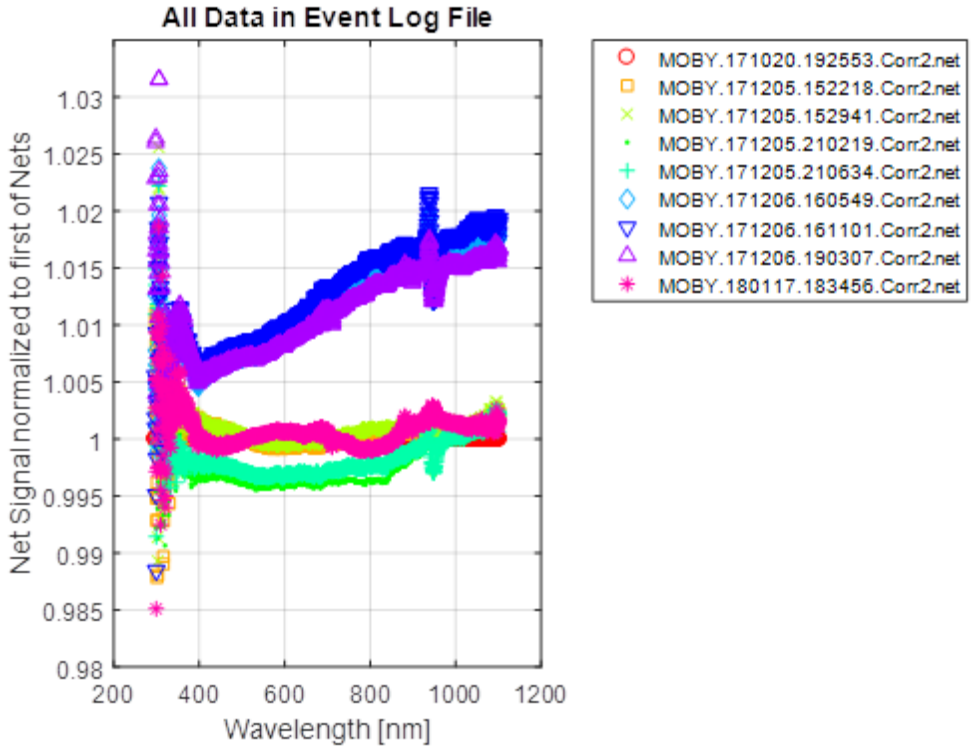
From: Johnson, B. Carol (Fed)
To: Voss, Kenneth J; feinholz@mlml. calstate. edu (feinholz@mlml.calstate.edu); yarbrough@mlml. calstate. edu (yarbrough@mlml.calstate.edu); twinsf2@gmail. com (twinsf2@gmail.com); Arthur Gleason; Darryl Peters (dpeters@mlml.calstate.edu); Sean Mundell
Subject: MOBY-NET Stability Source: more looking at UM trip results
Date: Friday, November 15, 2019 3:55:00 PM
Attachments: image001.png
image002.png
image003.png
image004.png
image011.png
image012.png
image014.png

Hi All,
Now that I think I've finished the CAS thermal work, I redid the corrections to the NIST/UM results. The difference is the fit for responsivity(temperature) was redone with a correction for the drift in the source used in the thermal tests.
It did not change things much. Recall this data set includes before and after the trip to UM at NIST. UM work was Dec 5 & 6.
I still get a disparity, and actually the size of the disparity, up to 1.5% at the NIR, was not expected to be resolved once we did the thermal characterization, because the recorded ambient temperatures for these tests did not vary by more about 2 deg C and the temperature sensitivity is about 0.12%/degC at 775 nm, way too small to explain things.

