中国科学技术大学
University of Science and Technology of China

fit result of

$J/\psi \to \gamma\eta_c \to \gamma\pi^+\pi^-\pi^0K^+K^-$

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Preliminary Selection

- Charged track selection:
  - ✓ $|V_z| \leq 10cm$
  - ✓ $|V_r| \leq 1cm$
  - ✓ $|Cos(\theta)| \leq 0.93$
  - ✓ $N_{good} = 4 \;\&\&\; Q_{total} = 0$
- Photon selection:
  - ✓ $Barrel: (|Cos(\theta)| \leq 0.8) \;\&\&\; E_\gamma \geq 25MeV$
  - ✓ $Endcap: (0.86 \leq |Cos(\theta)| \leq 0.92) \;\&\&\; E_\gamma \geq 50MeV$
  - ✓ $Time\ of\ flight: 0ns \leq TDC \leq 700ns$
  - ✓ $Angle\ with\ the\ nearest\ track: \theta \geq 10^o$
  - ✓ $N_\gamma \geq 3$
- Particle identify:
  - ✓ $P(\pi) > P(K) \;\&\&\; P(\pi) > P(p)$
  - ✓ $P(K) > P(\pi) \;\&\&\; P(K) > P(p)$

Preliminary Selection

- Kinematic fit:
  - ✓ $ecms(GeV) = (0.034,0,0,3.097)$
  - ✓ $\chi^2 \leq 200$

- $\pi^0\ reconstruction$:
  - ✓ $ecms(GeV) = (0.034,0,0,3.097)$
  - ✓ $m_{\pi^0}(GeV) = 0.135(by\ iterating\ 2-gamma\ combinations)$
  - ✓ $\chi^2 \leq 200$

further selection criteria

- $\chi^2_{5C} \leq 50$
- $M_{\eta_c} > 2.8\ GeV/c^2$

Efficiency

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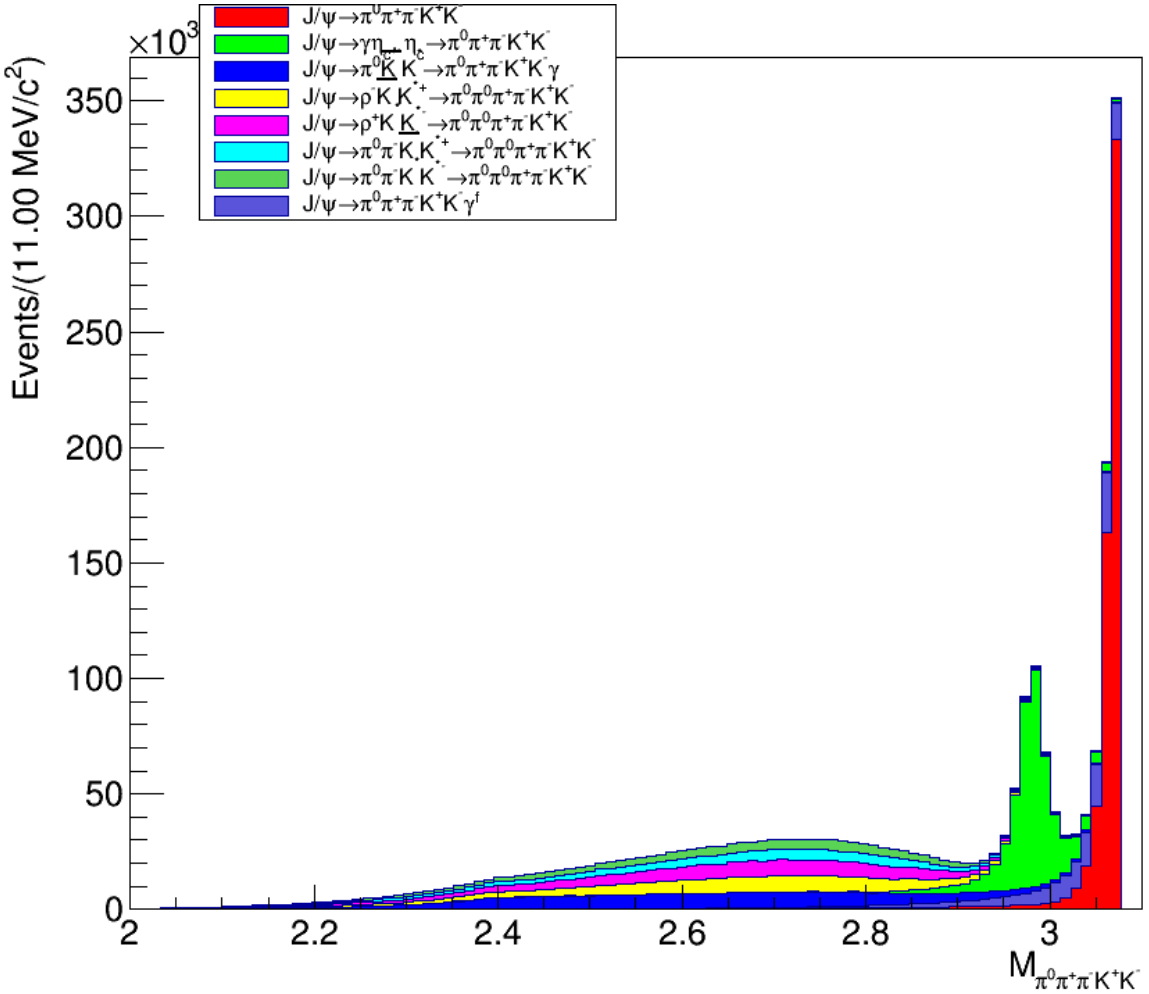
Criteria	events	Efficiency(%)	Relative efficiency(%)
SignalMC	2million	100	
$N_{good} = 4 \&\& Q_{total} = 0$	530044	26.50	26.50
$N_{\gamma} \geq 3$	313451	15.67	59.14
Pass Pid	284875	14.24	90.88
Vertex Fit	283105	14.16	99.38
Pass 4C	182538	9.13	64.48
Pass 5C	175281	8.76	96.02
5c cut	144296	7.21	82.32
Analysis area	141591	7.08	98.13

