

**Subject:** Re: Test data from Herbarium C  
**Date:** Wednesday, March 13, 2024 at 16:23:12 Central European Standard Time  
**From:** Chelsea Alene Graham  
**To:** Kim Steenstrup Pedersen  
**Attachments:** image001.jpg, image002.jpg

Thank you very much, Kim!

Matilde focused on building the final enclosure cover today. She will take a test image to see how the different material may have impacted the environment in the enclosure. Rebekka will start re-imaging tomorrow.

The annotated images are in my comment **highlighted in green below**

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**From:** Kim Steenstrup Pedersen <[kimstp@di.ku.dk](mailto:kimstp@di.ku.dk)>  
**Date:** Wednesday, March 13, 2024 at 10:24  
**To:** Chelsea Alene Graham <[chelsea.graham@snm.ku.dk](mailto:chelsea.graham@snm.ku.dk)>  
**Subject:** Re: Test data from Herbarium C

Hi Chelsea

See my response below.

By the way, we should have a look at the pinned insect images as well when we are done with the herbarium setup.

On 12 Mar 2024, at 16.13, Chelsea Alene Graham  
<[chelsea.graham@snm.ku.dk](mailto:chelsea.graham@snm.ku.dk)> wrote:

Thanks a bunch, Kim.

I've been out at Priorparken with Sara today setting some things up and taking some tests. Besides a lamp power source going out for no apparent reason, things have been going smoothly (luckily, we have an extra set of lights for the next workstation, so we can use one of their power sources while contacting our supplier about this issue).

Please see my responses **highlighted in blue below** 😊 I would appreciate your feedback on the test data point (second to last). If you have a preference as to the shutter speed, it would be helpful to know as soon as possible. Matilde will be at Priorparken tomorrow and Jesper on Thursday. Matilde can spend a little time on the workstation enclosure in the morning,

but it would be great if we could get her to kick off the re-digitization tomorrow afternoon or on Thursday morning.

mvh  
Chelsea

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**From:** Kim Steenstrup Pedersen <[kimstp@di.ku.dk](mailto:kimstp@di.ku.dk)>  
**Date:** Saturday, March 9, 2024 at 18:02  
**To:** Chelsea Alene Graham <[chelsea.graham@snm.ku.dk](mailto:chelsea.graham@snm.ku.dk)>  
**Subject:** Re: Test data from Herbarium C

Hi Chelsea

I can see that it takes time to load the 600MB TIFF images, but we have to live with that :-)

See my answers and questions below:

On 8 Mar 2024, at 13.43, Chelsea Alene Graham <[chelsea.graham@snm.ku.dk](mailto:chelsea.graham@snm.ku.dk)> wrote:

Dear Kim,

Just as a follow-up from our meeting about evenness of illumination and calibration out at Herbarium C, I wanted to share the following data with you and ask for your input.

### **ILLUMINATION**

Summary: We strive to achieve even illumination across the subject.

Task: <https://github.com/NHMDenmark/Herbarium-Sheets-workstation/issues/56#issuecomment-1966410170>

Matilde and Jesper worked together to physically move the aluminum profiles and lamps to achieve a luminance with a deviation of 11 units on 28 February. Although above the 8 units that Rijksmuseum uses as their tolerance, this is a 4.3% margin of error.

Their data is located here: N:/SCI-SNM-DigitalCollections/DaSSCo/Workflows and workstations/Herbarium/Calibration/20240228\_calibrate\_MJG\_JMJ

**Feedback Requested: *Do you agree that we should strive to hit the 8 unit difference, but accept within 13 units (5% margin of error)?***

Yes, we can live with an up to 5% margin of error / variation across the sheet. I assume you managed to find an optimal angle for the light and we then stick with this - right?

I think we should carry out this test on a regular basis, at least to begin with, just to make sure there is no drifting of the illumination settings. It could simply be to take a photo of white paper and do the check for differences. Maybe once per week to begin with and then maybe less frequent later.

It looks like the shutter speed was set to 1/15 in this test. Does it change if you use shutter speed 1/30?

See discussion below.

