But What About the Failed Events?

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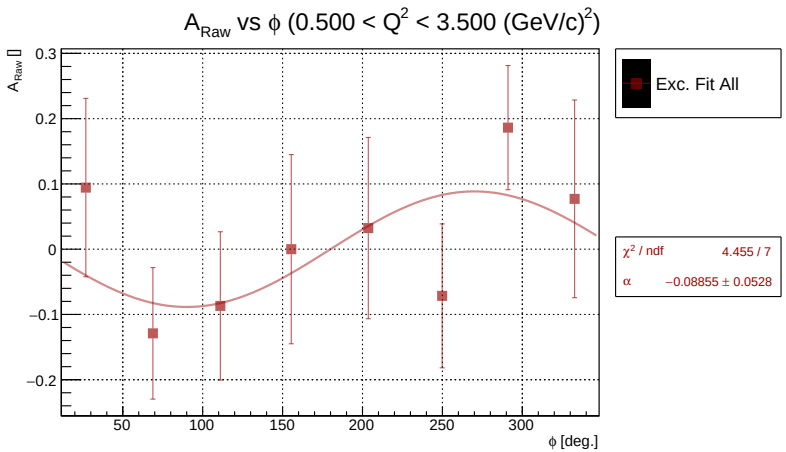
Refresher: The Problem

For the EG6 experiment, the BSA for the coherent DVMP process

$$e\ {}^4\mathrm{He} \rightarrow e\ {}^4\mathrm{He}\ \pi^0 \rightarrow e\ {}^4\mathrm{He}\ \gamma\ \gamma \tag{1}$$

is obtained from two different event selection methods:

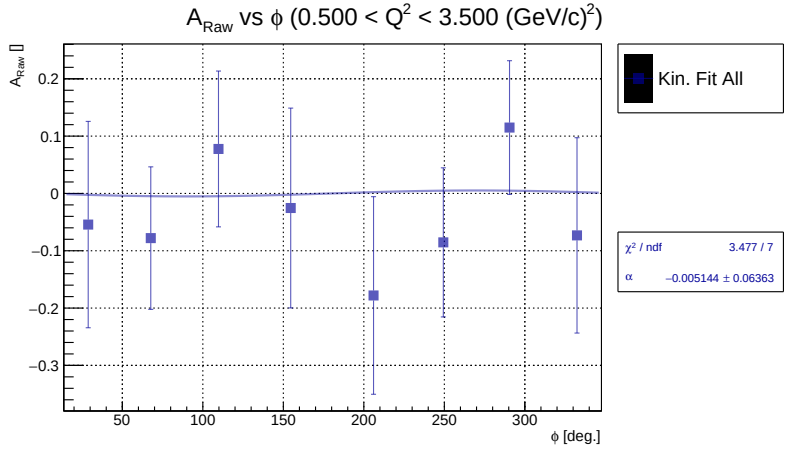
Exclusivity Cuts



BSA = -8.9±5.3 %

(800 events)

Kinematic Fit

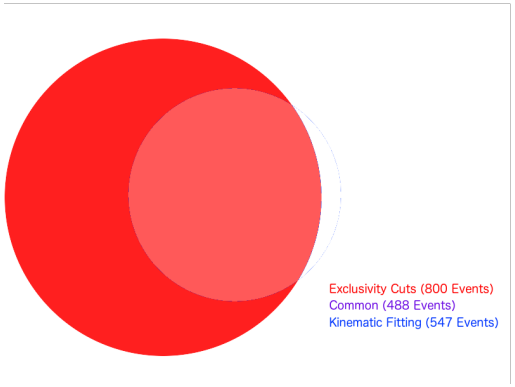


BSA = -0.5±6.3 %

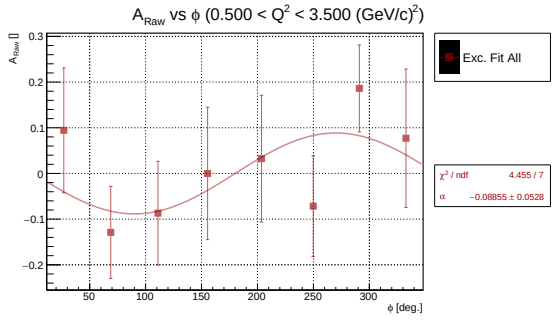
(537 events)

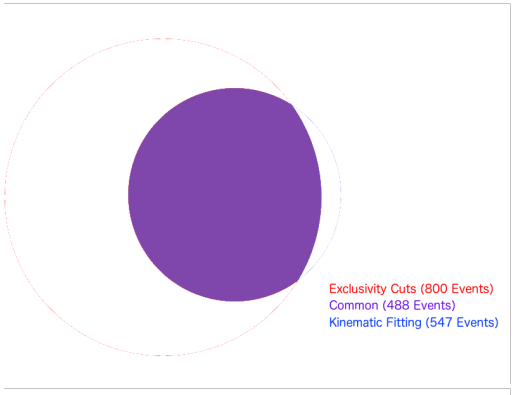
Refresher: Partitioning the Dataset

Beam spin asymmetries summary:

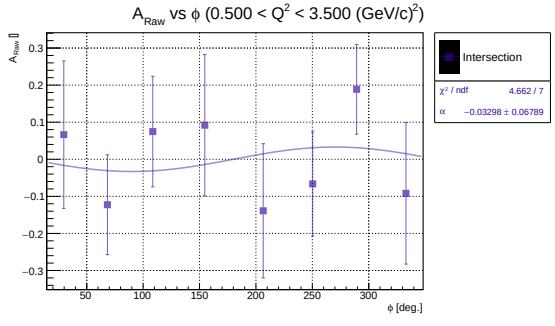


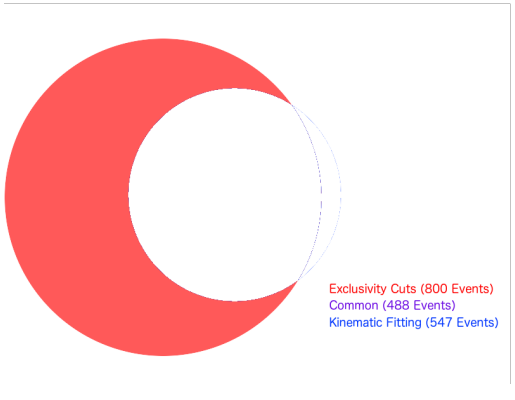
(800 events, BSA = -8.9±5.3%)



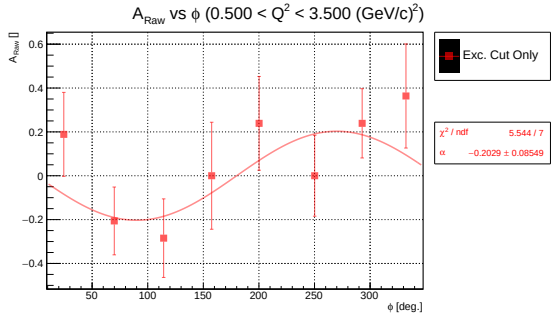


(488 events, BSA = -3.3±6.8%)



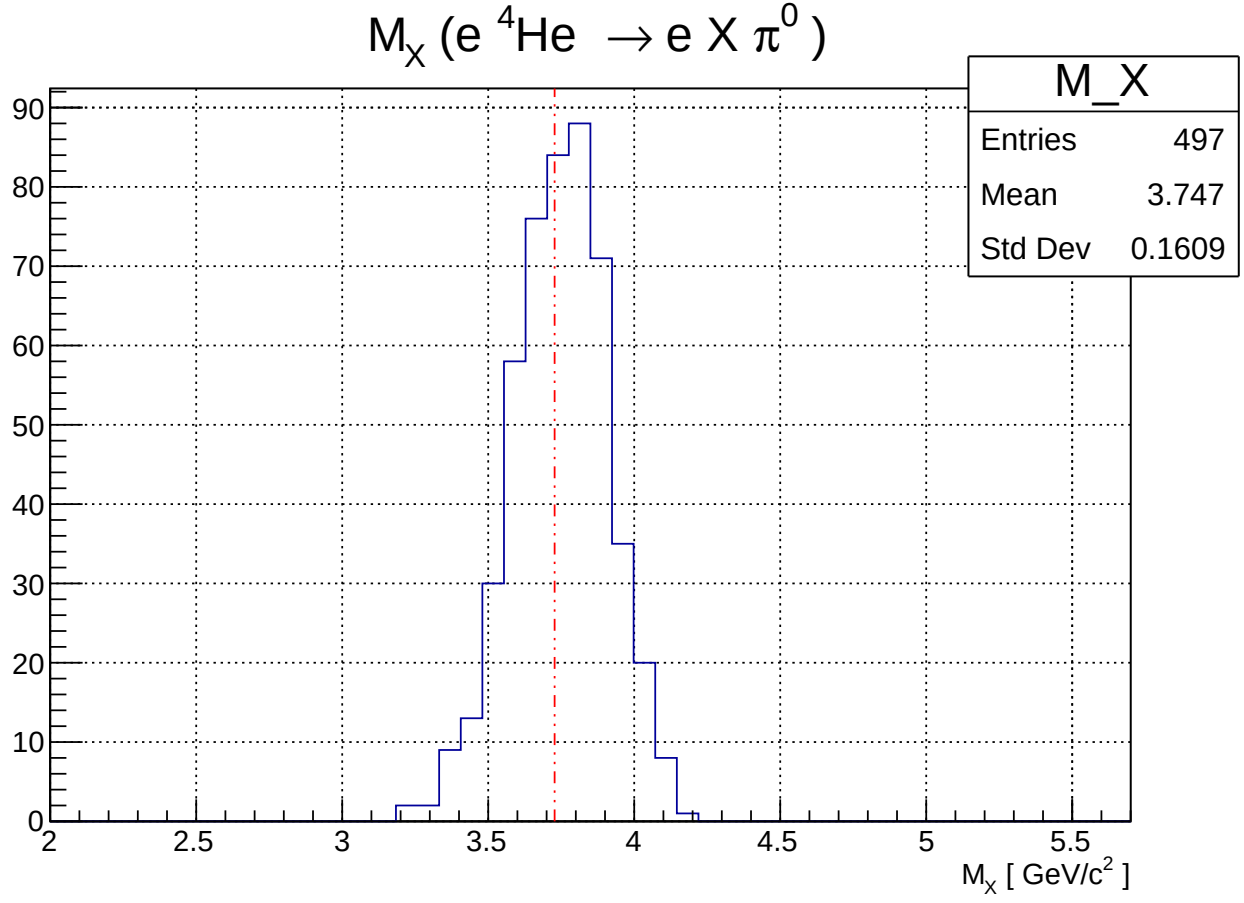


(312 events, BSA = -20.3±8.5%)



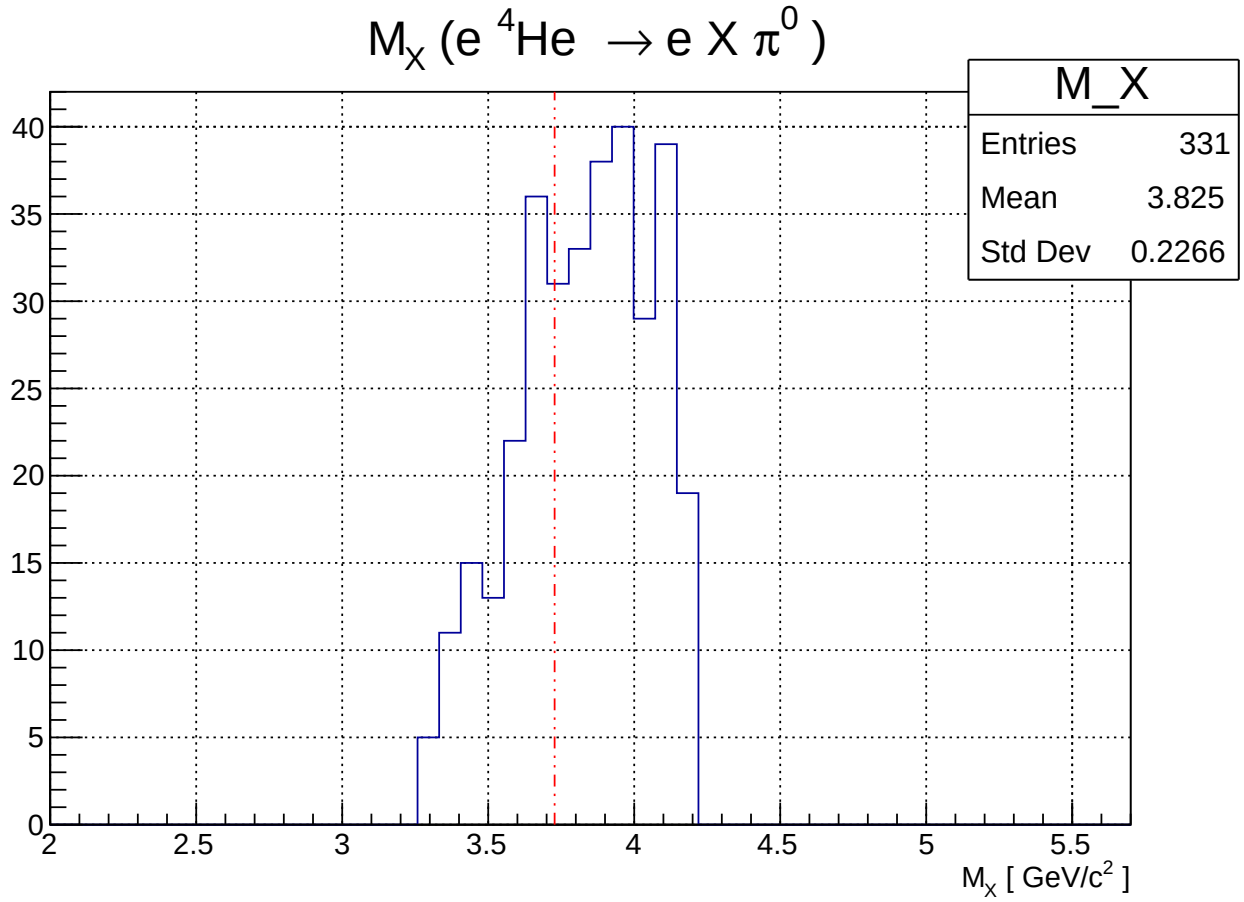
M_X ($e^4\mathrm{He} \to eX\gamma\gamma$): Events Passing Kin. Fit

In searching for exactly what this large background asymmetry is, we look to this missing mass:

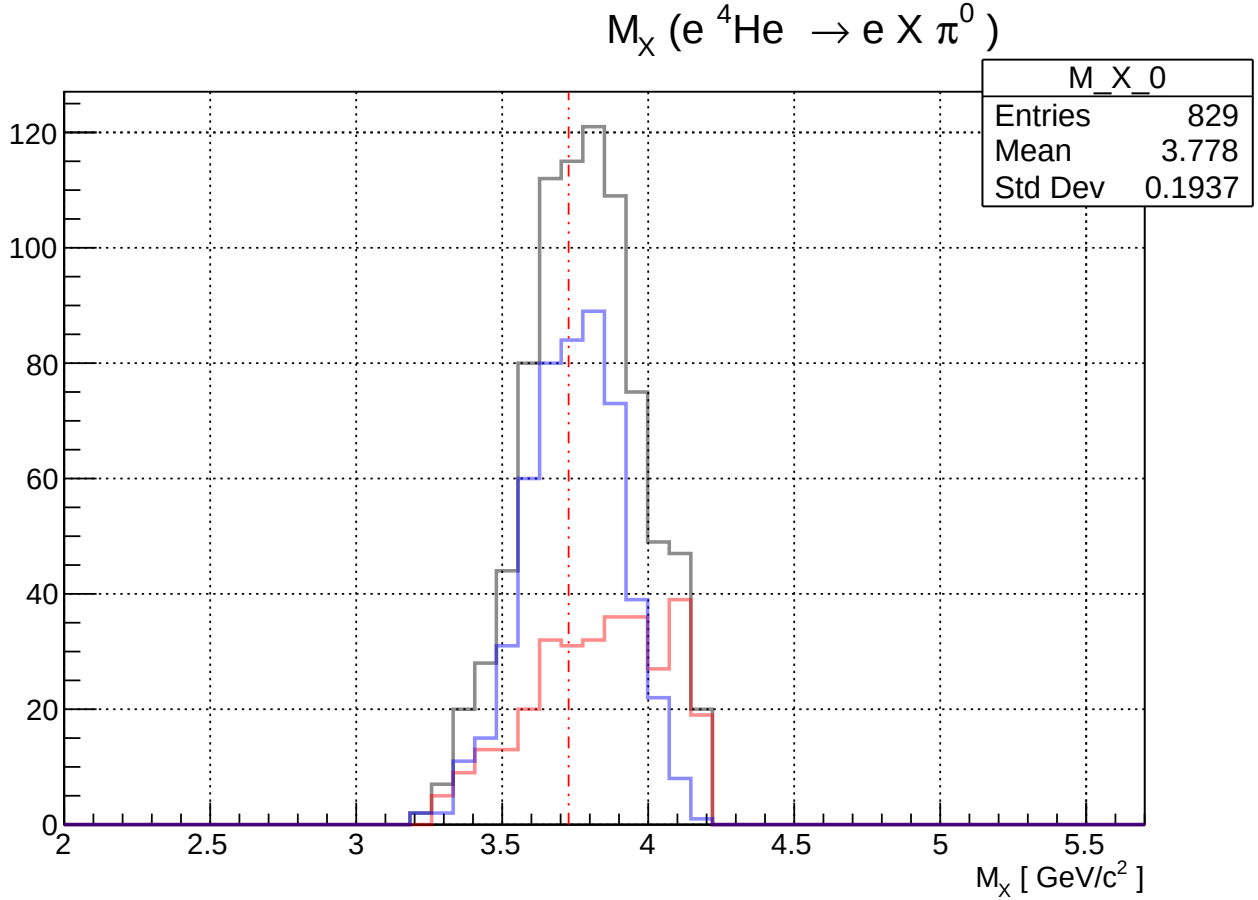


But What Does the Distribution of the Failed Events Look Like?

M_X ($e^4\mathrm{He} \to eX\gamma\gamma$): Events Failing Kin. Fit



$M_X\ (e^4\mathrm{He} \to eX\gamma\gamma)$



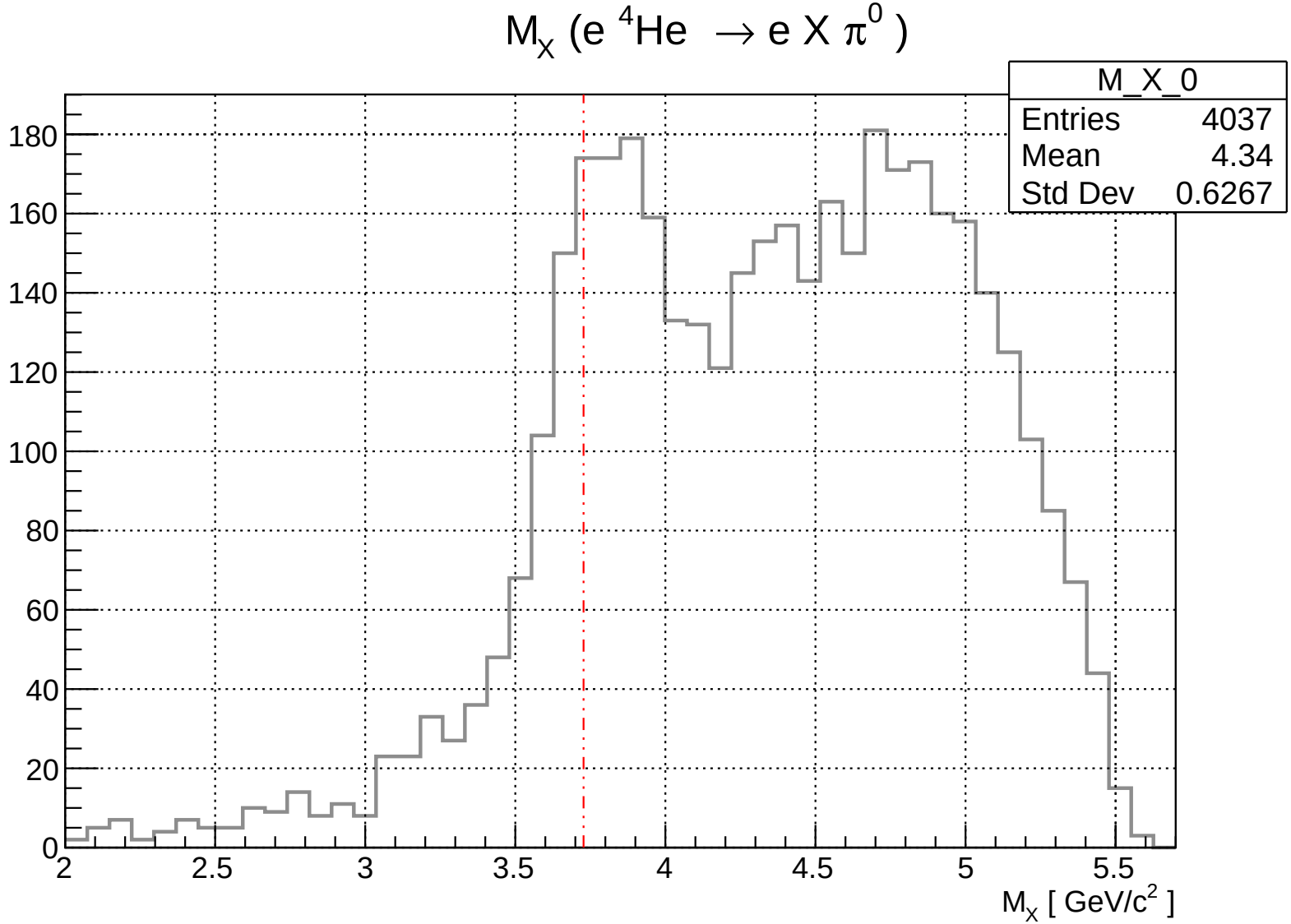
Black: Passing EITHER exc. cut OR kin. fit (BSA $\approx -$ 8.5%)

Blue: Passing Kinematic Fit (BSA $\approx$ 0 %)

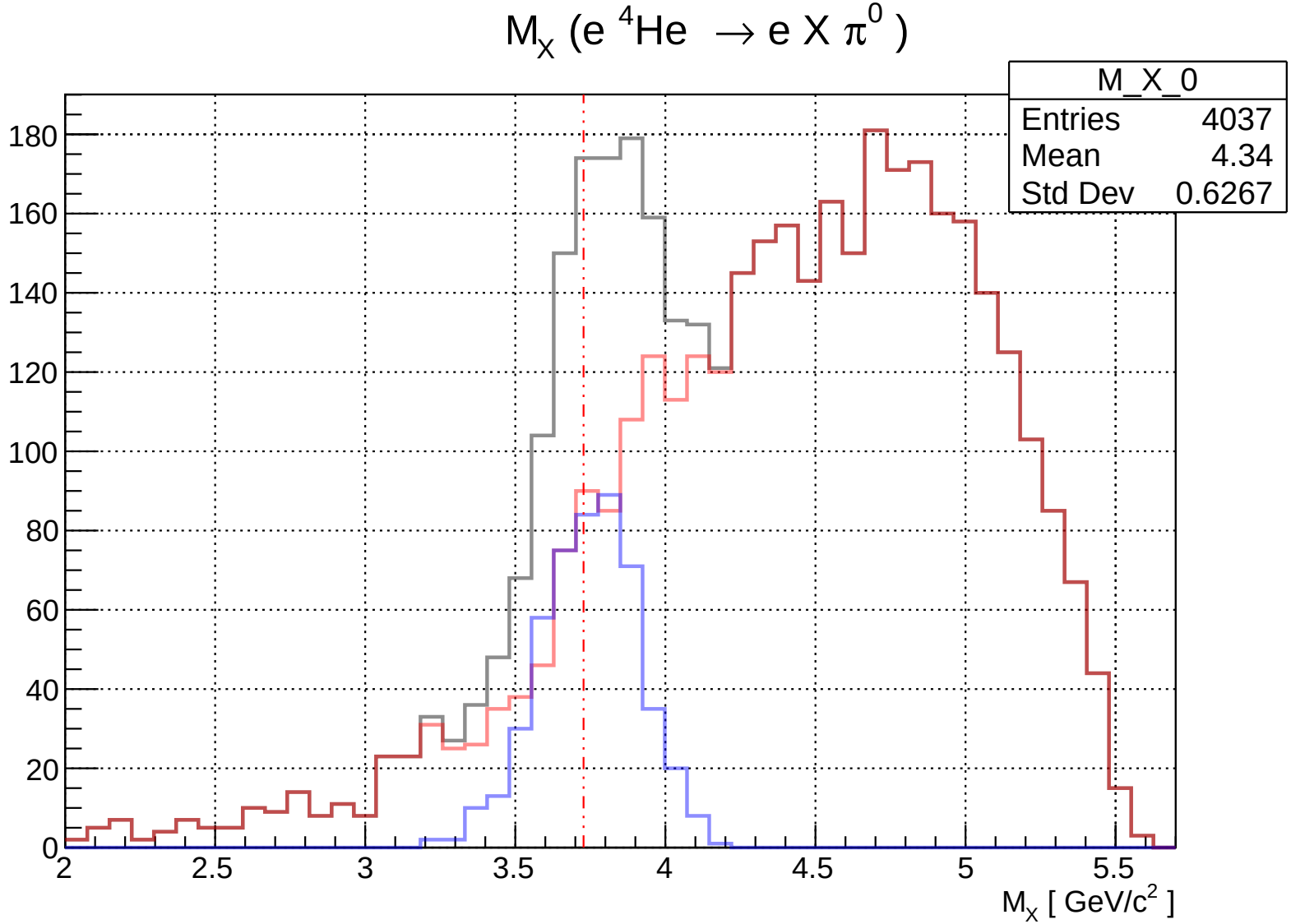
Red: Failing Kinematic Fit (BSA $\approx -20.0\%$)

Only Apply Coplanarity Cut

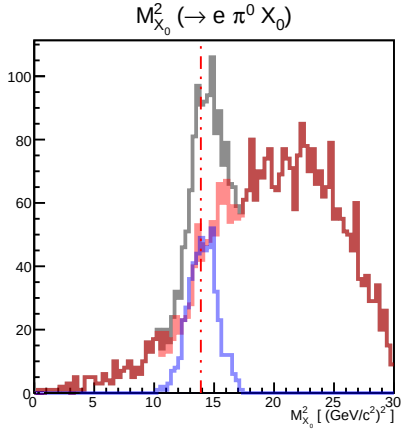
$M_X\ (e^4\mathrm{He} \rightarrow eX\pi^0)$

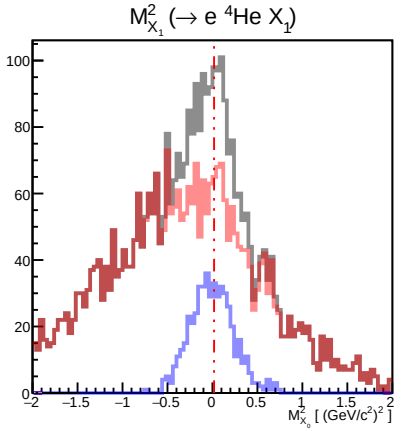


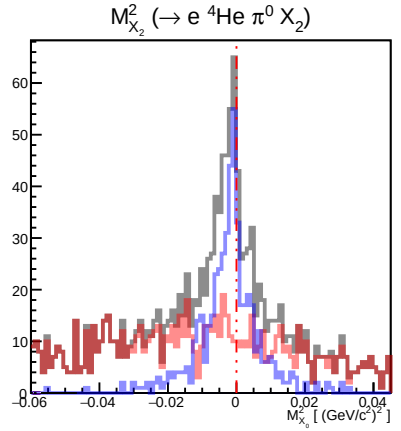
$M_X\ (e^4\mathrm{He} \rightarrow eX\pi^0)$

