The truth about TENDL

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① Pictures (real truth)
② Past & present
③ Future

The real truth

The TENDL building (2007)

The real truth

The TENDL building (2014)

The real truth

The TENDL building (2014)

and two interns.

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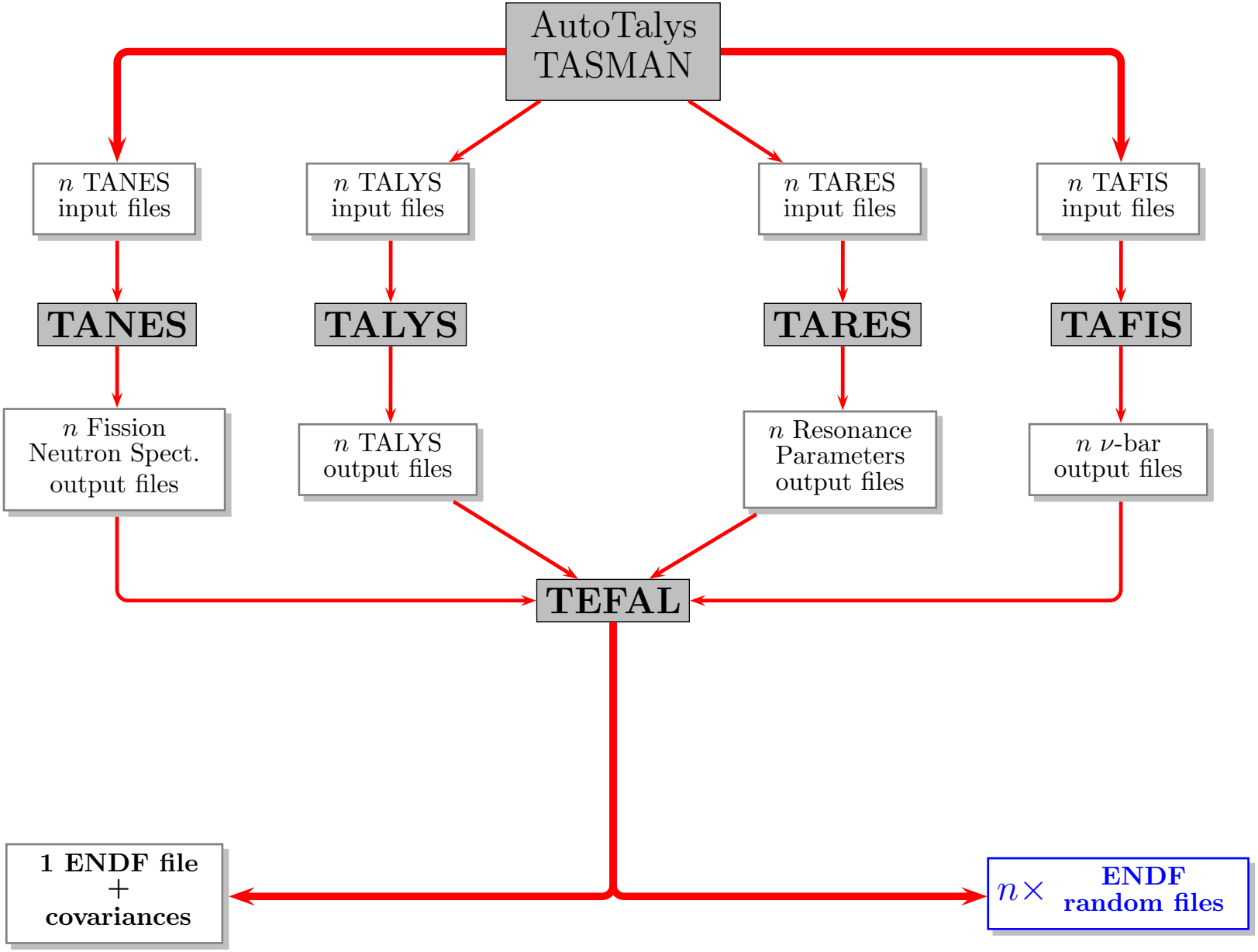
Nuclear data file evaluation and production with the TALYS system.



Possible outcomes based on the TALYS system

- Goal: improve simulations (C/E) for the European library and TENDL,
- Methods: reproductibility & completeness, development of a portable system (called T6) capable of producing TENDL + random nuclear data files and to process them for applications,
- Background: theoretical calculations (TALYS) with experimental inputs, and alternatively, TALYS normalization from other libraries

