

EARBOX system

How to use your EARBOX Mini

**January 2023
Earbox Version: 2.2b**



1. **Listing Items - p.3**
2. **Getting started with Earbox Mini - p.4**
3. **Start an acquisition sequence - p.17**
4. **How to turn off your Earbox Mini - p.19**
5. **User interface details - p.21**
6. **Preparing the maize ears for image acquisition - p.27**
7. **Image management - p.28**
8. **Image analysis - p.29**
9. **Maintenance of your Earbox - p.30**

1 – Listing Items

- **1x Earbox mini (with HDMI)**
- **1x 12V Power supply (on the right side)**
- **1x Barcode scanner with its holder (inside the box)**
- **1x Hard Drive (inside the box)**
- **1x Brush (on the right side)**
- **2x Power cables for 12V power supply and LED driver (in the packaging)**

2- Getting started with Earbox Mini

1. Reposition the front door handle, Barcode scanner holder, and remove the tape from the polarizing lens.



Using an Allen key for hexagonal screws, unscrew and screw the door handle to position it on the right side.



Use the Allen key to position the lock nut by sliding it along the key to position it in its housing.

2- Getting started with Earbox Mini

1. Reposition the front door handle, Barcode scanner holder, and remove the tape from the polarizing lens.



Using an Allen key for hexagonal screws, unscrew the screw on the top right of the button panel.



Reposition the barcode scanner holder (pack with the scanner).

Push the holder to position **the largest hole** on the head of the screw to the left of the first screw you loosened.

Then screw the screw back into the left, smaller hole of the holder.

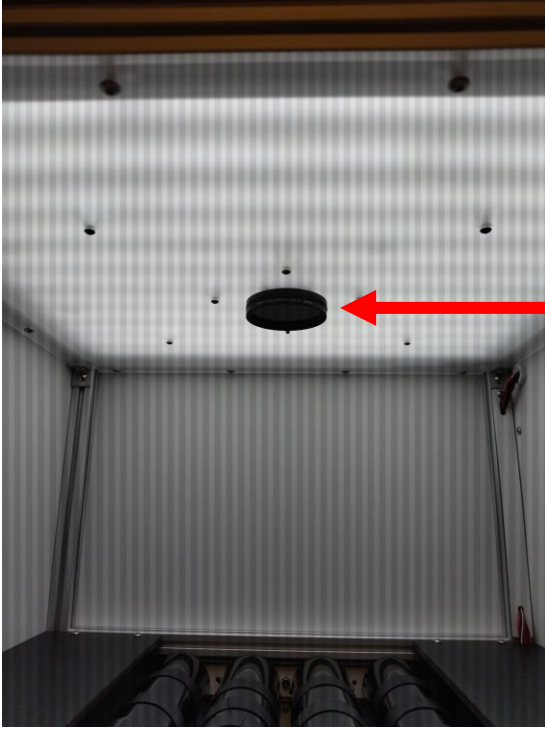


Largest hole

Smallest hole

2- Getting started with Earbox Mini

1. Reposition the front door handle, Barcode scanner holder, and remove the tape from the polarizing lens.



Remove the tape from the polarizing lens.

2- Getting started with Earbox Mini

2. Check/prepare the electronic components:

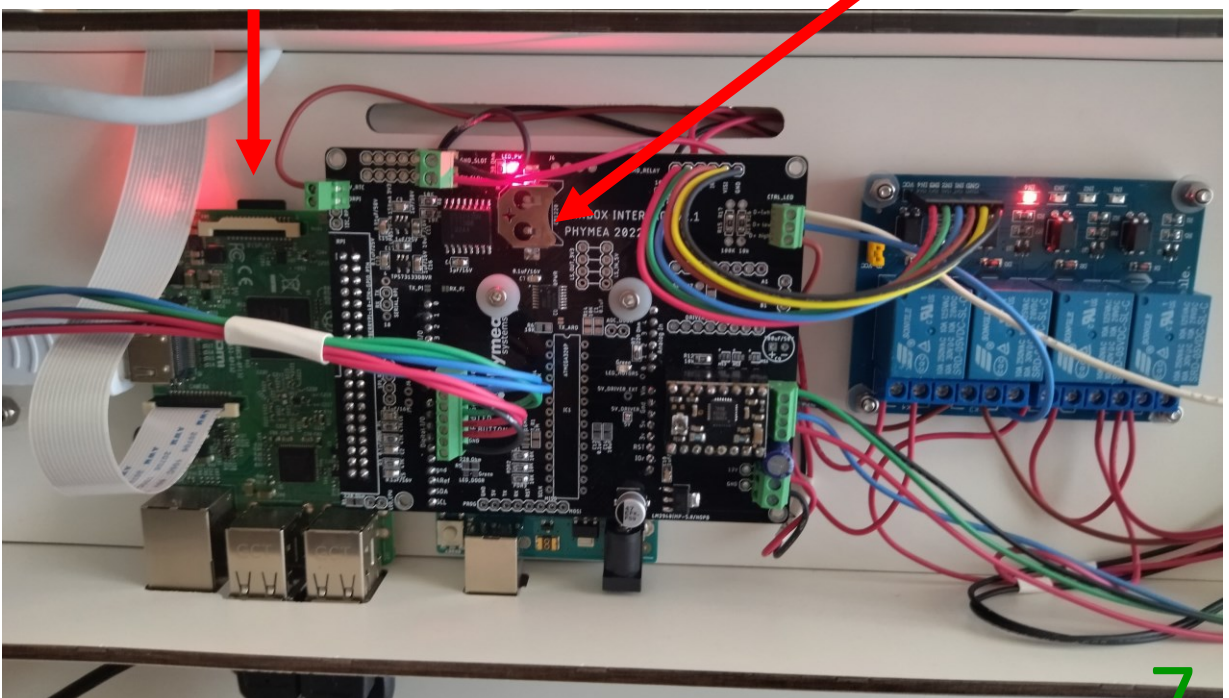
- Unscrew the Plexiglas from the electronics compartment.
- Remove the protective film from the Plexiglas **and put aside the Plexiglas to discharge static electricity (~1min)** that could damage the electronic components.

Then check:

- The correct insertion of the SD card of the Raspberry Pi.
- The connections (check that the cables connected to the different terminals are correctly tightened, these cables being tinned, the terminals can become loose with time and transport).
- **OPTIONAL:** if you want the Earbox to stay on time when it is completely disconnected from the mains (AC 220V), insert a CR1220 (3V) battery for the RTC (Real Time Clock) on the interface PCB.
- Finally screw the Plexiglas back on.

