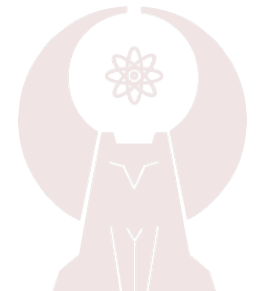


Investigating the Structure of ^{46}Ca through the Beta Decay of ^{46}K Utilizing the New GRIFFIN Spectrometer

Jennifer Pore
PhD Candidate

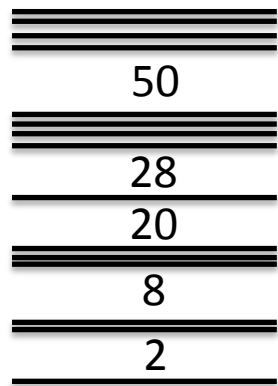
Simon Fraser University, Burnaby, BC
CAP 2015-Edmonton, AB



Evolution of Shell Structure

Aim to study the evolution of shell structure towards more neutron-rich nuclei.

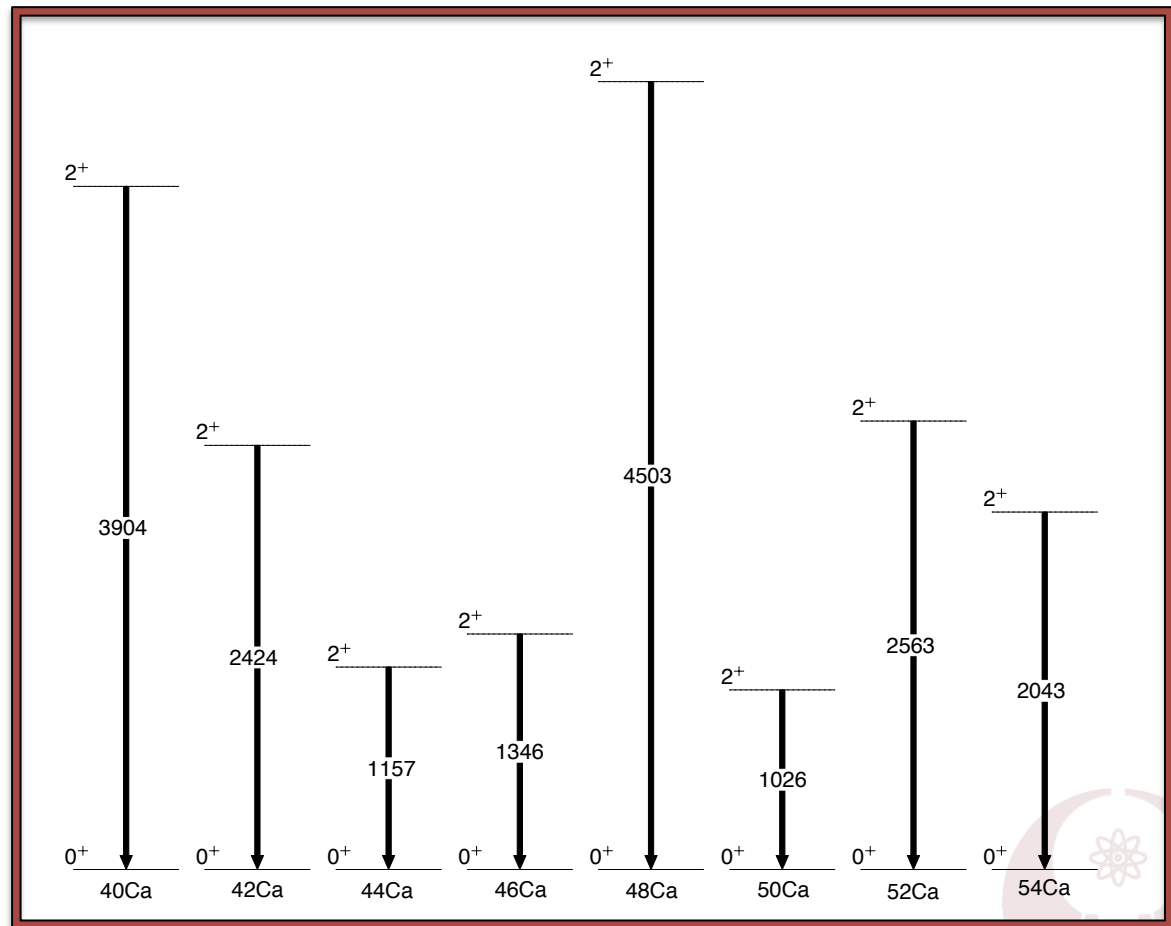
Near stability



For $N \gg Z$



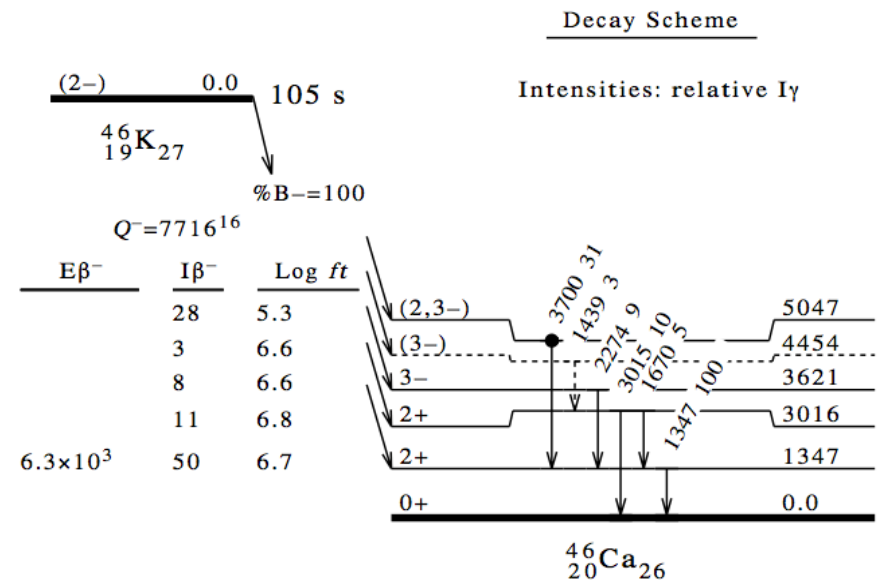
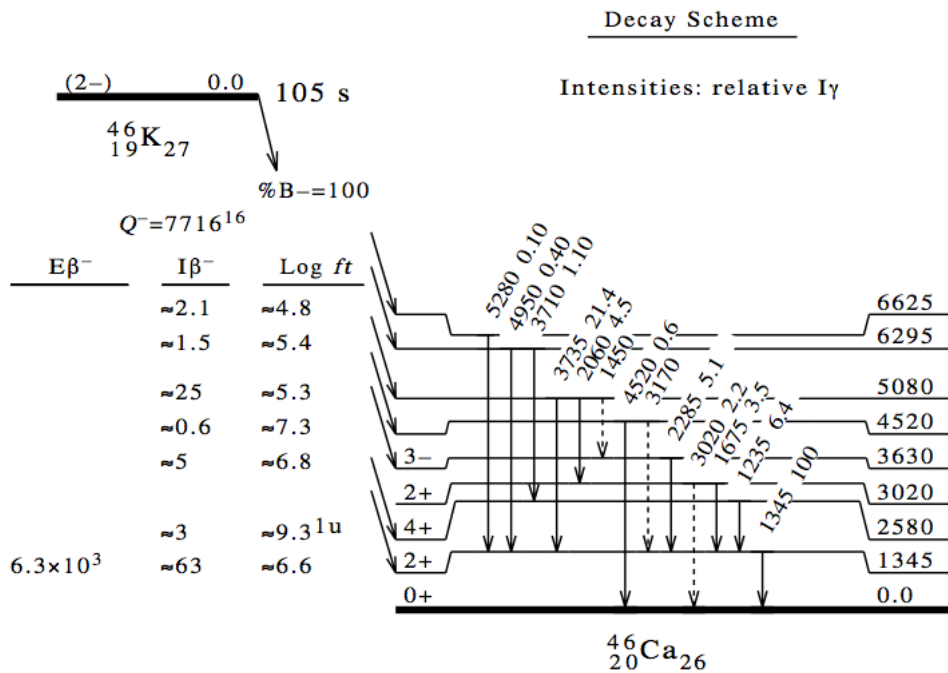
The calcium isotopes are ideal for studies of shell closures in medium mass nuclei.



