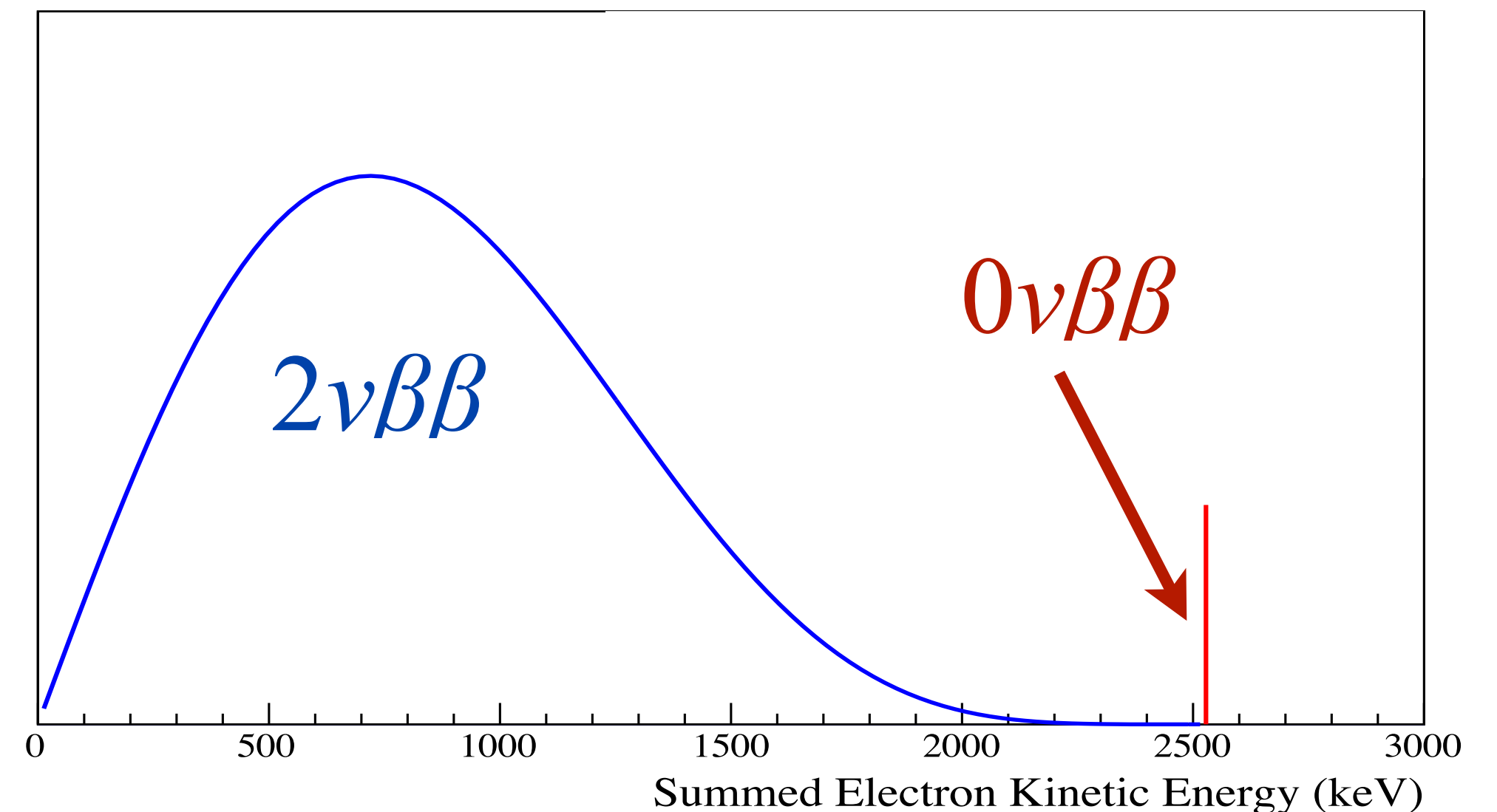
