KaonLT Replay

- Rerun replay the all 10 settings in **Q^2=3.0, W=3.14** and **Q^2=2.1,W=2.95**
- Used repository :
  - Hallc_replay_ly : https://github.com/JeffersonLab/hallc_replay_lt/tree/LTSep_Analysis_2022
  - UTIL_KAONLT : https://github.com/JeffersonLab/UTIL_KAONLT/tree/LTSep_Analysis_2024

- Issues:
  - File size > what Richard provides (847M vs 713M),
  - But Missing mass is identical (probably just root version diff)

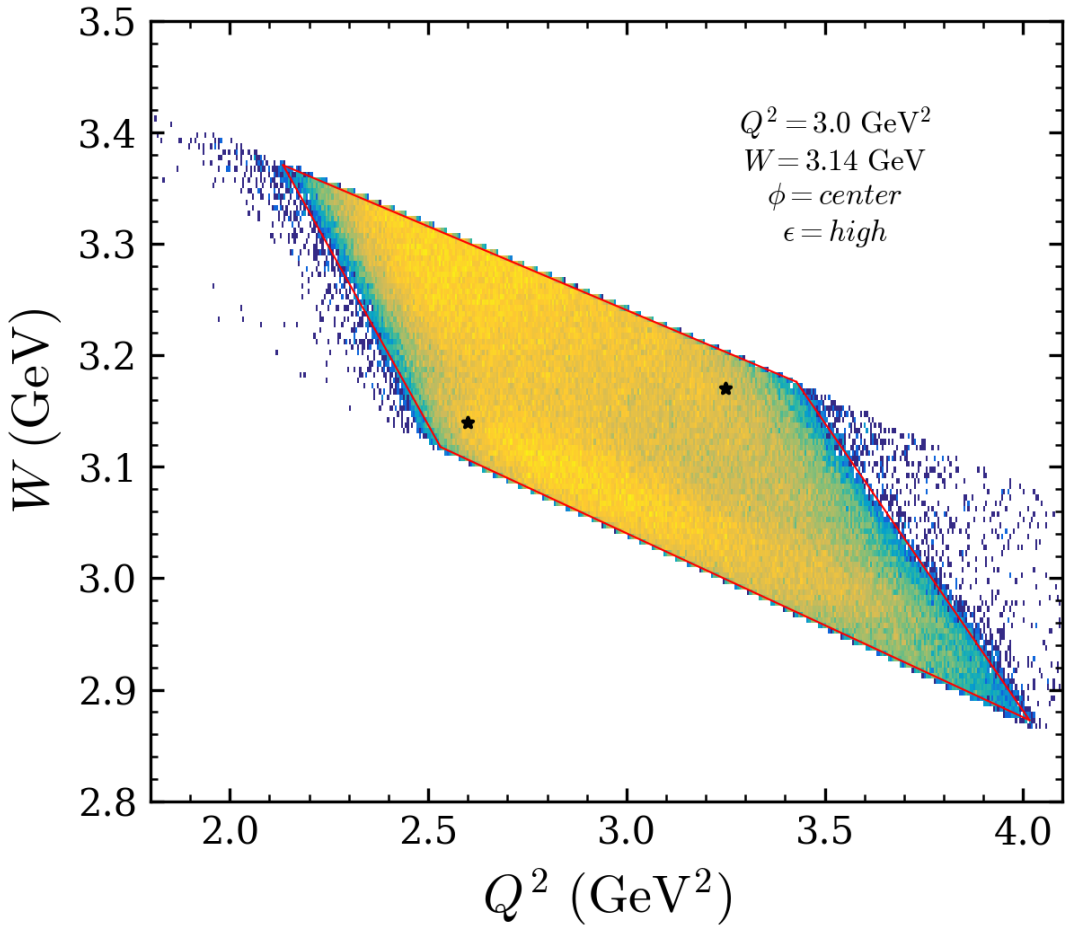
```
/lustre24/expphy/cache/hallc/kaonlt/Pass3_Dec_2023/ROOTfiles/Analysis/KaonLT
[ckin@ifarm2402 KaonLT]$ ls -lh | grep 5013
-r--r--r--. 1 trottar enp  713M Apr 22 21:48 Kaon_coin_replay_production_5013_-1.root
```

```
/lustre24/expphy/volatile/hallc/c-kaonlt/ckin/ROOTfiles/Analysis/KaonLT
[ckin@ifarm2402 KaonLT]$ ls -lh | grep 5013
-rw-r--r--. 1 ckin c-comm2017  847M Sep  6 10:39 Kaon_coin_replay_production_5013_-1.root
```

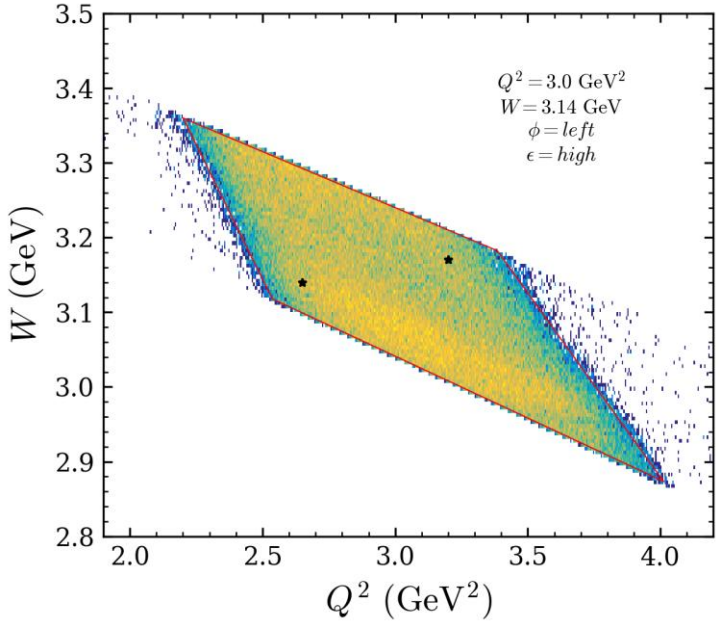
Diamond cut

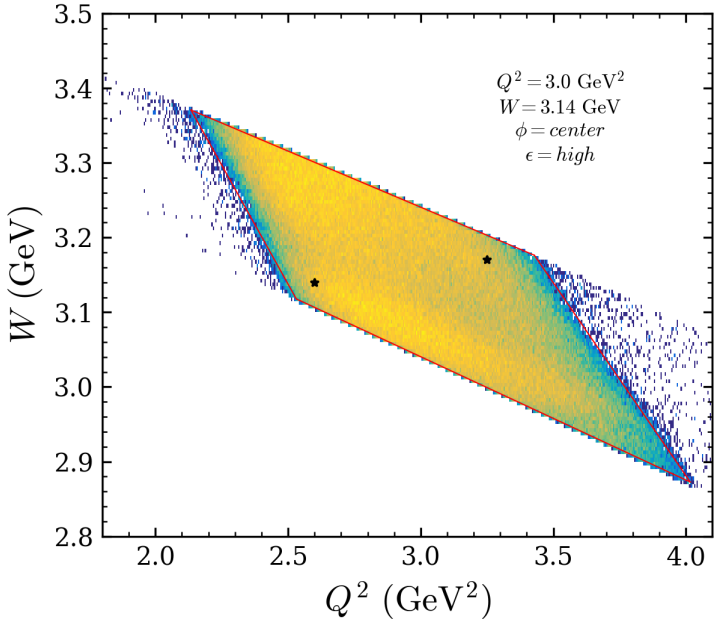
- Threshold = 3 counts
- Pick two control points well within the diamond
- Pointed are selected by the first and last non-zero bin
- Fit all 4 sides

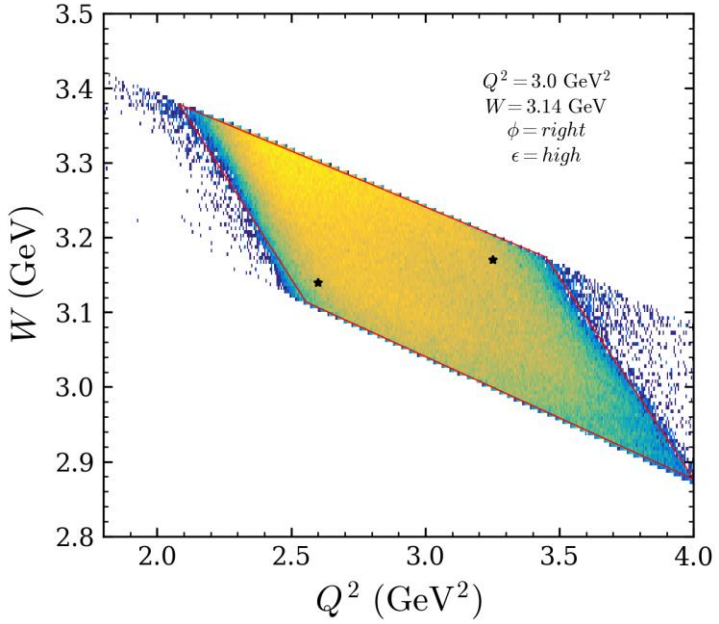
- smear the histogram first for the noise ?

