FISH instrument problems

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The purpose of this document is to give a quick overview of some of the problems which were seen with the FISH instruments. Mostly so we don't forget. Some of the "problems" will overlap. So keep that in mind. These are just quick over views the problems, more details are in the websites listed.

The experiment is the September 2013 shadowing experiment and the all other data collected to characterize the instrument. The website for this experiment is http://data.moby.mlml.calstate.edu/moby2_testing/20120903_shadowing/resonon/resonon.html

1) Data drop-outs

These appear to have only happened during the beginning of the Sept 2013 trip. So they are probably just part if the initial programing and instrument development.

During the 20120909 OL420/LED data set collected by Mike I found that for Track 8 there was a ~4000 (ADU/pix/sec) drop which was about 10%. After looking at the matrices you can see that there was a readout problem with Track 8 on image 7. I rewrote my program to removed any tracks with zeros in them.

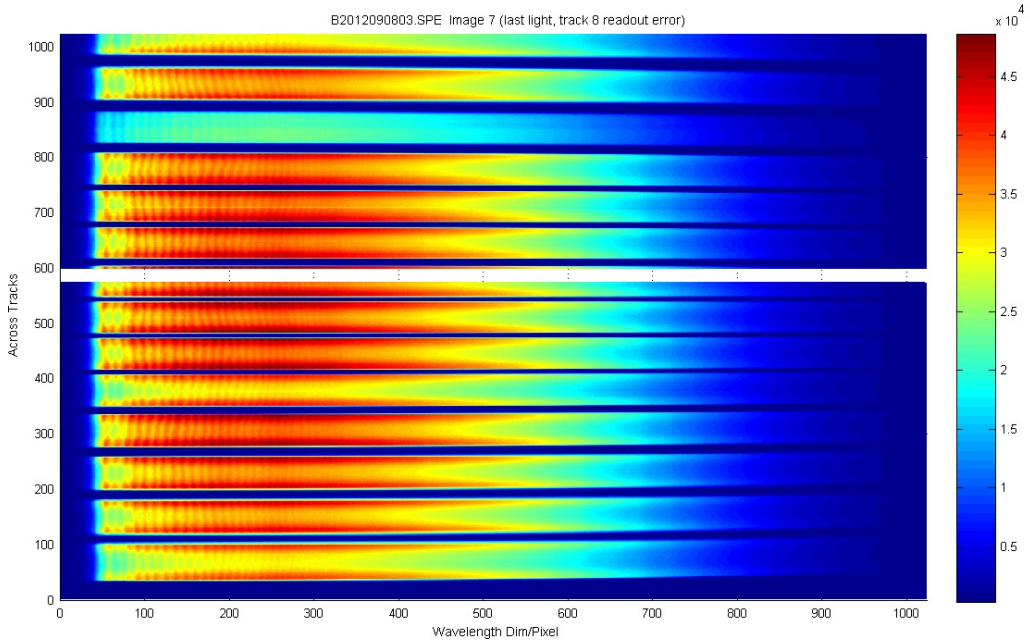
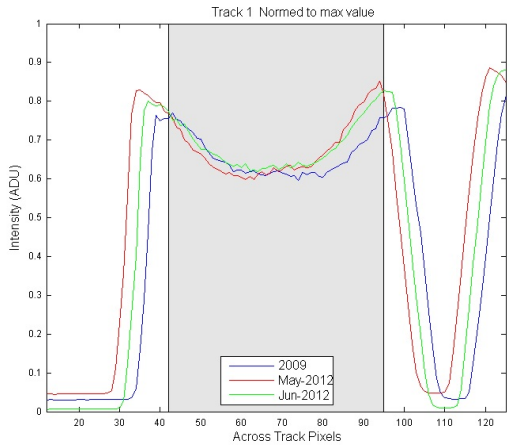
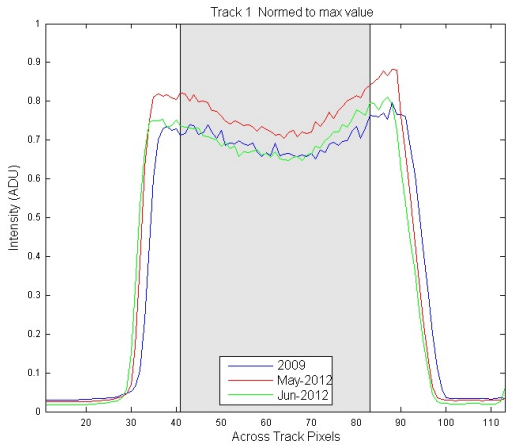


Figure 1. Image showing the data drop-out (white area) which are all zeros.

Website:
http://data.moby.mlml.calstate.edu/moby2_testing/20120903_shadowing/resonon/20120908_OL420/plt_track_readout_error_/checktracks.html

2) Tracks moving

When comparing the tracks from three different experiments: NIST in 2009, Hawaii May 2012 and Sept 2013 data the tracks had shifted significantly. The movements were much larger for the blue spec and for the red spec. The figures below show the shifts for Track 1. When looking at the data collected during the Sept 2013 experiment, it does not appear as if the tracks moved. So at lest within this experiment the tracks were stability.

	
Track 1 for the blue spectrograph	Track 1 for the red spectrograph

Website: Blue spec
http://data.moby.mlml.calstate.edu/moby2_testing/20120903_shadowing/resonon/res_prcdata/plt_blue_comp_checktracks_/plt_blue_comp_checktracks_.html

Website: Red spec
http://data.moby.mlml.calstate.edu/moby2_testing/20120903_shadowing/resonon/res_prcdata/plt_red_comp_checktracks_/plt_red_comp_checktracks_.html

Sept Exp Track stability Website:
http://data.moby.mlml.calstate.edu/moby2_testing/20120903_shadowing/resonon/res_prcdata/plt_chktrcks_/plt_chktrcks_.html

3) Grey Plaque experiment

During the grey plaque experiment on Day02 even with the data normalized to the Es data the different track gave different values. This could be the system response or other light variations not accounted for in the Es. This may not be a real problem but I bring it up because Dennis noticed a problem with the BSG data in the in-water data, which may be related.

