Getting Started

STATIC PHANTOM

Static Phantom

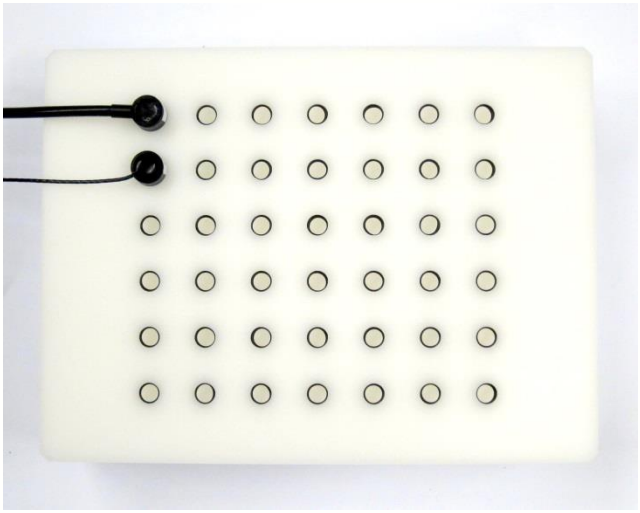
TROUBLESHOOTING WITH THE STATIC PHANTOM

We deliver high quality instruments to ensure outstanding performance and durability. Some parts however, when not handled properly or when exceeding their life expectancy, may not function as expected. All NIRx instruments are provided with static phantoms that allow you to verify that the optodes, sources and detectors, are always functioning as expected.

Please remind that the procedures described in this tutorial do not need to be run on a periodical basis for calibration purposes, but we do recommend to run them frequently.

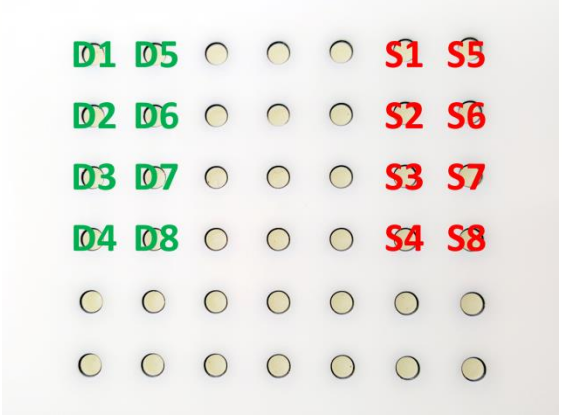
PLACEMENT OF THE OPTODES INTO THE STATIC PHANTOM FOR TESTING

The static phantom, provided with any type of NIRx system, has been designed to maximize light transmission. It provides 42 slots, in an arrangement of 6x7, to accommodate the optodes.



The arrangement of the optodes in the static phantom depends on the type of system you are using (NIRScout vs. NIRSport) and the amount of available sources and detectors.

OPTODE ARRANGEMENT FOR THE NIRSPORT



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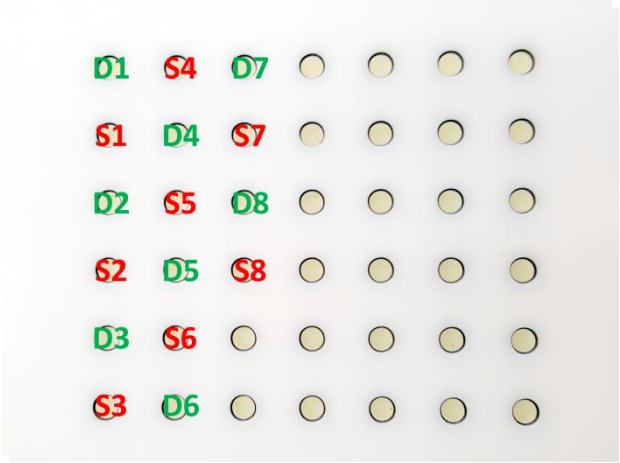
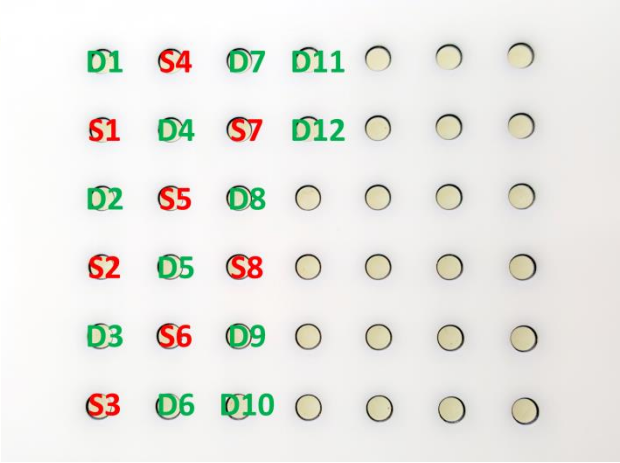
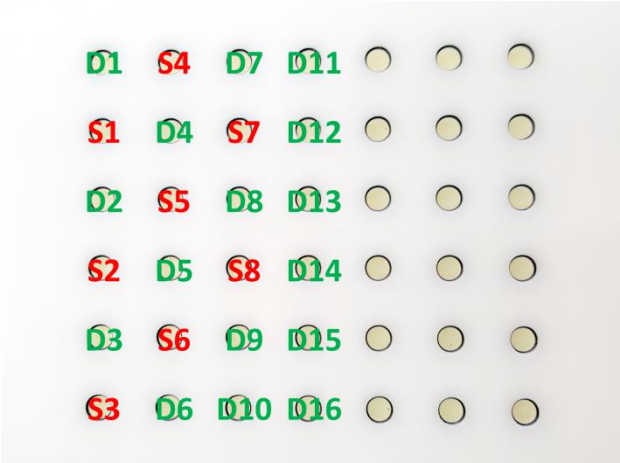
Optode arrangement for the NIRScout



