



University
of Regina

Kaon L,T, LT, TT Model Optimization - Towards Data/SIMC ~ 1 -

Abdennacer Hamdi

KaonLT Meeting
2026/02/19

L, T, LT, TT Models

$$\frac{d\sigma_T}{dt} = \frac{p_1}{Q^2} + \frac{|t|^{p_2}}{(Q^2 + p_3)^2}$$

$$\frac{d\sigma_L}{dt} = \frac{(|t|^{p_4} + p_5)^2}{(Q^2 + p_6)^2}$$

$$\frac{d\sigma_{LT}}{dt} = \frac{p_7 e^{-p_8(t-t_{min})}}{(Q^2 + p_9)^2} \sin(\theta)$$

$$\frac{d\sigma_{TT}}{dt} = \frac{p_{10} e^{-p_{11}(t-t_{min})}}{(Q^2 + p_{12})^2} \sin^2(\theta)$$

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

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

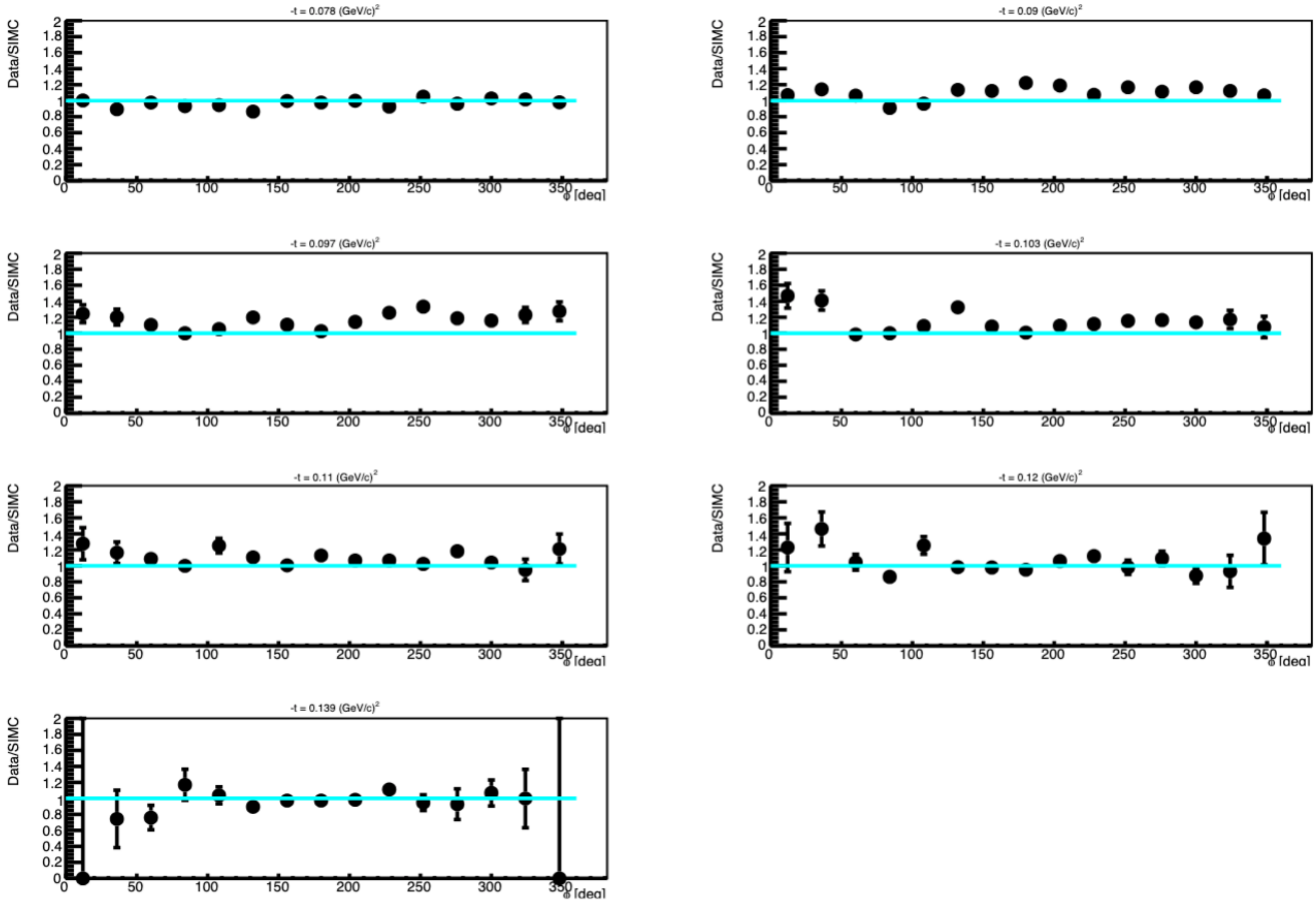
Canceled

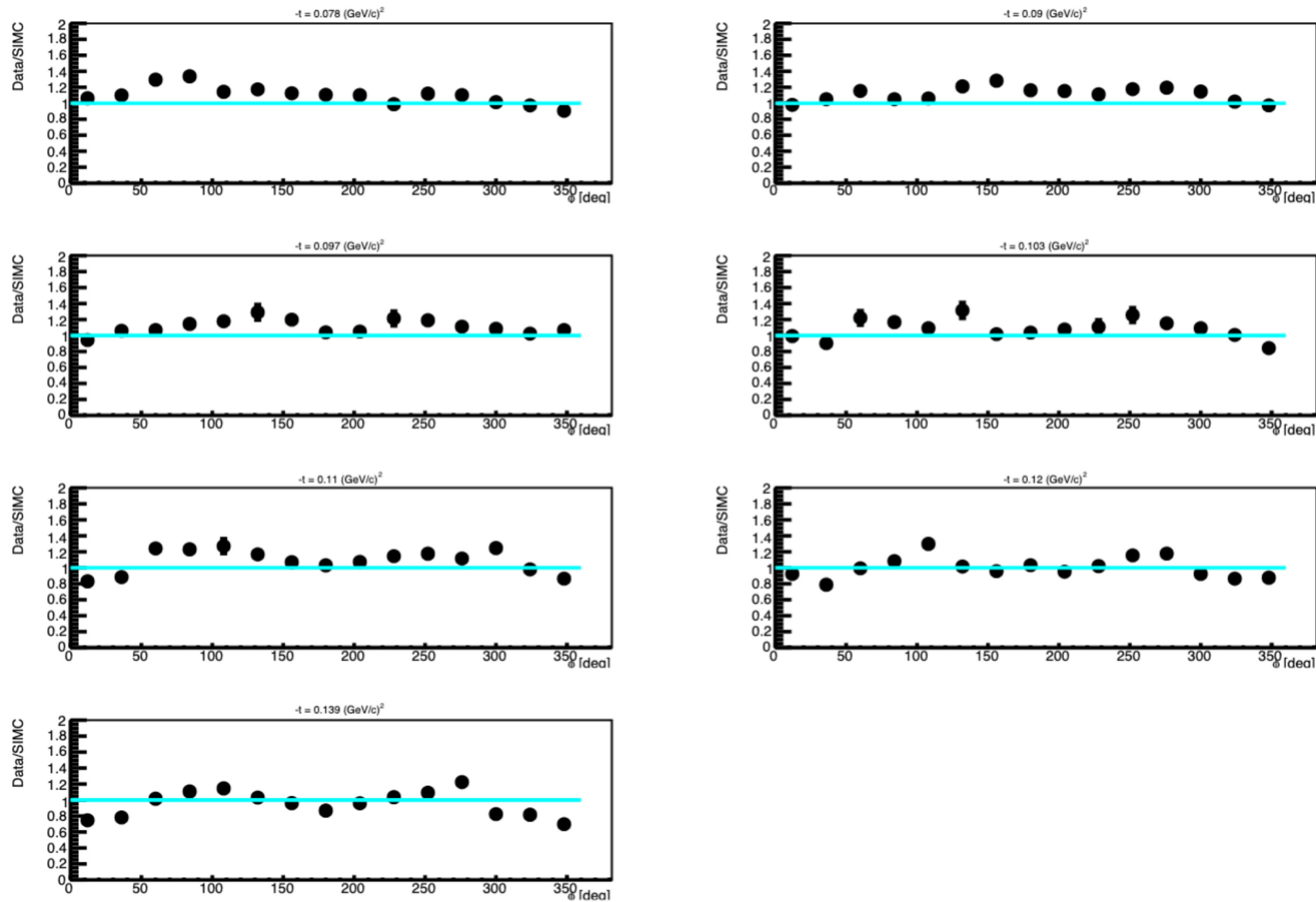
Canceled

Canceled

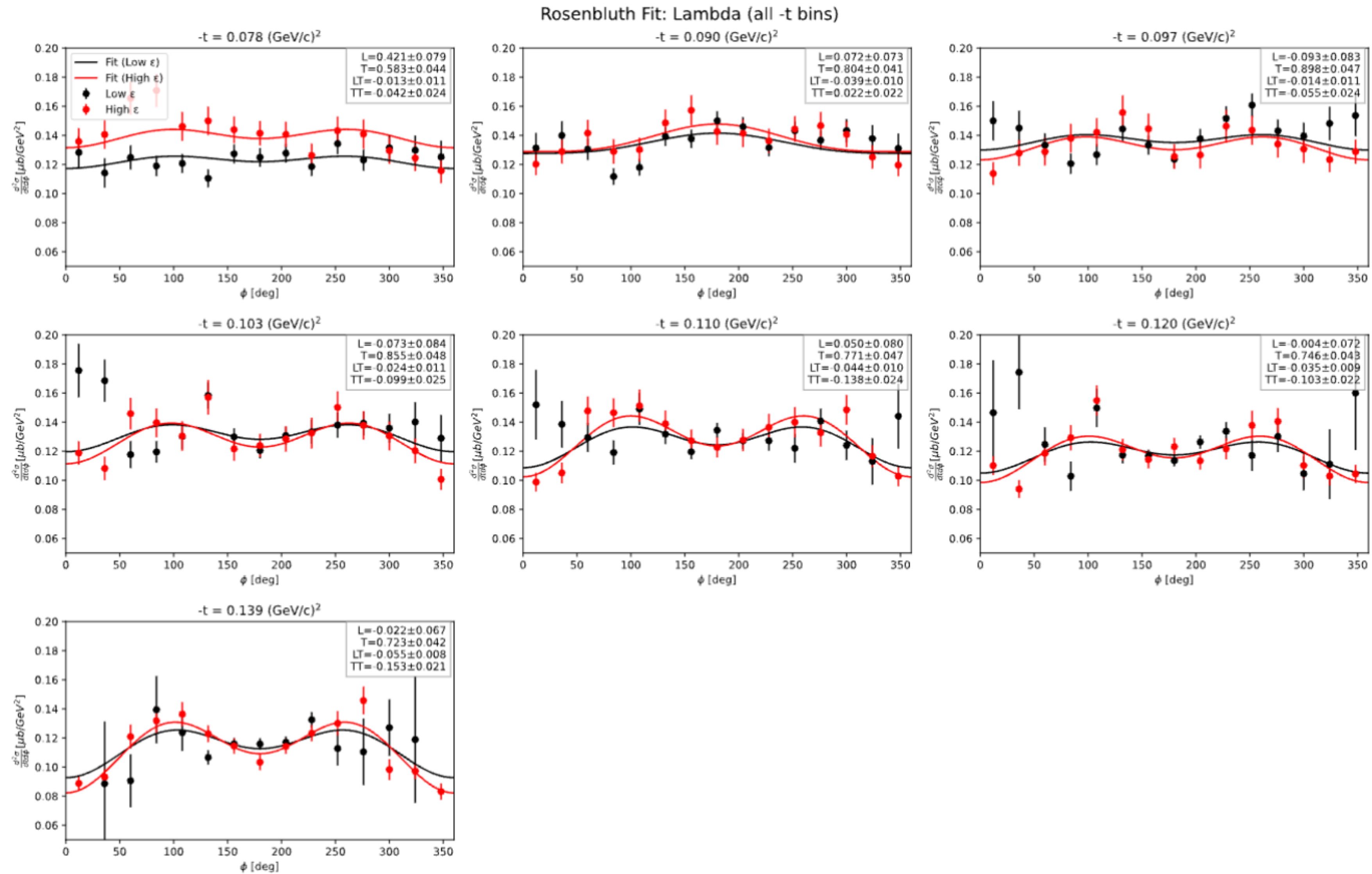
--- iteration 03 parameters ---			----- iteration 04 parameters ----		
8.785	0.589	1	8.785	0.590	1
0.658	1.422	2	0.658	1.421	2
0.161	0.913	3	0.161	0.912	3
0.000	0.000	4	0.000	0.000	4
0.000	0.000	5	0.000	0.000	5
0.000	0.000	6	0.000	0.000	6
0.000	0.000	7	0.000	0.000	7
0.000	0.000	8	0.000	0.000	8
0.000	0.000	9	0.000	0.000	9
0.000	0.000	10	0.000	0.000	10
0.000	0.000	11	0.000	0.000	11

Iteration 03

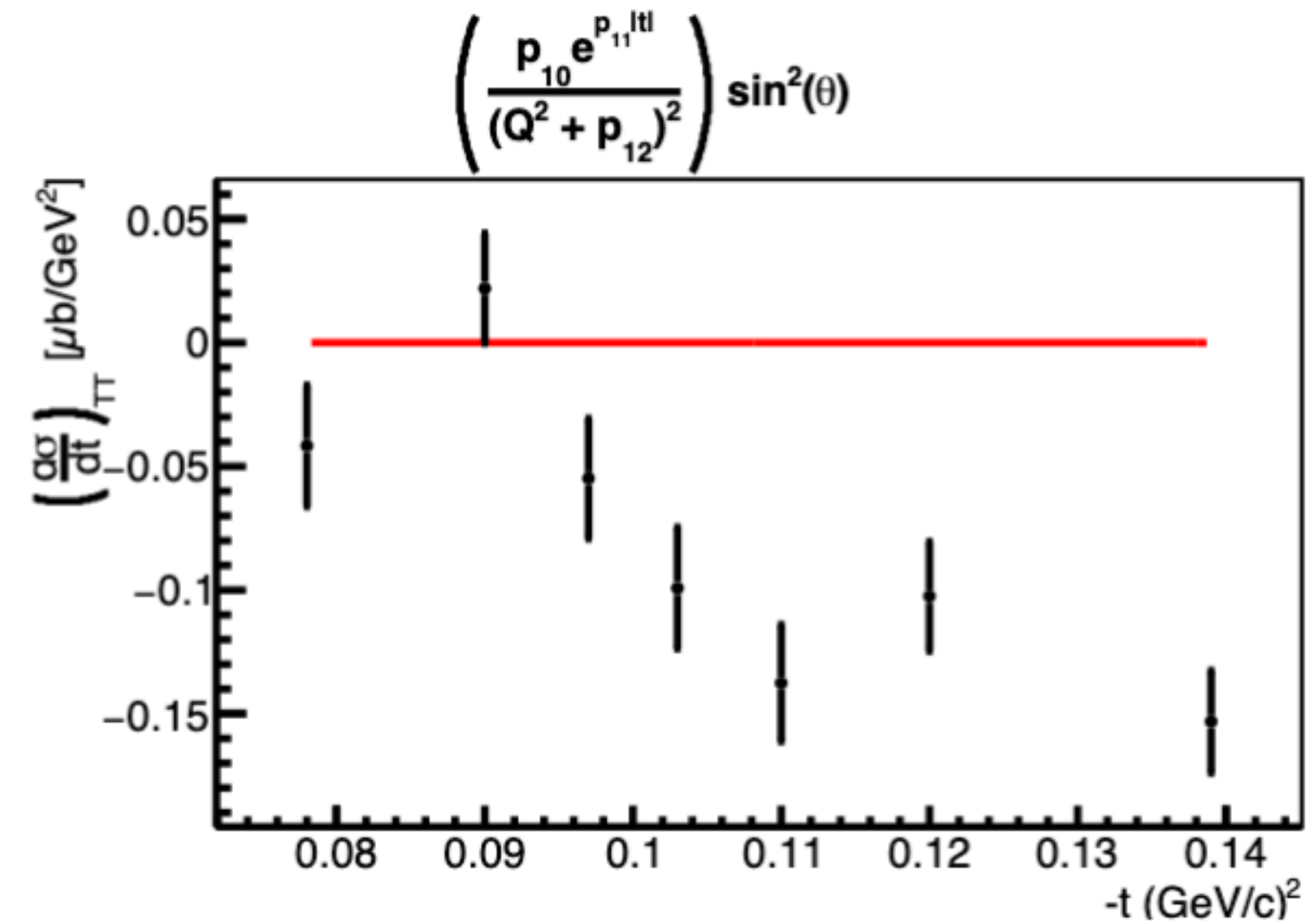
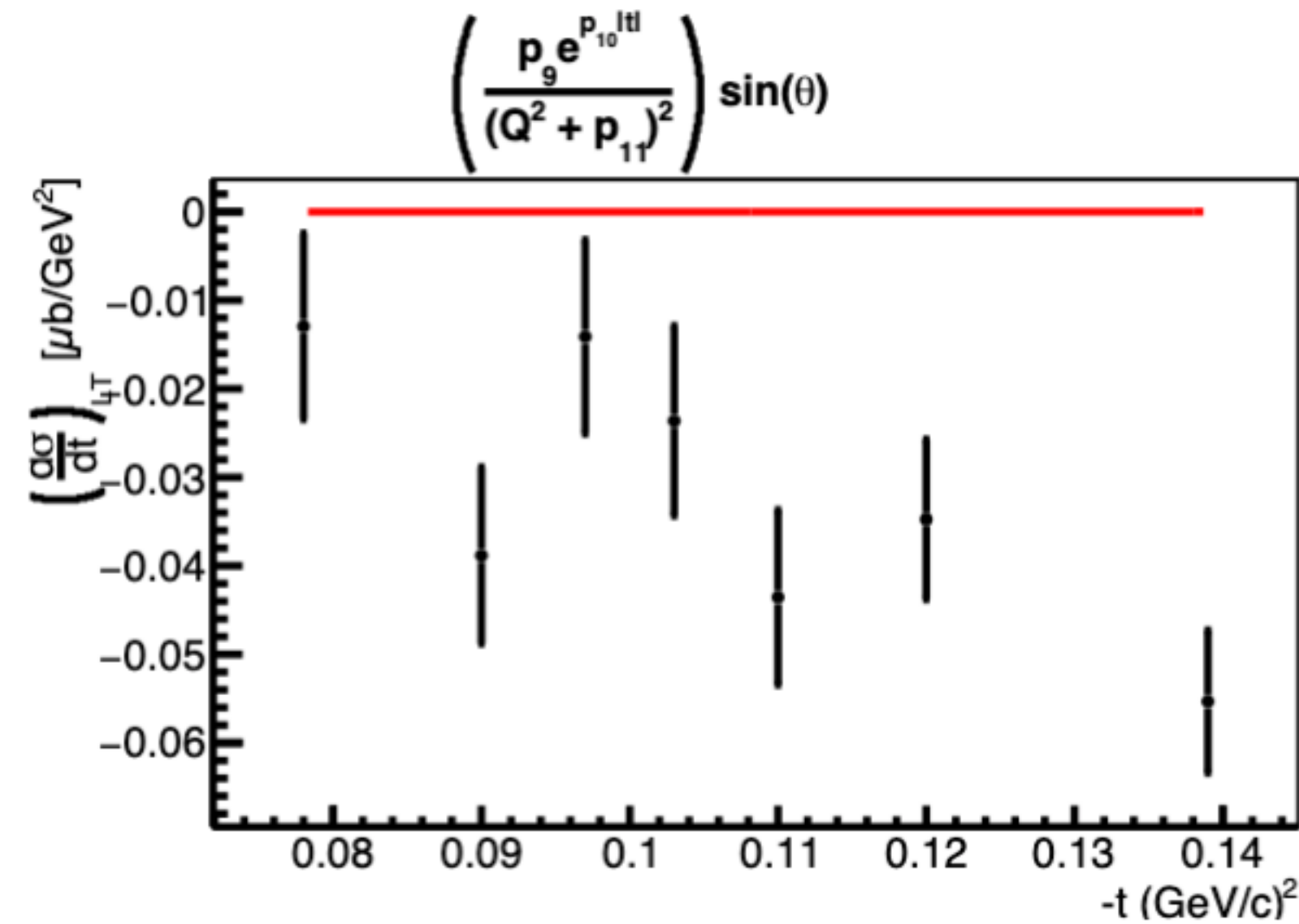
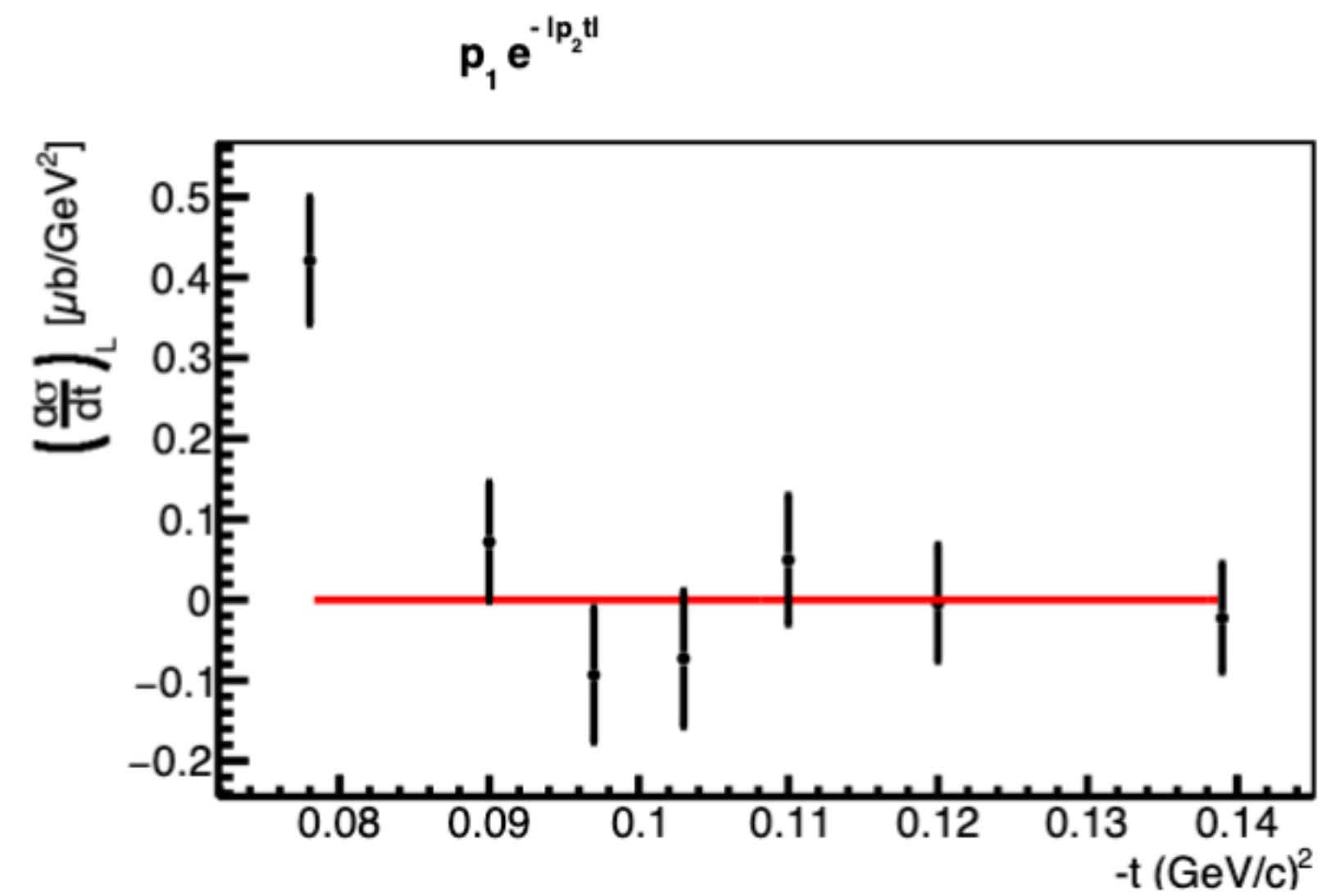
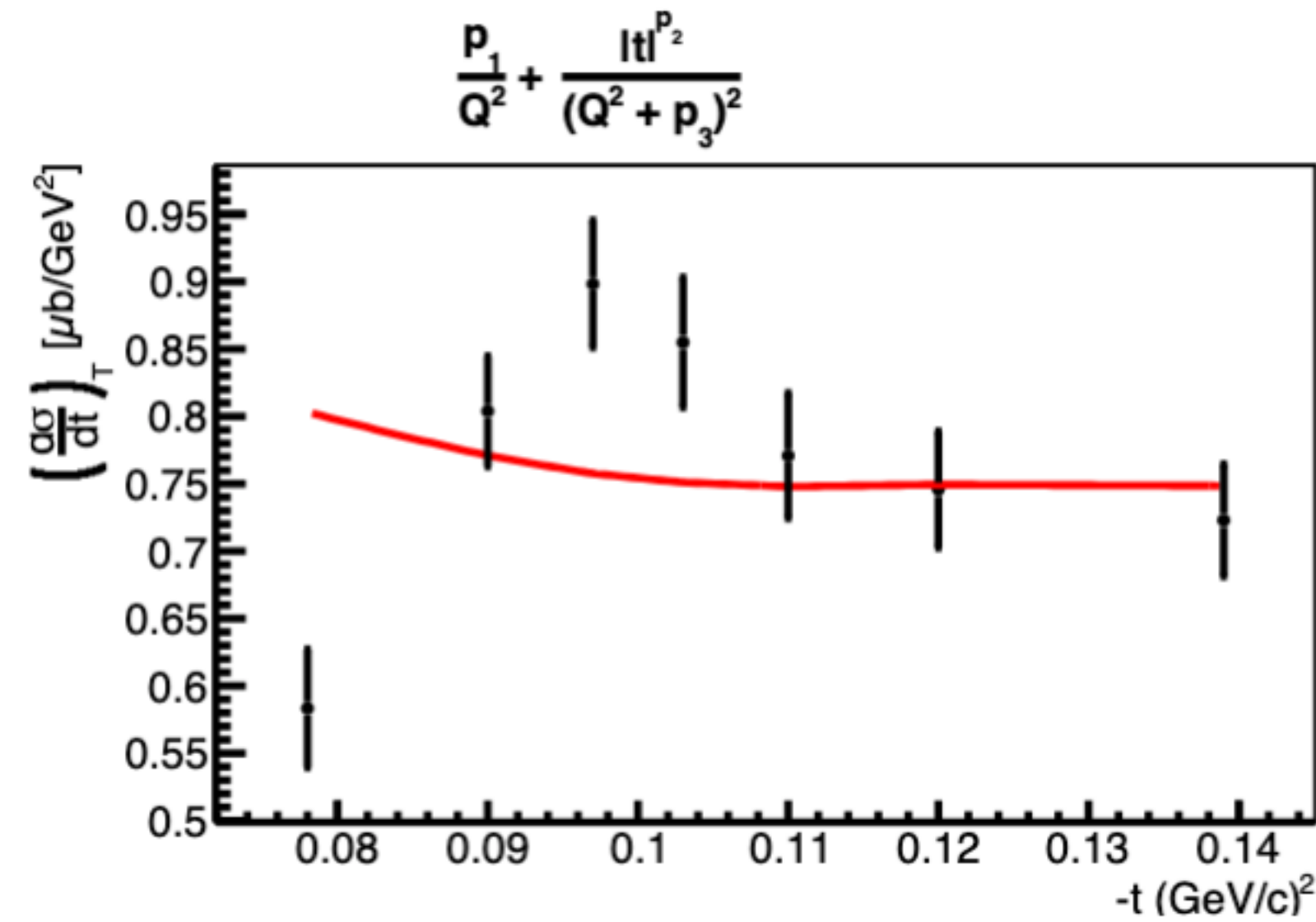




