

# Coh $\phi^0$ Analysis (P+,P- > **2.0**) (zetanorm)

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# 1 Analysis Method Comments

## Analysis methods used:

- NCDIS MC uses only the NEGLIB simulation.
- CCDISnorm = 1.0
- CohRho0 = 0.669 (from Coh $\rho^0$  analysis)
- OBG 0<sup>th</sup> norm is near the value we found in Coh $\rho^0$  (0.22)

## DS Correction function(s) applied to NCDIS:

- \* Mass
- \* Zeta

DS renormalization factor: 0.98986641 NCDIS is normalized on Phi12 with: Zeta>0.075

OBG is normalized on Mkk in the range (1.05-1.1475)

Coh $\phi^0$  is normalized on a Zeta plot within the Phi Mass, or on an Mkk plot with Zeta $\leq$ 0.075.

The Chisq. calculation is then iterated until convergence.

## 2 Zeroth Norms

Table 1 shows the generated, MC-Z-weighted number of events to pass basic cuts. These numbers are used for weighting to the desired number of "Zeroth Norm" events.

**The cuts include:**

1. Fid  $|x,y-5| \leq 130$  ;  $5 < zvs < 405$
2. Pfermi cut
3.  $W^2$  cut (DIS only)

**Note:** These zeroth norm values do not include any factors from other analyses (like Coherent  $\rho^0$  or  $\pi^0$ ). These factors are applied later (I will eventually add them here).

	Gen Number	Zroth Norm
CCDIS	4477717.5	1440000.0
NCDIS	3241992.5	547200.0
CohPhi0	4075.9	200.0
CohPi0	38022.6	5000.0
CohRho0	25235.8	1000.0
aNuMu NC	184929.3	13680.0
CohPi+	412962.8	10000.0
CohRho+	147680.4	7380.1
aNuMu CC	373331.0	36000.0
QE	9887975.0	32000.0
Nue CC	425471.2	21600.0
aNue CC	183138.1	2160.0
Res	5600115.0	50400.0
JPsi	10567.5	29.6

Table 1: Generated Number of MC Events

### 3 General Information

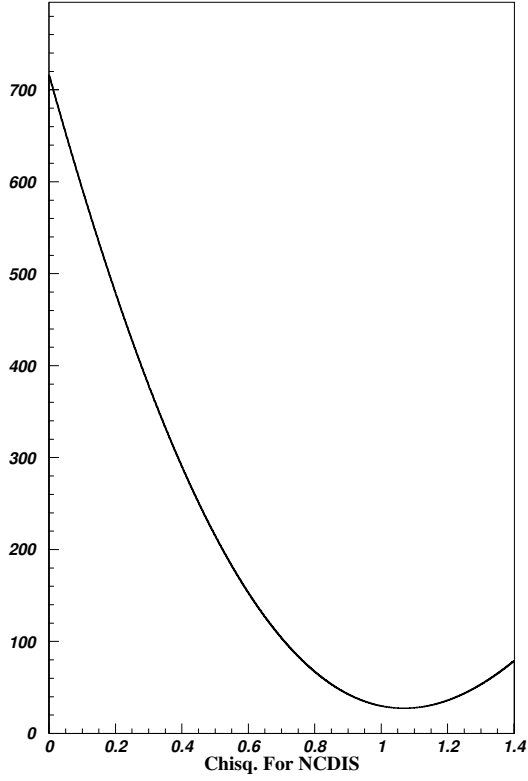
#### 3.1 Summary Cut Table

Cut Name	NCDIS	CCDIS	OBG	Coh $\rho^0$	Coh $\phi^0$	Other	Total	Data
1) Raw Events	156203.8	34081.7	55192.2	623.3	87.4	35927.4	282115.8	975135.0
2) OBGfid,Trig+CohGenTh	156203.8	34081.7	7028.0	623.3	87.4	35927.4	233951.6	975135.0
3) Pfermi & W2	156203.8	34081.7	7028.0	623.3	87.4	35781.6	233805.8	975135.0
4) Fid. Vol. -X	149643.3	31706.1	6711.3	596.9	84.0	34026.1	222767.8	903682.0
5) Fid. Vol. -Y	142779.1	28062.7	6556.4	572.8	80.4	32324.4	210375.8	812220.0
6) Fid. Vol. -Z	142779.1	28062.7	4866.8	572.8	80.4	32324.4	208686.2	393448.0
7) No Muons	142779.1	28062.7	4549.0	545.2	72.0	18942.8	194950.8	393448.0
8) ncand=2	64683.3	13721.3	4549.0	495.5	63.6	4729.1	88241.8	291148.0
9) tnchg=2	55198.9	11733.2	4549.0	481.1	59.9	4123.0	76145.2	212028.0
10) +/- Tracks (V0)	44695.4	9143.9	4546.8	474.2	59.1	3425.0	62344.4	156090.0
11) Tube/Veto Cut	44695.4	9143.9	4546.8	474.2	59.1	3425.0	62344.4	156090.0
12) Ekk > 4.0	18080.6	3237.8	1208.6	453.2	58.3	1950.8	24989.3	26211.0
13) P+- > 1.0	11738.5	2452.3	805.7	398.3	58.0	1231.0	16683.7	17844.0
14) Theta<2.62 rad	11657.6	2444.1	794.1	398.1	58.0	1223.3	16575.2	15314.0
15) Upstream Hangers	10970.4	2336.7	794.1	395.5	57.7	1182.4	15736.8	14243.0
16) nsecond < 4	10565.9	2243.9	794.1	390.1	57.1	1142.8	15194.0	13419.0
17) Hanger F.V.	9155.5	1941.7	794.1	363.6	53.7	1009.2	13317.8	11525.0
18) No Hangers near Vert	8184.4	1770.8	794.1	359.1	53.1	936.3	12097.8	10755.0
19) Pz>0 for tracks	8182.1	1770.8	794.1	359.1	53.1	935.8	12095.0	10711.0
20) Thprimord<0.4	6333.6	1282.5	629.8	347.0	50.9	735.1	9378.8	8675.0
21) Nunh*fracunh<200	6331.2	1282.0	629.8	347.0	50.9	734.1	9375.0	8535.0
22) Pt+wrt- >= 0.05	6247.4	1276.4	314.1	346.5	49.9	729.4	8963.7	8150.0
23) mee > 0.1	6207.2	1272.0	254.5	346.3	47.0	726.4	8853.4	8025.0
24) PAN >= 0.5	4501.1	893.3	213.0	342.8	46.8	506.8	6503.8	5850.0
25) -0.4< P asym <0.4	2242.6	457.3	86.4	167.2	45.8	153.8	3153.1	2848.0
26) Phi12 < 100deg	1704.6	46.4	74.1	88.0	43.6	54.9	2011.7	1848.0
27) P+- > 1.25	1694.0	46.1	73.9	87.9	43.6	54.6	2000.1	1843.0
28) P+- > 1.5	1585.8	40.0	71.8	87.3	43.6	50.4	1878.9	1760.0
29) P+- > 1.75	1395.6	32.9	67.6	85.7	43.5	44.9	1670.2	1610.0
30) P+- > 2.0	1171.4	23.9	63.3	83.1	42.9	36.9	1421.5	1432.0
31) P+- > 2.5	826.7	10.4	54.6	77.4	41.4	25.1	1035.7	1098.0

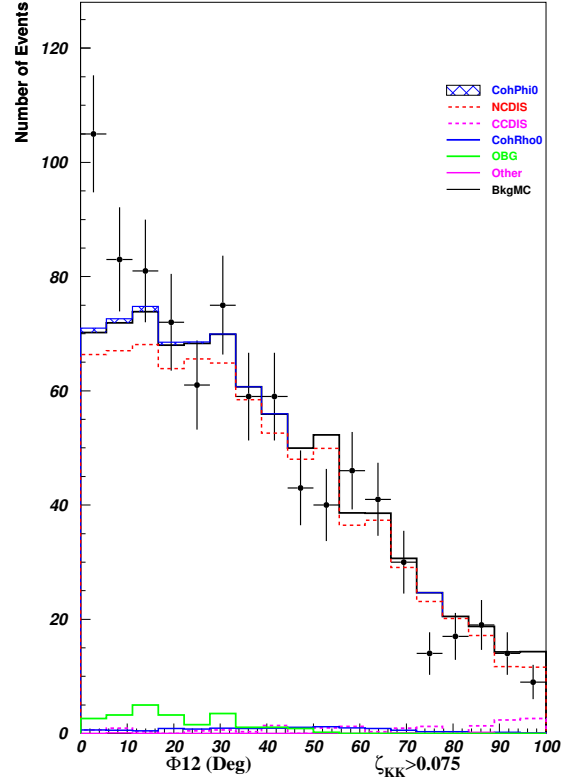
Table 2: Summary Cut Table

## 4 Normalizations

### 4.1 NCDIS Normalization



(a)  $1\sigma$   $\chi^2$  plot for NCDIS ([chisq/chisq-ncdis.pdf](#))



(b) Plot used for NCDIS chisq. normalization ([nc-chisq-plot.pdf](#))

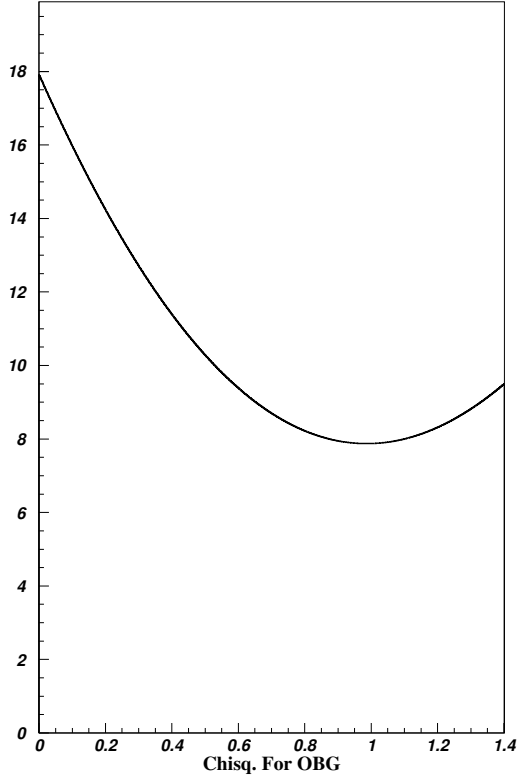
Figure 1: Plots for NCDIS normalization

$\chi^2$ Min 27.431 Number of bins used: 18. One $\sigma$ : 1.234		
Norm at Min $\chi^2$	NCDIS	
$-1\sigma$	1.068	
	1.020	( 4.5%)
$+1\sigma$	1.117	( 4.6%)

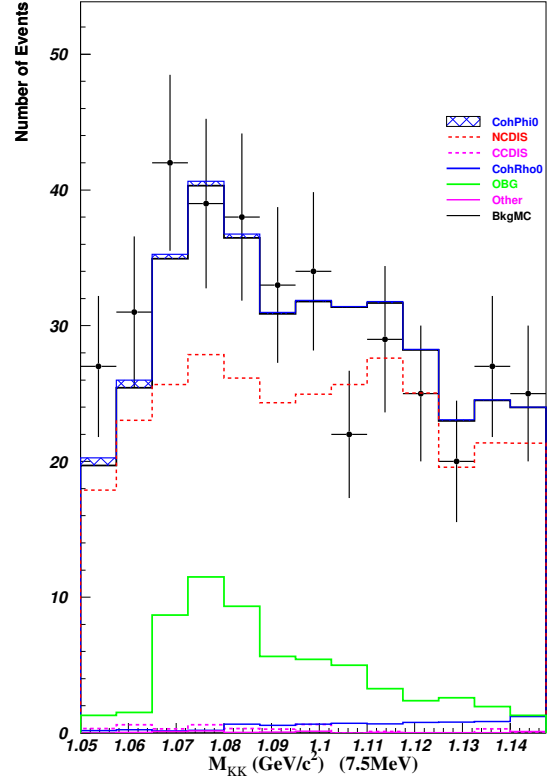
Table 3:  $\chi^2$  for NCDIS on plot:Phi12 ZetaBkg



## 4.2 OBG Normalization



(a)  $1\sigma$   $\chi^2$  plot for OBG (chisq/chisq-obg.pdf)



(b) Plot used for OBG chisq. normalization (obg-chisq-plot.pdf)

Figure 2: Plots for OBG normalization

$\chi^2$ Min 7.874 Number of bins used: 13. One $\sigma$ : 0.778		
Norm at Min $\chi^2$	OBG	
$-1\sigma$	0.986	
$+1\sigma$	0.708	( 28.2%)
	1.270	( 28.8%)

Table 4:  $\chi^2$  for OBG on plot:Mkk OBG

### 4.3 $\text{Coh}\phi^0$ Normalization

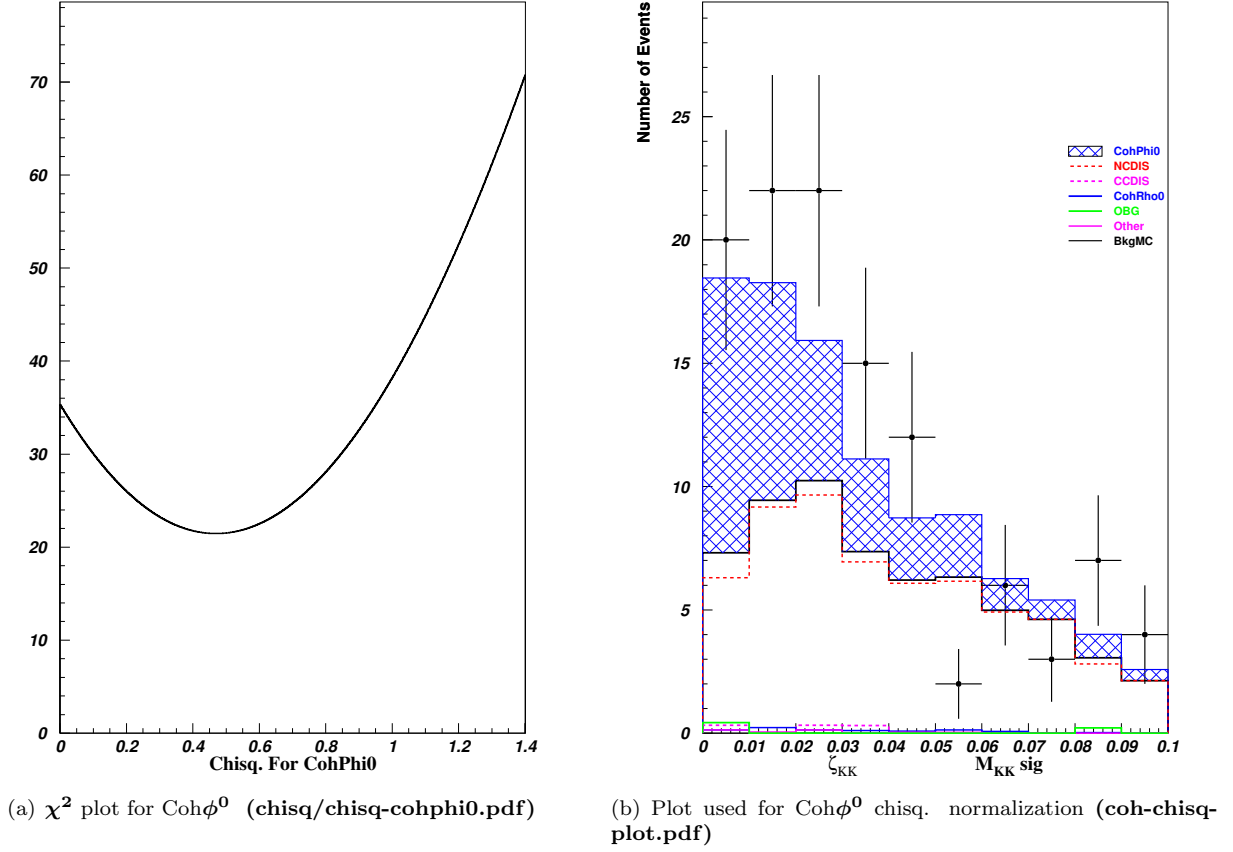


Figure 3: Plots for  $\text{Coh}\phi^0$  normalization

$\chi^2$ Min 21.461 Number of bins used: 10. One $\sigma$ : 1.465		
Norm at Min $\chi^2$	CohPhi0	
$-1\sigma$	0.469	
$+1\sigma$	0.316	( 32.6%)
	0.623	( 32.8%)

Table 5:  $\chi^2$  for CohPhi0 on plot:ZetaKK PhiMass

## 5 Plots

### 5.1 $M_{KK}$ Plots

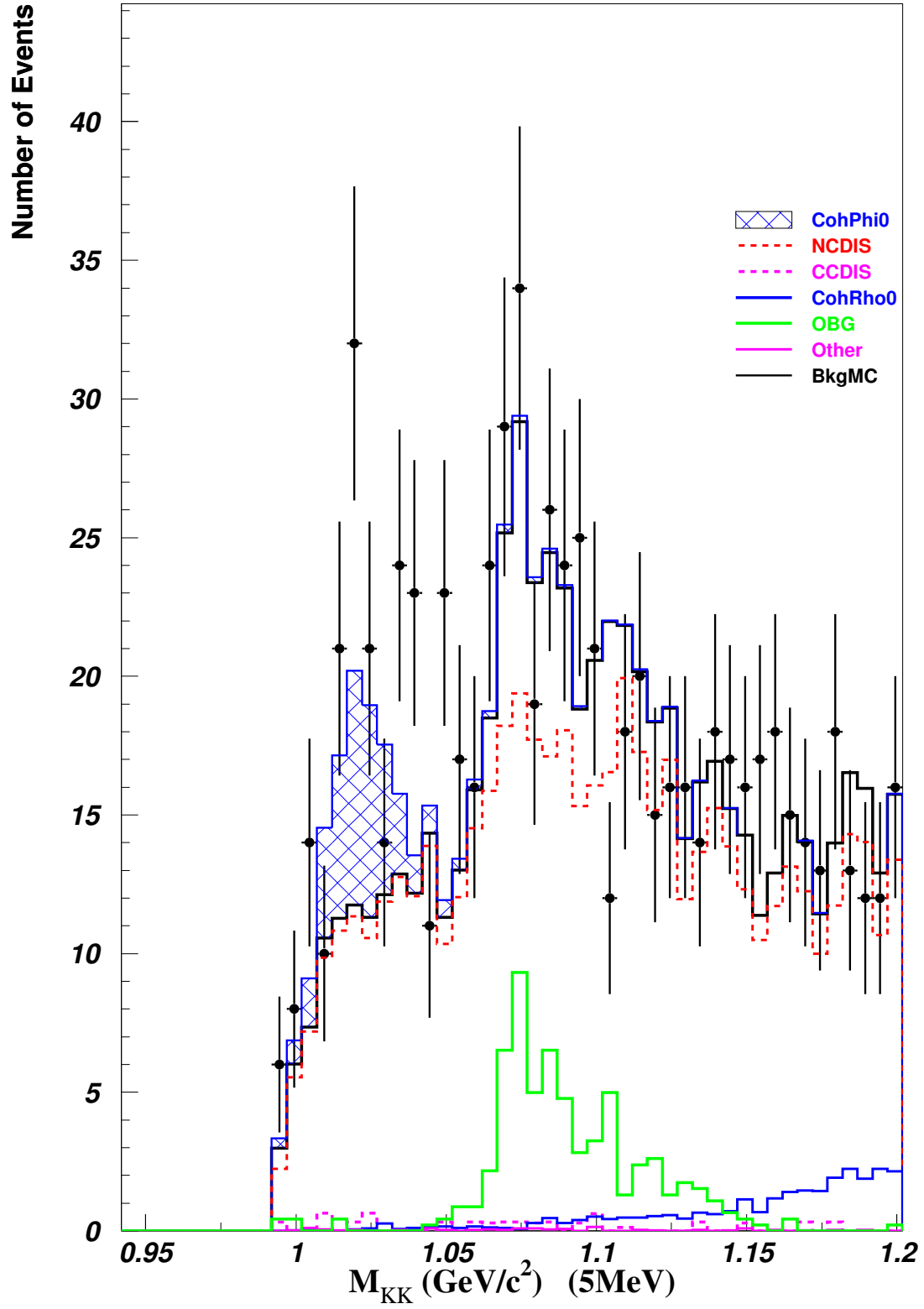


Figure 4:  $M_{KK}$  5MeV up to 1.2 GeV (figs/mkk-5mev-to1.2.pdf)

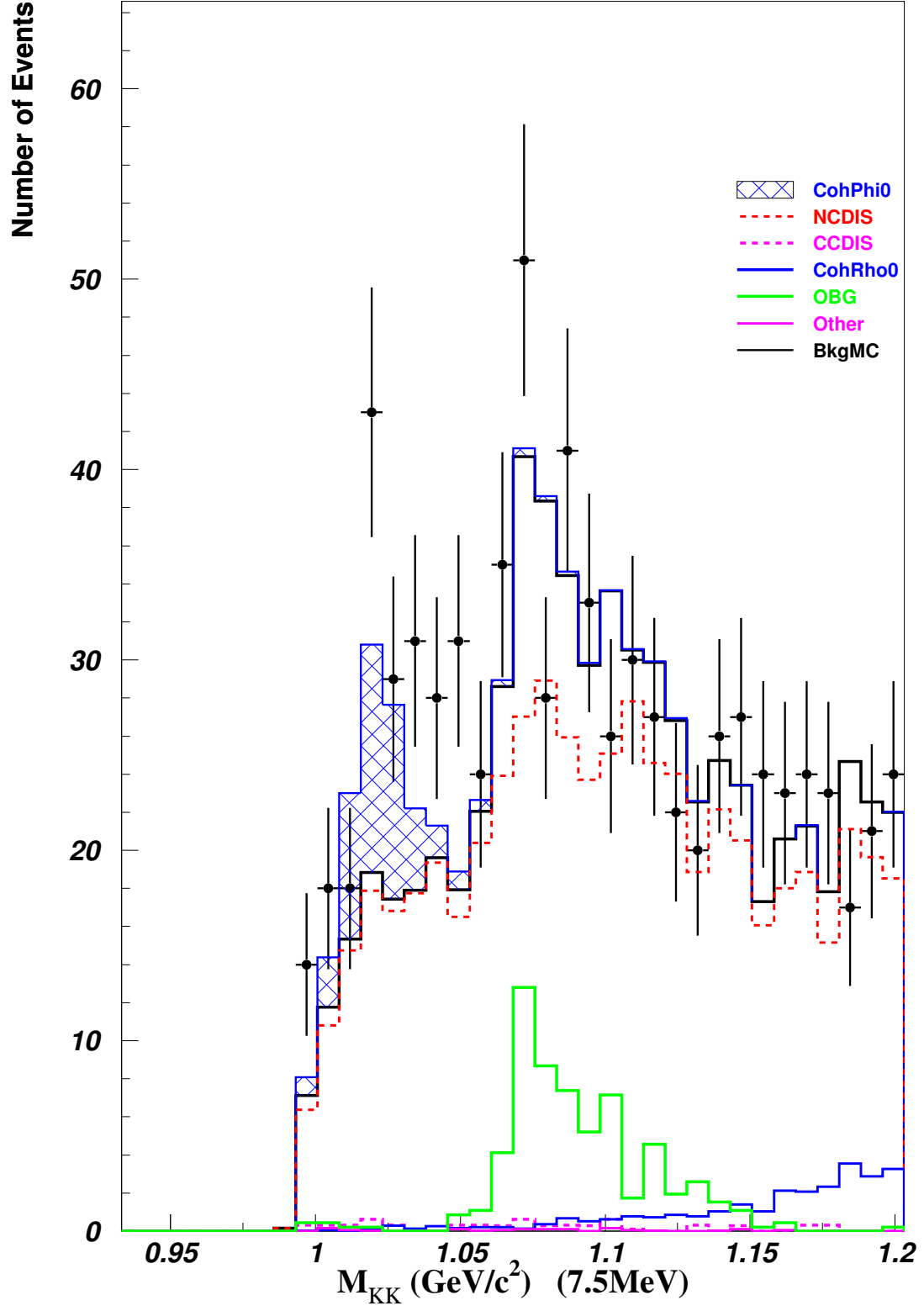


Figure 5:  $M_{KK}$  7.5MeV up to 1.2 GeV (figs/mkk-7.5mev-to1.2.pdf)

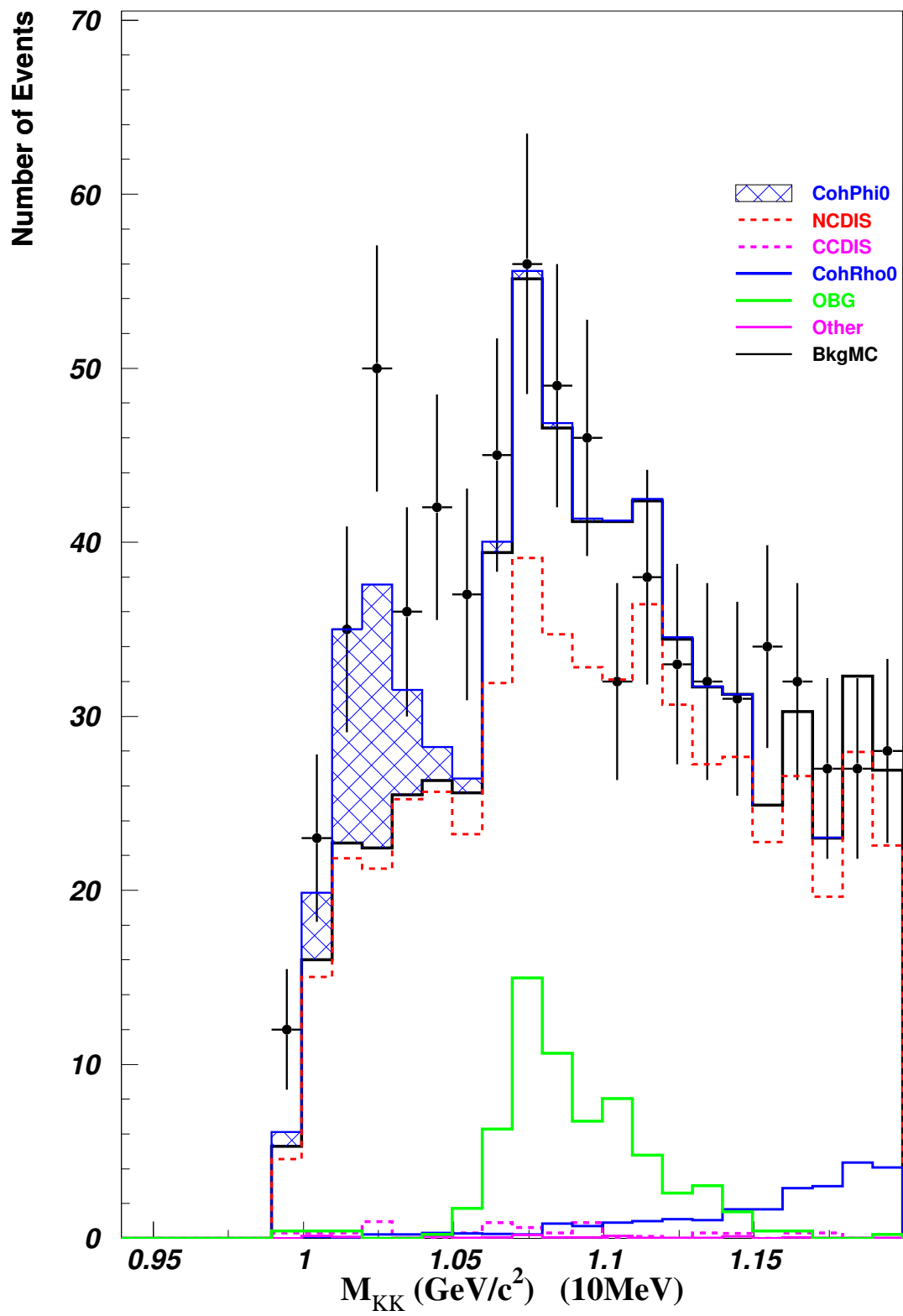
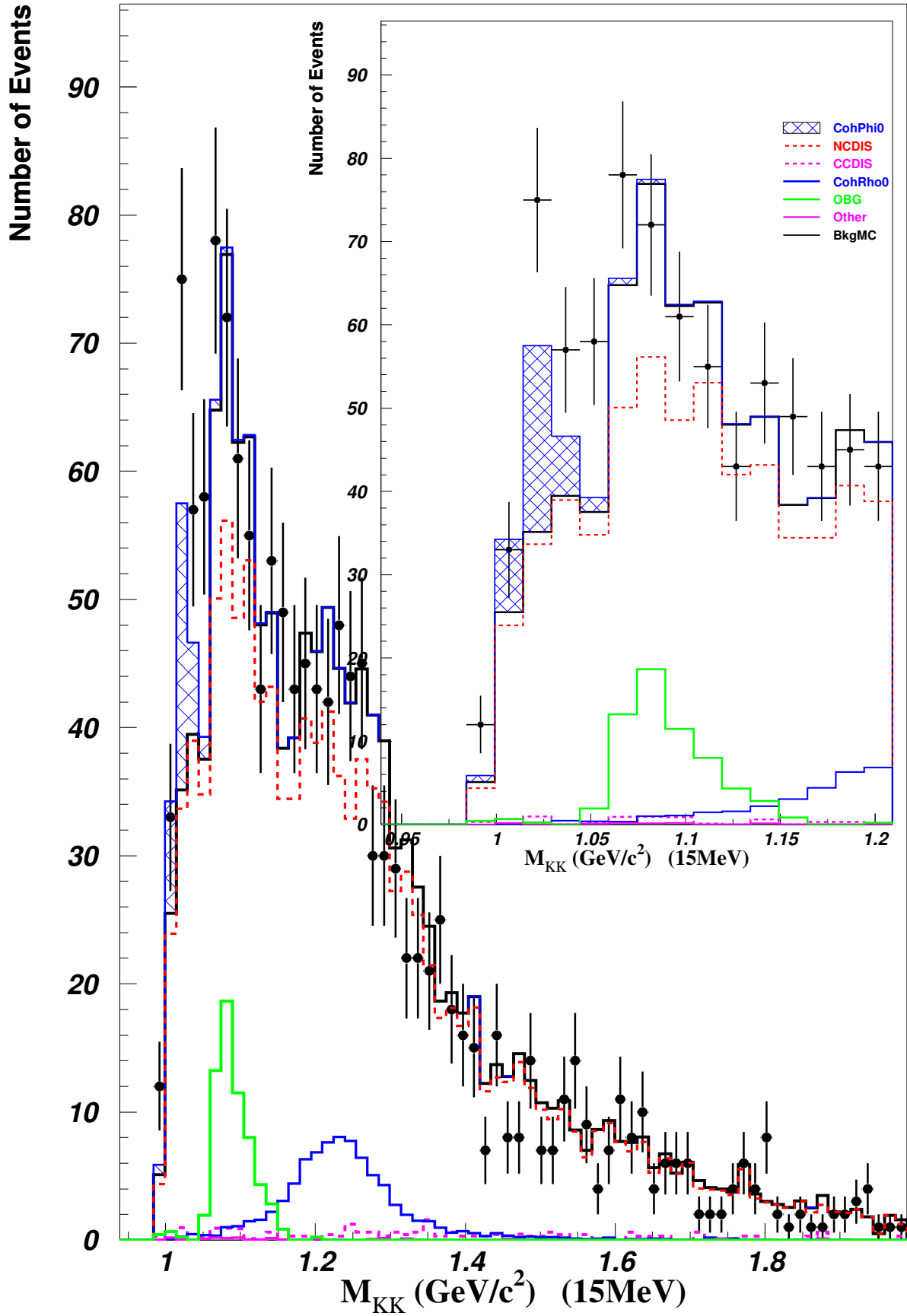


Figure 6:  $M_{KK}$  10MeV up to 1.2 GeV (figs/mkk-10mev-to1.2.pdf)



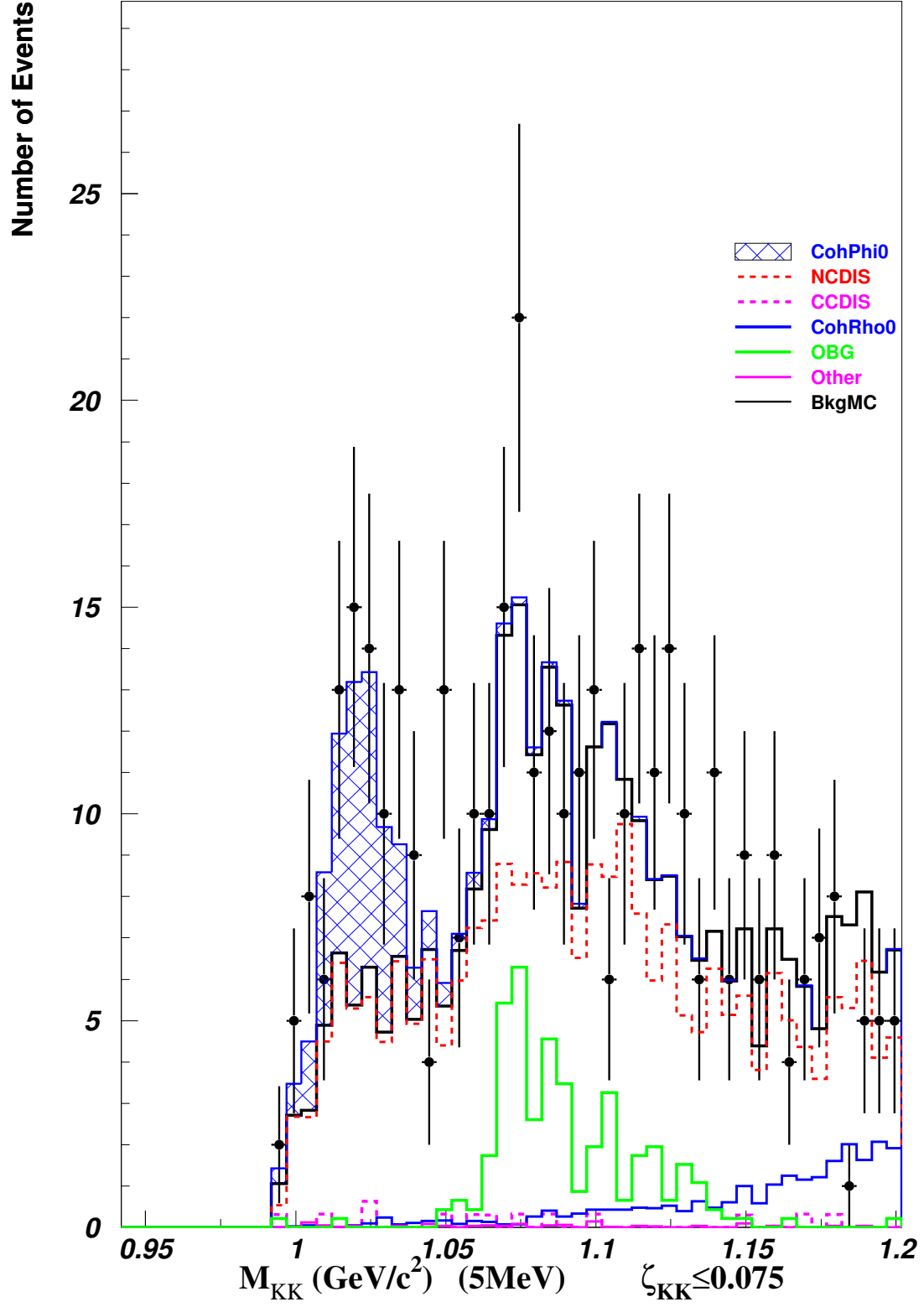


Figure 7:  $M_{KK}$  5MeV up to 1.2 GeV (Sig. Region) (figs/mkk-5mev-to1.2-sig.pdf)

