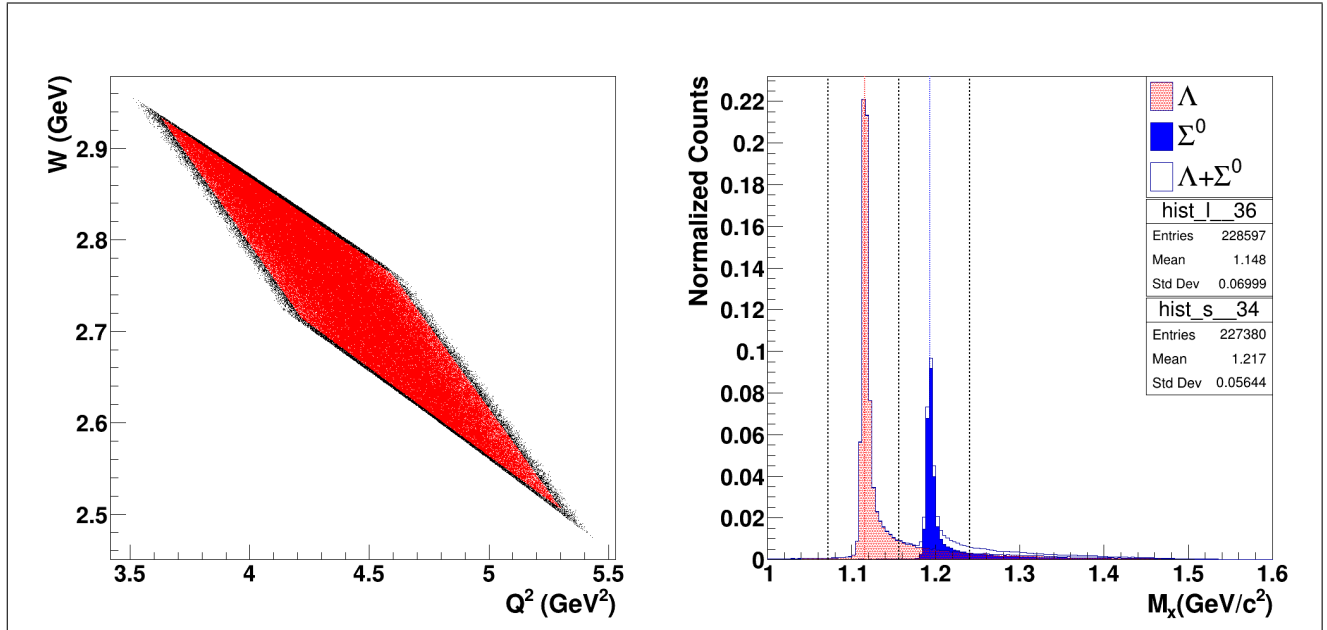




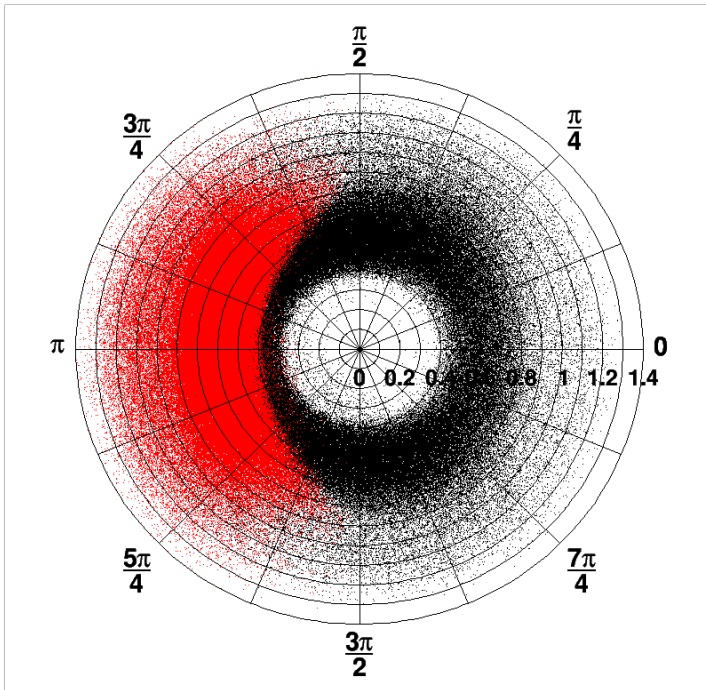
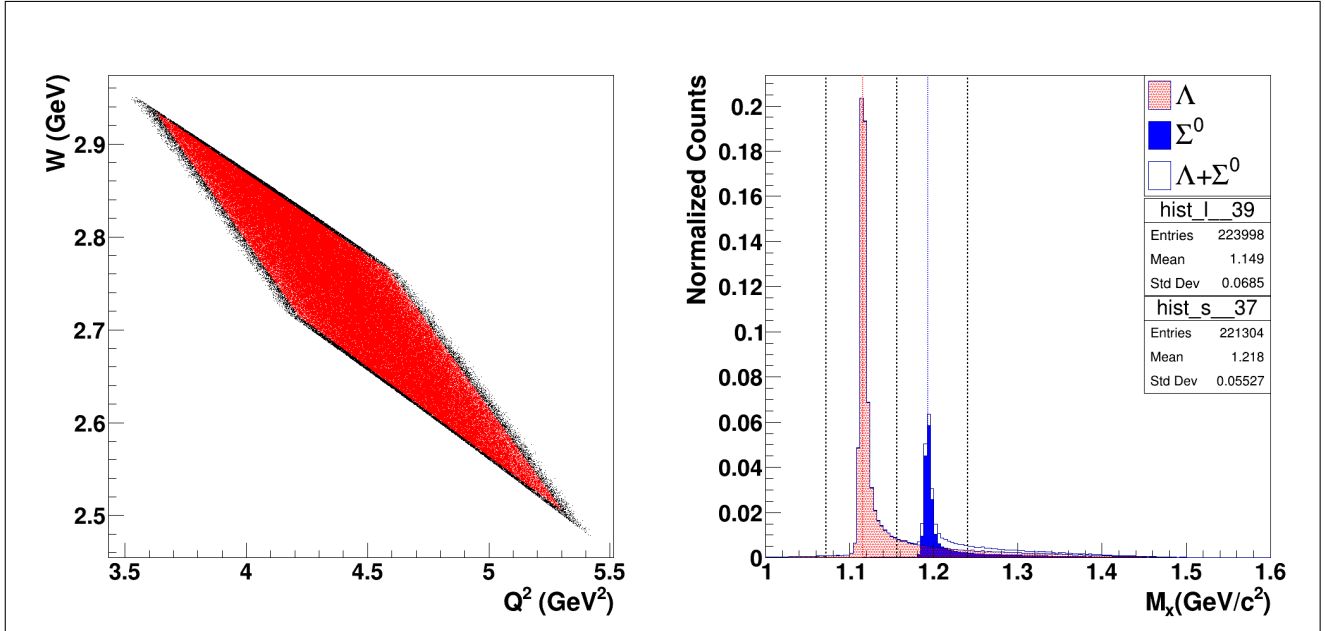
5 Setting: $Q^2 = 4.40 \text{ GeV}^2$, $W = 2.74 \text{ GeV}$

5.1 $E_{beam} = 8.191 \text{ GeV}$ (low ε)

