Lambda(Λ) missing mass w/ SIDIS data

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Kinematics Setting Used

- Q^2 = 3.10 GeV^2
- W = 2.78 GeV
- I_{beam} = 40 μA

HMS Setting (-ve polarity)

- P_{HMS} = 5.27 GeV/c
- Θ_{HMS} = 13.5°

SHMS Setting (+ve polarity)

- P_{SHMS} = 5.05 GeV/c
- Θ_{SHMS} = 12.0°

Kinematic Group 1

Kinematics: x=0.31, Q2=3.10 GeV2

HMS settings: p=-5.27 GeV, theta = 13.5

SHMS polarity: positive

#	HMS P	HMS Theta	SHMS P	SHMS Theta	x	Q2	z	p_t	W'2	nom muA	RHMS Khz	RSHMS kHz	evnts K/hr	accid/ real	trg6 Hz	Done?
1	-5.27	13.5	5.05	12.0	0.31	3.10	0.90	-0.06	1.16	40.0	11.3	28.5	24.6	0.06	16.6	yes
2	-5.27	13.5	**5.05**	14.0	0.31	3.10	0.90	0.12	1.14	40.0	11.3	10.6	23.8	0.02	9.3	yes
3	-5.27	13.5	3.37	12.0	0.31	3.10	0.60	-0.04	3.35	40.0	11.3	178.1	99.4	0.16	140.0	yes
4	-5.27	13.5	**3.37**	14.0	0.31	3.10	0.60	0.08	3.34	40.0	11.3	81.1	97.8	0.07	78.0	yes
5	-5.27	13.5	2.53	8.0	0.31	3.10	0.45	-0.21	4.35	13.5	3.8	476.2	23.5	0.63	108.9	yes
6	-5.27	13.5	**2.53**	10.0	0.31	3.10	0.45	-0.12	4.41	22.8	6.4	472.9	46.2	0.54	186.6	yes
7	-5.27	13.5	**2.53**	12.0	0.31	3.10	0.45	-0.03	4.44	39.6	11.2	470.3	89.5	0.49	327.1	yes, taken twice
8	-5.27	13.5	**2.53**	14.0	0.31	3.10	0.45	0.06	4.44	40.0	11.3	265.6	88.3	0.28	197.5	yes
9	-5.27	13.5	**2.53**	16.0	0.31	3.10	0.45	0.15	4.40	40.0	11.3	145.5	80.8	0.17	117.3	yes
10	-5.27	13.5	**2.53**	18.0	0.31	3.10	0.45	0.23	4.32	40.0	11.3	78.1	66.3	0.11	69.2	yes
11	-5.27	13.5	**2.53**	20.0	0.31	3.10	0.45	0.32	4.21	40.0	11.3	41.0	58.9	0.07	43.0	yes
12	-5.27	13.5	**2.53**	22.0	0.31	3.10	0.45	0.41	4.07	40.0	11.3	21.1	36.5	0.05	23.7	yes
13	-5.27	13.5	**2.53**	24.0	0.31	3.10	0.45	0.50	3.89	40.0	11.3	10.6	21.3	0.05	12.7	yes
14	-5.27	13.5	**2.53**	26.0	0.31	3.10	0.45	0.58	3.68	40.0	11.3	5.2	16.2	0.03	7.8	yes