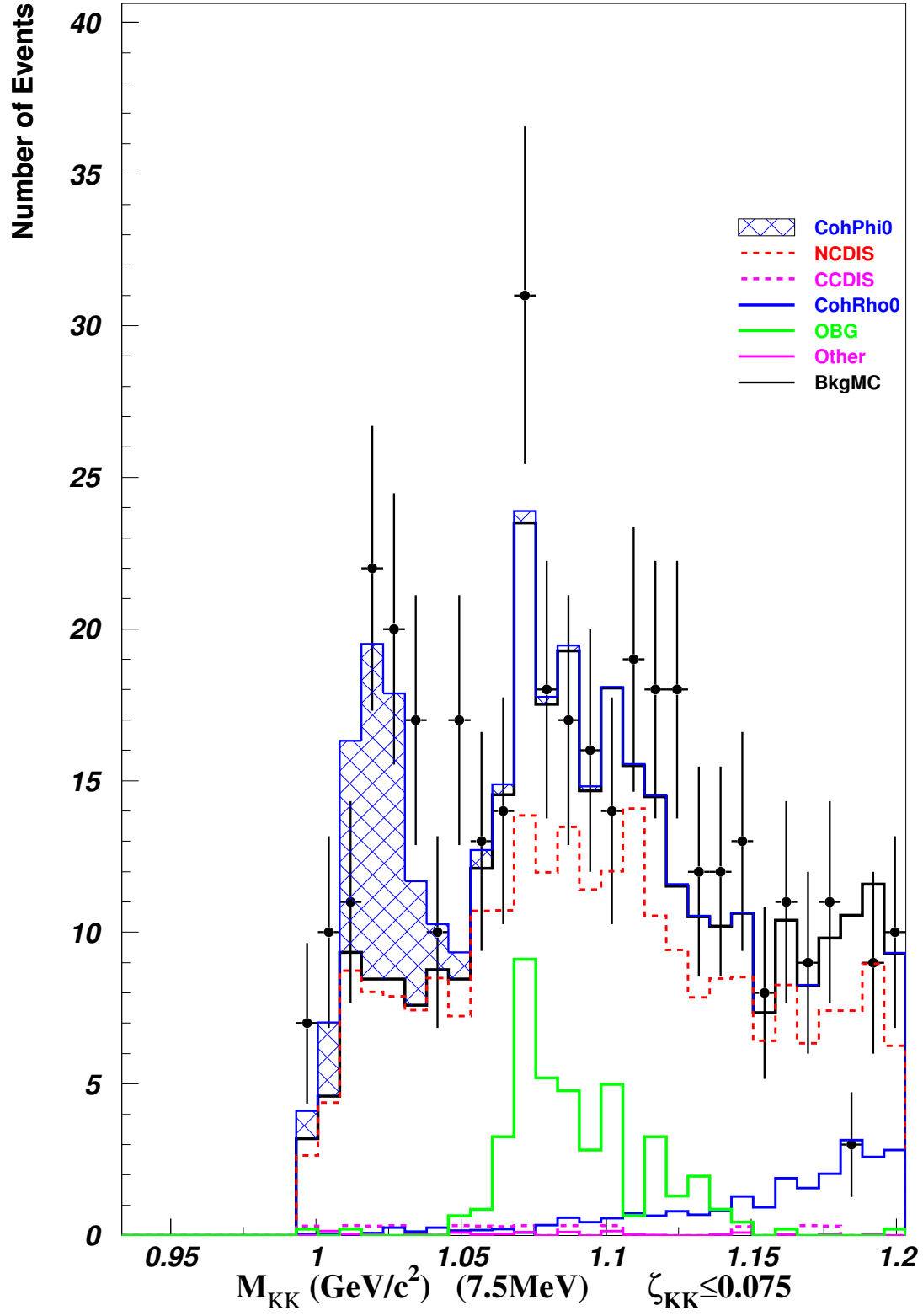


Figure 8:  $M_{KK}$  7.5MeV up to 1.2 GeV (Sig. Region) (figs/mkk-7.5mev-to1.2-sig.pdf)



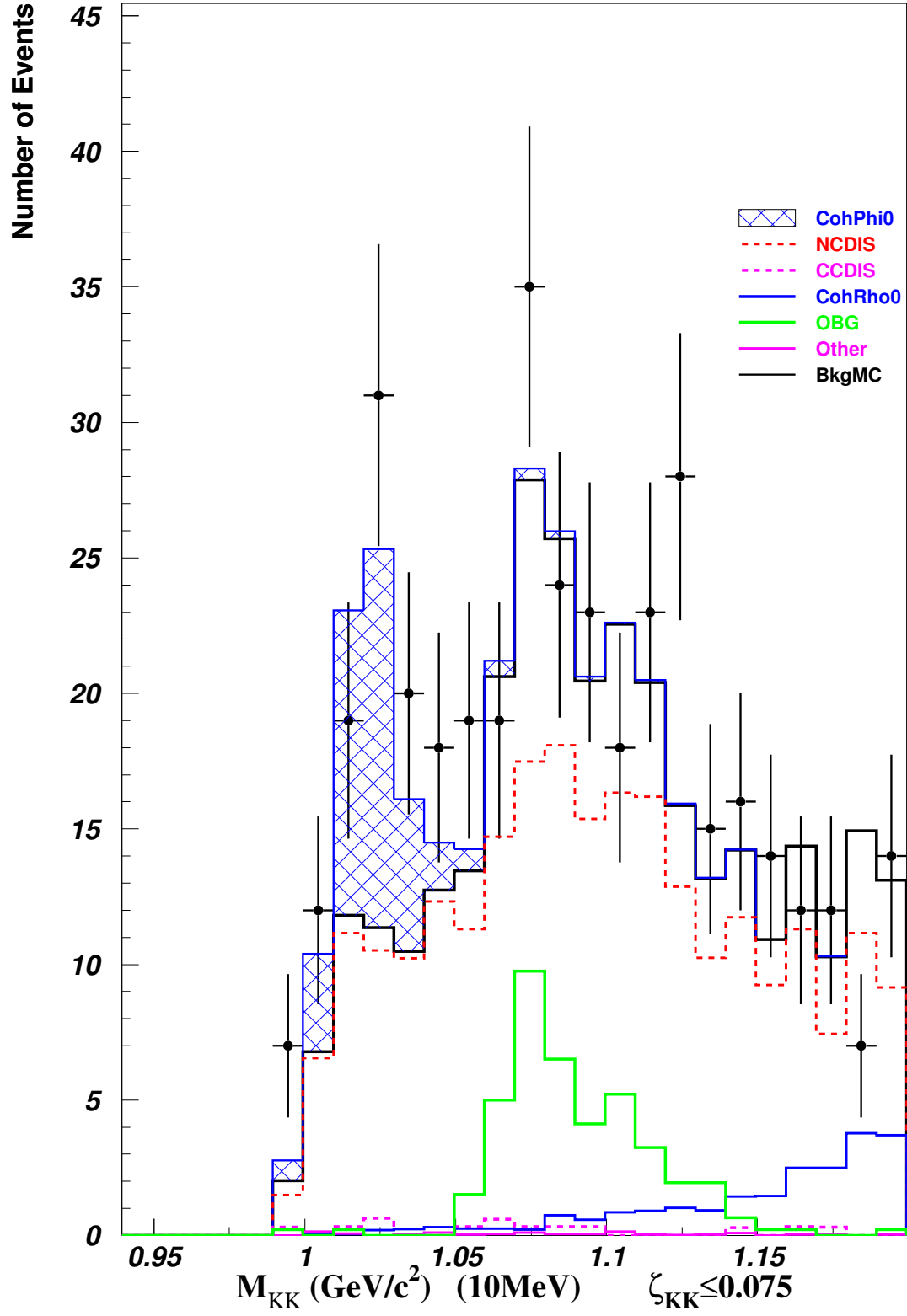
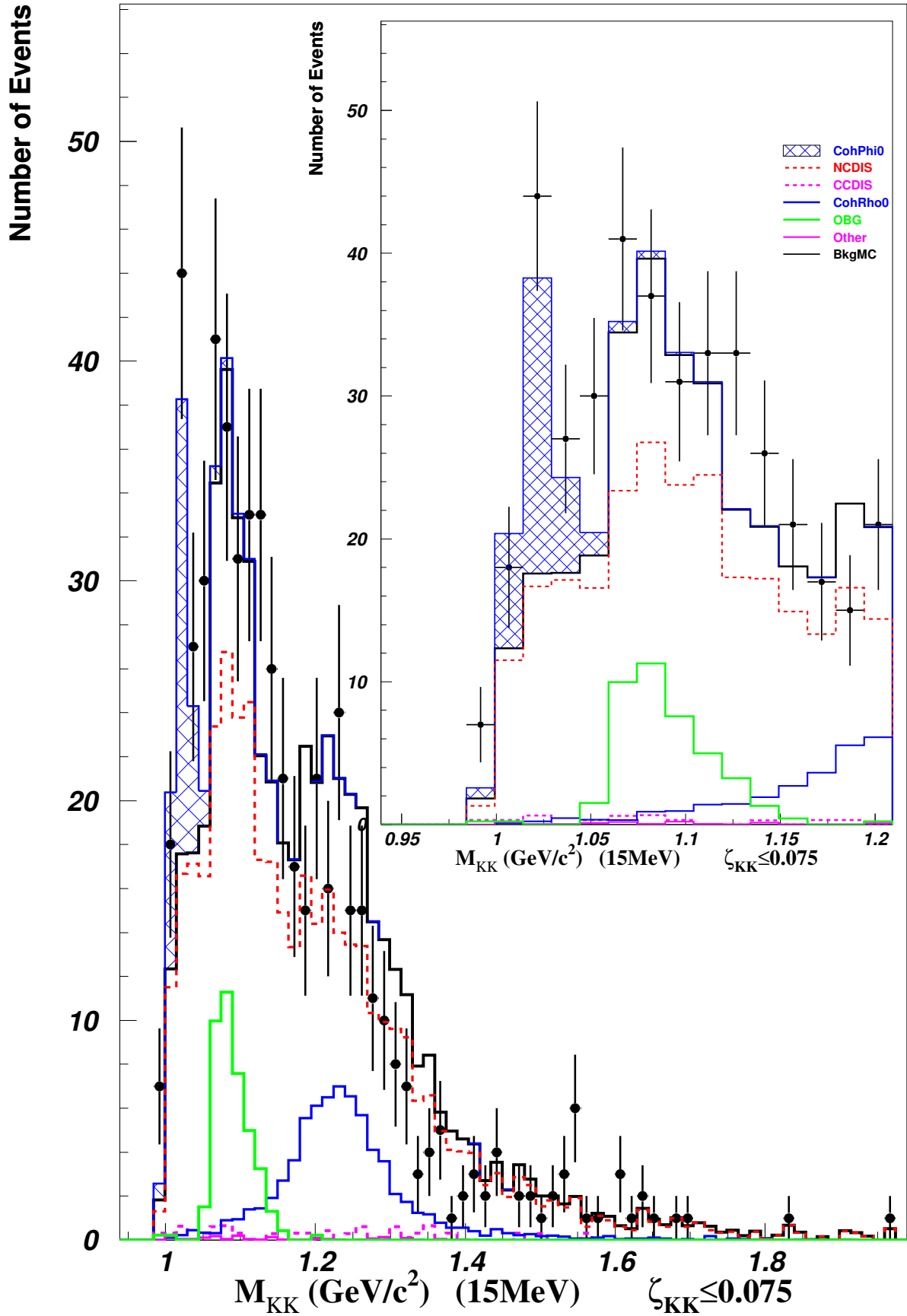


Figure 9:  $M_{KK}$  10MeV up to 1.2 GeV (Sig. Region) (figs/mkk-10mev-to1.2-sig.pdf)



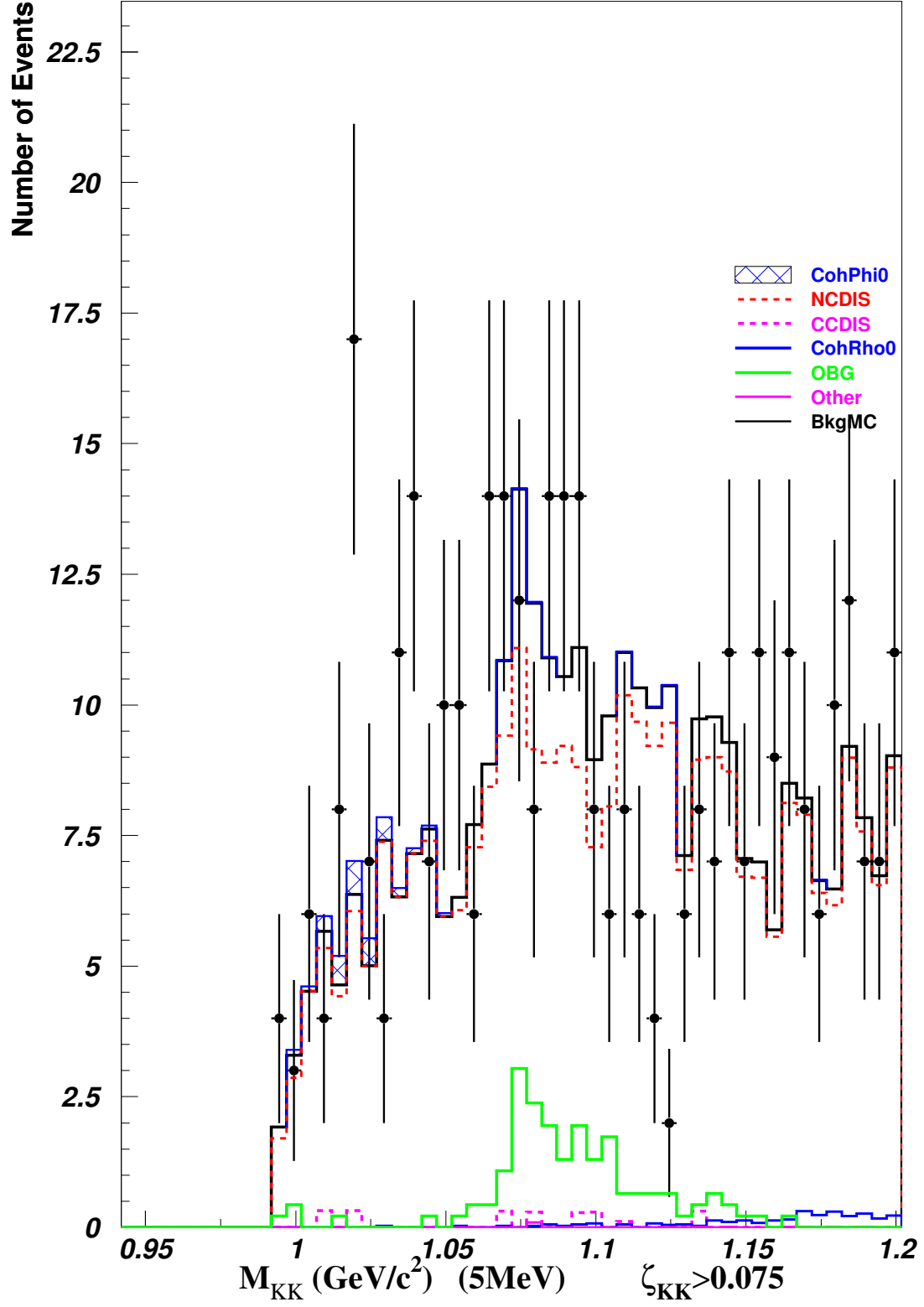


Figure 10:  $M_{KK}$  5MeV up to 1.2 GeV (BKG Region) (figs/mkk-5mev-to1.2-bkg.pdf)

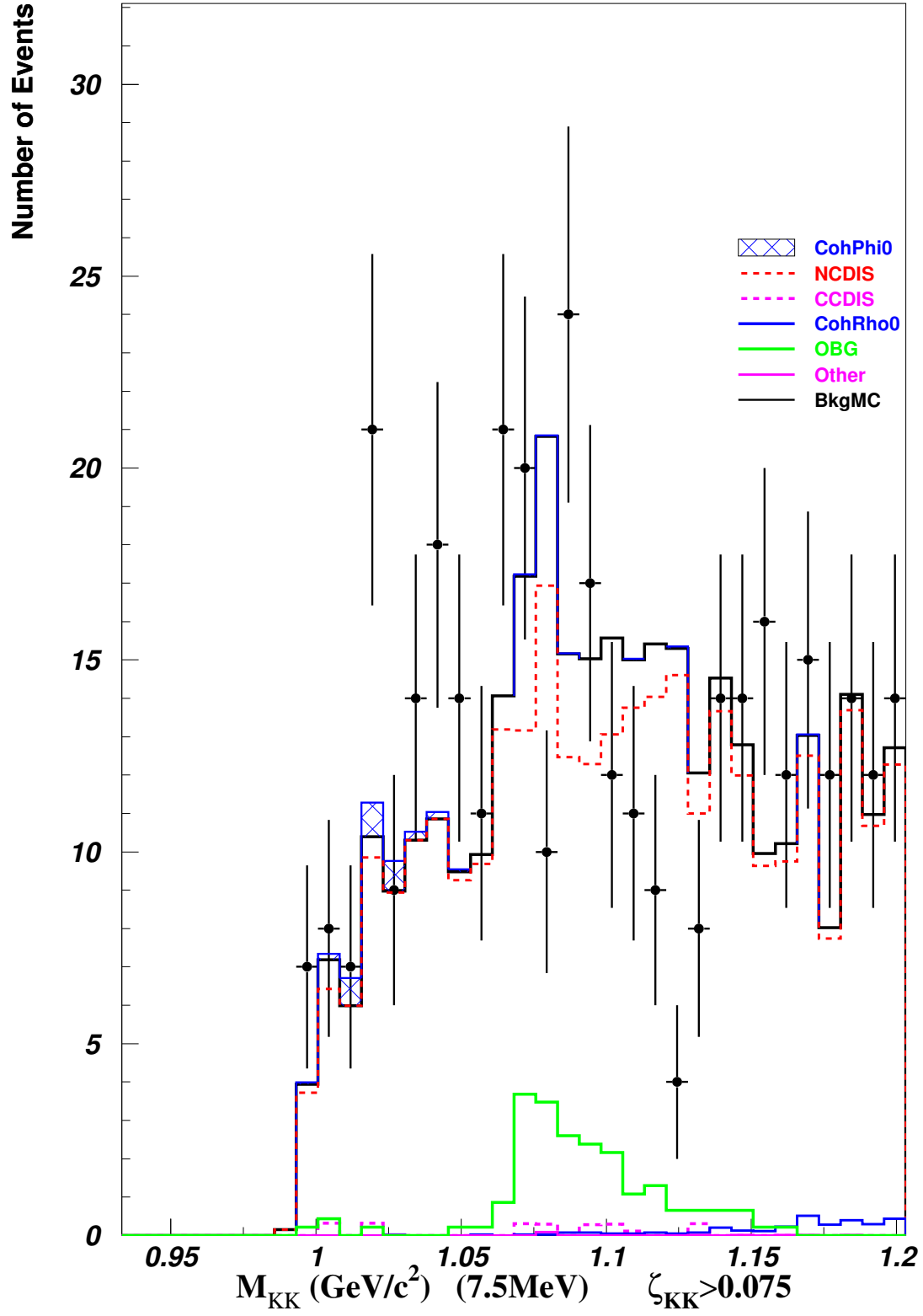


Figure 11:  $M_{KK}$  7.5MeV up to 1.2 GeV (BKG Region) (figs/mkk-7.5mev-to1.2-bkg.pdf)

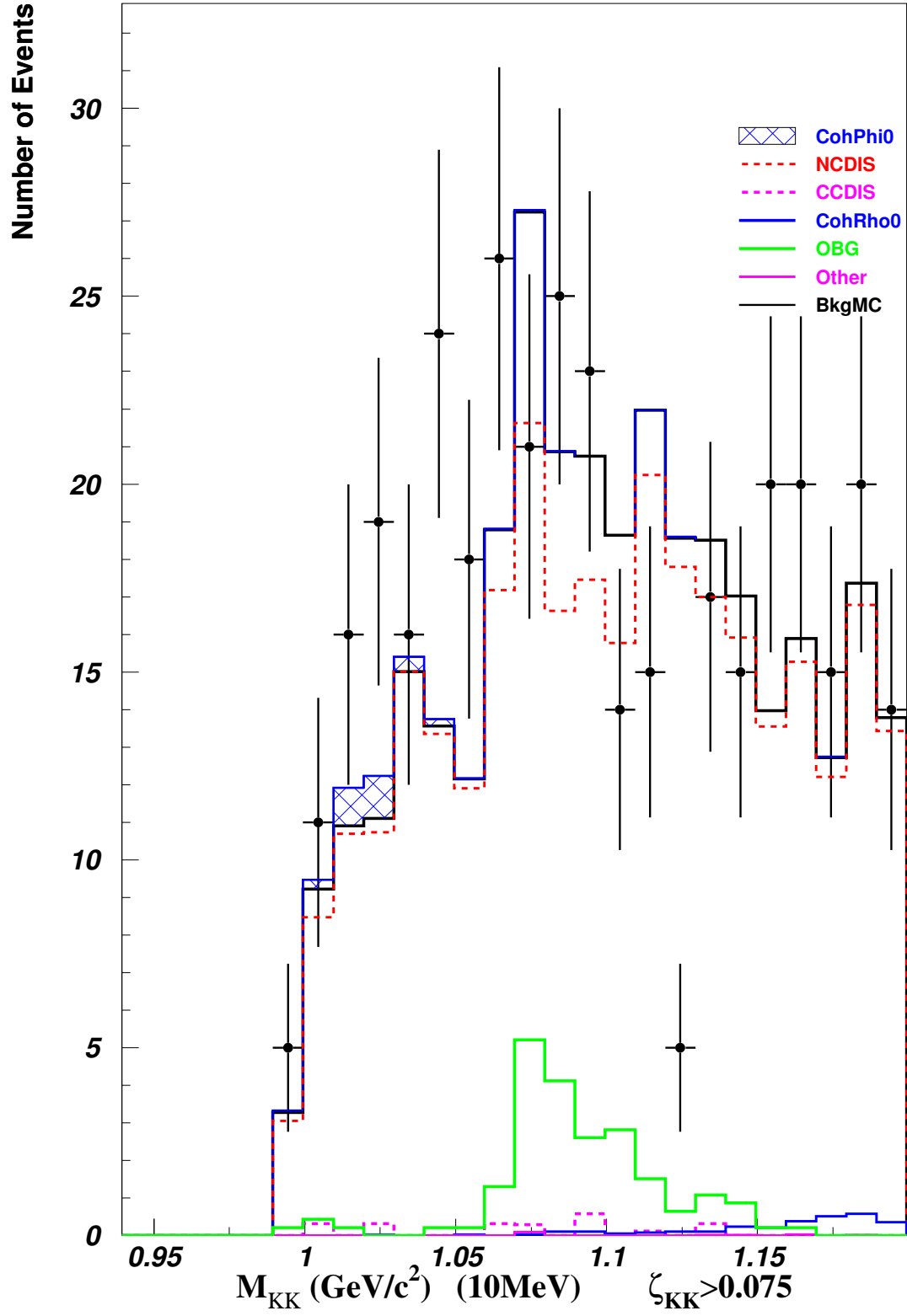
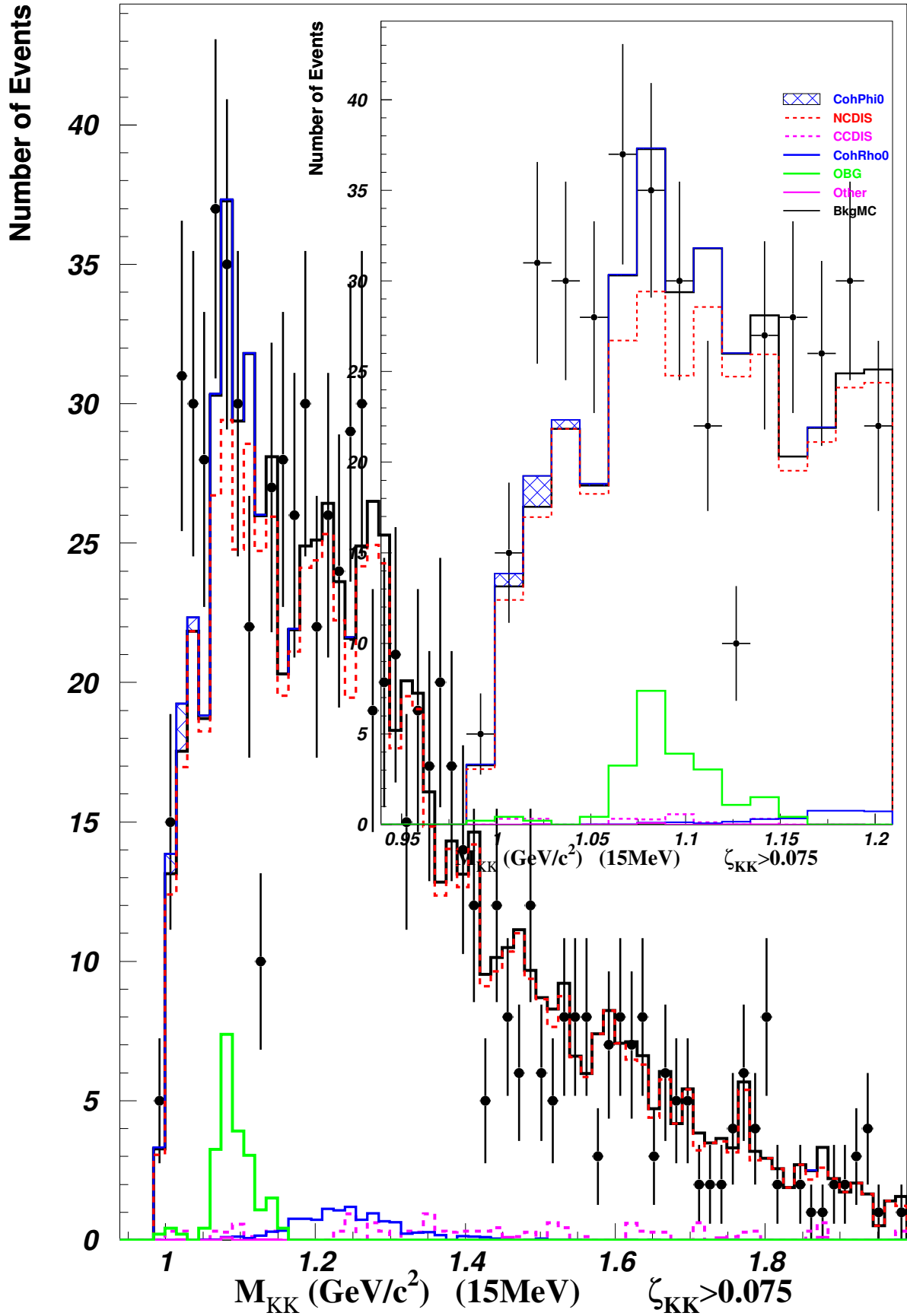


Figure 12:  $M_{KK}$  10MeV up to 1.2 GeV (BKG Region) (figs/mkk-10mev-to1.2-bkg.pdf)



## 5.2 $\zeta_{KK}$ Plots

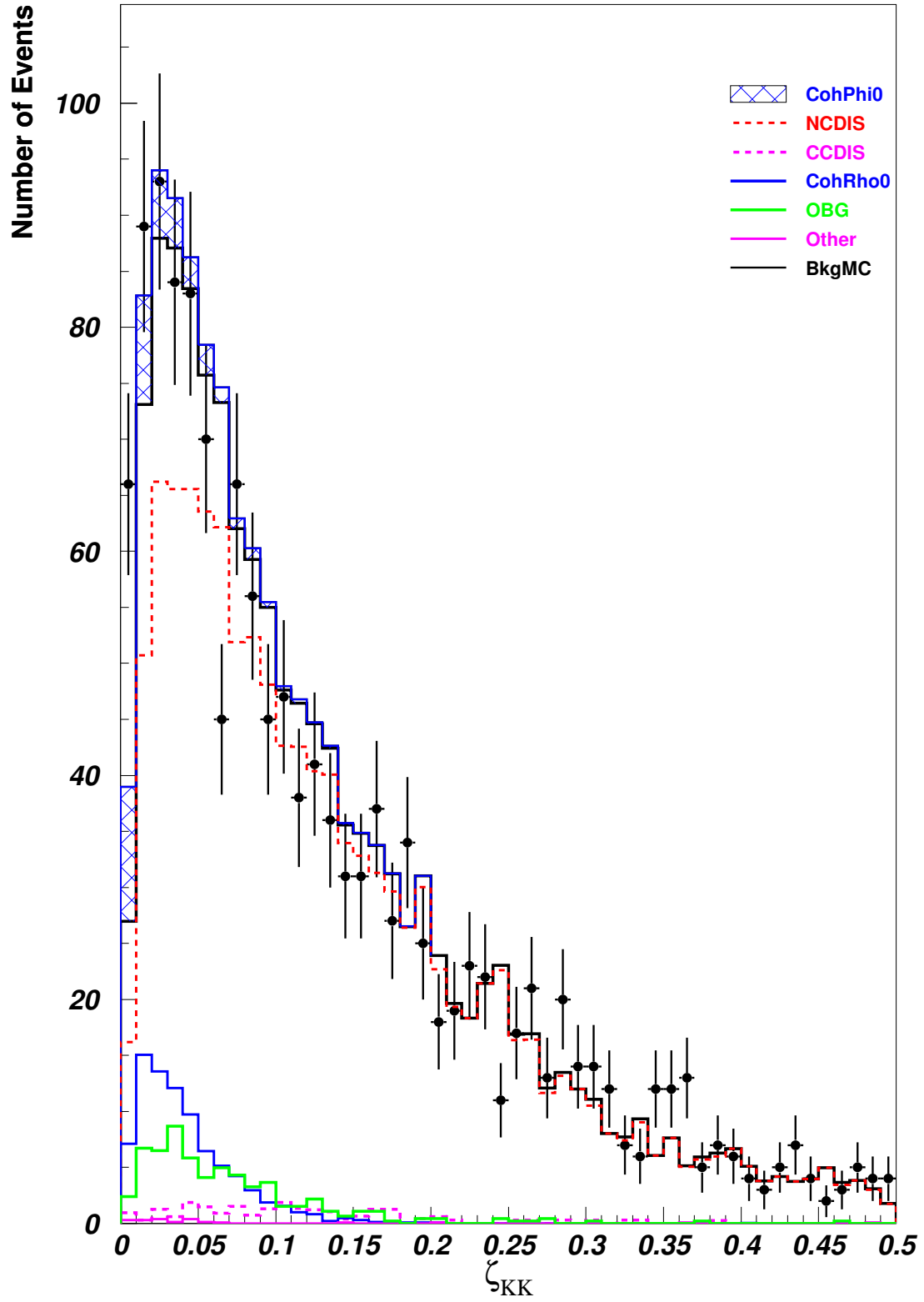


Figure 13:  $\zeta_{KK}$  (figs/zetaphi.pdf)

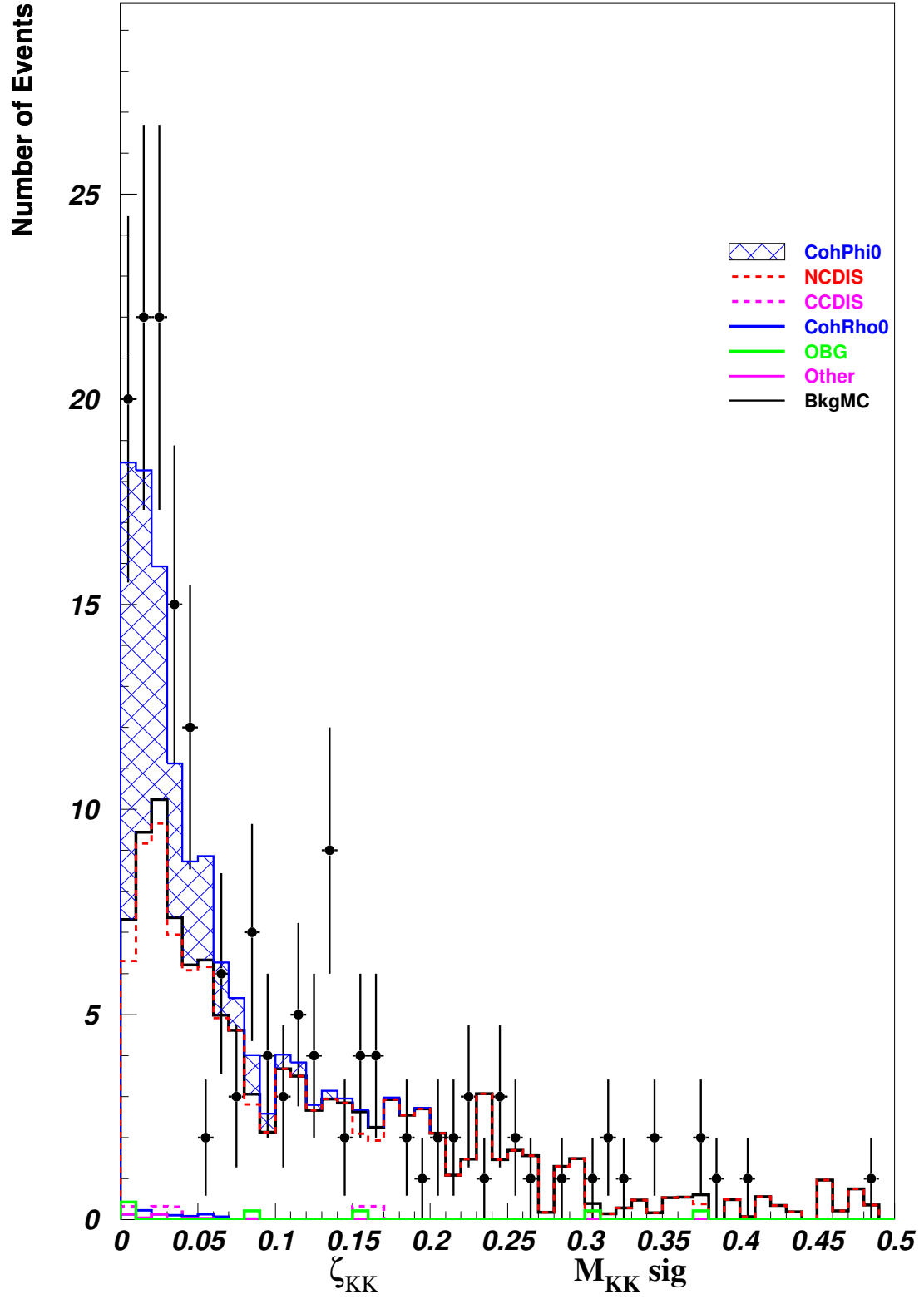


Figure 14:  $\zeta_{KK}$  ( $\phi$  Mass Region) (figs/zetaphi-mphi.pdf)



### 5.3 $\phi_{12}$ Plots

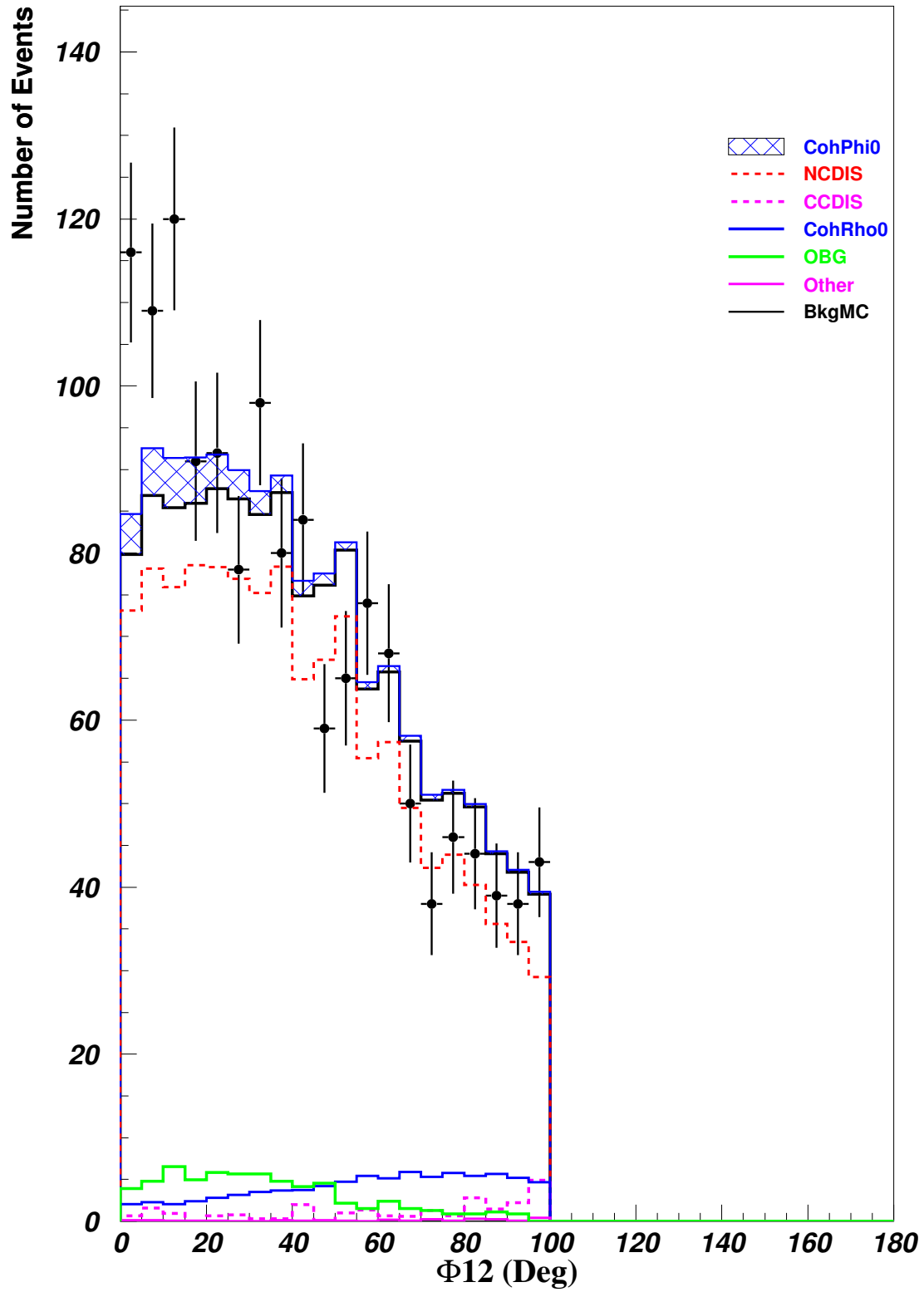


Figure 15:  $\phi_{12}(0-180\text{deg})$  (figs/phi12-full.pdf)

