x>1 and EMC Effect (XEM2) Run Plan

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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.

Table 1: Coincidence Hydrogen Elastic Data Taking

Setting	P_{HMS} **(GeV)**	θ_{HMS}	P_{SHMS} **(GeV)**	θ_{SHMS}	**Target**	$\boldsymbol{I}$ (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	10 min	
KIN 5	+2.076	45.36°	-9.2	9.24°	LH2	65	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	10 min	

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)

- **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	

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	

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.

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 5 and take data.

Table 5: 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!

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 6 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	

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 7 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***	**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	

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***	**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	

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

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	
	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	
	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	
	1-7	1-7	-1	0	12C	60	10 min	
	1-7	1-7	-1	0	LD2	60	10 min	
5	1-8	1-7	-1	0	LD2	60	10 min	
	1-8	1-7	-1	0	12C	60	10 min	
	1-8	1-7	0	-1	12C	60	10 min	
6	1-7	1-8	0	-1	12C	60	10 min	
	1-7	1-8	-1	0	12C	60	10 min	
	1-7	1-8	-1	0	LD2	60	10 min	

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	
	none	none	-1	0	12C	60	10 min	
	1-5	1-7	-1	0	12C	60	10 min	
	1-5	1-7	0	-1	12C	60	10 min	
	1-6	1-8	0	-1	12C	60	10 min	
	1-6	1-8	-1	0	12C	60	10 min	
	1-7	1-8	-1	0	12C	60	10 min	
	1-7	1-8	0	-1	12C	60	10 min	
2	1-7	1-8	-1	0	LD2	60	10 min	
	1-6	1-8	-1	0	LD2	60	10 min	
	1-5	1-7	-1	0	LD2	60	10 min	
	none	none	-1	0	LD2	60	10 min	

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-squared Dependence Studies at 26 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 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 12 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 12. Take data with the SHMS and HMS simultaneously.
- Estimated run times are with 100% efficiency.

Table 12: Q^2 Dependence Studies at 26° - Setting 1

Target	***I*** (μA)	**HMS PS** PS1	PS2	**SHMS PS** PS1	PS2	**Est. Time**	**Target** e^-	**Done ?**
LH2	60	-1	0	-1	0	5.5 hrs	10K	
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	

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 13 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 13. Take data with the SHMS and HMS simultaneously.
- Estimated run times are with 100% efficiency.

Table 13: Q^2 Dependence Studies at 26° - Setting 2

Target	***I*** (μA)	**HMS PS** PS1	PS2	**SHMS PS** PS1	PS2	**Est. Time**	**Target** e^-	**Done ?**
12C	60	0	-1	0	-1	5 min	-	
12C	60	-1	0	-1	0	3.5 hrs	120K	
40Ca	60	-1	0	-1	0	2.5 hrs	120K	
40Ca	60	0	-1	0	-1	5 min	-	
Al dummy	40	-1	0	-1	0	25 min	15K	
LD2	60	-1	0	-1	0	40 min	65K	
LH2	60	-1	0	-1	0	1.5 hrs	65K	

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 14 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 14. Take data with the SHMS and HMS simultaneously.
- Estimated run times are with 100% efficiency.

Table 14: Q^2 Dependence Studies at 26° - Setting 3

Target	***I***	**HMS PS**		**SHMS PS**		**Est. Time**	**Target** e^-	**Done ?**
	(μA)	PS1	PS2	PS1	PS2			
LH2	60	-1	0	-1	0	2 hrs	550K	
LD2	60	-1	0	-1	0	1 hr	550K	
Al dummy	40	-1	0	-1	0	30 min	130K	
40Ca	60	-1	0	-1	0	2.5 hrs	550K	
40Ca	60	0	-1	0	-1	5 min	-	
12C	60	0	-1	0	-1	5 min	-	
12C	60	-1	0	-1	0	3.5 hrs	550K	

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 15 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 15. Take data with the SHMS and HMS simultaneously.
- Estimated run times are with 100% efficiency.

Table 15: Q^2 Dependence Studies at 26° - Setting 4

Target	***I***	**HMS PS**		**SHMS PS**		**Est. Time**	**Target** e^-	**Done ?**
	(μA)	PS1	PS2	PS1	PS2			
12C	60	-1	0	-1	0	1 hr	400K	
12C	60	0	-1	0	-1	5 min	-	
40Ca	60	0	-1	0	-1	5 min	-	
40Ca	60	-1	0	-1	0	45 min	400K	
Al dummy	40	-1	0	-1	0	10 min	100K	
LD2	60	-1	0	-1	0	20 min	400K	
LH2	60	-1	0	-1	0	30 min	400K	

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 16 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 16. Take data with the SHMS and HMS simultaneously.
- Estimated run times are with 100% efficiency.

