

Taking data with the CMB Experiment

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Startup

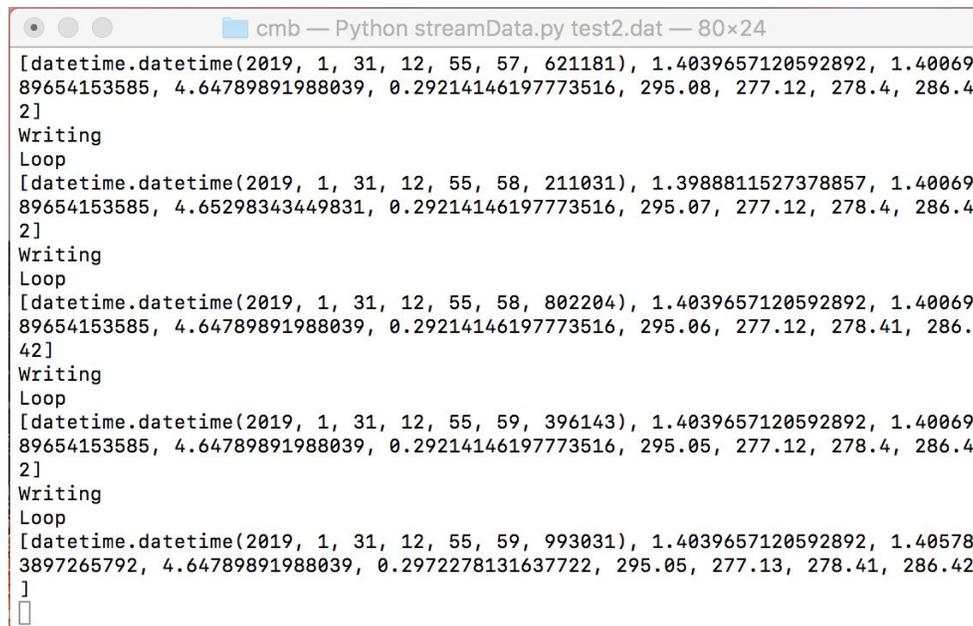
First make sure that the power supply, the power meter, and the temperature monitor are plugged in and turned on. (The temperature monitor has a switch on the back.)

Note that the data acquisition system is new and subject to failure. Make sure to keep a good log in your notebook of the power at every angle and its error

Turn on the computer and log in (the password should be labeled on the machine). Open a terminal (command+space, type terminal, hit enter) and navigate to /Users/upperdivisionlab/cmb. (You can do this by typing “cd /Users/upperdivisionlab/cmb”.) Run the program called streamData.py by typing
python3 streamdata.py (yourdataname).dat
where you replace (yourdataname) with whatever you wish to call your data, ie. “mydata.dat”

```
Last login: Thu Jan 31 12:48:14 on ttys000
[Uppers-MacBook-Pro:~ upperdivisionlab$ cd cmb
Uppers-MacBook-Pro:cmb upperdivisionlab$ python3 streamData.py mydata.dat
```