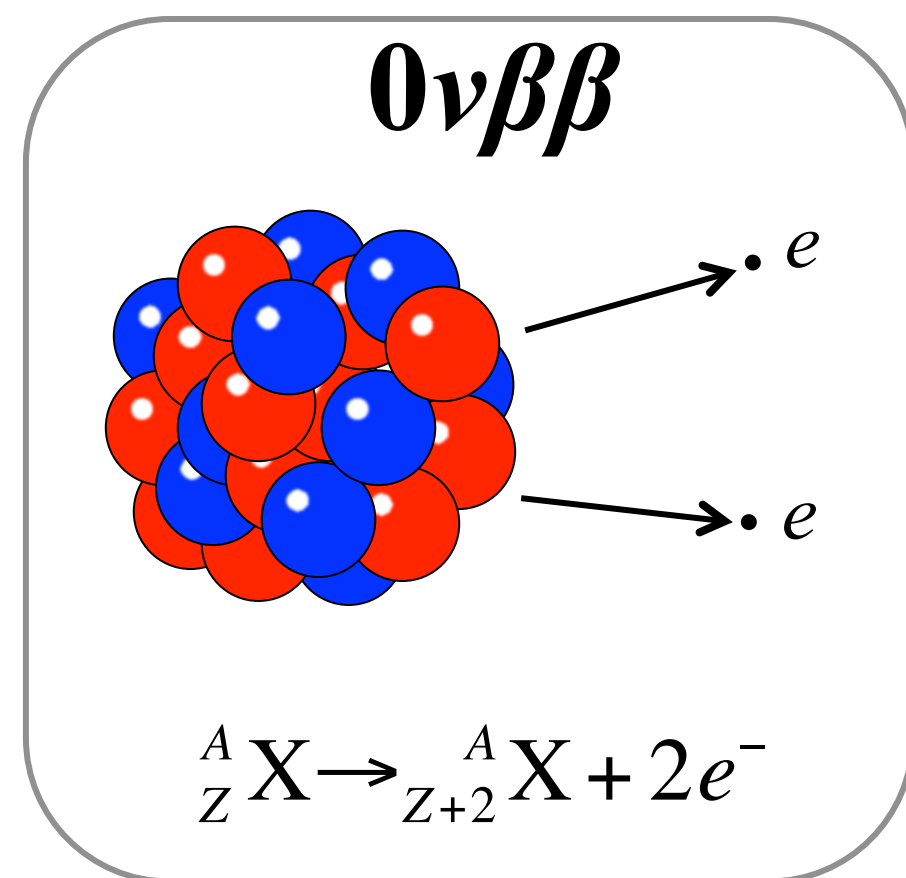