5.1.1 central angle

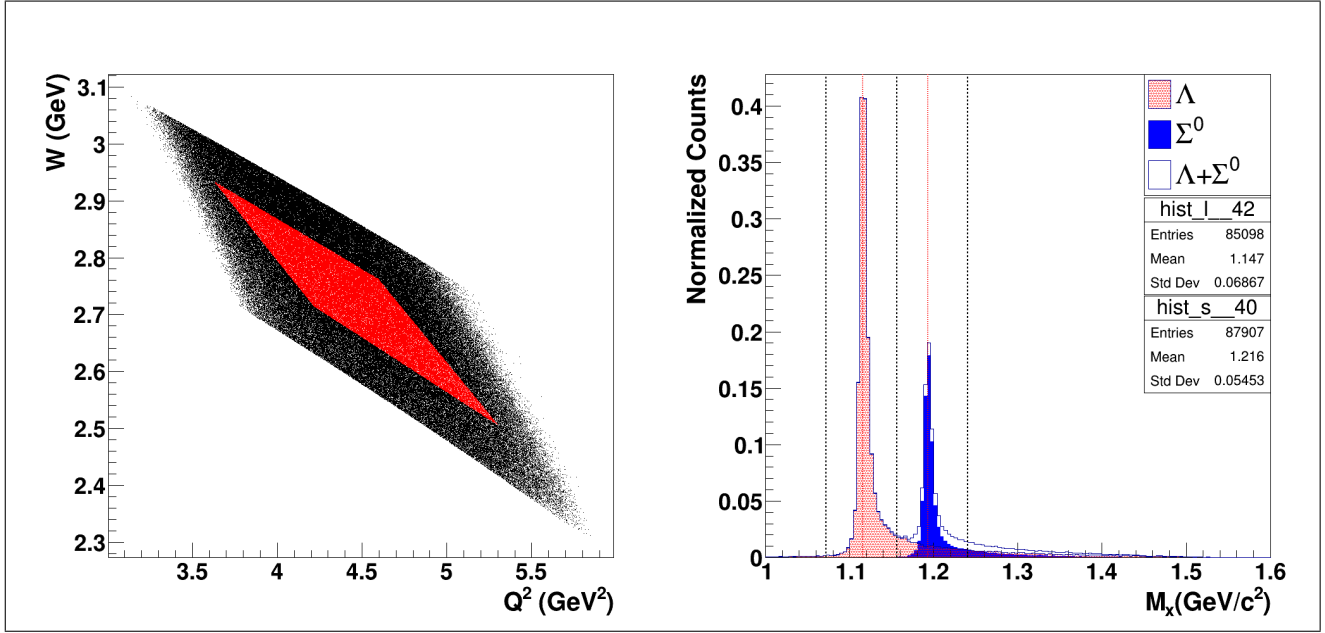


5.1.2 $+3.00^\circ$

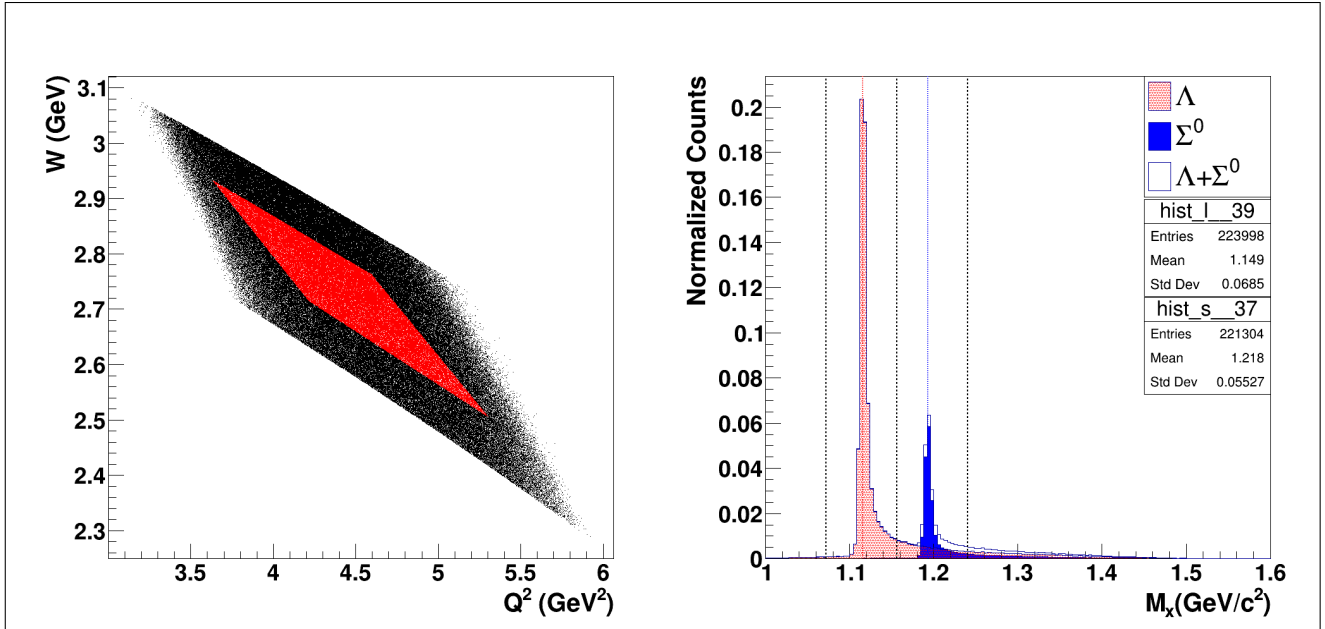


5.2 $E_{beam} = 10.921$ GeV (high ε)

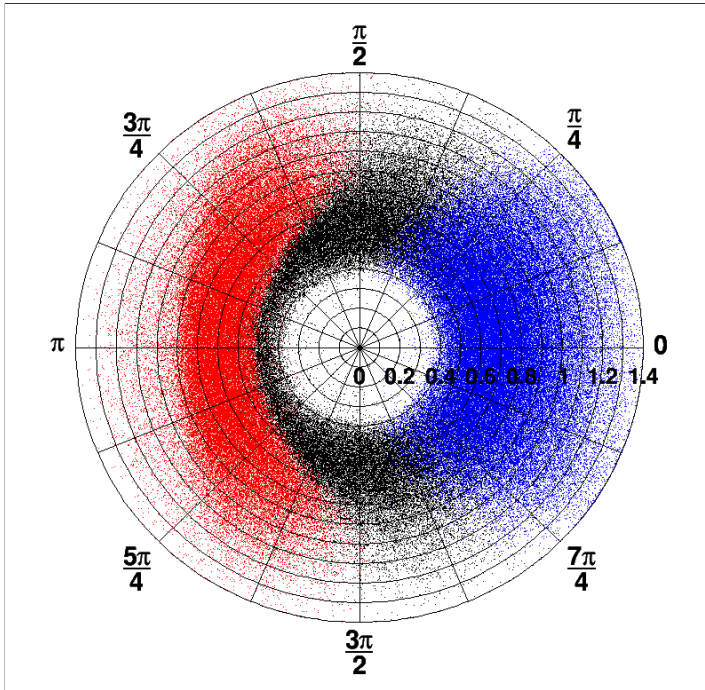
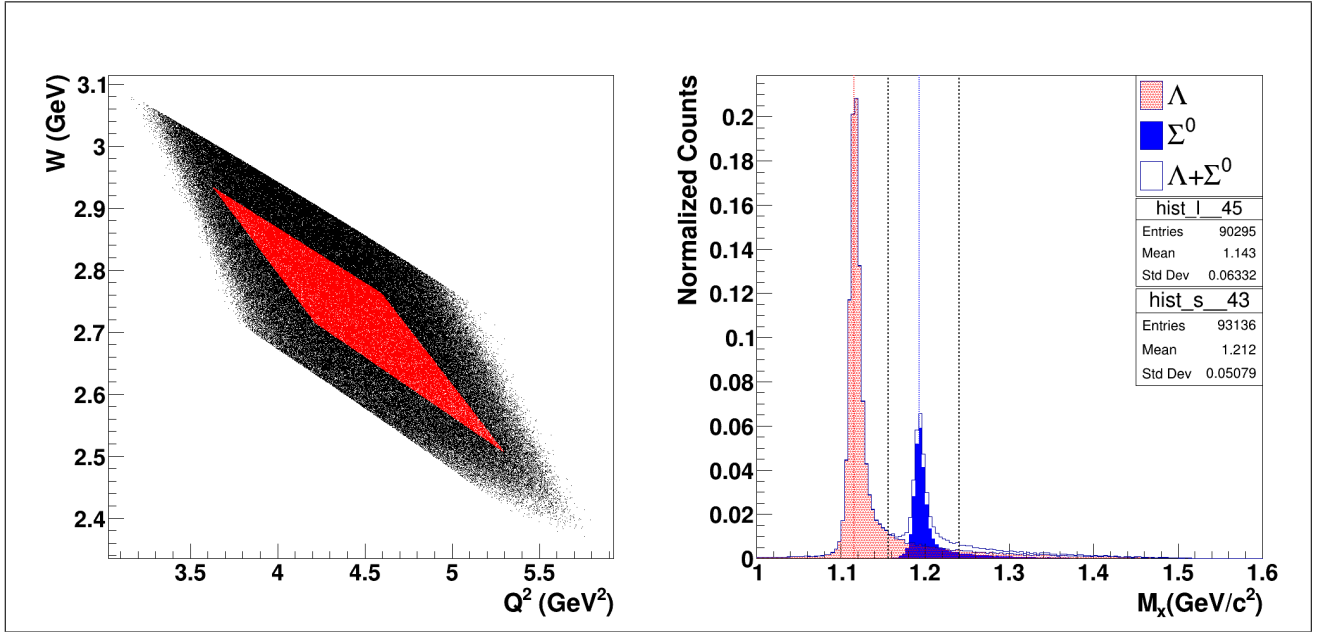
5.2.1 central angle



