KAON-LT Run Plan - Part 1

September 21, 2018

10.618 GeV Beam Plan

Initial beam activities

- Hall entry for SHMS aerogel change.
  During the pass change, and in co-ordination with the RC, the SHMS aerogel experts (Bernikov, Trotta, Horn) need to enter the hall to remove the n=1.011 aerogel and replace it with n=1.015 aerogel. Estimated time required – 8 hours.

- SHMS fringe field beam steering study. Call D.Gaskell
  MCC will want to do this "first thing" after beam is delivered to the hall, to establish operating parameters. Set the SHMS to the smallest angle, highest momentum setting needed at this beam energy [6.66^o, –8.035 GeV/c (polarity apparently does not matter)], and follow MCC instructions to either rotate the spectrometer or change the momentum setting. It could take 2–6 hours to complete the studies, depending on how much deflection they find. They should also calibrate the 'Big BPM' as part of this study.

- After the studies are done, configure the spectrometers for the detector and trigger checkout:

  1. SHMS angle = 18.00 deg (from TV). **Beam off during the SHMS movement. Pay close attention to the hall cameras while departing the beamline, and be prepared to hit the rotation kill switch, if necessary.**
  2. SHMS momentum = -2.53 GeV/c (negative polarity).
  3. HMS angle = 13.50 deg (from TV).
  4. HMS momentum = -5.27 GeV/c (negative polarity and all magnets cycled).
  5. $z = 0$ 1.5% r.l. carbon target. If rates are low, switch to the 6% r.l. C target (50 μA current limit).
  6. Prescale factors:
     HMS singles daq disabled (all PS=-1).
     SHMS singles daq disabled (all PS=-1).
     COIN daq PS1(SHMS-3/4)=0, PS2=(SHMS-ELREAL)=–1, PS3(HMS-ELREAL)=–1, PS4(HMS-3/4)=0, PS5(HMS-ELREAL×SHMS-3/4)=–1,
     PS6(HMS-3/4×SHMS-3/4)=–1.

- 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.

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

- Superharp scan.
  The Run Co-ordinator should let the MCC know in advance that we are planning a Superharp scan. The beam should be stable and less than 25 μA. We want this done with the raster off, so that the beam spot size can be measured. If the spot size at 00A is $<$ 0.1mm (sigma), instruct MCC to increase the spot size and remeasure to verify. **This must be completed before any production cross section data are to be taken!**

- 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.

- High and low current BCM calibrations.
  The Run Co-ordinator will coordinate the timing of this with the Program Deputy, as it reqires the other Hall lasers to be turned off. This requires MCC's ability to reliably deliver 65-70 μA beam, so this calibration might have to wait at least a few days. Acquire data at 0, 2.5, 5, 10, 14, 20, 28, 40, 60, 80 μA, following the instructions in the "BCM Calibration" How-to at `https://hallcweb.jlab.org/doc-public/ShowDocument?docid=957`. Dave Mack will analyze the data later.

Detector checkout - Malace, Pooser, Berdnikov, Ambrose

Mostly already done with cosmics, probably just some checks needed:

- SHMS hodoscope timing checkout and adjustment. Malace
- SHMS Preshower checkout and adjustment. Voskanyan?
- SHMS Heavy Gas Čerenkov detector checkout and adjustment. Ambrose
- SHMS Aerogel Čerenkov detector checkout and adjustment. Berdnikov
- HMS Čerenkov detector checkout and adjustment. Ambrose

Coincidence trigger checkout - Pooser, Sawatzky, Malace, Huber,Trotta

We want to set up the following configurations in the coincidence DAQ:

HMS (e^- trigger): A(ELREAL $e^- + \frac{\pi^- + K^-}{5-10}$))
SHMS (e^- trigger): A(ELREAL $e^- + \frac{\pi^- + K^-}{5-10}$)
SHMS (K^+ trigger): B (SCIN-3/4)
HMS $A \times$ SHMS B
HMS $B \times$ SHMS B

- Check the single arm trigger legs.
- Check the coincidence trigger with existing HMS-ELREAL.
- Check SHMS, HMS detector fADC timing windows and thresholds (currently 40 ns, 10 mV), might be different for different channels/detectors. Pooser
- Check fADC pedestals. Check fADC reference times and ADC gates (widths should be 40 ns).
- PID leg checkout. Fine tune thresholds. Simona might want to change momentum and/or angle to get a good e/π ratio.
  - Take a short run with SCIN-3/4 trigger. Then based on that decide on specific cuts or scale factors appropriate for $p(e, e'K^+)$ while not excluding $p(e, e'\pi^+)$ and $p(e, e'p)$ events.
  - Double-check HMS Č threshold in ELREAL. → Don't want to lose electrons.
  - Double-check HMS Calorimeter threshold in ELREAL. → Should be a loose cut (5:1 π^- rejection is desired).
  - Double-check SHMS HGC threshold in ELREAL. → Don't want to lose electrons.
  - Double-check SHMS Calorimeter threshold in ELREAL. → Should be a loose cut.
- Double-check SHMS timing for kaons, pions and protons.
- Double-check SHMS+HMS coincidence timing. A 100 ns coincidence window is preferred, if possible. To limit noise/backround, narrow the gate as needed. For SIDIS, the coin peak was not centered within the timing window (at least initially). Need to recheck and adjust timing. HMS start, SHMS stop.
- The EDTM (Electronic Dead Time Monitor) should be set to a rate to give on the order of 10^4 accepted EDTM triggers (i.e. triggers on disk after deadtime losses) over the course of a run. After all thresholds are set, it would be good to post them together on hclog.

Calibration runs.

The first three of these can proceed in parallel with the trigger checkout, if still not complete. The remainder require a stable, working trigger.

1. Set up configuration:

   (a) SHMS angle = 9.50 deg (from TV). Turn off beam while doing the movement.

   (b) SHMS momentum = -8.035 GeV/c. Negative polarity and all magnets cycled.

   (c) HMS momentum = -6.600 GeV/c. Negative polarity and all magnets cycled.

