HANUL Meeting
191001

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Event Selection of $\Lambda_c^+ \to pK^-\pi^+$

TABLE IV: Event selection criteria for $\Lambda_c^+ \to pK^-\pi^+$ channel

Selection Type	Quantity	Selected Condition
Λ_c Selection		
Scaled momentum		
	x_p	> 0.54
χ^2 of vertex fitting		
	χ^2	< 40
Charged Particle Selection		
Impact Parameter		
	$\|dr\|$	< 0.10 cm
	$\|dz\|$	< 2.00 cm
PID(K)		
	$\mathcal{R}(K\|\pi)$	> 0.90
	$\mathcal{R}(p\|K)$	< 0.60
PID(p)		
	$\mathcal{R}(p\|K)$	> 0.90
	$\mathcal{R}(p\|\pi)$	> 0.90
PID(π)		
	$\mathcal{R}(K\|\pi)$	< 0.60
	$\mathcal{R}(p\|\pi)$	< 0.60
Lepton PID		
	$\mathcal{R}(e)$	< 0.90
Number of SVD hits		
	$r\phi$-layer	≥ 1
	z-layer	≥ 1

- In order to calculate relative branching fraction $\Gamma(\Lambda_c^+ \to pK_s^0\pi^0)/\Gamma(\Lambda_c^+ \to pK^-\pi^+)$
- **Except for x_p cut,**
  same conditions for $\Lambda_c^+ \to pK^-\pi^+$ selection of SB Yang's DSC study are used.
- x_p cut is same as $\Lambda_c^+ \to pK_s^0\pi^0$

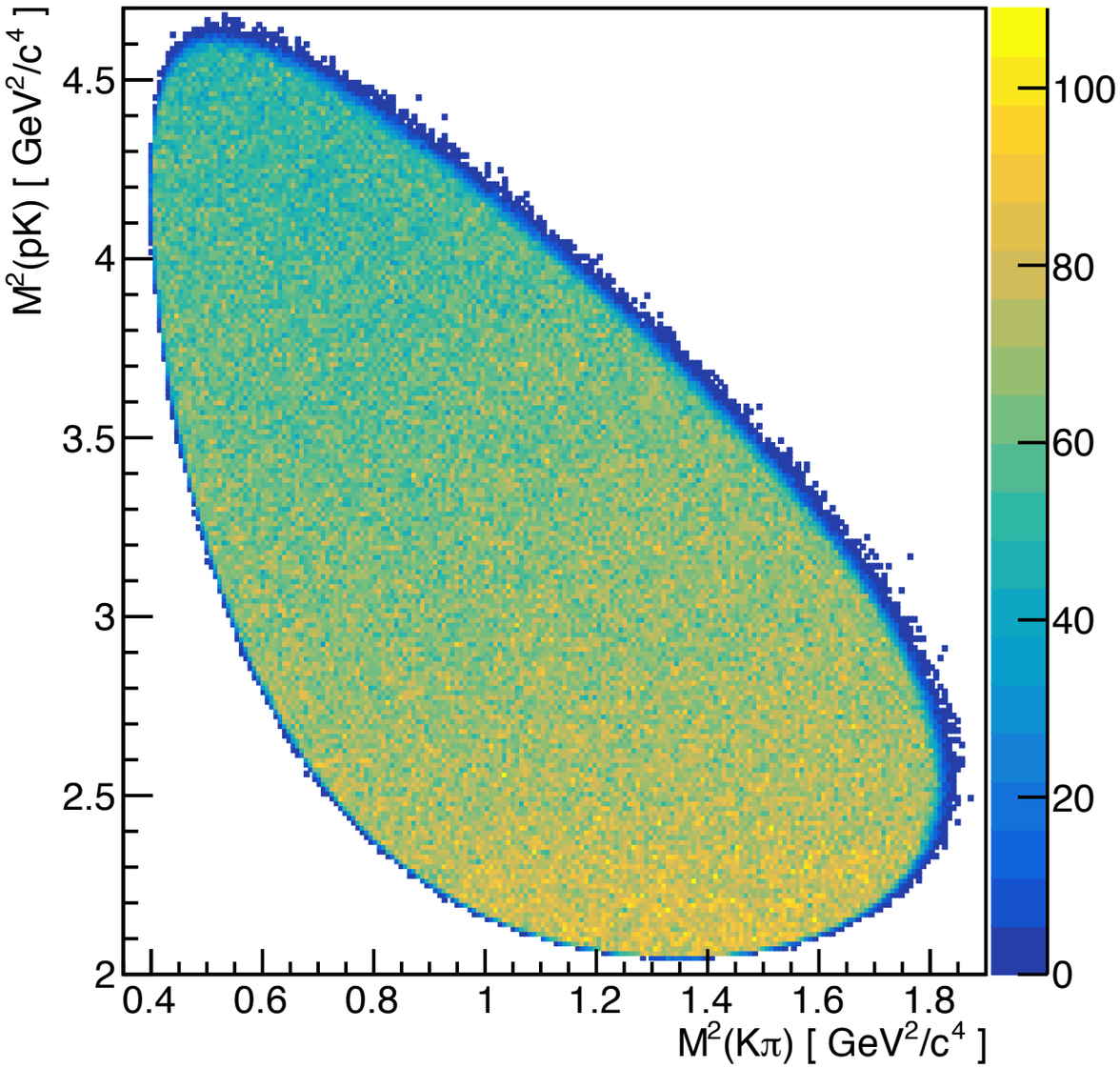
Obtaining Detection Efficiency

- Efficiency tables on the Dalitz plane were obtained by non-resonant signal MC analysis :
  - 5x10 bins in $M^2(pK)$ vs. $M^2(K\pi)$ plane.
  - 10M events of non-resonant decay of $\Lambda_c^+ \to pK^-\pi^+$
    → done(?)
  - 10M events of non-resonant decay of $\Lambda_c^+ \to pK_s^0\pi^0$
    → ongoing

$$\Lambda_c^+ \to pK^-\pi^+$$

$\Lambda_c^+ \to pK^-\pi^+$ Detection efficiency

Accepted



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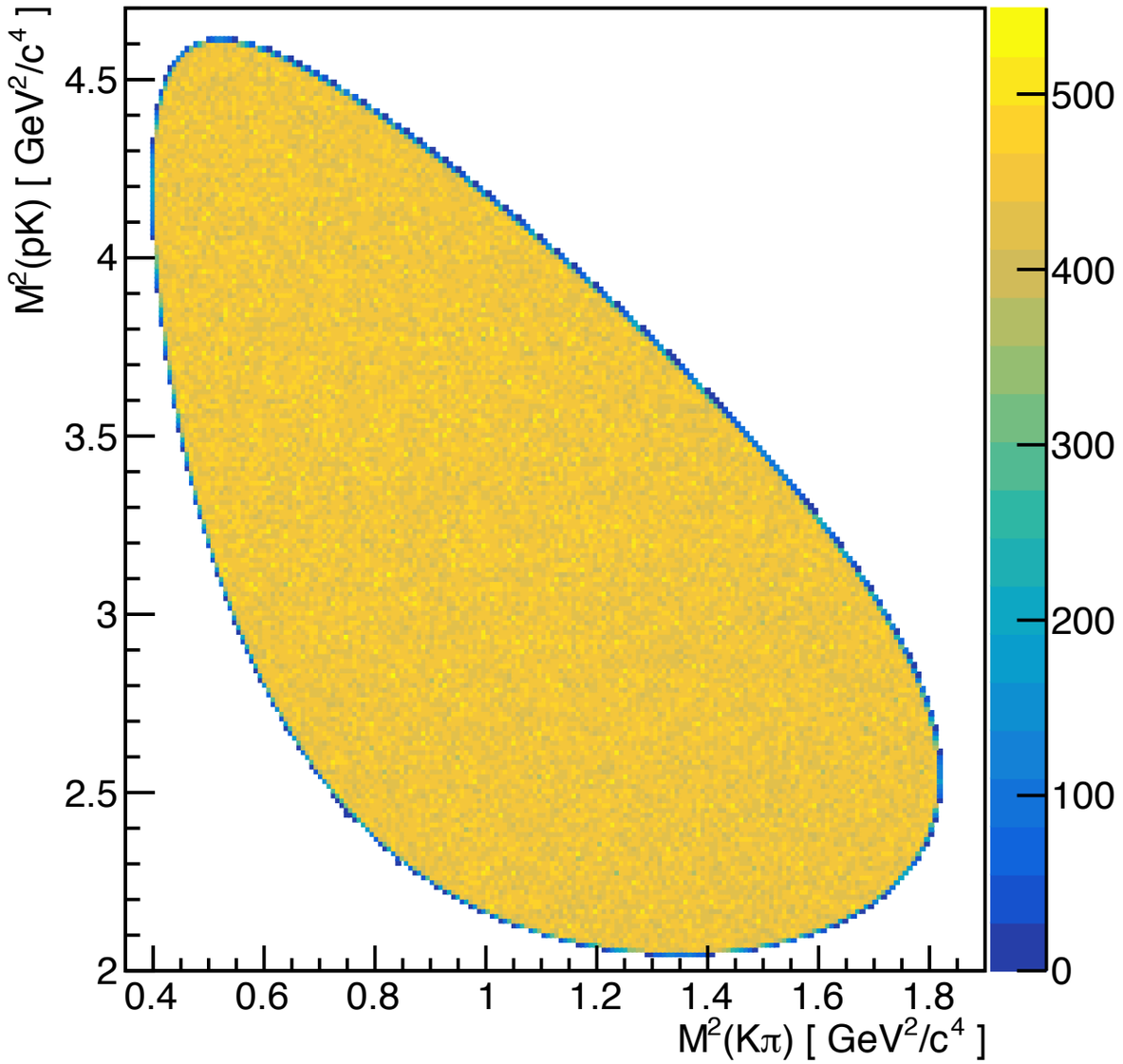
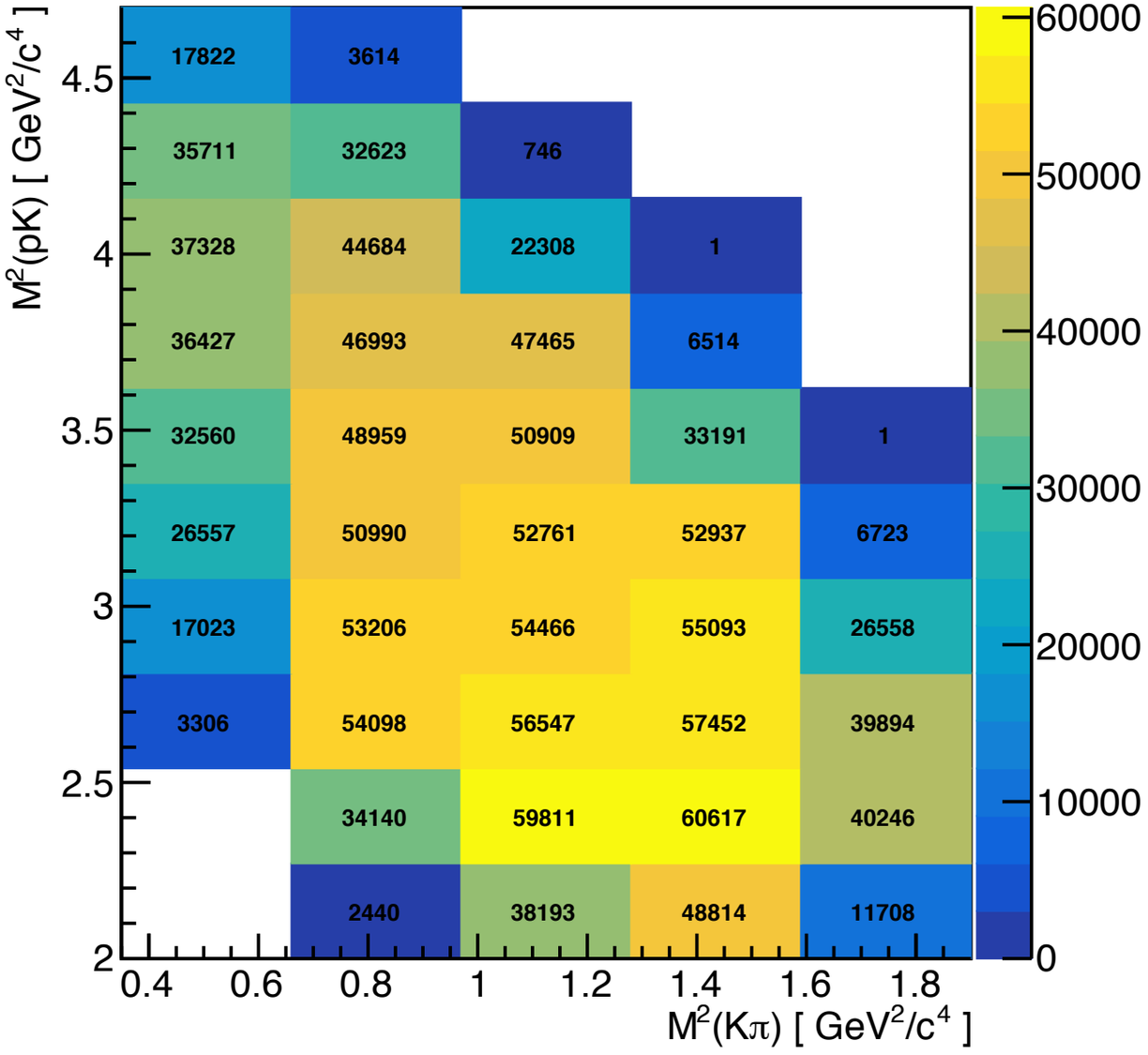