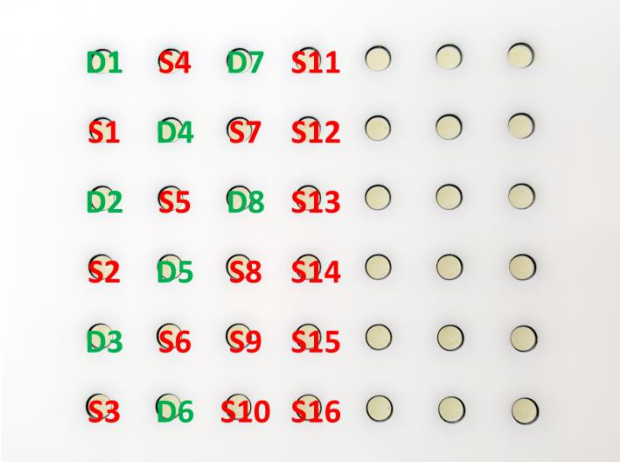
8 sources, 8 detectors



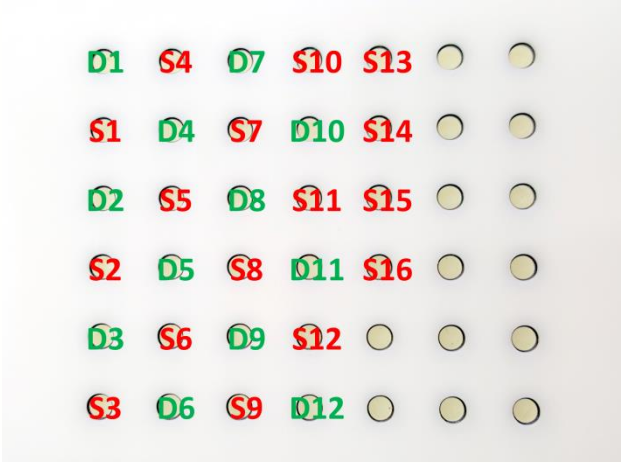
8 sources, 12 detectors



8 sources, 16 detectors

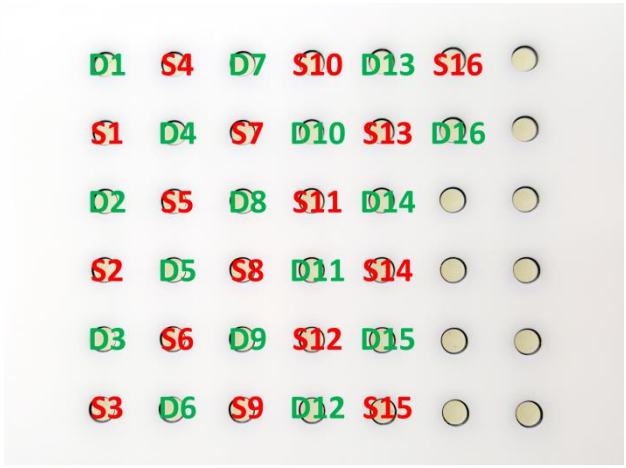


16 sources, 8 detectors

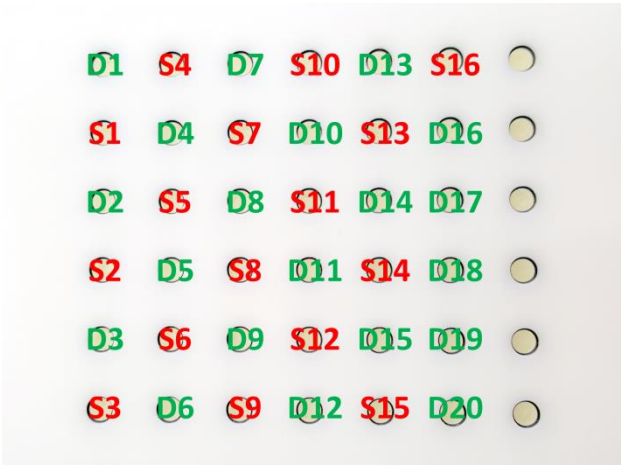


16 sources, 12 detectors

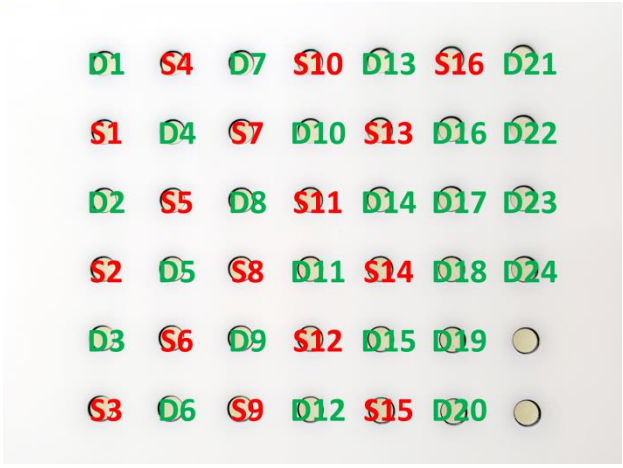
Static Phantom



16 sources, 16 detectors



16 sources, 20 detectors



16 sources, 24 detectors

1. The slots have been designed to exactly fit the optodes, their placement should be straightforward**. If you encounter resistance when pushing the optode in, please make sure that the slot is clean and that there are no obstructions that could damage the optode**.
2. Place the optodes into the phantom according to the diagrams shown above.
3. **Before running any test it is essential that the phantom is completely shielded from any light source**. Each static phantom is provided with a fitting case (similar to the one in the picture), in which the phantom needs to be placed in order to shield the optodes from any possible external light source.
4. Make sure to close the case as much as possible without damaging the optical fibers or the wires.

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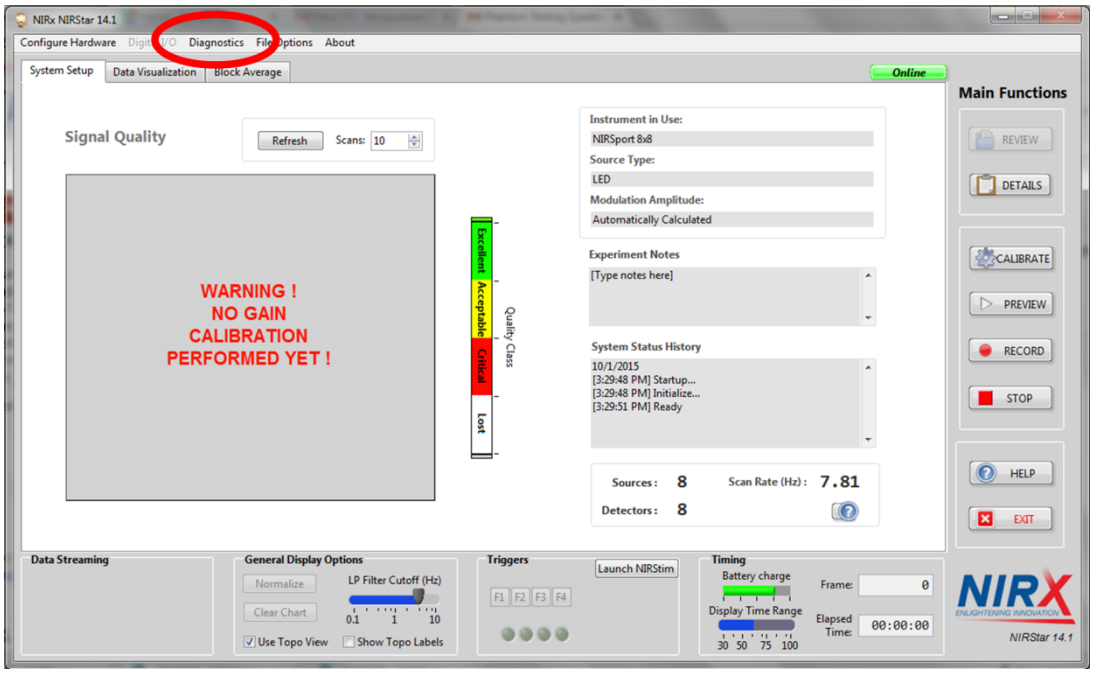
Dark noise tests of detectors