SD card

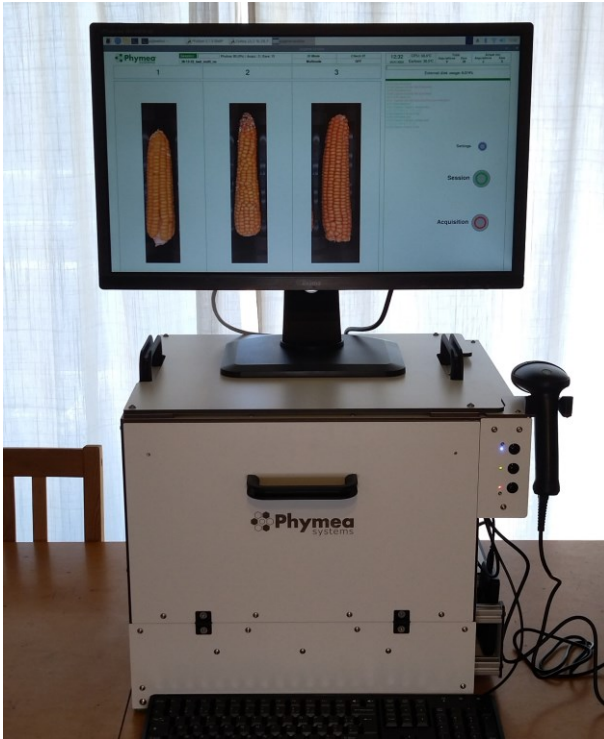
CR1220 battery
location (+ side
towards you)



2- Getting started with Earbox Mini

3. Connect the peripherals:

- HDMI screen



The connected HDMI cable is located on the back of the Earbox.

- USB peripherals: Hard-drive, barcode scanner and your keyboard.



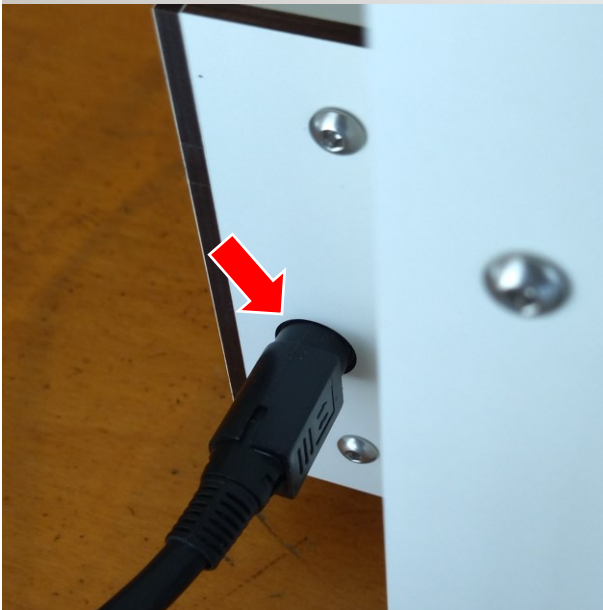
2- Getting started with Earbox Mini

4. Connect the Power Supplies:

- 12V Power supply

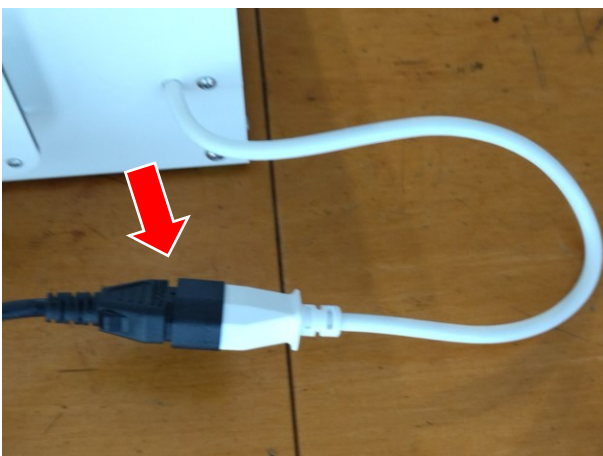


Connect a power cable to the 12V power supply.



Connect the 12V power supply to the back of the box, positioning the plug as shown on the picture (rectangular part towards the inside of the box, and the round part towards the outside).

- Led Driver



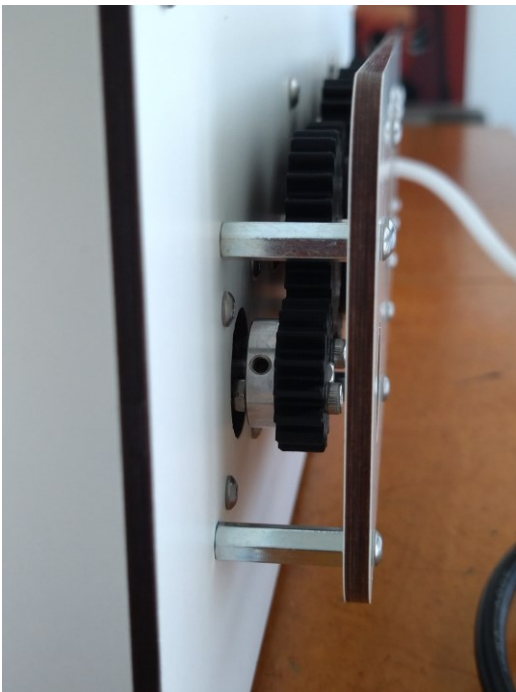
Connect a power cable to the LED driver socket on the back of the box.

2- Getting started with Earbox Mini

5. Turn on the box with the ON/OFF switch
(Green button - right side of the box)



! Check that the motor runs briefly when Earbox is switched on.



If the motor does not turn on, continue the startup as normal, until you get to the session selection page, where the MENU button is displayed.

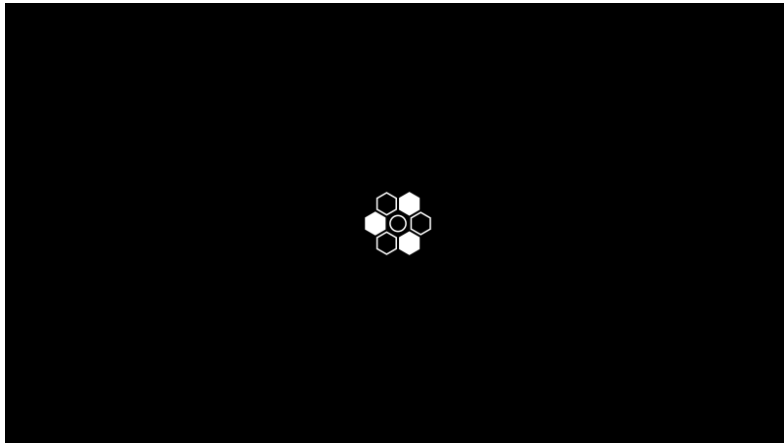
Press the MENU button, then SHUTDOWN to turn off the EARBOX (see 3- How to turn off your Earbox Mini). Then restart the EARBOX after at least 30 seconds of waiting. If the motor still does not turn on the second time, contact Phymea systems.

