KaonLT Meeting

December 4-5th, 2025

Richard L. Trotta

Constants:

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

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

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

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

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

$$\sigma_T = p_5 \exp\left(-|p_6 t|\right),$$

$$\sigma_{LT} = p_9 \exp\left(-|p_{10} t|\right) \sin^2\theta,$$

$$\sigma_{TT} = p_{13} \exp\left(-|p_{14} t|\right) \sin^2\theta,$$

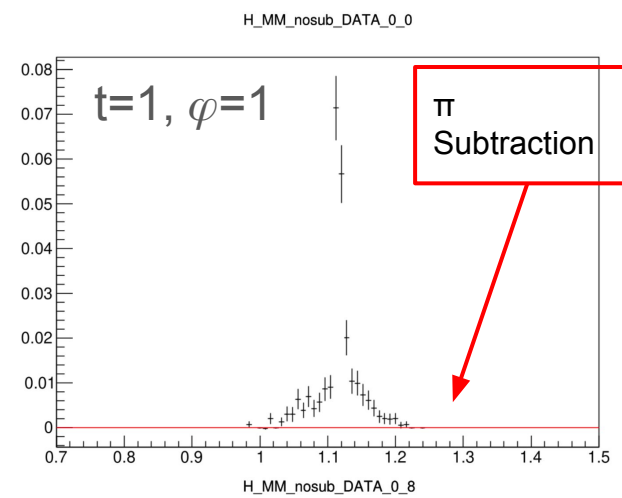
$$w_{\text{factor}} = \frac{1}{\left(W^2_{\text{set}} - M^2_{\text{tar}}\right)^{\left(0.85 W^2_{\text{set}} - 5.97 W_{\text{set}} + 12.68\right)}},$$

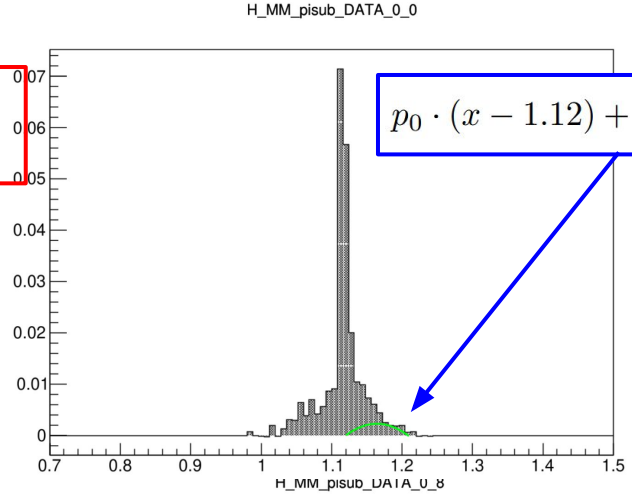
Data has pion subtraction and empirical fit

