Running log of run1

Poelker

Day29 of run1, October 6, 2020

1. Beam restored easily
2. Raster tests, another waveform solution from Bill, and an attempt to run with a macropulse synchronized to the raster, where we turn OFF beam when the raster is illuminating the target center, where it’s too bright. No luck with either
3. Tried to run qsutility one more time but there’s no QE left, can’t make enough tune mode for the harp to see
4. Beam OFF at 4:30 pm, end run1

Things to do in the days between end of run1 and start of run2

1. PSS recertification
2. Beam Authorization through December
3. Microphonics assessment with Peter Owen, baseline and cold and running beam
4. Laser alignment through viewers ITVM904 and ITVM905, then install the copper aperture plates to determine where the holes should be drilled
5. Drill the holes, obtain epics control
6. Replace RC#3 with RC#1? Install ceramic breaks on either side to float the coil?
7. Install another harp upstream of ITVM905
8. UED, update it, put elements in desired order
9. Quick reference update
10. Heat/activate a photocathode
11. Rooftiles OFF, then ON
12. Load unpolarized target
13. Need an fsd and audible alarm for GDR trips to SEL mode
14. Need video from ITVMA01B
15. Magnet rack errors in the alarm handler
16. Templates for viewers that don’t get over-ridden
17. FCup4 position sensors, get it straight
18. Remove from beamline steering magnets MHBM904B H&V and MHBM904C H and pull these trim cards
19. Replace bad RA valve at VIPMA01
20. M503 quad can’t cycle, the trim card slot is iffy
21. Magnet rack alarms
22. some magnet channel that repeatedly mismatch
23. Raster synchronization with laser macropulse
24. UHV soft limit trip troubleshooting

Day28 of run1, October 5, 2020

1. Neil and Ricky and Bern replaced the ceiling tiles (excellent job) and Dave Hamlette verified our shielding was acceptable. I unlocked the gun HVPS and the high power RF
2. Verified good vacuum and that valves and viewers were functional. HDice prep-ed the target, we locked up at 10am, beam restored to the dump viewer by noon after more quad centering, accomplished mostly by adjusting the MDLM801 dipole at the top of the vertical chicane. No idea why this always seems to be required. Once this adjustment was made, quad centering was pretty good through the 900 series quads. Beam was quad centered nicely in the 500 series and 800 series quads.
3. It was easy to steer through the IBC without the copper target but I mistakenly went down the wrong path thinking I could now center beam on ITVM905. Indeed, I can center beam on ITVM905 and put beam on the dump but it’s not centered on the axis of the IBC. When the superconducting solenoids were energized, the beam moved by a large amount, which is unacceptable. So although there’s no easy solution for the aperture M6 which requires a hole off the axis (assuming the viewer is ~ on beamline axis), it’s nice to know the beam path through the IBC is the same as with copper target installed. Our golden orbit remains golden
4. Beam on the 2mm thick YAG screen at ITVM905 is definitely better than the image obtained with 4mm thick YAG, but still difficult to make a circle there. Can’t tell if the thickness of screen is fooling me.
5. We made an access while Bill Gunning and William Lu loaded new raster programs which required IOC reboots, trying to display the entire M905 YAG screen in the camera image, no luck
6. I tried to use the YAG screens at ITVM904 and ITVM905 to determine beam sizes, so that we can drill holes with correct diameters. I am dissatisfied with my empirically determined optics/quad settings. Based on the YAG images it seems to me that beam is smaller at 904 than 905, and this is the opposite of what we want. In other words, I want a converging beam, getting smaller as it travels from 904 to 905, and ideally forming a waist at the HDIce target. The dump viewer cannot be used to help focus the beam because the radiation baffle (aluminum foil window) inside the IBC blows up the beam.
7. Team HDIce and Bill Gunning tried other raster patterns. One of them does a better job illuminating the target like a top hat, with uniform spatial distribution, but Andy thinks the raster is too slow.

To do – Jonathan called to say CEBAF is taking more time than expected, we have LHe at booster through Tuesday 4pm, or so. We will run another day.

1. Golden orbit? Good enough, move on
2. Set the A5 and A6 hole sizes. I think we will be drilling three holes in each copper paddle!
3. Quad adjustments? Get the beam envelope we want?
4. Raster studies ad nauseam
5. RC#3 studies
6. Qsutility, get a Y-quad scan we like, use it to back propagate the beam optics to gun, and forward to the HDIce target

Day27 of run1, October 4, 2020

* Team HDice finished their work, the copper target was removed, the IBC rotated horizontal again and attached to beamline. Dump is getting pumped, I activated the GP100 on the upstream section (2.7A for 30 minutes) and the ion pump VIPMA10 is now ON, but attached to a local supply
* Neil, Ricky and Bern will re-install the ceiling tiles tomorrow morning
* To do:
  + Call Radcon, verify roof tiles in place, ok to make beam
  + Unlock the gun HV power supply and HPA
  + Move VIPMA10 from local supply to UHV supply
  + re-attach electrical controls to VBVMA01
  + open the manual valve upstream of ITVM904,
  + open valves to IBC
  + run beam again, beam to ITVMA01A (check with Chris about video from ITVMA01B)
  + What does beam look like on thinner YAG screen at ITVM905?
  + Raster amplitude
  + Assign diameters to A5 and A6 apertures

Day26 of run1, October 2, 2020

1. Neil and crew removed the rooftiles so that Team HDIce can remove the copper target. The gun and high power RF were locked out last night.
2. Phil and Marcy replaced the YAG screen inside ITVM905, swapping out the 4mm thick crystal for a 2mm thick crystal. We hope the image is more useful on Monday, it will help us set the hole size for aperture 6, when the raster is powered. Manual upstream valve closed, downstream valve electrical controls removed so that it can’t open, ion pumps in this region disabled. Ions pumps are already ON
3. Team HDIce has vented the apparatus and disconnected from the beamline, preparing to rotate vertical to remove the copper target. Will work over the weekend
4. Expect to be under vacuum Sunday, Neil to replace the ceiling tiles Monday morning
5. Monday plan: set raster beam size, set aperture 6 hole diameter

