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C-A OPERATIONS PROCEDURES MANUAL

8.1.6 Cavity RF Systems Turn On

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Hand Processed Changes

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Approved: _____ ***Signature on File*** _____
Collider-Accelerator Department Chairman Date

V. LoDestro

8.1.6 Cavity RF Systems Turn On

1. Purpose

To provide instructions for Linac staff on how to turn on the Linac accelerating cavity RF systems.

2. Responsibilities

Trained Linac staff can turn on the cavity RF systems.

3. Prerequisites

- 3.1 All personnel involved in working on any electrical system or equipment in the C-A shall be familiar with BNL ES&H Standards 1.5.0, 1.5.1 and 1.5.2. C-A will provide on-site/work specific training to individuals in the electrical safety aspects of their job functions and assignments.
- 3.2 The accelerating cavities must be under good vacuum ($< 2 \times 10^{-6}$ Torr).
- 3.3 The Linac tunnel must either be secured for beam or cleared for RF before RF Systems can be turned on.
- 3.4 The Linac Operations Coordinator shall be consulted prior to turn on, and shall be informed of any problems during turn on which could lead to significant delays.
- 3.5 Qualified and trained Linac staff.

4. Precautions

The crowbar systems for the 7835, primary and redundant, and the 4616 shall be tested during the yearly maintenance, as well as after a crowbar system repair has been made. An entry in the log book by each crowbar test point will indicate the date of the last test. Do not turn on the RF system unless the crowbars for that system have been tested within the previous 12 months.

5. Procedure

- 5.1 Check that all 480 VAC power plugs are in each cabinet. Check that all cabinet doors are closed and locked (Kirk key system).
- 5.2 Turn on the main 480 VAC disconnect switches:
 - FDS MOD 1-3, located between Mod 2 CCA and Mod 3 driver.
 - FDS MOD 4-6, located between Mod 6 CCA and Mod 7 driver
 - FDS MOD 7-9, located after Mod 9 CCA.

- 5.3 Turn on the main 208 VAC disconnect switch. (Located at each Local Control Station (LCS) in the breaker box in the leftmost rack).
- 5.4 Turn on all plug-in breakers on the wall:
- Driver
 - Power Ampere.
 - Modulator
 - Cap Bank
- 5.5 Turn on the 480 VAC cabinet breakers. All cabinet blowers must come on.
- 5.6 Check to see that the low level drive RF system is on and pulsing. This system is located in the rightmost rack in Mod 1 LCS (rack A11). The "Master Oscillator", and solid state amplifiers should be on. One should measure a 1.4 V pulse on the "Low Level Drive" output in the RF Monitor panel.
- 5.7 Clear any "Local Lock" on the Master Filament turn on chassis or PanelView screen located in ICR Rack 6. If there is a "Remote Lock", this must be cleared from the Linac Control Room, Rack F6.
- 5.8 At the 4616 Driver cabinet:
- 5.8.1 If there is no malfunction indicated on the filament turn on switch, clear the local lock and turn on the 4616 filament.
- 5.8.1.1 For PLC Controls, at the LCS, if there is no malfunction indicated on the Panel View Screen, Driver Page, turn on the filaments by pressing F2. The 4616 and 7651 filaments will come on. After a two min. time delay the HV filament interlock will clear and the Driver HV will be able to be turned on.
- 5.8.2 Check that 6-6.3 VAC is showing on the 7651 filament meter.
- 5.8.3 Check that 120 V is showing on the 7651 grid bias meter.
- 5.8.4 The 4616 filament current should be rising to 470 A. Within 2 minutes, the red "ON" light in the Driver AC Logic bucket must come on or the Red On indicator will display on the PanelView.
- 5.9 At the Power Amplifier Filament cabinet:
- 5.9.1 Check that the filament "Auto/Manual" switch is in Auto.
- 5.9.1.1 For PLC Controls, at the LCS, if there is no malfunction indicated on the Panel View Screen 7835 Filament page, turn on the filaments by pressing F3.
- 5.9.2 If there is no malfunction indicated on the filament turn on switch, clear the local lock and turn on the 7835 filament.
- 5.9.3 The voltage and current should begin rising smoothly. Within 5 minutes, the voltage should stop at 4.8 V and the current should stop at 6,900 A. The "on" light must come on, or the Red On Indicator will display on the

PanelView.

5.10 At the Modulator cabinet:

5.10.1 If there is no malfunction indicated on the filament turn on switch, clear the local lock and turn on the modulator filaments.

5.10.2 Push the reset button on the modulator SCR control bucket.

5.10.3 From the SCR control bucket, check that the grid deck voltage is rising to 110 VAC, the LPT filament current should rise to 190 A, and the 8618 filament current should rise to 310 A.

Within 3-5 minutes, the "on" light must come on the Modulator AC Logic bucket.

