

Investigation of the Beta Emitter in Neutron-Deficient $^{154}_{72}\text{Hf}$ Nuclei and $^{152}_{70}\text{Yb}$ Nuclei.

PhD Student: Norah Al Wadie

Supervisor: Prof. Robert Page



Outline

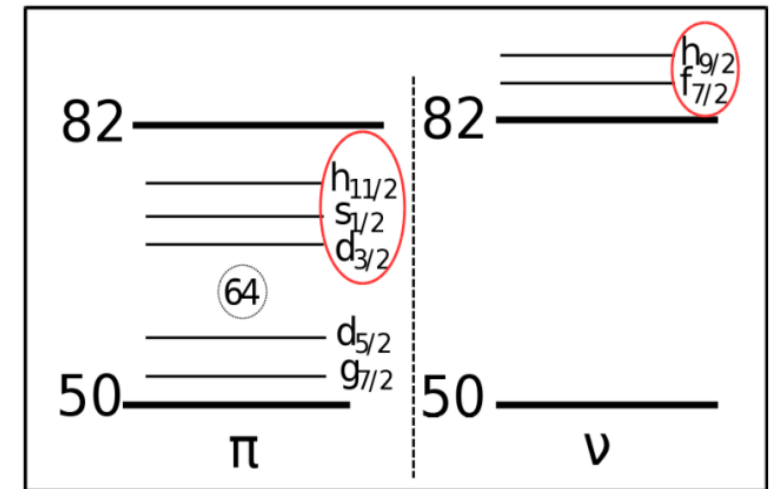
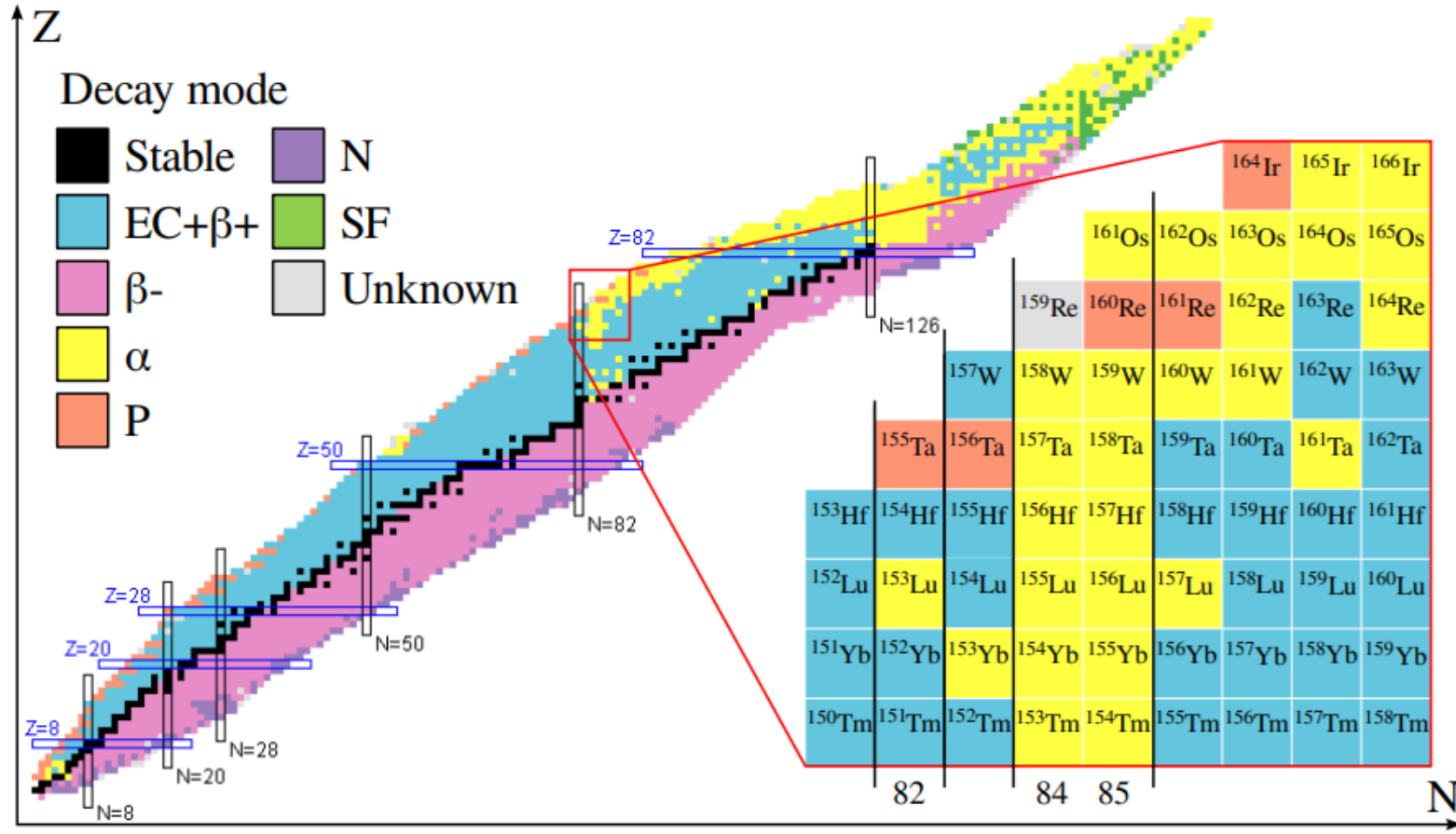
01. Introduction and the aim of my project

02. Experimental **Set up**.

03. Results and Discussion.

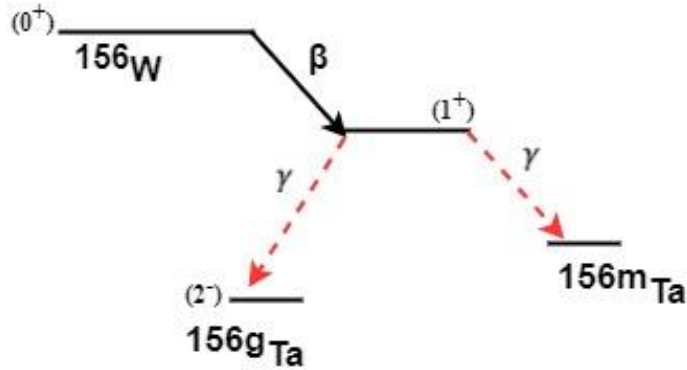
04. Future work

Introduction

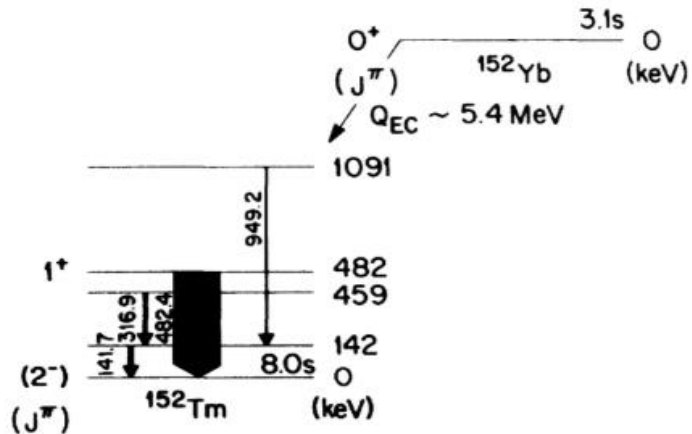


Literature Review

The last study was conducted by Briscoe and other researchers in 2023.



