

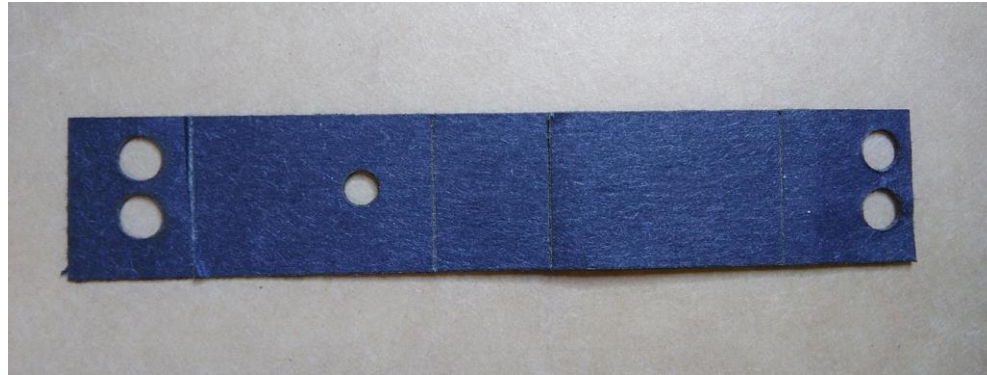
Measuring small leaves

Masking your MultispeQ can allow you to measure leaves that may otherwise be too small.



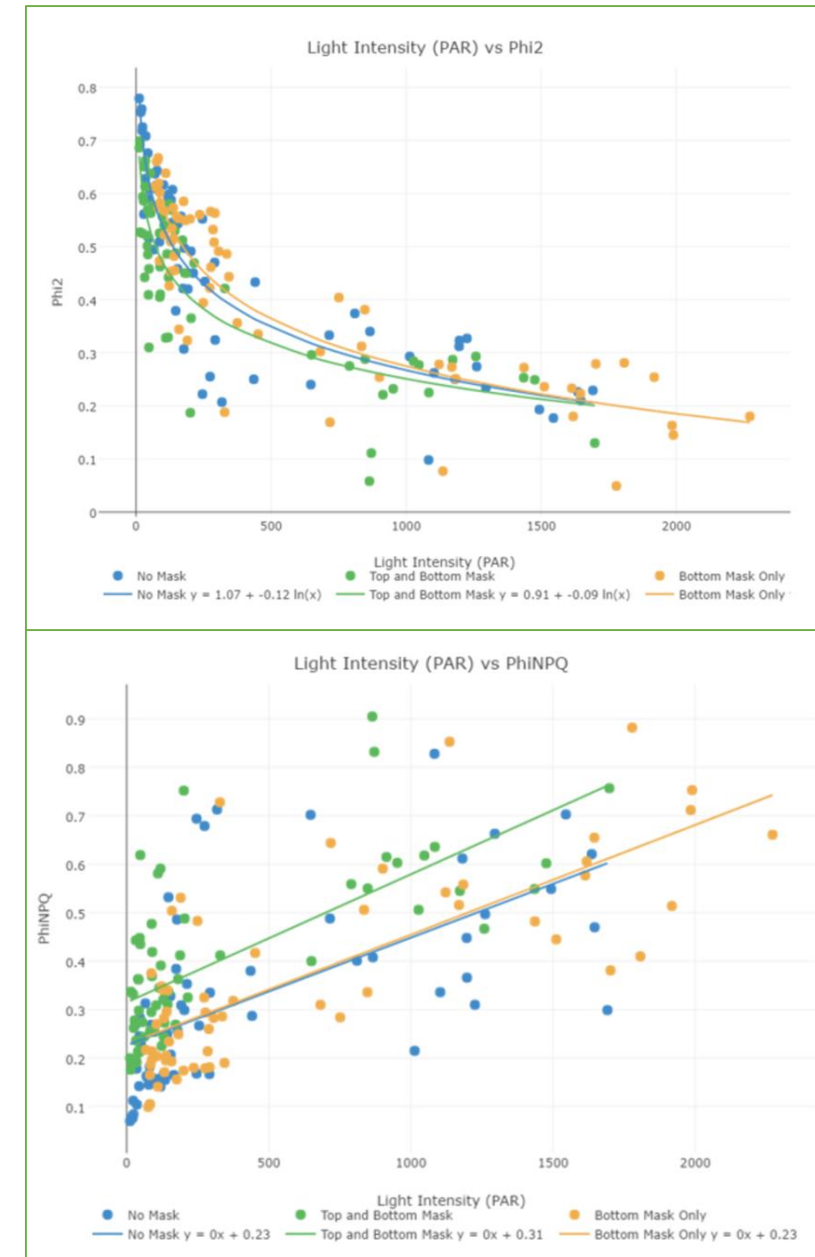
Why mask your multispeQ?

If the leaves that you are measuring do not completely cover the light guide, you will not be able to take absorbance measurements unless you mask the light guide to reduce the aperture of measurements.