Kinematic Group 2

Kinematics: x=0.31, Q2=3.10 GeV2

HMS settings: p=-5.27 GeV, theta = 13.5

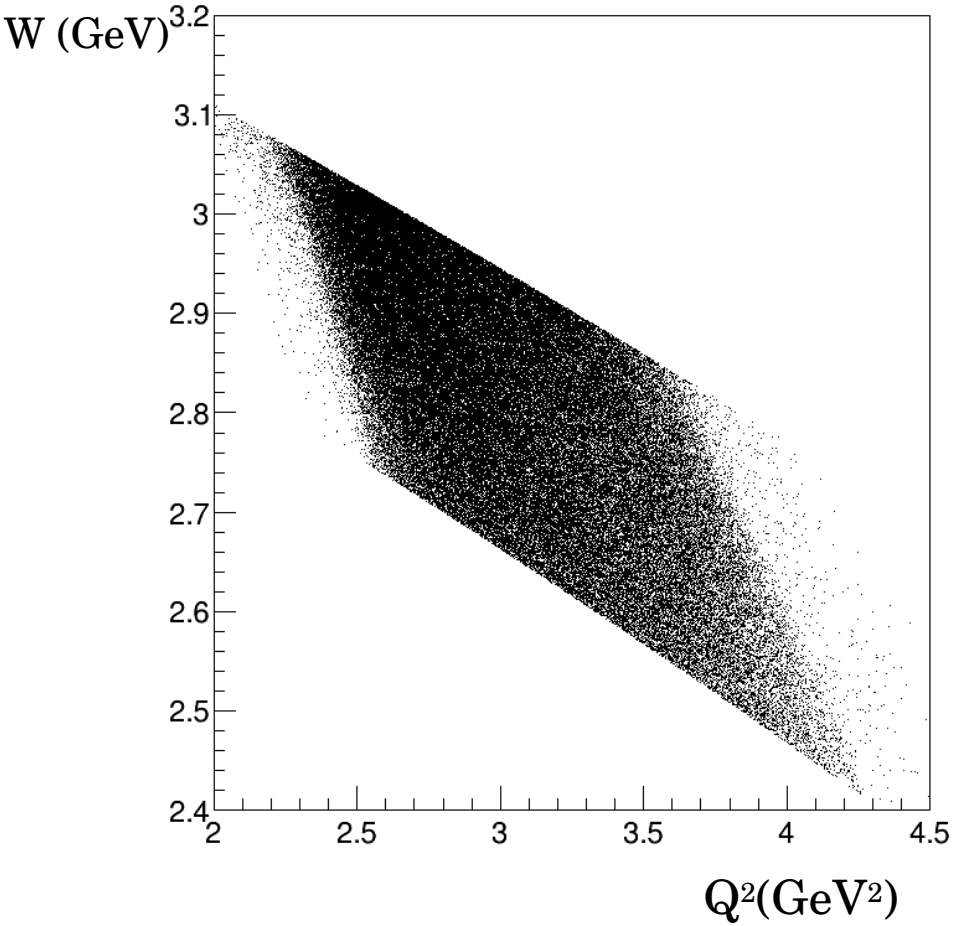
SHMS polarity: negative

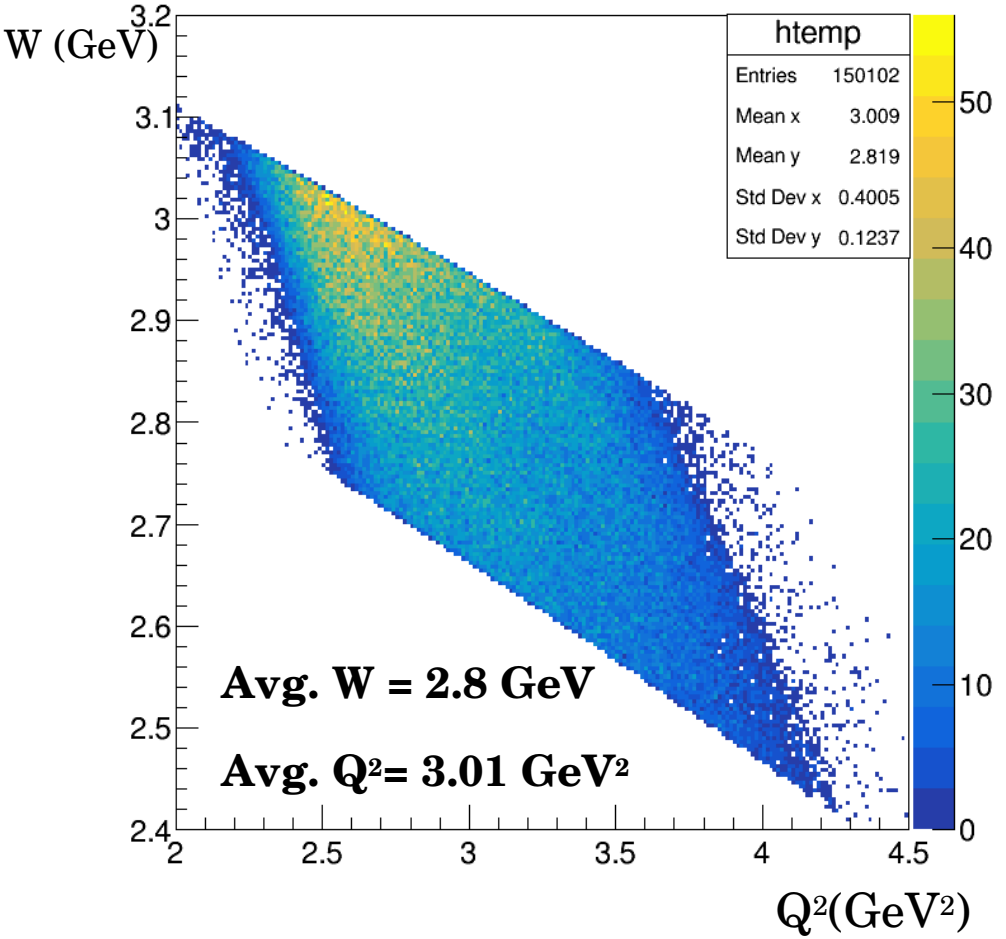
#	HMS P	HMS Theta	SHMS P	SHMS Theta	x	Q2	z	p_t	W'2	nom muA	RHMS Khz	RSHMS kHz	evnts K/hr	accid/ real	trg6 Hz	Done?
1	-5.27	13.5	-5.05	12.0	0.31	3.10	0.90	-0.06	1.16	40.0	11.3	28.5	24.6	0.06	16.6	yes
2	-5.27	13.5	**-5.05**	14.0	0.31	3.10	0.90	0.12	1.14	40.0	11.3	10.6	23.8	0.02	9.3	yes
3	-5.27	13.5	-3.37	12.0	0.31	3.10	0.60	-0.04	3.35	40.0	11.3	178.1	99.4	0.16	140.0	yes
4	-5.27	13.5	**-3.37**	14.0	0.31	3.10	0.60	0.08	3.34	40.0	11.3	81.1	97.8	0.07	78.0	yes
5	-5.27	13.5	-2.53	8.0	0.31	3.10	0.45	-0.21	4.35	13.5	3.8	476.2	23.5	0.63	108.9	yes
6	-5.27	13.5	**-2.53**	10.0	0.31	3.10	0.45	-0.12	4.41	22.8	6.4	472.9	46.2	0.54	186.6	yes
7	-5.27	13.5	**-2.53**	12.0	0.31	3.10	0.45	-0.03	4.44	39.6	11.2	470.3	89.5	0.49	327.1	yes