The dark noise characterizes a detector channel's sensitivity by evaluating the amplitude and variance of the detector reading if no input signal (i.e., incident light) is present. The residual signal variation is caused by the noise of the light sensor and the electronics and is a measure of the optical sensitivity of the device. **Increased noise values can be indicative of faulty hardware.**

For the dark noise tests it is not strictly necessary to use the static phantom, but as usually static phantom calibration tests are run immediately after dark noise measurement, it is very handy to place the optodes in the static phantom as required by the phantom calibration test. Please place the optodes into the static phantom as described in the previous section.

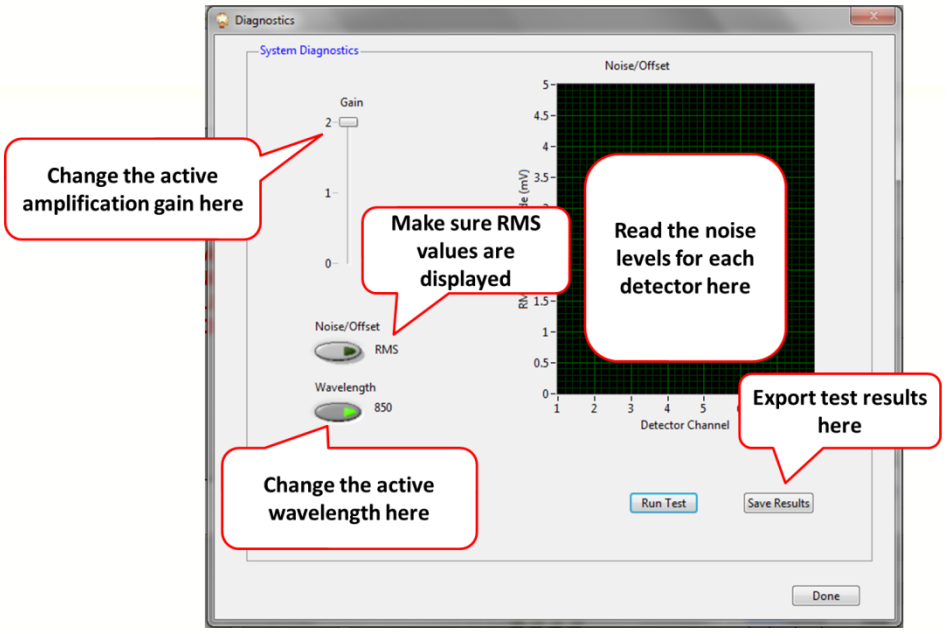
1. Make sure to plug all available source and detector bundles to your NIRx device.
2. Connect your NIRSport or NIRScout to the acquisition PC, laptop or tablet as normally and start the NIRStar acquisition software.
3. Make sure any artificial light source is turned off.
4. Under the "Configure Hardware" menu item, open the "Channel Setup" tab. Make sure that under "Number of Sources" and "Number of Detectors" the total number of available sources and detectors is set.
5. Launch the dark noise test window by clicking the "Diagnostics" menu item in the main NIRStar window menu.
6. Run the test by pressing the "Run test" button.



