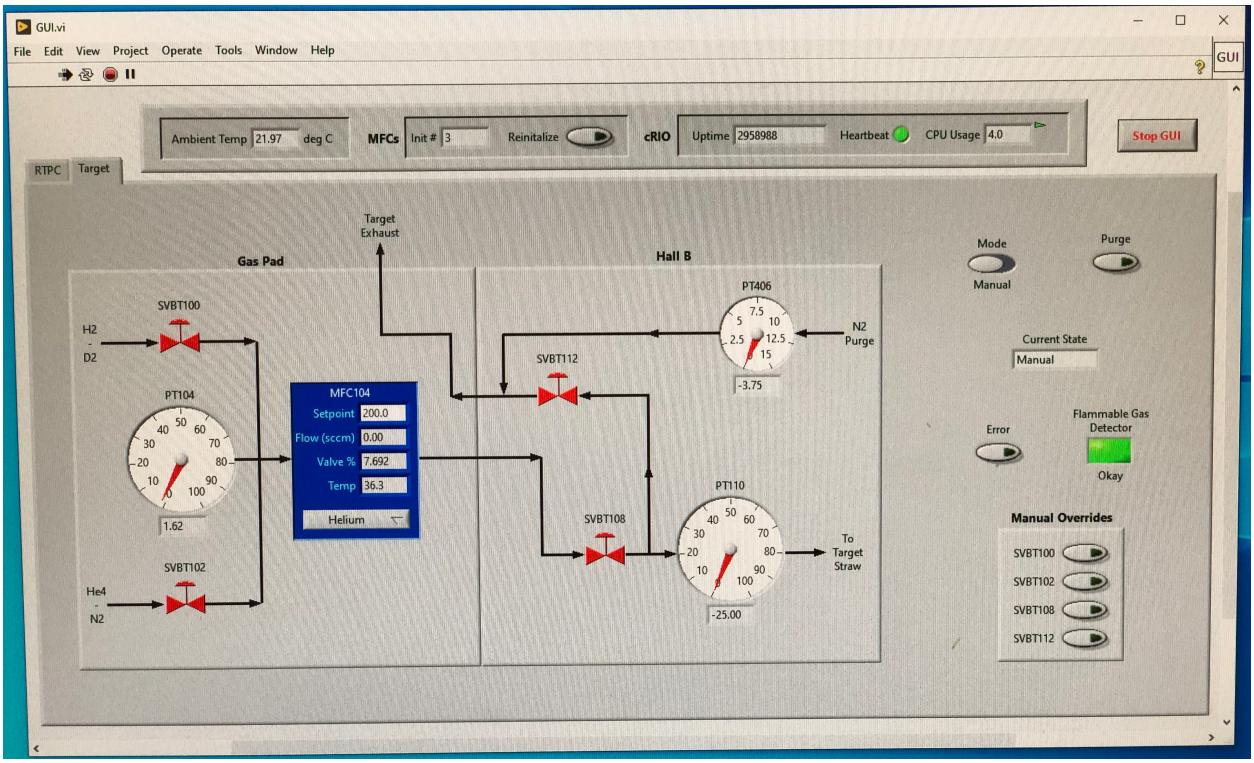
Instructions for RTPC experts to operate Target Controls