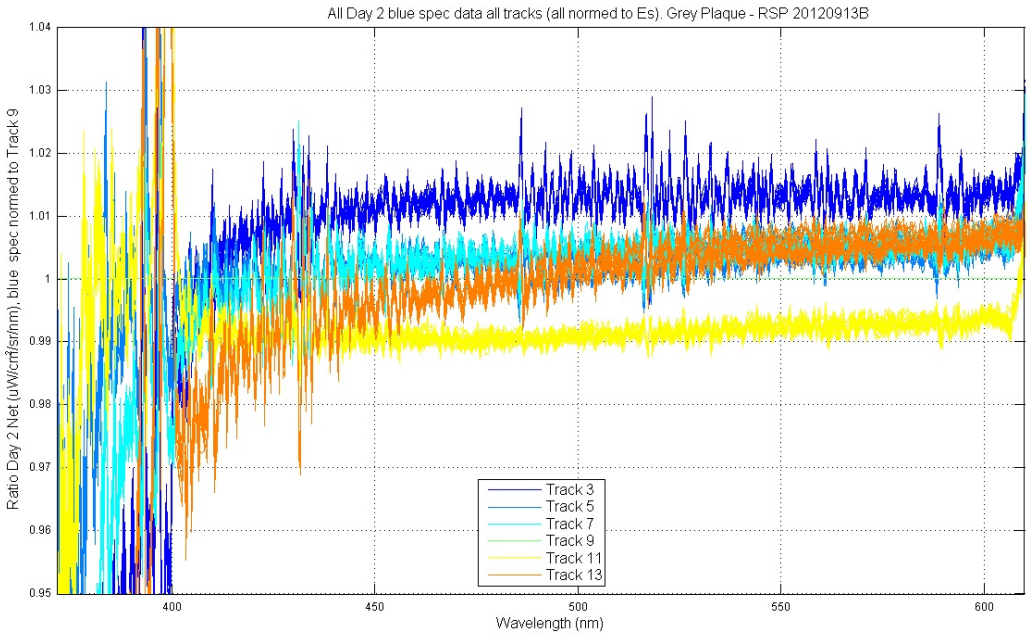


Figure 4. BSG grey plaque data normalized to Track 9.

Website BSG:
http://data.moby.mlml.calstate.edu/moby2_testing/20120903_shadowing/resonon/res_prcdata/plt_plaque_bsg_/plt_plaque_bsg_.html

Website RSG:
http://data.moby.mlml.calstate.edu/moby2_testing/20120903_shadowing/resonon/res_prcdata/plt_plaque_rsg_/plt_plaque_rsg_.html

4) Dark less than zero - Blue spec only

On Day 2 grey plaque data I noticed that a lot of the darks for the lower track numbers were zero or very close to zero. In theory the bias should keep this from happening. The big question on this one is what happened to the bias? We did not see this on the red spec. This happened though out the Sept 2013 experiment.

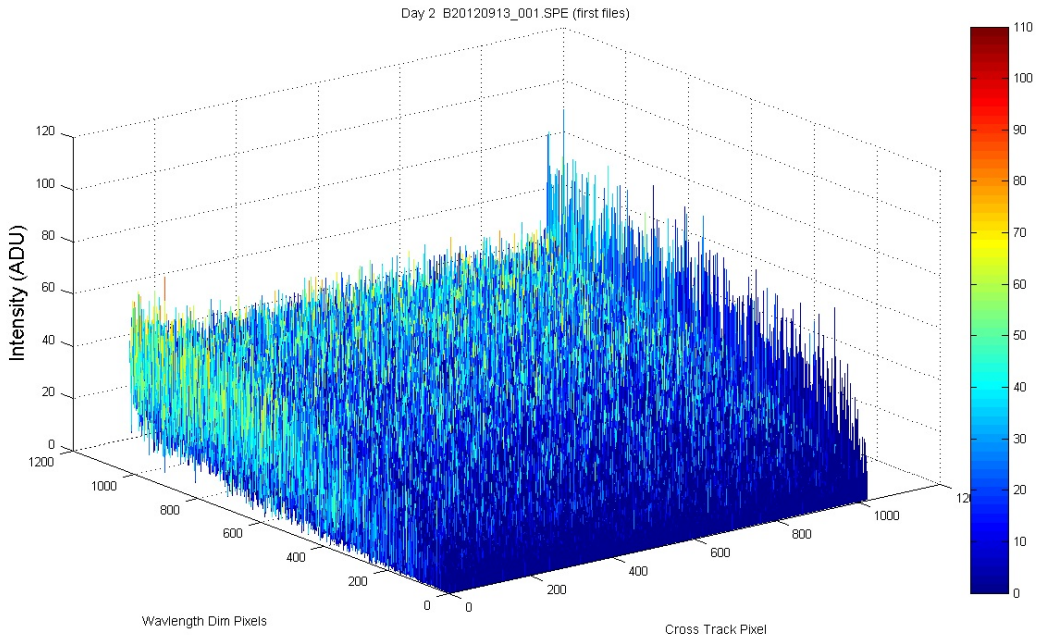


Figure 5. Dark image from Day 2 plaque data showing lower track number's dark at zero.

Website:
http://data.moby.mlml.calstate.edu/moby2_testing/20120903_shadowing/resonon/20120913_Day02_plaque/plt_darkchk_/plt_darkchk_.html

5) Blue and Red spec respond differently to gain and rate changes

On Day04 darks were collected on the red and blue spec at 1 second integration time but at different Gains and Rates. Below are the plots. For the RSG the changes are pretty minor and it seems like the bias does not move, only the shape changes. It is a different story on the BSG. The 100kHz rate looks good and the bias seems stable but when you change to the 2 MHz rate it looks like the bias is either gone or becomes variable. This does not seem right.

