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C-A OPERATIONS PROCEDURES MANUAL

8.5.2 Operation of the RHIC 197 MHZ RF System

Text Pages 2 through 8

Attachment

Hand Processed Changes

<u>HPC No.</u>	<u>Date</u>	<u>Page Nos.</u>	<u>Initials</u>
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Collider-Accelerator Department Chairman Date

A. Zaltsman

8.5.2 Operation of the RHIC 197 MHz RF System

1. Purpose and Scope

To detail the proper operation of the 197 MHz RF system and to protect personnel and equipment during operation of the 197 MHz RF systems.

2. Responsibilities

- 2.1 RF Group personnel are responsible for compliance.
- 2.2 Line supervisors are responsible for determining when Lockout/Tagout procedures shall be used.
- 2.3 The supervisors shall verify that RF personnel using this procedure are currently qualified.
- 2.4 The Safety System Group is responsible for interlock testing and documentation. The Safety System Group is responsible for all RHIC Personal Access Security System (PASS) critical devices and related circuitry. See Attachment 4.

3. Prerequisites

- 3.1 All personnel working on any electrical system or equipment in the C-AD shall be familiar with BNL [SBMS Electrical Safety](#), BNL [SBMS Lockout/Tagout \(LO/TO\)](#), [C-A-OPM 1.5, "Electrical Safety Implementation Plan"](#), [C-A-OPM 1.5.3 "Procedure to Open or Close Breakers and Switches and Connecting/Disconnecting Plugs"](#), [C-A-OPM 2.36, "Lockout/Tagout for Control of Hazardous Energy"](#). C-AD will provide on-site/work specific training to individuals in the electrical safety aspects of their job functions and assignments.
- 3.2 Training
 - 3.2.1 Lockout/Tagout (OSH-151B) for those individuals requiring access inside either the Anode Power Supply or power amplifier.
 - 3.2.2 Electrical Safety 1 (OSH-150B)
 - 3.2.3 Radiation Worker 1 (RWT-002).
 - 3.2.4 Radiation Safety Lockout/Tagout (RS-LOTO), as applicable.
 - 3.2.5 RS-LOTO Tag and Record Book
- 3.3 BNL Hold Tag and Tag Record Book

- 3.4 Film Badge (TLD).
- 3.5 The RHIC RF cavities are intense sources of x-rays when energized. The PASS is used to disable RF power supplies for tunnel access.

4. Precautions

- 4.1 All personnel shall ensure their own safety by following the standards, safety rules, and the training they receive. In general, all energy sources must be locked out and tagged. Working on or near energized sources is not permitted unless a valid Energized Electrical Work (EEW) permit has been issued. Personnel shall utilize tools, instruments, equipment (e.g., proper connectors and proper ac line cords), etc., that are safe and proper for the job. If any part of a job appears unsafe to any individual it is their duty to discontinue work and inform the supervisor, manager, ESH Coordinator or the C-A ESSHQ Division Head, of the unsafe condition.
- 4.2 Operation of the 197 MHz storage system requires the PASS Interlock System to be operational.
- 4.3 Testing which requires energizing of the high voltage Anode Power Supplies without the PASS RF-enable in place will require (RS-LOTO). In this case the H.V. cable (RG-219) must be disconnected from the Anode Power Supply and R.S. Loto Tag placed on its end.

5. Procedure

5.1 PASS Operations for RF System

- 5.1.1 Before starting amplifier or cavity operations which require the Anode Power Supply to be energized, the PASS must be in mode 24 (“No Access”).

5.2 Amplifier and Cavity Operations

- 5.2.1 First select “AUTO” or “MANUAL” control for the system from PLC control panel (see Figure 1).

- 5.2.2 if “AUTO”

- 5.2.2.1 Turn on filaments by pressing “STBY”.

- 5.2.2.2 Wait for “HV READY/RESET” to light (approx. 6 minutes).

- 5.2.2.3 Turn on system by pressing “ON”. This will turn on the ANODE (UVC), then the SCREEN (GLASSMAN), and then turn on the DRIVER (QEI).

