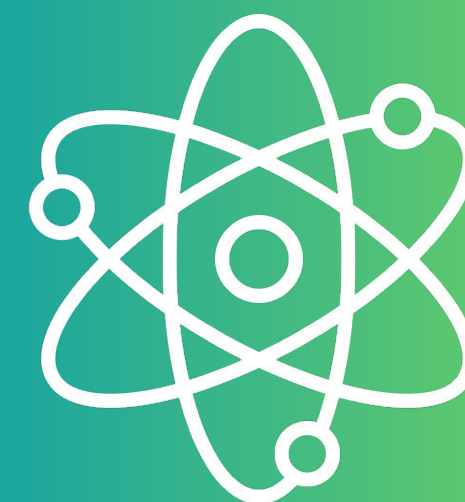




ELECTRIC AND MAGNETIC Dipole response of Ruthenium 102/104



Flor Nardone

Mentor: Akaa Daniel Ayangeakaa

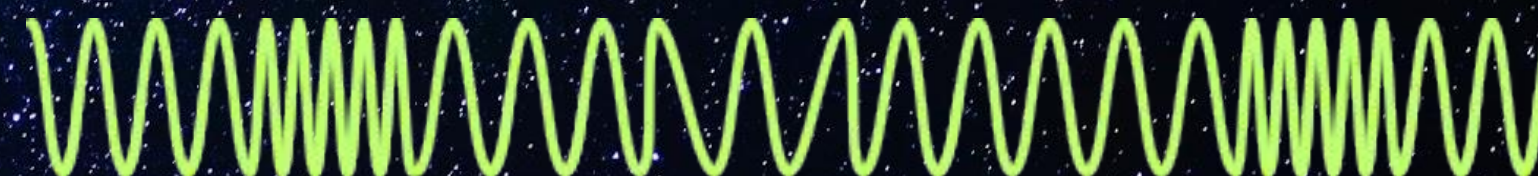


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What is NRF?
Why is this important?



Calibrations

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Calibrations



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The Future

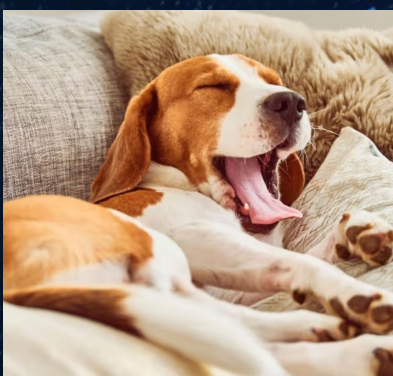
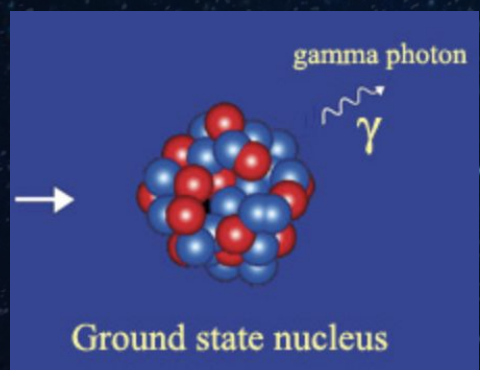
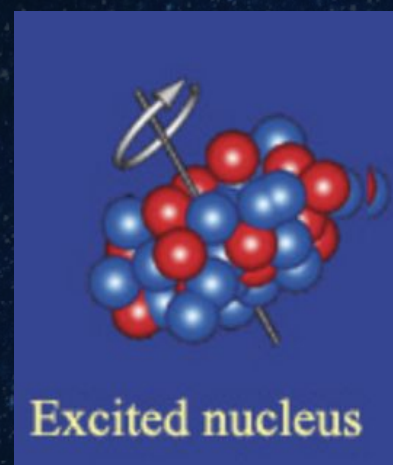
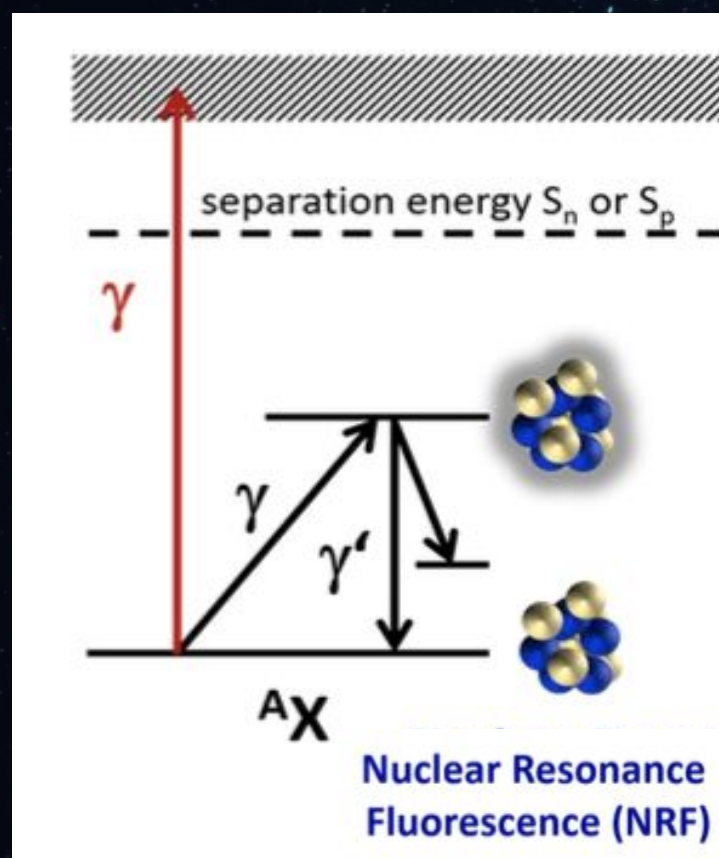
What will be done in the future:
Continue with Code
Coincidences



Introduction

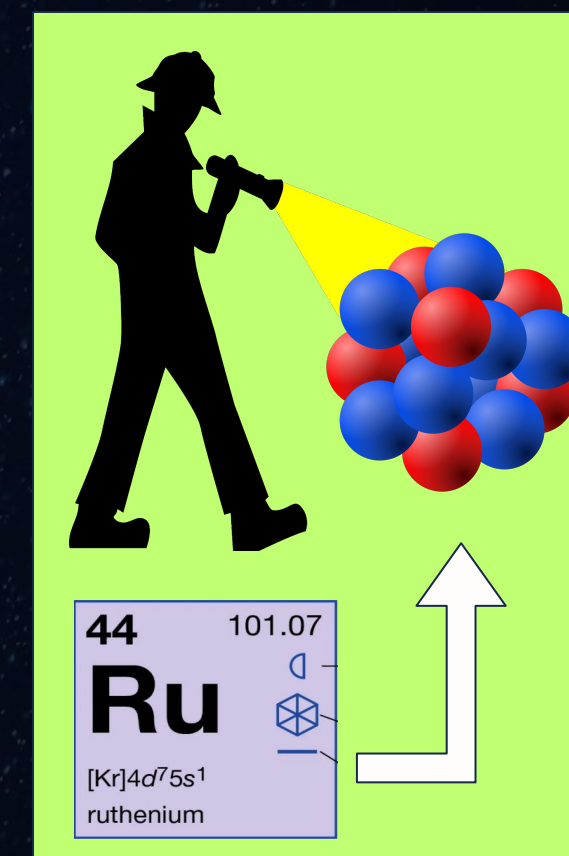
Nuclear Resonance Fluorescence (NRF):

