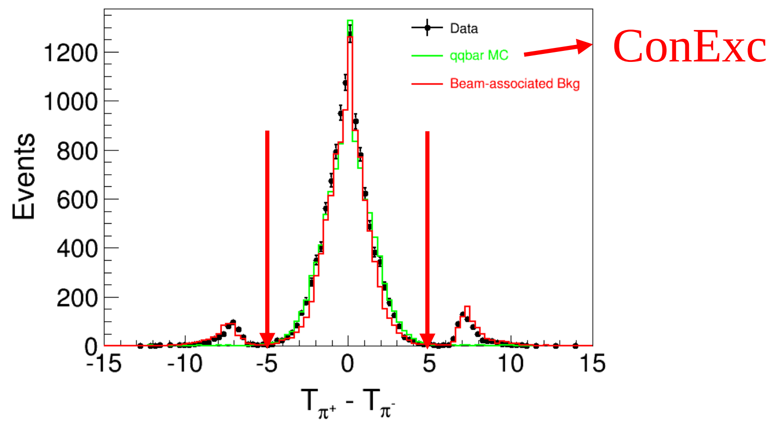
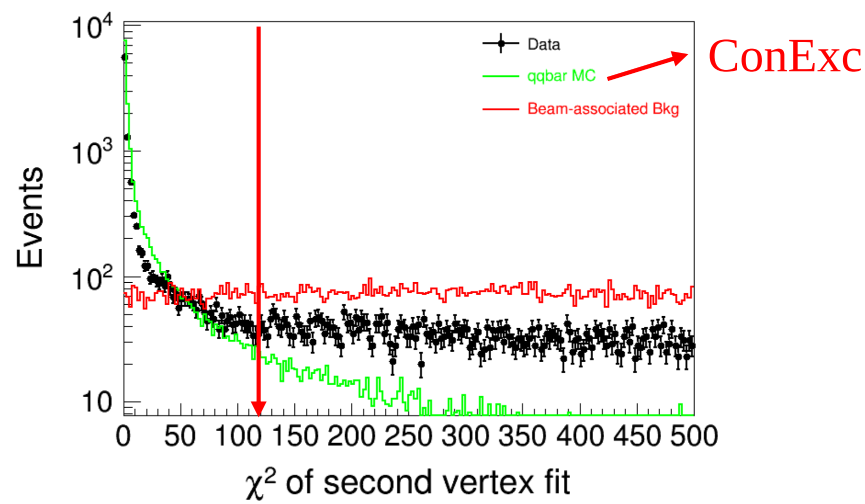
Ks cut criteria

- ✓ Track selection
  - ➢ |Vr|< 10cm, |Vz|<30cm
- ✓ PID: Prob π > Prob K and Prob π > Prob P

  $N_{\pi+}$ >=1 and $N_{\pi-}$ >=1
- ✓ Second vertex fitting: $L/\sigma_L > 2.0$



✓ Remove the cosmic rays: $|T(\pi^+) - T(\pi^-)| < 5$



✓ Remove the beam-associated backgrounds: χ^2(second vertex fit) < 120

1, Ks efficiency differences

Here, MSTJ(21) = 0

Table 18: K_S^0 efficiencies (%) vary with momentum in different MC models.

p(GeV)	$\varepsilon(K_S^0)$ from ConExc	$\varepsilon(K_S^0)$ from Lundalw	Uncertainty
0.0-0.1	30.3	31.9	-5.4
0.1-0.2	39.8	39.8	-0.1
0.2-0.3	44.3	44.8	-1.2
0.3-0.4	45.3	46.4	-2.4
0.4-0.5	48.2	48.7	-1.1
0.5-0.6	45.3	50.5	-11.5
0.6-0.7	43.4	49.4	-13.8
0.7-0.8	44.3	55.2	-24.5
0.8-0.9	49.6	57.7	-16.3
0.9-1.0	55.8	53.1	4.7
1.0-1.1	52.8	57.3	-8.6
1.1-1.2	47.8	45.3	5.3
1.2-1.3	62.6	12.3	80.4
1.3-1.4	81.8	0.6	99.3

Ks truth events using different MSTJ(21) parameters (1M MC)

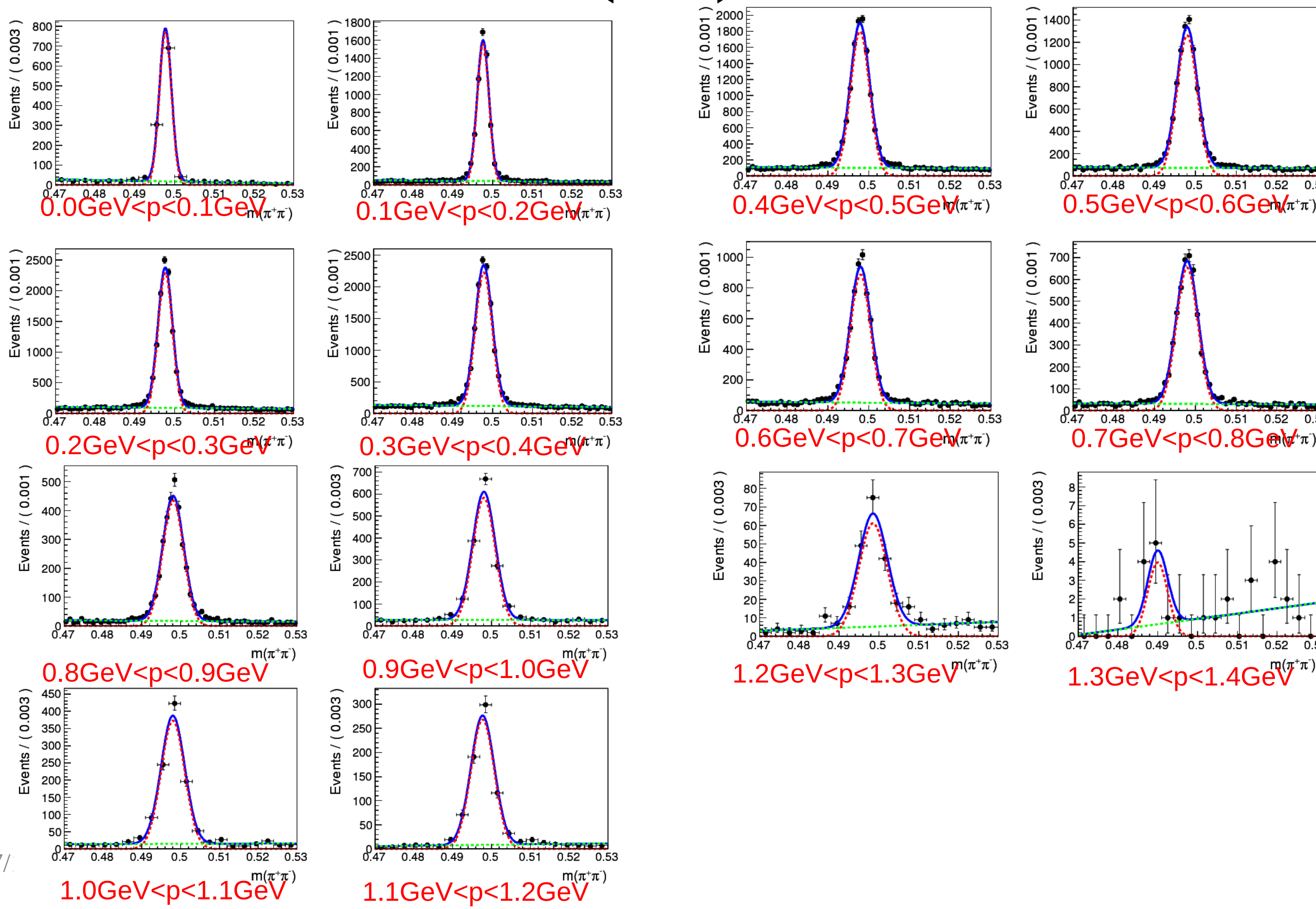
MSTJ(21) = 0

MSTJ(21) = 2

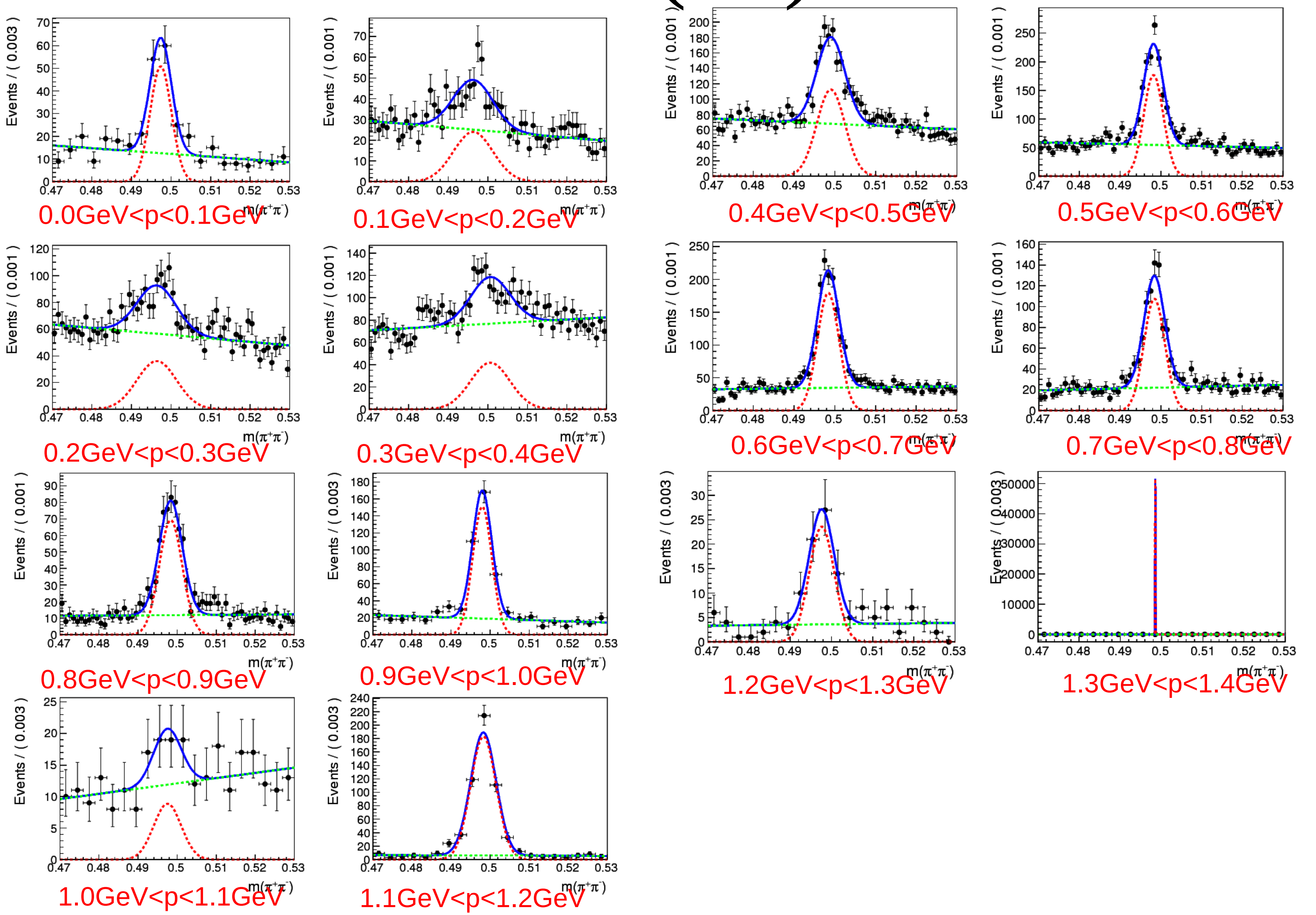
Table 20: K_S^0 truth events using different MSTJ(21) parameters.

p(GeV)	Events in Lundalw(0)	Events in Lundalw(2)
0.0-0.1	3098	0
0.1-0.2	14703	0
0.2-0.3	23387	134
0.3-0.4	26025	277
0.4-0.5	21816	1216
0.5-0.6	15705	1639
0.6-0.7	11183	1821
0.7-0.8	7979	1209
0.8-0.9	5099	778
0.9-1.0	2668	534
1.0-1.1	1657	61
1.1-1.2	1499	710
1.2-1.3	588	73
1.3-1.4	0	0

Ks mass distribution with MSTJ(21) = 0

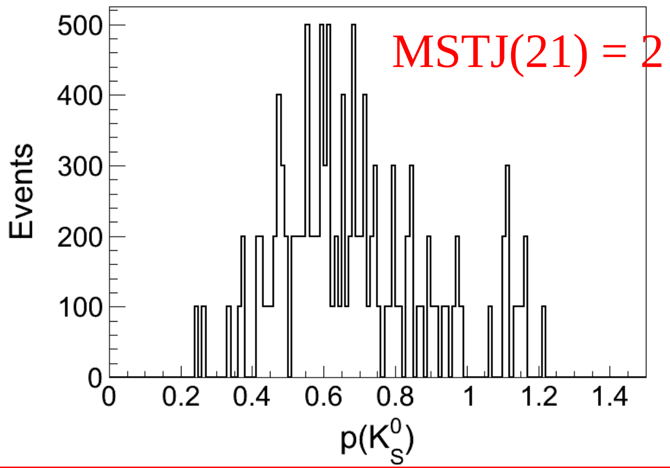


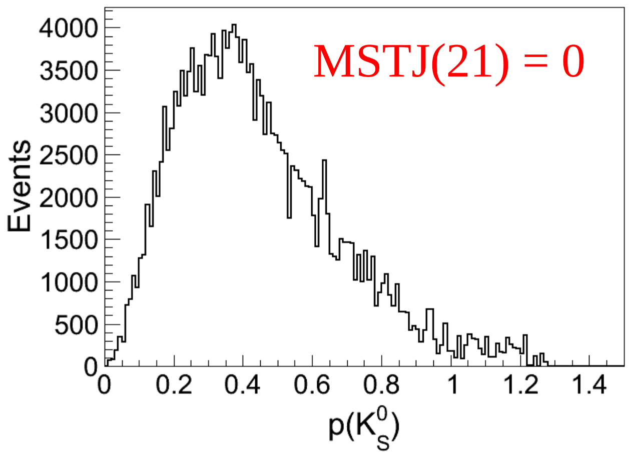
Ks mass distribution with MSTJ(21) = 2



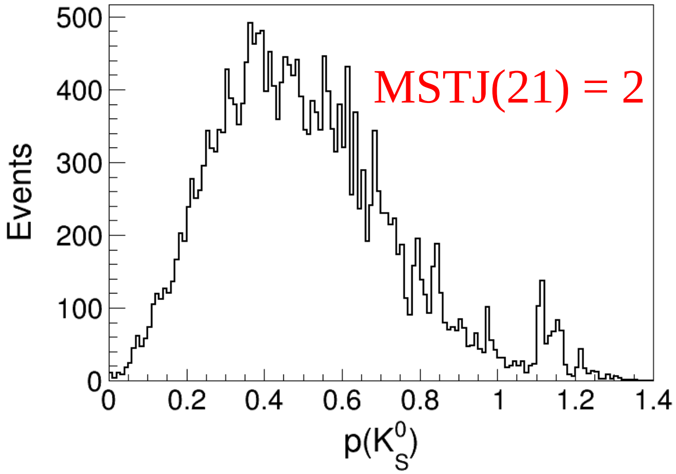
Ks momentum in truth level and detect level

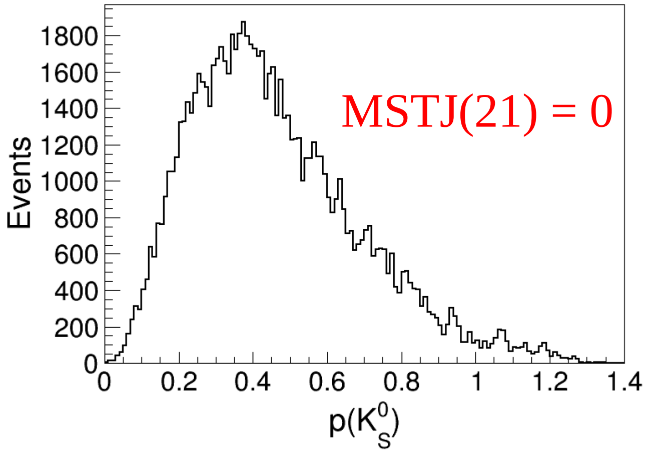
Ks momentum in truth level:





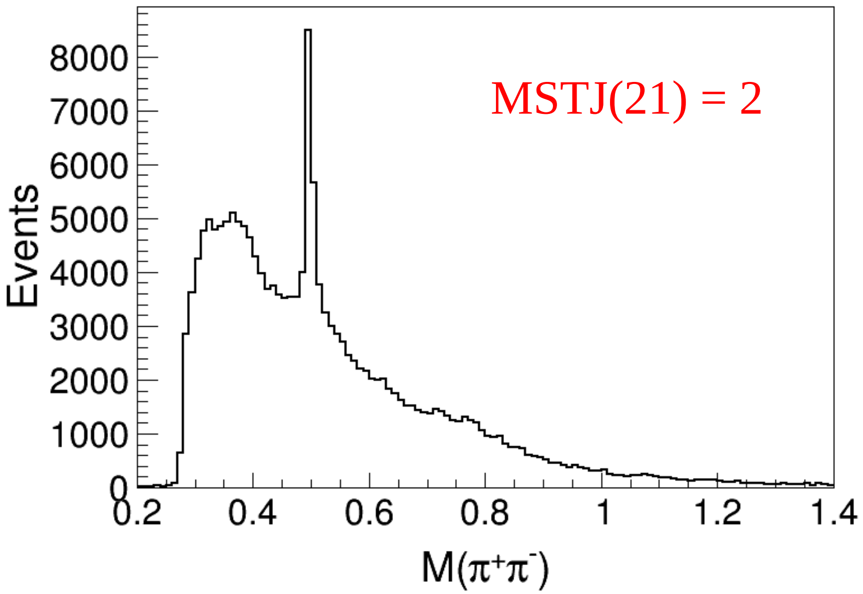
Ks momentum in detect level:

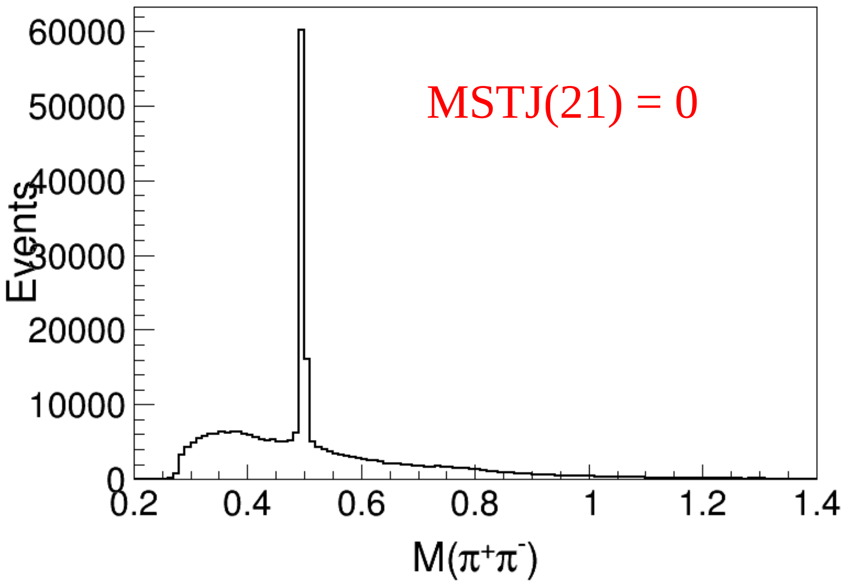




Ks mass in detect level

Ks mass in detect level:





2, Hadron efficiency differences

- Hadronic event selection efficiency:

  74.3% (Here, the generator is Lundalw, and MSTJ(21) = 2, Gao zhen's efficiency is 72.7%)

  82.9% (Here, the generator is Lundalw, and MSTJ(21) = 0)

  72.8% (Here, the generator is ConExc, and Gao Zhen's efficiency is 72.7%)

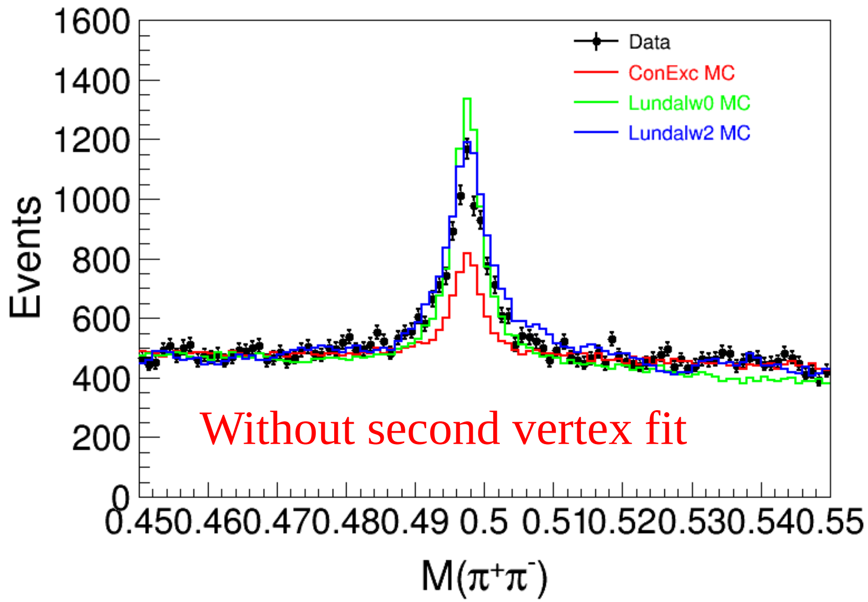
Cut flow for hadronic event selection:

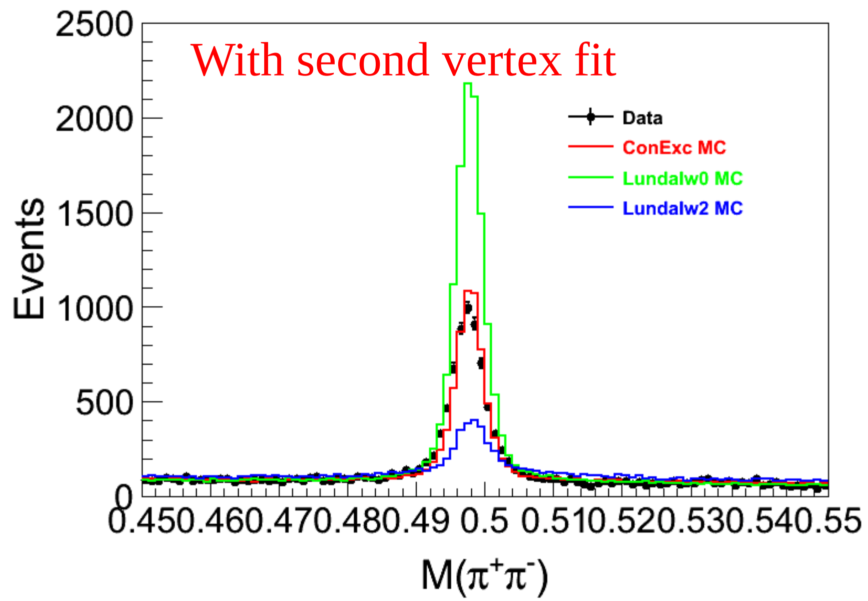
MSTJ(21) = 0 MSTJ(21) = 2

Table 19: Hadron efficiencies (%) using different Lundalw parameters.

Cut criteria	Lundalw(0)		Lundalw(2)		ε differences
	Events	$\varepsilon(hadron)$	Events	$\varepsilon(hadron)$	
Total events	200000	-	200000	-	-
$\lvert\theta_1+\theta_2-180^\circ\rvert<10^\circ$ and $E>0.65*E_{beam}$	199986	99.99	199960	99.98	0.01
N_{good} >= 2	179987	90.00	163270	81.65	8.35
$N_{good}=2$	44845	-	40771	-	-
$\lvert\theta_1+\theta_2-180^\circ\rvert<15^\circ$ and $\lvert\lvert\phi_1-\phi_2\rvert-180^\circ\rvert<10^\circ$	43104	96.11	39608	97.15	-1.04
$N_{Isolated}>=2$	34086	79.08	28938	73.06	6.02
	169228	94.02	151437	92.75	1.27
$N_{good}=3$	45524	-	38322	-	-
$\lvert\theta_1+\theta_2-180^\circ\rvert<15^\circ$ and $\lvert\lvert\phi_1-\phi_2\rvert-180^\circ\rvert<10^\circ$	43692	95.98	36801	96.03	-0.05
$N_{eop}>1$	42600	97.50	35952	97.69	-0.19
$N_{ProbE}>1$	42223	99.11	35592	99.00	-0.11
	165927	98.05	148707	98.20	-0.15
Finally Efficiency	165927	82.96	148707	74.35	8.61

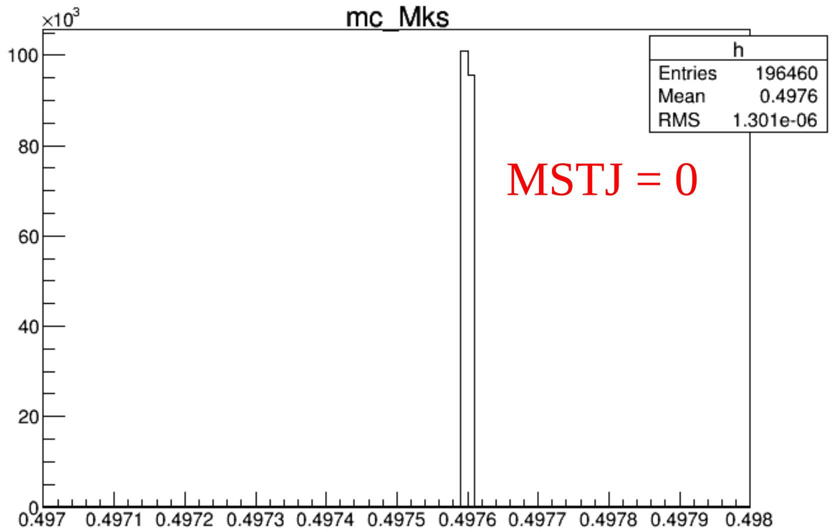
Ks mass distribution

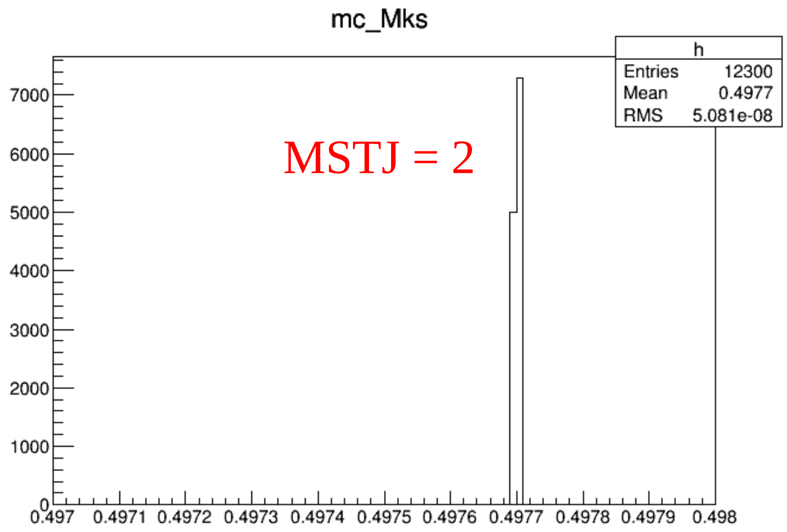


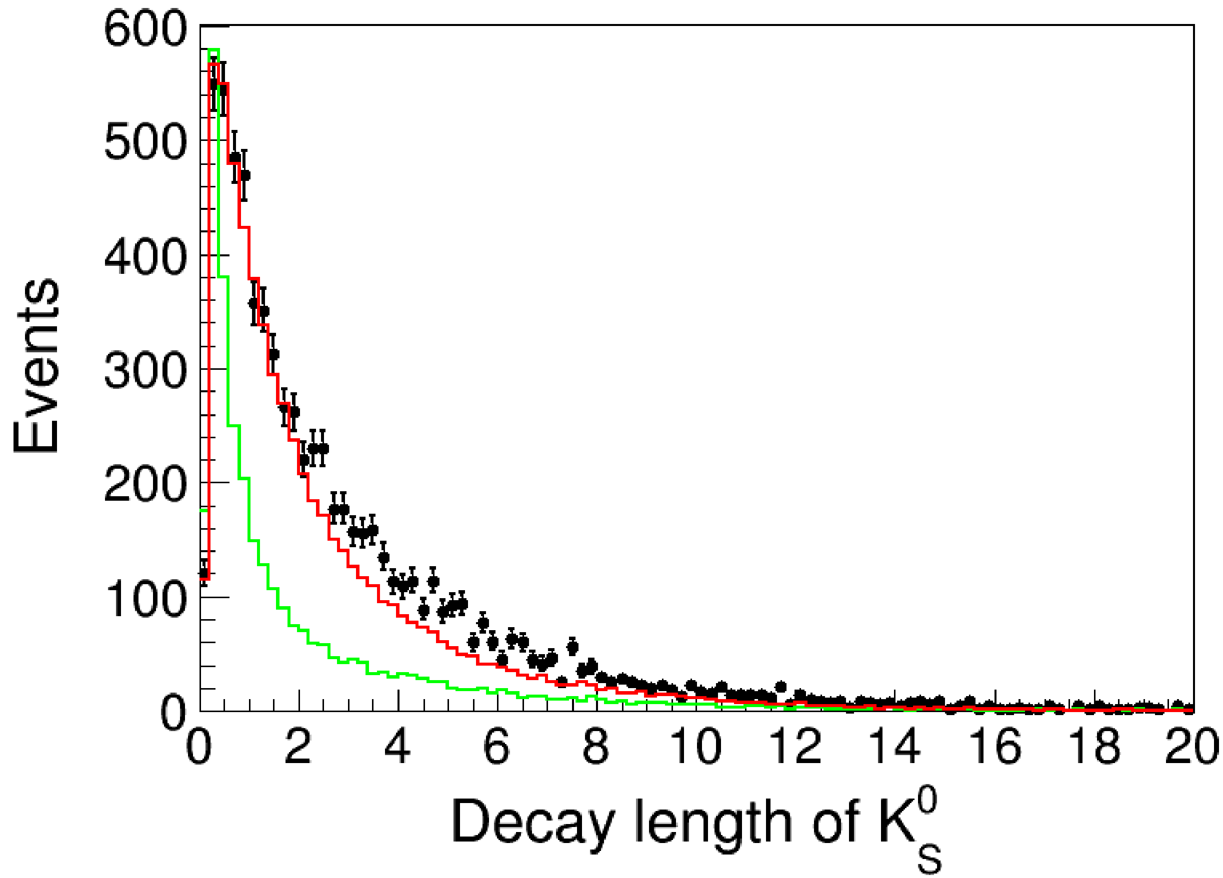


For the invariant mass distribution of Ks, the left plot show the result without second vertex fit and the right one using the second vertex fit.

Lundalw0 means lundalw generator with MSTJ(21) = 0
and Lundalw2 means lundalw generator with MSTJ(21) = 2

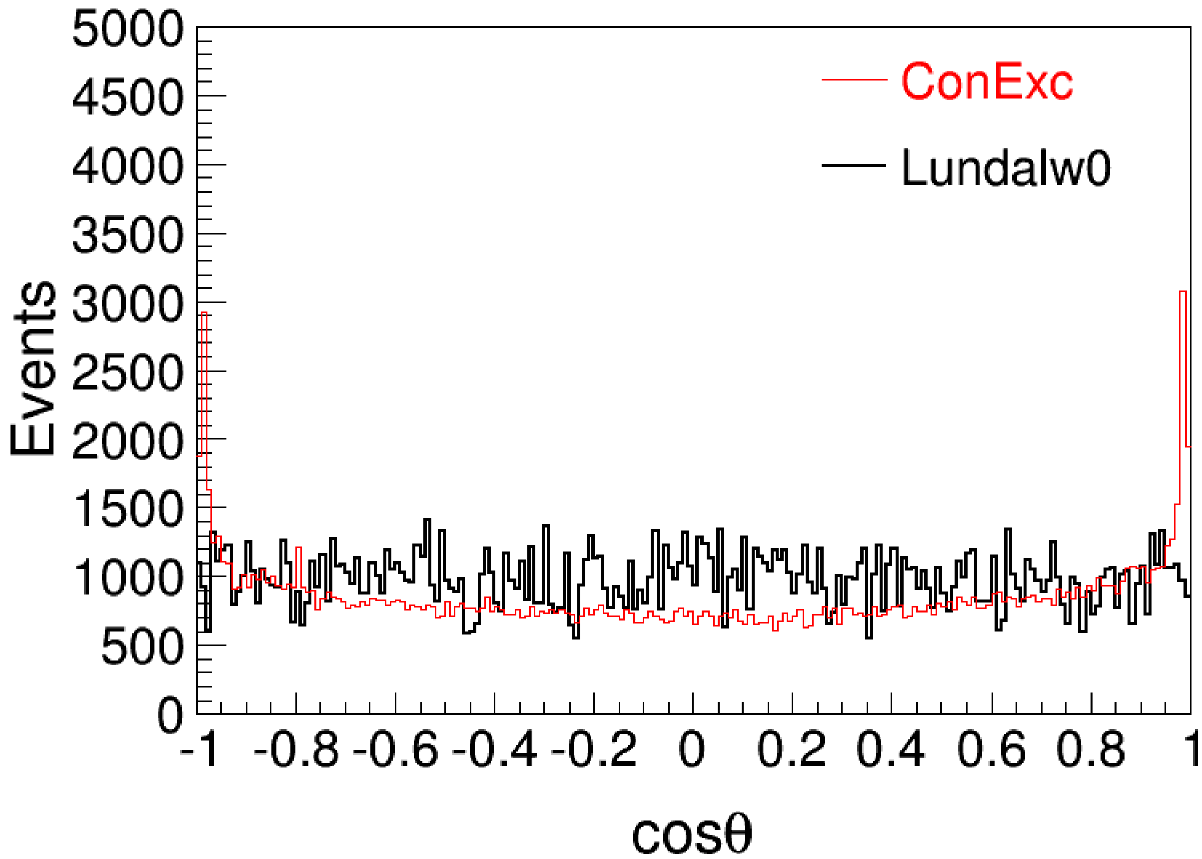

mc_Mks
×10³
h
Entries 196460
Mean 0.4976
RMS 1.301e-06
MSTJ = 0
0.497 0.4971 0.4972 0.4973 0.4974 0.4975 0.4976 0.4977 0.4978 0.4979 0.498


mc_Mks
h
Entries 12300
Mean 0.4977
RMS 5.081e-08
MSTJ = 2
0.497 0.4971 0.4972 0.4973 0.4974 0.4975 0.4976 0.4977 0.4978 0.4979 0.498