8	-5.27	13.5	**-2.53**	14.0	0.31	3.10	0.45	0.06	4.44	40.0	11.3	265.6	88.3	0.28	197.5	yes
9	-5.27	13.5	**-2.53**	16.0	0.31	3.10	0.45	0.15	4.40	40.0	11.3	145.5	80.8	0.17	117.3	yes
10	-5.27	13.5	**-2.53**	18.0	0.31	3.10	0.45	0.23	4.32	40.0	11.3	78.1	66.3	0.11	69.2	yes
11	-5.27	13.5	**-2.53**	20.0	0.31	3.10	0.45	0.32	4.21	40.0	11.3	41.0	58.9	0.07	43.0	yes
12	-5.27	13.5	**-2.53**	22.0	0.31	3.10	0.45	0.41	4.07	40.0	11.3	21.1	36.5	0.05	23.7	yes
13	-5.27	13.5	**-2.53**	24.0	0.31	3.10	0.45	0.50	3.89	40.0	11.3	10.6	21.3	0.05	12.7	yes
14	-5.27	13.5	**-2.53**	26.0	0.31	3.10	0.45	0.58	3.68	40.0	11.3	5.2	16.2	0.03	7.8	yes

From Hall C wiki SIDIS runplan (**Runs 3420 onwards**)

Plots in this work are from Run #3423

W vs Q^2 Diamond Plot





Cuts applied:

- Loose HMS and SHMS acceptance cuts
- Variable names : gtr.dp for delta; gtr.th for xptar; gtr.ph for yptar