Low & High ϵ Simultaneous Fit (Rosenbluth)



L, T, LT, TT Cross Sections



New t-bins

- Add an extra t-bin for Lambda
- Rebin in -t for both Lambda and Sigma cross section

```
t_lambda = [0.070,0.086,0.094,0.100,0.106,0.114,0.126,0.152] ### old
```

```
t_lambda = [0.070,0.084,0.090,0.096,0.102,0.108,0.116,0.128,0.152] ### new
```

```
t_sigma = [0.100,0.120,0.132,0.142,0.154,0.182] ### old
```

```
t_sigma = [0.100,0.122,0.134,0.144,0.156,0.182] ### new
```

L, T, LT, TT Models

$$\frac{d\sigma_T}{dt} = \frac{p_1}{Q^2} + \frac{|t|^{p_2}}{(Q^2 + p_3)^2}$$

$$\frac{d\sigma_L}{dt} = \frac{(|t|^{p_4} + p_5)^2}{(Q^2 + p_6)^2}$$

$$\frac{d\sigma_{LT}}{dt} = \frac{p_7 e^{-p_8(t-t_{min})}}{(Q^2 + p_9)^2} \sin(\theta)$$

$$\frac{d\sigma_{TT}}{dt} = \frac{p_{10} e^{-p_{11}(t-t_{min})}}{(Q^2 + p_{12})^2} \sin^2(\theta)$$

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

Canceled

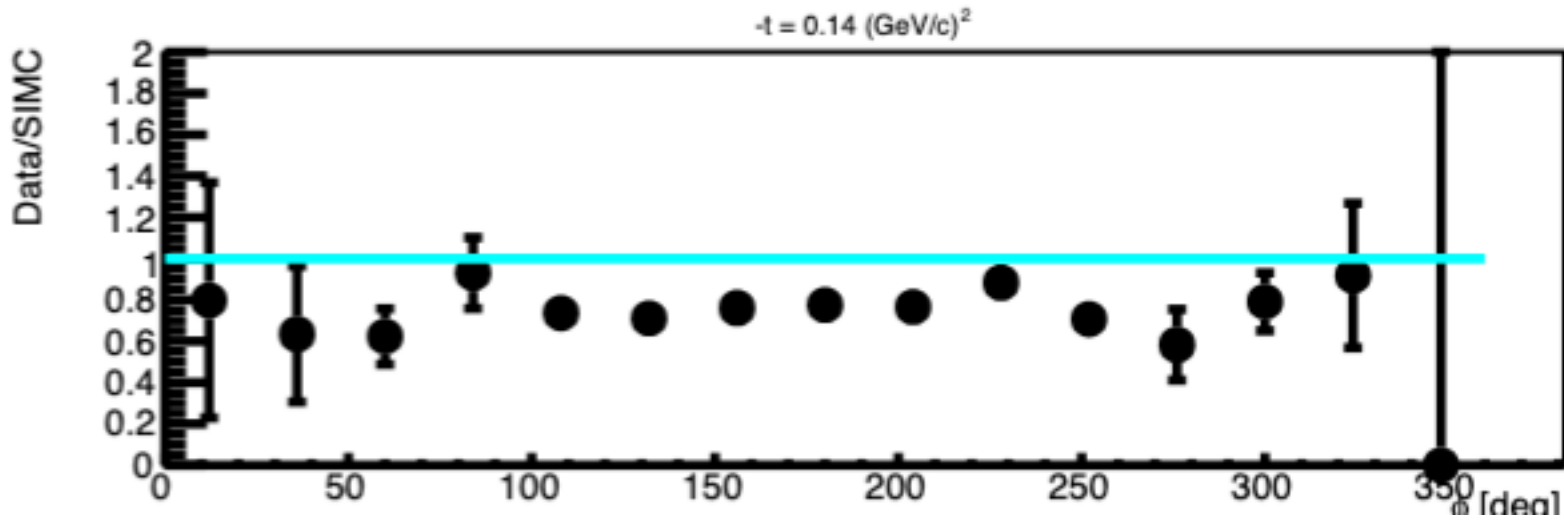
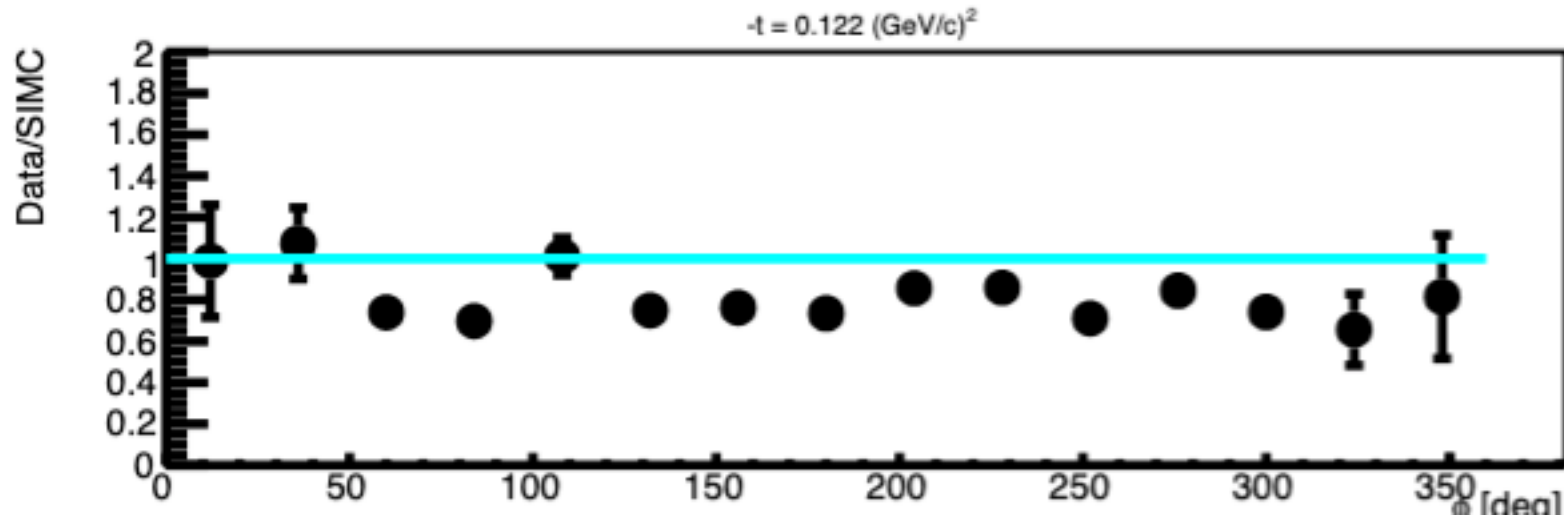
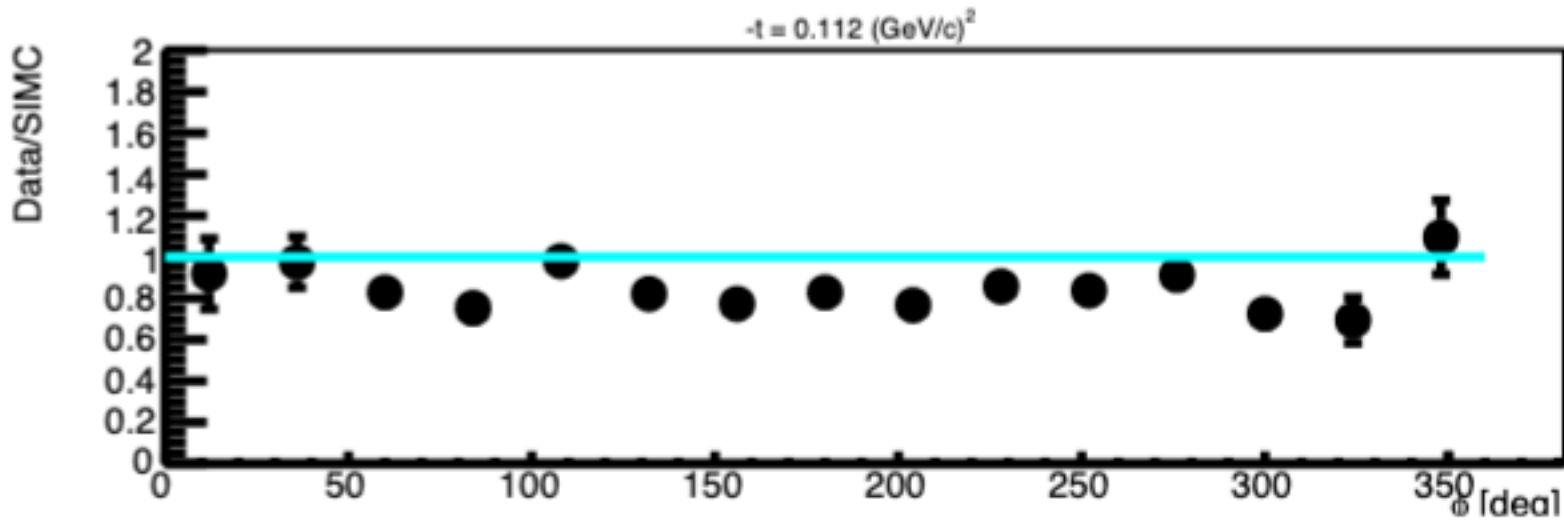
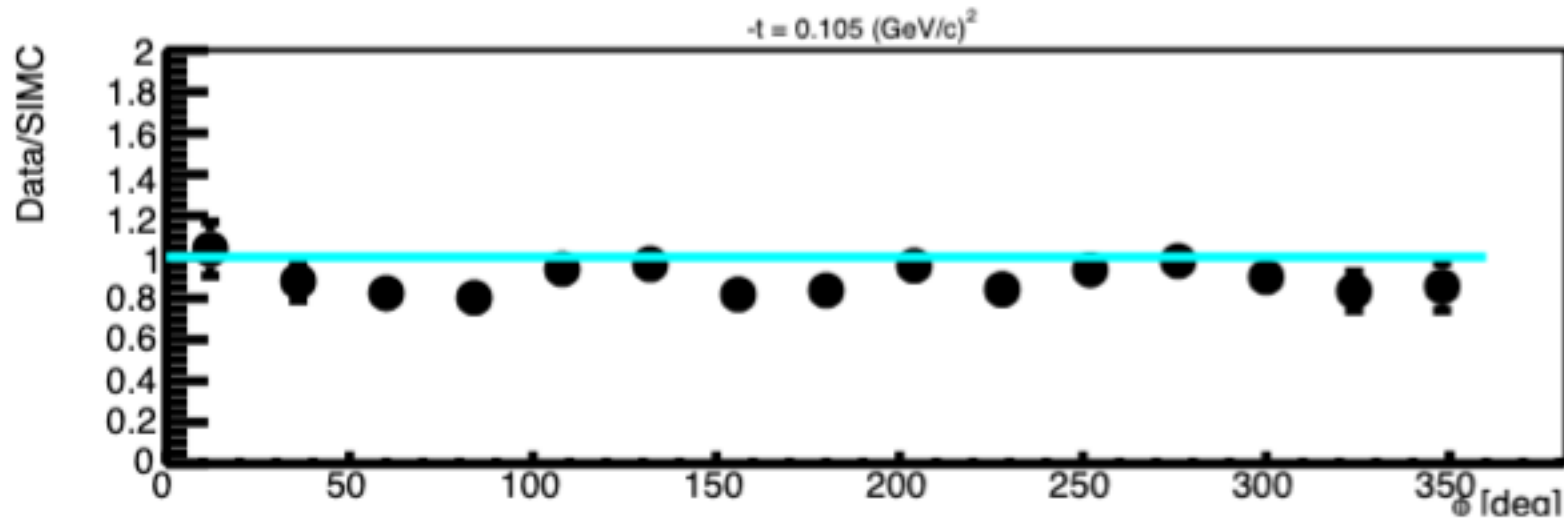
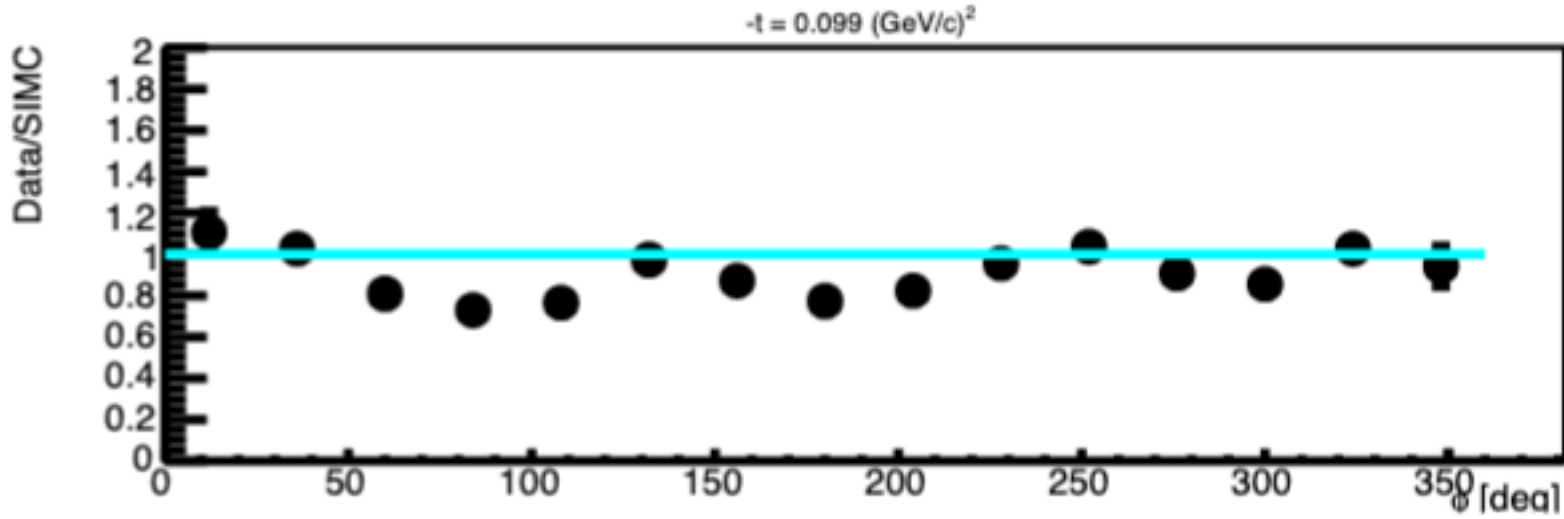
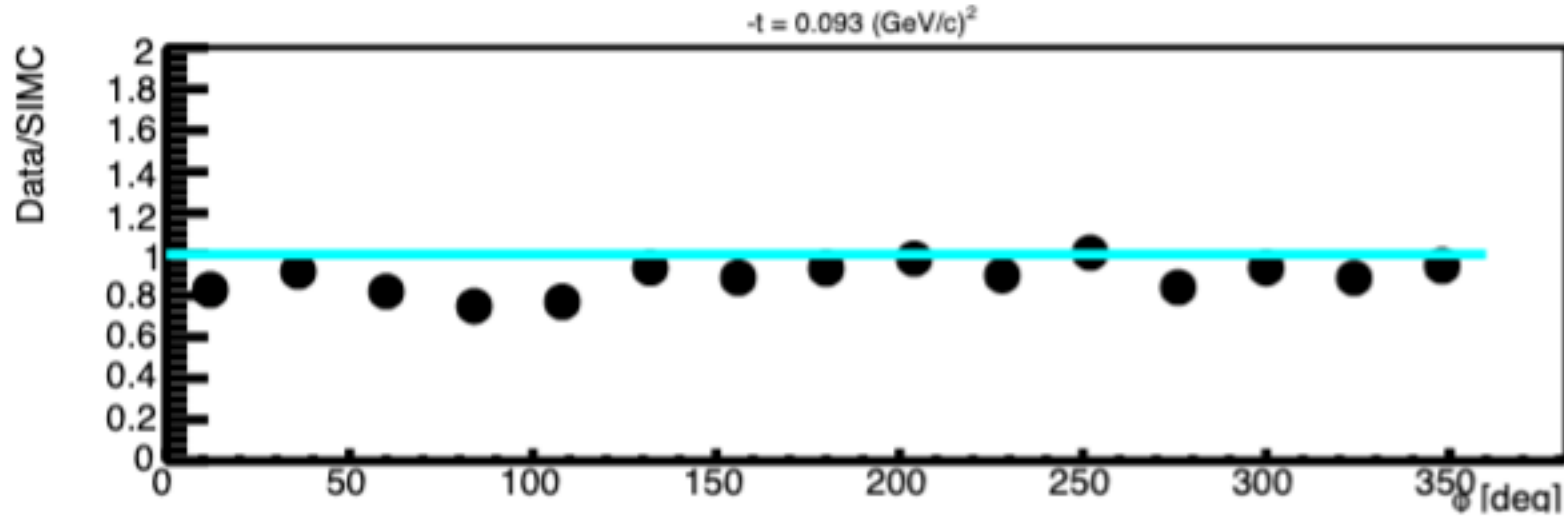
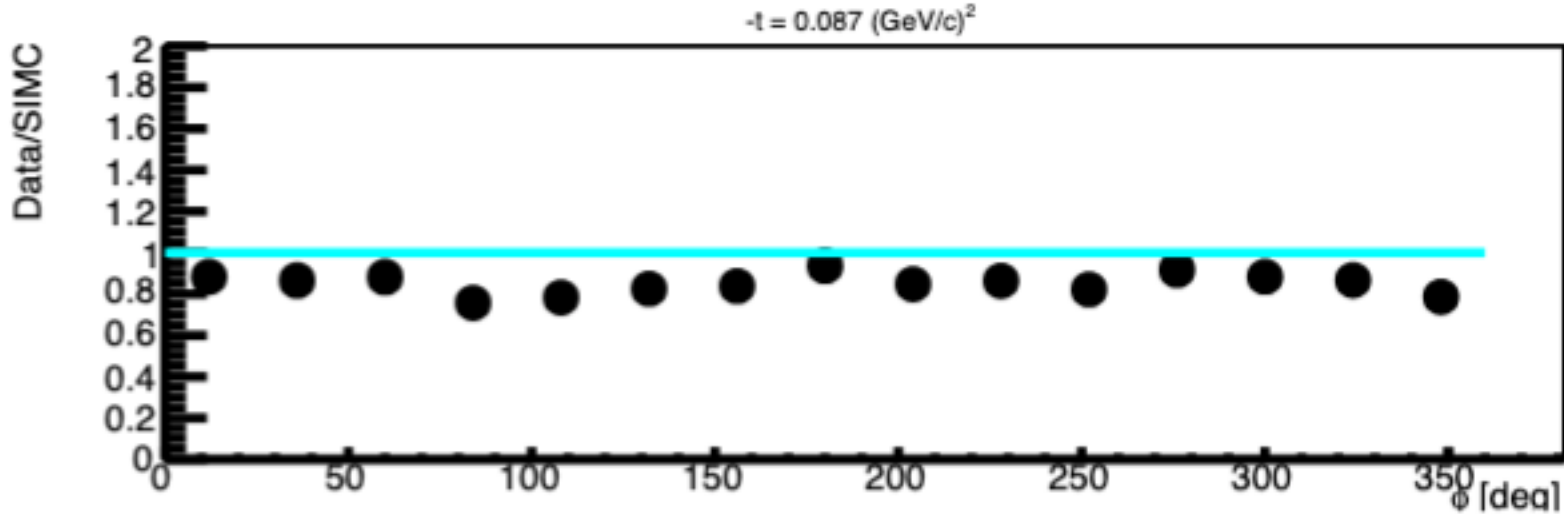
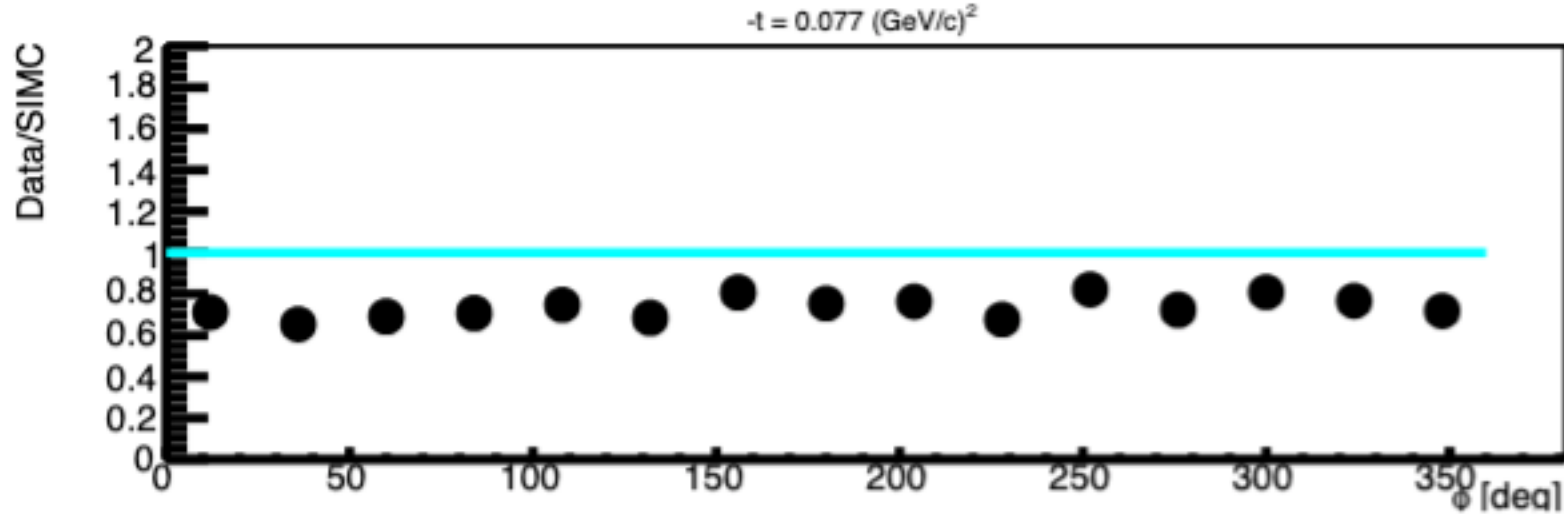
Canceled

