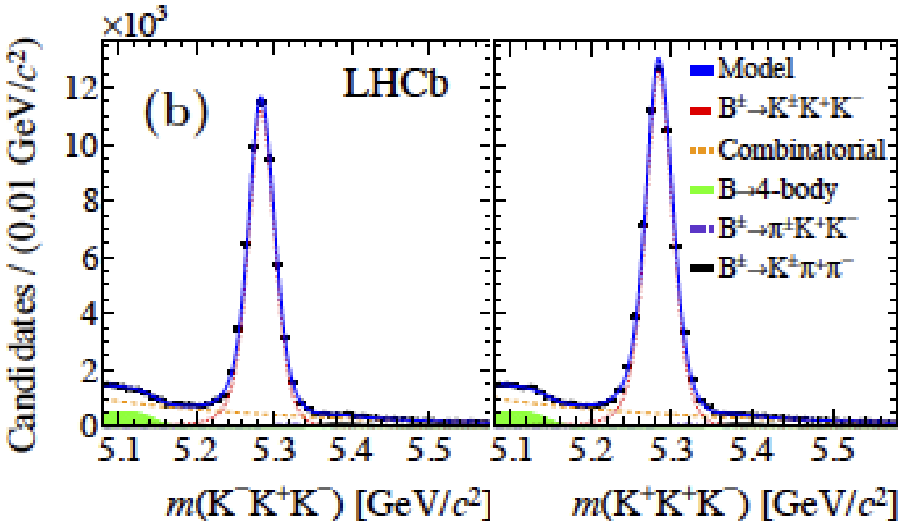
Ignacio Bediaga, Jeremy Dalseno, Juan Otalora, Jussara Miranda

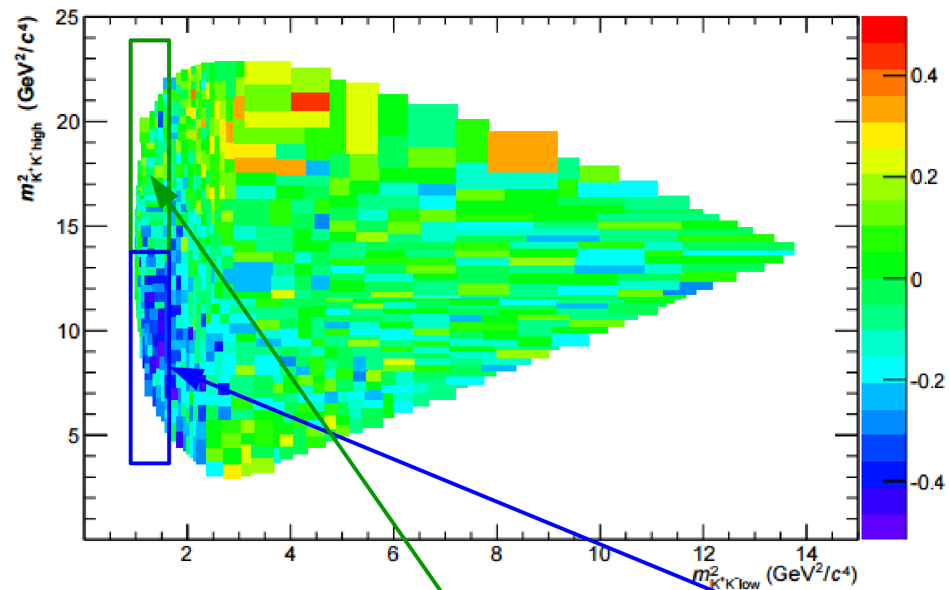
- Starting point: Measurements of CP violation in the three-body phase space of charmless $B^{\pm}$ decays
  (LHCb-PAPER-2014-044, LHCb-ANA-2014-050, TWiki, BnoC WG database, August 2014)
  arXiv:1408.5373
  Phys.Rev.D90, 112004 (2014), DOI:10.1103/PhysRevD.90.112004

- Report on the Run1 B→ kkk amplitude analisys effort: **a work in progress**

- Will assume an audience familiar with the Isobar approach to Dalitz plot fitting and also the QMI for the s-wave

- Use Laura++ for the Isobar and Jeremy's (and Juan) fitter for QMI





- Total:

$$B^\pm \to K^\pm K^+ K^- \quad 109\,240 \pm 354$$

$$A_{CP}(B^\pm \to K^\pm K^+ K^-) = -0.036 \pm 0.004 \pm 0.002 \pm 0.007\,,$$

- KK ↔ππ rescattering region (1< mkk <1.5Gev):

Decay	N_S	A_{CP}
$B^\pm \to K^\pm K^+ K^-$	$16\,992 \pm 142$	$-0.211 \pm 0.011 \pm 0.004 \pm 0.007$

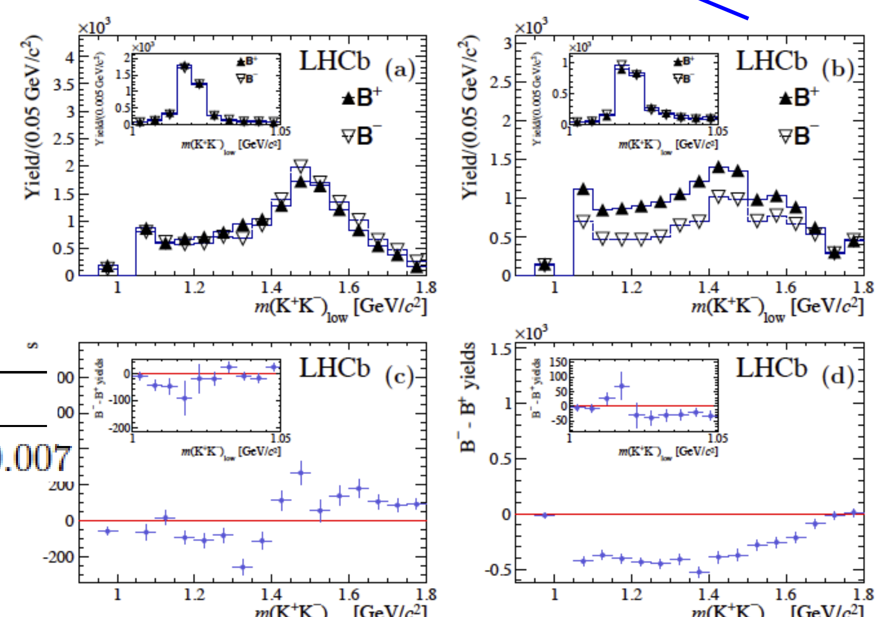
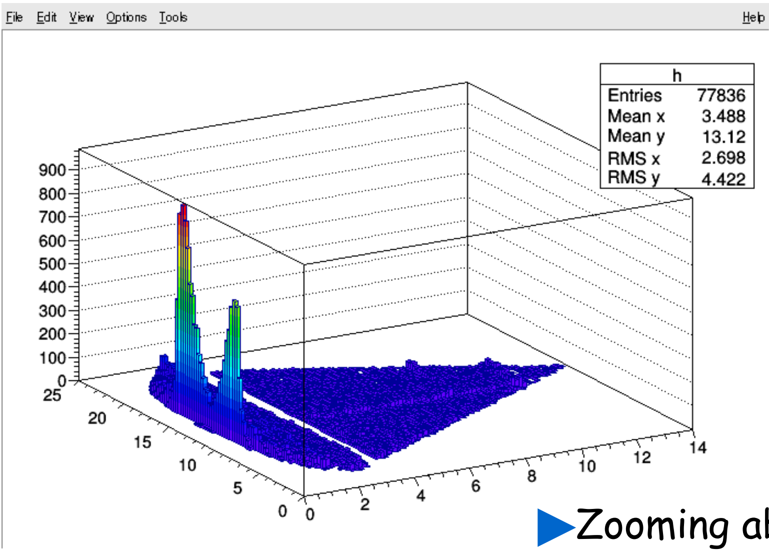


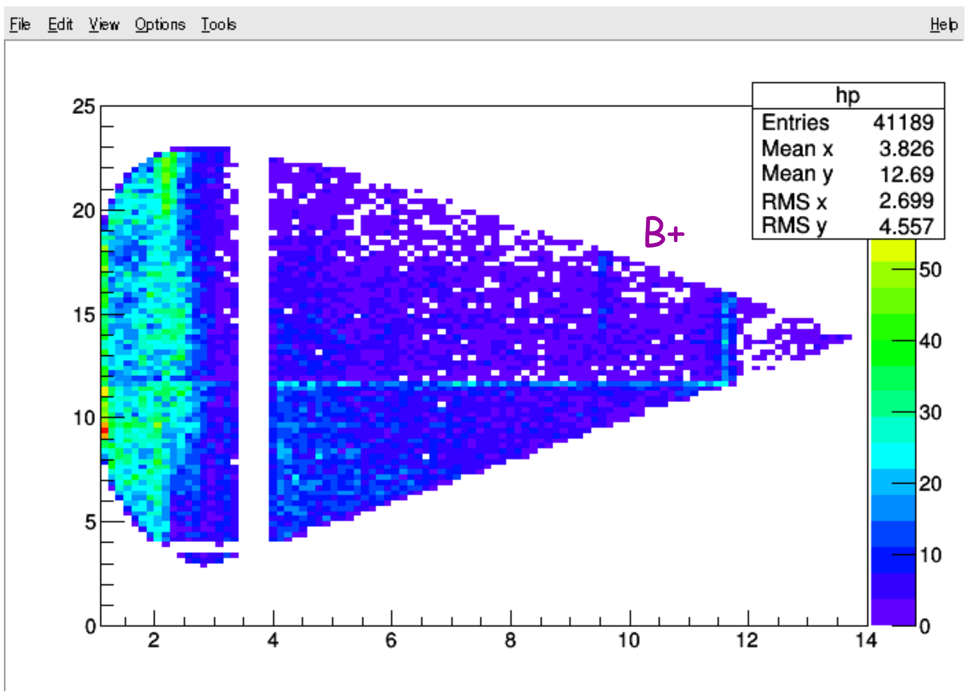
Figure 6: Projections in bins of the $m(K^+K^-)_{\rm low}$ variable of (a, b) the number of B^- and B^+ signal events and (c, d) their difference for $B^\pm \to K^\pm K^+ K^-$ decays. The inset plots show the ϕ resonance region of $m(K^+K^-)_{\rm low}$ between 1.00 and 1.05 GeV/c^2, which is excluded from the main plots. The plots are restricted to events with (a, c) $\cos\theta < 0$ and (b, d) $\cos\theta > 0$. The yields are acceptance-corrected and background-subtracted. A guide line for zero (horizontal red line) was included on plots (c, d).

