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

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Supervisor: Prof. Robert Page

Outline

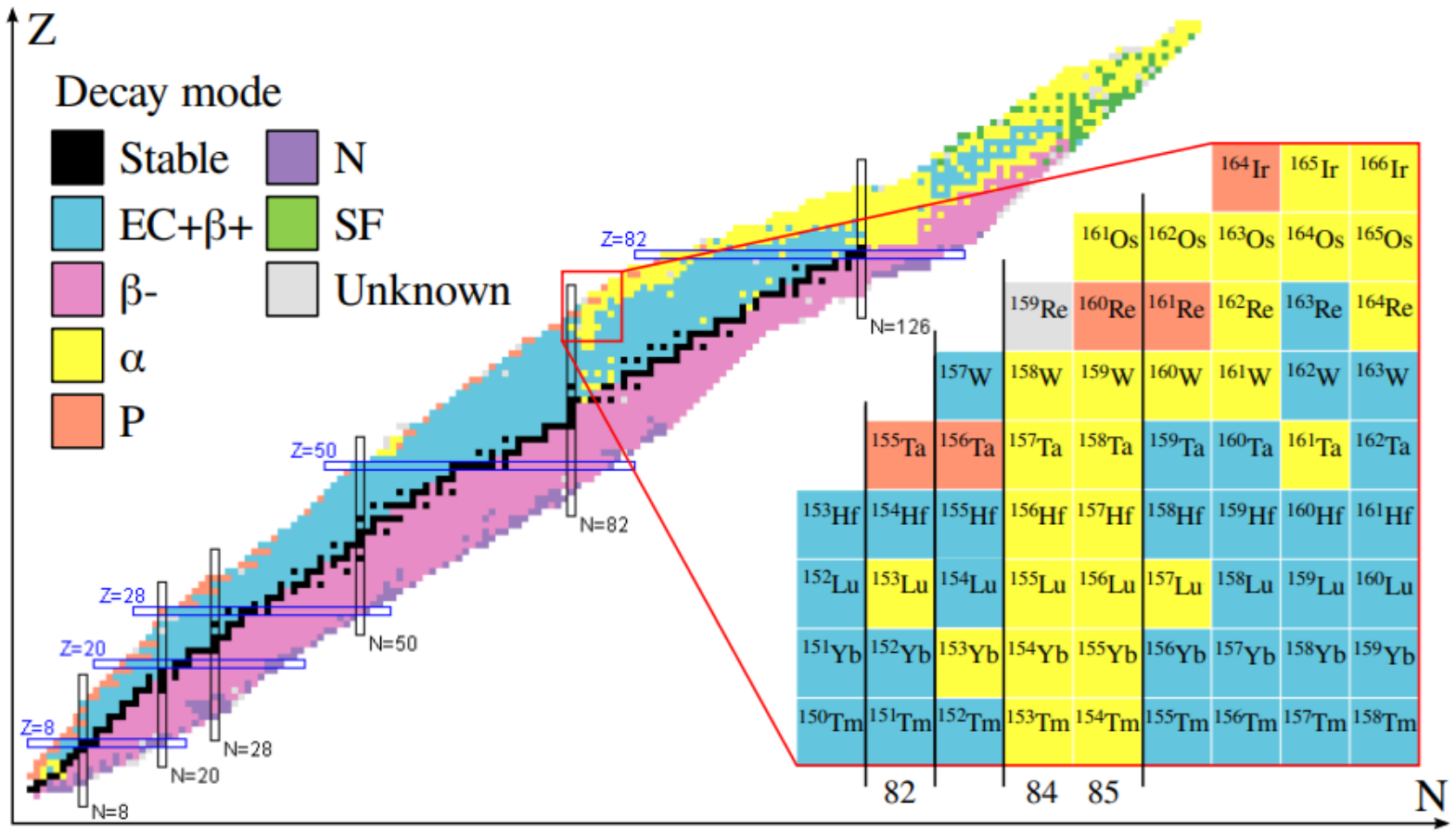
01. Introduction and the aim of my project

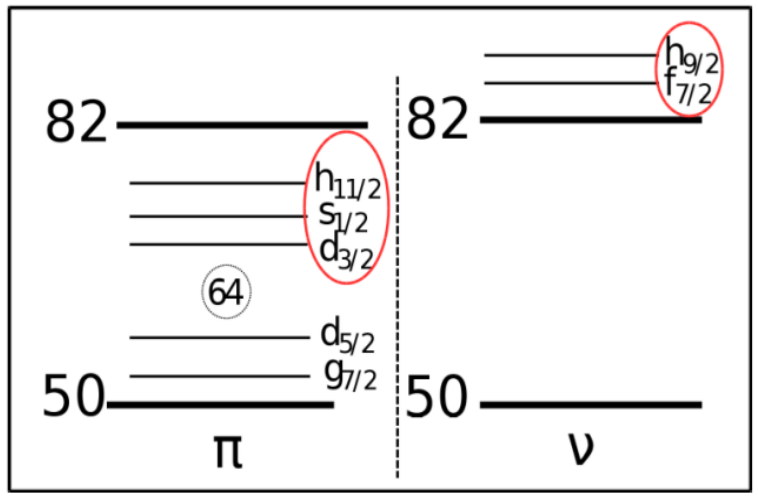
02. Experimental **Set up**.

