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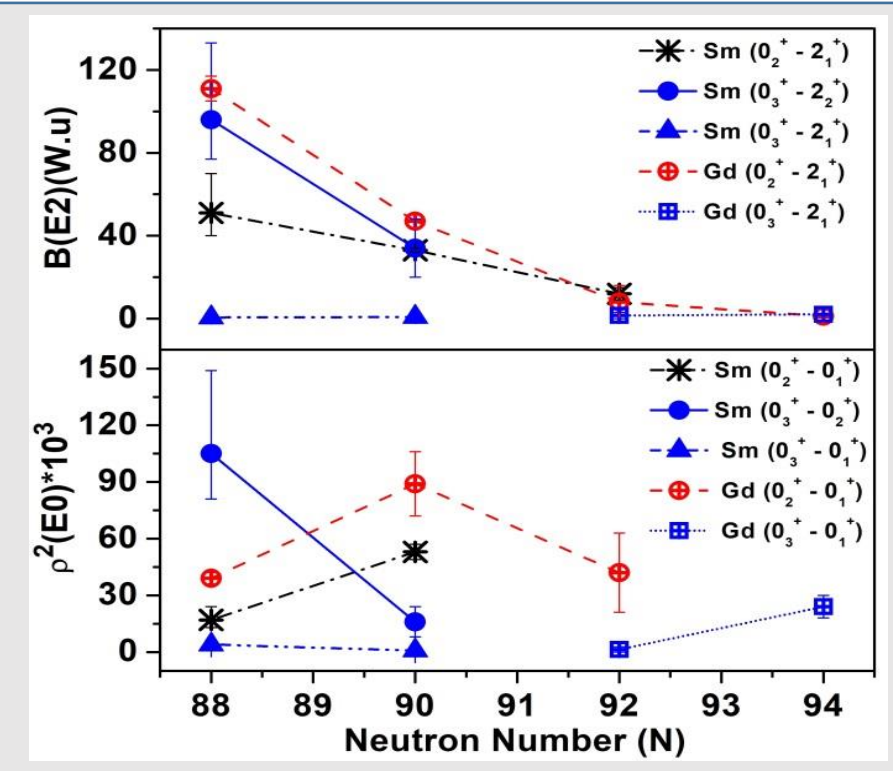
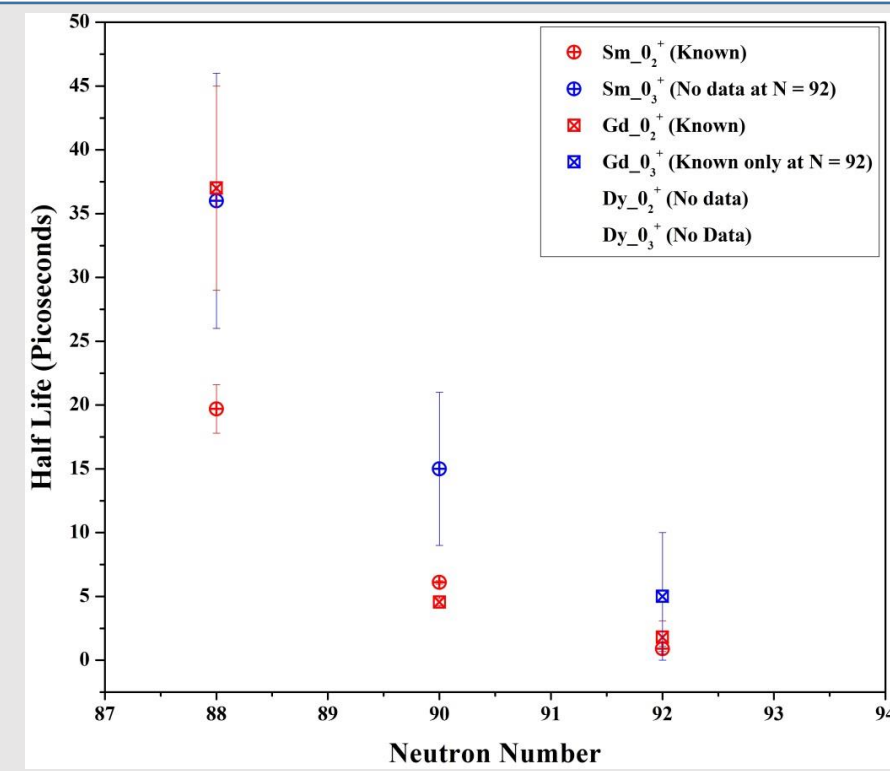
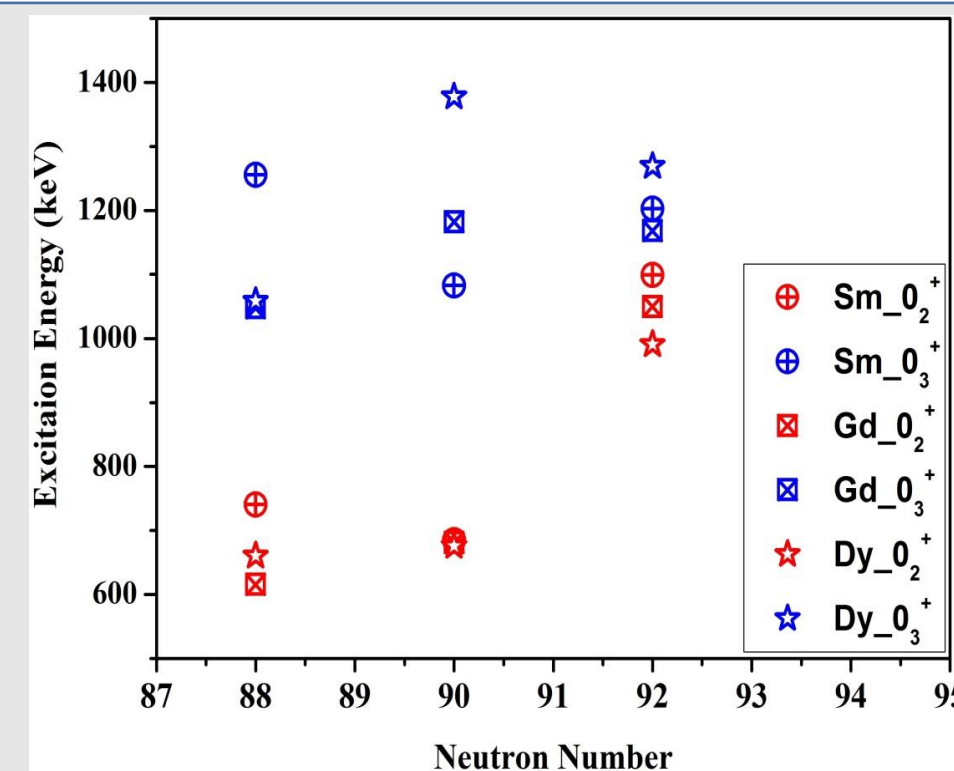
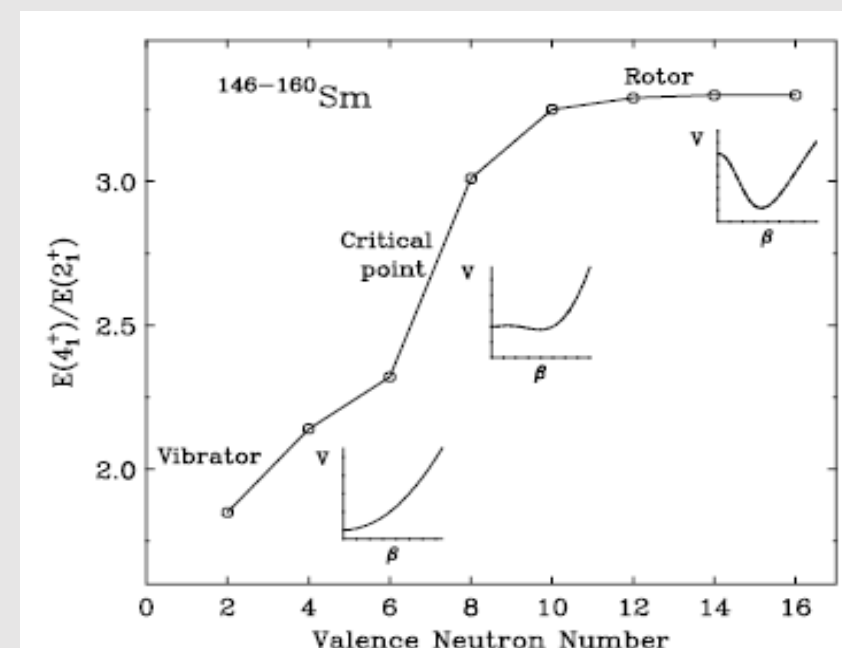
