F_+ from KsPiPi vs 4Pi and KlPiPi vs 4Pi

11/12/2014 Claire Prouve

KsPiPi vs 4Pi – peaking bkg

Peaking bkg: KsPiPi vs KsPiPi $B_i^{peak} = B_{tot}^{peak} \cdot a_i^{peak}$

- total number of peaking bkg events from generic MC: 18.45 ± 1.13
- Percentage of peaking bkg events in bin i from data: apply KsPiPi-Selection cut on 4Pi side
  BUT: potential bias in distribution due to difference in Ks-Veto and Ks-Selection

KsPiPi vs KsPiPi MC reconstructed as KsPiPi vs 4Pi

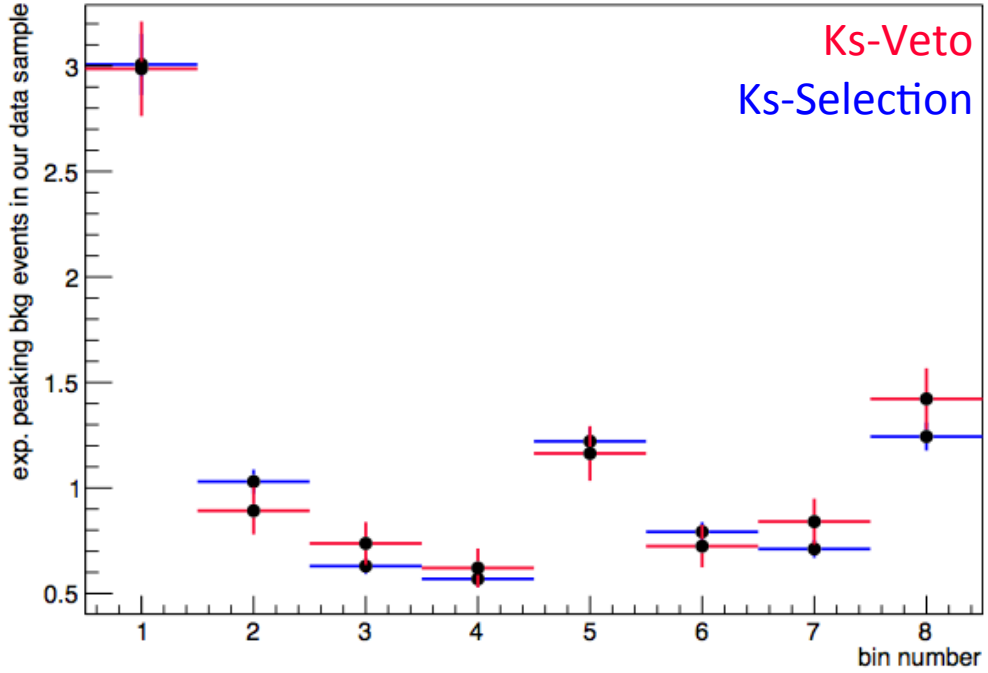

Figure 1.1: *Distribution of $K_S^0\pi\pi$ vs $K_S^0\pi\pi$ events over the bins determined by using $K_S^0\pi\pi$ vs $K_S^0\pi\pi$ MC. Blue: Ks-Selection cut of FS>2, red: Ks-Veto cut of FS<0 as is used in the data sample.*

⇒ Determine the effect of different cuts using KsPiPi vs KsPiPi signal MC (280000 events)

⇒ Weight a_i^{peak} accordingly

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bin i	B_i^{peak}	old B_i^{peak}	bin i	B_i^{peak}	old B_i^{peak}
1	2.43 ± 0.54	2.44 ± 0.52	-1	1.84 ± 0.46	2.4 ± 0.52
2	0.74 ± 0.29	0.86 ± 0.32	-2	0.93 ± 0.34	0.86 ± 0.32
3	1.29 ± 0.46	1.10 ± 0.36	-3	0.95 ± 0.38	1.10 ± 0.36
4	0.53 ± 0.28	0.49 ± 0.24	-4	0.15 ± 0.15	0.49 ± 0.24
5	1.28 ± 0.40	1.34 ± 0.39	-5	1.52 ± 0.44	1.34 ± 0.39
6	0.56 ± 0.26	0.61 ± 0.27	-6	0.86 ± 0.32	0.61 ± 0.27
7	1.59 ± 0.51	1.34 ± 0.39	-7	0.59 ± 0.30	1.34 ± 0.39
8	2.38 ± 0.60	2.08 ± 0.48	-8	1.06 ± 0.35	2.08 ± 0.48

All differences within uncertainties anyway….

