x>1 and EMC Effect (XEM2) Run Plan

October 2, 2022

1 Initial Non-Production Beam Activities

1.1 Coincidence Hydrogen Elastic Data Taking

- **DAQ:** COIN
- **Trigger** PS6 (SHMS 3/4 + HMS 3/4 COINCIDENCE)
- **electron arm:** SHMS & **proton arm:** HMS
- **Prescale:** PS6=0, PS5=-1, PS3=-1, PS2=-1
- Set target rates of **100 Hz** for **PS1 and PS4**
- **electron arm:** SHMS & **proton arm:** HMS
- We will take coincidence elastic data at 6 different settings. At each setting data will be taken with 10 cm LH2 and Al dummy targets. At the lowest two Q^2 settings, we will also take data with the 48Ca Target to measure the possible hydrogen contamination in 48Ca.
- The goal is **10K elastic coincidences** at each setting.
- **For the first setting (KIN 1 with LH2 target):** the first run should be 15 minutes long. Start the second run immediately after ending the first short run. The first short run will be analyzed while taking the second run.
- Follow Table 1 and take data.

FOR A QUICK ESTIMATE OF THE # OF COIN. ELASTICS using the first short run → RUN THE → SCRIPT →

go-analysis

cd UTIL_XEM/HeeP

coinElas.C

# of elastic estimation

Table 1: Coincidence Hydrogen Elastic Data Taking

Setting	P_{HMS} (GeV)	θ_{HMS}	P_{SHMS} (GeV)	θ_{SHMS}	Target	I (μA)	Est. Time	Done ?
KIN 1	+6.476	19.52°	-4.935	26°	LH2	65	5 hrs	✓
	+6.476	19.52°	-4.935	26°	dummy	40	40 min	✓
KIN 2	+5.107	24.89°	-6.286	20°	dummy	40	10 min	✓
	+5.107	24.89°	-6.286	20°	LH2	65	40 min	✓
KIN 3	+3.738	31.86°	-7.626	15°	LH2	65	10 min	✓
	+3.738	31.86°	-7.626	15°	dummy	40	10 min	✓
KIN 4	+2.289	43.09°	-9.005	10°	dummy	40	10 min	✓
	+2.289	43.09°	-9.005	10°	LH2	~~65~~ 70	10 min	✓
KIN 5	+2.076 ✓	45.36° ✓	-9.2 ✓	9.24° ✓	LH2	~~65~~ 70	10 min	✓
	+2.076	45.36°	-9.2	9.24°	dummy	40	10 min	✓
KIN 6	+1.739 ✓	49.49° ✓	-9.502 ✓	8° ✓	dummy	40	10 min	✓
	+1.739	49.49°	-9.502	8°	48Ca	40	10 min	✓
	+1.739	49.49°	-9.502	8°	LH2	~~65~~ 70	10 min	✓

← SHMS Q2 MCL stopped at -3416 A

↳ coin rate: ~2 kHz

1.1.1 Coincidence Elastic Data with SHMS Sieve Slit

- HMS Collimator: "Large Collimator"
- SHMS Collimator: "Collimator" or "Centered Sieve"
- **Trigger Settings:** PS2, PS4. PS6

Setting 1 (Same as the last setting) (= kin 6)

- **SHMS Momentum and Angle:** -9.502 GeV and 8 deg
- **HMS Momentum and Angle:** +1.739 GeV and 49.49 deg

Table 2: Setting 1

SHMS Coll Setting	Target	I (μA)	Est. Time	Done ?
Centered Sieve	LH2	70 uA	10 min	✓
Centered Sieve	Beryllium	70 uA	10 min	✓

~1 kHz T2. 150 Hz T6
PS2=6 PS4=1, PS6=0
~5min

Setting 2

- **SHMS Momentum and Angle:** -9.026 GeV and 8 deg
- **HMS Momentum and Angle:** +1.739 GeV and 49.49 deg

Table 3: Setting 2

SHMS Coll Setting	Target	I (μA)	Est. Time	Done ?
Centered Sieve	Beryllium	70 uA	10 min	✓
Centered Sieve	LH2	70 uA	10 min	✓
Collimator	LH2	70 uA	10 min	✓
Collimator	dummy	40 uA	10 min	✓

~1kHz 5min
~200 Hz 5min

Setting 3

- **SHMS Momentum and Angle:** -8.55 GeV and 8 deg
- **HMS Momentum and Angle:** +1.739 GeV and 49.49 deg

Table 4: Setting 3

SHMS Coll Setting	Target	I (μA)	Est. Time	Done ?
Collimator	dummy	40 uA	10 min	
Collimator	LH2	70 uA	10 min	
Centered Sieve	LH2	70 uA	10 min	
Centered Sieve	Beryllium	70 uA	10 min	

- Total estimated time for section 1.1 including the momentum and target changes: **12 hrs** with 100% efficiency.

Call Casey for DAQ changeover

Call Bob michaels abt 1 hour before changeover

REMOVE SIEVE

1.2 Delta Scan with the SHMS

- **DAQ:** COIN
- **Trigger** PS6 (SHMS 3/4 + HMS 3/4 COINCIDENCE)
- **electron arm:** SHMS & **proton arm:** HMS
- **Prescale:** PS6=0, PS5=-1, PS3=-1, PS2=-1
- Set target rates of **100 Hz** for **PS1 and PS4**
- We will take data at 6 different settings. At each setting data will be taken with 10 cm LH2 and Al dummy targets.
- Since this is a delta scan with the SHMS, the central momentum for the SHMS will be kept at -8 GeV for the entire study.
- The goal is **10K elastic coincidences** at each setting.
- Follow Table 2 and take data.

Table 2: Delta Scan with the SHMS

Setting	P_{HMS} (GeV)	θ_{HMS}	P_{SHMS} (GeV)	θ_{SHMS}	Target	I (μA)	Est. Time	Done ?
KIN 1	+4.18	29.37°	-8.0	16.54°	LH2	65	15 min	✓
	+4.18	29.37°	-8.0	16.54°	dummy	40	10 min	✓
KIN 2	+3.77	31.69°	-8.0	15.09°	dummy	40	10 min	✓
	+3.77	31.69°	-8.0	15.09°	LH2	65	10 min	✓
KIN 3	+3.35	34.32°	-8.0	13.67°	LH2	65	10 min	✓
	+3.35	34.32°	-8.0	13.67°	dummy	40	10 min	✓
KIN 4	+2.94	37.34°	-8.0	12.24°	dummy	40	10 min	✓
	+2.94	37.34°	-8.0	12.24°	LH2	65	10 min	✓
KIN 5	+2.51	40.93°	-8.0	10.78°	LH2	65	10 min	✓
	+2.51	40.93°	-8.0	10.78°	dummy	40	10 min	✓
KIN 6	+2.08	45.32°	-8.0	9.25°	dummy	40	10 min	✓
	+2.08	45.32°	-8.0	9.25°	LH2	65	10 min	

- Total estimated time for section 1.2 including the momentum and target changes: **5 hrs** with 100% efficiency.

BEFORE MOVING ON TO THE NEXT SECTION THE DAQ AND EDTM SHOULD BE SET UP FOR THE SINGLE ARM MODE!

+ SIEVE SLIT REMOVED

1.3 Calibration Data Taking and PID Threshold Checks

- **DAQ:** Single Arm
- At 3 different settings, we will take data with ELREAL trigger on each arm to calibrate the detectors and also with 3/4 trigger on each arm to check the PID trigger thresholds.

1.3.1 Setting 1

- **SHMS Settings:** -4.0 GeV & 20°
- **HMS Settings:** -4.0 GeV & 20°
- **Target:** LH2
- **Trigger**: SHMS/HMS PS2 (ELREAL) **OR** SHMS/HMS PS1 (3/4)
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 3 should be set to **-1**.
- Adjust the prescales on **EACH** prescale GUI to keep the rates below 3 kHz.
- The goal number of events is **50K-100K** for each setting.
- **For defocusing: Increase the nominal SHMS Q2 and HMS Q2 currents by +20%.**
- Follow Table 6. Take SHMS and HMS single arm data simultaneously.
- Estimated run times are with 100% efficiency.

Table 6: Calibration/PID Threshold Checks - Setting 1

SHMS/HMS Q2	HMS PS		SHMS PS		I	Est. Time	Done ?
	PS1	PS2	PS1	PS2	(μA)		
+20% defocused Q2	-1	0	-1	0	60	15 min	✓
nominal Q2	-1	0	-1	0	60	15 min	✓
nominal Q2	0	-1	0	-1	60	15 min	✓

X 'Switch matrix'

1.3.2 Setting 2

- **SHMS Settings:** -3.5 GeV & 25°
- **HMS Settings:** -3.5 GeV & 25°
- **Target:** LH2
- **Trigger:** SHMS/HMS PS2 (ELREAL) **OR** SHMS/HMS PS1 (3/4)
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 4 should be set to **-1**.
- Adjust the prescales on **EACH** prescale GUI to keep the rates below 3 kHz.
- The goal number of events is **50K-100K** for each setting.
- **For defocusing: Increase the nominal SHMS Q2 and HMS Q2 currents by +20%.**
- Follow Table 7: Take SHMS and HMS single arm data simultaneously.
- Estimated run times are with 100% efficiency.

Table 7: Calibration/PID Threshold Checks - Setting 2

SHMS/HMS Q2	HMS PS		SHMS PS		I (μA)	Est. Time	Done ?
	PS1	PS2	PS1	PS2			
+20% defocused Q2	-1	0	-1	0	60	15 min	✓
nominal Q2	-1	0	-1	0	60	15 min	✓
nominal Q2	0	-1	0	-1	60	15 min	✓

1.3.3 Setting 3

- **SHMS Settings:** -2.5 GeV & 35°
- **HMS Settings:** -2.5 GeV & 35°
- **Target:** LH2
- **Trigger**: SHMS/HMS PS2 (ELREAL) **OR** SHMS/HMS PS1 (3/4)
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 8 should be set to **-1**.
- Adjust the prescales on **EACH** prescale GUI to keep the rates below 3 kHz.
- The goal number of events is **50K-100K** for each setting.
- **For defocusing: Increase the nominal SHMS Q2 and HMS Q2 currents by +20%.**
- Follow Table 8. Take SHMS and HMS single arm data simultaneously.
- Estimated run times are with 100% efficiency.

Table 8: Calibration/PID Threshold Checks - Setting 3

SHMS/HMS Q2	HMS PS		SHMS PS		I (μA)	Est. Time	Done ?
	PS1	PS2	PS1	PS2			
+20% defocused Q2	-1	0	-1	0	60	15 min	✓
nominal Q2	-1	0	-1	0	60	15 min	✓
nominal Q2	0	-1	0	-1	60	15 min	✓

1.3.4 Setting 4

- **SHMS Settings:** -1.24 GeV & 35°
- **HMS Settings:** -1.24 GeV & 35°
- **Target:** LH2
- **Trigger**: SHMS/HMS PS1 (3/4)
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 9 should be set to **-1**.
- Adjust the prescales on **EACH** prescale GUI to keep the rates below 3 kHz.
- The goal number of events is **50K-100K** for each setting.

- Follow Table 9. Take SHMS and HMS single arm data simultaneously.
- Estimated run times are with 100% efficiency.

Table 9: PID Threshold Checks - Setting 4

SHMS/HMS Q2	HMS PS		SHMS PS		I	Est. Time	Done ?
	PS1	PS2	PS1	PS2	(μA)		
nominal Q2	0	-1	0	-1	60	15 min	✓

- Total estimated time for section 1.3 including the momentum and target changes: **4 hrs**. Estimated run times are with 100% efficiency.

1.4 SHMS Hodoscope Paddle Test

At the 8 degree SHMS settings, we will run with all hodoscopes, and then with four different subsets turned off to check the acceptance. Same for 8.5 with a limited subset.

JRA: No HMS plan for this setting; maybe we can squeeze in some parasitic PID checks or something...

1.4.1 Setting 1

- **DAQ:** Single Arm. SHMS only
- **SHMS Settings:** -9.2 GeV & 8°
- **Target:** LD2 or 12C
- **Trigger:** SHMS PS2 (ELREAL) **OR** SHMS PS1 (3/4)
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 10 should be set to **-1**.
- Adjust the prescales on **EACH** prescale GUI to keep the rates below 3 kHz.
- Estimated run times are with 100% efficiency.
- (note for experts:) If 3/4 rate (T1) is only slightly (<50%) larger than ELREAL rate (T2), can do PS1=0 for both targets (slightly longer time) and drop the PS2=0
- Follow Table 10.

50-100k events??

Table 10: SHMS acceptance test with some hodoscopes turned off at 8.0°

Setting	HV off		SHMS PS		Target	I	Est. Time	Done ?
	S1X	S2X	PS1	PS2		(μA)		
1	none	none	-1	0	LD2	60	10 min	✓ need to redo ✓ redone, no edits
	none	none	-1	0	12C	60	10 min	✓
	none	none	0	-1	12C	60	10 min	✓
2	1-7	1-6	0	-1	12C	60	10 min	✓
	1-7	1-6	-1	0	12C	60	10 min	✓
	1-7	1-6	-1	0	LD2	60	10 min	✓
3	1-8	1-6	-1	0	LD2	60	10 min	✓ +17294
	1-8	1-6	-1	0	12C	60	10 min	✓
	1-8	1-6	0	-1	12C	60	10 min	✓
4	1-7	1-7	0	-1	12C	60	10 min	✓ 3/4 17289
	1-7	1-7	-1	0	12C	60	10 min	✓ ELREAL 17290
	1-7	1-7	-1	0	LD2	60	10 min	✓ ELREAL 17292
5	1-8	1-7	-1	0	LD2	60	10 min	✓ ELREAL 17293
	1-8	1-7	-1	0	12C	60	10 min	✓ 17299
	1-8	1-7	0	-1	12C	60	10 min	✓ 17298
6	1-7	1-8	0	-1	12C	60	10 min	✓ 17297
	1-7	1-8	-1	0	12C	60	10 min	✓ 17296
	1-7	1-8	-1	0	LD2	60	10 min	✓ 17295

1.4.2 Setting 2

- **DAQ:** Single Arm, SHMS only
- **SHMS Settings:** -9.2 GeV & 8.5°
- **Target:** LD2 or 12C
- **Trigger**: SHMS PS2 (ELREAL) **OR** SHMS PS1 (3/4)
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 11 should be set to **-1**.
- Adjust the prescales on **EACH** prescale GUI to keep the rates below 3 kHz.
- Estimated run times are with 100% efficiency.
- Follow Table 11

Table 11: SHMS acceptance test with some upper hodoscopes turned off at 8.5°

Setting	HV off		SHMS PS		Target	I	Est. Time	Done ?
	S1X	S2X	PS1	PS2		(μA)		
1	none	none	0	-1	12C	60	10 min	17300
	none	none	-1	0	12C	60	10 min	17301
	1-5	1-7	-1	0	12C	60	10 min	17302
	1-5	1-7	0	-1	12C	60	10 min	17303
	1-6	1-8	0	-1	12C	60	10 min	17304
	1-6	1-8	-1	0	12C	60	10 min	17305
	1-7	1-8	-1	0	12C	60	10 min	17306
	1-7	1-8	0	-1	12C	60	10 min	17307
2	1-7	1-8	-1	0	LD2	60	10 min	17308
	1-6	1-8	-1	0	LD2	60	10 min	17309
	1-5	1-7	-1	0	LD2	60	10 min	17310
	none	none	-1	0	LD2	60	10 min	17311, 17312

BEFORE MOVING ON TO THE NEXT SECTION TURN ALL OF THE HODOSCOPE HV CHANNELS BACK ON!

2 XEM2 Production Run Plan - Part I

2.1 Q^2 Dependence Studies at 26° - Target Ladder I

- In this section, we will take data with the SHMS and HMS simultaneously in the single arm mode using a subset of targets on the target ladder I.
- While the SHMS and HMS angles will be kept the same, the SHMS and HMS will be configured to several different momentum settings. Please follow the tables below in the order written.

2.1.1 Setting 1

- Set **SHMS momentum** to **-5.42 GeV**.
- Set **HMS momentum** to **-5.42 GeV**.
- **SHMS angle: 26°**
- **HMS angle: 26°**
- **Trigger**: SHMS/HMS PS2 (ELREAL) **OR** SHMS/HMS PS1 (3/4)
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 17 should be set to **-1**.
- **Prescale values are only estimated; adjust them on both SHMS and HMS Prescale GUIs accordingly to keep the rates below 3 kHz.**
- Follow Table 17. Take data with the SHMS and HMS simultaneously.
- Estimated run times are with 100% efficiency.

HMS runs SHMS run

Table 17: Q^2 Dependence Studies at 26° - Setting 1

Target	I (μA)	HMS PS PS1	HMS PS PS2	SHMS PS PS1	SHMS PS PS2	Est. Time	Target e^-	Done ?
LH2	60	-1	0	-1	0	5.5 hrs	10K	4470,1, 17326,7
LD2	60	-1	0	-1	0	2.5 hrs	10K	
Al dummy	40	-1	0	-1	0	1.5 hrs	2.5K	
40Ca	60	-1	0	-1	0	1.5 hrs	5.5K	
40Ca	60	0	-1	0	-1	5 min	-	
12C	60	0	-1	0	-1	5 min	-	
12C	60	-1	0	-1	0	2 hrs	5.5K	

↑ HMS

ALL DONE

2.1.2 Setting 2

- Set **SHMS momentum** to **-4.767 GeV**.
- Set **HMS momentum** to **-4.767 GeV**.
- **SHMS angle: 26°**
- **HMS angle: 26°**
- **Trigger**: SHMS/HMS PS2 (ELREAL) **OR** SHMS/HMS PS1 (3/4)
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 18 should be set to **-1**.
- **Prescale values are only estimated; adjust them on both SHMS and HMS Prescale GUIs accordingly to keep the rates below 3 kHz.**
- Follow Table 18. Take data with the SHMS and HMS simultaneously.
- Estimated run times are with 100% efficiency.

Table 18: Q^2 Dependence Studies at 26° - Setting 2

Target	I (μA)	HMS PS		SHMS PS		Est. Time	Target e^-	Done ?
		PS1	PS2	PS1	PS2			✓ 4494
12C	60	0	-1	0	-1	5 min	-	✓ 4494
12C	60	-1	0	-1	0	3.5 hrs	120K	✓ 4490, 1, 2, 3
40Ca	60	-1	0	-1	0	2.5 hrs	120K	4496, 7, 8, 9
40Ca	60	0	-1	0	-1	5 min	-	✓4495
Al dummy	40	-1	0	-1	0	25 min	15K	4502, 02, 03
LD2	60	-1	0	-1	0	40 min	65K	4504
LH2	60	-1	0	-1	0	1.5 hrs	65K	4505, 4506

↑ HMS

2.1.3 Setting 3

- Set **SHMS momentum** to **-4.19 GeV**.
- Set **HMS momentum** to **-4.19 GeV**.
- **SHMS angle: 26°**
- **HMS angle: 26°**
- **Trigger**: SHMS/HMS PS2 (ELREAL) **OR** SHMS/HMS PS1 (3/4)
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 19 should be set to **-1**.

- **Prescale values are only estimated; adjust them on both SHMS and HMS Prescale GUIs accordingly to keep the rates below 3 kHz.**
- Follow Table 19. Take data with the SHMS and HMS simultaneously.
- Estimated run times are with 100% efficiency.

Table 19: Q^2 Dependence Studies at 26° - Setting 3

HMS RUN #'S

Target	I (μA)	HMS PS PS1	HMS PS PS2	SHMS PS PS1	SHMS PS PS2	Est. Time	Target e^-	Done ?
LH2	60	-1	0	-1	0	2 hrs	550K	~~4507~~, 4508
LD2	60	-1	0	-1	0	1 hr	550K	4509, 4510
Al dummy	40	-1	0	-1	0	30 min	130K	4511
40Ca	60	-1	0	-1	0	2.5 hrs	550K	4512, 13, 14, 15
40Ca	60	0	-1	0	-1	5 min	-	4516
12C	60	0	-1	0	-1	5 min	-	4517
12C	60	-1	0	-1	0	3.5 hrs	550K	4518, 19, 20, 21

↑ HMS ALL DONE

2.1.4 Setting 4

- Set **SHMS momentum** to **-3.69 GeV**.
- Set **HMS momentum** to **-3.69 GeV**.
- **SHMS angle: 26°**
- **HMS angle: 26°**
- **Trigger**: SHMS/HMS PS2 (ELREAL) **OR** SHMS/HMS PS1 (3/4)
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 20 should be set to **-1**.
- **Prescale values are only estimated; adjust them on both SHMS and HMS Prescale GUIs accordingly to keep the rates below 3 kHz.**
- Follow Table 20. Take data with the SHMS and HMS simultaneously.
- Estimated run times are with 100% efficiency.

-3.69 GeV

Table 20: Q^2 Dependence Studies at 26° - Setting 4

Target	I (μA)	HMS PS PS1	HMS PS PS2	SHMS PS PS1	SHMS PS PS2	Est. Time	Target e^-	Done ?
12C	60	-1	0	-1	0	1 hr	400K	4522, 4530
12C	60	0	-1	0	-1	5 min	-	4523
40Ca	60	0	-1	0	-1	5 min	-	4524
40Ca	60	-1	0	-1	0	45 min	400K	4525
Al dummy	40	-1	0	-1	0	10 min	65K ~~100K~~	4526
LD2	60	-1	0	-1	0	20 min	400K	4527, 4528
LH2	60	-1	0	-1	0	30 min	400K	4529

↑ HMS

2.1.5 Setting 5

- Set **SHMS momentum** to **-3.25 GeV**.
- Set **HMS momentum** to **-3.25 GeV**.
- **SHMS angle: 26°**
- **HMS angle: 26°**
- **Trigger**: SHMS/HMS PS2 (ELREAL) **OR** SHMS/HMS PS1 (3/4)
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 21 should be set to **-1**.
- **Prescale values are only estimated; adjust them on both SHMS and HMS Prescale GUIs accordingly to keep the rates below 3 kHz.**
- Follow Table 21. Take data with the SHMS and HMS simultaneously.
- Estimated run times are with 100% efficiency.

Table 21: Q^2 Dependence Studies at 26° - Setting 5

Target	I (μA)	HMS PS PS1	HMS PS PS2	SHMS PS PS1	SHMS PS PS2	Est. Time	Target e^-	Done ?
LH2	60	-1	0	-1	0	15 min	250K	4531
LD2	60	-1	0	-1	0	10 min	250K	4532
Al dummy	40	-1	0	-1	0	10 min	40K ~~60K~~	4533
40Ca	60	-1	0	-1	0	20 min	250K	4534
40Ca	60	0	-1	0	-1	5 min	-	4536
12C	60	0	-1	0	-1	5 min	-	4537
12C	60	-1	0	-1	0	30 min	250K	4538

↑ HMS

2.1.6 Setting 6

- Set **SHMS momentum** to **-2.86 GeV**. 2.86
- Set **HMS momentum** to **-2.86 GeV**.
- **SHMS angle: 26°**
- **HMS angle: 26°**
- **Trigger**: SHMS/HMS PS2 (ELREAL) **OR** SHMS/HMS PS1 (3/4)
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 22 should be set to **-1**.
- **Prescale values are only estimated; adjust them on both SHMS and HMS Prescale GUIs accordingly to keep the rates below 3 kHz.**
- Follow Table 22. Take data with the SHMS and HMS simultaneously.
- Estimated run times are with 100% efficiency.

Table 22: Q^2 Dependence Studies at 26° - Setting 6

Target	I (μA)	HMS PS		SHMS PS		Est. Time	Target e^-	Done ?
		PS1	PS2	PS1	PS2			
12C	60	-1	0	-1	0	15 min	190K	4539, 40
12C	60	0	-1	0	-1	5 min	-	4541
40Ca	60	0	-1	0	-1	5 min	-	4542
40Ca	60	-1	0	-1	0	10 min	190K	4543
Al dummy	40	-1	0	-1	0	10 min	31K ~~40K~~	4544
LD2	60	-1	1	-1	1	10 min	190K	4545
LH2	60	-1	0	-1	0	10 min	190K	

↑ HMS

2.1.7 Setting 7

- Set **SHMS momentum** to **-2.52 GeV**.
- Set **HMS momentum** to **-2.52 GeV**. -2.52
- **SHMS angle: 26°**
- **HMS angle: 26°**
- **Trigger**: SHMS/HMS PS2 (ELREAL) **OR** SHMS/HMS PS1 (3/4)
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 23 should be set to **-1**.

- **Prescale values are only estimated; adjust them on both SHMS and HMS Prescale GUIs accordingly to keep the rates below 3 kHz.**
- Follow Table 23. Take data with the SHMS and HMS simultaneously.
- Estimated run times are with 100% efficiency.

Table 23: Q^2 Dependence Studies at 26° - Setting 7

Target	I (μA)	**HMS PS** PS1	PS2	**SHMS PS** PS1	PS2	**Est. Time**	**Target** e^-	**Done ?**
LH2	60	-1	1	-1	1	10 min	155K	4547
LD2	60	-1	2	-1	2	10 min		4548
Al dummy	40	-1	0	-1	0	10 min	25K ~~40K~~	4549
40Ca	60	-1	0	-1	0	10 min	155K	4550
40Ca	60	1	-1	1	-1	5 min	-	4551
12C	60	0	-1	0	-1	5 min	-	4552
12C	60	-1	0	-1	0	10 min	155K	4553

↑HMS

2.1.8 Setting 8

- Set **SHMS momentum** to **-2.21 GeV**.
- Set **HMS momentum** to **-2.21 GeV**.
- **SHMS angle: 26°**
- **HMS angle: 26°**

-2.21

- **Trigger**: SHMS/HMS PS2 (ELREAL) **OR** SHMS/HMS PS1 (3/4)
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 24 should be set to **-1**.
- **Prescale values are only estimated; adjust them on both SHMS and HMS Prescale GUIs accordingly to keep the rates below 3 kHz.**
- Follow Table 24. Take data with the SHMS and HMS simultaneously.
- Estimated run times are with 100% efficiency.

Table 24: Q^2 Dependence Studies at 26° - Setting 8

Target	I (μA)	HMS PS		SHMS PS		Est. Time	Target e^-	Done ?
		PS1	PS2	PS1	PS2			
12C	60	-1	1	-1	1	15 min	135K	4554
12C	60	1	-1	1	-1	5 min	-	4555
40Ca	60	2	-1	2	-1	5 min	-	4556
40Ca	60	-1	2	-1	2	15 min	135K	4557
Al dummy	40	-1	0	-1	0	10 min	22K ~~35K~~	4558
LD2	60	-1	3	-1	3	10 min	135K	4560
LH2	60	-1	1	-1	1	10 min	135K	4561

↑HMS

Setting 9

- Set **SHMS momentum** to **-1.95 GeV**.
- Set **HMS momentum** to **-1.95 GeV**.
- **SHMS angle: 26°**
- **HMS angle: 26°**
- **Trigger**: SHMS/HMS PS2 (ELREAL) **OR** SHMS/HMS PS1 (3/4)
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 25 should be set to **-1**.
- **Prescale values are only estimated; adjust them on both SHMS and HMS Prescale GUIs accordingly to keep the rates below 3 kHz.**
- Follow Table 25. Take data with the SHMS and HMS simultaneously.
- Estimated run times are with 100% efficiency.

Total estimated time for section 2.1 including the momentum and target changes: **41 hrs** with 100% efficiency.

Table 25: Q^2 Dependence Studies at 26° - Setting 9

Target	I (μA)	**HMS PS** PS1	PS2	**SHMS PS** PS1	PS2	**Est. Time**	**Target** e^-	**Done ?**
LH2	60	-1	3	-1	3	15 min	120K	✓
LH2	60	3	-1	3	-1	5 min	-	17314
LD2	60	4	-1	4	-1	5 min	-	17313
LD2	60	-1	4	-1	4	10 min	120K	✓
Al dummy	40	-1	1	-1	1	10 min	30K	✓
Al dummy	40	1	-1	1	-1	5 min	-	17315
40Ca	60	3	-1	3	-1	5 min	-	✓
40Ca	60	-1	3	-1	3	15 min	120K	✓
12C	60	-1	1	-1	1	10 min	120K	✓
12C	60	1	-1	1	-1	5 min	-	

runs

4464, 17325

4468; 17325
4467, 17321

4466, 17321

2.2 Charge Symmetric Background (CSB) Studies at 26°

- BEWARE of the POLARITY CHANGE IN THIS SECTION

When changing polarity:
Ramp magnets to zero.
before clicking the polarity button
Click button, then adjust set point
(Check wiki for more detail)

- Follow Table 26. Take data with the SHMS and HMS simultaneously.