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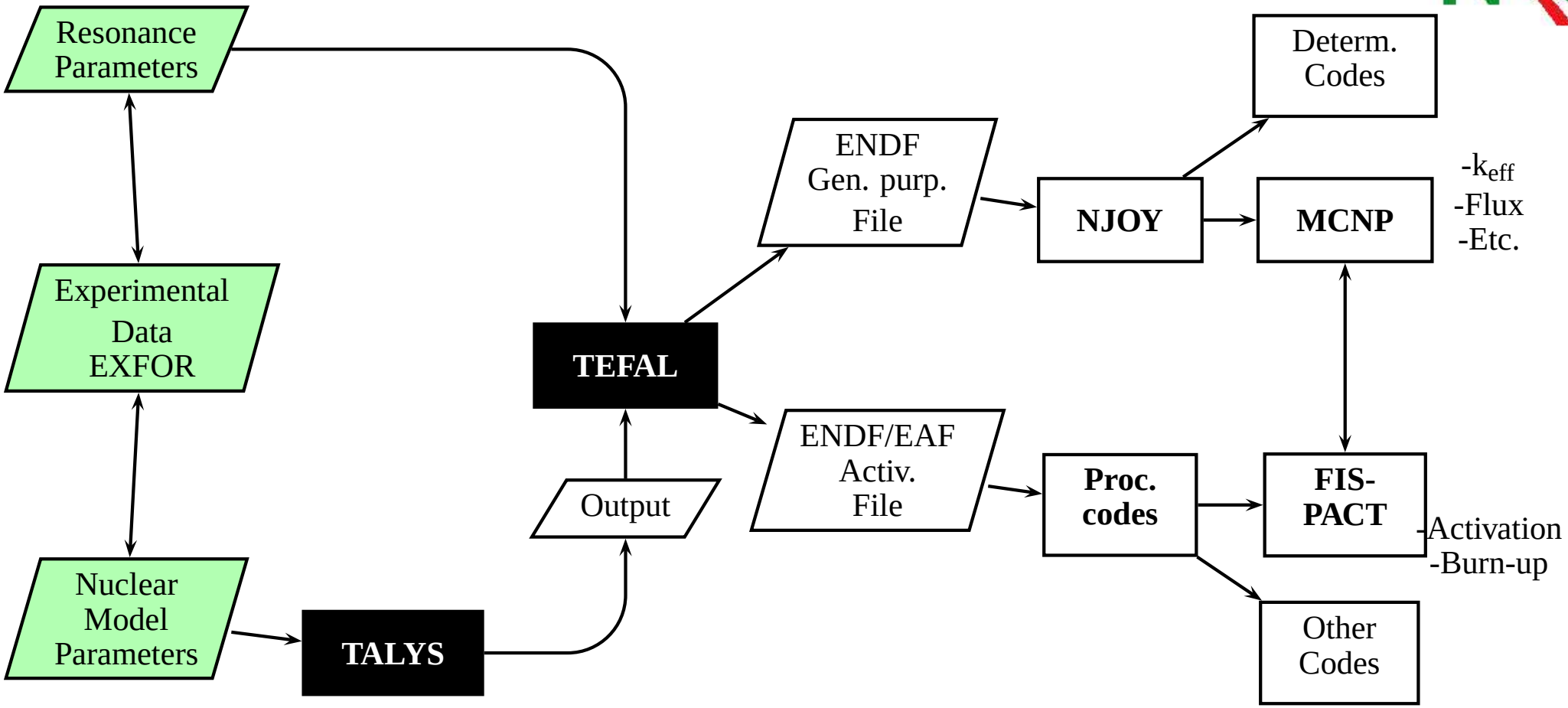
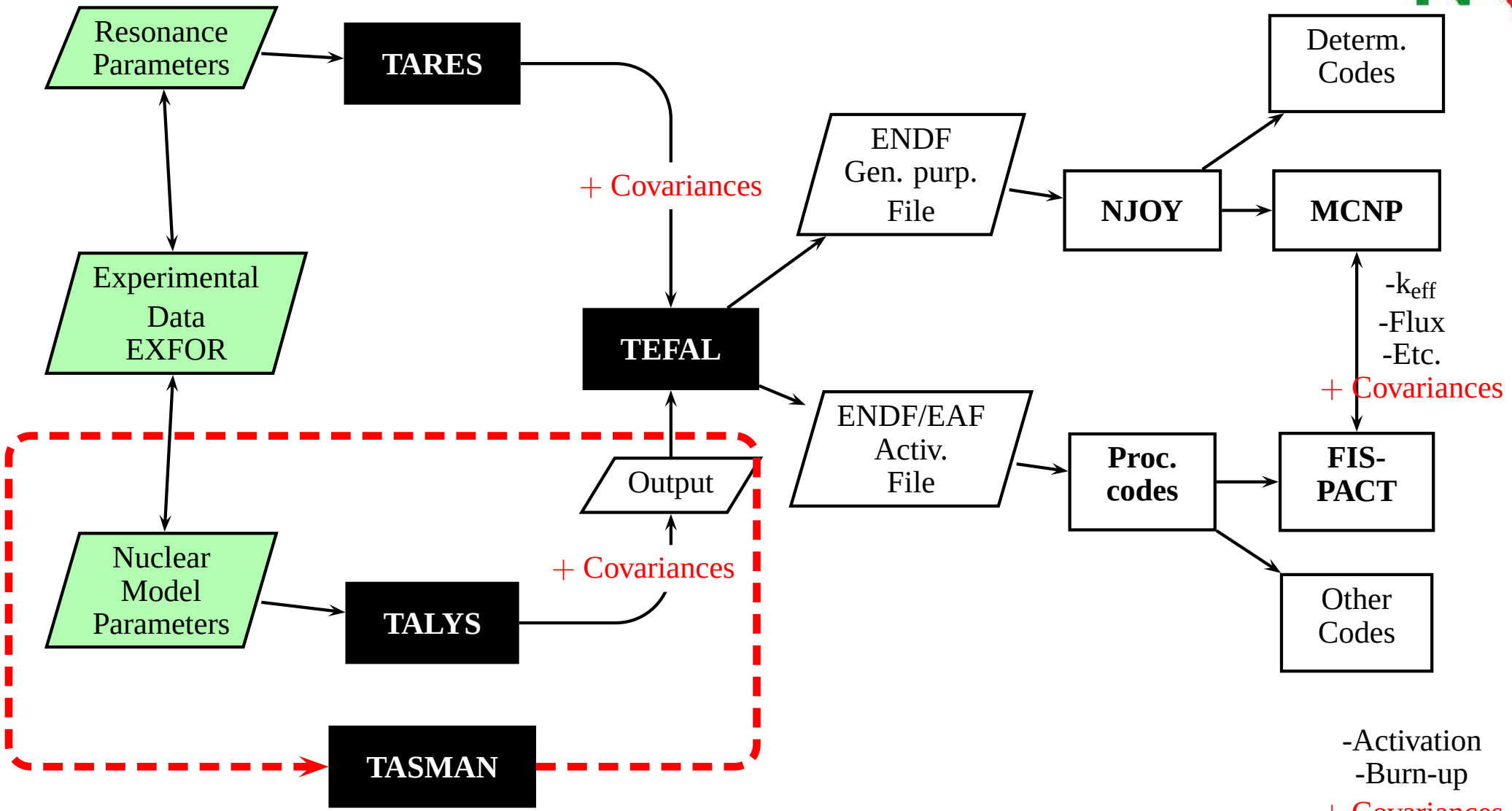
- Impact:
  - TENDL-2008 to 2013 (2600 isotopes),
  - all isotopes with covariances,
  - fully implemented in FISPACT-II,
  - more than 80 isotopes in JEFF-3.2,
  - more than 250 publications using TENDL,

- Normalized MTs:
  - MT2: 61 cases,
  - MT4: 19 cases,
  - MT16: 49 cases,
  - MT18: 26 cases,
  - MT102: 38 cases,
  - MT103: 22 cases,
  - MT107: 11 cases,

Concept: Standard nuclear data scheme



Concept: Nuclear Data Scheme with covariances



TENDL releases

- Available at www.talys.eu/
- Neutrons: ENDF files (MF1-15 and MF31-40), 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	Covariances
TENDL-2013	**2630**	**2625**	**2625**	**2625**	**2624**	**2624**	**2626**	**-**	**2630**
TENDL-2012	**2435**	**2429**	**2428**	**2348**	**2429**	**2429**	**2430**	**-**	**2338**
TENDL-2011	**2425**	**2429**	**2419**	**2431**	**2429**	**2428**	**2428**	**574**	**2416**
TENDL-2010	**2394**	**1157**	**1159**	**1156**	**1159**	**1140**	**1152**	**529**	**1086**
TENDL-2009	**2375**	**1163**	**1164**	**1116**	**1163**	**1127**	**1165**	**509**	**1141**
TENDL-2008	348	344	336	339	342	338	327		**342**
(JEFF-3.2)	*472*								*218*
(ENDF/B-VII.1)	*423*	*47*	*5*	*3*		2	*163*	*80*	*146*
(JENDL-4.0)	*406*								*90*

Available files

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)
10. Random ENDF files (to get uncertainties on anything with TMC)

