Precision measurements of $\beta$-spectra $^{144}$Ce - $^{144}$Pr nuclei in order to define the spectrum of electron antineutrinos.

St. Petersburg Nuclear Physics Inst., NRC “Kurchatov Institute”, Gatchina, Russia

**$^{144}$Ce - $^{144}$Pr antineutrino source**

The artificial source of antineutrinos $^{144}$Ce – $^{144}$Pr seems to be the most promising for the experiments on the search for neutrino oscillations to the sterile state.

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$^{144}$Ce is fission fragment, 5% in spent fuel, 7.5 kW/Mci, 300 m/Mci, 3 PBq - 0.6 kW.

**4β-spectrometer with two Si-detectors**

Si(Li) detectors produced in PNPI with sensitive region 16 mm, thick 9 mm, [1]$^4$=10 $\mu$A at 100 V. The low threshold of detected energy is 5 keV. The energy resolution measured with γ lines of 241Am is FWHM=1.1 keV. The response function of the spectrometer is close to Gaussian and does not contain a part associated with backscattering of electrons from the crystal surface, J. of Phys. 1390 (2019) 012117.

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**Elastronics and DAQ system**

Si(Li)-detector has two spectrometric channels: a preamplifier with resistive feedback, an amplifier with a time constant 2 $\mu$s.

**Si(Li)-detector spectra with $^{207}$Bi**

The Si(Li)-detector has two spectrometric channels: a preamplifier with resistive feedback, an amplifier with a time constant 2 $\mu$s and 14-bit ADC. Instr. Exp. Tech. 61, 323, 2018.

**Fit of $^{144}$Pr β-spectrum and shape factor**

Gaussian response function of 4$\beta$-spectrometer allows to directly measure the energy of electrons in $\beta$-decay and, accordingly, to determine the spectrum of electron antineutrinos. Parameters of shape factor are measured with 1% precision that is enough for new experiments with $^{144}$Ce-$^{144}$Pr.

**Spectra of 4$\pi$ β-spectrometer**

A - calibration with $^{232}$Bi. B - two-dimensional spectrum measured with $^{207}$Bi. The oblique lines correspond to backscattering of 570, 1084 and 1770 keV γ-quanta. The rectangles mark the events from the cascade of γ-quanta. C - $^{144}$Ce-$^{144}$Pr source measured with a 4$\pi$ β-spectrometer. 1 - total detected energy, 2 - events in only one detector, 3 - events registered by two detectors, 4 - coinciding events from one detector.

**Transitions to the exited states of $^{144}$Nd**

The measurement of the total energy electron spectrum practically solves the problem of antineutrino spectrum. The quality of the fit is tested by allowed transition 0$^+$$\rightarrow$1$^-$. 

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