03. Results and Discussion.

04. Future work

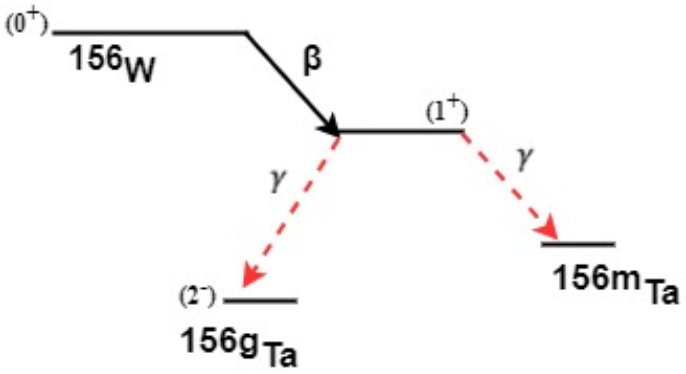
Introduction



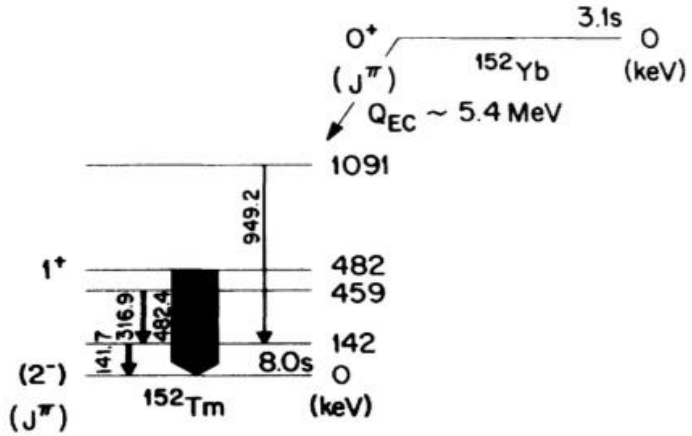


Literature Review

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



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



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

Phys. Lett. B 847 (2023) 138310

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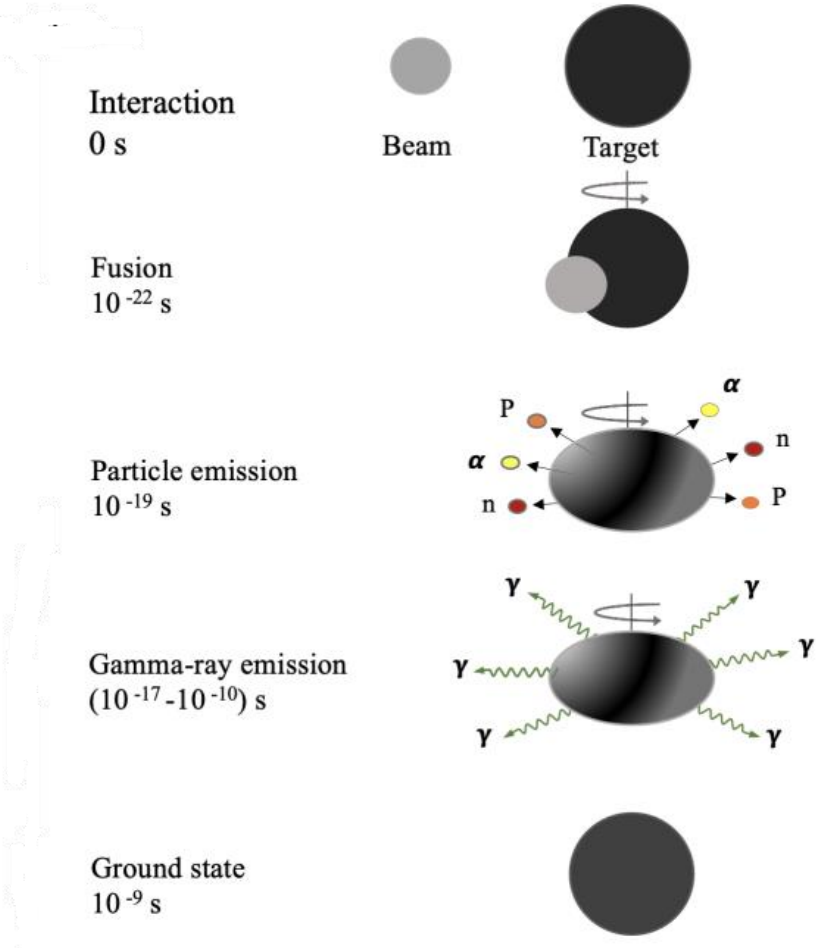
Letter

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 [e], G. Beeton [d], M. Birova [f], V. Bogdanoff [b], R.M. Clark [g], J.G. Cubiss [h], D.M. Cullen [e], J. Deary [d], U. Forsberg [b], T. Grahn [b], P.T. Greenlees [b], J.B. Hilton [a,b], A. Illana [b,n], H. Joukainen [b], D.S. Judson [a], R. Julin [b], H. Jutila [b], J.M. Keatings [d], M. Labiche [i], 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. Papadakis [i], E. Parr [a], J. Partanen [b,1], 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. Szwec [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

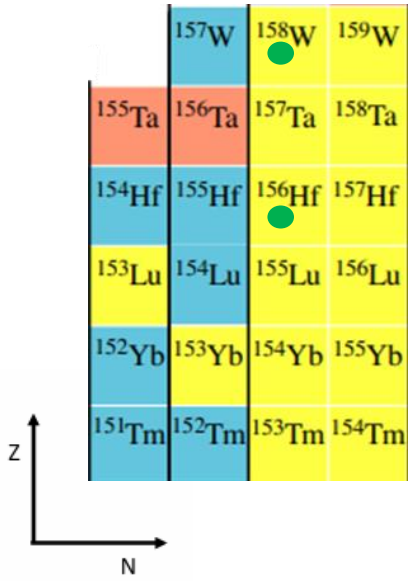


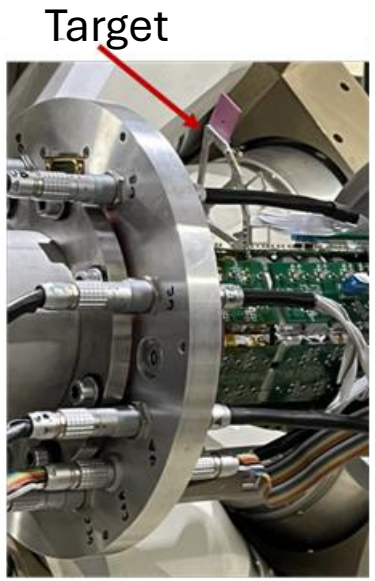
Alayed, B.M.A. (2023)

Experimental Setup.

$^{106}_{48}Cd\ (^{58}_{28}Ni, 2p4n)^{158}_{74}W$

$^{106}_{48}Cd\ (^{58}_{28}Ni, 4p4n)^{156}_{72}Hf$



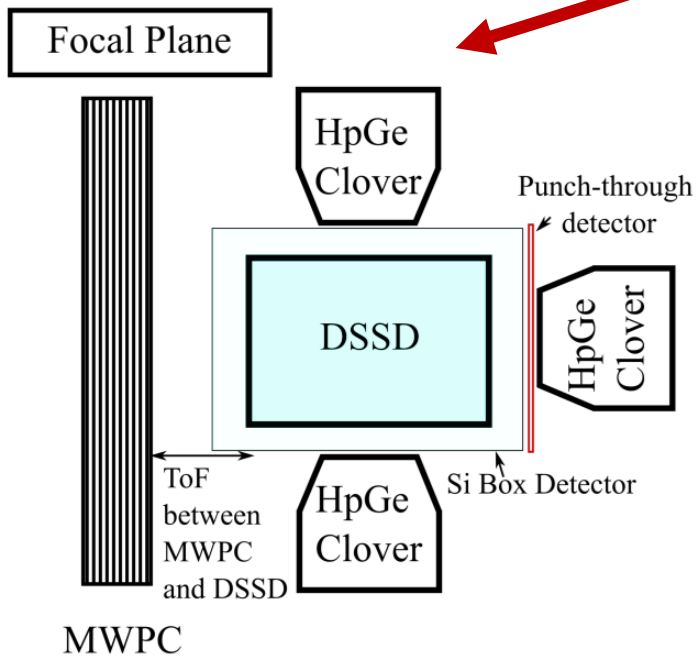


Alayed, B.M.A. (2023)

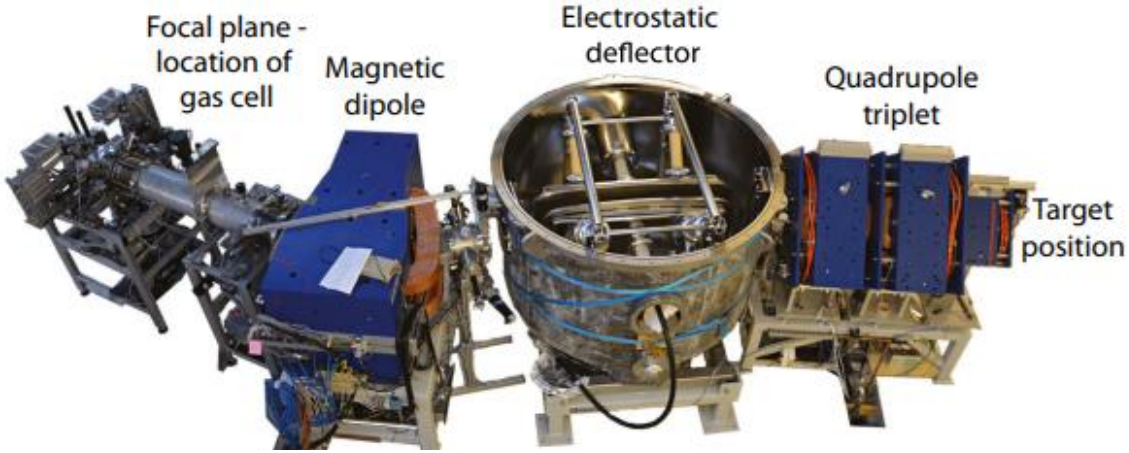
Target thickness: 1 mg/cm2.

