

# **Operation Procedure for LERG Gun cathode re-cesiation (AKA quantum efficiency rejuvenation)**

## **Initial Conditions:**

Gun valve closed, VBV0F01

Cathode position; inserted (for running beam)

Light box scanner window covered with foil

Greenie laser scanning (on foil above)

All 3 rods for the cesiator (rear right side SF<sub>6</sub> Tank) fully retracted (out position)

HVPS contactor in the ON position

## **DANGER**

**The gun high voltage power supply produces potentially lethal voltages and currents. Insure that the power supply disconnect is locked out using the approved LOTO procedure prior to moving any of the cesiator rods.**

## **Procedure:**

1. Turn off HVPS and lock out contactor per procedure, and apply a personal LOTO lock for each person who may be touching the gun hardware.
2. Insert the gun tank ground rod, this is the right most of the 3 rods. In all cases the Swage fitting should be loosened by hand before inserting/retracting then re-tightened. Be sure that there is a shorted BNC connector on the end of this rod as well as a ground strap. This rod has a blunt end and need only touch inner electrodes. Remove the shorting BNC plug and connect the "SCAN" cable.
3. Vacuum reported by VIP0F01 must approximately  $5 \times 10^{-11}$ .
4. Open the Gun Valve, VBV0F01.
5. Remove the Foil from the lightbox viewport and do a QE Scan per the procedure described at the end of this document, making a LERFLOG entry with the QE map before continuing with the Recesiation.
6. Remove the "SCAN" cable, reconnect the shorting BNC plug, and insert the remaining two rods.
7. Connect the "Motor Drive" Cable which is a BNC connection from the drive box. Switch the drive box direction to the "Out" position and turn the box "ON". Note the time because it will take ~10 mins for the move to complete.
8. While the motor is moving connect the two banana plugs (red and black) from the DC power supply mounted in the injector pit rack to the Cesium channels rod.
9. Connect the charge collector cable to the BNC connector just below the red/black banana jacks of the same center rod and to the Aluminum mini-box next to chart recorder (labeled GUN).
10. Make sure the power supply is set to 0V and turn on. Ramp up the voltage until the current reads 3 amps for warming up the cesium channels.

11. Remove scanner turning mirror by loosening thumb screw on back side being VERY careful not to bump mirror. Set this assembly aside.
12. Turn on White light source to position 3 and align the output light to scanner window port on light box. This is the source for photo-emission during cesiation. Place the light so that it is slightly clipping on the edge for maximizing the photocurrent.
13. Turn on Keithly electrometer
  - a. Click "Amps"
  - b. Click "Zero Check" to OFF
  - c. Click range up to read 0.00X microamps
14. Set "Battery Box" to position 3, Keithly should read 0.5 to 1 microamp
15. Set chart recorder to: (also turn black pen around and engage with paper)
  - a. 2"/min, Divide by 10
  - b. 1 Volt full scale
  - c. Chart ON
16. While watching the Keithly and chart recorder, raise the CCPS current to 5 amps. The current will raise then begin to fall. SHUT OFF the CCPS when the drop is 20% of the maximum. Do this twice but the second time only 10%.
17. The Keithly and chart recorder will dip further down then increase and roll over to a stable reading. Once this happens the Cesium is complete.
18. Connect the "Motor Drive" Cable which is a BNC connection from the drive box. Switch the drive box direction to the "IN" position and turn the box "ON". Note the time because it will take ~10 mins for the move to complete.
19. Turn off "Battery Box", Keithly, and chart recorder (also cap and flip recorder pen)
20. Unplug charge collection cable & CCPS banana plugs from center tank rod and retract rod (loosen & tighten Swage fitting).
21. Turn OFF white light source and remove from viewport.
22. Restore scanner turning mirror, while replacing it is fitted to the upper Aluminum plate for alignment. Tighten thumb screw.
23. Once the cathode is fully in (motor drive will stop when the cathode reaches the limit switch), disconnect that cable and shut off the drive box. Retract the motor rod fully and tighten the fitting.
24. Perform a QE scan as described above and make a LERFLOG entry with the QE map.
25. Once QE scan is complete. Put the Foil back over the view port. Unplug scan cable. Ensure all three rods are completely retracted and reconnect the shorting BNC plug. Remove personal lock from HVPS and turn the disconnect back on. Close the Gun Valve.
26. The procedure is complete.

### **Cathode QE Scan Procedure:**

1. If it is not already locked out. Turn off HVPS and lock out contactor per procedure, and apply a personal LOTO lock for each person who may be touching the gun hardware.

2. If it is not already in place, insert the gun tank ground rod (right hand rod) and insure that it is fully inserted and touching the gun high voltage conductor. The swage fitting should be loosened by hand before inserting/retracting the rod then re-tightened.
3. Connect scanner current cable to the tank ground rod. The other end of BNC cable connects to the scanner chassis. (left side of chassis power plug)
4. Insure that the 96V bias switch located on the front panel of the scanner chassis is in the ON position.
5. If the foil is in place over the optical port located just down-stream of the gun on the south side of the beamline remove it and set it aside.
6. Verify that the gun valve (VBV0F01) is open. If not go to the Vacuum Controls Screen, and using EPICS open the valve.
7. Using EPICS bring up "Cathode Scan" under the "High Voltage" menu, press the green "GO" button. Once this is complete (progress bar beneath button), press "Raster Plot" button and then "Cathode Raster Plot" this will display cathode raster plot. Record this and the max Qe in an FLOG.
8. Remove Grounding rod connection and restore shorting BNC. Retract the rod to the out position.
9. Cover light box Greenie port with foil.
10. If you are not preparing to bring the machine up right away, close the gun valve (VBV0F01) using EPICS
11. Unlock HVPS contactor and return it to the ON position.

**DO NOT FORGET:**

- 1. Cover Greenie scanner port**
- 2. Retract all 3 rods from HVPS tank**
- 3. Place the Shorting BNC plug on the shorting rod**
- 4. Unlock and turn ON HVPS contactor**
- 5. Close the gun valve.**