1 Introduction

This guide will show you how to fill out a run sheet, open all readouts (including the master readout), how to start SpecTcl for experimental runs, and how to unpack runs and do diagnostics. Before this DAQ version, MoNA, LISA, and Sweeper all had different run numbers (i.e. 1xxx for MoNA, 2xxx for LISA, 3xxx for Sweeper) and were merged offline. With DAQ11 and the event builder, data is merged online. This requires the use of a master readout, which enslaves the MoNA, LISA, and Sweeper readouts and merges their data online using the event builder.

2 Filling out a Run Sheet

Run sheets can be found in the folder attached to the wall between Data-U PC's 2 and 3. One needs to be filled out each hour when a new run is started. **DO NOT copy from previous runsheets!**
They should be filled out according to the following:

1. Write down the run number from the master readout and **MAKE SURE THAT ALL READOUTS HAVE THE SAME RUN NUMBER.**
2. Experimenter in charge will be located on the experiment monitor above u5pc4.
3. Recorder should be your name.
4. Title will be what is set in the master readout title box. It will likely refer to the type of run (i.e. "production").
5. Date will be the current date.
6. Start and end times: write in military time. (i.e. 5:00 PM should be written as 1700).
7. Beam will be either ^{11}Be or ^{12}B.
8. Target will be ^{9}Be (segmented target). Comment on target position (in/out).
9. Blocker position: the blocker may or may not be used; so if it is, this field needs to be filled with the blocker position.
10. Pot.Scint scaler should be read from the scalers (likely located on u5pc4).
11. XFP.scint should also be read from the scalers (likely located on u5pc4).
12. Trigger Condition should be read off the Level 3 Trigger GUI (i.e. Sweeper singles).
13. Computer_Go scaler may not be used.
14. Sweeper Current should be read from the Panel Mate. This is usually located on the computer to the right of u5pc2.
15. Hall probe values should be read from the Panel Mate. This is usually located on the computer to the right of u5pc2.
16. Pot Voltage should be read form the power supply labeled "POT-SCI" on the crate in Data-U5.
17. MoNA and LISA local triggers may be unavailable.
18. Crdc1.anode and Crdc2.anode should be read from the scalers (likely located on u5pc4).
19. Notes: add anything potentially relevant to the data (i.e. ended early, beam stopped, etc.).

3 Starting MoNA-LISA

This section will familiarize you with starting the MoNA-LISA CFD, XLM, and Readout GUIs. Where you see MoNA(LISA) it means that the commands are for *either* MoNA or LISA, and the commands inside the parenthesis are for LISA. So if you see a command like `gocfd mona(lisa)` it means you would type `gocfd mona` for the MoNA CFD GUI and you would type `gocfd lisa` for the LISA CFD GUI. You will start **all** of MoNA first, then repeat the entire "Starting MoNA-LISA" section for LISA.

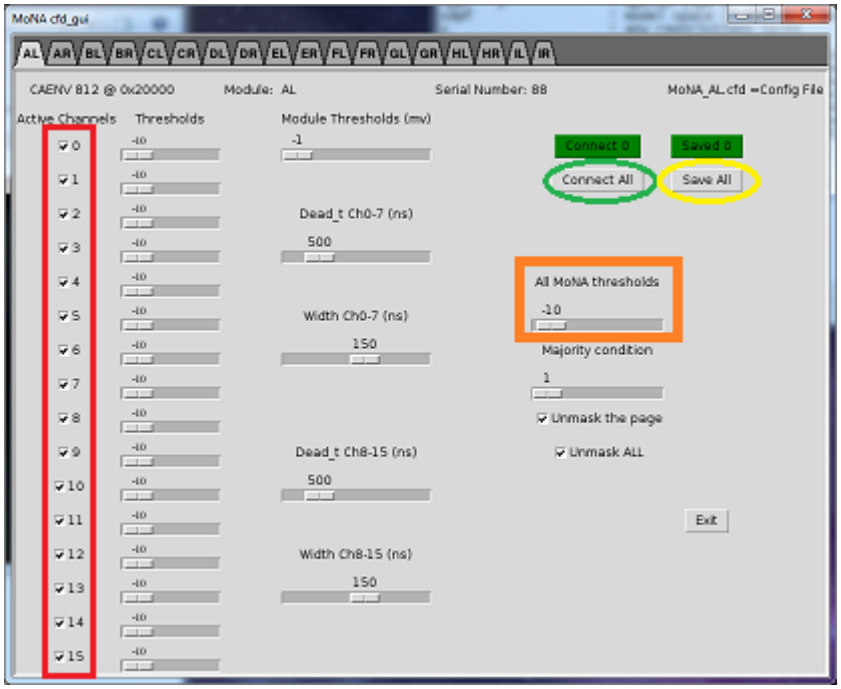
3.1 Starting the CFD GUIs

1. Begin by signing into a Data-U computer (likely u5pc3) with the e15091 experimental account and password.

2. Open up a terminal in an empty desktop. To start the MoNA(LISA) CFD GUI, type:

   ```
   >gocfd mona(lisa)
   ```

3. Wait for the CFD GUI to come up. It should look similar to the picture below. Click **Connect All**, circled in gree, to connect the array. Ensure all layers are connected (the check boxes in the red box are all checked for every layer).



4. Set the threshold for MoNA(LISA) CFDs to `-10 mV(-20 mV)`. This is the slider located in the orange box in the picture above.