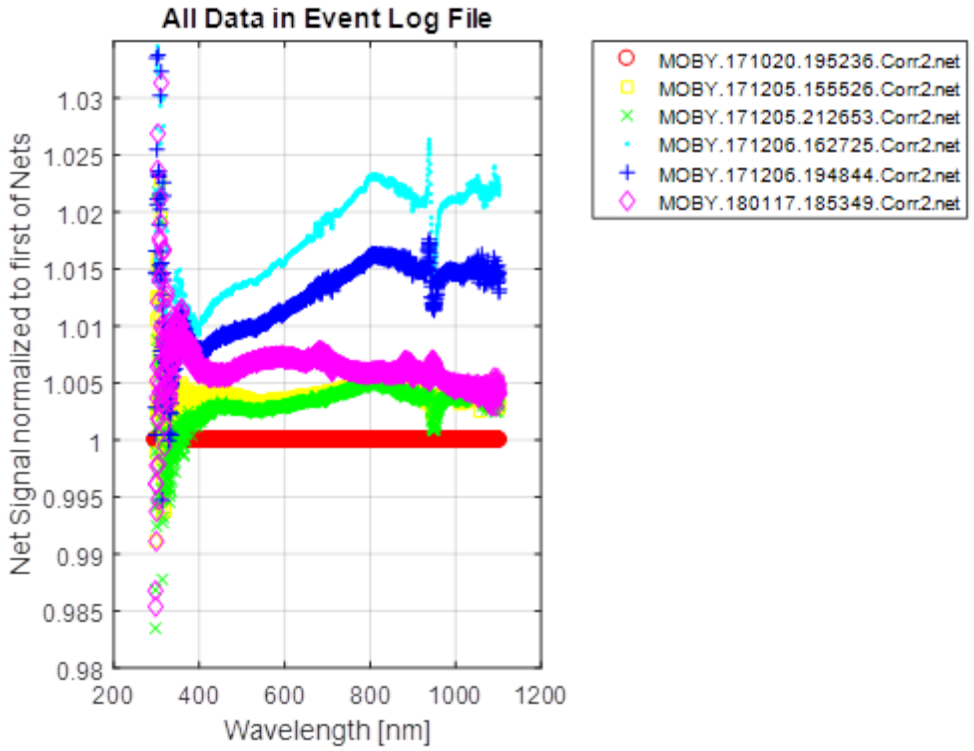
Steph if you want to post this somewhere on the MOBY net site that is fine by me.

Read to the end after the main plots for conclusions.