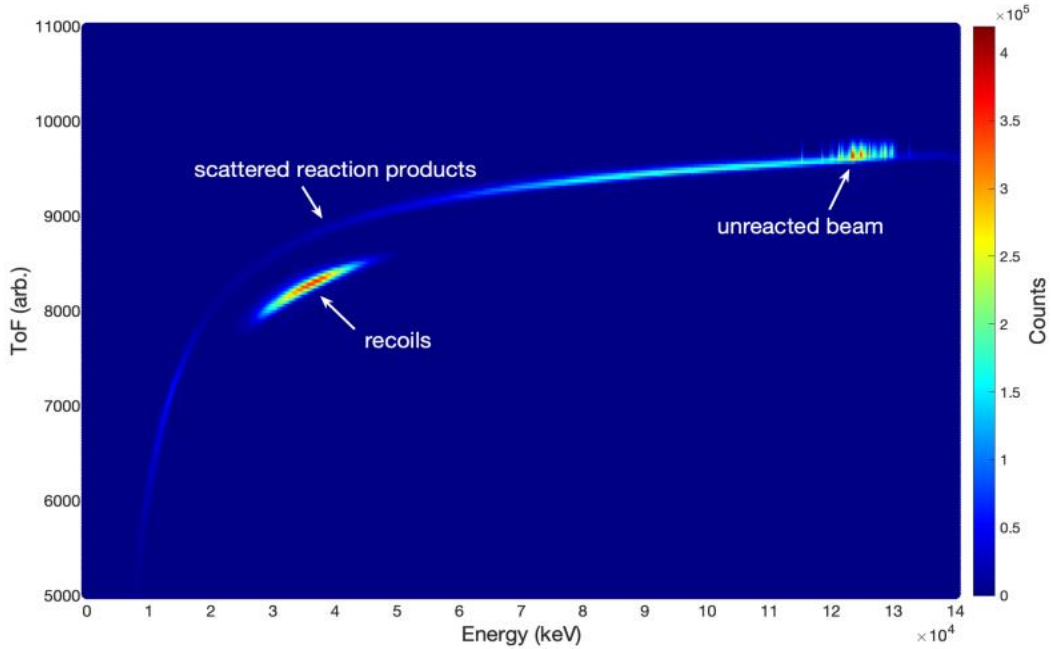
The beam energy: 310 MeV

The Mass Analysing Recoil Apparatus(MARA).



Briscoe, A. (2021)

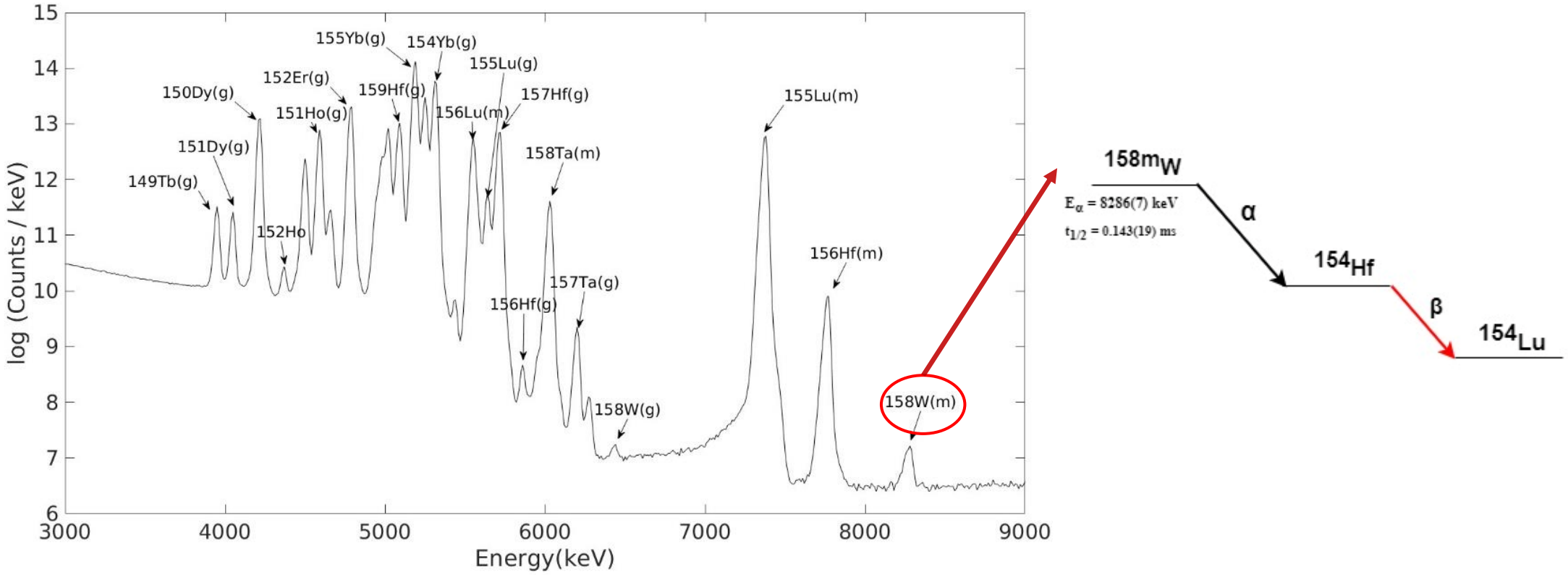




Alayed, B.M.A. (2023)

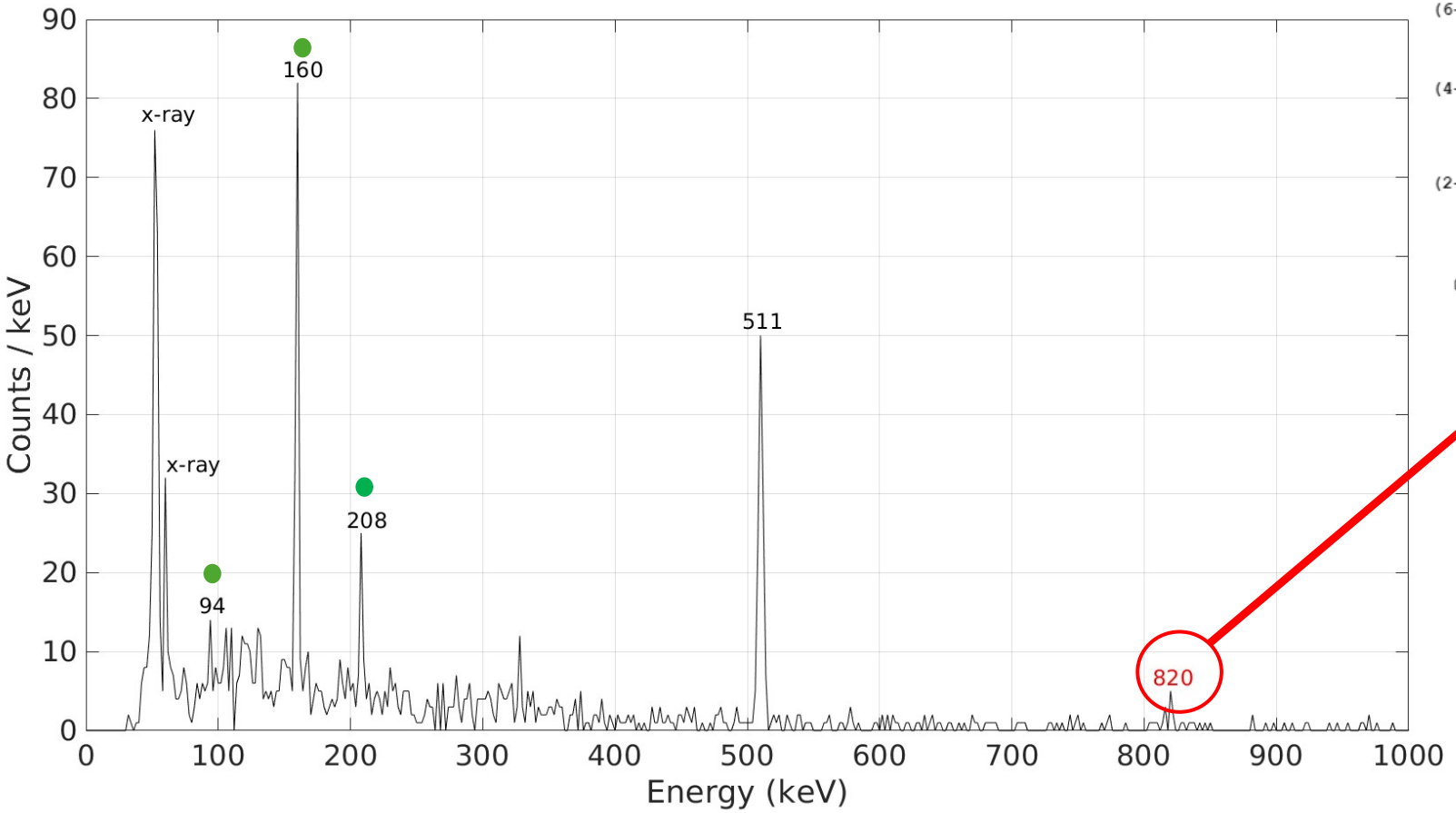
Result and Discussion:

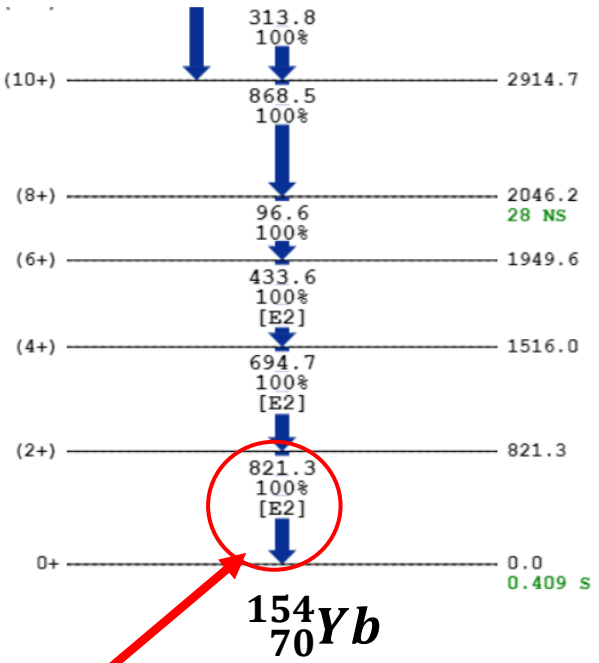
The energy of alpha decay is measured within the DSSD.



β decay of $^{154}_{72}Hf$

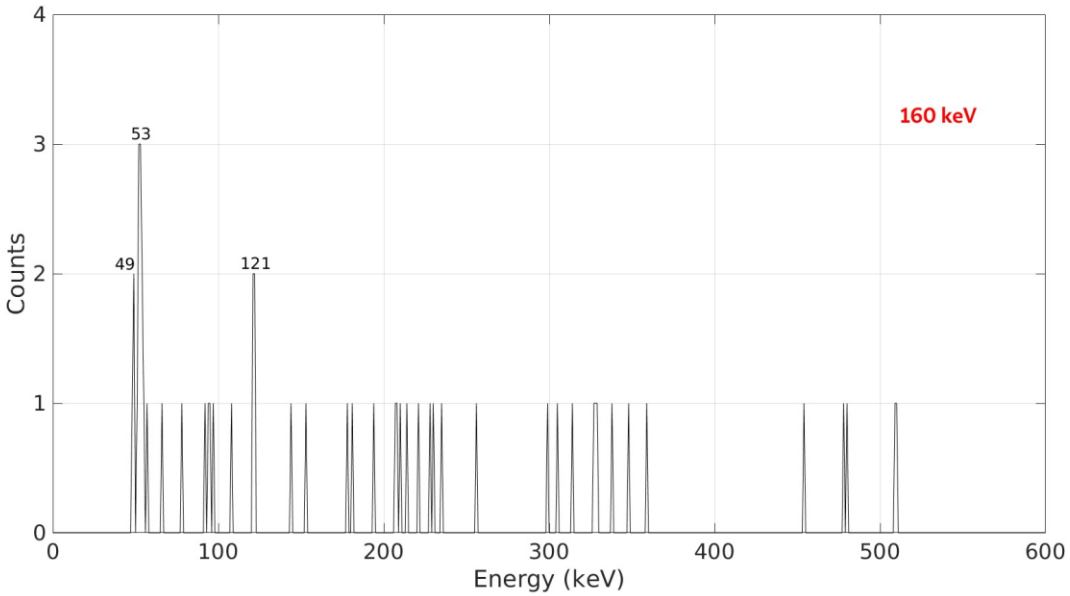
The first observation of the γ ray for $^{154}_{72}Hf$