Unlike the light nucleus such as $^{152}_{70}\text{Yb}$



Toth, K.S. *et al.* (1987)

Phys. Lett. B 847 (2023) 138310



ELSEVIER

Contents lists available at ScienceDirect

Physics Letters B

journal homepage: www.elsevier.com/locate/physletb



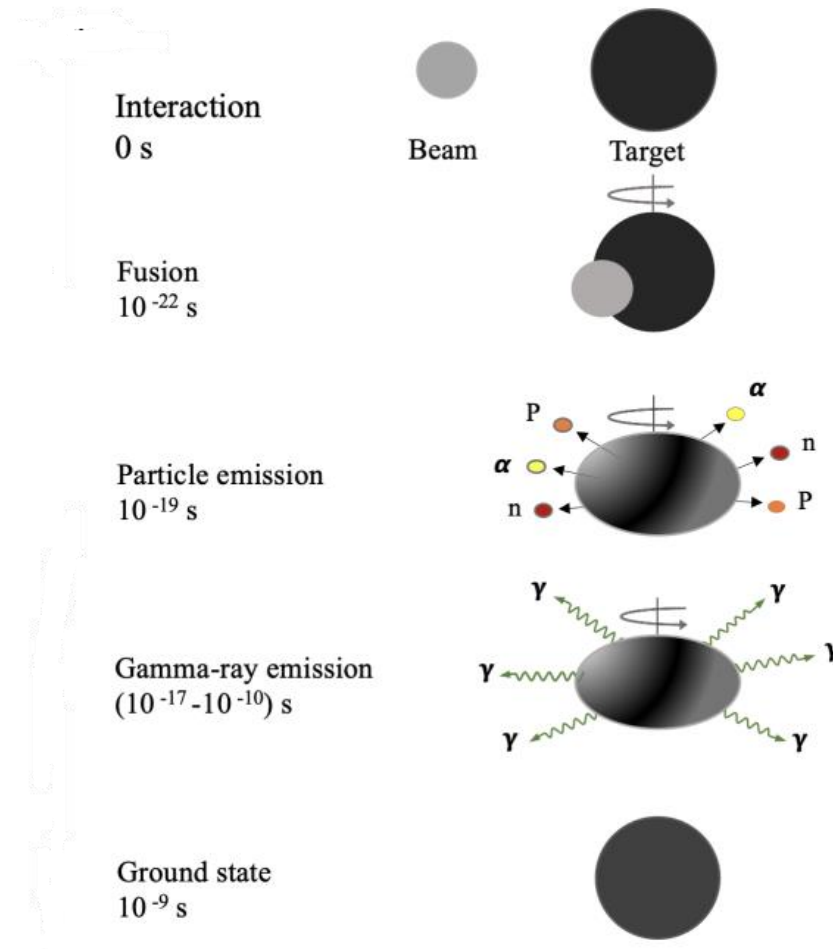
Letter

Decay spectroscopy at the two-proton drip line: Radioactivity of the new nuclides ^{160}Os and ^{156}W

A.D. Briscoe^{a,b,*,}, R.D. Page^{a,*,}, J. Uusitalo^{b,a}, D.T. Joss^a, M.A.M. AlAqeel^{l,a}, B. Alayed^{m,a}, B. Andel^c, S. Antalic^c, K. Auranen^b, H. Ayatollahzadeh^d, H. Badran^b, L. Barber^c, G. Beeton^d, M. Birova^f, V. Bogdanoff^b, R.M. Clark^g, J.G. Cubiss^h, D.M. Cullen^c, J. Deary^d, U. Forsberg^b, T. Grahn^b, P.T. Greenlees^b, J.B. Hilton^{a,b}, A. Illana^{b,n}, H. Joutinen^b, D.S. Judson^a, R. Julin^b, H. Jutila^b, J.M. Keatings^d, M. Labicheⁱ, M. Leino^b, M.C. Lewis^a, J. Louko^b, M. Luoma^b, I. Martel^{a,o}, A. McCarter^a, P.P. McKee^d, P. Mosat^c, S.N. Nathaniel^a, O. Neuvonen^b, D. O'Donnell^d, J. Ojala^b, C.A.A. Page^h, A.M. Plaza^{a,b}, J. Pakarinen^b, P. Papadakisⁱ, E. Parr^a, J. Partanen^{b,l}, P. Rahkila^b, P. Ruotsalainen^b, M. Sandzelius^b, J. Sarén^b, B. Saygi^{j,p}, J. Smallcombe^a, J.F. Smith^d, J. Sorri^k, C.M. Sullivan^a, S. Szewc^b, H. Tann^{a,b}, A. Tolosa-Delgado^b, E. Uusikylä^b, M. Venhart^f, L.J. Waring^a, G. Zimba^b

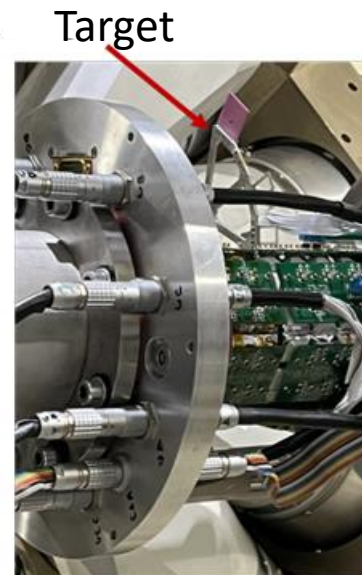
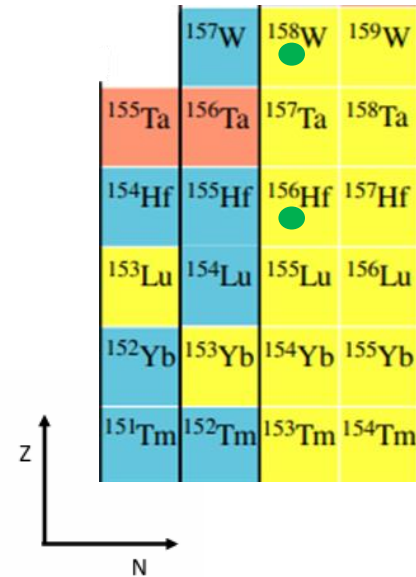
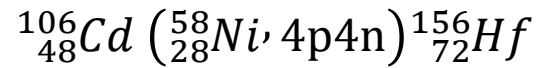
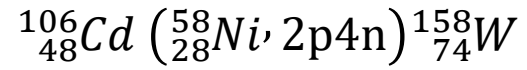


Heavy-Ion Fusion-Evaporation Reactions



Alayed, B.M.A. (2023)

Experimental Setup.