Systematics of the 2_1^+ State in the Even Ca Isotopes

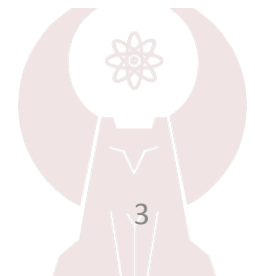
A Little About ^{46}Ca

Two previous beta decay experiments from late 1960's



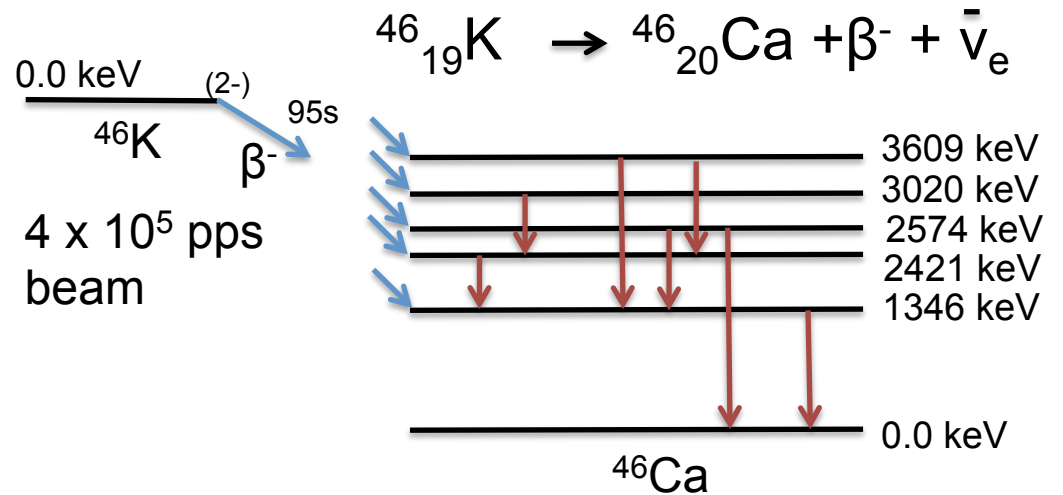
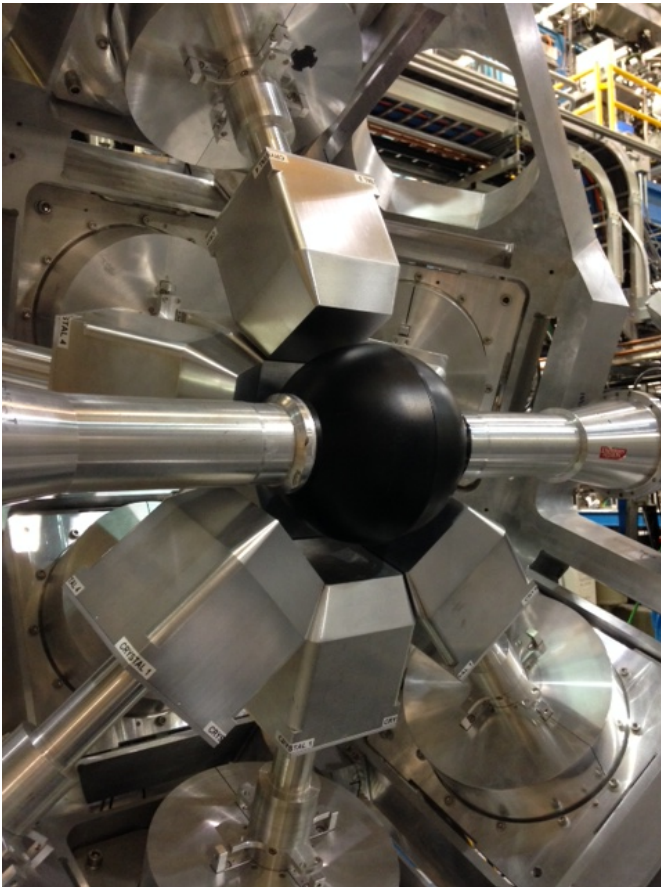
B. Parsa and G. Gordon, Phys. Lett. 23, 269 (1966).

M. Yagi et al., Res. Rep. Lab. Nucl. Sci., Tohoku Univ. 1, No. 2, 60 (1968).



The Experiment

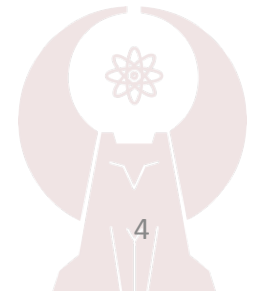
Use the Beta Decay of $^{46}\text{K} \rightarrow ^{46}\text{Ca}$ $Q = 7716 \text{ keV}$



