We detail the γ ray decay scheme of the $^{137}_{55}$Cs and $^{60}_{27}$Co, both of which we will use in the experiment.

Decay scheme for $^{137}_{55}$Cs

Caesium-137 ($^{137}_{55}$Cs) or radiocaesium, is a radioactive isotope of caesium that is formed as one of the more common fission products by the nuclear fission of uranium-235. The decay scheme for the $^{137}_{55}$Cs is given in the schema below.

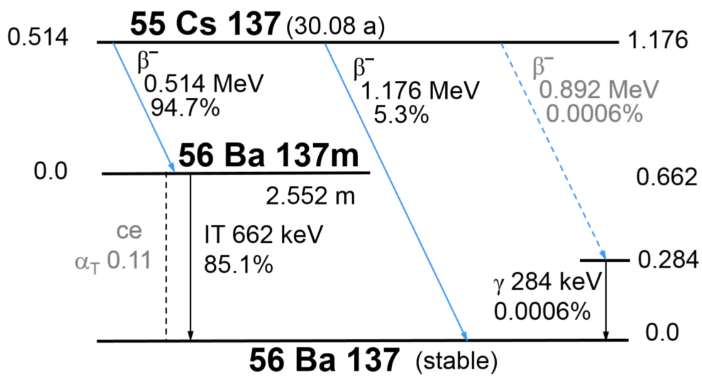

Figure 1: Decay scheme of $^{137}_{55}$Cs into $^{137}_{56}$Ba (Source: The Internet)

There are three decay schemes for $^{137}_{55}$Cs decaying into $^{137}_{56}$Ba. The most observed ones are the β decay into $^{137m}_{56}$Ba and then γ decay into $^{137}_{56}$Ba, and the direct β decay into $^{137}_{56}$Ba. We are observing the γ ray spectrum for the γ ray emitted on transition from $^{137m}_{56}$Ba to $^{137}_{56}$Ba. The 'm' in $^{137m}_{56}$Ba stands for metastable or unstable. The third decay scheme occurs only 0.0006% of the time, so, we can safely ignore that.

The decay leaves 94.7% of the parent Caesium nuclei into the metastable $^{137m}_{56}$Ba nucleus via a β^- ray interaction and the release of an anti-neutrino. Then a γ ray decay of energy 662keV converts the metastable nuclei into the the ground state $^{137}_{56}$Ba. The nuclear reactions are written below.

$$^{137}_{55}\text{Cs} \longrightarrow {}^{137m}_{56}\text{Ba} + e^- + \overline{\nu}_e \longrightarrow {}^{137}_{56}\text{Ba} + e^- + \overline{\nu}_e + \gamma(661.65keV)$$

Decay scheme for $^{60}_{27}$Co

Cobalt-60 ($^{60}_{27}$Co) is a synthetic radioactive isotope of cobalt with a half-life of 5.2714 years. It is produced artificially in nuclear reactors.

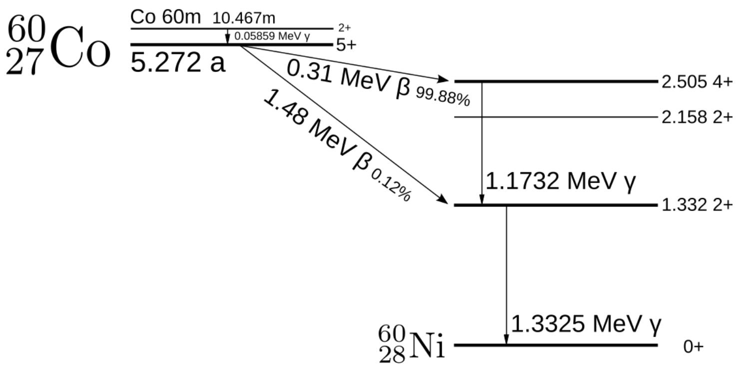

Figure 2: Decay scheme of $^{60}_{27}$Co into $^{60}_{28}$Ni (Source: The Internet)

This is produced on activation of $^{59}_{27}$Co via neutron activation. The dominant interaction here is a β^- decay to a intermediate state and then two consecutive γ ray decays to get to $^{60}_{28}$Ni. Then we get a multistep decay from ${}^{59}_{27}\mathrm{Co}$ to ${}^{60}_{28}\mathrm{Ni}$. We observe a multistep decay due to some selection rules that do not allow transitions to certain states to take place. We thus get the following decay processes

$$ {}^{59}_{27}\mathrm{Co} + n \longrightarrow {}^{60}_{27}\mathrm{Co} $$

$$ {}^{60}_{27}\mathrm{Co} \longrightarrow {}^{60}_{28}\mathrm{Ni}^{*} + e^{-} + \overline{\nu}_e \longrightarrow {}^{60}_{28}\mathrm{Ni}^{*} + e^{-} + \overline{\nu}_e + \gamma(1.173MeV) + \gamma(1.333MeV) $$