Gamma detector notes

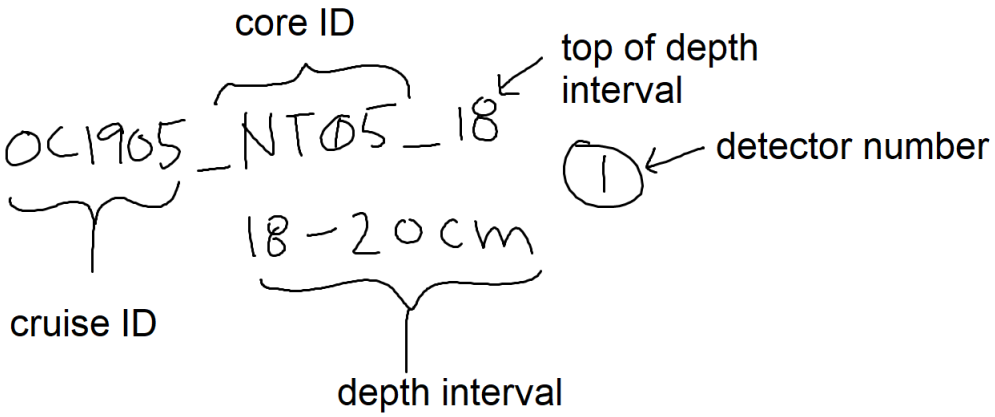
Sample preparation

Notes:

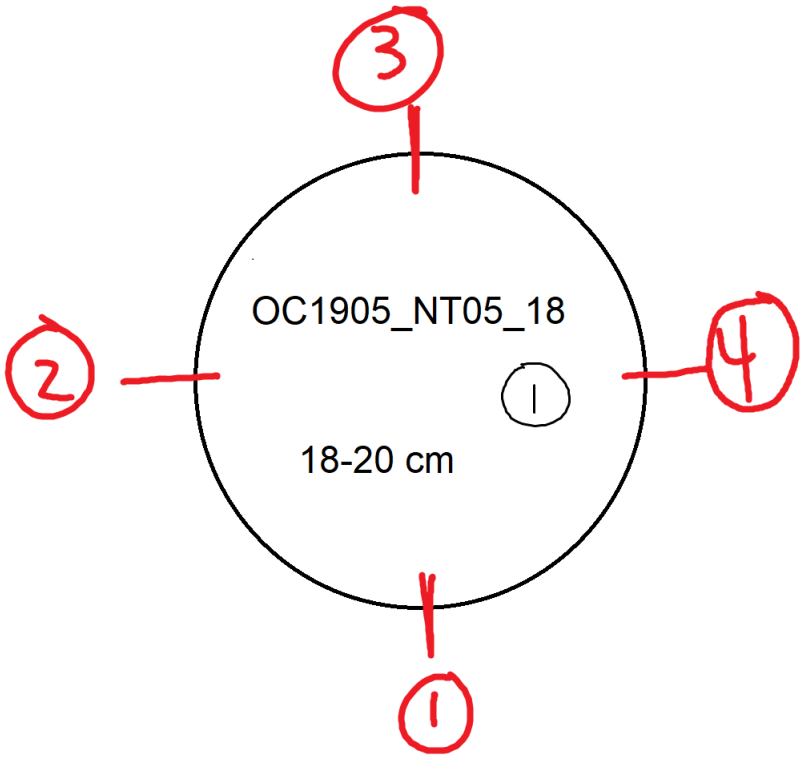
- You need a minimum of 10g dry sediment per measured sample

Procedure:

1. Weigh your bagged wet sediment.
2. Dry your samples using the drying ovens or by freeze drying (depending on what data you need).
    a. When drying your samples, dry at 60 ˚C in the ovens. Depending on sediment porosity, it should take approximately 24 hours to dry. If high porosity (~0.65-0.8) may take ~3 days to dry.
3. Weigh your bagged dried sediment. This can be used to estimate sediment porosity.
4. Once dried, disaggregate sediment using a mortar and pestle.
    a. Alternate between mortars and pestles, washing and drying in between, to prevent contamination.
5. Weigh and pre-label empty jars per sample. The naming/labeling scheme is recommended as follows:



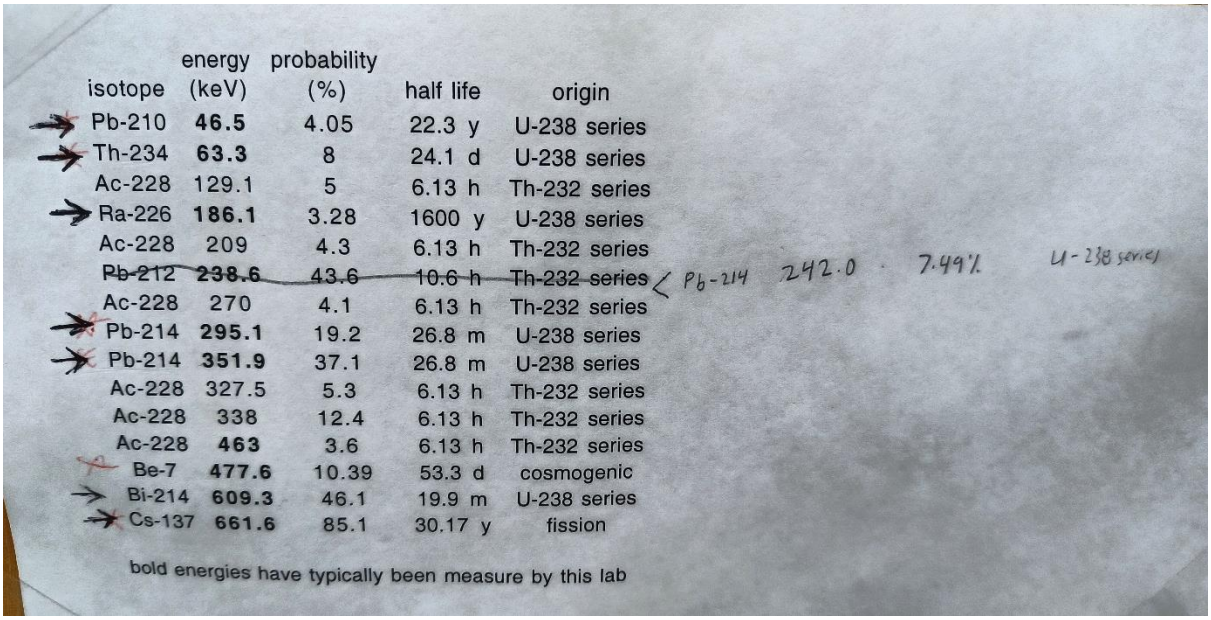
6. Transfer your sediment into individual pre-labeled and pre-weighed jars. If you have large particles in them, you should remove them with forceps. You can use weigh paper to transfer your sediment into jars, but it shouldn't be necessary.
    a. Use the plastic spoon to scrape the leftover fines into the jar.
    b. If your jar is over-weight/over-capacity, you do not need to put all the sediment from your sample into the jars. However, it's important to make sure that the sediment is well-mixed so you're not selecting for larger grain sizes when pouring into jars.
7. Weigh the jars filled with sediment.
8. Level the surface of the sediment in the jars by shaking and sliding the jar back and forth.
9. Measure using calipers the height of the sediment in four different places. For consistency, measure the sediment like so:



10. Place prepped samples to be measured on the bottom shelf of the cabinet directly over detector 1. The ones to be measured first should be closer to the middle of the shelf and the later ones towards the outside.

Calibrating the detectors

1. Calibrate detectors for each new core using standards in the cabinet on the sink bench close to the main door. The key for the cabinet should be in the red tool-box near the fume hood.
2. Place standards (labeled with which detector they should be in) in their respective detectors.
3. Clear the detector counts for each detector.
4. Start the detectors and run them for at least 20 minutes. You should get enough counts to determine the peak of the gaussian/normal distribution curves.
5. Stop detector counting, and go to "Energy Only Calibration" under the "Calibration" tab.
6. You will get to a window where you can enter the energy in keV and the Channel. Each of the proper energies to calibrate to is listed on the sheet to the right of the computer, taped to the bookshelf. (See below) The ones you should be using and entering are indicated by arrows except for ^{137}Cs.