Non-resonant decay signalMC 10M events

$\Lambda_c^+ \to pK^-\pi^+$ Detection efficiency

Accepted



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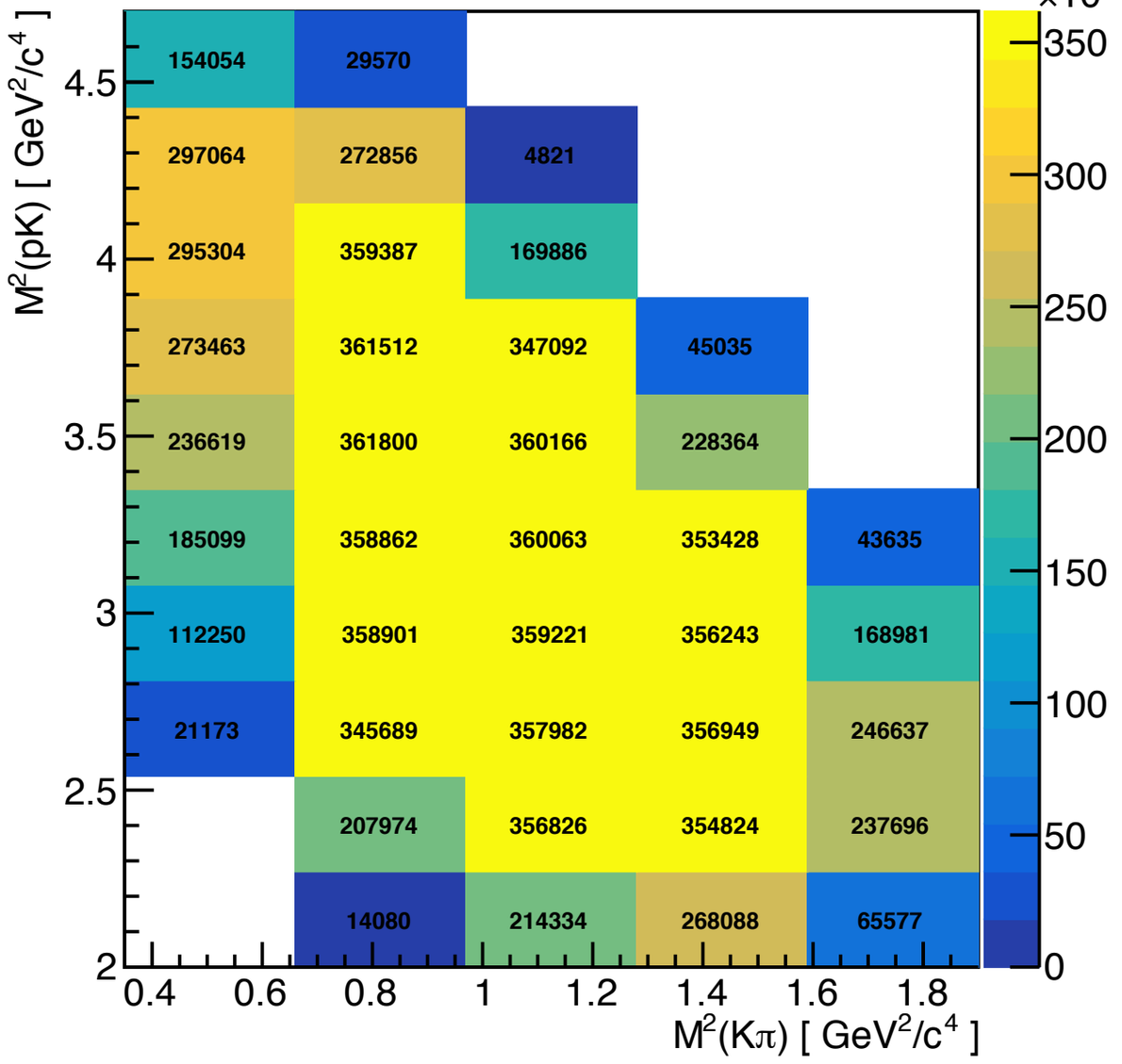
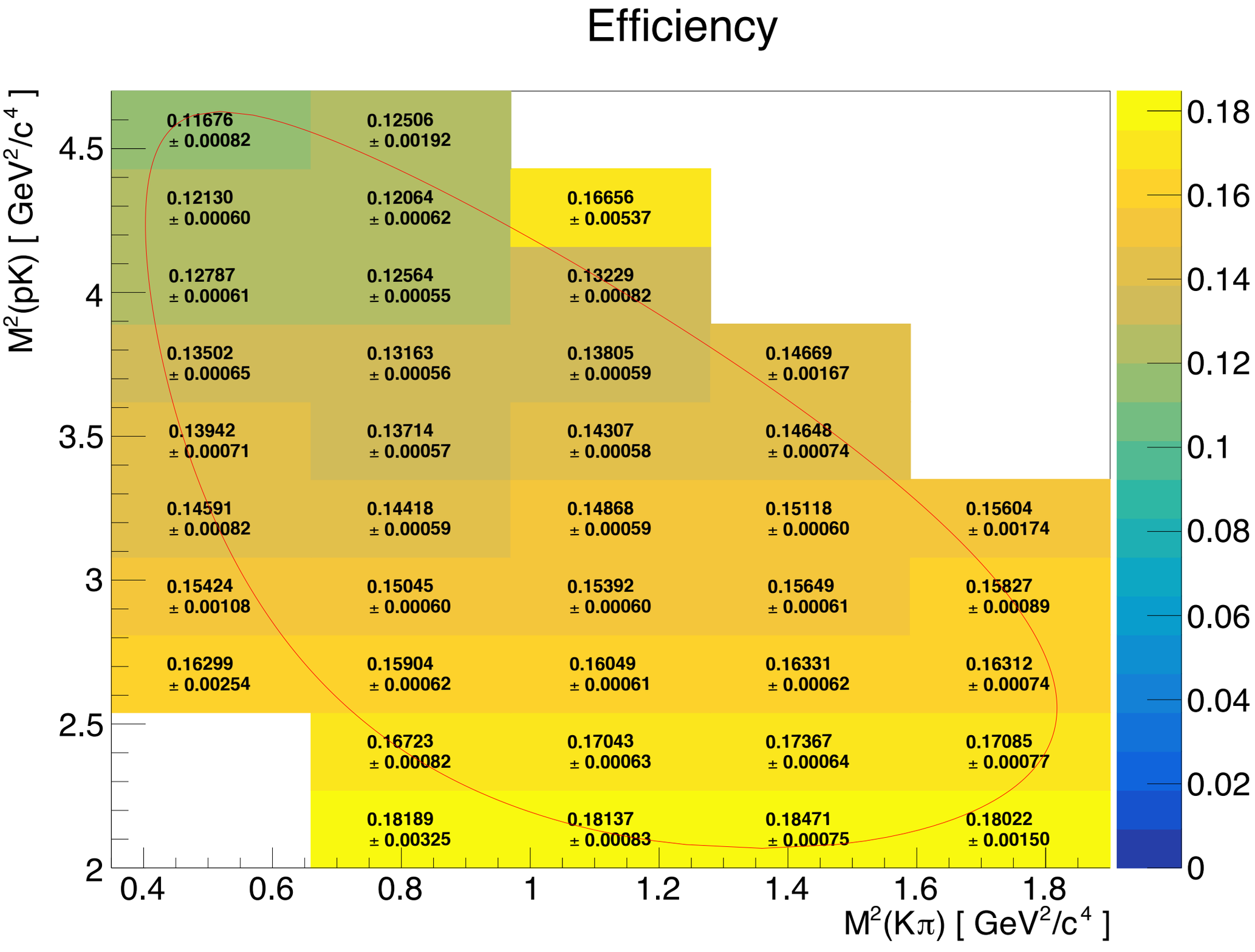