Day25 of run1, October 1, 2020

1. The folks from SRF removed stuff from Cave2 rooftop in anticipation of Neil and company visiting on Friday morning to remove the rooftiles, to provide Team HDice with access to the IBC. Team HDIce will rotate the IBC vertical and then remove the copper target, then rotate down again to take beam for one more day, October 5
2. Kiarra and I locked up and restored beam to the dump viewer MA01A without a single tweak to the setup Yan saved the previous day. Beam momentum 9.7 MeV/c. That bodes well, we can turn OFF beam and restore it without any changes to the setup.
3. Then we sent the beam to M703 viewer in the MeV spectrometer line and we found stable beam at 9.7 and 9.5 MeV/c. Recall two days ago the beam at 9.5 MeV/c suffered giant energy variations, giant stripes on viewers in the energy plane. Today beam was fine at the momentum, so possible a good result stemming from the vibration isolation pads installed under the dilution refrigerator. Or possibly some other reason.
4. We decided to leave beam momentum at 9.7 MeV/c for the rest of the experiments, including run2 and 3
5. We made an access so that HDIce could make some cabling changes
6. Chris Gould visited to discuss the apertures we must install soon: how to put the holes where the beam is? He offered helpful suggestions, including rotate the crosses such that hole travels along the line formed by the beam offset radial position relative to center
7. Restored beam to the HDIce dump and Team HDIce studied halo counters, golden orbit, and raster

After running beam tonight:

1. lock out the gun HV and the booster high power RF, make logbook entry, so that Neil can remove the cave2 rooftiles per OSP
2. close manual valves, lock out the last valve leading to IBC

Day24 of run1, September 30, 2020

1. Clyde came over and was puzzled why we didn’t know the reason for booster instability. Like Tomasz, he came into the enclosure and complained of the low frequency hum that only a deaf man like me couldn’t hear. In short order, he suggested we turn OFF HDIce, which of course is not possible. But Andy had some vibration isolation pads and we installed these under the dilution refrigerator “cart” which weighs 3500 lbs.
2. Meanwhile, Eric and Jason spent time troubleshooting why the chopper solenoid magnets can’t cycle to the requested +/- current of 1.75 A. Plenty of voltage available, and 10A cards.? So we reduced the cycle limits to 1.5 A. One less alarm now.
3. We fired up beam and Mike M. did some frame grabbing of viewers ITVM904, 905 and A01, with templates (aka green boxes) set to features we can assign a dimension to, such that in the future we can put beam at the right place, our desired launch. We would prefer templates that don’t get erased when a new template is saved.
4. Matt M. came on board and we completed an entire viewer walk for posterity
5. Matt M. setup a chime to alert us to trips from GDR to SEL mode, and setting beam mode to Beam Sync, nice.
6. Team HDIce used the halo detectors to very accurately send beam down the axis of the apparatus. Beam centered when halo detectors read the same value on either side of the beamline. A much more sensitive centering technique than using viewer images.
7. Halo detector commissioning with Italian collaborators on the phone
8. We never got a chance to send beam to M703 viewer, the MeV spectrometer, to see if beam is now stable at 9.5 MeV/c. Did the vibration isolation of dilution refrigerator help, is the energy instability still there? We will do this check sometime soon.
9. On second shift, Yan will assist HDIce with halo detector commissioning, viewer image frame grabbing, raster studies and perhaps Rowgowski coil studies.
10. I would like to lock up early Thursday to check beam stability at 9.5 MeV/c using the spectrometer
11. Still undecided:
    1. Remove the roof tiles to remove the copper aperture target. We lose two beam days, and the raster is not really working very well (still dwells too long in the center, so what do we learn from that?)
    2. Remove 4mm thick YAG screen at ITVM905 and replace with 2mm screen, one that tells us more about the beam size at this location. We lose one beam day. Beam appears very large at this viewer now, but it can’t be that large in reality, it’s smaller on either side and there are no focusing elements in this region
    3. Setup the chopper, does this help clean up beam? Do halo detectors show lots of garbage on the beam?

Day23 of run1, September 29, 2020

1. Took a long time to lockup today. Mike Lowry is retiring and IT locked out his computer accounts used to operate HDIce!
2. Gary dried out FCup water lines, there’s less leakage current now, sub-nA. But we didn’t get a chance to verify readings with CW beam. I flipped the position sensors for IN/OUT and now positions are correct on the current monitoring screen, but beam destination is still flipped.
3. Kevin Banks connected the radiabeam steering magnet, MCRM905C H&V, and installed the 10A cards, while Gary Croke updated UED and provided a controls screen. Nice. Recall this is plan B, remove all the steering coils from the vacuum pipe that gets moved when target is rotated vertical. The test for today is to see if MHBM905B H&V + MCRM905C H&V can put beam through HDIce on the IBC centerline. If so, then we remove the haimsons from the moveable vacuum pipe, life is good.
4. I checked quad centering and found the orbit had drifted again! I reasoned it was because the keV dipole was not on loop, and I put it on loop, changing the orbit at the front end. But when I was finishing this process, the booster became very unhappy. Now I wonder if all problems with orbit relate to energy drifts at the booster? I don’t know. But the group is getting better saving files with magnets cycled and on loop and with no mismatches
5. While waiting to lock up, Mike McCaughan was very helpful making the alarm handler more useful, slowly we will eliminate all the things in alarm.
6. Clyde, Rama, Tomasz and Jonathan all took a look at the booster, to help calm it down. Clyde suggested opening the JT valve because sometimes they start to resonate. This did not help. He commented that there’s lots of 59 Hz on the beam which makes him think of pump motor. Tomorrow he will visit the UITF to hunt for sources of mechanical vibration.
7. Thinking the problem was the 2-cell which shows the most modulation, Matt Mock suggested we reduce the 2-cell gradient and perhaps even run with it OFF. Reducing the 2-cell gradient didn’t do anything to improve stability, but INCREASING the 7-cell gradient vastly improved booster energy stability.
8. Once the booster became cooperative, it was not hard to steer beam through the IBC using the desired steering magnets: MHBM905B H&V + MCRM905C H&V. What we don’t know is if we are on axis.
9. With 9.71 MeV/c beam (7-cell GSet increased from 12.45 to 12.8), the HDIce folks are looking at the orbit of the beam through the IBC, checking dump spot vs solenoid field.

To do:

1. I ordered another radiabeam steering magnet, hope it gets here soon
2. Use accelerometer to look for source of mechanical vibration that might be making the booster so unhappy, producing so much energy jitter
3. All the other things….

