

Low background HPGe spectrometer in investigations of 2β decay

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To search for double beta decay processes to the excited states of daughter nuclei, such as resonant $0\nu\text{EC}/\text{EC}$ decay of ^{106}Cd (TGV experiment) and $2\nu 2\beta^-$ decay of ^{100}Mo (NEMO-3 experiment) to the 0^+ (1130 keV) and 2^+ (540 keV) excited states of ^{100}Ru , a low background HPGe spectrometer Obelix with sensitive volume of 600 cm³ and efficiency of ~160% was installed at the Modane Underground Laboratory (LSM, France, 4800 m w.e.), as a common activity of JINR-IEAP CTU-LSM (details of the spectrometer will be presented by P.Loaiza). Such types of investigations are based on analyzing of γ -rays emitting in de-excitation of the excited states of daughter nuclei. The sensitivity of the Obelix spectrometer for 2β measurements is higher than $T_{1/2} \sim 10^{21}$ years. To obtain the detector efficiency for such measurements the original method of using special low-active samples with known mass and activity was developed. The samples were produced from the powder of La_2O_3 . The natural La in this powder consists of ~0.09% of ^{138}La ($T_{1/2} = 1.02 \times 10^{11}$ years), which is characterized by emission of γ -rays with energies of 788.7 keV and 1435.8 keV. Based on the results of measurements of La_2O_3 and standard sources of ^{152}Eu and ^{133}Ba , efficiency curves for the measurements of double beta emitters were obtained. Metallic foil of enriched ^{100}Mo with a mass of 2517 g was measured with the Obelix spectrometer for 2288 hours. From this measurement the contamination of ^{100}Mo foil (radioactive isotopes and their activities) as well as half-life of $2\nu 2\beta^-$ decay of ^{100}Mo to the 0^+ and 2^+ excited states of ^{100}Ru were obtained. The preliminary results will be presented.

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