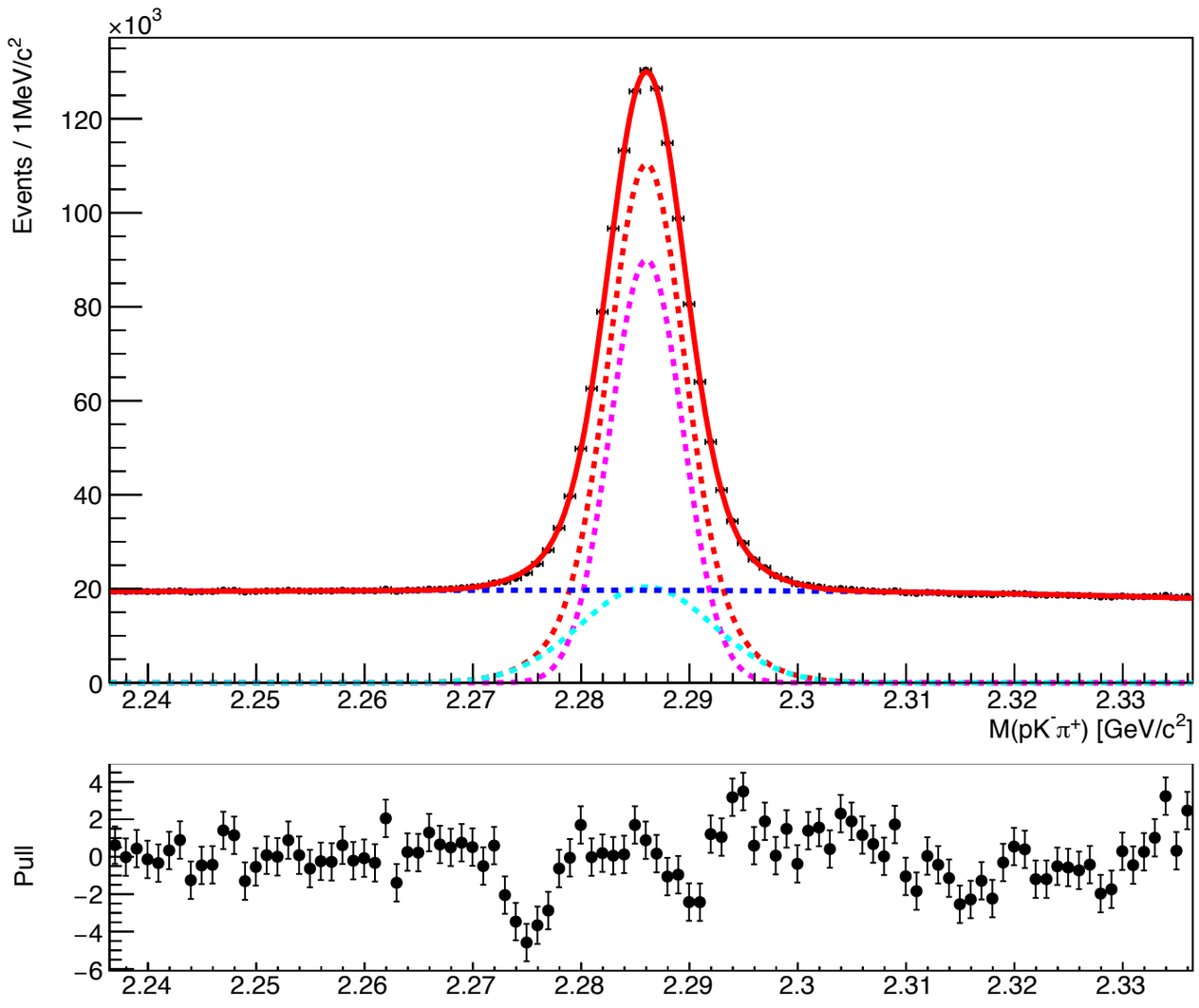
The number of events in each Dalitz bin

$\Lambda_c^+ \to pK^-\pi^+$ Detection efficiency



Signal / Background PDF

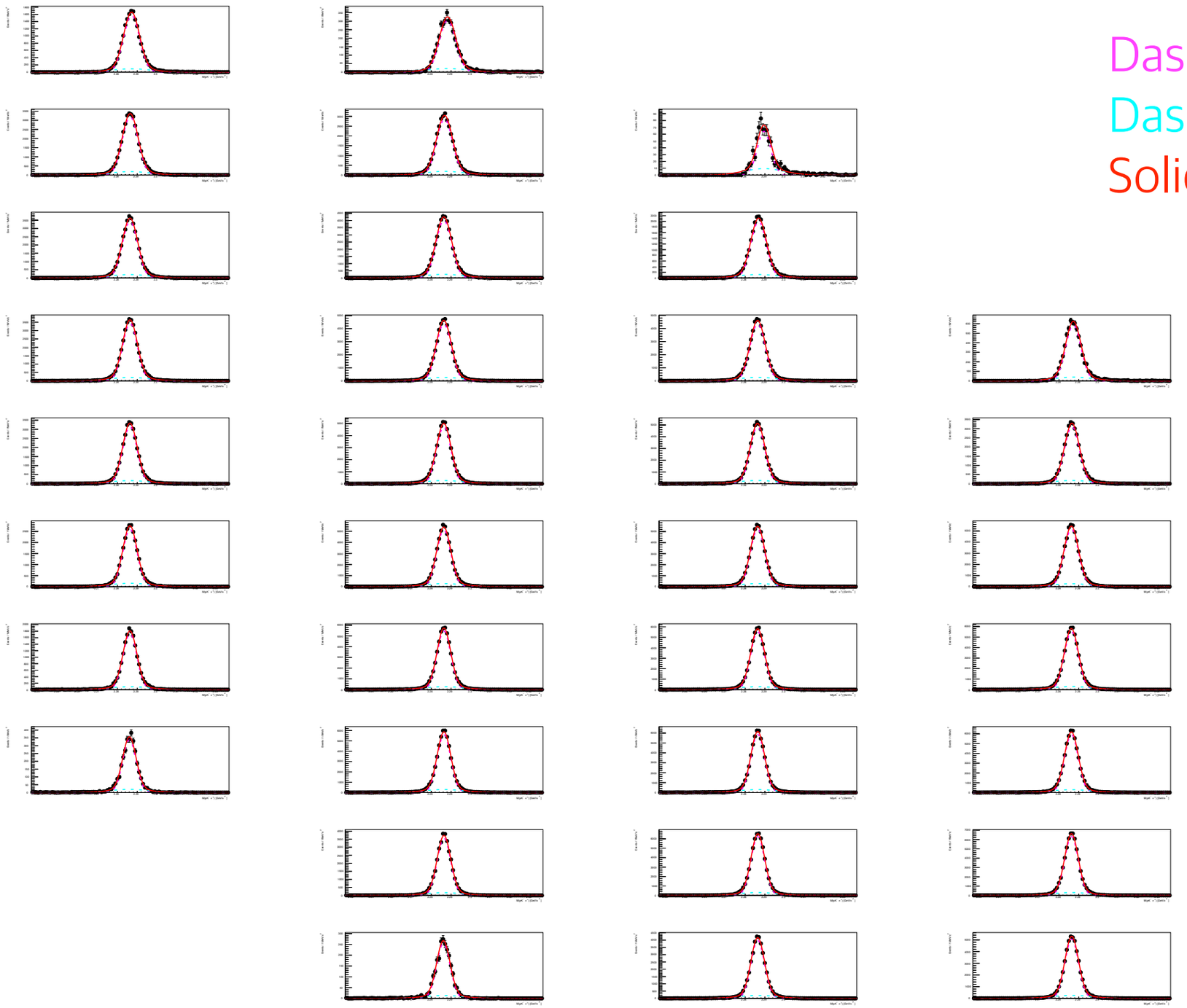
$$\Lambda_c^+ \to pK^-\pi^+$$



Signal PDF : **f1** * $Gaus1(m, \sigma_1)$ + **f2** * $Gaus2(m, \sigma_2)$

Background PDF : 3rd order Chebychev

Fixing Fit Parameters Signal MC Fit result

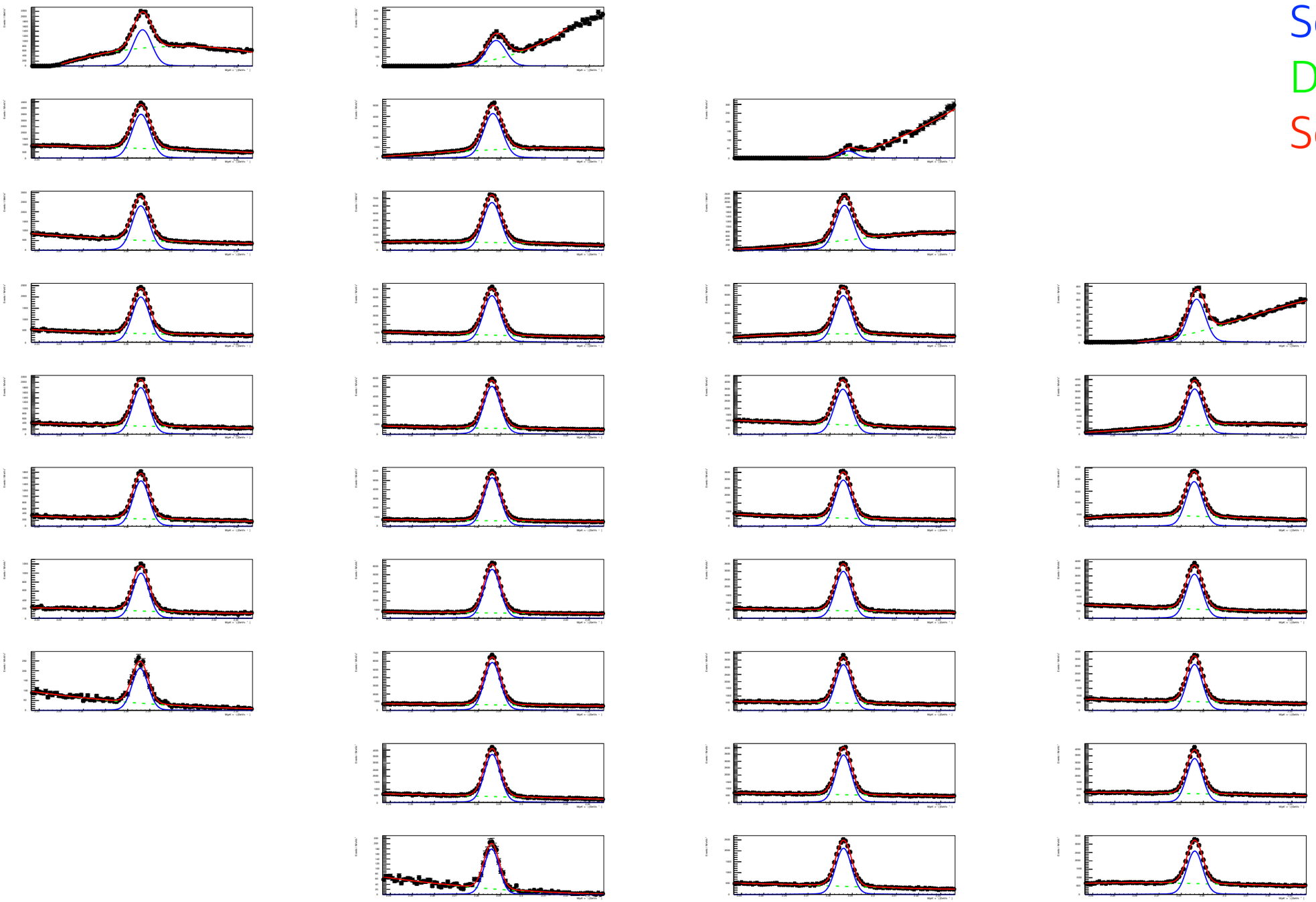


Dashed Magenta : Gaus1
Dashed Cyan : Gaus2
Solid Red : Signal PDF

Signal PDF : **f1** * $Gaus1(m, \sigma_1)$ + **f2** * $Gaus2(m, \sigma_2)$

Yield ratio f1/f2 and Sigma ratio σ_1/σ_2 are fixed for each bin.