Table 1.4: *Number of peaking background events per bin in the data sample before efficiency correction.*

KsPiPi vs 4Pi - efficiency

KsPiPi vs 4Pi signal selection efficiency now determined from **KsPiPi vs 4Pi signal MC alone**
260k events generated

bin	ϵ [%]	bin	ϵ [%]
1	15.93 ± 0.17	-1	16.32 ± 0.18
2	16.05 ± 0.30	-2	15.83 ± 0.29
3	18.31 ± 0.42	-3	18.27 ± 0.42
4	16.95 ± 0.42	-4	17.52 ± 0.43
5	16.13 ± 0.28	-5	16.67 ± 0.28
6	17.26 ± 0.37	-6	16.79 ± 0.36
7	15.64 ± 0.34	-7	16.75 ± 0.35
8	16.68 ± 0.28	-8	16.69 ± 0.28

Table 1.7: *Signal efficiency per bin.*

Efficiencies from K3Pi vs 4Pi
250k events

Bin	ε	σ
0	0.158604	0.000797
1	0.157600	0.001382
2	0.157509	0.002351
3	0.163625	0.003198
4	0.172690	0.003451
5	0.156697	0.002179
6	0.152732	0.002730
7	0.156512	0.002698
8	0.160328	0.002188

KsPiPi vs 4Pi - T_i

T_i: fraction yield of flavour tagged KsPiPi events per bin
K'_i given by arXiv:1401.1904 contain first order effects of mixing (which are not present at CLEO)

$$K'_i = T_i + \sqrt{T_i T_{-i}}(yc_i + xs_i)$$

x, y: latest HFAG results (x = (0.63 ± 0.19)%, y = (0.75 ± 0.12)%)
=> fit for T_i, using Gaussian constraints on c_i, x and y and demanding sum T_i =1

New values w/o mixing:

bin	T_i	bin	T_i
1	0.1695 ± 0.0053	-1	0.0781 ± 0.0014
2	0.0873 ± 0.0012	-2	0.0186 ± 0.0002
3	0.0723 ± 0.0020	-3	0.0201 ± 0.0003
4	0.0258 ± 0.0011	-4	0.0161 ± 0.0015
5	0.0889 ± 0.0024	-5	0.0523 ± 0.0013
6	0.0589 ± 0.0011	-6	0.0147 ± 0.0003
7	0.1252 ± 0.0018	-7	0.0132 ± 0.0004
8	0.1320 ± 0.0021	-8	0.0270 ± 0.0010

Old values with mixing:

Bin	K'_i	Bin	K'_i
1	0.1701 ± 0.0014	-1	0.0786 ± 0.0013
2	0.0875 ± 0.0012	-2	0.0187 ± 0.0002
3	0.0726 ± 0.0021	-3	0.0198 ± 0.0003
4	0.0257 ± 0.0011	-4	0.0159 ± 0.0016
5	0.0883 ± 0.0027	-5	0.0519 ± 0.0013
6	0.0587 ± 0.0011	-6	0.0147 ± 0.0003
7	0.1249 ± 0.0019	-7	0.0135 ± 0.0004
8	0.1320 ± 0.0023	-8	0.0273 ± 0.0010