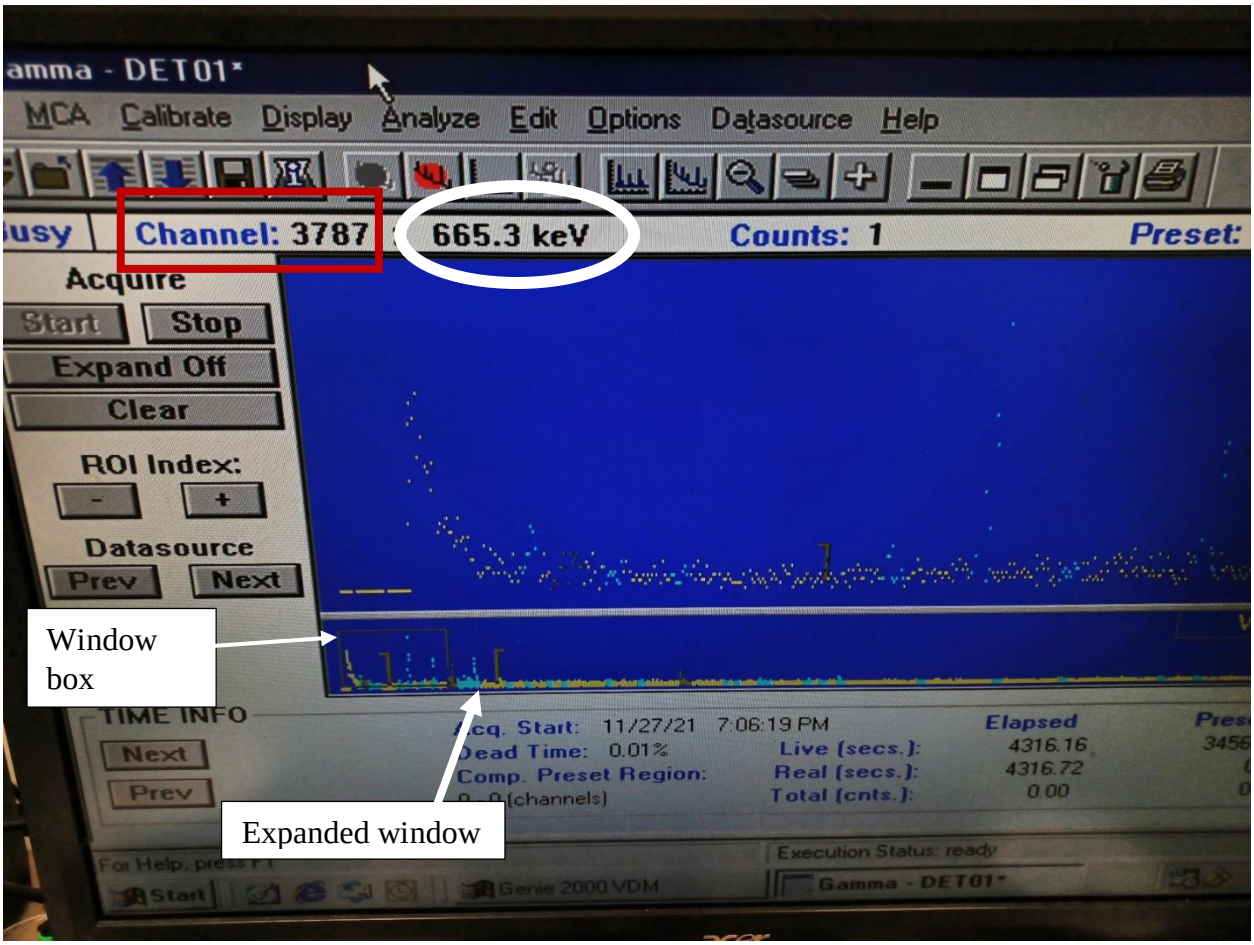


isotope	energy (keV)	probability (%)	half life	origin
Pb-210	**46.5**	4.05	22.3 y	U-238 series
Th-234	**63.3**	8	24.1 d	U-238 series
Ac-228	129.1	5	6.13 h	Th-232 series
Ra-226	**186.1**	3.28	1600 y	U-238 series
Ac-228	209	4.3	6.13 h	Th-232 series
~~Pb-212~~	~~**238.6**~~	~~43.6~~	~~10.6 h~~	~~Th-232 series~~
Ac-228	270	4.1	6.13 h	Th-232 series
Pb-214	**295.1**	19.2	26.8 m	U-238 series
Pb-214	**351.9**	37.1	26.8 m	U-238 series
Ac-228	327.5	5.3	6.13 h	Th-232 series
Ac-228	338	12.4	6.13 h	Th-232 series
Ac-228	**463**	3.6	6.13 h	Th-232 series
Be-7	**477.6**	10.39	53.3 d	cosmogenic
Bi-214	**609.3**	46.1	19.9 m	U-238 series
Cs-137	**661.6**	85.1	30.17 y	fission