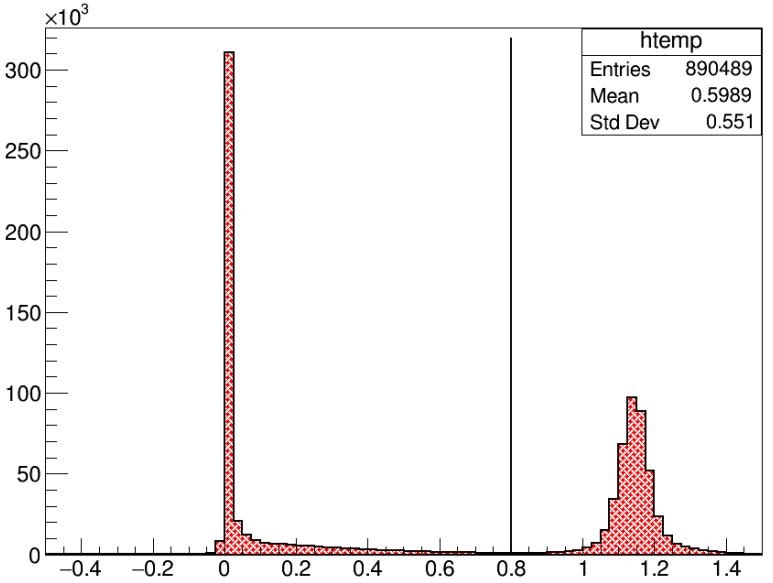
Missing Mass (M_x)

Reaction: e + p → e' + K^+ + Λ(Σ^0)