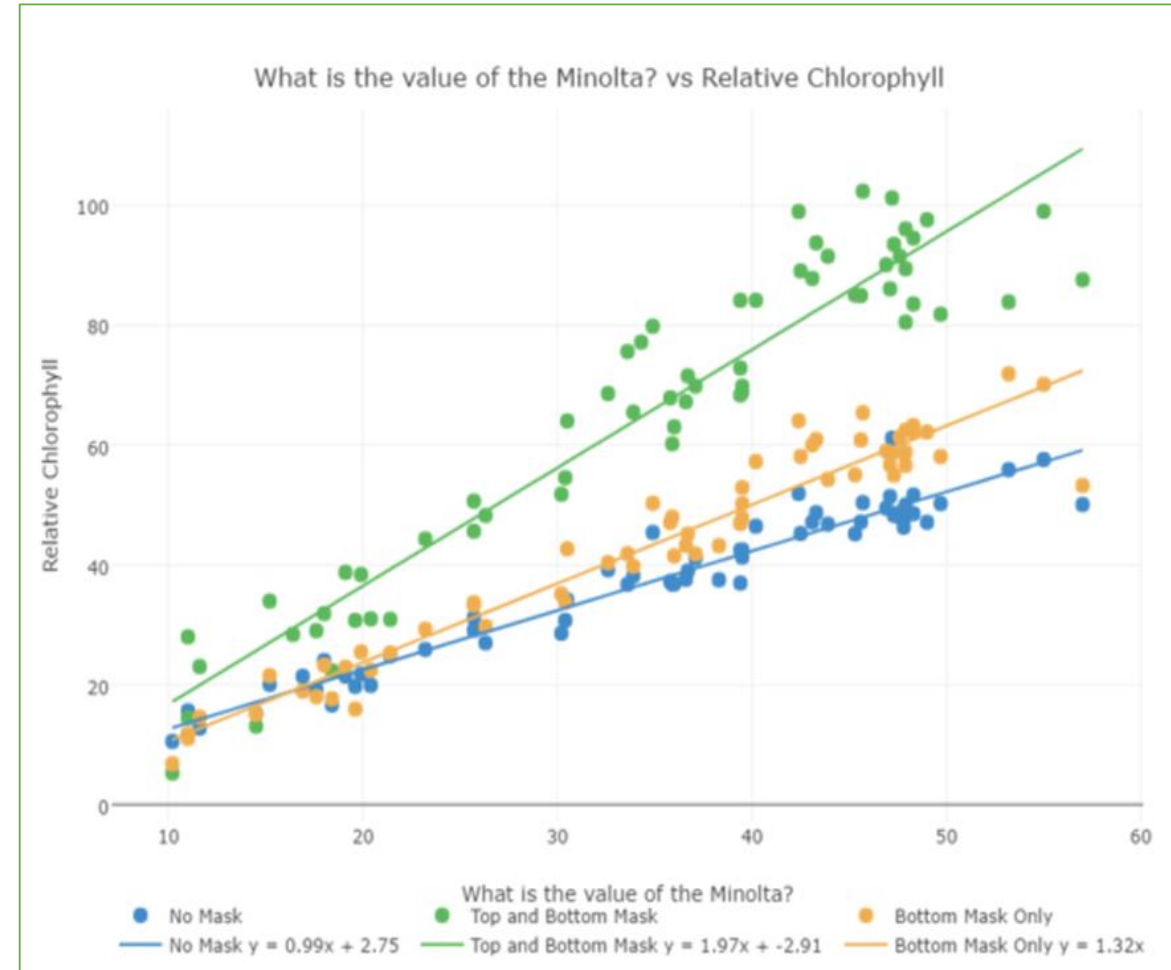
Measuring chlorophyll fluorescence with a mask

- Chlorophyll fluorescence parameters are self referencing, so we can measure Phi2, PhiNPQ, and PhiNO on small leaves with or without a mask.
- However, it appears that the results are more consistent between unmasked (blue) and a mask on the bottom clamp only (yellow) compared to masking both light guides (green).
- More detailed results are available [here](#).



Measuring absorbance with a mask

- Relative chlorophyll content can be measured using masked MultispeQ's, but only if they are recalibrated after the mask has been fitted over the light guide.
- However, even when recalibrated it is hard to get accurate results if using masks over both light guides (green).



Measuring environmental parameters with a mask

- Masking will not affect MultispeQ readings of ambient temperature, relative humidity or pressure.
- Leaf temperature measurements will only be accurate if the leaf covers the contactless temperature sensor.



Properly Fitting a Mask to the MultispeQ

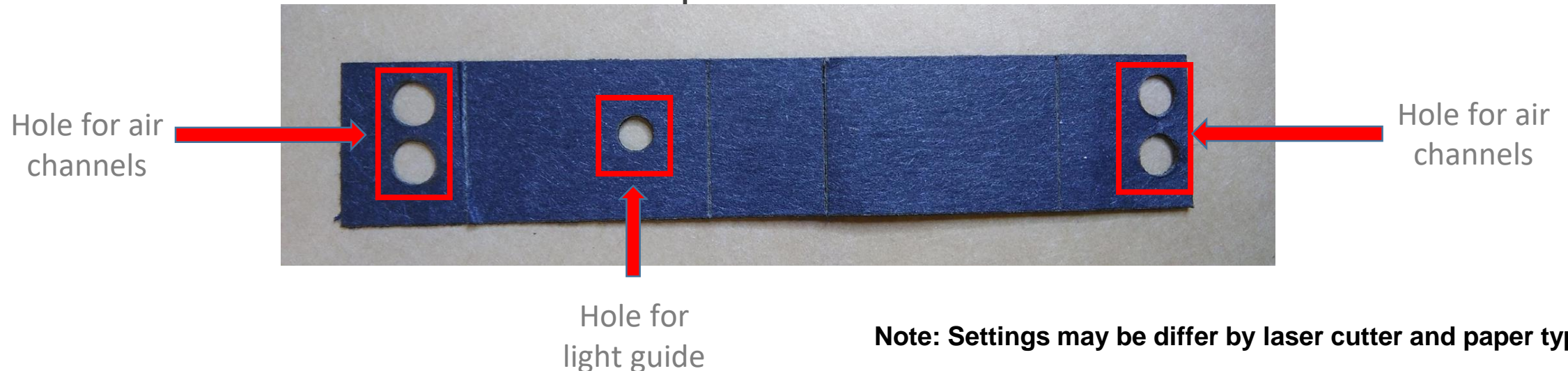
Masks can be cut out using a laser cutter or manually

Laser printing the mask from a PDF file

The [PDF](#) is formatted so it will be properly cut with a laser printer. You will need black construction paper.

