Release and Distribution of ENDF/B-VIII.0-Based ACE Files

LA-UR 18-305402

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November 11–15, 2018

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ENDF/B-VIII.0

- Released by National Nuclear Data Center (February 2, 2018)
- Many years of work
- International collaboration
- 557 incident neutron materials
- 34 thermal scattering $(S(\alpha, \beta))$ materials

https://www.nndc.bnl.gov/endf/b8.0/

D.A. Brown et al. "ENDF/B-VIII.0: The 8th Major Release of the Nuclear Reaction Data Library with CIELO-project Cross Sections, New Standards and Thermal Scattering Data". In: *Nuclear Data Sheets* 148 (2018). Special Issue on Nuclear Reaction Data, pp. 1–142. ISSN: 0090-3752

Format Changes in ENDF

- Tabulated fission energy release ($\texttt{MF=1}$, $\texttt{MT=458}$)
- $P(\nu|E)$ for fission neutrons ($\texttt{MF=6}$)
- Provision for sub-actinide fission ($\texttt{MF=8}$, $\texttt{MF=10}$)

Processing and release of ENDF/B-VIII.0-based ACE files

Updates to NJOY2016 for ENDF/B-VIII.0

- Updates to handle format changes

    https://github.com/njoy/NJOY2016/issues

- HEATR to include data from tabulated fission energy release
- ACER for plot generation and thermal scattering data formatting
- ERRORR for covariance processing
- LEAPR for generating thermal scattering data
- PURR for unresolved resonance probability tables
- THERMR for thermal scattering data

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HEATR Updates

Fission energy release:

- Thermal point using Sher and Beck systematics

- Polynomial energy dependence (2010)

- Tabulated energy dependence (2017)

$$k_f^{(n)}(E) = [Q_k(E) + Q_{\gamma,p}(E)]\,\sigma_f(E)$$

where:

$$Q_k = \text{kinetic energy of the fission products}$$

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Wim Haeck et al. *NJOY2016 updates for ENDF/B-VIII.0*. Tech. rep. LA-UR-18-22676. 2018

ENDF/B-VIII.0-Based ACE Data Libraries

Lib80x—continuous-energy incident neutron

- 556 different materials (MCNP can't do neutron-neutron calculations)
- 7 different temperatures
  - 293.6 K, 600 K, 900 K, 1200 K, 2500 K, 0.1 K, 250 K

ENDF80SaB—thermal scattering, continuous representation

- 33 different materials
- All temperatures on evaluation file

Processed with NJOY2016.35

https://www.njoy21.io/NJOY2016

Temperatures and extensions for ZAIDs and SZAIDs in `Lib80x`

Temperature (K)	ZAID Extension	SZAID Extension
293.6	.00c	.800c
600	.01c	.801c
900	.02c	.802c
1200	.03c	.803c
2500	.04c	.804c
0.1	.05c	.805c
250	.06c	.806c

Materials in the thermal scattering ACE library, `ENDF80SaB`

- blue = new data
- red = renamed ZAID
- 293.6 K (if exists) has .80t extension

- al-27
- be-beo
- be-met
- benz
- c-sic
- d-d2o
- fe-56
- grph10
- grph30
- grph
- h-h2o

- h-ice
- h-luci
- h-poly
- h-yh2
- h-zrh
- lmeth
- n-un
- o-beo
- o-d2o
- o-ice
- orthoD

- orthoH
- o-uo2
- paraD
- paraH
- sio2
- si-sic
- smeth
- u-un
- u-uo2
- y-yh2
- zr-zrh