- production of: **excited nucleus**
- detection** of: **photons** (specifically gamma rays at Higs) upon deexcitation

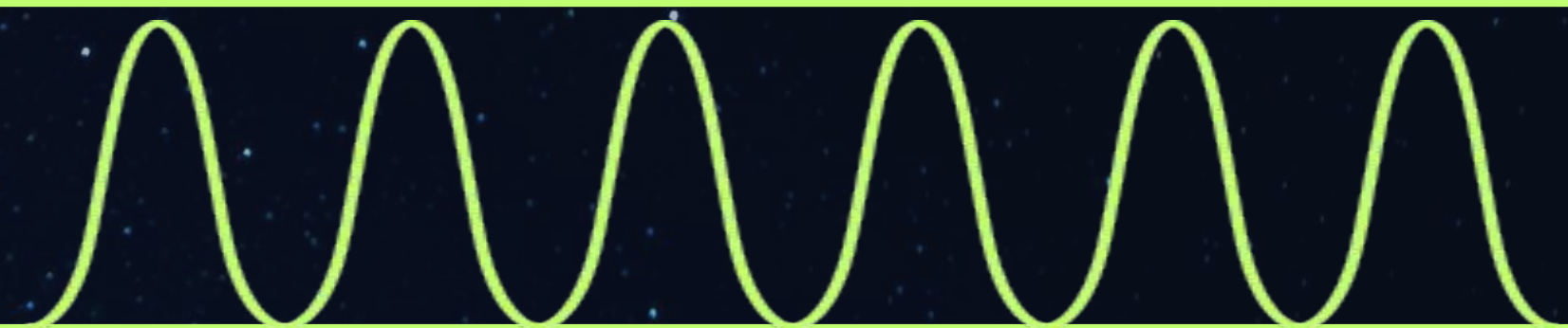


At HIGS:

- **High Intensity Gamma-ray Source** generated by Compton-backscattering
- Allows exploration of **Photonuclear reaction explorations** (like NRF)
 - photoabsorption cross section
 - investigation of isolated states
 - study dipole response of nuclei



Intro Cont.

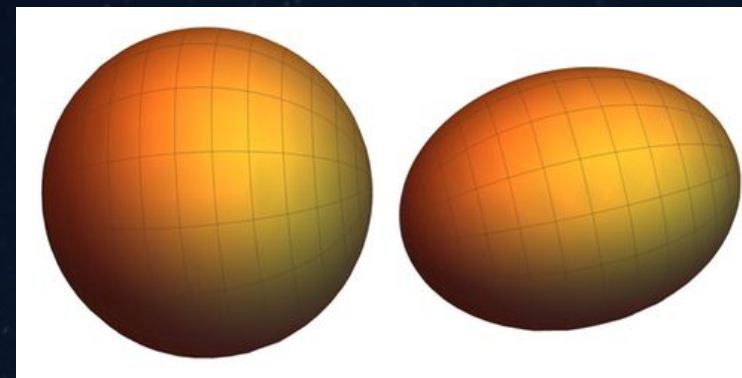


Goal:

- understand dipole response of nuclei whom deviated from traditional models

Ruthenium (Ru) 102/104:

- transitional nucleus:
 - strays from strictly spherical or strictly deformed nucleus shape
 - its dipole properties remain vastly unidentified



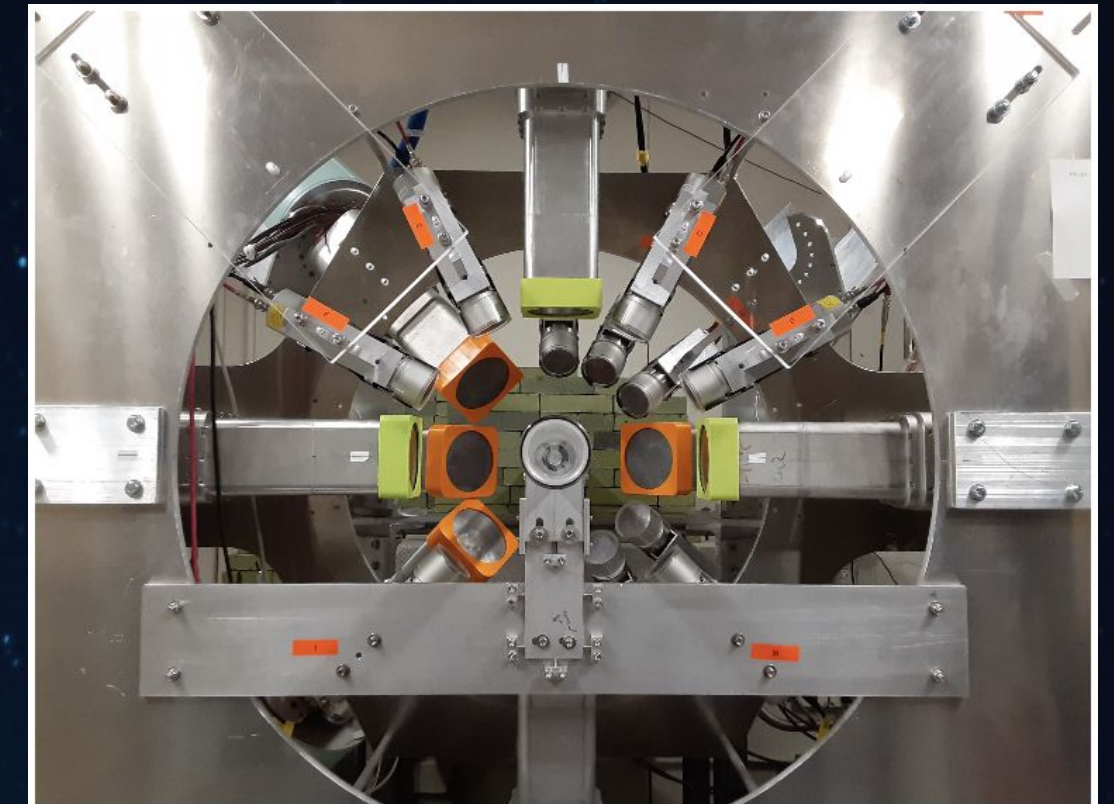
Ruthenium:



Us:



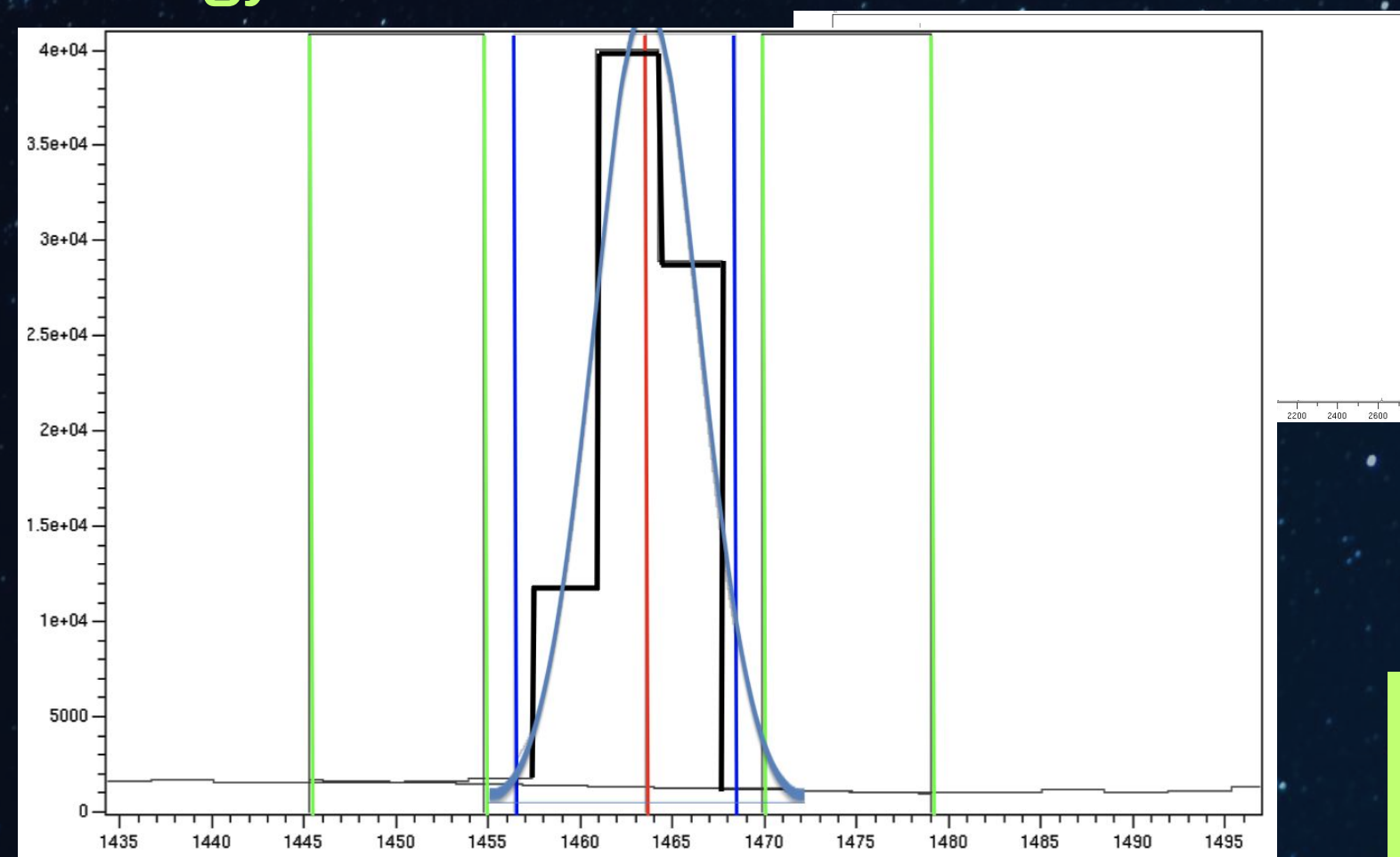
Detectors



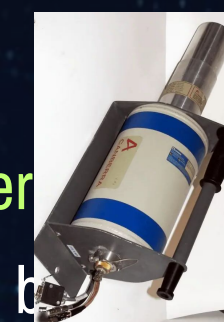
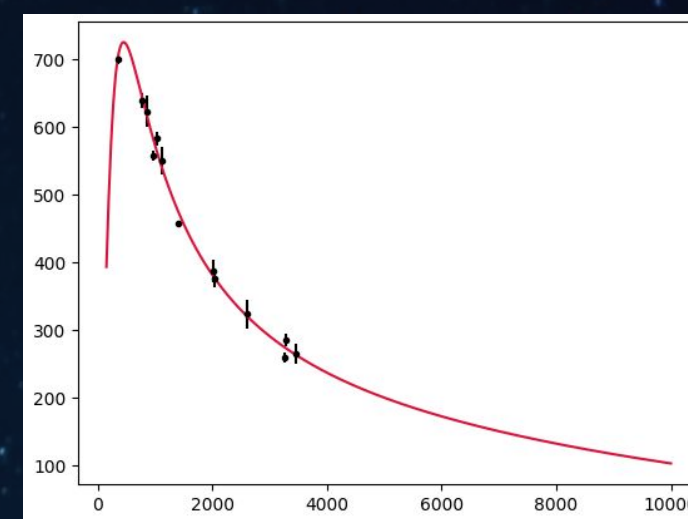
- 8 clover-type HPGe (high purity Germanium) detectors
 - 4 front , 4 back
- each detector has 4 channels
 - total of 32 channels

Energy and Efficiency Calibration

Energy: 152Eu (Europium) and 11B (Boron) lines



Efficiency: 152Eu (Europium) and Co (Cobalt) lines



Detector matters:

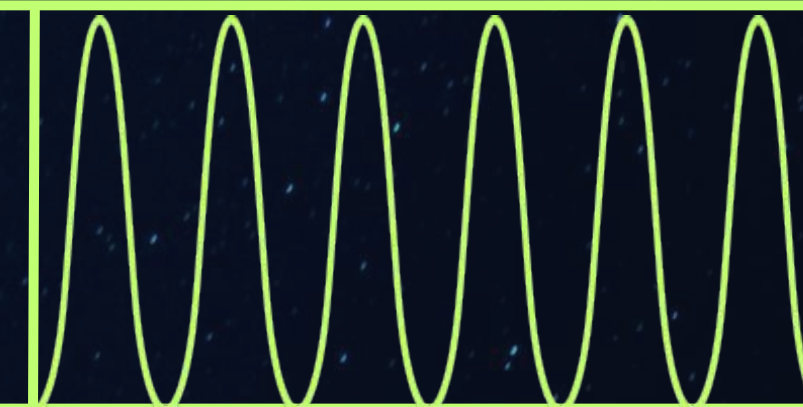
- detectors have a set efficiency defined by a curve
- depending on the detector they will be able to detect more or less at a specific energy

What I used:

- hdtv
- python

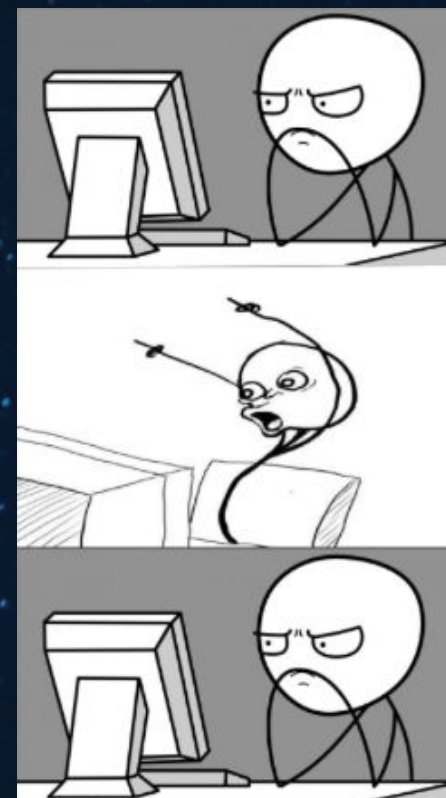
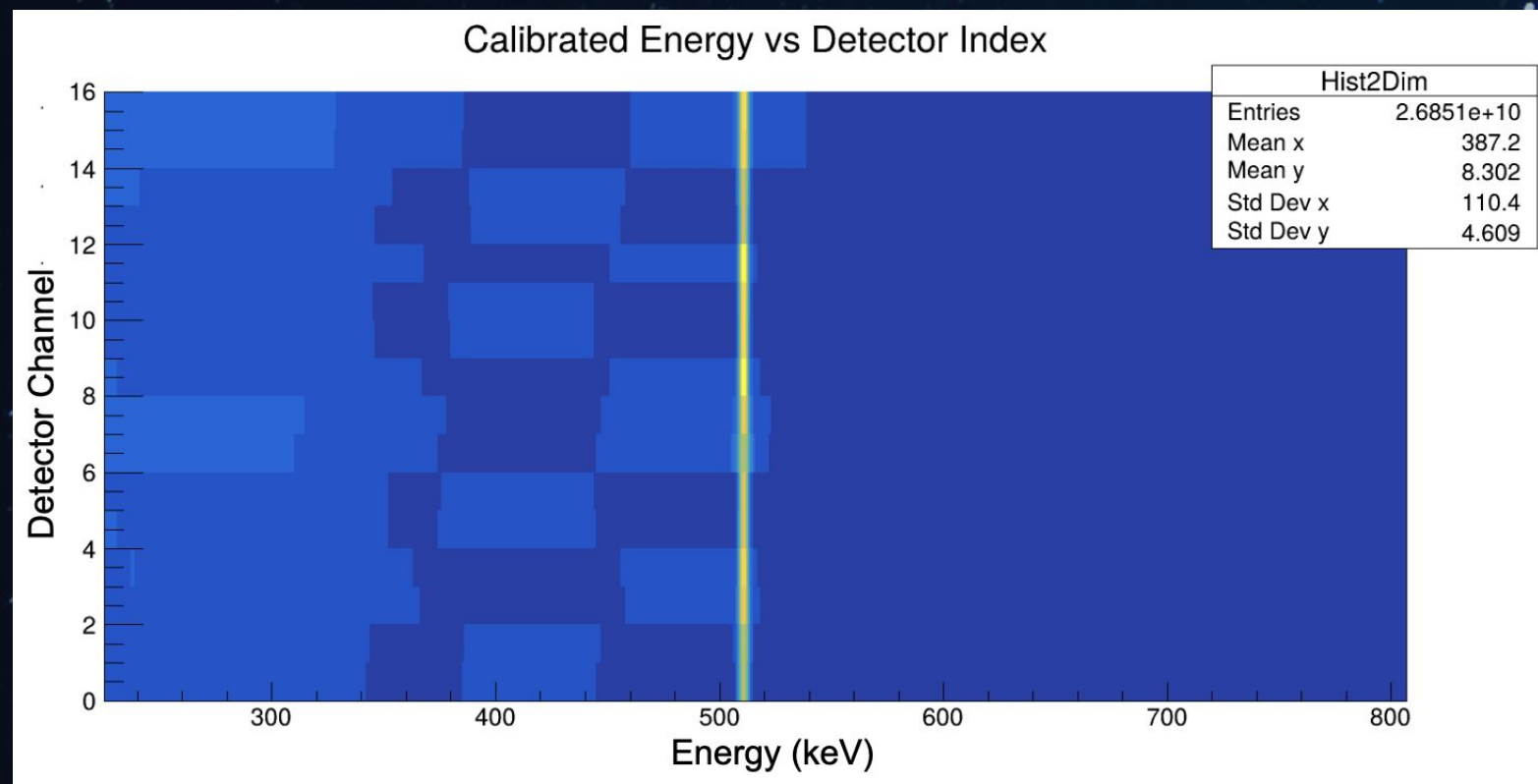
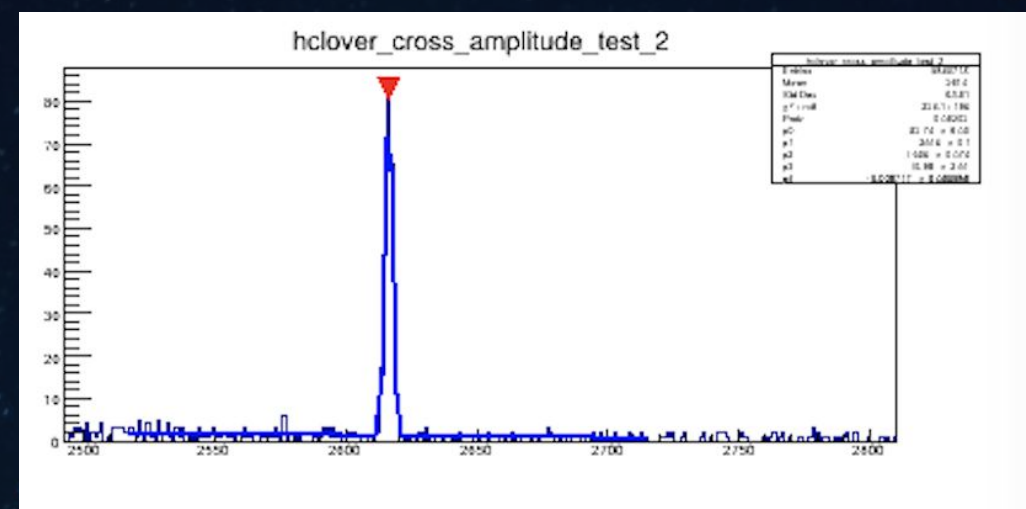
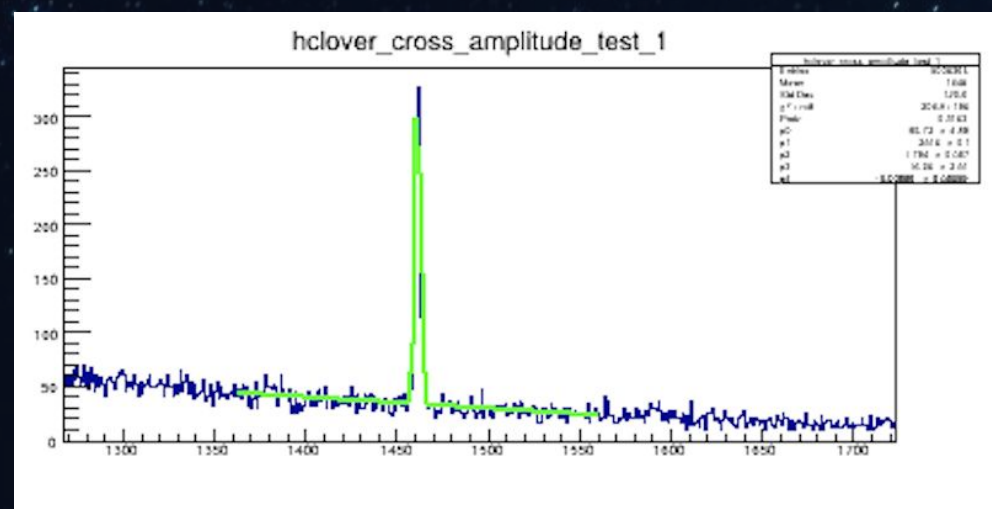
Takeaways:

- way to minimize and account for sources of error
- time consuming process



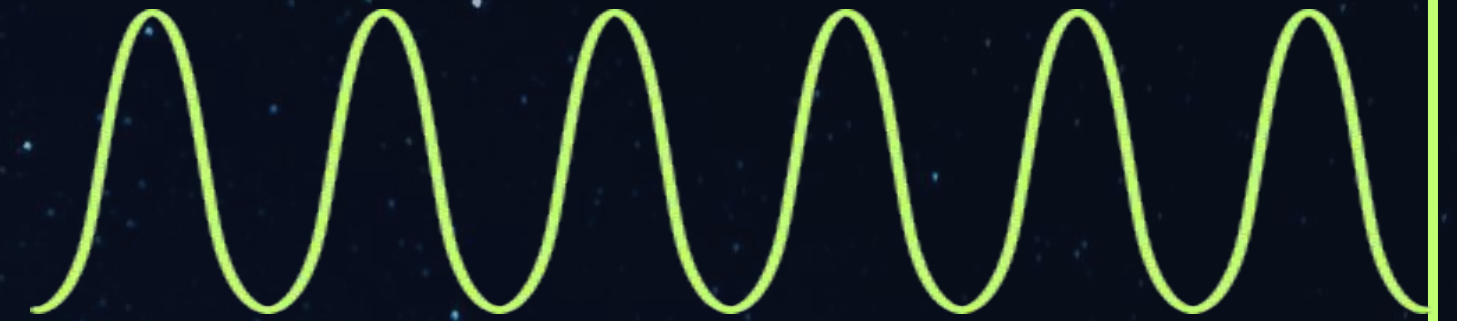
Auto-fitter

Creating/using software to automate the calibrations process. Scripts written in C++.



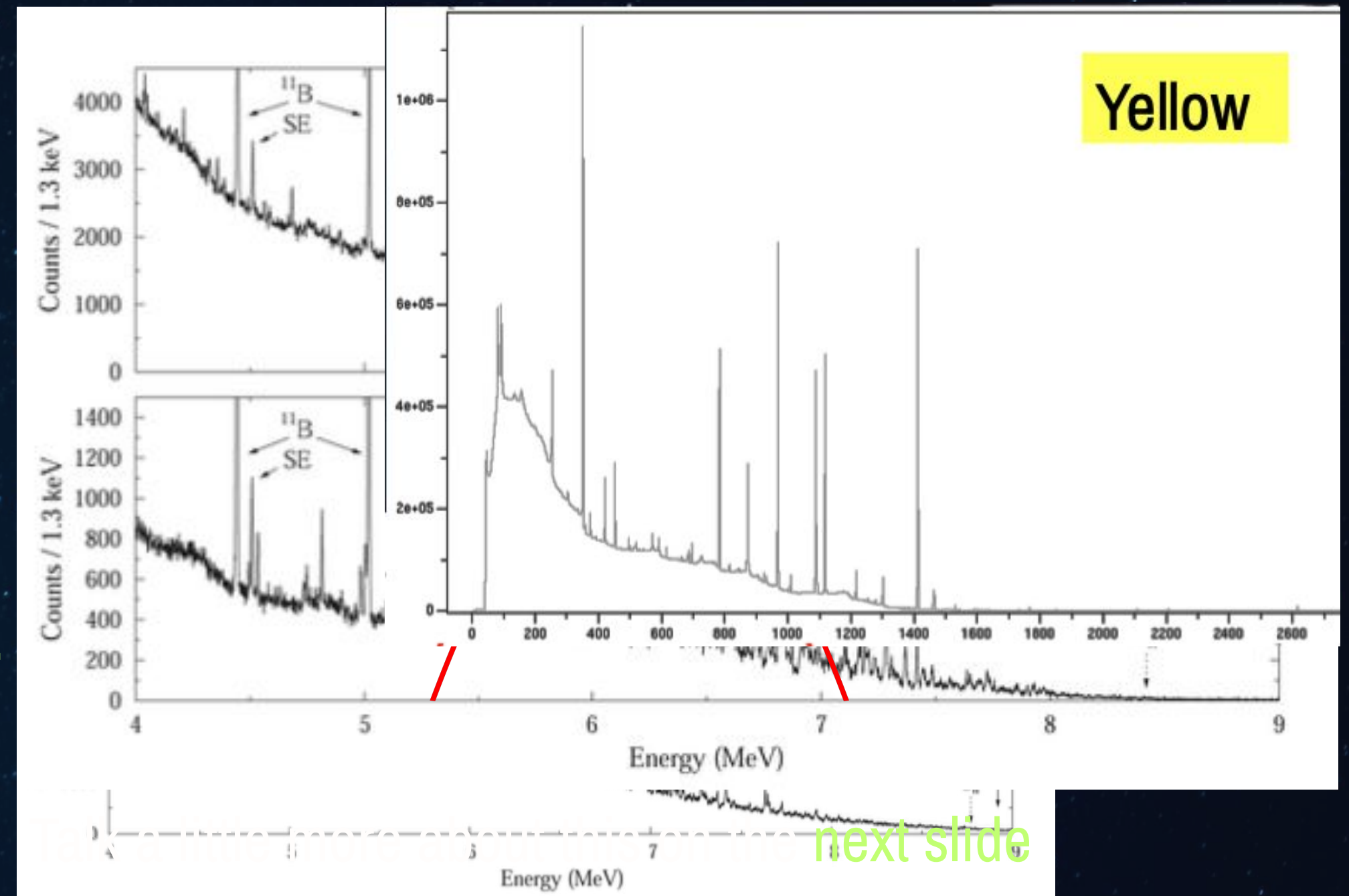
- **input:**
 - 3 chosen background lines/peaks
 - min and max of where the peak should be
 - minimum height
 - width
- **output:**
 - calibrated energy spectrum
 - currently working on accounting for efficiency
 - calibration histograms

Summing



Creating/using software to **automate** the **calibrations and summation** process. Written in **C++**.