Day22 of run1, September 28, 2020

1. We disconnected the water from FCup4 and attached Keithley picoammeter 6487 with 500 VDC bias. However we forgot to blow out the lines, and so I suspect we suffer some leakage current, ~ 400 pA.
2. Golden orbit search continued, with haimsons, our plan A. Max’s orbit seems good. Beam spot largely stationary at dump viewer when superconducting magnet currents are varied
3. Max observed that we left our quads and dipole off loop. This could explain why our golden orbit seems to drift around and why it seems we are always quad centering. New mandate, all saves must be done with magnets on loop and with no mismatched magnets present
4. RC#3 tests, dithering a steering magnet at 0.1 Hz

To do:

1. Blow out the water lines of FCup4
2. Hook up the radiabeam magnet, update UED and test it

Day21 of run1, September 26, 2020

1. We turned ON the accelerator and restored the beam orbit through IBC and onto the dump following the mu-metal party and S&A moving quad3 back onto the line. Now the correctors are happier, none of them are railed. Beam still appears to the left on viewer ITVM905 but thanks to the bigger diameter, we can see beam on upstream and downstream viewers without having to change magnet settings.
2. The new 2” diameter YAG viewer at ITVM905 is thick, 2mm, and perhaps this results in a comet-like tail, a little annoying
3. Andy doesn’t like that the beam diameter is bigger on ITVM905 than we promised, of the order 1 mm, instead of 200 microns. We can try to tighten the beam up.
4. The beam orbit is slightly mis-aligned relative to the axis of the IBC, because we can see the beam move as the IBC magnets are varied
5. The raster still seems to disappoint, in that there is a longer than expected dwell in the center of the raster, no top hat profile. Is the spot too big? See item3

To do:

1. Decide if we want to play with radiabeam magnet as way to center beam on viewer M905
2. Improve dispersion compensation, tighten the beam spot at M905?
3. Repeat qsutility Y emittance measurement
4. Determine aperture hole sizes
5. Install Keithley ammeter 6487 on FCup4 – Kevin needs an epics variable name

Day 20 of run1, September 25, 2020

We accomplished our maintenance day tasks:

1. Installed new, larger diameter YAG screen at ITVM905, vacuum coming down
2. Installed the radiabeam steering magnet, but needs to be wired to trim cards
3. Surveyed the elevated beamline and HDIce apparatus. Quad 904 was shifted by 3 mm in horizontal plane, this might have been a result of swapping out the 3” dia. pipes for 2.5” dia. pipes. And Andy moved this quad upstream. This quad was moved back onto the line. No other obvious kinks or misalignments were discovered.
4. Re-installed magnets on one of the ion pumps near ITVM905, added lots of mu-metal
5. Bill Gunning proposed a new raster algorithm

Other:

1. Dennis Turner used Max’s data from qsutlity to imagine a match solution. Some iterations required, and Dennis recommends we repeat the Y-emittance measurement.

Day19 of run1, September 24, 2020

1. Chris Gould visited the cave, we explained there seems to be a kink in the beamline, the line of the elevated beamline is not coincident with the line formed by the IBC, target and dump. He will survey things on Friday morning
2. Riad found one extra radiabeam steering magnet, H & V, and we plan to install this between the last valve and FCup4, to make our “dogleg” needed to center beam on ITVM904 and the hole in the copper target. Gary will make a support for us, Kevin Banks can install it, we will need one more channel, but the spare cable is already pulled
3. Andy also suggested we simply remove the 1” dia. ITVM904 viewer and replace it with a 2” dia. YAG screen. We will do this on Friday, pumping over the weekend (note, should we do this? Maybe the radiabeam magnet will work, and we’ve fixed our problem?)
4. Then we locked up, I quad centered and adjusted quad settings in the hopes of minimizing the vertical beam motion. Good news, this seemed to help. I followed Joe’s advice, adjusting the three quads in the chicane. Now the bdl values of chicane quads 801, 802 and 803 are -580, 206 and -580, respectively. This ratio is similar to what Joe recommended. To implement this, I also had to adjust all the other quads which took some time. Beam on the viewers looks decent, the spot at ITVM904 and 905 seems good to me, but we wait to see what beam looks like on the IBC dump viewer. We need to adjust quads 903 and 904 to pass beam through the hole in the copper target.
5. Next we performed raster studies. This time however, we put low current CW beam on YAG viewer ITVM905 and this helped drastically. In VL mode, the beam is ON for only 10 uA, and this creates the “sector” images described previously. The aliasing between the 60 Hz line locked VL macropulse and the raster frequencies creates confusing images, such that Andy wanted to make movies, etc., In CW mode, this problem doesn’t exist, you see on the viewer what the target will see. To implement this, I had to reduce the fiber amp current from 1900 mA to 1200 mA and use atten = 110.
6. Then there was an IBC scare so we opened up for Team HDIce to respond to the crisis, all is well. But upon resweeping and restoring, a number of problems we observed on RHEL7 machines: could not open the FSD reset screen, could not open adviewer, could not run qsutility. What else?
7. This was the swing shift plan, not sure how things will go:
   1. Qsutilty (use two quads this tie, one for X and one for Y)
   2. Energy spread using harp 803, remember to set the 800 series quads to zero, cycle them
   3. Beam to MA01A, set the spot size at the hole in copper target using quad 903 and 904, save setup
   4. Then assist HDIce tests….raster, viewer as current meter, RC#3 studies, maybe IBC superconducting magnets ON/OFF

To do:

1. Get the epics programs to work again: FSD reset page, adviewer, qsutility, etc.,
2. Software control of the IBC superconducting magnets
3. Add the radiabeam magnet, update UED, one more channel, 10amp cards? Verify the dogleg is sufficient
4. Install the 2” diameter YAG screen at ITVM905, restore good vacuum
5. Survey the beamline, find a kink?
6. Raster spends too much time at beam center

Day18 of run1, September 23, 2020

1. The extra steering magnet was added to the beamline, M904C H (thanks to Jason Delk and Gary Croke for updating UED and the magnet screen)
2. But alas, this haimson pair does not have enough strength to steer beam through the IBC with the beam on viewer ITVM904
3. Some raster studies, the raster does not appear to be working properly
4. Beam jumping up/down on viewers of the elevated line, not good, very annoying. Energy instability it seems

Note from Andy following today’s work:

(1) beam is jumping around, mainly vertically  
- suspect the Booster; can some from RF do something ???

(2) getting the beam on ITVM905 AND on the dump viewer ITVMA01A requires a huge dog-leg, we're still not at the center of the viewers.  
A) ask Chris Gould to survey the outside of the IBC nose. The inside can't be shifted by more than about 3 mm.  
B) obtain stronger coils for the dog-leg. eg. 10 A coils and 10 A cards  
- with all solenoids OFF, steer beam to the center of M905 and the dump YAG MA01A  
- now turn the solenoids back on. DOES THE BEAM MOVE? If not, we have beam on the axis of the IBC  
C) with solenoids OFF, steer beam with M904.  
- Do motions on TVM905 and dump match g4BL predictions?  
- move beam to extremes; do we see it strike inside walls of IBC? Is the motion at least symmetrical ?