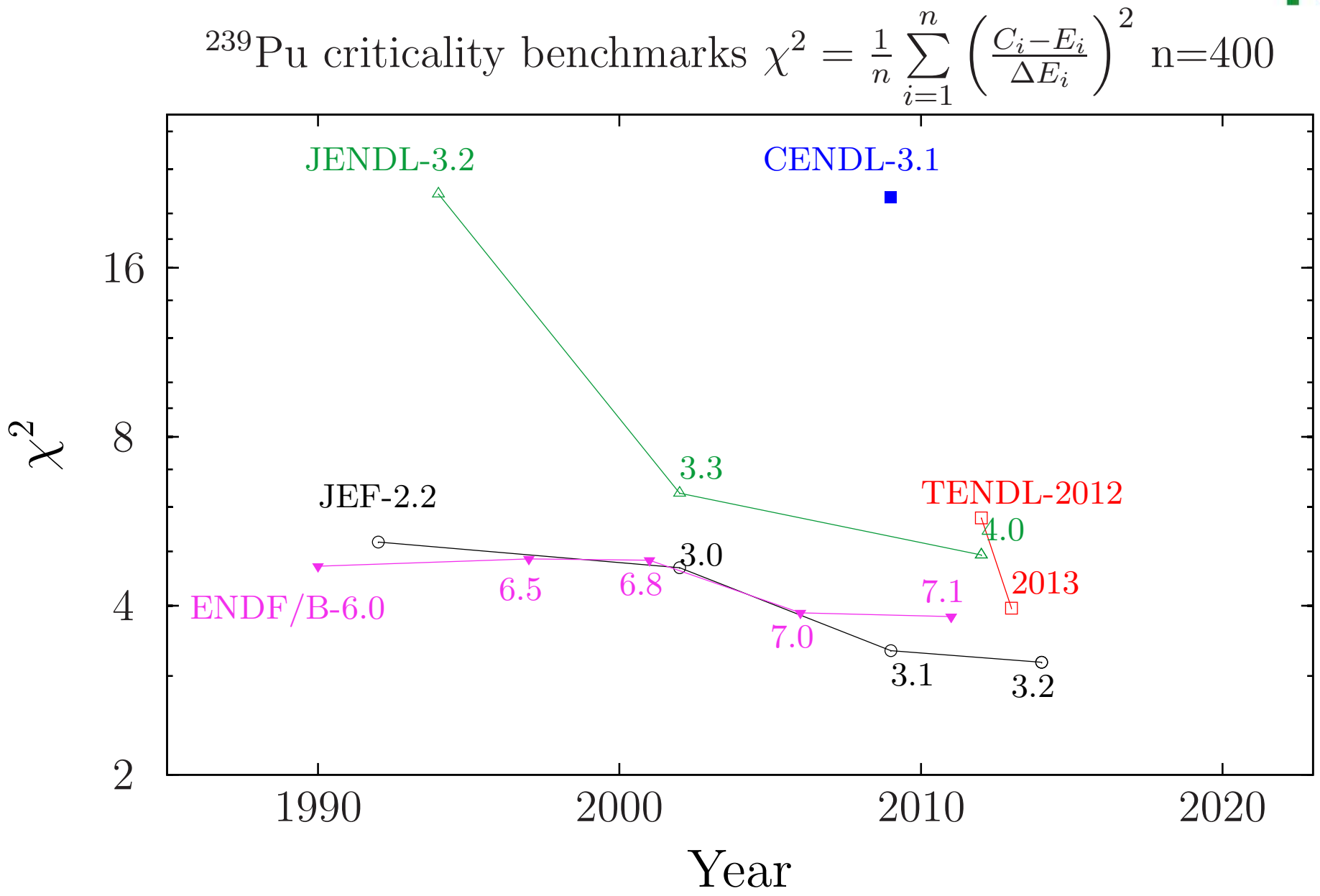
TENDL-2013 Neutron library: from MF-1 to MF-40

Content of a typical file up to 200 MeV:

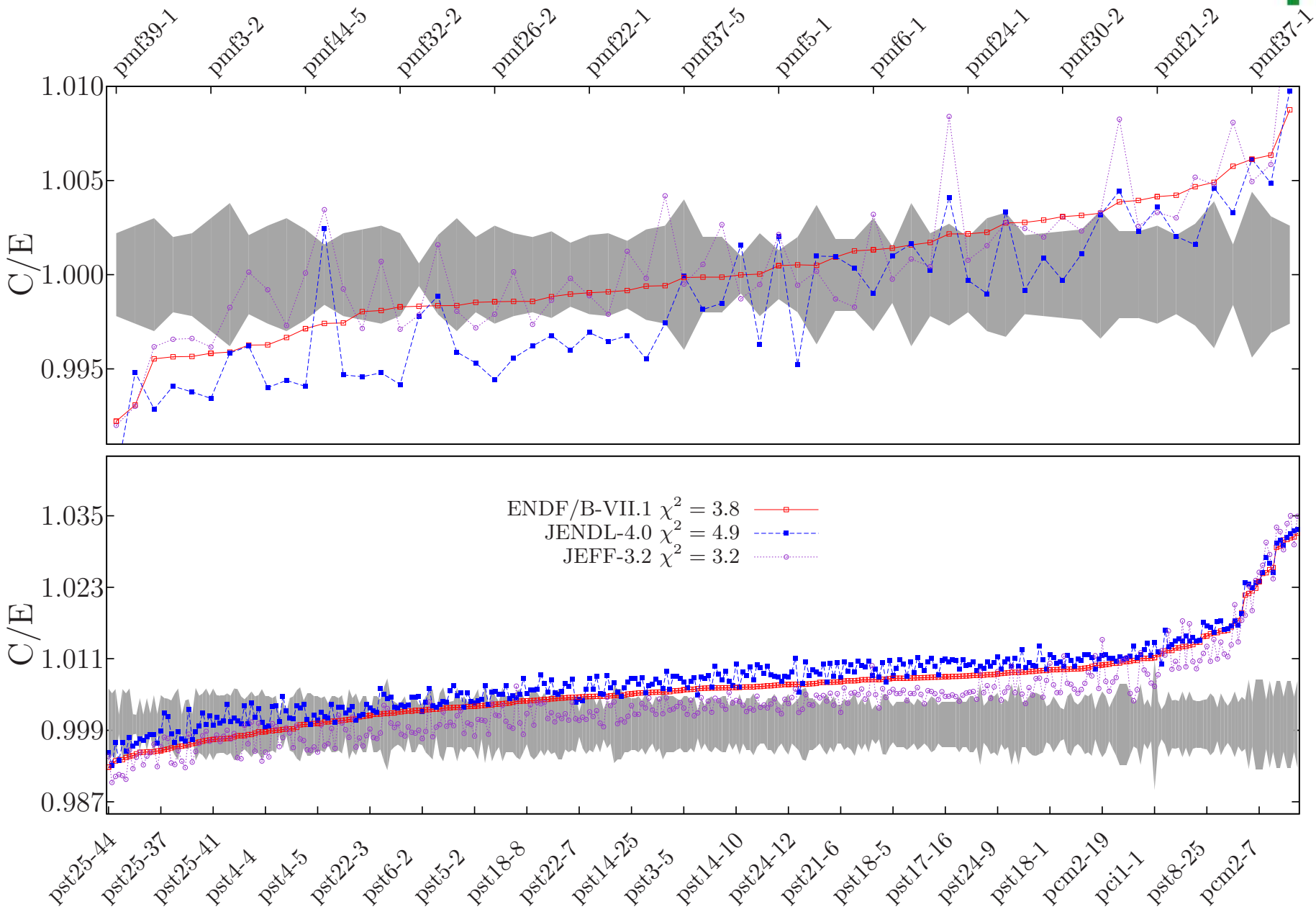
- MF-1: Description + fission parameters
- MF-2: Resonance parameters (Reich-Moore or Multi-level Breit Wigner)
- MF-3: Cross sections (n,tot), (n,el), (n,non), (n,inl$_i$), ..., (n,γ), (n,p$_i$), (n,α_i)
- MF-4: Elastic angular distribution (Legendre Polynomials)
- MF-5: Fission neutron spectrum
- MF-6: Double differential distributions and spectra for (n,2n), ..., (n,α_i)
- MF- 8-10: Isomeric cross sections
- MF- 12-15: Gamma yields, angular distributions and spectra
- MF- 31-32-33-34-35, 40: nubar, Resonance parameter, cross section, elastic angular distribution and fission neutron spectrum covariances, radionuclide production.

Contents

How well do we work ?



