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# $\Lambda_c$ Production in ep system (pythia+RHIC)

8<sup>th</sup> August, 2022

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# $\Lambda_c$ in $ep$

- Source 1: from proton

I	KS	id	orig	daughter	
1	21	11	0	3	4
2	21	2212	0	5	0
3	21	11	1	0	0
4	21	22	1	0	0
5	21	2212	2	0	0
6	21	22	4	0	0
7	21	-4	5	0	0
8	21	22	6	0	0
9	21	-4	7	0	0
10	21	-4	9	0	0
11	11	4122	5	16	18
12	1	11	3	0	0
13	12	2	5	20	22
14	12	21	10	20	22
15	11	-4	10	20	22
16	11	213	11	23	24
17	1	2112	11	0	0
18	11	-311	11	25	25
19	11	92	13	20	22

- Source: from quark fragmentation

I	KS	id	orig	daughter	
1	21	11	0	3	4
2	21	2212	0	5	0
3	21	11	1	0	0
4	21	22	1	0	0
5	21	2212	2	0	0
6	21	9900440	4	0	0
7	21	2212	5	0	0
8	12	-4	6	13	16
9	11	4	6	13	16
10	1	2212	7	0	0
11	1	11	3	0	0
12	11	92	8	13	16
13	11	-4122	8	17	19
14	11	3122	8	20	21
15	11	311	9	22	22
16	11	411	9	23	25
17	1	321	13	0	0

