The ENDF/B-VIII.1 release and future plans on structural materials

G.P.A. Nobre[1], D.A. Brown[1] *et al.*

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INDEN Consultants Meeting on Structural Materials
IAEA, Vienna, Austria
December 18-21, 2023

Outline

- The next release and library infrastructure
- “Big Paper”
- ENDF/B-VIII.1 release status
  - Beta releases
  - What to expect for Beta3
- Updates on INDEN evaluations for structural materials
- Release timeline
- Future plans

The next ENDF/B release

ENDF/B-VIII.1 release

The next release of the ENDF/B library is scheduled for **May 2024!**

Although technically “minor”, it will have **major** impact.

- Why **VIII.1** and not **IX**?
  - There are no planned updates of the standards library for this release
  - Standards are well-stablished cross sections, in specific energy ranges, used in ratios with other measurements
  - However, many, many important and impactful changes are on the way!!
- Next release will be in both legacy **ENDF-6** format and **GNDS-2.0**
- Will have an accompanying **“Big Paper”**
- Implemented review system: Multiple VIII.1 Beta versions have been released
- Preliminary validation indicate that this will be the best-performing library ever!

ENDF/B
VIII.1-β2

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What to expect when expecting…
… the ENDF/B-VIII.1 release

Neutrons:

- Many INDEN contributions
- Actinides:
  - ^{239}**Pu**: multi-institution effort, with important updates to fission, nubar, PFNS, capture, URR, RRR, (n,2n)
  - ^{235}**U**: resonances, nubar, covariances,
  - ^{238}**U**: resonance update to improve performance on depletion benchmarks
  - ^{240,241}**Pu**: work in concert with changes in ^{239}Pu and ^{238}U to recover burnup performance
- Stainless steel & other structure materials:
  - ^{54,56,57}**Fe**: Corrects leakage deficiency from ENDF/B-VIII.0
  - ^{50,52,53,54}**Cr**: Thorough re-evaluation, impact in criticality and leakage benchmarks
  - ^{206,207,208}**Pb**: complete evaluations (RPI/LANL)
  - ^{63,65}**Cu**: improved performance
  - ^{55}**Mn**: Gamma spectra
  - ^{28,29,30}**Si**: resonance evaluations
- Others:
  - ^{6}**Li**, ^{9}**Be** (LANL)
  - ^{234,236}**U** (LANL)
  - ^{140,142}**Ce** (ORNL)
  - ^{103}**Rh** (RPI/IRSN)
  - ^{86}**Kr** (BNL)
  - ^{181}**Ta** (RPI/ORNL/LANL)
  - ^{95}**Mo** (IRSN/LANL)
  - Many, many, many more…

What to expect when expecting…
… the ENDF/B-VIII.1 release

TSL:

- 70+ new updated/files
- **Polystyrene**, **zirconium hydride**, **UC**, **UN**, **UO_2**, **sapphire**, **lucite**, **FLiBe**, **etc…**
- Fuel materials with different enrichments
- So many new evaluations that we had to re-think how to identify them.
- Low-temperature extrapolations to light water
- Community-wide review and validation

Fission Yields:

- Many fixes
- …but no changes to the actual yields

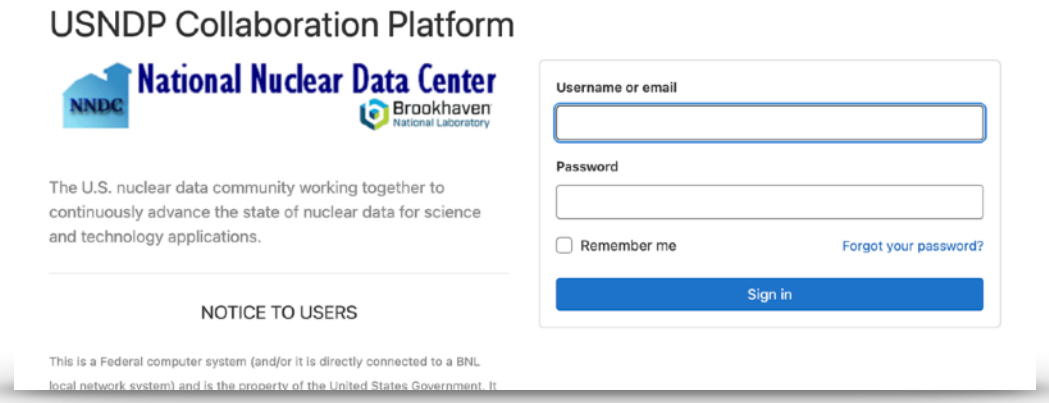
Photo-nuclear:

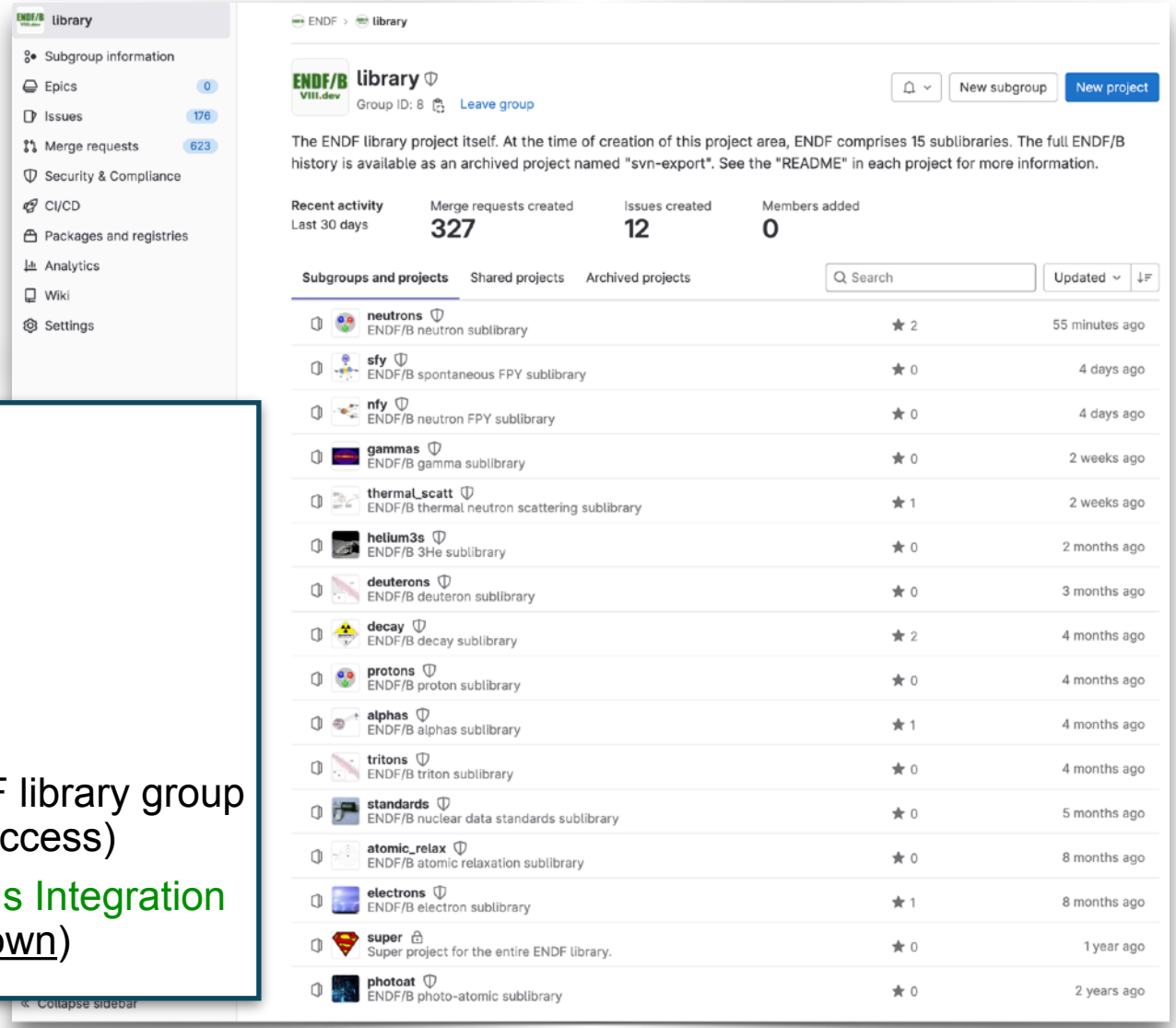
- **200+** updates coming from IAEA CRP

Charged particles:

- A few improvements and fixes

ENDF versioned repository: GitLab





- Constantly updated and maintained
- Keeps track of
  - Any changes
  - Development, **review** and release branches
  - Issue trackers
  - etc…
- Usage is growing! Currently ~60 active members in ENDF library group (unfortunately there's a seat limit: victims of our own success)
- Integration of library repository in GitLab with a Continuous Integration system: **ADVANCE** (R. Arcilla, R. Coles, B. Shu, D. Brown)

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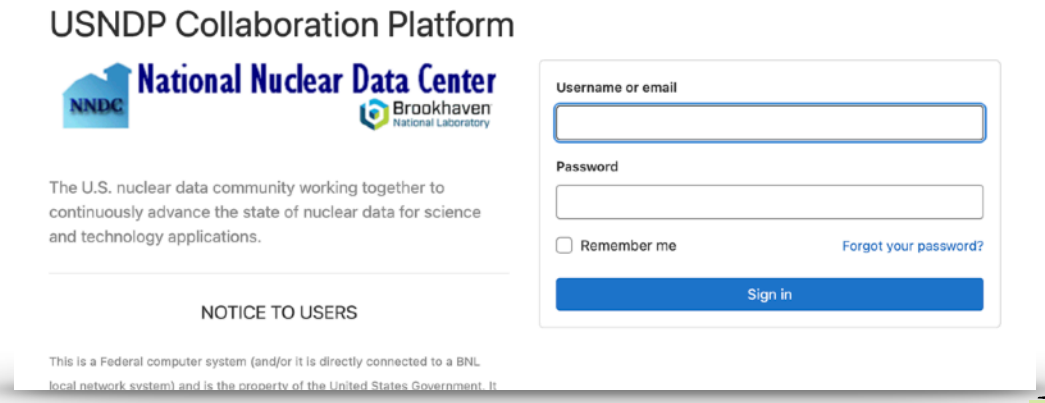

