Measurement of $e^+e^- \to p\bar{p}p\bar{p}$

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Questions and suggestions

1.The motivation part can also be added to the continuum process until the final state is decrease, so the observed cross section is basically the contribution of the resonance state.

2. The case chose to use PID, but there are two problems. One is that the current PID package is very inefficient at low momentum, such as the efficiency of the 4009 energy point is much lower than others; in addition, the dE/dx amplitude could be good to distinguish protons from other particles.

3.Lacked the chi^2 distribution of data.

4.After kinematics fitting, E_meas/E_tot must be around 1, so this condition is basically useless.

Questions and suggestions

5.Why is the distribution of the upper right corner of the angular distribution different from the others?

6.Is it possible to consider only kinematics fitting of momentum (3C) and then look at energy changes?

7.Have you considered the background from the beam?

8.There may be a background,such as 4K + n gams.

9.Because the measurement cross section at that point is 0,the ISR correction factor at 4210 is large. It is recommended to use a smooth curve fit to make an ISR correction factor estimate.

4 **1. The motivation part can also be added to the continuum process until the final state is decrease, so the observed cross section is basically the contribution of the resonance state.**

Motivation

- Search for the new decay mode of Y(4260) and confirm if it is multi-quark state. $e^+e^- \to p\bar{p}p\bar{p}$ is a good candidate channel (few background contamination)
- Confirm the double structures near 4.26 GeV

2. The case chose to use PID, but there are two problems. One is that the current PID package is very inefficient at low momentum, such as the efficiency of the 4009 energy point is much lower than others; in addition, the dE/dx amplitude could be good to distinguish protons from other particles.

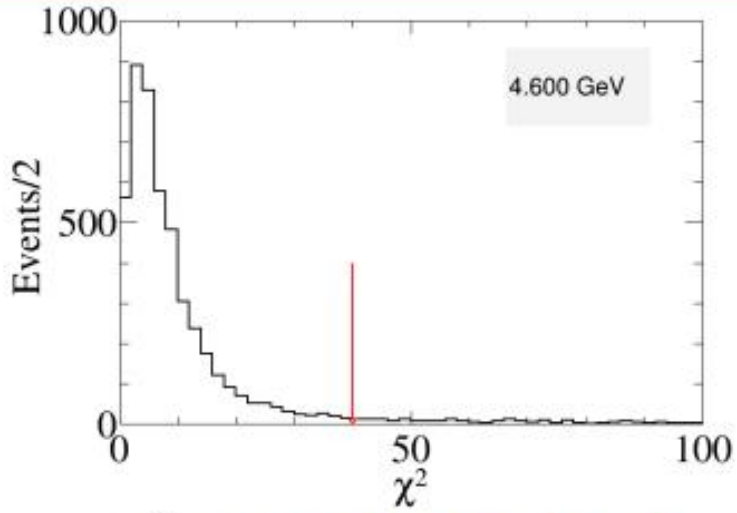
	$N_{de/dx}$	$Eff_{de/dx}$	N_{pid}	Eff_{pid}
4009	2144	0.2144	2128	0.2128
4180	3736	0.3736	3736	0.3736
4190	3870	0.387	3870	0.387
4200	4036	0.4036	4036	0.4036
4210	3965	0.3965	3965	0.3965
4220	4111	0.4111	4111	0.4111
4230	4262	0.4262	4262	0.4262
4237	4297	0.4297	4297	0.4297
4246	4391	0.4391	4391	0.4391
4260	4465	0.4465	4465	0.4465
4270	4432	0.4432	4432	0.4432
4360	4796	0.4796	4796	0.4796
4420	4829	0.4829	4829	0.4829
4600	5179	0.5179	5179	0.5179

It indicates that the current PID is OK.

3. Lacked the chi^2 distribution of data.

Previous result

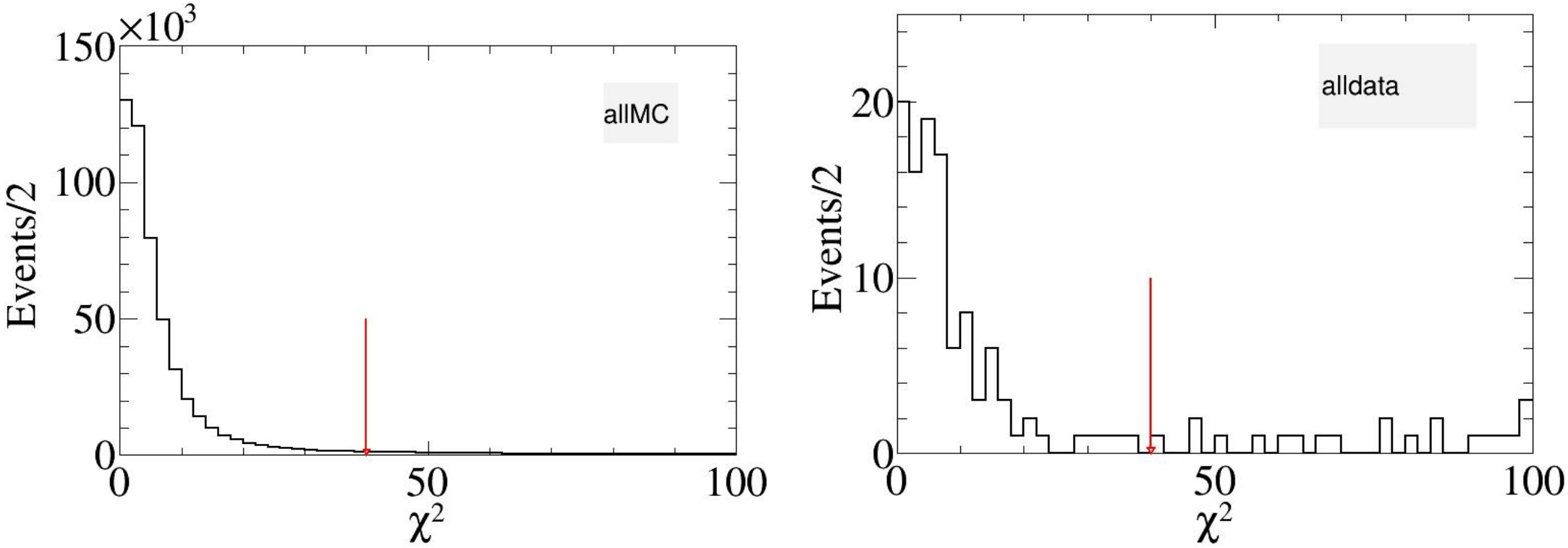
Backgroung study



χ^2_{4C} distribution from 4.6 GeV single MC

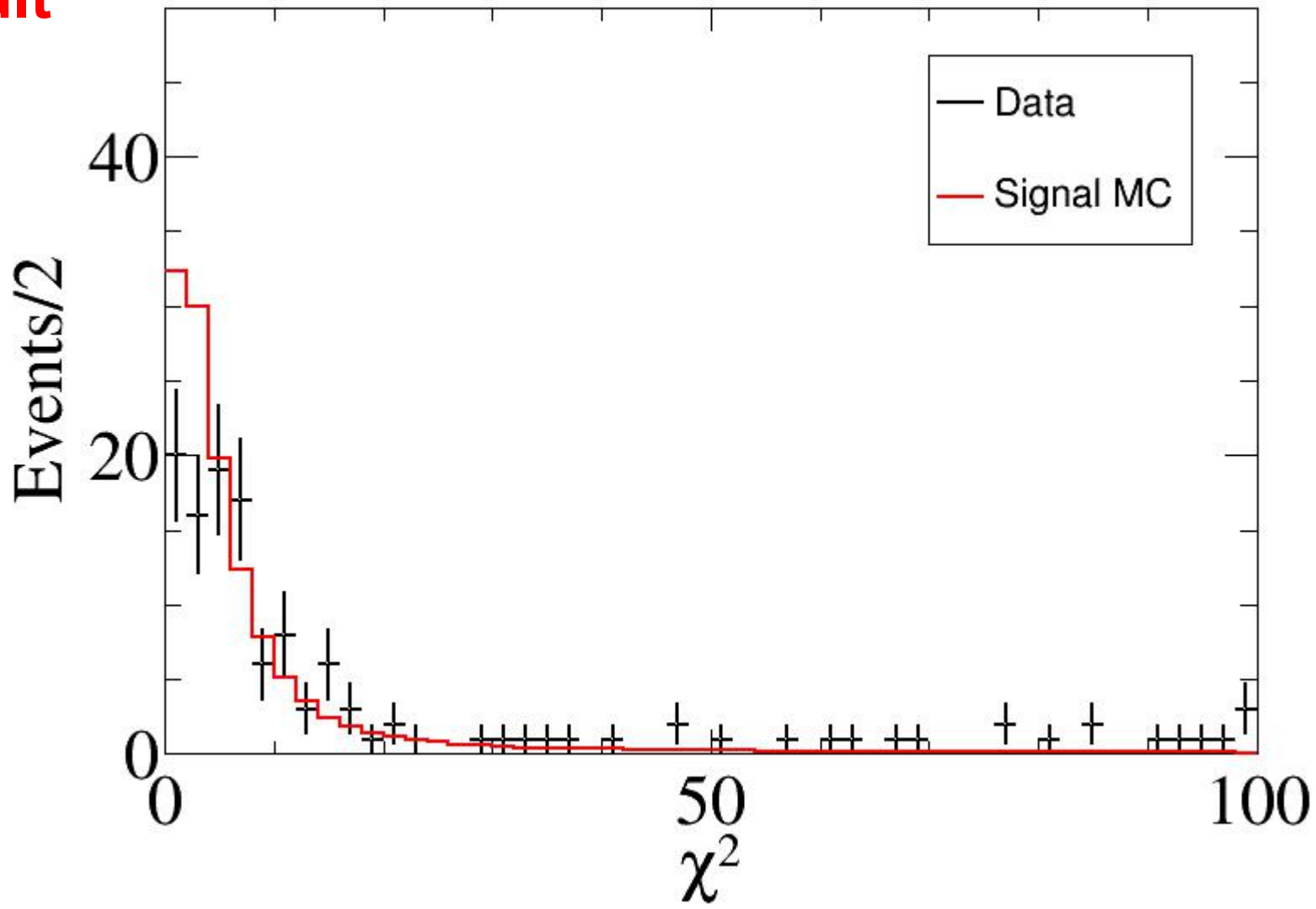
Previously, I only looked at the 4.600 GeV energy. Because there are fewer events, I don't compare the data with MC.