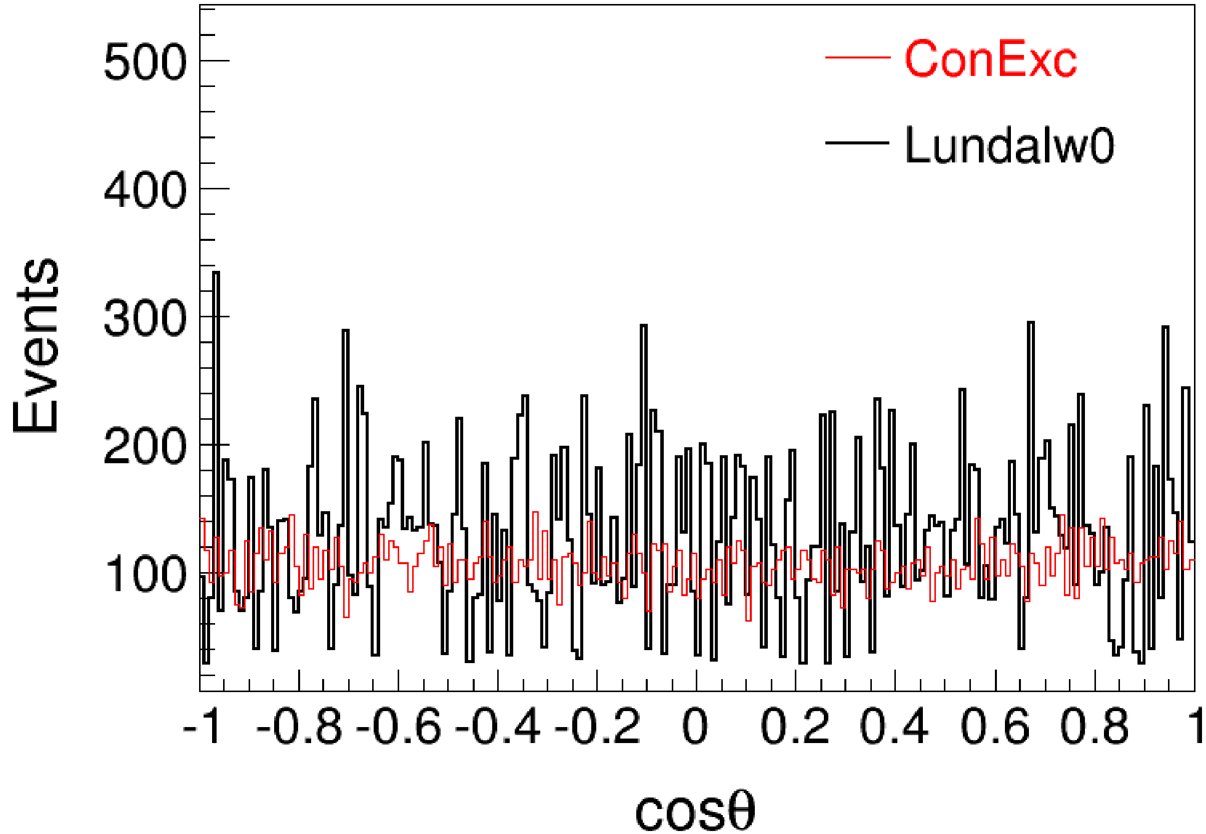


Events
600
500
400
300
200
100
0
0
2
4
6
8
10
12
14
16
18
20
Decay length of K_S^0

Costheta distribution

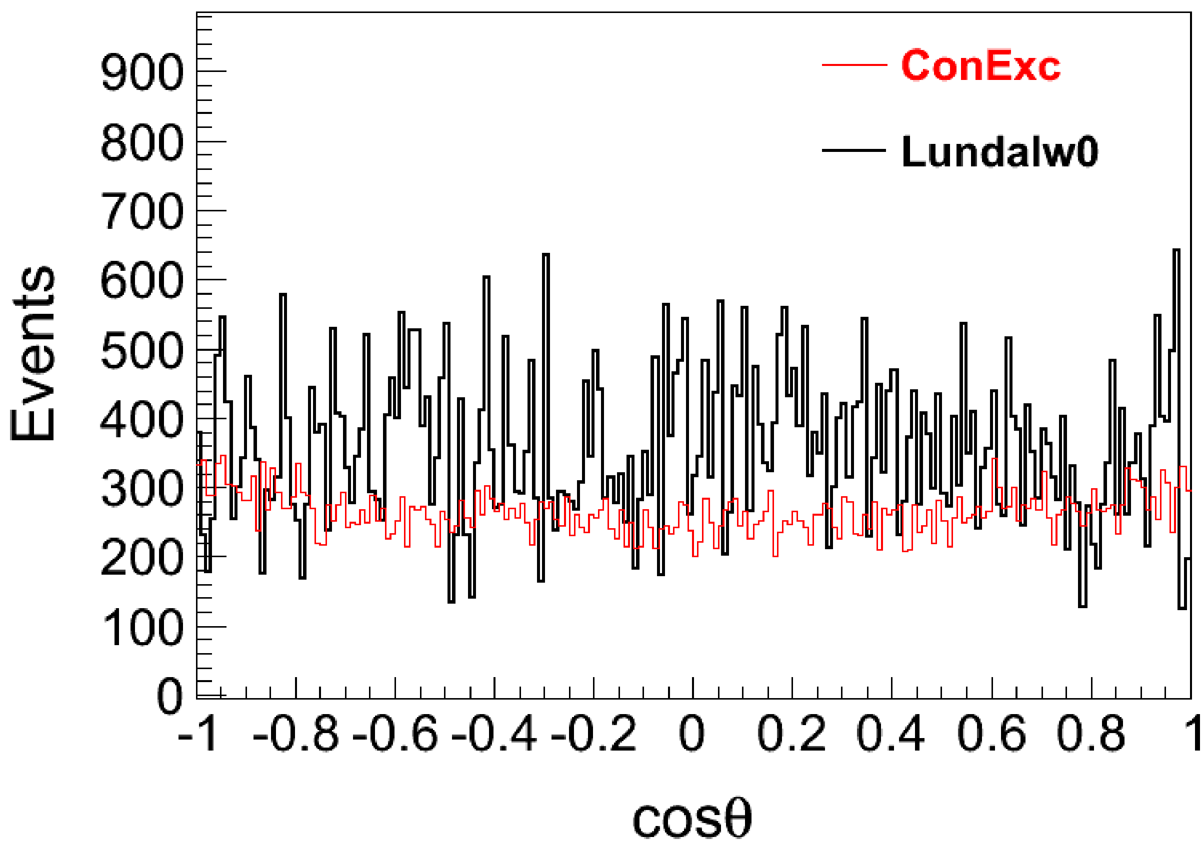


0-0.2



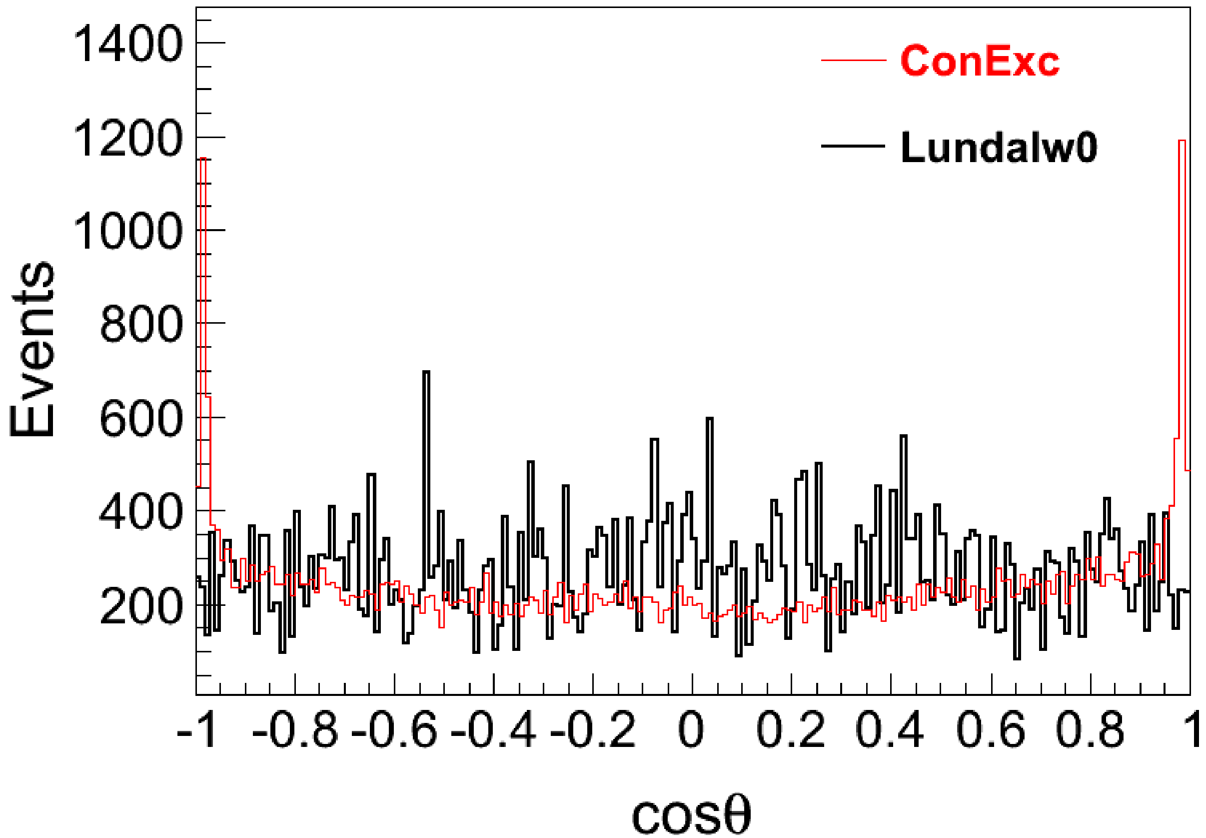
ConExc
Lundalw0
Events
500
400
300
200
100
-1
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1
cosθ

0.2-0.4

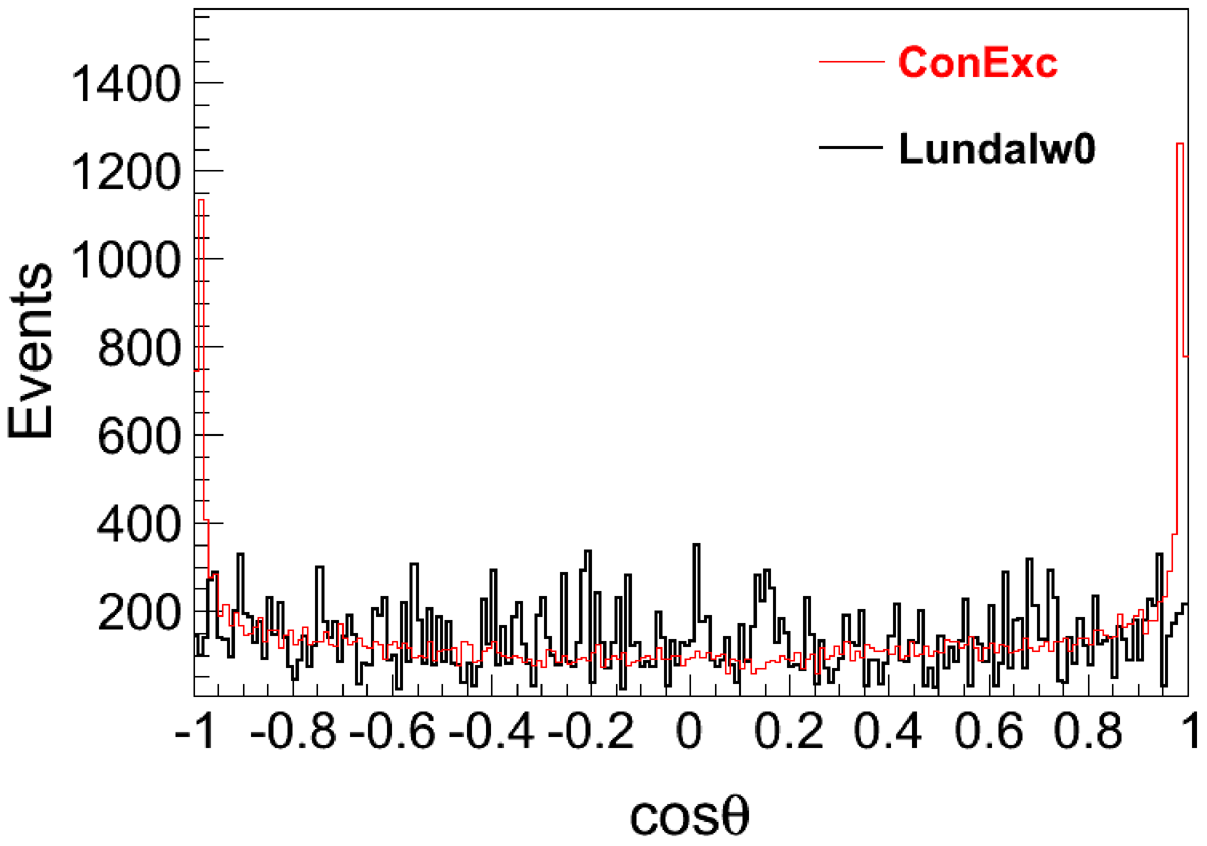


ConExc
Lundalw0
Events
cosθ
0
100
200
300
400
500
600
700
800
900
-1
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1

0.4-0.6

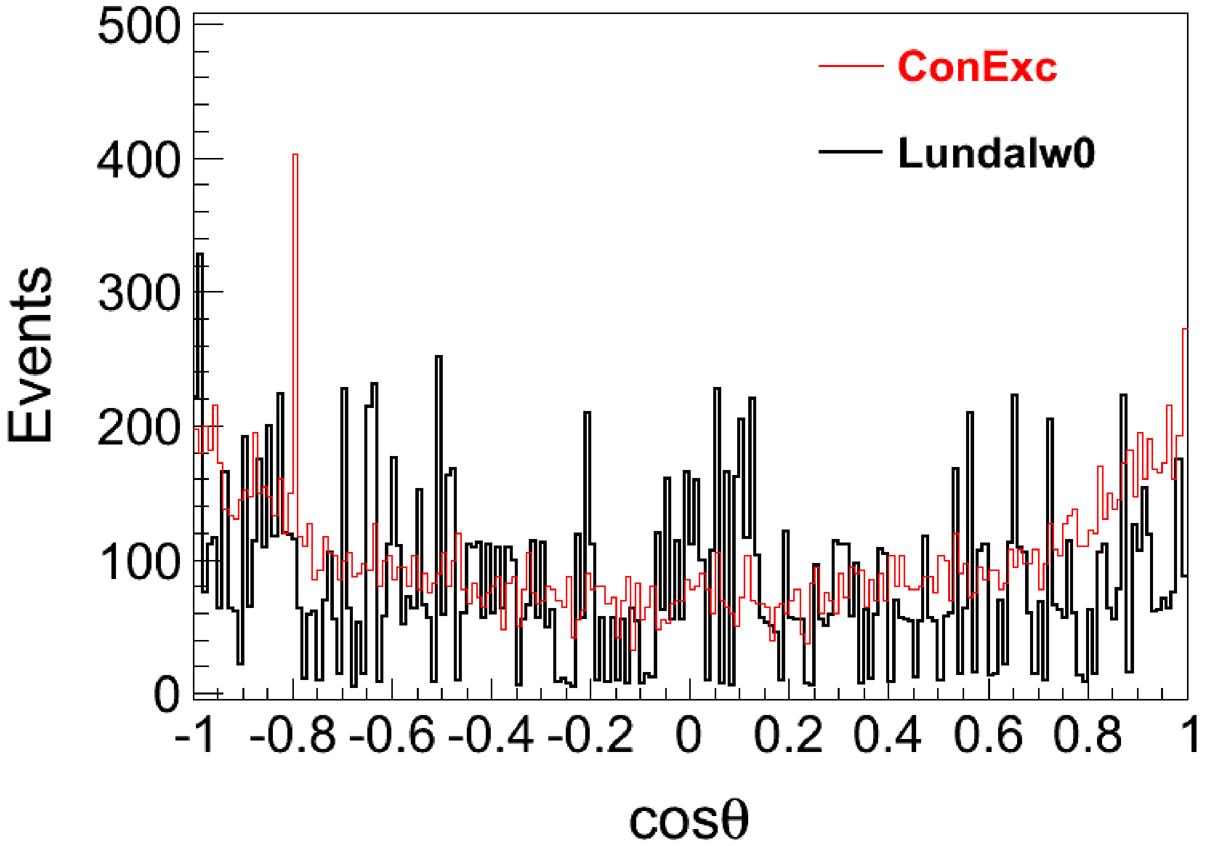

ConExc
Lundalw0
Events
1400
1200
1000
800
600
400
200
-1
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1
cosθ

0.6-0.8



ConExc
Lundalw0
Events
1400
1200
1000
800
600
400
200
-1
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1
cosθ