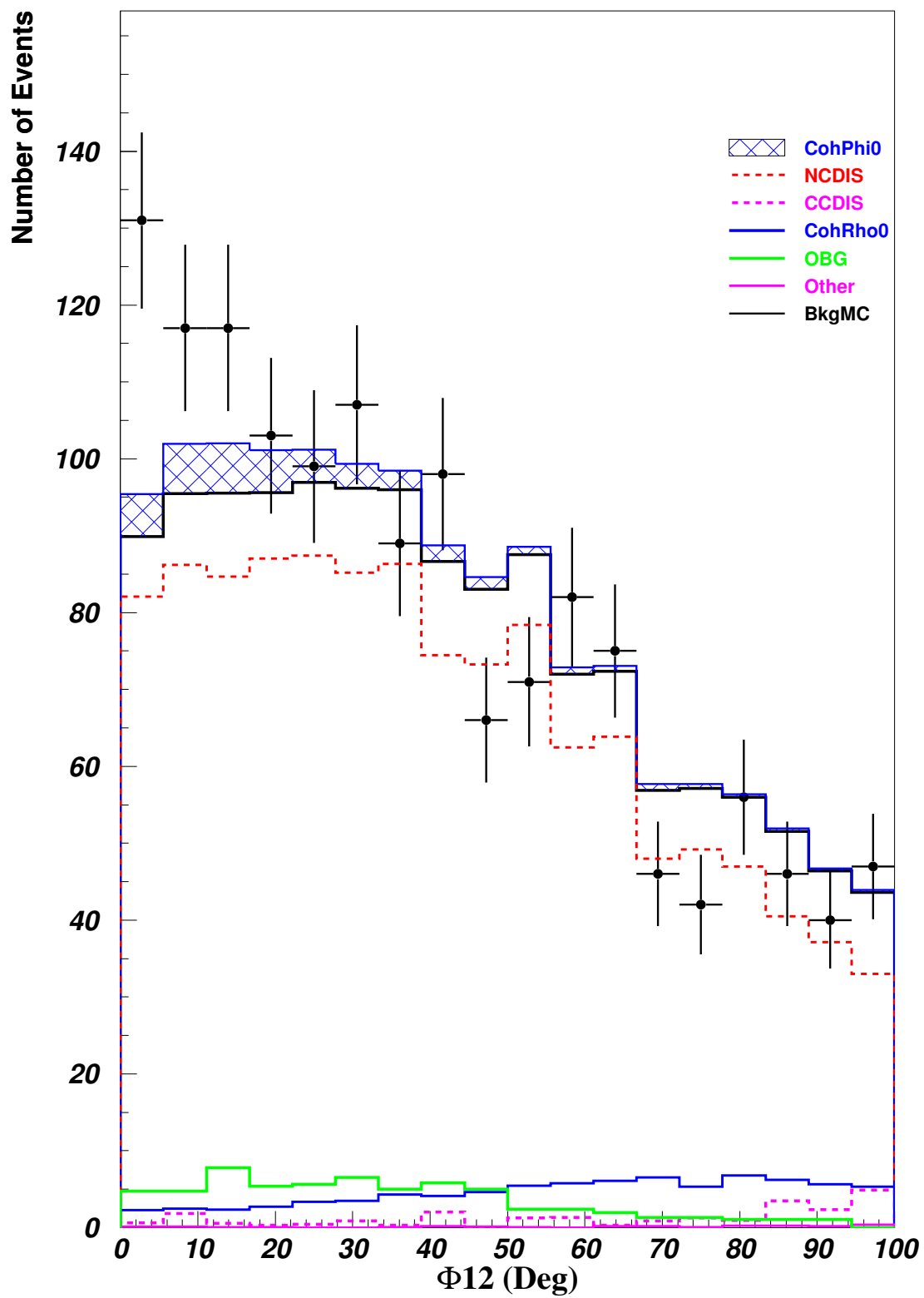


Figure 16:  $\phi_{12}$  (figs/phi12.pdf)

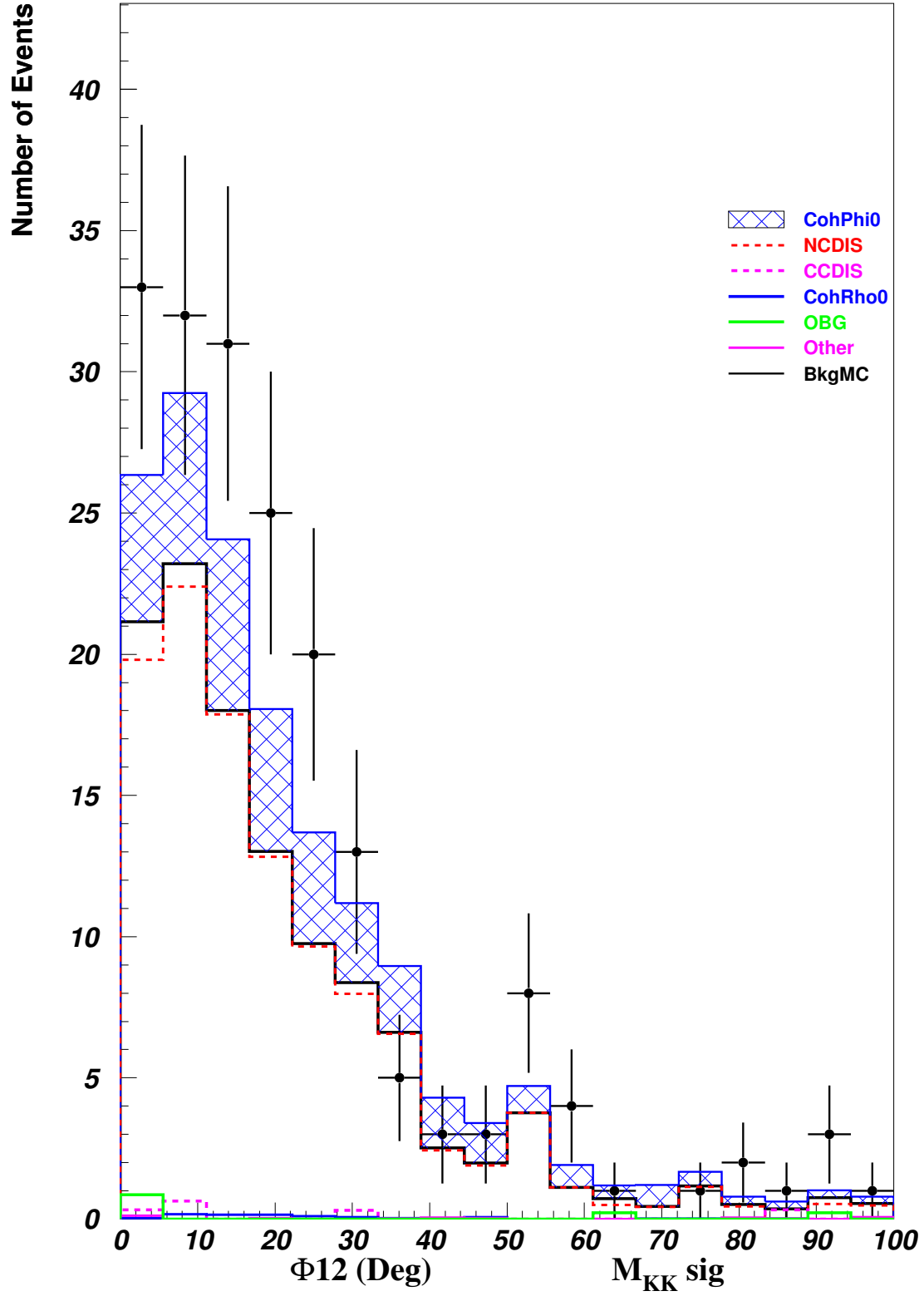
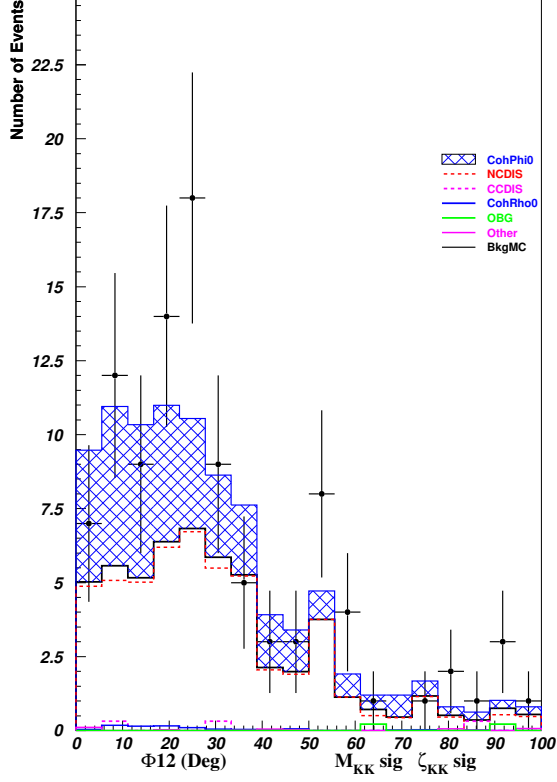
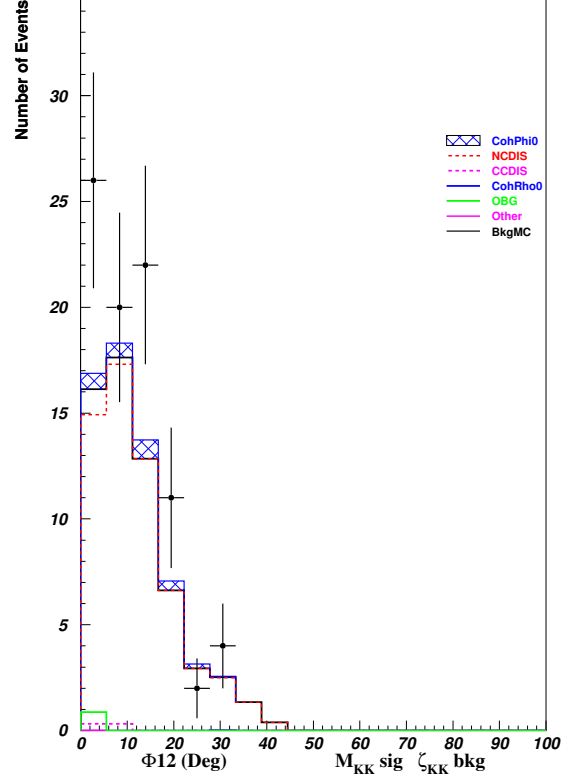


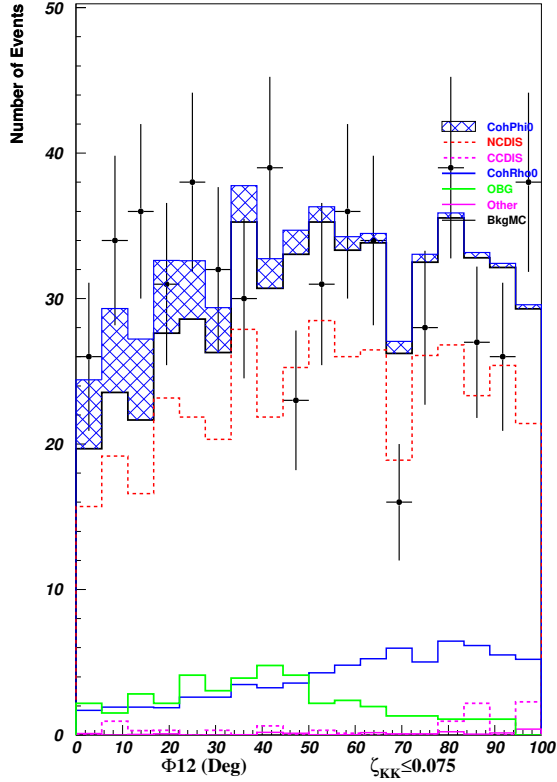
Figure 17:  $\phi_{12}$  (In  $\phi$  Mass range) (figs/phi12-mphi.pdf)



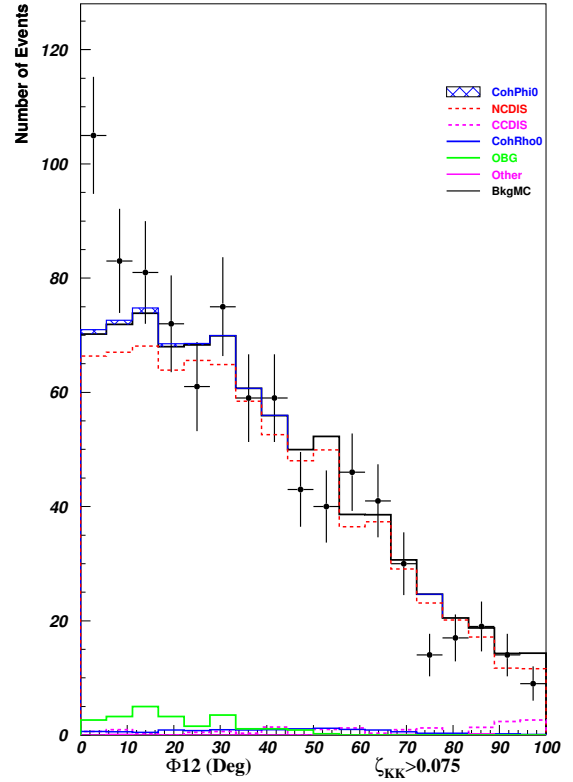
(a)  $\phi_{12}$  (Signal Region in  $\phi$  Mass) (figs/phi12-sig-mphi.pdf)



(b)  $\phi_{12}$  (Background Region in  $\phi$  Mass) (figs/phi12-bkg-mphi.pdf)



(c)  $\phi_{12}$  (Signal Region) (figs/phi12-sig.pdf)



(d)  $\phi_{12}$  (Background Region) (figs/phi12-bkg.pdf)

Figure 18: Various  $\phi_{12}$  Plots

#### 5.4 $\zeta_{K^+}$ and $\zeta_{K^-}$ Plots

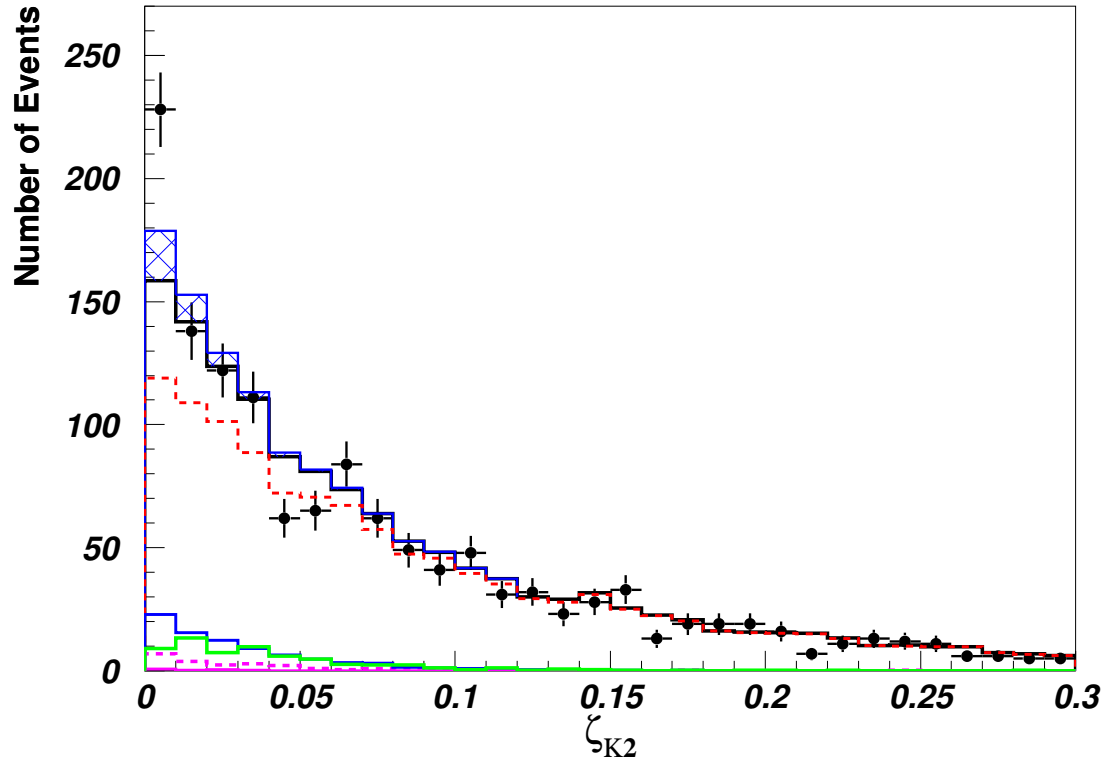
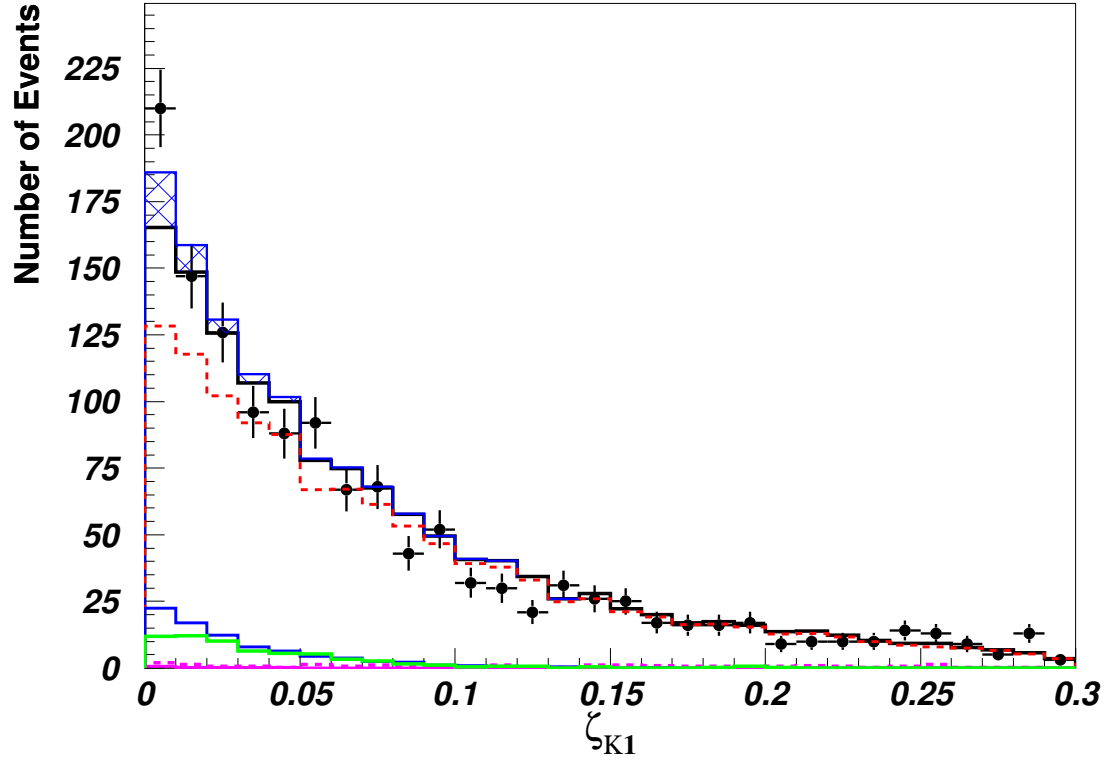
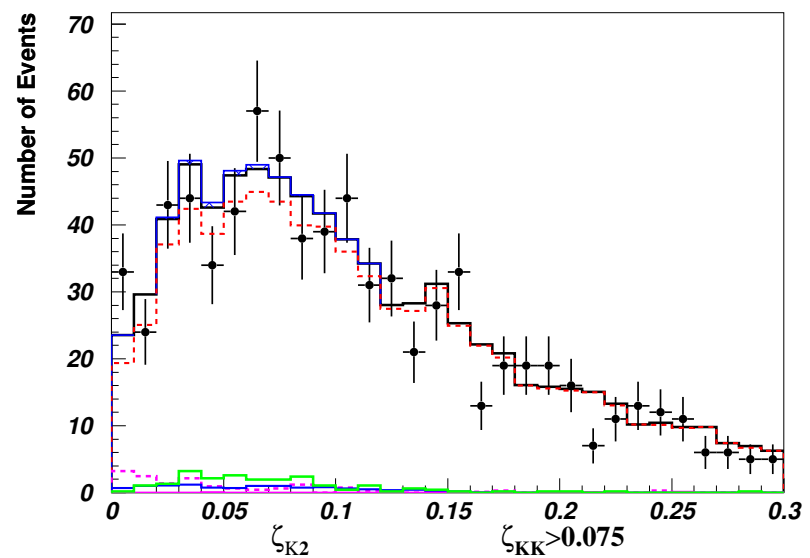
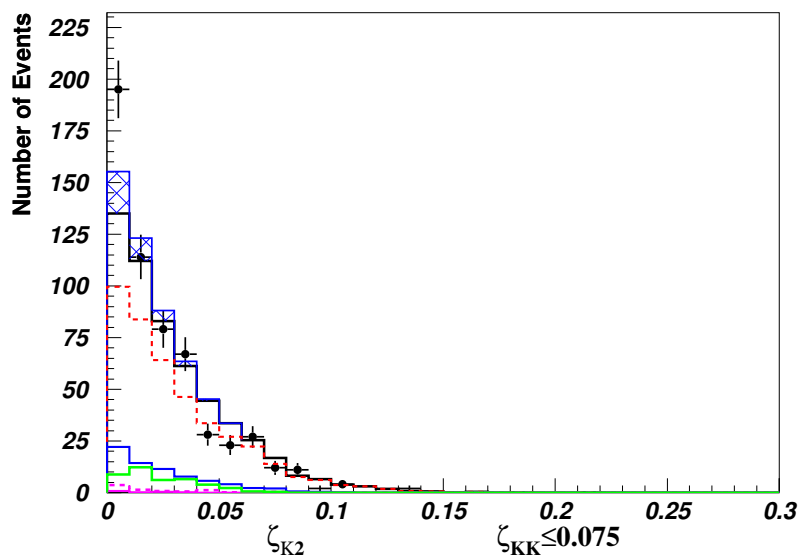
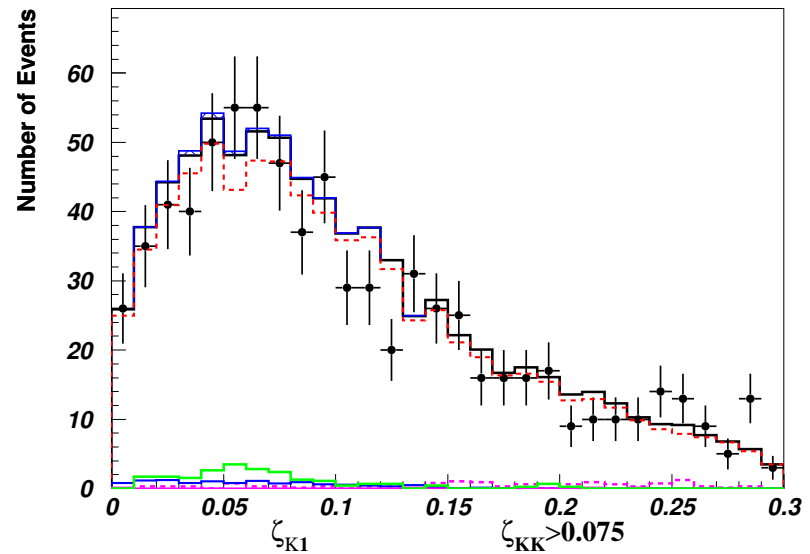
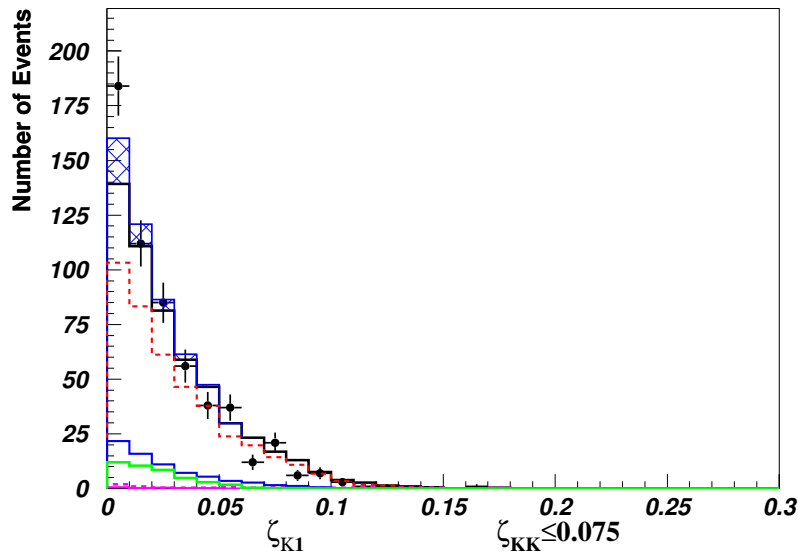


Figure 19:  $\zeta_{K^+}$  and  $\zeta_{K^-}$  (figs/zeta12.pdf)



(a)  $\zeta_{K+}$  and  $\zeta_{K-}$  (Signal Region) (figs/zeta12-sig.pdf)

(b)  $\zeta_{K+}$  and  $\zeta_{K-}$  (Background Region) (figs/zeta12-bkg.pdf)

Figure 20:

## 5.5 $\theta_{K^+}$ and $\theta_{K^-}$ Plots

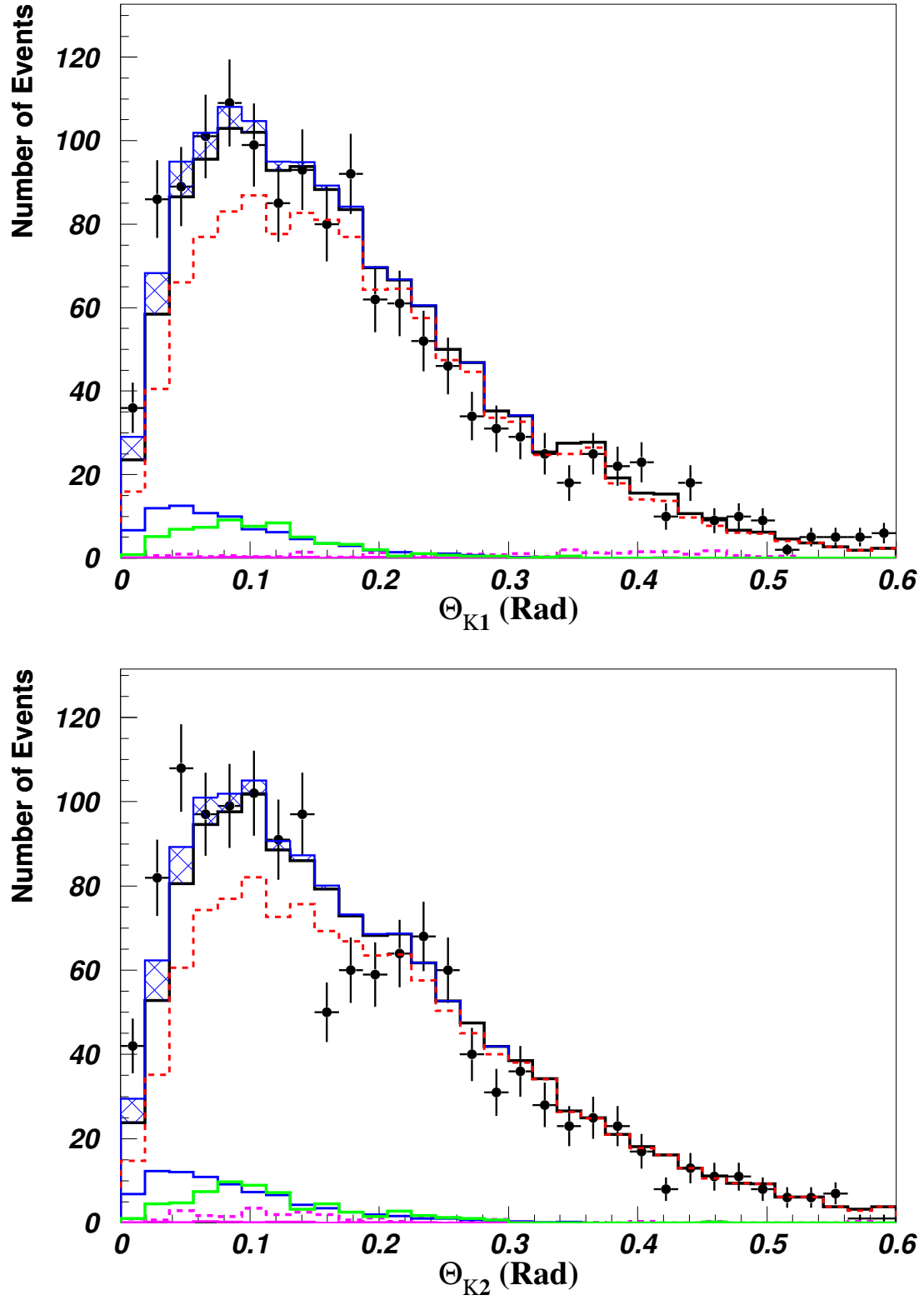


Figure 21:  $\theta_{K^+}$  and  $\theta_{K^-}$  (figs/theta1+2.pdf)

