Beam schedule

10/17/23	Tuesday	2.1	Physics	E12-09-016	8.4/45/p/500	Run Group D	10.5/200/p/500	NPS Group	10.5/50/p/500
10/18/23	Wednesday	2.1	Physics	E12-09-016	8.4/45/p/500	Run Group D	10.5/200/p/500	NPS Group	10.5/50/p/500
10/19/23	Thursday	2.1	Physics	E12-09-016	8.4/45/p/500	Run Group D	10.5/200/p/500	NPS Group	10.5/50/p/500
10/20/23	Friday	2.1	Physics	E12-09-016	8.4/45/p/500	Run Group D	10.5/200/p/500	NPS Group	10.5/50/p/500
10/21/23	Saturday	2.1	Physics	E12-09-016	8.4/45/p/500	Run Group D	10.5/200/p/500	NPS Group	10.5/50/p/500
10/22/23	Sunday	2.1	Physics	E12-09-016	8.4/45/p/500	Run Group D	10.5/200/p/500	NPS Group	10.5/50/p/500
10/23/23	Monday	2.1	Physics	E12-09-016	8.4/45/p/500	Run Group D	10.5/200/p/500	NPS Group	10.5/50/p/500
10/24/23	Tuesday	2.1	Physics	Reconfigure		Run Group D	10.5/200/p/500	NPS Group	10.5/50/p/500
10/25/23	Wednesday	2.1	Physics	Reconfigure		Run Group D	10.5/200/p/500	NPS Group	10.5/50/p/500
10/26/23	Thursday	2.1	Physics	Reconfigure		Run Group D	10.5/200/p/500	NPS Group	10.5/50/p/500
10/27/23	Friday	2.1	Physics	Pass change		Run Group D	10.5/200/p/500	NPS Group	10.5/50/p/500
10/28/23	Saturday	2.1	Physics	E12-15-006	6.4/45/p/500	Run Group D	10.5/200/p/500	NPS Group	10.5/50/p/500
10/29/23	Sunday	2.1	Physics	E12-15-006	6.4/45/p/500	Run Group D	10.5/200/p/500	NPS Group	10.5/50/p/500
10/30/23	Monday	2.1	Physics	E12-15-006	6.4/45/p/500	Run Group D	10.5/200/p/500	NPS Group	10.5/50/p/500
10/31/23	Tuesday	2.1	Physics	E12-15-006	6.4/45/p/500	Run Group D	10.5/200/p/500	NPS Group	10.5/50/p/500
11/1/23	Wednesday	2.1	Physics	E12-15-006	6.4/45/p/500	Run Group D	10.5/200/p/500	NPS Group	10.5/50/p/500
11/2/23	Thursday	2.1	Physics	E12-15-006	6.4/45/p/500	Run Group D	10.5/200/p/500	NPS Group	10.5/50/p/500
11/3/23	Friday	2.1	Physics	E12-15-006	6.4/45/p/500	Run Group D	10.5/200/p/500	NPS Group	10.5/50/p/500
11/4/23	Saturday	2.1	Physics	E12-15-006	6.4/45/p/500	Run Group D	10.5/200/p/500	NPS Group	10.5/50/p/500
11/5/23	Sunday	2.1	Physics	E12-15-006	6.4/45/p/500	Run Group D	10.5/200/p/500	NPS Group	10.5/50/p/500
11/6/23	Monday	2.1	Physics	Install		Run Group D	10.5/200/p/500	NPS Group	10.5/50/p/500
11/7/23	Tuesday	2.1	Physics	Install		Run Group D	10.5/200/p/500	Pass change	
11/8/23	Wednesday	2.1	Physics	Install		Run Group D	10.5/200/p/500	NPS Group	8.4/50/p/500
11/9/23	Thursday	2.1	Physics	Install		Run Group D	10.5/200/p/500	NPS Group	8.4/50/p/500
11/10/23	Friday	2.1	Physics	Install		Run Group D	10.5/200/p/500	NPS Group	8.4/50/p/500
11/11/23	Saturday	2.1	Physics	Install		Run Group D	10.5/200/p/500	NPS Group	8.4/50/p/500
11/12/23	Sunday	2.1	Physics	Install		Run Group D	10.5/200/p/500	NPS Group	8.4/50/p/500

