

First Look at RG-E Lambda Production Channel

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Outline

SIDIS Production

Kinematic Cuts

Physics Observables

Online RG-E Analysis

Lambda Production Channel

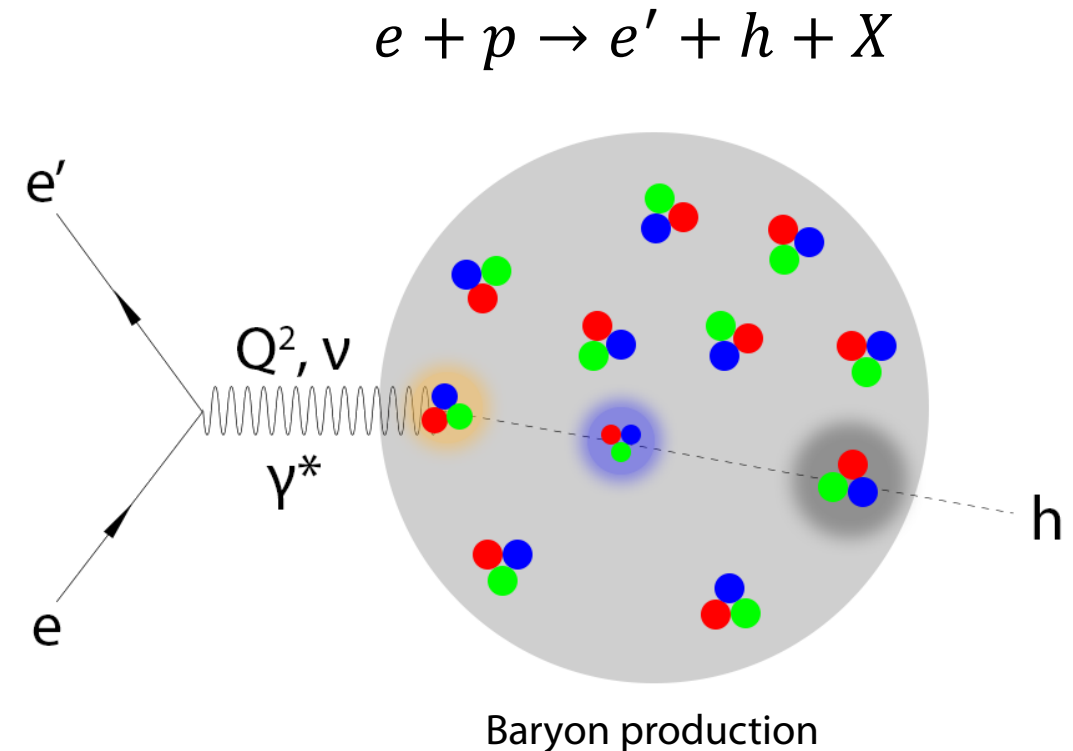
Summary and Outlook



SIDIS Production

❖ The hadronization dynamics are probed in the semi-inclusive deep inelastic scattering (SIDIS) described by this set of kinematic variables:

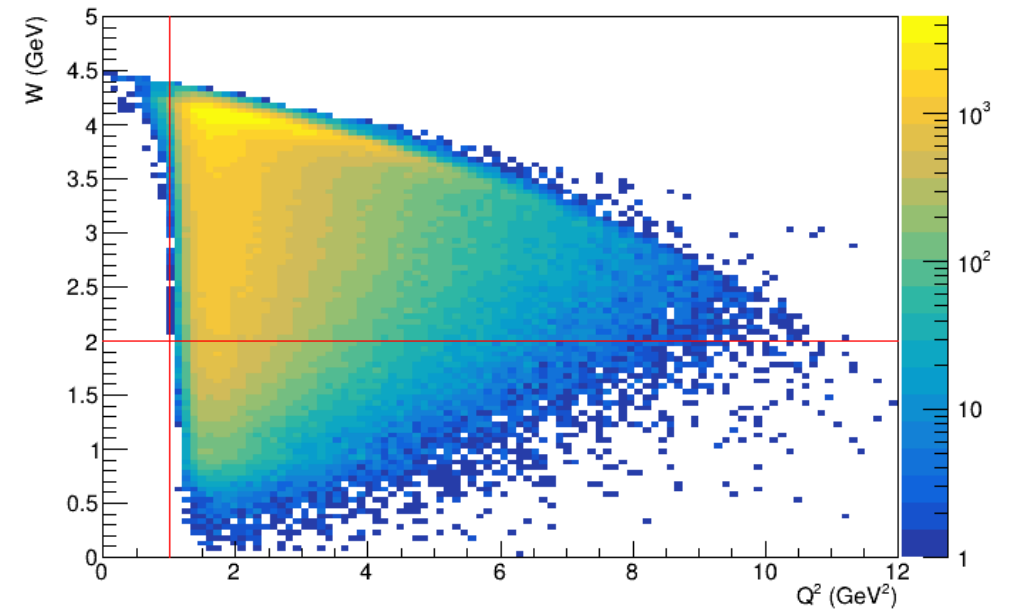
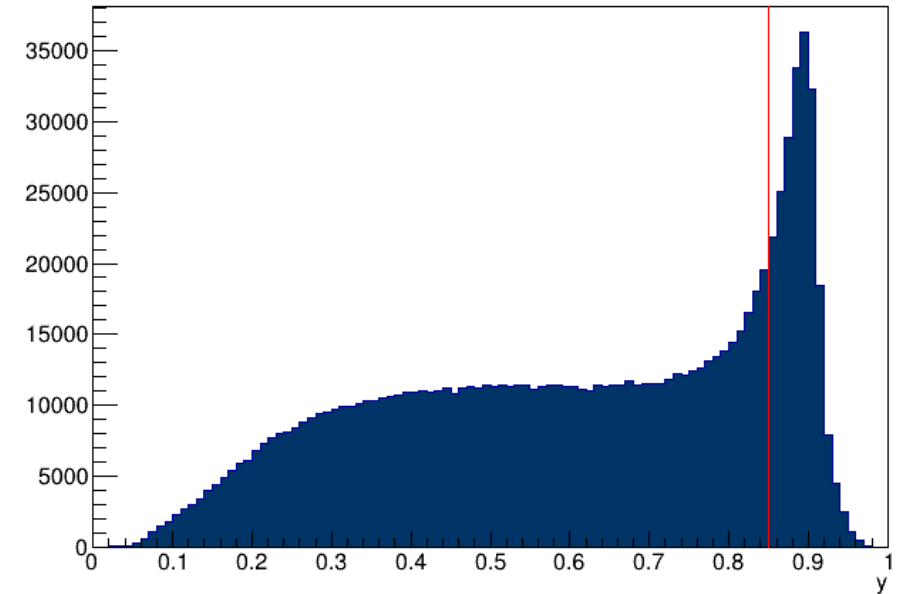
- ν : electron energy loss or initial energy of a struck quark
- Q^2 : four-momentum transferred squared
- $y = \nu/E_{beam}$: electron energy fraction transferred to a struck quark
- $W = \sqrt{M_n^2 + 2\nu M_n - Q^2}$: total mass of the hadronic final state, where M_n is the nucleon mass
- $z_h = E_h/\nu$: struck quark's initial energy fraction carried by the formed hadron
- p_T : hadron transverse momentum measured with regard to the virtual photon direction