- **input:**
 - spectra
 - calibration parameters (from auto-fitter)
- **output:**
 - calibrated spectra
 - **summation** of the cross **horizontal** (detectors 1 and 5) and **perpendicular calibrated spectra** (detectors 3 and 7)



Future if it ran

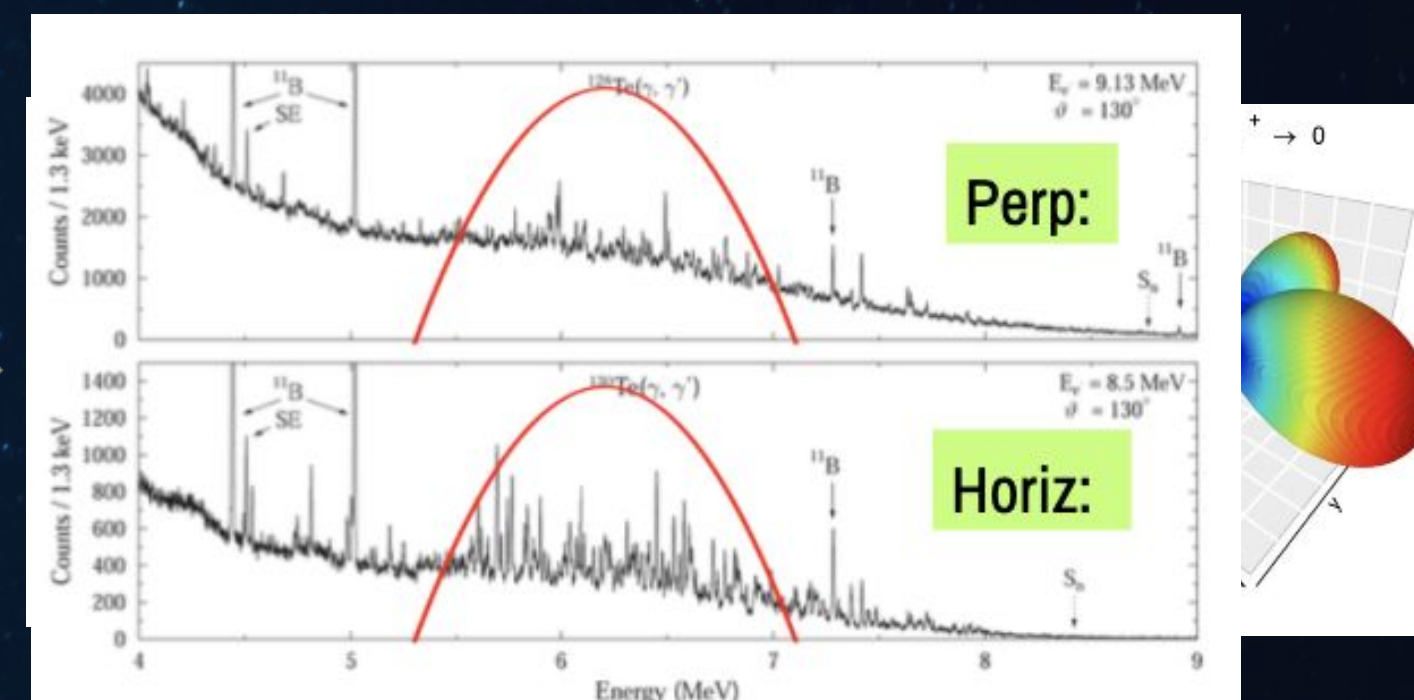
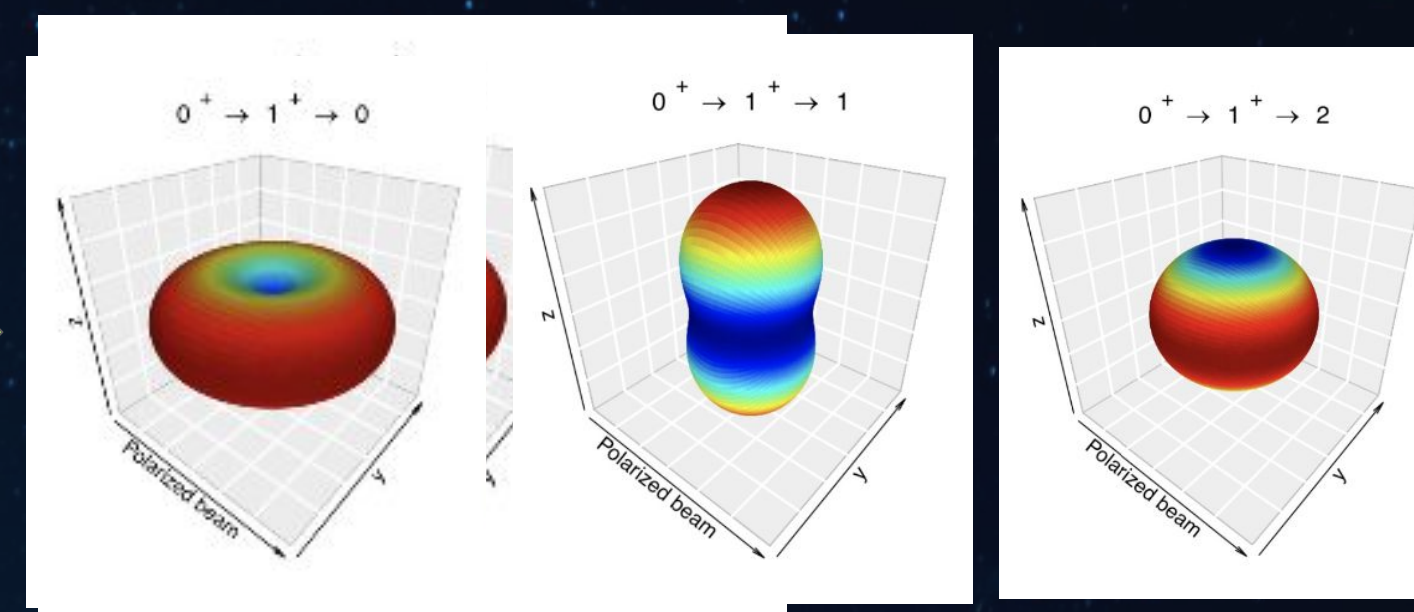
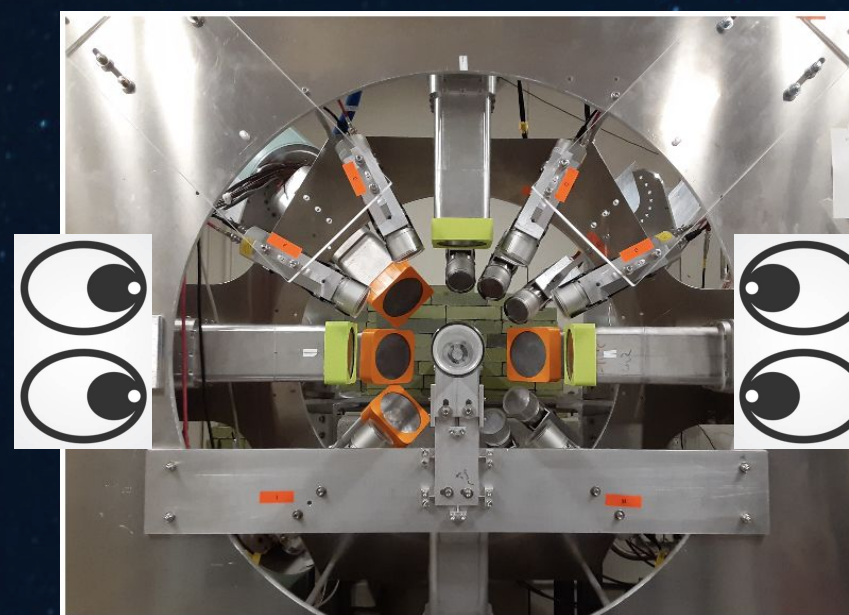
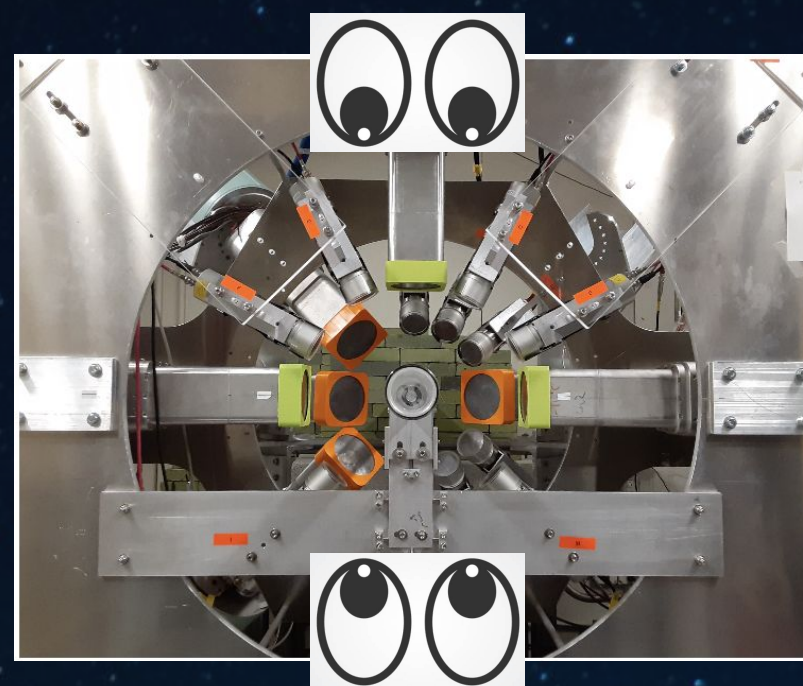
What do we see?