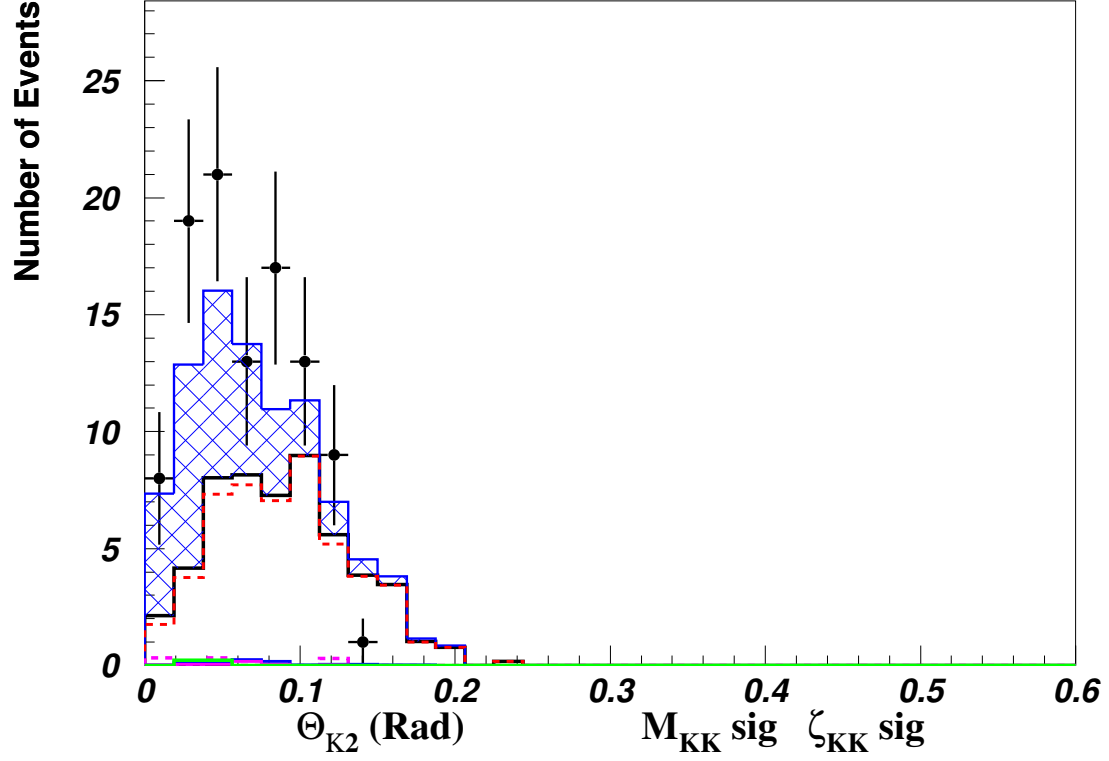
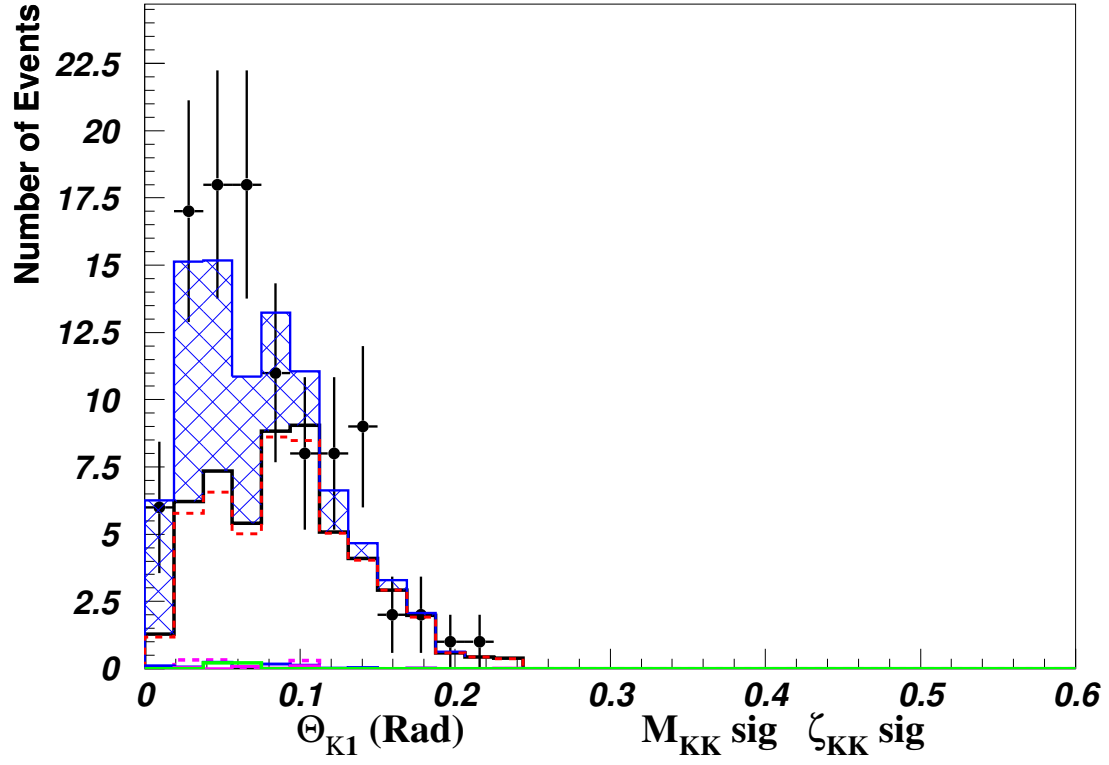
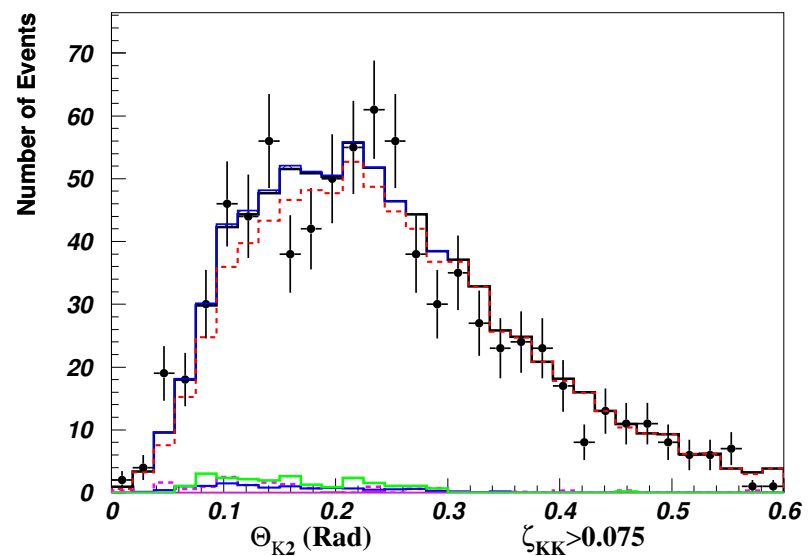
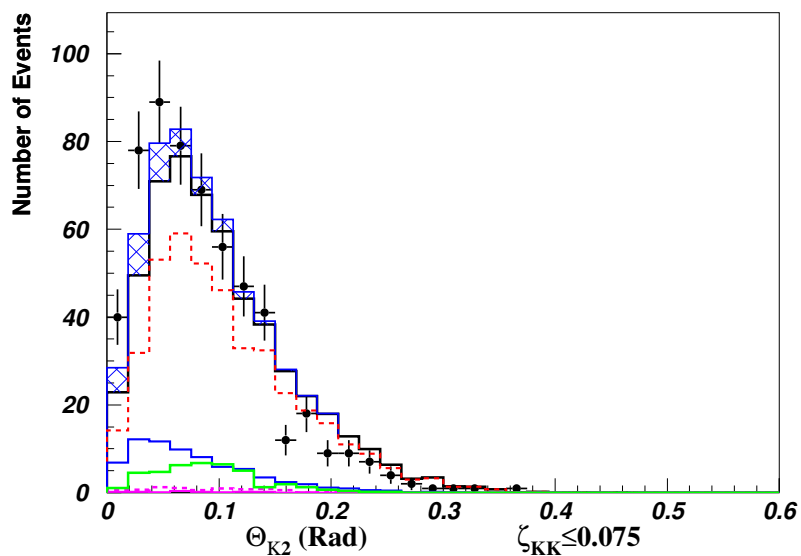
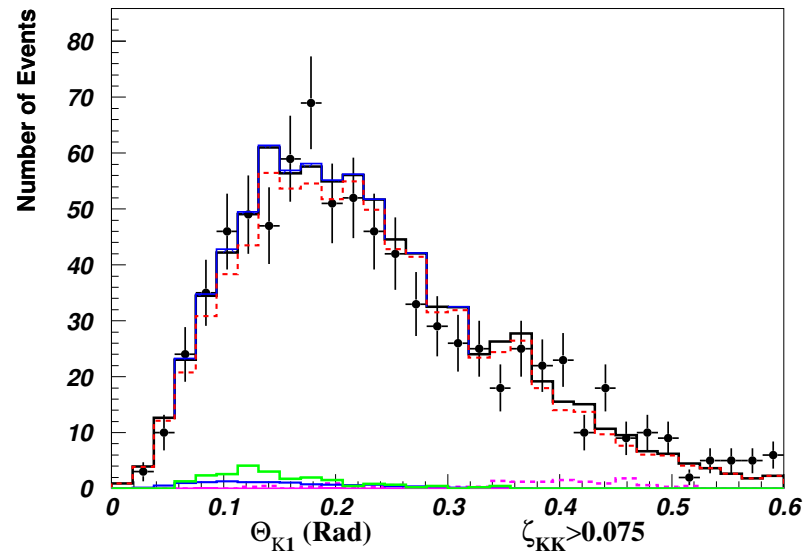
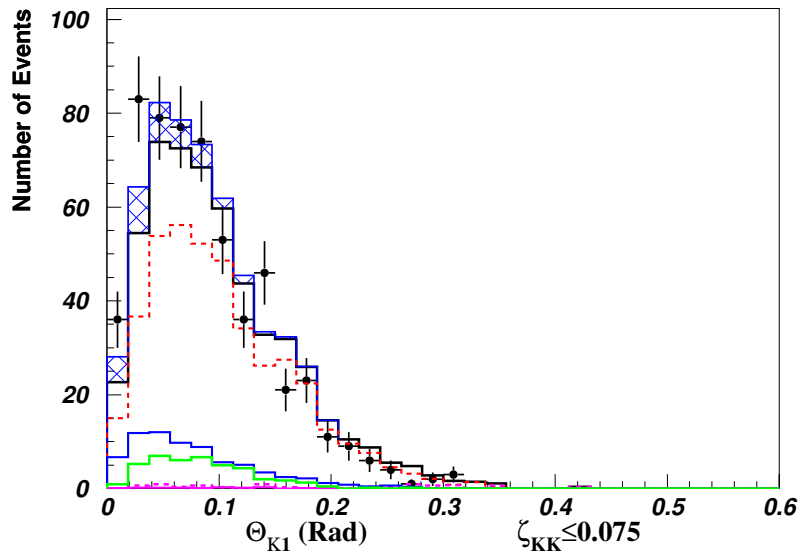


Figure 22:  $\theta_{K+}$  and  $\theta_{K-}$  ( $\phi$ -Mass and ZetaSig Region) (figs/theta1+2-sig-mphi.pdf)





(a)  $\theta_{K+}$  and  $\theta_{K-}$  (Signal Region) (figs/theta1+2-sig.pdf)

(b)  $\theta_{K+}$  and  $\theta_{K-}$  (Background Region) (figs/theta1+2-bkg.pdf)

Figure 23:

## 5.6 $\theta_{KK}$ and $\theta_{12}$ Plots

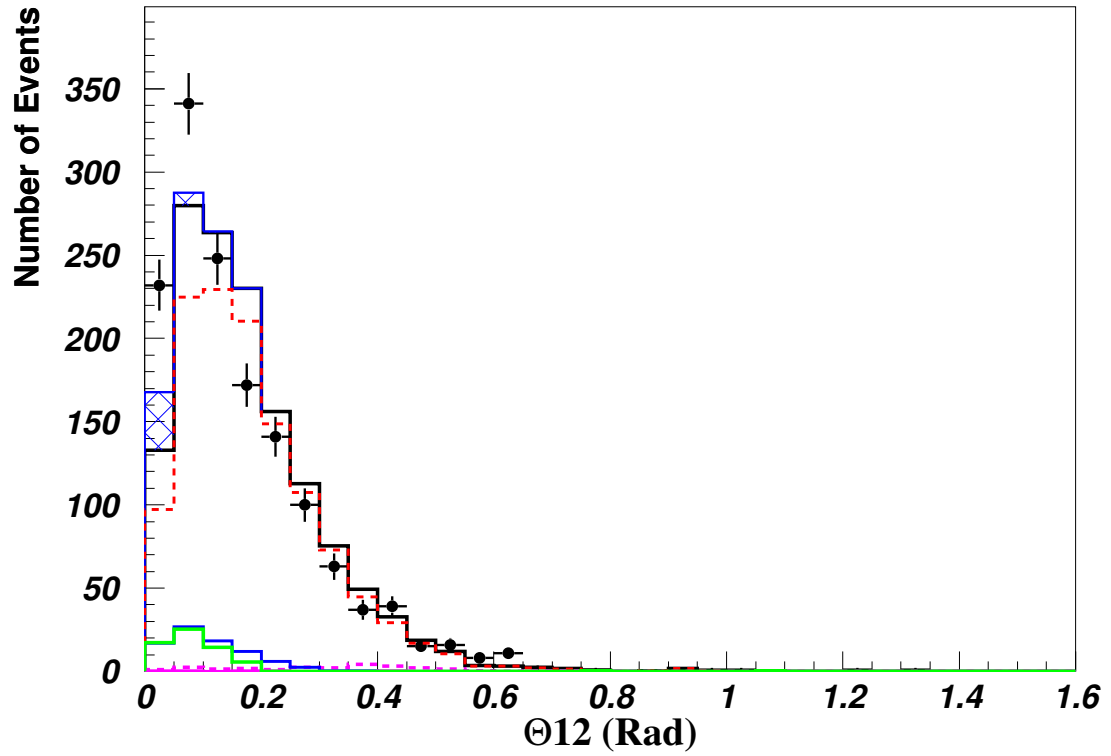
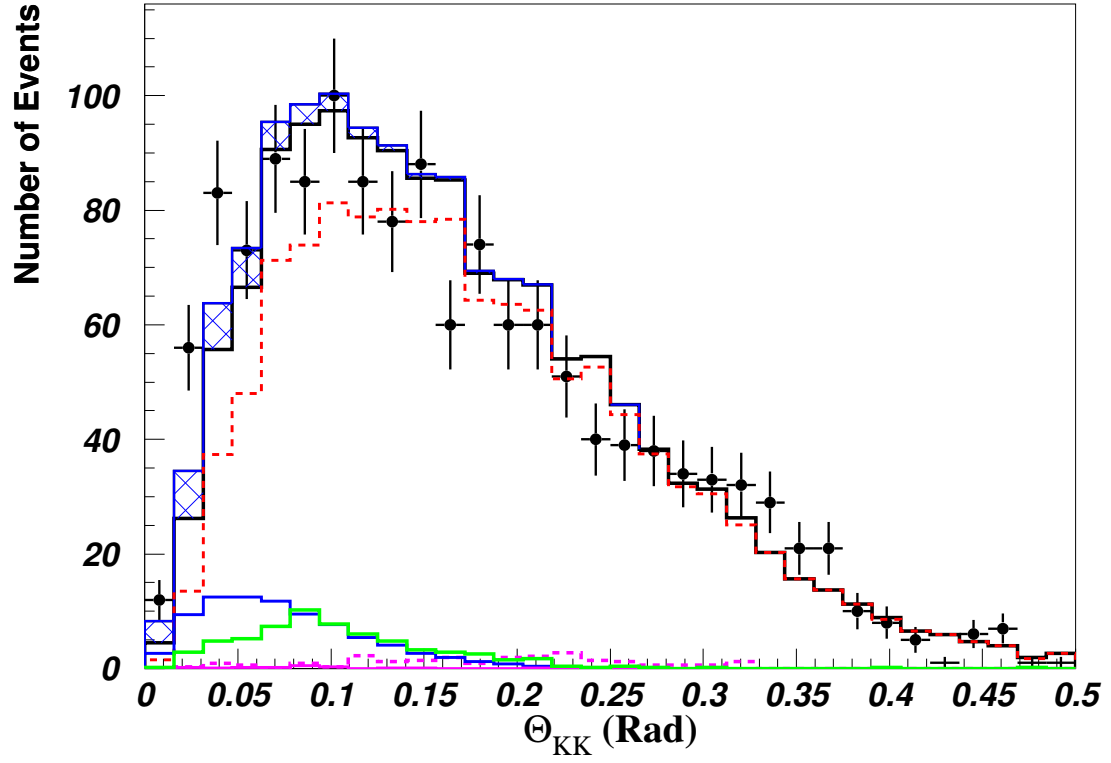


Figure 24:  $\theta_{KK}$  and  $\theta_{12}$  (figs/thetaphi12.pdf)

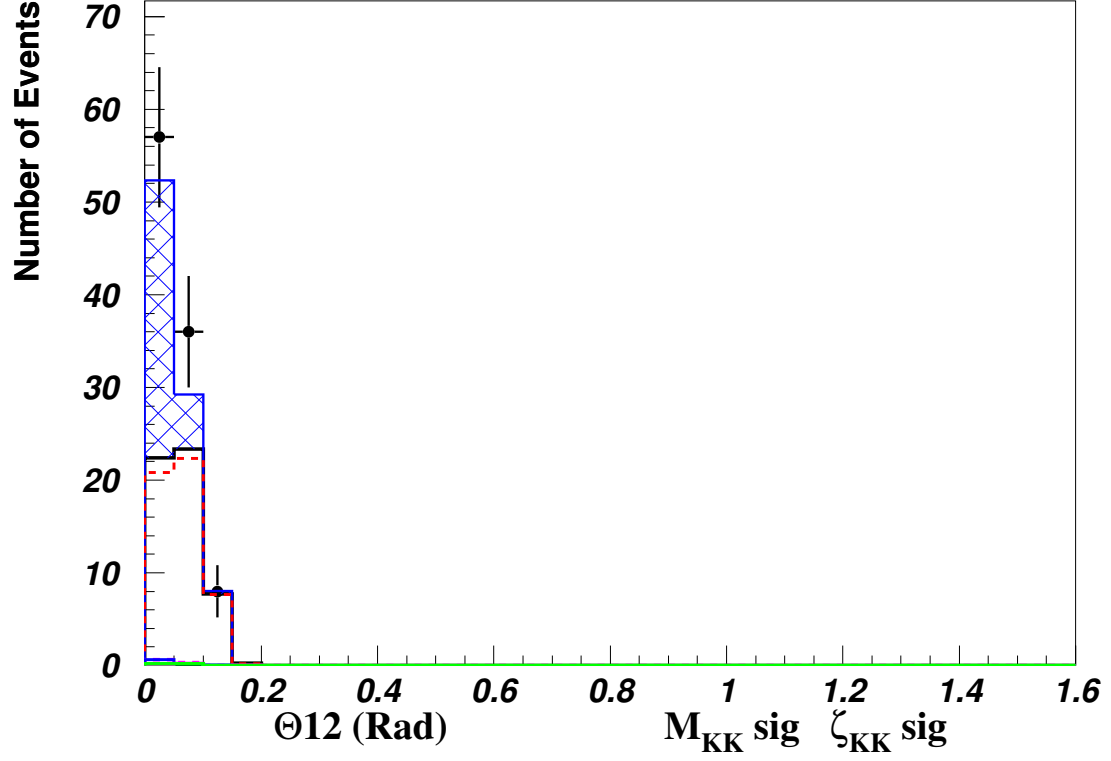
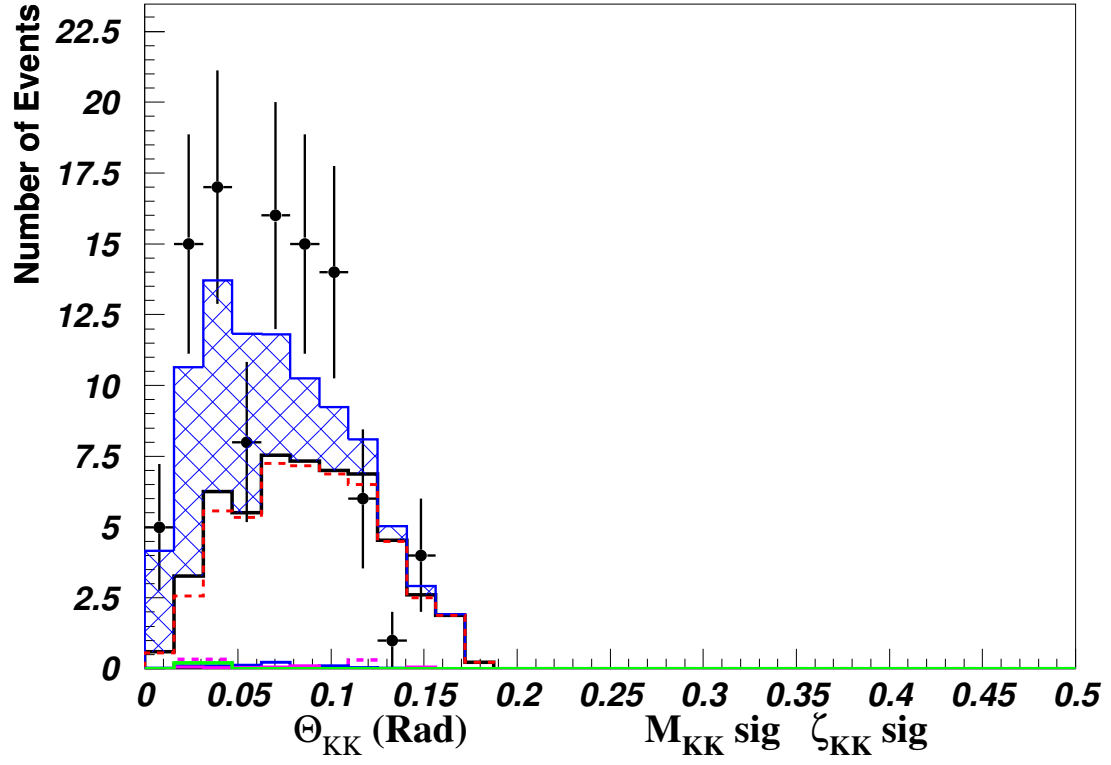
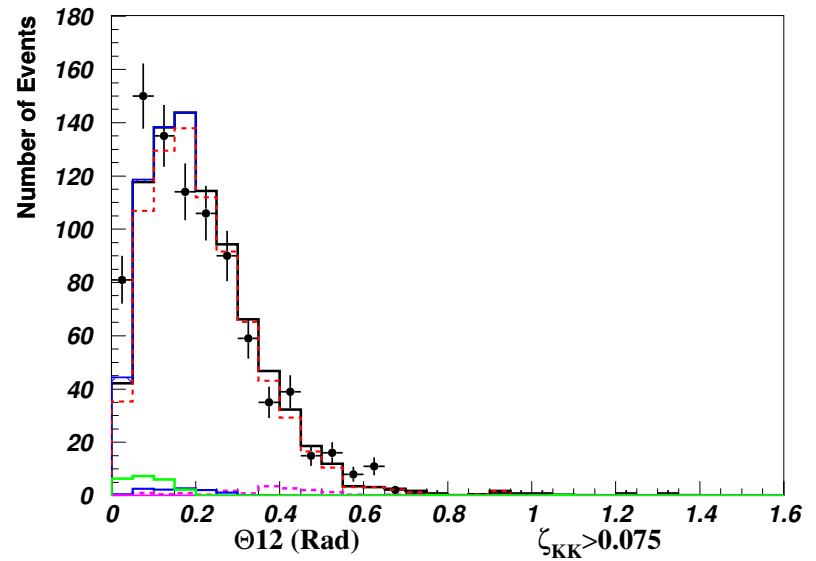
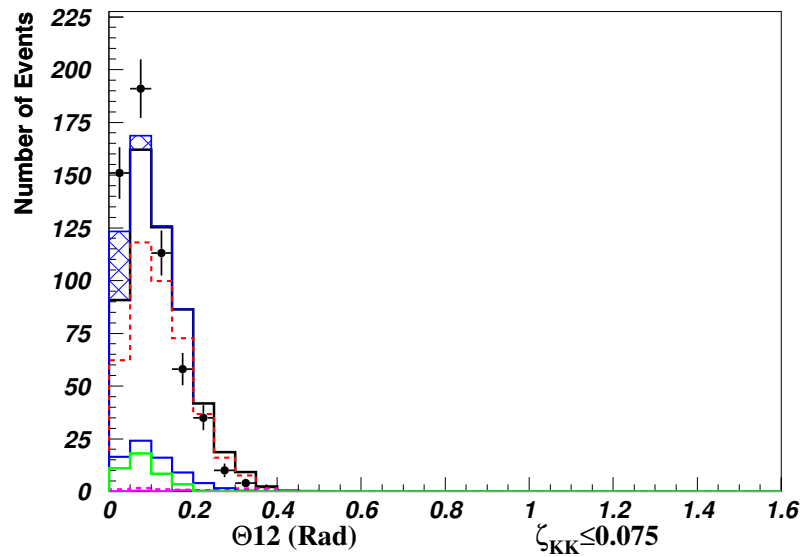
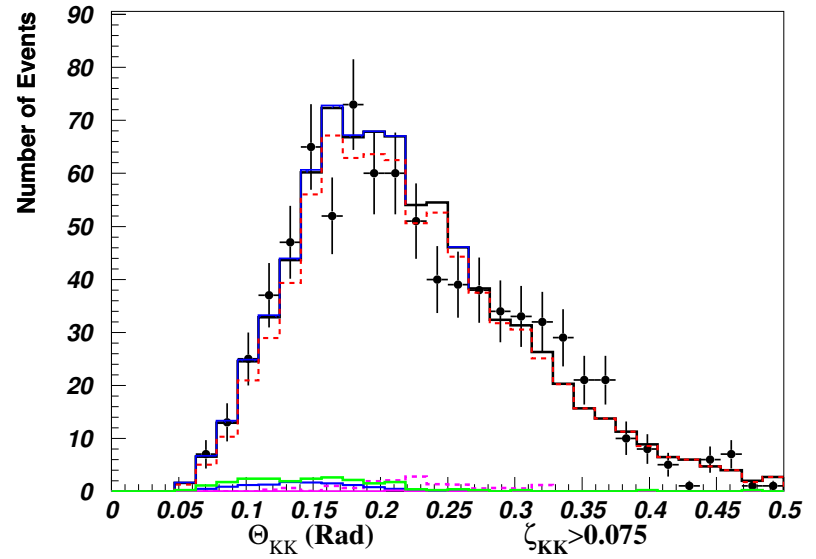
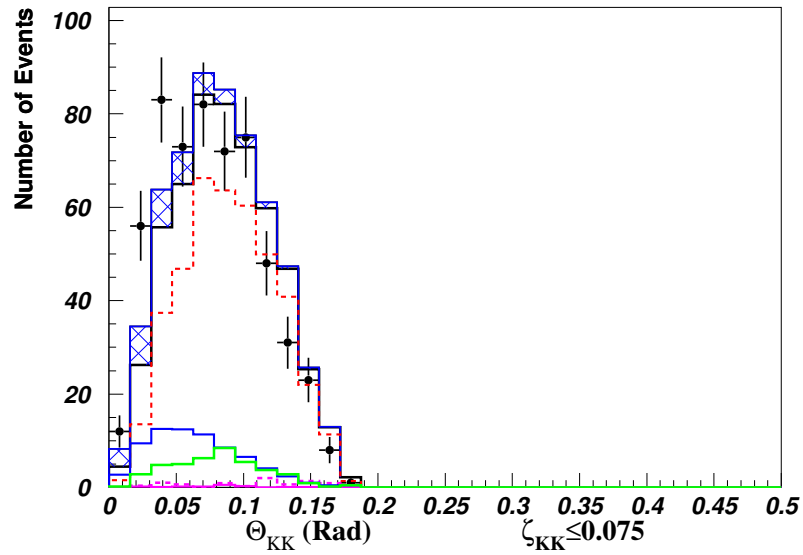


Figure 25:  $\theta_{KK}$  and  $\theta_{12}$  ( $\phi$ -Mass and ZetaSig Region) (figs/thetaphi12-sig-mphi.pdf)



(a)  $\theta_{KK}$  and  $\theta_{12}$  (Signal Region) (figs/thetaphi12-sig.pdf)

(b)  $\theta_{KK}$  and  $\theta_{12}$  (Background Region) (figs/thetaphi12-bkg.pdf)

Figure 26:

## 5.7 $P_t KK$ Plots

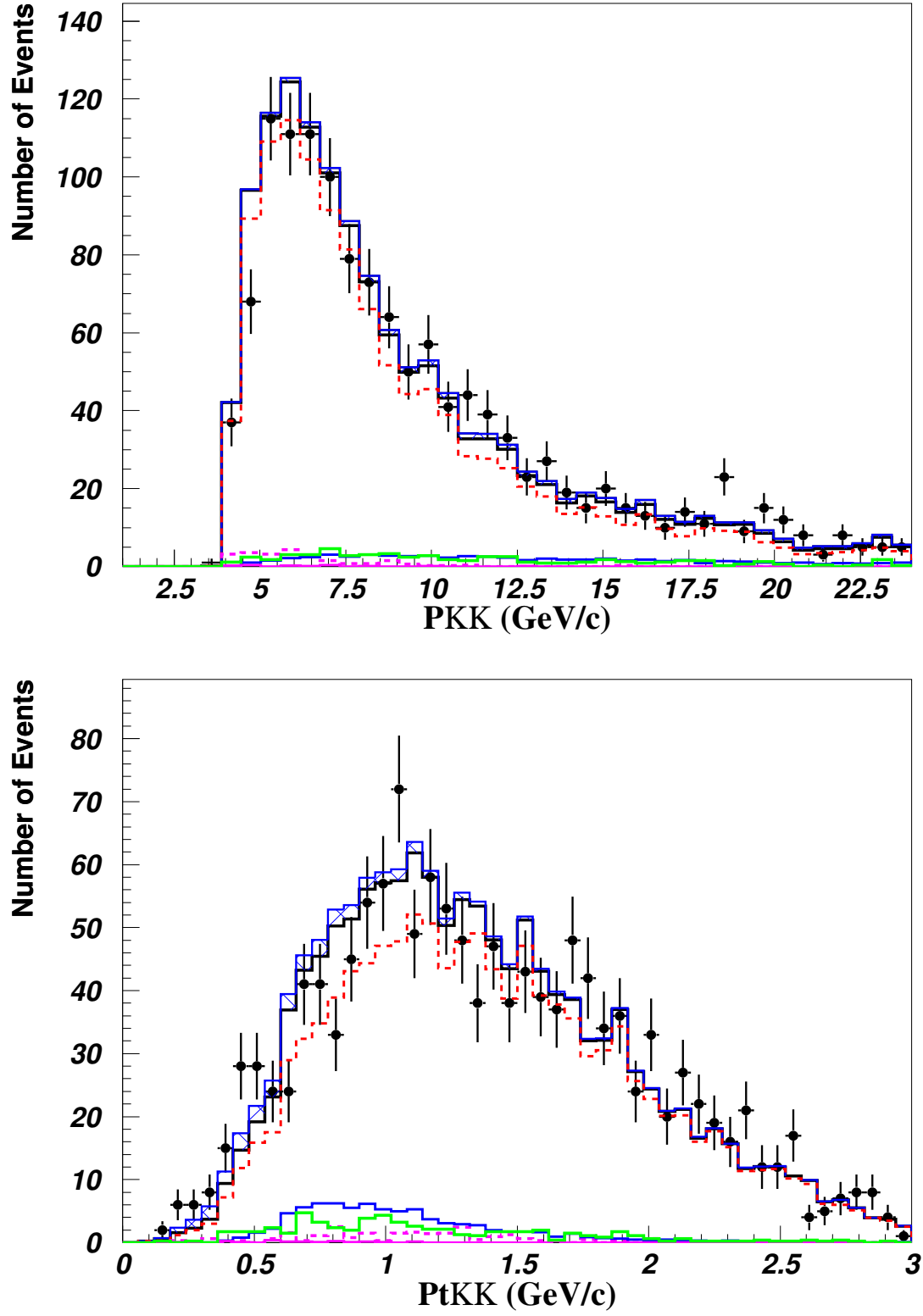


Figure 27:  $P_t KK$  (figs/ptphi.pdf)

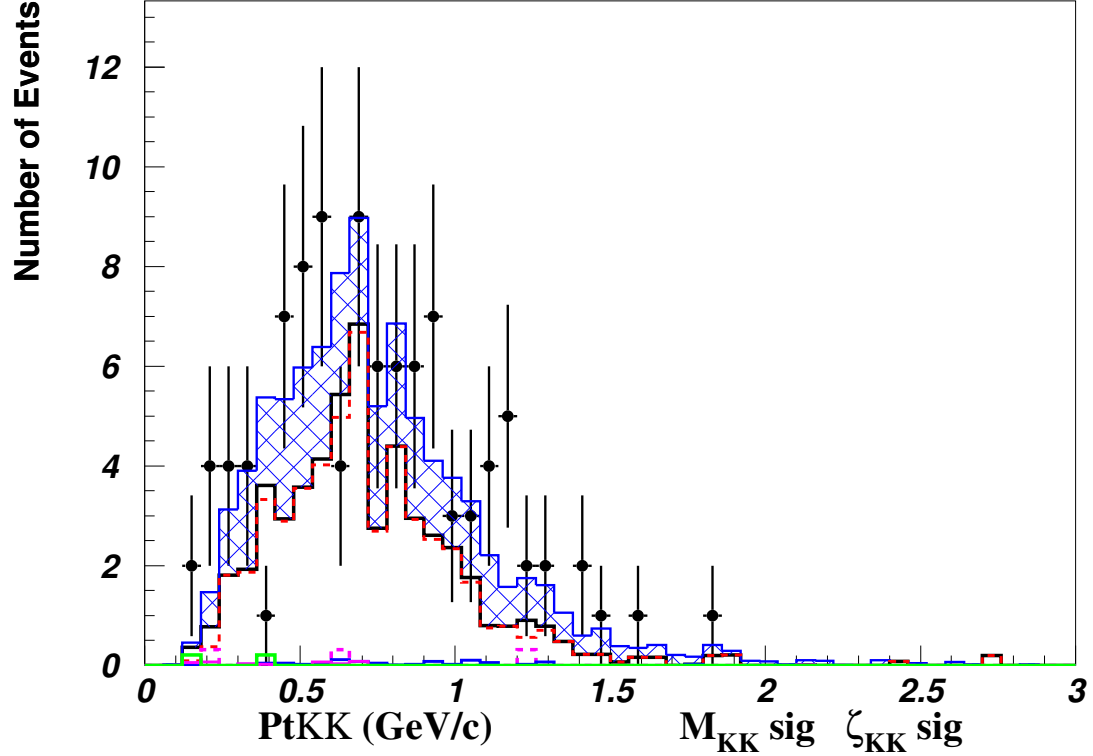
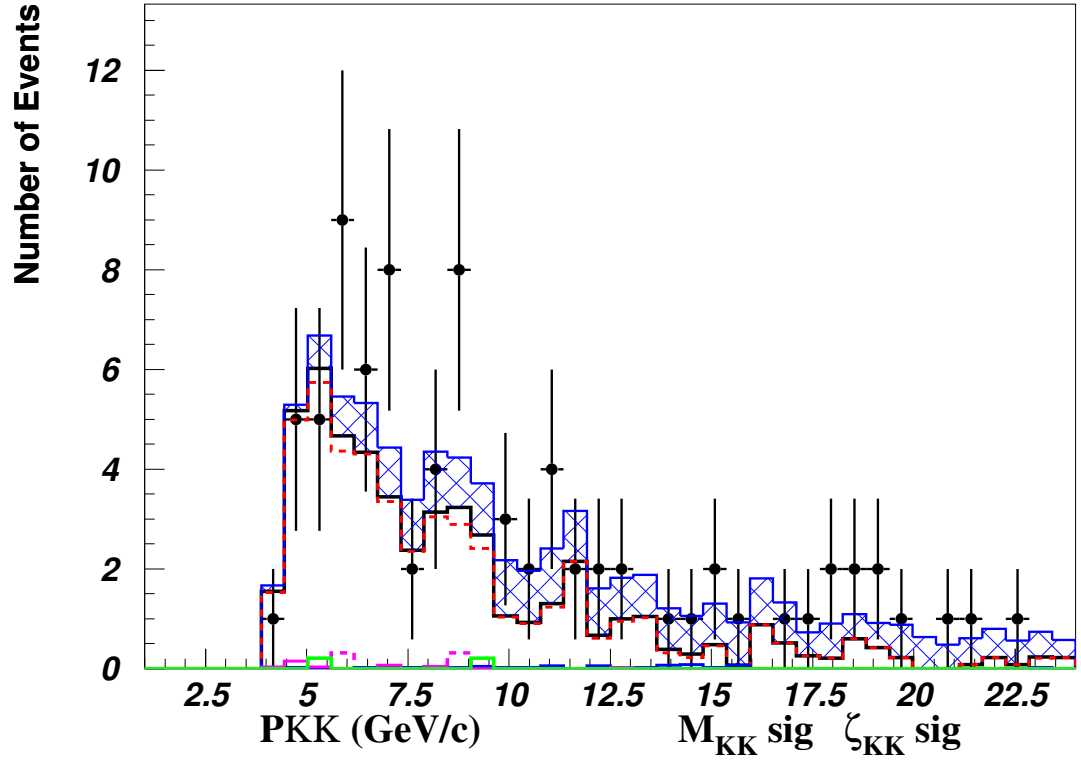
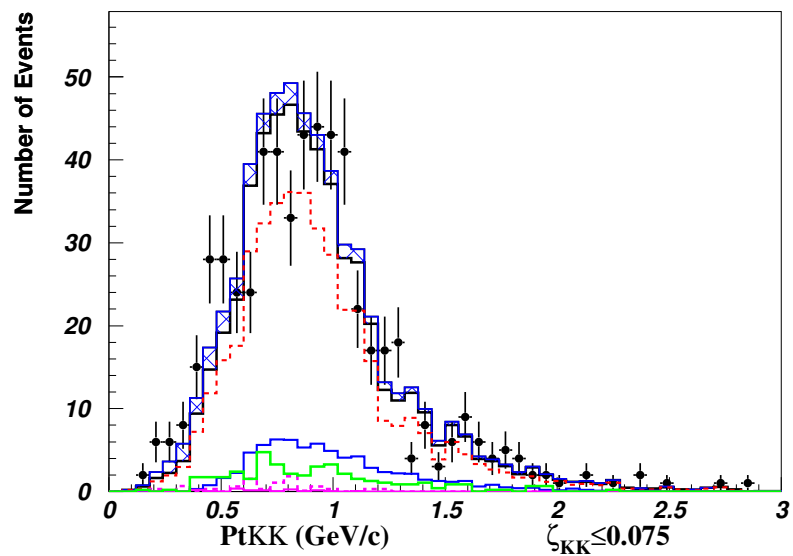
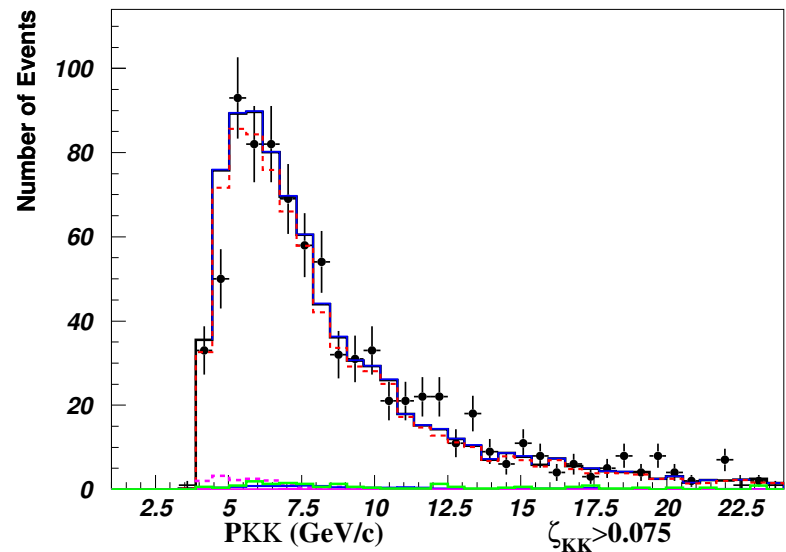
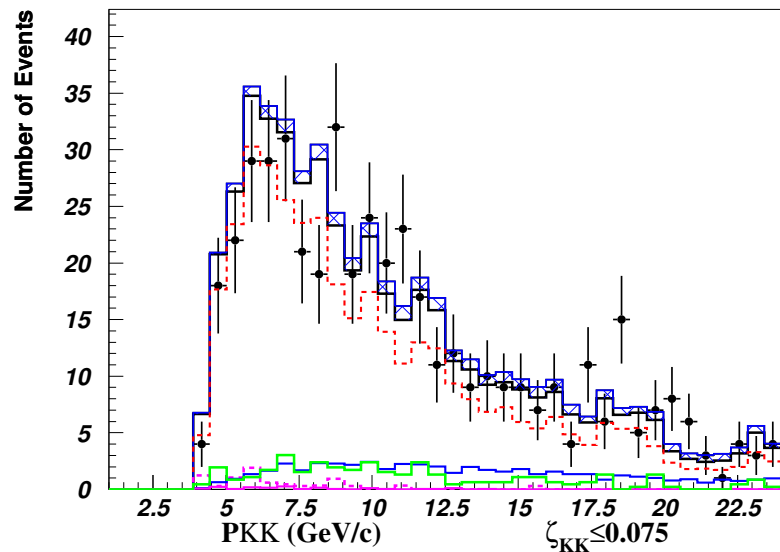
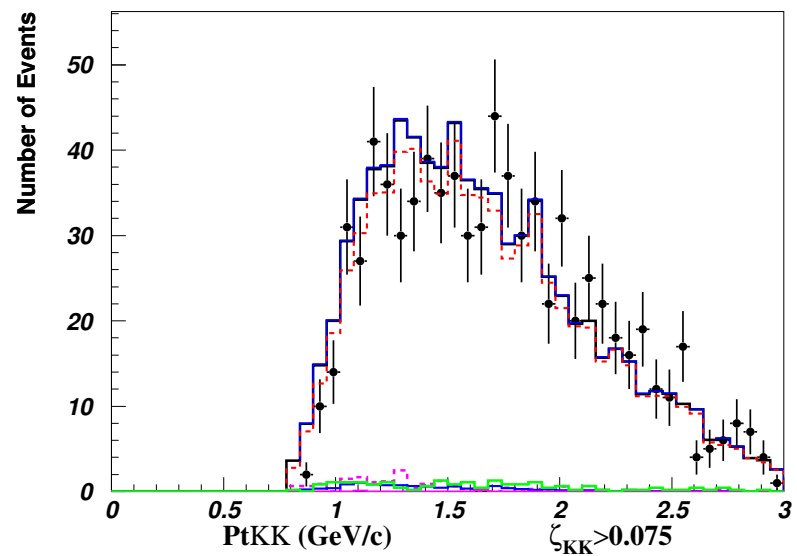


