Update on Ta181 evaluation

M. Herman and T. Kawano

Nov 1, 2022

Managed by Triad National Security, LLC for the U.S. Department of Energy's NNSA

LA-UR-22-31437

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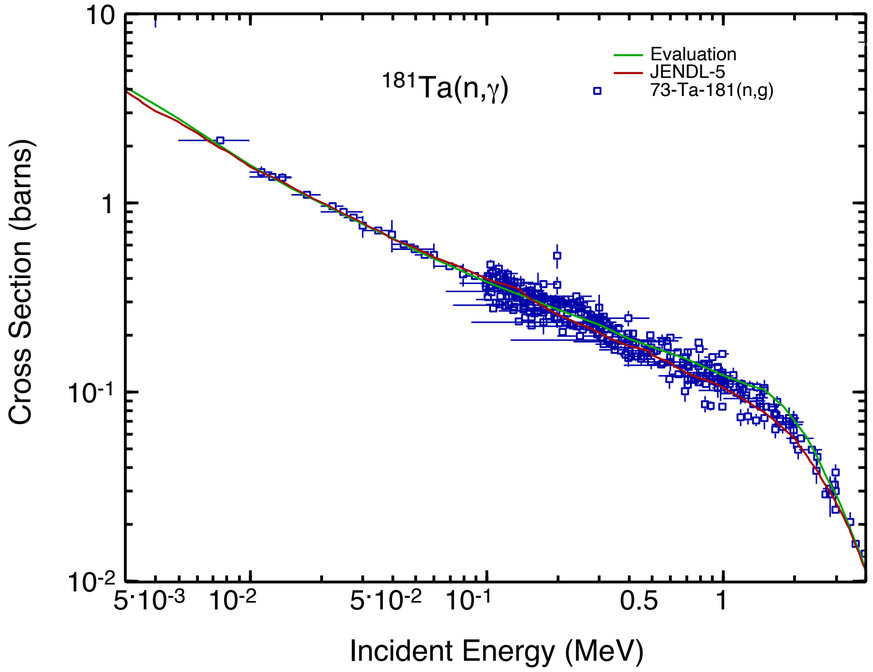
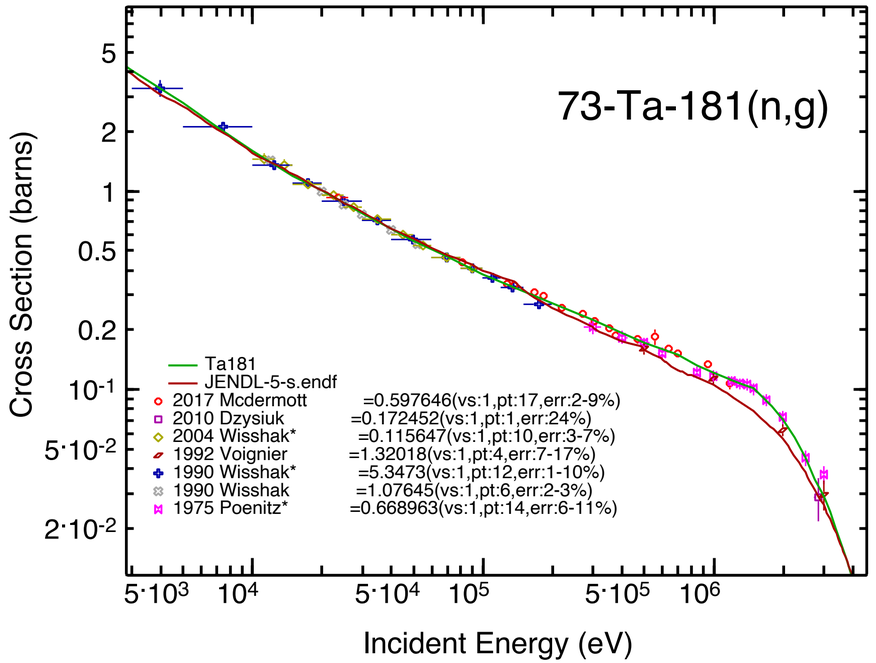
Capture

Guided by the selected measurements

Some difference compared to JENDL-5

- Dense cloud of experimental data.
- Default model goes roughly through the middle of this cloud.
- There is a set of trustful and consistent measurements.
- These were given priority over model results (energy dependent tuning up to 1.25 at 0.7 MeV).

