

Eclosion recording

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1 Introduction

We have camera-based recording boxes to record eclosion behaviour.

2 Materials

- Pupae sample (films or 96-well plates)
- A red marker
- Transparent tape

3 Introduction to the recording box

The recording box consists of

1. a sealed black box
2. white and red LED strips
3. a camera
4. a horizontal plate on which sample is set

We now have 8 recording boxes (`box1` through `box8`) monitored by 4 Raspberry Pi computers (`rpi1` through `rpi4`) (Table 1). Each box has a camera on the bottom (facing up). The cameras are controlled by the Raspberry Pi computers. The 4 Raspberry Pi are controlled by another Raspberry Pi (`rpi0`. i.e. You start and stop recording from `rpi0` by accessing `rpi1-4`). LED lights are controlled by analog timer switches, not computers.

Table 1: Computers

Computer	Function
<code>rpi0</code>	Controls <code>rpi1</code> , <code>rpi2</code> , <code>rpi3</code> , <code>rpi4</code>

Computer	Function
rpi1	Controls cameras of box1, and box2
rpi2	Controls cameras of box3, and box4
rpi3	Controls cameras of box5, and box6
rpi4	Controls cameras of box7, and box8

Each box holds a semi-opaque or transparent rectangular plate (“recording plate”). You can place 96-well plates with fly pupae on top of the transparent plate or overhead films with pupae on the bottom of the semi-opaque plate.

[TODO: Images]

4 Methods

4.1 Set up box

1. Take the recording plate from the recording box to the fly room (0.03).
2. In the fly room,
 - Film:
 - Remove films from the vials.
 - Remove remaining fly food on the film using tissue paper.
 - Attach films on the bottom side of the recording plate using transparent tapes
 - 96-well plate
 - Write the sample info with a red marker on transparent tape and put it next to the 96-well plate on the recording plate
3. Transfer the recording plate with samples to the incubating chamber.¹
4. Place the recording plate with the sample in the box.

4.2 Log in

Inside the incubating chamber, we have a screen, a keyboard, and a mouse. They are connected to rpi0. The computers are always on, so you do not have to boot it.

1. Turn on the screen. The switch is behind the screen at the bottom right corner.
2. Open a terminal by pressing **Ctrl+Alt+T**.

¹Use trays to avoid pupae falling on the floor

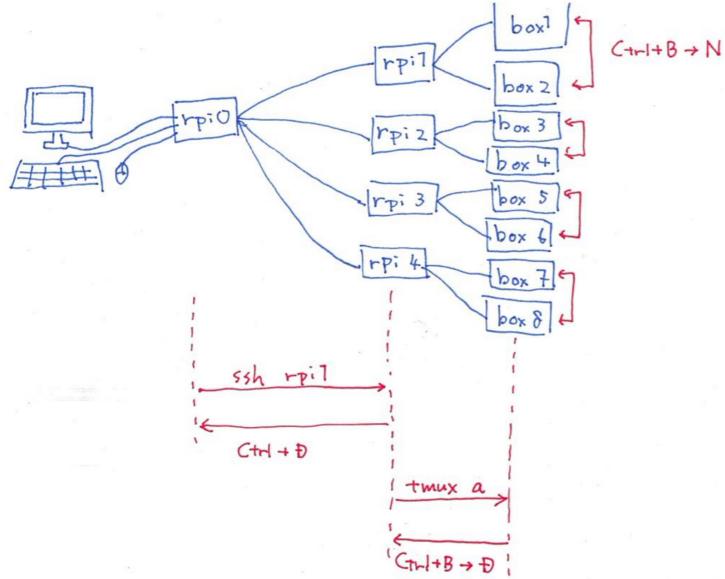


Figure 1: Computers and commands

- In terminal, log in to the focal Raspberry Pi (e.g. box 1 -> rpi1, box4 -> rpi2 etc) by entering the following command. Change **rpi1** to one of **rpi1**, **rpi2**, **rpi3**, **rpi4**.

```
ssh rpi2-admin
```

- Confirm that you see something like the following in terminal. This means that any command you run in this terminal will be run not in **rpi0** but in **rpi2**.

```
junishigohoka@rpi1:~ $
```

This tells you that you have logged in as user **junishigohoka** to computer **rpi2**.

