Acer Predator XB272 Testing

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Updated: January 9, 2019

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1 Summary

Here we describe tests done on a new monitor (Acer Predator XB272) to replace the 144Hz ASUS 278 in the DPI. As of **Jan 7, 2019** we have put the ACER 272 in the DPI after 3 rounds of testing which we describe in this report. The NVIDIA settings for NS's experiment are Brightness - 10, Contrast - 10, Gamma - 1. The general NVIDIA settings are **Brightness - 40, Contrast - 40, Gamma - 2.03**.

There are monitor settings as well that allow additional functionality. They can be adjusted by the monitor buttons. The settings used were saved in 'Action' mode which

were: Brightness - 0, Contrast - 0, Blue Light - Off, Dark Boost - Off, Adaptive Contrast - Off, Gamma - 2.2, Color temp. (red, green, blue) - 50, Saturation - 100. While we did not test changes on these settings, as further work finer luminance calibration could be obtained experimenting with these additional settings.

Note that bit stealing has not been succesfully tested on this monitor and needs further development.

2 Specs

- See full specs here: `https://www.acer.com/ac/en/GB/content/predator-model/UM.HX2EE.005`
- 1920 × 1080 resolution
- up to 240Hz

The screen size is the same as the ASUS 278 (which goes up to 2560×1440 and 144Hz) so pixel angles should be the same at the same distance.

3 Refresh Rate Confirmation

The refresh rate is 200 Hz. This was measured by Janis on October 7, 2018 (results on OPUS: `Z:\Monitors\ACER_XB272\PhotocellTest_2018-10-07\test_photocell.m`).

