Comparison of Alpha/Beta Separation Performance of Commercially Available Scintillation Cocktails Counting by Quantulus™ 1220 Liquid Scintillation Counter

Shing-Fa Fang, Jeng-Jong Wang,Tzu-Wen Wang and Jih-Hung Chiu
Division of Health Physics, Institute of Nuclear Energy Research, 1000 Wen-Hua Road, Chiaan Village, Lungtan, Taoyuan, Taiwan, R.O.C.

Abstract

It is rapidly developing for determining gross alpha/beta activities in water samples by using low-level liquid scintillation counter equipped with an electric device. The electric device can separate alpha and beta events from radiations into their respective spectra by the characteristics of alpha and beta pulses. The electric device of Quantulus™ 1220 is termed as pulses shape analysis, PSA. The PSA value should be set properly to separate alpha/beta well. The pulse tail of beta would be longer as beta energy is higher. The beta with higher energy is easierly to be misjudged as the alpha in the counting. Four kinds of commercially available scintillation cocktails were tested to optimize the alpha/beta counting performances of the Quantulus™ 1220 in this study. Optiphase HiSafe 2 scintillation cocktail shows its good alpha/beta separation ability compared with other cocktails. An analysis method that uses Quantulus™ 1220 as counter and uses Optiphase HiSafe 2 as scintillation cocktail was well established for gross alpha/beta in water sample. The method had been used to participate in Quality Assessment Programe (QAP 54) of Environmental Measurements Laboratory and its result achieved the criteria for acceptable performance.

Key Word: Gross alpha/beta, Pulse shape analysis, PSA, Liquid scintillation counter, Scintillation cocktail.

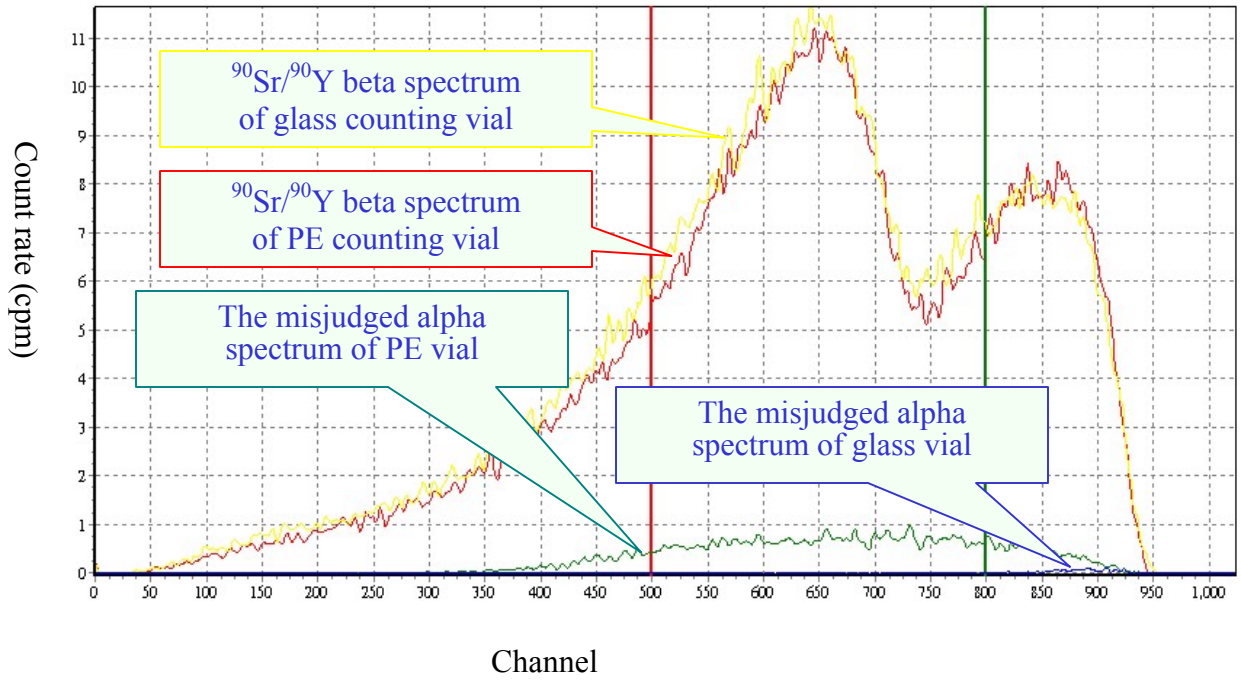

Fig. 1 The comparison of the misjudged alpha spectra of ^{90}Sr/^{90}Y beta emitter counted in different vials (HiSafe 2, PSA=100)