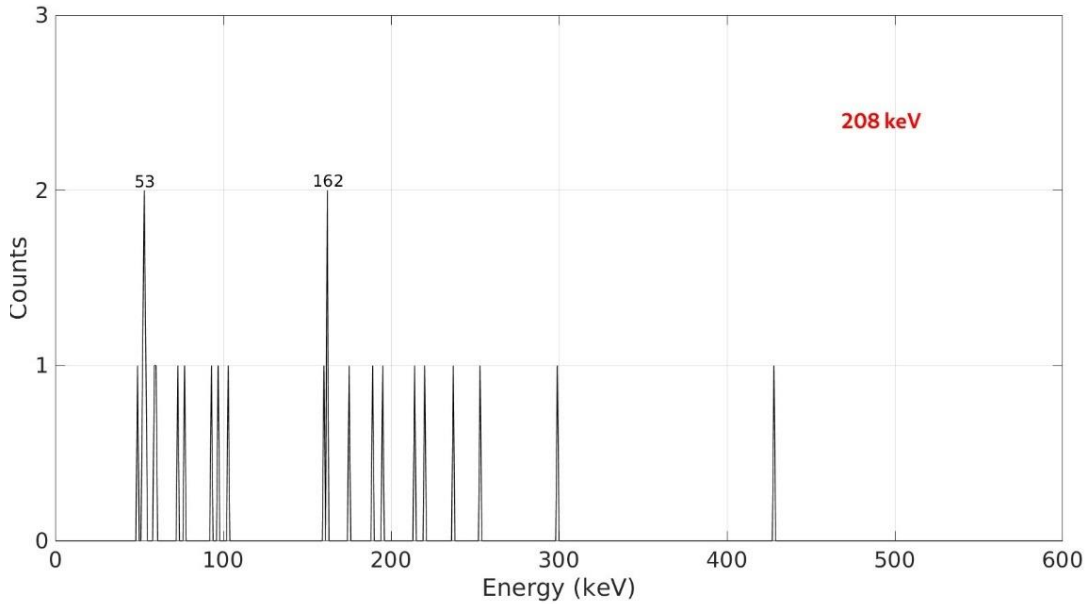


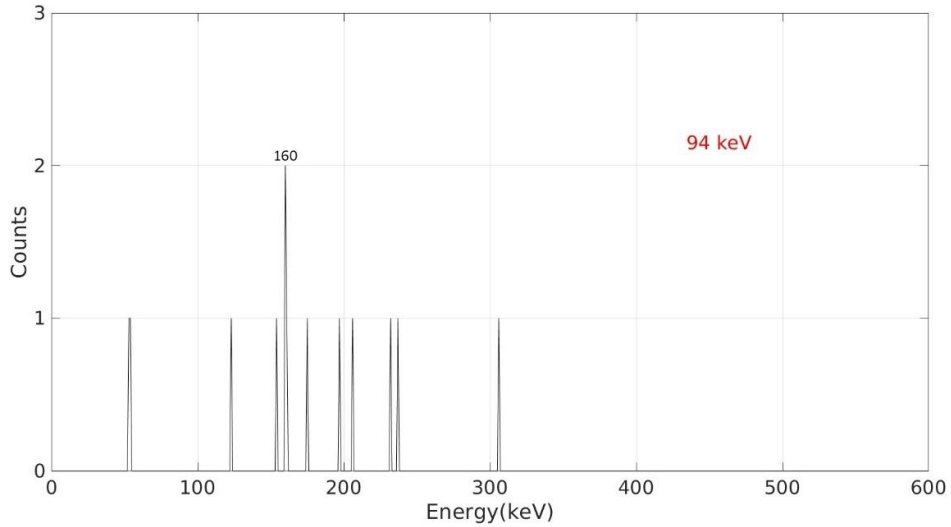


$^{154}_{70}Yb$

γ-ray coincidence



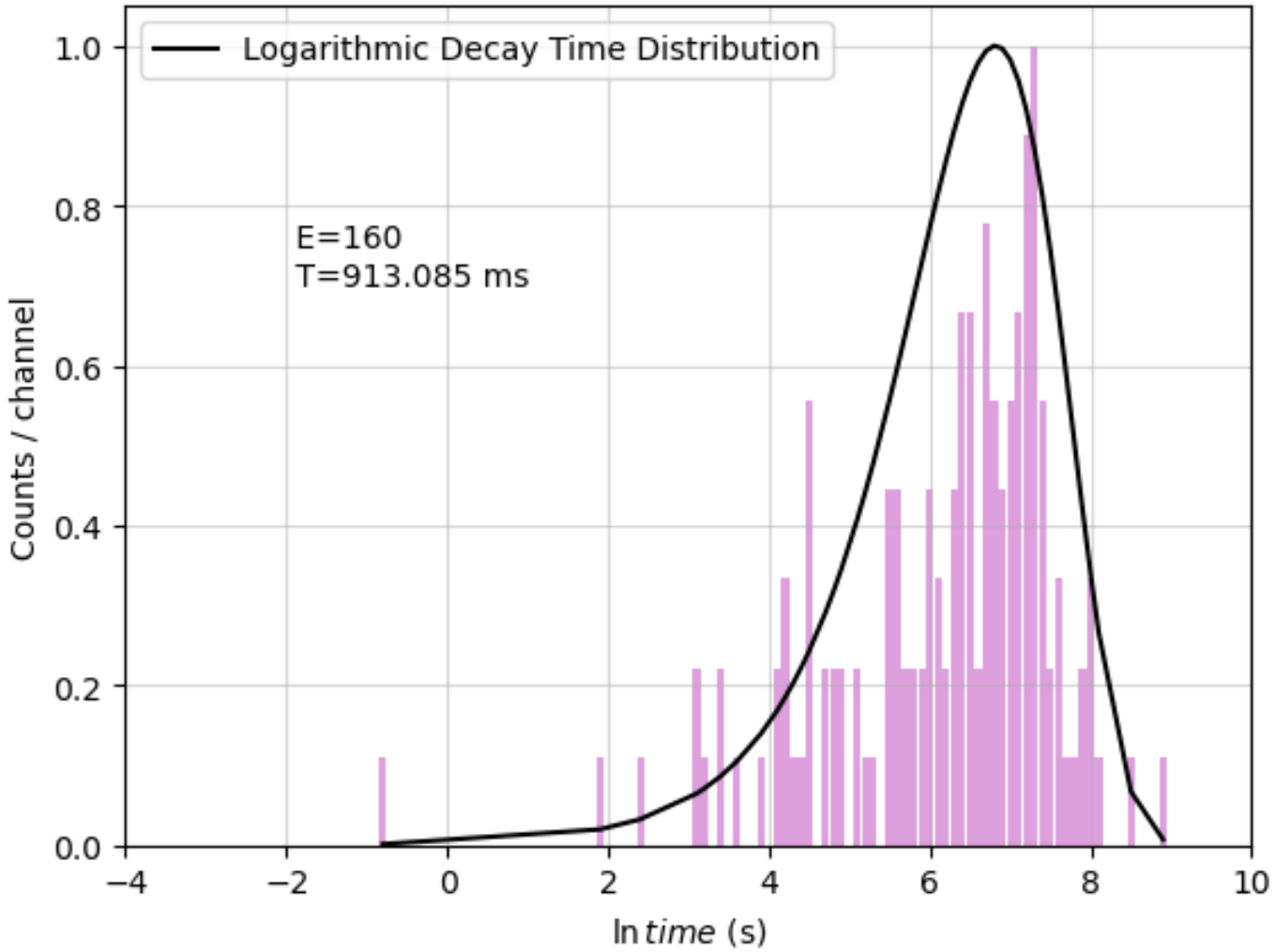




I am not sure might Compton?