Generic MC Fit Results $\Lambda_c^+ \to pK^-\pi^+$

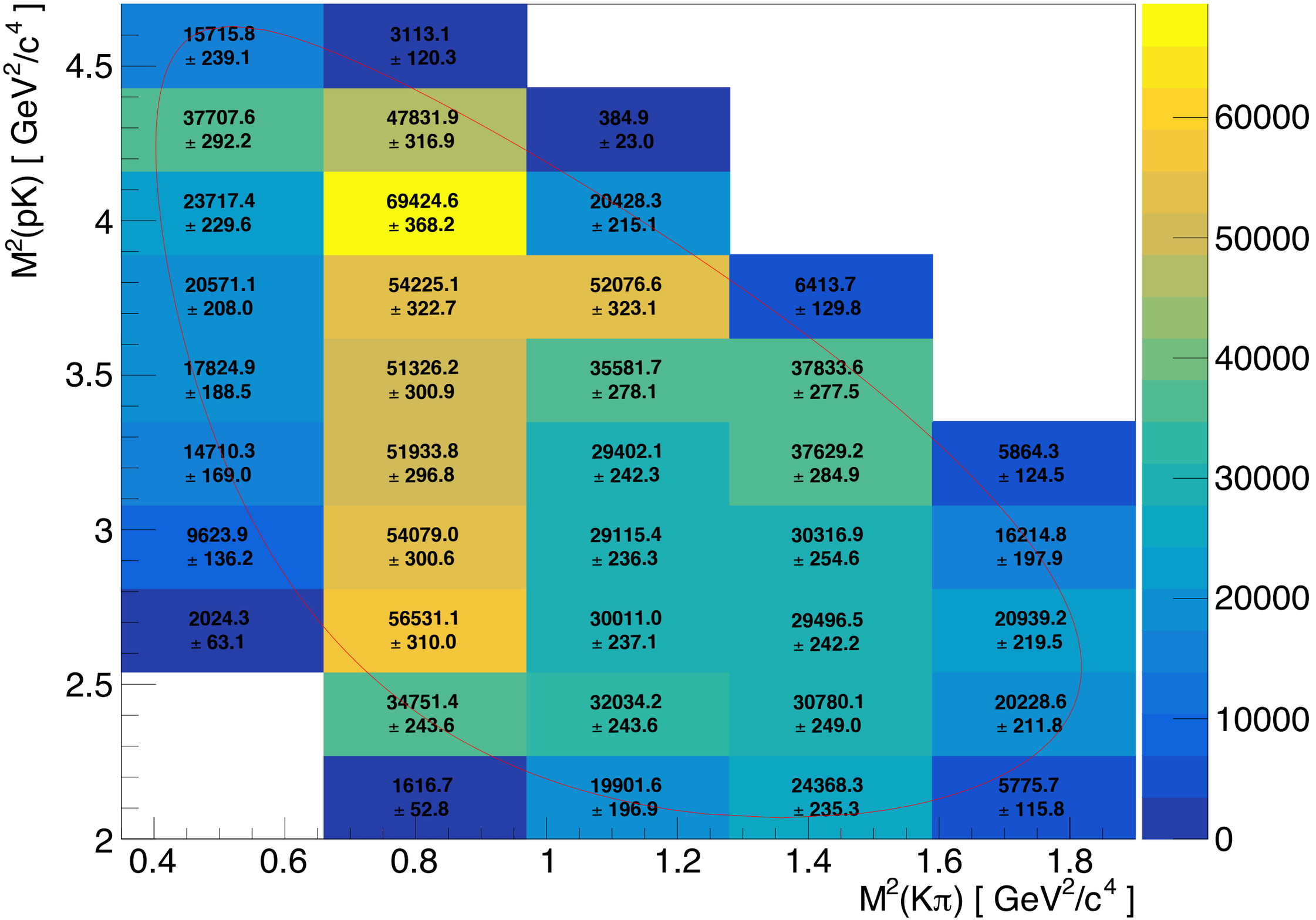


Solid Blue : Signal

Dashed Green : Bkg

Solid Red : Total Fit

Extracted Signal Yields



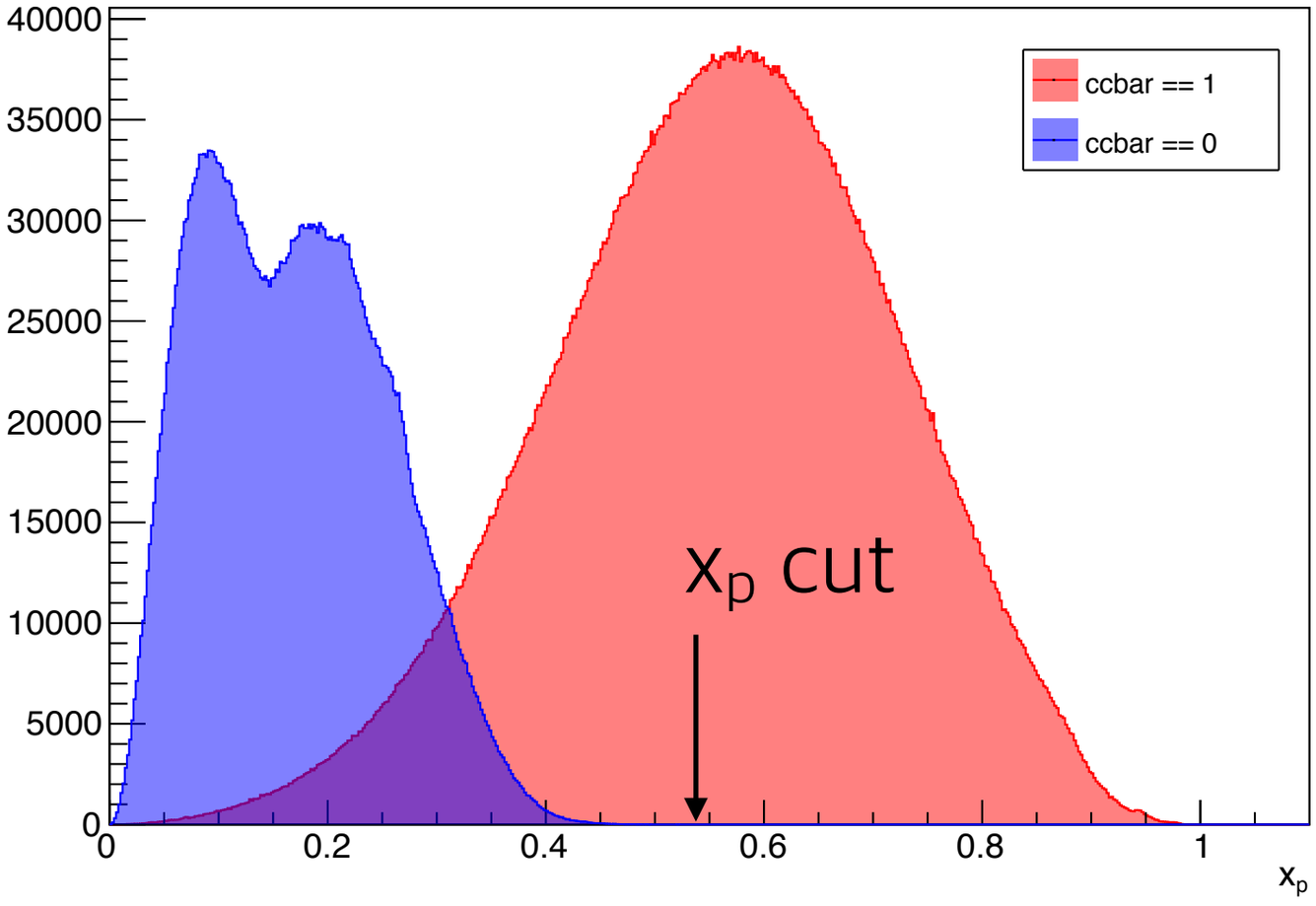
Efficiency Corrected Yield

$\Lambda_c^+ \to pK^-\pi^+$

Generated signal events (from ccbar): 7,581,551

Efficiency corrected yield : 7,446,278 ± 12134

