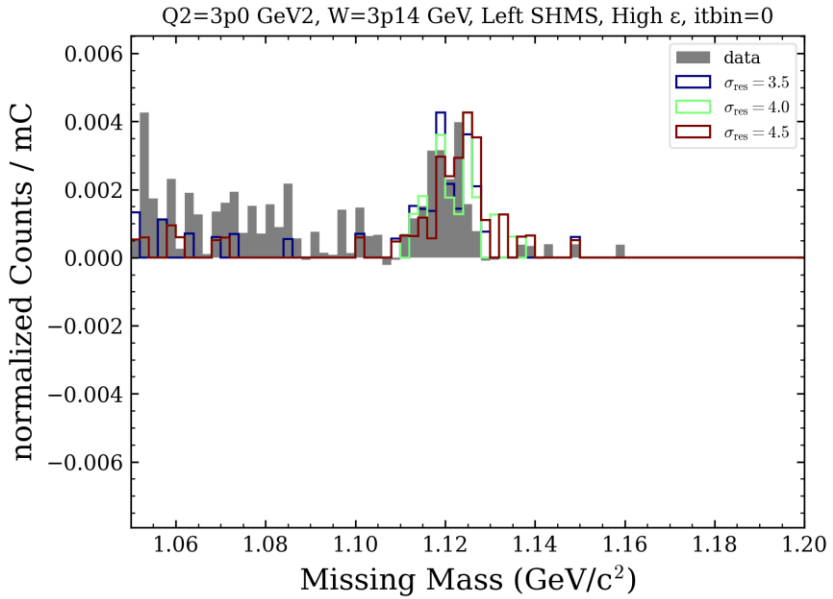
HMS :

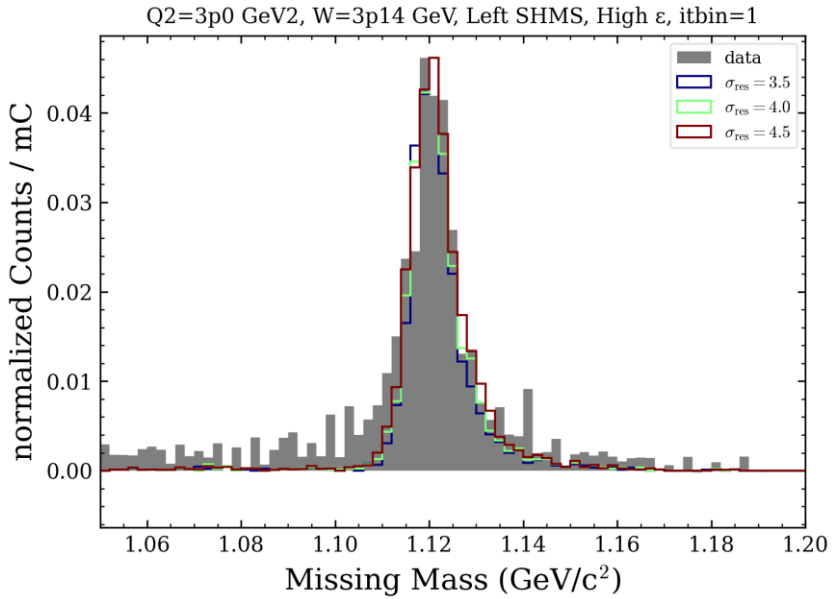
```
;h_recon_coeff_filename =   'DATFILES/hms_recon_coeff.dat'  ;hms optics matrix
h_recon_coeff_filename =   'DATFILES/hms_recon_coeff_opt2018.dat'  ;hms optics matrix
;h_recon_coeff_filename =   'DATFILES/hms_newfit_poltar.dat'  ; new fit hms optics matrix
;h_recon_coeff_filename =   'DATFILES/hms_newfit_6_59.dat'  ; Jacob's new fit hms optics
matrix (high momentum)
```

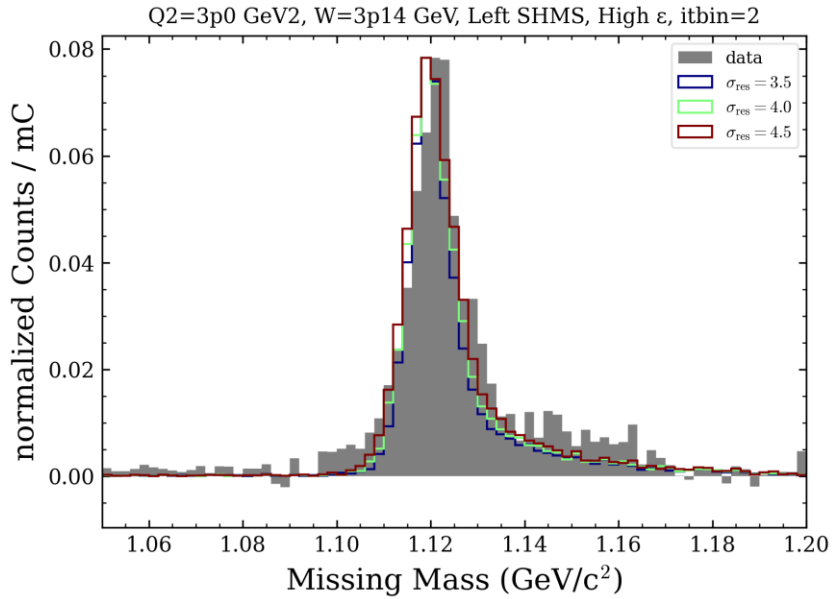
SHMS:

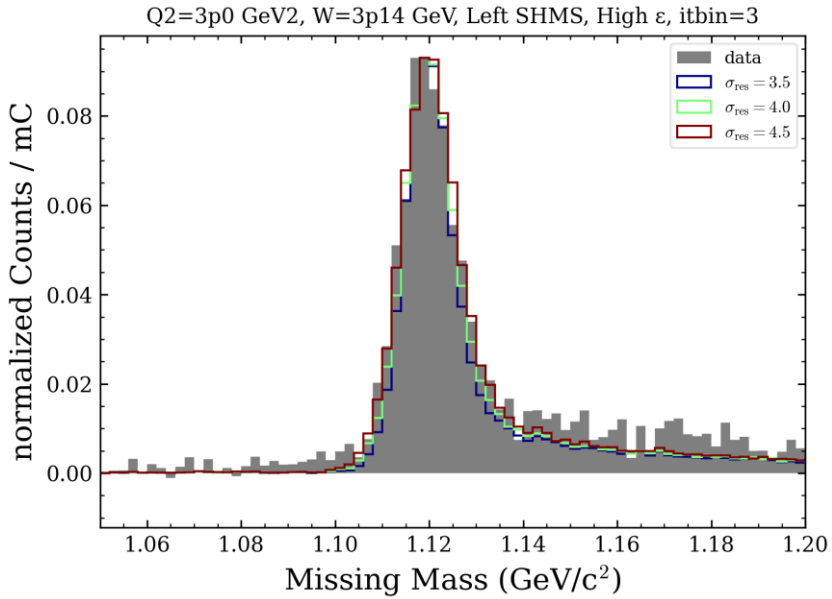
```
; SHMS Optics April 2020 (suggested by M. Jones for PION-LT 2021)
p_recon_coeff_filename = "DATFILES/shms_newfit_xptar_april2020.dat"
```

Left High e

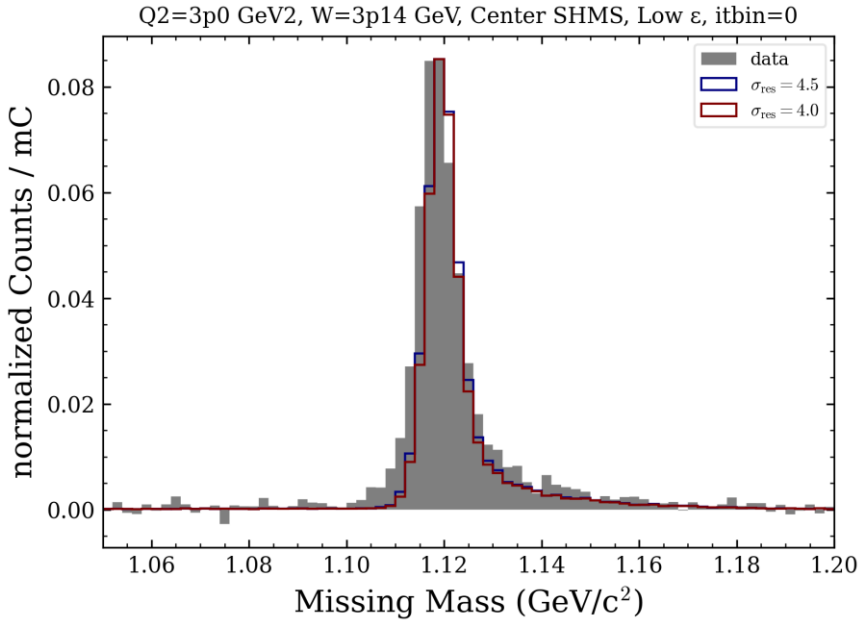

Q2=3p0 GeV2, W=3p14 GeV, Left SHMS, High ε, itbin=0
data
$\sigma_{res} = 3.5$
$\sigma_{res} = 4.0$
$\sigma_{res} = 4.5$
normalized Counts / mC
Missing Mass (GeV/c^2)

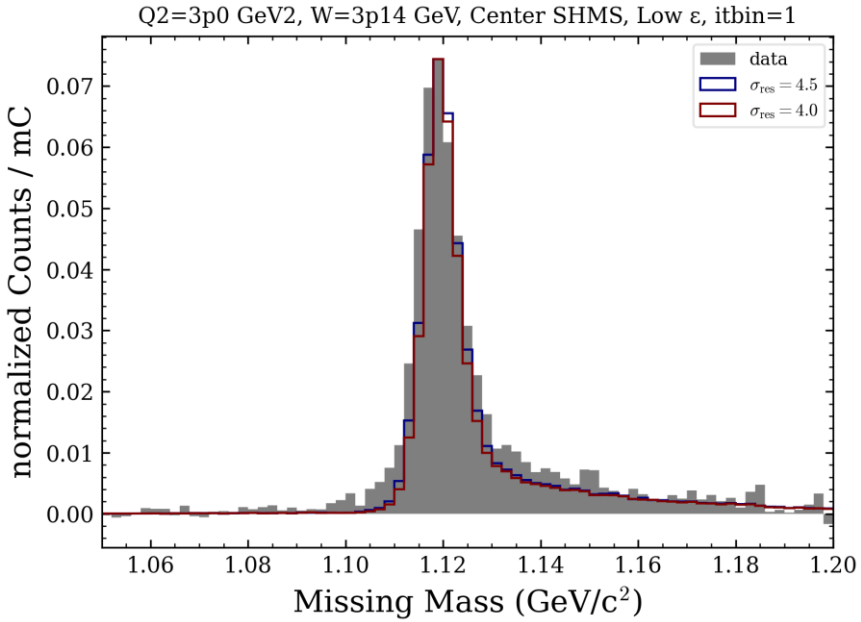

Q2=3p0 GeV2, W=3p14 GeV, Left SHMS, High ε, itbin=1
data
$\sigma_{res} = 3.5$
$\sigma_{res} = 4.0$
$\sigma_{res} = 4.5$
normalized Counts / mC
Missing Mass (GeV/c^2)