   (d) HMS angle = 13.00 deg (from TV). **Pay close attention to the hall cameras while approaching the beamline, and be prepared to hit the rotation kill switch, if necessary.**

   (e) $z = 0, \pm 10$ cm carbon optics target. ✓

   (f) Prescale factors:
   HMS singles daq disabled (all PS=-1).
   SHMS singles daq disabled (all PS=-1).
   COIN daq PS1(SHMS-3/4)=–1, PS2(SHMS-ELREAL)=0, PS3(HMS-ELREAL)=0, PS4(HMS-3/4)=–1, PS5(HMS-ELREAL×SHMS-3/4)=–1, PS6(HMS-3/4×SHMS-3/4)=–1.

   (g) Sieve slits on both spectrometers. ✓

   (h) 70 μA beam (or highest available) with 2×2 raster.

   (i) Verify that MCC has position at target lock on, and energy lock on.

2. HMS/SHMS optics study.
   Take carbon sieve runs with the $z = 0, \pm 10$ cm carbon optics target with the SHMS and HMS momenta as in the following table.

P_{SHMS}	$Rate_{SHMS}$	P_{HMS}	$Rate_{HMS}$	$\frac{Time}{run}$
X -8.035	1000 Hz	-6.600	120 Hz	30 min
X -6.842	1500 Hz	-6.300	125 Hz	30 min
-6.300	1500 Hz	~~-6.000~~ 5.9	130 Hz	30 min
-5.500	1200 Hz	-5.500	150 Hz	30 min
-5.000	1100 Hz	-5.300	150 Hz	30 min ← 5.1?
-4.500	900 Hz	-5.000	140 Hz	30 min
Total Time (including overhead): 4.5 hrs				

Afterwards, Holly Szumila-Vance will analyze these data, looking for rotations in the $y - tar$ vs $yp - tar$ scatterplots versus momentum, to determine the optimal SHMS Q1 tune.

3. Check nominal beam position using HMS and SHMS sieve runs with $z = 0$ 1.5% r.l. carbon target.

   We need to determine that the "nominal center" co-ordinates $x = -1.0$, $y = -1.1$ on 3H07A and 3H07C from the spring 2018 run are still appropriate, and establish a reference comparison for other beam energies.

   Insert $z = 0$ 1.5% r.l. carbon target and sieve slit collimators on both SHMS and HMS. **Raster off. Current limit=20 μA.** ELREAL singles. Take 100,000 HMS and 100,000 SHMS electron triggers. Adjust PS2(SHMS-ELREAL) and PS3(HMS-ELREAL) as necessary to keep the deadtime at reasonable levels (below 20%).

	E_e	θ'_e	P'_e
HMS:	10618.0	13.0	-5000.0
SHMS:	10618.0	9.5	-4500.0

   Look at HMS and SHMS $x - fp$ vs $y - fp$ scatterplots. The "hourglass" should be nicely aligned vertically, indicating alignment of the beam with the HMS and SHMS optical axes, as described above. Mark Jones or Holly Szumila-Vance are planning to be present for this, and should be consulted if they are not present.

4. Luminosity scans on LH2 and $z = 0$ 1.5% r.l. C targets.

   This scan relies on MCC's ability to deliver high beam currents. If they can not, then RC will instruct whether to defer the luminosity scan later in the experiment.

   ELREAL trigger in both arms. Set the PS2, PS3 target DAQ rates to 1 kHz, to give a total rate to disk of about 2 kHz.

   Make sure the raster is on (2×2), and take HMS and SHMS runs at 5, 15, 30, 50, 80 μA. Start at the highest current and do both targets. Then go down in current and repeat.

   Also, take one Thick Dummy target run at 30 μA. 125,000 electrons per run.

   Try to get runs with a minimum of beam trips (if possible).

   Trotta 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.

NOT DONE (see new p.23).

μA	Targets	$\frac{Rate_{SHMS}}{LHrun}$	$\frac{Rate_{HMS}}{LHrun}$	DAQ_{SHMS}	DAQ_{HMS}	$\frac{Time}{run}$
10.618 GeV Luminosity Scans						
$\theta_{HMS} = 11.50$, P_{HMS}=-5.000 GeV/c, $\theta_{SHMS} = 9.50$, P_{SHMS}=-6.000 GeV/c SHMS will need to be cycled						
80	LH2, C	250 kHz	64 kHz	1 kHz	1 kHz	10 min
50	C, LH2	160 kHz	40 kHz	1 kHz	1 kHz	10 min
30	LH2, Dummy, C	95 kHz	24 kHz	1 kHz	1 kHz	10 min
15	C, LH2	50 kHz	12 kHz	1 kHz	1 kHz	10 min
5	LH2, C	16 kHz	4 kHz	1 kHz	1 kHz	10 min
$\theta_{HMS} = 16.00$, P_{HMS}=-4.000 GeV/c, $\theta_{SHMS} = 8.00$, P_{SHMS}=-6.842 GeV/c Beam off during HMS and SHMS rotations. Be prepared to hit the rotation kill switch, if necessary. Then follow SHMS cycling procedure.						
80	LH2, C	700 kHz	12 kHz	1 kHz	1 kHz	10 min
50	C, LH2	430 kHz	7.5 kHz	1 kHz	1 kHz	10 min
30	LH2, Dummy, C	260 kHz	4.4 kHz	1 kHz	1 kHz	10 min
15	C, LH2	130 kHz	2.2 kHz	1 kHz	1 kHz	10 min
5	LH2, C	45 kHz	0.7 kHz	1 kHz	1 kHz	10 min
Total Time (including overhead): 6.8 hrs						

SHMS

+3.486 12.180

~700kHz@ 60uA

+4.983 10.740.

~200kHz@60uA

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

Set up the following configuration:

(a) HMS and SHMS angles and momenta as specified in the tables below. The HMS will have to be cycled initially. Negative polarity.