Kinematical Cuts

❖ SIDIS production cuts:

- $Q^2 > 1 \text{ GeV}^2$: to probe the intrinsic structure of nucleons
- $W > 2 \text{ GeV}$: to avoid contamination from the resonance region
- $y < 0.85$: to reduce radiative effects



Physics Observables

Multiplicity Ratio

$$R_A = \frac{N_{SIDIS}^{h(A)} / N_{DIS}^{e(A)}}{N_{SIDIS}^{h(LD_2)} / N_{DIS}^{e(LD_2)}}$$

- R_A describes the attenuation of formed hadrons in the medium

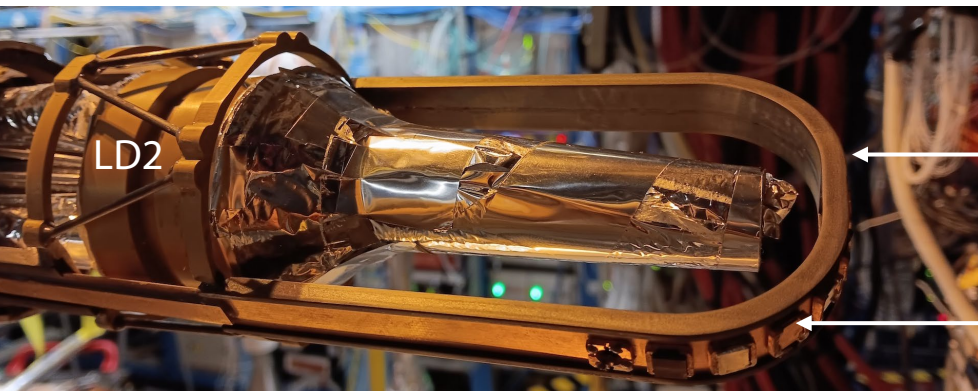
Transverse Momentum Broadening

$$\Delta p_T^2 = \langle p_T^2 \rangle_A - \langle p_T^2 \rangle_{LD_2}$$

- Δp_T^2 describes the energy loss of the propagating struck quark, and the elastic and inelastic scattering of prehadrons and hadrons