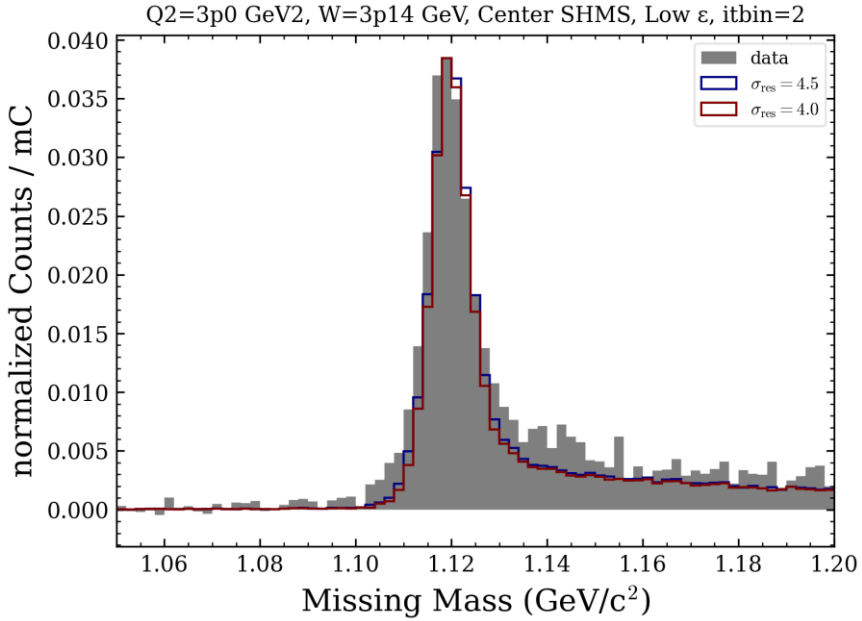

Q2=3p0 GeV2, W=3p14 GeV, Left SHMS, High ε, itbin=2
data
$\sigma_{res} = 3.5$
$\sigma_{res} = 4.0$
$\sigma_{res} = 4.5$
normalized Counts / mC
Missing Mass (GeV/c^2)

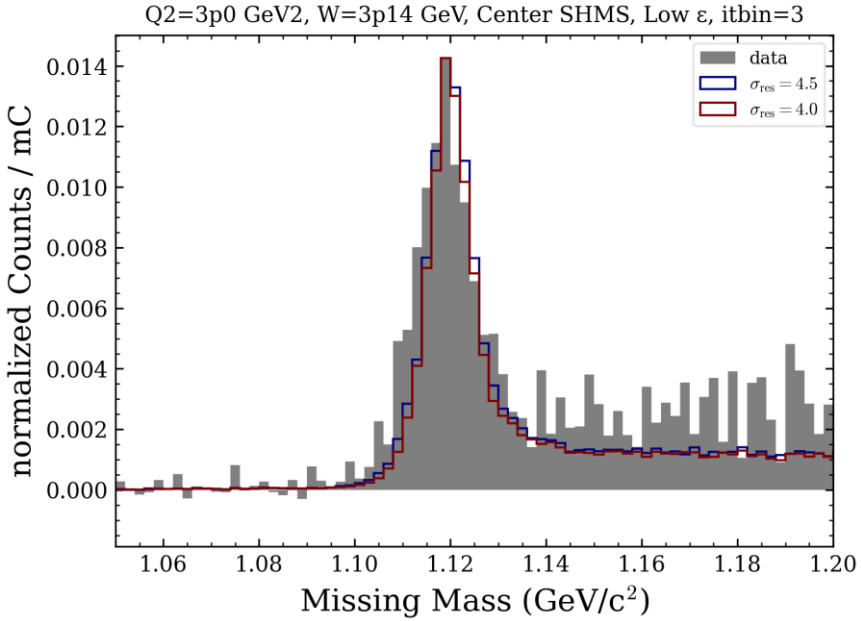

Q2=3p0 GeV2, W=3p14 GeV, Left SHMS, High ε, itbin=3
data
$\sigma_{res} = 3.5$
$\sigma_{res} = 4.0$
$\sigma_{res} = 4.5$
normalized Counts / mC
Missing Mass (GeV/c^2)

Center Low e

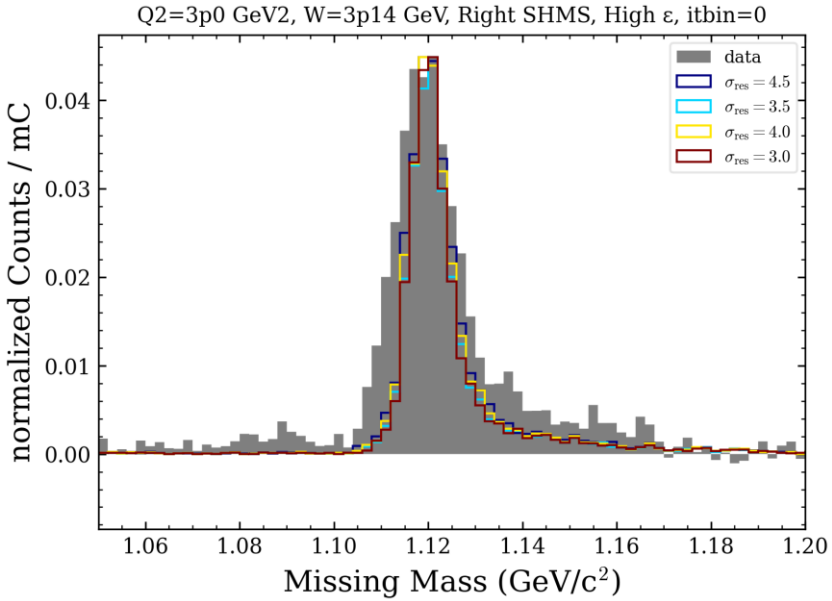

Q2=3p0 GeV2, W=3p14 GeV, Center SHMS, Low ε, itbin=0
data
$\sigma_{res} = 4.5$
$\sigma_{res} = 4.0$
normalized Counts / mC
Missing Mass (GeV/c^2)

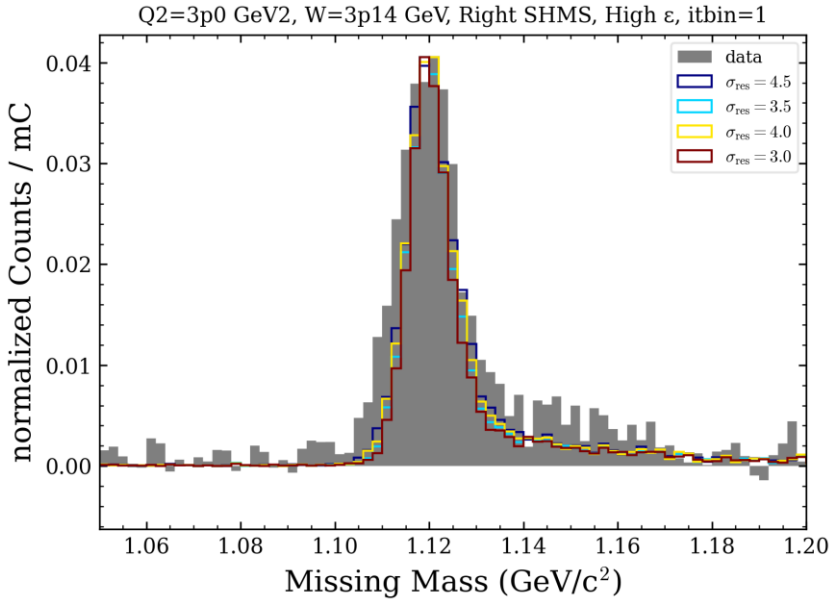

Q2=3p0 GeV2, W=3p14 GeV, Center SHMS, Low ε, itbin=1
data
$\sigma_{res} = 4.5$
$\sigma_{res} = 4.0$
normalized Counts / mC
Missing Mass (GeV/c^2)

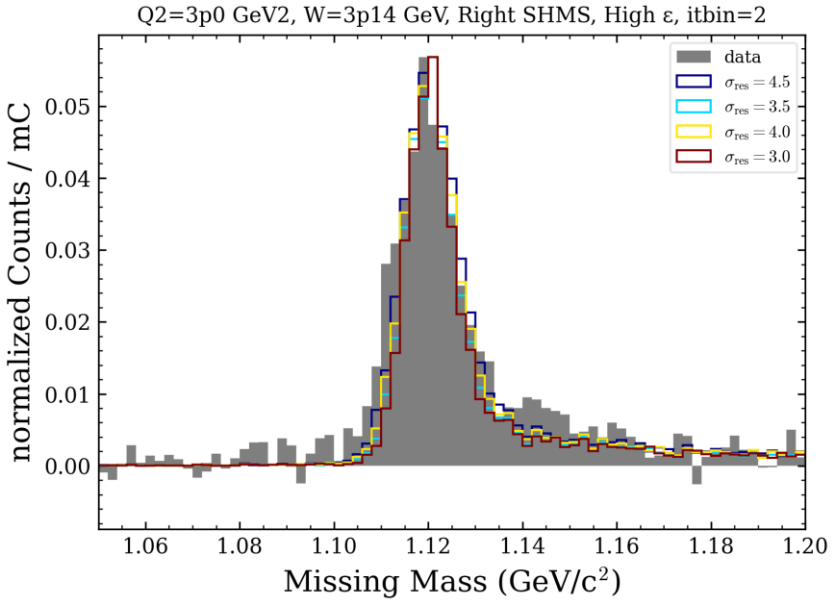

Q2=3p0 GeV2, W=3p14 GeV, Center SHMS, Low ε, itbin=2
data
$\sigma_{res} = 4.5$
$\sigma_{res} = 4.0$
normalized Counts / mC
Missing Mass (GeV/c^2)

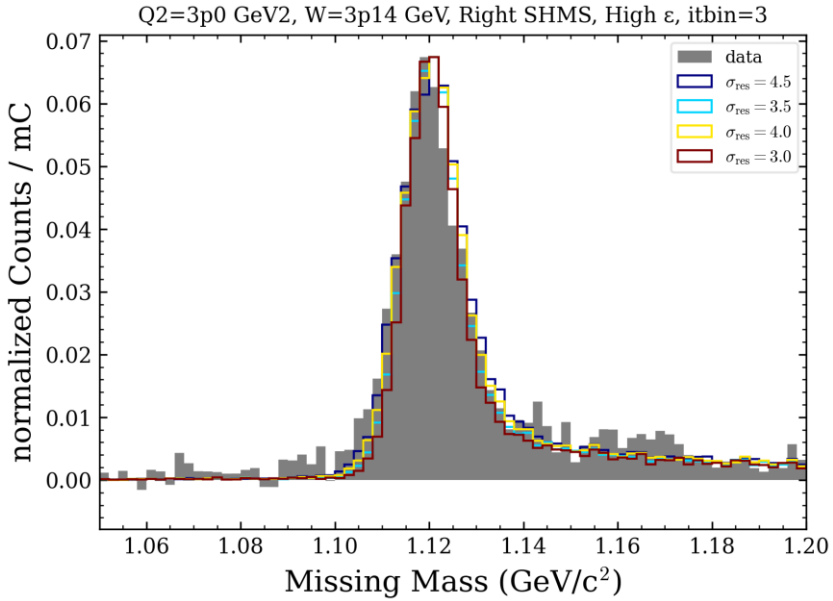

Q2=3p0 GeV2, W=3p14 GeV, Center SHMS, Low ε, itbin=3
data
$\sigma_{res} = 4.5$
$\sigma_{res} = 4.0$
normalized Counts / mC
Missing Mass (GeV/c^2)

Right high e


Q2=3p0 GeV2, W=3p14 GeV, Right SHMS, High ε, itbin=0
data
$\sigma_{res} = 4.5$
$\sigma_{res} = 3.5$
$\sigma_{res} = 4.0$
$\sigma_{res} = 3.0$
normalized Counts / mC
Missing Mass (GeV/c^2)

