University of Regina

Final Cross Sections
- including all factors -

Abdennacer Hamdi

KaonLT Meeting
2026/05/22

$$p(e, e'K^+)\Lambda$$

L, T, LT, TT Models

$p(e, e'K^+)\Lambda$

$$\frac{d\sigma_L}{dt} = \frac{p_0 |t|}{(|t| + m_k^2)^2} e^{-p_1|t|}$$

$$\frac{d\sigma_T}{dt} = p_2 e^{-|p_3 t|}$$

$$\frac{d\sigma_{LT}}{dt} = p_4 e^{-p_5|t|} sin(\theta)$$

$$\frac{d\sigma_{TT}}{dt} = p_6 e^{-p_7|t|} sin^2(\theta)$$

$$w_{factor} = \frac{1}{(W^2 - m_p^2)^2}$$

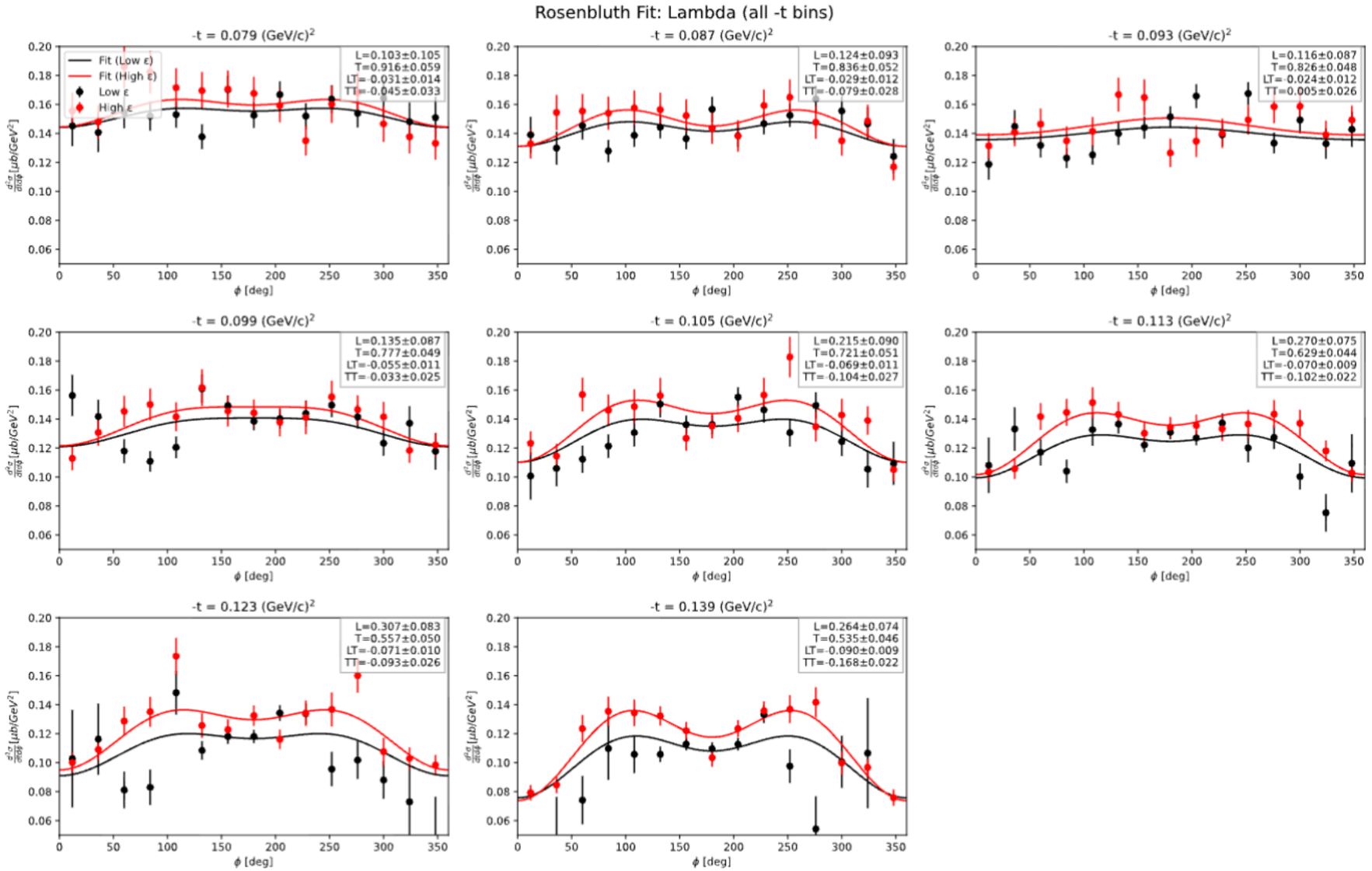
Negligible variation in the fit parameters

```
--- iteration 01 parameters -------- iteration 02 parameters ---
1.639       1.431  1              |   1.639       1.431  1
-11.072      7.279  2              |   -11.072      7.279  2
52.362       7.951  3              |   52.362       7.951  3
-10.767      1.489  4              |   -10.767      1.489  4
-8.352       3.521  5              |   -8.352       3.521  5
-0.550       3.445  6              |   -0.550       3.445  6
-93.523     77.863  7              |   -93.523     77.863  7
2.299       6.580  8               |   2.299       6.580  8
```

$$2\pi \frac{d^2\sigma}{dtd\phi} = \epsilon \frac{d\sigma_L}{dt} + \frac{d\sigma_T}{dt} + \sqrt{2\epsilon(\epsilon+1)} \frac{d\sigma_{LT}}{dt} cos\phi + \epsilon \frac{d\sigma_{TT}}{dt} cos2\phi$$

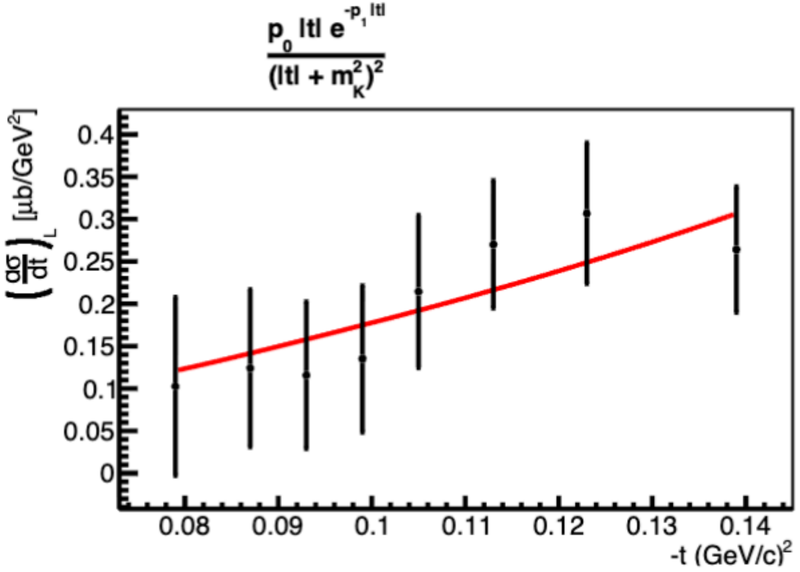
Low & High ε Simultaneous Fit (Rosenbluth)