Table 26: CSB Studies at 26° - Setting 1

Target	I (μA)	HMS PS			SHMS PS			Est. Time	Done ?
		PS1	PS2	PS3	PS1	PS2	PS3		
12C	60	-1	-1	0	-1	-1	0	10 min	~~4563~~
12C	60	0	-1	-1	0	-1	-1	10 min	
40Ca	60	0	-1	-1	0	-1	-1	10 min	4565
40Ca	60	-1	-1	0	-1	-1	0	10 min	4563
LH2 (wrong momentum)	60	-1	-1	0	-1	-1	0	10 MIN	4562

2.2.2 Setting 2

- Set **SHMS momentum** to **+2.52 GeV**.
- Set **HMS momentum** to **+2.52 GeV**.
- **SHMS angle: 26°**
- **HMS angle: 26°**
- **Trigger**: SHMS/HMS PS3 (ELCLEAN) **OR** SHMS/HMS PS1 (3/4)
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 27 should be set to **-1**.

- **Prescale values are only estimated; adjust them on both SHMS and HMS Prescale GUIs accordingly to keep the rates below 3 kHz.**
- Follow Table 27. Take data with the SHMS and HMS simultaneously.

Table 27: CSB Studies at 26° - Setting 2

Target	I	**HMS PS**			**SHMS PS**			**Est. Time**	Done ?
	(μA)	PS1	PS2	PS3	PS1	PS2	PS3		
40Ca	60	-1	-1	0	-1	-1	0	10 min	4569
40Ca	60	0	-1	-1	0	-1	-1	10 min	4570
12C	60	0	-1	-1	0	-1	-1	10 min	4571
12C	60	-1	-1	0	-1	-1	0	10 min	4572
Al dummy	40	-1	-1	0	-1	-1	0	10 min	4574
Al dummy	40	0	-1	-1	0	-1	-1	10 min	4578
LD2	60	0	-1	-1	0	-1	-1	10 min	4576
LD2	60	-1	-1	0	-1	-1	0	10 min	4577
LH2	60	-1	-1	0	-1	-1	0	10 min	4578
LH2	60	0	-1	-1	0	-1	-1	10 min	

2.2.3 Setting 3

- Set **SHMS momentum** to **+2.21 GeV**.
- Set **HMS momentum** to **+2.21 GeV**.
- **SHMS angle: 26°**
- **HMS angle: 26°**
- **Trigger**: SHMS/HMS PS3 (ELCLEAN) **OR** SHMS/HMS PS1 (3/4)
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 28 should be set to **-1**.
- **Prescale values are only estimated; adjust them on both SHMS and HMS Prescale GUIs accordingly to keep the rates below 3 kHz.**
- Follow Table 28. Take data with the SHMS and HMS simultaneously.

Table 28: CSB Studies at 26° - Setting 3

Target	I (μA)	**HMS PS** PS1	PS2	PS3	**SHMS PS** PS1	PS2	PS3	**Est. Time**	Done ?
40Ca	60	-1	-1	0	-1	-1	0	10 min	4583, 4588
40Ca	60	0	-1	-1	0	-1	-1	10 min	4581, 4587, 17465
12C	60	0	-1	-1	0	-1	-1	10 min	4586, 17464
12C	60	-1	-1	0	-1	-1	0	10 min	4585, 17463

2.2.4 Setting 4

- Set **SHMS momentum** to **+1.95 GeV**.
- Set **HMS momentum** to **+1.95 GeV**.
- **SHMS angle: 26°**
- **HMS angle: 26°**
- **Trigger**: SHMS/HMS PS3 (ELCLEAN) **OR** SHMS/HMS PS1 (3/4)
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 29 should be set to **-1**.
- **Prescale values are only estimated; adjust them on both SHMS and HMS Prescale GUIs accordingly to keep the rates below 3 kHz.**
- Follow Table 29. Take data with the SHMS and HMS simultaneously.

Table 29: CSB Studies at 26° - Setting 4

Target	I (μA)	**HMS PS** PS1	PS2	PS3	**SHMS PS** PS1	PS2	PS3	**Est. Time**	Done ?
12C	60	-1	-1	0	-1	-1	0	10 min	4592, 17471
12C	60	0	-1	-1	0	-1	-1	10 min	4591, 17470
40Ca	60	0	-1	-1	0	-1	-1	10 min	4590, 17469
40Ca	60	-1	-1	0	-1	-1	0	10 min	✓ 4589, 17468
Al dummy	40	-1	-1	0	-1	-1	0	10 min	4593, 17472
Al dummy	40	0	-1	-1	0	-1	-1	10 min	4594, 17473
LD2	60	0	-1	-1	0	-1	-1	10 min	4598, 17477
LD2	60	-1	-1	0	-1	-1	0	10 min	4597, 17476
LH2	60	-1	-1	0	-1	-1	0	10 min	4596, 17475
LH2	60	0	-1	-1	0	-1	-1	10 min	4595, 17474

- Total estimated time for section 2.2 including the momentum and target changes: **10 hrs**. Estimated run times are with 100% efficiency.

2.3 Charge Symmetric Background Studies at 20°- Part I

- **BEWARE:** the POLARITY is STILL POSITIVE
- **SHMS S1X (1-7)** and **S2X (1-7)** on BOTH left and right sides are **OFF**

2.3.1 Setting 1

- Turn the **SHMS S1X (1-7)** and **S2X (1-7)** LEFT and RIGHT hodoscope paddles **OFF**.
- Set **HMS momentum** to **+3.40 GeV**.
- **SHMS angle: 8°**
- **SHMS momentum: +9.2 GeV**
- **HMS angle: 20°**
- **Trigger**: SHMS/HMS PS3 (ELCLEAN) **OR** SHMS/HMS PS1 (3/4)
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 30 should be set to **-1**.
- **Prescale values are only estimated; adjust them on both SHMS and HMS Prescale GUIs accordingly to keep the rates below 3 kHz.**
- Take data with the SHMS and HMS simultaneously.

Table 30: CSB Studies at 20° - Setting 1

Target	***I***	**HMS PS**			**SHMS PS**			**Est. Time**	Done ?
	(μA)	PS1	PS2	PS3	PS1	PS2	PS3		L
LD2	60	-1	-1	0	-1	-1	0	10 min	4599
12C	60	-1	-1	0	-1	-1	0	10 min	4600
12C	60	0	-1	-1	0	-1	-1	10 min	4602
40Ca	60	0	-1	-1	0	-1	-1	10 min	4603,4
40Ca	60	-1	-1	0	-1	-1	0	10 min	4605

DONE

2.3.2 Setting 2

- Make sure **SHMS S1X (1-7)** and **S2X (1-7)** LEFT and RIGHT hodoscope paddles are **OFF**.
- Set **HMS momentum** to **+3.04 GeV**.
- **SHMS angle: 8°**
- **SHMS momentum: +9.2 GeV**
- **HMS angle: 20°**
- **Trigger**: SHMS/HMS PS3 (ELCLEAN) **OR** SHMS/HMS PS1 (3/4)
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 31 should be set to **-1**.
- **Prescale values are only estimated; adjust them on both SHMS and HMS Prescale GUIs accordingly to keep the rates below 3 kHz.**
- Take data with the SHMS and HMS simultaneously.

3.04

Table 31: CSB Studies at 20° - Setting 2

Target	I (μA)	HMS PS			SHMS PS			Est. Time	Done ?
		PS1	PS2	PS3	PS1	PS2	PS3		
40Ca	60	-1	-1	0	-1	-1	0	10 min	4606
40Ca	60	0	-1	-1	0	-1	-1	10 min	4607
12C	60	0	-1	-1	0	-1	-1	10 min	4608
12C	60	-1	-1	0	-1	-1	0	10 min	4609
LD2	60	-1	-1	0	-1	-1	0	10 min	4610

DONE

2.3.3 Setting 3

- Make sure **SHMS S1X (1-7)** and **S2X (1-7)** LEFT and RIGHT hodoscope paddles are **OFF**.
- Set **HMS momentum** to **+2.71 GeV**.
- **SHMS angle: 8°**
- **SHMS momentum: +9.2 GeV**
- **HMS angle: 20°**
- **Trigger**: SHMS/HMS PS3 (ELCLEAN) **OR** SHMS/HMS PS1 (3/4)

+2.71

- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 32 should be set to **-1**.
- **Prescale values are only estimated; adjust them on both SHMS and HMS Prescale GUIs accordingly to keep the rates below 3 kHz.**
- Take data with the SHMS and HMS simultaneously.

Table 32: CSB Studies at 20° - Setting3

Target	***I***	**HMS PS**			**SHMS PS**			**Est. Time**	Done ?
	(μA)	PS1	PS2	PS3	PS1	PS2	PS3		
LD2	60	-1	-1	0	-1	-1	0	10 min	4611
LH2	60	-1	-1	0	-1	-1	0	10 min	4612
12C	60	0	-1	-1	0	-1	-1	10 min	46164
12C	60	-1	-1	0	-1	-1	0	10 min	46163
Ca40	60	-1	-1	0	-1	-1	0	10 min	4616
Ca40	60	0	-1	-1	0	-1	-1	10 min	4615

DONE!

2.3.4 Setting 4

- Make sure **SHMS S1X (1-7)** and **S2X (1-7)** LEFT and RIGHT hodoscope paddles are **OFF**.
- Set **HMS momentum** to **+2.421 GeV**.
- **SHMS angle: 8°**
- **SHMS momentum: +9.2 GeV**
- **HMS angle: 20°**
- **Trigger**: SHMS/HMS PS3 (ELCLEAN) **OR** SHMS/HMS PS1 (3/4)
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 33 should be set to **-1**.
- **Prescale values are only estimated; adjust them on both SHMS and HMS Prescale GUIs accordingly to keep the rates below 3 kHz.**
- Take data with the SHMS and HMS simultaneously.

+2.421

- Total estimated time for section 2.3 including the momentum and target changes: **16.5 hrs**. Estimated run times are with 100% efficiency.

Table 33: CSB Studies at 20° - Setting 4

Target	I (μA)	HMS PS			SHMS PS			Est. Time	Done ?
		PS1	PS2	PS3	PS1	PS2	PS3		
Ca40	60	-1	-1	0	-1	-1	0	10 min	4617
Ca40	60	0	-1	-1	0	-1	-1	10 min	4619
Be9	60	0	-1	-1	0	-1	-1	10 min	4620
Be9	60	-1	-1	0	-1	-1	0	10 min	4621
Al dummy	40	-1	-1	0	-1	-1	0	10 min	4622
Al dummy	40	0	-1	-1	0	-1	-1	10 min	4623
LH2	60	-1	-1	0	-1	-1	0	10 min	4625 → REDO!
LH2	60	0	-1	-1	0	-1	-1	10 min	4624
LD2	60	0	-1	-1	0	-1	-1	10 min	4634
LD2	60	-1	-1	0	-1	-1	0	10 min	4636
Ca48	60	0	-1	-1	0	-1	-1	10 min	4637
Ca48	60	-1	-1	0	-1	-1	0	10 min	4638/4640
C12	60	-1	-1	0	-1	-1	0	10 min	4641
C12	60	0	-1	-1	0	-1	-1	10 min	4642
B4C-11	60	0	-1	-1	0	-1	-1	10 min	4643
B4C-11	60	-1	-1	0	-1	-1	0	10 min	4644
B4C-10	60	-1	-1	0	-1	-1	0	10 min	4645
B4C-10	60	0	-1	-1	0	-1	-1	10 min	4646
Sn (Tin)	40	-1	-1	0	-1	-1	0	10 min	4648
Sn (Tin)	40	0	-1	-1	0	-1	-1	10 min	4647
Titanium	40	0	-1	-1	0	-1	-1	10 min	4650
Titanium	40	-1	-1	0	-1	-1	0	10 min	4649
54Fe	40	-1	-1	0	-1	-1	0	10 min	4653
54Fe	40	0	-1	-1	0	-1	-1	10 min	4651 4652
108Ag	60	0	-1	-1	0	-1	-1	10 min	4655
108Ag	60	-1	-1	0	-1	-1	0	10 min	4654
232Thorium	60	-1	-1	0	-1	-1	0	10 min	4657
232Thorium	60	0	-1	-1	0	-1	-1	10 min	4656
Ni58	60	0	-1	-1	0	-1	-1	10 min	4659
Ni58	60	-1	-1	0	-1	-1	0	10 min	4658
Ni64	60	-1	-1	0	-1	-1	0	10 min	4661
Ni64	60	0	-1	-1	0	-1	-1	10 min	4660

call ^

2.4 20° EMC and 8° 2N-SRC Running - Target Ladder I

- Before starting, change polarity of spectrometers to "ELECTRON"
- Data will be taken with the SHMS and HMS simultaneously in the single arm mode using several targets on the target ladder I.
- For the entire section of 2.4: **SHMS S1X (1-7)** and **S2X (1-7)** on BOTH left and right sides are **OFF**
- Spectrometer Configurations:
  1. **SHMS angle: 8°**
  2. **SHMS momentum: -9.2 GeV**
  3. **HMS angle: 20°**
- While the above-mentioned SHMS angle, SHMS momentum, and HMS angle will be kept the same, the HMS will be configured to several different momentum settings. Please follow the tables below in the order written.

2.4.1 Setting 1

- Make sure **SHMS S1X (1-7)** and **S2X (1-7)** LEFT and RIGHT hodoscope paddles are **OFF**.
- Set **HMS momentum** to **-6.6 GeV**.
- **SHMS angle: 8°**
- **SHMS momentum: -9.2 GeV**
- **HMS angle: 20°**
- **Trigger**: SHMS/HMS PS2 (ELREAL) **OR** SHMS/HMS PS1 (3/4)
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 29 should be set to **-1**.
- **NOTE: Prescale values are only estimated, adjust them accordingly to keep the rates below ~~3 kHz~~ 5 kHz.**
- Follow Table 29. Take data with the SHMS and HMS simultaneously.
- Estimated run times are with 100% efficiency.

HMS counts

Table 29: 20° EMC and 8° 2N-SRC Running - Setting 1

Target	I (μA)	HMS PS PS1	HMS PS PS2	SHMS PS PS1	SHMS PS PS2	Est. Time	Target e^-	Done ?
LD2	30 ~~60~~	-1	0	-1	5	130 min x2	~~390K~~	✓
LH2	50 ~~60~~	-1	0	-1	3	1 hr	120K	✓
Al ~~dummy~~ Chem	~~40~~	-1	0	-1	0	53 ~~35~~ min	65K	✓
9Be	60	-1	0	-1	4	15 min	45K	✓
40Ca	60	-1	0	-1	3	80 min	90 ~~180~~K	✓
40Ca	60	0	-1	3	-1	5 min	-	✓
48Ca	40	-1	0	-1	2	2 hrs	90 ~~180~~K	✓
12C	60	-1	0	-1	~~3~~ 6	2 hrs	180K	✓
12C	60	0	-1	~~3~~ 6	-1	5 min	-	✓
B4C-11	60	-1	0	-1	3	1 hr	90K	✓
B4C-10	60	-1	0	-1	3	45 min	90K	✓
Sn (Tin)	40	-1	0	-1	2	45 min	45K	✓
Titanium	40	-1	0	-1	1	1.5 hr	45K	✓
54Fe	~~40~~	-1	0	-1	1	1 hr	45K	✓
108Ag	60	-1	0	-1	3	30 min	45K	✓
232Thorium	60	-1	0	-1	2	45 min	45K	✓
58Ni	60	-1	0	-1	1	1 hr	45K	✓
64Ni	~~60~~ 50	-1	0	-1	1	1 hr	45K	✓

OP Rest. ↑
CAM
60 μA

2.4.2 Setting 2

- Make sure **SHMS S1X (1-7)** and **S2X (1-7)** LEFT and RIGHT hodoscope paddles are **OFF**.
- Set **HMS momentum** to **-5.878 GeV**.
- **SHMS angle: 8°**
- **SHMS momentum: -9.2 GeV**
- **HMS angle: 20°**
- **Trigger**: SHMS/HMS PS2 (ELREAL) **OR** SHMS/HMS PS1 (3/4)
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 30 should be set to **-1**.
- **NOTE: Prescale values are only estimated, adjust them accordingly to keep the rates below 3 kHz.**
- Follow Table 30. Take data with the SHMS and HMS simultaneously.
- Estimated run times are with 100% efficiency.

Table 30: 20° EMC and 8° 2N-SRC Running - Setting 2

Target	I (μA)	HMS PS PS1	HMS PS PS2	SHMS PS PS1	SHMS PS PS2	Est. Time	Target e^-	Done ?
64Ni	50	-1	0	-1	1	75 min	230K	✓
58Ni	60	-1	0	-1	1	75 min	230K	✓
232Thorium	60	-1	0	-1	2	1 hr	230K	✓
108Ag	60	-1	0	-1	3	35 min	230K	✓
54Fe	40	-1	0	-1	1	70 min	230K	✓
Titanium	40	-1	0	-1	1	2 hrs	230K	✓
Sn (Tin)	40	-1	0	-1	2	1 hr	230K	✓
B4C-10	60	-1	0	-1	3	70 min	~~460K~~	✓ low
B4C-11	60	-1	0	-1	3	1 hr	460K	✓
12C	60	-1	0	-1	3	2.5 hrs	~~460~~ ~~920K~~ 920K	✓
12C	60	0	-1	3	-1	5 min	-	✓
48Ca	40	-1	0	-1	2	2.5 hrs	~~460~~ ~~920K~~	✓
40Ca	60	-1	0	-1	3	1.5 hrs	~~460~~ ~~920K~~	✓
40Ca	60	0	-1	3	-1	5 min	-	✓
9Be	60	-1	0	-1	4	20 min	230K	✓
Al ~~dummy~~ Sham	40	-1	0	-1	0	35 min	430K	✓
LH2	60	-1	0	-1	3	25 min	200K	✓
LD2	60	-1	0	-1	5	130 min	2.6M	✓

TBD it's real ..... EL REAL!

↑ HMS counts

2.4.3 Setting 3

- Make sure **SHMS S1X (1-7)** and **S2X (1-7)** LEFT and RIGHT hodoscope paddles are **OFF**.
- Set **HMS momentum** to **-5.36 GeV**.
- **SHMS angle: 8°**
- **SHMS momentum: -9.2 GeV**
- **HMS angle: 20°**
- **Trigger**: SHMS/HMS PS2 (ELREAL) **OR** SHMS/HMS PS1 (3/4)
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 31 should be set to **-1**.
- **NOTE: Prescale values are only estimated, adjust them accordingly to keep the rates below 3 kHz.**
- Follow Table 31. Take data with the SHMS and HMS simultaneously.
- Estimated run times are with 100% efficiency.

SHMS S2Y < 1M

Table 31: 20° EMC and 8° 2N-SRC Running - Setting 3

Target	I (μA)	HMS PS		SHMS PS		Est. Time	Target e^-	Done ?
		PS1	PS2	PS1	PS2			
LD2	60	-1	0	-1	5	10 min	670K	✓
LH2	60	-1	0	-1	3	20 min	670K	✓
Al dummy	40	-1	0	-1	0	10 min	110K	✓
9Be	60	-1	0	-1	4	20 min	670K	✓
40Ca	60	-1	0	-1	3	1.5 hrs	2.7M	✓
40Ca	60	0	-1	3	-1	5 min	-	✓
48Ca	40	-1	0	-1	2	2.5 hrs	2.7M	✓
12C	60	0	-1	3	-1	5 min	-	✓
12C	60	-1	0	-1	3	2.5 hrs	2.7M	✓
B4C-11	60	-1	0	-1	3	1 hr	1.3M	✓
B4C-10	60	-1	0	-1	3	70 min	1.3M	✓
Sn (Tin)	40	-1	0	-1	2	1 hr	670K	✓
Titanium	40	-1	0	-1	1	2 hrs	670K	✓
54Fe	40	-1	0	-1	1	70 min	670K	✓
108Ag	60	-1	0	-1	3	35 min	670K	✓
232Thorium	60	-1	0	-1	2	1 hr	670K	✓
58Ni	60	-1	0	-1	1	75 min	670K	✓
64Ni	60	-1	0	-1	1	75 min	670K	✓

30 50

↑ HMS counts

2.4.4 Setting 4

- Make sure **SHMS S1X (1-7)** and **S2X (1-7)** LEFT and RIGHT hodoscope paddles are **OFF**.
- Set **HMS momentum** to **-4.78 GeV**.
- **SHMS angle: 8°**
- **SHMS momentum: -9.2 GeV**
- **HMS angle: 20°**
- **Trigger**: SHMS/HMS PS2 (ELREAL) **OR** SHMS/HMS PS1 (3/4)
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 32 should be set to **-1**.
- **NOTE: Prescale values are only estimated, adjust them accordingly to keep the rates below 3 kHz.**
- Follow Table 32. Take data with the SHMS and HMS simultaneously.
- Estimated run times are with 100% efficiency.

Table 32: 20° EMC and 8° 2N-SRC Running - Setting 4

Target	I (μA)	HMS PS		SHMS PS		Est. Time	Target e^-	Done ?
		PS1	PS2	PS1	PS2			
64Ni	50	-1	0	-1	1	30 min	550K	✓
58Ni	60	-1	0	-1	1	30 min	550K	✓
232Thorium	60	-1	0	-1	2	20 min	550K	✓
108Ag	60	-1	0	-1	3	15 min	550K	✓
54Fe	40	-1	0	-1	1	25 min	550K	✓
Titanium	40	-1	0	-1	1	45 min	550K	✓
Sn (Tin)	40	-1	0	-1	2	20 min	550K	✓
B4C-10	60	-1	0	-1	3	25 min	1.1M	✓
B4C-11	60	-1	0	-1	3	20 min	1.1M	✓
12C	60	-1	0	-1	3	1 hr	2.2M	✓
12C	60	0	-1	3	-1	5 min	-	✓
48Ca	40	-1	0	-1	2	3 hrs	2.2M	✓ ← only took 1hr to get 2.2M e^-
40Ca	~~60~~ 55	-1	0	-1	3	2.5 hrs	2.2M	✓
40Ca	~~60~~ 55	0	-1	3	-1	5 min	-	✓
9Be	60	-1	0	-1	4	10 min	550K	✓
Al dummy	40	-1	0	-1	0	10 min	92K	✓
LH2	60	-1	0	-1	3	10 min	550K	✓
LD2	60	-1	1	-1	5	10 min	550K	✓

2.4.5 Setting 5

- Make sure **SHMS S1X (1-7)** and **S2X (1-7)** LEFT and RIGHT hodoscope paddles are **OFF**.
- Set **HMS momentum** to **-4.27 GeV**.
- **SHMS angle: 8°**
- **SHMS momentum: -9.2 GeV**
- **HMS angle: 20°**
- **Trigger**: SHMS/HMS PS2 (ELREAL) **OR** SHMS/HMS PS1 (3/4)
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 33 should be set to **-1**.
- **NOTE: Prescale values are only estimated, adjust them accordingly to keep the rates below 3 kHz.**
- Follow Table 33. Take data with the SHMS and HMS simultaneously.
- Estimated run times are with 100% efficiency.

Table 33: 20° EMC and 8° 2N-SRC Running - Setting 5

Target	***I***	**HMS PS**		**SHMS PS**		**Est. Time**	**Target e^-**	**Done ?**
	(μA)	PS1	PS2	PS1	PS2			
LD2	30~~00~~	-1	2	-1	5	10 min	320K	✓
LH2	50~~00~~	-1	1	-1	3	10 min	320K	✓
Al dummy	40	-1	0	-1	0	10 min	53K	✓
9Be	60	-1	1	-1	4	10 min	320K	✓
40Ca	60	-1	0	-1	3	20 min	1.2M	✓
40Ca	60	0	-1	3	-1	5 min	-	✓
48Ca	40	-1	0	-1	2	25 min	1.2M	✓
12C	60	-1	0	-1	3	25 min	1.2M	✓
12C	60	0	-1	3	-1	5 min	-	✓
B4C-11	60	-1	0	-1	3	10 min	650K	✓
B4C-10	60	-1	0	-1	3	10 min	650K	✓
Sn (Tin)	40	-1	0	-1	2	10 min	320K	✓
Titanium	40	-1	0	-1	1	20 min	320K	✓
54Fe	40	-1	0	-1	1	15 min	320K	✓
108Ag	60	-1	0	-1	3	10 min	320K	✓
232Thorium	60	-1	2	-1	0	10 min	320K	✓
58Ni	60	-1	0	-1	1	15 min	320K	✓
64Ni	~~60~~50	-1	0	-1	1	15 min	320K	✓

2.4.6 Setting 6

- Make sure **SHMS S1X (1-7)** and **S2X (1-7)** LEFT and RIGHT hodoscope paddles are **OFF**.
- Set **HMS momentum** to **-3.81 GeV**.
- **SHMS angle: 8°**
- **SHMS momentum: -9.2 GeV**
- **HMS angle: 20°**
- **Trigger**: SHMS/HMS PS2 (ELREAL) **OR** SHMS/HMS PS1 (3/4)
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 34 should be set to **-1**.
- **NOTE: Prescale values are only estimated, adjust them accordingly to keep the rates below 3 kHz.**
- Follow Table 34. Take data with the SHMS and HMS simultaneously.
- Estimated run times are with 100% efficiency.

Table 34: 20° EMC and 8° 2N-SRC Running - Setting 6

Target	I (μA)	HMS PS		SHMS PS		Est. Time	Target e^-	Done ?
		PS1	PS2	PS1	PS2			
64Ni	~~50~~ 60	-1	0	-1	1	10 min	220K	✓
58Ni	60	-1	0	-1	1	10 min	220K	✓
232Thorium	60	-1	0	-1	2	10 min	220K	✓
108Ag	60	-1	0	-1	3	10 min	220K	✓
54Fe	40	-1	0	-1	1	10 min	220K	✓
Titanium	40	-1	0	-1	1	10 min	220K	✓
Sn (Tin)	40	-1	0	-1	2	10 min	220K	✓
B4C-10	60	-1	0	-1	3	10 min	440K	✓
B4C-11	60	-1	0	-1	3	10 min	440K	✓
12C	60	-1	0	-1	3	15 min	880K	✓
12C	60	0	-1	3	-1	5 min	-	✓
48Ca	40	-1	0	-1	2	15 min	880K	✓
40Ca	60	-1	0	-1	3	20 min	880K	✓
40Ca	60	0	-1	3	-1	5 min	-	✓
9Be	60	-1	1	-1	4	10 min	220K	✓
Al dummy	40	-1	0	-1	0	10 min	35K	✓
LH2	~~50~~ 60	-1	1	-1	3	10 min	220K	✓
LD2	~~30~~ 60	-1	2	-1	5	10 min	220K	✓

Production runs should be at least 10 minutes!

2.4.7 Setting 7

- Make sure **SHMS S1X (1-7)** and **S2X (1-7)** LEFT and RIGHT hodoscope paddles are **OFF**.
- Set **HMS momentum** to **-3.40 GeV**.
- **SHMS angle: 8°**
- **SHMS momentum: -9.2 GeV**
- **HMS angle: 20°**
- **Trigger**: SHMS/HMS PS2 (ELREAL) **OR** SHMS/HMS PS1 (3/4)
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 35 should be set to **-1**.
- **NOTE: Prescale values are only estimated, adjust them accordingly to keep the rates below 3 kHz.**
- Follow Table 35. Take data with the SHMS and HMS simultaneously.
- Estimated run times are with 100% efficiency.

Table 35: 20° EMC and 8° 2N-SRC Running - Setting 7

Target	I (μA)	HMS PS		SHMS PS		Est. Time	Target e^-	Done ?
		PS1	PS2	PS1	PS2			
LD2	30 60	-1	3	-1	5	10 min	150K	✓
LH2	50 60	-1	2	-1	3	10 min	150K	✓
Al dummy	40	-1	1	-1	1	10 min	25K	✓
9Be	60	-1	2	-1	4	10 min	150K	✓
40Ca	60	-1	0	-1	3	20 min	600K	✓
40Ca	60	0	-1	3	-1	5 min	-	✓
48Ca	40	-1	0	-1	2	10 min	600K	✓
12C	60	-1	0	-1	3	20 min	600K	✓
12C	60	0	-1	3	-1	5 min	-	✓
B4C-11	60	-1	1	-1	3	10 min	300K	✓
B4C-10	60	-1	1	-1	3	10 min	300K	✓
Sn (Tin)	40	-1	0	-1	2	10 min	150K	✓
Titanium	40	-1	0	-1	1	10 min	150K	✓
54Fe	40	-1	0	-1	1	10 min	150K	✓
108Ag	60	-1	1	-1	3	10 min	150K	✓
232Thorium	60	-1	0	-1	2	10 min	150K	✓
58Ni	60	-1	0	-1	1	10 min	150K	✓
64Ni	50 60	-1	0	-1	1	10 min	150K	✓

Only 3.5 minutes of Beam!