background study

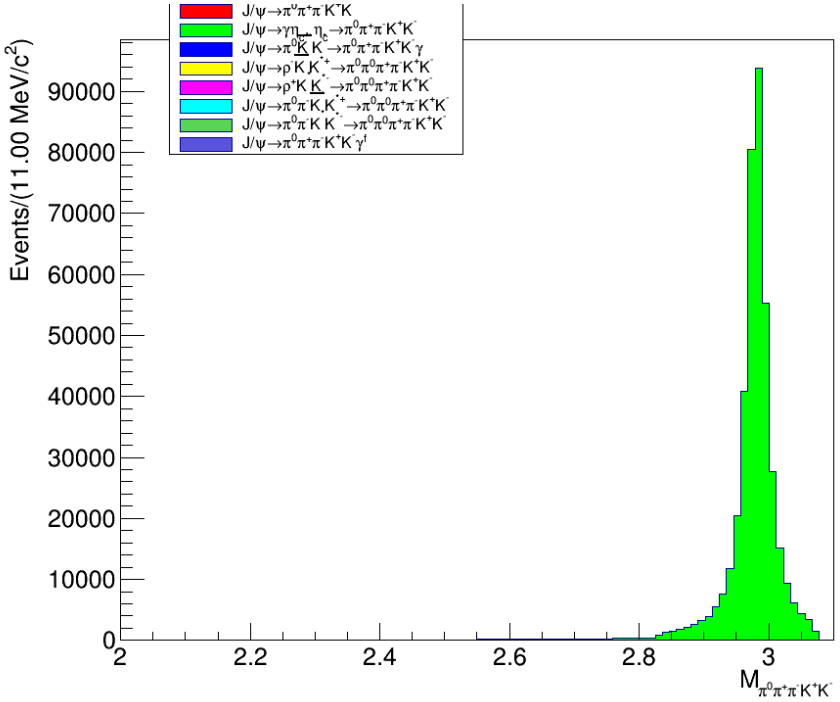
Table 1: Decay trees and their respective final states.

