KaonLT Meeting

July 10th, 2025

Richard L. Trotta

Constants:

$$\pi, \quad m_{\text{tar}} = 0.93827231, \quad m_{\pi+} = 0.139570, \quad m_{K+} = 0.493677$$

$$t_{\text{av}} = \left(0.05032 + 0.01345 \ln Q^2_{\text{set}}\right) Q^2_{\text{set}},$$

$$f_{\text{tav}} = \frac{|t| - t_{\text{av}}}{t_{\text{av}}},$$

$$f_t = \frac{|t|}{\left(|t| + m^2_{K+}\right)^2},$$

$$\sigma_L = \left(p_1 f_t\right) \exp\left(-|p_2 t|\right),$$

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

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

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

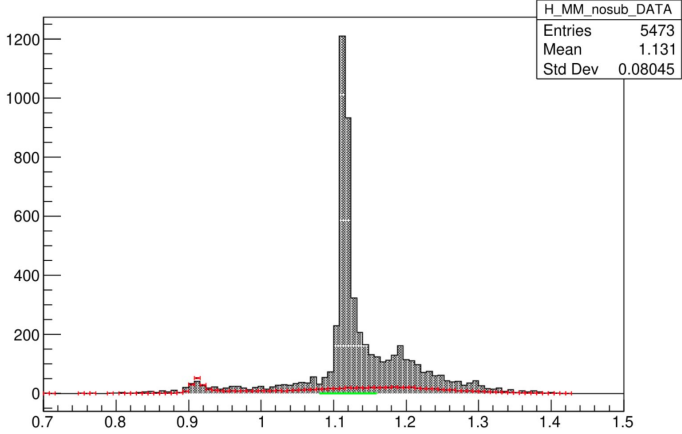
$$w_{\text{factor}} = \frac{1}{\left(W^2 - m^2_{\text{tar}}\right)^{0.85 W^2_{\text{set}} - 5.97 W_{\text{set}} + 12.68}}.$$

- Using same parameterization for all
  - Parameterization from 15 iterations shown 6/26/25 (all φ settings)
- All data shown is just **CENTER**

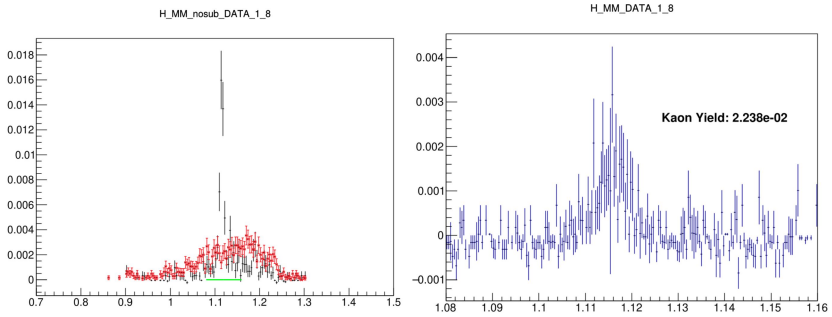
Improvements

- Adjusted pion background subtraction for **ALL** t-ϕ bin
  - Improved how pion peak was scaled to kaon data

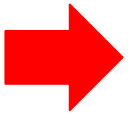
```
kaon_amp = integrate_hist_range(
    hist_bin_dict[f"H_MM_nosub_DATA_{j}_{k}"],
    pi_mm_min, pi_mm_max
)

pion_background_amp = integrate_hist_range(
    subDict[f"H_MM_nosub_SUB_DATA_{j}_{k}"],
    pi_mm_min, pi_mm_max
)
scale_factor = (kaon_amp / pion_background_amp) * 0.85
```