5. Click **Save All**, circled above in yellow, to save these settings.

6. You are done setting up the CFD GUI. Move onto the XLM GUI.

3.2 Starting the XLM GUIs

1. Open a new terminal in the same desktop, and type:

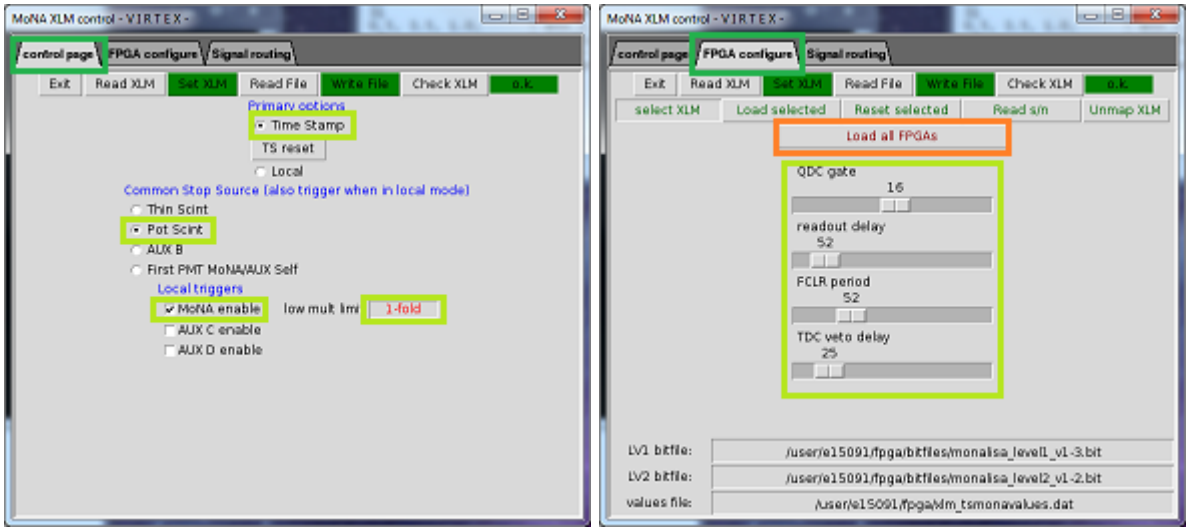
   ```
   >goxlm mona(lisa)
   ```

2. Wait for the XLM GUI to come up. You may need to load all FPGAs by pressing the "Load all FPGAs" button on the FPGA configure panel if this is the first time you open the XLM GUI, or if the associated spdaq has been power cycled. It won't ever hurt to do it, it just takes a few minutes. If you do NOT need to load all FPGAs, click **Read file** to read the XLM settings from file.

   The settings should be (refer to left picture below):

   Primary Option: **Time Stamp**
   Common Stop Source: **Pot Scint**
   Local Triggers: **MoNA(LISA) Enable**
   Low Mult Limit: **1-fold**

   On the **FPGA configure** panel (right side in pictures below), the settings should be:
   QDC Gate: **16**
   Readout Delay: **52**
   FCLR Period: **52**
   TDC Veto Delay: **25**



   If in doubt, the correct XLM settings for MoNA and LISA are tacked to the wall above u5pc2.

3. When you are done setting up the XLM, press the following buttons in order:
   Set XLM
   Write File (confirm overwrite)
   Check XLM (should have a green "o.k." next to it after pressing)

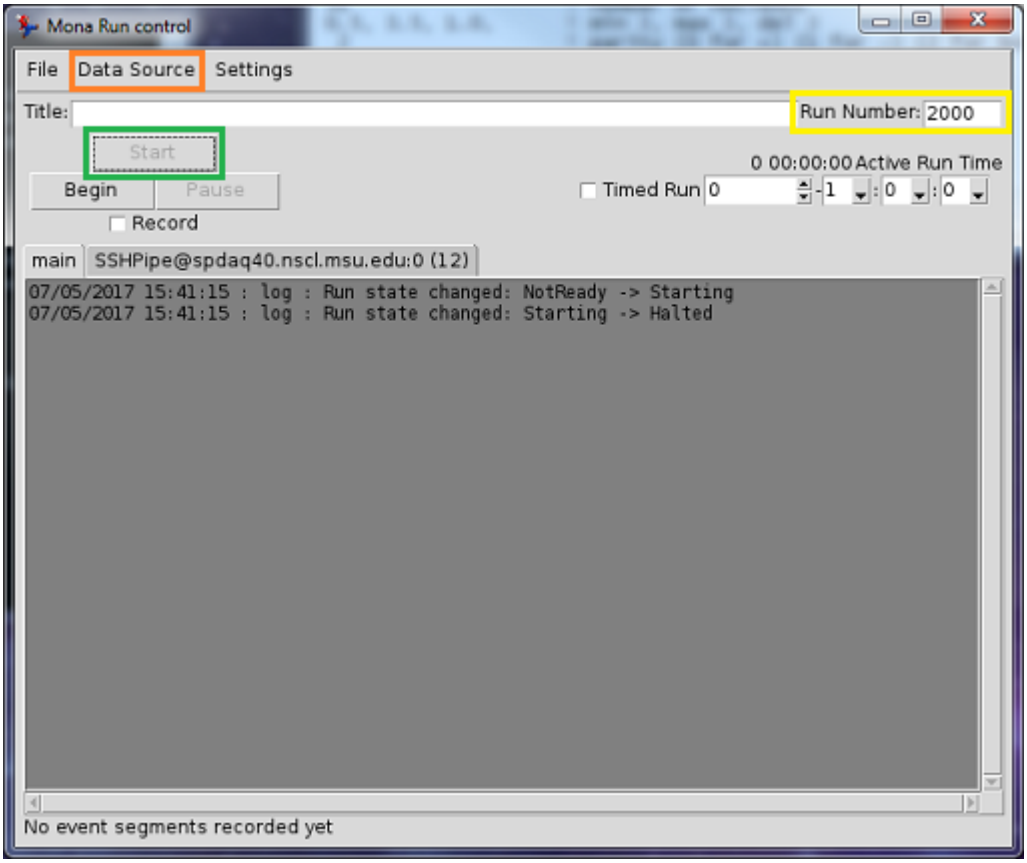
   You are finished setting up the XLM GUI. Move on to the readout GUI.

