

# Operating the “Mini-Maurice” S2D2 instrument

## Contents

### 1 Material Requirements

1. S2D2 Lamp fixture (Boxed contents)
  - Mini-Maurice S2D2 instrument
  - Universal power cord
  - Nuc computer
  - Monitor
  - Keyboard
  - Mouse
  - Network cable
  - USB memory stick
2. #2 Phillips head screwdriver
3. 2mm allen hex key

## 2 Initial Setup

There should be a single box of materials shipped that make up the entire fixture. The box contains the fixture itself, a monitor, peripherals, and the boxed RA lamps for testing.

The entire fixture with computer and monitor should take up less than  $1.25m^2$  of area when assembled. After verifying the contents of the boxes, plug the universal power cord into the rear of the fixture, and place the fixture onto a secure location on a table. Assemble the mouse, keyboard, monitor, and Nuc computer on the table next to the fixture.



Fixture: Box 1 Contents

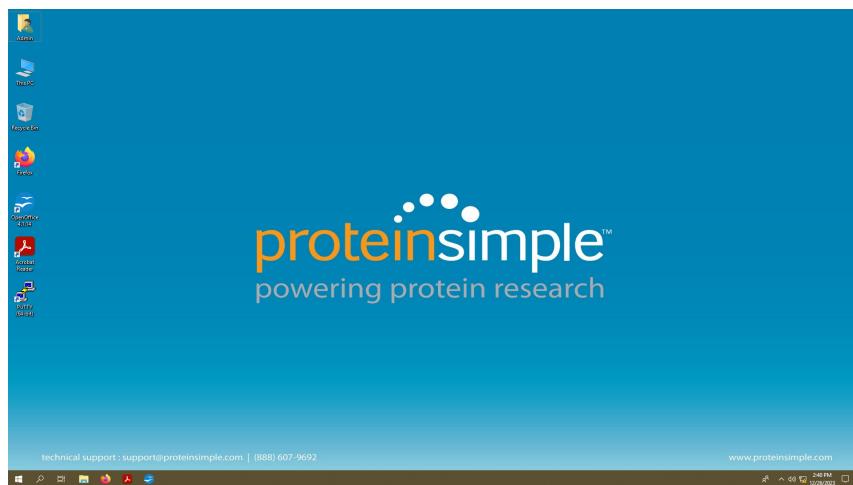


S2D2 lamp padding

The fixture has no S2D2 lamp installed, but is wrapped in padding for shipping transport. Open the door of the fixture and assemble an S2D2 lamp back in the enclosure as outlined in section ???. With the short network cable, connect the Nuc computer to the fixture using the network port on the back of the Nuc computer labeled "instrument," directly to the network port on the back of the fixture. At this point, plug the computer, the monitor, and the fixture into an available 120-220V power source. Once plugged in, turn on the monitor, computer, and the fixture (with the power switch in the back where the power cord plugs in).



You should see the desktop on the screen like this:



Ignore the “Unidentified Network” indicator for the windows network connections at the bottom of the page. This is normal for connecting to the fixture.

## 3 Getting Started

### 3.1 Navigating the Service Console

To get started with the basic operation functions of the fixture, double click with the mouse on the ‘Firefox’ desktop icon. The homepage is set to connect directly with the fixture through Firefox. Upon starting Firefox, you should see our service console with a list of various hyperlinks to different functions and folders on the fixture, as shown here to the right.

The primary link that we use for operating the fixture to generate data from the S2D2 lamps are found under the [Devices](#) page.

When collecting the data, we will use the link of the [Results Directory](#) page. Use the mouse and click on the link for the [Devices](#) page.

The [Devices](#) page should appear as below.

Service Console  
Name: Marquis S. de0002  
Type: Marquis S.  
Serial: de0002  
Version: 4.0.2021.11.13.00.57.51.08330cd8  
Camera:  
IP: 172.30.1.1  
Cycles: 0  
Errors: [Error Log](#)

System  
[Restart Embedded Application](#) | [Shutdown Computer](#)  
• [Update Embedded Software](#)  
• [Manufacturing Setup](#)

Applications  
[Calibration](#)  
[Cartridge](#)  
[Clean Size Cartridge](#)  
[Clean Paper](#)  
[Device History](#)  
[Network](#)  
[Run an Assay](#)  
[Run a Self Test](#)  
• [Run the Cap Movement Demo](#)  
• [Run Dark Frame Creation Demo](#)  
[Run Self Test](#)