Production runs should be at least 10 minutes long. Even if you have enough statistics! DG

2.4.8

- **Trigger**: SHMS/HMS PS2 (ELREAL) **OR** SHMS/HMS PS1 (3/4)
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 36 should be set to **-1**.
- **NOTE: Prescale values are only estimated, adjust them accordingly to keep the rates below ~~3 kHz.~~** 4 kHz
- Follow Table 36. Take data with the SHMS and HMS simultaneously.
- Estimated run times are with 100% efficiency.

Table 36: 20° EMC and 8° 2N-SRC Running - Setting 8

Target	***I***	**HMS PS**		**SHMS PS**		**Est. Time**	**Target e^-**	**Done ?**
	(μA)	PS1	PS2	PS1	PS2			
64Ni	~~60~~ 50	-1	0	-1	1	10 min	120K	✓
58Ni	~~60~~ 50	-1	0	-1	1	10 min	120K	✓
232Thorium	60	-1	1	-1	2	10 min	120K	✓
108Ag	60	-1	1	-1	3	10 min	120K	✓
54Fe	40	-1	0	-1	1	10 min	120K	✓
Titanium	40	-1	0	-1	1	10 min	120K	✓
Sn (Tin)	40	-1	1	-1	2	10 min	120K	✓
B4C-10	60	-1	2	-1	3	10 min	250K	✓
B4C-11	60	-1	2	-1	3	10 min	250K	✓
12C	60	0	-1	3	-1	5 min	-	✓
12C	60	-1	0	-1	3	15 min	500K	✓
48Ca	40	-1	1	-1	2	25 min	500K	✓
40Ca	60	-1	3	-1	3	25 min	500K	✓
40Ca	60	3	-1	3	-1	5 min	-	
9Be	60	-1	1	-1	4	15 min	~~120~~ 40K	✓
Al dummy	40	-1	1	-1	1	10 min	20K	✓
LH2	~~60~~ 50	-1	3	-1	3	10 min	120K	✓
LD2	~~60~~ 30	-1	0	-1	5	10 min	120K	✓

2.4.9 Setting 9

- Make sure **SHMS S1X (1-6)** and **S2X (1-6)** LEFT and RIGHT hodoscope paddles are **OFF**.
- Set **HMS momentum** to **-2.71 GeV**.
- **SHMS angle: 8°**
- **SHMS momentum: -9.2 GeV**
- **HMS angle: 20°**
- **Trigger**: SHMS/HMS PS2 (ELREAL) **OR** SHMS/HMS PS1 (3/4)
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 37 should be set to **-1**.
- **NOTE: Prescale values are only estimated, adjust them accordingly to keep the rates below 3 kHz.**
- Follow Table 37. Take data with the SHMS and HMS simultaneously.
- Estimated run times are with 100% efficiency.

Table 37: 20° EMC and 8° 2N-SRC Running - Setting 9

Target	I (μA)	HMS PS		SHMS PS		Est. Time	Target e^-	Done ?
		PS1	PS2	PS1	PS2			
LD2	60	-1	4	-1	5	10 min	90K	✓
LH2	60	-1	4	-1	3	10 min	90K	✓
Al dummy	40	-1	1	-1	1	10 min	15K	✓
9Be	60	-1	3	-1	4	10 min	90K	✓
40Ca	60	-1	3	-1	3	20 min	360K	✓
40Ca	60	3	-1	3	-1	5 min	-	✓
48Ca	40	-1	2	-1	2	15 min	360K	
12C	60	-1	2	-1	3	15 min	360K	
12C	60	2	-1	3	-1	5 min	-	
B4C-11	60	-1	3	-1	3	10 min	180K	
B4C-10	60	-1	3	-1	3	10 min	180K	
Sn (Tin)	40	-1	2	-1	2	10 min	90K	
Titanium	40	-1	0	-1	1	10 min	90K	
54Fe	40	-1	1	-1	1	10 min	90K	
108Ag	60	-1	3	-1	3	10 min	90K	
232Thorium	60	-1	2	-1	2	10 min	90K	
58Ni	60	-1	1	-1	1	10 min	90K	
64Ni	60	-1	1	-1	1	10 min	90K	

S1X (1-6) S2X (1-6) SHMS REDO WITH S1X (1-6 S2X (1-6 OFF

TURN S1X 7 (R/L) S2X 7 (R/L)
BACK OFF!

2.4.10 Setting 10

- Make sure **SHMS S1X (1-7)** and **S2X (1-7)** LEFT and RIGHT hodoscope paddles are **OFF**.
- Set **HMS momentum** to **-2.42 GeV**.
- **SHMS angle: 8°**
- **SHMS momentum: -9.2 GeV**
- **HMS angle: 20°**
- **Trigger**: SHMS/HMS PS2 (ELREAL) **OR** SHMS/HMS PS1 (3/4)
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 38 should be set to **-1**.
- **NOTE: Prescale values are only estimated, adjust them accordingly to keep the rates below 3 kHz.**
- Follow Table 38. Take data with the SHMS and HMS simultaneously.
- Estimated run times are with 100% efficiency.

Table 38: 20° EMC and 8° 2N-SRC Running - Setting 10

Target	I (μA)	HMS PS PS1	HMS PS PS2	SHMS PS PS1	SHMS PS PS2	Est. Time	Target e^-	Done ?
64Ni	50 ~~60~~	-1	2	-1	1	10 min	75K	✓
64Ni	50 ~~60~~	2	-1	1	-1	5 min	-	✓
58Ni	60	2	-1	1	-1	5 min	-	✓
58Ni	60	-1	2	-1	1	10 min	75K	✓
232Thorium	60	-1	2	-1	2	10 min	75K	✓
232Thorium	60	2	-1	2	-1	5 min	-	✓
108Ag	60	3	-1	3	-1	5 min	-	✓
108Ag	60	-1	3	-1	3	10 min	75K	✓
54Fe	40	-1	1	-1	1	10 min	75K	✓
54Fe	40	1	-1	1	-1	5 min	-	✓
Titanium	40	1	-1	1	-1	5 min	-	✓
Titanium	40	-1	1	-1	1	10 min	75K	✓
Sn (Tin)	40	-1	2	-1	2	10 min	75K	✓
Sn (Tin)	40	2	-1	2	-1	5 min	-	✓
B4C-10	60	3	-1	3	-1	5 min	-	✓
B4C-10	60	-1	3	-1	3	10 min	150K	✓
B4C-11	60	-1	3	-1	3	10 min	150K	✓
B4C-11	60	3	-1	3	-1	5 min	-	✓
12C	60	3	-1	3	-1	5 min	-	✓
12C	60	-1	3	-1	3	20 min	300K	✓
48Ca	40	-1	3	-1	2	20 min	300K	✓
48Ca	40	3	-1	2	-1	5 min	-	✓
40Ca	60	4	-1	3	-1	5 min	-	✓
40Ca	60	-1	4	-1	3	25 min	300K	✓
9Be	60	-1	4	-1	4	10 min	75K	✓
9Be	60	4	-1	4	-1	5 min	-	✓
Al dummy	40	2	-1	2	-1	5 min	-	✓
Al dummy	40	-1	2	-1	2	10 min	12K	✓
LH2	50 60	4	-1	3	-1	5 min	-	✓
LH2	50 60	-1	4	-1	3	10 min	75K	✓
LD2	30 60	-1	5	-1	5	10 min	75K	
LD2	30 60	5	-1	5	-1	5 min	-	✓

2.4.11 Setting 2 - PART TWO!!!

- Make sure **SHMS S1X (1-7)** and **S2X (1-7)** LEFT and RIGHT hodoscope paddles are **OFF**.
- Set **HMS momentum** to **-5.878 GeV** (Need to cycle HMS magnets).
- **SHMS angle: 8°**
- **SHMS momentum: -9.2 GeV**
- **HMS angle: 20°**
- **Trigger**: SHMS/HMS PS2 (ELREAL)
- **CERMODE10**: OFF for SHMS, ON for HMS
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 39 should be set to **-1**.
- **NOTE: Prescale values are only estimated, adjust them accordingly to keep the rates below 3 kHz.**
- Follow Table 39. Take data with the SHMS and HMS simultaneously.
- Estimated run times are with 100% efficiency.

Goal is to make best use of time before 8am RF recovery. Priorities are:

1. Complete extra 9Be, 108Ag data taking (~2 hours)
2. Want to complete rate dependence scan on at least one target; can reduce events slightly if needed to fit in all beam currents in the available time
3. If rate scans completed on 40Ca and LD2, take quick (2 minute) FADC-MODE10 run and then spend the remainder of the shift on LD2 (plus a bit of LH2 and Dummy)

Table 39: 20° EMC and 8° 2N-SRC Running - Setting 2 - PART TWO!!! CAN START SHMS DATA TAKING ON 9BE BEFORE SETTING HMS MAGNET.

Target	I (μA)	HMS PS PS1	HMS PS PS2	SHMS PS PS1	SHMS PS PS2	Est. Time	SHMS Target e^-	Done ?
Extra SHMS data (Target = "Extrapolated e-" from run sheets)								
9Be	50	-1	0	-1	4	60 min	75K	67K
108Ag	50	-1	0	-1	3	20 min	30K	
Rate dependence studies: (Target e- is SHMS Triggers) Try for 55uA on 9Be even if trip rate slightly higher Can shorten slightly (1.5M triggers) if needed to finish one (or both) target scans								
9Be	15	-1	0	-1	2	10 min	2M	
9Be	30	-1	0	-1	2	10 min	2M	
9Be	45	-1	0	-1	3	10 min	2M	
9Be	55	-1	0	-1	3	10 min	2M	
LD2	45	-1	0	-1	3	10 min	2M	
LD2	30	-1	0	-1	3	10 min	2M	
LD2	15	-1	0	-1	2	10 min	2M	
Turn FADCMODE10 ON for both HMS and SHMS								
LD2	50	-1	0	-1	3	2 min	N/A	
Turn FADCMODE10 OFF for both HMS and SHMS								
Extra SHMS data								
LD2	30	-1	0	-1	3	60 min	N/A	
LH2	50	-1	0	-1	1	10 min	N/A	
Al dummy	40	-1	0	-1	0	10 min	N/A	
Repeat cycle or scale up (down) run times above to try and end at 8am								
LD2	30	-1	0	-1	3	60 min	N/A	
LH2	50	-1	0	-1	1	10 min	N/A	
Al dummy	40	-1	0	-1	0	10 min	N/A	

Not done → time for RF recovery!

BEFORE MOVING ON TO THE NEXT SECTION TURN ALL OF THE HODOSCOPE HV CHANNELS BACK ON!

BEFORE MOVING ON TO THE NEXT SECTION TURN ALL OF THE HODOSCOPE HV CHANNELS BACK ON!

BEFORE MOVING ON TO THE NEXT SECTION TURN ALL OF THE HODOSCOPE HV CHANNELS BACK ON!

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BEFORE MOVING ON TO THE NEXT SECTION TURN ALL OF THE HODOSCOPE HV CHANNELS BACK ON!

2.6 Charge Symmetric Background Studies at 10°/35° - Part I

TURN ALL SHMS HODOSCOPE CHANNELS BACK ON
TURN ALL SHMS HODOSCOPE CHANNELS BACK ON
TURN ALL SHMS HODOSCOPE CHANNELS BACK ON

- All data in this section will be taken with the **PROTON** polarity.
- After the first three runs, all data will be taken with SHMS HV TURNED OFF for S1X paddles 1-5 and S2X paddles 1-6

2.6.1 Setting 1

- Set **HMS momentum** to **+2.40 GeV**.
- **SHMS angle: 10°**
- **SHMS momentum: +9.2 GeV**
- **HMS angle: 35°**
- **Trigger**: SHMS/HMS PS3 (ELCLEAN) **OR** SHMS/HMS PS1 (3/4)
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 40 and Table 41 should be set to **-1**.
- **Prescale values are only estimated; adjust them on both SHMS and HMS Prescale GUIs accordingly to keep the rates below 4 kHz.**
- Take data with the SHMS and HMS simultaneously.

Table 40: CSB kinematics; quick comparison of acceptance vs. disabled SHMS S1X and S2X paddles. HMS runs not needed for these three runs

Setting	HV off		SHMS PS		Target	I	Est. Time	Done ?
	S1X	S2X	PS1	PS2		(μA)		
1	none	none	0	-1	LD2	60	10 min	
	1-4	1-5	0	-1	LD2	60	10 min	
	1-5	1-6	0	-1	LD2	60	10 min	

Table 41: CSB Studies at 35° - Setting 1 SHMS S1X(1-5) and S2X(1-6) HV TURNED OFF

Target	I	**HMS PS**			**SHMS PS**			**Est. Time**	Done ?
	(μA)	PS1	PS2	PS3	PS1	PS2	PS3		
LD2	60	-1	-1	0	-1	-1	0	10 min	
LD2	60	0	-1	-1	0	-1	-1	5 min	
40Ca	60	0	-1	-1	0	-1	-1	5 min	
40Ca	60	-1	-1	0	-1	-1	0	10 min	
12C	60	-1	-1	0	-1	-1	0	10 min	
12C	60	0	-1	-1	0	-1	-1	5 min	

2.6.2 Setting 2

- Set **HMS momentum** to **+2.11 GeV**.
- **SHMS angle: 10°**
- **SHMS momentum: +9.2 GeV**
- **HMS angle: 35°**
- **Trigger**: SHMS/HMS PS3 (ELCLEAN) **OR** SHMS/HMS PS1 (3/4)
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 42 should be set to **-1**.
- **Prescale values are only estimated; adjust them on both SHMS and HMS Prescale GUIs accordingly to keep the rates below 4 kHz.**
- Take data with the SHMS and HMS simultaneously.

Table 42: CSB Studies at 35° - Setting 2 SHMS S1X(1-5) and S2X(1-6) HV TURNED OFF

Target	I (μA)	**HMS PS**			**SHMS PS**			**Est. Time**	Done ?
		PS1	PS2	PS3	PS1	PS2	PS3		
12C	60	0	-1	-1	0	-1	-1	5 min	✓
12C	60	-1	-1	0	-1	-1	0	15 min	✓
40Ca	~~60~~ 50	-1	-1	0	-1	-1	0	15 min	✓
40Ca	~~60~~ 50	0	-1	-1	0	-1	-1	5 min	✓
LD2	~~60~~ 50	0	-1	-1	0	-1	-1	5 min	✓
LD2	~~60~~ 50	-1	-1	0	-1	-1	0	15 min	✓

2.6.3 Setting 3

- Set **HMS momentum** to **+1.86 GeV**.
- **SHMS angle: 10°**
- **SHMS momentum: +9.2 GeV**
- **HMS angle: 35°**
- **Trigger**: SHMS/HMS PS3 (ELCLEAN) **OR** SHMS/HMS PS1 (3/4)
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 43 should be set to **-1**.
- **Prescale values are only estimated; adjust them on both SHMS and HMS Prescale GUIs accordingly to keep the rates below 4 kHz.**
- Take data with the SHMS and HMS simultaneously.

Table 43: CSB Studies at 35° - Setting 3 SHMS S1X(1-5) and S2X(1-6) HV TURNED OFF

Target	I	HMS PS			SHMS PS			Est. Time	Done ?
	(μA)	PS1	PS2	PS3	PS1	PS2	PS3		
LD2	60	-1	-1	0	-1	-1	0	10 min	✓
LD2	60	0	-1	-1	0	-1	-1	5 min	✓
LH2	60	0	-1	-1	0	-1	-1	5 min	✓
LH2	60	-1	-1	0	-1	-1	0	10 min	✓
Al dummy	40	-1	-1	0	-1	-1	0	10 min	✓
Al dummy	40	0	-1	-1	0	-1	-1	5 min	✓
40Ca	60	-1	-1	0	-1	-1	0	15 min	✓
40Ca	60	0	-1	-1	0	-1	-1	5 min	✓
12C	60	0	-1	-1	0	-1	-1	5 min	✓
12C	60	-1	-1	0	-1	-1	0	10 min	✓

2.6.4 Setting 4

- Set **HMS momentum** to **+1.63 GeV**.
- **SHMS angle: 10°**
- **SHMS momentum: +9.2 GeV**
- **HMS angle: 35°**
- **Trigger**: SHMS/HMS PS3 (ELCLEAN) **OR** SHMS/HMS PS1 (3/4)
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 44 should be set to **-1**.
- **Prescale values are only estimated; adjust them on both SHMS and HMS Prescale GUIs accordingly to keep the rates below 4 kHz.**
- Take data with the SHMS and HMS simultaneously.

Table 44: CSB Studies at 35° - Setting 4 SHMS S1X(1-5) and S2X(1-6) HV TURNED OFF

Target	***I***	**HMS PS**			**SHMS PS**			**Est. Time**	Done ?
	(μA)	PS1	PS2	PS3	PS1	PS2	PS3		
12C	60	-1	-1	0	-1	-1	0	10 min	✓
12C	60	0	-1	-1	0	-1	-1	15 min	✓
40Ca	60	0	-1	-1	0	-1	-1	5 min	✓
40Ca	60	-1	-1	0	-1	-1	0	20 min	✓
Al dummy	40	-1	-1	0	-1	-1	0	10 min	✓
Al dummy	40	0	-1	-1	0	-1	-1	5 min	✓
LH2	60	-1	-1	0	-1	-1	0	15 min	✓
LH2	60	0	-1	-1	0	-1	-1	5 min	✓
LD2	60	0	-1	-1	0	-1	-1	5 min	✓
LD2	60	-1	-1	0	-1	-1	0	15 min	✓

2.6.5 Setting 5

- Set **HMS momentum** to **+1.44 GeV**.
- **SHMS angle: 10°**
- **SHMS momentum: +9.2 GeV**
- **HMS angle: 35°**
- **Trigger**: SHMS/HMS PS3 (ELCLEAN) **OR** SHMS/HMS PS1 (3/4)
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 43 should be set to **-1**.
- **Prescale values are only estimated; adjust them on both SHMS and HMS Prescale GUIs accordingly to keep the rates below 4 kHz.**
- Take data with the SHMS and HMS simultaneously.

Table 45: CSB Studies at 35° - Setting 5 SHMS S1X(1-5) and S2X(1-6) HV TURNED OFF

Target	I	HMS PS			SHMS PS			Est. Time	Done ?
	(μA)	PS1	PS2	PS3	PS1	PS2	PS3		
LD2	60	-1	-1	0	-1	-1	0	20 min	✓
LD2	60	0	-1	-1	0	-1	-1	5 min	✓
LH2	60	0	-1	-1	0	-1	-1	5 min	✓
LH2	60	-1	-1	0	-1	-1	0	20 min	✓
Al dummy	40	-1	-1	0	-1	-1	0	15 min	✓
Al dummy	40	0	-1	-1	0	-1	-1	5 min	✓
40Ca	60	-1	-1	0	-1	-1	0	20 min	✓
40Ca	60	0	-1	-1	0	-1	-1	5 min	✓
12C	60	0	-1	-1	0	-1	-1	5 min	✓
12C	60	-1	-1	0	-1	-1	0	20 min	✓

2.6.6 Setting 6

- Set **HMS momentum** to **+1.26 GeV**.
- **SHMS angle: 10°**
- **SHMS momentum: +9.2 GeV**
- **HMS angle: 35°**
- **Trigger**: SHMS/HMS PS3 (ELCLEAN) **OR** SHMS/HMS PS1 (3/4)
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 46 should be set to **-1**.
- **Prescale values are only estimated; adjust them on both SHMS and HMS Prescale GUIs accordingly to keep the rates below 4 kHz.**
- Take data with the SHMS and HMS simultaneously.

Table 46: CSB Studies at 35° - Setting 6 SHMS S1X(1-5) and S2X(1-6) HV TURNED OFF

Target	I (μA)	HMS PS			SHMS PS			Est. Time	Done ?
		PS1	PS2	PS3	PS1	PS2	PS3		
12C	~~60~~55	-1	-1	0	-1	-1	0	15 min	✓
12C	~~60~~55	0	-1	-1	0	-1	-1	5 min	✓
40Ca	~~60~~55	0	-1	-1	0	-1	-1	5 min	✓
40Ca	~~60~~55	-1	-1	0	-1	-1	0	15 min	✓
Al dummy	40	0	-1	-1	0	-1	-1	5 min	✓
Al dummy	40	-1	-1	0	-1	-1	0	15 min	✓
LH2	60	-1	-1	0	-1	-1	0	10 min	✓
LH2	60	0	-1	-1	0	-1	-1	5 min	✓
LD2	60	0	-1	-1	0	-1	-1	5 min	✓
LD2	60	-1	-1	0	-1	-1	0	15 min	✓

- Total estimated time for section including the momentum and target changes: **14 hrs**. Estimated run times are with 100% efficiency.
- JRA note: since then we removed a few targets and increased several run times; total should still be very similar to the 14 hour estimate

3.6 SHMS Hodoscope Paddle Test

At the 10 degree SHMS settings, we will run with all hodoscopes, and then with four different subsets turned off to check the acceptance.

JRA: No HMS plan for this setting; maybe we can squeeze in some parasitic PID checks or something if experts are around...

3.6.1 Setting 1

- **DAQ:** Single Arm, SHMS only
- **SHMS Settings:** -9.2 GeV & 10°
- **Target:** LD2 or 12C
- **Trigger**: SHMS PS2 (ELREAL) **OR** SHMS PS1 (3/4)
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 52 should be set to **-1**.
- Adjust the prescales on **EACH** prescale GUI to keep the rates below 4-5 kHz.
- Estimated run times are with 100% efficiency.
- Follow Table 52

Table 52: SHMS acceptance test with some upper hodoscopes turned off at 10°

Setting	HV off		SHMS PS		Target	I	Est. Time	Done ?
	S1X	S2X	PS1	PS2		(μA)		
1	none	none	-1	0	LD2	60	10 min	✓
	none	none	0	-1	LD2	60	10 min	✓
	1-4	1-5	0	-1	LD2	60	10 min	✓
	1-4	1-5	-1	0	LD2	60	10 min	✓
	1-4	1-5	-1	0	12C	60	10 min	✓
	1-5	1-6	-1	0	12C	60	10 min	✓
	1-5	1-6	-1	0	LD2	60	10 min	✓
	1-5	1-6	0	-1	LD2	60	10 min	✓
	1-6	1-6	0	-1	LD2	60	10 min	✓
	1-5	1-7	0	-1	LD2	60	10 min	✓
	1-6	1-7	0	-1	LD2	60	10 min	✓

BEFORE MOVING ON TO THE NEXT SECTION MAKE SURE CORRECT SHMS PADDLES ARE ON (PROBABLY 1-5 OFF IN S1X, 1-6 IN S2X, IF WE'RE GOING TO MAIN 35/10 DATA TAKING!

3.7 SHMS Hodoscope Paddle Test SETTING #2

3.7.1 Setting 1

- **DAQ:** Single Arm, SHMS only
- **SHMS Settings:** 8.8 GeV & 10°
- **Target:** LD2
- **Trigger**: SHMS PS2 (ELREAL) **OR** SHMS PS3 (ELCLEAN)
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 53 should be set to **-1**.
- Adjust the prescales on **EACH** prescale GUI to keep the rates below 4-5 kHz.
- Estimated run times are with 100% efficiency.
- Follow Table 53
- Please record PS3 rate before prescale - "SHMS pTRIG3" scalar from TV - on the run sheet

Table 53: SHMS acceptance test with some upper hodoscopes turned off at 10°

Setting	**HV off**		**SHMS PS**			**Target**	***I***	**Time**	**Done ?**
1	S1X	S2X	PS1	PS2	PS3		(μA)		
ELREAL	1-7	1-7	-1	0	-1	LD2	50	5-10 min	✓
ELCLEAN	1-7	1-7	-1	-1	0	LD2	50	5-10 min	✓
ELCLEAN	1-7	1-8	-1	-1	0	LD2	50	5-10 min	✓
ELCLEAN	1-8	1-7	-1	-1	0	LD2	50	5-10 min	✓
ELCLEAN	1-8	1-8	-1	-1	0	LD2	50	5-10 min	✓
ELREAL	1-8	1-8	-1	0	-1	LD2	50	5-10 min	✓
ELCLEAN	1-8	1-9	-1	-1	0	LD2	50	5-10 min	✓
ELCLEAN	1-9	1-8	-1	-1	0	LD2	50	5-10 min	✓
ELCLEAN	1-9	1-9	-1	-1	0	LD2	50	5-10 min	✓

BEFORE MOVING BACK TO PRODUCTION RUNNING, SET THE SHMS MOMENTUM BACK TO -9.2 GeV

BEFORE MOVING ON TO THE NEXT SECTION MAKE SURE CORRECT SHMS PADDLES ARE ON (1-5 OFF IN S1X, 1-6 IN S2X)

TRY TO DO FULL REPLAYS FOR THESE RUNS OR ASK DAVE GASKELL TO MAKE SURE THEY GET FINISHED ON OWL SHIFT

Done 10/30/22
Swing Shift

3.7 SHMS 10 deg and HMS 35 deg - Target Ladder I

- In this section, we will take data with the SHMS and HMS simultaneously in the single arm mode using a subset of targets on the target ladder I.
- While the SHMS and HMS angles will be kept fixed (at different values), the HMS will be configured to several different momentum settings. Please follow the tables below in the order written.
- Set **SHMS momentum** to **-9.2 GeV**.
- Set **HMS momentum** to **-4.08 GeV**.
- Set **SHMS angle: 10°**
- Set **HMS angle: 35°**
- SHMS should have HV for S1X paddles 1-5 and S2X paddles 1-6 TURNED OFF for all settings
- Estimated run times are with 100% efficiency.

Done

3.8.2 Setting 1 - SPECIAL TESTS

Test runs to be performed with the SHMS while continuing with normal HMS data taking on setting 1. This can be done for any run except LH2 or the two short ELREAL settings

- ALL runs use ELCLEAN
- ALL runs have HV OFF for S1X channels 1-5 and S2X 1-6
- Preshower changes done with the HV GUI
- Changing 3/4 to 4/4 requires changing trigger module

Goal is to take 6 short runs; please note the pTRIG3 rate from the scalars on the runsheet when beam is at maximum current. A table with pTRIG3 rates vs. configuration should be entered in the ELOG.

✓ 1. 10 minute run in the default SHMS configuration (ELCLEAN, S1X 1-5 and S2X 1-6 HV OFF)

✓ 2. 10 minute run with PRESHOWER blocks 1-5 (left and right) turned off

✓ 3. 10 minute run with PRESHOWER blocks 1-6 (left and right) turned off

✓ 4. 10 minute run - ELCLEAN with 3/4 changed to 4/4, and PRESHOWER 1-6 (left and right) still turned off

✓ 5. 10 minute run - ELCLEAN with 3/4 still set to 4/4, all preshower blocks ON

✓ 6. 10 minute run - ELCLEAN back to 3/4, all preshower ON (duplicate of first run)

SHMS HV off for: S1X, 1-5
S2X, 1-6

3.7.1 Setting 1

- Set **HMS momentum** to **-4.08 GeV**.
- **SHMS momentum: -9.2 GeV**.
- **SHMS angle: 10°** **HMS angle: 35°**
- **Trigger**: SHMS/HMS PS2 (ELREAL) **OR** SHMS/HMS PS1 (3/4)
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 53 should be set to **-1**.
- **Prescale values are only estimated; adjust them on both SHMS and HMS Prescale GUIs accordingly to keep the rates below 4 kHz.**
- Follow Table 53. Take data with the SHMS and HMS simultaneously.
- Estimated run times are with 100% efficiency.

SHMS in ELCLEAN mainly

Table 53: High-Q^2 EMC (and scaling studies) at 35° - Setting 1

Target	I (μA)	HMS PS PS1	HMS PS PS2	SHMS PS PS1 (2)	SHMS PS PS2 (3)	Est. Time	Target e^-	Done ?
LD2	60	-1	0	-1	0	10 hrs	2100	only 3 hours, 242 events
LH2	60	-1	0	-1	0	0.5 hr	~~100~~	✓
Al dummy	40	-1	0	-1	0	2.5 hrs	~~400~~	✓
40Ca	60	-1	0	-1	0	5 hrs	1000	✓ → need 1 more hour
40Ca	60	0	-1	0	-1	30 min	-	✓
→ 12C	60	0	-1	0	-1	30 min	-	✓
12C	60	-1	0	-1	0	10 hrs	700	✓ 720 e⁻ (~10.25 Hrs)
40Ca	60	-1	0	-1	0	5 hrs	1000	✓
Al dummy	40	-1	0	-1	0	2.5 hrs	~~400~~	
LH2	60	-1	0	-1	0	0.5 hrs	~~100~~	
LD2	60	-1	0	-1	0	10 hrs	2100	

Done

see next page

HMS

Go back to Deuterium once beam comes back

Stop at 120% of Estimated time (100% efficiency) if still short of Target e⁻

3.8.1 Setting 1 - part 1 (SHMS: ELCLEAN, some paddles off, all preshower ON)

- Set **HMS momentum** to **-4.08 GeV**.
- **SHMS momentum: -9.2 GeV**.
- **SHMS angle: 10°** **HMS angle: 35°**
- **Trigger**: HMS is PS2(ELREAL) or PS1(3/4); SHMS is PS3(ELCLEAN) or PS2(ELREAL)
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 54 should be set to **-1**.
- **Prescale values are only estimated; adjust them on both SHMS and HMS Prescale GUIs accordingly to keep the rates below 5 kHz.**
- Follow Table 54. Take data with the SHMS and HMS simultaneously.
- SHMS should have HV for S1X paddles 1-5 and S2X paddles 1-6 TURNED OFF for all settings
- Estimated run times are with 100% efficiency. FOR THIS SETTING, STOP AT 120% OF THE ESTIMATED TIME, EVEN IF THE TARGET ELECTRON NUMBER IS NOT YET REACHED.