5.2.2 $+3.00^\circ$



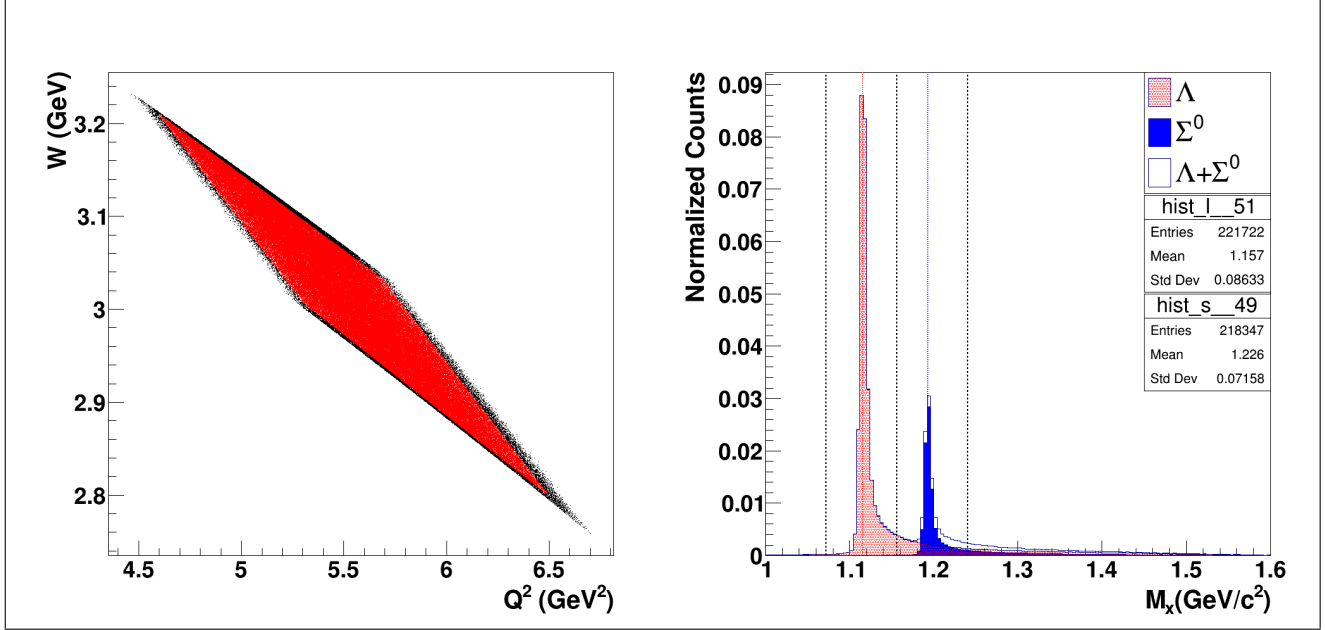
5.2.3 -3.00°



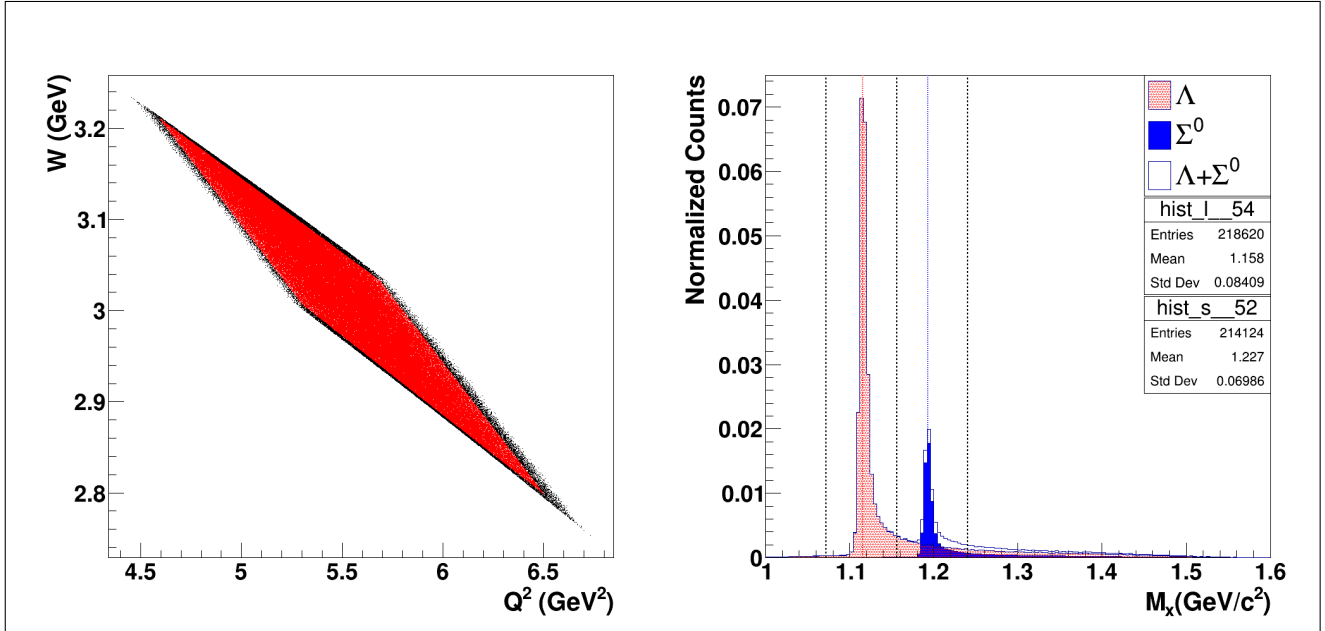
6 Setting: $Q^2 = 5.50 \text{ GeV}^2$, $W = 3.02 \text{ GeV}$

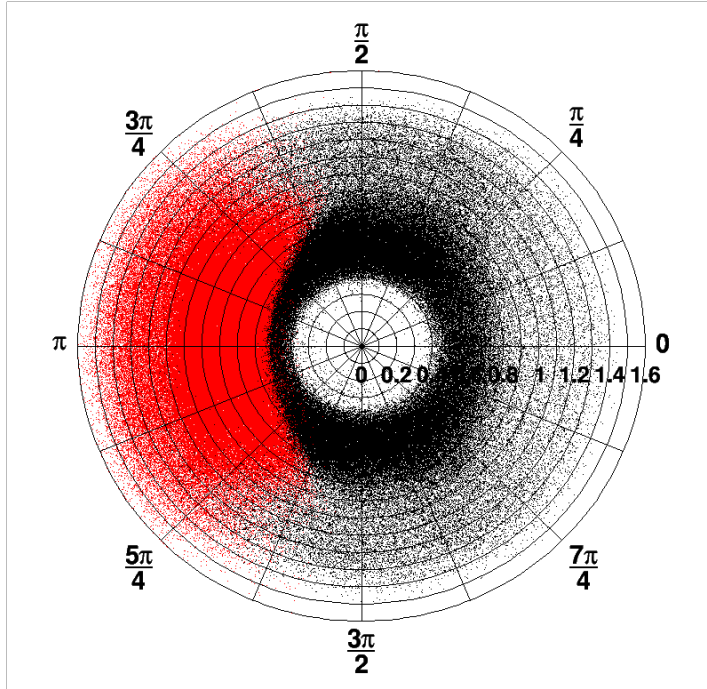
6.1 $E_{beam} = 9.343 \text{ GeV}$ (low ε)

6.1.1 central angle



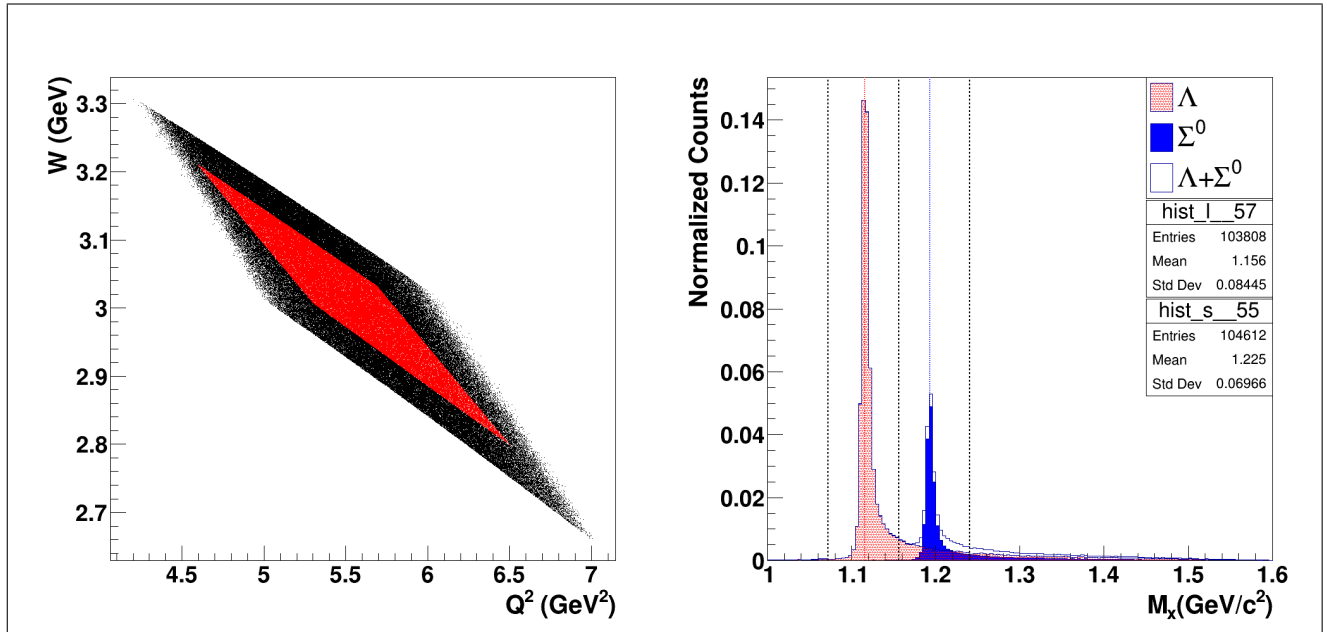
6.1.2 $+3.00^\circ$



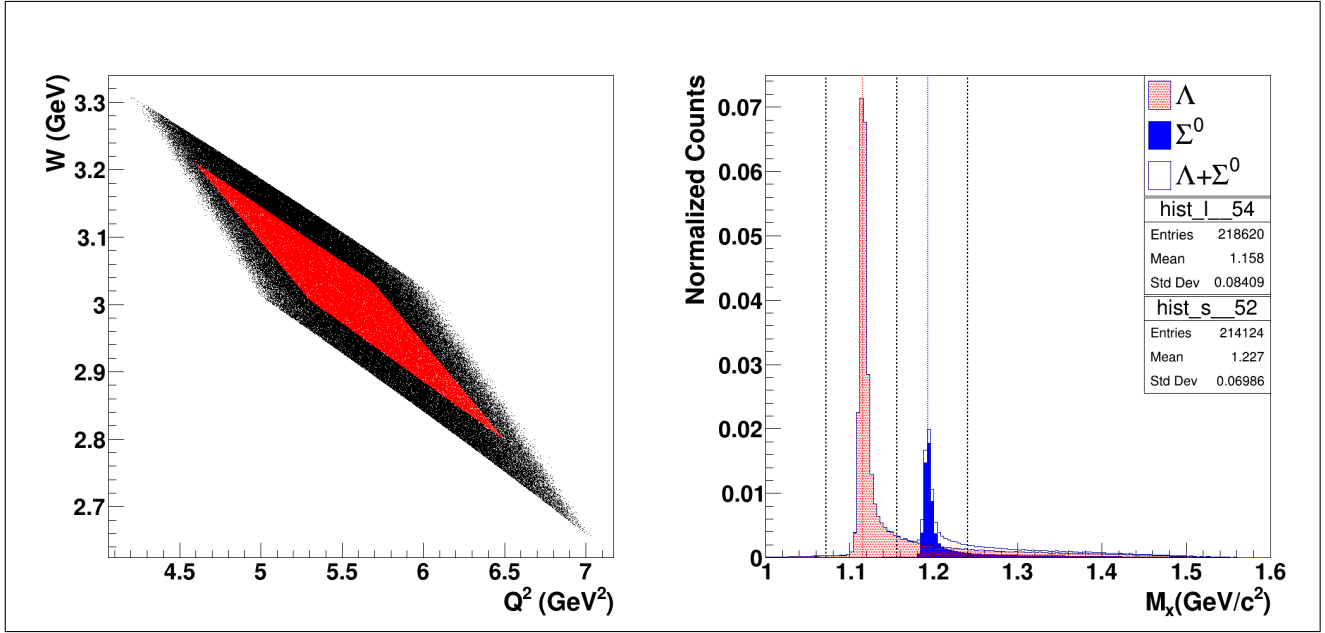


6.2 $E_{beam} = 10.921$ GeV (high ε)