SQM LO -Latest



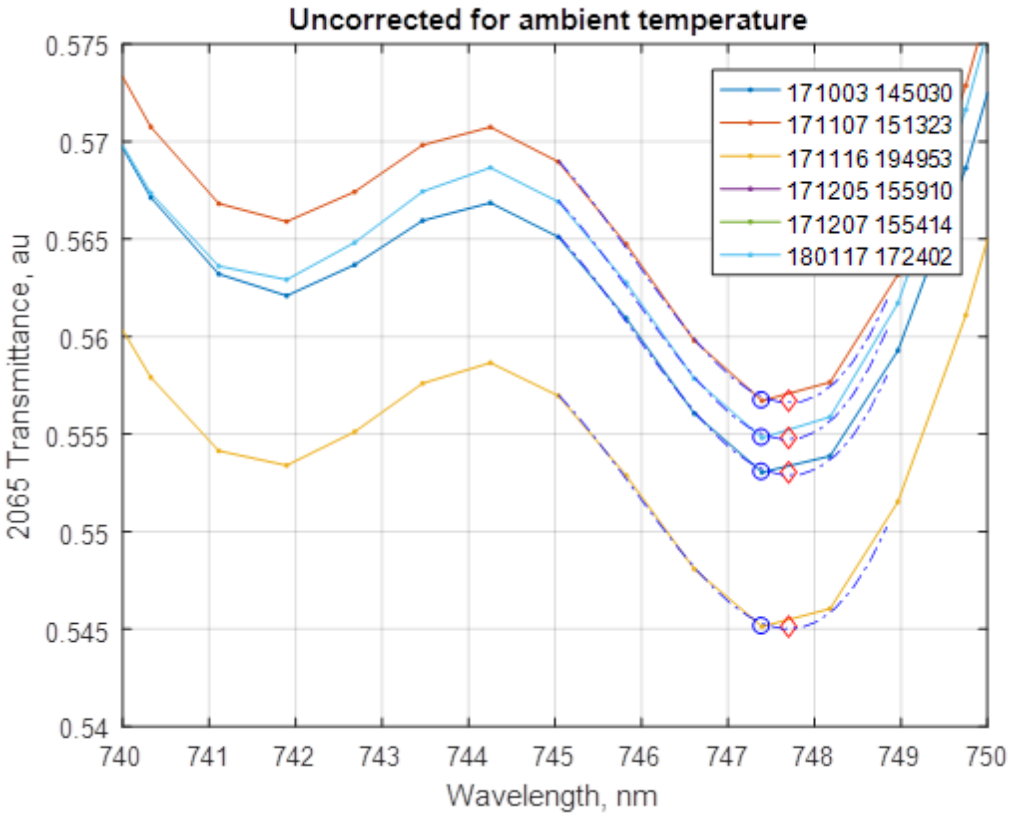
SQM MED - Latest

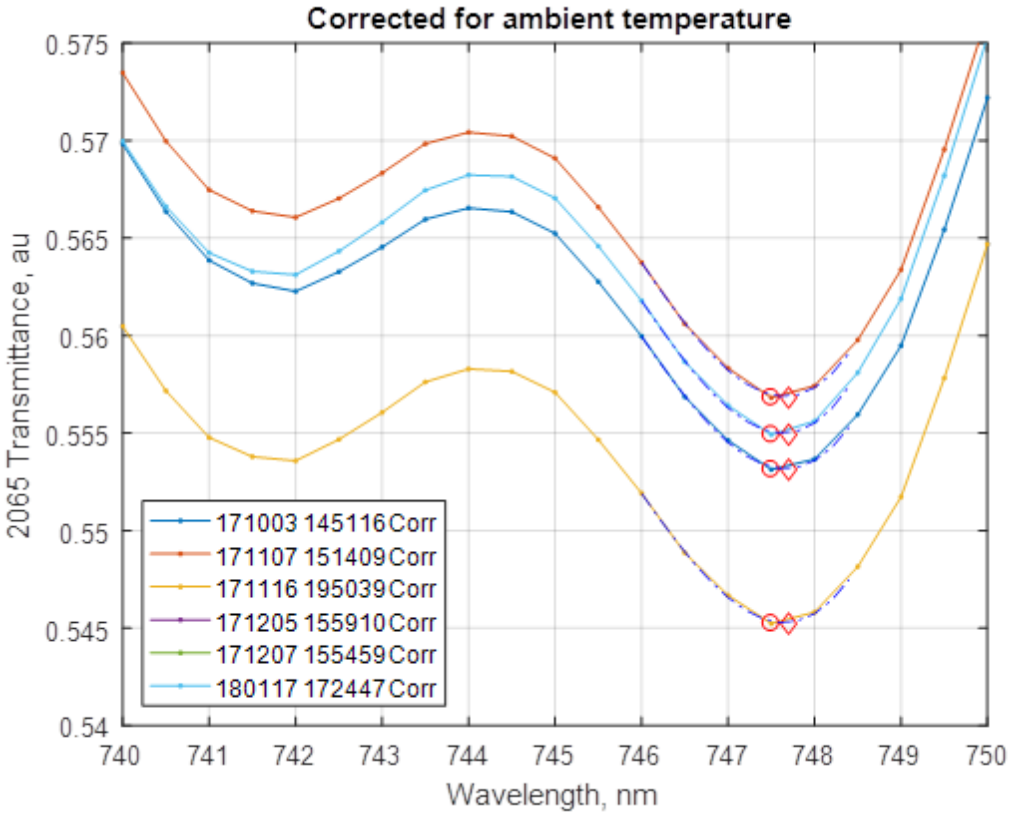


The high ones are outside and back inside at UM (16 and 19 h on Dec 6; with SQM LO we did the test with the black cloth covering the SQM outside and that is the third high one on that plot. The scans in these plots are referenced to the initial scan at NIST on Oct 20.