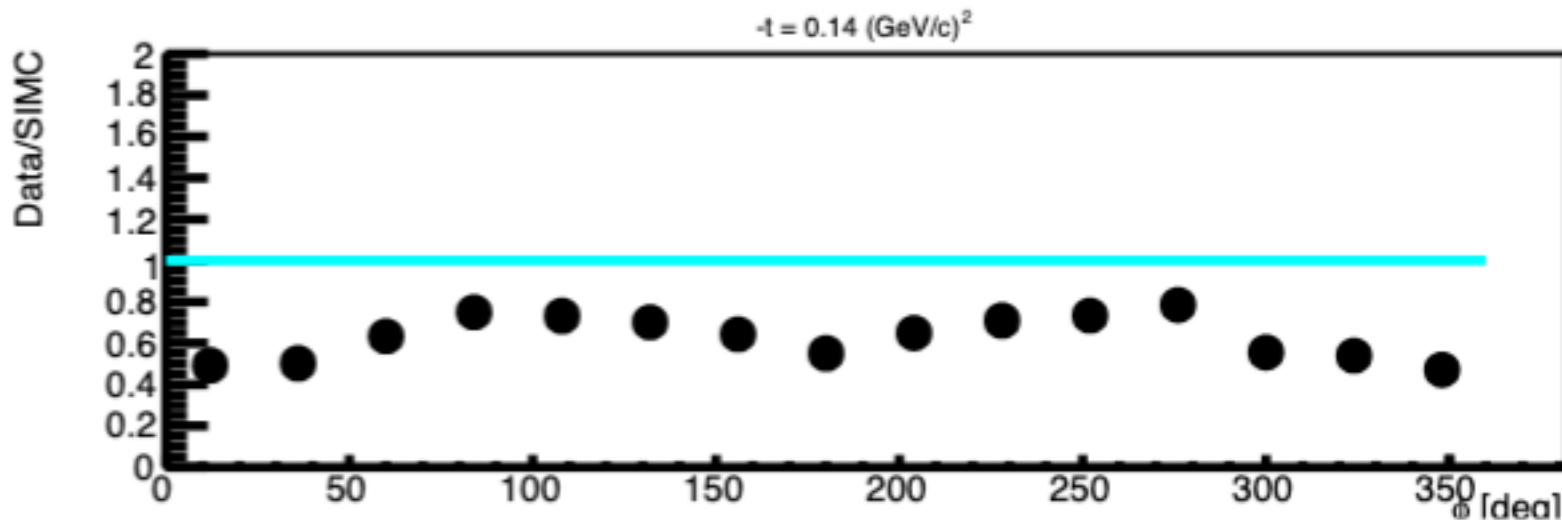
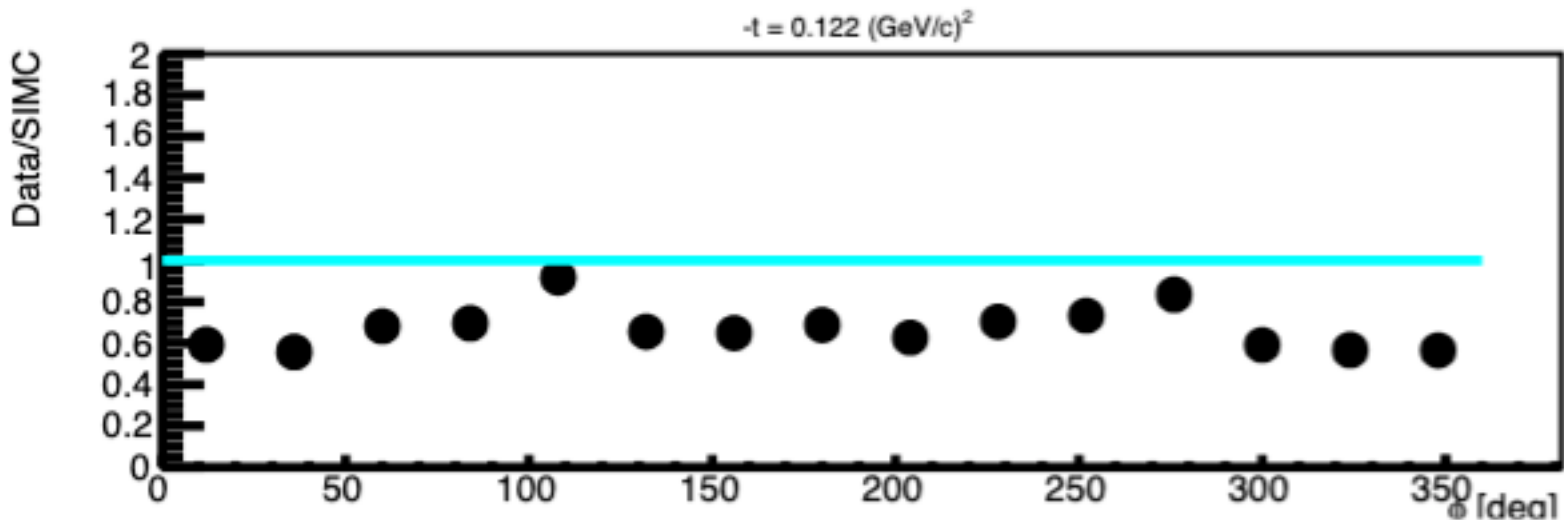
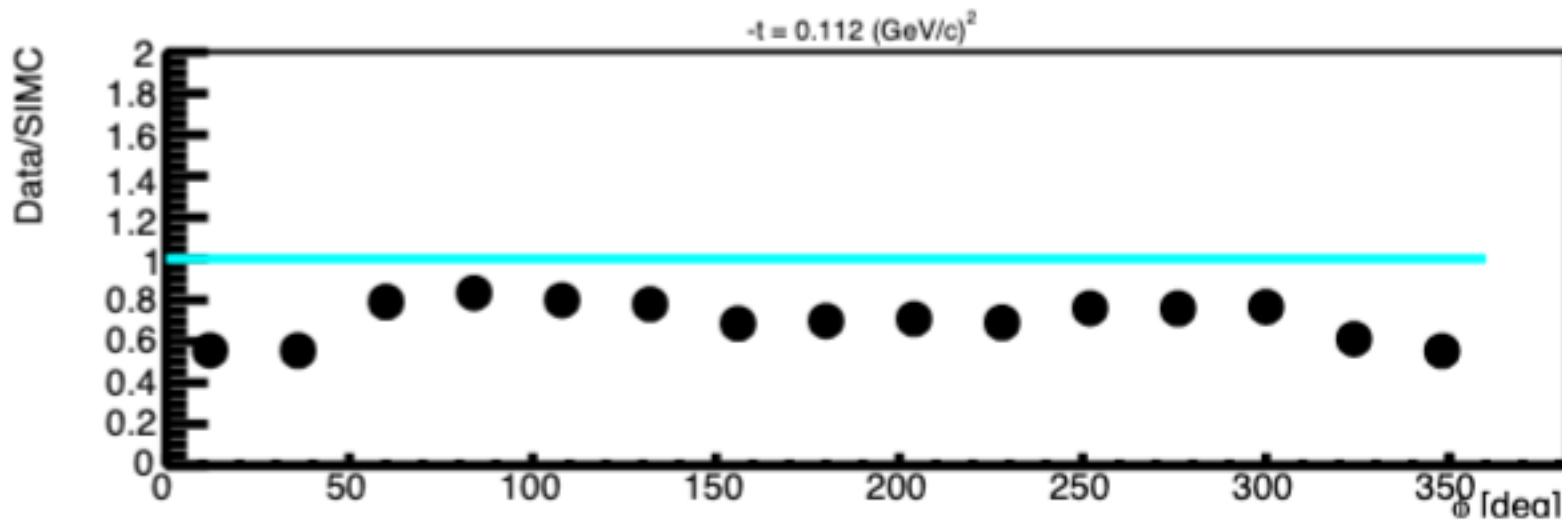
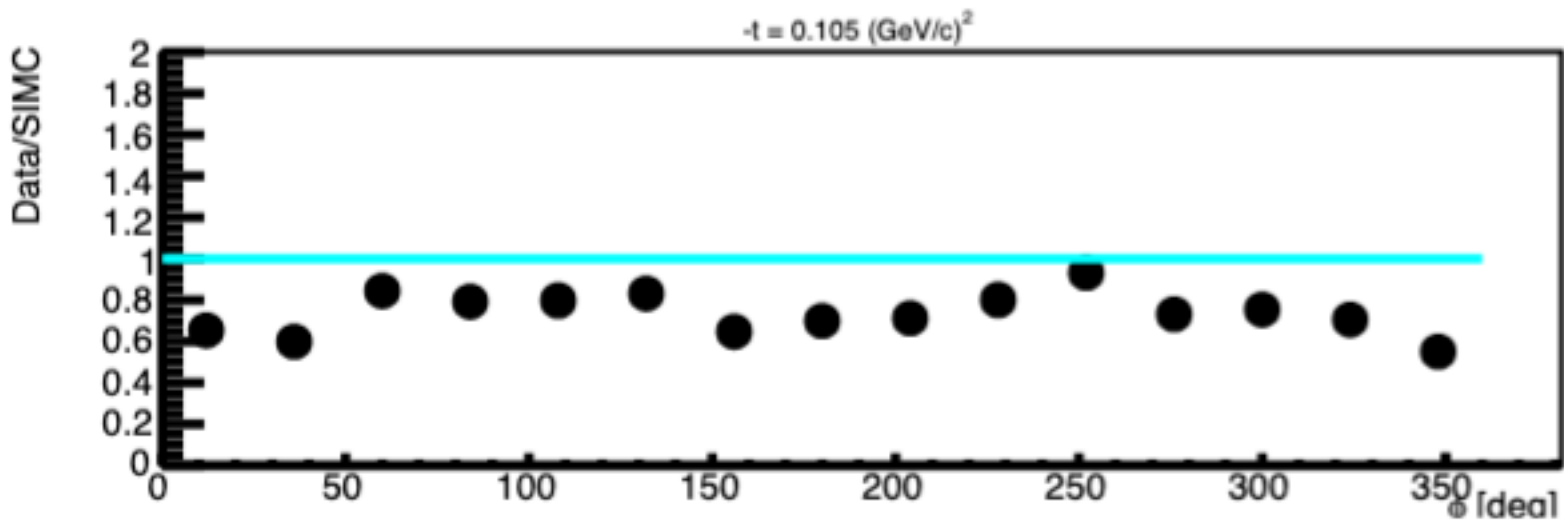
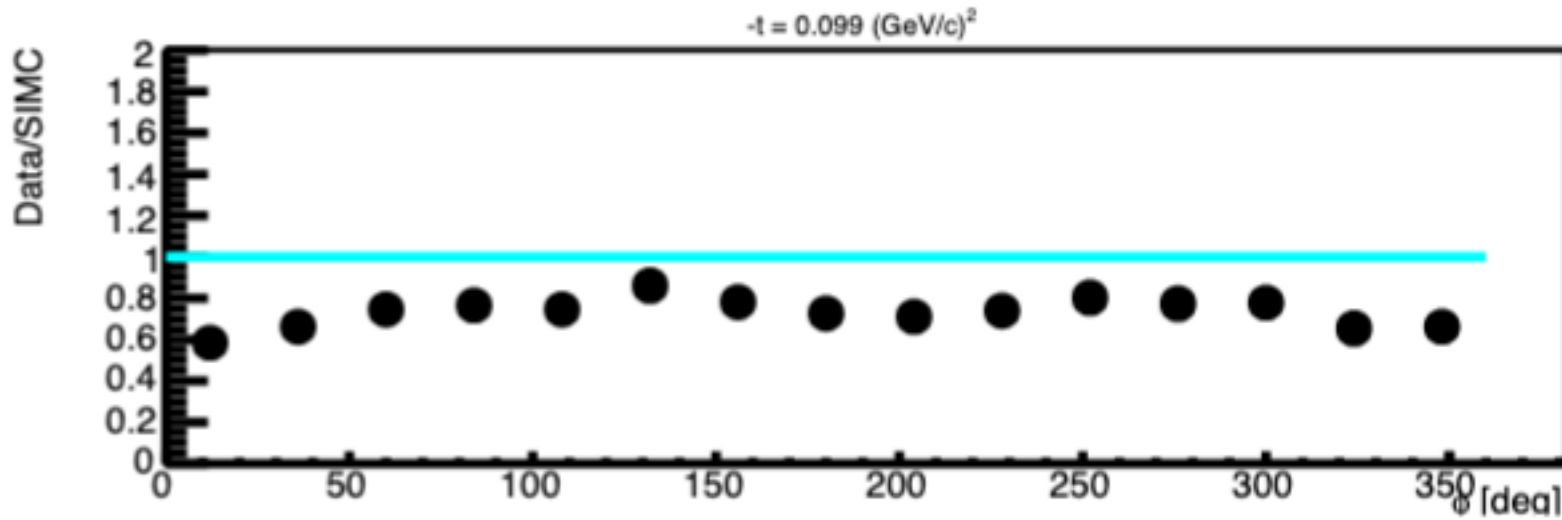
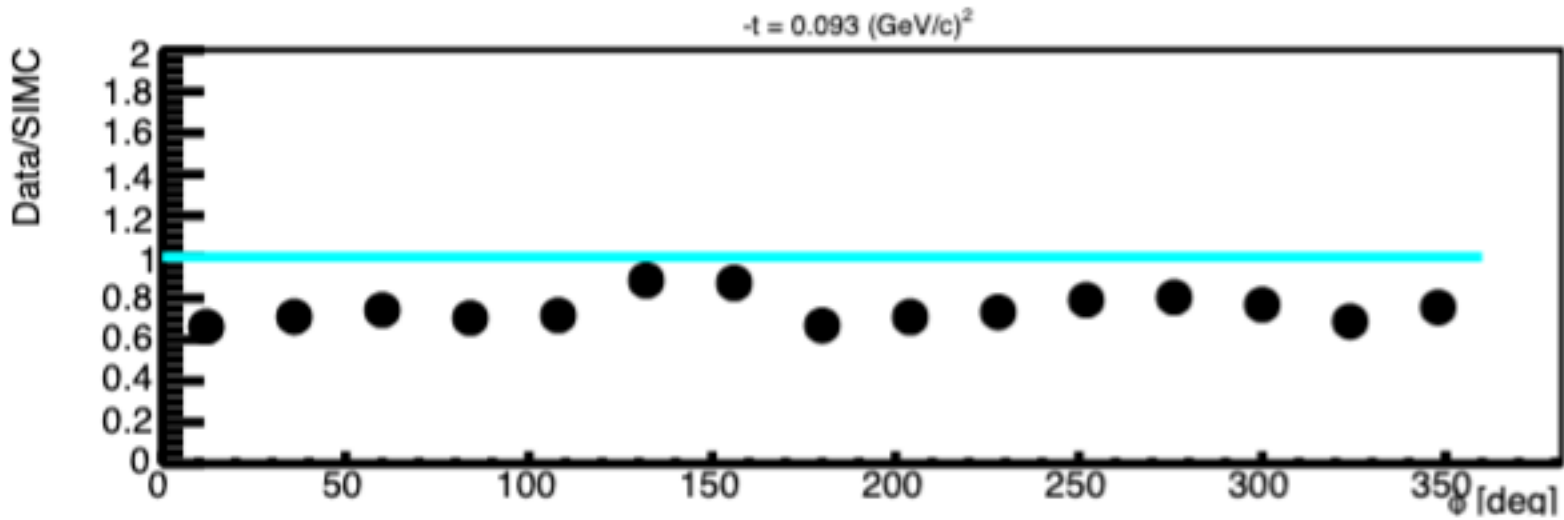
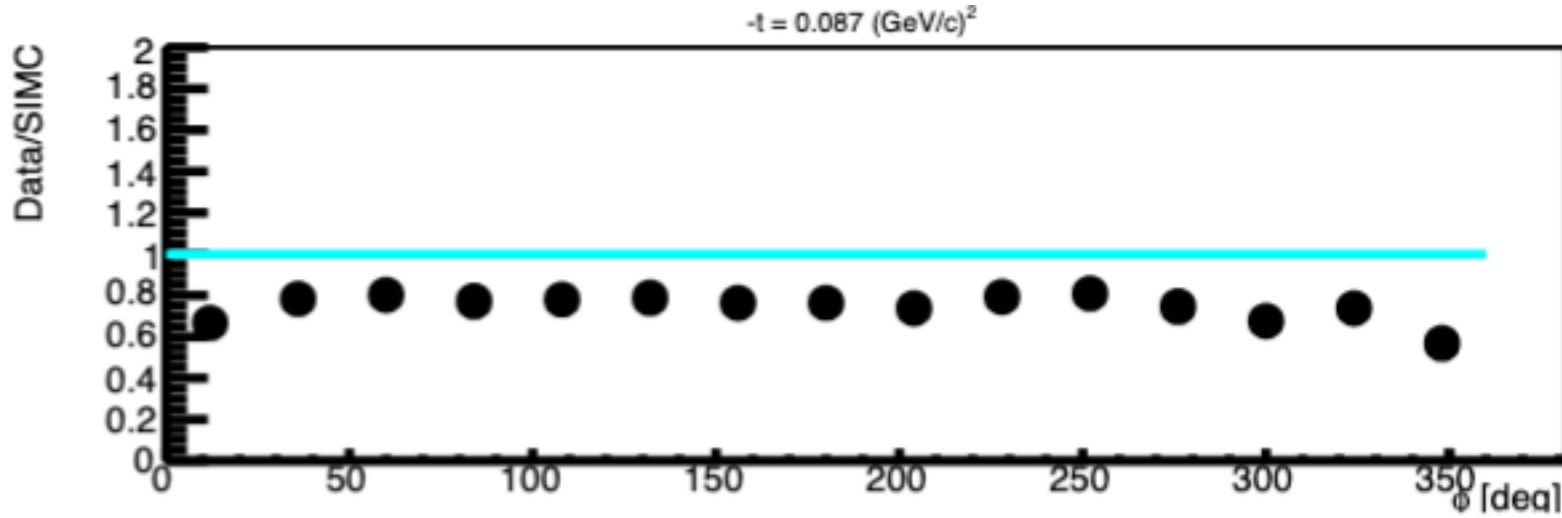
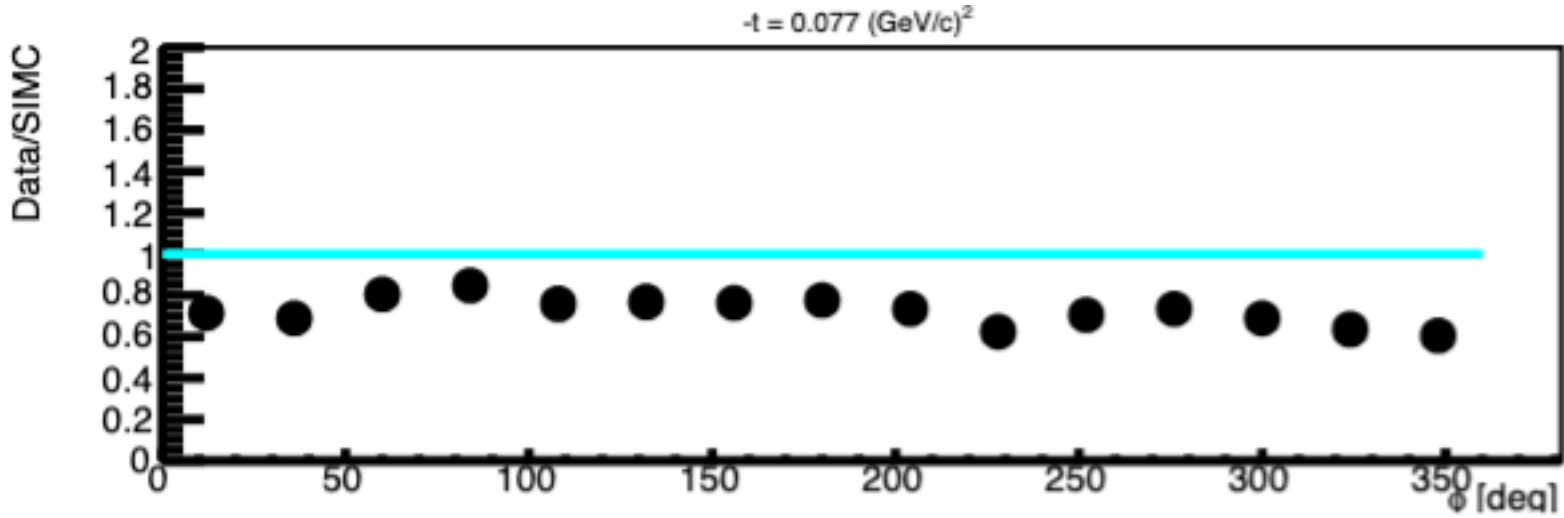
Canceled