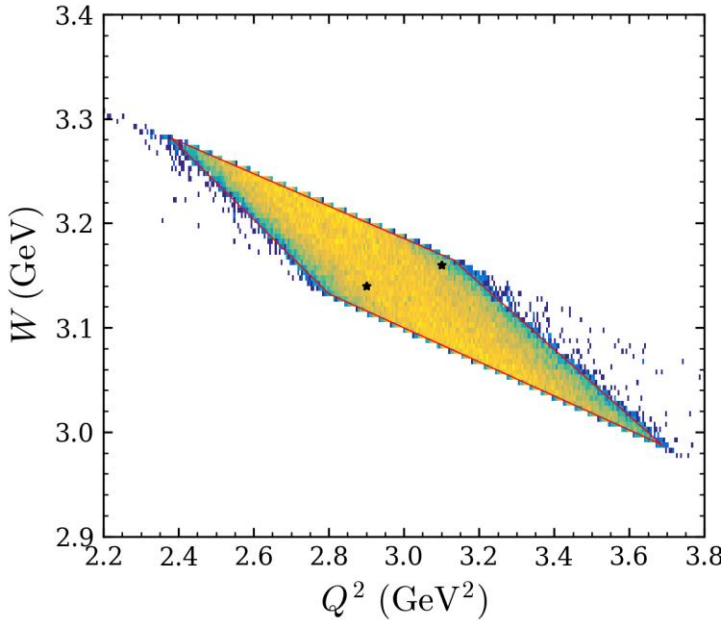


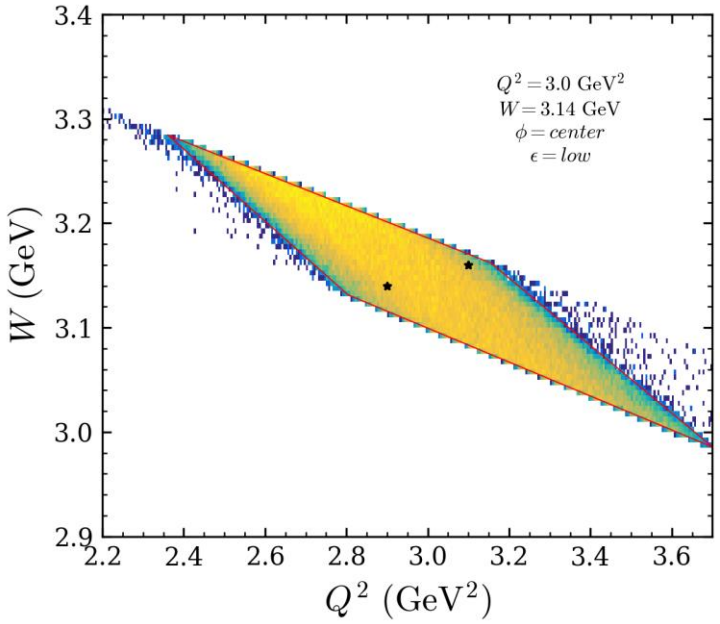
Diamond cut $Q^2 = 3.0, W = 3.14$



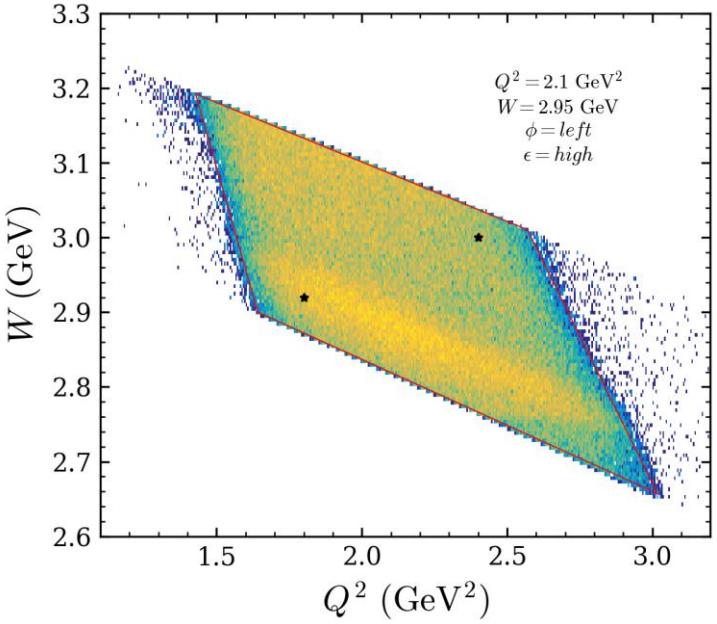


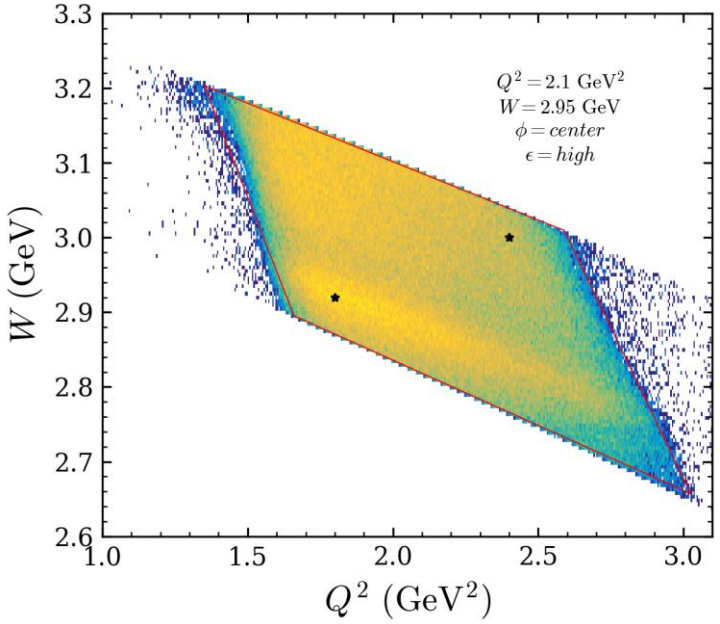


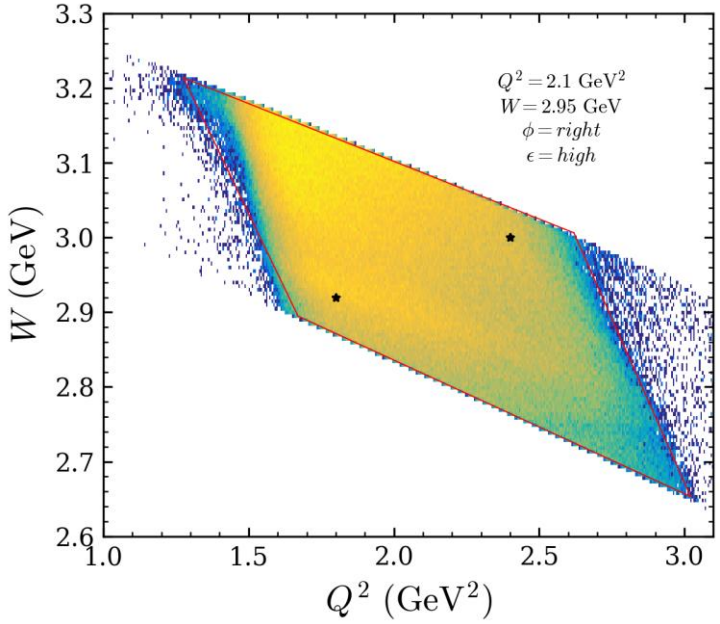


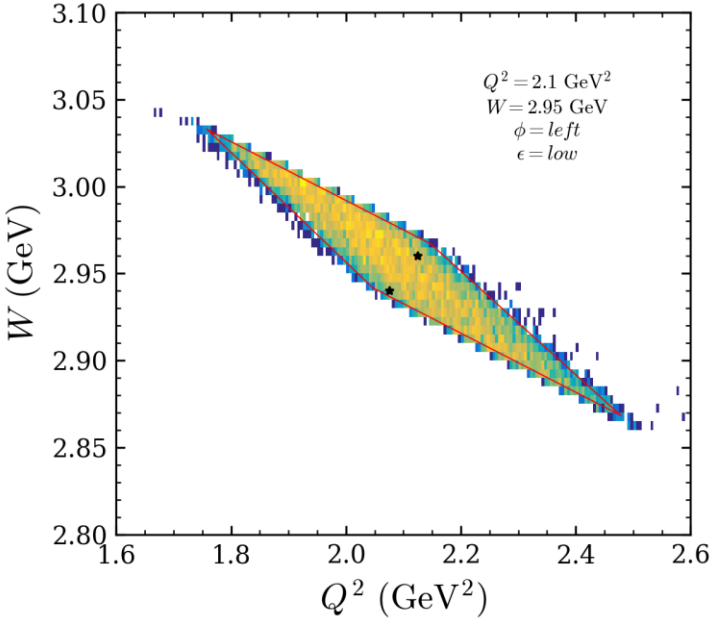


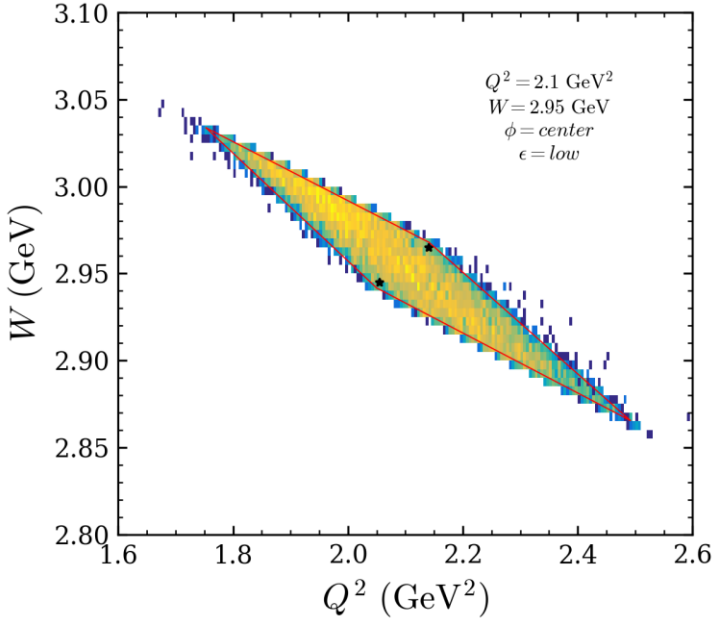
Diamond cut $Q^2 = 2.1, W = 2.95$

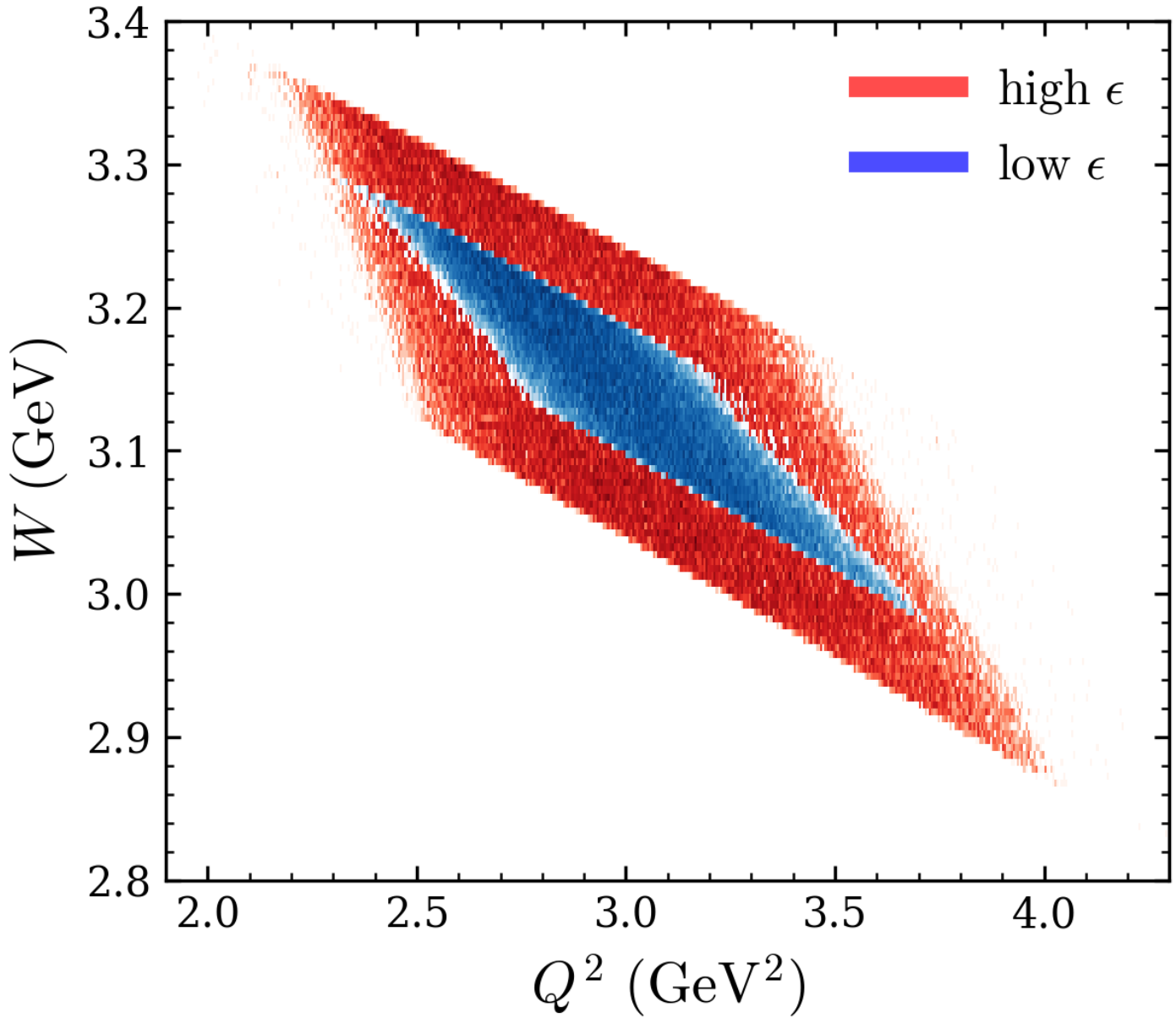