(3a) camera at TVMA01A is focused on the flange;  
- refocus on the grid of the YAG  
(3b) 2nd dump viewer, TVMA01B, does not appear to work

Day17 of run1, September 22, 2020

1. Kevin Banks flipped polarity of half the qauds, but we told him the wrong half! Need to back out and change polarity of the chicane and elevated beamline quads. Matt and Andy did this, polarities are now consistent and per convention
2. Kevin will hook up a horizontal steering magnet set downstream of the last valve, he will do this tomorrow
3. Yan steered up the beam and verified that none of our magnet tweaks served to straighten out the beam. Beam is still off the ITVM905 viewer in order to send beam through the IBC
4. After vilifying the quads for about two hours, we changed our tune and then vilified the booster, as being the cause for vertical motion. Tomasz thinks microphonics, which perhaps come and good, good days and bad days. Yesterday seemed like a bad day in terms of the magnitude of the vertical motion in the elevated beamline
5. Next, team HDIce studied the raster and declared it to be “not good”, not providing enough kick at the desired higher frequencies

To do:

1. Add 904CH pair
2. UED updates, sigh
3. Measure energy spread with chicane harp M803, quads cycled and OFF

Day16 of run1, September 21, 2020

1. To straighten the beam orbit, we removed the magnets from two ion pumps near 904/905 and we added an iron box to ion pump VIPMA01.
2. Andy moved one quad upstream so that steering coil 904H/V is now outside of the quad
3. Yan moved M903H&V upstream
4. Andy and Tom discovered all quads are wired as quads, but half of them are opposite polarity
5. Beam restored easily to FCup4 and viewer ITV905, but there appeared to be no benefit to any of the things we did to straighten the orbit, although we need to put beam through HDIce to say conclusively.
6. Two hours of RC#3 tests with 20nA CW to FCup4, no apparent beam position monitoring
7. DC Power did not visit today to investigate quad induced beam motion

Day15 of run1, September 19, 2020

1. Opened all the valves for the first time, a common vacuum space between the gun and HDIce dump
2. Yan figured out the reason for the vertical beam motion especially visible on the M905 viewer – the motion comes from quad MQDM803, the last quad in the vertical chicane. We swapped 10A trim cards, this did not solve the problem. So either two bad trim cards, or one bad quad. For now, we are sending beam without this magnet powered.
3. The last two quads in the elevated beamline might also be moving the beam, albeit not as much, we should swap these trim cards too. What did DC Power do when they fixed this problem on the waist height beamline? DC block?
4. With the vertical motion largely removed, Andy tested the raster and it indeed moves the beam. Perhaps some video aliasing that makes the viewer image puzzling? Should operate with free running clock, changing the frequency, maybe it will produce a less-puzzling viewer image
5. Yan sent beam through the IBC with the HDIce superconducting solenoid magnets ON. The best we could do was observe the copper target, but just a diffuse image, perhaps the e-beam bouncing off the side of the pipe.
6. So we opened the enclosure and turned OFF the superconducting solenoids, trying to find a launch through the IBC, success – Yan found a good launch. He adjusted the M904 quad to tighten up the beam, with most of the beam passing through the center 2 mm dia. Hole. But the launch is such that, you don’t see beam on the M905 viewer, it is about 1” to the left of the viewer. We could not move the beam right on M905 while still passing beam through the IBC and copper target. This won’t work long term, because we planned to use the beam on M905 viewer to set current during runs 2 and 3, and because we imagine the hole we drill in the aperture 2 plate – which is very close to the M905 viewer – will be centered in the plate, not 1.5” to the left.
7. Next we opened the cave so HDIce could re-energize the superconducting magnets. Excellent news, the same launch with magnets OFF permitted beam delivery through the IBC with magnets ON. Again we tried to move the beam onto the M905 viewer while passing beam through the IBC but no luck
8. We then did our first cursory calibration of the viewer as a faraday cup in CW mode. It seems we have plenty of dynamic range, with the YAG viewers sensitive to sub-nA beam current. The viewer method should work for us. We will repeat this measurement: it would be great if the adviewer software could provide the integral of the Gaussian fit to the beam profile, a better metric than peak max value.
9. Most of the beam passes through the YAG viewer at the dump (and every other YAG viewer too). At the HDIce dump, we see 90% of the beam at the dump cup, with plenty of video signal from the YAG screen. Andy thinks most of the beam will pass through the HDIce target, so during run2 and 3, we should see the YAG image and dump current.
10. The ammeter that Andy bought for the dump is superb!! Clean signal. With beam OFF, the leakage is -11 Amps. With beam ON, the S/N is excellent, clearly resolving 100s of picoamps, perhaps eve 10s of picoamps. I wish I had bought one for FCup4. Will try to get one fast.
11. Observation: as much as it makes sense to set quads in sensible way using qsutility, we learned today that it’s also fine to set the quads empirically. Dave Douglas’ ideas for managing energy spread are great, but it must be we don’t have much energy spread at UITF. I think the beam motion we see mostly comes from quad current supplies. There’s some jitter from the booster, but less than what the quads generate. We thin the apertures are going to protect us from the big energy swings that sometimes occur.

To do:

1. Get with DC Power and discuss the M5 quad fixes, implement them everywhere, whatever that was
2. Quad M803 is very bad, and we tried two boards. Two bad boards or one bad quad?\
3. Figure out what is pushing the beam so hard at quad M904, why is steering magnet M903H railed?
4. A better launch through M904 and M905, mu-metal? Move the steering magnet M904A H/V downstream of the valve, to create a dogleg there to provide centered beam on M905 and passage through the IBC target to dump
5. Use hall probe and check wiring of all quads. Andy says there’s lots of field at quad M904 with the magnets OFF? How’s that?
6. Ask Brian Freeman if the adviewer software can integrate the Gaussian fit to the image profile, a metric for beam intensity
7. Lock up and do it again…..

Day 14 of run1, September 18, 2020

1. Open all morning while HDIce dealt with computers that received software updates, and then they dealt with the aftermath
2. I disconnected the things (ion pump power supplies, raster magnet current supplies, some BPM thingy) that were getting 120 VAC from some romex cable feeding a power strip, hoping this would eliminate the beam motion at M905 viewer, it did not help
3. Joe analyzed the results from Max’s qsutility scans from the previous day, and he “back propagated” the results using elegant to suggest new quad settings. But these quad settings did not propagate beam. Maybe quads are not wired consistently ; they function like quads but polarity could be inconsistent, will ask Onish to check

To do:

1. Empirically set quads, use chicane to minimize jitter
2. Open valves either side of IBC and send beam through it!!

Day13 of run1, September 17, 2020

1. Beam quickly restored to FCup4 at 9.5 MeV/c
2. Radsurveys, 25 nA CW beam to FCup4 and FCup3, not much radiation, good
3. Tried to figure out why the beam moves up/down at viewer M905. WE turned OFF the rasters completely, no change
4. Max ran qsutility at 9.5 MeV/c and obtained x and y values of emittance. But the quads aren’t presently set to obtain a nice focus in both x and y using quad 4. We will revisit this again.
5. Finished the day trying to estimate the energy spread. Moved beam on the M703 dump viewer, calibrated pixel movement versus Bdl of the bend magnet MDLM601. Then noted the width of the beam and also calibrated pixels to mm. The info can be used to back out the energy spread

