QUANTUM STATE SELECTIVE DECAY SPECTROSCOPY OF ^{213}Ra & ^{53}Co

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By combining the mass resolving power of a Penning trap with the charged-particle-γ multicoincidence setup TASISpec it was possible to investigate and revise the decay path of the ^{213}Ra ground state and the proton-decay branch of the 3174-keV, $19/2^-$ isomer in ^{53}Co. Together with comprehensive Geant4 simulations, high-resolution quantum-state selective decay spectroscopy enables insight in regions far from the line of β stability where the preparation of isotopically clean sources and thus unambiguous decay information becomes most essential and challenging.
The experimental scheme has been realized at GSI Darmstadt where a ^{48}Ca beam, provided by the UNIversal Linear ACcelerator (UNILAC), was impinging on a thin ^{170}Er target foil. The reaction products went through standard velocity filtering in the Separator for Heavy Ion reaction Products (SHIP), then the nuclear ground state of ^{213}Ra was mass-selected in SHIPTRAP and transferred to the TASISpec decay-station. Although ^{213}Ra has been subject to many studies, the α/EC-branching of the ^{213}Ra ground state has been unchanged since the first studies nearly 50 years ago. In a similar manner the Penning trap JYFLTRAP at the end of the IGISOL-4 facility at the University of Jyväskylä, Finland was utilized to provide a clean beam of ^{53}Co^m. It is the first direct measurement of its proton decay branching ratio after more then 40 years after its discovery.
These two experiments exemplify the immense potential of high-resolution quantum-state selective decay spectroscopy.