AMPX Cross-Section Processing Status

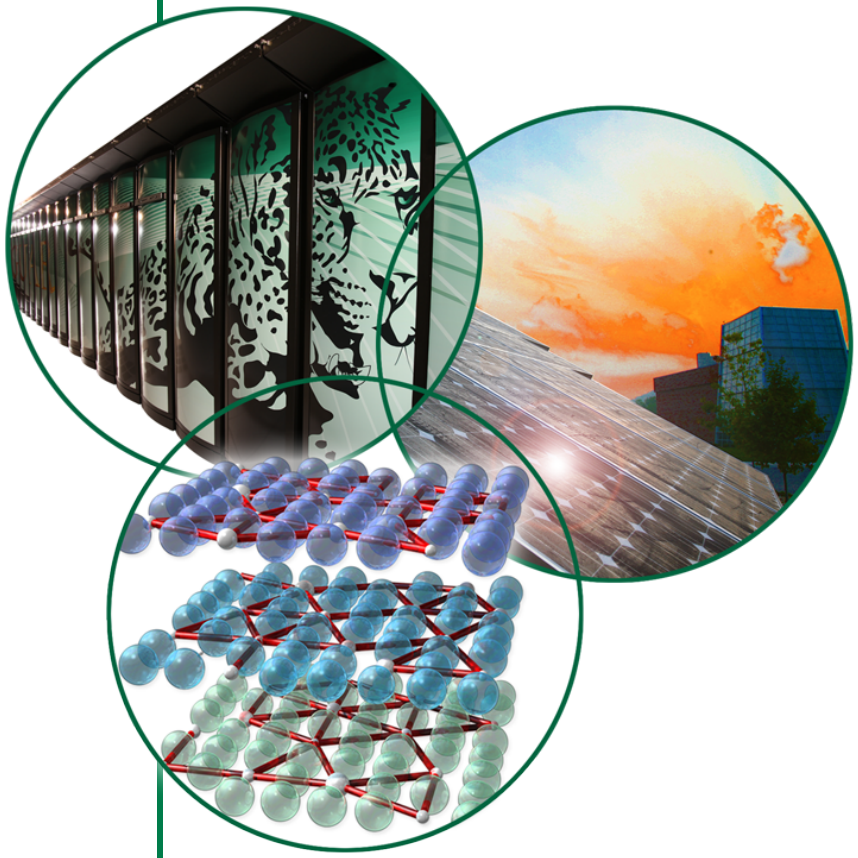
Dorothea Wiarda,

Michael Dunn,

Sedat Goluoglu,

Ian Gauld

CSEWG MEETING



U.S. DEPARTMENT OF ENERGY

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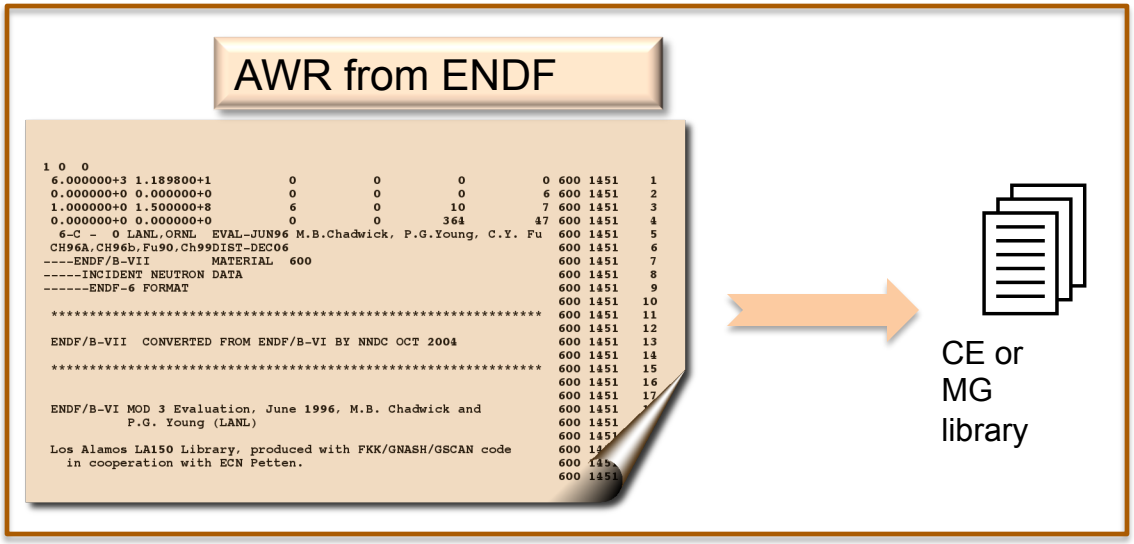
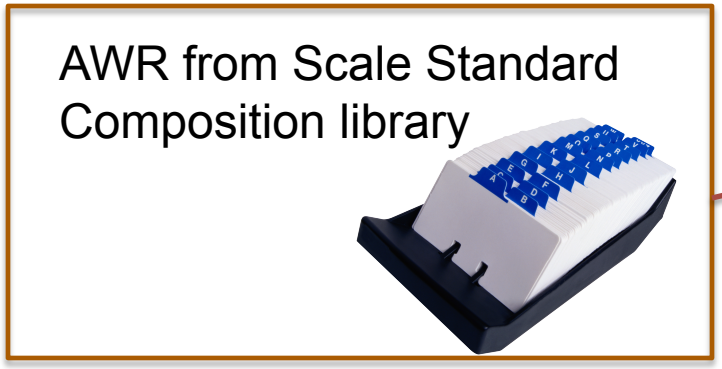