--- iteration 05 parameters ---			----- iteration 06 parameters ---		
7.932	0.527	1	7.932	0.527	1
0.381	1.310	2	0.381	1.312	2
0.471	1.319	3	0.471	1.322	3
0.000	0.000	4	0.000	0.000	4
0.000	0.000	5	0.000	0.000	5
0.000	0.000	6	0.000	0.000	6
0.000	0.000	7	0.000	0.000	7
0.000	0.000	8	0.000	0.000	8
0.000	0.000	9	0.000	0.000	9
0.000	0.000	10	0.000	0.000	10
0.000	0.000	11	0.000	0.000	11
0.000	0.000	12	0.000	0.000	12

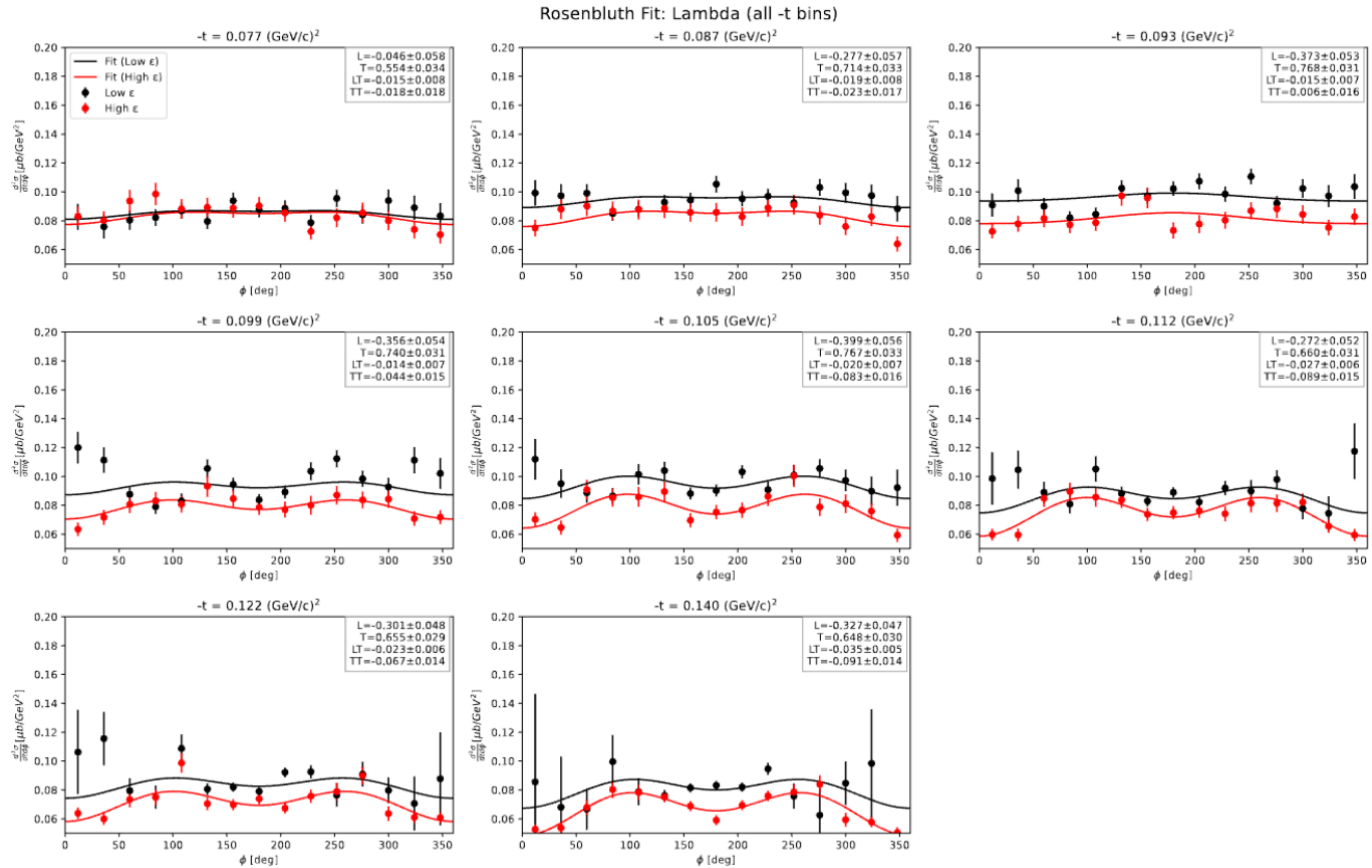
$$2\pi \frac{d^2\sigma}{dt d\phi} = \epsilon \frac{d\sigma_L}{dt} + \frac{d\sigma_T}{dt} + \sqrt{2\epsilon(\epsilon + 1)} \frac{d\sigma_{LT}}{dt} \cos\phi + \epsilon \frac{d\sigma_{TT}}{dt} \cos 2\phi$$

Iteration 05

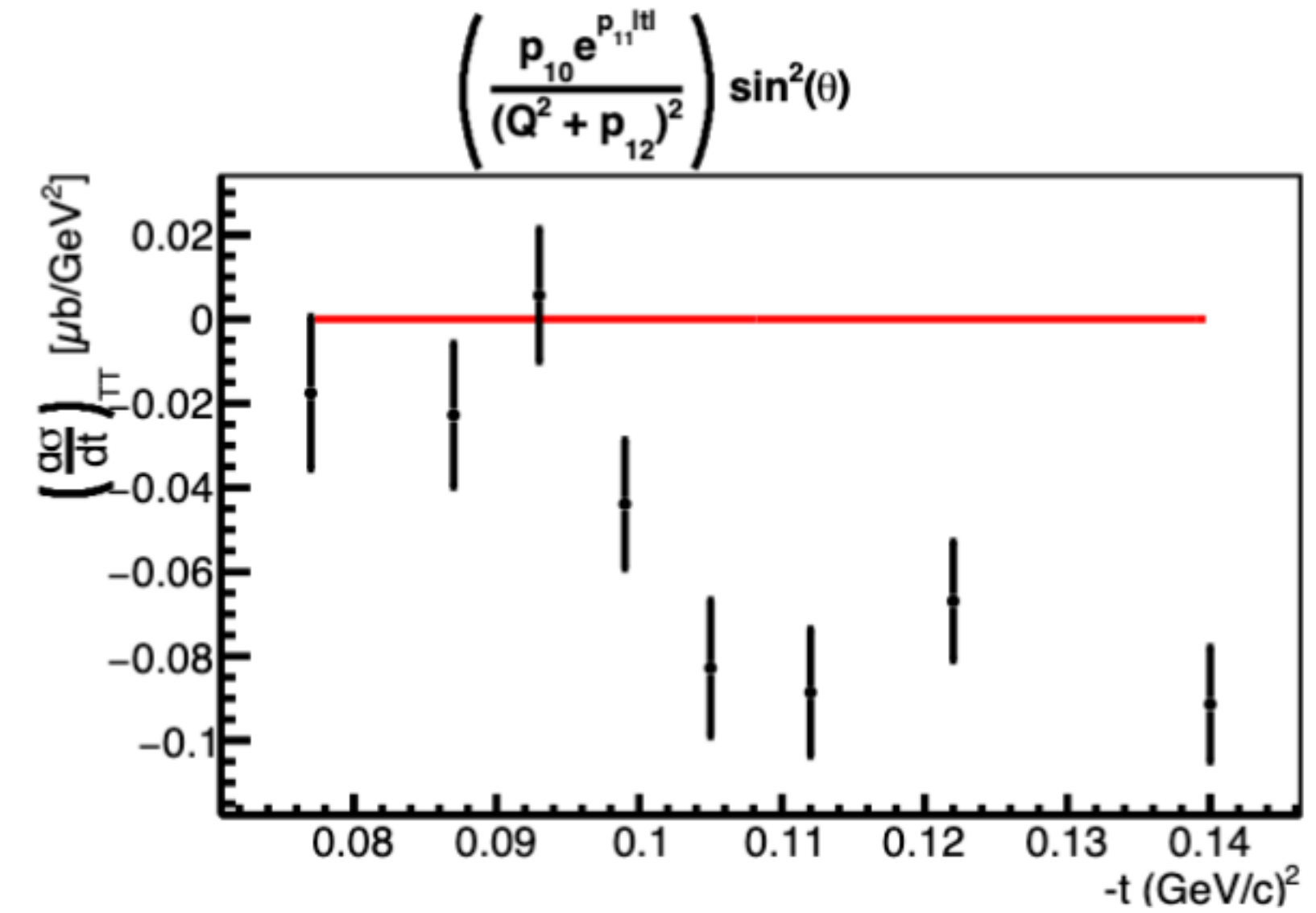
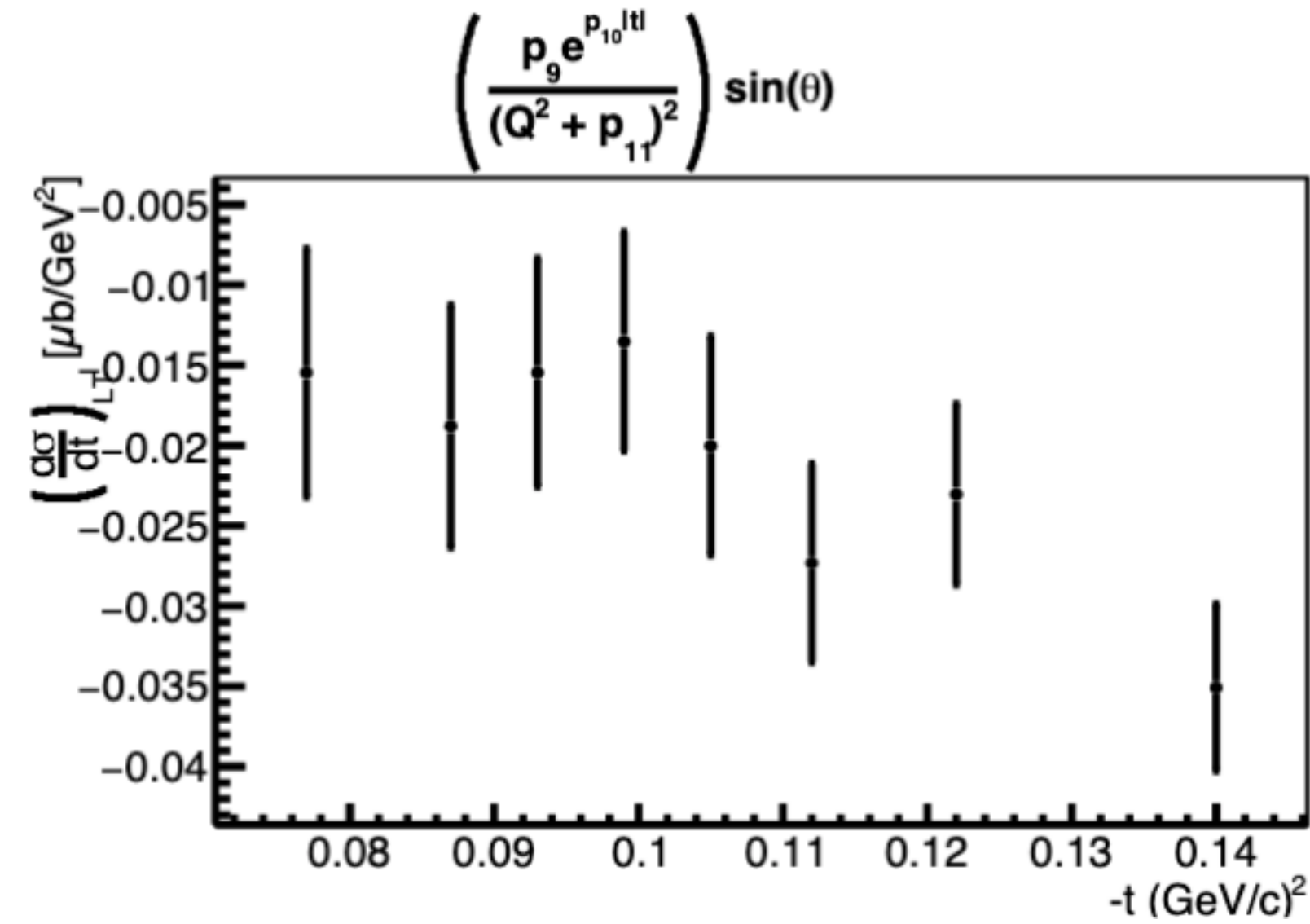
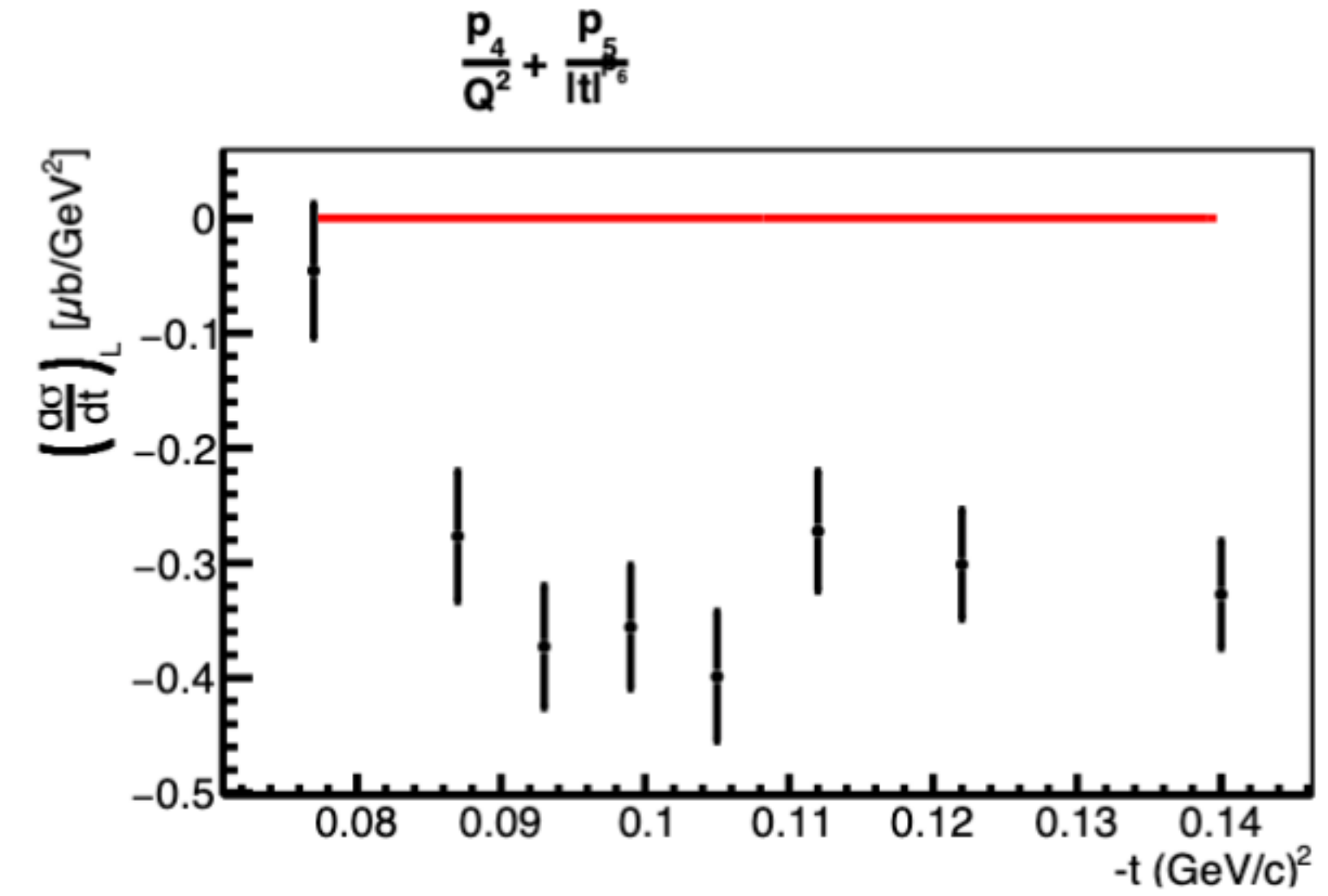
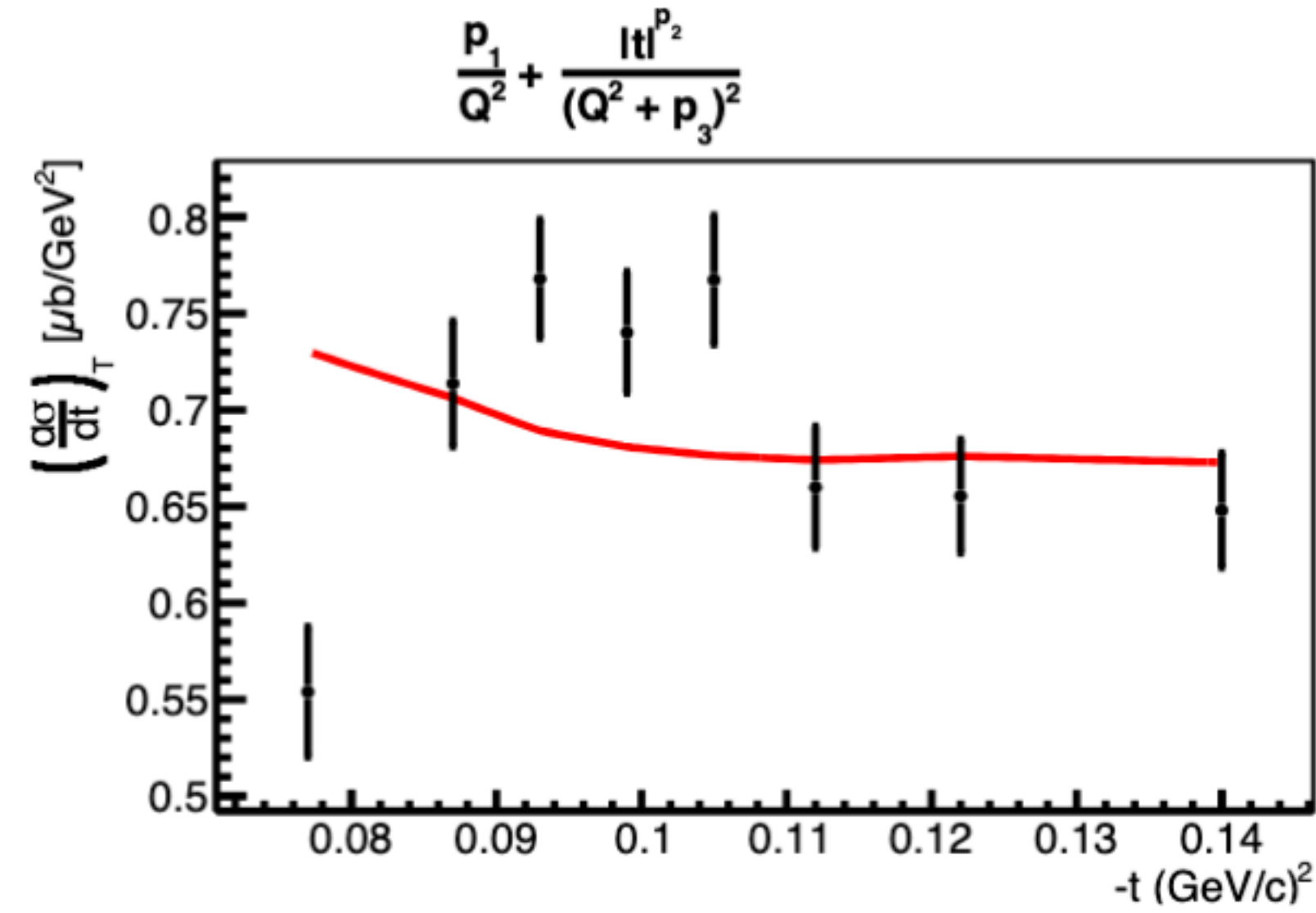