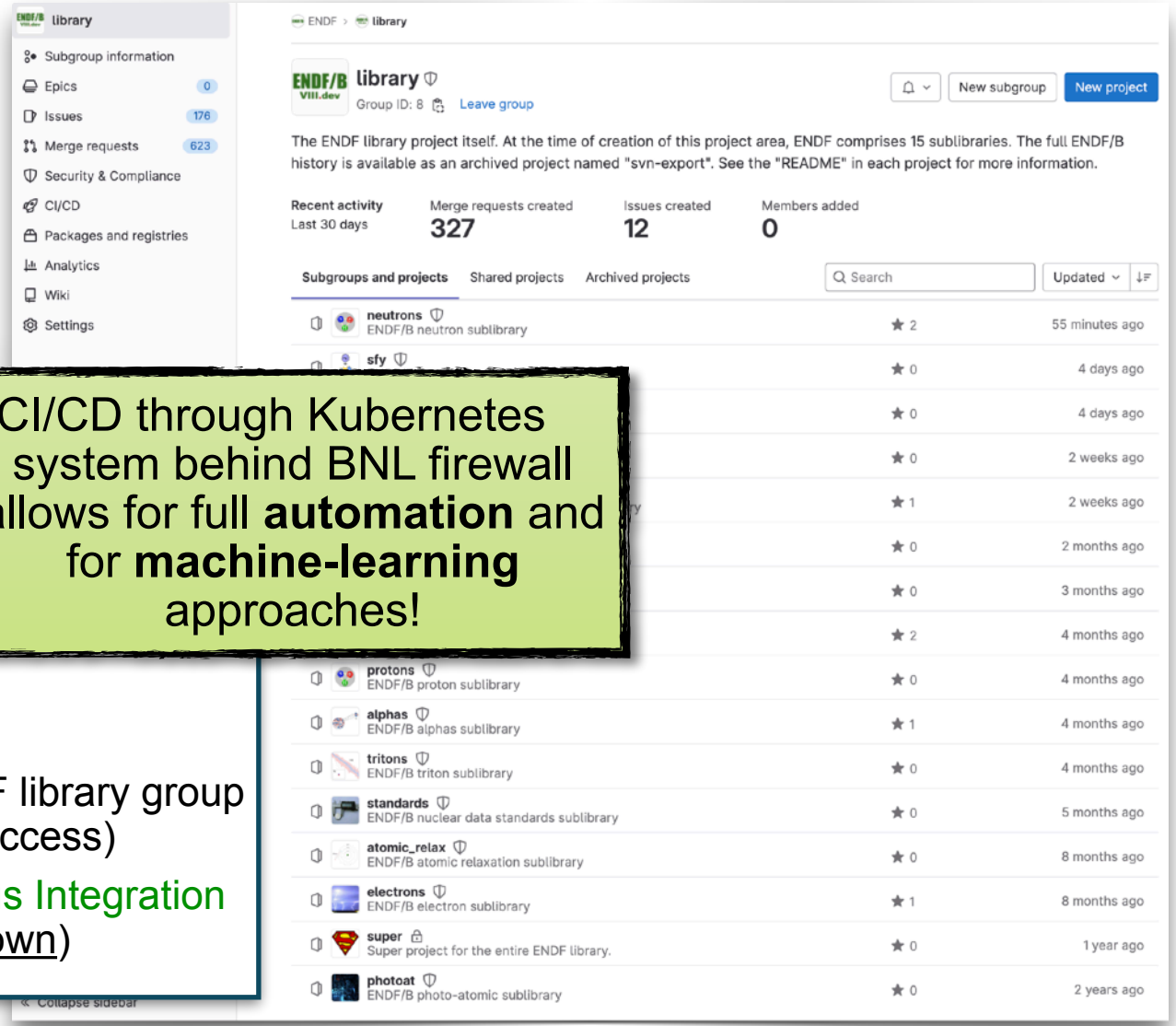

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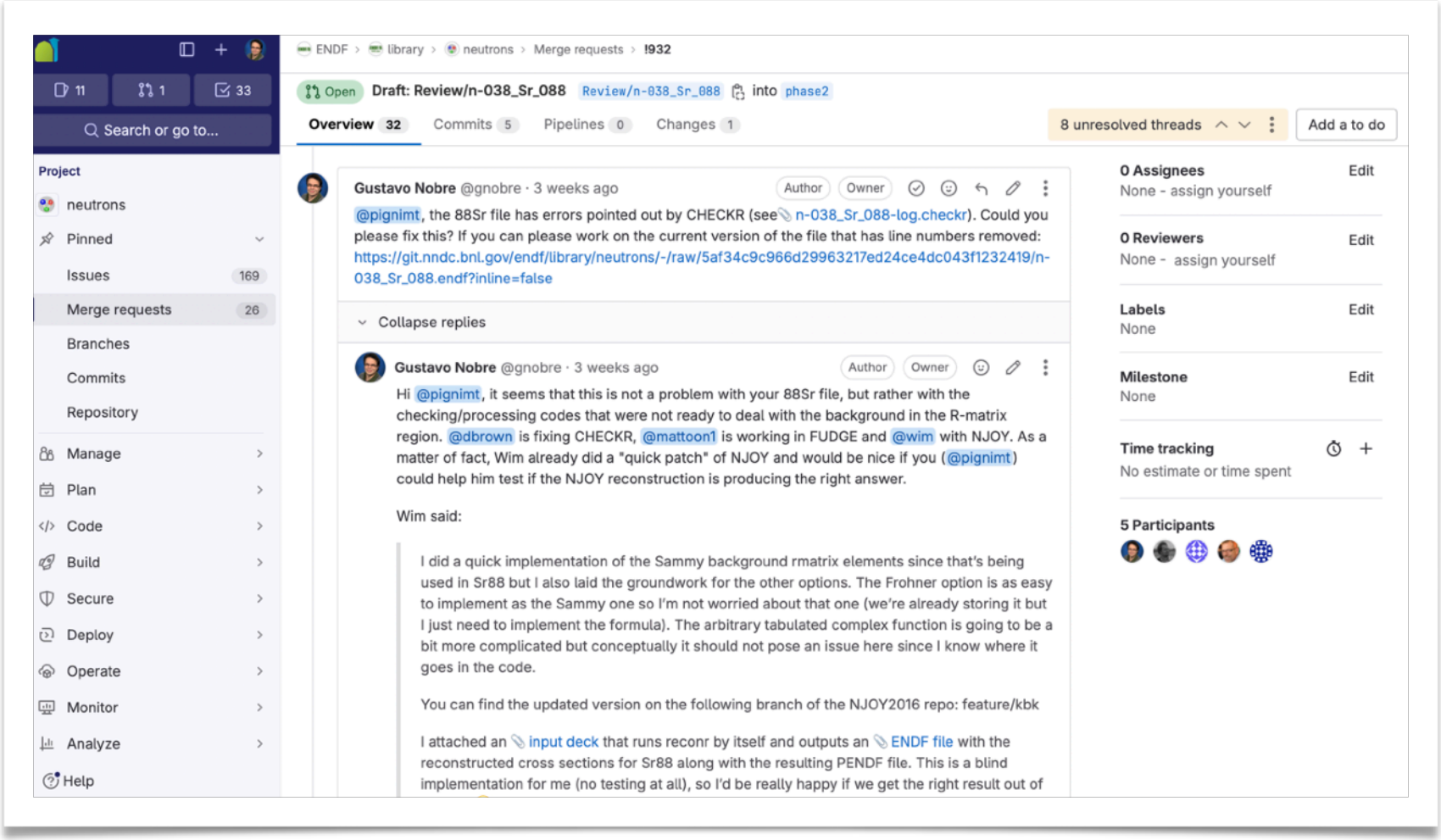
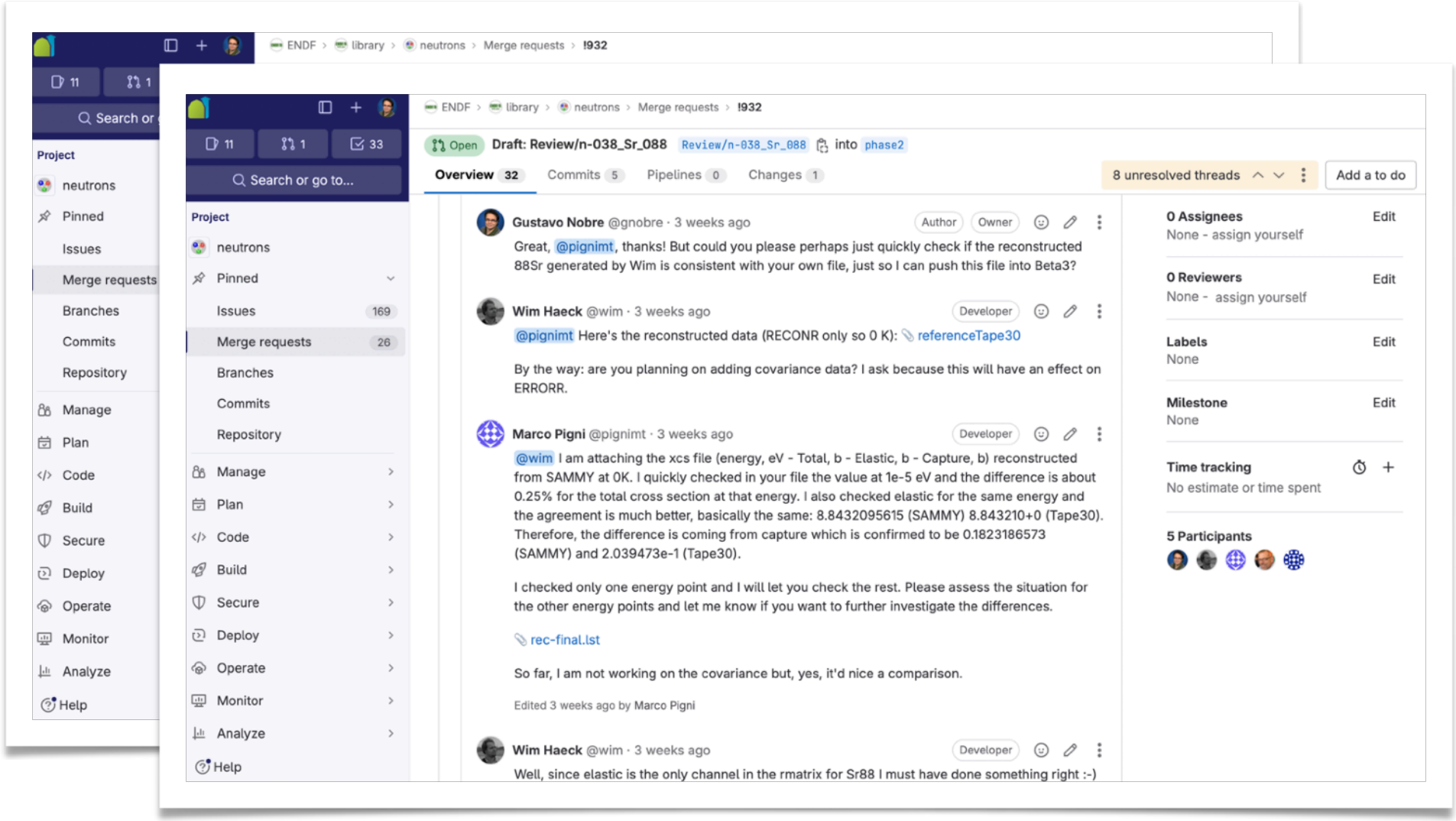
CI/CD through Kubernetes system behind BNL firewall allows for full **automation** and for **machine-learning** approaches!

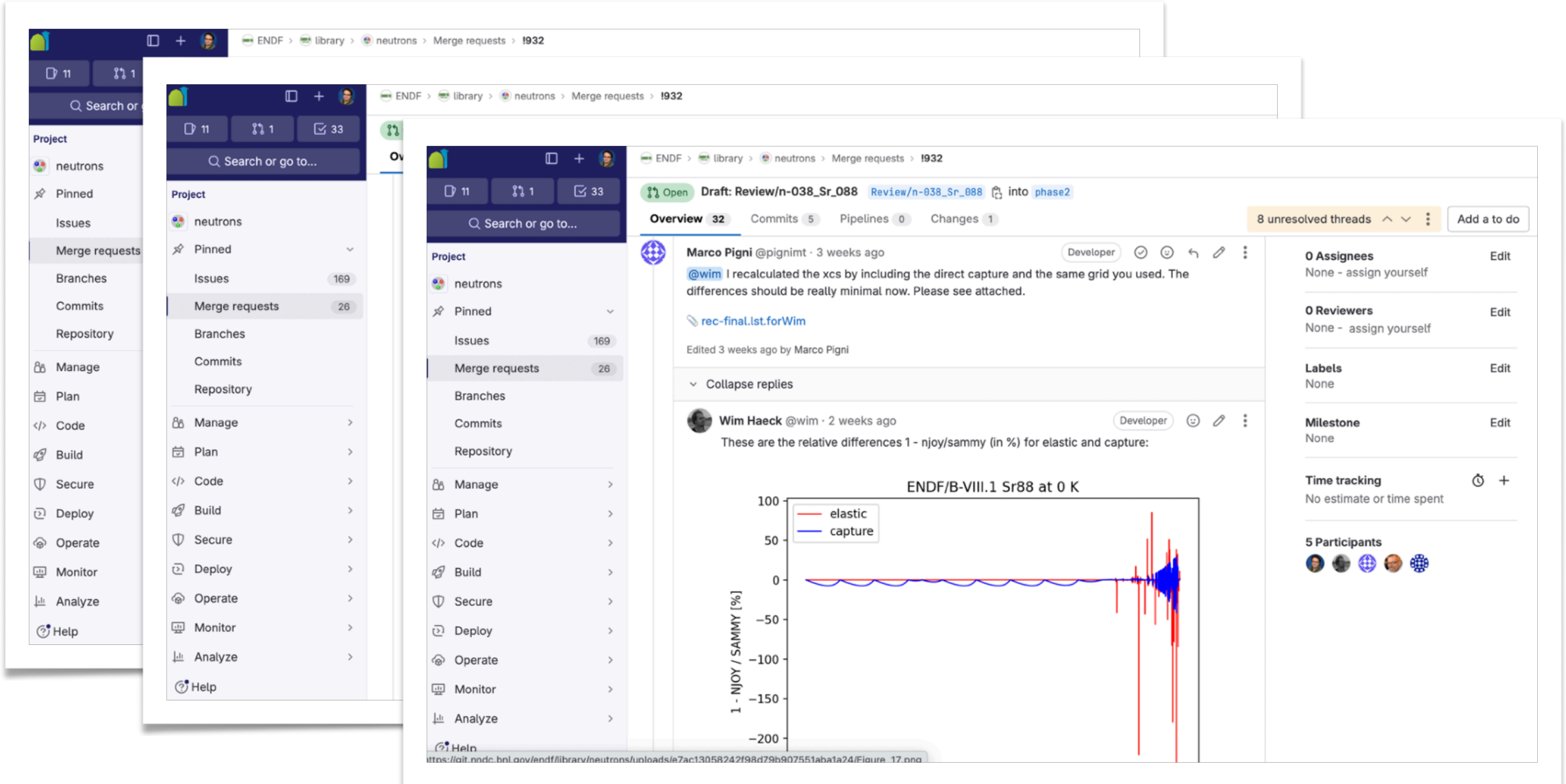
Showcase example: ^{88}Sr review



Showcase example: ^{88}Sr review



Showcase example: ^{88}Sr review



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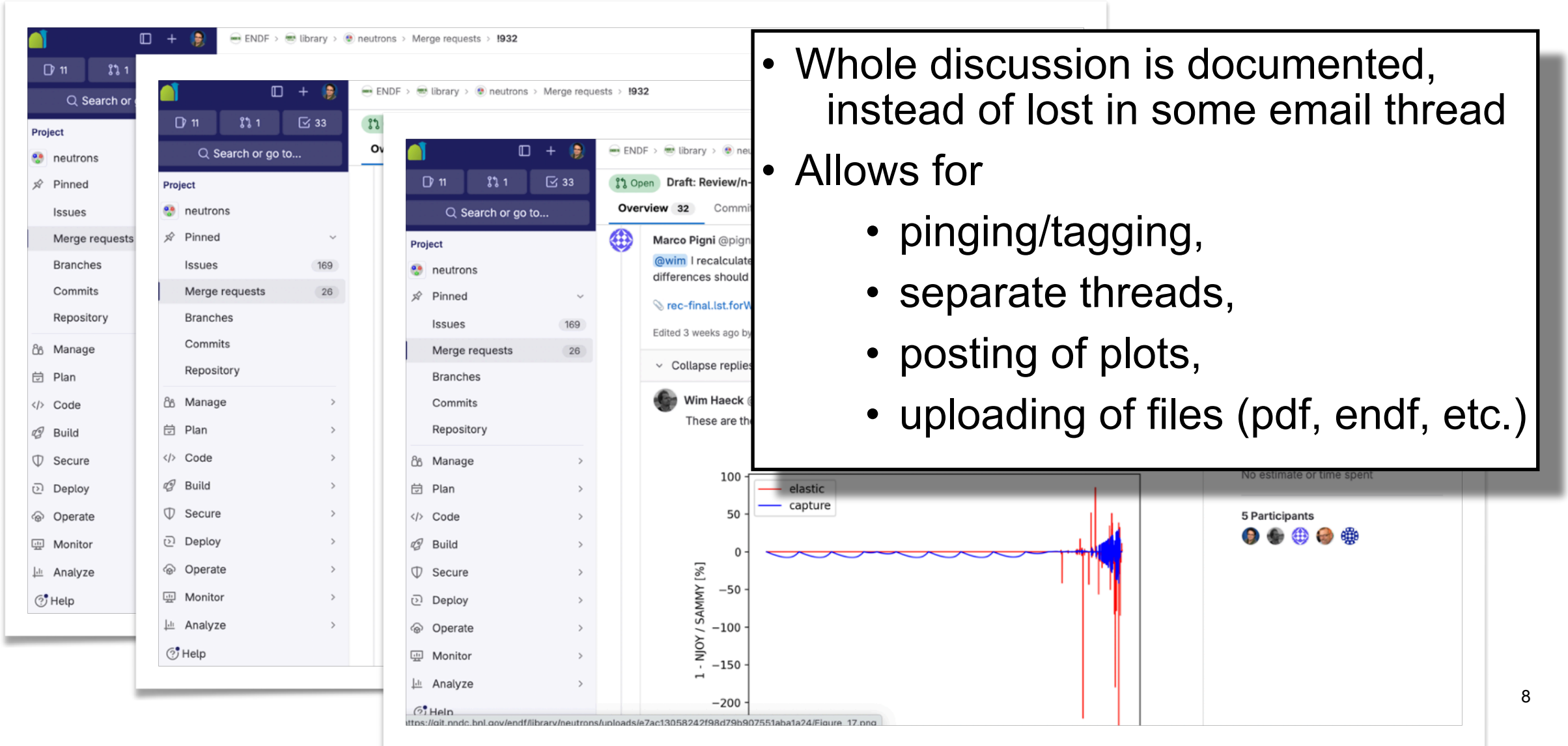


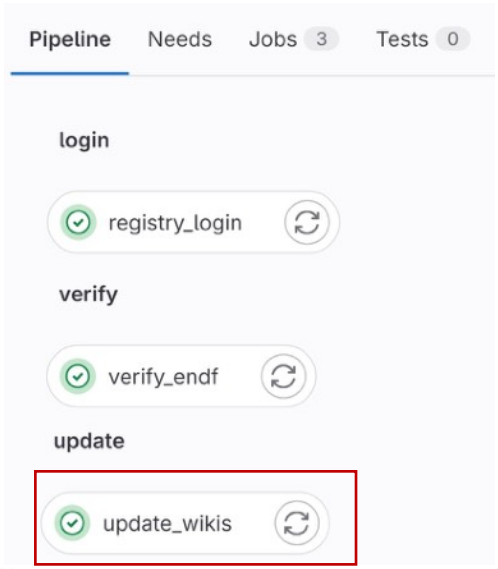
- Whole discussion is documented, instead of lost in some email thread
- Allows for
  - pinging/tagging,
  - separate threads,
  - posting of plots,
  - uploading of files (pdf, endf, etc.)

ENDF Repo Auto-updating Wikis

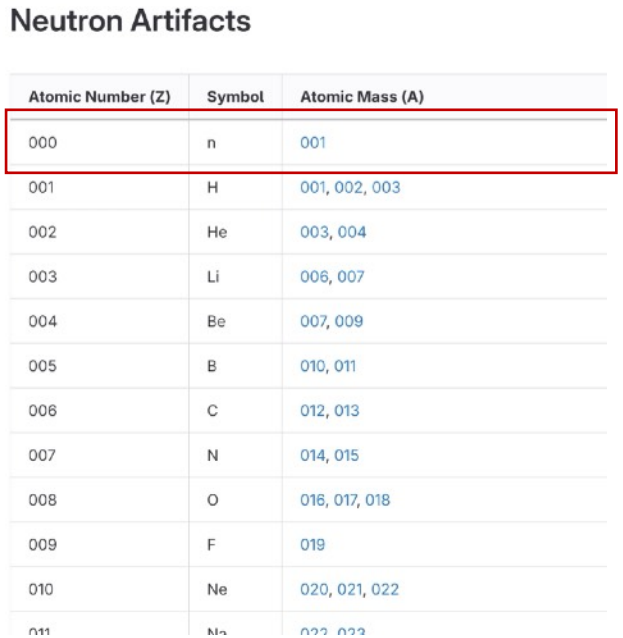
A new job is being added to GitLab ENDF repositories to auto-update the repo's wiki with useful information about job and artifact status.