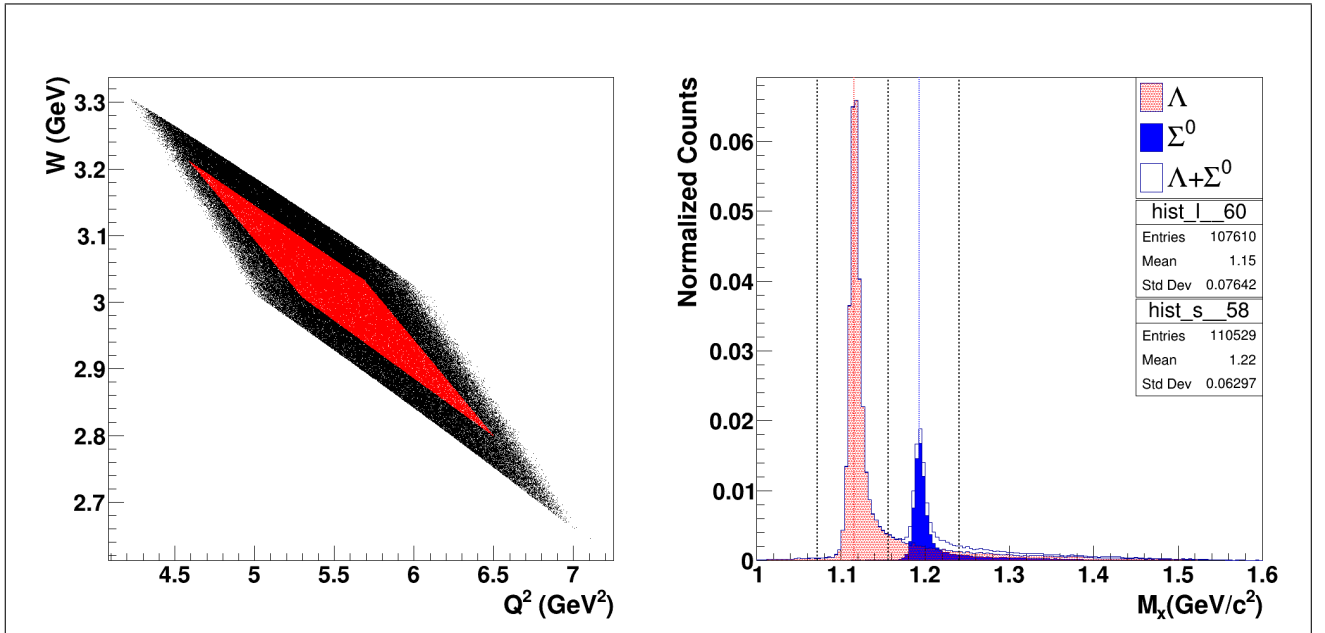
6.2.1 central angle

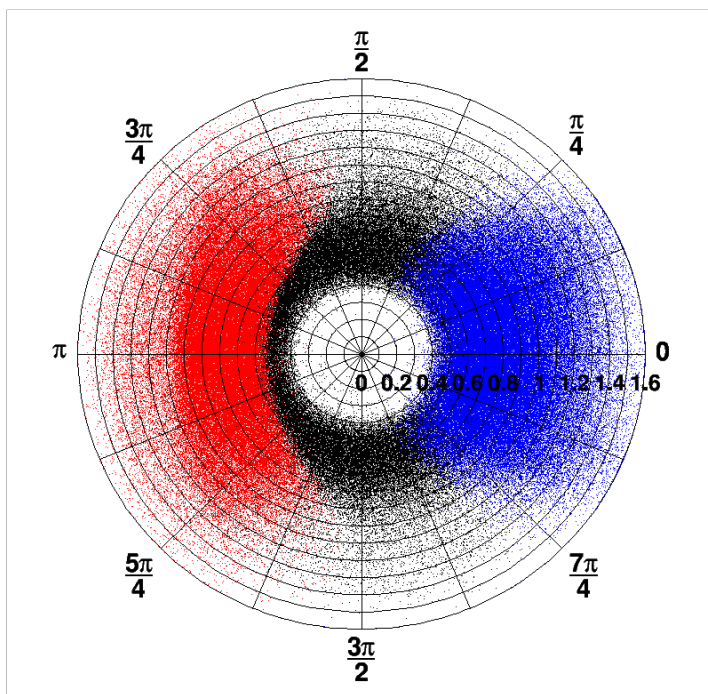


6.2.2 $+3.00^\circ$



6.2.3 -3.00°





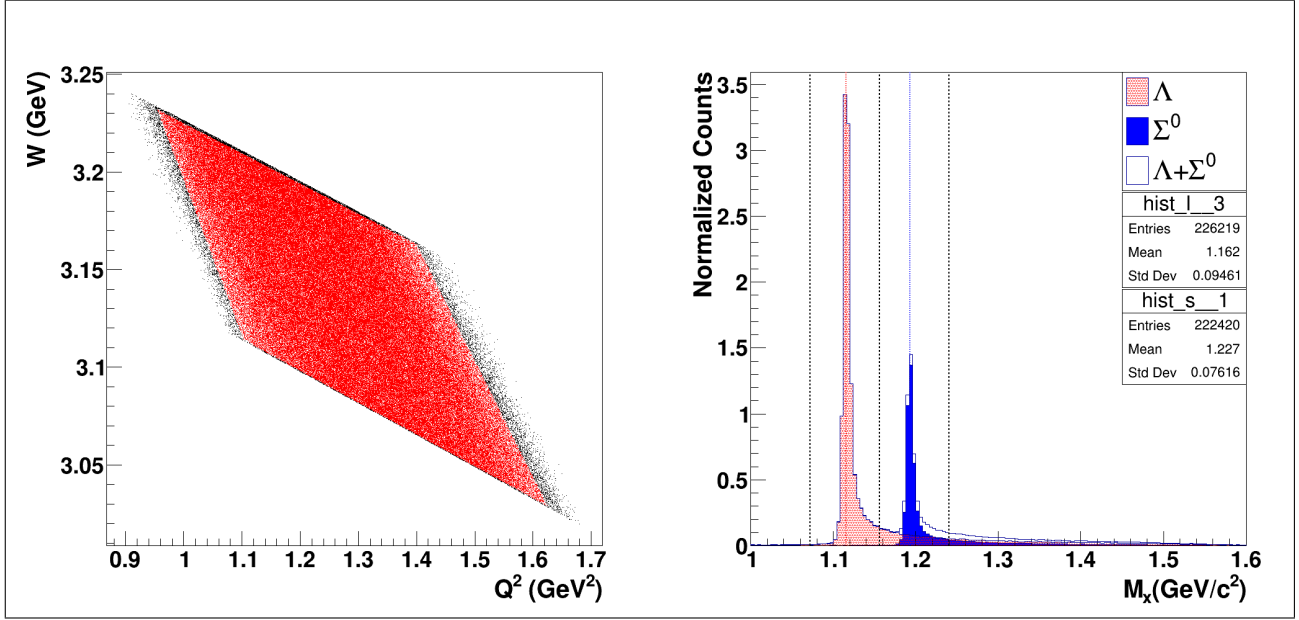
Part II

Remaining $p(e, e'K^+)\Lambda(\Sigma^0)$ kinematic settings

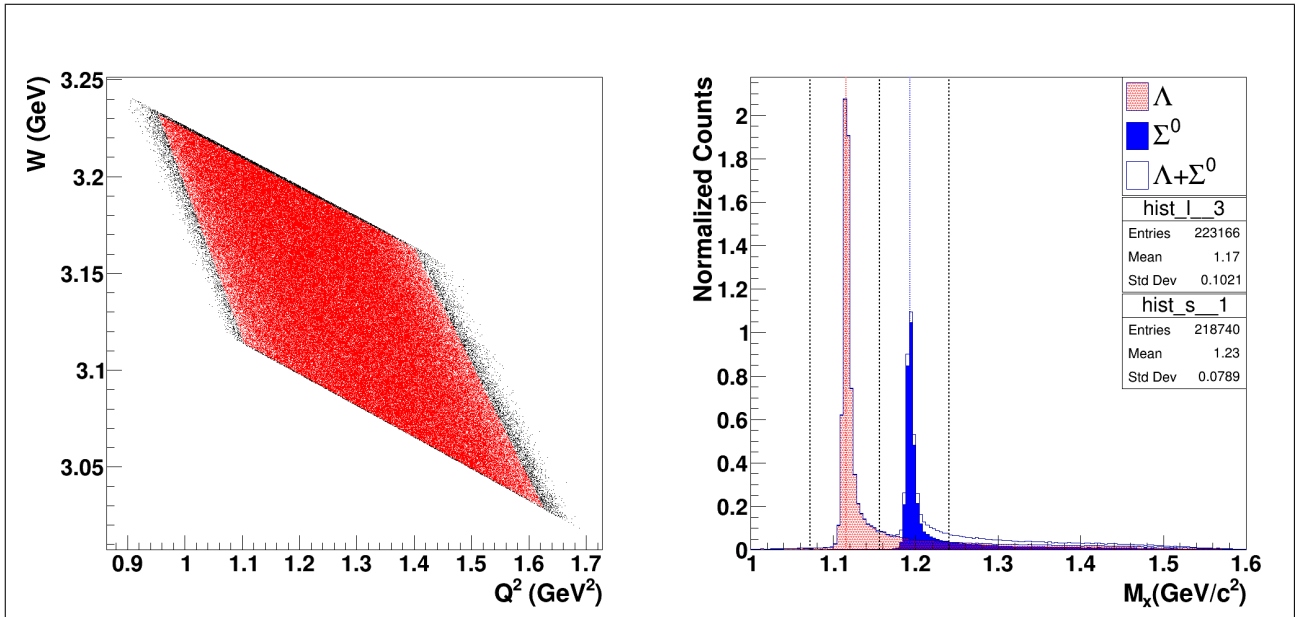
7 Setting: $Q^2 = 1.25 \text{ GeV}^2$, $W = 3.14 \text{ GeV}$

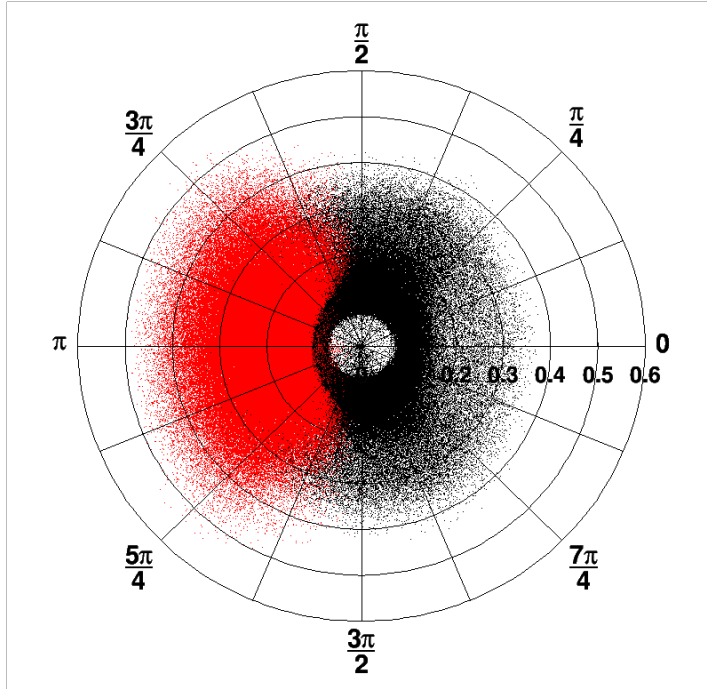
7.1 $E_{beam} = 7.495 \text{ GeV}$ (low ε)

