

Abstract

The SuperNEMO Demonstrator, which is the first module of the SuperNEMO experiment, is located in Modane underground laboratory (France) and search for neutrinoless double beta decay ($0\nu\beta\beta$) of ^{82}Se in order to unveil the nature of the neutrino. Its detection technique, based on tracking and calorimetry, allows the reconstruction of the full kinematics of detected particles, including individual energies and emission angle. This unique information allows us to investigate the mechanisms of various modes of $\beta\beta$ decay, reconstruct and fundamentally suppress the background. The creation of the SuperNEMO Demonstrator is the result of 11-year R&D in a number of areas: the creation of optical modules of the calorimeter with record resolution characteristics, a tracker with automated assembly of cells and radon control, improved techniques for creating sources and calibration systems, methodical work on low-background measurements (construction of dedicated setups, the fight against radon, the selection of ultrapure materials).

The goal of the Demonstrator is to validate the technique, achieve the claimed background level, and to reach a sensitivity of the $0\nu\beta\beta$ - decay half-life of about $T(0\nu)_{1/2} > 5.9 \times 10^{24}$ yr with “zero background” in the region interest on 7 kg of Se-82 for 2.5 years of measurement. Start of the Demonstrator is planned for next year. It is expected that the main data will be collected in 2019-2021. In the case of a successful work of the Demonstrator, the opportunity will be open for a full-scale SuperNEMO project aimed to measure 100 kg of Se-82 at a sensitivity of $T(0\nu)_{1/2} > 10^{26}$ years for 5 years of measurement.

The demonstrator has been built with the decisive contribution of JINR to a number of systems: calorimeter, tracker, $\beta\beta$ sources. The JINR team has 25 years of experience of successful participation in NEMO-2 / NEMO-3 experiments studied $\beta\beta$ processes in a set of nucleus: ^{48}Ca , ^{82}Se , ^{96}Zr , ^{100}Mo , ^{116}Cd , ^{130}Te , ^{150}Nd , and in the SuperNEMO R&D program. The required financing of the project is 245 k\$ for 3 years.