The measured noise levels will be displayed for each detector. **Make sure that the number of detectors displayed matches your hardware configuration**. If not, make sure your instrument is properly configured (see the NIRStar user guide). Noise levels will be displayed for each amplification gain. For NIRSport systems, noise levels will be displayed for gains 0-2, for NIRScout systems noise levels will be displayed for gains 0-7.

	Gain 0	*Gain 1*	*Gain 2*	*Gain 3*	*Gain 4*	*Gain 5*	*Gain 6*	*Gain 7*
NIRSport	**<<1.5 mV**	**<<1.5 mV**	**<1.5 mV**					
NIRScout	**<< 0.1mV**	**<< 0.1mV**	**<< 0.1mV**	**<< 0.1mV**	**<< 0.1mV**	**<< 0.1mV**	**< 1mV**	**< 7 mV**

Static Phantom



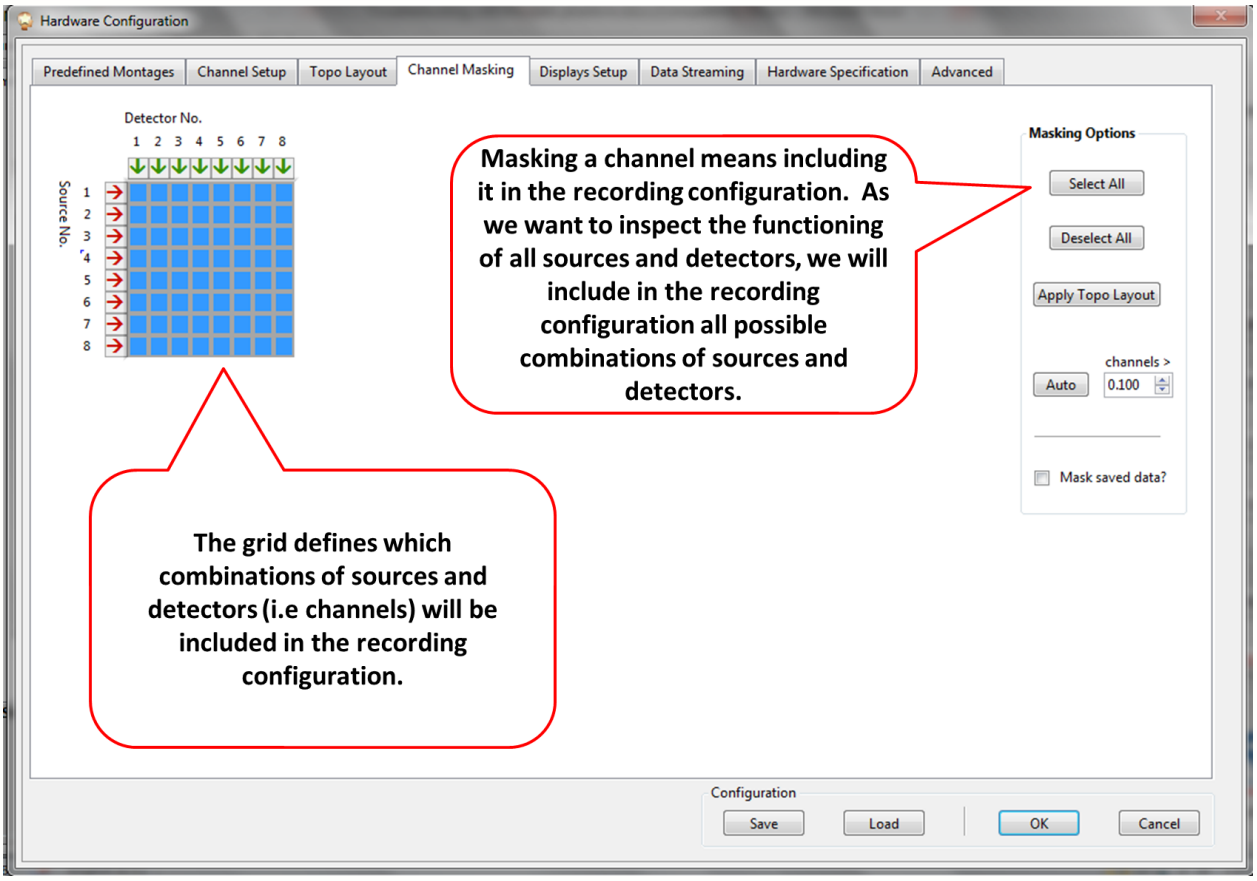
7. Please inspect the noise level **for each amplification gain**, and make sure they match the reference values in the table above.
8. Make sure that the noise levels **for each wavelength** match the reference values in the table above.
9. Save the results, by pressing the corresponding button. A path and filename have to be specified in the dialog box that opens when the button is pressed. While you can specify any Windows- and MATLAB-compatible filename, the software will automatically give the extensions .dn1 and .dn2 to the files containing data for the first and second wavelength, respectively. The specified name will be given to both files. The .dn1 and .dn2 files can be read with a standard text editor. Each row contains noise data for a different gain value (Gain 0 in the first row, Gain 1 in the second, *etc*.), and each column contains noise data for a different detector (Detector 1 in the first column, Detector 2 in the second, *etc*.). **Saving the test results is not strictly necessary, but it is recommended to document the system performance every time the test is run.**
10. If unsure about the interpretation of the results, please save the results of the dark noise test as described above and send them to the NIRx support team at support@nirx.net.