View/Download Files  
• [Dark Images Directory](#)  
• [Default Protocols Directory](#)  
• [Logs Directory](#)  
• [Logs Directory](#)  
• [Protocols Directory](#)  
• [Results Directory](#)  
• [Setup Directory \(User\)](#)  
• [Self Test Directory \(Service\)](#)  
• [Settings Directory](#)  
• [Test Images Directory](#)

Instrument Control  
Reset:  
[Failed Run](#) | [Soft](#) | [Hard](#) | [Dirty](#)



Devices			
Up to main			
PIC/Device			
Camera	Features	Connection	Status
ChassisIO	CCD Camera	USB port	
FilterWheelMotor	Door & Instrument State LEDs	INTERCON board to MAIN board to USB	
PiperMotor	Filter Wheel Stepper Motor	MOTOR board to MAIN board to USB	
KiferIO	Piper Motor	MOTOR board to MAIN board to USB	
PointDetectorIO	Door, V, Manifold Valve and Sensors, Temp, & DC Motor	MAIN board to USB	
Tray/Visitors	Data collector aka Point detector	DATA COLLECTOR board to USB	
	Tray Stepper Motors		
	X	MOTOR board to MAIN board to USB	
	Y	MOTOR board to MAIN board to USB	
	Z	MOTOR board to MAIN board to USB	

### Troubleshooting Help

Symptom	Possible Causes
Device not linked above	Device is not part of this Maurice configuration
Camera is not available.	Check power to camera and USB cable between camera and mini-ITX computer.
ChassisIO is not available.	Check connection between MAIN and INTERCON boards. Check the syringe pump connection. Without the syringe pump or a jumper, the main board cannot communicate with the ChassisIO microcontroller.
KiferIO is not available.	Check cable between MAIN board and MOTOR board. Check USB cable between MAIN board and computer.
Motors are not available.	Check cable between MAIN board and MOTOR board, and USB cable between MAIN board and computer.
Point DetectorIO is not available.	Check power to data collector board and USB cable between data collector board and computer.
No devices are available.	A soft reboot may have occurred, which triggers a bug in the RFID reader. Power-cycle the instrument.

The two links we will use from this page (bookmark them if you prefer), will be the [KiferIO](#) and the [PointDetectorIO](#) pages.

Right click on the [PointDetectorIO](#) link and select ‘Open Link in New Tab’ and then left click on the [KiferIO](#) link.

The [KiferIO](#) page appears as:

KiferIO

Up to devices

<b>Air Pressure</b>	<b>Manifold Vacuum</b>	<b>PWM All</b>
Accumulator Counts: 38 PSI: 0.31 SetPoint(%): 0.0 <input type="button" value="save"/>	High Vacuum Pump <input checked="" type="radio"/> Off <input type="radio"/> On High Vac Accumulator Counts: 1023 inHg: 0.50 SetPoint(%): 0.0 <input type="button" value="save"/>	PWMAll <input checked="" type="radio"/> Off <input type="radio"/> On PWMAllPeriod: 200 <input type="button" value="save"/>
Cap Counts: 36 PSI: 0.16 Valve <input type="button" value="Open"/> <input type="button" value="Close"/> <input type="button" value="Closed"/>	High Vac Cap Counts: 1023 inHg: 0.50 Output(%): 0.0 <input type="button" value="save"/>	Voltage Voltage <input checked="" type="radio"/> Off <input type="radio"/> On Voltage (V): 0.00 Voltage (counts): 0 Current (mA): 0.00 Duty: 10.000% HVVoltage: 100 <input type="button" value="save"/> HVScaleFactor: 135 <input type="button" value="save"/> HVVoltageMax: 7000 <input type="button" value="save"/>
<b>Block Insert</b>	<b>Low Vac Cap</b>	<b>Temperature (C)</b>
Plate Vials	Counts: 33 inH2O: 0.36 Output(%): 0.0 <input type="button" value="save"/>	Ambient: 27.60 Chamber: 0.00  Deuterium Lamp Note: Lamp may take 30 seconds or more to turn on. Lamp <input checked="" type="radio"/> Off <input type="radio"/> On
<b>Cartridge Detection</b>	<b>Pinch Valve Motor</b>	
Present	Move <input type="button" value="Open"/> <input type="button" value="Close"/> <input type="button" value="Stop"/> State: Open Closed	
<b>Cartridge Latch Motor</b>	<b>Plate Cooler</b>	
Move <input type="button" value="Open"/> <input type="button" value="Close"/> <input type="button" value="Stop"/> Current: 152 State: Open Closed	Pump <input checked="" type="radio"/> Off <input type="radio"/> On Temp (C): 84.20 PlateCooler <input checked="" type="radio"/> Off <input type="radio"/> On PIDSetPoint: 10.05 <input type="button" value="save"/> PIDGain: -150 <input type="button" value="save"/> PIDGain: -2000 <input type="button" value="save"/> PIDGain: -10 <input type="button" value="save"/> PIDMinDuty: 15000 <input type="button" value="save"/> PIDMaxDuty: 85000 <input type="button" value="save"/> PIDMaxError: 50 <input type="button" value="save"/>	
<b>Cartridge PCA LEDs</b>		
White <input type="radio"/> On <input type="radio"/> Off <input type="radio"/> On Amber <input type="radio"/> On <input type="radio"/> Off <input type="radio"/> On Blue <input type="radio"/> On <input type="radio"/> Off <input type="radio"/> On		
<b>Door</b>		
Closed Sensor 1 Closed Sensor 2 Closed		
<b>Fan</b>		
Duty: 20000 <input type="button" value="save"/>		



