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BETA-DECAY SPECTROSCOPIC STUDIES OF THE NEUTRON-RICH 211,212,213Tl and 219Bi ISOTOPES

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The study of the beta-decay process in heavy neutron-rich systems is of main importance to probe the nuclear models used in r-process calculations. Experimental evidence is particularly interesting in nuclei approaching the waiting point A~195, since the r-process nuclei are still inaccessible in laboratory and the beta-decay models used to extrapolate their properties show strong discrepancies in their predictions [1,2].
Here we present the first results of an experiment focused on the investigation of the neutron-rich Tl isotopes, carried out within the "Stopped beam Campaign"of the RISING collaboration at GSI. The nuclei of interest were produced in fragmentation reactions of a relativistic Uranium beam impinging on a thick Be target. The residues were subsequently identified in the magnetic spectrometer Fragment Separator (FRS) and were finally implanted in the RISING Active Stopper [3]. This device consisted of nine Double Sided Silicon Strip Detectors (DSSSD) that recorded the position and time of implantations and beta-electrons. The characteristic gamma-ray transitions of the daughter Pb nuclei were registered using the RISING gamma-ray spectrometer [4], placed in close isotropic geometry around the Active Stopper.
The event-by-event position and time correlations between implantations and gamma-labeled radioactive electrons allowed us to measure the beta-decay half-lives of 211,212,213Tl, as well as the low-energy structure of their daughter nuclei 211,212,213Pb. The comparison of the new lifetimes with the calculations of the nuclear models proposed to describe the r-process provides a significant experimental constraint to their validity near the third r-process abundance peak, confirming previous half-life measurements near the shell closure N=126 [5-7].

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