Pion-LT Run Plan - Part 3

August 16, 2022

6.399 GeV Beam Plan

Initial beam activities

- While waiting for beam, configure the spectrometers for beam checkout:

1. **Change SHMS polarity to positive.** Turn the beam off while ramping the SHMS, and carefully follow the magnet cycling procedure.
2. HMS angle = 13.81 (from TV). Be sure to record and photograph the actual vernier value to 0.005 degree precision.
3. HMS momentum = –3.921 GeV/c. Negative polarity. (follow the magnet cycling procedure).
4. SHMS angle = 17.86 deg (from TV). Be sure to record and photograph the actual vernier value to 0.005 degree precision.
5. SHMS momentum = 2.412 GeV/c.
6. Update *standard.kinematics* with the new settings.
7. Set the PS1(SHMS-3/4) and PS4(HMS-ELREAL) target rates to 100 Hz.
   For 50 μA beam and the projected rates listed above, these prescale factors should give 100 Hz HMS and SHMS singles event rates to disk, and a 215 Hz DAQ rate overall.

Projected prescale GUI settings:	
PS1(SHMS-3/4)	12
PS2(SHMS-ELREAL)	–1
PS3(HMS-3/4)	–1
PS4(HMS-ELREAL)	11
PS5(HMS-ELREAL×SHMS-3/4)	–1
PS6(HMS-3/4×SHMS-3/4)	–1
EDTM Target Prescale Rate	10 Hz
cermode10	ON

8. HMS large and SHMS collimators.
9. **Warning!!! Rates are high here!!!** 50 μA beam is the highest that is recommended. 2×2 raster should be on.

- Beam checkout.
  Follow the notes at:
  `https://hallcweb.jlab.org/wiki/index.php/Beam_Checkout_Procedures`
  including the "Carbon-hole" check to verify beam+target alignment and MCC raster size calibration.

- Fix beam angle at target.
  Do this step only if MCC is unable to restore the beam positions used at the previous energy.
  Use the gui at: `/home/cdaq/users/gaskelld/target_bpm/target_bpm.py`
  Adjust 3H07Ax,y to remove slope while keeping 3H07Cx,y fixed
  Recheck carbon hole and iterate as necessary.

Items to be done as soon as possible at this energy (time determined by RC).

- Energy determination with arc.
  The Run Co-ordinator will coordinate the timing of this with the Program Deputy. MCC will have to set up a clean dispersive tune. It is important for the Shift Leader to make a full hclog entry of the MCC data. Follow the "Hall C Beam Energy Measurement Procedure" at MCC Ops Doc: MCC-PR-06-004.

- BCM calibrations.
  The Run Co-ordinator will coordinate the timing of this with the Program Deputy. Due to very high rate settings at this beam, **we will need a special BCM calibration to estimate as accurately as possible to a current as low as 1 μA**, in addition to the regular BCM Calibration reliable at 80 μA beam. This requires MCC's ability to reliably deliver 65-80 μA beam, so this calibration might have to wait at least a few days. The BCM calibration procedure is at:
  `https://hallcweb.jlab.org/doc-public/ShowDocument?docid=957`.
  Dave Mack will analyze the data later.

Q^2=1.45, W=2.02, x=0.3118, high ϵ data taking

Nominal Q^2=1.45 GeV$^2/c^2$, W=2.02 GeV, x=0.3118 Kinematics

E_e GeV	$E_{e'}$ GeV	$\theta_{e'}$ deg	ϵ	$\lvert t\rvert$ (GeV/c)^2	p_π GeV/c	θ_q deg
6.399	3.921	13.81	0.867	0.114	2.412	-19.86

1. $p(e,e'\pi^+)n$ LH2 SHMS right ($\theta = 17.86^o$) run.

   Set up the following configuration:

   (a) Do not change the spectrometer angles or momenta. They should be the same as the previous setting.

   (b) Insert 10 cm LH2 target.

   (c) Update *standard.kinematics* with the new settings.

   (d) Set the PS1(SHMS-3/4) and PS4(HMS-ELREAL) target rates to 100 Hz.

   ✓For **50 μA** beam and the projected rates listed below, these prescale factors should give 100 Hz HMS and SHMS singles event rates to disk, and an 2800 Hz DAQ rate overall.

Projected prescale GUI settings:	
PS1(SHMS-3/4)	13 ✓
PS2(SHMS-ELREAL)	–1
PS3(HMS-3/4)	–1
PS4(HMS-ELREAL)	11 ✓
PS5(HMS-ELREAL×SHMS-3/4)	0
PS6(HMS-3/4×SHMS-3/4)	–1
EDTM Target Prescale Rate	10 Hz
cermode10	ON

These prescales were pretty accurate!

HMS e^- rate	HMS π^- rate	SHMS π^+ rate	SHMS K rate	SHMS p rate	Random coinc. $(e^- + \frac{\pi^-}{5}) \cdot (\pi + K + \mathrm{p})$	Real coinc. $e^- \cdot \pi$
92 kHz	16 kHz	241 kHz	48 kHz	161 kHz	2600 Hz	58 Hz

✓(e) **fadcmode10 Run:** Start by taking a 2 minute fadcmode10 run. Be sure to mark this clearly on the Run Sheet. After the run, it is extremely important to **unclick the fadcmode10 setting button.**

(f) **Take data for approximately 0.5 hour (at 100% efficiency) at 50 μA to give 104,000 p(e, e'π^+)n coincidences.** Use the physics replay to keep track of the event total.

The first run should be $\sim$ 10 minutes (at 100% data taking efficiency), and should be immediately analyzed to get an indication of the pion rate. Use this to calculate how long to run to get the desired statistics.

→ analyze only 60k.

Aim for 10-15 minute runs.
keep below <2m event!

✓ 2. $\boxed{\text{Al}(e, e'\pi^+)X}$ Thick Dummy target SHMS right ($\theta = 17.86^o$) run.

Now put in the "thick" dummy target ($\pm$5 cm) and initially set prescale factors to the same as the LH2 run.

If the HMS and SHMS singles event rates to disk are significantly less than 100 Hz each, the PS1,4 factors can be decreased accordingly.

Current limit: 40 μA.

DO NOT modify *standard.kinematics* for this run (i.e. keep as for LH2 target).

Take data for 0.1 hour (100% efficiency) at 40 μA.

3. $\boxed{p(e,e'\pi^+)n}$ LH2 SHMS center ($\theta = 19.86^o$) run.

(a) Move the SHMS to 19.86 deg (from TV). Be sure to record and photograph the actual vernier value to 0.005 degree precision.

(b) Insert the LH2 target. Leave the spectrometer magnet settings unchanged.

✓(c) Update *standard.kinematics* with the new settings.

(d) Set the PS1(SHMS-3/4) and PS4(HMS-ELREAL) target rates to 100 Hz.
For **60 μA** beam and the projected rates listed below, these prescale factors should give 100 Hz HMS and SHMS singles event rates to disk, and a 2500 Hz DAQ rate overall.

Projected prescale GUI settings:	
PS1(SHMS-3/4)	12
PS2(SHMS-ELREAL)	–1
PS3(HMS-3/4)	–1
PS4(HMS-ELREAL)	11
PS5(HMS-ELREAL×SHMS-3/4)	0
PS6(HMS-3/4×SHMS-3/4)	–1
EDTM Target Prescale Rate	10 Hz
cermode10	ON

HMS e^- rate	HMS π^- rate	SHMS π^+ rate	SHMS K rate	SHMS p rate	Random coinc. $(e^- + \frac{\pi^-}{5}) \cdot (\pi + K + \mathrm{p})$	Real coinc. $e^- \cdot \pi$
111 kHz	20 kHz	162 kHz	34 kHz	129 kHz	2200 Hz	18-20 Hz

✓(e) **fadcmode10 Run:** Start by taking a 2 minute fadcmode10 run. Be sure to mark this clearly on the Run Sheet. After the run, it is extremely important to **unclick the fadcmode10 setting button.**

✓(f) **Take data for 0.5 hour (100% efficiency) at 60 μA to get about 120,000 p(e, e'π^+)n coincidences.** Use the physics replay to keep track of the event total.
The first run should be ~ 20 minutes (at 100% data taking efficiency), and should be immediately analyzed to get an indication of the pion rate. Use this to calculate how long to run to get the desired statistics.

Aim for 10 - 15 minute runs.
Keep below 2n event!

4. $\boxed{\mathrm{Al}(e,e'\pi^+)X}$ Thick Dummy target SHMS center ($\theta = 19.86^o$) run.

Now put in the "thick" dummy target (± 5 cm) and initially set prescale factors to the same as the LH2 run.
If the HMS and SHMS singles event rates to disk are significantly less than 100 Hz each. the PS1,4 factors can be decreased accordingly.
Current limit: 40 μA.
DO NOT modify *standard.kinematics* for this run (i.e. keep as for LH2 target).

Take data for 0.1 hours (100% efficiency) at 40 μA.

5. $\boxed{p(e,e'\pi^+)n}$ LH2 SHMS left ($\theta = 21.86^o$) run.

(a) Move the SHMS 21.86 deg (from TV). Be sure to record and photograph the actual vernier value to 0.005 degree precision.

(b) Put in the LH2 target. Leave the spectrometer magnet settings unchanged.

(c) Update *standard.kinematics* with the new settings.

(d) Set the PS1(SHMS-3/4) and PS4(HMS-ELREAL) target rates to 100 Hz.
For **80 μA beam** and the projected rates listed below, these prescale factors should give 100 Hz HMS and SHMS singles event rates to disk, and a 2600 Hz DAQ rate overall.

Projected prescale GUI settings:	
PS1(SHMS-3/4)	12
PS2(SHMS-ELREAL)	–1
PS3(HMS-3/4)	–1
PS4(HMS-ELREAL)	11
PS5(HMS-ELREAL×SHMS-3/4)	0
PS6(HMS-3/4×SHMS-3/4)	–1
EDTM Target Prescale Rate	10 Hz
cermode10	ON

HMS e^- rate	HMS π^- rate	SHMS π^+ rate	SHMS K rate	SHMS p rate	Random coinc. $(e^- + \frac{\pi^-}{5}) \cdot (\pi + K$+p)	Real coinc. $e^- \cdot \pi$
147 kHz	26 kHz	114 kHz	26 kHz	114 kHz	2300 Hz	25-27 Hz

(e) **fadcmode10 Run:** Start by taking a 2 minute fadcmode10 run. Be sure to mark this clearly on the Run Sheet. After the run, it is extremely important to **unclick the fadcmode10 setting button.**

(f) **Take data for approximately 0.5 hour (at 100% efficiency) at 80 μA to get about 160,000 p$(e,e'\pi^+)$n coincidences.** Use the physics replay to keep track of the event total.
The first run should be $\sim$ 20 minutes (at 100% data taking efficiency), and should be immediately analyzed to get an indication of the pion rate. Use this to calculate how long to run to get the desired statistics.

Aim for short runs, maybe 20 minutes.

Keep below 2m event

6. $\boxed{\text{Al}(e,e'\pi^+)X}$ Thick Dummy target SHMS left ($\theta = 21.86^o$) run.

Now put in the "thick" dummy target (± 5 cm) and initially set prescale factors to the same as the LH2 run.

If the HMS and SHMS singles event rates to disk are significantly less than 100 Hz each, the PS1,4 factors can be decreased accordingly.

Current limit: 40 μA.

DO NOT modify *standard.kinematics* for this run (i.e. keep as for LH2 target).

Take data for 0.1 hours (100% efficiency) at 40 μA.

6.399 GeV fADC Deadtime Study

could be skipped

This is an optional setting to fill time before changing SHMS aerogel from the $n = 1.015$ tray, to the $n = 1.011$ tray. If there is significant delays the RC may decide to cut any amount of this setting in order to schedule the change with Vladimir Berdnikov and the other Hall C techs. The tray must be replaced before the starting the $Q^2 = 2.73$, W= 2.63, setting, but the Heep coins may be done before or after the change.