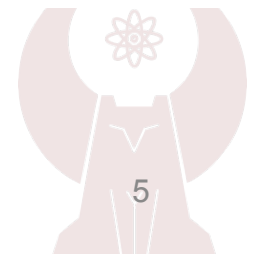
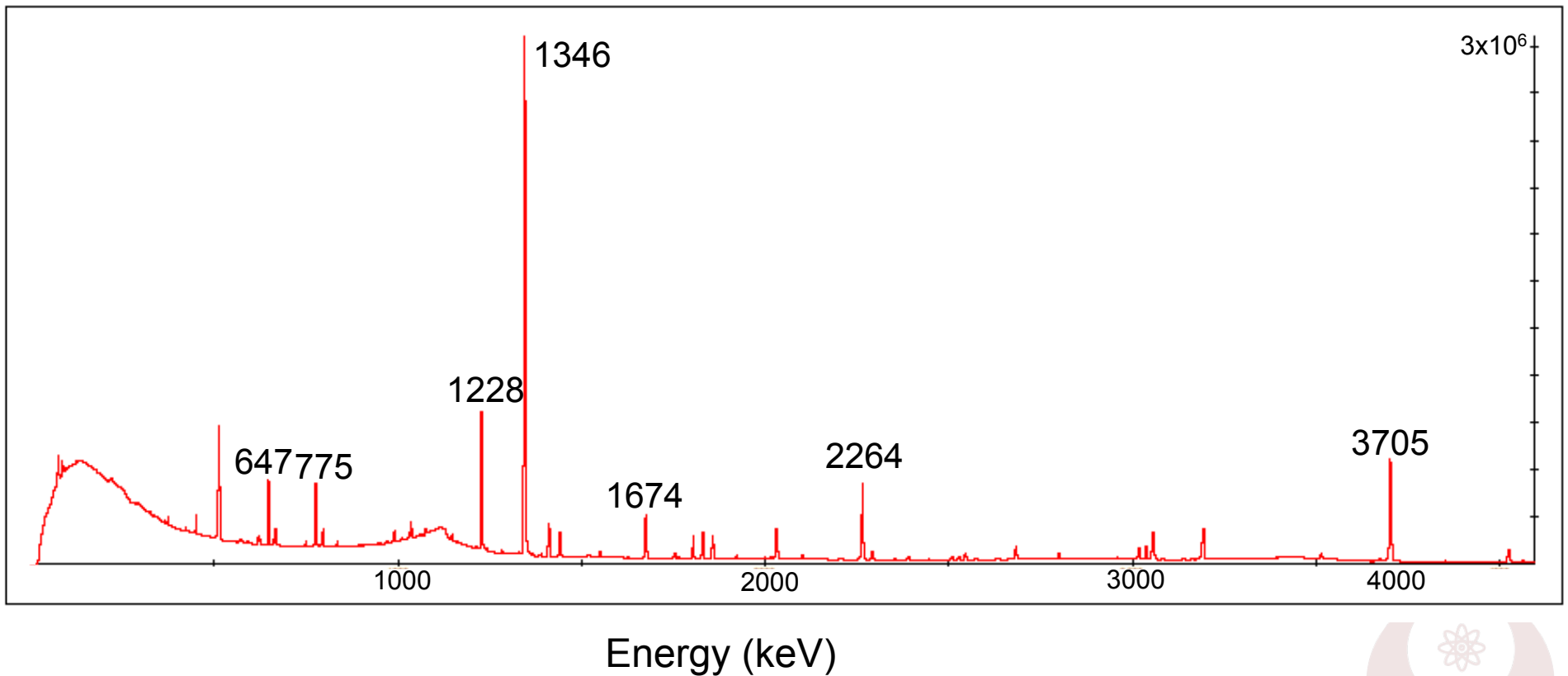
~40 hours of data collection

GRIFFIN Configuration

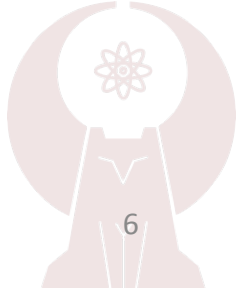
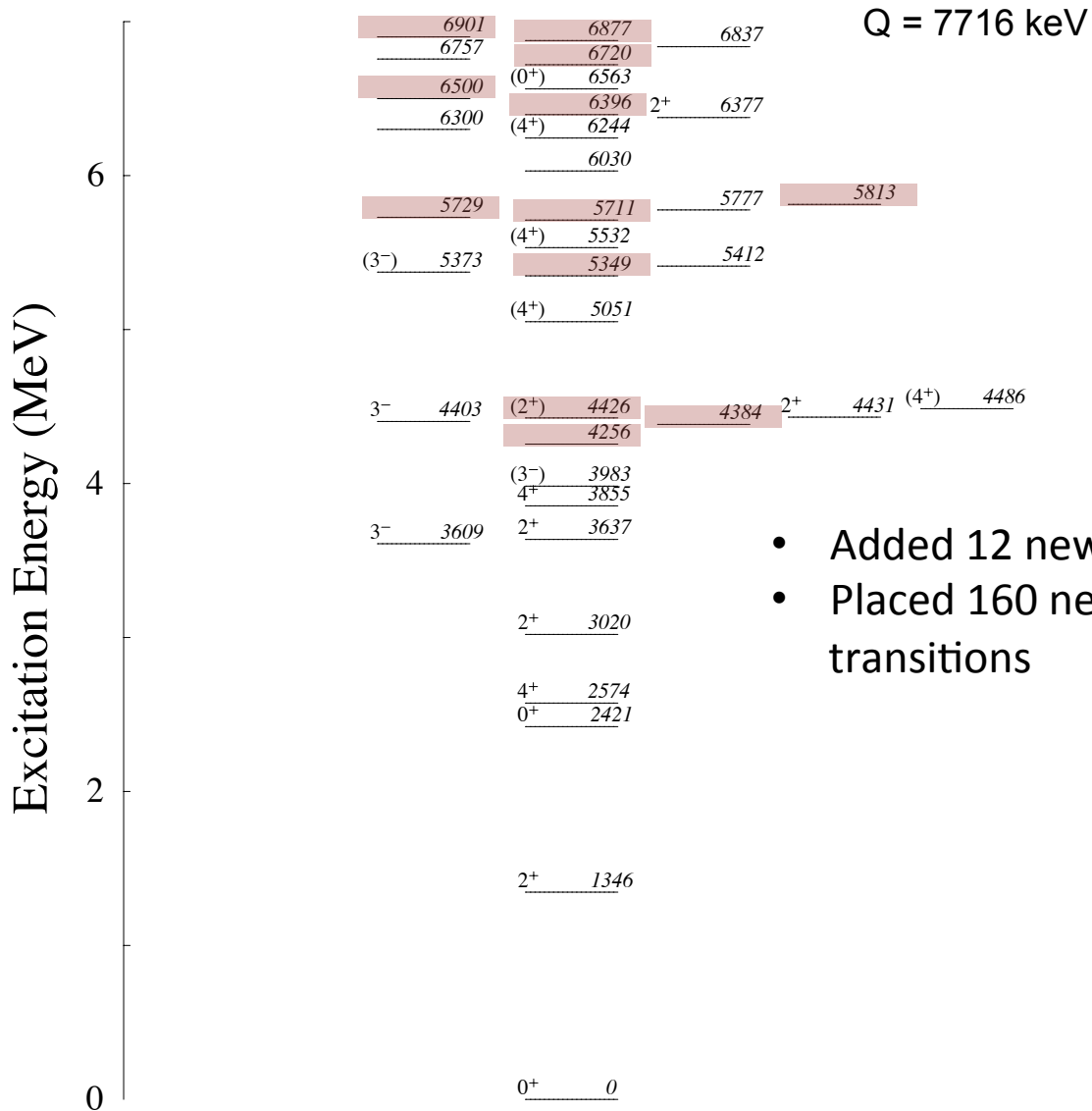
- 15 HPGe Clover Detectors
- 5 Si(Li) Detectors (PACES)
- 10 scintillators (SCEPTAR)
- Moving tape system