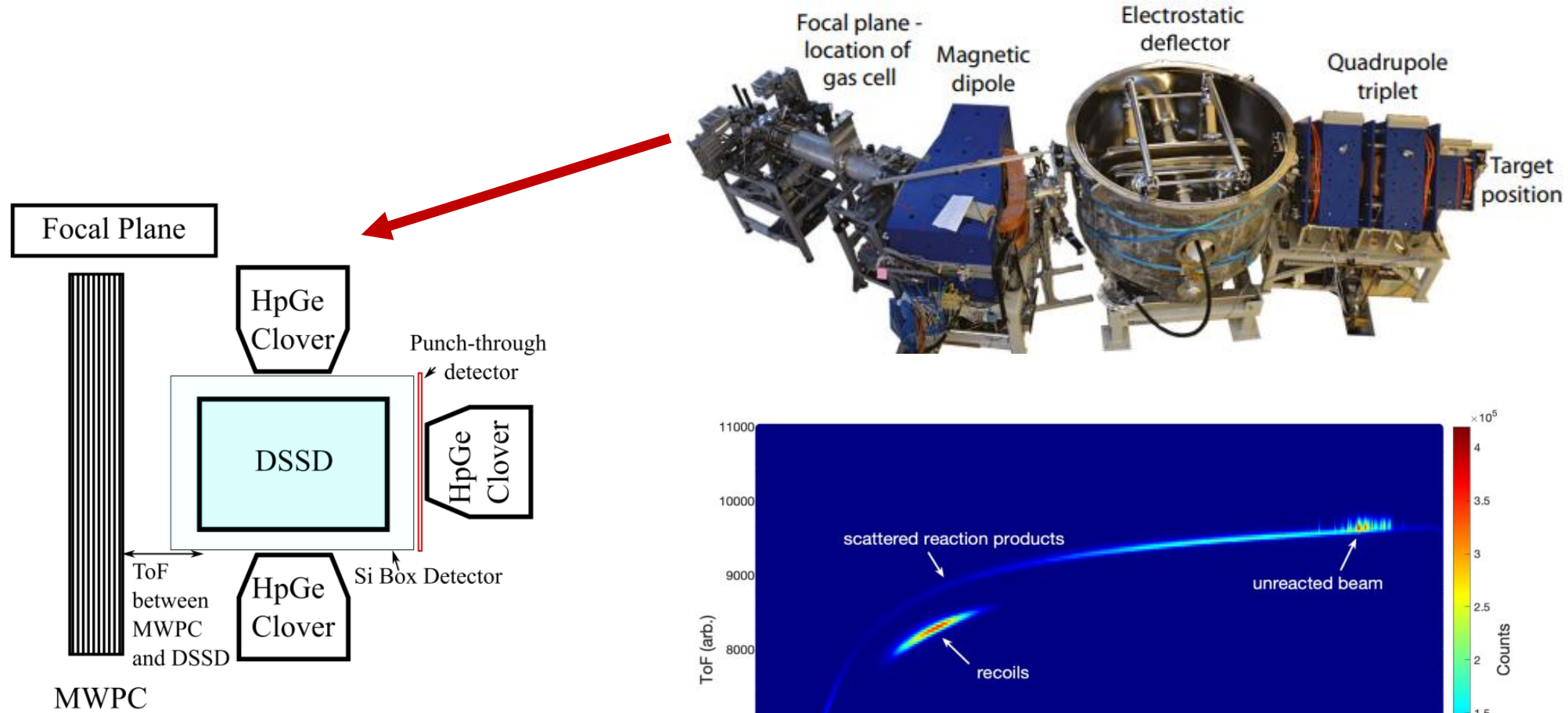


Target thickness: 1 mg/cm².

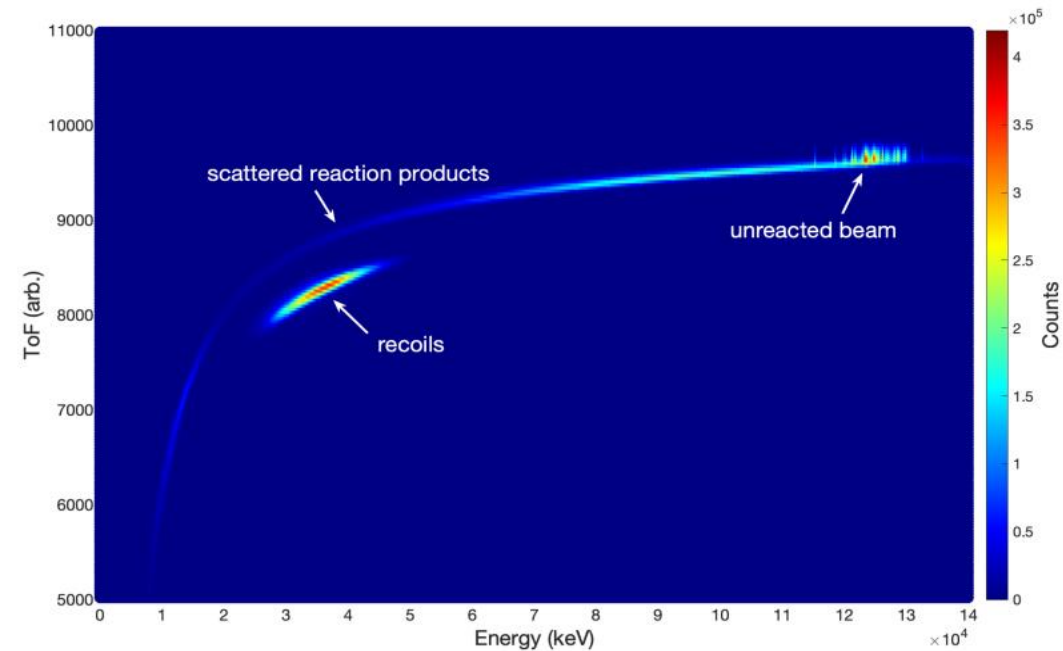
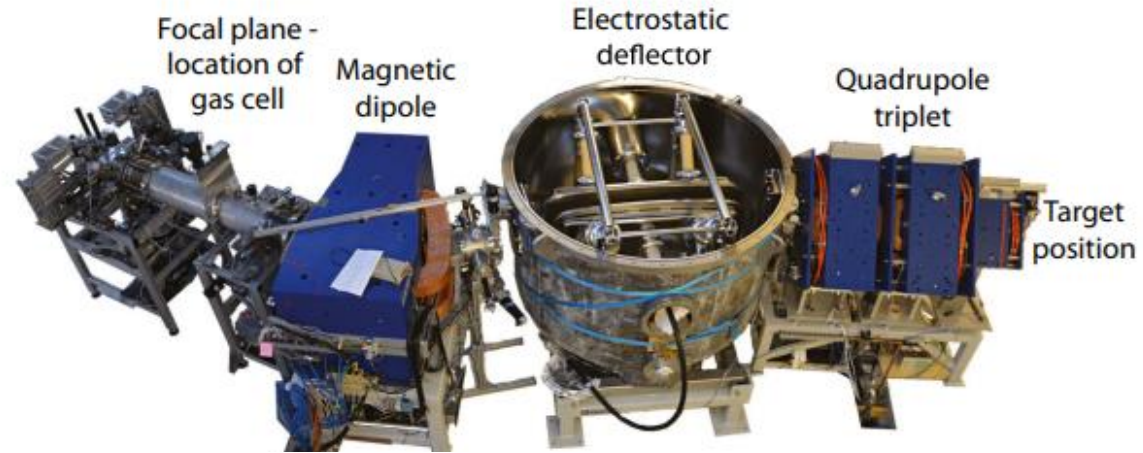
The beam energy: 310 MeV

Alayed, B.M.A. (2023)

The Mass Analysing Recoil Apparatus(MARA).



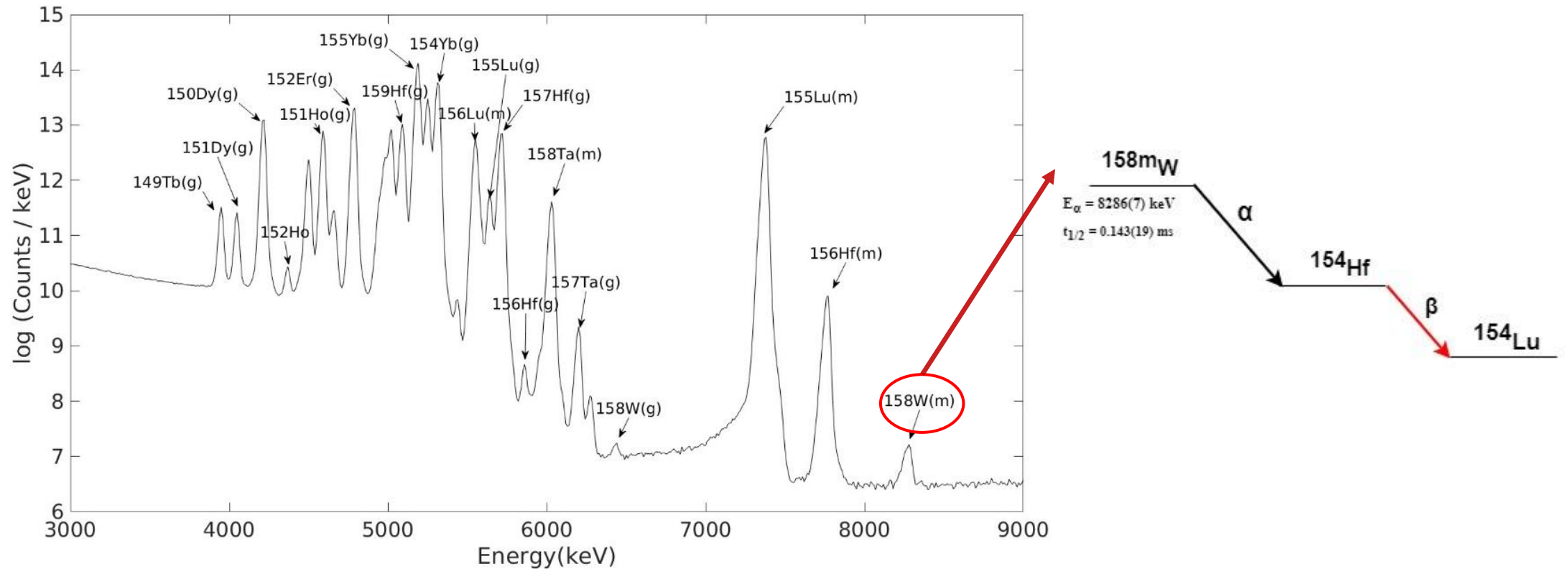
Briscoe, A. (2021)