E12-09-016	8.4/45/p/500	Run Group D	10.5/200/p/500	NPS Group	10.5/50/p/500
E12-09-016	8.4/45/p/500	Run Group D	10.5/200/p/500	NPS Group	10.5/50/p/500
E12-09-016	8.4/45/p/500	Run Group D	10.5/200/p/500	NPS Group	10.5/50/p/500
Reconfigure		Run Group D	10.5/200/p/500	NPS Group	10.5/50/p/500
Reconfigure		Run Group D	10.5/200/p/500	NPS Group	10.5/50/p/500
Reconfigure		Run Group D	10.5/200/p/500	NPS Group	10.5/50/p/500
Pass change		Run Group D	10.5/200/p/500	NPS Group	10.5/50/p/500
E12-15-006	6.4/45/p/500	Run Group D	10.5/200/p/500	NPS Group	10.5/50/p/500
E12-15-006	6.4/45/p/500	Run Group D	10.5/200/p/500	NPS Group	10.5/50/p/500
E12-15-006	6.4/45/p/500	Run Group D	10.5/200/p/500	NPS Group	10.5/50/p/500
E12-15-006	6.4/45/p/500	Run Group D	10.5/200/p/500	NPS Group	10.5/50/p/500
E12-15-006	6.4/45/p/500	Run Group D	10.5/200/p/500	NPS Group	10.5/50/p/500
E12-15-006	6.4/45/p/500	Run Group D	10.5/200/p/500	NPS Group	10.5/50/p/500
E12-15-006	6.4/45/p/500	Run Group D	10.5/200/p/500	NPS Group	10.5/50/p/500
E12-15-006	6.4/45/p/500	Run Group D	10.5/200/p/500	NPS Group	10.5/50/p/500
E12-15-006	6.4/45/p/500	Run Group D	10.5/200/p/500	NPS Group	10.5/50/p/500
Install		Run Group D	10.5/200/p/500	NPS Group	10.5/50/p/500
Install		Run Group D	10.5/200/p/500	Pass change	
Install		Run Group D	10.5/200/p/500	NPS Group	8.4/50/p/500
Install		Run Group D	10.5/200/p/500	NPS Group	8.4/50/p/500
Install		Run Group D	10.5/200/p/500	NPS Group	8.4/50/p/500
Install		Run Group D	10.5/200/p/500	NPS Group	8.4/50/p/500

Pion ALL plan

0) Production at 6.382 GeV electron beam
1) BB and SBS angles 32.0 deg, Eγ= 4.3 GeV
2) He-3 pol at 60 deg – Arun, for 50% field in SBS (as in GEn kin-2)
3) Trigger BB & HCAL coin. time 50 ns – Jiwan, distance to HCAL 11m
4) BB and SBS trackers - Holly
5) BBCal HV calibration – Provakar with SBS ON, threshold 0.25+ GeV
6) Optics for BB/SBS with C-foils – Andrew
7) Production 4 days with beam 10 uA
8) Polarity of BB and SBS flip on 11/2
9) Production 4 days

Could be a two-pass beam for e-p optics calibration after 11/6

From Rachel's talk in July

•Cross-section parameterisation*:

$$\frac{d\sigma}{dt}_{\gamma n \to \pi^- p} = 1.7 \times 0.83 \times (10/s)^7 (1 - cos(\theta_{CM}))^{-5} (1 + cos(\theta_{CM}))^{-4}$$

•Event rate $N_{\pi^- p}$:

$$N_{\pi^- p} = \frac{d\sigma}{dt}_{\pi^- p} \frac{p^2_{\pi^-}}{\pi} \Delta\Omega_{\pi^-} f_{\pi^- p} \left[\frac{\Delta E_\gamma}{E_\gamma} \frac{t_{rad}}{X_0} \mathcal{L}_{e-n} \right]$$

process cross-section

Range of Δt, expressed in p_π and BB solid angle (50msr)

fraction of events detected in SBS obtained from g4sbs

Number of photons per incident electron and for photon energy range.
t_{rad}/X_0 ~ 0.082
$\mathcal{L}$ ~ 1.8x10^{36}Hzcm^{-2}

Kin	A	B	C	D	E
$f_{\pi\text{-}p}$	0.31	0.18	0.51	0.35	0.37
Pion detection	0.41	0.38	0.37	0.42	0.37
Proton detection	0.86	0.81	0.88	0.92	0.93
$p_{miss\perp}$ cut	0.85	0.86	0.82	0.82	0.84
Estimated counts per hour	1420	980	1150	530	120

•To get final estimated rate, $N_{\pi\text{-}p}$ corrected for
- •expected DAQ dead time
- •from g4sbs studies: losses due to pion/proton detection/trigger efficiencies and event selection cut on missing momentum for reaction

* π^+ cross-section from: R.L. Anderson et al., Phys. Rev. D 14, 679 (1976)
Correction for π^- from π^+/π^+ yields from deuteron from: L.Y. Zhu et al., Phys. Rev. Lett. 91 (2003) 022003; Phys.Rev. C71 (2005) 044603