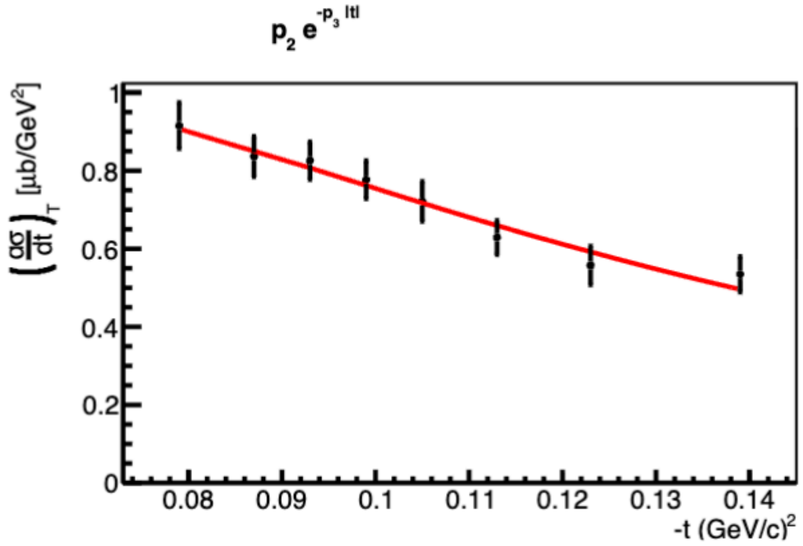
$p(e, e'K^+)\Lambda$

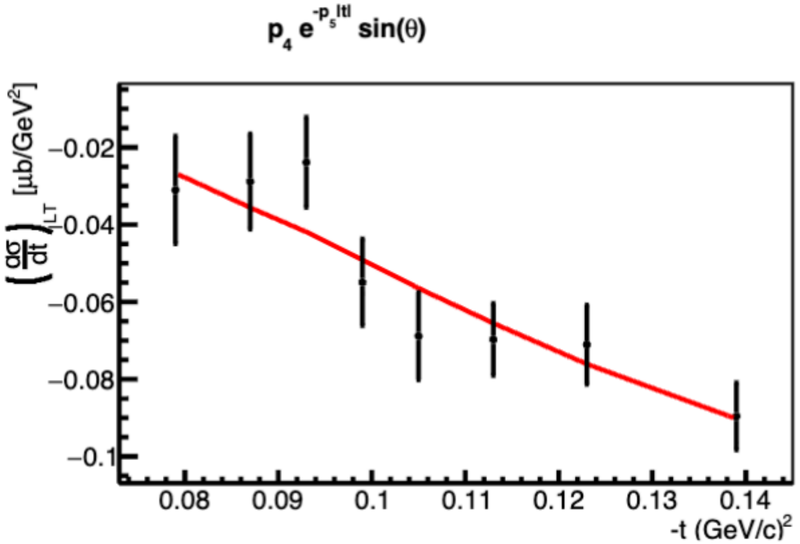


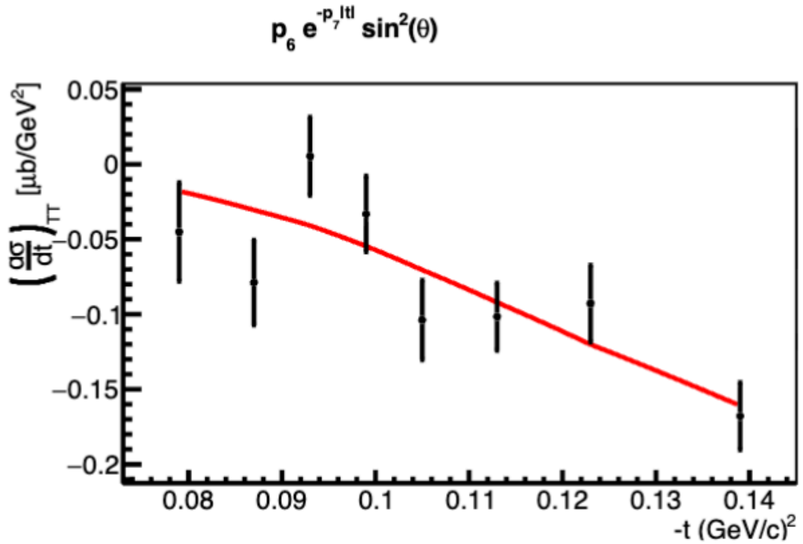
L, T, LT, TT Cross Sections

$p(e, e'K^+)\Lambda$





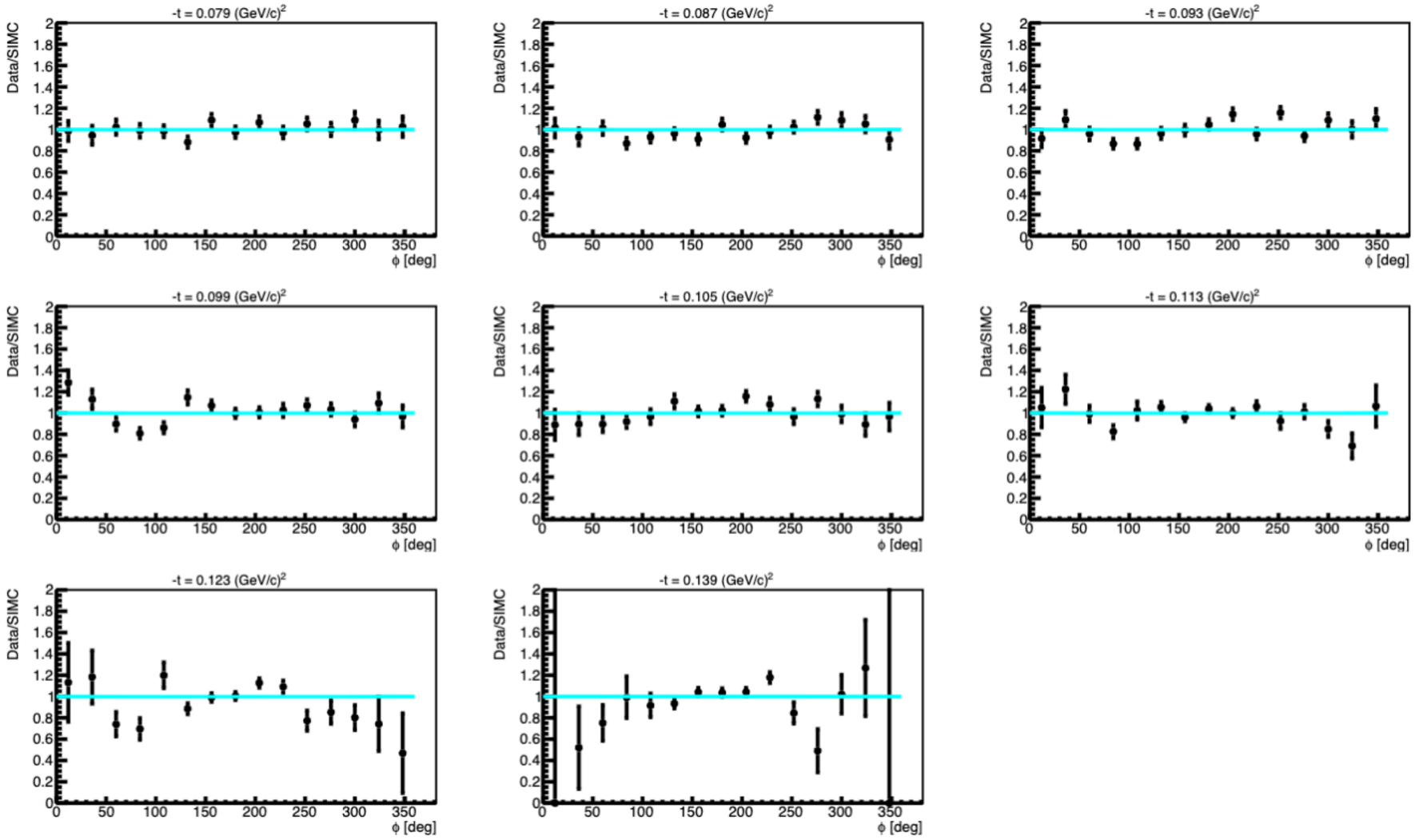




Data/SIMC Ratio

Low ε

$p(e, e'K^+)\Lambda$



Data/SIMC Ratio

High ε

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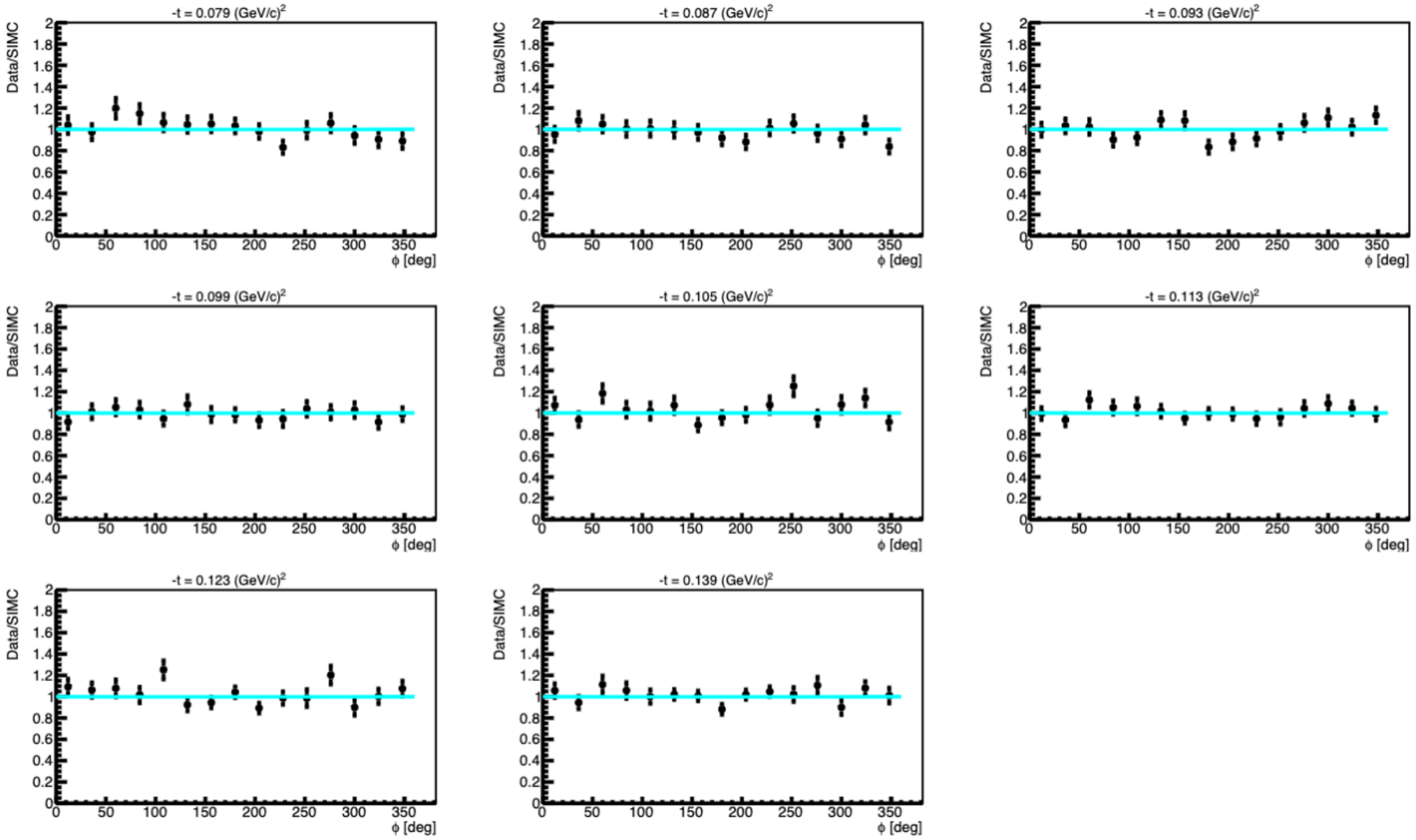


Data vs SIMC Kinematic

Centre Low ε

$p(e, e'K^+)\Lambda$

center_lowe

Λ(1116)