rowNo	decay tree	decay final state	iDcyTr	nEtr	nCEtr
1	$J/\psi \to \pi^0\pi^+\pi^-K^+K^-$	$\pi^0\pi^+\pi^-K^+K^-$	1	601618	601618
2	$J/\psi \to \eta_c\gamma, \eta_c \to \pi^0\pi^+\pi^-K^+K^-$	$\pi^0\pi^+\pi^-K^+K^-\gamma$	6	401887	1003505
3	$J/\psi \to \pi^0\pi^+\pi^-K^+K^-\gamma^f$	$\pi^0\pi^+\pi^-K^+K^-\gamma^f$	23	155705	1159210
4	$J/\psi \to \pi^+K^*K^{*-}, K^* \to \pi^-K^+, K^{*-} \to \pi^0K^-$	$\pi^0\pi^+\pi^-K^+K^-$	12	134682	1293892
5	$J/\psi \to \pi^-\bar{K}^*K^{*+}, \bar{K}^* \to \pi^+K^-, K^{*+} \to \pi^0K^+$	$\pi^0\pi^+\pi^-K^+K^-$	4	127444	1421336
6	$J/\psi \to \eta_c\gamma, \eta_c \to \pi^-\bar{K}^*K^{*+}, \bar{K}^* \to \pi^+K^-, K^{*+} \to \pi^0K^+$	$\pi^0\pi^+\pi^-K^+K^-\gamma$	0	101447	1522783
7	$J/\psi \to \eta_c\gamma, \eta_c \to \pi^+K^*K^{*-}, K^* \to \pi^-K^+, K^{*-} \to \pi^0K^-$	$\pi^0\pi^+\pi^-K^+K^-\gamma$	3	101122	1623905
8	$J/\psi \to \eta_c\gamma, \eta_c \to \pi^0K^*\bar{K}^*, K^* \to \pi^-K^+, \bar{K}^* \to \pi^+K^-$	$\pi^0\pi^+\pi^-K^+K^-\gamma$	44	74504	1698409
9	$J/\psi \to \pi^0K^*\bar{K}^*\gamma, K^* \to \pi^-K^+, \bar{K}^* \to \pi^+K^-$	$\pi^0\pi^+\pi^-K^+K^-\gamma$	5	74095	1772504
10	$J/\psi \to \rho^-\bar{K}^*K^{*+}, \rho^- \to \pi^0\pi^-, \bar{K}^* \to \pi^+K^-, K^{*+} \to \pi^0K^+$	$\pi^0\pi^0\pi^+\pi^-K^+K^-$	18	56863	1829367
11	$J/\psi \to \rho^+K^*K^{*-}, \rho^+ \to \pi^0\pi^+, K^* \to \pi^-K^+, K^{*-} \to \pi^0K^-$	$\pi^0\pi^0\pi^+\pi^-K^+K^-$	8	56604	1885971
12	$J/\psi \to \pi^0K^*\bar{K}^*, K^* \to \pi^-K^+, \bar{K}^* \to \pi^+K^-$	$\pi^0\pi^+\pi^-K^+K^-$	14	55245	1941216