Examples on criticality benchmarks



Example of the *Random search* on ^{239}Pu

① Use the ”TALYS system” to create a single ^{239}Pu evaluation close or equal to JEFF-3.2,

② Randomize all model parameters (resonances, nubar, fission neutron spectrum, TALYS parameters) to create 10 000 random ^{239}Pu evaluations,

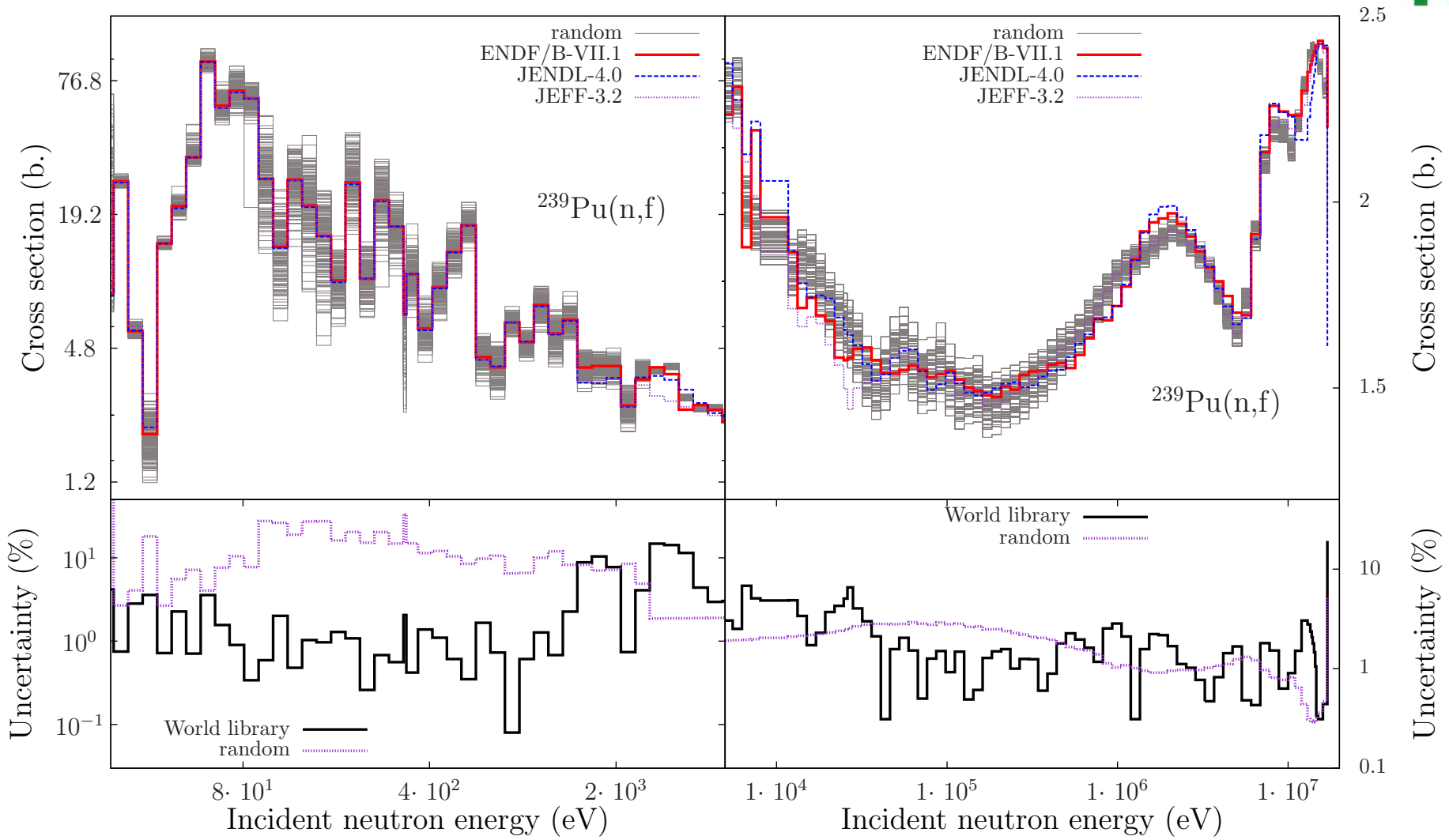
③ Benchmarks the 10 000 files with the same set of n criticality benchmarks for ENDF/B-VII.1, JEFF-3.2 and JENDL-4.0 ($\Longleftarrow 3 \times 10\,000 \times n$ calculations),