New result



χ^2_{3C} distribution from single MC and data

New result

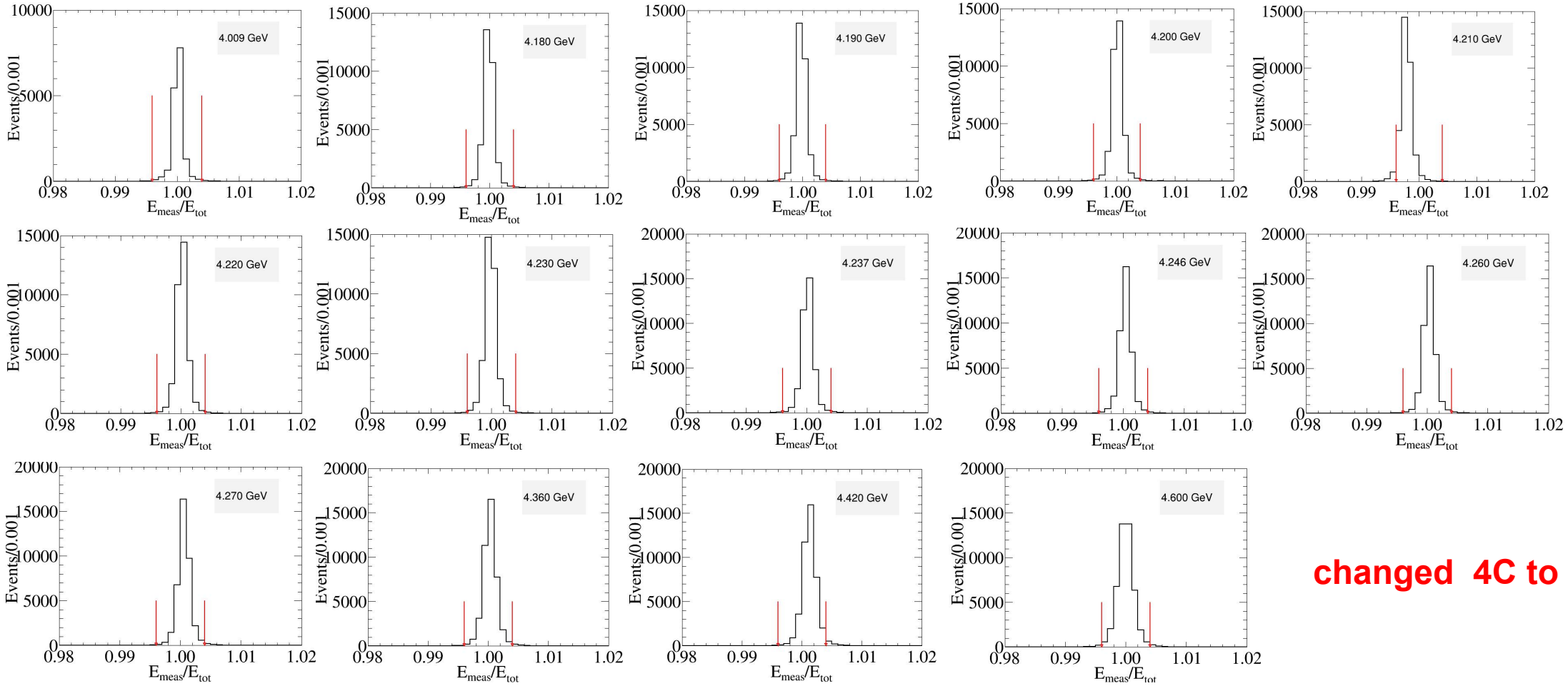


After the data and mc are normalized,and mc uses the events to weight.

9 4. After kinematics fitting, E_meas/E_tot must be around 1, so this condition is basically useless.

New result

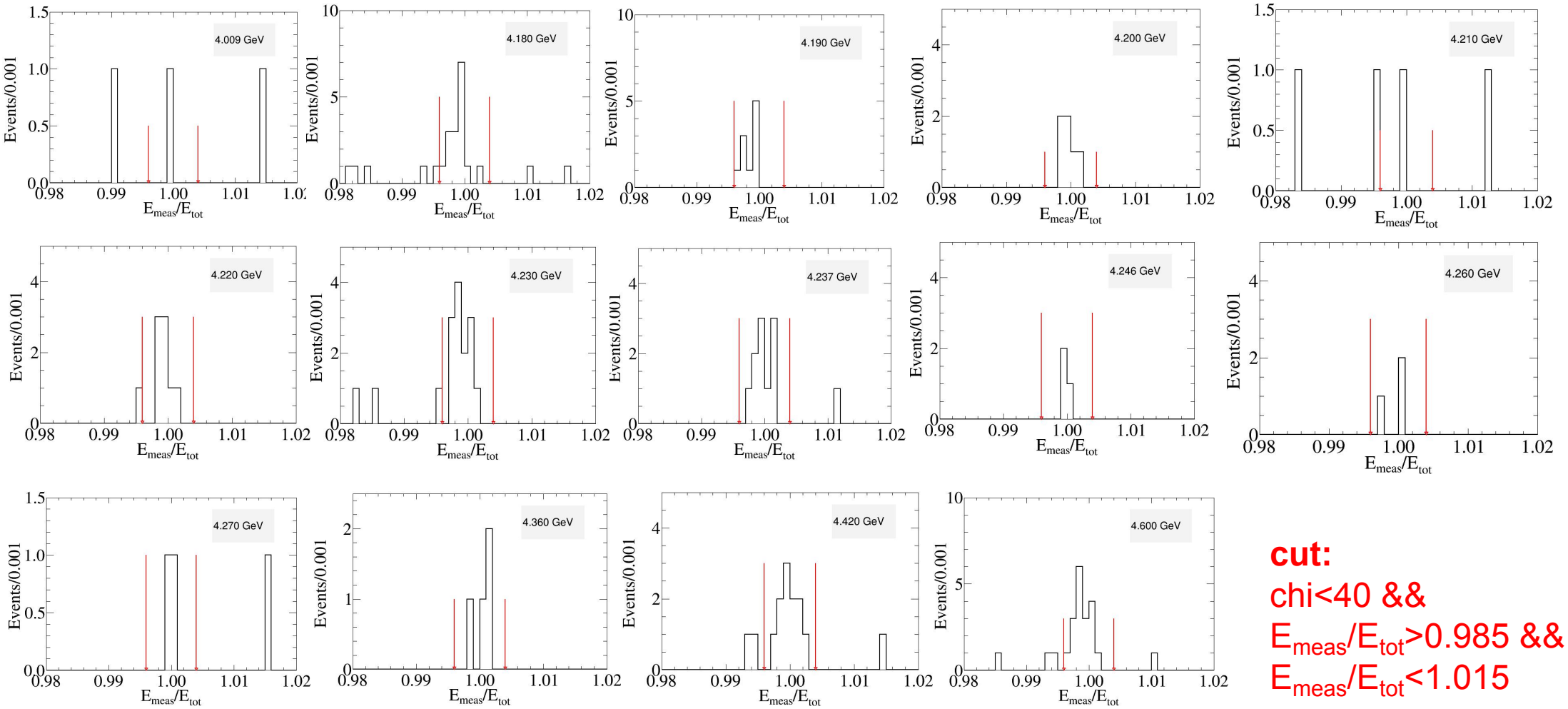
Final state energy distribution from Signal MC



changed 4C to 3C

New result

Final state energy distribution from Data

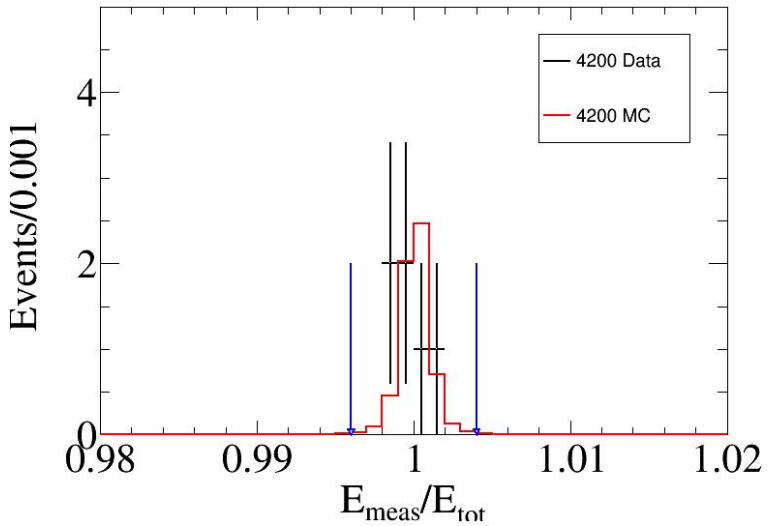


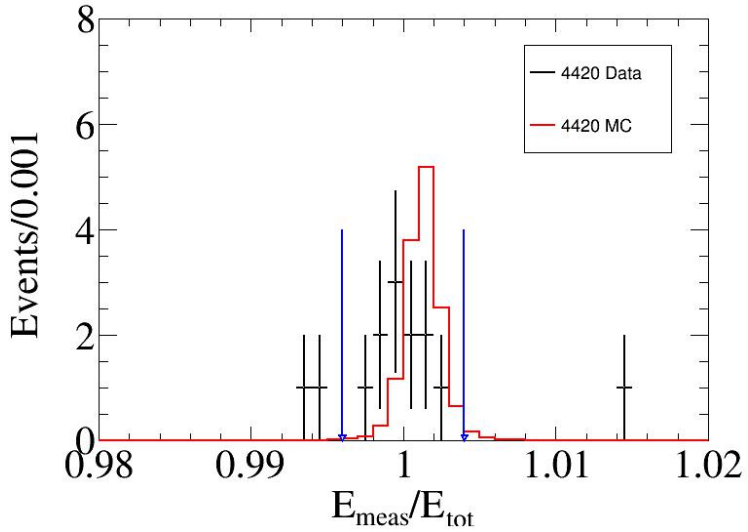
cut:

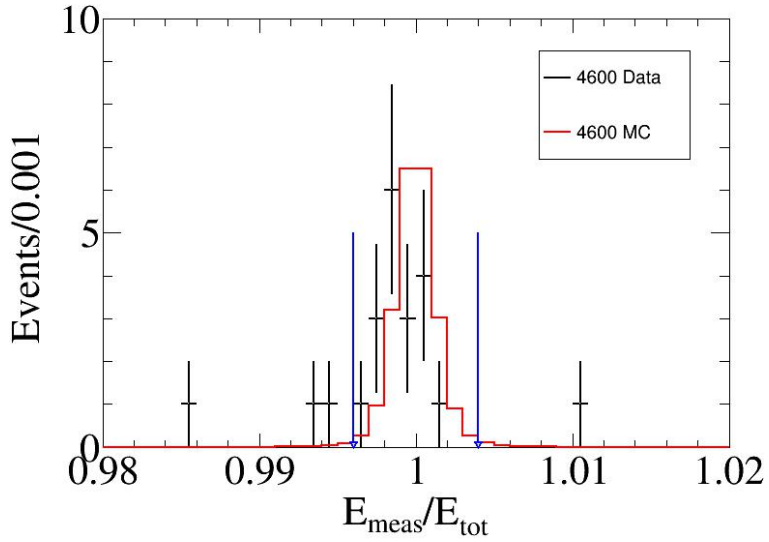
chi<40 &&

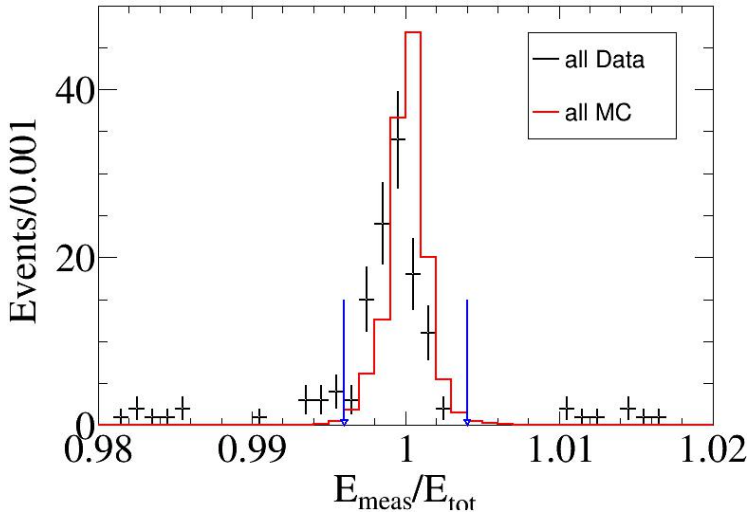
$E_{meas}/E_{tot}>0.985$ &&

$E_{meas}/E_{tot}<1.015$









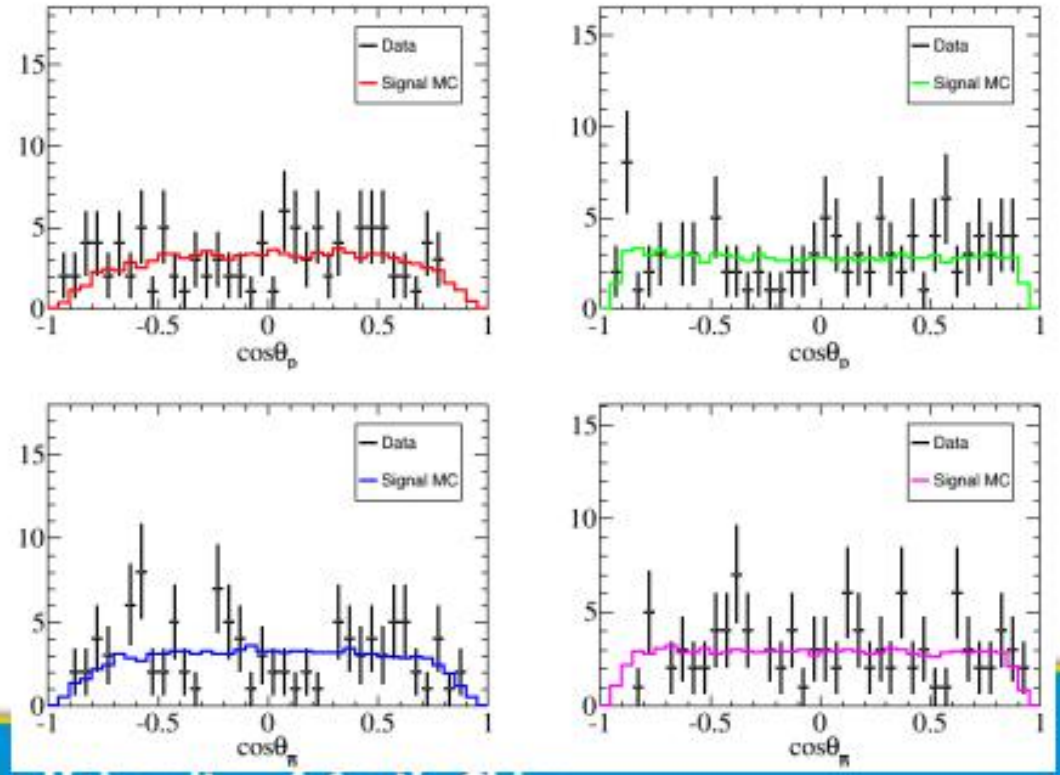
The typical energy points are weighted by events,and the data and mc are normalized.

125. Why is the distribution of the upper right corner of the angular distribution different from the others?

Previous result

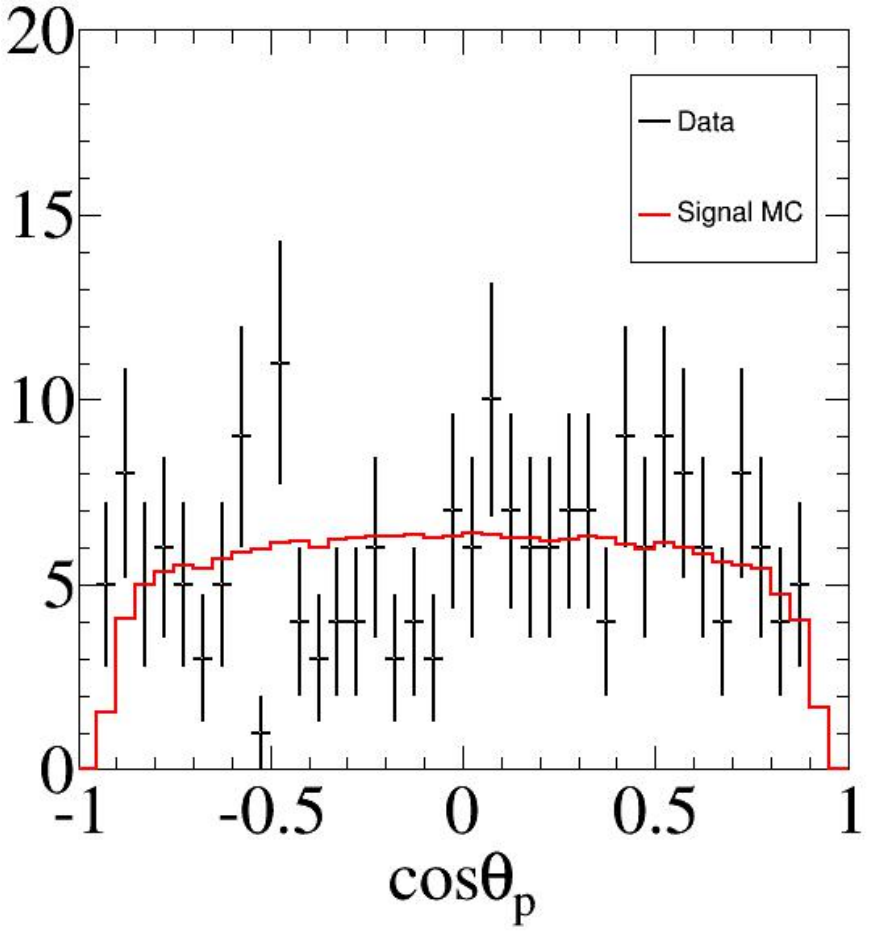
11

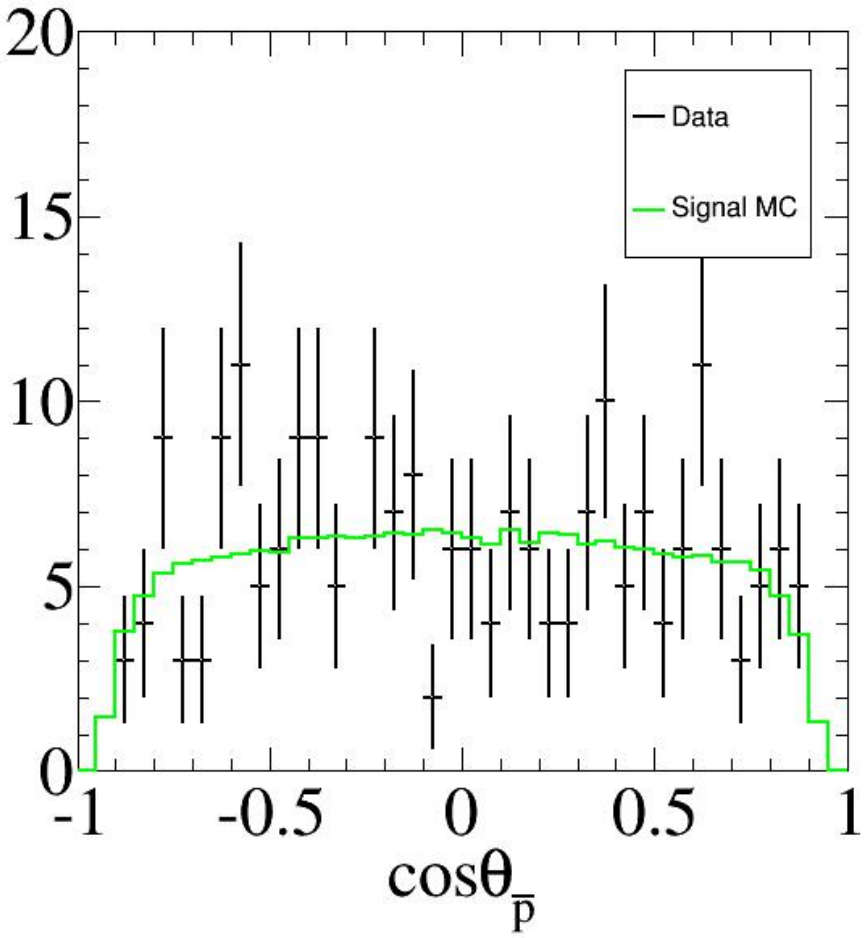
Angular distribution between data and MC



I used to separate two protons belonging to homologous particles to draw angular distribution.