Beam Energy = 3.834 GeV

Q^2 = 0.499 GeV^2

P_{HMS} = 0.968 GeV/c

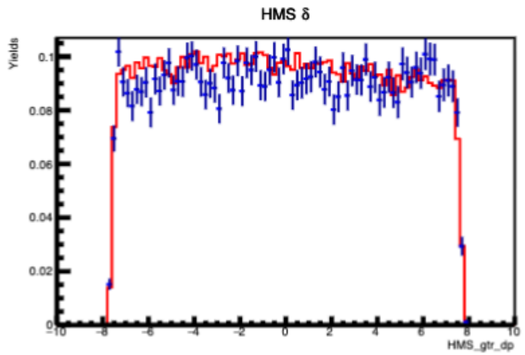
θ_{HMS} = 21.140°

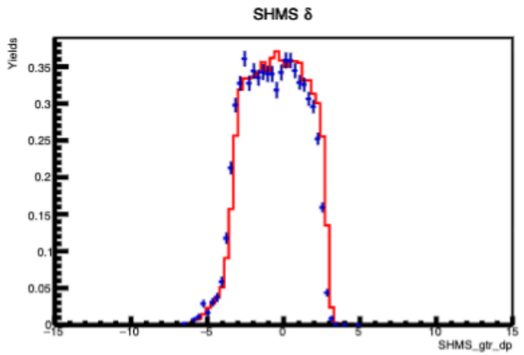
P_{SHMS} = 2.583 GeV/c

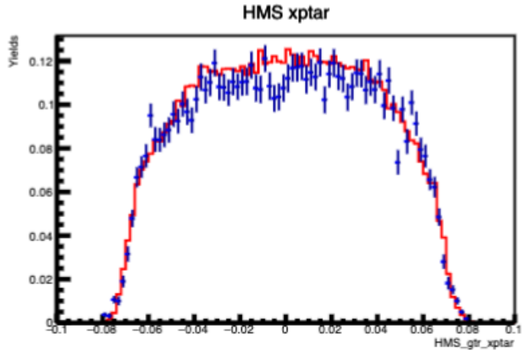
θ_{SHMS} = 6.790°

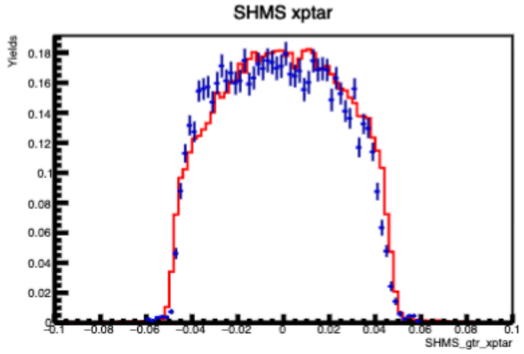
Red = SIMC

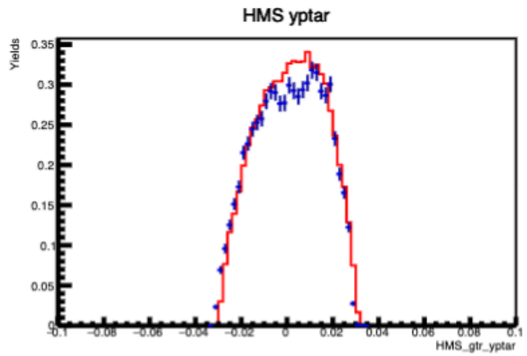
Blue = DATA

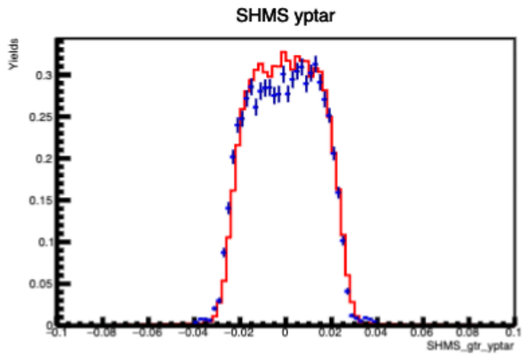


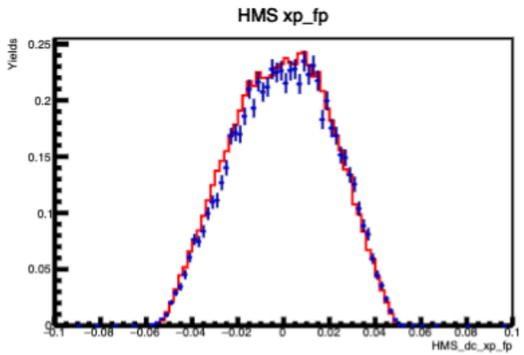








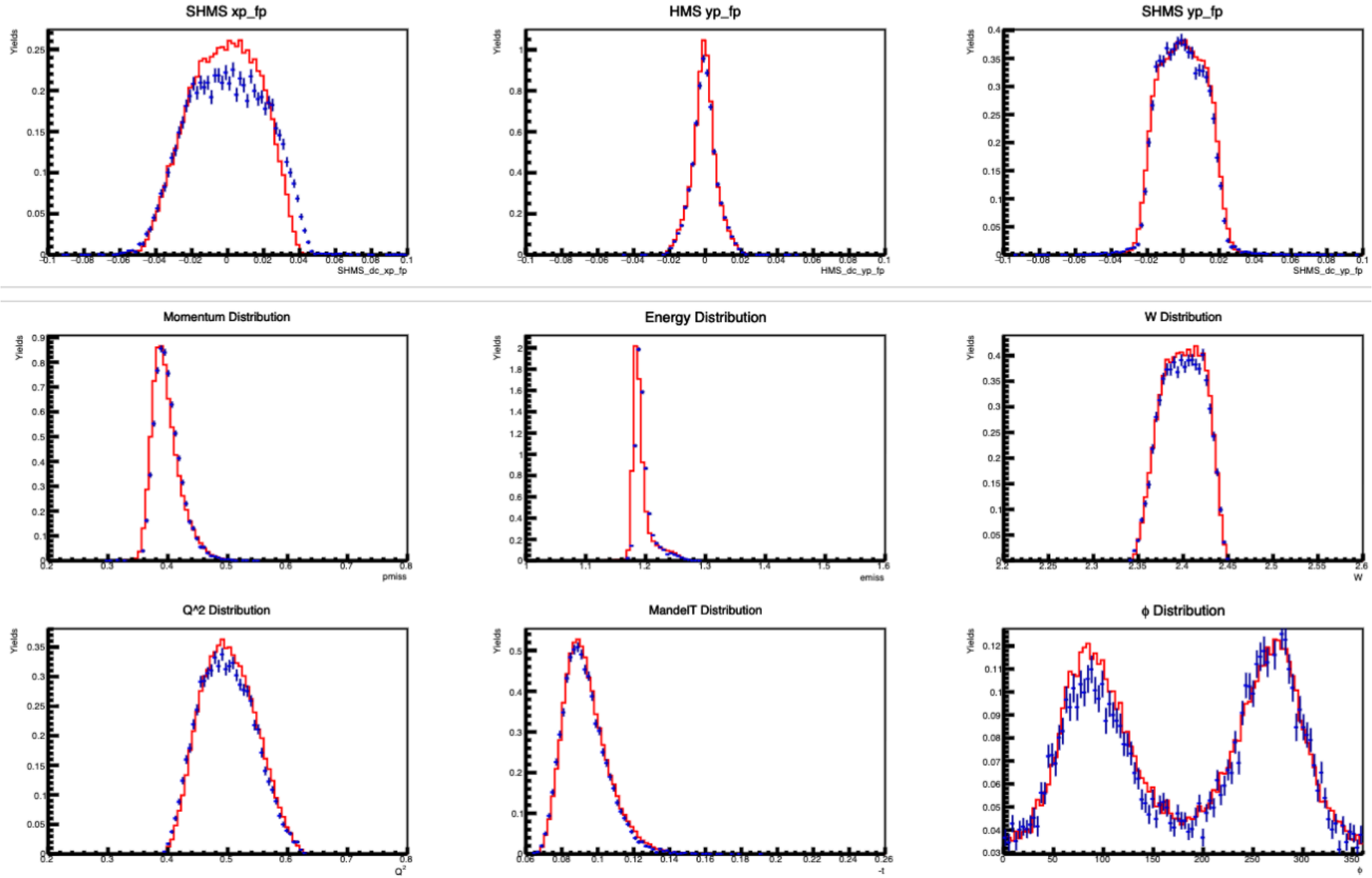




Data vs SIMC Kinematic

Centre Low ε

$p(e, e'K^+)\Lambda$



$$p(e, e'K^+)\Sigma^0$$

L, T, LT, TT Models

$p(e, e'K^+)\Sigma^0$

$$\frac{d\sigma_L}{dt} = \frac{p_0 |t|}{(|t| + m_k^2)^2} e^{-p_1|t|}$$

$$\frac{d\sigma_T}{dt} = p_2 e^{-|p_3 t|}$$

$$\frac{d\sigma_{LT}}{dt} = p_4 e^{-p_5|t|} sin(\theta)$$

$$\frac{d\sigma_{TT}}{dt} = p_6 e^{-p_7|t|} sin^2(\theta)$$