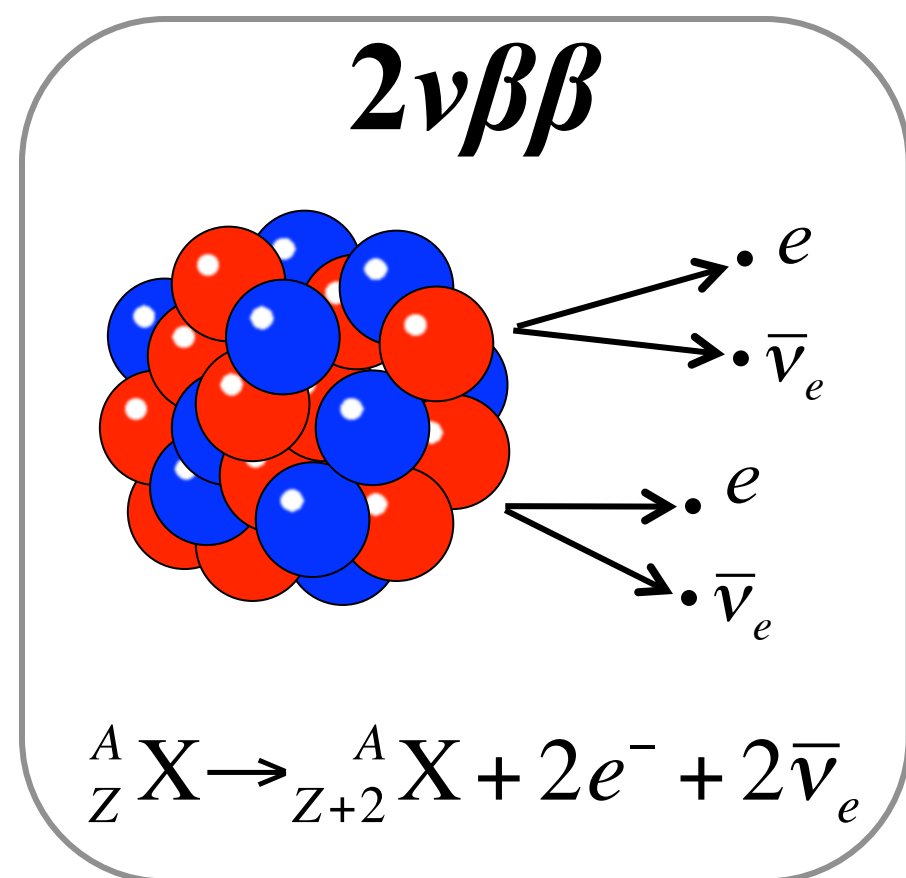