5.2.2.4 Turn ON RF drive.

5.2.3 If “MANUAL”

5.2.3.1 Turn on filaments by pressing “AUX ON”.

5.2.3.2 Wait for “HV READY/RESET” to light (approx. 6 minutes).

5.2.3.3 Turn on UVC Power Supply by pressing “ANODE ON”.

5.2.3.4 Turn on GLASSMAN Power Supply by pressing “SCREEN ON”.

5.2.3.5 Turn on the QEI Power Supply by pressing “DRIVER ON”.

5.2.3.6 Turn on RF drive.

5.3 System Shutdown

5.3.1 Turn off RF drive.

5.3.2 Method 1 Manual Shutdown

5.3.2.1 Turn off the Driver Amplifier with “DRIVER OFF” button.

5.3.2.2 Turn off the Screen Power Supply with “SCREEN OFF” button.

5.3.2.3 Turn off the Anode Power supply with “ANODE OFF” button.

5.3.2.4 If desired, turn off filaments with “AUX OFF”.

5.3.3 Method 2 using “STBY” and “OFF”.

5.3.3.1 Press “STBY” to turn off the High Voltage Power Supplies. This will leave the filaments on.

5.3.3.2 If desired, press “OFF” to turn off the filament power.

WARNING 1

In the event of a “radiation hazard enable” warning while tunnel access is permitted, the tunnel will be evacuated immediately and the Anode Power Supply(s) disconnect switch(s) shut off and locked out by MCR personnel until the Security Group clears the problem and PASS is retested.

If the MCR is not staffed then RF group personnel shall assume the LOTO responsibility, log the failure in the trouble log and notify the safety systems group at the next available staffed shift. In the event that the RF control room is to be left unattended then a crash cord will be actuated in the tunnel and the tunnel exited. This will cause PASS to be in Safe Mode and require a controlled access operation to permit a mode change. The controlled access and reset keys will then be pulled from the local PASS control panel and RS-LOTO'ed in a lock box.

WARNING 2

Testing and troubleshooting which requires the removal of the Power Amplifier covers or the opening of the 10kV Anode Power Supply doors shall be carried out under Lockout/Tagout procedures.

5.4 Lockout/Tagout

Lockout/Tagout procedure should be performed by trained and authorized RF group personnel.

There are two independent procedures: one, which applies when accessing the Anode Power Supply Cabinet, and the second when accessing Power Amplifier Unit (located in the RHIC tunnel at 4 o'clock area).

Before accessing Anode Power Supply, the system must be down to at most filament power (step(s) 5.3.2.4 and/or 5.3.3.2 are not required).

Before accessing the Power Amplifier, the system must be OFF (step(s) 5.3.2.4 and/or 5.3.3.2 must be executed).

5.4.1 Access of the Anode Power Supply Cabinet

- 5.4.1.1 Check for the presence of the 480VAC line voltages (L1-L2; L2-L3; L3-L1) in the Anode Power Supply Cabinet using Line Voltage Meter and the Line Switch (located at the front door of each Anode Power Supply Cabinet - see Fig. 2).
- 5.4.1.2 Turn off and Lockout/Tagout Anode Power Supply Disconnect Switch which is located at the wall in the Power Supply Building next to the particular Anode Power Supply Cabinet (see Fig. 2).
- 5.4.1.3 Check for the absence of the 480VAC line voltages in the Anode Power Supply Cabinet - all voltage reading (L1-L2; L2-L3; L3-L1) should be zero.
- 5.4.1.4 Verify 110 VAC at the test points on the Control Voltage/Grid Supply switch. Turn off and Lockout/Tagout the Control Voltage/Grid Supply Switch-located in the rear of the Power Supply Rack just above 120VAC strip (see Fig. 4). Verify the absence of 110VAC at the test points. Access to the switch requires opening the back door of the Power Supply Rack.
- 5.4.1.5 With GLASSMAN Power Supply “on,” verify front panel light is “on”. Verify the line cord for the GLASSMAN power supply by tracing end to end. Disconnect plug from 208V receptacle, place lock box around it and lock and tag out. With GLASSMAN Power Supply front panel switch still “on”, verify front panel power light is “off”.
- 5.4.1.6 Open the Anode Power Supply access door and ground the inner shield and inner conductor of the RG219 anode supply cable. Then, place the Ground Stick at the positive terminal of the High Voltage capacitor (located at the floor at the right side of the Anode Power Supply Cabinet (see Fig. 5).
- 5.4.1.7 To remove LOTO, replace grounding sticks to their micro-switch interlocked positions, close and lock Anode Power Supply doors. Supplies may then be unlocked and turned on in any order.

WARNING:

The Anode Power Supply cabinet has multiple power sources:

480 VAC; 110 VAC Control Voltage; Screen Power Supply Voltage; Grid Supply Voltage

5.4.2 Access of the Power Amplifier Cabinet

5.4.2.1 Turn off and Lockout/Tagout Anode Power Supply disconnect switch associated with the Anode Power Supply, as per section 5.4.1.1, 5.4.1.2 and 5.4.1.3.

5.4.2.2 Turn off and Lockout/Tagout the Filament Disconnect Switch-located in the Power Supply Rack. Verify LOTO by opening filament breaker box and using a category 3 or 4 (as appropriate) rated voltage meter, verifying meter by testing AC input test points at top of switch and absence of 480V AC on fuses. Power Supply Rack stands next to the particular Anode Power Supply Cabinet. Switch is located in the rear of the cabinet (see Fig. 3). Access to the switch requires opening the back door of the Power Supply Rack.