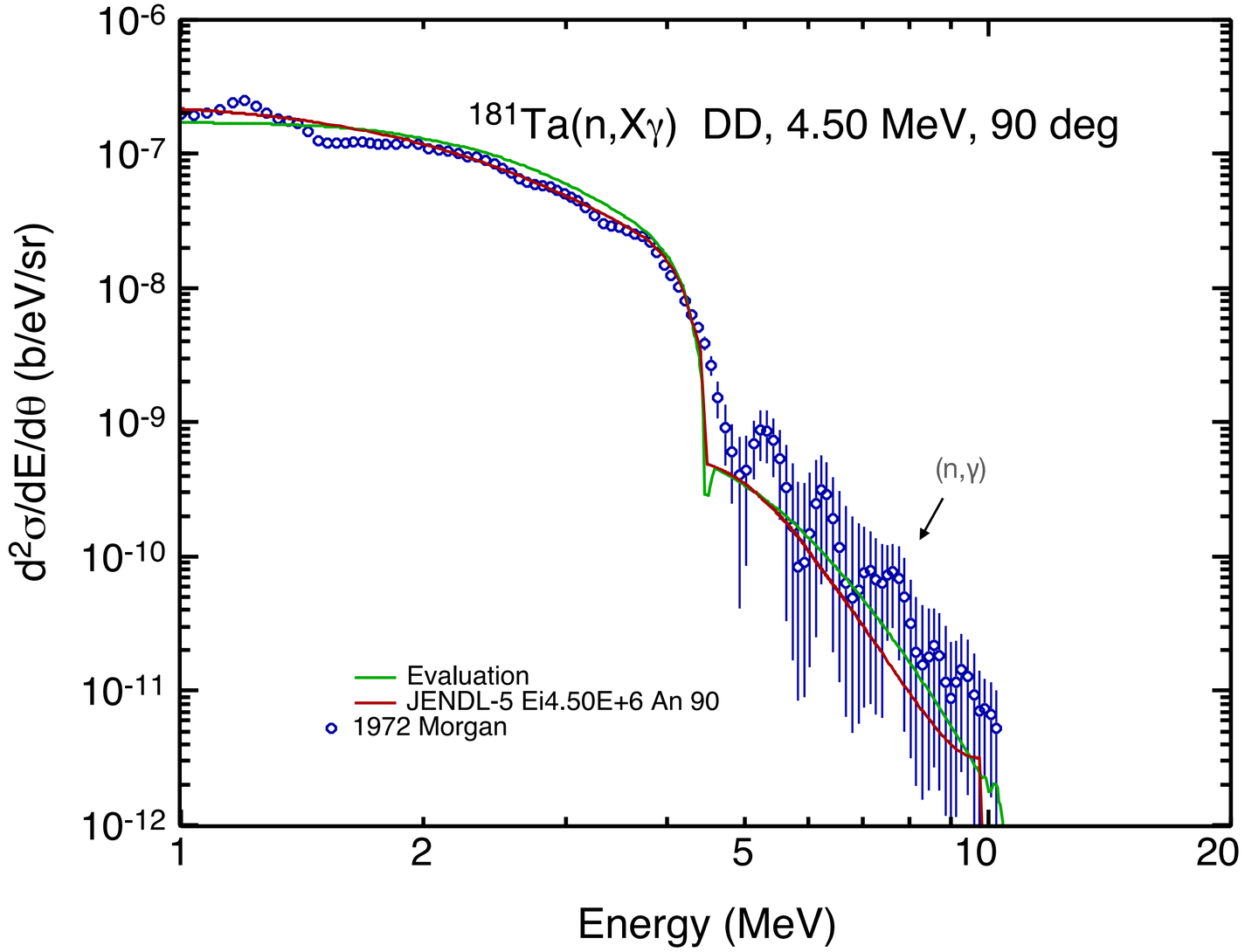




Gamma spectra

Capture guided calculations work well

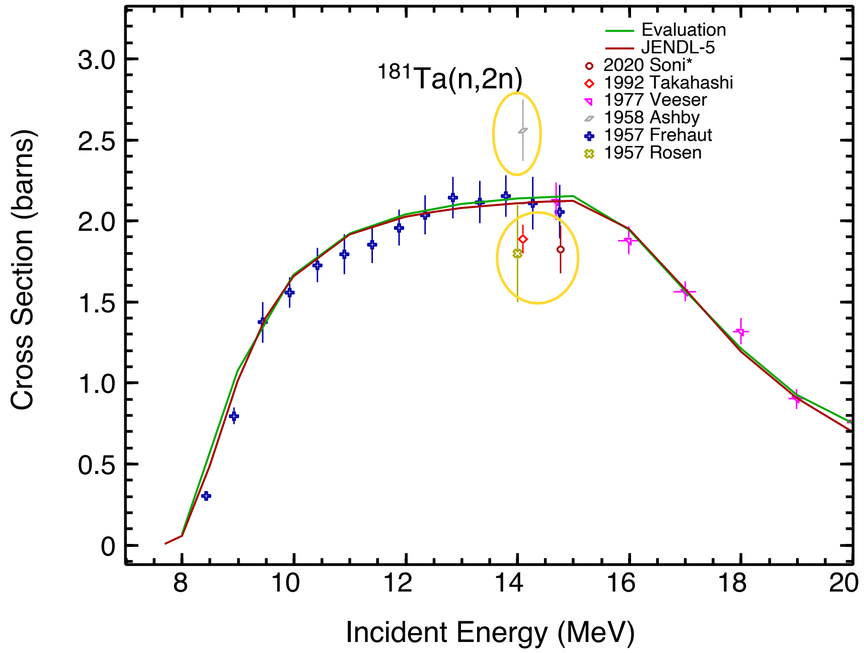
- Good reproduction of gamma spectra.
- High energy tail related directly to capture.
- At a few MeV range these tails might suggest that capture could be somewhat higher.

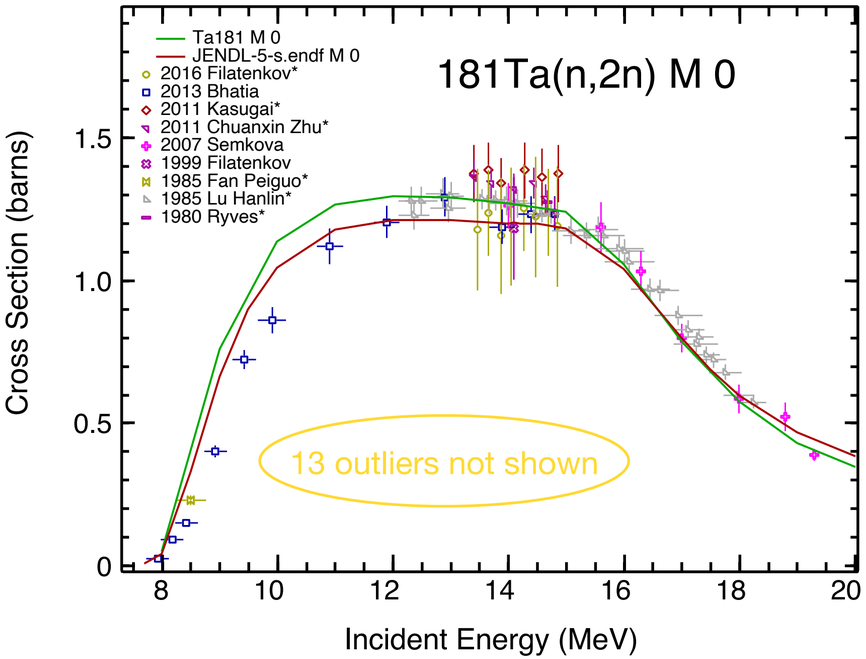


(n,2n)

Model adjusted experimental data

- Original calculations were higher than experiment.
- 10% increase of the a-parameter in target lev. dens. eliminated this difference
- Frehaut renormalized by 1.078.
- Out of 22 datasets for isomeric cross sections 13(!) are outliers, for total (n,2n) these are 4 out of 6.

