Optics Procedure for 2.5T, 90deg Target Field with NEW Right Septum

Introduction

Here is the optics plan for the new right septum. The chicane setting is for 2.5T, 90deg target field, the beam energy is 2.25365 GeV.

We have already taken optics data for several settings. We do not need to repeat everything we have done. What we are going to do is check how much the new septum field will change the optics. The following is the tasks we want to do.

- Tune right septum current (To optimize the center ray and acceptance), (2 hours)
- Pointing (40 mins)
- Delta scan (4 hours)

The detail procedure for all tasks is described in the next section. To finish the above 3 tasks, the total estimated time will be one shift. When we are taking optics data for the right arm, we are also taking optics data for the left arm.

Instruction for Shift Leader:

For opticcs, we always use 100nA beam, rasters should be off except special specified. Usually take 2 runs for each configuration, each run for 1M events with LHe or 0.3M without LHe.

0. Tuning septum current (Estimated time: 2 hours)

a. Check whether the sieve status is IN. If not, ask for an escorted access to move the sieve slit IN.

b. Check "Optics Mode" in Hall A General Tools. Click right button next to Left/Right "P0 SET". It opens a new window, which contains the "Optics Mode" pull down menu. Make sure it is in the “g2p/GEp_1” option.

c. Check the HRS momenta. Make sure both of them are C12 elastic peak[1] (p0=2.251 GeV).

[1] To calculate the elastic energe and septa current, use these 2 executables: ~adaq/GetElasE ~adaq/GetSeptaCurrent..

Make sure the septa currents are correct for both arms. In case the HRS momentum need to be increase, you will need to CYCLE Q2, Q3 before set it to the new value.

d. Start from 725.4A, increase by 5% each step to find the best range for the current. Then change step size to 1% to find out the optimal value. (Will provide the fp variable values from simulation.)

1. Pointing (Estimated time: 40 min)[2]:

a. Check whether the sieve slit is IN. If not, ask for an escorted access to move the sieve slit IN.

b. Check Hall A General Tools, right button next to Left/Right "P0 SET". It opens a new page. The top of the page shows an "Optics Mode" pull down menu. Make sure it is in "g2p/GEp_1" option.

c. Check the HRS momentum setting. Make sure both of them are C12 elastic peak[3] (delta=0%, detial values will be given in the table). Make sure the septa current are correct for both arms. In case the HRS momentum need to be increase, you will need to CYCLE Q2, Q3 before set it to the new value.

d. Ask the target operator to move the target to C12.

e. Ask MCC to send 100nA beam at the position of (0,0), take one run.

f. Ask the target operator (maybe with the help of target experts) to **drain OUT** the LHe. Keep taking data at the same time, 1M events each run.

g. During the target experts is draining the LHe out, ask 3rd person to keep checking T1&T3 scaler rates to tell whether LHe is drained OUT.

2. Acceptance Study (Part 1, estimated time 50 min):

a. Keep HRS and septa current configuration at delta=0%, stay at C12 target.

b. Ask MCC to turn on the fast raster with 2x2mm, and send 100nA beam with position (0,0). Check the beam position on Hall A General Tools screen. Then take 2 runs, do spot++ to check the beam position and make a halog.

c. Notify MCC that we need to turn on the slow raster. Ask student expert to turn on the slow raster1.5V or 2cm diameter). Take 2 runs.

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2 The actual time used may be longer than the estimated time, but please notify the student experts if you haven't finished the stage within 1.5 times the estimated time.

3 To calculate the elastic energe and septa current, use these 2 executable: ~adaq/GetElasE ~adaq/GetSeptaCurrent..

d. Let MCC know that we need to turn off both fast raster and slow raster. Ask student expert to turn off the slow raster. Take 2 run.

3. Delta scan (Estimated time:240 min):

There is 2 ways to do the delta scan:

1) start from 0% → 2% → 4% → cycle to -4% → -2% → 0%

2) cycle to -4% → -2% → 0% → 2% → 4% → cycle to 0%

Option 2) might save some change over time at the beginning or at the end if can be combined with other plan. Please discuss with the expert which option will be followed.

a. Keep sieve IN, C12 target, no LHe.

b. Asuuing use opting 1), set the LHRS delta (dp) to be 1%, 2%, 3%, 4%, **CYCLE** Q2, Q3, then -4%, -3%, -2%, -1%. simultaneously set RHRS momentum to be 2%, 3.5%, **CYCLE** Q2, Q3, then -3.5%, -2%. For each setting, set septa current to be the corresponding values in the table.

c. For each configuration, take 2 runs, halog the scaler rate once , replay at least one run for each arm, halog the focus and target pannel corresponded to the right delta(dp) value.