Table 16: Q^2 Dependence Studies at 26° - Setting 5

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

2.1.6 Setting 6

- Set **SHMS momentum** to **-2.86 GeV**.
- 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 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.

Table 17: Q^2 Dependence Studies at 26° - Setting 6

Target	***I***	**HMS PS**		**SHMS PS**		**Est. Time**	**Target** e^-	**Done ?**
	(μA)	PS1	PS2	PS1	PS2			
12C	60	-1	0	-1	0	15 min	190K	
12C	60	0	-1	0	-1	5 min	-	
40Ca	60	0	-1	0	-1	5 min	-	
40Ca	60	-1	0	-1	0	10 min	190K	
Al dummy	40	-1	0	-1	0	10 min	40K	
LD2	60	-1	1	-1	1	10 min	190K	
LH2	60	-1	0	-1	0	10 min	190K	

2.1.7 Setting 7

- Set **SHMS momentum** to **-2.52 GeV**.
- Set **HMS momentum** to **-2.52 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 7

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

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°**
- **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 8

Target	***I*** (μA)	**HMS PS** PS1	PS2	**SHMS PS** PS1	PS2	**Est. Time**	**Target** e^-	**Done ?**
12C	60	-1	1	-1	1	15 min	135K	
12C	60	1	-1	1	-1	5 min	-	
40Ca	60	2	-1	2	-1	5 min	-	
40Ca	60	-1	2	-1	2	15 min	135K	
Al dummy	40	-1	0	-1	0	10 min	35K	
LD2	60	-1	3	-1	3	10 min	135K	
LH2	60	-1	1	-1	1	10 min	135K	

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 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.

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

Table 20: Q^2 Dependence Studies at 26° - Setting 9

Target	***I***	**HMS PS**		**SHMS PS**		**Est. Time**	**Target** e^-	**Done ?**
	(μA)	PS1	PS2	PS1	PS2			
LH2	60	-1	3	-1	3	15 min	120K	
LH2	60	3	-1	3	-1	5 min	-	
LD2	60	4	-1	4	-1	5 min	-	
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	-	
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	-	

2.2 Charge Symmetric Background Studies at 26 deg - Part I

- BEWARE of the POLARITY CHANGE IN THIS SECTION
- All data in this section will be taken with the **positive** polarity.

2.2.1 Setting 1

- Set **SHMS momentum** to **+2.86 GeV**.
- Set **HMS momentum** to **+2.86 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 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.

Table 21: CSB Studies at 26° - Setting 1

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	10 min	
40Ca	60	0	-1	-1	0	-1	-1	10 min	
40Ca	60	-1	-1	0	-1	-1	0	10 min	

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 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.

Table 22: 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	
40Ca	60	0	-1	-1	0	-1	-1	10 min	
12C	60	0	-1	-1	0	-1	-1	10 min	
12C	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	10 min	
LD2	60	0	-1	-1	0	-1	-1	10 min	
LD2	60	-1	-1	0	-1	-1	0	10 min	
LH2	60	-1	-1	0	-1	-1	0	10 min	
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 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.

Table 23: CSB Studies at 26° - Setting 3

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	
40Ca	60	0	-1	-1	0	-1	-1	10 min	
12C	60	0	-1	-1	0	-1	-1	10 min	
12C	60	-1	-1	0	-1	-1	0	10 min	

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 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.

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

Table 24: CSB Studies at 26° - Setting 4

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	10 min	
40Ca	60	0	-1	-1	0	-1	-1	10 min	
40Ca	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	10 min	
LD2	60	0	-1	-1	0	-1	-1	10 min	
LD2	60	-1	-1	0	-1	-1	0	10 min	
LH2	60	-1	-1	0	-1	-1	0	10 min	
LH2	60	0	-1	-1	0	-1	-1	10 min	

2.3 Charge Symmetric Background Studies at 20 deg - 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 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.**
- Take data with the SHMS and HMS simultaneously.

Table 25: CSB Studies at 20° - Setting 1

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	
12C	60	-1	-1	0	-1	-1	0	10 min	
12C	60	0	-1	-1	0	-1	-1	10 min	
40Ca	60	0	-1	-1	0	-1	-1	10 min	
40Ca	60	-1	-1	0	-1	-1	0	10 min	

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 26 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 26: CSB Studies at 20° - 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	
40Ca	60	0	-1	-1	0	-1	-1	10 min	
12C	60	0	-1	-1	0	-1	-1	10 min	
12C	60	-1	-1	0	-1	-1	0	10 min	
LD2	60	-1	-1	0	-1	-1	0	10 min	

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)

- **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.**
- Take data with the SHMS and HMS simultaneously.