3.3 Starting the MoNA(LISA) Readout GUI

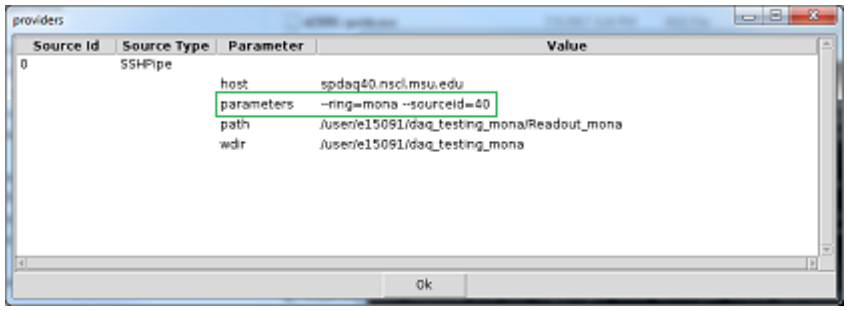
1. Open a new terminal in the same desktop, and type:

   ```
   godaq_mona(lisa)
   ```

2. Wait for the Readout GUI to come up. It should look similar to the picture below. Press "Start" (in the green box below) but DO NOT press "Begin." Find the run number in the top right corner (boxed in yellow below). This will be relevant later.



3. Click the "Data Source" dropdown menu at the top of the GUI (boxed in orange above) and select "list." In the data source list, check that the MoNA(LISA) readouts are attached to the mona(lisa) rings, and that the sourceid is the same as the device's spdaq number (40 for MoNA and 42 for LISA). These are highlighted in the picture below.



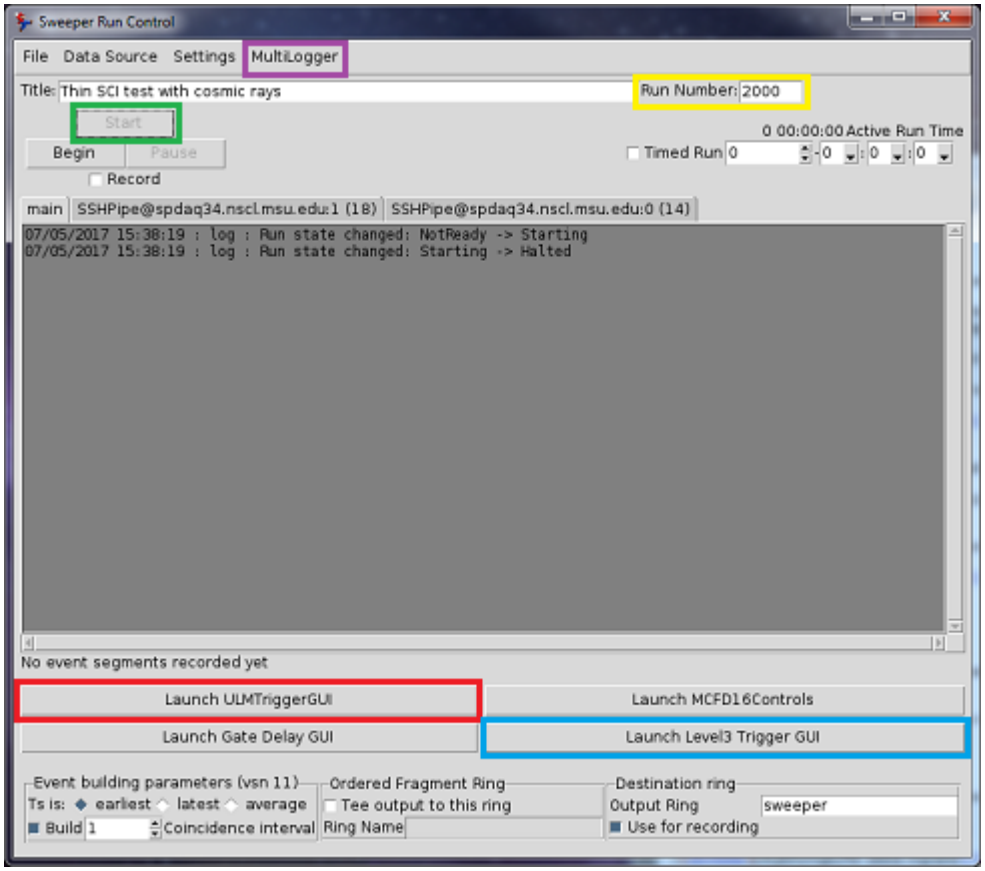
4. You are finished with setting up the MoNA(LISA) readout. Please repeat the "Starting MoNA-LISA" section in a clear desktop, and use the commands pertaining to the other array.