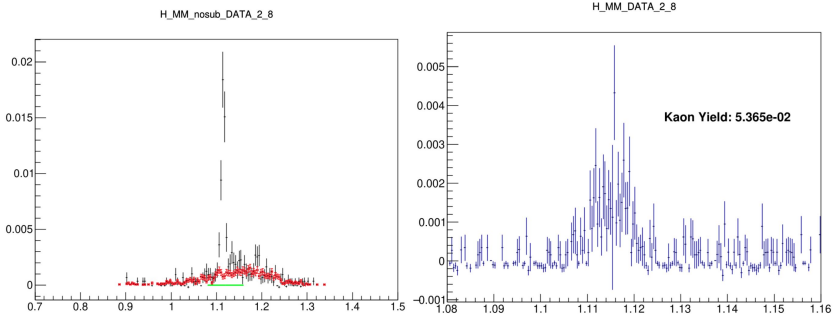


Center Low



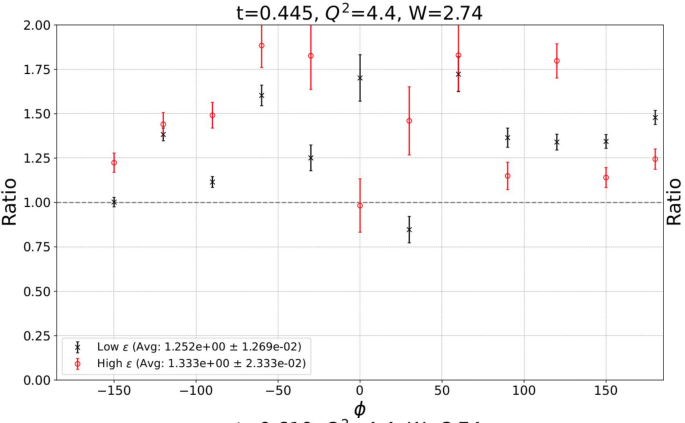
Before

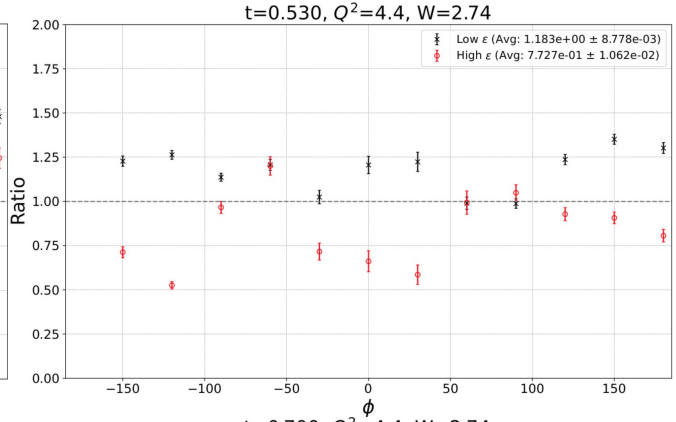


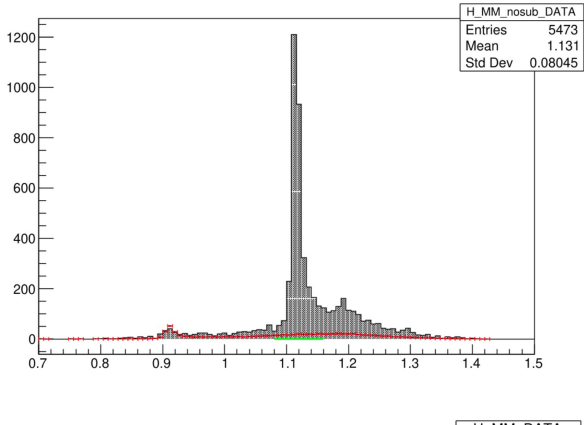


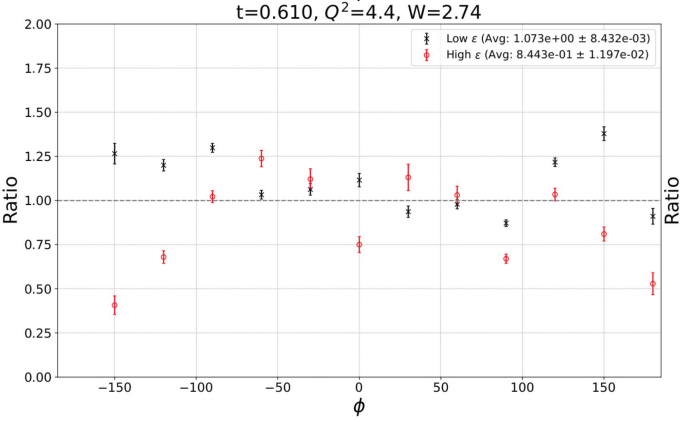
After

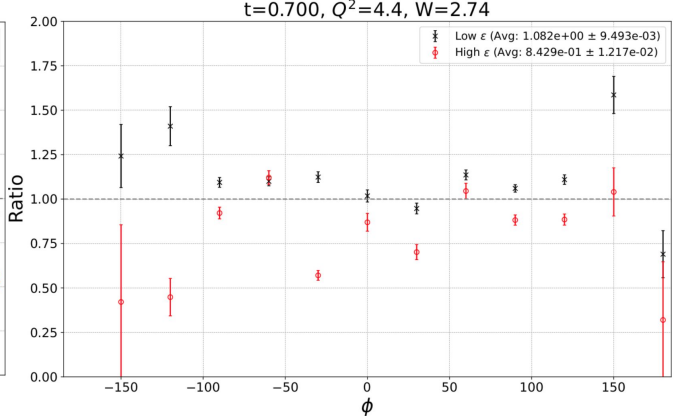
Q^2=4.4, W=2.74 | 1.08 ≤ M_K ≤ 1.16, 0.88 ≤ M_π ≤ 0.94

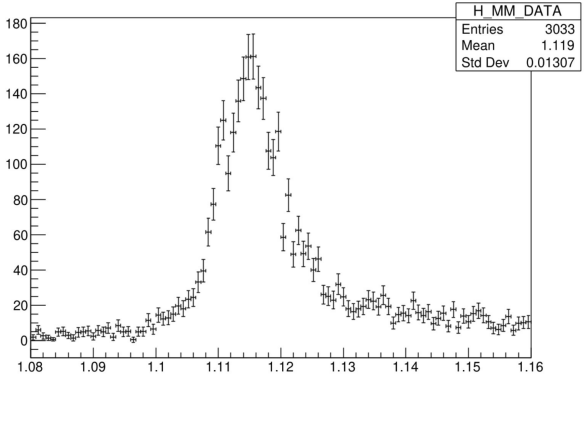




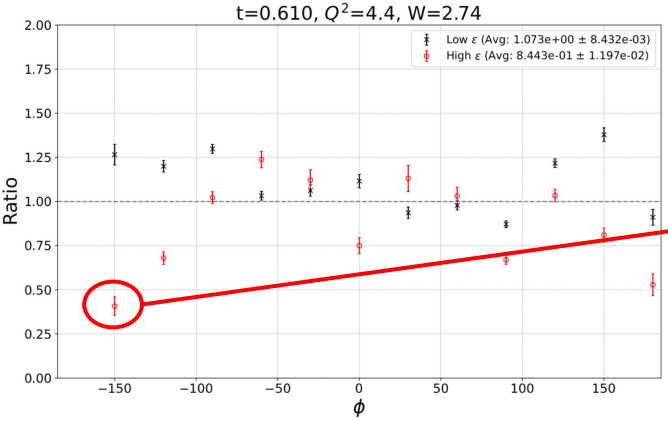


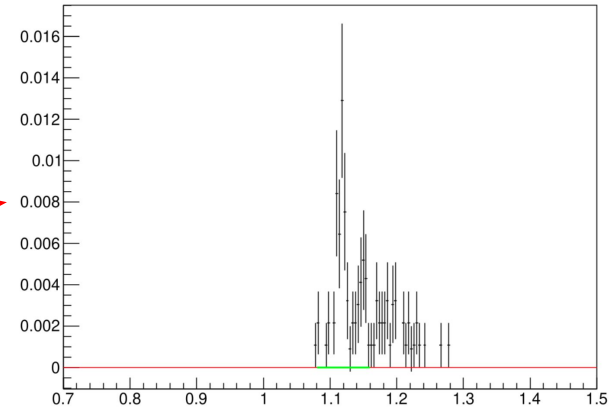




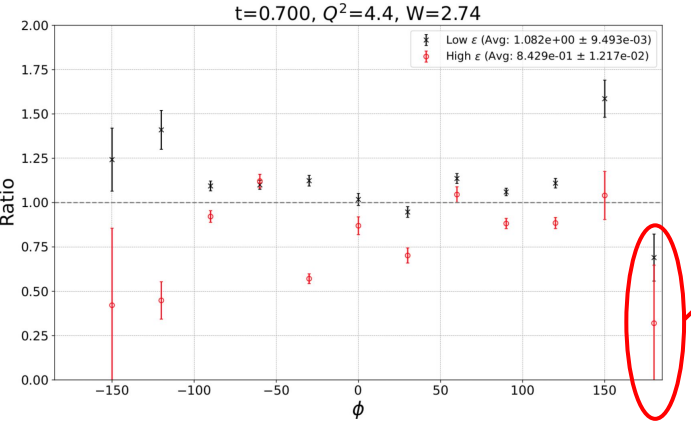


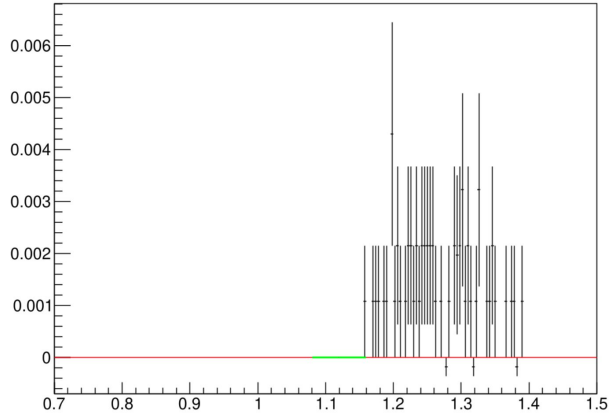
Q^2=4.4, W=2.74 | 1.08 ≤ M_K ≤ 1.16, 0.88 ≤ M_π ≤ 0.94