And the [PointDetectorIO](#) page appears as:

The screenshot shows the PointDetectorIO configuration page. At the top, there are tabs for 'KiferIO' and 'PointDetectorIO'. Below the tabs, there is a URL bar with the address 'de0002:8080/device/pointDetectorIO'. A link 'Up to devices' is visible.

**Point Detector, Timings (μs)**

Note: Cannot change values when running

Buttons: Start, Stop, Running, Chart

**1. First set timing registers**

t1, Reset:	1000	save
t2, PrechargeDelay:	10	save
t3, Precharge:	1	save
t4, FlashPeriod:	10	save
t5, Flash:	10	save
t6, SampleHoldDelay:	1000	save
t7, SampleHold:	1000	save
t9, ADCDelay:	1000	save
FlashNumber:	1	save

**2. Next set cycle time (max integration time is calculated and set)**

CycleTime: 150000 save

t8, Integration: 100000

## 4 Generating Lamp Data

In order to generate data and record power from the S2D2 lamps, the [KiferIO](#) and [PointDetectorIO](#) pages will be used to control the fixture's powering on of the S2D2 lamp and can be used for preliminary control of the lamp power data collection.

### 4.1 Preliminary Lamp Data

The S2D2 lamp On/Off is controlled directly from the [KiferIO](#) page. When powering on the fixture, you should notice that the **Deuterium Lamp On** is greyed out,



indicating that the lamp is *not* on, as shown in the image below.

The screenshot shows the KiferIO control interface with several sections: Air Pressure, Manifold Vacuum, PWM All, Voltage, Temperature (C), and Deuterium Lamp. The Deuterium Lamp section includes fields for HVVoltage, HVScaleFactor, and HVVoltageMax, along with a note: "Note: Lamp may take 30 seconds or more to turn on." A red arrow points to the "On" button in the "Lamp" row.

Ensure that the front door of the fixture is closed (the lamp will not turn on if the door is open). Use the mouse and left click the **On** button; be aware that the lamp will start the warm-up process and can take up to 30 seconds to turn on. When the lamp has turned on, the **On** indicator is now black as shown below.

The screenshot shows the KiferIO control interface with the same sections as before. The Deuterium Lamp section now shows the "On" button highlighted in black, indicating it is active. A red arrow points to the same "On" button as in the previous screenshot.

Return to the [PointDetectorIO](#) page. From here, you can control the integration chip.

The main controls are the **CycleTime** (bottom of the page), the **Start** & **Stop**



buttons, and the [Chart](#) link near the top of the page.

**Point Detector, Timings ( $\mu$ s)**

Note: Cannot change values when running

**1. First set timing registers**

t1, Reset:	1000	<input type="button" value="save"/>
t2, PrechargeDelay:	10	<input type="button" value="save"/>
t3, Precharge:	1	<input type="button" value="save"/>
t4, FlashPeriod:	10	<input type="button" value="save"/>
t5, Flash:	10	<input type="button" value="save"/>
t6, SampleHoldDelay:	1000	<input type="button" value="save"/>
t7, SampleHold:	1000	<input type="button" value="save"/>
t9, ADCDelay:	1000	<input type="button" value="save"/>
FlashNumber:	1	<input type="button" value="save"/>

**2. Next set cycle time (max integration time is calculated and set)**

CycleTime:

t8, Integration: 100000

Change the **CycleTime** to the value 100000, representing 100ms cycle time on the integration chip<sup>1</sup>. Left click with the mouse on the **Save** button after entering the cycle time value. Then left click with the mouse on the **Start** button. This will change the greyed out **Running** to **Running** as shown below. Also note the cycle time and t8, the integration time at the bottom.