(b) **Turn off the beam when doing the first SHMS rotation. Pay close attention to the hall cameras while departing the beamline, and be prepared to hit the rotation kill switch, if necessary. Then cycle all magnets before the first setting.**

(c) Record all TV angle values on run sheets.

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

(e) $z = 0$ 1.5% r.l. C target data should be taken with HMS and SHMS sieve. If rates are low, switch to the 6% r.l. C target (50 μA current limit).

LH2 target runs:
Take two runs for each of the following HMS, SHMS angle and momentum settings for buffered mode, and where specified, another two runs for unbuffered mode (see table). Stable 70 μA beam with **raster on.** Set the PS2(SHMS-ELREAL) and PS3(HMS-ELREAL) target rates to 1000 Hz, all others disabled (i.e. -1). As a guide, projected rates and PS factors are given in the table below. We want at least 10,000 elastics, which typically requires at least 100,000 total electron events (times below are only a guide). The total event estimate includes inelastics.

Thick Dummy target runs:
One run for each angle and momentum setting, taken immediately after the corresponding LH2 run (see table for buffered and unbuffered modes). Current limit: 40 μA.

Carbon sieve runs:
One 200,000 event run (in SHMS), buffered mode only. If rates are low, please assess what statistics are reasonably achievable, and if needed ask Mark Jones what is the minimum statistics he will find useful for his studies.

θ_{HMS}	P_{HMS}	θ_{SHMS}	P_{SHMS}	$Rate_{HMS}$	$\frac{PS3}{HMS}$	$Rate_{SHMS}$	$\frac{PS2}{SHMS}$	$\frac{Time}{LH2run}$	$\frac{Time}{ALrun}$	$\frac{Time}{Csieve}$
10.618 GeV Heep-check singles runs										
Do buffered mode only.										
24.15	-5.322	18.00	-6.842	0.03 kHz	0	0.3 kHz	0	15 min	10 min	nil
24.15	-5.322	16.25	-6.842	0.03 kHz	0	1.9 kHz	0	15 min	10 min	nil
24.15	-5.322	19.85	-6.842	0.03 kHz	0	0.025 kHz	0	20 min	10 min	nil
Do LH2, Dummy 2×, buffered and unbuffered mode.										
24.15	-5.322	13.80	-6.842	0.03 kHz	0	14.5 kHz	4	15 min	10 min	15 min
Do buffered mode only.										
22.60	-5.322	20.00	-6.311	0.15 kHz	0	0.13 kHz	0	20 min	10 min	15 min
Cycle HMS and SHMS magnets.										
Do LH2, Dummy 2×, buffered and unbuffered mode.										
18.80	-6.620	13.70	-8.035	0.23 kHz	0	3.4 kHz	2	15 min	10 min	nil
17.20	-6.620	11.70	-8.035	1.4 kHz	0	27 kHz	6	15 min	10 min	15 min
Do buffered mode only.										
19.75	-6.620	15.65	-8.035	0.06 kHz	0	0.24 kHz	0	30 min	10 min	nil
Total Time (including overhead): 9.3 hrs										

Instructions on switching between buffered and unbuffered modes: Open to the CODA scalers GUI, and find the option on bottom right called bufferlevel. Set to 10 for buffered mode, and 1 for unbuffered. Save, then press the Reset icon on the main CODA control window, followed by the Configure icon, and then the Start icon.

Once the buffered/unbuffered data have been taken, Richard and/or Ryan should check if they give the same normalized yields (within errors).

do the sieve at 13.0°

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6. $p(e, e'p)$ Heep-check coincidence run.

Set up the following configuration:

(a) Switch the SHMS to positive polarity (follow the cycling procedure) and set to +4.840 GeV/c.
(b) SHMS angle = 26.13 deg (from TV).
(c) Set HMS magnets to −6.590 GeV/c (should already be there).
(d) HMS angle = 18.85 deg (from TV).
(e) Prescale factors PS1(SHMS-3/4)=0, PS3(HMS-ELREAL)=0, PS5(HMS-ELREAL×SHMS-3/4)=0. All others disabled (i.e. -1).
(f) HMS large and SHMS collimators.
(g) Stable 70 μA beam with raster on.
(h) Update *standard.kinematics* with the new settings.

Take two runs with a combined total of ~~50,000~~ 25K $e + p$ elastic scattering coincidences. The first run should be 30 minutes, and should be immediately analyzed, checking E_m and p_m, while taking the second run.

10.588 GeV Heep-check coincidence run

θ_{HMS}	P_{HMS}	θ_{SHMS}	P_{SHMS}	$Rate_{HMS}$	$Rate_{DAQ}$	Time
18.85	-6.590	26.13	4.840	0.23 kHz	240 Hz	3.7 hr

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

Insert the "thick" dummy target (±5 cm) and **run for 24 minutes** at 40 μA (assuming 100% efficiency).

DONE

Q^2=3.0, W=2.32, x=0.40, high ϵ data taking

Nominal Q^2=3.0 GeV$^2/c^2$, W=2.32 GeV, x=0.40 Kinematics

E_e GeV	$E_{e'}$ GeV	$\theta_{e'}$ deg	ϵ	$\|t\|$ (GeV/c)^2	p_K GeV/c	θ_q deg
10.588	6.590	11.90	0.8791	0.531	3.486	-18.18

1. $p(e, e'K^+)\Lambda$ LH2 SHMS right ($\theta = 15.18^o$) run.

   Set up the following configuration:

   (a) HMS angle = 11.90 deg (from TV). **Beam off during the HMS movement. Pay close attention to the hall cameras while approaching the beamline, and be prepared to hit the rotation kill switch, if necessary.**

   (b) HMS momentum = -6.590 GeV/c. Negative polarity. (Should already be there.)

   (c) SHMS angle = 15.18 deg (from TV).

   (d) SHMS momentum = 3.486 GeV/c. Positive polarity.

   (e) 10 cm LH2 target.