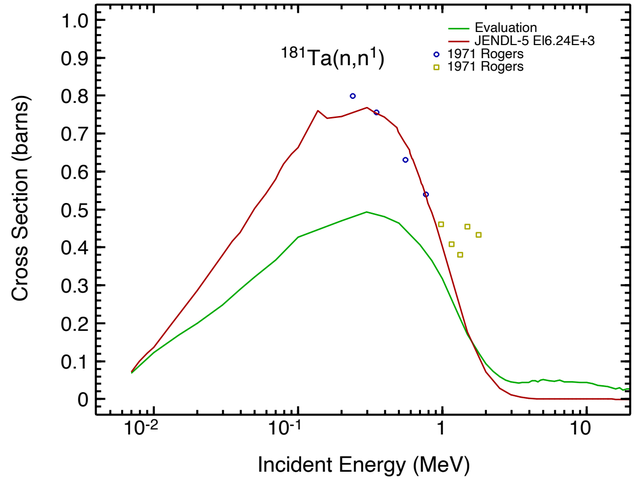




Inelastic

Major difference to JENDL-5

- Our 1st inelastic considerably lower than Rogers while JENDL-5 follows Rogers!
- Reasonable agreement for higher inelastics
- Two 14 MeV points ignored by both evaluations



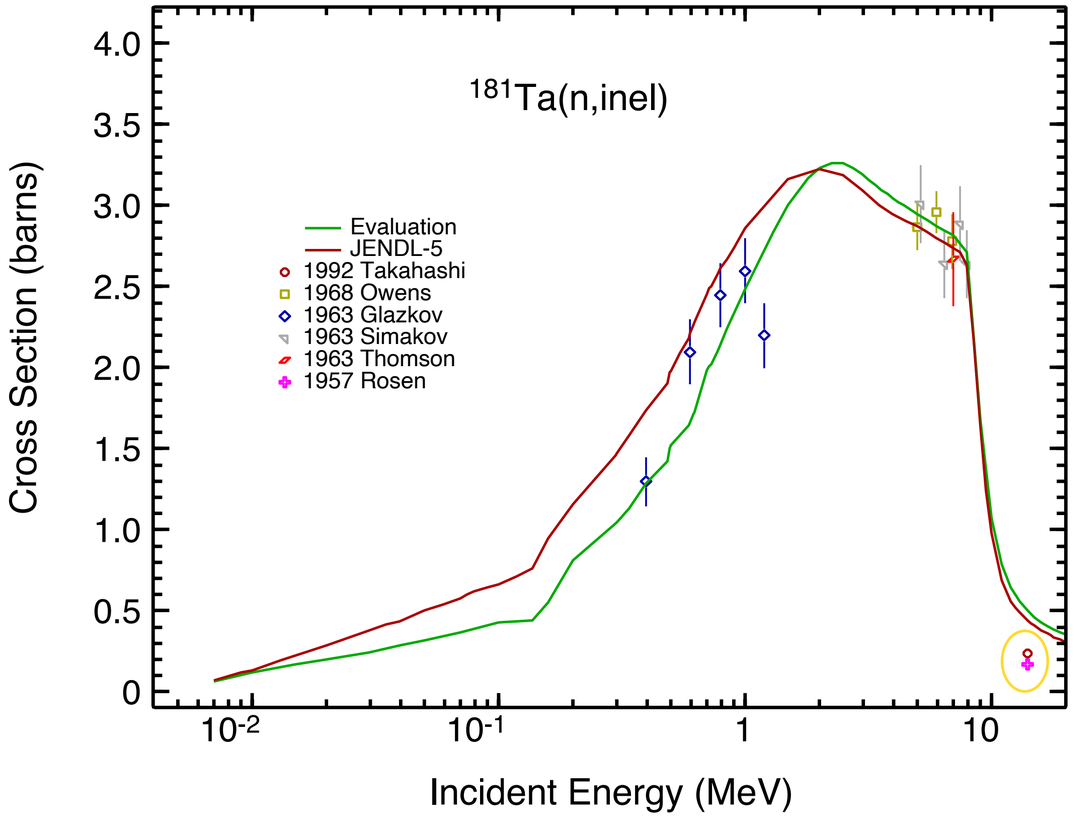


TABLE V

Tantalum Level Excitation Functions (mb)

Energy Level (keV)	Gamma-Ray Energy (keV)	Neutron Energy (MeV)								
		0.24	0.35	0.56	0.77	0.98	1.16	1.34	1.5	1.79
6		800	756	632	540	462	409	381	455	434
136	136	489	425	682	643	696	797	834	792	707
159	153	94	153	192	226	224	354	332	356	375
301	165 301		183 (0.36)	337	270	365	401	499	514	500
339	180			33 (0.57)	80	109	121	102	124	107
482	346 476-482			172	208	231	305	306	349	351
498	197 362			13 (0.58)	50	69	104	95	98	92
546	209				14	20	29	30	26	29
615					20	32	38	41	42	42
619					68	101	104	104	103	102
718	220				9 (0.78)	14	19	19		35

