

Status of ENDF/B-VII.1 & resolutions of known deficiencies

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The logo for Brookhaven National Laboratory, featuring a stylized orange and red arc above the text "BROOKHAVEN NATIONAL LABORATORY".
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We used CHECKR, FIZCON, PSYCHE, fudge and NJOY to search for problems and we found a lot...

- I'm going to talk about
 - Things we fixed
 - Things we don't need to fix
 - Things we shouldn't fix
- Tune into Ramon's talk for a summary of:
 - Things we didn't have time to fix
 - Things we can't fix
- Tune into Sam and my talks for similar lists of covariance related fixes

**In this talk,
things in red
might actually
affect validation**

Things we fixed going from beta 4->5 (full laundry list)

- H-3: Q-values units converted to eV rather than old units of MeV.
- F-19: Revert to VII.0 evaluation.
- Ag-109: Slight modification of bound res parameters.
- Ag-109: fix poor URR + High energy transition
- In-115: Fix QI in MF9/MT102 to match state given in Nudat & MF8.
- In-115: Add branching ratio for In-116m production on capture.
- Te-132: Fix threshold for MF3/MT103.
- Tm-169,169,170: New BNL evaluations. [see Gustavo's talk]
- TI-203,205: New BNL evaluations. [see Gustavo's talk]
- W-186: correct residual in MF3,10/ MT113.
- Pa-231: Fix Q-value to match value in fission energy release file MF1/MT458.
- Pa-231: fix negative gamma yields.
- U-234: p(E) table in DFNS extended to 30 MeV.
- U-238: p(E) table in DFNS extended to 30 MeV.
- U-238: Fission energy release uncertainty (MF1/451) reset to 10%.
- Np-237: Incorrect primary gamma flag corrected for MF12/MT52.
- Es-255: Correct MAT number in MF33.
- Cd-isotopes: Use AP instead of constant APL.
- Zr-isotopes: Fix value of isomeric states in MF8 to match those in MF10.
- Many: Update fission Q-values in MT=18,19,20,38 MF=3 to agree with fission energy release data..
- Many: Fix all MF=12 gamma branching ratios to they sum to 1.0
- Many: Updated to latest ENSDF data & Q-values in Decay library.

**Most fixes
are minor
formatting
fixes**

These are the biggest changes

- New evaluations [see Gustavo's talk]
 - $^{169,169,170}\text{Tm}$: New BNL evaluations
 - $^{203,205}\text{TI}$: New BNL evaluations
- ^{19}F : Revert to VII.0 evaluation
- Updated to latest ENSDF data & Q-values in Decay library. [see Alejandro's talk]