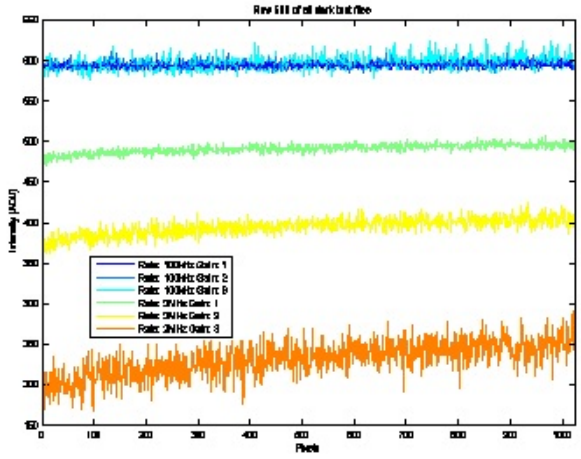


Figure 6

BSG darks by gain and ADC rate

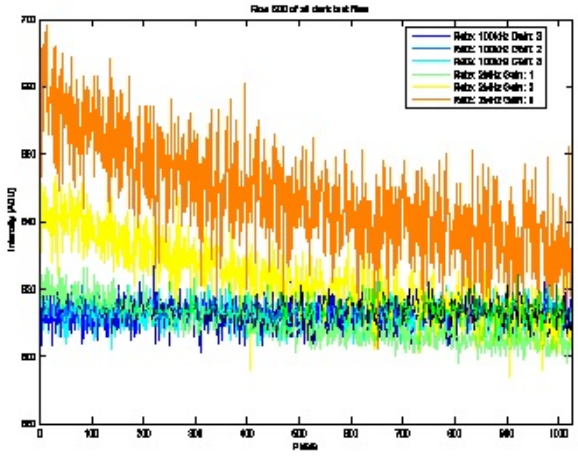


Figure 7

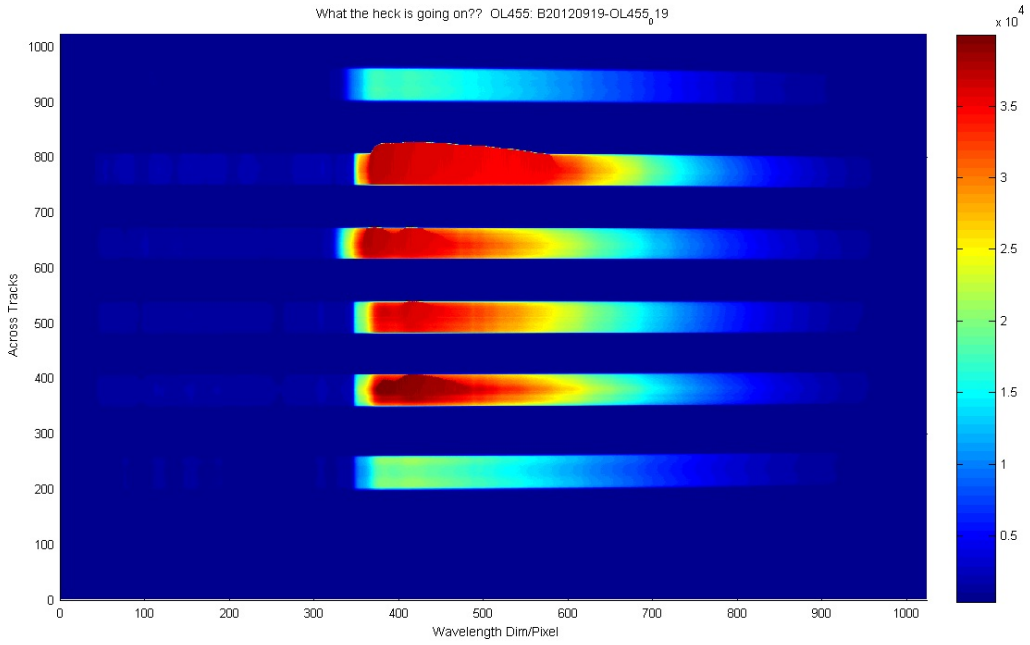
RSG darks by gain and ADC Rate

Website BSG:
http://data.moby.mlml.calstate.edu/moby2_testing/20120903_shadowing/resonon/20120915_Day04_darktest/checkdarks_gain_rate_/checkdarks_gain_rate_.html

Website RSG:
http://data.moby.mlml.calstate.edu/moby2_testing/20120903_shadowing/resonon/20120915_Day04_darktest/checkdarks_gain_rate_red_/checkdarks_gain_rate_red_.html

6) Blooming problem and saturation at Gain 1

When the Gain is 1 and the Rate is 2 MHz the data are saturated lower than the 65,000 ADU level. And when they saturate they "bloom" in the track direction. The value at which the date saturates is spectral. I.E. it is not the same value for all wavelengths, there is shape to it. This means that the Gain setting really have no practical use.



Website:
http://data.moby.mlml.calstate.edu/moby2_testing/20120903_shadowing/resonon/20120919_Day07_OL455/plt_20120919_file19_problem_/plt_20120919_file19_problem_.html

Second site:
http://data.moby.mlml.calstate.edu/moby2_testing/20120903_shadowing/resonon/res_prcdata/plt_comp_blooming_data_/plt_comp_blooming_data_.html

7) Occulted Es measurements

Occulted Es measurements make using the HyperPro Es sensor did not match the model. One FISH occulted data set was closer to the model, a bit higher. A look at older data sets show they match with the HyperPro data better than the FISH data. So this leaves us with the question is the model too high and the HyperPro is correct or is the Model and FISH correct and all the other instruments wrong. Still working on this one.

