



# TENDL-2011: TALYS-based Evaluated Nuclear Data Library

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# Motivations

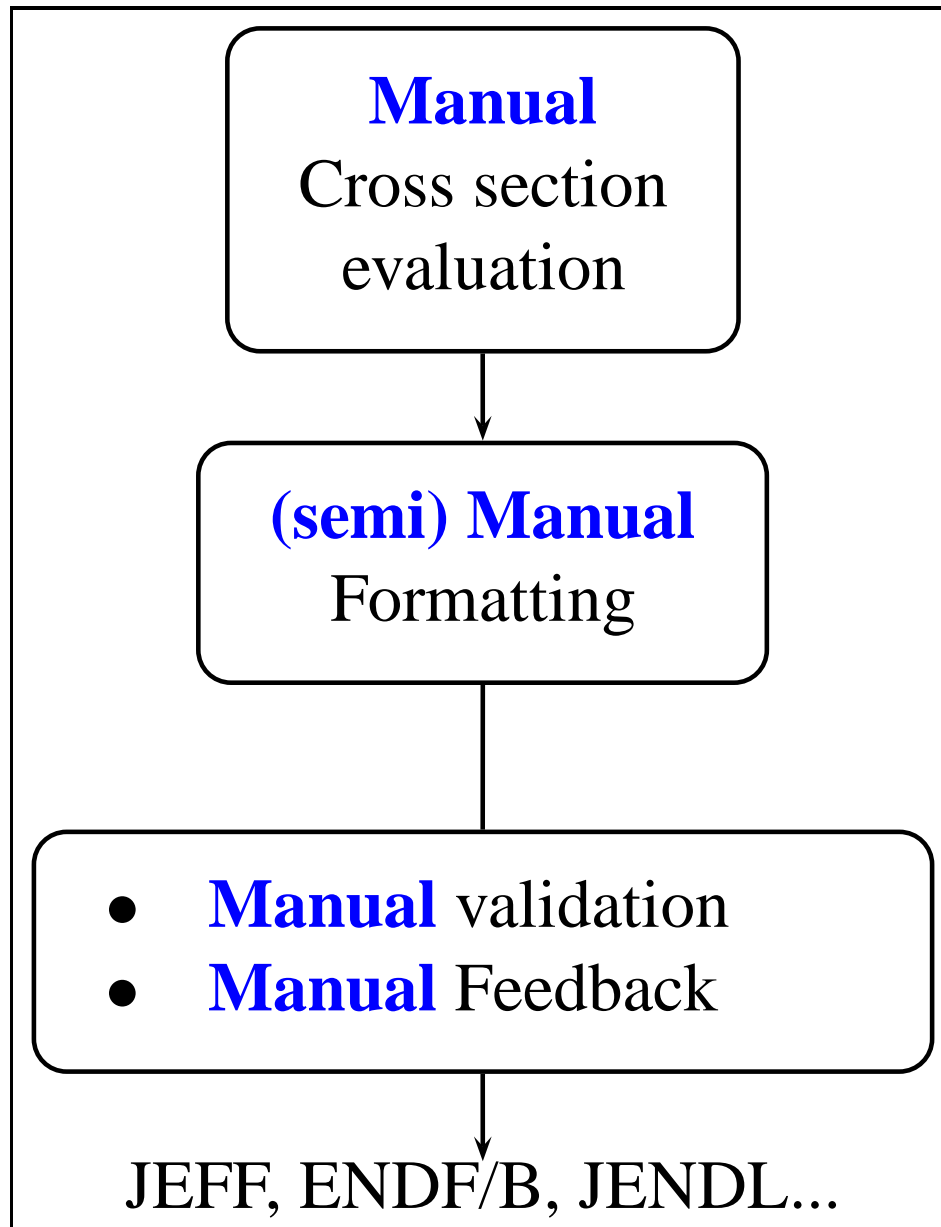


We need a **consistent and complete** nuclear data library to be integrated in reactor calculations, including realistic covariance data.

