More on Coincidence Summing

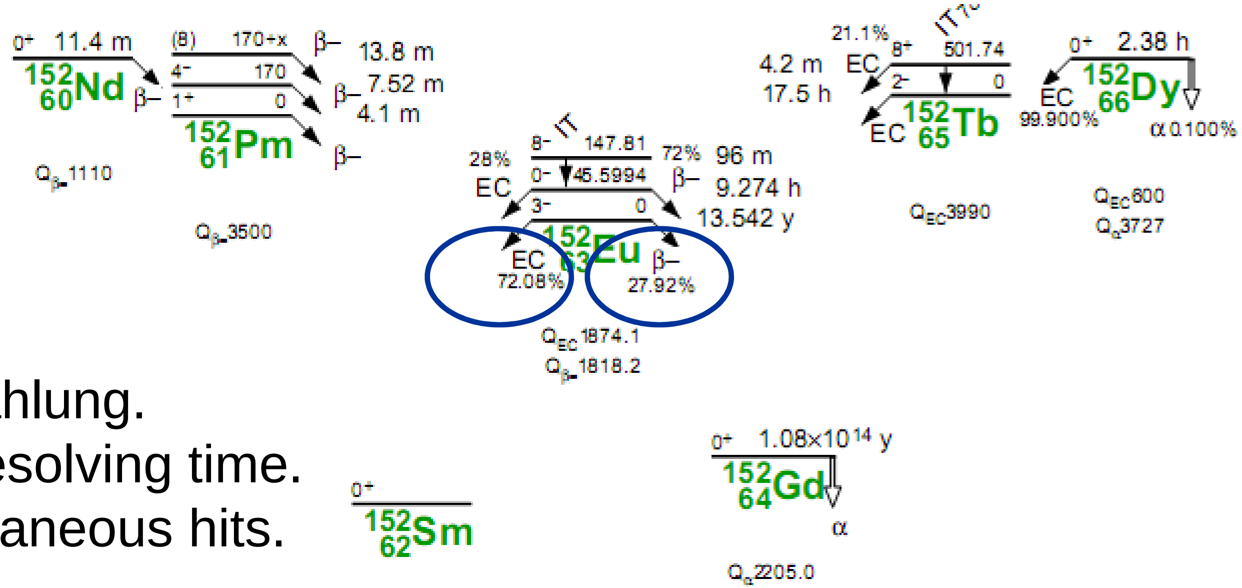
- The task is to calculate an unknown activity A.
- Measure the unknown and find the **net** area under the full-energy peak in the gamma spectrum. This net area should also be corrected for **dead time**. The count rate N is then used to calculate the activity A:

$$A = \frac{N}{I_\gamma \varepsilon_\gamma} = \frac{N}{p_\gamma \varepsilon_\gamma}$$

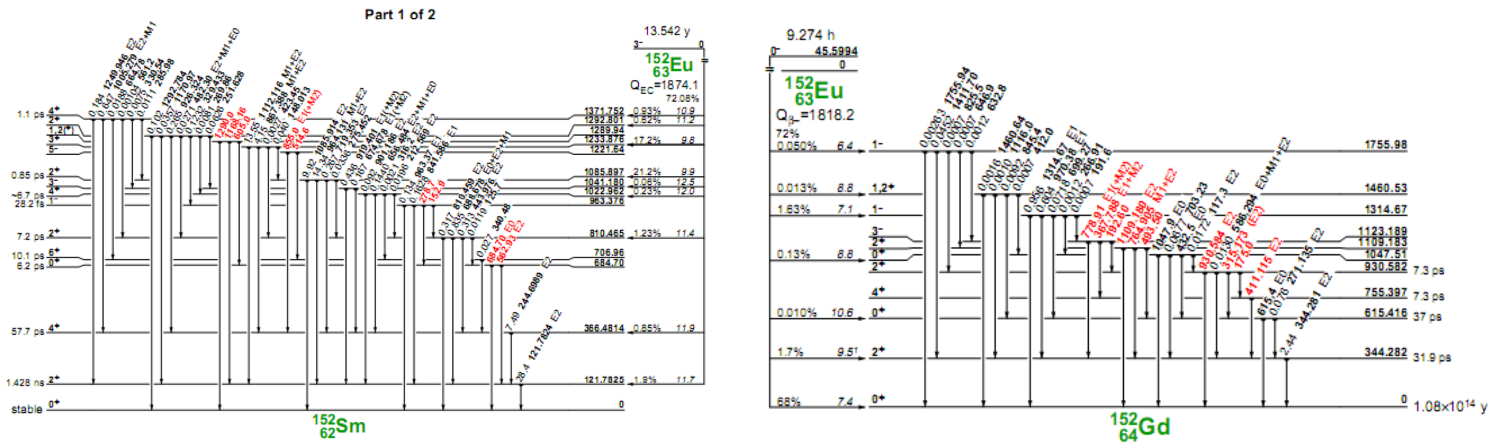
- ε_γ (or N) should be corrected for:
  - Self absorption.
  - Extended geometry.
  - **True coincidence summing.**

More on Coincidence Summing

- **True** coincidences (not random).