$$w_{factor} = \frac{1}{(W^2 - m_p^2)^2}$$

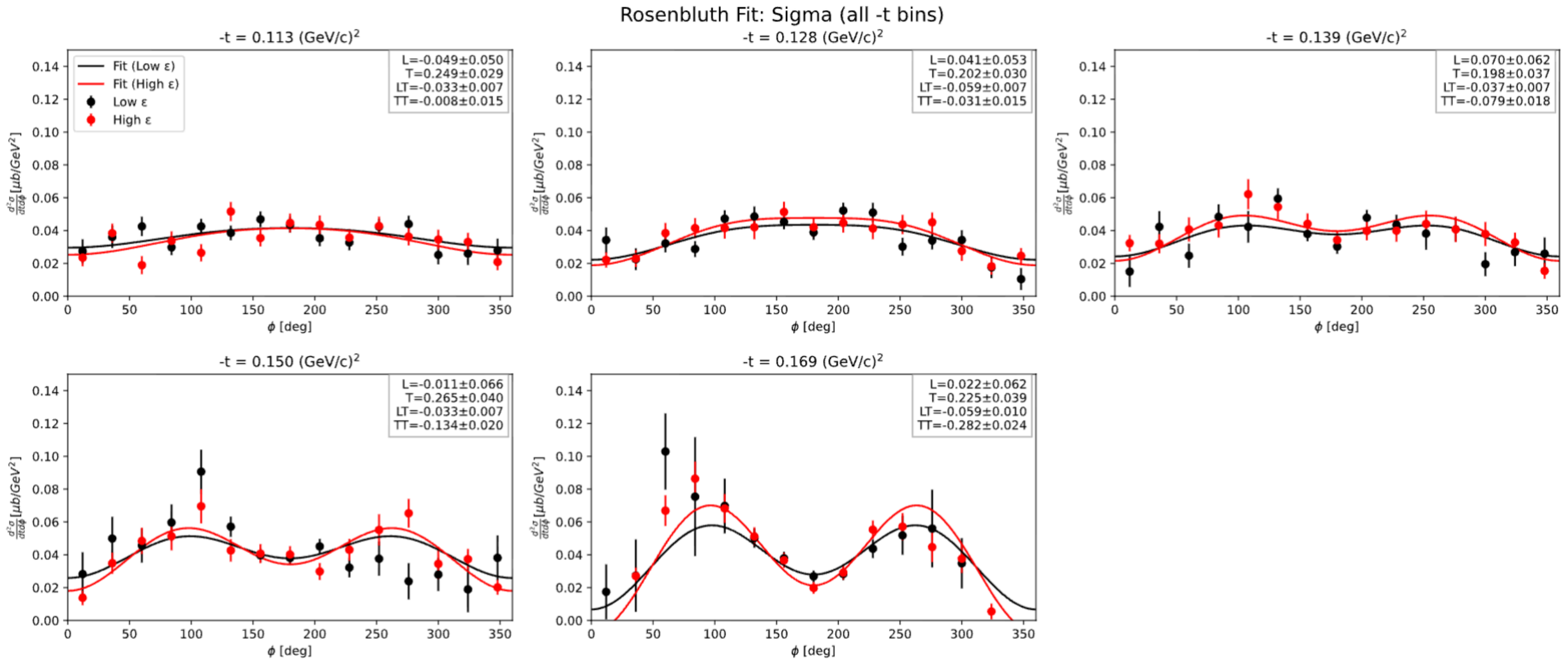
Negligible variation in the fit parameters

```
--- iteration 01 parameters ------- iteration 02 parameters ---
0.014      0.134  1              |   0.014      0.134  1
-22.831     61.146  2             |   -22.831     61.146  2
6.298      3.192  3              |   6.298      3.192  3
-1.123      3.721  4             |   -1.123      3.721  4
-56.272     36.879  5            |   -56.272     36.879  5
15.253      4.731  6             |   15.253      4.731  6
-4.409      3.945  7             |   -4.409      3.945  7
-19.523      5.530  8            |   -19.523      5.530  8
```

$$2\pi \frac{d^2\sigma}{dtd\phi} = \epsilon \frac{d\sigma_L}{dt} + \frac{d\sigma_T}{dt} + \sqrt{2\epsilon(\epsilon+1)} \frac{d\sigma_{LT}}{dt} cos\phi + \epsilon \frac{d\sigma_{TT}}{dt} cos2\phi$$