5.10.4 For PLC Controls, at the LCS, if there is no malfunction indicated on the Panel View Screen, Modulator page, turn on the filaments by pressing F2.

5.10.4.1 To monitor the turn up of the SCR controllers, press F8.

Displayed will be 8618 and LPT-32 currents and voltages. Also you can change the filament and grid deck reference set points from this page. After a two min. time delay, the F2 Modulator on indicator will display red.

5.11 At the Capacitor Bank, check that the Mechanical Grounding Switch is in the LIVE position and no malfunctions are indicated.

5.11.1 For PLC Controls, at the LCS, check that if there are no malfunctions indicated on the Panel View Screen, Cap Bank page.

5.12 The 4616 HV turn on switch is located in the Driver HV Logic bucket. If a malfunction is indicated on this switch, then check the system indicated by the corresponding individual malfunction light. When there is no malfunction, clear the Local Lock and turn on the supplies. If there is a Remote Lock, this must be cleared from the LCR. Once the Driver HV is turned on, check the following:

- the 7651 Screen Grid comes to 600 V
- the 7651 Anode comes to 4.5 kV
- the 4616 Bias comes to 2 kV
- the 4616 Anode comes to about 17 kV

5.12.1 For PLC Controls at the LCS Panel View Screen, Driver page, press F3, ON. If the filament turn-on has been satisfied, the HV will display RED. The set point is controlled from the 4616 Anode Power Supply Regulator located in the Driver Equipment Cabinet, just above the Crowbar Bucket. Once the HV is on, check the tube voltages as per 5.12.

- 5.13 In the General Purpose Pulse Delay bucket at the LCS, the "RF Malf - Amplitude" light shall be blinking. (This is checked to show that the malfunction is working).
- 5.14 Check to see that the Tank 1 and Tank 9 gates are closed, and the tunnel is either cleared for RF or secured for beam.
- 5.15 If no malfunction is indicated on the pulsing turn on switch (in the Pulsing Turn on bucket), then clear the Local Lock and turn on pulsing. If there is a Remote Lock, it must be cleared from the LCR. (If the Linac tunnel not secured or cleared for RF, that will also generate a Remote Lock on the pulsing turn on switch). Once pulsing is turned on, the red "on" light will come on, and the 4616 will be running. At this point, the following signals shall be checked:
- the 4616 input forward power should be 3 V ("4616 input F" on the Signal Monitor Panel)
 - the 4616 input reverse power should be < 0.5 V ("4616 input R" on the Signal Monitor Panel)
 - the Driver Fwd Pwr (on Pulsing Logic bucket) shall be 7 V min.
 - the Driver Rev Pwr (on Pulsing Logic bucket) shall be < 0.5 V.
 - the 4616 screen voltage ("Screen Mod Vol" in Pulsing Turn on bucket) should be 9 V.

If any of the above signals are not proper, the 4616 should be tuned.

- 5.16 Check to see that all the RF spread sheet phase & amplitude references are set to their last saved values.
- 5.17 50 KV Power Supply control is PLC at each Local Control Station, LCS.
- 5.17.1 Located at the LCS is an Allen Bradley Redi Panel, push the buttons labeled Local and Zero KV.
- 5.17.2 On the LCS Panel View Screen, push F2, STANDBY. If all malfunctions and interlocks are satisfied, the 50 KV PS will go into STANDBY Mode (after a slight delay to allow for all cooling fans to come up to speed).
- 5.17.3 Press F3, HV ON, which will lift the Cap Bank and Modulator electronic HV shorting switches. The HV Command will now seal ON.
- 5.18 With the power amp forward and reverse powers displayed on a scope, slowly raise the 50 kV voltage in 1 kV steps from the LCS RediPanel. The cap bank voltage should start to rise, and the fwd. and rev. power waveforms should appear on the scope. Continue raising the HV until you reach 30 kV, 15 kV for Mods 1 & 2. If at any point the reverse power starts to break up, lower the HV until the sparking stops. (Check the 7835 and feedloop matches, and tune as necessary). Then continue trying to bring the HV up to 30 kV.

5.19 If all the malfunction lights go out, the RF system is ready to run. If a malfunction light remains on, check the following LCS monitors:

- The tank probe should be 0.2 V peak in amplitude, at the correct Gradient Detector Bias (slideback).
- The fast phase loop should be nulled.
- The Ref. tank phase loop should be nulled.
- "Driver Rev Pwr" in the Pulsing Logic bucket should be < 1V.
- Power Ampere Rev Pwr should be < 1V.
- Low energy loop rev pwr should be < 0.5 V.
- High energy loop rev pwr should be < 0.5 V.

5.20 If the RF system cannot be brought up to correct power levels, consult with the Linac Operations Coordinator concerning the possible need for tube replacement.

5.21 When all rf systems have been brought on, inform the Linac Operations Coordinator.

6. Documentation

None

7. References

None

8. Attachments

None