Magnetic moment measurement of isomeric state in $^{99}$Zr and characterization of the abrasion-fission mechanism


The region of neutron-rich isotones N=59 is on the border of a sudden change of the ground state shape of nuclei. A direct consequence is the existence of many nuclei with isomeric states in this region. These nuclei are well produced by fission. Measuring the magnetic moment of these states often allows a clear determination of their single-particle structure and allows us to determine the spin parity of the isomeric state. The production of spin-aligned nuclei is primordial for these types of studies; however, the explanations of the production mechanisms of such nuclei are not well known. An alignment of 18(8)% was previously measured for isomers produced in the abrasion-fission reaction. The purpose of the experiment described here is to probe different momentum regions and determine the one with the highest alignment rate. Owing to the high beam intensity delivered by RIBF, the nuclear photodetectors were placed around the crystal at 90° relative to each other.

The online analysis did not allow us to extract a preliminary magnetic moment measurement. The $^{99}$Zr nuclei were selected and identified through BigRIPS and were implanted in a non-disturbing copper crystal at F8. An external magnetic field of 0.250 T was applied to induce a Larmor precession of the nuclei. This perturbation modified the number of photons emitted at a given angle depending on the time. To detect this variation, 4 germanium detectors were placed around the crystal at 90° relative to each other.

Fig. 1. Preliminary gamma energy spectra measured for $^{99}$Zr with the decay curve associated to the 130.2 keV line.

References