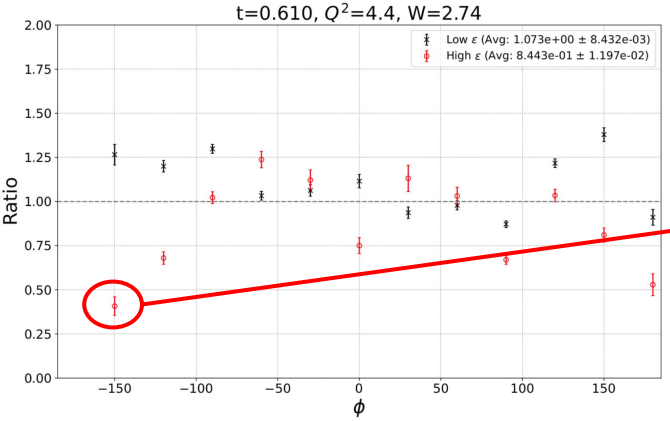
- Λ peak sitting on background
  - No π peak to fit

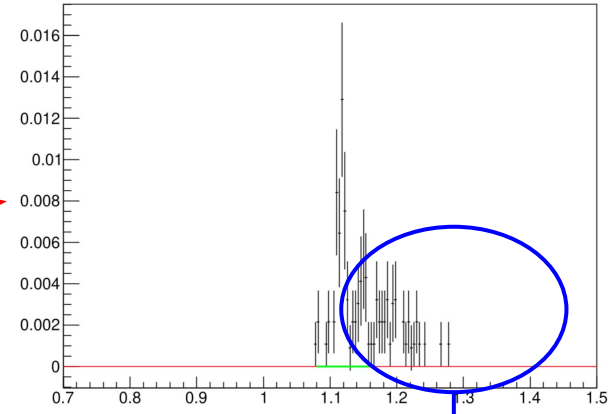




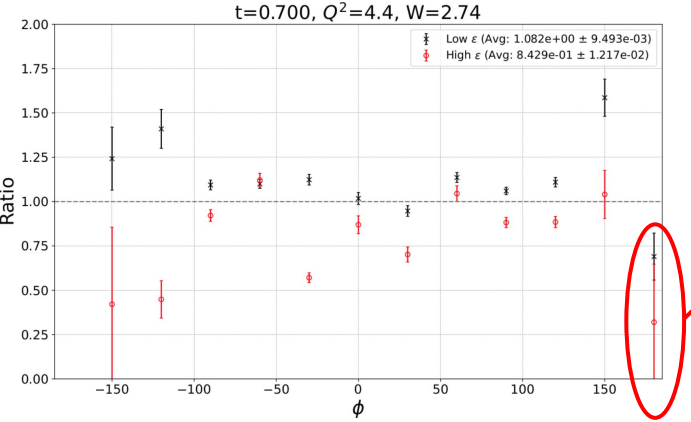
No visible Λ peak

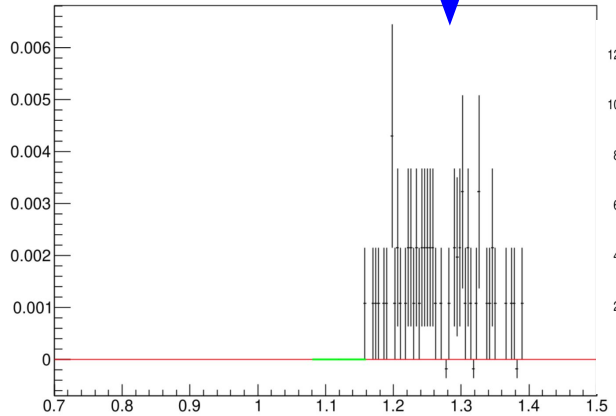
Q^2=4.4, W=2.74 | 1.08 ≤ M_K ≤ 1.16, 0.88 ≤ M_π ≤ 0.94

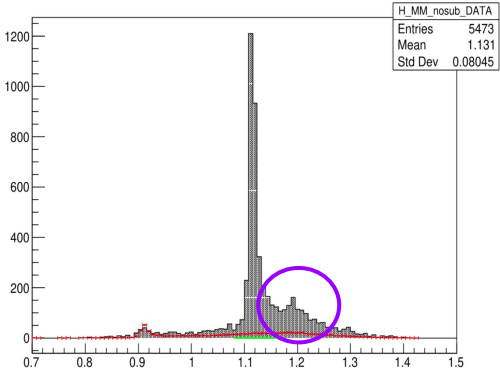




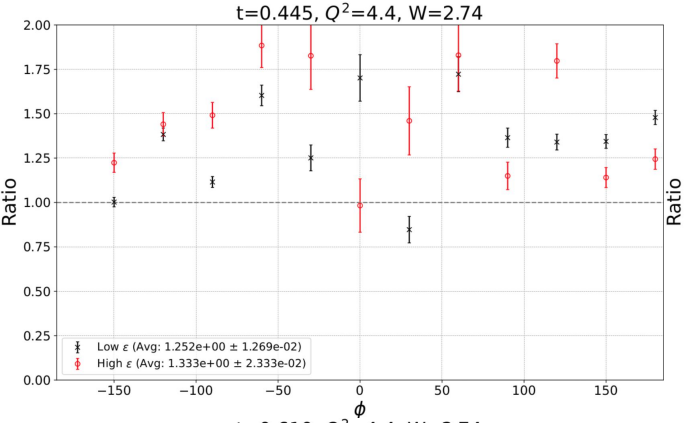
- Backgrounds similar in mass range and magnitude
- Either due to…
  - Σ
  - SIDIS