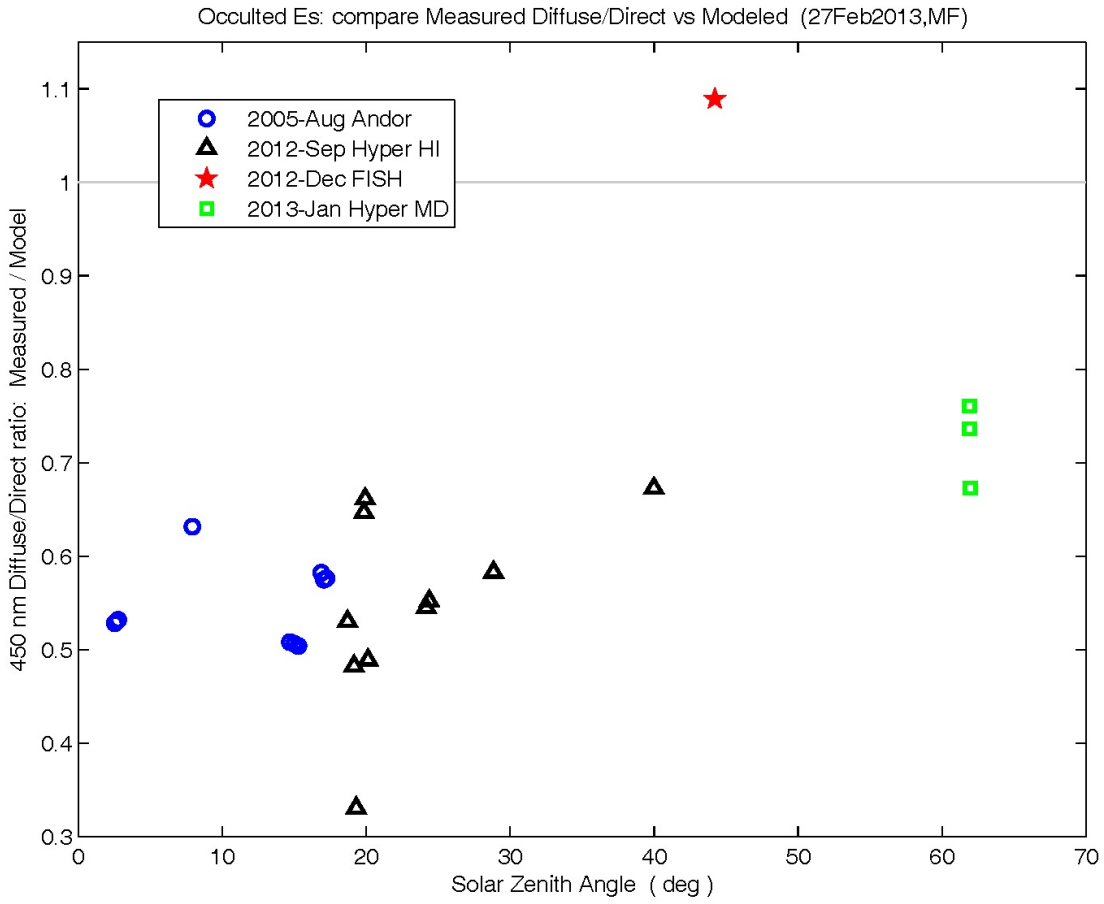


Figure 9. Ratio of instrument occulted measurements to the model at 450 nm.

Website:
http://data.moby.mlml.calstate.edu/moby2_testing/20120903_shadowing/resonon/resonon.html

On the Resonon website above see Experiment numbers 3.01 through 3.09.

8) Linearity

Note sure where we left off on this so it might not be a problem. But I am not sure if we can to any conclusions about what data was not linear and needed to be fixed or chucked (if any).

Website:
http://data.moby.mlml.calstate.edu/moby2_testing/20120903_shadowing/resonon/resonon.html

On the Resonon website above see Experiment numbers 50.01-50.08

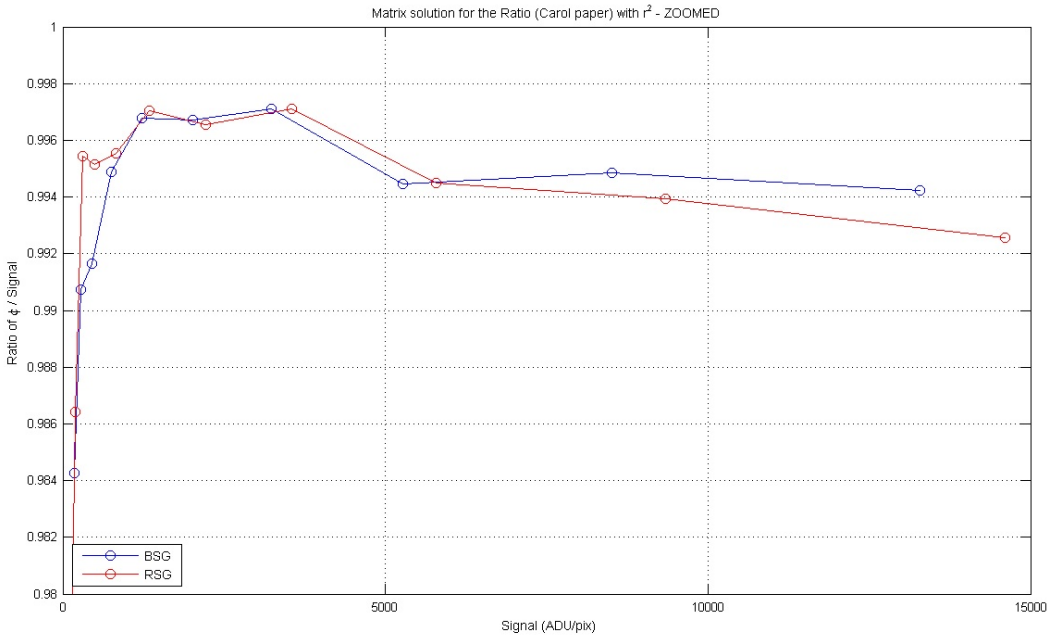


Figure 10. From experiment number 50.07 on Resonon page

9) Darks way to sensitive to Ambient Temperature

During the whole experiment the darks have been all over the place, the blue spec being much worse than the red spec (at lest there the bias level is concerned). I had plotted the data verses the internal thermistors and there did not seem to be a relationship. But then on 24 Jan 2013 Mike did a linearity experiment and the darks went up and down in a saw tooth pattern. When I looked at the temperatures the Ambient Temperature were going up and down in a saw tooth pattern but the internal temperatures were not. The Figure below shows the darks from that experiment. See the intial website link below for more details.

