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High-Precision Half-Life Measurements for the Superallowed β^+ emitter ^{10}C

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High precision measurements of superallowed Fermi beta transitions between 0^+ isobaric analogue states allow for stringent tests of the electroweak interaction described by the Standard Model. In particular, these transitions provide an experimental probe of the unitary of the Cabibbo-Kobayashi-Maskawa (CKM) matrix, the Conserved-Vector-Current (CVC) hypothesis, as well as set limits on the existence of scalar currents in the weak interaction. Half-life measurements for the lightest of the superallowed emitters are of particular interest as it is the low-Z superallowed decays that are most sensitive to a possible scalar current contribution.

The half-life of ^{10}C can be measured by directly counting the β particles or measuring the γ-ray activity following β decay. Previous results for the ^{10}C half-life measured via these two methods differ at the 1.5σ level, prompting simultaneous and independent measurements of the ^{10}C half-life using both techniques. Since ^{10}C is the lightest nucleus for which superallowed β decay is possible, a high precision measurement of its ft value is essential for obtaining an upper limit on the presence of scalar currents in the weak interaction.

Measurements of the ^{10}C half-life via both gamma-ray photo-peak and direct beta counting were performed at TRIUMF's Isotope Separator and Accelerator (ISAC) facility using the 8π spectrometer and a 4π gas proportional β counter at the ISAC General Purpose Station. The 8π γ-ray spectrometer consists of 20 High Purity Germanium (HPGe) detectors as well as the Zero Degree β detector, a fast plastic scintillator located at the end of the beam line within the 8π. This presentation will highlight the importance of these measurements and preliminary half-life results for ^{10}C will be presented.

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