New result



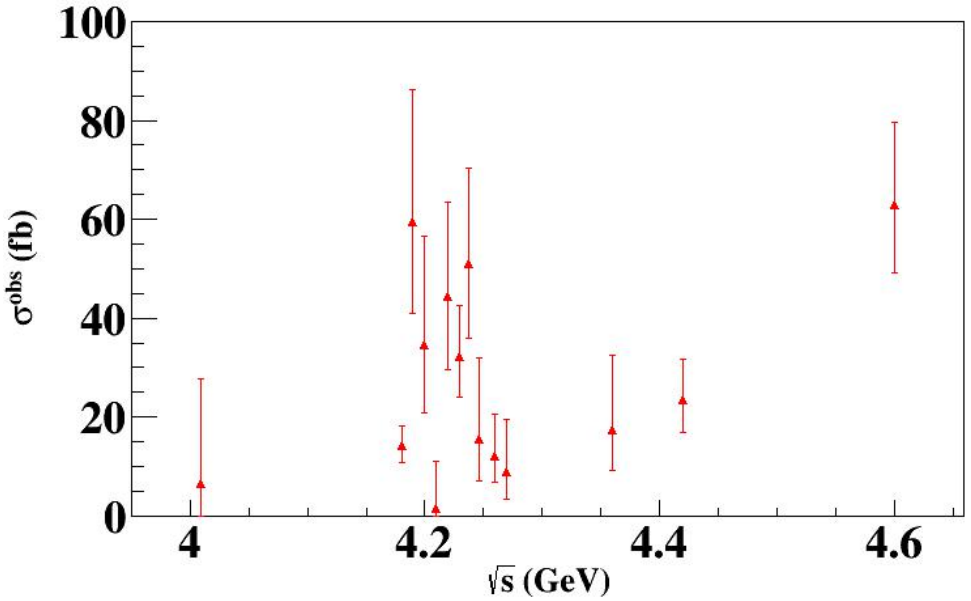


Angular distribution of two homologous particles

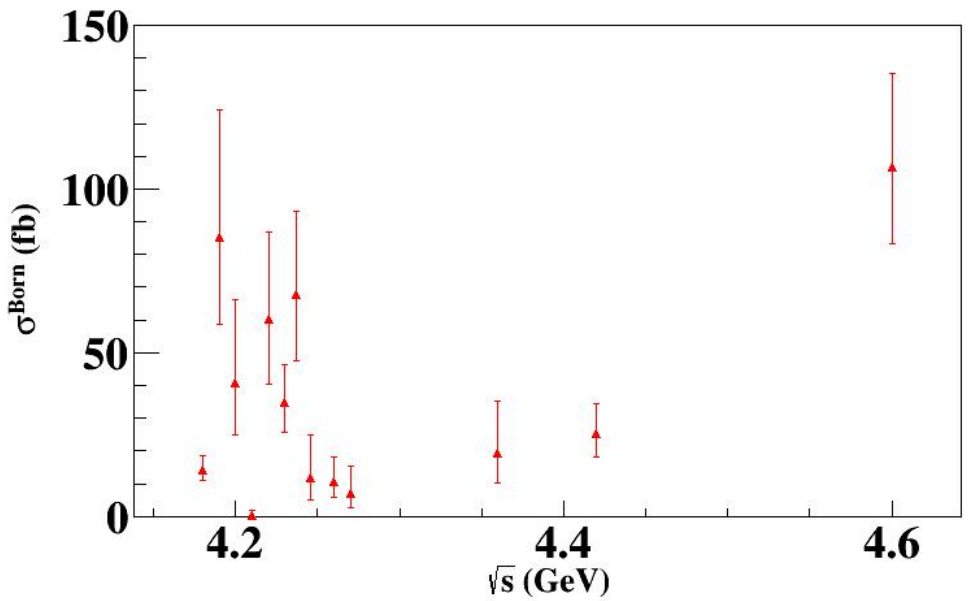
6. Is it possible to consider only kinematics fitting of momentum (3C) and then look at energy changes?

New result

Observation section



Born section



$$\sigma^{obs} = \frac{N_{\text{net}}}{\varepsilon \cdot L}$$

$$\sigma^{B} = \frac{\sigma^{obs}}{(1+\delta^{vac})(1+\delta^{ISR})}$$

In order to see the possible resonant structure, the Bonn section only draws 4.180 to 4.600 GeV.

	Luminosity(pb-1)	MC		data			σ obs(fb)	1+δ ISR	1+δ vac	σ Born(fb)
		N_{sig}	efficiency	N_{sig}	N_{bkg}	N_{net}				
4009	482.0±0.1±4.7	15917	0.16	$1.00^{+2.30}_{-0.83}$	$0.50^{+0.66}_{-0.32}$	$0.50^{+1.64}_{-0.51}$	$6.00^{+21.00}_{-7.00}$	0.0322	1.0438	$179.00^{+633.00}_{-197.00}$
4180	3160	31606	0.32	$16.00^{+5.09}_{-3.95}$	$1.75^{+0.94}_{-0.65}$	$14.25^{+4.15}_{-3.31}$	$14.00^{+4.00}_{-3.00}$	0.9325	1.0543	$14.00^{+4.00}_{-3.00}$
4190	526.0±0.1±2.1	32566	0.32	$10.00^{+4.27}_{-3.11}$	$0.00^{-0.25}_{-0.00}$	$10.00^{+4.52}_{-3.11}$	$59.00^{+27.00}_{-18.00}$	0.6555	1.0559	$85.00^{+39.00}_{-27.00}$
4200	526.0±0.1±2.1	33508	0.33	$6.00^{+3.58}_{-2.38}$	$0.00^{-0.25}_{-0.00}$	$6.00^{+3.83}_{-2.38}$	$35.00^{+22.00}_{-14.00}$	0.8145	1.0565	$41.00^{+26.00}_{-16.00}$
4210	518.0±0.1±1.8	32646	0.32	$1.00^{+2.30}_{-0.83}$	$0.75^{+0.73}_{-0.41}$	$0.25^{+1.57}_{-0.42}$	$2.00^{+9.00}_{-3.00}$	0.7521	1.0568	$2.52^{+9.40}_{+0.67}$
4220	514.6±0.1±1.8	34158	0.34	$8.00^{+3.95}_{-2.77}$	$0.25^{+0.58}_{-0.21}$	$7.75^{+3.34}_{-2.56}$	$44.00^{+19.00}_{-15.00}$	0.6896	1.0564	$60.00^{+26.00}_{-20.00}$
4230	1056.4±0.1±7.0	36164	0.36	$13.00^{+4.70}_{-3.56}$	$0.75^{+0.73}_{-0.41}$	$12.25^{+3.97}_{-3.15}$	$32.00^{+10.00}_{-8.00}$	0.8680	1.0561	$35.00^{+11.00}_{-9.00}$
4237	530.3±0.1±2.7	36103	0.36	$10.00^{+4.27}_{-3.11}$	$0.25^{+0.58}_{-0.21}$	$9.75^{+3.70}_{-2.90}$	$51.00^{+19.00}_{-15.00}$	0.7137	1.0555	$68.00^{+26.00}_{-20.00}$
4246	538.1±0.1±2.6	36340	0.36	$3.00^{+2.92}_{-1.63}$	$0.00^{-0.25}_{-0.00}$	$3.00^{+3.17}_{-1.63}$	$15.00^{+16.00}_{-8.00}$	1.1978	1.0555	$12.00^{+13.00}_{-7.00}$
4260	828.4±0.1±5.5	37300	0.37	$4.00^{+3.16}_{-1.91}$	$0.25^{+0.58}_{-0.21}$	$3.75^{+2.59}_{-1.70}$	$12.00^{+8.00}_{-6.00}$	1.0773	1.0535	$11.00^{+7.00}_{-5.00}$
4270	531.1±0.1±3.1	37554	0.37	$2.00^{+2.64}_{-1.29}$	$0.25^{+0.58}_{-0.21}$	$1.75^{+2.07}_{-1.08}$	$9.00^{+11.00}_{-6.00}$	1.1899	1.0531	$7.00^{+8.00}_{-4.00}$
4360	543.9±0.1±3.6	41849	0.42	$4.00^{+3.16}_{-1.91}$	$0.00^{-0.25}_{-0.00}$	$4.00^{+3.41}_{-1.91}$	$18.00^{+15.00}_{-8.00}$	0.8850	1.0511	$19.00^{+16.00}_{-9.00}$
4420	1043.9±0.1±6.9	42221	0.42	$11.00^{+4.42}_{-3.26}$	$0.75^{+0.73}_{-0.41}$	$10.25^{+3.69}_{-2.85}$	$23.00^{+8.00}_{-7.00}$	0.8657	1.0525	$25.00^{+9.00}_{-7.00}$
4600	586.9±0.1±3.9	45719	0.46	$18.00^{+5.32}_{-4.20}$	$1.00^{+0.79}_{-0.48}$	$17.00^{+4.53}_{-3.72}$	$63.00^{+17.00}_{-14.00}$	0.5594	1.0546	$107.00^{+28.00}_{-23.00}$

7. Have you considered the background from the beam?

At present, the work of estimating the beam background has not been done.

8. There may be a background,such as 4K + n gams.

This kind of background cannot exist in the 4C, so there is no such background in the last result. But now I am switching to 3C, which may need to be considered. I have not done any related work yet, and I will do it later.

9. Because the measurement cross section at that point is 0,the ISR correction factor at 4210 is large. It is recommended to use a smooth curve fit to make an ISR correction factor estimate.