- Cascade summing.
- Sum with x-rays.
- Sum with bremsstrahlung.
- Level lifetimes << resolving time.
- Possibility for simultaneous hits.



More on Coincidence Summing

Hit probabilities:

at 0 mm

One gamma => 42%

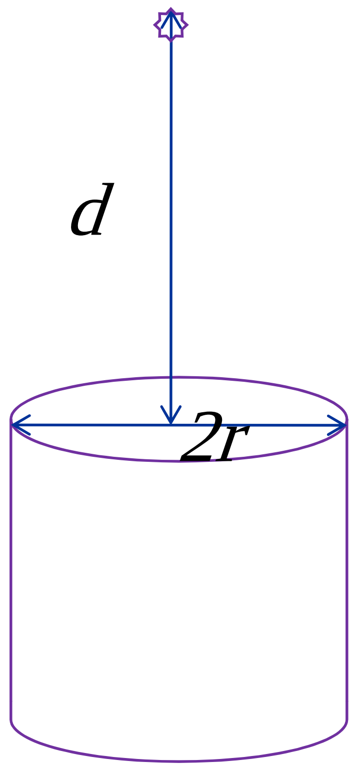
Two gammas => 17%

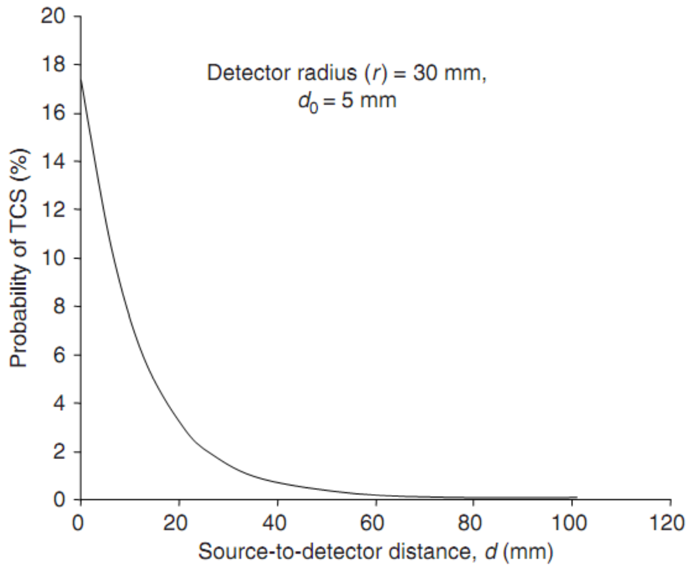
at 115 mm

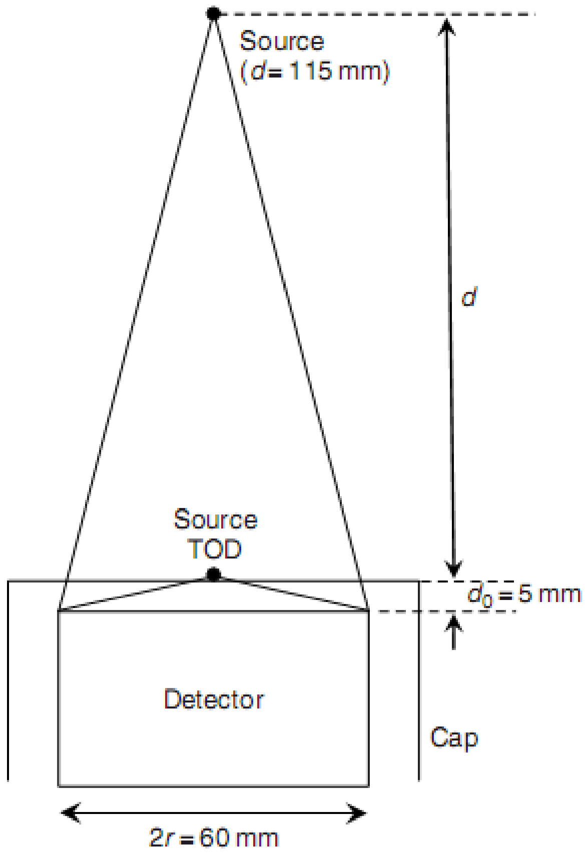
One gamma => 1.5%

Two gammas => 0.02%

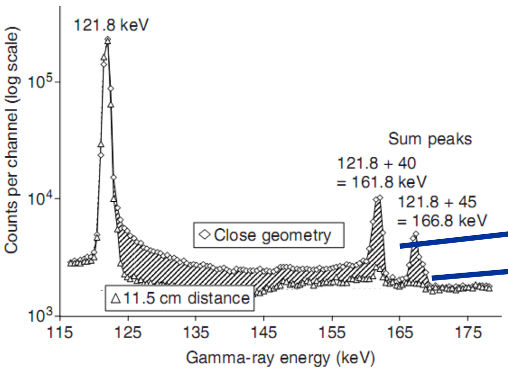
$$\Omega \approx 2\pi\left(1-\frac{d}{\sqrt{d^2+r^2}}\right)$$