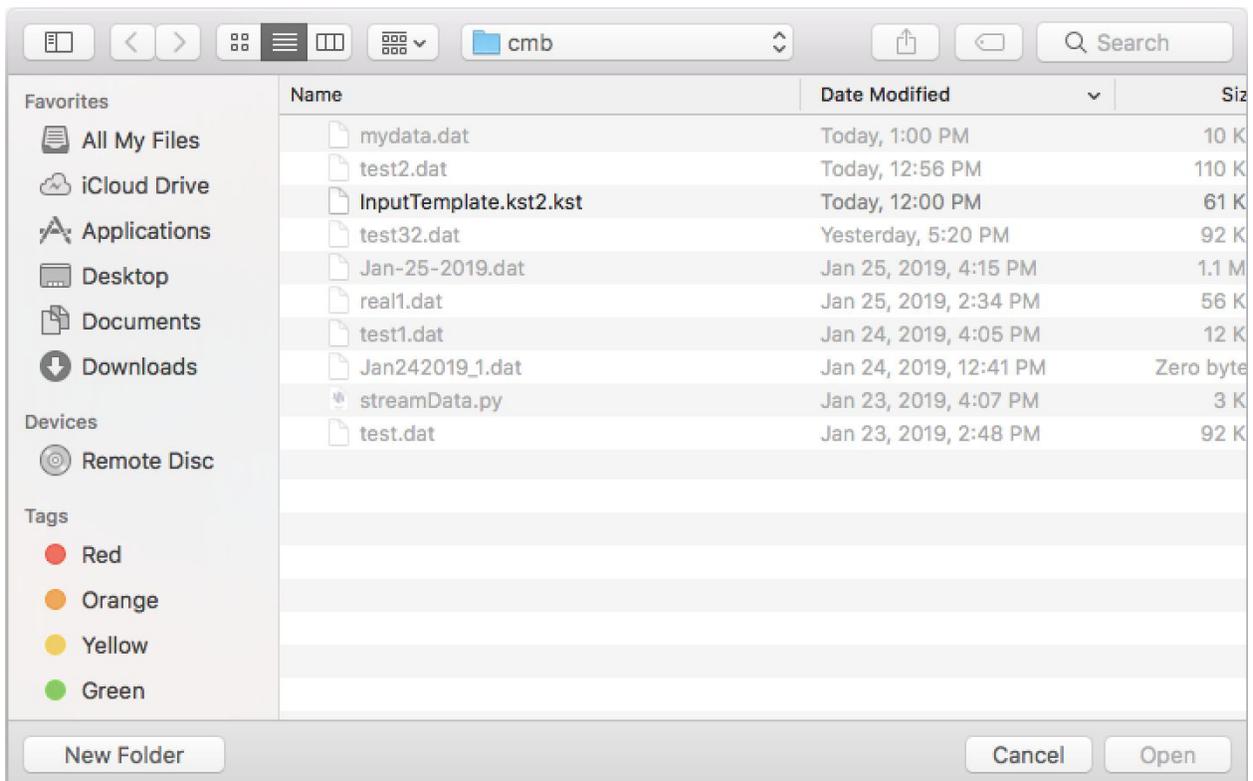
The terminal should start recursively reading out data of the form:



```
[datetime.datetime(2019, 1, 31, 12, 55, 57, 621181), 1.4039657120592892, 1.4006989654153585, 4.64789891988039, 0.29214146197773516, 295.08, 277.12, 278.4, 286.42]
Writing
Loop
[datetime.datetime(2019, 1, 31, 12, 55, 58, 211031), 1.3988811527378857, 1.4006989654153585, 4.65298343449831, 0.29214146197773516, 295.07, 277.12, 278.4, 286.42]
Writing
Loop
[datetime.datetime(2019, 1, 31, 12, 55, 58, 802204), 1.4039657120592892, 1.4006989654153585, 4.64789891988039, 0.29214146197773516, 295.06, 277.12, 278.41, 286.42]
Writing
Loop
[datetime.datetime(2019, 1, 31, 12, 55, 59, 396143), 1.4039657120592892, 1.4006989654153585, 4.64789891988039, 0.29214146197773516, 295.05, 277.12, 278.4, 286.42]
Writing
Loop
[datetime.datetime(2019, 1, 31, 12, 55, 59, 993031), 1.4039657120592892, 1.405783897265792, 4.64789891988039, 0.2972278131637722, 295.05, 277.13, 278.41, 286.42]
]
█
```