4 Starting Sweeper

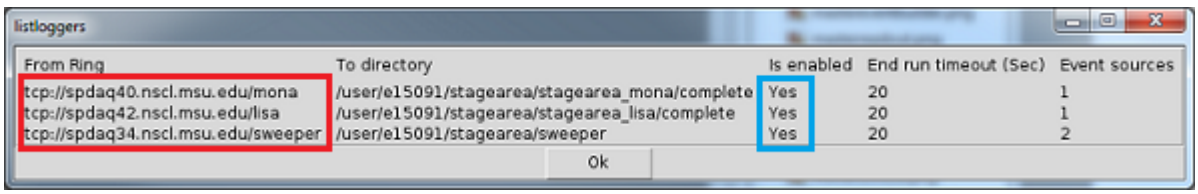
This section will familiarize you with starting the Sweeper readout GUI and its associated GUIs.
If extra documentation is needed, visit the sweeper DAQ page:
https://wikihost.nscl.msu.edu/SweeperMagnet/doku.php?id=sweeper_data_acquisition_daq

4.1 Starting Sweeper Readout GUI

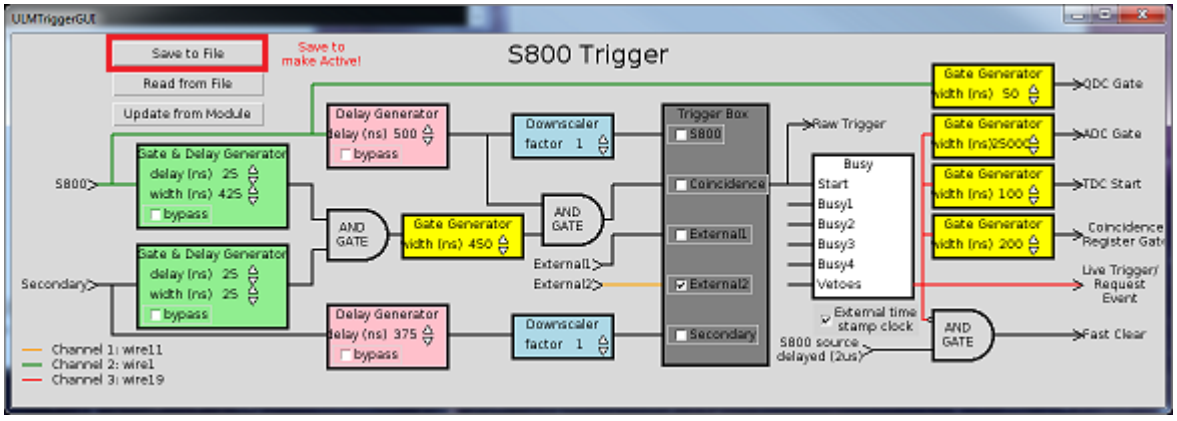
1. Begin by signing into a Data-U computer (likely u5pc4) with the sweeper account and password.
2. Click the "DAQ Sweeper" desktop icon to start the Sweeper Readout GUI.
3. Click "Start" (boxed in green below) and observe the extra buttons that appear at the bottom of the GUI. Below is the readout after beig started. Find the run number (boxed in yellow below). This will be relevant later.



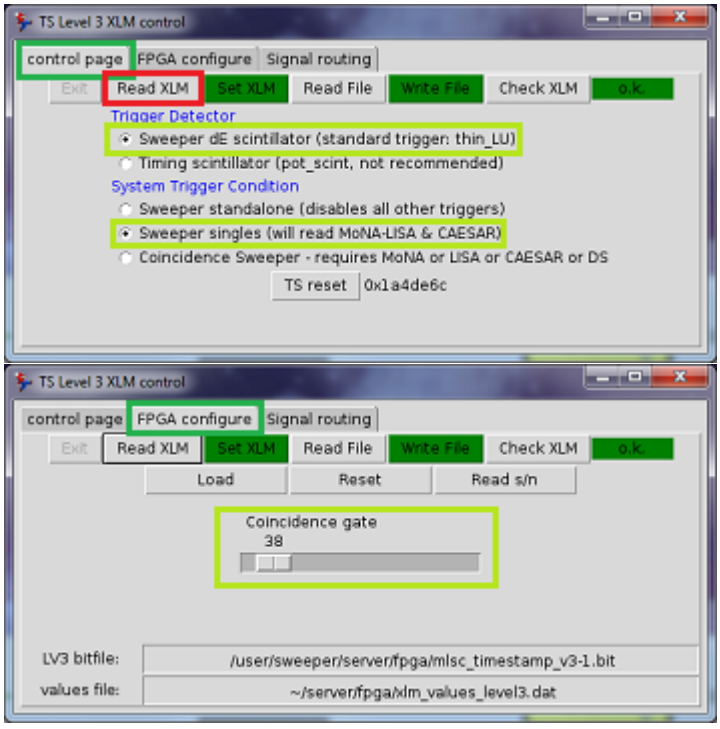
4. Click the "multilogger" dropdown menu and click "List Loggers..." to bring up a list of loggers. Make sure that the mona, lisa, and sweeper rings (boxed in red below) are enabled (boxed in blue below).