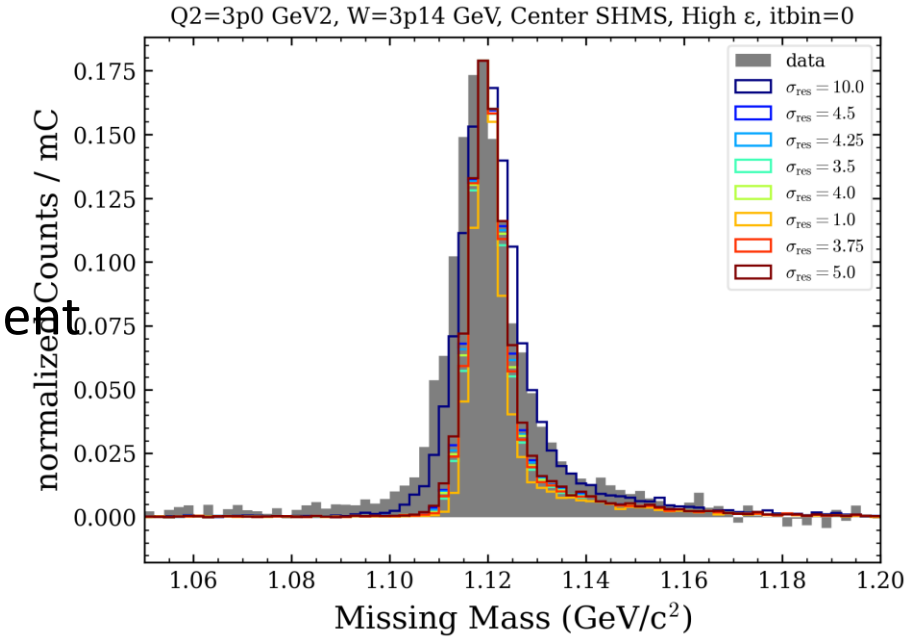

Q2=3p0 GeV2, W=3p14 GeV, Right SHMS, High ε, itbin=1
data
$\sigma_{res} = 4.5$
$\sigma_{res} = 3.5$
$\sigma_{res} = 4.0$
$\sigma_{res} = 3.0$
normalized Counts / mC
Missing Mass (GeV/c^2)

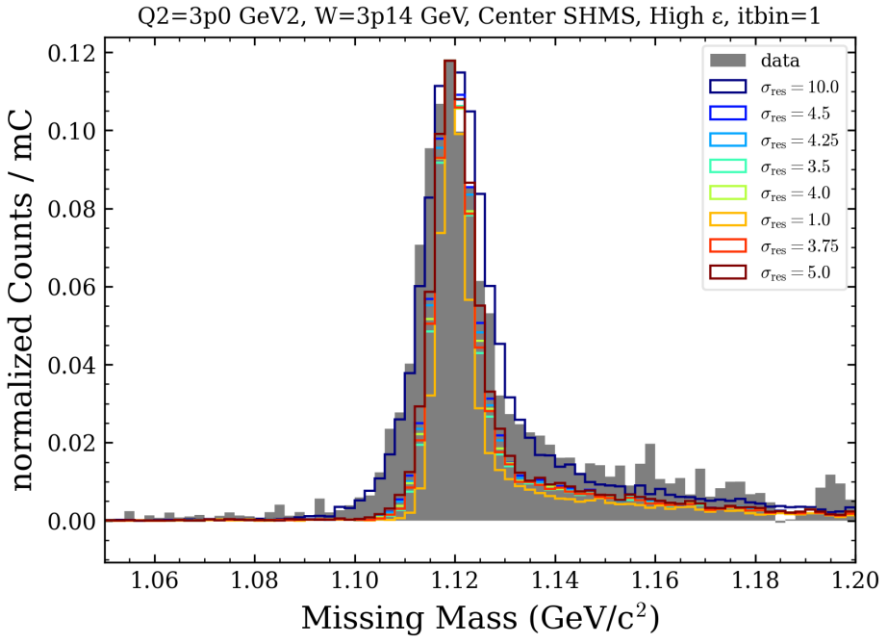

Q2=3p0 GeV2, W=3p14 GeV, Right SHMS, High ε, itbin=2
data
$\sigma_{res} = 4.5$
$\sigma_{res} = 3.5$
$\sigma_{res} = 4.0$
$\sigma_{res} = 3.0$
normalized Counts / mC
Missing Mass (GeV/c^2)

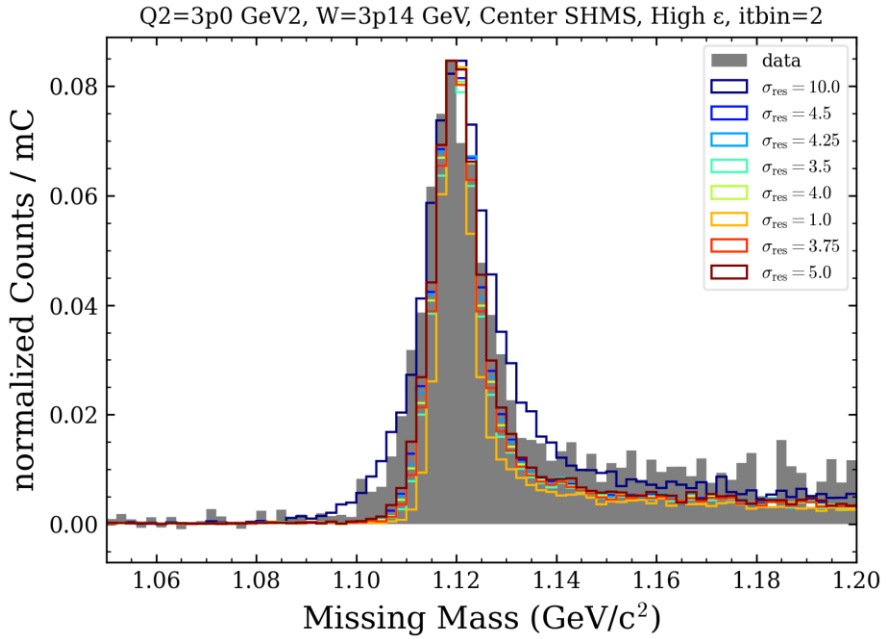

Q2=3p0 GeV2, W=3p14 GeV, Right SHMS, High ε, itbin=3
data
$\sigma_{res} = 4.5$
$\sigma_{res} = 3.5$
$\sigma_{res} = 4.0$
$\sigma_{res} = 3.0$
normalized Counts / mC
Missing Mass (GeV/c^2)

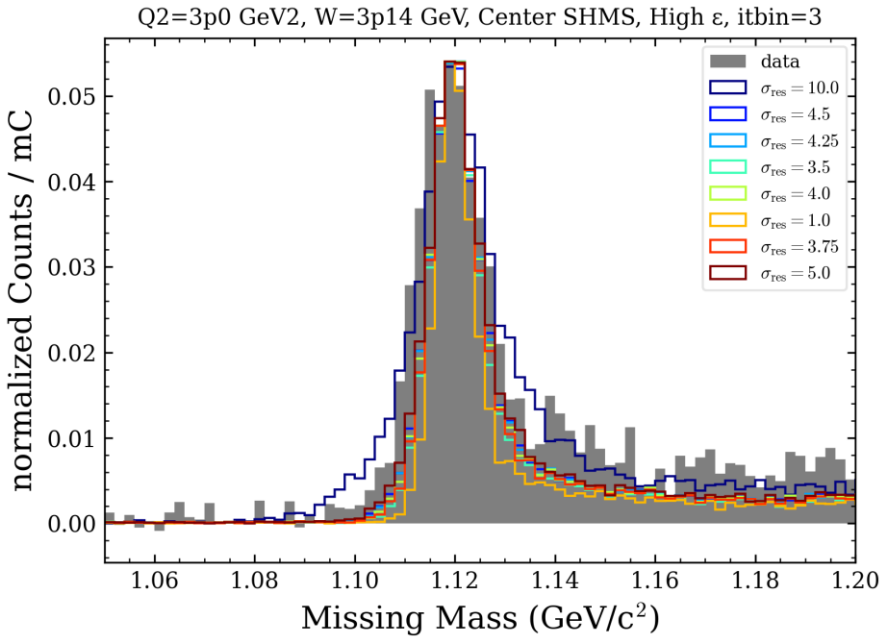
Center High e

- Resolution is t-dependent
- only in center highe ?

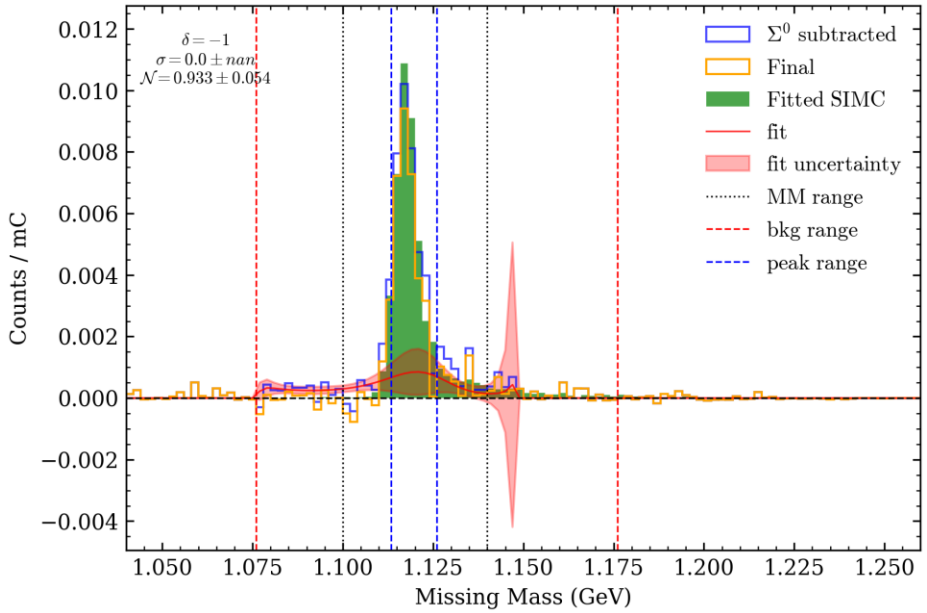




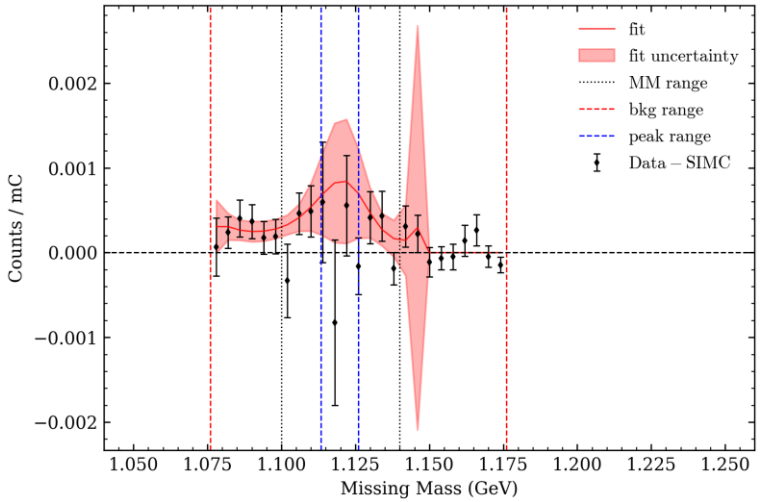




Background fit procedure (when resolution is not a problem)



Center lowe, tbin=0, phi=-180



- Fit a gaussian to both data and SIMC to find the peak → apply offset
- Separate the χ^2 for the peak and the sidebands so we are minimizing