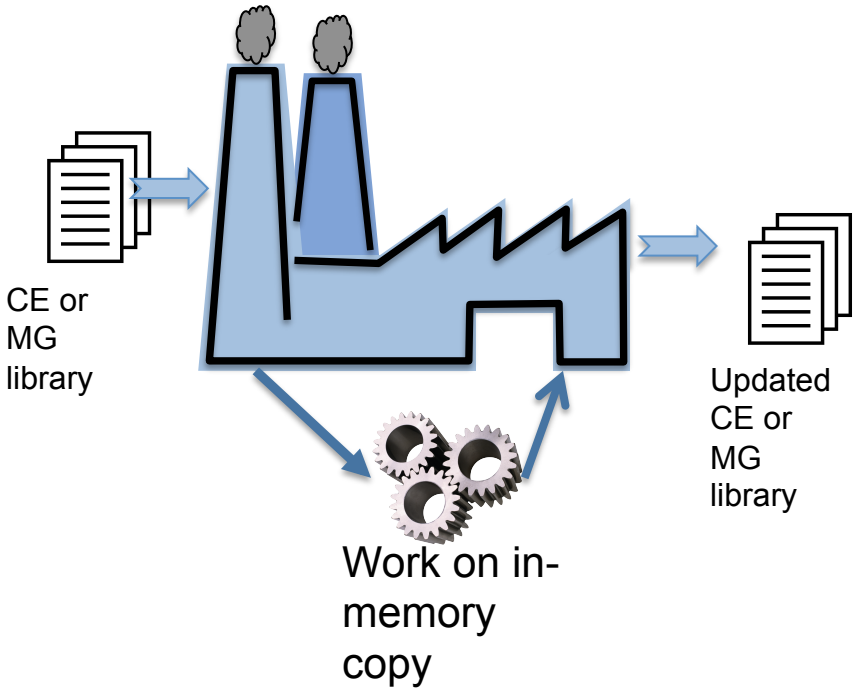


scale

Nuclear Systems Modeling & Simulation

Scale Standard Composition Library was updated with mass values from
A.H. Wapstra, G. Audi, and C. Thibault. Nuclear Physics A729, 129 (2003)
We want the AWR values to be consistent

Update Mass Ratio in all libraries

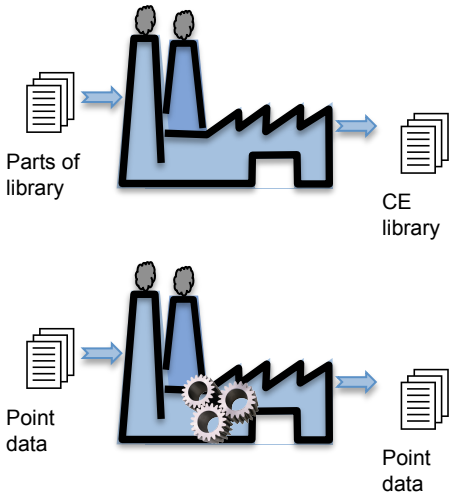


- Module to read/write MG already existed
- Created Module to read/write CE libraries
- Changed the mass ratio in all libraries

- Compare results of criticality benchmarks to ensure results changed within expected limits