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

   (g) Set the PS1(SHMS-3-4) and PS3(HMS-ELREAL) target rates to 100 Hz, PS5(HMS-ELREAL×SHMS-3/4)=0, all others disabled (i.e. -1). For the projected rates listed below, these should correspond to factors of about PS1(SHMS-3/4)=10, PS3(HMS-ELREAL)=10, giving 100 Hz HMS and SHMS singles event rates to disk, and a 730 Hz DAQ rate overall, for 70 μA beam.

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. $e^- \cdot K$
63 kHz	0.5 kHz	39 kHz	11 kHz	23 kHz	470 Hz	1.0-1.2 Hz

   The real rate above is only for the $p(e, e'K^+)\Lambda$ reaction, exclusive π^+ and p coincidence reactions are likely to at least triple this rate.

   Take data for approximately 2.4 hours (at 100% efficiency) to give 8,200-10,500 $\mathbf{p(e, e'K^+)\Lambda}$ coincidences. Use the physics replay to keep track of the event total.

2. $\mathrm{Al}(e, e'K^+)X$ Thick Dummy target SHMS right ($\theta = 15.18^o$) 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, then the PS1,3 factors can be decreased accordingly.

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

5. $p(e,e'K^+)\Lambda$ LH2 SHMS left ($\theta = 21.18^o$) run.

(a) Move the SHMS to 21.18 deg (from TV), and put the 10 cm LH2 target back in. Leave the magnet settings unchanged.

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

(c) Set the PS1(SHMS-3-4) and PS3(HMS-ELREAL) target rates to 100 Hz, PS5(HMS-ELREAL×SHMS-3/4)=0, all others disabled (i.e. -1). For the projected rates listed below, these should correspond to factors of about PS1(SHMS-3/4)=7, PS3(HMS-ELREAL)=10, giving 100 Hz HMS and SHMS singles event rates to disk, and a 250 Hz DAQ rate overall, for 70 μA beam.

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. $e^- \cdot K$
63 kHz	0.5 kHz	2.3 kHz	0.8 kHz	2.8 kHz	40 Hz	1.0-1.2 Hz

The real rate above is only for the $p(e,e'K^+)\Lambda$ reaction, exclusive π^+ and p coincidence reactions are likely to at least triple this rate.

Take data for approximately 2.4 hours (at 100% efficiency) to give 10,000-12,000 $\mathbf{p(e,e'K^+)\Lambda}$ coincidences. Use the physics replay to keep track of the event total.

6. $\mathrm{Al}(e,e'K^+)X$ Thick Dummy target SHMS left ($\theta = 21.18^o$) 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, then the PS1,3 factors can be decreased accordingly.

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

Q^2=2.115, W=2.95, x=0.21, high ϵ data taking

NOT TAKEN YE

Nominal Q^2=2.115 GeV$^2/c^2$, W=2.95 GeV, x=0.21 Kinematics						
E_e GeV	$E_{e'}$ GeV	$\theta_{e'}$ deg	ϵ	$\|t\|$ (GeV/c)^2	p_K GeV/c	θ_q deg
10.588	5.292	11.15	0.7864	0.175	4.983	-10.74

HMS   SHMS

1. $p(e,e'K^+)\Lambda$ LH2 SHMS right ($\theta = 7.74°$) run.

   Set up the following configuration:

   (a) HMS angle = 11.15 deg (from TV). **Beam off during the movement. Pay close attention to the hall cameras while approaching the beamline, and be prepared to hit the rotation kill switch, if necessary.** Be sure to record the actual achieved vernier value on the run sheets.

   (b) HMS momentum = –5.292 GeV/c. Negative polarity.

   (c) SHMS angle = 7.74 deg (from TV). **Beam must be off for the SHMS movement.**

   (d) SHMS momentum = 4.983 GeV/c. Positive polarity. Magnets cycled.

   (e) Put the 10 cm LH2 target back in.

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

   (g) Set the PS1(SHMS-3-4) and PS3(HMS-ELREAL) target rates to 100 Hz, PS5(HMS-ELREAL×SHMS-3/4)=0, all others disabled (i.e. -1). For the projected rates listed below, these should correspond to factors of about PS1(SHMS-3/4)=11, PS3(HMS-ELREAL)=10, giving 100 Hz HMS and SHMS singles event rates to disk, and a 1350 Hz DAQ rate overall, for 70 μA beam.

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. $e^- \cdot K$
67 kHz	0.6 kHz	97 kHz	32 kHz	31 kHz	1100 Hz	1.4-2.0 Hz

The real rate above is only for the $p(e,e'K^+)\Lambda$ reaction, exclusive π^+ and p coincidence reactions are likely to at least triple this rate.

Take data for approximately 9.9 hours (at 100% efficiency) to give 51,000-73,000 p(e,e'K$^+$)Λ coincidences. Use the physics replay to keep track of the event total. → 21930

43%

↓

11K

12. $\boxed{Al(e,e'K^+)X}$ Thick Dummy target SHMS right ($\theta = 7.74^o$) 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, then the PS1,3 factors can be decreased accordingly.

Take data for 0.7 hours (100% efficiency) at 40 μA.

→ in progress

13. $\boxed{p(e,e'K^+)\Lambda}$ LH2 SHMS center ($\theta = 10.74^o$) run.

(a) Move the SHMS to 10.74 deg (from TV), and put the 10 cm LH2 target back in. Beam amust be off for the SHMS movement. Leave the magnet settings unchanged.

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

(c) Set the PS1(SHMS-3-4) and PS3(HMS-ELREAL) target rates to 100 Hz, PS5(HMS-ELREAL×SHMS-3/4)=0, all others disabled (i.e. -1). For the projected rates listed below, these should correspond to factors of about PS1(SHMS-3/4)=10, PS3(HMS-ELREAL)=10, giving 100 Hz HMS and SHMS singles event rates to disk, and a 600 Hz DAQ rate overall, for 70 μA beam.