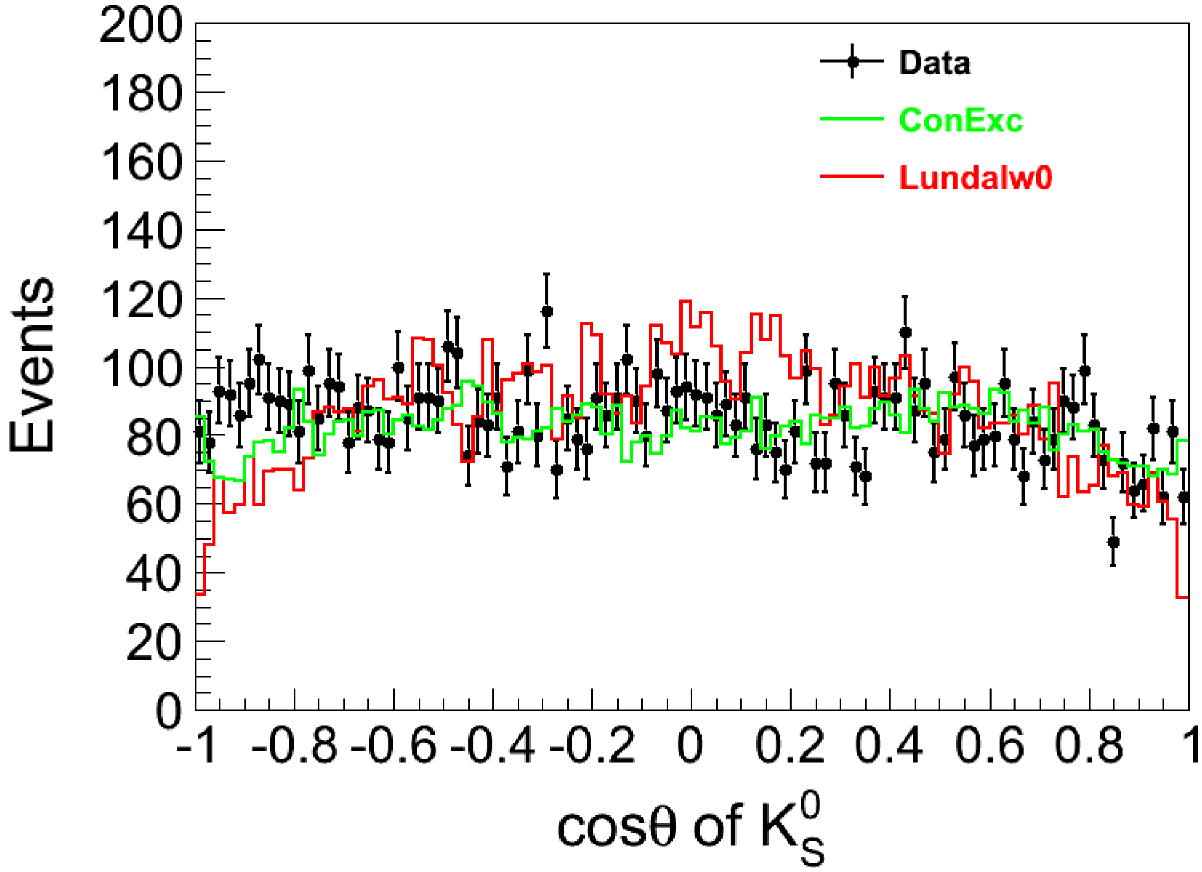
0.8-1.5



ConExc
Lundalw0
Events
500
400
300
200
100
0
-1
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1
cosθ

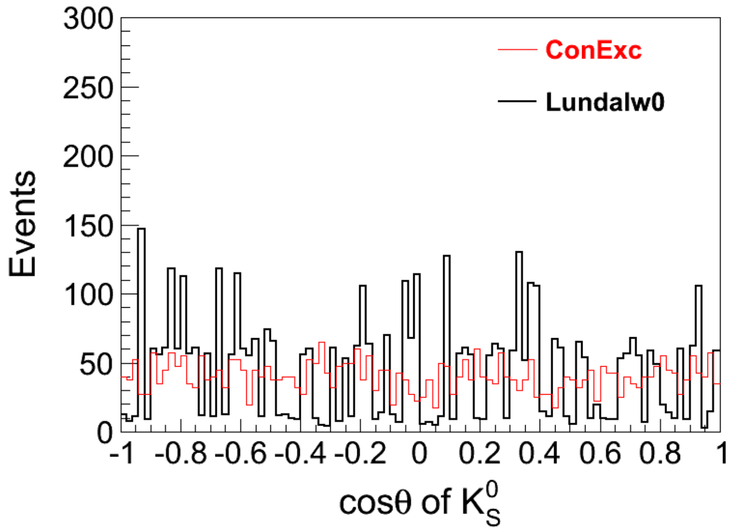
Table 19: Hadron efficiencies (%) using different Lundalw parameters.

Cut criteria	ConExc		Lundalw(0)		Lundalw(2)		ε diff
	Events	$\varepsilon(hadron)$	Events	$\varepsilon(hadron)$	Events	$\varepsilon(hadron)$	
Total events	200000	-	200000	-	200000	-	-
$N_{good}>=1$(No cut)	190099	95.05	195275	97.64	185678	92.84	4.8
$\|\theta_1+\theta_2-180^\circ\|<10^\circ$ and $E>0.65*E_{beam}$	199937	99.97	199986	99.99	199960	99.98	0.01
$N_{good}>=2$	164894	82.47	179987	90.00	163270	81.65	8.35
$N_{good}=2$	54850	-	44845	-	40771	-	-
$\|\theta_1+\theta_2-180^\circ\|<15^\circ$ and $\|\|\phi_1-\phi_2\|-180^\circ\|<10^\circ$	52805	96.27	43104	96.11	39608	97.15	-1.04
$N_{Isolated}>=2$	38316	72.56	34086	79.08	28938	73.06	6.02
	148360	89.97	169228	94.02	151437	92.75	1.27
$N_{good}=3$	38313	-	45524	-	38322	-	-
$\|\theta_1+\theta_2-180^\circ\|<15^\circ$ and $\|\|\phi_1-\phi_2\|-180^\circ\|<10^\circ$	36892	96.29	43692	95.98	36801	96.03	-0.05
$N_{eop}>1$	35959	97.45	42600	97.50	35952	97.69	-0.19
$N_{ProbE}>1$	35526	98.80	42223	99.11	35592	99.00	-0.11
	145573	98.12	165927	98.05	148707	98.20	-0.15
Finally Efficiency	145971	72.99	165927	82.96	148707	74.35	8.61

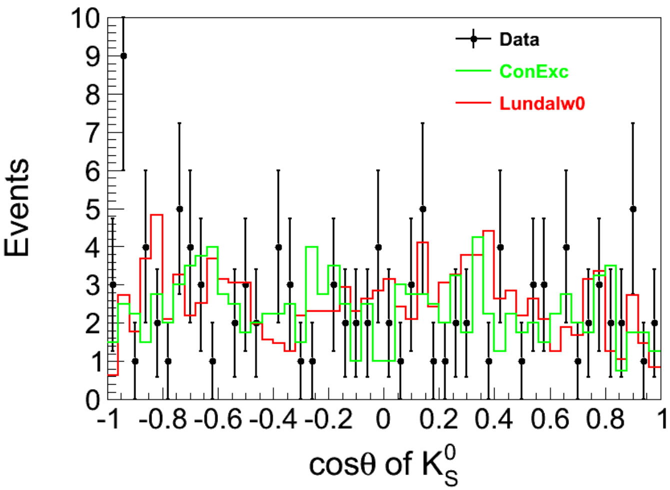


Events
cosθ of K_S^0
Data
ConExc
Lundalw0
200
180
160
140
120
100
80
60
40
20
0
-1
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1

0.0-0.1

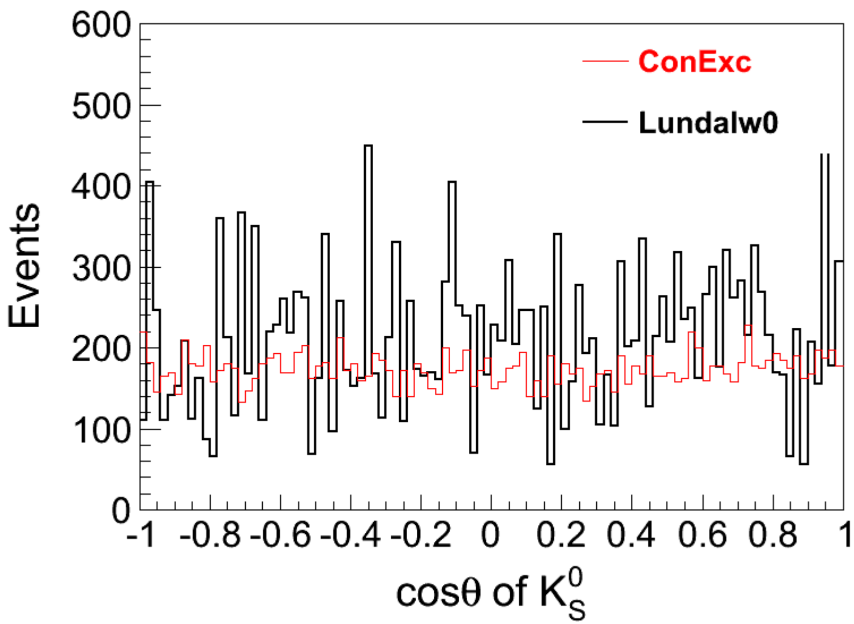


ConExc
Lundalw0
Events
cosθ of K_S^0

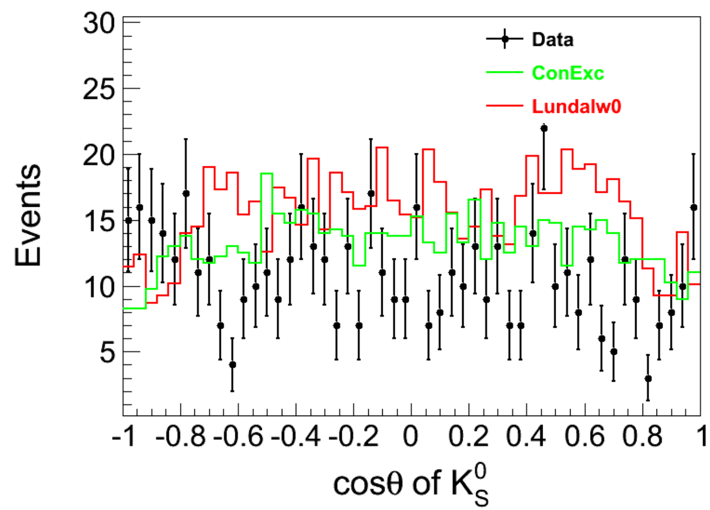


Data
ConExc
Lundalw0
Events
cosθ of K_S^0

0.1-0.2

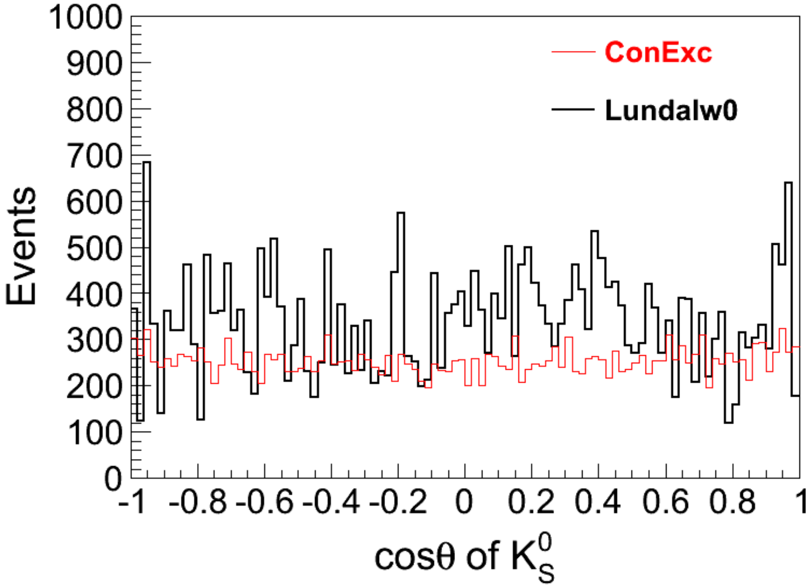


ConExc
Lundalw0
Events
cosθ of K_S^0

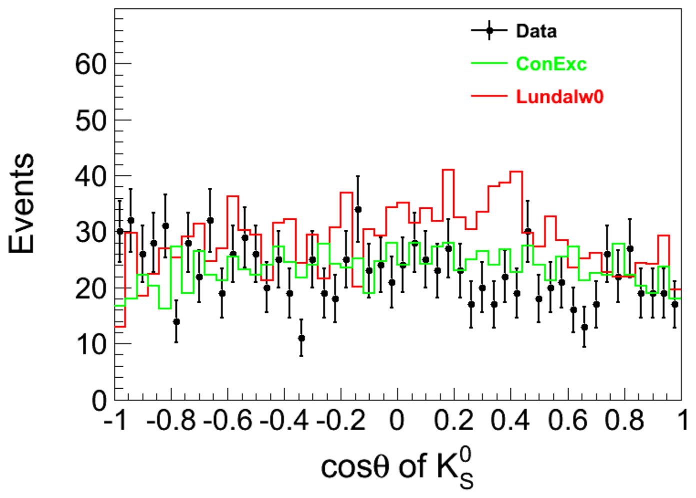


Data
ConExc
Lundalw0
Events
cosθ of K_S^0

0.2-0.3

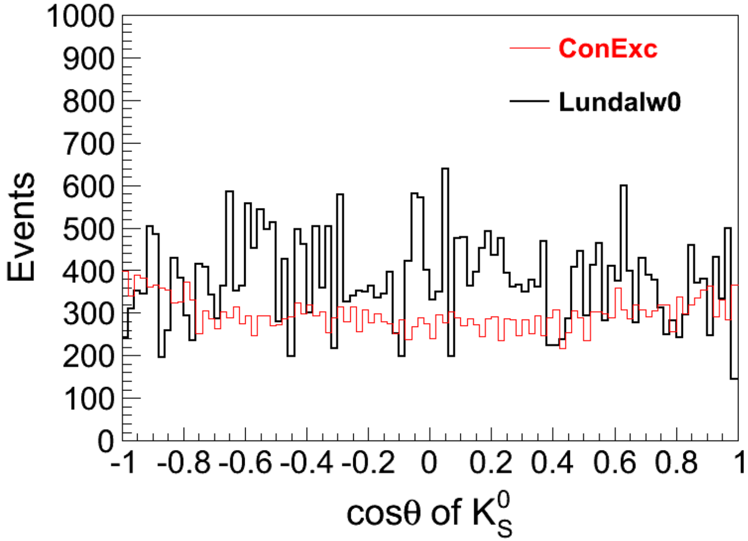


ConExc
Lundalw0
Events
$\cos\theta$ of K^0_S

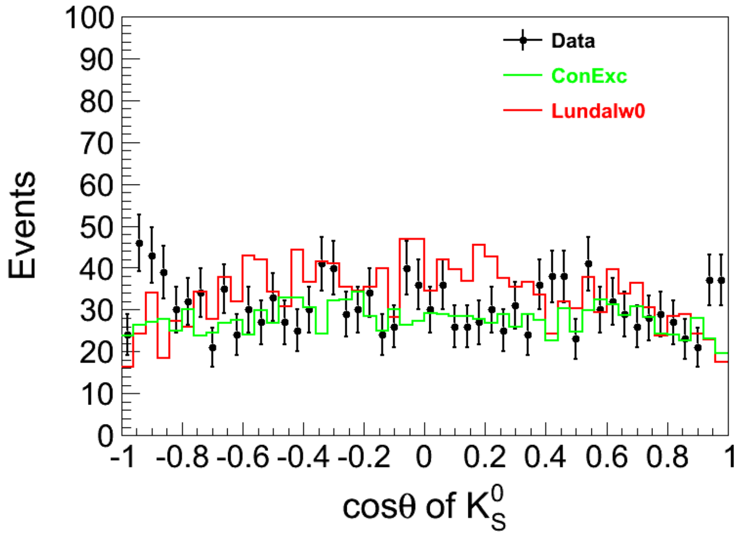


Data
ConExc
Lundalw0
Events
$\cos\theta$ of K^0_S

0.3-0.4

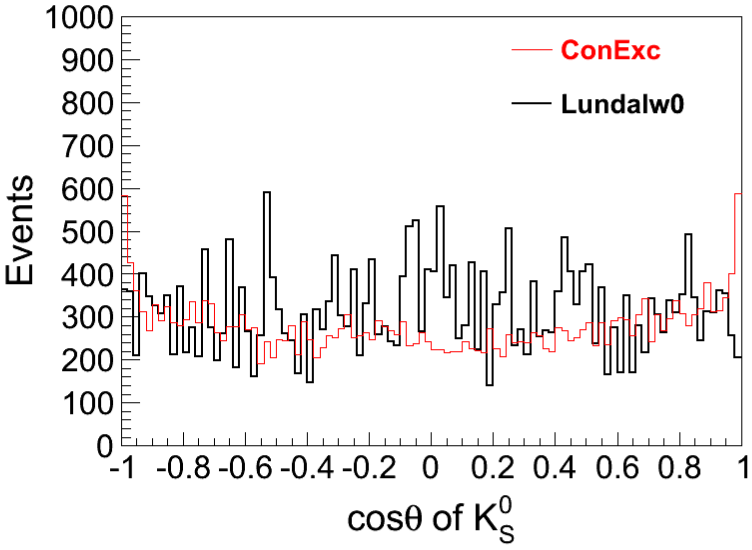


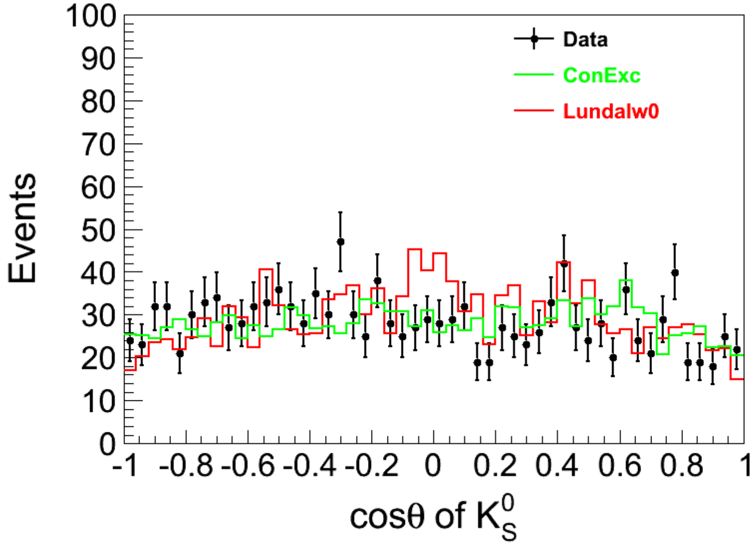
ConExc
Lundalw0
Events
1000
900
800
700
600
500
400
300
200
100
0
-1
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1
cosθ of K_S^0