④ Select the best random file for each ENDF/B-VII.1, JEFF-3.2 and JENDL-4.0,

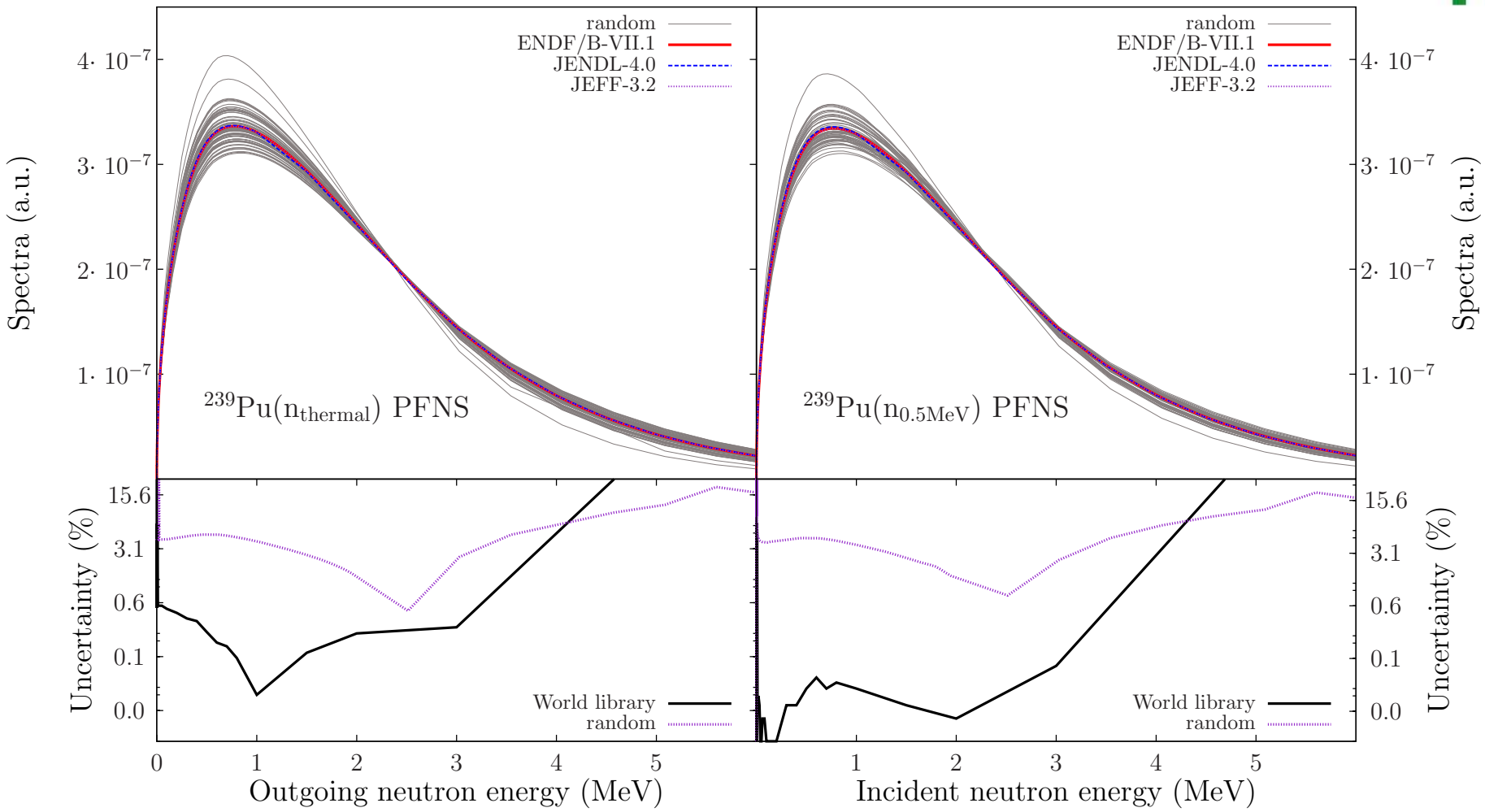
⑤ Test the predictive power,

⑥ Even better: combine many random ACE files to get a better χ^2,

Examples of random cross sections



Examples of random PFNS



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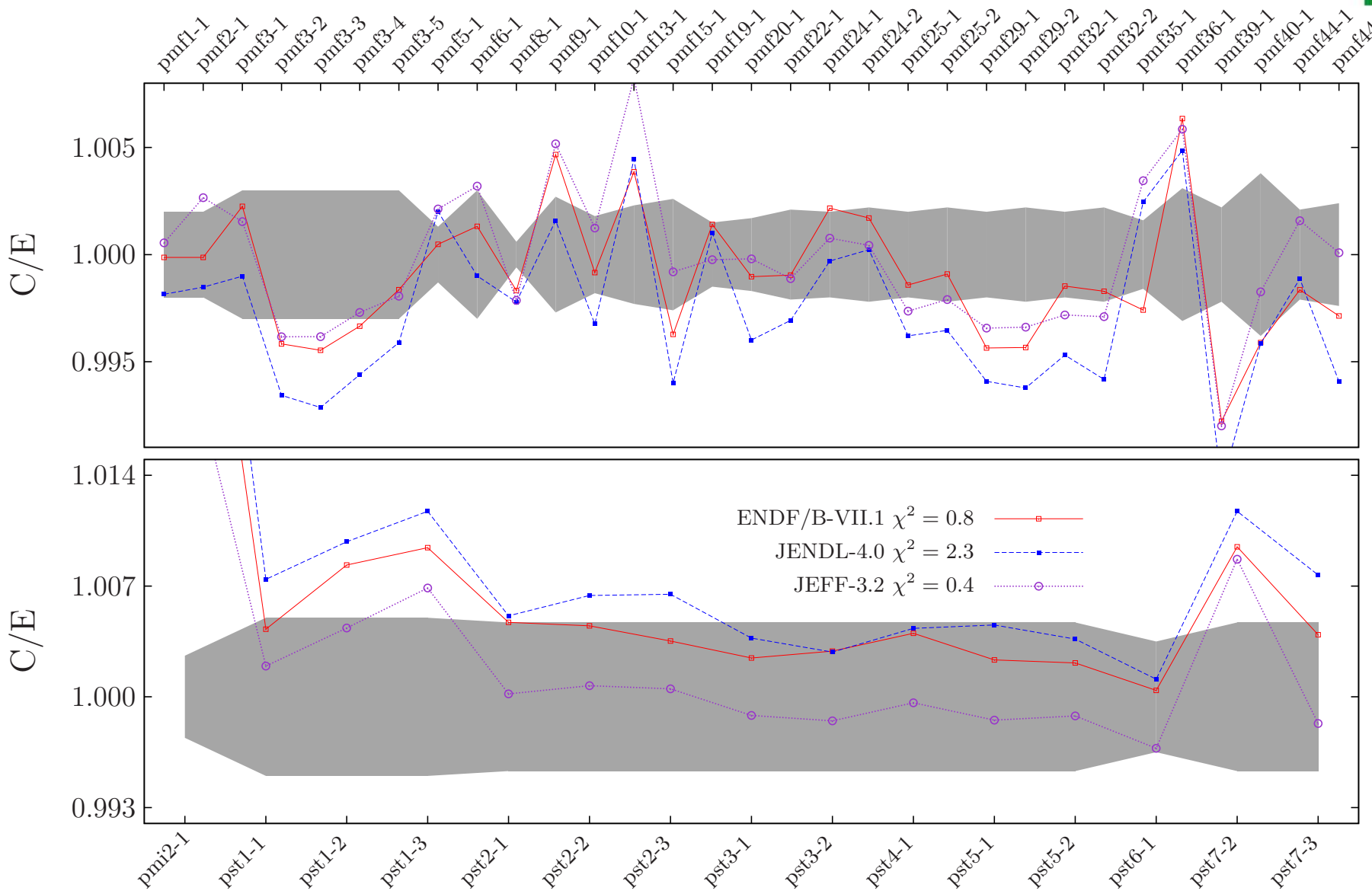

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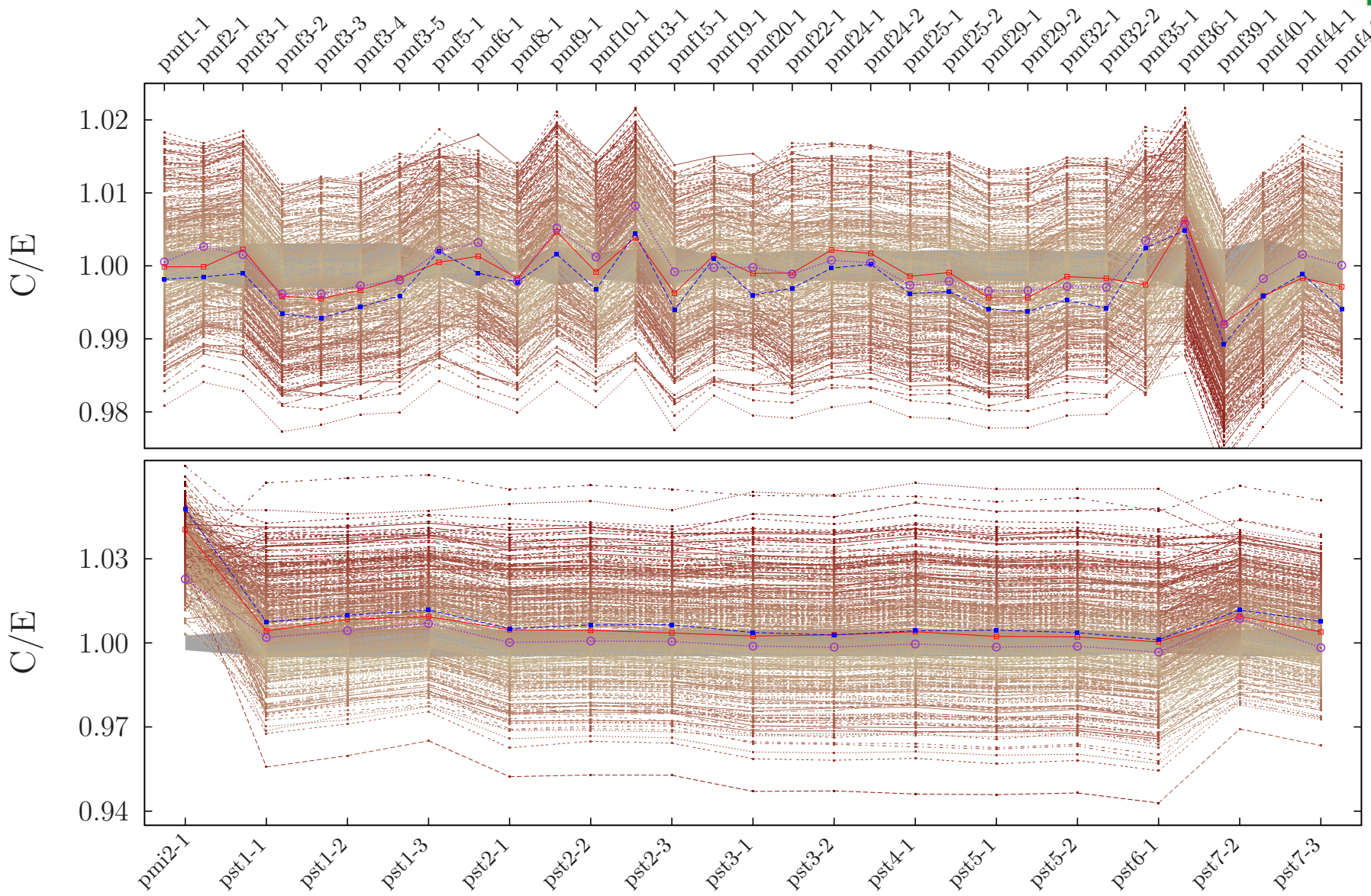

