Canadian Penning Trap: Q-Values of Superallowed Beta Transitions

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The collaboration based on the Canadian Penning Trap (CPT) Mass Spectrometer has continued to measure atomic masses related to superallowed $\beta$ decay. Our result for the $Q_{EC}$ value of $^{46}$V, 7052.90(40) keV, which was reported in last year’s Annual Report, has recently been published [1]. It was the first Penning-trap measurement of the $Q_{EC}$ value of a “well known” superallowed transition and it disagrees significantly with the previously accepted value of 7050.71(89) keV, a survey result [2] principally based on a 30-year-old measurement [3] of the $^{46}$Ti ($^3$He,t) $^{46}$V reaction Q-value. Since the $Q_{EC}$ values for all the best known superallowed transitions are currently based on reaction measurements, this raised concern [4] that there could be a previously undetected systematic error in all reaction measurements which, when corrected, might lead to a significant shift in $V_{ud}$ from the value obtained in the survey.

In the past year, the collaboration has measured masses from which the $Q_{EC}$ values for $^{10}$C, $^{14}$O, $^{26}$Al$^m$, $^{34}$Cl, $^{38}$K$^m$ and $^{42}$Se will be extracted. The data are still being analyzed.