**Injector setup Goals and Procedures**

Stephen Benson, March 13, 2019

**Injector setup goals:** As a pre-cursor to the isotope exposure operation we would like to run the beam to the 0G 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. Explore the behavior of the injector when running at a charge of 1-6 pC.

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

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

**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 Allsave #4327 (9/1/16 carlino)
	2. Only verify the injector (0F) parameters when restoring the BURT file.
	3. Only turn on the MFELINJ power supply. All other bulk supplies can stay off.
	4. Only open valves in the 0F region (VBV0F01, VBV0F02, VBV0F02A, VBV0F06, and VBV0G00)
	5. Verify that the 0G dump current is on TekScope B with the yellow trace.
	6. Verify that the Machine Mode is 1 (0G dump)
2. Thread the beam to the 0G dump.
	1. When the shutter is opened try to see if beam can be seen on the buncher GASK on Tekscope 3. If a signal is seen, set the laser phase to zero this signal with the signal moving positive for a positive change in the laser phase.
	2. If a GASK signal can be seen on booster cavity 4, adjust the drive laser/buncher phase to maximize the GASK signal.
	3. Use the cavity 3 phase to maximize the cavity 3 GASK signal.
	4. See if the beam can be found on ITV0F04.
	5. 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.
	6. Using the cavity 3 phase, try to find the beam on the 0F06 viewer and BPMs. Roughly phase cavity 3 and set to -10 degrees (in EPICs) off crest (the beam should bet larger as the phase goes from crest to -10 degrees).
	7. See if there is a signal on the 0G dump current monitor. Use the drive laser attenuator to set the current to 280 µA of beam current with the micro-pulse repetition rate set to 4.678 MHz (this is 60 pC). Record the current cavity voltage and create a LERF log with this value.
	8. Set the bunch size on ITV0F04 using the laser/buncher gang phase with 1.17 MHz beam to the value in the last mini-phase procedure.
	9. Set the position to zero on IPM0F06A using the cavity 3 phase.
	10. All-save the injector setup. This is the “threaded to the 0G dump” setup for 60 pC beam. Record the spots on ITV0F04 and ITV0F06.
3. 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. Reset the laser/buncher gang phase and cavity 3 phase to recover the last mini-phase spots.
4. 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 0g 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.