1.78% difference



Efficiency Corrected Yield

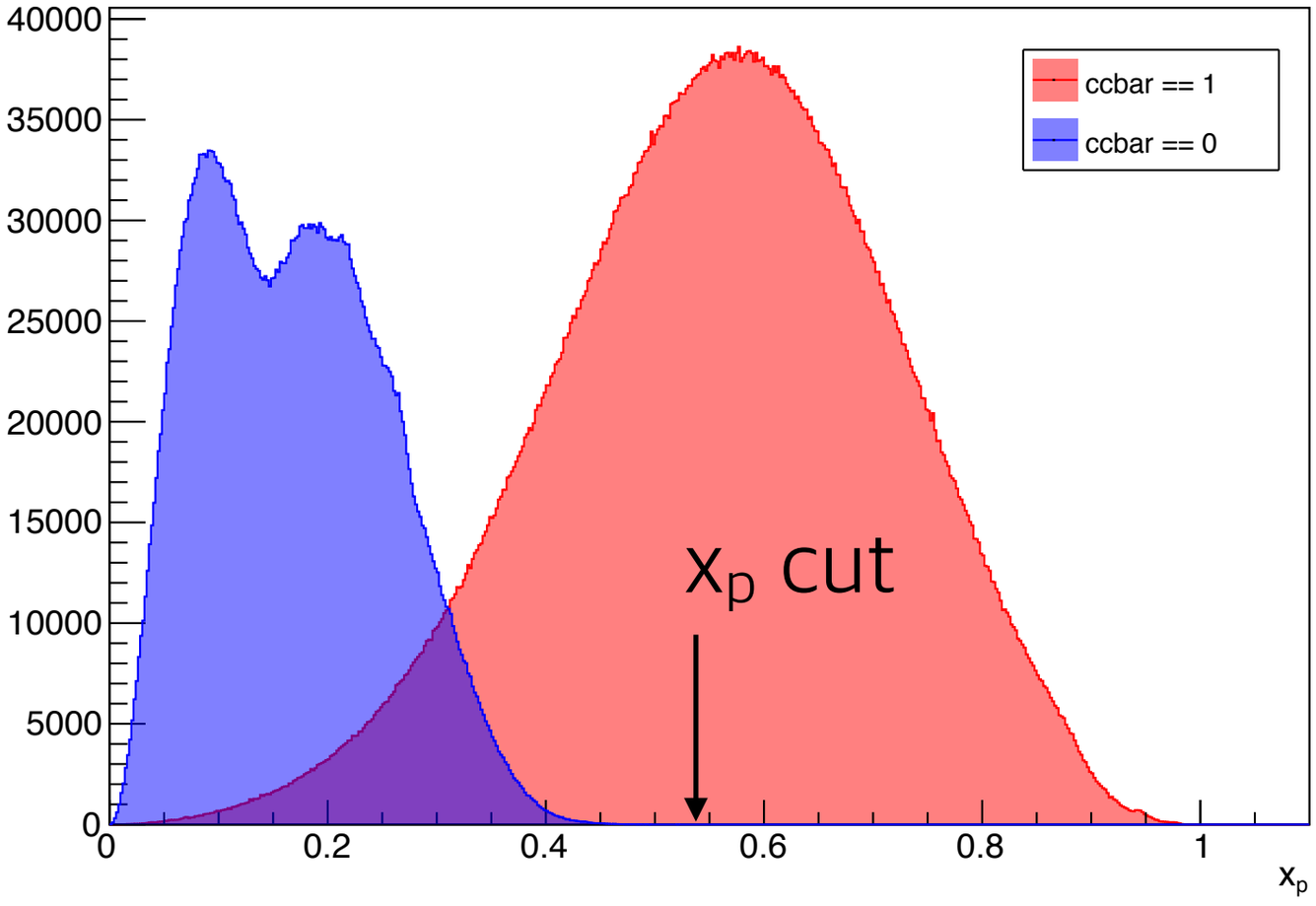
$\Lambda_c^+ \to pK^-\pi^+$

PHOTOS Energy loss < 10MeV

Generated signal events (from ccbar): ~~7,581,551~~ **7,499,353**

Efficiency corrected yield : 7,446,278 ± 12134

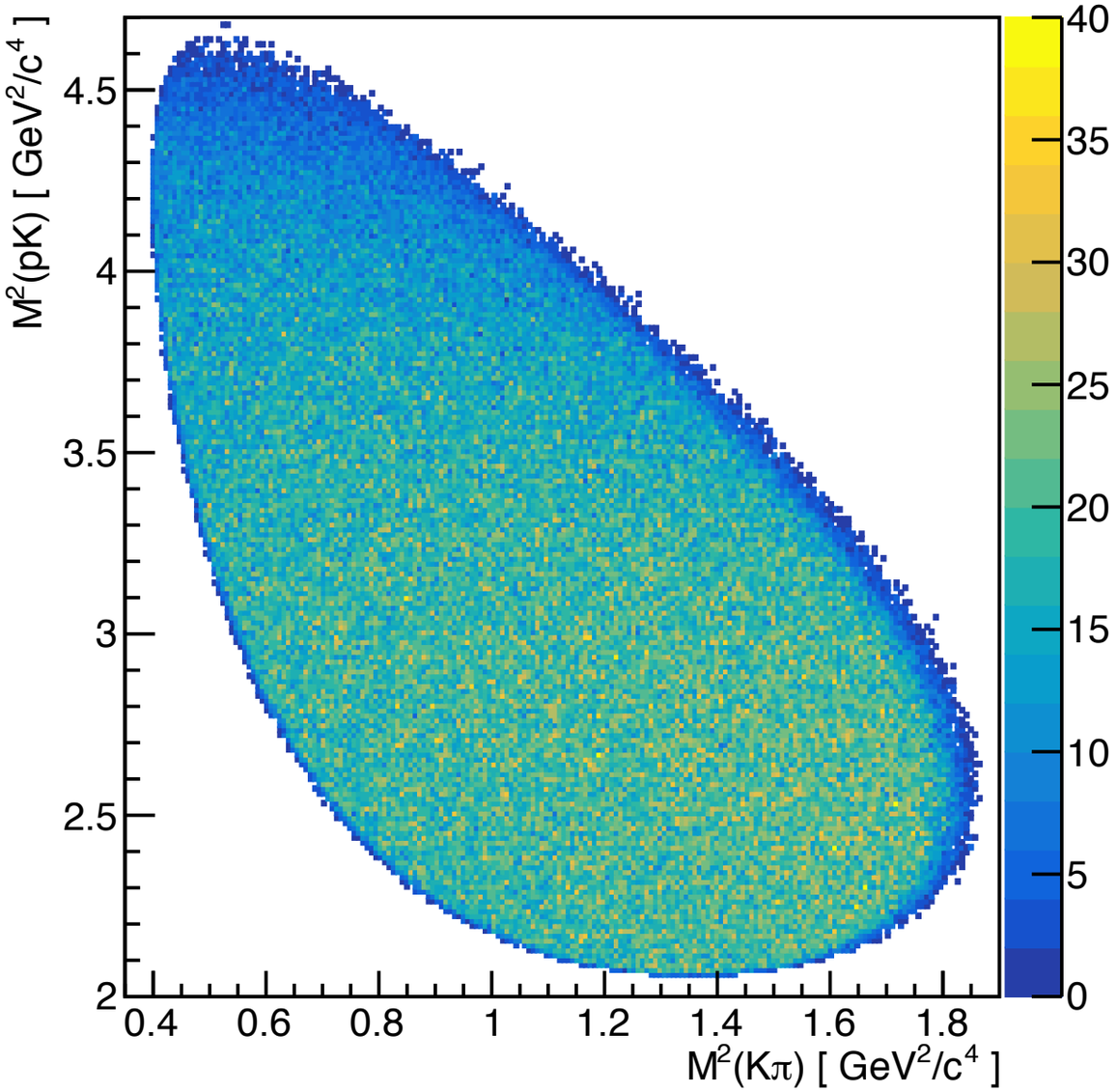
0.71% difference



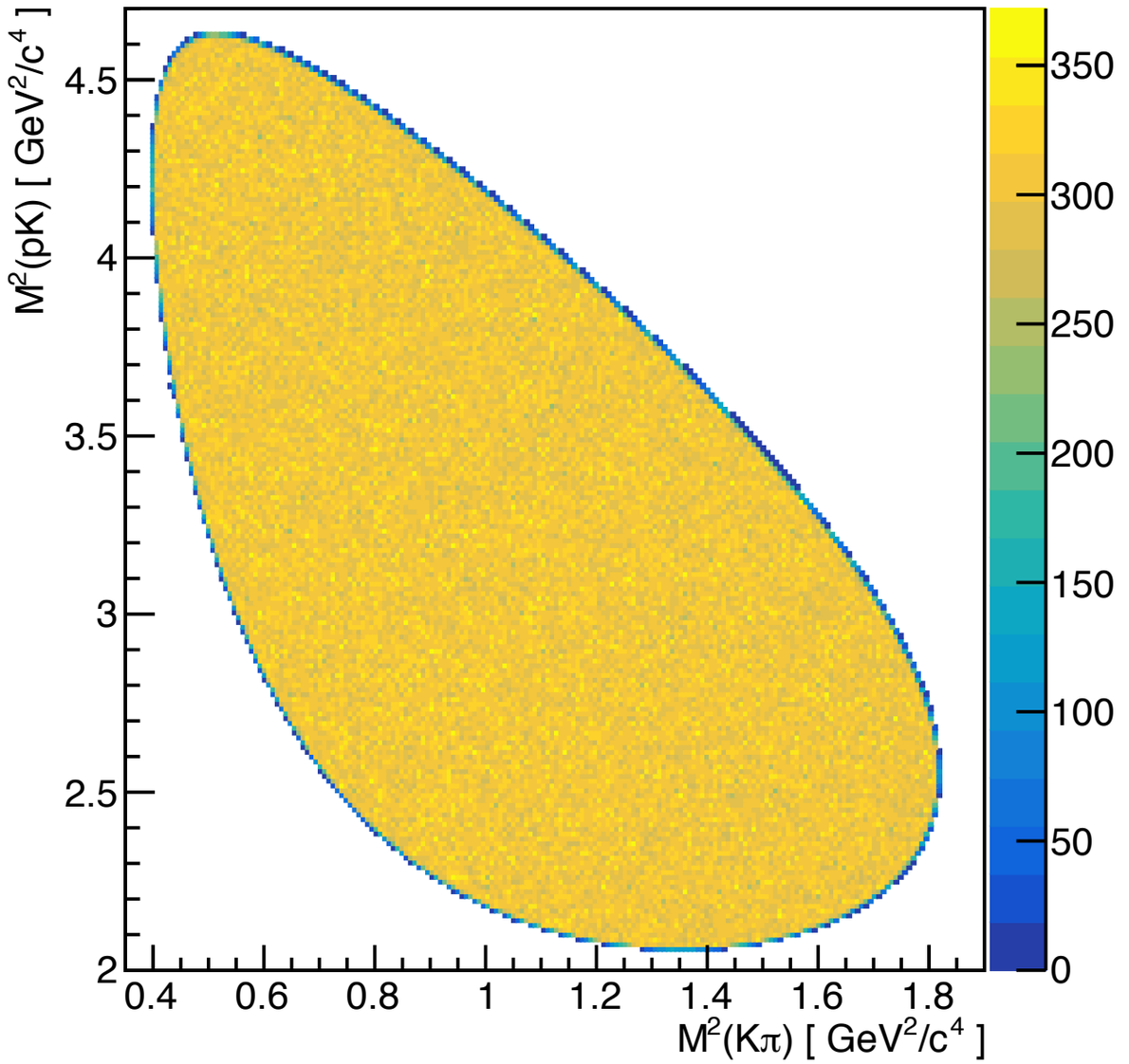