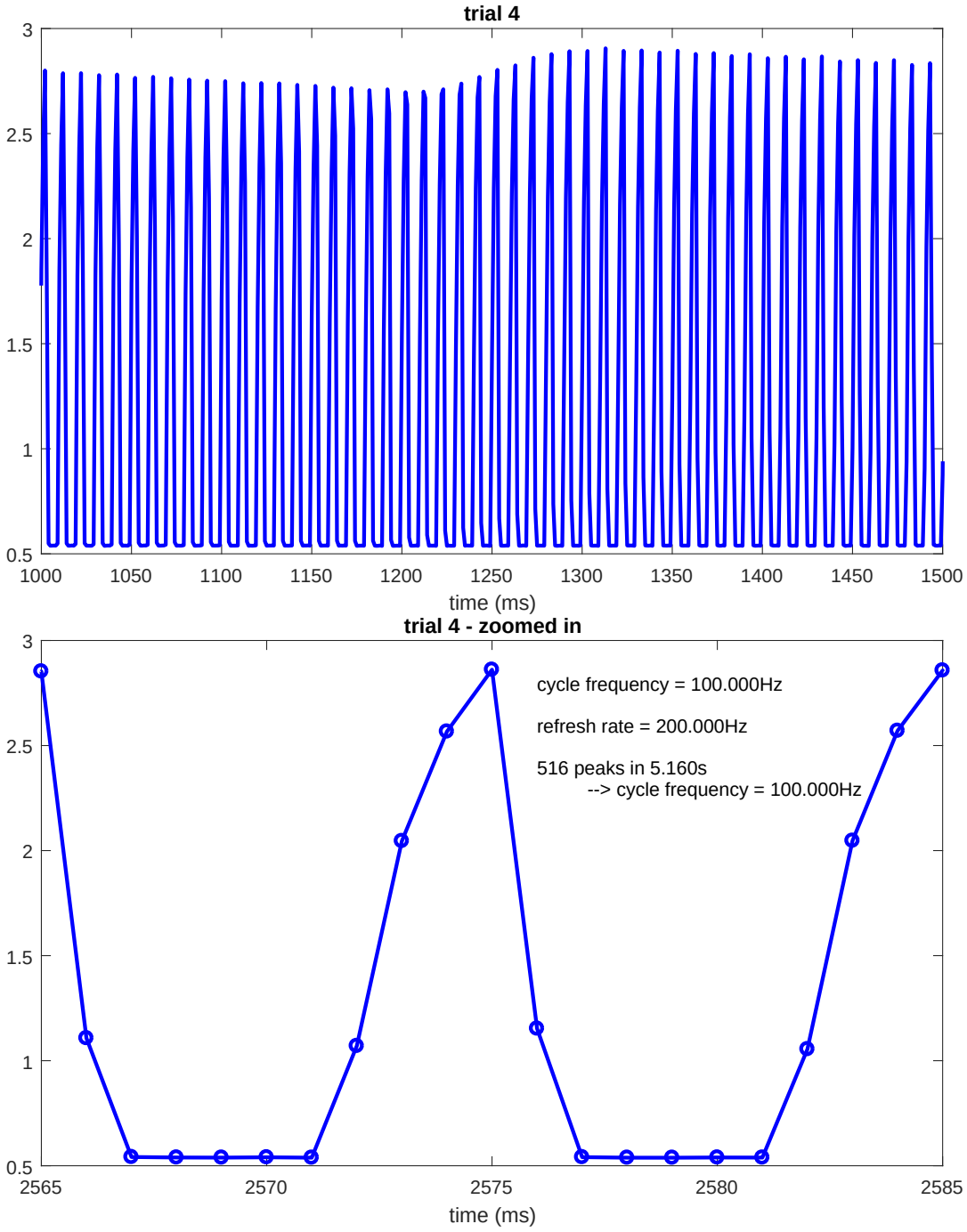

Figure 1: Photocell readings from ACER272 monitor. Y-axis are in arbitrary units. TOP shows a 500ms period. BOTTOM shows two periods of the square wave.

4 Luminance Comparisons

4.1 Non-calibrated: Exogenous Attention & Spatial Attention studies

This section compares luminances to the ASUS with settings used in a couple of experiments. (See results on OPUS: `Z:\Monitors\ACER_XB272\PhotocellTest_2018-10-07\compareAsusAcer.m`)

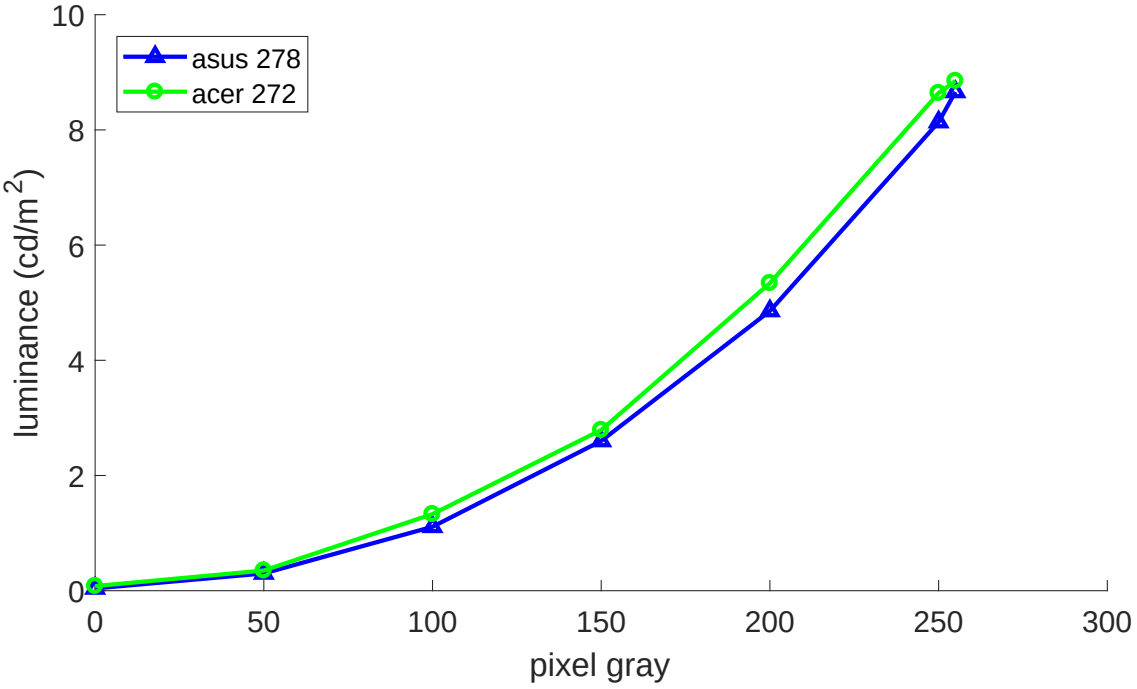

Figure 2: Comparable luminances for the two different monitors. See table below for full settings.