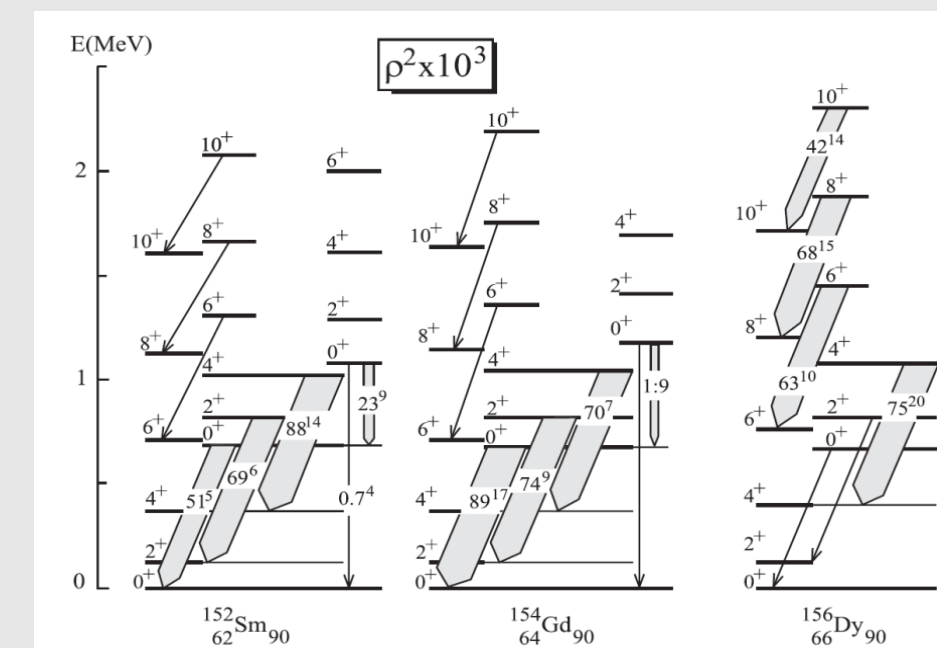
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17th International Symposium on Capture Gamma Ray Spectroscopy and Related Topics-CGS17, July 17 - 21, 2023
Grenoble, France