Table 54: High-Q^2 EMC (and scaling studies) at 35° - Setting 1

Target	***I***	**HMS PS**		**SHMS PS**		**Est. Time**	**Target e^-**	**Done ?**
	(μA)	PS1	PS2	PS2	PS3			
LD2	60	-1	0	-1	0	7 hrs	1400	yes
LH2	60	-1	0	-1	0	0.5 hr	-	yes
Al dummy	40	-1	0	-1	0	2.5 hrs	-	yes
40Ca	60	-1	0	-1	0	5 hrs	1000	yes
40Ca	60	0	-1	0	-1	30 min	-	yes
12C	60	0	-1	0	-1	30 min	-	yes
12C	60	-1	0	-1	0	10 hrs	700	yes

↑ HMS

11/1/22

3 Target Boiling Studies - Part I

TURN ALL SHMS HODOSCOPE CHANNELS BACK ON
TURN ALL SHMS HODOSCOPE CHANNELS BACK ON
TURN ALL SHMS HODOSCOPE CHANNELS BACK ON

- This study requires stable high current. It will be postponed if high current beam is unavailable at the moment.
- **DAQ:** Single Arm
- **SHMS/HMS Trigger:** PS2 (ELREAL)/PS2 (ELREAL)
- **SHMS Settings:** -4.0 GeV & 20°
- **HMS Settings:** -4.0 GeV & 20°
- Adjust the prescales (SHMS PS2 and HMS PS2) to keep the rates below 4 kHz. All the other prescales should be set to **-1**.
- The goal number of events is 50K-100K for each target at every current.

3.1 Boiling studies - LD2 target

- Move target to LD2 and take one run with each current setting.

Table 47: Boiling Studies - LD2 Target

Target	I (μA)	est. time	Done ?
LD2	60 μA	10 min	✓
LD2	40 μA	10 min	✓
LD2	30 μA	10 min	✓
LD2	20 μA	10 min	✓
LD2	10 μA	10 min	✓

3.2 Boiling studies - LH2 target

- Move target to LH2 and take one run with **each current setting.**

Table 48: Boiling Studies - LH2 Target

Target	I (μA)	est. time	Done ?
LH2	60 μA	10 min	✓
LH2	40 μA	10 min	✓
LH2	30 μA	10 min	✓
LH2	20 μA	10 min	✓
LH2	10 μA	10 min	✓

3.3 Boiling Studies - Al dummy target

- Move target to Al dummy and take one run with each current setting.

Table 49: Boiling Studies - Al dummy target

Target	I (μA)	est. time	Done ?
dummy	40 μA	10 min	✓
dummy	30 μA	10 min	✓
dummy	20 μA	10 min	✓
dummy	10 μA	10 min	✓

3.4 Boiling studies - Beryllium target

- Move target to Beryllium and take one run with each current setting.

Table 50: Boiling Studies - Beryllium Target

Target	I (μA)	est. time	Done ?
Beryllium	60 μA	10 min	✓
Beryllium	40 μA	10 min	✓
Beryllium	30 μA	10 min	✓
Beryllium	20 μA	10 min	✓
Beryllium	10 μA	10 min	✓

3.5 Boiling studies - Carbon target

- Move target to Carbon and take one run with each current setting.

Table 51: Boiling Studies - Carbon Target

Target	I (μA)	**est. time**	**Done ?**
Carbon	60 μA	10 min	✓
Carbon	40 μA	10 min	✓
Carbon	30 μA	10 min	✓
Carbon	20 μA	10 min	✓
Carbon	10 μA	10 min	✓

Total estimated time for section 1.5 including the momentum and target changes: **7 hrs** with 100% efficiency.

3.8.2 Setting 1 - part 2 (SHMS: ELCLEAN, some paddles off, some preshower off)

- **HMS momentum: -4.08 GeV.**
- **SHMS momentum: -9.2 GeV.**
- **SHMS angle: 10°** **HMS angle: 35°**
- **Trigger**: HMS is PS2(ELREAL) or PS1(3/4); SHMS is PS3(ELCLEAN) or PS2(ELREAL)
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 55 should be set to **-1**.
- **Prescale values are only estimated; adjust them on both SHMS and HMS Prescale GUIs accordingly to keep the rates below 8 kHz.**
- Follow Table 55. Take data with the SHMS and HMS simultaneously.
- SHMS should have HV for S1X paddles 1-5 and S2X paddles 1-6 TURNED OFF for all settings
- Turn off HV for SHMS Preshower blocks 1-6 (both positive and negative channels)
- Estimated run times are with 100% efficiency. FOR THIS SETTING, STOP AT 120% OF THE ESTIMATED TIME, EVEN IF THE TARGET ELECTRON NUMBER IS NOT YET REACHED.

Table 55: High-Q^2 EMC (and scaling studies) at 35° - Setting 1

Target	I (μA)	HMS PS PS1	HMS PS PS2	SHMS PS PS2	SHMS PS PS3	Est. Time	Target e^-	Done ?
LD2	60	-1	0	-1	0	~~10~~ 15 hrs	~~2700~~	✓
LH2	60	-1	0	-1	0	0.5 hr	-	✓
Al dummy	40	-1	0	-1	0	2.5 hrs	-	✓
40Ca	60	-1	0	-1	0	5 hrs	1000	✓
40Ca	60	0	-1	0	-1	20 min	-	✓
12C	60	0	-1	0	-1	20 min	-	✓
12C	60	-1	0	-1	0	2 hrs	700	✓

3.8.4 Setting 2

- Set **HMS momentum to -3.57 GeV.**
- **SHMS momentum: -9.2 GeV.**
- **SHMS angle: 10°** **HMS angle: 35°**
- **Trigger**: HMS is PS2(ELREAL) or PS1(3/4); SHMS is PS3(ELCLEAN) or PS2(ELREAL)
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 56 should be set to **-1**.
- Prescale values are only estimated; Use the lowest prescale values that keep the trigger rate in the **HMS near or below 4 kHz** and the **SHMS near or below 8kHz**
- SHMS should have HV for S1X paddles 1-5, S2X paddles 1-6, and preshower blocks 1-6 (+ and -) TURNED OFF for all settings
- Follow Table 56. Take data with the SHMS and HMS simultaneously.
- Estimated run times are with 100% efficiency.

Table 56: High-Q^2 EMC (and scaling studies) at 35° - Setting 2

Target	I (μA)	HMS PS PS1	HMS PS PS2	SHMS PS PS2	SHMS PS PS3	Est. Time	Target e^-	Done ?
LD2	60	-1	0	-1	0	3 ~~2~~ hrs	12k	✓ (10.8k) e^-
LH2	60	-1	0	-1	0	3 ~~1~~ hr	5.5k	✓
Al dummy	40	-1	0	-1	0	1 ~~0.5~~ hrs	2k	✓
9Be	60	-1	0	-1	0	~~4~~ hrs	16k	✓
40Ca	60	-1	0	-1	0	~~5~~ hrs	16k	✓
40Ca	60	0	-1	0	-1	20 min	-	✓
12C	60	0	-1	0	-1	20 min	-	✓
12C	60	-1	0	-1	0	5 hrs	10k	✓
LD2	60	-1	0	-1	0	3 2 hrs	12k	✓
LH2	60	-1	0	-1	0	1 hr	5.5k	1.2K
Al dummy	40	-1	0	-1	0	0.5 hrs	2k	1K ok
9Be	60	-1	0	-1	0	4 hrs	16k	✓ 17.5K
40Ca	60	-1	0	-1	0	5 hrs	16k	✓ 16.5K
40Ca	60	0	-1	0	-1	20 min	-	✓
12C	60	0	-1	0	-1	20 min	-	✓
12C	60	-1	0	-1	0	5 hrs	10k	✓ 11.3K

Actual Time

3.1
3.5 hours
2.2 hours
5.2 hours
6.5 hours
5.0 hours

3.8.5 Setting 3

- Set **HMS momentum** to **-3.09 GeV**.
- **SHMS momentum: -9.2 GeV**.
- **SHMS angle: 10°** **HMS angle: 35°**
- **Trigger**: HMS is PS2(ELREAL) or PS1(3/4); SHMS is PS3(ELCLEAN) or PS2(ELREAL)
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 57 should be set to **-1**.
- Prescale values are only estimated; Use the lowest prescale values that keep the trigger rate in the **HMS near or below 4 kHz** and the **SHMS near or below 8kHz**
- SHMS should have HV for S1X paddles 1-5, S2X paddles 1-6, and preshower blocks 1-6 (+ and -) TURNED OFF for all settings
- Follow Table 57. Take data with the SHMS and HMS simultaneously.
- Estimated run times are with 100% efficiency.

Table 57: High-Q^2 EMC (and scaling studies) at 35° - Setting 3

Target	I (μA)	HMS PS		SHMS PS		Est. Time	Target e^-	Done ?
		PS1	PS2	PS2	PS3			
12C	60	-1	0	-1	0	8 hrs	120k	✓
12C	60	0	-1	0	-1	15 min	-	✓
40Ca	60	0	-1	0	-1	15min	-	✓
40Ca	60	-1	0	-1	0	8 hrs	180k	✓
9Be	60	-1	0	-1	0	6.4 hrs	180k	✓
Al dummy	40	-1	0	-1	0	1.0 hrs	15k	✓
LH2	~~70~~	-1	0	-1	0	4 hrs	95k	✓
LD2	~~70~~	-1	0	-1	0	4 hrs	200k	✓

3.8.7 Setting 5

- Set **HMS momentum** to **-2.40 GeV**.
- **SHMS momentum: -9.2 GeV**.
- **SHMS angle: 10°** **HMS angle: 35°**
- **Trigger**: HMS is PS2(ELREAL) or PS1(3/4); SHMS is PS3(ELCLEAN) or PS2(ELREAL)
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 59 should be set to **-1**.
- Prescale values are only estimated; Use the lowest prescale values that keep the trigger rate in the **HMS near or below 4 kHz** and the **SHMS near or below 8kHz**
- SHMS should have HV for S1X paddles 1-5, S2X paddles 1-6, and preshower blocks 1-6 (+ and -) TURNED OFF for all settings
- Follow Table 59. Take data with the SHMS and HMS simultaneously.
- Estimated run times are with 100% efficiency.

Table 59: High-Q^2 EMC (and scaling studies) at 35° - Setting 5

Target	I (μA)	HMS PS PS1	HMS PS PS2	SHMS PS PS2	SHMS PS PS3	Est. Time	Target e^-	Done ?
LD2	60	-1	0	-1	0	0.8 hrs	250k	✓
LH2	60	-1	0	-1	0	1.8 hrs	250k	✓
Al dummy	40	-1	0	-1	0	20 min	40k	✓
9Be	60	-1	0	-1	0	1.4 hrs	250k	✓
40Ca	60	-1	0	-1	0	1.8 hrs	250k	✓
40Ca	60	0	-1	0	-1	10 min	-	✓
12C	60	0	-1	0	-1	10 min	-	✓
12C	60	-1	0	-1	0	1.9 hrs	170k	✓

DO IT IN THIS ORDER

3.8.9 Setting 7

- Set **HMS momentum** to **-1.85 GeV**.
- **SHMS momentum: -9.2 GeV**.
- **SHMS angle: 10°** **HMS angle: 35°**
- **Trigger**: HMS is PS2(ELREAL) or PS1(3/4); SHMS is PS3(ELCLEAN) or PS2(ELREAL)
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 61 should be set to **-1**.
- Prescale values are only estimated: Use the lowest prescale values that keep the trigger rate in the **HMS near or below 4 kHz** and the **SHMS near or below 8kHz**
- SHMS should have HV for S1X paddles 1-5, S2X paddles 1-6, and preshower blocks 1-6 (+ and -) TURNED OFF for all settings
- Follow Table 61. Take data with the SHMS and HMS simultaneously.
- Estimated run times are with 100% efficiency.

FOLLOW THIS ORDER

Table 61: High-Q^2 EMC (and scaling studies) at 35° - Setting 7

Target	I (μA)	HMS PS PS1	HMS PS PS2	SHMS PS PS2	SHMS PS PS3	Est. Time	Target e^-	Done ?
LD2	60	-1	0	-1	0	30 min	145k	✓
LH2	60	-1	0	-1	0	30 min	145k	✓
Al dummy	40	-1	0	-1	0	10 min	25k	✓
9Be	60	-1	0	-1	0	30 min	145k	✓
40Ca	60	-1	0	-1	0	30 min	145k	✓
40Ca	60	0	-1	0	-1	10 min	-	✓
12C	60	0	-1	0	-1	10 min	-	✓
12C	60	-1	0	-1	0	45 min	145k	✓

3.8.11 Setting 9

- Set **HMS momentum** to **-1.44 GeV**.
- **SHMS momentum: -9.2 GeV**.
- **SHMS angle: 10°** **HMS angle: 35°**
- **Trigger**: HMS is PS2(ELREAL) or PS1(3/4); SHMS is PS3(ELCLEAN) or PS2(ELREAL)
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 63 should be set to **-1**.
- Prescale values are only estimated; Use the lowest prescale values that keep the trigger rate in the **HMS near or below 4 kHz** and the **SHMS near or below 8kHz**
- SHMS should have HV for S1X paddles 1-5, S2X paddles 1-6, and preshower blocks 1-6 (+ and -) TURNED OFF for all settings
- Follow Table 63. Take data with the SHMS and HMS simultaneously.
- Estimated run times are with 100% efficiency.

Table 63: High-Q^2 EMC (and scaling studies) at 35° - Setting 9

Target	I	HMS PS		SHMS PS		Est. Time	Target e^-	Done ?
	(μA)	PS1	PS2	PS2	PS3			
12C	60	-1	0	-1	0	45 min	95k	✓
12C	60	0	-1	0	-1	5 min	-	✓
48Ca	60	0	-1	0	-1	5 min	-	✓
48Ca	60	-1	0	-1	0	35 min	95k	
40Ca	60	-1	0	-1	0	40 min	95k	✓
40Ca	60	0	-1	0	-1	5 min	-	✓
9Be	60	-1	0	-1	0	40 min	95k	57K DONE ONLY ✓
Al dummy	40	-1	0	-1	0	15 min	15k	✓
Al dummy	40	0	-1	0	-1	5 min	-	✓
LH2	60	0	-1	0	-1	5 min	-	✓
LH2	60	-1	0	-1	0	45 min	95k	✓
LD2	60	-1	0	-1	0	60 min	95k	✓
LD2	60	0	-1	0	-1	5 min	-	✓

Now totally done!

3.8.12 Setting 10

- Set **HMS momentum** to **-1.26 GeV**.
- **SHMS momentum: -9.2 GeV.**
- **SHMS angle: 10°** **HMS angle: 35°**
- **Trigger**: HMS is PS2(ELREAL) or PS1(3/4); SHMS is PS3(ELCLEAN) or PS2(ELREAL)
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 64 should be set to **-1.**
- Prescale values are only estimated; Use the lowest prescale values that keep the trigger rate in the **HMS near or below 4 kHz** and the **SHMS near or below 8kHz**
- SHMS should have HV for S1X paddles 1-5, S2X paddles 1-6, and preshower blocks 1-6 (+ and -) TURNED OFF for all settings
- Follow Table 64. Take data with the SHMS and HMS simultaneously.
- Estimated run times are with 100% efficiency.

Table 64: High-Q^2 EMC (and scaling studies) at 35° - Setting 10

Target	I	HMS PS		SHMS PS		Est. Time	Target e^-	Done ?
	(μA)	PS1	PS2	PS2	PS3			
LD2	60	-1	5	-1	5	80 min	75K	✓
LD2	60	5	-1	5	-1	5 min	-	✓
LH2	60	3	-1	3	-1	5 min	-	✓
LH2	60	-1	3	-1	3	50 min	75K	✓
Al dummy	40	-1	1	-1	1	20 min	12K	✓
Al dummy	40	1	-1	1	-1	5 min	-	✓
9Be	60	3	-1	3	-1	5 min	-	✓
9Be	60	-1	2	-1	2	50 min	75K	✓
40Ca	60	3	-1	3	-1	5 min	-	✓
40Ca	60	-1	2	-1	2	50 min	75K	✓
48Ca	60	-1	2	-1	2	40 min	75K	✓
48Ca	60	3	-1	3	-1	5 min	-	✓
12C	60	2	-1	2	-1	5 min	-	✓
12C	60	-1	2	-1	2	40 min	75K	

3.9 Additional 8 deg electron and 35 deg positron running with 48Ca

PLEASE READ!!!

- **TURN ALL SHMS PRESHOWER BLOCKS BACK ON**

- **Note the SHMS hodoscope paddle configuration change:**

  SHMS S1X (1-7) and S2X (1-7) on BOTH left and right sides are OFF

- **Note the polarity change in the HMS. Ramp the HMS magnets down first to change the polarity.**

- **Specific instructions on rotating SHMS to 8 degrees:**

1. Watch the rotation on the SHMS rotation camera.
2. DO NOT rotate SHMS below 8 degrees. It will trip the limit switch.
3. On the rotation GUI, start with entering **8.1 degrees** instead of 8 degrees. This will prevent SHMS to be rotated below 8 degrees in the very likely case of an offset on the rotation GUI.
4. Note the offset and correct for it to rotate the SHMS to 8 degrees.

3.9.1 Setting 1

- Set **HMS momentum** to **+2.40 GeV**.
- **SHMS angle: 8°**
- **SHMS momentum: -9.2 GeV**
- **HMS angle: 35°**
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at Table 65 should be set to **-1**.
- **Prescale values are only estimated; adjust them on both SHMS and HMS Prescale GUIs accordingly to keep the rates below 4 kHz.**
- Take data with the SHMS and HMS simultaneously.

Table 65: CSB Studies at 35° with 48Ca - Setting 1

Target	I	HMS PS			SHMS PS			Est. Time	Done ?
	(μA)	PS1	PS2	PS3	PS1	PS2	PS3		
48Ca	50	-1	-1	0	-1	0	-1	10 min	
48Ca	50	0	-1	-1	0	-1	-1	5 min	

3.9.2 Setting 2

- Set **HMS momentum** to **+2.11 GeV**.
- **SHMS angle: 8°**
- **SHMS momentum: -9.2 GeV**
- **HMS angle: 35°**
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 66 should be set to **-1**.
- **Prescale values are only estimated; adjust them on both SHMS and HMS Prescale GUIs accordingly to keep the rates below 4 kHz.**
- Take data with the SHMS and HMS simultaneously.

Table 66: CSB Studies at 35° with 48Ca - Setting 2

Target	I	HMS PS			SHMS PS			Est. Time	Done ?
	(μA)	PS1	PS2	PS3	PS1	PS2	PS3		
48Ca	50	0	-1	-1	0	-1	-1	5 min	✓
48Ca	50	-1	-1	0	-1	0	-1	15 min	✓

3.9.3 Setting 3 +1.85

- Set **HMS momentum** to ~~+1.86~~ **GeV**.
- **SHMS angle: 8°**
- **SHMS momentum: -9.2 GeV**
- **HMS angle: 35°**
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 43 should be set to **-1**.
- **Prescale values are only estimated; adjust them on both SHMS and HMS Prescale GUIs accordingly to keep the rates below 4 kHz.**
- Take data with the SHMS and HMS simultaneously.

Table 67: CSB Studies at 35° with 48Ca - Setting 1

Target	I	HMS PS			SHMS PS			Est. Time	Done ?
	(μA)	PS1	PS2	PS3	PS1	PS2	PS3		
48Ca	50	-1	-1	0	-1	0	-1	15 min	✓
48Ca	50	0	-1	-1	0	-1	-1	5 min	✓

3.9.4 Setting 4

- Set **HMS momentum to +1.63 GeV.**
- **SHMS angle: 8°**
- **SHMS momentum: -9.2 GeV**
- **HMS angle: 35°**
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 44 should be set to **-1**.
- **Prescale values are only estimated; adjust them on both SHMS and HMS Prescale GUIs accordingly to keep the rates below 4 kHz.**
- Take data with the SHMS and HMS simultaneously.

Table 68: CSB Studies at 35° with 48Ca - Setting 4

Target	I	HMS PS			SHMS PS			Est. Time	Done ?
	(μA)	PS1	PS2	PS3	PS1	PS2	PS3		
48Ca	50	0	-1	-1	0	-1	-1	5 min	✓
48Ca	50	-1	-1	0	-1	0	-1	20 min	✓

3.9.5 Setting 5

- Set **HMS momentum** to **+1.44 GeV**.
- **SHMS angle: 8°**
- **SHMS momentum: -9.2 GeV**
- **HMS angle: 35°**
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 69 should be set to **-1**.
- **Prescale values are only estimated; adjust them on both SHMS and HMS Prescale GUIs accordingly to keep the rates below 4 kHz.**
- Take data with the SHMS and HMS simultaneously.

Table 69: CSB Studies at 35° with 48Ca - Setting 1

Target	***I***	**HMS PS**			**SHMS PS**			**Est. Time**	Done ?
	(μA)	PS1	PS2	PS3	PS1	PS2	PS3		
48Ca	50	-1	-1	0	~~-1~~	0	~~-1~~	20 min	✓
48Ca	50	0	-1	-1	~~0~~	-1	-1	5 min	✓

-1 6 -1

6 -1 -1

3.9.6 Setting 6

- Set **HMS momentum** to **+1.26 GeV**.
- **SHMS angle:** ~~10°~~ 8°
- **SHMS momentum:** ~~8~~ **9.2 GeV**
- **HMS angle: 35°**
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 70 should be set to **-1**.
- **Prescale values are only estimated; adjust them on both SHMS and HMS Prescale GUIs accordingly to keep the rates below 4 kHz.**
- Take data with the SHMS and HMS simultaneously.

Table 70: CSB Studies at 35° with 48Ca - Setting 1

Target	***I***	**HMS PS**			**SHMS PS**			**Est. Time**	Done ?
	(μA)	PS1	PS2	PS3	PS1	PS2	PS3		
48Ca	50	0	-1	-1	~~0~~ -1	~~-1~~ 6	~~-1~~ -1	5 min	✓
48Ca	50	-1	-1	0	~~-1~~ 6	~~0~~ -1	~~-1~~ -1	15 min	

- Total estimated time for subsection including the momentum and target changes: **? hrs**. Estimated run times are with 100% efficiency.

3.10 Additional 8 deg electron and 20 deg positron running

PLEASE READ!!!

- **Specific instructions on rotating HMS to 20 degrees:**

  Warning: when rotating the HMS to 20 degrees, there is an increased chance that the rotation will get "stuck" and require expert intervention.

  Please follow the instructions below:

  1. When rotating to 20 degrees from smaller HMS angle, it is ok to go directly to 20 degrees.
  2. When rotating to 20 degrees from larger angle, first rotate to 19 degrees, and then to 20 degrees.

- Make sure **SHMS S1X (1-7)** and **S2X (1-7)** LEFT and RIGHT hodoscope paddles are **OFF**.

3.10.1 Setting 1

- Set **HMS momentum** to **+3.040 GeV**.
- **HMS angle: 20°**
- **SHMS momentum: -9.2 GeV**
- **SHMS angle: 8°**
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 71 should be set to **-1**.
- **Prescale values are only estimated; adjust them on both SHMS and HMS Prescale GUIs accordingly to keep the rates below 4 kHz in the HMS and below 8 kHz in the SHMS.**
- Take data with the SHMS and HMS simultaneously.

Table 71: Additional CSB Studies at 20° - Setting 1

Target	***I***	**HMS PS**			**SHMS PS**			**Est. Time**	Done ?
	(μA)	PS1	PS2	PS3	PS1	PS2	PS3		
LD2	30	-1	-1	0	-1	0	-1	10 min	✓
LH2	60	-1	-1	0	-1	0	-1	10 min	✓
Al dummy	40	-1	-1	0	-1	0	-1	10 min	✓
Be9	60	-1	-1	0	-1	0	-1	10 min	✓
Ca40	60	-1	-1	0	-1	0	-1	10 min	✓
Ca40	60	0	-1	-1	-1	0	-1	10 min	✓
Ca48	50	-1	-1	0	-1	0	-1	10 min	✓
C12	60	-1	-1	0	-1	0	-1	10 min	✓
C12	60	0	-1	-1	-1	0	-1	10 min	✓
B4C-11	60	-1	-1	0	-1	0	-1	10 min	✓
B4C-10	60	-1	-1	0	-1	0	-1	10 min	✓
Sn (Tin)	50	-1	-1	0	-1	0	-1	10 min	✓
Titanium	50	-1	-1	0	-1	0	-1	10 min	✓
54Fe 60 ~~40~~		-1	-1	0	-1	0	-1	10 min	✓
108Ag	60	-1	-1	0	-1	0	-1	10 min	✓
232Thorium	60	-1	-1	0	-1	0	-1	10 min	✓
232Thorium	60	0	-1	-1	-1	0	-1	10 min	✓
Ni58	50	-1	-1	0	-1	0	-1	10 min	✓
Ni64	~~50~~ 60	-1	-1	0	-1	0	-1	10 min	✓

3.11 SHMS Rate Dependence Studies with LD2

PLEASE READ THE ENTIRE SECTION 3.11 BEFORE YOU START

1. **SHMS S1X (1-7)** and **S2X (1-7)** on BOTH left and right sides are **OFF**
2. SHMS kinematic setting (same as before):
   - **SHMS angle: 8°**
   - **SHMS momentum: -9.2 GeV**
3. **NOTE: Prescale values are only estimated, adjust them accordingly to keep the rates below 8 kHz.**
4. In this section, we will take data **ONLY** with the SHMS. While taking data with the SHMS, start setting the HMS for the following configuration.

   Please note the polarity change in the HMS! Don't forget to ramp the HMS magnets down to zero for the polarity change!
   - **HMS momentum: -5.878 GeV**
   - **HMS angle: 21.36°**
5. Follow the Table 72 and take data with the SHMS.

Table 72: SHMS Rate Dependence Studies with LD2

Target	$I(\mu A)$	SHMS PS1	SHMS PS2	Est. SHMS Time	SHMS target e^-	Done ?
LD2	45	-1	3	10 min	2M	✓
LD2	30	-1	3	10 min	2M	
LD2	15	-1	2	10 min	2M	

3.12 Single Arm Hydrogen Elastic Data Taking

- **Trigger:** SHMS PS2 and HMS PS2
- **SHMS Prescale:** PS2=0, rest=-1
- **HMS Prescale:** PS2=0, rest=-1
- Adjust the prescales (SHMS PS2 and HMS PS2) to keep the rates below 4 kHz. All the other prescales should be set to **-1**.
- Follow Table 73 and take data.

Table 73: Single Arm Hydrogen Elastic Data Taking

Setting	P_{HMS} (GeV)	θ_{HMS}	P_{SHMS} (GeV)	θ_{SHMS}	Target	I (μA)	target # of elastics	Est. Time	Done ?
KIN 1	-5.878	21.36°	-5.878	21.36°	LH2	60	10K	50 min	✓
	-5.878	21.36°	-5.878	21.36°	dummy	40	N/A	15 min	✓
KIN 2	-5.36	23.61°	-5.36	23.61°	dummy	40	N/A	30 min	✓
	-5.36	23.61°	-5.36	23.61°	LH2	60	10K	2 hrs	7.6 K
KIN 3	-4.78	26.41°	-4.78	26.41°	LH2	60	6K	3 hrs	✓
	-4.78	26.41°	-4.78	26.41°	dummy	40	N/A	45 min	✓

4 Target Boiling Studies - Part II

- **MAKE SURE ALL SHMS HODOSCOPE CHANNELS BACK ON**
- Warning: when rotating the HMS to 20 degrees, there is an increased chance that the rotation will get "stuck" and require expert intervention.