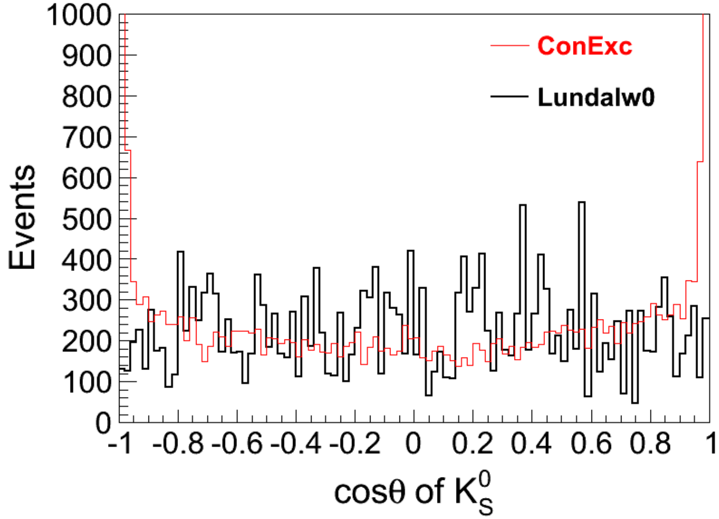
Data
ConExc
Lundalw0
Events
100
90
80
70
60
50
40
30
20
10
0
-1
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1
cosθ of K_S^0

0.4-0.5

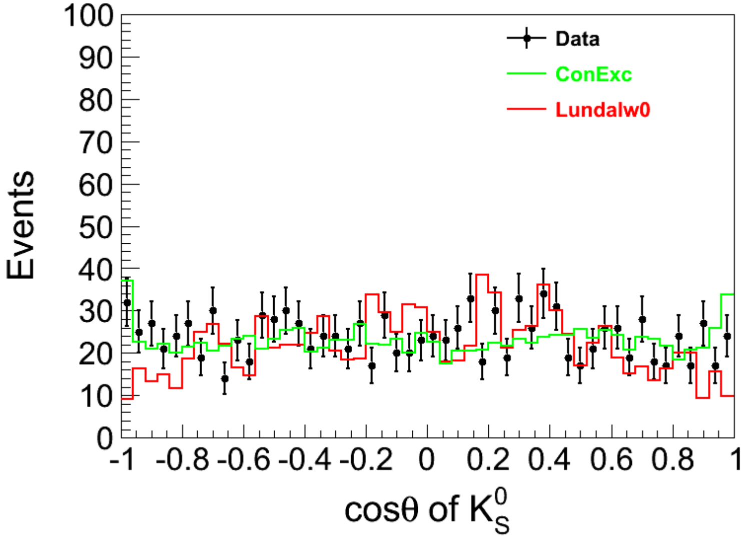

ConExc
Lundalw0
Events
1000
900
800
700
600
500
400
300
200
100
0
-1
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1
cosθ of K_S^0


Data
ConExc
Lundalw0
Events
100
90
80
70
60
50
40
30
20
10
0
-1
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1
cosθ of K_S^0

0.5-0.6

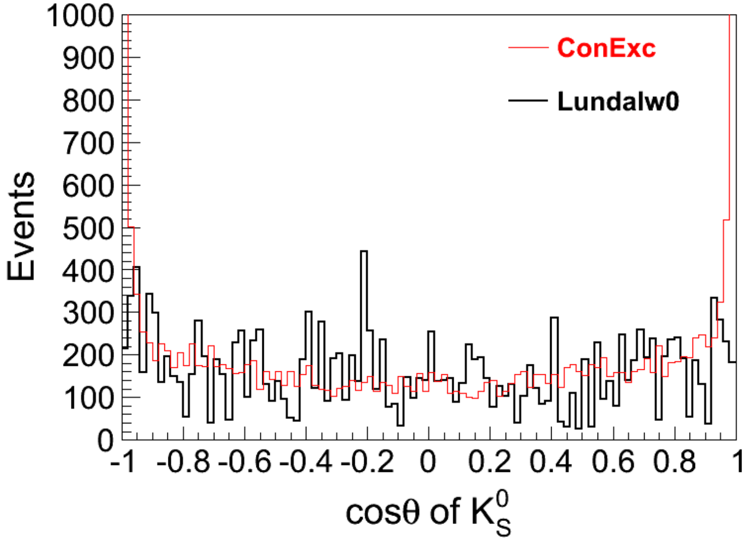


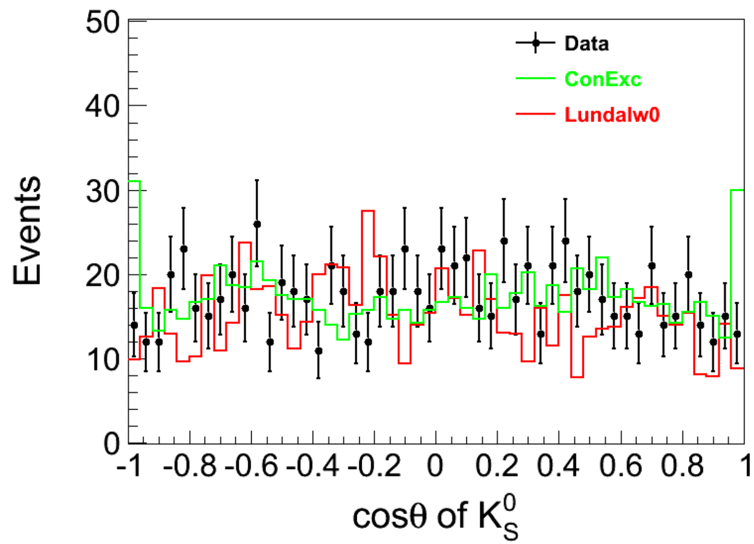
ConExc
Lundalw0
Events
0
100
200
300
400
500
600
700
800
900
1000
-1
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1
cosθ of K_S^0



Data
ConExc
Lundalw0
Events
0
10
20
30
40
50
60
70
80
90
100
-1
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1
cosθ of K_S^0

0.6-0.7

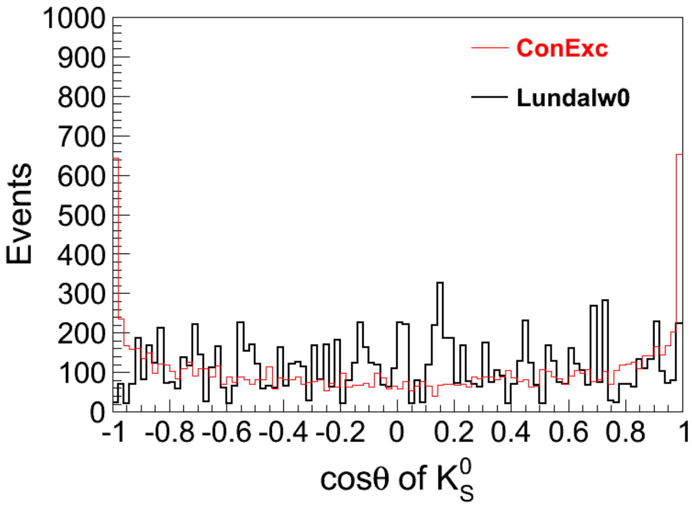




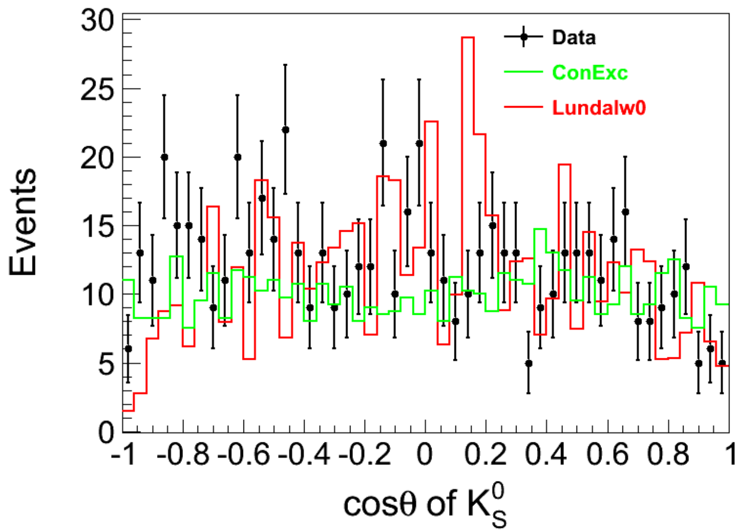
No.	decay chain	final states	iTopo	nEvt	nTot
0	$e^+e^- \to \gamma K_L K_S,\ K_S \to \pi^-\pi^+$	$e^+e^- \to \gamma\pi^+K_L\pi^-$	5	179	179
1	$e^+e^- \to \gamma\gamma^*,\ \gamma^* \to \pi^-\pi^-\pi^0\pi^0\pi^+\pi^+$	$e^+e^- \to \gamma\pi^+\pi^+\pi^0\pi^0\pi^-\pi^-$	17	66	245
2	$e^+e^- \to \pi^-\pi^-\pi^0\pi^0\pi^+\pi^+$	$e^+e^- \to \pi^+\pi^+\pi^0\pi^0\pi^-\pi^-$	13	61	306
3	$e^+e^- \to \gamma\gamma^*,\ \gamma^* \to \pi^-\pi^-\pi^-\pi^+\pi^+\pi^+$	$e^+e^- \to \gamma\pi^+\pi^+\pi^+\pi^-\pi^-\pi^-$	3	44	350
4	$e^+e^- \to \gamma\gamma K_L K_S,\ K_S \to \pi^-\pi^+$	$e^+e^- \to \gamma\gamma\pi^+K_L\pi^-$	41	40	390
5	$e^+e^- \to \pi^-\pi^-\pi^-\pi^+\pi^+\pi^+$	$e^+e^- \to \pi^+\pi^+\pi^+\pi^-\pi^-\pi^-$	0	30	420
6	$e^+e^- \to \pi^-\pi^-\gamma\pi^+\pi^+$	$e^+e^- \to \gamma\pi^+\pi^+\pi^-\pi^-$	54	21	441
7	$e^+e^- \to \pi^-\gamma\pi^0\pi^+$	$e^+e^- \to \gamma\pi^+\pi^0\pi^-$	38	16	457
8	$e^+e^- \to \pi^-\gamma\pi^0\pi^0\pi^+$	$e^+e^- \to \gamma\pi^+\pi^0\pi^0\pi^-$	29	11	468
9	$e^+e^- \to a_1^-\pi^+a_1^0,\ a_1^- \to \pi^-\rho^0,\ a_1^0 \to \pi^-\rho^+,\ \rho^+ \to \pi^0\pi^+,\ \rho^0 \to \pi^-\pi^+$	$e^+e^- \to \pi^+\pi^+\pi^+\pi^0\pi^-\pi^-\pi^-$	16	8	476
10	$e^+e^- \to K^-\pi^-\pi^0\pi^+K^+$	$e^+e^- \to K^+\pi^+\pi^0\pi^-K^-$	60	8	484
11	$e^+e^- \to \gamma\gamma^*,\ \gamma^* \to \pi^-K_SK^+,\ K_S \to \pi^-\pi^+$	$e^+e^- \to \gamma K^+\pi^+\pi^-\pi^-$	117	7	491
12	$e^+e^- \to a_1^-K_SK^+,\ a_1^- \to \pi^-\rho^0,\ K_S \to \pi^-\pi^+,\ \rho^0 \to \pi^-\pi^+$	$e^+e^- \to K^+\pi^+\pi^+\pi^-\pi^-\pi^-$	55	6	497
13	$e^+e^- \to \gamma\gamma^*,\ \gamma^* \to \pi^-\pi^-\pi^0\pi^+\pi^+$	$e^+e^- \to \gamma\pi^+\pi^+\pi^0\pi^-\pi^-$	140	6	503
14	$e^+e^- \to \pi^-\pi^-\pi^+\pi^+\eta,\ \eta \to \gamma\gamma$	$e^+e^- \to \gamma\gamma\pi^+\pi^+\pi^-\pi^-$	209	6	509
15	$e^+e^- \to \pi^-\pi^-\pi^0\pi^+\pi^+$	$e^+e^- \to \pi^+\pi^+\pi^0\pi^-\pi^-$	63	5	514
16	$e^+e^- \to K^-K_Sa_1^+,\ K_S \to \pi^-\pi^+,\ a_1^+ \to \rho^0\pi^+,\ \rho^0 \to \pi^-\pi^+$	$e^+e^- \to \pi^+\pi^+\pi^+\pi^-\pi^-K^-$	76	5	519
17	$e^+e^- \to \gamma\gamma^*,\ \gamma^* \to \pi^-\pi^-\pi^+\pi^+\eta,\ \eta \to \pi^-\pi^0\pi^+$	$e^+e^- \to \gamma\pi^+\pi^+\pi^+\pi^0\pi^-\pi^-\pi^-$	23	5	524
18	$e^+e^- \to K_LK_Sa_1^0,\ K_S \to \pi^-\pi^+,\ a_1^0 \to \pi^-\rho^+,\ \rho^+ \to \pi^0\pi^+$	$e^+e^- \to \pi^+\pi^+K_L\pi^0\pi^-\pi^-$	36	5	529
19	$e^+e^- \to \pi^-\pi^-\pi^+\pi^+\eta,\ \eta \to \pi^-\pi^0\pi^+$	$e^+e^- \to \pi^+\pi^+\pi^+\pi^0\pi^-\pi^-\pi^-$	42	5	534