Online Multiplicity Ratios

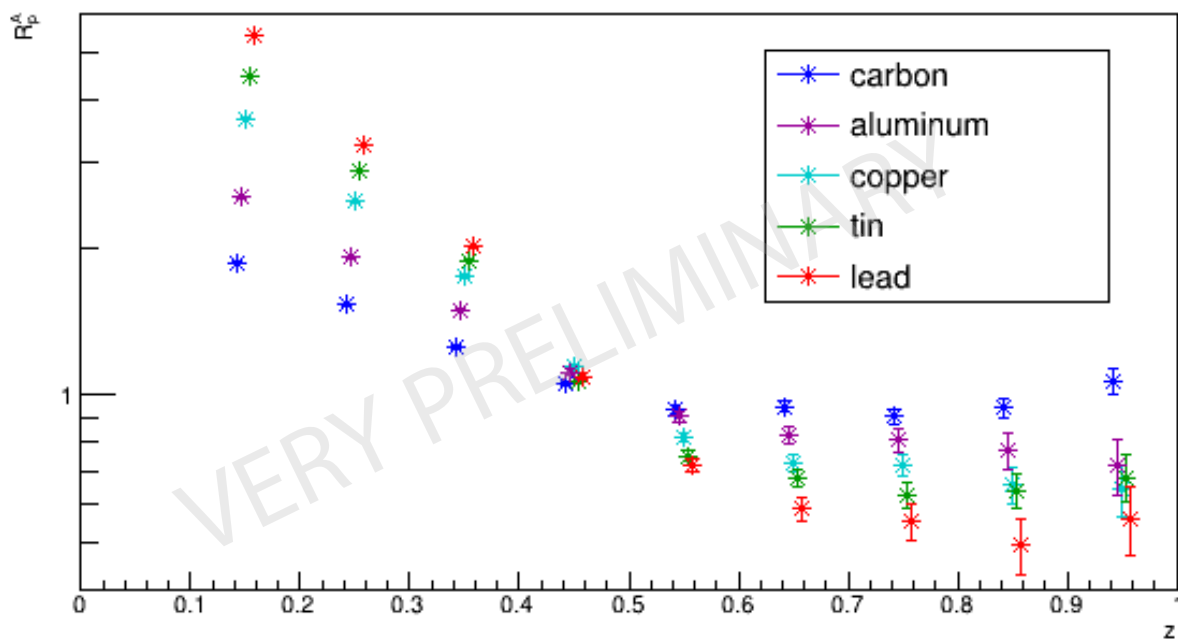
RG-E dual-target setup



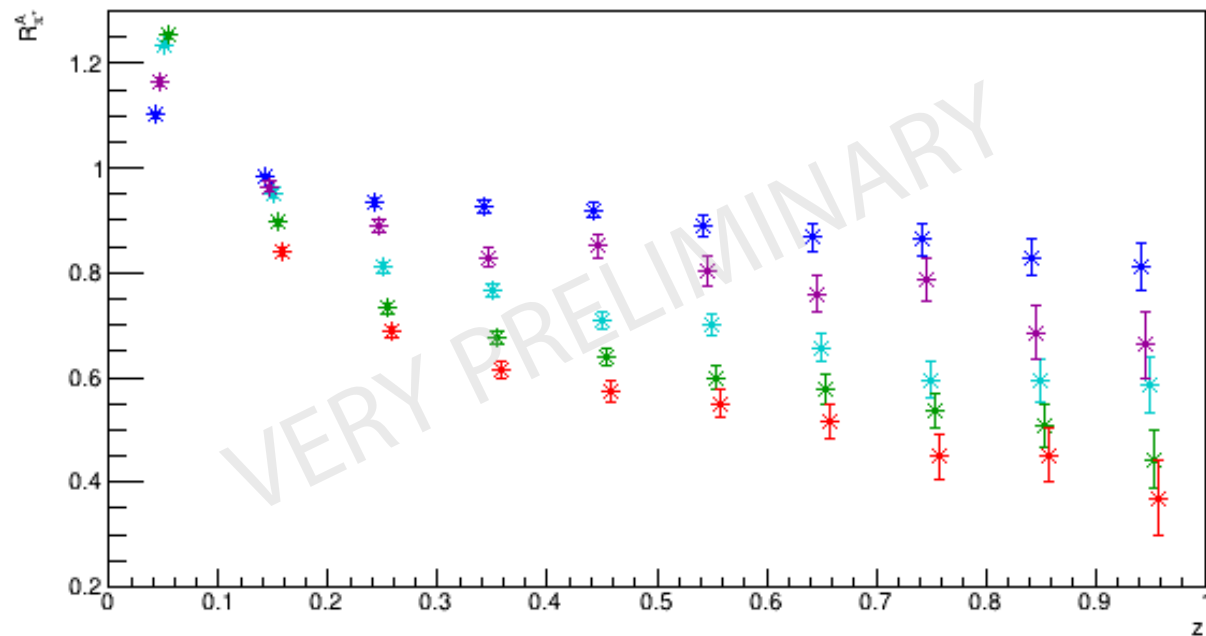
Solid foils:

- C
- Al
- Cu
- Sn
- Pb

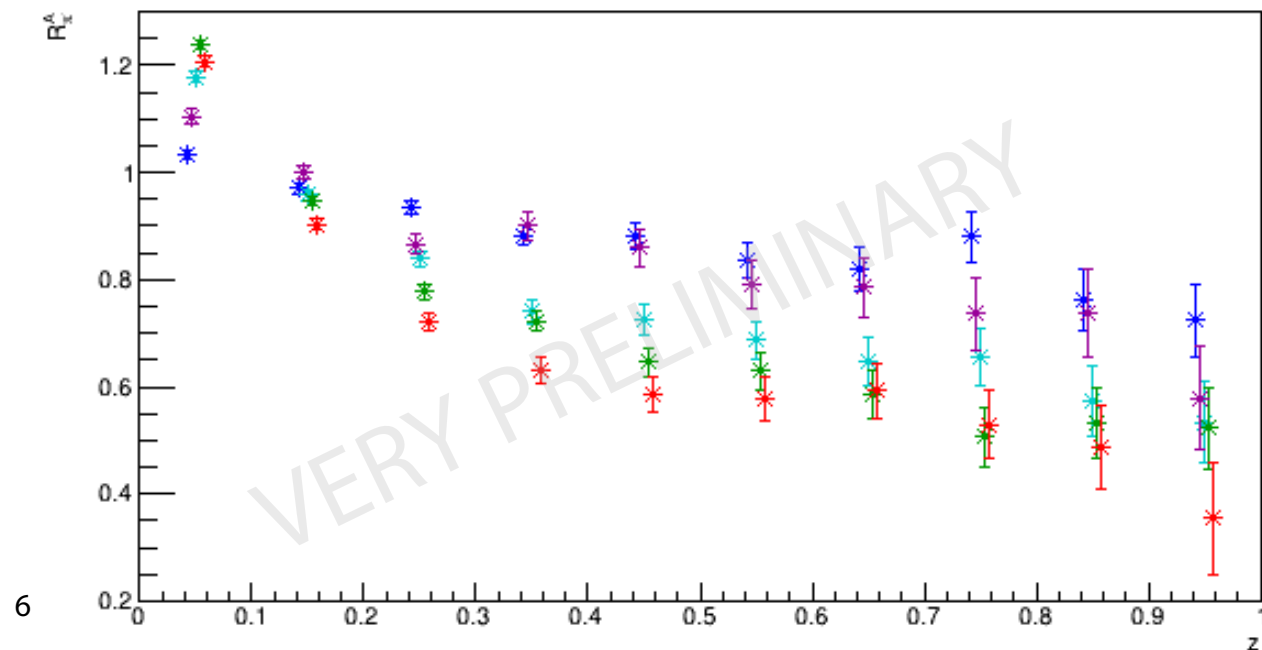
RG-E: Multiplicity Ratio for protons



RG-E: Multiplicity Ratio for π^+

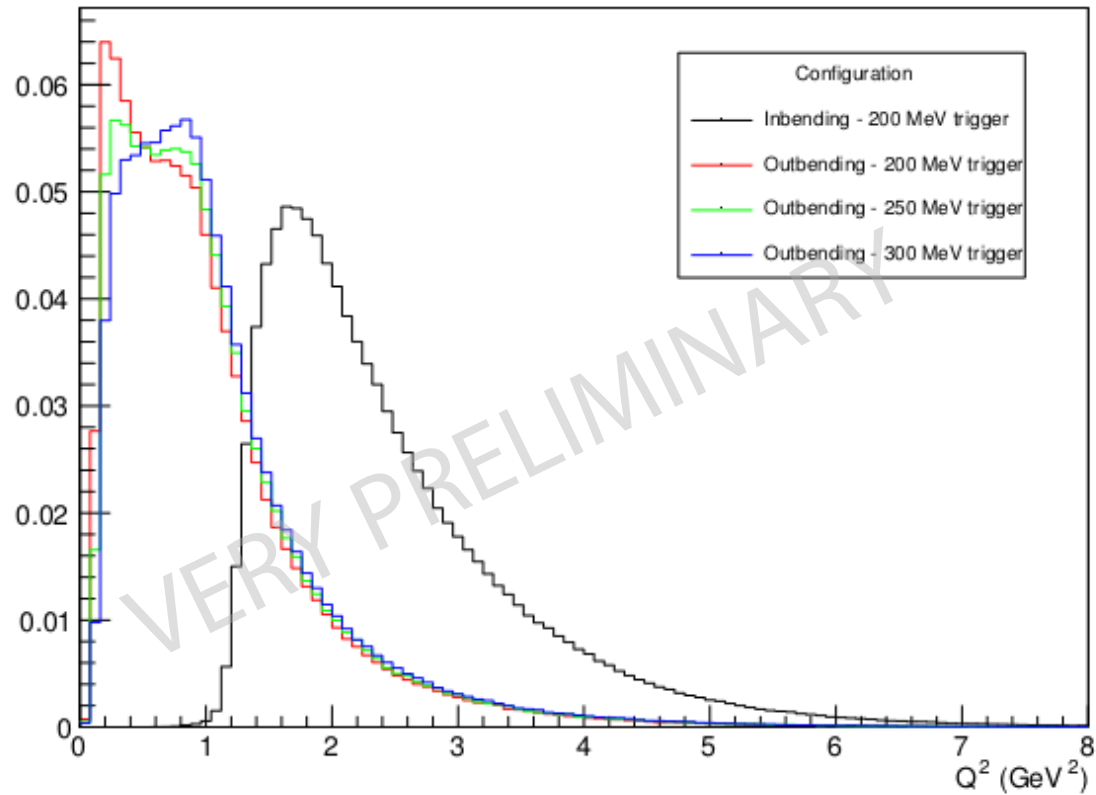


RG-E: Multiplicity Ratio for π^-