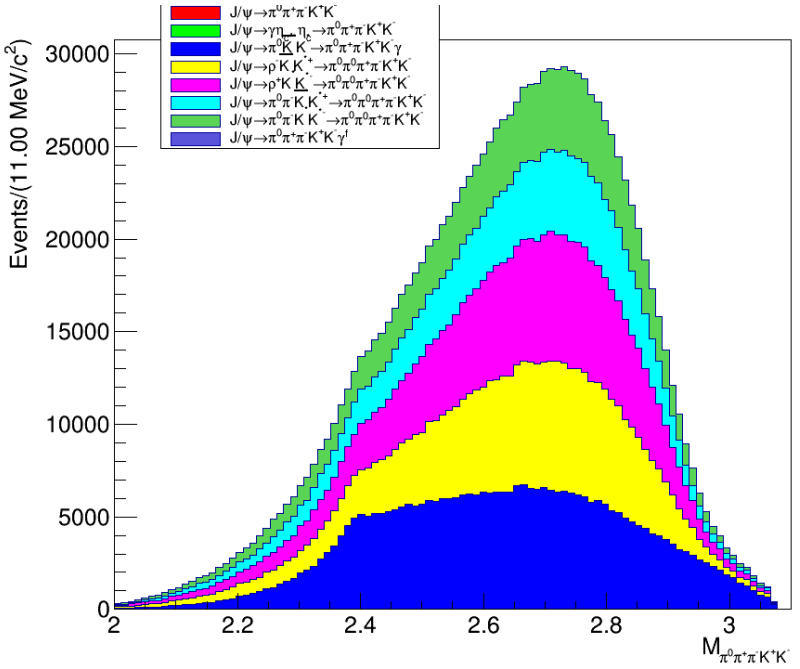
background study



background study

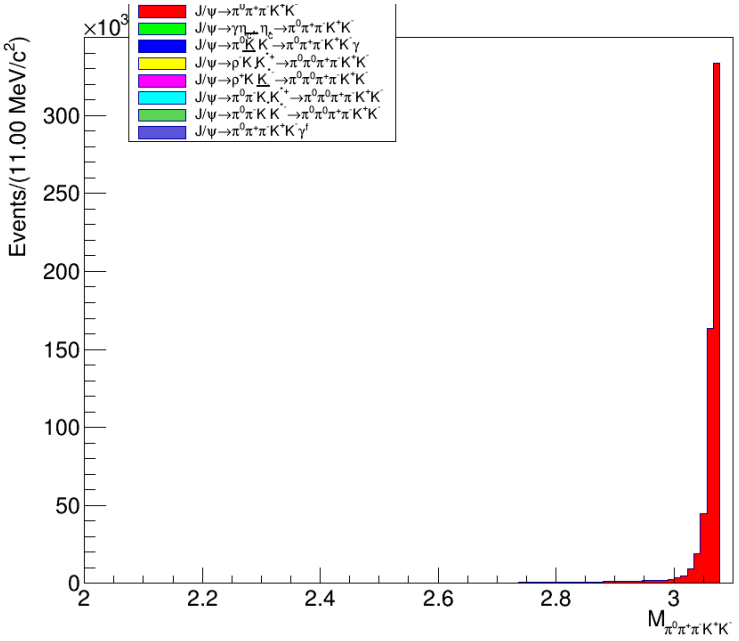


signal

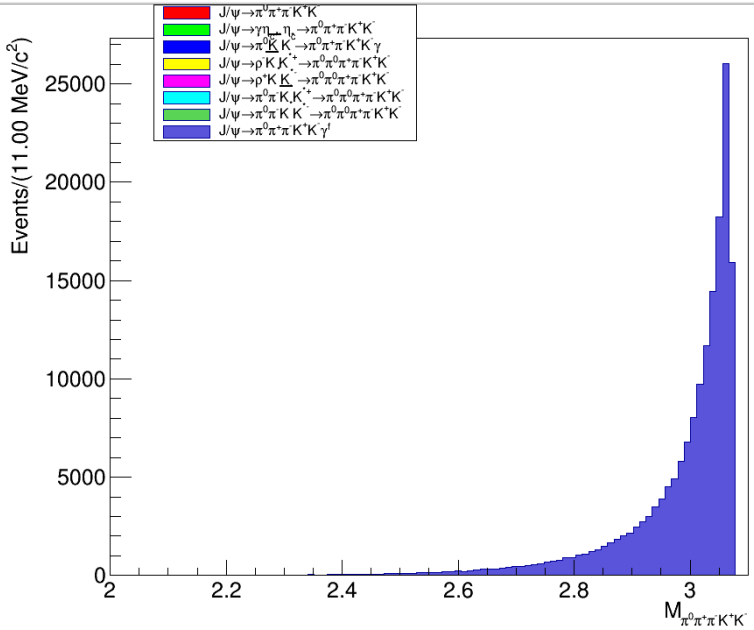


bkg3(bump bkg)

background study



bkg1($J/\psi \rightarrow anything \rightarrow KK3\pi$)