To do:

1. Find cause and eliminate the source of vertical beam motion at the M905 viewer. Tough to proceed with this motion present

Day12 of run1, September 16, 2020

Summary today's work, a good day. Beam immediately upstream of the HDIce apparatus. Need to sleuth a vertical motion problem that originates in the region with raster magnets. But even with the motion, we are ready to send beam through empty HDIce.

before locking up:  
1) viewer M504 and M905 fixed  
2) FCup4 in and out via epics  
3) magnet rack ITF07 repairs complete  
4) good progress on alarm handler: but I need to figure out how to clear magnet alarms (incessant beeping now prevents me from using the alarm handler in a useful way)  
5) good progress updating UED, Gary waiting for Joe to weigh in on dipole magnets  
6) harp controls for harp M7 swapped with k501, but still couldn't see a good harp swipe with beam

Locked up, running beam  
1) it was easy to restore beam to elevated beamline viewers, booster is very stable  
2) set the beam momentum to 9.5 MeV, based on MDLM601. It was a little high. 7-cell GSet reduced from 12.5 to 12.45  
3) Yan quad centered up the vertical chicane and along the elevated beamline trhough M903. Could not quad center in the final quad, one steerng magnet railed, need to investigate this  
4) Yan empirically set the quads, very nice round and tight beam spots along vertical chicane and elevated beamline. Simple spot size estimate at viewer M904 (where we will install the aperture) says spot < 1mm (1-sigma)  
5) Dipole MDLM504 at beginning of chicane was moving beam vertically at ~ 0.1 Hz. DC power replaced the 10A card and the problem went away, nice  
6) there is vertical motion at last viewer before HDIce M905, smallish but easy to see with eye. We will need to get rid of this motion. 60 Hz somewhere between M904 and M905? raster ON when it says it's OFF?  
7) Finished the day with 20nA CW to FCup4 for Kevin's RC#3 studies

Accelerator folks (i.e., us) need to do the following:

1) setup a decent beam to Faraday Cup4, where "decent" means quad centered beam from the booster all the way to HDIce (Yan and I should complete this today).  Save setup!!

2) on Friday with Max's help, we perform qsutility study, and then we sweet talk Joe and Dennis to analyze the results, and ask them provide us recommendations for a refined setup with sensible quad settings that provide a small beam spot at aperture 5/viewer M904 just in front of the raster magnets, save setup!!  then everyday until all HDIce tests are over, we turn ON the UITF accelerator using this same file

What are the 1% technical issues remaining?  there's a magnet cycling ON/OFF or mismatching at 0.1 Hz.  And the harp in M7 spectrometer line doesn't work, and won't work for this project.  Guestimate an energy spread, that's the best we can do.

Then starting next week Monday, what's the plan?  complete the HDIce run1 tests.  An interested reader can look at <https://wiki.jlab.org/ciswiki/images/0/0c/HDIce_run1_tasks_and_goals.pdf> or see below:

1) test RC#3, this is Kevin's project, we put nA beam in FCup4 and steer it up down left right, while he looks at the lock in amps

2) we calibrate YAG viewer M905 in CW mode against Faraday Cup4 current, extrapolate to low low current.  Viewer M905 will be our FCup for HDIce tests with targets.  We ask Brian to provide us an epics readout of the intensity of this view screen.

3) turn ON the raster, check it's functionality

4) OPEN all the valves, send beam to the dump viewers!!

5) aperture study, pencil beam, etc., vague here because Andy is going to get more specific with us.

Day11 of run1, September 15, 2020

A maintenance day….

1. We covered the M601 dump with lead brick, content to operate at just 25 nA for the rest of the HDIce tests
2. Chris Norris got the two viewers to work, M504 and M905, and Scott Higgins removed the collision interlock software for viewer M905
3. Made some headway on getting the Alarm Handler useful, some more work remains
4. Made some headway updating the UED, from vertical dipole to HDIce, some further review is required
5. Kevin Banks worked to install the spare fan on 3rd magnet rack
6. Team HDice and Paul Metcalf are checking out the HDIce-related FSD nodes
7. HDIce cool down continues
8. Keith Cole said he would figure out how to make FCup4 move in and out with epics
9. John Musson will pick a BPM and install a signal generator that somehow can be used to help troubleshoot the Tune Mode vs CW issue

Day10 of run1, September 14, 2020

1. Neil added more shielding at the exterior north wall, and at the gap between cave1 and control room. Andy prefers we quit making radiation (i.e., he suggests we quit sending beam to unshielded dumps at 10 uA CW) because he thinks we fried some halo detectors.
2. We sent VL beam down the elevated beampipe at 9.6 MeV/c, wonderful news. Beam to viewer ITVM904, knocking at the door to HDIce. We could have gone further but there’s no video coming from M905.
3. Max got the qsutility to work! And he measured the Y-emittance at 9.6 MeV/c, typical value ~ 0.1 mm mrad, then the magnet rack overheated and we had to stop before we could measure the X-emittance.
4. All this happened at average current less than 25 nA, per Keith’s request

Things to do while cave is OPEN on Tuesday morning:

1. Finish cooling down HDIce
2. HDIce dump vacuum ok? Can we open ALL valves?
3. No camera on M504, don’t know where it went to
4. Viewer M905 shows a conflict on the viewer page, it goes in but no video to control room. Software, I will ask Scott Higgins.
5. Faraday Cup 4 has no controls, it’s IN now but anticipate the day we have to withdraw it, prefer this to happen with epics, Tony Delacruz?
6. Magnet repairs? Seems we burned up M504B H and V
7. Magnet rack #3 blower cooling fan replacement
8. Magnet inductance measurements
9. Label the channels in new magnet rack
10. Finish the HDIce FSD connections
11. Put the lead on the M601 dump
12. Get the alarm handler working
13. Not sure 905 vacuum will ever be UHV supply compatible (i.e., < 100 uA), but if by chance this should happen, we need to move one pump to UHV supply
14. Cover M601 dump with lead brick

Next time we lock up….