Please follow the instructions below:

1. When rotating to 20 degrees from smaller HMS angle, it is ok to go directly to 20 degrees.
2. When rotating to 20 degrees from larger angle, first rotate to 19 degrees, and then to 20 degrees.

- This study requires stable high current. It will be postponed if high current beam is unavailable at the moment.
- **DAQ:** Single Arm
- **SHMS/HMS Trigger:** PS2 (ELREAL)/PS2 (ELREAL)
- **SHMS Settings:** -4.0 GeV & 20°
- **HMS Settings:** -4.0 GeV & 20°
- Adjust the prescales (SHMS PS2 and HMS PS2) to keep the rates below 4 kHz. All the other prescales should be set to **-1**.
- The goal number of events is 50K-100K for each target at every current.

4.1 Boiling studies - LD2 target

- Move target to LD2 and take one run with each current setting.

Table 74: Boiling Studies - LD2 Target

Target	I (μA)	est. time	Done ?
LD2	70 μA	10 min	✓
LD2	60 μA	10 min	✓
LD2	50 μA	10 min	
LD2	40 μA	10 min	✓
LD2	30 μA	10 min	✓
LD2	20 μA	10 min	✓
LD2	10 μA	10 min	✓
10 extra	10 μA	10 min	✓

do 70, 60 on all target first.

4.2 Boiling studies - LH2 target

- Move target to LH2 and take one run with **each current setting**.

Table 75: Boiling Studies - LH2 Target

Target	I (μA)	**est. time**	**Done ?**
LH2	70 μA	10 min	✓
LH2	60 μA	10 min	✓
LH2	50 μA	10 min	✓
LH2	40 μA	10 min	✓
LH2	30 μA	10 min	✓
LH2	20 μA	10 min	✓
LH2	10 μA	10 min	✓
No edtm	10 μA	10 min	✓

4.3 Boiling Studies - Al dummy target

- Move target to Al dummy and take one run at 40 μA.

Table 76: Boiling Studies - Al dummy target

Target	I (μA)	**est. time**	**Done ?**
dummy	40 μA	10 min	✓

4.4 Boiling studies - Carbon target

- Move target to Carbon and take one run with each current setting.

Table 77: Boiling Studies - Carbon Target

Target	I (μA)	**est. time**	**Done ?**
Carbon	70 μA	10 min	✓
Carbon	60 μA	10 min	✓
Carbon	50 μA	10 min	✓
Carbon	40 μA	10 min	✓
Carbon	30 μA	10 min	✓
Carbon	20 μA	10 min	✓
Carbon	10 μA	10 min	✓
No edtm	10 μA	10 min	✓

Total estimated time for this section including the momentum and target changes: **?** **hrs** with 100% efficiency.

4.5 SHMS 8 deg and HMS 35 deg Running with Ca48

- **TURN SHMS S1X (1-7) and S2X (1-7)** on BOTH left and right sides OFF
- **VERIFY THAT ALL HV FOR ALL SHMS PRESHOWER BLOCKS TURNED ON**
- Estimated run times are with 100% efficiency. You should run until we hit the target number of electrons in the HMS (based on the replays).

4.5.1 Setting 3 (skipping settings 1-2 for this target)

- Set **HMS momentum** to **-3.09 GeV**.
- **SHMS momentum: -9.2 GeV**.
- **SHMS angle: 8°** **HMS angle: 35°**
- **Trigger**: HMS is PS2(ELREAL) or PS1(3/4); SHMS is PS2(ELREAL) or PS1(3/4)
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 78 should be set to **-1**.
- Prescale values are only estimated; Use the lowest prescale values that keep the trigger rate in the **HMS near or below 4 kHz** and the **SHMS near or below 8kHz**
- Follow Table 78. Take data with the SHMS and HMS simultaneously.
- Estimated run times are with 100% efficiency. You should run until we hit the target number of electrons in the HMS (based on the replays).

Table 78: High-Q^2 EMC (and scaling studies) at 35° - Setting 3

Target	I (μA)	HMS PS		SHMS PS		Est. Time	Target e^-	Done ?
		PS1	PS2	PS1	PS2			
48Ca	50	-1	0	-1	0	6.5 hrs	180k	
48Ca	50	0	-1	-1	0	5 min	-	

4.5.2 Setting 4

- Set **HMS momentum** to **-2.72 GeV**.
- **SHMS momentum: -9.2 GeV**.
- **SHMS angle: 8°** **HMS angle: 35°**
- **Trigger**: HMS is PS2(ELREAL) or PS1(3/4); SHMS is PS2(ELREAL) or PS1(3/4)
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 79 should be set to **-1**.
- Prescale values are only estimated; Use the lowest prescale values that keep the trigger rate in the **HMS near or below 4 kHz** and the **SHMS near or below 8kHz**
- Follow Table 79. Take data with the SHMS and HMS simultaneously.
- Estimated run times are with 100% efficiency. You should run until we hit the target number of electrons in the HMS (based on the replays).

Table 79: High-Q^2 EMC (and scaling studies) at 35° - Setting 4

Target	I (μA)	HMS PS		SHMS PS		Est. Time	Target e^-	Done ?
		PS1	PS2	PS1	PS2			
48Ca	50	0	-1	-1	0	5 min	-	√
48Ca	50	-1	0	-1	0	4.6 hrs	400k	√

-> ran 5594

4.5.3 Setting 5

- Set **HMS momentum** to **-2.40 GeV**.
- **SHMS momentum: -9.2 GeV.**
- **SHMS angle: 8°** **HMS angle: 35°**
- **Trigger**: HMS is PS2(ELREAL) or PS1(3/4); SHMS is PS2(ELREAL) or PS1(3/4)
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 80 should be set to **-1**.
- Prescale values are only estimated; Use the lowest prescale values that keep the trigger rate in the **HMS near or below 4 kHz** and the **SHMS near or below 8kHz**
- Follow Table 80. Take data with the SHMS and HMS simultaneously.
- Estimated run times are with 100% efficiency. You should run until we hit the target number of electrons in the HMS (based on the replays).

Table 80: High-Q^2 EMC (and scaling studies) at 35° - Setting 5

Target	I (μA)	HMS PS		SHMS PS		Est. Time	Target e^-	Done ?
		PS1	PS2	PS1	PS2			
48Ca	50	-1	0	-1	0	1.5 hrs	250k	✓
48Ca	50	0	-1	-1	0	5 min	-	✓

5609

4.5.4 Setting 6

- Set **HMS momentum** to **-2.11 GeV**.
- **SHMS momentum: -9.2 GeV.**
- **SHMS angle: 8°** **HMS angle: 35°**
- **Trigger**: HMS is PS2(ELREAL) or PS1(3/4); SHMS is PS2(ELREAL) or PS1(3/4)
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 81 should be set to **-1**.
- Prescale values are only estimated; Use the lowest prescale values that keep the trigger rate in the **HMS near or below 4 kHz** and the **SHMS near or below 8kHz**
- Follow Table 81. Take data with the SHMS and HMS simultaneously.
- Estimated run times are with 100% efficiency. You should run until we hit the target number of electrons in the HMS (based on the replays).

Table 81: High-Q^2 EMC (and scaling studies) at 35° - Setting 6

Target	I (μA)	HMS PS		SHMS PS		Est. Time	Target e^-	Done ?
		PS1	PS2	PS1	PS2			
48Ca	50	0	-1	-1	0	5 min	-	√
48Ca	50	-1	0	-1	0	40 min	180k	

5690

4.5.5 Setting 7

- Set **HMS momentum** to **-1.85 GeV**.
- **SHMS momentum: -9.2 GeV.**
- **SHMS angle: 8°** **HMS angle: 35°**
- **Trigger**: HMS is PS2(ELREAL) or PS1(3/4); SHMS is PS2(ELREAL) or PS1(3/4)
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 82 should be set to **-1**.
- Prescale values are only estimated; Use the lowest prescale values that keep the trigger rate in the **HMS near or below 4 kHz** and the **SHMS near or below 8kHz**
- Follow Table 82. Take data with the SHMS and HMS simultaneously.
- Estimated run times are with 100% efficiency. You should run until we hit the target number of electrons in the HMS (based on the replays).

Table 82: High-Q^2 EMC (and scaling studies) at 35° - Setting 7

Target	I (μA)	HMS PS		SHMS PS		Est. Time	Target e^-	Done ?
		PS1	PS2	PS1	PS2			
48Ca	50	-1	0	-1	0	25 min	145k	✓
48Ca	50	0	-1	-1	0	5 min	-	✓

4.5.6 Setting 8

- Set **HMS momentum** to **-1.63 GeV**.
- **SHMS momentum: -9.2 GeV.**
- **SHMS angle: 8°** **HMS angle: 35°**
- **Trigger**: HMS is PS2(ELREAL) or PS1(3/4); SHMS is PS2(ELREAL) or PS1(3/4)
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 83 should be set to -1.
- Prescale values are only estimated; Use the lowest prescale values that keep the trigger rate in the **HMS near or below 4 kHz** and the **SHMS near or below 8kHz**
- Follow Table 83. Take data with the SHMS and HMS simultaneously.
- Estimated run times are with 100% efficiency.

Table 83: High-Q^2 EMC (and scaling studies) at 35° - Setting 8

Target	I (μA)	HMS PS		SHMS PS		Est. Time	Target e^-	Done ?
		PS1	PS2	PS1	PS2			
48Ca	50	0	-1	-1	0	5 min	-	
48Ca	50	-1	0	-1	0	30 min	110k	

4.6 SHMS 8 deg and HMS 35 deg Running with LD2

- **VERIFY THAT SHMS S1X (1-7) and S2X (1-7) ARE TURNED OFF FOR BOTH LEFT AND RIGHT PMTS**
- **VERIFY THAT ALL HV FOR ALL SHMS PRESHOWER BLOCKS TURNED ON**
- Estimated run times are with 100% efficiency.

4.6.1 Setting 1

- Set **HMS moment**
- **SHMS momentu**
- **SHMS angle:** 8
- **Trigger:** HMS (EAL) or ~~PS1(3/4)~~
- **Important** that are NOT specifi
- Prescale va values that keep the t the **SHMS near or**
- Follow Table 84. Take data taneously.
- Estimated run times are with 100% efficie d run until we ~~hit the target number of electrons in the HMS (based on the replays).~~

We are here

Still 6 hrs @ 100% eff?

Table 84: High-Q^2 EMC (and scaling studies) at 35° - Setting 1

Target	I (μA)	HMS PS PS1	HMS PS PS2	SHMS PS PS1	SHMS PS PS2	Est. Time	Target e^-	Done ?
LD2	30	-1	0	-1	0	6 hrs	-	✓
Al dummy	40	-1	0	-1	0	1.5 hrs	-	✓
LD2	30	-1	0	-1	0	6 hr	-	✓
Al dummy	40	-1	0	-1	0	1.5 hr	-	✓

SHMS start ← 02:37
5619 - 5624
5625 - 5626
5627 - 5633
5634 - 5635

1.1587
1.1694

4.7 SHMS 8 deg and HMS 35 deg Running with LD2 - PADDLE/PRESHOWER TRIGGER TESTS

- Same kinematics as last section. HMS keeps taking 35 degree runs at -4.08 GeV/c; SHMS at 8 degrees, -9.2 GeV/c.
- HMS can stop/start as needed; only SHMS needs configuration changes and multiple short runs for these tests
- **Change SHMS to ELCLEAN**; HMS stays ELREAL
- **SHMS changes S1X, S2X paddle HV, and SHMS preshower HV configurations following the table.**
- **SHMS PRESCALE SHOULD BE ADJUSTED FOR EACH CONFIGURATION.** Use the lowest prescale values that keep the SHMS trigger rate **near or below 8kHz**
- The only changes are turning on/off S1X, S2X, and Preshower HV (and prescale) - **please check all three columns carefully**
- **Record SHMS ELCLEAN rate from scalar page on runsheets and make entry with HV configuration and ELCLEAN vs run**

Table 85: SHMS acceptance test with some hodoscopes turned off at 8.0°

Setting	HV off		PRESHOWER off	SHMS PS		Target	I	Est. Time	Done ?	
	S1X	S2X	+ and -	PS1,2	PS3		(μA)			
1.1	1-7	1-7	none	-1	?	LD2	30	10 min	✓	19150
1.2	1-7	1-7	1-6	-1	?	LD2	30	10 min	✓	19151
1.3	1-7	1-7	1-7	-1	?	LD2	30	10 min	✓	19152
2.1	1-7	1-8	1-6	-1	?	LD2	30	10 min	✓	19153
2.2	1-7	1-8	1-7	-1	?	LD2	30	10 min	✓	19154
3.1	1-8	1-7	1-6	-1	?	LD2	30	10 min	✓	19155
3.2	1-8	1-7	1-7	-1	?	LD2	30	10 min	✓	19156
4.1	1-8	1-8	1-6	-1	?	LD2	30	10 min	✓	19157
4.2	1-8	1-8	1-7	-1	?	LD2	30	10 min	✓	19158
4.3	1-8	1-8	1-8	-1	?	LD2	30	10 min	✓	19159

4.8 Single Arm Hydrogen Elastic Data Taking

Make sure to turn on all SHMS hodoscope and preshower channels before starting this section

- **Trigger:** SHMS PS2 and HMS PS2
- **SHMS Prescale:** PS2=0, rest=-1
- **HMS Prescale:** PS2=0, rest=-1
- Adjust the prescales (SHMS PS2 and HMS PS2) to keep the rates below 4 kHz. All the other prescales should be set to **-1**.
- Follow Table 87 and take data.

Table 87: Single Arm Hydrogen Elastic Data Taking (Part 2)

Setting	P_{HMS}	θ_{HMS}	P_{SHMS}	θ_{SHMS}	Target	I (μA)	target # of elastics	Est. Time	Done ?
KIN 1	-4.20	30.05°	-4.20	30.05°	LH2	60	1k (HMS)	1 hour, 15 min	✓
	-4.20	30.05°	-4.20	30.05°	dummy	40	-	15 min	✓
KIN 2	-3.57	34.30°	-3.57	34.30°	dummy	40	-	40 min	✓
	-3.57	34.30°	-3.57	34.30°	LH2	60	1k (HMS)	3 hrs, 15 min	✓
KIN 3	-3.00	39.08°	-3.00	39.08°	LH2	60	500 (HMS)	3 hrs. 45 min	✓
	~~-3.00~~	~~39.08°~~	~~-3.00~~	~~39.08°~~	~~dummy~~	~~40~~	~~-~~	~~1 hour~~	

KIN 3 ONLY WITH THE HMS SHMS cannot be rotated to 73°

11/23 OWL

4.9 SHMS 35 deg and HMS 35 deg Running with LD2

- **ALL SHMS HODOSCOPE AND PRESHOWER CHANNELS SHOULD BE TURNED ON**
- RUNNING IS BASED ON ESTIMATED BEAM-ON TIME.

4.9.1 Setting 1

- Set **SHMS momentum** to **-3.57 GeV**.
- Set **SHMS angle** to **35°**
- **HMS momentum: -4.08 GeV**.
- **HMS angle: 35°**
- **Trigger**: HMS is PS2(ELREAL) or PS1(3/4); SHMS is PS2(ELREAL) or PS1(3/4)
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 88 should be set to **-1**.
- Prescale values are only estimated; Use the lowest prescale values that keep the trigger rate in the **HMS near or below 4 kHz** and the **SHMS near or below 8kHz**
- Follow Table 88. Take data with the SHMS and HMS simultaneously.

Table 88: High-Q^2 EMC (and scaling studies) at 35° - Setting 1

Target	I (μA)	HMS PS		SHMS PS		Est. Time	Target e^- (HMS)	Done ?
		PS1	PS2	PS1	PS2			
LD2	60	-1	0	-1	0	6 hrs	600	✓ (602)
Al dummy	40	-1	0	-1	0	1.5 hrs	80 ~~130~~	✓ [Run for maximum of 2h 15min]
LD2	60	-1	0	-1	0	6 hr	600	✓
Al dummy	40	-1	0	-1	0	1.5 hr	80 ~~130~~	✓ 106
LD2	60	-1	0	-1	0	6 hrs	600	✓
Al dummy	40	-1	0	-1	0	1.5 hrs	80 T30	✓ 69
LD2	60	-1	0	-1	0	6 hr	600	✓
Al dummy	40	-1	0	-1	0	1.5 hr	80 ~~130~~	✓ 91
LD2	60	-1	0	-1	0	6 hr	600	✓
Al dummy	40	-1	0	-1	0	1.5 hr	80 ~~130~~	✓ 94
LD2	60	-1	0	-1	0	6 hr	600	✓
Al dummy	40	-1	0	-1	0	1.5 hr	80 ~~130~~	✓

4.10 SHMS 10 deg Running with Be

- In this section, we will take data ONLY with the SHMS. In the meantime, the HMS configuration will be set for the next setting.
- **TURN THE SHMS S1X (1-5) and SHMS S2X (1-6) PADDLES (BOTH LEFT AND RIGHT) OFF**
- **Rotate the SHMS to 10°.**
- **SHMS momentum: -9.2 GeV.**
- Move the target to Be.
- Adjust the prescales to keep the SHMS rates below 8 kHz.

Table 89: SHMS 10° Running with Be

Target	***I*** (μA)	**SHMS PS** PS2	PS3	**Est. Time**	**Target** e^-	**Done ?**
Be	60	-1	0	1 hr	-	

- While taking data in the SHMS, start setting the HMS magnets for the following momentum:
- **HMS momentum: -3.09 GeV.**
- **HMS angle: 35°**

4.12 SHMS 8.5 deg PADDLE/PRESHOWER TESTS (while HMS keeps data taking on 10B/11B at 35 deg)

- **Make sure that we are going to be on the same target (either 10B or 11B) for at least a few hours before starting this - we don't want to change targets in the middle**
- HMS keeps taking 35 degree EMC data on 10B, 11B.. HMS can stop/start as needed; only SHMS needs configuration changes and multiple short runs for these tests
- **Rotate SHMS to 8.5 degrees; set to -9.2 GeV/c**; trigger=ELCLEAN
- **SHMS changes S1X, S2X paddle HV, and SHMS preshower HV configurations following the table.**
- **SHMS PRESCALE SHOULD BE ADJUSTED FOR EACH CONFIGURATION**. Use the lowest prescale values that keep the SHMS trigger rate **near or below 8kHz**
- We will be turning on/off S1X, S2X, Preshower HV and modifying prescales (plusELREAL runs at end) - **please check all three columns carefully**
- **Record SHMS trigger rate (ELCLEAN or ELREAL) from scalar page on runsheets**

TO TAPE 4KHZ

Table 98: SHMS acceptance test with some hodoscopes and preshower blocks turned off at 8.5°

Setting	HV off		PRESHOWER	SHMS PS		Target	I	Est. Time	Done ?	
	S1X	S2X	off (+ and -)	PS1,2	PS3		(μA)			
1	1-7	1-7	none ✓	-1	? 4	B4C	60	30 min		19263
	1-7	1-7	1-6 ✓	-1	? 2	B4C	60	10 min		19264
	1-7	1-7	1-7 ✓	-1	? 2	B4C	60	10 min		19265
	1-6	1-6	1-6 ✓	-1	? 3	B4C	60	30 min		19266
2	1-7	1-8	1-6 ✓	-1	? 1	B4C	60	10 min		19267
	1-7	1-8	1-7 ✓	-1	? 1	B4C	60	10 min		19268
3	1-8	1-7	1-6 ✓	-1	? 2	B4C	60	10 min		19269
	1-8	1-7	1-7 ✓	-1	? 2	B4C	60	10 min		19270
4	1-8	1-8	1-6 ✓	-1	? 1	B4C	60	10 min		19271
	1-8	1-8	1-7 ✓	-1	? 0	B4C	60	10 min		19272
	1-8	1-8	1-8 ✓	-1	? 0	B4C	60	10 min		19273
5	1-7	1-7	1-7 ✓	-1 ?	-1 5	B4C	60	10 min	ELREAL !!!	19274
	1-7	1-7	1-6 ✓	-1 ?	-1 5	B4C	60	10 min	ELREAL !!!	19275
	1-7	1-7	none	-1 ?	-1 5	B4C	60	10 min	ELREAL !!!	19276

4.11 SHMS 11 deg and HMS 35 deg Running with Boron Targets

- **NOTE THE SHMS HODO AND PRESHOWER HV CONFIGURATION CHANGES !!!**
- **SHMS should have HV for S1X paddles 1-3 and S2X paddles 1-4 (+ and -) TURNED OFF for all settings.**
- **SHMS preshower blocks 1-4 (+ and -) TURNED OFF for all settings.**
- **RC or Expert will consider turning off more if we still need to prescale, but run as described above until we make an official decision**

4.11.1 Setting 1

- Set **HMS momentum** to **-3.09 GeV**.
- **SHMS momentum: -9.2 GeV**
- **SHMS angle: 11°** **HMS angle: 35°**
- **SHMS Trigger**: SHMS PS3 (ELCLEAN) **OR** SHMS PS2 (ELREAL)
- **HMS Trigger**: HMS PS2 (ELREAL) **OR** HMS PS1 (3/4)
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 90 should be set to **-1**.
- **Prescale values are only estimated; adjust them to keep the HMS rates below 4 kHz and SHMS rates below below 8 kHz.**
- Follow Table 90. Take data with the SHMS and HMS simultaneously.
- Estimated run times are with 100% efficiency.

Table 90: SHMS 11 deg and HMS 35 deg Boron Running Setting 1

Target	I (μA)	HMS PS		SHMS PS		Est. Time	Target e^- (HMS)	Done ?
		PS1	PS2	PS2	PS3			
B4C-11	60	-1	0	-1	0	11 hrs	180K	✓ 184K
B4C-10	60	-1	0	-1	0	12 hrs	180K	

4.11.2 Setting 2

- **NOTE THE SHMS HODO AND PRESHOWER HV CONFIGURATION CHANGES !!!**
- **SHMS should have HV for S1X paddles 1-5 and S2X paddles 1-6 (+ and -) TURNED OFF.**
- **SHMS preshower blocks 1-6 (+ and -) TURNED OFF.**
- Set **HMS momentum** to **-2.72 GeV**.
- **Rotate SHMS to 10 deg!**
- **SHMS angle: 10°** **HMS angle: 35°**
- **SHMS momentum: -9.2 GeV**
- **SHMS Trigger**: SHMS PS3 (ELCLEAN) **OR** SHMS PS2 (ELREAL)
- **HMS Trigger**: HMS PS2 (ELREAL) **OR** HMS PS1 (3/4)
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 91 should be set to **-1**.
- **Prescale values are only estimated; adjust them to keep the HMS rates below 4 kHz and SHMS rates below below 8 kHz**
- Follow Table 91. Take data with the SHMS and HMS simultaneously.
- Estimated run times are with 100% efficiency.

Table 91: SHMS red10 deg and HMS 35 deg Boron Running Setting 2

Target	I (μA)	**HMS PS** PS1	PS2	**SHMS PS** PS2	PS3	**Est. Time**	**Target** e^- (HMS)	**Done ?**
B4C-10	60	-1	0	-1	0	8.5 hrs	400K	✓ 416K
B4C-11	60	-1	0	-1	0	8 hrs	400K	✓ 416K

4.11.3 Setting 3

- **TURN ALL SHMS PRESHOWER BLOCKS BACK ON.** important.
- **SHMS should have HV for S1X paddles 1-5 and S2X paddles 1-6 (+ and -) TURNED OFF (SAME AS SETTING 2)**
- Set **HMS momentum** to **-2.40 GeV**.
- **SHMS momentum: -9.2 GeV**
- **SHMS angle: 10°** **HMS angle: 35°**
- **SHMS Trigger**: SHMS PS3 (ELCLEAN) **OR** SHMS PS2 (ELREAL)
- **HMS Trigger**: HMS PS2 (ELREAL) **OR** HMS PS1 (3/4)
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 92 should be set to **-1**.
- **Prescale values are only estimated; adjust them to keep the HMS rates below 4 kHz and SHMS rates below below 8 kHz**
- Follow Table 92. Take data with the SHMS and HMS simultaneously.
- Estimated run times are with 100% efficiency.

Table 92: SHMS 10 deg and HMS 35 deg Boron Running Setting 3

Target	I (μA)	HMS PS		SHMS PS		Est. Time	Target e^- (HMS)	Done ?
		PS1	PS2	PS2	PS3			
B4C-11	60	-1	0	-1	0	2 hrs and 20 min	250K	253k ✓
B4C-10	60	-1	0	-1	0	2 hrs and 40 min	250K	

4.11.4 Setting 4

- **TURN SHMS** preshower blocks 1-4 (+ and -) **OFF.**
- **SHMS should have HV for** S1X paddles 1-3 **and** S2X paddles 1-4 (+ and -) **TURNED OFF.**
- Set **HMS momentum** to **-2.11 GeV.**
- **Rotate SHMS to 12 deg!**
- **SHMS angle:** 12° **HMS angle: 35°**
- **SHMS momentum: -9.2 GeV**
- **SHMS Trigger**: SHMS PS3 (ELCLEAN) **OR** SHMS PS2 (ELREAL)
- **HMS Trigger**: HMS PS2 (ELREAL) **OR** HMS PS1 (3/4)
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 93 should be set to **-1.**
- **Prescale values are only estimated; adjust them to keep the HMS rates below 4 kHz and SHMS rates below below 8 kHz**
- Follow Table 93. Take data with the SHMS and HMS simultaneously.
- Estimated run times are with 100% efficiency.

Table 93: SHMS 12 deg and HMS 35 deg Boron Running Setting 4

Target	I (μA)	HMS PS		SHMS PS		Est. Time	Target e^- (HMS)	Done ?
		PS1	PS2	PS2	PS3			
B4C-10	60	-1	0	-1	0	1 hr and 10 min	180K	192K
B4C-11	60	-1	0	-1	0	1 hr	180K	193K

4.11.5 Setting 5

- Set **HMS momentum** to **-1.85 GeV**.
- **SHMS momentum: -9.2 GeV**
- **SHMS angle: 12°** **HMS angle: 35°**
- **SHMS Trigger**: SHMS PS3 (ELCLEAN) **OR** SHMS PS2 (ELREAL)
- **HMS Trigger**: HMS PS2 (ELREAL) **OR** HMS PS1 (3/4)
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 94 should be set to **-1**.
- **Prescale values are only estimated; adjust them to keep the HMS rates below 4 kHz and SHMS rates below below 8 kHz**
- Follow Table 94. Take data with the SHMS and HMS simultaneously.
- Estimated run times are with 100% efficiency.

Table 94: SHMS 12 deg and HMS 35 deg Boron Running Setting 5

Target	I (μA)	HMS PS		SHMS PS		Est. Time	Target e^- (HMS)	Done ?
		PS1	PS2	PS2	PS3			
B4C-11	60	-1	0	-1	0	40 min	145K	165K
B4C-10	60	-1	0	-1	0	45 min	145K	153K

4.11.6 Setting 6

- Set **HMS momentum** to **-1.63 GeV**.
- **SHMS momentum: -9.2 GeV**
- **SHMS angle: 12°** **HMS angle: 35°**
- **SHMS Trigger**: SHMS PS3 (ELCLEAN) **OR** SHMS PS2 (ELREAL)
- **HMS Trigger**: HMS PS2 (ELREAL) **OR** HMS PS1 (3/4)
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 95 should be set to **-1**.
- **Prescale values are only estimated; adjust them to keep the HMS rates below 4 kHz and SHMS rates below below 8 kHz**
- Follow Table 95. Take data with the SHMS and HMS simultaneously.
- Estimated run times are with 100% efficiency.

Table 95: SHMS 12 deg and HMS 35 deg Boron Running Setting 6

Target	I (μA)	HMS PS PS1	HMS PS PS2	SHMS PS PS2	SHMS PS PS3	Est. Time	Target e^- (HMS)	Done ?
B4C-10	60	-1	0	-1	0	30 min	110K	11 8 12
B4C-11	60	-1	0	-1	0	25 min	110K	11 5 12

4.11.7 Setting 7

- Set **HMS momentum** to **-1.44 GeV**.
- **SHMS momentum: -9.2 GeV**
- **SHMS angle: 12°** **HMS angle: 35°**
- **SHMS Trigger**: SHMS PS3 (ELCLEAN) **OR** SHMS PS2 (ELREAL)
- **HMS Trigger**: HMS PS2 (ELREAL) **OR** HMS PS1 (3/4)
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 96 should be set to **-1**.
- **Prescale values are only estimated; adjust them to keep the HMS rates below 4 kHz and SHMS rates below below 8 kHz**
- Follow Table 96. Take data with the SHMS and HMS simultaneously.
- Estimated run times are with 100% efficiency.

