CSEWG initiative on establishing templates of expected measurement uncertainties

Denise Neudecker

Thanks to: all contributors to this initiative

LA-UR-19-30585 (short version)

Los Alamos
NATIONAL LABORATORY
EST.1943

EST.1943

NNSA
National Nuclear Security Administration

What is a template?

Unc. Source	Absolute	Clean Ratio	Indirect Ratio
Sample Mass	> 1%	Both Samples	Both samples
Counting Statistics	Sample-dependent	Both, combined	Both samples
Attenuation	0.2-2%	0.02-0.2%	0.2-2%
Detector Efficiency	1-2%	0-0.3%	1-2%, 0.5-1%
FF Angular Distrib.	~0.1%	Less than for abs.	~0.1%
Background	0.2 - >10%	0.2 - >10%	0.2 - >10%
Energy Unc.	1%, 1-2 ns	Combined	Both detectors
Neutron Flux	>1%	Cancels or small	Cancels or small
Multiple Scattering	0.2-1%	Reduced for abs.	0.2-1%
Impurit. in Sample	Sample-dependent	Both samples	Both samples
Dead Time	>0.1%	Both, combined	Both detectors

Los Alamos
NATIONAL LABORATORY
EST.1943

NNSA
National Nuclear Security Administration

A template *can be used by experimental community* as check-list if all unc. are provided.

Unc. Source	Ab
Sample Mass	
Counting Statistics	Sample-
Attenuation	0.
Detector Efficiency	1
FF Angular Distrib.	~(
Background	0.2
Energy Unc.	1%,
Neutron Flux	
Multiple Scattering	0.
Impurit. in Sample	Sample-
Dead Time	>(

☑ Sample Mass
☑ Counting
☑ Background
❑ *OOPS!*

- Comparing unc. sources of a measurement to the template, makes it less likely that some unc. sources are forgotten.

- **Giving evaluators information needed makes the data easier to use with fewer assumptions made (i.e., more citations).**
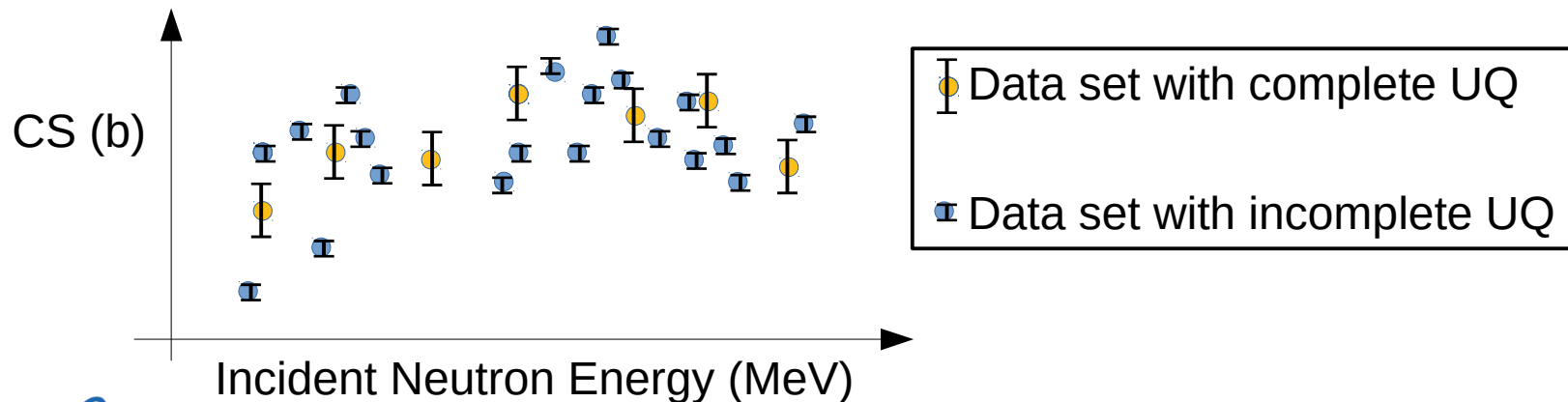
Los Alamos
NATIONAL LABORATORY
— EST.1943 —

EXFOR compilers and editors have guidelines they can point to for information needed.