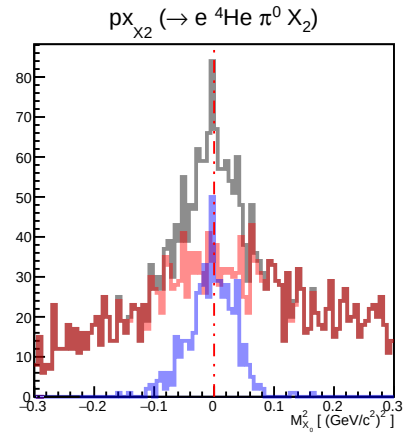


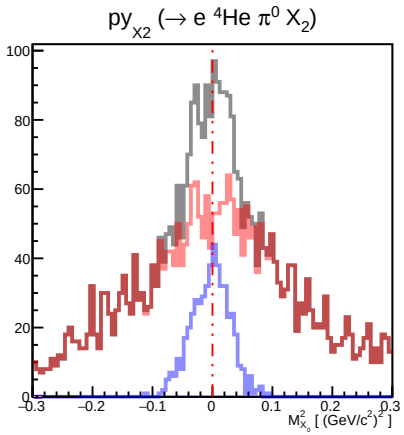
All Exclusivity Variables

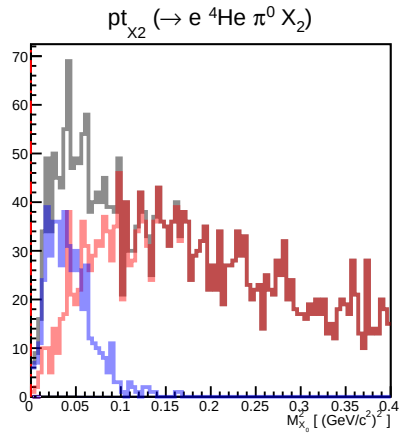


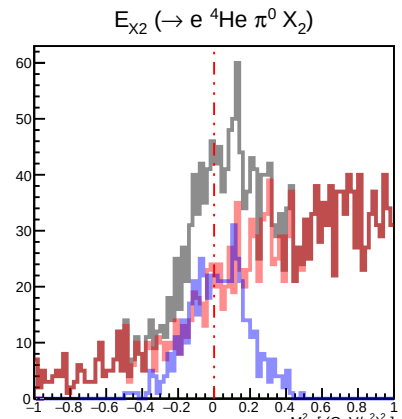


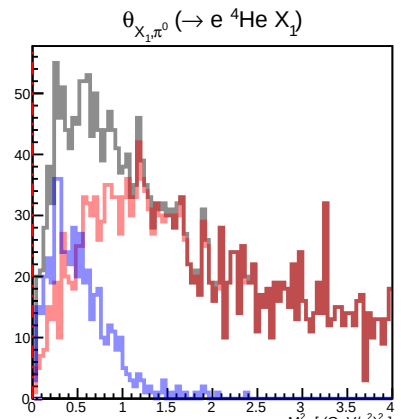


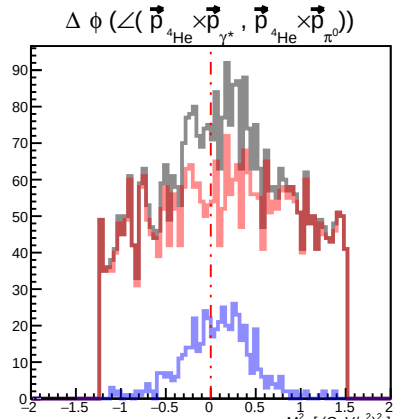






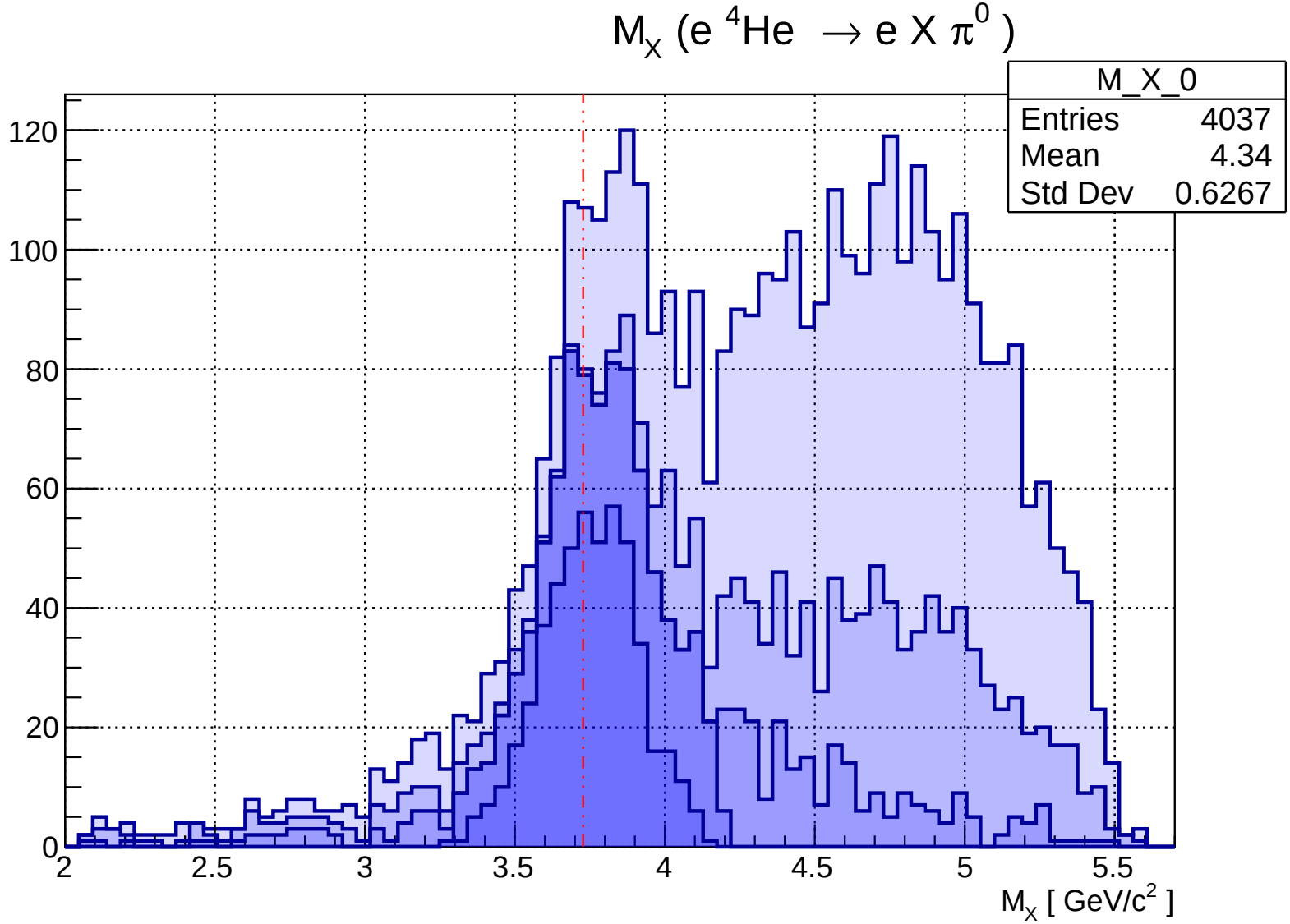






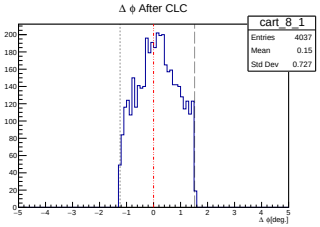
Removing One Cut at a Time

$M_X\ (e^4\mathrm{He} \rightarrow eX\pi^0)$

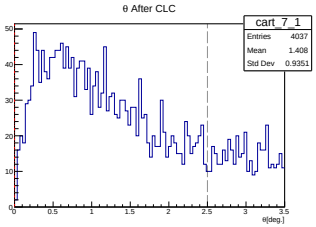


M_X and BSA ($e^4\mathrm{He} \rightarrow eX\pi^0$)

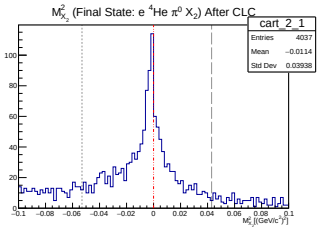
Coplanarity



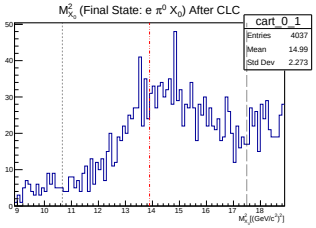
Cone Angle

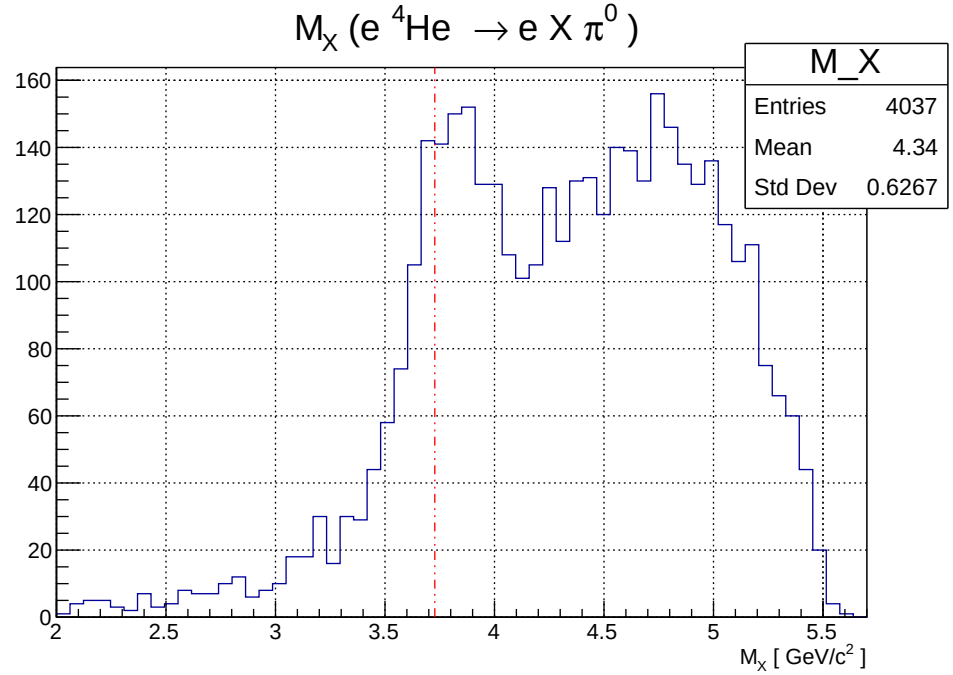


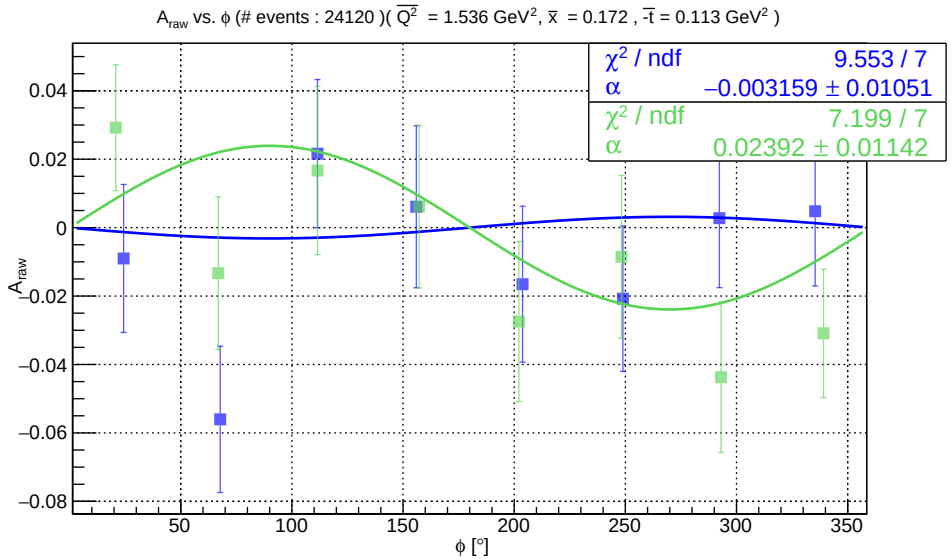
$M^2_{X_{\pi 0}}$



$M^2_{X_{^4\mathrm{He}}}$

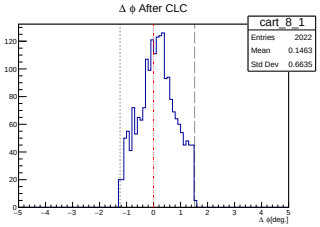




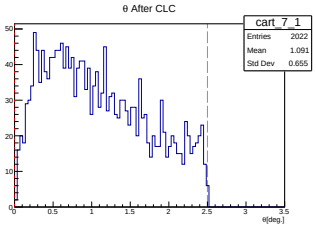


M_X and BSA ($e^4\mathrm{He} \rightarrow eX\pi^0$)

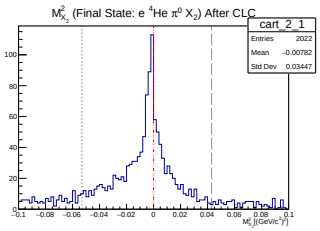
Coplanarity



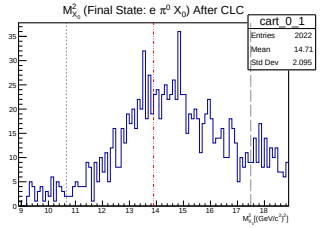
Cone Angle

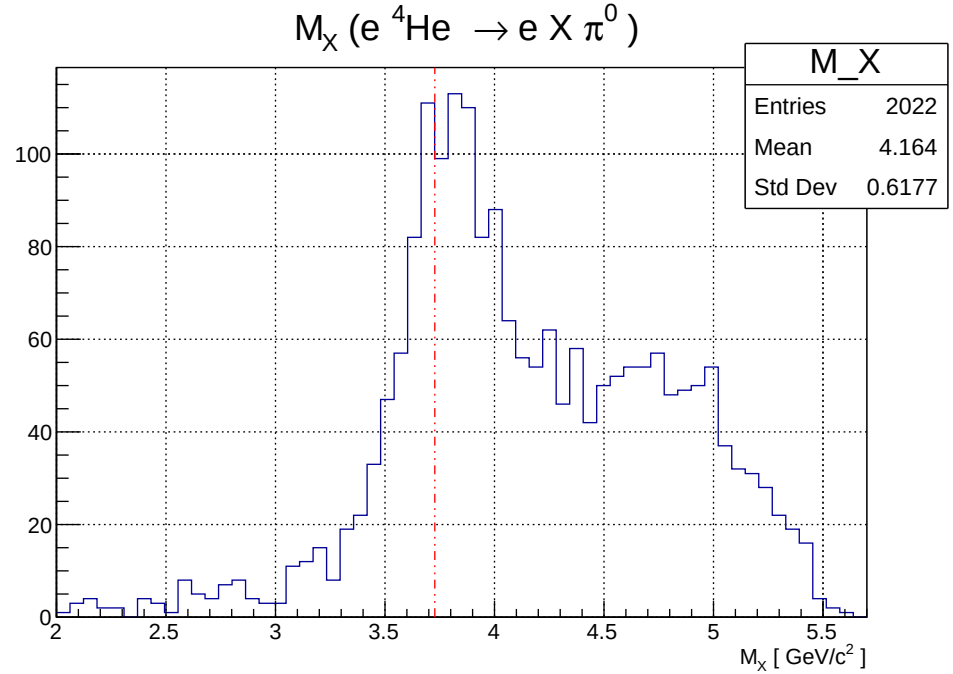


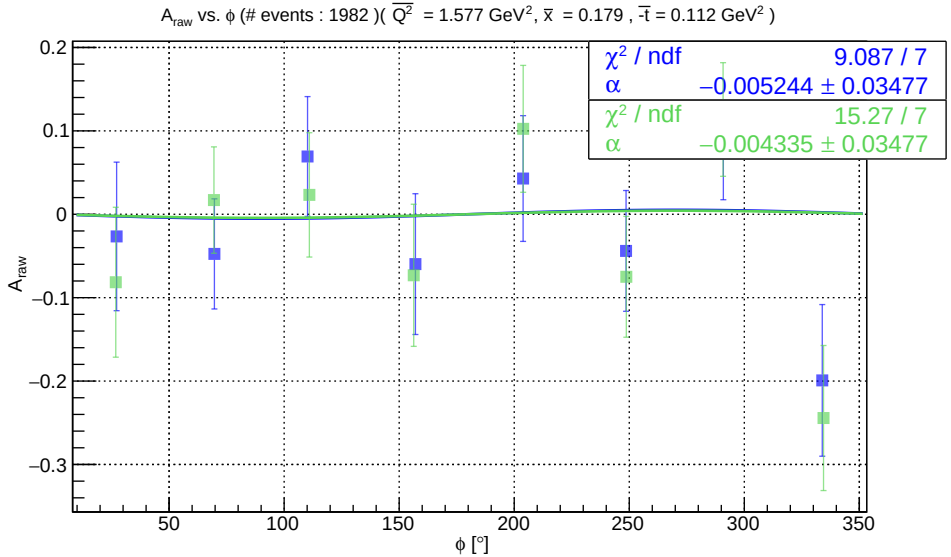
$M^2_{X_{\pi 0}}$



$M^2_{X_{^4\mathrm{He}}}$

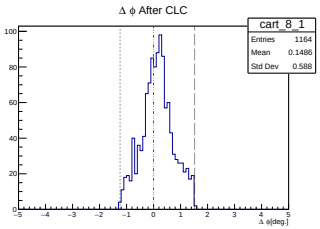




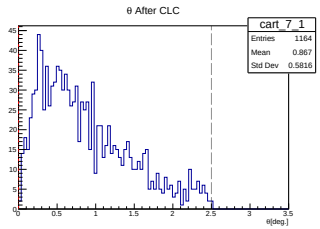


M_X and BSA ($e^4\mathrm{He} \rightarrow eX\pi^0$)