Example: https://git.nndc.bnl.gov/endf/library/neutrons/-/wikis/Neutron-Artifacts

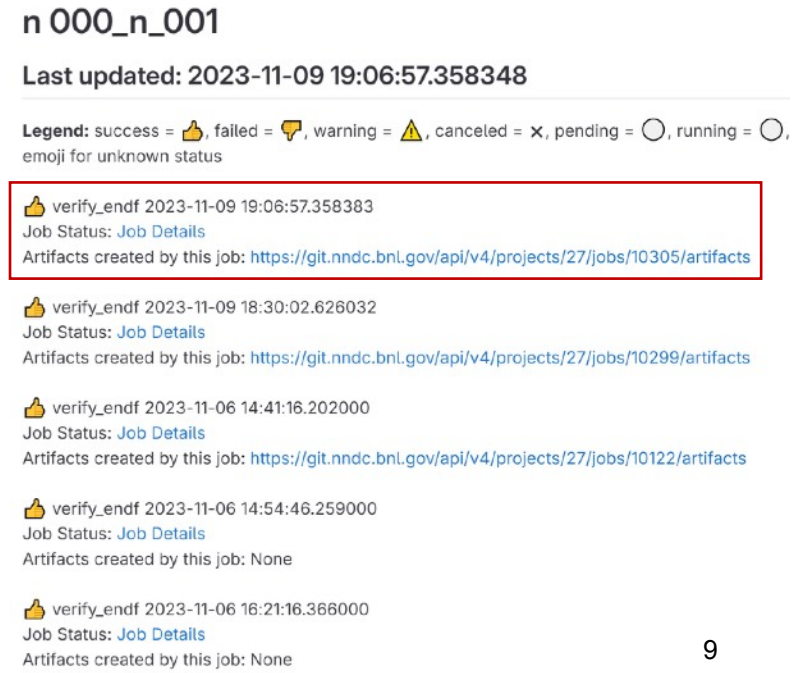
1) update_wikis job runs after verify_endf



2) Use Wiki table of contents to find your data



3) Enjoy a record of job and artifact data all in one place

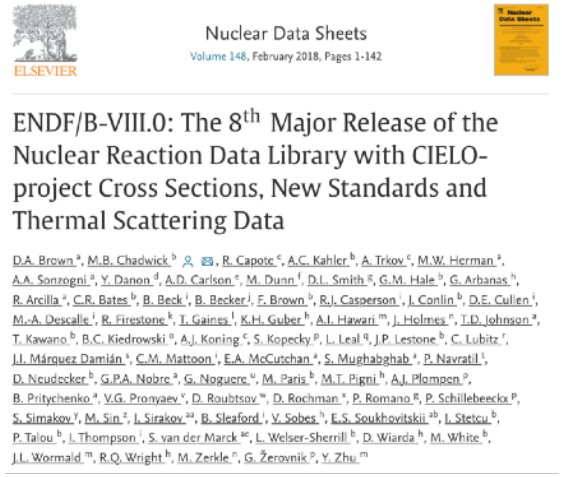


Status of “Big Paper”

Past ENDF release published accompanying paper in Nuclear Data Sheets

ENDF B-VIII.0

Nuclear Data Sheets 148, 1-142 (2018)



Cited 1,658 times!

This is really, *really* impactful!

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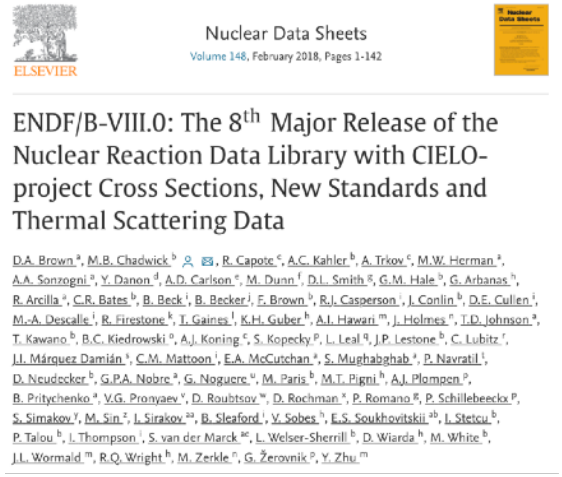
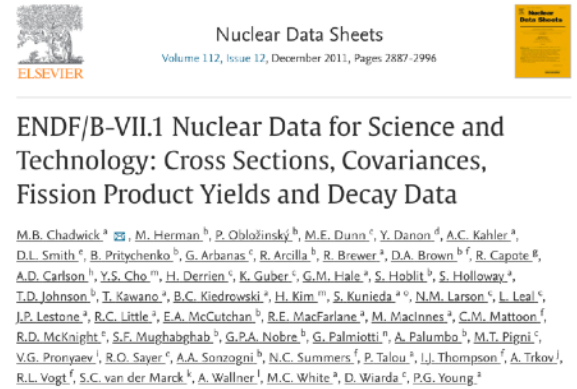


Cited 1,658 times!

ENDF B-VII.1

Nuclear Data Sheets 112, 2887-2996 (2011)



Cited 3,138 times!

ENDF B-VII.0 Evaluated Nuclear Data File

Nuclear Data Sheets, 107 (2006), p. 2931

Cited 2,753 times!

This is really, *really* impactful!

Big Paper updates

- Many contributions have been sent but there are still gaps that will be addressed after CSEWG Meeting
- Defined preliminary full author list and ordering
- Big Paper is shaping up: huge “stitching” effort
- Aiming to have a complete manuscript soon

FIXME: Full title of ENDF/B-VIII.1 paper

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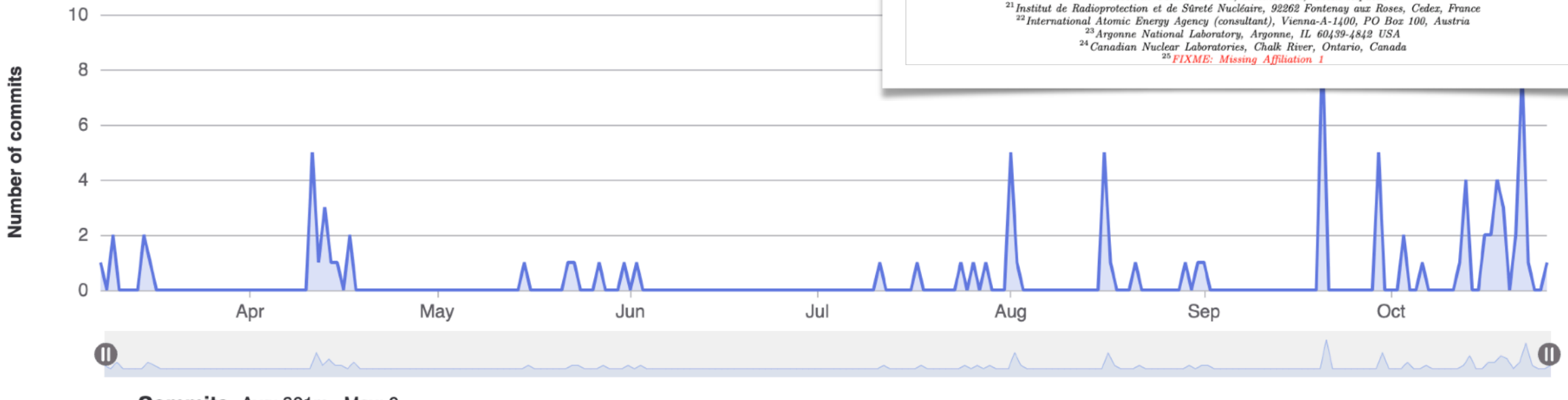
[24] *Canadian Nuclear Laboratories, Chalk River, Ontario, Canada*
[25] *FIXME: Missing Affiliation 1*

Commits to development

Excluding merge commits. Limited to 6,000 commits.



ENDF release status

Progress towards ENDF/B-VIII.1

- **Beta1** was released on March 1st, 2023:
  - Mostly neutrons sublibraries
  - Mostly INDEN
- **Beta1.1** was released on April 18th, 2023:
  - Mostly TSL files
  - Some few specific neutrons fixes
- Mini-CSEWG (LLNL): April 24-28, 2023
- **Beta2** was released on August 4, 2023
  - All neutrons contributions incorporated
  - New ^{239}Pu that restores depletion performance, following feedback from mini-CSEWG
  - Gaps in exit distributions filled
  - Many dosimetry reactions consistently adopted from IRDFF-II
  - Many updates on photonuclear library based on IAEA CRP
- Hackathon (LANL): August 6-8, 2023
- CSEWG Meeting: November 15-17, 2023

ENDF/B VIII.1-β1

ENDF/B VIII.1-β1.1

ENDF/B VIII.1-β2

Additional overall updates in neutrons sub library

ENDF/B VIII.1-β2

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ENDF/B VIII.1-β2

- For many nuclides, there were no outgoing distributions for some emitted particles
  - Wherever it was missing, exit spectra was taken from TENDL
  - Cross sections left unchanged
  - Impacted 219 files

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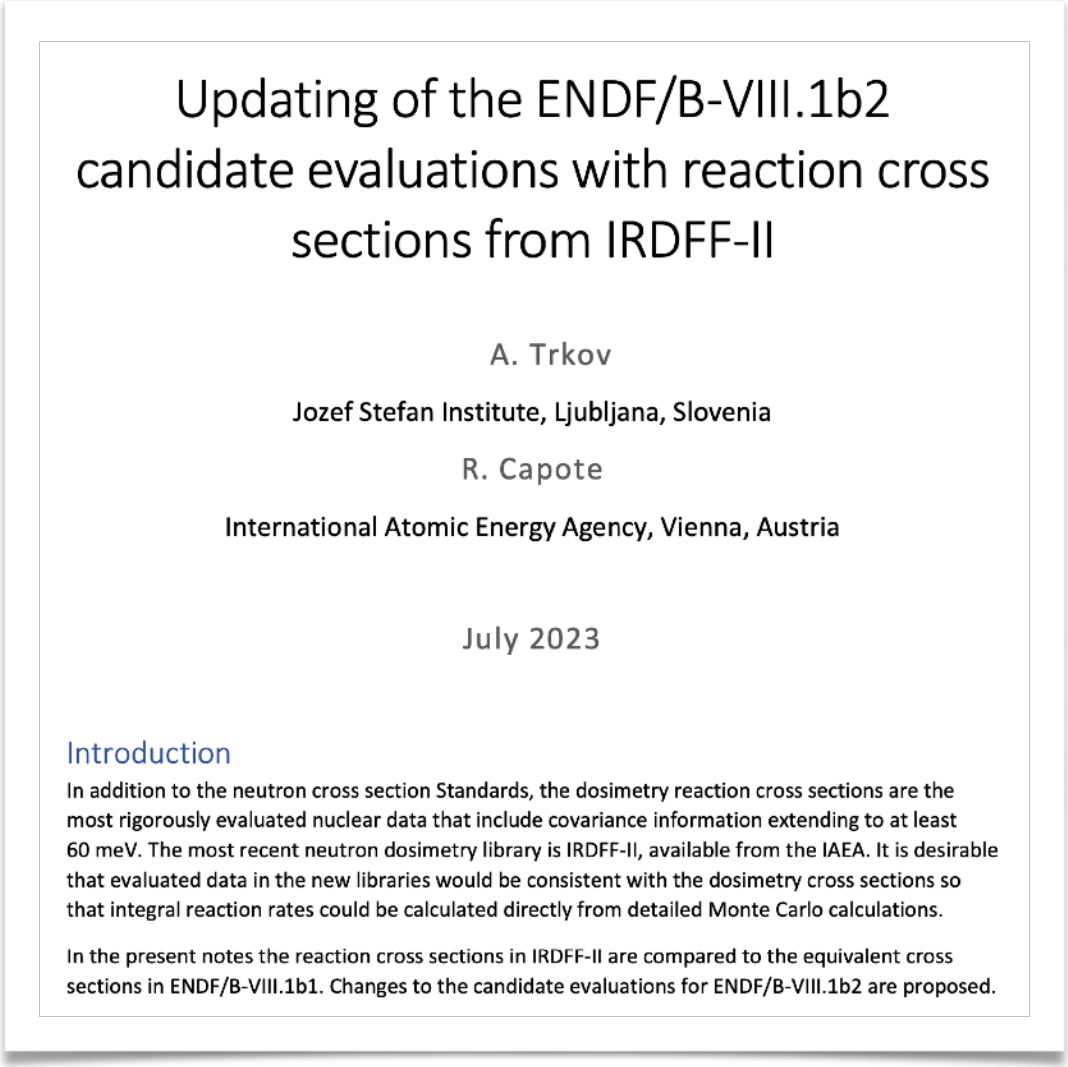
  - This tends to be more accurate than any full, self-consistent evaluation
  - 34 files had something replaced by IRDFF
  - Had to reconstruct other reactions to preserve unitarity



Updating of the ENDF/B-VIII.1b2 candidate evaluations with reaction cross sections from IRDFF-II

A. Trkov

Jozef Stefan Institute, Ljubljana, Slovenia

R. Capote

International Atomic Energy Agency, Vienna, Austria

July 2023

Introduction

In addition to the neutron cross section Standards, the dosimetry reaction cross sections are the most rigorously evaluated nuclear data that include covariance information extending to at least 60 meV. The most recent neutron dosimetry library is IRDFF-II, available from the IAEA. It is desirable that evaluated data in the new libraries would be consistent with the dosimetry cross sections so that integral reaction rates could be calculated directly from detailed Monte Carlo calculations.

In the present notes the reaction cross sections in IRDFF-II are compared to the equivalent cross sections in ENDF/B-VIII.1b1. Changes to the candidate evaluations for ENDF/B-VIII.1b2 are proposed.

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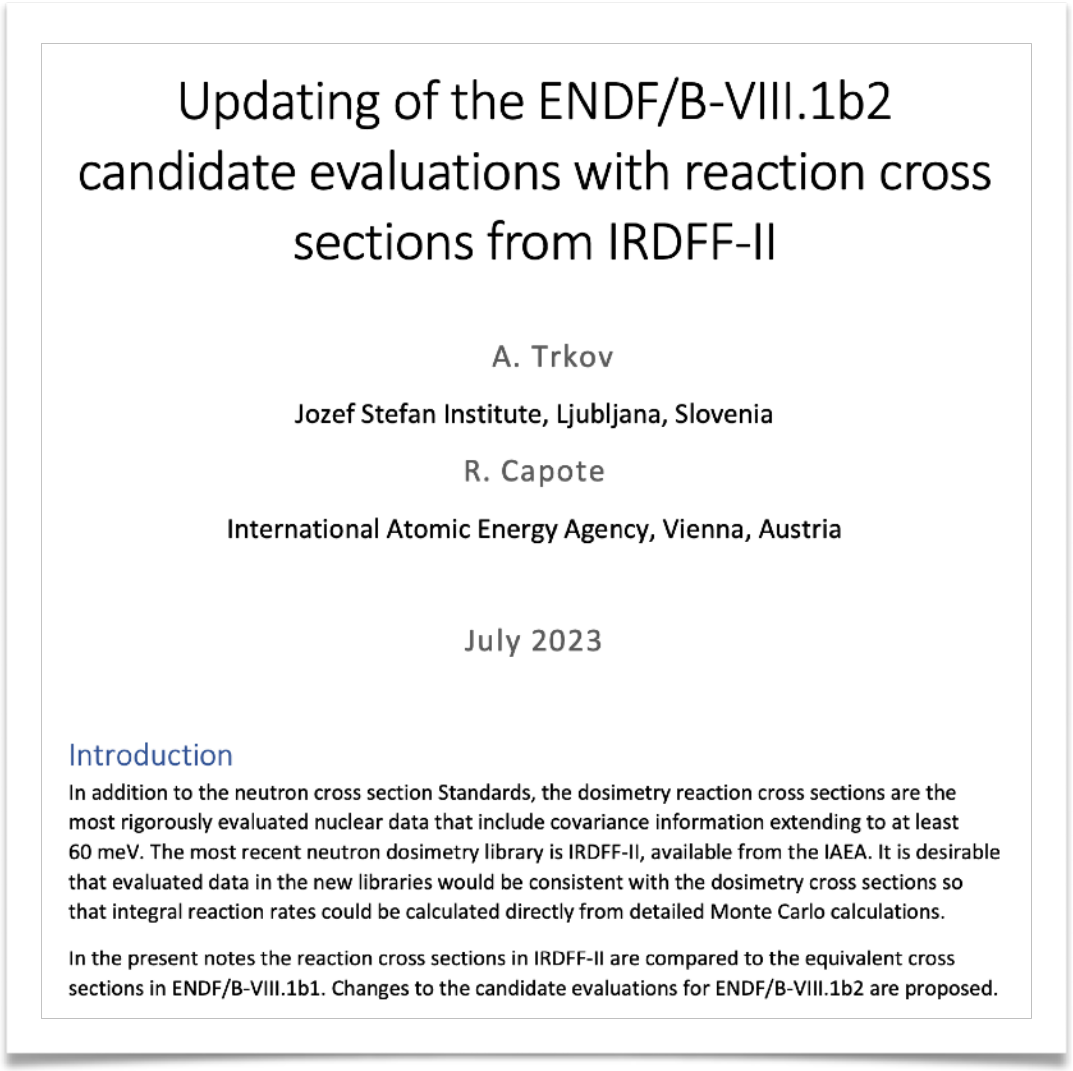
  - This tends to be more accurate than any full, self-consistent evaluation
  - 34 files had something replaced by IRDFF
  - Had to reconstruct other reactions to preserve unitarity
- These efforts were done semi-simultaneously, independently, by different groups, often in the same file
  - Logistic challenge to coordinate all this!