Comparable settings:

	ASUS 278	ACER 272
Monitor Brightness	0	0
Monitor Contrast	0	0
NVIDIA Brightness	50%	**10%**
NVIDIA Contrast	50%	**10%**
Gamma Correction (all)	1.0	1.0

4.2 Calibrated for Contrast Sensitivity (Oct 7 attempt)

Here I attempt to duplicated the ASUS 278 luminance values I have been using for experiments. I have not found a comparable setting for the ACER yet but here's the closest I have gotten. See results on OPUS: `Z:\Monitors\ACER_XB272\PhotocellTest_2018-10-07\acer272_rgbtest.m`

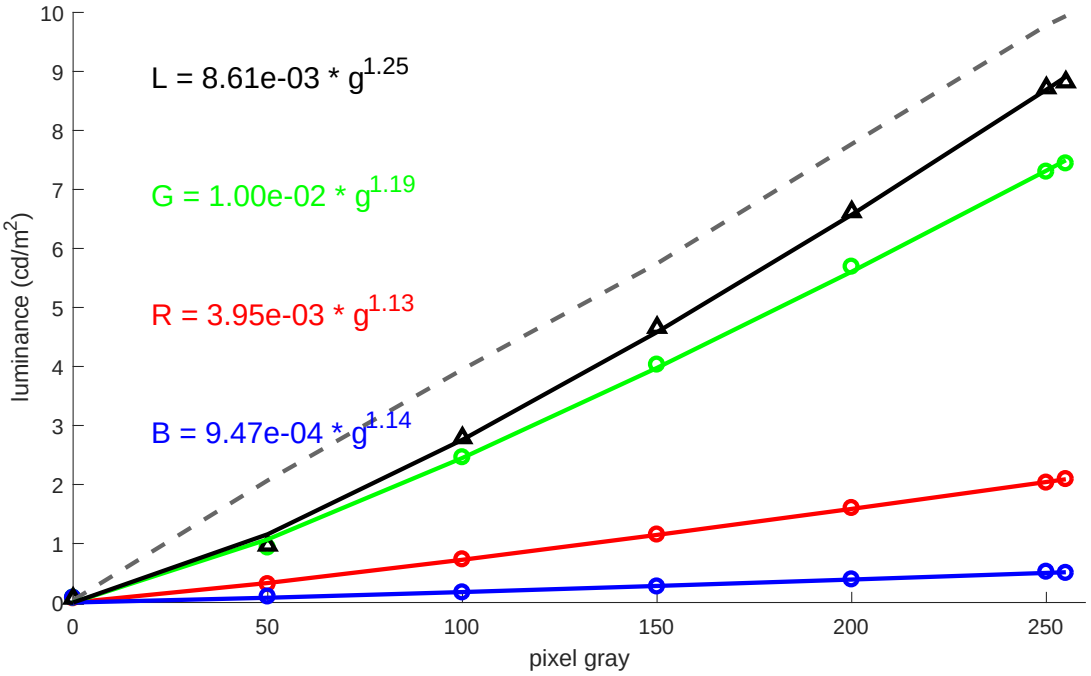

Figure 3: Comparable luminances for the two different calibrated monitors. Solid lines are different channels and total luminance for ACER 272. Dashed gray line is the luminance from the ASUS 278. See table below for full settings.

Comparable settings:

	ASUS 278	ACER 272
Monitor Brightness	0	0
Monitor Contrast	0	0
Red Brightness	50%	10%
Red Contrast	50%	10%
Red Gamma Correction	2.10	1.95
Green Brightness	50%	5%
Green Contrast	50%	5%
Green Gamma Correction	2.17	2.10
Blue Brightness	50%	10%
Blue Contrast	50%	10%
Blue Gamma Correction	2.58	1.45

4.3 Calibrated for Contrast Sensitivity (Oct 8 attempt)

Today's closest results - See results on OPUS: `Z:\Monitors\ACER_XB272\PhotocellTest_2018-10-08\acer272_rgbtest.m`