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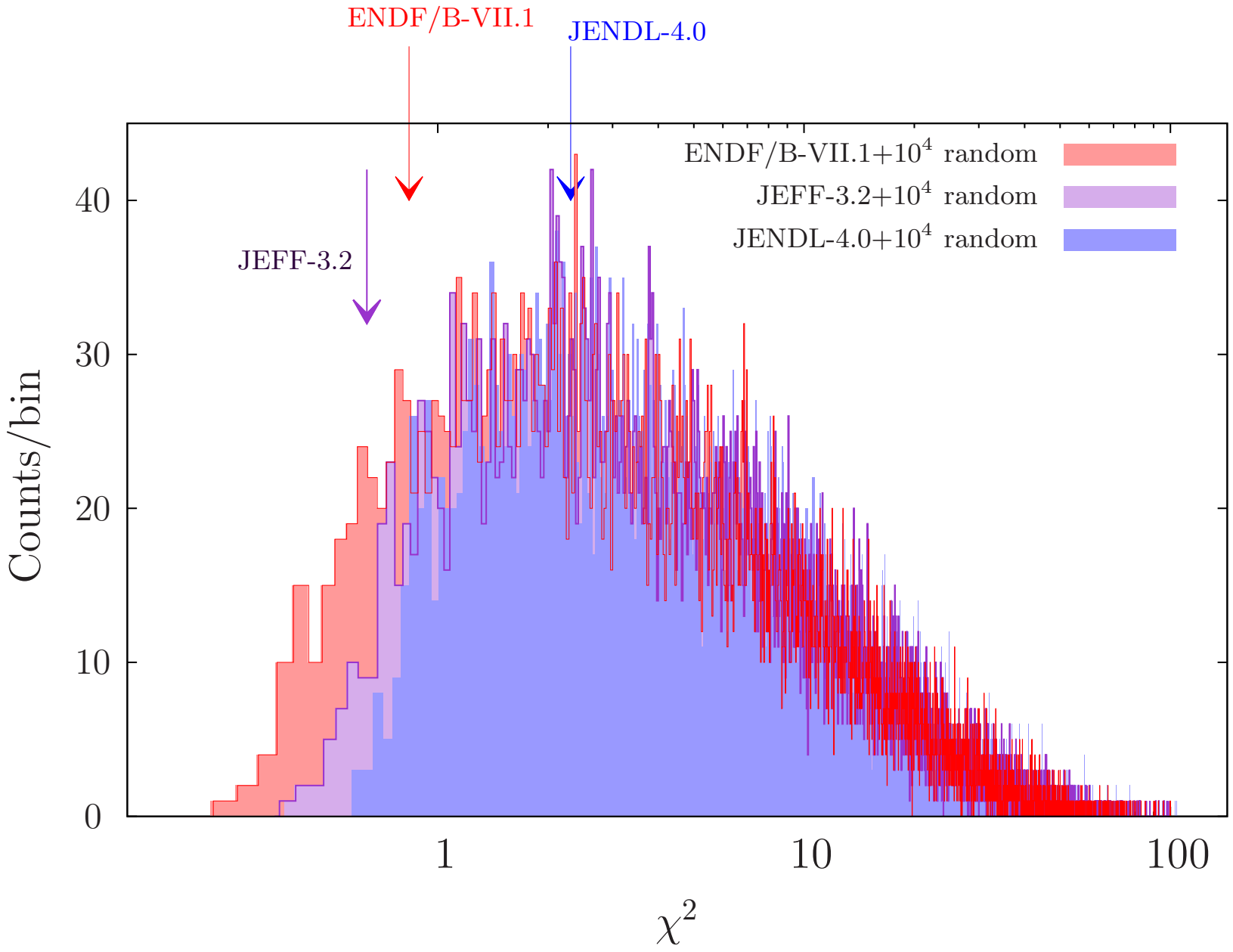

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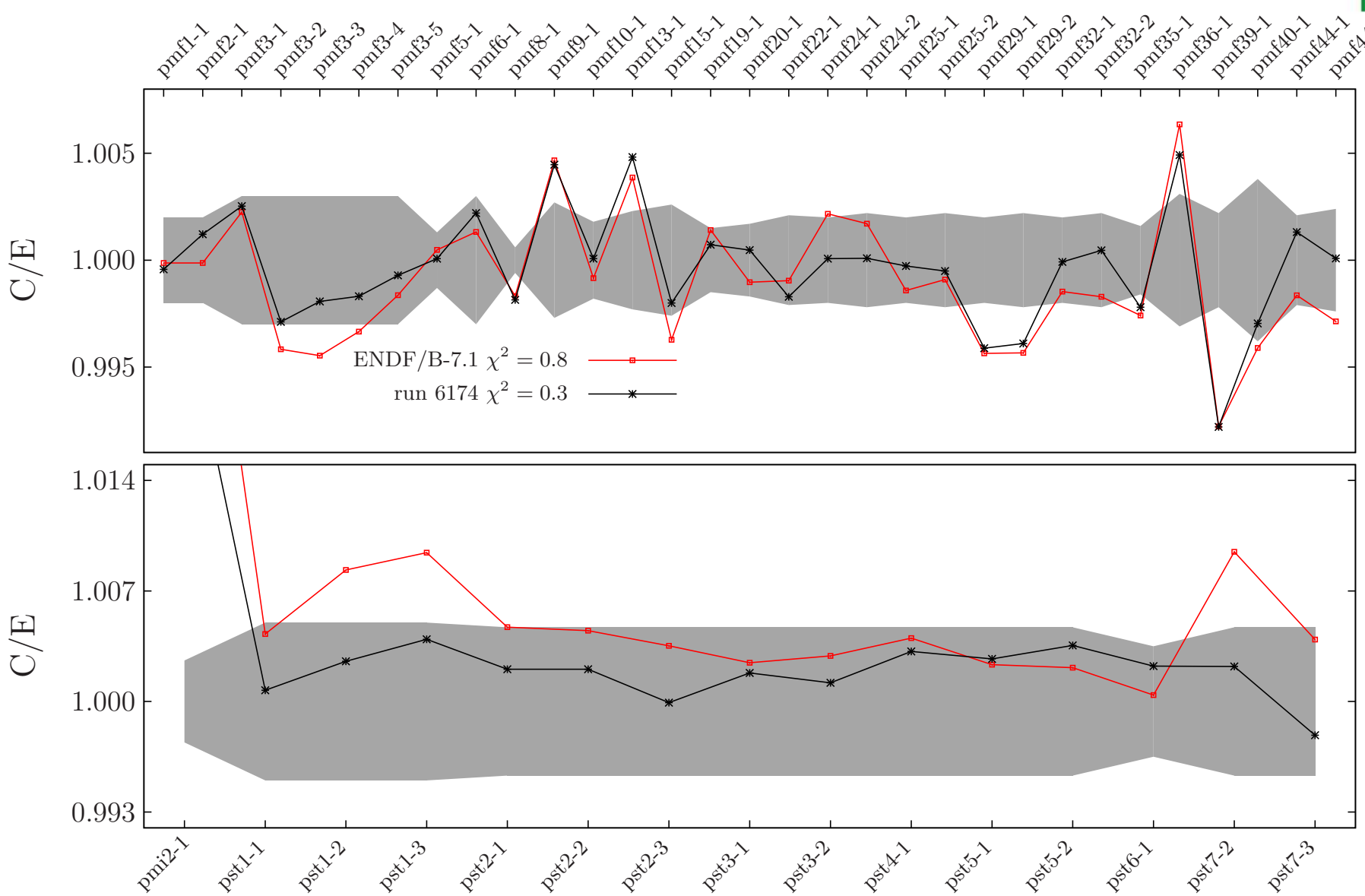

