

February 21, 2018

1 Introduction

When a nucleus relaxes to the ground state by emitting a γ -photon, the probability of emitting in a given direction depends on its angle with the nuclear spin axis. If the relaxation happens by emitting two simultaneous photons, these show an angular correlation. This correlation can be measured, which is the goal of the experiment. To that end, first the γ -ray spectrum of the sample (^{60}Co) was measured, then a FAST-SLOW coincidence circuit was set up (see Figure 2).

2 Theory

Figure 1 shows the decay scheme of the sample used. The ^{60}Co (half-life ≈ 5.3 years) decays via β^- -radiation into ^{60}Ni ; with highest probability to the $4+$ angular momentum state. The lifetime of these excited Ni states are on the order of 1 ps. Decaying to the ground state follows via emitting one or more γ photons. The relaxing process with the largest branching ratio is the $4+ \rightarrow 2+ \rightarrow 0+$ decay, produces two γ photons. The corresponding lifetimes are short enough for the emissions to be considered coincidental (from the detecting electronics point of view), and for the assumption that extra-nuclear forces do not cause perturbation in the correlation between the photons.

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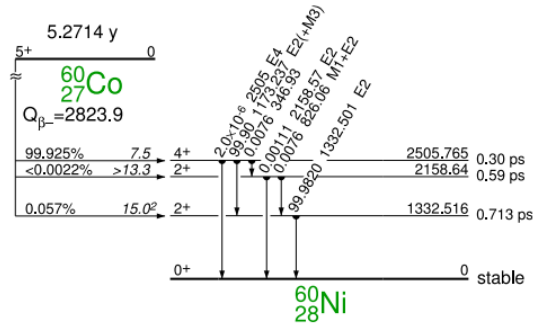


Figure 1: Cobalt decay scheme [2]

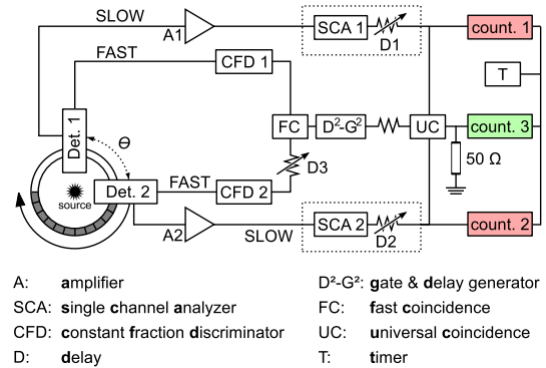


Figure 2: Experimental setup [1]

3 Experimental setup

4 useful

- Leo 11.3: For technical reasons which we will consider later, it is important to distinguish be-

tween fast and slow pulses in an electronics system. Fast signals generally refer to pulses with rise times of a few nanoseconds or less while slow signals have rise times on the order of hundreds of nanosecond or greater. This definition includes both linear and logic signals. Fast pulses are very important for timing applications and high count rates; in these applications it is very important to preserve their rapid rise times throughout the electronics system. Slow pulses, on the other hand, are generally less susceptible to noise and offer better pulse height information for spectroscopy work.

References

- [1] Booklet.
- [2] R. B. Firestone, Table of Isotopes 8th edition (Wiley, New York, 1996)