1. Repeat qsutility and find out how this tool can be used to set quads to obtain our desired 100um spot at viewer M904 (where we plan to install the small aperture)
2. Check with Keith and go CW to FCup4, set current to 20nA and let Kevin check out RC#3
3. Work our way through the run1 milestones per Andy’s list: https://wiki.jlab.org/ciswiki/images/0/0c/HDIce\_run1\_tasks\_and\_goals.pdf

Day9 of run1, September 11, 2020

Mostly another maintenance day:

1. HDIce moved LHe from one dewar to another as part of the process to cool the IBC. They trouble-shot a computer connection that’s supposed to mirror the IBC computer screen outside the enclosure. There’s some 60 Hz noise on one of the raster magnets
2. We found the ion pumps tripped OFF in the M904 and M905 region. There are a total of five ion pumps in this area. Two will be cabled to the UHV supplies and the remaining three will be powered by a local supply. Phil leak-checked but didn’t find any leaks. I will try to get the pumps ON before going home
3. We locked up for Tomasz so that he could look at the rf feeding the 2-cell. He sees 59 Hz that is modulated at ~ 1 Hz. He believes he can hear a hum inside the enclosure near HDIce that mimics the modulation.
4. Yan and Max bent the Viewer Limited beam up the chicane and found good beam on viewer M804, nice. The did a harp swipe and the M8 harp is good, functional.
5. Neil Wilson tried to fill the holes at the two worrisome locations that Keith requires us to address, but no luck. We remain limited to 25 nA average current.
6. Gary Croke is working on the updated magnet screens, Kevin banks brought over the 1A trim cards from the CEBAF pepo line, but I think we might still need a few more.

Day8 of run1, September 10, 2020

Maintenance Day

1. Keith Welch and Neil Wilson discussed the two shielding “holes”, one near the control room and one at the north end of the cave. We will see what Neil comes up with.
2. Until the shielding deficiencies are dealt with, we are limited to 25 nA average current, which means Viewer Limited mode and Tune Mode with macropulse current 1.7 uA, which might be sufficient to run harp swipes and measure beam emittance with qsutility. After the shielding holes are dealt with, we are limited to 100 nA average current at MeV energy, which is fine for the UITF program including HDIce and waste water treatment. More shielding deficiencies will need to be addressed to go to higher currents.
3. The Beam Authorization page was updated, we are now approved to start run1 (i.e., thread beam up the elevated line), albeit with the 25 nA average current restriction. Again, this is fine for run1 and the Viewer Limited beam we plan to use for this task
4. The operational restrictions were modified to reflect the 25 nA MeV beam current limit
5. Eric and Kevin made good progress on the magnet installation job, for the elevated beamline. Kevin will tell Gary Croke about modifications and Gary will update the UED and screens.
6. We are short about 10 trim cards, 1A. Maybe DC power can find some. Jim Coleman took the 1 A cards from GTS already, for the isotope run. We can borrow cards from CEBAF once the SAD starts, but that’s not until September 21. We have enough cards and magnets to push beam a significant portion of the elevated line.
7. Phil installed the FCup4 pneumatic cylinder, he will get with Chris Norris, no anti-collision circuit is required. Maybe this is why viewer M905 shows a conflict?
8. Safety System Group worked on HDIce FSD nodes, not sure how far they got
9. Tomasz waited patiently for us to lock up, but we never did

To do:

1. Find trim cards
2. Finish the magnet work, update the screens
3. Finish the cup and viewer work that remains
4. Ion pumps along the elevated beamline plugged into UHV supplies
5. Open the manual valve on elevated beamline, survey the elevated beamline vacuum

With Cave locked UP:

1. Support Tomasz and the 2-cell RF investigation
2. Thread beam to IBC
3. Qsutility at 2, 5 and 9.5 MeV/c
4. BPM study: orbit seems wrong in tune mode
5. Booster deflection, x/y coupling
6. Energy spread, energy jitter (which might be reduced if Tomasz discovers the source of 59 Hz on the 2-cell rf)

Day7 of run1, September 9, 2020

Today was a maintenance day:

1. Kevin and Eric added magnets to elevated line, extended some cables, renamed some magnets, I believe they need to get with Gary Croke to update the UED and screens
2. Keith Welch visited the UITF to check on the shielding deficiencies that were discovered during surveys from yesterday. He recommends we operate with average current less than 25 nA until some “holes” are filled. He will talk with Neil Wilson to coordinate. I have asked him to clarify if we are allowed to begin threading beam through the elevated line, not sure if that’s allowed yet
3. We put lead brick on the M703 dump but then learned Keith would prefer it stay unshielded for future rad surveys. So maybe the brick need to come off
4. Brian Freeman came fixed the adviewer pull down menu, we can now see video from all the viewers!
5. Scott repaired the TMG with bad high voltage output. Next he will get the spare ready for use
6. Kevin moved the lockin amp rack under the beamline so that the Safety System Group can hook up the HDIce-related FSD nodes, which would happen tomorrow
7. HDIce moved LHe from one dewar to another, and other assorted tasks
8. Tomasz delivered some equipment to the Cave1 rooftop to assist trouble shooting the noisy 2-cell cavity with 59 Hz modulation
9. Phil declares the elevated beamline vacuum as “good”, no need to bake the line. All pumps are now attached to UHV supplies with epics readback. When ready, we can open the manual valve that Phil added to simplify beamline modifications

What now:

1. Find out if we can send beam up the elevated line, do that as first priority
2. If we can’t send beam upstairs, spend time measuring emittance at various momenta using qsutility
3. Assist Tomasz and low level rf with 2-cell investigation; eliminate the 59 Hz, which might be the source of energy jitter
4. Brian says he would be happy to provide an epics variable for video info, which we could use to assess jitter and energy spread, but might have to wait till the SAD

Day6 of run1, September 8, 2020

This was a day of radiation surveys, 10uA CW delivered to three destinations – the MeV dumps M601, M703 and Faraday Cup3 downstream of the booster, at two momenta 5.2 and 9,6 MeV/c. By far, these were the most extensive surveys to date, with David and Adam sniffing the exterior in great detail.

Our first attempt to put 10uA CW into FCup3 at 9.6 MeV/c caused us to drop the sweep on excessive radiation detected by the CARMs. David increased the trip setpoint level which allowed us to finish the survey. We dropped the sweep last week too, and this explains why. After the surveys, David restored the trip setpoints to original values

After surveys, Kevin studied RC#2, looking for beam motion using 20 to 50 nA CW beam. It seems the coil detects the presence of beam but there’s a long lag time which makes it difficult to discern cause and effect.

The machine was cooperative today. A few trips during beam delivery to FCup3 but I think this was vacuum related. Max steered up the beam, it did not take long to setup the two momenta.

tomorrow is a maintenance day:

1. magnets on the elevated beamline, cable pulls for the two steering sets near IBC?
2. FSD connects related to HDIce (need to move the lockin rack under the beamline)
3. viewers: focusing, some means to look at the viewers in the M8, M9 and Ma regions
4. If our radiation surveys are complete enough, I'd like to cover the dumps with lead and lock out Faraday Cup3
5. beamline vacuum work? bakeout?
6. TMG electronics swap?