Static Phantom Calibration Test

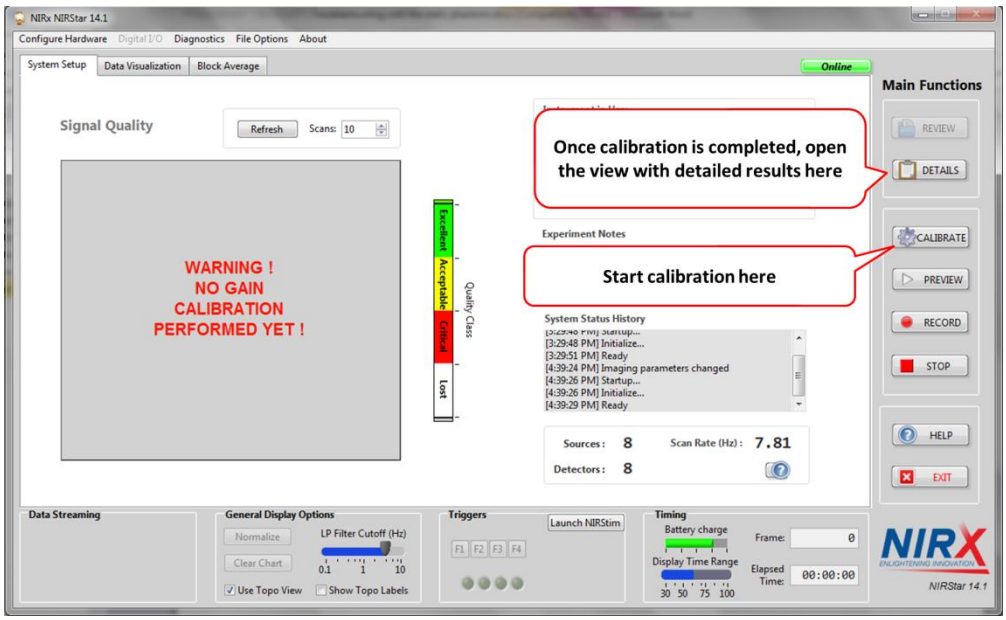
While the dark noise test inspects the performance of the detectors, the calibration test in the static phantom will help you verify the correct functioning of both sources and detectors.

1. Make sure to plug all available source and detector bundles to your NIRx device.
2. Please place the optodes into the static phantom as described in Placement of the optodes into the static phantom for testing section.
3. Make sure any artificial light source is turned off.
4. Connect your NIRSport or NIRScout to the acquisition PC, laptop or tablet as normally and start the NIRStar acquisition software.
5. Under the "Configure Hardware" menu item, open the “Channel Setup” tab. Make sure that under “Number of Sources” and “Number of Detectors” the total number of available sources and detectors is set.
6. Under the "Configure Hardware" menu item, open the “Channel Masking” tab.
7. Mask all channels by pressing the “Select all” button.