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Previously non-existent exit distributions added by LLNL

ENDF/B VIII.1-β2

- Na22
- Na23
- Mg24
- Mg25
- Mg26
- Si28
- P31
- S32
- S33
- S34
- S36
- Ar36
- Ar38
- K39
- K40
- K41
- Sc45
- Ti46
- Ti47
- Ti48
- Ti49
- Ti50
- V50
- V51
- Co58m1
- Zn64
- Zn65
- Zn66
- Zn67
- Zn68
- Zn70
- Ga69
- Ga71
- Ge70
- Ge72
- Ge73
- Ge74
- Ge76
- Se74
- Se76
- Se77
- Se78
- Se79
- Se80
- Se82
- Br79
- Br81
- Kr80
- Kr82
- Kr83
- Kr84
- Rb85
- Rb87
- Sr86
- Sr87
- Sr88
- Sr89
- Sr90
- Y91
- Nb93
- Nb94
- Nb95
- Mo92
- Mo94
- Mo95
- Mo96
- Mo97
- Mo98
- Mo99
- Mo100
- Ru96
- Ru98
- Ru99
- Ru100
- Ru102
- Ru103
- Ru104
- Ru105
- Ru106
- Rh103
- Rh105
- Pd107
- Ag107
- Ag110m1
- Cd106
- Cd108
- Cd110
- Cd111
- Cd112
- Cd113
- Cd114
- Cd116
- In113
- In115
- Sn112
- Sn114
- Sn115
- Sn116
- Sn117
- Sn118
- Sn119
- Sn122
- Sn123
- Sn124
- Sn126
- Sb121
- Sb123
- Sb124
- Sb125
- Te120
- Te122
- Te123
- Te124
- Te125
- Te126
- Te127m1
- Te128
- Te129m1
- Te130
- I129
- I131
- I135
- Xe126
- Xe128
- Xe129
- Xe130
- Xe132
- Xe133
- Xe134
- Xe135
- Xe136
- Cs134
- Cs135
- Cs136
- Cs137
- Ba130
- Ba132
- Ba134
- Ba135
- Ba136
- Ba137
- Ba138
- Ba140
- La138
- Ce140
- Ce141
- Ce142
- Ce144
- Pr143
- Nd143
- Nd145
- Pm147
- Pm148
- Pm148m1
- Pm149
- Sm147
- Sm149
- Sm153
- Eu151
- Eu152
- Eu153
- Eu154
- Eu155
- Eu156
- Gd152
- Gd153
- Gd155
- Gd157
- Tb159
- Dy154
- Dy159
- Er162
- Er164
- Er166
- Er167
- Er168
- Er170
- Yb168
- Yb170
- Yb171
- Yb172
- Yb173
- Yb174
- Yb176
- Lu175
- Lu176
- Hf174
- Hf176
- Hf178
- Hf179
- Hf180
- Hf181
- Hf182
- Ta182
- Os184
- Os186
- Os187
- Os188
- Os189
- Os190
- Os192
- Hg196
- Hg198
- Hg199
- Hg200
- Hg201
- Hg202
- Hg204
- Bi209
- Ra223
- Ra224
- Ra225
- Ra226
- U235
- Pu238
- Am242
- Am242m1
- Am244
- Am244m1

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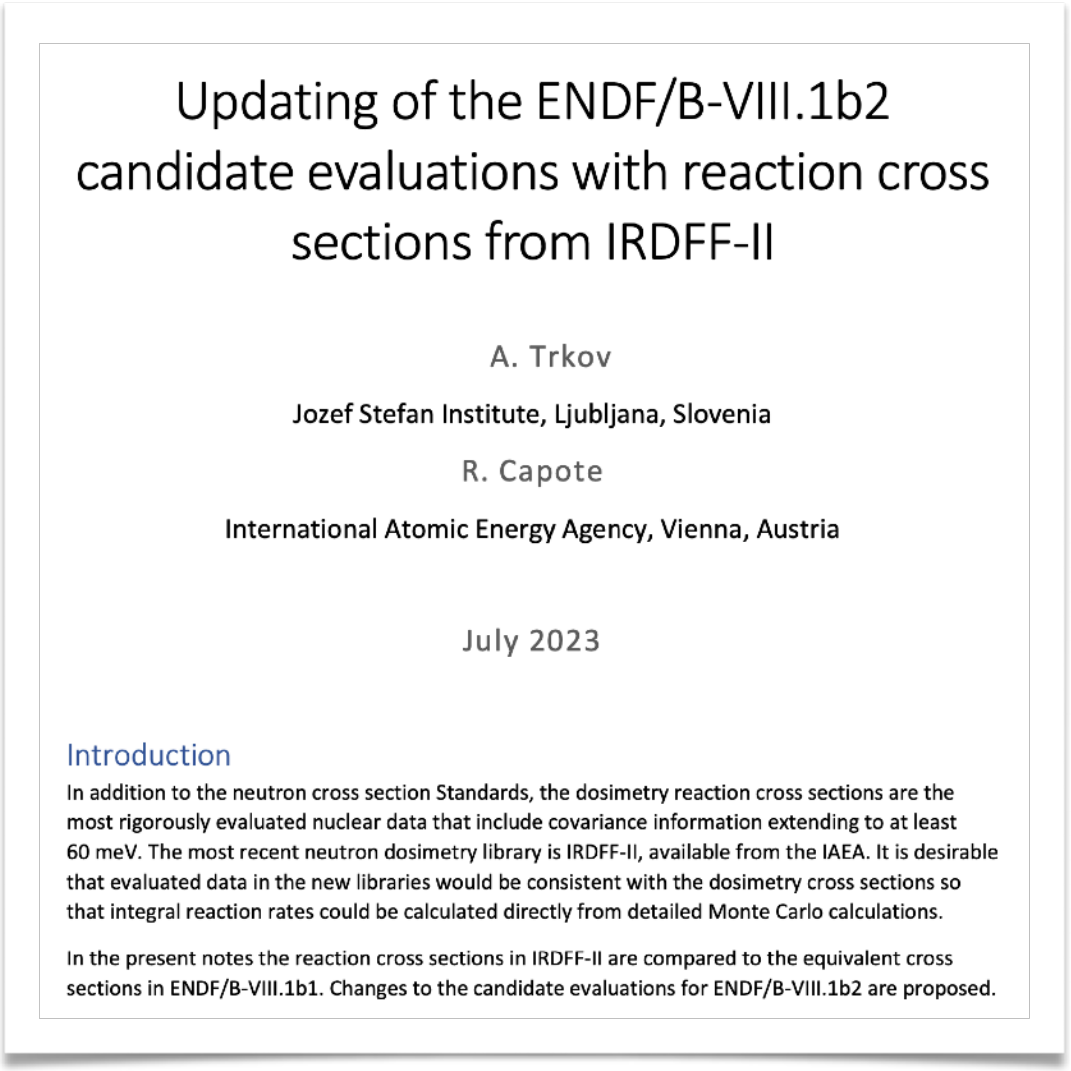
IRDFF-II replacements

ENDF/B VIII.1-β2

- 7Li
- 23Na
- 24Mg
- 27Al
- 28Si
- 29Si
- 31P
- 32S
- 46Ti
- 47Ti
- 48Ti
- 51V
- 55Mn
- 54Fe
- 59Co
- 58Ni
- 60Ni
- 64Zn
- 67Zn
- 68Zn
- 75As
- 89Y
- 90Zr
- 92Mo
- 103Rh
- 113In
- 115In
- 127I
- 141Pr
- 169Tm
- 197Au
- 199Hg
- 204Pb
- 209Bi



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Jozef Stefan Institute, Ljubljana, Slovenia

R. Capote

International Atomic Energy Agency, Vienna, Austria

July 2023

Introduction

In addition to the neutron cross section Standards, the dosimetry reaction cross sections are the most rigorously evaluated nuclear data that include covariance information extending to at least 60 meV. The most recent neutron dosimetry library is IRDFF-II, available from the IAEA. It is desirable that evaluated data in the new libraries would be consistent with the dosimetry cross sections so that integral reaction rates could be calculated directly from detailed Monte Carlo calculations.

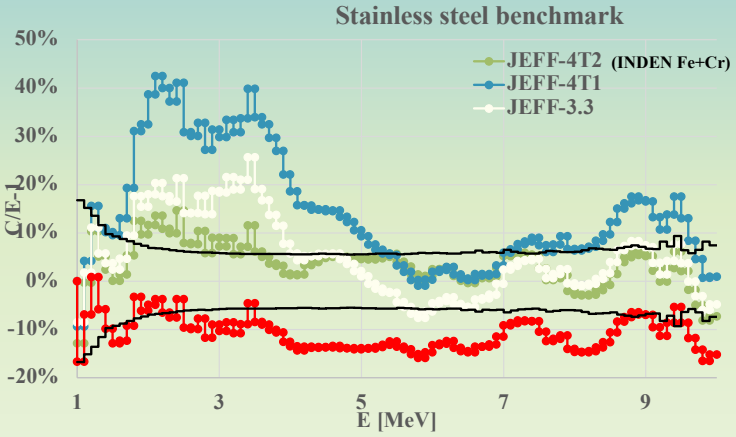
In the present notes the reaction cross sections in IRDFF-II are compared to the equivalent cross sections in ENDF/B-VIII.1b1. Changes to the candidate evaluations for ENDF/B-VIII.1b2 are proposed.

Results sensitive to stainless steel

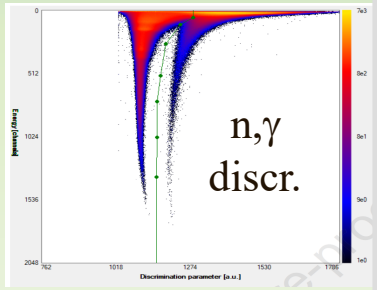
INDEN updated "structural" evaluations:

see nds.iaea.org/INDEN/ - **Validation**

- ✓ Fe isotopes (IAEA/JSI), fe54e80o, fe56e80X29r41, fe54e80o
- ✓ Cr isotopes, BNL/ORNL/IAEA/JSI/CEA, v2.3.2



Kostal et al, priv. com. stilbene meas.



Stainless steel, neutron leakage (Rez, CZ, 11/2021)

Roberto Capote, IAEA Nuclear Data Section
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Web: http://www-nds.iaea.org

The Pool Critical Assembly (PCA) Pressure Vessel Simulator experiment was performed in the early 1980s as part of the NRC's LWR Pressure Vessel Surveillance Dosimetry Improvement Program (LWR-PV-SDIP)

Benchmark was recently re-analyzed with exact geometry by Dr. Kulesza (LANL/X-5), and MCNP inputs were published and available for use:
- NUCLEAR TECHNOLOGY · VOLUME 197 · 284–295 · MARCH 2017
- Paper: https://doi.org/10.1080/00295450.2016.1273711
- MCNP Inputs: https://doi.org/10.2172/1601379

Pool Critical Assembly Benchmarking

- C/E Results (ENDF/B-VIII.1b1):
  - MC uncertainty ~= 1%

Depends on U-235, water & SS

	al27a	ni48p	rh103n	in115n	u238f	np237f	avg	std dev
	0.97	0.96	1.04	1.00			**0.99**	**3.9%**
	1.02	0.98	1.08	1.01			**1.02**	**4.3%**
	1.05	1.01	1.07	1.06			**1.05**	**2.5%**
	1.03	0.96	1.00	1.01	0.98	1.03	**1.00**	**2.7%**
	1.03	0.96	0.95	1.00	0.98	1.05	**0.99**	**4.0%**
	1.04	1.02	0.93	1.03	0.98	1.03	**1.00**	**4.1%**
			0.96	0.99	0.99	1.13	**1.02**	**7.6%**
avg	**1.02**	**0.98**	**1.01**	**1.01**	**0.98**	**1.06**	**1.01**	
std dev	**2.8%**	**2.9%**	**6.4%**	**2.1%**	**0.1%**	**1.0%**		**4.2%**

Presented by Greg Fischer, Westinghouse @ miniCSWEG April 2023

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- Significant performance improvements in SS (Fe and Cr)
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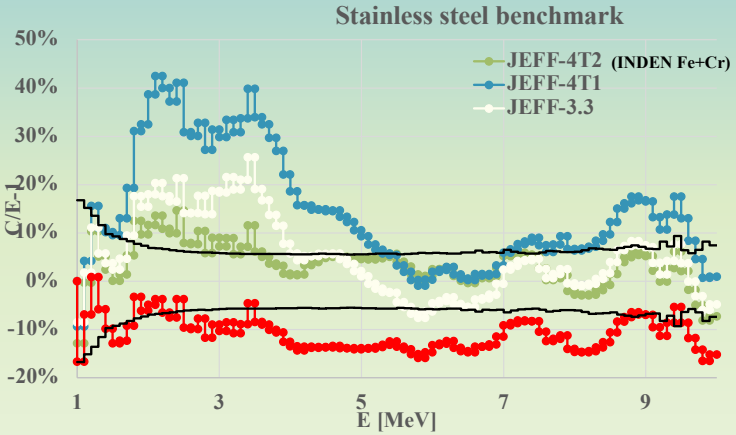

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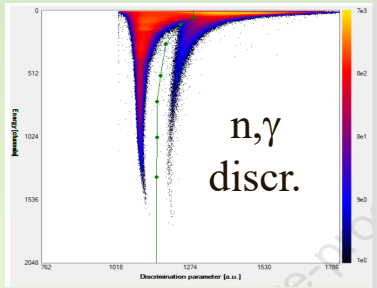