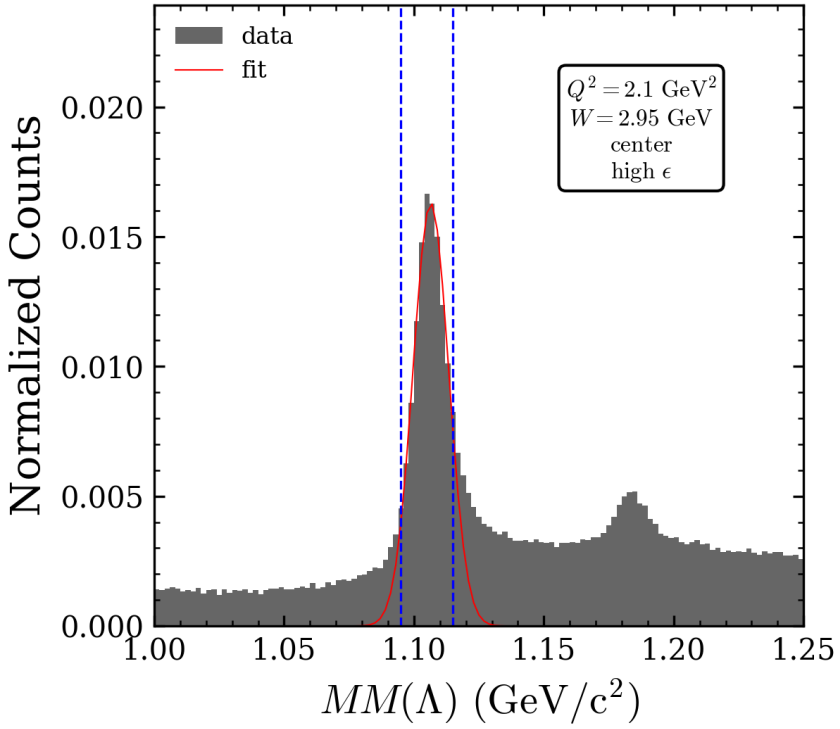


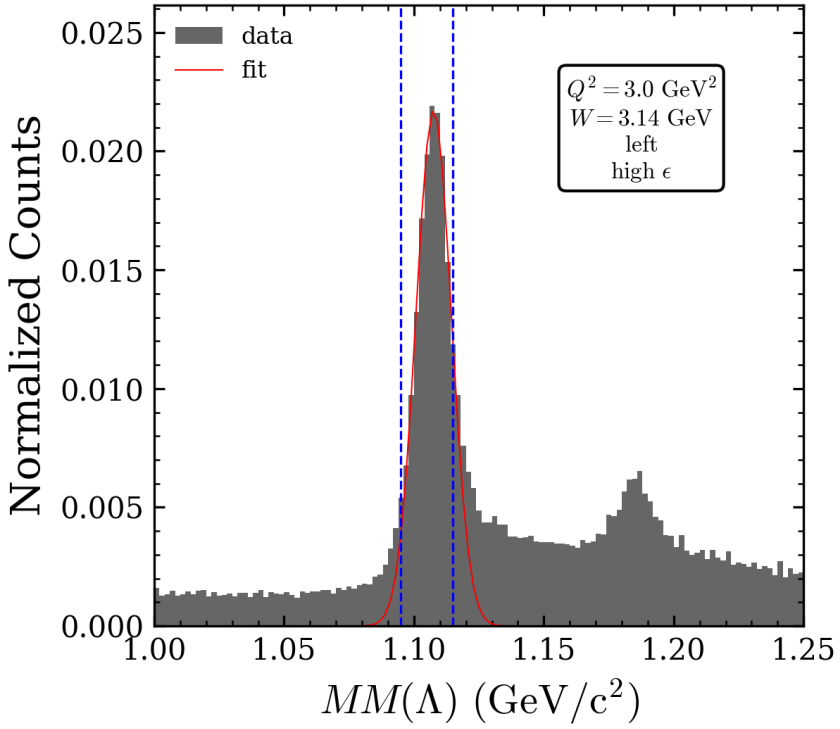



high ϵ
low ϵ
W (GeV)
Q^2 (GeV^2)
3.4
3.3
3.2
3.1
3.0
2.9
2.8
2.0
2.5
3.0
3.5
4.0

Missing Mass Fit

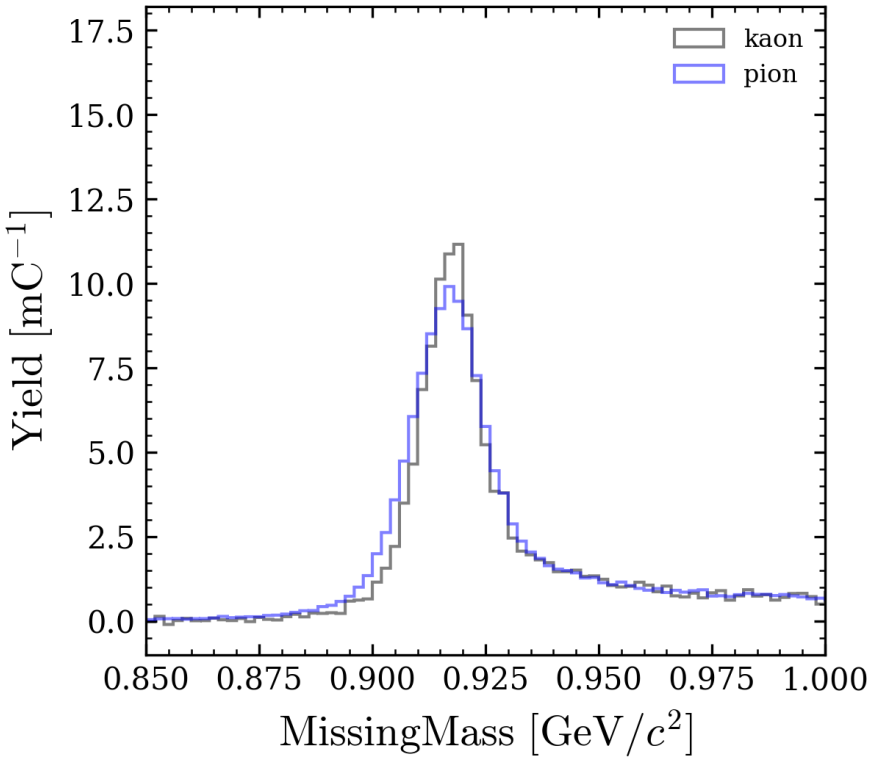
- As usual, fit the Λ peak with gaussian
- The same shift is used for pion-selected data
- Shift is applied to P_kin_secondary_MMK for both cases
- Random subtraction is as previously reported