HMS e^- rate	HMS π^- rate	SHMS π^+ rate	SHMS K rate	SHMS p rate	Random coinc. $(e^- + \frac{\pi^-}{5}) \cdot (\pi + K\text{+p})$	Real coinc. $e^- \cdot K$
67 kHz	0.6 kHz	30 kHz	11 kHz	13 kHz	360 Hz	1.7-2.7 Hz

The real rate above is only for the $p(e,e'K^+)\Lambda$ reaction, exclusive π^+ and p coincidence reactions are likely to at least triple this rate.

Take data for approximately 9.9 hours (at 100% efficiency) to give 59,000-95,000 $\mathbf{p(e,e'K^+)\Lambda}$ coincidences. Use the physics replay to keep track of the event total. ↳ 25370

+ (49)

14. $\boxed{Al(e,e'K^+)X}$ Thick Dummy target SHMS center ($\theta = 10.74^o$) 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, then the PS1,3 factors can be decreased accordingly.

Take data for 0.7 hours (100% efficiency) at 40 μA.

5. $\boxed{p(e,e'K^+)\Lambda}$ LH2 SHMS left ($\theta = 13.74^o$) run. → DONE 21K out of 49K

   (a) Move the SHMS to 13.74 deg (from TV), and put the 10 cm LH2 target back in. Leave the magnet settings unchanged.

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

   (c) Set the PS1(SHMS-3-4) and PS3(HMS-ELREAL) target rates to 100 Hz, PS5(HMS-ELREAL×SHMS-3/4)=0, all others disabled (i.e. -1). For the projected rates listed below, these should correspond to factors of about PS1(SHMS-3/4)=8, PS3(HMS-ELREAL)=10, giving 100 Hz HMS and SHMS singles event rates to disk, and a 300 Hz DAQ rate overall, for 70 μA beam.

HMS e^- rate	HMS π^- rate	SHMS π^+ rate	SHMS K rate	SHMS p rate	Random coinc. $(e^- + \frac{\pi^-}{5}) \cdot (\pi + K\text{+p})$	Real coinc. $e^- \cdot K$
67 kHz	0.6 kHz	5.3 kHz	2.2 kHz	3.2 kHz	75 Hz	1.4-2.2 Hz

The real rate above is only for the $p(e,e'K^+)\Lambda$ reaction, exclusive π^+ and p coincidence reactions are likely to at least triple this rate.

Take data for approximately 9.9 hours (at 100% efficiency) to give 49,000-78,000 p(e, e'K$^+$)Λ coincidences. Use the physics replay to keep track of the event total. → 43% ↳ 21K

6. $\boxed{Al(e,e'K^+)X}$ Thick Dummy target SHMS left ($\theta = 13.74^o$) 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, then the PS1,3 factors can be decreased accordingly.

Take data for 0.7 hours (100% efficiency) at 40 μA.

Q^2=4.4, W=2.74, x=0.40, high ϵ data taking

We are here

Nominal Q^2=4.4 GeV^2/c^2, W=2.74 GeV, x=0.40 Kinematics

E_e GeV	$E_{e'}$ GeV	$\theta_{e'}$ deg	ϵ	$\|t\|$ (GeV/c)^2	p_K GeV/c	θ_q deg
10.588	4.712	17.08	0.7148	0.507	5.389	-12.81

1. $p(e, e'K^+)\Lambda$ LH2 SHMS right ($\theta = 9.81^o$) run.

16 h Oct 5 - Oct 6 OK

Set up the following configuration:

   (a) Hall entry for SHMS aerogel change.
   In co-ordination with the RC, the SHMS aerogel experts (Bernikov, Trotta, Horn) need to enter the hall to remove the n=1.015 aerogel and replace it with n=1.011 aerogel. Estimated time required – 8 hours.

   (b) HMS angle = 17.08 deg (from TV). Do this during the hall entry. Pay close attention while moving away from the beamline, and be prepared to hit the rotation kill switch, if necessary.

   (c) HMS momentum = –4.712 GeV/c. Negative polarity

   (d) SHMS angle = 9.81 deg (from TV).

   (e) SHMS momentum = 5.389 GeV/c. Positive polarity. Magnets cycled.

   (f) 10 cm LH2 target.

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

   (h) Set the PS1(SHMS-3-4) and PS3(HMS-ELREAL) target rates to 100 Hz, PS5(HMS-ELREAL×SHMS-3/4)=0, all others disabled (i.e. -1). For the projected rates listed below, these should correspond to factors of about PS1(SHMS-3/4)=10, PS3(HMS-ELREAL)=7, giving 100 Hz HMS and SHMS singles event rates to disk, and a 300 Hz DAQ rate overall, for 70 μA beam.

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. $e^- \cdot K$
8 kHz	0.6 kHz	35 kHz	13 kHz	13 kHz	50 Hz	0.20-0.27 Hz

The real rate above is only for the $p(e, e'K^+)\Lambda$ reaction, exclusive π^+ and p coincidence reactions are likely to at least triple this rate.

Take data for approximately 8.7 hours (at 100% efficiency) to give 6,200-8,400 $\mathbf{p(e, e'K^+)\Lambda}$ coincidences. Use the physics replay to keep track of the event total.

2. $\boxed{Al(e,e'K^+)X}$ Thick Dummy target SHMS right ($\theta = 9.81^o$) 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, then the PS1,3 factors can be decreased accordingly.

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

Oct 6 - DAY + SW

3. $\boxed{p(e,e'K^+)\Lambda}$ LH2 SHMS center ($\theta = 12.81^o$) run.

   (a) Move the SHMS to 12.81 deg (from TV), and put the 10 cm LH2 target back in. Leave the magnet settings unchanged.

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

   (c) Set the PS1(SHMS-3-4) and PS3(HMS-ELREAL) target rates to 100 Hz, PS5(HMS-ELREAL×SHMS-3/4)=0, all others disabled (i.e. -1). For the projected rates listed below, these should correspond to factors of about PS1(SHMS-3/4)=7, PS3(HMS-ELREAL)=7, giving 100 Hz HMS and SHMS singles event rates to disk, and a 280 Hz DAQ rate overall, for 70 μA beam.