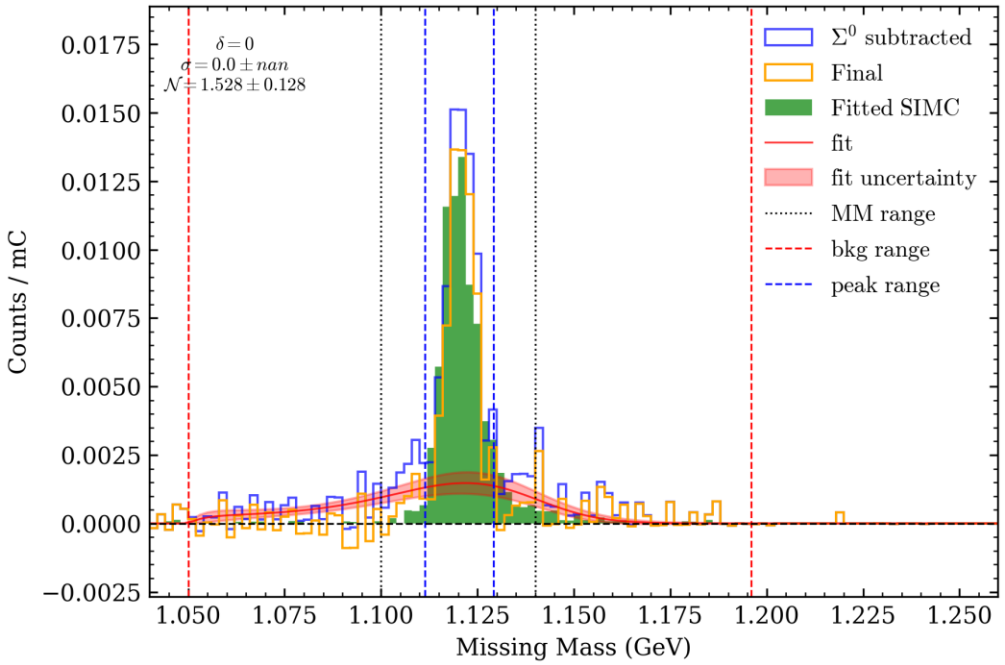
$$\chi^2_{peak} = \frac{y_{peak} - \alpha y_{SIMC,peak}}{\delta y_{peak}}$$

$$\chi^2_{sb} = \frac{y_{sb} - \alpha y_{SIMC,sb} - f_{bkg}(x_{sb})}{\delta y_{sb}}$$

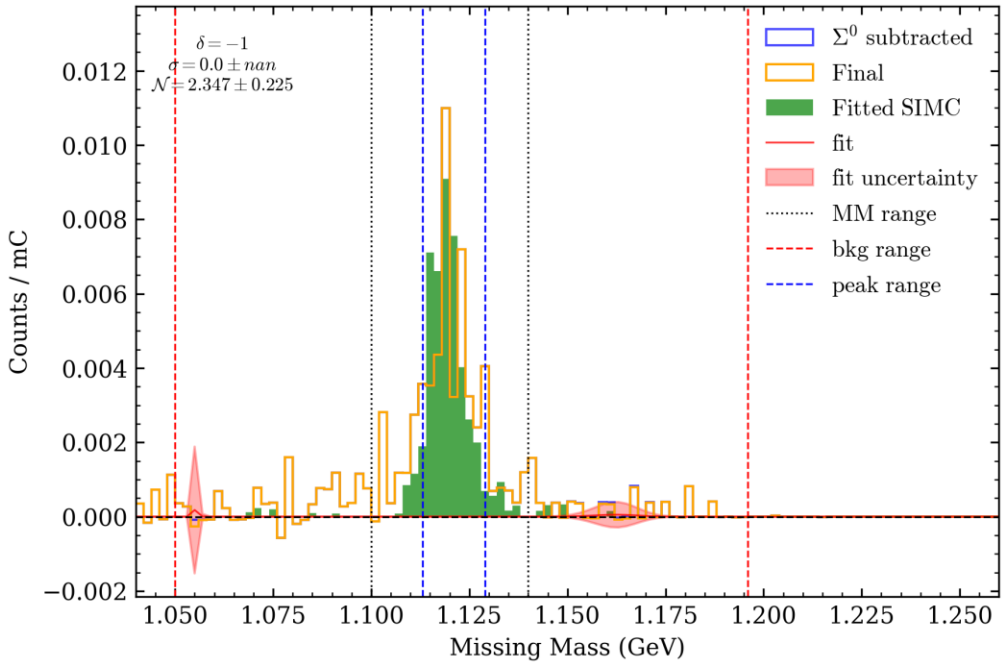
- Avoid the background from contributing too much to the peak (within the **blue**)

Background fit procedure (when resolution is not a problem)

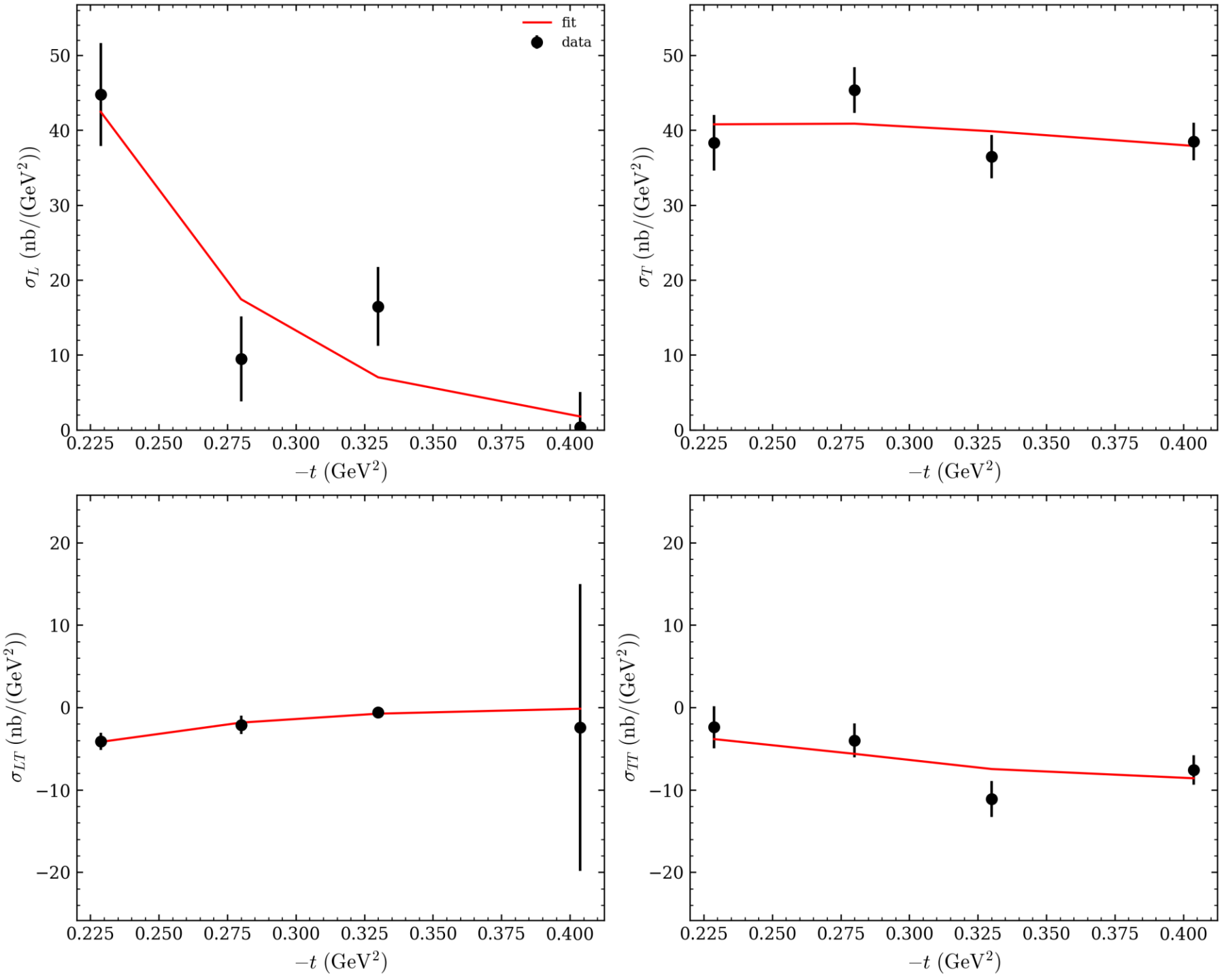
Left high e, tbin=1, phi=-180



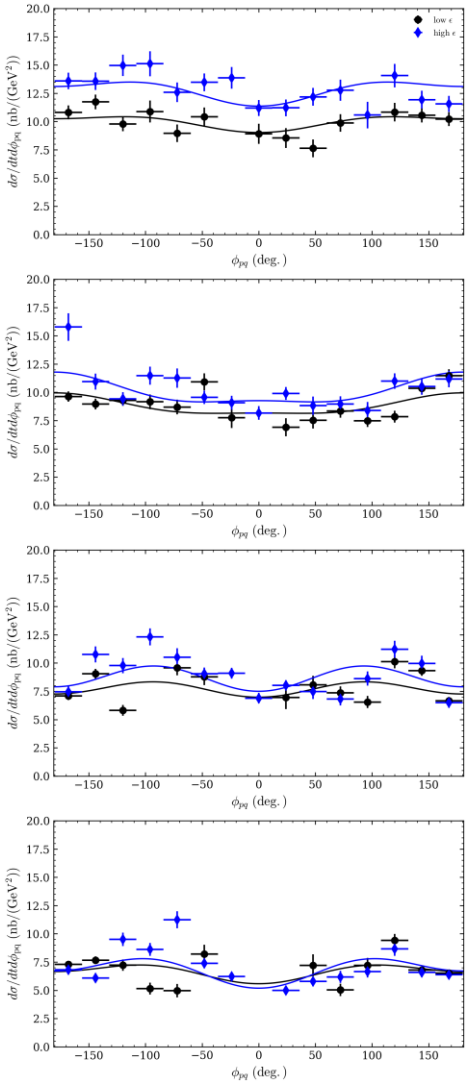
Left high e, tbin=1, phi=-168



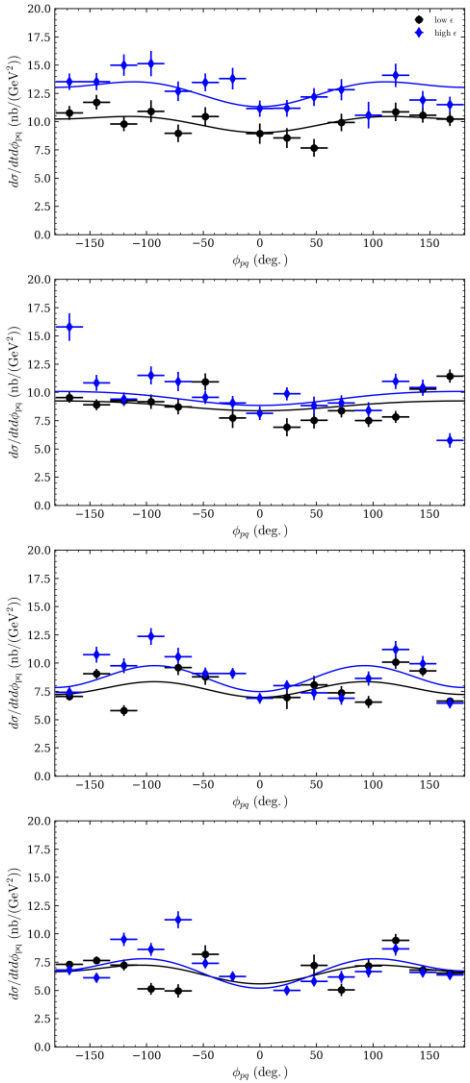
- Some works, some just need individual attention


fit
data
σ_L (nb/(GeV^2))
σ_T (nb/(GeV^2))
σ_{LT} (nb/(GeV^2))
σ_{TT} (nb/(GeV^2))
$-t$ (GeV^2)
0.225 0.250 0.275 0.300 0.325 0.350 0.375 0.400
50 40 30 20 10 0
20 10 0 −10 −20