5.4.2.3 Turn off and Lockout/Tagout the Control Voltage/Grid Supply Switch-located in the rear of the Power Supply Rack just above 120VAC strip (see Fig. 4). Access to the switch requires opening the back door of the Power Supply Rack. Verify LOTO by measuring voltage on test points on switch box 110V AC, using a category 3 or 4 (as appropriate) rated voltage meter before and after LOTO.

5.4.2.4 With GLASSMAN Power Supply “on,” verify front panel light is “on” Verify the line cord for the GLASSMAN power supply by tracing end to end. Disconnect plug from 208V receptacle, place lock box around it and lock and tag out. With GLASSMAN Power Supply front panel switch still in the “on” position, verify power “off”.

5.4.2.5 To remove LOTO, verify power amplifier is in place and all cables properly connected. Ensure Anode Power Supply doors are locked. Remove locks. Power supplies may be energized in any order.

6. Documentation

- 6.1 Cognizant engineer/physicist/technician shall maintain a development logbook.
- 6.2 Tag Record Book
- 6.3 RS-LOTO Record Book

7. References

- 7.1 [C-A-OPM 1.5, “Electrical Safety Implementation Plan”](#).
- 7.2 [C-A-OPM 1.5.3 “Procedure to Open or Close Breakers and Switches and Connecting/Disconnecting Plugs”](#).
- 7.3 [C-A-OPM 2.36, “Lockout/Tagout for Control of Hazardous Energy”](#).
- 7.4 [SBMS Electrical Safety](#).
- 7.5 [SBMS Lockout/Tagout \(LOTO\)](#).

8. Attachments

- 1. Figure 1 - RF Control Rack Redi Panel
Figure 2 - Anode Power Supply Cabinet
- 2. Figure 3 - Filament Disconnect Switch
Figure 4 - Control Voltage Switch
- 3. Figure 5 - Positive Terminal of the High Voltage Capacitor
- 4. RF Critical Device List