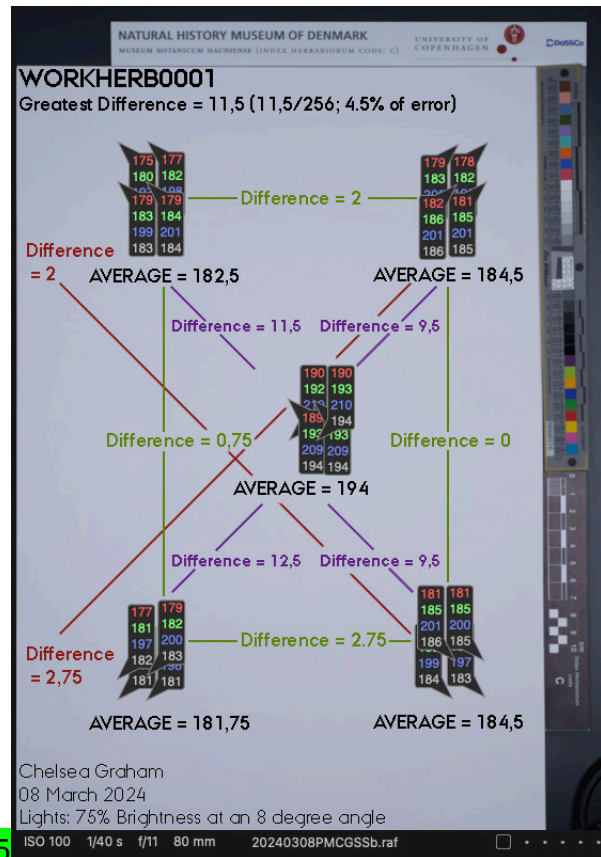
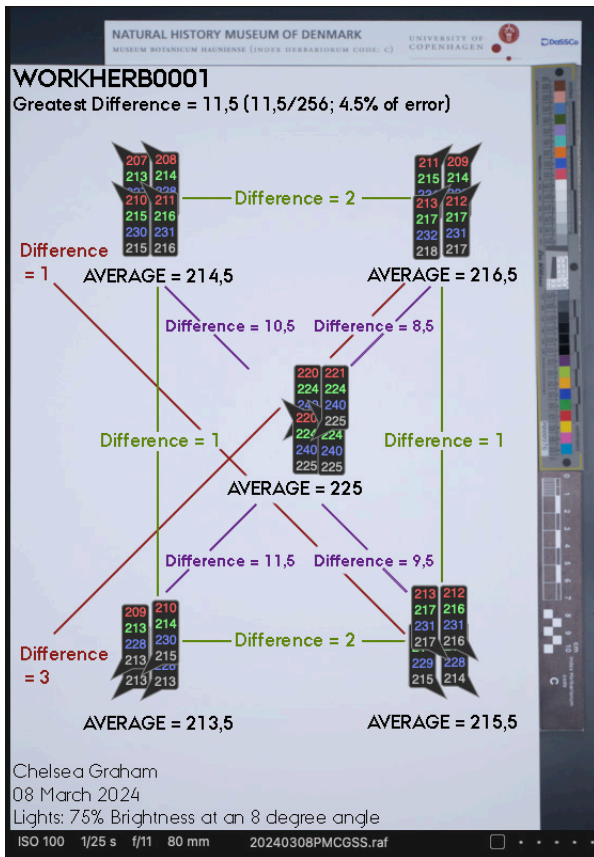
We will operate within the 13 units variance between sampled areas. Matilde and Jesper had the lights angled 10 degrees toward the center, but after the light issue this afternoon, Sara and I had to reestablish the evenness and found that an angle closer to 8 degrees yielded the closest results. I established a temporary protocol for taking a calibration image at the beginning of each session for the rest of the month. I will assess and annotate those images and share them. From there, we can see how often we should calibrate the workstation.

This sounds good.

I took the calibration image at a couple of shutter speeds to test. The shutter speed did not appear to impact the evenness of illumination captured, just took all of the values down consistently. I will annotate the images to be sure and get back to you later this week.

Good to know. The important thing is that we sanity checked this part. I will like to see the images when you are ready.

I made the two annotated versions of the images of the white sheet that were taken at two different shutter speeds for comparison.



1/25

1/40

This data is located N:/SCI-SNM-DigitalCollections/DaSSCo/Workflows and workstations/Herbarium/Calibration/AnnotatedCalibrations

## LINEAR RESPONSE CURVE

Summary: In our meeting, we discussed how Laura Green of Kew suggested that we employ the Linear Response Curve (<https://support.captureone.com/hc/en-us/articles/360002424317-What-is-the-Curve-section-of-the-Base-Characteristics-tool>) to our images before exporting from Capture One. She said that Kew uses it and it is a cultural heritage standard. I see this curve is suggested in the Digital Transitions Color Reproduction Guide ([https://heritage-digitaltransitions.com/wp-content/uploads/woocommerce\\_uploads/2018/12/DTCH-ColorReproductionGuide\\_2018.pdf](https://heritage-digitaltransitions.com/wp-content/uploads/woocommerce_uploads/2018/12/DTCH-ColorReproductionGuide_2018.pdf)) for most flat art reproduction photography. They say, "The linear response curve is linear throughout most of the tonal range, but provides slight compression of bright highlights that preserves tone and color in highlights." it provides a slight compression of the bright highlights