$$\Lambda_c^+ \to pK_s^0\pi^0$$

$\Lambda_c^+ \to pK_s^0\pi^0$ Detection efficiency

Accepted



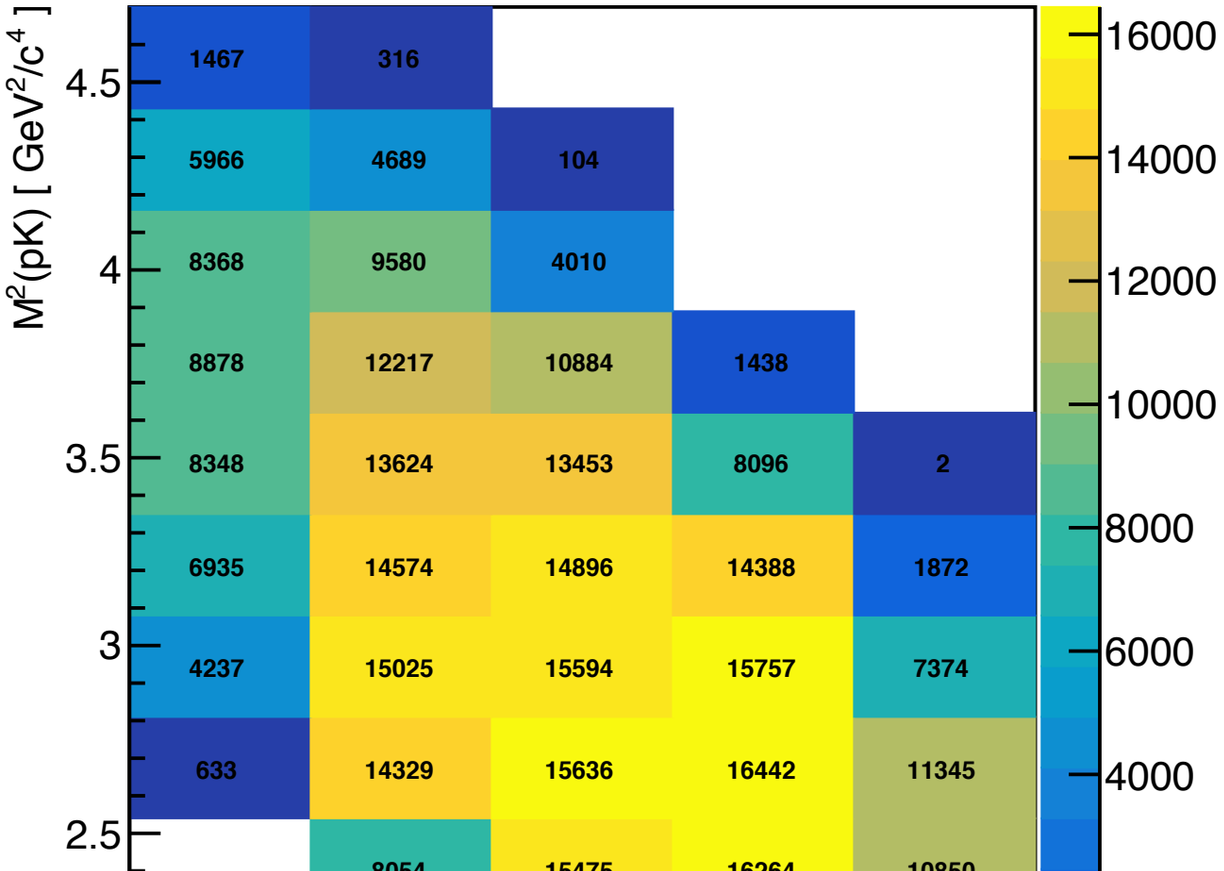
Generated



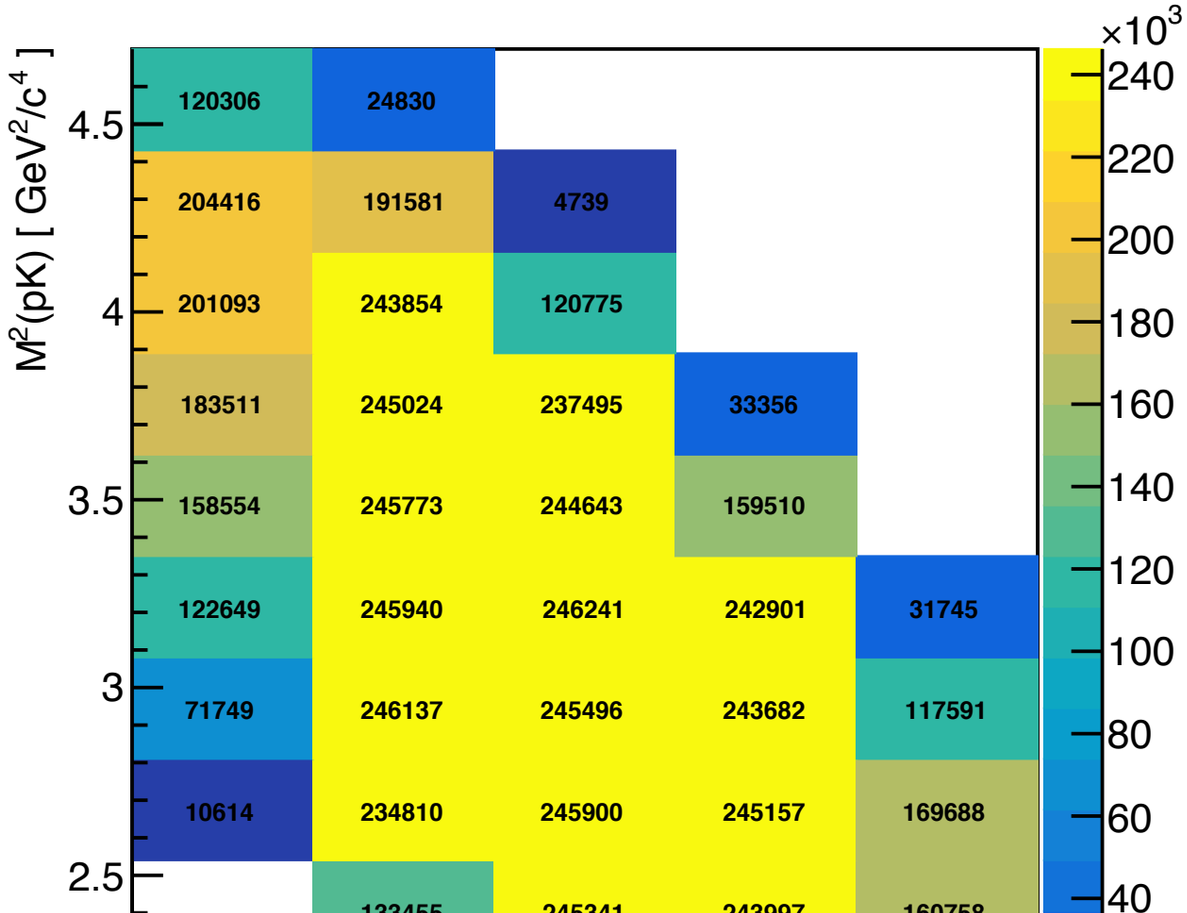
Non-resonant decay signalMC 10M events

$\Lambda_c^+ \to pK_s^0\pi^0$ Detection efficiency

Accepted

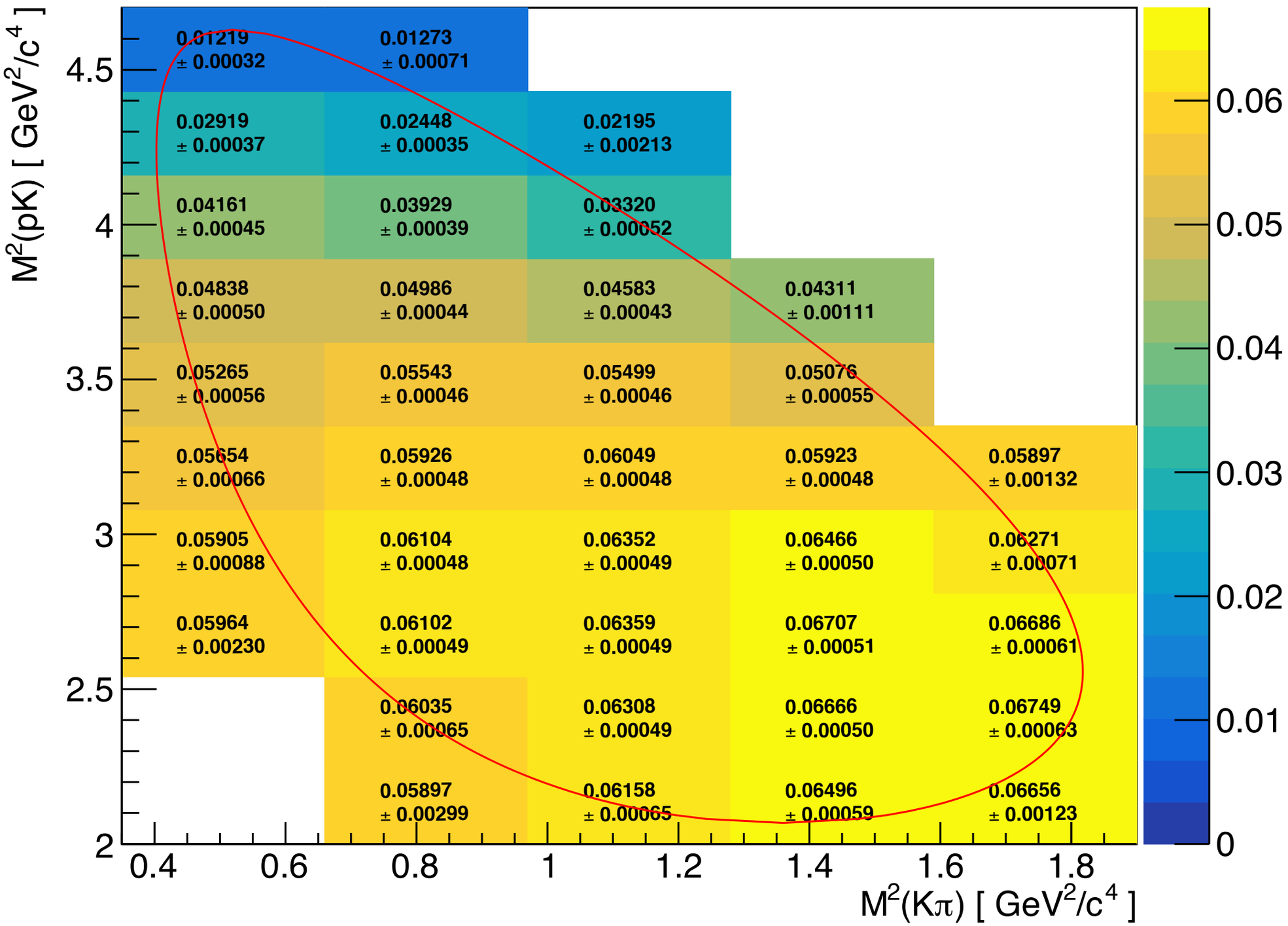


Generated