Alayed, B.M.A. (2023)

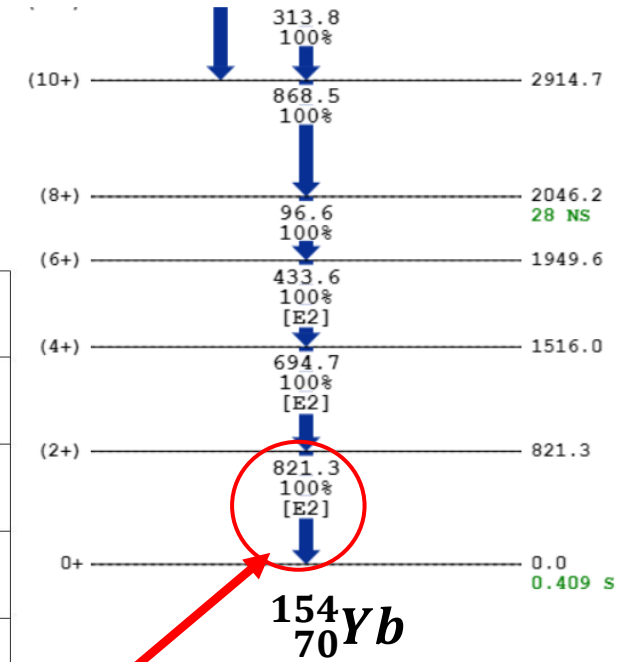
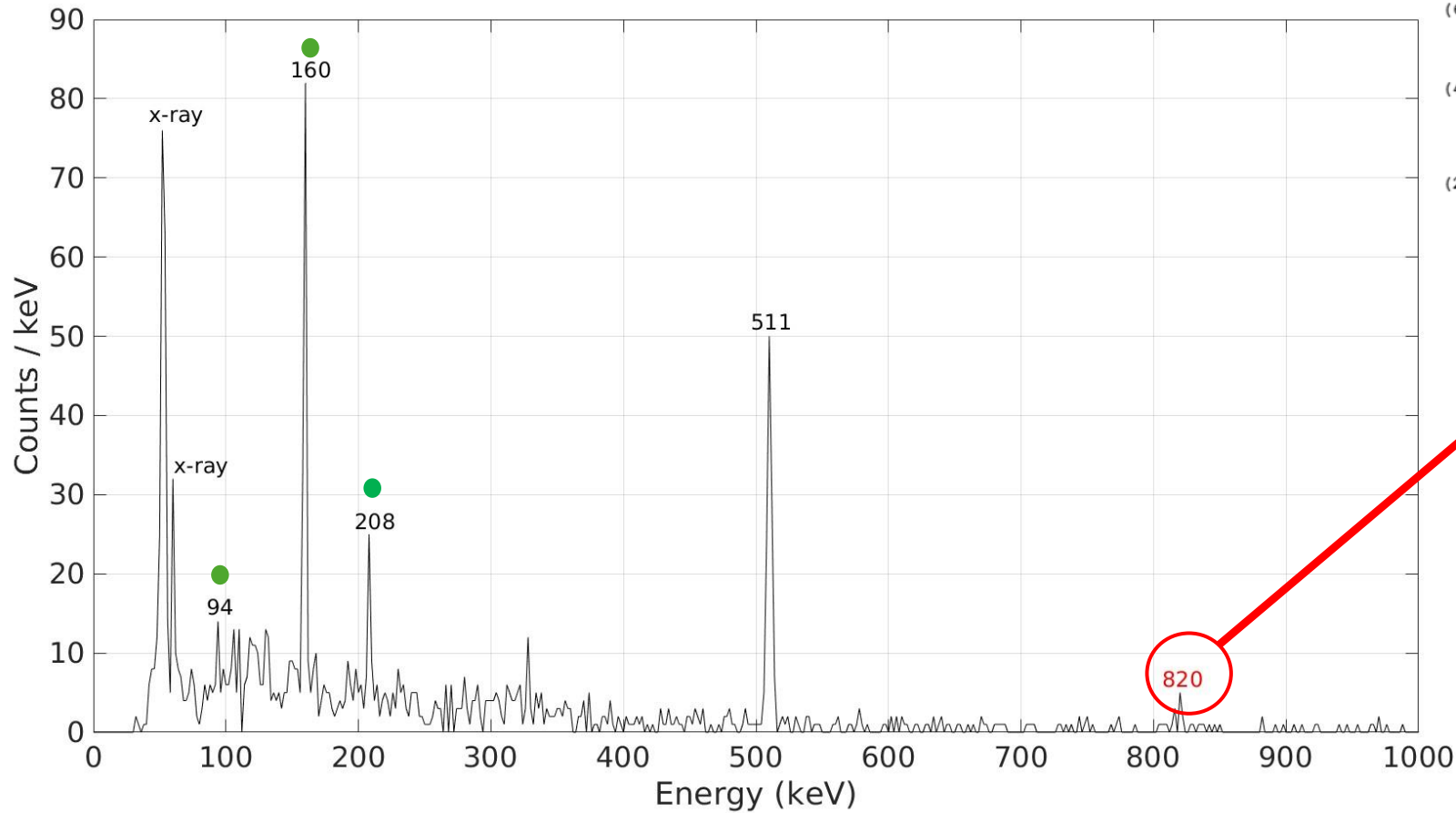
Result and Discussion:

The energy of alpha decay is measured within the DSSD.

