

UNCLASSIFIED

# Evaluations for ENDF/B-VII (focus on LANL efforts)

- Observations on Data Testing
- Summary of Beta1 to Beta2 changes
  - Deficiencies to fix

**Mark Chadwick, Phil Young, Bob MacFarlane  
Toshihiko Kawano, Patrick Talou, Skip Kahler  
Russ Mosteller, Bob Little, Gerry Hale  
LANL**

Detailed presentations will be given by MacFarlane,  
Kahler, Mosteller from LANL

# Observations on data testing validation

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1. Beta-2 performs very well. Significant advance over earlier evaluations - WELL DONE ALL!
  - Fast systems good (Godiva, Jezebel, Jezebel33, Flattops...); Intermediate systems good.
  - Solution thermal 235U +O good still. Didn't break the good B-VI.8 results (important since o16 also changed)
  - Thermal 238U.. LCTs.. v. good (more reactive than beta1).
  - But some issues: Pu solutions; poly & Be, Pb, Cu reflectors etc
  
2. NJOY updates made by MacFarlane
  
3. Much data testing by MacFarlane, Kahler, and Mosteller, and VDM, Sublet, + many others
  - 2 Independent NJOY/MCNP validation simulations (LANL and Petten)
  - 2 Independent transport codes: MCNP v TRIPOLI (Sublet: ~ no bias now!)

This meeting should:

  - identify where we have made advances
  - have we made anything worse?
  - what deficiencies should be fixed for B-VII release?
  - what future work needed should be tabulated for future generations?!

## Eval. cross sec changes from beta1 to beta2:

1. FP evaluations from BN; decay library from BNL... see later talks
2. Final-final standards adopted for 235, 238U and 239Pu fission cross sections. Adjustments (small) made to nubar to preserve good fast-criticality agreements, though changes generally within exp data uncertainties. Confirmation with Allan Carlson & Pronyaev that we have used the correct 235U standard on correct grid
3. 237Np fission modified (<1 MeV) based on new LANSCE data. This new evaluation allows a better prediction of the LANL U-Np composite assembly- remaining discrepancies probably due largely to driver 235U spectrum deficiencies. (Final 237Np file that also includes new resonance parameters to replace this for B-VII)
4. 241Am n2n modified based on latest analysis and new (old!) Gancarz data found. New preliminary TUNL data at 14 MeV and below appears in good agreement. Format bugs in other Am isotope file fixed. (Little found a remaining small bug - needs to be fixed for B-VII and revised file has been submitted to BNL)
5. Completely new 208Pb evaluation done, using GNASH and ECIS. Some Pb reflector benchmarks improved, others still problematic
6. Be with new elastic distribution submitted. Improves some assemblies in terms of a bias seen against thickness... not others. Just the total & total elastic were changed.
7. n+6Li, 10B (n,a below 1 MeV) and Au(n,g) (5keV-2.8MeV) modified to be consistent with B-VII standards
8. 16O n,alpha decreased by 32%. Consistent with more recent exp data. (not full R-matrix analysis)
9. 234U(n,g) increased as LANSCE data was revised upwards. Updated 234 resolved & unresolved res. params.
10. New scattering kernels from MacFarlane, for 1H, ....
11. Covariance data for Gd isotopes?
12. New 191,193Ir and 89Y evaluations from BNL and LANL.
13. File1 cleaned and updated by PGY... for B-VII release, for 235,238U and 239Pu
14. Additional text and figures made for B-VII paper ... passed on to BNL
15. Interaction on DN with Danas Ridikas/ Wilson. (somewhat unresolved questions?)

## Reminder on 1H by Hale... New Results for Thermal n-p Capture and Scattering

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- Capture cross section forced to 332.0 mb at thermal. Gave no significant overall increase in chi-square from the high-precision measured value of 332.6 mb.
- New high-precision (NIST) measurement of n-p coherent scattering length included. Fitted cross sections now agree with this thermal measurement, and are perfectly consistent with earlier measurements of the polarized cross section and “zero-energy” scattering cross section (Houk, 1971, but *not* Dilg, 1975). A recent analysis by Hackenburg [*Phys. Rev. C* **73**, 044002 (2006)] using somewhat different data comes to essentially the same conclusion.
- n-p scattering cross sections are  $\leq 0.3\%$  lower than the pre-ENDF/B VII values.

Though  $\beta_2 = \beta_1$ , except for MacFarlane's new kernel

## Known deficiencies... to fix for B-VII

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- 233U nubar thermal standard should be adopted, with a value lower by 0.3%. Testing of a fixed file improves 233U thermal benchmarks
- Am datafile fixed. Little noticed a bug...revised version already sent to BNL.
- Study whether to include Madland's new prompt energy deposition results for 235,8U and 239Pu. NJOY change needed and format extension needed (trivial I think). [Skip will comment on this.](#)
- Release latest 237Np (also includes new resonance parameters from JENDL in addition to our recent fission x/s change). Test on Np-U assembly.
- More peer review of new DN. ANL? Beta-effective comparisons?
- Add spectral index critical assembly data testing results
- Include 191,193Ir as well as 89Y (if not in beta2)
- Kawano noted an issue on 232U capture... discontinuity to fix?

# Known deficiencies... & FUTURE WORK (1)

(Also - a thrust beyond B-VII : Advanced reactors need

~~covariances, & minor & major actinide work~~

- Spectral indices in godiva, jezebel, 5% low -> deficiencies in  $^{235}\text{U}$  and  $^{239}\text{Pu}$  nuclear data (inelastics,  $\chi$ ?)
- $^{235}\text{U}$  at unresolved energies ... Russ' concerns
- $^{235}\text{U}$  capture near 100 keV. 10% discrepancies with JENDL... Also Cecil has raised questions here.
- nubar issue: Standard value in B-VI was 0.2% off, erroneously. (discovered by Talou!) Carried over to B-VII.... But we renorm to crit assemblies anyway in places, though the changes are largely within exp nubar uncertainties
- Np fast criticality issues (improved - remaining could be U driver not Np)
- Pu solutions look bad still.
- n+D ang dist in 1-3 MeV range. EDA informed by p+D data. New fundamental calcs can help - though issues with magnitude of 3 body force. Russ doesn't like these new ang dist (from 6.5), though notes the exp data are somewhat discrepant too.

# Known deficiencies... & FUTURE WORK (2)

(Also - a thrust beyond B-VII : Advanced reactors need

~~covariances, & minor & major actinide work~~

- Pb reflection... some improvements made, but other deficiencies remain
- Be reflection. Some improvements made, but discrepancies remain
- Poly reflectors. Some got worse; Cu reflector poor in fast range
  
- $n+6\text{Li}, 10\text{B}$  were made consistent for  $n, a < 1$  MeV with standards, and used EDA angular distributions. Could do a full new EDA analysis.
- extend  $n+H$  analysis from 20 to 200 MeV
- DN fractions (Skip/Cecil discussion)
  
- Covariance data ... & NJOY / ERROR RJ advances
- Minor actinide data for Th, Np, Am, Cm isotopes