For beam of 10 uA the number of events will be 11k in 48 hours

MC results using **g4sbs**

Statistics: [4X24 / 4] hours is 5.5k in combined pi-p + p-pi (10 uA beam)

With 6.6 GeV electron and P_e =0.82 for 4.5 GeV photon P_γ ~ 0.72

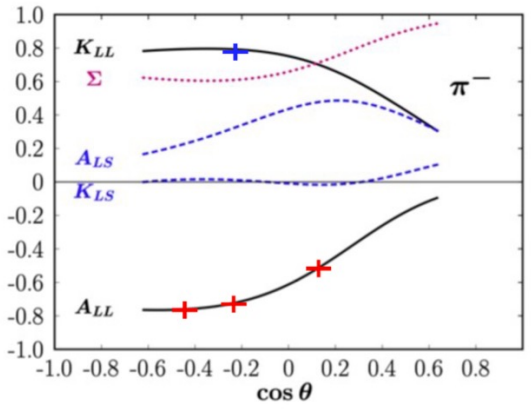
With $P_n = 0.90 \times P_{He}$ = 0.36, so the polarization product is 0.26

Resulting accuracy for physics asymmetry 0.052

Projected result is ALL = -0.70 +/- 0.070 (or +/- 0.05 pending beam delivery)

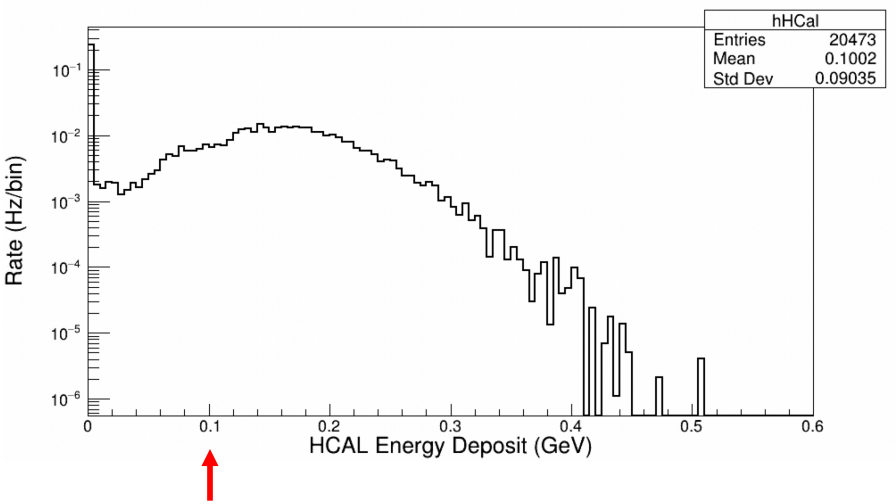
In the proposal:

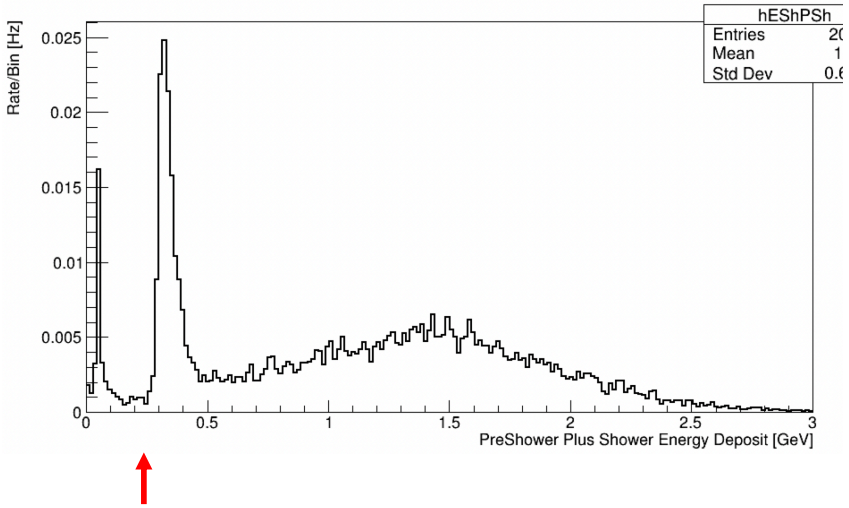
We propose an experiment to measure the helicity correlation parameter, A_{LL} for meson photo-production in the wide angle regime for five different kinematic settings. This proposed experiment will be performed in Hall A of Jefferson Lab using the SBS apparatus, a 60 cm long polarized ^{3}He target, a 6% copper radiator and three different CEBAF beam energies at 20 μA beam current.