**Point Detector, Timings ( $\mu$ s)**

Note: Cannot change values when running

**1. First set timing registers**

t1, Reset:	1000	<input type="button" value="save"/>
t2, PrechargeDelay:	10	<input type="button" value="save"/>
t3, Precharge:	1	<input type="button" value="save"/>
t4, FlashPeriod:	10	<input type="button" value="save"/>
t5, Flash:	10	<input type="button" value="save"/>
t6, SampleHoldDelay:	1000	<input type="button" value="save"/>
t7, SampleHold:	1000	<input type="button" value="save"/>
t9, ADCDelay:	1000	<input type="button" value="save"/>
FlashNumber:	1	<input type="button" value="save"/>

**2. Next set cycle time (max integration time is calculated and set)**

CycleTime:   Saved

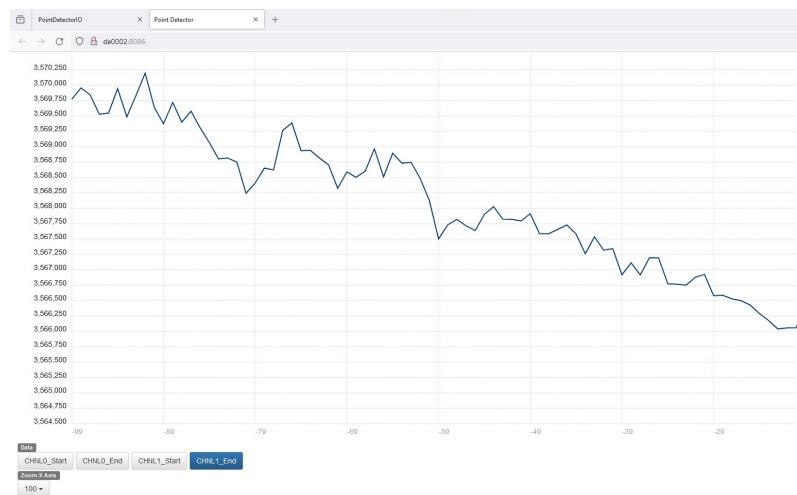
t8, Integration: 97938

At this point, we have the S2D2 lamp on and with the point detector on we are collecting power output data for the S2D2 lamp. We can verify this by left clicking

<sup>1</sup>100ms is a good time for comparison of S2D2 lamps. More integration time can be used (as can less) but too much can saturate the photodiode+integration chip system.



with the mouse on the [Chart](#) hyperlink. This will open a new tab in Firefox with a chart displaying the real-time data as shown here.



**Limitations of collecting S2D2 lamp data from the [PointDetectorIO](#) page.** There are two severe limitations on collecting data from the [PointDetectorIO](#) page.

1. The power data is not stored persistently; as noted above, the data in the [DataCollection.txt](#) is overwritten each time the [Start](#) button is pressed.
2. There is a limitation on the memory allocated to this function in the embedded software. This limitation is approximately 40 minutes of data collected; the workaround is covered next.