➡ $E_{miss} = E_e + E_{e'} - E_K$

➡ $\mathbf{p}_{miss} = \mathbf{q} - \mathbf{p}_K$

➡ $M_x = \sqrt{(E_{miss}^2 - |\mathbf{p}_{miss}|^2)}$

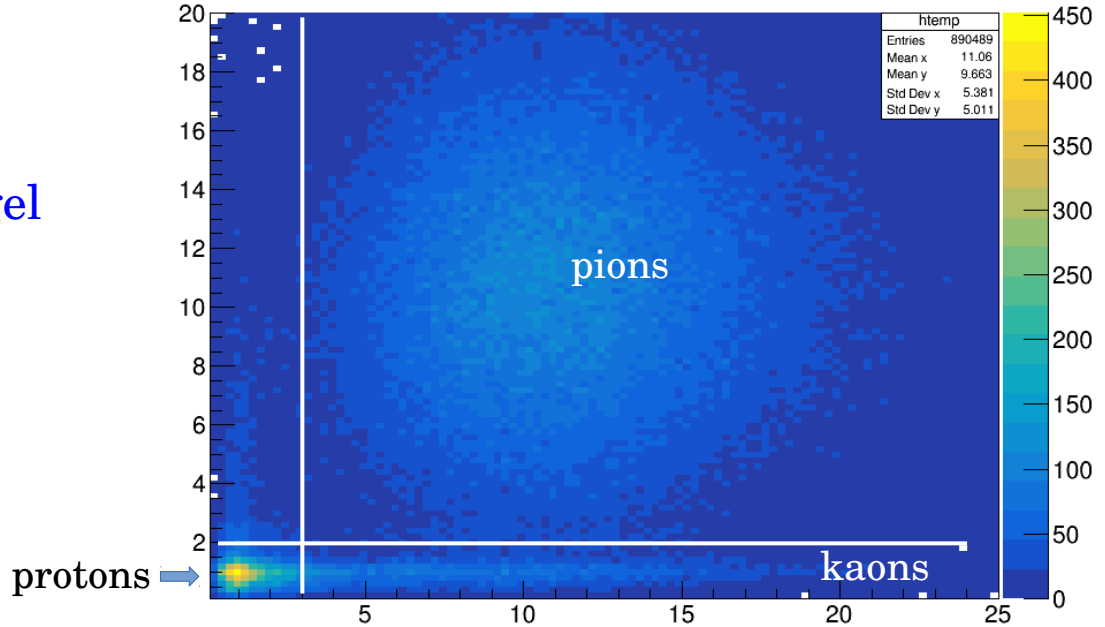


HMS calorimeter energy normalized to the central momentum

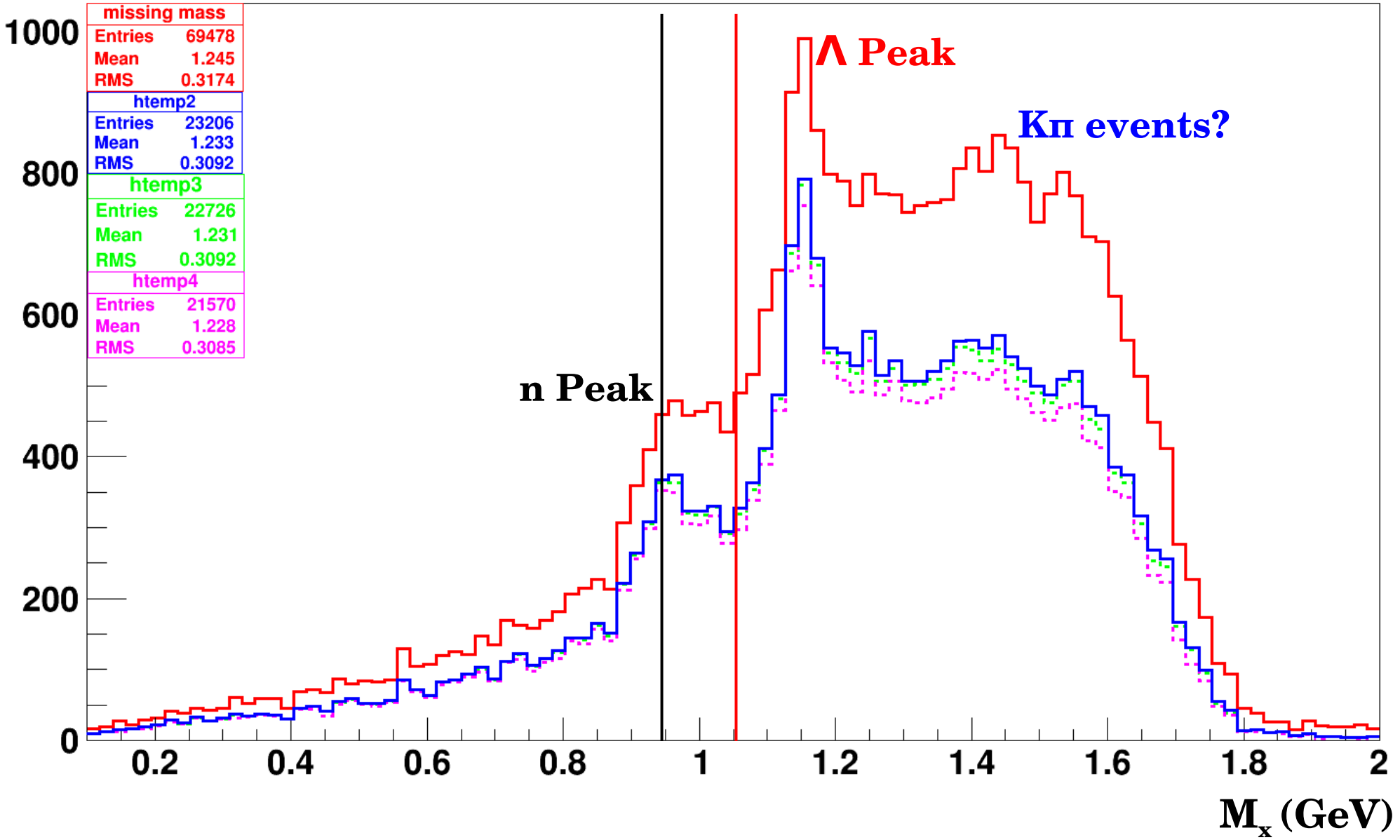
PID cuts:

- Electron in HMS : calorimeter cut
- Kaon in SHMS : HGC and aerogel cherenkovs

➡ Z-position of the target to crudely remove the aluminum cell wall contribution



HGC vs Aerogeal total # of photoelectrons


missing mass
Entries 69478
Mean 1.245
RMS 0.3174
htemp2
Entries 23206
Mean 1.233
RMS 0.3092
htemp3
Entries 22726
Mean 1.231
RMS 0.3092
htemp4
Entries 21570
Mean 1.228
RMS 0.3085
Λ Peak
Kπ events?
n Peak
1000
800
600
400
200
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
M_x (GeV)

Further Work

- Coincidence time cut to clean up the pion events
- Comparison with the SIMC data
- Analyze other settings from the SIDIS data
- Continue w/ kinematics optimization