Physics:

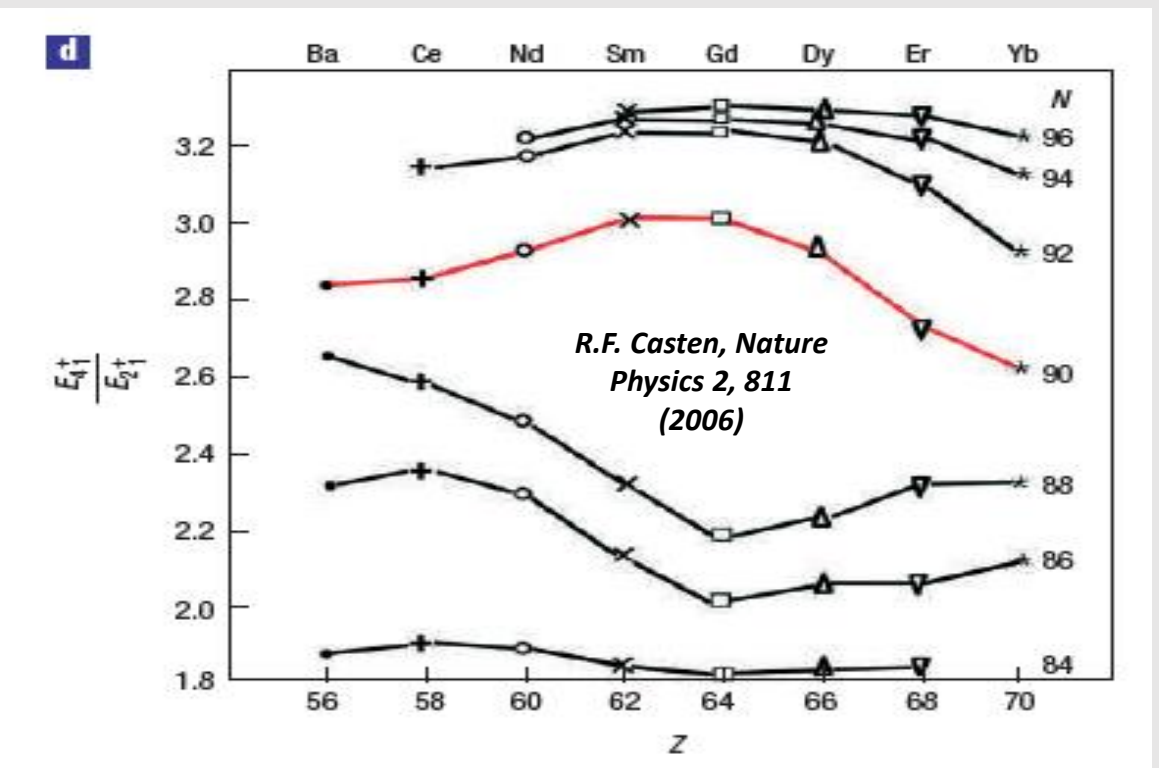
- A wide variety of nuclear shapes and their co-existence are displayed by the nuclei around $N = 90$.
- Existence of multiple excited 0^+ levels, associated with different shapes compared to that of ground state.
- The 0^+ states are believed to be developed due to mixed microscopic configurations – As a results the $0^+ \rightarrow 0^+$ E0 decays show large strength - giving rise to indication of co-existing shapes.



