

OPERATING GUIDELINES FOR AØPI KLYSTRONS

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Based on the classic... "As told to W. Hartung by M. Champion & P. Prieto"

Turning **ON** the 3 MW Klystron (Gun)

1. Ensure that the "*3 MW RF Klystron Filament P.S.*" is set to "**RED HEAT ENABLED**" and the "**RED HEAT READY**" green LED is lit. (Red heat will take 15 minutes to time out, but you can continue to step 12). (Located in relay rack RF04).
2. Ensure that the "*3 MW RF Wave guide Sulfur Hexafluoride*" bottle gas valve, and the two green inline valves are **open**. The wave-guide pressure must be above **0.8 psi** in order to run. (Located by the 3 MW Klystron Tube).
3. **Secure the *South Cave*** (see Search & Secure procedure), **unlock** all 6 of the yellow **Configuration Control Pad Locks**, and **enable** the AØPI Safety System "**B**" loops with the Key. (PAD 146). (Located in the Safety System Relay Rack).
4. Switch "**ON**" the "*480 V disconnect switch*" in the back of the "*3 MW RF Charging Supply Cabinet*". (Located on relay rack RF01).
5. Switch "**ON**" the "*3 MW RF Klystron Solenoid Coil Power Supply Controller*". (The *PS's ON* LED should be green). (The power supply should read about **85V** and about **42 – 47A**). (Located in relay rack RF03).
6. Ensure that the big red "**Emergency OFF**" button is pulled **out**. Ensure that the "*3 MW PFN door key*" is in the key switch (next to the big red button) and turned all the way **clockwise**. (Both of these are located in relay rack RF02).
7. Ensure that the "*3 MW RF TWA*" (Traveling Wave Amplifier) is in **STAND BY**. (Located in relay rack RF07).
8. Set the "**PFN Phase Controller**" knob to "**0.00**". (Located in relay rack RF02).
9. "**RESET**" the "*3 MW RF Modulator Safety Interlock*" chassis. (All of the *Interlock Status* lights and the *480 V Contactor ON* light should turn **green**). (Located in relay rack RF02).
10. Press the **ON** button on the "**Charging Supply Controller Panel**". (Located in relay rack RF01).
11. Press the **MASTER RESET** button on the "**EOL-Counter**" module. (All of the red *PFN interlock* lights in that chassis should become **lit**). (Located in relay rack RF02).
12. Ensure that the *3 MW RF Klystron filament P.S.* "**RED HEAT READY**" LED is **green** before proceeding. (See Step 1 for details). (Located in relay rack RF04).
13. "**RESET**" the *3 MW RF Klystron Interlock Chassis*. All of the **red** interlock LED's should go **out**. (Located in relay rack RF03).

14. Switch **ON** the “*Charge Switch*” in the “*3 MW RF Klystron Interlock Chassis*”. (Located in relay rack RF03). (The *RF ON Enable* light should turn **green** and the *Charging Power Supply* should come **on**).
15. Slowly turn up the “*PFN Phase Controller*” knob to **8.10**, while monitoring the high voltage on the scope (ch. 2) and the pressure on the KIP (Klystron Ion Pump). (If there is a pressure increase, slow down or stop increasing the voltage until the pressure subsides). (Setting of 8.18 gives 6V on a scope for the *Gun_V* signal).. (Located in relay rack RF02).
16. Ensure that the “*Gun low-level RF drive*” is **off**. (i.e. set the *SP Voltage* to **0** in the *FERMI.RF/DSP/PHOTO_GUN* window of the *DDD* program on a LINUX computer). (*Hazel* it the LLRF control computer in the Ao Control Room).
17. Switch **ON** the “*3 MW RF TWA*” (Traveling Wave Amplifier). (Located in relay rack RF07).
18. Switch **on** the “*Gun low-level RF drive*”. (i.e. Turn on Feedforward and raise the *SP Voltage* from **0** to a value ≥ 5). (Located in the *FERMI.RF/DSP/PHOTO_GUN* window of the *DDD* program on a LINUX computer).
19. Recall panel setup **2** on “*LeCroy*” scope. $P(f) = 52\text{mV} = 35 \text{ MV/m}$.