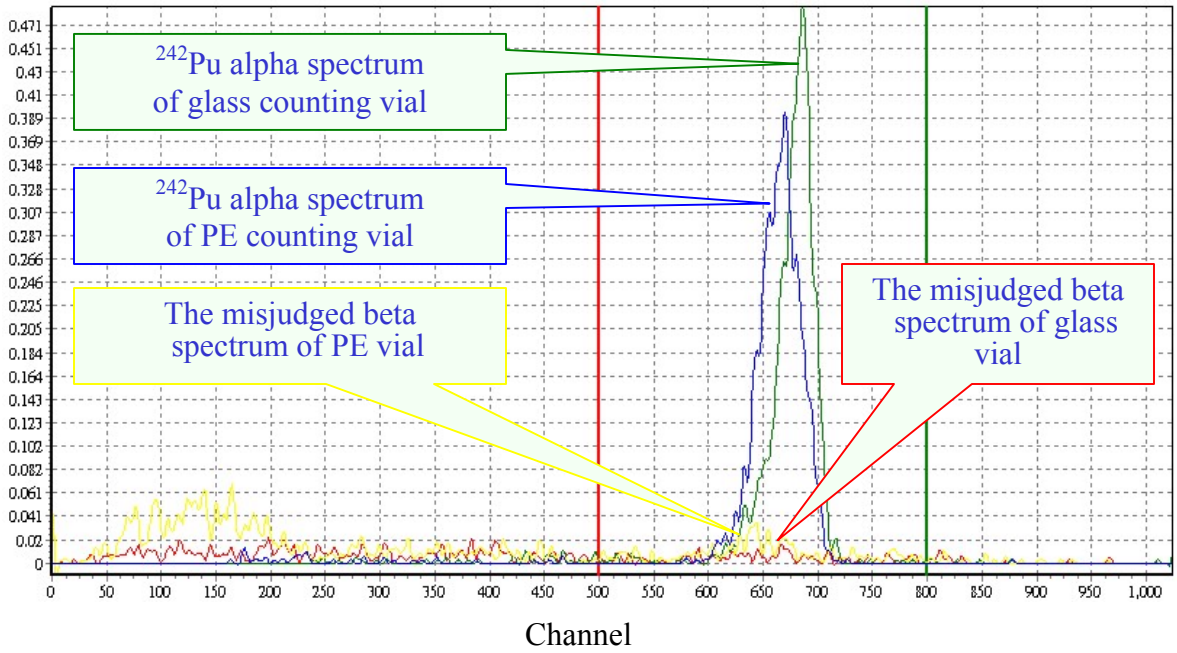

Fig. 2 The comparison of the misjudged beta spectra of ^{242}Pu alpha emitter counted in different vials (HiSafe 2, PSA=100)