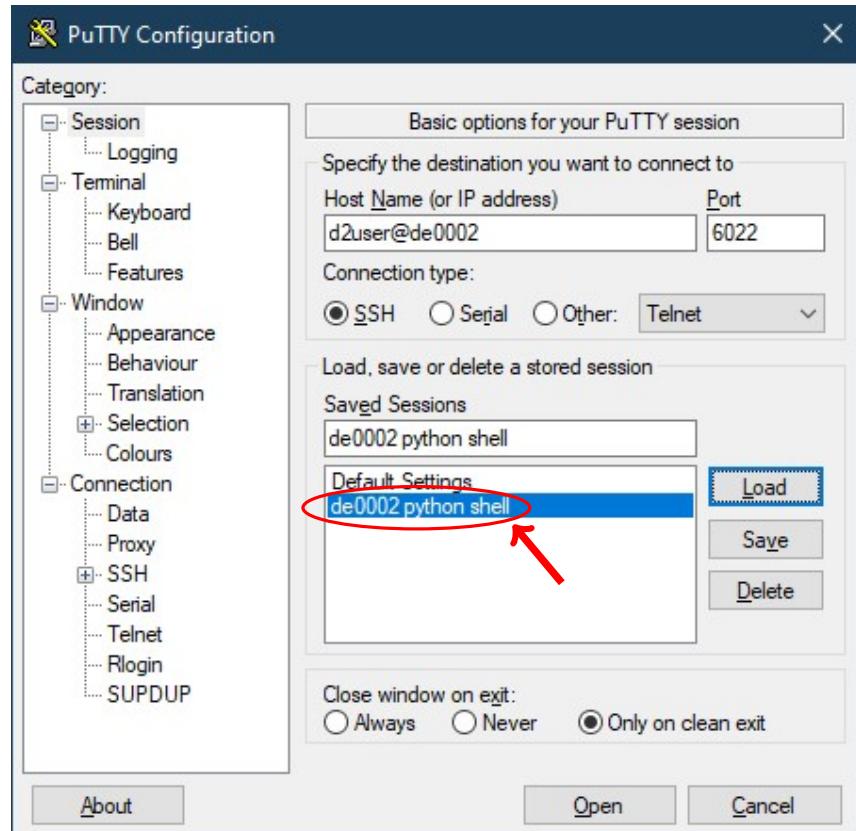
#### 4.2 Extended Lamp Data Tools

In order to get around the limitations listed above, we are providing access to a python script which

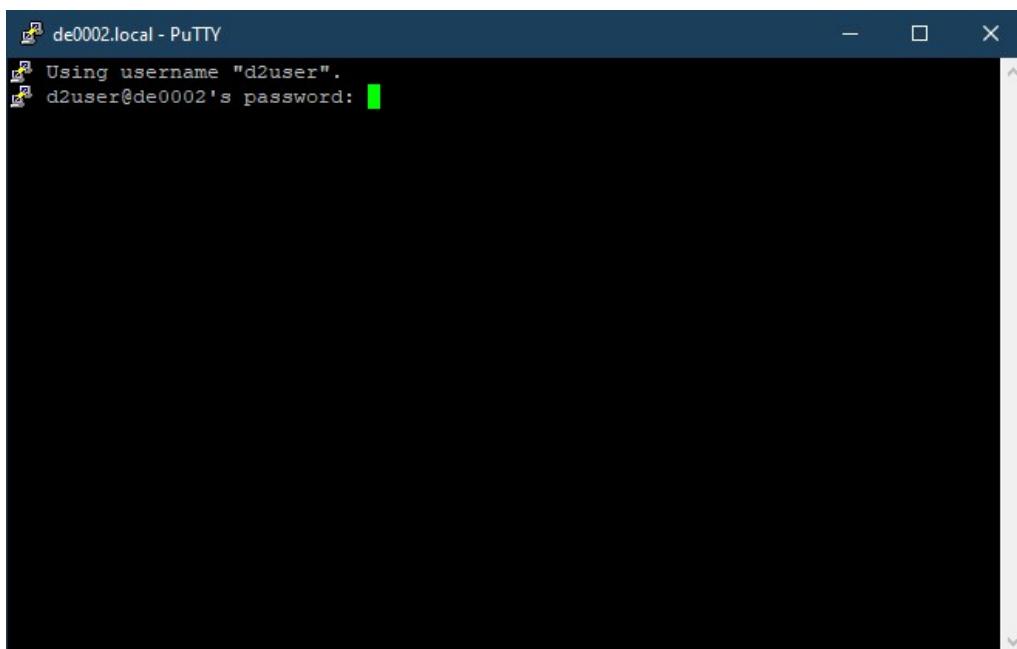
1. stores the data in a file with the timestamp as part of the name (so the file will not be overwritten) and
2. generates data for a longer time frame by stopping and re-starting the data collection process.

This will allow the user to generate S2D2 lamp data for a longer amount of time on this fixture.

**Using PuTTY** From the Desktop, locate the PuTTY icon and double click the icon to start PuTTY. The program should look as shown below.



