Cosmic Ray Telescope Software

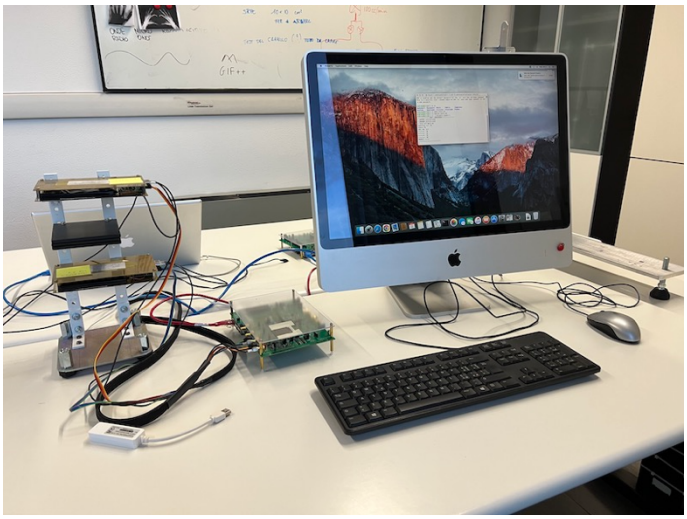
- *SOFTWARE DEVELOPMENT IS STILL GOING ON; SOME CONTROLS COULD BE DEACTIVATED*
- *THE SOFTWARE HAS BEEN DEVELOPED FOR THE RPi 4; IT COULD BE SLOW ON PREVIOUS MODELS*
- *ADC/DAC FOR SETTING/SENSING ARE NOT CALIBRATED, SO THERE MAY BE A DIFFERENCE BETWEEN VALUES DUE TO COMPONENTS TOLERANCES*

Sommario

1. Connections

The software is installed in the */home/pi/Telescope* directory

1.1. Connect from iMac



- boot in OSX partition
- login as *usr: admin*, *pwd: admin* or *usr: stages*, pwd not required
- connect iMac and RPi using an ethernet cable

- open terminal
- enter *ssh -X pi@raspberrypi.local* ***(Figure 1)***
- enter password: *raspberry; now you're logged in the Raspberry OS* (Figure 2*)*
- enter *source start.sh* from home directory *(Figure 3)* or *python3 dt_run_gui.py &* from */home/pi/Telescope* directory
- the Cosmic Ray Telescope will show up *(Figure 4)*