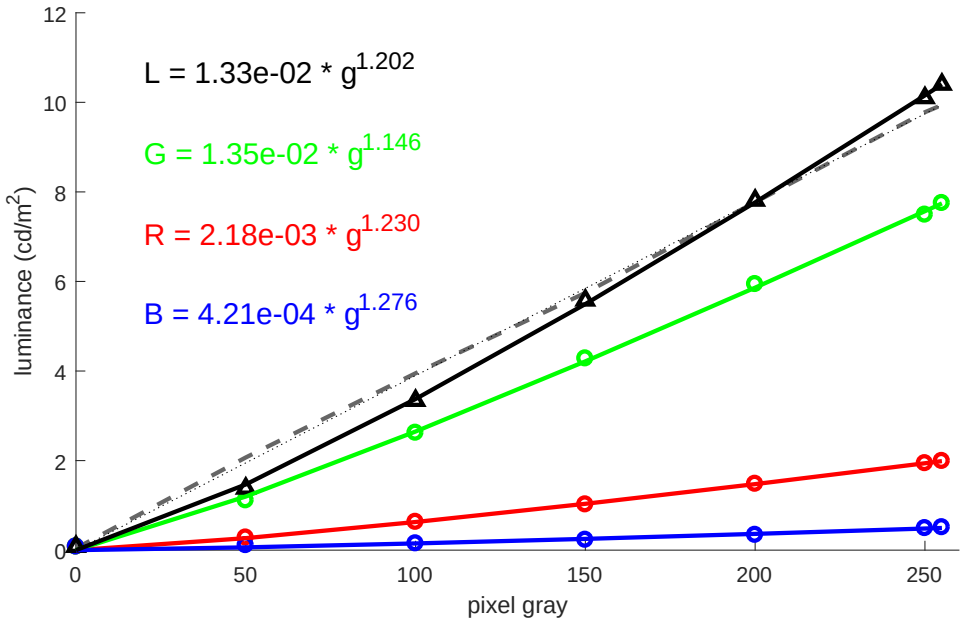

Figure 4: Comparable luminances for the two different calibrated monitors. Solid lines are different channels and total luminance for ACER 272. Dashed gray line is the luminance from the ASUS 278. See table below for full settings.

Comparable settings:

	ASUS 278	ACER 272
Monitor Brightness	0	0
Monitor Contrast	0	0
Red Brightness	50%	20%
Red Contrast	50%	20%
Red Gamma Correction	2.10	1.81
Green Brightness	50%	20%
Green Contrast	50%	20%
Green Gamma Correction	2.17	2.13
Blue Brightness	50%	20%
Blue Contrast	50%	20%
Blue Gamma Correction	2.58	1.17

5 Calibration for luminance (Dec 3 - NK,JI)

JI and NK measured luminances with the CS-100 right up against the Acer 272. See results on OPUS: `Z:\Monitors\ACER_XB272\2018-12-03_LuminanceTest\acer272_luminancetest.m`

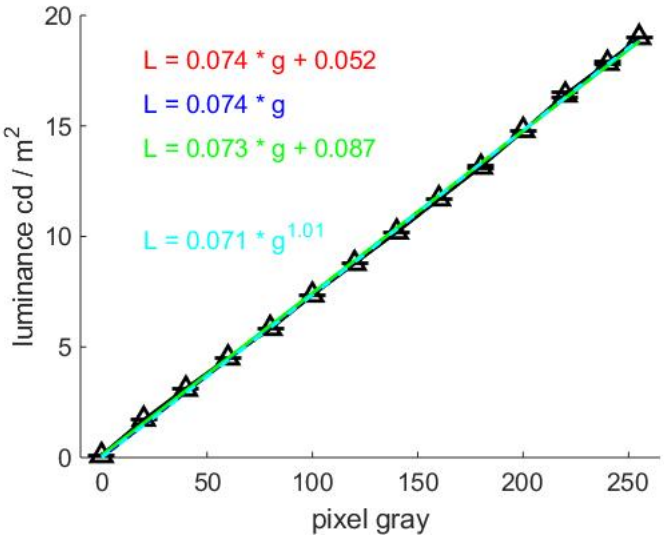

Figure 5: Luminance readings from the ACER272 monitor after gamma correction of 1.83.

6 Final Calibration for luminance (MAC,JI)

Here we used the Minolta CS-100A color meter to get readings. Previously we were manually using the device which restricted the number of readings, we developed an arduino adapter and matlab script to automatically get readings from the color meter. The link to details and instructions can be found on Wiki: `https://wiki.bcs.rochester.edu/ApLab/Equipment-ColorMeter`.

The first test was done on 10th Dec, 2018, the results are on OPUS: `Z:\Monitors\ACER_XB272\20181210_ACER272`. The second run of tests was done on 13th Dec, 2018, the results are on OPUS: `Z:\Monitors\ACER_XB272\20181213_ACER272`. Either day run of tests did not result in linearization of the monitor.