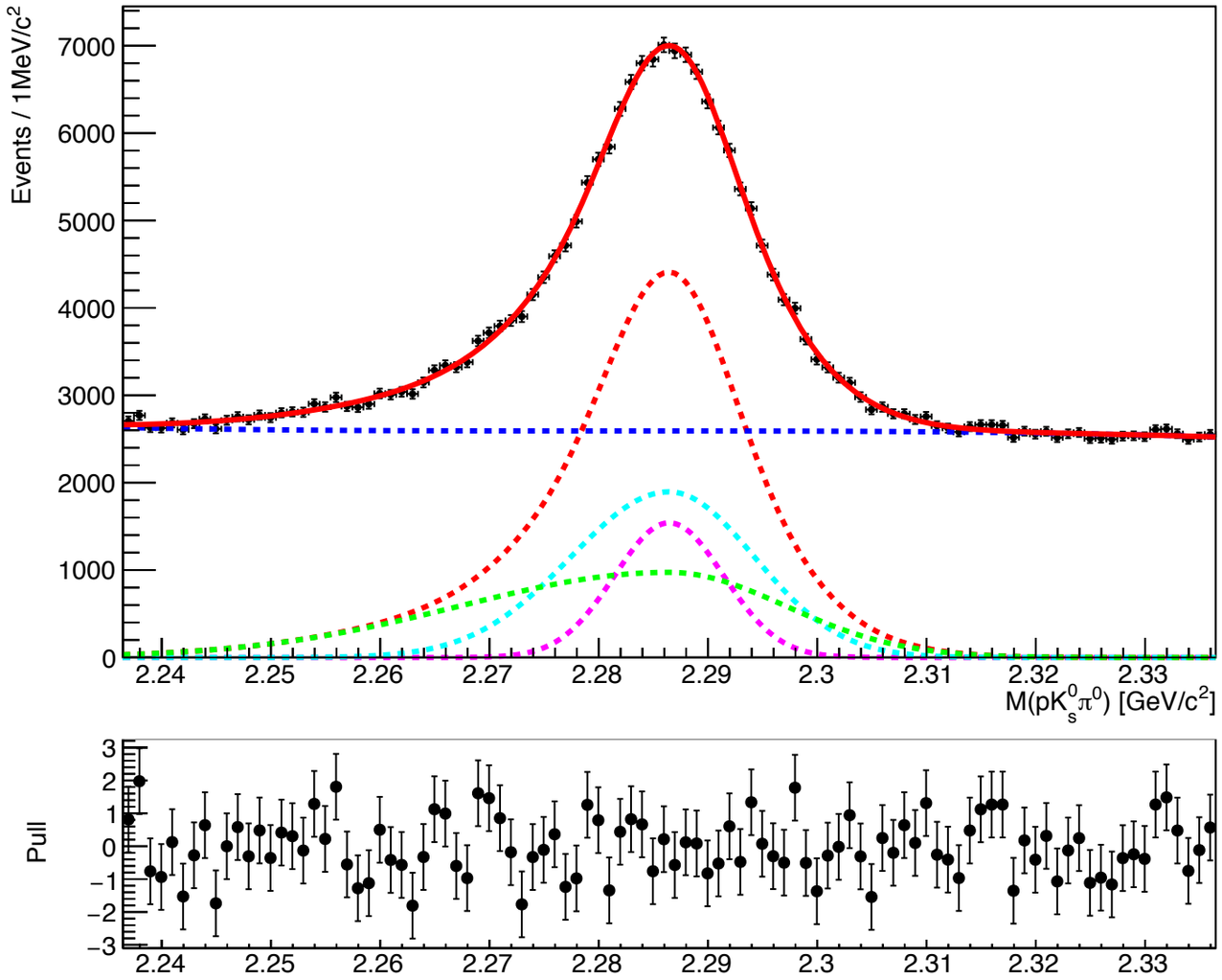
The number of events in each Dalitz bin

$\Lambda_c^+ \to pK_s^0\pi^0$ Detection efficiency



Signal / Background PDF

$$\Lambda_c^+ \to pK_s^0\pi^0$$



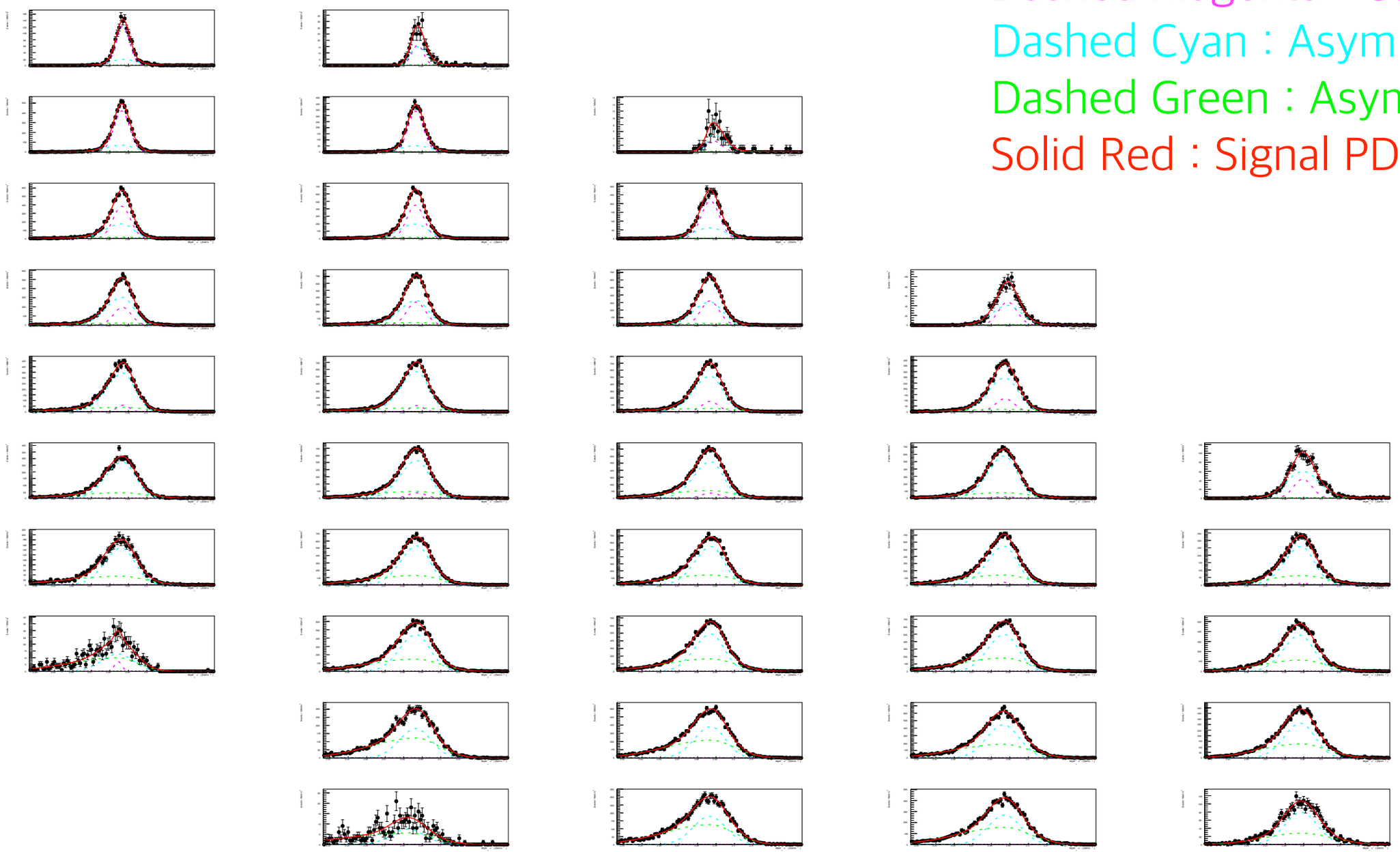
Signal PDF : **f1** * $Gaus(m,\sigma)$ + **f2** * $BifurGaus1(m,\sigma_{1L},\sigma_{1R})$ + **f3** * $BifurGaus2(m,\sigma_{2L},\sigma_{2R})$