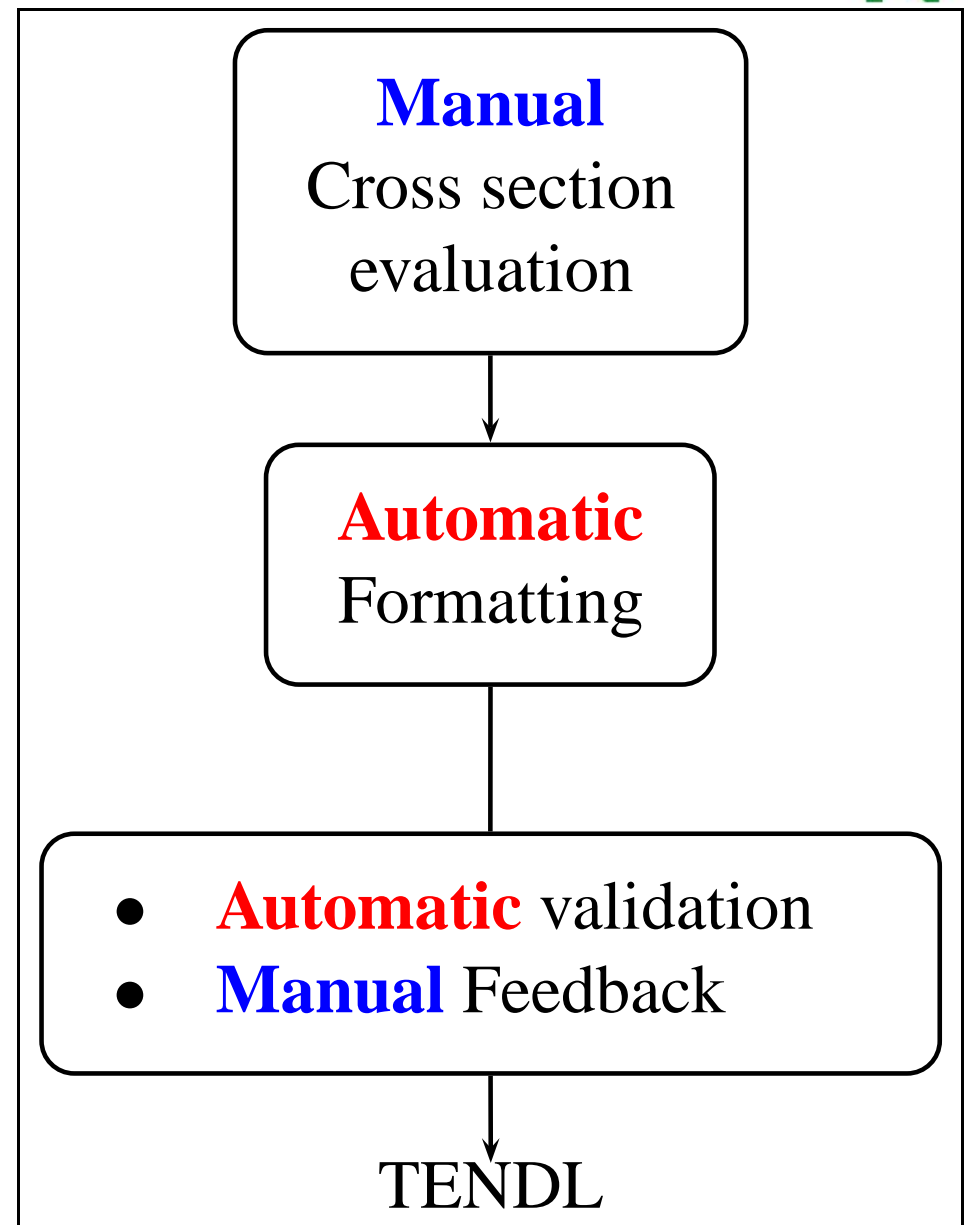
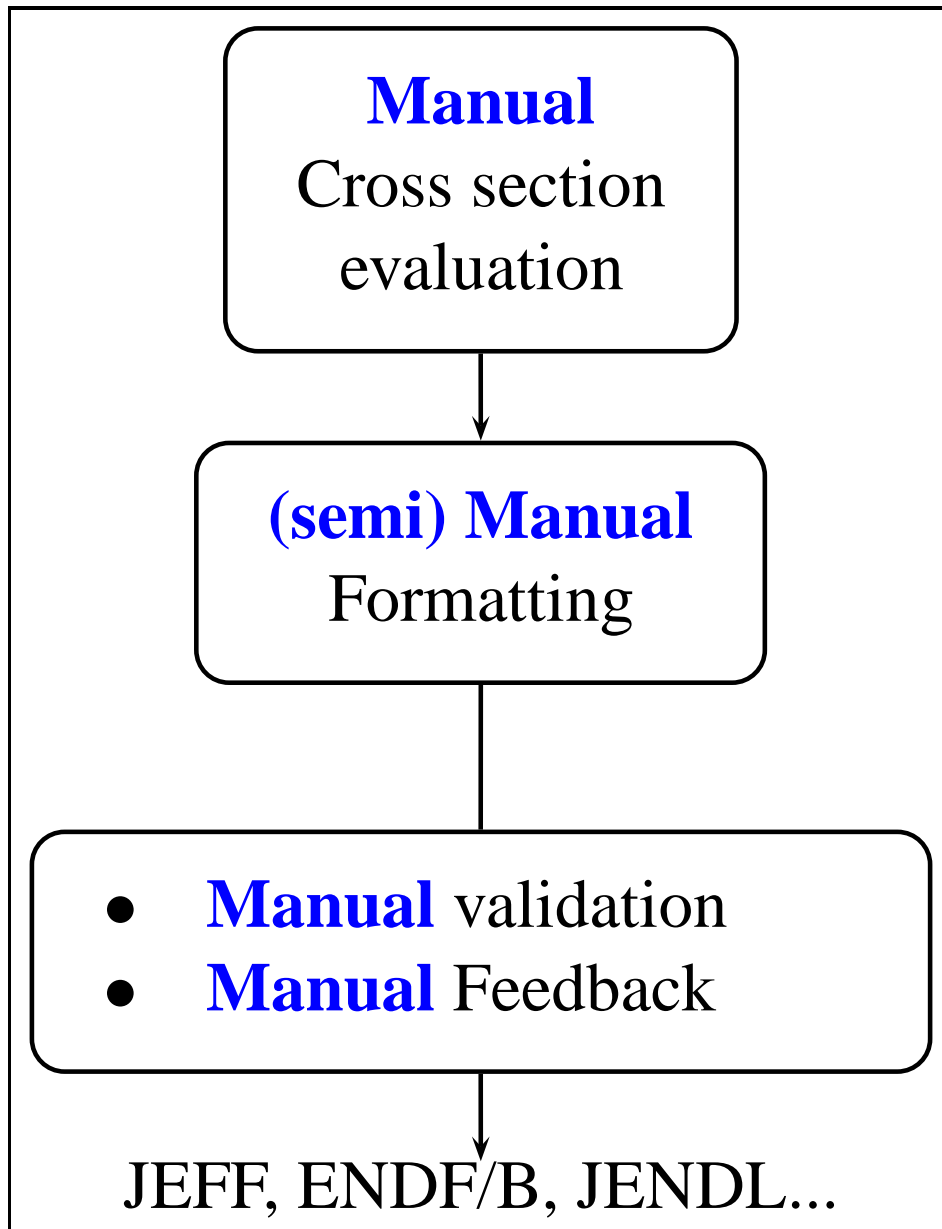
*(None of the existing libraries fulfill these requirements.)*

- Use global, robust TALYS method for the bulk of nuclides
- Use in-depth evaluation, adjustment... for important nuclides (e.g.  $^{56}\text{Fe}$ ,  $^{239}\text{Pu}$ )
- Reproducible library