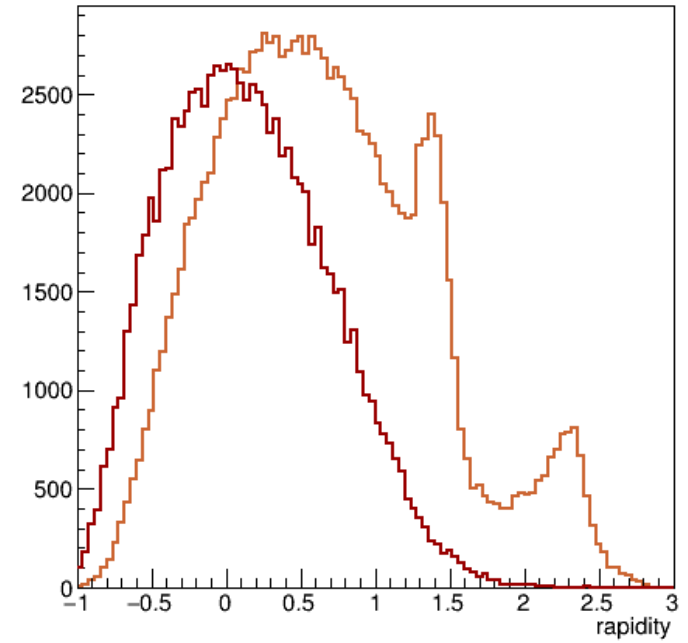
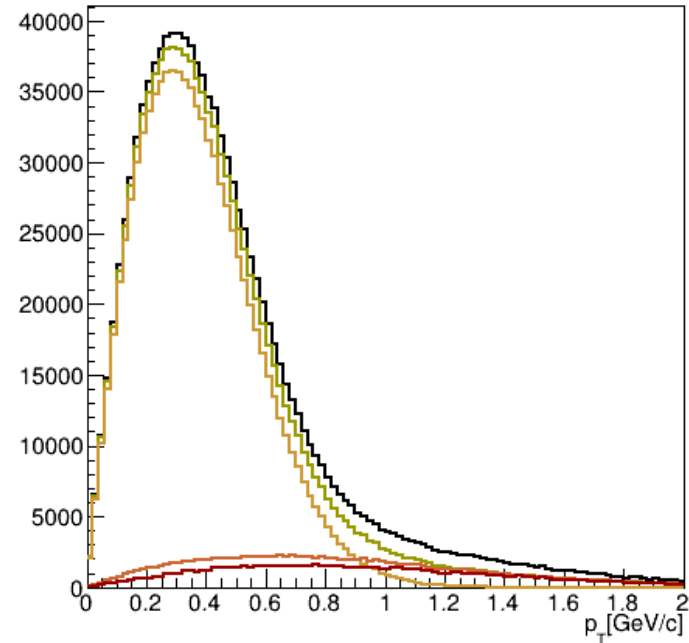
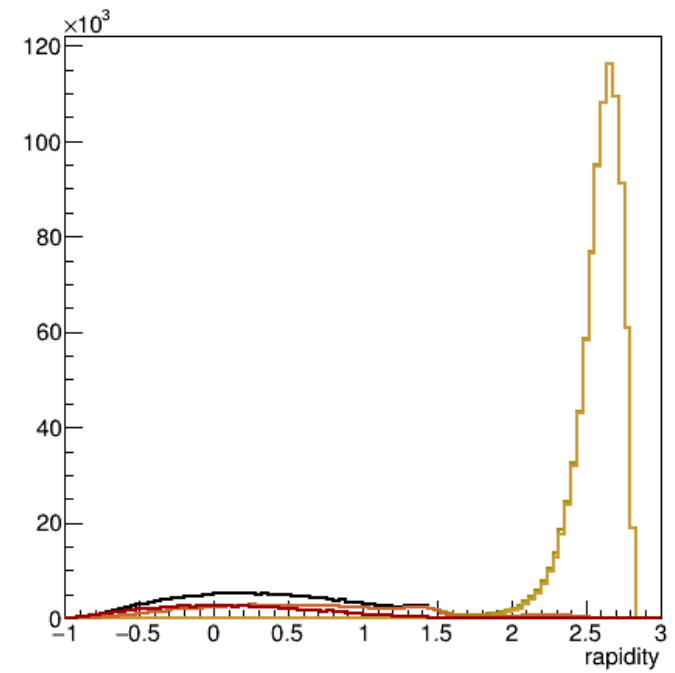
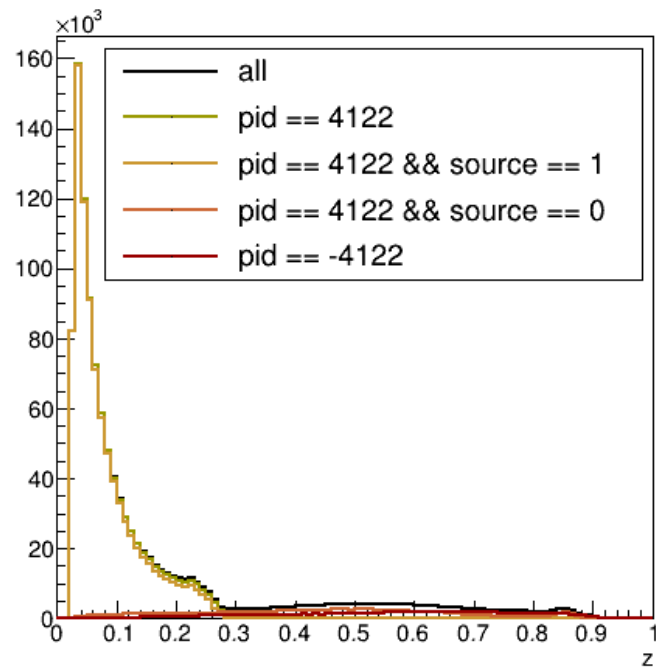
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4122; {4122, 5332, 5232, 5132, 5122, 4212, 4214, 4222, 4224, 4124, 4114}