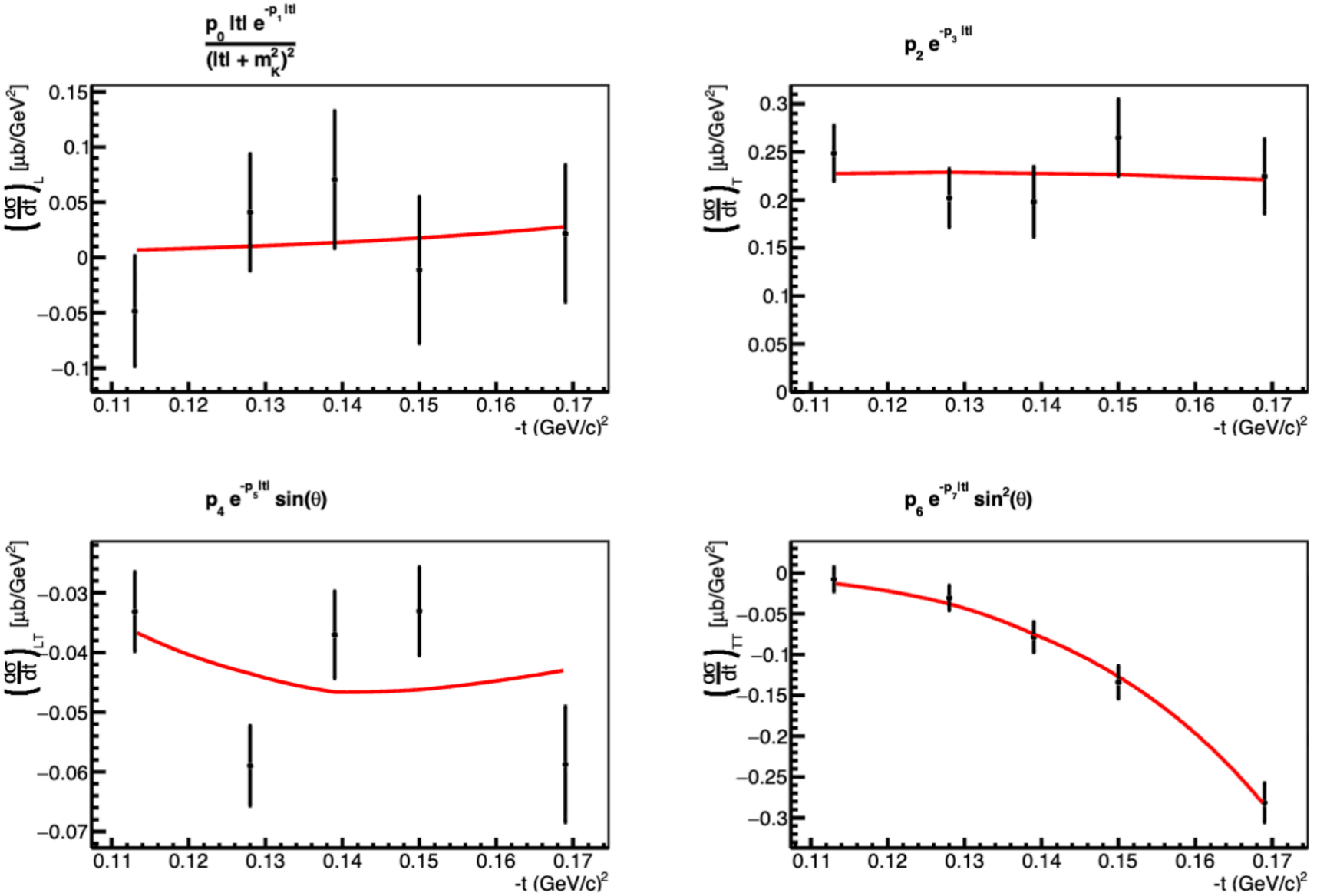
Low & High ε Simultaneous Fit (Rosenbluth)