7.1.1 central angle



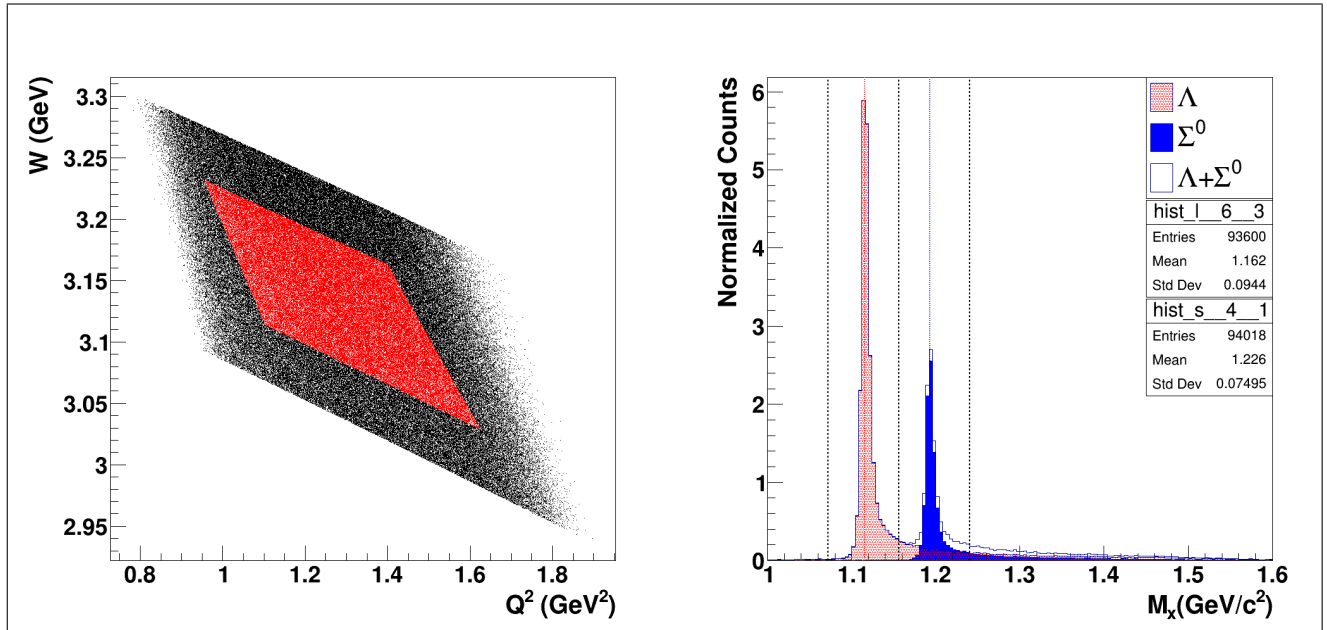
7.1.2 $+3.00^\circ$



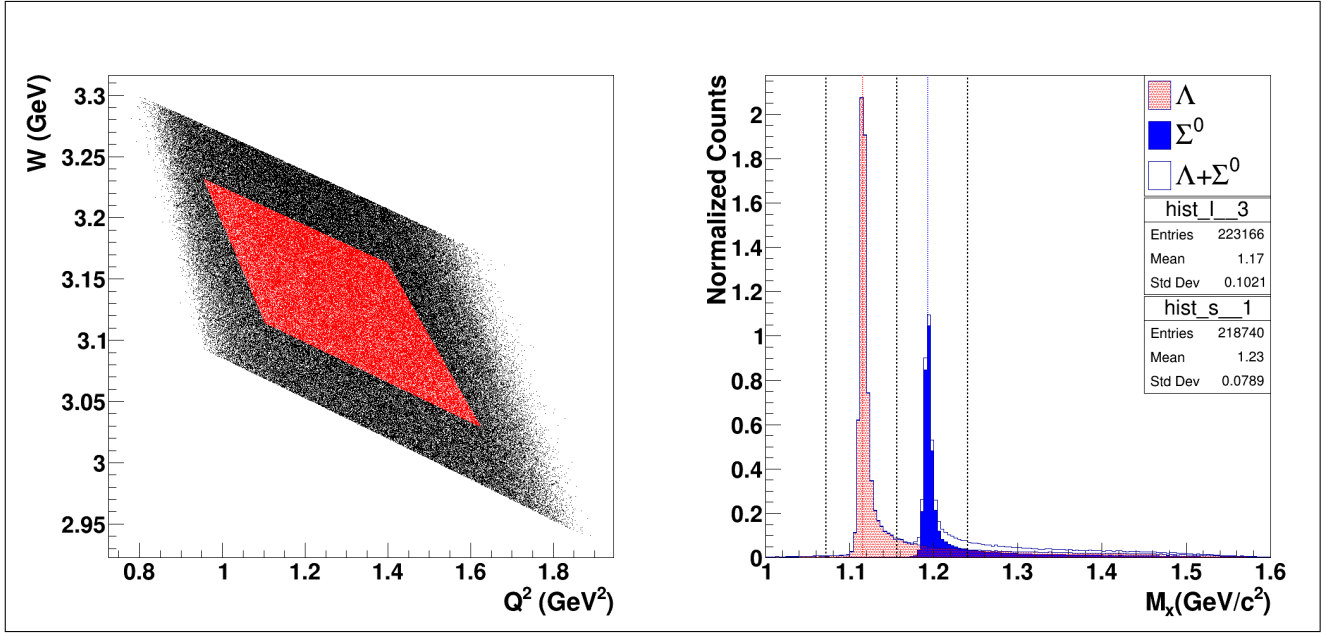


7.2 $E_{beam} = 9.393$ GeV (high ε)