Update Platinum

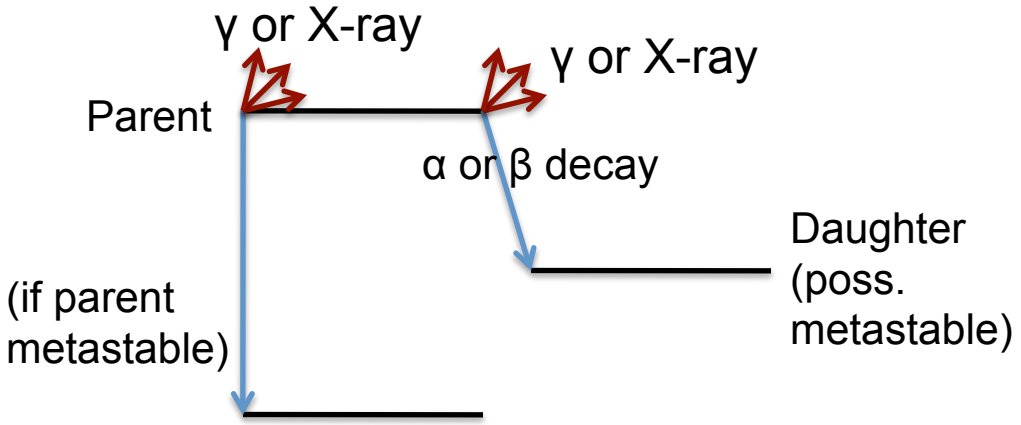
Module Platinum is used to create CE library files



- Platinum used internal code to handle 1-D point data
  - Switch to library function available in AMPX
- Platinum used internal code to handle kinematics data
  - Switch to library functions available in AMPX

- Add new processing to handle gamma production data
- Update CE library format to allow for incident energy dependent yield