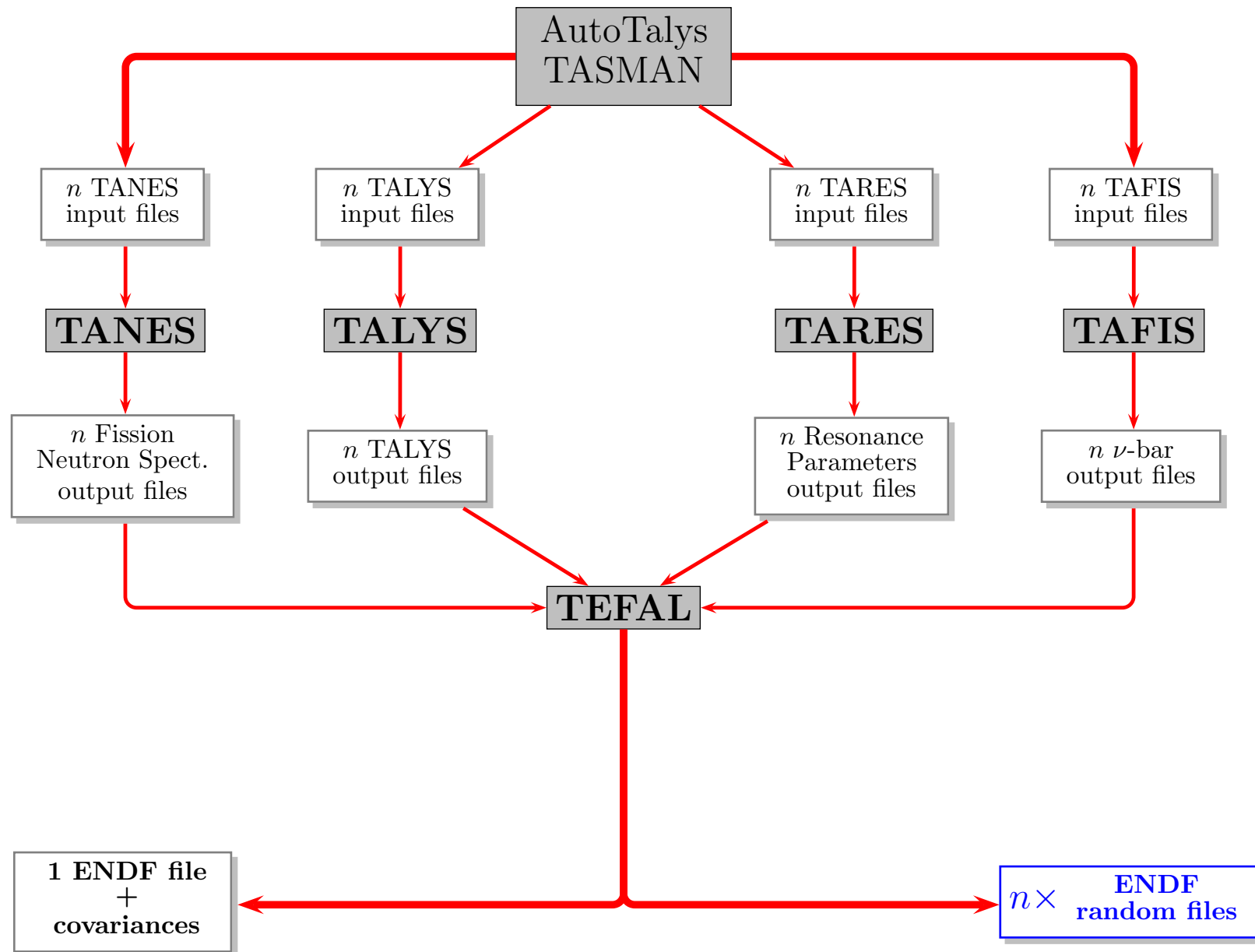
Produce TENDL-2008, -2009, -2010... with an increasing quality with regard to:  
**differential data, model development, integral validation, completeness and covariance data**



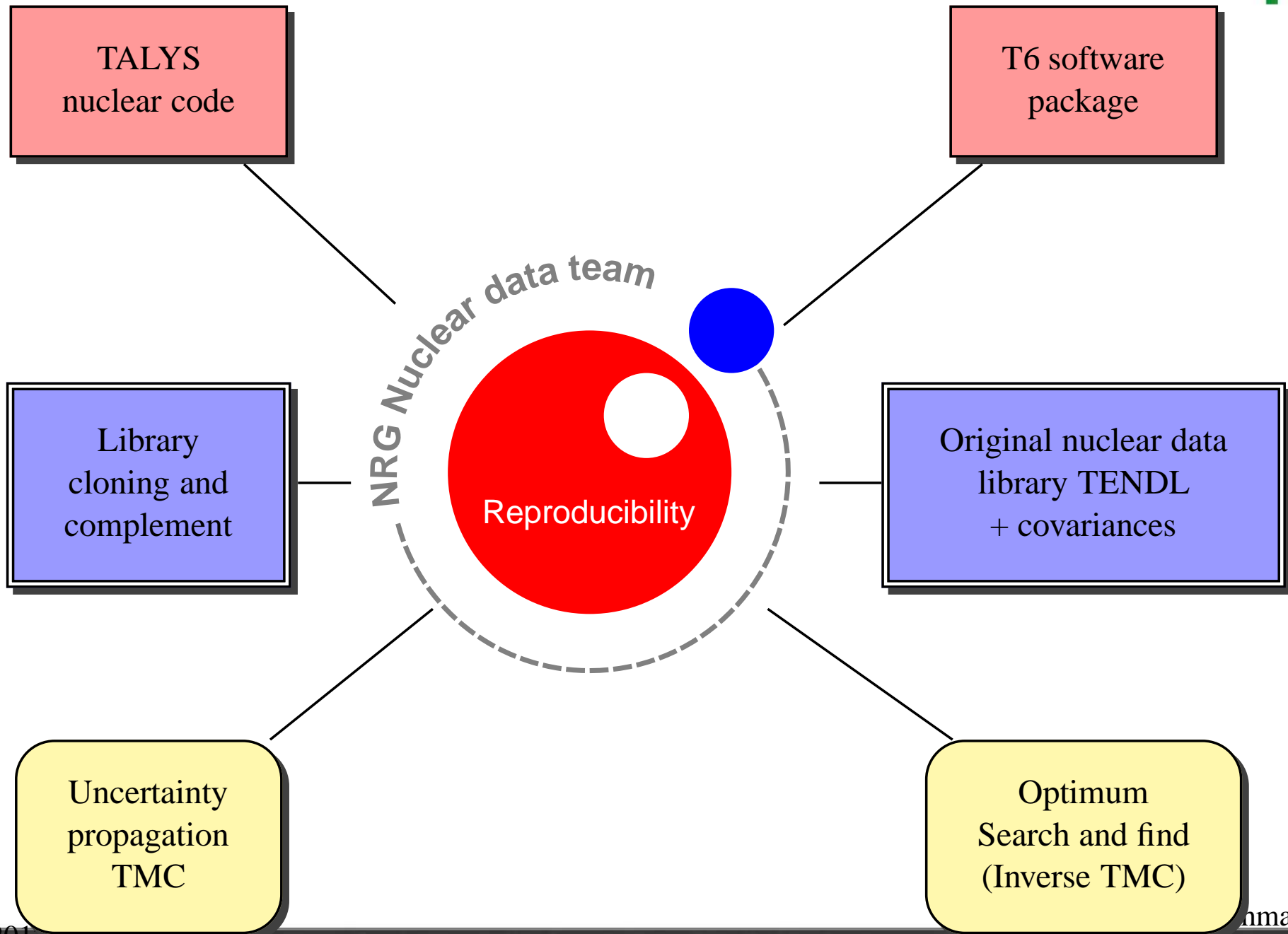
# Standard and modern approaches



# Nuclear data file evaluation and production with the TALYS system.



# Possible outcomes based on the TALYS system



# Content 1- TENDL-2011



- Available at [www.talys.eu/tendl-2011](http://www.talys.eu/tendl-2011)
- Neutrons: ENDF files (MF1-15 and MF31-35), plots, ACE, EAF, processed files and **random** files (do your own Total Monte Carlo)
- Protons, deuterons, tritons, alphas, gammas: ENDF, ACE, EAF files
- Based on TALYS + **automatic normalization**

