BESIII Oxford Group Meeting

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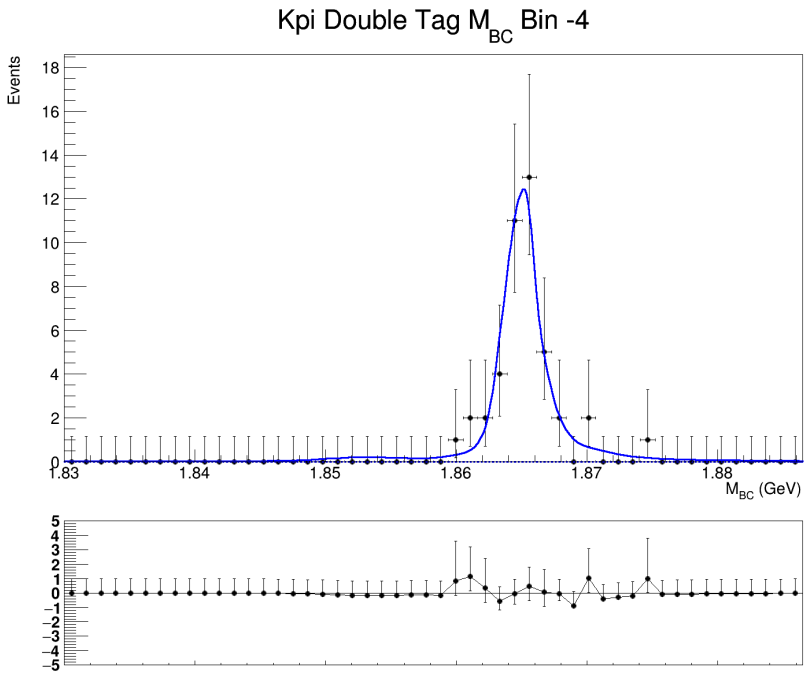
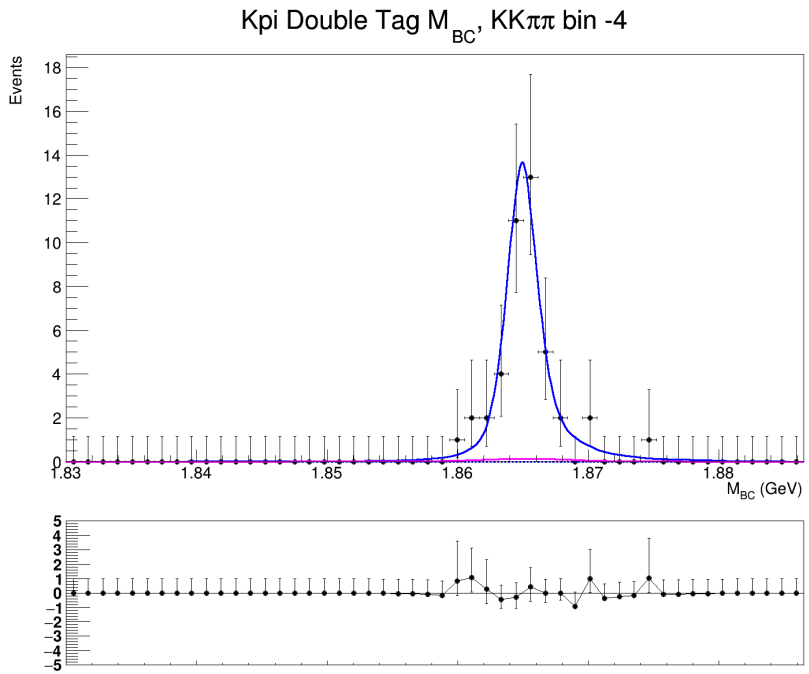
Oxford LHCb