ORIGEN GAMMA library update

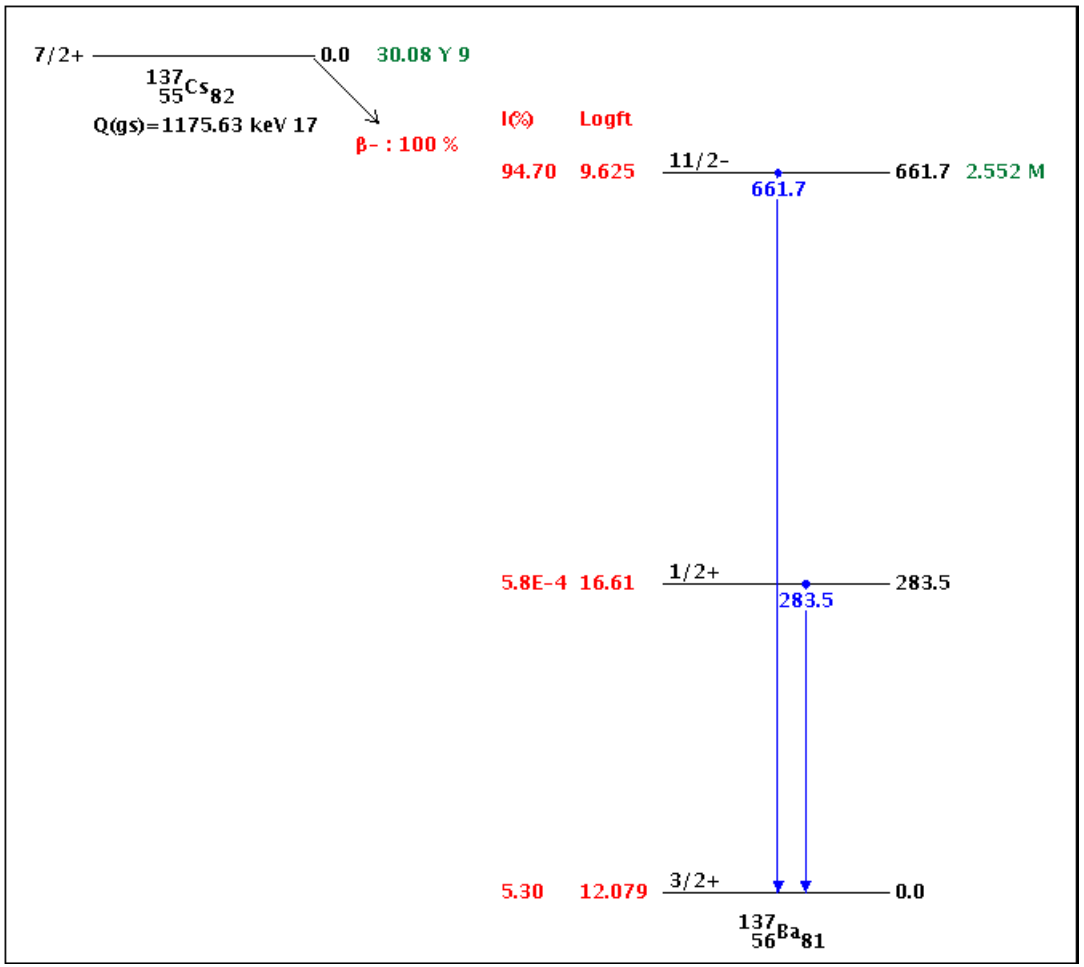


Previously based on ENSDF, ENDF, and JEF

We updated using NUDAT, which is based on newest ENSDF:

- Gives decay up to the ground state and lists all γ and X-ray intensities
- Includes all emissions, including metastable daughter

- Lines must be correctly assigned to prompt and delayed (metastable) emissions
- Intensities must be adjusted to account for decay to metastable daughter



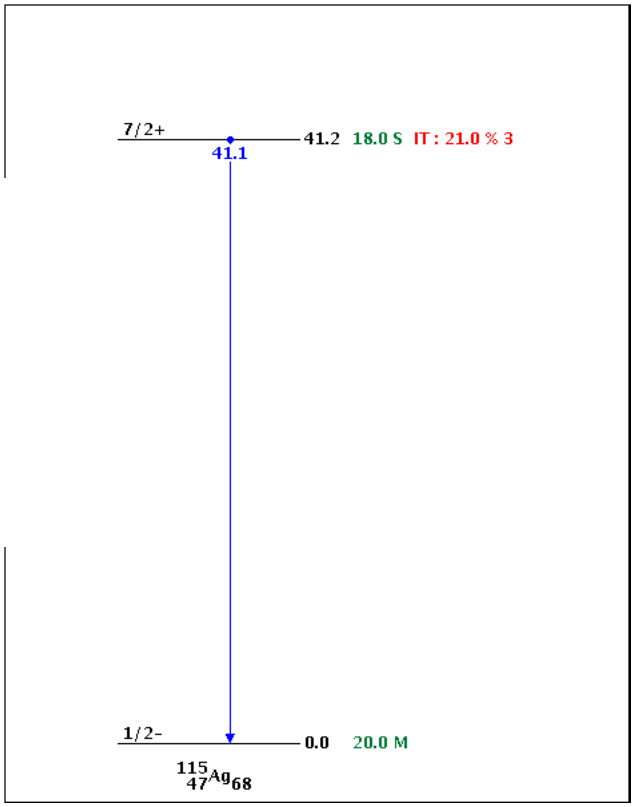
- 661.7 keV must be assigned to ^{137m}Ba – not ^{137}Cs
- 283.5 keV is listed under ^{137m}Ba and ^{137}Cs – with intensities adjusted for each parent

A new module was added to AMPX to process NUDAT text file and convert to ORIGEN Gamma library format.
ORIGEN decay library contains decay constants, which are used to identify and associate states and levels
Inconsistencies are flagged for later inspection

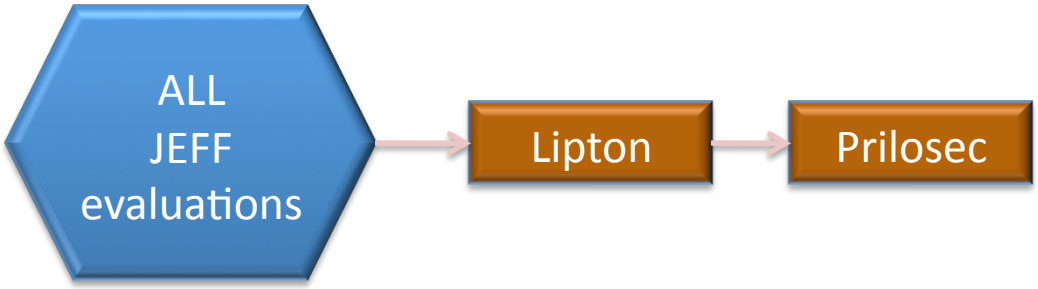
- **If daughter is metastable, all γ lines that appear in entry for daughter need to appear in parent**
  - **Intensities expected in parent to ground can be calculated from NUDAT and decay constants in ORIGEN decay library and should agree within given uncertainties.**
- **Check that decay modes in NUDAT and ORIGEN decay library agree**
- **Do manual correction as needed**