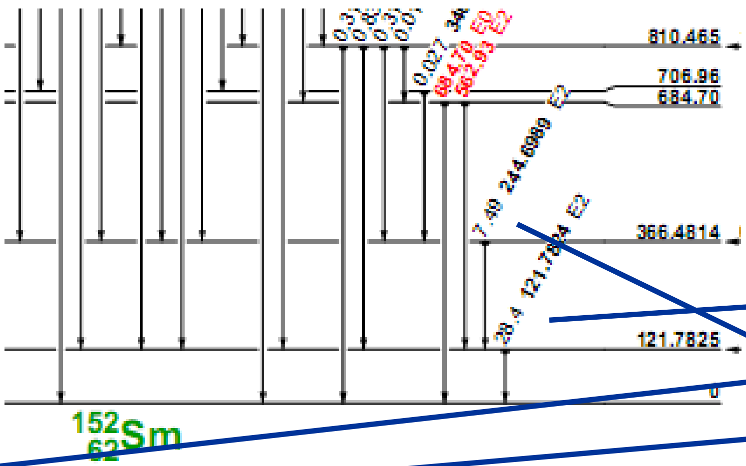


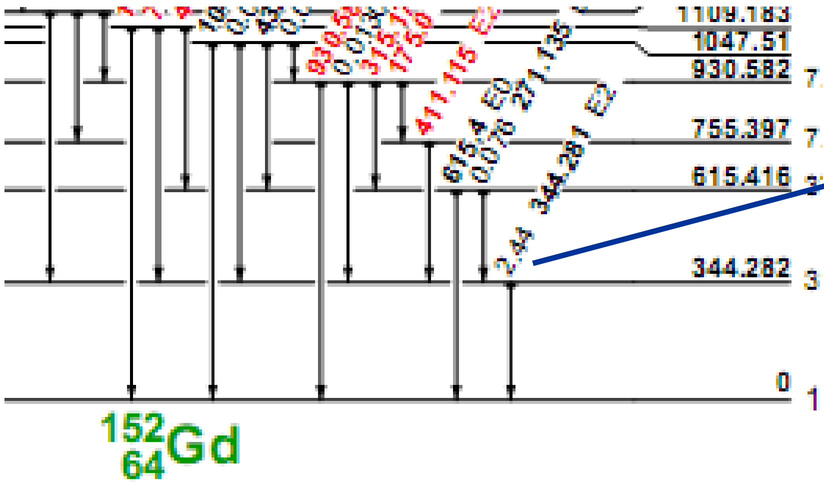




More on Coincidence Summing





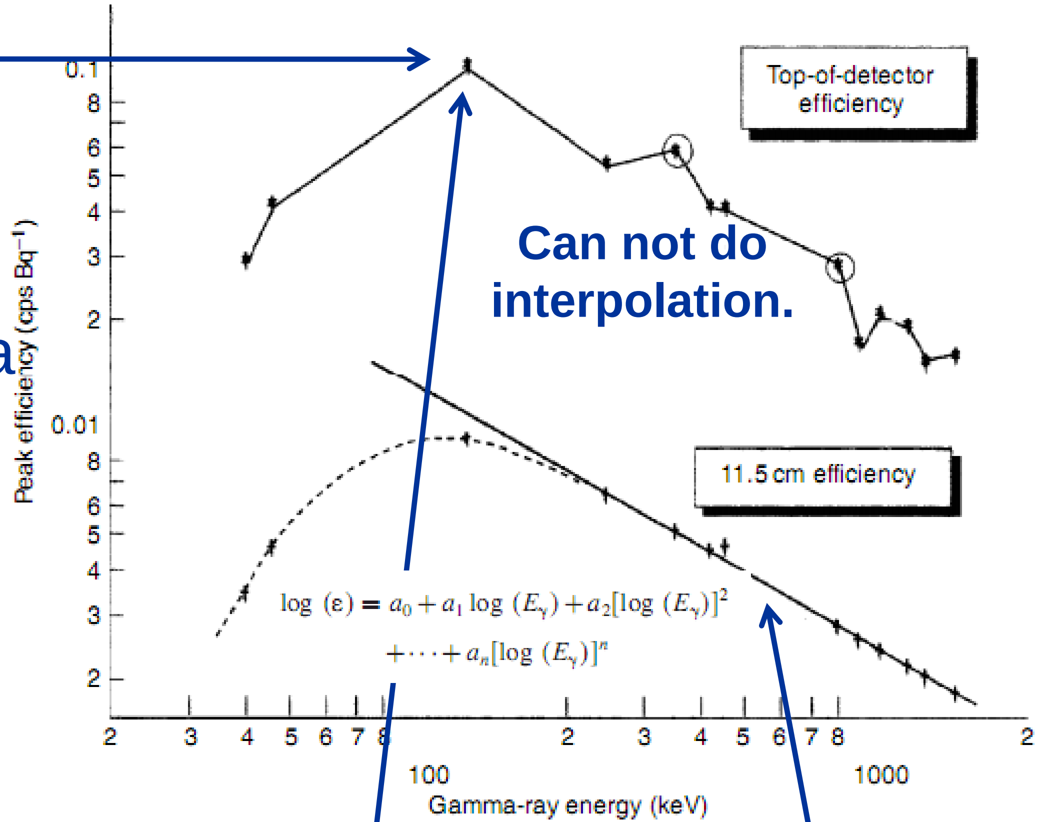


	Energy (keV)[a]	
Sm Kα X-rays	39.60	
Sm Kβ X-rays	45.23	
	121.83	
	161.62	S
	167.16	S
	244.83	
	284.70	S
	290.17	S
	296.09	
	344.44	
121 + 244	367.33	S
	411.28	
	444.12	
	488.79	
	564.29	

No 121 + 344 ??

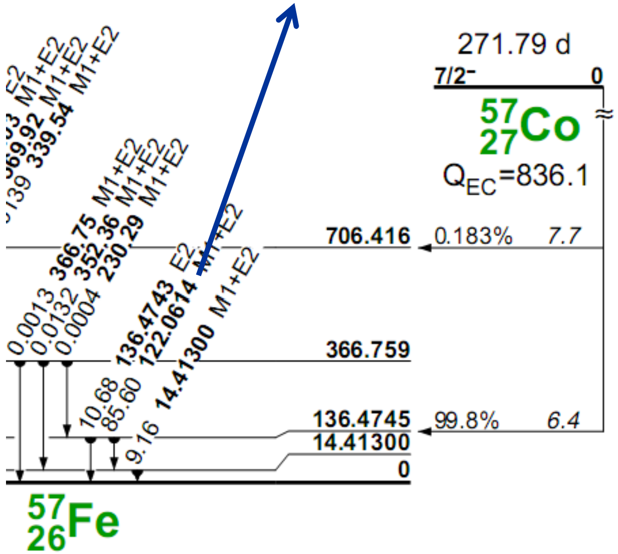
More on Coincidence Summing