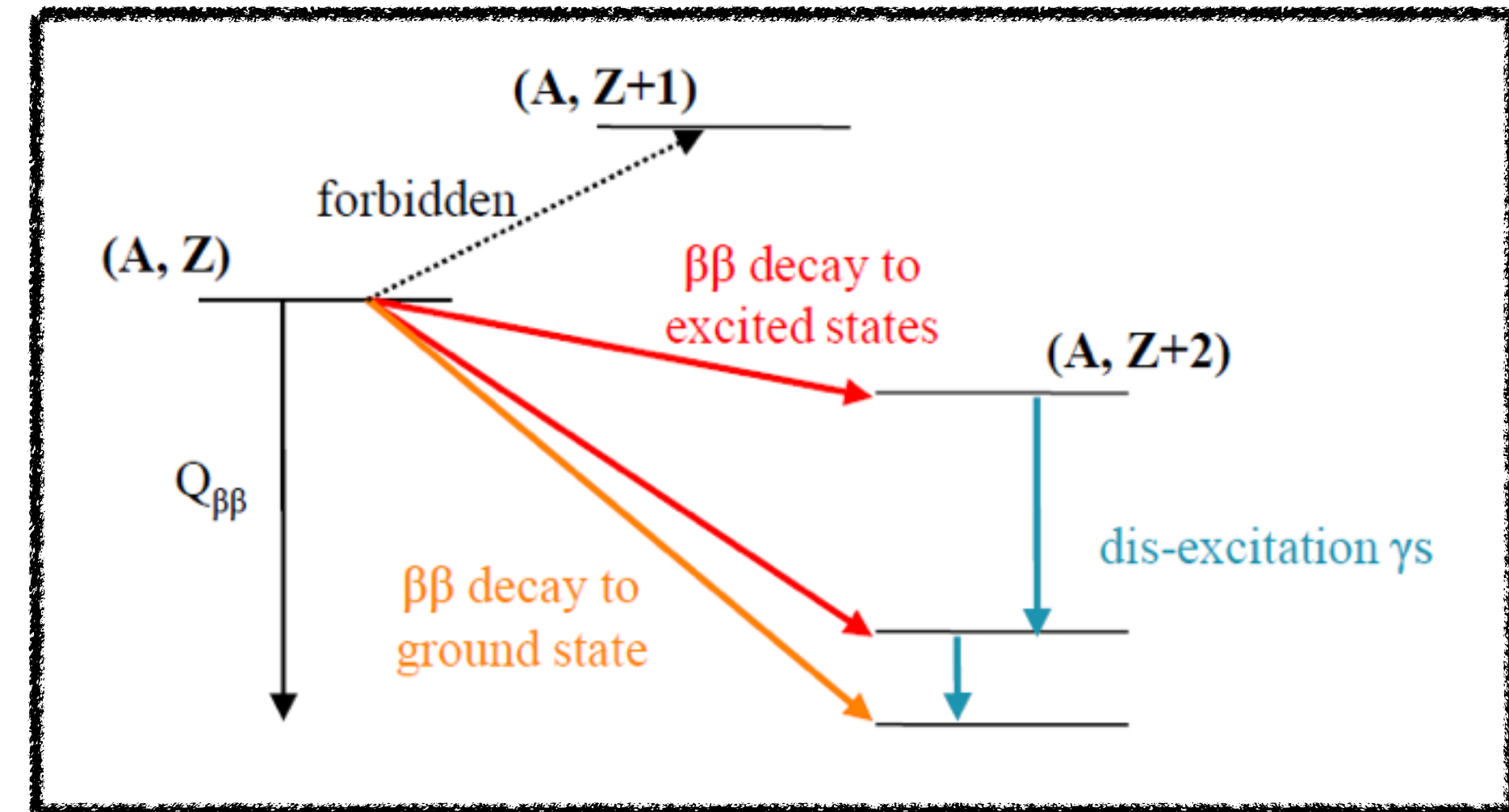