12th January 2022

Double tag fit of $K\pi$



(a) Before bug fix



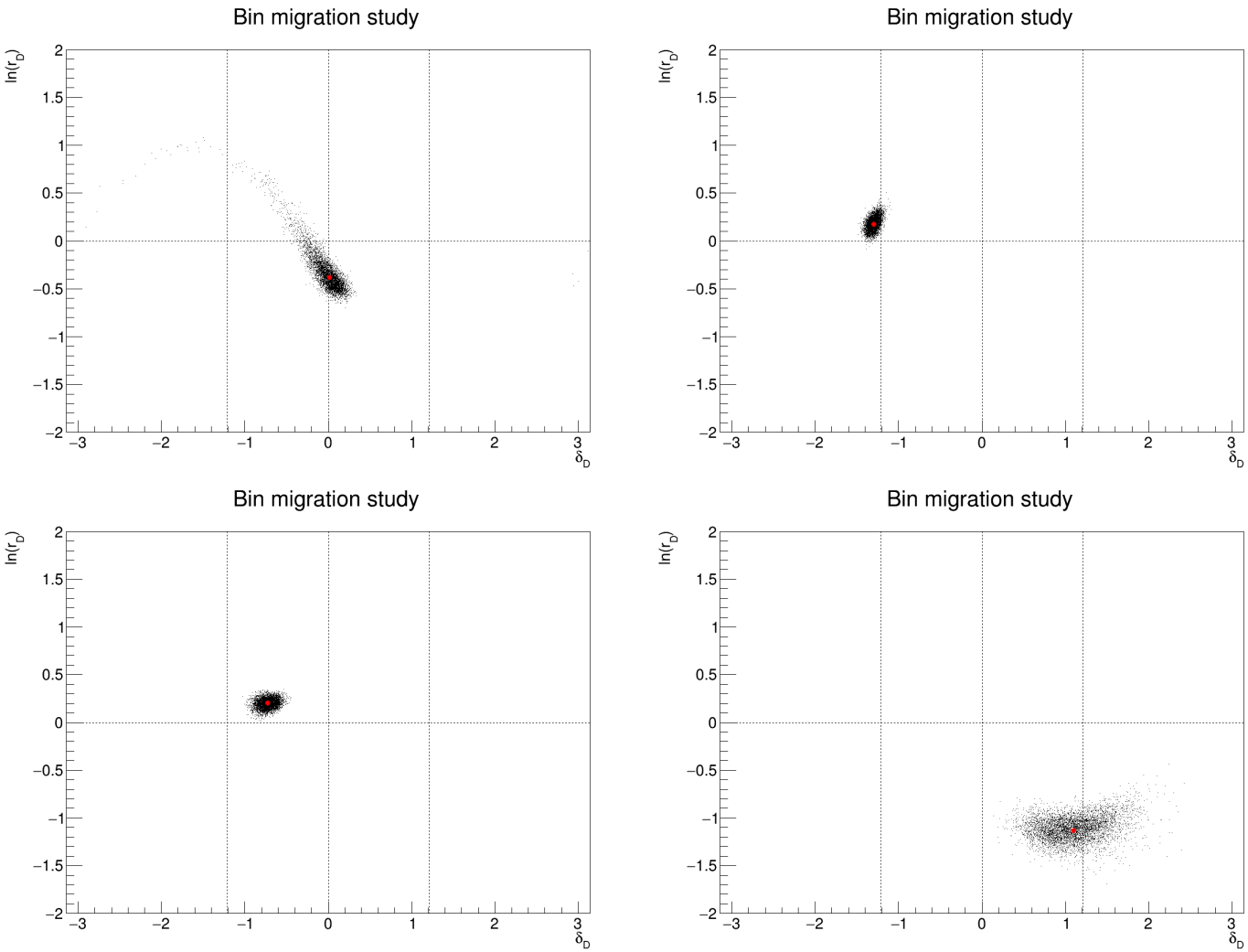
(b) After bug fix

Efficiency corrections

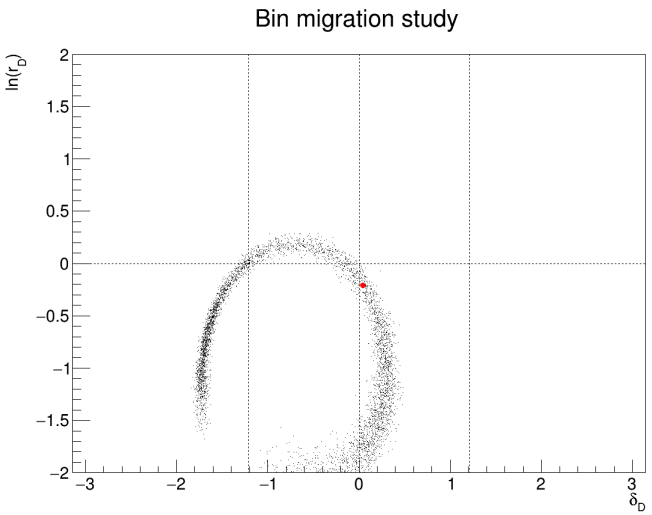
- Study bin migration
- Obtain resolution by comparing true and reconstructed momentum in signal MC