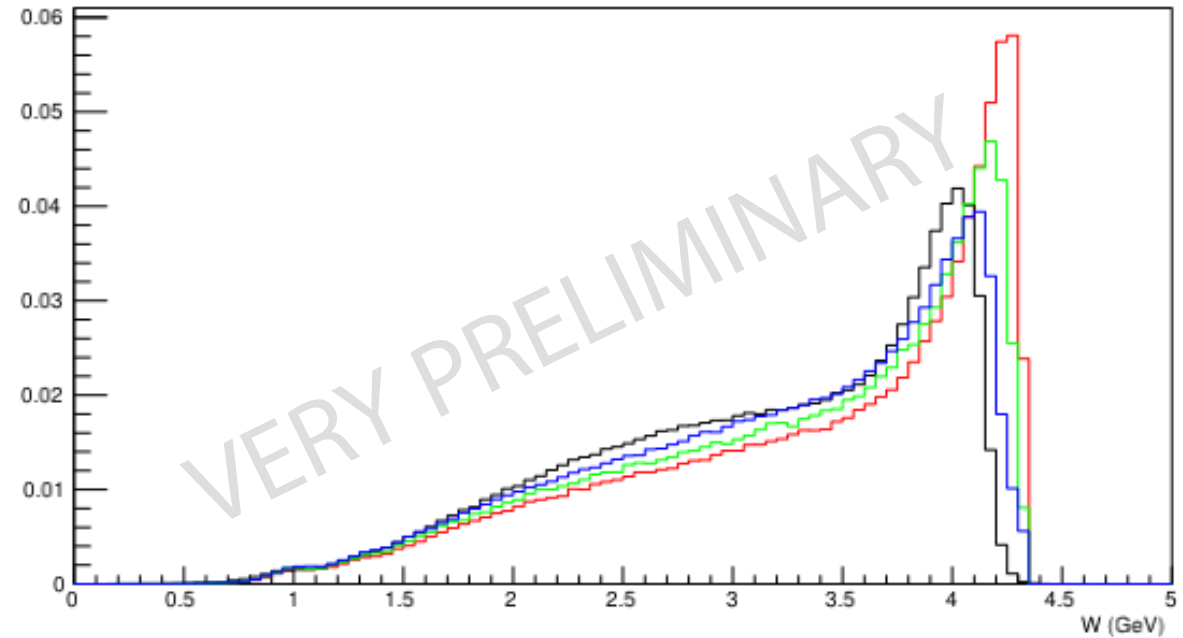


Comparison of Inbending and Outbending Configurations

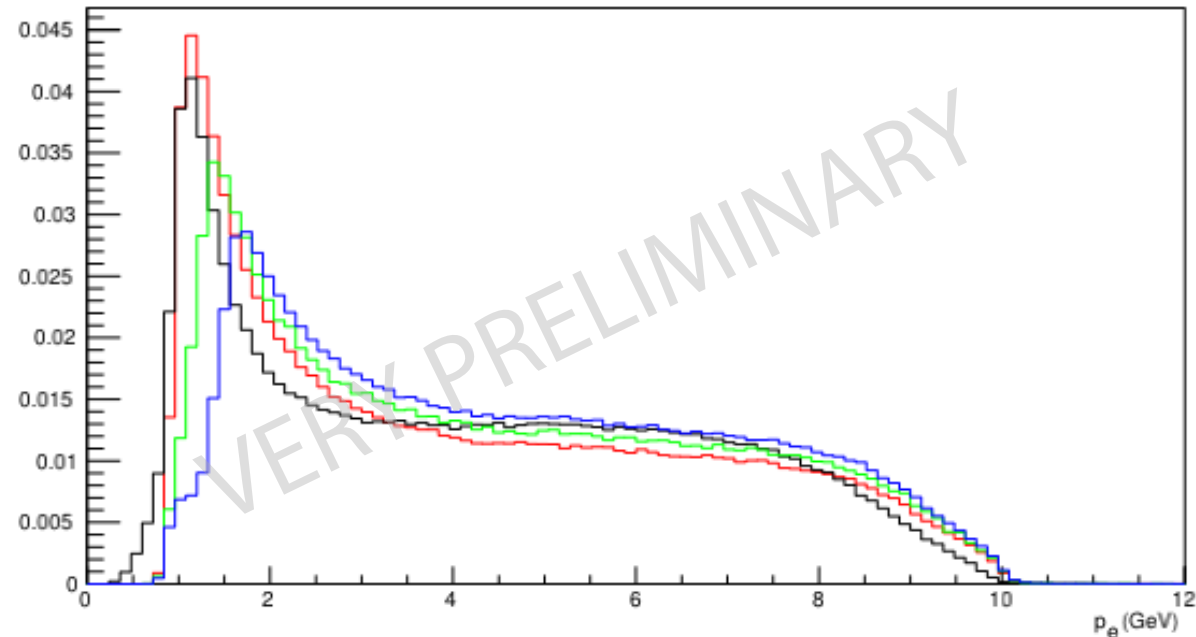
RG-E: LD2+C



RG-E: LD2+C

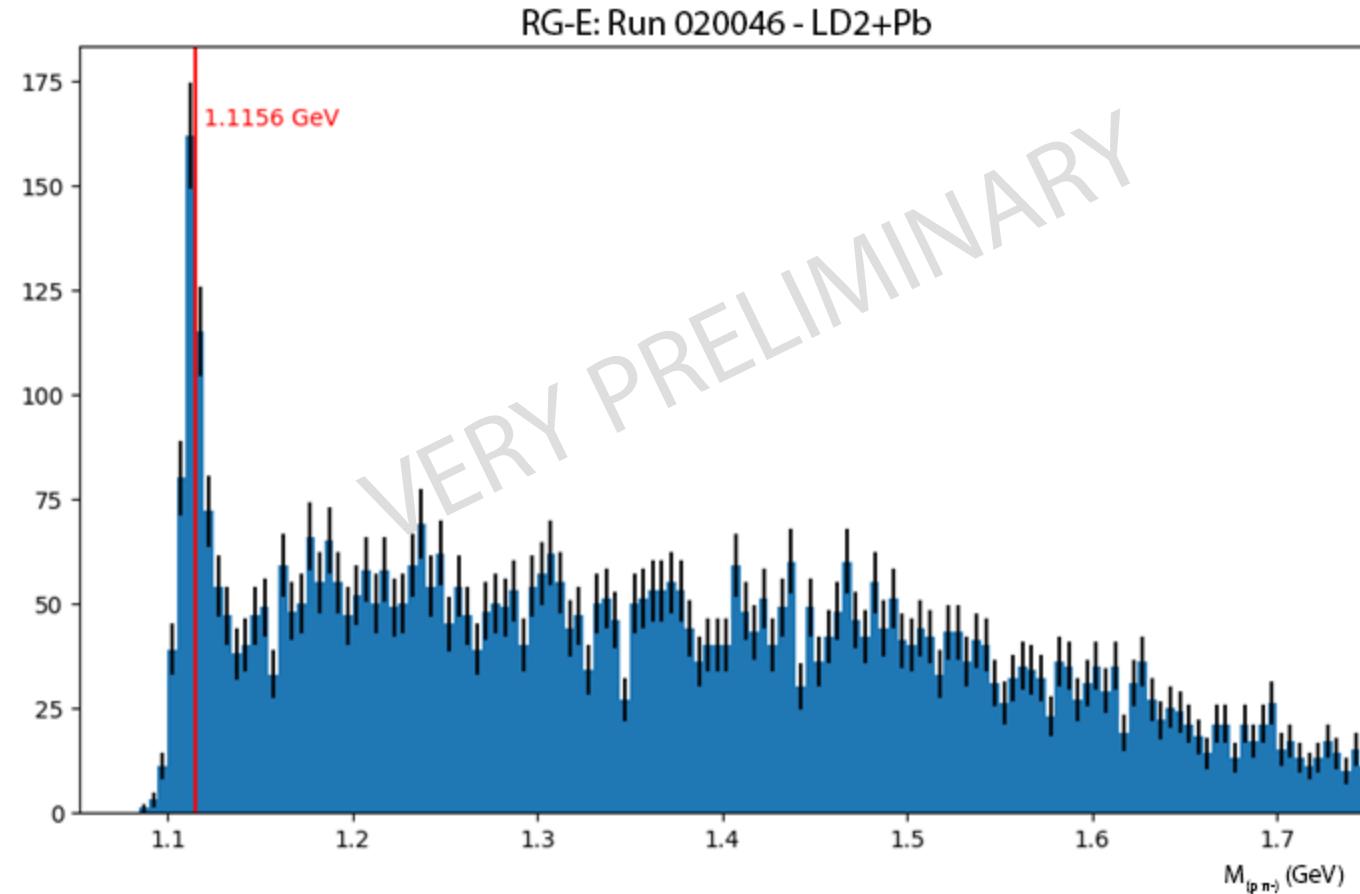
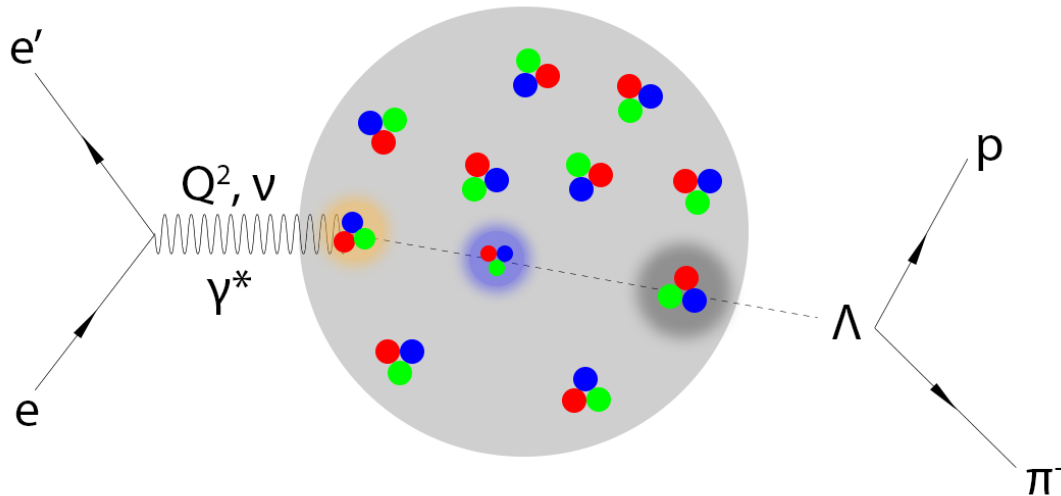


