BESIII Charm Meeting

Martin Tat
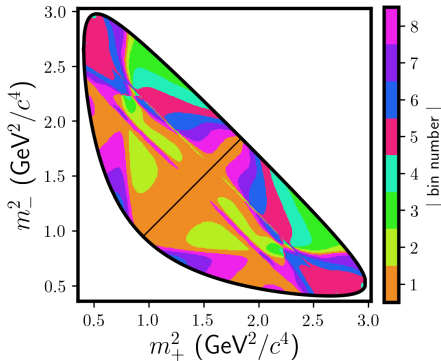
31st August 2021

Measurement of $\delta_D^{K\pi}$ with $D \to K_{S,L} \pi^+ \pi^-$ tags

- Measurement of <u>both</u> $r_D^{K\pi} \cos \delta_D^{K\pi}$ and $r_D^{K\pi} \sin \delta_D^{K\pi}$

- Equal-$\Delta \delta_D$ phase space binning

- Double tag yields taken from Phys. Rev. D **101** (2020)

- K_i, c_i, s_i re-determined without $D \to K^- \pi^+$ inputs

$D \to K^0_{S,L}\pi^+\pi^-$ inputs

$K^-\pi^+$ vs $K^0_{S,L}\pi^+\pi^-$ double tag yield prediction

$Y(K^-\pi^+|K^0_{S,L}\pi^+\pi^-)_i =$

$H^{(\prime)}\left(K_i^{(\prime)} + (r_D^{K\pi})^2 K_{-i}^{(\prime)} \mp 2r_D^{K\pi}\sqrt{K_i^{(\prime)}K_{-i}^{(\prime)}}\left[c_i^{(\prime)}\cos\delta_D^{K\pi} - s_i^{(\prime)}\sin\delta_D^{K\pi}\right]\right)$

- K_i: Flavour tag yields
  - $D \to K^0_{S,L}\pi^+\pi^-$ vs $D \to K^-\pi^+\pi^0$
  - $D \to K^0_{S,L}\pi^+\pi^-$ vs $D \to K^-\pi^+\pi^-\pi^+$
  - $D \to K^0_S\pi^+\pi^-$ vs $D \to K^-e^+\nu_e$
  - Updated coherence factors from J. High Energ. Phys. **2021**, 164

- c_i and s_i: Amplitude-averaged strong phases
  - CP tags
  - No $D \to K^-\pi^+$ inputs

Fit setup and results

- Minimize $\chi^2 = \sum \left(\frac{Y_{\text{obs}} - Y_{\text{exp}}}{\Delta Y_{\text{obs}}} \right)^2$
    - ΔY_{obs} statistical uncertainty only

- Systematic uncertainties: Run 10^5 fits with smearing
    - K_i: Independent Gaussian smearing according to uncertainties
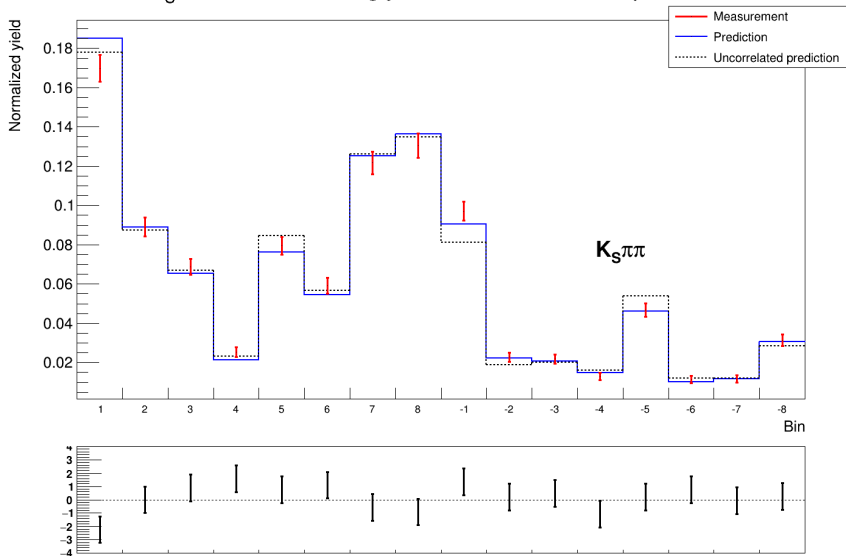   - c_i, s_i: Gaussian smearing according to correlations and uncertainties