These are the minor fixes

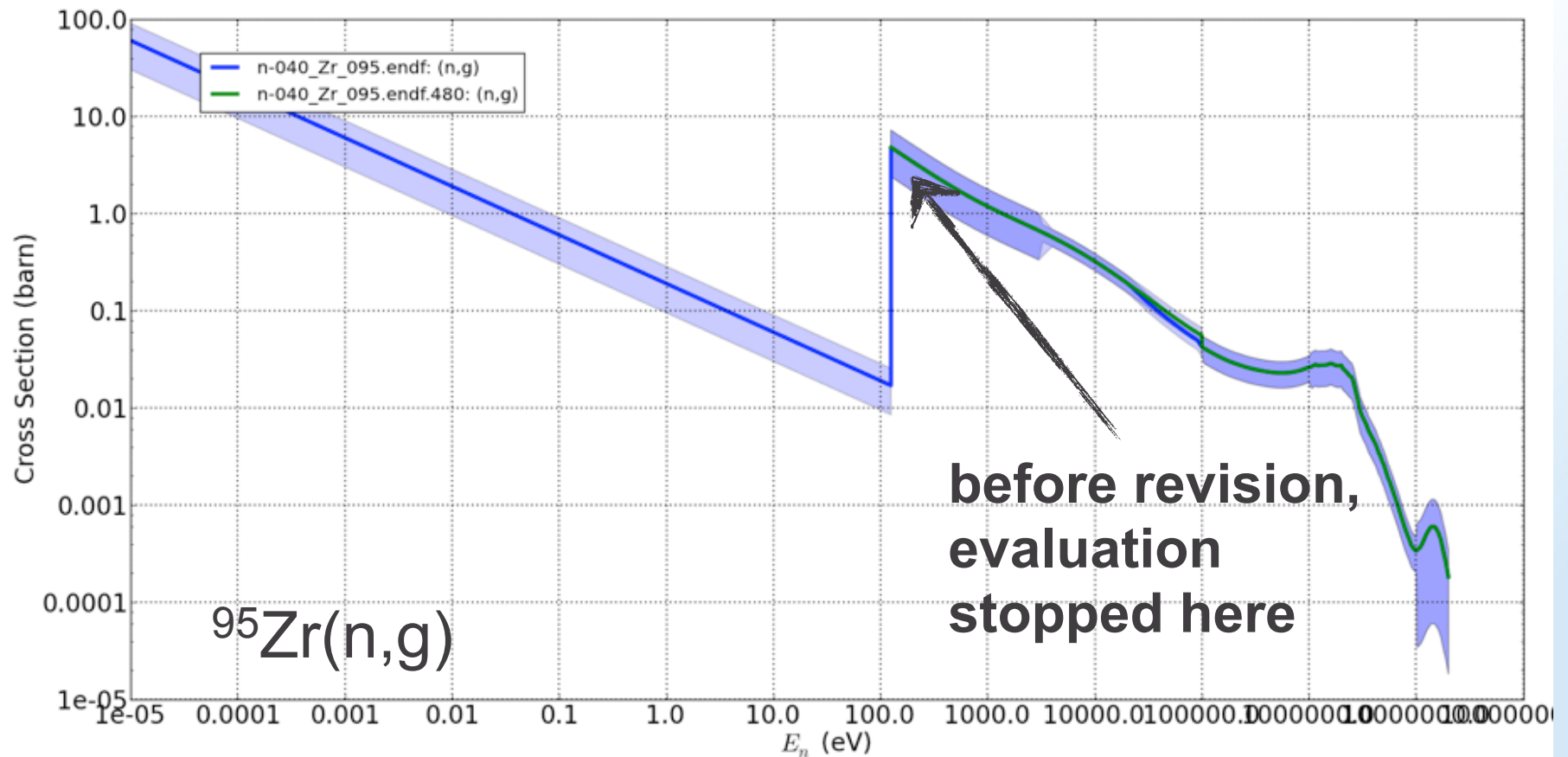
- ^3H : Q-values units converted to eV rather than old units of MeV.
- ^{109}Ag :
 - Slight modification of bound res. parameters
 - fix poor URR + High energy transition (after beta5 release)
- ^{95}Zr : Forgot to add smooth background to RR (after beta5 release)
- ^{115}In :
 - Fix QI in MF9/MT102 to match state given in Nudat & MF8.
 - Add branching ratio for $^{116\text{m}}\text{In}$ production on capture.
- ^{132}Te : Fix threshold for MF3/MT103.
- ^{231}Pa : fix negative gamma yields
- $^{234,238}\text{U}$:
 - The p(E) table in DFNS stop at 20 MeV while Theta(E) and g(E) tables extend to 30 MeV
 - They were already constant so this was safe to do
- ^{238}U :
 - Fission energy release uncertainty (MF1/451) reset to 10%.
 - Previously was set to -10% (oops)