Neutrinoless Double Beta Decay

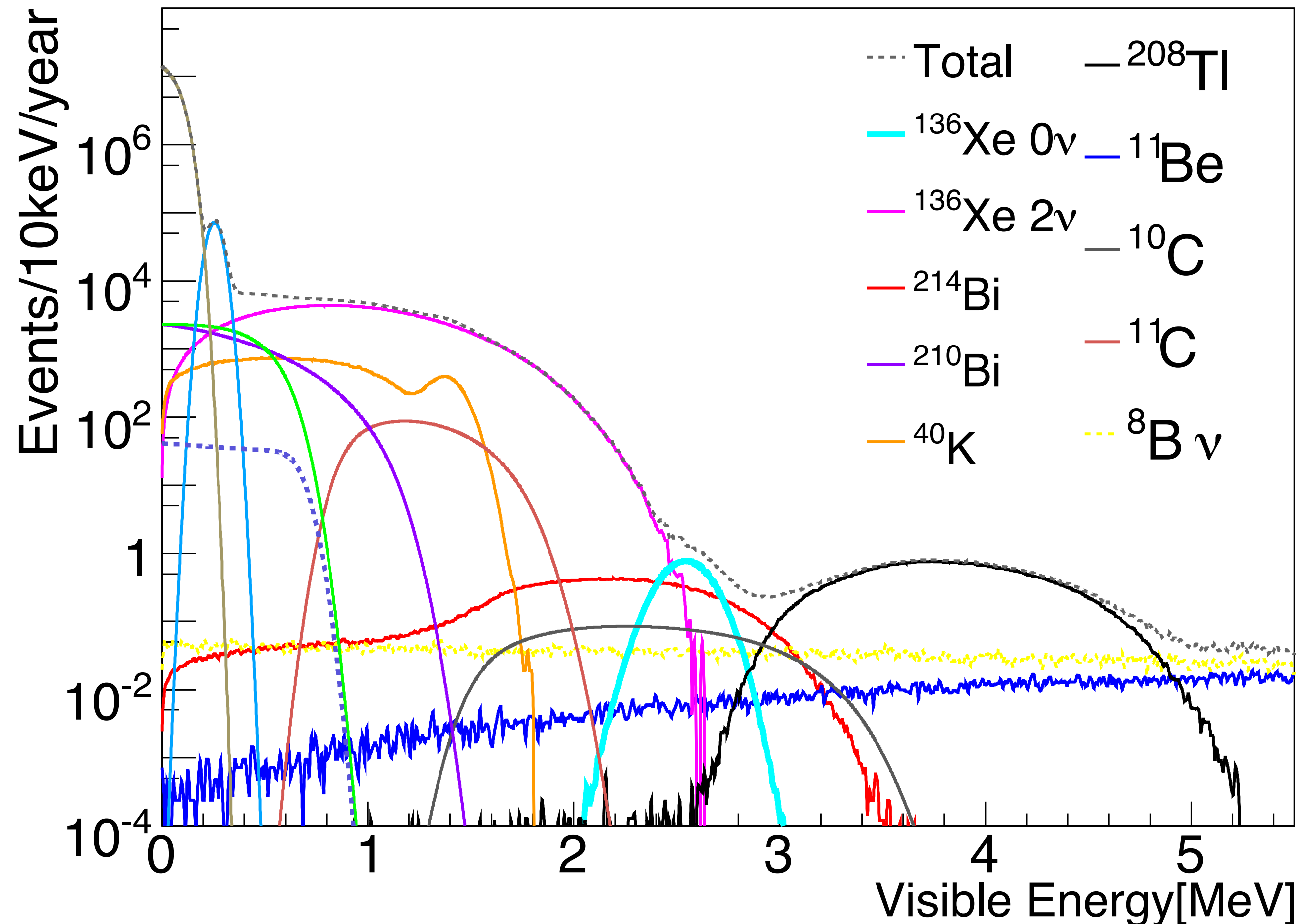
- $2\nu\beta\beta$
- Standard Model process
- Emits two neutrinos which carry away energy
- $0\nu\beta\beta$
- Violates lepton number
- Signal at the Q-value of the decay with width of σ_E
- Candidate isotopes: ^{48}Ca , ^{76}Ge , ^{82}Se , ^{96}Zr , ^{100}Mo , ^{116}Cd , ^{128}Te , ^{130}Te , ^{136}Xe , ^{150}Nd