Since even with the corrected, there was still a little blip at the NIR feature, I decided to take a look at the scans of the SRM 2065 that bracketed this test. We did not do the SRM outside, but we do have scans before and after; the after is for the Dec 6 when we came back inside and the signals were too high. I wondered if the instrument just shifts mechanically with movement, changing the wavelength scale.

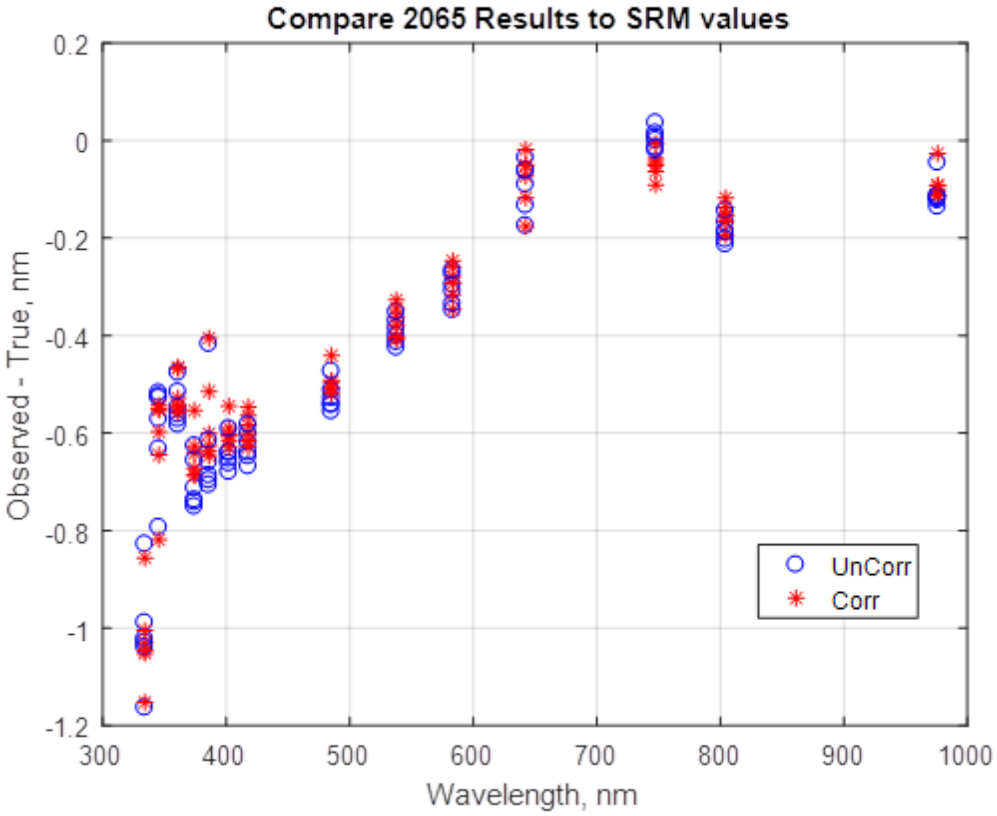
The first two plots below are a blow up of one of the SRM lines (google NIST SRM 2065 certificate). The diamond is where it is stated to be for a 3 nm bandpass, the circle is the nearest neighbor and defines bracket reference point (e.g. +2 and -3 defined the range), the dots+line are the CAS measurements, and the dash dot line is a poly3 fitted for the selected region. The guidelines call for the fit to be only 5 points, but since the wavecal is off I had to increase to 6 points and make the bracket asymmetric. I plotted this one line because it is an outlier (see the last two plots) but I don't see anything obvious in the fit to explain. I took the derivative of the fitted poly3 and found the positive root of the quadratic to get the measured position.