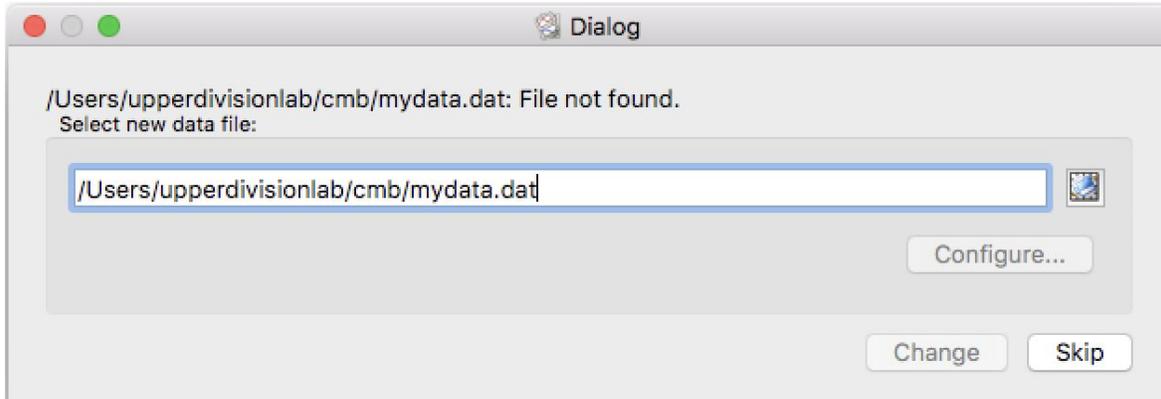
This is your time followed by your various power, angle and temperature readings. This will be exported into a .dat file in the cmb directory. The only part you should be concerned about reading from the terminal is the time. (2019, 1, 31, 12, 55, 59, 993031) means the data was taken on January 31, 2019 at 12:55 and 59.993031 seconds. Your data for a given day will be output in a single file so keep good noted in your notebook on when you start and stop taking a given type of data. Use the data read out in the terminal so that the time you write down actually correlates to the correct data. Do not assume the program time is synchronized with your watch.

While the data is running, open the program “kst2” from the desktop. Click “File → Open → InputTemplate.kst2.kst”

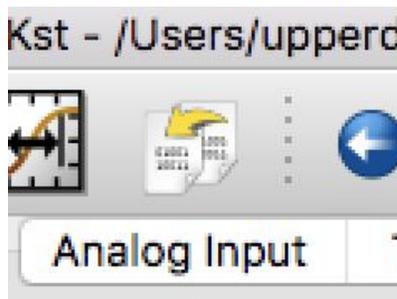


This should do one of two things

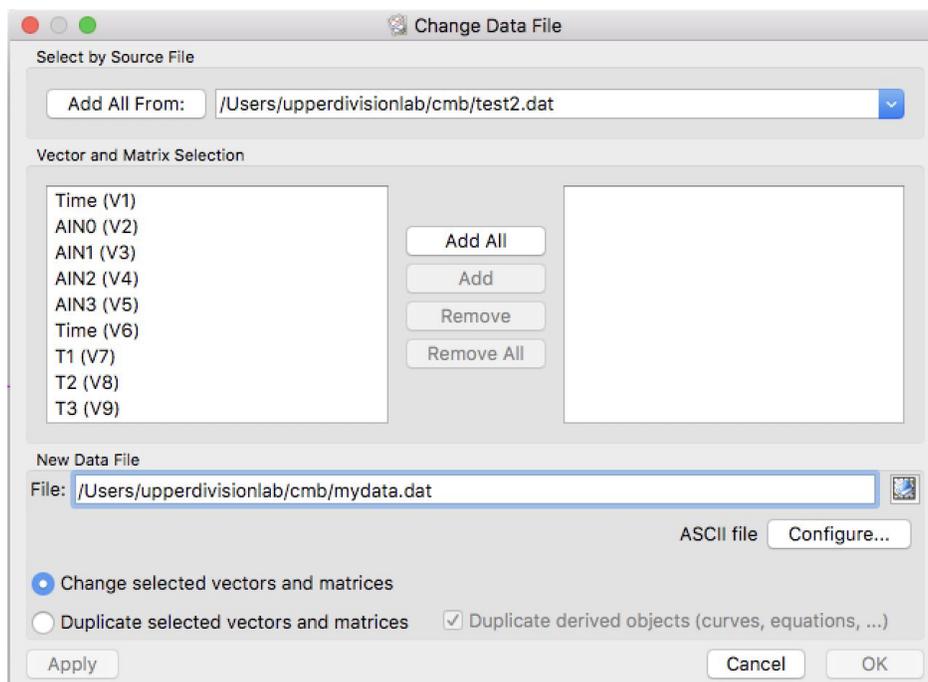
1) If the file kst was set to read does not exist it will bring up a dialogue window. If this happens, change the file name to your .dat file that is being written from the terminal and click “change”.