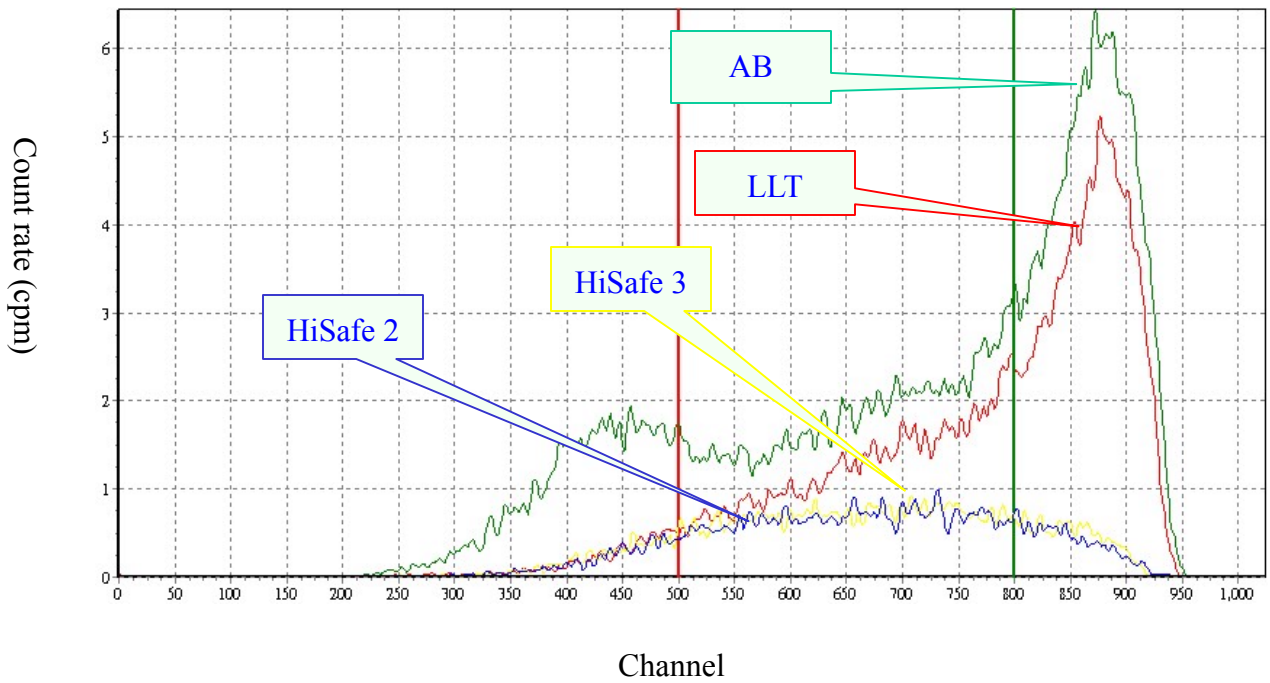

Fig 3 The misjudged alpha spectra of $^{90}Sr/^{90}Y$ beta spectrum for the four kinds of scintillation cocktails counted in PE vial (PSA=100)