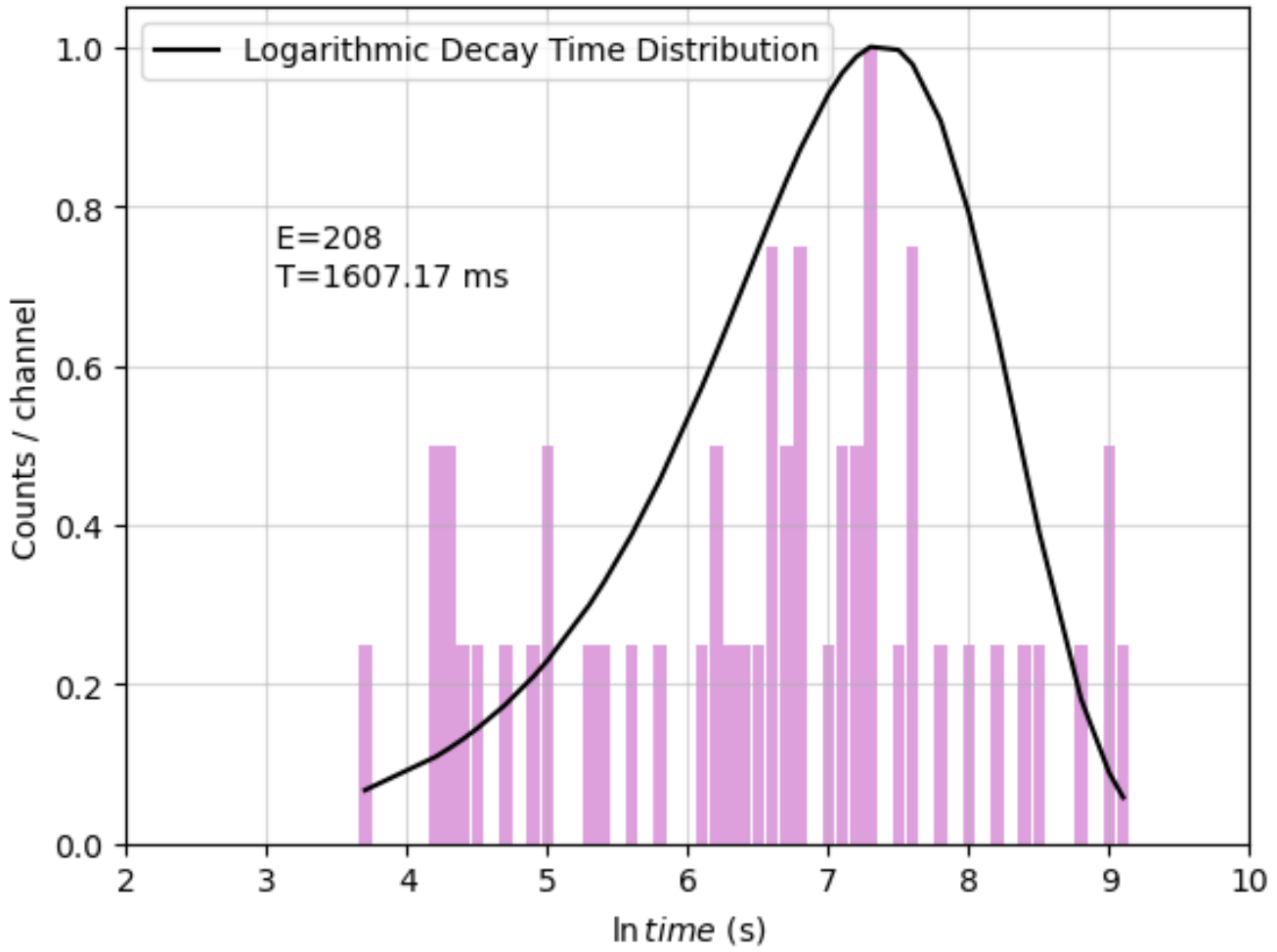
Half-life of $^{154}_{72}Hf$

The measurement of the 160 keV decay half-life of $^{154}_{72}Hf$, $t_{1/_2} = 632.84\ ^{+59}_{-49}ms$.



