PicoMuon Detector RPi Python code software manual

Pico$^\mu$

Python code for the UKRAA PicoMuon

Set of Python code to run on an RPi4/5 to get, process and present data from the UKRAA PicoMuon detector

This software was written to suit a specific set-up, feel free to use as you see fit.

Instructions for setting up a Raspberry Pi4/5 are included in the **docs** folder
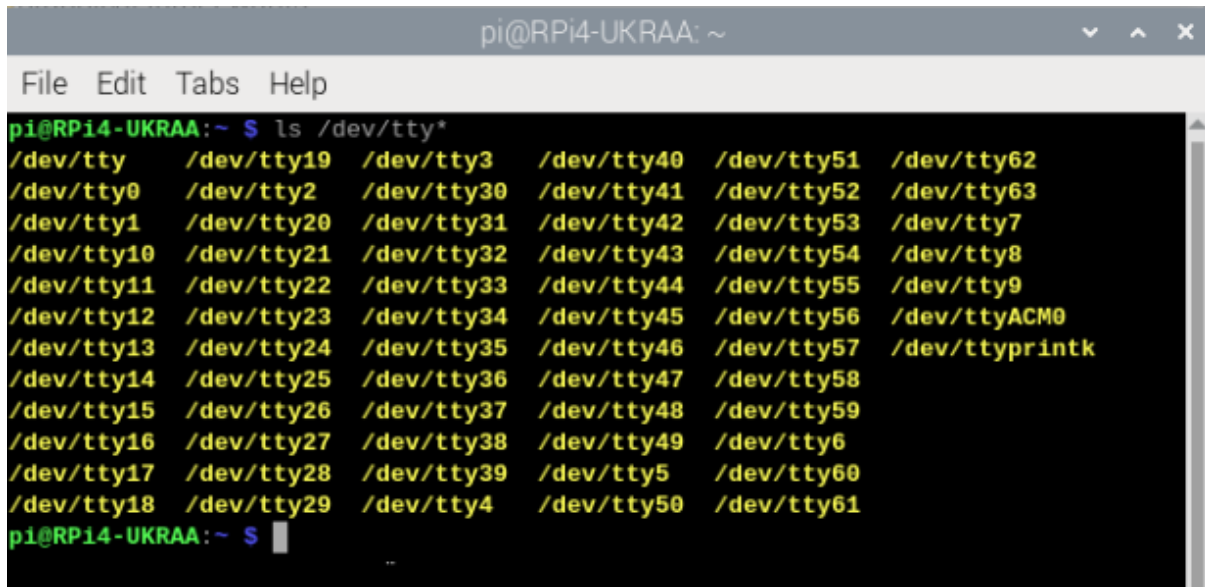
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Where is my detector?

Plug your detector into any of the RPi USB ports - I normally use one of the blue ports (USB3).

1. Open a terminal window and type the following command and press enter

   ls /dev/tty*

2. You are looking for **/dev/ttyACM0** - this is on the right hand side of the screen shot above.

3. This is the USB address for your attached detector - if you have more than one detector attached you may see **/dev/ttyACM1** etc.

4. If you do not see **/dev/ttyACM0**, then unplug and plug the detector back in and try again.

5. As long as you see **/dev/ttyACM0** then you do not have to make any changes to the python scripts, because they are looking for **ACM0**.

Install the software onto your RPi

1. Log into your Raspberry Pi4/5 using VNC.

2. Open a terminal window, type the following command and press enter

   git clone https://github.com/UKradioastro/UKRAA_PicoMuon

This will download all of the code to the directory **UKRAA_PicoMuon** inside **/home/pi**

Using the code

The code assumes that your UKRAA PicoMuon detector is connected to the RPi4/5 via supplied USB cable and that it is **/dev/ttyACM0** - you can check this by using **ls /dev/tty*** in a terminal window on the RPi4/5 and reviewing the response.

The code assumes username is **pi**. If **pi** is not the username, then you will need to change all occurrences of '**/home/pi**' to '**/home/*username***' in the python and gnuplot scripts, where *username* is the username you have selected for your RPi4/5.