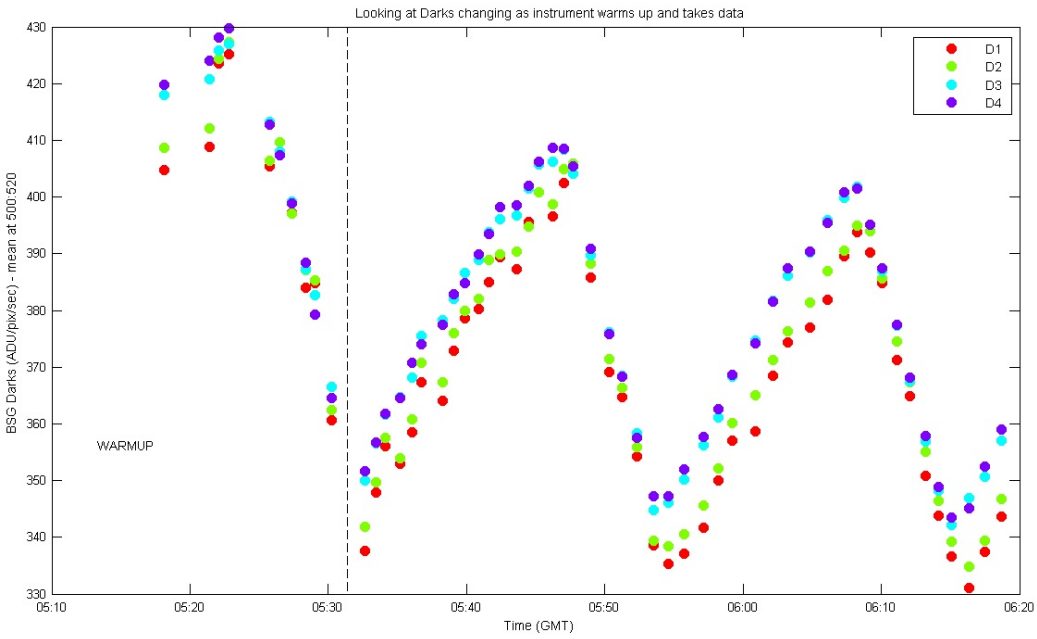


Figure 11. Darks collected during the linearity Experiment on Jan 24, 2013

Intial Problem Seen:
http://data.moby.mlml.calstate.edu/moby2_testing/20120903_shadowing/resonon/20130124_linearity/plt_darks_/plt_darks_.html

So I decided to plot the darks verses ambient temperature and it turns out there is a really strong relationship with ambient temperature (See next page for figures and web links). This is one of the reasons the darks were going negative. On the good side darks increase with integration time. But they decrease with increasing temperature. There are a number of problems with that. One the CCD is cooled to -70 C (at lest this is what we set it too). So the darks should barely change. And they should not be affected this much by ambient temperatures. Mark said this is more likely the other electronics and converted being affected by the temperatures.

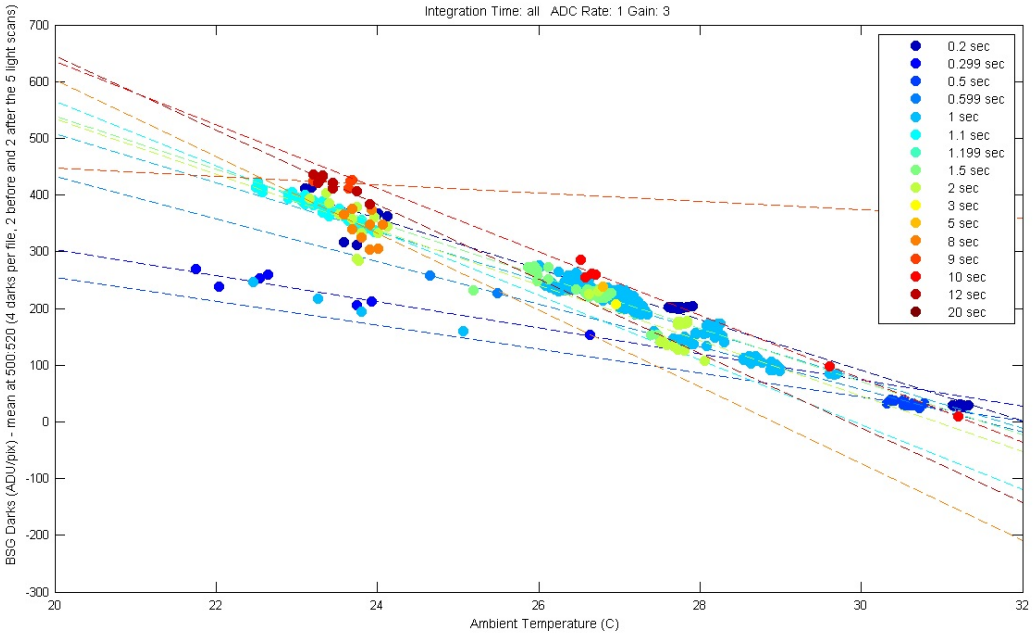


Figure 12. Darks (ADU) verses Ambient Temperature for different integration times

Website BSG:
http://data.moby.mlml.calstate.edu/moby2_testing/20120903_shadowing/resonon/res_prcdata/plt_darks_vs_time_adu_/plt_darks_vs_time_adu_.html

Website RSG:
http://data.moby.mlml.calstate.edu/moby2_testing/20120903_shadowing/resonon/res_prcdata/plt_darks_vs_time_adu_/plt_darks_vs_time_adu_.html

10) LED's not nearly stable enough

Mark and Mike installed a ThorLabs Coolwhite LED to monitor stability. To use the LED to monitor stability the LED needs to be stable and it was not. Also because of the cross track from 14 to 13 very early on we stopped having the LED on all the time. So for a lot of data track 14 was only collected occationally.