The subshell closure at $Z = 64$ also plays a major role

The excited 0^+ levels and $B(E2)$ and $\rho^2(E0)$ transition strengths must be explored around $Z = 64$

Lifetime measurements in Sm ($Z = 62$), Gd ($Z = 64$) and Dy ($Z = 66$) nuclei are important



Motivation:

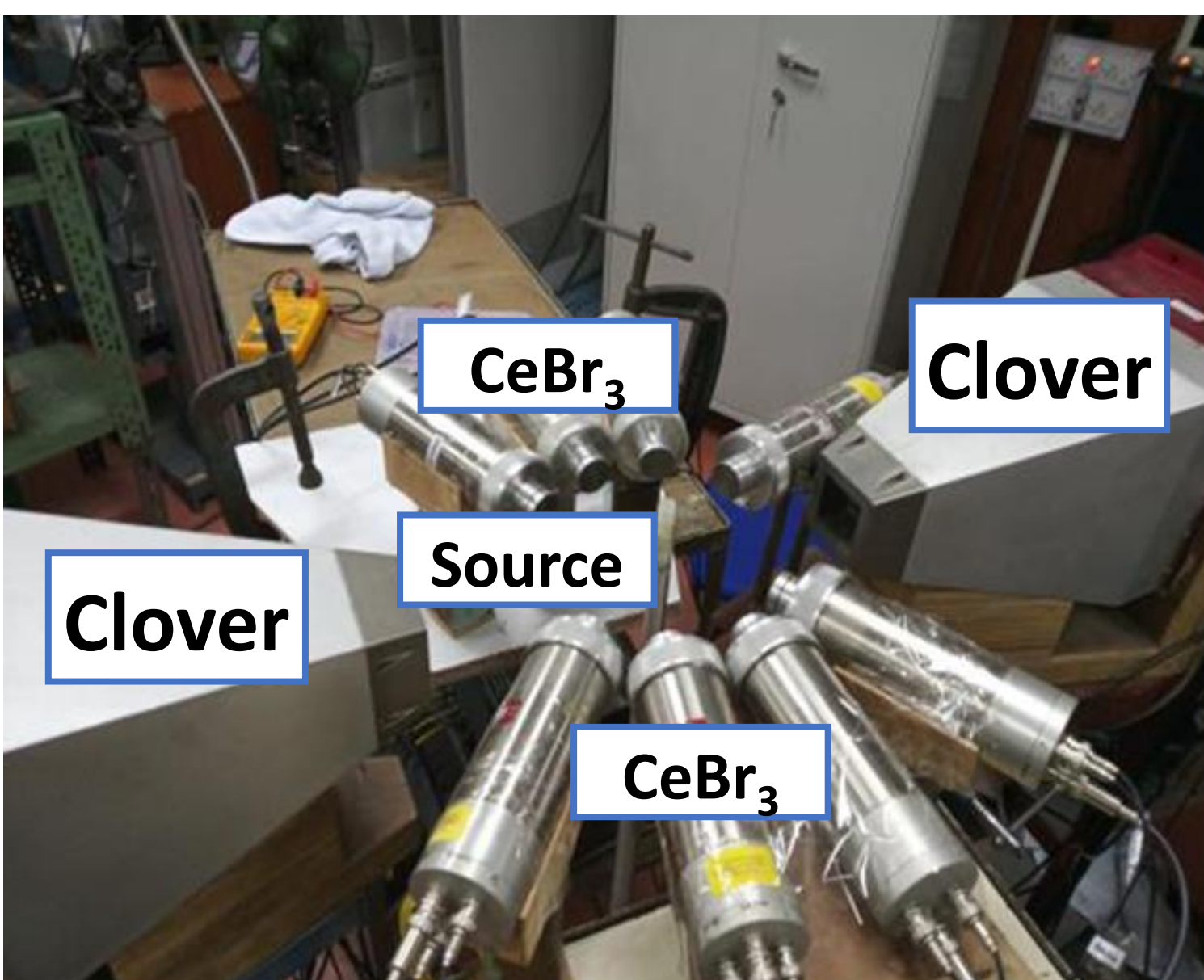
The Sm, Gd and Dy nuclei are to be studied systematically in order to determine the $B(E2)$ and $\rho^2(E0)$ transition strengths

Lifetime information are important that vary from few picoseconds to tens of picoseconds

Gamma-gamma fast timing technique has been successfully employed in ^{152}Gd and ^{150}Sm utilizing decay spectroscopy (S. Basak et al., Phys. Rev. C 104, 024320 (2021), J. Wiederhold et al., Phys. Rev. C 94, 044302 (2016).)