Table 27: 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	
LH2	60	-1	-1	0	-1	-1	0	10 min	
12C	60	0	-1	-1	0	-1	-1	10 min	
12C	60	-1	-1	0	-1	-1	0	10 min	
Ca40	60	-1	-1	0	-1	-1	0	10 min	
Ca40	60	0	-1	-1	0	-1	-1	10 min	

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 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.**
- Take data with the SHMS and HMS simultaneously.

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

Table 28: CSB Studies at 20° - Setting 4

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

2.4 20 deg EMC and 8 deg 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.**
- Follow Table 29. Take data with the SHMS and HMS simultaneously.
- Estimated run times are with 100% efficiency.

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

Target	***I***	**HMS PS**		**SHMS PS**		**Est. Time**	**Target e^-**	**Done ?**
	(μA)	PS1	PS2	PS1	PS2			
LD2	60	-1	0	-1	5	130 min	390K	
LH2	60	-1	0	-1	3	1 hr	120K	
Al dummy	40	-1	0	-1	0	35 min	65K	
9Be	60	-1	0	-1	4	15 min	45K	
40Ca	60	-1	0	-1	3	80 min	180K	
40Ca	60	0	-1	3	-1	5 min	-	
48Ca	40	-1	0	-1	2	2 hrs	180K	
12C	60	-1	0	-1	3	2 hrs	180K	
12C	60	0	-1	3	-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	-1	0	-1	1	1 hr	45K	

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***	**HMS PS**		**SHMS PS**		**Est. Time**	**Target e^-**	**Done ?**
	(μA)	PS1	PS2	PS1	PS2			
64Ni	60	-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	
B4C-11	60	-1	0	-1	3	1 hr	460K	
12C	60	-1	0	-1	3	2.5 hrs	920K	
12C	60	0	-1	3	-1	5 min	-	
48Ca	40	-1	0	-1	2	2.5 hrs	920K	
40Ca	60	-1	0	-1	3	1.5 hrs	920K	
40Ca	60	0	-1	3	-1	5 min	-	
9Be	60	-1	0	-1	4	20 min	230K	
Al dummy	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	

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.

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

Target	***I***	**HMS PS**		**SHMS PS**		**Est. Time**	**Target e^-**	**Done ?**
	(μA)	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	

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***	**HMS PS**		**SHMS PS**		**Est. Time**	**Target e^-**	**Done ?**
	(μA)	PS1	PS2	PS1	PS2			
64Ni	60	-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	
40Ca	60	-1	0	-1	3	2.5 hrs	2.2M	
40Ca	60	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	60	-1	2	-1	5	10 min	320K	
LH2	60	-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	-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***	**HMS PS**		**SHMS PS**		**Est. Time**	**Target** e^-	**Done ?**
	(μA)	PS1	PS2	PS1	PS2			
64Ni	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	60	-1	1	-1	3	10 min	220K	
LD2	60	-1	2	-1	5	10 min	220K	

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***	**HMS PS**		**SHMS PS**		**Est. Time**	**Target e^-**	**Done ?**
	(μA)	PS1	PS2	PS1	PS2			
LD2	60	-1	3	-1	5	10 min	150K	
LH2	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	60	-1	0	-1	1	10 min	150K	

2.4.8 Setting 8

- 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 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.**
- 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	-1	0	-1	1	10 min	120K	
58Ni	60	-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	500K	
Al dummy	40	-1	1	-1	1	10 min	20K	
LH2	60	-1	3	-1	3	10 min	120K	
LD2	60	-1	0	-1	5	10 min	120K	

2.4.9 Setting 9

- Notice the change in the SHMS hodoscope paddle configuration.
- SHMS hodoscope paddle configuration: **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.

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

Target	***I***	**HMS PS**		**SHMS PS**		**Est. Time**	**Target e^-**	**Done ?**
	(μA)	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	

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

Target	***I***	**HMS PS**		**SHMS PS**		**Est. Time**	**Target e^-**	**Done ?**
	(μA)	PS1	PS2	PS1	PS2			
64Ni	60	-1	2	-1	1	10 min	75K	
64Ni	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	60	4	-1	3	-1	5 min	-	
LH2	60	-1	4	-1	3	10 min	75K	
LD2	60	-1	5	-1	5	10 min	75K	
LD2	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	PS2	**SHMS PS** PS1	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	
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	

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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2.5 BCM Calibration - Part I

Need a reliable beam delivery of high current 70-80 uA RC needs to coordinate this with the PD.