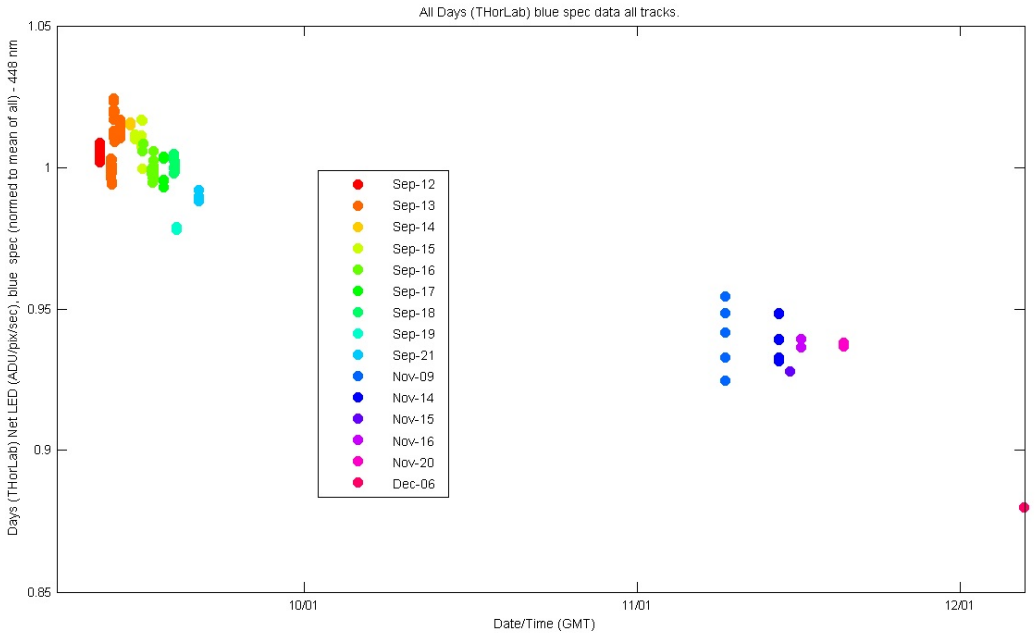


Figure 13. Time series of Track 14 LED data for all data collected.

Website:
http://data.moby.mlml.calstate.edu/moby2_testing/20120903_shadowing/resonon/res_prcdata/plt_led_data_/plt_led_data_.html

11) For the blue spec the deeper bare fiber is higher in the blue and the shallow bare fiber in the blue spectral region.

Dennis noticed that a large percent of the time the deeper bare fiber was higher than the shallow bare fiber (Track 9). We tried looking at a number of different reasons this might be, including the different system response, darks, relative responses with no success. Dennis recalled that is was also the case on other shadowing attempts in the past. The pattern seems odd.