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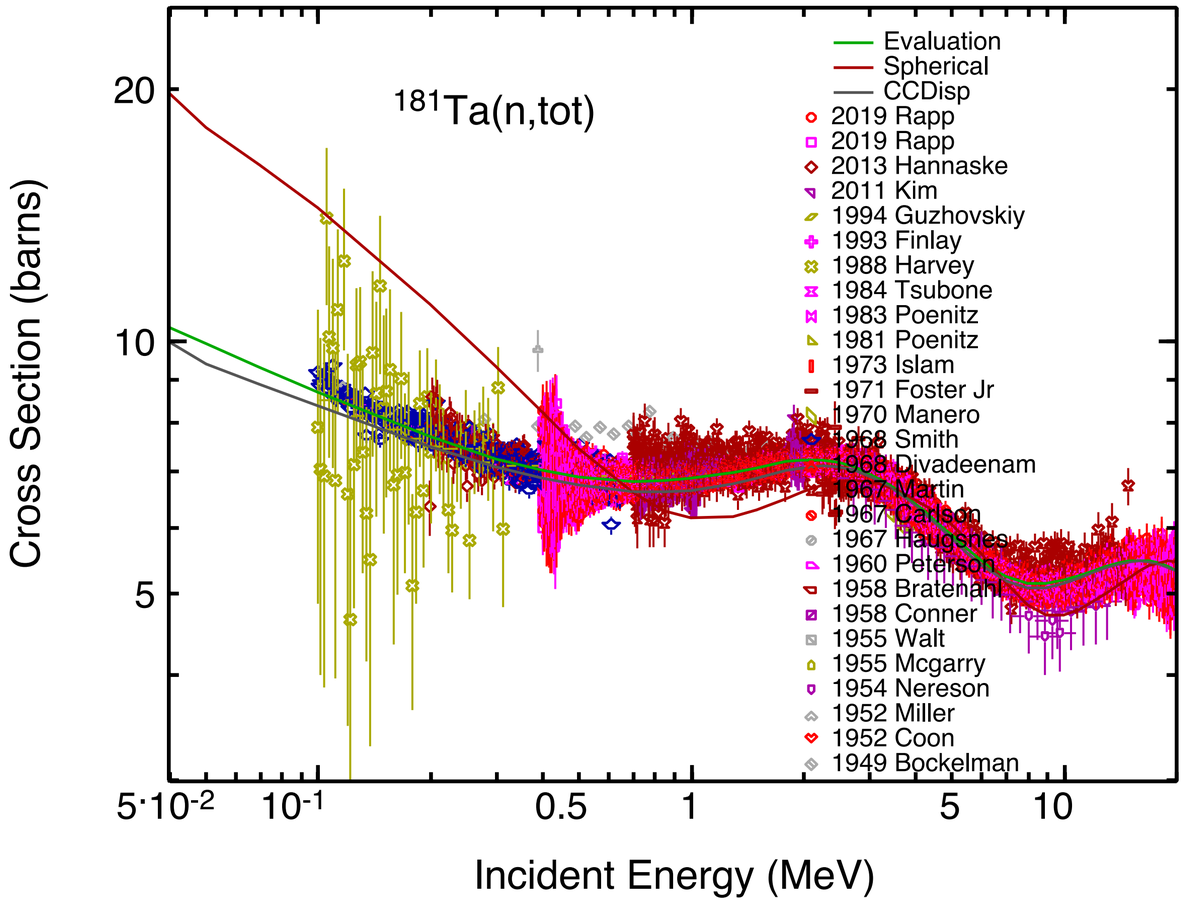
V. C. Rogers et al: “Values listed for the 6-, 615-, and 619-keV levels are from the theoretical calculations. Errors associated with cross sections are from 30 to 40% mainly due to the uncertainties in the self-absorption and the internal conversion factors. ”

Total cross section

Spherical OM over-calculate total below 0.7 MeV



Validation (including NNL/ORNL RRR/URR)