Turning OFF the 3 MW Klystron (Gun)

1. **CLOSE** the “*SHUTER*” for the Laser using *ParameterPage*. (Channel 5aa:140)
2. Switch **off** the “*Gun low-level RF drive*”. (i.e. Turn off Feedforward and/or lower the *SP Voltage* to **0**). (Located in the *FERMI.RF/DSP/PHOTO_GUN* window of the *DDD* program on a LINUX computer).
3. Switch into **STAND BY** the “*3 MW RF TWA*”. (Located in relay rack RF07).
4. Set the “*PFN Phase Controller*” knob to “**0.00**”. (Located in relay rack RF02).
5. Switch “**OFF**” the “*Charge Switch*” in the “*3 MW RF Klystron Interlock Chassis*”. (Located in relay rack RF03).
6. Switch “**OFF**” the “*Charging Supply Controller Panel*”. (Located in relay rack RF01).
7. Switch “**OFF**” the *3 MW RF Charging Supply 480 V DISCONNECT SWITCH* and **lock it out** with the yellow Configuration Control padlock. (Located in back of relay rack RF01).

If the 3 MW Klystron will be off for more than 24 hours, continue on...

8. Ensure that the “*3 MW RF Klystron Filament P.S.*” is set to **BLACK HEAT ENABLED**. (Located in relay rack RF04)
9. Ensure that the “*3 MW RF Wave guide Sulfur Hexafluoride*” bottle gas valve is **closed**. (Located by the 3 MW Klystron Tube).

Turning ON the 200 kW Klystron (9-Cell)

1. Ensure that the “**200 KW Klystron Filament P.S.**” is set to “**RED HEAT ENABLED**” and the “**RED HEAT READY**” green LED is lit. (Located in relay rack RF05). (It will take 10 minutes to time out, but you can proceed up to step 7).
2. **Secure the South Cave. Unlock all 6 of the yellow Configuration Control Pad Locks.**
3. Switch “**ON**” the **480V disconnect switches** for the **200 KW RF HV Power Supply** and **200 KW RF Modulator**. (Located on the East outside wall).
4. Ensure that the **MODULATOR CONTROL UNIT** chassis red **ALARM** lights are all **cleared** (unlit). If not, then “**RESET**” them. (Located in the 200 KW RF Modulator)
5. Ensure that the **FILAMENT** “**TIMED OUT**” and **DECK POWER** “**TIMED OUT**” LEDs are **green**. (Located in the *Modulator Control Unit* chassis in the *200 KW RF Modulator*). (If not, turn the *Filament* and *Deck* circuit breakers to **ON** and turn the *Filament* switch to **ON**. Located in the *200 KW RF Modulator*) (“*Timing*” will take 20 minutes).
6. Switch “**ON**” the **Klystron Solenoid Coil Power Supply Controller**. (Green “**PS’s ON**” LED will lite.) (Located in relay rack RF06).
7. Ensure that the **200 KW RF Klystron filament P.S.** “**RED HEAT READY**” and **MODULATOR CONTROL UNIT** LED’s are **green** before proceeding. (See steps 1 & 5 above)
8. “**RESET**” the **200 KW RF Klystron Interlock Chassis**. All of the **red** interlock LED’s should go **out**. (Located in relay rack RF06).
9. Ensure that the **200 KW RF TWA** (Traveling Wave Amplifier) is in “**STAND BY**”. (Located in relay rack RF06).
10. Set the **High Voltage Knob** to “**0.00**” on the **200 KW RF High Voltage Power Supply**.
11. Switch “**ON**” the **Charge Switch**, in the **200 KW RF Klystron Interlock Chassis**. (Located in relay rack RF06). (The *RF ON Enable* LED should turn **green**). (The *High Voltage Ready* light should come on –Located at the 200KW RF Modulator).
12. Switch “**ON**” the **High Voltage**. (Green LED will come on). (Located in the *Modulator Control Unit* chassis in the *200 KW RF Modulator*).
13. Switch “**ON**” the **CURRENT SOURCE** and set knobs to **640V**. When unit is on, the red light is lit. (Setting of 640 gives 60KV on a scope for *1K VIEW* signal on the *YK1240 KLYSTRON GUN VOLTAGE MONITOR* NIM card in same modulator). (Located in NIM crate in the *200 KW RF Modulator*).
14. “**RESET**” the **200 KW RF HIGH VOLTAGE POWER SUPPLY**. All of the interlock lights should turn on. (The *SOLENOID ENERGIZED* light takes a few seconds). (Located in the *200 KW RF HIGH VOLTAGE POWER SUPPLY* rack).