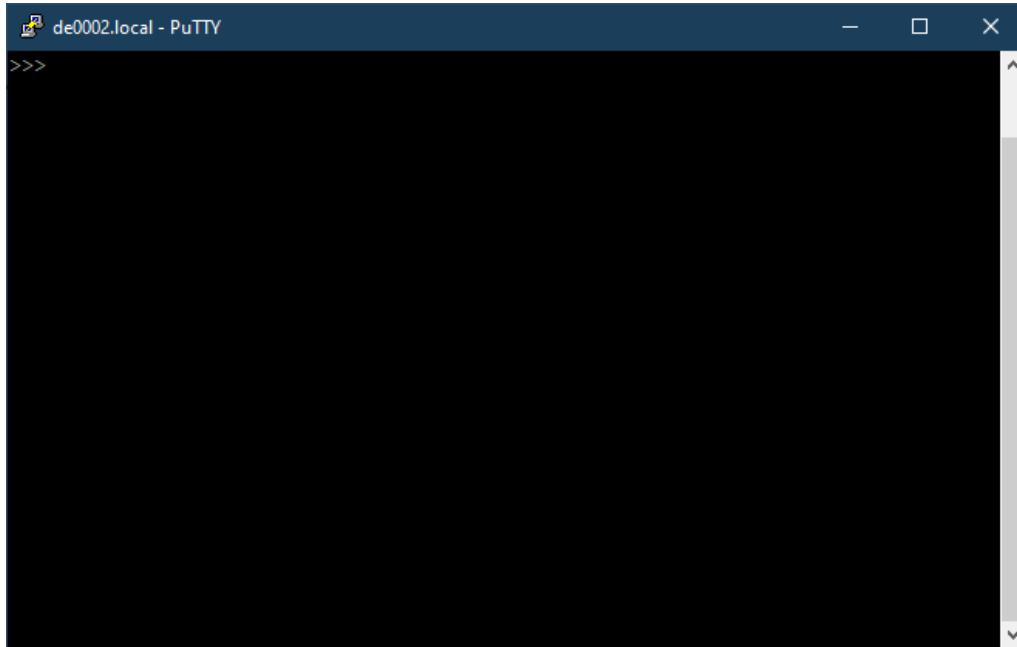
Double click on the saved **de0002 python shell**, which will automatically load the correct Hostname and Port. This will bring up a python shell environment prompting for a password as shown below.



The case-sensitive password is:

Hamamatsu

After hitting enter, the python prompt `>>>` will show. After hitting enter, the python prompt `>>>` will show.



The script needs to be loaded into memory prior to running. The command to load the script into memory is

- `>>> import mfgLampTest as collect`

The basic operation of the extended S2D2 lamp data collection script has the following operational commands:

- `>>> collect.start()`
- `>>> collect.stop()`

The 'stop' command doesn't accept any parameters, but the 'start command' accepts a decimal number of hours; the default time value is 1 hour. For example:

#### Python Console

---

```
>>> import mfgLampTest as collect
>>> collect.start(.05) #This collects data for 5\% of an hour
>>> collect.start(2)   #This collects data for 2 hours
>>> collect.stop()    #This stops the data collection at any point
```

---

### 4.3 Generating Extended S2D2 Lamp Data

The Python script is already located on the fixture, and since we have PuTTY available, we are ready to start generating extended S2D2 lamp data. The procedure for generating extended S2D2 lamp data is as follows.

1. Power on the fixture and the Nuc computer attached to the fixture.
2. Double click Firefox and wait until the fixture reports through Firefox with the Service Console.
3. Navigate to the [KiferIO](#) page (Click on the [Devices](#) link, then the [KiferIO](#) link).
4. From the Desktop, double click the PuTTY icon and enter the password to login.
5. Start four (4) hours<sup>2</sup> of data collection with the following Python console commands.

#### Python Console

---

```
>>> import mfgLampTest as collect  
>>> collect.start(4)
```

---

6. Return to Firefox at the [KiferIO](#) page and left click the **Deuterium Lamp** **On** button; wait 30 seconds until the greyed out **On** indicator reports back as **On**.
7. Close out the PuTTY terminal.
8. Return to the fixture after four (4) hours have elapsed and left click the **Deuterium Lamp** **Off** button.

**Limitations of the Extended S2D2 Lamp Data.** The only drawback to the extended collection of lamp power output is that there is about a seven (7) second gap between when the memory buffer is full, prompting the script to close the writing of the data on the disk, and then restarting the lamp power data collection. This does mean that there is a loss of data during this stopping and starting of the data collect recording.