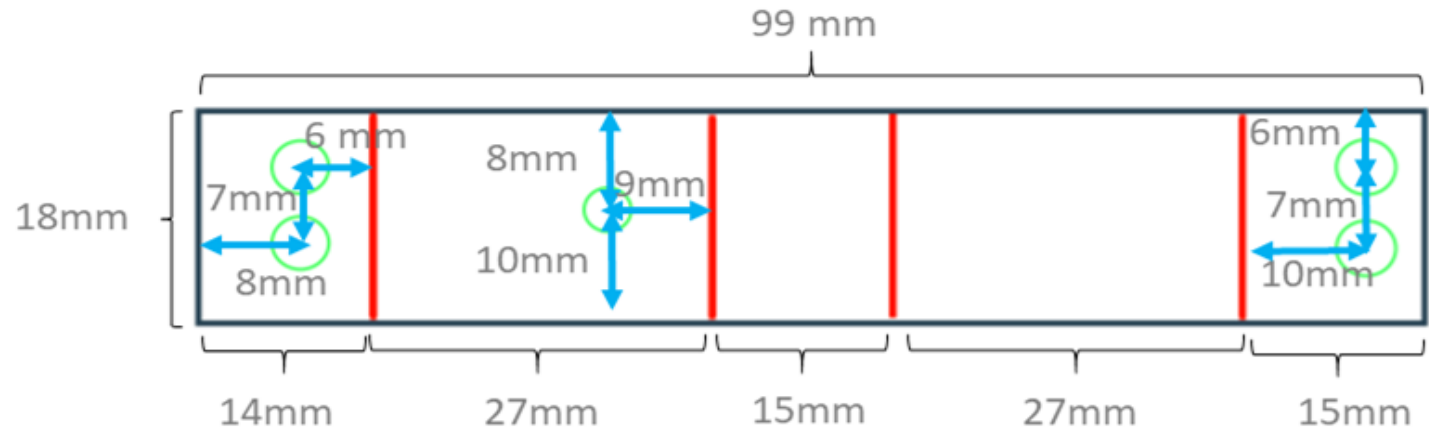
Here are the settings we use for our laser printer:

- . 5 mA
- . Outside lines and circles: 80% Power and 2 Repeats
- . Inside lines: 50% Power and 1 Repeat



Manually cutting out the mask

If a laser printer is not available, the mask can be cut out of black construction paper and a leather hole punch like [this one](#) can be substituted to create the holes for the air channels and light guide.



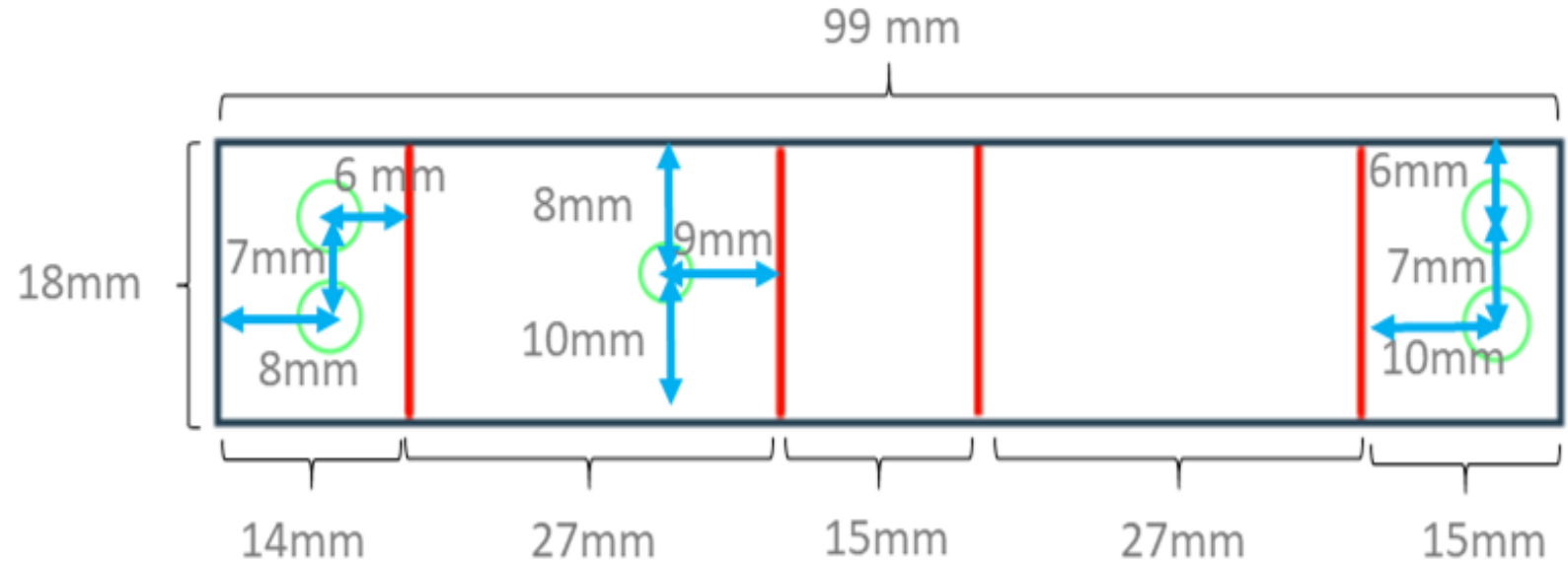
Manually cutting out the mask

The holes for the air channels need to be 4.5mm in diameter. Depending on the size of plant being measured, the hole for the light guide can range from 2 – 4mm in diameter.

Distance from hole to edge is measured from the center of the hole

These measurements are representative of a 4mm diameter light guide hole

The distance for the light guide hole will vary slightly depending on the diameter you choose



Applying the mask

Step 1. Pre-fold the perforated creases of the mask.

Step 2. Notice one set of double holes lays closer to the edge of the mask. Insert this set of holes over the air channels.