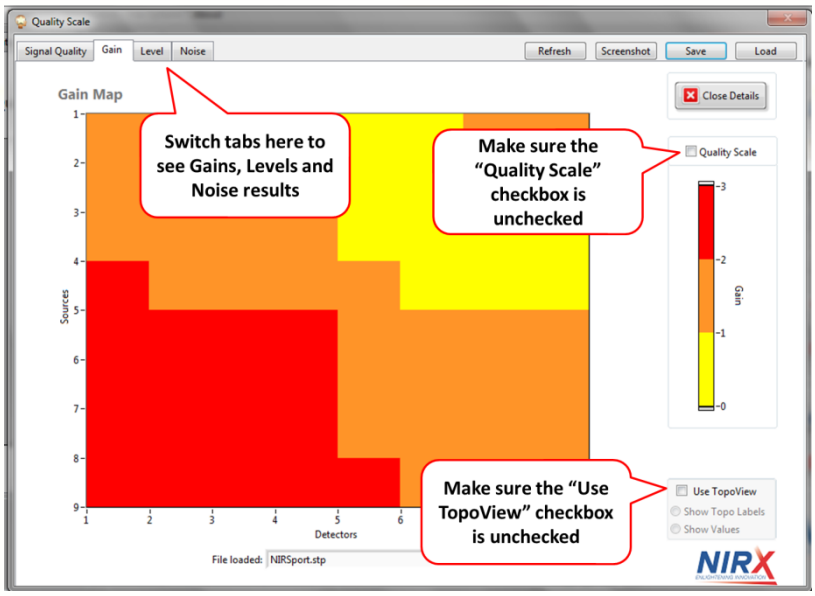
Static Phantom



8. **Only for NIRScout systems**: Under the "Configure Hardware" menu item, in the “Hardware Specification” tab, chose “Static Phantom” under “Study Type”.
9. Start the calibration by pressing the “Calibrate” button.
10. Once calibration is completed, press the “Details” button to open the view containing comprehensive calibration results.



Static Phantom

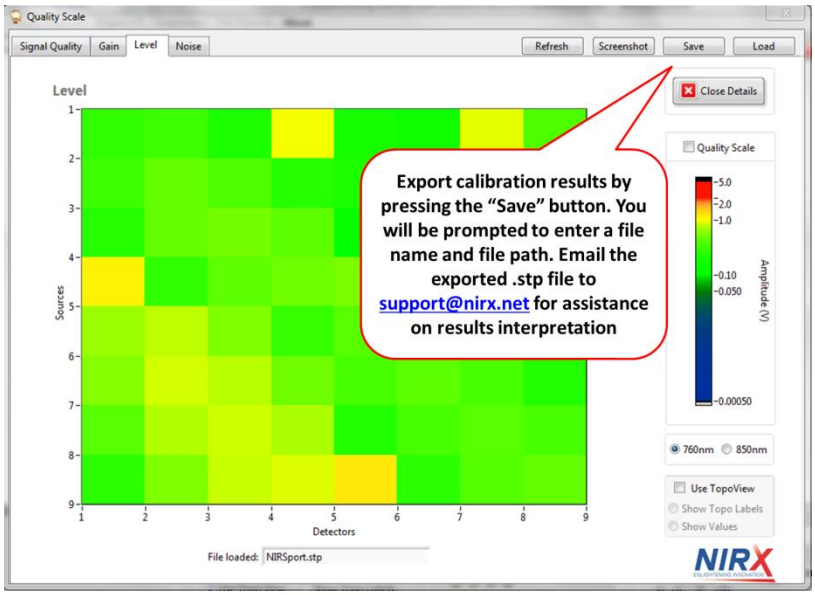


Interpretation of the results

In the following section you will find examples of static phantom calibration results, for different types of systems and for different types of optode configurations. It is important that your results do not significantly **qualitatively** differ from what shown here. Slight quantitative variations might be possible due to ambient light and other testing environment variables.

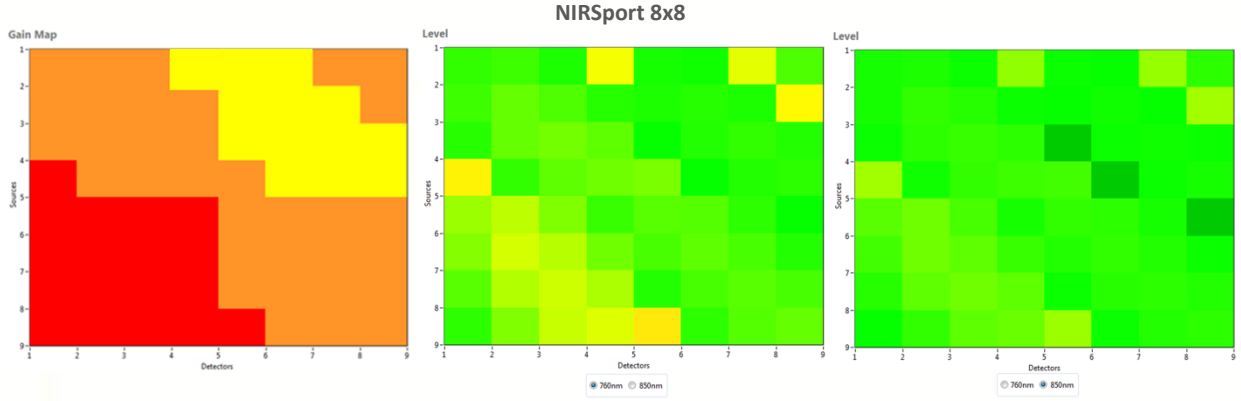
When inspecting the results, you should pay attention to the "Gain" and "Level" results. You should verify that combinations of sources and detectors which are closest to each other in the phantom are assigned smallest values of gains among all assigned gains. Channels formed by sources and detectors that are very close to each other in the phantom are often located in the top left –> bottom right diagonal of the grid**. When inspecting the "Level" results, please make sure to check the values for both wavelengths, as only one of the two LEDs in each source optode might be faulty!** These can be switched through dedicated radio buttons in the "Level " tab of the "Details" view.

If unsure about the interpretation of the results, please save them and email them to the NIRx support team at support@nirx.net, for immediate assistance.