4. Beam position cross scan (Estimated time: 240 min):

If possible, please combine this part with BPM calibration(sieve in, no Lhe).

a. Keep the HRS momentum setting to be delta=0% , and C12 target, no LHe.

b. Follow the detailed configuration in the table, ask MCC to move the beam position, check the beam position on the Hall A General Tools screen.

c. Ask 3rd person to take two runs for each configuration. For each run, ask 3rd person to do a spot++ check (type spot_L or spot_R on an adaq account) and halog the result.

5. Acceptance study (Part2, estimated time:80min):

a. Set delta=0% , use C12 target without LHe.

b. Ask MCC for an escorted access to move the sieve **OUT**. Student expert will go to the hall to move the Sieve **OUT**.

c. Ask the MCC to turn on the fast raster with 2x2mm and then take 2 runs.

d. Call MCC and tell them we need to turn on the slow raster, ask student expert to turn on the slow raster, then take 2 runs with 1M event.

e. Call MCC and tell them we need to turn off the fast raster and the slow raster, ask student expert to turn off the slow raster, then take 2 runs with 1M event.

6. Dilution Factor Study:

a. Refill LHe with the help of target experts.

b. Set the HRS momentum to Hydrogen elastic peak, also change septa currents.

c. Tell MCC we need to turn on the slow raster, ask student expert to turn on the slow raster (2cm diameter).

d. Move the target to the top NH3 target.

e. Ask MCC to send 100nA beam with fast raster on (2x2mm). Take 5M evetns for both arm.

f. Change to bottom NH3 target, take 5M events.

g. Change to empty target cell, take 3 M events.

h. Change to “no target”, take 3 M events..

If liquid helium is in, take 1M events for each run, otherwise 300k..

For each setting, snapshot the scaller rates window once, replay one run for each arm, snapshot the target tab and focus tab at the rigth delta. If beam position changed, take a snapshot for spot++.

Configuration	HRS P_0 (GeV)	Septa I (A)	Event Amount	Run Number	
Tuning right septum current					
With LHe	2.251	806.6	1M	R	
+0.5%		810.6		R	
+1%		814.6		R	
-0.5%		802.6		R	
-1%		798.5		R	
-2%					
Pointing, Sieve IN, 40mil C12 target, delta=0					
With LHe	2.251	725.4	1x1M	L	
		806.6		R	
Draining LHe	2.251	725.4	?x1M	L	
		806.6		R	
NO LHe	2.251	725.4	1x0.3M	L	
		806.6		R	
Delta Scan, Sieve IN, 40mil C12 target, LHRS					
0%(optional)	2.251	725.4	1x0.3M	L	
1%	2.228	717.0	2x0.3M	L	
2%	2.206	709.0	2x0.3M	L	
3%	2.183	700.6	2x0.4M	L	
4%	2.161	692.7	2x0.5M	L	
Cycle to -4%	2.341	759.0	2x0.3M	L	
-3%	2.319	750.7	2x0.3M	L	
-2%	2.296	742.1	2x0.3M	L	
-1%	2.274	733.9	2x0.3M	L	

Delta Scan, Sieve IN, 40mil C12 target, RHRS, do with LHRS simultaneously					
0%(optional)	2.251	806.6	1x0.3M	R	
2%	2.206	788.4	2x0.4M	R	
3.5%	2.172	774.6	2x0.5M	R	
Cycle to -3.5%	2.330		2x0.3M	R	
-2%	2.296		2x0.3M	R	
1%	2.228	797.3	2x0.3M	R	

Configuration	HRS P_0 (GeV)	Septa I (A)	Event Amount	Run Number Comments	
Acceptance Study Part I, Sieve IN, 40min C12 target, delta=0					
Fast raster	2.251	725.4	2x0.3M	L	
		806.6		R	
Fast raster + Slow raster	2.251	725.4	2x0.3M	L	
		806.6		R	
No rasters	2.251	725.4	2x0.3M	L	
		806.6		R	
Acceptance Study Part II, Sieve OUT, 40min C12 target, delta=0					
Fast raster	2.251	725.4	2x0.3M	L	
		806.6		R	
Fast raster + Slow raster	2.251	725.4	2x0.3M	L	
		806.6		R	
No raster	2.251	725.4	2x0.3M	L	
		806.6		R	

Beam Position	HRS P_0 (GeV)	Septa I (A)	Event Amount	Run Number Comments	
Beam Position Scan, Sieve IN, 40mil C12 target, delta=0%					
Beam Position (0, 0)	2.251	725.4	1x0.3M	L	
				R	
(0, 4)	2.251	725.4	2x0.3M	L	
				R	
(4, 4)	2.251	725.4	2x0.3M	L	
				R	
(4, 0)	2.251	725.4	2x0.3M	L	
				R	
(-4, 0)	2.251	725.4	2x0.3M	L	
				R	
(-4, -4)	2.251	725.4	2x0.3M	L	
				R	
(0, -4)	2.251	725.4	2x0.3M	L	
				R	
(0, 0)	2.251	725.4	1x0.3M	L	
				R	