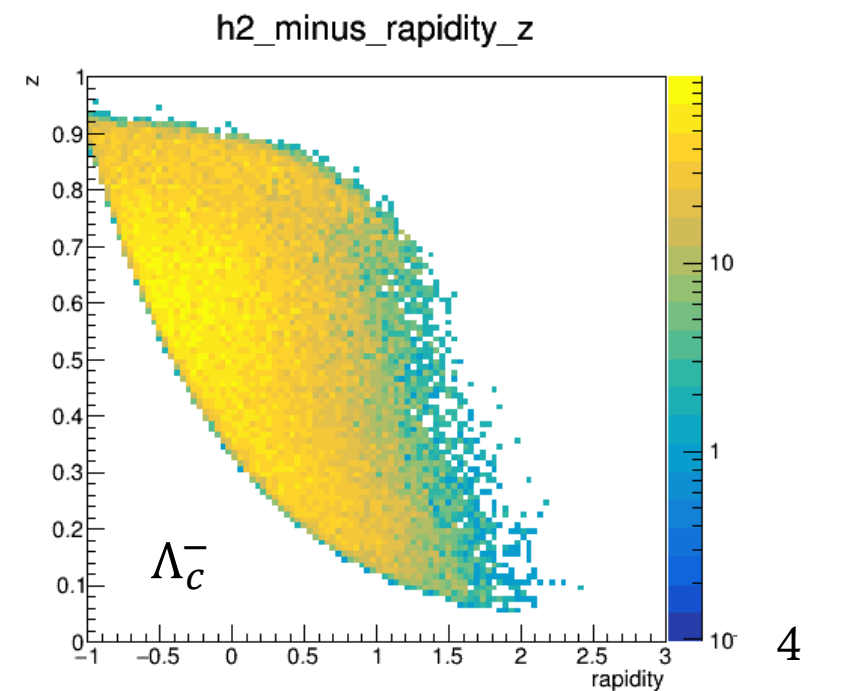
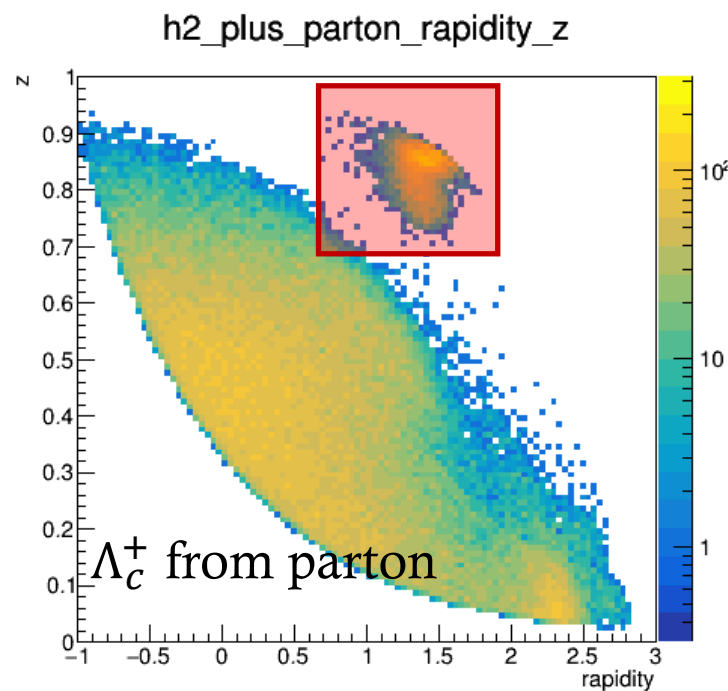
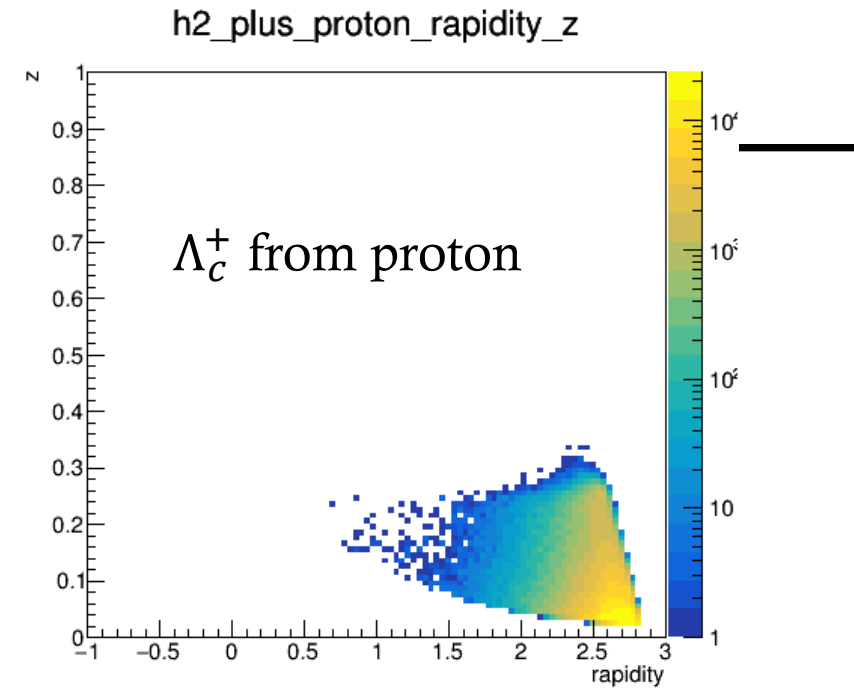