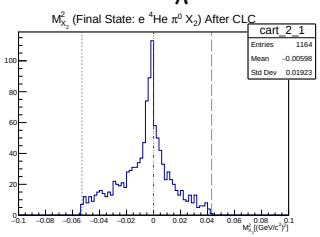
Coplanarity



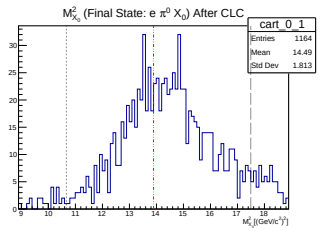
Cone Angle

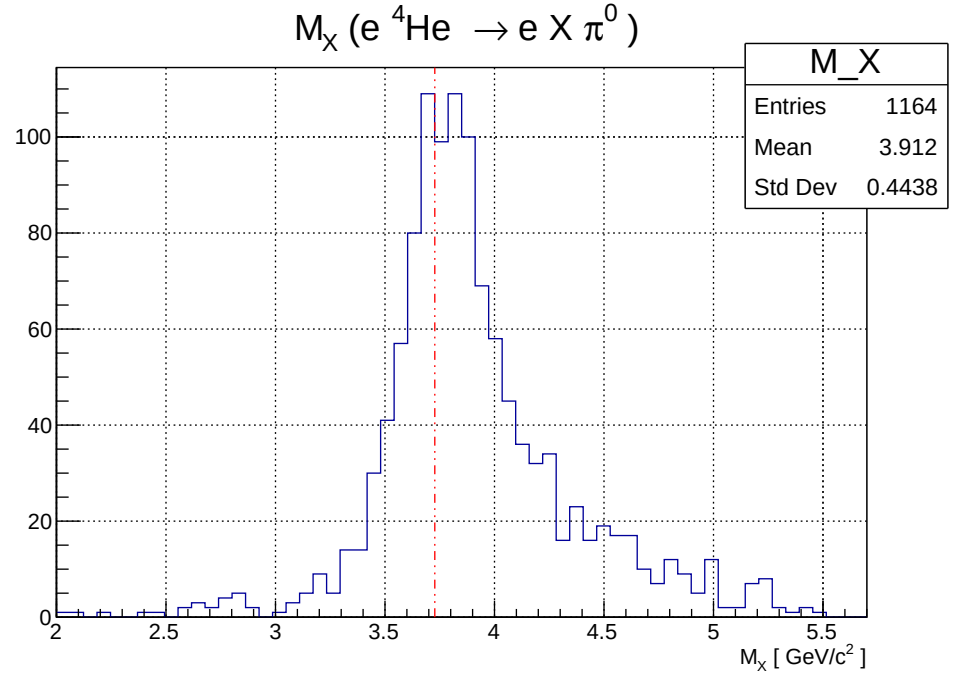


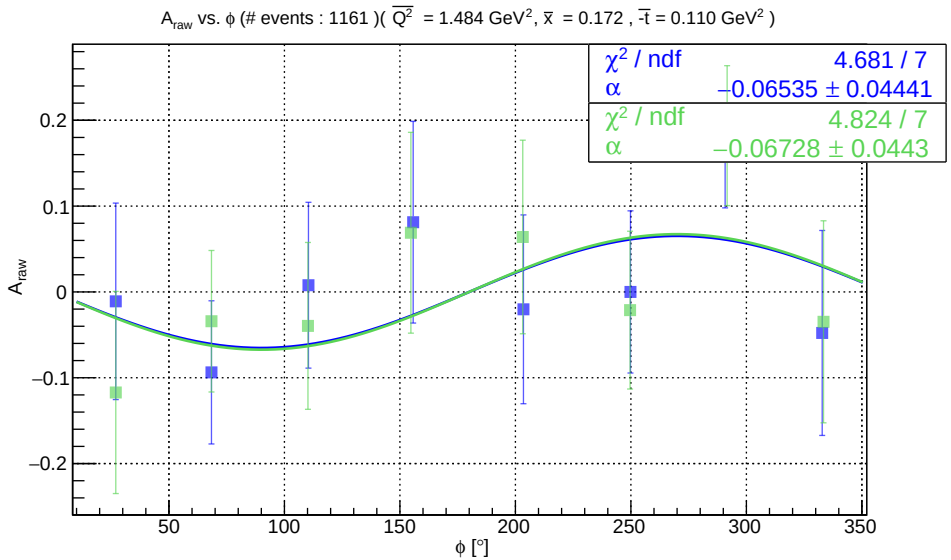
$M^2_{X_{\pi^0}}$



$M^2_{X_{^4\mathrm{He}}}$

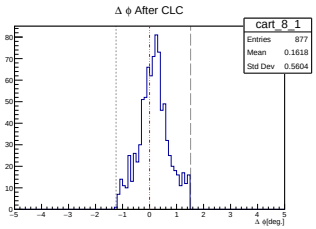




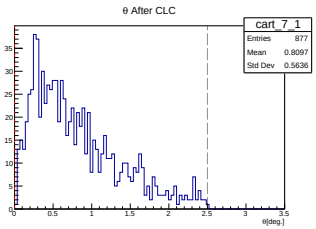


M_X and BSA ($e^4\mathrm{He} \rightarrow eX\pi^0$)

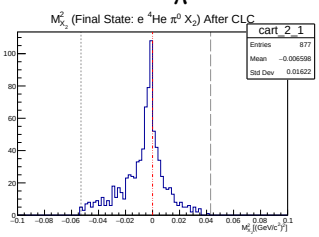
Coplanarity



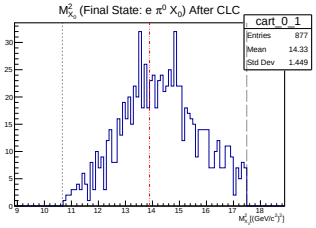
Cone Angle

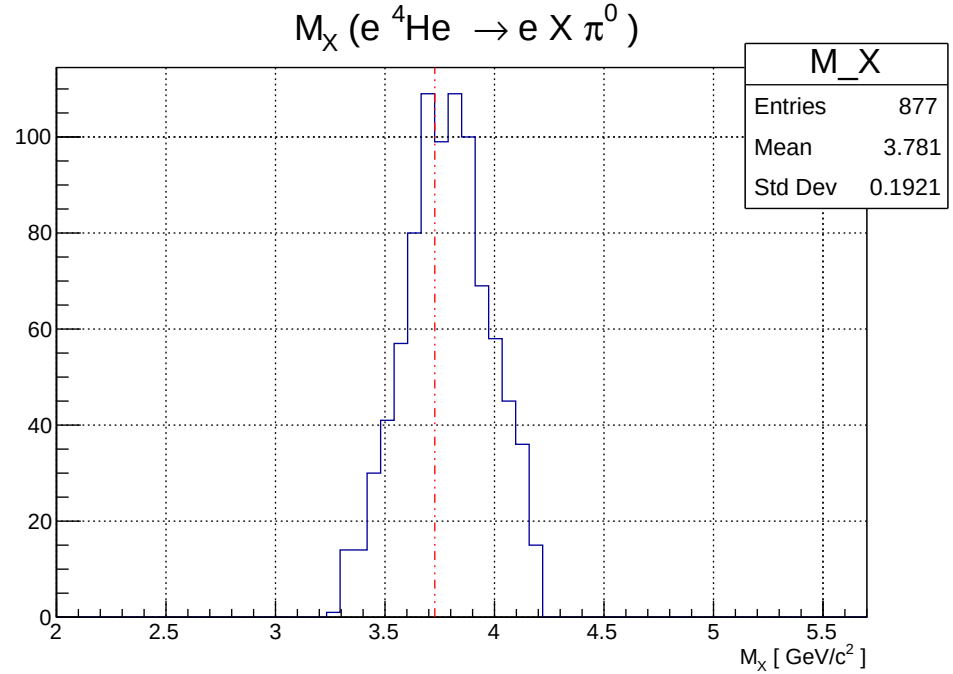


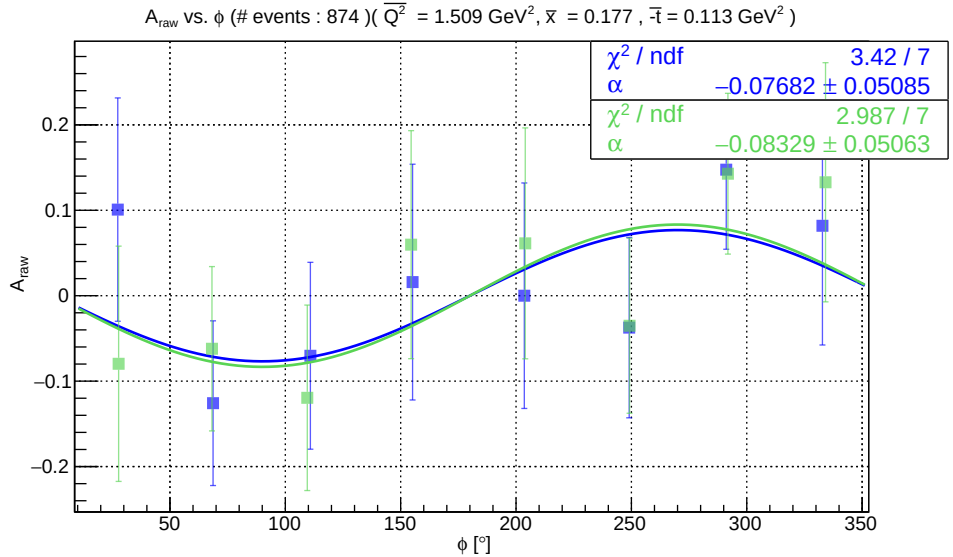
$M^2_{X_{\pi^0}}$



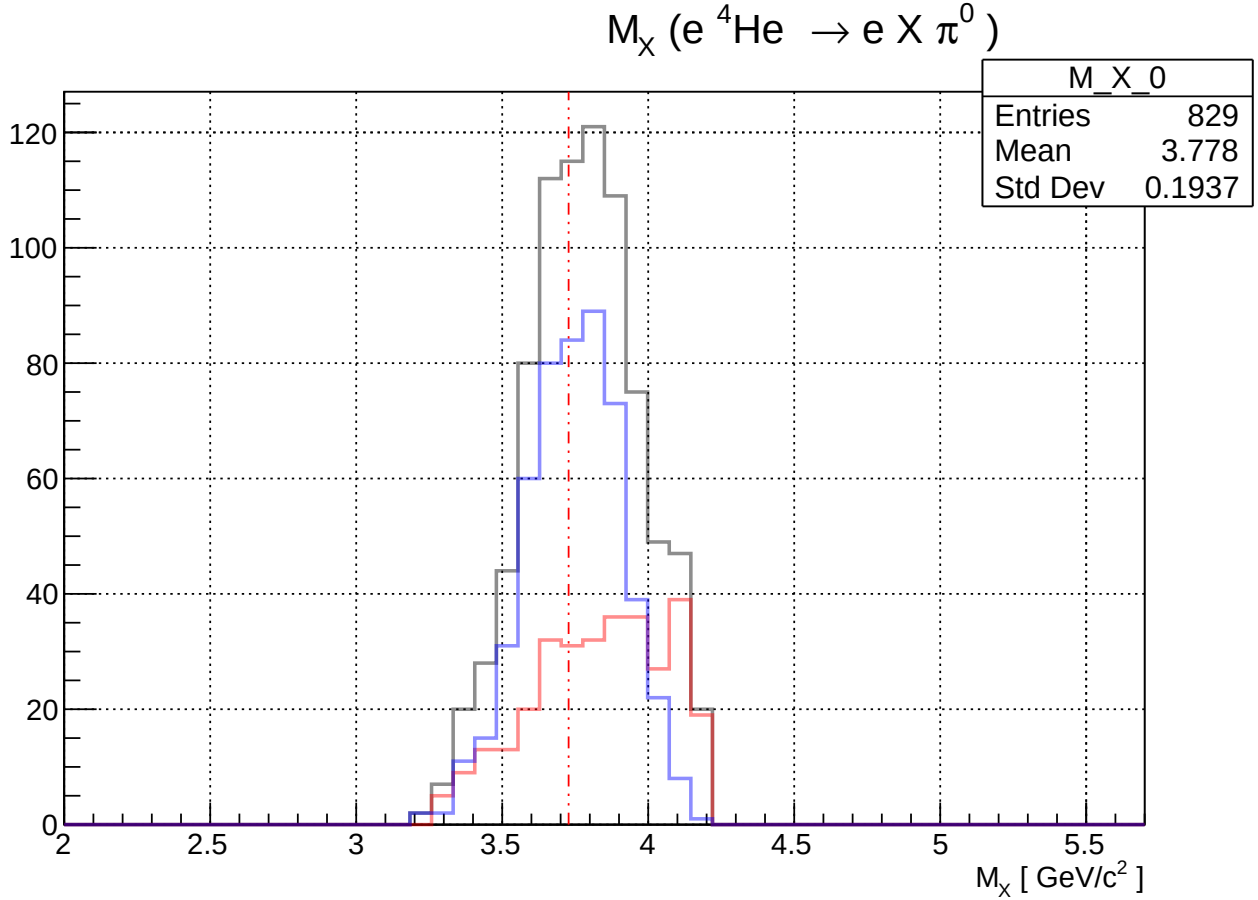
$M^2_{X_{^4\mathrm{He}}}$







$M_X\ (e^4\mathrm{He} \to eX\pi^0)$



Black: Passing EITHER exc. cut OR kin. fit (BSA $\approx -$ 8.5%)