Examples.
What does this tell us?:

- angular distribution patterns for the de-excitation of the nucleus with different parities

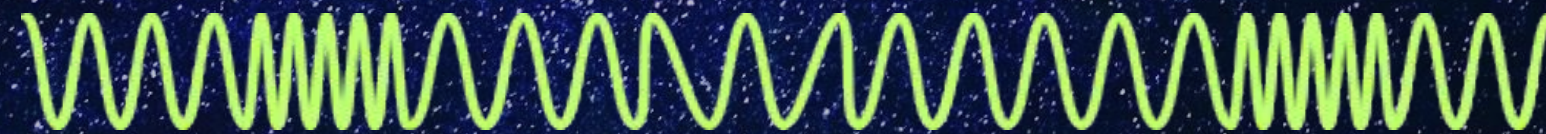
What does it not tell us?

- this does not directly tell us the shape of the nucleus (for that we need to compare our observations to theoretical models)





“There are older and fouler things than Orcs in the deep places of the world; like your code does not work like you want it to work) in the deep places of the world.”



— J. R. R. Tolkien (Edited by Flor Nardone)

Future Cont.

Future tasks:

1. continue working and **resolving bugs** in auto-fitter and summation code
2. **look for peaks** or lack thereof in summed/addback spectra
3. search for coincidences
4. analyze results for the the existence or lack thereof of the scissors mode
5. **draw conclusions** on the **behaviour and shape** of Ruthenium 102/104 **based on observational results and comparison to theory**