5. Click the "Launch ULMTriggerGUI" button (boxed above in red), and wait for the GUI to appear. Click the "Save to File" button on the top left (boxed in red below). Sometimes an error message pertaining to slow communication will pop up while trying to open the ULM Trigger Settings GUI. If this happens, try opening the GUI again (it can and has happened multiple times in a row).



6. Open the Level 3 Trigger GUI by clicking the "Launch Level3 Trigger GUI" button.



7. Click "Read XLM" (boxed in red above) to read the settings from the XLM module. The settings (highlighted above) should be:
   Trigger Detector: **Sweeper DE scintillator**
   System Trigger Condition: **Sweeper singles**

   and in the **FPGA configure** panel,

   Coincidence gate: **38**

   If in doubt, the correct settings are tacked to the wall above u5pc4 for the level 3 trigger settings.

8. When you are done setting up the Level 3 Trigger GUI, press the following buttons in order:
   Set XLM
   Write File (confirm overwrite)
   Check XLM (should have a green "o.k." next to it after pressing)

9. Now, the Sweeper Readout GUI is fully configured.

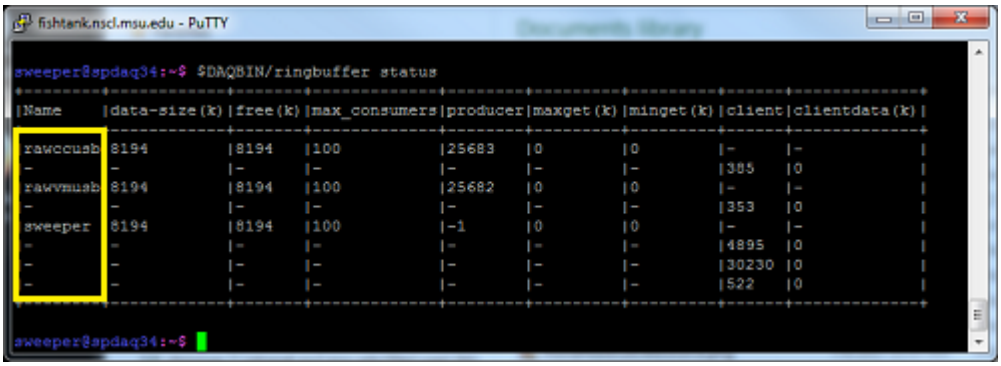
4.2 Troubleshooting Sweeper Readout

1. Occasionally, the process of starting the Sweeper readout will have issues. If this is the case, we may need to delete the rings associated with this readout, and try starting the Sweeper readout again.

2. First, ssh into the spdaq for sweeper, spdaq34 if you are not already there. Then, to delete a ring, first bring up a list of existing rings:

   ```
   >ssh -Y spdaq34 >$DAQBIN/ringbuffer status
   ```

   This should show you a list of rings(see below). If the rings "rawccusb," "rawvmusb," and "sweeper" exist (boxed in yellow below), we will need to delete them.



3. To delete the rings, use the folowing command:

   ```
   >$DAQBIN/ringbuffer delete ringname
   ```

   You should substitute "ringname" for the rings "rawccusb," "rawvmusb," and "sweeper."

4. Try to restart the sweeper readout GUI. If problems arise with any of the readouts, try going to their respective spdaq and deleting the rings present (likely named mona, lisa, etc.). Then try to restart the readout. Sometimes this solves the problem.

5. To ensure that the sweeper event builder is functioning properly, click "Begin" and notice the event builder window pop up. Wait until the event builder window looks to be processing data (i.e. no 0's for Total Fragments, Total Bytes, and output rates, and no -1's for the Hottest and Coldest source IDs) and then click "End."

5 Starting Master Readout

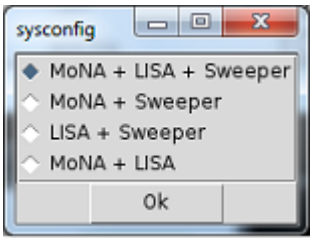
This section will familiarize you with starting the master Readout GUI.