1. Insert the 10 cm LH2 target, and leave the spectrometer settings unchanged from the previous setting.

2. Set the PS1(SHMS-3/4) and PS4(HMS-ELREAL) target rates to 100 Hz. The predicted prescale values are listed in the table below. Keep PS5 = 0 at all times. Beam current is assumed to be 80 μA.

Projected prescale GUI settings:	
PS1(SHMS-3/4)	See Table
PS2(SHMS-ELREAL)	–1
PS3(HMS-3/4)	–1
PS4(HMS-ELREAL)	See Table
PS5(HMS-ELREAL×SHMS-3/4)	0
PS6(HMS-3/4×SHMS-3/4)	–1
EDTM Target Prescale Rate	10 Hz
cermode10	ON

3. DO NOT check fADCmode10 in the coda GUI!

4. Take 50000 pion events at each setting current. Estimated run time is in at 100% efficiency.

6.399 GeV $p(e,e'\pi^+)n$ fADC Deadtime Study									
μA	Targets	$\frac{Rate_{SHMS}}{LHrun}$	$\frac{PS1}{SHMS}$	$\frac{Rate_{HMS}}{LHrun}$	$\frac{PS4}{HMS}$	DAQ_{SHMS}	DAQ_{HMS}	$\frac{Time}{run}$	
$\theta_{HMS} = 13.81$, P_{HMS}=-3.921 GeV/c, $\theta_{SHMS} = 21.86$, P_{SHMS}=+2.412 GeV/c									
(4) 60	LH2	191 kHz	12	131 kHz	11	100 Hz	100 Hz	0.20 hr	22 min
(1) 40	LH2	127 kHz	11	87 kHz	10	100 Hz	100 Hz	0.30 hr	33 min
(5) 30	LH2	96 kHz	11	65 kHz	10	100 Hz	100 Hz	0.40 hr	44.3 min
(2) 20	LH2	64 kHz	10	43 kHz	9	100 Hz	100 Hz	0.60 hr	66. min
(3) 12	LH2	38 kHz	9	26 kHz	9	100 Hz	100 Hz	1.0 hr	110.7 min
Total Time (at 100% efficiency): 2.5 hrs									4.6 hrs

Do in this order. Move on when you think it leaves enough time for Heep coin before Aerogel change.

Heep-check coincidence runs

could be done after aerogel change

1. $p(e,e'p)$ equal angles and momenta setting

6.399 GeV Heep-check coincidence run

θ_{HMS}	P_{HMS}	θ_{SHMS}	P_{SHMS}	$Rate_{HMS}$	$Rate_{DAQ}$	Time
18.60	-4.752	37.98	2.412	156 Hz	215 Hz	10 min

Set up the following configuration:

(a) **Change SHMS polarity to positive.** Turn the beam off while ramping the SHMS, and carefully follow the magnet cycling procedure.

(b) Set the SHMS magnets to +2.412 GeV/c.

(c) SHMS angle = 37.98 deg (from TV). Be sure to record and photograph the actual vernier value to 0.005 degree precision.

(d) Set HMS magnets to –4.752 GeV/c (follow the magnet cycling procedure).

(e) HMS angle = 18.60 deg (from TV). Be sure to record and photograph the actual vernier value to 0.005 degree precision.

(f) Update *standard.kinematics* with the new settings.

(g) Set the PS1(SHMS-3/4) and PS4(HMS-ELREAL) target rates to 100 Hz.
For 80 μA beam and the projected rates listed above, these prescale factors should give 100 Hz HMS and SHMS singles event rates to disk, and a 215 Hz DAQ rate overall.

Projected prescale GUI settings:	
PS1(SHMS-3/4)	5
PS2(SHMS-ELREAL)	–1
PS3(HMS-3/4)	–1
PS4(HMS-ELREAL)	3
PS5(HMS-ELREAL×SHMS-3/4)	0
PS6(HMS-3/4×SHMS-3/4)	–1
EDTM Target Prescale Rate	10 Hz
cermode10	ON

(h) HMS large and SHMS collimators.

(i) Stable 80 μA beam with 2 × 2 raster on.

fadcmode10 Run: Start by taking a 2 minute fadcmode10 run. Be sure to mark this clearly on the Run Sheet. After the run, it is extremely important to **unclick the fadcmode10 setting button.**

Data: Take one run with a total of 90,000 $e+p$ elastic scattering coincidences. This run should be taken for 10 minutes at 100% efficiency, and should be immediately analyzed, checking E_{miss} and p_{miss}, while taking the Dummy.

Estimated Running Time: 10 minutes at 100% efficiency.

2. $\boxed{\mathrm{Al}(e,e'p)X}$ Thick Dummy target run for Heep-check.

   Insert the "thick" dummy target (± 5 cm) and **run for 6 minutes** at 40 μA (assuming 100% efficiency).
   DO NOT modify *standard.kinematics* for this run (i.e. keep as for LH2 target).

SETTING 2

3. $p(e,e'p)$ setting for HMS angle and both spectrometer momenta

6.399 GeV Heep-check coincidence run

θ_{HMS}	P_{HMS}	θ_{SHMS}	P_{SHMS}	$Rate_{HMS}$	$Rate_{DAQ}$	Time
21.10	-4.391	34.47	2.792	76 Hz	238 Hz	10 min

Set up the following configuration:

(a) Set the SHMS magnets to +2.792 GeV/c (follow the magnet cycling procedure).

(b) SHMS angle = 34.474 deg (from TV). Be sure to record and photograph the actual vernier value to 0.005 degree precision.

(c) Set HMS magnets to –4.391 GeV/c.

(d) HMS angle = 21.10 deg (from TV). Be sure to record and photograph the actual vernier value to 0.005 degree precision.

(e) Update *standard.kinematics* with the new settings.

(f) Set the PS1(SHMS-3/4) and PS4(HMS-ELREAL) target rates to 100 Hz.
For 70 μA beam and the projected rates listed above, these prescale factors should give 100 Hz HMS and SHMS singles event rates to disk, and a 238 Hz DAQ rate overall.

Projected prescale GUI settings:	
PS1(SHMS-3/4)	4
PS2(SHMS-ELREAL)	–1
PS3(HMS-3/4)	–1
PS4(HMS-ELREAL)	5
PS5(HMS-ELREAL×SHMS-3/4)	0
PS6(HMS-3/4×SHMS-3/4)	–1
EDTM Target Prescale Rate	10 Hz
cermode10	ON

(g) HMS large and SHMS collimators.

(h) Stable 80 μA beam with 2 × 2 raster on.

fadcmode10 Run: Start by taking a 2 minute fadcmode10 run. Be sure to mark this clearly on the Run Sheet. After the run, it is extremely important to **unclick the fadcmode10 setting button.**

Data: Take one run with a total of 45,000 $e+p$ elastic scattering coincidences. This run should be taken for 10 minutes at 100% efficiency, and should be immediately analyzed, checking E_{miss} and p_{miss}, while taking the Dummy.

Estimated Running Time: 10 min at 100% efficiency.

4. $\boxed{\mathrm{Al}(e,e'p)X}$ Thick Dummy target run for Heep-check.

Insert the "thick" dummy target (± 5 cm) and **run for 6 minutes** at 40 μA (assuming 100% efficiency).
DO NOT modify *standard.kinematics* for this run (i.e. keep as for LH2 target).

SETTING 3

5. $p(e,e'p)$ setting for HMS angle and both spectrometer momenta

6.399 GeV Heep-check coincidence run

θ_{HMS}	P_{HMS}	θ_{SHMS}	P_{SHMS}	$Rate_{HMS}$	$Rate_{DAQ}$	Time
26.55	-3.716	28.46	3.493	21 Hz	244 Hz	20 min

Set up the following configuration:

(a) Set the SHMS magnets to +3.493 GeV/c (follow the magnet cycling procedure).

(b) SHMS angle = 28.46 deg (from TV). Be sure to record and photograph the actual vernier value to 0.005 degree precision.

(c) Set HMS magnets to –3.727 GeV/c.

(d) HMS angle = 26.55 deg (from TV). Be sure to record and photograph the actual vernier value to 0.005 degree precision.

(e) Update *standard.kinematics* with the new settings.

(f) Set the PS1(SHMS-3/4) and PS4(HMS-ELREAL) target rates to 100 Hz.
For 70 μA beam and the projected rates listed above. these prescale factors should give 100 Hz HMS and SHMS singles event rates to disk. and a 244 Hz DAQ rate overall.

Projected prescale GUI settings:	
PS1(SHMS-3/4)	3
PS2(SHMS-ELREAL)	–1
PS3(HMS-3/4)	–1
PS4(HMS-ELREAL)	2
PS5(HMS-ELREAL×SHMS-3/4)	0
PS6(HMS-3/4×SHMS-3/4)	–1
EDTM Target Prescale Rate	10 Hz
cermode10	ON

(g) HMS large and SHMS collimators.

(h) Stable 80 μA beam with 2 × 2 raster on.

fadcmode10 Run: Start by taking a 2 minute fadcmode10 run. Be sure to mark this clearly on the Run Sheet. After the run, it is extremely important to **unclick the fadcmode10 setting button.**

Data: Take two runs with a combined total of 25,000 $e+p$ elastic scattering coincidences. The first run should be taken for 10 minutes at 100% efficiency, and should be immediately analyzed, checking E_{miss} and p_{miss}, while taking the second run.

Estimated Running Time: 20 min at 100% efficiency.

6. $\boxed{\mathrm{Al}(e,e'p)X}$ Thick Dummy target run for Heep-check.

Insert the "thick" dummy target (± 5 cm) and **run for 10 minutes** at 40 μA (assuming 100% efficiency).
DO NOT modify *standard.kinematics* for this run (i.e. keep as for LH2 target).

Setting #4

7. $p(e,e'p)$ setting for HMS angle and both spectrometer momenta

6.399 GeV Heep-check coincidence run

θ_{HMS}	P_{HMS}	θ_{SHMS}	P_{SHMS}	$Rate_{HMS}$	$Rate_{DAQ}$	Time
28.40	-3.514	26.81	3.706	14 Hz	315 Hz	25 min

Set up the following configuration:

(a) Set the SHMS magnets to +3.706 GeV/c (follow the magnet cycling procedure).

(b) SHMS angle = 26.81 deg (from TV). Be sure to record and photograph the actual vernier value to 0.005 degree precision.

(c) Set HMS magnets to –3.514 GeV/c.

(d) HMS angle = 28.40 deg (from TV). Be sure to record and photograph the actual vernier value to 0.005 degree precision.

(e) Update *standard.kinematics* with the new settings.

(f) Set the PS1(SHMS-3/4) and PS4(HMS-ELREAL) target rates to 100 Hz.
For 80 μA beam and the projected rates listed above, these prescale factors should give 100 Hz HMS and SHMS singles event rates to disk, and a 315 Hz DAQ rate overall.

Projected prescale GUI settings:	
PS1(SHMS-3/4)	3
PS2(SHMS-ELREAL)	–1
PS3(HMS-3/4)	–1
PS4(HMS-ELREAL)	0
PS5(HMS-ELREAL×SHMS-3/4)	0
PS6(HMS-3/4×SHMS-3/4)	–1
EDTM Target Prescale Rate	10 Hz
cermode10	ON

(g) HMS large and SHMS collimators.

(h) Stable 80 μA beam with 2 × 2 raster on.

fadcmode10 Run: Start by taking a 2 minute fadcmode10 run. Be sure to mark this clearly on the Run Sheet. After the run, it is extremely important to **unclick the fadcmode10 setting button.**

Data: Take two runs with a combined total of 21,000 $e+p$ elastic scattering coincidences. The first run should be taken for 10 minutes at 100% efficiency, and should be immediately analyzed, checking E_{miss} and p_{miss}, while taking the second run.