The final run of tests was done on 18th Dec, 2018, the results are on OPUS: `Z:\Monitors\ACER_XB272\20181218_ACER272`. Runs 1-6 were done for calibrating only luminance and 'run04' contains data when linearization was achieved. Runs 7-13 tried to achieve bit-stealing, needs further testing. See final comparison result on OPUS: `Z:\Monitors\ACER_XB272\20181218_ACER272\compareAcerAsus.m`

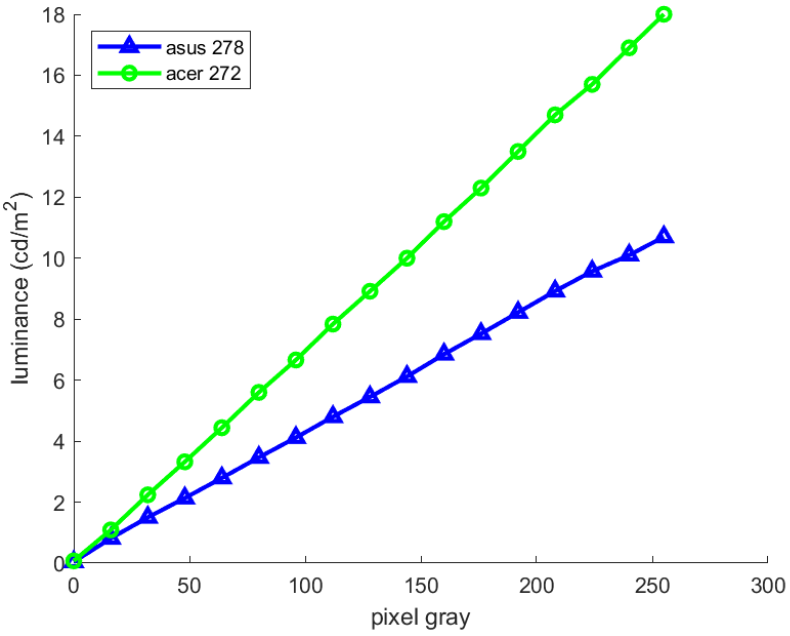

Figure 6: Comparing luminance readings from the ACER272 and ASUS278 monitors

Comparable settings:

	ASUS 278	ACER 272
Monitor Brightness	0	0
Monitor Contrast	0	0
NVIDIA Brightness	50%	**40%**
NVIDIA Contrast	50%	**40%**
Gamma Correction (all)	1.0	**2.03**

7 LCD Dynamics

This section characterizes the temporal profile of the LCD monitor. These recordings were done with high contrast and brightness settings - much higher than we would use for experiments - so that we could get clear readings from the photodiode. Recordings were made at several gray levels including both sustained presentation and flickering between a black and brighter frame. Recordings were made from only the corner of the monitor which was set to flicker.

(See results on OPUS `Z:\Monitors\ACER_XB272\PhotocellTest_2018-10-08\test_photocell.m`)