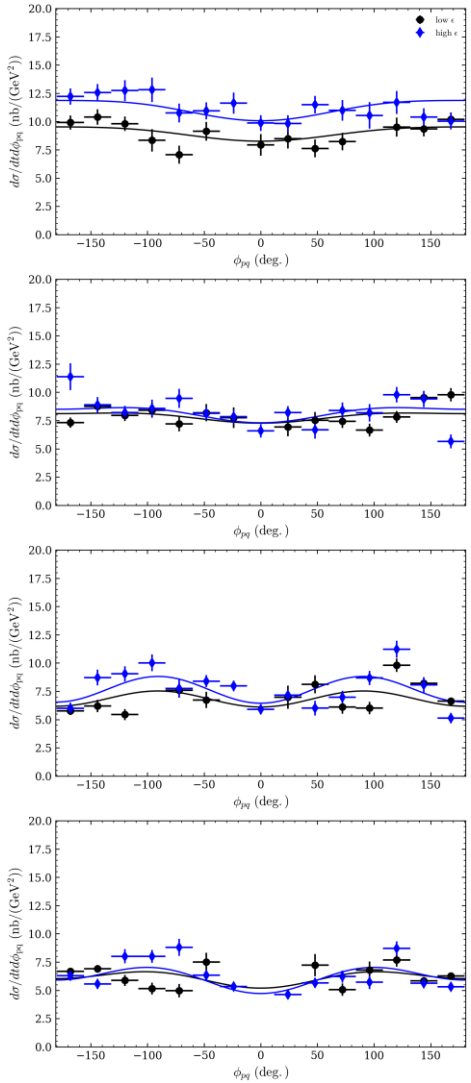
Pion sub



sigma0 sub

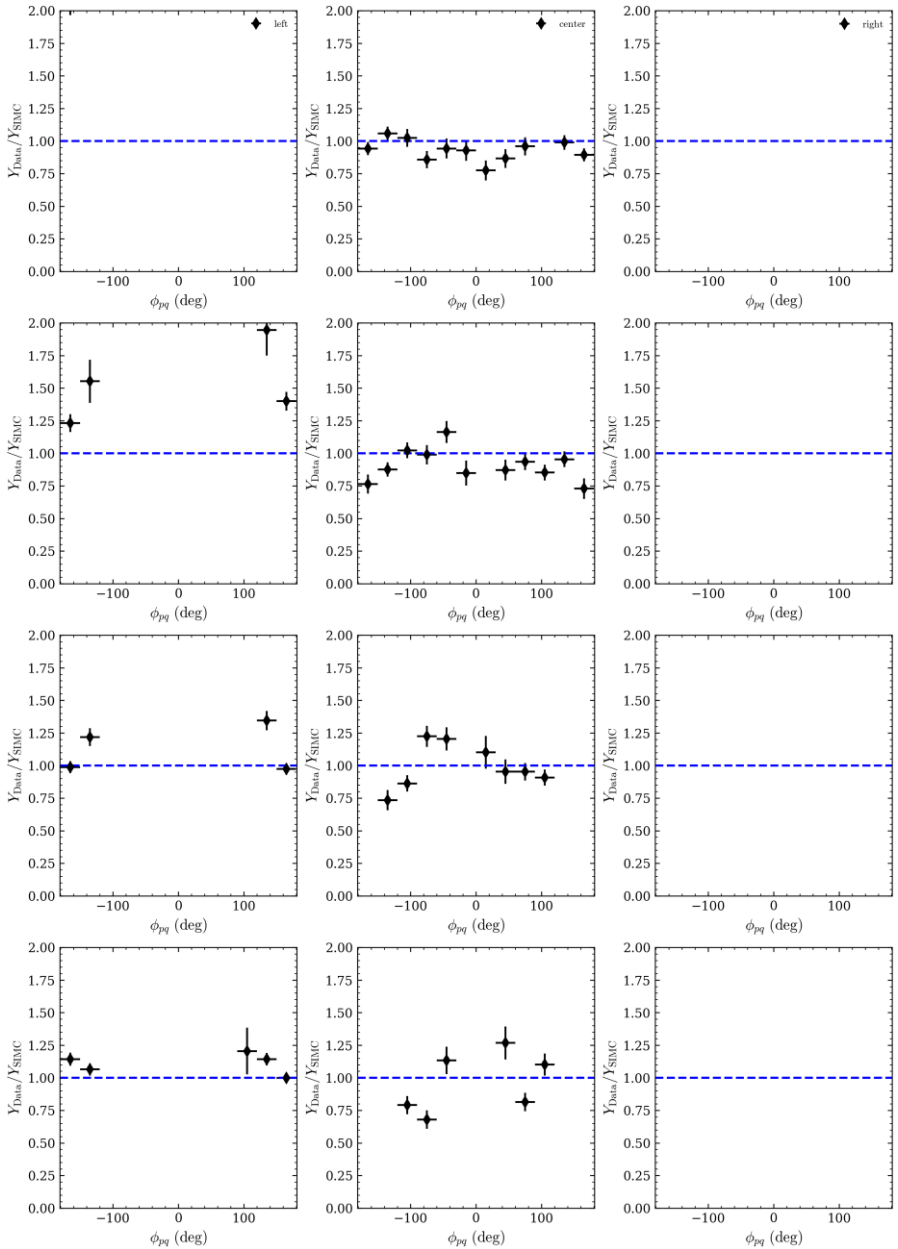


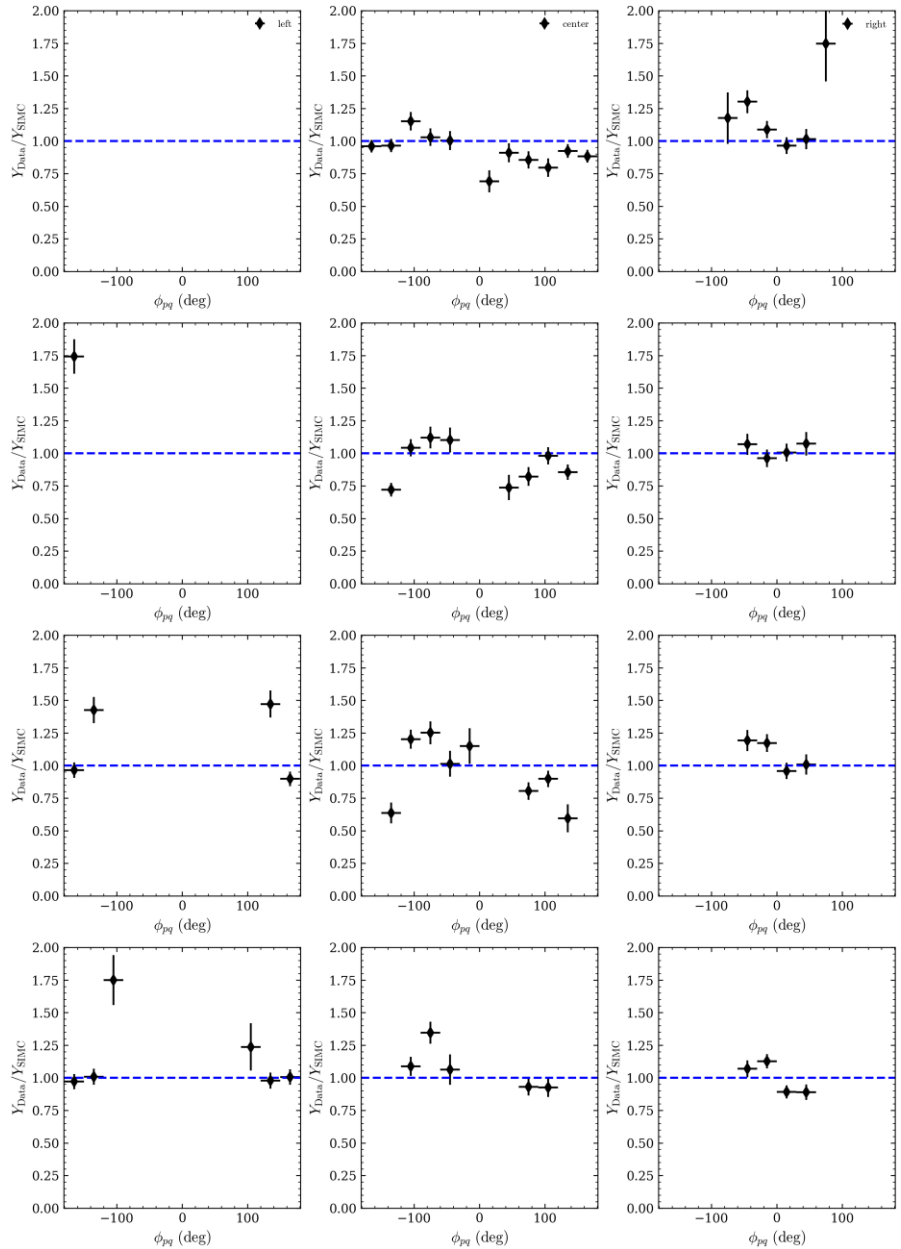
Additional bkg sub



Revert back to 4x12

Yield Ratio per setting





Yield Ratio

Up to Sigma0 sub

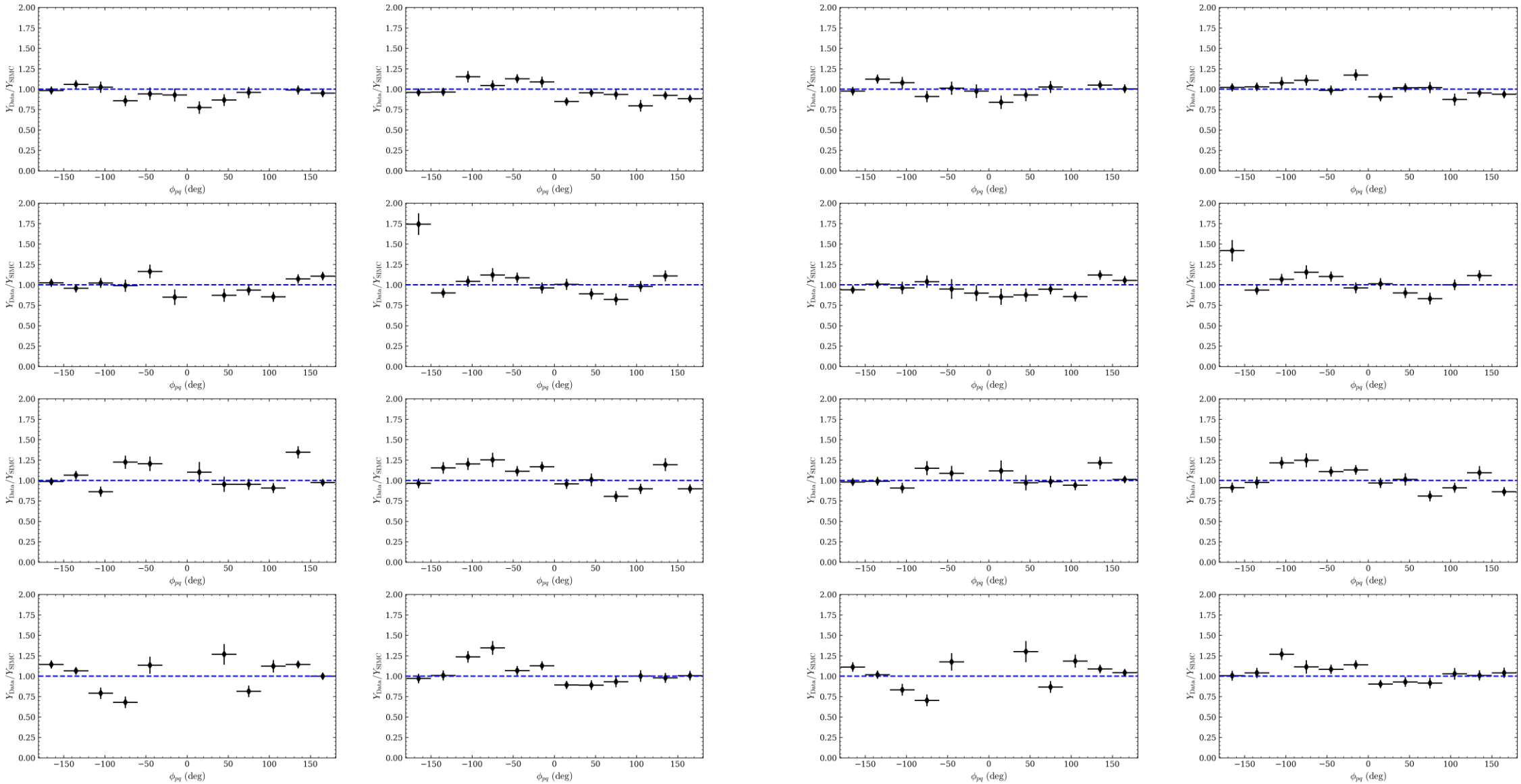
All sub