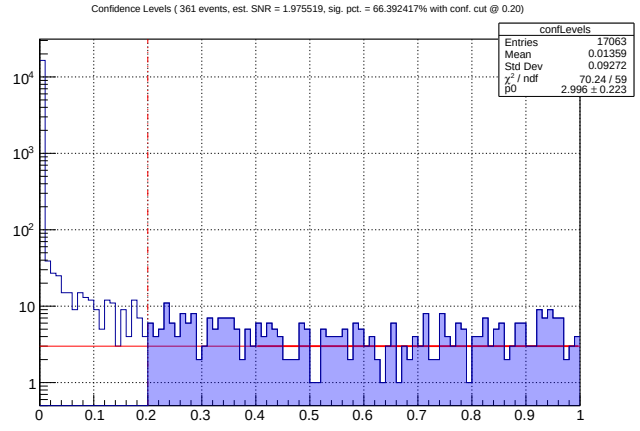
Blue: Passing Kinematic Fit (BSA $\approx$ 0 %)

Red: Failing Kinematic Fit (BSA $\approx -20.0\%$)

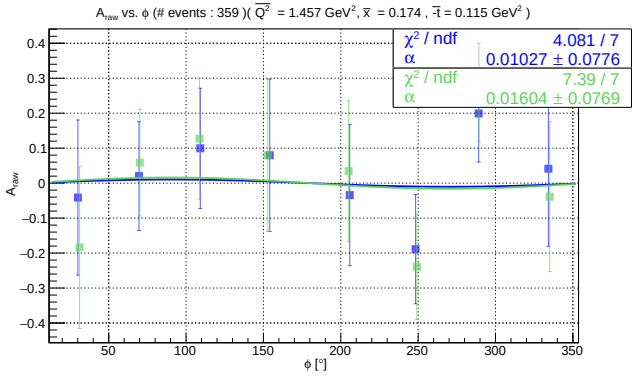
Moving Confidence Level Cut

Exc. Vars

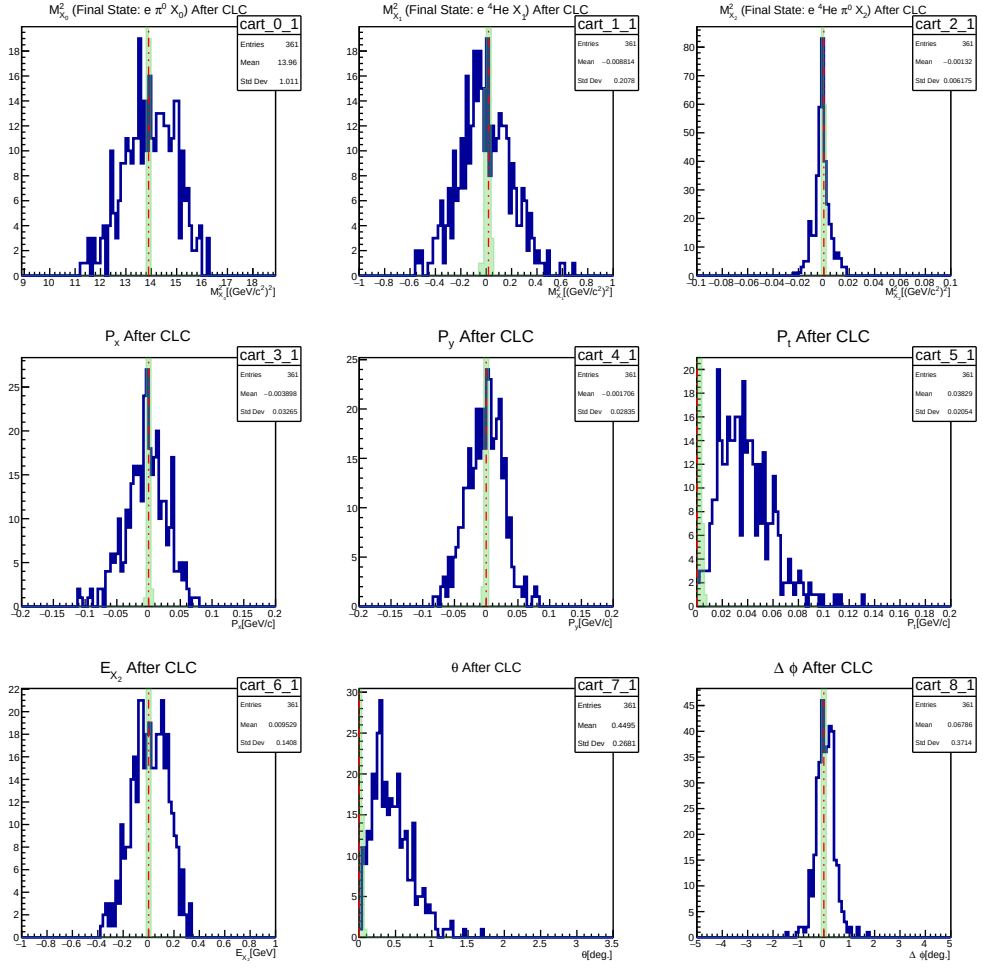
CLC = 20%



BSA = 1.0 ± 7.8%

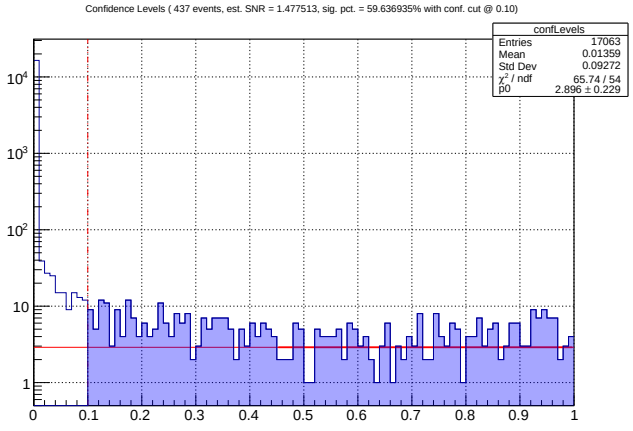


Events = 361

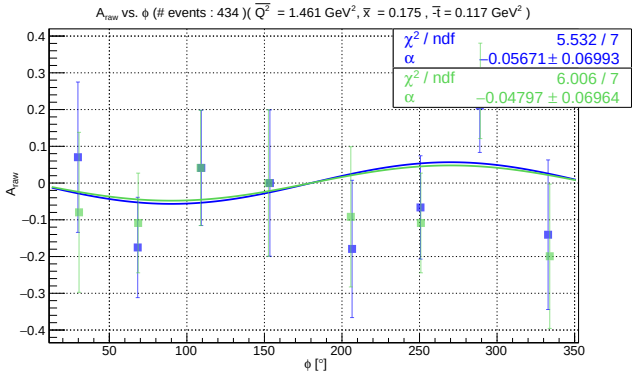


Exc. Vars

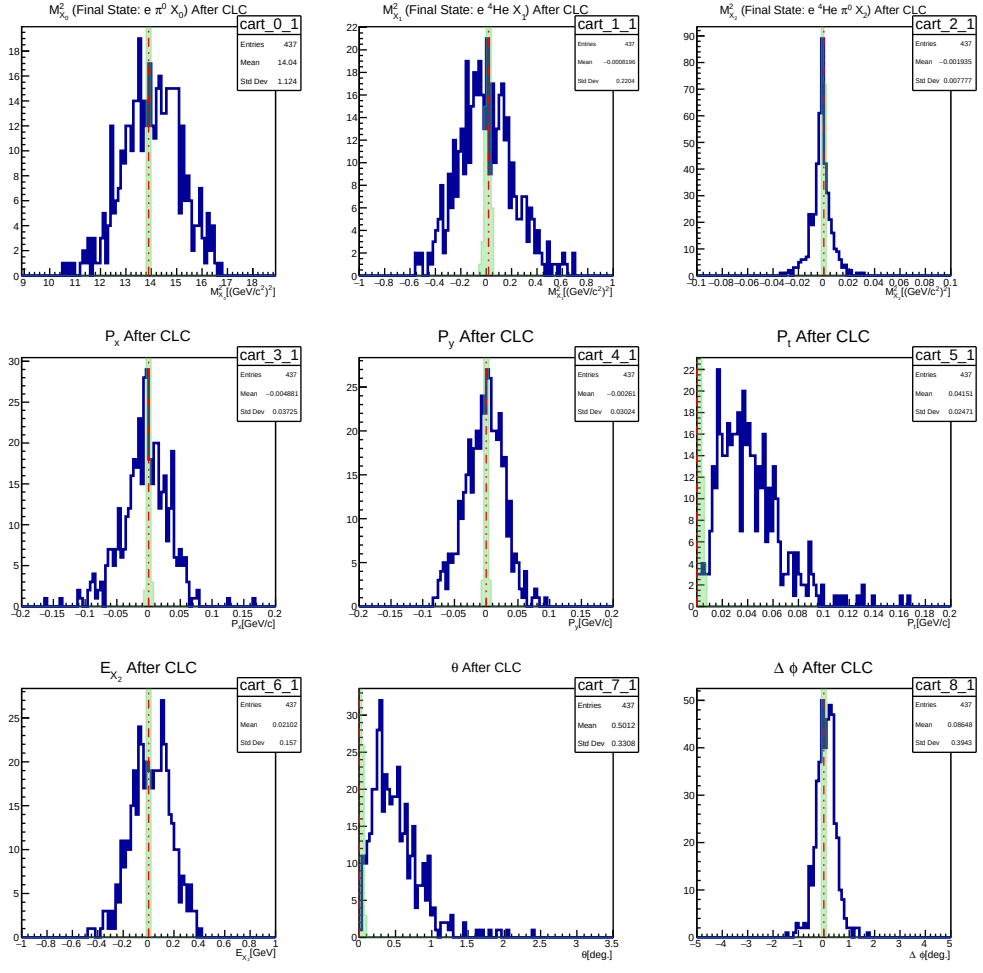
CLC = 10%



BSA = −5.7 ± 7.0%

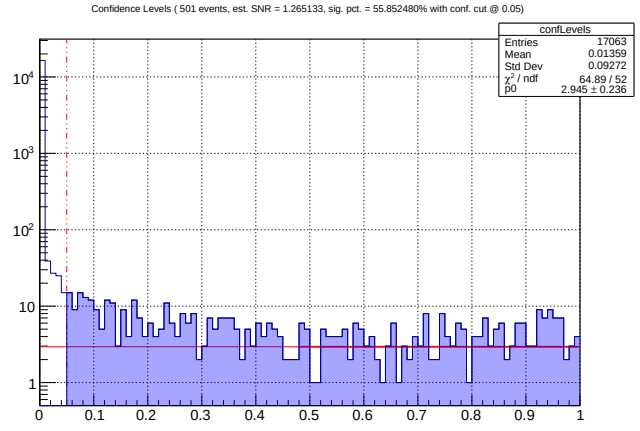


Events = 437

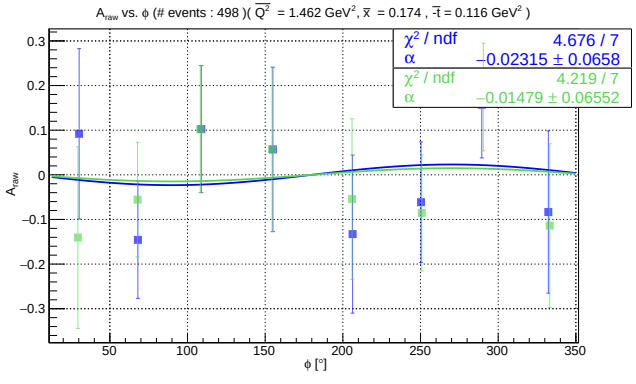


Exc. Vars

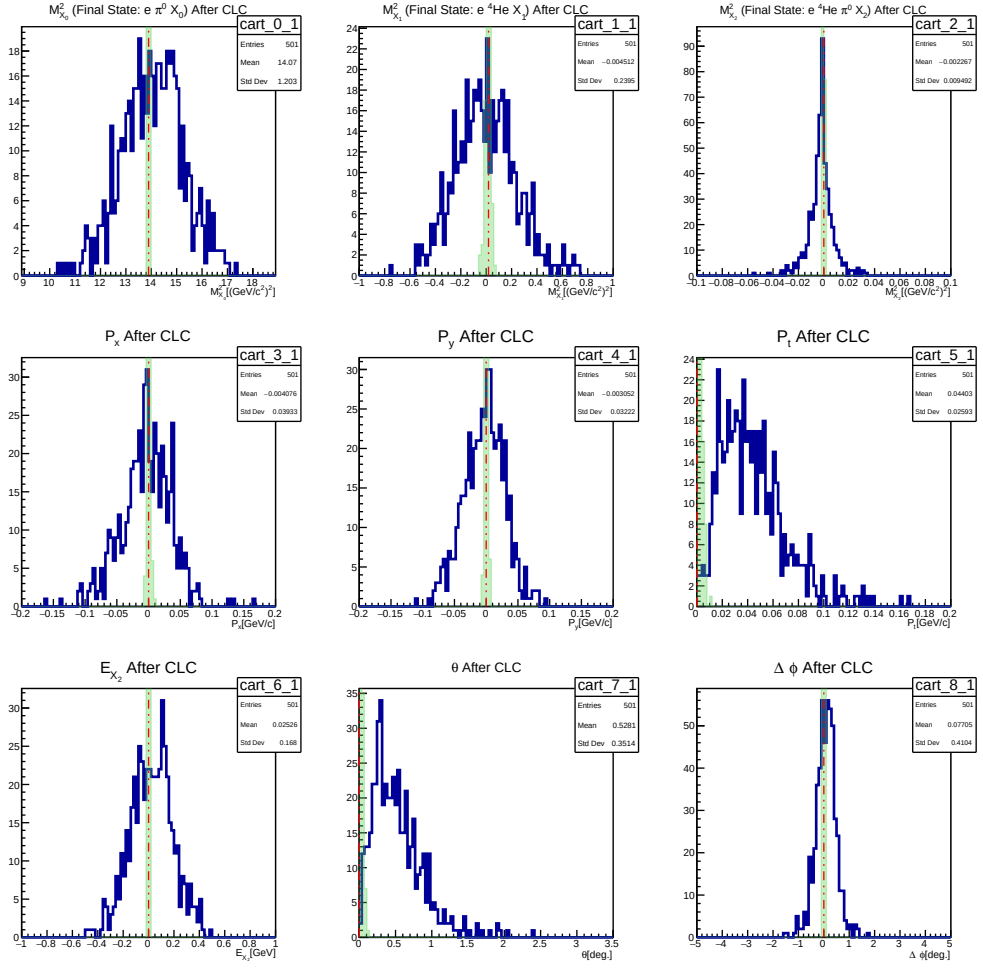
CLC = 5%



BSA = $-2.3 \pm 6.6\%$