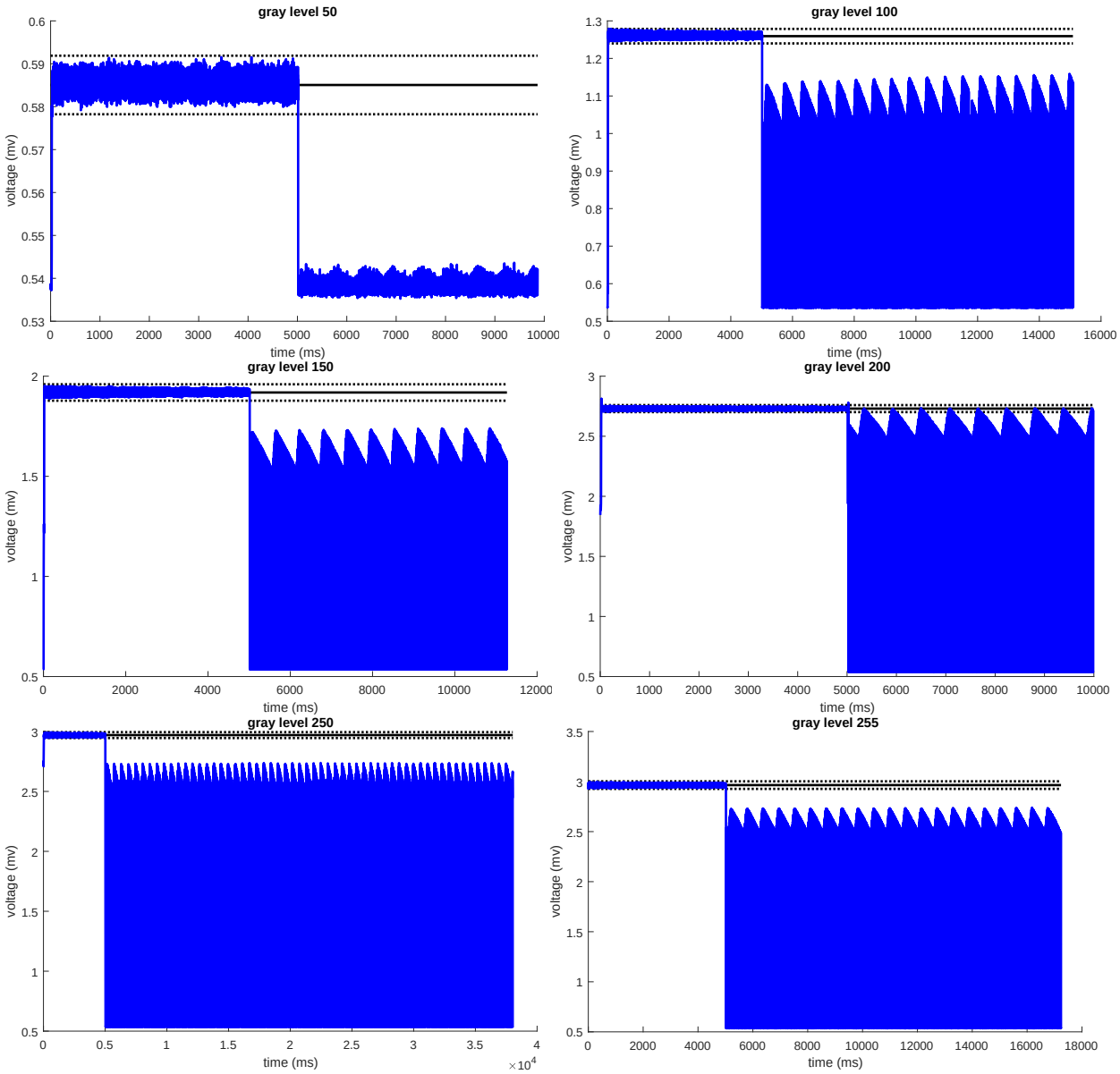

Figure 7: Data were recorded with the photodiode in trials that started with 5 seconds of sustained presentation of some gray level (50-255), followed by a period of alternating between black and the same initial gray level. The black lines show the mean±3SD of the voltage during the sustained period. Not shown: a sustained reading of a completely black screen was also made for comparison.