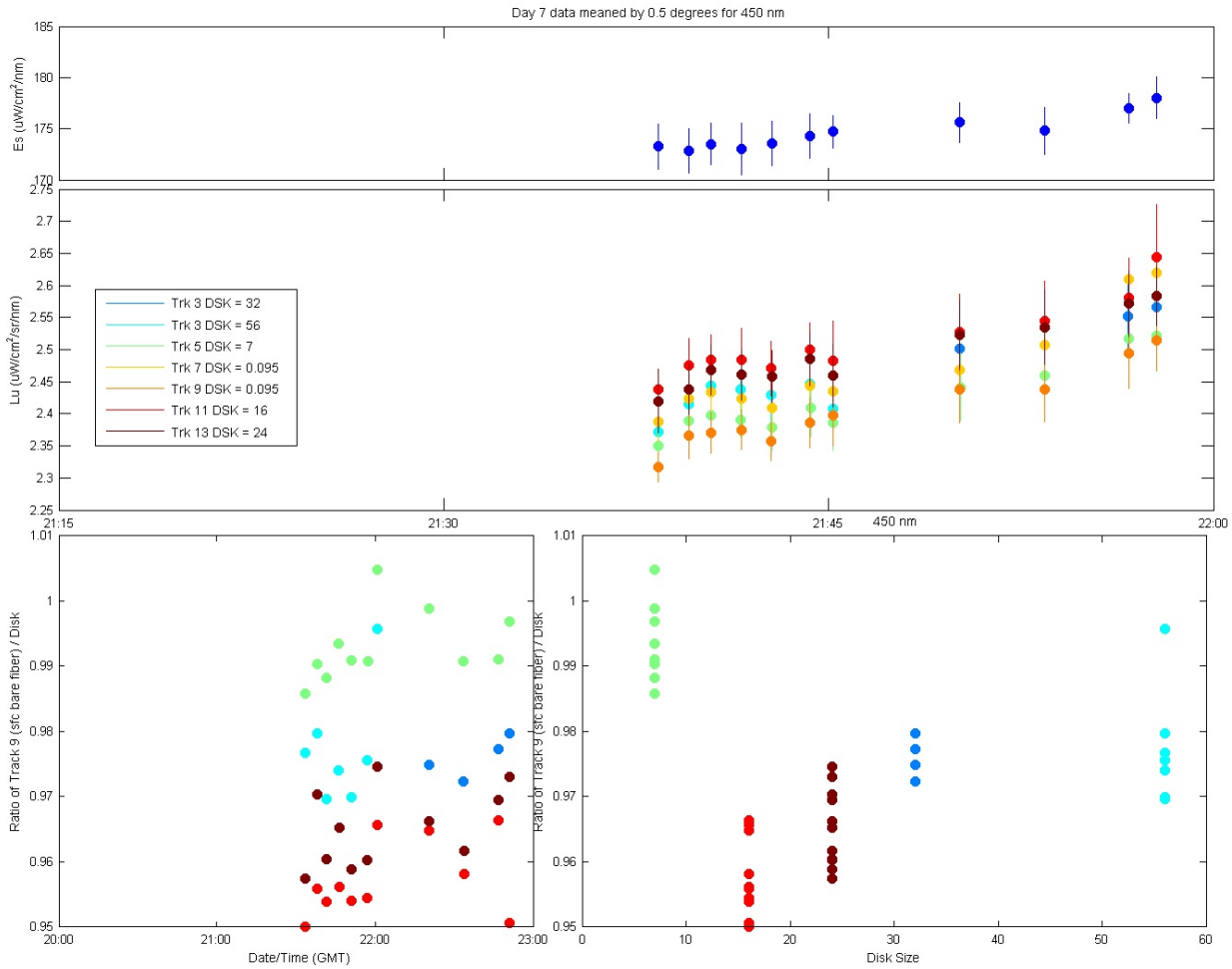


Figure 14. Day 7 data were grouped by zenith angle a mean and std was calculated for 450 nm. The top graphs shows the Es data and second graphs shows the Lu data (vertical lines are the std). The lower left graphs shows the ratio of track 9 to the tracks with disks. And the lower right graphs shows the same ratio but verses disk size.

Day 7 website:

http://data.moby.mlml.calstate.edu/moby2_testing/20120903_shadowing/resonon/day_data/day7/plt_day7_netfull_dennis_xls__Day7/plt_day7_netfull_dennis_xls__Day7.html

12) RSG Darks jumped from ~600 ADU to 13,000 ADU

For some unknown reason on day 6 the RSG in-water data being collected at 8 sec, Gain 3 and Rate 2 MHz jumped from ~600 ADU to over 13,000 ADU. This happened after the fork was pulled back to ship and the disk changed out and the fork was put back in the water. Mike does not note any anomalies on his log sheet. I checked the light data and compared the red and blue spec data (blue spec did not have this problem) and the red data looked good.