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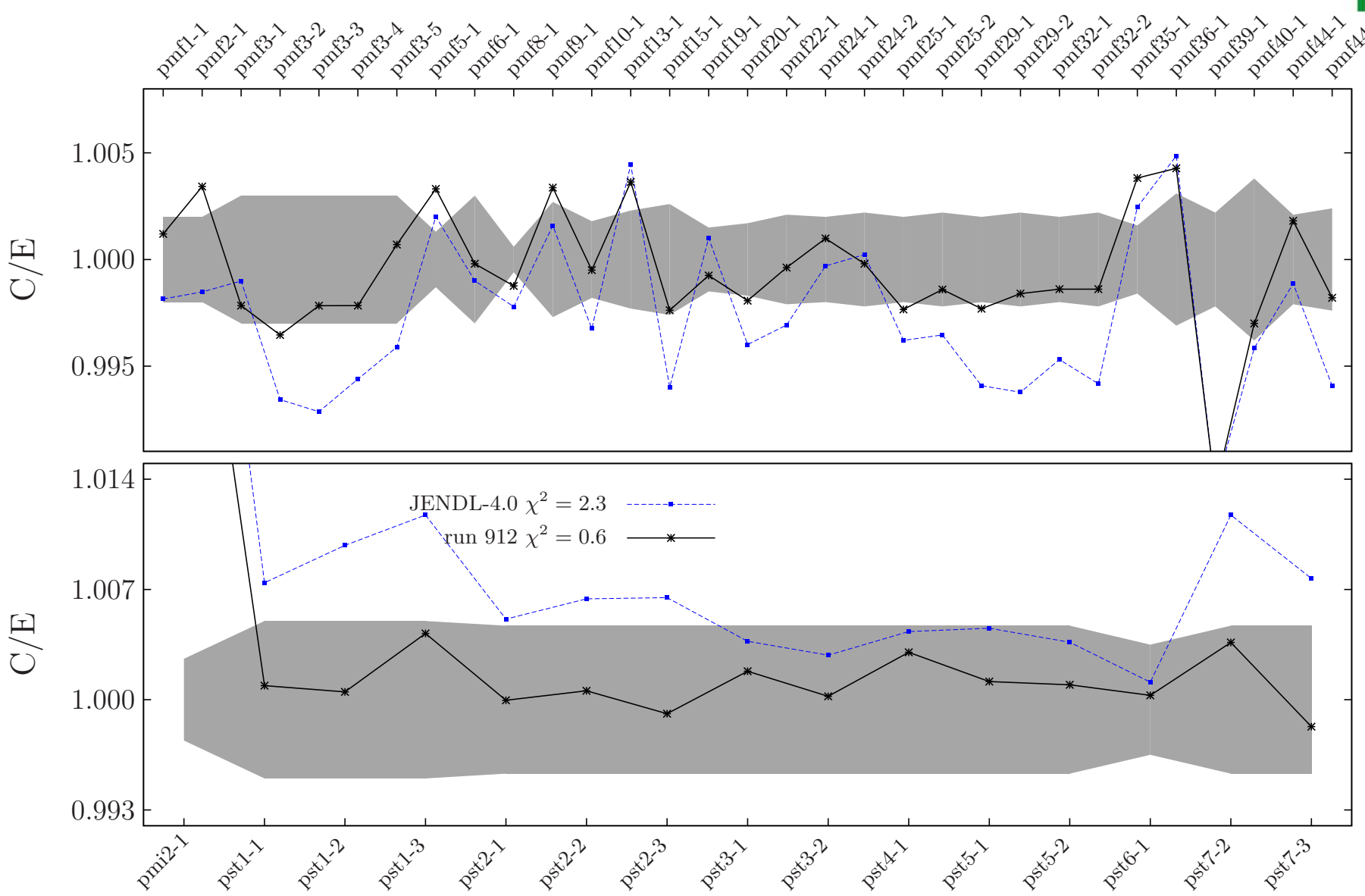