Primary Backgrounds for $0\nu\beta\beta$

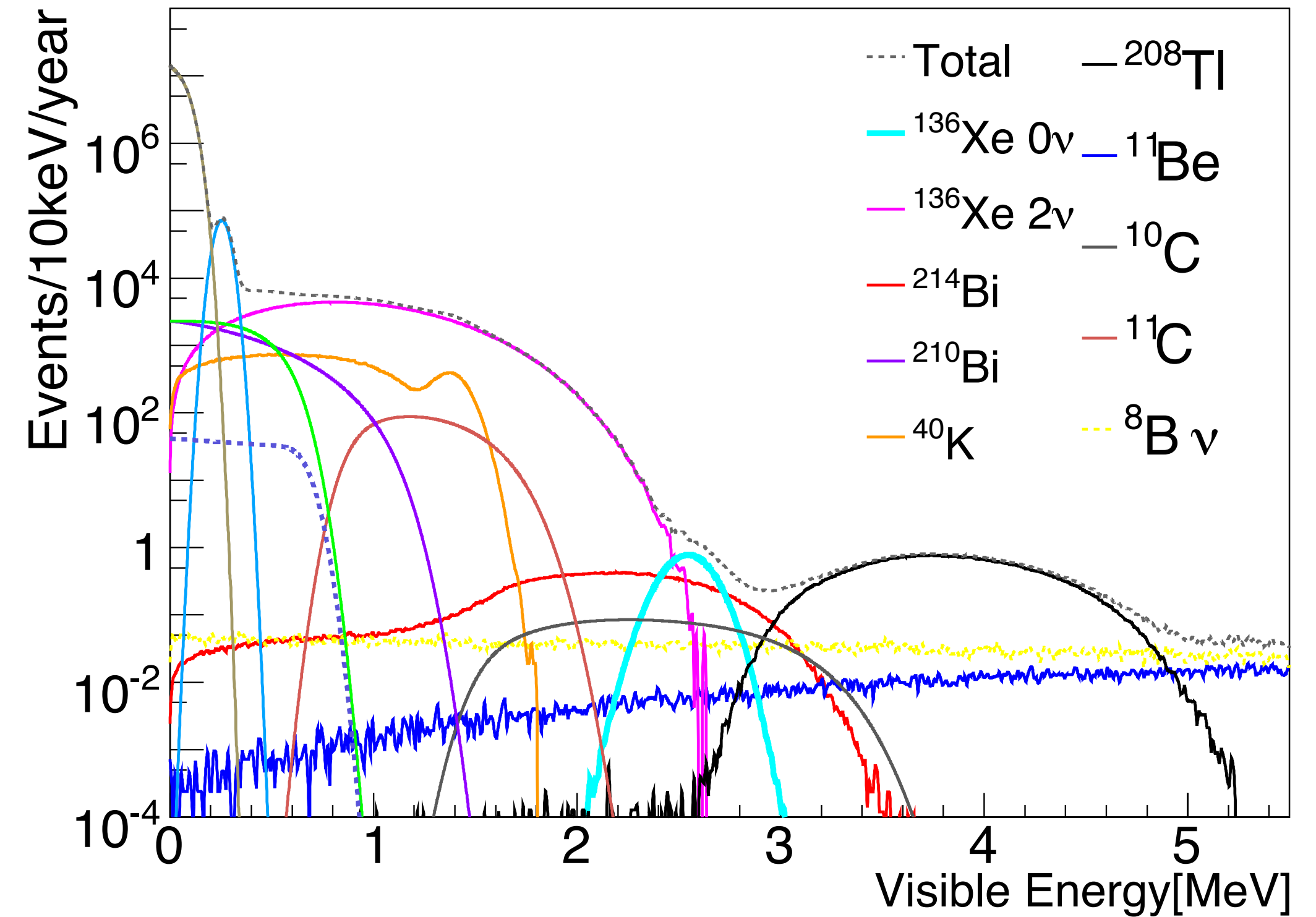
- Natural Radioactivity
 - ^{238}U
 - ^{232}Th
- Neutrino Backgrounds
 - Solar/Reactor ν
- Spallation Backgrounds
 - ^{10}C
 - ^{11}Be