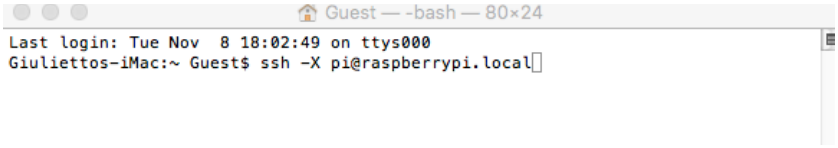


Figure 1: ssh to RPi

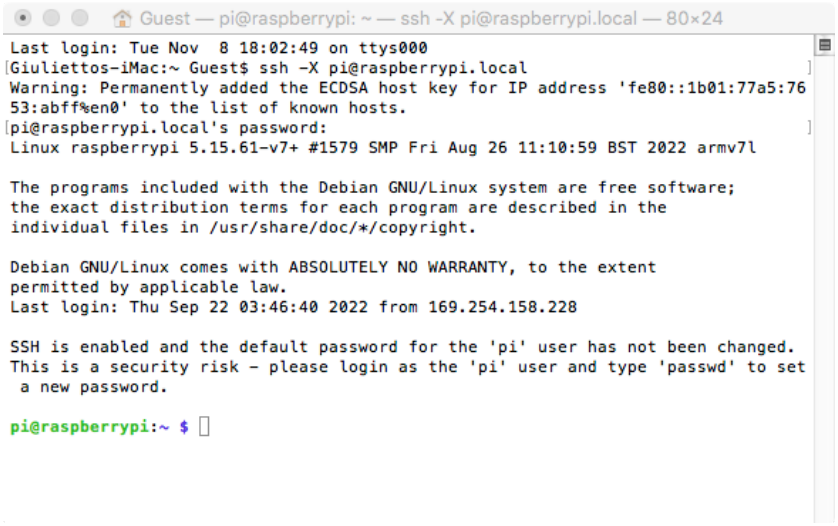


Figure 2: RPi shell

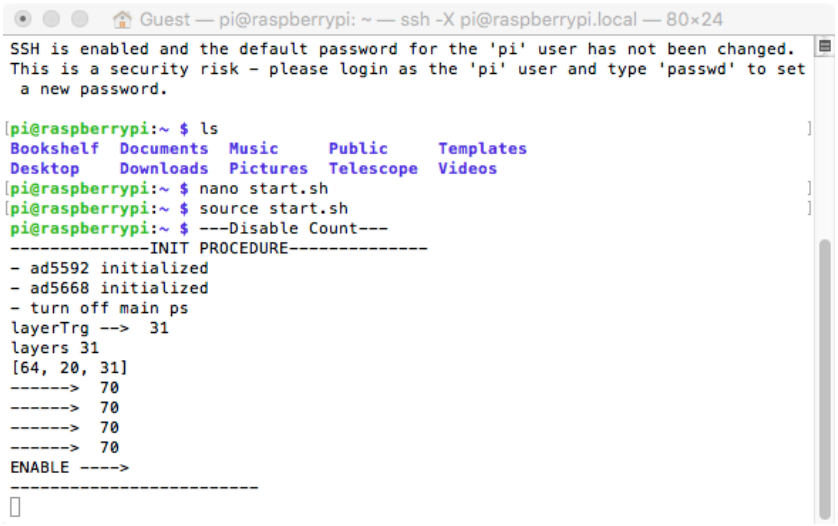


Figure 3: Launch GUI from home directory (source start.sh)

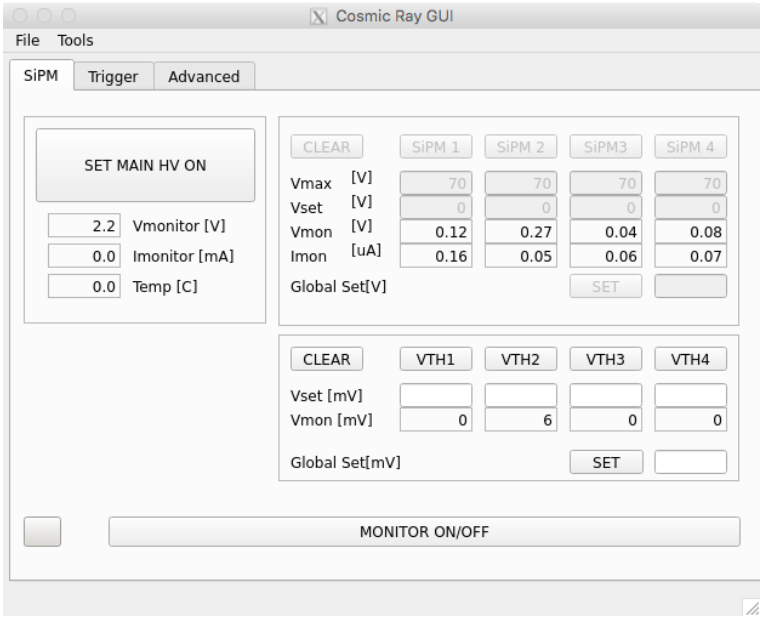


Figure 4: The Cosmic Ray Telescope GUI

- you can, also, use VNC *(Figure 5)* and *Telescope launch icon* to start the GUI *(*
- *Figure* 6*)*