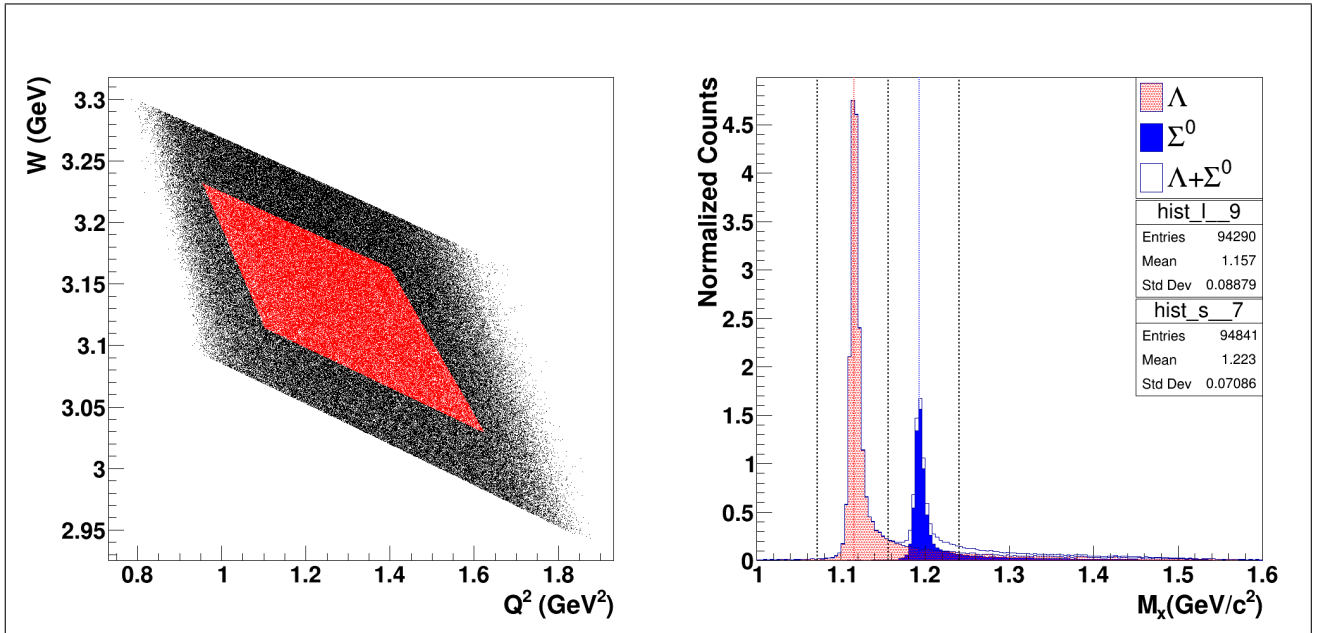
7.2.1 central angle

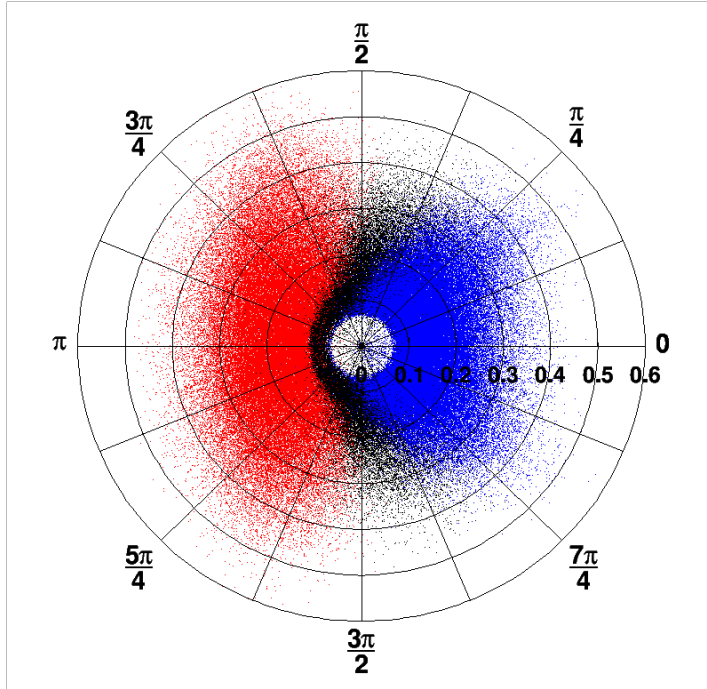


7.2.2 $+3.00^\circ$



7.2.3 -1.90°

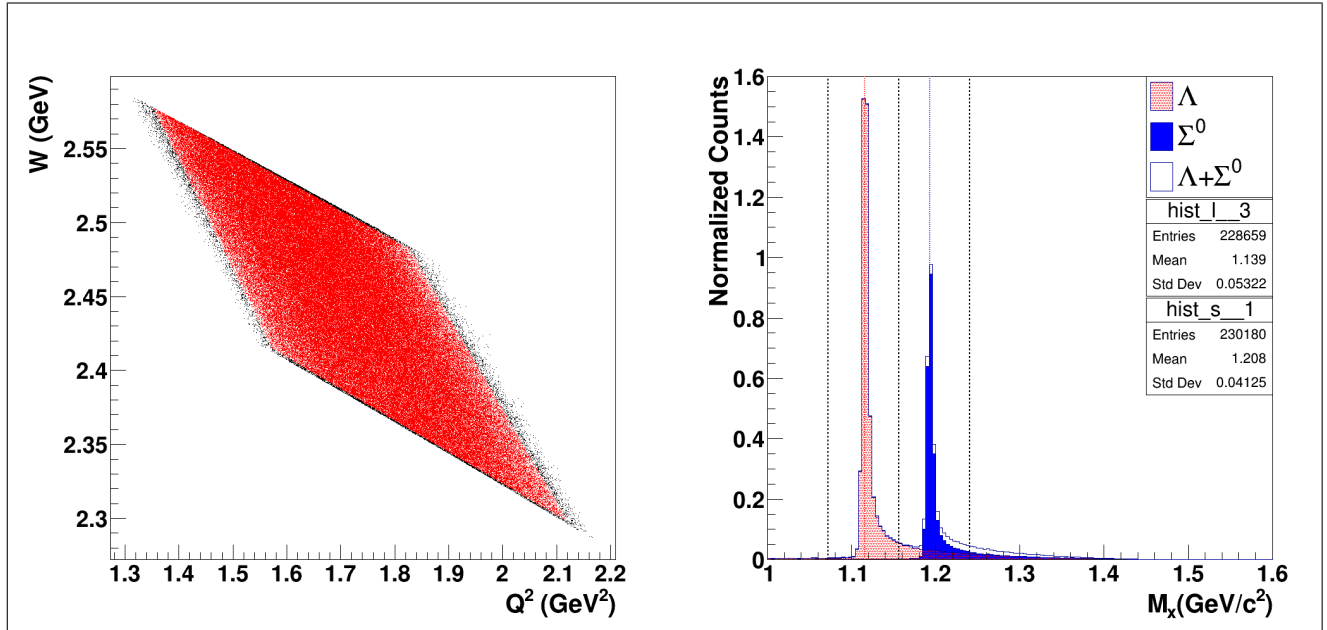




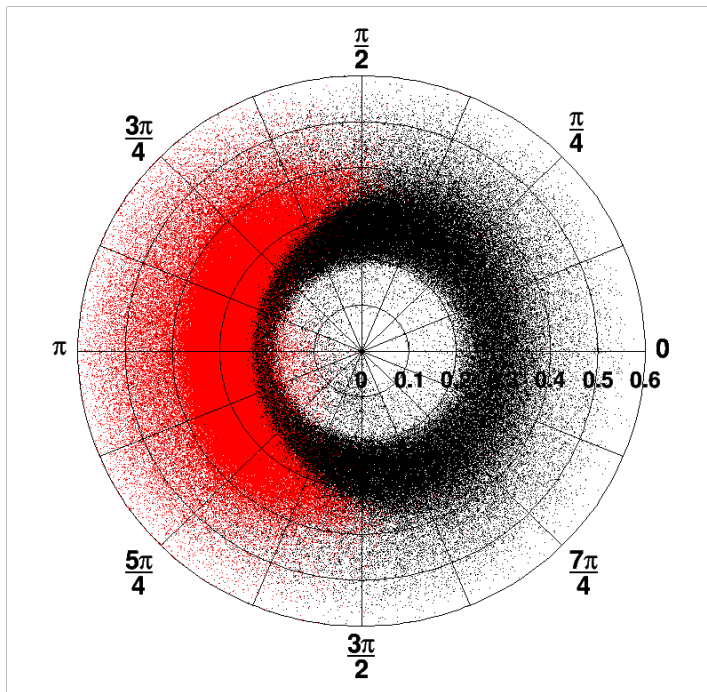
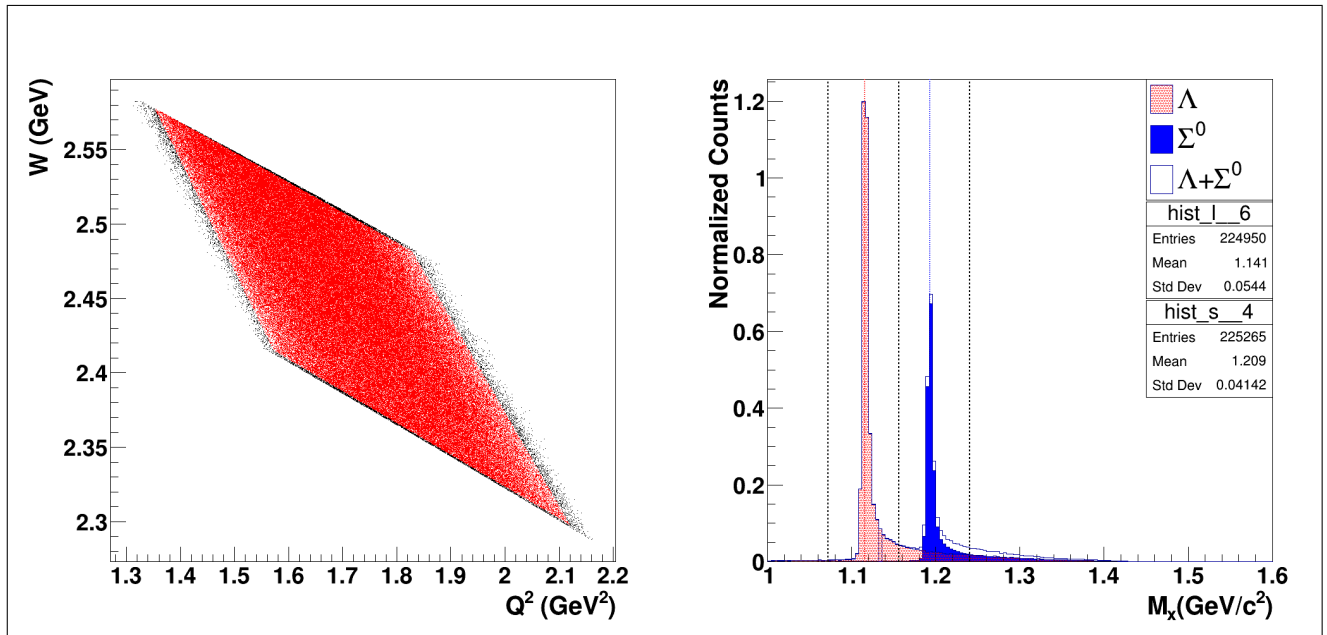
8 Setting: $Q^2 = 1.70 \text{ GeV}^2$, $W = 2.45 \text{ GeV}$

8.1 $E_{beam} = 5.647 \text{ GeV}$ (low ε)