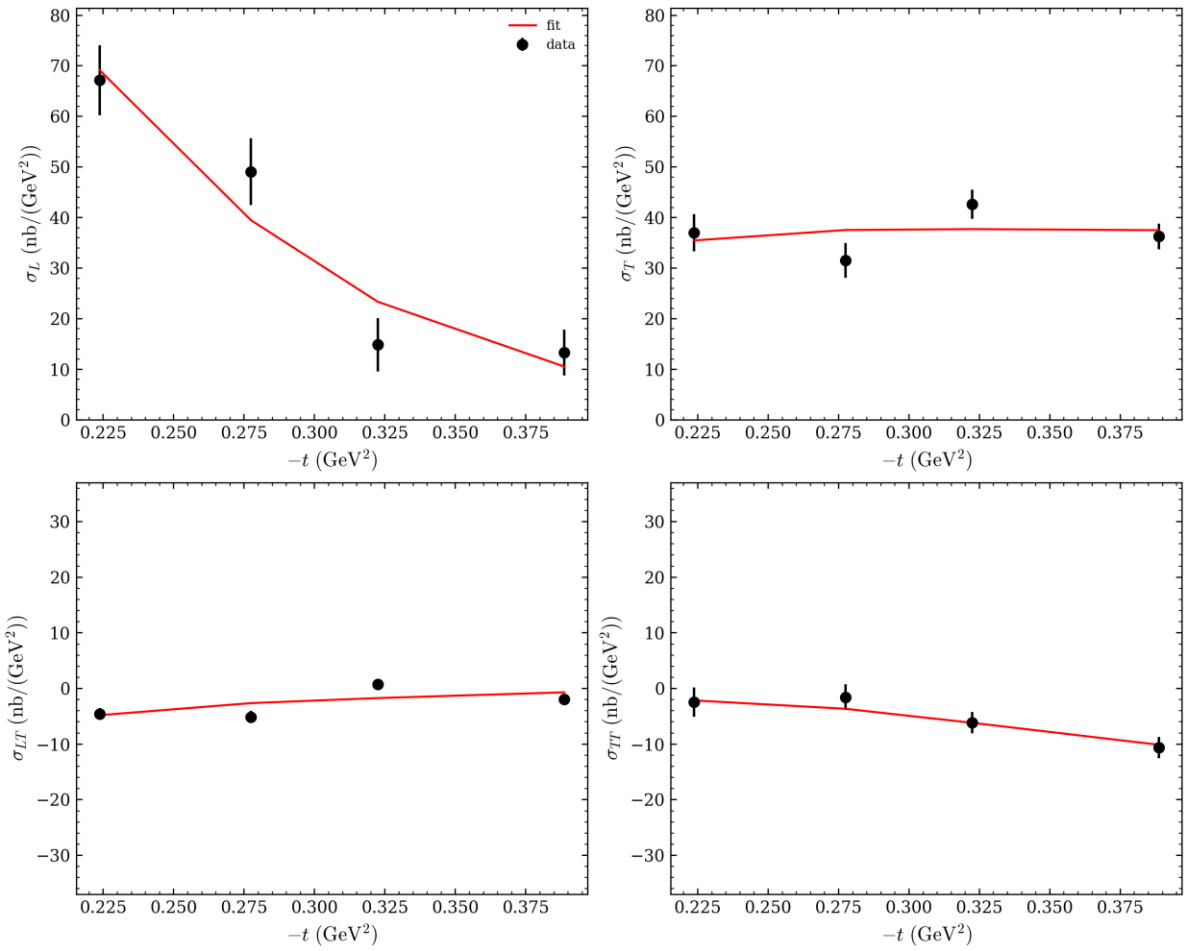
Low e

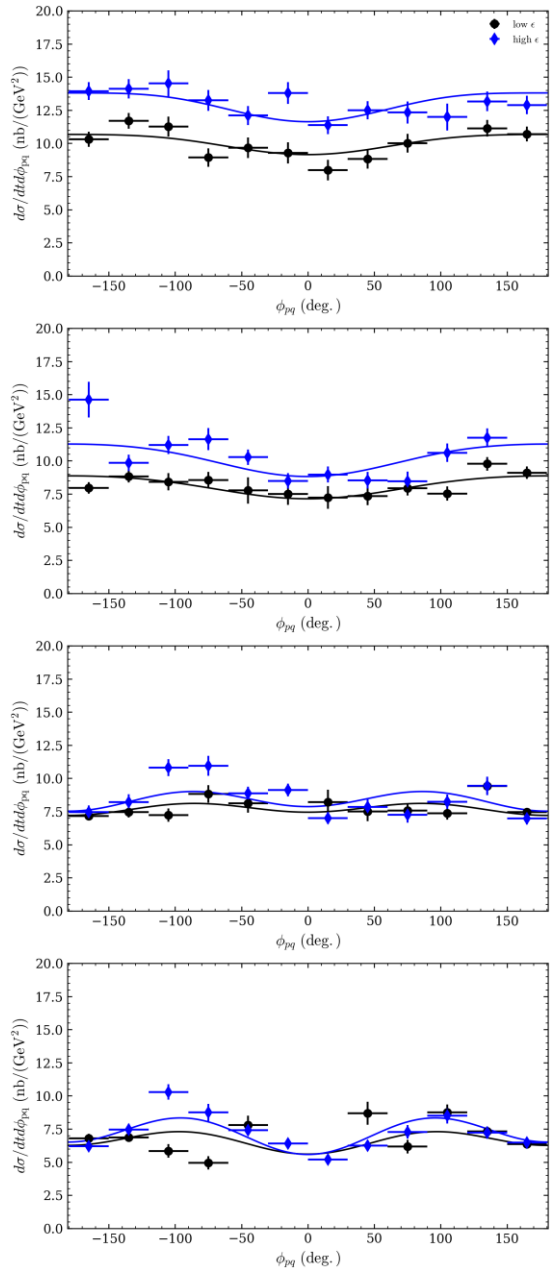
high e

Low e

high e



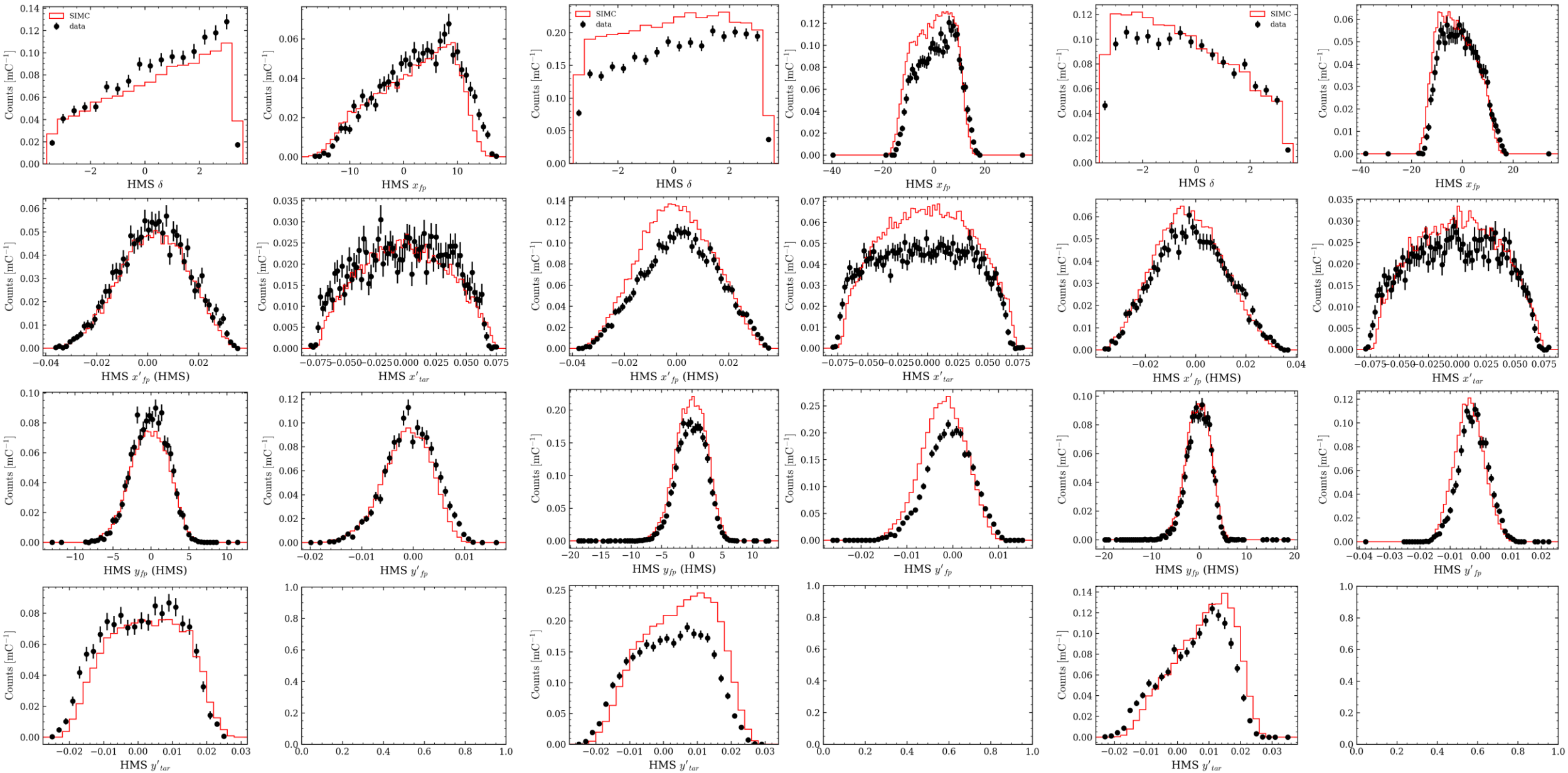

fit
data
σ_L (nb/(GeV^2))
σ_T (nb/(GeV^2))
σ_{LT} (nb/(GeV^2))
σ_{TT} (nb/(GeV^2))
$-t$ (GeV^2)


low ϵ
high ϵ
$d\sigma/dtd\phi_{pq}$ (nb/(GeV^2))
ϕ_{pq} (deg.)