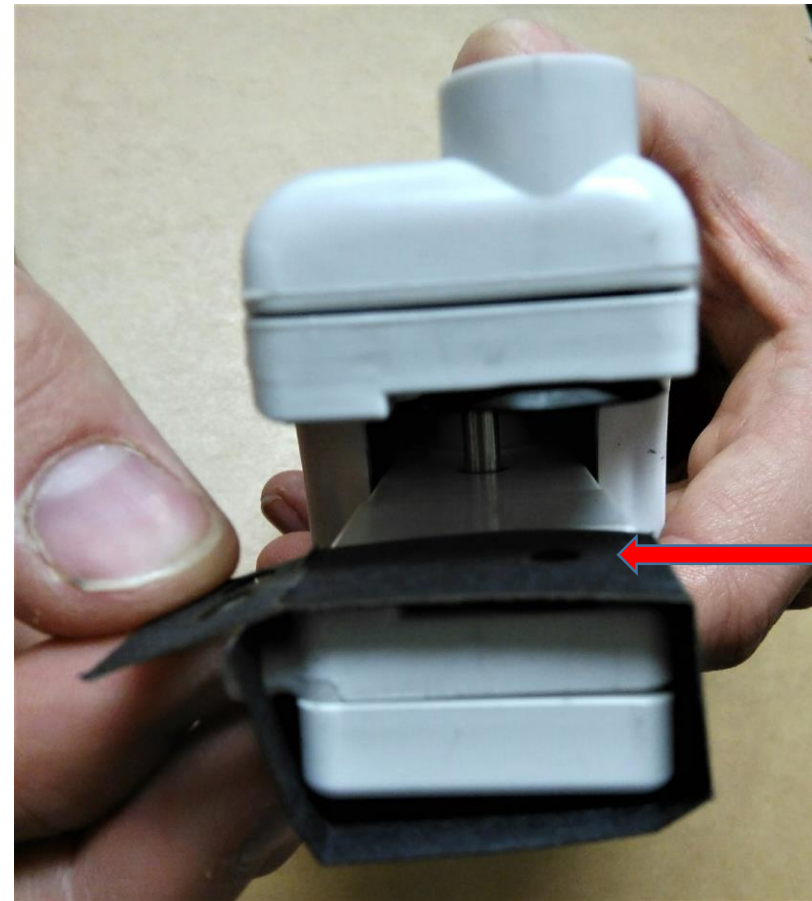


Applying the mask

Step 3. Fold the mask around the bottom jaw of the device.



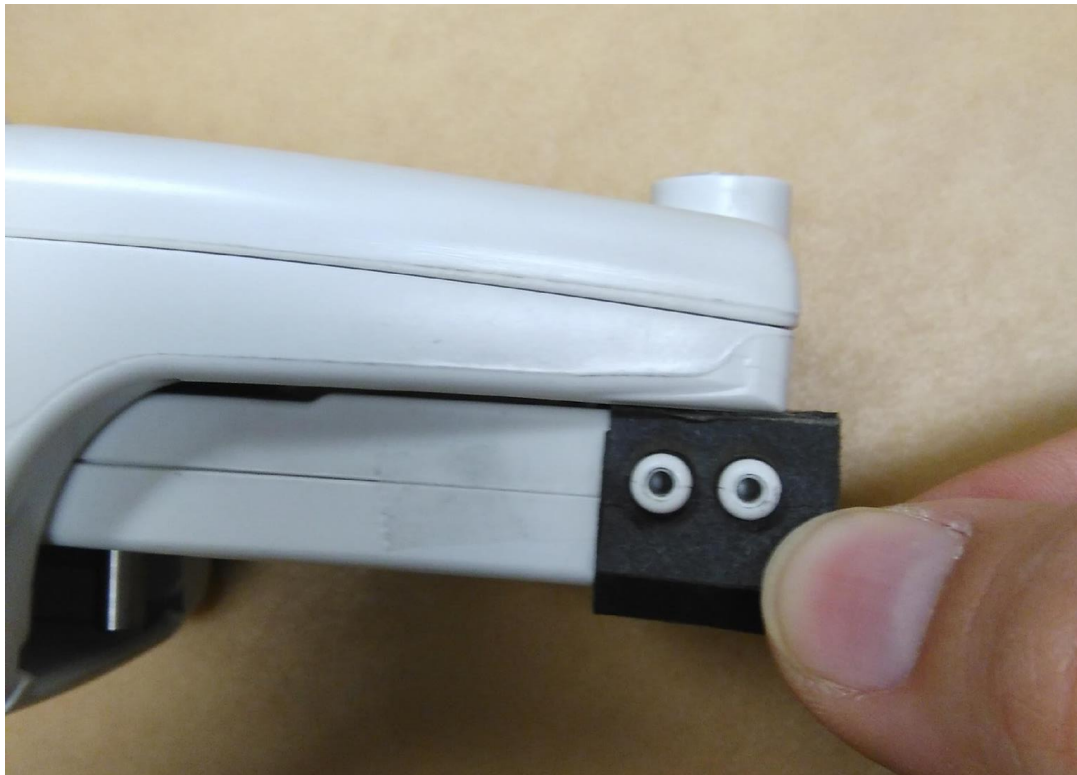
Step 4. Continue wrapping the mask around the bottom jaw of the device so it covers the light guide.