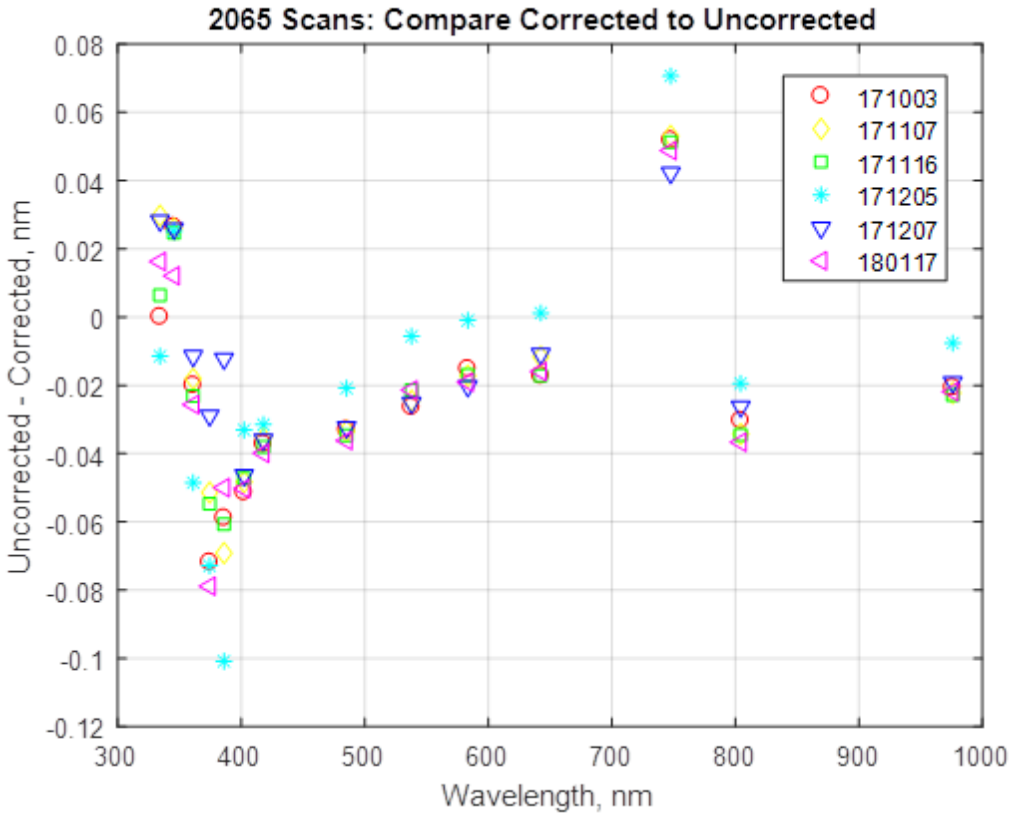


This plot shows the error in the CAS wavecal using this method. It is important to recall that the

correction for wavelength shift with temperature was found to be independent of wavelength from the chamber data results. Regarding ambient temperature, the SRM certificate explains the NIR band at 976 (which I use) depends on filter temperature; it does not give a temp co for the absorption lines in the vis so I assume we are ok there.
For all these data sets, the ambient temperatures used for the correction were between 23.17 and 24.4 deg C and the shifts seem in line with expectations from the characterization work.



This figure shows the difference from the thermal correction to the wavelength and responsivity scales. Now you can see why I looked more closely at the 747.7 absorption line.



Conclusions:

The fitted absorption peaks do not depend on experiment day or laboratory. The cyan stars on the above plot are for when we had to hold the Lu CAS head in front of the NPR for a reference scan, and then hold the filter in front of the Lu head while still aiming at NPR. So this may have caused some shift if there was filter tilt?