Table 1: The possible background channels extracted from Inclusive MC sample

0.7-0.8

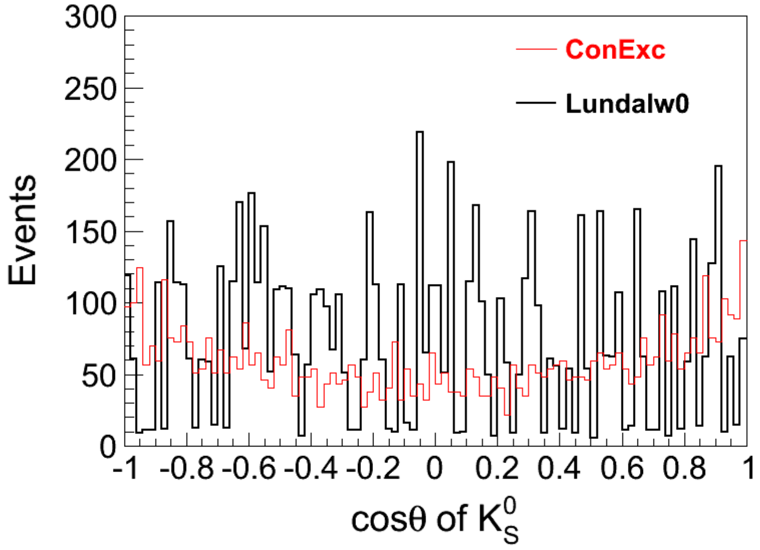


Events
ConExc
Lundalw0
cosθ of K_S^0

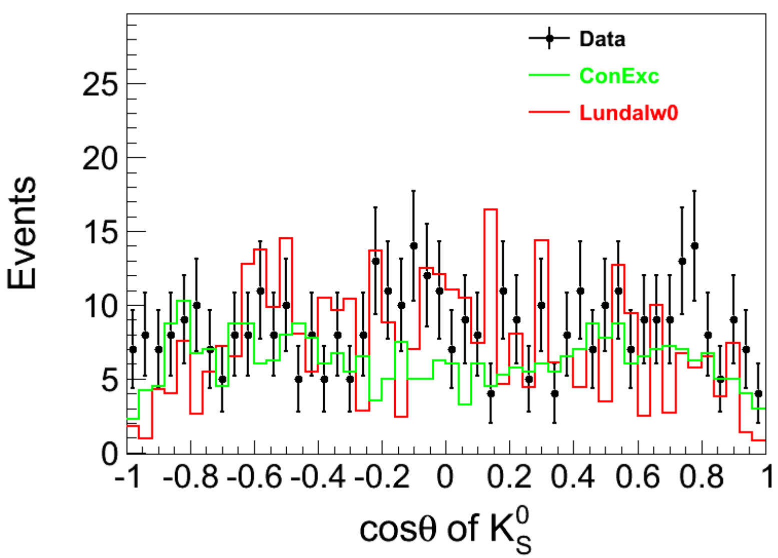


Events
Data
ConExc
Lundalw0
cosθ of K_S^0

0.8-0.9

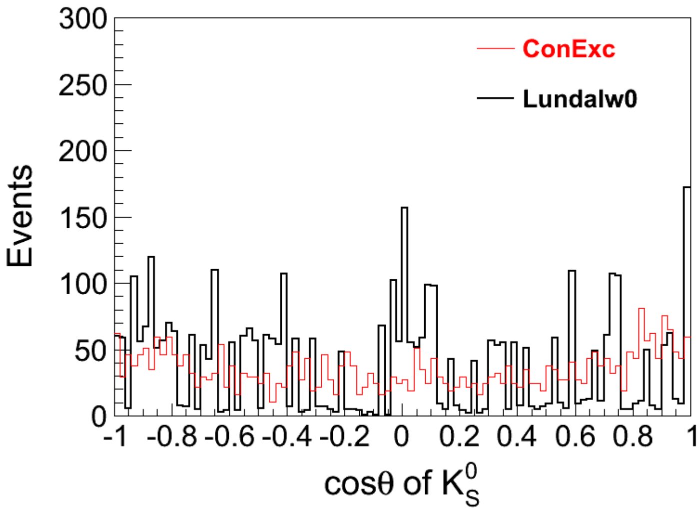


ConExc
Lundalw0
Events
cosθ of K_S^0

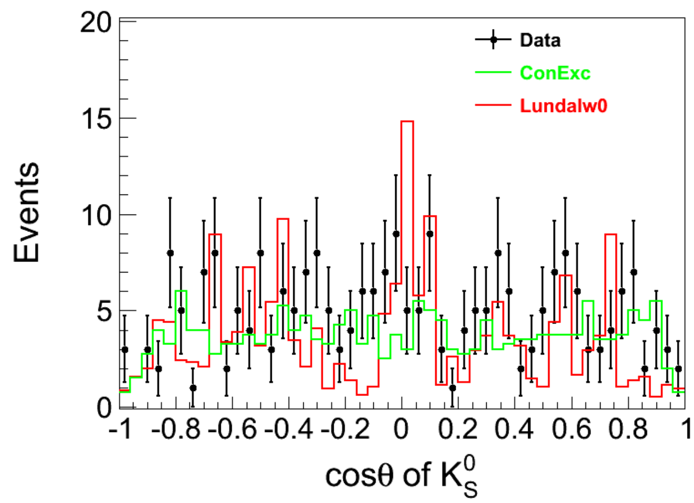


Data
ConExc
Lundalw0
Events
cosθ of K_S^0

0.9-1.0

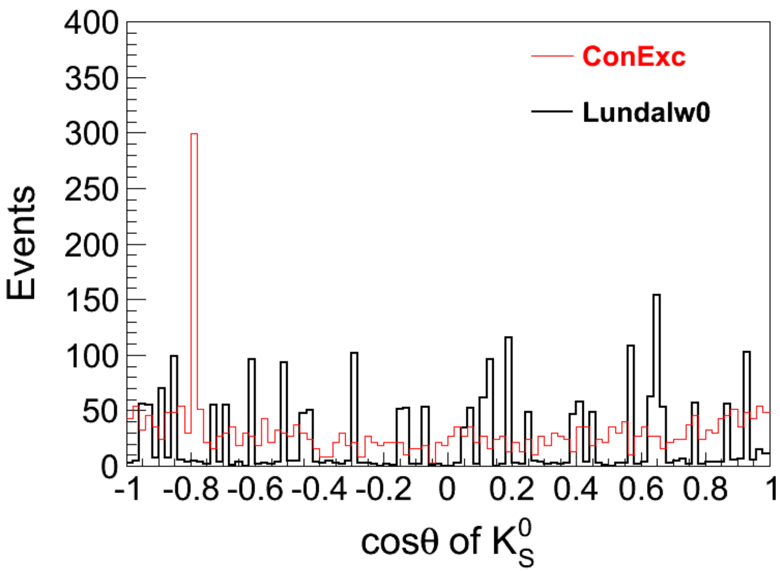


ConExc
Lundalw0
Events
300
250
200
150
100
50
0
-1
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1
cosθ of K_S^0

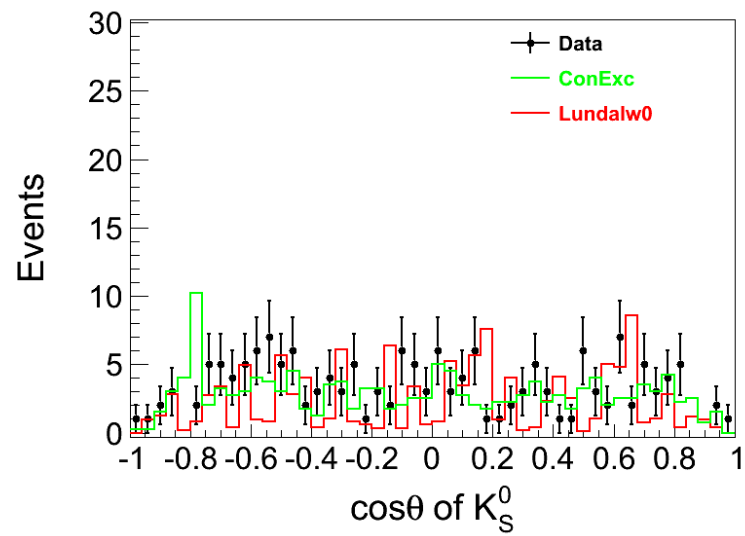


Data
ConExc
Lundalw0
Events
20
15
10
5
0
-1
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1
cosθ of K_S^0

1.0-1.1

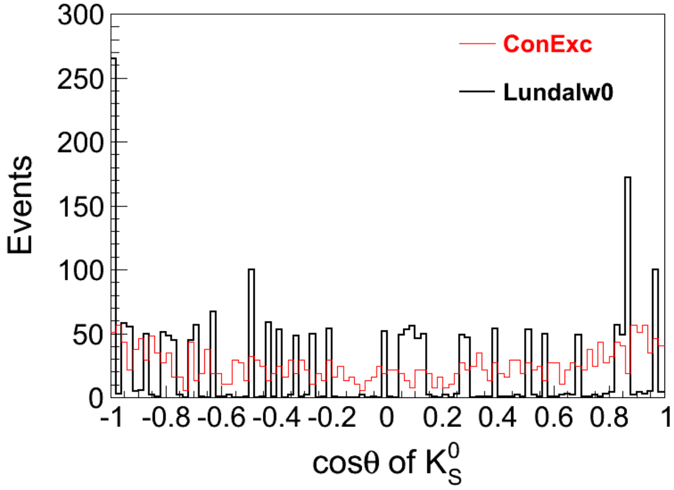


ConExc
Lundalw0
Events
cosθ of K_S^0

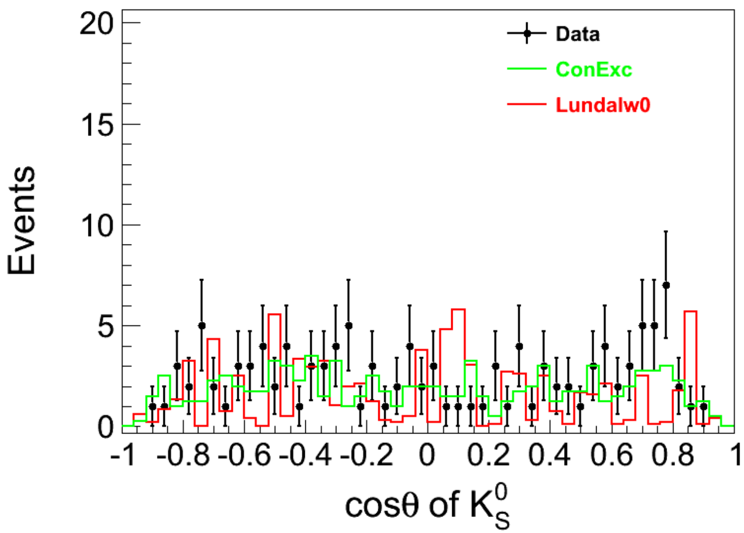


Data
ConExc
Lundalw0
Events
cosθ of K_S^0

1.1-1.2

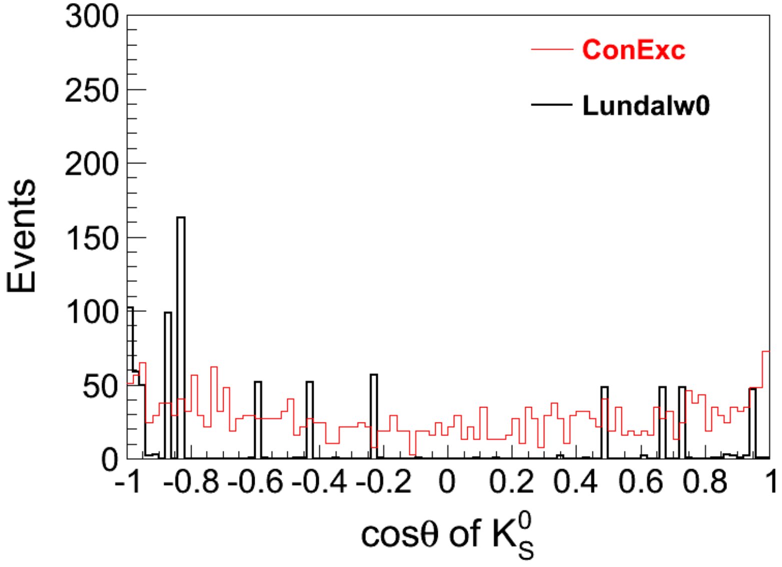


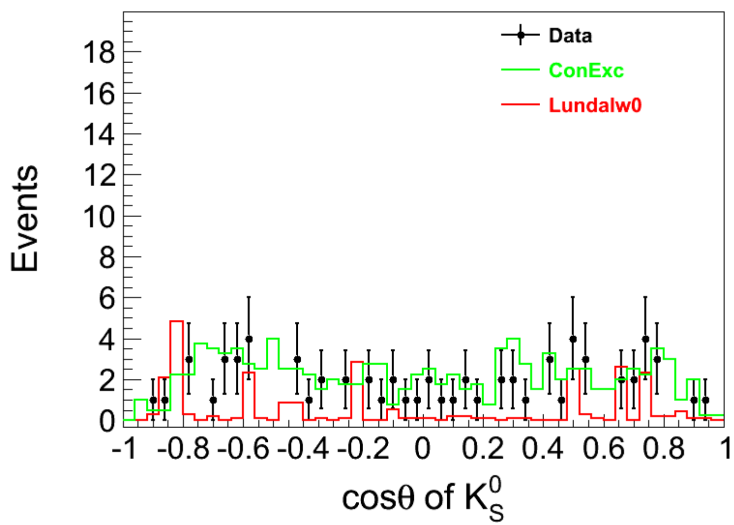
ConExc
Lundalw0
Events
cosθ of K_S^0
300
250
200
150
100
50
0
-1
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1



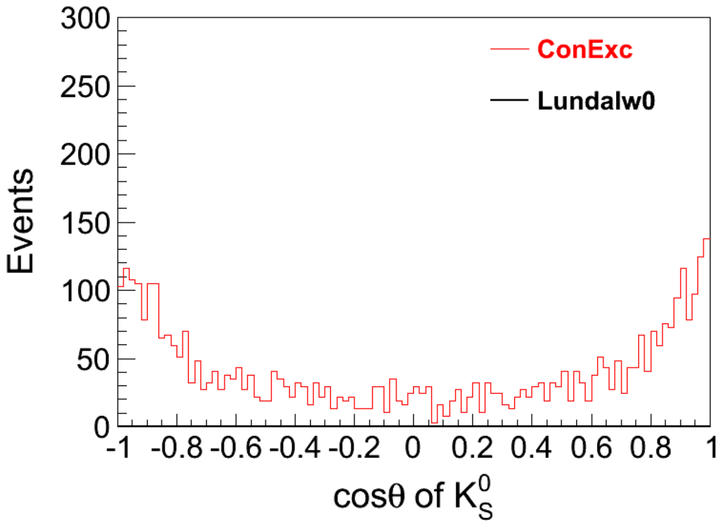
Data
ConExc
Lundalw0
Events
cosθ of K_S^0
20
15
10
5
0
-1
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1

1.2-1.3

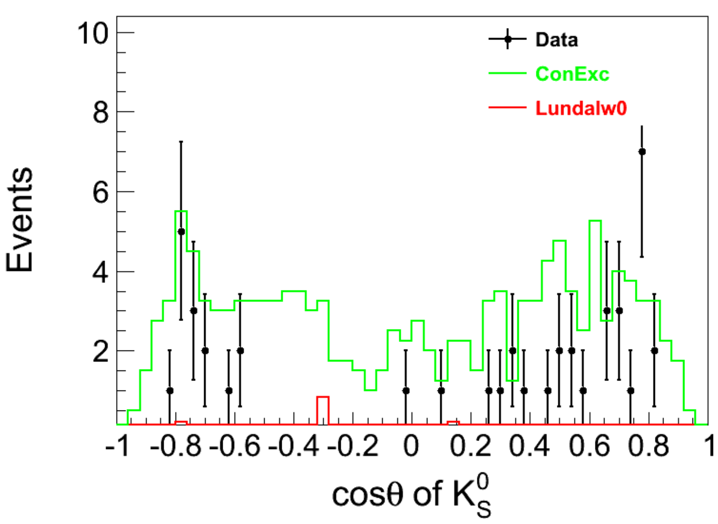

ConExc
Lundalw0
Events
300
250
200
150
100
50
0
-1
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1
cosθ of K^0_S


Data
ConExc
Lundalw0
Events
18
16
14
12
10
8
6
4
2
0
-1
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1
cosθ of K^0_S