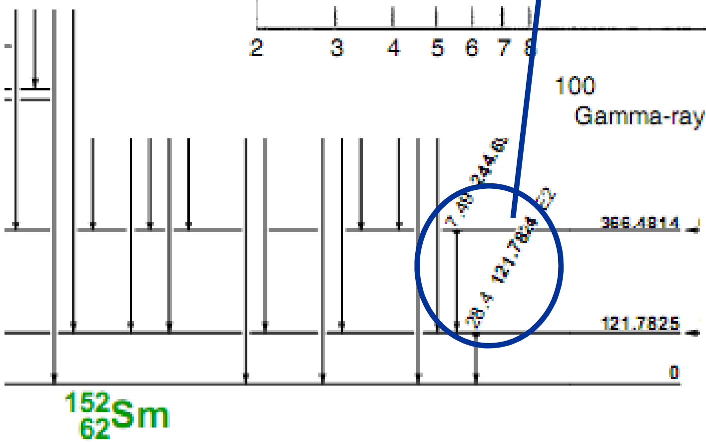
- Bad calibration point.
- Can only be used to measure ^{152}Eu.
- Does not represent efficiency at this energy for a "monoenergetic source".
- Can not be used to measure ^{57}Co (same energy).



Can not do interpolation.

$$\log(\varepsilon) = a_0 + a_1 \log(E_\gamma) + a_2[\log(E_\gamma)]^2 + \cdots + a_n[\log(E_\gamma)]^n$$





- Negligible summing.
- Same distance but larger detector?