- Templates could become a guideline sanctioned by the community on what (uncertainty) information is needed from measurement to be maximally helpful for evaluations. **EXFOR compilers/ editors can point to this document to ask for information.**

- May lead to **more complete uncertainties in new EXFOR entries**.

- **More usable information for evaluators in journal publications** (editors might not always know what evaluators need)
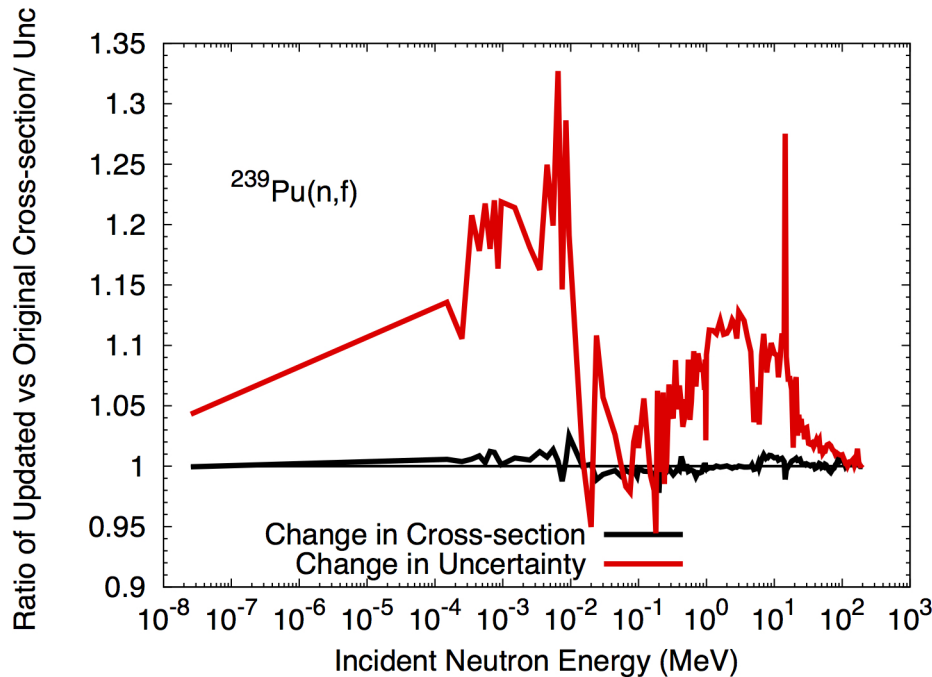
Templates help evaluators make better unc. assumptions .

- **Experimenters give via this template guidelines to evaluators what are realistic estimates of missing uncertainties**
- Leads to a **more balanced uncertainty quantification across different data sets.**
- **More complete uncertainties of future experiments**

LEADING TO more realistic evaluated uncertainties for nuclear data libraries.

CS (b)

Incident Neutron Energy (MeV)

Data set with complete UQ

Data set with incomplete UQ

UNCLASSIFIED

NNSA
National Nuclear Security Administration

^{239}Pu(n,f) cov. in the Neutron Data Standards database were updated with the template:

Updating these covariances with the template impacted
- **evaluated mean values,**
- **covariances and**
- **benchmark calculations**

Benchmark	C/E k_{eff} VIII.0	C/E k_{eff} upd. ^{239}Pu(n,f) cs	Δk_{eff} (pcm)
PMF001	0.99981 (8)	0.99892 (8)	-89
PMF002	1.00147 (8)	1.00075 (8)	-72
PMF006	0.99978 (10)	0.99869 (10)	-109
PMI002	1.00393 (7)	1.00316 (7)	-77
PST034.10	0.99652 (16)	0.99653(22)	1

Outlook:

- <u>Short-term goal</u>: **publish finalized templates** of several observables as journal article(s) and on the homepage of the NNDC **as a resource for evaluators, experimentalists, EXFOR compilers and editors for better uncertainty quantification of experimental data**.

- <u>Long-term goal</u>: **Engage international community** either through WPEC or IAEA.

Thank you for your attention!