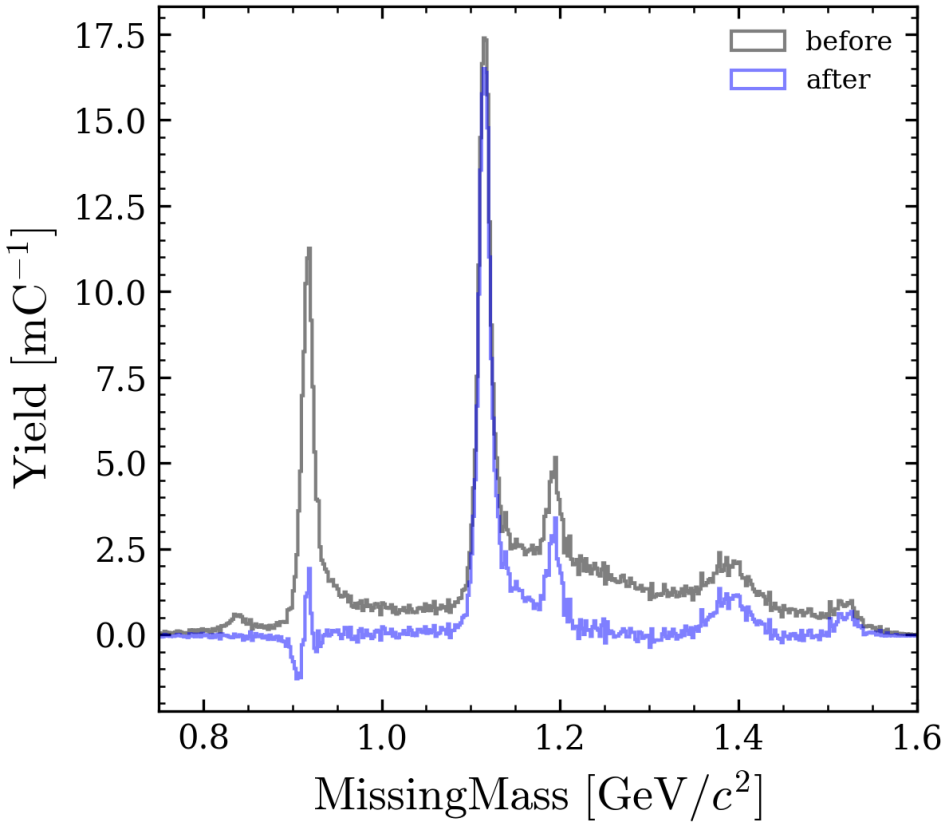




Pion background subtraction

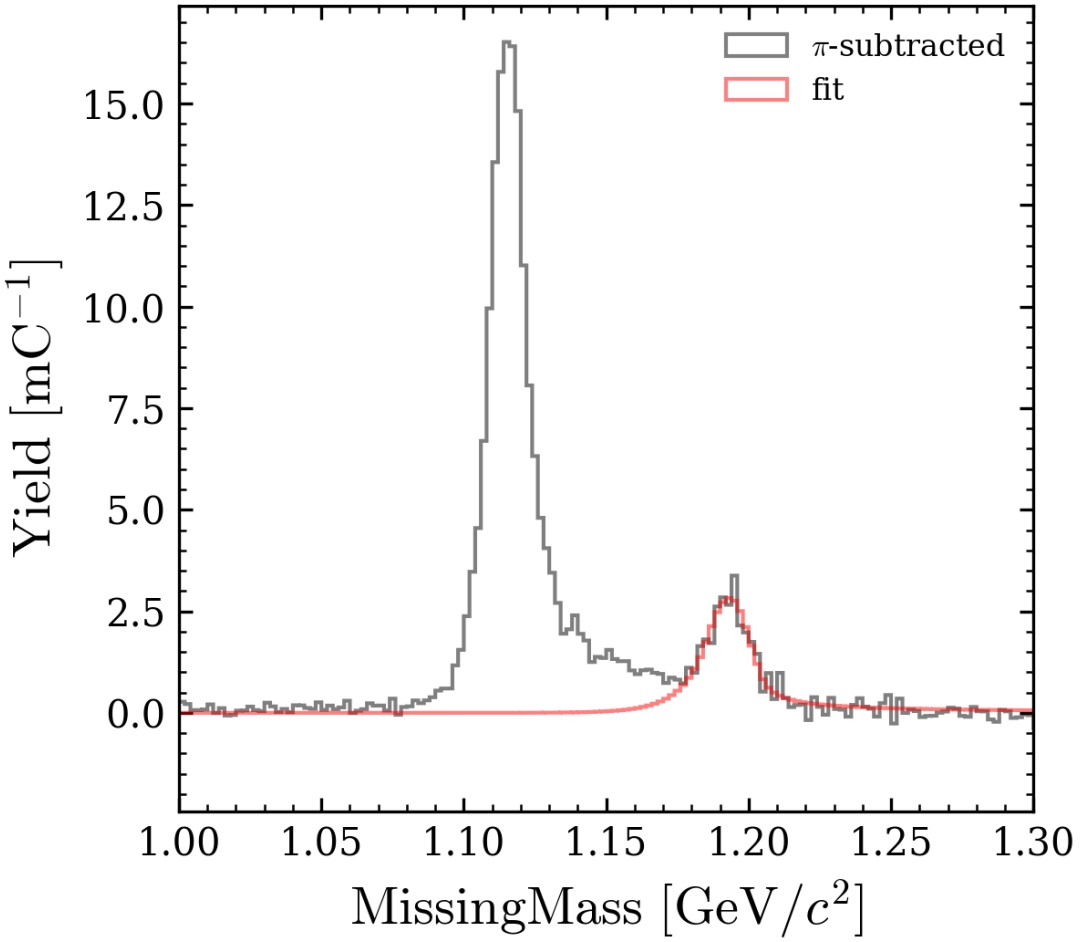
- Proton peaks align but differs in resolution
- Scale according to integral under the peak