- In terminal type the following and enter

```
tmux a
```

tmux is a program to manage multiple sessions and windows inside the terminal. **a** stands for “attach”. The entire command re-attaches you to pre-existing TMUX session that I made before.

6. You will see a green bar at the bottom of the window (Fig. 2) with

```
[boxes] 0:box3* 1:box4-
```

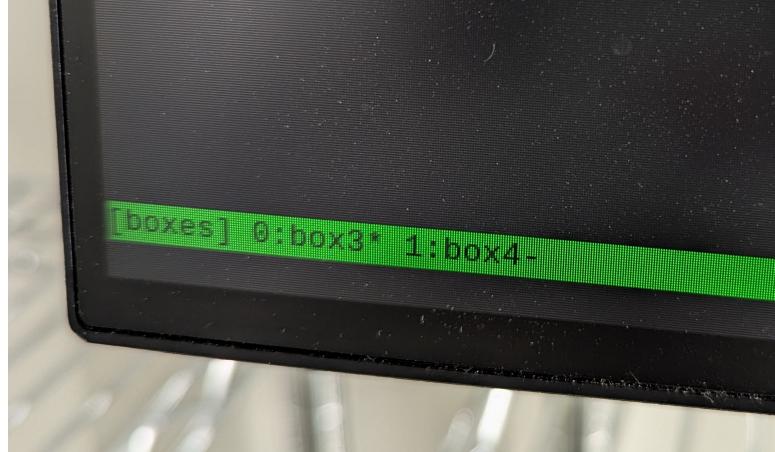


Figure 2: Green bar indicating the TMUX session

The presence of the green bar indicates that you are in a TMUX session that I set up on the rpi. [boxes] means that you are in a session called “boxes”.². 0:box3* 1:box4- means that within this session, there are two windows called box1 and box2. The asterisk after box3 means that you are viewing the window box3 of this session. You can change the window between the two by pressing **Ctrl+B** then **N**. Confirm that the asterisk moves between the two window names.

Now you are ready to start or stop recording of the box you are focusing in the window.

4.3 Log out

Let's assume we are in window box3 of session boxes in computer rpi2, and we want to log out.

1. Confirm that you still see the green bar at the bottom (i.e. You are in a TMUX session).
2. Detach from the session by **Ctrl+B** then **D**.
3. Confirm that you do not see the green bar at the bottom, and the last line of terminal says `junishigohoka@rpi2`.
4. Log out from rpi2 by **Ctrl+D**.
5. Confirm that the last line of the terminal is `jun@rpio0` (You are in rpio0).

²If you see something else like [seadrive] let me know

4.4 Start recording

Let's say we want to start recording of `box3`. We will use a custom script `eclosion_monitor.sh` to start recording.

1. Log in to `rpi-2`, then attach the `boxes` session, and move to window `box3`. See sec. 4.2 for details.
2. To see how to use `eclosion_monitor.sh`, type the following.

```
eclosion_monitor.sh -h
```

It will show the following.

```
Usage: eclosion_monitor.sh [OPTIONS]
```

Options:

-b, --box	Select camera (3 or 4)
-s, --starttime	Start time in "YYYY-MM-DD HH:mm"
-d, --dirout	Path to output directory
-i, --interval	Interval of recording in second
-r, --recid	Recording ID
-h, --help	Show this help message

3. To start recording in `box3`, make sure that you are in window `box3` (i.e. `box3*` in the green bar at the bottom), then type the following command

```
eclosion_monitor.sh -b 3 -s "2026-02-04 11:30" \
                     -i 600 -r rec_044 \
                     -d ~/seadrive/My\ Libraries/my_projects/fly/eclosion_monitors
```

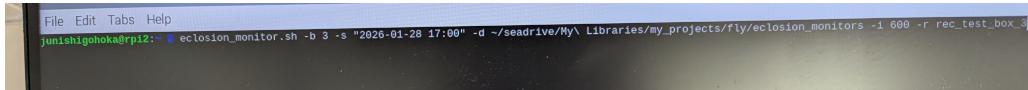


Figure 3: `eclosion_monitor.sh` command to start recording

This will start recording in `box3` (`-b`) from 2026-02-04 11:30 (`-s`). An image will be taken every 600 seconds (`-i`). All images will be stored in Jun's Keeper: a new folder starting with recording ID “`rec_044`” (`-r`) will be created inside `/My\ Libraries/my_projects/fly/eclosion_monitors` [TODO: link], and pictures will be transferred to the folder. Change the options `-b` `-s` `-i` `-r` according to your recording. Do not change the `-d` option.