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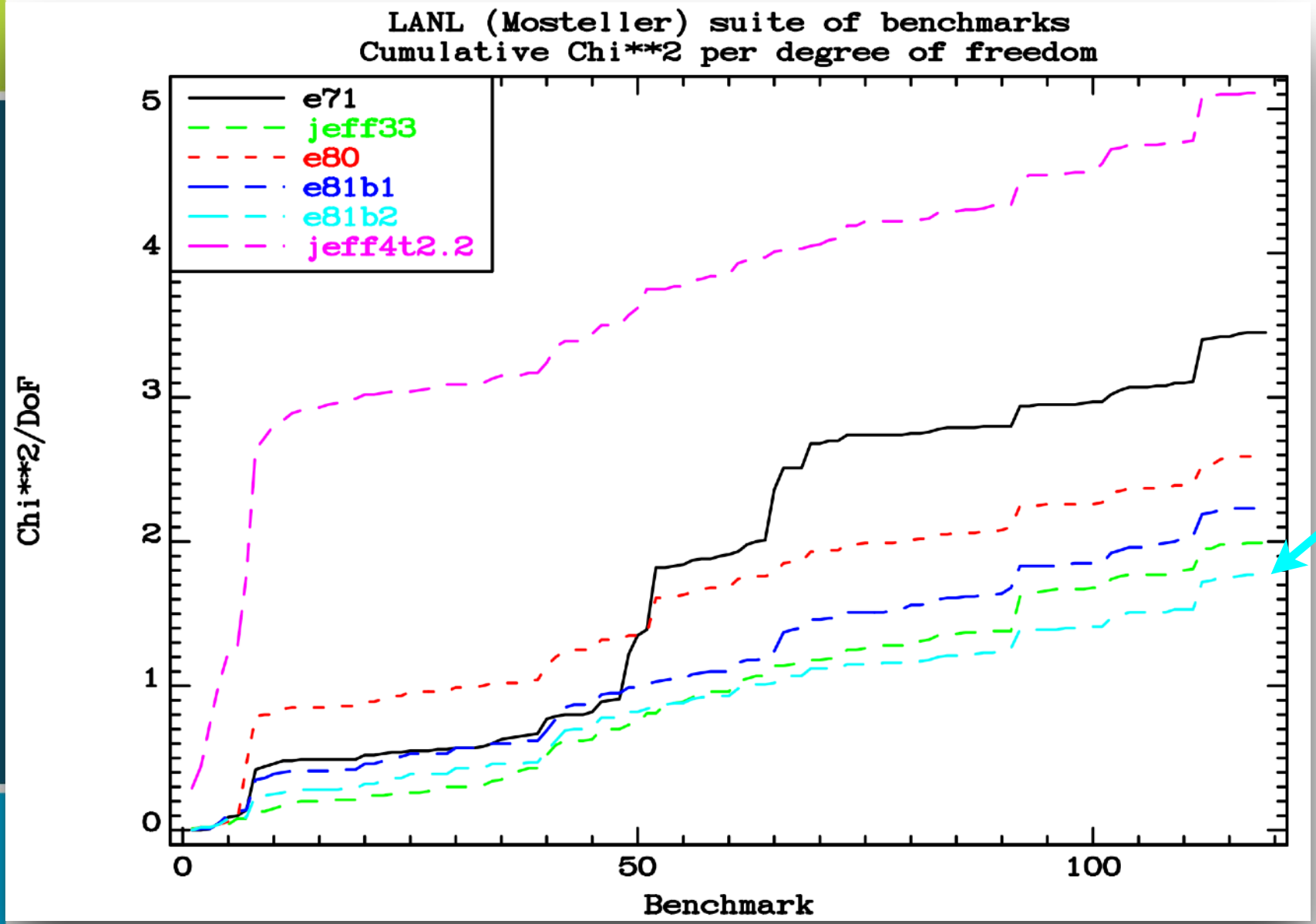
Preliminary validation on Beta2, by Andrej Trkov (JSI)



ENDF/BVIII.1 is on track to be the best-performing library to-date!

Caveat: Cumulative χ^2 of benchmarks provide only a global view. Detailed investigation of performance on specific benchmark are also important.

For more details on the ENDF-VIII.1-Beta2 performance, see talks in the **Validation** session of **2023 CSEWG Meeting**!

Some excerpts from Kleedtke's talk at the 2023 CSEWG Meeting

- *Reactor lattice category ("LCT", LEU-COMP- THERM) shows excellent overall performance*
- *Changes in 235,238U and 239Pu produce favorable changes in mixed U+Pu benchmarks simulated results*
- *PST benchmark simulated results are slightly concerning – E8.0 "success story" of reducing PST bias*
- *Discussion: should we compromise PST performance for better performance in depletion metrics, temperature coefficients, etc.?*
- *Overall, there is a significant reduction in mean absolute bias for 233U benchmarks simulated results from changes in the 233U file; however, C/E values are still very far from unity...*

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What to expect for Beta3

- **TSL:**
  - New MAT number assignments
  - Reviewed and new files
  - Extension of light water to low temperatures
- **Neutrons:**
  - Exit distributions form LANL/KAERI
  - Many fixes
  - Improved ^{239,240,241}Pu set with better criticality/depletion performance
- **Photonuclear:**
  - Reverted ^{180,182,183}W to VIII.0
  - ^{242}Pu from JENDL-5.0
  - ^{9}Be from IAEA CRP
- **Atomic sublibraries:**
  - Taken from EPICS-2023
    - Atomic relaxation sublibrary (EADL)
    - Electrons sublibrary (EEDL)
    - Photoatomic sublibrary (EPDL)

TSL MAT numbers

- Many, many new contributions: MAT number overload!
- Approved format change allow direct MAT assignments in the range of 1 to 9999
- New assignments were made, according to new guidelines:

Table C.1: Set of general rules used to assign MAT numbers for new materials in the TSL sublibrary.

MAT range	Description
1-10	legacy hydrogen (except organics) assignments
11-20	legacy deuterium assignments
21-25	legacy lithium assignments
26-29	legacy beryllium assignments
30-44	legacy carbon (including organics) assignments
45-50	legacy oxygen assignments
51-70	legacy metal assignments
71-99	legacy fuel assignments
100-299	single element (100 + Z for natural element and 200+Z for alternative form whenever possible)
300-999	graphite/diamond variations
1000-2999	carbon including organics
3000-3999	two-element inorganic compounds
4000-4999	three-element inorganic compounds
5000-5999	four-element inorganic compounds
6000-6499	five-element inorganic compounds
6500-6999	free slots
7000-7999	fuel compounds with plutonium
8000-8999	fuel compounds with uranium
9000-9999	free slots

TSL_MAT_numbers.csv (~/Calculations/ENDF/thermal_scatt) - VIM

```
##############################################################
##                                                          ##
##                  TSL MAT numbers                         ##
## associated with the ENDF/B-VIII.1-BetaX release          ##
##                                                          ##
## Note: empty file field means MAT number is reserved.     ##
##                                                          ##
##                                                          ##
##############################################################
##
##  MAT number, ENDF-6 file name                ,    Description
##
           1  , tsl-HinH2O.endf                  ,    H in H2O (liquid)
           2  , tsl-para-H.endf                 ,    para-Hydrogen
           3  , tsl-ortho-H.endf                ,    ortho-Hydrogen
           5  , tsl-HinYH2.endf                 ,    H in YH2
           7  , tsl-HinZrH.endf                 ,    H in ZrH
          10  , tsl-HinIceIh.endf               ,    H in H2O (ice (Ih))
          11  , tsl-DinD2O.endf                 ,    D in D2O (liquid)
          12  , tsl-para-D.endf                 ,    para-Deuterium
          13  , tsl-ortho-D.endf                ,    ortho-Deuterium
          14  ,                                 ,    D in D2O (ice)
TSL_MAT_numbers.csv                                          1,1           Top
        3002  , tsl-HinZrH2.endf                ,    H in ZrH2
        3006  , tsl-ZrinZrHx.endf               ,    Zr in ZrHx
        3007  , tsl-HinZrHx.endf                ,    H in ZrHx
        3011  , tsl-CainCaH2.endf               ,    Ca in CaH2
        3013  , tsl-H1inCaH2.endf               ,    H1 in CaH2
        3014  , tsl-H2inCaH2.endf               ,    H2 in CaH2
        3016  , tsl-SiinSiO2-alpha.endf         ,    Si in SiO2-alpha
        3017  , tsl-OinSiO2-alpha.endf          ,    O in SiO2-alpha
        3021  ,                                 ,    Si in SiO2-beta
        3022  ,                                 ,    O in SiO2-beta
        3031  , tsl-7Liin7LiH-mixed.endf        ,    7Li in 7LiH-mixed
        3032  , tsl-Hin7LiH-mixed.endf          ,    H in 7LiH-mixed
        3034  , tsl-7Liin7LiD-mixed.endf        ,    7Li in 7LiD-mixed
        3035  , tsl-Din7LiD-mixed.endf          ,    D in 7LiD-mixed
        3037  ,                                 ,    Mg in MgH2
        3038  ,                                 ,    H in MgH2
        3042  ,                                 ,    Mg in MgD2
        3043  ,                                 ,    D in MgD2
        3047  , tsl-FinHF.endf                  ,    F in HF
        3048  , tsl-HinHF.endf                  ,    H in HF
        3052  , tsl-AlinAl2O3.endf             ,    Al in Al2O3
        3053  , tsl-OinAl2O3.endf              ,    O in Al2O3
        3060  ,                                 ,    Pb in PbF2
TSL_MAT_numbers.csv                                        128,24          37%
```

TSL updates since Beta2 (in addition to new MAT assignments)

- tsl-Be-metal+Sd
- tsl-Be-metal
- tsl-BeinBeO
- tsl-CainCaH2
- tsl-CinC5O2H8.endf (fixes)
- tsl-CinC8H8 (minor fix)
- tsl-CinCF2.endf (minor fix)
- tsl-CinSiC
- tsl-CinUC-100P (new file)
- tsl-CinUC-10P
- tsl-CinUC-5P
- tsl-CinUC-HALEU (new file)
- tsl-CinUC-HEU
- tsl-CinUC
- tsl-DinD2O (minor fix)
- tsl-FinCF2 (minor fix)
- tsl-H1inCaH2
- tsl-H2inCaH2
- tsl-HinC5O2H8.endf (ORNL)
- tsl-HinH2O.endf (ESS)
- tsl-HinC8H8.endf (minor fix)
- tsl-HinIceIh.endf (minor fix)
- tsl-HinParaffinicOil (minor fix)
- tsl-HinYH2 (minor fix)
- tsl-HinZrH2 (minor fix)
- tsl-HinZrHx (minor fix)
- tsl-NinUN-100P
- tsl-NinUN-10P
- tsl-NinUN-5P
- tsl-NinUN-HALEU
- tsl-NinUN-HEU
- tsl-NinUN
- tsl-OinBeO
- tsl-OinC5O2H8.endf (fixes)
- tsl-OinD2O
- OinIceIh
- tsl-OinPuO2
- tsl-OinSiO2-alpha
- tsl-OinUO2-100P
- tsl-OinUO2-10P
- tsl-OinUO2-5P
- OinUO2-HALEU
- tsl-OinUO2-HEU
- tsl-OinUO2
- tsl-PuinPuO2
- tsl-SiinSiC
- tsl-SiinSiO2-alpha
- tsl-U-metal-10P
- tsl-U-metal-5P
- tsl-U-metal-HEU
- tsl-U-metal
- tsl-UinUC-100P
- tsl-UinUC-10P
- tsl-UinUC-5P
- tsl-UinUC-HALEU
- tsl-UinUC-HEU
- tsl-UinUC
- tsl-UinUN-100P
- tsl-UinUN-10P
- tsl-UinUN-5P
- tsl-UinUN-HALEU
- tsl-UinUN-HEU
- tsl-UinUN
- tsl-UinUO2-100P
- tsl-UinUO2-10P
- tsl-UinUO2-5P
- tsl-UinUO2-HALEU
- tsl-UinUO2-HEU
- tsl-UinUO2
- tsl-YinYH2
- tsl-ZrinZrH2 (minor fix)
- tsl-ZrinZrHx (minor fix)
- tsl-graphiteSd
- tsl-reactor-graphite-10P
- tsl-reactor-graphite-20P
- tsl-reactor-graphite-30P
- tsl-s-CH4
- tsl-CinZrC
- tsl-ZrinZrC
- tsl-ortho-D
- tsl-para-D
- tsl-ortho-H
- tsl-para-H

KAERI/LANL exit distributions

- al27
  - MF=6 MT= 600-619, 650-669, 700-710, 800-819 were updated.
- si28
  - MF=12/14 MT= 601-613, 801-815 were deleted.
  - MF=6 MT= 104 were deleted.
  - MF=3 MT= 650-659, 699 were added.
  - MF=6 MT= 650-659, 699 were added.
  - MF=6 MT= 600-613, 800-815 were updated.
- si29
  - MF=12/14 MT= 601-615, 801-819 were deleted.
  - MF=6 MT= 600-615, 800-819 were updated.
- si30
  - MF=12/14 MT= 601-605, 801-811 were deleted.
  - MF=6 MT= 600-605, 800-811 were updated.
- si31
  - MF=4 MT= 600, 800-814 were deleted.
  - MF=12/14 MT= 801-814 were deleted.
  - MF=6 MT= 600, 800-814 were added.
- si32
  - MF=4 MT= 600, 800 were deleted.
  - MF=6 MT= 600, 800 were added.
- cl35
  - MF=6 MT= 600-629, 650-680, 700-730, 800-820 were updated.
- cl36
  - MF=4 MT= 600-615, 800-831 were deleted.
  - MF=12/14 MT= 601-615, 801-831 were deleted.
  - MF=6 MT= 600-615, 800-831 were added.
- cl37
  - MF=3 MT= 600-609, 649 were added.
  - MF=6 MT= 600-609 were added.
  - MF=6 MT= 649, 650-661, 700-715, 800-805 were updated.
- k39
  - MF=15 MT= 103, 107 were deleted.
  - MF=12/14 MT= 601-609, 801-809 were deleted.
  - MF=3 MT= 600-609, 649, 800-809, 849 were added.
  - MF=6 MT= 600-609, 649, 800-809, 849 were added.
- k40
  - MF=15 MT= 103, 107 were deleted.
  - MF=12/14 MT= 601-609, 801-809 were deleted.
  - MF=3 MT= 600-609, 649, 800-809, 849 were added.
  - MF=6 MT= 600-609, 649, 800-809, 849 were added.
- k41
  - MF=15 MT= 103, 107 were deleted.
  - MF=12/14 MT= 601-609, 801-809 were deleted.
  - MF=3 MT= 600-609, 649, 800-809, 849 were added.
  - MF=6 MT= 600-609, 649, 800-809, 849 were added.
- ti46
  - MF=6 MT= 104, 105, 106 were deleted.
  - MF=3 MT= 600-609, 649, 650-659, 699, 700-709, 749, 750-759, 799, 800-809, 849 were added.
  - MF=6 MT= 600-609, 649, 650-659, 699, 700-709, 749, 750-759, 799, 800-809, 849 were added.
- ti47
  - MF=6 MT= 104, 105, 106 were deleted.
  - MF=3 MT= 600-609, 649, 650-659, 699, 700-709, 749, 750-759, 799, 800-809, 849 were added.
  - MF=6 MT= 600-609, 649, 650-659, 699, 700-709, 749, 750-759, 799, 800-809, 849 were added.
- ti48
  - MF=6 MT= 104, 105, 106 were deleted.
  - MF=3 MT= 600-609, 649, 650-659, 699, 700-709, 749, 750-759, 799, 800-809, 849 were added.
  - MF=6 MT= 600-609, 649, 650-659, 699, 700-709, 749, 750-759, 799, 800-809, 849 were added.
- ti49
  - MF=6 MT= 104, 105, 106 were deleted.
  - MF=3 MT= 600-609, 649, 650-659, 699, 700-709, 749, 750-759, 799, 800-809, 849 were added.
  - MF=6 MT= 600-609, 649, 650-659, 699, 700-709, 749, 750-759, 799, 800-809, 849 were added.