1. Ensure that the MoNA, LISA, and Sweeper Radout GUI's have all been "Started" (BUT NOT BEGUN).

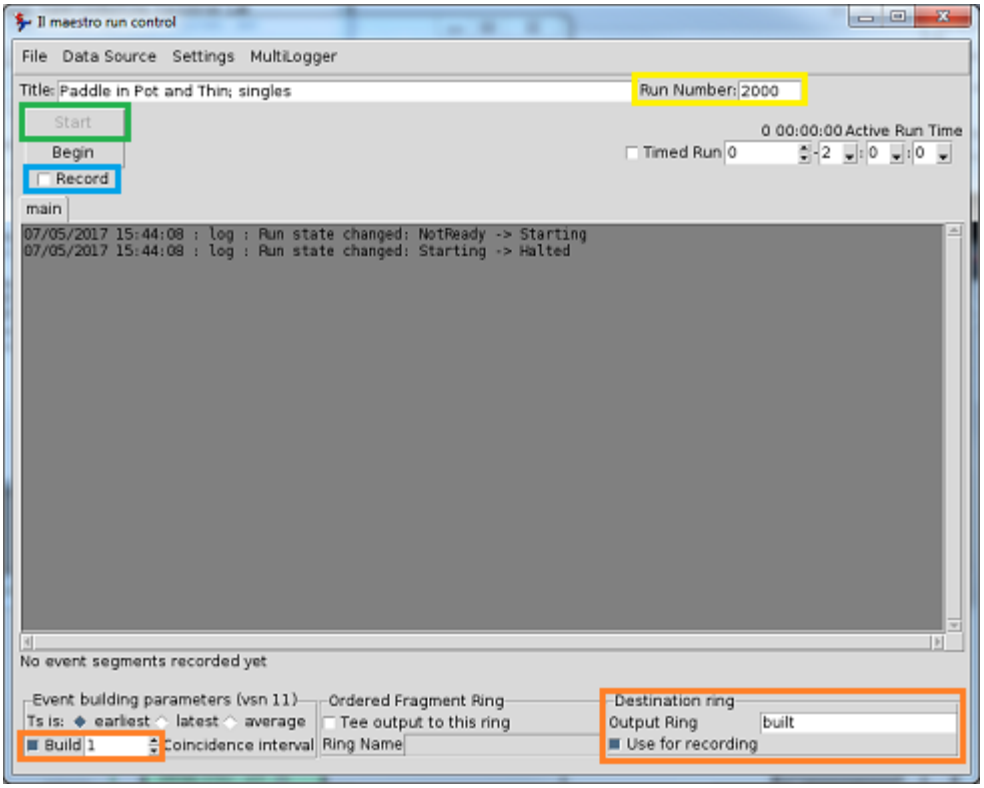
2. Open a terminal on a Data-U PC, signed in with the e15091 experimental account, and type:

   ```
   >godaq_all
   ```

   Choose the option **MoNA + LISA + Sweeper** for experimental runs (we want all devices).



3. This starts the Master Readout GUI. Press "Start" DO NOT press "Begin" yet.
   When you press "Start" some event builder information will pop up at the bottom of the GUI. Check that the output ring is called "built." (below boxed in orange) This is the ring that will contain fully built events that contain MoNA, LISA, and the pre-built Sweeper data. If you go back to any of the three enslaved readouts, you will see that their "Start," "Begin," and "End" buttons are gone, replaced by a statement telling you they are enslaved by the Master Readout. Find the run number (boxed in yellow). This will be relevant later.



4. **Ensure that the MoNA, LISA, and Sweeper Readout GUIs all have the SAME RUN NUMBER as the Master Readout GUI.**

5. Check the "Record" box (boxed in blue in the above picture). **DO NOT** click the "Timed Run" box. Each run will last for approximately an hour, but they need to be manually started and stopped by the user.

6. Press "Begin" when you are ready to take data. Note that the master readout takes about 30 seconds to actually start up once you press "Begin."

7. **If you need to exit the readouts, exit the Master Readout first.**

5.1 Ending and Beginning a Run

1. Each run should last an hour. When you are ready to stop a run, press "End" on the **Master** readout. It can take up to 30 seconds to end the run completely.

2. Be sure to fill out the "End Time" on the runsheet.

3. Fill out a new run sheet for your next run, leaving the "End time" blank for now.

4. **Once again make sure that all the readouts have the SAME RUN NUMBER as the Master readout.**

5. Once the run sheet is filled out and the run numbers have been confirmed to be the same, you may press "Begin" to start the next run.

6. After beginning the run, check the SpecTcl histograms to ensure data in coming in from MoNA, LISA and Sweeper and it looks normal.

7. Once an hour has passed, refer to the beginning of this subsection "Ending and Beginning a Run" and repeat the process.

6 SpecTcl

SpecTcl lets us look at online data. Since we are building MoNA, LISA, and Sweeper data online, we can use the same SpecTcl for all of them. This section will familiarize you with starting up SpecTcl and attaching it to the "built" ring.