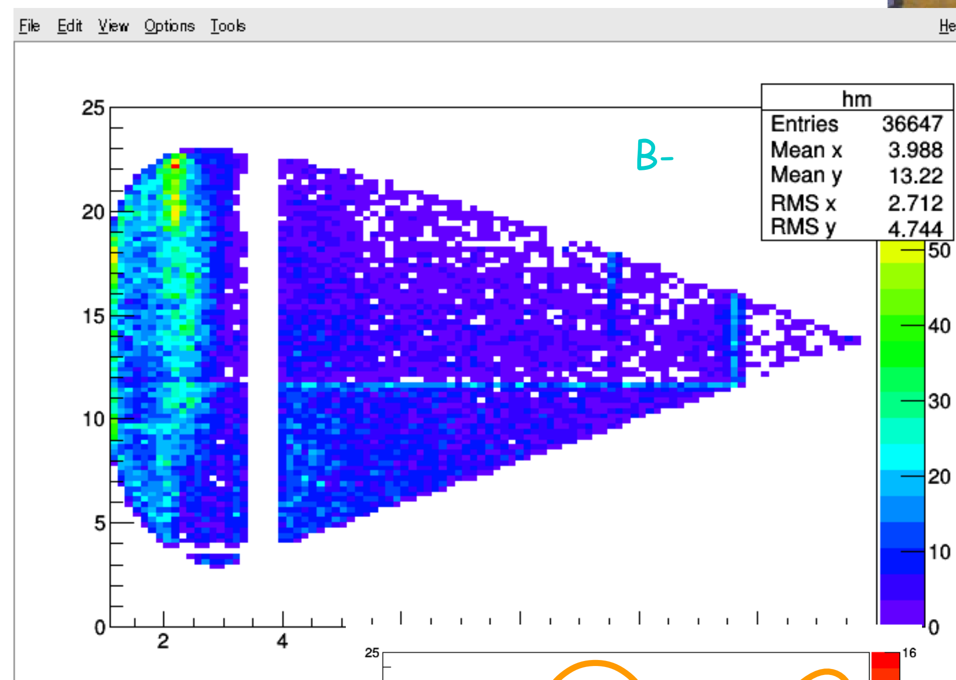
Dalitz oveview

- ~80k events in 80Mev window
- Clear: Φ(1020) ~ (15%), J/ψ,Xc
- Lot of structure indicating non s-wave contribution, not clear which f2(1525)? Φ(1680)??
- Very large NR ~35% of the events are above $m_{KK}^2>4$
- Obvious CPV not following known structures

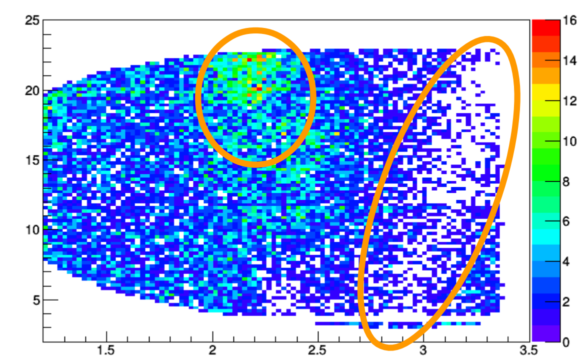


- Zooming above Φ(1020)





- Super zoom in B- anticipating Problematic regions



From the Isobar model the total signal amplitude for B^+ and B^- is defined as:

$$\mathcal{A}(\mathbf{m}^2_{K\pi},\mathbf{m}^2_{KK}) = \sum_j c_j \mathcal{M}_{Rj}(\mathbf{m}^2_{K\pi},\mathbf{m}^2_{KK}),$$

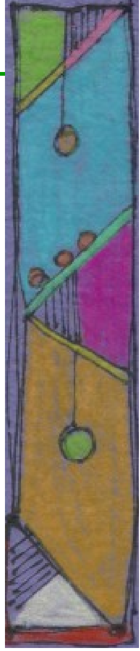
where $c_j = (x + \Delta x) + i(y + \Delta y)$ and $\bar{c}_j = (x - \Delta x) + i(y - \Delta y)$ is the complex coefficient for a given resonance decay mode j. Δx_j and Δy_j parametrize the CPV in the decay.

Caveats:

- Need to be particularly careful on adding scalar contributions- no angular signature, long list of poorly stablished states enhance the possibility of destabilizing the fit producing large interfering solutions

- Sum of fit fractions >> or << than 100% signs large destructive or constructive inteference terms

- Relative phases and amplitudes are measured. Phases are determined through the interference. Need to chose one contributions to have the parameters fixed: Φ(1020) and Xc are too narrow and the NR is too unknown.



BaBar: Study of CP violation in Dalitz-plot analyses of $B^0 \to K^+K^-K^0_S$, $B^+ \to K^+K^-K^+$, and $B^+ \to K^0_S K^0_S K^+$ Physical Review D 85, 112010 (2012)

▶ $F_{NR}(s_{12}, s_{23}) = e^{\alpha s_{12}} + e^{\alpha s_{23}}$,

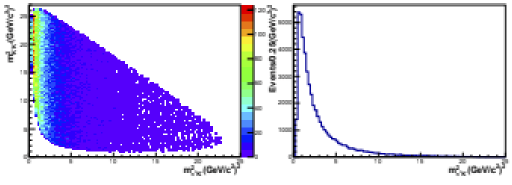
▶ $$\mathcal{A}_{NR}(s_{12}, s_{23}) = (a_{S0} + a_{S1}x + a_{S2}x^2) + (a_{P0} + a_{P1}x + a_{P2}x^2)\, P_1(\cos\theta_3)\,,$$

TABLE VIII: Branching fractions (neglecting interference), CP asymmetries, and CP-violating phases (see Eq. (11)) for $B^+ \to K^+K^-K^+$. The $\mathcal{B}(B^+ \to RK^+)$ column gives the branching fractions to intermediate resonant states, corrected for secondary branching fractions obtained from Ref. [15]. Central values and uncertainties are obtained from Solution I. In addition to quoting the overall NR branching fraction, we quote the S-wave and P-wave NR branching fractions separately.

Decay mode	$\mathcal{B}(B^+ \to K^+K^-K^+) \times FF_j$ (10^{-6})	$\mathcal{B}(B^+ \to RK^+)$ (10^{-6})	A_{CP} (%)	$\Delta\phi_j$ (deg)
$\phi(1020)K^+$	$4.48 \pm 0.22^{+0.33}_{-0.24}$	$9.2 \pm 0.4^{+0.7}_{-0.5}$	$12.8 \pm 4.4 \pm 1.3$	$23 \pm 13^{+4}_{-5}$
$f_0(980)K^+$	$9.4 \pm 1.6 \pm 2.8$		$-8 \pm 8 \pm 4$	$9 \pm 7 \pm 6$
➡ $f_0(1500)K^+$	$0.74 \pm 0.18 \pm 0.52$	$17 \pm 4 \pm 12$		
$f_2'(1525)K^+$	$0.69 \pm 0.16 \pm 0.13$	$1.56 \pm 0.36 \pm 0.30$	$14 \pm 10 \pm 4$	$-2 \pm 6 \pm 3$
➡ $f_0(1710)K^+$	$1.12 \pm 0.25 \pm 0.50$			
$\chi_{c0}K^+$	$1.12 \pm 0.15 \pm 0.06$	$184 \pm 25 \pm 14$		$-4 \pm 13 \pm 2$
➡ NR	$22.8 \pm 2.7 \pm 7.6$		$6.0 \pm 4.4 \pm 1.9$	0 (fixed)
➡ NR (S-wave)	$52^{+23}_{-14} \pm 27$			
➡ NR (P-wave)	$24^{+22}_{-12} \pm 27$			

▶ We want to include explicitly the rescattering amplitude but its parametrization is still under study. as a start (see Melissa's taslk) because we believe that it can be the carrier of CPV

▶ We have “interpreted” the exponential NR form …
(obs: since this is a symmetrical state this amplitude automatically Interferes construtively with is self)