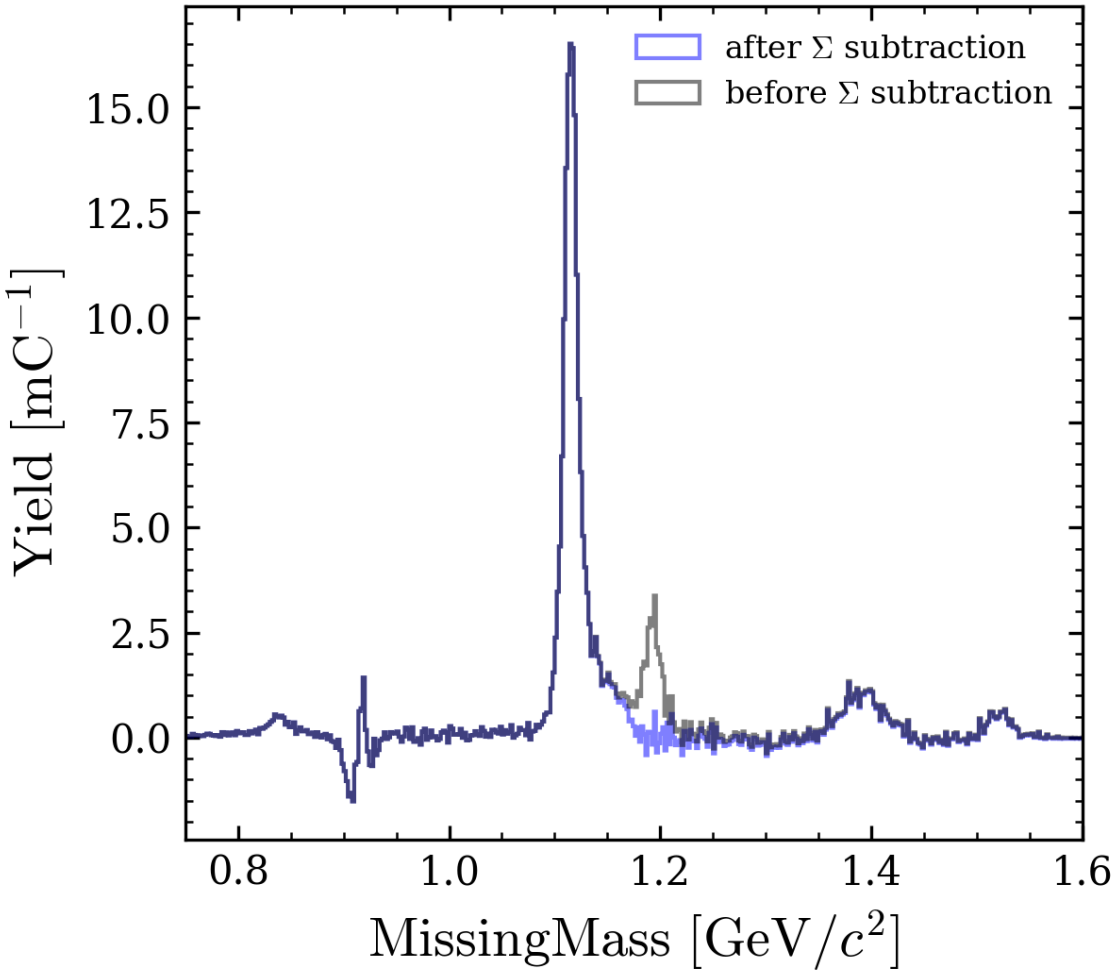




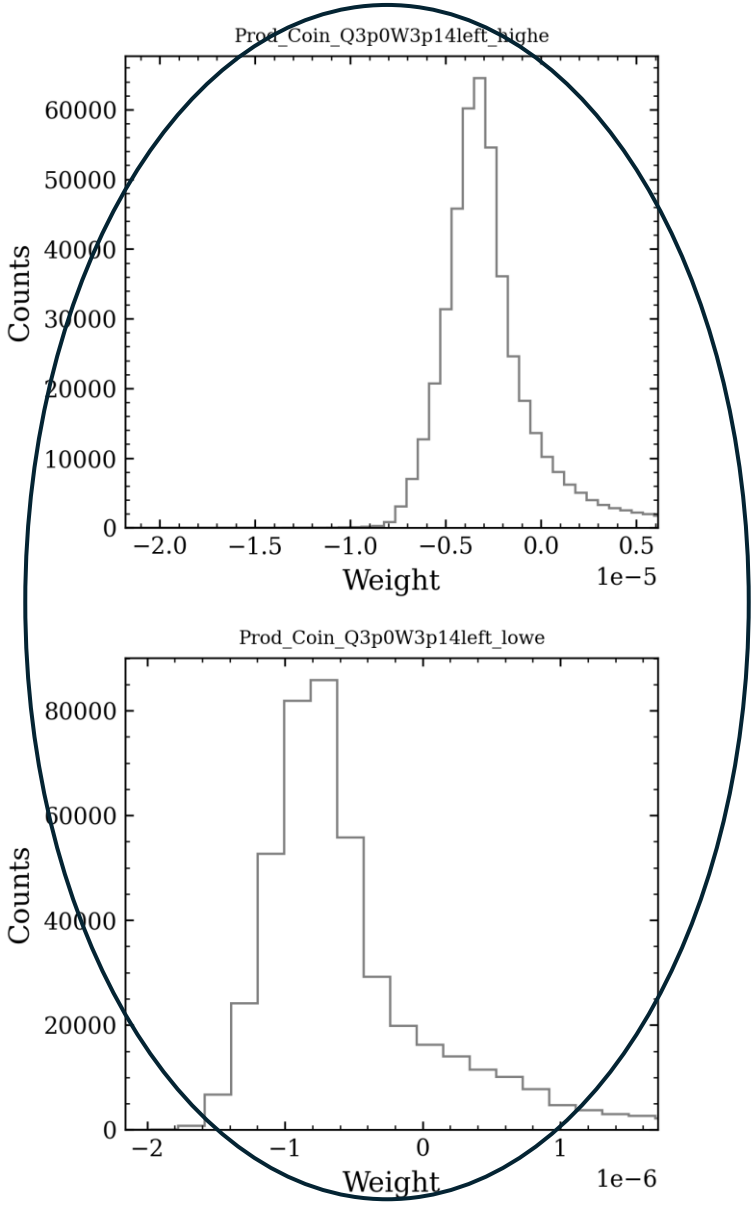
- Deconvolve before subtraction ?