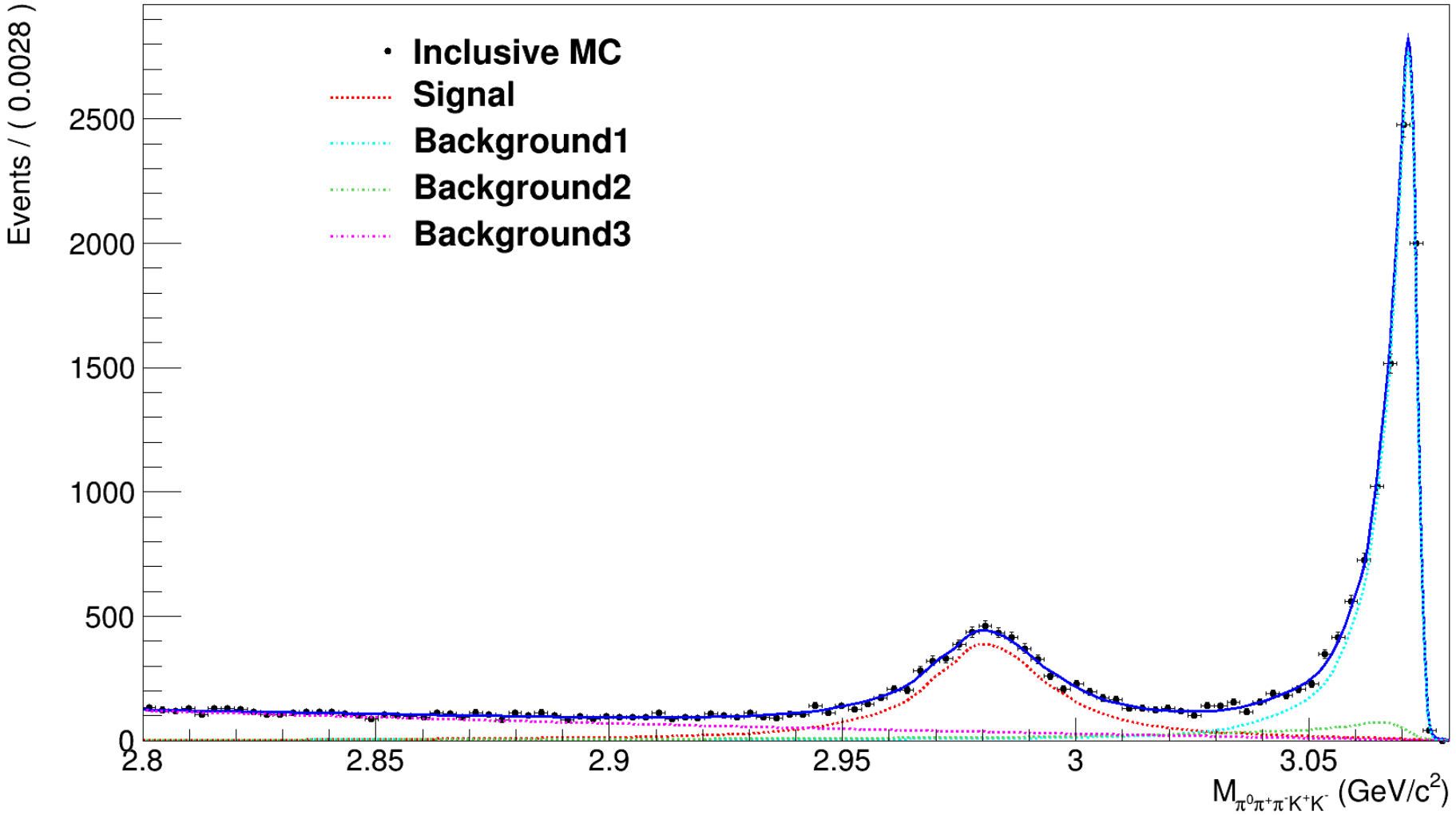


bkg2($J/\psi \rightarrow anything \rightarrow KK3\pi\gamma^f$)