2.6 Charge Symmetric Background Studies at 10 deg/35 deg - 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 subsection 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***	**HMS PS**			**SHMS PS**			**Est. Time**	Done ?
	(μA)	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	-1	-1	0	-1	-1	0	15 min	
40Ca	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	

2.6.3 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***	**HMS PS**			**SHMS PS**			**Est. Time**	Done ?
	(μA)	PS1	PS2	PS3	PS1	PS2	PS3		
12C	60	-1	-1	0	-1	-1	0	15 min	
12C	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	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 subsection 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

2.7 Target Boiling Studies - Part II

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.

2.7.1 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	

2.7.2 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	

2.7.3 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	

2.7.4 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	

2.7.5 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 subsection 1.5 including the momentum and target changes: **7 hrs** with 100% efficiency.

2.8 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...

2.8.1 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!

2.9 SHMS Hodoscope Paddle Test SETTING #2

2.9.1 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

2.10 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**$^\circ$
- Set **HMS angle: 35**$^\circ$
- 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.

2.10.1 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	
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

2.10.2 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 5 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
- SHMS should have HV for SHMS Preshower blocks 1-6 (+ and -) TURNED OFF
- 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***	**HMS PS**		**SHMS PS**		**Est. Time**	**Target e^-**	**Done ?**
	(μA)	PS1	PS2	PS2	PS3			
LD2	60	-1	0	-1	0	13 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	

2.10.3 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)

2.10.4 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	PS2	**SHMS PS** PS2	PS3	**Est. Time**	**Target** e^-	**Done ?**
LD2	60	-1	0	-1	0	2 hrs	12k	
LH2	60	-1	0	-1	0	1 hr	5.5k	
Al dummy	40	-1	0	-1	0	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	2 hrs	12k	
LH2	60	-1	0	-1	0	1 hr	5.5k	
Al dummy	40	-1	0	-1	0	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	

2.10.5 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***	**HMS PS**		**SHMS PS**		**Est. Time**	**Target e^-**	**Done ?**
	(μA)	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	60	-1	0	-1	0	4 hrs	95k	
LD2	60	-1	0	-1	0	4 hrs	200k	

2.10.6 Setting 4

- Set **HMS momentum** to **-2.72 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 58 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 58. Take data with the SHMS and HMS simultaneously.
- Estimated run times are with 100% efficiency.

Table 58: High-Q^2 EMC (and scaling studies) at 35° - Setting 4

Target	***I***	**HMS PS**		**SHMS PS**		**Est. Time**	**Target e^-**	**Done ?**
	(μA)	PS1	PS2	PS2	PS3			
LD2	60	-1	0	-1	0	2.6 hrs	400k	
LH2	60	-1	0	-1	0	2.6 hrs	180k	
Al dummy	40	-1	0	-1	0	0.6 hrs	30k	
9Be	60	-1	0	-1	0	4.6 hrs	400k	
40Ca	60	-1	0	-1	0	6 hrs	400k	
40Ca	60	0	-1	0	-1	10 min	-	
12C	60	0	-1	0	-1	10 min	-	
12C	60	-1	0	-1	0	6 hrs	280k	

2.10.7 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***	**HMS PS**		**SHMS PS**		**Est. Time**	**Target e^-**	**Done ?**
	(μA)	PS1	PS2	PS2	PS3			
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	

2.10.8 Setting 6

- Set **HMS momentum** to **-2.11 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 60 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 60. Take data with the SHMS and HMS simultaneously.
- Estimated run times are with 100% efficiency.

Table 60: High-Q^2 EMC (and scaling studies) at 35° - Setting 6

Target	***I***	**HMS PS**		**SHMS PS**		**Est. Time**	**Target e^-**	**Done ?**
	(μA)	PS1	PS2	PS2	PS3			
LD2	60	-1	0	-1	0	25 min	190k	
LH2	60	-1	0	-1	0	50 min	190k	
Al dummy	40	-1	0	-1	0	15 min	30k	
9Be	60	-1	0	-1	0	45 min	180k	
40Ca	60	-1	0	-1	0	50 min	180k	
40Ca	60	0	-1	0	-1	10 min	-	
12C	60	0	-1	0	-1	10 min	-	
12C	60	-1	0	-1	0	80 min	180k	

2.10.9 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.

Table 61: 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			
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	

2.10.10 Setting 8

- Set **HMS momentum** to **-1.63 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 62 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 62. Take data with the SHMS and HMS simultaneously.
- Estimated run times are with 100% efficiency.

Table 62: 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			
LD2	60	-1	0	-1	0	25 min	110k	
LD2	60	0	-1	0	-1	5 min	-	
LH2	60	0	-1	0	-1	5 min	-	
LH2	60	-1	0	-1	0	40 min	110k	
Al dummy	40	-1	0	-1	0	10 min	20k	
Al dummy	40	0	-1	0	-1	5 min	-	
9Be	60	-1	0	-1	0	40 min	110k	
40Ca	60	-1	0	-1	0	40 min	110k	
40Ca	60	0	-1	0	-1	5 min	-	
12C	60	0	-1	0	-1	5 min	-	
12C	60	-1	0	-1	0	30 min	110k	

2.10.11 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	
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	-	

2.10.12 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	

2.11 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.