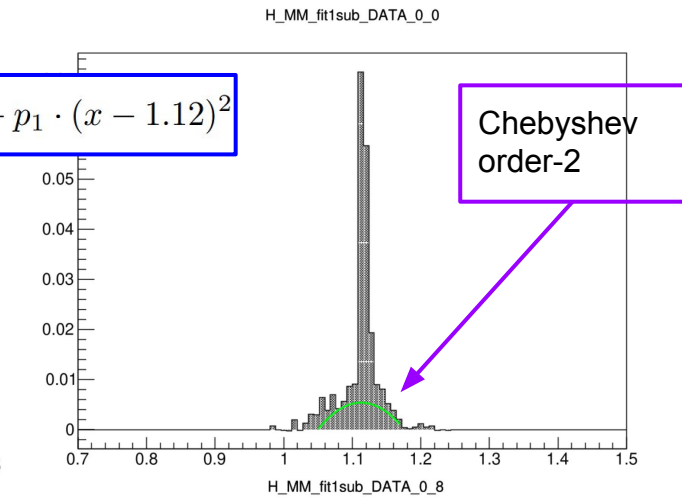
- No Σ fit

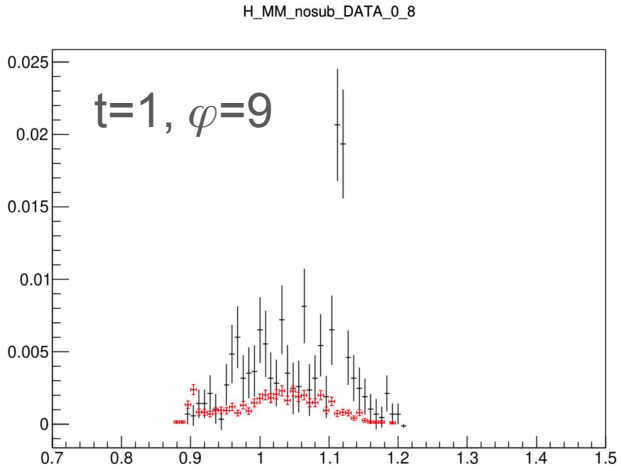
Empirical Fits

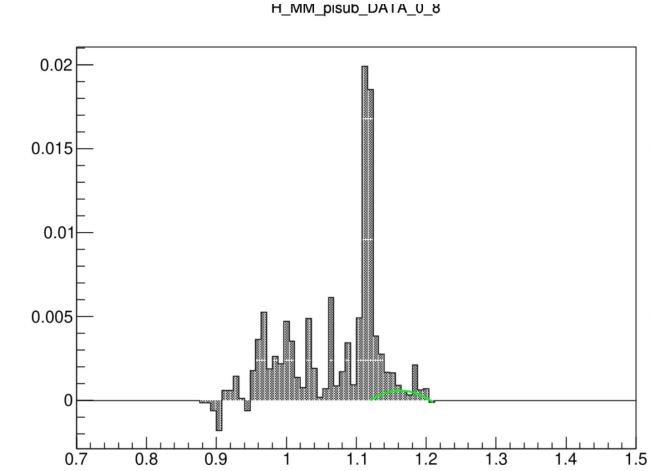
Q^2=3.0, W=2.32, Center Low Epsilon

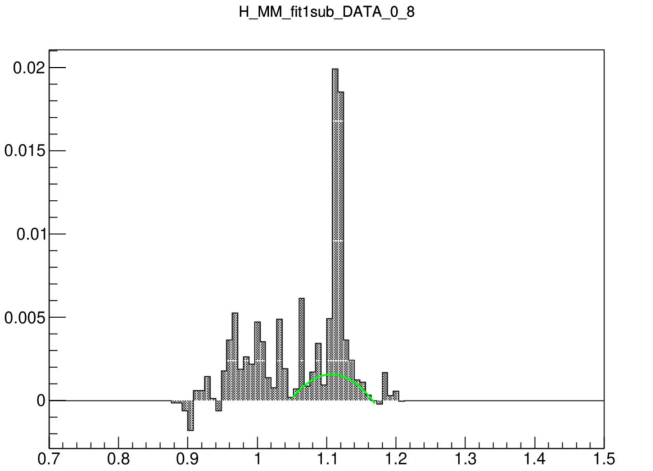












Empirical Fit Error Calculation (1)

- Define the (normalized) background yield in the analysis window

$$N_{\mathrm{bg}}^{\mathrm{norm}}(\mathbf{p}) = \sum_{i \in [M_{\mathrm{min}}, M_{\mathrm{max}}]} \max\left(0,\ \frac{1}{\Delta M_{\mathrm{ref}}} \int_{M_i}^{M_{i+1}} B(M;\mathbf{p})\, dM\right)$$

- Propagate the fit uncertainty to the integrated background using the full covariance

$$\sigma^2\left(N_{\mathrm{bg}}^{\mathrm{norm}}\right) = \nabla N^T\, C\, \nabla N, \qquad (\nabla N)_k = \frac{\partial N_{\mathrm{bg}}^{\mathrm{norm}}}{\partial p_k}$$

- If C is unavailable/invalid, fall back to a diagonal approximation
- Evaluate numerically via central differences

$$\frac{\partial N_{\mathrm{bg}}^{\mathrm{norm}}}{\partial p_k} \approx \frac{N_{\mathrm{bg}}^{\mathrm{norm}}(p_k + \delta p_k) - N_{\mathrm{bg}}^{\mathrm{norm}}(p_k - \delta p_k)}{2\,\delta p_k}$$

- Convert the background-integral uncertainty into a fractional yield uncertainty

$$\left(\frac{\delta Y}{Y}\right)_{\mathrm{bg}} = \frac{\left|\sigma\left(N_{\mathrm{bg}}^{\mathrm{norm}}\right)\right|}{N_{\mathrm{sig}}^{\mathrm{norm}}}$$

Next Steps for Analysis

- Richard…
  - Q^2=3.0/W=2.32 [Needs refinement]
  - Q^2=4.4/W=2.74 [Needs refinement]
  - Q^2=5.5/W=3.02 **(Next up)**
- Kin…
  - Q^2=2.115/W=2.95
  - Q^2=3.0/W=3.14 (Kin's current focus)
- Refine model, last fit optimizations **(Late-November)**
  - Global fit for Q2=3.0(2.32), 4.4, 5.5
  - Once Kin finishes Q^2=3.0/W=3.14
    - He will do cross section checks/systematics on Q^2=3.0(2.32), 4.4, 5.5
  - While Kin does this…
    - Richard will focus will be on finishing fit algorithm studies+paper (Fpi1/2,Pion/KaonLT low Q^2)
- Final full replay and finalize systematics study **(Before Christmas)**
  - Sameer is finishing up cointime blocking correction
    - Once finished, we can begin full replay
  - When full replay is ready…
    - Richard can check Kin's systematics (consistency check)

EXTRA