2- Getting started with Earbox Mini

5. Turn on the box with the ON/OFF switch

Wait a few moments for the startup sequence to finish. You will see 3 different screens during the startup. This can take a few minutes.

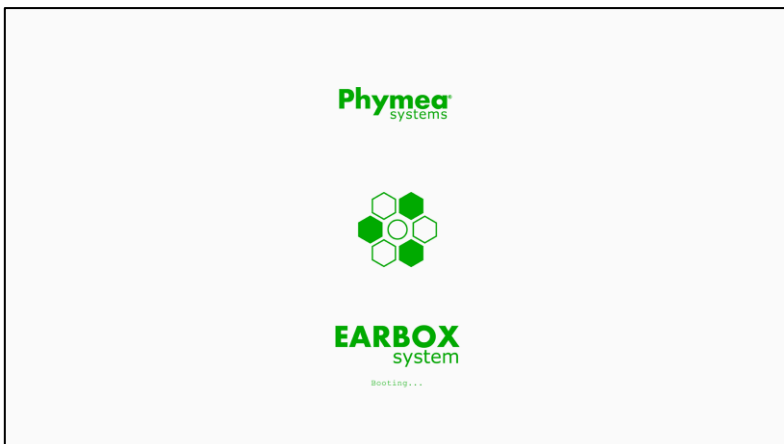
1



2



3



2- Getting started with Earbox Mini

6. Set the time on the RTC via the user interface

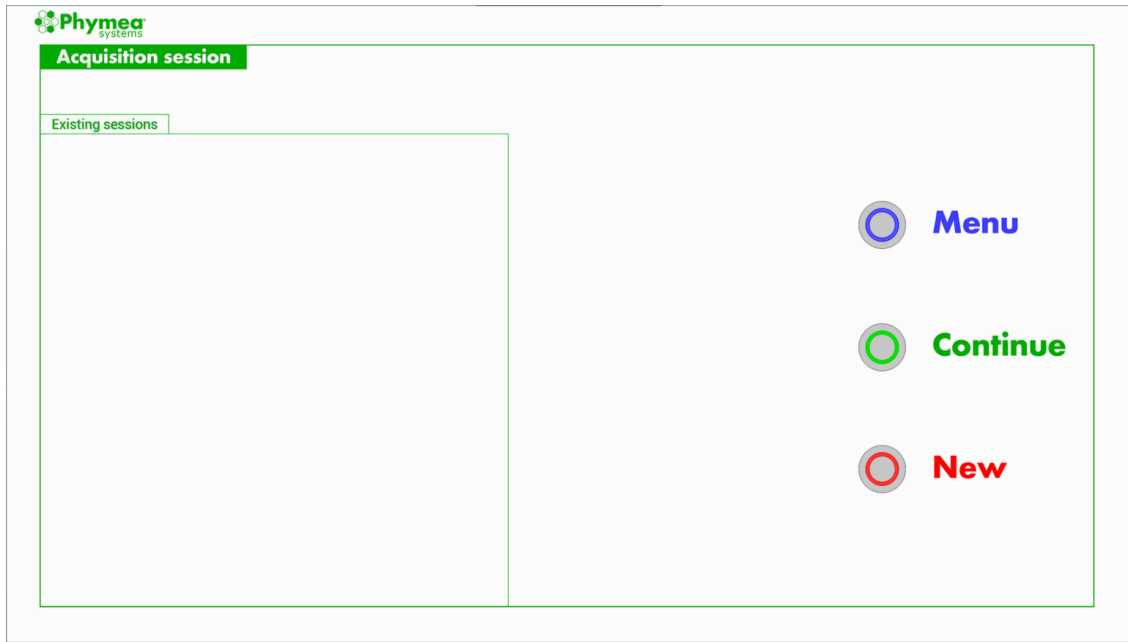


The screenshot shows the Phymea systems logo in the top left corner. Below it is a green header bar with the text "Date - Time". The main content area is a large white rectangle with a green border. In the center of this rectangle, there is a green instruction: "Enter the date and time in this format ->dd/mm/YYYY HH:MM". Below the instruction is a dark grey input field containing the text "24/12/2022 23:59".