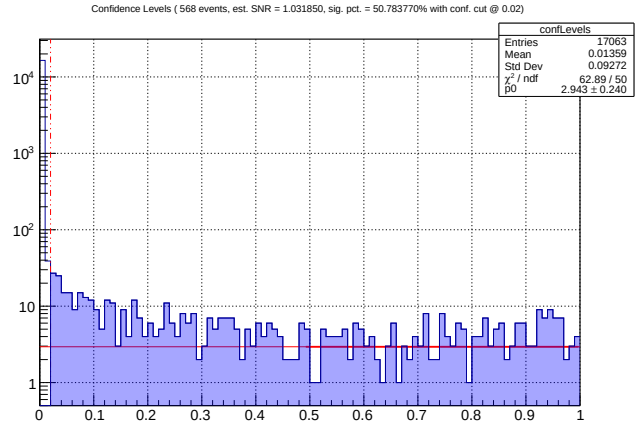


Events = 498

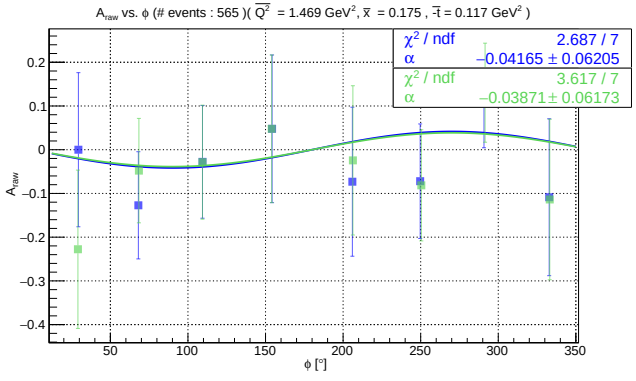


Exc. Vars

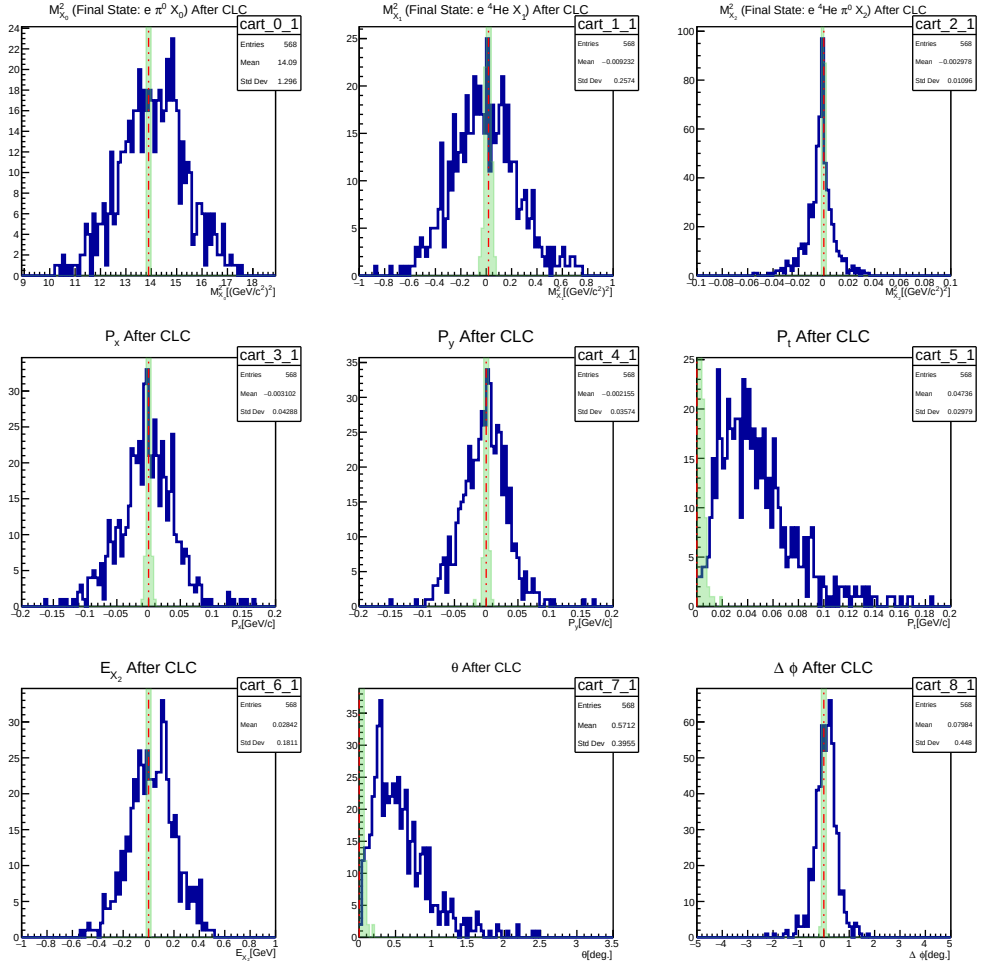
CLC = 2%



BSA = −4.2 ± 6.2%

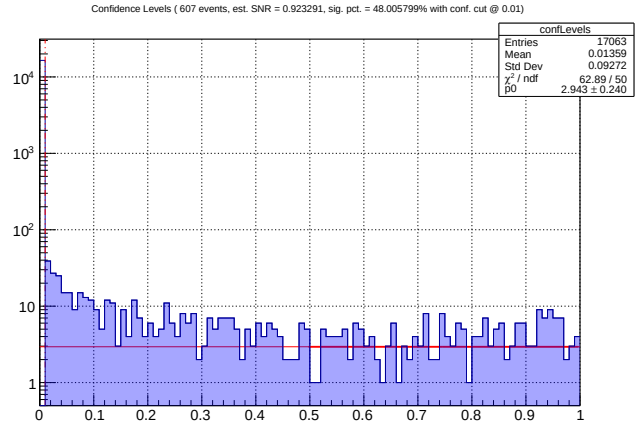


Events = 565

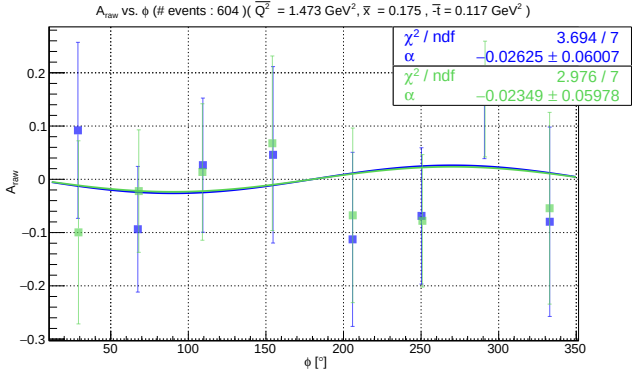


Exc. Vars

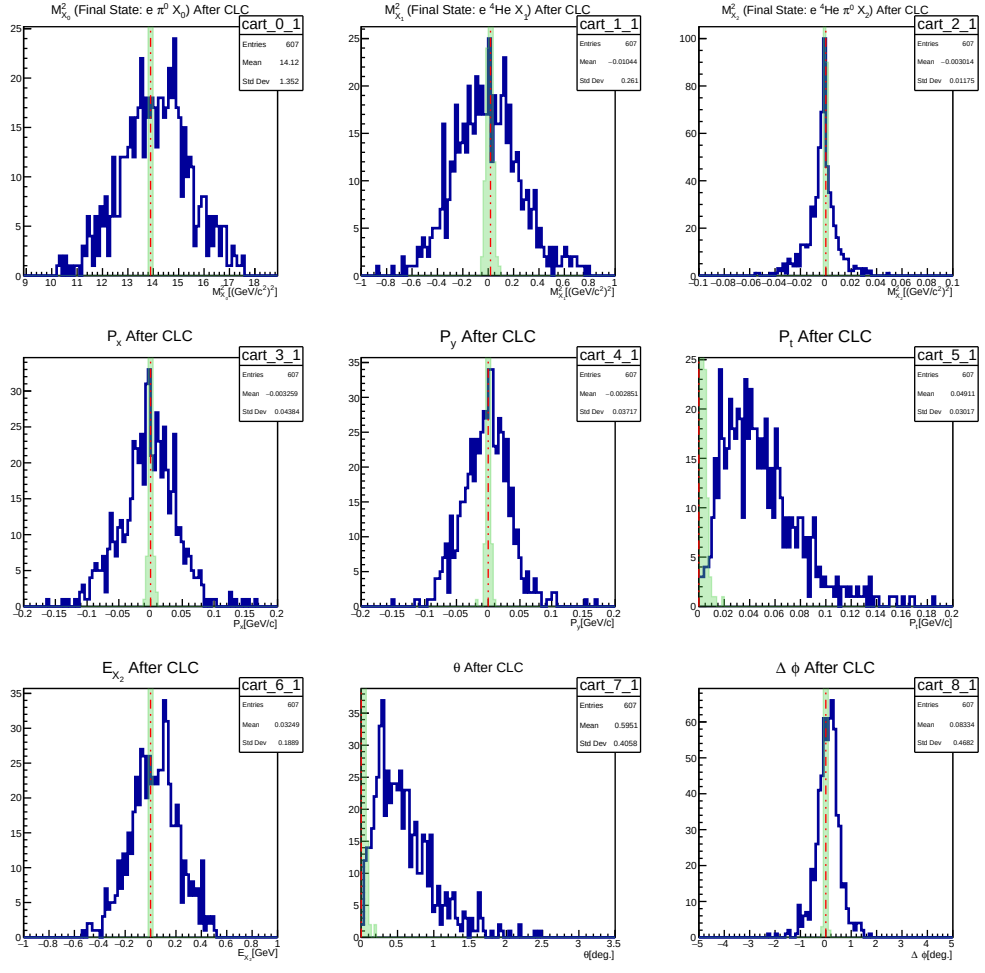
CLC = 1%



BSA = −2.6 ± 6.0%

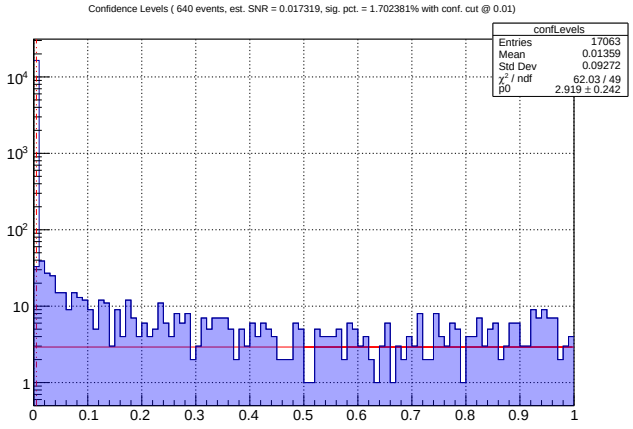


Events = 604

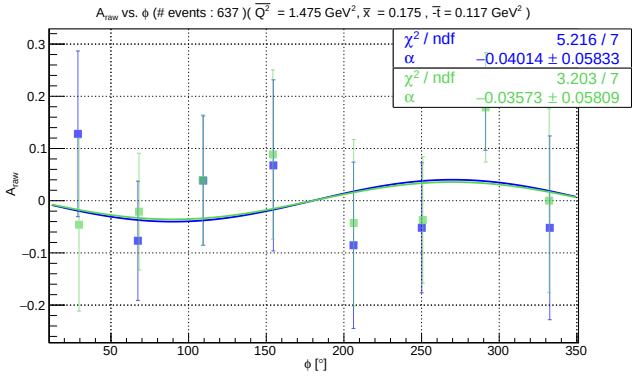


Exc. Vars

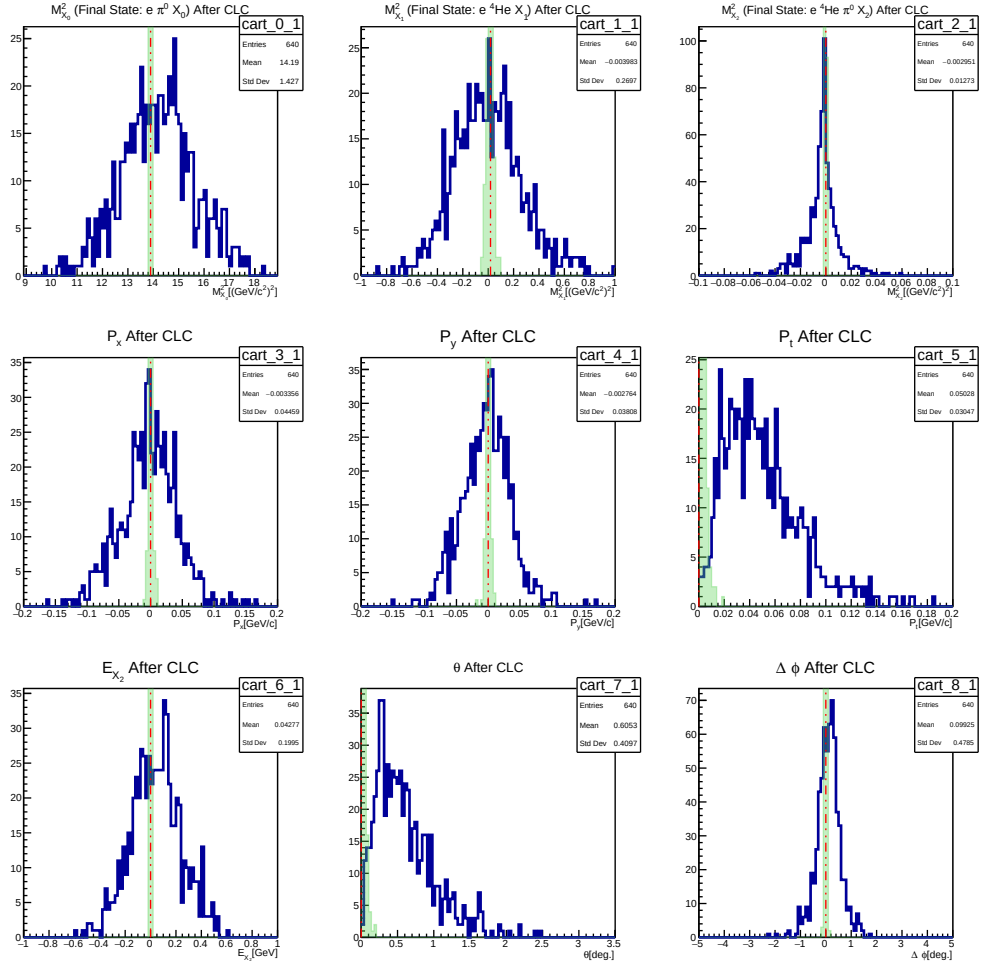
CLC = 0.5%



BSA = −4.0 ± 5.8%

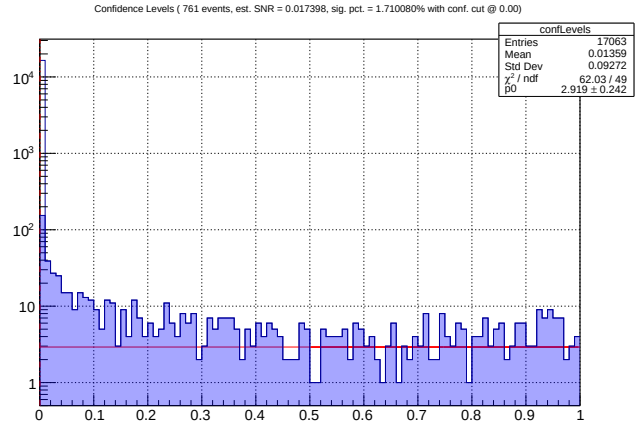


Events = 637

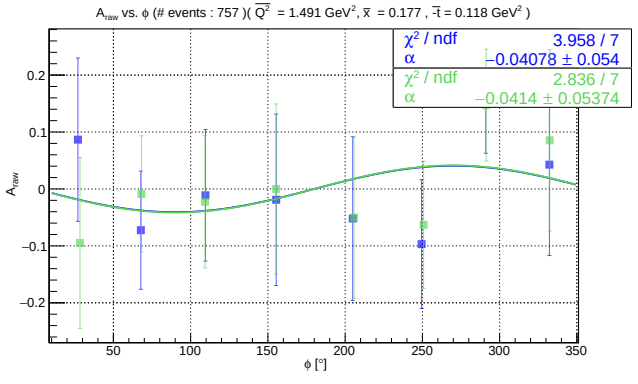


Exc. Vars

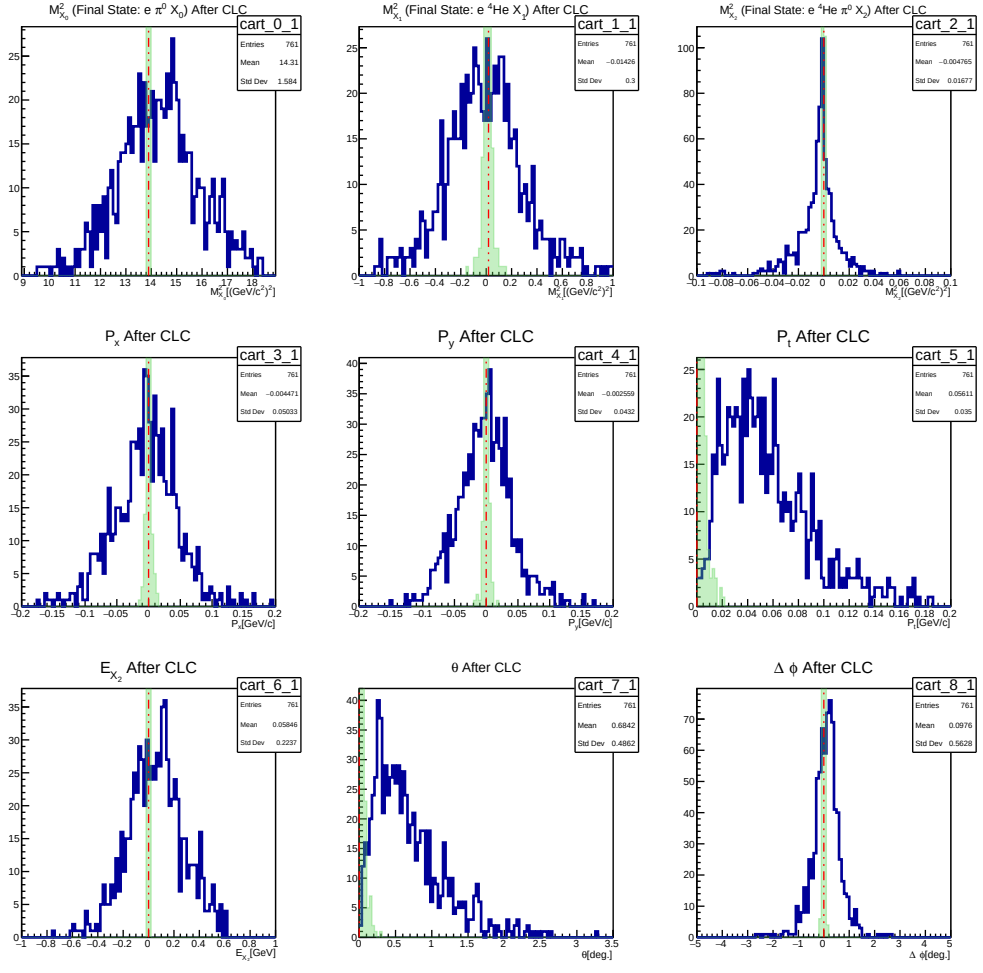