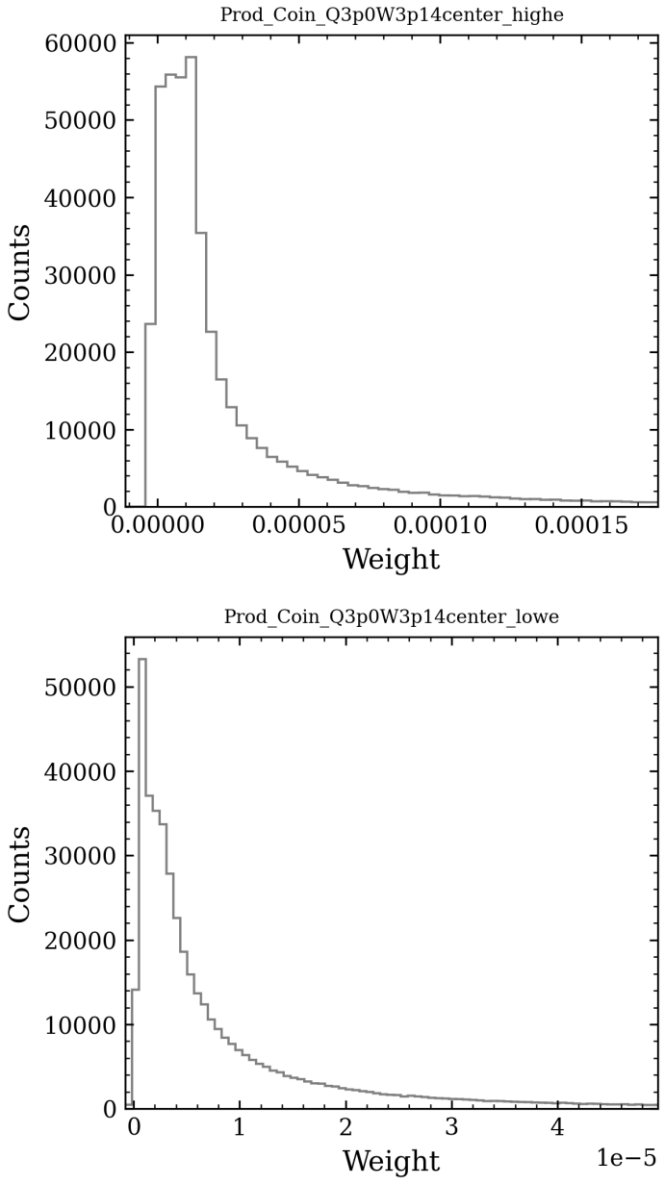
Sigma background subtraction

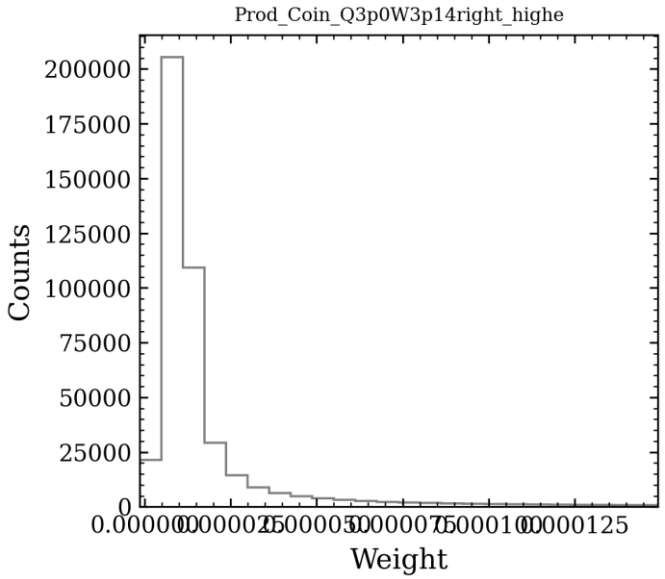




SIMC negative Weight

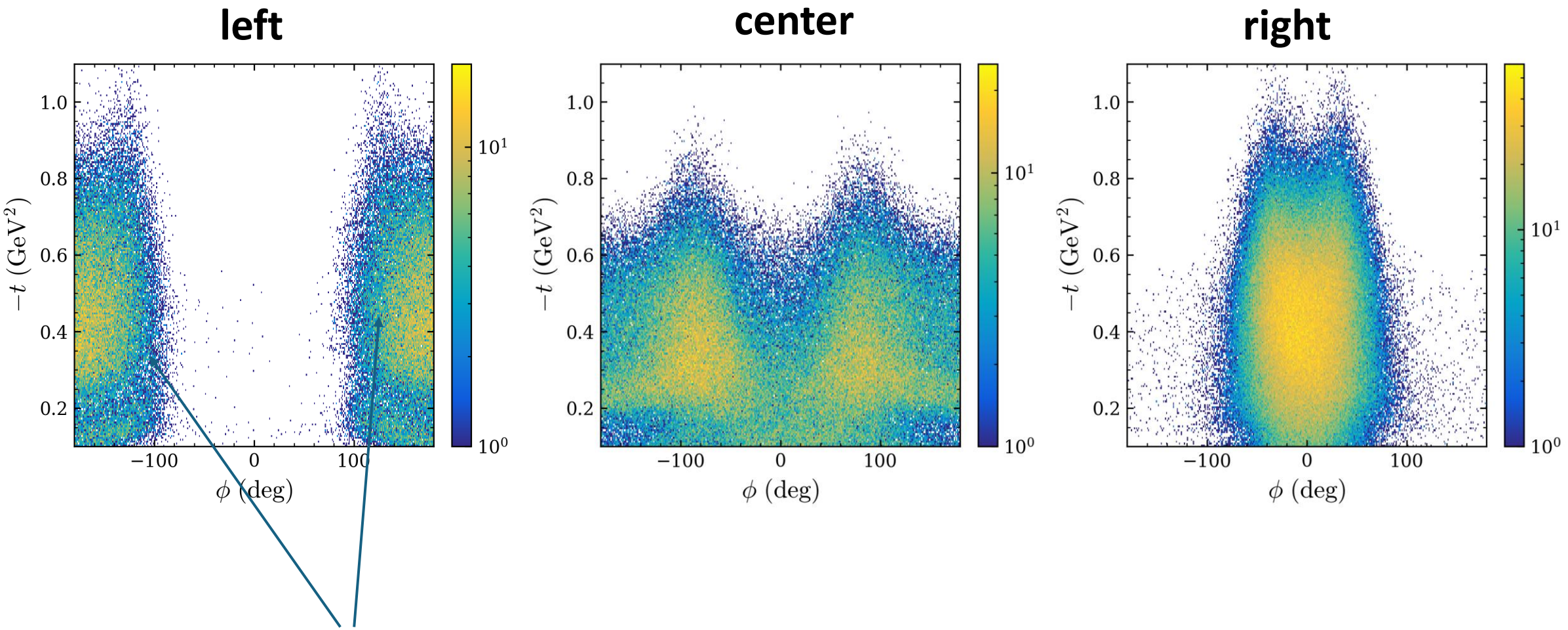






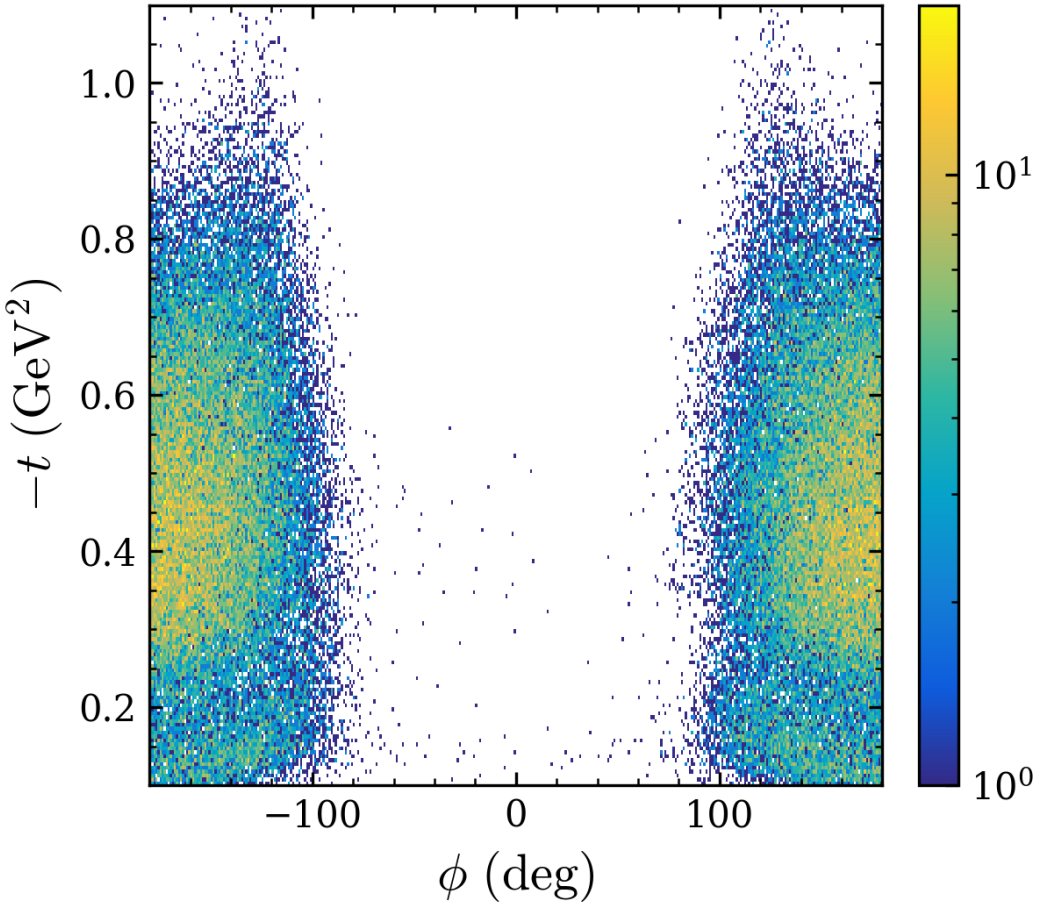
- Only Left gives negative xsect.

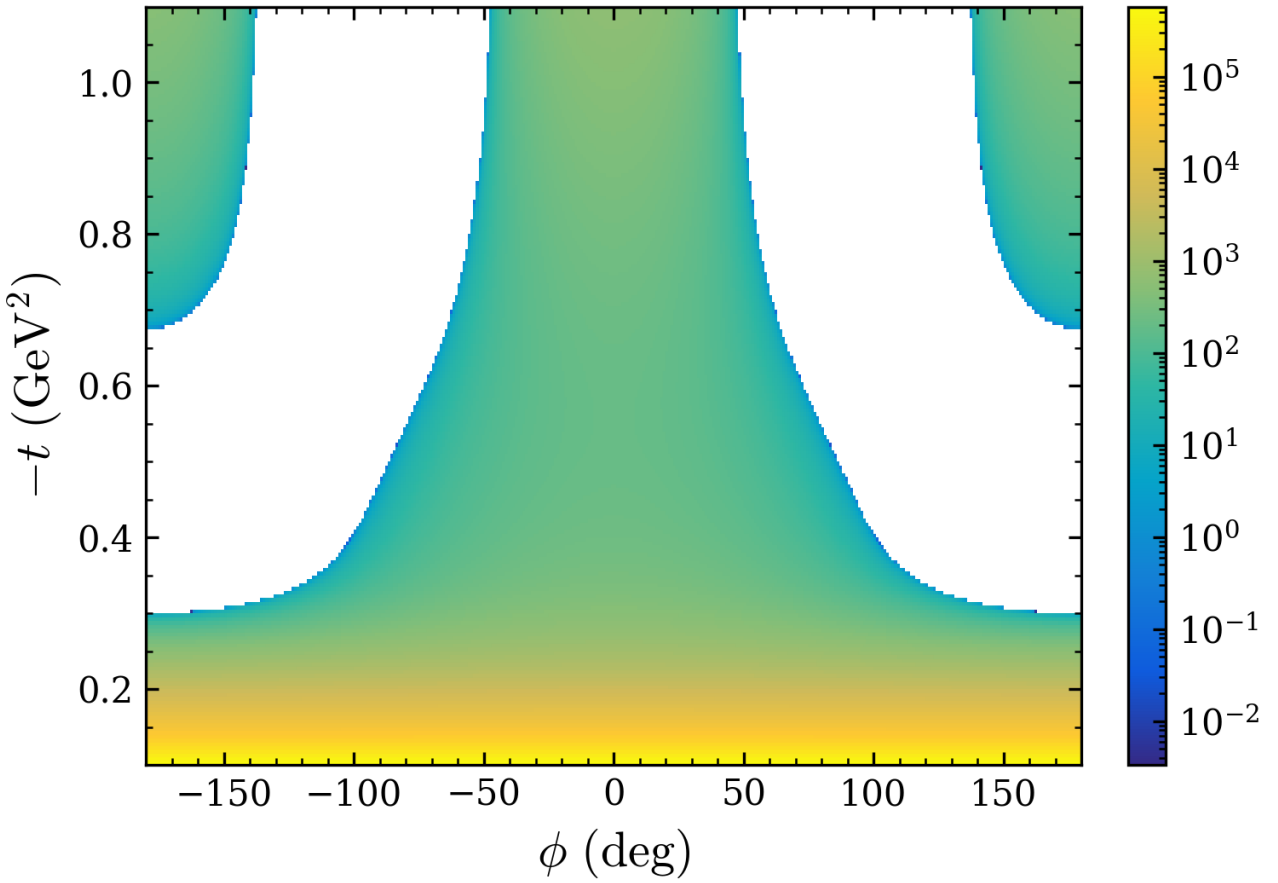
t vs ϕ distribution $Q^2 = 3.0, W = 3.14, high\ \epsilon$



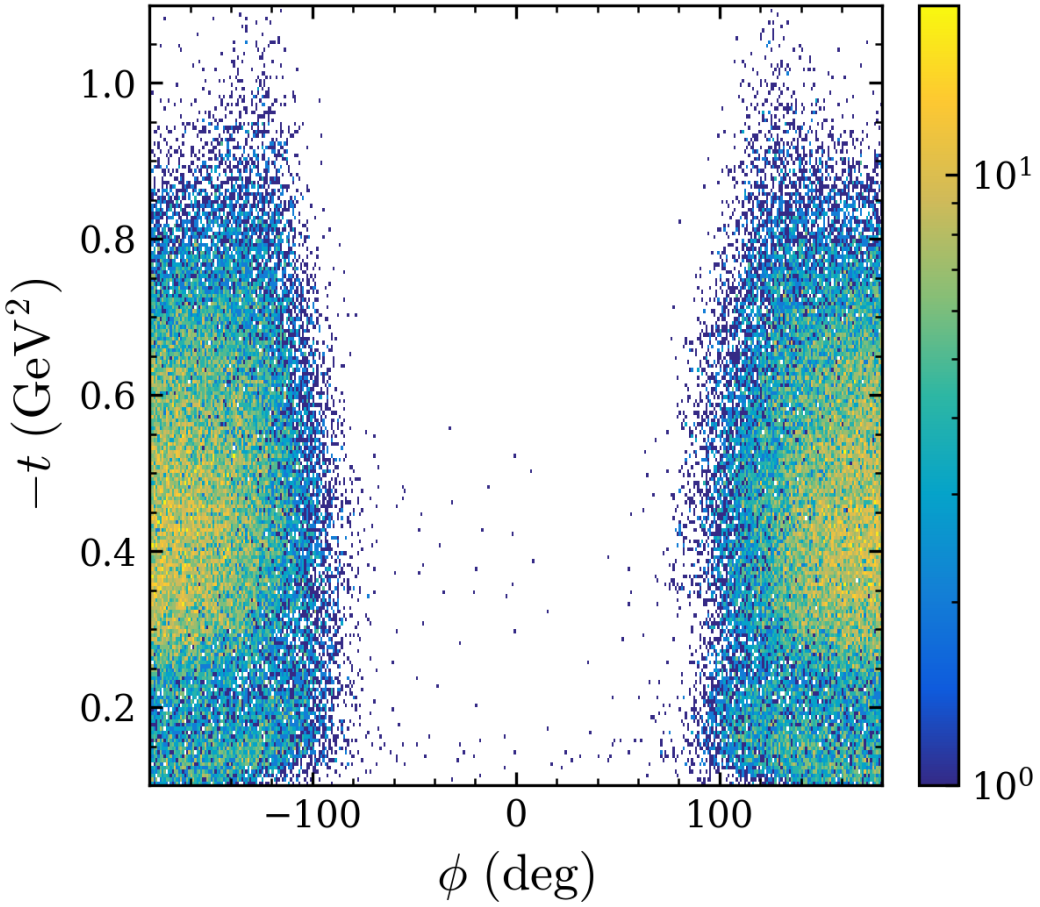
- Only Left gives negative xsect.