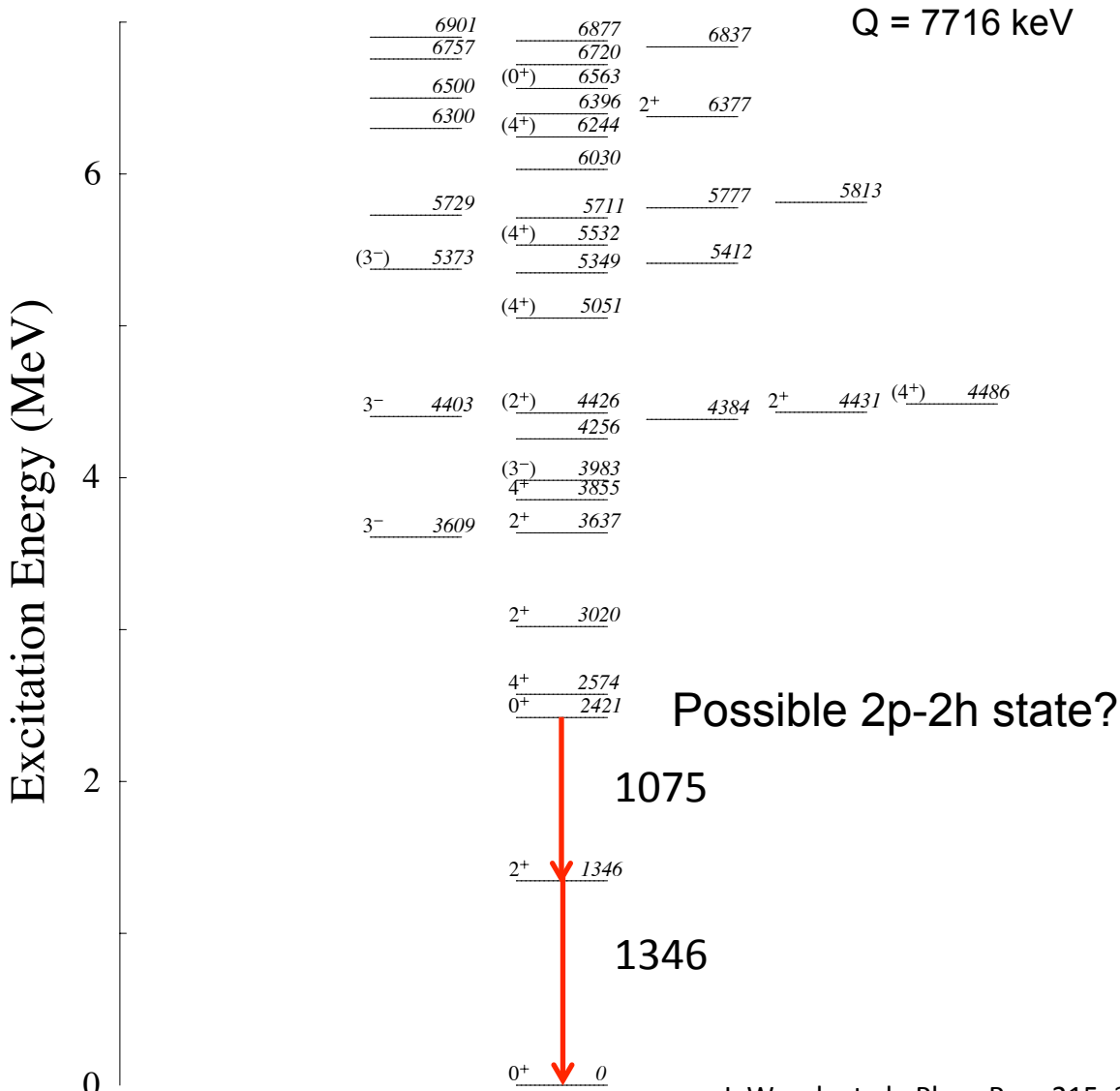
Gamma-Gamma Coincidences



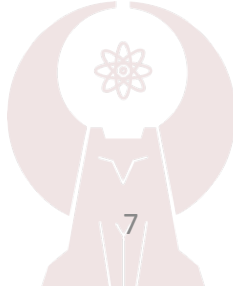
Observed Excited States



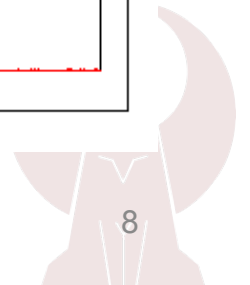
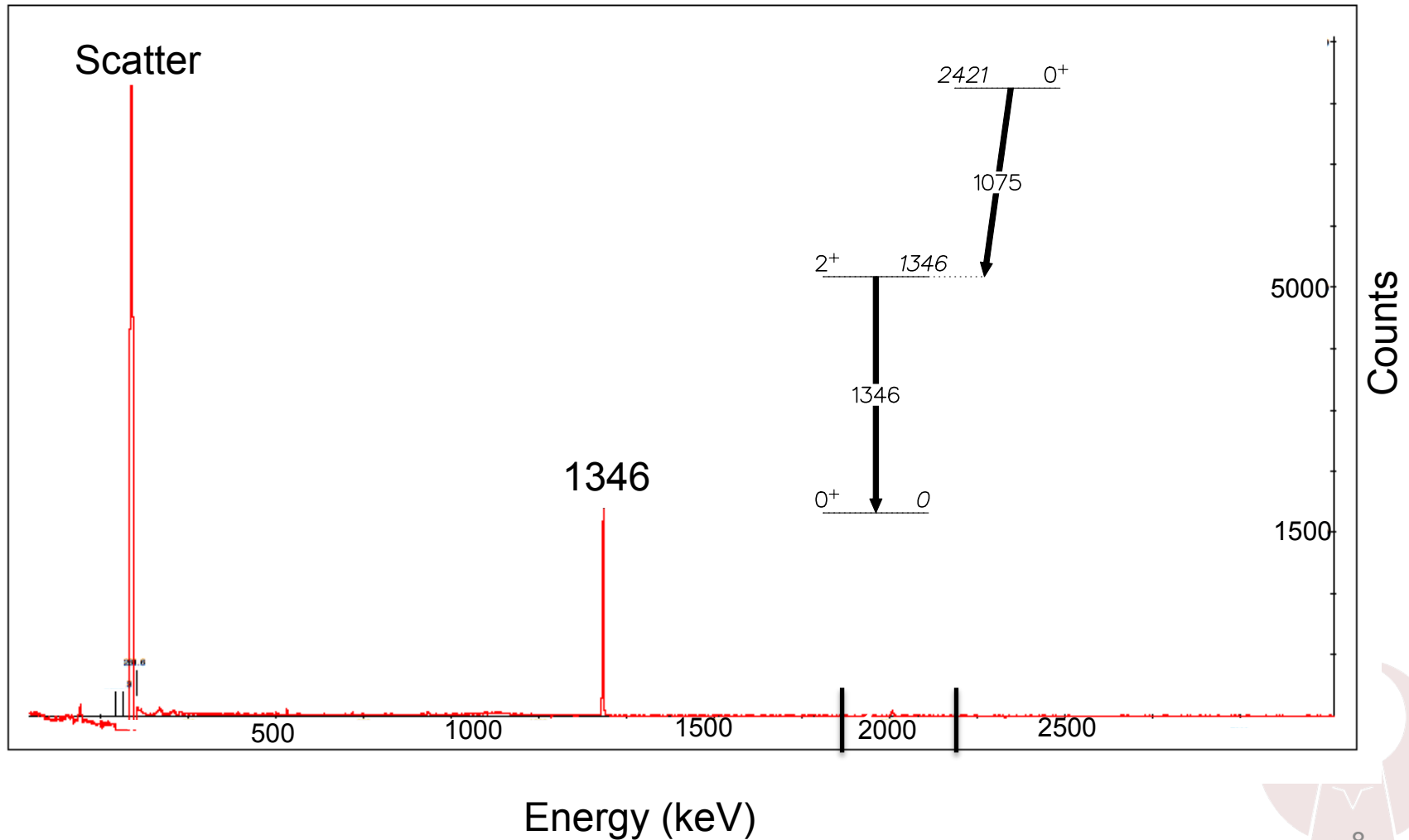
Observed Excited States