Figure 28:  $P_t K K$  ( $\phi$ -Mass and ZetaSig Region) (figs/ptphi-sig-mphi.pdf)



(a)  $P_t K K$  (Signal Region) (figs/ptphi-sig.pdf)



(b)  $P_t K K$  (Background Region) (figs/ptphi-bkg.pdf)

Figure 29:

## 5.8 $P_t K^+$ Plots

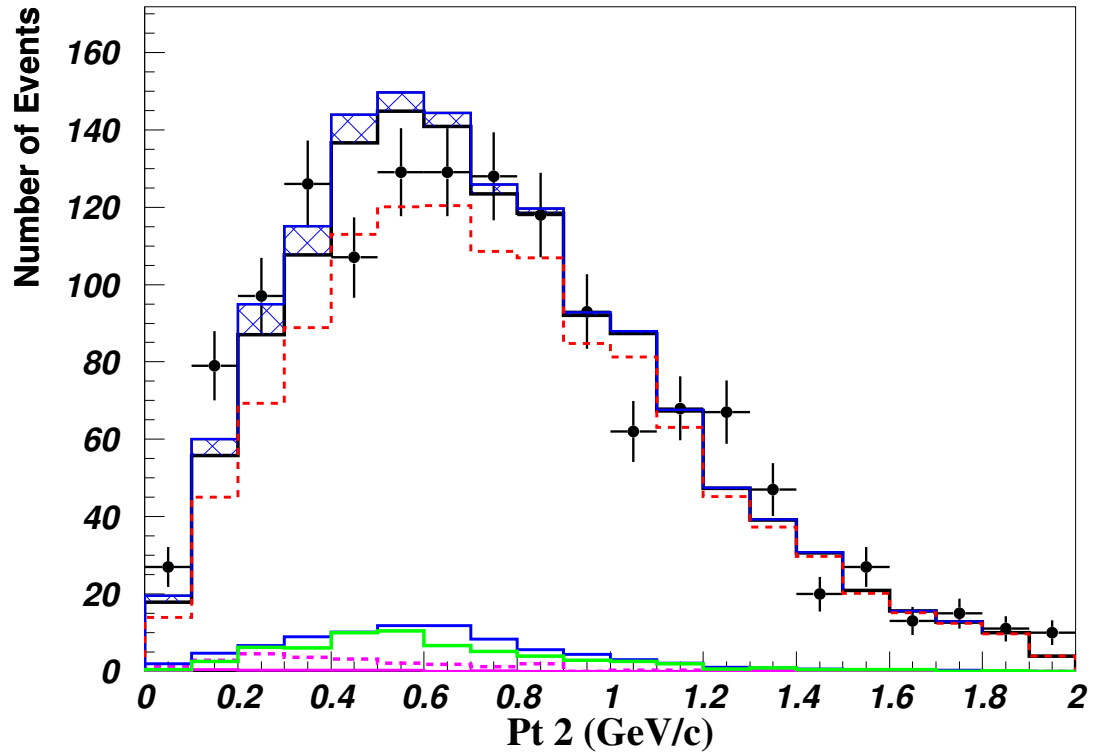
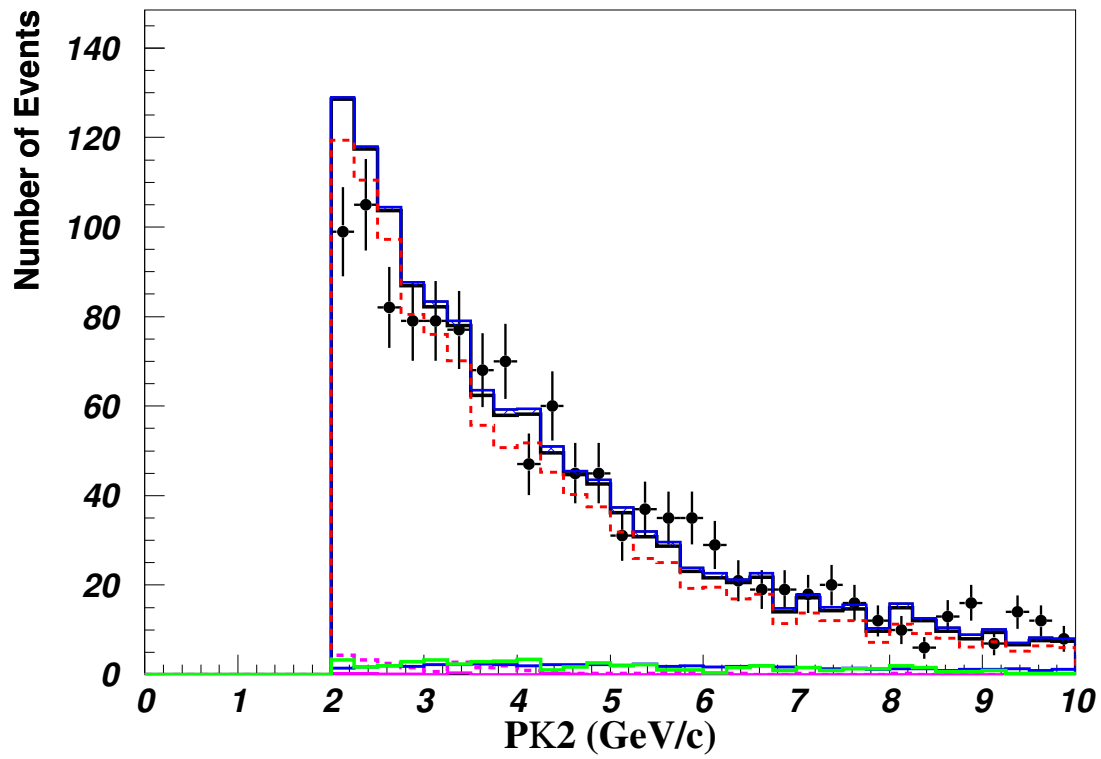


Figure 30:  $P_t K^+$  (figs/ptkpos.pdf)



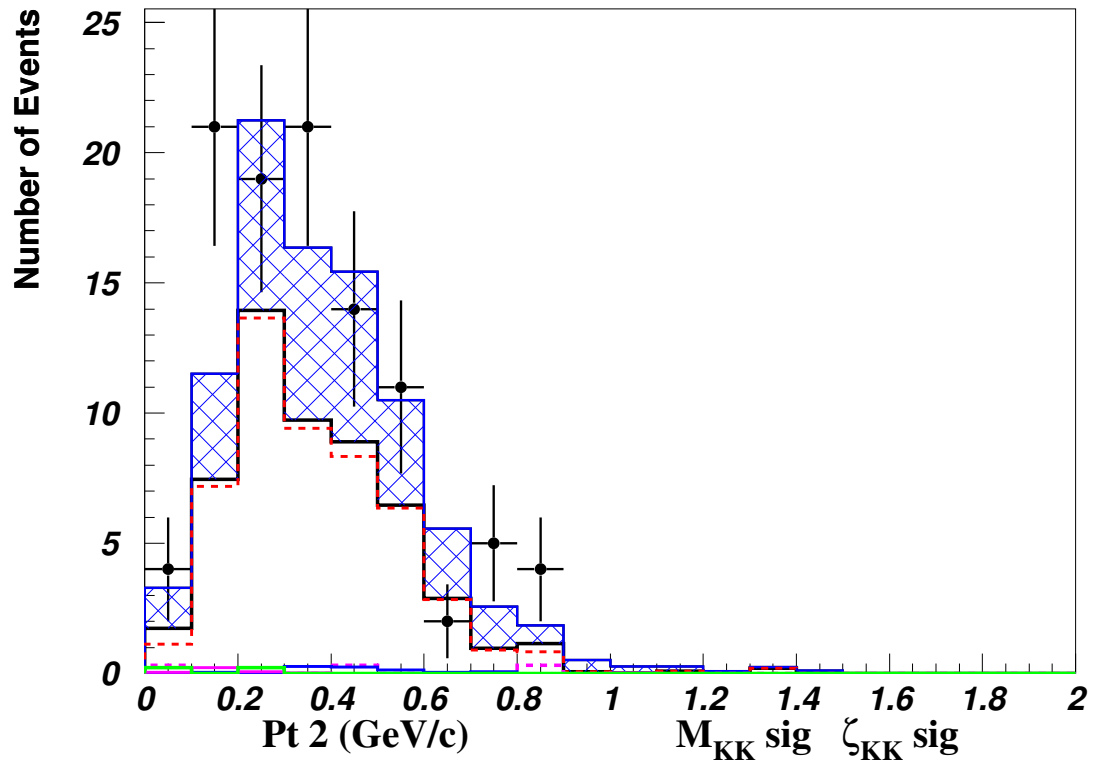
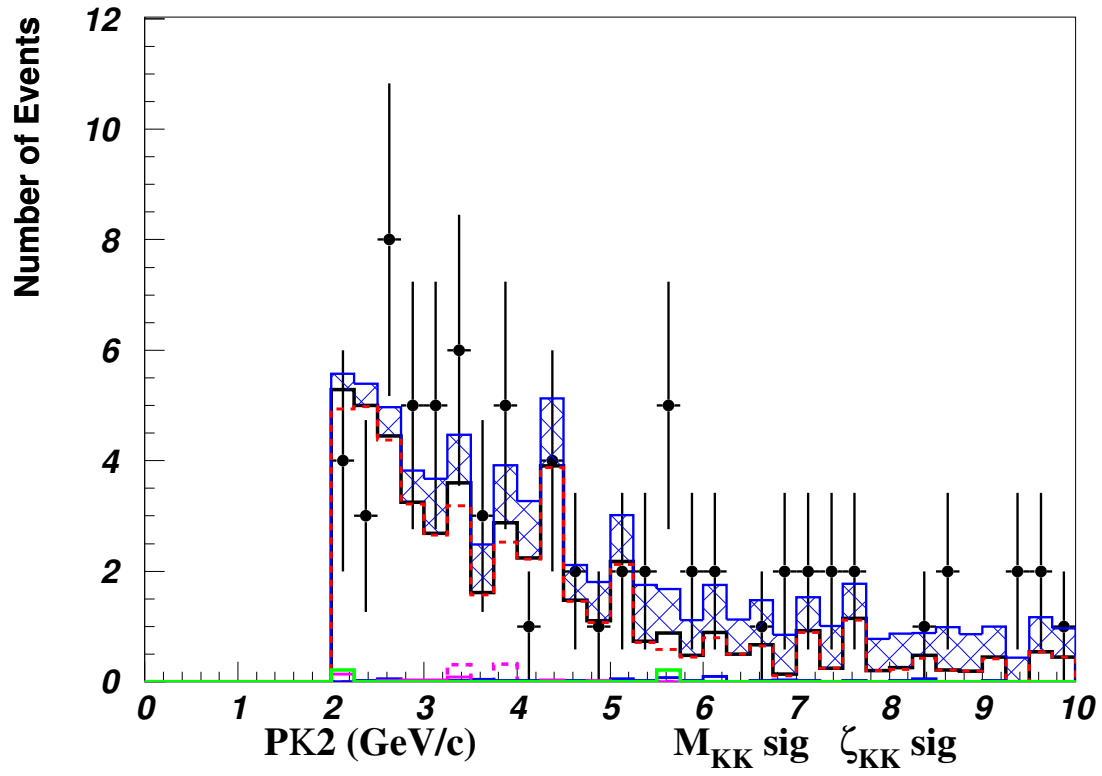
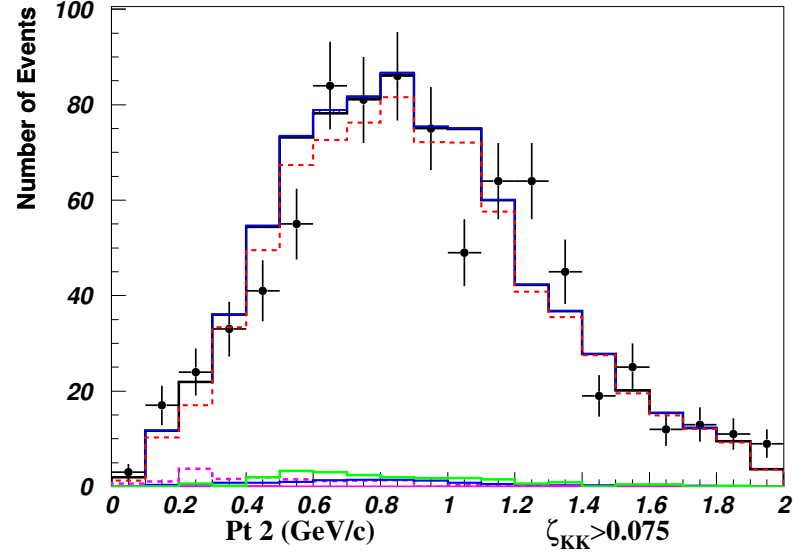
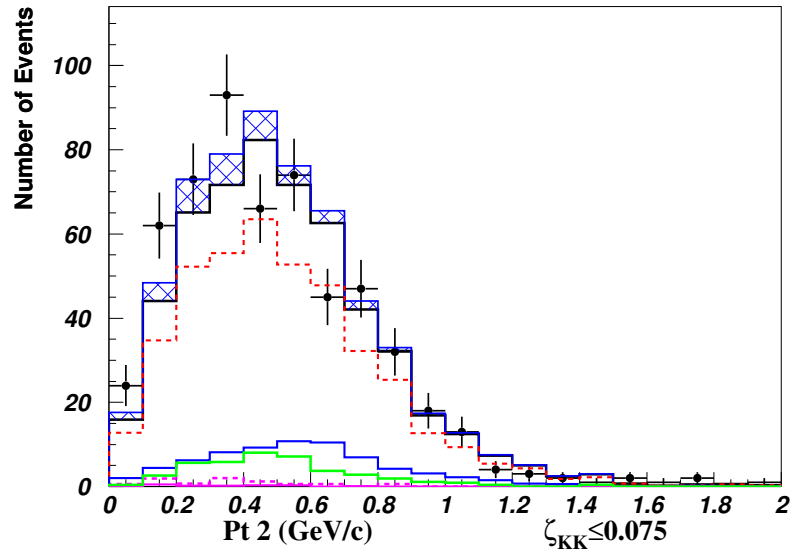
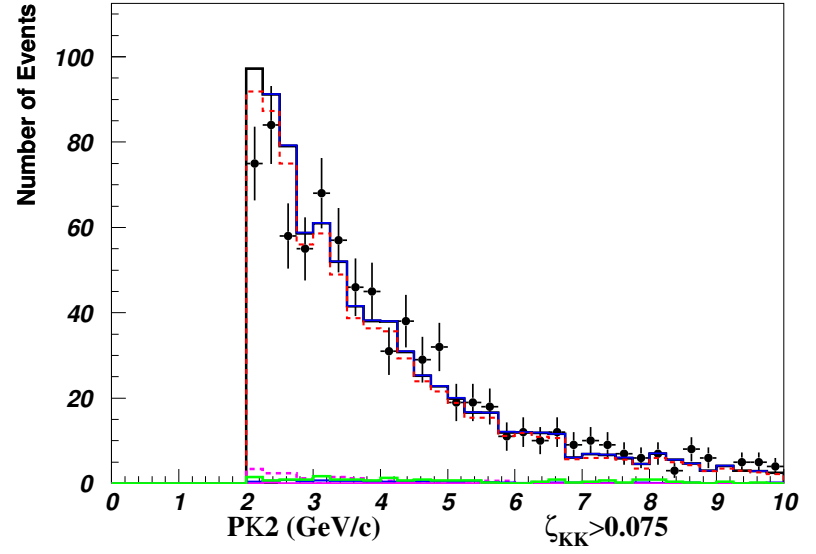
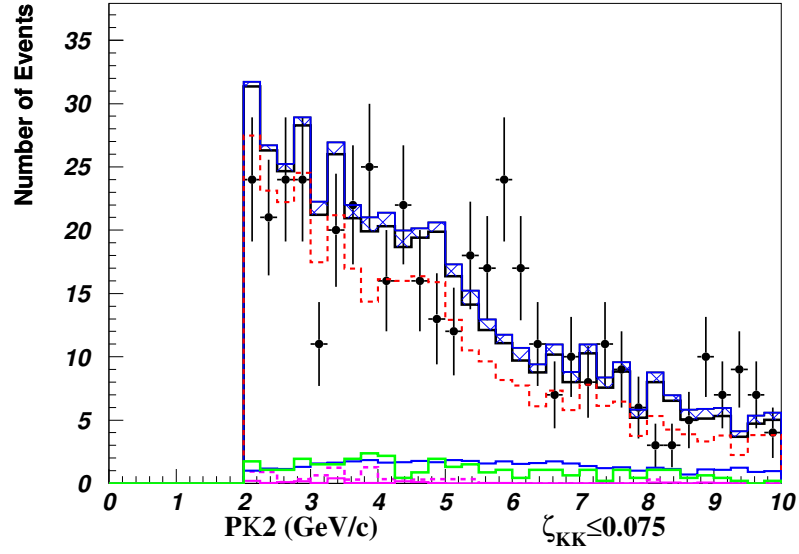


Figure 31:  $P_t K^+$  ( $\phi$ -Mass and ZetaSig Region) (figs/ptkpos-sig-mphi.pdf)



(a)  $P_t K^+$  (Signal Region) (figs/ptkpos-sig.pdf)

(b)  $P_t K^+$  (Background Region) (figs/ptkpos-bkg.pdf)

Figure 32:

## 5.9 $P_t K^-$ Plots

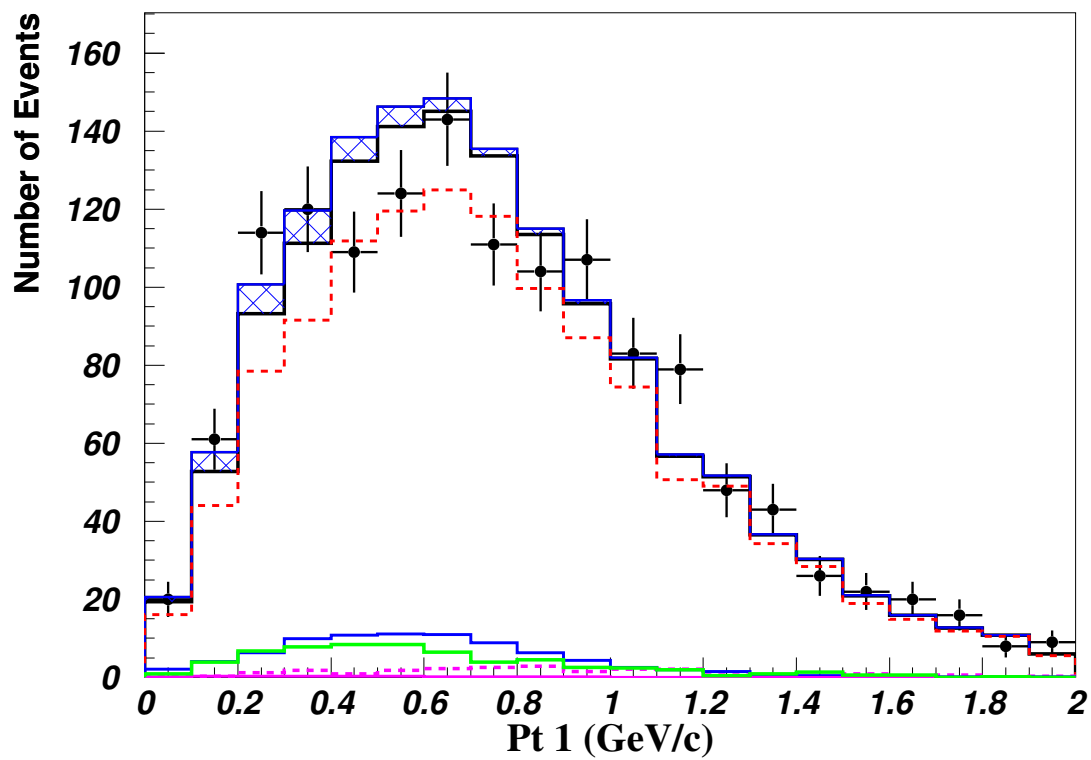
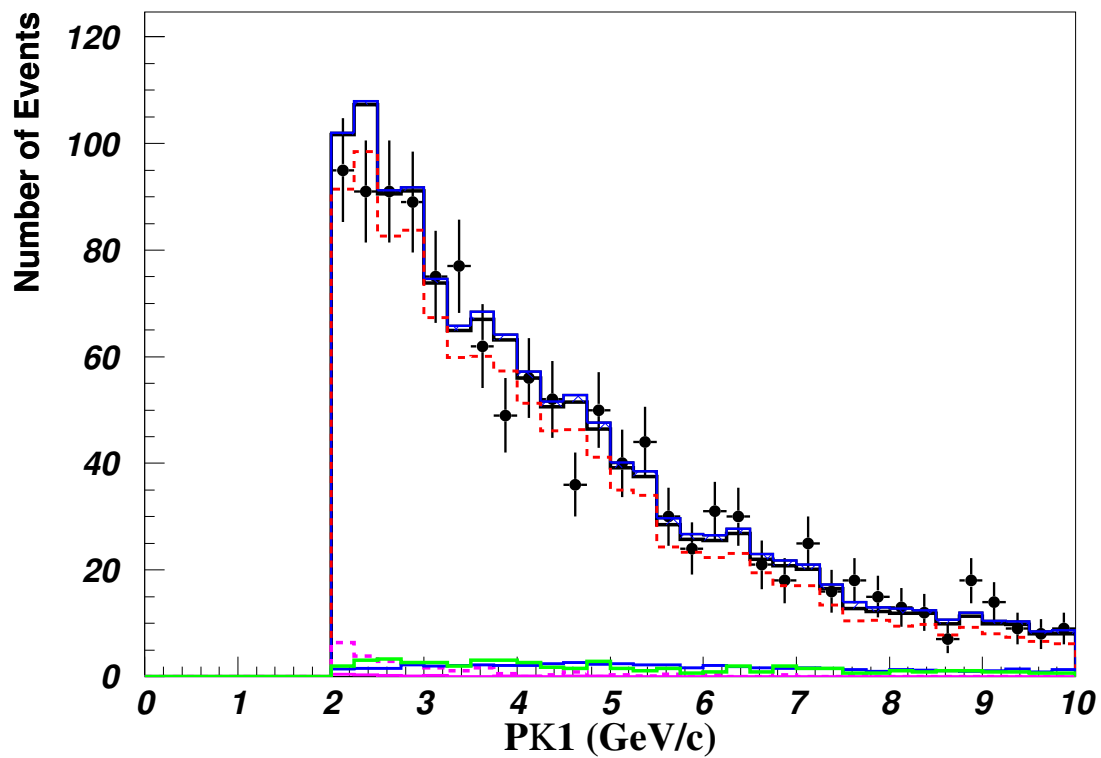


Figure 33:  $P_t K^-$  (figs/ptkneg.pdf)

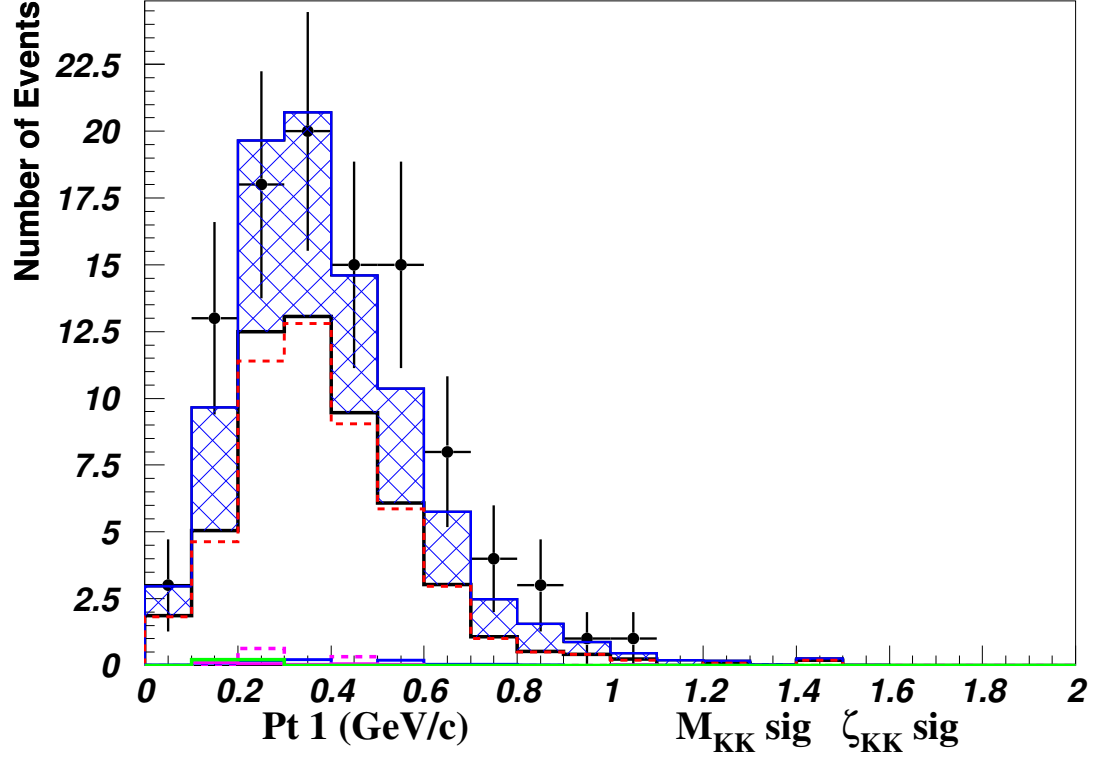
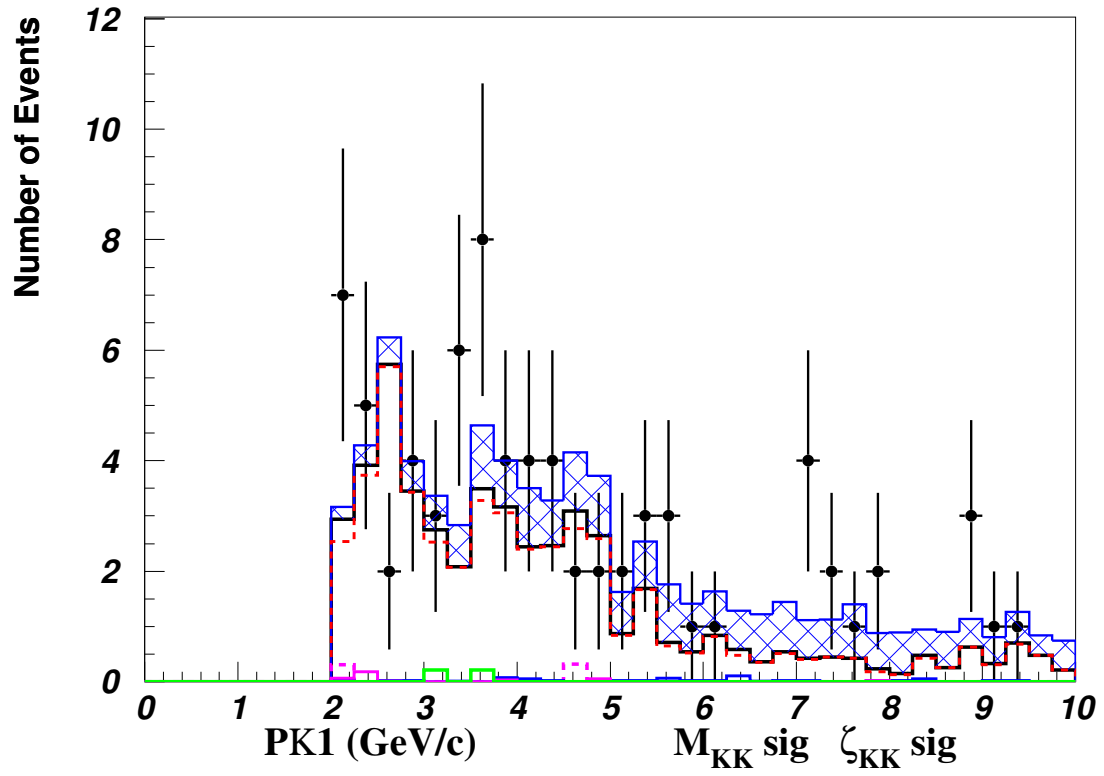


Figure 34:  $P_t K^-$  ( $\phi$ -Mass and ZetaSig Region) (figs/ptkneg-sig-mphi.pdf)

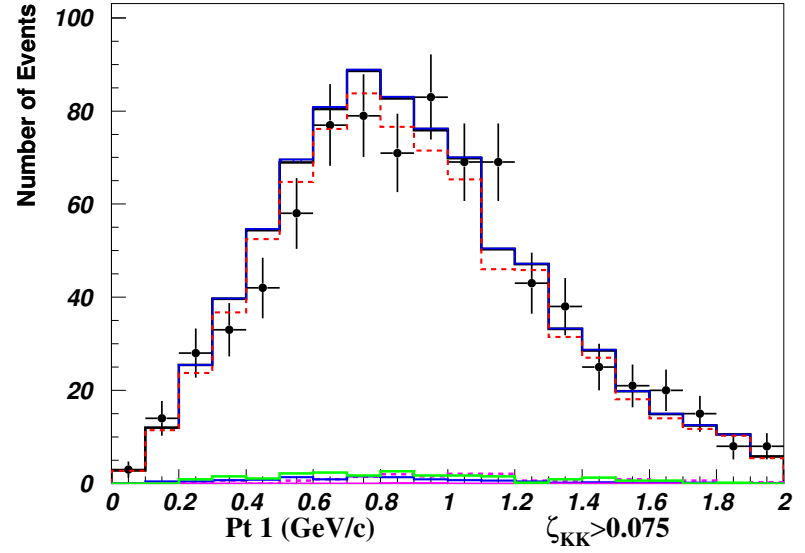
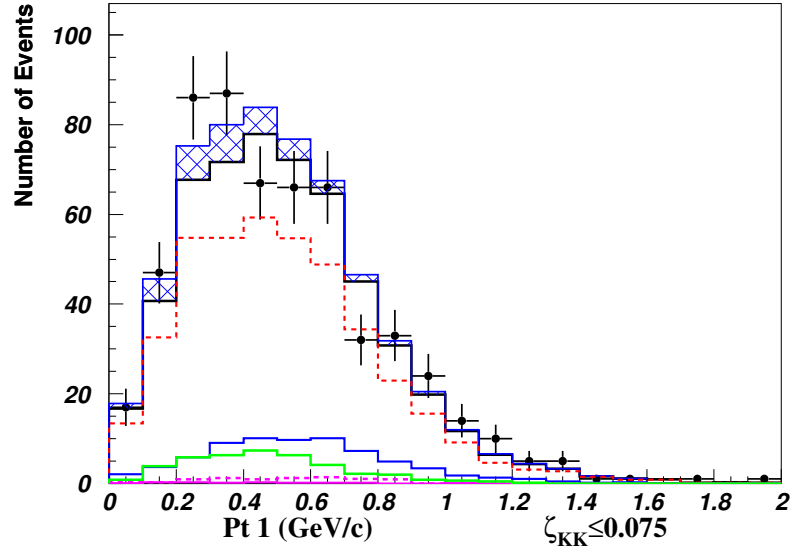
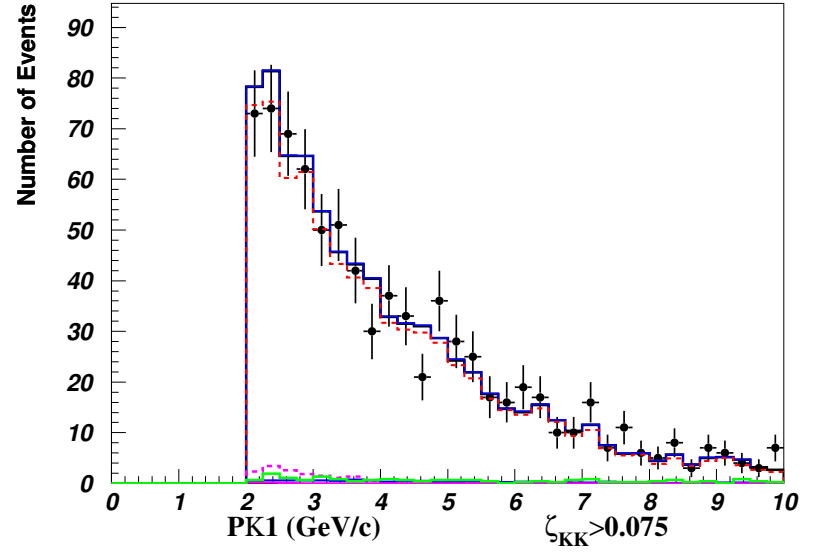
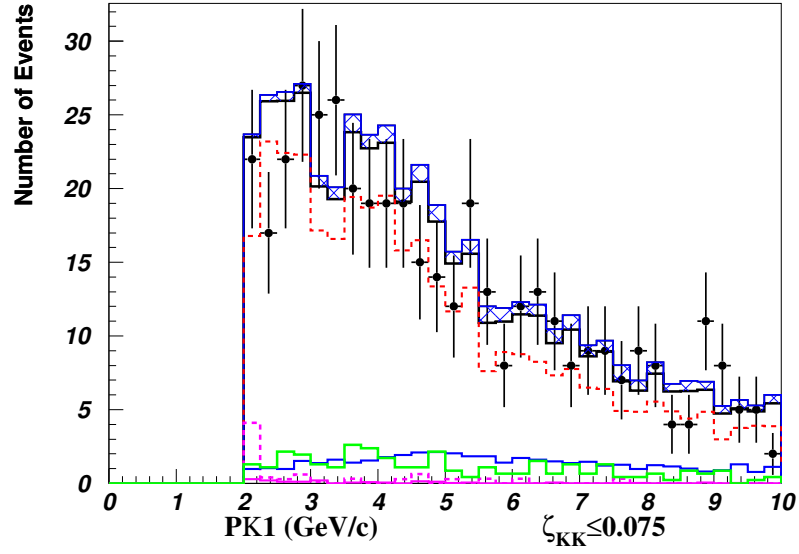
(a)  $P_t K^-$  (Signal Region) (figs/ptkneg-sig.pdf)(b)  $P_t K^-$  (Background Region) (figs/ptkneg-bkg.pdf)

Figure 35:

## 5.10 P<sub>t</sub>pos and P<sub>t</sub>neg Plots

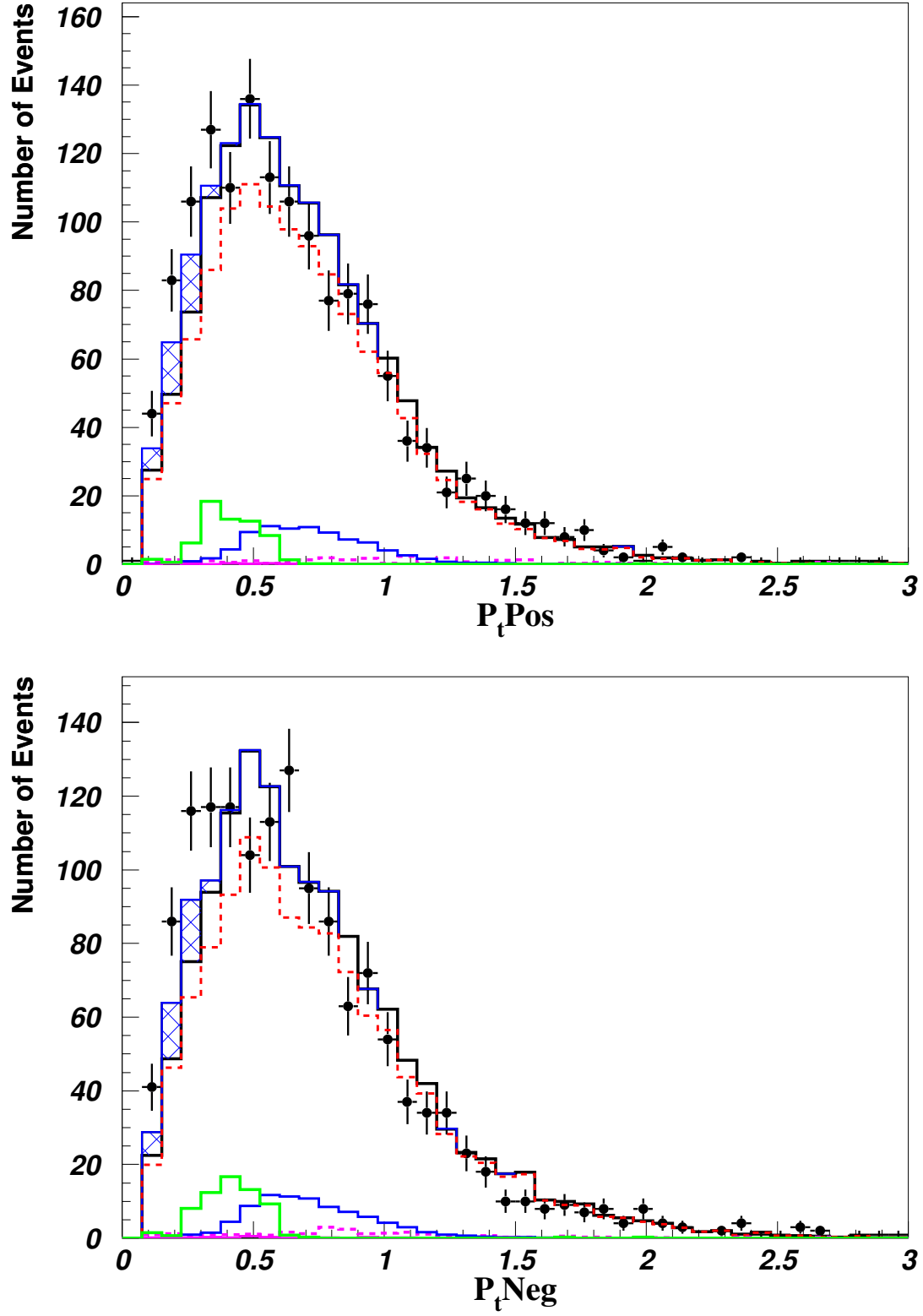
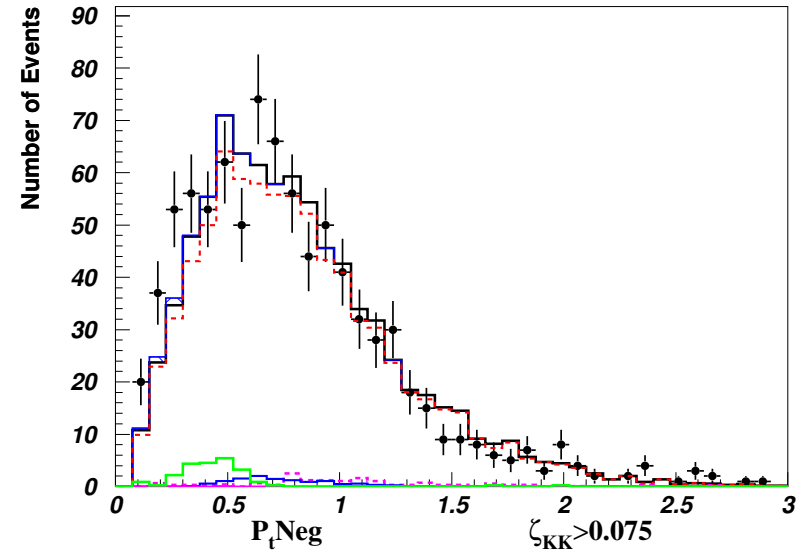
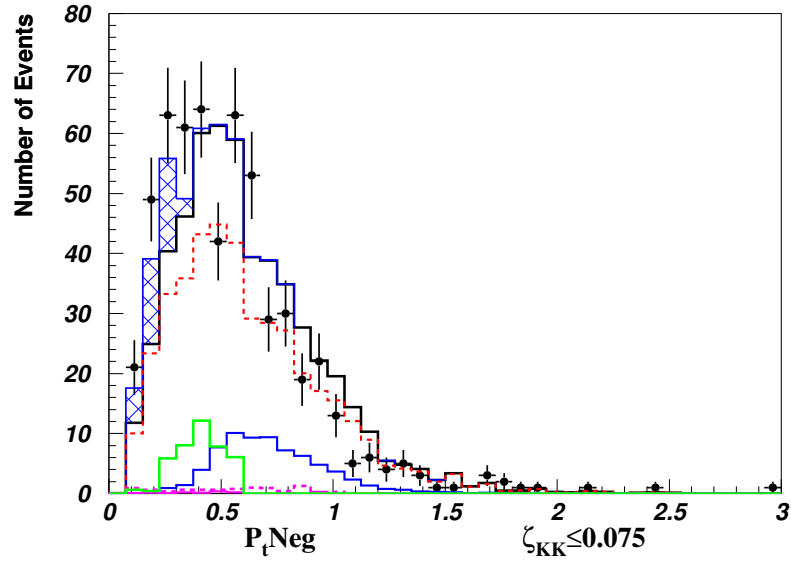
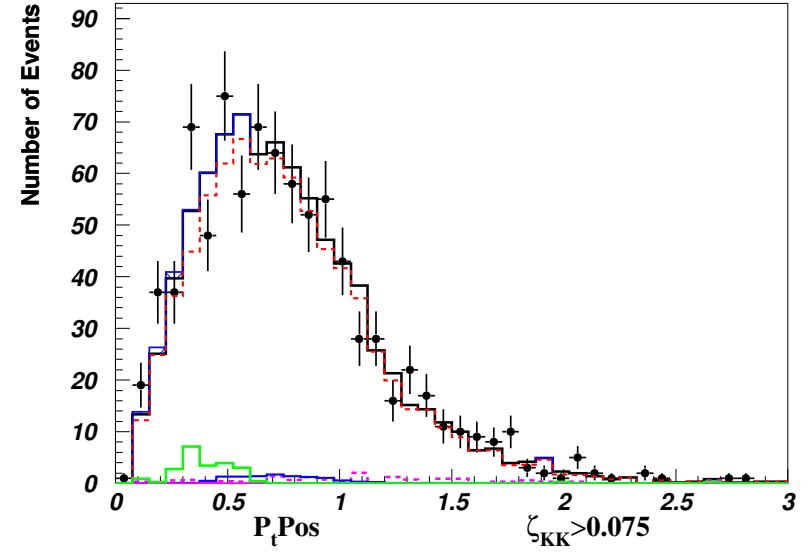
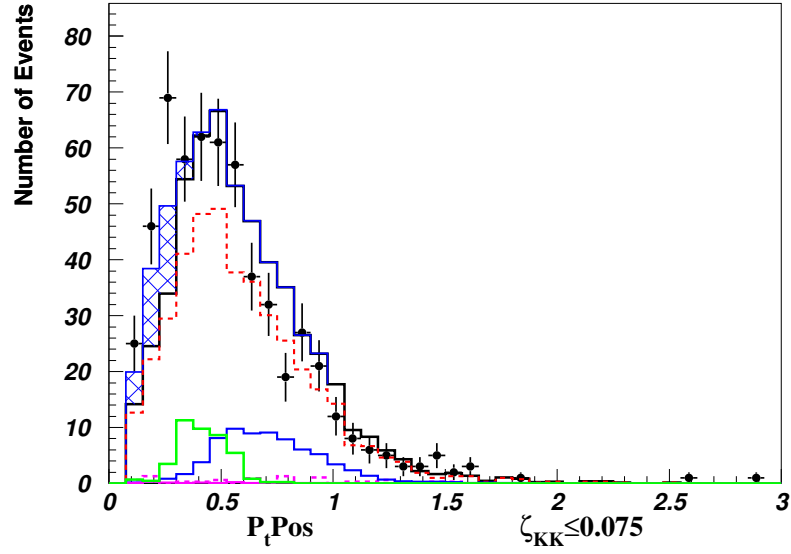


Figure 36: P<sub>t</sub>pos and P<sub>t</sub>neg (figs/ptpos-ptneg.pdf)



(a)  $P_t\text{pos}$  and  $P_t\text{neg}$  (Signal Region) (figs/ptpos-ptneg-sig.pdf)

(b)  $P_t\text{pos}$  and  $P_t\text{neg}$  (Background Region) (figs/ptpos-ptneg-bkg.pdf)

Figure 37:

## 5.11 PAN Plots

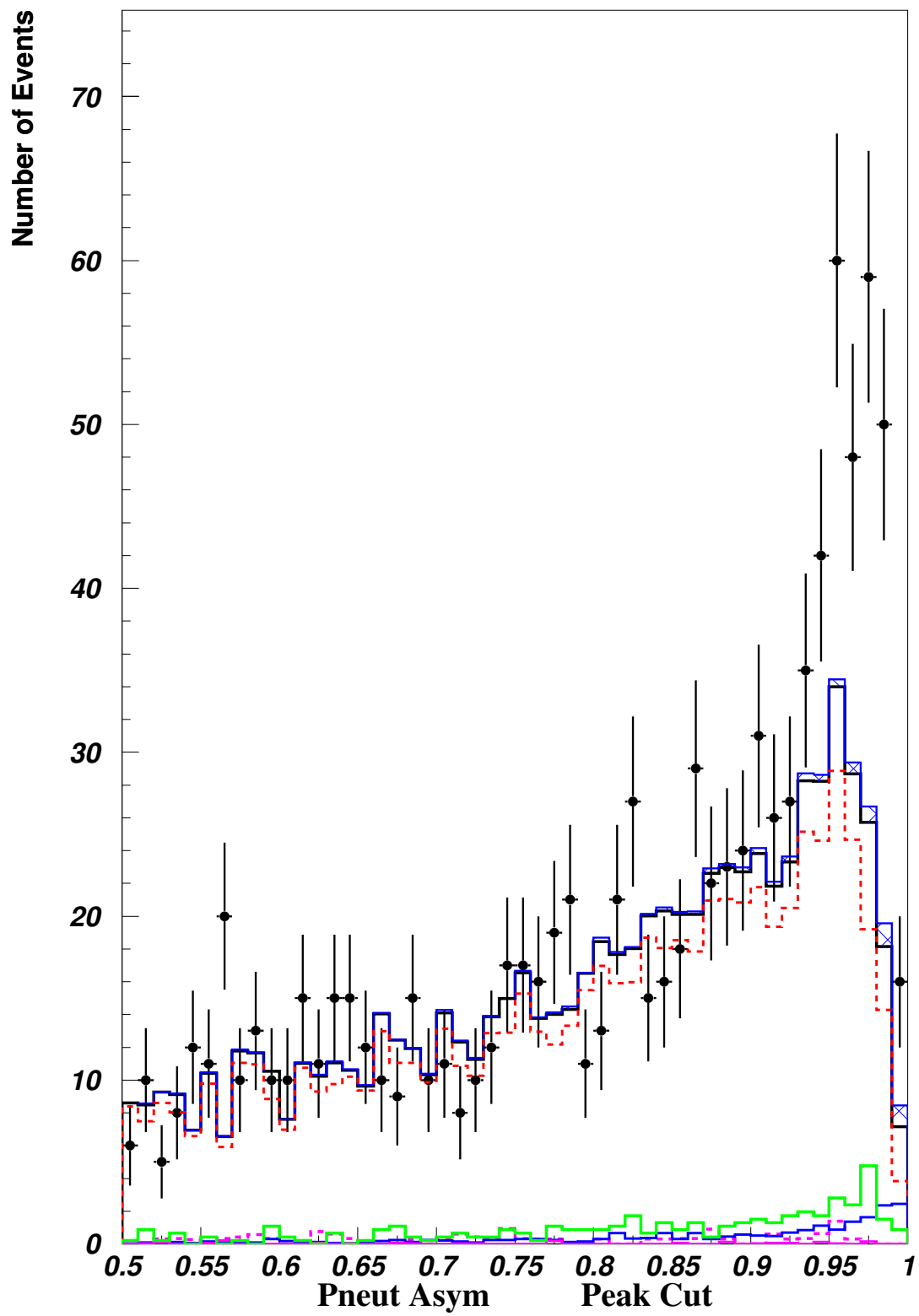


Figure 38: PAN (Neutral Momentum Assymetry) (figs/pan-lin.pdf)



## 5.12 Vertex Plots

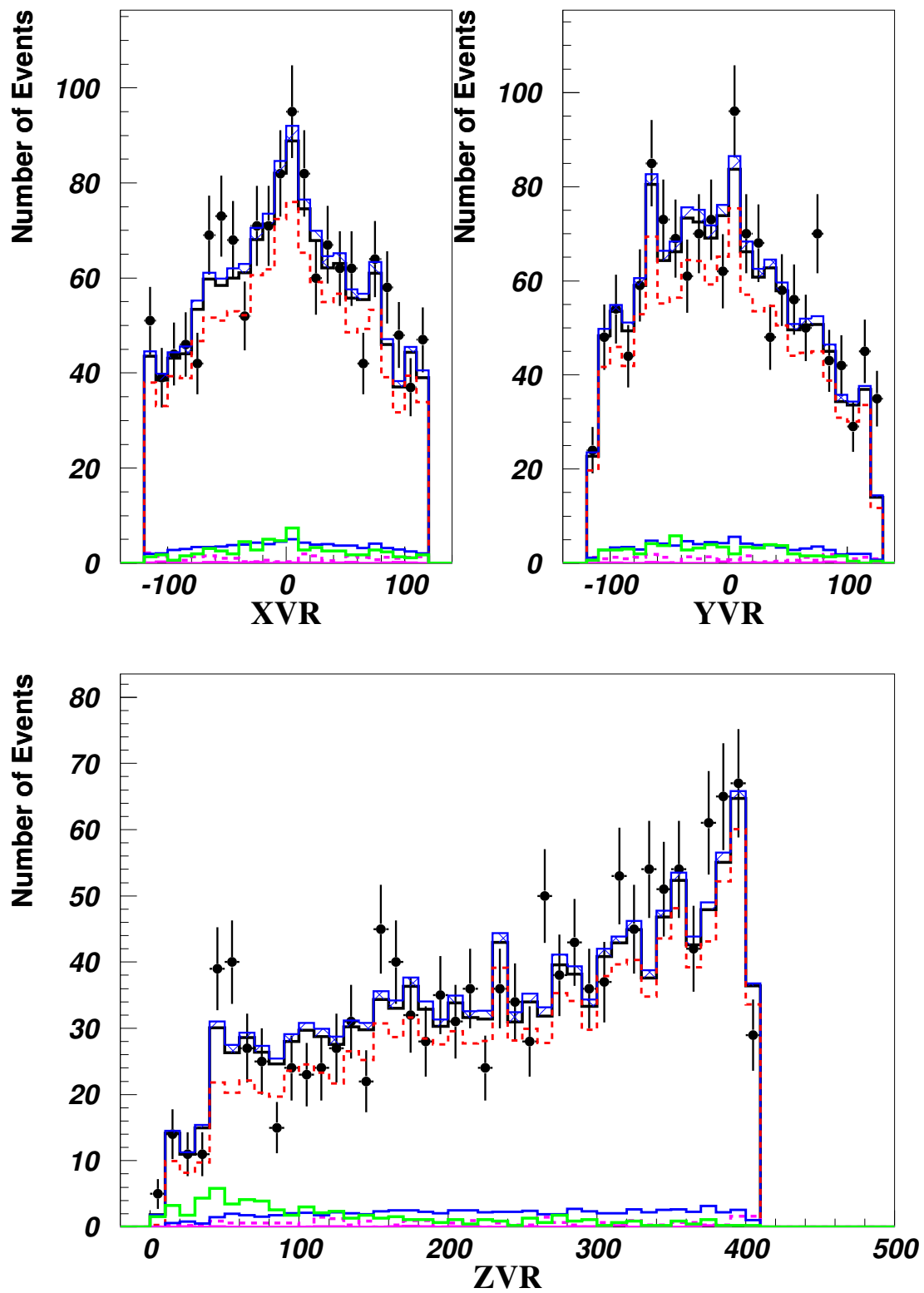


Figure 39: Vertex Position (figs/vertex.pdf)

## 6 DS Correction Plots

This section shows plots for the most recent DS correction. If no corrections were applied to NCDIS then this section is rather meaningless. See 1 for information on the DS corrections used.

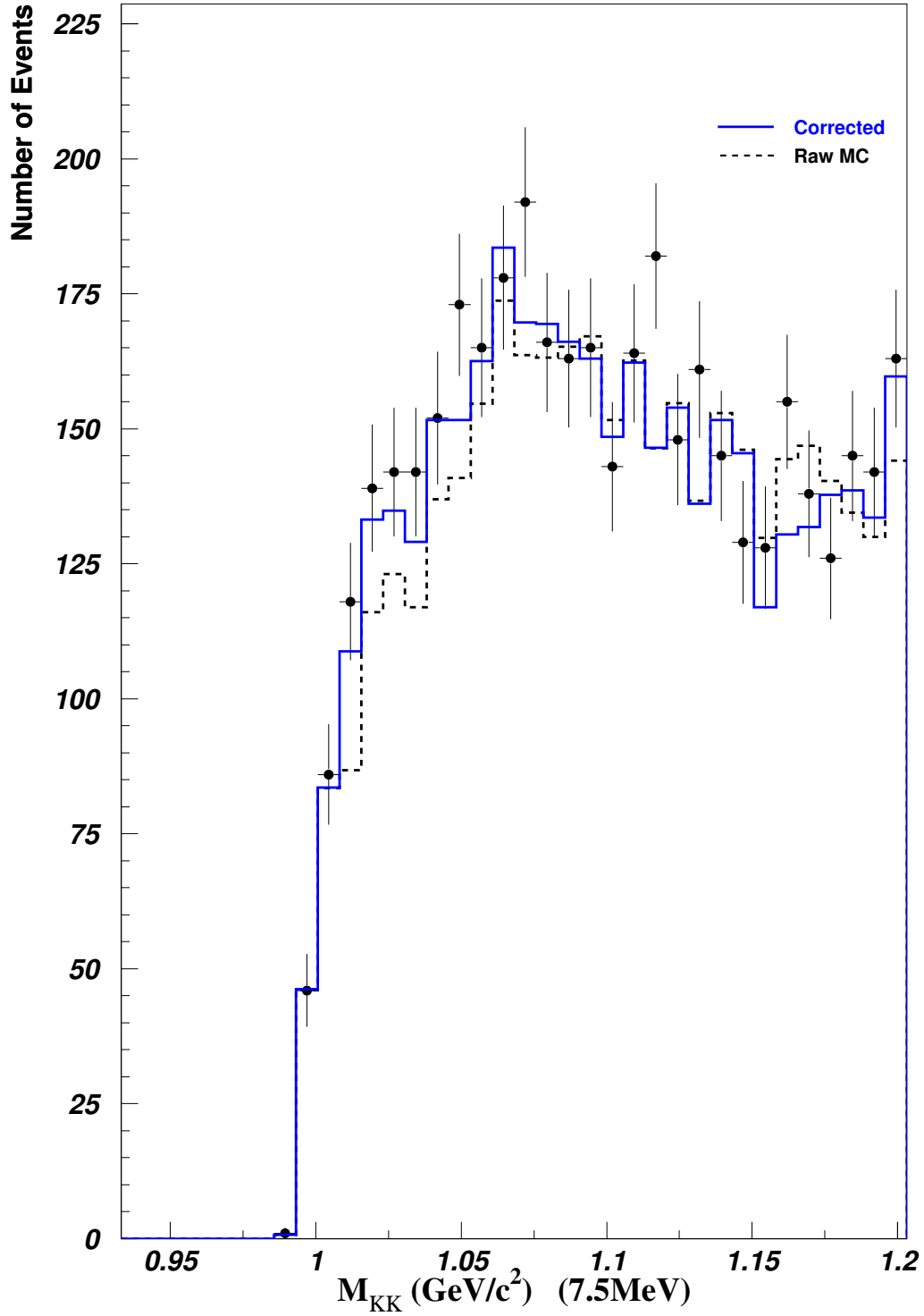
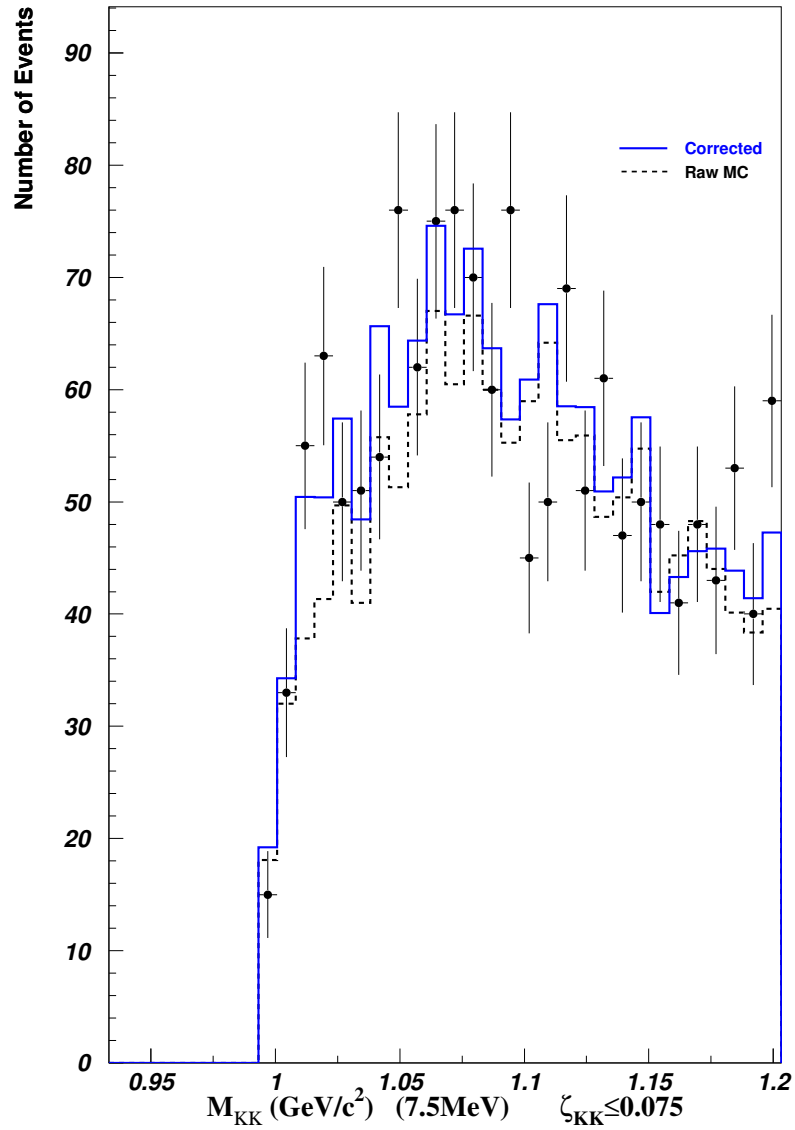
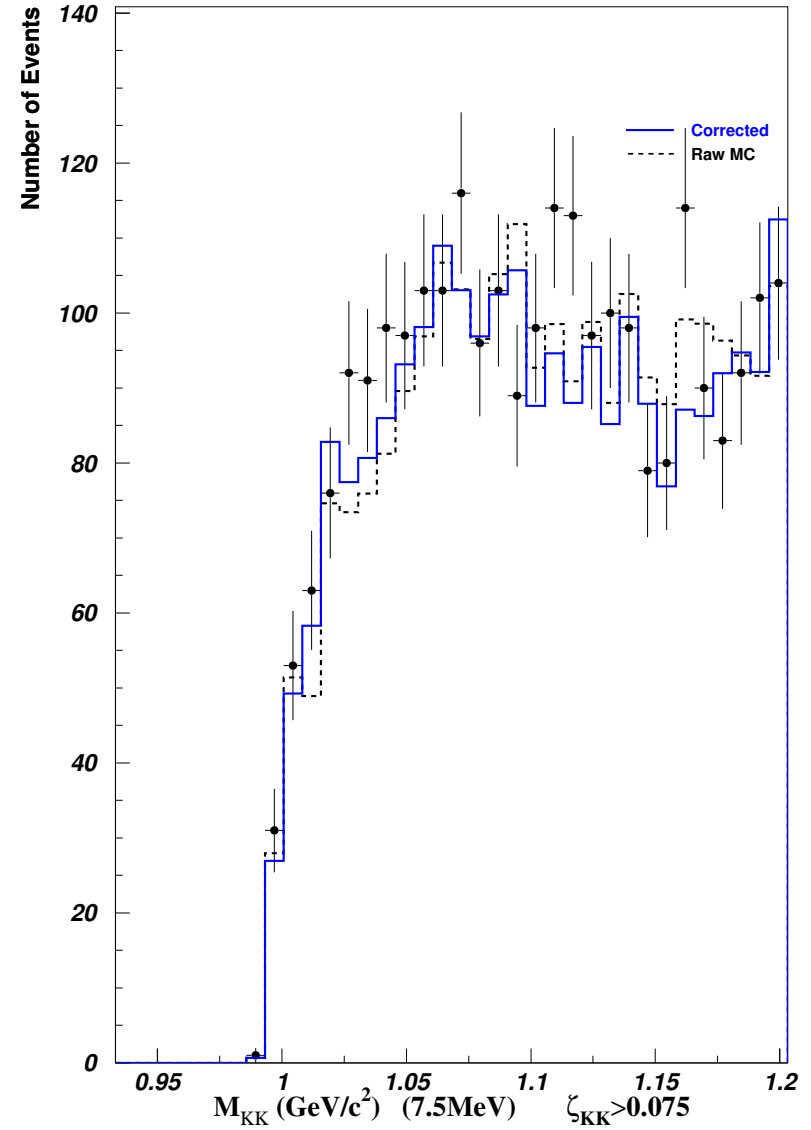


Figure 40: DS Correction  $M_{KK}$  (dsplots/dscorr-mkk-ncand34.pdf)

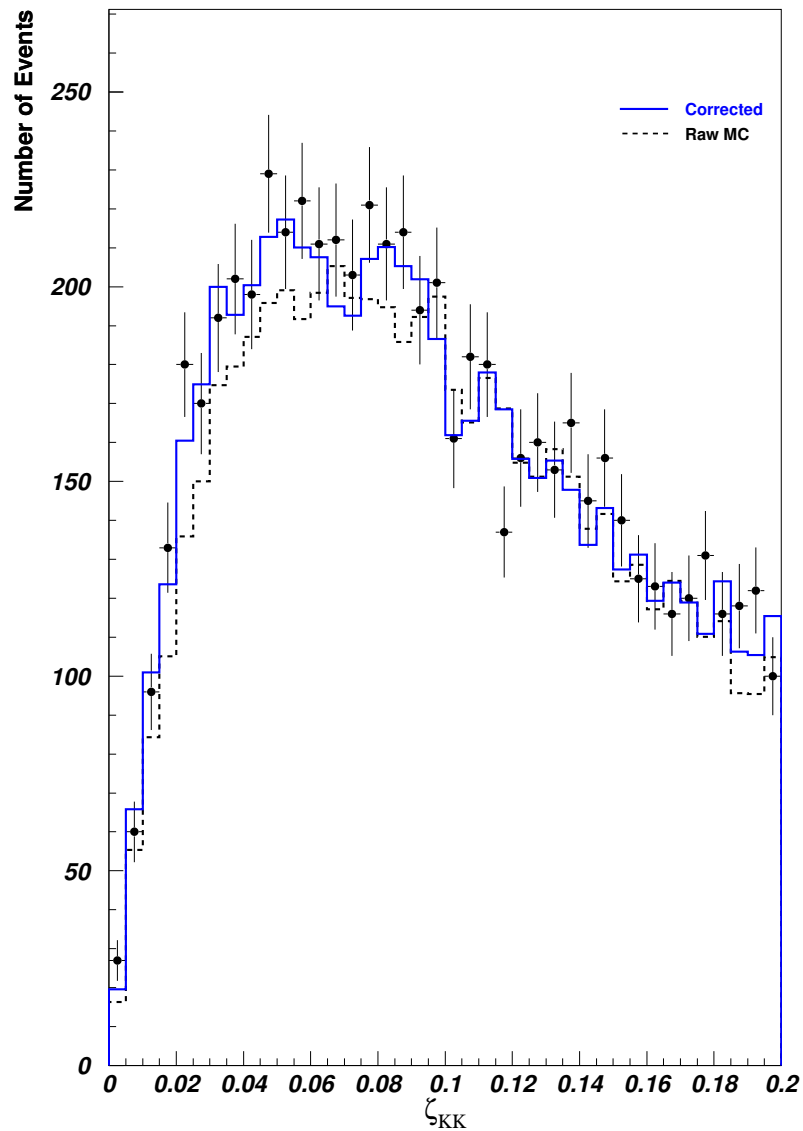


(a) DS Correction  $M_{KK}$  (zeta signal region) (dsplots/dscorr-mkk-ncand34-sig.pdf)

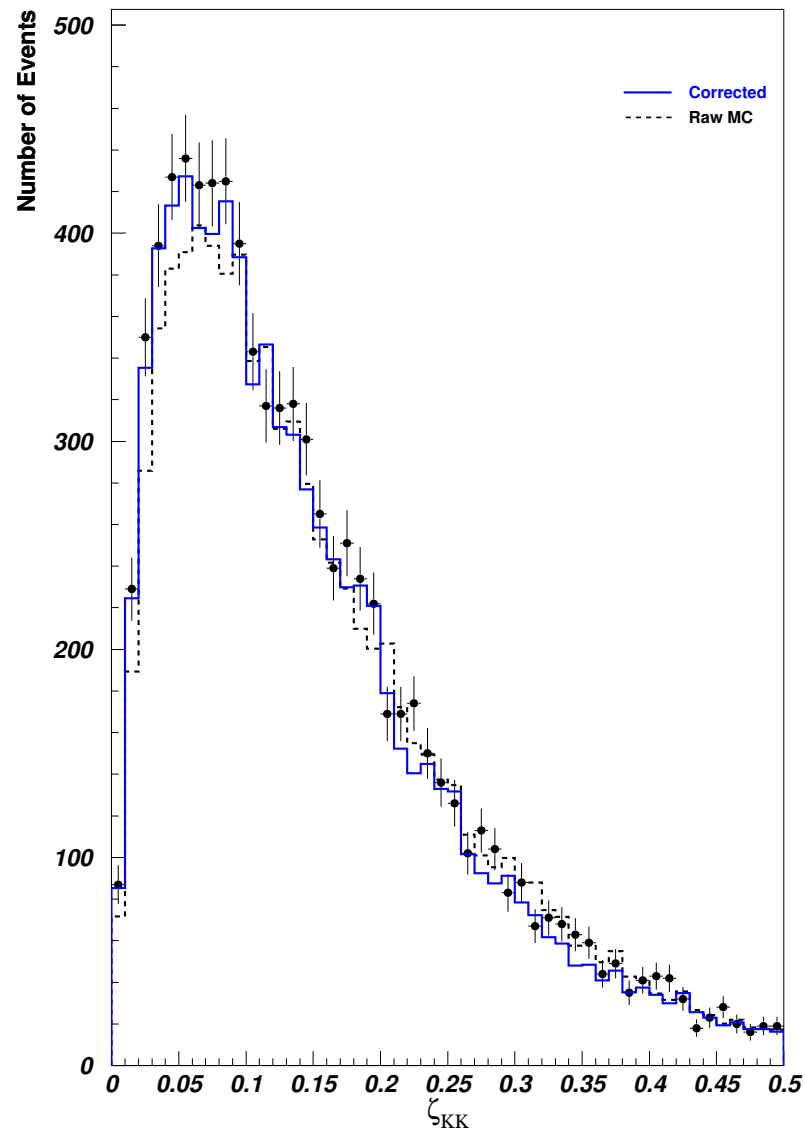


(b) DS Correction  $M_{KK}$  (zeta background region) (dsplots/dscorr-mkk-ncand34-bkg.pdf)

Figure 41:



(a) DS Correction  $\zeta_{KK}$  up to 2.0 (dsplots/dscorr-zetak-0.2-ncand34.pdf)



(b) DS Correction  $\zeta_{KK}$  up to 5.0 (dsplots/dscorr-zetak-0.5-ncand34.pdf)

Figure 42:

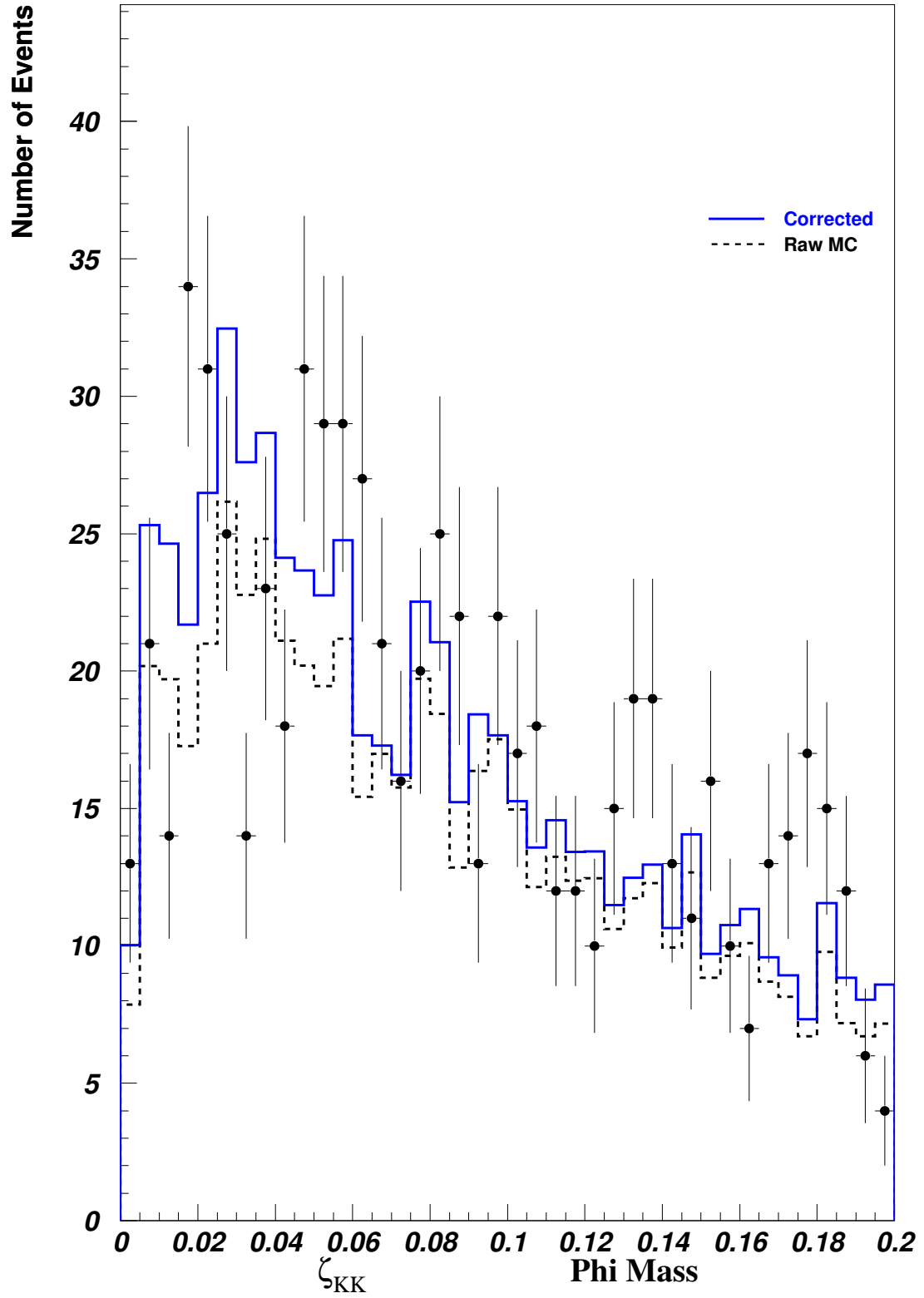


Figure 43: DS Correction  $\zeta_{KK}$  (mass signal region) (dsplots/dscorr-zetak-k-to0.2-ncand34-mphi.pdf)

## 7 Quasi-Exclusive $\phi^0$

$\chi^2$ Min 34.316		
Number of bins used: 28		
One $\sigma$ : 1.107		
Norm at Min $\chi^2$	Coh $\phi^0$	
$-1\sigma$	1.066	
$+1\sigma$	1.005	( 5.7%)
	1.127	( 5.7%)

Table 6: Coh $\rho^0$  normalization from Mkk (full)

The Quasi-Exclusive calculation uses the background normalizations (NCDIS and OBG) found with the zeta-norm method in the standard analysis. Then a mass correction is applied to the NCDIS everywhere **except** the  $\phi$  region (1.0 to 1.05). A fit of the  $\phi$  mass is then done on a full mass plot.