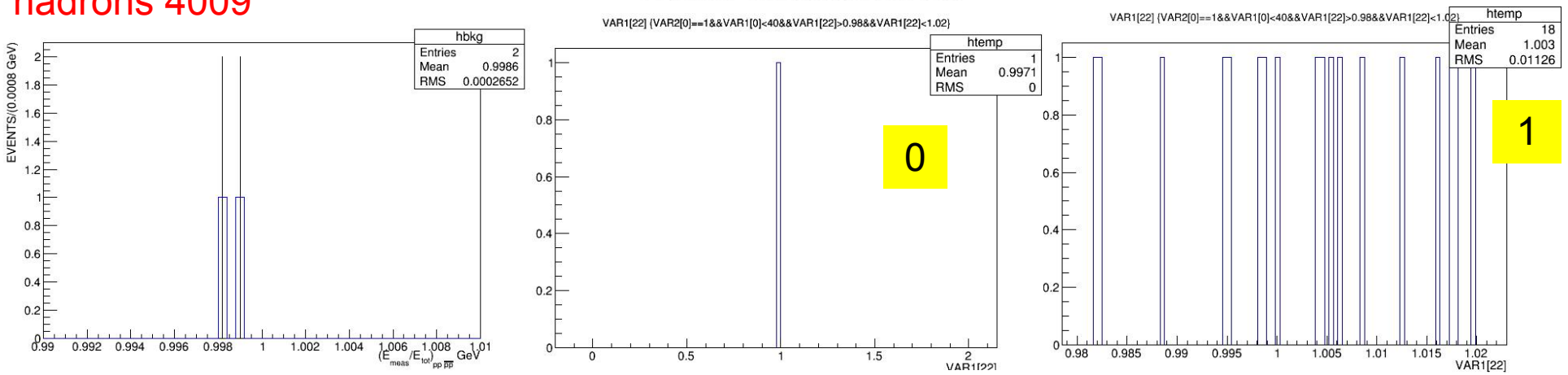
Since I did not fit the entire spectrum, the section of the theoretical curve was not used to make an estimate of the radiation correction, thus producing such a result. I will do related work later.

TopoAnaAlg

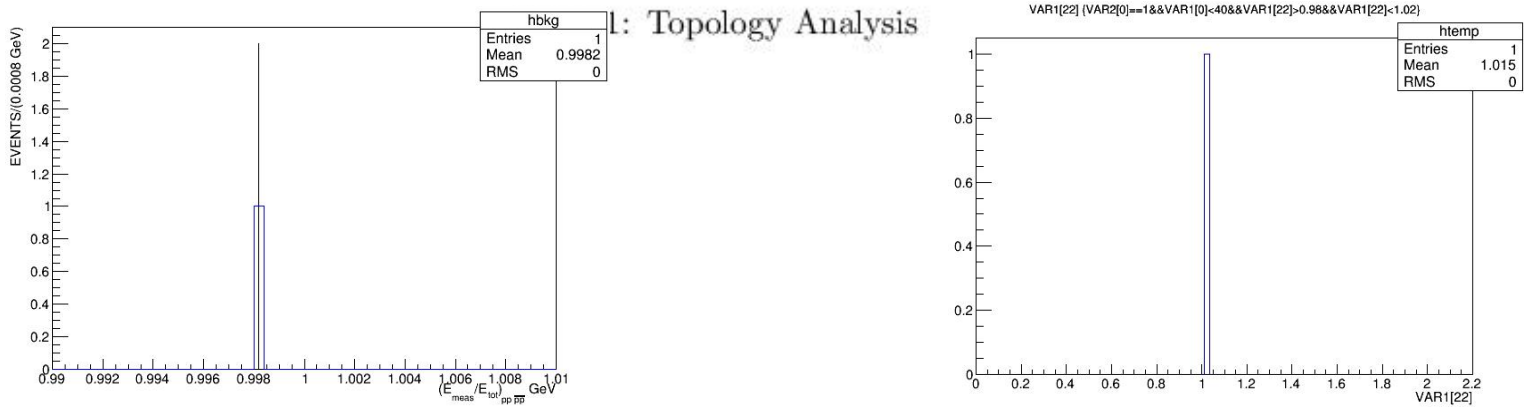
No.	decay chain	final states	iTopo	nEvt	nTot
0	$e^+e^- \to \pi^0\pi^0\psi',\ \psi' \to \Xi^0 K^*\Lambda,\ \Xi^0 \to \Lambda\pi^0,\ K^* \to K^-\pi^+,\ \Lambda \to \pi^0 n,\ \bar{\Lambda} \to \bar{p}\pi^+$	$e^+e^- \to n\pi^+\pi^+\pi^0\pi^0\pi^0\pi^0 K^-\bar{p}$	0	1	1
1	$e^+e^- \to \pi^-\pi^+\psi',\ \psi' \to \gamma\chi_{c0},\ \chi_{c0} \to \bar{\Delta}^{--}\pi^-\pi^+\Delta^{++},\ \bar{\Delta}^{--} \to \bar{p}\pi^-,\ \Delta^{++} \to \pi^+ p$	$e^+e^- \to \gamma p\pi^+\pi^+\pi^+\pi^-\pi^-\pi^-\bar{p}$	1	1	2

Table 1: Topology Analysis

hadrons 4009



No.	decay chain	final states	iTopo	nEvt	nTot
0	$e^+e^- \to \gamma\psi',\ \psi' \to \pi^-\pi^+ J/\psi,\ J/\psi \to \bar{p}\pi^-\pi^+ p$	$e^+e^- \to \gamma p\pi^+\pi^+\pi^-\pi^-\bar{p}$	0	1	1



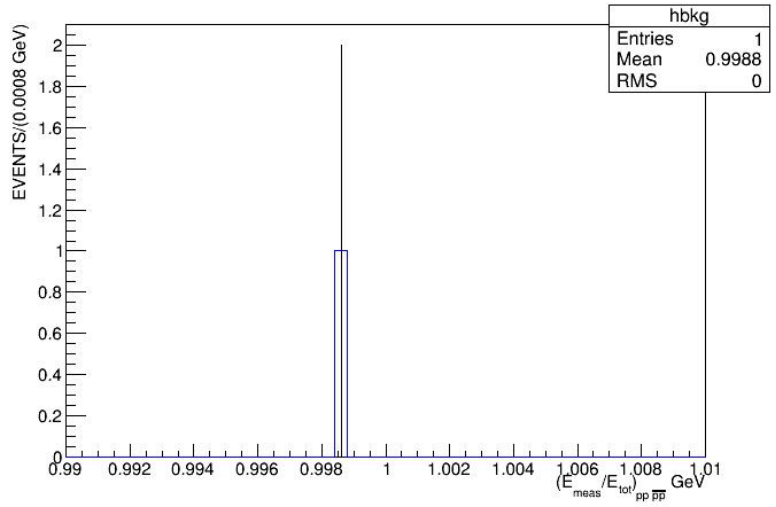
MC reconstruction
500,000 event

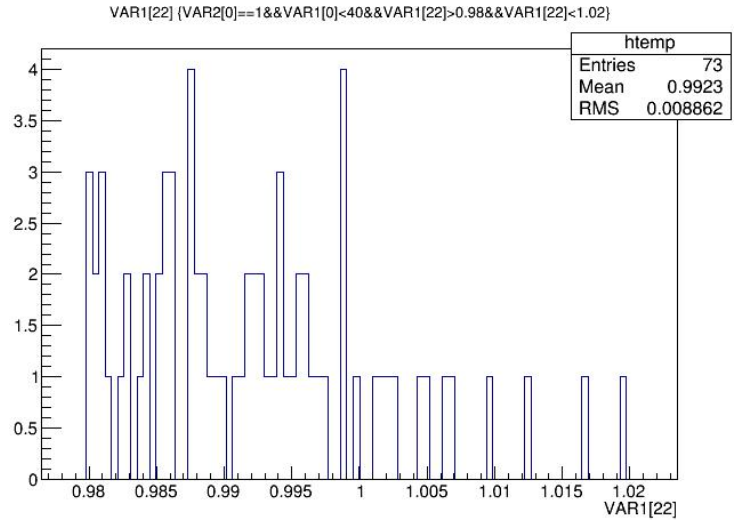
RR2S 4180

hadrons 4575

No.	decay chain	final states	iTopo	nEvt	nTot
0	$e^+e^- \to \phi\chi_{c2},\ \phi \to K^-K^+,\ \chi_{c2} \to \gamma J/\psi,\ J/\psi \to \bar{\Sigma}^0\Sigma^0,\ \bar{\Sigma}^0 \to \bar{\Lambda}\gamma,\ \Sigma^0 \to \gamma\Lambda,\ \Lambda \to \pi^- p,\ \bar{\Lambda} \to \bar{p}\pi^+$	$e^+e^- \to \gamma\gamma\gamma p K^+\pi^+\pi^- K^-\bar{p}$	0	1	1