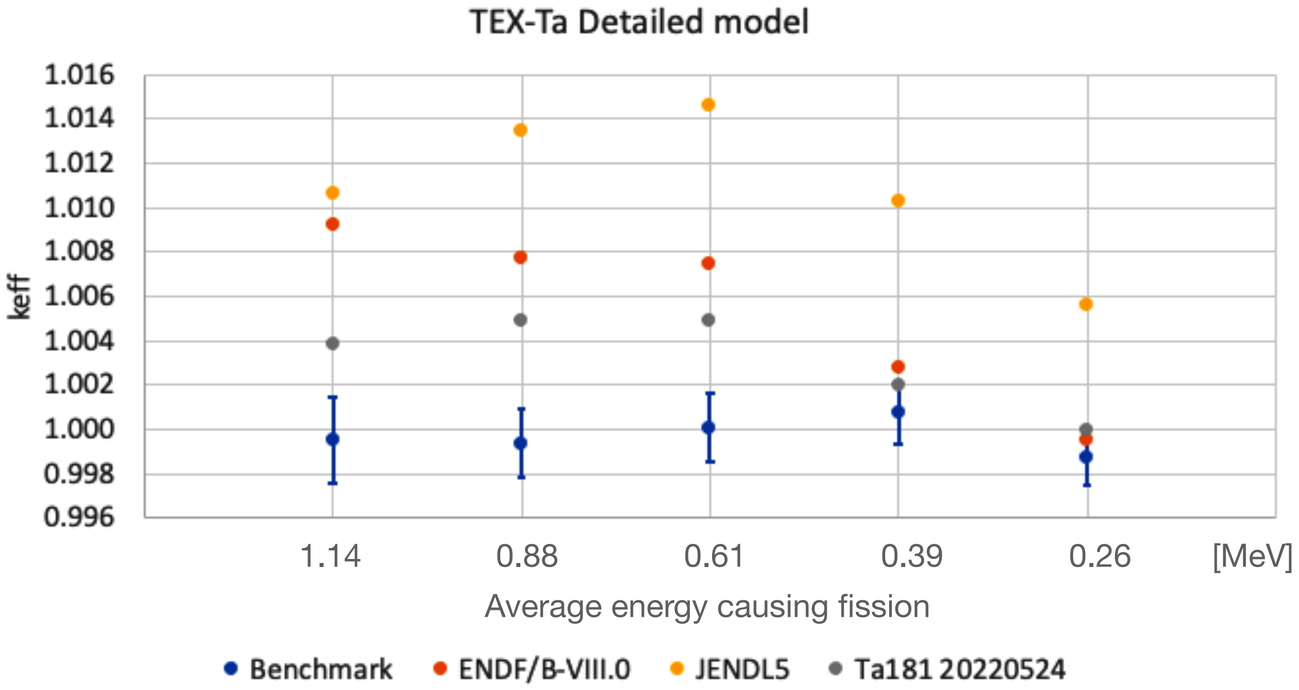
Major improvement!

- **PMF45** - late 50's, water moderator, weak dependence on ^{181}Ta, can't be fixed with ^{181}Ta.

- **Tex** - brand new, polyethylene moderator, slope decreased by ~50% compared to ENDF/B-VIII.0. JENDL-5.0 much worse. Main differences - inelastic and capture. Validation supports our choices.

Thanks to Catherine Percher for the decks and to Wim Haeck for running them.

	C/E0-1 Ta181 ENDF/B-	C/E-1 Ta181 20220524	C/E-1 Ta181 JENDL5
pu-met-fast-045-001-rev0	200 pcm	50 pcm	180 pcm
pu-met-fast-045-002-rev0	900 pcm	750 pcm	860 pcm
pu-met-fast-045-003-rev0	640 pcm	480 pcm	610 pcm
pu-met-fast-045-004-rev0	520 pcm	370 pcm	510 pcm
pu-met-fast-045-005-rev0	1060 pcm	970 pcm	920 pcm
pu-met-fast-045-006-rev0	1200 pcm	1030 pcm	1180 pcm
pu-met-fast-045-007-rev0	1280 pcm	1120 pcm	1260 pcm



Conclusions

- Evaluation totally expressed through the model fitted to differential data.
- No integral experiment influence.
- This work and JENDL-5 are very similar, but different choices were made for inelastic and capture. Ours were more fortunate (in validation).
- Tex validation with ENDF/B-VIII.0 shows decisive improvement but new ^{239}Pu evaluation should be taken into account.

Summa Summarum

- File merged with the new NNL/ORNL Resonance Region.
- Merged file submitted to the NNDC Git repository.
- Preliminary covariances.