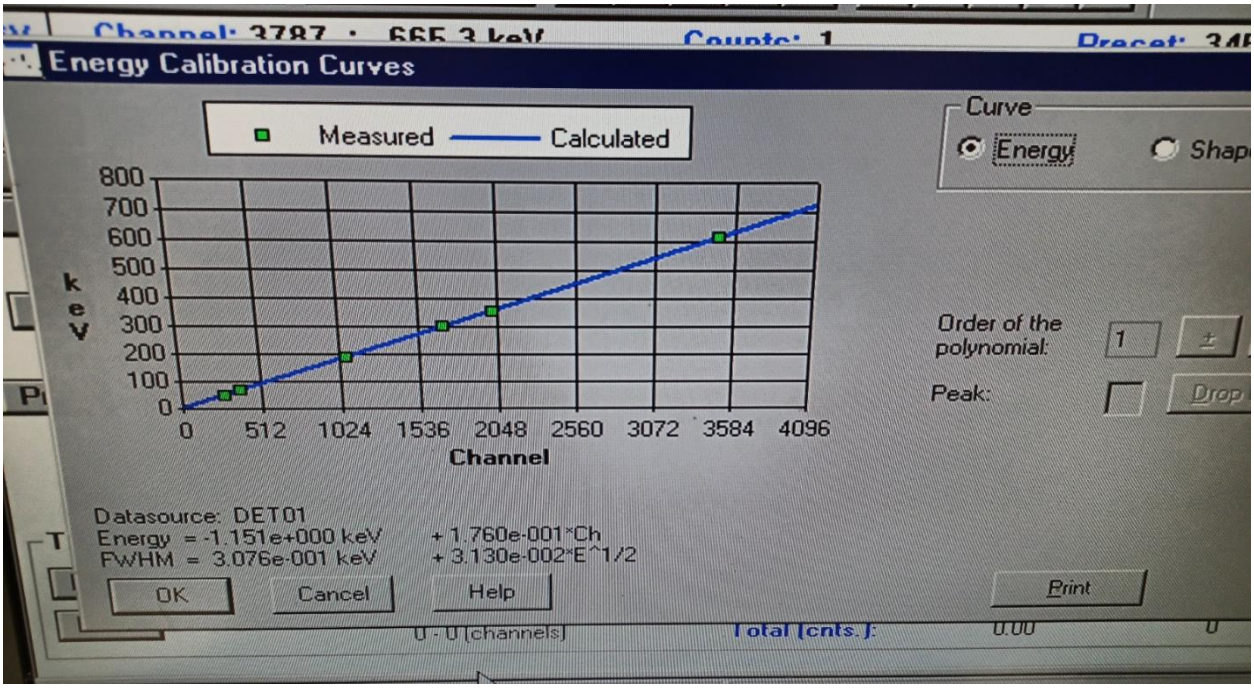
bold energies have typically been measure by this lab

Pb-214 242.0 7.49% U-238 series

7. For entries, start with the first one, which should be ^{210}Pb. Click the main window and using your arrow keys, move to the peak where it's approximately near the listed energy (46.5 keV, see white circle in figure below). You can also navigate by moving the square in the expanded window around (crosshairs should show up when you mouse over the center of the box).
    a. You can adjust the size of the main count window by adjusting the box in the expanded window (labeled "Window box" in figure below).



8. The count distribution should look like a normal distribution curve, so you need to find the peak. Enter the corresponding channel value into the calibration window along with the energy value in question. Do this for each of the radioisotopes on the sheet to the right of the computer.
9. Once done, view your calibration. It should look like a straight line. Now you can start with your measurements.



Measuring your samples in the detectors and important notes

- There should be a sheet to the right of the computer that details everything you need to know about measuring your samples.
- For consistency's sake, it's best to orient your samples in the same way every time, especially if you have to measure the samples again later to calculate excess/unsupported isotopes. (I personally have the bottom of the text facing me for all my samples.)
- When replacing your samples, make sure that you do not drop anything onto the detector window.
- When using the balances in the lab, make sure that they're balanced. There is a little oil bubble in a plastic window located at the back of each of the balances. The bubble should be centered. If it's not, adjust the legs of the balance until it is.
- **Do not move the gargoyle.**
- If anything happens with the computer and you must close the program to restart it, if it asks you to save, don't save before closing the program.
- Detectors will shut off and won't keep track of counts after ~5 days, so you cannot measure individual samples for more than 5 days.
- You need a minimum of 24 hours of counting to have statistically significant counts.