	Neutron	Proton	Deuteron	Triton	Alpha	Helium3	Photon	Fi. Yields
TENDL-2011	2425	2429	2419	2431	2429	2428	2428	574
TENDL-2010	2394	1157	1159	1156	1159	1140	1152	529
TENDL-2009	2375	1163	1164	1116	1163	1127	1165	509
TENDL-2008	348	344	336	339	342	338	327	
(JEFF-3.1)	381	26						44
(ENDF/B-VII.0)	393	48	5	3			163	80

# Content 2- TENDL-2011 Neutron library: $^{19}\text{F}$ to $^{281}\text{Ds}$ ( $t_{1/2} > 1$ sec)

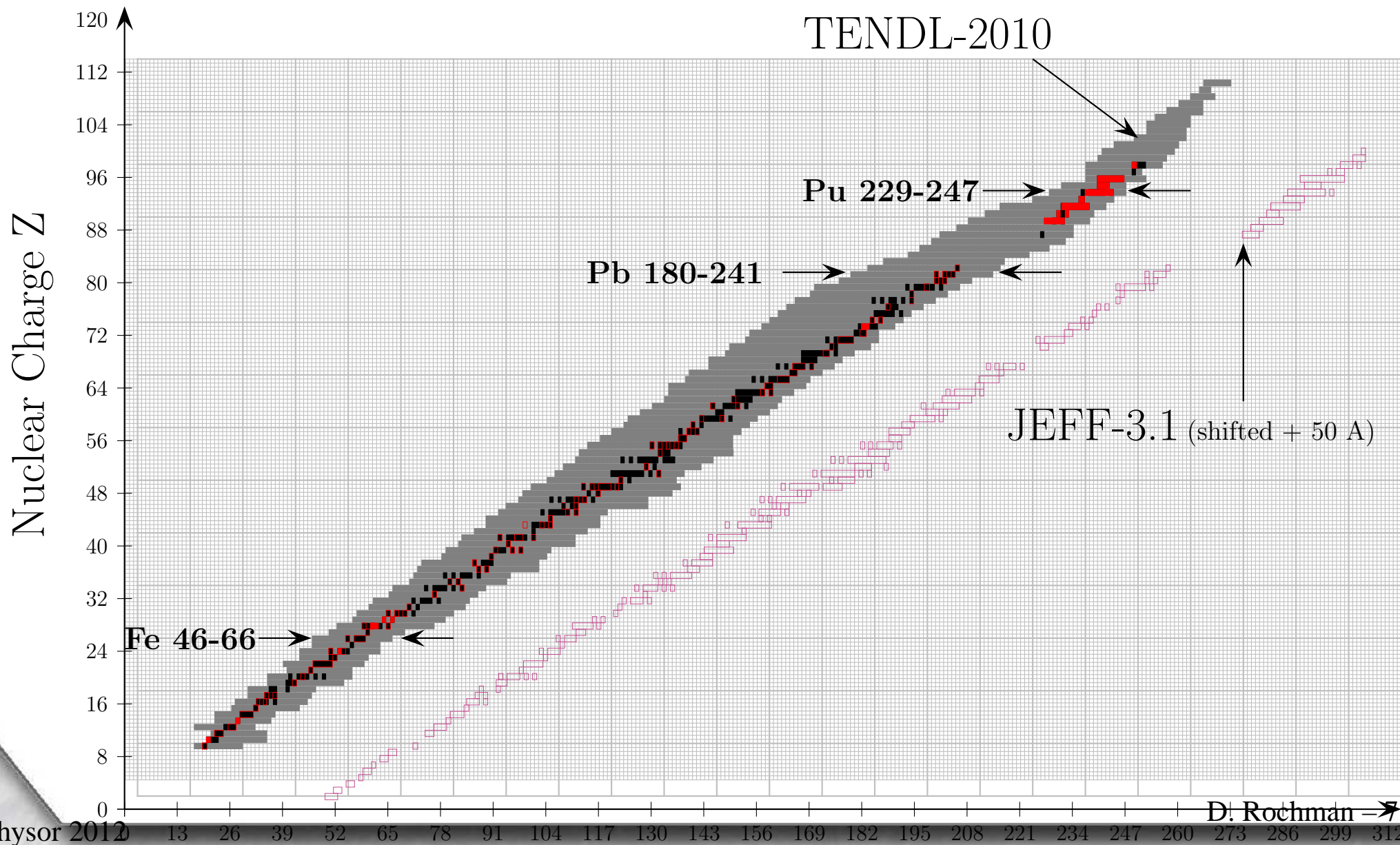


Default Calculations

Medium Quality

Activation Quality

Better Quality





## Content 3- Available files

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- ① Tabular angular distributions
- ② Tabular Gamma-ray intensities
- ③ Tabular partial cross sections to discrete levels
- ④ Tabular residual cross sections
- ⑤ Tabular cross sections
- ⑥ ENDF files including covariances
- ⑦ EAF cross section and variance files
- ⑧ Processed ACE files (with NJOY)
- ⑨ Processed covariances (tabular and plots)