2.11.1 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	

2.11.2 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	

2.11.3 Setting 3

- 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	

2.11.4 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	

2.11.5 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	

2.11.6 Setting 6

- Set **HMS momentum** to **+1.26 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 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	5 min	
48Ca	50	-1	-1	0	-1	0	-1	15 min	

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

2.12 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**.

2.12.1 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	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	60	-1	-1	0	-1	0	-1	10 min	

2.13 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*(μA)**	**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	

2.14 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	
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	

2.15 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.

2.15.1 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	

2.15.2 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	

2.15.3 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	

2.15.4 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	

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

2.16 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).

2.16.1 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** PS1	PS2	**SHMS PS** PS1	PS2	**Est. Time**	**Target** e^-	**Done ?**
48Ca	50	-1	0	-1	0	6.5 hrs	180k	
48Ca	50	0	-1	-1	0	5 min	-	

2.16.2 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** PS1	PS2	**SHMS PS** PS1	PS2	**Est. Time**	**Target** e^-	**Done ?**
48Ca	50	0	-1	-1	0	5 min	-	
48Ca	50	-1	0	-1	0	4.6 hrs	400k	

2.16.3 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** PS1	PS2	**SHMS PS** PS1	PS2	**Est. Time**	**Target** e^-	**Done ?**
48Ca	50	-1	0	-1	0	1.5 hrs	250k	
48Ca	50	0	-1	-1	0	5 min	-	

2.16.4 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** PS1	PS2	**SHMS PS** PS1	PS2	**Est. Time**	**Target** e^-	**Done ?**
48Ca	50	0	-1	-1	0	5 min	-	
48Ca	50	-1	0	-1	0	40 min	180k	

2.16.5 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** PS1	PS2	**SHMS PS** PS1	PS2	**Est. Time**	**Target** e^-	**Done ?**
48Ca	50	-1	0	-1	0	25 min	145k	
48Ca	50	0	-1	-1	0	5 min	-	

2.16.6 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** PS1	PS2	**SHMS PS** PS1	PS2	**Est. Time**	**Target** e^-	**Done ?**
48Ca	50	0	-1	-1	0	5 min	-	
48Ca	50	-1	0	-1	0	30 min	110k	

2.17 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.

2.17.1 Setting 1

- Set **HMS momentum** to **-4.08 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 84 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 84. 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 84: High-Q^2 EMC (and scaling studies) at 35° - Setting 1

Target	***I*** (μA)	**HMS PS** PS1	PS2	**SHMS PS** PS1	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	-	

2.18 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	1-7	1-7	none	-1	?	LD2	30	10 min	
	1-7	1-7	1-6	-1	?	LD2	30	10 min	
	1-7	1-7	1-7	-1	?	LD2	30	10 min	
2	1-7	1-8	1-6	-1	?	LD2	30	10 min	
	1-7	1-8	1-7	-1	?	LD2	30	10 min	
3	1-8	1-7	1-6	-1	?	LD2	30	10 min	
	1-8	1-7	1-7	-1	?	LD2	30	10 min	
4	1-8	1-8	1-6	-1	?	LD2	30	10 min	
	1-8	1-8	1-7	-1	?	LD2	30	10 min	
	1-8	1-8	1-8	-1	?	LD2	30	10 min	

2.18.1 Setting 1 again - extra 9Be and 40Ca data. Same kinematics as last two sections...

- **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**
- **SHMS TRIGGER GOES BACK TO ELREAL**
- **SHMS momentum: -9.2 GeV HMS momentum: -4.08 GeV**.
- **SHMS angle: 8°** **HMS angle: 35°**
- **Trigger**: HMS & SHMS both use either 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 84 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 86. Take data with the SHMS and HMS simultaneously.
- Estimated run times are with 100% efficiency; run based on estimated beam-on time, even if current is lower (I assume we'll be closer to 50, but no reason not to take 60 if they can deliver it)

Table 86: High-Q^2 EMC (and scaling studies) at 35° - Setting 1

Target	***I*** (μA)	**HMS PS** PS1	PS2	**SHMS PS** PS1	PS2	**Est. Time**	**Target** e^-	**Done ?**
9Be	60	-1	0	-1	0	9 hrs	-	
40Ca	60	-1	0	-1	0	4 hrs	-	
9Be	60	0	-1	0	-1	10 min	-	
40Ca	60	0	-1	0	-1	10 min	-	
9Be	60	-1	0	-1	0	4 hr	-	
40Ca	60	-1	0	-1	0	5 hr	-	

2.19 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	

2.20 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.