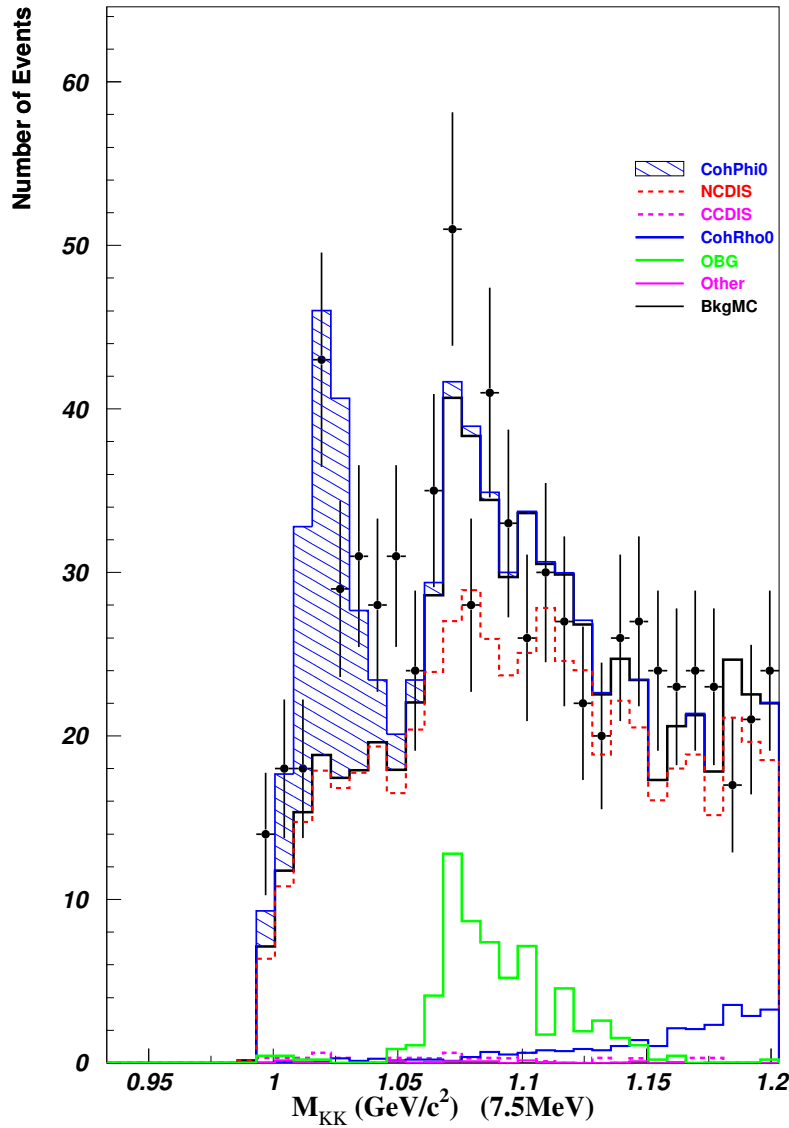
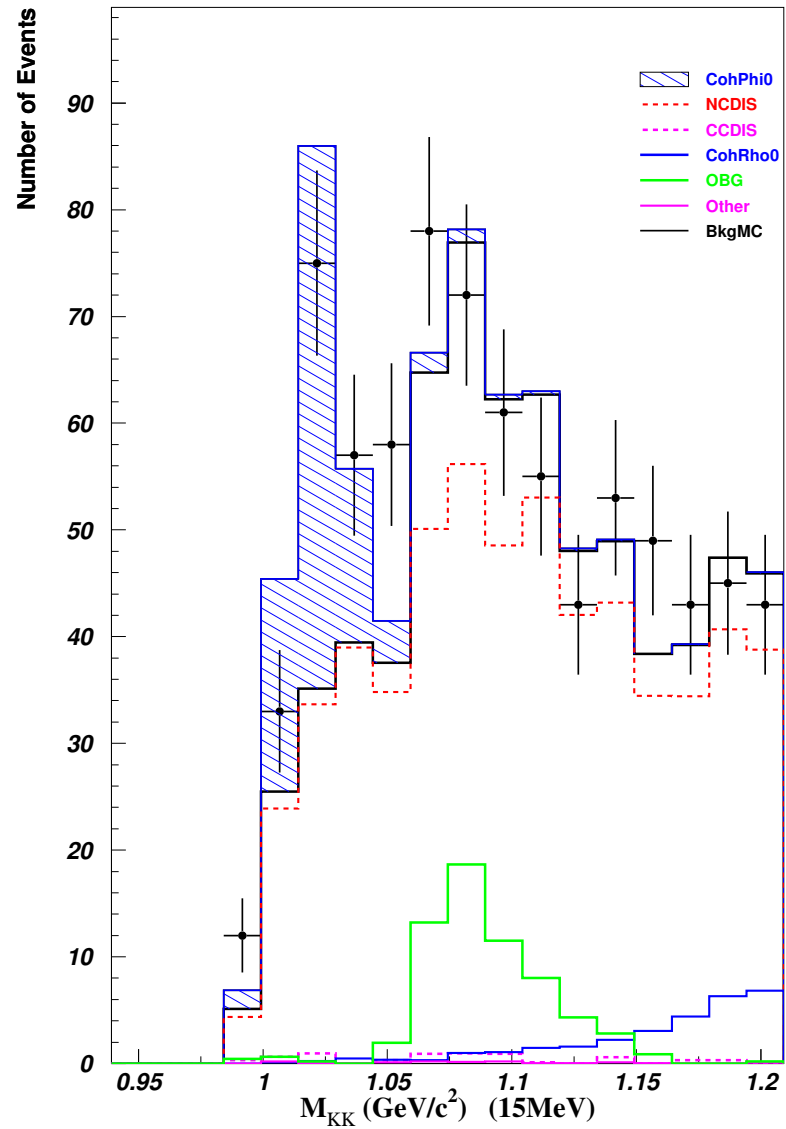
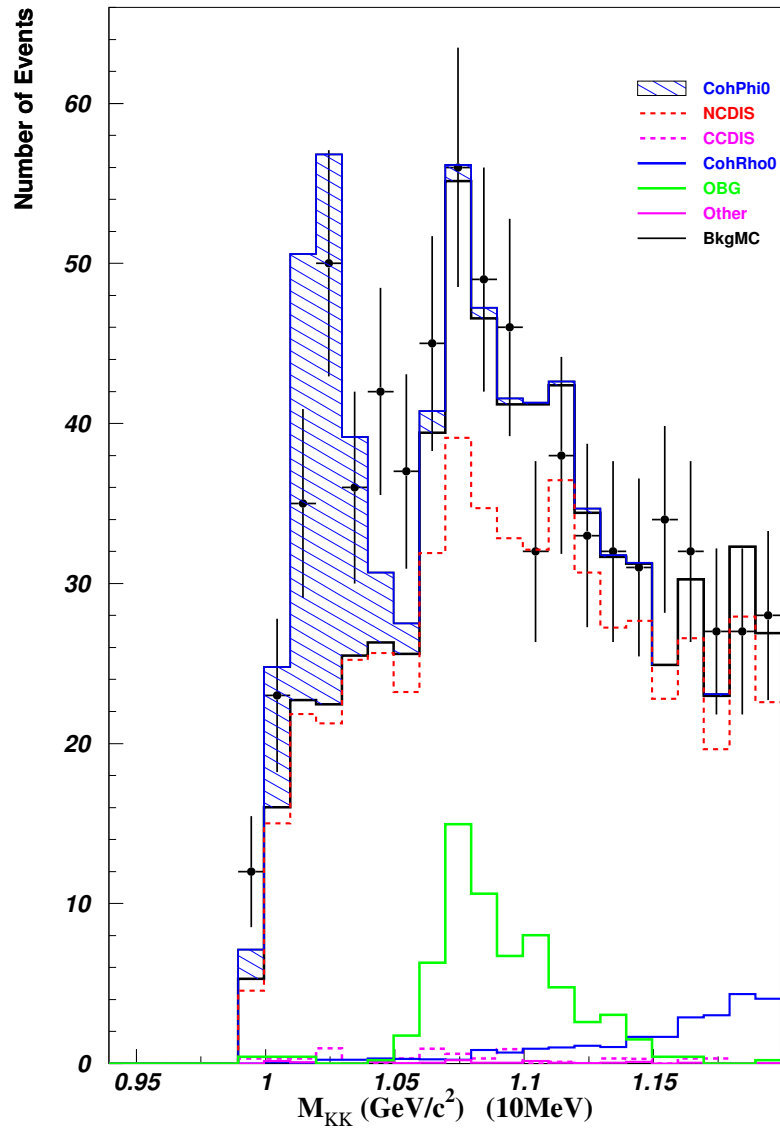


Figure 44: Full  $M_{KK}$  for QEphi, 7.5MeV up to 1.2 GeV (figs/mkk-qephi-7.5mev-to1.2.pdf)



(a) Full  $M_{KK}$  for QEphi, 10 MeV up to 1.2 GeV (figs/mkk-qephi-10mev-to1.2.pdf) (b) Full  $M_{KK}$  for QEphi, 15 MeV up to 1.2 GeV (figs/mkk-qephi-15mev-to1.2.pdf)

Figure 45:

## 8 Extra Plots and Tables

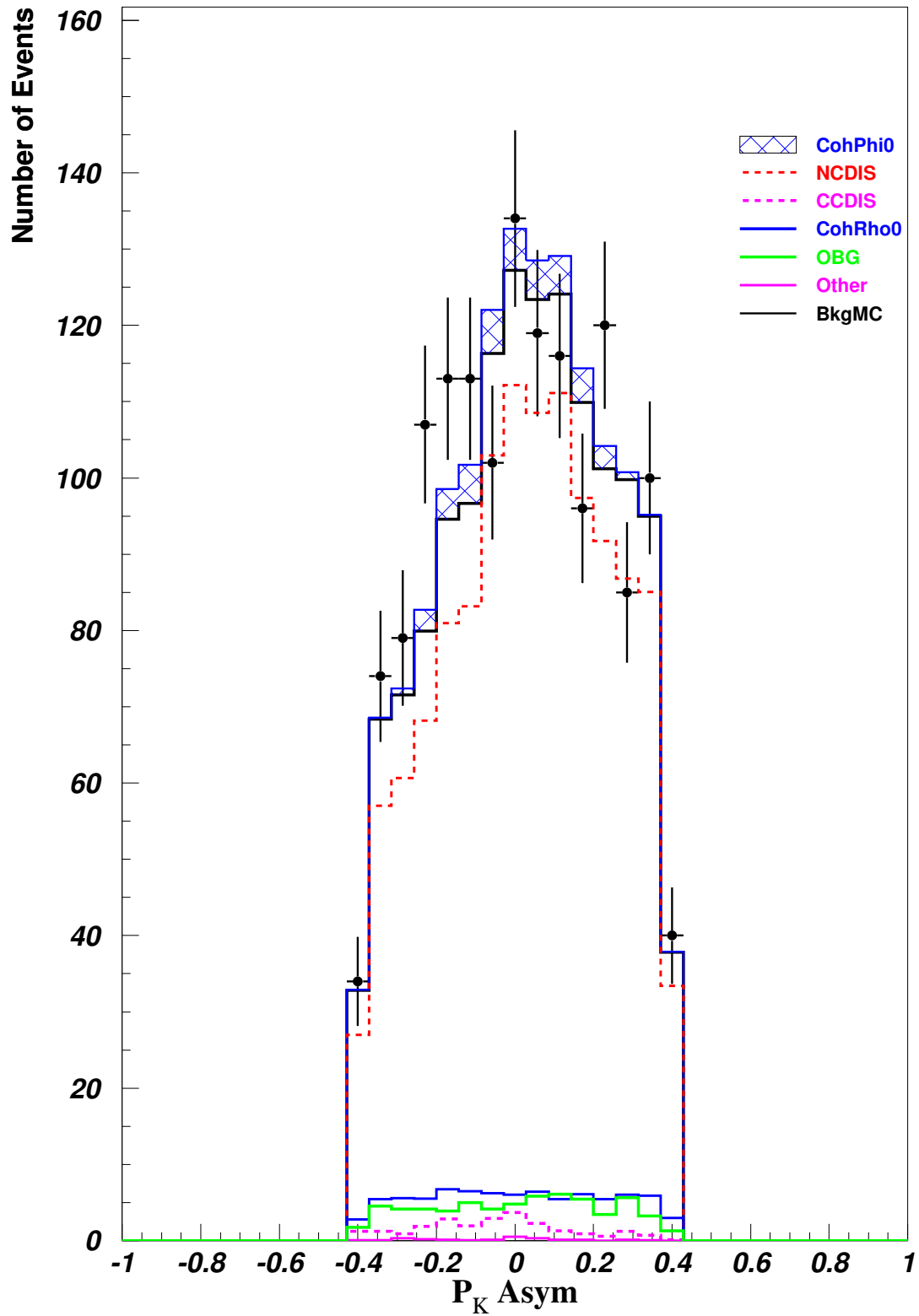


Figure 46:  $P_K$  Asymmetry (figs/pkasympdf)



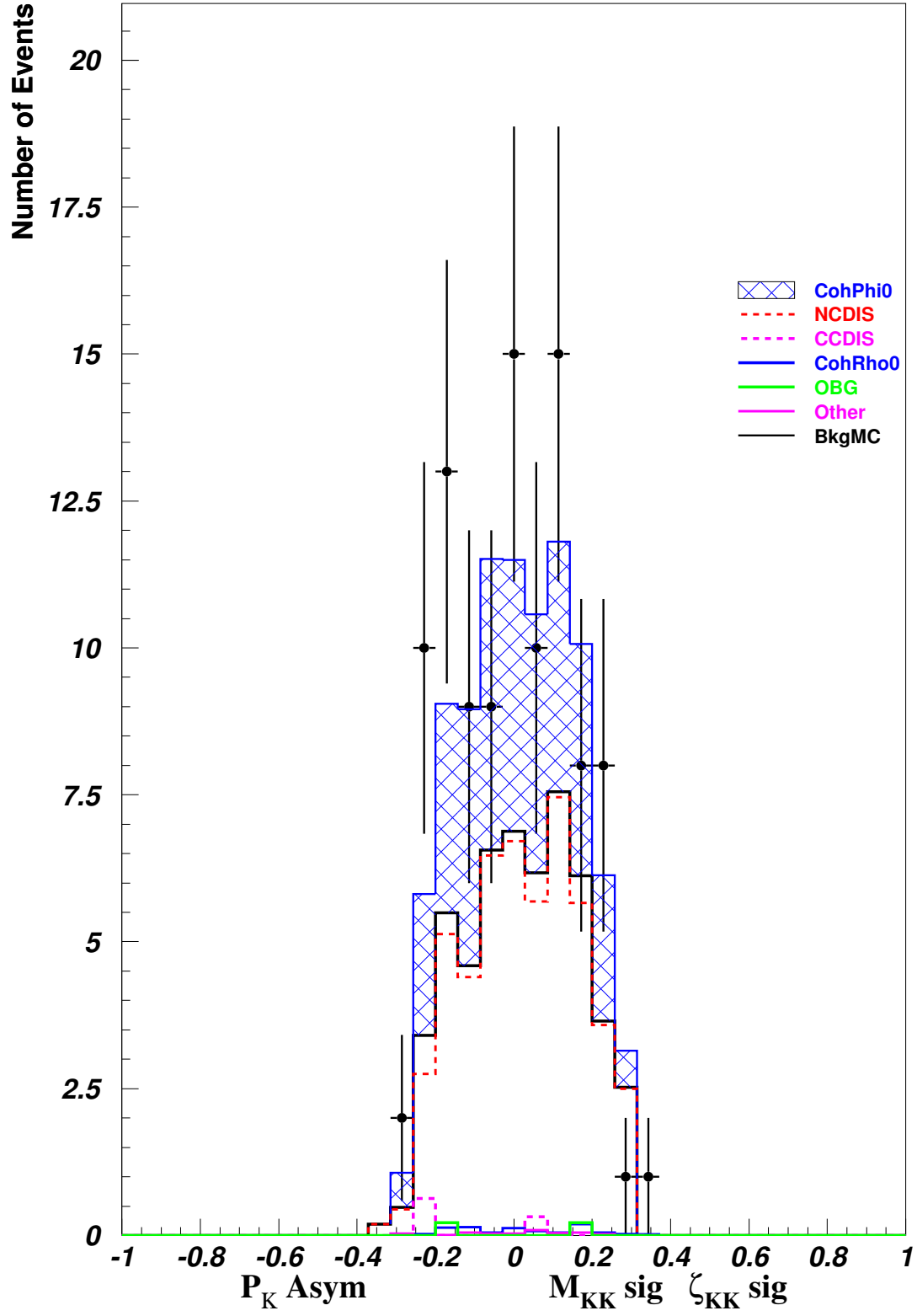
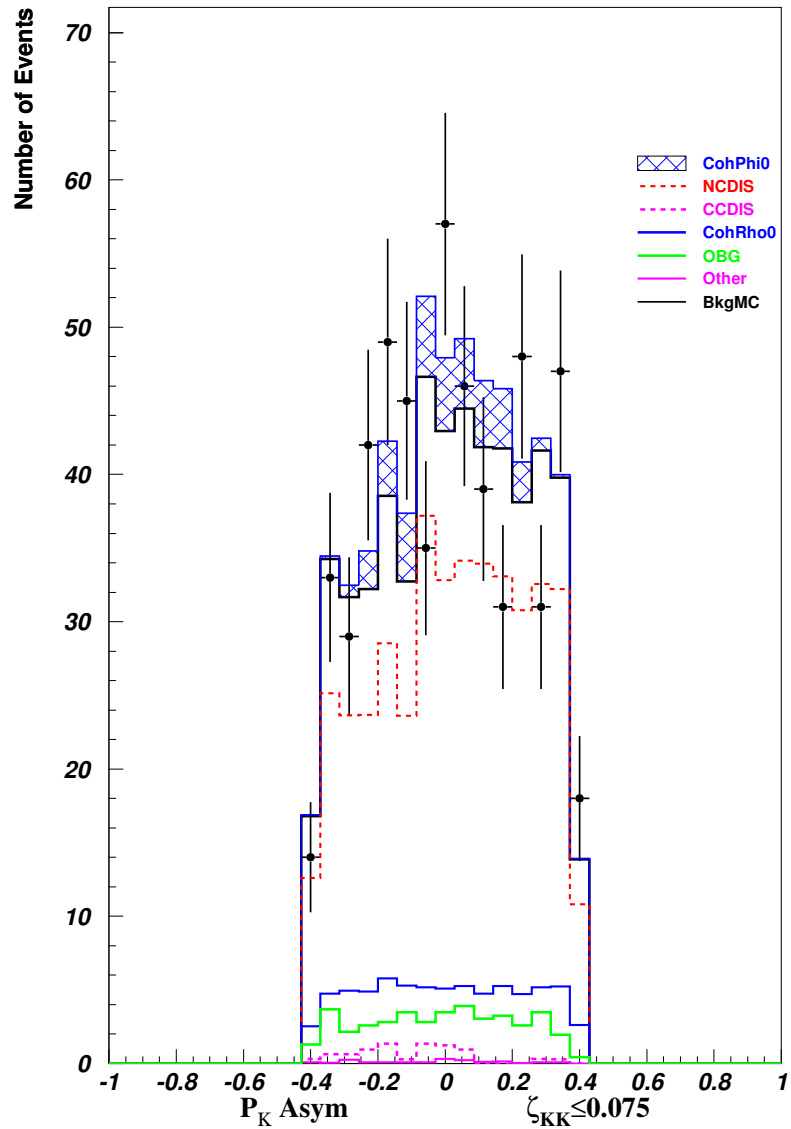
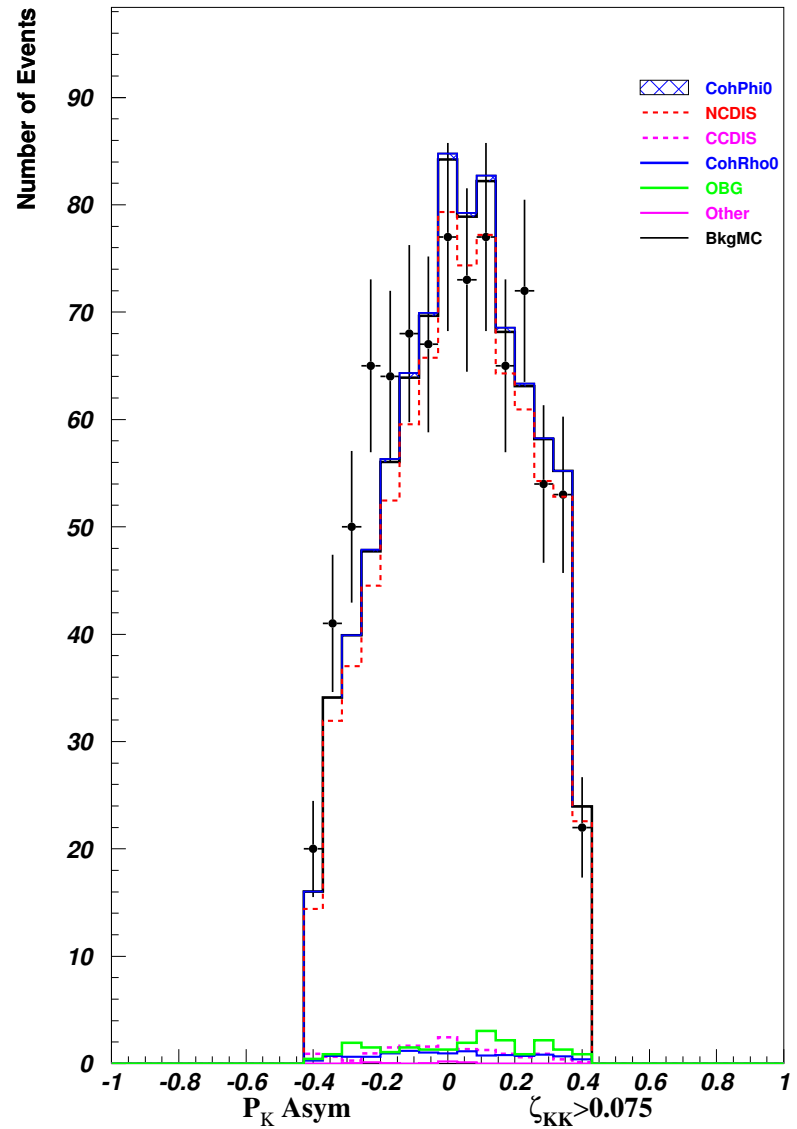


Figure 47:  $P_K$  Asymmetry ( $\phi$ -Mass and ZetaSig Region) (figs/pkasym-sig-mphi.pdf)



(a)  $P_K$  Asymmetry (Signal Region) (figs/pkasym-sig.pdf)



(b)  $P_K$  Asymmetry (Background Region) (figs/pkasym-bkg.pdf)

Figure 48:

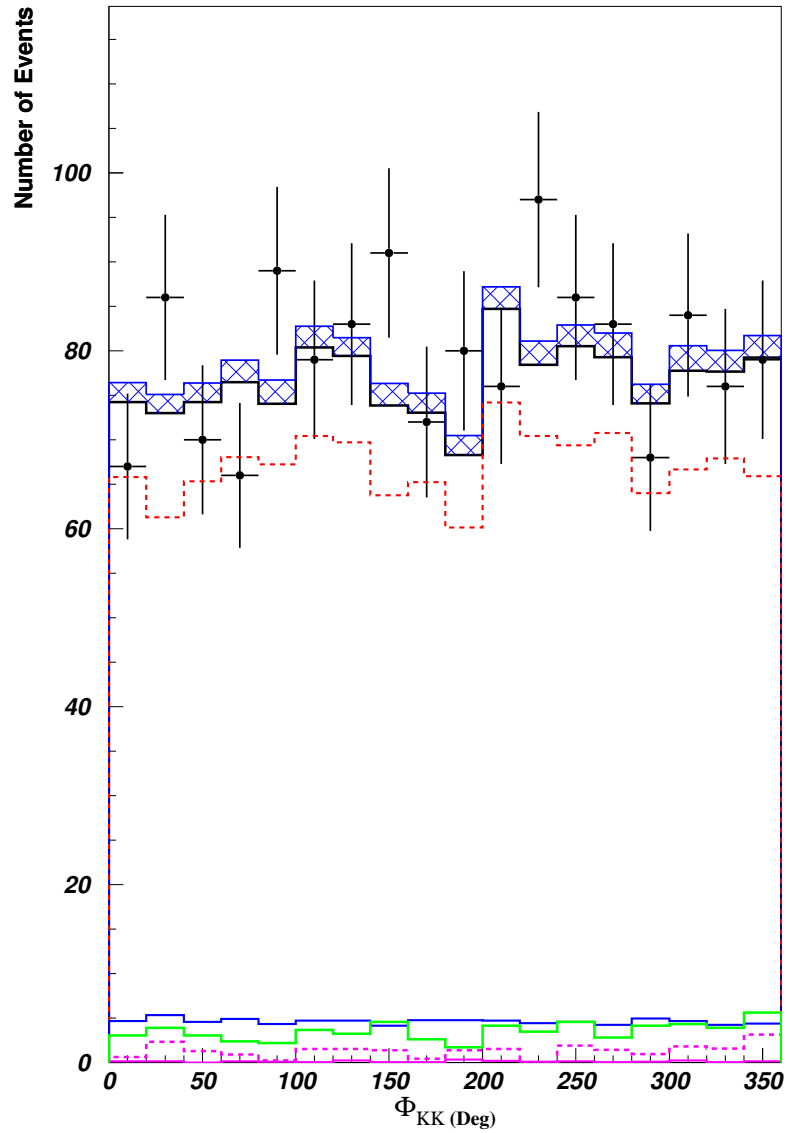
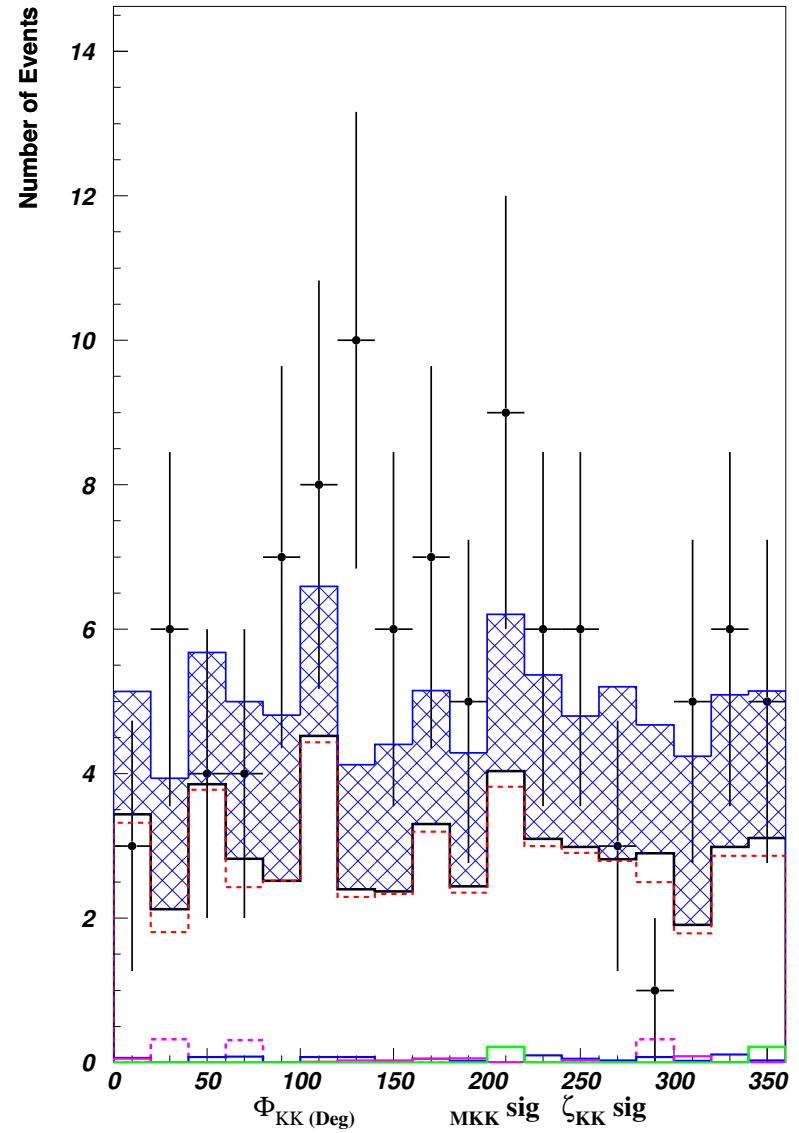
(a)  $\phi_{KK}$  (figs/phikk.pdf)(b)  $\phi_{KK}(\phi\text{-Mass and ZetaSig Region})$  (figs/phikk-sig-mphi.pdf)

Figure 49:

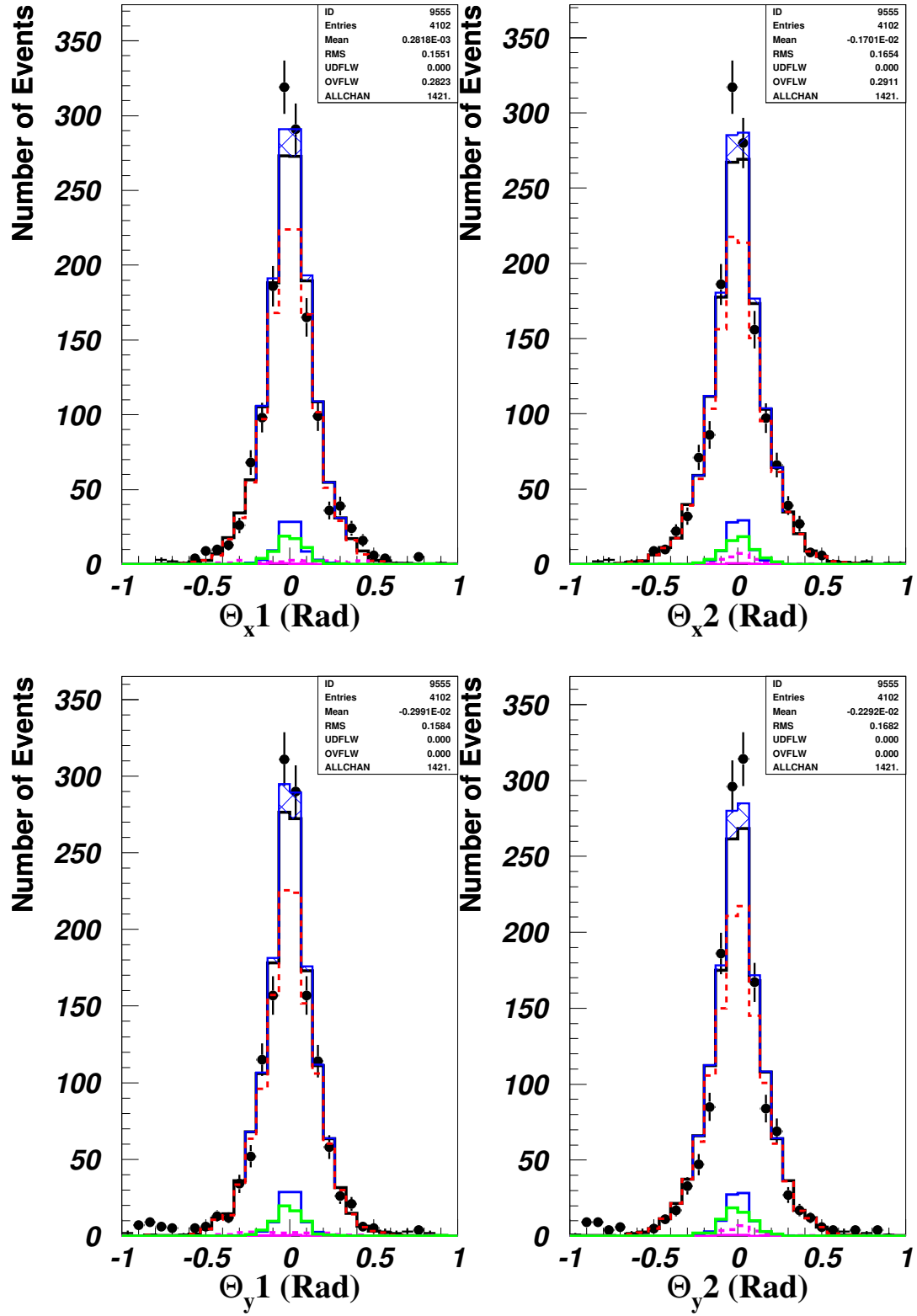


Figure 50:  $\theta_x$  and  $\theta_y$  (figs/thetaxy.pdf)

## 8.1 Extra Tables

### 8.1.1 Data Cut Table

Cut	Raw	Z-weight	Norm0	Final
1) Raw Events	975135.0	975135.0	975135.0	975135.0
2) OBGfid,Trig+CohGenTh	975135.0	975135.0	975135.0	975135.0
3) Pfermi & W2	975135.0	975135.0	975135.0	975135.0
4) Fid. Vol. -X	903682.0	903682.0	903682.0	903682.0
5) Fid. Vol. -Y	812220.0	812220.0	812220.0	812220.0
6) Fid. Vol. -Z	393448.0	393448.0	393448.0	393448.0
7) No Muons	393448.0	393448.0	393448.0	393448.0
8) ncand=2	291148.0	291148.0	291148.0	291148.0
9) tnchgd=2	212028.0	212028.0	212028.0	212028.0
10) +/- Tracks (V0)	156090.0	156090.0	156090.0	156090.0
11) Tube/Veto Cut	156090.0	156090.0	156090.0	156090.0
12) Ekk > 4.0	26211.0	26211.0	26211.0	26211.0
13) P+- > 1.0	17844.0	17844.0	17844.0	17844.0
14) Theta<2.62 rad	15314.0	15314.0	15314.0	15314.0
15) Upstream Hangers	14243.0	14243.0	14243.0	14243.0
16) nsecond < 4	13419.0	13419.0	13419.0	13419.0
17) Hanger F.V.	11525.0	11525.0	11525.0	11525.0
18) No Hangers near Vert	10755.0	10755.0	10755.0	10755.0
19) Pz>0 for tracks	10711.0	10711.0	10711.0	10711.0
20) Thprimord<0.4	8675.0	8675.0	8675.0	8675.0
21) Nunh*fracunh<200	8535.0	8535.0	8535.0	8535.0
22) Pt+wrt- >= 0.05	8150.0	8150.0	8150.0	8150.0
23) mee > 0.1	8025.0	8025.0	8025.0	8025.0
24) PAN >= 0.5	5850.0	5850.0	5850.0	5850.0
25) -0.4< Pasym <0.4	2848.0	2848.0	2848.0	2848.0
26) Phi12 < 100deg	1848.0	1848.0	1848.0	1848.0
27) P+- > 1.25	1843.0	1843.0	1843.0	1843.0
28) P+- > 1.5	1760.0	1760.0	1760.0	1760.0
29) P+- > 1.75	1610.0	1610.0	1610.0	1610.0
30) P+- > 2.0	1432.0	1432.0	1432.0	1432.0
31) P+- > 2.5	1098.0	1098.0	1098.0	1098.0