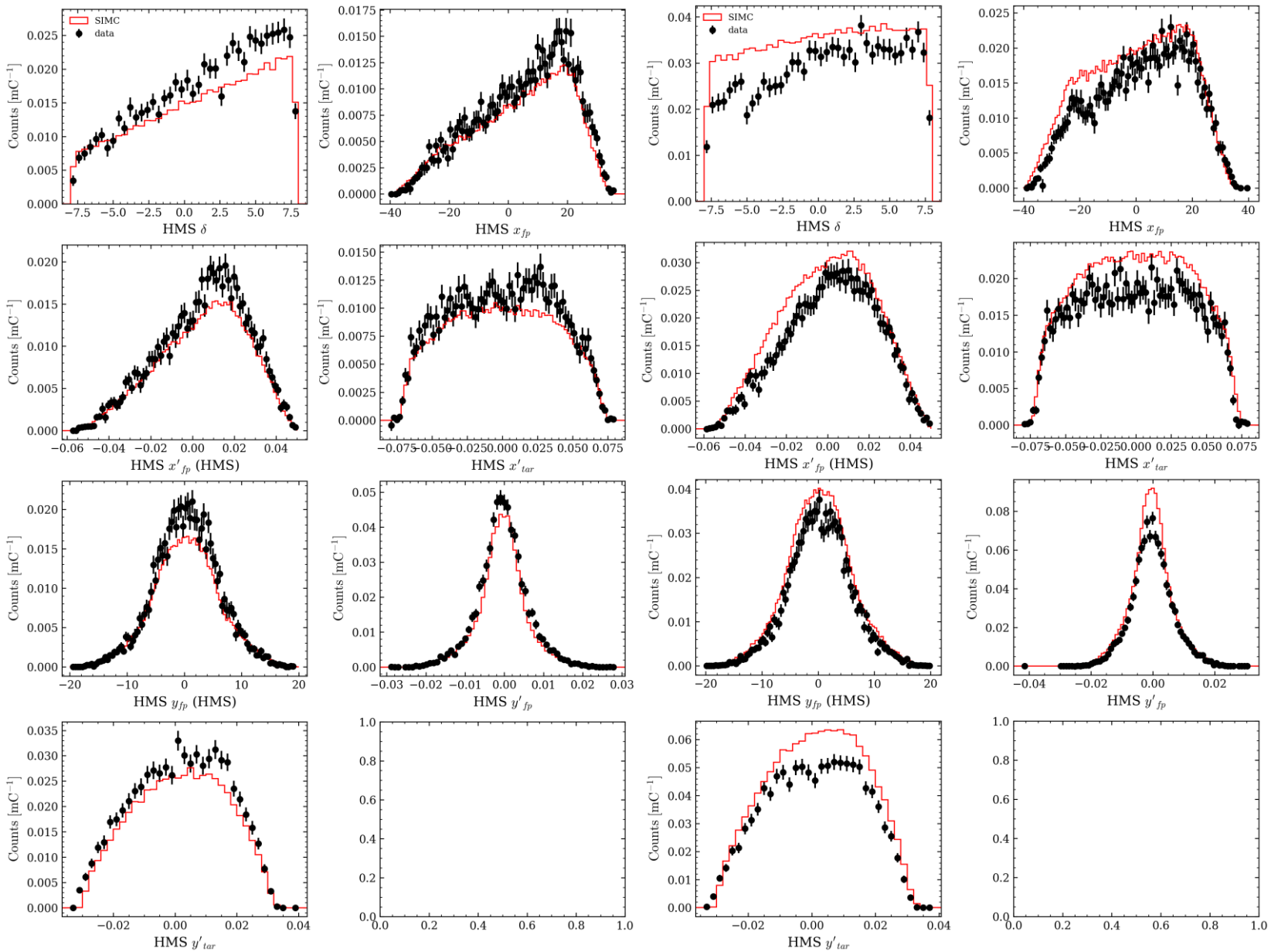
Distribution comparison

- Data and SIMC has a slightly different t range.
- Data (0.2 – 0.45)
- SIMC (0.19-0.43)

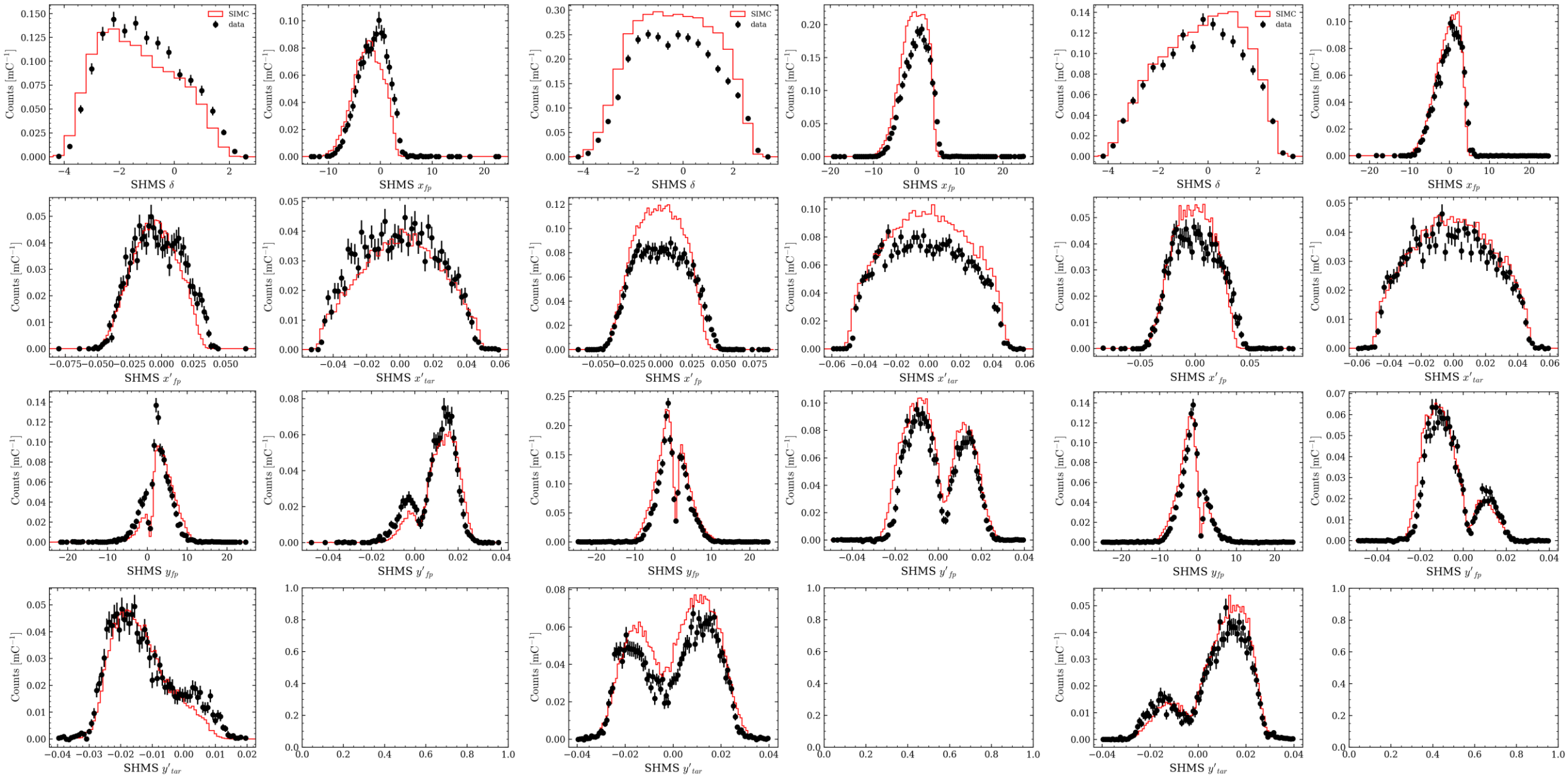
HMS variables (High e)



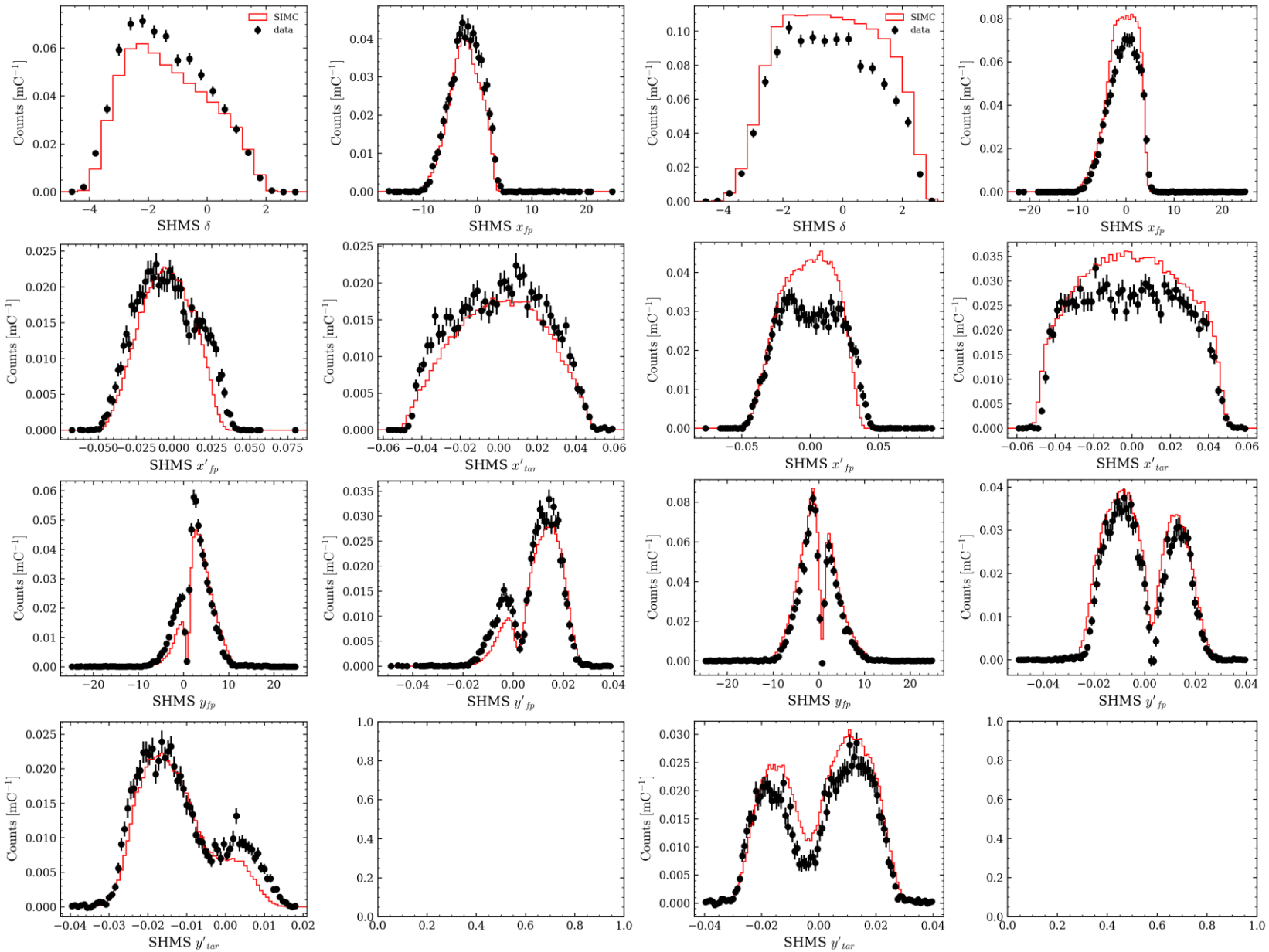
HMS variables (low e)