- Take a random event from signal MC, smear daughter momenta and determine "Dalitz coordinate"

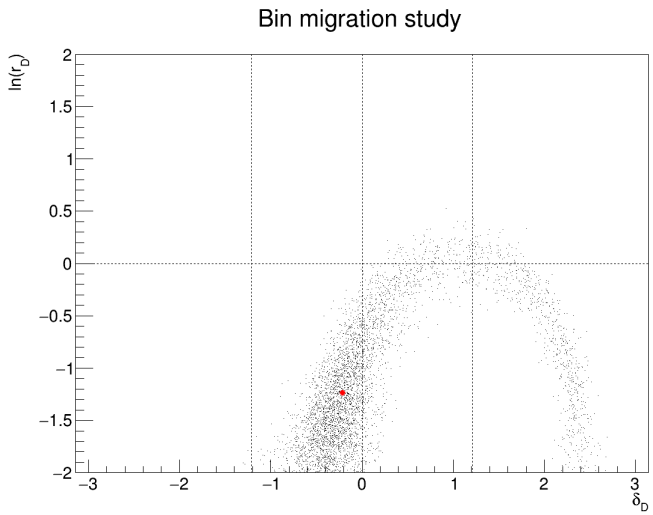
$$\epsilon_{ij} = \frac{N_{ij}^{\text{reconstructed}}}{N_{j}^{\text{generated}}}$$