These are the minor fixes

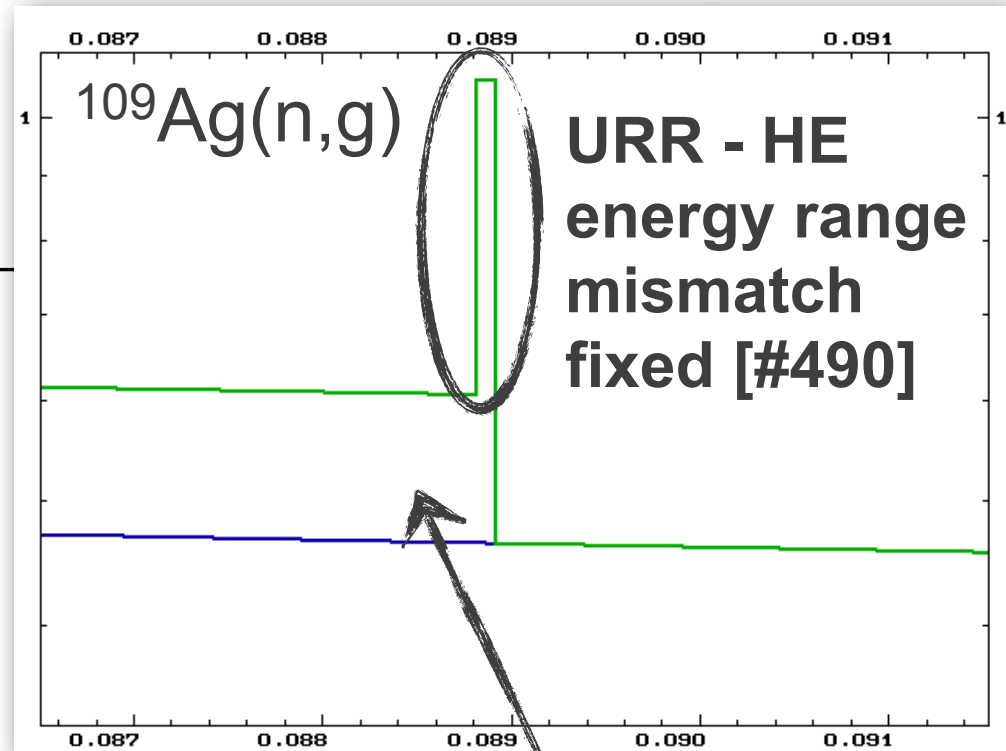
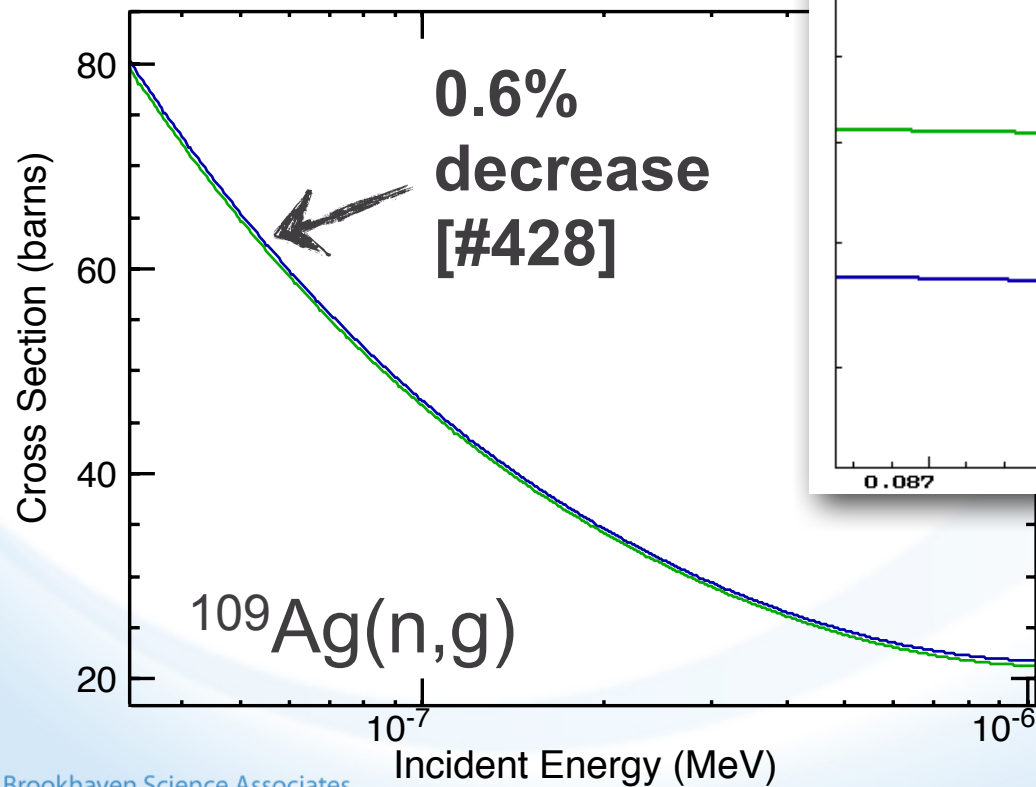
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- ^{238}U :
 - Fission energy release uncertainty (MF1/451) reset to 10%.
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Why didn't we catch these earlier?

^{95}Zr was a big goof, but it is unstable and never gets used in validation



^{109}Ag fixes were subtler and probably don't affect validation (Ag tested only in activation foils)



