Dear all,

The enclosed EXCEL file (cor&norm-PFNS-5U-2013) contains experimental data for 235U PFNS in the energy range from thermal to 5MeV.

1. Johansson’s experimental data was corrected for multiple scattering in sample and new data from Drosg’s evaluation for efficiency of the neutron detector.
2. Staples’s data were corrected for “neutron time spread due to sample size”, “time resolution and bin corrections”
3. IPPE’s data for 0.5MeV and 5MeV were received from authors in the end of past century.

In addition I investigated the sensitivity of the spectra normalization (in my notation a1 fitted parameter), and average neutron energy to model for PFNS shape. Three different models (with different shapes) were analyzed. Some parameters were fitted to reach better description of experimental spectra for each model.

1. SCALE method. Fitted parameters: a1 – normalization, and average energy <E> (NSE 169,(2011), 290-295);
2. 2WATT model. Fitted parameters: a1 – normalization, and α – reduction of CMS energy per nucleon (Physics of Atomic Nuclei, 62(2), 1999, 173-185);
3. Scission Neutrons and Madlan&Nix model (SCN M&N), Fitted parameters: a1 – normalization, and Tm– temperature parameter (INDC(CCP)-435, 2002, IAEA).

All parameters are collected in sheet “normalization”. Summary for a1 parameter is given in table 1.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  | Scale | 2Watt | SCN+M&N | <a1> | std |
|  |  |  |  |  |  |  |
| Kornilov | 0 | 1.006 | 0.999 | 1.001 | 1.002 | 0.003 |
| Starostov | 0 | 0.631 | 0.632 | 0.631 | 0.631 | 0.001 |
| Lajtai | 0 | 1.001 | 0.994 | 1.002 | 0.999 | 0.004 |
| Yufeng | 0 | 1.009 | 0.998 | 1.001 | 1.003 | 0.006 |
| Johansson | 0.5 | 1.020 | 1.011 | 1.017 | 1.016 | 0.005 |
| Trufanov | 0.5 | 0.991 | 0.989 | 0.987 | 0.989 | 0.002 |
| Staples | 0.5 | 1.009 | 0.998 | 1.005 | 1.004 | 0.006 |
| Staples | 1.5 | 1.026 | 1.018 | 1.018 | 1.021 | 0.005 |
| Staples | 2.5 | 1.031 | 1.022 | 1.019 | 1.024 | 0.006 |
| Boykov | 2.9 | 1.003 | 1.002 | 1.002 | 1.002 | 0.001 |
| Staples | 3.5 | 1.090 | 1.072 | 1.053 | 1.072 | 0.019 |
| Lovchikova | 5 | 1.003 | 1.002 | 1.000 | 1.002 | 0.002 |

For all experimental spectra the standard deviation is <0.6%. Only Staples’s data at 3.5 MeV (neutron energies >3.5 MeV was measured) demonstrated higher sensitivity to model spectrum shape.

**First conclusion: “the problem “how to normalize the PFNS is rather artificial or does not exist at all”.**

The average energy as function of input neutron energy may be described with linear function with parameters collected in table 2:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | <E>th,MeV | | slope |
| Scale |  | 1.973751 |  | 2.296E-02 |
| 2Watt |  | 1.979593 |  | 2.331E-02 |
| SCN+M&N | | 1.980737 |  | 2.403E-02 |
|  |  |  |  |  |
|  | avg=> | 1.978 |  | 2.343E-02 |
|  | std=> | 0.004 |  | 5.485E-04 |

Experimental points and fitted functions are plotted in “chart1, chart2, chart3” for each model. The average value is in very good agreement with evaluated value for thermal experiments (see paper with scale method).

**Second conclusion: - not only thermal experiments BUT all experimental data in the input energy range 0-5 MeV confirm that average energy of PFNS of 235U at thermal energy is 1.974±0.002 MeV (**NSE 169,(2011)).