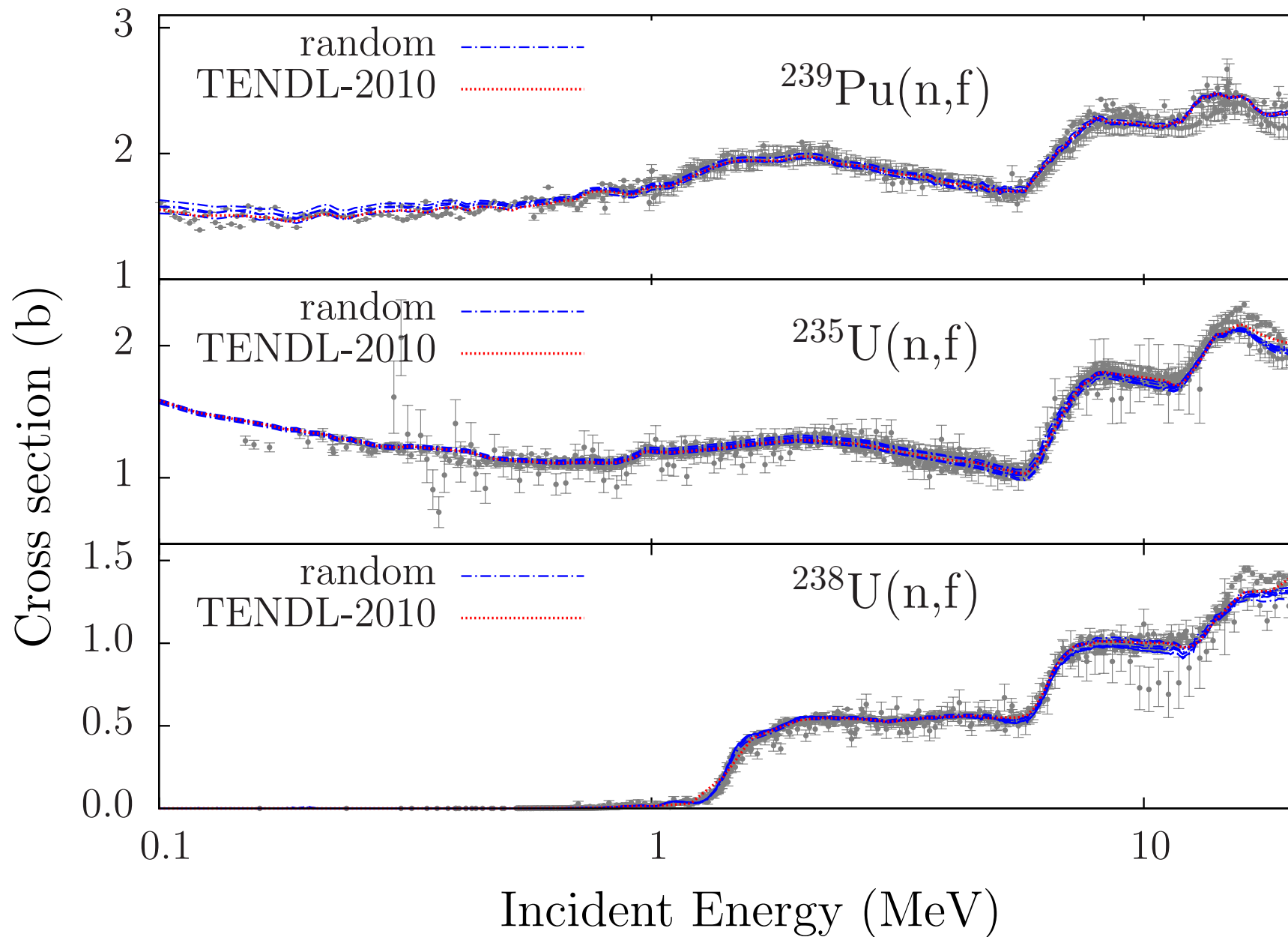
## Content 4- TENDL-2011 Neutron library: from MF-1 to MF-35



Content of a typical file up to **200 MeV**:

- ➔ **MF-1**: Description + fission parameters
- ➔ **MF-2**: Resonance parameters (Reich-Moore or Multi-level Breit Wigner)
- ➔ **MF-3**: Cross sections (n,tot), (n,el), (n,non), (n,inl<sub>i</sub>), ..., (n,γ), (n,p<sub>i</sub>), (n,α<sub>i</sub>)
- ➔ **MF-4**: Elastic angular distribution (Legendre Polynomials)
- ➔ **MF-5**: Fission neutron spectrum
- ➔ **MF-6**: Double differential distributions and spectra for (n,2n), ..., (n,α<sub>i</sub>)
- ➔ **MF- 8-10**: Isomeric cross sections
- ➔ **MF- 12-15**: Gamma yields, angular distributions and spectra
- ➔ **MF- 31-32-33-34-35**: nubar, Resonance parameter, cross section, elastic angular distribution and fission neutron spectrum covariances