$p(e, e'K^+)\Sigma^0$



L, T, LT, TT Cross Sections

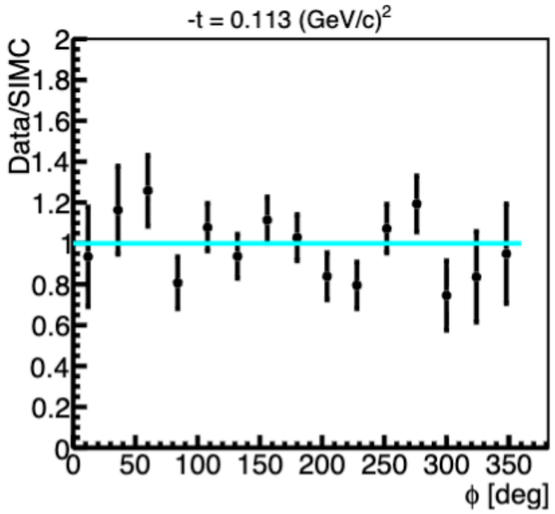
$p(e, e'K^+)\Sigma^0$

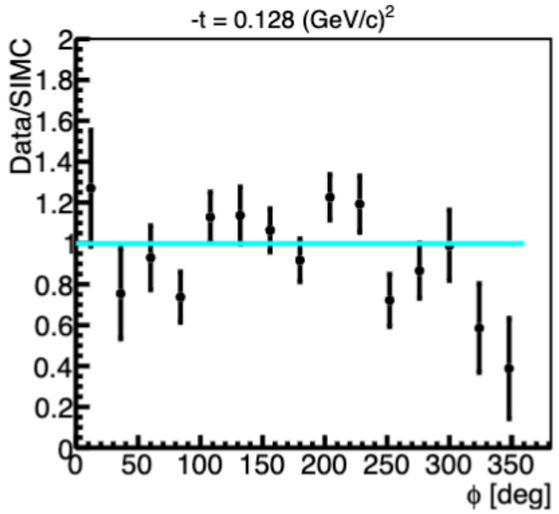


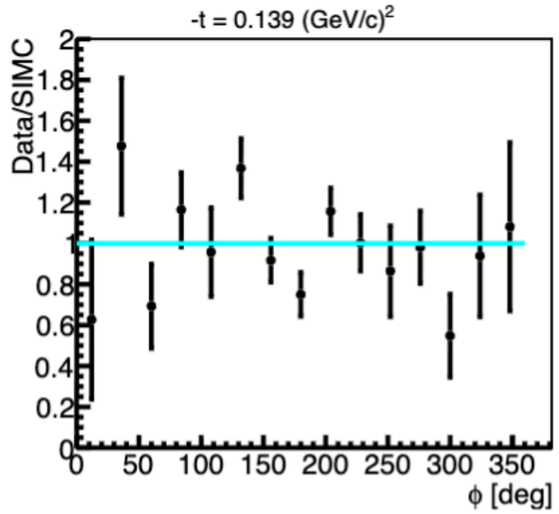
Data/SIMC Ratio

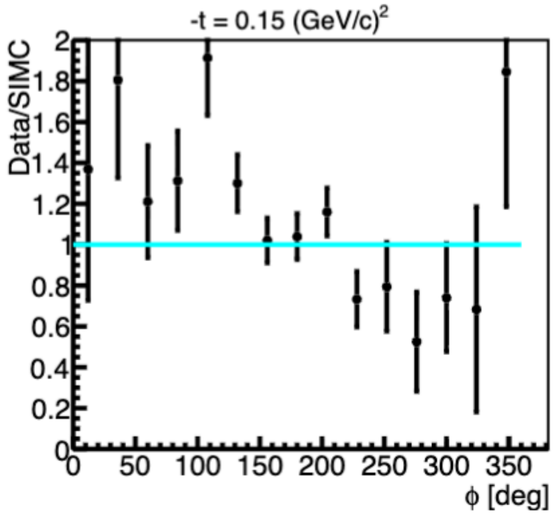
Low ε

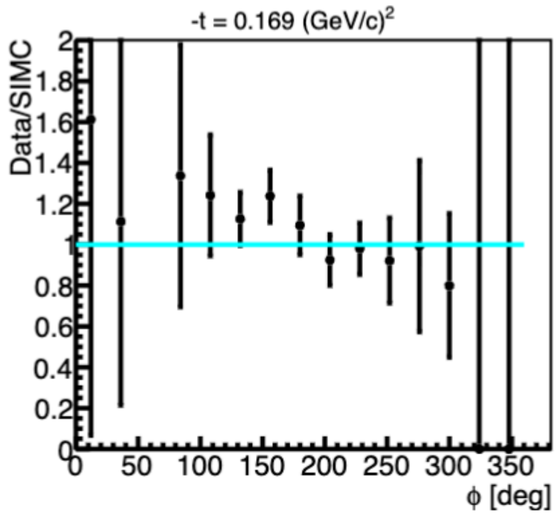
$p(e, e'K^+)\Sigma^0$











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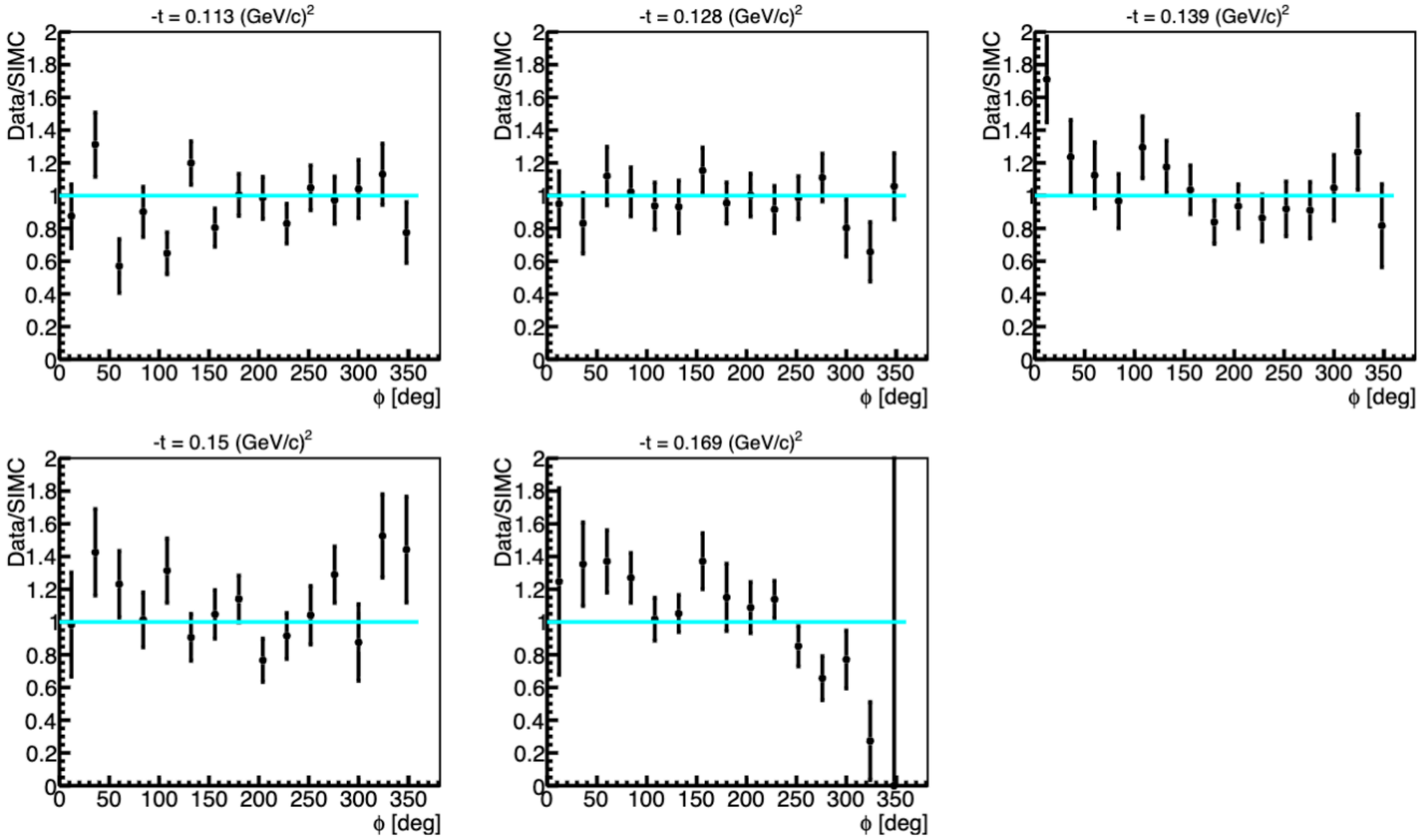

Data vs SIMC Kinematic

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$p(e, e'K^+)\Sigma^0$

center_lowe
$\Sigma^0(1193)$
Beam Energy = 3.834 GeV
Q^2 = 0.500 GeV^2
P_{HMS} = 0.968 GeV/c
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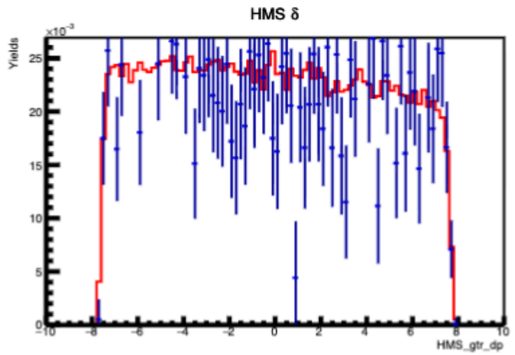
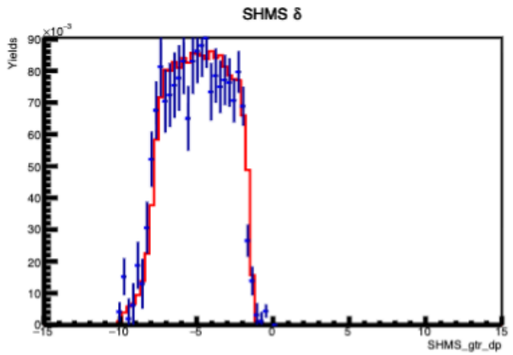
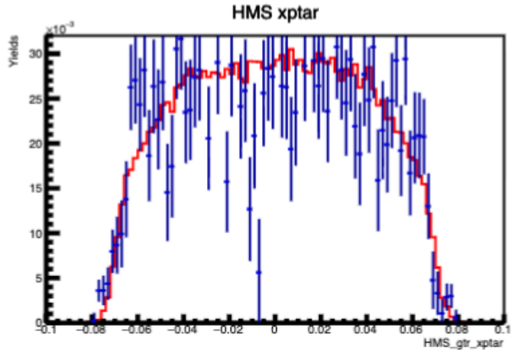
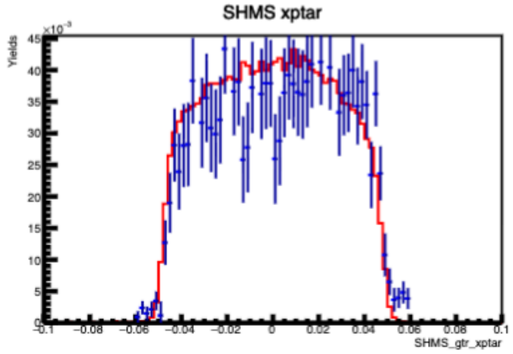
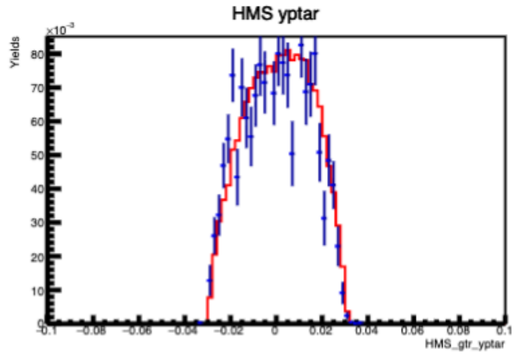
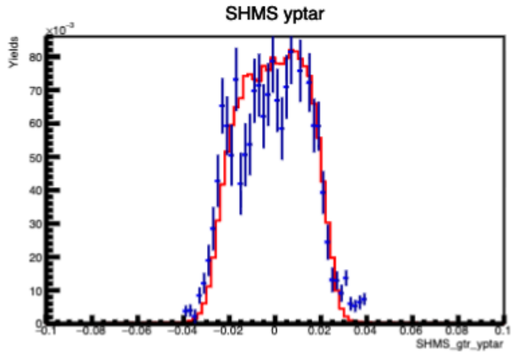