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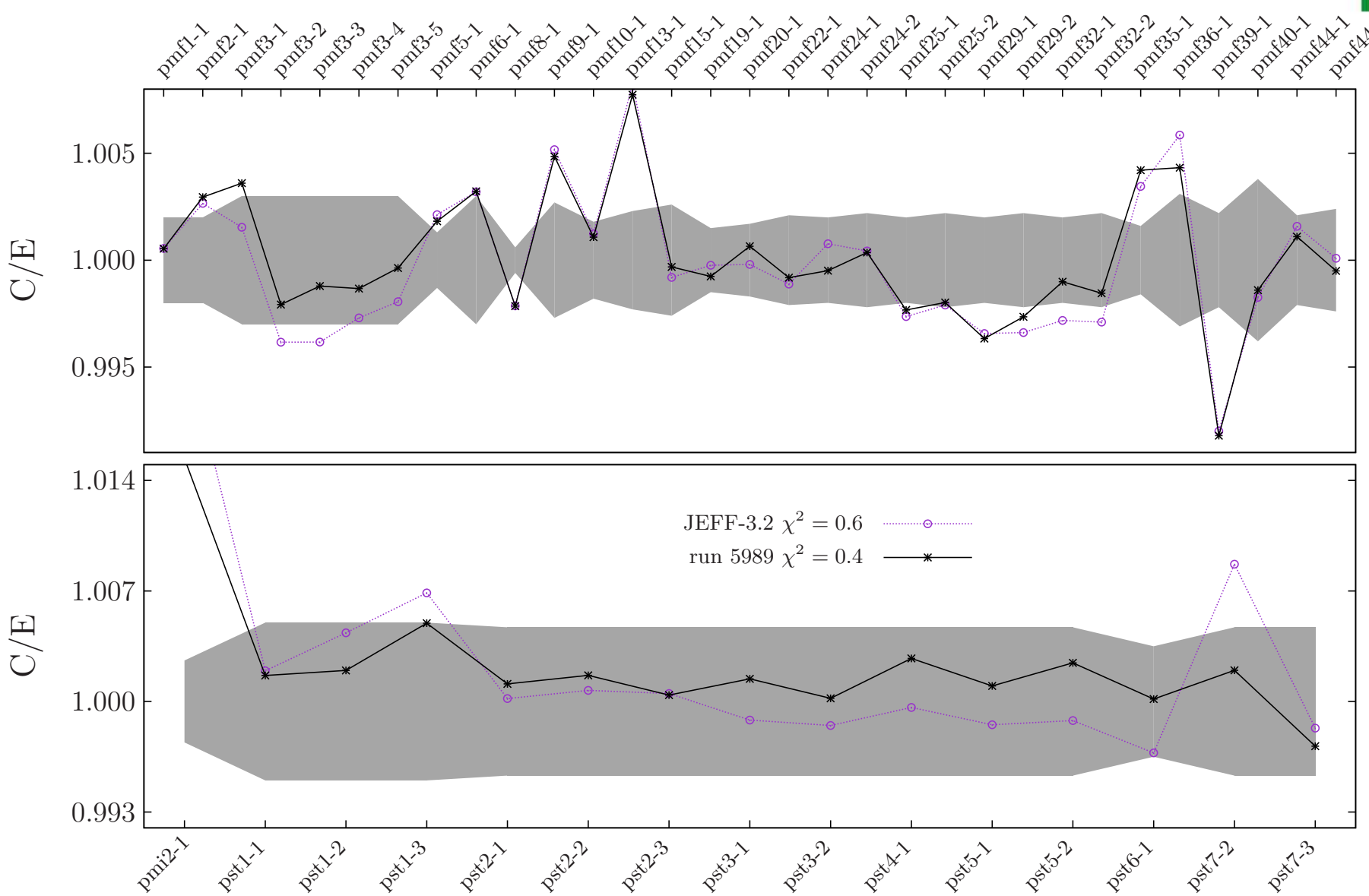
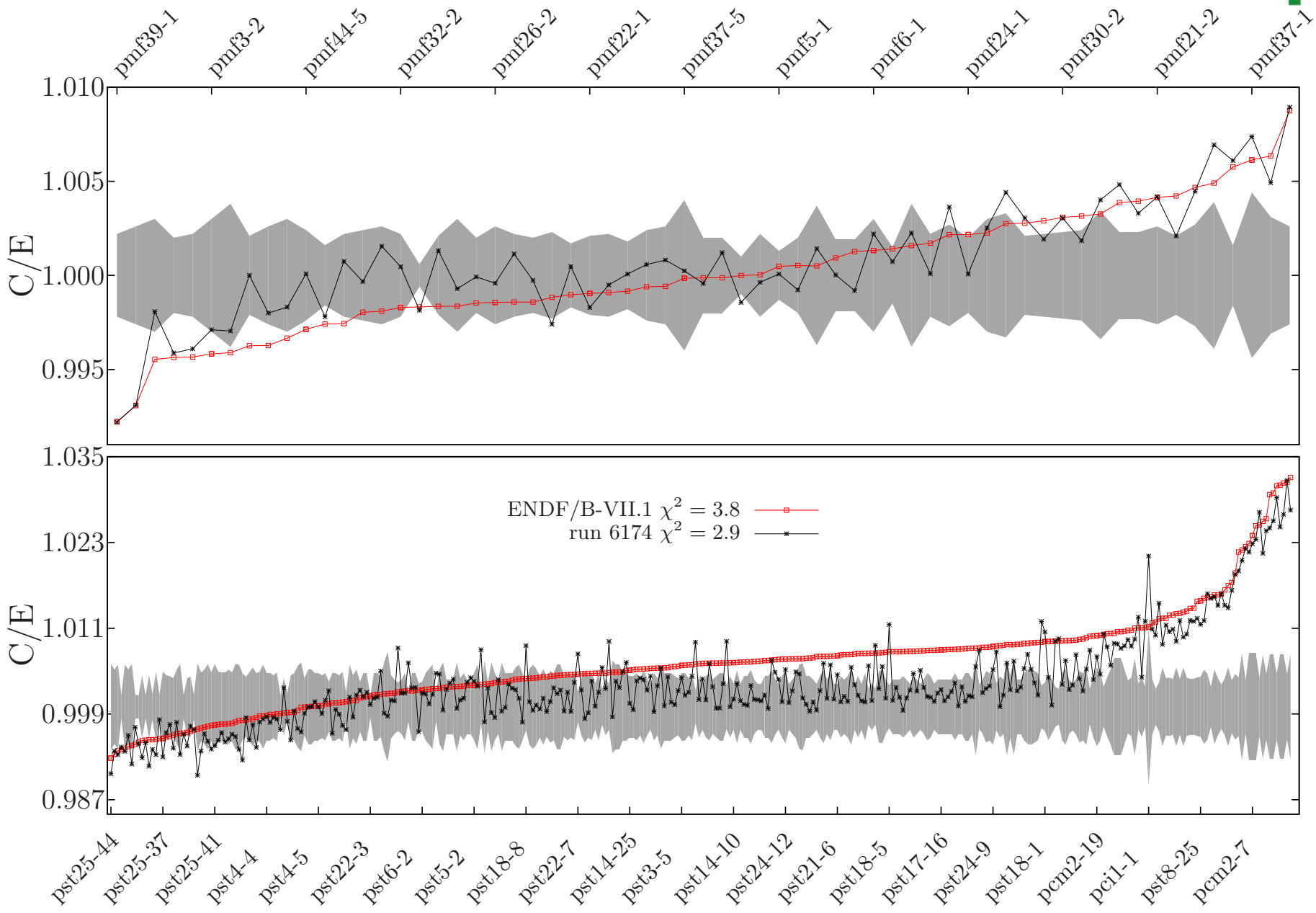
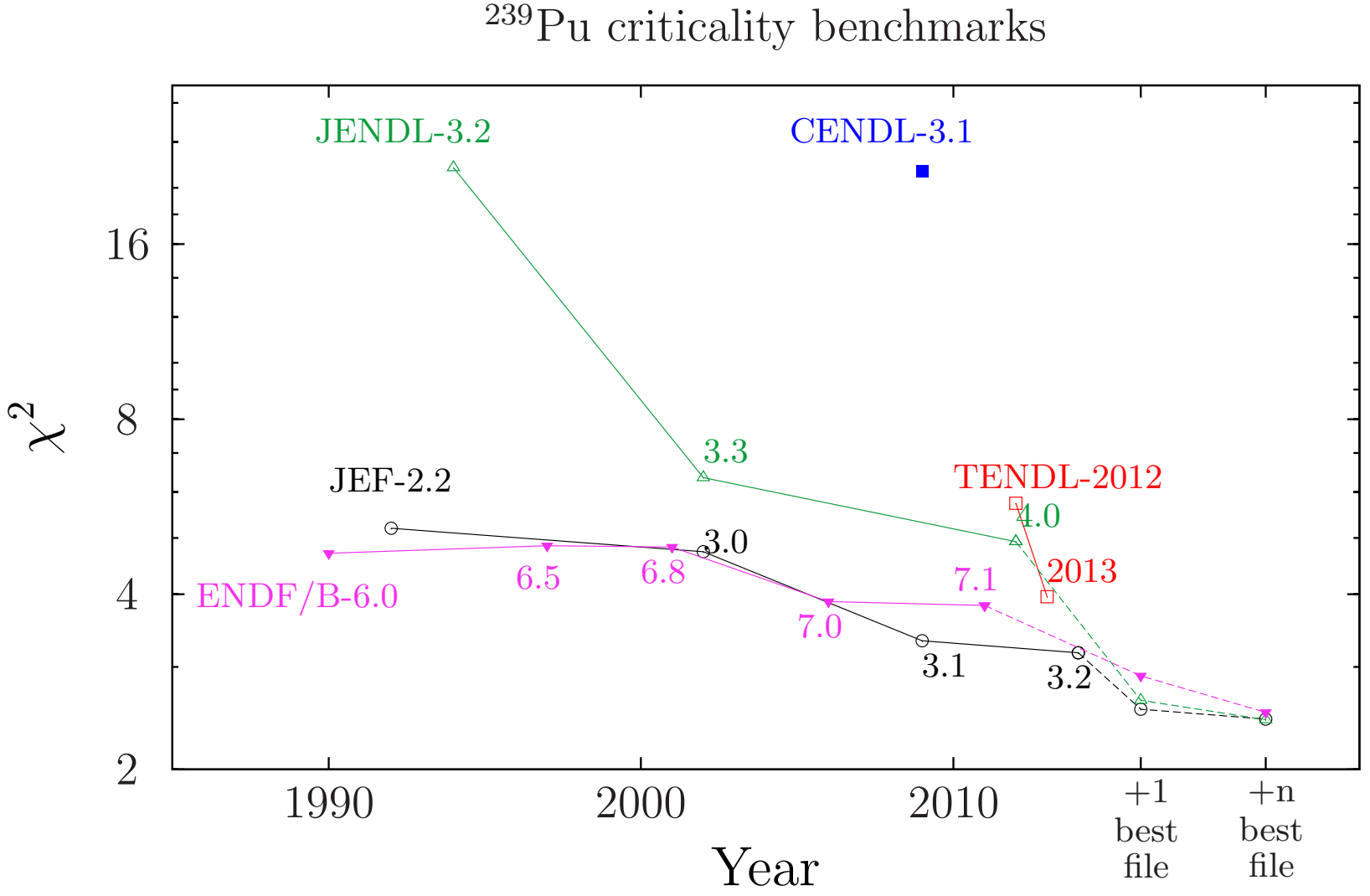


Predictive power



Conclusion



What can we obtain by repeating this for ^{235,238}U, ^{16}O,^{56}Fe... ?