Table 1: Topology Analysis

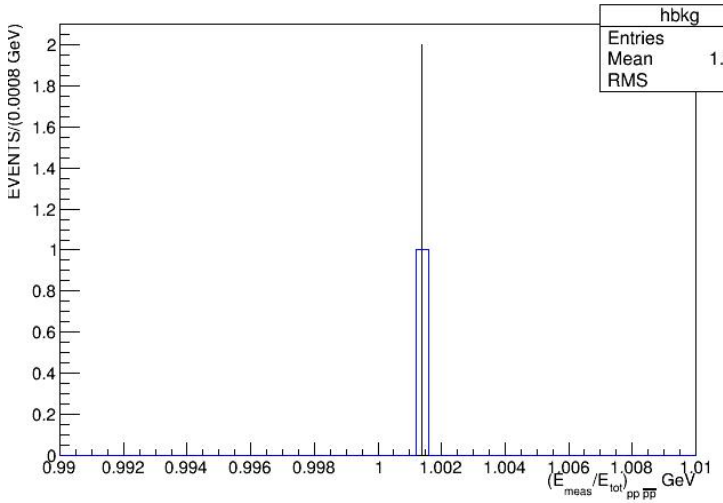


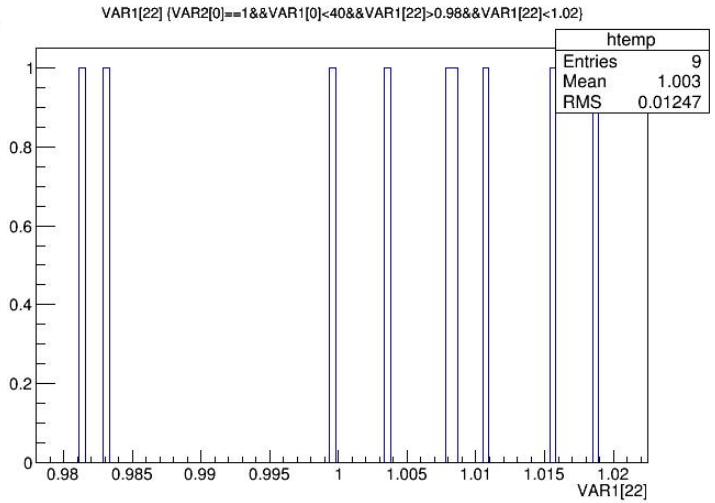


HCT 4180

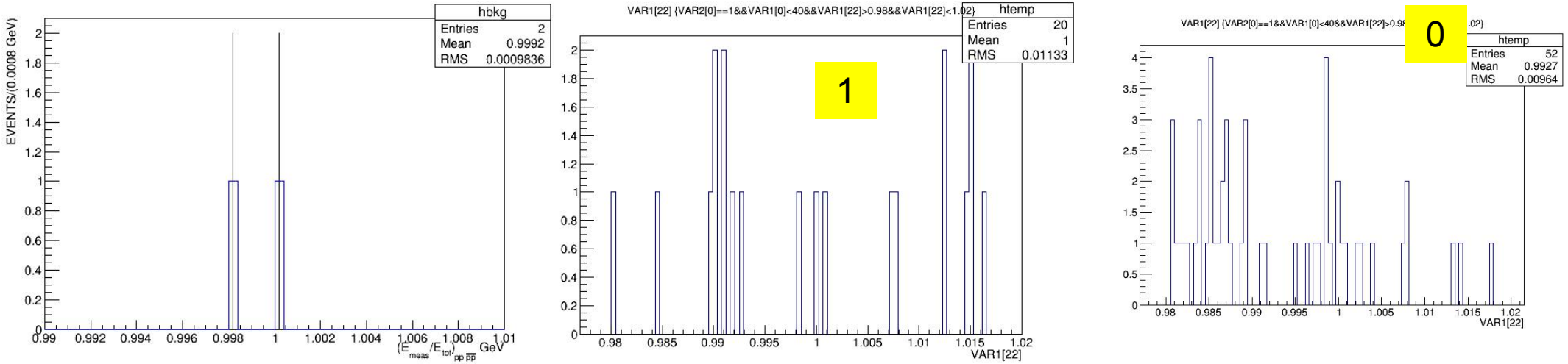
No.	decay chain	final states	iTopo	nEvt	nTot
0	$e^+e^- \to \gamma DIY1,\ DIY1 \to \pi^0\pi^0 J/\psi,\ J/\psi \to \Xi^+\Xi^-,\ \Xi^+ \to \Lambda\pi^+,\ \Xi^- \to \pi^-\Lambda,\ \Lambda \to \pi^- p,\ \bar{\Lambda} \to \bar{p}\pi^+$	$e^+e^- \to \gamma p\pi^+\pi^+\pi^0\pi^0\pi^-\pi^-\bar{p}$	0	1	1

pology Analysis



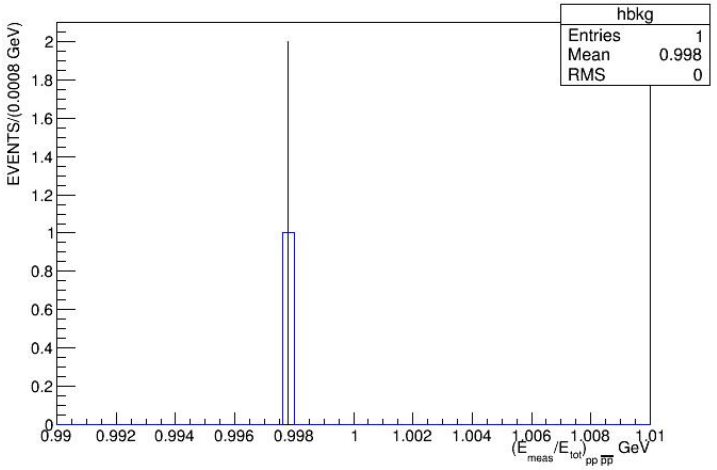


qqbar 4009



No.	decay chain	final states	iTopo	nEvt	nTot
0	$e^+e^- \to \pi^-\pi^+\psi',\ \psi' \to \pi^-\pi^+J/\psi,\ J/\psi \to \bar{\Delta}^+\omega p,\ \bar{\Delta}^+ \to \bar{p}\pi^0,\ \omega \to \pi^-\pi^0\pi^+$	$e^+e^- \to p\pi^+\pi^+\pi^+\pi^0\pi^0\pi^-\pi^-\pi^-\bar{p}$	0	1	1
1	$e^+e^- \to \pi^-\pi^+\psi',\ \psi' \to \pi^-\pi^+J/\psi,\ J/\psi \to \bar{\Sigma}^0\gamma\Sigma^0,\ \bar{\Sigma}^0 \to \bar{\Lambda}\gamma,\ \Sigma^0 \to \gamma\Lambda,\ \bar{\Lambda} \to \bar{p}\pi^+,\ \Lambda \to \pi^- p$	$e^+e^- \to \gamma\gamma\gamma p\pi^+\pi^+\pi^+\pi^-\pi^-\pi^-\bar{p}$	1	1	2

Table 1: Topology Analysis



No.	decay chain	final states	iTopo	nEvt	nTot
0	$e^+e^- \to \gamma J/\psi,\ J/\psi \to \bar{p}\pi^-\pi^0\Delta^{++},\ \Delta^{++} \to \pi^+ p$	$e^+e^- \to \gamma p\pi^+\pi^0\pi^-\bar{p}$	0	1	1

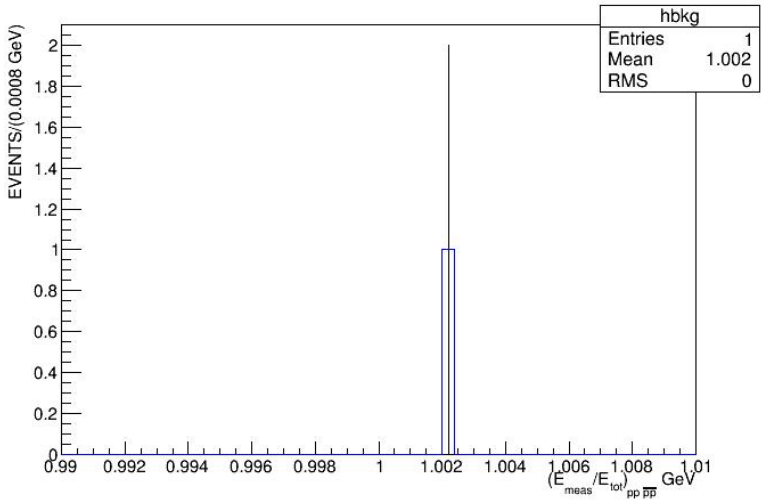
Table 1: Topology Analysis

RR1S 4180

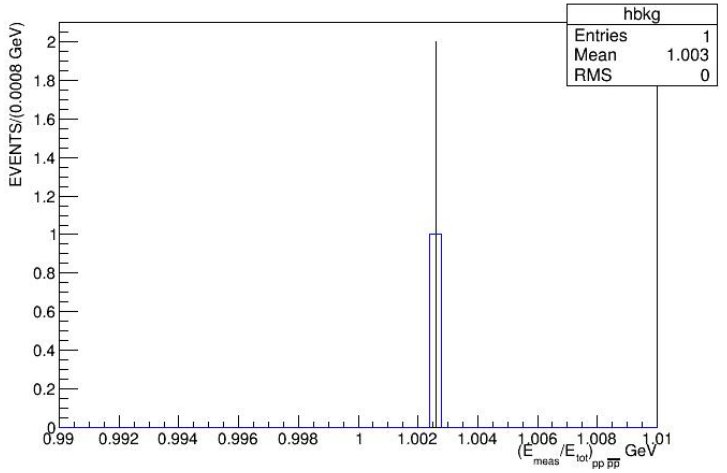
No.	decay chain	final states	iTopo	nEvt	nTot
0	$e^+e^- \to D^{*0}D^{*0},\ D^{*0} \to D^0\pi^0,\ D^{*0} \to \gamma D^0,\ D^0 \to \pi^-\rho^0 K_L\pi^+,\ D^0 \to \pi^-\pi^+ K_S,\ \rho^0 \to \pi^-\pi^+,\ K_S \to \pi^-\pi^+$	$e^+e^- \to \gamma\pi^+\pi^+\pi^+\pi^+ K_L\pi^0\pi^-\pi^-\pi^-\pi^-$	0	1	1

DST0DST0 4180

Table 1: Topology Analysis

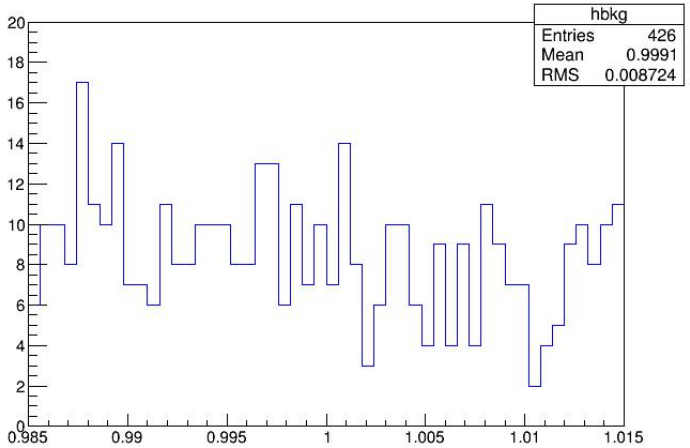


TwoGam 4180



No.	decay chain	final states	iTopo	nEvt	nTot
0	$e^+e^- \to e^+e^+,\ \to \bar{\Sigma}^0\Lambda,\ \bar{\Sigma}^0 \to \bar{\Lambda}\gamma$	$e^+e^- \to \gamma\Lambda e^+e^+\bar{\Lambda}$	0	1	1

Table 1: Topology Analysis



qq 4180

No peak background

21 qq 4180

Table 2: Decay final states.