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. $e^- \cdot K$
8 kHz	0.6 kHz	4.6 kHz	2.0 kHz	2.7 kHz	8 Hz	0.33-0.37 Hz

The real rate above is only for the $p(e,e'K^+)\Lambda$ reaction, exclusive π^+ and p coincidence reactions are likely to at least triple this rate.

Take data for approximately 8.7 hours (at 100% efficiency) to give 10,000-11,500 $\mathbf{p(e,e'K^+)\Lambda}$ coincidences. Use the physics replay to keep track of the event total.

4. $\boxed{Al(e,e'K^+)X}$ Thick Dummy target SHMS center ($\theta = 12.81^o$) 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, then the PS1,3 factors can be decreased accordingly.

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

5. $\boxed{p(e,e'K^+)\Lambda}$ LH2 SHMS left ($\theta = 15.81^o$) run.

   (a) Move the SHMS to 15.81 deg (from TV), and put the 10 cm LH2 target back in. Leave the magnet settings unchanged.

   Oct 4 Owl DAY

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

   (c) Set the PS1(SHMS-3-4) and PS3(HMS-ELREAL) target rates to 100 Hz, PS5(HMS-ELREAL×SHMS-3/4)=0, all others disabled (i.e. -1). For the projected rates listed below, these should correspond to factors of about PS1(SHMS-3/4)=4, PS3(HMS-ELREAL)=7, giving 100 Hz HMS and SHMS singles event rates to disk, and a 260 Hz DAQ rate overall, for 70 μA beam.

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. $e^- \cdot K$
8 kHz	0.6 kHz	0.5 kHz	0.2 kHz	0.4 kHz	1.0 Hz	0.23-0.33 Hz

The real rate above is only for the $p(e,e'K^+)\Lambda$ reaction. exclusive π^+ and p coincidence reactions are likely to at least triple this rate.

Take data for approximately 8.7 hours (at 100% efficiency) to give 7,200-10,000 $\mathbf{p(e,e'K^+)\Lambda}$ coincidences. Use the physics replay to keep track of the event total.

6. $\boxed{\mathrm{Al}(e,e'K^+)X}$ Thick Dummy target SHMS left ($\theta = 15.81^o$) 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, then the PS1,3 factors can be decreased accordingly.

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

Sunday eve
Oct 7 SW
Oct 9 OW

Q^2=3.0, W=3.14, x=0.25, high ϵ data taking

Nominal Q^2=3.0 GeV^2/c^2, W=3.14 GeV, x=0.25 Kinematics

E_e GeV	$E_{e'}$ GeV	$\theta_{e'}$ deg	ϵ	$\|t\|$ (GeV/c)^2	p_K GeV/c	θ_q deg
10.588	4.204	14.91	0.6668	0.219	6.053	-9.42

1. $p(e, e'K^+)\Lambda$ LH2 SHMS center ($\theta = 9.42^o$) run.

   (a) HMS momentum = –4.204 GeV/c. Negative polarity.

   (b) HMS angle = 14.91 deg (from TV).

   (c) SHMS momentum = 6.053 GeV/c. Positive polarity. Magnets cycled.

   (d) SHMS angle = 9.42 deg (from TV). Beam should be off during the SHMS movement.

   (e) 10 cm LH2 target.

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

   (g) Set the PS1(SHMS-3-4) and PS3(HMS-ELREAL) target rates to 100 Hz, PS5(HMS-ELREAL×SHMS-3/4)=0, all others disabled (i.e. -1). For the projected rates listed below, these should correspond to factors of about PS1(SHMS-3/4)=9, PS3(HMS-ELREAL)=9, giving 100 Hz HMS and SHMS singles event rates to disk, and a 280 Hz DAQ rate overall, for 70 μA beam.

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. $e^- \cdot K$
20 kHz	7 kHz	20 kHz	8 kHz	7 kHz	70 Hz	0.8-1.3 Hz

The real rate above is only for the $p(e, e'K^+)\Lambda$ reaction, exclusive π^+ and p coincidence reactions are likely to at least triple this rate.

Take data for approximately 21.8 hours (at 100% efficiency) to give 41,000-66,500 $\mathbf{p(e, e'K^+)\Lambda}$ coincidences. Use the physics replay to keep track of the event total.

2. $\mathrm{Al}(e, e'K^+)X$ Thick Dummy target SHMS center ($\theta = 9.42^o$) 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, then the PS1,3 factors can be decreased accordingly.

Take data for 1.5 hours (100% efficiency) at 40 μA.

3. $p(e,e'K^+)\Lambda$ LH2 SHMS left ($\theta = 12.42^o$) run.

   (a) Move the SHMS to 12.42 deg (from TV), and put the 10 cm LH2 target back in. Leave the magnet settings unchanged.

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

   (c) Set the PS1(SHMS-3-4) and PS3(HMS-ELREAL) target rates to 100 Hz, PS5(HMS-ELREAL×SHMS-3/4)=0, all others disabled (i.e. -1). For the projected rates listed below, these should correspond to factors of about PS1(SHMS-3/4)=6, PS3(HMS-ELREAL)=9, giving 100 Hz HMS and SHMS singles event rates to disk, and a 200 Hz DAQ rate overall, for 70 μA beam.

HMS e^- rate	HMS π^- rate	SHMS π^+ rate	SHMS K rate	SHMS p rate	Random coinc. $(e^- + \frac{\pi^-}{5}) \cdot (\pi + K + \text{p})$	Real coinc. $e^- \cdot K$
20 kHz	7 kHz	1.7 kHz	0.9 kHz	1.1 kHz	8 Hz	0.5-0.9 Hz

The real rate above is only for the $p(e,e'K^+)\Lambda$ reaction, exclusive π^+ and p coincidence reactions are likely to at least triple this rate.

Take data for approximately 21.8 hours (at 100% efficiency) to give 25,500-47,000 p(e, e'K$^+$)Λ coincidences. Use the physics replay to keep track of the event total.

$\text{Al}(e,e'K^+)X$ Thick Dummy target SHMS ~~right~~ left ($\theta = 12.42^o$) 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, then the PS1,3 factors can be decreased accordingly.