Hole properly
covering the
light guide

Applying the mask

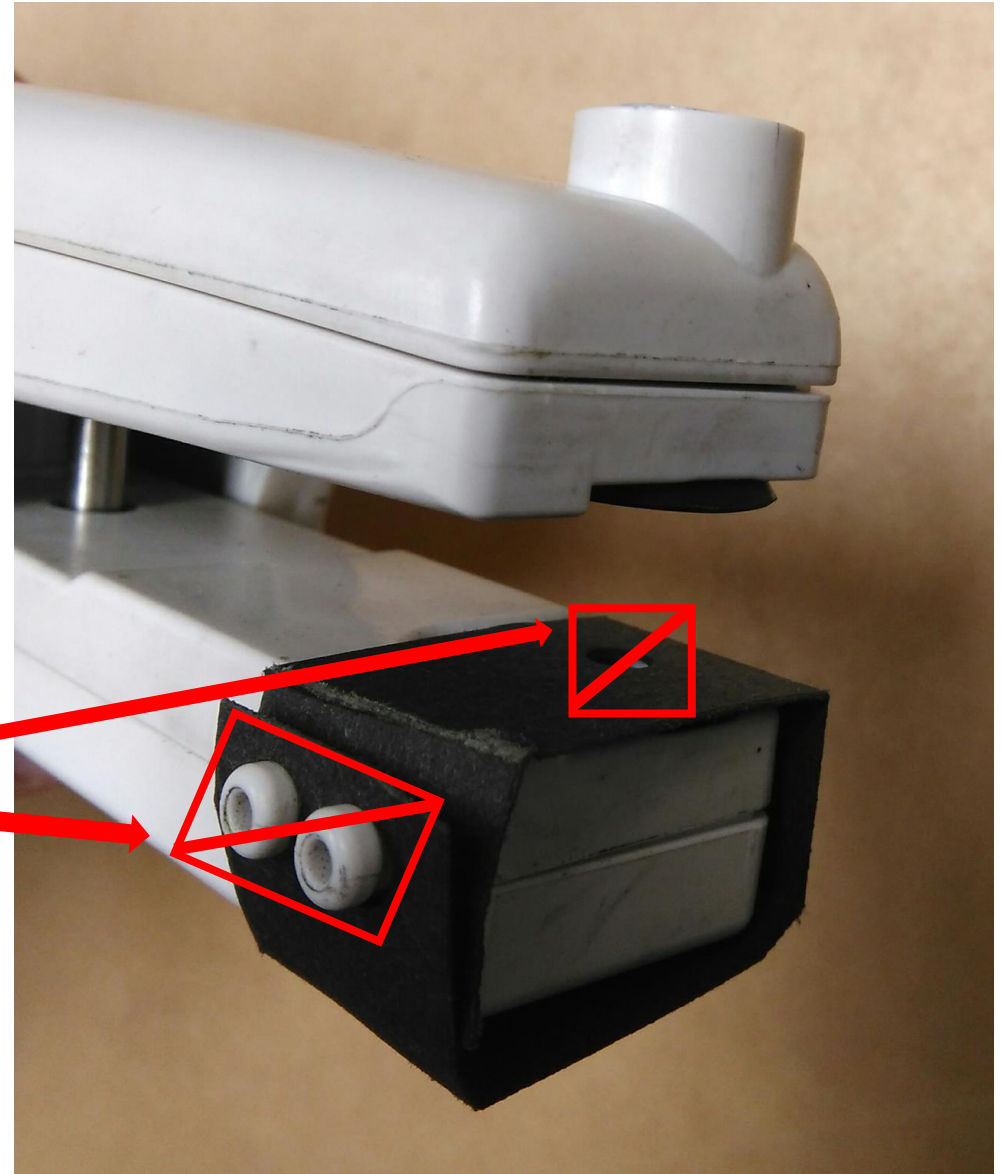
Step 5. Fold the end of the mask over the air channels. This will secure it onto the device.



Applying the mask

Step 6 (Optional). We recommend adding clear tape along the folds of the mask to increase longevity and stability on the MultispeQ.

****Be sure the tape is not covering the air channels or light guide****



Using your masked MultispeQ

Recalibrating the MultispeQ and choosing the correct protocol

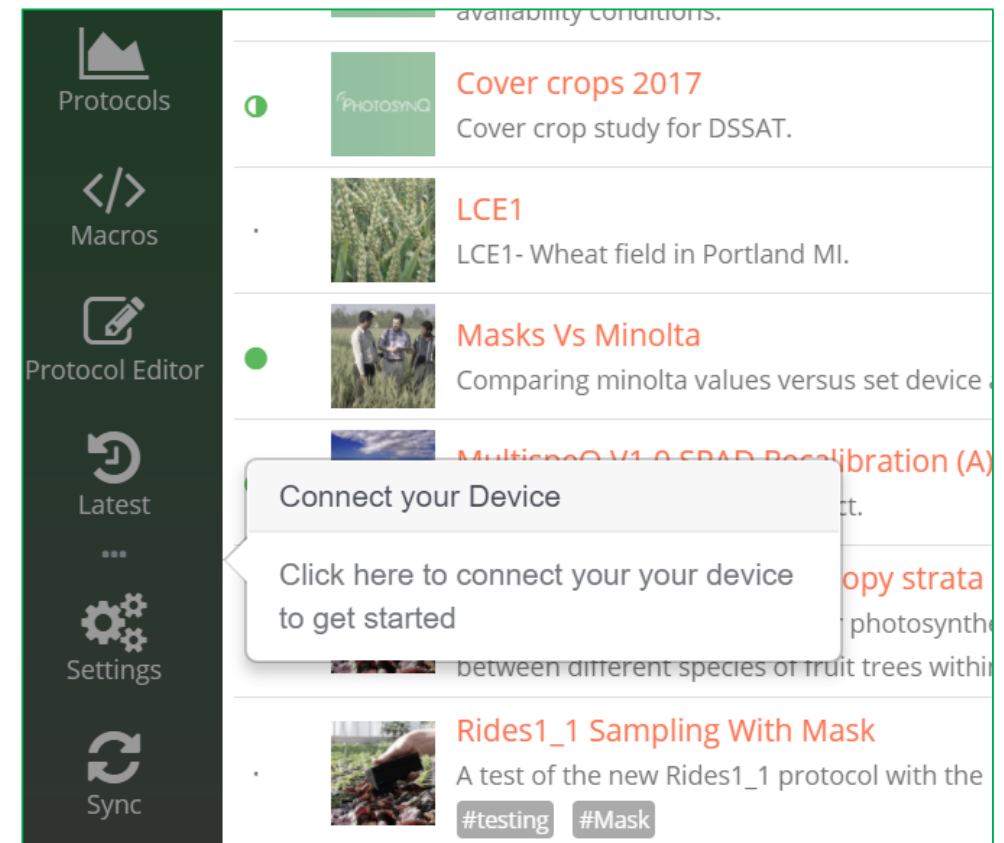
Recalibrating your MultispeQ

****Your MultispeQ should be recalibrated every time a mask is applied or removed****

Step 1. Open the PhotosynQ desktop app.

