

Measurement of the half-life of the $T=1/2$ mirror decay of ^{29}P

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Mixed Fermi and Gamow-Teller transitions between $T = 1/2$ mirror nuclei are mediated by both the vector and axial-vector component of the weak interaction. Thus, the extraction of V_{ud} from this transition requires the measurement of ft value and any one of the angular-correlation coefficients. ^{29}P is a mixed Fermi and Gamow-Teller transitions and the relatively large uncertainty contribution in the V_{ud} value is dominated by the precision of ρ , the ratio of Gamow-Teller to Fermi matrix elements, which was obtained from a $\pm 12\%$ measurement of the beta asymmetry parameter, A_β [1]. The ft value [2] is known much better, to $\pm 0.4\%$, with the largest contribution to its uncertainty being the lifetime of the decay. The aim of the present work is to improve the lifetime of ^{29}P so that it no longer dominates the uncertainty in the deduced ft value.

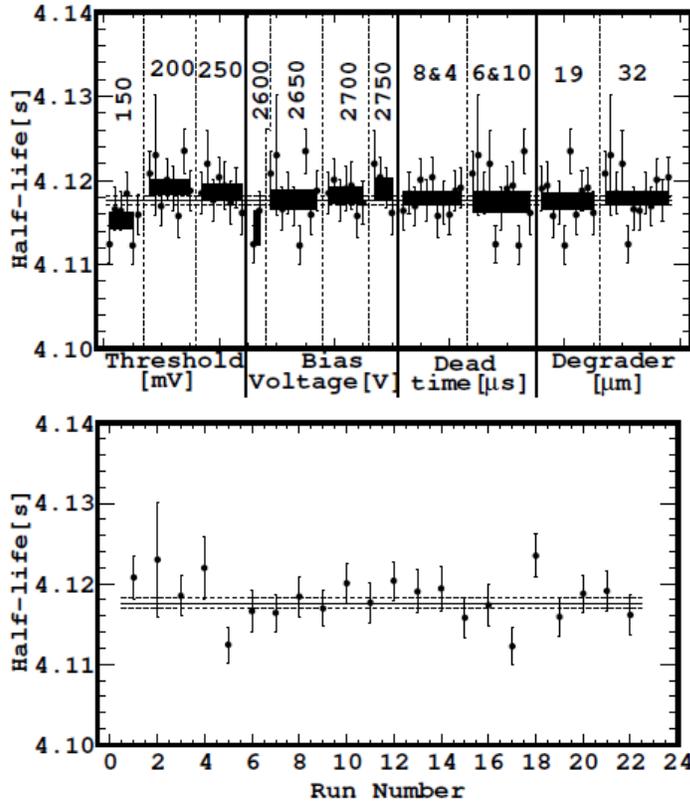


Fig. 1. The half-life obtained for ^{29}P with different experimental conditions. The bottom panel shows the result from all 22 runs. In the top panel the results from all 22 runs appear four times, grouped by threshold settings, bias voltages, deadtime and degrader thickness. The gray bands represent the limits of the average half-life for a given condition. The average value for all the runs appears as solid horizontal line, with the corresponding dashed lines as the statistical uncertainty limits.

After sorting the data last year, the data for all the runs were analyzed and different type of systematic studies were carried out to estimate the dependence of the deduced half-life on experimental conditions, e.g. count rates, detector thresholds, gas-counter bias voltages, etc. Fig. 1 shows the half-life obtained for ^{29}P with different experimental conditions.

The analysis indicates that the half-life of ^{29}P is 4.1217(26) s, where the 2.6 ms uncertainty is purely statistical. We do see a systematic dependence on the “channel-chopping” analysis (removing early times from the fit, which shouldn’t change the deduced lifetime). The data is being independently analyzed by other member of the group to cross check the analysis and attempt to limit/remedy this systematic uncertainty; if unsuccessful, we will take new data after doing some maintenance on our fast-tape transport system and thoroughly re-characterizing the gas-proportional counter.

[1] G.S. Masson and P.A. Quin, Phys. Rev. C **42**, 1110 (1990).

[2] N. Severijns, M. Tandecki, T. Phalet, and I.S. Towner, Phys. Rev. C **78**, 055501 (2008).