---

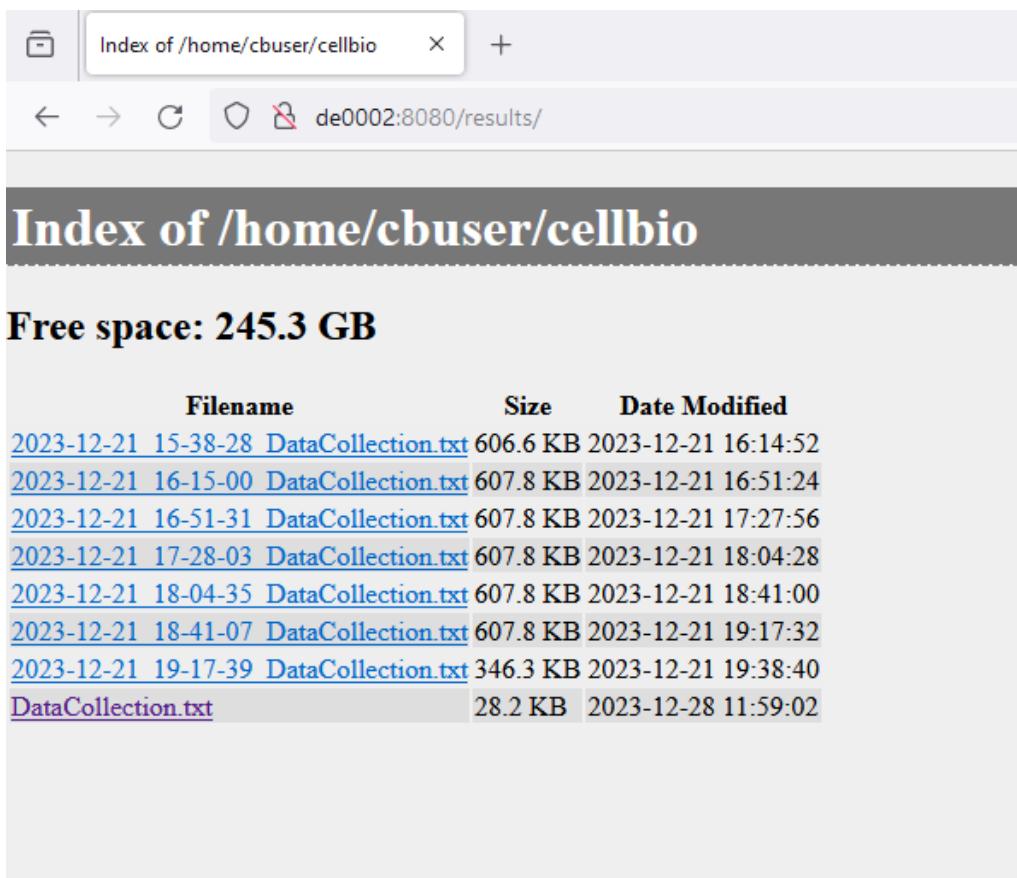
<sup>2</sup>Or any length of time agreed upon to test lamps.

## 5 Collecting Lamp Data

Now that the data has been recorded for four hours, we can now download the recorded data and analyze it.

### 5.1 Transferring Collected Data

From the Desktop, double click the Firefox icon. At the Firefox homepage, locate the [Results Directory](#) and left click on that link. The page should appear like the image below, where the last set of data collected will have a timestamp in the name of the files corresponding to the files generated from the time the Python script collected extended lamp data. For four hours of lamp data, there should be seven files generated as shown below.

