**Running to the 1G Dump Goals and Procedures**

Stephen Benson, March 29, 2019

**Injector setup goals:** As a pre-cursor to the isotope exposure operation we would like to run the beam to the 1G dump in order to:

1. Test out the hardware and verify that it is working.
2. Train operators and injector staff in LERF injector setup procedures as well as bringing the procedures up-to-date.
3. Verify the behavior of the FL02 module with beam.

**Prerequisites:** This setup assumes that Hot Check-out procedures have been carried out for all the subsystems in the injector and 1F region and that everything is functional.

Once all systems have been signed off and beam approval has been granted by Arne Freyberger, one shift of operations and one contingent shift must be scheduled.

The 0G dump switch on the last GV magnet must be switched to allow beam to go through the 1F02 module.

**Required staff:**

1. The MCC must have a Crew Chief and an SSO on duty during these procedures.
2. At least one LERF operator should be present in the control room carrying out the detailed procedures.
3. At least one injector staff member should be present during these procedures.
4. At least on LSOC (LERF Scientist On Call) should be present or available during these procedures.

**Procedures:**

1. Carry out the “LERF Cold Startup Procedure” sections 1-7, 9-11  
   <http://opsntsrv.acc.jlab.org/ops_docs/online_document_files/LERF_online_files/LERF_Cold_Startup_Procedure.pdf> with the following details:
   1. Use the last allsave from March 22nd.
   2. Only turn on the MFELINJ and MFELEXT power supplies. All other bulk supplies can stay off.
   3. Only open valves in the 0F and 1F region (VBV0F01, VBV0F02, VBV0F02A, VBV0F06, VBV1F02, VBV1F02a, VBV1F03, VBV1F05, and VBV1F05a)
   4. Verify that the Machine Mode is 3 (1G dump) isotope
2. Thread the beam to the 1G dump.
   1. Set the 1F02 module gradients to 5 MV/m on cavities 7 and 8 and turn off the other cavities.
   2. Set the FELEXT magnet to maximum current (50 A). This is approximately
   3. Start with a laser attenuator setting of 5%. Open the laser shutter.
   4. Verify that the signal is about 10 mV on the buncher GASK and that the signal increases when the drive laser phase increases.
   5. Use the laser/buncher gang phase to get a spot size similar to the DarkLight run on the 0F04 viewer.
   6. See if the beam can be found on ITV0F06. Adjust the cavity 3 phase to get the beam approximately -10 degrees off crest.
   7. See if the beam is present on the BPMs before the injection chicane (IPM0F03 and IPM0F05) Dither the laser/buncher phase +/- 10 degrees and see if the beam moves on those BPMS. Use the MSX0F02 correctors to “center” in the unit. This can be done on the 0F04 viewer as well.
   8. See if there is a signal on the 0F cavity current monitor. Use the drive laser attenuator to set the current to 624 mV of voltage with the micro-pulse repetition rate set to 4.678 MHz (this is 60 pC).
   9. Find the beam on the 1F02 viewer. Center the beam on the viewer using the 0F06a correctors.
   10. Use the GASK signal for cavities 7 and 8 to phase the FL02 module.
   11. Try to find the beam on the BPMs downstream of the FL02 module. Use the 1F02 correctors to center the beam at 1F03.
   12. Use the 1F03 correctors to center the beam in the downstream BPMs.
   13. Find the beam on the 1G02 viewer. You might have to reduce the FELEXT current to see the beam. Once the beam is found, maximize the energy using the cavity 7 and 8 phases. Adjust the FELEXT current to keep the beam centered at 1G02.
   14. All-save the machine setup. This is the “threaded to the 1G dump” setup for 60 pC beam.
3. Verify FL02 cavity gradients and diagnostic operation.
   1. Turn off cavity 7. Turn on each cavity to 5 MV/m and maximize the energy using the cavity phase. Verify that the energy is about the same as with cavity 7.
   2. Turn cavity 7 back on and turn off all the downstream cavities.
   3. Verify that the beam can be seen on all the viewers in the 1F region.
   4. Verify that the beam can be seen on all the 1F BPMs.
4. Center in the beamline elements
   1. Carry out the procedures spelled out in ATLis numbers 15549 and 15551. These procedures center the beam in the buncher and second solenoid.
   2. Use MSX0F02 to “center” in the cryounit again by dithering the laser/buncher gang phase and looking for movement in IPM0F03 and IPM0F05.
   3. Use the 0F03 and 0F05 correctors to center in MQJ0F05 and MQJ0F06.
   4. Run the injector phasing script to get the proper injector cavity phases.
   5. Check to make sure that the current cavity voltage is still 624 mV.
   6. Record spot sizes on ITV0F04 and ITV0F06. The repetition rate must be lowered to 1 MHz for ITV0F04.
5. Characterize the beam at low charge.
   1. Lower the laser attenuator value until the current at the 0G dump and the current cavity is 28 µA. Vary the buncher gradient until the horizontal spot size is minimized at ITV0F06. Log this buncher gradient value. Record the beam spots at ITV0F04 and ITV0F06.
   2. Lower the laser attenuator value until the current at the 1g dump and the current cavity is 5 uA. Record the ITV0F04 and ITV0F06 beam images.
   3. All-save this configuration. This is the isotope exposure injector setup.