Step 2. On the left side of the screen, select **settings**.

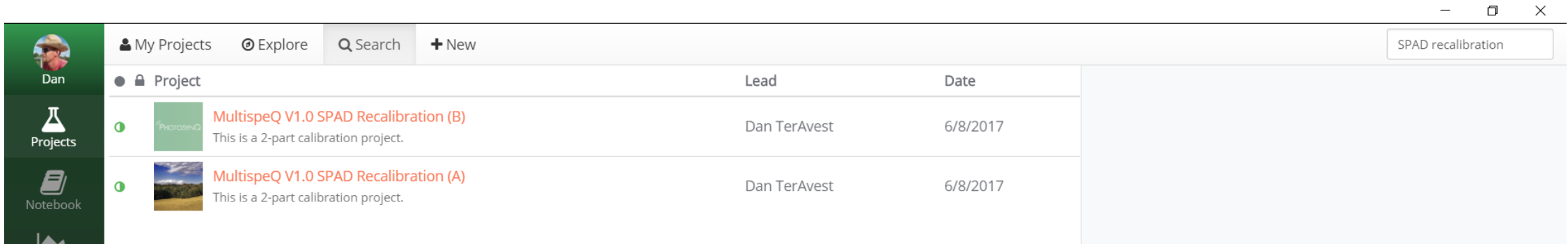
Step 3. Connect the MultispeQ device with a MicroUSB cable. Select the **connect** function.





Recalibrating your MultispeQ

Step 4. Once you have connected to your MultispeQ, select **Projects** from the left side bar.

Step 5. Enter “SPAD Recalibration” in the search bar. You will need to run both projects: *MultispeQ V1.0 Recalibration (A)* and *MultispeQ V1.0 Recalibration (B)*

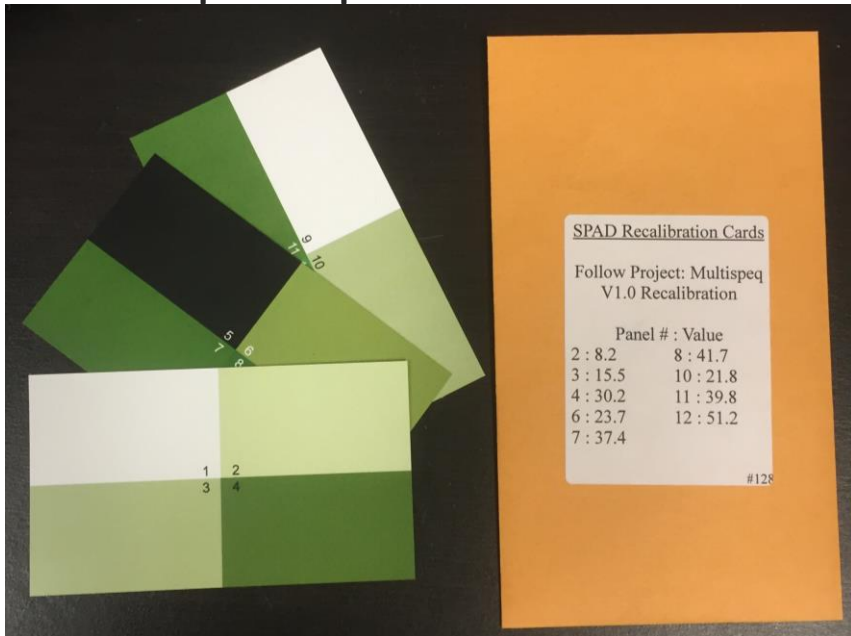


The screenshot shows the MultispeQ software interface. On the left is a dark green sidebar with icons for 'Dan' (user profile), 'Projects' (flask icon), and 'Notebook' (notepad icon). The main area has a light gray header with 'My Projects', 'Explore', 'Search' (with a magnifying glass icon), and '+ New'. A search bar on the right of the header contains the text 'SPAD recalibration'. Below the header, a table lists projects. The table has columns for 'Project', 'Lead', and 'Date'. Two projects are listed, both with a green status icon and a thumbnail image.