RG-E: LD2+C



Lambda Production Channel

- Our channel of interest is the Lambda SIDIS production off nuclei
- Lambda is identified through its decay daughter particles, proton and π^- , detected in coincidence with the scattered electron



Work done in coordination with Veronique Ziegler

Summary and Outlook

- Hadronization studies are carried out in the SIDIS framework
- Online multiplicity ratio results are consistent with published CLAS6 results
- My analysis codes are under development to polish the Lambda signal and extract its preliminary results
- Ongoing effort to compile the RG-E golden runs

Spreadsheet of Runs

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A1	Number	A	B	C	D	E	F	G	H	I	J	K
11	20055	2024-03-21	1:25:29	0:19:26	5,275,519	60 nA	10547.3	LD2 + Pb	-1	-1	rge_inb_v1.0_200MeV	junk - hole in SVT
12	20056	2024-03-21	1:52:07	0:31:27	3,891,195	60 nA	10547.3	LD2 + Pb	-1	-1	rge_inb_v1.0_200MeV	Production, short run due to MCC taking beam
13	20057	2024-03-21	3:17:28	2:11:04	34,120,609	60 nA	10547.3	LD2 + Pb	-1	-1	rge_inb_v1.0_200MeV	Production, ended due to DAQ 0 trigger rate
14	20059	2024-03-21	5:43:03	2:17:09	38,110,331	60 nA	10547.3	LD2 + Pb	-1	-1	rge_inb_v1.0_200MeV	Production
15	20060	2024-03-21	9:43:49	0:16:27	5,804,422	70 nA	10547.3	LD2 + Pb	-1	-1	rge_inb_v1.0_200MeV	Production, ended due to persisting alarm on
16	20062	2024-03-21	10:20:05	0:17:54	708,710	70 nA	10547.3	LD2 + Pb	-1	-1	rge_inb_v1.0_200MeV	junk? 10 mins of beam? - almost no beam -
17	20074	2024-04-04	0:52:39	0:18:25	531,125	5 nA	10547.3	LD2 + Pb	-1	-1	rge_inb_v1.0_200MeV	junk, DAQ Test
18	20075	2024-04-04	1:17:59	2:16:09	47,658,686	70 nA	10547.3	LD2 + Pb	-1	-1	rge_inb_v1.0_200MeV	Production
19	20076	2024-04-04	3:51:17	0:09:20	3,226,870	70 nA	10547.3	LD2 + Pb	-1	-1	rge_inb_v1.0_200MeV	Production, Torus ramping down by itself
20	20077	2024-04-04	14:26:32	2:43:33	48,818,752	70 nA	10547.3	LD2 + Pb	-1	-1	rge_inb_v1.0_200MeV	Production, 1st run after Torus recovery, SVT
21	20078	2024-04-04	17:30:27	1:06:20	22,803,613	70 nA	10547.3	LD2 + Pb	-1	-1	rge_inb_v1.0_200MeV	Production, BMT HV SEC2 L5 HV tripped thr
22	20079	2024-04-04	18:43:54	0:27:04	7,481,812	70 nA	10547.3	LD2 + Pb	-1	-1	rge_inb_v1.0_200MeV	Production, BMT HV SEC1 L4 HV tripped, er
23	20080	2024-04-04	19:16:01	2:59:37	62,525,873	70 nA	10547.3	LD2 + Pb	-1	-1	rge_inb_v1.0_200MeV	Production, BMT HV SEC1 L4 HV tripped
24	20081	2024-04-04	22:22:46	2:11:30	31,179,258	70 nA	10547.3	LD2 + Pb	-1	-1	rge_inb_v1.0_200MeV	Production, BMT HV SEC3 L4 HV tripped, no
25	20082	2024-04-05	0:39:01	2:52:49	56,678,641	70 nA	10547.3	LD2 + Pb	-1	-1	rge_inb_v1.0_200MeV	Production, BMT HV SEC1,2,3 L4 tripped
26	20083	2024-04-05	3:36:03	1:12:20	24,455,042	70 nA	10547.3	LD2 + Pb	-1	-1	rge_inb_v1.0_200MeV	Production, ended due to DAQ livetime alarm
27	20084	2024-04-05	5:15:50	1:56:47	40,813,819	70 nA	10547.3	LD2 + Pb	-1	-1	rge_inb_v1.0_200MeV	Production, ended due to DAQ problem
28	20085	2024-04-05	7:18:07	3:02:52	62,117,150	70 nA	10547.3	LD2 + Pb	-1	-1	rge_inb_v1.0_200MeV	Production, good run
29	20086	2024-04-05	10:25:07	2:00:40	41,573,106	70 nA	10547.3	LD2 + Pb	-1	-1	rge_inb_v1.0_200MeV	Production, probably good run, but DAQ issu
30	20089	2024-04-05	12:57:43	1:59:01	38,681,089	70 nA	10547.3	LD2 + Pb	-1	-1	rge_inb_v1.0_200MeV	Production, probably good run but tdcpcal6 is
31	20090	2024-04-05	15:00:11	2:37:51	57,769,216	70 nA	10547.3	LD2 + Pb	-1	-1	rge_inb_v1.0_200MeV	Production, ended due to ROC tdcpcal6 issu
32	20091	2024-04-05	17:44:35	1:43:05	27,831,988	70 nA	10547.3	LD2 + Pb	-1	-1	rge_inb_v1.0_200MeV	Production, run failed after dc62 issue
33	20093	2024-04-05	19:44:00	2:04:25	42,019,883	70 nA	10547.3	LD2 + Pb	-1	-1	rge_inb_v1.0_200MeV	Production, run failed due to L3DAQ6 issue
34	20094	2024-04-05	21:58:41	0:52:36	16,362,845	70 nA	10547.3	LD2 + Pb	-1	-1	rge_inb_v1.0_200MeV	Production, FMT gas alarms
35	20095	2024-04-05	23:09:36	2:57:58	53,020,620	70 nA	10547.3	LD2 + Pb	-1	-1	rge_inb_v1.0_200MeV	Production, Beam tripped (recurring trips of
36	20096	2024-04-06	2:23:58	0:22:09	6,475,932	70 nA	10547.3	LD2 + Pb	-1	-1	rge_inb_v1.0_200MeV	Production, run failed due to tdcpcal6 100%
37	20097	2024-04-06	2:52:32	3:03:59	64,273,535	70 nA	10547.3	LD2 + Pb	-1	-1	rge_inb_v1.0_200MeV	Production
38	20098	2024-04-06	5:59:11	2:40:11	51,151,919	70 nA	10547.3	LD2 + Pb	-1	-1	rge_inb_v1.0_200MeV	Production, MVTS3L4 alarm, end failed due t
39	20099	2024-04-06	8:45:37	0:23:14	2,483,764	70 nA	10547.3	LD2 + Pb	-1	-1	rge_inb_v1.0_200MeV	junk, Only 5 mins useful data
40	20100	2024-04-06	9:17:53	0:57:52	19,981,936	70 nA	10547.3	LD2 + Pb	-1	-1	rge_inb_v1.0_200MeV	Production, Good run / tdcpcal6 issue at the
41	20101	2024-04-06	10:22:00	0:23:15	6,662,204	70 nA	10547.3	LD2 + Pb	-1	-1	rge_inb_v1.0_200MeV	Production, Good run / tdcpcal6 issue at the
42	20104	2024-04-06	11:41:21	1:54:33	40,011,868	70 nA	10547.3	LD2 + Pb	-1	-1	rge_inb_v1.0_200MeV	Production, good run, ended earlier by mistak
43	20105	2024-04-06	13:39:28	0:26:12	7,761,423	70 nA	10547.3	LD2 + Pb	-1	-1	rge_inb_v1.0_200MeV	Production, good run, tdcpcal6 issue at the e
44	20106	2024-04-06	14:13:05	0:19:30	6,695,721	70 nA	10547.3	LD2 + Pb	-1	-1	rge_inb_v1.0_200MeV	Junk due to SVT issue at the end of the run