index	decay final states	iDcyFSt	nEtrs	nCmltEtrs
1	$e^+e^- \to pppp$	1	14457	14457
2	$e^+e^- \to \pi^0\pi^+\pi^+\pi^-\pi^-pp$	2	25	14482
3	$e^+e^- \to \pi^0\pi^0\pi^+\pi^+\pi^-\pi^-pp$	5	25	14507
4	$e^+e^- \to \pi^0\pi^+\pi^+\pi^-\pi^-\Lambda\bar{\Lambda}$	12	15	14522
5	$e^+e^- \to \pi^+\pi^-K^+K^-\Lambda\bar{\Lambda}$	15	14	14536
6	$e^+e^- \to \pi^0\pi^+\pi^-\bar{K}^0\Lambda\bar{\Lambda}$	10	11	14547
7	$e^+e^- \to \pi^0\pi^+\pi^-\Lambda\bar{\Lambda}$	32	11	14558
8	$e^+e^- \to \pi^0\pi^0K^+K^-\Lambda\bar{\Lambda}$	68	11	14569
9	$e^+e^- \to \pi^0\pi^0\pi^+\pi^-pp$	36	10	14579
10	$e^+e^- \to \pi^0\pi^0\pi^+\pi^-\Lambda\bar{\Lambda}$	25	9	14588
11	$e^+e^- \to \pi^+K^0K^-\Lambda\bar{\Lambda}$	28	8	14596
12	$e^+e^- \to \pi^0\pi^+\pi^-pp$	88	8	14604
13	$e^+e^- \to \pi^0\pi^+\pi^-K^-p\bar{\Lambda}$	14	7	14611
14	$e^+e^- \to \pi^0\pi^+\pi^-K^+p\Lambda$	0	7	14618
15	$e^+e^- \to \pi^+\pi^-K^+K^-pp$	4	6	14624
16	$e^+e^- \to \pi^+\pi^-\pi^-\bar{K}^0p\bar{\Lambda}$	38	6	14630
17	$e^+e^- \to \pi^0\pi^+K^-\Lambda\bar{\Lambda}$	17	6	14636
18	$e^+e^- \to \pi^+\pi^+\pi^-K^-\Lambda\bar{\Lambda}$	23	6	14642
19	$e^+e^- \to \pi^+\pi^+\pi^-\pi^-\Lambda\bar{\Lambda}$	51	5	14647
20	$e^+e^- \to \pi^-\bar{K}^0p\bar{\Lambda}$	55	5	14652
21	$e^+e^- \to \pi^0\pi^0\pi^+K^-\Lambda\bar{\Lambda}$	7	5	14657
22	$e^+e^- \to \pi^0\pi^0\pi^+\pi^+\pi^-n\bar{p}$	71	5	14662
23	$e^+e^- \to \pi^0\pi^0\pi^-\bar{K}^0p\bar{\Lambda}$	26	5	14667
24	$e^+e^- \to \pi^+\pi^+\pi^-\pi^-pp$	92	5	14672
25	$e^+e^- \to \pi^0\pi^0\pi^+\pi^-K^-p\bar{\Lambda}$	118	5	14677
26	$e^+e^- \to \pi^+\pi^+\pi^-K^0p\Lambda$	128	5	14682
27	$e^+e^- \to \pi^0\pi^+\pi^-\bar{K}^0\Lambda\bar{\Lambda}$	27	4	14686
28	$e^+e^- \to \pi^0\pi^0\pi^0\pi^+\pi^-pp$	16	4	14690
29	$e^+e^- \to \pi^+\pi^-\Lambda\bar{\Lambda}$	63	4	14694
30	$e^+e^- \to \pi^+\pi^-\bar{K}^0\Lambda\bar{\Lambda}\gamma$	100	4	14698
31	$e^+e^- \to \pi^0\pi^+K^0p\Lambda$	66	4	14702
32	$e^+e^- \to \pi^+\pi^-K^0\bar{K}^0pp$	29	4	14706
33	$e^+e^- \to \pi^+\pi^-\pi^-K^+\Lambda\bar{\Lambda}$	65	3	14709
34	$e^+e^- \to \pi^0\pi^+\pi^-\pi^-K^+\Lambda\bar{\Lambda}$	31	3	14712
35	$e^+e^- \to \pi^0\pi^0K_LK_S\Lambda\bar{\Lambda}$	39	3	14715
36	$e^+e^- \to \pi^0\pi^0\pi^+\pi^+\pi^-p\Lambda$	41	3	14718
37	$e^+e^- \to \pi^0\pi^0\pi^+\pi^-\Lambda\bar{\Lambda}\gamma\gamma$	76	3	14721
38	$e^+e^- \to \pi^0\pi^+\pi^-\pi^-\bar{K}^0p\bar{\Lambda}$	79	3	14724
39	$e^+e^- \to \pi^0\pi^+\pi^+\pi^-K^-\Lambda\bar{\Lambda}$	80	3	14727
40	$e^+e^- \to \pi^+\pi^-K^-p\bar{\Lambda}$	81	3	14730
41	$e^+e^- \to \pi^0\pi^+K^0K^-pp$	43	3	14733
42	$e^+e^- \to \pi^0\pi^+\pi^-\bar{K}^0\Lambda\bar{\Lambda}\gamma$	47	3	14736
43	$e^+e^- \to \pi^+K^0p\Lambda$	94	3	14739
44	$e^+e^- \to \pi^0\pi^+K^-\Lambda\bar{\Lambda}\gamma$	19	3	14742
45	$e^+e^- \to K^+K^-K^-p\bar{\Lambda}$	112	3	14745
46	$e^+e^- \to \pi^0\pi^-\bar{K}^0p\bar{\Lambda}$	34	3	14748
47	$e^+e^- \to \pi^0\pi^+\pi^-K^+K^-pp$	22	3	14751
48	$e^+e^- \to \pi^0\pi^+\pi^-\bar{K}^0pp$	72	2	14753
49	$e^+e^- \to \pi^+\pi^+\pi^-\pi^-K^-p\bar{\Lambda}$	74	2	14755
50	$e^+e^- \to \pi^0\pi^+\pi^-K^0\Lambda\bar{\Lambda}\gamma$	20	2	14757
51	$e^+e^- \to \pi^0\pi^+\pi^-\pi^-p\bar{\Lambda}$	33	2	14759
52	$e^+e^- \to \pi^0\pi^0\pi^+\pi^-\bar{K}^0pp$	57	2	14761
53	$e^+e^- \to \pi^0\pi^+\pi^+\pi^-K^0p\Lambda$	58	2	14763
54	$e^+e^- \to K_LK_S\Lambda\bar{\Lambda}\gamma\gamma$	86	2	14765
55	$e^+e^- \to \pi^+\pi^-K^-p\bar{\Lambda}\gamma$	59	2	14767
56	$e^+e^- \to \pi^0\pi^+\pi^+\pi^+\pi^-\pi^-\pi^-pp$	18	2	14769
57	$e^+e^- \to \pi^-\bar{K}^0K^+\Lambda\bar{\Lambda}\gamma\gamma$	64	2	14771
58	$e^+e^- \to \pi^0\pi^+\pi^-\pi^-n\bar{p}$	35	2	14773
59	$e^+e^- \to \pi^0K^+K^-\Lambda\bar{\Lambda}\gamma$	105	2	14775
60	$e^+e^- \to \pi^0\pi^+\pi^-K^-p\bar{\Lambda}\gamma$	44	2	14777
61	$e^+e^- \to \pi^0\pi^0\pi^-K^+\Lambda\bar{\Lambda}$	113	2	14779
62	$e^+e^- \to \pi^0\pi^0\pi^-K^+\Lambda\bar{\Lambda}\gamma$	46	2	14781
63	$e^+e^- \to \pi^+\pi^+\pi^-\pi^-n\bar{\Lambda}\gamma$	6	2	14783
64	$e^+e^- \to \pi^0K^0\bar{K}^0\Lambda\bar{\Lambda}$	8	1	14784
65	$e^+e^- \to \pi^-K^+n\Lambda$	42	1	14785
66	$e^+e^- \to \pi^0\pi^0\pi^0\pi^-\bar{K}^0p\bar{\Lambda}$	24	1	14786
67	$e^+e^- \to K_L\pi^+K_SK^0K^+K^-K^-$	13	1	14787
68	$e^+e^- \to \pi^0K^0n\bar{\Lambda}$	67	1	14788
69	$e^+e^- \to \pi^0\pi^+\pi^+\pi^-\eta n\bar{p}$	45	1	14789
70	$e^+e^- \to \pi^0\pi^0\pi^+\pi^-K^-p\bar{\Lambda}\gamma$	69	1	14790
71	$e^+e^- \to \pi^-K^+n\bar{n}$	70	1	14791
72	$e^+e^- \to \pi^0\pi^+K^-n\bar{\Lambda}$	9	1	14792
73	$e^+e^- \to \pi^0\pi^0\pi^+\pi^-\Lambda\bar{\Lambda}\gamma$	3	1	14793
74	$e^+e^- \to \pi^-\bar{K}^0K^+\Lambda\bar{\Lambda}$	73	1	14794
75	$e^+e^- \to \pi^+K^0K^-\Lambda\bar{\Lambda}\gamma$	48	1	14795
76	$e^+e^- \to \pi^+\pi^-\bar{K}^0K^-p\bar{\Lambda}$	75	1	14796
77	$e^+e^- \to \pi^0\eta pp$	49	1	14797
78	$e^+e^- \to \pi^0\pi^0\pi^+K^0K^-pp$	77	1	14798
79	$e^+e^- \to \pi^0\pi^+\pi^+\pi^-K^-n\bar{\Lambda}$	78	1	14799
80	$e^+e^- \to \pi^+\pi^-pp$	50	1	14800
81	$e^+e^- \to \pi^0\pi^+\eta p\Lambda$	21	1	14801
82	$e^+e^- \to \pi^0\pi^+\pi^+\pi^-K^-\Lambda\bar{\Lambda}\gamma$	52	1	14802
83	$e^+e^- \to \pi^+\pi^-K^-n\bar{p}$	82	1	14803
84	$e^+e^- \to \pi^+\pi^+\pi^+\pi^-\pi^-K^0K^-$	83	1	14804
85	$e^+e^- \to \pi^+\pi^-\Lambda\bar{\Lambda}\gamma$	84	1	14805
86	$e^+e^- \to \pi^0\pi^-\bar{K}^0K^+\Lambda\bar{\Lambda}\gamma$	85	1	14806
87	$e^+e^- \to \pi^0\pi^0\pi^0\pi^+\pi^-\pi^-p\bar{\Lambda}$	53	1	14807
88	$e^+e^- \to \pi^0\pi^0\pi^+\pi^+\pi^+\pi^-\pi^-\pi^-$	87	1	14808
89	$e^+e^- \to \pi^0\pi^+\pi^+\pi^-\pi^-n\bar{n}$	54	1	14809
90	$e^+e^- \to \pi^0\pi^0\pi^+\pi^+\pi^-\pi^-\Lambda\bar{\Lambda}$	89	1	14810
91	$e^+e^- \to \pi^+\pi^+\pi^-\pi^-n\bar{\Lambda}$	90	1	14811
92	$e^+e^- \to \pi^+\pi^-\eta K^-p\bar{\Lambda}$	91	1	14812
93	$e^+e^- \to \pi^0K^+K^-\Lambda\bar{\Lambda}$	37	1	14813
94	$e^+e^- \to \pi^+K^-\Lambda\bar{\Lambda}$	93	1	14814
95	$e^+e^- \to \pi^+\pi^+\pi^+\pi^-\pi^-\pi^-pp$	56	1	14815
96	$e^+e^- \to \pi^0\pi^-K^+\Lambda\bar{\Lambda}$	95	1	14816