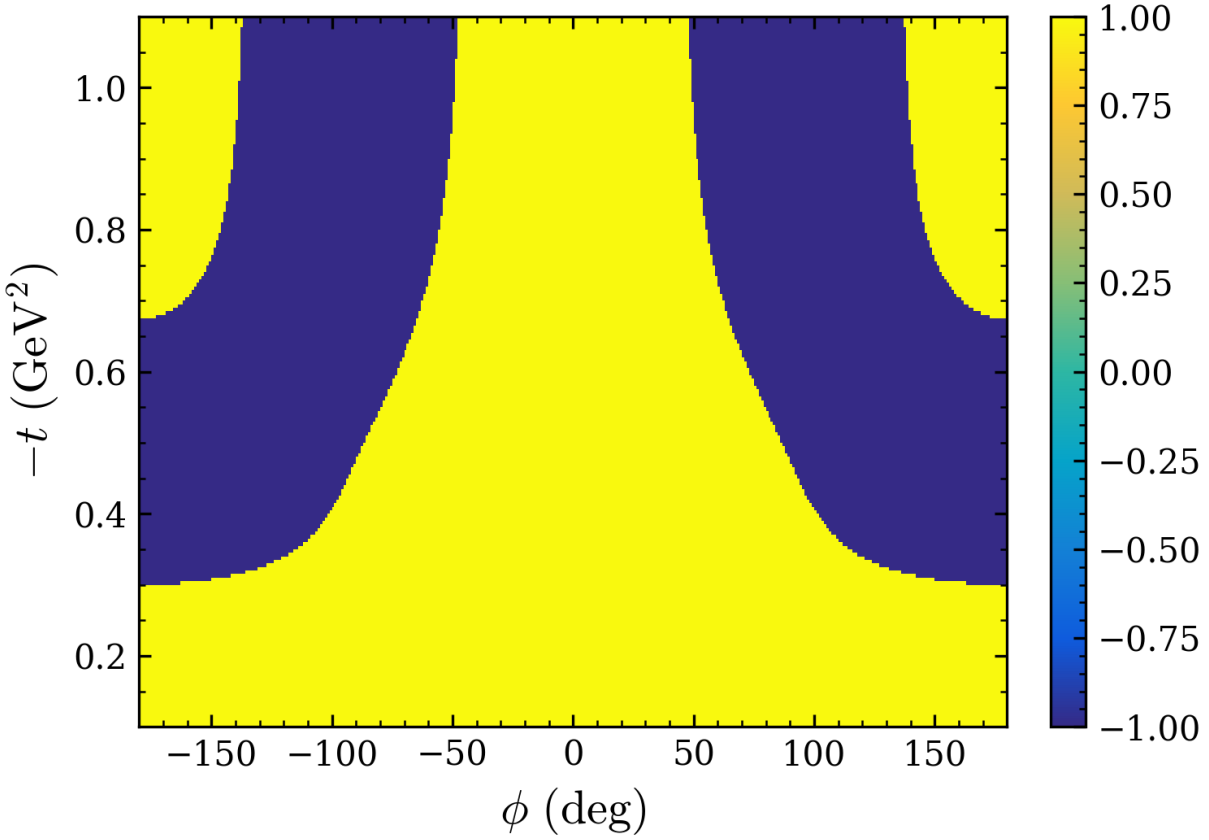
Xsect values





Xsect values





- Need to modify the parameters in phi-dependent terms to make xsect positive
- Everywhere ?

Parameterization

$$\sigma_L = \frac{p_1|t|}{(|t| + m_K^2)^2} \exp(-p_2|t|)$$

$$\sigma_T = \frac{p_5}{|t|^{p_6}} \exp(-|p_7 t|)$$

$$\sigma_{LT} = \frac{p_9}{|t|}$$

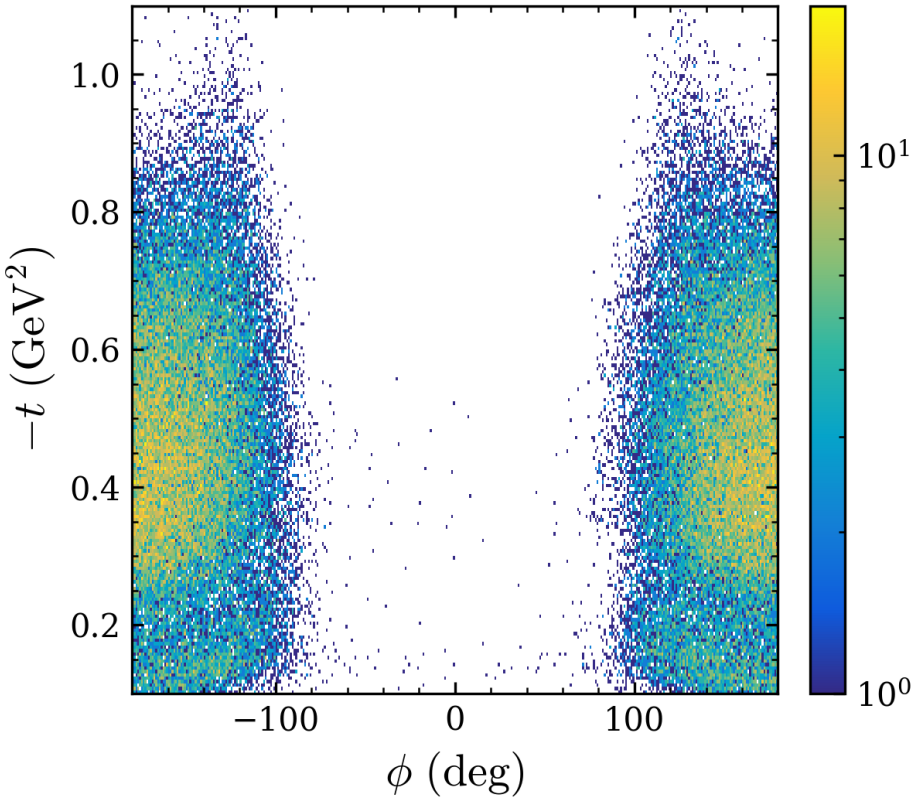
$$\sigma_{TT} = \frac{p_{13}}{|t|^{p_{14}}} \exp(-|p_{15} t|)$$

1	4.34253e+01
2	1.45694e+00
3	0.00000e+00
4	0.00000e+00
5	1.98779e-02
6	7.34330e+00
7	6.19457e-12
8	-5.26738e-01
9	3.23135e+01
10	0.00000e+00
11	-1.85133e+02
12	0.00000e+00
13	3.75752e+02
14	-3.52052e+00
15	6.12463e-18
16	1.85370e-08

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

- w factor always positive.

Parameterization



- $\cos(\pm 160^\circ) \approx -0.93$
- $\cos(\pm 320^\circ) \approx 0.76$
- Let's just decrease p9 so all are +ve

