Isomeric state studies using the DTAS detector

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In this contribution we present preliminary work aimed to assess the capabilities of the DTAS detector to study isomeric states. They are of particular interest, since they can provide information about nuclear structure. They are also relevant in the analysis of total absorption data, since they may break the continuity of emitted gamma-ray cascades from high lying states populated in beta decay. This contribution is related to experiment NP1612-RIBF147,[1)] which focuses on the study of the beta decay of ^{100}Sn and neighbouring nuclei using the DTAS modular total absorption spectrometer[2)] and the AIDA implantation detector.

In the study, we developed analysis tools to look for nuclei with unknown isomeric states in the vicinity of ^{100}Sn using DTAS in combination with the in-flight radioactive ion beam separator BigRIPS. This setup allows one to study the gamma rays of a particular isomeric decay, looking for time correlations between ions identified in BigRIPS and the associated gamma cascade detected in DTAS, taking advantage of its high efficiency. In our analysis two dimensional spectra were generated where in one axis we have the time difference between the time of correlated gamma events detected in DTAS modules and the ion implantation time provided by BigRIPS and on the other axis we have the energy detected by the DTAS individual modules. Isomeric states should be seen in this figure as gamma transitions (or levels) vanishing as time differences increase. The very high efficiency of the DTAS detector to gamma cascades can be an asset in this context.

To test the viability of the procedure we have studied the ^{98}Cd case, which has a high production rate in our experiment and has well known isomeric states. The gamma cascade data obtained with the DTAS detector from the de-excitation of ^{98}Cd isomeric decay populated in the fragmentation reaction can be compared with data obtained previously from high resolution experiments using germanium detectors.[3)]

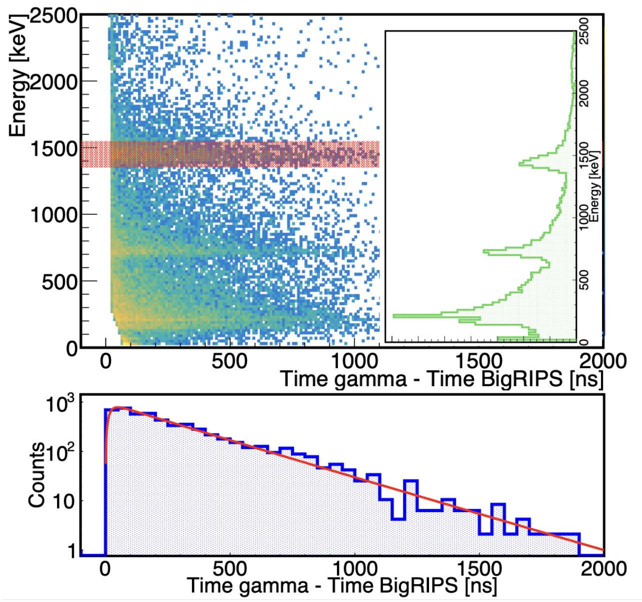

Fig. 1. Top: 2D figure corresponding to a ^{98}Cd gamma cascade detected in DTAS and its energy projection. Bottom: Fit of the the time projection of a gate around the ∼1400 keV energy peak marked in the upper panel.

The comparison between the half-lives from the literature[3,4)] and the results from our preliminary analysis shows the validity of the method. In the analysis of the lower states, feeding from above is taking into account.

Level	Literature[3,4)]	Present Work
12^+	224(5) ns	216(7) ns
8^+	154(16) ns	150(3) ns
6^+	13(2) ns	11(1) ns

In the next step we plan to systematically look for isomers produced in our experiment.

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