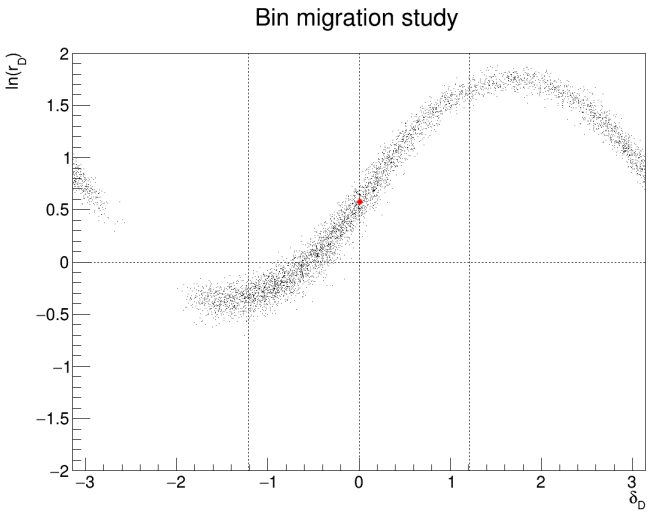
Efficiency corrections

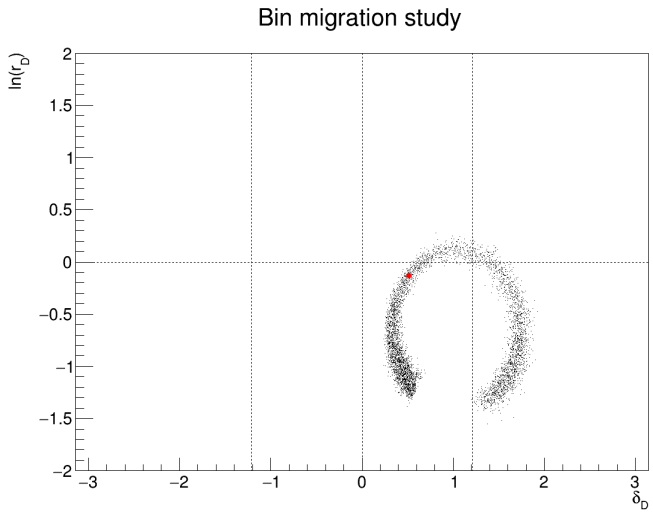


Efficiency corrections







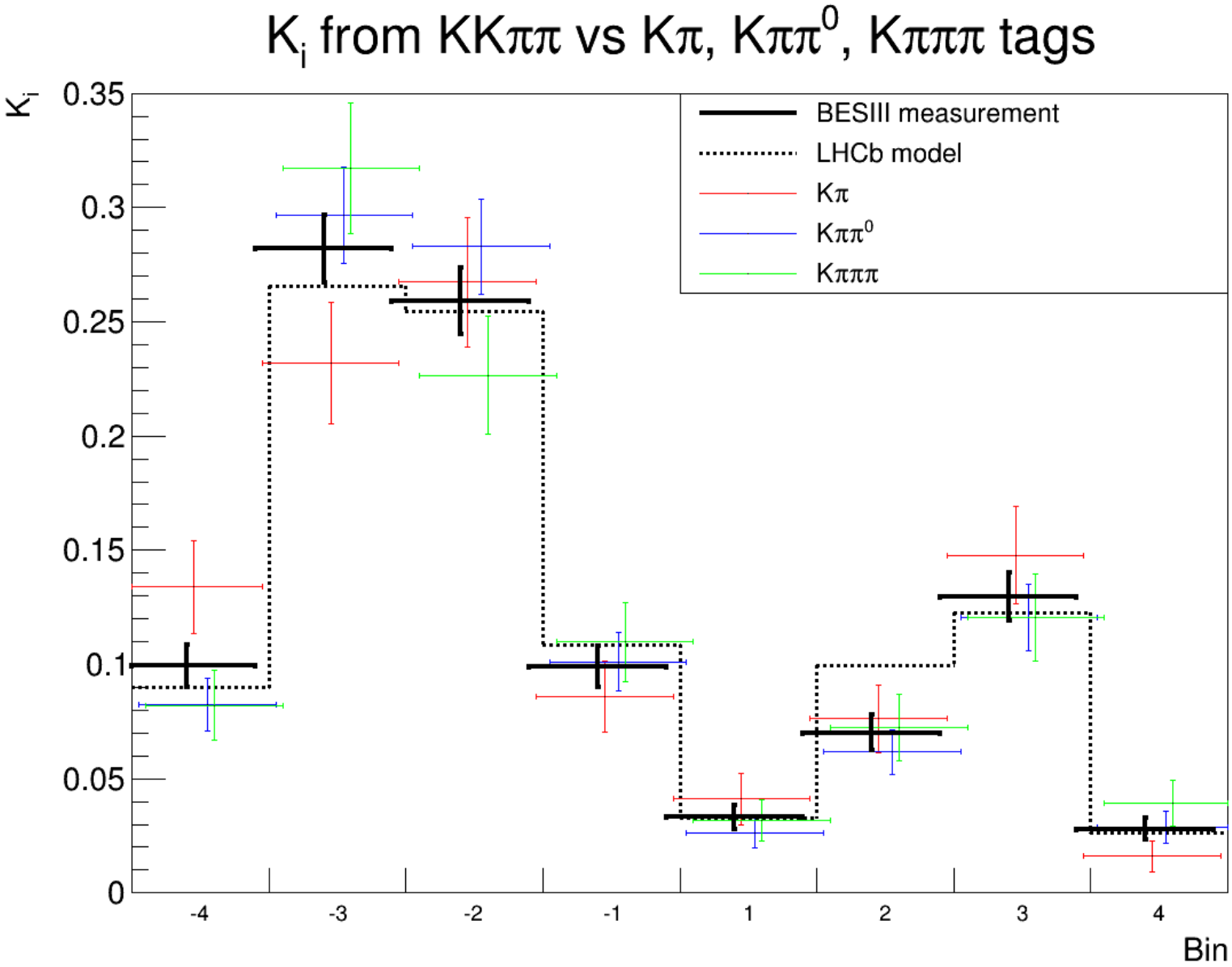


DCS corrections

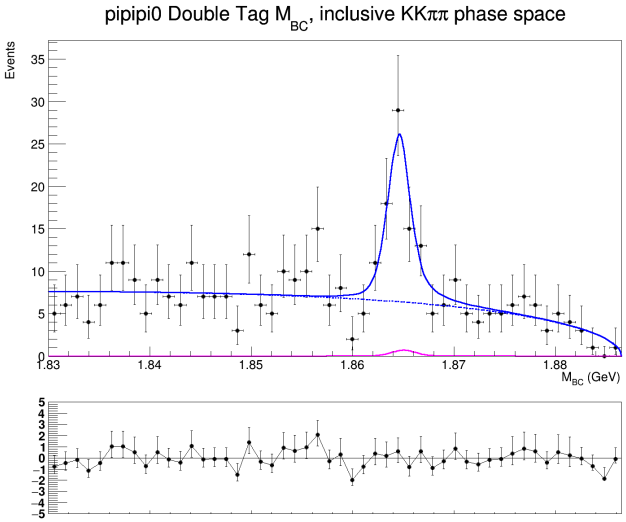
$$f_i = \frac{K_i}{K_i + K_{-i} - 2r_D R\big(c_i \cos(\delta_D) - s_i \sin(\delta_D)\big)}$$

Bin	$K\pi$	$K\pi\pi^0$	$K\pi\pi\pi$
R	1.0	0.79 ± 0.04	0.44 ± 0.10
$\delta_D(^\circ)$	190.0 ± 4.2	196 ± 11	161 ± 28
-4	1.0091 ± 0.0017	1.0039 ± 0.0028	1.0079 ± 0.0049
-3	0.9538 ± 0.0007	0.9716 ± 0.0017	0.9845 ± 0.0042
-2	0.9669 ± 0.0014	0.9815 ± 0.0028	0.9833 ± 0.0041
-1	1.0166 ± 0.0016	1.0111 ± 0.0024	1.0016 ± 0.0050
$+1$	1.0599 ± 0.0228	1.0174 ± 0.0332	1.0595 ± 0.0640
$+2$	0.7833 ± 0.0027	0.8574 ± 0.0075	0.9089 ± 0.0193
$+3$	0.8263 ± 0.0060	0.8959 ± 0.0132	0.9021 ± 0.0197
$+4$	1.1850 ± 0.0229	1.1198 ± 0.0313	0.9913 ± 0.0528

