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Half-life Estimation by Statistical Sampling

The half-life of a radionuclide represents the amount of time it takes for one half of the radioactive atoms to decay. Experimental measurements of radionuclides have consistently shown that they follow a pattern of exponential decay and that there is no way to influence the rate of decay. Because of this constant rate of decay, it is possible to calculate the half-life of a radionuclide from observations of the activity of a pure sample. Traditionally this is done by observing a sample for a sufficiently long time period in comparison to its half-life. Then, the amount of counts detected is graphed against time and an exponential fit is found using least squares regression. Finally, the half-life is derived from the exponential fit that was found for the data set. A recently developed alternate method uses statistical sampling instead to estimate a sample's half-life. This method is theoretically better than using exponential regression, but the two methods have not been compared using experimental data. This research seeks to determine the effectiveness of statistical sampling as a half-life estimation technique along with determining whether its theoretical benefits hold true when the method is used with experimental data.