Attachment 1

Redi Panel



Figure 1

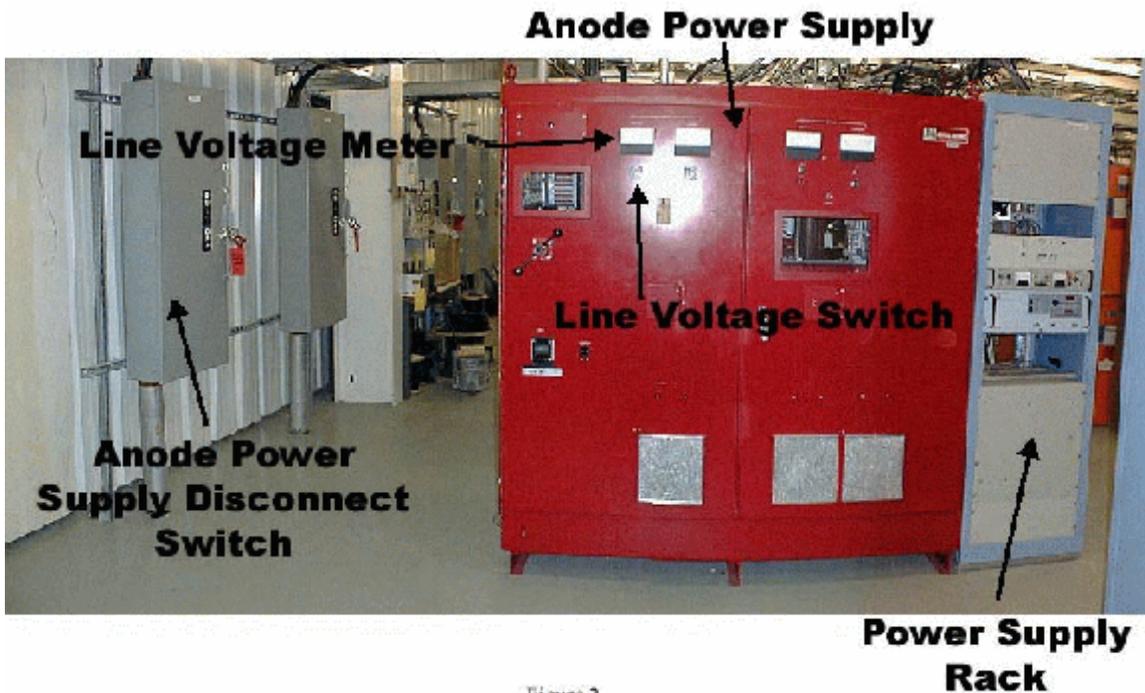


Figure 2

Attachment 2

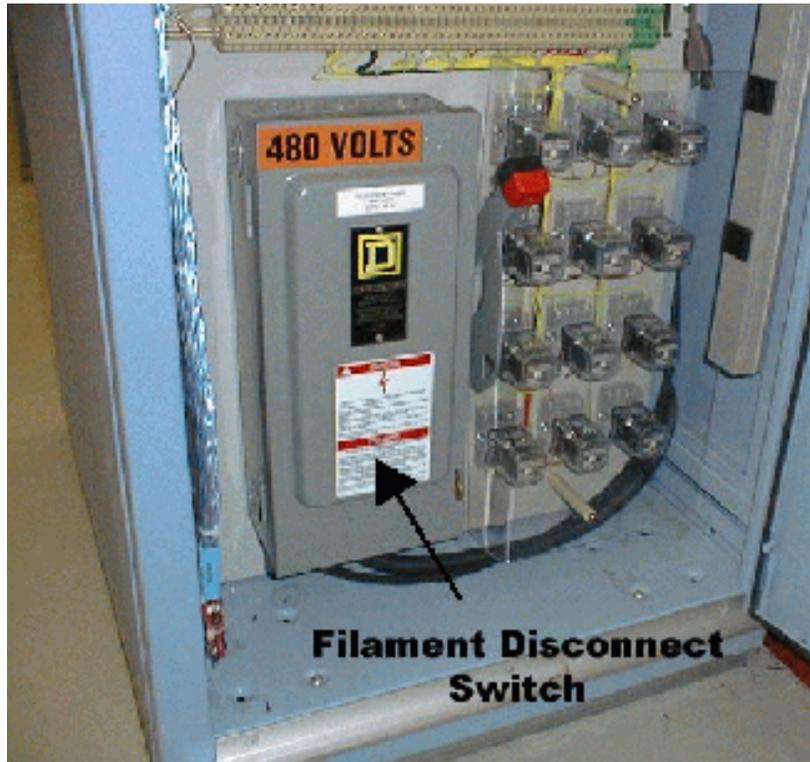


Figure 3

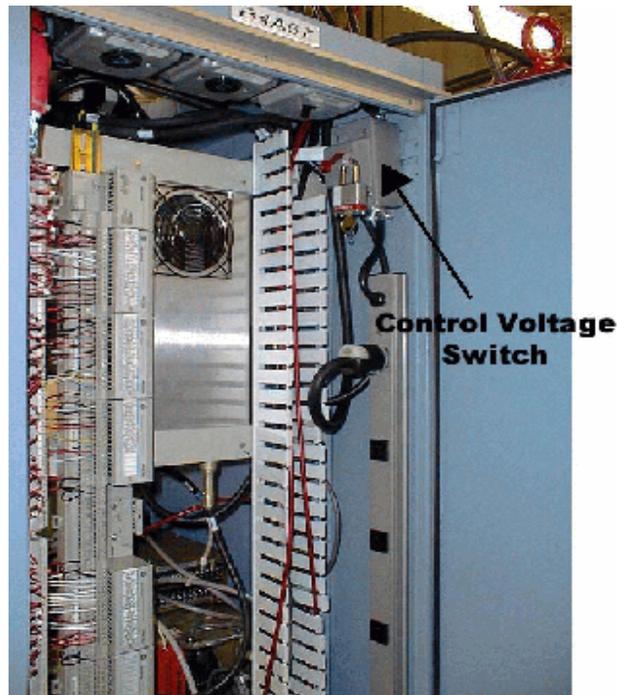


Figure 4

Attachment 3



Figure 5

Attachment 4

RF Critical Device List

Personnel Access Security System (PASS) connections to critical devices in RHIC RF System Anode Power Supplies (Drawing number 71025000).

The PASS critical devices (RF-CD1 and RF-CD2) for inhibiting RF power to the cavities are located in the High Voltage Anode Power Supplies. **Before starting work on the following subsystems, the security group must be notified.** The system must be Radiation Safety Locked Out/Tagged Out (RS-LOTO) by authorized personnel. After completing the work, the components must undergo a functional recheck as determined by the Security Group personnel.

1. K101F
2. K102
3. K106
4. A2K1B
5. PC Board A2
6. K120, R120
7. K121, R121
8. K122, R122
9. K123
10. K124
11. K125, R125
12. K126, R126
13. K127, R127
14. TB101, Terminals 1 and 2
15. TB112

The power supply is a QA A1 device, and no substitution or modification of any parts may be undertaken without an Engineering Change Notice (ECN). Preventive maintenance and repairs, including replacing defective parts to subsystems not itemized on the restrictive list, may be performed by RF Group personnel without notifying the Security Group. When troubleshooting the power supply, external sources of power (110VAC or 24VDC, etc.) may not be introduced downstream of the critical devices actuating relays.