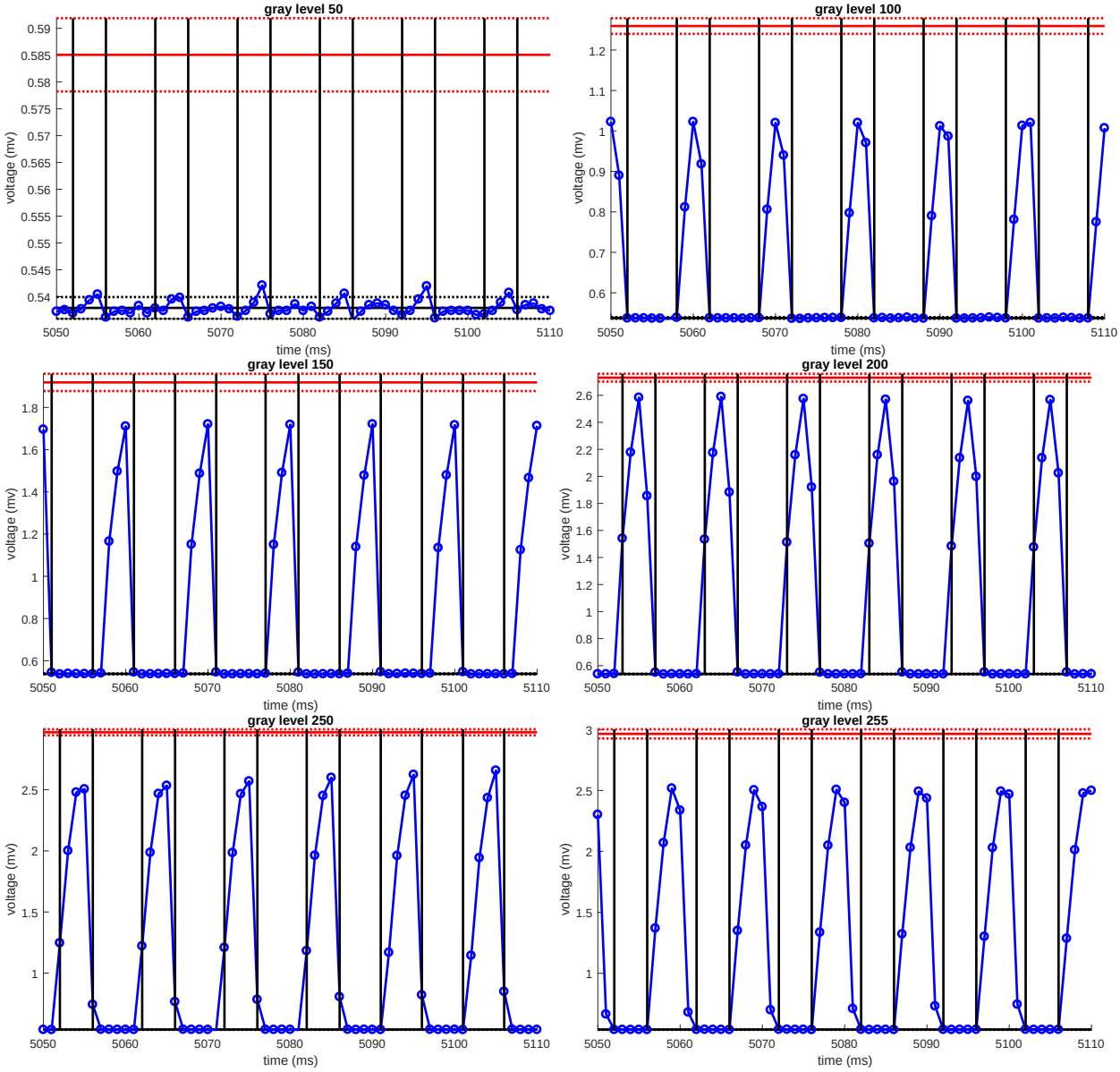

Figure 8: Here are the voltage changes during the alternating period for several frames as the corner of the monitor flickered between black (graylevel = 0) and the gray levels shown. The red lines show the mean±3SD of the corresponding sustained period. The black lines show the mean±3SD of the sustained black presentation. Note that the voltage never reaches the level measured during sustained presentation.