Take data for 1.5 hours (100% efficiency) at 40 μA.

PAGES 21-25 REPLACED BY GH on OCT 13.

GH Note: SHMS and HMS hadron singles rates recalculated for this point onward (see hclog entry 3603590).

5. $\boxed{p(e,e'K^+)\Lambda}$ LH2 SHMS right ($\theta = 6.5^o$) run.

   (a) Move the SHMS to 6.5 deg (from TV). **Beam off during the SHMS movement. Pay close attention to the hall cameras while approaching the beamline, and be prepared to hit the rotation kill switch, if necessary.**

   (b) Leave the magnet settings unchanged.

   (c) Put the 10 cm LH2 target back in.

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

   (e) Set the PS1(SHMS-3-4) and PS3(HMS-ELREAL) target rates to 100 Hz, PS5(HMS-ELREAL×SHMS-3/4)=0, all others disabled (i.e. -1). For the projected rates listed below, these should correspond to factors of about PS1(SHMS-3/4)=13, PS3(HMS-ELREAL)=8, giving 100 Hz HMS and SHMS singles event rates to disk, and an 1100 Hz DAQ rate overall, for **35 μA beam.**

HMS	HMS	SHMS	SHMS	SHMS	Random coinc.	Real coinc.
e^- rate	π^- rate	π^+ rate	K rate	p rate	$(e^- + \frac{\pi^-}{5}) \cdot (\pi + K$+p)	$e^- \cdot K$
10 kHz	16 kHz	400 kHz	130 kHz	90 kHz	820 Hz	0.6-0.8 Hz

The real rate above is only for the $p(e,e'K^+)\Lambda$ reaction, exclusive π^+ and p coincidence reactions are likely to at least triple this rate.

Take data for approximately 32.8 hours (at 100% efficiency) to give 22,100-27,600 $\mathbf{p(e,e'K^+)\Lambda}$ coincidences. Use the physics replay to keep track of the event total.

6. $\boxed{\mathrm{Al}(e,e'K^+)X}$ Thick Dummy target SHMS right ($\theta = 6.55^o$) 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, then the PS1,3 factors can be decreased accordingly.

Take data for 1.5 hours (100% efficiency) at 40 μA.

Q^2=5.5, W=3.02, x=0.40, high ϵ data taking

Nominal Q^2=5.5 GeV$^2/c^2$, W=3.02 GeV, x=0.40 Kinematics

E_e GeV	$E_{e'}$ GeV	$\theta_{e'}$ deg	ϵ	$\|t\|$ (GeV/c)^2	p_K GeV/c	θ_q deg
10.588	3.266	23.00	0.5291	0.503	6.842	-9.56

1. $p(e,e'K^+)\Lambda$ LH2 SHMS right ($\theta = 6.5^o$) run.

   (a) HMS momentum = –3.266 GeV/c. Negative polarity.

   (b) HMS angle = 23.00 deg (from TV).

   (c) SHMS momentum = 6.842 GeV/c. Positive polarity. Magnets cycled.

   (d) SHMS angle = 6.5 deg (should already be there).

   (e) 10 cm LH2 target.

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

   (g) Set the PS1(SHMS-3-4) and PS3(HMS-ELREAL) target rates to 100 Hz, PS5(HMS-ELREAL×SHMS-3/4)=0, all others disabled (i.e. -1). For the projected rates listed below, these should correspond to factors of about PS1(SHMS-3/4)=13, PS3(HMS-ELREAL)=6, giving 100 Hz HMS and SHMS singles event rates to disk, and a 450 Hz DAQ rate overall, for 70 μA beam.

HMS e^- rate	HMS π^- rate	SHMS π^+ rate	SHMS K rate	SHMS p rate	Random coinc. $(e^- + \frac{\pi^-}{5}) \cdot (\pi + K\text{+p})$	Real coinc. $e^- \cdot K$
2.0 kHz	5.1 kHz	380 kHz	150 kHz	95 kHz	190 Hz	0.05-0.06 Hz

The real rate above is only for the $p(e,e'K^+)\Lambda$ reaction, exclusive π^+ and p coincidence reactions are likely to at least triple this rate.

Take data for approximately 27.8 hours (at 100% efficiency) to give 5,250-6,000 $\mathbf{p(e,e'K^+)\Lambda}$ coincidences. Use the physics replay to keep track of the event total.

2. $\text{Al}(e,e'K^+)X$ Thick Dummy target SHMS right ($\theta = 6.65^o$) 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, then the PS1,3 factors can be decreased accordingly.

Take data for 1.9 hours (100% efficiency) at 40 μA.

3. Luminosity scans on LH2 and $z = 0$ 1.5% r.l. C targets.

The electrons in the HMS will be used to monitor cryotarget boiling, while the positive polarity SHMS will be used to investigate the reliability of hadron tracking efficiencies at high rates.

Set the PS1, PS3 target DAQ rates to 1.5 kHz, to give a total rate to disk of about 3 kHz.

The EDTM event trigger rate needs to be increased to about 10 kHz, to ensure that after prescaling there are 10k-100k EDTM events per run. **The number of accepted EDTM events needs to be monitored carefully during the luminosity scan!**

Make sure the raster is on (2 × 2), and take HMS and SHMS runs at 5, 15, 30, 50, 70 μA. Start at the highest current and do both targets. Then go down in current and repeat.

Also, take one Thick Dummy target run at 30 μA. 125,000 HMS electrons per run.

Try to get runs with a minimum of beam trips (if possible).

Trotta 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.

