Determination of the resonance parameters for ^{232}Th from high resolution transmission and capture measurements at GELINA;

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To deduce the resonance parameters for ^{232}Th in the resolved resonance region, high resolution transmission and capture measurements are being performed. The measurements are performed at the Time-Of-Flight facility GELINA. A comparison of experimental data resulting from capture (top) and transmission (bottom) are shown in Fig. 1.
The transmission measurements are performed at a 50 m flight path. The neutron are detected with a 0.25'' thick lithium glass (NE912) placed in an Al sphere and viewed by a 5'' EMI KQB photomultiplier orthogonal to the neutron beam axis. The injection of a stabilised light pulse in the detecotr during the measurements provided an efficient tool to control to better than 1% the gain of the entire electronics. The experimental set-up includes a sample-changer, placed at 23 m from the neutron soruce, which is driven by the acquisition system. The determination of the flight path length, was based on transmission of the 6.673 eV resonance of ^{238}U. In table 1 we summarise, for the different energy regions of interest, the scheduled measurement conditions: the operation frequency of the accelarator and the target thickness. A simultaneous analysis of the data using REFIT will result in the resonance parameters from 0 to 4 keV. In fig. 2 we show the result of a resonance shape analysis for the resonances at 21.8 and 23.5 eV. The resulting resonance parameters are important for the energy calibration and normalisation of the capture measurements in both the resolved and unresolved resonance region[1].
The capture measurements are completed and were performed at a 60 m flight path. The sample consisted of a metallic natural thorium disc of 8 cm diameter and 1.0 mm thick, corresponding to a thickness of 3.176 10^{-3} at/b. The neutron flux was measured with an ionisation chamber loaded with three back-to-back layers of about 40 μg/cm^2 ^{10}B. The gamma rays, originating from the ^{232}Th(n,γ) reaction, were detected by four C_6D_6-based liquid scintillators (NE230) placed perpendicular to the neutron beam. Each scintillator is coupled through a boron-free quartz window to an EMI9823-KQB photomultiplier. The pulse height weighting technqiue is used to derive the capture yield. The interpretation of the data in terms of resonance parameters is in progress and will be based on a resonance shape analysis using REFIT_IRMM[2]. The energy calibration and normalisation of the capture data will be based on the parameters for the resonances at and eV obtained from transmission measurements.

Energy region eV	Operation frequency Hz	^{232}Th target thickness at/b
0.14 – 10000	100	8.51 10^{-4}
11.00 – 100000	800	34.04 10^{-4}
11.00 – 100000	800	68.08 10^{-4}
11.00 – 100000	800	85.10 10^{-4}

Table 1

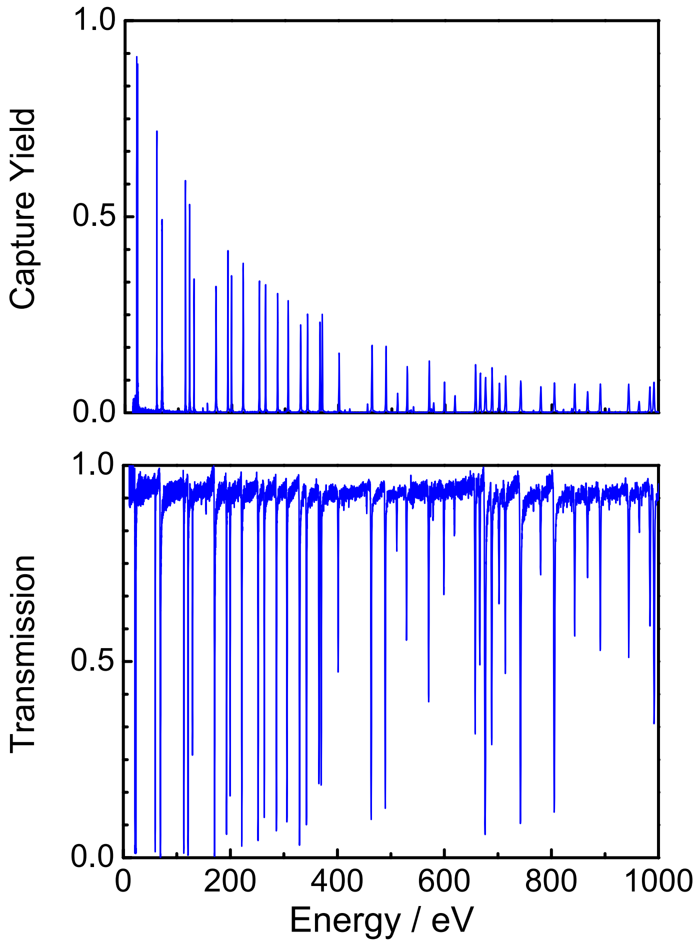

Fig.1 A comparison of the capture yield (top) and the transmission (bottom) of ^{232}Th in the resolved resonance region up to 1000 eV.

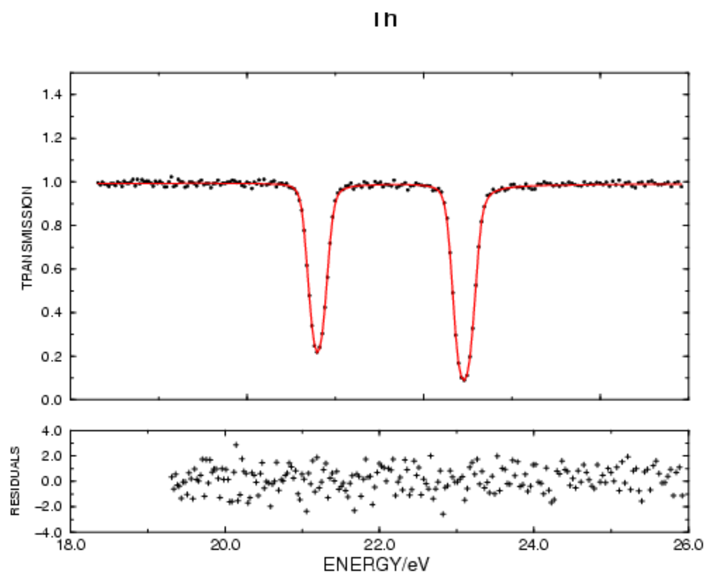

Fig. 2 The result of a renance shape analysis with REFIT_IRMM for the 21.8 and 23.5 eV resonances of ^{232}Th.

References

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