Day5 of run1, September 4, 2020

Not a very productive day. We restored the 9.5 MeV/c beam and sent it to the MeV spectrometer viewer, hoping to see less energy jitter because Frank Humphry had turned OFF and disconnected the turbo pumps that were used to improve insulating vacuum on booster and one of the u-tubes. But the beam jitter was the same as before.

Next we setup 5 MeV/c beam for a radiation survey. This was difficult at first because the 7-cell cavity was not regulating properly. Clyde worked some magic (changing a phase offset?) and the 7-cell started to behave. Max steered up the beam, centering in the quads, beam at this momentum looks very good.

We called RadCon and they came to survey but no one was on-site to unlock the niobium inventory storage gate! So we punted, will try to do this next week if people come to work. Granted it’s Friday before a holiday weekend but still….

Finally, we sent 35 nA beam to the straight ahead dump for Kevin Wei to look for signal from Rowgowski coil#2.

This morning, I reattached the shutter to the TMG, cycled power and all was well, the TMG functionality restored.

The usual magnet mismatches occurred

To do:

* Work with RadCon to measure and re-measure radiation outside the cave once Neil packs the “hole” with concrete.
* Put the magnets on the elevated beamline, work some magic to get them to stay matched
* Put the shielding on the dumps, lock out FCup3
* When we get permission to operate in Tune Mode, do the qsutility studies at waist height
* Find a way to view the video from viewers M8, M9 and MA: these viewers are not accessible on the pull down menu of the adviewer software
* Thread beam to HDIce
* Curt wants to improve the performance of the 2-cell, eliminate the 60 Hz modulation that contaminates the field.

Day4 of run1, September 3, 2020

Beam restored easily at 9.5 MeV/c in support of rf field control measurements. Curt Hovater summary provided below. Tomorrow, Frank Humphry will disconnect the two turbo pumps attached to the booster, valves are closed now but they were used to improve insulating vacuum on the booster and u-tube. Perhaps this will reduce the beam jitter? More tomorrow when we send VL beam to the M7 dump viewer

After the rf measurements, we invited RadCon to sniff for radiation outside the enclosure, with 10uA beam at 9.5 MeV/c delivered to M6 straight-ahead dump, M7 spectrometer dump and Faraday Cup 3 downstream of the booster. Radiation was higher than observed at 7 MeV/c, which I guess is not surprising, but they did find a hole in our shielding on the NW corner of cave2 roof. It was always there, but discovered this time. And when attempting to deliver 10 uA to Faraday Cup3, the sweep dropped on radiation, which I’ve never seen before. Keith Welch asked us to operate only in Viewer Limited mode when RadCon is not present, until additional shielding is added to the cave2 roof area.

During the radiation survey, the TMG quit working, the shutter opening/closing at 1 Hz. I removed the shutter but did not check to see if the other aspects of the TMG were functional.

With cave open, Yan and Eric Diggs looked at the elevated beamline, in preparation for adding the steering magnets up there.

Tomorrow, lock up at 9am and restore beam at 9.5 MeV to dump, look to see if jitter is smaller with turbo pumps removed.

Then set momentum to 5 MeV/c for another Radiation Survey with RadCon

Booster Field Control Measurements

2-Cell Cavity

This cavity sees lots of noise at 60 Hz.

Because of that the field control regulation is not good.

5W amp?? Doesn’t appear on 5 W supply.

There are two pumps near the Booster one for the U tubes and one for the insulation Vacuum

We would like to correlate the dispersive BPM signal to look at how the jitter translates to beam.

EPICS: GLDER: 6.3e-3, PLDER:0.76

Signal is too starved to measure on signal analyzer will need an amp.

This needs more investigation.

7-Cell Cavity

GSET=12.5

Integrated phase noise is 200 mdeg. This meets specification even with a not-so-good master reference.

Amplitude noise: 0.1%, we want it about ½ that.

EPICS: GLDER: 9e-4, PLDER: 0.1

We can get better with gain optimization.

60 Hz is not seen on the seven cell.

Day3 of run1, September 2, 2020

1. Heated and reactivated the photocathode. Everything went fine, the only remaining issue is whether we grew a field emitter on the cathode electrode, via scraping. Tomorrow will tell.
2. HDIce is cooling down the IBC with LHe
3. Kevin and Phil replaced Rowgowski coil #1 with #3. RC1 was missing one quadrant, a connection had fallen off inside the vacuum space. Pumping down this section of beamline now.
4. Scott measured the voltage applied to the Tune Mode Generator inside the laser room, for reference

Day2 of run1, September 1, 2020

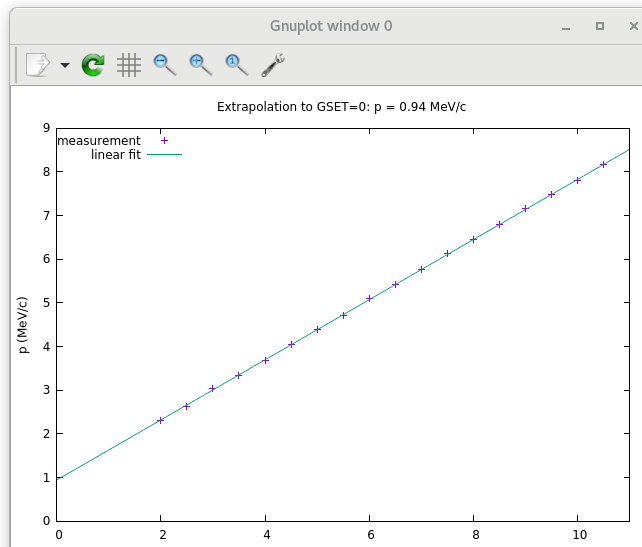
Beam restored this morning relatively easily at 8.4 MeV/c and 7-cell GSet = 11 even though last night, Yan could not operate at this GSet reliably. Don’t know why it was stable today and not last night. The magnets were fine this morning, but later we had to reseat some trim cards. While doing chopper studies, the familiar vertical stripe at the M703 viewer became a round spot, this was because the M5 quads mis-matched.

Max and I revisited the keV beamline and lens centered, and turned ON the solenoids inside the chopper region. We also delivered beam to the MeV spectrometer and inserted the chopper slit, with chopper cavities energized. It’s hard to tell if the chopper slit serves to remove unwanted beam, but it should certainly help us reduce beam current in some manageable way for HDIce. Two things to do:

1. focus the camera better at the chopper viewer, maybe the beam is tight there, like it’s supposed to be?
2. do a more careful phase study, particularly for chopper 2, so we are certain that chopper2 bucks the kick of chopper1.
3. Then with harp working in MeV spectrometer, measure energy spread over some parameter space such as buncher GSet, and chopper slit position, cavity phases

We obtained beam at 9.55 MeV/c, using 2-cell at GSet=3.6 and 7-cell GSet=12.5. These settings are less than max values determined by Mike Drury, so we can operate here safely without fear of damaging the booster. We operated at this setting for more than one hour with only one incident of trip to SEL mode, and this was for the 2-cell cavity. Jonathan mentioned this was coincident with an aggressive VTA maneuver.