Table 96: SHMS 12 deg and HMS 35 deg Boron Running Setting 7

Target	I (μA)	HMS PS		SHMS PS		Est. Time	Target e^- (HMS)	Done ?
		PS1	PS2	PS2	PS3			
B4C-11	60	-1	1	-1	0	35 min	95K	100K
B4C-10	60	-1	1	-1	0	40 min	95K	101K

4.11.8 Setting 8

- Set **HMS momentum** to **-1.26 GeV**.
- **SHMS momentum: -9.2 GeV**
- **SHMS angle: 12°** **HMS angle: 35°**
- **SHMS Trigger**: SHMS PS3 (ELCLEAN) **OR** SHMS PS2 (ELREAL)
- **HMS Trigger**: HMS PS2 (ELREAL) **OR** HMS PS1 (3/4)
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 97 should be set to **-1**.
- **Prescale values are only estimated; adjust them to keep the HMS rates below 4 kHz and SHMS rates below below 8 kHz**
- Follow Table 97. Take data with the SHMS and HMS simultaneously.
- Estimated run-times are with 100% efficiency.

Table 97: SHMS 12 deg and HMS 35 deg Boron Running Setting 8

Target	I (μA)	HMS PS		SHMS PS		Est. Time	Target e^- (HMS)	Done ?
		PS1	PS2	PS2	PS3			
B4C-10	60	-1	2	-1	0	45 min	75K	60K ✓
B4C-10	60	2	-1	0	-1	5 min	-	✓
B4C-11	60	2	-1	0	-1	5 min	-	✓
B4C-11	60	-1	2	-1	0	40 min	75K	✓

4.13 Additional Be Running with SHMS at 10 deg

- Start with moving the target to Be and setting up the SHMS. As soon as SHMS is ready, start taking data. Then work on setting the HMS momentum.
- **NOTE THE SHMS HODO AND PRESHOWER HV CONFIGURATION CHANGES !!!**
- **SHMS should have HV for S1X paddles 1-5 and S2X paddles 1-6 (+ and -) TURNED OFF.**
- **SHMS preshower blocks 1-6 (+ and -) TURNED OFF.**
- **Rotate SHMS to 10 deg!**
- **SHMS angle: 10°** **HMS angle: 35° (unchanged)**
- Set **HMS momentum** to **-4.08 GeV.**
- **SHMS momentum: -9.2 GeV (unchanged)**
- **SHMS Trigger**: SHMS PS3 (ELCLEAN)
- **HMS Trigger**: HMS PS2 (ELREAL)
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 99 should be set to **-1.**
- **Prescale values are only estimated; adjust them to keep the HMS rates below 4 kHz and SHMS rates below below 8 kHz**
- **Take 1 hr - or 6 million events - long runs, whichever comes first.**
- **Take data at this configuration until Nov 28th, Monday 7:20 am.**

Table 99: SHMS 10 deg and HMS 35 deg Be Running Setting 1

Target	I (μA)	HMS PS		SHMS PS		Est. Time	Done ?
		PS1	PS2	PS2	PS3		
Be	60	-1	0	-1	0	-	-

- Jay Benesch will run a 10 min long low current BPM lock test at 7:20 am on Monday. Following that beam will be taken away for the target ladder changeover.
- Once you end your ongoing runs at 7:20 am, please rotate the HMS to 15 degrees.

19.

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① Target order:
3He, dummy, 4He
use time on dummy to
park 3He and power
up 4He

② First time on Li
targets → burn off
oil

3.3 20 deg EMC and 8 deg 2N-SR... Ladder II

- Before starting, change polarity of the HMS t...
- First, ramp down all the HMS magnets to 0 ...
- TURN **SHMS S1X (1-7)** and **S2X (1-7)** (...

3.3.1 Setting 1

- Set **HMS momentum** to **-6.6 GeV**.
- **SHMS momentum: -9.2 GeV**
- **HMS angle: 20°** **SHMS angle: 8°**
- Make sure **SHMS S1X(1-7)** and **S2X(1-7)** (Left & Right) are **OFF**
- **Trigger**: SHMS/HMS PS2 (ELREAL) **OR** SHMS/HMS PS1 (3/4)
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 104 should be set to **-1**.
- Prescale values are only estimated; Use the lowest prescale values that keep the trigger rate in the **HMS near or below 4 kHz** and the **SHMS near or below 8kHz**
- Take data with SHMS and HMS simultaneously. Estimated run times are for 100% efficiency, but run based on Target e^- from Table 104 if given

Table 104: 20° EMC and 8° 2N-SRC Running - Setting 1

Target	I (μA)	HMS PS PS1	HMS PS PS2	SHMS PS PS1	SHMS PS PS2	Est. Time	Target e^-	Done ?
3He	~~60~~ 40	-1	0	-1	2	35 min	30K	✓
4He	60	0	-1	2	-1	30 min	-	✓
4He	60	-1	0	-1	2	35 min	30K	✓
Al dummy	40	-1	0	-1	0	10 min	10K	✓
6Li	40	-1	0	-1	0	1.5 hrs	45K	✓
7Li	40	-1	0	-1	0	1.5 hrs	45K	✓
12C	60	-1	0	-1	3	0.5 hrs	45K	✓
27Al	40	-1	0	-1	2	1 hr	45K	✓
63Cu	60	-1	0	-1	3	20 min	45K	✓
63Cu	60	0	-1	2	-1	20 min	-	✓
197Au	60	-1	0	-1	2	45 min	45K	✓

3.3.2 Setting 2

- Set **HMS momentum** to **-5.878 GeV**.
- **SHMS momentum: -9.2 GeV**
- **HMS angle: 20°** **SHMS angle: 8°**
- **Trigger**: SHMS/HMS PS2 (ELREAL) **OR** SHMS/HMS PS1 (3/4)
- Make sure **SHMS S1X(1-7)** and **S2X(1-7)** (Left & Right) are **OFF**
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 105 should be set to **-1**.
- Prescale values are only estimated; Use the lowest prescale values that keep the trigger rate in the **HMS near or below 4 kHz** and the **SHMS near or below 8kHz**
- Take data with SHMS and HMS simultaneously. Estimated run times are for 100% efficiency, but run based on Target e^- from Table 105 if given

Table 105: 20° EMC and 8° 2N-SRC Running - Setting 2

Target	I (μA)	HMS PS		SHMS PS		Est. Time	Target e^-	Done ?
		PS1	PS2	PS1	PS2			
197Au	60	-1	0	-1	2	1 hr	230K	✓
63Cu	60	0	-1	3	-1	20 min	-	✓
63Cu	60	-1	0	-1	3	30 min	230K	✓
27Al	40	-1	0	-1	2	65 min	230K	✓
12C	60	-1	0	-1	3	40 min	230K	✓
7Li	40	-1	0	-1	0	105 min	230K	✓
6Li	40	-1	0	-1	0	105 min	230K	✓
Al dummy	40	-1	0	-1	0	15 min	75K	✓
4He 40	~~60~~	0	-1	2	-1	1530 min	-	✓
4He 40	~~60~~	-1	0	-1	2	25 min ~~1 hr~~	230K	✓
3He 40	~~60~~	-1	0	-1	2	45 ~~1 hr~~	200K	✓

Dec 7, 2022
at the starting of owl shift.

3.3.3 Setting 3

- Set **HMS momentum** to **-5.36 GeV**.
- **SHMS momentum: -9.2 GeV**
- **HMS angle: 20°** **SHMS angle: 8°**
- **** CHANGE ***** For THIS setting, HV for **SHMS S1X (1-5)** and **S2X (1-5)** (LEFT AND RIGHT) are **OFF**
- **Trigger**: SHMS/HMS PS2 (ELREAL) **OR** SHMS/HMS PS1 (3/4)
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 106 should be set to **-1**.
- Prescale values are only estimated; Use the lowest prescale values that keep the trigger rate in the **HMS near or below 4 kHz** and the **SHMS near or below 8kHz**
- Take data with SHMS and HMS simultaneously. Estimated run times are for 100% efficiency, but run based on Target e^- from Table 106 if given

Table 106: 20° EMC and 8° 2N-SRC Running - Setting 3

Target	I (μA)	HMS PS PS1	HMS PS PS2	SHMS PS PS1	SHMS PS PS2	Est. Time	Target e^-	Done ?
3He	40 ~~60~~	-1	0	-1	2	45 ~~1 hr~~ min	655K	✓
4He	40 ~~60~~	0	-1	2	-1	15 ~~30~~ min	-	✓
4He	40 ~~60~~	-1	0	-1	2	25 ~~1 hr~~ min	738K	✓
Al dummy	40	-1	0	-1	5	15 min	240K	✓
6Li	40	-1	0	-1	0	105 min	670K	
7Li	40	-1	0	-1	0	105 min	670K	✓
12C	60	-1	0	-1	3	40 min	670K	✓
27Al	40	-1	0	-1	2	65 min	670K	✓
63Cu	60	0	-1	3	-1	15 min	-	✓
63Cu	60	-1	0	-1	3	30 min	670K	✓
197Au	60	-1	0	-1	2	1 hr	670K	✓

← S1X, S2X(1-7)OFF 16 86.6

← S1X, S2X(1-7)OFF

3.3.4 Setting 4

- Set **HMS momentum** to **-4.78 GeV**.
- **SHMS momentum: -9.2 GeV**
- **HMS angle: 20°** **SHMS angle: 8°**
- *** CHANGE *** Go back to running with HV for **SHMS S1X (1-7)** and **S2X (1-7)** (LEFT AND RIGHT) turned **OFF**
- **Trigger**: SHMS/HMS PS2 (ELREAL) **OR** SHMS/HMS PS1 (3/4)
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 107 should be set to **-1**.
- Prescale values are only estimated; Use the lowest prescale values that keep the trigger rate in the **HMS near or below 4 kHz** and the **SHMS near or below 8kHz**
- Take data with SHMS and HMS simultaneously. Estimated run times are for 100% efficiency, but run based on Target e^- from Table 107 if given

Table 107: 20° EMC and 8° 2N-SRC Running - Setting 4

Target	I (μA)	HMS PS		SHMS PS		Est. Time	Target e^-	Done ?
		PS1	PS2	PS1	PS2			
197Au	60	-1	2	-1	5	~~10 min~~ 35	550K	✓
63Cu	60	0	-1	3	-1	~~5 min~~	-	✓
63Cu	60	-1	0	-1	3	10 min	550K	✓
27Al	40	-1	0	-1	2	25 min	550K	✓
12C	60	-1	0	-1	3	15 min	550K	✓
7Li	40	-1	0	-1	0	40 min	550K	✓
6Li	40	-1	0	-1	0	40 min	550K	✓
Al dummy	40	-1	0	-1	0	10 min	200K	✓ Not done yet. ✓
4He	~~40~~ 60	0	-1	2	-1	5 ~~15~~ min	-	✓
4He	~~40~~ 60	-1	0	-1	2	10 ~~25~~ min	620K	✓
3He	~~40~~ 60	-1	0	-1	2	20 ~~25~~ min	550K	✓

3.3.5 Setting 5

- Set **HMS momentum** to **-4.27 GeV**.
- **SHMS momentum: -9.2 GeV**
- **HMS angle: 20°** **SHMS angle: 8°**
- Make sure **SHMS S1X(1-7)** and **S2X(1-7)** (Left & Right) are **OFF**
- **Trigger**: SHMS/HMS PS2 (ELREAL) **OR** SHMS/HMS PS1 (3/4)
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 108 should be set to **-1**.
- Prescale values are only estimated; Use the lowest prescale values that keep the trigger rate in the **HMS near or below 4 kHz** and the **SHMS near or below 8kHz**
- Take data with SHMS and HMS simultaneously. Estimated run times are for 100% efficiency, but run based on Target e^- from Table 108 if given

Table 108: 20° EMC and 8° 2N-SRC Running - Setting 5

Target	I (μA)	HMS PS		SHMS PS		Est. Time	Target e^-	Done ?
		PS1	PS2	PS1	PS2			
3He	40 60	-1	0	-1	2	10 min	350K	✓
4He	40 60	0	-1	2	-1	5 min	-	✓
4He	40 60	-1	0	-1	2	10 min	330K	✓
Al dummy	40	-1	0	-1	0	10 min	110K	✓
6Li	40	-1	0	-1	0	20 min	330K	✓
7Li	40	-1	0	-1	0	20 min	330K	✓
12C	60	-1	0	-1	3	10 min	330K	✓
27Al	40	-1	0	-1	2	10 min	330K	
63Cu	60	0	-1	3	-1	5 min	-	
63Cu	60	-1	0	-1	3	10 min	330K	✓
197Au	60	-1	0	-1	2	10 min	330K	

3.3.6 Setting 6

- Set **HMS momentum** to **-3.81 GeV**.
- **SHMS momentum: -9.2 GeV**
- **HMS angle: 20°** **SHMS angle: 8°**
- Make sure **SHMS S1X(1-7)** and **S2X(1-7)** (Left & Right) are **OFF**
- **Trigger**: SHMS/HMS PS2 (ELREAL) **OR** SHMS/HMS PS1 (3/4)
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 109 should be set to **-1**.
- Prescale values are only estimated; Use the lowest prescale values that keep the trigger rate in the **HMS near or below 4 kHz** and the **SHMS near or below 8kHz**
- Take data with SHMS and HMS simultaneously. Estimated run times are for 100% efficiency, but run based on Target e^- from Table 109 if given

Table 109: 20° EMC and 8° 2N-SRC Running - Setting 6

Target	I (μA)	HMS PS		SHMS PS		Est. Time	Target e^-	Done ?
		PS1	PS2	PS1	PS2			
197Au	~~60~~	-1	0	-1	2	10 min	220K	
63Cu	~~60~~	0	-1	3	-1	5 min	-	
63Cu	~~60~~	-1	0	-1	3	10 min	220K	
27Al	40	-1	0	-1	2	10 min	220K	
12C	60	-1	0	-1	3	10 min	220K	
7Li	40	-1	0	-1	0	10 min	220K	
6Li	40	-1	0	-1	0	10 min	220K	
Al dummy	40	-1	0	-1	0	10 min	75K	
4He	~~60~~	0	-1	2	-1	5 min	-	
4He	~~60~~	-1	0	-1	2	10 min	230K	
3He	~~60~~	-1	0	-1	2	10 min	230K	

3.3.7 Setting 7

- Set **HMS momentum** to **-3.40 GeV**.
- **SHMS momentum: -9.2 GeV**
- **HMS angle: 20°** **SHMS angle: 8°**
- Make sure **SHMS S1X(1-7)** and **S2X(1-7)** (Left & Right) are **OFF**
- **Trigger**: SHMS/HMS PS2 (ELREAL) **OR** SHMS/HMS PS1 (3/4)
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 110 should be set to **-1**.
- Prescale values are only estimated; Use the lowest prescale values that keep the trigger rate in the **HMS near or below 4 kHz** and the **SHMS near or below 8kHz**
- Take data with SHMS and HMS simultaneously. Estimated run times are for 100% efficiency, but run based on Target e^- from Table 110 if given

Table 110: 20° EMC and 8° 2N-SRC Running - Setting 7

Target	***I*** (μA)	**HMS PS** PS1	PS2	**SHMS PS** PS1	PS2	**Est. Time**	**Target e^-**	**Done ?**
3He	~~60~~ 40	-1	0	-1	2	10 min	150K	✓
4He	~~60~~ 40	0	-1	2	-1	5 min	-	✓
4He	~~60~~ 40	-1	0	-1	2	10 min	150K	✓
Al dummy	40	-1	0	-1	0	10 min	50K	✓
6Li	40	-1	0	-1	0	10 min	150K	✓
7Li	40	-1	0	-1	0	10 min	150K	✓
12C	60	-1	1	-1	3	10 min	150K	✓
27Al	40	-1	0	-1	2	10 min	150K	✓
63Cu	60	0	-1	3	-1	5 min	-	✓
63Cu	60	-1	0	-1	3	10 min	150K	✓
197Au	60	-1	0	-1	3	10 min	150K	✓

3.3.8 Setting 8

- Set **HMS momentum** to **-3.04 GeV**. ✓
- **SHMS momentum: -9.2 GeV** ✓
- **HMS angle: 20°** ✓ **SHMS angle: 8°** ✓
- Make sure **SHMS S1X(1-7)** and **S2X(1-7)** (Left & Right) are **OFF** ✓
- **Trigger**: SHMS/HMS PS2 (ELREAL) **OR** SHMS/HMS PS1 (3/4) ✓
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 111 should be set to **-1**. ✓
- Prescale values are only estimated; Use the lowest prescale values that keep the trigger rate in the **HMS near or below 4 kHz** and the **SHMS near or below 8kHz**
- Take data with SHMS and HMS simultaneously. Estimated run times are for 100% efficiency, but run based on Target e^- from Table 111 if given

– 10min 100% efficiency.

* SHMS S2Y should be kept below 1 MHz.

Table 111: 20° EMC and 8° 2N-SRC Running - Setting 8

Target	I (μA)	HMS PS PS1	HMS PS PS2	SHMS PS PS1	SHMS PS PS2	Est. Time	Target e^-	Done ?	
197Au	60	-1	0	-1	3	10 min	120K	✓	1
63Cu	~~60~~	0	-1	3	-1	5 min	-	✓	3
63Cu	~~60~~ 40μA	-1	0	-1	3	10 min	120K	✓	2
27Al	40	-1	0	-1	2	10 min	120K	✓	4
12C	60	-1	1	-1	3	10 min	120K	✓	5
7Li	40	-1	0	-1	0	10 min	120K	✓	7
6Li	40	-1	0	-1	0	10 min	120K	✓	6
Al dummy	40	-1	0	-1	0	10 min	40K	✓	10
4He	~~40~~60	0	-1	2	-1	5 min	-	✓	8
4He	~~40~~60	-1	0	-1	2	10 min	120K	✓	9
3He	~~40~~60	-1	0	-1	2	10 min	120K		11

3.3.9 Setting 9

- Set **HMS momentum** to **-2.71 GeV.** ✓
- **SHMS momentum: -9.2 GeV** ✓
- **HMS angle: 20°** ✓ **SHMS angle: 8°** ✓
- Make sure **SHMS S1X(1-7)** and **S2X(1-7)** (Left & Right) are **OFF** ✓
- **Trigger**: SHMS/HMS PS2 (ELREAL) **OR** SHMS/HMS PS1 (3/4) ✓
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 112 should be set to **-1.** ✓
- Prescale values are only estimated; Use the lowest prescale values that keep the trigger rate in the **HMS near or below 4 kHz** and the **SHMS near or below 8kHz**
- Take data with SHMS and HMS simultaneously. Estimated run times are for 100% efficiency, but run based on Target e^- from Table 112 if given

10 min
100% eff.

* Watch SHMS S2Y rate < 1MHz Beam ON

Table 112: 20° EMC and 8° 2N-SRC Running - Setting 9

Target	I (μA)	HMS PS		SHMS PS		Est. Time	Target e^-	Done ?	
		PS1	PS2	PS1	PS2				
3He	~~60~~ 40	-1	0	-1	2	10 min	90K	✓	1
4He	~~60~~ 40	0	-1	2	-1	5 min	-	✓	3
4He	~~60~~ 40	-1	0	-1	2	10 min	90K	✓	4
Al dummy	40	-1	0	-1	0	10 min	30K	✓	2
6Li	40	-1	0	-1	0	10 min	90K	✓	6
7Li	40	-1	0	-1	0	10 min	90K	✓	5
12C	60	-1	1	-1	3	10 min	90K	✓	7
27Al	40	-1	0	-1	2	10 min	90K	✓	8
63Cu	~~60~~ 40	0	-1	3	-1	5 min	-	✓	9
63Cu	~~60~~ 40	-1	0	-1	3	10 min	90K	✓	10
197Au	60	-1	0	-1	3	10 min	90K	✓	

After 3He ☆

* run Al dummy (10 min)

* while on Al dummy Park 3He & increase JT valve for 4He

3.3.10 Setting 10

- Set **HMS momentum** to **-2.42 GeV**.
- **SHMS momentum: -9.2 GeV**
- **HMS angle: 20°** **SHMS angle: 8°**
- Make sure **SHMS S1X(1-7)** and **S2X(1-7)** (Left & Right) are **OFF**
- **Trigger**: SHMS/HMS PS2 (ELREAL) **OR** SHMS/HMS PS1 (3/4)
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 113 should be set to **-1**.
- Prescale values are only estimated; Use the lowest prescale values that keep the trigger rate in the **HMS near or below 4 kHz** and the **SHMS near or below 8kHz**
- Take data with SHMS and HMS simultaneously. Estimated run times are for 100% efficiency, but run based on Target e^- from Table 113 if given

Table 113: 20° EMC and 8° 2N-SRC Running - Setting 10

Target	I (μA)	HMS PS PS1	HMS PS PS2	SHMS PS PS1	SHMS PS PS2	Est. Time	Target e^-	Done ?
197Au	60	0	-1	2	-1	5 min	-	✓
197Au	60	-1	0	-1	5	10 min	75K	✓
63Cu	60	-1	0	-1	5	≥ 10 min	75K	✓
63Cu	60	0	-1	5	-1	5 min	-	✓
27Al	40	0	-1	5	-1	5 min	-	✓
27Al	40	-1	0	-1	5	10 min	75K	✓
12C	60	-1	0	-1	5	10 min	75K	✓
12C	60	0	-1	5	-1	5 min	-	✓
7Li	40	0	-1	5	-1	5 min	-	✓
7Li	40	-1	0	-1	5	10 min	75K	✓
6Li	40	-1	0	-1	5	10 min	75K	✓
6Li	40	0	-1	5	-1	5 min	-	✓
Al dummy	40	0	-1	0	-1	5 min	-	✓
Al dummy	40	-1	0	-1	5	10 min	25K	✓
4He	~~60~~ 40	-1	0	-1	5	10 min	75K	✓
4He	~~60~~ 40	0	-1	5	-1	5 min	-	✓
3He	~~60~~ 40	0	-1	5	-1	5 min	-	✓
3He	~~60~~ 40	-1	0	-1	5	10 min	75K	✓

2
1

After 4He

mmmmm ... mmy

!!! TURN ALL THE SHMS HODO PADDLES BACK ON !!!

3.4 Target Boiling Studies - Part III (Ladder II)

Warning: when rotating the HMS to 20 degrees, there is an increased chance that the rotation will get "stuck" and require expert intervention.

Please follow the instructions below:

1. When rotating to 20 degrees from smaller HMS angle, it is ok to go directly to 20 degrees.
2. When rotating to 20 degrees from larger angle, first rotate to 19 degrees, and then to 20 degrees.

- **DAQ:** Single Arm
- **SHMS/HMS Trigger:** ELREAL-ELREAL (SHMS PS2, HMS PS2)
- SHMS Settings: -4.0 GeV & 20 deg
- HMS Settings: -4.0 GeV & 20 deg

Keep rates below 4 kHz on both shms and hms

3.4.1 Boiling studies - 3He target

- Move target to 3He and take one run with each current setting.

2:20 am

Target	I (μA)	est. time	Done ?
3He	40 μA	10 min	✓
3He	35 μA	10 min	✓
3He	30 μA	10 min	✓
3He	25 μA	10 min	✓
3He	20 μA	10 min	✓
3He	10 μA	10 min	✓

ok 2:30 AM

3.4.2 Boiling studies - 4He target

- Move target to 4He and take one run with each current setting.

Target	I (μA)	est. time	Done ?
4He	40 μA	10 min	✓
4He	35 μA	10 min	✓
4He	30 μA	10 min	✓
4He	25 μA	10 min	✓
4He	20 μA	10 min	✓
4He	10 μA	10 min	✓

3.4.3 Boiling studies - Carbon target

- Move target to Carbon and take one run with each current setting.

Target	I (μA)	est. time	Done ?
Carbon	50 μA	10 min	✓ ~5 min
Carbon	40 μA	10 min	
Carbon	35 μA	10 min	
Carbon	30 μA	10 min	
Carbon	25 μA	10 min	
Carbon	20 μA	10 min	✓ ~5 min
Carbon	10 μA	10 min	

3.4.4 Boiling studies - Al dummy target

- Move target to Al dummy and take one run with each current setting.

Target	I (μA)	est. time	Done ?
dummy	40 μA	10 min	✓

start here
-> image hole
target
first

4.2 Target Boiling Studies - Part III (La

Warning: when rotating the HMS to 20 degrees, there is
that the rotation will get "stuck" and require expert inter

Please follow the instructions below:

1. When rotating to 20 degrees from smaller HMS angle,
to 20 degrees.
2. When rotating to 20 degrees from larger angle, first ro 19 degrees,
and then to 20 degrees.

- **DAQ:** Single Arm
- **SHMS/HMS Trigger:** ELREAL-ELREAL
- SHMS Settings: -4.0 GeV & 20 deg
- HMS Settings: -4.0 GeV & 20 deg

4.2.1 Boiling studies - 3He target

- Move target to 3He and take one run with each current setting.

Target	I (μA)	est. time	Done ?
3He	40 μA	10 min	✓
3He	35 μA	10 min	✓
3He	30 μA	10 min	✓
3He	25 μA	10 min	✓
3He	20 μA	10 min	✓
3He	10 μA	10 min	✓

4.2.2 Boiling studies - 4He target

- Move target to 4He and take one run with each current setting.

Target	I (μA)	est. time	Done ?
4He	40 μA	10 min	✓
4He	35 μA	10 min	✓
4He	30 μA	10 min	✓
4He	25 μA	10 min	✓
4He	20 μA	10 min	✓
4He	10 μA	10 min	✓

4.2.3 Boiling studies - Carbon target

- Move target to Carbon and take one run with each current setting.

Target	I (μA)	est. time	Done ?
Carbon	50 μA	10 min	✓
Carbon	40 μA	10 min	✓
Carbon	35 μA	10 min	✓
Carbon	30 μA	10 min	✓
Carbon	25 μA	10 min	✓
Carbon	20 μA	10 min	✓
Carbon	10 μA	10 min	✓

4.2.4 Boiling studies - Al dummy target

- Move target to Al dummy and take one run with each current setting.

Target	I (μA)	est. time	Done ?
dummy	40 μA	10 min	✓

4.3 Charge Symmetric Background Studies at 20 deg - Part II

- TURN the **SHMS S1X (1-7)** and **S2X (1-7)** LEFT and RIGHT HODOSCOPE PADDLES **OFF**.
- TURN the **SHMS PRESHOWER (1-6)** LEFT and RIGHT BLOCKS **OFF**.
- In this section, we will take data with the SHMS and HMS simultaneously in the single arm mode. HMS takes positron data (subset of targets at all 4 kinematics, additional targets for 2 kinematics) with both ELCLEAN and 3/4 triggers; SHMS runs the entire time in a single configuration (fixed trigger, fixed kinematics).
- While the SHMS and HMS angles will be kept fixed (at different values), the HMS will be configured to several different momentum settings. Please follow the tables below in the order written.
- the SHMS can continue running while the HMS settings (trigger or momentum) are being changed. SHMS runs only need to start/stop when the target changes.

4.3.1 Setting 1

- **SHMS S1X (1-7)** and **S2X (1-7)** LEFT and RIGHT HODOSCOPE PADDLES **OFF**.
- **SHMS PRESHOWER (1-6)** LEFT and RIGHT BLOCKS **OFF**.
- Set **HMS momentum** to **+3.40 GeV**.
- **SHMS momentum: -9.2 GeV**
- **HMS angle: 20°** **SHMS angle: 8.5°**
- **Trigger**: SHMS PS3 (ELCLEAN), HMS PS3 OR PS1 (ELCLEAN or 3/4)
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 110 should be set to **-1**.
- **Prescale values are only estimated; adjust them on both SHMS and HMS Prescale GUIs accordingly to keep the HMS rates below 4 kHz and the SHMS rates below 8 kHz**
- Take data with the SHMS and HMS simultaneously. SHMS can take a single run while HMS is taking both ELCLEAN and 3/4 trigger data for the same target
- Can take extra SHMS data while changing the HMS momentum between settings.

Table 110: CSB Studies at 20° - Setting 1

Target	***I***	**HMS PS**			**SHMS PS**			**Est. Time**	Done ?
	(μA)	PS1	PS2	PS3	PS1	PS2	PS3		
3He	40	-1	-1	0	-1	-1	0	10 min	✓
3He	40	0	-1	-1	-1	-1	0	10 min	✓
12C	60	0	-1	-1	-1	-1	0	10 min	✓
12C	60	-1	-1	0	-1	-1	0	10 min	✓
4He	40	-1	-1	0	-1	-1	0	10 min	✓
4He	40	0	-1	-1	-1	-1	0	10 min	✓
63Cu	60	0	-1	-1	-1	-1	0	10 min	✓
63Cu	60	-1	-1	0	-1	-1	0	10 min	✓
40Ca	60	-1	-1	0	-1	-1	0	10 min	✓
40Ca	60	0	-1	-1	-1	-1	0	10 min	✓

4.3.2 Setting 2

- **SHMS S1X (1-7)** and **S2X (1-7)** LEFT and RIGHT HODOSCOPE PADDLES **OFF**.
- **SHMS PRESHOWER (1-6)** LEFT and RIGHT BLOCKS **OFF**.
- Set **HMS momentum** to **+3.04 GeV**.
- **SHMS momentum: -9.2 GeV**
- **HMS angle: 20°** **SHMS angle: 8.5°**
- **Trigger**: SHMS PS3 (ELCLEAN), HMS PS3 OR PS1 (ELCLEAN or 3/4)
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 111 should be set to **-1**.
- **Prescale values are only estimated; adjust them on both SHMS and HMS Prescale GUIs accordingly to keep the HMS rates below 4 kHz and the SHMS rates below 8 kHz.**
- Take data with the SHMS and HMS simultaneously. SHMS can take a single run while HMS is taking both ELCLEAN and 3/4 trigger data for the same target
- Can take extra SHMS data while changing the HMS momentum between settings.