# Examples: Some actinides of TENDL-2011



# Examples 5: TENDL-2011 adjusted for activation

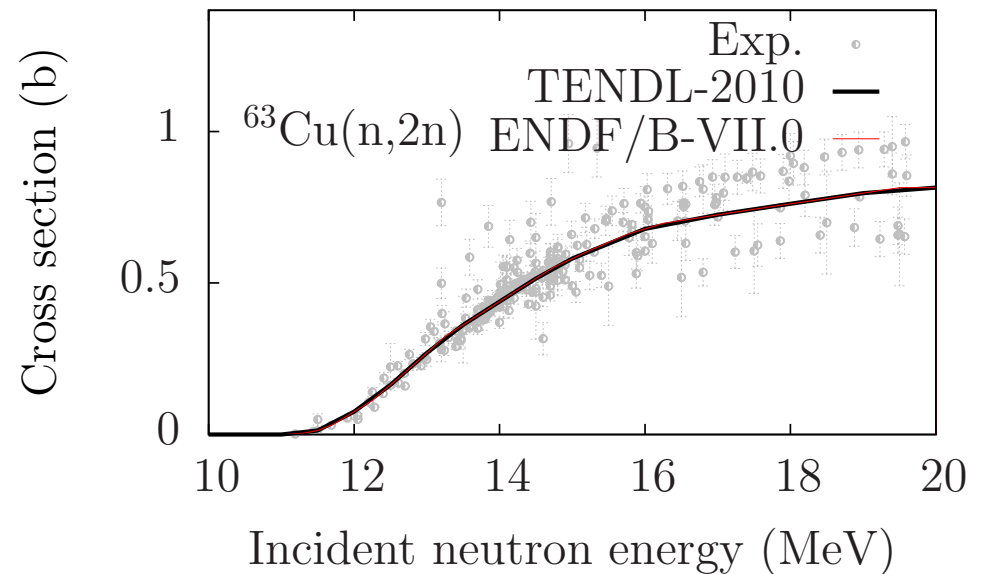
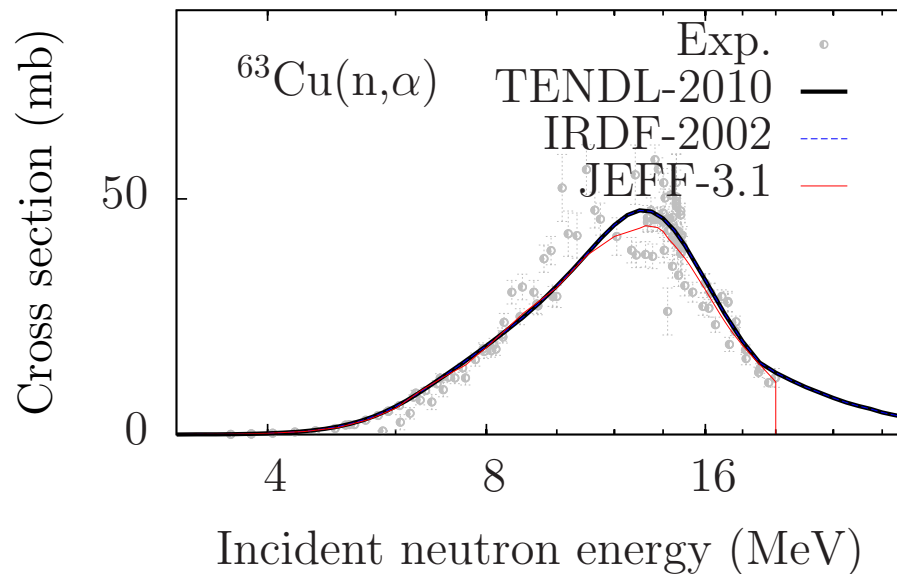
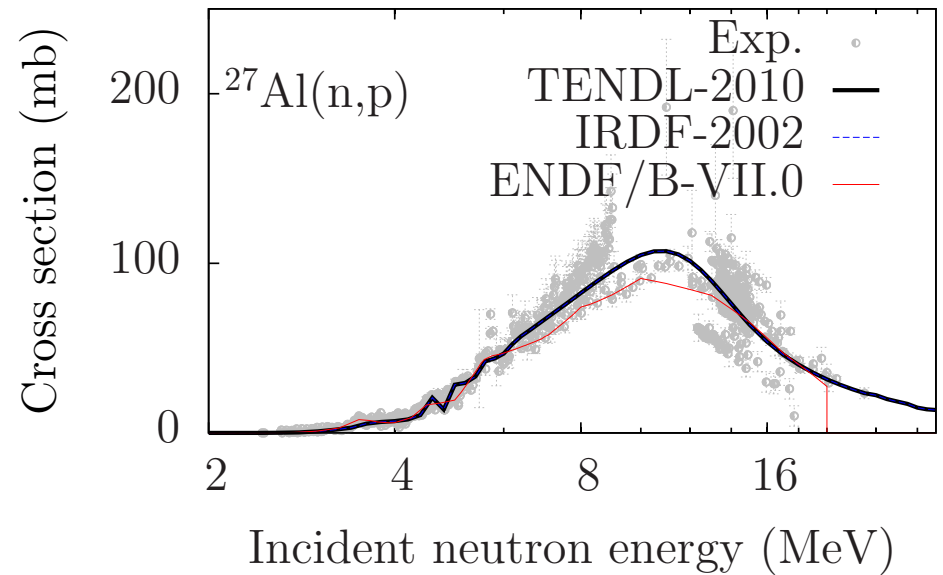
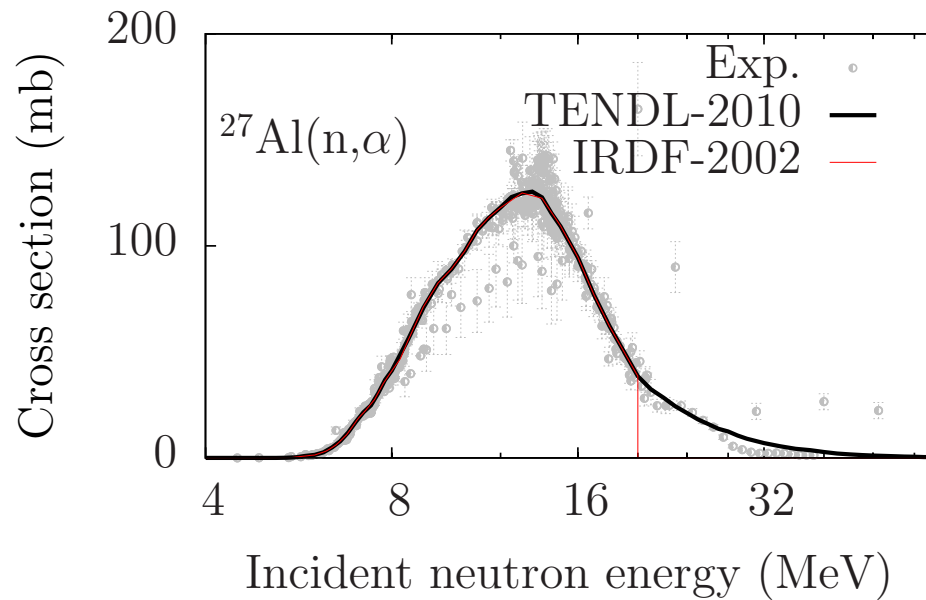
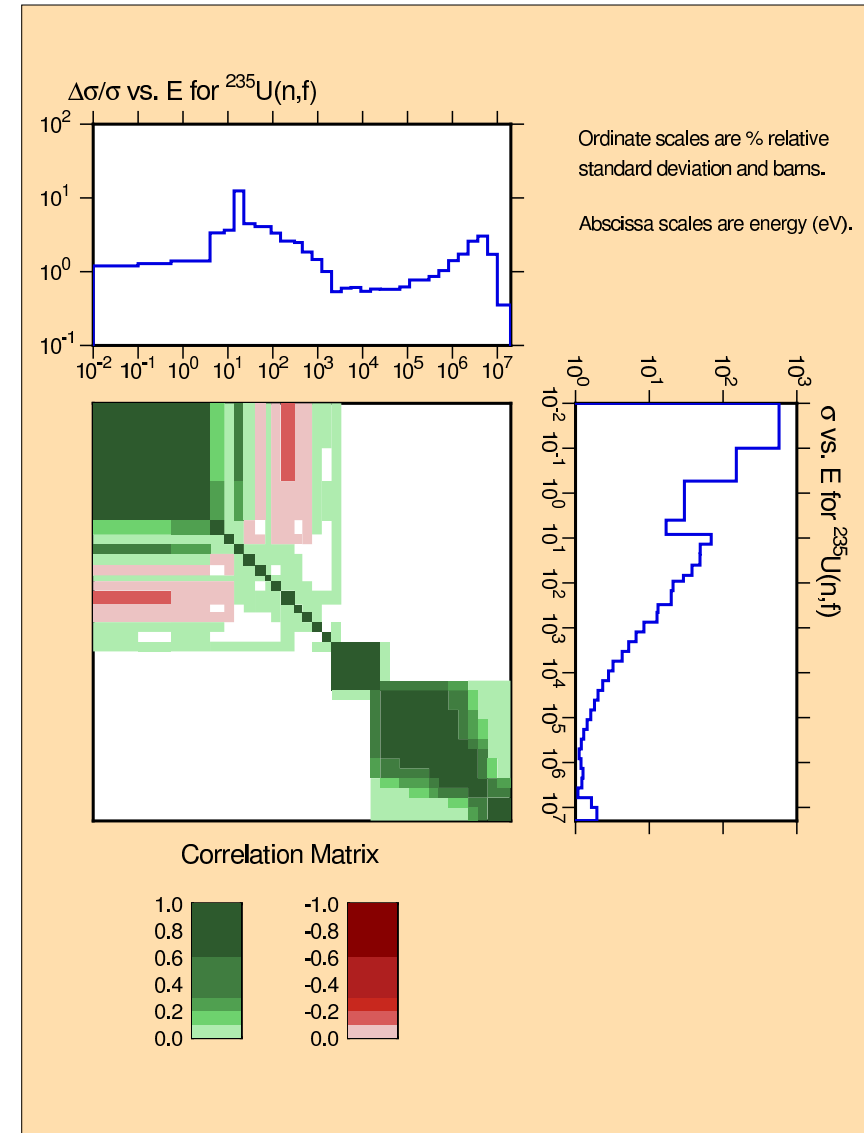
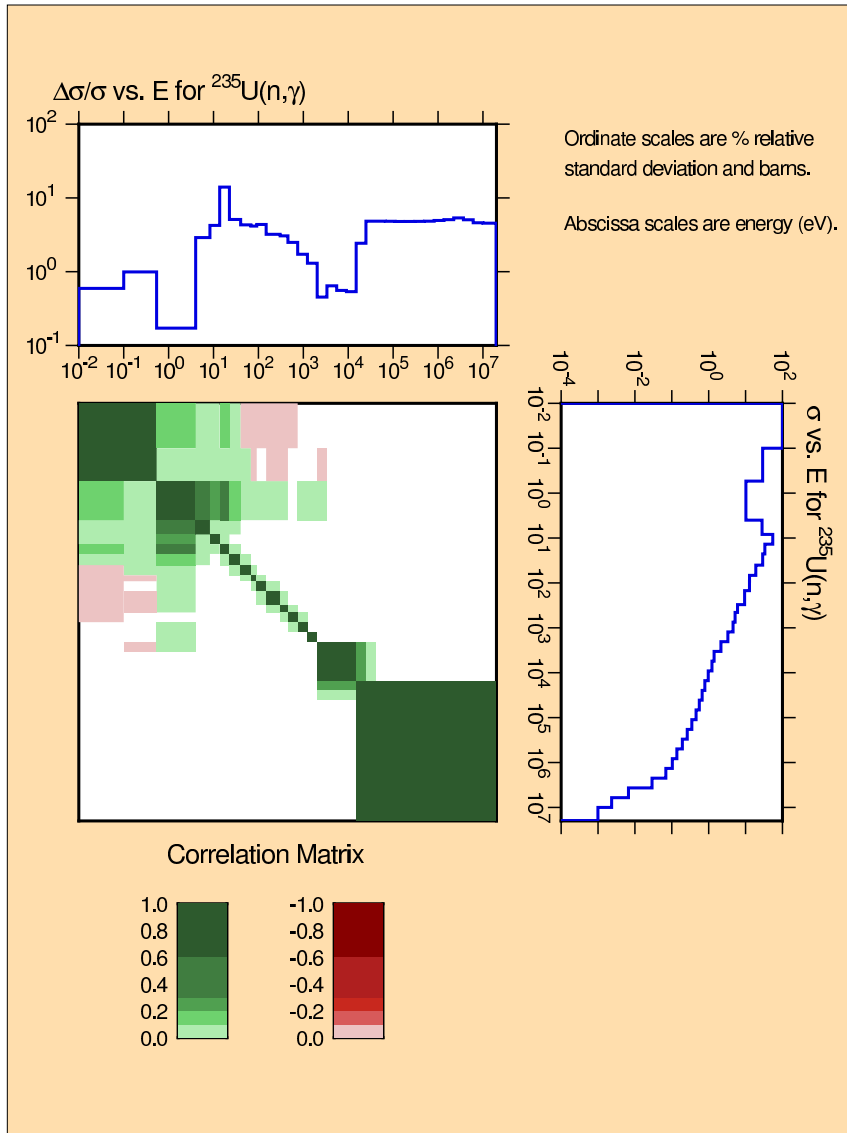