The code assumes one detector connected to the RPi4/5 USB and that it will be connected via **/dev/ttyACM0**, if there are other devices connected to the RPi and your detector is not **/dev/ttyACM0**, then you will need to change **/dev/ttyACM0** to **/dev/*ttyACMx*** in the **GetDataRawACM0.py** python script, where *ttyACMx* is the tty address of you connected detector.
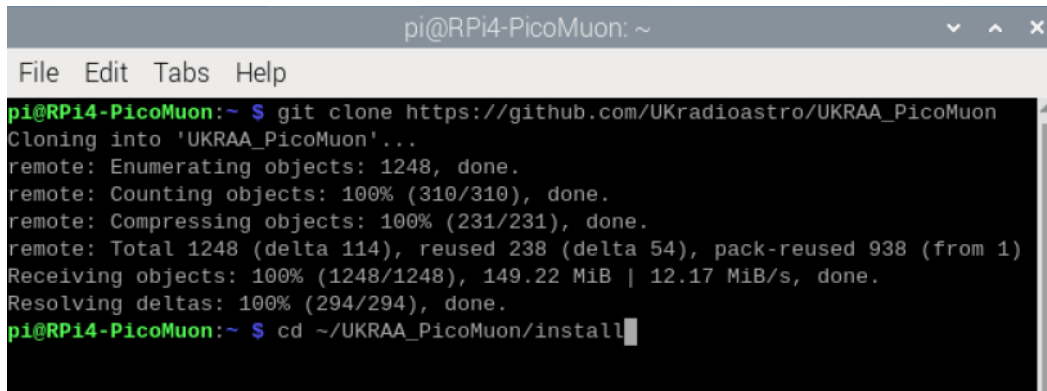
GetDataRawACM0.py is run as a service.

Other scripts (Python and gnuplot) are run from **cron**

Install the software onto your RPi

1. Open a terminal window and type the following command and press enter
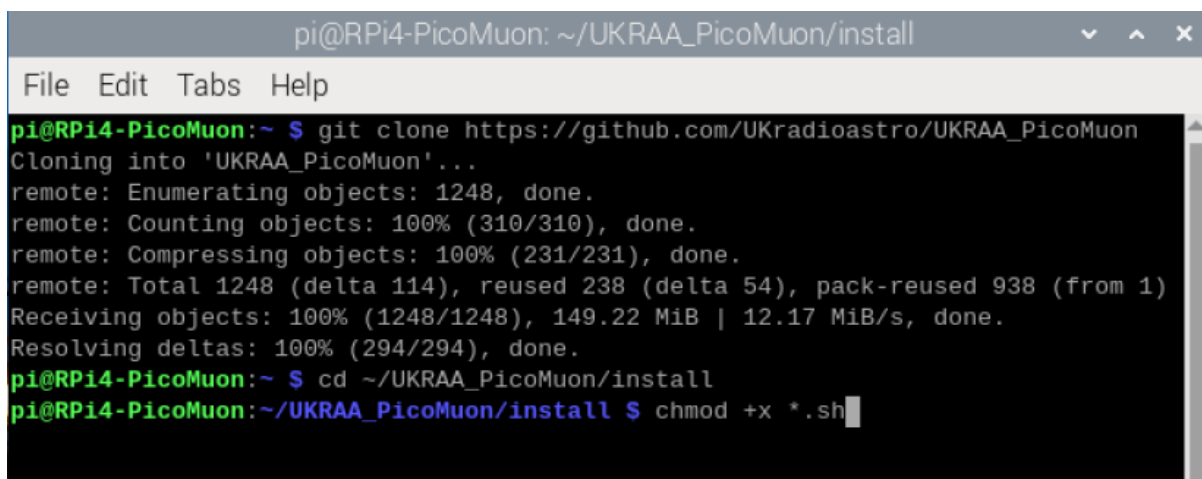
    cd ~/UKRAA_PicoMuon/install

This will take you to the **install** directory inside **/home/pi/UKRAA_PicoMuon**