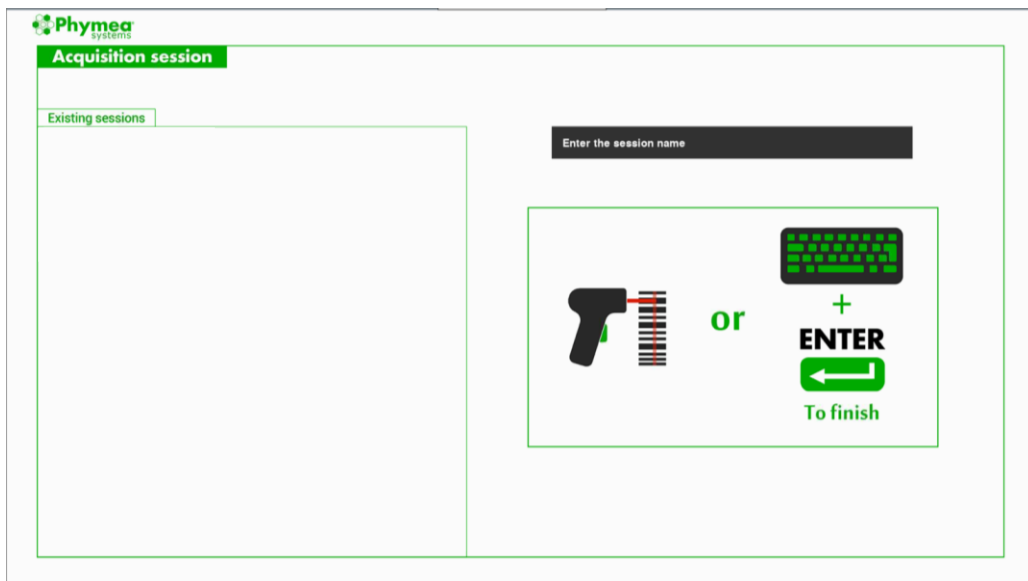
2- Getting started with Earbox Mini

7. Declare your first acquisition session

- Press NEW



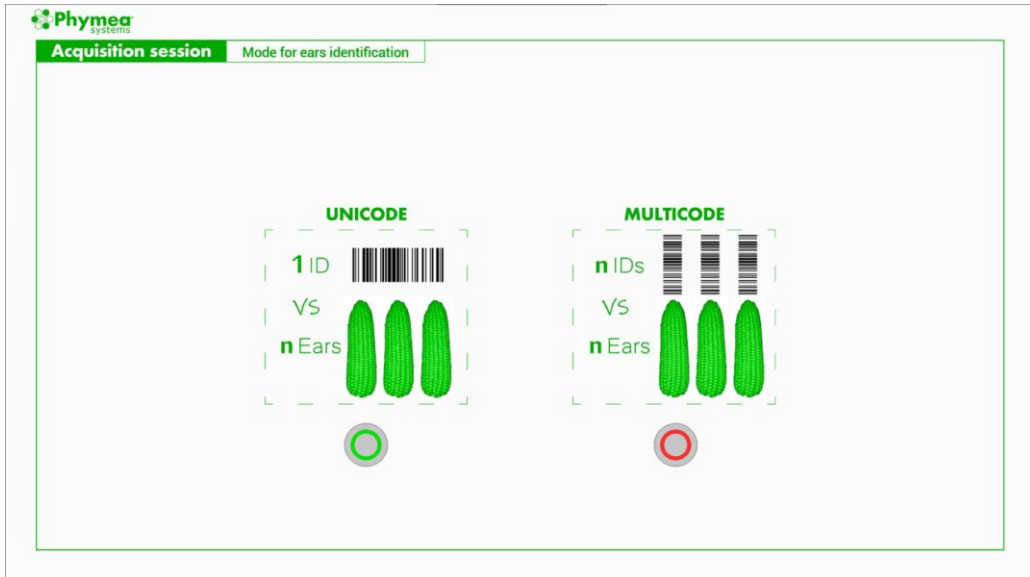
- Enter a session name with the keyboard or the scanner
(The box automatically adds a number and the date after the session name)



2- Getting started with Earbox Mini

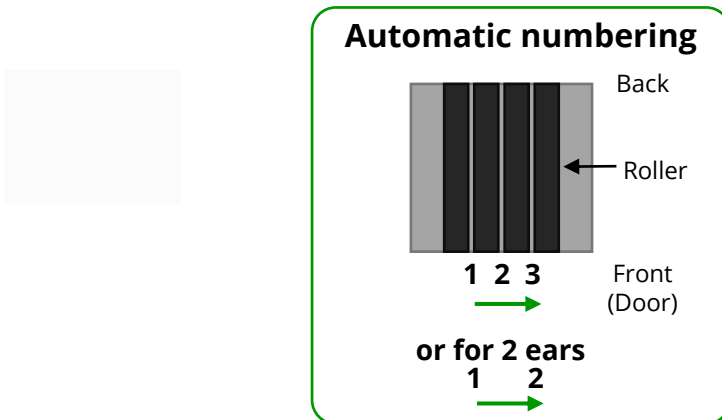
7. Declare your first acquisition session

- Select the Mode for ear identification



UNICODE = 1 code/ID for several ears (ex: a same plot/genotype).
The ears are automatically numbered from left to right.

MULTICODE = 1 unique code for each ear.

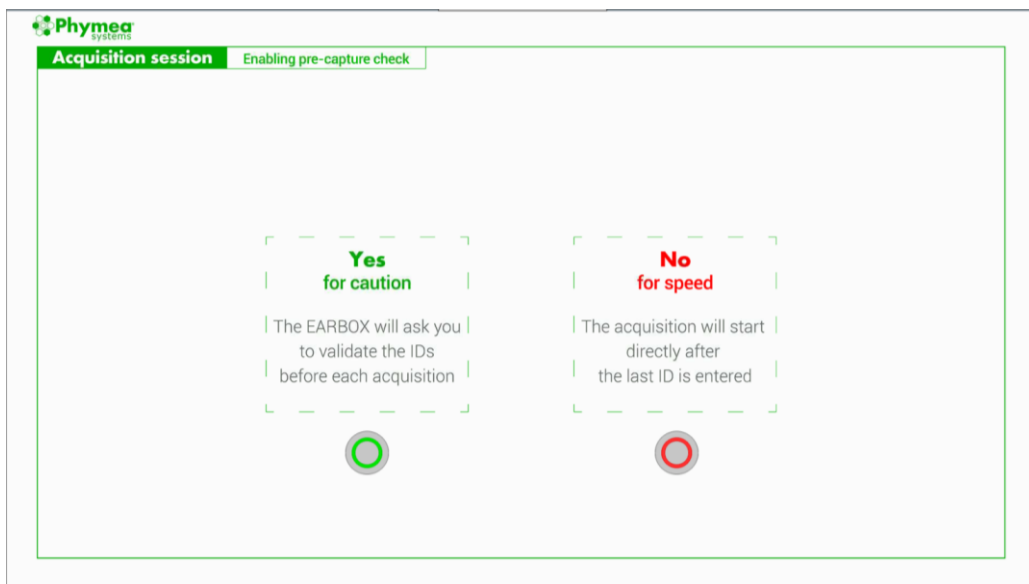


2- Getting started with Earbox Mini

7. Declare your first acquisition session

- **Enable/Disable pre-capture check**

Enabling Pre-capture check forces the user to verify and confirm ear IDs before triggering the image acquisition sequence.



2- Getting started with Earbox Mini

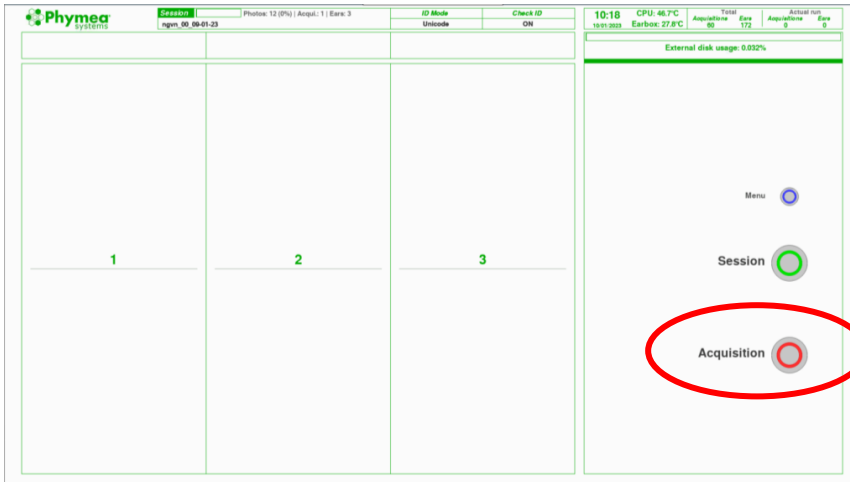
8. The Earbox is ready!

The screenshot displays the Phymea systems interface. At the top left is the Phymea systems logo. The main interface is divided into several sections:

- Session Information:** Shows the session name 'ngvn_00_09-01-23', photo status 'Photos: 12 (0%)', acquisition status 'Acqui.: 1', and ear count 'Ears: 3'.
- ID Mode:** Set to 'Unicode'.
- Check ID:** Set to 'ON'.
- System Status:** Displays the time '10:18' on '10/01/2023', CPU temperature '46.7°C', and Earbox temperature '27.8°C'.
- Acquisition Statistics:** A table showing 'Total Acquisitions' (60), 'Total Ears' (172), and 'Actual run Acquisitions' (0) for 'Ears' (0).
- Disk Usage:** Shows 'External disk usage: 0.032%'.
- Control Buttons:** Three circular buttons labeled 'Menu', 'Session', and 'Acquisition' are visible on the right side.
- Image Grid:** A large grid area is divided into three columns labeled '1', '2', and '3', which are currently empty.