10.588 GeV Luminosity Scans – Rates at 70 μA								
P_{HMS}	θ_{HMS}	HMS e^- rate	HMS π^- rate	P_{SHMS}	θ_{SHMS}	SHMS π^+ rate	SHMS K rate	SHMS p rate
-4.204	14.91	20 kHz	31 kHz	+6.053	6.55	803 kHz	261 kHz	174 kHz
-3.266	12.50	34 kHz	395 kHz	+6.842	6.55	381 kHz	147 kHz	93 kHz

μA	Targets	$\frac{Rate_{SHMS}}{LHrun}$	$\frac{Rate_{HMS}}{LHrun}$	DAQ_{SHMS}	DAQ_{HMS}	$\frac{Time}{run}$
$\theta_{HMS} = 14.91$, P_{HMS}=-4.204 GeV/c, $\theta_{SHMS} = 6.55$, P_{SHMS}=+6.053 GeV/c						
70	LH2, C	1240 kHz	51 kHz	1.5 kHz	1.5 kHz	12 min
50	C, LH2	885 kHz	36 kHz	1.5 kHz	1.5 kHz	12 min
30	LH2, Dummy, C	530 kHz	22 kHz	1.5 kHz	1.5 kHz	12 min
15	C, LH2	265 kHz	11 kHz	1.5 kHz	1.5 kHz	12 min
5	LH2, C	89 kHz	3.6 kHz	1.5 kHz	1.5 kHz	12 min
$\theta_{HMS} = 12.50$, P_{HMS}=-3.266 GeV/c, $\theta_{SHMS} = 6.55$, P_{SHMS}=+6.842 GeV/c. Follow the SHMS cycling procedure.						
70	LH2, C	621 kHz	430 kHz	1.5 kHz	1.5 kHz	12 min
50	C, LH2	443 kHz	307 kHz	1.5 kHz	1.5 kHz	12 min
30	LH2, Dummy, C	266 kHz	184 kHz	1.5 kHz	1.5 kHz	12 min
15	C, LH2	133 kHz	92 kHz	1.5 kHz	1.5 kHz	12 min
5	LH2, C	44 kHz	31 kHz	1.5 kHz	1.5 kHz	12 min
Total Time (including overhead): 6.8 hrs						

4. $p(e,e'K^+)\Lambda$ LH2 SHMS center ($\theta = 9.56^o$) run.

   (a) Move the SHMS to 9.56 deg (from TV). **Beam off during the SHMS movement. Pay close attention to the hall cameras while departing the beamline, and be prepared to hit the rotation kill switch, if necessary.**

   (b) Put the 10 cm LH2 target back in. Leave the magnet settings unchanged.

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

   (d) Set the PS1(SHMS-3-4) and PS3(HMS-ELREAL) target rates to 100 Hz, PS5(HMS-ELREAL×SHMS-3/4)=0, all others disabled (i.e. -1). For the projected rates listed below, these should correspond to factors of about PS1(SHMS-3/4)=10, PS3(HMS-ELREAL)=6, giving 100 Hz HMS and SHMS singles event rates to disk, and a 300 Hz DAQ rate overall, for 70 μA beam.

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. $e^- \cdot K$
2.0 kHz	5.1 kHz	43 kHz	19 kHz	18 kHz	25 Hz	0.085-0.092 Hz

The real rate above is only for the $p(e,e'K^+)\Lambda$ reaction, exclusive π^+ and p coincidence reactions are likely to at least triple this rate.

Take data for approximately 27.8 hours (at 100% efficiency) to give 8,500-9,250 p(e, e'K$^+$)Λ coincidences. Use the physics replay to keep track of the event total.

5. $\mathrm{Al}(e,e'K^+)X$ Thick Dummy target SHMS center ($\theta = 9.56^o$) 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, then the PS1,3 factors can be decreased accordingly.

Take data for 1.9 hours (100% efficiency) at 40 μA.

6. $\boxed{p(e,e'K^+)\Lambda}$ LH2 SHMS left ($\theta = 12.56^o$) run.

   (a) Move the SHMS to 12.56 deg (from TV), and put the 10 cm LH2 target back in. Leave the magnet settings unchanged.

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

   (c) Set the PS1(SHMS-3-4) and PS3(HMS-ELREAL) target rates to 100 Hz, PS5(HMS-ELREAL×SHMS-3/4)=0, all others disabled (i.e. -1). For the projected rates listed below, these should correspond to factors of about PS1(SHMS-3/4)=7, PS3(HMS-ELREAL)=6, giving 100 Hz HMS and SHMS singles event rates to disk, and a 250 Hz DAQ rate overall, for 70 μA beam.

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. $e^- \cdot K$
2.0 kHz	5.1 kHz	4.3 kHz	2.1 kHz	2.7 kHz	3 Hz	0.05-0.06 Hz

The real rate above is only for the $p(e,e'K^+)\Lambda$ reaction, exclusive π^+ and p coincidence reactions are likely to at least triple this rate.

Take data for approximately 27.8 hours (at 100% efficiency) to give 5,250-6,000 $\mathbf{p(e,e'K^+)\Lambda}$ coincidences. Use the physics replay to keep track of the event total.

7. $\boxed{\mathrm{Al}(e,e'K^+)X}$ Thick Dummy target SHMS left ($\theta = 12.56^o$) 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, then the PS1,3 factors can be decreased accordingly.

Take data for 1.9 hours (100% efficiency) at 40 μA.

8. **To be determined in consultation with the RC:** If there is extra time left over before the transition to E12-09-017, go back to the $p(e,e'K^+)\Lambda$ setting with the lowest statistics and take more data.

18.10.19

$Q^2 = 5.50$, $W = 3.02$

θ_{SHMS}	I (uA)	$K\Lambda^0$ Events for 60%	Hrs @ 50% eff
+ 9.56° (center)	70	867	5.7
+ 12.56° (left)	70	789	8.8
6.5° (right)	45	2227	16.0 ← end ≈ 9pm Saturday

→ Do Lumi runs @ 50, 70 μA — 4.0

target - 1.5%C - 65 μA

cycle magnets

$Q^2 = 3.0$, $W = 3.14$

θ_{SHMS}	I (uA)	$K\Lambda^0$ Events for 60%	Hrs @ 50% eff
+ 9.42° (center)	60-70	5724	4.6
12.42° (left)	60-70	1340	1.7
6.5° (right)	25-30 (lower than before)	8968	19.4 ← end 8am Monday