MC results using **g4sbs**

Trigger for the hadrons

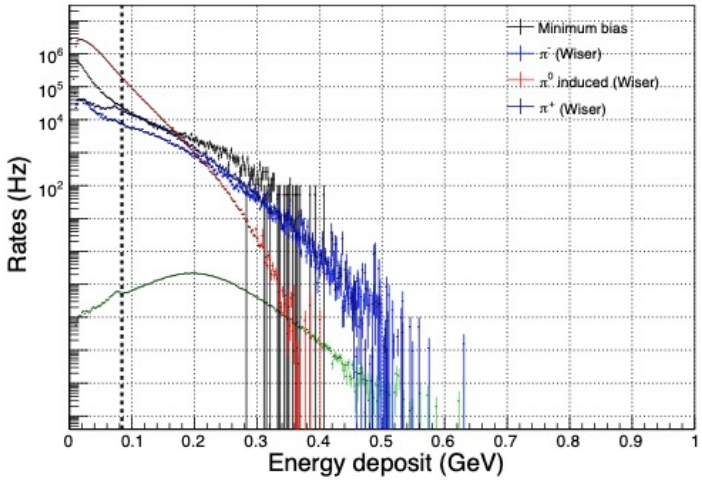


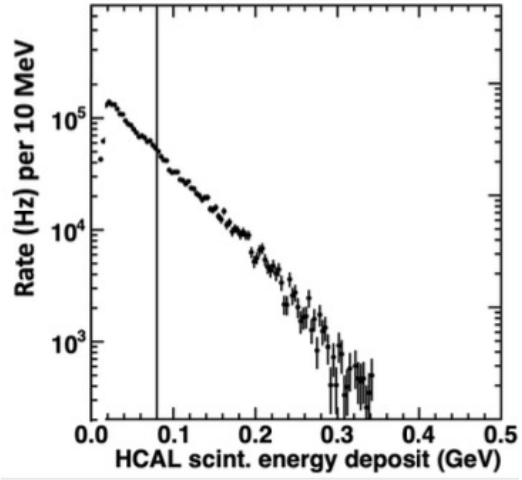


proton SBS = HCAL

pion BB = PS + SH

Expected detector and DAQ rates





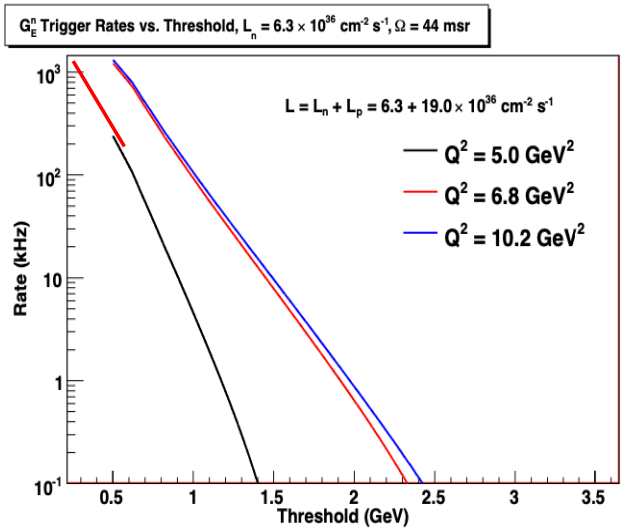


Figure 15: HCAL rate vs. energy deposition. Left: Rate above the given threshold (figures is taken from E12-20-010). Right: Rate per 10 MeV (figure is taken from E12-20-008). Figures are corrected to the luminosity of this proposal.

BBCal in GEn-II proposal

In HCAL expected ~ 250 kHz for 10 uA beam
(also 32 deg vs. 18 deg and (17/11)^2)