Final results

$r_D^{K\pi} \cos \delta_D^{K\pi} = -0.0547 \pm 0.0084 \pm 0.0049 \pm 0.0010$

$r_D^{K\pi} \sin \delta_D^{K\pi} = -0.010 \pm 0.012 \pm 0.007 \pm 0.0003$

- Uncertainties: Statistical $\pm$ K_i systematics $\pm$ c_i/s_i systematics
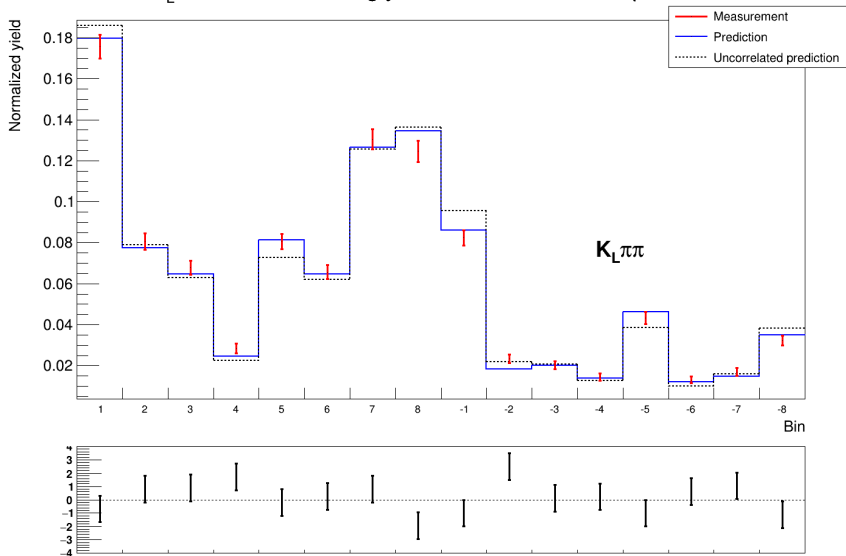
Bin yield yield vs prediction

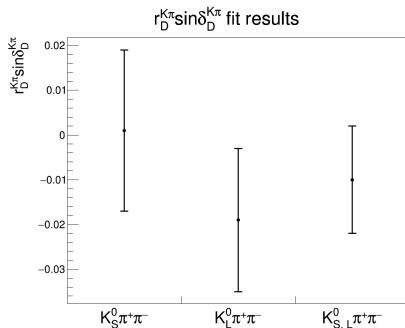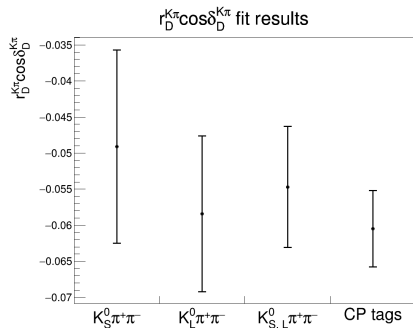K_Shh vs $K\pi$ double tag yield measurement and prediction

Bin yield yield vs prediction

$K_L hh$ vs $K\pi$ double tag yield measurement and prediction

$K_L \pi\pi$

Separate $K_S^0 \pi^+ \pi^-$ and $K_L^0 \pi^+ \pi^-$ fits

Sample	$r_D^{K\pi} \cos \delta_D^{K\pi}$	$r_D^{K\pi} \sin \delta_D^{K\pi}$	χ^2/ndf
$K_S^0 \pi^+ \pi^-$	-0.0491 ± 0.0134	0.001 ± 0.018	$14.4/14$
$K_L^0 \pi^+ \pi^-$	-0.0584 ± 0.0108	-0.019 ± 0.016	$20.1/14$
$K_{S,L}^0 \pi^+ \pi^-$	-0.0547 ± 0.0084	-0.010 ± 0.012	$35.4/30$
CP tags	-0.0605 ± 0.0053	-	