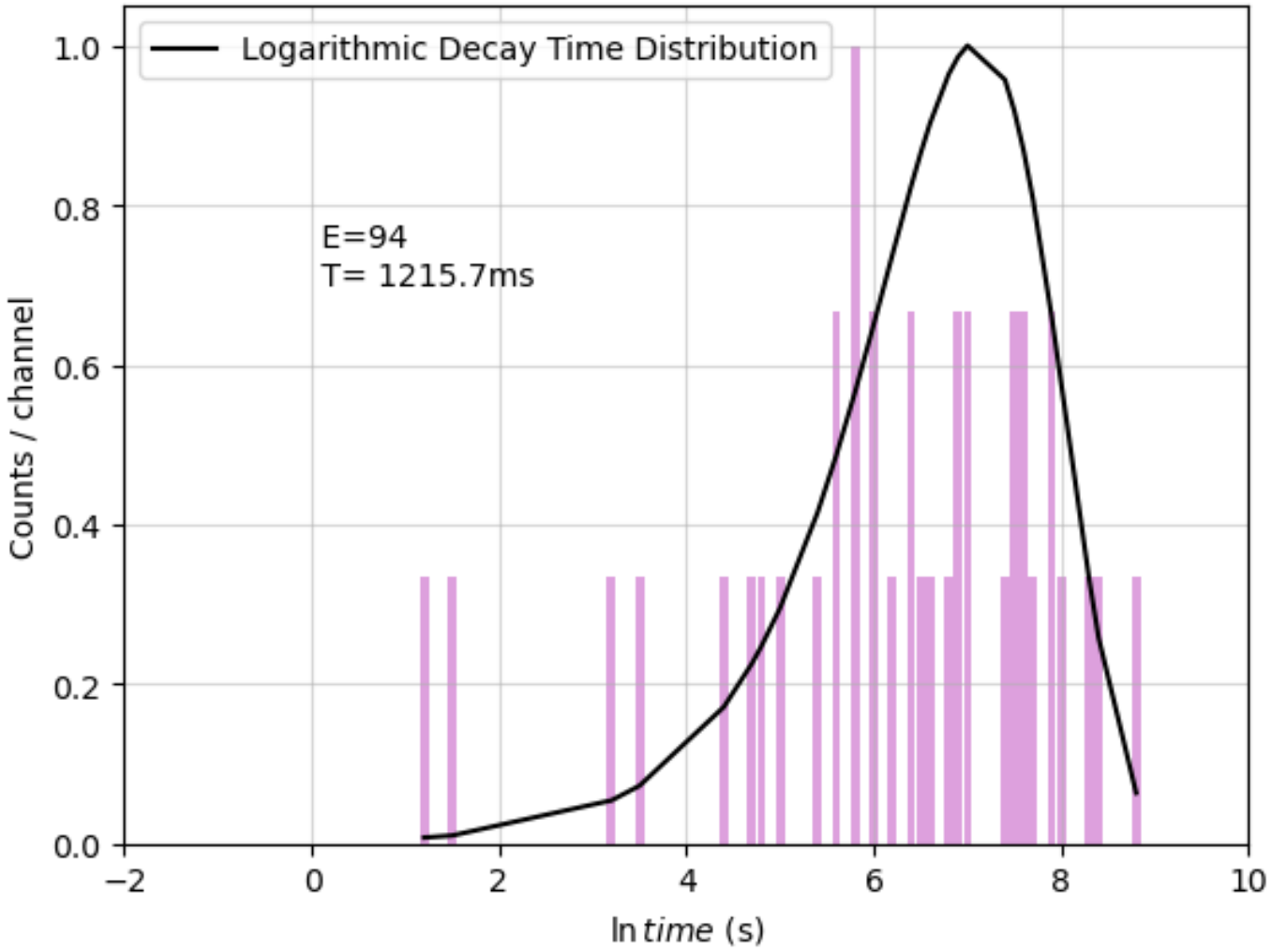
Half-life of $^{154}_{72}Hf$

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

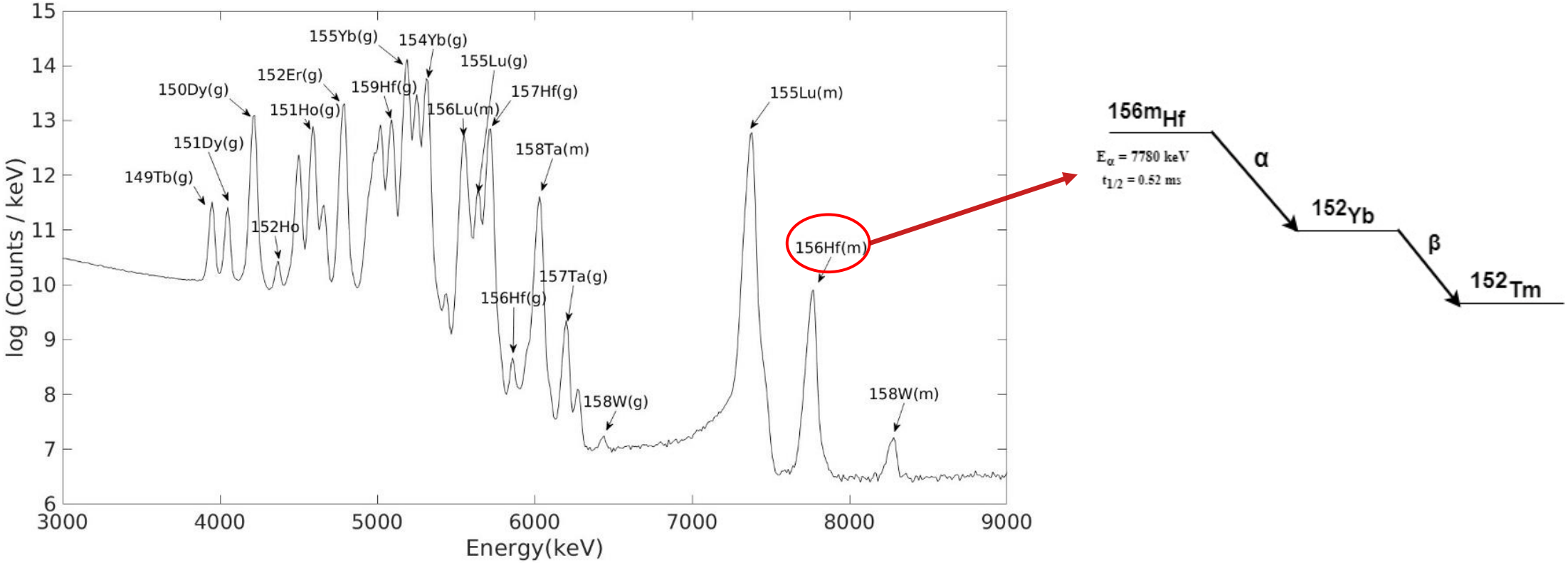


Half-life of $^{154}_{72}Hf$

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

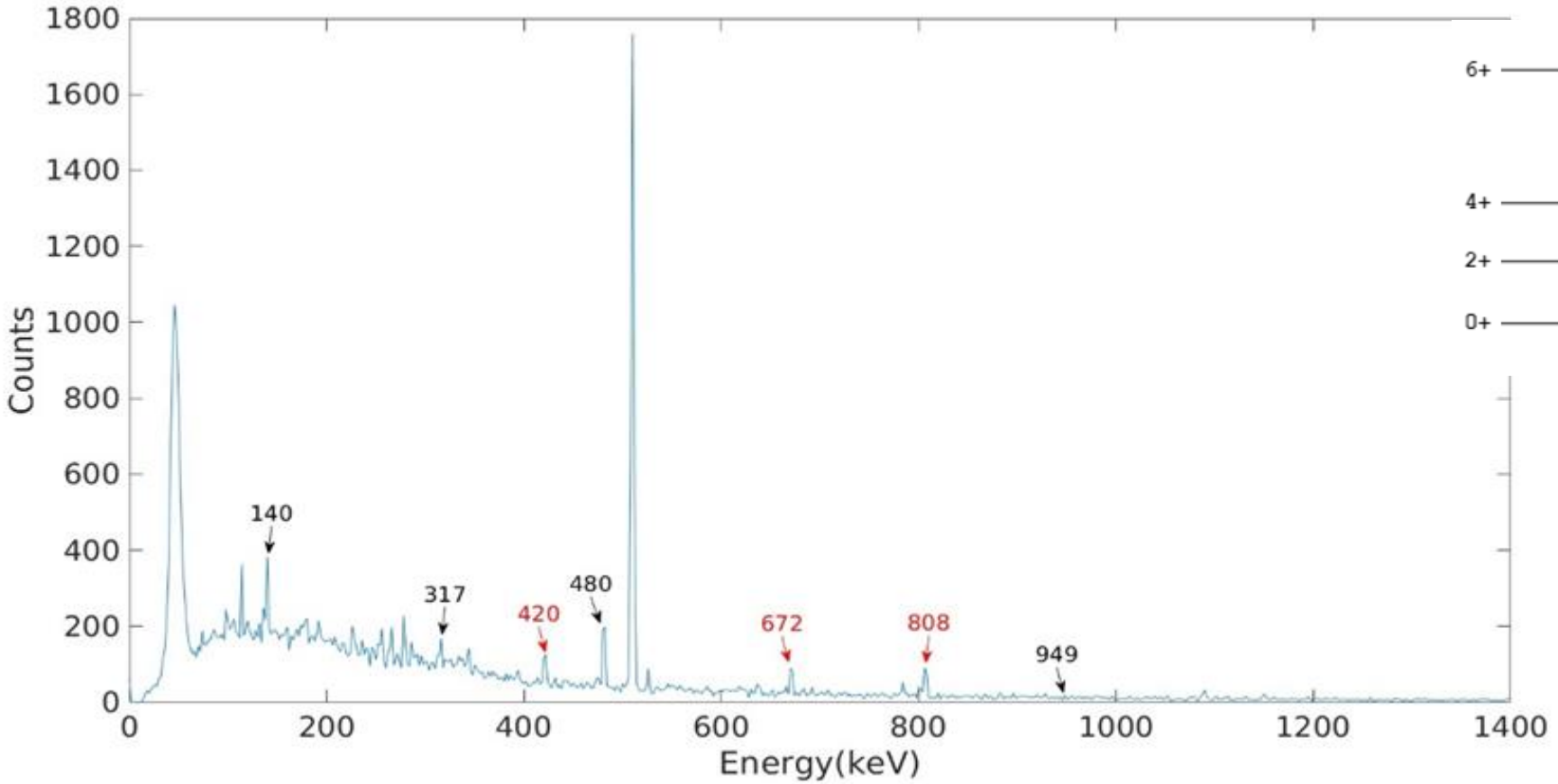


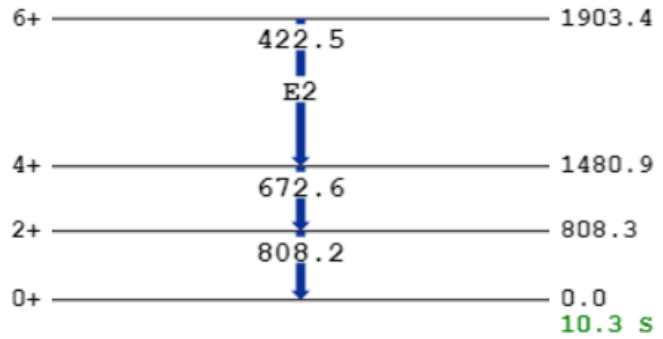
The energy of alpha decay is measured within the DSSD.



β decay of $^{152}_{70}Yb$

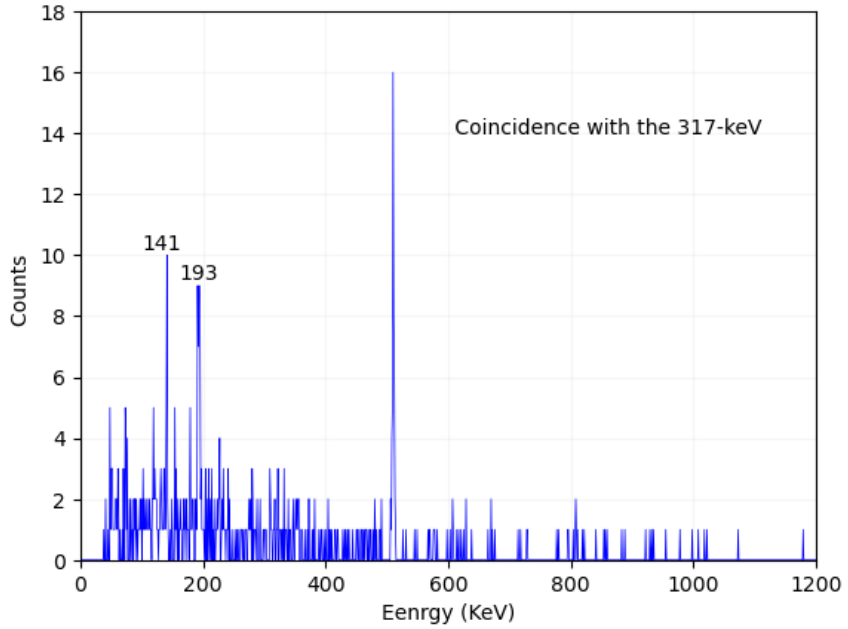
The energy spectrum of γ rays measured in coincidence with the β decay .