2.20.1 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** PS1	PS2	**SHMS PS** PS1	PS2	**Est. Time**	**Target** e^- (HMS)	**Done ?**
LD2	60	-1	0	-1	0	6 hrs	600	
Al dummy	40	-1	0	-1	0	1.5 hrs	130	
LD2	60	-1	0	-1	0	6 hr	600	
Al dummy	40	-1	0	-1	0	1.5 hr	130	
LD2	60	-1	0	-1	0	6 hrs	600	
Al dummy	40	-1	0	-1	0	1.5 hrs	130	
LD2	60	-1	0	-1	0	6 hr	600	
Al dummy	40	-1	0	-1	0	1.5 hr	130	
LD2	60	-1	0	-1	0	6 hr	600	
Al dummy	40	-1	0	-1	0	1.5 hr	130	
LD2	60	-1	0	-1	0	6 hr	600	
Al dummy	40	-1	0	-1	0	1.5 hr	130	

2.21 SHMS 10 deg Running with Be (ALL PRESHOWER BLOCKS ON)

- 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°**

2.22 SHMS 10/11/12 deg and HMS 35 deg Running with Boron Targets

2.22.1 Setting 1

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

2.22.2 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	
B4C-11	60	-1	0	-1	0	8 hrs	400K	

2.22.3 Setting 3

- **TURN ALL SHMS PRESHOWER BLOCKS BACK ON.**
- **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** PS1	PS2	**SHMS PS** PS2	PS3	**Est. Time**	**Target** e^- (HMS)	**Done ?**
B4C-11	60	-1	0	-1	0	2 hrs and 20 min	250K	
B4C-10	60	-1	0	-1	0	2 hrs and 40 min	250K	

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

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

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

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

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

2.23 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**

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	?	B4C	60	30 min	
	1-7	1-7	1-6	-1	?	B4C	60	10 min	
	1-7	1-7	1-7	-1	?	B4C	60	10 min	
	1-6	1-6	1-6	-1	?	B4C	60	30 min	
2	1-7	1-8	1-6	-1	?	B4C	60	10 min	
	1-7	1-8	1-7	-1	?	B4C	60	10 min	
3	1-8	1-7	1-6	-1	?	B4C	60	10 min	
	1-8	1-7	1-7	-1	?	B4C	60	10 min	
4	1-8	1-8	1-6	-1	?	B4C	60	10 min	
	1-8	1-8	1-7	-1	?	B4C	60	10 min	
	1-8	1-8	1-8	-1	?	B4C	60	10 min	
5	1-7	1-7	1-7	-1	? -1	B4C	60	10 min	ELREAL !!!
	1-7	1-7	1-6	-1	? -1	B4C	60	10 min	ELREAL !!!
	1-7	1-7	none	-1	? -1	B4C	60	10 min	ELREAL !!!

2.24 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** PS1	PS2	**SHMS PS** PS2	PS3	**Est. Time**	**Done ?**
Be	60	-1	0	-1	0	-	-

- Jay Beneasch 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.

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3 XEM2 Production Run Plan - Part II

3.1 Target/Beam Centering Check with Hole Target

- Move target to "hole"
- Raster: 2 mm x 2 mm
- Set **HMS momentum** to **+3.40 GeV**.
- Set **SHMS momentum** to **-9.2 GeV**
- **HMS angle: 20° (See instructions below!!!)**
- **SHMS angle: 8° (See intructions below!!!)**
- **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.
- Full procedure: https://hallcweb.jlab.org/wiki/index.php/Beam_Checkout_Procedures

Specific instructions on rotating SHMS to 8 degrees:

- Watch the rotation on the SHMS rotation camera.
- DO NOT rotate SHMS below 8 degrees. It will trip the limit switch.
- 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.
- Note the offset and correct for it to rotate the SHMS to 8 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.

3.2 Charge Symmetric Background Studies at 20 deg - Part II

3.2.1 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 momentum: -9.2 GeV**
- **HMS angle: 20°** **SHMS angle: 8°**
- **Trigger**: SHMS PS2 or PS1 (ELREAL or 3/4) **OR** 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 100 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.

Table 100: CSB Studies at 20° - Setting 1

Target	***I***	**HMS PS**			**SHMS PS**			**Est. Time**	Done ?
	(μA)	PS1	PS2	PS3	PS1	PS2	PS3		
4He	40	-1	-1	0	-1	0	-1	10 min	
12C	60	-1	-1	0	-1	0	-1	10 min	
12C	60	0	-1	-1	0	-1	-1	10 min	
64Cu	60	0	-1	-1	0	-1	-1	10 min	
64Cu	60	-1	-1	0	-1	0	-1	10 min	

3.2.2 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 momentum: -9.2 GeV**
- **HMS angle: 20°** **SHMS angle: 8°**
- **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 101 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.