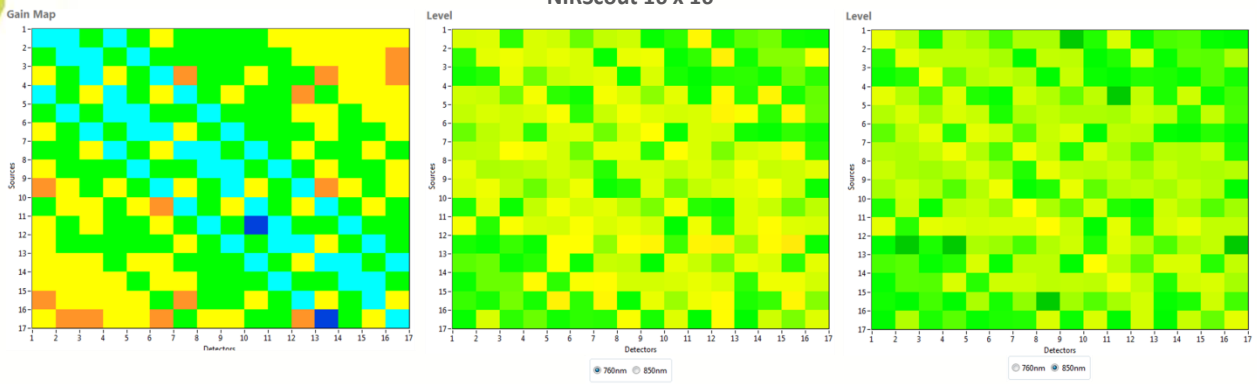


Static Phantom

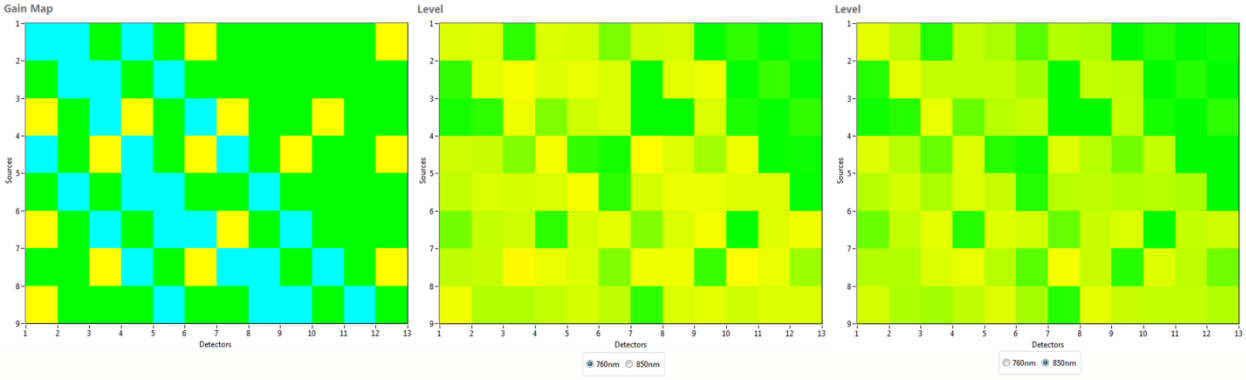
NIRSport 8x8



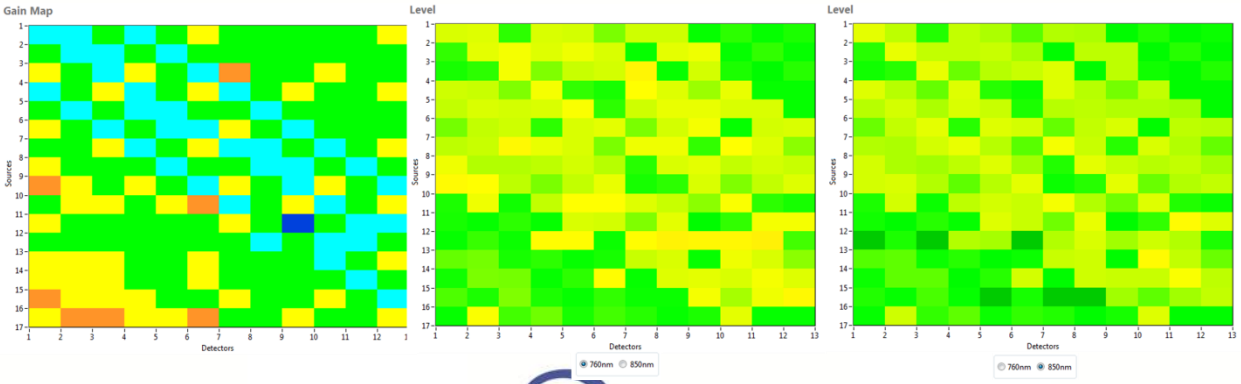
NIRScout 16 x 16



NIRScout 8 x 12



NIRScout 16 x 12



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