Low & High ϵ Simultaneous Fit (Rosenbluth)



L, T, LT, TT Cross Sections



L, T, LT, TT Models

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

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

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

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

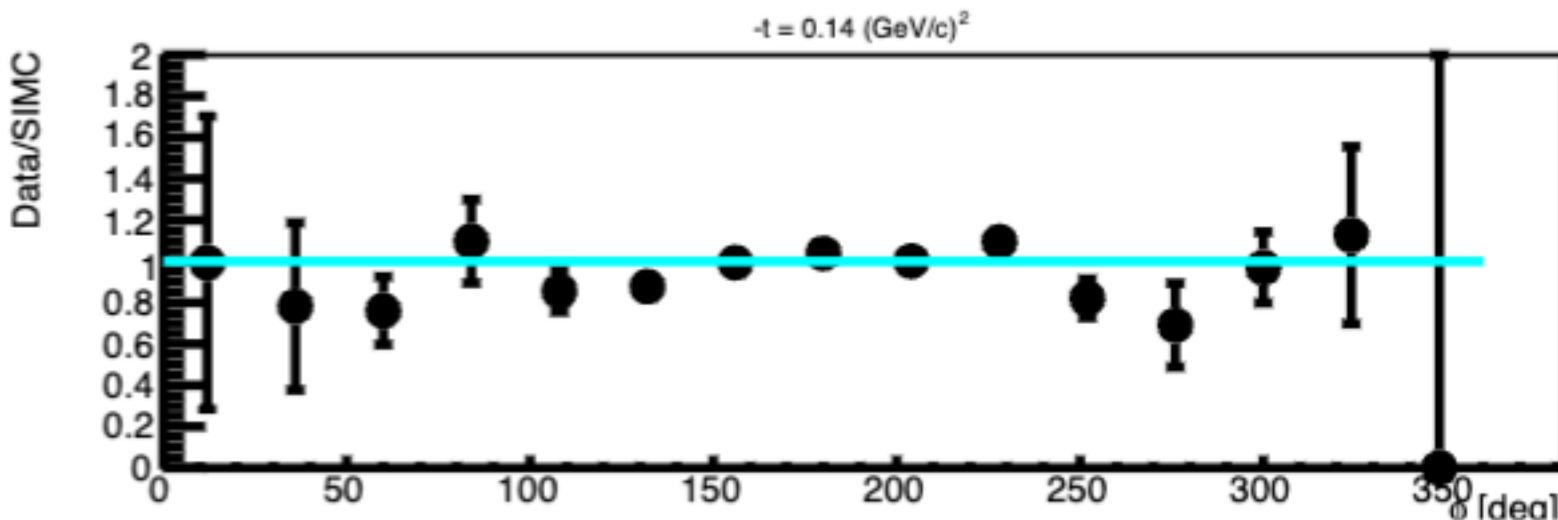
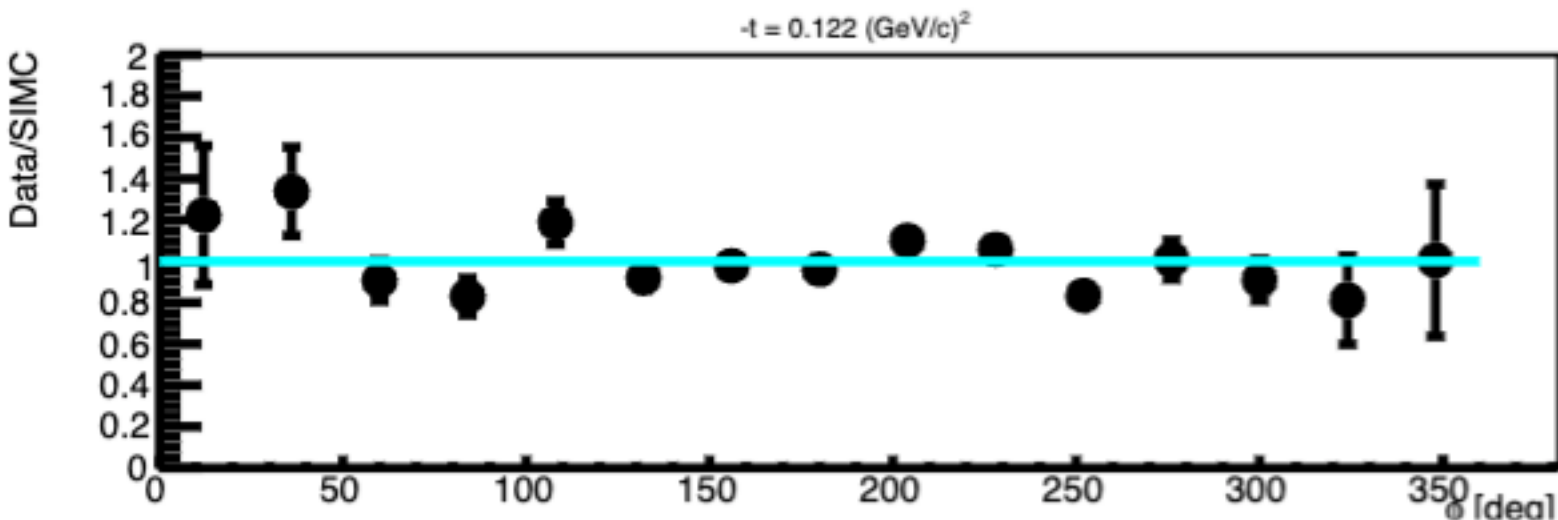
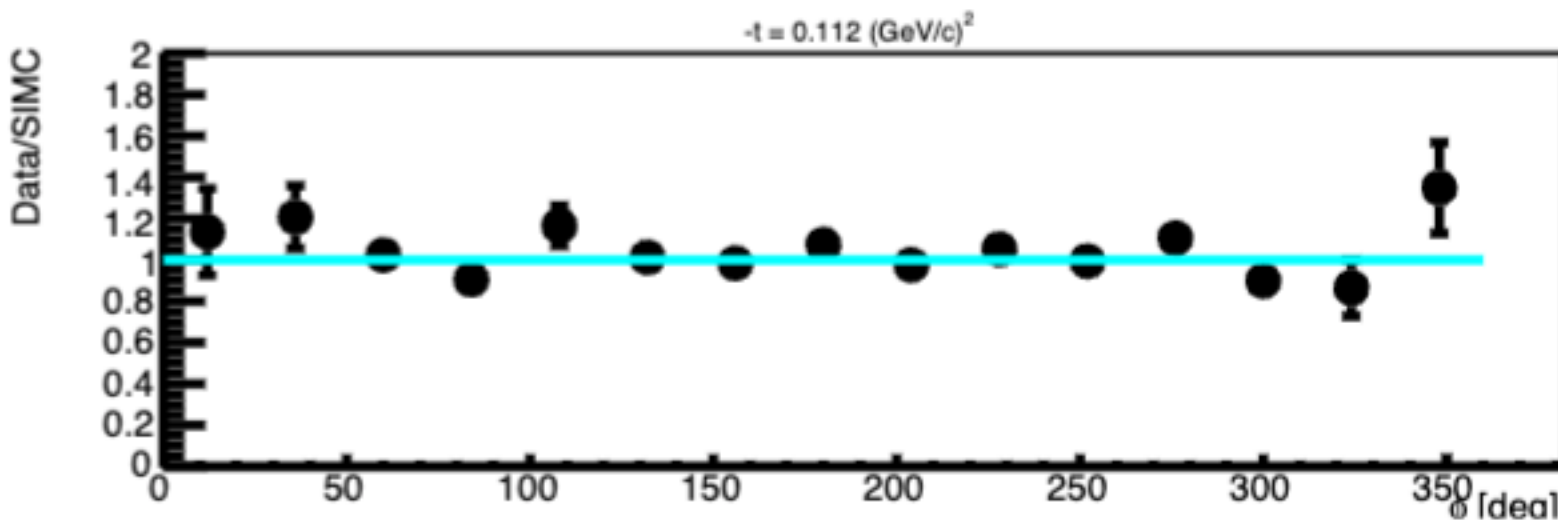
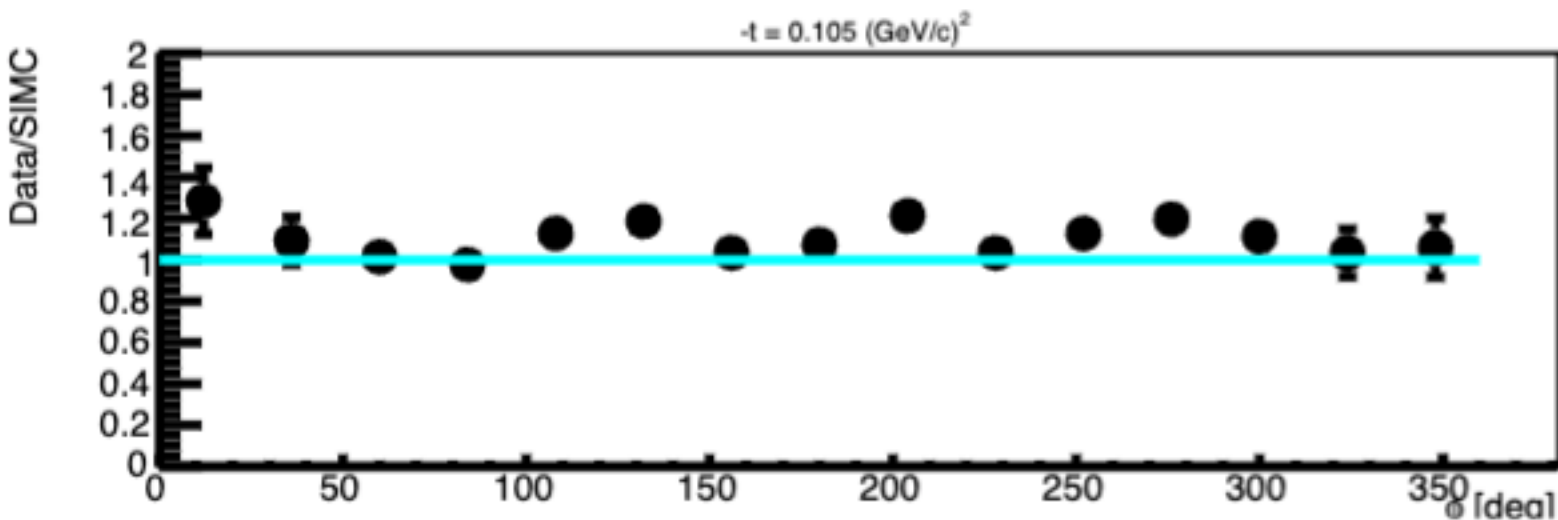
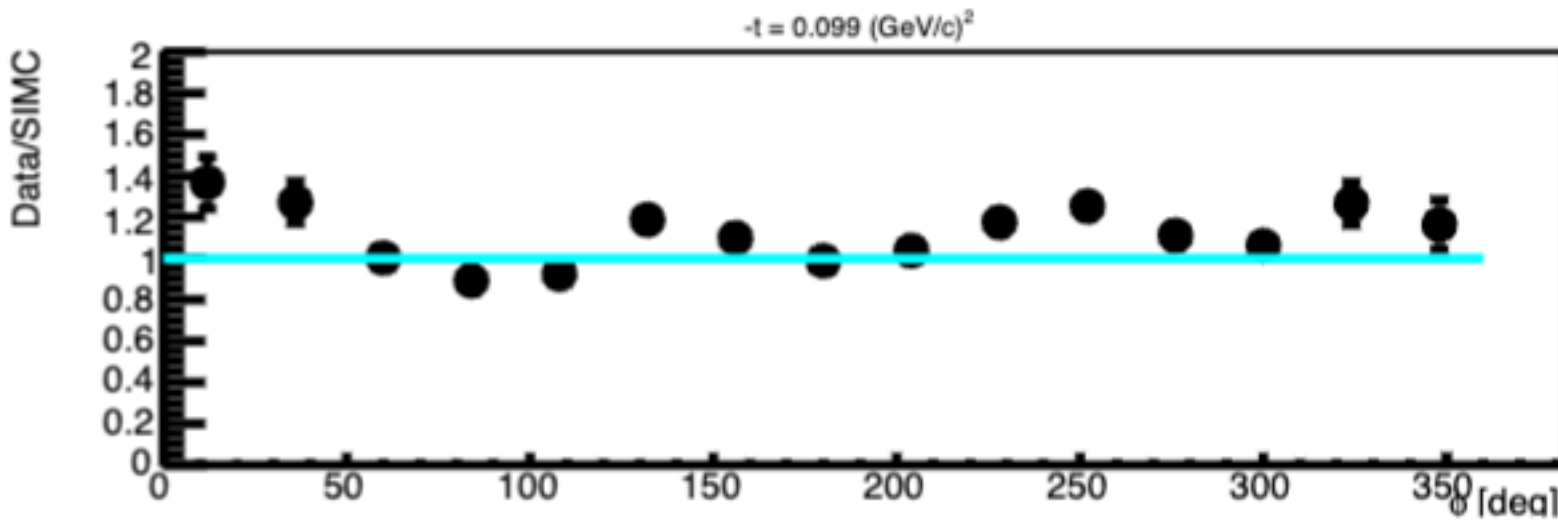
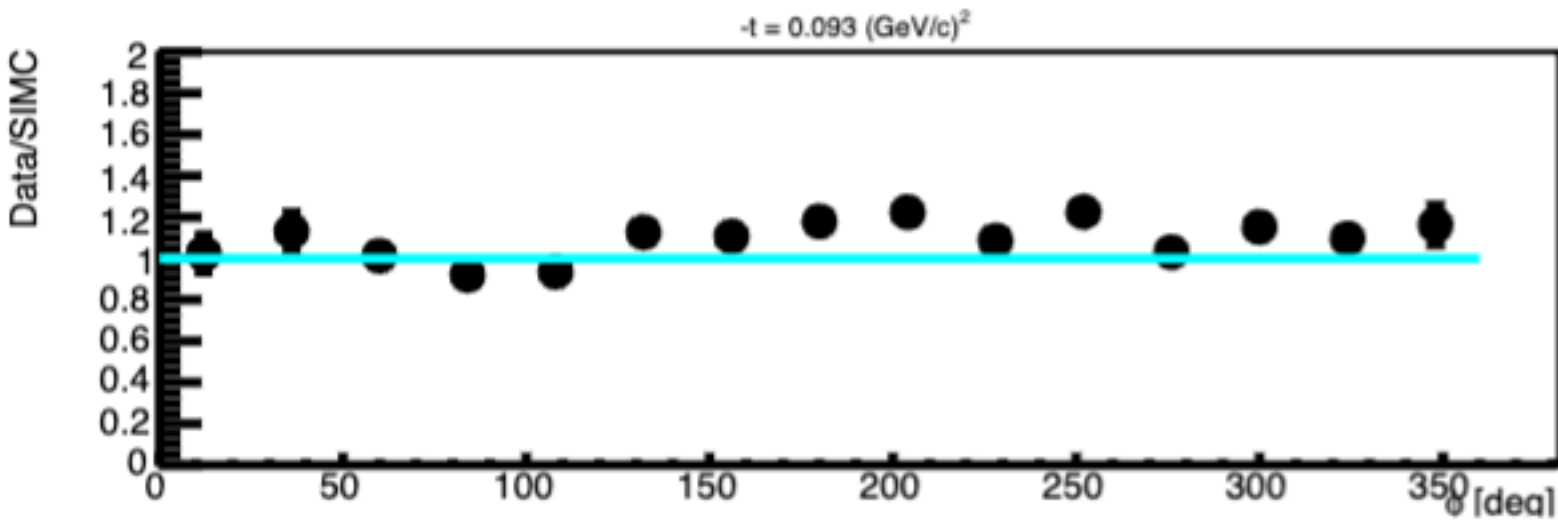
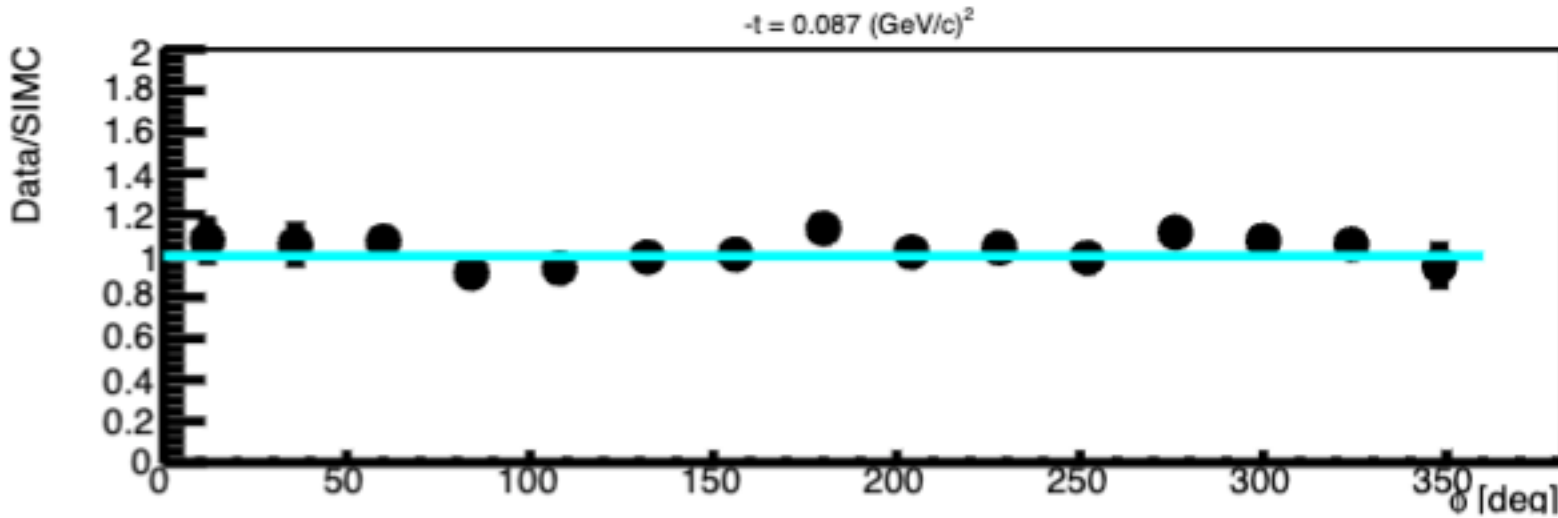
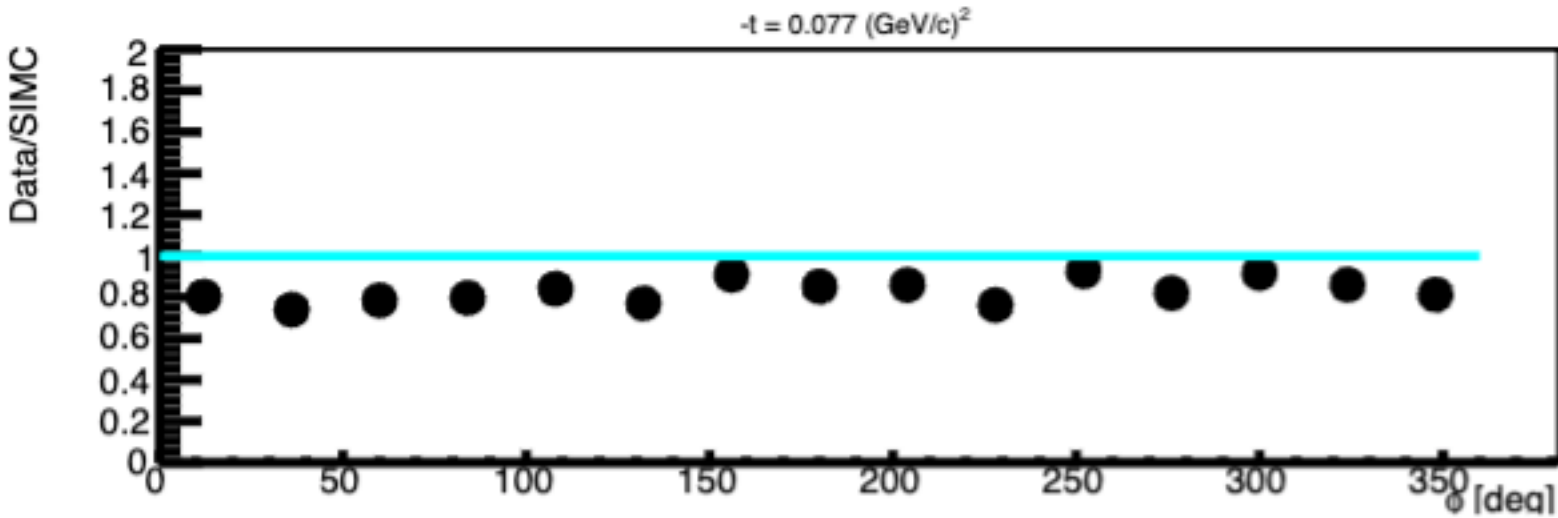
$$w_{factor} = \frac{1}{(W^2 - m_p^2)^2}$$