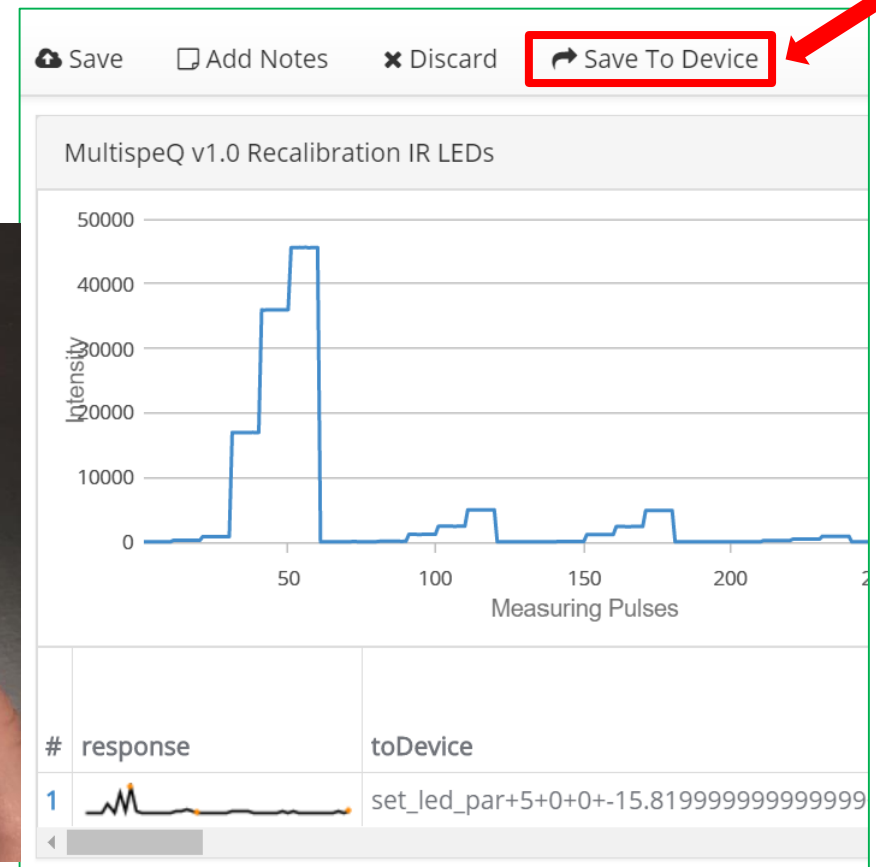
Project	Lead	Date
 MultispeQ V1.0 SPAD Recalibration (B) This is a 2-part calibration project.	Dan TerAvest	6/8/2017
 MultispeQ V1.0 SPAD Recalibration (A) This is a 2-part calibration project.	Dan TerAvest	6/8/2017

Recalibrating your MultispeQ

Step 6. Select *MultispeQ v1.0 SPAD Recalibration (A)* and then select *make contribution*. You will need SPAD Recalibration Cards (shipped in the box with your MultispeQ) to complete the on screen prompts.

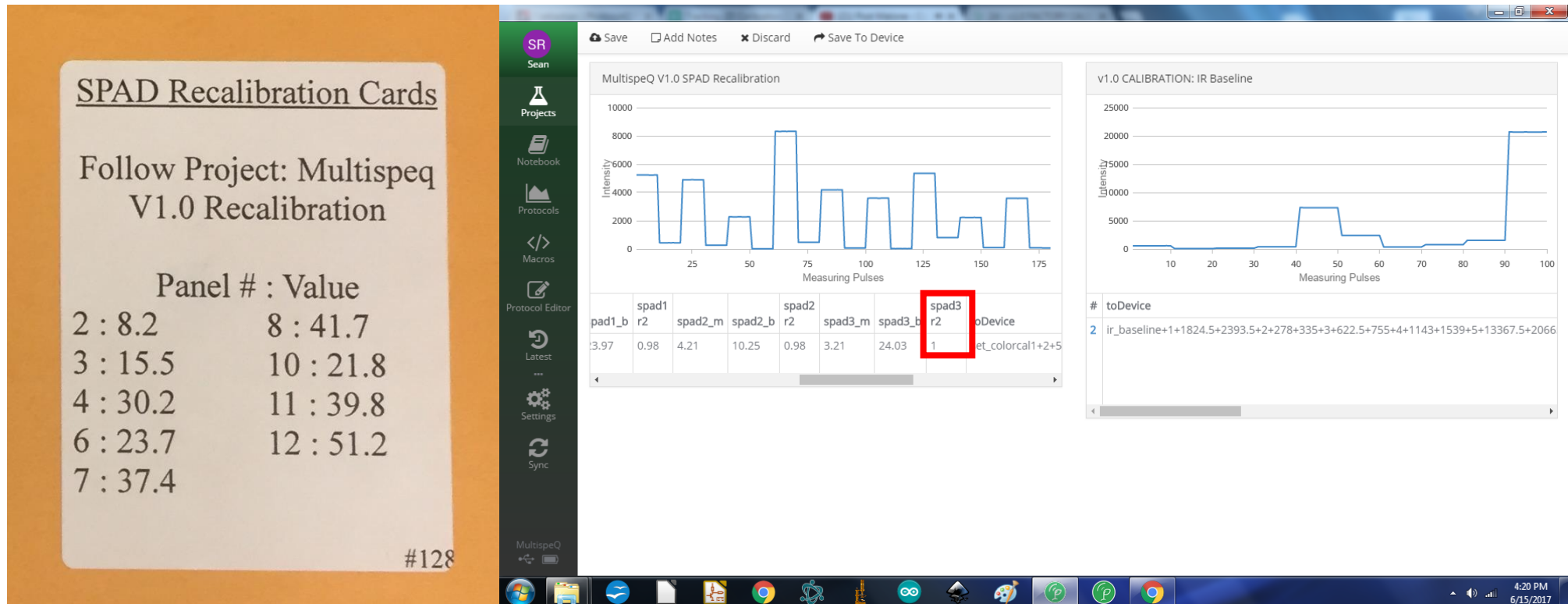


Step 7. At the top of the screen, select **Save To Device**.