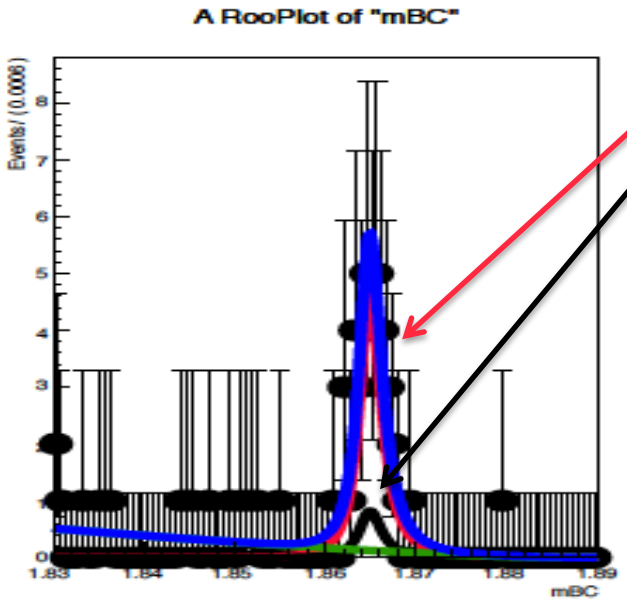
KsPiPi vs 4Pi - M_i

bin	$M_i + M_{-i}$
1 + -1	184.691 ± 38.7358
2 + -2	119.295 ± 29.6759
3 + -3	98.5683 ± 25.332
4 + -4	61.8512 ± 20.2901
5 + -5	333.006 ± 47.1659
6 + -6	126.458 ± 28.8478
7 + -7	164.885 ± 34.0446
8 + -8	221.777 ± 39.1979

Table 1.8: $M_i + M_{-i}$

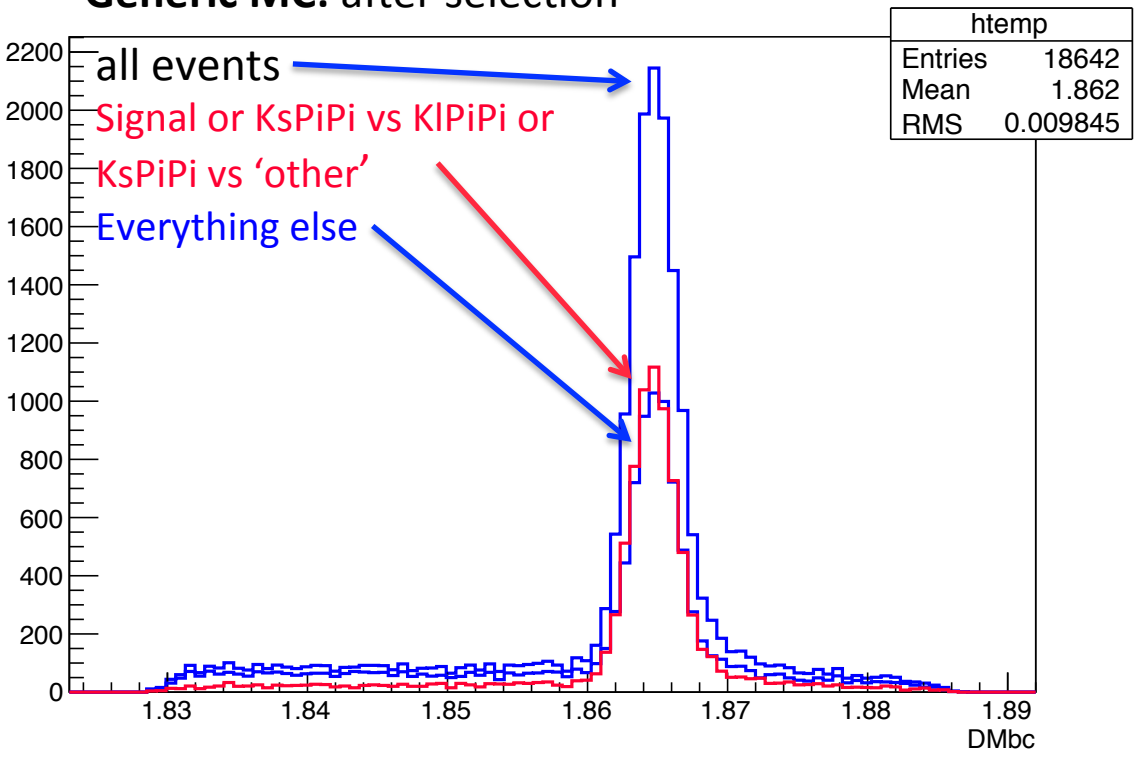
KlPiPi vs 4Pi

Plan for raw signal yield: cut on MissMassSq and fit to $M_{bc}(D)$



signal shape: fixed from signal MC
peaking bkg shape: same as signal
number of peaking bkg events: …?