2) If the file kst was set to draw on exists, then it is displaying old data. In this case click the “Show Change Data File Dialog” icon, or simply hit “F”.



Click “Add All”, change the New Data File to your .dat file and click “OK”.



Readouts

There should be four readouts each in the “Analog Input,” “Temperature,” “Angle,” and “Power” tabs that are constantly updating data.

Temperature:

The four readouts in the temperature tab should be:

T1 – Cold load diode (Small bronze diode)

T2 – Warm Load diode (Loose Black diode)

T3 – Horn coupled diode

T4 – LNB coupled diode.

Note that the readouts on the temperature monitor are 5, 6, 7, and 8 corresponding to T1, T2, T3, and T4.

Analog Input:

These are four analog voltage readouts, not the true measurements of power, and angle.

Therefore these numbers need to be scaled and offset to give units of power and angle. We also have a digital power readout so the only thing we care about here is angle.

AIN2 – Angle

Angle:

To convert the AIN2 readout to angle in degrees, you take

$$\text{Angle (degrees)} = ([\text{AIN2}] - 2.5) * 15$$

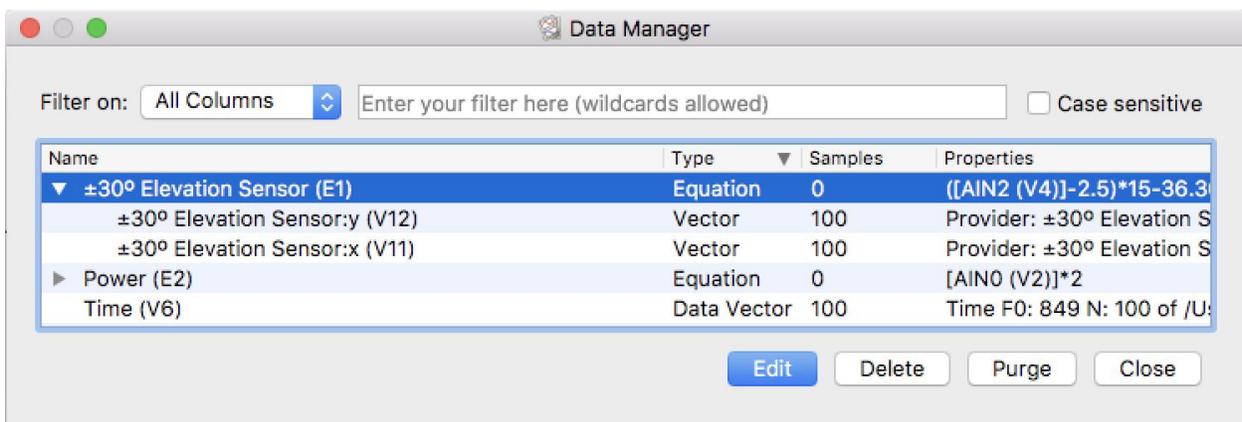
Additionally you will need to offset the degree measurement so that zero is vertical. This should be preset in the “Angle” tab, but to make sure it is accurate, take the electronic level and place it on the aluminum rim of the horn at some angle. (Make sure that this is in the range that the angle meter measures.)



Move the level along the rim to find the point at which the angle is maximized. Compare this value to that read out in the angle tab. In any case click on the Show Data Manager icon, or press “D”.