index	decay final states	iDcyFSt	nEtrs	nCmltEtrs
97	$e^+e^- \to \pi^+\pi^- K^0 \Lambda\bar{\Lambda}\gamma$	96	1	14817
98	$e^+e^- \to \pi^0\pi^+\pi^+\pi^- n p$	97	1	14818
99	$e^+e^- \to \pi^0\pi^0\pi^+\pi^- K^0 p p$	98	1	14819
100	$e^+e^- \to \pi^+\pi^- K^0 n\bar{\Lambda}\gamma$	99	1	14820
101	$e^+e^- \to \pi^0\pi^0\pi^0\pi^0\pi^+\pi^+\pi^-\pi^- K^0 K^0$	11	1	14821
102	$e^+e^- \to \pi^+\pi^+\pi^-\pi^-\eta\Lambda\bar{\Lambda}$	101	1	14822
103	$e^+e^- \to \pi^+\pi^- K^+ p\Lambda\gamma$	102	1	14823
104	$e^+e^- \to \pi^0\pi^0\pi^0\pi^0\pi^+\pi^- p p$	103	1	14824
105	$e^+e^- \to \pi^+\pi^- K^+ p\Lambda$	104	1	14825
106	$e^+e^- \to \pi^0\pi^- K^0 K^0 p\bar{\Lambda}$	30	1	14826
107	$e^+e^- \to \pi^0\pi^- K^0 K^+\Lambda\bar{\Lambda}$	106	1	14827
108	$e^+e^- \to \pi^+\eta K^-\Lambda\bar{\Lambda}$	107	1	14828
109	$e^+e^- \to \pi^0\pi^0\pi^0\pi^+\pi^+\pi^- p\Lambda$	108	1	14829
110	$e^+e^- \to \pi^0\pi^+\pi^-\eta p p$	109	1	14830
111	$e^+e^- \to \pi^+\pi^-\eta n\Lambda$	110	1	14831
112	$e^+e^- \to \pi^0\pi^+\pi^-\Lambda\bar{\Lambda}\gamma$	111	1	14832
113	$e^+e^- \to \pi^0\pi^0\pi^+\pi^- p p\gamma$	40	1	14833
114	$e^+e^- \to K^+K^-K^- p\bar{\Lambda}\gamma$	60	1	14834
115	$e^+e^- \to \pi^0\pi^0\pi^+\pi^-\pi^- p\bar{\Lambda}$	114	1	14835
116	$e^+e^- \to K^+K^+K^- p\Lambda$	115	1	14836
117	$e^+e^- \to \pi^0\pi^+\pi^-\pi^- K^0 p\bar{\Lambda}\gamma$	116	1	14837
118	$e^+e^- \to \pi^0\pi^0\pi^+\pi^+\pi^+\pi^-\pi^- n p$	117	1	14838
119	$e^+e^- \to K_S K_S K^- p\bar{\Lambda}\gamma$	61	1	14839
120	$e^+e^- \to \pi^0\pi^+\pi^+\pi^- K^0 n p$	119	1	14840
121	$e^+e^- \to \pi^0\pi^0 K^0 K^- p\Lambda$	120	1	14841
122	$e^+e^- \to \pi^0\pi^+\pi^+\pi^+\pi^-\pi^-\pi^-$	121	1	14842
123	$e^+e^- \to \pi^+\pi^+\pi^-\pi^-\eta p p$	122	1	14843
124	$e^+e^- \to \pi^0\pi^+\pi^- n\bar{n}$	123	1	14844
125	$e^+e^- \to \pi^0\pi^+\pi^-\pi^- K^+ p p$	124	1	14845
126	$e^+e^- \to \pi^0\pi^0\pi^0\pi^+\pi^-\Lambda\bar{\Lambda}$	125	1	14846
127	$e^+e^- \to \pi^-\eta K^+\Lambda\bar{\Lambda}\gamma$	126	1	14847
128	$e^+e^- \to \pi^0\pi^+\pi^+\pi^-\pi^-\eta p p$	127	1	14848

index	decay final states	iDcyFSt	nEtrs	nCmltEtrs
129	$e^+e^- \to \pi^0 K^0\Lambda\bar{\Lambda}\gamma$	62	1	14849
130	$e^+e^- \to \pi^+\pi^+\pi^- K^-\Lambda\bar{\Lambda}\gamma$	129	1	14850
131	$e^+e^- \to \pi^+\pi^-\eta\Lambda\bar{\Lambda}\gamma$	130	1	14851
132	$e^+e^- \to \pi^0\pi^0\pi^+ K^+ K^- p\Lambda$	131	1	14852
133	$e^+e^- \to \pi^0\pi^+\pi^+\pi^-\pi^- n\bar{\Lambda}$	132	1	14853
134	$e^+e^- \to \pi^0\pi^+ K^0 K^0 n p$	133	1	14854
135	$e^+e^- \to \pi^0\pi^+ K^- n\bar{\Lambda}\gamma$	134	1	14855
136	$e^+e^- \to \pi^0\pi^+ K^0 K^-\Lambda\bar{\Lambda}$	135	1	14856
137	$e^+e^- \to \pi^0\pi^+\pi^+\pi^-\pi^-\Lambda\bar{\Lambda}\gamma$	136	1	14857
138	$e^+e^- \to \pi^0 K^- p\bar{\Lambda}$	137	1	14858
139	$e^+e^- \to K_L\pi^+\pi^- K_S\Lambda\bar{\Lambda}$	138	1	14859
140	$e^+e^- \to \pi^0\pi^-\eta K^+ p p$	139	1	14860
141	$e^+e^- \to \pi^0\pi^0\pi^+\pi^+\pi^- p\Lambda\gamma$	140	1	14861
142	$e^+e^- \to \pi^+\pi^-\pi^- K^+ n\Lambda$	141	1	14862
143	$e^+e^- \to \pi^+\pi^- K^0 n\bar{\Lambda}$	142	1	14863
144	$e^+e^- \to \pi^+\pi^+\pi^-\pi^- K^0\Lambda\bar{\Lambda}$	143	1	14864
145	$e^+e^- \to \pi^0\pi^+\pi^- K^0 p p$	144	1	14865
146	$e^+e^- \to \pi^0\pi^+\pi^- p p\gamma\gamma$	145	1	14866
147	$e^+e^- \to \pi^0\pi^0\pi^+\pi^+\pi^- K^- p p$	146	1	14867
148	$e^+e^- \to \pi^0\pi^0 K^+ K^- p p$	147	1	14868
149	$e^+e^- \to K_L\pi^+\pi^-\pi^- K_S K^0 K^+$	148	1	14869
150	$e^+e^- \to \pi^0\pi^0\pi^+\pi^-\pi^- p\bar{\Lambda}\gamma$	149	1	14870
151	$e^+e^- \to \pi^0\pi^0\pi^0\pi^+ K^0 K^0 K^0 K^-$	150	1	14871
152	$e^+e^- \to \pi^0\pi^0\pi^+ K^0 p\Lambda$	151	1	14872
153	$e^+e^- \to \eta K^+ p\Lambda$	152	1	14873
154	$e^+e^- \to \pi^0\pi^0\pi^+\pi^- K^+ p\Lambda$	153	1	14874
155	$e^+e^- \to \pi^0\pi^+\pi^- K^+ p\Lambda\gamma$	154	1	14875
156	$e^+e^- \to \pi^+\pi^-\eta p p$	155	1	14876
157	$e^+e^- \to \pi^0\pi^+\pi^- K^0 n\bar{\Lambda}$	156	1	14877
158	$e^+e^- \to \pi^0\pi^+ K^- K^- p\bar{\Lambda}$	157	1	14878
159	$e^+e^- \to \pi^0\pi^0\pi^0\pi^+\pi^+\pi^+\pi^+\pi^-\pi^-\pi^-\pi^-$	158	1	14879
160	$e^+e^- \to K^+K^-\Lambda\bar{\Lambda}$	159	1	14880

index	decay final states	iDcyFSt	nEtrs	nCmltEtrs
161	$e^+e^- \to \pi^0\pi^0 K^0 p p$	160	1	14881
162	$e^+e^- \to \pi^0\pi^0\pi^+\pi^-\eta p p$	161	1	14882
163	$e^+e^- \to \pi^0\pi^0\pi^+ p\Lambda$	162	1	14883

TopoAnaAlg

Topo	4009		4230	4260	4360	4420	4575		4600
	N_{track}	N	N	N	N	N	N_{track}	N	N
QED		–	–	–	–	–		–	0
hadrons	0	1	0	0	0	0	0	73	0
	1	18							
DDbar		0	0	0	0	0		0	0
qqbar	0	52	0	0	0	0		0	0
	1	20							

N_{track}: Number of decay process;
N:Event

Topo (4180)											
	RR1S	DDSTPIp	DSTODSTO	HCT	RR3770	DODO	DpDm	DSTpDm	mm	DDSTPIO	DSTODO
N_{track}				0							
N	0	0	0	9	0	0	0	0	0	0	0
	TwoGam	DDPIO	DsDs	DSTpDSTm	qq	tt	DDPIp	DsSTDs	ee	eeNLO	RR2S
N_{track}											0
N	0	0	0	0	0	0	0	0	0	0	1

Topology analysis of eight energy points has been completed and a large number of samples of MC reconstruction have been performed on the possible peak background.

Summary

- The line-shape of $e^+e^- \to pp\overline{pp}$ favors the double structures hypothesis around Ecm=4.26 GeV. Just like our measurement of $\sigma(e^+e^-\to\pi^+\pi^-J/\psi)$.
- The ISR factor at Ecm=4.009 need to be further studied.
- We will try to fit the line-shape according to the scheme in $\sigma(e^+e^-\to\pi^+\pi^-J/\psi)$ and $\sigma(e^+e^-\to\pi^+\pi^-h_c)$.

Thank you!