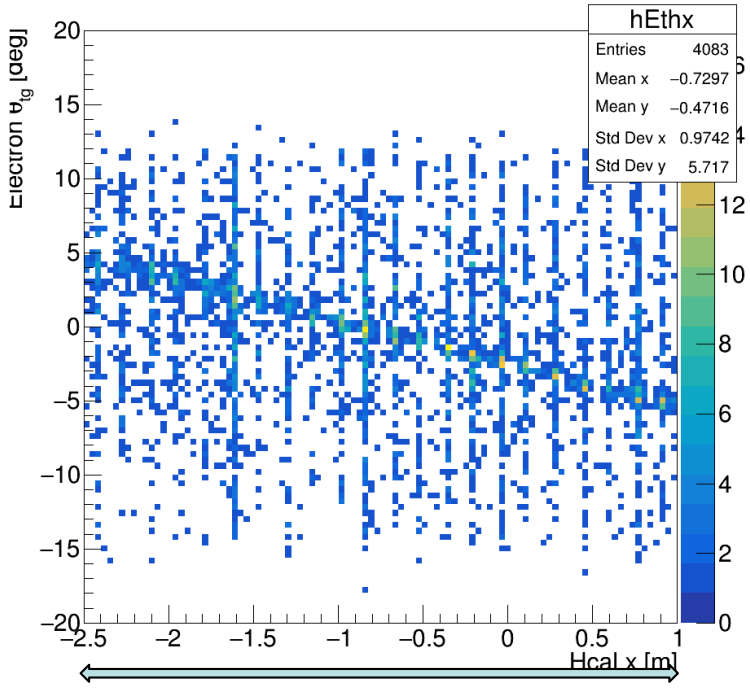
Need to prepare 50 ns coincidence time

Observed rate for He-3, 45 uA, 35°

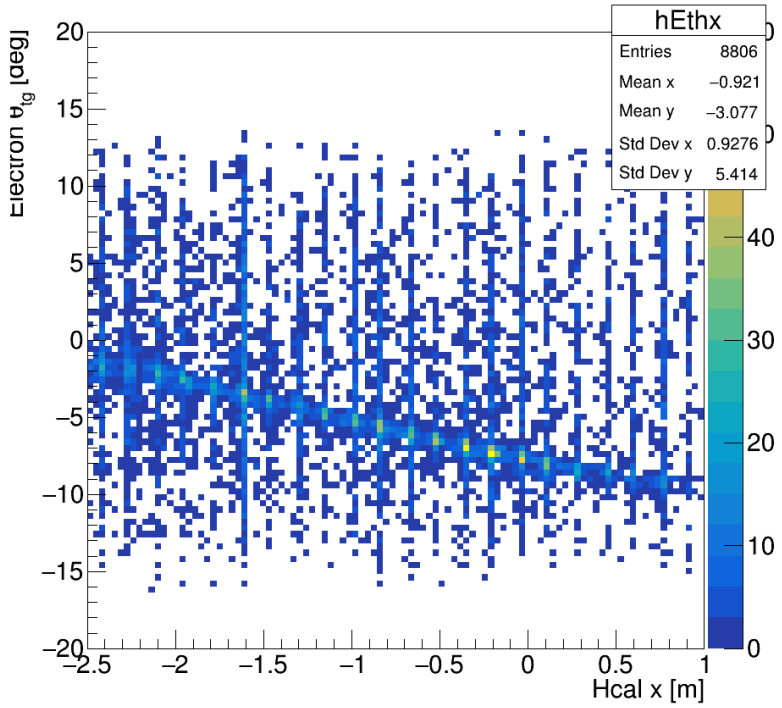
350mV: 670 Hz	2 GeV
179mV: 27380 Hz	1 GeV
93mV: 3.76e5 Hz	0.5 GeV

BB vs. SBS vertical acceptance

	Name	Energy	Program	BB angle	BB dista	SBS angle	SBS dista	HCAL angle	HCAL	B direction	P_nucleon	SBS current	P_elect.
2			Q2, GeV2						distance	degree, left	GeV/c	% 2100 amp	GeV/c
3	GEN-1	2.20	GEn Comm.	47.5	1.63	34.7	2.80	34.7	17		1.64	0, 50, 100%	1.11
4	~~GEN-1~~	~~2.20~~	~~GEn 1.7~~	~~47.5~~	~~1.63~~	~~34.7~~	~~2.80~~	~~34.7~~	~~17~~	~~60.1~~	~~1.64~~	~~100%~~	~~1.11~~
5	GEN-2	4.30	GEn 2.9	29.5	1.63	34.7	2.80	34.7	17	60.1	2.36	100%	2.70
6	GEN-3	6.40	GEn 6.6	35.9	1.63	22.1	2.80	21.6	17	67.8	4.45	100%	2.79
7	GEN-4	8.50	GEn 9.7	35.0	1.63	18.0	2.80	17.5	17	72.5	6.15	100%	3.22



Elastic e-p



12 deg, J_v = 1.14

SBS at 628 A

SBS at 2100 A

Data analysis, event selection

2.5 kHz trigger vs ~ 0.1-0.2 Hz signal events

1. Momentum reconstruction in each arm (use > 1.5 GeV): reduction of the effective trigger rate to ~ 5 Hz
2. Photon energy reconstruction in each arm: factor ~ 0.2/4
3. Angles at the vertex (P_{perp}/P ~ 100/2500): factor ~ 1/5
4. Coincidence time offline ~ 5 ns gate, factor ~1/10

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