Determination of the total energy Q_{EC} for ^{156}Ho ($T_{1/2} \simeq$56m) β^+/EC-decay by using the total absorption γ-ray spectrometer

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Abstract. The total energy $\mathbf{Q_{EC}}$ for ^{156}Ho β^+/EC-decay has been determined using χ^2-analysis of the total absorption γ-ray spectra. The $\mathbf{Q_{EC}} = (4.91 \pm 0.15)$MeV was obtained.

Determination of the β-decay total energy from the end point of the total absorption spectra by using total absorption spectrometer (TAS, fig.1) may be applied for wide range of nuclei [1].

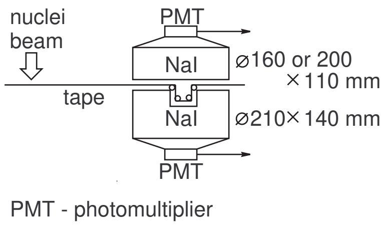

Fig.1 TAS scheme.

In this work we analyse the parts of spectra with enough high counting per channel. The Q_{EC} as a parameter is determined by using χ^2-criterion (fig.2-3). Theoretical spectrum was constructed as:

$$N(E) = \int_0^{Q_{EC}} S_\beta(e) f(e, Q_{EC}) \epsilon(e) \phi(e, E) de$$

where: $S_\beta(E)$ - β-decay strength function; $f(e, Q_{EC})$- Fermi function for β-decay; $\epsilon(e)$ - spectrometer efficient; $\phi(e, E)$- response function of spectrometer.

From the χ^2 minimum the Q_{EC} was determined. After linearization the error ΔQ_{EC} was established. Such procedure was used for different energy intervals. In all cases we obtained approximately the same values of Q_{EC} but different ΔQ_{EC}.

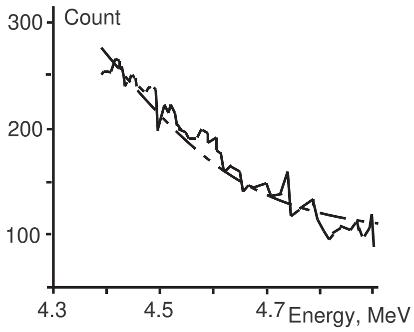

Fig.2 Experimental and calculated (dash-dot) TAS γ-spectra for ^{156}Ho β^+/EC decay in analysing interval.

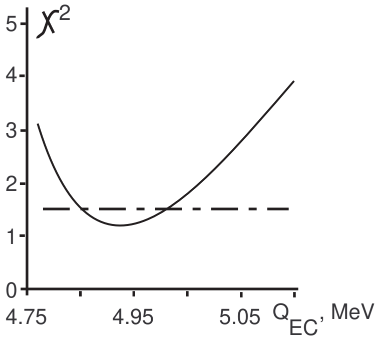

Fig.3 χ^2 dependence from the Q_{EC} of ^{156}Ho. Analyzing energy interval was 4.38÷4.8 MeV. Dash-dot line – 1% limit.

The optimal energy interval was selected from ΔQ_{EC} minimum. The $Q_{EC} = (4.91 \pm 0.15) MeV$ for ^{156}Ho was obtained.

[1] Yu. V. Naumov, A. A. Bykov and I. N. Izosimov, Sov. J. Part. Nucl. 14, 175 (1983)