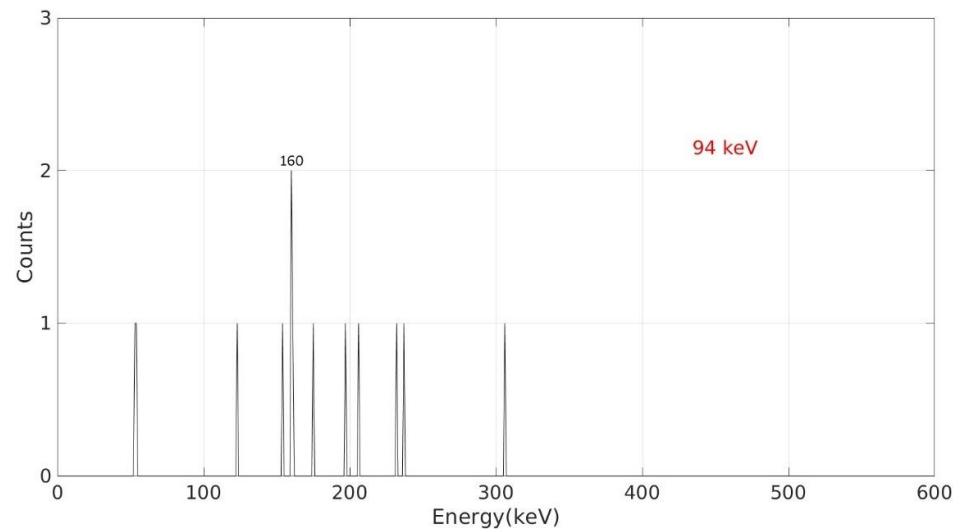
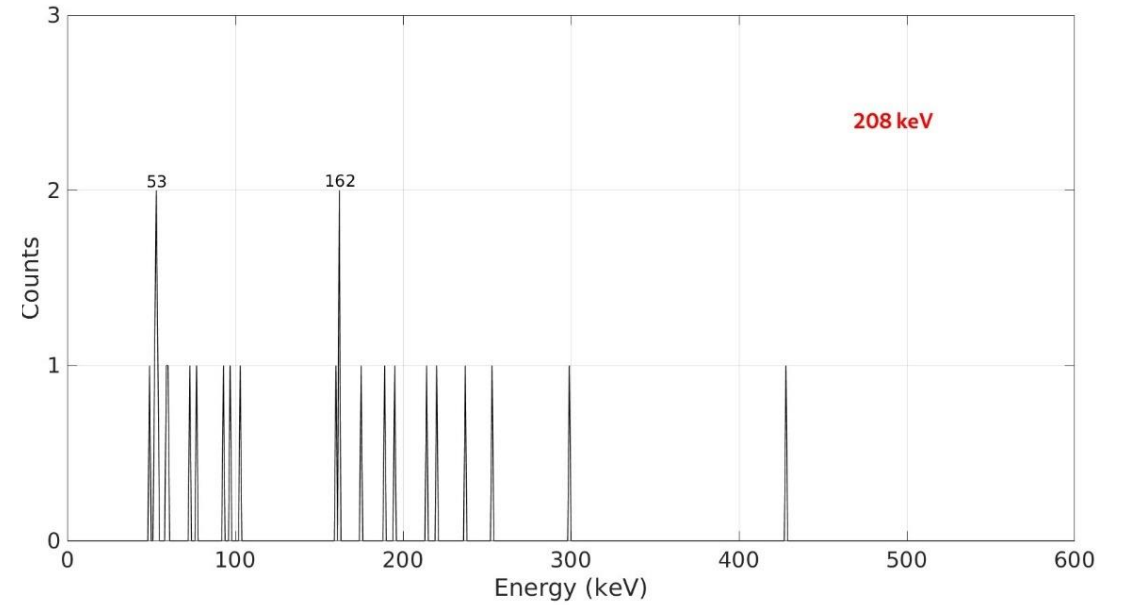
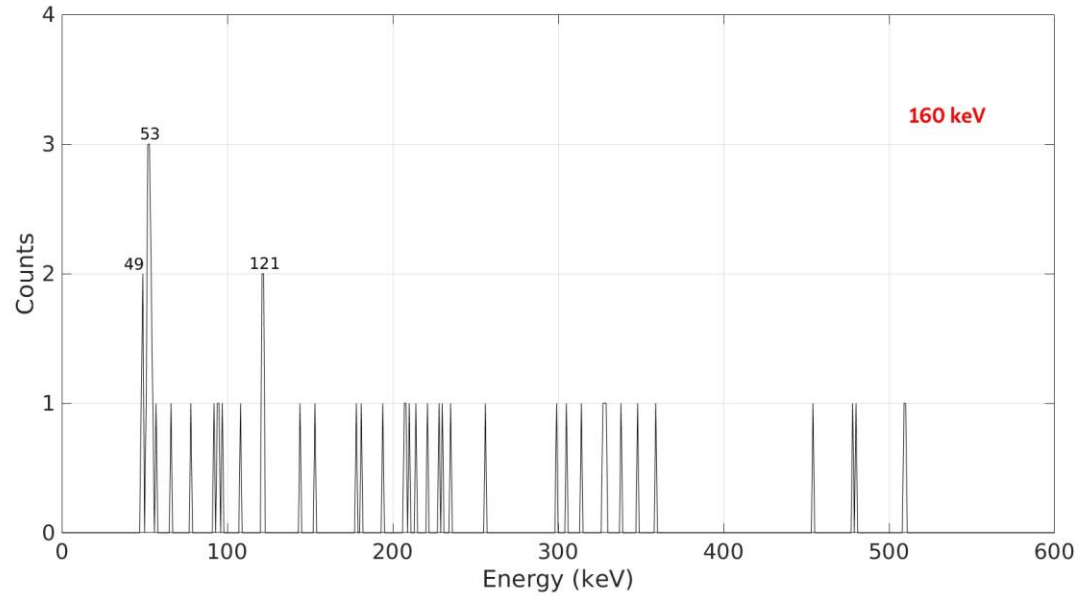


β decay of $^{154}_{72}\text{Hf}$

The first observation of the γ ray for $^{154}_{72}\text{Hf}$



γ -ray coincidence

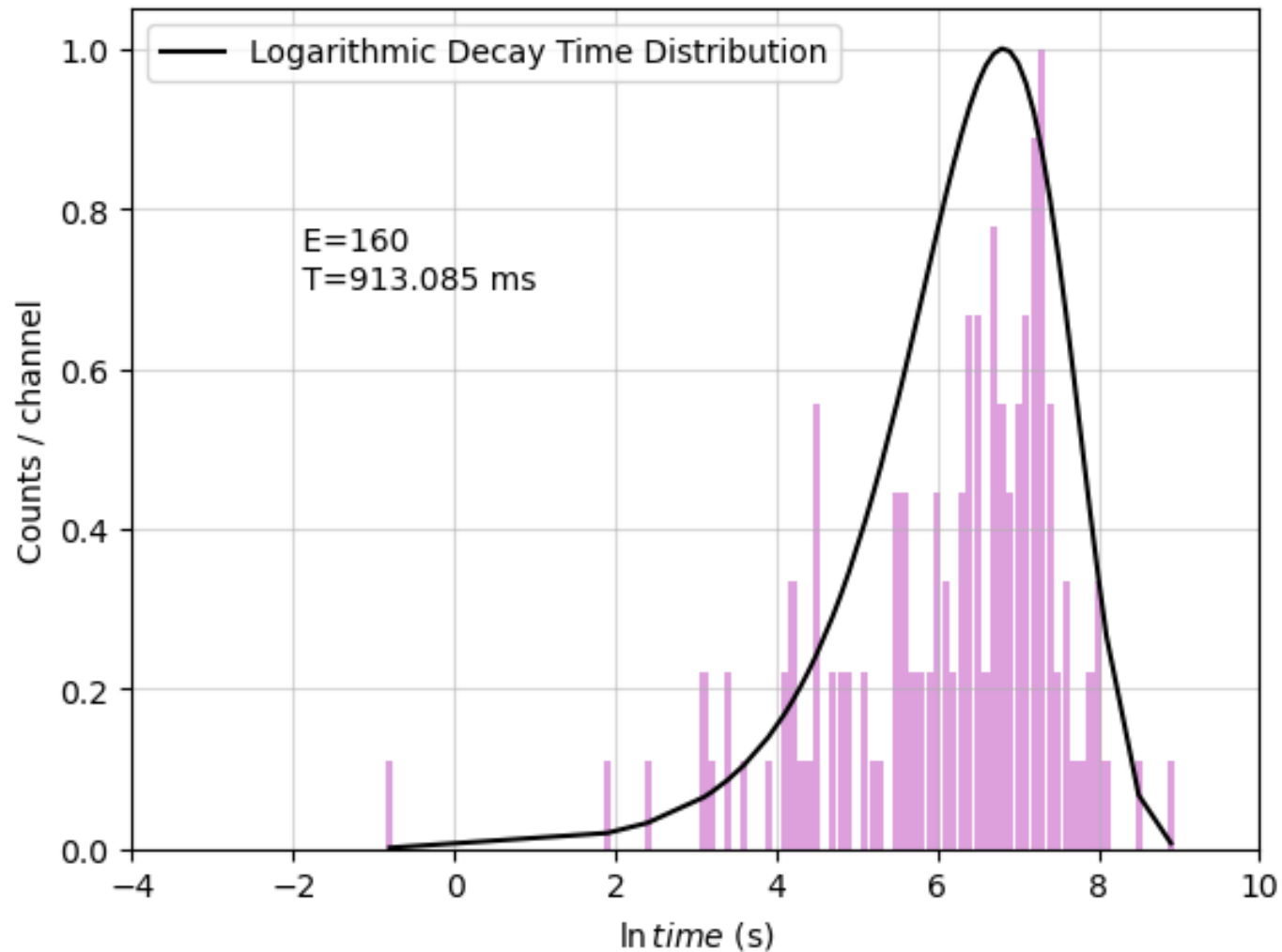


I am not sure might Compton?