Estimated Running Time: 25 min at 100% efficiency.

8. $\boxed{\mathrm{Al}(e,e'p)X}$ Thick Dummy target run for Heep-check.

   Insert the "thick" dummy target (± 5 cm) and **run for 10 minutes** at 40 μA (assuming 100% efficiency).
   DO NOT modify *standard.kinematics* for this run (i.e. keep as for LH2 target).

Setting #5

9. $p(e, e'p)$ setting for HMS angle and both spectrometer momenta

6.399 GeV Heep-check coincidence run

θ_{HMS}	P_{HMS}	θ_{SHMS}	P_{SHMS}	$Rate_{\cancel{HMS}\ Coin}$	$Rate_{DAQ}$	Time
33.35	-3.014	23.12	4.220	6 Hz	802 Hz	1 hour

Set up the following configuration:

(a) Set the SHMS magnets to +4.220 GeV/c (follow the magnet cycling procedure).

(b) SHMS angle = 23.12 deg (from TV). Be sure to record and photograph the actual vernier value to 0.005 degree precision.

(c) Set HMS magnets to –3.014 GeV/c.

(d) HMS angle = 33.35 deg (from TV). Be sure to record and photograph the actual vernier value to 0.005 degree precision.

(e) Update *standard.kinematics* with the new settings.

(f) Set the PS1(SHMS-3/4) and PS4(HMS-ELREAL) target rates to 100 Hz.
For 70 μA beam and the projected rates listed above, these prescale factors should give 100 Hz HMS and SHMS singles event rates to disk, and a 802 Hz DAQ rate overall.

Projected prescale GUI settings:	
PS1(SHMS-3/4)	0
PS2(SHMS-ELREAL)	–1
PS3(HMS-3/4)	–1
PS4(HMS-ELREAL)	0
PS5(HMS-ELREAL×SHMS-3/4)	0
PS6(HMS-3/4×SHMS-3/4)	–1
EDTM Target Prescale Rate	10 Hz
cermode10	ON

(g) HMS large and SHMS collimators.

(h) Stable 80 μA beam with 2×2 raster on.

✓ **fadcmode10 Run:** Start by taking a 2 minute fadcmode10 run. Be sure to mark this clearly on the Run Sheet. After the run, it is extremely important to **unclick the fadcmode10 setting button.**

Data: Take two runs with a combined total of 21,000 $e + p$ elastic scattering coincidences. The first run should be taken for 30 minutes at 100% efficiency, and should be immediately analyzed, checking E_{miss} and p_{miss}, while taking the second run.

Estimated Running Time: 1 hour at 100% efficiency.

10. Al$(e, e'p)X$ Thick Dummy target run for Heep-check.

Insert the "thick" dummy target (± 5 cm) and **run for 10 minutes** at 40 μA (assuming 100% efficiency).
DO NOT modify *standard.kinematics* for this run (i.e. keep as for LH2 target).

Once done here, go to Page 40 (SHMS -ve polarity running)

SJDK 22/8/22

Aerosol Change $n=1.015 \Rightarrow n=1.011$

Q^2=2.73, W=2.63, x=0.3114, low ϵ data taking

Nominal Q^2=2.73 GeV$^2/c^2$, W=2.63 GeV, x=0.3114 Kinematics

E_e	$E_{e'}$	$\theta_{e'}$	ϵ	$\lvert t\rvert$	p_π	θ_q
GeV	GeV	deg		(GeV/c)^2	GeV/c	deg
6.399	1.727	28.77	0.458	0.118	4.605	-9.66

1. $p(e,e'\pi^+)n$ LH2 SHMS right ($\theta = 7.66^o$) run.

   Set up the following configuration:

(+) (a) HMS angle = 28.77 (from TV). Be sure to record and photograph the actual vernier value to 0.005 degree precision.

→ (b) HMS momentum = –1.727 GeV/c. Negative polarity. (follow the magnet cycling procedure).

(+) (c) SHMS angle = 7.66 deg (from TV). Be sure to record and photograph the actual vernier value to 0.005 degree precision.

(+) (d) SHMS momentum = 4.605 GeV/c.

(+) (e) 10 cm LH2 target.

(+) (f) Update *standard.kinematics* with the new settings.

(+) (g) Set the PS1(SHMS-3/4) and PS4(HMS-ELREAL) target rates to 100 Hz.
For **80 μA** beam and the projected rates listed below, these prescale factors should give 100 Hz HMS and SHMS singles event rates to disk, and an 830 Hz DAQ rate overall.

Projected prescale GUI settings:	
PS1(SHMS-3/4)	14
PS2(SHMS-ELREAL)	–1
PS3(HMS-3/4)	–1
PS4(HMS-ELREAL)	8
PS5(HMS-ELREAL×SHMS-3/4)	0
PS6(HMS-3/4×SHMS-3/4)	–1
EDTM Target Prescale Rate	10 Hz
cermode10	ON

HMS e^- rate	HMS π^- rate	SHMS π^+ rate	SHMS K rate	SHMS p rate	Random coinc. $(e^- + \frac{\pi^-}{5}) \cdot (\pi + K$+p)	Real coinc. $e^- \cdot \pi$
3 kHz	49 kHz	491 kHz	149 kHz	149 kHz	630 Hz	2.5-2.7 Hz

(h) **fadcmode10 Run:** Start by taking a 2 minute fadcmode10 run. Be sure to mark this clearly on the Run Sheet. After the run, it is extremely important to **unclick the fadcmode10 setting button.**

< 2 mil coast ev.

20

(i) **HMS-3/4 trigger run:** Since the HMS momentum is fairly low, take a 30 min run with HMS-3/4 triggers enabled instead of hELREAL (i.e. PS6 instead of PS5, and PS3 instead of PS4). This is to monitor the ELREAL threshold and will count as part of the physics run total. If the PS3 trigger rate is excessive, adjust PS3 to a higher level to compensate.

(j) **Take data for approximately 1.3 hour (at 100% efficiency) at 80 μA to give 11,000 p(e, e'π^+)n coincidences.** Use the physics replay to keep track of the event total.

The first run should be $\sim$ 30 minutes (at 100% data taking efficiency), and should be immediately analyzed to get an indication of the pion rate. Use this to calculate how long to run to get the desired statistics.

2. $\boxed{\mathrm{Al}(e, e'\pi^+)X}$ Thick Dummy target SHMS right ($\theta = 7.66^o$) run.

Now put in the "thick" dummy target ($\pm$5 cm) and initially set prescale factors to the same as the LH2 run.

If the HMS and SHMS singles event rates to disk are significantly less than 100 Hz each, the PS1,4 factors can be decreased accordingly.

Current limit: 40 μA.

DO NOT modify *standard.kinematics* for this run (i.e. keep as for LH2 target).

Take data for 0.2 hour (100% efficiency) at 40 μA.

Analyse 100k events and extrapolate required # events

3. $\boxed{p(e,e'\pi^+)n}$ LH2 SHMS center ($\theta = 9.66^o$) run.

(a) Move the SHMS to 9.66 deg (from TV). Be sure to record and photograph the actual vernier value to 0.005 degree precision.

(b) Insert the LH2 target. Leave the spectrometer magnet settings unchanged.

(c) Update *standard.kinematics* with the new settings.

(d) Set the PS1(SHMS-3/4) and PS4(HMS-ELREAL) target rates to 100 Hz.
For **80 μA** beam and the projected rates listed below, these prescale factors should give 100 Hz HMS and SHMS singles event rates to disk, and a 510 Hz DAQ rate overall.

Projected prescale GUI settings:	
PS1(SHMS-3/4)	12
PS2(SHMS-ELREAL)	–1
PS3(HMS-3/4)	–1
PS4(HMS-ELREAL)	8
PS5(HMS-ELREAL×SHMS-3/4)	0
PS6(HMS-3/4×SHMS-3/4)	–1
EDTM Target Prescale Rate	10 Hz
cermode10	ON

HMS e^- rate	HMS π^- rate	SHMS π^+ rate	SHMS K rate	SHMS p rate	Random coinc. $(e^- + \frac{\pi^-}{5}) \cdot (\pi + K$+p)	Real coinc. $e^- \cdot \pi$
3 kHz	49 kHz	183 kHz	59 kHz	75 kHz	250 Hz	2.5-2.7 Hz

(e) **fadcmode10 Run:** Start by taking a 2 minute fadcmode10 run. Be sure to mark this clearly on the Run Sheet. After the run, it is extremely important to **unclick the fadcmode10 setting button.**

(f) **HMS-3/4 trigger run:** Since the HMS momentum is fairly low, take a 30 min run with HMS-3/4 triggers enabled instead of hELREAL (i.e. PS6 instead of PS5, and PS3 instead of PS4). This is to monitor the ELREAL threshold and will count as part of the physics run total. If the PS3 trigger rate is excessive, adjust PS3 to a higher level to compensate.

(g) **Take data for 1.3 hours (100% efficiency) at 80 μA to get about 11,000 p(e, e'π^+)n coincidences.** Use the physics replay to keep track of the event total.
The first run should be $\sim$ 30 minutes (at 100% data taking efficiency), and should be immediately analyzed to get an indication of the pion rate. Use this to calculate how long to run to get the desired statistics.

4. $\boxed{\text{Al}(e, e'\pi^+)X}$ Thick Dummy target SHMS center ($\theta = 9.66^o$) run.

Now put in the "thick" dummy target (± 5 cm) and initially set prescale factors to the same as the LH2 run.
If the HMS and SHMS singles event rates to disk are significantly less than 100 Hz each. the PS1,4 factors can be decreased accordingly.
Current limit: 40 μA.
DO NOT modify *standard.kinematics* for this run (i.e. keep as for LH2 target).

Take data for 0.2 hours (100% efficiency) at 40 μA.

5. $\boxed{p(e,e'\pi^+)n}$ LH2 SHMS left ($\theta = 11.66^o$) run.

(a) Move the SHMS 11.66 deg (from TV). Be sure to record and photograph the actual vernier value to 0.005 degree precision.

(b) Put in the LH2 target. Leave the spectrometer magnet settings unchanged.

(c) Update *standard.kinematics* with the new settings.

(d) Set the PS1(SHMS-3/4) and PS4(HMS-ELREAL) target rates to 100 Hz.
For 80 μA beam and the projected rates listed below, these prescale factors should give 100 Hz HMS and SHMS singles event rates to disk, and a 325 Hz DAQ rate overall.

Projected prescale GUI settings:	
PS1(SHMS-3/4)	11
PS2(SHMS-ELREAL)	-1
PS3(HMS-3/4)	-1
PS4(HMS-ELREAL)	8
PS5(HMS-ELREAL×SHMS-3/4)	0
PS6(HMS-3/4×SHMS-3/4)	-1
EDTM Target Prescale Rate	10 Hz
cermode10	ON

HMS e^- rate	HMS π^- rate	SHMS π^+ rate	SHMS K rate	SHMS p rate	Random coinc. $(e^- + \frac{\pi^-}{5}) \cdot (\pi + K$+p)	Real coinc. $e^- \cdot \pi$
3 kHz	49 kHz	65 kHz	23 kHz	35 kHz	100 Hz	2.5-2.7 Hz

(e) **fadcmode10 Run:** Start by taking a 2 minute fadcmode10 run. Be sure to mark this clearly on the Run Sheet. After the run, it is extremely important to **unclick the fadcmode10 setting button.**

(f) **HMS-3/4 trigger run:** Since the HMS momentum is fairly low, take a 30 min run with HMS-3/4 triggers enabled instead of hELREAL (i.e. PS6 instead of PS5, and PS3 instead of PS4). This is to monitor the ELREAL threshold and will count as part of the physics run total. If the PS3 trigger rate is excessive, adjust PS3 to a higher level to compensate.