The Lifetime measurements in Gd isotopes are taken up through gamma-gamma fast timing in the present work

Experimental Setup



Experimental setup of VENTURE [NIM A 874, 103 (2017)]

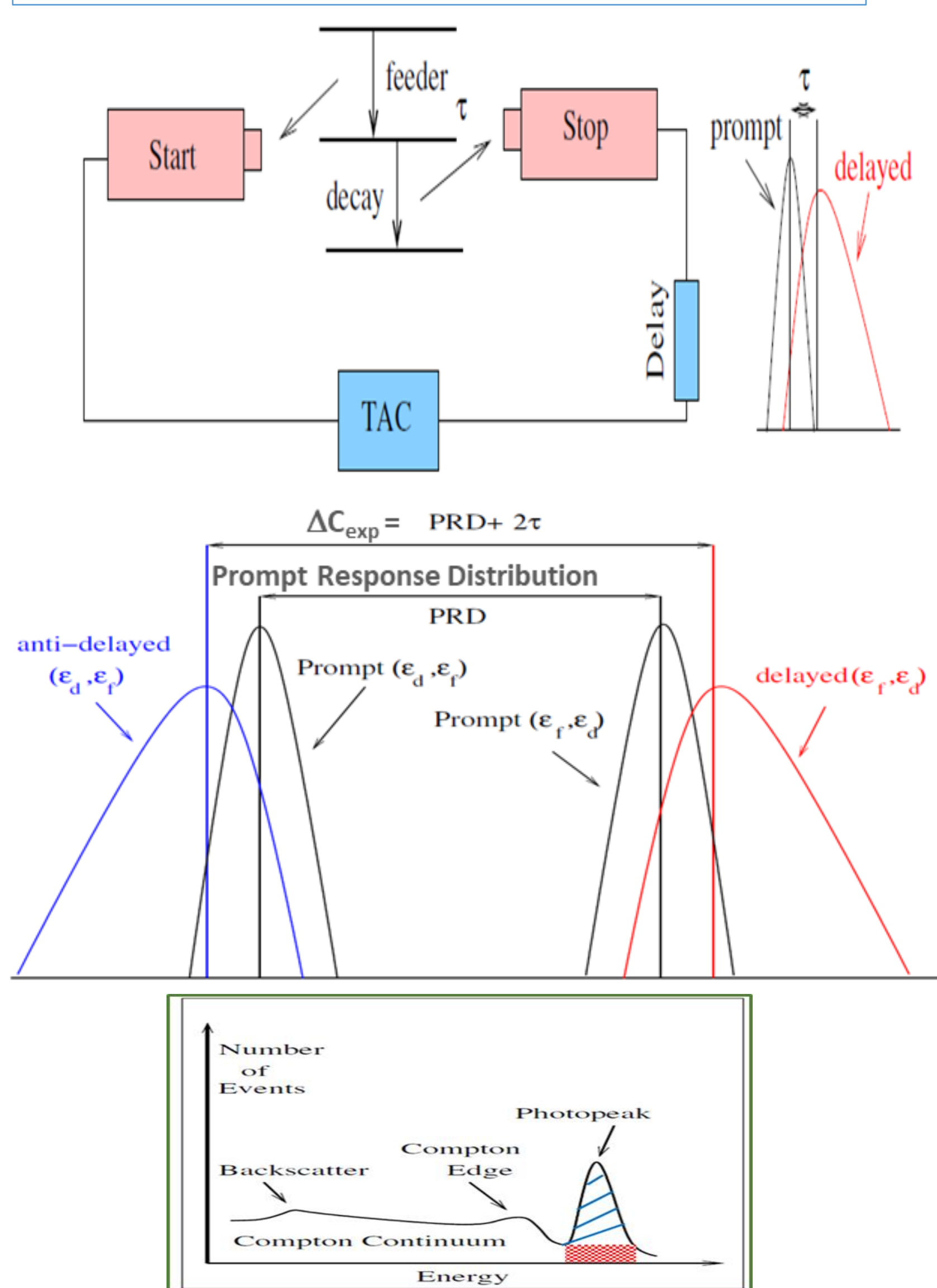
The excited levels of Gd isotopes were populated from beta decay of Tb

Tb isotopes produced Using $^{154}\text{Gd}(p,n)^{154}\text{Tb}$ reaction with 12 MeV proton beam.