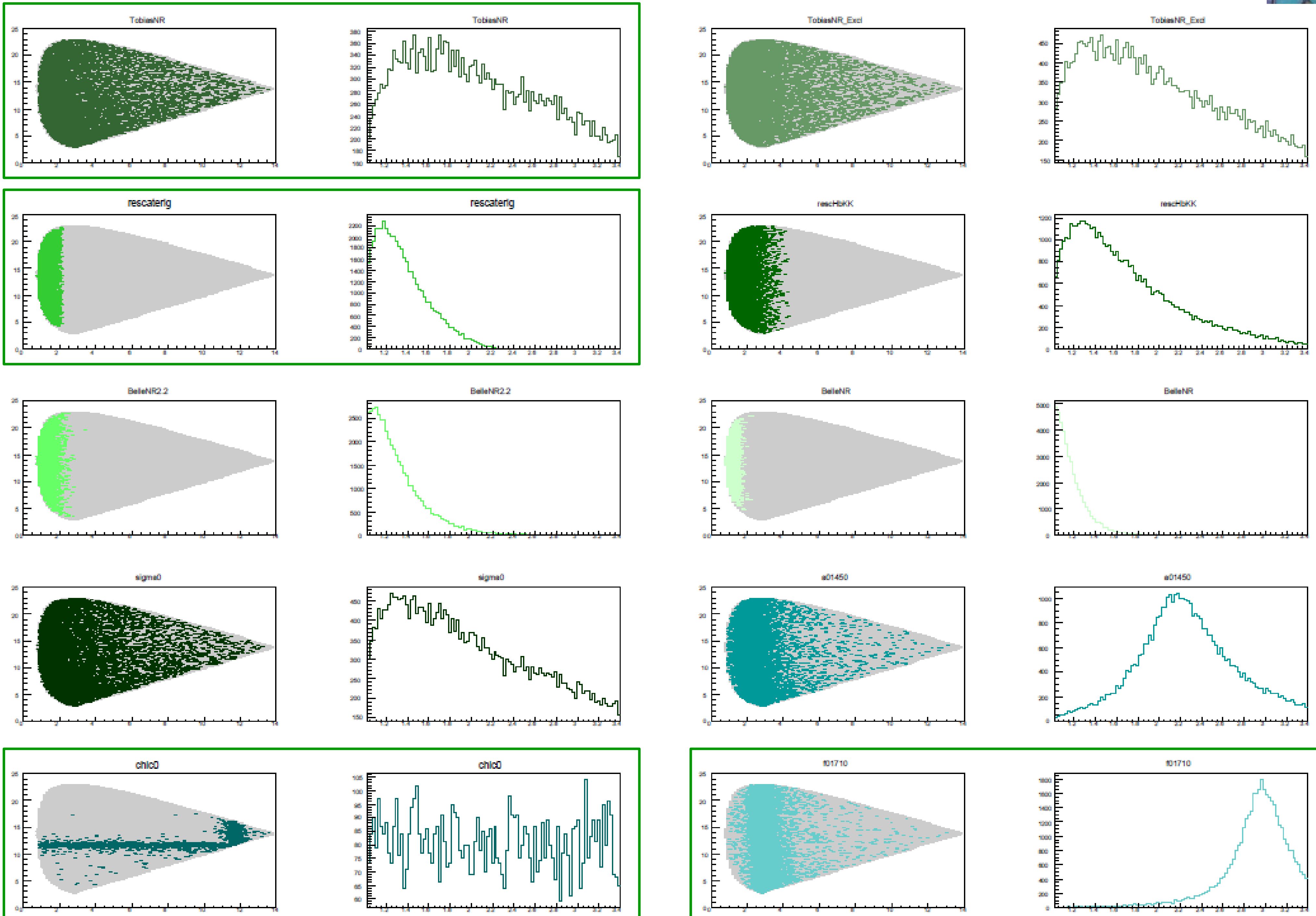


• Tobias non-resonant function [Phys.Rev.D92.054010,2015] instead of κ

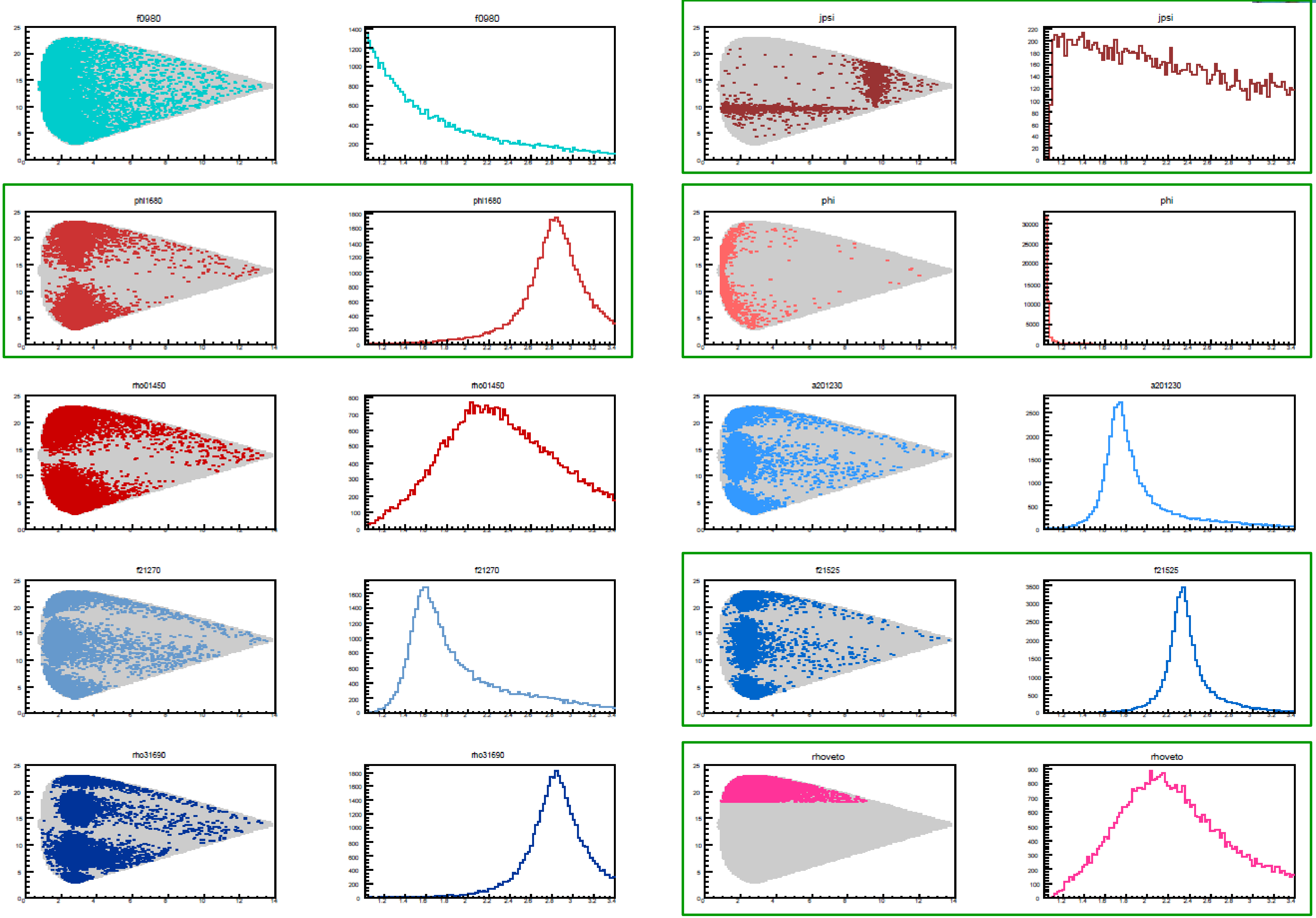
$$T_{nr}(m^2_{\pi^+K^-}) = \left(1 + \frac{m^2_{\pi^+K^-}}{\Lambda^2}\right)^{-1},$$

where Λ was set to 1 GeV.

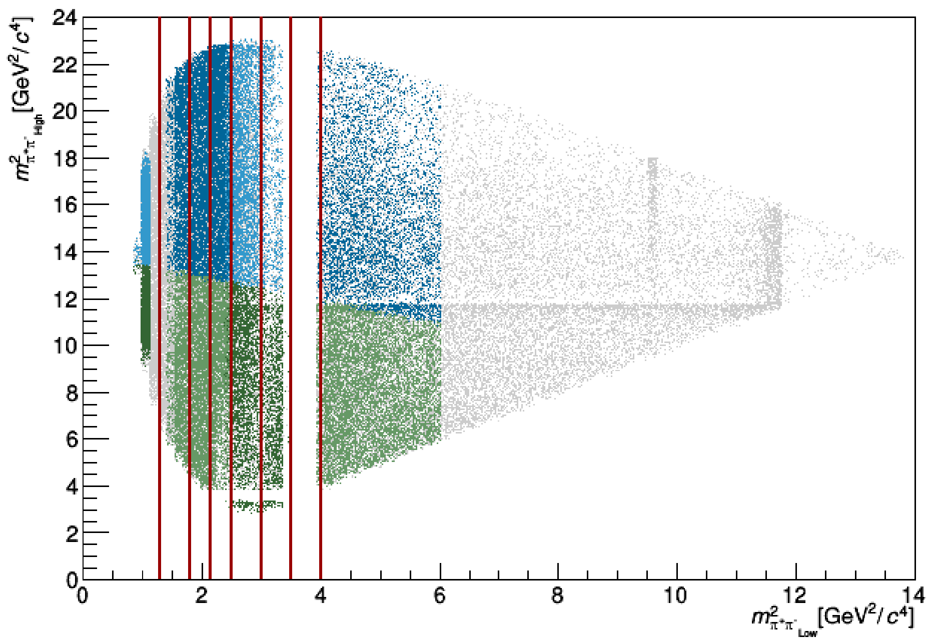
contribuitions



contribuitions



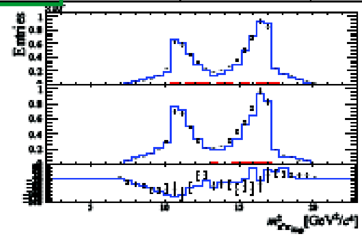
- We tried many, many, many combinations. I will show one fit… which is the "best"and yet pretty bad… and than we make a change in the strategy
- We never include wide scalars that populate the same phase space region, i.e, either TobiasNR or a low mass free MW pole or f0(980)
- We had to "create" the rhoVETO object to accommodate the B-(and B+) structure at high mass
- The interference of f0(1700) with the NR +- solve empty region at m2KK~3
- To evaluate the model we compare plot s_high for the regions defined by the re lines and s_low for costheta13> and <0 for the blue and green regions

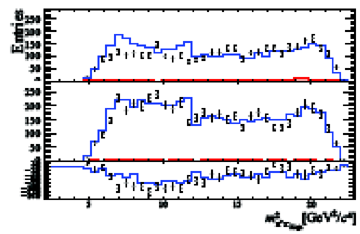


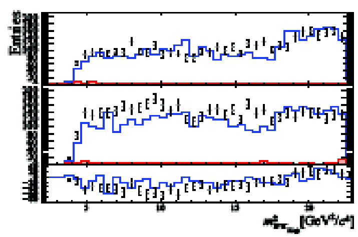
```
reson = negSigModel->addResonance("rho0(1450)",  2, LauAbsResonance::RelBWVeto);
reson->changeResonance(1.48,     0.08,-1);
```