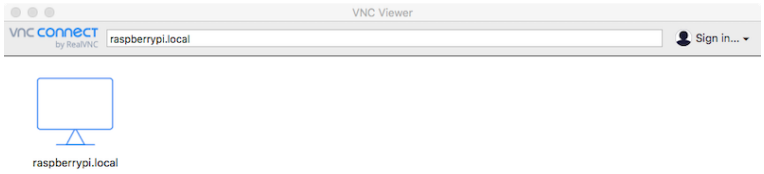


Figure 5: VNC Software

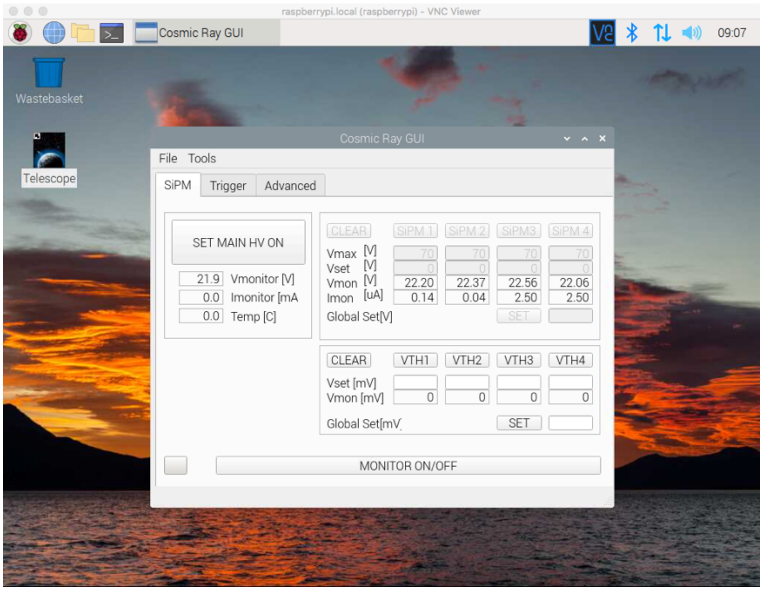


Figure 6: RPi VNC connection

1.2. Connect from ACER notebook

- login in *stages* account (pwd: *stages)*
- connect notebook and RPi using an ethernet cable
- launch *Xming (Figure 7)*
- open *Putty* and use raspberry_local configuration to connect to RPi *(Figure 8*)
- use *pi (user)* and raspberry (password) to login
- enter source *start.sh* from home directory or *python3 dt_run_gui.py &* from */home/pi/Telescope* directory *(Figure 9)*
- The Cosmic Ray Telescope GUI will show up *(Figure 10)*

Figure 7: launch Xming

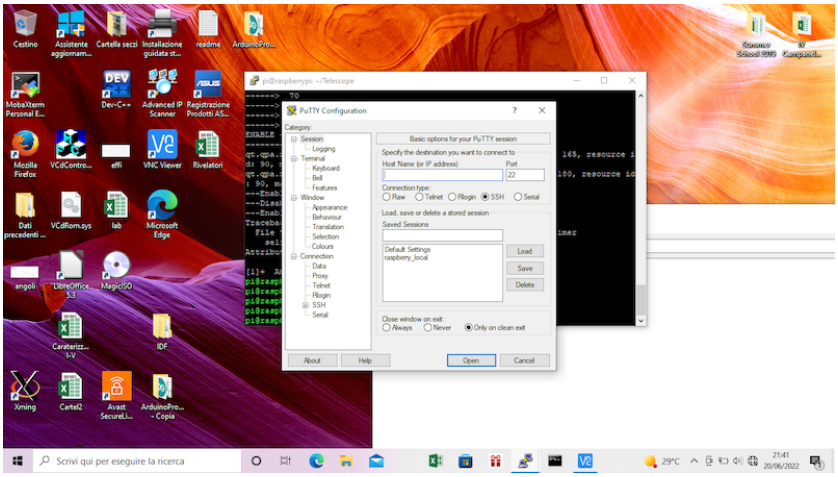


Figure 8: Launch Putty and open raspberry_local configuration

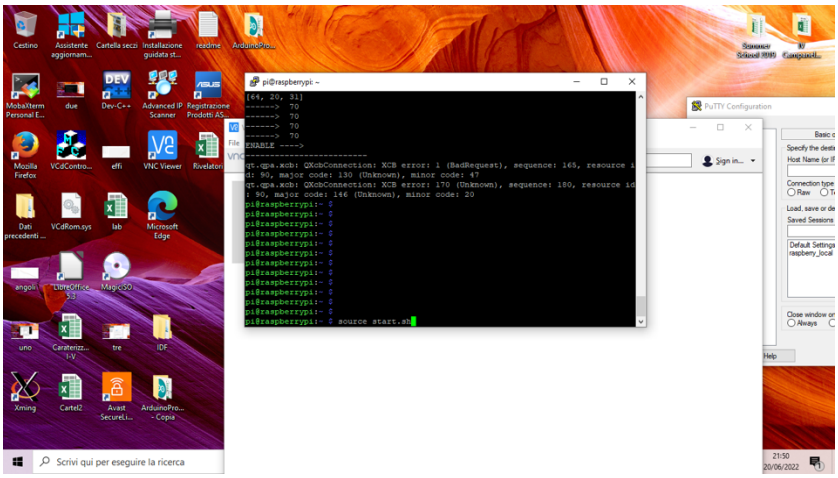


Figure 9: source start.sh from home directory or python3 dt_run_gui.py & from /home/pi/Telescope directory