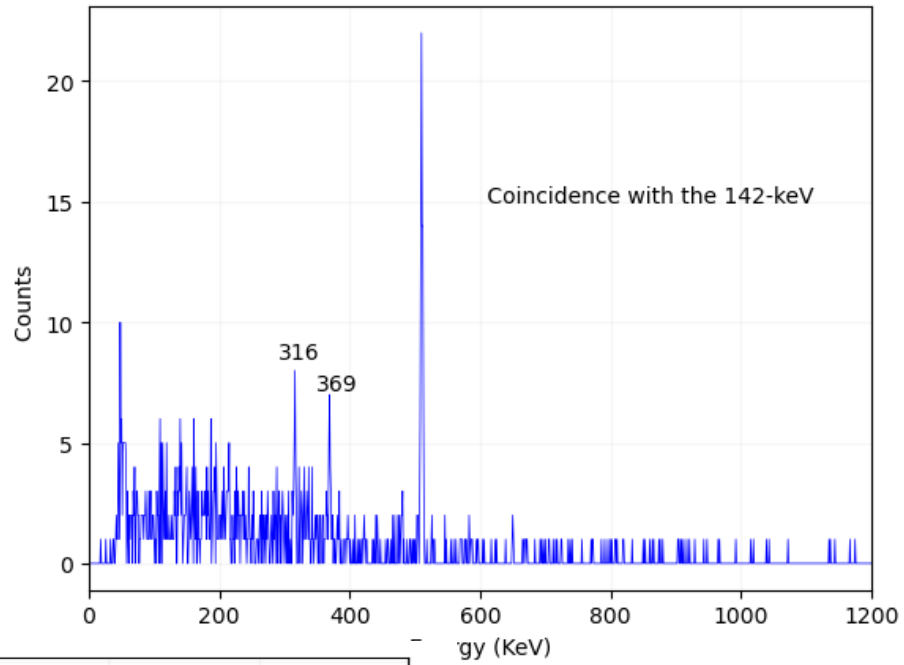


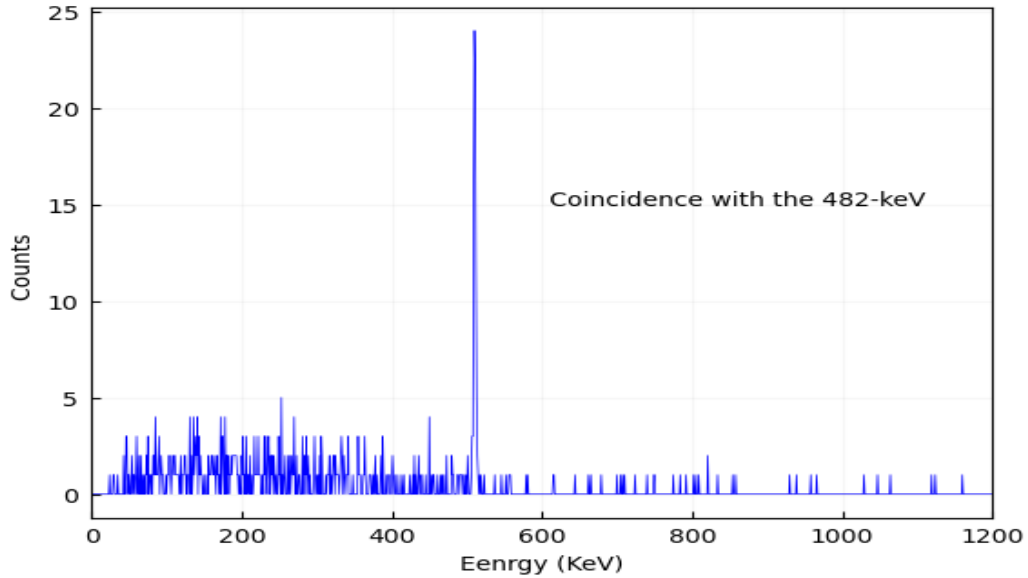


$^{152}_{68}Er$

γ-ray coincidence



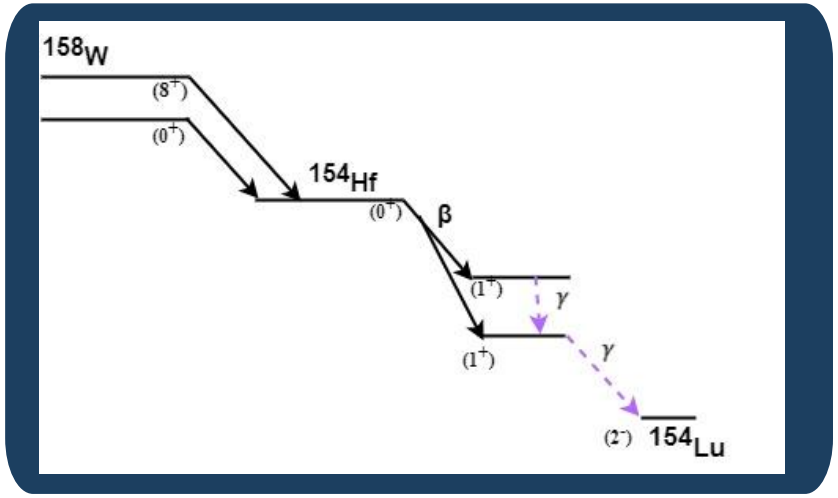




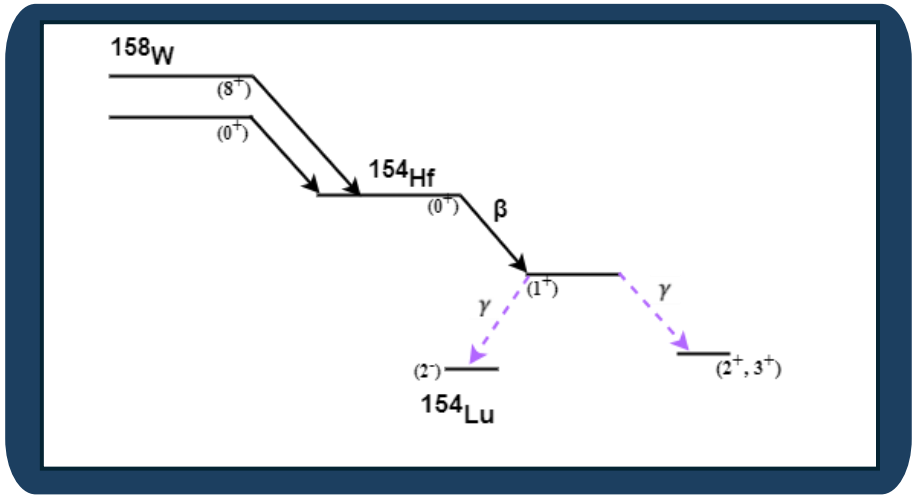
Summary and future work

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

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



or



Thank You

For Your Attention

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Reference

[1] Briscoe, A.D. *et al.* (2023) 'Decay spectroscopy at the two-proton drip line: Radioactivity of the new nuclides 160Os and 156W', *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 segrè 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 160Os, the beta emitter 156W and an electromagnetic decay branch from the 25/2 − spin gap isomer in 155Lu*. phd. University of Liverpool. Available at: https://livrepository.liverpool.ac.uk/3143087 (Accessed: 17 February 2024).