

IBD & Radioactivity simulation from Fifteen

Qing He

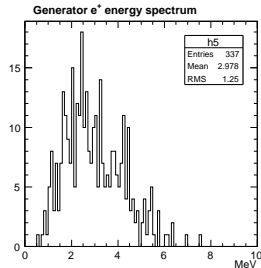
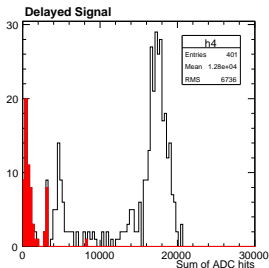
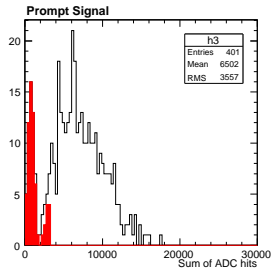
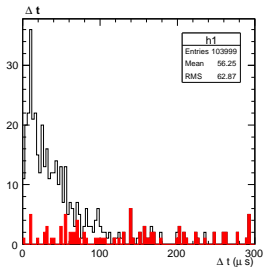
Princeton University

Dayabay Collaboration

Radioactivity decay rates

- Taken from DYB-doc-1408
- Assume the radioactivity of GD-LS is 10^{-3} ppb for ^{40}K , ^{238}U , and ^{232}Th each. The corresponding rates for 20-ton GD-LS are 5.3 Hz for ^{40}K , 0.25 Hz for ^{238}U , and 0.08 Hz for ^{232}Th .
- Because of the cascade decays of ^{238}U and ^{232}Th , multipliers of 9 and 4 are applied to the above rates to get the final rates for ^{238}U and ^{232}Th , respectively.

IBD & Radioactivity events in gds at Daya Bay site



● Assume ADC pedestal = 500

- $\Delta t = t_{curr} - t_{prev}$, each readout has a Δt except the first one.
- IBD Candidate requirement: $\Delta t < 200\mu s$, no energy requirement yet.
- Found 401 candidtes, among which 337 are true IBD events.
- Found one readout is used twice in the candidates($\Delta t < 200\mu s$). The sequence is: ^{40}K , IBD prompt signal, IBD delayed signal, with the interval between ^{40}K and IBD prompt signal less than $200\mu s$.
- Multiple candidates selection should be made *after* all cuts applied.

One puzzle

Type	Readouts	Lifetime(s)	rate/IBD	Generated	rate/IBD
IBD	681	71	1	342	1
K40	95510	0.19	374	154406	451
Uranium	857	0.44	161	998	2.9
Thorium	6952	3.1	23	7875	23

- The input lifetime for IBD, K, U, and Th generators are 71 s, 0.19 s, 0.44 s, and 3.1 s, respectively. Corresponding relative rates ratio is: 1:374:161:23
- The generated number ratio is: 1:451:2.9:23
- Uranium generation rate is too low.