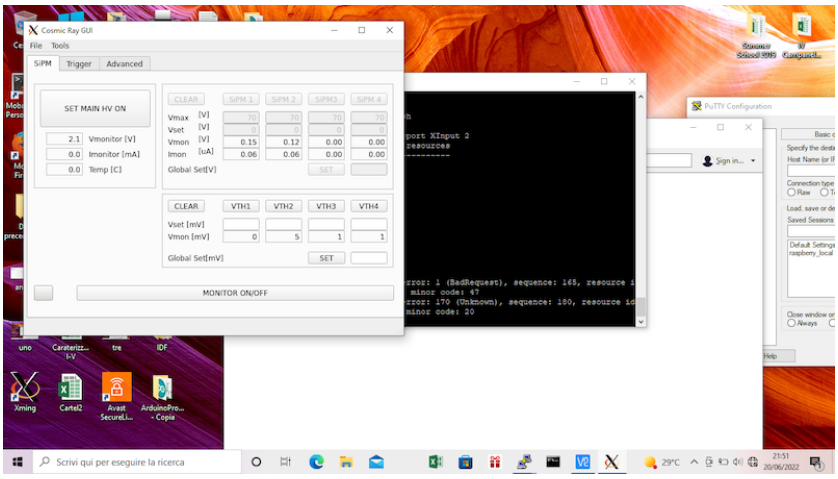


Figure 10: The Cosmic Ray telescope GUI

1.3. Connect from Apple Notebook

- login as *usr: stages*, pwd: *stages*
- connect notebook and RPi using an ethernet cable
- open terminal
- enter *ssh -X pi@raspberrypi.local (Figure 1)*
- enter password: *raspberry (Figure 2)*
- Enter *source start.sh* from home directory or *python3 dt_run_gui.py &* from */home/pi/Telescope* directory *(Figure 3)*

1.4. Raspberry Desktop

- Connect a monitor/keyboard/mouse to RPi
- login as *usr: pi*, pwd: *raspberry*
- Use the *Telescope launch icon* to start the GUI

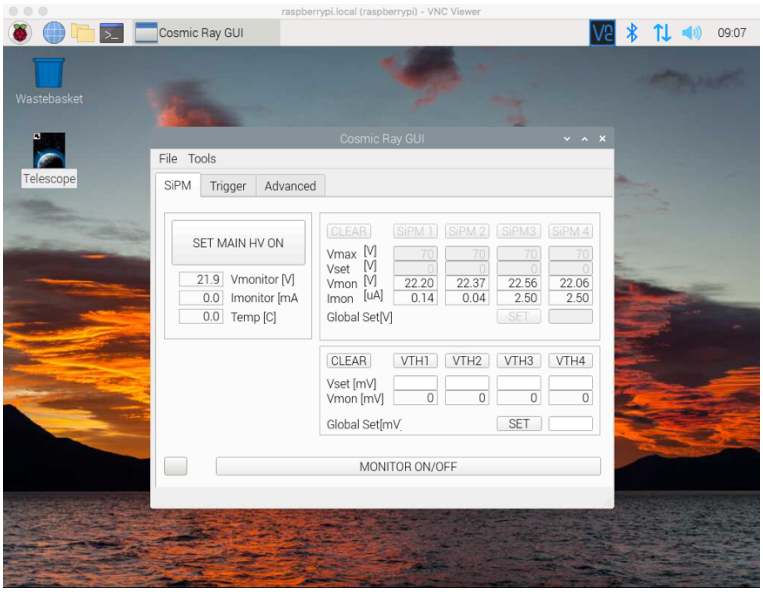


Figure 11: Use the Telescopelaunch icon to start the GUI

2. The Software

The Telescope software is based on a PyQT GUI running on a Raspberry Pi mini-computer. The RPi board is interconnected to the Main Board by means of the expansion connector and allows to set/sense SiPM operating voltage and threshold values as well as manage counting rate measurement.

The simplest way to run the software is to use ethernet connection and VNC client to lauch the app using the desktop launch icon or the menu item as shown in Figure 12.