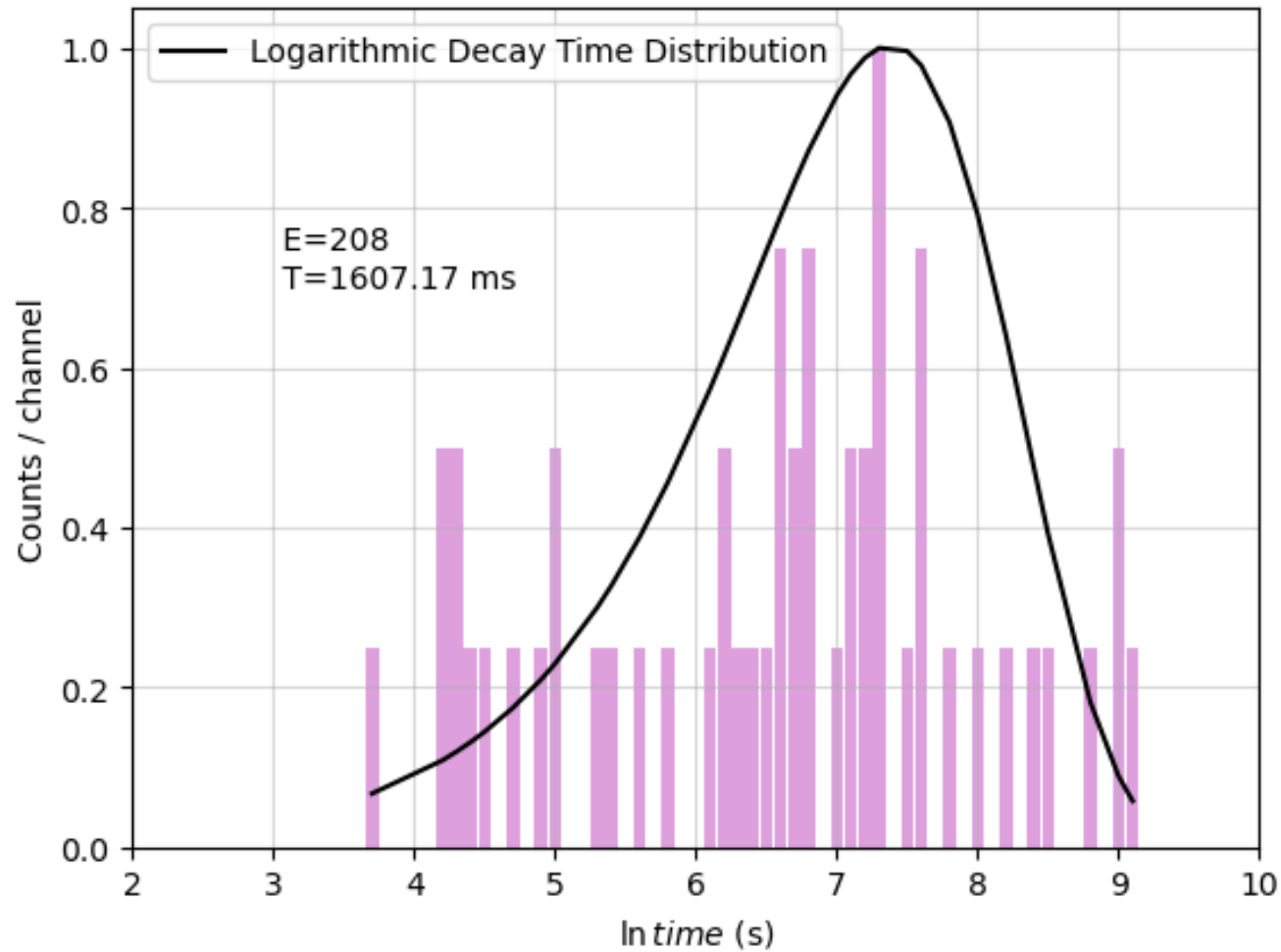
Half-life of $^{154}_{72}\text{Hf}$

The measurement of the 160 keV decay half-life of $^{154}_{72}\text{Hf}$, $t_{1/2} = 632.84^{+59}_{-49}\text{ms}$.



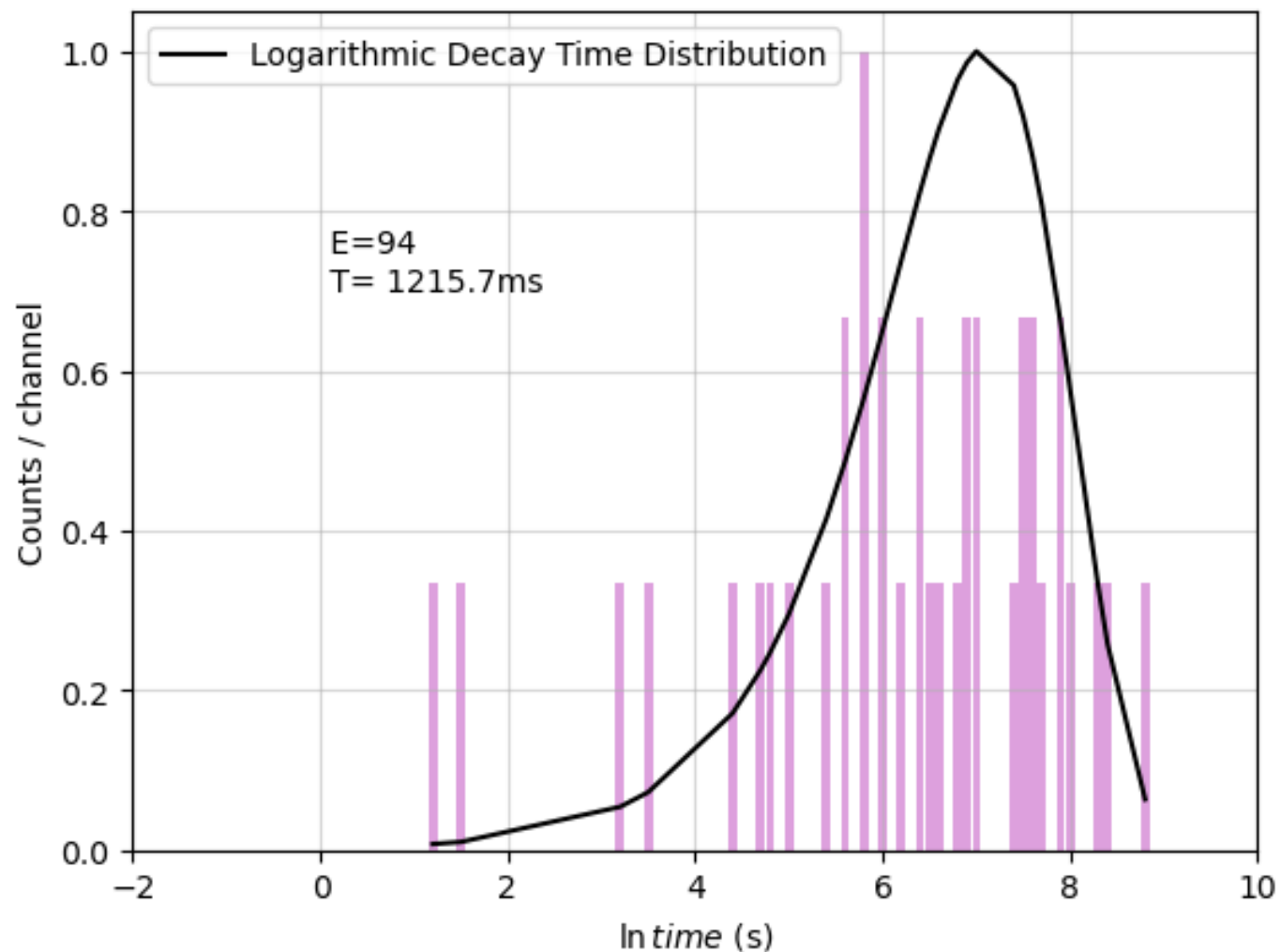
Half-life of $^{154}_{72}\text{Hf}$

The measurement of the 208 keV decay half-life of $^{154}_{72}\text{Hf}$, $t_{1/2} = 1113.88^{+178}_{-135} \text{ ms}$