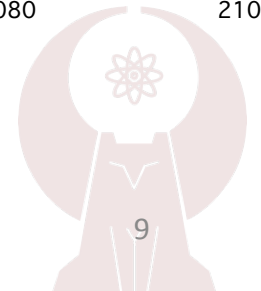
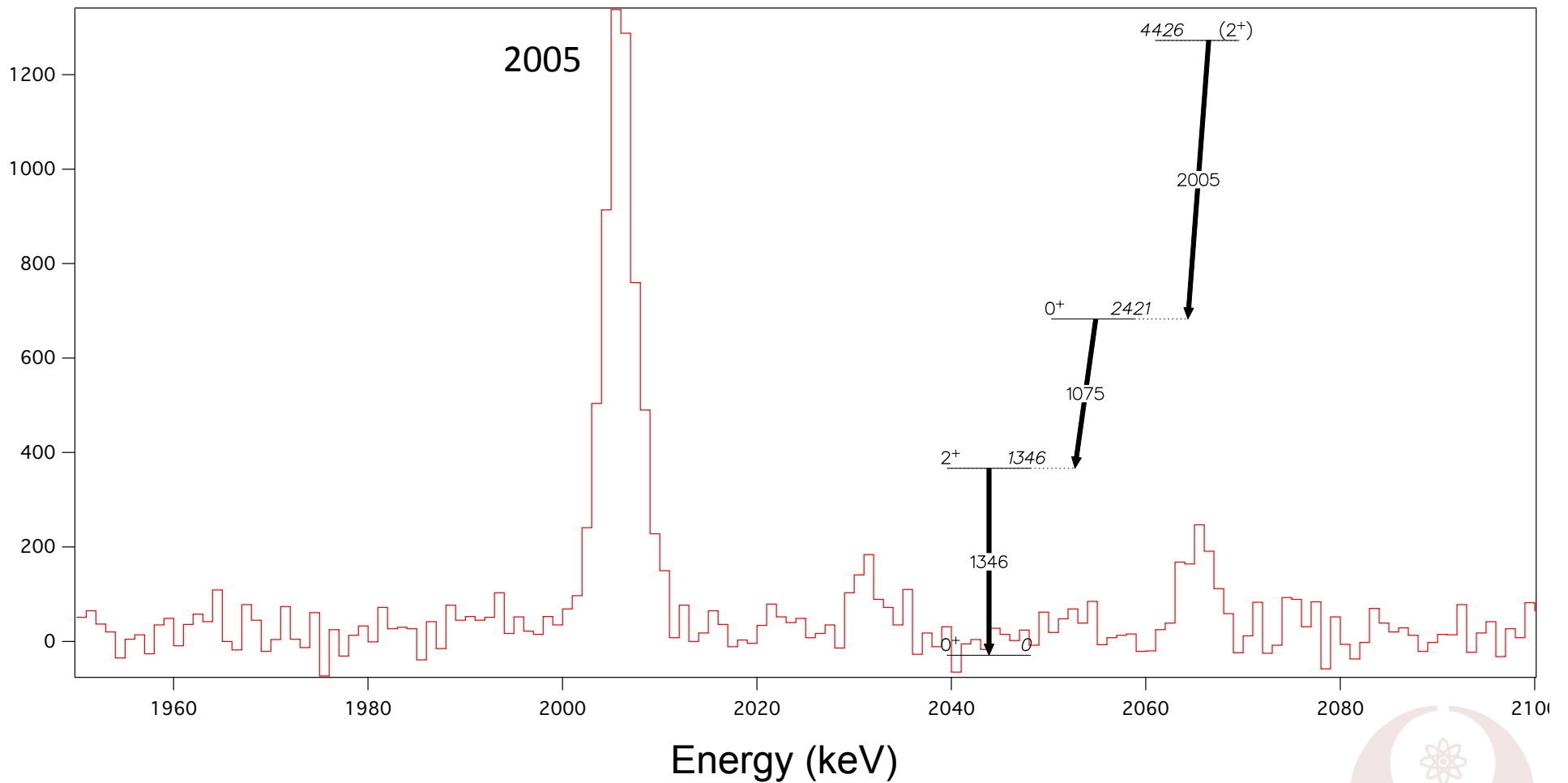
J. Wood, et al., Phys. Rep. 215, 3 (1992)



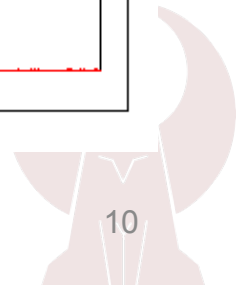
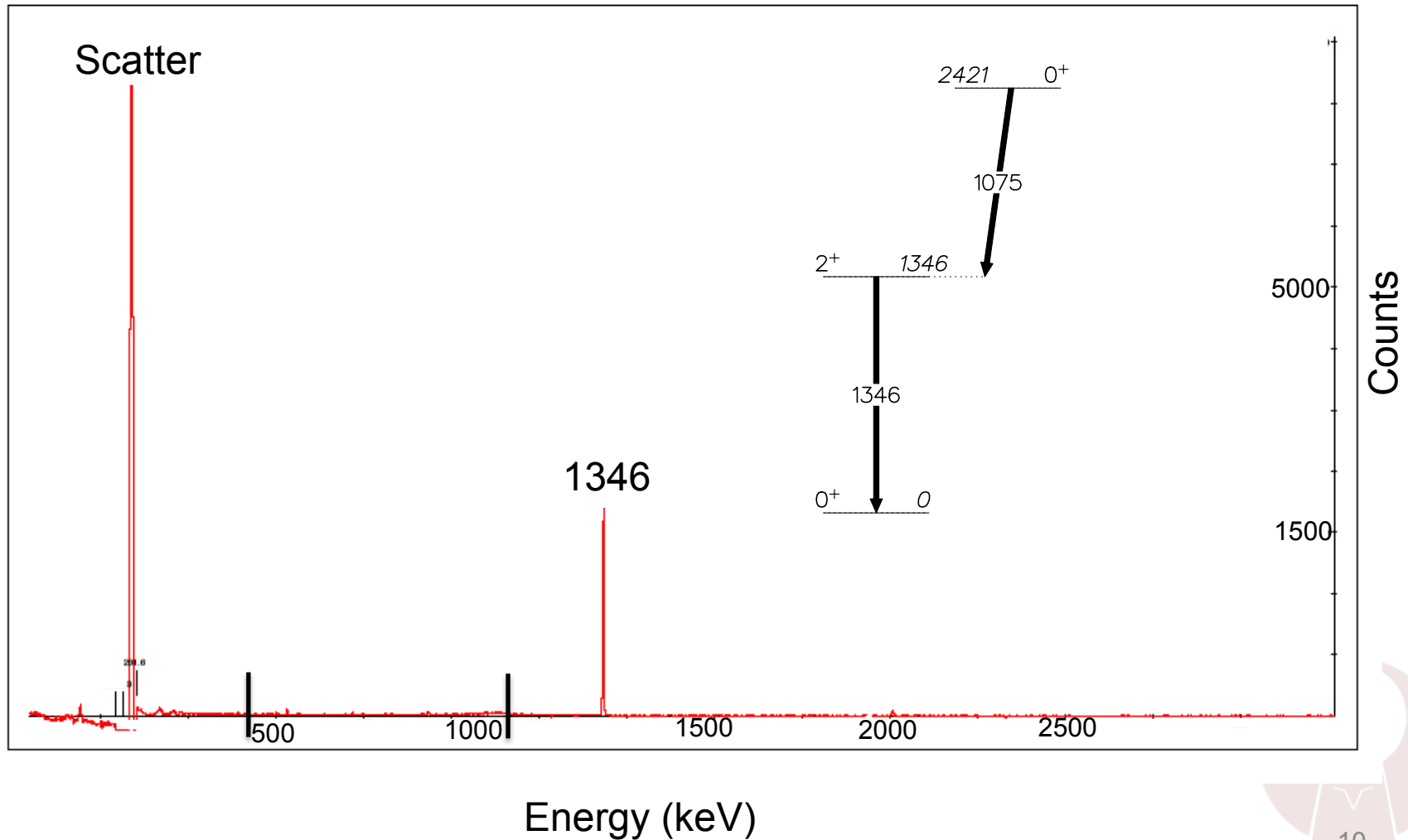
Gate on 1075 keV Gamma