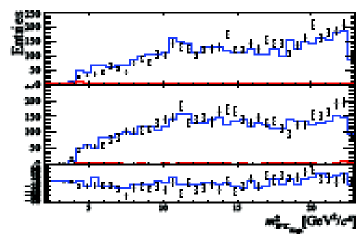
fit10050

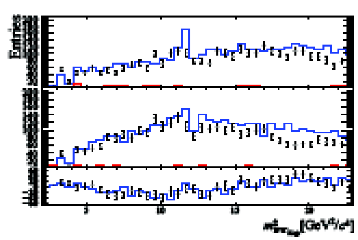
[NLL -361353] Component	Fit fraction (%) < FF >	(B^-, B^+)	Magnitude and phase coefficients a_i^+	δ_i^+ [°]	a_i^-	δ_i^- [°]	A_{CP} (%)
NRTobiasNR	89.6	(89.0, 90.1)	1.07 ± 0.00	0 ± 0	0.93 ± 0.00	0 ± 0	-13.1 ± 0.4
$\phi(1020)$	12.8	(13.6, 12.2)	0.39 ± 0.01	-51 ± 1	0.37 ± 0.01	-60 ± 1	-7.0 ± 2.7
$\phi(1680)$	1.3	(2.0, 0.8)	0.10 ± 0.00	-15 ± 3	0.14 ± 0.01	-27 ± 2	32.4 ± 5.5
$\rho VETO$	1.5	(1.8, 1.2)	0.12 ± 0.01	-43 ± 3	0.13 ± 0.01	-50 ± 3	9.8 ± 6.5
$f_2'(1525)$	0.6	(0.7, 0.5)	0.08 ± 0.01	53 ± 4	0.09 ± 0.01	61 ± 4	3.0 ± 8.9
$f_2(1270)$	0.6	(0.4, 0.7)	0.10 ± 0.00	20 ± 3	0.07 ± 0.00	15 ± 4	-36.6 ± 7.8
J/Ψ	0.1	(0.2, 0.1)	0.03 ± 0.01	-150 ± 9	0.04 ± 0.01	-125 ± 10	19.7 ± 25.6
χ_{c0}	2.5	(2.6, 2.5)	0.18 ± 0.01	-18 ± 2	0.16 ± 0.01	-17 ± 2	-10.3 ± 4.4
Re-scattering	1.7	(2.7, 1.0)	0.11 ± 0.01	-112 ± 2	0.16 ± 0.01	-98 ± 1	37.7 ± 6.8
$f_0(1710)$	4.4	(4.1, 4.7)	0.24 ± 0.01	59 ± 1	0.20 ± 0.01	62 ± 1	19.0 ± 3.6
Fit Fraction Sum	115.2	(117.2, 113.7)					

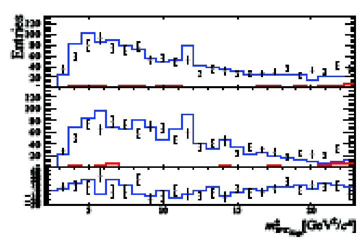

(a) (Top: 3.92; 6e-11) (Mid.: 4.23; 3e-12)
(Cut: m13Sq>0.7 AND m13Sq<1.3)

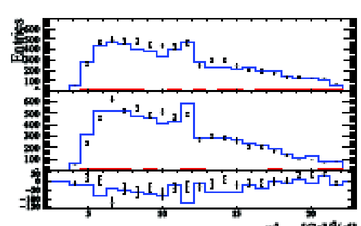

(b) (Top: 9.77; 1e-50) (Mid.: 4.6; 1e-17)
(Cut: m13Sq>1.3 AND m13Sq<1.8)

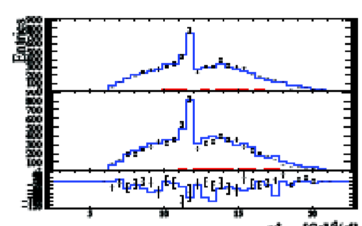

(c) (Top: 5.22; 5e-23) (Mid.: 6.89; 2e-34)
(Cut: m13Sq>1.8 AND m13Sq<2.15)

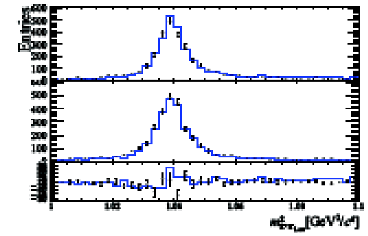

(d) (Top: 5.99; 3e-28) (Mid.: 3.34; 2e-11)
(Cut: m13Sq>2.15 AND m13Sq<2.5)

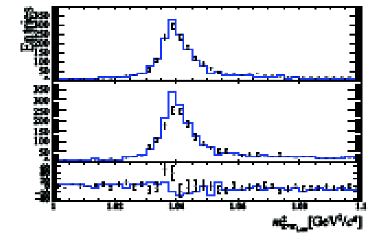

(e) (Top: 6.39; 2e-32) (Mid.: 7.11; 1e-37)
(Cut: m13Sq>2.5 AND m13Sq<3.)

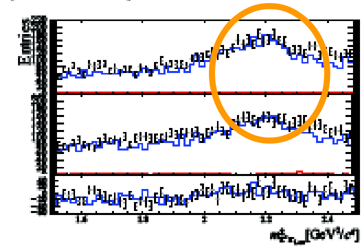

(f) (Top: 3.78; 1e-09) (Mid.: 5.38; 2e-16)
(Cut: m13Sq>3. AND m13Sq<3.5)

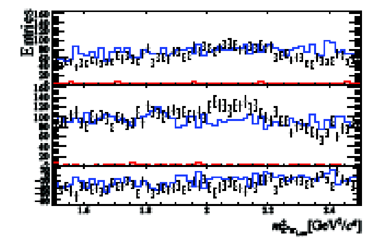

(g) (Top: 4.09; 1e-10) (Mid.: 6.02; 2e-18)
(Cut: m13Sq>4 AND m13Sq<6.)

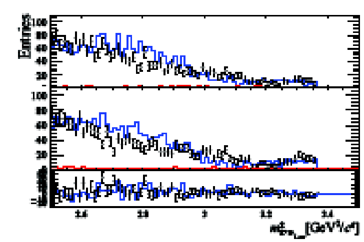

(h) (Top: 4.39; 1e-14) (Mid.: 7.14; 1e-29)
(Cut: m13Sq>6)

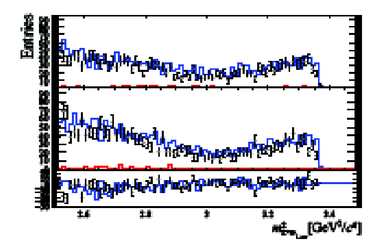

(a) (Top: 8.72; 2e-53) (Mid.: 2.57; 1e-07)
(Cut: cosHel13<0)

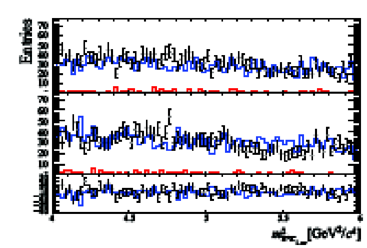

(b) (Top: 11.33; 7e-75) (Mid.: 3.71; 5e-15)
(Cut: cosHel13>0)

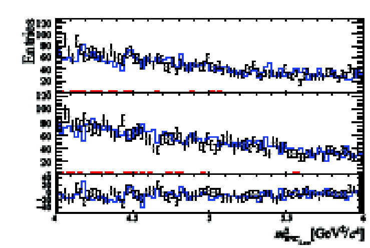

(c) (Top: 4.43; 1e-28) (Mid.: 3.59; 6e-20)
(Cut: cosHel13<0)


(d) (Top: 7.22; 8e-60) (Mid.: 5.86; 3e-44)
(Cut: cosHel13>0)

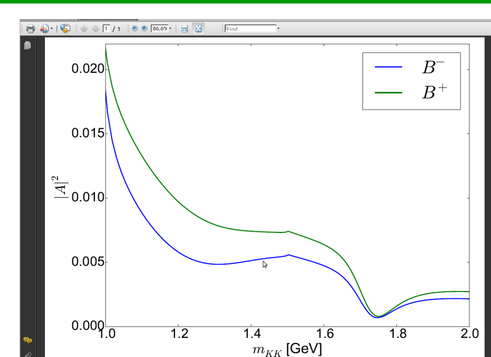

(e) (Top: 8.82; 1e-83) (Mid.: 8.02; 3e-52)
(Cut: cosHel13<0)

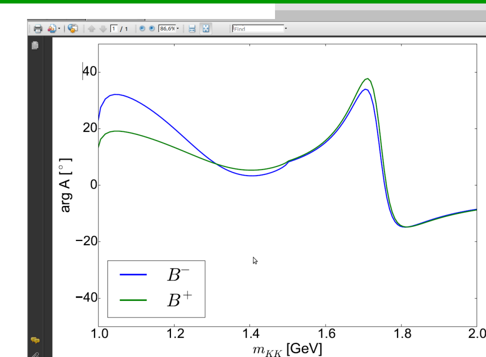

(f) (Top: 3.36; 3e-20) (Mid.: 3.64; 4e-23)
(Cut: cosHel13>0)

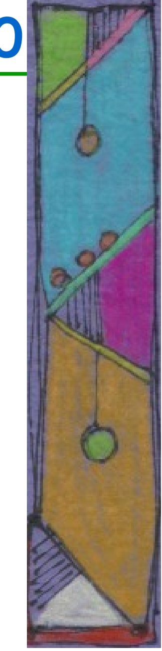

g) (Top: 2.41; 2e-11) (Mid.: 2.56; 3e-13)
Cut: cosHel13<0)


(h) (Top: 2.86; 1e-18) (Mid.: 3.06; 4e-19)
(Cut: cosHel13>0)

sWave







- With the known (or even created) objects it is very hard to ha a reasonable fit
- Notice the large interference and the fact that the rescattering ACP>0 where we'd expect <0

- We did not yet tried a generic NR ~ BaBar... Rather we are trying the QMI

- Inspired in:

Nuclear Physics B 899 (2015) 247–264

Three-body non-leptonic B decays and QCD factorization

Susanne Kränkl, Thomas Mannel, Javier Virto *

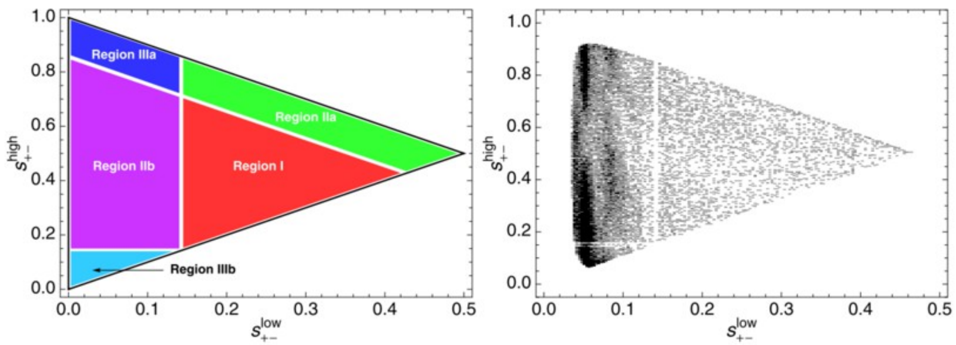
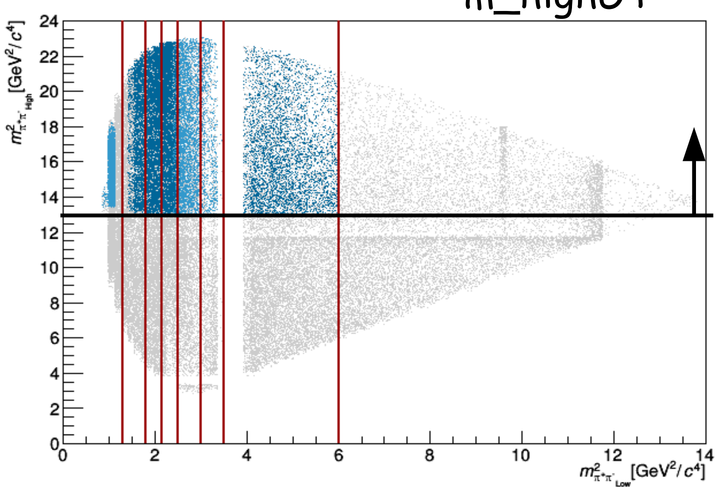


Fig. 1. Left: The physical kinematical region in the plane of two independent momentum invariants s_{+-}^{low}, s_{+-}^{high} (Dalitz plot), divided into the different regions with special kinematical configurations: I – Mercedes Star configuration, IIa, IIb – Two collinear pions, IIIa, IIIb – One soft pion. Right: Dalitz plot distribution for $B^+ \to \pi^+\pi^-\pi^+$ from Ref. [5].

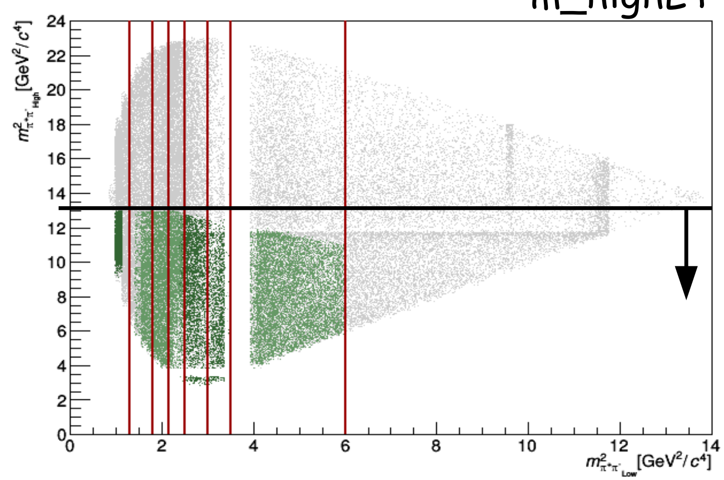
… we are now splitting the Dalitz
… at first we started doing this porposed split

- But for now just the siple split:

m_highGT



m_highLT

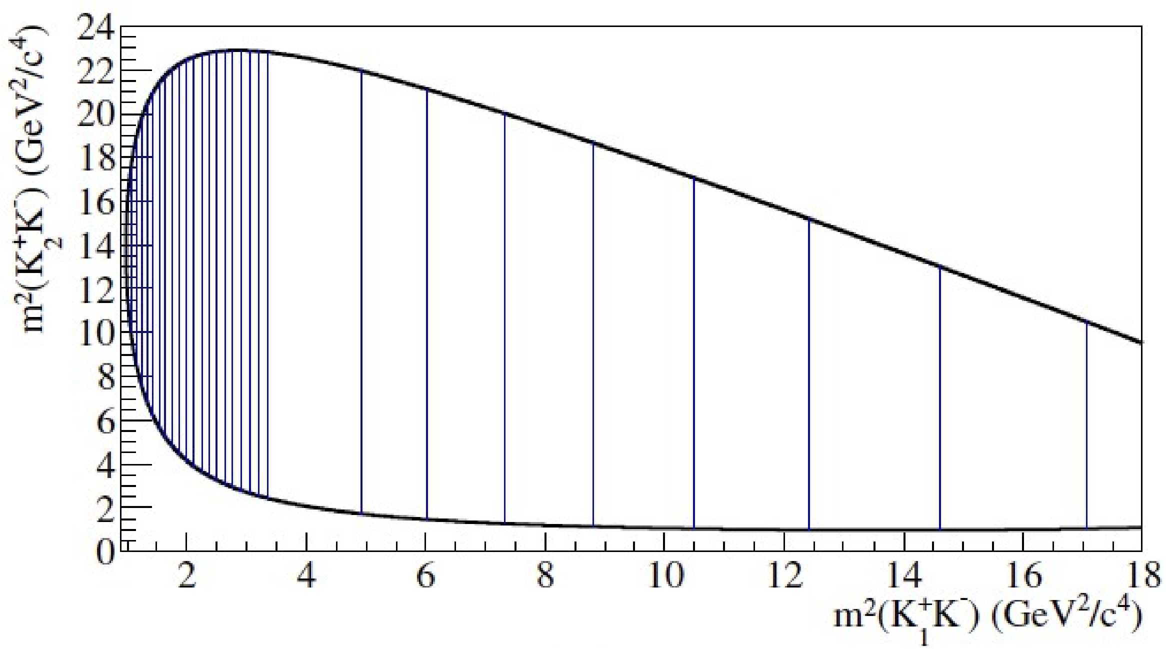


Setup

Non-S-wave: $\phi(1020)$, $f_2'(1525)$ and χ_{c0}

S-wave: 20 bins below charm threshold, 10 bins above, spread evenly in the mass

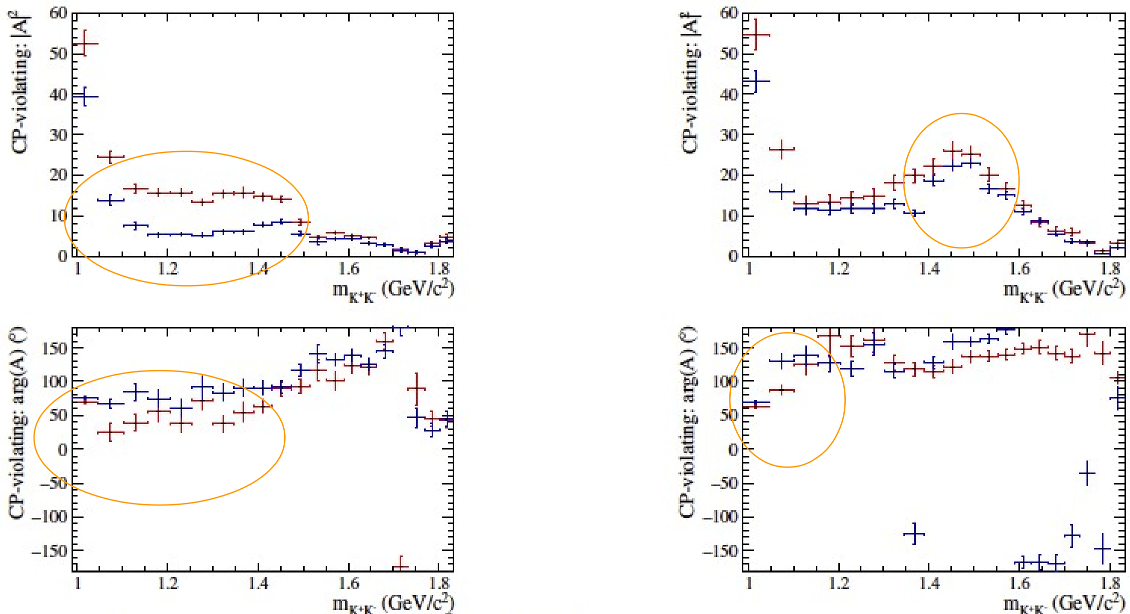
Bose symmetric binning in orthogonal direction implied



Jeremy fits the whole phase space but also splits … I will show only those to compare w isobar

Results

$m^2_{\rm high}(K^+K^-) < 14~{\rm GeV}^2/c^4$ $\qquad$ $m^2_{\rm high}(K^+K^-) > 14~{\rm GeV}^2/c^4$



S-wave motion clearly different in $m^2_{\rm high}(K^+K^-)$ regions which is unexpected
Could be looking at a new CP violating mechanism!
Next step is to pixelise the QMI

$B^+ \to K^+K^+K^-$ QMI 6

shigh > 14

FF(phiKp) = 15.3876 +/- 0.328246
FF+(phiKp) = 15.3885 +/- 0.414427
FF-(phiKp) = 15.3867 +/- 0.389577

FF(f2Kp) = 1.73203 +/- 0.232363
FF+(f2Kp) = 1.30891 +/- 0.324183
FF-(f2Kp) = 2.15516 +/- 0.311331

FF(chic0Kp) = 0.96111 +/- 0.1203
FF+(chic0Kp) = 0.937932 +/- 0.148136
FF-(chic0Kp) = 0.984288 +/- 0.149289