KAERI/LANL exit distributions

- ti50
  - MF=6 MT= 104, 105, 106 were deleted.
  - MF=3 MT= 600-608, 649, 650-659, 699, 700-709, 749, 750, 800-809, 849 were added.
  - MF=6 MT= 600-608, 649, 650-659, 699, 700-709, 749, 750, 800-809, 849 were added.
- v49
  - MF=4 MT= 600-639, 800-839 were deleted.
  - MF=12/14 MT= 601-639, 801-839 were deleted.
  - MF=6 MT= 600-639, 800-839 were added.
- v50
  - MF=6 MT= 104, 105, 106 were deleted.
  - MF=3 MT= 600-609, 649, 650-659, 699, 700-709, 749, 750-759, 799, 800-809, 849 were added.
  - MF=6 MT= 600-609, 649, 650-659, 699, 700-709, 749, 750-759, 799, 800-809, 849 were added.
- v51
  - MF=6 MT= 104, 105, 106 were deleted.
  - MF=3 MT= 600-609, 649, 650-659, 699, 700-709, 749, 750-759, 799, 800-809, 849 were added.
  - MF=6 MT= 600-609, 649, 650-659, 699, 700-709, 749, 750-759, 799, 800-809, 849 were added.
- cr50
  - MF=12/14 MT= 601-639, 801-839 were deleted.
  - MF=6 MT= 104, 105, 106 were deleted.
  - MF=3 MT= 650-659, 699, 701-709, 749, 750-759, 799 were added.
  - MF=6 MT= 650-659, 699, 701-709, 749, 750-759, 799 were added.
  - MF=6 MT= 600-639, 800-839 were updated.
- cr51
  - MF=4 MT= 600-639, 800-839 were deleted.
  - MF=12/14 MT= 601-639, 801-839 were deleted.
  - MF=6 MT= 104, 105, 106 were deleted.
  - MF=3 MT= 650-659, 699, 700-709, 749, 750-759, 799 were added.
  - MF=6 MT= 600-639, 650-659, 699, 700-709, 749, 750-759, 799, 800-839 were added.
- cr52
  - MF=12/14 MT= 601-631, 801-839 were deleted.
  - MF=6 MT= 104, 105, 106 were deleted.
  - MF=3 MT= 650-659, 699, 701-709, 749, 750-759, 799 were added.
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  - MF=6 MT= 600-610, 800-839 were updated.
- cr54
  - MF=12/14 MT= 601-616, 801-834 were deleted.
  - MF=6 MT= 104, 105, 106 were deleted.
  - MF=3 MT= 650-659, 699, 701-709, 749, 750-759, 799 were added.
  - MF=6 MT= 650-659, 699, 701-709, 749, 750-759, 799 were added.
  - MF=6 MT= 600-616, 800-834 were updated.
- co58
  - MF=4 MT= 600-639, 800-839 were deleted.
  - MF=12/14 MT= 601-639, 801-839 were deleted.
  - MF=6 MT= 104, 105 were deleted.
  - MF=3 MT= 650-659, 699, 700-709, 749 were added.
  - MF=6 MT= 600-639, 650-659, 699, 700-709, 749, 800-839 were added.
- co59
  - MF=6 MT= 103, 104, 105, 106, 107 were deleted.
  - MF=3 MT= 600-609, 649, 650-659, 699, 700-709, 749, 750-759, 799, 800-809, 849 were added.
  - MF=6 MT= 600-609, 649, 650-659, 699, 700-709, 749, 750-759, 799, 800-809, 849 were added.
- ni58
  - MF=6 MT= 103, 104, 105, 107 were deleted.
  - MF=3 MT= 600-609, 649, 650-659, 699, 700-709, 749, 800-809, 849 were added.
  - MF=6 MT= 600-609, 649, 650-659, 699, 700-709, 749, 800-809, 849 were added.

KAERI/LANL exit distributions

- ni59
  - MF=6 MT= 103, 104, 105, 106, 107 were deleted.
  - MF=3 MT= 600-609, 649, 650-659, 699, 700-709, 749, 750-759, 799, 800-809, 849 were added.
  - MF=6 MT= 600-609, 649, 650-659, 699, 700-709, 749, 750-759, 799, 800-809, 849 were added.
- ni60
  - MF=6 MT= 103, 104, 105, 107 were deleted.
  - MF=3 MT= 600-609, 649, 650-659, 699, 700-709, 749, 800-809, 849 were added.
  - MF=6 MT= 600-609, 649, 650-659, 699, 700-709, 749, 800-809, 849 were added.
- ni61
  - MF=6 MT= 103, 104, 105, 107 were deleted.
  - MF=3 MT= 600-609, 649, 650-659, 699, 700-709, 749, 800-809, 849 were added.
  - MF=6 MT= 600-609, 649, 650-659, 699, 700-709, 749, 800-809, 849 were added.
- ni62
  - MF=6 MT= 103, 104, 105, 107 were deleted.
  - MF=3 MT= 600-609, 649, 650-659, 699, 700-709, 749, 800-809, 849 were added.
  - MF=6 MT= 600-609, 649, 650-659, 699, 700-709, 749, 800-809, 849 were added.
- ni63
  - MF=4 MT= 600-625, 800-827 were deleted.
  - MF=12/14 MT= 601-625, 801-827 were deleted.
  - MF=6 MT= 600-625, 800-827 were added.
- ni64
  - MF=6 MT= 103, 104, 105, 107 were deleted.
  - MF=3 MT= 600-609, 649, 650-659, 699, 700-709, 749, 800, 849 were added.
  - MF=6 MT= 600-609, 649, 650-659, 699, 700-709, 749, 800, 849 were added.
- cu63
  - MF=6 MT= 103, 104, 105, 107 were deleted.
  - MF=3 MT= 600-609, 649, 650-659, 699, 700-709, 749, 800-809, 849 were added.
  - MF=6 MT= 600-609, 649, 650-659, 699, 700-709, 749, 800-809, 849 were added.
- cu64
  - MF=4 MT= 600-639, 800-839 were deleted.
  - MF=12/14 MT= 601-639, 801-839 were deleted.
  - MF=6 MT= 600-639, 800-839 were added.
- cu65
  - MF=6 MT= 103, 104, 105, 107 were deleted.
  - MF=3 MT= 600-609, 649, 650-659, 699, 700-709, 749, 800-809, 849 were added.
  - MF=6 MT= 600-609, 649, 650-659, 699, 700-709, 749, 800-809, 849 were added.
- zn64
  - MF=6 MT= 104, 105, 106 were deleted.
  - MF=3 MT= 600-609, 649, 650-659, 699, 700-709, 749, 750-759, 799, 800-809, 849 were added.
  - MF=6 MT= 600-609, 649, 650-659, 699, 700-709, 749, 750-759, 799, 800-809, 849 were added.
- zn65
  - MF=6 MT= 104, 105, 106 were deleted.
  - MF=3 MT= 600-609, 649, 650-659, 699, 700-709, 749, 750-759, 799, 800-809, 849 were added.
  - MF=6 MT= 600-609, 649, 650-659, 699, 700-709, 749, 750-759, 799, 800-809, 849 were added.
- zn66
  - MF=6 MT= 104, 105, 106 were deleted.
  - MF=3 MT= 600-609, 649, 650-659, 699, 700-709, 749, 750-759, 799, 800-809, 849 were added.
  - MF=6 MT= 600-609, 649, 650-659, 699, 700-709, 749, 750-759, 799, 800-809, 849 were added.
- zn67
  - MF=6 MT= 103, 104, 105, 106, 107 were deleted.
  - MF=3 MT= 600-609, 649, 650-659, 699, 700-709, 749, 750-759, 799, 800-809, 849 were added.
  - MF=6 MT= 600-609, 649, 650-659, 699, 700-709, 749, 750-759, 799, 800-809, 849 were added.

KAERI/LANL exit distributions

- zn68
  - MF=6 MT= 104, 105, 106 were deleted.
  - MF=3 MT= 600-607, 649, 650-659, 699, 700-709, 749, 750-759, 799, 800-809, 849 were added.
  - MF=6 MT= 600-607, 649, 650-659, 699, 700-709, 749, 750-759, 799, 800-809, 849 were added.
- zn69
  - MF=4 MT= 600-616, 800-817 were deleted.
  - MF=12/14 MT= 601-616, 801-817 were deleted.
  - MF=6 MT= 600-616, 800-817 were added.
- zn70
  - MF=6 MT= 104, 105, 106 were deleted.
  - MF=3 MT= 600, 649, 650-659, 699, 700-707, 749, 750-757, 799, 800, 849 were added.
  - MF=6 MT= 600, 649, 650-659, 699, 700-707, 749, 750-757, 799, 800, 849 were added.
- as73
  - MF=6 MT= 103, 107 were deleted.
  - MF=3 MT= 600-609, 649, 800-809, 849 were added.
  - MF=6 MT= 600-609, 649, 800-809, 849 were added.
- as74
  - MF=6 MT= 103, 107 were deleted.
  - MF=3 MT= 600-609, 649, 800-809, 849 were added.
  - MF=6 MT= 600-609, 649, 800-809, 849 were added.
- zr90
  - MF=4 MT= 600-611, 800-808 were deleted.
  - MF=12/14 MT= 601-611, 801-808 were deleted.
  - MF=6 MT= 104, 105 were deleted.
  - MF=3 MT= 650-659, 699, 700-709, 749 were added.
  - MF=6 MT= 600-611, 650-659, 699, 700-709, 749, 800-808 were added.
- zr91
  - MF=4 MT= 600-605, 800-839 were deleted.
  - MF=12/14 MT= 601-605, 801-839 were deleted.
  - MF=6 MT= 104, 105 were deleted.
  - MF=3 MT= 650-659, 699, 700-709, 749 were added.
  - MF=6 MT= 600-605, 650-659, 699, 700-709, 749, 800-839 were added.
- zr92
  - MF=4 MT= 600, 800-839 were deleted.
  - MF=12/14 MT= 801-839 were deleted.
  - MF=6 MT= 104, 105 were deleted.
  - MF=3 MT= 650-659, 699, 700-709, 749 were added.
  - MF=6 MT= 600, 650-659, 699, 700-709, 749, 800-839 were added.
- zr93
  - MF=4 MT= 600-616, 800-826 were deleted.
  - MF=12/14 MT= 601-616, 801-826 were deleted.
  - MF=6 MT= 104, 105 were deleted.
  - MF=3 MT= 650-658, 699, 700-709, 749 were added.
  - MF=6 MT= 600-616, 650-658, 699, 700-709, 749, 800-826 were added.
- zr94
  - MF=4 MT= 600-609, 800-839 were deleted.
  - MF=12/14 MT= 601-609, 801-839 were deleted.
  - MF=6 MT= 104, 105 were deleted.
  - MF=3 MT= 650-659, 699, 700-708, 749 were added.
  - MF=6 MT= 600-609, 650-659, 699, 700-708, 749, 800-839 were added.
- zr95
  - MF=4 MT= 600-615, 800-808 were deleted.
  - MF=12/14 MT= 601-615, 801-808 were deleted.
  - MF=6 MT= 104, 105 were deleted.
  - MF=3 MT= 650-659, 699, 700-709, 749 were added.
  - MF=6 MT= 600-615, 650-659, 699, 700-709, 749, 800-808 were added.

KAERI/LANL exit distributions

- zr96
  - MF=4 MT= 600-602, 800-809 were deleted.
  - MF=12/14 MT= 601-602, 801-809 were deleted.
  - MF=6 MT= 104, 105 were deleted.
  - MF=3 MT= 650-659, 699, 700-709, 749 were added.
  - MF=6 MT= 600-602, 650-659, 699, 700-709, 749, 800-809 were added.
- ag107
  - MF=15 MT= 103, 107 were deleted.
  - MF=12/14 MT= 601-609, 801-809 were deleted.
  - MF=3 MT= 600-609, 649, 800-809, 849 were added.
  - MF=6 MT= 600-609, 649, 800-809, 849 were added.
- ag109
  - MF=4 MT= 600-630, 800-801 were deleted.
  - MF=12/14 MT= 601-630, were deleted.
  - MF=6 MT= 600-630, 800-801 were added.
- ta180
  - MF=15 MT= 103, 104, 105, 107 were deleted.
  - MF=12/14 MT= 601-609, 651-659, 701-709, 801-809 were deleted.
  - MF=6 MT= 103, 104, 105, 107 were deleted.
  - MF=3 MT= 600-609, 649, 650-659, 699, 700-709, 749, 800-809, 849 were added.
  - MF=6 MT= 600-609, 649, 650-659, 699, 700-709, 749, 800-809, 849 were added.
- ta181
  - MF=4 MT= 600-635, 800-814 were deleted.
  - MF=12/14 MT= 601-635, 801-814 were deleted.
  - MF=6 MT= 106 were deleted.
  - MF=3 MT= 750-759, 799 were added.
  - MF=6 MT= 600-635, 750-759, 799, 800-814 were added.
- au197
  - MF=3 MT= 600-609, 649, 800-809, 849 were added.
  - MF=6 MT= 600-609, 649, 800-809, 849 were added.

Additional changes from Beta2

- n-001_H_002 (minor fix)
- n-004_Be_009 (problems above 2.8 MeV)
- n-005_B_011 (fix of wrong gamma flagging)
- n-006_C_012 (minor fix)
- n-006_C_013 (primary gammas & minor fix)
- n-008_O_016 (minor fix plus flagging of primary gammas, branching ratios added)
- n-008_O_018 (fix by removing 21MeV point in capture)
- n-009_F_019 (flagged primary gammas)
- n-014_Si_028 (flagged primary gammas)
- n-016_S_032 (added inelastic gammas)
- n-016_S_033 (added inelastic gammas)
- n-016_S_034 (added inelastic gammas)
- n-024_Cr_050 (added VIII.0 covariances and KAERI exit dist.)
- n-024_Cr_051 (KAERI exit dist.)
- n-024_Cr_052 (added VIII.0 covariances and KAERI exit dist.)
- n-024_Cr_053 (added VIII.0 covariances and KAERI exit dist.)
- n-024_Cr_054 (KAERI exit dist.)
- 029_Cu_063 (fixes and KAERI exit dist.)
- 029_Cu_065 (fixes and KAERI exit dist.)
- n-038_Sr_088 (ORNL evaluation)
- n-045_Rh_103 (minor fixes)
- n-046_Pd_110 (minor fixes)
- n-049_In_113 (MT=3 fix)
- n-049_In_115 (format fixes that were breaking NJOY)
- n-058_Ce_140 (updated covariances, fixes)
- n-058_Ce_142 (updated covariances, fixes)
- n-059_Pr_141 (processing fixes)
- n-066_Dy_161 (minor fixes)
- n-066_Dy_164 (minor fixes)
- n-073_Ta_180m1 (new file based on JENDL-5)
- n-073_Ta_181 (updated URR and doc.)
- n-074_W_182 (minor fix)
- n-074_W_183 (minor fix)
- n-074_W_184 (minor fix)
- n-074_W_186 (minor fix)
- n-082_Pb_206 (fixes by evaluator)
- n-082_Pb_207 (fixes by evaluator)
- n-082_Pb_208 (fixes by evaluator)
- n-092_U_233 (minor fixes)
- n-092_U_234 (uncertainty and other fixes by evaluator)
- n-092_U_235 (Restored MF=6 MT=18 P(nu), fixed typo in 232TH yield)
- n-092_U_238 (Fixed typo in p-wave resonance)
- n-092_U_236 (uncertainty and other fixes by evaluator)
- n-094_Pu_239 (new criticality vs burn-up compromise solution)
- n-094_Pu_242 (covariance fix)
- n-078_Pt_190
- n-078_Pt_191
- n-078_Pt_192
- n-078_Pt_193
- n-078_Pt_194
- n-078_Pt_195
- n-078_Pt_196
- n-078_Pt_197
- n-078_Pt_198
- n-023_V_051
- Prompt nubar of 20 nuclides

Additional changes from Beta2 Prompt nubar from RQW

- Maslov, INDC(BLR) reports:
  - Pa-230
  - Pa-232
  - U-230
  - U-231
  - U-232
  - Am-240
  - Am-244
  - Cm-240
- Madland-Nix calculations:
  - Cf-246
  - Cf-248
  - Cf-249
  - Cf-250
  - Cf-251
  - Cf-252
  - Cf-253
  - Cf-254
  - Pu-237
- Input for Cf isotopes was revised relative to the values used for VIII.0 R. Q. Wright evaluations:
  - ~~Np-234~~ (too similar to VIII.0)
  - ~~Np-235~~ (too similar to VIII.0)
- Es-254m1 is the same as Es-254

Additional changes from Beta2 - tritons

- t-002_He_003 (fixes)
- t-002_He_004 (LANL evaluation)

Photonuclear sublibrary

- 180,182,183,186W: reverted to VIII.0
- 242Pu: inexistent, taken from JENDL-5.0
- 9Be: ~~NNL evaluation~~ Take from CRP