Task: <https://github.com/NHMDenmark/Herbarium-Sheets-workstation/issues/19#issuecomment-1966659985>

Matilde and Jesper imaged 10 herbarium sheets at different shutter speeds 1/15 second (over-exposed), 1/20 second and 1/30 second. They took two images for each – one that they edited using this curve and one that they did not. This way we have examples of before and after and also to ability to see how the curve reacts to an image with exposure warnings.

Their data is located here: N:/SCI-SNM-DigitalCollections/DaSSCo/Pilot Data/Herbarium Working Data/20240228/LinearCurveComparison

Feedback Requested: *Do you agree that digitizers should apply this curve in Capture One before exporting?*

No I don't think we should. I am very suspicious of this linearization done by Capture One. I suspect this is either histogram equalization or gamma correction and both actually alters the pixel values in a non-linear way that may cause loss of information (the process cannot be inverted). If you look at the histograms of each color channel it does a different transformation on each channel which in effect changes the colors in each pixel. So since we do not fully understand how this is computed I would say no to this. We want the raw originals to be changed as little as possible.

The linear images looks nice, but we can do this afterwards in processing on the servers for the web friendly nice version of the original image, if we want to.

The 1/15 images below are overexposed and this cannot be fixed by the linear transform. I checked the histograms and did some statistics. You find an excel sheet and pdfs of color histograms in N:/SCI-SNM-DigitalCollections/DaSSCo/Pilot Data/Herbarium Working Data/20240228/LinearCurveComparison/Kims\_Stats

An image is overexposed if there are many pixels that are saturated at the maximum value that can be represented in each channel at a pixel. In our case the camera uses 16 bit unsigned integers which means the maximum value in each channel is 65535 ( $=2^{16}-1$ ). If RGB all have maximum value this means the pixel is white. Similar an image is underexposed if there are many black pixels (that is RGB all have value 0) and the color histograms are shifted towards small values. In our case we have trouble with some of the shutter speed settings leading to overexposure.

Check out the columns in the spreadsheet called “#Saturated pixels in ...” and especially the one called max (org and lin refers to the original and the linear transformed version called edit in file names).

For the 1/15 images you can see a high max count and you can even see it in the histograms as peaks at the max value of 65535

The 1/20 and 1/30 images are also overexposed but slightly less with in the order of 10 pixels in the 1/30 images hitting the maximum value. Looking at the histograms the total range of pixel values are better used (spread out through the complete range) when using 1/30 speed. Ok, there are a few cases where it looks like 1/20 is slightly better such at image NHMD\_Herb01\_10.

We should at least use the 1/30 shutter speed setting. Can the camera do a faster shutter speed? E.g 1/40?

We will not elect to include application of the Linear Response Curve to our digitizer pipeline. Thank you for explaining and illustrating the impacts of the curve.

Good.

Those pictures were taken with 100% brightness on the lamps. We have since determined that the lamps are heating up and the heat can be trapped a bit in the enclosure. As a result, we have opted to experiment with 75% brightness in hopes that the lights do not get as hot. We have shifted the shutter speed accordingly. Please see my new comment under FIRST 100 IMAGES below.

Ok, that sounds like a good precaution.

### **OBJECT LEVEL TARGET**

Summary: In our meeting, we discussed how the new lighting reflects off of the color patches on the target and causes distortion of color. We plan to create a new angle that allows for a slight tilt of the color target.

Task: <https://github.com/NHMDenmark/Herbarium-Sheets-workstation/issues/73#issuecomment-1959347892>

Rebekka took a series of images of the bar Object Level Target flat, at a 10 degree angle, at a 20 degree angle and at a 30 degree angle.

Her data is located here: N:/ SCI-SNM-DigitalCollections/DaSSCo/Pilot Data/Herbarium Working Data/20240223/ColorTarget

Feedback Requested: *Do you agree that we should tilt the*

*Object Level Target at a 10 degree angle to retain the integrity of the color values?*

I think the problem is that you are using shutter speed 1/15 when doing this check. To me the 1/30 shutter speed images looks ok with the object target flat (from the above test images), or am I missing something in the details on the target?

Sara and I did a test this AM to be sure. The shutter speed minimally impacted the details visible on the color target when flat angle. The section of patches that range from grays to blacks (visible in the last image) are what is not registering correctly while flat.

