

BESIII Charm Meeting

Guy Wilkinson, Yu Zhang, Martin Tat

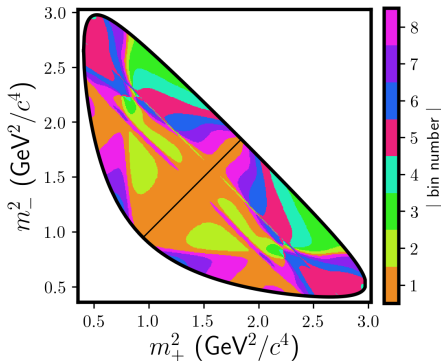
31st August 2021



$$D \rightarrow K_{S,L}^0 \pi^+ \pi^- \text{ tags}$$

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

- Measurement of both
 $r_D^{K\pi} \cos \delta_D^{K\pi}$ 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** \(2020\)](#)



$D \rightarrow K_{S,L}^0 \pi^+ \pi^-$ inputs

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

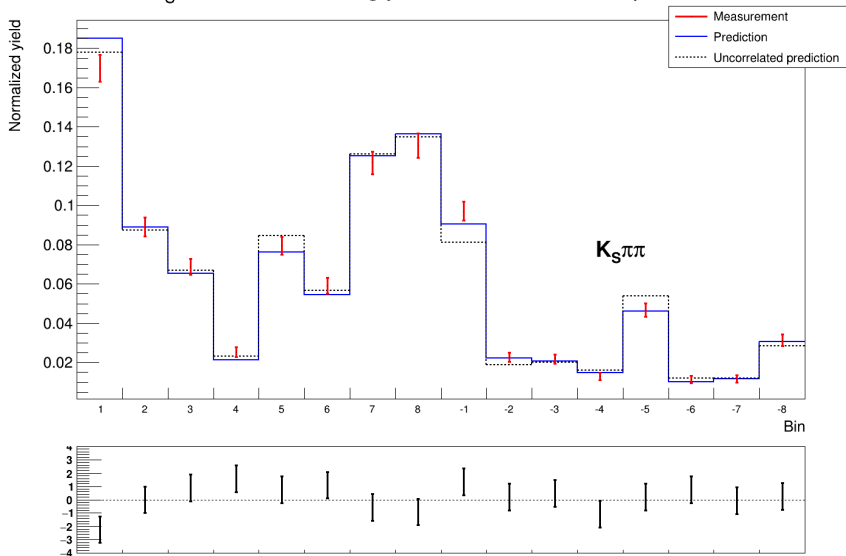
$$Y(K^- \pi^+ | K_{S,L}^0 \pi^+ \pi^-)_i =$$

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

- K_i : Flavour tag yields
 - $D \rightarrow K_{S,L}^0 \pi^+ \pi^-$ vs $D \rightarrow K^- \pi^+ \pi^0$
 - $D \rightarrow K_{S,L}^0 \pi^+ \pi^-$ vs $D \rightarrow K^- \pi^+ \pi^- \pi^+$
 - $D \rightarrow K_S^0 \pi^+ \pi^-$ vs $D \rightarrow K^- e^+ \nu_e$
- c_i and s_i : Amplitude-averaged strong phases
 - CP tags
 - No $D \rightarrow K^- \pi^+$ inputs

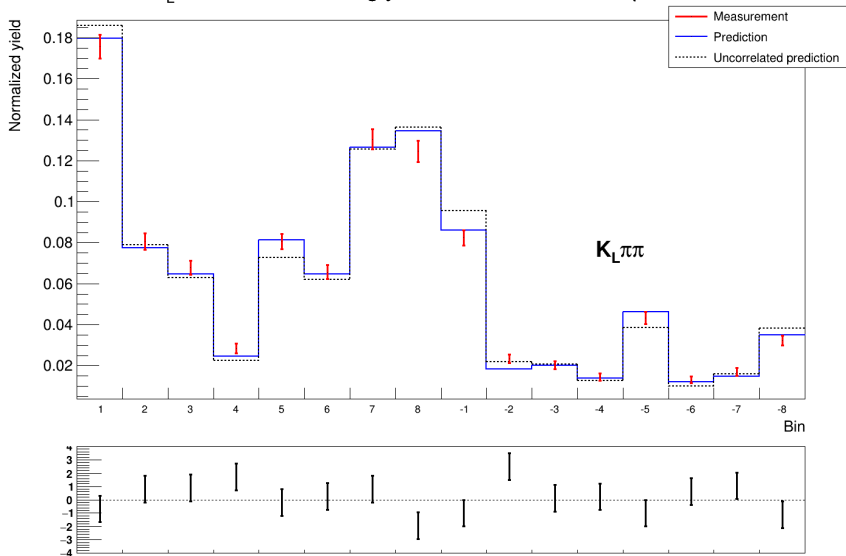
Bin yield yield vs prediction

$K_S hh$ 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



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

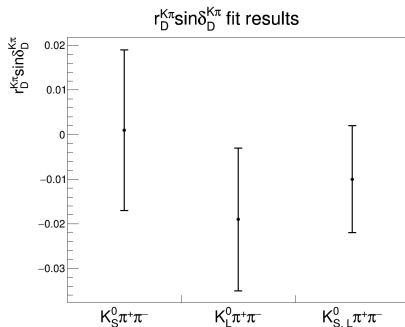
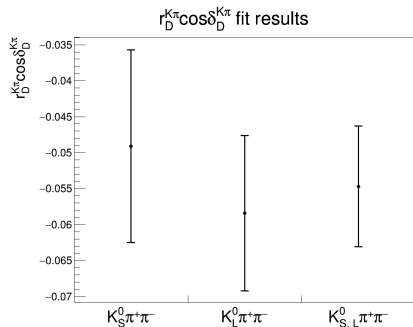
Final results

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

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

- Uncertainties: Statistical \pm K_i systematics \pm c_i/s_i systematics

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

- Some conclusion here

Thank you!