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How to use non-Mo sectors background fo 0^+ analysis. Proposal.

There is a very old idea, that we can use non-Mo sectors (Se+Cd+Te+Cu) for background estimation in Mo-100 decay to excited states analysis. The simplest way to do it is if one assume that almost all the background comes from Rn and external background. If we believe in this, and that Rn and external backgrounds are uniformly distributed, then ^{100}Mo background (B) should be proportional to non-Mo background (B‘).

$$B/B‘ = k(1.1)$$

First approximation for k is ratio between Mo and non-Mo foil surfaces (1.5). But this doesn't take into account non-homogenyties in detector efficiency (mainly due to bad or not working PMs).

1 Cuts selection

Useful application of non-Mo background study is cut selection. The data in Mo foil consist of 0^+ signal and background:

$$D = S + B(1.2)$$

If one wants to minimize systematics introduced by background uncertainty, he needs to maximize S/B. In this case:

$$S/B = (D - B)/B = (D/B - 1) = (D/kB‘ - 1) = 1/k(D/B‘ - k)(1.3)$$

k is unknown, but fixed! So maximizing S/B means to maximize $D/B‘$. The advantage of this method in comparison with what was presented in Caen is that we are working with real events distribution and not Monte-Carlo one. So I propose use relation (1.3) with k 1.5 as well as Monte-Carlo S/B for cuts selection.

2 Mo-100 background estimation

The possible critics of relation (1.1) is that there are other background components (namely 2b2n to g.s. decay, internal ^{208}Tl, decay to excited stays in other isotopes) apart from Rn and external background.

There is no other way as to take MC estimation of 2b2n(g.s.) decay contribution $B_{g.s.}$.

Estimation of ^{208}Tl activity in Mo is 0.5 mBq and in other sectors it is 1 mBq (e.g. see my talk July 2004 in Dubna). It means 2 time higher. And as first approximation one can use Mo ^{208}Tl somulation, multiplied by 2.

Decay to excited states in other nuclei is negligible. Typical experimental limits for Se, Cd and Te are on the order of $2 \cdot 10^{21}$ y. In ^{100}Mo we have 50 events from 6.9 kg of isotope with $T_{1/2} \sim 5 \cdot 10^{20}$. Assuming same efficiency for others:

$$50 * (2.0/6.9) * (2./50.) = 0.5$$

So reasonable way to estimate ^{100}Mo from other foils is:

1) Select events in non-Mo foil (Se+Te+Cd+Cu) (B‘)

2) Calculate MC background in non-Mo according to our model ($B‘_{MC}$).

3) Calculate MC background in Mo (B_{MC}) and separately Tl (B_{Tl}) and g.s. (B_{gs}) contributions.

3) See if (B‘) compatible with ($B‘_{MC} - 2B_{Tl}$)

4) Use $(B_{MC}/B`_{MC})$ as estimation of k value
5) Finally (^{100}Mo) background estimation from non-Mo foils is:

$$B = \frac{B_{MC}}{B`_{MC}} * (B` - 2B_{Tl}) + B_{Tl} + B_{gs}(1.4)$$