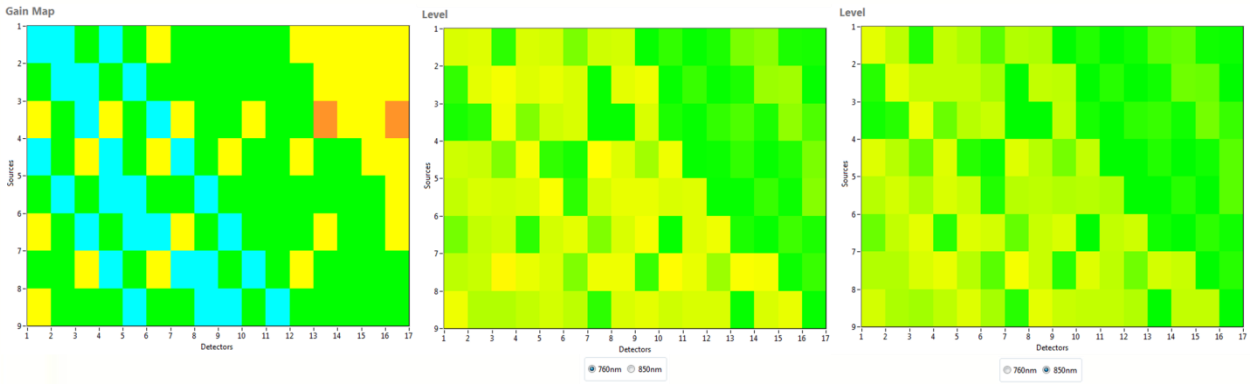
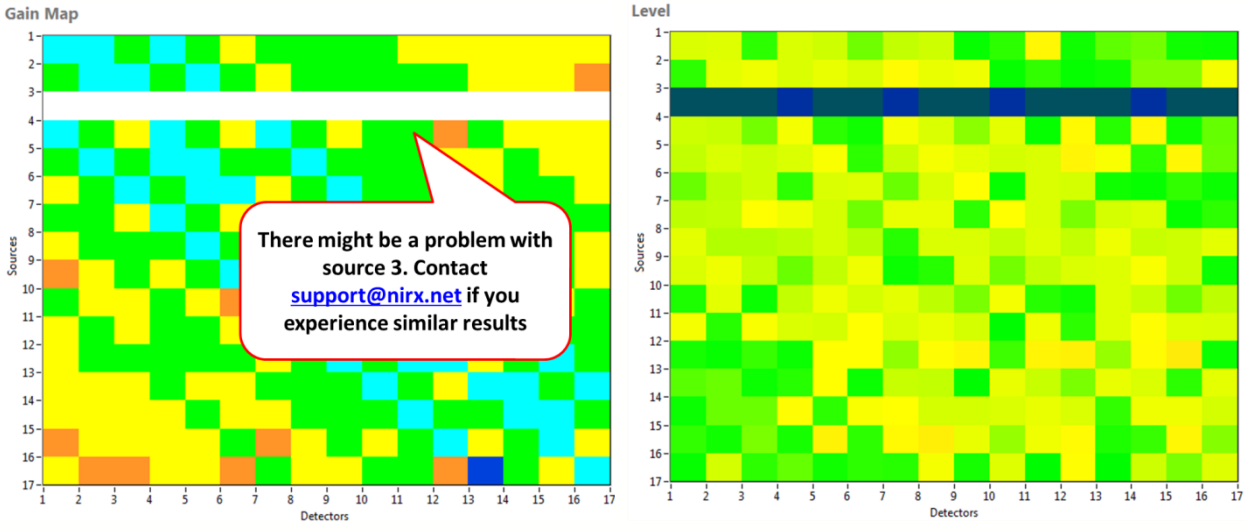
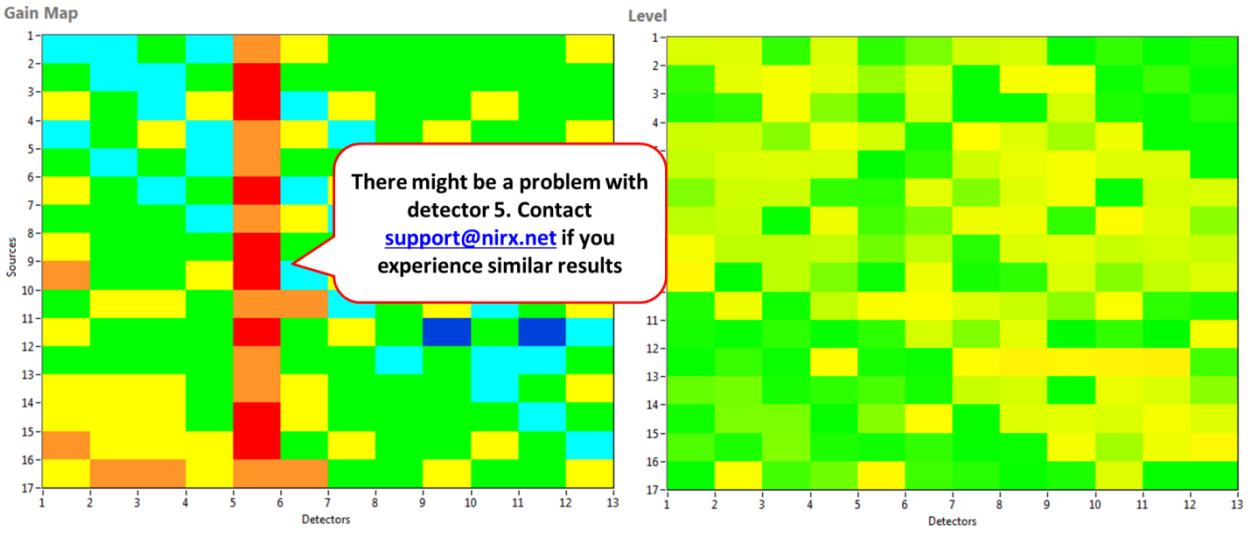
NIRScout 8 x16



Examples of results when optodes are damaged or misplaced





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