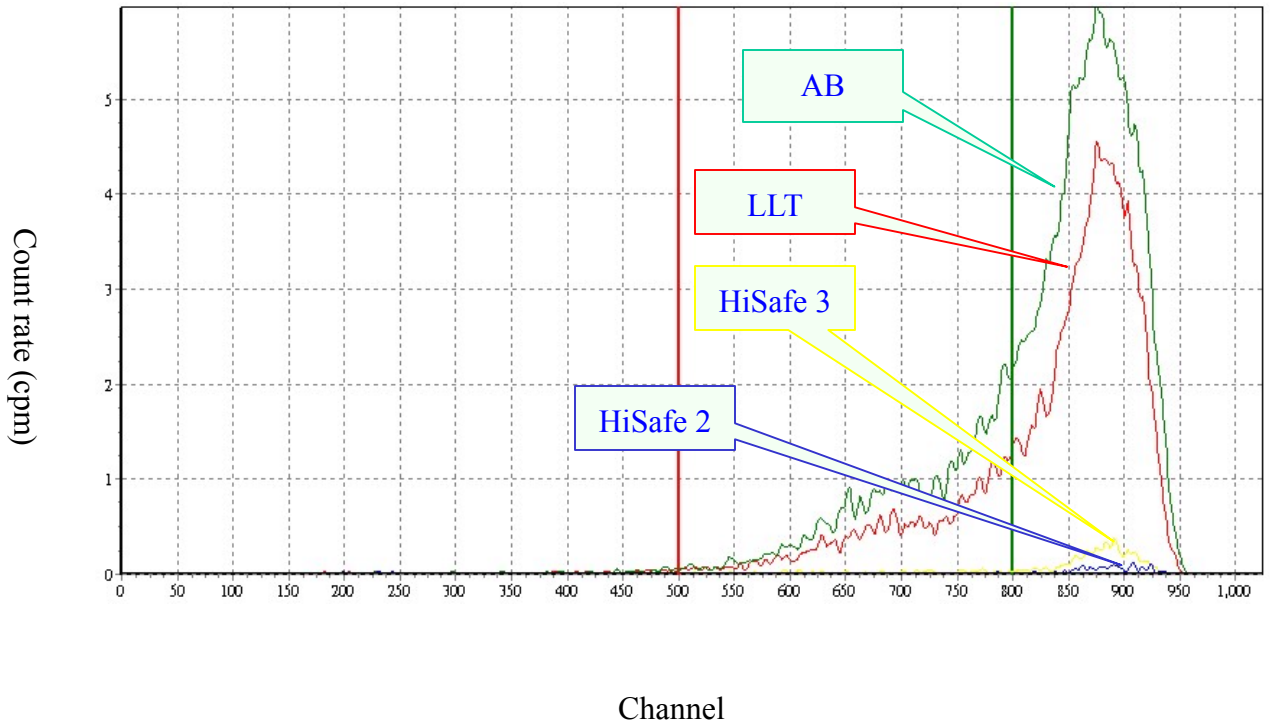

Fig 4 The misjudged alpha spectra of $^{90}Sr/^{90}Y$ beta spectrum for the four kinds of scintillation cocktails counted in glass vial (PSA=100)

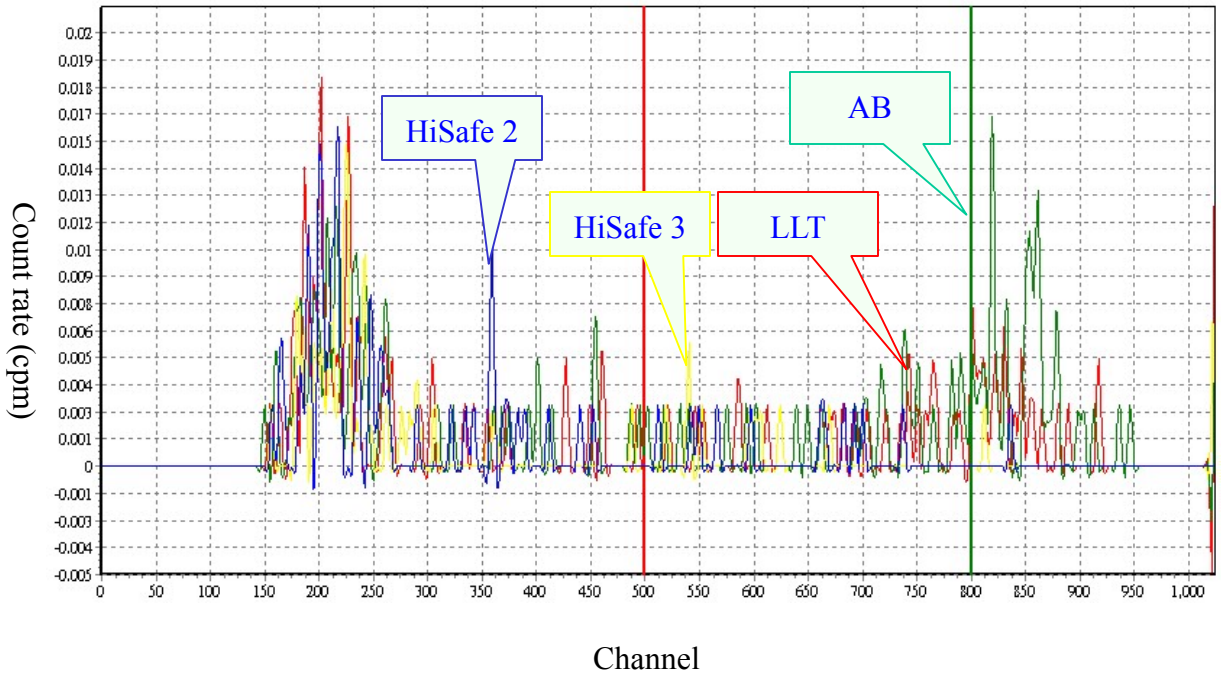

Fig 5 The beta background spectrum of the four kinds of scintillation cocktails in PE vial

