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The phase-imaging ion-cyclotron-resonance detection technique used at ISOLTRAP/CERN

The Penning-trap mass spectrometer ISOLTRAP located at the radioactive ion beam facility ISOLDE at CERN performs high-precision mass measurements of short-lived nuclides. This gives access to the study of nuclear structure effects like the location of shell and subshell closures and provides precision β-decay Q-values to test nuclear models and fundamental interactions. For three decades the measurement principle has been based on the time-of-flight ion-cyclotron-resonance (ToF-ICR) detection technique, which is currently reaching its limits for accessible half-lives and relative uncertainties. With the new phase-imaging ion-cyclotron-resonance (PI-ICR) detection technique [S. Eliseev et al., Phys. Rev. Lett. 110 082501 (2013)], experiments can be performed with fewer ions and higher resolving power, providing access to new areas of the nuclear chart. This poster will report on the ion-optical and data-acquisition improvements required for the implementation of the PI-ICR detection technique at ISOLTRAP, as well as results from first on-line measurements in both the high-precision and high-resolution regimes. During a systematic on-line study the Q-value of the ^{88}Sr-^{88}Rb β-decay was determined with an uncertainty of < 130 eV as a validation of the successful implementation of the PI-ICR detection technique with ISOLTRAP. Furthermore, the new detection technique allowed spatial separation of the close-lying isomeric states in ^{127}Cd and ^{129}Cd from which their excitation energy was derived. A mass resolving power $\frac{m}{\Delta m} > 10^6$ was reached for only 100 ms phase-accumulation time.

Summary

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