

ARGONNE NATIONAL LABORATORY

HIGH ENERGY PHYSICS DIVISION

AWA

ARGONNE WAKEFIELD ACCELERATOR

RF SYSTEM OPERATING SYSTEM

Approved:

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February 6, 2008

INTRODUCTION

This document is intended for use by a certified operator as a guide to safe, orderly and efficient operation of the accelerator. **If any malfunctions occur, which make it impossible to satisfactorily complete any of the procedures, such malfunctions must be corrected before continuing.** Due to the complexity of the equipment and the multitude of malfunctions which may occur, no attempt is made to specify repair procedures. All repairs must be made in compliance with applicable safety standards. Think safety, work safely, injuries can last a lifetime and death is quite permanent.

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RF SYSTEM OPERATING PROCEDURES**TO START UP ACCELERATOR, PROCEED AS FOLLOWS:**

Please follow the steps in order. If a problem is encountered at any step, correct problem before continuing to next step. While moving from area to area, when performing the startup, make a visual check of the shielding to determine that all shielding is in place.

1. Open the main valves and the by-pass lines on both SF₆ cylinders. The final equilibrium pressure in the waveguides should be between 13.5 and 14.0 psi. It may take 45 minutes to reach final pressure.
2. Turn on the three chillers and the circulator heater, on the roof.
3. While on the roof, check ion-gauge readings in the beamline. Ion gauge #2 (gun) should be reading about 3×10^{-10} Torr, ion gauge #3 (linac) should be about 6×10^{-10} Torr, and ion gauge #4 should be in the low 10^{-9} Torr, depending on how much pumping time it has had since the last venting.
4. Turn on the Control Power disconnect switch and the water pump.
5. In the control room, check the vacuum in the klystron. The ion-pump supply should show about 6 kV and 0 μ A. Abort the turn-on procedure if it does not.
6. Launch the AWA Control System on the computer.
7. Energize the fiber-optic interlock control system, and reset it. Most of the LEDs should stay lit.
8. Enable the klystron filament heater (if not already checked) and use "set exact" to 3200. Observe the gauges going up slowly. Determine that the vacuum in the klystron does not degrade. (If it does, abort the klystron filament heater immediately.)
9. Go upstairs and verify that things are progressing normally: chillers, circulator temperature, SF₆ pressures.
10. Later on, after verifying that chillers, circulator temperature, and SF₆ pressures have reached their operating points, turn on the power supplies for the magnets.
11. In the bunker, examine the beamline carefully: there should be a beamstop in the beamline (except in a few specific experiments), cameras should be aligned and turned on, no unnecessary radiation sensitive equipment should be present.

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12. Perform a survey and turn on the blower.
13. Turn on the High Voltage disconnect switch and the supply for the klystron solenoid.
14. Verify that the laser switch is in the "close" position. Insert and turn the key on the fiber-optic interlock control system. Press reset. The HVPS-READY LED should turn on. Press HV on. The HVPS-CONT LED should turn on.
15. Insert YAG 1. Turn on the Gun Solenoids to approximately: TSB = 15000, TSF = 15000, TSM = 17500, or recall appropriate previous settings.
16. Slide the bars to set HV VVT to approximately 5 and Charge Deck to approximately 3.
17. Pulse the RF at 1 pps. Observe that the scopes are being triggered and that the RF is actually pulsing.
18. Stop pulsing. Slide the bars to set HV VVT to approximately 10 and Charge Deck to approximately 8. Pulse again at 1 pps. Observe the knee on the PFN charging curve, and make changes on Charge Deck if necessary.
19. Using the PageUp key, increase HV VVT and make knee corrections with Charge Deck until the Klystron Current signal reads slightly above 3 V.
20. Use the PageUp key to increase the RF Level slowly, observing the RF traces. If there are no frequent arcs, keep going up until you reach 2400.
21. Change repetition rate to 2 pps. Using the PageUp key, increase HV VVT and make knee corrections with Charge Deck until you reach the desired level of RF power into the gun (between 180 and 220 mV at GF). Do not allow frequent arcing. Do not exceed 6.2 V on the Klystron Current signal.
22. Set the laser switch to the "open" position. Set it back to "close" if it causes arcing or explosive emission.
23. Change the repetition rate to 5 pps if desired.
24. Adjust Laser Fine Delay to the proper phase. Adjust the solenoids.
25. Remember to check things periodically: knee on the PFN charging curve, pressure in the beamline, SF₆ pressures, Klystron ion pump current.

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TO BRIEFLY INTERRUPT ACCELERATOR OPERATION AND ENTER THE BUNKER, PROCEED AS FOLLOWS:

1. Stop pulsing the RF.
2. Set the laser switch to the "close" position.
3. Remove key from the fiber-optic interlock control system and take it with you as you proceed to the bunker door.
4. Remove a Safety Switch key from key interlock box and retain it on your person while in the bunker. Everyone else entering the bunker should do the same. **Do not** forget to replace key when leaving the area.
5. Unlock and open bunker door and proceed with the desired tasks in the bunker.
6. When finished, perform a survey and replace your key in the key interlock box.
7. Insert and turn the key on the fiber-optic interlock control system. Press reset. Press HV on.
8. Verify that the laser switch is in the "close" position.
9. Pulse the RF system at 1 pps.
10. Set the laser switch to the "open" position. Set it back to "close" if it causes much arcing.
11. Change the repetition rate if desired.

TO INTERRUPT ACCELERATOR OPERATION, PROCEED AS FOLLOWS:

1. Stop pulsing the RF.
2. Set the laser switch to the "close" position.
3. Remove key from the fiber-optic interlock control system.
4. Save the magnets settings and set all of them to zero.
5. Lock the computer.

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6. Turn off and lock the High Voltage disconnect. Turn off the supply for the klystron solenoid.
7. Put the laser in stand-by mode.
8. Turn off the blower and unlock the bunker (considering the possibility that it may be needed as a tornado shelter during the operator's absence).

TO RESUME ACCELERATOR OPERATION, PROCEED AS FOLLOWS:

1. Go upstairs and verify the status of chillers, SF₆ pressures, vacuum, magnet power supplies, circulator temperature.
2. Perform a survey and turn on the blower.
3. Turn on the High Voltage disconnect and the supply for the klystron solenoid.
4. Insert and turn the key on the fiber-optic interlock control system. Press reset. Press HV on.
5. Verify that the laser switch is in the "close" position.
6. Pulse the RF system at 1 pps.
7. Set the laser switch to the "open" position. Set it back to "close" if it causes much arcing.
8. Change the repetition rate if desired.

TO SHUT DOWN ACCELERATOR, PROCEED AS FOLLOWS:

1. Stop pulsing.
2. Set the laser switch to the "close" position.
3. Remove key from the fiber-optic interlock control system.
4. Use "set exact" to set klystron filament heater to zero.
5. Slide the bars to zero on: HV VVT, RF Level.
6. Save the magnets settings and set all of them to zero.

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7. If klystron heater filament voltage and current have already reached zero, uncheck the box to disable it.
8. Turn off and lock the High Voltage disconnect. Turn off the supply for the klystron solenoid.
9. Close the SF₆ cylinders. Turn off the chillers, the circulator heater, and the magnet power supplies upstairs.
10. Open the bunker doors and turn off the blower.
11. If the HV gauge reads less than 10 kV, turn off the fiber-optic interlock control system.
12. Close the computer control system and lock the computer.
13. Turn off and lock the Control Power disconnect.