Experimental report

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Proposal: 3-01-663 **Council:** 4/2018

Title: Fast timing measurements of excited level lifetimes in the 94,95Y isotopes

Research area: Nuclear and Particle Physics

This proposal is a new proposal

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Samples:

Instrument	Requested days	Allocated days	From	To
PN1	19	9	12/09/2018	21/09/2018

Abstract:

We propose the measurement of the B(M1,3-1 -> 2-1) value in 94Y and the B(E2,5/2-1 -> 1/2-1), B(M1; 5/2- -> 3/2-), B(M1; 3/2- -> 1/2-) values in 95Y by using the fast timing technique with LaBr3(Ce) detectors in the decay of mass-separated microsecond isomers with the LOHENGRIN recoil separator. The obtained results will be compared with the state-of-the-art shell-model calculations.

Experimental report

Fast timing measurements of excited level lifetimes in the ^{94,95}Y isotopes

The current experiment aims at detailed investigation of the properties of states populated in the decay of low-spin isomers in the ^{94,95}Y isotopes, by measuring their lifetimes.

In the case of the ^{95}Y isotope, the 52.6-μs, $9/2^+$ isomer has been investigated as a product of the fission of a ^{235}U target, separated by LOHENGRIN spectrometer while $LaBr_3$(Ce) detector setup was used to measure the lifetimes of the nuclear excited states in picoseconds range. The levels of interest were populated directly from the isomer via the 261- and 402-keV transitions having $5/2^-$ and $3/2^-$ assignments, respectively. Based on the observed lifetimes, the set of the transition probabilities values will be determined i.e. B(E2; $5/2^- \rightarrow 1/2^-$), B(M1; $5/2^- \rightarrow 3/2^-$), B(M1; $3/2^- \rightarrow 1/2^-$) for 827-, 141-, and 686-keV lines, respectively. A part of the experiment which regards the ^{94}Y isotope assumes study of the decay branch from the (5^+), 1.35-μs isomer, in particular, the lifetime of the strongly populated (3^-) level with fast timing technique.

Both measurements have been performed in September 2018 using LOHENGRIN mass spectrometer. The nuclei of interest were produced in the thermal-neutron-induced fission of a ^{233}U target, mass-separated. Gamma rays emitted from the stopped fragments were detected by four $LaBr_3$(Ce) detectors surrounding the focal point.

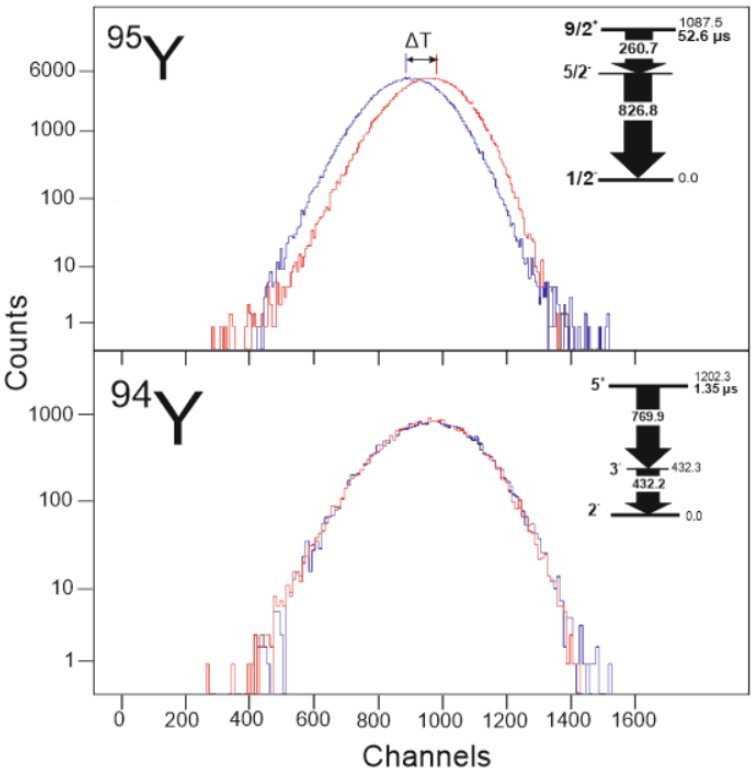

FIG. 1. $LaBr_3$(Ce) ɣ - ɣ time distributions of the $5/2^-$ (top) and 3^- (bottom) states in ^{95}Y and ^{94}Y, respectively.

The experimental setup worked very well allowing for collect statistic sufficient for accurate data analysis. The analysis is based on the technique of electronic fast timing determining the lifetime of a nuclear state through the time difference between two measurement signals (start and stop). The preliminary results from the current measurement is shown on Fig. 1 where the time difference curves corresponds to the lifetimes of the $5/2^-$ state in ^{95}Y and 3^- in ^{94}Y isotopes are displayed. The analysis and interpretation of the results in ongoing.