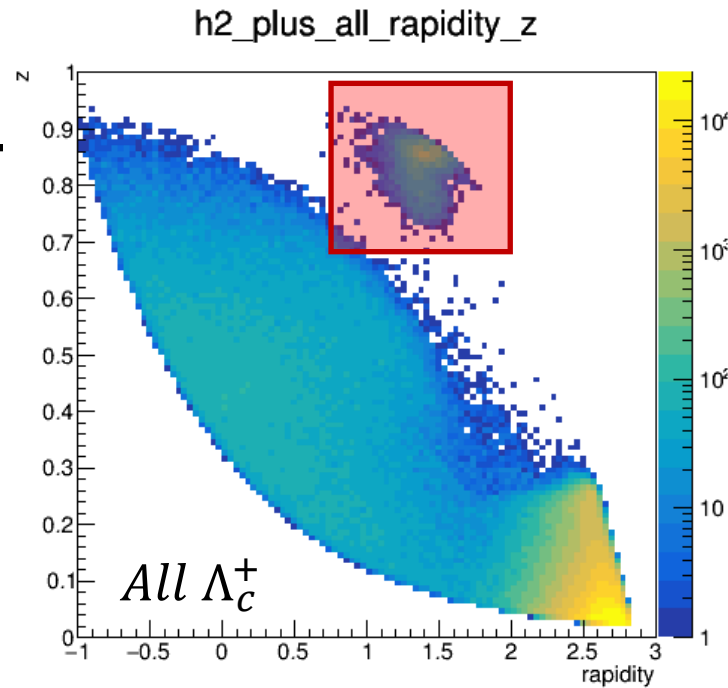
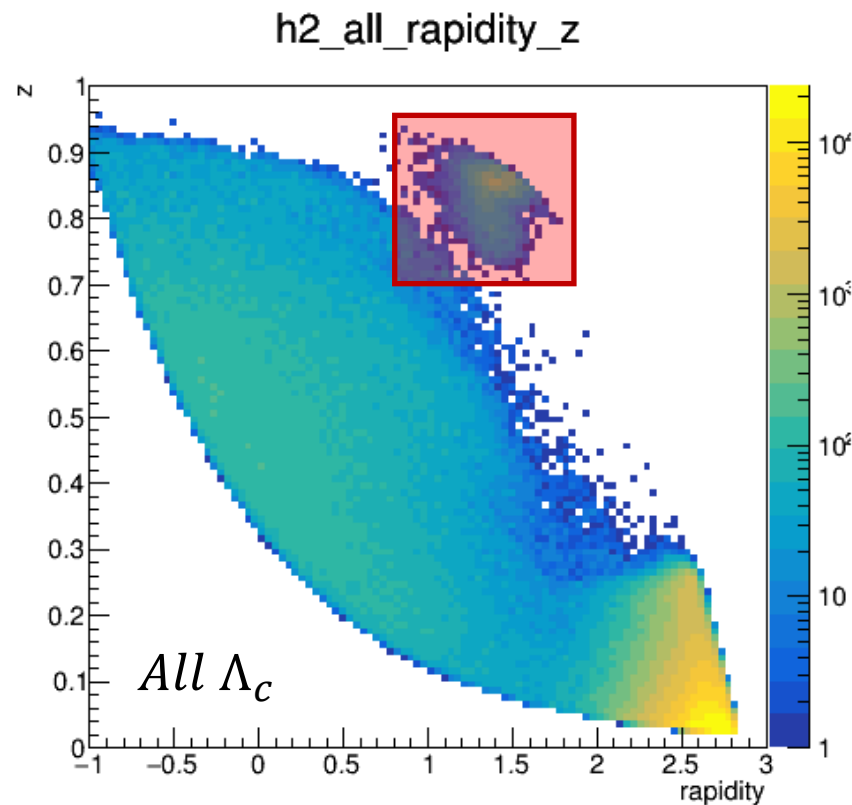
# Distiribution