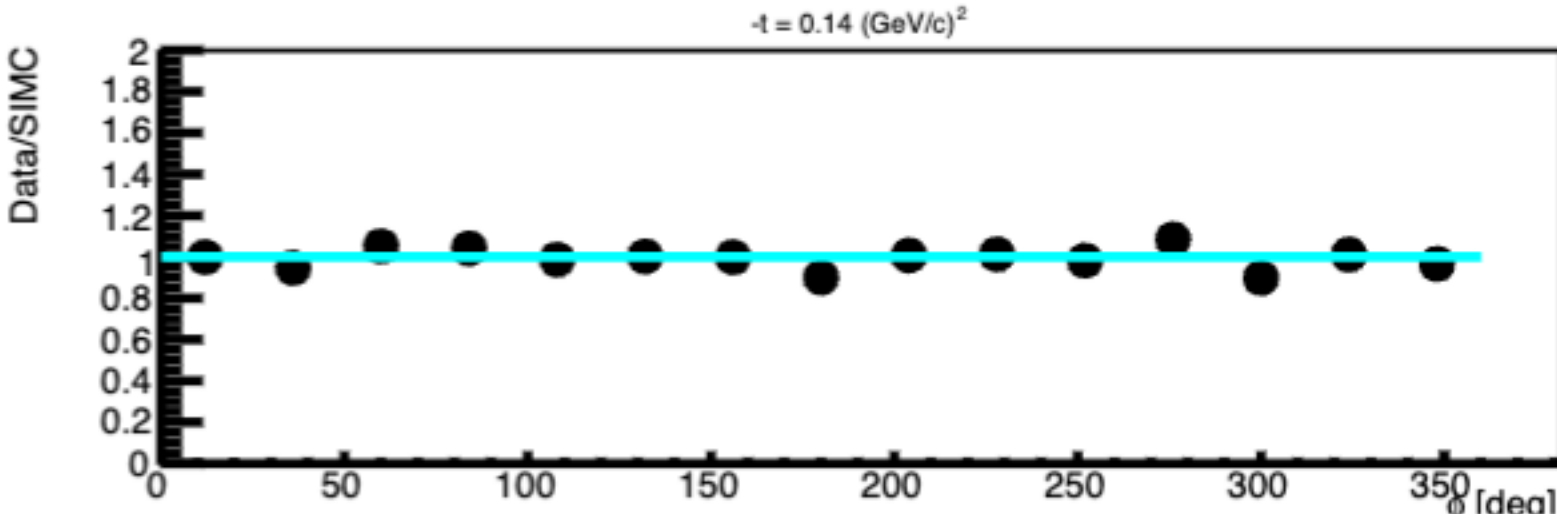
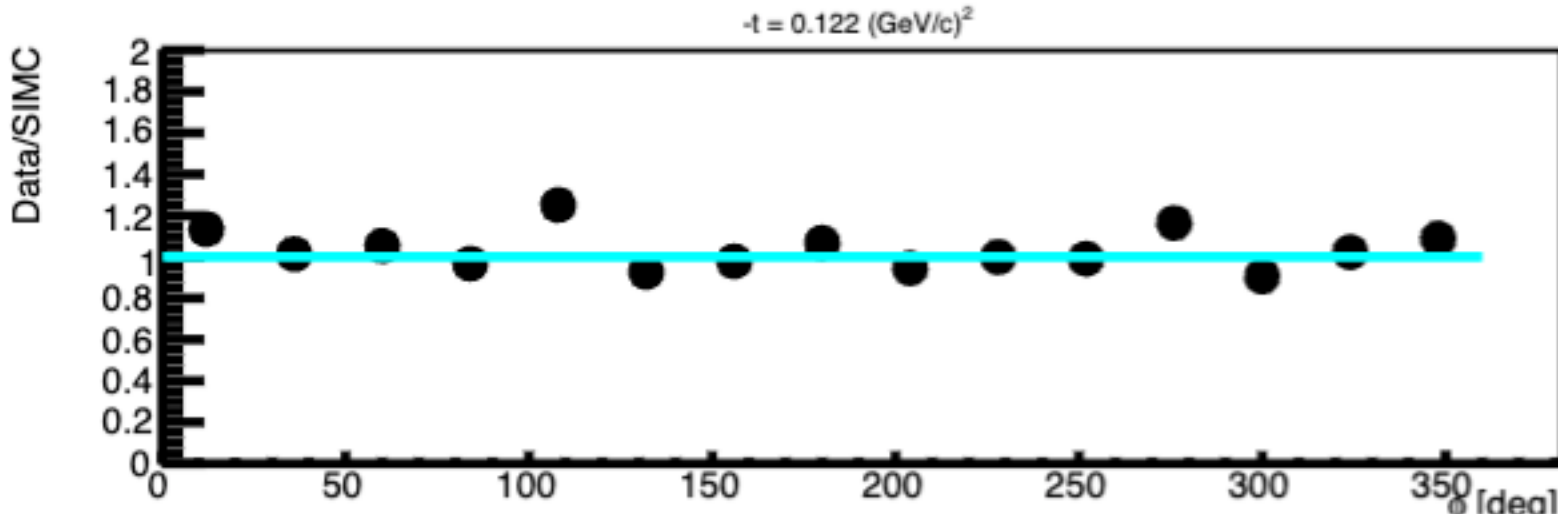
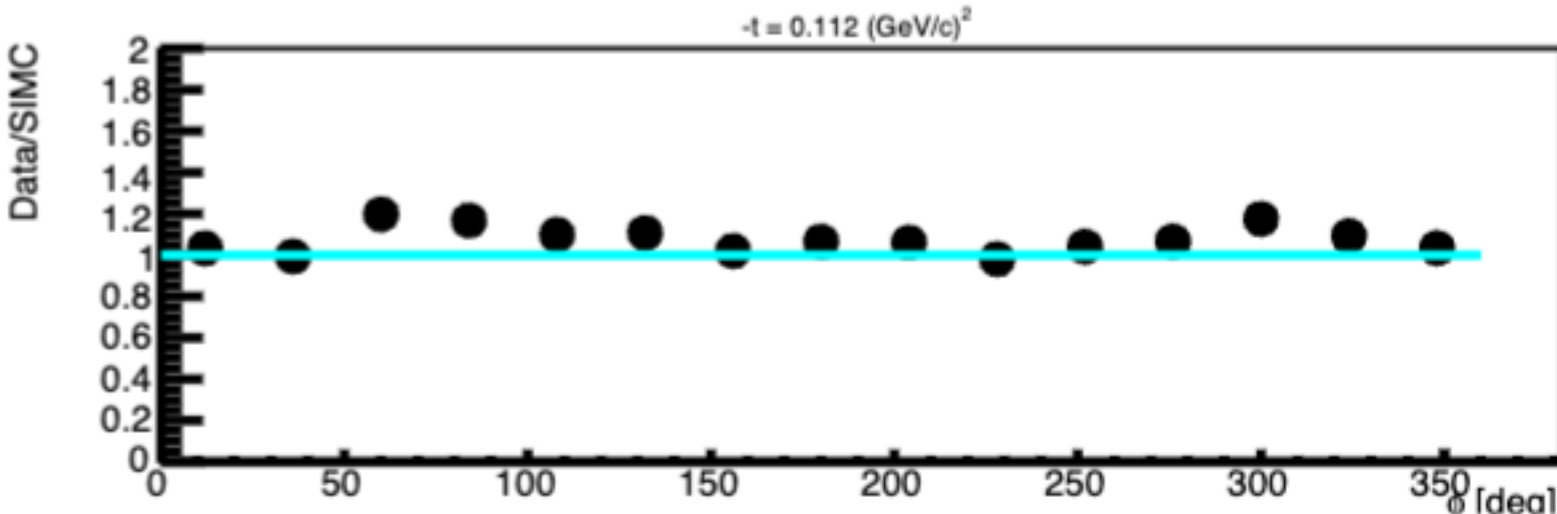
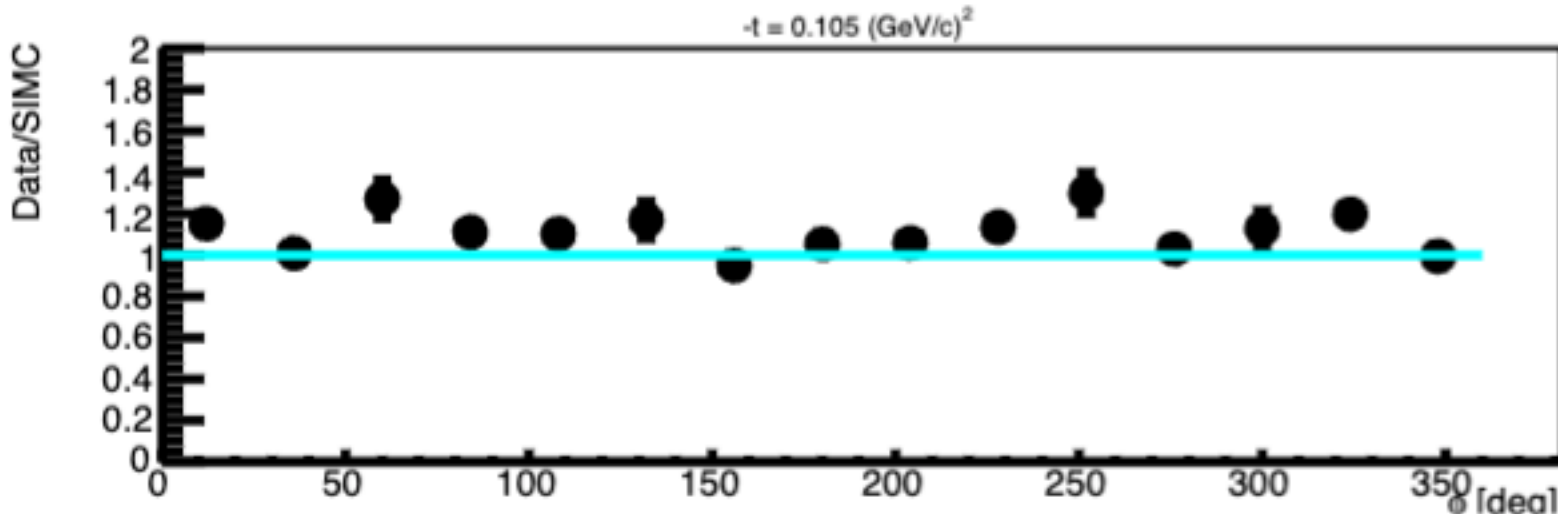
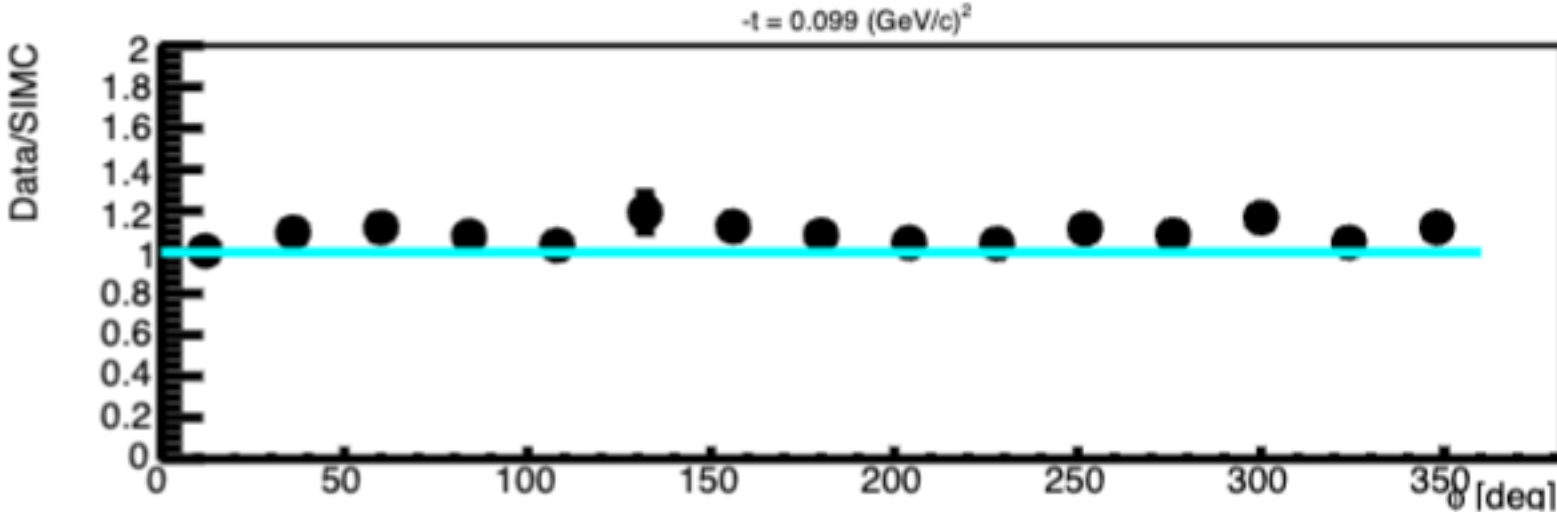
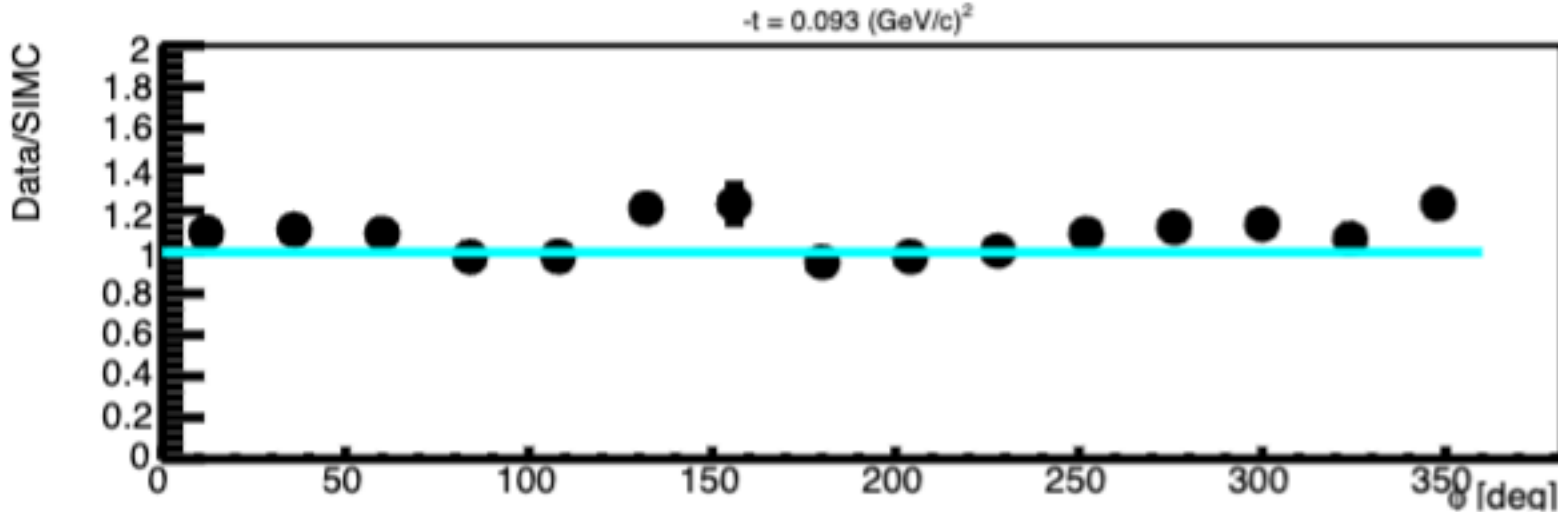
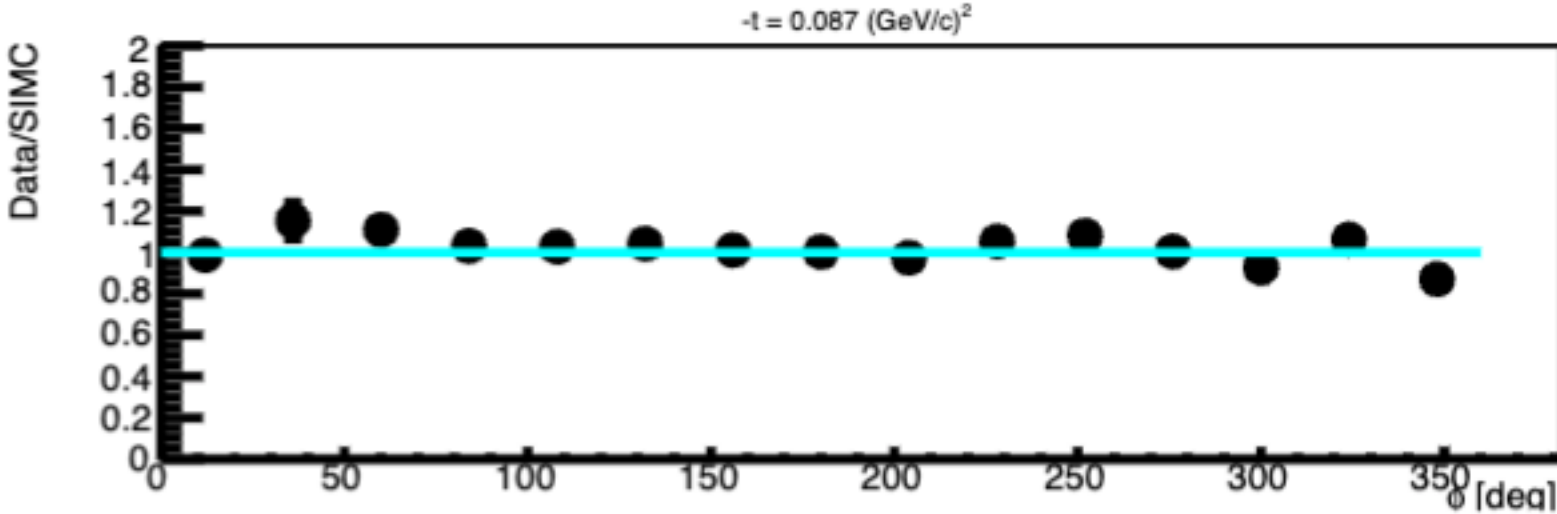
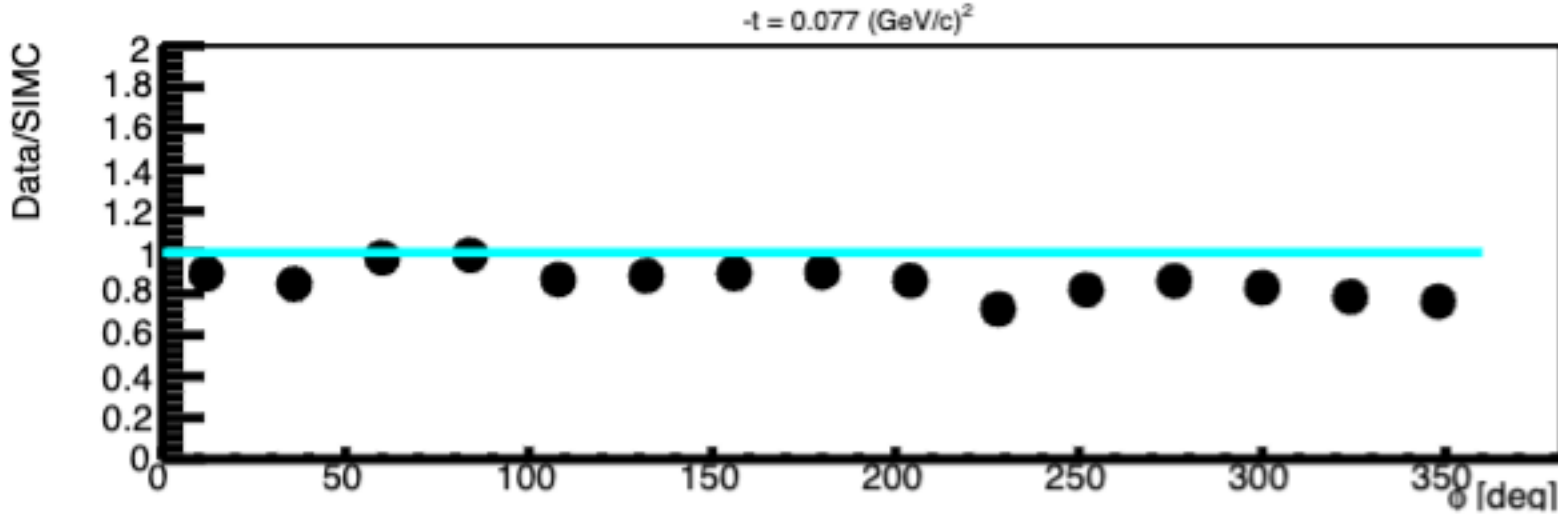
Negligible variation in the fit parameters