12-14-22

Table 111: CSB Studies at 20° - Setting 2

Target	I (μA)	HMS PS			SHMS PS			Est. Time	Done ?
		PS1	PS2	PS3	PS1	PS2	PS3		
40Ca	60	-1	-1	0	-1	-1	0	10 min	✓
40Ca	60	0	-1	-1	-1	-1	0	10 min	✓
197Au	60	0	-1	-1	-1	-1	0	10 min	✓
197Au	60	-1	-1	0	-1	-1	0	10 min	✓
63Cu	60	-1	-1	0	-1	-1	0	20 min	✓
63Cu	60	0	-1	-1	-1	-1	0	10 min	✓
27Al	40	0	-1	-1	-1	-1	0	10 min	✓
27Al	40	-1	-1	0	-1	-1	0	10 min	✓
12C	60	-1	-1	0	-1	-1	0	20 min	✓
12C	60	0	-1	-1	-1	-1	0	10 min	✓
6Li	40	0	-1	-1	-1	-1	0	10 min	✓
6Li	40	-1	-1	0	-1	-1	0	10 min	✓
7Li	40	-1	-1	~~0~~ 3	-1	-1	0	10 min	✓
7Li	40	0	-1	-1	-1	-1	0	10 min	✓
4He	40	0	-1	-1	-1	-1	0	10 min	✓
4He	40	-1	-1	0	-1	-1	0	20 min	✓
Al dummy	40	-1	-1	0	-1	-1	0	10 min	✓
Al dummy	40	0	-1	-1	-1	-1	0	10 min	✓
3He	40	0	-1	-1	-1	-1	0	10 min	✓
3He	40	-1	-1	0	-1	-1	0	10 min	✓

REDONE
PS1 : 3
PS2 = PS3 =

~~after that while changing magnet, ask acc to do their Energy measurement.~~

Good run
✓
19716

4He SHMS : PS set wrong. Only 10m total
PS3

14,15
bad

4.3.3 Setting 3

- **SHMS S1X (1-7)** and **S2X (1-7)** LEFT and RIGHT HODOSCOPE PADDLES **OFF**.
- **SHMS PRESHOWER (1-6)** LEFT and RIGHT BLOCKS **OFF**.
- Set **HMS momentum** to **+2.71 GeV**.
- **SHMS momentum: -9.2 GeV**
- **HMS angle: 20°** **SHMS angle: 8.5°**
- **Trigger**: SHMS PS3 (ELCLEAN), HMS PS3 OR PS1 (ELCLEAN or 3/4)
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 112 should be set to **-1**.
- **Prescale values are only estimated; adjust them on both SHMS and HMS Prescale GUIs accordingly to keep the HMS rates below 4 kHz and the SHMS rates below 8 kHz.**
- Take data with the SHMS and HMS simultaneously. SHMS can take a single run while HMS is taking both ELCLEAN and 3/4 trigger data for the same target
- Can take extra SHMS data while changing the HMS momentum between settings.

Table 112: CSB Studies at 20° - Setting3

Target	***I***	**HMS PS**			**SHMS PS**			**Est. Time**	Done ?
	(μA)	PS1	PS2	PS3	PS1	PS2	PS3		
3He	40	-1	-1	0	-1	-1	0	10 min	✓
3He	40	0	-1	-1	-1	-1	0	10 min	✓
12C	60	0	-1	-1	-1	-1	0	10 min	✓
12C	60	-1	-1	0	-1	-1	0	10 min	✓
4He	40	-1	-1	0	-1	-1	0	10 min	✓
4He	40	0	-1	-1	-1	-1	0	10 min	✓
63Cu	60	0	-1	-1	-1	-1	0	10 min	✓
63Cu	60	-1	-1	0	-1	-1	0	10 min	✓
40Ca	60	-1	-1	0	-1	-1	0	10 min	✓
40Ca	60	0	-1	-1	-1	-1	0	10 min	✓

4.3.4 Setting 4

- **SHMS S1X (1-7)** and **S2X (1-7)** LEFT and RIGHT HODOSCOPE PADDLES **OFF**.
- **SHMS PRESHOWER (1-6)** LEFT and RIGHT BLOCKS **OFF**.
- Set **HMS momentum** to **+2.42 GeV**.
- **SHMS momentum: -9.2 GeV**
- **HMS angle: 20°** **SHMS angle: 8.5°**
- **Trigger**: SHMS PS3 (ELCLEAN), HMS PS3 OR PS1 (ELCLEAN or 3/4)
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 113 should be set to **-1**.
- **Prescale values are only estimated; adjust them on both SHMS and HMS Prescale GUIs accordingly to keep the HMS rates below 4 kHz and the SHMS rates below 8 kHz.**
- Take data with the SHMS and HMS simultaneously. SHMS can take a single run while HMS is taking both ELCLEAN and 3/4 trigger data for the same target
- Can take extra SHMS data while changing the HMS momentum between settings.
- Total estimated time for this section including the momentum and target changes: **10.5 hrs**. Estimated run times are with 100% efficiency.

Table 113: CSB Studies at 20° - Setting 4

Target	I	**HMS PS**			**SHMS PS**			**Est. Time**	Done ?
	(μA)	PS1	PS2	PS3	PS1	PS2	PS3		
40Ca	60	0	-1	-1	-1	-1	0	10 min	✓
40Ca	60	-1	-1	0	-1	-1	0	10 min	✓
197Au	60	-1	-1	0	-1	-1	0	10 min	✓
197Au	60	0	-1	-1	-1	-1	0	10 min	✓
63Cu	60	0	-1	-1	-1	-1	0	10 min	✓
63Cu	60	-1	-1	0	-1	-1	0	10 min	✓
27Al	40	-1	-1	0	-1	-1	0	10 min	✓
27Al	40	0	-1	-1	-1	-1	0	10 min	✓
C12	60	0	-1	-1	-1	-1	0	10 min	✓
C12	60	-1	-1	0	-1	-1	0	10 min	✓
6Li	40	-1	-1	0	-1	-1	0	10 min	✓
6Li	40	0	-1	-1	-1	-1	0	10 min	✓
7Li	40	0	-1	-1	-1	-1	0	10 min	✓
7Li	40	-1	-1	0	-1	-1	0	10 min	✓
4He	40	-1	-1	0	-1	-1	0	10 min	✓
4He	40	0	-1	-1	-1	-1	0	10 min	✓
Al dummy	40	0	-1	-1	-1	-1	0	10 min	✓
Al dummy	40	-1	-1	0	-1	-1	0	10 min	✓
3He	40	-1	-1	0	-1	-1	0	10 min	✓
3He	40	0	-1	-1	-1	-1	0	10 min	✓

BCM Calibration (~1 hour)

Dave Mack updated 8/12/22
Updated by Dave Gaskell 12/15/2022

Instructions to Hall C shift crew:

1. Give the MCC operator a copy of this procedure.

1. Fast Raster on 2x2 (to protect stuff)

2. 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 .)

3. 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,

4. Start a run labelled "BCM calibration".

5. 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.

6. 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 vs time would be greatly appreciated.

- Do each of the following currents, plateauing for ~1.5 minutes 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 1.5 minute clock.)

- Approximate currents are fine. The Hall C Unser will determine the true beam current.

- The zeroes are as important as the beam-on periods. *(No need to close the slit for these.)*

In units of muA:

0, 60, 0, 55, 0, 50, 0, 40, 0, 30, 0, 20, 0, 10

Then

0, 60, 0, 55, 0, 50, 0, 40, 0, 30, 0, 20, 0, 10, 0.

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

4.4 SHMS 8.5 deg and HMS 35 deg - Target Ladder II

- TURN OFF HV for SHMS S1X paddles 1-8 and S2X 1-8 (+ and -)
- TURN OFF HV for SHMS Preshower blocks 1-8 (+ and -)
- In this section, we will take data with the SHMS and HMS simultaneously in the single arm mode using a subset of targets on the target ladder II.
- While the SHMS and HMS angles will be kept fixed (at different values), the HMS will be configured to several different momentum settings. Please follow the tables below in the order written.
- Estimated run times are with 100% efficiency.

4.4.1 Setting 1

- **HMS momentum: -4.08 GeV.**
- **SHMS momentum: -9.2 GeV.**
- **SHMS angle: 8.5°** **HMS angle: 35°**
- SHMS should have HV for S1X paddles 1-8 and S2X paddles 1-8 TURNED OFF for all settings
- SHMS should have HV for SHMS Preshower blocks 1-8 (+ and -) TURNED OFF
- **Trigger**: HMS is PS2(ELREAL); SHMS is PS3(ELCLEAN)
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 114 should be set to **-1**.
- Prescale values are only estimated; Use the lowest prescale values that keep the trigger rate in the **HMS near or below 4 kHz** and the **SHMS near or below 8kHz**
- Follow Table 114. Take data with the SHMS and HMS simultaneously.
- Estimated run times are with 100% efficiency.

Table 114: 8.5 deg 3N-SRC and high-x at 35° - Setting 1. Spend half of the time before the break cycling through targets at setting 1, then switch to setting 2.

Target	I	HMS PS		SHMS PS		Est. Time	Target e^-	Done ?
	(μA)	PS1	PS2	PS2	PS3			
3He	40	-1	0	-1	0	2 hrs	-	✓
Dummy	40	-1	0	-1	0	1 hrs	-	✓
4He	40	-1	0	-1	1	2 hrs	-	✓
9Be	60	-1	0	-1	0	1.5 hrs	-	✓
12C	60	-1	0	-1	0	1.5 hrs	-	✓
40Ca	60	-1	0	-1	0	1.5 hrs	-	✓
40Ca	60	-1	0	-1	0	1.5 hrs	-	✓
12C	60	-1	0	-1	0	1.5 hrs	-	✓
9Be	60	-1	0	-1	0	1.5 hrs	-	✓
4He	40	-1	0	-1	1	2 hrs	-	✓
Dummy	40	-1	0	-1	0	1 hrs	-	✓
3He	40	-1	0	-1	0	2 hrs	-	✓
3He	40	-1	0	-1	0	2 hrs	-	✓
Dummy	40	-1	0	-1	0	1 hrs	-	✓
4He	40	-1	0	-1	1	2 hrs	-	✓
9Be	60	-1	0	-1	0	1.5 hrs	-	✓
12C	60	-1	0	-1	0	1.5 hrs	-	✓
40Ca	60	-1	0	-1	0	1.5 hrs	-	✓
40Ca	60	-1	0	-1	0	1.5 hrs	-	✓
12C	60	-1	0	-1	0	1.5 hrs	-	✓
9Be	60	-1	0	-1	0	1.5 hrs	-	✓
4He	40	-1	0	-1	1	2 hrs	-	✓
Dummy	40	-1	0	-1	0	1 hrs	-	✓
3He	40	-1	0	-1	0	2 hrs	-	✓

4.4.2 Setting 2

- Set **HMS momentum** to **-3.57 GeV**. Everything else as setting 1)
- **SHMS momentum: -9.2 GeV.**
- **SHMS angle: 8.5°** **HMS angle: 35°**
- SHMS should have HV for S1X paddles 1-8 and S2X paddles 1-8 TURNED OFF for all settings
- SHMS should have HV for SHMS Preshower blocks 1-8 (+ and -) TURNED OFF
- **Trigger:** HMS is PS2(ELREAL); SHMS is PS3(ELCLEAN)
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 115 should be set to **-1**.
- Prescale values are only estimated; Use the lowest prescale values that keep the trigger rate in the **HMS near or below 4 kHz** and the **SHMS near or below 8kHz**
- Estimated run times are with 100% efficiency.

Table 115: 8.5 deg 3N-SRC and high-x at 35° - Setting 2

Target	I (μA)	**HMS PS** PS1	PS2	**SHMS PS** PS2	PS3	**Est. Time**	**Target e^-**	**Done ?**
3He	40	-1	0	-1	0	2 hrs	-	
Dummy	40	-1	0	-1	0	1 hrs	-	
4He	40	-1	0	-1	1	2 hrs	-	
9Be	60	-1	0	-1	0	1.5 hrs	-	
12C	60	-1	0	-1	0	1.5 hrs	-	
40Ca	60	-1	0	-1	0	1.5 hrs	-	
40Ca	60	-1	0	-1	0	1.5 hrs	-	
12C	60	-1	0	-1	0	1.5 hrs	-	
9Be	60	-1	0	-1	0	1.5 hrs	-	
4He	40	-1	0	-1	1	2 hrs	-	
Dummy	40	-1	0	-1	0	1 hrs	-	
3He	40	-1	0	-1	0	2 hrs	-	
3He	40	-1	0	-1	0	2 hrs	-	
Dummy	40	-1	0	-1	0	1 hrs	-	
4He	40	-1	0	-1	1	2 hrs	-	
9Be	60	-1	0	-1	0	1.5 hrs	-	
12C	60	-1	0	-1	0	1.5 hrs	-	
40Ca	60	-1	0	-1	0	1.5 hrs	-	
40Ca	60	-1	0	-1	0	1.5 hrs	-	
12C	60	-1	0	-1	0	1.5 hrs	-	
9Be	60	-1	0	-1	0	1.5 hrs	-	
4He	40	-1	0	-1	1	2 hrs	-	
Dummy	40	-1	0	-1	0	1 hrs	-	
3He	40	-1	0	-1	0	2 hrs	-	

~40 mins of data taken 19th Dec, 7:00 AM

Not done

Holiday shutdown

4.5 Target/Beam Centering Check with Hole Target (January 2023)

- Move target to "hole"
- Raster: 2 mm x 2 mm
- Set **HMS momentum** to **+2.40 GeV**.
- **SHMS angle: 10°**
- **SHMS momentum: -9.2 GeV**
- **HMS angle: 35°**
- **Make sure all the hodoscope and preshower HVs are ON.**
- When ready ask for 5uA and start the SHMS DAQ.
- Run the 50K replay and check the fast raster pattern.
- Iterate the beam position until the hole is clear and is centered in the square raster pattern. → see last measurement ∇
- Full procedure: https://hallcweb.jlab.org/wiki/index.php/Beam_Checkout_Procedures

4.6 Charge Symmetric Background Studies at 35 deg - Part II

- TURN SHMS S1X(1-5) and S2X(1-6) HV OFF
- ALL PRESHOWER BLOCKS ARE ON

4.6.1 Setting 1

- Set **HMS momentum** to **+2.40 GeV**.
- **SHMS angle: 10°**
- **SHMS momentum: -9.2 GeV**
- **HMS angle: 35°**
- **Trigger**: SHMS/HMS PS3 (ELCLEAN) **OR** SHMS/HMS PS1 (3/4)
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 116 should be set to **-1**.
- Prescale values are only estimated; Use the lowest prescale values that keep the trigger rate in the **HMS near or below 4 kHz** and the **SHMS near or below 8kHz**
- Take data with the SHMS and HMS simultaneously.

Table 116: CSB Studies at 35° - Setting 1 SHMS S1X(1-5) and S2X(1-6) HV TURNED OFF

Target	I	**HMS PS**			**SHMS PS**			**Est. Time**	Done ?
	(μA)	PS1	PS2	PS3	PS1	PS2	PS3		
4He	40	-1	-1	0	-1	-1	0	10 min	✓
4He	40	0	-1	-1	-1	-1	0	5 min	✓
63Cu	60	0	-1	-1	-1	-1	0	5 min	✓
63Cu	60	-1	-1	0	-1	-1	0	10 min	✓
12C	60	-1	-1	0	-1	-1	0	10 min	✓
12C	60	0	-1	-1	-1	-1	0	5 min	✓

4.6.2 Setting 2

- Set **HMS momentum** to **+2.11 GeV**.
- **SHMS angle: 10°**
- **SHMS momentum: -9.2 GeV**
- **HMS angle: 35°**
- **Trigger**: SHMS/HMS PS3 (ELCLEAN) **OR** SHMS/HMS PS1 (3/4)
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 117 should be set to **-1**.
- Prescale values are only estimated; Use the lowest prescale values that keep the trigger rate in the **HMS near or below 4 kHz** and the **SHMS near or below 8kHz**
- Take data with the SHMS and HMS simultaneously.

Table 117: CSB Studies at 35° - Setting 2 SHMS S1X(1-5) and S2X(1-6) HV TURNED OFF

Target	I	**HMS PS**			**SHMS PS**			**Est. Time**	Done ?
	(μA)	PS1	PS2	PS3	PS1	PS2	PS3		
12C	60	0	-1	-1	-1	-1	0	5 min	✓
12C	60	-1	-1	0	-1	-1	0	15 min	✓
63Cu	60	-1	-1	0	-1	-1	0	15 min	✓
63Cu	60	0	-1	-1	-1	-1	0	5 min	✓
4He	40	0	-1	-1	-1	-1	0	5 min	✓
4He	40	-1	-1	0	-1	-1	0	15 min	✓

→ still here
look about
half of it.

4.6.3 Setting 3

- Set **HMS momentum** to **+1.85 GeV**.
- **SHMS angle: 10°**
- **SHMS momentum: -9.2 GeV**
- **HMS angle: 35°**
- **Trigger**: SHMS/HMS PS3 (ELCLEAN) **OR** SHMS/HMS PS1 (3/4)
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 118 should be set to **-1**.
- Prescale values are only estimated; Use the lowest prescale values that keep the trigger rate in the **HMS near or below 4 kHz** and the **SHMS near or below 8kHz**
- Take data with the SHMS and HMS simultaneously.

Table 118: CSB Studies at 35° - Setting 3 SHMS S1X(1-5) and S2X(1-6) HV TURNED OFF

Target	I (μA)	HMS PS			SHMS PS			Est. Time	Done ?
		PS1	PS2	PS3	PS1	PS2	PS3		
4He	40	-1	-1	0	-1	-1	0	10 min	✓
4He	40	0	-1	-1	-1	-1	0	5 min	✓
3He	40	0	-1	-1	-1	-1	0	5 min	✓
3He	40	-1	-1	0	-1	-1	0	10 min	✓
Al dummy	40	-1	-1	-1	-1	-1	0	10 min	✓
Al dummy	40	0	-1	-1	-1	-1	-1	5 min	✓
63Cu	60	-1	-1	0	-1	-1	0	15 min	✓
63Cu	60	0	-1	-1	-1	-1	0	5 min	✓
197Au	60	-1	-1	0	-1	-1	0	15 min	✓
197Au	60	0	-1	-1	-1	-1	0	5 min	✓
12C	60	0	-1	-1	-1	-1	0	5 min	✓
12C	60	-1	-1	0	-1	-1	0	10 min	✓
11B	60	0	-1	-1	-1	-1	0	5 min	✓
11B	60	-1	-1	0	-1	-1	0	15 min	✓
10B	60	0	-1	-1	-1	-1	0	5 min	✓
10B	60	-1	-1	0	-1	-1	0	15 min	✓

Let RC know when you're ready to move to carbon. (Only during normal hours)

4.6.4 Setting 4

- Set **HMS momentum** to **+1.63 GeV**.
- **SHMS angle: 10°**
- **SHMS momentum: -9.2 GeV**
- **HMS angle: 35°**
- **Trigger**: SHMS/HMS PS3 (ELCLEAN) **OR** SHMS/HMS PS1 (3/4)
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 119 should be set to **-1**.
- Prescale values are only estimated; Use the lowest prescale values that keep the trigger rate in the **HMS near or below 4 kHz** and the **SHMS near or below 8kHz** Prescaled rate keep EDTM following table
- Take data with the SHMS and HMS simultaneously.

40 μA

Table 119: CSB Studies at 35° - Setting 4 SHMS S1X(1-5) and S2X(1-6) HV TURNED OFF

Target	I (μA)	HMS PS			SHMS PS			Est. Time	Done ?
		PS1	PS2	PS3	PS1	PS2	PS3		
11B	60	0	-1	-1	-1	-1	0	5 min	✓
11B	60	-1	-1	0	-1	-1	0	15 min	✓
10B	60	0	-1	-1	-1	-1	0	5 min	✓
10B	60	-1	-1	0	-1	-1	0	15 min	✓
12C	60	-1	-1	0	-1	-1	0	10 min	✓
12C	60	0	-1	-1	-1	-1	0	15 min	✓
197Au	60	-1	-1	0	-1	-1	0	15 min	✓
197Au	60	0	-1	-1	-1	-1	0	5 min	✓
63Cu	60	0	-1	-1	-1	-1	0	5 min	✓
63Cu	60	-1	-1	0	-1	-1	0	20 min	✓
Al dummy	40	-1	-1	0	-1	-1	0	10 min	✓
Al dummy	40	0	-1	-1	-1	-1	0	5 min	✓
3He	~~60~~ 40	-1	-1	0	-1	-1	0	15 min	✓
3He	~~60~~ 40	0	-1	-1	-1	-1	0	5 min	✓
4He	~~60~~ 40	0	-1	-1	-1	-1	0	5 min	✓
4He	~~60~~ 40	-1	-1	0	-1	-1	0	15 min	✓

40 μA on Helium

4.6.5 Setting 5

- Set **HMS momentum** to **+1.44 GeV**.
- **SHMS angle: 10°**
- **SHMS momentum: -9.2 GeV**
- **HMS angle: 35°**
- **Trigger**: SHMS/HMS PS3 (ELCLEAN) **OR** SHMS/HMS PS1 (3/4)
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 118 should be set to **-1**.
- Prescale values are only estimated; Use the lowest prescale values that keep the trigger rate in the **HMS near or below 4 kHz** and the **SHMS near or below 8kHz**
- Take data with the SHMS and HMS simultaneously.

Table 120: CSB Studies at 35° - Setting 5 SHMS S1X(1-5) and S2X(1-6) HV TURNED OFF

Target	***I*** (μA)	**HMS PS** PS1	PS2	PS3	**SHMS PS** PS1	PS2	PS3	**Est. Time**	Done ?
4He	60	-1	-1	0	-1	-1	0	20 min	✓
4He	60	0	-1	-1	-1	-1	0	5 min	✓
3He	60	0	-1	-1	-1	-1	0	5 min	✓
3He	60	-1	-1	0	-1	-1	0	20 min	✓
Al dummy	40	-1	-1	-1	-1	-1	0	15 min	✓
Al dummy	40	0	-1	-1	-1	-1	0	5 min	✓
63Cu	60	0	-1	-1	-1	-1	0	5 min	✓
63Cu	60	-1	-1	0	-1	-1	0	20 min	✓
197Au	60	-1	-1	0	-1	-1	0	20 min	✓
197Au	60	0	-1	-1	-1	-1	0	5 min	✓
12C	60	0	-1	-1	-1	-1	0	5 min	✓
12C	60	-1	-1	0	-1	-1	0	20 min	✓

No more than 40μA on helium

4.6.6 Setting 6

- Set **HMS momentum** to **+1.26 GeV**.
- **SHMS angle: 10°**
- **SHMS momentum: -9.2 GeV**
- **HMS angle: 35°**
- **Trigger**: SHMS/HMS PS3 (ELCLEAN) **OR** SHMS/HMS PS1 (3/4)
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 121 should be set to **-1**.
- Prescale values are only estimated; Use the lowest prescale values that keep the trigger rate in the **HMS near or below 4 kHz** and the **SHMS near or below 8kHz**
- Take data with the SHMS and HMS simultaneously.

Table 121: CSB Studies at 35° - Setting 6 SHMS S1X(1-5) and S2X(1-6) HV TURNED OFF

Target	***I*** (μA)	**HMS PS** PS1	PS2	PS3	**SHMS PS** PS1	PS2	PS3	**Est. Time**	Done ?
11B	60	0	-1	-1	-1	-1	0	5 min	✓
11B	60	-1	-1	0	-1	-1	0	15 min	✓
10B	60	0	-1	-1	-1	-1	0	5 min	✓
10B	60	-1	-1	0	-1	-1	0	15 min	✓
12C	60	-1	-1	0	-1	-1	0	15 min	✓
12C	60	0	-1	-1	-1	-1	0	5 min	✓
63Cu	60	0	-1	-1	-1	-1	0	5 min	✓
63Cu	60	-1	-1	0	-1	-1	0	20 min	✓
197Au	60	0	-1	-1	-1	-1	0	5 min	✓
197Au	60	-1	-1	0	-1	-1	0	15 min	✓
Al dummy	40	0	-1	-1	-1	-1	0	5 min	✓
Al dummy	40	-1	-1	-1	-1	-1	0	15 min	✓
3He	40	-1	-1	0	-1	-1	0	10 min	✓
3He	40	0	-1	-1	-1	-1	0	5 min	✓
4He	40	0	-1	-1	-1	-1	0	5 min	✓
4He	40	-1	-1	0	-1	-1	0	15 min	✓

- Total estimated time for subsection including the momentum and target changes: **14 hrs**. Estimated run times are with 100% efficiency.

NO more than 40μA on helium

4.7 SHMS 10 deg and HMS 35 deg - Target Ladder II

- SHMS should have HV for S1X paddles 1-5 and S2X paddles 1-6 TURNED OFF for all settings
- SHMS should have HV for SHMS Preshower blocks 1-6 (+ and -) TURNED OFF for all settings
- In this section, we will take data with the SHMS and HMS simultaneously in the single arm mode using a subset of targets on the target ladder II.
- While the SHMS and HMS angles will be kept fixed (at different values), the HMS will be configured to several different momentum settings. Please follow the tables below in the order written.
- Estimated run times are with 100% efficiency.

4.7.1 Setting 1

- **HMS momentum: -4.08 GeV**.
- **SHMS momentum: -9.2 GeV**.
- **SHMS angle: 10°** **HMS angle: 35°**
- SHMS should have HV for S1X paddles 1-5 and S2X paddles 1-6 TURNED OFF for all settings
- SHMS should have HV for SHMS Preshower blocks 1-6 (+ and -) TURNED OFF
- **Trigger**: HMS is PS2(ELREAL) or PS1(3/4); SHMS is PS3(ELCLEAN) or PS2(ELREAL)
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 122 should be set to **-1**.
- Prescale values are only estimated; Use the lowest prescale values that keep the trigger rate in the **HMS near or below 4 kHz** and the **SHMS near or below 8kHz**
- Follow Table 122. Take data with the SHMS and HMS simultaneously.
- Estimated run times are with 100% efficiency. FOR THIS SETTING, STOP AT 120% OF THE ESTIMATED TIME, EVEN IF THE TARGET ELECTRON NUMBER IS NOT YET REACHED.

Table 122: High-Q^2 EMC (and scaling studies) at 35° - Setting 1

Target	***I*** (μA)	**HMS PS** PS1	PS2	**SHMS PS** PS2	PS3	**Est. Time**	**Target e^-**	**Done ?**
12C	60	0	-1	0	-1	20 min	-	✓
12C	60	-1	0	-1	0	6 hrs	350	✓
4He	40	0	-1	0	-1	20 min	-	✓
4He	40	-1	0	-1	0	6 hrs	500	✓
Al dummy	40	-1	0	-1	0	2 hrs	40	✓
3He	40	-1	0	-1	0	6 hrs	250	✓
~~12C~~	~~60~~	~~0~~	~~-1~~	~~0~~	~~-1~~	~~20 min~~	~~-~~	
12C	60	-1	0	-1	0	6 hrs	350	✓
3He	40	-1	0	-1	0	6 hrs	250	✓
Al dummy	40	-1	0	-1	0	2 hrs	40	✓
4He	40	-1	0	-1	0	6 hrs	500	

→ 470 e⁻
→ 331 e⁻
→ 72 e⁻
← 160/250
322/350
227
5 (241)

Dave Approved

4.7.2 Setting 2

- Set **HMS momentum** to **-3.57 GeV**.
- **SHMS momentum: -9.2 GeV**.
- **SHMS angle: 10°** **HMS angle: 35°**
- SHMS should have HV for S1X paddles 1-5 and S2X paddles 1-6 TURNED OFF for all settings
- SHMS should have HV for SHMS Preshower blocks 1-6 (+ and -) TURNED OFF
- **Trigger**: HMS is PS2(ELREAL) or PS1(3/4); SHMS is PS3(ELCLEAN) or PS2(ELREAL)
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 123 should be set to **-1**.
- Prescale values are only estimated; Use the lowest prescale values that keep the trigger rate in the **HMS near or below 4 kHz** and the **SHMS near or below 8kHz**
- Estimated run times are with 100% efficiency.