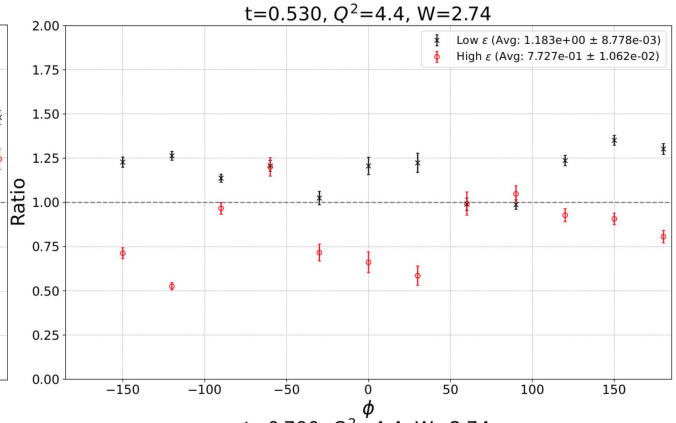


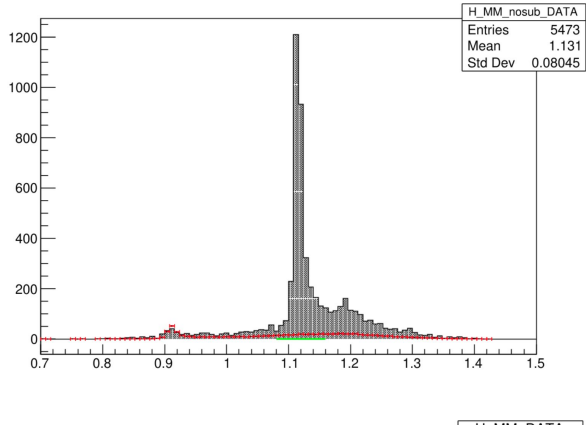


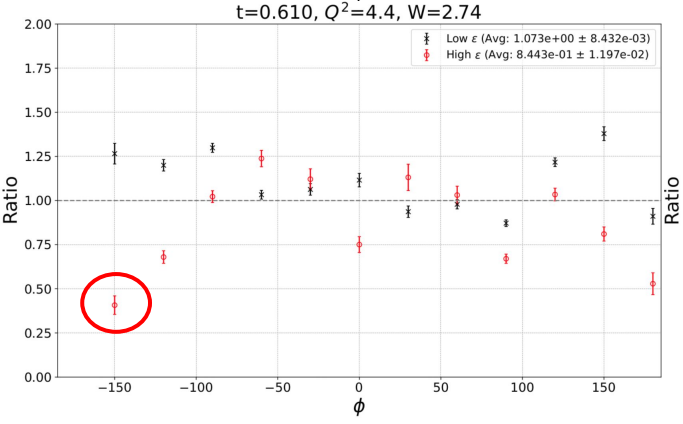


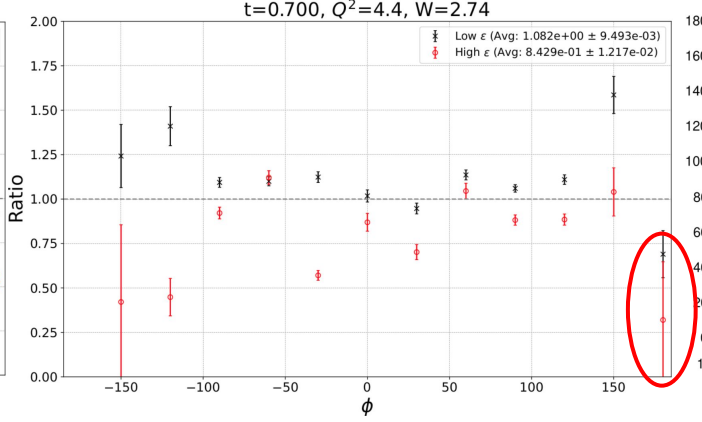
Q^2=4.4, W=2.74 | 1.08 ≤ M_K ≤ 1.16, 0.88 ≤ M_π ≤ 0.94