Recommendation from M.Chadwick @ mini-CSEWG

Need more time to assess and review these files. So, for now, keeping them from VIII.0

- Consider ^{9}Be from NNL
- Adopt evaluations from 2019 IAEA CRP for (almost) all nuclei: 200+ files
- Except for 16 select mission-critical materials:

• ^{2}H	• ^{27}Al	• ^{184}W	• ^{237}Np
• ^{12}C	• ^{28}Si	• ^{206}Pb	• ^{235}U
• ^{14}N	• ^{40}Ca	• ^{207}Pb	• ^{238}U
• ^{16}O	• ^{63}Cu	• ^{208}Pb	• ^{239}Pu

- For those, for now, keep older LANL evaluations present in ENDF/B-VIII.0

This is what is in Beta2

Photo-nuclear sub library

= Submitted
= Not submitted
= Under review
= Approved

- ~~g-001_H_002.endf~~
- g-002_He_003.endf
- g-003_Li_006.endf
- g-003_Li_007.endf
- g-004_Be_009.endf
- ~~g-006_C_012.endf~~
- g-006_C_013.endf
- g-006_C_014.endf
- ~~g-007_N_014.endf~~
- g-007_N_015.endf
- ~~g-008_O_016.endf~~
- g-008_O_017.endf
- g-008_O_018.endf
- g-009_F_019.endf
- g-011_Na_023.endf
- g-012_Mg_024.endf
- g-012_Mg_025.endf
- g-012_Mg_026.endf
- ~~g-013_Al_027.endf~~
- g-014_Si_027.endf
- ~~g-014_Si_028.endf~~
- g-014_Si_029.endf
- g-014_Si_030.endf
- g-016_S_032.endf
- g-016_S_033.endf
- g-016_S_034.endf
- g-016_S_036.endf
- g-017_Cl_035.endf
- g-017_Cl_037.endf
- g-018_Ar_036.endf
- g-018_Ar_038.endf
- g-018_Ar_040.endf
- g-019_K_039.endf
- g-019_K_040.endf
- g-019_K_041.endf
- ~~g-020_Ca_040.endf~~
- g-020_Ca_042.endf
- g-020_Ca_043.endf
- g-020_Ca_044.endf
- g-020_Ca_046.endf
- g-020_Ca_048.endf
- g-021_Sc_045.endf
- g-022_Ti_046.endf
- g-022_Ti_047.endf
- g-022_Ti_048.endf
- g-022_Ti_049.endf
- g-022_Ti_050.endf
- g-023_V_050.endf
- g-023_V_051.endf
- g-024_Cr_050.endf
- g-024_Cr_052.endf
- g-024_Cr_053.endf
- g-024_Cr_054.endf
- g-025_Mn_055.endf
- g-026_Fe_054.endf
- g-026_Fe_056.endf
- g-026_Fe_057.endf
- g-026_Fe_058.endf
- g-027_Co_059.endf
- g-028_Ni_058.endf
- g-028_Ni_060.endf
- g-028_Ni_061.endf
- g-028_Ni_062.endf
- g-028_Ni_064.endf
- ~~g-029_Cu_063.endf~~
- g-029_Cu_065.endf
- g-030_Zn_064.endf
- g-030_Zn_066.endf
- g-030_Zn_067.endf
- g-030_Zn_068.endf
- g-030_Zn_070.endf
- g-032_Ge_070.endf
- g-032_Ge_072.endf
- g-032_Ge_073.endf
- g-032_Ge_074.endf
- g-032_Ge_076.endf
- g-033_As_075.endf
- g-034_Se_076.endf
- g-034_Se_078.endf
- g-034_Se_080.endf
- g-034_Se_082.endf
- g-038_Sr_084.endf
- g-038_Sr_086.endf
- g-038_Sr_087.endf
- g-038_Sr_088.endf
- g-038_Sr_090.endf
- g-039_Y_089.endf
- g-040_Zr_090.endf
- g-040_Zr_091.endf
- g-040_Zr_092.endf
- g-040_Zr_093.endf
- g-040_Zr_094.endf
- g-040_Zr_096.endf
- g-041_Nb_093.endf
- g-041_Nb_094.endf
- g-042_Mo_092.endf
- g-042_Mo_094.endf
- g-042_Mo_095.endf
- g-042_Mo_096.endf
- g-042_Mo_097.endf
- g-042_Mo_098.endf
- g-042_Mo_100.endf
- g-044_Ru_098.endf
- g-045_Rh_103.endf
- g-046_Pd_102.endf
- g-046_Pd_104.endf
- g-046_Pd_105.endf
- g-046_Pd_106.endf
- g-046_Pd_107.endf
- g-046_Pd_108.endf
- g-046_Pd_110.endf

Typo/dictionary fix
Kept from VIII.0
Level index fix on isomeric production
Not from CRP
NNL new eval.

Photo-nuclear sub library

- g-047_Ag_107.endf
- g-047_Ag_108.endf
- g-047_Ag_109.endf
- g-048_Cd_106.endf
- g-048_Cd_108.endf
- g-048_Cd_110.endf
- g-048_Cd_111.endf
- g-048_Cd_112.endf
- g-048_Cd_113.endf
- g-048_Cd_114.endf
- g-048_Cd_116.endf
- g-049_In_115.endf
- g-050_Sn_112.endf
- g-050_Sn_114.endf
- g-050_Sn_115.endf
- g-050_Sn_116.endf
- g-050_Sn_117.endf
- g-050_Sn_118.endf
- g-050_Sn_119.endf
- g-050_Sn_120.endf
- g-050_Sn_122.endf
- g-050_Sn_124.endf
- g-051_Sb_121.endf
- g-051_Sb_123.endf
- g-052_Te_120.endf
- g-052_Te_122.endf
- g-052_Te_123.endf
- g-052_Te_124.endf
- g-052_Te_125.endf
- g-052_Te_126.endf
- g-052_Te_128.endf
- g-052_Te_130.endf
- g-053_I_127.endf
- g-053_I_129.endf
- g-054_Xe_132.endf
- g-055_Cs_133.endf
- g-055_Cs_135.endf
- g-055_Cs_137.endf
- g-056_Ba_138.endf
- g-057_La_139.endf
- g-058_Ce_140.endf
- g-058_Ce_142.endf
- g-059_Pr_141.endf
- g-060_Nd_142.endf
- g-060_Nd_143.endf
- g-060_Nd_144.endf
- g-060_Nd_145.endf
- g-060_Nd_146.endf
- g-060_Nd_148.endf
- g-060_Nd_150.endf
- g-062_Sm_144.endf
- g-062_Sm_147.endf
- g-062_Sm_148.endf
- g-062_Sm_149.endf
- g-062_Sm_150.endf
- g-062_Sm_151.endf
- g-062_Sm_152.endf
- g-062_Sm_154.endf
- g-063_Eu_153.endf
- g-064_Gd_156.endf
- g-064_Gd_157.endf
- g-064_Gd_158.endf
- g-064_Gd_160.endf
- g-065_Tb_158.endf
- g-065_Tb_159.endf
- g-066_Dy_162.endf
- g-066_Dy_163.endf
- g-067_Ho_165.endf
- g-068_Er_166.endf
- g-068_Er_170.endf
- g-069_Tm_169.endf
- g-071_Lu_175.endf
- g-072_Hf_174.endf
- g-072_Hf_176.endf
- g-072_Hf_177.endf
- g-072_Hf_178.endf
- g-072_Hf_179.endf
- g-072_Hf_180.endf
- g-073_Ta_181.endf
- g-074_W_180.endf
- g-074_W_182.endf
- g-074_W_183.endf
- ~~g-074_W_184.endf~~
- g-074_W_186.endf
- g-075_Re_185.endf
- g-075_Re_187.endf
- g-076_Os_186.endf
- g-076_Os_188.endf
- g-076_Os_189.endf
- g-076_Os_190.endf
- g-076_Os_192.endf
- g-078_Pt_194.endf
- g-079_Au_197.endf
- ~~g-082_Pb_206.endf~~
- ~~g-082_Pb_207.endf~~
- ~~g-082_Pb_208.endf~~
- g-083_Bi_209.endf
- g-088_Ra_226.endf
- g-090_Th_232.endf
- g-092_U_233.endf
- g-092_U_234.endf
- ~~g-092_U_235.endf~~
- g-092_U_236.endf
- ~~g-092_U_238.endf~~
- ~~g-093_Np_237.endf~~
- g-094_Pu_238.endf
- ~~g-094_Pu_239.endf~~
- g-094_Pu_240.endf
- g-094_Pu_241.endf
- g-095_Am_241.endf

Typo/dictionary fix
Kept from VIII.0
Level index fix on isomeric production
Not from CRP

Atomic sub libraries

Red Cullen submitted the 2023 version of EPICS leading to updates to:

- Atomic relaxation sublibrary (EADL)
- Electrons sublibrary (EEDL)
    - This did NOT overwrite ZAP format fix done by Bret Beck for VIII.1-Beta2
- Photoatomic sublibrary (EPDL)

Charged Particles

- Deuterons, tritons, helions, protons
- Submitted files have issues. We're still trying to define the best course of action

Updates to INDEN evaluations of structural materials

Between the evaluations and the ENDF/B-VIII.1-Beta3 release

Be careful when ~~opening~~ updating the ~~overhead~~ evaluations ~~bins~~ as the ~~items~~ files may have shifted

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evaluations

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  - So, **don't be alarmed** if the released file is **not *exactly* the same** as the one submitted
  - **I will quickly report on the changes done to INDEN evaluations for structural materials after submitted**

28Si

neutrons — less ‹ git log -- n-014_Si_028.endf — 89×40

```
commit 753f15754fa0ca88ebb97ff18cd8de0ff0c9a7ec
Author: Gustavo Nobre <gnobre@bnl.gov>
Date:   Wed Nov 29 09:34:51 2023 -1000

    Update sent by H.I. Kim on Nov. 29, 2023, Correcting merging Energy: 2.000010+7 => 2.
000001+7

commit 7dacbdd541df38423f7729d8b037d6191179687d
Author: echimansk <echimansk@bnl.com>
Date:   Mon Nov 6 16:49:46 2023 -0500

    capture primaries flagged

commit 568a098ce15e42a4d069e9ff4e535d9b54f1fc4d
Author: Gustavo Nobre <gnobre@bnl.gov>
Date:   Thu Sep 14 15:21:15 2023 -0400

    Updated n-014_Si_028.endf with exit distributions from KAERI/LANL. Summary of MF/MT c
hanges can be found in the file documentation section.

commit 973fe543b9e85c1506868448db3807b6271b925c
Author: Ian J. Thompson <thompson97@llnl.gov>
Date:   Mon Jul 24 14:17:38 2023 -0400

    Remove Kalbach-Mann parameters too high in energy n-014_Si_028.endf

commit 91f5d1bd960273ec205ad60293e0928d809d284c
Author: Gustavo Nobre <gnobre@bnl.gov>
Date:   Thu Jul 20 09:14:18 2023 -0700

    Inclusion of dosimetry production reactions from IRDFF-II sent by A. Trkov.

commit bf775d3e6bbba7076d5553465056691d6f495f74
Author: Caleb M. Mattoon <mattoon1@llnl.gov>
Date:   Wed Apr 26 11:06:51 2023 -0700

    Fix two issues with prior commit: NLIB was set to -1 (unknown library), and covarianc
e energy bounds (and values in the case of MF35) were accidentally converted to MeV

:
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commit 30a149b6a4a8afd40a8737801d1b042de3086a1d
Author: Ian J. Thompson <thompson97@llnl.gov>
Date:   Sat Apr 22 08:30:23 2023 -0400

    Adding exit charged-particle and gamma distributions where previously missing.
    The CHANGELOG lists the added exit distributions

commit b6357d7975561a313545fb8e5c8967f997c25cb3
Author: Gustavo Nobre <gnobre@bnl.gov>
Date:   Mon Apr 17 10:02:54 2023 -0400

    Updated file for 28Si sent by A. Trkov on April 16. He stated that "there was an erro
r in uploading the silicon files to the INDEN web page, which eventually went into ENDF/B
-VIII.1[-Beta1]. The files [were] missing the direct capture component, which destroys co
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commit c6e5f5608eb71a4db132a5c4e816fbcdecd461bf
Author: Nathan Gibson <ngibson@lanl.gov>
Date:   Tue Sep 20 09:27:43 2022 -0600

    Updated directory for n-014_Si_028.endf; previously, directory items had incorrect NC
 values.

commit 0dc3637214a8d06c5f6b413a2a28ef4572fa5b38
Author: Gustavo Nobre <gnobre@bnl.gov>
Date:   Tue Sep 6 14:55:59 2022 -0400

    Removed line numbers from 28,29,30Si files, which came from INDEN.

commit ba37846287ae7c7b021158be6e20510baebd49e9
Author: Nobre <gnobre@130-199-210-147.dhcp.bnl.gov>
Date:   Mon Nov 23 17:06:08 2020 -0500

    New INDEN files for 28,29,30Si. Description of files can be found in the technical re
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28Si

- Directory and other minor fixes
- Covariance fixes
- IRDFF cross sections
- Exit distributions from LLNL and KAERI
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29Si

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commit bbaa4f7e2097aa2a2f966c40905605bee3f9f703
Author: Gustavo Nobre <gnobre@bnl.gov>
Date:   Thu Sep 14 15:27:24 2023 -0400

    Updated n-014_Si_029.endf with exit distributions from KAERI/LANL. Summary of MF/MT c
hanges can be found in the file documentation section.

commit 66ad4b20ace1491083aefd240ecc31a653162187
Author: David Brown <dbrown@bnl.gov>
Date:   Thu Aug 3 18:42:41 2023 -0400

    fixed upper energy of MF10 MT5


    (cherry picked from commit 5747e09d654ee186ba6e270f884c6a95c59ad3b0)

commit 6aaec71747ab8384dd2c3ade038bb9314e46f599
Author: Gustavo Nobre <gnobre@bnl.gov>
Date:   Thu Jul 20 09:19:08 2023 -0700

    Inclusion of dosimetry production reactions from IRDFF-II sent by A. Trkov.

commit 2939e04003815be3254fc6a0aa2467aa134a61b8
Author: Gustavo Nobre <gnobre@bnl.gov>
Date:   Mon Apr 17 10:03:17 2023 -0400

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commit cf9e1d276c9ceb751cd895f06eae91c3705e7e42
Author: David Alan Brown <dbrown@bnl.gov>
Date:   Sat Nov 23 11:43:03 2019 -0500

    initial commit from project export
(END)
```

29Si

- Directory and other minor fixes
- IRDFF cross sections
- Fixed energy range of MF=10, MT=5
- Exit distributions from KAERI

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commit bbaa4f7e2097aa2a2f966c40905605bee3f9f703
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Date:   Tue Sep 6 14:55:59 2022 -0400