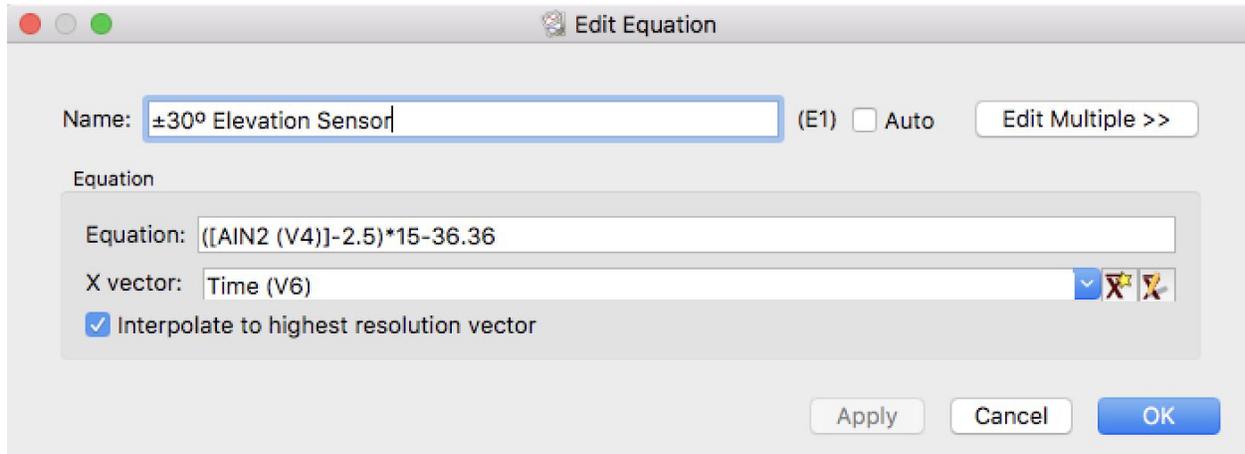


This should bring up a window, double click on the $\pm 30^\circ$ Elevation Sensor (E1) equation to edit it.



Change the equation by adding any offset you measured and click “OK”. In other words change $([AIN2 (V4)] - 2.5)*15-36.36$ to

$$([AIN2 (V4)] - 2.5) * 15 - (36.36 + x)$$
where x is how far off the angle is on the angle tab.



The readout on the Angle tab should now match that on the electronic level.

Note that is this is poorly calibrated, it will introduce a systematic error to your experiment that will throw off your accuracy. Note your uncertainty in this calibration.

Make sure to write down the equation to convert AIN2 to angle for your data analysis later.

Power:

The power tab takes the readout of the power meter digitally in watts and should update constantly.

Make sure the top readout on the front panel of the power meter reads out in Watts. If it instead reads out dBm your data file will have dBm in the power column. You need watts!

To reset the power meter to watts:

Press the green Preset/Local button in the upper left corner.

Select “Confirm”

Press the dBm/W button.

Select “W”

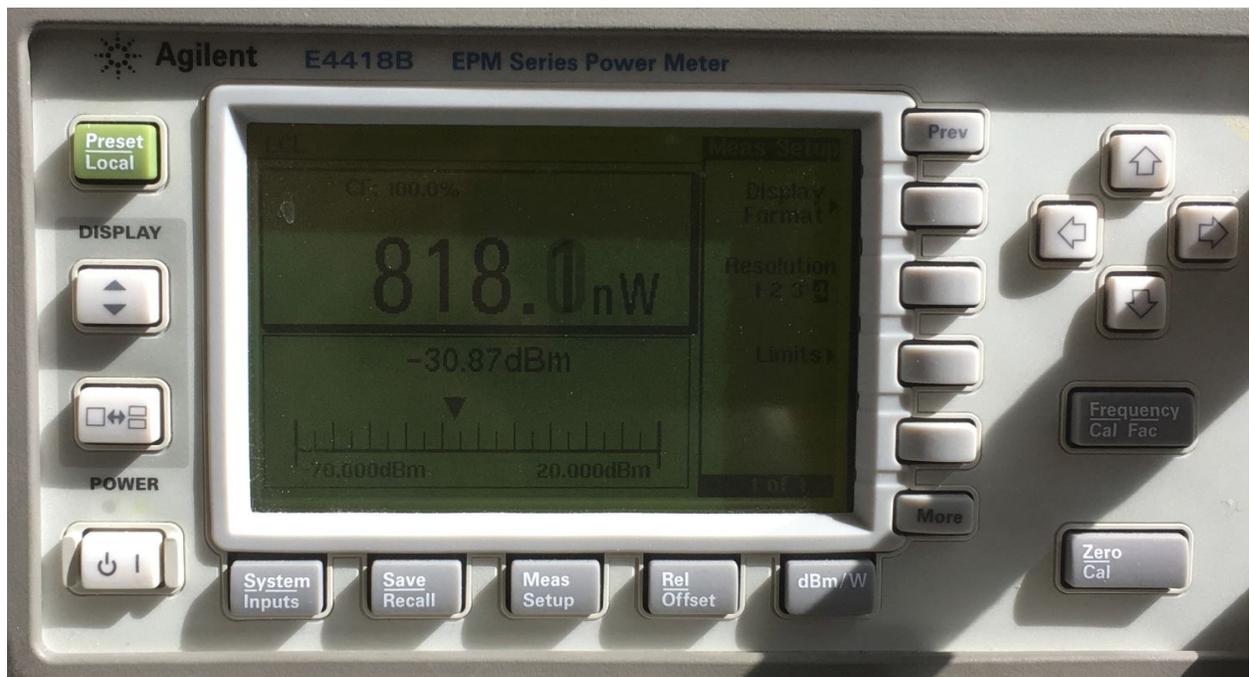
You should also make sure you are reading out 4 decimal places. If not:

Press the green Preset/Local button in the upper left corner.

Select “Confirm”

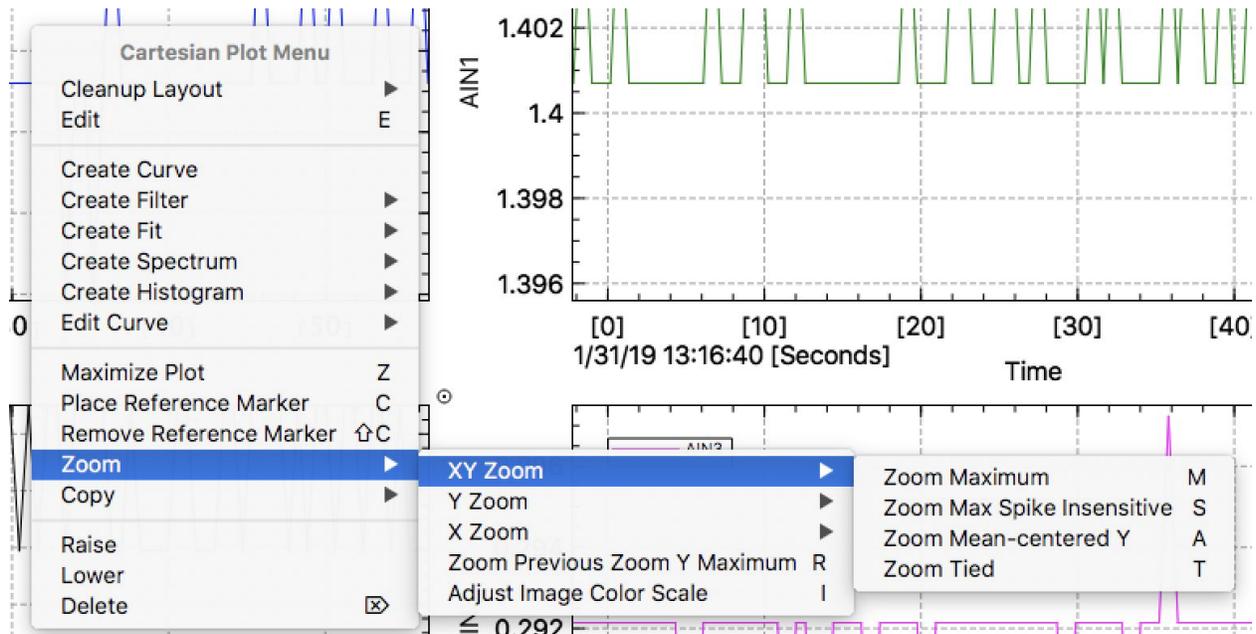
Press the Meas Setup button

Select Resolution 4



Plots not updating

If one of your plots is not updating this is likely due to a zoom setting. Click on the plot and hit the “M” key. Or right click on the plot and navigate to Zoom → XY Zoom → Zoom Maximum



Your data should now be live updating on KST and be written as a continuous data file.