$$\text{CLC} = 0.05\%$$



$$\text{BSA} = -4.1 \pm 5.4\%$$

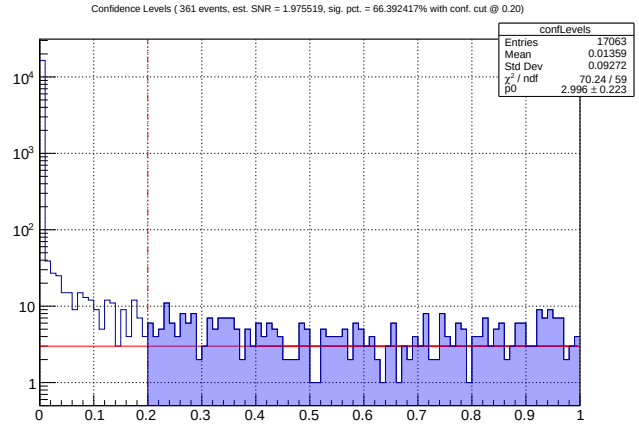


$$\#\ \text{Events} = 757$$

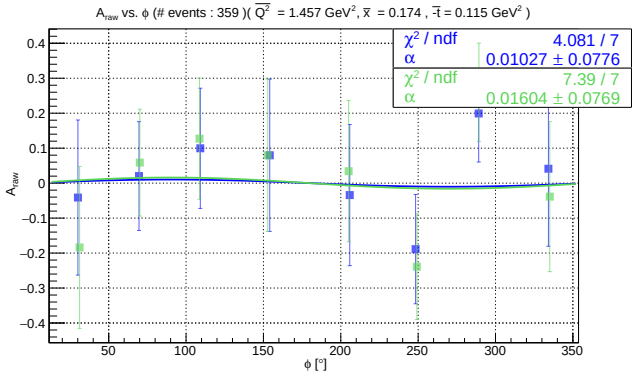


M_X and BSA ($e^4\mathrm{He} \rightarrow eX\pi^0$)

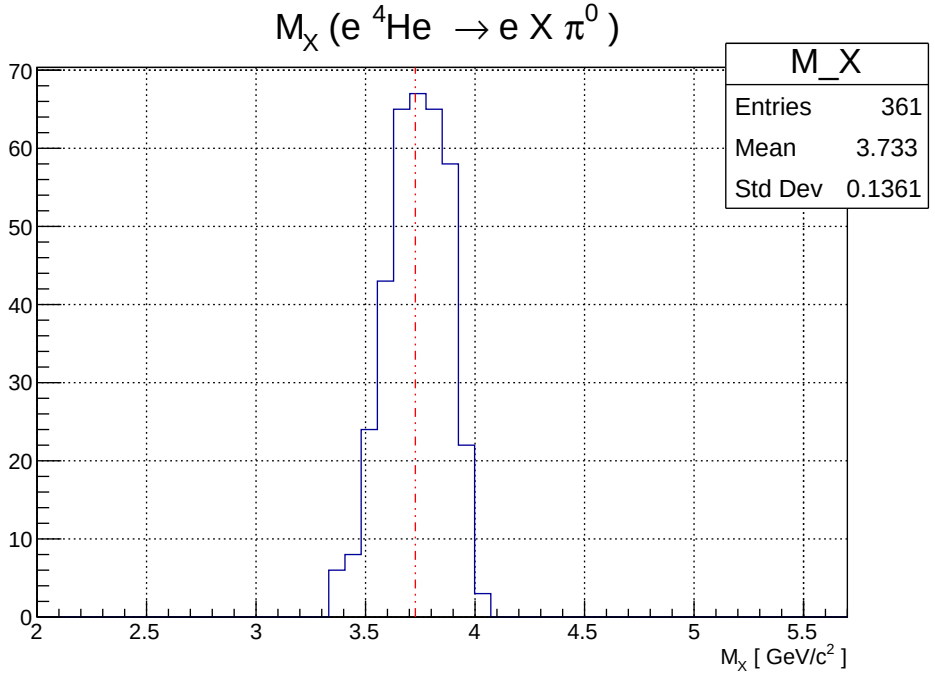
CLC = 20%



BSA = $1.0 \pm 7.8\%$

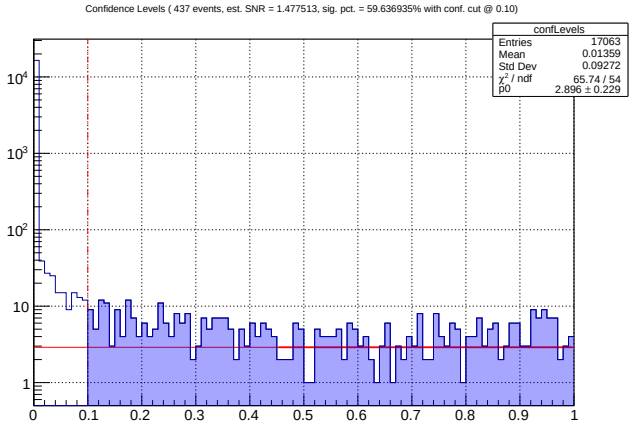


Events = 361

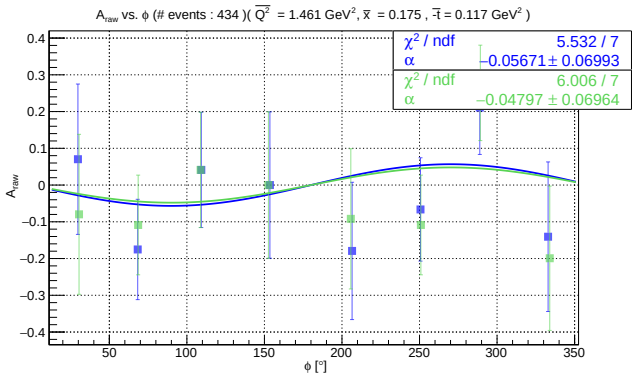


M_X and BSA ($e^4\mathrm{He} \to eX\pi^0$)

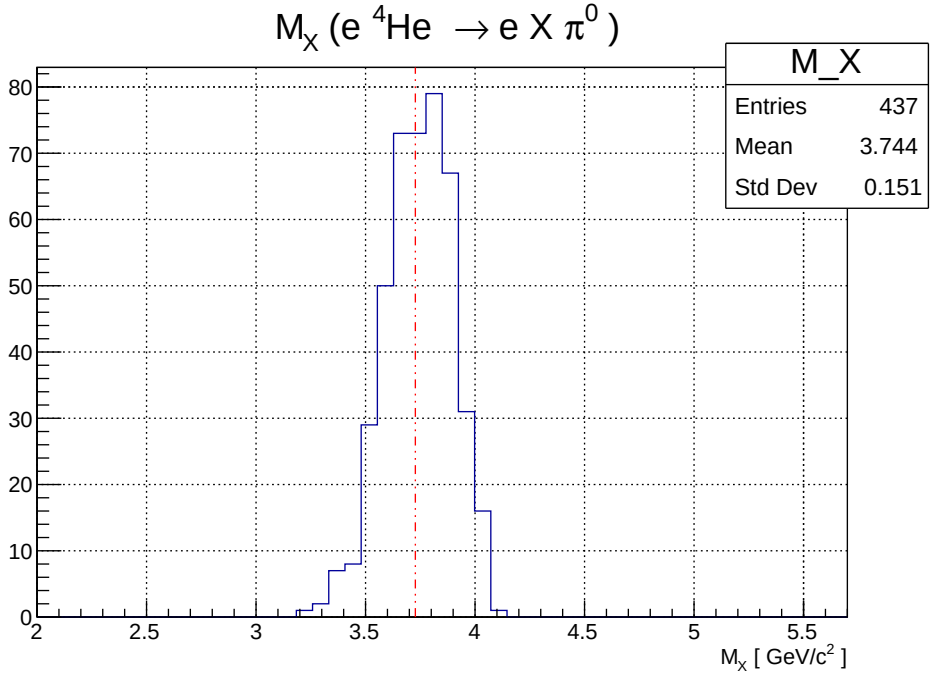
CLC = 10%



BSA = $-5.7 \pm 7.0\%$

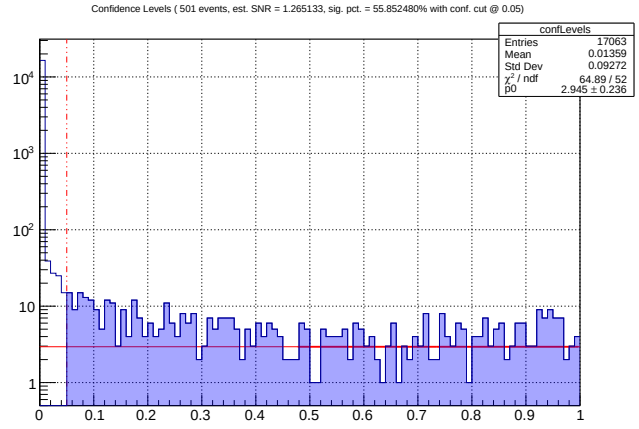


Events = 437

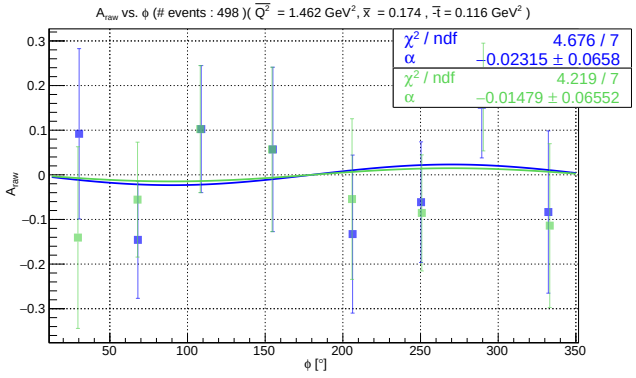


M_X and BSA ($e^4\mathrm{He} \rightarrow eX\pi^0$)