<image001.png> 1/15 flat <image002.png> 1/30 flat <image003.png> 1/60 flat <image004.png> 1/15 at 10 degrees

This data is located N:/ SCI-SNM-DigitalCollections/DaSSCo/Pilot Data/Herbarium Working Data/20240312/Tests

I can see that the gray to black looks quite wrong in the flat image, so lets go for 10 degrees title angle.

#### **DEVICE LEVEL TARGET**

Summary: In our meeting, we discussed how we usually capture the large Device Level Target at the beginning of a session, but the new lighting reflects off of the target and causes distortion of color. If we tilt the target, we can incur distortion of geometry on the target.

Task: <https://github.com/NHMDenmark/Herbarium-Sheets-workstation/issues/19#issuecomment-1966557226>

Matilde and Jesper captured images of the Device Level Target flat, at a 10 degree angle, at a 20 degree angle and at a 30 degree angle.

Their data is located here: N:/ SCI-SNM-DigitalCollections/DaSSCo/Pilot Data/Herbarium Working Data/20240228/DeviceLevelTarget

*Feedback Requested: Do you suggest we tilt this target when we image it to get the correct color information, or do you think it is best to capture flat to retain undistorted geometry on the target?*

It is best to capture this flat otherwise it is hard to use it for geometry undistorting. Again if you use shutter speed 1/30 would it lead to less a problem with saturation and representation of the colors?

We will continue to capture the Device Level Target flat.



Good.

### **FIRST 100 IMAGES**

Summary: Sara is out at Priorparken today and is taking a test set of 100 images.

Task: <https://github.com/NHMDenmark/Herbarium-Sheets-workstation/issues/84>

Sara will image 100 herbarium sheets and export a version of the images with usual edits (ICC color profile of the camera, white balance) and then a version with the linear response curve applied. Yesterday, I emailed Bhupjit and Thomas to inquire whether it may be possible for them to prioritize processing this preliminary data from the Herbarium so that it can be ready for you and Pip to assess ASAP, or if there are other considerations. Her data will be located here: N:/SCI-SNM-DigitalCollections/DaSSCo/Pilot Data/Herbarium Working Data/20240308

*Feedback Requested: Do you suggest that we ingest this data and if so, would you like it labeled or handled in a specific way so that you may assess it?*

I had a look at some of the images in the folder you mention and they appear to be at shutter speed 1/30 with an angled object target. But they have been saved as 8 bit TIFF images and I cannot tell whether she applied the linearization or not. Can you check with Sara if the ones in the folder are without linearization?

Lets not ingest this data into Specify until we are absolutely sure the setup is working.

Sara and I looked over the data she captured on Friday today. There was a mistake made in the export as they were indeed 8 bit TIFFs instead of 16 bit TIFFs. She had exported the files with usual edits (ICC color profile created for the camera, white balance using target 13 on the Object Level Target) and then she had created a folder entitled `_ed` where she exported the files with the Linear Response Curve applied in addition.

This afternoon, Sara took another set of preliminary data, taking into consideration your mention of the different, quicker shutter speeds under Linear Response Curve. I asked her to image 20 herbarium sheets at 1/25, 1/30 and 1/40 of a second.



Task: <https://github.com/NHMDenmark/Herbarium-Sheets-workstation/issues/84#issuecomment-1991743518>

Her data will be located here: N:/ SCI-SNM-DigitalCollections/DaSSCo/Pilot Data/Herbarium Working Data/20240312/Shutter speed tests

Feedback Requested: *Do you have a preference as to which shutter speed we should select?*

I just had a quick look at the two sets of shutter speed test images and ran my code on this. It looks like 1/30 speed got a bit darker with the reduced brightness of the lamp which as can be expected

The 1/25 appears to fill up the histogram range nicely. The 1/40 speed is too dark.

Overall I think the 1/30 speed looks the best (Pip agrees). Lets go with this speed.

By the way I started making some code to automate some of these calibration tests. Its in <https://github.com/NHMDenmark/calibration>

I took a quick look at this, but I think that it would be best for me to chat about with you to better understand. 😊

No worries.

Mvh,

Kim

Mvh,

Kim

I know that I have provided a lot of information, but it would be very helpful to have your thoughts before Tuesday or Wednesday of next week, if at all possible.

I will plan to be at Priorparken on Monday and we will hope to begin reimaging from Tuesday or Wednesday. Please let me know what you think.

Mvh :)  
Chelsea

**Chelsea Graham**  
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[<image001.jpg>](#)

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