Results: Nuclear Wallet Card

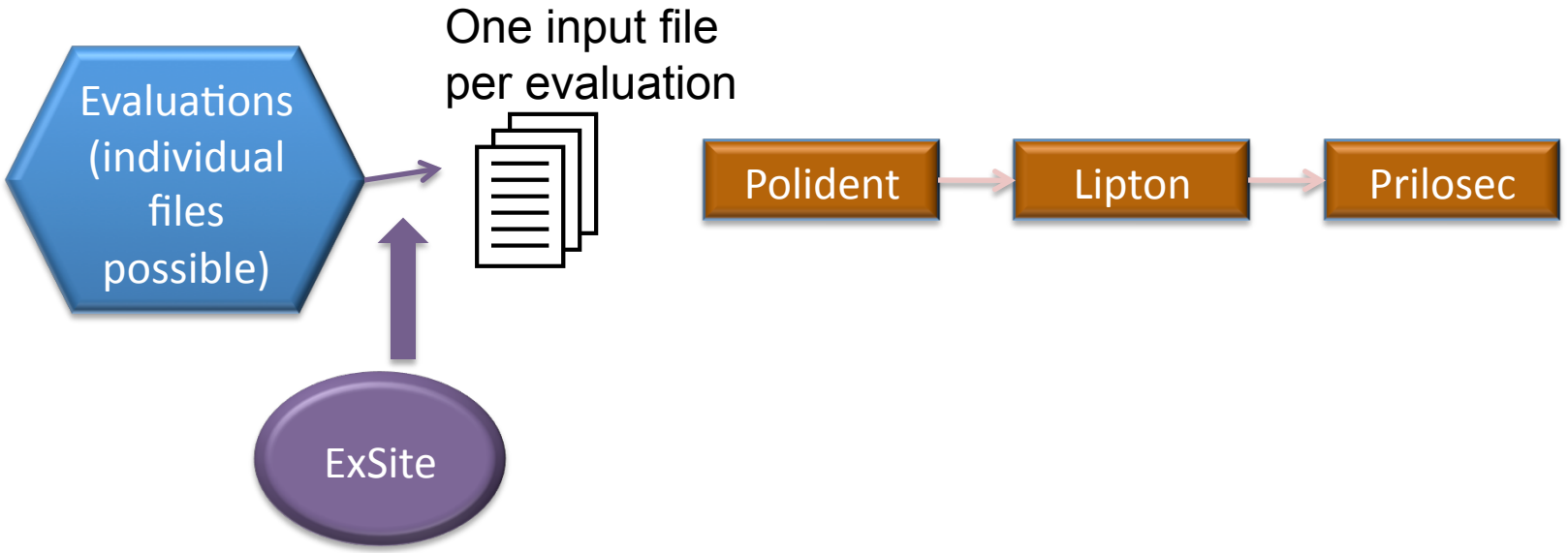
Nucleus	E(level) (MeV)	Jπ	Δ(MeV)	$T_{1/2}$	Abundance	Decay Modes
$^{115}_{47}Ag$ FF	0.0000	1/2-	-84.9832	20.0 m *5*		β⁻ : 100.00 %
$^{115m}_{47}Ag$	0.0412	7/2+	-85.0244	18.0 s 7		β⁻ : 79.00 % IT : 21.00 %