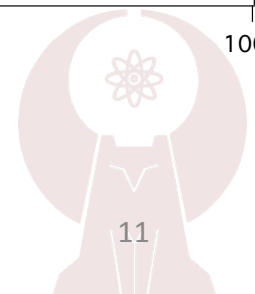
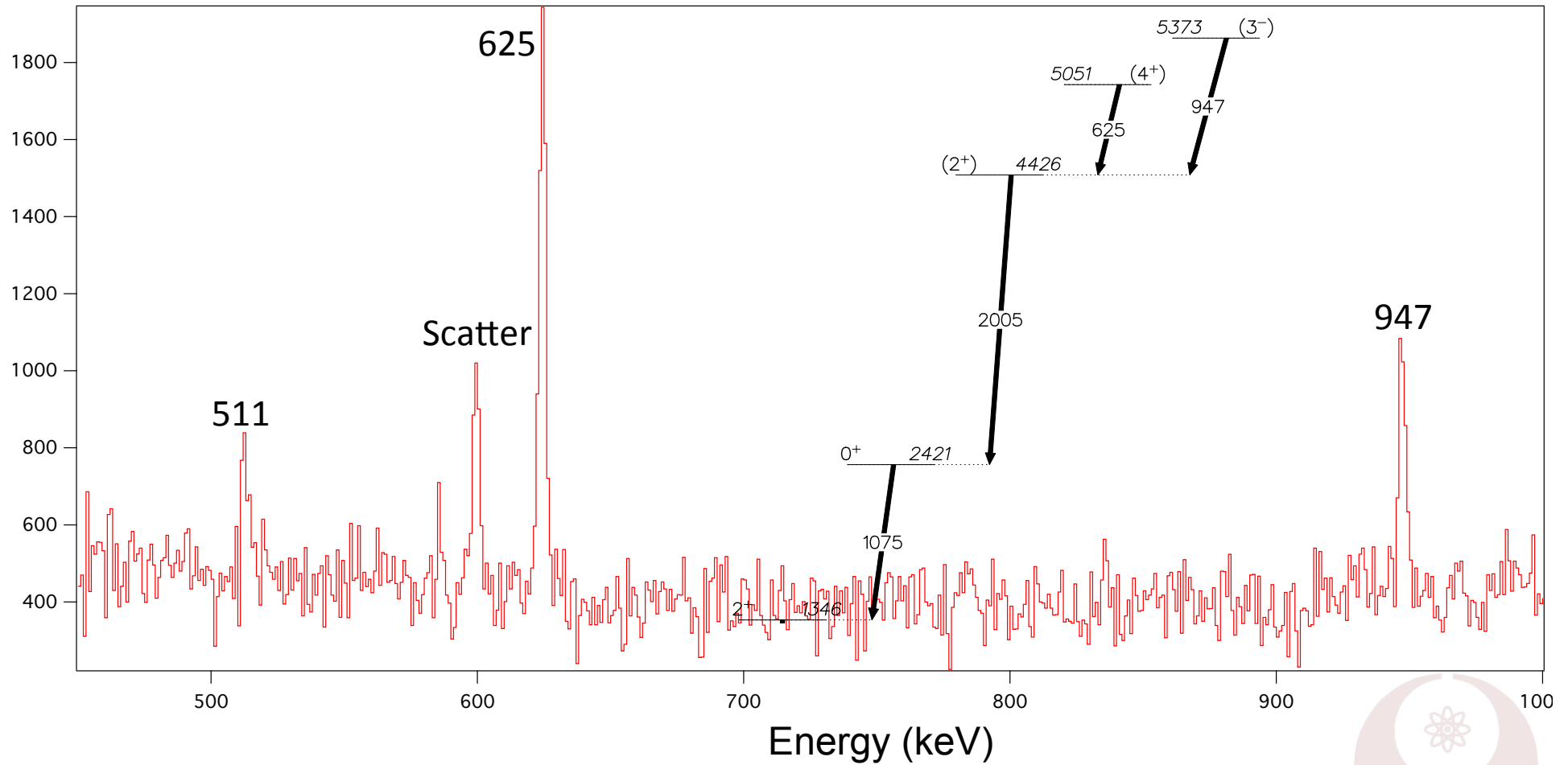
Gate on 1075 keV Gamma