3- Start an acquisition sequence

- **Insert ears (between rollers) in the EARBOX and press Acquisition**



Start acquisition screen

The EARBOX triggers detection of the ears and displays their image according to their position in the box.

- **Ear identification**

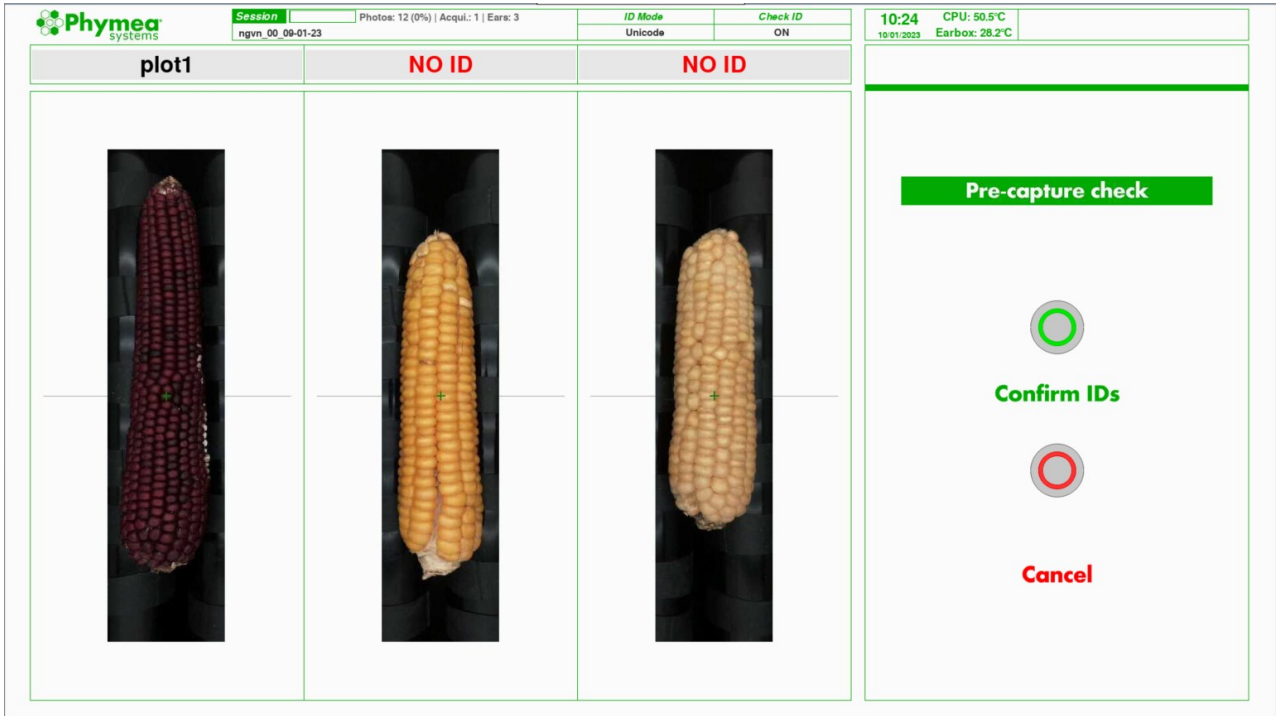
You can then enter the ID(s) of the ears by following the instructions on the screen.

Information: the barcodes displayed on screen can be scanned to perform the whole identification procedure with the scanner.



3- Start an acquisition sequence

- **OPTIONAL: Confirm IDs if Pre-capture check is enabled**



- **The acquisition then starts automatically**

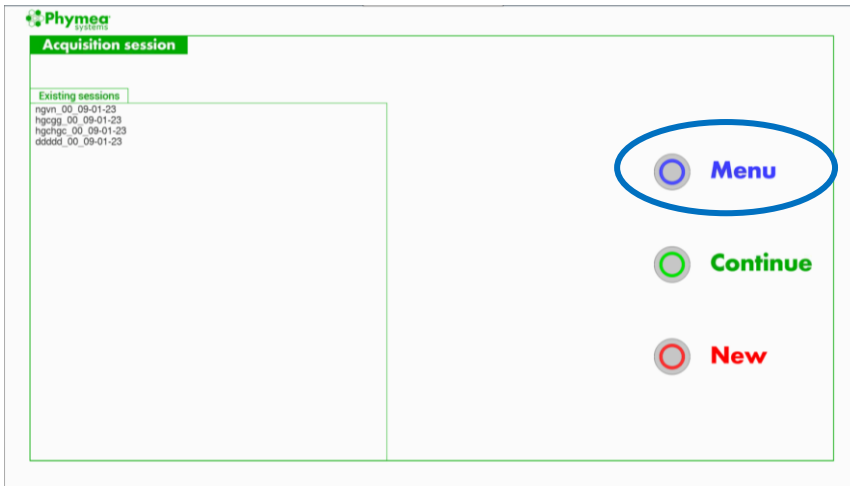
The acquisition sequence takes between 24 and 30 seconds. During this period you should hear the rollers turning 5 times (6 sides). At the end of the capture the Earbox warns the user ("Capture done").