8.1.1 central angle

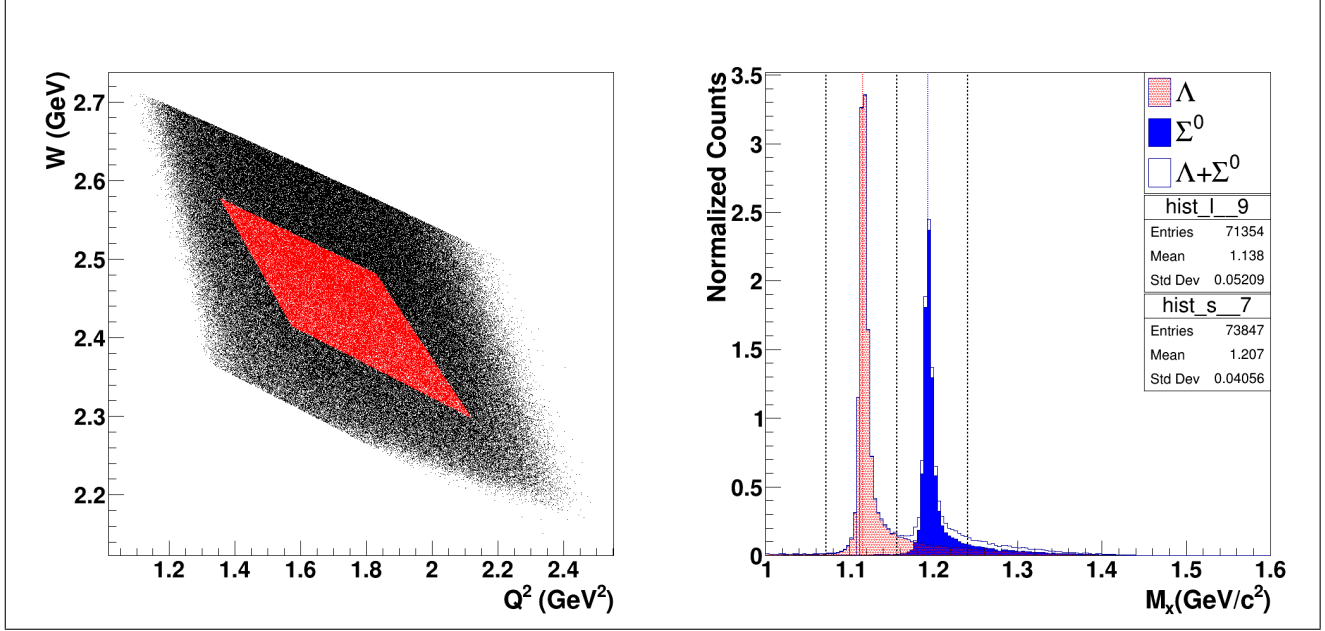


8.1.2 $+3.00^\circ$

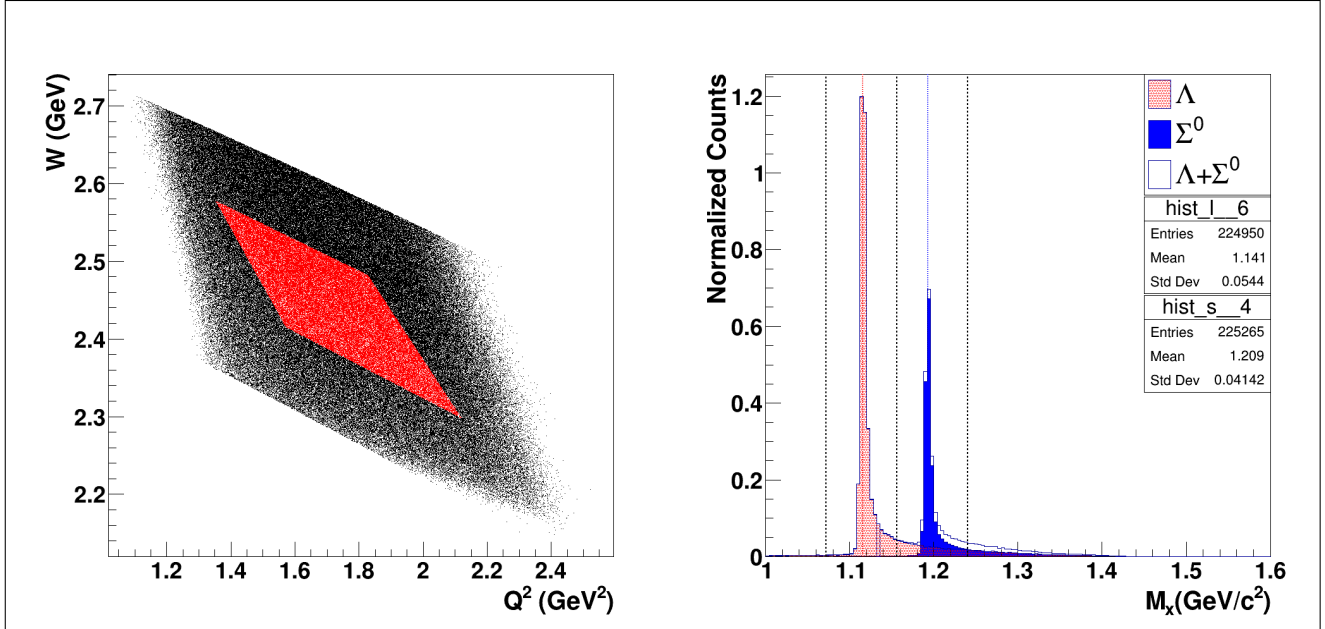


8.2 $E_{beam} = 8.761$ GeV (high ε)

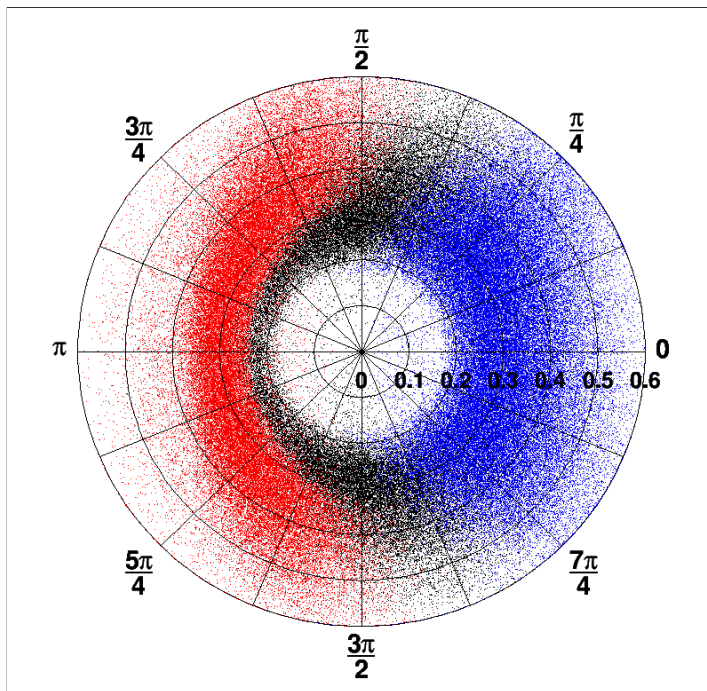
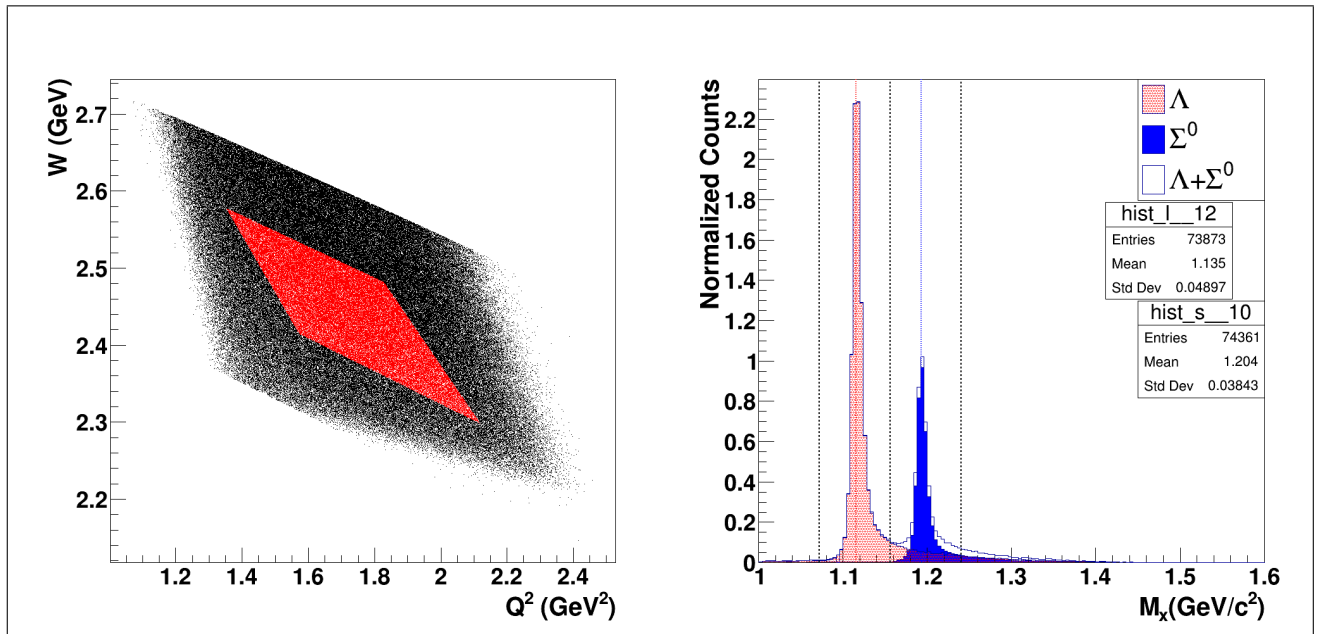
8.2.1 central angle