(g) **Take data for approximately 1.3 hour (at 100% efficiency) at 80 μA to get about 11,000 p(e, e'π^+)n coincidences.** Use the physics replay to keep track of the event total.
The first run should be $\sim$ 30 minutes (at 100% data taking efficiency), and should be immediately analyzed to get an indication of the pion rate. Use this to calculate how long to run to get the desired statistics.

6. $\boxed{\text{Al}(e, e'\pi^+)X}$ Thick Dummy target SHMS left ($\theta = 11.66^o$) run.

Now put in the "thick" dummy target (± 5 cm) and initially set prescale factors to the same as the LH2 run.

If the HMS and SHMS singles event rates to disk are significantly less than 100 Hz each. the PS1,4 factors can be decreased accordingly.

Current limit: 40 μA.

DO NOT modify *standard.kinematics* for this run (i.e. keep as for LH2 target).

Take data for 0.2 hours (100% efficiency) at 40 μA.

4000/hr

Q^2=3.85, W=2.62, x=0.3915, low ϵ data taking

Nominal Q^2=3.85 GeV$^2/c^2$, W=2.62 GeV, x=0.3915 Kinematics

E_e	$E_{e'}$	$\theta_{e'}$	ϵ	$\lvert t\rvert$	p_π	θ_q
GeV	GeV	deg		(GeV/c)^2	GeV/c	deg
6.399	1.158	42.23	0.292	0.208	5.127	–8.00

1. $\boxed{p(e,e'\pi^+)n}$ LH2 SHMS left ($\theta = 10.00^o$) run.

   Set up the following configuration:

   (a) HMS angle = 42.23 (from TV). Be sure to record and photograph the actual vernier value to 0.005 degree precision.

   (b) HMS momentum = –1.158 GeV/c. Negative polarity. (follow the magnet cycling procedure).

   (c) SHMS angle = 10.00 deg (from TV). Be sure to record and photograph the actual vernier value to 0.005 degree precision.

   (d) SHMS momentum = 5.127 GeV/c.

   (e) 10 cm LH2 target.

   (f) Update *standard.kinematics* with the new settings.

   (g) Set the PS1(SHMS-3/4) and PS4(HMS-ELREAL) target rates to 100 Hz.
   For **80 μA** beam and the projected rates listed below, these prescale factors should give 100 Hz HMS and SHMS singles event rates to disk, and an 278 Hz DAQ rate overall.

Projected prescale GUI settings:	
PS1(SHMS-3/4)	11
PS2(SHMS-ELREAL)	–1
PS3(HMS-3/4)	–1
PS4(HMS-ELREAL)	7
PS5(HMS-ELREAL×SHMS-3/4)	0
PS6(HMS-3/4×SHMS-3/4)	–1
EDTM Target Prescale Rate	10 Hz
cermode10	ON

HMS e^- rate	HMS π^- rate	SHMS π^+ rate	SHMS K rate	SHMS p rate	Random coinc. $(e^- + \frac{\pi^-}{5}) \cdot (\pi + K + p)$	Real coinc. $e^- \cdot \pi$
0.5 kHz	34 kHz	61 kHz	23 kHz	31 kHz	51 Hz	0.40-0.47 Hz

   (h) **fadcmode10 Run:** Start by taking a 2 minute fadcmode10 run. Be sure to mark this clearly on the Run Sheet. After the run, it is extremely important to **unclick the fadcmode10 setting button.**

(i) **HMS-3/4 trigger run:** Since the HMS momentum is fairly low, take a 1 hour run with HMS-3/4 triggers enabled instead of hELREAL (i.e. PS6 instead of PS5, and PS3 instead of PS4). This is to monitor the ELREAL threshold and will count as part of the physics run total. If the PS3 trigger rate is excessive, adjust PS3 to a higher level to compensate.

(j) **Take data for approximately 7 hour (at 100% efficiency) at 80 μA to give ~~10,000~~ $p(e,e'\pi^+)n$ coincidences.** Use the physics replay to keep track of the event total.

8000

SJDK

19/8/22

The first run should be $\sim$ 1 hour (at 100% data taking efficiency), and should be immediately analyzed to get an indication of the pion rate. Use this to calculate how long to run to get the desired statistics.

k) Park the LH2 target, Prepare LD2 Cryo Loads

Take 6h for new then move on

SJDK

2. $\boxed{\text{Al}(e, e'\pi^+)X}$ Thick Dummy target SHMS left ($\theta = 10.00^o$) run.

Now put in the "thick" dummy target (± 5 cm) and initially set prescale factors to the same as the LH2 run.

If the HMS and SHMS singles event rates to disk are significantly less than 100 Hz each, the PS1,4 factors can be decreased accordingly.

Current limit: 40 μA.

DO NOT modify *standard.kinematics* for this run (i.e. keep as for LH2 target).

Take data for 1.4 hour (100% efficiency) at 40 μA.

3. $\boxed{n(e,e'\pi^+)p}$ LD2 SHMS left ($\theta = 10.00^o$) run.

Set up the following configuration:

(a) Insert 10 cm LD2 target. Leave the spectrometer settings unchanged.

(b) Update *standard.kinematics* with the new settings.

(c) Set the PS1(SHMS-3/4) and PS4(HMS-ELREAL) target rates to 100 Hz.
For **80 μA** beam and the projected rates listed below, these prescale factors should give 100 Hz HMS and SHMS singles event rates to disk, and an 432 Hz DAQ rate overall.

Projected prescale GUI settings:	
PS1(SHMS-3/4)	12
PS2(SHMS-ELREAL)	–1
PS3(HMS-3/4)	–1
PS4(HMS-ELREAL)	8
PS5(HMS-ELREAL×SHMS-3/4)	0
PS6(HMS-3/4×SHMS-3/4)	–1
EDTM Target Prescale Rate	10 Hz
cermode10	ON

HMS e^- rate	HMS π^- rate	SHMS π^+ rate	SHMS K rate	SHMS p rate	Random coinc. $(e^- + \frac{\pi^-}{5}) \cdot (\pi + K$+p)	Real coinc. $e^- \cdot \pi$
0.9 kHz	69 kHz	121 kHz	46 kHz	62 kHz	205 Hz	0.40-0.47 Hz

(d) **fadcmode10 Run:** Start by taking a 2 minute fadcmode10 run. Be sure to mark this clearly on the Run Sheet. After the run, it is extremely important to **unclick the fadcmode10 setting button.**

(e) **HMS-3/4 trigger run:** Since the HMS momentum is fairly low, take a 1 hour run with HMS-3/4 triggers enabled instead of hELREAL (i.e. PS6 instead of PS5, and PS3 instead of PS4). This is to monitor the ELREAL threshold and will count as part of the physics run total. If the PS3 trigger rate is excessive, adjust PS3 to a higher level to compensate.

(f) **Take data for approximately 7 hour (at 100% efficiency) at 80 μA to give ~~10,000~~ p(e,e'π^+)n coincidences.** Use the physics replay to keep track of the event total.
The first run should be $\sim$ 1 hour (at 100% data taking efficiency), and should be immediately analyzed to get an indication of the pion rate. Use this to calculate how long to run to get the desired statistics.

8000
SJDK
19/8/22

Take 6000 for now, then move on

4. $\boxed{n(e,e'\pi^+)p}$ LD2 SHMS center ($\theta = 8.00°$) run.

(a) Move the SHMS 8.00 deg (from TV). Be sure to record and photograph the actual vernier value to 0.005 degree precision.

(b) Put in the LD2 target. (Should already be there.) Leave the spectrometer magnet settings unchanged.

(c) Update *standard.kinematics* with the new settings.

(d) Set the PS1(SHMS-3/4) and PS4(HMS-ELREAL) target rates to 100 Hz.
For **80 μA** beam and the projected rates listed below, these prescale factors should give 100 Hz HMS and SHMS singles event rates to disk, and a 830 Hz DAQ rate overall.

Projected prescale GUI settings:	
PS1(SHMS-3/4)	13
PS2(SHMS-ELREAL)	–1
PS3(HMS-3/4)	–1
PS4(HMS-ELREAL)	8
PS5(HMS-ELREAL×SHMS-3/4)	0
PS6(HMS-3/4×SHMS-3/4)	–1
EDTM Target Prescale Rate	10 Hz
cermode10	ON

HMS e^- rate	HMS π^- rate	SHMS π^+ rate	SHMS K rate	SHMS p rate	Random coinc. $(e^- + \frac{\pi^-}{5}) \cdot (\pi + K + \mathrm{p})$	Real coinc. $e^- \cdot \pi$
0.9 kHz	69 kHz	366 kHz	128 kHz	135 kHz	563 Hz	0.40-0.47 Hz

(e) **fadcmode10 Run:** Start by taking a 2 minute fadcmode10 run. Be sure to mark this clearly on the Run Sheet. After the run, it is extremely important to **unclick the fadcmode10 setting button.**

(f) **HMS-3/4 trigger run:** Since the HMS momentum is fairly low, take a 1 hour run with HMS-3/4 triggers enabled instead of hELREAL (i.e. PS6 instead of PS5, and PS3 instead of PS4). This is to monitor the ELREAL threshold and will count as part of the physics run total. If the PS3 trigger rate is excessive, adjust PS3 to a higher level to compensate.

(g) **Take data for approximately 7 hour (at 100% efficiency) at 80 μA to get about 10,000 p(e, e'π^+)n coincidences.** Use the physics replay to keep track of the event total.
The first run should be $\sim$ 1 hour (at 100% data taking efficiency), and should be immediately analyzed to get an indication of the pion rate. Use this to calculate how long to run to get the desired statistics.

SJDK 14/8/22 h) Park the LD2 target, Prepare LH2 cryo

5. $\boxed{\text{Al}(e, e'\pi^+)X}$ Thick Dummy target SHMS center ($\theta = 8.00^o$) run.

Now put in the "thick" dummy target (± 5 cm) and initially set prescale factors to the same as the LH2 run.
If the HMS and SHMS singles event rates to disk are significantly less than 100 Hz each, the PS1.4 factors can be decreased accordingly.
Current limit: 40 μA.
DO NOT modify *standard.kinematics* for this run (i.e. keep as for LH2 target).

Take data for 1.4 hours (100% efficiency) at 40 μA.

201.6 mC

6. $\boxed{p(e,e'\pi^+)n}$ LH2 SHMS center ($\theta = 8.00^o$) run.

(a) Put in the LH2 target. Leave the spectrometer settings unchanged.

(b) Update *standard.kinematics* with the new target.

(c) Set the PS1(SHMS-3/4) and PS4(HMS-ELREAL) target rates to 100 Hz.
For **80 μA beam** and the projected rates listed below, these prescale factors should give 100 Hz HMS and SHMS singles event rates to disk, and a 409 Hz DAQ rate overall.

Projected prescale GUI settings:	
PS1(SHMS-3/4)	12
PS2(SHMS-ELREAL)	-1
PS3(HMS-3/4)	-1
PS4(HMS-ELREAL)	7
PS5(HMS-ELREAL×SHMS-3/4)	0
PS6(HMS-3/4×SHMS-3/4)	-1
EDTM Target Prescale Rate	10 Hz
cermode10	ON

HMS e^- rate	HMS π^- rate	SHMS π^+ rate	SHMS K rate	SHMS p rate	Random coinc. $(e^- + \frac{\pi^-}{5}) \cdot (\pi + K + p)$	Real coinc. $e^- \cdot \pi$
0.5 kHz	34 kHz	183 kHz	64 kHz	67 kHz	141 Hz	0.40-0.47 Hz

(d) **fadcmode10 Run:** Start by taking a 2 minute fadcmode10 run. Be sure to mark this clearly on the Run Sheet. After the run, it is extremely important to **unclick the fadcmode10 setting button.**

(e) **HMS-3/4 trigger run:** Since the HMS momentum is fairly low, take a 1 hour run with HMS-3/4 triggers enabled instead of hELREAL (i.e. PS6 instead of PS5, and PS3 instead of PS4). This is to monitor the ELREAL threshold and will count as part of the physics run total. If the PS3 trigger rate is excessive, adjust PS3 to a higher level to compensate.