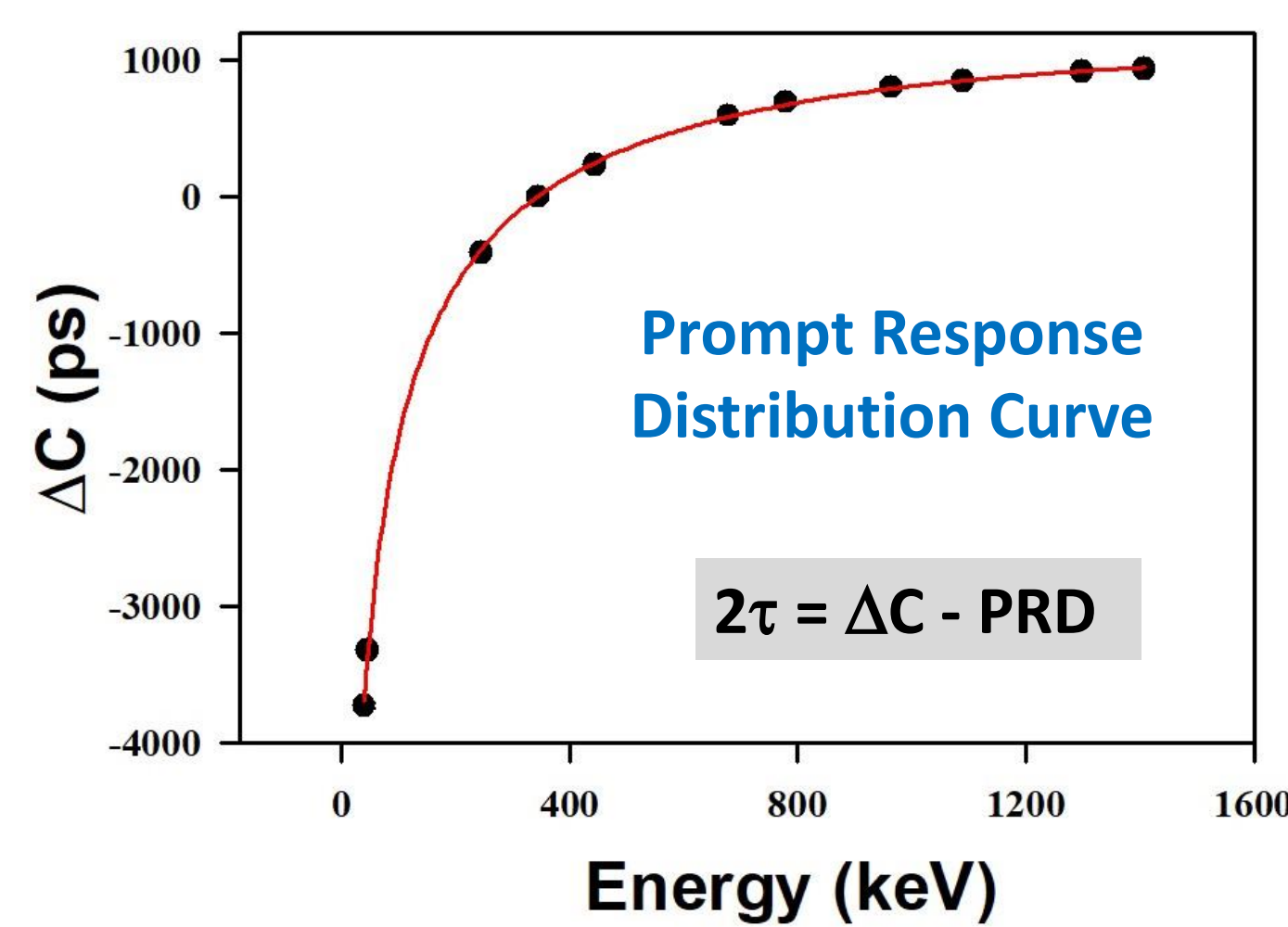
Target : ^{154}Gd
(67 % enriched)