8.2.2 $+3.00^\circ$



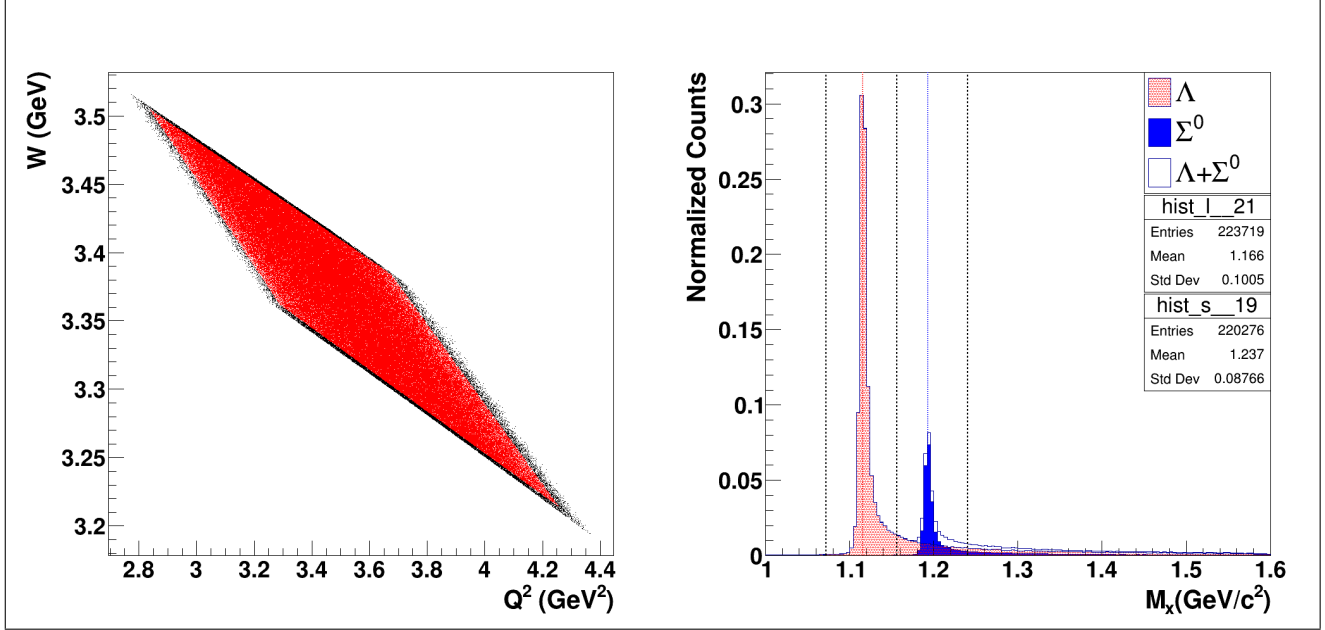
8.2.3 -3.00°



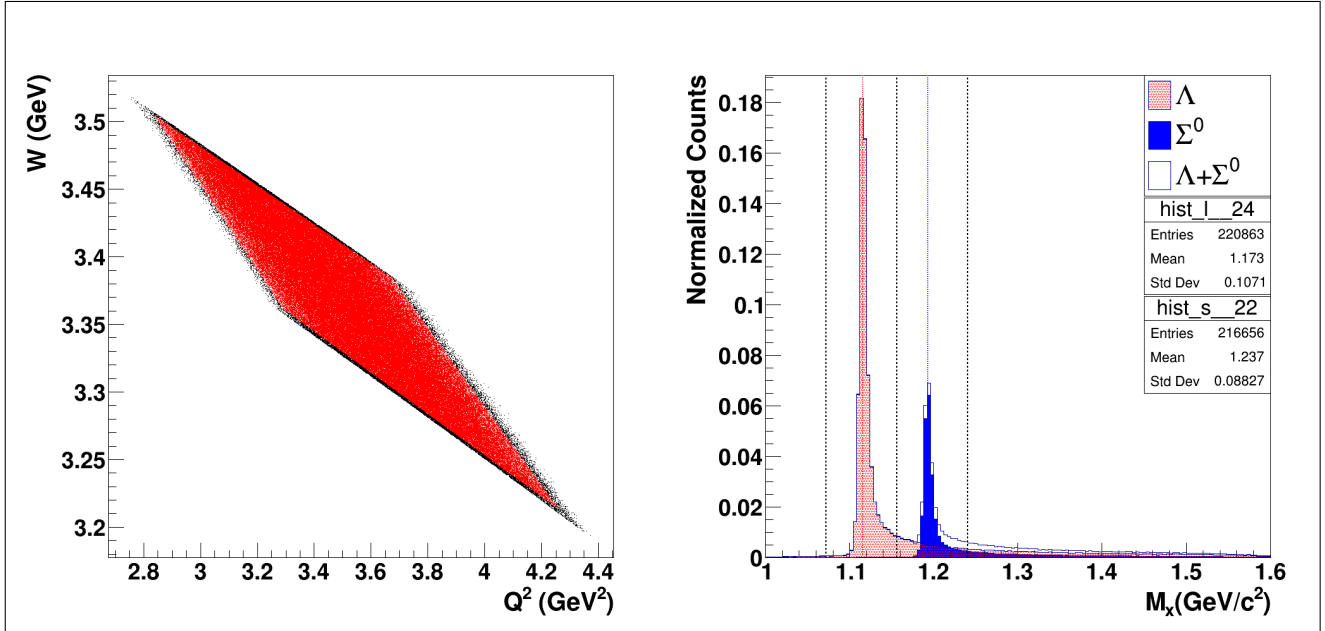
9 Setting: $Q^2 = 3.50 \text{ GeV}^2$, $W = 3.37 \text{ GeV}$

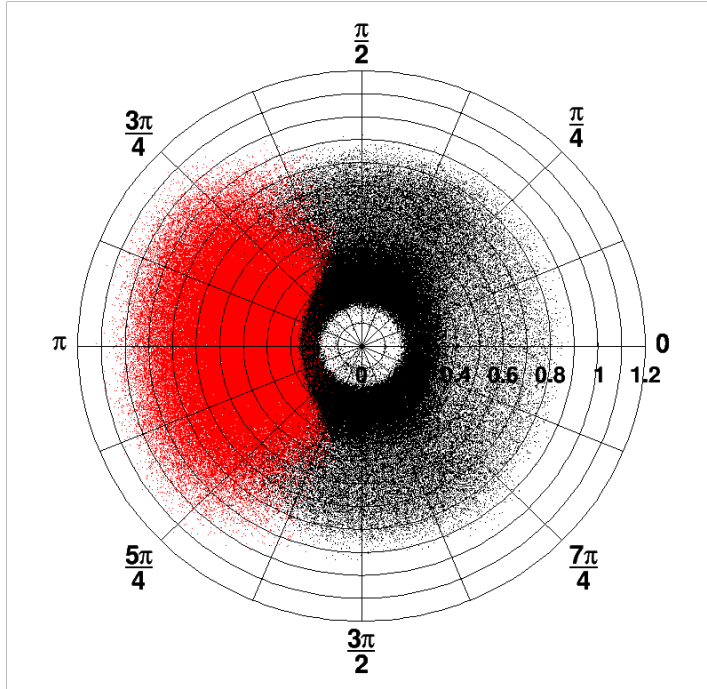
9.1 $E_{beam} = 9.343 \text{ GeV}$ (low ε)

9.1.1 central angle



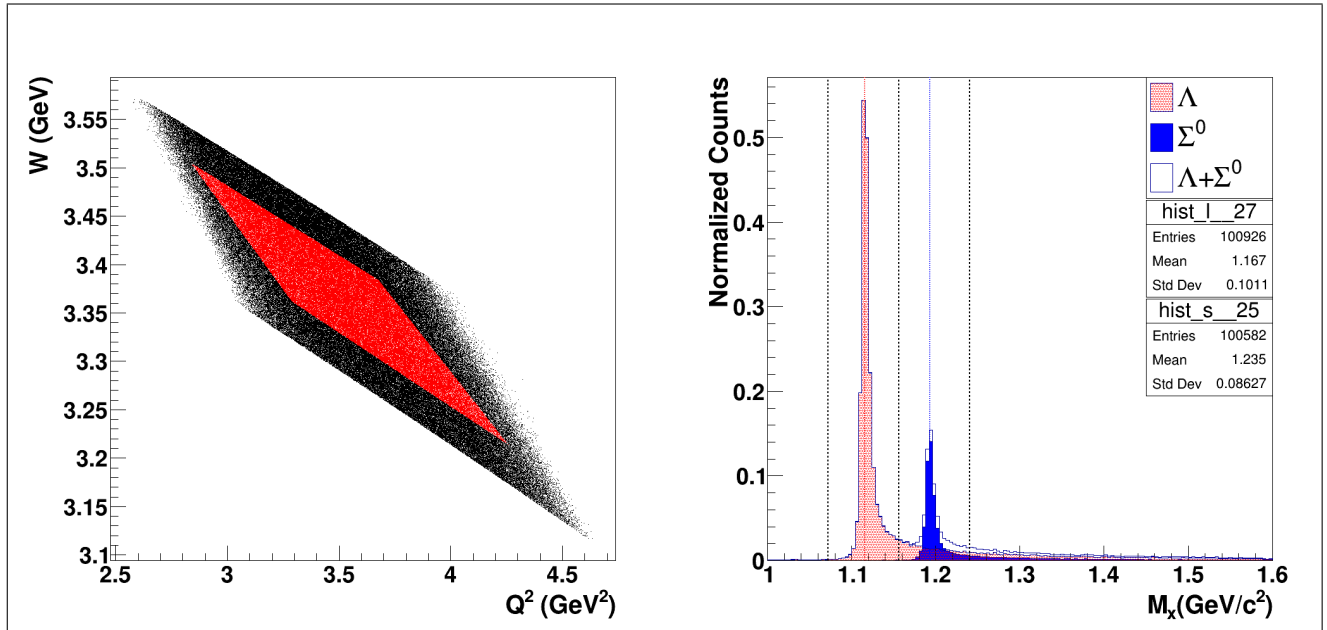
9.1.2 $+3.00^\circ$



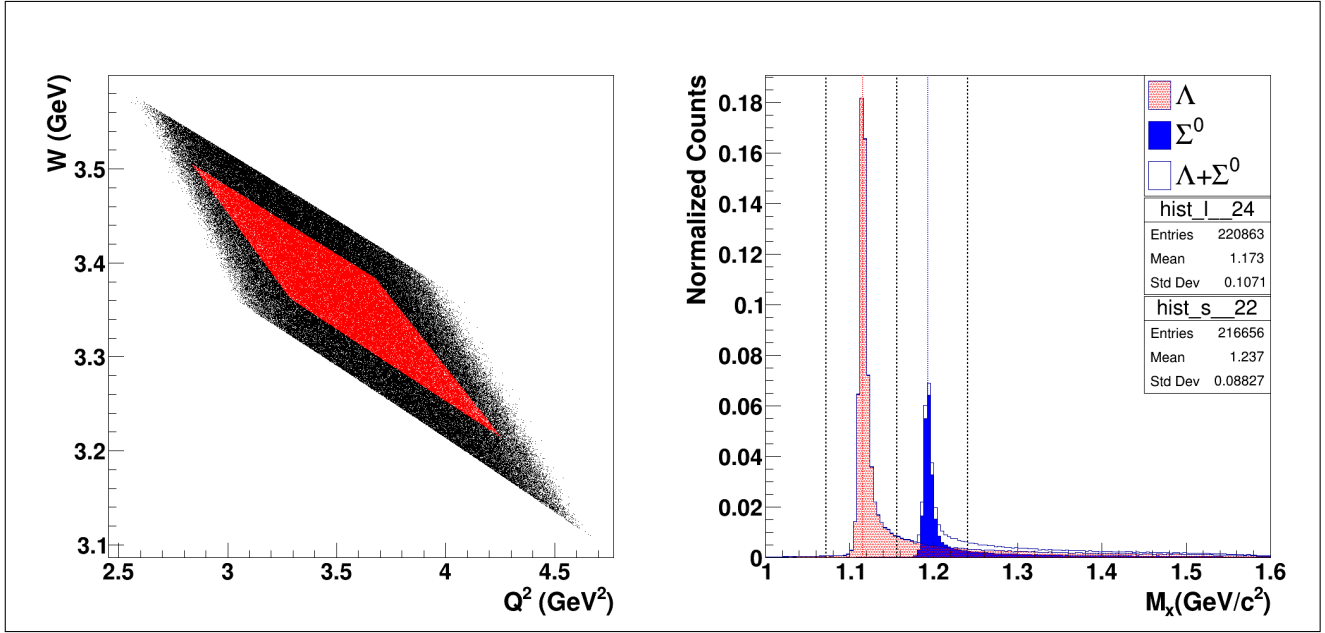


9.2 $E_{beam} = 10.921$ GeV (high ε)

9.2.1 central angle



9.2.2 $+3.00^\circ$



9.2.3 -3.00°