- **The Earbox is ready for a new acquisition**

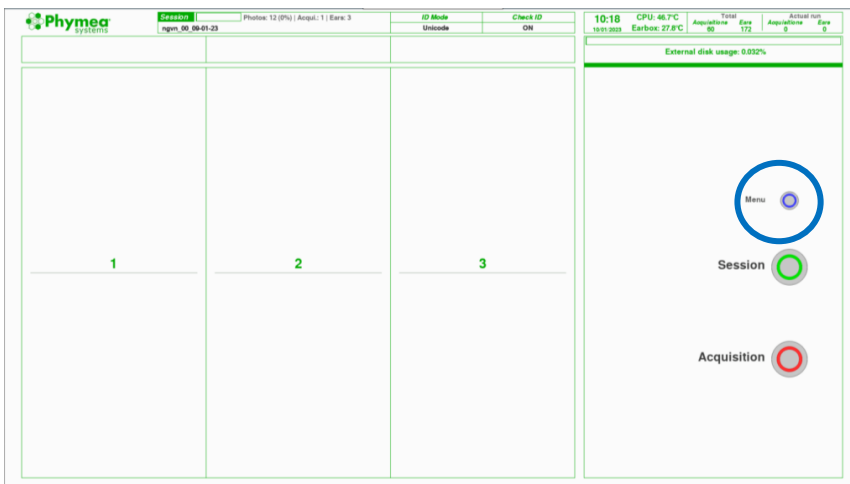
4- How to turn off your Earbox Mini

- Press **Menu**



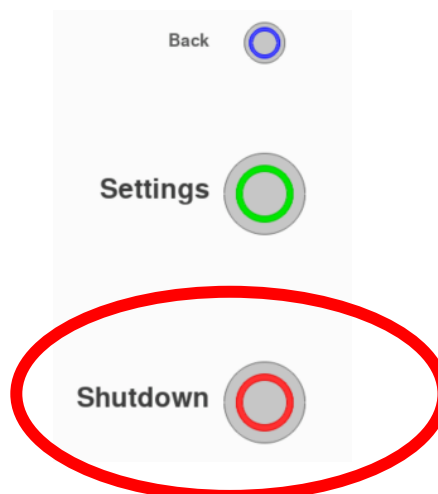
Select/Create session screen

OR



Main screen

- Press **Shutdown**

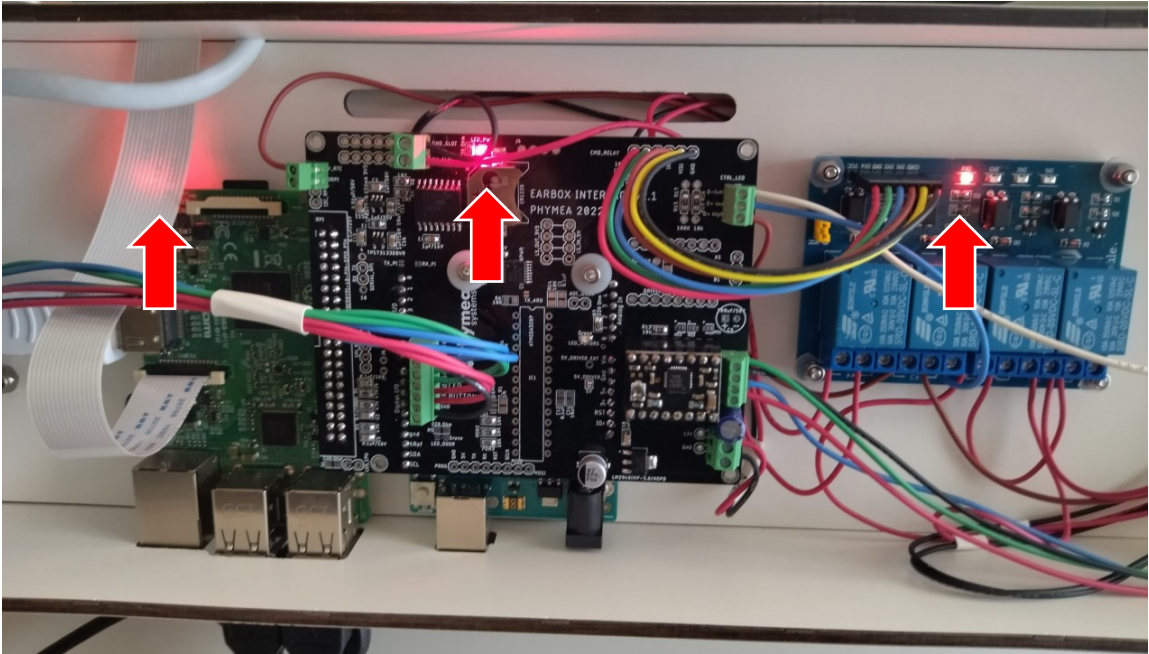


4- How to turn off your Earbox Mini

- Wait a few seconds until all **3 red LEDs** are off



If the Earbox is turned off before the red LEDs go out, there is a risk of damaging the Linux system on the SD card.

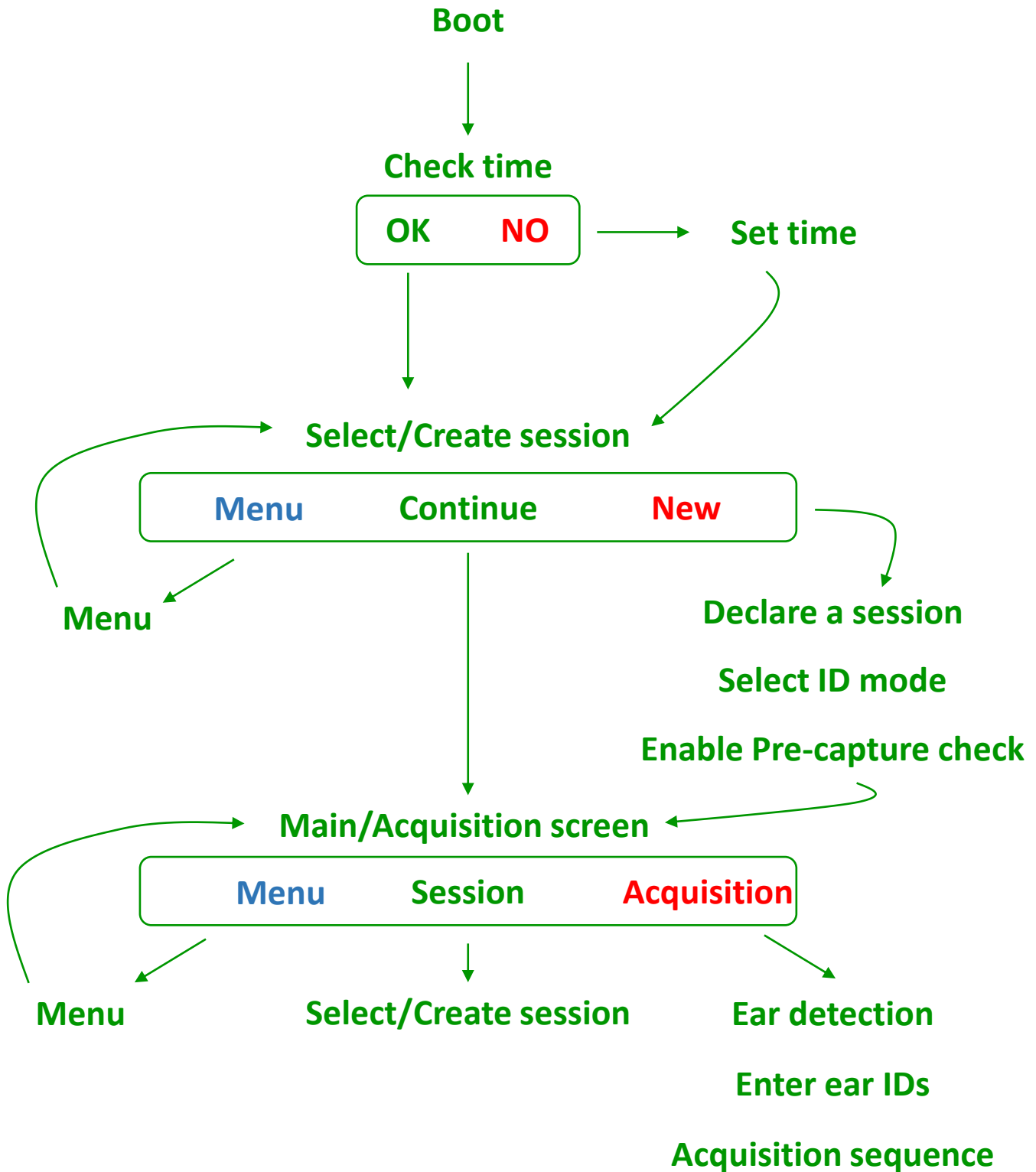


- Once the LEDs are off, you can turn off the EARBOX with the ON/OFF switch.