--- iteration 06 parameters ---			----- iteration 07 parameters ---		
31.899	4.085	1	31.900	4.085	1
4.058	1.194	2	4.058	1.194	2
74148.724	315268.524	3	73144.316	258859.858	3
-112.804	53.897	4	-112.640	44.555	4
-6.629	3.138	5	-6.648	3.148	5
-1.534	3.845	6	-1.508	3.847	6
-296.237	174.634	7	-297.208	175.105	7
10.506	4.785	8	10.530	4.782	8

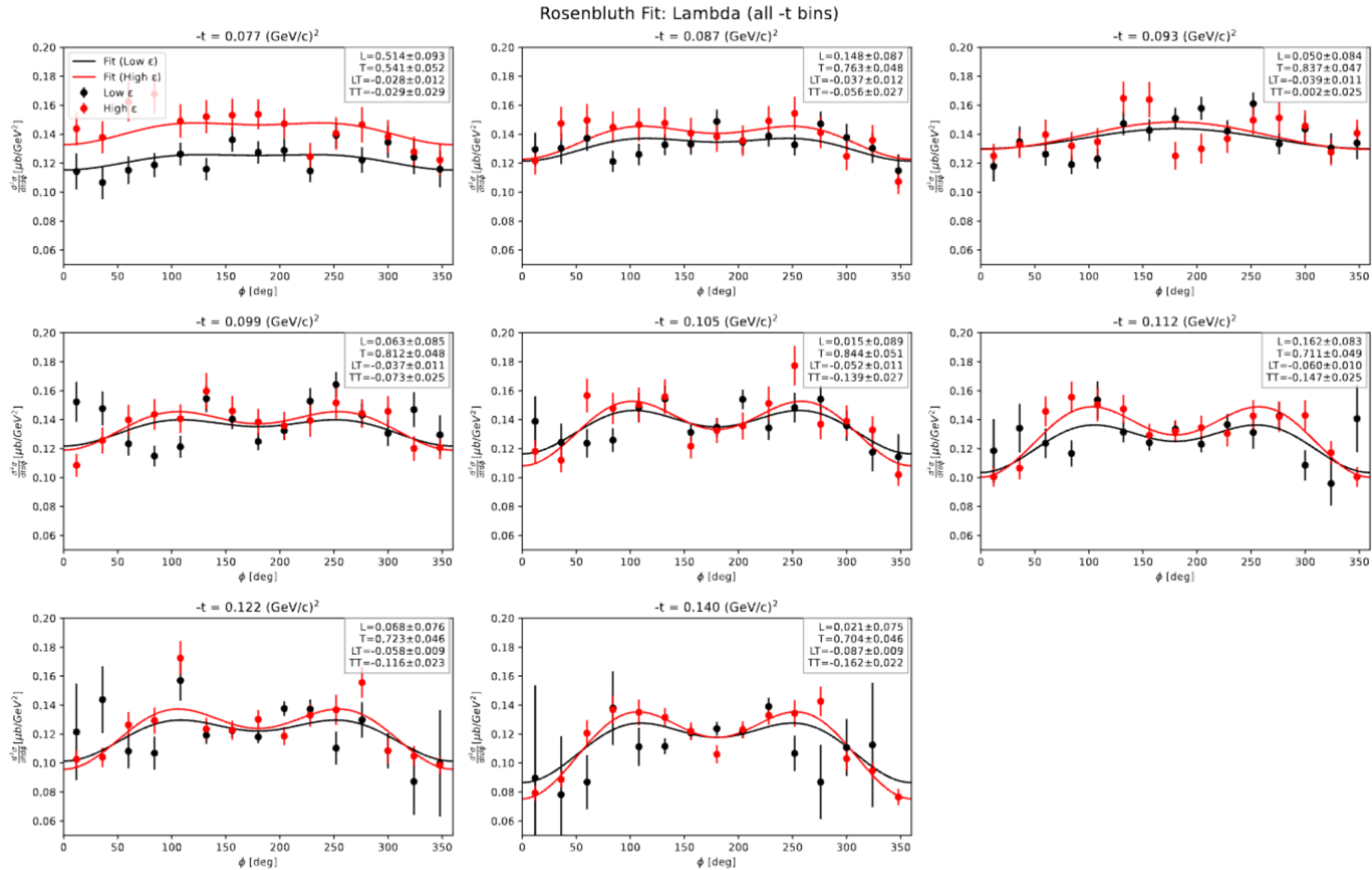
$$2\pi \frac{d^2\sigma}{dt d\phi} = \epsilon \frac{d\sigma_L}{dt} + \frac{d\sigma_T}{dt} + \sqrt{2\epsilon(\epsilon + 1)} \frac{d\sigma_{LT}}{dt} \cos\phi + \epsilon \frac{d\sigma_{TT}}{dt} \cos 2\phi$$

Iteration 06

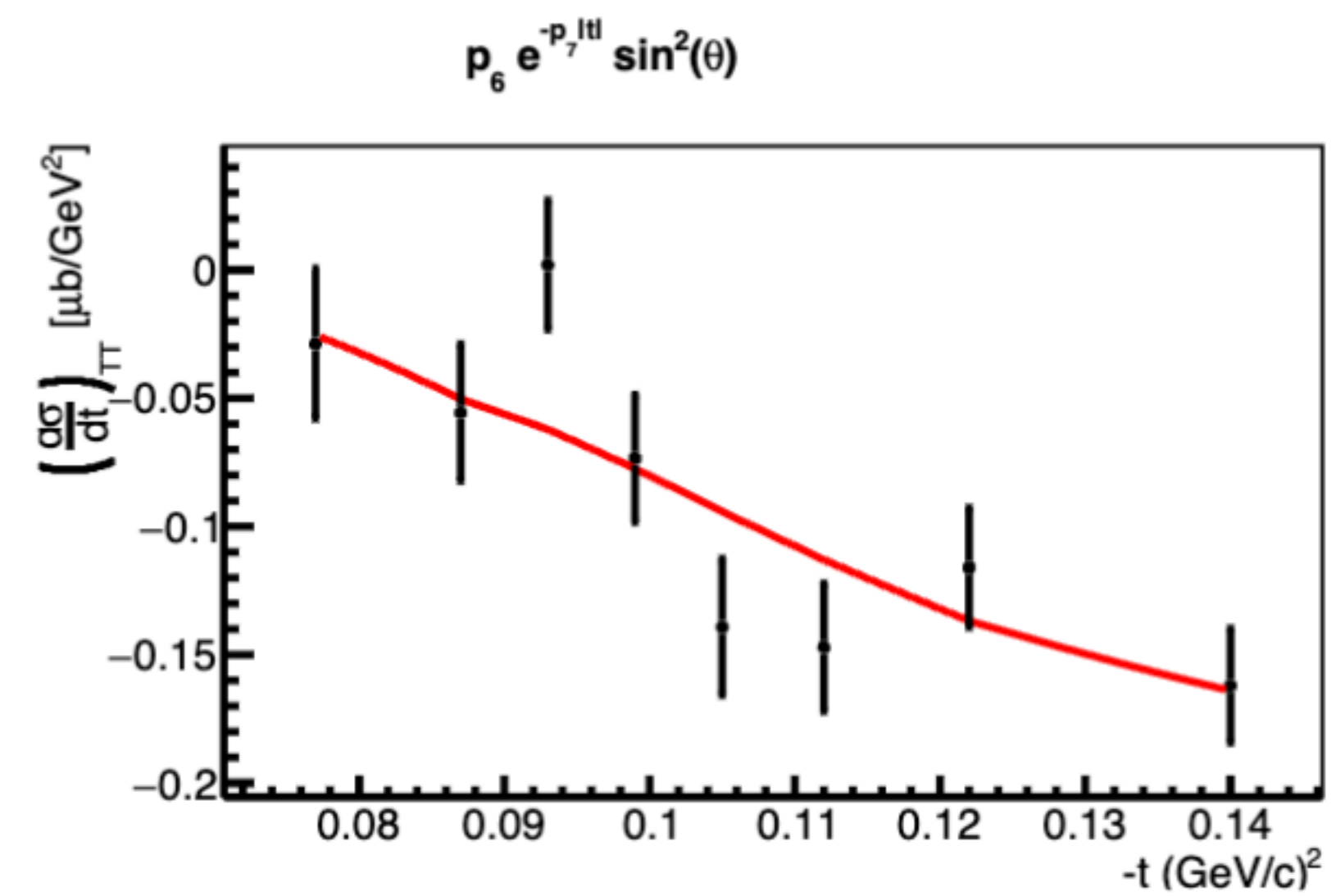
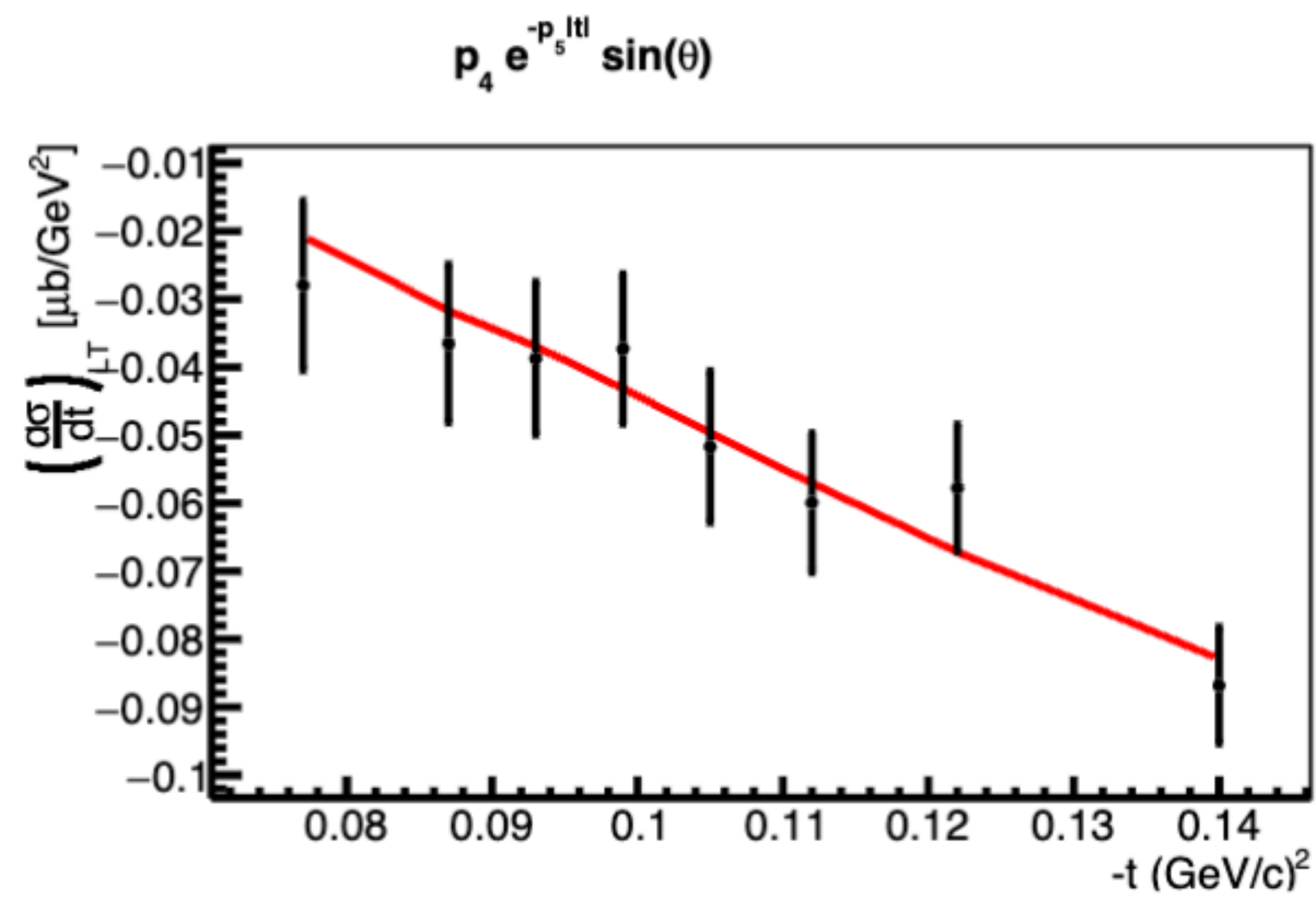
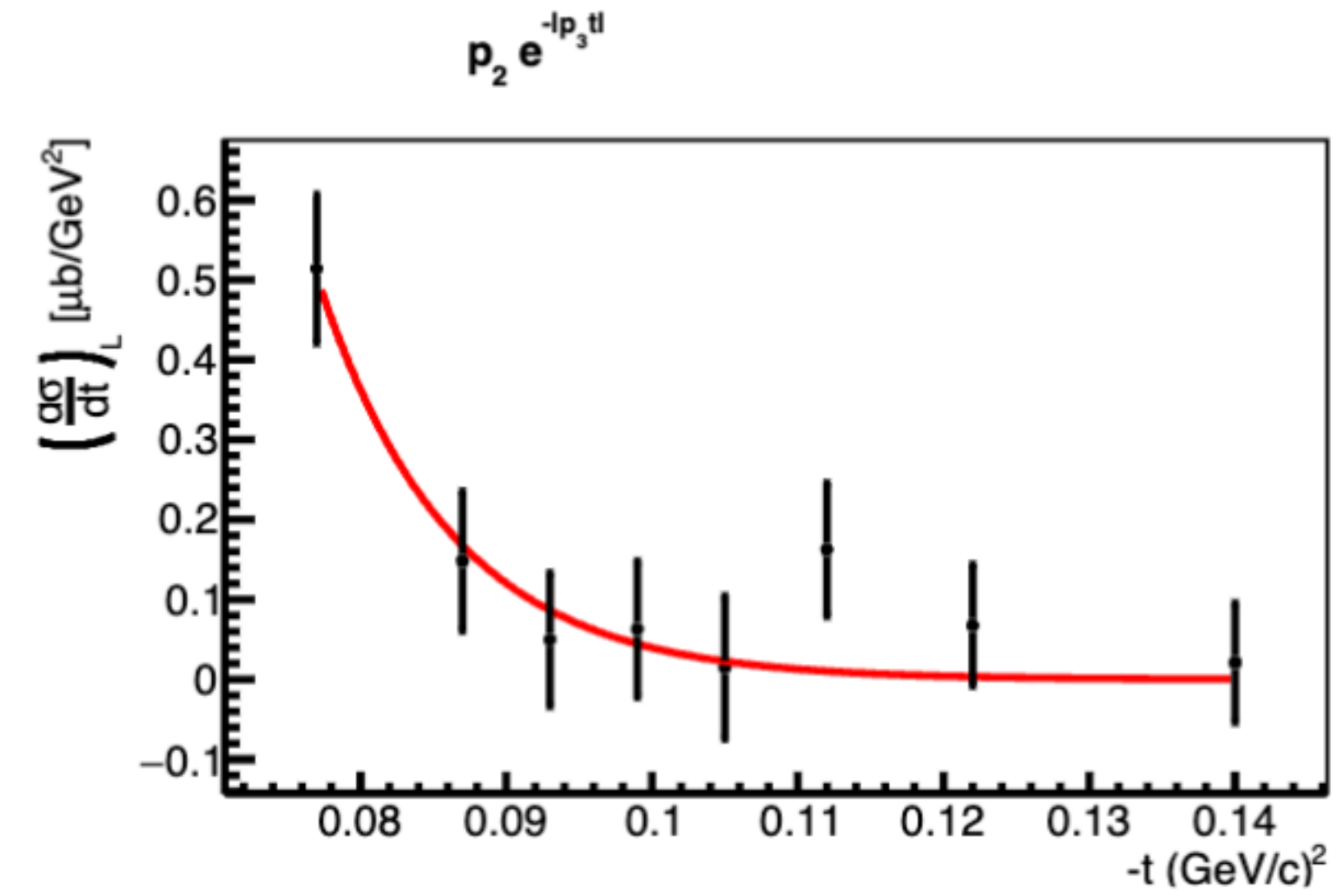
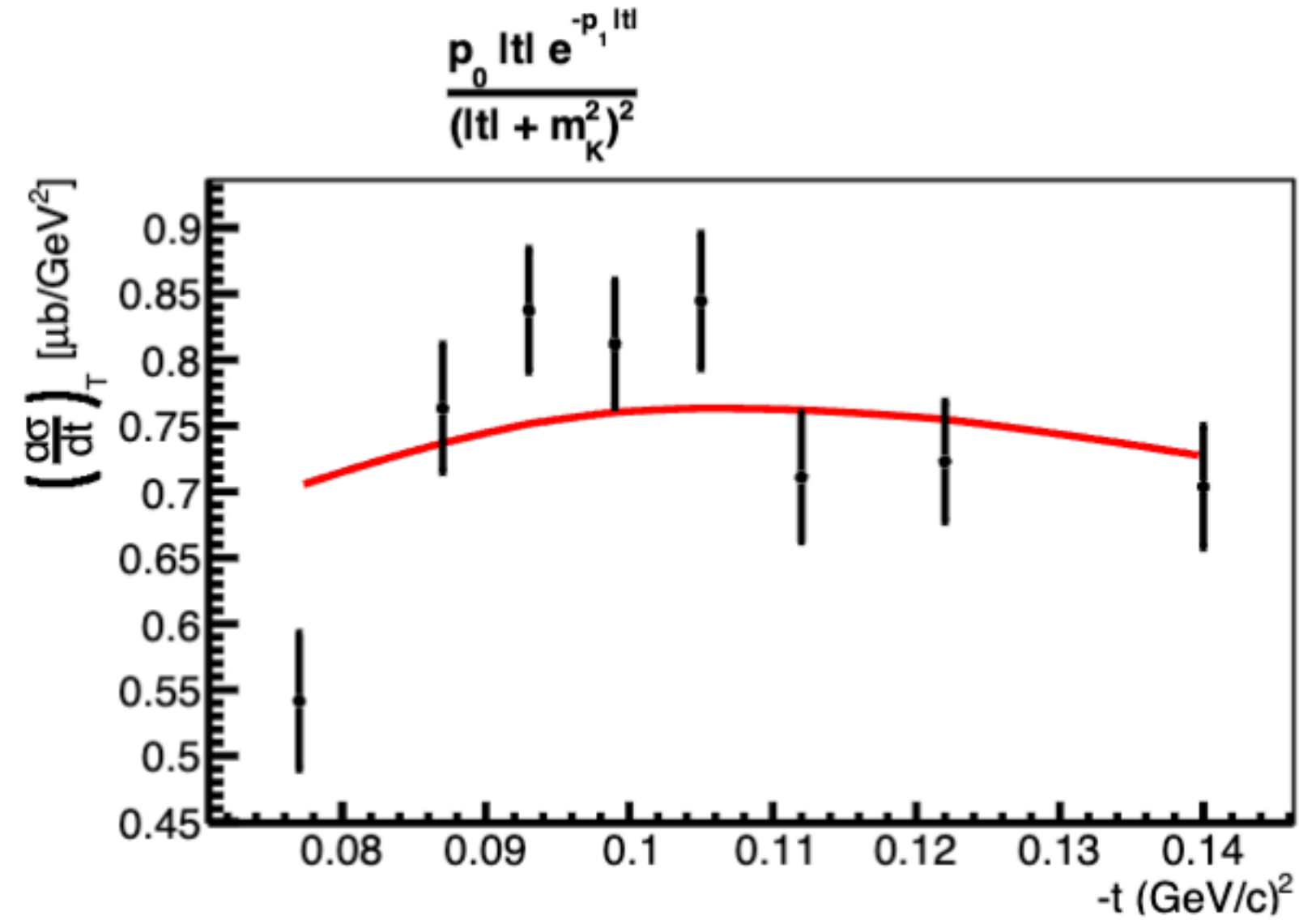