FF(SwaveKp) = 70.8911 +/- 0.619718
FF+(SwaveKp) = 71.7097 +/- 1.68053
FF-(SwaveKp) = 70.0725 +/- 1.01145

FF(Sum) = 88.9718 +/- 0.505555
FF+(Sum) = 89.345 +/- 1.5163
FF-(Sum) = 88.5986 +/- 1.12189

Acp(phiKp) = -5.81554e-05 +/- 0.0174326
Acp(f2Kp) = 0.244292 +/- 0.131327
Acp(chic0Kp) = 0.0241157 +/- 0.0864499
Acp(SwaveKp) = -0.0115474 +/- 0.0138049

shigh < 14

FF(phiKp) = 12.4058 +/- 0.184568
FF+(phiKp) = 12.1633 +/- 0.282241
FF-(phiKp) = 12.6483 +/- 0.289112

FF(f2Kp) = 2.55233 +/- 0.195227
FF+(f2Kp) = 2.62721 +/- 0.313784
FF-(f2Kp) = 2.47746 +/- 0.239317

FF(chic0Kp) = 5.90076 +/- 0.188311
FF+(chic0Kp) = 3.89043 +/- 0.261576
FF-(chic0Kp) = 7.91109 +/- 0.274622

FF(SwaveKp) = 79.9672 +/- 0.709158
FF+(SwaveKp) = 88.6826 +/- 1.02964
FF-(SwaveKp) = 71.2518 +/- 0.971649

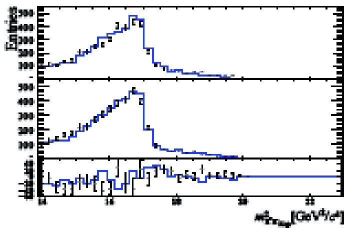
FF(Sum) = 100.826 +/- 0.667746
FF+(Sum) = 107.364 +/- 1.03655
FF-(Sum) = 94.2886 +/- 0.94534

Acp(phiKp) = 0.0195457 +/- 0.0170584
Acp(f2Kp) = -0.0293366 +/- 0.0760898
Acp(chic0Kp) = 0.34069 +/- 0.0283046

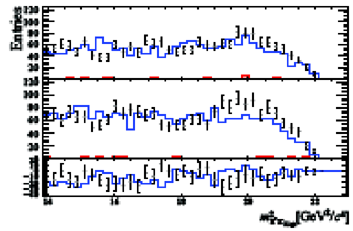
- ~comaparable non Swave
- Very different Swave: amplitude shape; phase motion and CPV

fit 24003

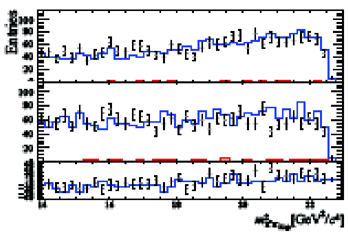
[NLL -186657] Component	Fit fraction (%) <FF>	(B^-, B^+)	Magnitude and phase coefficients a_i^+	δ_i^+ [°]	a_i^-	δ_i^- [°]	A_{CP} (%)
NRTobiasNR	79.4	(79.4, 79.5)	1.06 ± 0.01	0 ± 0	0.94 ± 0.01	0 ± 0	-11.0 ± 0.9
$\phi(1020)$	12.0	(12.3, 11.7)	0.40 ± 0.01	-47 ± 2	0.37 ± 0.01	-59 ± 2	-8.2 ± 4.1
$\rho VETO$	0.5	(0.4, 0.5)	0.09 ± 0.01	66 ± 6	0.07 ± 0.01	7 ± 7	-21.8 ± 16.0
$f_2'(1525)$	1.8	(1.2, 2.2)	0.18 ± 0.01	-16 ± 3	0.12 ± 0.01	-19 ± 5	-38.3 ± 8.7
J/Ψ	0.4	(0.5, 0.4)	0.07 ± 0.00	-95 ± 7	0.08 ± 0.00	-85 ± 6	8.2 ± 8.8
χ_{c0}	2.6	(2.7, 2.5)	0.19 ± 0.01	-40 ± 4	0.17 ± 0.01	-30 ± 4	-7.4 ± 9.7
Re-scattering	2.3	(2.5, 2.2)	0.17 ± 0.01	-112 ± 2	0.17 ± 0.01	-106 ± 2	-5.0 ± 8.9
$f_0(1710)$	2.8	(3.2, 2.6)	0.19 ± 0.01	39 ± 3	0.19 ± 0.01	37 ± 3	-0.8 ± 6.3
$f_0(1500)$	5.0	(3.5, 6.2)	0.29 ± 0.01	-47 ± 2	0.20 ± 0.01	-65 ± 4	-37.1 ± 6.7
Fit Fraction Sum	106.9	(105.8, 107.8)					



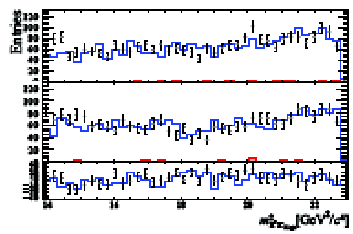
(a) (Top: 3.13; 5e-08) (Mid.: 1.45; 0.08)
(Cut: m13Sq>0.7 AND m13Sq<1.3)



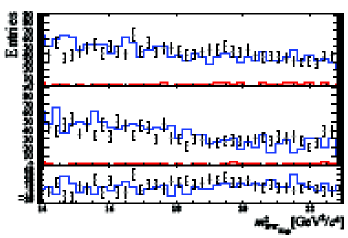
(b) (Top: 3.54; 2e-12) (Mid.: 3.0; 4e-09)
(Cut: m13Sq>1.3 AND m13Sq<1.8)



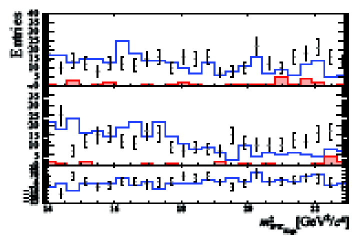
(c) (Top: 1.41; 0.05) (Mid.: 2.29; 1e-09)
(Cut: m13Sq>1.8 AND m13Sq<2.15)



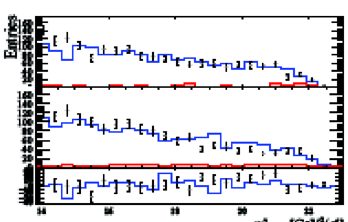
(d) (Top: 2.75; 2e-08) (Mid.: 2.69; 4e-08)
(Cut: m13Sq>2.15 AND m13Sq<2.5)



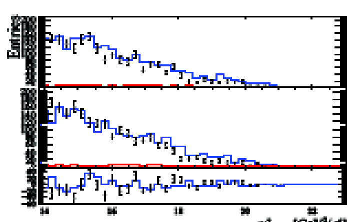
(e) (Top: 2.82; 8e-09) (Mid.: 3.48; 9e-13)
(Cut: m13Sq>2.5 AND m13Sq<3.)



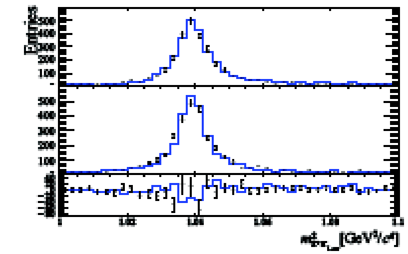
(f) (Top: 2.8; 2e-05) (Mid.: 4.48; 5e-13)
(Cut: m13Sq>3. AND m13Sq<3.5)



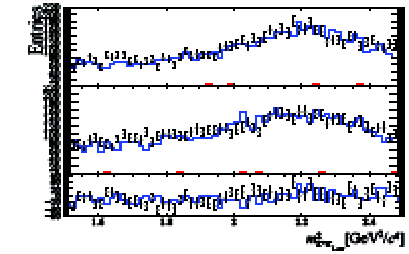
(g) (Top: 3.33; 6e-08) (Mid.: 3.54; 9e-09)
(Cut: m13Sq>4 AND m13Sq<6.)



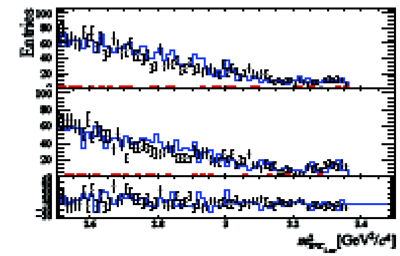
(h) (Top: 5.93; 3e-24) (Mid.: 6.65; 1e-27)
(Cut: m13Sq>8)



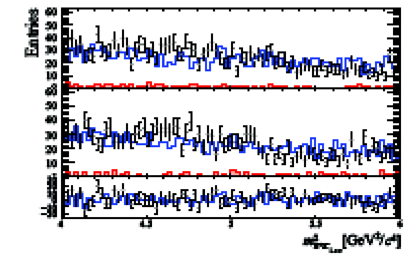
(a) (Top: 2.17; 2e-05) (Mid.: 2.59; 8e-08)
(Cut: cosHel13<0)



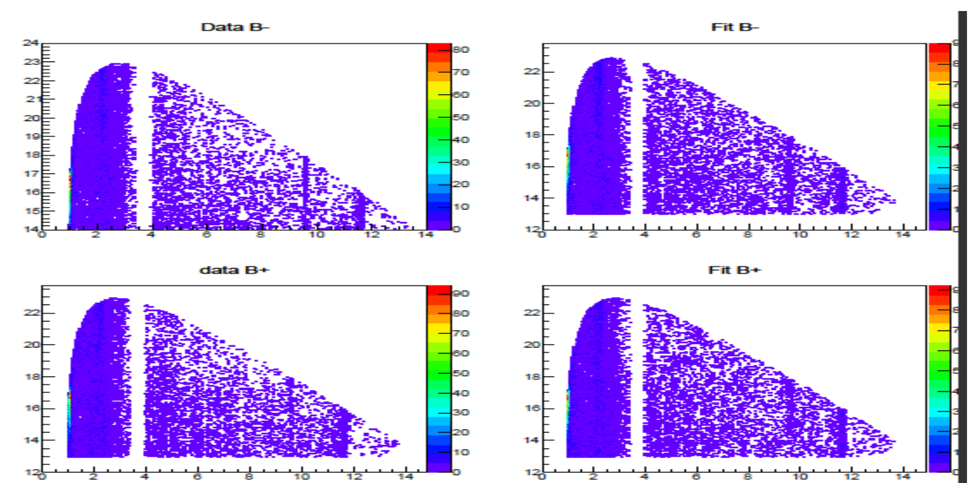
(b) (Top: 2.85; 4e-11) (Mid.: 2.25; 7e-08)
(Cut: cosHel13<0)