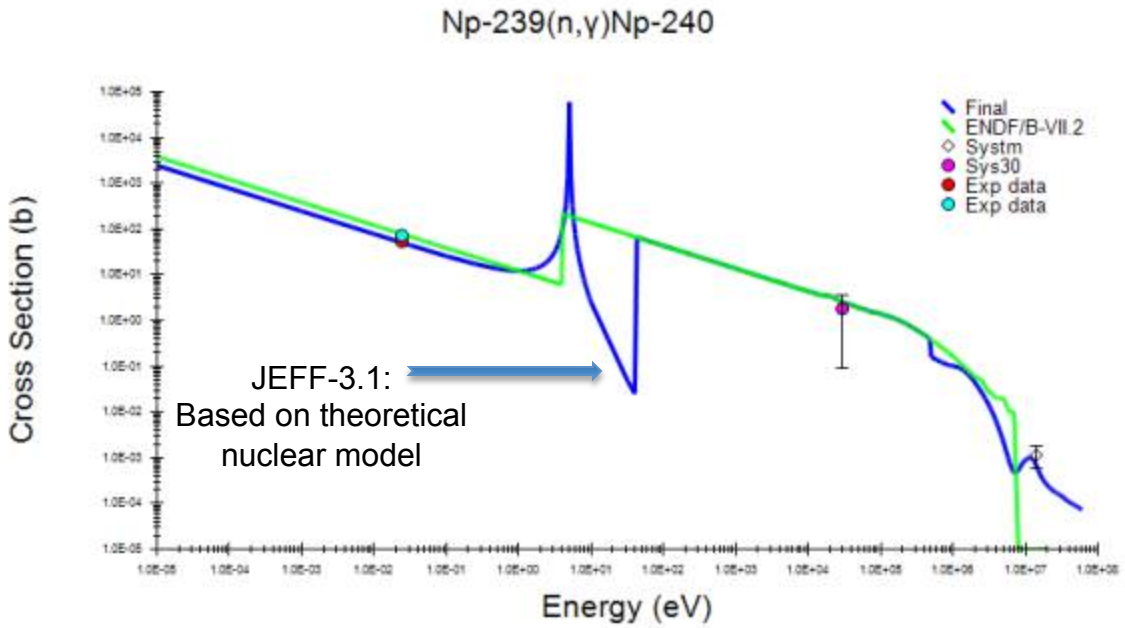
ORIGEN Cross Section libraries



Change procedure to be more flexible and process JEFF and ENDF/B-VII data and to be similar to other AMPX processing procedures.



- We evaluated impact of ENDF/B-VII.0 vs. JEFF-3.1 – currently JEFF-3.1 is more complete
- ^{239}Np: Use ENDF/B-VII.0 capture cross section data
- ^{241}Am: Use ENDF/B-VII.0 branching ratio and JEFF-3.1A cross section data
- Used JEFF-3.1 for all other nuclides



Large differences between ^{239}Np(n,γ) resulted in dramatic different Pu isotopics at low burnup. ORIGEN results for experimental Pu isotopic data from Hanford support the use of ENDF/B-VII ^{239}Np cross section data.

AMPX code testing

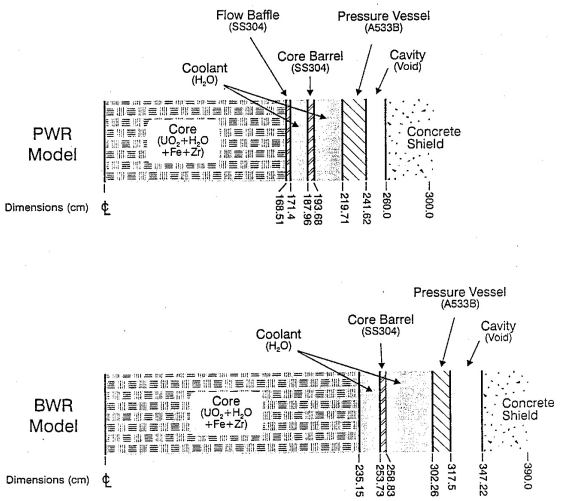
- Processed ENDF/B-VII.1-beta MG library
- Processed JENDL-4.0
- Processed ENDF/B-VII.1 beta3 covariance matrices
- Corrected processing error in PUFF-IV for LRF=7 with different number of open channels per spin group (Only applicable for patched version)

MG library specialized for HTGR applications

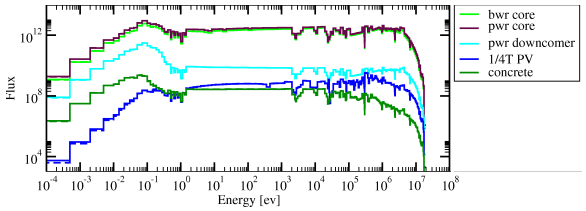
- Based on a collapse from a 999 group MG library, a suitable group structure of 81 neutron groups was determined
- A specialized 81 neutron group library was created from ENDF/VII.0 data using a HTGR pin cell flux generated by centrm.
- An new AMPX module creates λ factors for all isotopes and add f-factors for IR treatment for fissionable nuclides.
- The λ factors and f-factors are based on CENTRM/PMC calculations. Number densities are adjusted until all background cross section values can be interpolated to a user defined precision.
- The library is currently tested in various benchmark cases.

New VitaminB7/BugleB7 library

199n/42g → 47n/20g based on ENDF/VII.0



- **VitaminB7 and BugleB7 are now available from RSICC**
- In the absence of benchmark cases for gamma production data we used unit test to compare to MCNP results.



Summary

- A beta version of AMPX-6 is available in RSICC
- We are finalizing the documentation
- Expect release by end of Q1