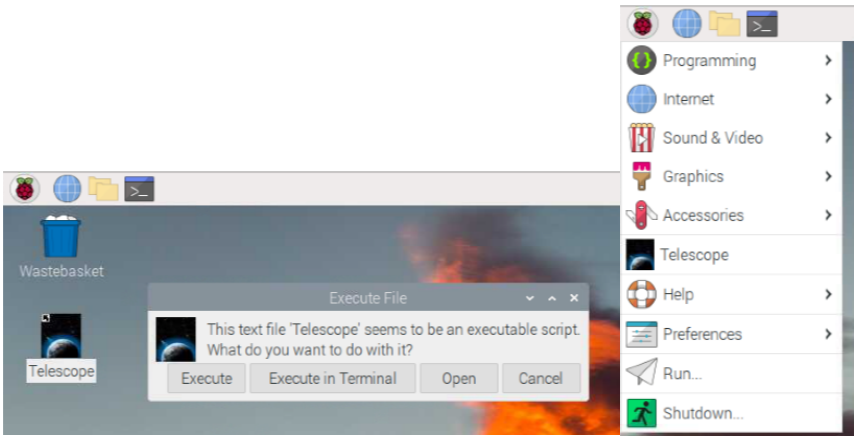


Figure 12: Start GUI from Desktop icon or menu item

The Telescope GUI will show up; the controls to set SiPM power supply voltages will be disabled until the Main Power will be switched on. The list of available controls are shown in Figure 13.

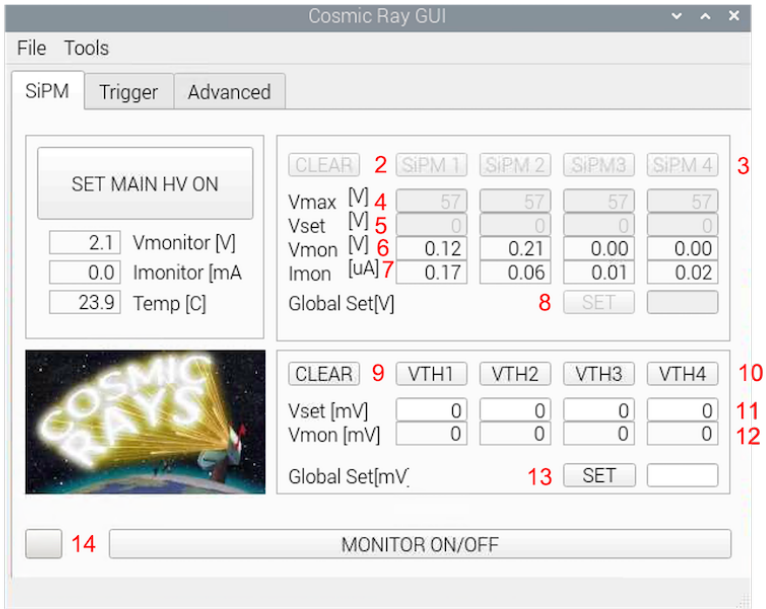


Figure 13: SiPM Tab available controls

SiPM Panel Controls

1. turn on/off the main generator;
2. clear SiPM supply voltage;
3. set voltage on the selected SiPM (or press return after entered the value);
4. maximum voltage for SiPM (to change the values: Tools - Unlock Vmax);

5. SiPM voltages;
6. SiPM voltages monitor;
7. SiPM current monitor;
8. set SiPM voltage for all SiPM;
9. clear comparator thresholds;
10. set threshold on the selected SiPM signal (or press return after entered the value);
11. threshold value for the selected SiPM signal;
12. threshold monitor;
13. set signal threshold value for all SiPM;
14. sensing on/off.

The Trigger panel allows to select the layers that will contribute to trigger generation. For example assuming Layer 1 and Layer 2 are selected, as shown in Figure 14, the trigger will be generated and counter incremented only if both signals are present in a 100 ns time window. To start a measurement click the RATE MEASUREMENT – COUNTDOWN button