Instructions for Control Interfaces

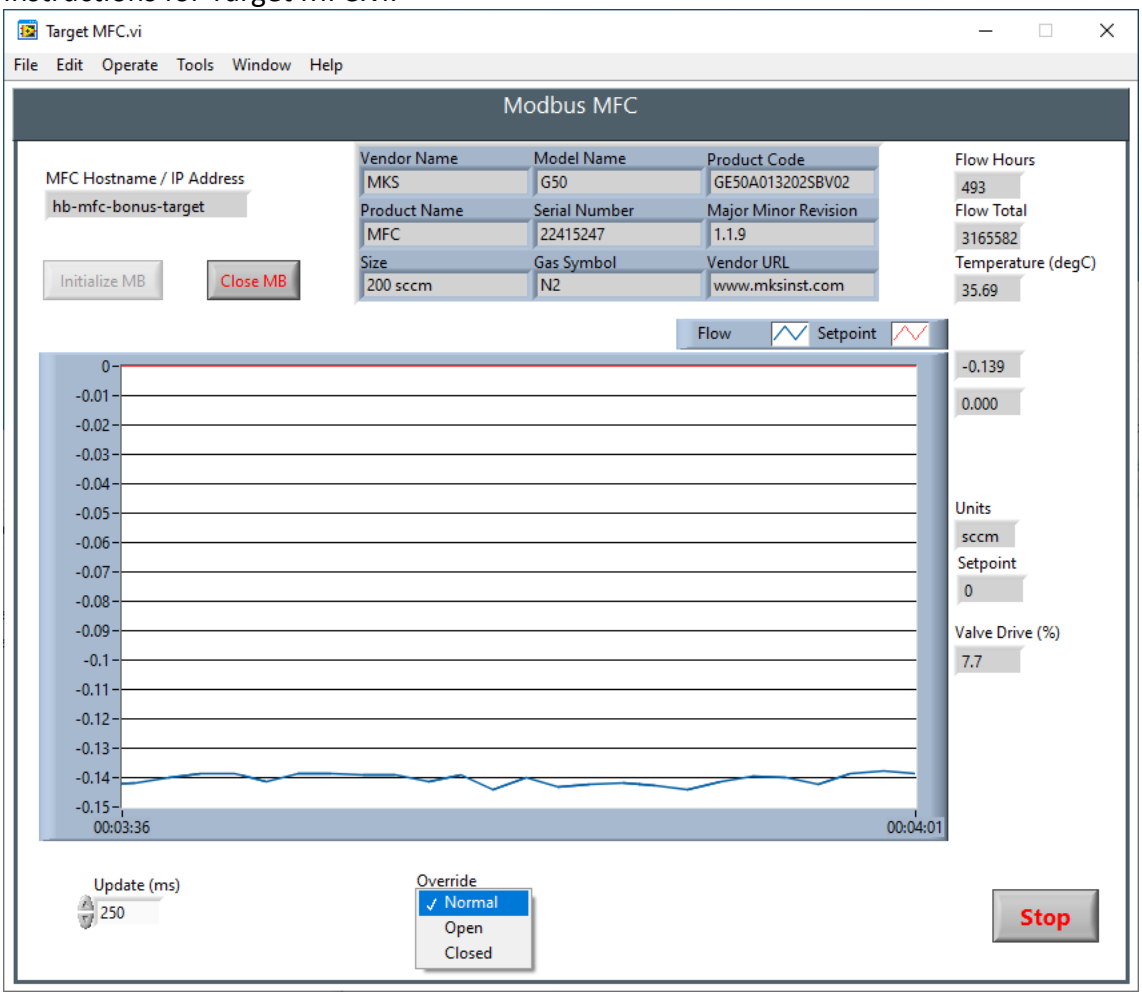
1) Log into the “RESERVED” computer BTECH03 (Windows) using your CUE credentials
2) Depending on what you intend to do, open (both) “GUI.vi” (for general target and RTPC gas controls - in C:\Users\Public\Downloads) and/or “Target MFC.vi” (to control the Mass Flow Controller valve – EXPERTS ONLY -; use the Search function to find “Target MFC.exe” and double-click).
3) Instructions for GUI.vi



   a. If the GUI is not running (Menu bar with white arrow), click on the white arrow to start it.
   b. The GUI should be used in MANUAL mode only. It controls the status of all electric valves (SVBT100, 102, 108 and 112), the maximum flow rate (“Setpoint”) and the gas type (pull-down menu) for the Mass Flow Controller (MFC104), and reads back the pressure on the inlet side of the MFC (PT104) and close to the target (PT110). (It also shows the Nitrogen purge gas pressure PT406 which is controlled from the Hall, and an “Error” indicator if an alarm threshold is exceeded, as well as a flammable gas detector alarm readout). All devices and gas lines to the left of the divider are in the gas shed behind the counting house. Instructions on standard operations for target purges and target gas changes are listed below under their own heading.

c. For now, we recommend to ONLY use the GUI.vi in “Mamual” mode. The “Purge” button will not work. If an error occurs (“Error” turns red), you have to click “Error” to acknowledge it, fix the underlying issue (likely overpressure, interlocks etc.) and then continue.
d. Note that any operations involving change in target pressure will trigger various interlocks. It is highly recommended to
    i. Temporarily override the BONuS interlocks PT110 and PT110:deriv (there still will be alarms, but no HV ramp-down)
    ii. Inform the RTPC on-call person since their phone will automatically ring

4) Instructions for Target MFC.vi:



a. IF “Target MFC.vi” has a menu bar with an arrow in it, click the arrow – otherwise it should be running automatically.
b. Click on the “Initialize MB” button – the fields should fill and the flow and setpoint strip charts should be running. (If it’s running too fast, change the “Update” value to a higher setting).
c. If you want to change the valve setting manually, select “Open” or “Closed” under “Override”. Otherwise, choose “Normal”.

d. Note: All of the fields ABOVE the strip chart are static – to update, you have to click “Close MB” TWICE and then “Initialize MB”.
e. If you’re done with the interface, click “STOP” and close the window.

NOTE: Unless a target fill cycle takes much longer than the usual 5-6 min, leave the “Override” in “Normal” Mode. If you need to speed up filling the target, choose “Open” instead until the target is filled, then return to “Normal” Mode.

Instructions for Normal Target Operation

During normal data taking on H2, D2 or Helium-4, the corresponding inlet valve (SVBT100 for H2/D2 or SVBT102 for Helium-4) as well as SVBT108 should be open and SVBT112 closed. The target pressure should be around 64-66 psig; if the pressure is below that, you might need to increase the supply pressure (very carefully and in small steps; always close SVBT108 first and avoid overpressuring the system in which case it will go into automatic Error mode and empty the target).

Instructions for Emptying the Target

The target should be in empty state for beam studies (moving the beam around to find target edges etc.). In addition, once a week we should take an empty target run (after running on a full H2 target – see below).