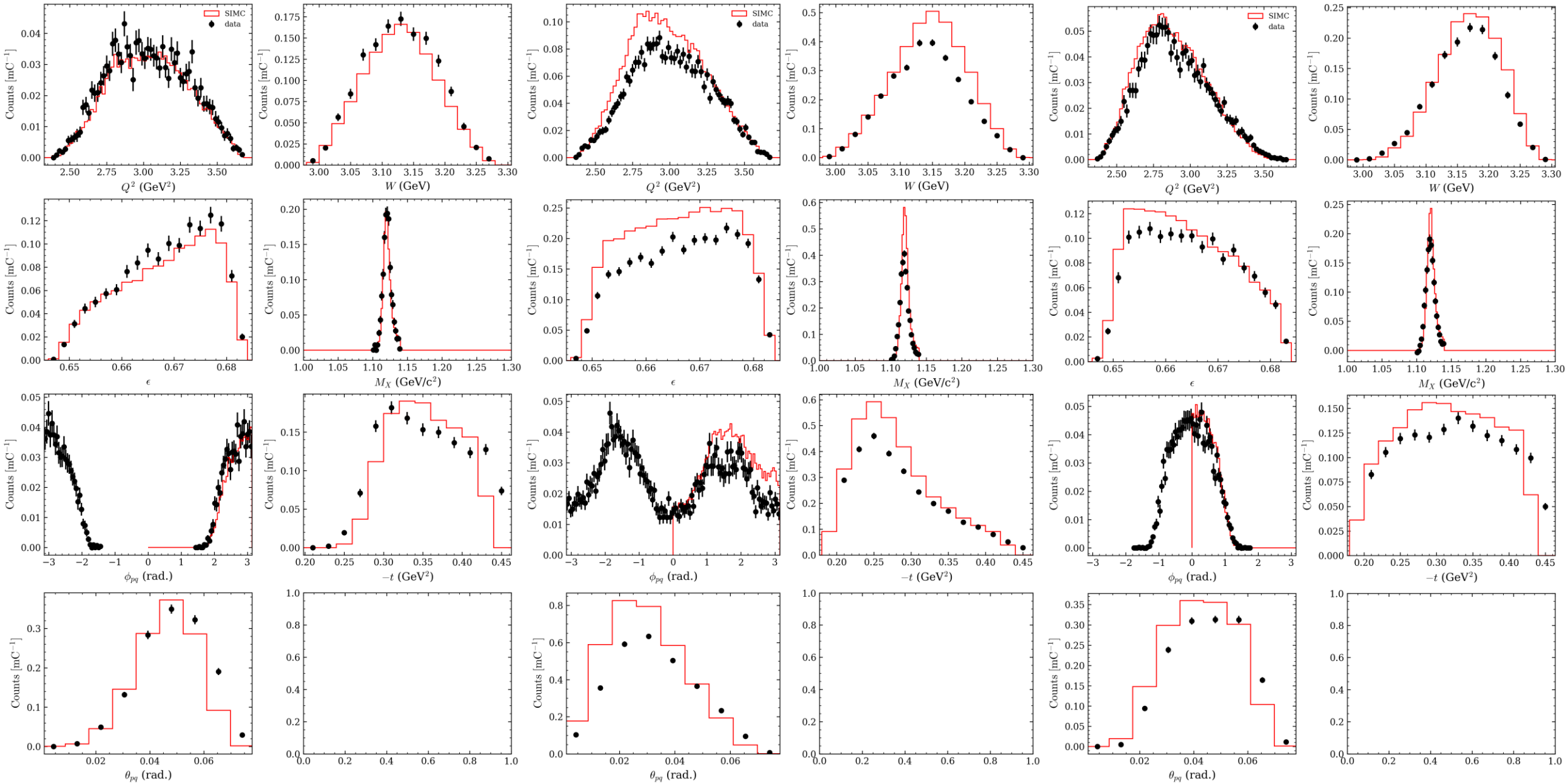
SHMS variables (High e)



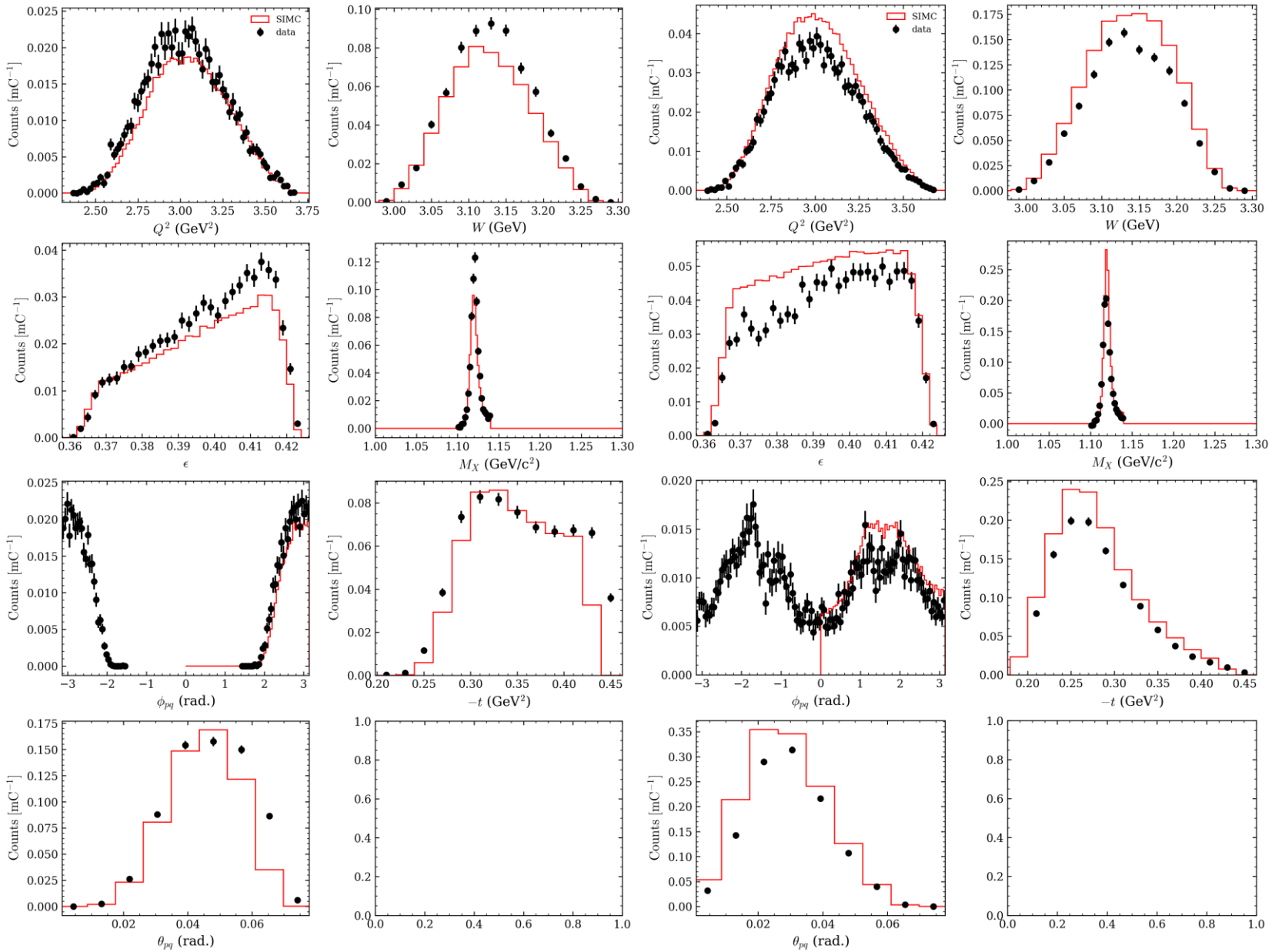
SHMS variables (low e)



Kinematics variables (High e)



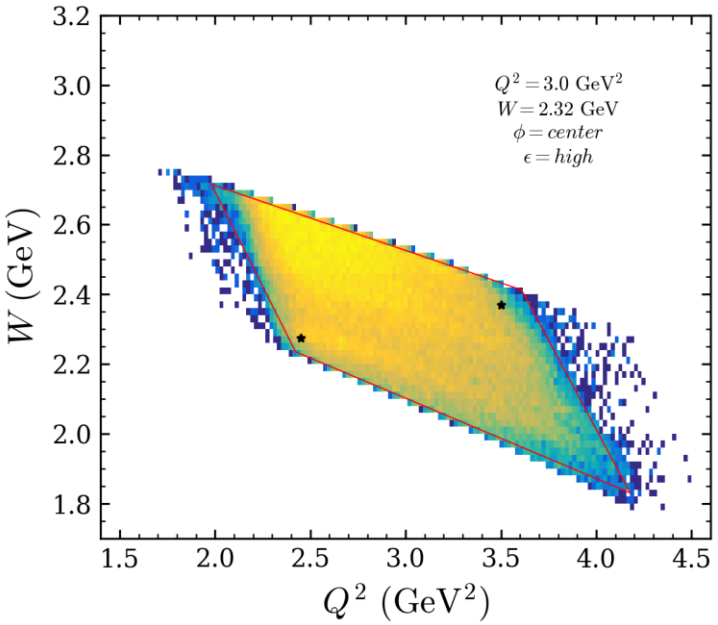
Kinematics variables (low e)



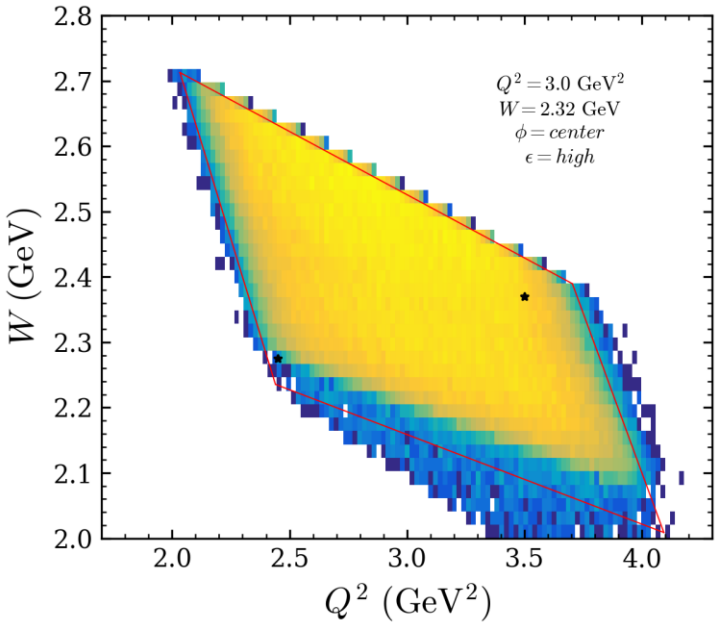
- Ran all 5 settings for simc, diamond cut, mm shift, etc…
- Prepare to run iteration

Q3p0_W2p32_center_high

Data

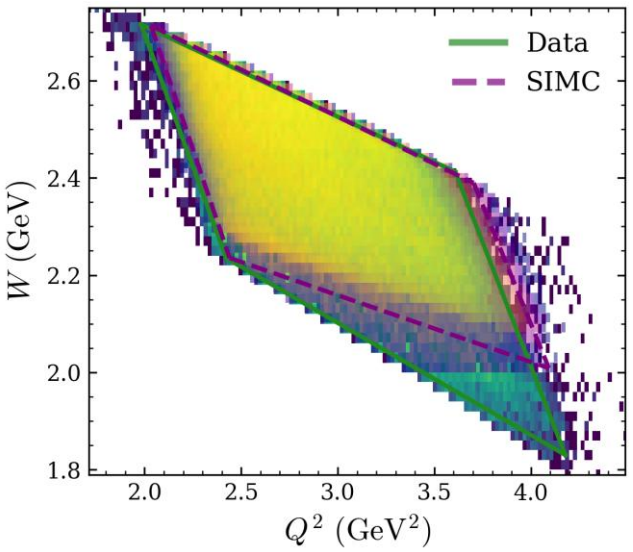


SIMC



Just run more MC ?

Q3p0_W2p32_center_high



Q2p1_W2p95_right_high