fit method

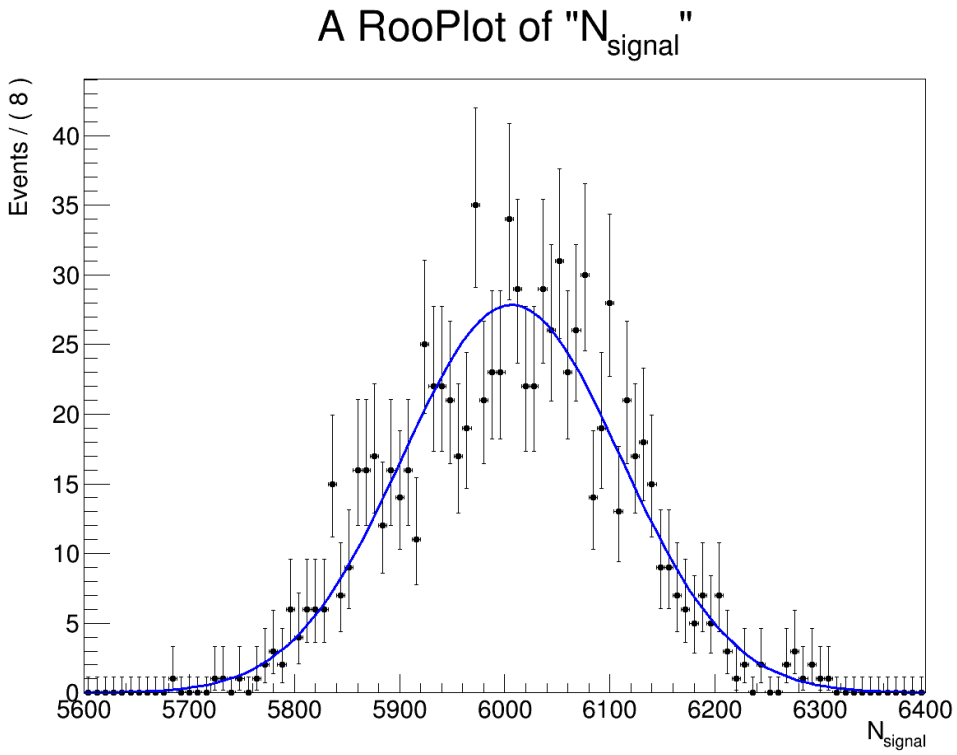
- Signal: MC shape convolute gauss
- bkg1($J/\psi \rightarrow anything \rightarrow KK3\pi$) : MC shape convolute gauss
- bkg2($J/\psi \rightarrow anything \rightarrow KK3\pi\gamma^{f}$) : MC shape convolute gauss
- bkg3(bump background) : argus distribution

fit result of inclusiveMC



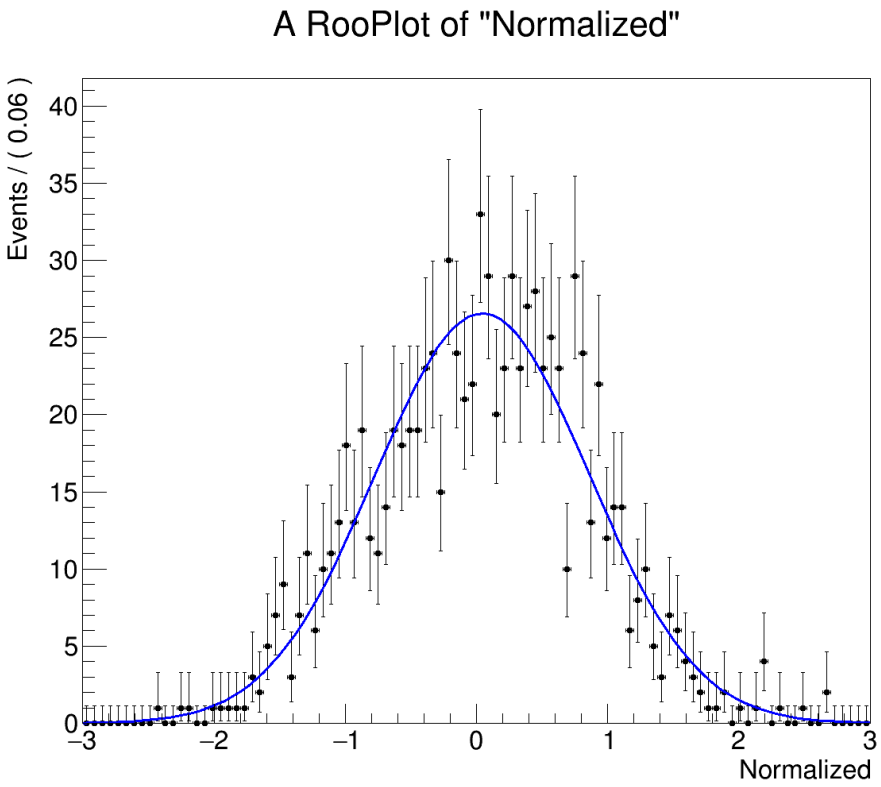
IOcheck of fitting Inclusive MC

- 1000 arbitrary examples containing known signal number of 6000 and background number 16888 based on BR in inclusive MC.
- at most 100 iterates in each fit.
- fit result : 6006 ± 3.456