^{155}Gd : 21%
 ^{156}Gd : 5.7%

γ - γ Fast timing technique



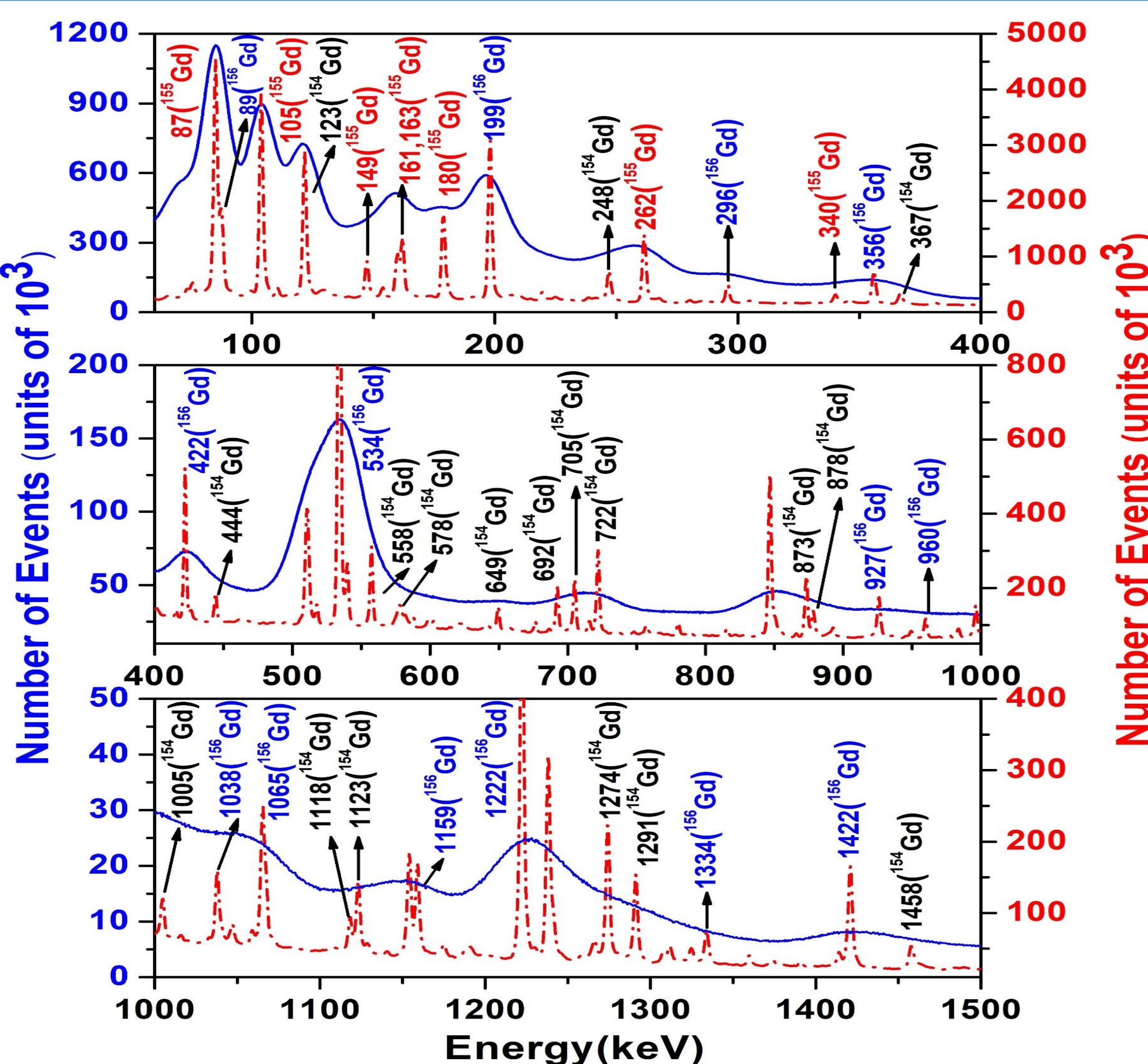
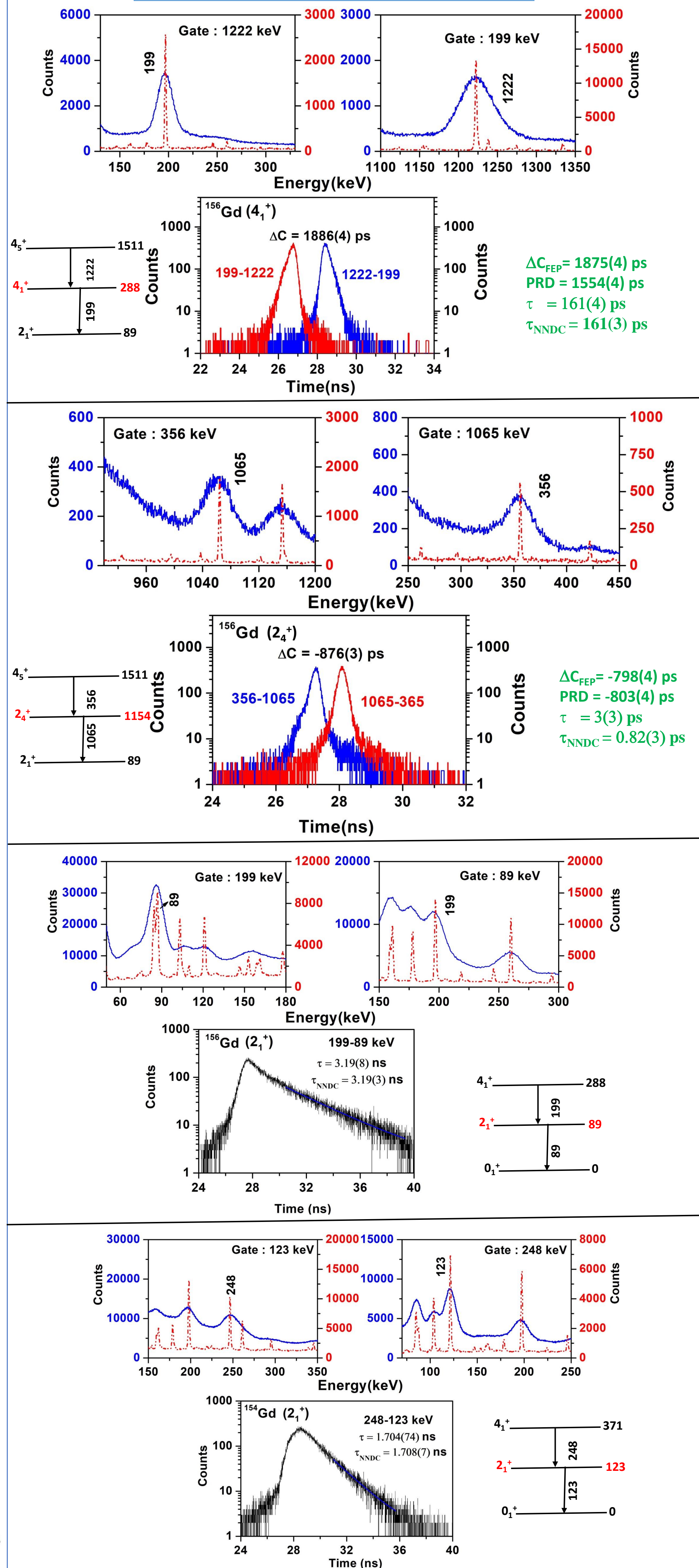
[J. -M. Regis et al, Nuclear Instr. & Meth. in Phys. Res. A 823, 72 (2016)]