(c) (Top: 3.08; 9e-17) (Mid.: 3.33; 1e-19)
(Cut: cosHel13<0)



(d) (Top: 3.42; 2e-23) (Mid.: 2.53; 8e-13)
(Cut: cosHel13<0)

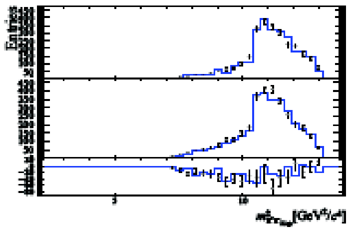


This have the same nonSWave as the QMI
(unfortunately I do no have the phase and amplitude for the SWave)

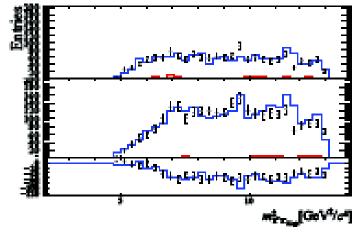
Parameters	Values

fit2300LT (same as 10050)

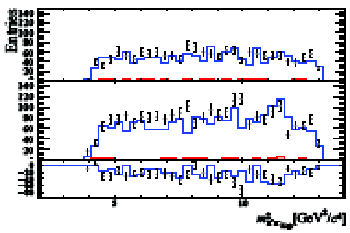
[NLL -175436] Component	Fit fraction (%) < FF >	(B^-, B^+)	Magnitude and phase coefficients a_i^+	δ_i^+ [°]	a_i^-	δ_i^- [°]	A_{CP} (%)
NRTobiasNR	104.8	(107.8, 102.6)	1.06 ± 0.01	0 ± 0	0.94 ± 0.01	0 ± 0	-12.8 ± 0.7
$\phi(1020)$	8.4	(9.4, 7.7)	0.29 ± 0.01	71 ± 3	0.28 ± 0.01	110 ± 3	-5.8 ± 4.0
$\phi(1680)$	1.8	(2.8, 1.1)	0.11 ± 0.01	-44 ± 7	0.15 ± 0.01	-16 ± 6	29.0 ± 14.4
$f_2'(1525)$	1.0	(1.1, 1.0)	0.11 ± 0.01	76 ± 4	0.09 ± 0.01	83 ± 5	-13.2 ± 11.5
$f_2(1270)$	0.1	(0.1, 0.1)	0.04 ± 0.01	64 ± 11	0.03 ± 0.01	-36 ± 14	-25.7 ± 29.7
J/Ψ	0.2	(0.2, 0.2)	0.05 ± 0.01	112 ± 7	0.04 ± 0.01	110 ± 8	-15.2 ± 16.5
χ_{c0}	2.7	(2.8, 2.6)	0.17 ± 0.01	-11 ± 2	0.15 ± 0.01	-17 ± 2	-11.2 ± 4.9
Re-scattering	2.4	(4.7, 0.6)	0.08 ± 0.01	-70 ± 5	0.20 ± 0.01	-74 ± 2	69.5 ± 6.5
$f_0(1710)$	5.1	(6.1, 4.5)	0.22 ± 0.01	64 ± 3	0.22 ± 0.01	67 ± 3	0.1 ± 8.2
Fit Fraction Sum	126.6	(134.9, 120.5)					



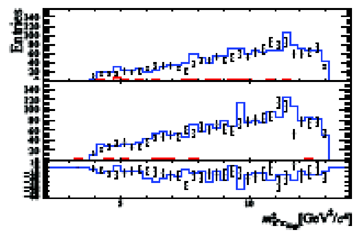
(a) (Top: 2.96; 1e-05) (Mid.: 1.7; 0.03)
(Cut: m13Sq>0.7 AND m13Sq<1.3)



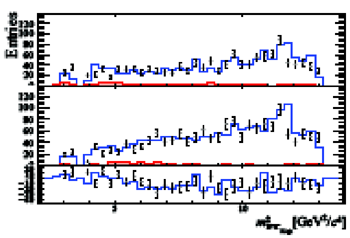
(b) (Top: 3.24; 2e-08) (Mid.: 4.39; 7e-14)
(Cut: m13Sq>1.3 AND m13Sq<1.8)



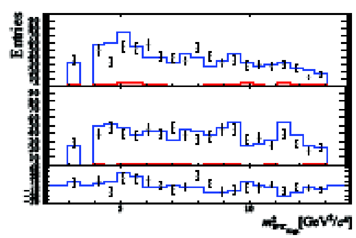
(c) (Top: 2.53; 5e-08) (Mid.: 4.5; 1e-15)
(Cut: m13Sq>1.8 AND m13Sq<2.15)



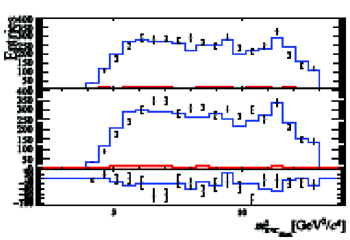
(d) (Top: 3.18; 6e-09) (Mid.: 4.14; 3e-14)
(Cut: m13Sq>2.15 AND m13Sq<2.5)



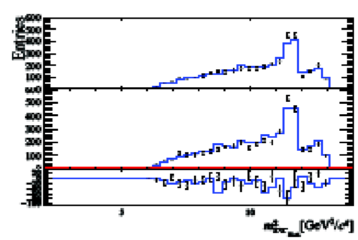
(e) (Top: 4.03; 8e-14) (Mid.: 3.96; 1e-13)
(Cut: m13Sq>2.5 AND m13Sq<3)



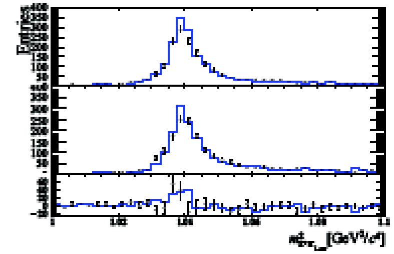
(f) (Top: 3.06; 5e-06) (Mid.: 1.87; 0.01)
(Cut: m13Sq>3. AND m13Sq<3.5)



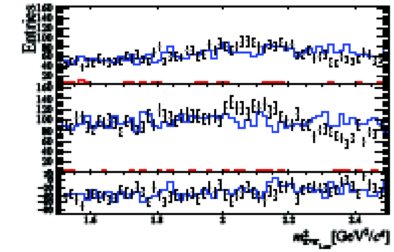
(g) (Top: 2.78; 6e-05) (Mid.: 4.87; 1e-11)
(Cut: m13Sq>4 AND m13Sq<6)



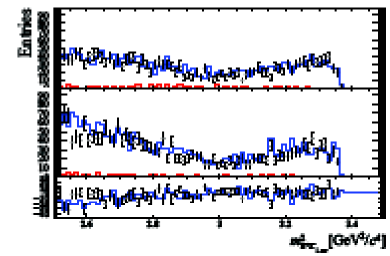
(h) (Top: 2.98; 1e-06) (Mid.: 3.12; 4e-07)
(Cut: m13Sq>6)



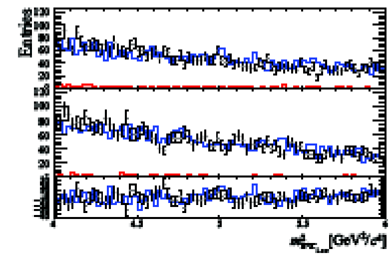
(a) (Top: 2.27; 7e-06) (Mid.: 2.71; 1e-08)
(Cut: cosHel13>0)



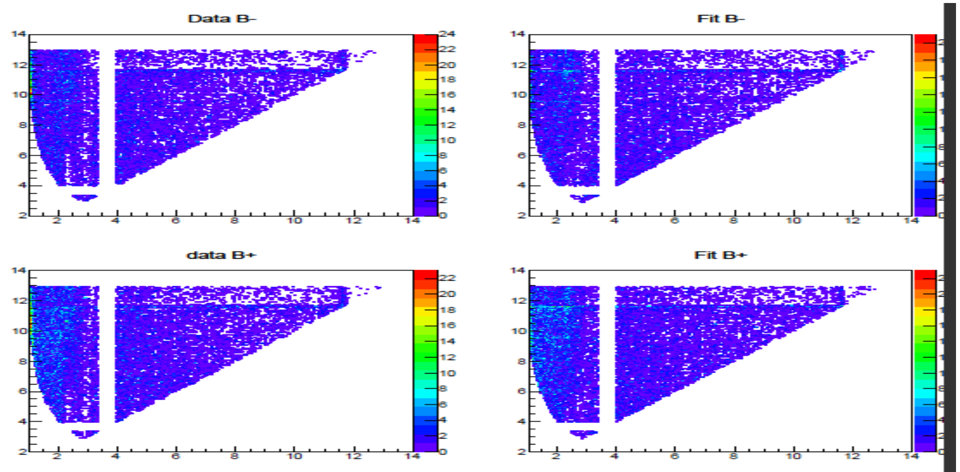
(b) (Top: 3.93; 2e-23) (Mid.: 5.52; 2e-40)
(Cut: cosHel13>0)

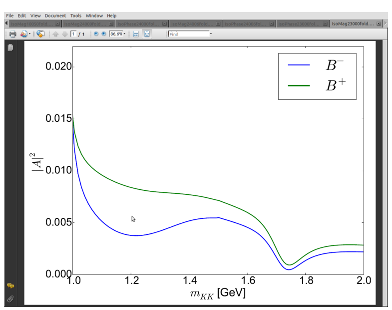


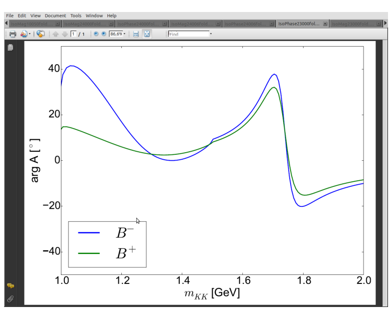
(c) (Top: 2.81; 3e-14) (Mid.: 3.24; 1e-18)
(Cut: cosHel13>0)



