The reactions $^{50}Ti+^{206,208}Pb$ studied at TASCA

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Cross sections of the 1n and 2n evaporation channels of the complete fusion reactions $^{50}Ti + ^{206,208}Pb$ were measured. Selected beam energies correspond to the known or expected maxima of the 1n and 2n excitation functions. Evaporation residues (ER) were separated from the primary beam by TASCA [1] and implanted into a stop detector consisting of two double-sided silicon-strip detectors (DSSD). Two signals from the DSSD were read out and processed in analog (front strips) and digital electronics (back strips) as described in [2].

Rf isotopes were identified in a correlation analysis between the ER implantation signal and the subsequent radioactive decay (alpha emission or/and spontaneous fission (SF)).

Half-lives were deduced from the measured time distributions (see Fig. 1) and agree well with literature values [3]. Time distributions of the correlated alpha or/and SF decays of these isotopes are shown in Fig. 1 together with fits of the universal time distribution function [4].

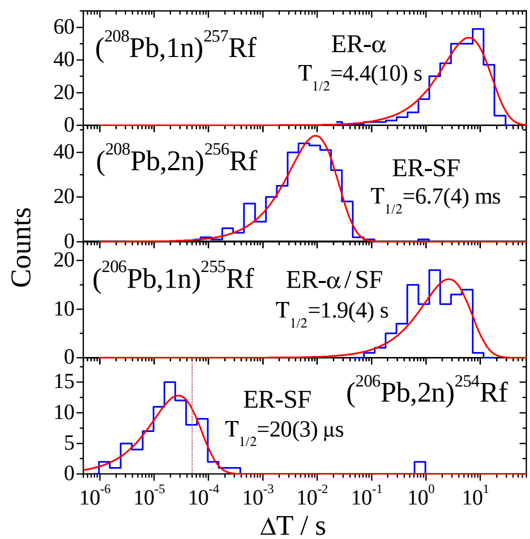

Fig 1: Time distribution of α/SF decays of $^{254-257}$Rf. The dotted line indicates the minimum readout time of the combined DAQ system.|

Both analog and digital data were evaluated for the identification of short-lived ^{254}Rf.

The analog energy *vs.* correlation time plot for ER-SF correlations is shown in Fig. 2a. This energy is the uncorrected pulse height recorded in the stop detector, applying a calibration with an external α-source. Traces of two SF events (circled in Fig. 2a) are shown in Fig. 2b as illustrative examples. The energies recorded by the analog electronics were 94 and 150 MeV. In the digital part both traces saturate due to the pre-amplified SF signals, which are higher than the input voltages of the sampling ADC. However, the saturation time, T_{sat}, can be related to the SF energy. A typical trace of an ER correlated with a short-lived SF is shown in Fig. 2c. Such digital data were exploited in the analysis of ^{254}Rf data given in Fig. 1. Note that such events result in a single ER event in the analog electronics and fast decays of ^{254}Rf would be lost.

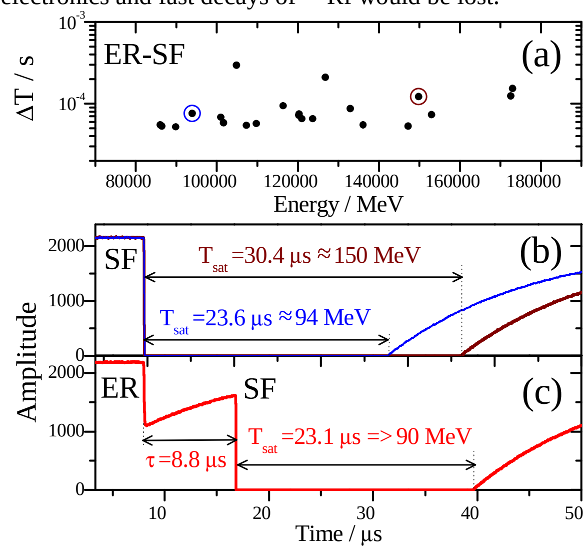

Fig 2: (a) Energy *vs.* correlation time plot. (b) Two traces of SF events selected from the analog ER-SF correlations. (c) Trace of an ER followed by a short-lived SF.

The cross section values for $^{50}Ti(^{208}Pb,1\text{-}2n)^{256,257}Rf$ and $^{50}Ti(^{206}Pb,2n)^{254}Rf$ were in agreement with the values measured at SHIP [5]. The cross section around the expected maximum for the $^{50}Ti(^{206}Pb,1n)^{255}Rf$ excitation function was measured for the first time. The data are currently under final analysis.

References

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