1.3-1.4

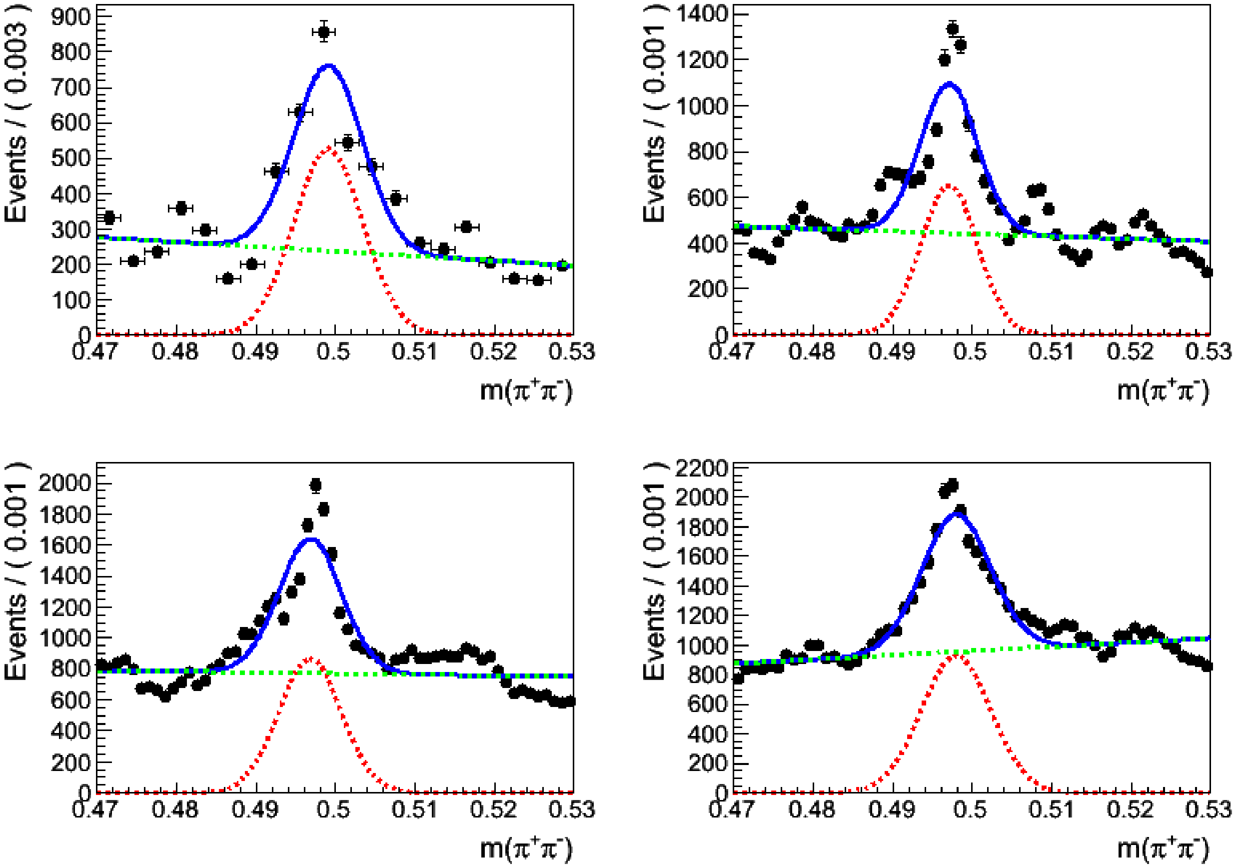


ConExc
Lundalw0
Events
cosθ of K_S^0



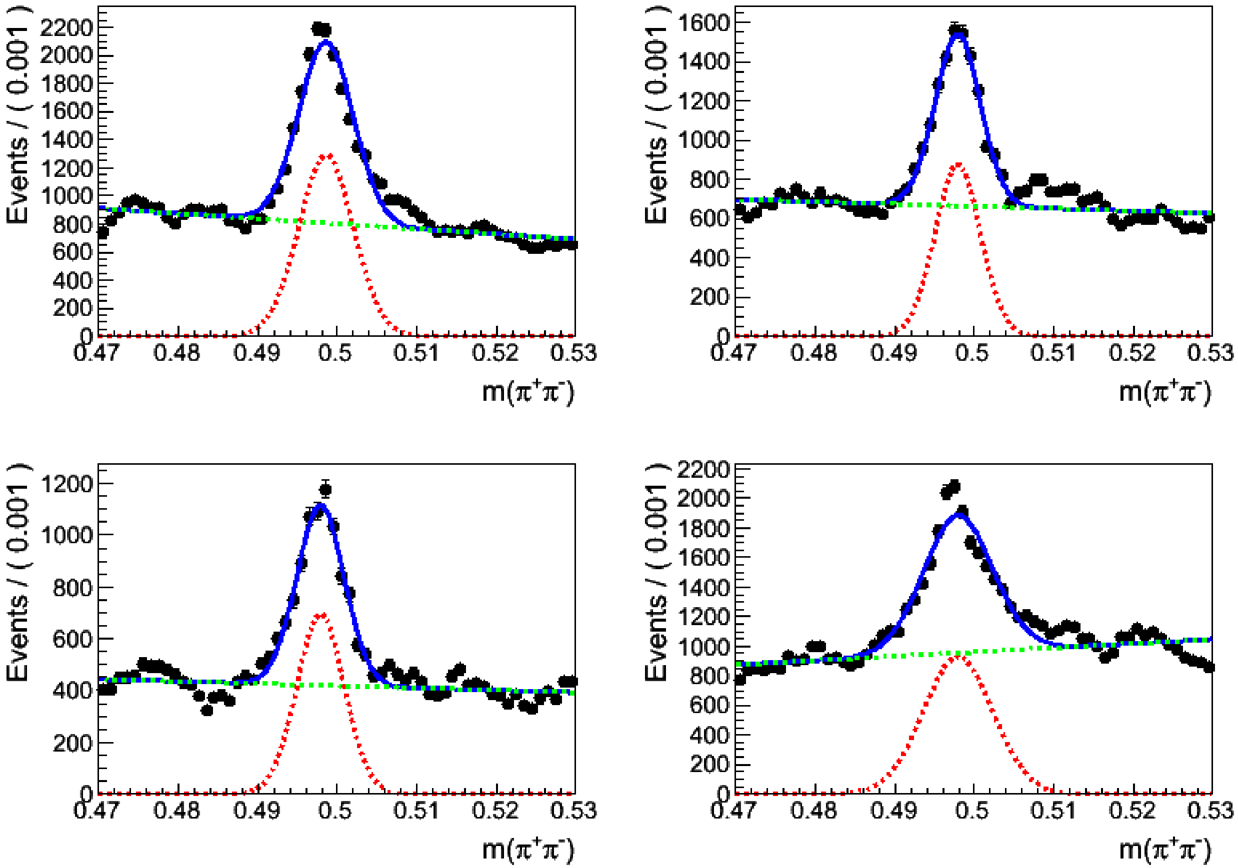
Data
ConExc
Lundalw0
Events
cosθ of K_S^0

2

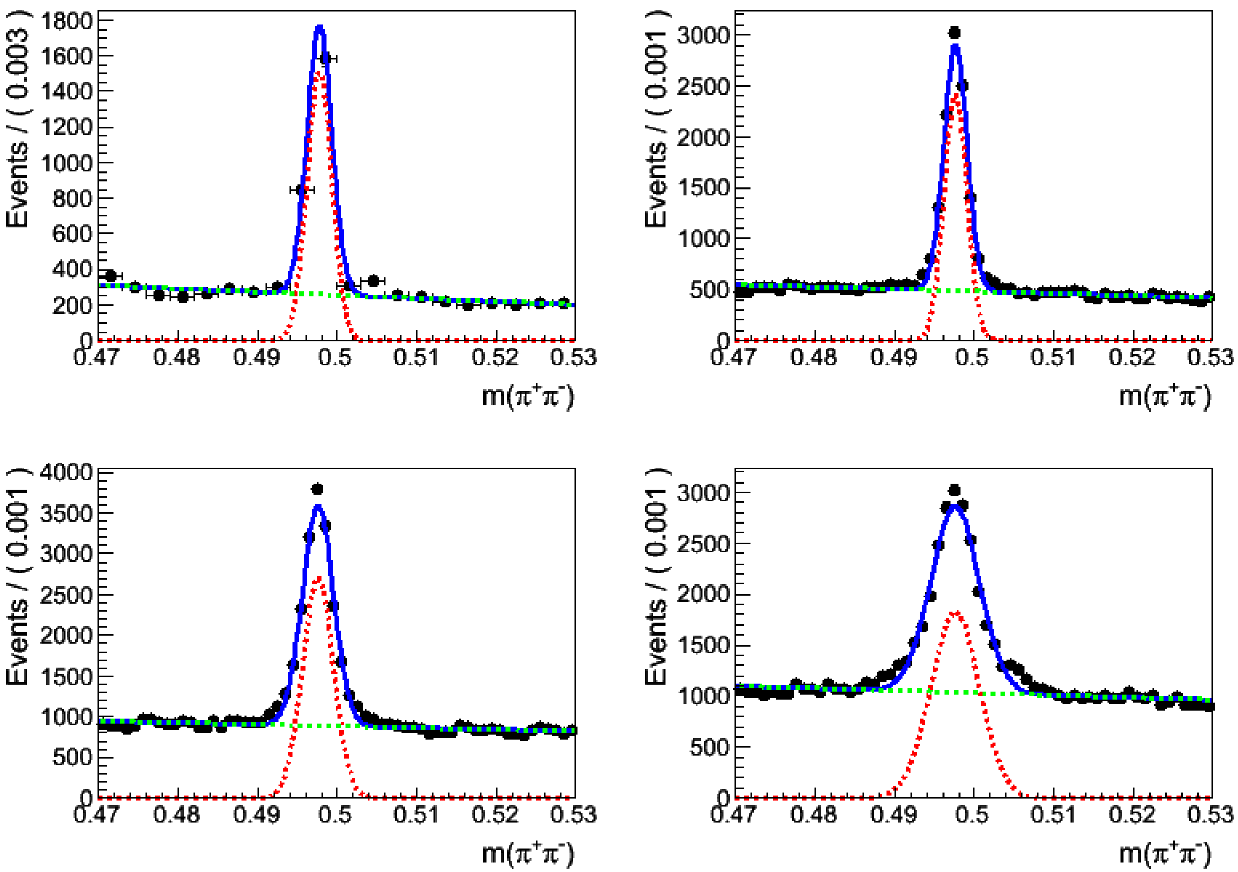


Events / (0.003)
Events / (0.001)
Events / (0.001)
Events / (0.001)
m(π⁺π⁻)
m(π⁺π⁻)
m(π⁺π⁻)
m(π⁺π⁻)

2

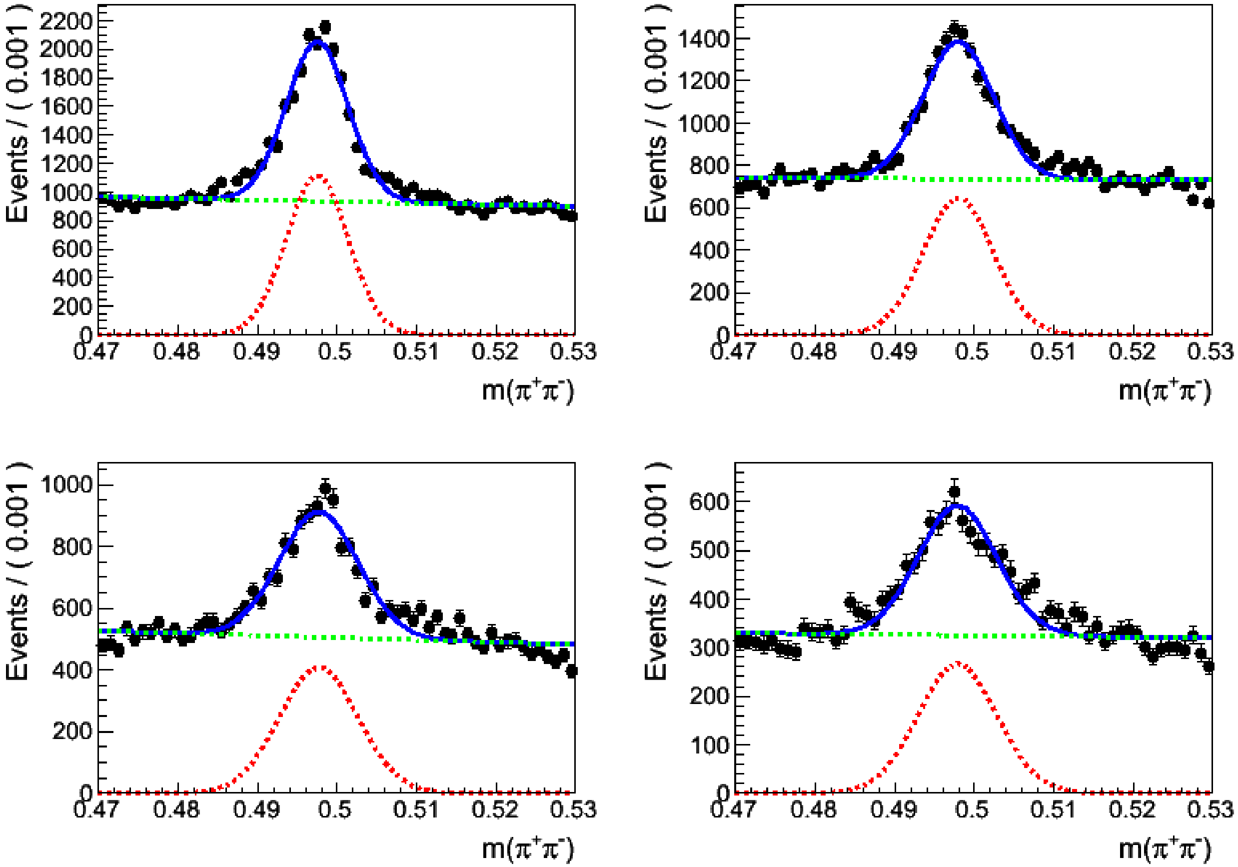


1

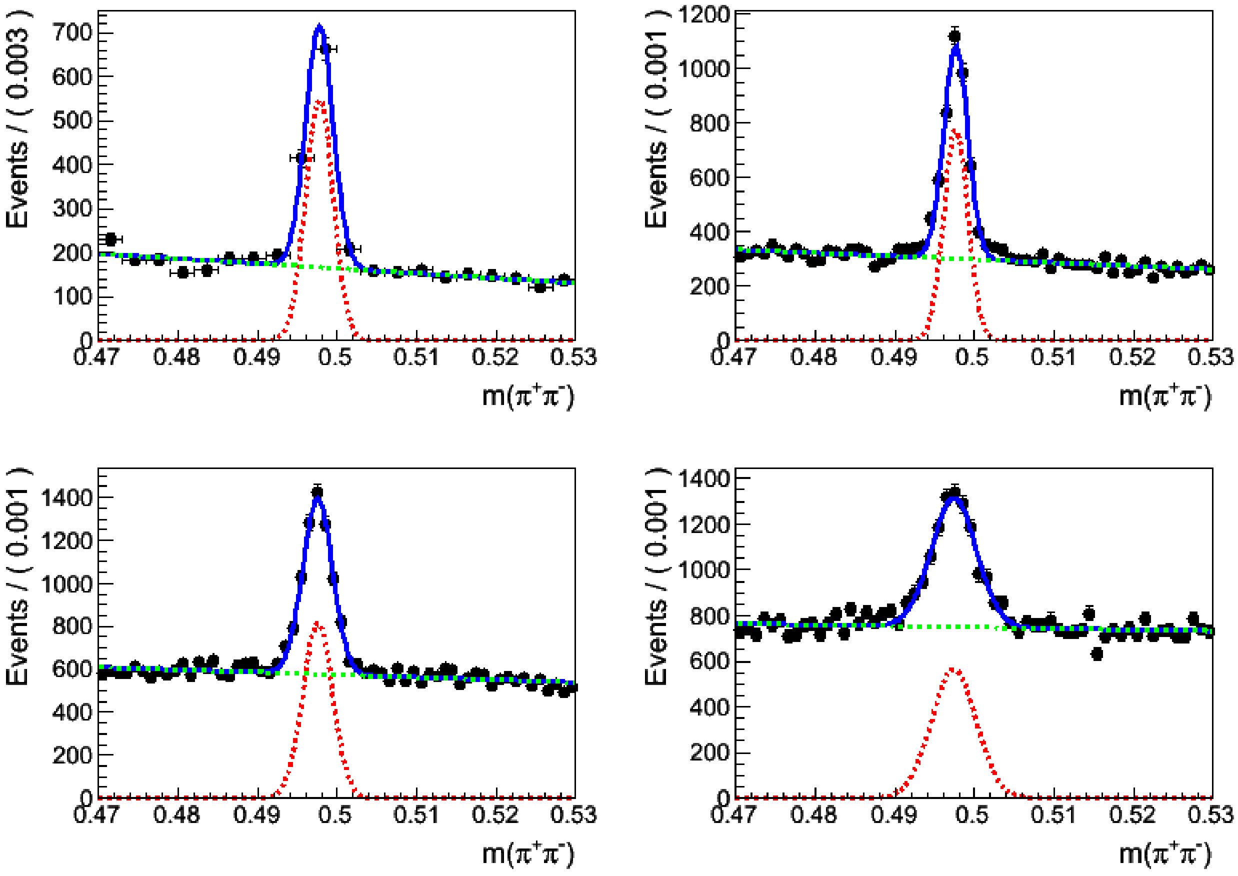


Events / (0.003)
1800
1600
1400
1200
1000
800
600
400
200
0
0.47 0.48 0.49 0.5 0.51 0.52 0.53
m(π⁺π⁻)
Events / (0.001)
3000
2500
2000
1500
1000
500
0
0.47 0.48 0.49 0.5 0.51 0.52 0.53
m(π⁺π⁻)
Events / (0.001)
4000
3500
3000
2500
2000
1500
1000
500
0
0.47 0.48 0.49 0.5 0.51 0.52 0.53
m(π⁺π⁻)
Events / (0.001)
3000
2500
2000
1500
1000
500
0
0.47 0.48 0.49 0.5 0.51 0.52 0.53
m(π⁺π⁻)