Background PDF : 3rd order Chebychev

Fixing Fit Parameters

Signal MC Fit result

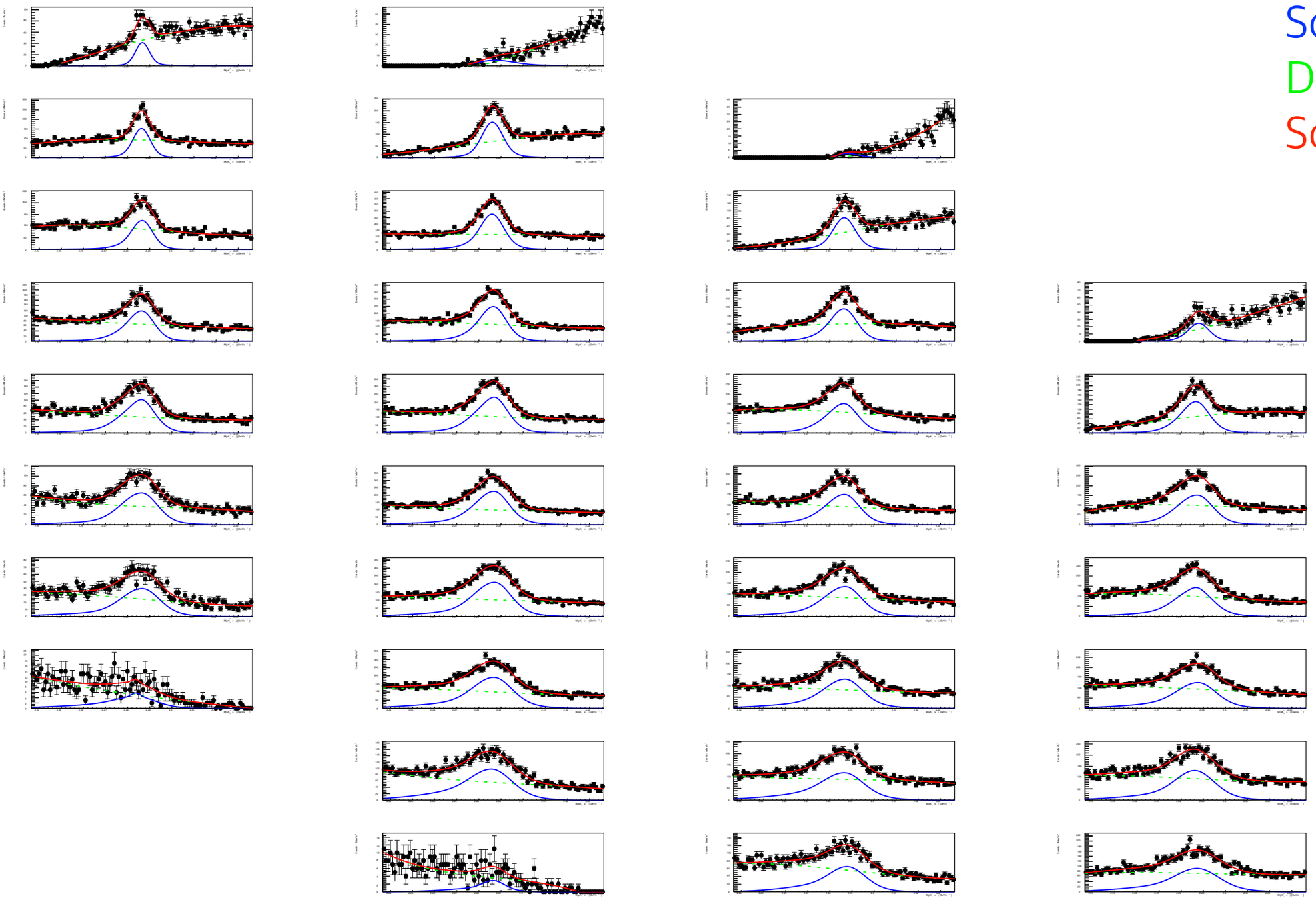
Dashed Magenta : Gaus
Dashed Cyan : Asym Gaus1
Dashed Green : Asym Gaus2
Solid Red : Signal PDF



Signal PDF : **f1** * $Gaus(m,\sigma)$ + **f2** * $BifurGaus1(m,\sigma_{1L},\sigma_{1R})$ + **f3** * $BifurGaus2(m,\sigma_{2L},\sigma_{2R})$

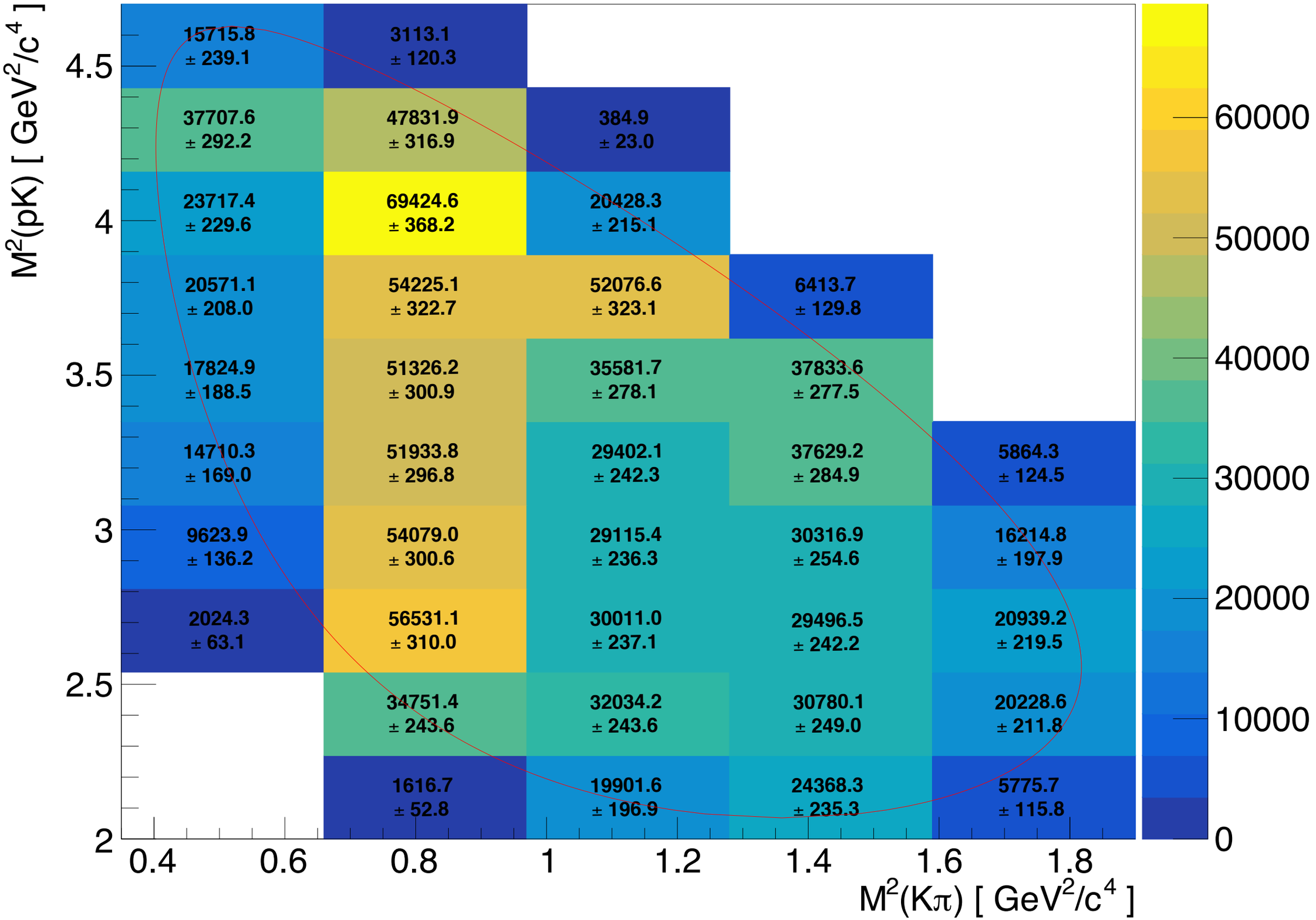
Yield ratio between f1, f2, f3 and Sigma ratio between σ, σ_{1LR}, σ_{2LR} are fixed for each bin.

Generic MC Fit Results $\Lambda_c^+ \to pK_s^0\pi^0$



Solid Blue : Signal
Dashed Green : Bkg
Solid Red : Total Fit

Extracted Signal Yields



Efficiency Corrected Yield

$\Lambda_c^+ \to pK_s^0\pi^0$

Generated signal events (from ccbar): 1,715,929

Efficiency corrected yield : 1,628,752 ± 16667

5.08% difference

Efficiency Corrected Yield

$\Lambda_c^+ \to pK_s^0\pi^0$ **PHOTOS Energy loss < 10MeV**

Generated signal events (from ccbar): ~~1,715,929~~ **1,713,618**

Efficiency corrected yield : 1,628,752 ± 16667

4.95% difference

Branching Fraction

$$\Gamma(\Lambda_c^+ \to pK_s^0\pi^0)/\Gamma(\Lambda_c^+ \to pK^-\pi^+)$$

GenHep table :
1,713,618 / 7,499,353 = **22.85%**

Efficiency corrected yield :
1,628,752 ± 16667 / 7,446,278 ± 12134 = **21.87 ± 0.23 %**

4.29% difference

back up