(f) **Take data for approximately 7 hour (at 100% efficiency) at 80 μA to get about 10,000 p(e,e'π^+)n coincidences.** Use the physics replay to keep track of the event total.
The first run should be $\sim$ 30 minutes (at 100% data taking efficiency), and should be immediately analyzed to get an indication of the pion rate. Use this to calculate how long to run to get the desired statistics.

Subject: [Revised Logentry] Hall C - Plan for the next 24 hours
From: sjdkay@jlab.org
Date: 21/08/2022, 11.55
To: ent@jlab.org, heinricn@jlab.org, huberg@jlab.org, noahswan@jlab.org, rom@jlab.org, tangl@jlab.org

Hall C - Plan for the next 24 hours -21/8/22

- Edit
- Delete

Lognumber 4032016. Submitted by sjdkay on Sun, 08/21/2022 - 11:40.
Last updated on Sun, 08/21/2022 - 11:50

Logbooks: HCLOG

The plan for the next 24 hours is as follows -

1) Get to 10k pions on the Q2=3.85 W=2.62 x=0.39 LH2+ central setting - We are at ~5k currently, so this should finish at some point in swing shift

Time permitting, the goal is then

2) Go back to the Q2=3.85 W=2.62 x=0.39 LH2+ left setting and get 2k more pions (~4 hours) - Page 26 of the run plan - Go for 8k total pions
3) Go back to the Q2=3.85 W=2.62 x=0.39 LD2+ left setting and get 2k more pions (~4 hours) - Page 29 of the run plan - Go for 8k total pions

If there are no delays, 2 and 3 should both be done mid-owl shift. In this situation -

4) Change configuration to the - Q2=1.60, W=3.06, x=0.1568, low Ïµ data taking. Start taking some data for the LH2 Left (7.50) setting - Page 33 - Run here until 08:00.

Goals 2), 3) and 4) are all goals that we would "like" rather than "need".

So long as we have objective 1) done (10k on LH2+ centre), the shift crew should call for beam off at 08:00 and request a survey so that we can enter the hall and rotate the SHMS to 5.50 degrees.

After the rotation, we will start with the LH2+ central setting for this kinematic - Page 39 of the run plan. During the beam off and rotation access, the spectrometer momenta should be set for the Q2=1.60, W=3.06, x=0.1568, low Ïµ setting and the LH2 target should be prepared for use (if it isn't already). Once the rotation and access is done, we'll start with this setting.

Let me know if you have any questions, I will keep an eye on progress and update if 1) looks like it won't be met due to accelerator/hall issues.

Once done here, go to page 16

Q^2=1.60, W=3.06, x=0.1568, low ϵ data taking

Nominal Q^2=1.60 GeV$^2/c^2$, W=3.06 GeV, x=0.1568 Kinematics

E_e GeV	$E_{e'}$ GeV	$\theta_{e'}$ deg	ϵ	$\lvert t\rvert$ (GeV/c)^2	p_π GeV/c	θ_q deg
6.399	0.960	29.55	0.269	0.026	5.422	–4.87

1. $p(e,e'\pi^+)n$ LH2 SHMS left ($\theta = 7.50^o$) run.

   Set up the following configuration:

   (a) HMS angle = 29.55 (from TV). Be sure to record and photograph the actual vernier value to 0.005 degree precision.

   (b) HMS momentum = –0.960 GeV/c. Negative polarity. (follow the magnet cycling procedure).

   (c) SHMS angle = 7.50 deg (from TV). Be sure to record and photograph the actual vernier value to 0.005 degree precision.

   (d) SHMS momentum = 5.422 GeV/c.

   (e) 10 cm LH2 target.

   (f) Update *standard.kinematics* with the new settings.

   (g) Set the PS1(SHMS-3/4) and PS4(HMS-ELREAL) target rates to 100 Hz.
   For **80 μA** beam and the projected rates listed below, these prescale factors should give 100 Hz HMS and SHMS singles event rates to disk, and an 455 Hz DAQ rate overall.

Projected prescale GUI settings:	
PS1(SHMS-3/4)	12
PS2(SHMS-ELREAL)	–1
PS3(HMS-3/4)	–1
PS4(HMS-ELREAL)	8
PS5(HMS-ELREAL×SHMS-3/4)	0
PS6(HMS-3/4×SHMS-3/4)	–1
EDTM Target Prescale Rate	10 Hz
cermode10	ON

HMS e^- rate	HMS π^- rate	SHMS π^+ rate	SHMS K rate	SHMS p rate	Random coinc. $(e^- + \frac{\pi^-}{5}) \cdot (\pi + K$+p)	Real coinc. $e^- \cdot \pi$
2 kHz	46 kHz	149 kHz	54 kHz	55 kHz	219 Hz	0.9 Hz

   (h) **fadcmode10 Run:** Start by taking a 2 minute fadcmode10 run. Be sure to mark this clearly on the Run Sheet. After the run, it is extremely important to **unclick the fadcmode10 setting button.**

(i) **HMS-3/4 trigger run:** Since the HMS momentum is fairly low, take a 30 min run with HMS-3/4 triggers enabled instead of hELREAL (i.e. PS6 instead of PS5, and PS3 instead of PS4). This is to monitor the ELREAL threshold and will count as part of the physics run total. If the PS3 trigger rate is excessive, adjust PS3 to a higher level to compensate.

(j) **Take data for approximately 3.1 hour (at 100% efficiency) at 80 μA to give 10,000 p(e,e'π^+)n coincidences.** Use the physics replay to keep track of the event total.

The first run should be $\sim$ 30 min (at 100% data taking efficiency), and should be immediately analyzed to get an indication of the pion rate. Use this to calculate how long to run to get the desired statistics.

2. $\boxed{\text{Al}(e, e'\pi^+)X}$ Thick Dummy target SHMS left ($\theta = 7.50^o$) run.

Now put in the "thick" dummy target (± 5 cm) and initially set prescale factors to the same as the LH2 run.

If the HMS and SHMS singles event rates to disk are significantly less than 100 Hz each, the PS1,4 factors can be decreased accordingly.

Current limit: 40 μA.

DO NOT modify *standard.kinematics* for this run (i.e. keep as for LH2 target).

Take data for 0.6 hour (100% efficiency) at 40 μA.

Work backwards until Page 33

SJDK 2218/22

3. $\boxed{n(e,e'\pi^+)p}$ LD2 SHMS left ($\theta = 7.50^o$) run.

Set up the following configuration:

(a) Insert 10 cm LD2 target. Leave the spectrometer settings unchanged.

(b) Update *standard.kinematics* with the new settings.

(c) Set the PS1(SHMS-3/4) and PS4(HMS-ELREAL) target rates to 100 Hz.
For **80 μA** beam and the projected rates listed below, these prescale factors should give 100 Hz HMS and SHMS singles event rates to disk, and an 1111 Hz DAQ rate overall.

Projected prescale GUI settings:	
PS1(SHMS-3/4)	13
PS2(SHMS-ELREAL)	–1
PS3(HMS-3/4)	–1
PS4(HMS-ELREAL)	9
PS5(HMS-ELREAL×SHMS-3/4)	0
PS6(HMS-3/4×SHMS-3/4)	–1
EDTM Target Prescale Rate	10 Hz
cermode10	ON

HMS e^- rate	HMS π^- rate	SHMS π^+ rate	SHMS K rate	SHMS p rate	Random coinc. $(e^- + \frac{\pi^-}{5}) \cdot (\pi + K + \mathrm{p})$	Real coinc. $e^- \cdot \pi$
5 kHz	93 kHz	297 kHz	107 kHz	110 kHz	875 Hz	0.9 Hz

(d) **fadcmode10 Run:** Start by taking a 2 minute fadcmode10 run. Be sure to mark this clearly on the Run Sheet. After the run, it is extremely important to **unclick the fadcmode10 setting button.**

(e) **HMS-3/4 trigger run:** Since the HMS momentum is fairly low, take a 30 min run with HMS-3/4 triggers enabled instead of hELREAL (i.e. PS6 instead of PS5, and PS3 instead of PS4). This is to monitor the ELREAL threshold and will count as part of the physics run total. If the PS3 trigger rate is excessive, adjust PS3 to a higher level to compensate.

(f) **Take data for approximately 3.1 hour (at 100% efficiency) at 80 μA to give 10,000 p(e, e'π^+)n coincidences.** Use the physics replay to keep track of the event total.
The first run should be $\sim$ 30 min (at 100% data taking efficiency), and should be immediately analyzed to get an indication of the pion rate. Use this to calculate how long to run to get the desired statistics.

4. $\boxed{n(e,e'\pi^+)p}$ LD2 SHMS center ($\theta = 5.50^o$) run.

   (a) Move the SHMS 5.50 deg (from TV). **This will require a hall access, The Run Coordinator will need to arrange in advance which expert personnel (e.g. Amy Comer, Steve Lassiter) and spotters need to be present.** Be sure to record and photograph the actual vernier value to 0.005 degree precision.

   (b) Put in the LD2 target. (Should already be there.) Leave the spectrometer magnet settings unchanged.

   (c) Update *standard.kinematics* with the new settings.

   (d) Set the PS1(SHMS-3/4) and PS4(HMS-ELREAL) target rates to 100 Hz.
   For **35 μA beam** and the projected rates listed below, these prescale factors should give 100 Hz HMS and SHMS singles event rates to disk, and a 705 Hz DAQ rate overall.

Projected prescale GUI settings:	
PS1(SHMS-3/4)	13
PS2(SHMS-ELREAL)	–1
PS3(HMS-3/4)	–1
PS4(HMS-ELREAL)	8
PS5(HMS-ELREAL×SHMS-3/4)	0
PS6(HMS-3/4×SHMS-3/4)	–1
EDTM Target Prescale Rate	10 Hz
cermode10	ON

HMS e^- rate	HMS π^- rate	SHMS π^+ rate	SHMS K rate	SHMS p rate	Random coinc. $(e^- + \frac{\pi^-}{5}) \cdot (\pi + K + \mathrm{p})$	Real coinc. $e^- \cdot \pi$
2 kHz	41 kHz	400 kHz	120 kHz	96 kHz	458 Hz	0.4 Hz

   (e) **fadcmode10 Run:** Start by taking a 2 minute fadcmode10 run. Be sure to mark this clearly on the Run Sheet. After the run, it is extremely important to **unclick the fadcmode10 setting button.**

run 16436

   (f) **HMS-3/4 trigger run:** Since the HMS momentum is fairly low, take a 1 hour run with HMS-3/4 triggers enabled instead of hELREAL (i.e. PS6 instead of PS5, and PS3 instead of PS4). This is to monitor the ELREAL threshold and will count as part of the physics run total. If the PS3 trigger rate is excessive, adjust PS3 to a higher level to compensate.

runs 16437 16438

   (g) **Take data for approximately 7 hour (at 100% efficiency) at 35 μA to get about 10,000 p$(e,e'\pi^+)$n coincidences.** Use the physics replay to keep track of the event total.
   The first run should be $\sim$ 1 hour (at 100% data taking efficiency), and should be immediately analyzed to get an indication of the pion rate. Use this to calculate how long to run to get the desired statistics.

keep SHMS 3/4 below ~650kHz, SHMS 5 below 2.5 MHz

Work backwards until you reach page 33

SJDK 2/18/17

5. $\boxed{\text{Al}(e,e'\pi^+)X}$ Thick Dummy target SHMS center ($\theta = 5.50^o$) run.

Now put in the "thick" dummy target (± 5 cm) and initially set prescale factors to the same as the LH2 run.
If the HMS and SHMS singles event rates to disk are significantly less than 100 Hz each. the PS1.4 factors can be decreased accordingly.
Current limit: 40 μA.
DO NOT modify *standard.kinematics* for this run (i.e. keep as for LH2 target).