Table 101: CSB Studies at 20° - Setting 2

Target	***I***	**HMS PS**			**SHMS PS**			**Est. Time**	Done ?
	(μA)	PS1	PS2	PS3	PS1	PS2	PS3		
197Au	60	-1	-1	0	-1	0	-1	20 min	
197Au	60	0	-1	-1	0	-1	-1	10 min	
64Cu	60	0	-1	-1	0	-1	-1	10 min	
64Cu	60	-1	-1	0	-1	0	-1	10 min	
Al	40	-1	-1	0	-1	0	-1	10 min	
Al	40	0	-1	-1	0	-1	-1	10 min	
C12	60	-1	-1	0	-1	0	-1	20 min	
C12	60	0	-1	-1	0	-1	-1	10 min	
6Li	40	0	-1	-1	0	-1	-1	10 min	
6Li	40	-1	-1	0	-1	0	-1	10 min	
7Li	40	-1	-1	0	-1	0	-1	10 min	
7Li	40	0	-1	-1	0	-1	-1	10 min	
Al dummy	40	0	-1	-1	0	-1	-1	10 min	
Al dummy	40	-1	-1	0	-1	0	-1	10 min	
4He	40	-1	-1	0	-1	0	-1	20 min	
4He	40	0	-1	-1	0	-1	-1	10 min	
3He	40	0	-1	-1	0	-1	-1	10 min	
3He	40	-1	-1	0	-1	0	-1	10 min	

3.2.3 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 momentum: -9.2 GeV**
- **HMS angle: 20°** **SHMS angle: 8°**
- **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 102 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.

Table 102: CSB Studies at 20° - Setting3

Target	***I***	**HMS PS**			**SHMS PS**			**Est. Time**	Done ?
	(μA)	PS1	PS2	PS3	PS1	PS2	PS3		
4He	40	-1	-1	0	-1	0	-1	10 min	
3He	40	-1	-1	0	-1	0	-1	10 min	
12C	60	0	-1	-1	0	-1	-1	10 min	
12C	60	-1	-1	0	-1	0	-1	10 min	
64Cu	60	-1	-1	0	-1	0	-1	10 min	
64Cu	60	0	-1	-1	0	-1	-1	10 min	

3.2.4 Setting 4

- Make sure **SHMS S1X (1-7)** and **S2X (1-7)** LEFT and RIGHT hodoscope paddles are **OFF**.
- Set **HMS momentum** to **+2.42 GeV**.
- **SHMS momentum: -9.2 GeV**
- **HMS angle: 20°** **SHMS angle: 8°**
- **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 103 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.

Table 103: CSB Studies at 20° - Setting 4

Target	***I***	**HMS PS**			**SHMS PS**			**Est. Time**	Done ?
	(μA)	PS1	PS2	PS3	PS1	PS2	PS3		
197Au	60	-1	-1	0	-1	0	-1	10 min	
197Au	60	0	-1	-1	0	-1	-1	10 min	
64Cu	60	0	-1	-1	0	-1	-1	10 min	
64Cu	60	-1	-1	0	-1	0	-1	10 min	
Al	40	-1	-1	0	-1	0	-1	10 min	
Al	40	0	-1	-1	0	-1	-1	10 min	
C12	60	-1	-1	0	-1	0	-1	10 min	
C12	60	0	-1	-1	0	-1	-1	10 min	
6Li	40	0	-1	-1	0	-1	-1	10 min	
6Li	40	-1	-1	0	-1	0	-1	10 min	
7Li	40	-1	-1	0	-1	0	-1	10 min	
7Li	40	0	-1	-1	0	-1	-1	10 min	
Al dummy	40	0	-1	-1	0	-1	-1	10 min	
Al dummy	40	-1	-1	0	-1	0	-1	10 min	
4He	40	-1	-1	0	-1	0	-1	10 min	
4He	40	0	-1	-1	0	-1	-1	10 min	
3He	40	0	-1	-1	0	-1	-1	10 min	
3He	40	-1	-1	0	-1	0	-1	10 min	

- Total estimated time for this section including the momentum and target changes: **10.5 hrs**. Estimated run times are with 100% efficiency.