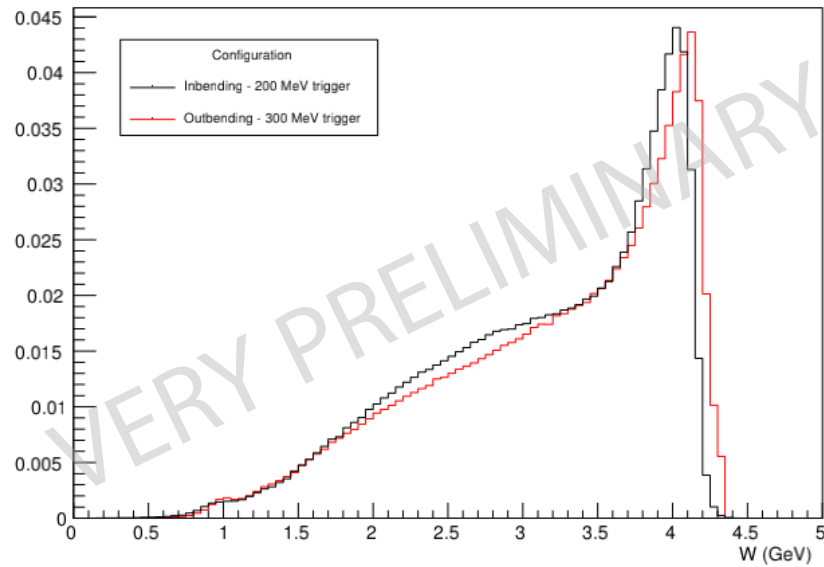
Thank You!

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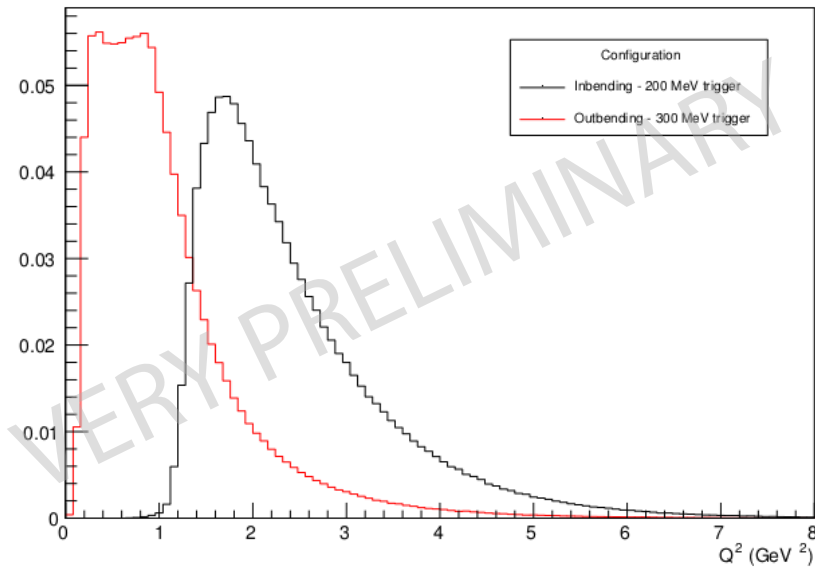
Backup Slides