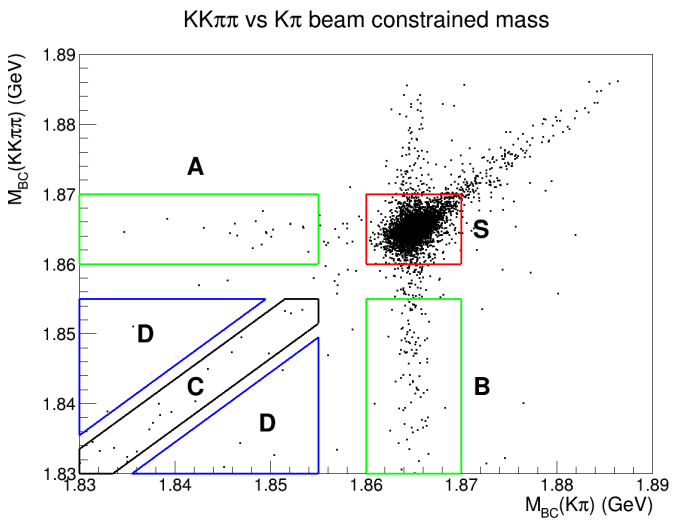
K_i results for $KK\pi\pi$ vs $K\pi$



Measurement of F_+



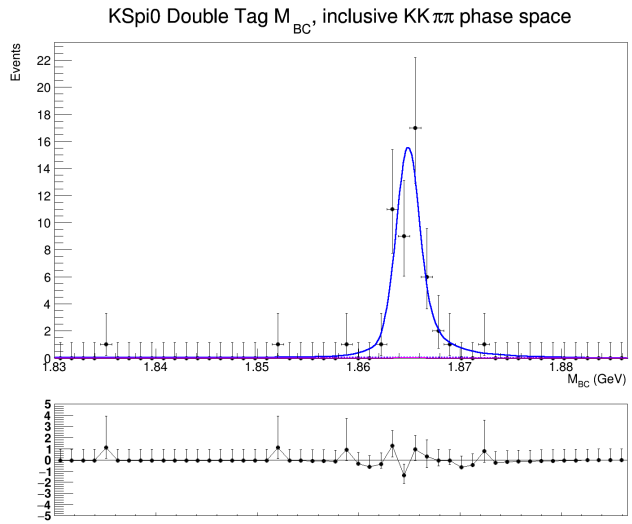
(a) $KK\pi\pi$ vs $\pi\pi\pi^0$



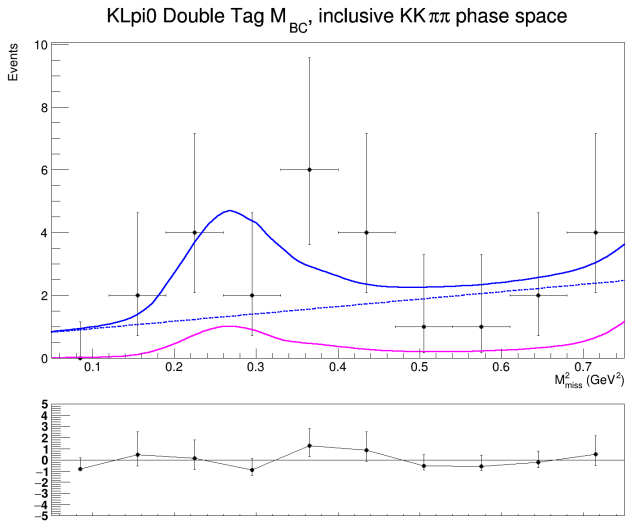
(b) 2D m_{BC}

Cannot apply cut to $m_{\mathrm{BC}}^{\mathrm{tag}}$ because the sideband is removed
Sideband subtraction for correctly reconstructed signal side?