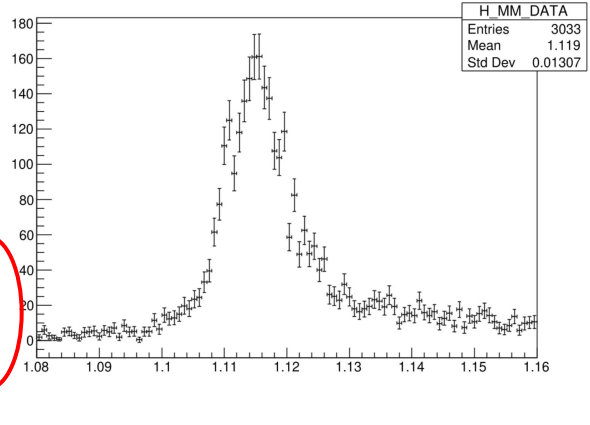




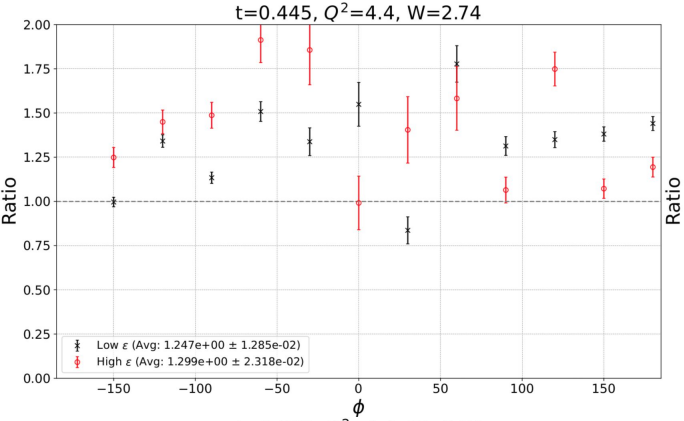


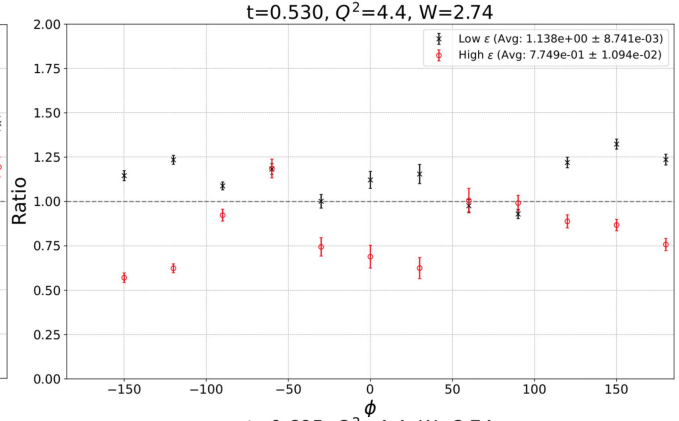


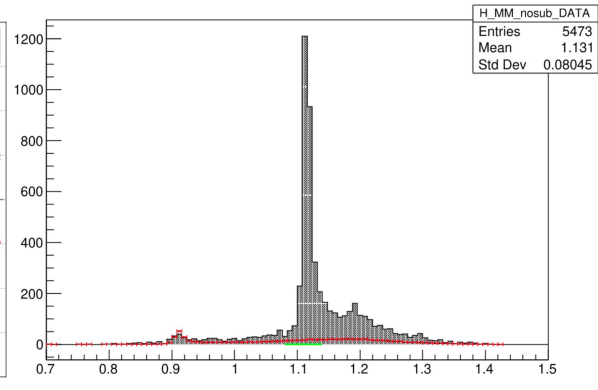


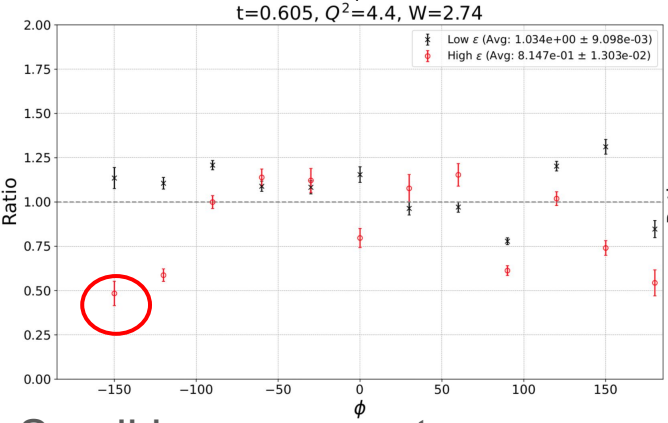


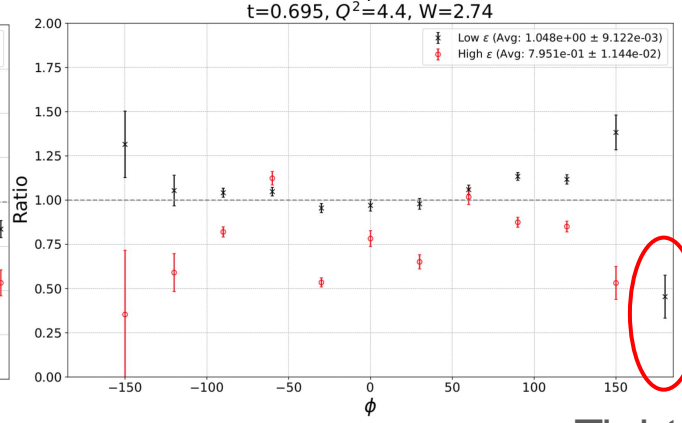
Q^2=4.4, W=2.74 | 1.08 ≤ M_K ≤ 1.14, 0.88 ≤ M_π ≤ 0.94

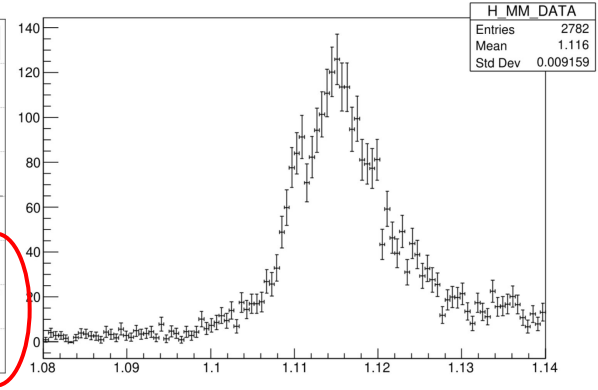








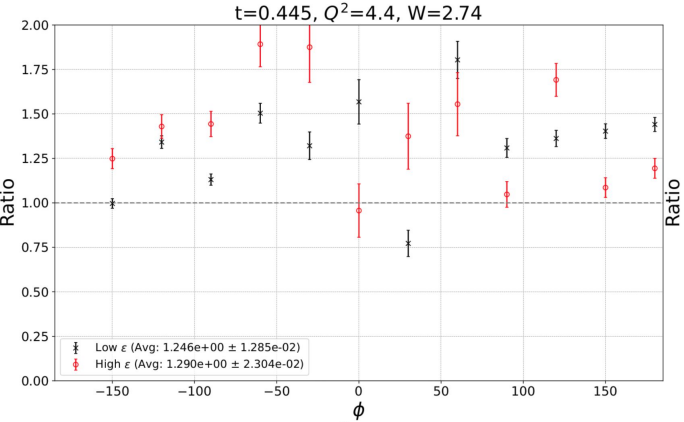


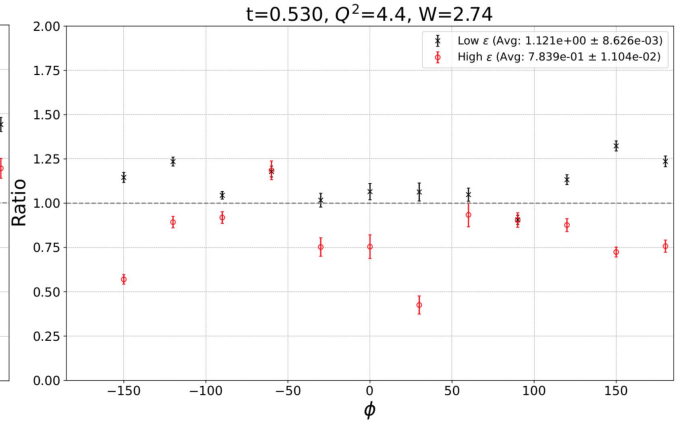


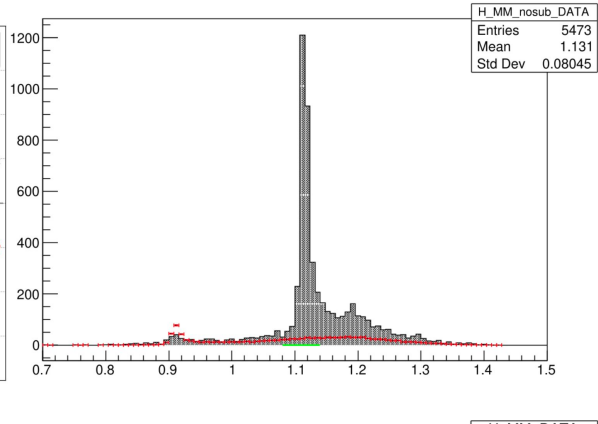
Small improvement

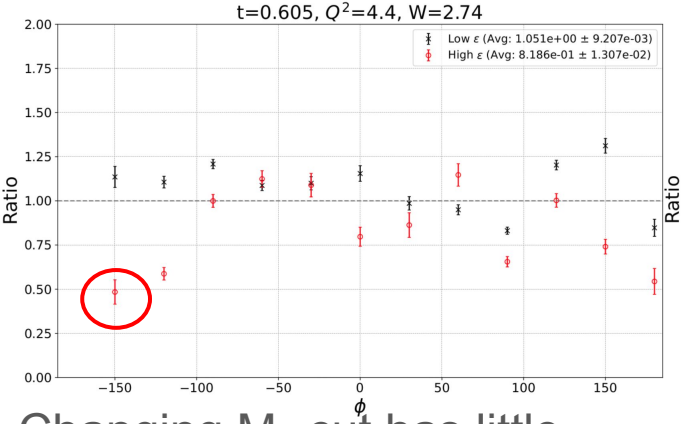
Tighter M_K cut removes background, point now zero