3.3 20 deg EMC and 8 deg 2N-SRC Running - Target Ladder II

- Before starting, change polarity of the HMS to "ELECTRON"
- First, ramp down all the HMS magnets to 0 A for the polarity change.
- TURN **SHMS S1X (1-7)** and **S2X (1-7)** (LEFT AND RIGHT) **OFF**

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	PS2	**SHMS PS** PS1	PS2	**Est. Time**	**Target** e^-	**Done ?**
3He	40	-1	0	-1	2	25 min	30K	
4He	40	0	-1	2	-1	10 min	-	
4He	40	-1	0	-1	2	15 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** PS1	PS2	**SHMS PS** PS1	PS2	**Est. Time**	**Target** e^-	**Done ?**
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	0	-1	2	-1	15 min	-	
4He	40	-1	0	-1	2	25 min	230K	
3He	40	-1	0	-1	2	45 min	200K	

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	PS2	**SHMS PS** PS1	PS2	**Est. Time**	**Target** e^-	**Done ?**
3He	40	-1	0	-1	2	45 min	655K	
4He	40	0	-1	2	-1	15 min	-	
4He	40	-1	0	-1	2	25 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	

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** PS1	PS2	**SHMS PS** PS1	PS2	**Est. Time**	**Target** e^-	**Done ?**
197Au	60	-1	2	-1	5	10 min	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	
4He	40	0	-1	2	-1	5 min	-	
4He	40	-1	0	-1	2	10 min	620K	
3He	40	-1	0	-1	2	20 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** PS1	PS2	**SHMS PS** PS1	PS2	**Est. Time**	**Target** e^-	**Done ?**
3He	40	-1	0	-1	2	10 min	350K	
4He	40	0	-1	2	-1	5 min	-	
4He	40	-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** PS1	PS2	**SHMS PS** PS1	PS2	**Est. Time**	**Target** e^-	**Done ?**
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	40	0	-1	2	-1	5 min	-	
4He	40	-1	0	-1	2	10 min	230K	
3He	40	-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	40	-1	0	-1	2	10 min	150K	
4He	40	0	-1	2	-1	5 min	-	
4He	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

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

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

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

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

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

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	PS2	**SHMS PS** PS1	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	40	-1	0	-1	5	10 min	75K	
4He	40	0	-1	5	-1	5 min	-	
3He	40	0	-1	5	-1	5 min	-	
3He	60	-1	0	-1	5	10 min	75K	

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 Settings: -4.0 GeV & 20 deg
- HMS Settings: -4.0 GeV & 20 deg

3.4.1 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	

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	
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	

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	

3.5 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

3.5.1 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 114 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 114: 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	0	-1	-1	5 min	
63Cu	60	0	-1	-1	0	-1	-1	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	0	-1	-1	5 min	

3.5.2 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 115 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 115: 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	0	-1	-1	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	0	-1	-1	5 min	
4He	40	0	-1	-1	0	-1	-1	5 min	
4He	40	-1	-1	0	-1	-1	0	15 min	

3.5.3 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 116 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 116: 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		
4He	40	-1	-1	0	-1	-1	0	10 min	
4He	40	0	-1	-1	0	-1	-1	5 min	
3He	40	0	-1	-1	0	-1	-1	5 min	
3He	40	-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	
63Cu	60	-1	-1	0	-1	-1	0	15 min	
63Cu	60	0	-1	-1	0	-1	-1	5 min	
197Au	60	-1	-1	0	-1	-1	0	15 min	
197Au	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	

3.5.4 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 117 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 117: 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	
197Au	60	-1	-1	0	-1	-1	0	15 min	
197Au	60	0	-1	-1	0	-1	-1	5 min	
63Cu	60	0	-1	-1	0	-1	-1	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	0	-1	-1	5 min	
3He	60	-1	-1	0	-1	-1	0	15 min	
3He	60	0	-1	-1	0	-1	-1	5 min	
4He	60	0	-1	-1	0	-1	-1	5 min	
4He	60	-1	-1	0	-1	-1	0	15 min	

3.5.5 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 116 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 118: 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		
4He	60	-1	-1	0	-1	-1	0	20 min	
4He	60	0	-1	-1	0	-1	-1	5 min	
3He	60	0	-1	-1	0	-1	-1	5 min	
3He	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	
63Cu	60	0	-1	-1	0	-1	-1	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	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	

3.5.6 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 119 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 119: CSB Studies at 35° - Setting 6 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	15 min	
12C	60	0	-1	-1	0	-1	-1	5 min	
63Cu	60	0	-1	-1	0	-1	-1	5 min	
63Cu	60	-1	-1	0	-1	-1	0	20 min	
197Au	60	0	-1	-1	0	-1	-1	5 min	
197Au	60	-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	
3He	60	-1	-1	0	-1	-1	0	10 min	
3He	60	0	-1	-1	0	-1	-1	5 min	
4He	60	0	-1	-1	0	-1	-1	5 min	
4He	60	-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.