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- e(3.5 GeV) p(20 GeV)



# Distribution



# $\Lambda_c^+$ (source 0)

- in red shadow area

I	KS	id	orig	daughter
1	21	11	0	3 4
2	21	2212	0	5 0
3	21	11	1	0 0
4	21	22	1	0 0
5	21	2212	2	0 0
6	21	22	4	0 0
7	21	4	5	0 0
8	21	22	6	0 0
9	21	4	7	0 0
10	21	4	9	0 0
11	11	-423	5	17 18
12	1	11	3	0 0
13	12	4	10	16 16
14	11	2103	5	16 16
15	11	91	13	16 16
16	11	4214	13	19 20
17	11	-421	11	21 24

- outside red shadow area

I	KS	id	orig	daughter
1	21	11	0	3 4
2	21	2212	0	5 0
3	21	11	1	0 0
4	21	22	1	0 0
5	21	2212	2	0 0
6	21	22	4	0 0
7	21	4	5	0 0
8	21	22	6	0 0
9	21	4	7	0 0
10	21	4	9	0 0
11	11	-413	5	15 16
12	1	11	3	0 0
13	12	4	10	18 22
14	11	2203	5	18 22
15	11	-411	11	23 25
16	11	111	11	26 27
17	11	92	13	18 22
18	11	4122	13	28 30

Another parton emitted

Charm Hadrons *recoiling*

$\gamma g \rightarrow c\bar{c}$

I	KS	id	orig	daughter
1	21	11	0	3 4
2	21	2212	0	5 0
3	21	11	1	0 0
4	21	22	1	0 0
5	21	2212	2	0 0
6	21	21	4	0 0
7	21	-2	5	0 0
8	21	21	6	0 0
9	21	-2	7	0 0
10	21	21	0	0 0
11	21	-2	0	0 0
12	11	2224	5	25 26
13	1	11	3	0 0
14	12	-2	11	21 21
15	12	21	10	23 23
16	11	4	4	24 24
17	12	-4	4	20 20
18	11	1	5	20 20
19	11	91	17	20 20
20	11	-413	17	27 28
21	12	-2	14	30 33
22	12	21	19	30 33
23	12	21	15	30 33
24	11	4	16	30 33
25	1	2212	12	0 0
26	1	211	12	0 0
27	11	-411	20	34 36
28	11	111	20	37 38
29	11	92	21	30 33
30	11	111	21	39 40
31	1	-211	24	0 0
32	1	-2112	24	0 0
33	11	4122	24	41 44

$\Lambda_c^-$  $\Lambda_c^-, \Lambda_c^+$ : 63444, total  $\Lambda_c^-$ : 95912, total  $\Lambda_c^+$ : 1032710

I	KS	id	orig	daughter
1	21	11	0	3 4
2	21	2212	0	5 0
3	21	11	1	0 0
4	21	22	1	0 0
5	21	2212	2	0 0
6	21	22	4	0 0
7	21	-4	5	0 0
8	21	22	6	0 0
9	21	-4	7	0 0
10	21	-4	9	0 0
11	11	4122	5	15 17
12	1	11	3	0 0
13	12	-4	10	19 20
14	11	2	5	19 20
15	1	211	11	0 0
16	1	2112	11	0 0
17	11	111	11	21 22
18	11	92	13	19 20
19	11	-4122	13	23 26

- Light Hadron Recoiling

I	KS	id	orig	daughter
1	21	11	0	3 4
2	21	2212	0	5 0
3	21	11	1	0 0
4	21	22	1	0 0
5	21	2212	2	0 0
6	21	21	4	0 0
7	21	-3	5	0 0
8	21	21	6	0 0
9	21	-3	7	0 0
10	21	21	0	0 0
11	21	-3	0	0 0
12	11	3122	5	22 23
13	1	11	3	0 0
14	12	-3	11	20 21
15	11	4	4	20 21
16	12	-4	4	25 26
17	12	21	10	25 26
18	11	2	5	25 26
19	11	91	14	20 21
20	11	311	14	27 27
21	11	413	15	28 29
22	1	2212	12	0 0
23	1	-211	12	0 0
24	11	92	16	25 26
25	11	-4122	16	30 32