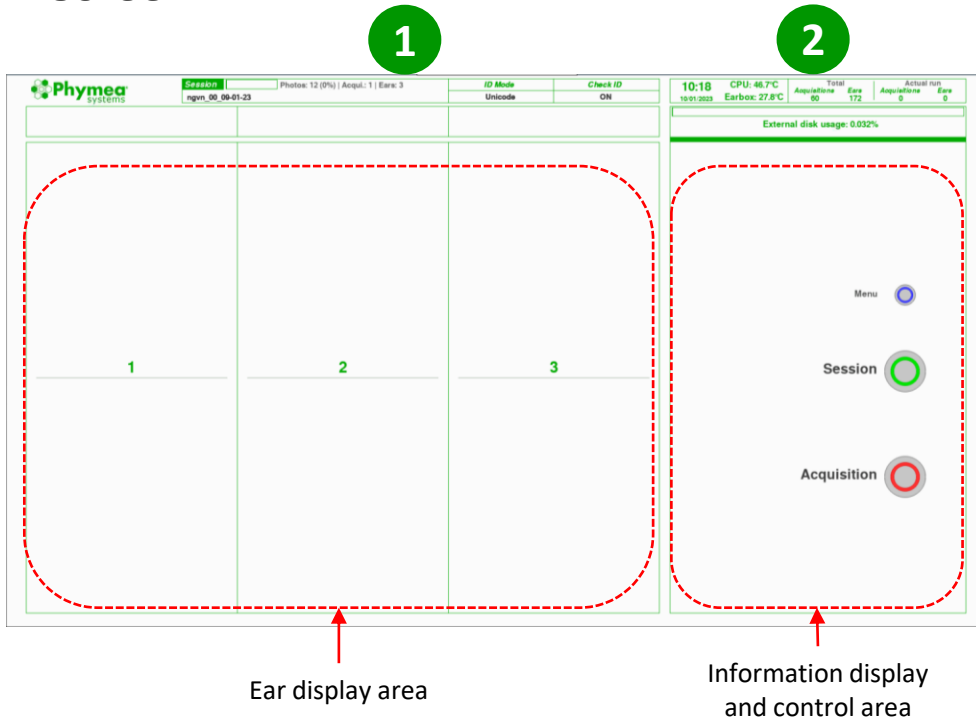
5- User interface details

- User interface tree



5- User interface details

- Main screen



Info example:
 10:19-Ears detection
 10:20-Capture aborted by user
 10:20-Ears detection
 10:24-Capture aborted. Too many IDs entered
 10:24-Ears detection
 10:27-Capture 60 begins, please wait...
 10:27-ID list: plot1

1

Number of images in the current session folder.
 If the number of photos is >15000, the system creates a new folder with the same name, incrementing the session number.

Number of acquisitions of the current session

Session		Photos: 12 (0%) Acqui.: 1 Ears: 3	ID Mode	Check ID
ngvn_00	09-01-23		Unicode	ON

Session name Session date

Session number
 (this number is automatically generated to identify multiple directories for a same session)

Number of ears of the current session

Ear identification Mode:
 Unicode or Multicode

Pre-capture status

5- User interface details

- Main screen

2

Time and Date of the Earbox (and images)

Raspberry Pi CPU and electronic compartment temperatures

10:18 10/01/2023	CPU: 46.7°C Earbox: 27.8°C	Total	Actual run
		<i>Acquisitions</i> <i>Ears</i>	<i>Acquisitions</i> <i>Ears</i>
		60 172	0 0

External disk usage 0.032%

Hard drive filling status

Number of acquisitions and ears since the first start

Number of acquisitions and ears since the last start

CPU Temperature: 40 to 68°C

Earbox Temperature: 15° to 45°C

If temperatures rise above their threshold continuously, move the Earbox to a cooler and more airy place.

5- User interface details

- Ear identification mode
 - UNICODE



In this mode it is possible to capture several ears with the same identifier, such as a plot identifier or a genotype identifier.

To do this you only have to enter one ID in box 1 and press Enter.

Use the same identifier several times:

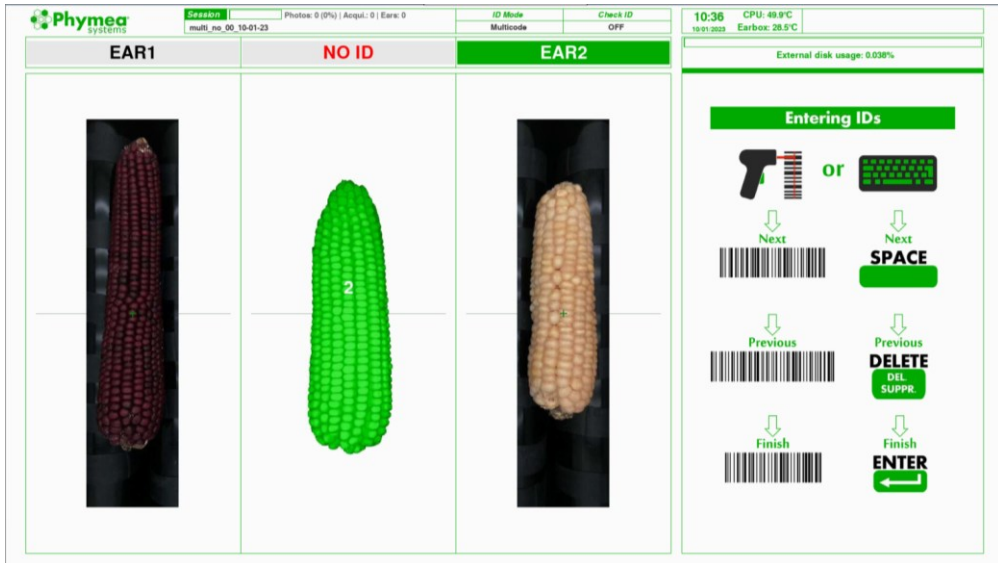
If you have more than 3 ears, at the second acquisition enter your unique ID again. The system will ask you if you want to “Continue with this ID” or “Erase last recorded REP” to replace the previous images.