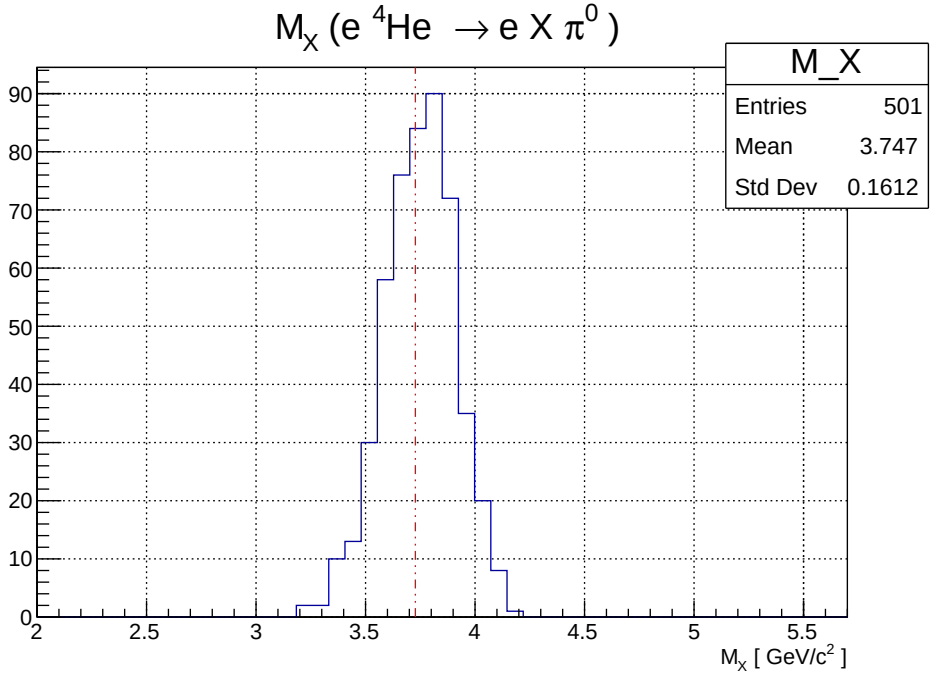
CLC = 5%



BSA = $-2.3 \pm 6.6\%$

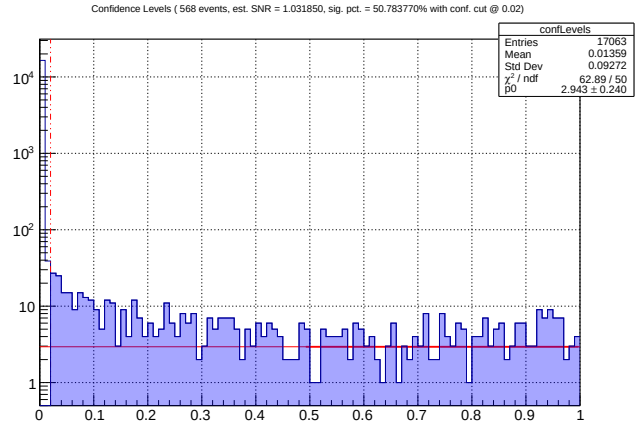


Events = 498

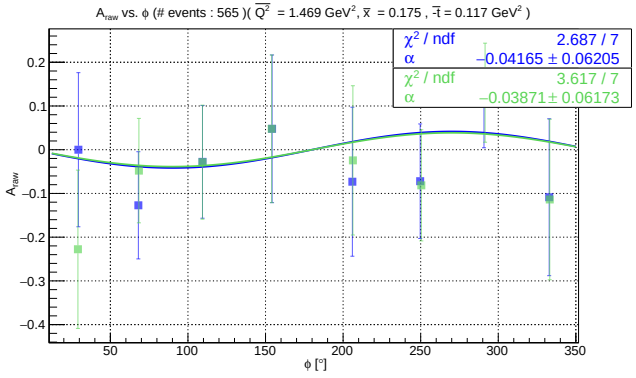


M_X and BSA ($e^4\mathrm{He} \rightarrow eX\pi^0$)

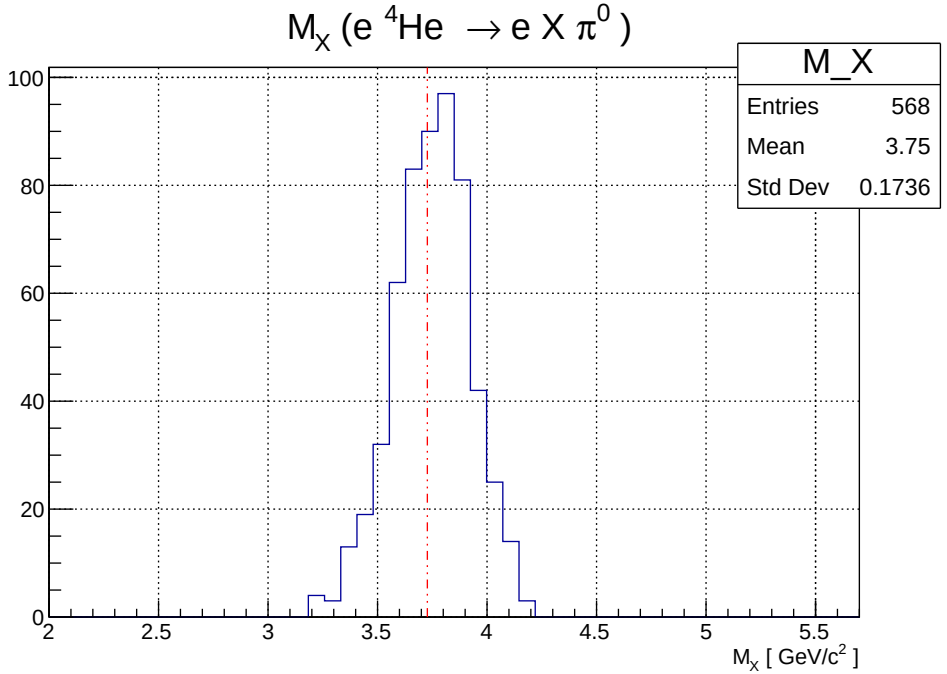
CLC = 2%



BSA = $-4.2 \pm 6.2\%$

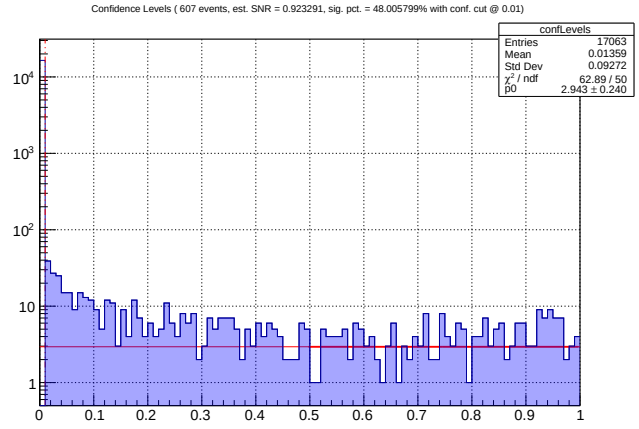


Events = 565

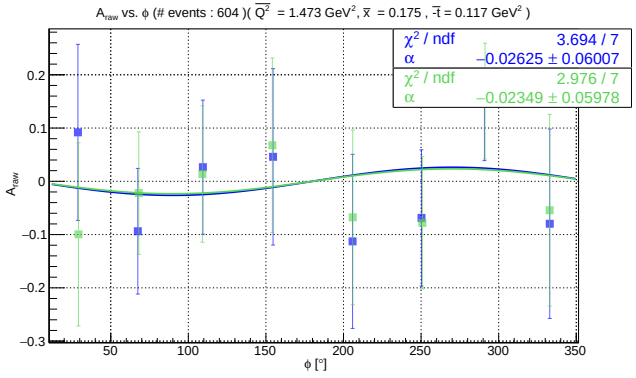


M_X and BSA ($e^4\mathrm{He} \to eX\pi^0$)

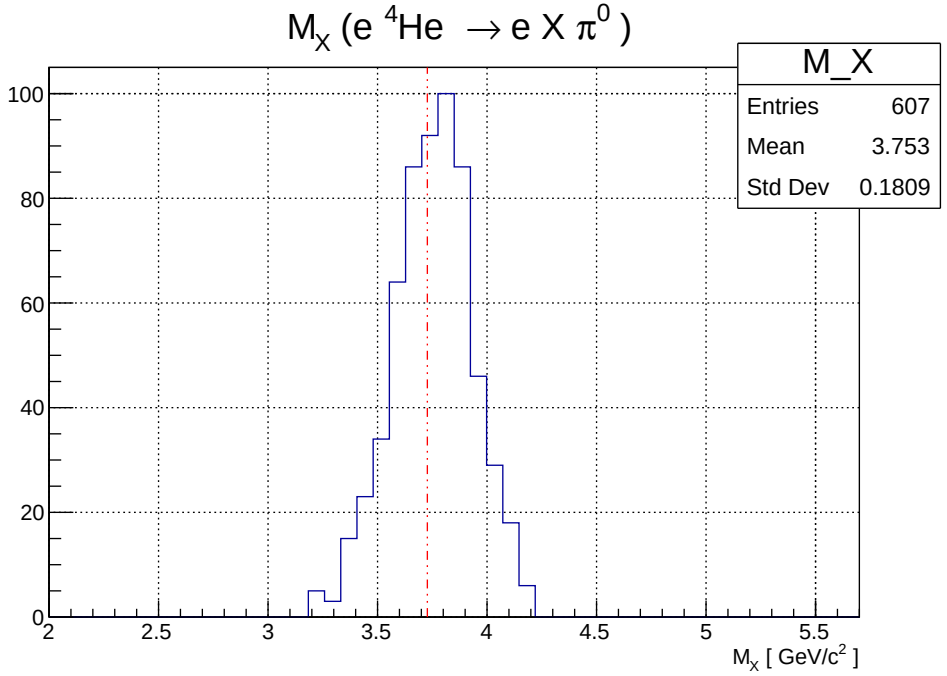
CLC = 1%



BSA = $-2.6 \pm 6.0\%$

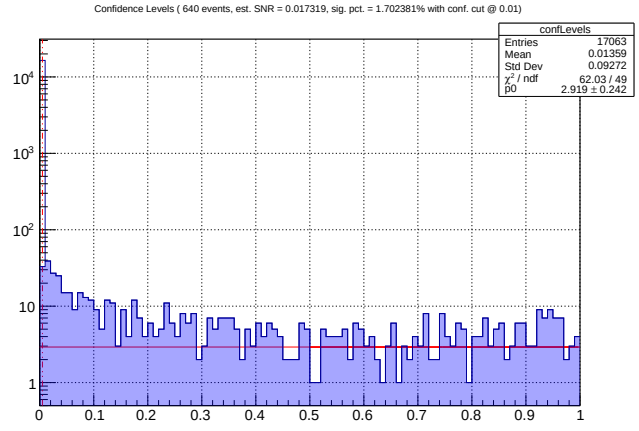


Events = 604

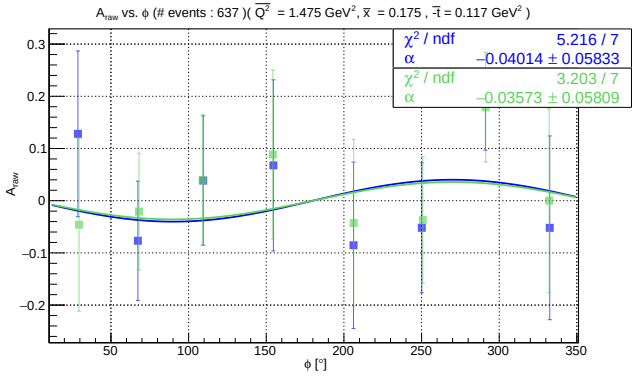


M_X and BSA ($e^4\mathrm{He} \rightarrow eX\pi^0$)

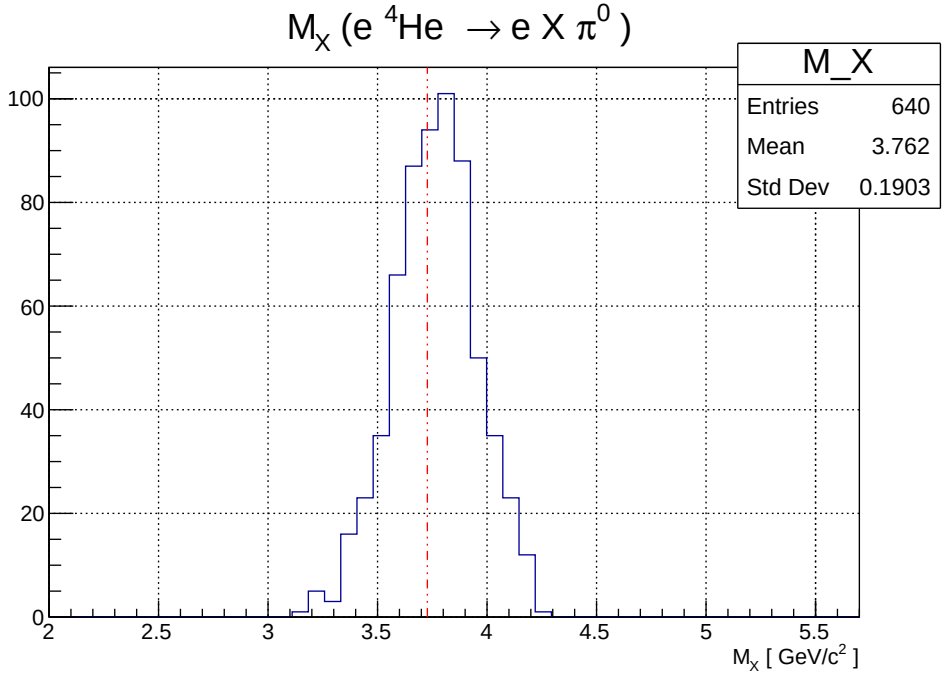
CLC $= 0.5\%$



BSA $= -4.0 \pm 5.8\%$

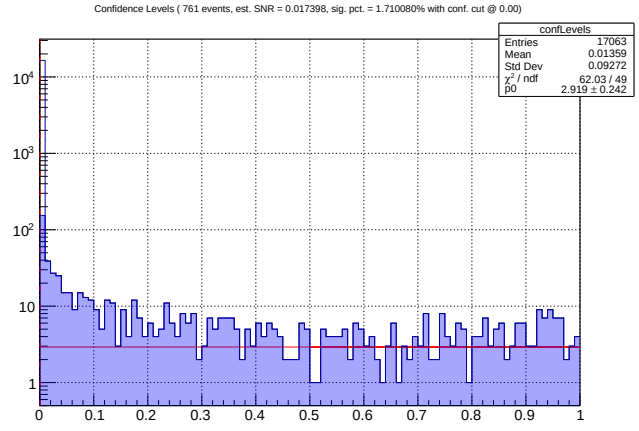


Events $= 637$

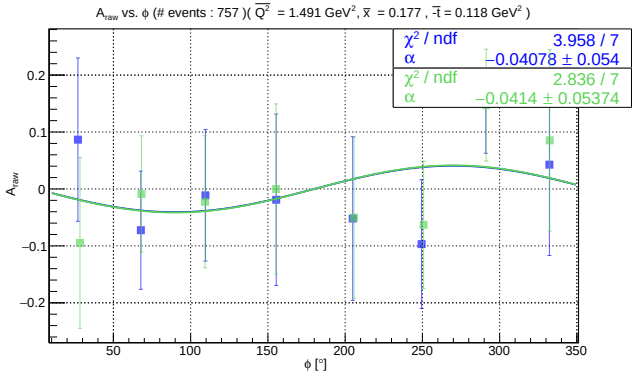


M_X and BSA ($e^4\mathrm{He} \to eX\pi^0$)

CLC = 0.05%



BSA = $-4.1 \pm 5.4\%$



Events = 757