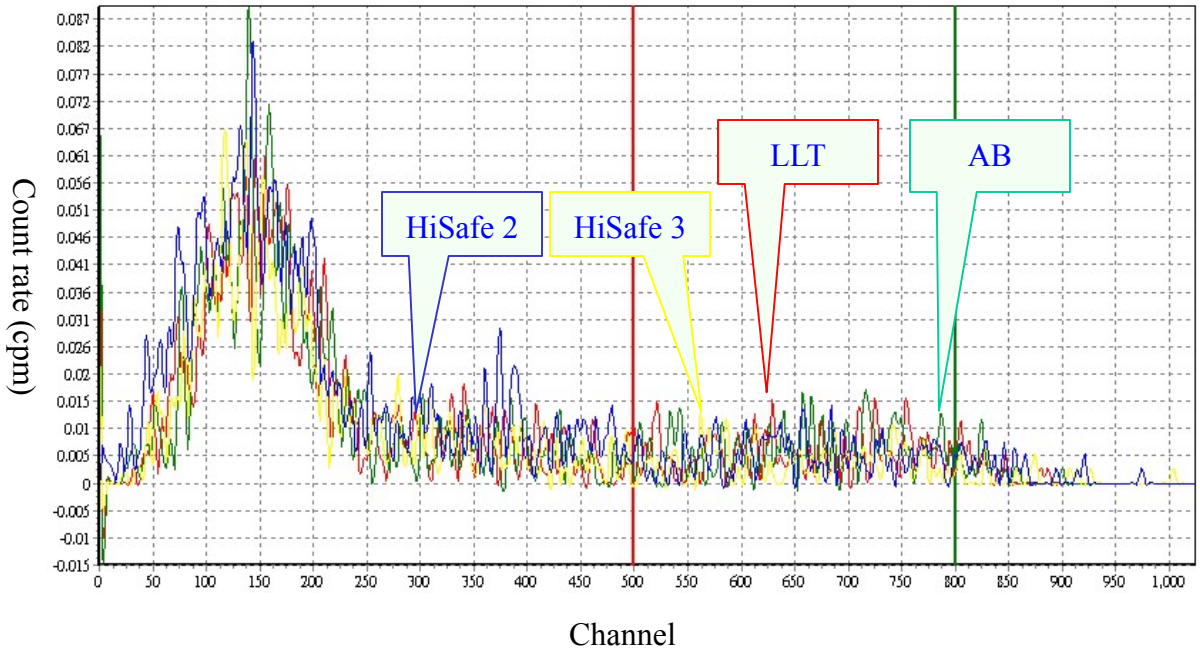

Fig 6 The alpha background spectrum of the four kinds of scintillation cocktails in glass vial