Me Currently

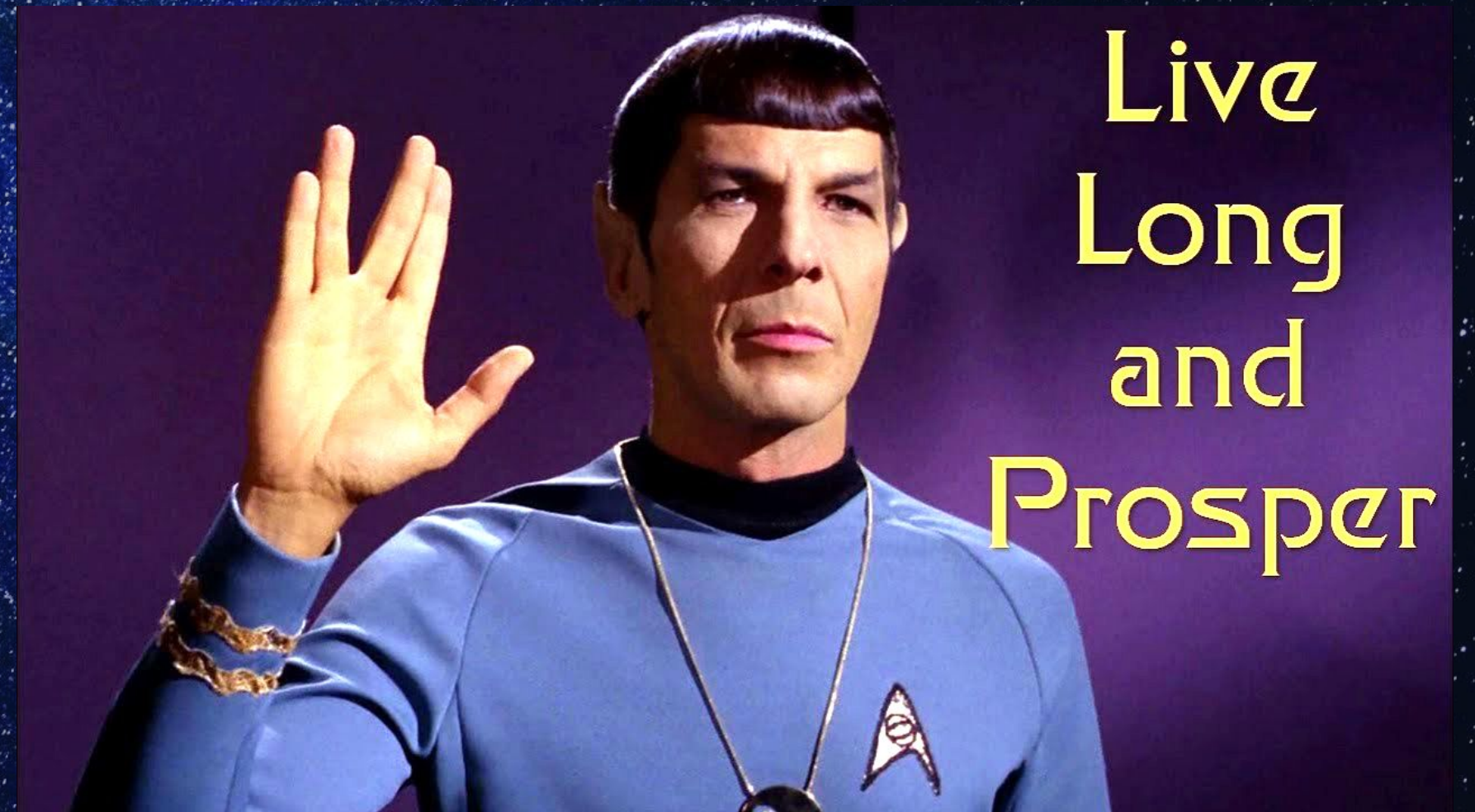
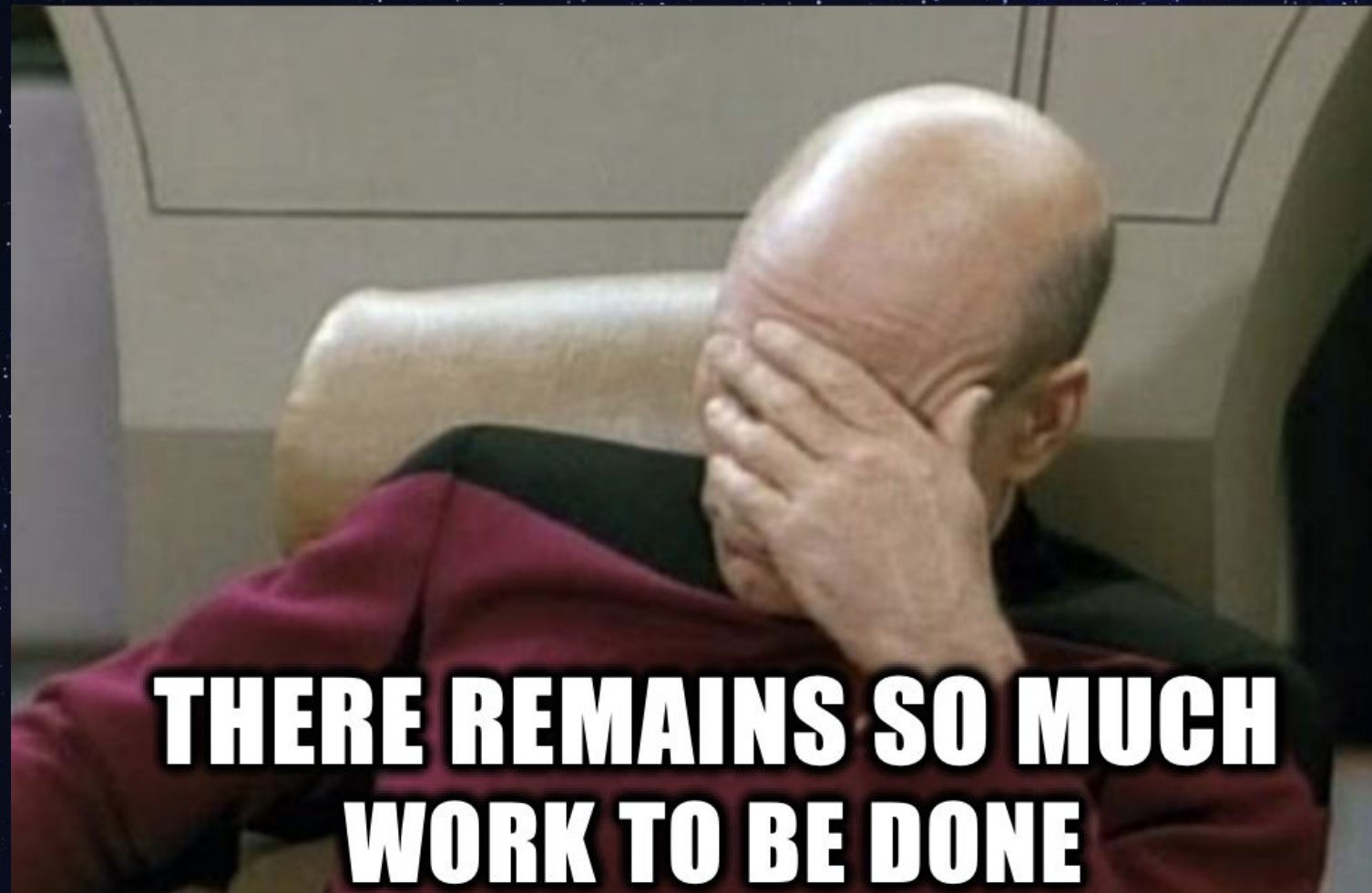


My path:

- not strictly linear
 - which I appreciated
 - Allowed me to explore a lot of things
- learned at least a little bit of a lot of differing skills



The End (for now)



Acknowledgement



**Akaa Daniel
Ayangeakaa**

My Mentor, Advisor and
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Antonella Saracino

For all her help and guidance.

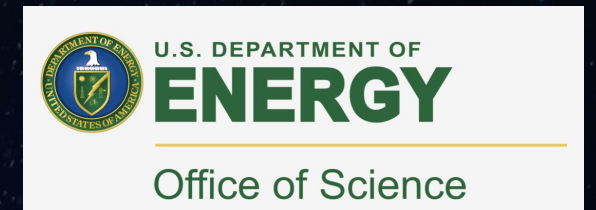
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Robert Janssens

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**THE UNIVERSITY
of NORTH CAROLINA
at CHAPEL HILL**



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