KamLAND-Zen Simulated Background

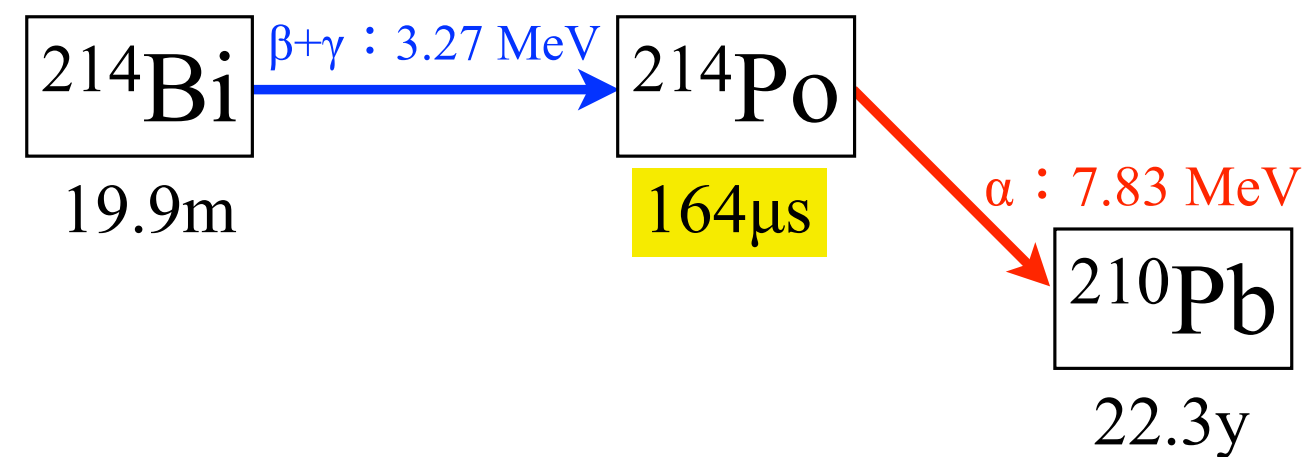


Natural Radioactivity

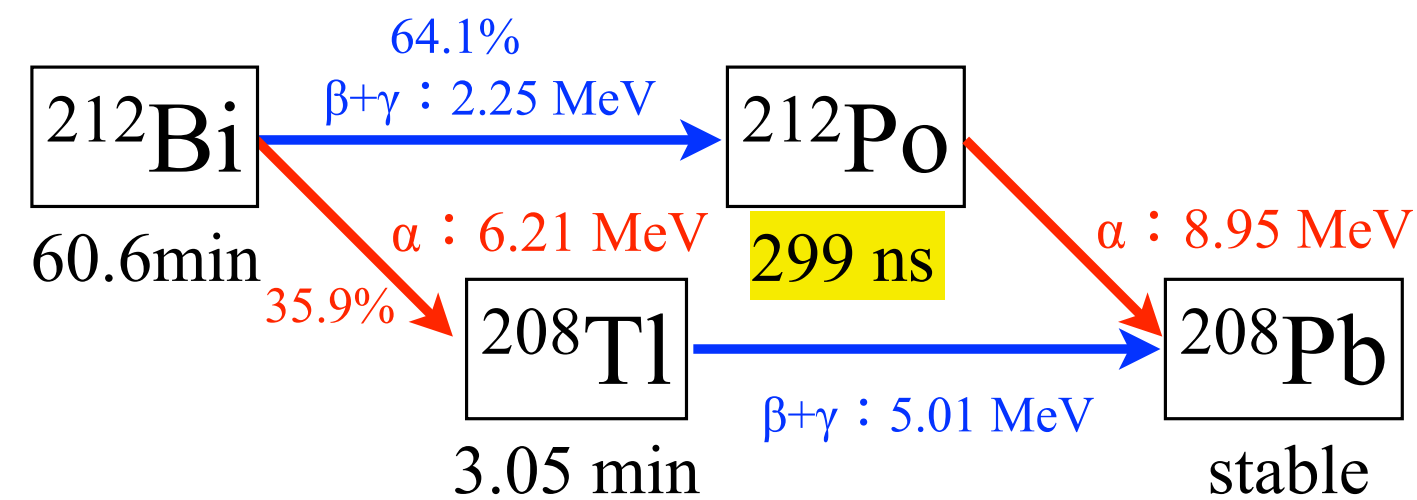
- Bi-Po Tagging
 - Need small dead time to reject ^{214}Bi .
 - Current efficiency is 99.97% in LS
- Ability to discriminate ^{212}Bi - ^{212}Po pile-up
 - Current efficiency is 89%
- Double coincidence to reject ^{208}Tl