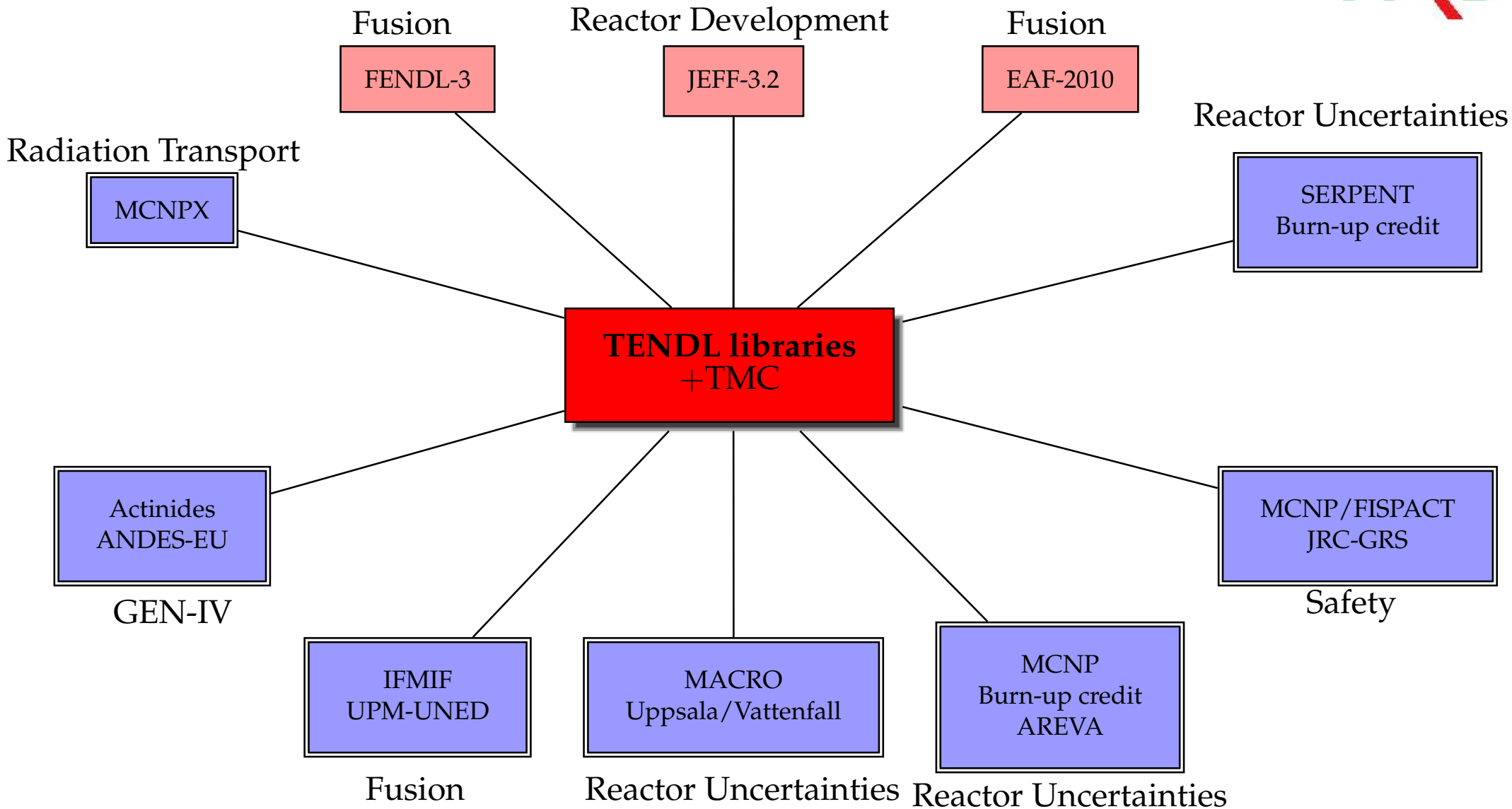
Table 1: C/E ICSBEP benchmarks calculated with TRIPOLI.