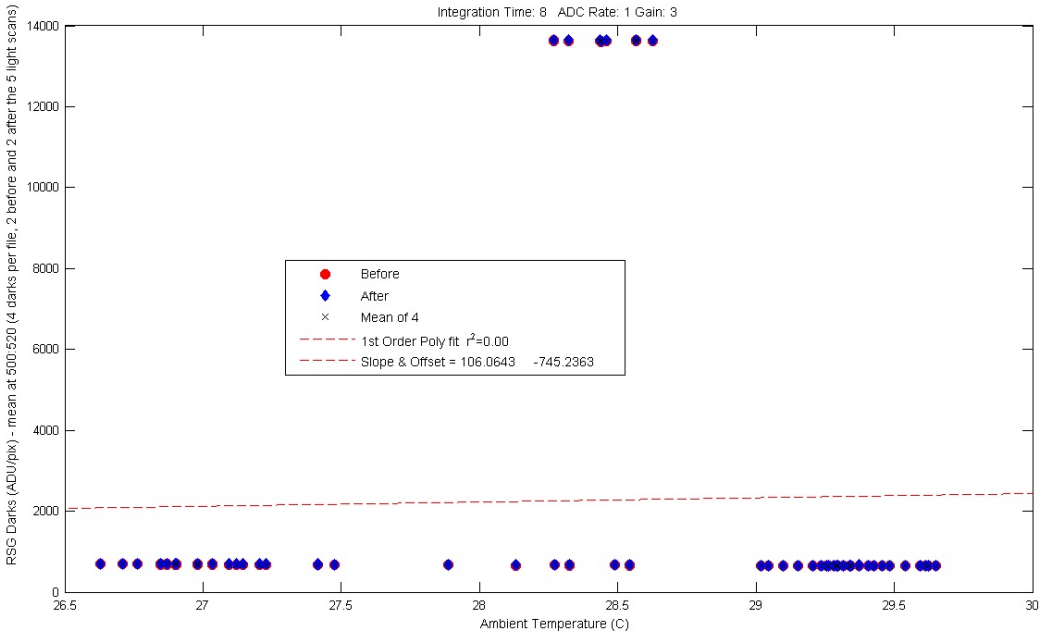


Figure 15. RSG darks jump from Day 6 in-water data

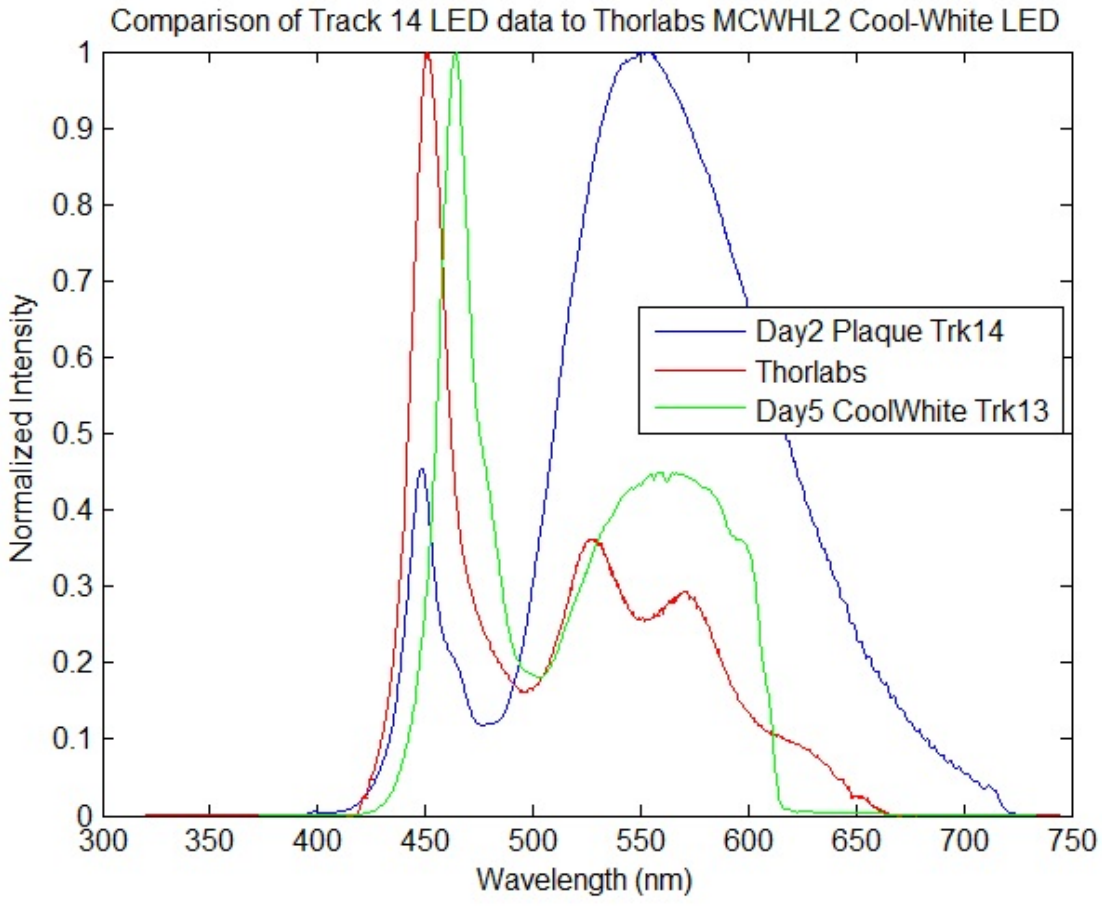
Website darks vs time and temperature:
http://data.moby.mlml.calstate.edu/moby2_testing/20120903_shadowing/resonon/res_prcdata/plt_red_darks_vs_time_adu_/plt_red_darks_vs_time_adu_.html

Website Raw data:
http://data.moby.mlml.calstate.edu/moby2_testing/20120903_shadowing/resonon/20120917_Day06/20120917_Day06_net.html

13) Which LED did we have on Track 14.

Is the track 14 LED really the ThorLabs CoolWhite LED. The track 14 data does not look the Thorlab spectra. So is it the Track 14 system respsonse or something else. Or is the Thorlabs spectra wrong.

Mike's email info on the Track 14 LED.
The FISH track#14 LED is a Thorlabs Cool White LED (6500 K colour temp.) - Mod: MCWHL2, S/N: M00248703. Run via a Thorlabs LED Driver LEDD1B - mode = CW (not MOD), 1.2 A current limit setting - shining into a small (~3 cm dia) Ocean Optics integrating sphere labeled "RSL 2" - which came from B.Carol. coupled to an Ocean Optics bifurcated fiber optic - FO# OOS-001887-03 (probably 600 um UV-VIS ?) - the two ends of which are connected to the shutter blocks - I.E. this LED does NOT pass through a dichroic beam splitter ! I think the "Cool White" is achieved by tuning the brightness of Blue LED vs a Green & Red - more blue = "cool", less = "warm". There may be some phosphor involved ? The OSRAM mfg. specs. only say that the CIE colour coordinates are x=0.31, y=0.32, @ 6500 K - nothing about the composition of individual LEDs...



Cd G:\zflora\mldata\MOBY2\20120903_shadowing\Resonon\docs
plot_cool_white

14) "Why is binned bias level at a different ADU when the single pixel bias.

Mark did a dark experiment to see how the darks work with CCD and ambient temperature when the darks are binned. There is a file for the BSG and the RSG. For the BSG, why is binned bias level at 3000 ADU when the single pixel bias is 250 ADU and the ambient temp correction is 38ADU/deg. For the RSG, Why is binned bias level at 1241 ADU when the single pixel bias is 660 ADU and the ambient temp correction is 9.6 ADU/deg. The binned darks bias should be the same as the single pixel bias also why are the red and blue specs so different in their bias level and temperature correction. The ADU for zero dark current bias (CCD below about -50 C°) should be the same for binned vs unbinned pixels.

The only complications (If I remember this right is the software required and update to run and Mark used another software package, name?).

Blue Camera
Serial Number 1205080003

2 mHz .200 Sec Hdw Bin All Rows Single pixel mean
High Gain 1X1024 256 ADU @ 28.0
Experiment to show temperature sensitivity of the zero dark current bias level

CCD Temp	Amb Temp	ADU mean	SD
0	24.7	7932	160
-10	24.7	4180	
-20	24.7	3358	
-30	24.8	3194	
-40	24.8	3177	
-50	24.8	3170	
-60	24.8	3162	
-70	24.9	3168	
-80	25.4	3171	
-80	29.0	3026	
-80	29.1	3014	
-80	29.2	3005	
-80	29.3	3001	
-80	29.5	2991	
-80	29.7	2975	
-80	29.9	2968	
-80	30.0	2959	
-80	30.2	2950	
-80	30.5	2927	
-80	30.8	2913	
-80	31.0	2902	
-80	31.2	2900	
-80	30.8	2919	

-80	30.6	2928
-80	30.4	2938
-80	30.1	2955
-80	29.9	2969
-80	29.7	2978
-80	29.0	2998
-80	28.9	3004
-80	28.6	3013
-80	28.5	3010
-80	28.5	3005
-80	28.4	3018
-80	28.4	3017
-80	28.3	3026

Tempco on zero dark Bias level @38 ADU/C° (abient)
Why is binned bias level at 3000 ADU when the single pixel bias is 250 ADU

Excel spread sheets can be found at:
BSG website: http://data.moby.mlml.calstate.edu/moby2_testing/Doc/BlueCCDBias.xlsx
RSG website: http://data.moby.mlml.calstate.edu/moby2_testing/Doc/RedCCDBias.xlsx