15. Switch “**ON**” the **200 KW RF HIGH VOLTAGE POWER SUPPLY**. (If the *CROWBAR TRIGGERED* light is on, press **OFF**, **RESET**, and **ON** to clear it). (If the *FUSES* light is off, have the RF Group replace the broken fuses inside the cabinet). (Located in the *200 KW RF HIGH VOLTAGE POWER SUPPLY* rack).
16. While watching the current (< 20 mA), **SLOWLY** turn up the **High Voltage Knob** to a setting of **4.20** (~60 kV). (Located in the *200 KW RF HIGH VOLTAGE POWER SUPPLY* rack).
17. Turn **off** the **Capture Cavity low-level RF drive**. (i.e. lower the *SP Voltage* to **0** and turn **off** the *Low-Level RF Feedback* in the *FERMI.RF/DSP/CAPTURE_CAVITY* window of the *DDD* program on a LINUX computer).
18. Switch “**ON**” the **200 KW RF TWA** (Traveling Wave Amplifier). (Located in relay rack RF06).
19. Turn **on** the **Capture Cavity low-level RF drive**. (i.e. turn **on** the *Low-Level RF Feedback* and raise the *SP Voltage* from **0** in the *FERMI.RF/DSP/CAPTURE_CAVITY* window of the *DDD* program on a LINUX computer).
20. Recall panel setup **1** on “*LeCroy*” scope. $P(f) = 52\text{mV} = 35 \text{ MV/m}$.

Turning **OFF** the 200 KW Klystron (9-Cell)

1. **CLOSE** the **UV LASER SHUTER** using the *ParameterPage* program. (IRM Channel 5aa:140)
2. Turn **off** the **Capture Cavity low-level RF drive**. (i.e. lower the *SP Voltage* to **0** and turn **off** the *Low-Level RF Feedback* in the *FERMI.RF/DSP/CAPTURE_CAVITY* window of the *DDD* program on a LINUX computer).
3. Switch into “**STAND BY**” the **200 KW RF TWA**. (Located in relay rack RF06).
4. Set the **High Voltage Knob** to “**0.00**” on the *200 KW RF High Voltage Power Supply*. The high voltage will slowly decrease. Allow voltage to decrease below **20 kV** before proceeding. (Located in the *200 KW RF HIGH VOLTAGE POWER SUPPLY* rack).
5. Switch “**OFF**” the **200 KW RF High Voltage Power Supply**. (Located in the *200 KW RF HIGH VOLTAGE POWER SUPPLY* rack).
6. Switch “**OFF**” the **200 KW RF Modulator HIGH VOLTAGE**. (Located in the *Modulator Control Unit* chassis in the *200 KW RF Modulator*).
7. Switch “**OFF**” the **200 KW RF Klystron Interlock Chassis CHARGE SWITCH**. (Located in relay rack RF06).
8. Switch “**OFF**” the **200 KW RF HV Power Supply 480 V DISCONNECT SWITCH** and **Lock it** out with the yellow Configuration Control padlock. (Located on the East Wall).

~~If the 200 KW Klystron will be off for more than 24 hours, continue on...~~

10. Ensure that the “**200 KW RF Klystron Filament P.S.**” is set to **BLACK HEAT ENABLED**. (Located in relay rack RF05)