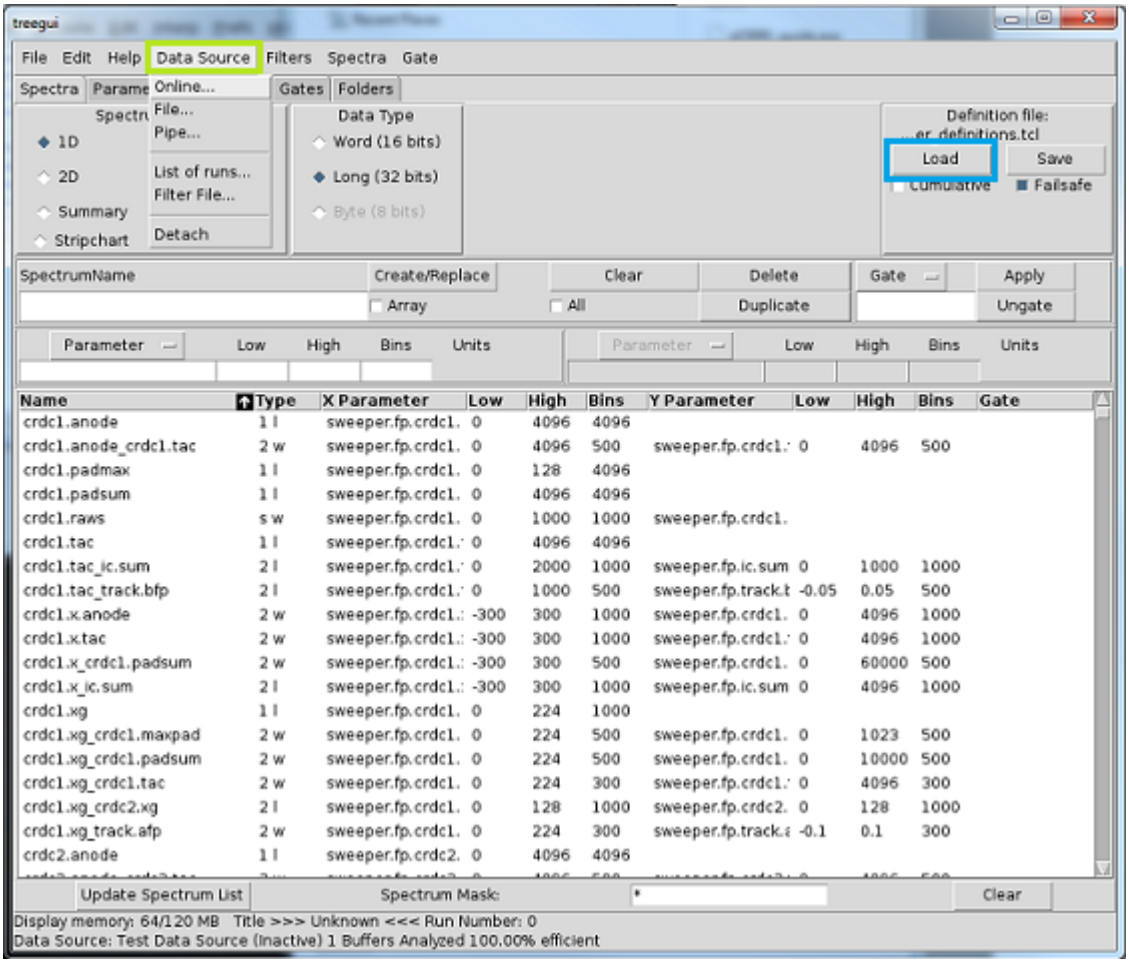
1. Log into a Data-U PC with the e15091 account and password.

2. Open a terminal and type:

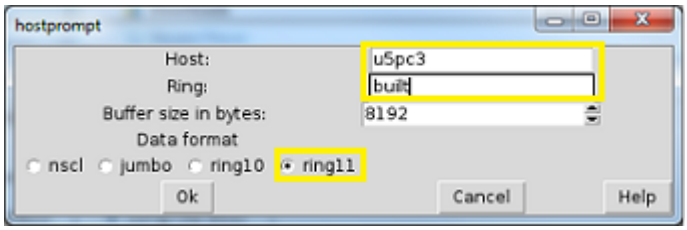
   ```
   >gospec_master
   ```

   This will open up SpecTcl control, the Xamine window, and the Tree GUI. The rest is less important to us.

3. In the Tree GUI, we need to load the definitions file that has the histograms we are interested in seeing online defined. To do this, click the "Load Definitions" button (boxed in blue below). In the file explorer, click and hold the dropdown menu at the top, and find the e15091 directory. Navigate to /e15091/spectcl_master/definitions/ and double click "master_definitions.tcl" to open the definitions file. You should see many histogram definitions pop up in the Tree GUI, for Sweeper and for MoNA-LISA. The Tree GUI should look like the picture below after loading the definitions.



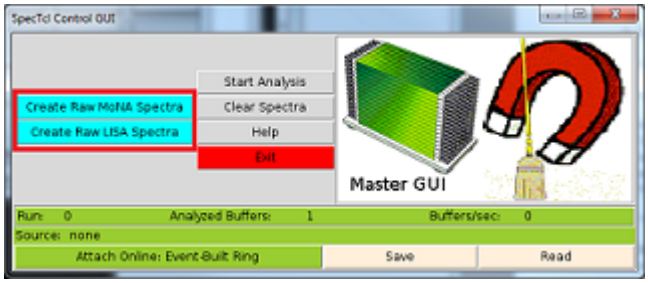
4. Now we need to attach SpecTcl to read online data. The MoNA, LISA, and Sweepr readouts are enslaved by the Master Readout, which has the output ring "built." This is the ring we want to attach to. To do this, go to the dropdown menu "Data Source" at the top of the Tree GUI (boxed in green above). Click the "online" option, and fill in the following:



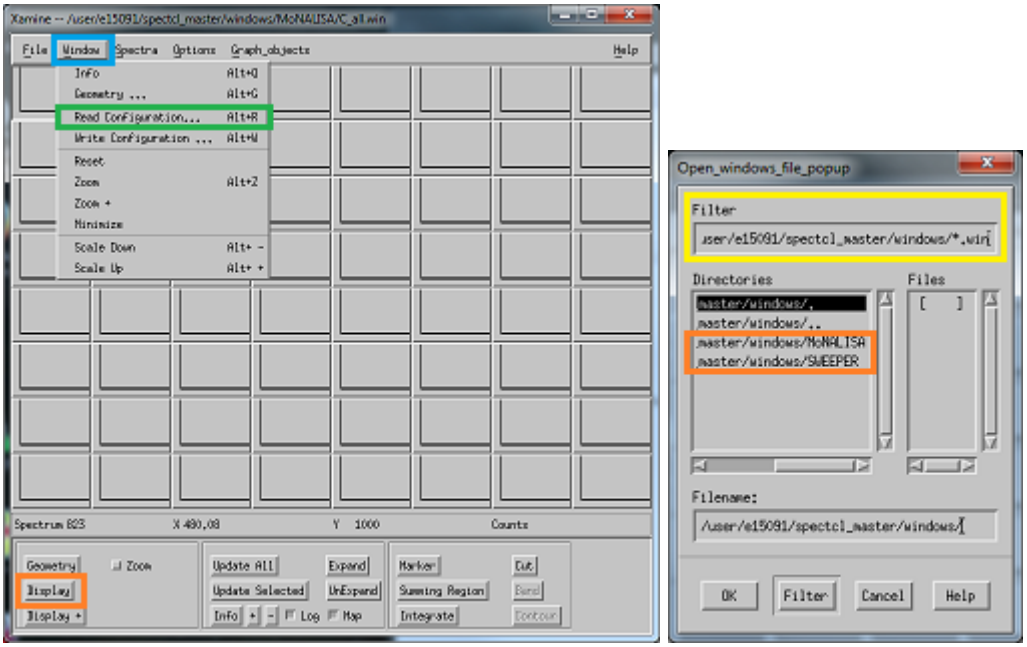
`Host:  u5pc#` (This should be the computer that **Master Readout** is running on)
`Ring:  built`
`Data Format:  Ring 11`

When done, click OK. Now SpecTcl is attached to the "built" ring, and once the master readout is running, this data will be available to SpecTcl.

5. On the SpecTcl Control GUI, click the "Create Raw MoNA(LISA) Spectra" buttons (see below).



In order to look at the histograms that are defined in the Tree GUI, go to the Xamine window. In the bottom left, you can click "Display" (boxed in orange on the left below) to see the histograms available. Alternatively, you can go to the "Window" drop down menu (blue box below) and select "Read Configuration" (green box below). In the explorer, go up one directory (spectcl_master/NewTcl/..) and find the folder "windows" (boxed in yellow below). Here you will find pre-defined MoNA-LISA and Sweeper histogram configurations(boxed in orage on the right below).



7 Unpacker

This section will show you how to run the unpacker.

1. Log into a Data-U PC with the e15091 account and passowrd.

2. Open a new terminal and type:

   `>unpack_master.sh` *`runnumber runsegments`*

   Where *runnumber* should be substituted for your run number, NOT INCLUDING preceeding zeros. The *runsegments* argument should be replaced with how many run segments are in that run. To find out how many segments are in a run, open a new terminal and go to the directory `~/stagearea/stagearea_mona(lisa)/co` and list the contents. You should be able to see how many run segments there are. For example, if there are 2 run segments in run 27, then to unpack it we would type:

   ```
   >unpack_master.sh 27 2
   ```

3. Recall that since we are building data from MoNA, LISA, and Sweeper, and they all have the same run number, we only need to unpack one run number.

8 Diagnostics

There are two diagnostic scripts located in `e15091/analysis_master/macros`. This section will teach you how to use them.

8.1 Run Diagnostics

1. This macro will output various informative histograms useful for diagnostics. First, sign into a Data-U PC with the e15091 account and password. Then, type:

   ```
   >cd analysis_master/macros
   ```

2. Start a ROOT session[1]:

   ```
   >root -l
   ```

3. Load `run_diagnostics.C`:

   ```
   root[] .L run_diagnostics.C
   ```

4. To run this macro, you will need the filename with its path. The file should be unpacked into a .root file (See the "Unpacker" section above for instructions on unpacking a run). For example, if we wanted diagnostics for run 27, we would type:

   ```
   root[] run_diagnostics(~/saved_data/root_merged/run-0027-00-cal.root)
   ```

   Note that this run has been calibrated.

[1] The -l option makes it so the splash screen doesn't come up

5. This will output many windows with various histograms. If instructed, print these out and put in the e5091 experimental binder. When prompted for the print command, use `lpr -P u6-color`. If in doubt, the print command is on a sticky note attached to the u5pc2 monitor. The plots will print to the printer in Data-U6.

8.2 Time Diagnostics

1. This macro will output various histograms that can show the detector character over time. This is a useful diagnostic to make sure our detectors are performing uniformly throughout the experiment. Begin by signing into a Data-U PC with the e15091 account and password. Then, type:

   ```
   >cd analysis_master/macros
   ```

2. Open up the `time_diagnostics.C` file:

   ```
   >gvim time_diagnostics.C
   ```

3. Scroll down until you see lines similar to:

   ```
   TChain * inChain = new TChain("t","Chained data for time diagnostics");

   inChain->Add("~/saved_data/root_merged/run-0023-00-cal.root");
   inChain->Add("~/saved_data/root_merged/run-0024-00-cal.root")
   ```

   Change these lines to incorporate the files you'd like to add to the chain and run time diagnostics for.

4. Save and close the file.

5. Open a ROOT session:

   ```
   >root -l
   ```

6. Load and run the `time_diagnostics.C` macro:

   ```
   root[] .L time_diagnostics.C
   root[] time_diagnostics()
   ```

   This will create various histograms that are useful for time diagnostics. If instructed, print these out and put in the e5091 experimental binder. When prompted for the print command, use `lpr -P u6-color`. If in doubt, the print command is on a sticky note attached to the u5pc2 monitor. The plots will print to the printer in Data-U6.