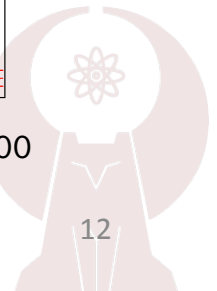
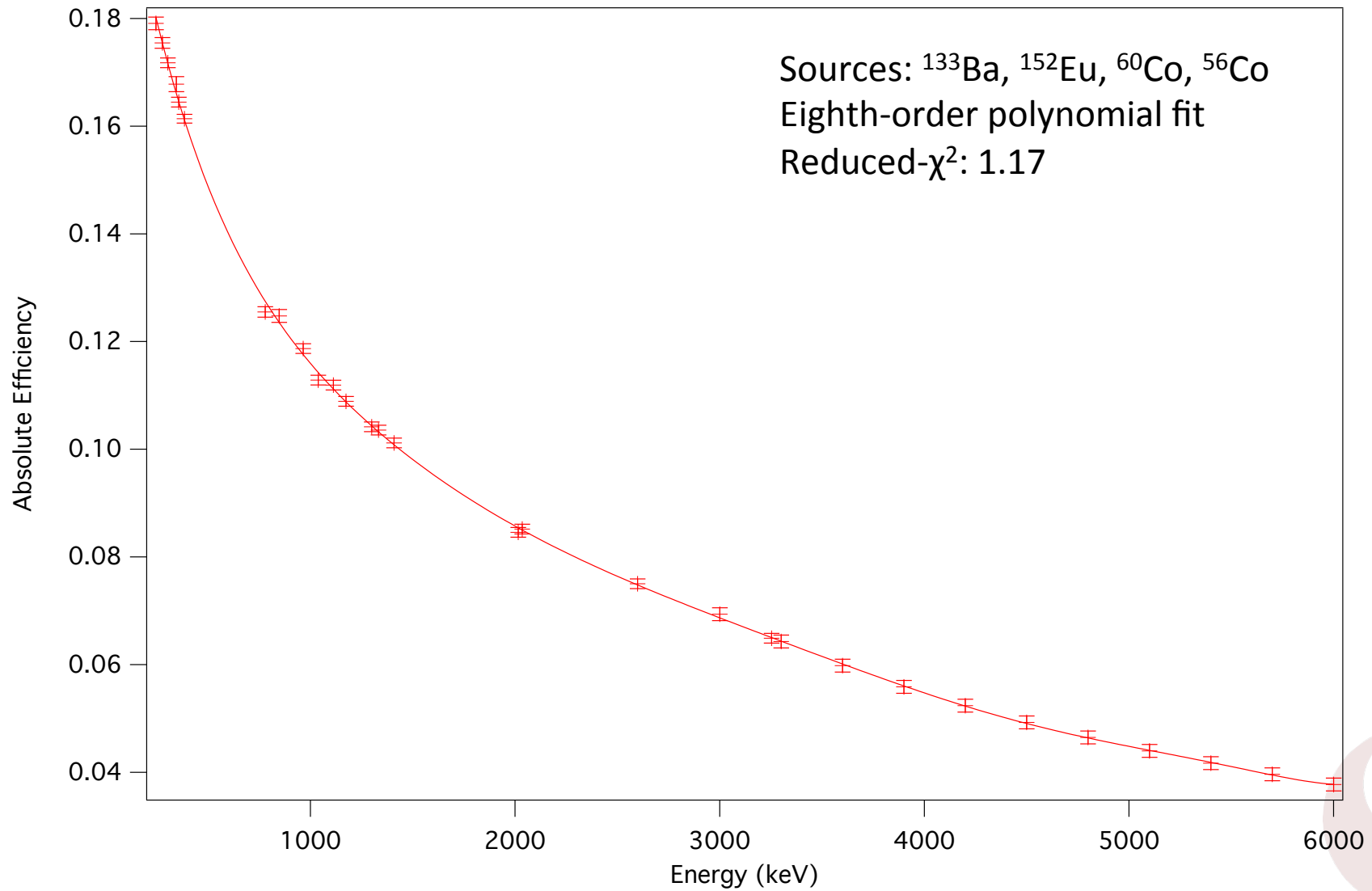
Gate on 1075 keV Gamma



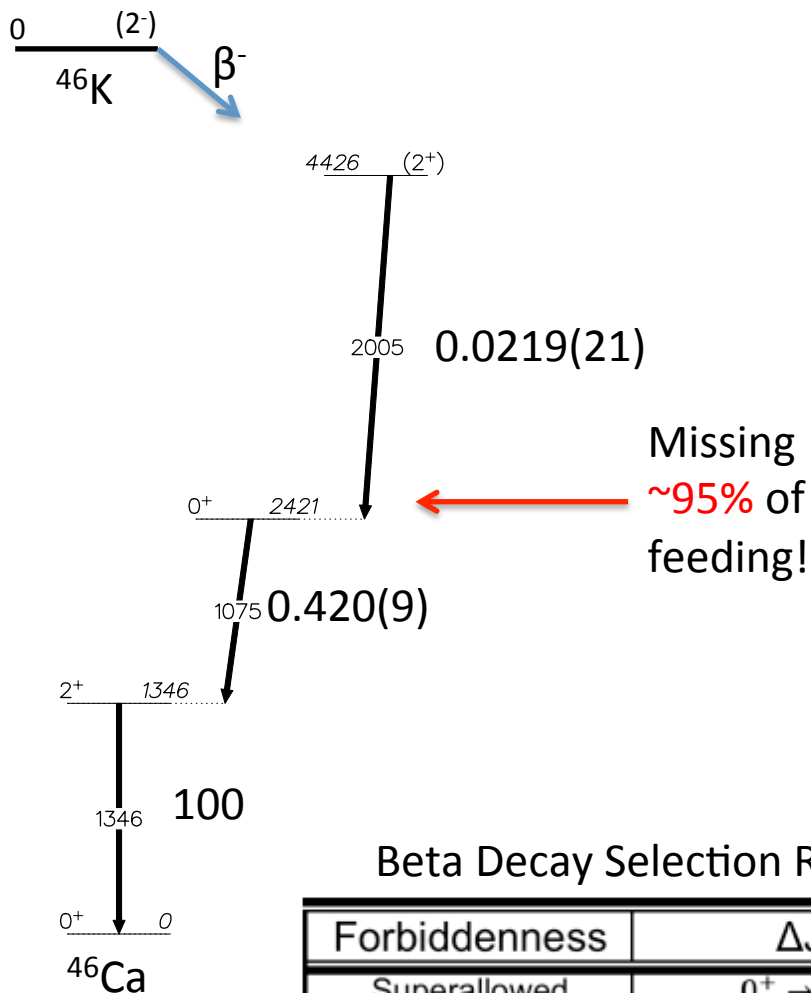
Gate on 1075 keV Gamma



Absolute Efficiency of GRIFFIN



Beta Feeding into the 0+ State



Energy (keV)	1966 Feeding	1968 Feeding
6625	2.1	NOB
6295	1.5	NOB
5080	25	28
4520	0.6	NOB
4454	NOB	3
3630	5	8
3580	3	NOB
3020	0	11
1345	63	50

Beta Decay Selection Rules

Forbiddenness	ΔJ	$\Delta \pi$	$\log ft$
Superallowed	$0^+ \rightarrow 0^+$	No	2.9-3.7
Allowed	0, 1	No	4.4-6.0
First Forbidden	0,1,2	Yes	6-10
Second Forbidden	1,2,3	No	10-13
Third Forbidden	2,3,4	Yes	>15