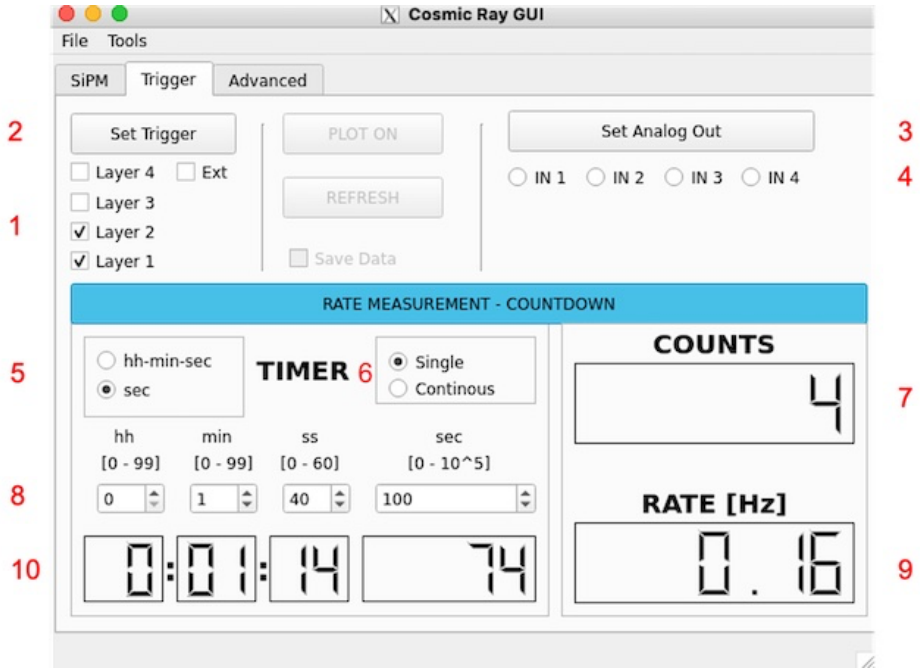


Figure 14: the Trigger Panel

Trigger Panel Controls

1 - layers selection;
2 - set trigger conditions;
3 - output the analog monitor signal;
4 - select the monitor input;
5 - select the countdown time format;
6 - select single or continuous measurement (default: single);
7 - the counter (cleared when countdown is started);
8 - set the countdown time according to the time format (hh:min:sec or sec);
9 - rate measurement;
10 - countdown timer.

Finally, the Advanced Panel shown in Figure 15 allows to clear offsets in the SiPM current measurement.

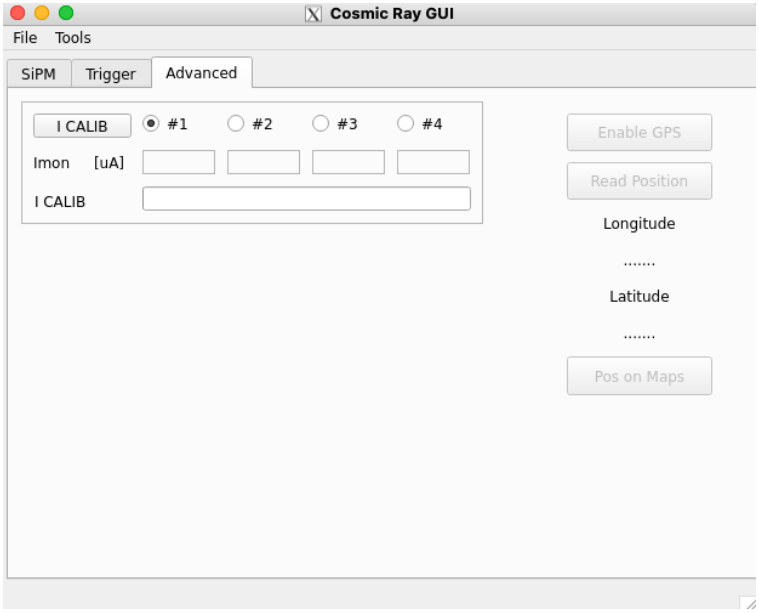


Figure 15: the Advanced Panel

3. Quick Startup

3.1. SiPM Panel

- Click tools and select UnlockVmax
- Set Vmax value according to the SiPM type (56V or 67V)
- Turn On Main HV generator
- Set the SiPM operating point according to the SiPM type (55.7 0r 66.6). Note: sense value can be different from the set value as ADC/DAC must be calibrated
- Set a 30/40 mV as threshold value

3.2. SiPM Panel

- Select 2 instrumented layers;
- Push the set trigger button (the trigger conditions will be written);
- Leave the time format default selection (sec):
- Leave Timer default conditions (Single)
- Enter the countdown timer value (default: 100 sec)
- Start the measurement

3.3. Advanced Panel

- Turn Main HV off
- Select the SiPM using radio button
- Push ICalib; at the end of the procedure the offset value will be written in the dedicated field and yellow background will be set to indicate the offset measurement has been completed