4. Confirm that the recording is running (Fig. 4)

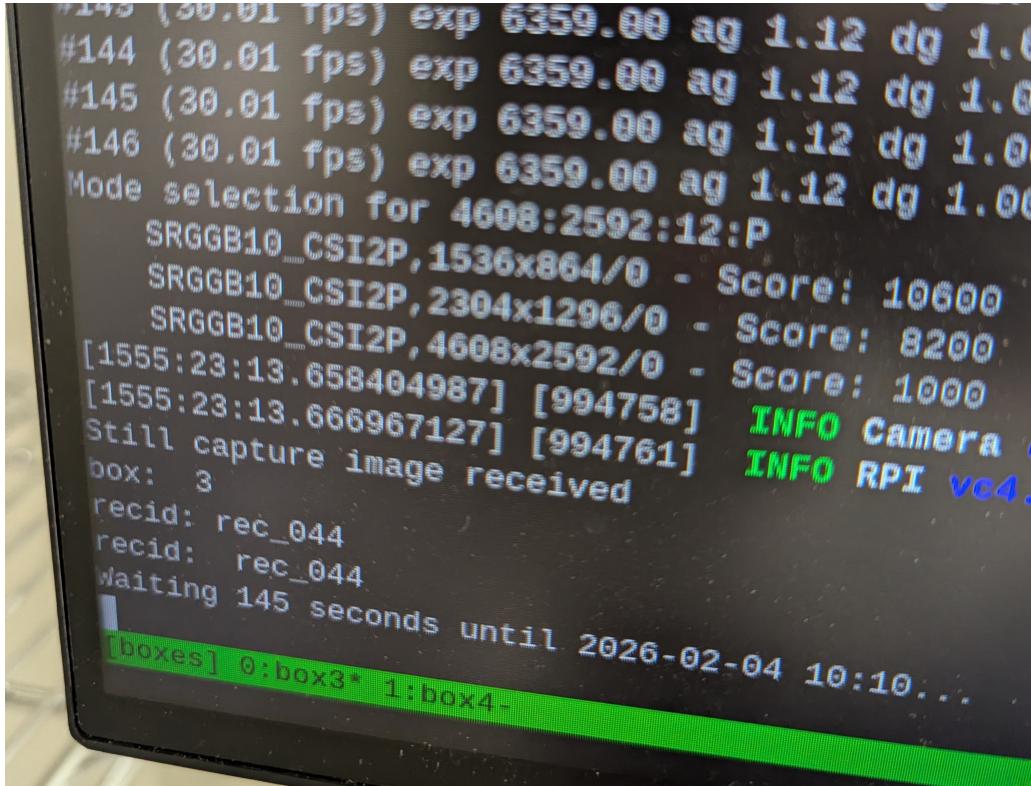


Figure 4: Screen when recording is running.

5. The above command will first take an image `rec_044_init.jpeg`. Access the file in Keeper and check whether the focus is correct. If not, stop the recording (see sec. 4.5), and re-run the command.
6. Detach from the TMUX session and log out from `rpi2` following sec. 4.3.
7. Close the terminal
8. Turn off the display

4.5 Stop recording

Let's say we want to stop a recording that is running in `box5`, which is controlled by `rpi3`.

1. Log in to `rpi3`, attach to the TMUX session `boxes`, and move to window `box5`. See sec. 4.2 for details.

2. Confirm that the recording is still running (Fig. 4).
3. Stop `eclosion_monitor.sh` by pressing `Ctrl+C`.
4. Confirm that it has stopped. The last line of the window should be

```
junishigohoka@rpi3:~$
```

5. Detach from the TMUX session and log out from `rpi3` following sec. 4.3.
6. Eclose the terminal
7. Turn off the display
8. Take out the plate and sample from the box.

5 What's next?

- `image_analysis.pdf`