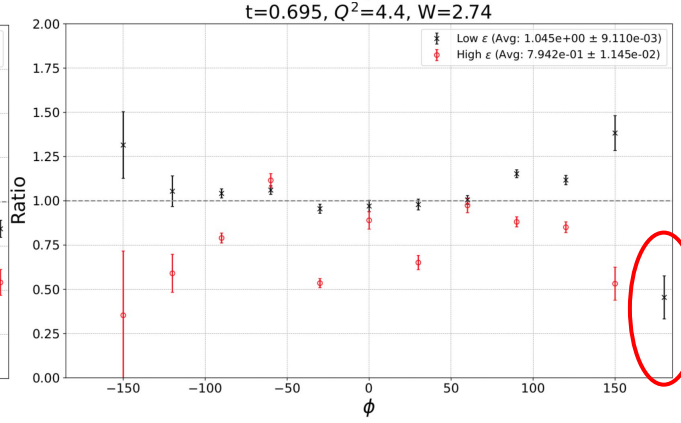
Q^2=4.4, W=2.74 | 1.08 ≤ M_K ≤ 1.14, 0.91 ≤ M_π ≤ 0.98 Vijay's cut

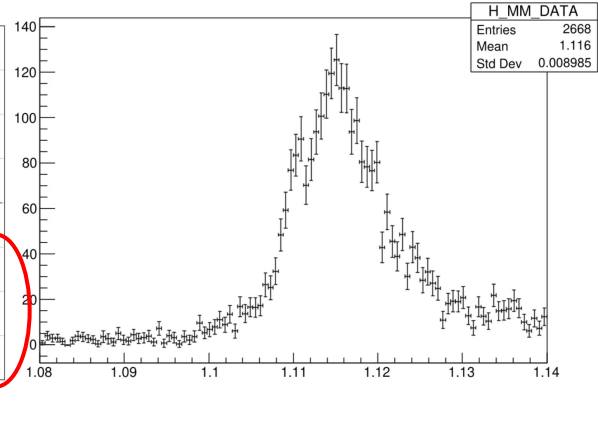






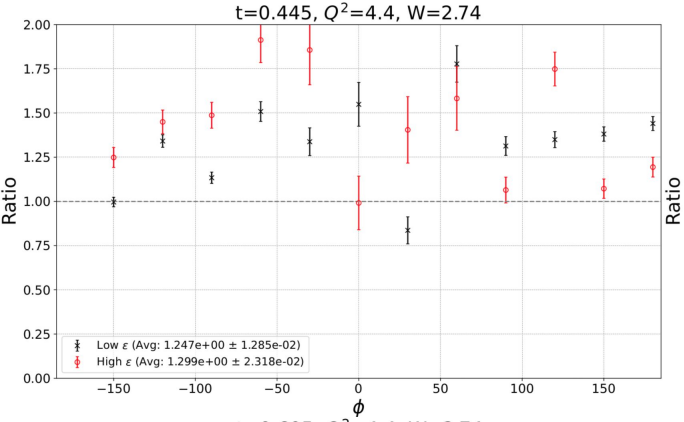


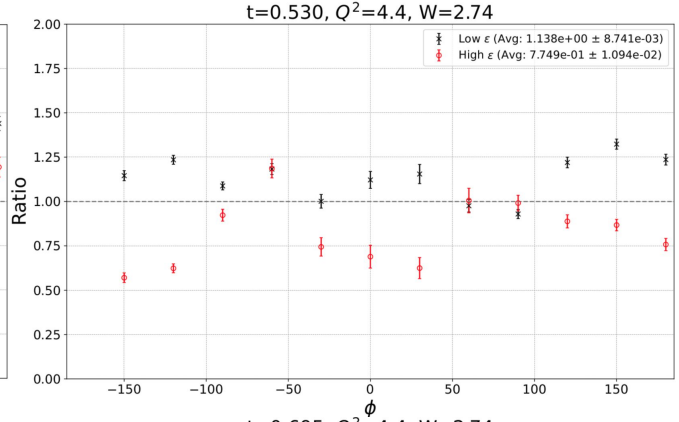


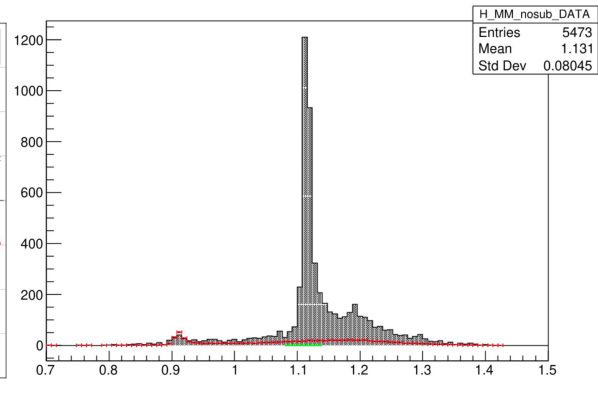


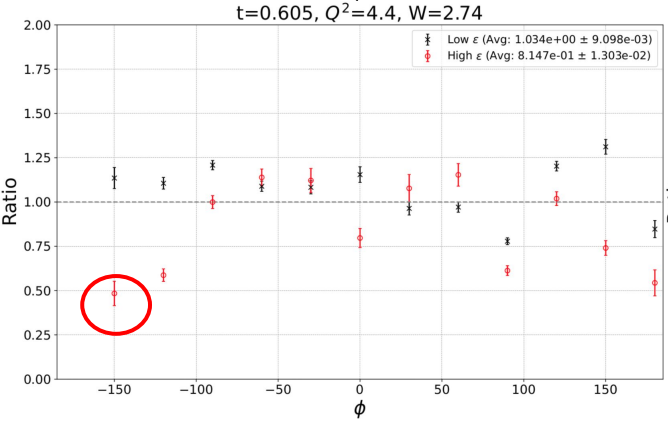
Changing M_π cut has little effect, as expected

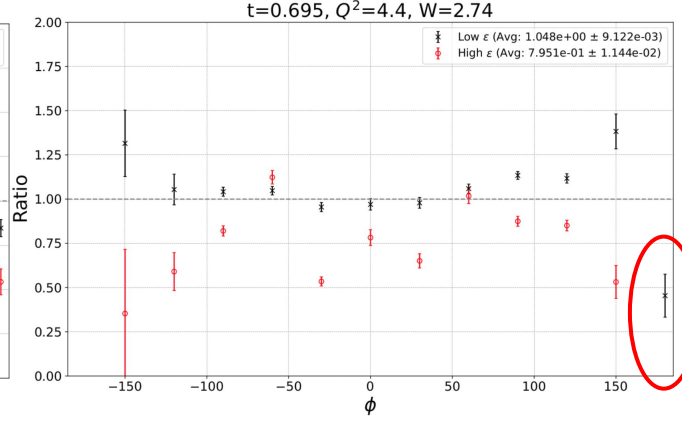
Q^2=4.4, W=2.74 | 1.08 ≤ M_K ≤ 1.14, 0.88 ≤ M_π ≤ 0.94