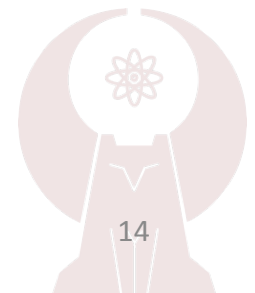
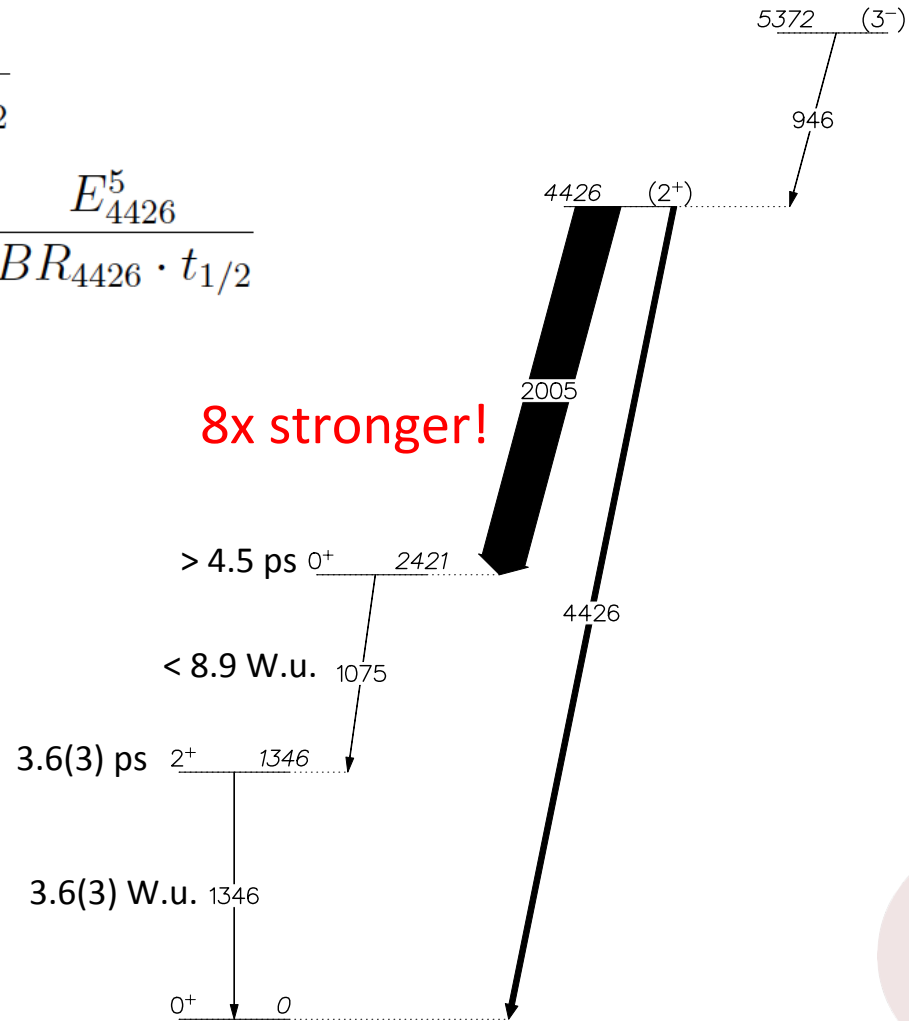


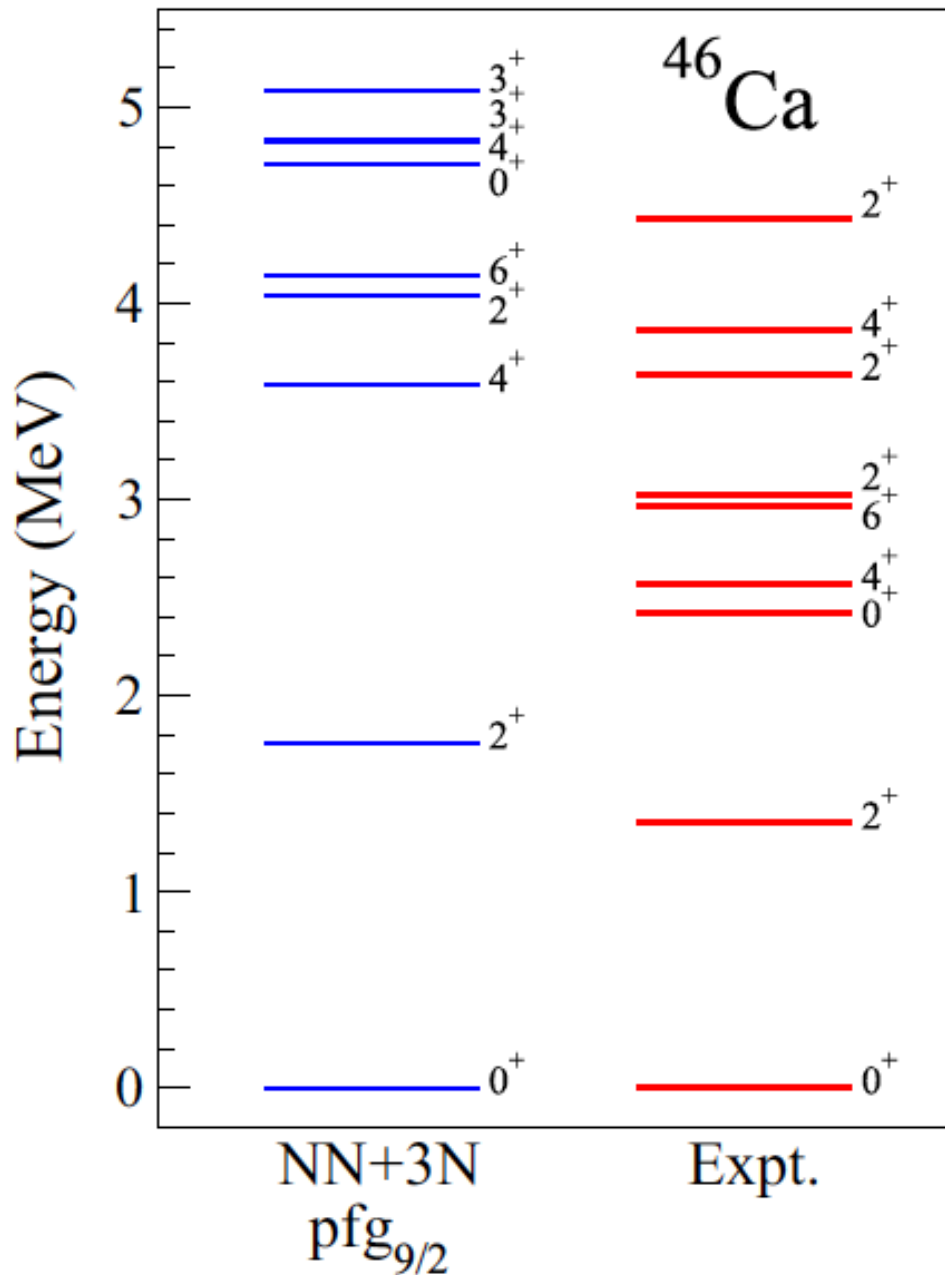
Relative B(E2) Transition Strengths

$$B(E2) \propto \frac{BR}{E_\gamma^5 \cdot t_{1/2}}$$

$$Rel.B(E2) = \frac{BR_{2005} \cdot t_{1/2}}{E_{2005}^5} \cdot \frac{E_{4426}^5}{BR_{4426} \cdot t_{1/2}}$$

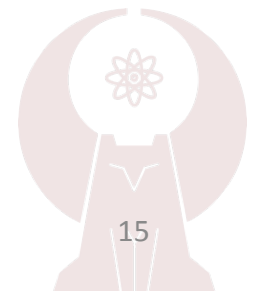
More Relative B(E2) values to come once more spins and parities are assigned.





Future Work

1. Determine intensities of placed gamma-ray transitions.
2. Investigate beta feeding for each excited state.
3. Assign angular momenta and parity for each excited state.
4. Compare results to theory.



Thank You!

- Dr. Corina Andreoiu
- Dr. Adam Garnsworthy
- Dr. Jenna Smith
- GRIFFIN Collaboration

jpore@sfu.ca