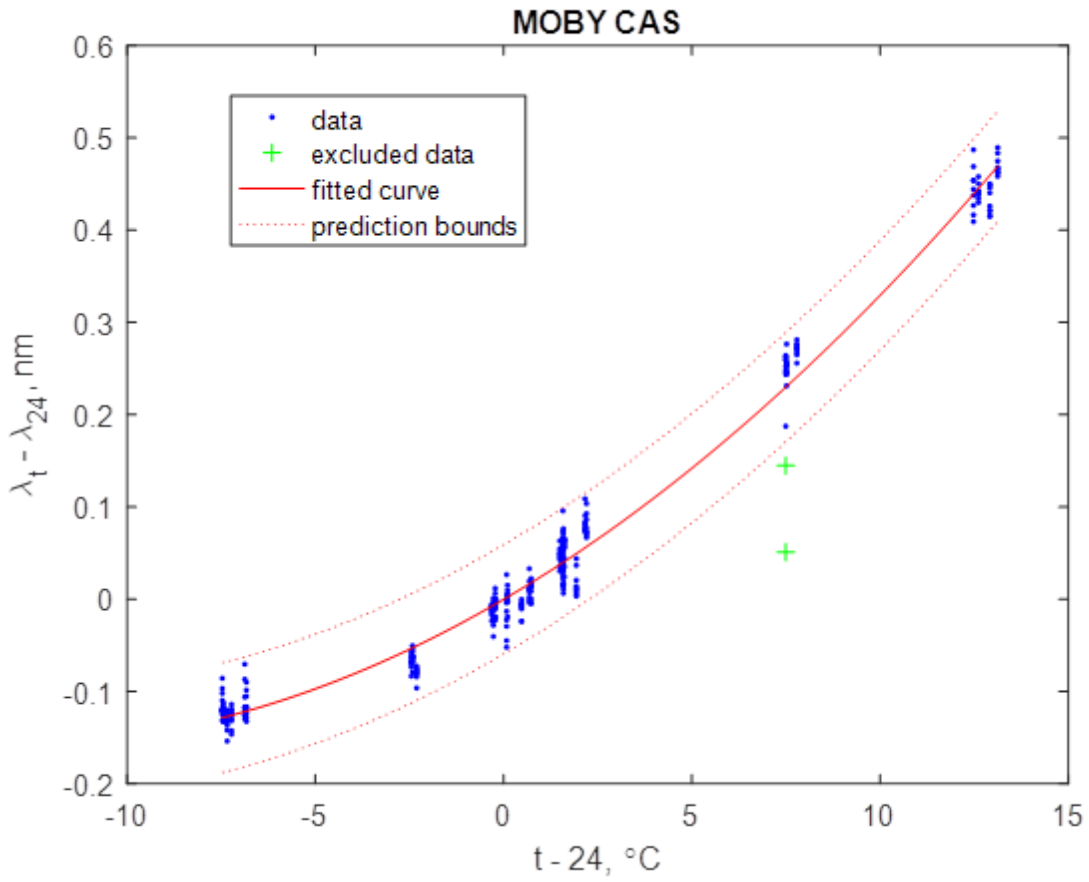
The blip in the scan ratios may be coming from the CAS optical fiber bundle. It may be sensitive to temperature or ambient humidity or flexing of the bundle etc. During the CAS thermal tests, we had about ½ of the fiber bundle inside the chamber and I don't know if is is worthwhile to try to just measure the fiber bundle transmittance. But we could do this.

So we still have an unresolved issue. I propose we show these results to Justin and see if we want to send the MOBY CAS to them for a look see and possible refurishment / upgrade to the D model.

Another possibility is there is something funky going on in the Lu head I designed, like it is extremely sensitive to alignment (lens to fiber bundle). The only way to check this is to reconfigure it and start a new time series. Or maybe Clarennce could run some models.

Thoughts??

PS this is the temp co of the wavelength



B. Carol Johnson, Physicist
Sensor Science Division
NIST
100 Bureau Drive MS 8441
Gaithersburg, MD 20899-8441
Tel. 301-975-2322
Fax. 301-975-2884
cjohnson@nist.gov
carol.johnson@nist.gov