Precise Half Life Measurement of $^{10}$C V.E. IACOB, V. GOLOVKO, J. GOODWIN, J.C. HARDY, N. NICA, H.I. PARK, L. TRACHE, R.E. TRIBBLE, Cyclotron Institute, Texas A&M University — We have measured the half-life of $^{10}$C as part of our program to test the unitarity of the Cabibbo-Kobayashi-Maskawa (CKM) matrix via $0^+ \rightarrow 0^+$ superallowed $\beta$ transitions. The $^{10}$C half-life has been measured twice before, with precisions of 0.10% and 0.08%. With our current techniques, we expect to be able to improve that precision by a factor of two. To obtain $^{10}$C, we used a $^{11}$B primary beam at 23.4 MeV to bombard a cryogenic hydrogen target. From the reaction products, a high purity $^{10}$C beam of 18.5 A MeV was produced by the MARS spectrograph. The beam was then extracted in air, passed through a 0.3-mm-thick BC-404 plastic scintillator and a set of Al degraders, which had been adjusted so that the $^{10}$C nuclei stopped in the center of the 76-$\mu$m-thick aluminized-mylar tape of our fast tape-transport system. We collected $^{10}$C nuclei for 10, 15 or 20 s; then the beam was switched off and the activity was moved in less than 0.2 s to the center of a $4\pi$ proportional counter, located in a well shielded region. The observed decays were then multi-scaled over a 400 s time span. To ensure an unbiased result, we split the experiment into several runs, each differing from the others in its discriminator threshold, detector bias or dominant dead-time setting. The analysis of these separate runs showed no systematic bias with these parameters. Our preliminary result is $t_{1/2}^{(10)C} = 19.313(10)$ s, a result with 0.05% precision.

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