2. Type the following command and press enter
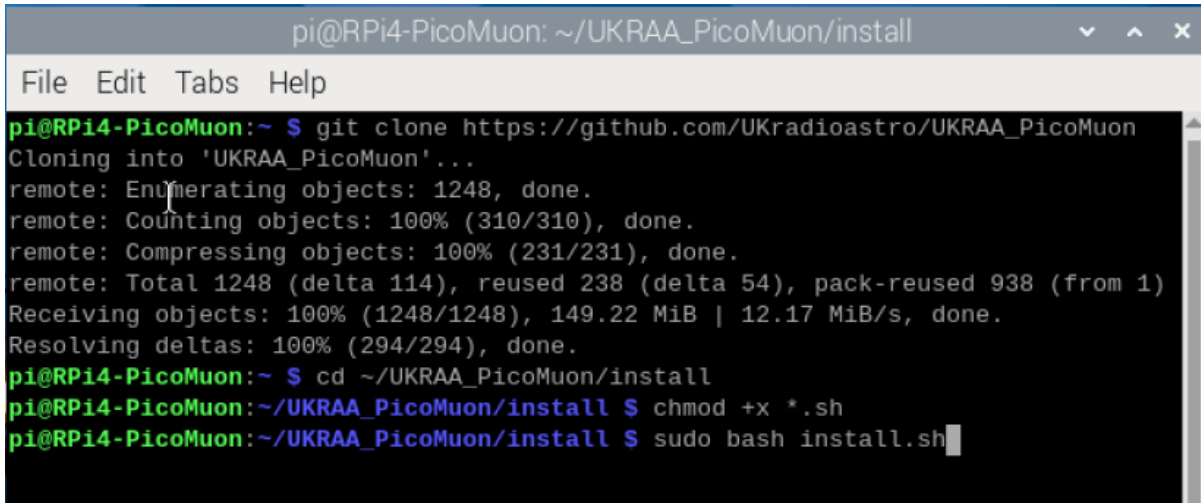
    chmod +x *.sh

This will make the **install.sh** script executable.

3. Type the following command and press enter

   sudo bash install.sh

This will run the install script.

There will be occasions during the running of the install script that require you to make a keyboard entry.

When asked **Do you want to continue? [Y/n]** - enter **Y** or **y**

During **mysql_secure_installation** you will be asked a number of questions.

- Enter current password for root (enter for none):   **press enter**
- Switch to unix_socket authentication [Y/n]   **n**
- Change the root password? [Y/n]   **n**
- Remove anonymous users? [Y/n]   **y**
- Disallow root login remotely? [Y/n]   **y**
- Remove test database and access to it? [Y/n]   **y**
- Reload privilege tables now? [Y/n]   **y**

That's it!

The code is now set up to run automatically; it will get the data from the detector, process yesterdays data, plot yesterdays data and post yesterdays plots to your intranet web page once per day, at 8.00am in the morning.

What does the code do?

The code receives the event data from the UKRAA PicoMuon detector via serial over the supplied USB cable and stores the event data to the raw data folder.

The raw data will be processed overnight, via CRON, to get counts per minute, the frequency of the counts per minute and the frequency of the adc values for your previous day's data.

Three plots will be created:

- counts per minute
- frequency of counts per minute
- frequency of ADC values recorded

A request will be made to **NMDB** (https://www.nmdb.eu/), via NEST, to get the previous days recorded neutron count, this data will be overlaid onto the day / week / month & % variation counts per minute graphs.

These will appear as the required amount of data is recorded by the detector

A simple web server and web page is set up on your RPi so that you can view your detector's results on your smart phone when connected to your home network.

Check GetDataRawACM0.py is running

1. To check the **status** of your service, type the following command and press enter.

   sudo systemctl status PicoMuonACM0.service

2. To **start** your service, type the following command and press enter.

   sudo systemctl start PicoMuonACM0.service

3. To **stop** your service, type the following command and press enter.

   sudo systemctl stop PicoMuonACM0.service

4. To **enable** your service, type the following command and press enter.

   sudo systemctl enable PicoMuonACM0.service

5. To **disable** your service, type the following command and press enter.

   sudo systemctl disable PicoMuonACM0.service

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