(a) sub-chain of ^{238}U



(b) sub-chain of ^{232}Th

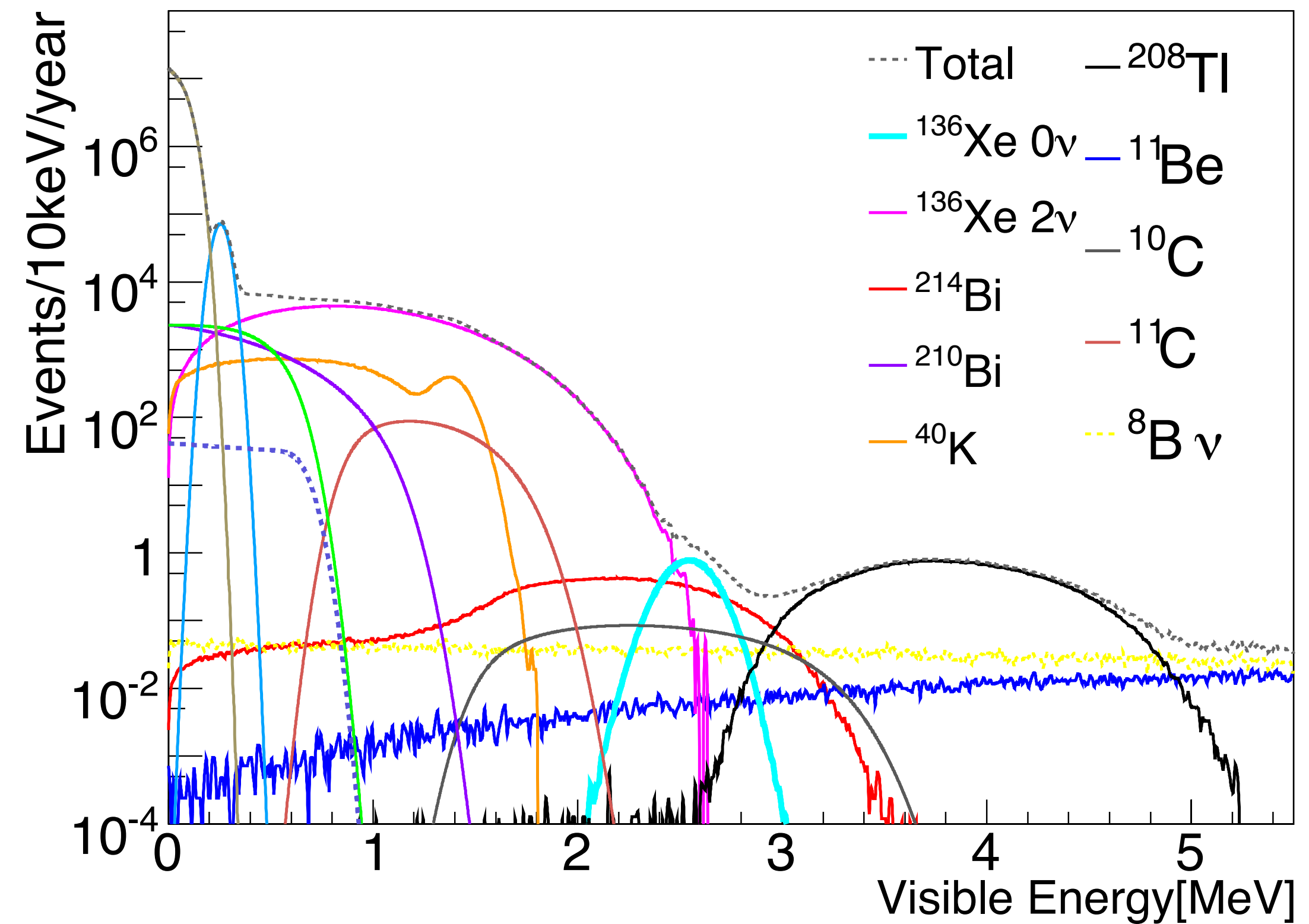


	Rate (events/day)
^{214}Bi - ^{214}Po	0.8
^{212}Bi - ^{212}Po	1.15
^{208}Tl	2.16

Spallation Backgrounds (in KZ)

- $(^{12}\text{C}+\mu\rightarrow^{10}\text{C}), (^{12}\text{C}+\mu\rightarrow^{11}\text{C})$, Spallation on Xe, . . .
- n produced in many of these reactions
- n lifetime in LS is 206 μs
- Ability to tag double or triple coincidence results in high efficiency removal of these backgrounds

	Q-Value	Lifetime	Production Rate cnts/day/kton
^{10}C	3.65	27.8s	21
^{11}C	1.98	20.4m	1110
^{11}Be	11.5	19.9s	1.4
(^{136}Xe)	?	?	negligible?



A Background Free Experiment

	5 year 1 kton experiment	
	Events in 2-3 MeV	Requirement for 0.1 events (roughly)
^{214}Bi	846	Need to be able to tag second decays separated by >19 ns
^{10}C	26061	Tag all neutrons, reject 10% of events with no neutron
^{212}Bi	?	
^{11}Be	140	

All numbers are approximate...