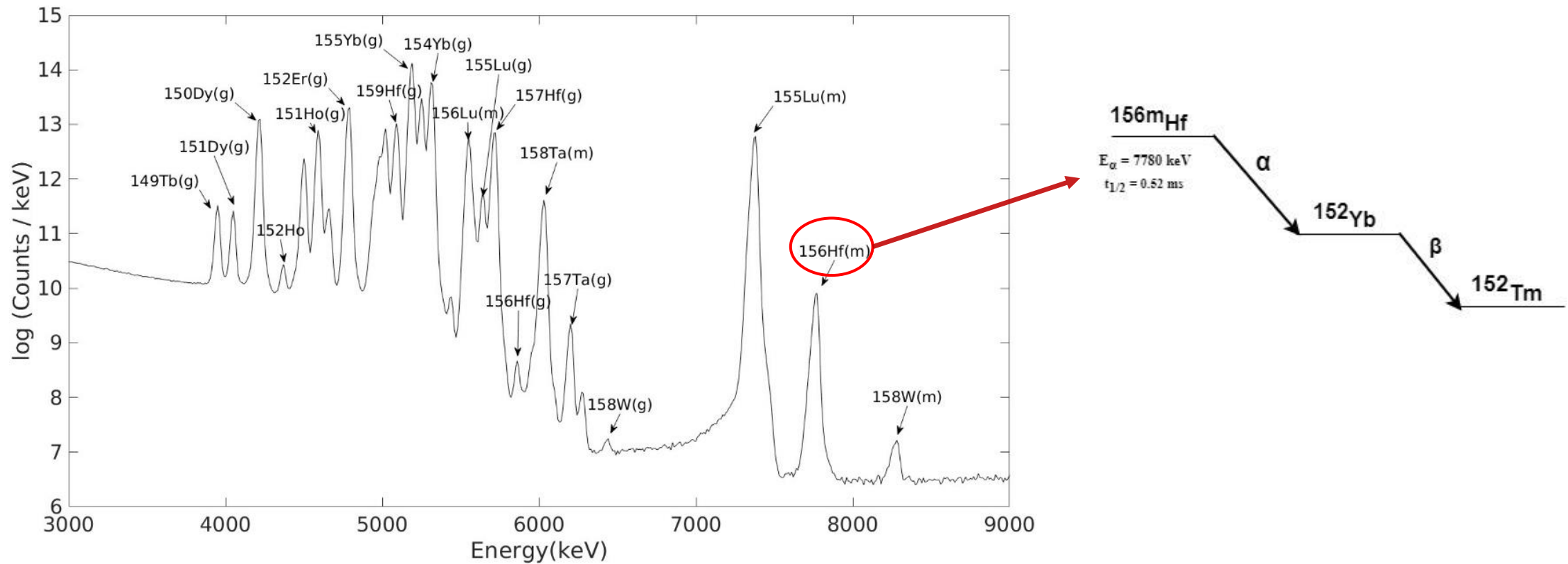


Half-life of $^{154}_{72}\text{Hf}$

The measurement of the 94 keV decay half-life of $^{154}_{72}\text{Hf}$, $t_{1/2} = 842.1^{+162}_{-117}\text{ms}$

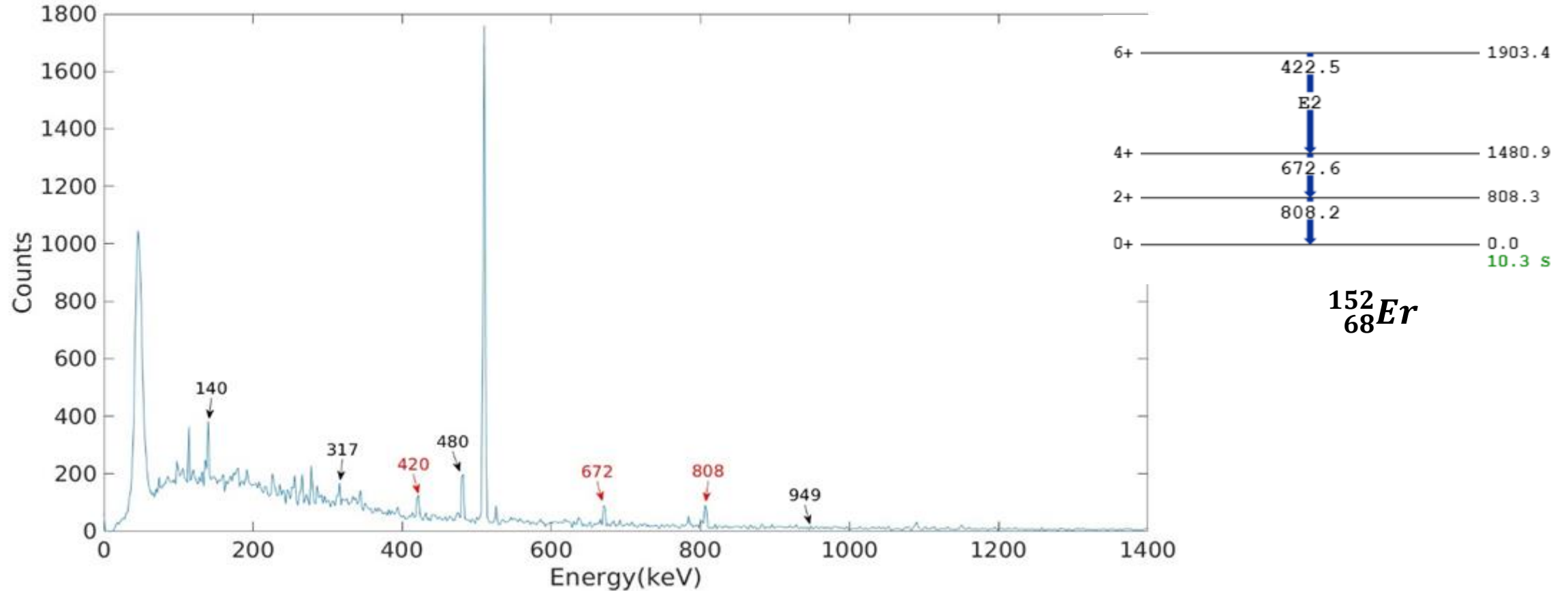


The energy of alpha decay is measured within the DSSD.

