Rensselaer | DEPARTMENT OF MECHANICAL, AEROSPACE, AND NUCLEAR ENGINEERING
Nuclear Engineering and Engineering Physics Program

P154

Title: "Measurements of the neutron capture cross sections of ^{232}Th, ^{231}Pa, ^{234}U and ^{236}U"

Dear Dr. Folcard.

I reviewed the proposal "Measurements of the neutron capture cross sections of ^{232}Th, ^{231}Pa, ^{234}U and ^{236}U". Following is a summary of my comments. Some of the comments might relate to general concerns of capture measurements with n_TOF facility (comments 3-6) .

The proposal is well written and the need for more accurate measurements of ^{232}Th, ^{231}Pa, ^{234}U and ^{236}U is well explained. The accuracy required (5%) seems to be achievable assuming careful determination of the neutron background, detector efficiency, neutron flux shape and the n_TOF resolution function. Overall it the proposal seems feasible but several issues need to be addressed to clarify that the authors are aware of potential problems.

1. The samples composition is not mentioned. This issue is very important since the samples are hard to get. For example small impurities of U-235 (and U-238) in the U-236 samples will results in gammas from fission and capture in U-235 (or U-238). We are currently measuring the total cross sections of such U-236 sample (86% enriched) and a correction is required. This question is applies to the all the other isotopes. An analysis of these background counts and the proposed corrections should be included. Also to accurately determine the widths of some of the resonance, different sample thicknesses are required. What are required the sample thicknesses? Also the samples size and uniformity are not mentioned.
2. What is the contribution of the background from inelastic scattering? Since they might have the same energy as the capture gamma rays, how can they be discriminated?
3. It is mentioned that the neutron flux shape will be measured with Si Detectors. Can more information be provided on the flux shape determination especial in the high-energy region?

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4. The background problem is addressed in the proposal. I am also aware that an iron wall was built to further reduced the background. However there are no specific details on how the time dependent neutron background will be measured. And what is the expected signal to background ratio as a function of the neutron energy. This is extremely important issue since most of the samples are small or have small cross sections and thus result in low count rates.
5. Precise knowledge of the n_TOF resolution function is extremity important. This is an important parameter on the various resonance parameter-fitting codes such as SAMMY and REFIT. The use of inaccurate resolution function can result in very good-looking fits but wrong resonance parameters. This is not mentioned in the proposal or other documents I received.
6. I have one problem with C_6D_6 PHWT. It is clear the PHWT works well under the assumption of low intrinsic efficiency and no coincidence counting. On the other hand there is a desire to get the detectors close to the sample, which increases both. Are there any calculations of the detection efficiency as a function of the coincidence probability?
7. I am not familiar with the n_TOF collimation system, so I can only assume that the beam size at the sample position is smaller than the sample size and the last collimator is not close to the sample such that capture gamma rays (or scattered neutrons) from the collimator will contribute to the background.

Sincerely,

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