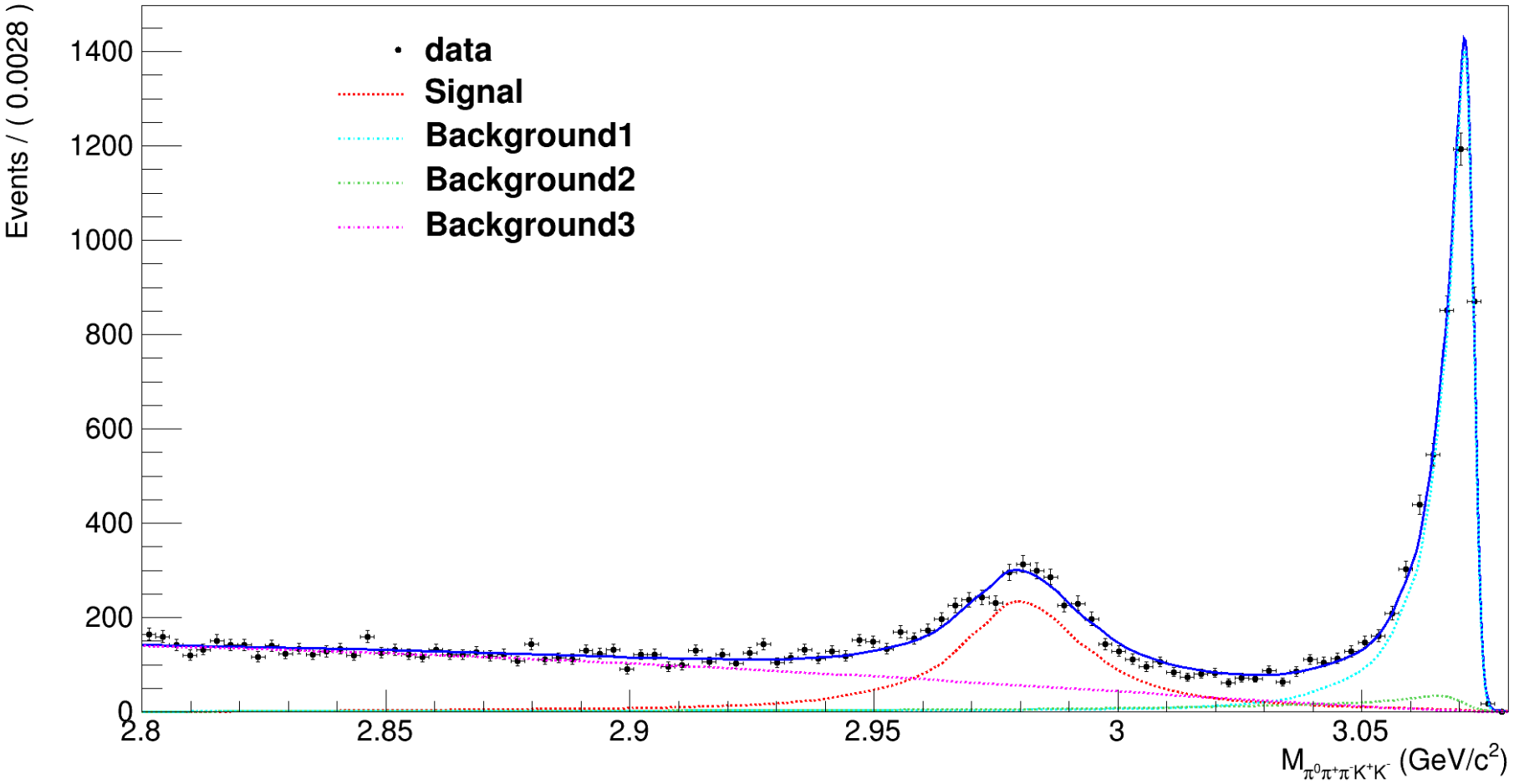
pull distribution

- normalized result:
  - mean: 0.0448 ± 0.0271
  - sigma:0.816 ± 0.0194



fit result of data

- a small example of data



to do next

- similar fit method will be used in $J/\psi \rightarrow \gamma\eta_c \rightarrow \gamma\omega\phi$

Thanks!

Here starts backup

signalmc dec


```
Decay J/psi
  1.000  gamma  eta_c     JPE ;
Enddecay

Decay eta_c
  1.000 K+ K- pi+ pi- pi0                  PHSP;
Enddecay

Decay pi0
  1.000  gamma gamma       PHSP;
Enddecay

End
```

details of fit result of inclusiveMC example