Verification and Validation of ACE Data Libraries

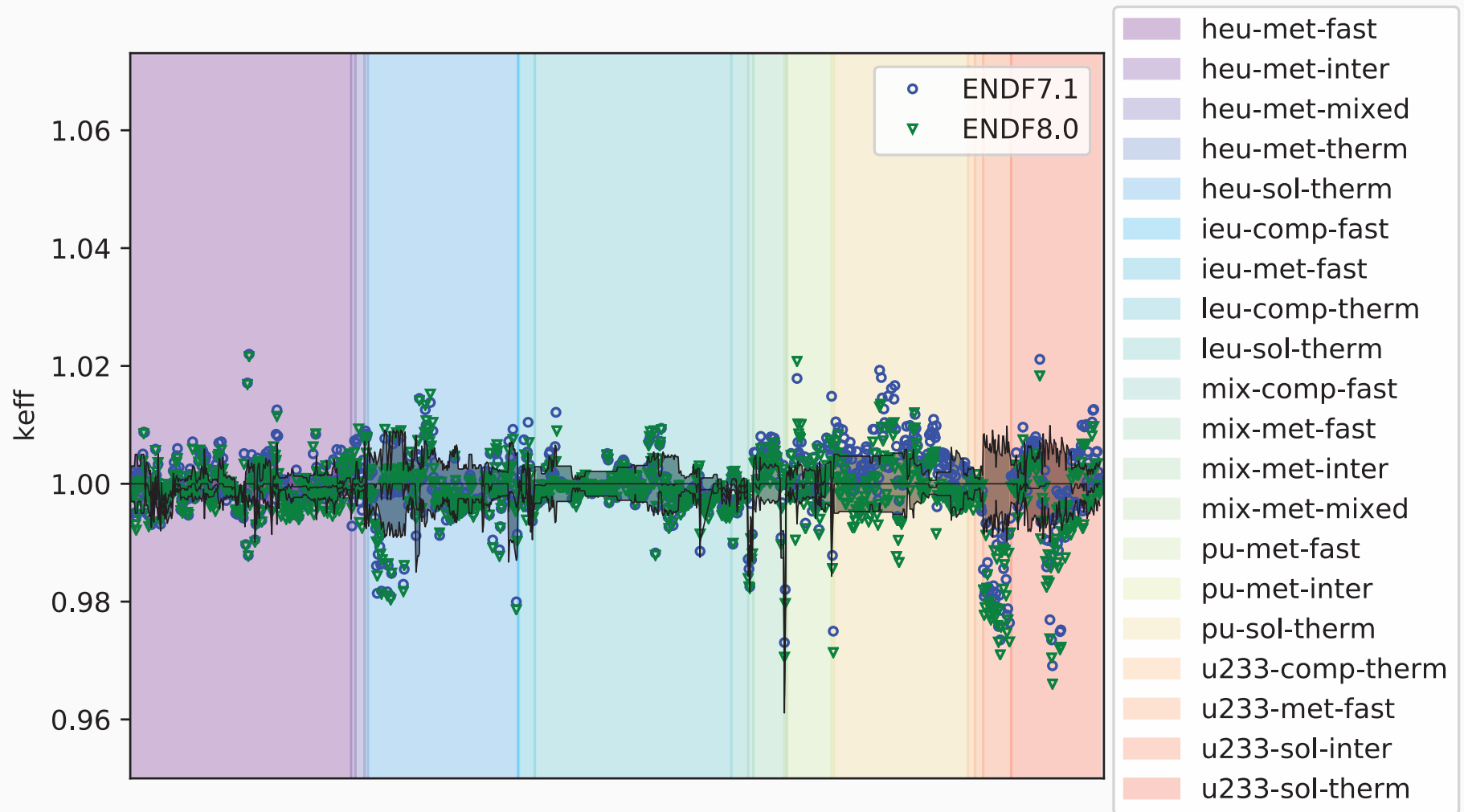checkace—suite of programs used to perform simple checks on ACE files

- Many problems reported by checkace were fixed prior to ENDF/B-VIII.0 final
- Several evaluations with negative KERMA/heating values:

  - ^{94}Mo
  - ^{96}Mo
  - ^{97}Mo
  - ^{98}Mo
  - ^{119m1}Ag
  - ^{131m1}Te

  - ^{132m1}I
  - ^{137m1}Cs
  - ^{168}Yb
  - ^{170}Yb
  - ^{171}Yb
  - ^{172}Yb

  - ^{173}Yb
  - ^{174}Yb
  - ^{176}Yb
  - ^{194m1}Ir
  - ^{197m1}Hg
  - ^{208}Po

keff Benchmark Results

Distribution of ACE Data Libraries

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Download

https://nucleardata.lanl.gov

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1. `Lib80x.tgz` or `Lib80x.zip`
   1.1 Verify checksum

2. Decompress tarball
   `tar -xzvf Lib80x.tgz`

3. Copy data to `$DATAPATH`
   `mv Lib80x/Lib80x $DATAPATH`

4. Add entries to xsdir_MCNP6.2

File structure:

```
Lib80x/
   Lib80x/
   docs/
   xsdir
   xsdir_2.0
```

`https://nucleardata.lanl.gov/ACE/install.html`

Conclusion

- ENDF/B-VIII.0 released by NNDC, February 2, 2018
- NJOY updated to:
  - Handle new data formats
  - Fix bugs and inconsistencies
- Neutron and Thermal Scattering sublibraries processed by NJOY2016.35
- Lib80x and ENDF80SaB ACE Libraries
- ACE libraries available to download *today* from:
  https://nucleardata.lanl.gov