Comparison of Inbending and Outbending Configurations

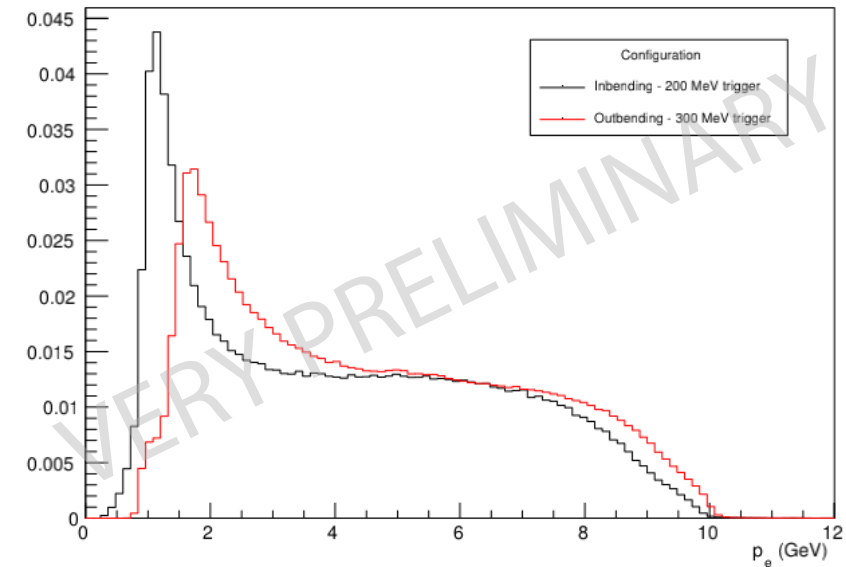
RGE: LD2+Pb



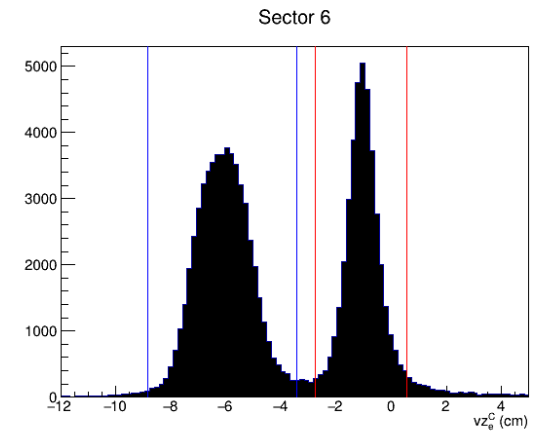
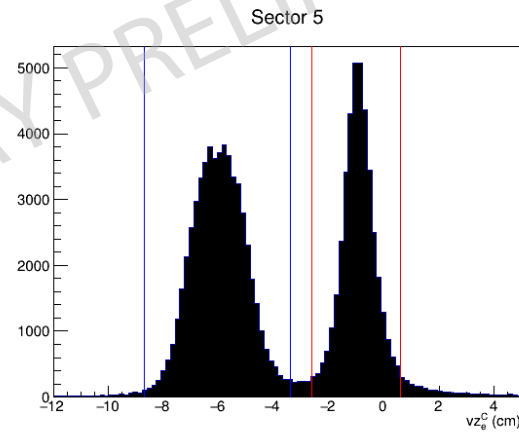
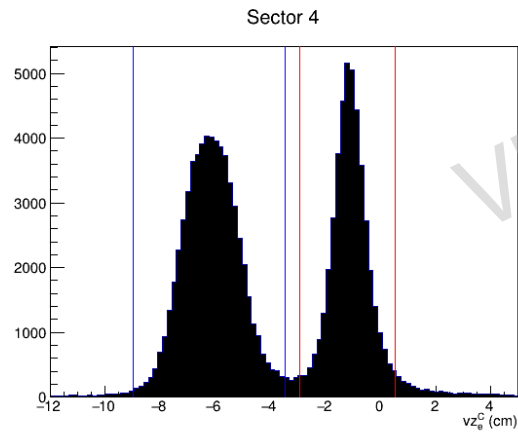
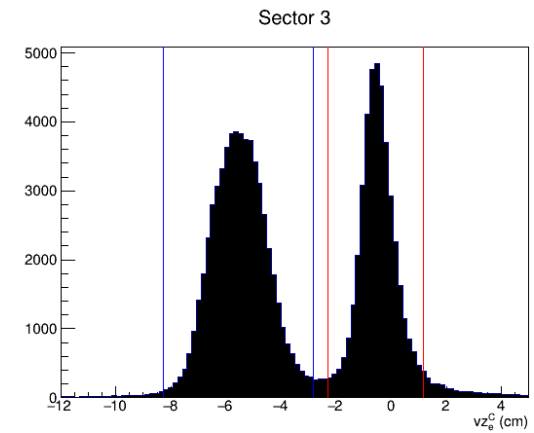
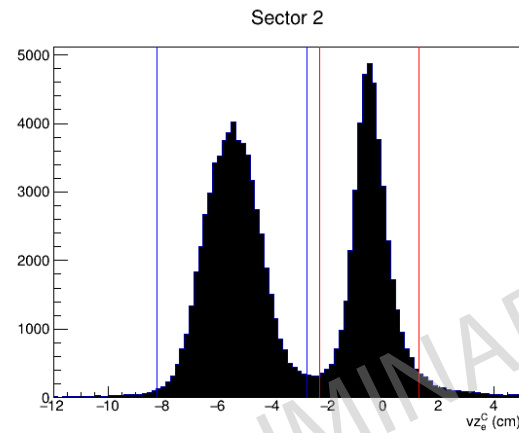
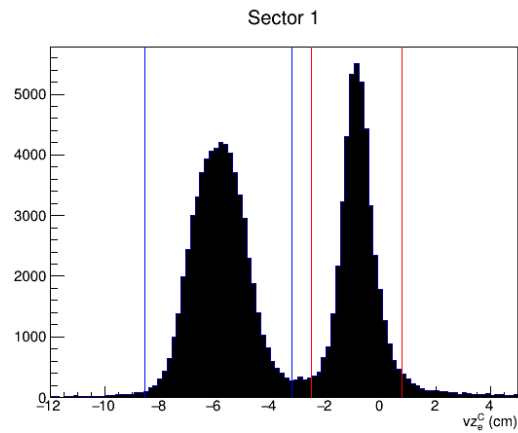
RGE: LD2+Pb



RGE: LD2+Pb



RG-E Vertex Distributions for LD2+C



VERY PRELIMINARY