(d) (Top: 3.92; 5e-30) (Mid.: 3.46; 5e-24)
(Cut: cosHel13>0)



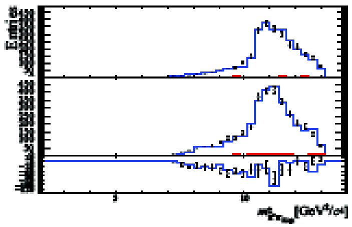




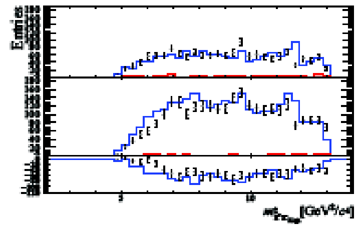
fit 23000

fit2304LT(-Φ(1680) - f2(1270))

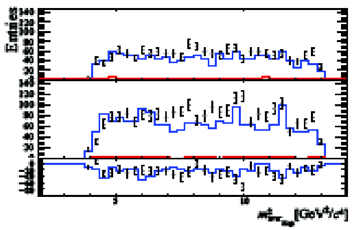
[NLL -175347] Component	Fit fraction (%) $<FF>$	(B^-, B^+)	Magnitude and phase coefficients a_i^+	δ_i^+ [°]	a_i^-	δ_i^- [°]	A_{CP} (%)
NRTobiasNR	98.2	(100.1, 96.8)	1.07 ± 0.00	0 ± 0	0.93 ± 0.00	0 ± 0	-13.7 ± 0.7
$\phi(1020)$	8.7	(9.8, 7.9)	0.31 ± 0.01	68 ± 3	0.29 ± 0.01	103 ± 3	-4.6 ± 3.8
$f_2'(1525)$	2.6	(2.7, 2.5)	0.17 ± 0.01	80 ± 2	0.15 ± 0.01	84 ± 2	-10.2 ± 6.7
J/Ψ	0.2	(0.2, 0.2)	0.05 ± 0.01	103 ± 7	0.04 ± 0.01	110 ± 8	-17.4 ± 16.1
χ_{c0}	2.7	(2.8, 2.6)	0.18 ± 0.01	-13 ± 2	0.16 ± 0.01	-16 ± 2	-12.0 ± 4.9
Re-scattering	1.4	(3.1, 0.2)	0.04 ± 0.01	-56 ± 11	0.17 ± 0.01	-77 ± 3	87.1 ± 5.5
$f_0(1710)$	4.4	(4.4, 4.3)	0.23 ± 0.01	103 ± 3	0.20 ± 0.01	118 ± 3	-14.1 ± 5.8
Fit Fraction Sum	118.2	(123.3, 114.5)					



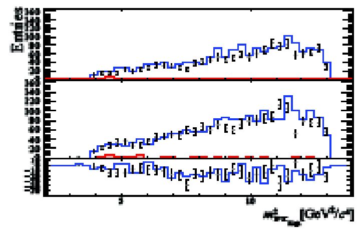
(a) (Top: 1.47; 0.08) (Mid.: 2.78; 3e-05)
(Cut: m13Sq>0.7 AND m13Sq<1.3)



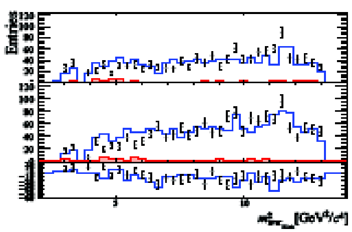
(b) (Top: 5.7; 2e-20) (Mid.: 5.79; 8e-21)
(Cut: m13Sq>1.3 AND m13Sq<1.8)



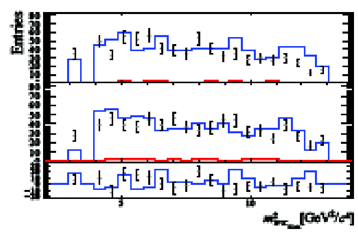
(c) (Top: 2.97; 6e-08) (Mid.: 5.45; 7e-21)
(Cut: m13Sq>1.8 AND m13Sq<2.15)



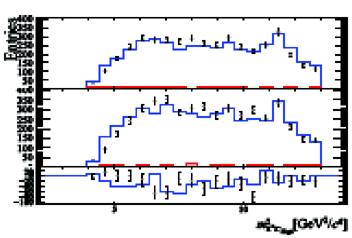
(d) (Top: 3.12; 1e-08) (Mid.: 3.7; 7e-12)
(Cut: m13Sq>2.15 AND m13Sq<2.5)



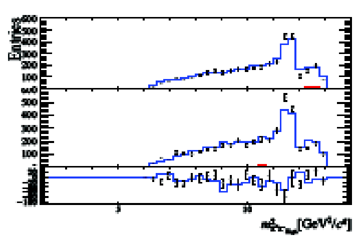
(e) (Top: 4.45; 2e-16) (Mid.: 4.65; 2e-17)
(Cut: m13Sq>2.5 AND m13Sq<3.)



(f) (Top: 5.05; 8e-13) (Mid.: 2.05; 0.004)
(Cut: m13Sq>3. AND m13Sq<3.5)

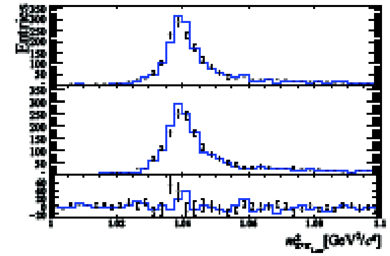


(g) (Top: 2.7; 8e-05) (Mid.: 5.78; 8e-15)
(Cut: m13Sq>4 AND m13Sq<6.)

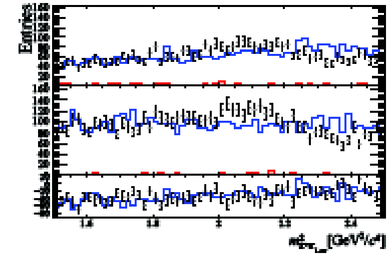


(h) (Top: 3.3; 8e-08) (Mid.: 3.55; 9e-09)
(Cut: m13Sq>6)

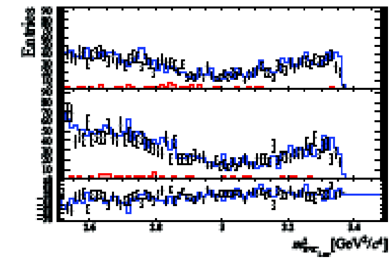
Parameters	Values
$m[f_0(1710)]$	1.7529 ± 0.0037
$\Gamma[f_0(1710)]$	0.1330 ± 0.0065



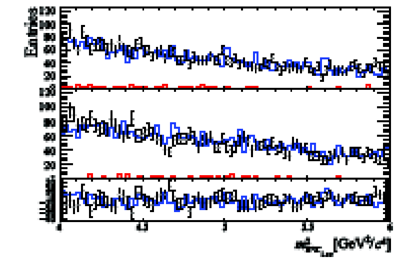
(a) (Top: 2.72; 2e-08) (Mid.: 2.06; 6e-05)
(Cut: cosHel13>0)



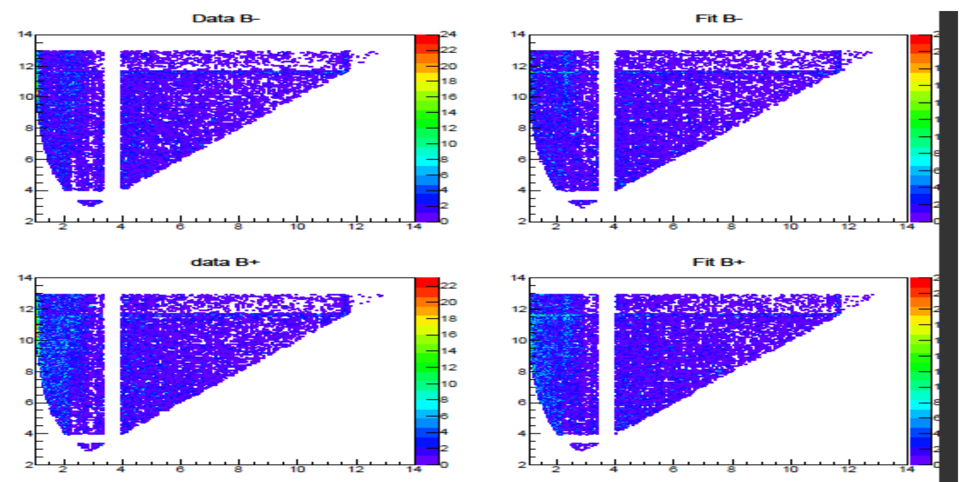
(b) (Top: 4.95; 4e-34) (Mid.: 6.34; 1e-49)
(Cut: cosHel13>0)



(c) (Top: 2.46; 8e-11) (Mid.: 2.89; 6e-15)
(Cut: cosHel13>0)



(d) (Top: 3.22; 6e-21) (Mid.: 3.16; 3e-20)
(Cut: cosHel13>0)



The isobar M_highLT region reproduce the CPV via destructive interference of TobiasNR and Rescatt!

fit 23004

final remarks

- Very interesting, large statistics and low background... should be the first to be done, but...NO too hard!

- Special features:
  - Large NR – need better model
  - Large localized CPV not clearly associated to standard possible contributions – need better model
  - Apparently the quasi-2body approximation fail in several regions, really?
  - Nevetheless some stable isobar outcomes: NR>~80% CPV~-13%

- Very recently we started the QMI approach – very promising
  - sensitive to non Swave model
  - difficult to interpret, but it is a guide to isobar -win win
  - start working on 2D QMI (Juan Otalora) – if indeed quasi-2body fails … even more sensitive to noSwave model