- No Charmed Hadron Recoiling
- Light hadron recoiling

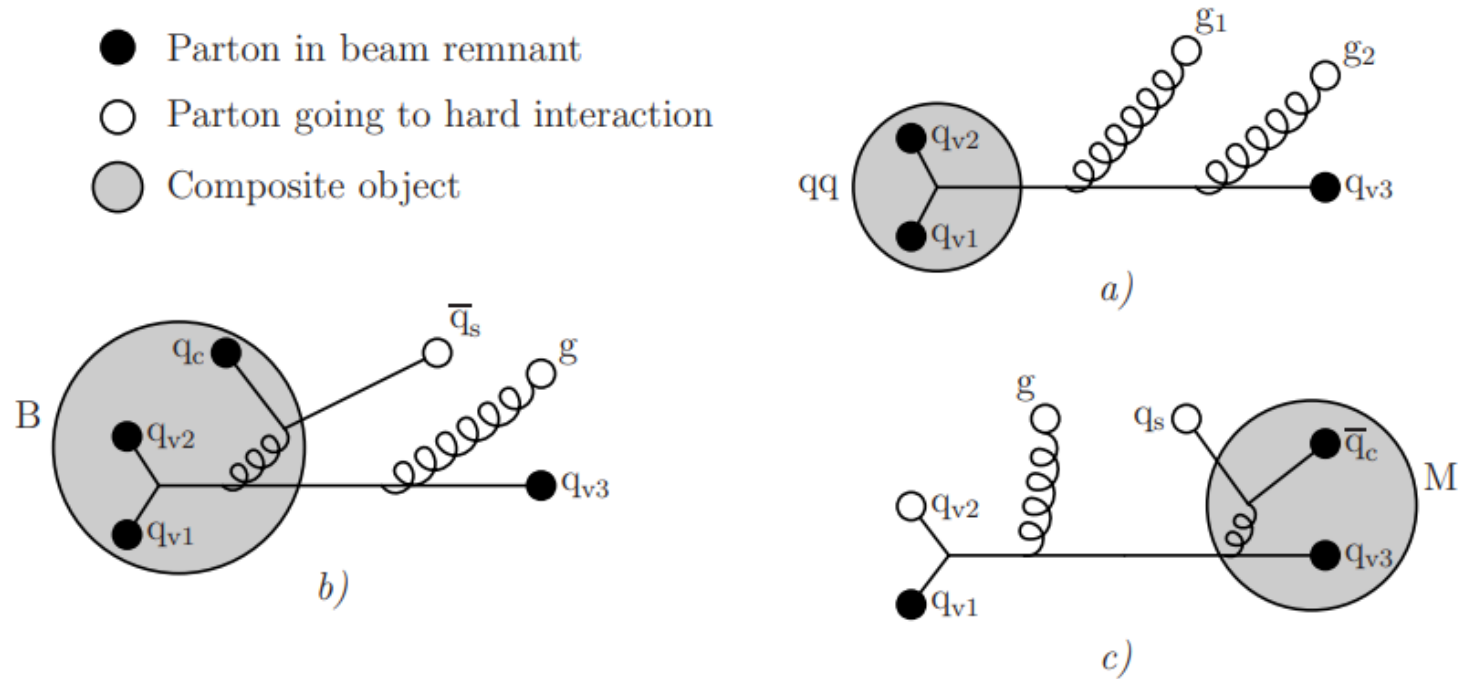


Figure 10: Examples of the formation of composite objects in a baryon beam remnant: (a) diquark, (b) baryon and (c) meson.

[\[hep-ph/0402078v2\]](https://arxiv.org/abs/hep-ph/0402078v2) Multiple Interactions and the Structure of Beam Remnants (arxiv.org)

# Conclusion

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$\Lambda_c^+$	from proton
	from quark fragmentation, with a D meson and a parton recoiling
	from quark fragmentation, $\gamma g \rightarrow c\bar{c}$
$\Lambda_c^-$	from quark fragmentation, with $\Lambda_c^+$ recoiling
	from quark fragmentation, $\gamma g \rightarrow c\bar{c}$ , with light hadron recoiling

- In ep events generated by pythiaeRHIC, the processes  $\Lambda_c^+$  produced are very different with that  $\Lambda_c^-$  produced.