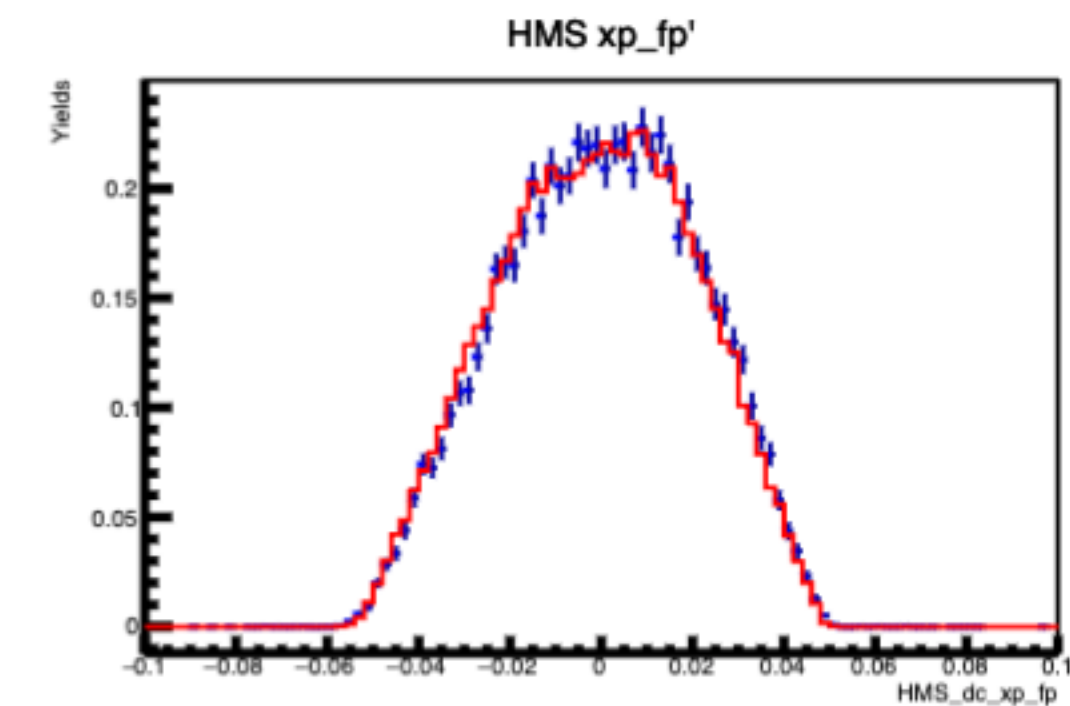
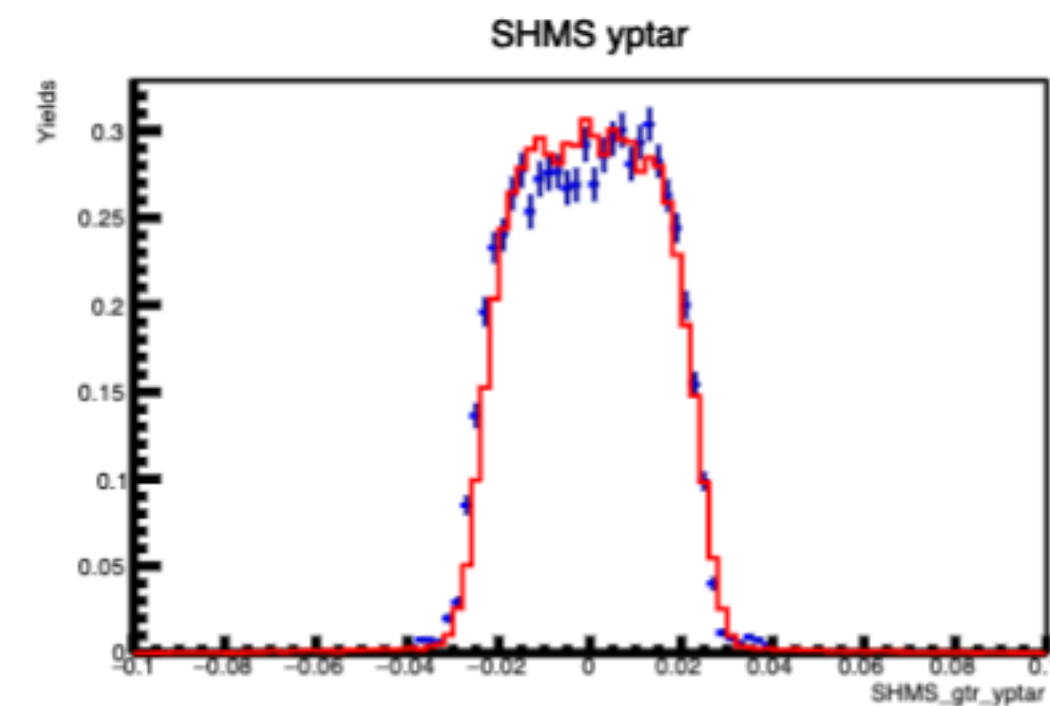
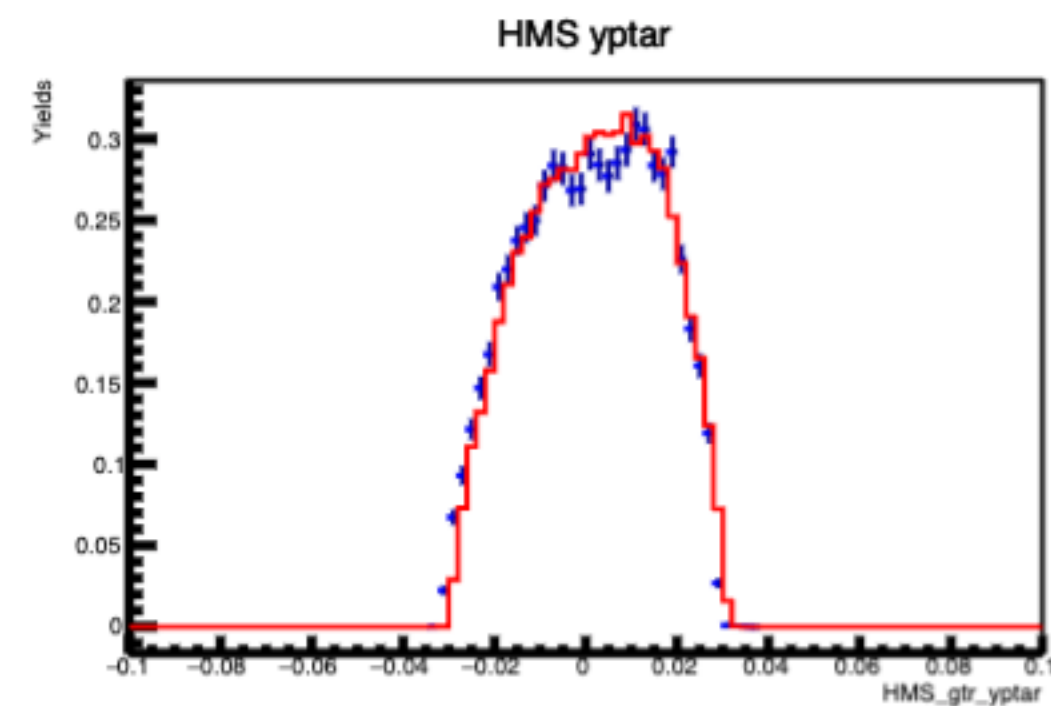
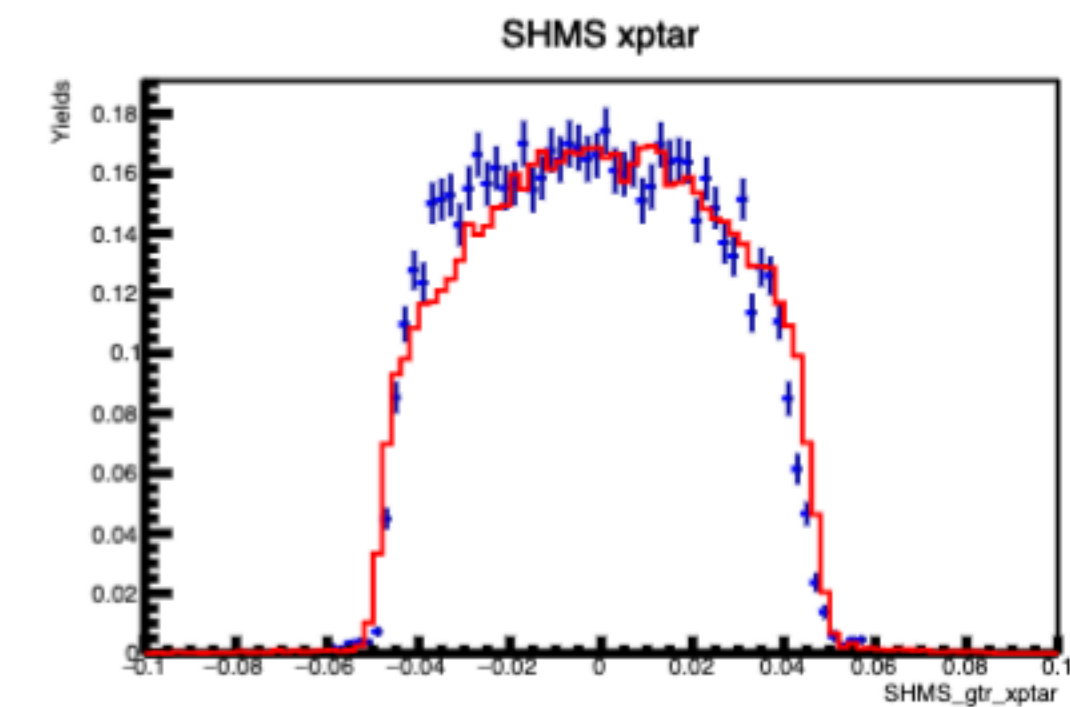
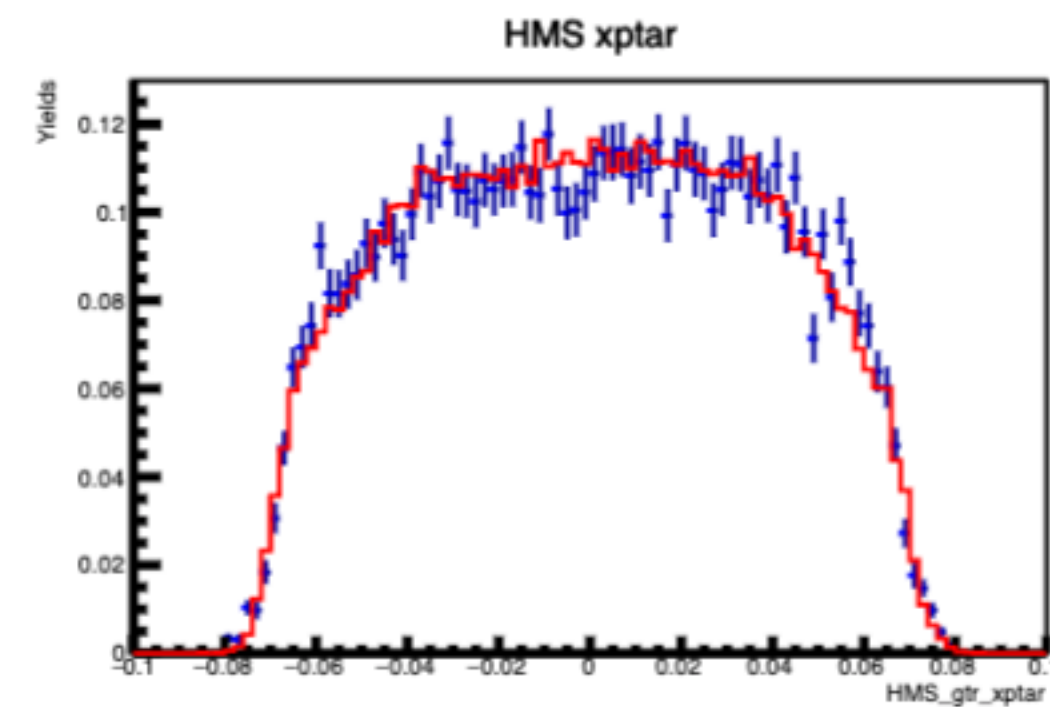
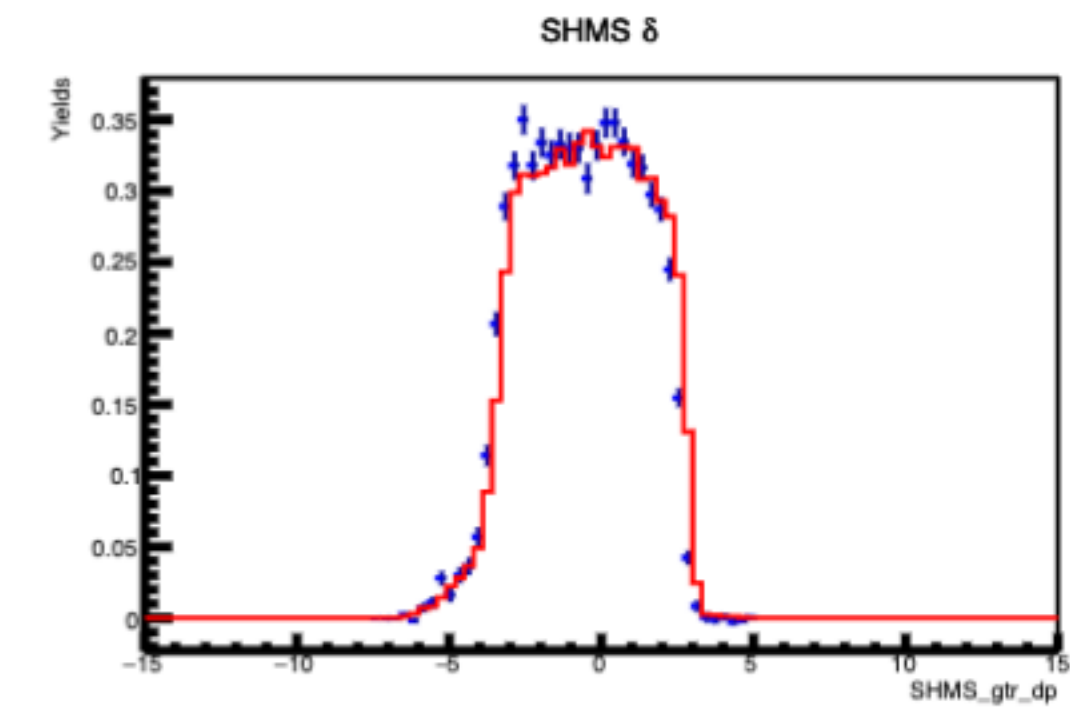
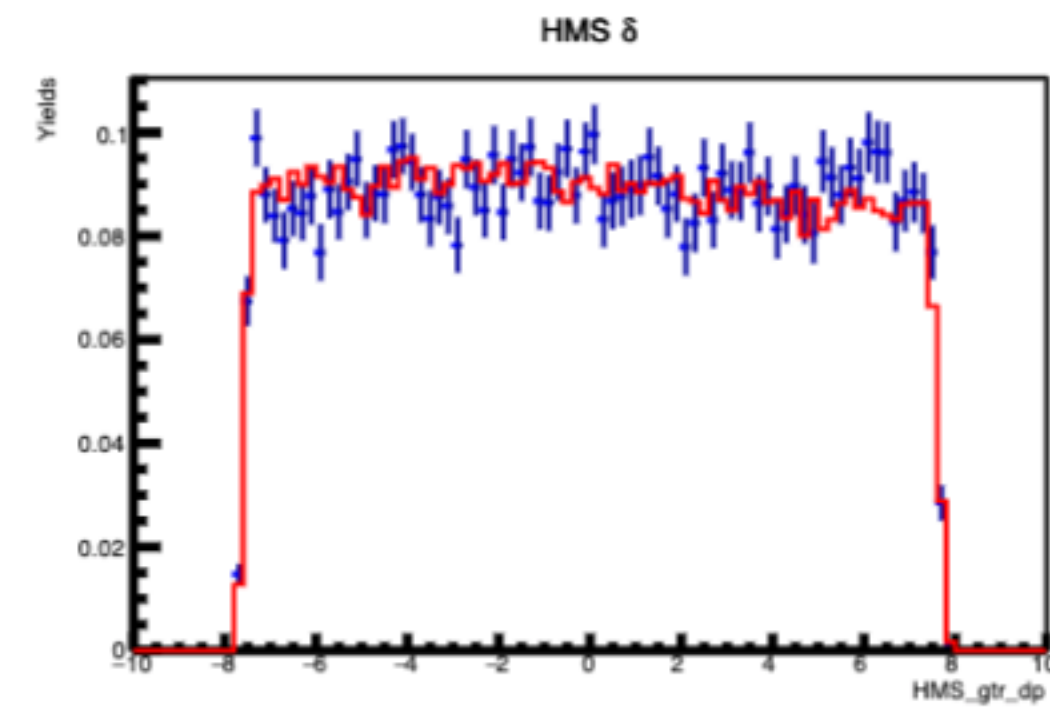
Low & High ϵ Simultaneous Fit (Rosenbluth)

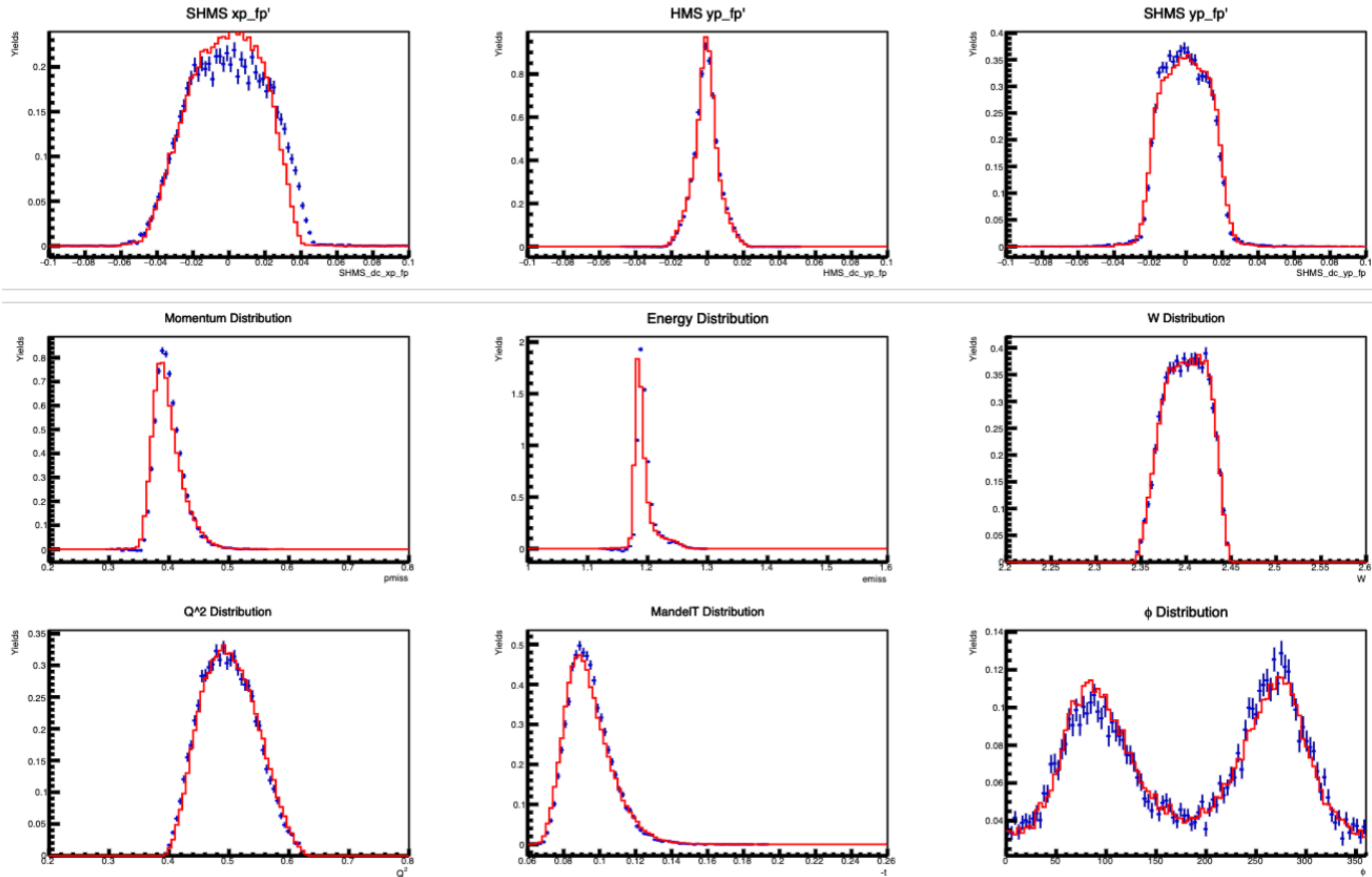


L, T, LT, TT Cross Sections



center_lowe
 $\Lambda^0(1116)$
 Beam Energy = 3.834 GeV
 $Q^2 = 0.499 \text{ GeV}^2$
 $P_{\text{HMS}} = 0.968 \text{ GeV}/c$
 $\theta_{\text{HMS}} = 21.140^\circ$
 $P_{\text{SHMS}} = 2.583 \text{ GeV}/c$
 $\theta_{\text{SHMS}} = 6.790^\circ$
 Red = SIMC
 Blue = DATA





center_highe
 $\Lambda^0(1116)$
 Beam Energy = 3.834 GeV
 $Q^2 = 0.501 \text{ GeV}^2$
 $P_{\text{HMS}} = 0.968 \text{ GeV/c}$
 $\theta_{\text{HMS}} = 21.140^\circ$
 $P_{\text{SHMS}} = 2.583 \text{ GeV/c}$
 $\theta_{\text{SHMS}} = 6.790^\circ$
 Red = SIMC
 Blue = DATA