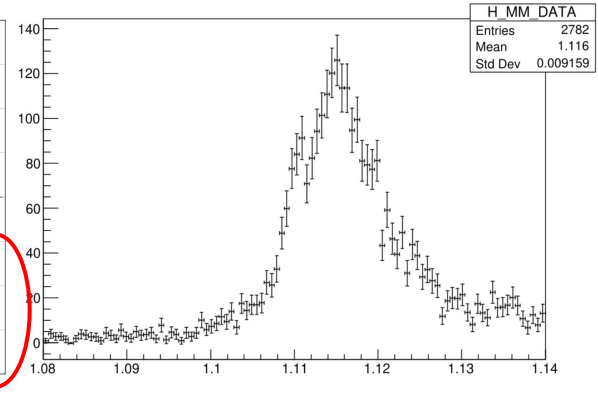




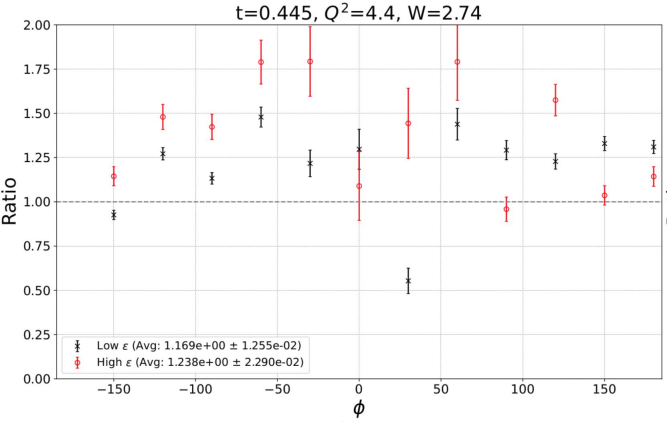


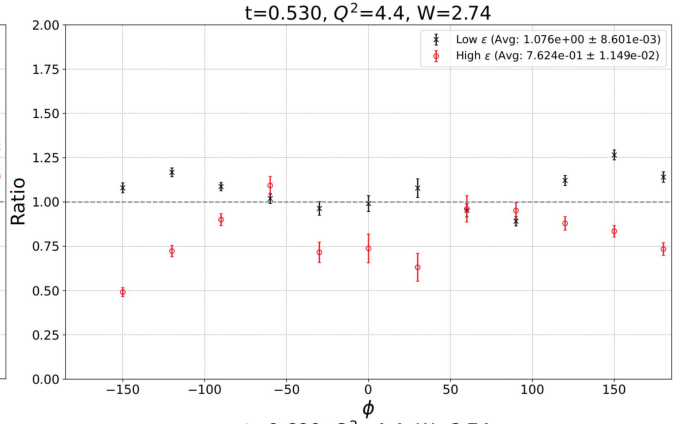


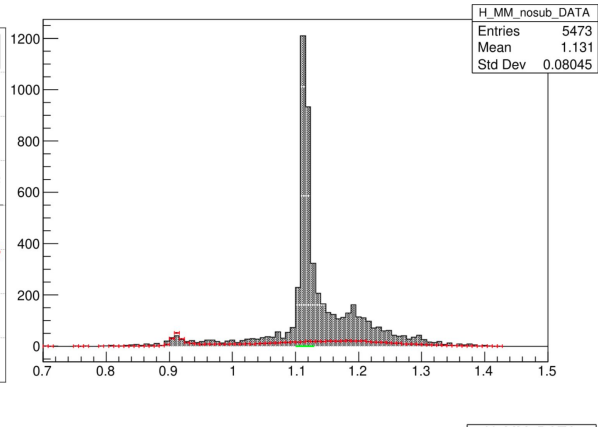


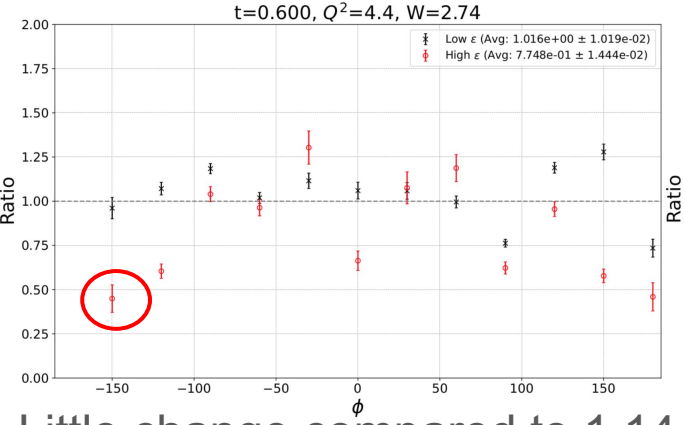


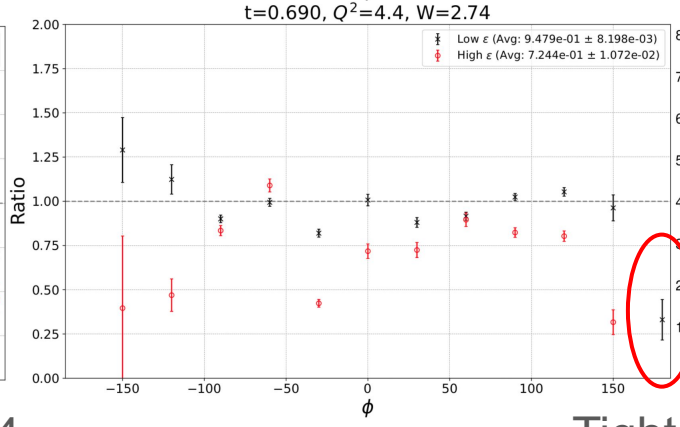
Q^2=4.4, W=2.74 | 1.10 ≤ M_K ≤ 1.13, 0.88 ≤ M_π ≤ 0.94