20% step: still need to revise HE region

These are the automated fixes

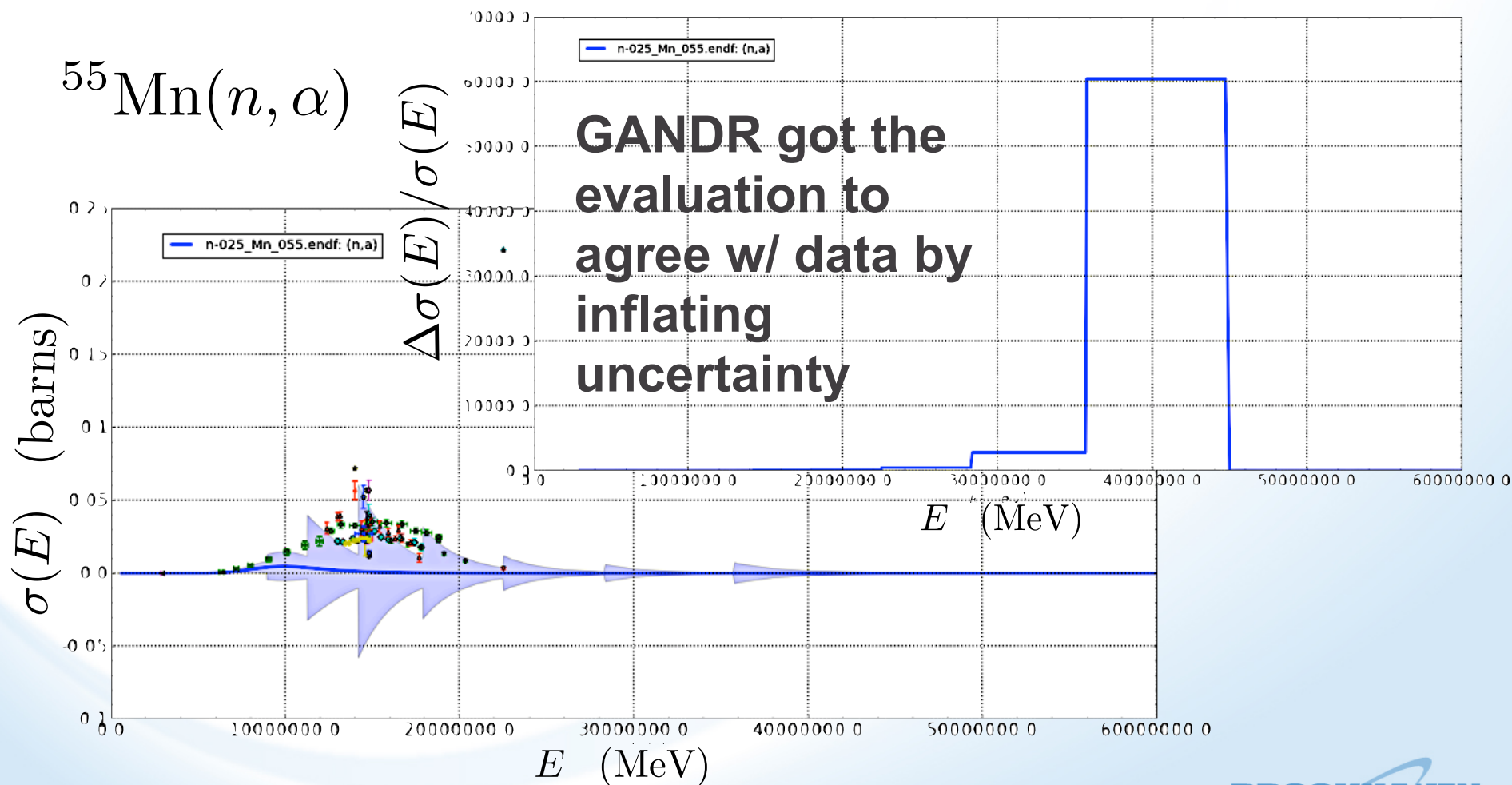
- Update fission Q-values in MT=18,19,20,38 MF=3 to agree with fission energy release data.
 - Nearly all actinides affected
 - FUDGE helped here
- Fix all MF=12 gamma branching ratios to they sum to 1.0
 - 63 isotopes affected
 - again, FUDGE helped here

Things we don't need to fix

(but are flagged as errors)

- Two-body reactions that wouldn't be two-body reactions for heavier isotopes: $n(^1\text{H},g)^2\text{H}$, $^6\text{Li}(n,d)\alpha$
 - FIZCON hates these
 - ENDF format says they're OK (use MF=6, LAW=2)
- Uncertainty bigger than values in fission energy release
 - FIZCON hates these
 - Clearly OK
- Variance too big in several covariance matrices
 - All relative covariances
 - FIZCON flags ^{55}Mn , all W, ^{232}Th and ^{238}U
 - ^{238}U is OK, just a dip between two resonances
 - See next page for rest...

^{55}Mn , ^{232}Th and all W have lumped covariances for all small channels



Things we shouldn't fix

(in my opinion, these shouldn't be errors)

- ENDF format requires delayed fission neutron spectra if delayed nubar given
 - affects most most minor actinides
 - *very* difficult to compute via model, forget measuring
- ENDF and FIZCON require distinct levels in all level schemes
 - In real life, this can and does happen
 - Work around is to nudge one of levels
 - Only ^{249}Cf affected
- Covariance positive definiteness [I will discuss further tomorrow]

<RANT>

Clear your tracker items!!!!!!

</RANT>

- Trackers are a form of customer communication
- Every tracker item (CSEWG list or deficiency list) is essentially a bug
 - Anyway, it looks that way from the outside
 - In most cases they were (are?) real bugs
 - In most cases they are fixed!
- It looks like we didn't do anything when we don't close out trackers
 - So, I tried to clean out as many as I could...
- Also, after my last commit, Mike showed me the trick for associating a commit with a tracker item:
 - [#604] in beginning of svn message