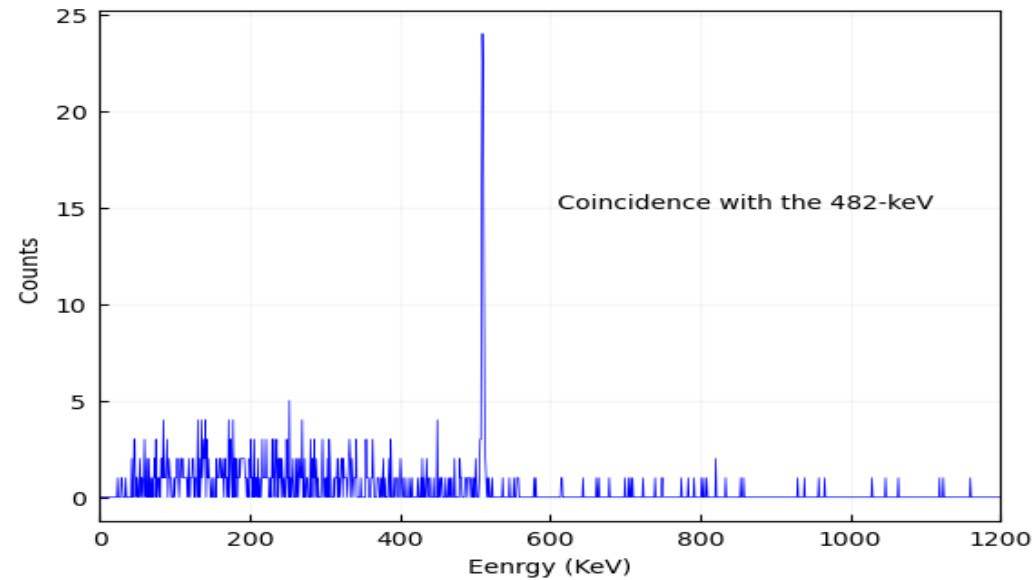
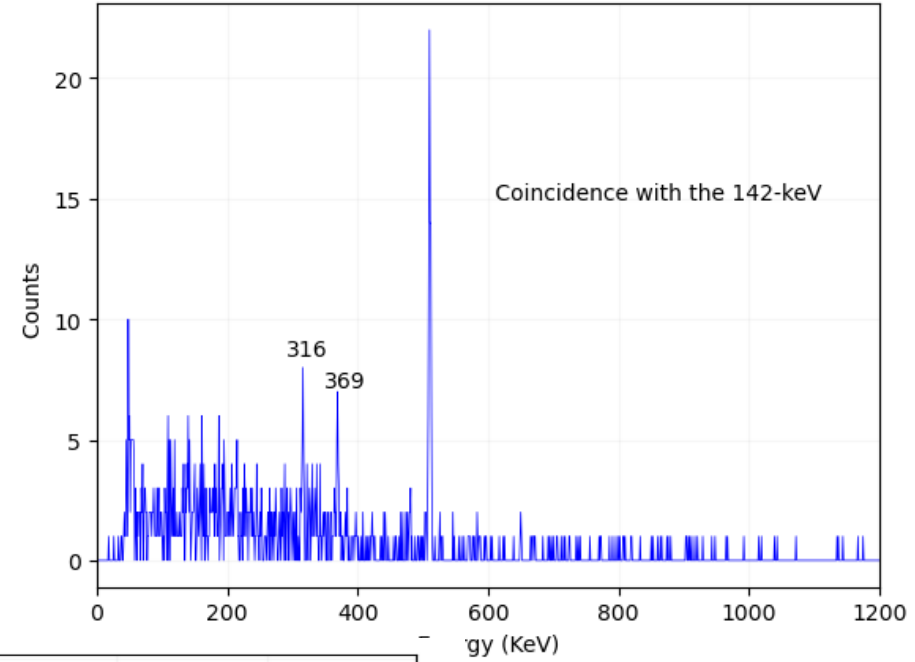
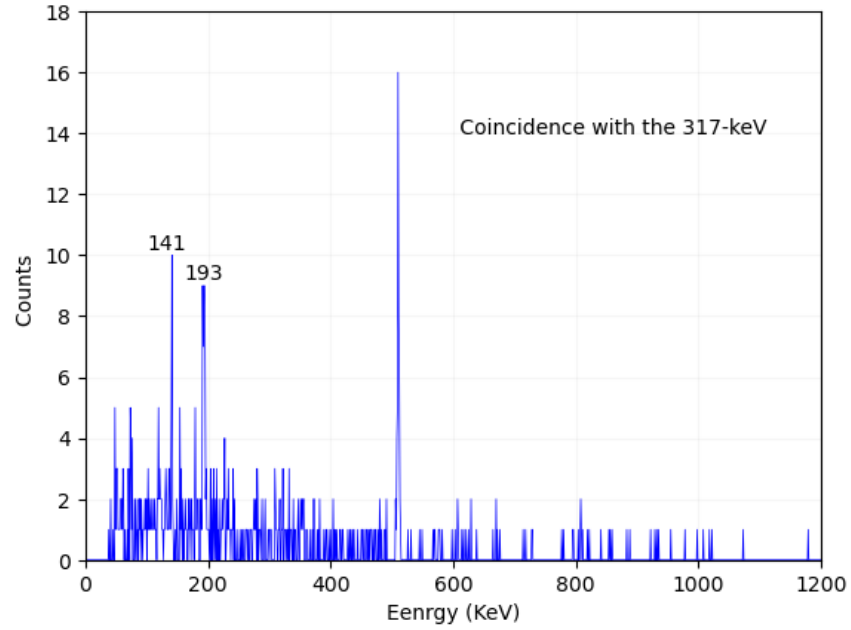


β decay of $^{152}_{70}\text{Yb}$

The energy spectrum of γ rays measured in coincidence with the β decay .



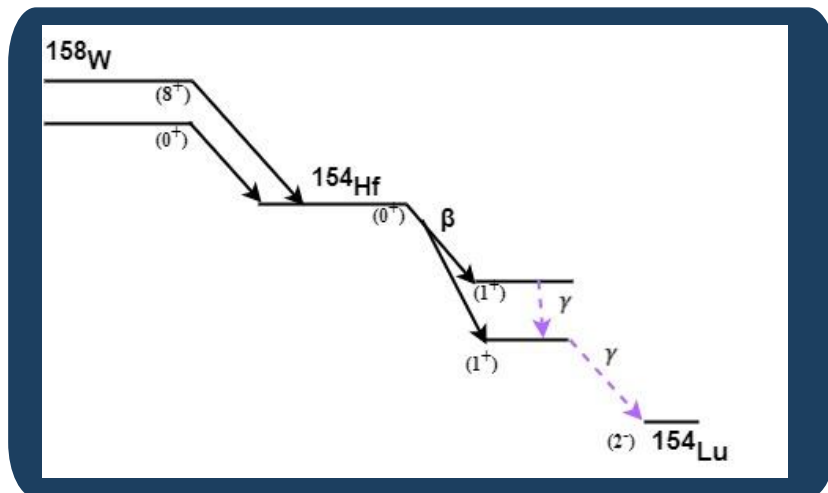
γ -ray coincidence



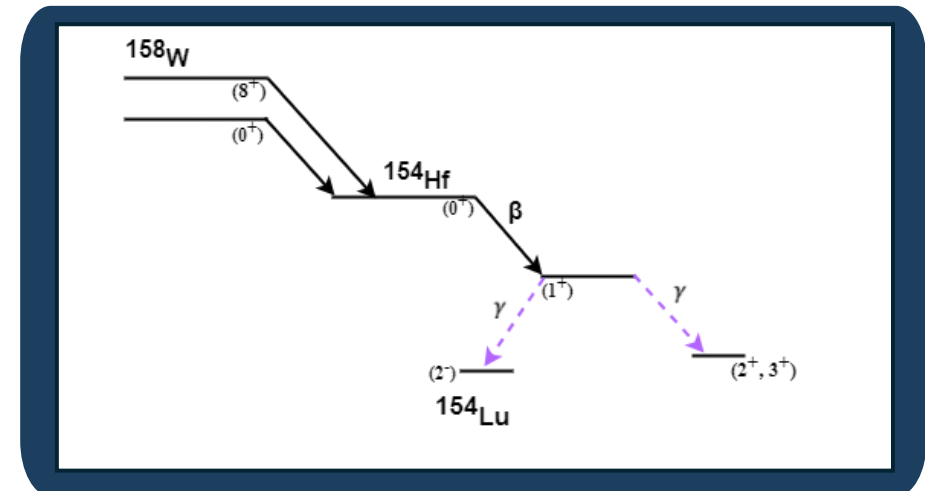
Summary and future work

Identified γ rays from $^{154}_{72}\text{Hf}$ and measure the half-life from these gamma rays.

Investing behaviour of beta decay of $^{154}_{72}\text{Hf}$



or



Thank You

For Your Attention

✉ psnalwa2@liverpool.ac.uk



Reference

- [1] Briscoe, A.D. *et al.* (2023) 'Decay spectroscopy at the two-proton drip line: Radioactivity of the new nuclides ^{160}Os and ^{156}W ', *Physics Letters B*, 847, p. 138310. Available at: <https://doi.org/10.1016/j.physletb.2023.138310>.
- [2] Toth, K.S. *et al.* (1987) 'Investigation of $A=152$ radioactivities with mass-separated sources: Identification of Lu 152', *Physical Review C*, 35(1), pp. 310–314. Available at: <https://doi.org/10.1103/PhysRevC.35.310>.
- [3] *The segre chart | chemogenesis* (no date). Available at: https://www.meta-synthesis.com/webbook/33_segre/segre.php (Accessed: 4 April 2024).
- [4] Briscoe, A. (2021) *The discovery of the alpha emitter ^{160}Os , the beta emitter ^{156}W and an electromagnetic decay branch from the $25/2^-$ spin gap isomer in ^{155}Lu* . phd. University of Liverpool. Available at: <https://livrepository.liverpool.ac.uk/3143087> (Accessed: 17 February 2024).