Take data for 1.4 hours (100% efficiency) at 40 μA.

22/08/22 - 24 hr Run Plan

Lognumber 4032448. Submitted by sjdkay on Mon, 08/22/2022 - 14:46.

Logbooks: HCLOG

A pretty straightforward run plan for the next 24 hours. Consult the run plan in the counting house or the online version here - https://redmine.jlab.org/attachments/download/1572/2022Runplan6p4GeV.pdf

Two general reminders, we have some settings that will likely be DAQ rate limited. Adjust the beam current so that the SHMS S1X rate does not exceed ~2.5 MHz and the raw pTrig1 rate does not exceed 650 kHz. Please post a screenshot of the rates at the current we end up running at (see https://logbooks.jlab.org/entry/4031145 as an example) for each setting.

Additionally, do not rotate the SHMS out from 5.50 degrees until we have all of the data we need on the central settings (pages 37, 38 and 39 of the run plan).

Other than that, follow the run plan instructions for each setting, we should get a good chunk of the Q2=1.60, W =3.06, x=0.1568, low ε data in the next 24 hours.

We're doing the run plan as written a bit back to front. We begin with -

1) Run page 39 of the run plan, we're starting on the LH2 central setting. The spectrometers and target are all set up and ready for this.
2) Switch target to the dummy and execute page 38 of the run plan, whilst running the dummy, get the LD2 target ready for use and park the LH2 target.
3) After the dummy target, move to page 37 of the plan and run the LD2 central setting. Check the S1X and pTrig1 rates carefully here.

Once we have 1-3 done, we can rotate the SHMS out to 7.50 degrees. We keep reversing through the run plan -

4) Take the LD2 left setting on page 36
5) Switch to the dummy and take the left setting for this too, page 35. Whilst running the dummy target, park the LD2 target and prepare the LH2 target for use
6) Take the LH2 left setting, page 33

It sounds like we can expect beam around the start of swing shift. If this is the case, we should get through most of this in 24 hours.

If we get through all of it, then the plan is to finish the two HeePCoin settings we missed earlier on before going to negative polarity -

7) Set up and run the 4th HeePCoin setting on page 16 of the run plan
8) Set up and run the 5th HeePCoin setting on page 18 of the run plan
9) If we somehow get all of this done, move to page 40 of the run plan. Set up the spectrometers (note the SHMS polarity change) and begin running this setting. This one should take us a while.

Additionally, we plan to do the BCM calibration tomorrow at around 11:30/12:00. I'll drop by the counting house before we begin this.

I've tagged the shift crew for the next three shifts, If you have any questions or want to clarify something, please get in touch.

Comment Form

6. $\boxed{p(e,e'\pi^+)n}$ LH2 SHMS center ($\theta = 5.50^o$) run.

(a) Put in the LH2 target. Leave the spectrometer settings unchanged.

(b) Update *standard.kinematics* with the new target.

(c) Set the PS1(SHMS-3/4) and PS4(HMS-ELREAL) target rates to 100 Hz.
For **65 μA beam** and the projected rates listed below, these prescale factors should give 100 Hz HMS and SHMS singles event rates to disk, and a 625 Hz DAQ rate overall.

Projected prescale GUI settings:	
PS1(SHMS-3/4)	13
PS2(SHMS-ELREAL)	–1
PS3(HMS-3/4)	–1
PS4(HMS-ELREAL)	8
PS5(HMS-ELREAL×SHMS-3/4)	0
PS6(HMS-3/4×SHMS-3/4)	–1
EDTM Target Prescale Rate	10 Hz
cermode10	ON

HMS e^- rate	HMS π^- rate	SHMS π^+ rate	SHMS K rate	SHMS p rate	Random coinc. $(e^- + \frac{\pi^-}{5}) \cdot (\pi + K + \mathrm{p})$	Real coinc. $e^- \cdot \pi$
2 kHz	38 kHz	371 kHz	111 kHz	89 kHz	395 Hz	0.7 Hz

(d) **fadcmode10 Run:** Start by taking a 2 minute fadcmode10 run. Be sure to mark this clearly on the Run Sheet. After the run, it is extremely important to **unclick the fadcmode10 setting button.**

run 16405

(e) **HMS-3/4 trigger run:** Since the HMS momentum is fairly low, take a 30 min run with HMS-3/4 triggers enabled instead of hELREAL (i.e. PS6 instead of PS5, and PS3 instead of PS4). This is to monitor the ELREAL threshold and will count as part of the physics run total. If the PS3 trigger rate is excessive, adjust PS3 to a higher level to compensate.

run 16408

(f) **Take data for approximately ~~4~~ 6 hour (at 100% efficiency) at ~~65~~ 40 μA to get about 10,000 p(e, e'π^+)n coincidences.** Use the physics replay to keep track of the event total.
The first run should be $\sim$ 30 minutes (at 100% data taking efficiency), and should be immediately analyzed to get an indication of the pion rate. Use this to calculate how long to run to get the desired statistics.

Work backwards from here until you reach Page 33

←

SJDK
22/8/22

Q^2=3.85, W=2.62, x=0.3915, low ϵ data taking

Nominal Q^2=3.85 GeV$^2/c^2$, W=2.62 GeV, x=0.3915 Kinematics

E_e	$E_{e'}$	$\theta_{e'}$	ϵ	$\lvert t\rvert$	p_π	θ_q
GeV	GeV	deg		(GeV/c)^2	GeV/c	deg
6.399	1.158	42.23	0.292	0.208	5.127	-8.00

1. $n(e,e'\pi^-)p$ LD2 SHMS center ($\theta = 8.00^o$) run.
   Set up the following configuration:

(a) HMS angle = 42.23 (from TV). Be sure to record and photograph the actual vernier value to 0.005 degree precision.

(b) HMS momentum = –1.158 GeV/c. Negative polarity.

(c) SHMS angle = 8.00 deg (from TV). Be sure to record and photograph the actual vernier value to 0.005 degree precision.

(d) SHMS momentum = –5.127 GeV/c. Negative polarity. (follow the magnet cycling procedure).

(e) 10 cm LD2 target.

(f) Update *standard.kinematics* with the new settings.

(g) Rate will be very high at this setting. Make sure the rates do not exceed the following: SHMS-S1X around 2.5MHz and SHMS-3/4 up to 700kHz

(h) Set the PS1(SHMS-3/4) and PS4(HMS-ELREAL) target rates to 100 Hz.
For 12 μA beam and the projected rates listed below, these prescale factors should give 100 Hz HMS and SHMS singles event rates to disk, and an 260 Hz DAQ rate overall.

Projected prescale GUI settings:	
PS1(SHMS-3/4)	14
PS2(SHMS-ELREAL)	–1
PS3(HMS-3/4)	–1
PS4(HMS-ELREAL)	4
PS5(HMS-ELREAL×SHMS-3/4)	0
PS6(HMS-3/4×SHMS-3/4)	–1
EDTM Target Prescale Rate	10 Hz
cermode10	ON

HMS e^- rate	HMS π^- rate	SHMS e^- rate	SHMS π^- rate	Random coinc. $(e^- + \frac{\pi^-}{5}) \cdot (\pi^- + e^-)$	Real coinc. $e^- \cdot \pi^-$
0.08 kHz	6.0 kHz	772 kHz	18 kHz	62 Hz	0.02-0.06 Hz

(i) **fadcmode10 Run:** Start by taking a 2 minute fadcmode10 run. Be sure to mark this clearly on the Run Sheet. After the run, it is extremely important to **unclick the fadcmode10 setting button.**

RC Report -- 09/06/22

Lognumber 4038313. Submitted by dhamilto on Tue, 09/06/2022 - 08:49.

Logbooks: HCLOG
Entry Makers: dhamilto

We are just in the process of completing production running at 2.5 uA on LD2 for the final kinematic setting in the run plan (Q2=1.60, W=3.08 Th_shms=6.00). There have been no major issues: beam was down for a couple of hours during Swing due to a quadrupole mismatch and we had an HMS Q1 trip during owl (it came back after a reset).

It looks like beam may be available earlier than expected tomorrow after the maintenance day down. We should expect to hear more later today. Ops have requested that we finish at 8.30am rather than 8am on Friday.

The modified run plan involves: → goal 5000 pions

1) Switching to the Q2=3.85, W=2.62, Th_SHMS=8.00 setting to take data at 12 uA on LD2 until the maintenance day down (we also need around 200 mC of dummy target data).
2) Low current BCM calibration using the Faraday cup when beam is restored on Wednesday (coordinate with Dave Mack).
3) Changing to the the Q2=3.85, W=2.62, Th_SHMS=10.00 setting to take data at 38 uA on LD2 for around two shifts (we also need around 60 mC of dummy target data at this setting).
4) One last change back to the Q2=3.85, W=2.62, Th_SHMS=8.00 setting to take data at 12 uA on LD2 until Friday morning.

Let's have a short meeting today at 11am to discuss.
https://jlab-org.zoomgov.com/j/1607100885?pwd=ZFBsRTFsYm5Zb0laZ0tyZXNjcE
Meeting ID: 160 710 0885 - Passcode: 595071

(j) **HMS-3/4 trigger run:** Since the HMS momentum is fairly low, take a 1 hour run with HMS-3/4 triggers enabled instead of hELREAL (i.e. PS6 instead of PS5, and PS3 instead of PS4). This is to monitor the ELREAL threshold and will count as part of the physics run total. If the PS3 trigger rate is excessive, adjust PS3 to a higher level to compensate.

(k) **Take data for approximately 40.0 hours (at 100% efficiency) to give 5200 $\mathbf{n(e, e'\pi^-)p}$ coincidences.** Use the physics replay to keep track of the event total. The first 1 hour run should be immediately analyzed to get an indication of the pion rate. Use this to calculate how long to run to get the desired statistics.

2. $\boxed{\mathrm{Al}(e, e'\pi^-)X}$ Thick Dummy target SHMS center ($\theta = 8.00^o$) run.

Now put in the "thick" dummy target (± 5 cm) and initially set prescale factors to the same as the LD2 run.

If the HMS and SHMS singles event rates to disk are significantly less than 100 Hz each, the PS1,4 factors can be decreased accordingly.

Current limit: 40 μA.

DO NOT modify *standard.kinematics* for this run (i.e. keep as for LD2 target).

~~**Take data for 8.0 hours (100% efficiency) at 40 μA.**~~

3. $\boxed{n(e,e'\pi^-)p}$ LD2 SHMS left ($\theta = 10.00^o$) run.

Set up the following configuration:

(a) SHMS angle = 10.00 deg (from TV). Be sure to record and photograph the actual vernier value to 0.005 degree precision.

(b) Insert the 10 cm LD2 target. Leave all other spectrometer settings unchanged.

(c) Update *standard.kinematics* with the new settings.

(d) Rate will be very high at this setting. Make sure the rates do not exceed the following: SHMS-S1X around 2.5MHz and SHMS-3/4 up to 700kHz

(e) Set the PS1(SHMS-3/4) and PS4(HMS-ELREAL) target rates to 100 Hz.
For ~~25~~ 38 μA beam and the projected rates listed below, these prescale factors should give 100 Hz HMS and SHMS singles event rates to disk, and an 260 Hz DAQ rate overall.