1

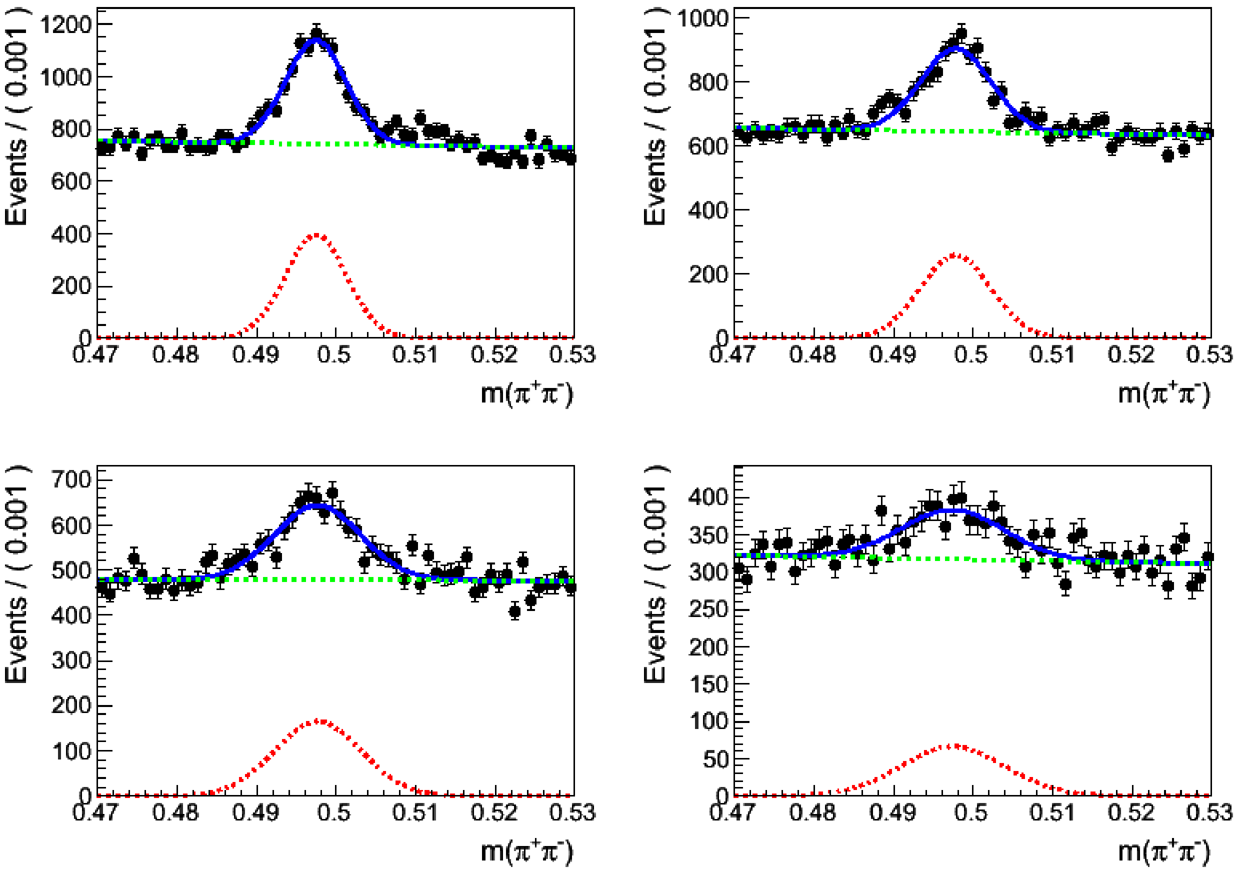


ConExc



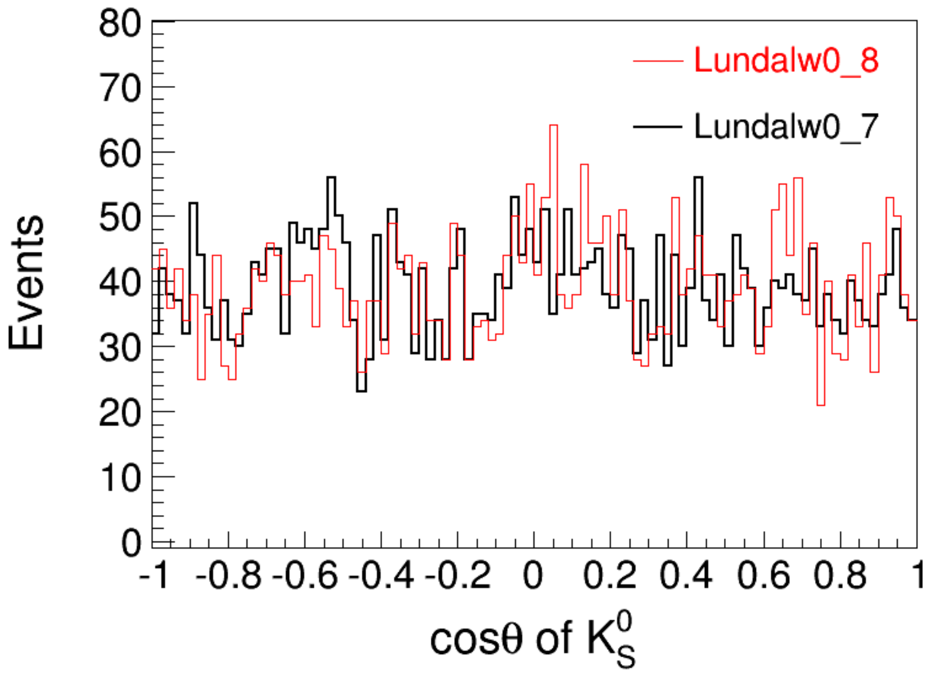
Events / (0.003)
m(π⁺π⁻)
Events / (0.001)
m(π⁺π⁻)
Events / (0.001)
m(π⁺π⁻)
Events / (0.001)
m(π⁺π⁻)

ConExc



ConExc	ConExc	lundalw0	lundalw0
0.302751	0.69094	0.319148	0.63949
0.397911	0.623102	0.398315	0.599547
0.443055	0.553204	0.448189	0.565126
0.45294	0.531752	0.463812	0.536853
0.4819	0.535268	0.487055	0.503383
0.452636	0.470879	0.504829	0.46188
0.434087	0.462643	0.493919	0.455481
0.44314	0.402372	0.551666	0.418467

MSTJ0

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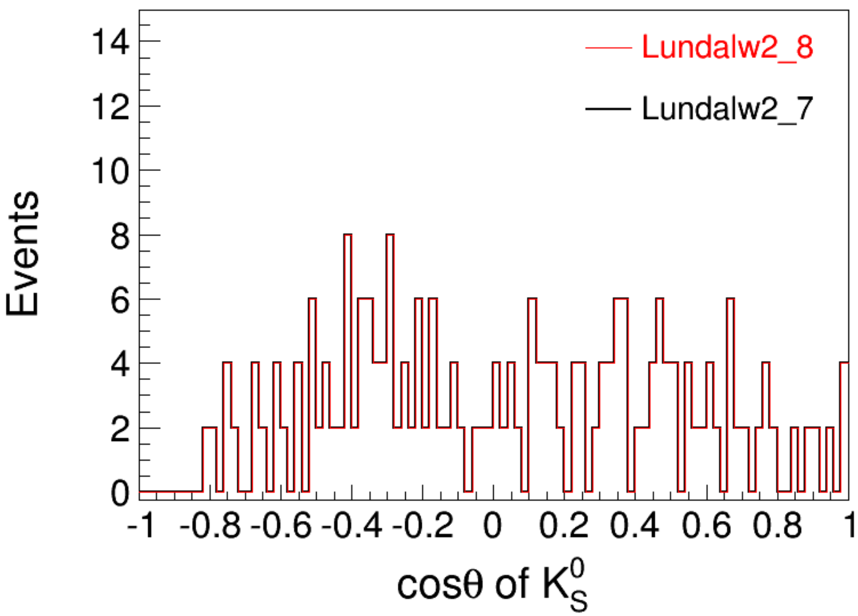
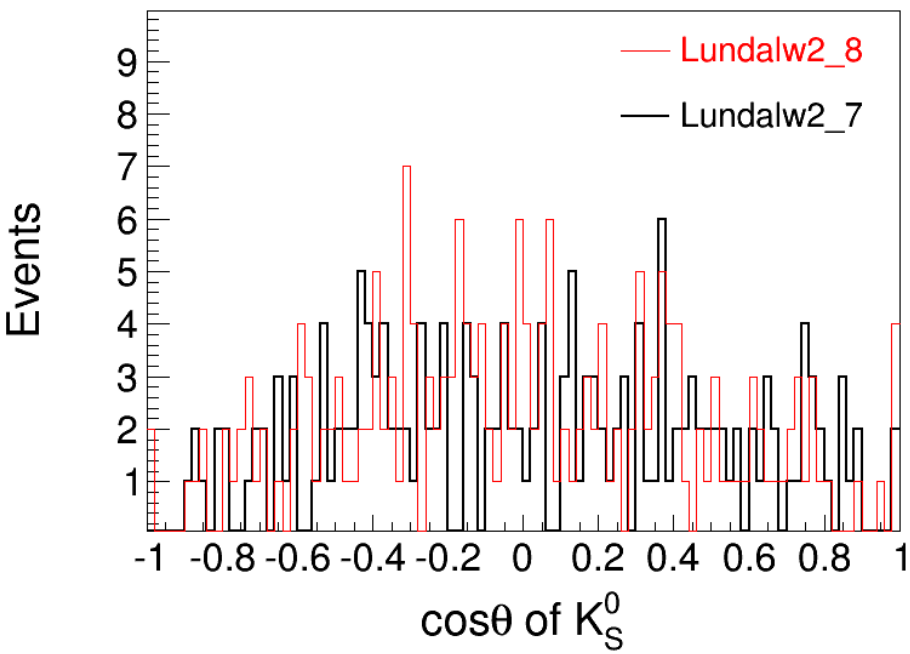
data2800_044_run.txt.bosslog:BesRndmGenSvc.RndmSeed = 248;
data2800_045_run.txt.bosslog:BesRndmGenSvc.RndmSeed = 168;
data2800_045_run.txt.bosslog:BesRndmGenSvc.RndmSeed = 168;
data2800_046_run.txt.bosslog:BesRndmGenSvc.RndmSeed = 251;
data2800_046_run.txt.bosslog:BesRndmGenSvc.RndmSeed = 251;
data2800_047_run.txt.bosslog:BesRndmGenSvc.RndmSeed = 253;
data2800_047_run.txt.bosslog:BesRndmGenSvc.RndmSeed = 253;
data2800_048_run.txt.bosslog:BesRndmGenSvc.RndmSeed = 255;
data2800_048_run.txt.bosslog:BesRndmGenSvc.RndmSeed = 255;
data2800_049_run.txt.bosslog:BesRndmGenSvc.RndmSeed = 257;
data2800_049_run.txt.bosslog:BesRndmGenSvc.RndmSeed = 257;
data2800_04_run.txt.bosslog:BesRndmGenSvc.RndmSeed = 175;
data2800_04_run.txt.bosslog:BesRndmGenSvc.RndmSeed = 175;
data2800_050_run.txt.bosslog:BesRndmGenSvc.RndmSeed = 259;
data2800_050_run.txt.bosslog:BesRndmGenSvc.RndmSeed = 259;
data2800_05_run.txt.bosslog:BesRndmGenSvc.RndmSeed = 177;
data2800_05_run.txt.bosslog:BesRndmGenSvc.RndmSeed = 177;
data2800_06_run.txt.bosslog:BesRndmGenSvc.RndmSeed = 179;
data2800_06_run.txt.bosslog:BesRndmGenSvc.RndmSeed = 179;
data2800_07_run.txt.bosslog:BesRndmGenSvc.RndmSeed = 180;
data2800_07_run.txt.bosslog:BesRndmGenSvc.RndmSeed = 180;
data2800_08_run.txt.bosslog:BesRndmGenSvc.RndmSeed = 182;
data2800_08_run.txt.bosslog:BesRndmGenSvc.RndmSeed = 182;
data2800_09_run.txt.bosslog:BesRndmGenSvc.RndmSeed = 184;
data2800_09_run.txt.bosslog:BesRndmGenSvc.RndmSeed = 184;
```

MSTJ2




```
data2800_044_run.txt.bosslog:BesRndmGenSvc.RndmSeed = 248;
data2800_045_run.txt.bosslog:BesRndmGenSvc.RndmSeed = 168;
data2800_045_run.txt.bosslog:BesRndmGenSvc.RndmSeed = 168;
data2800_046_run.txt.bosslog:BesRndmGenSvc.RndmSeed = 251;
data2800_046_run.txt.bosslog:BesRndmGenSvc.RndmSeed = 251;
data2800_047_run.txt.bosslog:BesRndmGenSvc.RndmSeed = 253;
data2800_047_run.txt.bosslog:BesRndmGenSvc.RndmSeed = 253;
data2800_048_run.txt.bosslog:BesRndmGenSvc.RndmSeed = 255;
data2800_048_run.txt.bosslog:BesRndmGenSvc.RndmSeed = 255;
data2800_049_run.txt.bosslog:BesRndmGenSvc.RndmSeed = 257;
data2800_049_run.txt.bosslog:BesRndmGenSvc.RndmSeed = 257;
data2800_04_run.txt.bosslog:BesRndmGenSvc.RndmSeed = 175;
data2800_04_run.txt.bosslog:BesRndmGenSvc.RndmSeed = 175;
data2800_050_run.txt.bosslog:BesRndmGenSvc.RndmSeed = 259;
data2800_050_run.txt.bosslog:BesRndmGenSvc.RndmSeed = 259;
data2800_05_run.txt.bosslog:BesRndmGenSvc.RndmSeed = 177;
data2800_05_run.txt.bosslog:BesRndmGenSvc.RndmSeed = 177;
data2800_06_run.txt.bosslog:BesRndmGenSvc.RndmSeed = 179;
data2800_06_run.txt.bosslog:BesRndmGenSvc.RndmSeed = 179;
data2800_07_run.txt.bosslog:BesRndmGenSvc.RndmSeed = 180;
data2800_07_run.txt.bosslog:BesRndmGenSvc.RndmSeed = 180;
data2800_08_run.txt.bosslog:BesRndmGenSvc.RndmSeed = 182;
data2800_08_run.txt.bosslog:BesRndmGenSvc.RndmSeed = 182;
data2800_09_run.txt.bosslog:BesRndmGenSvc.RndmSeed = 184;
data2800_09_run.txt.bosslog:BesRndmGenSvc.RndmSeed = 184;
```

MSTJ2(Gao Zhen)

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data2800_010_run.txt.bosslog:BesRndmGenSvc.RndmSeed = 400;
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data2800_011_run.txt.bosslog:BesRndmGenSvc.RndmSeed = 600;
data2800_011_run.txt.bosslog:BesRndmGenSvc.RndmSeed = 600;
data2800_012_run.txt.bosslog:BesRndmGenSvc.RndmSeed = 800;
data2800_012_run.txt.bosslog:BesRndmGenSvc.RndmSeed = 800;
data2800_01_run.txt.bosslog:BesRndmGenSvc.RndmSeed = 1000;
data2800_01_run.txt.bosslog:BesRndmGenSvc.RndmSeed = 1000;
data2800_02_run.txt.bosslog:BesRndmGenSvc.RndmSeed = 1200;
data2800_02_run.txt.bosslog:BesRndmGenSvc.RndmSeed = 1200;
data2800_03_run.txt.bosslog:BesRndmGenSvc.RndmSeed = 1400;
data2800_03_run.txt.bosslog:BesRndmGenSvc.RndmSeed = 1400;
data2800_04_run.txt.bosslog:BesRndmGenSvc.RndmSeed = 1600;
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data2800_05_run.txt.bosslog:BesRndmGenSvc.RndmSeed = 1800;
data2800_05_run.txt.bosslog:BesRndmGenSvc.RndmSeed = 1800;
data2800_06_run.txt.bosslog:BesRndmGenSvc.RndmSeed = 100;
data2800_06_run.txt.bosslog:BesRndmGenSvc.RndmSeed = 100;
data2800_07_run.txt.bosslog:BesRndmGenSvc.RndmSeed = 2100;
data2800_07_run.txt.bosslog:BesRndmGenSvc.RndmSeed = 2100;
data2800_08_run.txt.bosslog:BesRndmGenSvc.RndmSeed = 2300;
data2800_08_run.txt.bosslog:BesRndmGenSvc.RndmSeed = 2300;
data2800_09_run.txt.bosslog:BesRndmGenSvc.RndmSeed = 200;
data2800_09_run.txt.bosslog:BesRndmGenSvc.RndmSeed = 200;
```

Table 19: Hadron efficiencies (%) using different Lundalw parameters.

Cut criteria	ConExc		Lundalw(0)		Lundalw(2)		ε diff
	Events	$\varepsilon(hadron)$	Events	$\varepsilon(hadron)$	Events	$\varepsilon(hadron)$	
Total events	200000	-	200000	-	200000	-	-
N_{good} >= 1(No cut)	190099	95.05	195275	97.64	185678	92.84	4.8
$\|\theta_1+\theta_2-180^\circ\| < 10^\circ$ and $E > 0.65 * E_{beam}$	199937	99.97	199986	99.99	199960	99.98	0.01
N_{good} >= 2	164894	82.47	179987	90.00	163270	81.65	8.35
$N_{good} = 2$	54850	-	44845	-	40771	-	-
$\|\theta_1+\theta_2-180^\circ\| < 15^\circ$ and $\|\|\phi_1-\phi_2\|-180^\circ\| < 10^\circ$	52805	96.27	43104	96.11	39608	97.15	-1.04
$N_{Isolated}$ >= 2	38316	72.56	34086	79.08	28938	73.06	6.02
	148360	89.97	169228	94.02	151437	92.75	1.27
$N_{good} = 3$	38313	-	45524	-	38322	-	-
$\|\theta_1+\theta_2-180^\circ\| < 15^\circ$ and $\|\|\phi_1-\phi_2\|-180^\circ\| < 10^\circ$	36892	96.29	43692	95.98	36801	96.03	-0.05
$N_{eop} > 1$	35959	97.45	42600	97.50	35952	97.69	-0.19
$N_{ProbE} > 1$	35526	98.80	42223	99.11	35592	99.00	-0.11
	145573	98.12	165927	98.05	148707	98.20	-0.15
Finally Efficiency	145971	72.99	165927	82.96	148707	74.35	8.61

Table 21: Hadron efficiencies (%) using different Lundalw parameters.

Cut criteria	Lundalw(0)$_{Truth}$		Lundalw(0)	
	Events	$\varepsilon(hadron)$	Events	$\varepsilon(hadron)$
Total events	200000	-	200000	-
$N_{good} >= 1$(No cut)	195776	97.89	195275	97.64
$\|\theta_1 + \theta_2 - 180°\| < 10°$ and $E > 0.65 * E_{beam}$	199905	99.95	199986	99.99
$N_{good} >= 2$	185175	92.63	179987	90.00
$N_{good} = 2$	26805	-	44845	-
$\|\theta_1 + \theta_2 - 180°\| < 15°$ and $\|\|\phi_1 - \phi_2\| - 180°\| < 10°$	25809	96.28	43104	96.11
$N_{Isolated} >= 2$	21594	83.67	34086	79.08
	179964	97.18	169228	94.02
$N_{good} = 3$	25936	-	45524	-
$\|\theta_1 + \theta_2 - 180°\| < 15°$ and $\|\|\phi_1 - \phi_2\| - 180°\| < 10°$	24809	95.65	43692	95.98
$N_{eop} > 1$	24081	97.07	42600	97.50
$N_{ProbE} > 1$	23856	99.07	42223	99.11
	177884	98.12	165927	98.05
Finally Efficiency	177884	88.94	165927	82.96