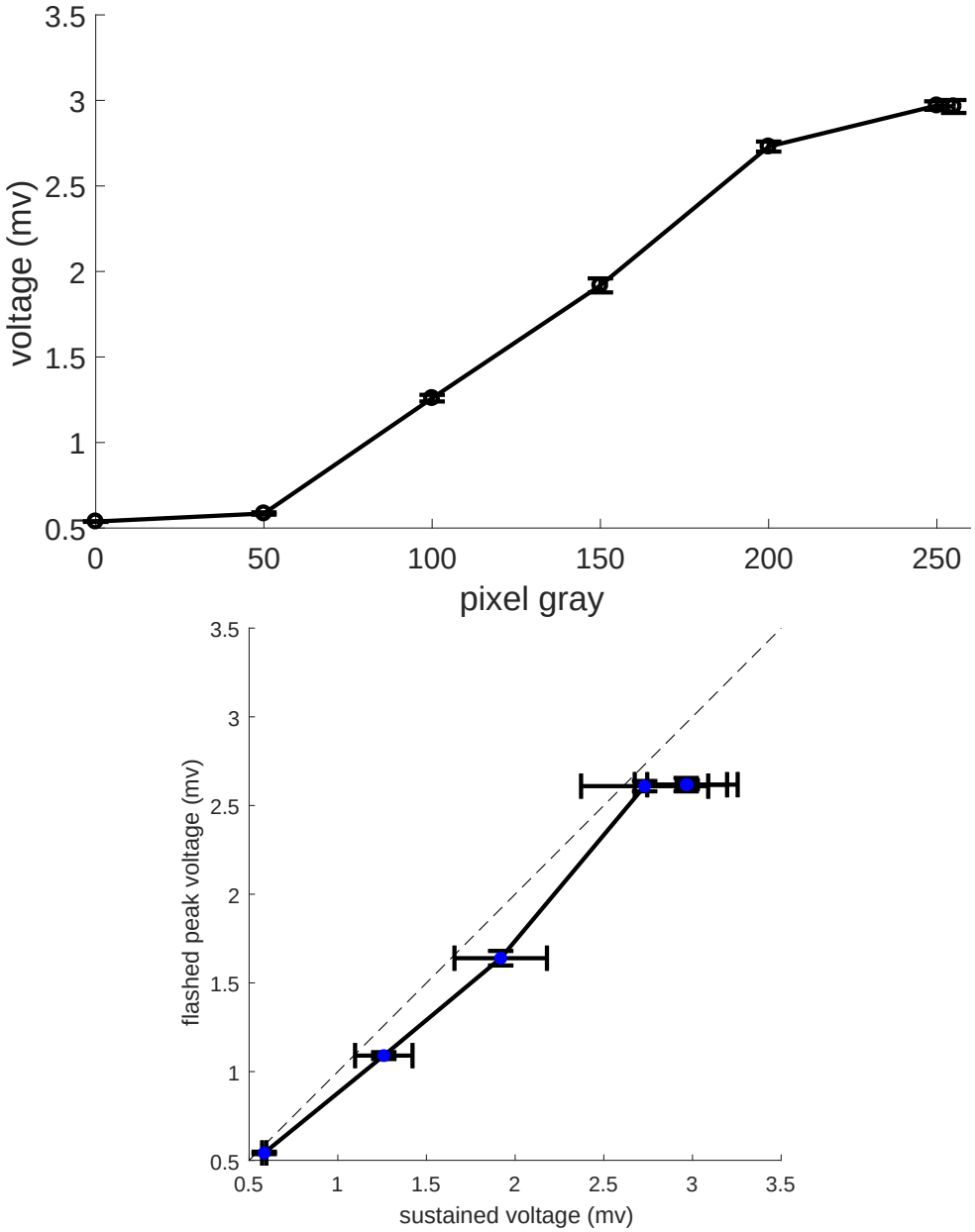

Figure 9: TOP: mean±3SD of the sustained periods for each gray level. BOTTOM: mean±3SD of peak values during alternating period versus mean±3SD during sustained period. Below the unity line means that the peaks during the alternating period are less than the voltage during sustained presentation.

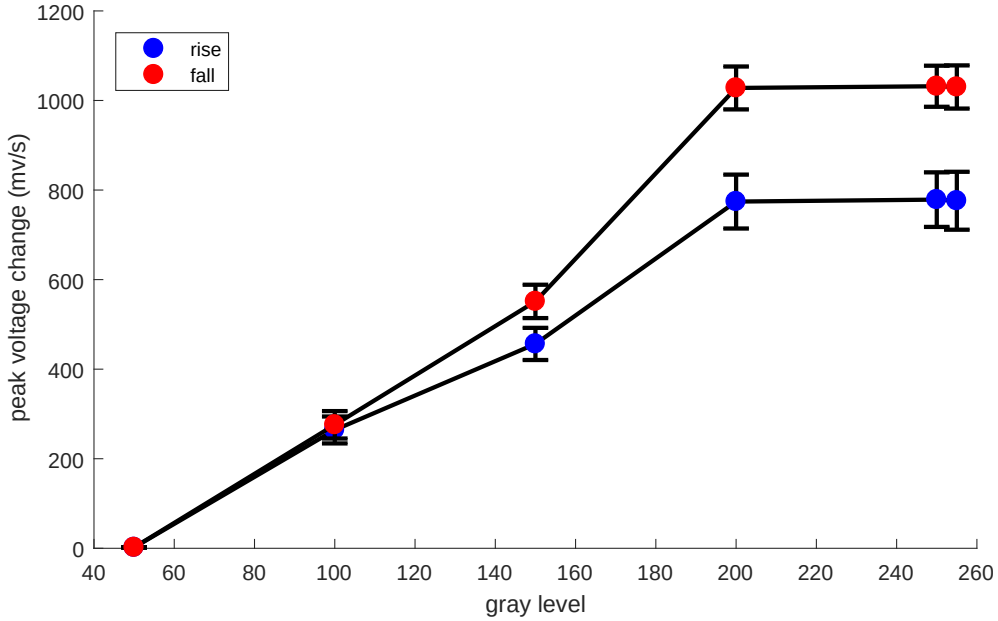

Figure 10: Averages of peak rising and falling speeds at each gray level during the alternating period. Speeds were estimated using an sgolay filter with a window size of 3 (using the difference between neighboring times gave similar results). Note that the falling speed (red) is higher than the rising speed (blue) as expected, and the changes in either are faster with increasing gray level - though it seems to saturate at higher contrasts.