Projected prescale GUI settings:	
PS1(SHMS-3/4)	14
PS2(SHMS-ELREAL)	–1
PS3(HMS-3/4)	–1
PS4(HMS-ELREAL)	6
PS5(HMS-ELREAL×SHMS-3/4)	0
PS6(HMS-3/4×SHMS-3/4)	–1
EDTM Target Prescale Rate	10 Hz
cermode10	ON

HMS e^- rate	HMS π^- rate	SHMS e^- rate	SHMS π^- rate	Random coinc. $(e^- + \frac{\pi^-}{5}) \cdot (\pi^- + e^-)$	Real coinc. $e^- \cdot \pi^-$
0.3 kHz	23.1 kHz	769 kHz	23 kHz	239 Hz	0.12-0.16 Hz

Run 16586 ✓ (f) **fadcmode10 Run:** Start by taking a 2 minute fadcmode10 run. Be sure to mark this clearly on the Run Sheet. After the run, it is extremely important to **unclick the fadcmode10 setting button.**

Runs 16594-99 ✓ (g) **HMS-3/4 trigger run:** Since the HMS momentum is fairly low, take a 1 hour run with HMS-3/4 triggers enabled instead of hELREAL (i.e. PS6 instead of PS5, and PS3 instead of PS4). This is to monitor the ELREAL threshold and will count as part of the physics run total. If the PS3 trigger rate is excessive, adjust PS3 to a higher level to compensate.

(h) **Take data for approximately 10.5 hours (at 100% efficiency) to give ~~5200~~ 3.2k $\mathbf{n(e,e'\pi^-)p}$ coincidences.** Use the physics replay to keep track of the event total. The first 1 hour run should be immediately analyzed to get an indication of the pion rate. Use this to calculate how long to run to get the desired statistics.

Run Plan as of Sept. 7 - Nathan Ettinger
dictated by S.J.D. Kay

1. take data at setting discribed on pg. 42 for 2 shifts (swing sept. 7, owl sept. 8)
2. take ~200mC charge on dummy (still pg. 42) (~90min)
3. rotate back to central setting (pg 40)
   take ~60mC on dummy target (~30 min)
4. take data on that setting until beam turns off. (12 uA of current)

40uA on dummy target for both settings

For left (Page 42) → 38uA on LD2 PS1 = 14, PS4 = 6

For centre (Page 40) → 12uA on LD2 PS1 = 14, PS4 = 4

PS5 = 0 for all settings

Special Low Current BCM Calibration using Faraday Cup (~1 hour)

Dave Mack updated 9/7/22

Instructions to Hall C shift crew:

1. Give the MCC operator a copy of this procedure.
2. Fast Raster on 2x2 (to protect stuff)
3. Target out will make life simpler. (But LH2 or LD2 is in principle OK according to operational restrictions at http://opsweb.acc.jlab.org/internal/ops/ops_webpage/restrictions/ops_restrictions.html .)
4. Ask the MCC operator to show they can stably reach the maximum desired current.

We're only interested in scalers. Check that the Unser and BCM scalers are counting on one of the xscalers screens. When the MCC calls to tell you they are ready,

1. Start a run labelled "FC-based BCM calibration".
2. Make sure the daq keeps running during the procedure until the operator calls to say it is complete. You should keep track of the progress.
3. Replay the run because I need the scalers in the ROOT file. (It may be simplest to use the standard full replay.)

Instructions to the MCC operator:

- A strip chart in the elog of Hall C current and FC current vs time would be greatly appreciated. (Their readings will be complementary.)

- The settings to center the beam on the FC were established in https://logbooks.jlab.org/entry/4037104 . Please do a quick verification.

- Do each of the following currents, plateauing for ~1 minute each. (If you get a trip, then 45 seconds is long enough. But if there's a trip too near the start of beam-on interval, then restart the 1 minute clock.) Approximate currents are fine.

- IN and OUT refer to the FC status. The IN state will block beam to the other halls.

43 muA:	IN,	OUT,	IN,
20 muA:	IN,	OUT,	IN,
10 muA:	IN,	OUT,	IN,
5 muA:	IN,	OUT,	IN,
2.5 muA:	IN,	OUT,	IN,
1 muA:	IN,	OUT,	IN,
43 muA:	IN,	OUT,	IN,
20 muA:	IN,	OUT,	IN,
10 muA:	IN,	OUT,	IN,
5 muA:	IN,	OUT,	IN,
2.5 muA:	IN,	OUT,	IN,
1 muA:	IN,	OUT,	IN,

Let Hall C know when you're done. Thanks!

JEFFERSON LAB ELECTRONIC LOGBOOK

Run time estimate: LD- Q2=3.85 W=2.62 THshms=10.000

Lognumber 4035131. Submitted by huberg on Sun, 08/28/2022 - 18:42.
Last updated on Sun, 08/28/2022 - 19:07

Logbooks: HCLOG

Five full length runs @ 38uA have been acquired so far, which should be enough to do a reasonable time estimate for this setting.

Run#	Time(min)	pi-	Q(mc)
16588	61	102	93.0
16589	58	87	95.0
16590	60	87	80.7
16591	62	136	133.2
16592	53	91	99.4
TOTAL	**294**	**503**	**501.3**

We have 3222 pi- for the Center (THshms=8.000) setting, so we should aim for similar statistics for the Left (THshms=10.000) setting.

This will take 31.2 hour, or 3189.4mC of beam charge. If we have the same rate of beam trips as today, and no major outages, we will reach this goal around 20:00 Monday swing (Aug 29).

To this have to add ~3 hours of dummy target, so the configuration change to the next Q2 would be near the Monday swing--Tuesday owl shift change (midnight Aug 30).

LD- Q2=1.60 W=3.08 running:

We then have two choices.

a) Probably it makes most sense to then move to the THshms=7.50(left setting). Data taking is

supposed to take ~2 days. However, this would put the small angle rotation at the Wednesday swing--Thursday owl shift change, unless there is a significant delay (midnight Sept 1).

b) The other option is to move first to THshms=6.00(offset center). That is supposed to take about a week of data taking.

Either way, the small angle rotation is unlikely to be during normal work hours. Fortunately, Steve Lassiter has indicated that an access is not needed, just expert observers watching remotely.

Final settings:

We need to be sure we leave enough time at the end for the Heep-singles and Lumi scans before beam goes off. The Lumi scans should really be done with this cryotarget, while if we are really short of time, Mark has promised that our Heep-singles settings could be fit in with the later run groups. However, if at all possible, we should try to get everything wrapped up during our beam period. For sure, this emphasizes just how tight the schedule is, with very little room for problems. Hopefully we are able to continue running at higher than projected beam current, and gain a bit of buffer that way.

Comment Form

4. $\boxed{\text{Al}(e, e'\pi^-)X}$ Thick Dummy target SHMS center ($\theta = 10.00^o$) run.

Now put in the "thick" dummy target (± 5 cm) and initially set prescale factors to the same as the LD2 run.

If the HMS and SHMS singles event rates to disk are significantly less than 100 Hz each, the PS1,4 factors can be decreased accordingly.

Current limit: 40 μA.

DO NOT modify *standard.kinematics* for this run (i.e. keep as for LD2 target).

Take data for ~~24~~ hours (100% efficiency) at 40 μA.

↳ Take 10% of LD_2 beam charge.

Q^2=1.60, W=3.08, x=0.1568, low ϵ data taking

Nominal Q^2=1.60 GeV$^2/c^2$, W=3.08 GeV, x=0.1568 Kinematics

E_e GeV	$E_{e'}$ GeV	$\theta_{e'}$ deg	ϵ	$\lvert t\rvert$ (GeV/c)^2	p_π GeV/c	θ_q deg
6.399	0.960	29.55	0.269	0.026	5.422	-4.87

1. $n(e,e'\pi^-)p$ LD2 SHMS left ($\theta = 6.00^o$) run.

   Set up the following configuration:

   (a) HMS angle = 29.55 (from TV). Be sure to record and photograph the actual vernier value to 0.005 degree precision.

   (b) HMS momentum = –0.960 GeV/c. Negative polarity.

   (c) SHMS angle = 6.00 deg (from TV). **This will require a hall access, The Run Coordinator will need to arrange in advance which expert personnel (e.g. Amy Comer, Steve Lassiter) and spotters need to be present**. Be sure to record and photograph the actual vernier value to 0.005 degree precision.

   (d) SHMS momentum = –5.422 GeV/c. Negative polarity. (follow the magnet cycling procedure).

   (e) 10 cm LD2 target.

   (f) Update *standard.kinematics* with the new settings.

   (g) Rate will be very high at this setting. Make sure the rates do not exceed the following: SHMS-S1X around 2.5MHz and SHMS-3/4 up to 700kHz

   (h) Set the PS1(SHMS-3/4) and PS4(HMS-ELREAL) target rates to 100 Hz.
   For **1.5 μA** beam and the projected rates listed below, these prescale factors should give 100 Hz HMS and SHMS singles event rates to disk, and an 230 Hz DAQ rate overall.

Projected prescale GUI settings:	
PS1(SHMS-3/4)	14
PS2(SHMS-ELREAL)	–1
PS3(HMS-3/4)	–1
PS4(HMS-ELREAL)	3
PS5(HMS-ELREAL×SHMS-3/4)	0
PS6(HMS-3/4×SHMS-3/4)	–1
EDTM Target Prescale Rate	10 Hz
cermode10	ON

HMS e^- rate	HMS π^- rate	SHMS e^- rate	SHMS π^- rate	Random coinc. $(e^- + \frac{\pi^-}{5}) \cdot (\pi^- + e^-)$	Real coinc. $e^- \cdot \pi^-$
0.1 kHz	1.7 kHz	793 kHz	7 kHz	26 Hz	0.05-0.09 Hz

done ✓ (i) **fadcmode10 Run:** Start by taking a 2 minute fadcmode10 run. Be sure to mark this clearly on the Run Sheet. After the run, it is extremely important to **unclick the fadcmode10 setting button.**

(j) **HMS-3/4 trigger run:** Since the HMS momentum is fairly low, take a 1 hour run with HMS-3/4 triggers enabled instead of hELREAL (i.e. PS6 instead of PS5, and PS3 instead of PS4). This is to monitor the ELREAL threshold and will count as part of the physics run total. If the PS3 trigger rate is excessive, adjust PS3 to a higher level to compensate.

start (k) **Take data for approximately 81.0 hours (at 100% efficiency) to give 5000 n(e, e′π⁻)p coincidences.** Use the physics replay to keep track of the event total. The first 1 hour run should be immediately analyzed to get an indication of the pion rate. Use this to calculate how long to run to get the desired statistics.

2. $\boxed{\text{Al}(e, e'\pi^-)X}$ Thick Dummy target SHMS left ($\theta = 6.00^o$) run.

Now put in the "thick" dummy target (±5 cm) and initially set prescale factors to the same as the LD2 run.

Needs SimC If the HMS and SHMS singles event rates to disk are significantly less than 100 Hz each, the PS1,4 factors can be decreased accordingly.
Current limit: 40 μA. → Look at SHMS-5/X, SAMS-3/4 rates.
DO NOT modify *standard.kinematics* for this run (i.e. keep as for LD2 target).

Take data for ~~16.2~~ hours (100% efficiency) at 40 μA.

→ Run 10% of beam charge on LD2 target
Consult with RC
SJDK
27/8/22
Given the difference in beam current, it should come in quickly.

3. $\boxed{n(e,e'\pi^-)p}$ LD2 SHMS further left ($\theta = 7.50^o$) run.

Set up the following configuration:

(a) SHMS angle = 7.50 deg (from TV). **The Run Co-ordinator will need to arrange in advance which expert personnel (e.g. Amy Comer, Steve Lassiter), to watch the rotation remotely**. Be sure to record and photograph the actual vernier value to 0.005 degree precision.

(b) Insert the 10 cm LD2 target. Leave all other spectrometer settings unchanged.

(c) Update *standard.kinematics* with the new settings.

(d) Set the PS1(SHMS-3/4) and PS4(HMS-ELREAL) target rates to 100 Hz.
For **5.2 μA beam** and the projected rates listed below, these prescale factors should give 100 Hz HMS and SHMS singles event rates to disk, and an 260 Hz DAQ rate overall.