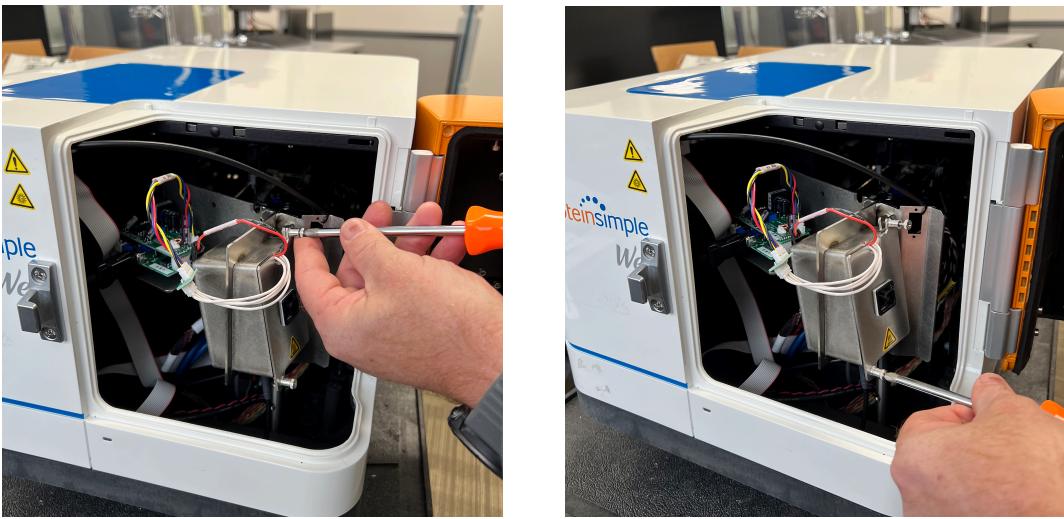


Right click on each of the files generated, and from the Firefox context menu, select 'Save Link As...' to whichever folder you choose. The USB drive included with the fixture can be plugged in to the Nuc computer and used to transfer files to any computer where you want to perform general analysis of the S2D2 lamp power output.

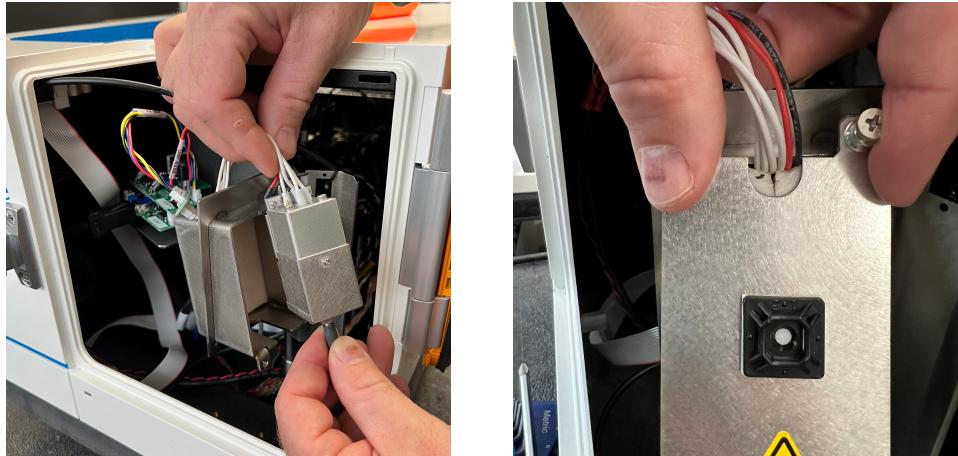
## 6 General Care and Maintenance

### 6.1 Replacing the S2D2 Lamp

The main operation on this fixture beyond S2D2 power data collection is the replacement of the S2D2 lamps. In order to replace the lamps, first open the door. Immediately inside the door is the housing for the S2D2 lamp; the cover contains two screws. Remove the two screws of the cover with the Phillips head screwdriver.



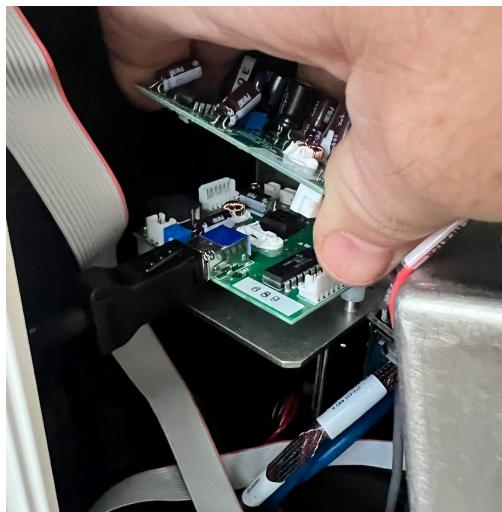
Inside is the custom S2D2 lamp housing (L10671H).



Since this is a Hamamatsu part, the replacement of the S2D2 lamp following this point is not covered. Reassembly is the reverse of disassembly; please ensure that the five (5) cables to the S2D2 lamp socket pass through the cutout on the top of the cover as shown above and that the fiber optic passes cleanly through the cutout in the bottom of the enclosure.

## 6.2 Replacing the S2D2 Lamp Power Supply

The S2D2 lamp power supply (L10671P) is held in place with three M2.5 screws. To access these three screws, you must remove the top piece of the power supply first.



Once the top board is removed, access to the three screws is enabled. Again, since this is a Hamamatsu part, the replacement of the S2D2 lamp power supply following this point is not covered. Reassembly is the reverse of disassembly. Take care that the three plastic sleeves are installed between the power supply and the mounting ports.