To empty the target, close Valve SVBT100 (leave SVBT108 open) and then open SVBT112. Wait at least 10 minutes for target pressure to fall below 5 psig (don’t go much below 5 psig!). Then close SVBT108 and SVBT112 and begin empty target run (if desired).

Instructions for Target Purges (ONCE A DAY)

I assume the target has been filled with H2 or D2 gas for the previous runs and is in Normal Target Operation mode (see above). Purging takes about 1 hour and should ideally be scheduled during a time when beam or experiment are down anyway; however, it should be done daily during a time when a RTPC expert or the RC are present (typically day/early swing shift).
The purpose of purging is to remove any Helium contamination that might have seeped into the target (and hence also the gas fill line!). Therefore, the first purge should include the whole gas line from the gas pad on. The following steps should be executed:

1) Empty the target and the gas fill line: Close SVBT100 but leave SVBT108 open. Open SVBT112 – the target pressure PT110 as well as the fill pressure PT104 should start falling. If the latter doesn’t go to (close to) zero quickly, you can use the Target MFC.vi interface to Open the MFC valve (Override). Normally, PT104 will go to zero quickly and PT110 will decrease slowly (exponentially).

2) As soon as PT104 is close to zero, close SVBT108 and open SVBT100 to allow the (long) gas line to refill with H2/D2 even while the target itself (PT110) is still emptying.
3) Once the target pressure PT110 reaches 5 psig (should take roughly 15 min), close SVBT112. **NOTE**: Don't let PT110 go much below 5 psig – unfortunately, that means paying close attention and not getting distracted by something else!
4) Open SVBT108 to start a fill cycle. Target pressure PT110 should slowly increase and reach about 50 psig in 5-7 min. If it takes a lot longer, you can speed up the process by taking the Override on Target MFC.vi into "Open", but go back to "Normal" once you reach 50 psig.
5) For the next empty-fill cycles, it is sufficient to only empty the target itself: Close SVBT108 and open SVBT112 (leave SVBT100 open). Go back down to 5 psig on PT110 (this should go a bit faster), then close SVBT112 and repeat 4) above. Repeat this sequence one more time (for a total of 3 empty-fill cycles) but afterwards let the target pressure continue to build beyond 50 psig to its maximum value (SVBT100 and SVBT108 remain open, SVBT112 closed). Go back to "Normal Target Operation".
6) The full 3x empty-fill purge cycle should take about 1 hour.

Note: Whenever you purge the target, also check the supply pressure for HeCO2 for the RTPC drift gas and the pressure in the target gas bottle. If either goes below 200-300 psi, initiate a change of gas bottles (experts only). Make a HBLOG logbook entry with all gas pressures, stating that you did a purge.

Instructions for Changes in Target Gas

At least once per week, we need to take auxiliary runs on H2 and Helium targets. Changing the target gas typically takes significantly longer than 1 hour, so ideally it should be scheduled while the experiment or beam is down for other reasons.

A typical sequence is as follows: After 1 week of D2 running, we take one run (at least 10 M events) on Helium and then 5-10 runs (at least 50 M events) on H2. This is followed by an empty target run (see above) and then return to D2.

Note that to switch from D2 to H2 or vice versa, the flammable gas pressure reducer has to be swapped physically on the gas pad. This can be done during a He run (from D2 to H2) and during the empty target run (from H2 to back to D2). You must be trained in the proper procedure to change the pressure reducer from one bottle to the other (keep in mind that flammable gas bottles have "reverse" threads and that you have to always check that your connections are leak-tight using the spray bottle.

The first step is always to empty the target: Close both SVBT102 and SVBT100 and open SVBT112 (keep SVBT 108 open to empty the gas line). While that is going on, go to the gas shed and check that the correct bottle is attached (He / D2 / H2) and turn the manual valves such that only the next required gas bottle is open to the gas panel. Open the gas bottle main valve and check the pressure on the pressure reducer – it should be close to but below 68 psi. NOTE:

The He pressure reducer is quite finnicky – you may have to adjust it several times and release excess pressure by pulling on the ring of the overpressure release valve until it is stable at 66-68 psi. It's better to run at lower pressure than to overpressurize the system (which will result in an automatic error mode).

After the target is empty, close SVBT112 AND SVBT108! Open first SVBT102 (if He is desired) or SVBT100 (if H2 or D2 is desired). Select the correct gas from the MFC104 interface on GUI.vi! Make sure that PT104 has the right pressure (64-66 psi) and that things have stabilized before opening SVBT108. Then fill the target (SVBT108 open; if it takes too long, change "Override" to "Open" on Target MFC.vi). At this point we will have a mixture of target gases, so we will have to follow the Target Purge steps TWICE to get a pure target (if going from D2 or H2 to He, once might be enough). During the first (3-cycle) purge, ALWAYS purge all the way to the gas pad (SVBT100 and SVBT102 closed, but all other valves open) for all 3 empty-fill cycles. Otherwise, and for the 2nd 3-cycle purge follow the instructions under "Target Purges".
Resume data taking once the target is back at (at least 62 psig) full pressure.

QUESTIONS? Call or email Sebastian (757 639 6640 / kuhn@jlab.org) or send an email to Brian Eng.