Choose “Continue with this ID” to acquire new ears.

These ears will be automatically numbered from 4 to 6, and so on. The system counts ears in the following way: if there were only 2 ears in the first acquisition, the numbering would have been from 3 to 5, for a second acquisition of 3 ears.

5- User interface details

- Ear identification mode
 - MULTICODE



This mode is intended to acquire ears with unique identifiers, for example for variety collections.

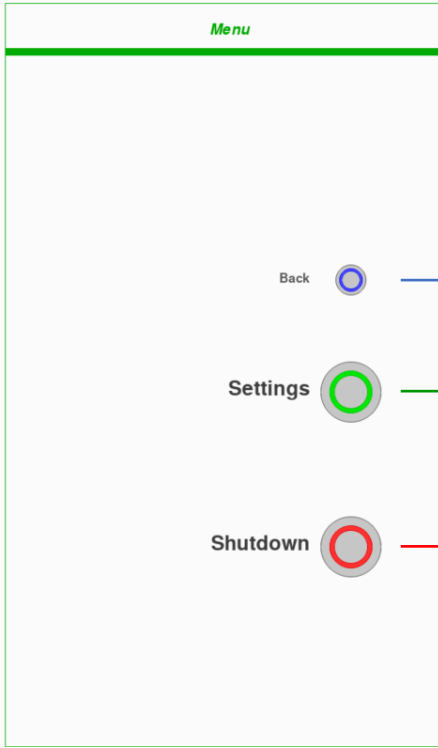
To do this, enter an ID above each ear, strictly respecting the correct correspondence between ears and IDs as shown in the image.

If you enter the same series of identifiers twice (here, EAR1 and EAR2), the system will alert you and allow you to either overwrite the old images or cancel the acquisition.

But if you enter EAR2 and then EAR1, the system will consider that it is a new series and will not alert you.

5- User interface details

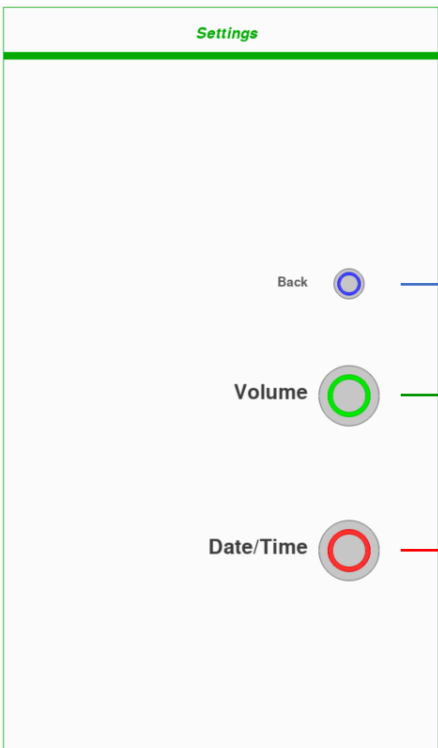
- **Menu and settings screens**



Back → Back to main screen

Settings → Go to settings (Volume and Date/Time)

Shutdown → Shutdown the Earbox
(See 4-How to turn off your Earbox Mini, for more information on the shutdown procedure.)



Back → Back to main screen

Volume → Adjust the volume

Date/Time → Adjust Date and Time

6- Preparing maize ears for image acquisition

- Ears must be clean to be properly characterized/measured.

It is necessary to remove :

- The husks
- The silks and fungi with the brush provided
- The peduncle with a shears

OK



Not good for
analysis



The silks can lead to over-segmentation (over estimation of grain number), it is preferable to remove them as much as possible.

The peduncle will be detected as a basal abortion of the ear.

7- Image management

- **Acquisition session**

During the acquisition, the images (files) are stored by acquisition session (folders).

The name of each image is coded, it includes the identification mode of the ears (Unicode or Multicode), the identifiers of all ears present on the image, as well as the image wavelength (visible or IR) and the face of the ears (from 1 to 6). For Unicode mode, it also includes the repetition number of a same identifier.

When a session has more than 15000 images, the Earbox automatically creates a new session (folder) with the same name but with a new session number and a new date.

For example:

Session1_00_date1

Session1_01_date2

Etc.

- **Retrieve images**

To retrieve images, you need to turn off the Earbox, unplug the external drive and connect it to your personal computer.

The images are stored per session in the folder:

/Earbox_drive/Session/

- **Remove a session or images**

To remove a session or images, you need to turn off the Earbox, unplug the external drive and connect it to your personal computer.

To delete sessions and images it is necessary to delete the whole session folder. Do not remove images directly. Because the system saves in an external file the number of images and ears of the session. Removing images (files) means that this external file is no longer coherent, which can lead to file management or system errors. So to remove session, images or empty the hard drive it is necessary to delete the folders present in the folder: /Earbox_drive/Session/

8- Image analysis

- **Transfer images**

Retrieve the sessions (folders) that you want to analyze.

The images must remain in their session folder, so the directory tree on the hard disk must be kept and respected (do not remove images from the session for example)

Finally zip the session folders to be analyzed and contact Phymea systems to exchange the images and schedule the image analysis.

This procedure is provisional, we are working on its automatization for a better ergonomics.

o retrieve images, you need to turn off the Earbox, unplug the external drive and connect it to your personal computer.

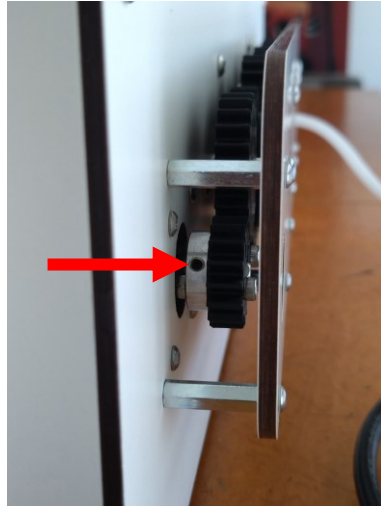
- **Contact Phymea Systems.**

Contact us at this adress for image analysis or support:

earbox@phymea-systems.com

9- Maintenance of your Earbox

- **Clean the rollers regularly** with a mild degreaser, so that the rubbers adhere to the ears and ensure the proper rotation of the ears.
- **Check the tightening of the grub screw** of the motor coupling (do not over tighten! Correct tightening = contact + 1/4 turn).



- With the Earbox turned off, **check that the gears turn smoothly in both directions**. You can clean/grease them with a toothbrush and commercial products.
- **Clean the bottom of the Earbox**, by unscrewing the two bottom screws and pulling the black bottom plate towards you.