Benchmarks	JEFF-3.1.2	ENDF/B-VII.1	TENDL-2011
IMF-7 (BigTen) detailed	0.99430	1.00028	0.99824
IMF-7 (BigTen) simple	0.99323	1.00076	0.99746
IMF-12 (ZPR-16 %)	1.00191	1.00299	1.00916
IMF-10 (ZPR-9 %)	0.99649	1.00170	0.99900
IMF-2	0.99207	0.99912	1.00083

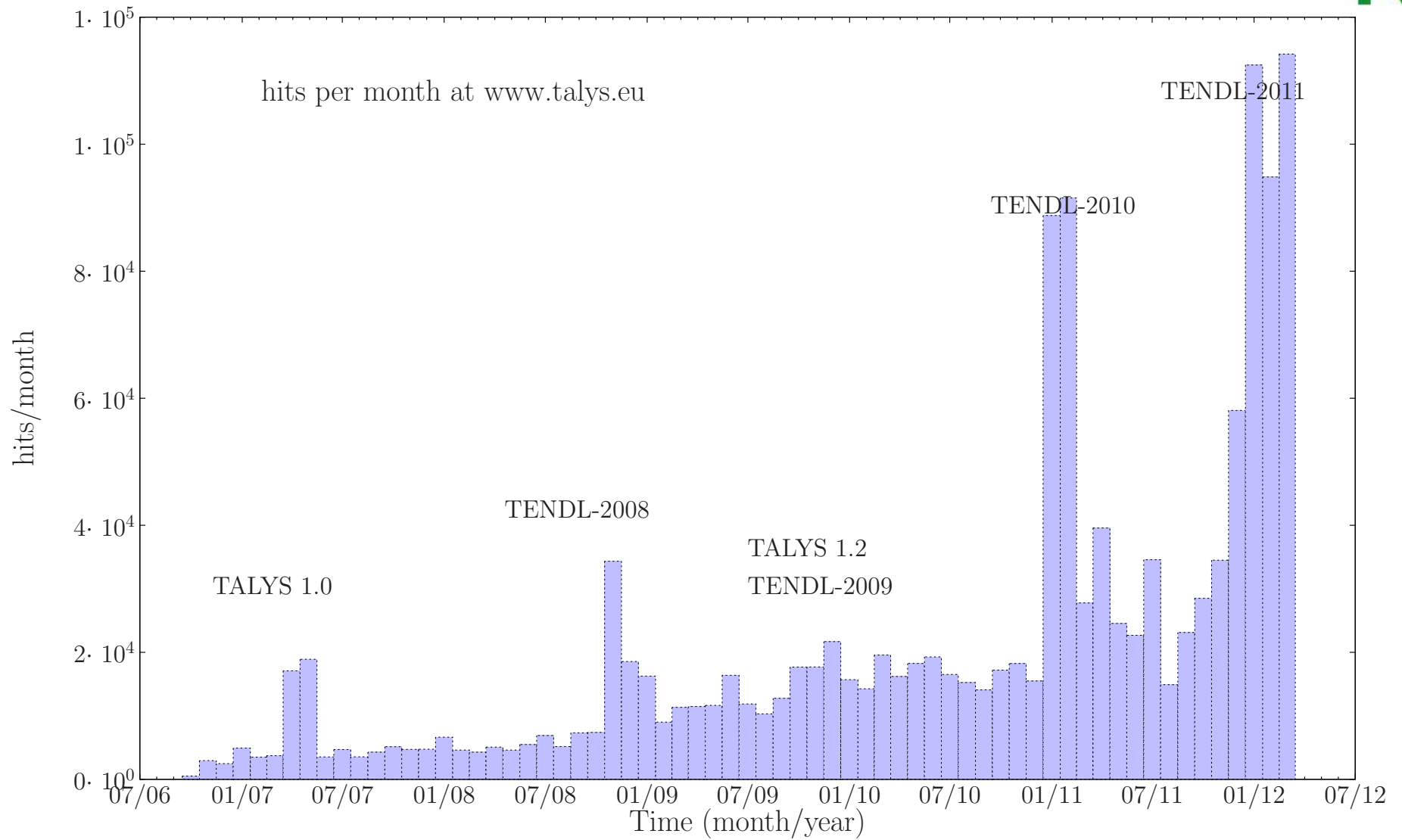
# Covariance examples



# Current and future (next year) partnerships



# TENDL "clicks"





# Conclusions and Future improvements



- ➡ Consistent, complete data files with automatic updates for all **nuclides, projectiles, energies reaction channels and quantities,**
- ➡ Includes 315 URRs, random files
- ➡ Detailed TALYS and resonance parameter fitting per individual isotope

Release date: December 28<sup>th</sup>, 2011

- ➡ Possibility to adopt an entire existing data library (e.g. JEFF-3.1.1) and **make it complete**
- ➡ More extensive validation (burn-up...) with uncertainties
- ➡ Improve global model and uncertainties, Addition of original URR