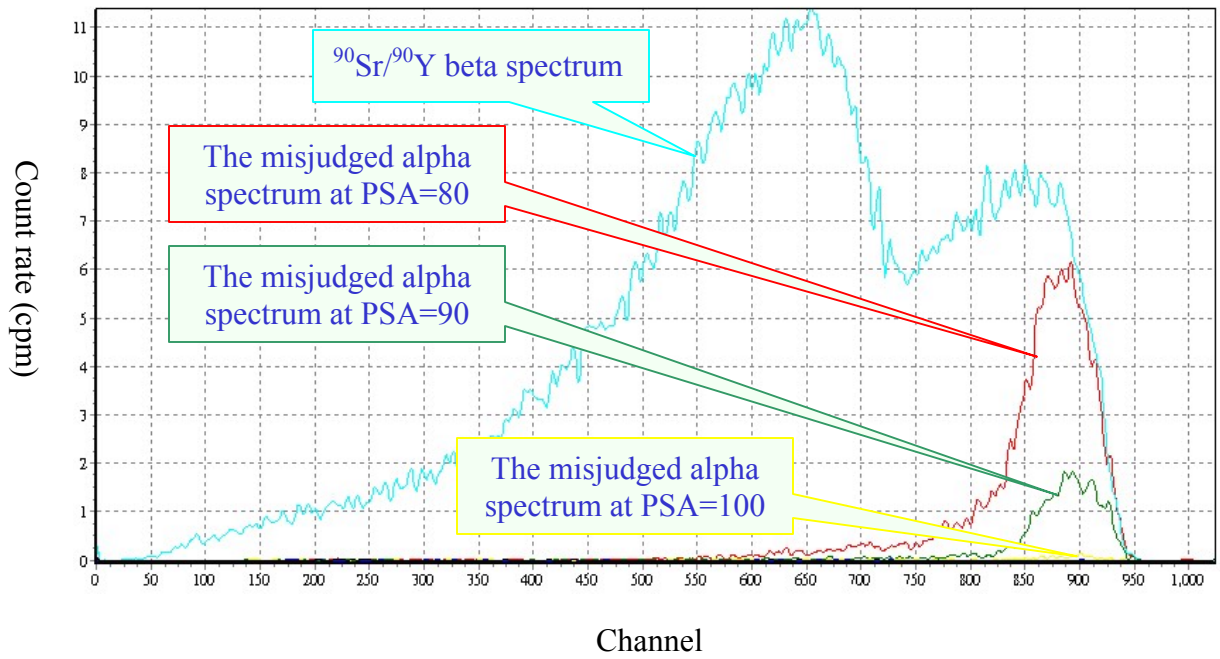

Fig. 7 The misjudged alpha spectrum of 90Sr/90Y beta emitter at different PSA value
（HiSafe 2, glass vial）

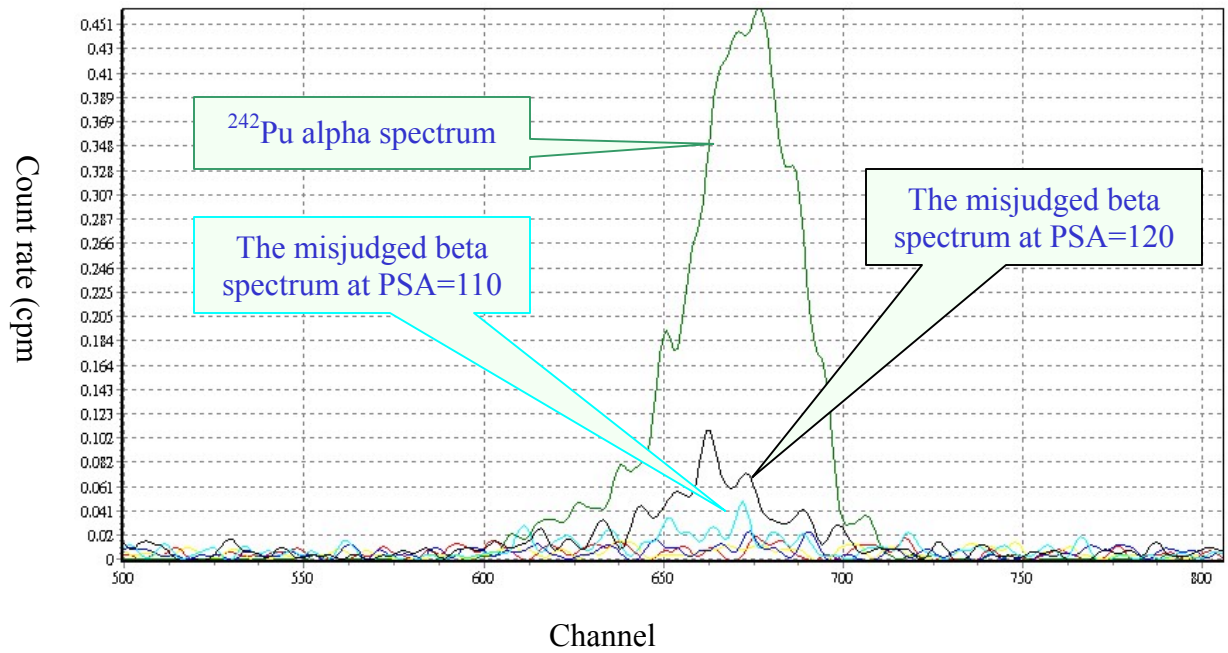

Fig. 8 The misjudged beta spectrum of ^{242}Pu alpha emitter at different PSA value
（HiSafe 2, glass vial）