Prompt Response Distribution Curve

$$2\tau = \Delta C - \text{PRD}$$

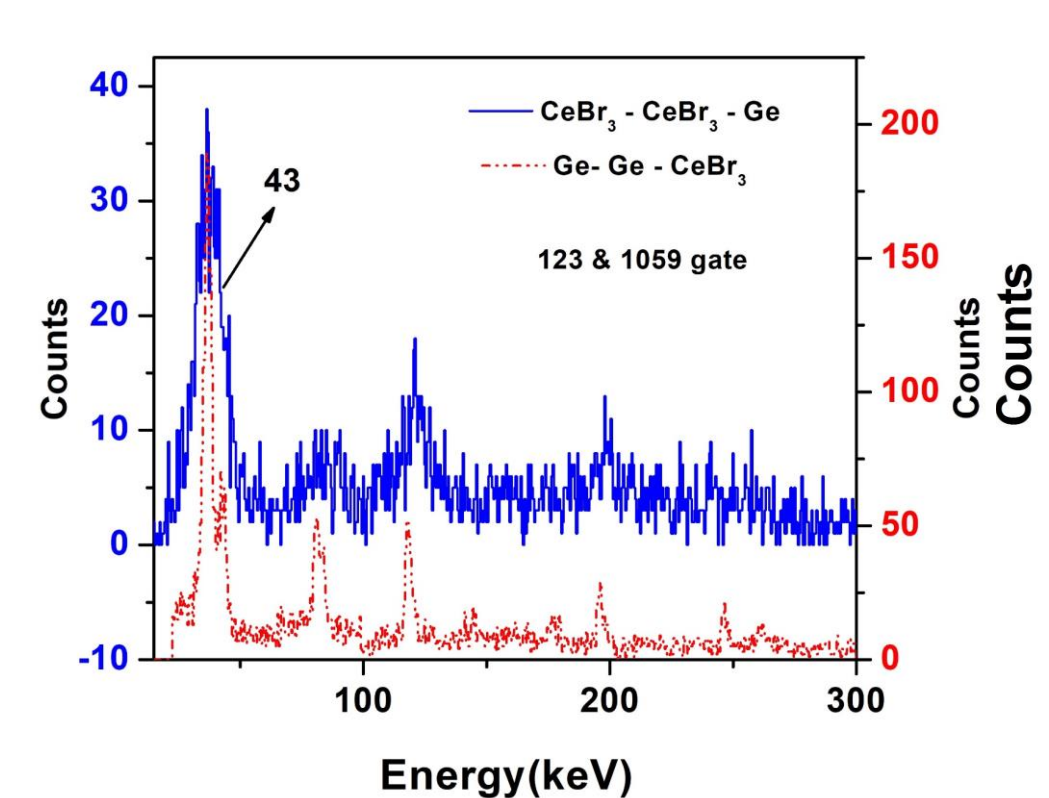
Data Analysis



Lifetime measurement for 0^+ states

Problem: 0^+ excited levels have very weak feeding

Solution: Lifetime measurement with Ge – CeBr_3 – CeBr_3 (X-ray) coincidence



Summary:

Lifetime measurement using VENTURE array with γ - γ fast timing (GCD and Slope) has been taken up for Gd ($Z = 64$) nuclei around $N = 90$, populating the excited levels through beta decay.

Lifetimes of several states have been measured. Lifetime measurement of 0^+ levels are attempted through γ - γ -X-ray coincidence. Analysis is in progress.

Acknowledgement:

We acknowledge the support from Cyclotron staffs for providing good quality Proton beam. Members of RCD-BARC, VECC are acknowledged for support during target preparation. Members of Physics Lab, VECC are acknowledged for maintenance of detectors throughout the year.