$$\sigma_L = \frac{p_1|t|}{(|t| + m_K^2)^2} \exp(-p_2|t|)$$

$$\sigma_T = \frac{p_5}{|t|^{p_6}} \exp(-|p_7 t|)$$

$$\sigma_{LT} = \frac{p_9}{|t|}$$

$$\sigma_{TT} = \frac{p_{13}}{|t|^{p_{14}}} \exp(-|p_{15} t|)$$

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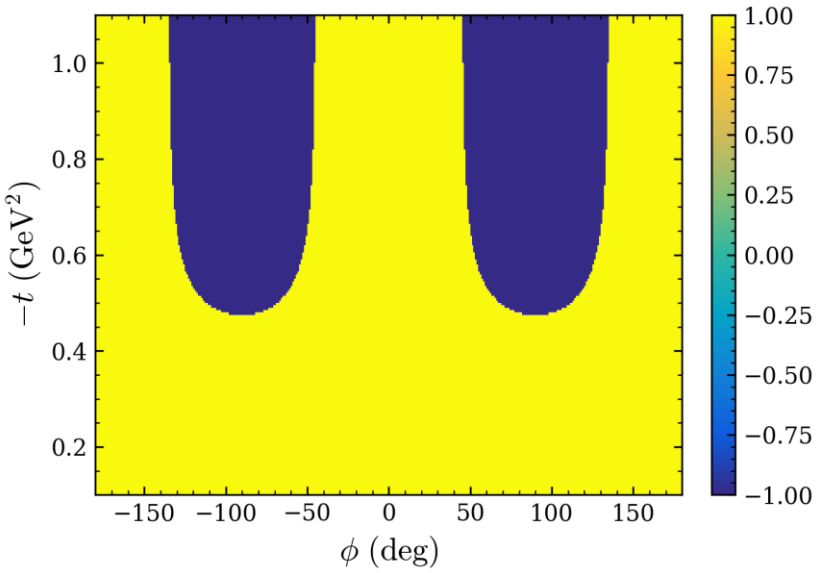
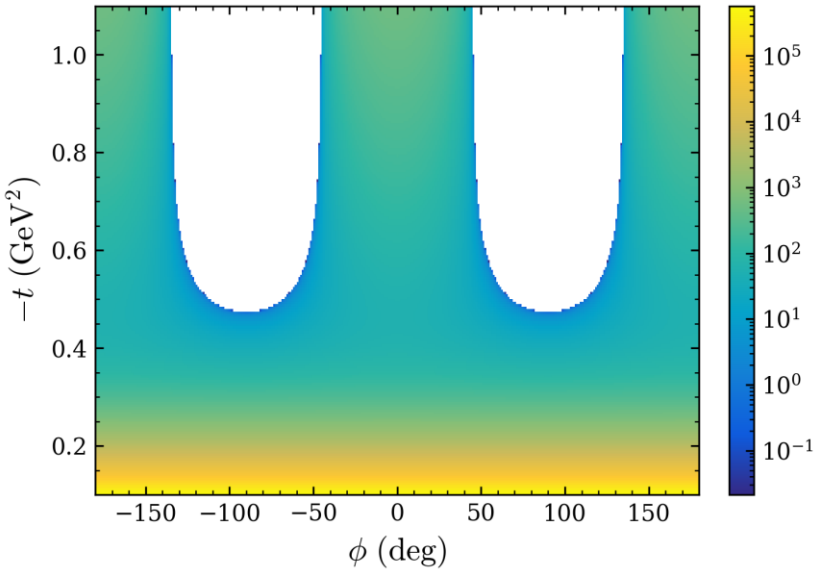
$$2\pi \frac{d\sigma}{dtd\phi} = \varepsilon \frac{d\sigma_L}{dt} + \frac{d\sigma_T}{dt} + \sqrt{2\varepsilon(\varepsilon+1)} \frac{d\sigma_{LT}}{dt} \cos\phi + \varepsilon \frac{d\sigma_{TT}}{dt} \cos 2\phi$$

Total (sign)

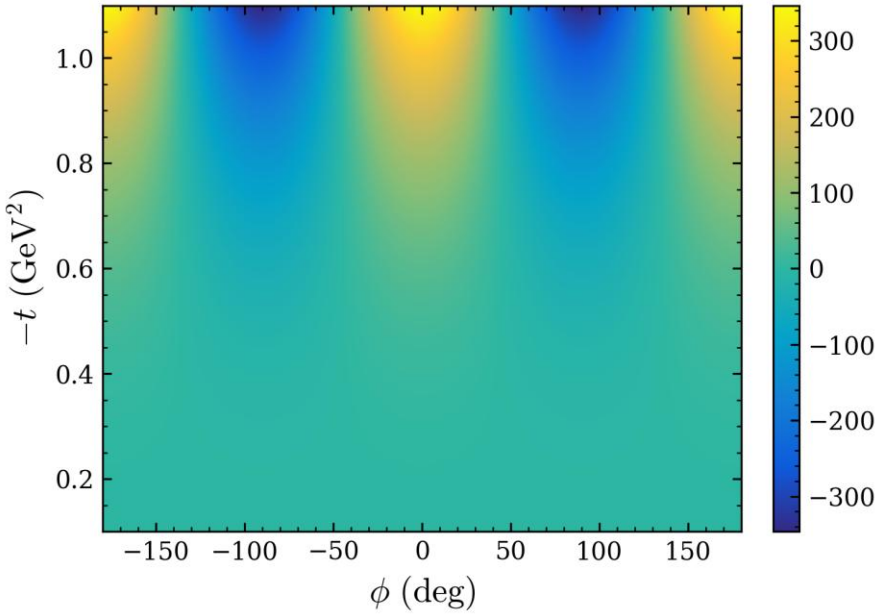


- $32.3 \rightarrow 0.0$
- Negative region in large |t|
- Right and center settings
- Need everywhere +ve ?

Total



TT term



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9	0.00000e+00
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12	0.00000e+00
13	3.75752e+02
14	-3.52052e+00
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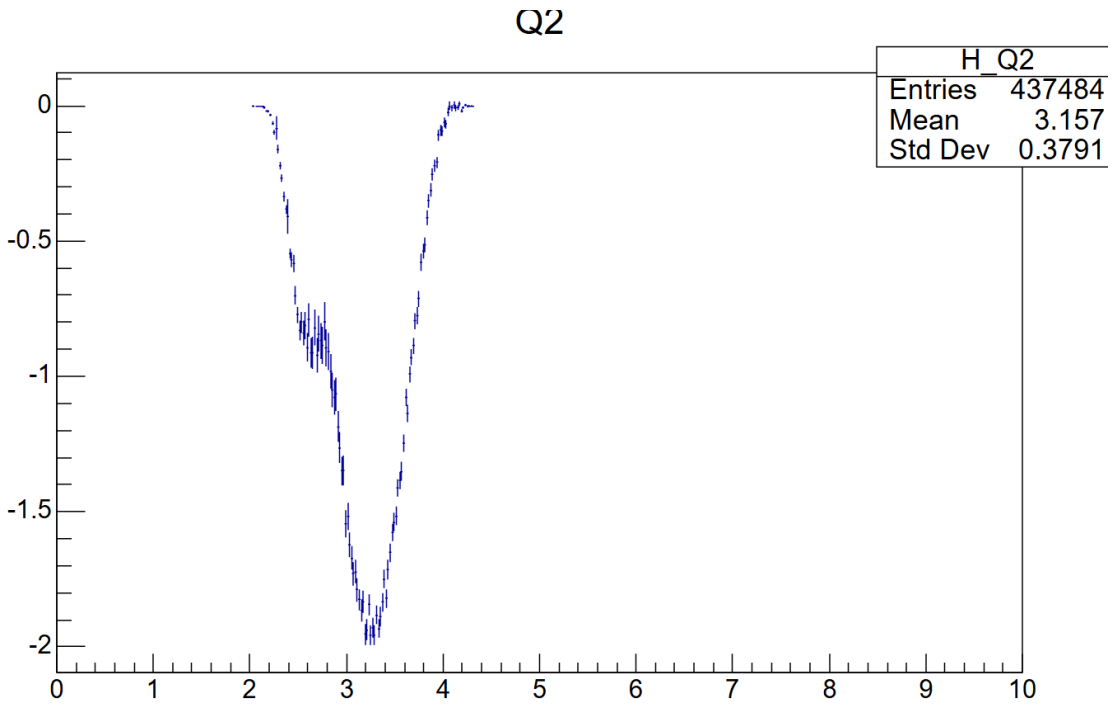
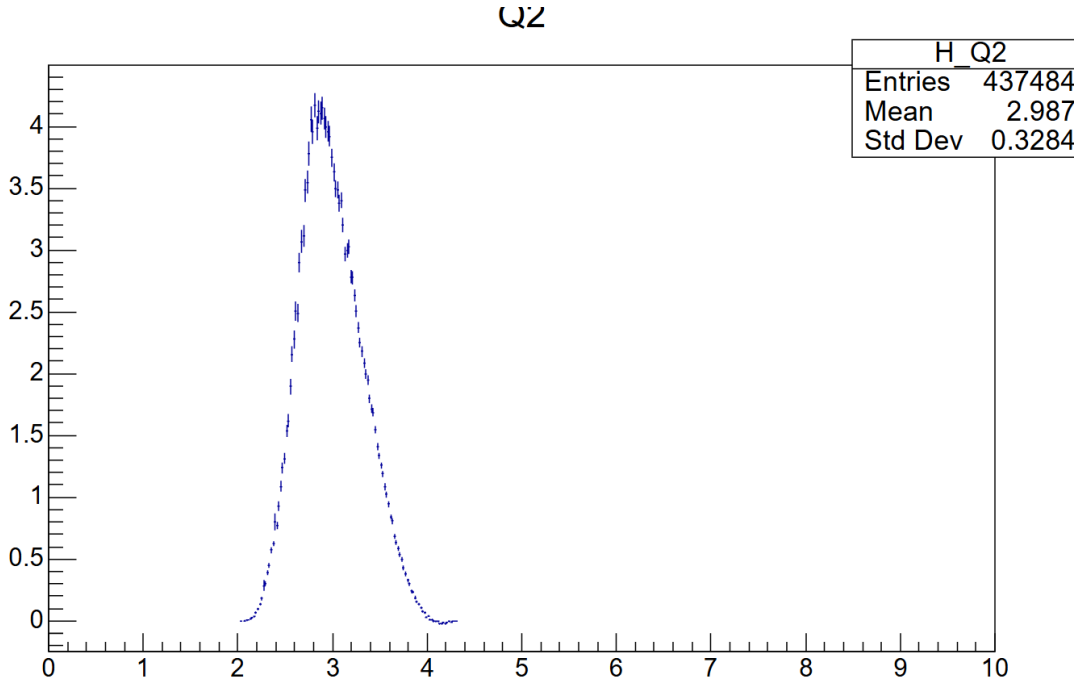
before



after



Next

- Done : “Optimal” binning by simply making sure each bin has a minimum counts
- Yield as a function of t/\phi for both data and simc
- Check ratio for the 0-th iteration