Description and usage of experimental data for evaluation in the resolved resonance region

Subgroup - 36

EC – JRC – IRMM

Standards for Nuclear Safety, Security and Safeguards (SN3S)

Agenda

1) Status SG – 36 , P. Schillebeeckx

2) Activities at IRMM in 2012 – 2013, B. Becker

3) Preparation report

4) Preparation status report for WPEC meeting

Objective

Produce accurate cross section data together with reliable covariance information in the resonance region

- ⇒ **Reduce bias effects**
- ⇒ **Produce reliable and realistic covariance data**

Activities

The main task:

identify and quantify the metrological parameters involved in each step of the evaluation process, starting from the production of experimental data.

Activities:

(1) Identify the uncertainty components

(2) Identify methods for evaluating uncertainties in the resonance region using experimental covariance information

(3) Define and analyse case studies

(4) Provide recommendations for reporting and usage of experimental details and uncertainty components

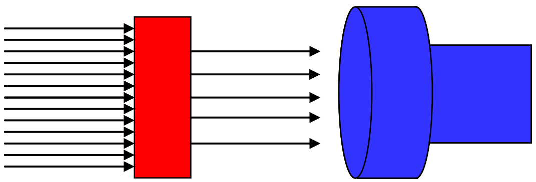
Contributions from mainly:

CEA Cadarache, IAEA, INFN Bologna, IRMM (+ Moxon)

1) Uncertainty components of experimental observables

Transmission

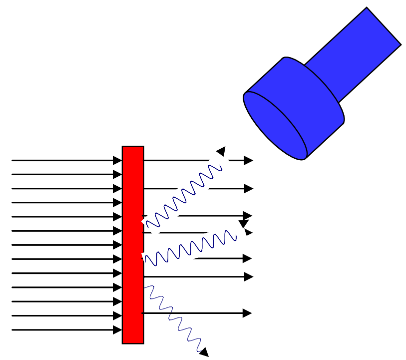
$$T_m \propto e^{-n_x \sigma_{tot}}$$



$$T_{exp} = N \frac{C'_{in} - B'_{in}}{C'_{out} - B'_{out}}$$

Reaction cross section

$$Y_m \propto \frac{\sigma_r}{\sigma_{tot}} (1 - e^{-n_x \sigma_{tot}}) + \dots$$



$$C = \varepsilon_r \, \Omega_r \, F_r \, Y_r \, A_r \, \varphi$$

$$Y_{exp} = N \frac{\sigma_\varphi}{\varepsilon_r} \frac{C'_r - B'_r}{C'_\varphi - B'_\varphi}$$

Nuclear data sheets, 113 (2012) 3054 - 3100

2) Evaluation methods

Methods to account for all uncertainty components and avoid PPP

- **Conventional uncertainty propagation (CUP)** Fröhner, NSE 126 (1997) 1 – 18
- **Monte Carlo (MC)** De Saint Jean et al., NSE 161 (2009) 363 - 370
- **Marginalization (MA)** Habert et al., NSE 166 (2010) 276 - 287

Differ in the way the uncertainty of experimental parameters are taken into account

⇒ **Application: NDS 113 (2012) 3054 – 3100 + Becker et al. (ND2013) + presentation B. Becker**

+ Zero Variance Penalty proposed by Noguere et al. (ND2013)

3) Define and analyse case studies

See presentation B. Becker

4) Recommendations to report experimental data

- **Facility/ Neutron production TOF-response functions**
  - **No feedback from last meeting**
  - **see CIELO correspondence + IAEA initiative**

- **Target characteristics**

- **Experimental data uncertainties**
  - **Report TOF**
  - **Ideally : AGS-concept**
  - **In any case report separately**
    - **Uncorrelated component (due to counting statistics)**
    - **Normalization uncertainty**

Otuka et al., JKPS 59 (2011) 1314
Becker et al., JINST 7 (2012) P11002

Data reduction : AGS concept

Observable Z (dimension n) with
k sources of correlated uncertainties

$$V_Z = D_Z + S_z S_z^T$$

D_Z : uncorrelated part
n values

S_Z : correlated part
dim. (n x k)