EUROPEAN COMMISSION
DIRECTORATE GENERAL JRC
JOINT RESEARCH CENTRE
Institute for Reference Materials and Measurements
IRMM

Geel, 23 April 2002

Dear Dr. Flocard,

I reviewed the proposal for experiments at the n-TOF facility of the CERN "Measurements of the neutron capture cross sections of ^{232}Th, ^{231}Pa, ^{234}U and ^{236}U".

The need for the determination of the cross-sections, in particular ^{232}Th, is clear. It is also obvious that n-TOF is the ideal facility to determine the capture cross-sections of radioactive material, in particular ^{232}Th, and materials that are only available in small quantities. The feasibility of the proposal depends mainly on the result of the commissioning tests of n-TOF. These tests should result in an assessment of the background conditions, highest achievable neutron energy due to the influence of the gamma-flash, and a good description of the resolution function.

The approach to determine the weigthing function by Monte Carlo simulations, validated by experimental data, will result in a good evaluation of the various systematic effects and related uncertainties. The reduction of effects due to inelastic scattering by adjusting the lower threshold should be carefully verified. Such an adjustment has an influence on the weighting function, and can only be applied if the capture gamma ray spectrum does not appreciably change with neutron energy. Due to the predominance of positive parity low-lying states in ^{233}Th, the gamma spectrum following p-wave capture differs significantly from the spectrum after s-wave capture. Also the ratio between the p- and s-wave capture cross section varies with neutron energy, from about 0.52 at 5 keV to 2.17 at 200 keV. Therefore, the shape of the gamma spectrum will depend on the neutron energy.

The major comment is related to the detemination of the energy dependent neutron flux profile. In the proposal one only mentions the type of charged particle detector without specifying the neutron reaction, related targets and geometry. Problems due to anisotropy effects in the reaction probability, when using ^{10}B and in particular ^{6}Li as target material, could arise in the high energy region. Therefore, the determination of the flux profile using a fission chamber could be recommended. Also the determination of the energy dependent background is not explained. Black resonance filters can only be used in a limited energy region.

Sincerely,
P. Schillebeeckx

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