

Effect of Gamma Window Setting on Activity Measurement of ^{134}Cs by $4\pi\beta\gamma$ Coincidence Method

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Caesium-134 (^{134}Cs) is one of the radiocaesium released to the environment when a nuclear accident occurs. This characteristic makes the information on the activity level of ^{134}Cs essential to determine this radionuclide's distribution in the environment. One method that can be used to determine the activity of ^{134}Cs without the necessity for an external standard is the $4\pi\beta\text{-}\gamma$ coincidence counting method. This method determines the activity value based on an efficiency function developed by considering both the detector's response and the radionuclide's decay scheme parameters. The ^{134}Cs have a complex decay scheme with four different paths of β -emission and eleven γ -emissions to the ground state of ^{134}Ba . The complex decay scheme allows the activity measurement of this radionuclide to be performed at different gamma window settings. The fact that there is no single beta-gamma coincidence path makes the selection of gamma window settings might affect the efficiency function used to determine the activity value. From five gamma window settings used in this work, only the gamma window setting around the 795.86 keV gives a linear efficiency function for the whole β -efficiency range, while other settings show some slope changes when the β -efficiency reach under 50%. Applying the extrapolation technique to a specific range of the β -efficiency gives a less than 0.5% difference of activity values obtained from the five different gamma window settings. The mean of these values is used as the final activity value of ^{134}Cs , which is (1145.5 ± 5.0) kBq/g at the reference date with the quoted uncertainty evaluate at $k = 1$. This paper describes in detail the settings of the five gamma windows and the factor that causes the slope changes in some gamma window settings.

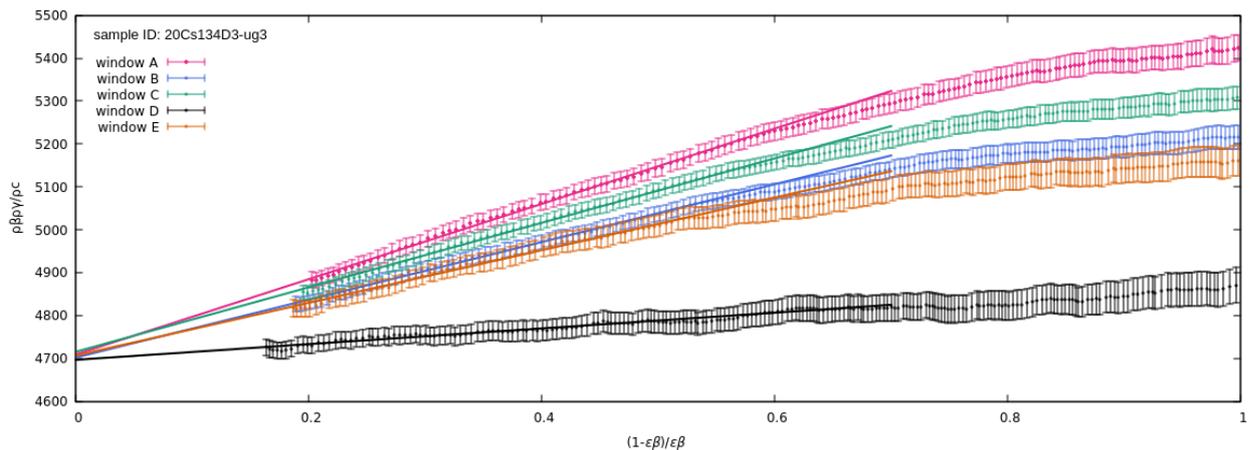


Fig. 1. Typical efficiency curve of ^{134}Cs measurements at five different gamma windows.

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