Generic MC: after selection



What about the 'everything else' events that seem to be peaking in M_{bc} too?

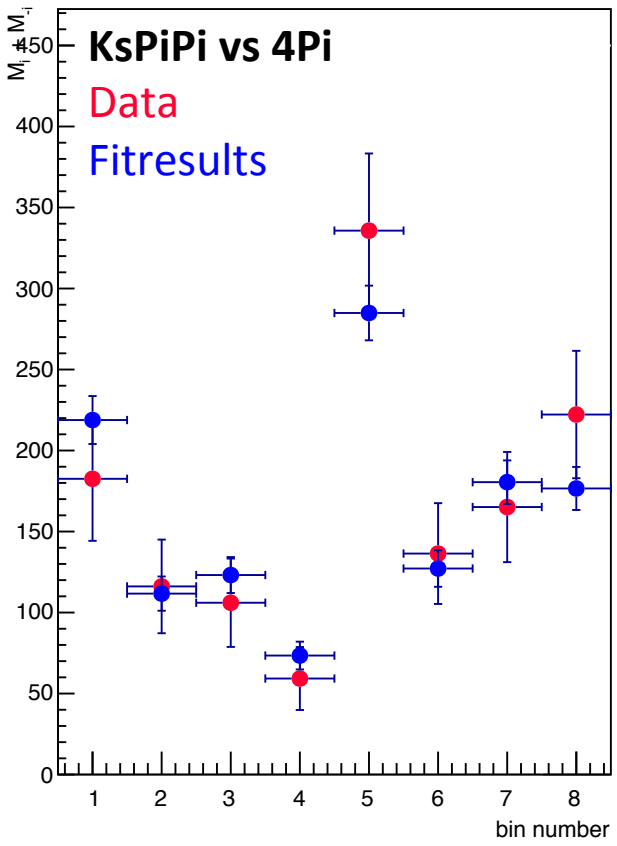
F_+

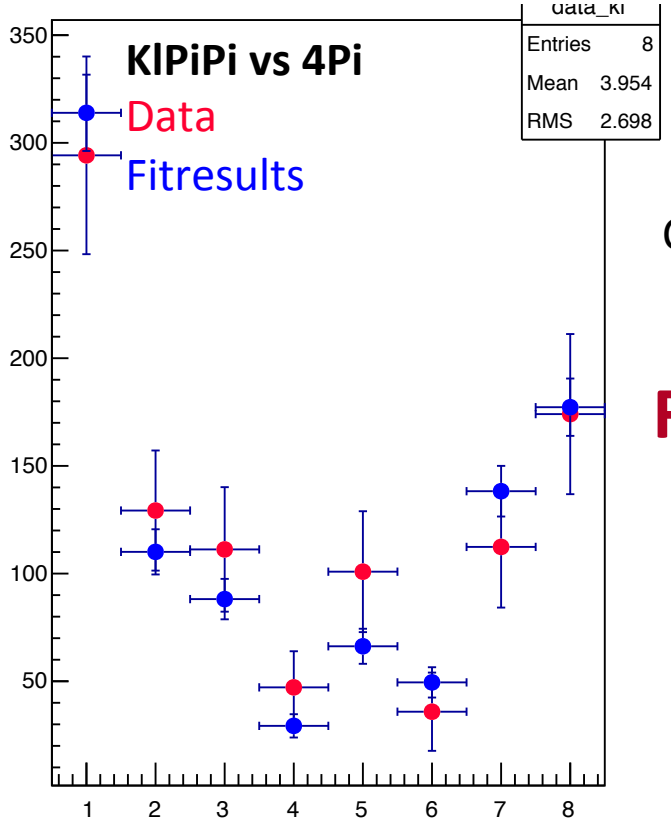
For now: assume only peaking bkg is KsPiPi vs KlPiPi

⇒ Raw KlPiPi vs 4Pi yields from fits to M_{bc} in each bin

⇒ Signal efficiency from KlPiPi vs 4Pi Signal MC

⇒ Fit F_+ for KsPiPi vs 4Pi and KlPiPi vs 4Pi simultaneously (leaving both norm. terms free)





Chi2/n_dof = 0.627104

F_+ = 0.775 ± 0.056