Table 7: Cut Table Data

### 8.1.2 $\text{Coh}\phi^0$ Cut Table

Cut	Raw	Z-weight	Norm0	Final
1) Raw Events	4171.0	3799.8	186.4	87.4
2) OBGfid,Trig+CohGenTh	4171.0	3799.8	186.4	87.4
3) Pfermi & W2	4171.0	3799.8	186.4	87.4
4) Fid. Vol. -X	4008.0	3651.4	179.2	84.0
5) Fid. Vol. -Y	3836.0	3494.5	171.5	80.4
6) Fid. Vol. -Z	3836.0	3494.5	171.5	80.4
7) No Muons	3446.0	3131.0	153.6	72.0
8) ncand=2	3041.0	2764.3	135.6	63.6
9) tnhgd=2	2866.0	2603.6	127.8	59.9
10) +/- Tracks (V0)	2830.0	2570.9	126.1	59.1
11) Tube/Veto Cut	2830.0	2570.9	126.1	59.1
12) Ekk > 4.0	2791.0	2533.6	124.3	58.3
13) P+- > 1.0	2775.0	2519.0	123.6	58.0
14) Theta<2.62 rad	2774.0	2518.0	123.6	58.0
15) Upstream Hangers	2762.0	2506.6	123.0	57.7
16) nsecond < 4	2725.0	2482.4	121.8	57.1
17) Hanger F.V.	2548.0	2331.0	114.4	53.7
18) No Hangers near Vert	2523.0	2307.4	113.2	53.1
19) Pz>0 for tracks	2523.0	2307.4	113.2	53.1
20) Thprimord<0.4	2408.0	2210.8	108.5	50.9
21) Nunh*fracunh<200	2408.0	2210.8	108.5	50.9
22) Pt+wrt- >= 0.05	2360.0	2166.0	106.3	49.9
23) mee > 0.1	2225.0	2041.5	100.2	47.0
24) PAN >= 0.5	2216.0	2033.4	99.8	46.8
25) -0.4< Pasym <0.4	2169.0	1990.2	97.7	45.8
26) Phi12 < 100deg	2067.0	1896.1	93.0	43.6
27) P+- > 1.25	2067.0	1896.1	93.0	43.6
28) P+- > 1.5	2066.0	1895.1	93.0	43.6
29) P+- > 1.75	2059.0	1888.3	92.7	43.5
30) P+- > 2.0	2034.0	1864.8	91.5	42.9
31) P+- > 2.5	1965.0	1799.9	88.3	41.4

Table 8: Cut Table  $\text{Coh}\phi^0$

### 8.1.3 Coh $\rho^0$ Cut Table

Cut	Raw	Z-weight	Norm0	Final
1) Raw Events	25790.0	23512.4	931.7	623.3
2) OBGfid,Trig+CohGenTh	25790.0	23512.4	931.7	623.3
3) Pfermi & W2	25790.0	23512.4	931.7	623.3
4) Fid. Vol. -X	24698.0	22517.2	892.3	596.9
5) Fid. Vol. -Y	23699.0	21605.9	856.2	572.8
6) Fid. Vol. -Z	23699.0	21605.9	856.2	572.8
7) No Muons	22561.0	20565.8	814.9	545.2
8) ncand=2	20419.0	18691.6	740.7	495.5
9) tnhgd=2	19812.0	18147.9	719.1	481.1
10) +/- Tracks (V0)	19536.0	17889.0	708.9	474.2
11) Tube/Veto Cut	19536.0	17889.0	708.9	474.2
12) Ekk > 4.0	18689.0	17094.4	677.4	453.2
13) P+- > 1.0	16441.0	15025.4	595.4	398.3
14) Theta<2.62 rad	16432.0	15016.9	595.1	398.1
15) Upstream Hangers	16331.0	14919.7	591.2	395.5
16) nsecond < 4	16078.0	14715.9	583.1	390.1
17) Hanger F.V.	14934.0	13714.7	543.5	363.6
18) No Hangers near Vert	14749.0	13546.2	536.8	359.1
19) Pz>0 for tracks	14749.0	13546.2	536.8	359.1
20) Thprimord<0.4	14211.0	13091.2	518.8	347.0
21) Nunh*fracunh<200	14209.0	13089.3	518.7	347.0
22) Pt+wrt- >= 0.05	14190.0	13071.5	518.0	346.5
23) mee > 0.1	14182.0	13063.8	517.7	346.3
24) PAN >= 0.5	14029.0	12930.6	512.4	342.8
25) -0.4< Pasym <0.4	6825.0	6306.1	249.9	167.2
26) Phi12 < 100deg	3592.0	3318.9	131.5	88.0
27) P+- > 1.25	3590.0	3317.0	131.4	87.9
28) P+- > 1.5	3562.0	3292.1	130.5	87.3
29) P+- > 1.75	3496.0	3231.8	128.1	85.7
30) P+- > 2.0	3392.0	3135.6	124.3	83.1
31) P+- > 2.5	3154.0	2918.1	115.6	77.4

Table 9: Cut Table Coh $\rho^0$

### 8.1.4 NCDIS Cut Table

Cut	Raw	Z-weight	Norm0	Final
1) Raw Events	932209.0	859738.5	145111.0	156203.8
2) OBGfid,Trig+CohGenTh	932209.0	859738.5	145111.0	156203.8
3) Pfermi & W2	932209.0	859738.5	145111.0	156203.8
4) Fid. Vol. -X	893317.0	824042.3	139086.0	149643.3
5) Fid. Vol. -Y	852754.0	786788.5	132798.2	142779.1
6) Fid. Vol. -Z	852754.0	786788.5	132798.2	142779.1
7) No Muons	852754.0	786788.5	132798.2	142779.1
8) ncand=2	387279.0	357517.6	60343.6	64683.3
9) tnchg=2	331637.0	305600.3	51580.8	55198.9
10) +/- Tracks (V0)	268027.0	247182.6	41720.7	44695.4
11) Tube/Veto Cut	268027.0	247182.6	41720.7	44695.4
12) Ekk > 4.0	112528.0	102945.9	17375.7	18080.6
13) P+- > 1.0	71143.0	65051.5	10979.7	11738.5
14) Theta<2.62 rad	70593.0	64556.7	10896.2	11657.6
15) Upstream Hangers	66660.0	60903.1	10279.5	10970.4
16) nsecond < 4	63904.0	58727.2	9912.3	10565.9
17) Hanger F.V.	55367.0	51005.7	8609.0	9155.5
18) No Hangers near Vert	49667.0	45692.0	7712.1	8184.4
19) Pz>0 for tracks	49652.0	45677.4	7709.7	8182.1
20) Thprimord<0.4	38081.0	35539.4	5998.5	6333.6
21) Nunh*fracunh<200	38062.0	35525.6	5996.2	6331.2
22) Pt+wrt- >= 0.05	37591.0	35094.3	5923.4	6247.4
23) mee > 0.1	37363.0	34880.0	5887.2	6207.2
24) PAN >= 0.5	27754.0	25644.8	4328.5	4501.1
25) -0.4< Pasym <0.4	13513.0	12455.2	2102.2	2242.6
26) Phi12 < 100deg	10354.0	9547.8	1611.5	1704.6
27) P+- > 1.25	10288.0	9486.5	1601.2	1694.0
28) P+- > 1.5	9619.0	8866.5	1496.5	1585.8
29) P+- > 1.75	8449.0	7793.5	1315.4	1395.6
30) P+- > 2.0	7080.0	6535.4	1103.1	1171.4
31) P+- > 2.5	4965.0	4586.1	774.1	826.7

Table 10: Cut Table NCDIS



### 8.1.5 CCDIS Cut Table

Cut	Raw	Z-weight	Norm0	Final
1) Raw Events	116495.0	105978.0	34081.7	34081.7
2) OBGfid,Trig+CohGenTh	116495.0	105978.0	34081.7	34081.7
3) Pfermi & W2	116495.0	105978.0	34081.7	34081.7
4) Fid. Vol. -X	108290.0	98591.0	31706.1	31706.1
5) Fid. Vol. -Y	95708.0	87261.8	28062.7	28062.7
6) Fid. Vol. -Z	95708.0	87261.8	28062.7	28062.7
7) No Muons	95708.0	87261.8	28062.7	28062.7
8) ncand=2	46635.0	42666.8	13721.3	13721.3
9) tnchgd=2	40101.0	36484.8	11733.2	11733.2
10) +/- Tracks (V0)	31025.0	28433.1	9143.9	9143.9
11) Tube/Veto Cut	31025.0	28433.1	9143.9	9143.9
12) Ekk > 4.0	11263.0	10067.9	3237.8	3237.8
13) P+- > 1.0	8542.0	7625.5	2452.3	2452.3
14) Theta<2.62 rad	8514.0	7600.0	2444.1	2444.1
15) Upstream Hangers	8157.0	7265.9	2336.7	2336.7
16) nsecond < 4	7792.0	6977.6	2243.9	2243.9
17) Hanger F.V.	6743.0	6037.9	1941.7	1941.7
18) No Hangers near Vert	6164.0	5506.4	1770.8	1770.8
19) Pz>0 for tracks	6164.0	5506.4	1770.8	1770.8
20) Thprimord<0.4	4380.0	3988.0	1282.5	1282.5
21) Nunh*fracunh<200	4377.0	3986.3	1282.0	1282.0
22) Pt+wrt- >= 0.05	4357.0	3969.1	1276.4	1276.4
23) mee > 0.1	4343.0	3955.4	1272.0	1272.0
24) PAN >= 0.5	3093.0	2777.7	893.3	893.3
25) -0.4< Pasym <0.4	1591.0	1421.8	457.3	457.3
26) Phi12 < 100deg	168.0	144.3	46.4	46.4
27) P+- > 1.25	167.0	143.3	46.1	46.1
28) P+- > 1.5	147.0	124.4	40.0	40.0
29) P+- > 1.75	121.0	102.4	32.9	32.9
30) P+- > 2.0	89.0	74.2	23.9	23.9
31) P+- > 2.5	41.0	32.2	10.4	10.4

Table 11: Cut Table CCDIS

### 8.1.6 OBG Cut Table

Cut	Raw	Z-weight	Norm0	Final
1) Raw Events	254436.0	254436.0	254436.0	55192.2
2) OBGfid,Trig+CohGenTh	32399.0	32399.0	32399.0	7028.0
3) Pfermi & W2	32399.0	32399.0	32399.0	7028.0
4) Fid. Vol. -X	30939.0	30939.0	30939.0	6711.3
5) Fid. Vol. -Y	30225.0	30225.0	30225.0	6556.4
6) Fid. Vol. -Z	22436.0	22436.0	22436.0	4866.8
7) No Muons	20971.0	20971.0	20971.0	4549.0
8) ncand=2	20971.0	20971.0	20971.0	4549.0
9) tnchgd=2	20971.0	20971.0	20971.0	4549.0
10) +/- Tracks (V0)	20961.0	20961.0	20961.0	4546.8
11) Tube/Veto Cut	20961.0	20961.0	20961.0	4546.8
12) Ekk > 4.0	5572.0	5572.0	5572.0	1208.6
13) P+- > 1.0	3714.0	3714.0	3714.0	805.7
14) Theta<2.62 rad	3661.0	3661.0	3661.0	794.1
15) Upstream Hangers	3661.0	3661.0	3661.0	794.1
16) nsecond < 4	3661.0	3661.0	3661.0	794.1
17) Hanger F.V.	3661.0	3661.0	3661.0	794.1
18) No Hangers near Vert	3661.0	3661.0	3661.0	794.1
19) Pz>0 for tracks	3661.0	3661.0	3661.0	794.1
20) Thprimord<0.4	2903.0	2903.0	2903.0	629.8
21) Nunh*fracunh<200	2903.0	2903.0	2903.0	629.8
22) Pt+wrt- >= 0.05	1448.0	1448.0	1448.0	314.1
23) mee > 0.1	1173.0	1173.0	1173.0	254.5
24) PAN >= 0.5	982.0	982.0	982.0	213.0
25) -0.4< Pasym <0.4	398.0	398.0	398.0	86.4
26) Phi12 < 100deg	342.0	342.0	342.0	74.1
27) P+- > 1.25	341.0	341.0	341.0	73.9
28) P+- > 1.5	331.0	331.0	331.0	71.8
29) P+- > 1.75	312.0	312.0	312.0	67.6
30) P+- > 2.0	292.0	292.0	292.0	63.3
31) P+- > 2.5	252.0	252.0	252.0	54.6

Table 12: Cut Table OBG

### 8.1.7 $\bar{\nu}_e$ CC Cut Table

Cut	Raw	Z-weight	Norm0	Final
1) Raw Events	206120.0	188250.8	2220.3	2220.3
2) OBGfid,Trig+CohGenTh	206120.0	188250.8	2220.3	2220.3
3) Pfermi & W2	204341.0	186620.3	2201.1	2201.1
4) Fid. Vol. -X	191869.0	175271.4	2067.2	2067.2
5) Fid. Vol. -Y	180977.0	165329.5	1950.0	1950.0
6) Fid. Vol. -Z	180977.0	165329.5	1950.0	1950.0
7) No Muons	176659.0	161364.9	1903.2	1903.2
8) ncand=2	23540.0	21560.8	254.3	254.3
9) tnchgd=2	18645.0	17183.9	202.7	202.7
10) +/- Tracks (V0)	11552.0	10677.4	125.9	125.9
11) Tube/Veto Cut	11552.0	10677.4	125.9	125.9
12) Ekk > 4.0	10268.0	9505.6	112.1	112.1
13) P+- > 1.0	4003.0	3683.7	43.4	43.4
14) Theta<2.62 rad	3909.0	3595.4	42.4	42.4
15) Upstream Hangers	3790.0	3483.3	41.1	41.1
16) nsecond < 4	3607.0	3341.5	39.4	39.4
17) Hanger F.V.	3106.0	2892.7	34.1	34.1
18) No Hangers near Vert	2818.0	2623.8	30.9	30.9
19) Pz>0 for tracks	2816.0	2621.8	30.9	30.9
20) Thprimord<0.4	2073.0	1983.3	23.4	23.4
21) Nunh*fracunh<200	2067.0	1978.8	23.3	23.3
22) Pt+wrt- >= 0.05	2064.0	1976.0	23.3	23.3
23) mee > 0.1	2054.0	1966.2	23.2	23.2
24) PAN >= 0.5	1245.0	1197.0	14.1	14.1
25) -0.4< Pasym <0.4	142.0	135.1	1.6	1.6
26) Phi12 < 100deg	14.0	13.7	0.2	0.2
27) P+- > 1.25	14.0	13.7	0.2	0.2
28) P+- > 1.5	13.0	12.7	0.1	0.1
29) P+- > 1.75	13.0	12.7	0.1	0.1
30) P+- > 2.0	11.0	10.7	0.1	0.1
31) P+- > 2.5	7.0	6.8	0.1	0.1

Table 13: Cut Table aNueCC

### 8.1.8 $\bar{\nu}_\mu$ CC Cut Table

Cut	Raw	Z-weight	Norm0	Final
1) Raw Events	10808.0	9798.9	944.9	944.9
2) OBGfid,Trig+CohGenTh	10808.0	9798.9	944.9	944.9
3) Pfermi & W2	10808.0	9798.9	944.9	944.9
4) Fid. Vol. -X	10087.0	9145.7	881.9	881.9
5) Fid. Vol. -Y	8978.0	8155.7	786.5	786.5
6) Fid. Vol. -Z	8978.0	8155.7	786.5	786.5
7) No Muons	8978.0	8155.7	786.5	786.5
8) ncand=2	4448.0	4017.1	387.4	387.4
9) tnhgd=2	3861.0	3472.2	334.8	334.8
10) +/- Tracks (V0)	2751.0	2482.2	239.4	239.4
11) Tube/Veto Cut	2751.0	2482.2	239.4	239.4
12) Ekk > 4.0	687.0	605.4	58.4	58.4
13) P+- > 1.0	456.0	400.5	38.6	38.6
14) Theta<2.62 rad	454.0	398.5	38.4	38.4
15) Upstream Hangers	442.0	388.9	37.5	37.5
16) nsecond < 4	422.0	375.0	36.2	36.2
17) Hanger F.V.	370.0	330.4	31.9	31.9
18) No Hangers near Vert	335.0	300.4	29.0	29.0
19) Pz>0 for tracks	335.0	300.4	29.0	29.0
20) Thprimord<0.4	259.0	238.6	23.0	23.0
21) Nunh*fracunh<200	258.0	237.6	22.9	22.9
22) Pt+wrt- >= 0.05	256.0	235.8	22.7	22.7
23) mee > 0.1	255.0	235.4	22.7	22.7
24) PAN >= 0.5	190.0	173.6	16.7	16.7
25) -0.4< Pasym <0.4	98.0	89.2	8.6	8.6
26) Phi12 < 100deg	23.0	19.9	1.9	1.9
27) P+- > 1.25	23.0	19.9	1.9	1.9
28) P+- > 1.5	23.0	19.9	1.9	1.9
29) P+- > 1.75	17.0	15.2	1.5	1.5
30) P+- > 2.0	10.0	8.2	0.8	0.8
31) P+- > 2.5	8.0	6.2	0.6	0.6

Table 14: Cut Table anMuCC

### 8.1.9 $\bar{\nu}_\mu$ NC Cut Table

Cut	Raw	Z-weight	Norm0	Final
1) Raw Events	149256.0	137433.8	10166.6	10166.6
2) OBGfid,Trig+CohGenTh	149256.0	137433.8	10166.6	10166.6
3) Pfermi & W2	148000.0	136270.7	10080.5	10080.5
4) Fid. Vol. -X	139984.0	128892.3	9534.7	9534.7
5) Fid. Vol. -Y	132637.0	122141.5	9035.3	9035.3
6) Fid. Vol. -Z	132637.0	122141.5	9035.3	9035.3
7) No Muons	129125.0	118907.7	8796.1	8796.1
8) ncand=2	22646.0	20953.2	1550.0	1550.0
9) tnchgd=2	19361.0	17885.8	1323.1	1323.1
10) +/- Tracks (V0)	15461.0	14295.5	1057.5	1057.5
11) Tube/Veto Cut	15461.0	14295.5	1057.5	1057.5
12) Ekk > 4.0	5832.0	5346.5	395.5	395.5
13) P+- > 1.0	3653.0	3343.1	247.3	247.3
14) Theta<2.62 rad	3621.0	3312.2	245.0	245.0
15) Upstream Hangers	3439.0	3144.1	232.6	232.6
16) nsecond < 4	3330.0	3057.6	226.2	226.2
17) Hanger F.V.	2902.0	2676.7	198.0	198.0
18) No Hangers near Vert	2636.0	2423.9	179.3	179.3
19) Pz>0 for tracks	2636.0	2423.9	179.3	179.3
20) Thprimord<0.4	2094.0	1949.0	144.2	144.2
21) Nunh*fracunh<200	2093.0	1949.0	144.2	144.2
22) Pt+wrt- >= 0.05	2053.0	1912.3	141.5	141.5
23) mee > 0.1	2036.0	1898.8	140.5	140.5
24) PAN >= 0.5	1594.0	1478.8	109.4	109.4
25) -0.4< Pasymp <0.4	773.0	717.4	53.1	53.1
26) Phi12 < 100deg	556.0	514.1	38.0	38.0
27) P+- > 1.25	553.0	511.7	37.9	37.9
28) P+- > 1.5	519.0	481.2	35.6	35.6
29) P+- > 1.75	465.0	430.3	31.8	31.8
30) P+- > 2.0	387.0	359.7	26.6	26.6
31) P+- > 2.5	270.0	249.8	18.5	18.5

Table 15: Cut Table anMuNC

### 8.1.10 Coherent $\pi^0$ Cut Table

Cut	Raw	Z-weight	Norm0	Final
1) Raw Events	37043.0	33949.3	4464.4	4397.4
2) OBGfid,Trig+CohGenTh	37043.0	33949.3	4464.4	4397.4
3) Pfermi & W2	36714.0	33646.4	4424.5	4358.2
4) Fid. Vol. -X	35338.0	32373.6	4257.2	4193.3
5) Fid. Vol. -Y	34084.0	31230.8	4106.9	4045.3
6) Fid. Vol. -Z	34084.0	31230.8	4106.9	4045.3
7) No Muons	29116.0	26720.1	3513.7	3461.0
8) ncand=2	4020.0	3706.5	487.4	480.1
9) tnchgd=2	3459.0	3180.2	418.2	411.9
10) +/- Tracks (V0)	2794.0	2570.9	338.1	333.0
11) Tube/Veto Cut	2794.0	2570.9	338.1	333.0
12) Ekk > 4.0	1198.0	1081.0	142.1	140.0
13) P+- > 1.0	751.0	680.1	89.4	88.1
14) Theta<2.62 rad	745.0	674.2	88.7	87.3
15) Upstream Hangers	698.0	631.7	83.1	81.8
16) nsecond < 4	674.0	614.2	80.8	79.6
17) Hanger F.V.	587.0	540.8	71.1	70.0
18) No Hangers near Vert	530.0	486.9	64.0	63.1
19) Pz>0 for tracks	530.0	486.9	64.0	63.1
20) Thprimord<0.4	411.0	386.3	50.8	50.0
21) Nunh*fracunh<200	410.0	386.3	50.8	50.0
22) Pt+wrt- >= 0.05	402.0	378.5	49.8	49.0
23) mee > 0.1	397.0	373.5	49.1	48.4
24) PAN >= 0.5	296.0	277.0	36.4	35.9
25) -0.4< Pasym <0.4	152.0	142.2	18.7	18.4
26) Phi12 < 100deg	103.0	96.1	12.6	12.4
27) P+- > 1.25	101.0	94.3	12.4	12.2
28) P+- > 1.5	90.0	83.7	11.0	10.8
29) P+- > 1.75	81.0	74.8	9.8	9.7
30) P+- > 2.0	68.0	62.3	8.2	8.1
31) P+- > 2.5	43.0	39.6	5.2	5.1

Table 16: Cut Table Coh $\pi^0$

### 8.1.11 Coherent $\pi^+$ Cut Table

Cut	Raw	Z-weight	Norm0	Final
1) Raw Events	433311.0	393115.4	9519.4	9376.6
2) OBGfid,Trig+CohGenTh	433311.0	393115.4	9519.4	9376.6
3) Pfermi & W2	433255.0	393063.0	9518.1	9375.3
4) Fid. Vol. -X	415276.0	376742.8	9122.9	8986.1
5) Fid. Vol. -Y	398955.0	361913.4	8763.8	8632.4
6) Fid. Vol. -Z	398955.0	361913.4	8763.8	8632.4
7) No Muons	6093.0	5381.1	130.3	128.4
8) ncand=2	4845.0	4333.5	104.9	103.4
9) tnchgd=2	4710.0	4215.5	102.1	100.5
10) +/- Tracks (V0)	4560.0	4100.4	99.3	97.8
11) Tube/Veto Cut	4560.0	4100.4	99.3	97.8
12) Ekk > 4.0	3181.0	2825.2	68.4	67.4
13) P+- > 1.0	2606.0	2318.2	56.1	55.3
14) Theta<2.62 rad	2601.0	2313.9	56.0	55.2
15) Upstream Hangers	2592.0	2305.3	55.8	55.0
16) nsecond < 4	2575.0	2292.1	55.5	54.7
17) Hanger F.V.	2467.0	2202.1	53.3	52.5
18) No Hangers near Vert	2449.0	2185.0	52.9	52.1
19) Pz>0 for tracks	2449.0	2185.0	52.9	52.1
20) Thprimord<0.4	2411.0	2154.1	52.2	51.4
21) Nunh*fracunh<200	2411.0	2154.1	52.2	51.4
22) Pt+wrt- >= 0.05	2404.0	2149.5	52.1	51.3
23) mee > 0.1	2382.0	2128.9	51.6	50.8
24) PAN >= 0.5	2358.0	2109.6	51.1	50.3
25) -0.4< P asym <0.4	691.0	608.6	14.7	14.5
26) Phi12 < 100deg	18.0	14.8	0.4	0.4
27) P+- > 1.25	18.0	14.8	0.4	0.4
28) P+- > 1.5	16.0	13.5	0.3	0.3
29) P+- > 1.75	13.0	10.6	0.3	0.3
30) P+- > 2.0	8.0	6.2	0.2	0.1
31) P+- > 2.5	3.0	2.9	0.1	0.1

Table 17: Cut Table Coh $\pi^+$

### 8.1.12 Coherent $\rho^+$ Cut Table

Cut	Raw	Z-weight	Norm0	Final
1) Raw Events	155019.0	141019.7	7047.2	4714.6
2) OBGfid,Trig+CohGenTh	155019.0	141019.7	7047.2	4714.6
3) Pfermi & W2	155019.0	141019.7	7047.2	4714.6
4) Fid. Vol. -X	148454.0	135075.0	6750.1	4515.8
5) Fid. Vol. -Y	142252.0	129415.5	6467.3	4326.6
6) Fid. Vol. -Z	142252.0	129415.5	6467.3	4326.6
7) No Muons	11441.0	10334.8	516.5	345.5
8) ncand=2	8102.0	7393.3	369.5	247.2
9) tnhgd=2	7839.0	7154.6	357.5	239.2
10) +/- Tracks (V0)	7661.0	6994.1	349.5	233.8
11) Tube/Veto Cut	7661.0	6994.1	349.5	233.8
12) Ekk > 4.0	6218.0	5666.6	283.2	189.4
13) P+- > 1.0	4171.0	3787.2	189.3	126.6
14) Theta<2.62 rad	4169.0	3785.2	189.2	126.5
15) Upstream Hangers	4142.0	3761.9	188.0	125.8
16) nsecond < 4	4072.0	3710.9	185.4	124.1
17) Hanger F.V.	3730.0	3410.2	170.4	114.0
18) No Hangers near Vert	3695.0	3377.5	168.8	112.9
19) Pz>0 for tracks	3695.0	3377.5	168.8	112.9
20) Thprimord<0.4	2528.0	2371.0	118.5	79.3
21) Nunh*fracunh<200	2527.0	2370.1	118.4	79.2
22) Pt+wrt- >= 0.05	2524.0	2367.2	118.3	79.1
23) mee > 0.1	2506.0	2349.7	117.4	78.6
24) PAN >= 0.5	1096.0	1018.6	50.9	34.1
25) -0.4< Pasymp <0.4	129.0	115.8	5.8	3.9
26) Phi12 < 100deg	27.0	24.4	1.2	0.8
27) P+- > 1.25	27.0	24.4	1.2	0.8
28) P+- > 1.5	24.0	21.5	1.1	0.7
29) P+- > 1.75	19.0	17.8	0.9	0.6
30) P+- > 2.0	15.0	13.9	0.7	0.5
31) P+- > 2.5	6.0	5.3	0.3	0.2

Table 18: Cut Table Coh $\rho^+$



### 8.1.13 Coherent $J\psi$ Cut Table

Cut	Raw	Z-weight	Norm0	Final
1) Raw Events	11130.0	10127.8	28.4	28.4
2) OBGfid,Trig+CohGenTh	11130.0	10127.8	28.4	28.4
3) Pfermi & W2	11130.0	10127.8	28.4	28.4
4) Fid. Vol. -X	10666.0	9701.9	27.2	27.2
5) Fid. Vol. -Y	10263.0	9335.8	26.2	26.2
6) Fid. Vol. -Z	10263.0	9335.8	26.2	26.2
7) No Muons	1.0	1.0	0.0	0.0
8) ncand=2	1.0	1.0	0.0	0.0
9) tchgd=2	1.0	1.0	0.0	0.0
10) +/- Tracks (V0)	1.0	1.0	0.0	0.0
11) Tube/Veto Cut	1.0	1.0	0.0	0.0
12) Ekk > 4.0	1.0	1.0	0.0	0.0
13) P+- > 1.0	1.0	1.0	0.0	0.0
14) Theta<2.62 rad	1.0	1.0	0.0	0.0
15) Upstream Hangers	1.0	1.0	0.0	0.0
16) nsecond < 4	1.0	1.0	0.0	0.0
17) Hanger F.V.	1.0	1.0	0.0	0.0
18) No Hangers near Vert	1.0	1.0	0.0	0.0
19) Pz>0 for tracks	1.0	1.0	0.0	0.0
20) Thprimord<0.4	1.0	1.0	0.0	0.0
21) Nunh*fracunh<200	1.0	1.0	0.0	0.0
22) Pt+wrt- >= 0.05	1.0	1.0	0.0	0.0
23) mee > 0.1	1.0	1.0	0.0	0.0
24) PAN >= 0.5	1.0	1.0	0.0	0.0
25) -0.4< Pasym <0.4	0.0	0.0	0.0	0.0
26) Phi12 < 100deg	0.0	0.0	0.0	0.0
27) P+- > 1.25	0.0	0.0	0.0	0.0
28) P+- > 1.5	0.0	0.0	0.0	0.0
29) P+- > 1.75	0.0	0.0	0.0	0.0
30) P+- > 2.0	0.0	0.0	0.0	0.0
31) P+- > 2.5	0.0	0.0	0.0	0.0

Table 19: Cut Table Coh $J/\psi$

### 8.1.14 $\nu_e$ CC Cut Table

Cut	Raw	Z-weight	Norm0	Final
1) Raw Events	74532.0	68425.1	3473.8	3473.8
2) OBGfid,Trig+CohGenTh	74532.0	68425.1	3473.8	3473.8
3) Pfermi & W2	74532.0	68425.1	3473.8	3473.8
4) Fid. Vol. -X	69576.0	63926.4	3245.4	3245.4
5) Fid. Vol. -Y	63767.0	58606.0	2975.3	2975.3
6) Fid. Vol. -Z	63767.0	58606.0	2975.3	2975.3
7) No Muons	63767.0	58606.0	2975.3	2975.3
8) ncand=2	27353.0	25222.5	1280.5	1280.5
9) tnhgd=2	23707.0	21864.6	1110.0	1110.0
10) +/- Tracks (V0)	21227.0	19617.5	995.9	995.9
11) Tube/Veto Cut	21227.0	19617.5	995.9	995.9
12) Ekk > 4.0	18923.0	17470.9	886.9	886.9
13) P+- > 1.0	12169.0	11230.4	570.1	570.1
14) Theta<2.62 rad	12112.0	11177.0	567.4	567.4
15) Upstream Hangers	11725.0	10801.6	548.4	548.4
16) nsecond < 4	11064.0	10292.9	522.5	522.5
17) Hanger F.V.	9511.0	8880.7	450.9	450.9
18) No Hangers near Vert	8748.0	8148.2	413.7	413.7
19) Pz>0 for tracks	8742.0	8142.4	413.4	413.4
20) Thprimord<0.4	6404.0	6108.8	310.1	310.1
21) Nunh*fracunh<200	6385.0	6095.1	309.4	309.4
22) Pt+wrt- >= 0.05	6372.0	6082.5	308.8	308.8
23) mee > 0.1	6369.0	6079.5	308.6	308.6
24) PAN >= 0.5	3974.0	3807.5	193.3	193.3
25) -0.4< Pasym <0.4	459.0	438.6	22.3	22.3
26) Phi12 < 100deg	16.0	14.9	0.8	0.8
27) P+- > 1.25	16.0	14.9	0.8	0.8
28) P+- > 1.5	15.0	13.9	0.7	0.7
29) P+- > 1.75	15.0	13.9	0.7	0.7
30) P+- > 2.0	13.0	11.9	0.6	0.6
31) P+- > 2.5	11.0	9.9	0.5	0.5

Table 20: Cut Table Nue-CC

### 8.1.15 Coherent $\phi^0$ Cut Table

Cut	Raw	Z-weight	Norm0	Final
1) Raw Events	43833.0	40668.6	131.6	131.6
2) OBGfid,Trig+CohGenTh	43833.0	40668.6	131.6	131.6
3) Pfermi & W2	43833.0	40668.6	131.6	131.6
4) Fid. Vol. -X	42060.0	38985.8	126.2	126.2
5) Fid. Vol. -Y	40770.0	37760.8	122.2	122.2
6) Fid. Vol. -Z	40770.0	37760.8	122.2	122.2
7) No Muons	40770.0	37760.8	122.2	122.2
8) ncand=2	39053.0	36195.0	117.1	117.1
9) tunchgd=2	37865.0	35100.0	113.6	113.6
10) +/- Tracks (V0)	35493.0	33129.8	107.2	107.2
11) Tube/Veto Cut	35493.0	33129.8	107.2	107.2
12) Ekk > 4.0	14629.0	13200.9	42.7	42.7
13) P+- > 1.0	10370.0	9468.8	30.6	30.6
14) Theta<2.62 rad	10306.0	9409.0	30.4	30.4
15) Upstream Hangers	10287.0	9390.4	30.4	30.4
16) nsecond < 4	10275.0	9382.1	30.4	30.4
17) Hanger F.V.	9998.0	9144.5	29.6	29.6
18) No Hangers near Vert	9927.0	9082.0	29.4	29.4
19) Pz>0 for tracks	9912.0	9067.6	29.3	29.3
20) Thprimord<0.4	9835.0	9006.1	29.1	29.1
21) Nunh*fracunh<200	9834.0	9005.1	29.1	29.1
22) Pt+wrt- >= 0.05	9833.0	9004.2	29.1	29.1
23) mee > 0.1	9833.0	9004.2	29.1	29.1
24) PAN >= 0.5	9812.0	8983.9	29.1	29.1
25) -0.4< Pasym <0.4	5875.0	5486.5	17.8	17.8
26) Phi12 < 100deg	4.0	3.9	0.0	0.0
27) P+- > 1.25	4.0	3.9	0.0	0.0
28) P+- > 1.5	4.0	3.9	0.0	0.0
29) P+- > 1.75	4.0	3.9	0.0	0.0
30) P+- > 2.0	3.0	3.0	0.0	0.0
31) P+- > 2.5	1.0	1.0	0.0	0.0

Table 21: Cut Table QE

### 8.1.16 Res CC Cut Table

Cut	Raw	Z-weight	Norm0	Final
1) Raw Events	56945.0	52574.4	473.2	473.2
2) OBGfid,Trig+CohGenTh	56945.0	52574.4	473.2	473.2
3) Pfermi & W2	56945.0	52574.4	473.2	473.2
4) Fid. Vol. -X	53961.0	49810.4	448.3	448.3
5) Fid. Vol. -Y	51135.0	47174.2	424.6	424.6
6) Fid. Vol. -Z	51135.0	47174.2	424.6	424.6
7) No Muons	51135.0	47174.2	424.6	424.6
8) ncand=2	37292.0	34343.2	309.1	309.1
9) tnchgd=2	34689.0	31907.4	287.2	287.2
10) +/- Tracks (V0)	27853.0	26056.9	234.5	234.5
11) Tube/Veto Cut	27853.0	26056.9	234.5	234.5
12) Ekk > 4.0	7400.0	6485.5	58.4	58.4
13) P+- > 1.0	3842.0	3443.4	31.0	31.0
14) Theta<2.62 rad	3805.0	3408.0	30.7	30.7
15) Upstream Hangers	3710.0	3315.7	29.8	29.8
16) nsecond < 4	3693.0	3304.1	29.7	29.7
17) Hanger F.V.	3495.0	3129.7	28.2	28.2
18) No Hangers near Vert	3222.0	2878.6	25.9	25.9
19) Pz>0 for tracks	3211.0	2868.0	25.8	25.8
20) Thprimord<0.4	3053.0	2728.0	24.6	24.6
21) Nunh*fracunh<200	3053.0	2728.0	24.6	24.6
22) Pt+wrt- >= 0.05	3053.0	2728.0	24.6	24.6
23) mee > 0.1	3051.0	2726.1	24.5	24.5
24) PAN >= 0.5	2969.0	2650.4	23.9	23.9
25) -0.4< Pasym <0.4	1640.0	1511.6	13.6	13.6
26) Phi12 < 100deg	52.0	44.7	0.4	0.4
27) P+- > 1.25	51.0	43.7	0.4	0.4
28) P+- > 1.5	40.0	34.4	0.3	0.3
29) P+- > 1.75	30.0	26.5	0.2	0.2
30) P+- > 2.0	16.0	14.8	0.1	0.1
31) P+- > 2.5	2.0	1.4	0.0	0.0

Table 22: Cut Table CC-Res