Measurement of F_+



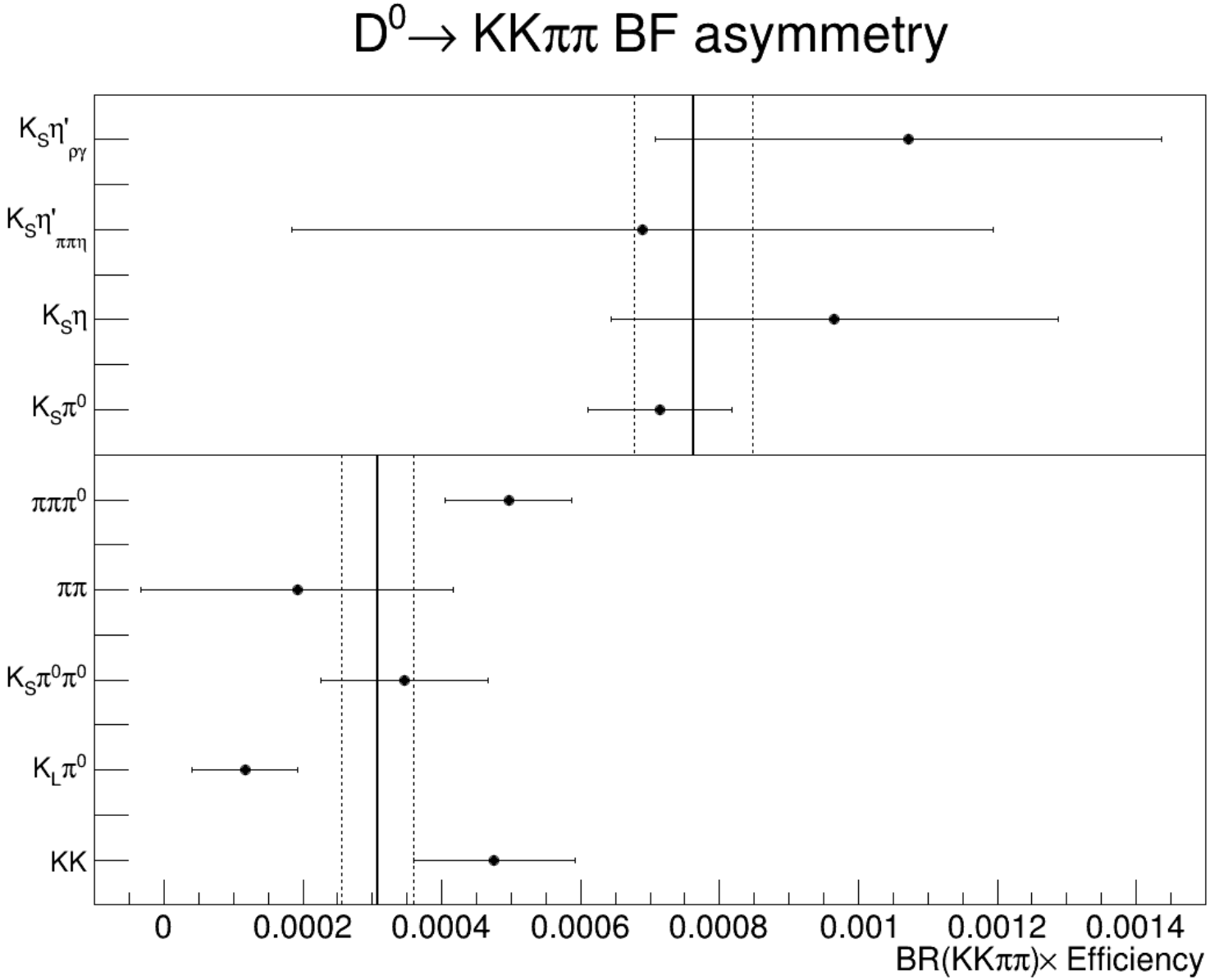
(a) $KK\pi\pi$ vs $K_S\pi^0$



(b) $KK\pi\pi$ vs K_Lpi^0

Do the $K_L\pi^0$ plot look suspicious?
How do I account for QC in K_SKK backgrounds?

Measurement of F_+



Some challenges with selection currently...

1. Very low tag efficiency for 4-body modes with kaons
   - Tracking efficiency is poor at low momentum
   - Softer kaon momentum in $KK\pi\pi$
   - How to loosen IP cuts?
     - $V_{\mathrm{xy}} < 1.0\,\mathrm{cm}$
     - $V_{\mathrm{z}} < 10.0\,\mathrm{cm}$
2. Kalman kinematic fit in $K_L h^+ h^-$ gives very strange results
   - $K_L K^+ K^-$ looks like it's working
   - $K_L \pi^+ \pi^-$ fit doesn't change pion momenta
   - χ^2 is too small (10^{-6})

Conclusion and next steps

- K_i looks encouraging, can probably start some toy studies of binned CP double tags
- Bin migration seems large, but probably a result of binning scheme
- F_+ measurement looks possible with the current dataset
- Some issues with selection that requires more thinking...