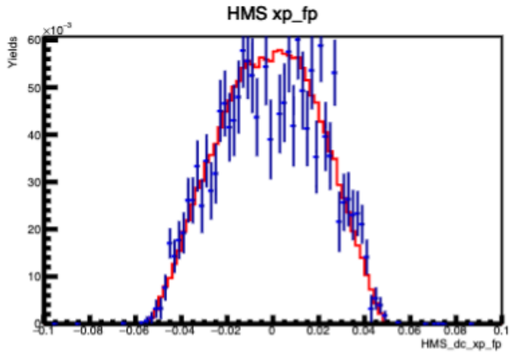








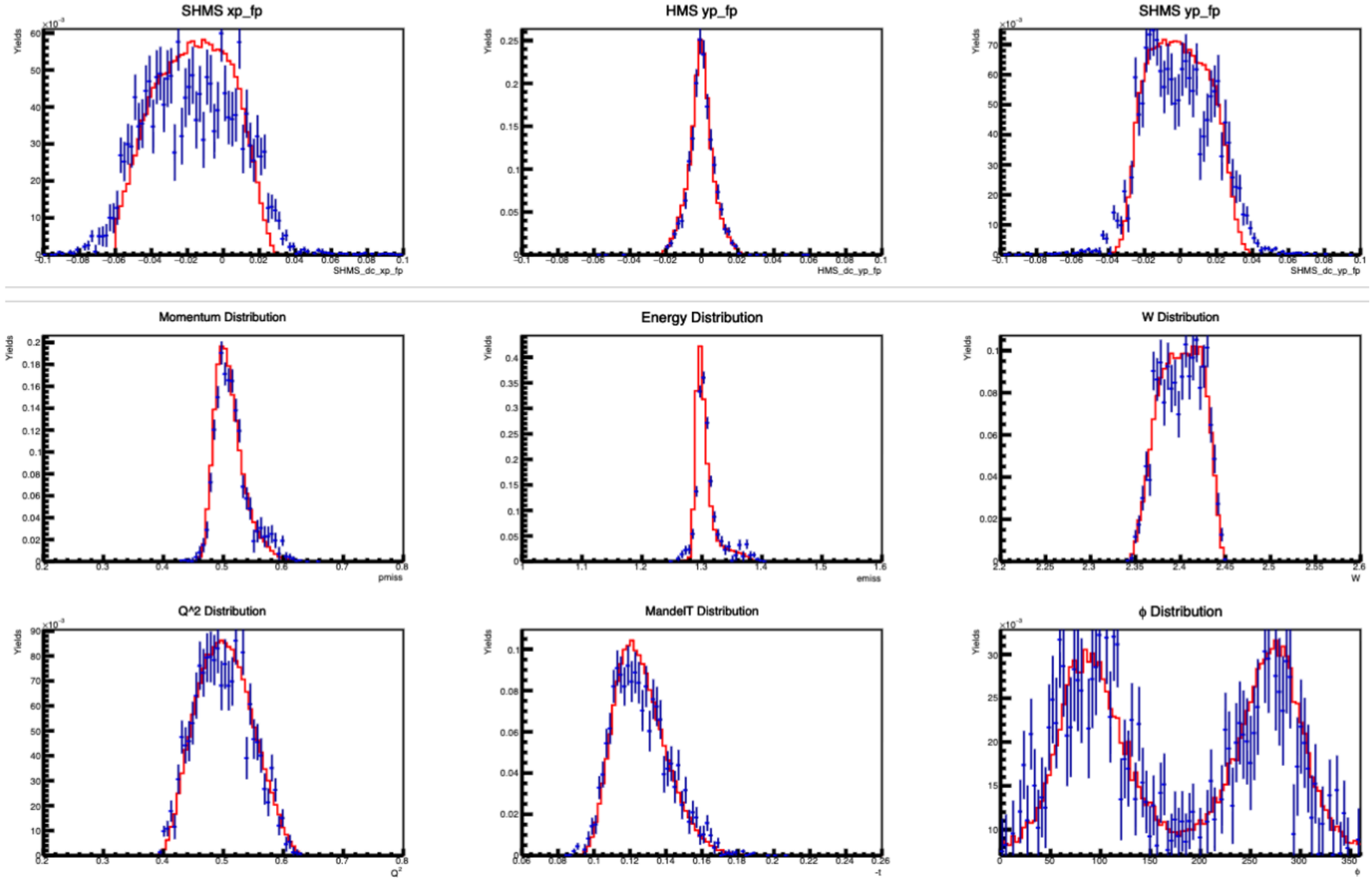




Data vs SIMC Kinematic

Centre Low ε

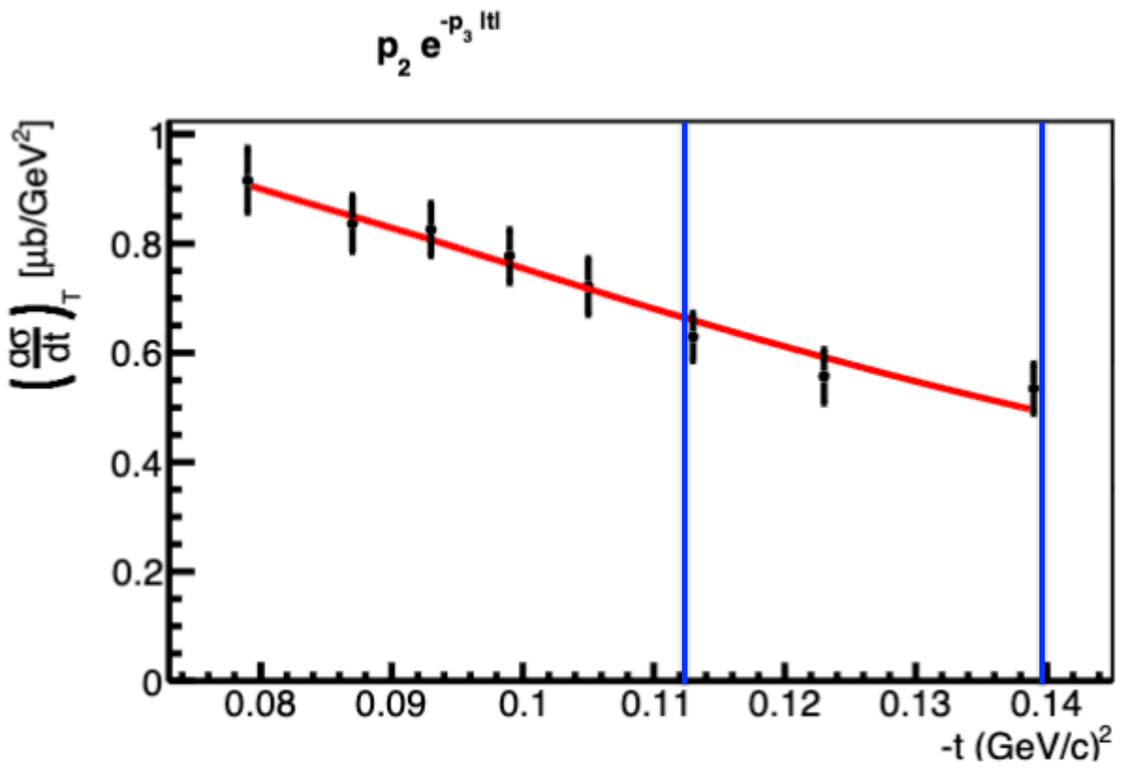
$p(e, e'K^+)\Sigma^0$



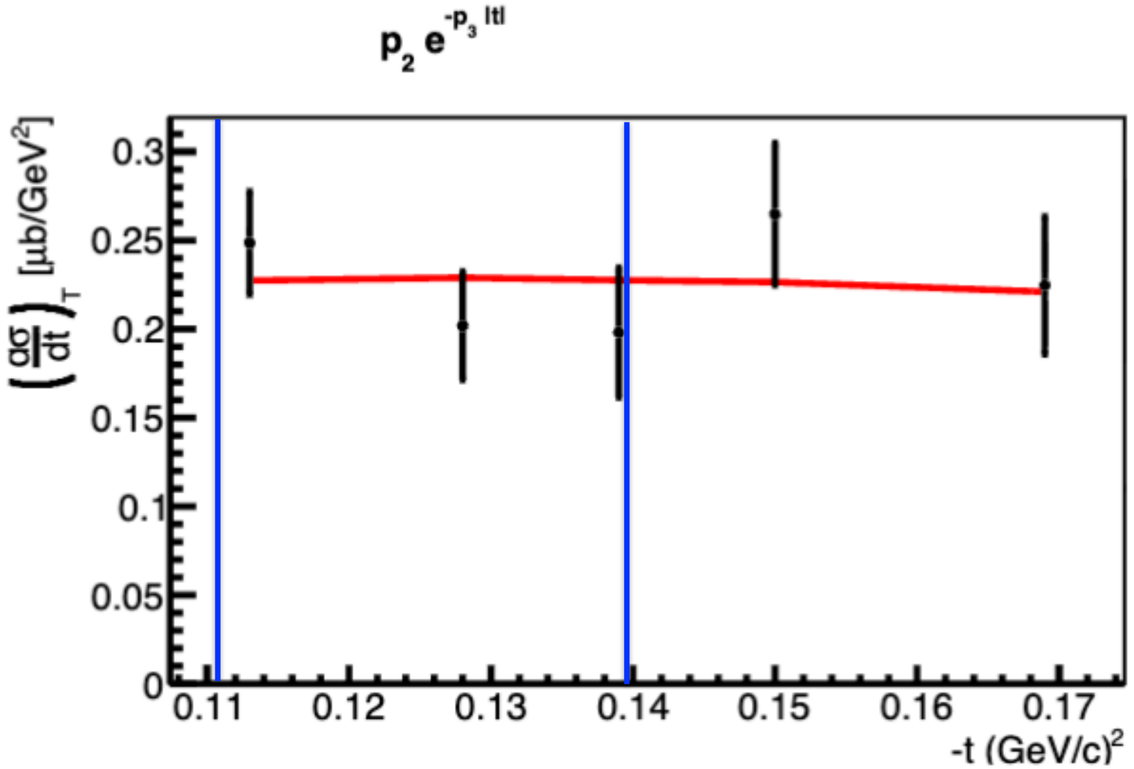
$$\frac{\sigma_T(\gamma^* p \rightarrow K^+\Sigma^0)}{\sigma_T(\gamma^* p \rightarrow K^+\Lambda)}$$

Transverse Cross Section Overlap Region

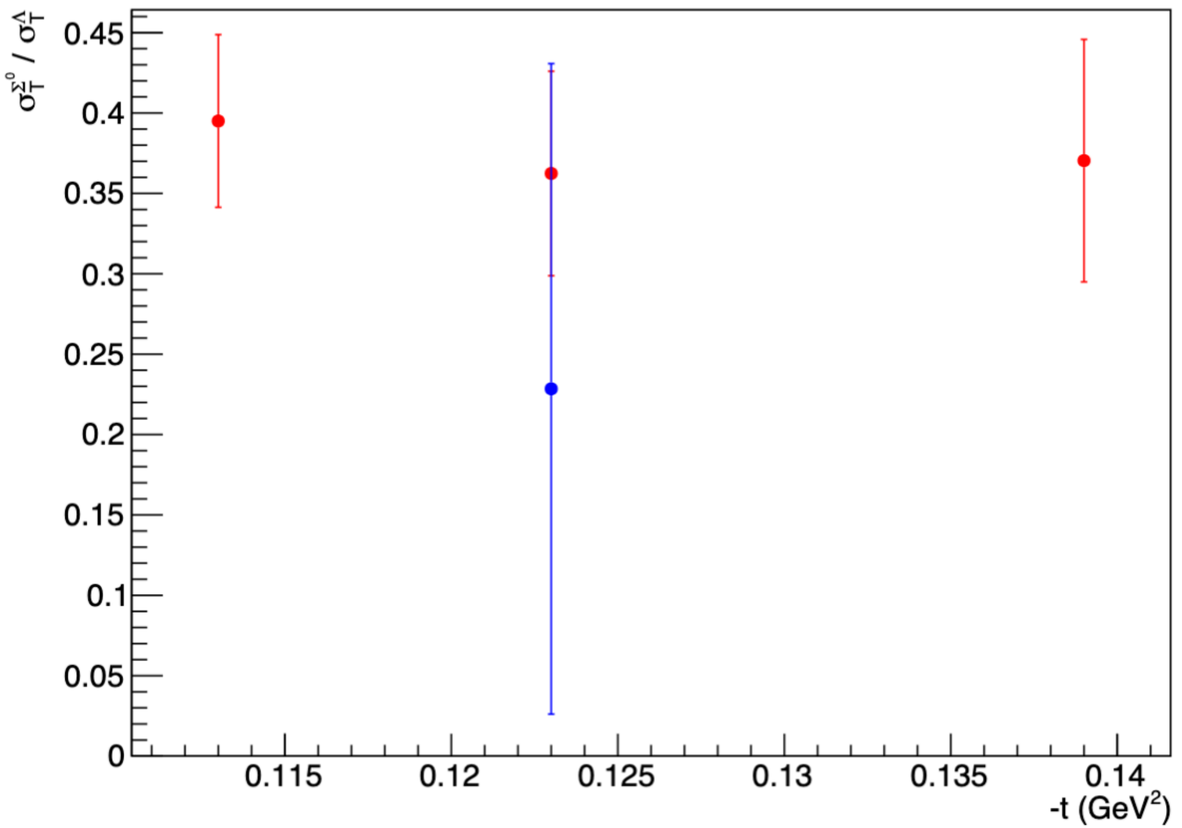
$p(e, e'K^+)\Lambda$



$p(e, e'K^+)\Sigma^0$



Transverse Cross Section ratio (Σ^0/Λ)



tc_lambda,	T_lambda,	T_err_lambda,	tc_sigma,	T_sigma,	T_err_sigma,	T_ratio,	T_ratio_err,	T_sigma_func,	T_sigma_func_err
0.113,	0.629 ,	0.0439,	0.113,	0.2485,	0.029 ,	0.3951,	0.0537,	0.2273,	0.1929
0.123,	0.5571,	0.0497,	0.128,	0.2019,	0.0305,	0.3624,	0.0636,	0.2284,	0.2023
0.139,	0.5346,	0.0456,	0.139,	0.198 ,	0.0366,	0.3704,	0.0754,	0.2276,	0.2184