Projected prescale GUI settings:	
PS1(SHMS-3/4)	14
PS2(SHMS-ELREAL)	–1
PS3(HMS-3/4)	–1
PS4(HMS-ELREAL)	5
PS5(HMS-ELREAL×SHMS-3/4)	0
PS6(HMS-3/4×SHMS-3/4)	–1
EDTM Target Prescale Rate	10 Hz
cermode10	ON

HMS e^- rate	HMS π^- rate	SHMS e^- rate	SHMS π^- rate	Random coinc. $(e^- + \frac{\pi^-}{5}) \cdot (\pi^- + e^-)$	Real coinc. $e^- \cdot \pi^-$
0.3 kHz	6.0 kHz	787 kHz	10 kHz	88 Hz	0.22-0.26 Hz

(e) **fadcmode10 Run:** Start by taking a 2 minute fadcmode10 run. Be sure to mark this clearly on the Run Sheet. After the run, it is extremely important to **unclick the fadcmode10 setting button.**

(f) **HMS-3/4 trigger run:** Since the HMS momentum is fairly low, take a 1 hour run with HMS-3/4 triggers enabled instead of hELREAL (i.e. PS6 instead of PS5, and PS3 instead of PS4). This is to monitor the ELREAL threshold and will count as part of the physics run total. If the PS3 trigger rate is excessive, adjust PS3 to a higher level to compensate.

(g) **Take data for approximately 23 hours (at 100% efficiency) to give 5000 $\mathbf{n(e,e'\pi^-)p}$ coincidences.** Use the physics replay to keep track of the event total.
The first 1 hour run should be immediately analyzed to get an indication of the pion rate. Use this to calculate how long to run to get the desired statistics.

4. $\boxed{\text{Al}(e, e'\pi^-)X}$ Thick Dummy target SHMS center ($\theta = 10.00^o$) run.

Now put in the "thick" dummy target (±5 cm) and initially set prescale factors to the same as the LD2 run.

If the HMS and SHMS singles event rates to disk are significantly less than 100 Hz each, the PS1,4 factors can be decreased accordingly.

Current limit: 40 μA. → Look at SHMS-SIX, SHMS-3/4 rates.

DO NOT modify *standard.kinematics* for this run (i.e. keep as for LD2 target).

Take data for ~~4.7~~ hours (100% efficiency) at 40 μA.

↳ Take 10% of LD_2 beam charge. Given the difference in beam current, it should come in quickly.

Got 108 mC
Expect ~1000mC on LD2-
SFDK 30/8/22

→ Should do another BCM calibration.

6.399 GeV Luminosity Scans

→ use the new version of page - Nathan

Set the following configuration:

1. HMS angle = 14.00 (from TV). Be sure to record and photograph the actual vernier value to 0.005 degree precision.
2. HMS momentum = –3.970 GeV/c. Negative polarity. (follow the magnet cycling procedure).
3. SHMS angle = 11.00 deg (from TV). Be sure to record and photograph the actual vernier value to 0.005 degree precision.
4. SHMS momentum = –4.770 GeV/c. Negative polarity. (follow the magnet cycling procedure).
5. Update *standard.kinematics* with the new settings.
6. ELREAL trigger in both arms. Set the PS2, PS4 target DAQ rates to 1 kHz, to give a total rate to disk of about 2 kHz.
7. Make sure the raster is on (2×2), and take HMS and SHMS runs at 80, 60, 40, 25, 18, 12, 8, 5, 2.5, 1 μA on LH2 target. Start at the highest current, then go down in current. Times are listed at 100% efficiency.
8. **Try to get runs with minimum beam trips (if possible).**
9. Take one Thick Dummy target run at 40 μA. 125,000 electrons per run, about 20 min. During this run, the Target Operator should park the LH2 target and prepare for LD2 data taking.
10. Repeat scans with Carbon 0.5% r.l. target.
11. Repeat scans with LD2 target. Skip 80 and 60 μA settings as the rates will be to high.
12. An expert (Jacob?) should do a sanity-check of the EDTM (and any other hardware deadtime measurement system) by comparing runs over a range of detector rates but with low software deadtimes.

6.399 GeV Luminosity Scans

μA	Targets	$\frac{Rate_{SHMS}}{LH_{run}}$	$\frac{PS2}{SHMS}$	$\frac{Rate_{HMS}}{LH_{run}}$	$\frac{PS4}{HMS}$	DAQ_{SHMS}	DAQ_{HMS}	$\frac{Time}{run}$
$\theta_{HMS} = 14.00$, $P_{HMS} = --3.970$ GeV/c, $\theta_{SHMS} = 11.00$, $P_{SHMS} = --4.770$ GeV/c								
80	LH2, C	744 kHz	10	160 kHz	8	1000 Hz	1000 Hz	10 min
60	LH2, C	558 kHz	10	120 kHz	8	1000 Hz	1000 Hz	10 min
40	LH2, LD2, Dummy, C	372 kHz	9	80 kHz	7	1000 Hz	1000 Hz	10 min
25	LH2, LD2, C	232 kHz	9	50 kHz	6	1000 Hz	1000 Hz	10 min
15	LH2, LD2, C	139 kHz	8	36 kHz	6	1000 Hz	1000 Hz	10 min
8	LH2, LD2, C	74 kHz	7	16 kHz	5	1000 Hz	1000 Hz	10 min
5	LH2, C	46 kHz	6	10 kHz	4	1000 Hz	1000 Hz	10 min
2.5	LH2, C	23 kHz	5	5 kHz	3	1000 Hz	1000 Hz	10 min
1.5	LH2, C	23 kHz	5	5 kHz	3	1000 Hz	1000 Hz	10 min
1	LH2, C	9 kHz	4	2 kHz	1	1000 Hz	1000 Hz	10 min
Total Time (Including Overhead): 11.6 Hours								

Calibration runs with SHMS at negative polarity

1. $\boxed{p(e,e')p}$ Hydrogen elastic singles, and associated Dummy target runs.

   Set up the following configuration:

   (a) HMS and SHMS angles and momenta as specified in the tables below. Both spectrometers are negative polarity, and both will have to be cycled initially.

   (b) Record all TV angle values on run sheets and hclog. Update *standard.kinematics* with the new settings.

   (c) 10 cm LH2 and "thick" dummy target data should be taken with the HMS large and SHMS collimators.

   LH2 target runs:

   - Set the PS2(SHMS-ELREAL) and PS4(HMS-ELREAL) target rates to 1000 Hz, all others disabled (i.e. -1). The sum of the two rates should not exceed 2500 Hz. It is also desirable that one of the prescale factors are set to 0, although this is not necessary. As a guide, projected rates and PS factors are given in the table below.
   - Projected beam currents are listed below, we desire to keep the SHMS-3/4 rate below 600 kHz so adjust accordingly. Stable beam with 2×2 **raster on.**
   - We want about 20,000 elastics in the SHMS, and about 10,000 elastics in the HMS for each setting, which typically requires at least 400,000 total electron events (times are only a guide). The total event estimate in right-most column includes inelastics.

   Thick Dummy target runs:

   One run for each angle and momentum setting, current limit: 40 μA.

   To be efficient, please minimize target changes and do LH2, Dummy for first setting, followed by Dummy, LH2 for second setting, etc.

6.399 GeV Heep-check singles runs

	θ_{HMS}	P_{HMS}	θ_{SHMS}	P_{SHMS}	Current	$Rate_{HMS}$	$\frac{PS4}{HMS}$	$Rate_{SHMS}$	$\frac{PS2}{SHMS}$	$\frac{Time}{LH2run}$	$\frac{Time}{ALrun}$	Evt_{SHMS}
1)	~~13.30~~	-5.587	8.00	-6.265	10 μA	7.7 kHz	4	60 kHz	10	10 min	6 min	450k
2)	~~13.65~~	-5.320	10.50	-5.512	10 μA	2.9 kHz	2	8.5 kHz	8	10 min	6 min	400k
3)	~~12.45~~	-4.752	12.45	-5.4218	10 μA	1.5 kHz	0	2.2 kHz	7	10 min	6 min	240k
4)	~~13.00~~	-4.256	14.35	-5.4218	20 μA	1.7 kHz	0	1.3 kHz	6	10 min	6 min	270k
5)	~~23.40~~	-3.716	16.30	-5.127	80 μA	0.07 kHz	0	25 kHz	6	15 min	6 min	670k
6)	~~29.55~~	-3.300	19.65	-4.605	80 μA	0.2 kHz	0	7.1 kHz	5	15 min	6 min	360k
7)	~~34.00~~	-3.000	21.65	-4.200	80 μA	0.03 kHz	0	4.7 kHz	4	20 min	6 min	580k
8)	~~34.00~~	-3.000	23.65	-4.200	80 μA	0.03 kHz	0	0.5 kHz	0	20 min	6 min	340k

Total Time (including overhead): 9 hrs

Estimated Total Time for this Run Plan: 539.1 hours

HRs 48

6.399 GeV Luminosity Scans

Set the following configuration:

1. HMS angle = 14.00 (from TV). Be sure to record and photograph the actual vernier value to 0.005 degree precision.
2. HMS momentum = −3.970 GeV/c. Negative polarity. (follow the magnet cycling procedure).
3. Update *standard.kinematics* with the new settings.
4. ELREAL trigger in HMS turn SHMS OFF. Set the PS2 = −1, PS4 target DAQ rates to 2.5 kHz, to give a total rate to disk of about 2.5 kHz.
5. Make sure the raster is on (2×2), and take HMS and then SHMS runs at 80, 60, 40, 25, 18, 12, 8, 5, 2.5, 1 μA on LH2 target. Start at the highest current, then go down in current. Times are listed at 100% efficiency.
6. **Try to get runs with minimum beam trips (if possible).**
7. Take one Thick Dummy target run at 40 μA. 125,000 electrons per run, about 20 min. During this run, the Target Operator should park the LH2 target and prepare for LD2 data taking.
8. Repeat scans with Carbon 0.5% r.l. target.
9. Repeat scans with LD2 target.

all wrong! These are for 1 kHz.

6.399 GeV Luminosity Scans					
μA	Targets	$\frac{Rate_{HMS}}{LH_{run}}$	$\frac{PS4}{HMS}$	DAQ_{HMS}	$\frac{Time}{run}$
$\theta_{HMS} = 14.00$, $P_{HMS} = -3.970$ GeV/c					
80	~~LH2~~, ~~LD2~~, C	160 kHz	8	~~1000~~ Hz	10 min
60	~~LH2~~, ~~LD2~~, C	120 kHz	8	~~1000~~ Hz	10 min
40	~~LH2~~, ~~LD2~~, Dummy, C	80 kHz	7	~~1000~~ Hz	10 min
25	~~LH2~~, ~~LD2~~, C	50 kHz	6	~~1000~~ Hz	10 min
15	~~LH2~~, ~~LD2~~, C	30 kHz	6	~~1000~~ Hz	10 min
8	~~LH2~~, ~~LD2~~, C	16 kHz	5	~~1000~~ Hz	10 min
5	~~LD2~~, C	10 kHz	4	1000 Hz	10 min
2.5	LH2, ~~LD2~~, C	5 kHz	3	~~1000~~ Hz	10 min
1	~~LD2~~, C	2 kHz	1	1000 Hz	10 min
Total Time (Including Overhead): 11.6 Hours					

2500 Hz

Calibration runs with SHMS at negative polarity

1. $p(e,e')p$ Hydrogen elastic singles, and associated Dummy target runs.

   Set up the following configuration:

   (a) HMS and SHMS angles and momenta as specified in the tables below. Both spectrometers are negative polarity, and both will have to be cycled initially.

SHMS Lumi Scans

22.09.01
GH

$\theta_{SHMS} = 14.000$
$P_{SHMS} = -3.970$.

Highest priority are:
Carbon 0.5%
LD_2
→ do these first, then LH_2 if there's time.

80, 60, 40, 25, 15, 8, 5, 2.5, 1 μA

If there's still time before the 08:00 SHMS angle change, consider doing some useful part of Lumi scan #2 on the spread sheet.