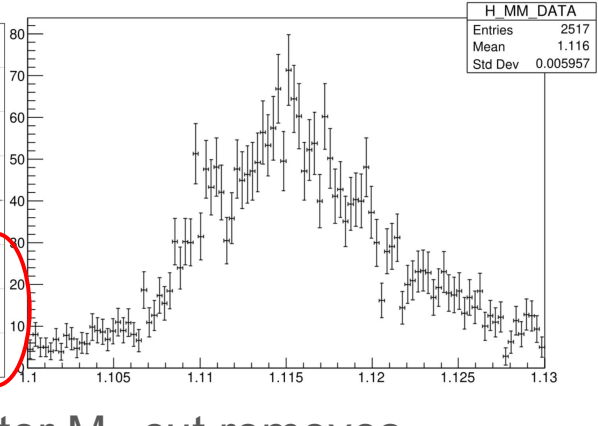












Little change compared to 1.14

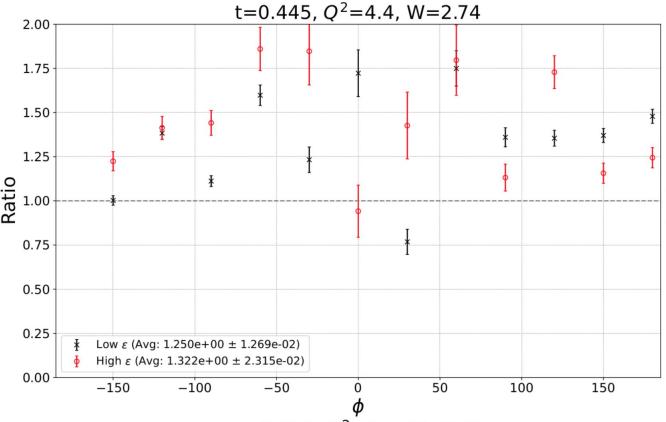
Tighter M_K cut removes background, point now zero

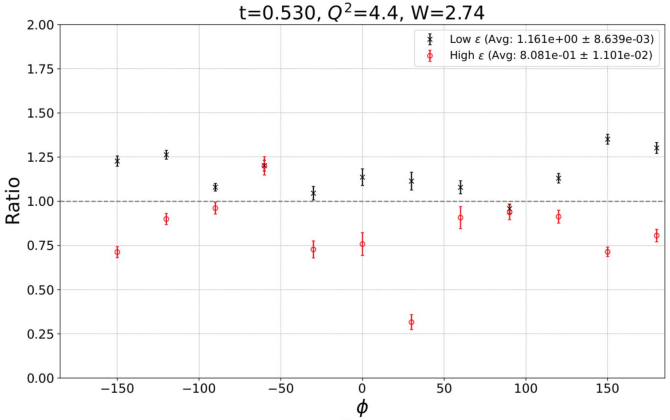
Final Comments

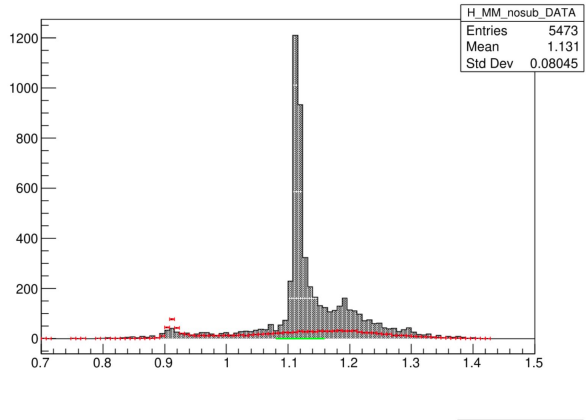
- New M_K (1.14) cut seem to have improvement, but the more extreme (1.13) cut may be cutting too much in Λ tail
- Adjusting M_π cuts has little effect overall, possibly even makes things worse depending on cut
- Outstanding issue
  - How to deal with remaining background in some bins?
    - Σ and π-SIDIS
- Possible solutions
  - Σ fit to remove background, has this been done by Peter or someone?
  - π-SIDIS background fit?
  - Improve HGCer geometric cut
    - In particular, high ε (E = 10.6 GeV)

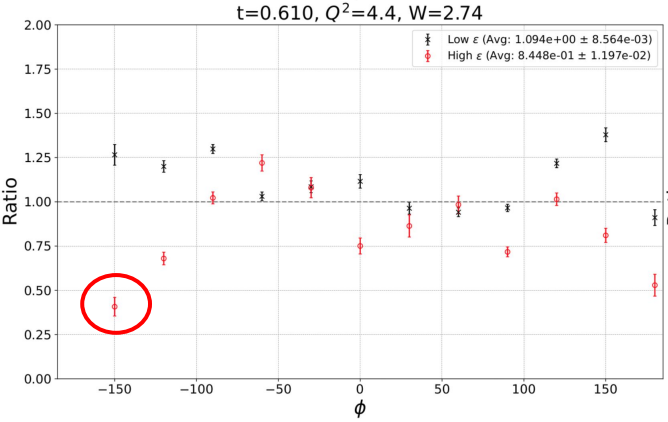
Extra

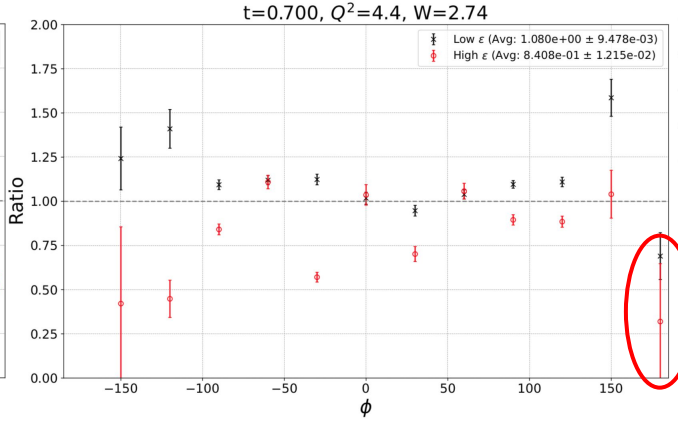
Q^2=4.4, W=2.74 | 1.08 ≤ M_K ≤ 1.16, 0.91 ≤ M_π ≤ 0.98

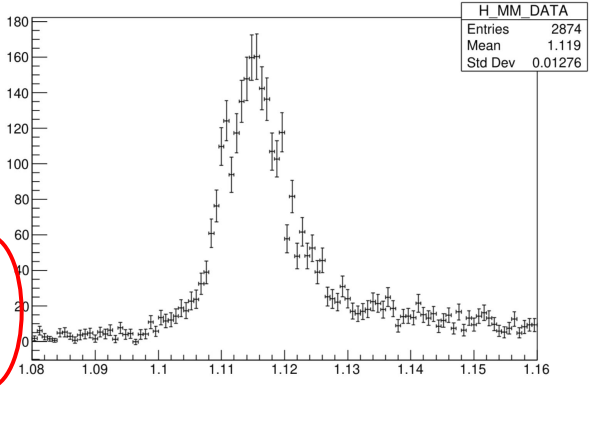












Q^2=4.4, W=2.74 | 1.10 ≤ M_K ≤ 1.13, 0.91 ≤ M_π ≤ 0.98