Dave Approved

Table 123: High-Q^2 EMC (and scaling studies) at 35° - Setting 2

Target	I (μA)	HMS PS PS1	HMS PS PS2	SHMS PS PS2	SHMS PS PS3	Est. Time	Target e^-	Done ?
4He	40	-1	0	-1	0	4 hrs	10 ~~12k~~	✓
Al dummy	40	-1	0	-1	0	2 hrs	2k	✓
3He	40	-1	0	-1	0	6 hrs	8 ~~10k~~	✓
12C	60	-1	0	-1	0	5 hrs	8 ~~10k~~	✓
12C	60	0	-1	0	-1	20 min	-	✓

4.7.3 Setting 3

- Set **HMS momentum** to **-3.09 GeV**.
- **SHMS momentum: -9.2 GeV**.
- **SHMS angle: 10°** **HMS angle: 35°**
- SHMS should have HV for S1X paddles 1-5, S2X paddles 1-6, and preshower blocks 1-6 (+ and -) TURNED OFF for all settings
- Follow Table 124. Take data with the SHMS and HMS simultaneously.
- **Trigger**: HMS is PS2(ELREAL) or PS1(3/4); SHMS is PS3(ELCLEAN) or PS2(ELREAL)
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 124 should be set to **-1**.
- Prescale values are only estimated; Use the lowest prescale values that keep the trigger rate in the **HMS near or below 4 kHz** and the **SHMS near or below 8kHz**
- Estimated run times are with 100% efficiency.

Table 124: High-Q^2 EMC (and scaling studies) at 35° - Setting 3

Target	I (μA)	HMS PS PS1	HMS PS PS2	SHMS PS PS2	SHMS PS PS3	Est. Time	Target e^-	Done ?
12C	60	0	-1	-1	0	20 min	-	✓
12C	60	-1	0	-1	0	8 hrs	120k	✓
~~63Cu~~	~~60~~	~~-1~~	~~0~~	~~-1~~	~~0~~	~~7.5 hrs~~	~~200K~~	
~~63Cu~~	~~60~~	~~0~~	~~-1~~	~~0~~	~~-1~~	~~20 min~~		
3He	40	-1	2	-1	0	14.5 hrs	~~200K~~ 100K	✓
Al dummy	40	-1	0	-1	0	3.5 hrs	~~30K~~ 18K	✓
4He	40	-1	0	-1	0	8 hrs	200K	✓

Jan 23rd OWL SHIFT

NOT DONE HERE!

counts

Q (target scatters)

4.7.4 Setting 4

- Set **HMS momentum** to **-2.72 GeV**.
- **SHMS momentum: -9.2 GeV.**
- **SHMS angle: 10°** **HMS angle: 35°**
- SHMS should have HV for S1X paddles 1-5, S2X paddles 1-6, and preshower blocks 1-6 (+ and -) TURNED OFF for all settings
- Follow Table 124. Take data with the SHMS and HMS simultaneously.
- **Trigger**: HMS is PS2(ELREAL) or PS1(3/4); SHMS is PS3(ELCLEAN) or PS2(ELREAL)
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 125 should be set to **-1**.
- Prescale values are only estimated; Use the lowest prescale values that keep the trigger rate in the **HMS near or below 4 kHz** and the **SHMS near or below 8kHz**
- Estimated run times are with 100% efficiency.

Table 125: High-Q^2 EMC (and scaling studies) at 35° - Setting 4

Target	I (μA)	HMS PS		SHMS PS		Est. Time	Target e^-	Done ?
		PS1	PS2	PS2	PS3			
4He	40	-1	0	-1	0	5 hrs	405K	✓
Al dummy	40	-1	0	-1	0	2.5 hrs	61K	✓
3He	40	-1	1	-1	0	20 ~~9.5~~ hrs	405K	
12C	60	-1	0	-1	0	6 hrs	280K	✓
12C	60	0	-1	0	-1	20 min	-	✓
~~63Cu~~	~~60~~	~~0~~	~~1~~	~~0~~	~~1~~	~~20 min~~	~~-~~	
~~63Cu~~	~~60~~	~~1~~	~~0~~	~~1~~	~~0~~	~~5 hrs~~	~~405K~~	

Follow the target order:

→ ① 12C ✓

② 4He ✓

③ dummy ✓

④ 3He

4.7.5 Setting 5

- Set **HMS momentum to -2.40 GeV.**
- **SHMS momentum: -9.2 GeV.**
- **SHMS angle: 10°** **HMS angle: 35°**
- SHMS should have HV for S1X paddles 1-5, S2X paddles 1-6, and preshower blocks 1-6 (+ and -) TURNED OFF for all settings
- Follow Table 124. Take data with the SHMS and HMS simultaneously.
- **Trigger**: HMS is PS2(ELREAL) or PS1(3/4); SHMS is PS3(ELCLEAN) or PS2(ELREAL)
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 126 should be set to **-1.**
- Prescale values are only estimated; Use the lowest prescale values that keep the trigger rate in the **HMS near or below 4 kHz** and the **SHMS near or below 8kHz**
- Estimated run times are with 100% efficiency.

Table 126: High-Q^2 EMC (and scaling studies) at 35° - Setting 5

Target	I (μA)	HMS PS		SHMS PS		Est. Time	Target e^-	Done ?
		PS1	PS2	PS2	PS3			
~~63Cu~~	~~60~~	~~-1~~	~~0~~	~~-1~~	~~0~~	~~1.5 hrs~~	~~250K~~	
~~63Cu~~	~~60~~	~~0~~	~~-1~~	~~0~~	~~-1~~	~~10 min~~	~~-~~	
12C	60	0	-1	0	-1	10 min	-	✓
12C	60	-1	0	-1	0	1.9 hrs	170k	✓
3He	40	-1	0	-1	0	3 hrs	250K	✓
Al dummy	40	-1	0	-1	0	75 min	37K	✓
4He	40	-1	0	-1	0	1.5 hrs	250K	✓

4.7.6 Setting 6

- Set **HMS momentum** to **-2.11 GeV**.
- **SHMS momentum: -9.2 GeV.**
- **SHMS angle: 10°** **HMS angle: 35°**
- SHMS should have HV for S1X paddles 1-5, S2X paddles 1-6. and preshower blocks 1-6 (+ and -) TURNED OFF for all settings
- Follow Table 124. Take data with the SHMS and HMS simultaneously.
- **Trigger**: HMS is PS2(ELREAL) or PS1(3/4); SHMS is PS3(ELCLEAN) or PS2(ELREAL)
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 127 should be set to **-1**.
- Prescale values are only estimated; Use the lowest prescale values that keep the trigger rate in the **HMS near or below 4 kHz** and the **SHMS near or below 8kHz**
- Follow Table 127. Take data with the SHMS and HMS simultaneously.
- Estimated run times are with 100% efficiency.

Table 127: High-Q^2 EMC (and scaling studies) at 35° - Setting 6

Target	I (μA)	HMS PS		SHMS PS		Est. Time	Target e^-	Done ?
		PS1	PS2	PS2	PS3			
4He	40	-1	0	-1	0	45 min	180K	✓
Al dummy	40	-1	0	-1	0	20 min	27K	✓
3He	40	-1	0	-1	0	1.5 hrs	180K	✓
12C	60	-1	0	-1	0	80 min	180K	✓
12C	60	0	-1	0	-1	10 min	-	✓
~~63Cu~~	~~60~~	~~0~~	~~-1~~	~~0~~	~~-1~~	~~10 min~~	~~-~~	
~~63Cu~~	~~60~~	~~-1~~	~~0~~	~~-1~~	~~0~~	~~45 min~~	~~180K~~	

4.7.7 Setting 7

- Set **HMS momentum** to **-1.85 GeV**.
- **SHMS momentum: -9.2 GeV.**
- **SHMS angle: 10°** **HMS angle: 35°**
- SHMS should have HV for S1X paddles 1-5, S2X paddles 1-6, and preshower blocks 1-6 (+ and -) TURNED OFF for all settings
- Follow Table 124. Take data with the SHMS and HMS simultaneously.
- **Trigger**: HMS is PS2(ELREAL) or PS1(3/4); SHMS is PS3(ELCLEAN) or PS2(ELREAL)
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 128 should be set to **-1**.
- Prescale values are only estimated; Use the lowest prescale values that keep the trigger rate in the **HMS near or below 4 kHz** and the **SHMS near or below 8kHz**
- Follow Table 128. Take data with the SHMS and HMS simultaneously.
- Estimated run times are with 100% efficiency.

Table 128: High-Q^2 EMC (and scaling studies) at 35° - Setting 7

Target	I	HMS PS		SHMS PS		Est. Time	Target e^-	Done ?
	(μA)	PS1	PS2	PS2	PS3			
~~63Cu~~	~~60~~	~~-1~~	~~0~~	~~-1~~	~~0~~	~~30 min~~	~~145K~~	
~~63Cu~~	~~60~~	~~0~~	~~-1~~	~~0~~	~~-1~~	~~5 min~~	~~-~~	
12C	60	0	-1	0	-1	5 min	-	
12C	60	-1	0	-1	0	45 min	145K	
~~3He~~	~~40~~	~~-1~~	~~0~~	~~-1~~	~~0~~	~~50 min~~	~~145K~~	
Al dummy	40	-1	0	-1	0	15 min	22K	
4He	40	-1	0	-1	0	30 min	145K	

4.7.8 Setting 8

- Set **HMS momentum** to **-1.63 GeV.**
- **SHMS momentum: -9.2 GeV.**
- **SHMS angle: 10°** **HMS angle: 35°**
- SHMS should have HV for S1X paddles 1-5, S2X paddles 1-6, and preshower blocks 1-6 (+ and -) TURNED OFF for all settings
- Follow Table 124. Take data with the SHMS and HMS simultaneously.
- **Trigger**: HMS is PS2(ELREAL) or PS1(3/4); SHMS is PS3(ELCLEAN) or PS2(ELREAL)
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 129 should be set to **-1**.
- Prescale values are only estimated; Use the lowest prescale values that keep the trigger rate in the **HMS near or below 4 kHz** and the **SHMS near or below 8kHz**
- Follow Table 129. Take data with the SHMS and HMS simultaneously.
- Estimated run times are with 100% efficiency.

Table 129: High-Q^2 EMC (and scaling studies) at 35° - Setting 8

Target	I	HMS PS		SHMS PS		Est. Time	Target e^-	Done ?
	(μA)	PS1	PS2	PS2	PS3			
4He	40	-1	1	-1	0	30 min	110K	164K
Al dummy	40	-1	0	-1	0	15 min	22K	20K
3He	40	-1	0	-1	0	30 min	110K	73K
12C	60	0	-1	0	-1	5 min	-	13K
12C	60	-1	0	-1	0	30 min	110k	
~~63Cu~~	~~60~~	~~-1~~	~~1~~	~~-1~~	~~0~~	~~30 min~~	~~110K~~	
~~63Cu~~	~~60~~	~~1~~	~~-1~~	~~0~~	~~-1~~	~~5 min~~		

4.7.9 Setting 9

- Set **HMS momentum** to **-1.44 GeV**.
- **SHMS momentum: -9.2 GeV.**
- **SHMS angle: 10°** **HMS angle: 35°**
- SHMS should have HV for S1X paddles 1-5, S2X paddles 1-6, and preshower blocks 1-6 (+ and -) TURNED OFF for all settings
- Follow Table 124. Take data with the SHMS and HMS simultaneously.
- **Trigger**: HMS is PS2(ELREAL) or PS1(3/4); SHMS is PS3(ELCLEAN) or PS2(ELREAL)
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 130 should be set to **-1**.
- Prescale values are only estimated; Use the lowest prescale values that keep the trigger rate in the **HMS near or below 4 kHz** and the **SHMS near or below 8kHz**
- Follow Table 130. Take data with the SHMS and HMS simultaneously.
- Estimated run times are with 100% efficiency.

Table 130: High-Q^2 EMC (and scaling studies) at 35° - Setting 9

Target	I (μA)	HMS PS		SHMS PS		Est. Time	Target e^-	Done ?
		PS1	PS2	PS2	PS3			
~~63Cu~~	~~60~~	~~2~~	~~-1~~	~~0~~	~~-1~~	~~5 min~~		
~~63Cu~~	~~60~~	~~-1~~	~~2~~	~~-1~~	~~0~~	~~35 min~~	~~95K~~	
12C	60	-1	0	-1	0	45 min	95k	
12C	60	0	-1	0	-1	5 min	-	
3He	40	-1	X 0	-1	0	45 min	95K	
Al dummy	40	-1	0	-1	0	15 min	14K	
4He	40	-1	2	-1	0	40 min	95K	

4.7.10 Setting 10

- Set **HMS momentum** to **-1.26 GeV**.
- **SHMS momentum: -9.2 GeV**.
- **SHMS angle: 10°** **HMS angle: 35°**
- SHMS should have HV for S1X paddles 1-5, S2X paddles 1-6, and preshower blocks 1-6 (+ and -) TURNED OFF for all settings
- Follow Table 124. Take data with the SHMS and HMS simultaneously.
- **Trigger**: HMS is PS2(ELREAL) or PS1(3/4); SHMS is PS3(ELCLEAN) or PS2(ELREAL)
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 131 should be set to **-1**.
- Prescale values are only estimated; Use the lowest prescale values that keep the trigger rate in the **HMS near or below 4 kHz** and the **SHMS near or below 8kHz**
- Follow Table 131. Take data with the SHMS and HMS simultaneously.
- Estimated run times are with 100% efficiency.

Table 131: High-Q^2 EMC (and scaling studies) at 35° - Setting 10

Target	I	HMS PS		SHMS PS		Est. Time	Target e^-	Done ?
	(μA)	PS1	PS2	PS2	PS3			
4He	40	-1	3	-1	0	45 min	75K	✓
4He	40	2	-1	0	-1	15 min	-	✓
Al dummy	40	2	-1	0	-1	15 min	-	✓
Al dummy	40	-1	0	-1	0	15 min	11K	✓
3He	40	-1	2	-1	0	1 hr	75K	✓
3He	40	2	-1	0	-1	15 min	-	✓
12C	60	2	-1	2	-1	5 min	-	✓
12C	60	-1	2	-1	2	40 min	75K	✓
~~63Cu~~	~~60~~	~~-1~~	~~3~~	~~-1~~	~~0~~	~~45 min~~	~~75K~~	
~~63Cu~~	~~60~~	~~3~~	~~-1~~	~~0~~	~~-1~~	~~5 min~~	~~-~~	

4.7.11 Setting 3 - Additional 3He data taking

- Set **HMS momentum** to **-3.09 GeV**.
- **SHMS momentum: -9.2 GeV**.
- **SHMS angle: 10°** **HMS angle: 35°**
- SHMS should have HV for S1X paddles 1-5, S2X paddles 1-6, and preshower blocks 1-6 (+ and -) TURNED OFF for all settings
- Follow Table 132. Take data with the SHMS and HMS simultaneously.
- **Trigger**: HMS is PS2(ELREAL) or PS1(3/4); SHMS is PS3(ELCLEAN) or PS2(ELREAL)
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 132 should be set to **-1**.
- Prescale values are only estimated; Use the lowest prescale values that keep the trigger rate in the **HMS near or below 4 kHz** and the **SHMS near or below 8kHz**
- Estimated run times are with 100% efficiency.

Table 132: High-Q^2 EMC (and scaling studies) at 35° - Setting 3

Target	I	HMS PS		SHMS PS		Est. Time	Target e^-	Done ?
	(μA)	PS1	PS2	PS2	PS3		(HMS)	
3He	40	-1	[illegible]	-1	0	20 hrs	100K	
Al dummy	40	-1	0	-1	0	~2 hrs	12K	

4.8 20 deg EMC and 8 deg 2N-SRC Running - Target Ladder II (the sequel)

BEFORE ROTATING THE SPECTROMETERS PLEASE READ THE SPECIFIC INSTRUCTIONS BELOW!!!

- **Rotating SHMS to 8 degrees:**
  1. Watch the rotation on the SHMS rotation camera.
  2. DO NOT rotate SHMS below 8 degrees. It will trip the limit switch.
  3. On the rotation GUI, start with entering **8.1 degrees** instead of 8 degrees. This will prevent SHMS to be rotated below 8 degrees in the very likely case of an offset on the rotation GUI.
  4. Note the offset and correct for it to rotate the SHMS to 8 degrees.
- **Rotating HMS to 20 degrees:**
  1. When rotating to 20 degrees from smaller HMS angle, it is ok to go directly to 20 degrees.
  2. When rotating to 20 degrees from larger angle, first rotate to 19.7 degrees, and then to 20 degrees. Otherwise, the rotation will likely get "stuck" and require expert intervention.

4.8.1 Setting 3 (we skip setting 1 and 2 this time)

- Set **HMS momentum** to **-4.27 GeV**. ✓
- **SHMS momentum: -9.2 GeV** ✓
- **HMS angle: 20°** **SHMS angle: 8°**
- Make sure **SHMS S1X(1-7)** and **S2X(1-7)** (Left & Right) are **OFF** ✓ Preshower BACK ON ✓
- **Trigger**: SHMS/HMS PS2 (ELREAL) **OR** SHMS/HMS PS1 (3/4)
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 133 should be set to **-1**.
- Prescale values are only estimated; Use the lowest prescale values that keep the trigger rate in the **HMS near or below 4 kHz** and the **SHMS near or below 8kHz**
- Take data with SHMS and HMS simultaneously. Estimated run times are for 100% efficiency, but run based on Target e^- from Table 133 if given

** ~~CARBON~~ Aluminum HOLE WEDS after ~~OR~~ recovery ✓

Table 133: 20° EMC and 8° 2N-SRC Running - Setting 3

Target	I (μA)	HMS PS		SHMS PS		Est. Time	Target e^- (HMS)	Done ?
		PS1	PS2	PS1	PS2			
3He	40	-1	0	-1	2	10 min	350K	✓
Al dummy	40	-1	0	-1	0	10 min	110K	✓
4He	40	0	-1	2	-1	5 min	-	✓
4He	40	-1	0	-1	2	10 min	330K	✓
7Li	40	-1	0	-1	0	20 min	330K	✓
6Li	40	-1	0	-1	0	20 min	330K	✓
12C	60	-1	0	-1	3	10 min	330K	

4.8.2 Setting 4

- Set **HMS momentum** to **-3.81 GeV**.
- **SHMS momentum: -9.2 GeV**
- **HMS angle: 20°** **SHMS angle: 8°**
- Make sure **SHMS S1X(1-7)** and **S2X(1-7)** (Left & Right) are **OFF**
- **Trigger**: SHMS/HMS PS2 (ELREAL) **OR** SHMS/HMS PS1 (3/4)
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 134 should be set to **-1**.
- Prescale values are only estimated; Use the lowest prescale values that keep the trigger rate in the **HMS near or below 4 kHz** and the **SHMS near or below 8kHz**
- Take data with SHMS and HMS simultaneously. Estimated run times are for 100% efficiency, but run based on Target e^- from Table 134 if given

Table 134: 20° EMC and 8° 2N-SRC Running - Setting 4

Target	***I*** (μA)	**HMS PS** PS1	PS2	**SHMS PS** PS1	PS2	**Est. Time**	**Target** e^- (HMS)	**Done ?**
12C	60	-1	0	-1	3	10 min	220K	✓
6Li	40	-1	0	-1	0	10 min	220K	✓
7Li	40	-1	0	-1	0	10 min	220K	✓
4He	40	0	-1	2	-1	5 min	-	✓
4He	40	-1	0	-1	2	10 min	230K	✓
Al dummy	40	-1	0	-1	0	10 min	75K	✓
3He	40	-1	0	-1	2	10 min	230K	✓

4.8.3 Setting 5

- Set **HMS momentum** to **-3.40 GeV**.
- **SHMS momentum: -9.2 GeV**
- **HMS angle: 20°** **SHMS angle: 8°**
- Make sure **SHMS S1X(1-7)** and **S2X(1-7)** (Left & Right) are **OFF**
- **Trigger**: SHMS/HMS PS2 (ELREAL) **OR** SHMS/HMS PS1 (3/4)
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 135 should be set to **-1**.
- Prescale values are only estimated; Use the lowest prescale values that keep the trigger rate in the **HMS near or below 4 kHz** and the **SHMS near or below 8kHz**
- Take data with SHMS and HMS simultaneously. Estimated run times are for 100% efficiency, but run based on Target e^- from Table 135 if given

Table 135: 20° EMC and 8° 2N-SRC Running - Setting 5

Target	***I*** (μA)	**HMS PS** PS1	PS2	**SHMS PS** PS1	PS2	**Est. Time**	**Target** e^- (HMS)	**Done ?**
3He	40	-1	0	-1	2	10 min	150K	✓
Al dummy	40	-1	0	-1	0	10 min	50K	✓
4He	40	0	-1	2	-1	5 min	-	✓
4He	40	-1	0	-1	2	10 min	150K	✓
7Li	40	-1	0	-1	0	10 min	150K	✓
6Li	40	-1	0	-1	0	10 min	150K	✓
12C	60	-1	1	-1	3	10 min	150K	✓

4.8.4 Setting 6

- Set **HMS momentum** to **-3.04 GeV**.
- **SHMS momentum: -9.2 GeV**
- **HMS angle: 20°** **SHMS angle: 8°**
- Make sure **SHMS S1X(1-7)** and **S2X(1-7)** (Left & Right) are **OFF**
- **Trigger**: SHMS/HMS PS2 (ELREAL) **OR** SHMS/HMS PS1 (3/4)
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 136 should be set to **-1**.
- Prescale values are only estimated; Use the lowest prescale values that keep the trigger rate in the **HMS near or below 4 kHz** and the **SHMS near or below 8kHz**
- Take data with SHMS and HMS simultaneously. Estimated run times are for 100% efficiency, but run based on Target e^- from Table 136 if given

Table 136: 20° EMC and 8° 2N-SRC Running - Setting 6

Target	***I*** (μA)	**HMS PS** PS1	PS2	**SHMS PS** PS1	PS2	**Est. Time**	**Target** e^- (HMS)	**Done ?**
12C	60	-1	1	-1	3	10 min	120K	✓
6Li	40	-1	0	-1	0	10 min	120K	✓
7Li	40	-1	0	-1	0	10 min	120K	✓
4He	40	0	-1	2	-1	5 min	-	✓
4He	40	-1	0	-1	2	10 min	120K	✓
Al dummy	40	-1	0	-1	0	10 min	40K	✓
3He	40	-1	0	-1	2	10 min	120K	✓

4.8.5 Setting 7

- Set **HMS momentum** to **-2.71 GeV**.
- **SHMS momentum: -9.2 GeV**
- **HMS angle: 20°** **SHMS angle: 8°**
- Make sure **SHMS S1X(1-7)** and **S2X(1-7)** (Left & Right) are **OFF**
- **Trigger**: SHMS/HMS PS2 (ELREAL) **OR** SHMS/HMS PS1 (3/4)
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 137 should be set to **-1**.
- Prescale values are only estimated; Use the lowest prescale values that keep the trigger rate in the **HMS near or below 4 kHz** and the **SHMS near or below 8kHz**
- Take data with SHMS and HMS simultaneously. Estimated run times are for 100% efficiency, but run based on Target e^- from Table 137 if given

Table 137: 20° EMC and 8° 2N-SRC Running - Setting 7

Target	***I*** (μA)	**HMS PS** PS1	PS2	**SHMS PS** PS1	PS2	**Est. Time**	**Target** e^- (HMS)	**Done ?**
3He	40	-1	0	-1	2	10 min	90K	✓
Al dummy	40	-1	0	-1	0	10 min	30K	✓
4He	40	0	-1	2	-1	5 min	-	✓
4He	40	-1	0	-1	2	10 min	90K	✓
7Li	40	-1	0	-1	0	10 min	90K	✓
6Li	40	-1	0	-1	0	10 min	90K	✓
12C	60	-1	1	-1	3	10 min	90K	✓

4.8.6 Setting 8

- Set **HMS momentum** to **-2.42 GeV**.
- **SHMS momentum: -9.2 GeV**
- **HMS angle: 20°** **SHMS angle: 8°**
- Make sure **SHMS S1X(1-7)** and **S2X(1-7)** (Left & Right) are **OFF**
- **Trigger**: SHMS/HMS PS2 (ELREAL) **OR** SHMS/HMS PS1 (3/4)
- **Important note on the prescales:** All the other prescales that are NOT specified on each row at the Table 138 should be set to **-1**.
- Prescale values are only estimated; Use the lowest prescale values that keep the trigger rate in the **HMS near or below 4 kHz** and the **SHMS near or below 8kHz**
- Take data with SHMS and HMS simultaneously. Estimated run times are for 100% efficiency, but run based on Target e^- from Table 138 if given

Table 138: 20° EMC and 8° 2N-SRC Running - Setting 8

Target	***I*** (μA)	**HMS PS** PS1	PS2	**SHMS PS** PS1	PS2	**Est. Time**	**Target e^-** (HMS)	**Done ?**
12C	60	-1	0	-1	5	10 min	75K	✓
12C	60	0	-1	5	-1	5 min	-	✓
6Li	40	-1	0	-1	5	10 min	75K	✓
6Li	40	0	-1	5	-1	5 min	-	✓
7Li	40	0	-1	5	-1	5 min	-	✓
7Li	40	-1	0	-1	5	10 min	75K	✓
4He	40	-1	0	-1	5	10 min	75K	✓
4He	40	0	-1	5	-1	5 min	-	✓
Al dummy	40	0	-1	0	-1	5 min	-	✓
Al dummy	40	-1	0	-1	5	10 min	25K	✓
3He	40	0	-1	5	-1	5 min	-	✓
3He	60	-1	0	-1	5	10 min	75K	✓

4.9 Additional SHMS 10/8.5 deg SRC and HMS 35 deg SFQ Running - Target Ladder II

- **PLEASE NOTE:** Prescale values are only estimated; Use the lowest prescale values that keep the trigger rate in the **HMS near or below 4 kHz** and the **SHMS near or below 8kHz**

4.9.1 Setting 1

- **HMS momentum: -4.08 GeV**.
- **SHMS momentum: -9.2 GeV**.
- **SHMS angle: 10°** **HMS angle: 35°**
- SHMS should have HV for S1X paddles 1-5 and S2X paddles 1-6 TURNED OFF for all settings
- SHMS should have HV for SHMS Preshower blocks 1-6 (+ and -) TURNED OFF for all settings
- **Trigger**: HMS is PS2(ELREAL) or PS1(3/4); SHMS is PS3(ELCLEAN) or PS2(ELREAL)
- Follow the order on Table 139. Take data with the SHMS and HMS simultaneously.
- Estimated run times are with 100% efficiency. FOR THIS SETTING, STOP AT 120% OF THE ESTIMATED TIME, EVEN IF THE TARGET ELECTRON NUMBER IS NOT YET REACHED.

4.9.2 Setting 2

- HMS momentum: -4.08 GeV.
- SHMS momentum: -9.2 GeV.
- **SHMS angle: 8.5°** HMS angle: 35°
- TURN OFF HV for SHMS S1X paddles 1-8 and S2X 1-8 (+ and -)
- TURN OFF HV for SHMS Preshower blocks 1-8 (+ and -)
- **Trigger**: HMS is PS2(ELREAL) or PS1(3/4); SHMS is PS3(ELCLEAN) or PS2(ELREAL)
- Follow the order on Table 140. Take data with the SHMS and HMS simultaneously.

Table 140: High-Q^2 EMC (and scaling studies) at 35° - Setting 2

Target	***I*** (μA)	**HMS PS** PS1	PS2	**SHMS PS** PS2	PS3	**Est. Time**	**Target e^-** SHMS	**Done ?**
3He	40	-1	0	-1	0	20 hrs	72k	✓
Al dummy	40	-1	0	-1	0	5 hrs	36k	✓
4He	40	-1	0	-1	0	7 hrs	68k	✓
4He	40	0	-1	0	-1	15 min	-	✓
Carbon	60	-1	0	-1	0	1 hr	-	✓
3He	40	-1	0	-1	0	20 hrs	72k	✓
Al dummy	40	-1	0	-1	0	5 hrs	36k	✓
4He	40	-1	0	-1	0	7 hrs	68k	✓
4He	40	0	-1	0	-1	15 min	-	✓

↑ SHMS

Li 7 comes after ~ 40 μA

*^{4}He was taken at 50-60 kHz because the runplan didn't specify 0 as a placeholder