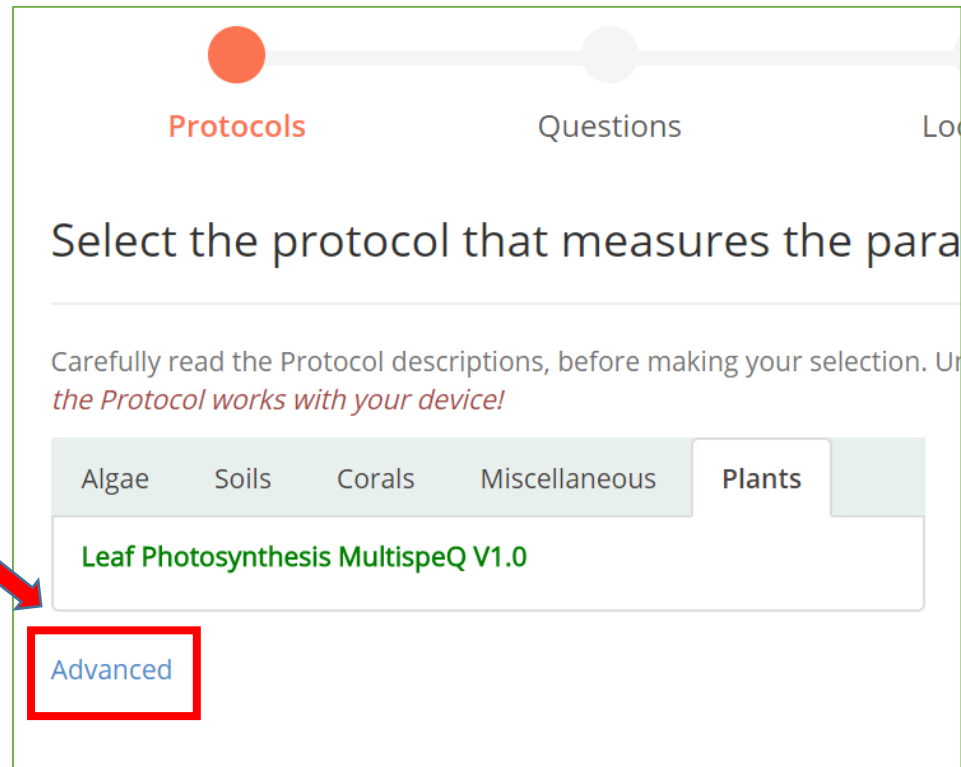
Recalibrating your MultispeQ

- **Step 8.** Select *MultispeQ v1.0 SPAD Recalibration (B)* and follow steps 6-7, making sure to enter the value on the front of the SPAD Recalibration Cards envelope. To confirm a quality calibration, check your spad3 r2 value, it should be near 1

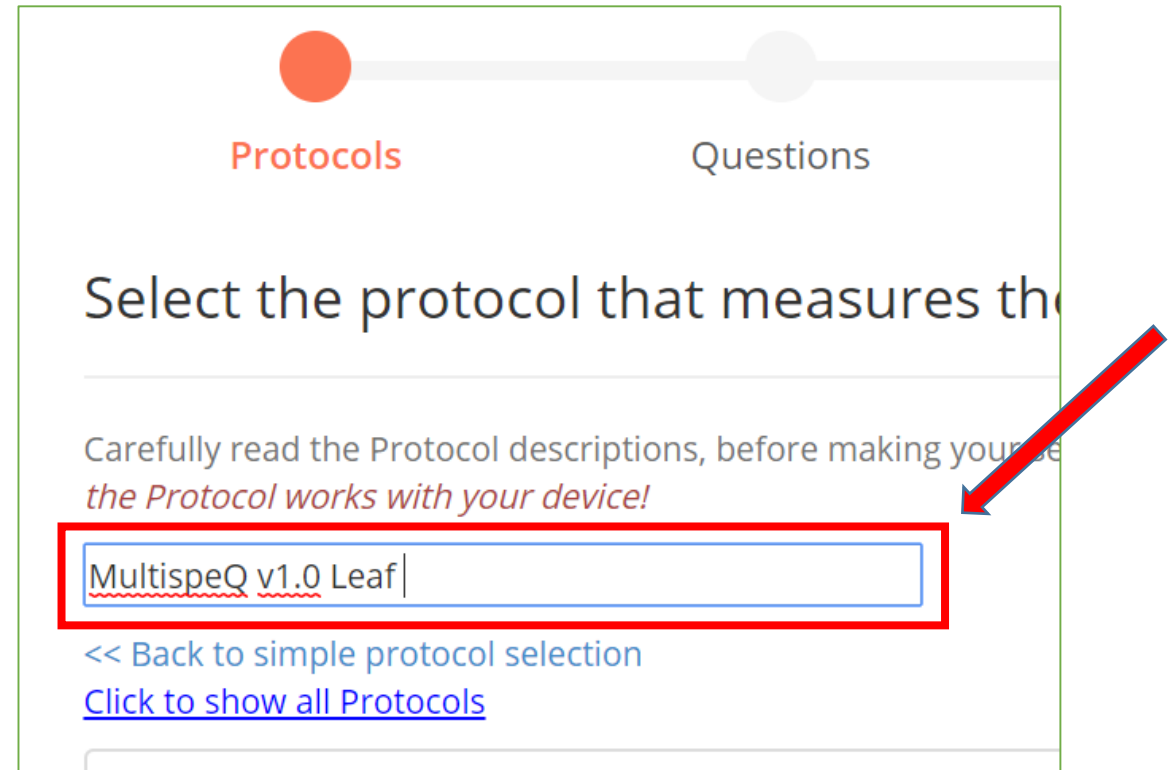


Choosing the correct protocol

Make sure the correct protocol is selected when creating your project.
You will have to select **Advanced** underneath the protocol box and search for *MultispeQ v1.0 Leaf Photosynthesis (Masked)*.



The screenshot shows a web interface for selecting a protocol. At the top, there is a progress bar with three circles; the first circle is red and labeled 'Protocols', the second is grey and labeled 'Questions', and the third is grey and labeled 'Location'. Below the progress bar, the text 'Select the protocol that measures the para' is visible. A warning message reads: 'Carefully read the Protocol descriptions, before making your selection. Use the Protocol works with your device!'. Below this, there are five tabs: 'Algae', 'Soils', 'Corals', 'Miscellaneous', and 'Plants'. The 'Plants' tab is selected, and a dropdown menu is open showing 'Leaf Photosynthesis MultispeQ V1.0'. A red box highlights the 'Advanced' button at the bottom left. A red arrow points from the left towards the 'Advanced' button.



The screenshot shows the same web interface as the previous one. The 'Plants' tab is selected, and the search bar contains the text 'MultispeQ v1.0 Leaf'. A red box highlights the search bar. A red arrow points from the right towards the search bar. Below the search bar, there are two links: '<< Back to simple protocol selection' and 'Click to show all Protocols'.

Now you are ready to use your
masked MultispeQ!