Max plotted Yan’s data from yesterday: 7-cell GSet versus Bdl and extrapolated to GSet = 0. The line intercepts the Y-axis at momentum 0.94 MeV/c which is very close the intended momentum for beam leaving the 2-cell (should be 0.91 MeV/c), and providing 559 keV keV. Subtracting the 200 keV from the gun, the 2-cell provides 359 keV kinetic energy, pretty close to 333 keV design.



But as follow up, Yan and Max “simply” turned OFF the 7-cell and delivered beam from 2-cell to the MeV spectrometer dump. With 7-cell OFF and the 2-cell GSet = 3.6, they measured beam momentum 1.08 MeV/c. Using the equations, this corresponds to kinetic energy of 685 keV. Subtracting away the 200 keV from the gun, the 2-cell adds 485 keV to the beam. Obviously that is higher than the 333 keV design boost. We can leave it alone or reduce the 2-cell GSet. opinions? Interestingly, the 2-cell was on crest at -7 degrees, the phase we chose empirically as optimum with both cavities ON, based on obtaining a minimum energy spread. My theory that the 2-cell accelerates AND bunches is incorrect!? Well maybe it accelerates AND bunches, but it does this while “crested”, at least when using energy spread as the metric to minimize.

Whereas Yan’s data from yesterday shows the 7-cell cavity phase must be adjusted to stay crested, as beam momentum varied from 2 MeV/c to 8 MeV/c, which is a very interesting range, from not-fully relativistic to pretty-close to fully relativistic. There’s a different phase that corresponds to the “effective cumulative crest” across all 7 cells when the beam propagates through the booster across this interesting range of momenta.

The tune mode generator worked all day, as evidence by looking at the pickoff Shukui provided. So this is good, we can repeat the BPM study when we have a fresh cathode.

To do:

1. Heat/activate the photocathode, TMG measurements, repair the spare TMG, start cooling IBC, put magnets on elevated beamline, remove RC#1 and repair it, rebake beamline (sigh), etc.,
2. Save setup for 1, 2, 5, 8, 9.5 MeV/c
3. Radiation measurements: 1, 2, 5, 8, 9.5 MeV/c
4. Use qsutility to measure emittance at 1, 2, 5, 8, 9.5 MeV/c
5. Energy spread at same momenta
6. Repeat some of the above with Choppers ON (phase up?)
7. Thread beam to elevated beamline, start run1 measurements (update beam authorizations, operational restrictions)

Day1 of run1, August 31, 2020

Good day today, we restored MeV beam.  Following Mike Drury’s re-commissioning of the booster, the 7-cell GSet is now much more representative of beam energy/momentum that it provides.  At 7-cell GSet of 7, we see 5.8 MeV/c beam in the spectrometer.

2-cell settings are the same as before. 7-cell phase in now very different.

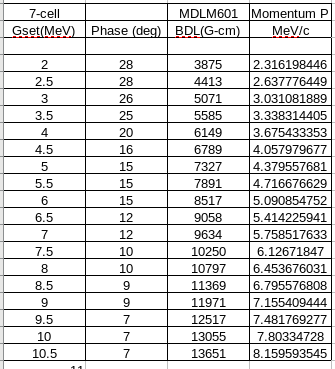
Tune mode generator is working albeit we prefer to be using the 18 VDC from the macropulse chassis.

Harp M703 does not see beam, although we only make 0.5 uA max current now, so it's possible it will work with more beam.  M601 harp does see the 0.5 uA beam, for what it's worth.

This evening, Yan will perform 7-cell GSet vs Bdl calibration, then in the morning Max and I will do the 2-cell GSet vs Bdl calibration, and make adjustment to the 2-cell gradient to have it provide the 333 keV boost set by the design.  And we want to measure 2-cell phase offset relative to crest.

(posted next day)

Yan had a great p.m. run yesterday, he calibrated the 7-cell GSet versus momentum over a wide range, from GSet= 2 to GSet = 10.5. For these measurements the 2-cell GSet and phase were constant at 3.6 and -10 degrees, respectively. It’s interesting that the 7-cell phase needed to be adjusted to crest the cavity. At the higher momenta, the 7 cell phase was becoming “constant”.



To do:

Heat and reactivate the photocathode

Magnets put on elevated beamline

Cool the IBC

RF field quality measurements (Rama and Curt)

Magnet issues

UED

screens

Long term, what to fix at UITF:

* Fix the gun alignment, vacuum chamber not at 15 degree
* Fix the gun, FE at 200 kV, lifetime very poor
* Add a load lock to the prep chamber, I have the sample manipulator and cross
* VIPk301 ion pump not energized, just spewing CH4 into beamline
* Laser power drift
* Laser power too low for superlattice photocathodes
* Move the laser under the table inside the enclosure? That’s what I would do, eliminate the fiber
* Install an insertable halfwave plate to provide polarization sign flip
* Align the beamline!
* To center in solenoid MFQk203, beam is far to right at ITVk203, and far to left downstream of chopper
* Mu-metal
* Always put viewers at beam waists, and BPMs at beam envelope maxima. Did not follow this advice with viewers, hence viewers are not helpful setting solenoids strengths
* Replace manual valve VMVM401 with fast valve
* Remove RC#2
* Move Faraday Cup 3 to downstream viewer cross? Not adjacent to control room is the point here, where radiation levels are problematic
* More concrete shielding!
* Consolidate the locations of steering magnets? Put them where they need to be
* Update the Operational Restrictions page to reflect RadCon shielding assessment
* I am uncomfortable with the amount of lead stacked on the keV dump structure
* What was the point of putting BPMs on the elevated beamline? Did we think they would see 1nA beam? I guess we just thought tune mode up there….
* Need a beam loss accounting system; MPS BCM cavity
* Need to learn how to use qsutility and set quads
* Harp at M703 doesn’t seem to work
* Need a supply of big and large haimsons on the shelf
* More UHV supplies, another set of them
* BPMs, would be great if they worked (presently we see “beam” when there’s no beam, and the TM vs CW orbits are different)
* Polarity of magnets not all correct
* For regions that get vented frequently, there should be flange mounted NEG pump
* Wouldn’t it be easier to use a 200 W solid state amp to drive the 2-cell? Forward power today is only 40 W, the 2-cell is not meant to be driven hard.