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Author: Nobre <gnobre@130-199-210-147.dhcp.bnl.gov>
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(END)
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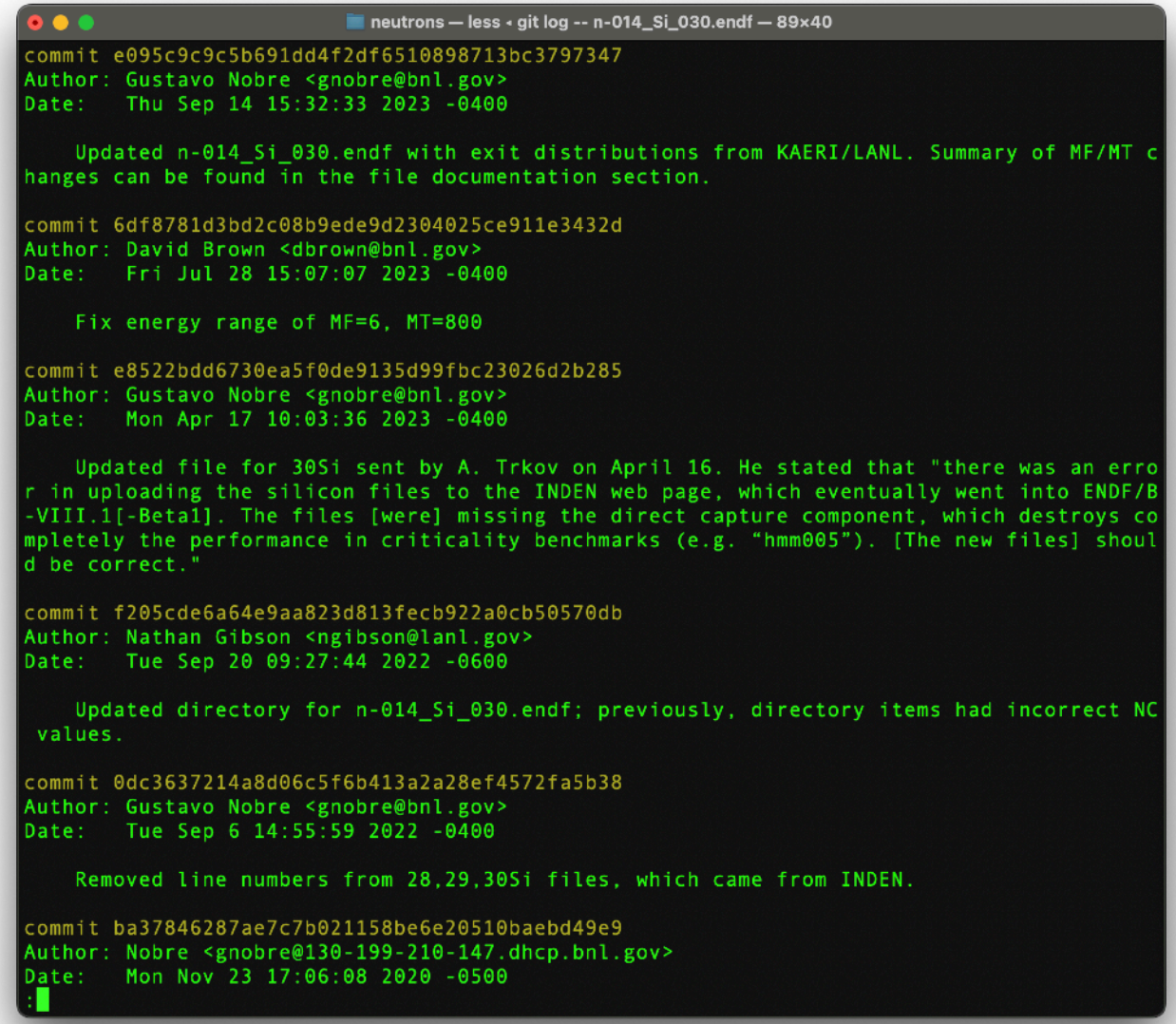
30Si


neutrons — less ‹ git log -- n-014_Si_030.endf — 89×40
commit e095c9c9c5b691dd4f2df6510898713bc3797347
Author: Gustavo Nobre <gnobre@bnl.gov>
Date: Thu Sep 14 15:32:33 2023 -0400
Updated n-014_Si_030.endf with exit distributions from KAERI/LANL. Summary of MF/MT changes can be found in the file documentation section.
commit 6df8781d3bd2c08b9ede9d2304025ce911e3432d
Author: David Brown <dbrown@bnl.gov>
Date: Fri Jul 28 15:07:07 2023 -0400
Fix energy range of MF=6, MT=800
commit e8522bdd6730ea5f0de9135d99fbc23026d2b285
Author: Gustavo Nobre <gnobre@bnl.gov>
Date: Mon Apr 17 10:03:36 2023 -0400
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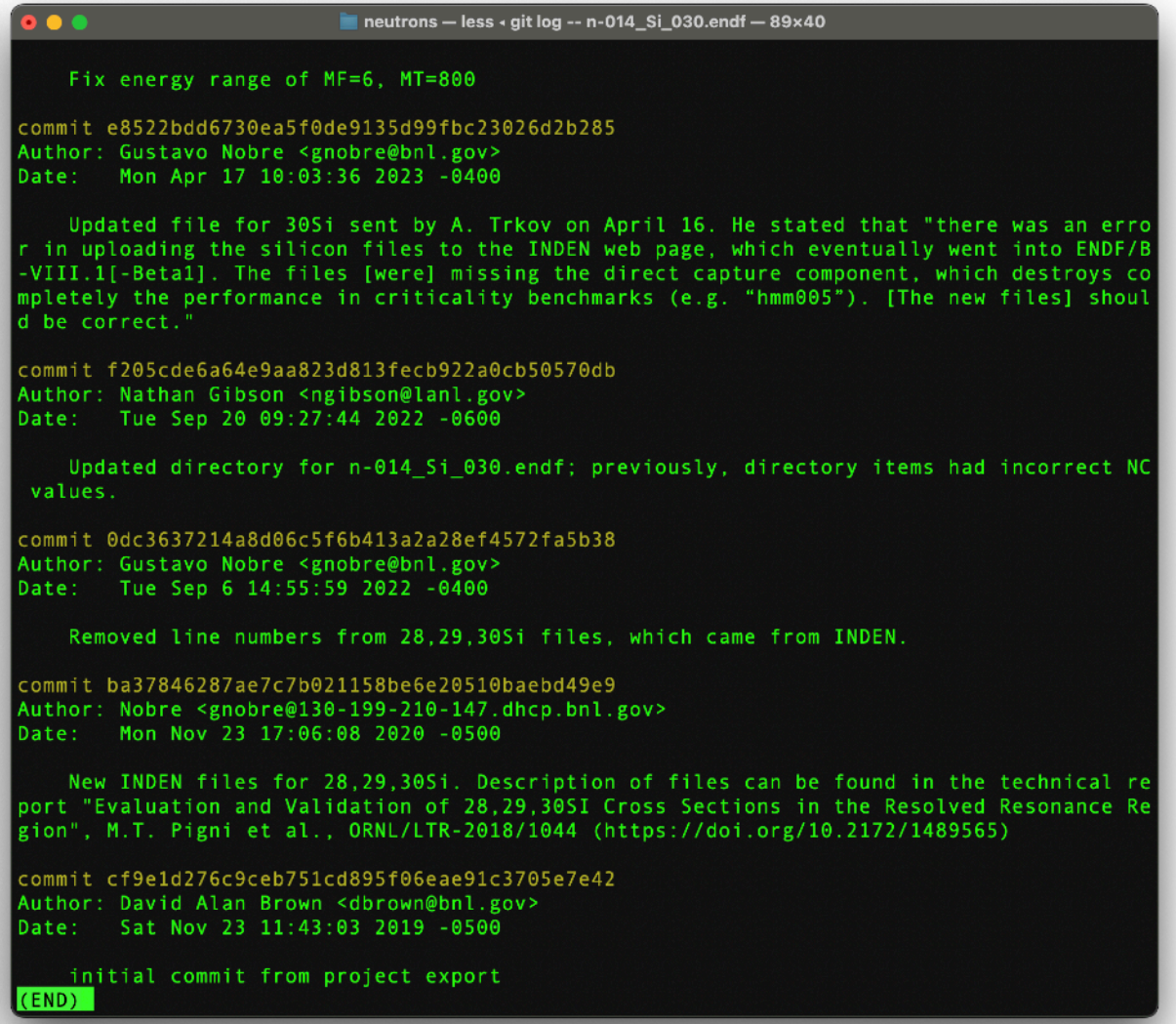
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:
```

neutrons — less ‹ git log -- n-014_Si_030.endf — 89×40

```
    Fix energy range of MF=6, MT=800

commit e8522bdd6730ea5f0de9135d99fbc23026d2b285
Author: Gustavo Nobre <gnobre@bnl.gov>
Date:   Mon Apr 17 10:03:36 2023 -0400

    Updated file for 30Si sent by A. Trkov on April 16. He stated that "there was an erro
r in uploading the silicon files to the INDEN web page, which eventually went into ENDF/B
-VIII.1[-Beta1]. The files [were] missing the direct capture component, which destroys co
mpletely the performance in criticality benchmarks (e.g. “hmm005”). [The new files] shoul
d be correct."

commit f205cde6a64e9aa823d813fecb922a0cb50570db
Author: Nathan Gibson <ngibson@lanl.gov>
Date:   Tue Sep 20 09:27:44 2022 -0600

    Updated directory for n-014_Si_030.endf; previously, directory items had incorrect NC
 values.

commit 0dc3637214a8d06c5f6b413a2a28ef4572fa5b38
Author: Gustavo Nobre <gnobre@bnl.gov>
Date:   Tue Sep 6 14:55:59 2022 -0400

    Removed line numbers from 28,29,30Si files, which came from INDEN.

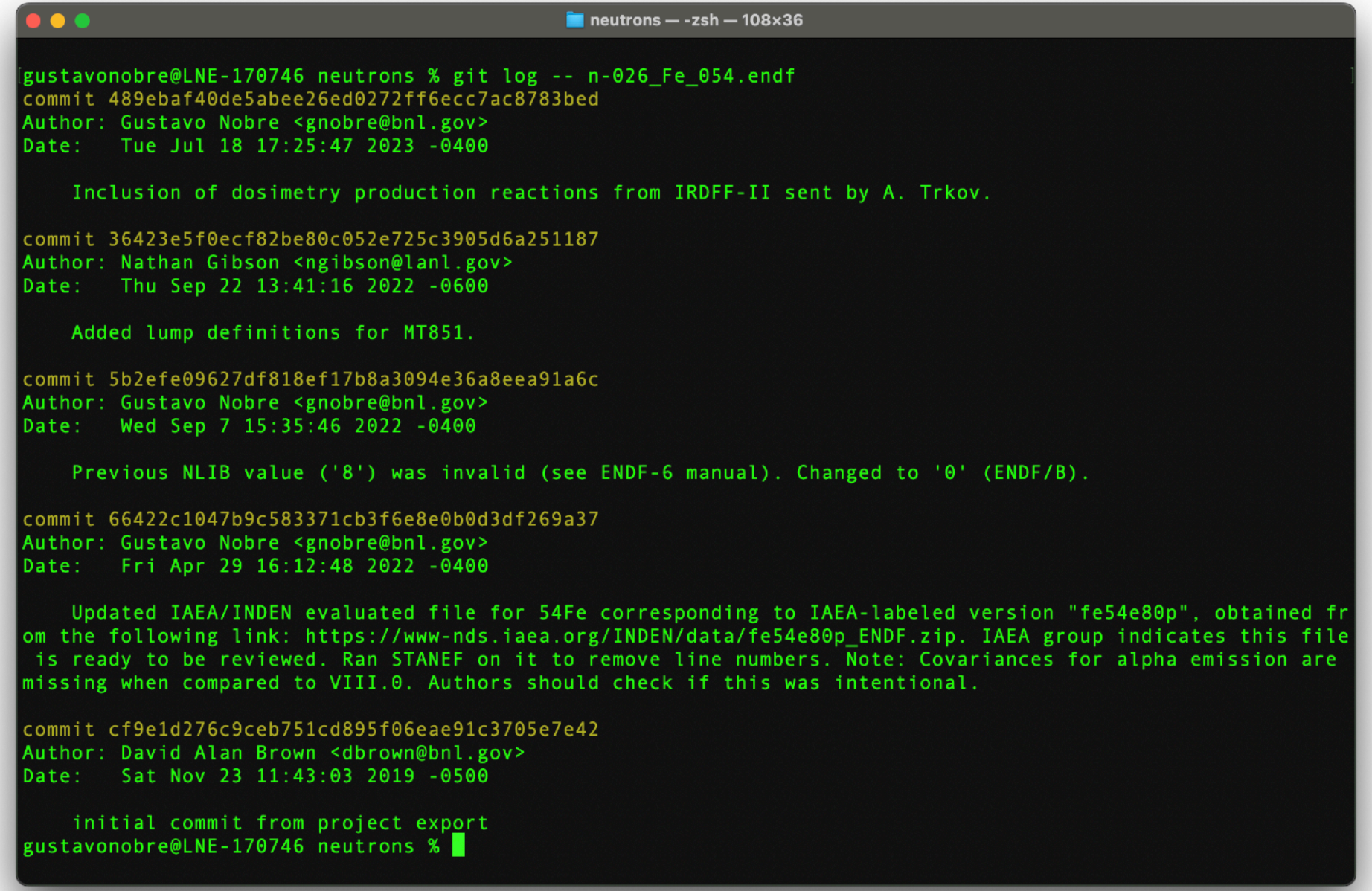
commit ba37846287ae7c7b021158be6e20510baebd49e9
Author: Nobre <gnobre@130-199-210-147.dhcp.bnl.gov>
Date:   Mon Nov 23 17:06:08 2020 -0500

    New INDEN files for 28,29,30Si. Description of files can be found in the technical re
port "Evaluation and Validation of 28,29,30SI Cross Sections in the Resolved Resonance Re
gion", M.T. Pigni et al., ORNL/LTR-2018/1044 (https://doi.org/10.2172/1489565)

commit cf9e1d276c9ceb751cd895f06eae91c3705e7e42
Author: David Alan Brown <dbrown@bnl.gov>
Date:   Sat Nov 23 11:43:03 2019 -0500

    initial commit from project export
(END)
```

54Fe


neutrons — -zsh — 108×36
gustavonobre@LNE-170746 neutrons % git log -- n-026_Fe_054.endf
commit 489ebaf40de5abee26ed0272ff6ecc7ac8783bed
Author: Gustavo Nobre <gnobre@bnl.gov>
Date: Tue Jul 18 17:25:47 2023 -0400
Inclusion of dosimetry production reactions from IRDFF-II sent by A. Trkov.
commit 36423e5f0ecf82be80c052e725c3905d6a251187
Author: Nathan Gibson <ngibson@lanl.gov>
Date: Thu Sep 22 13:41:16 2022 -0600
Added lump definitions for MT851.
commit 5b2efe09627df818ef17b8a3094e36a8eea91a6c
Author: Gustavo Nobre <gnobre@bnl.gov>
Date: Wed Sep 7 15:35:46 2022 -0400
Previous NLIB value ('8') was invalid (see ENDF-6 manual). Changed to '0' (ENDF/B).
commit 66422c1047b9c583371cb3f6e8e0b0d3df269a37
Author: Gustavo Nobre <gnobre@bnl.gov>
Date: Fri Apr 29 16:12:48 2022 -0400
Updated IAEA/INDEN evaluated file for 54Fe corresponding to IAEA-labeled version "fe54e80p", obtained fr
om the following link: https://www-nds.iaea.org/INDEN/data/fe54e80p_ENDF.zip. IAEA group indicates this file
is ready to be reviewed. Ran STANEF on it to remove line numbers. Note: Covariances for alpha emission are
missing when compared to VIII.0. Authors should check if this was intentional.
commit cf9e1d276c9ceb751cd895f06eae91c3705e7e42
Author: David Alan Brown <dbrown@bnl.gov>
Date: Sat Nov 23 11:43:03 2019 -0500
initial commit from project export
gustavonobre@LNE-170746 neutrons %

54Fe

- Minor fixes
- Corrected definition for MT=851
- IRDFF cross sections

```
gustavonobre@LNE-170746 neutrons % git log -- n-026_Fe_054.endf
commit 489ebaf40de5abee26ed0272ff6ecc7ac8783bed
Author: Gustavo Nobre <gnobre@bnl.gov>
Date:   Tue Jul 18 17:25:47 2023 -0400

    Inclusion of dosimetry production reactions from IRDFF-II sent by A. Trkov.

commit 36423e5f0ecf82be80c052e725c3905d6a251187
Author: Nathan Gibson <ngibson@lanl.gov>
Date:   Thu Sep 22 13:41:16 2022 -0600

    Added lump definitions for MT851.

commit 5b2efe09627df818ef17b8a3094e36a8eea91a6c
Author: Gustavo Nobre <gnobre@bnl.gov>
Date:   Wed Sep 7 15:35:46 2022 -0400

    Previous NLIB value ('8') was invalid (see ENDF-6 manual). Changed to '0' (ENDF/B).

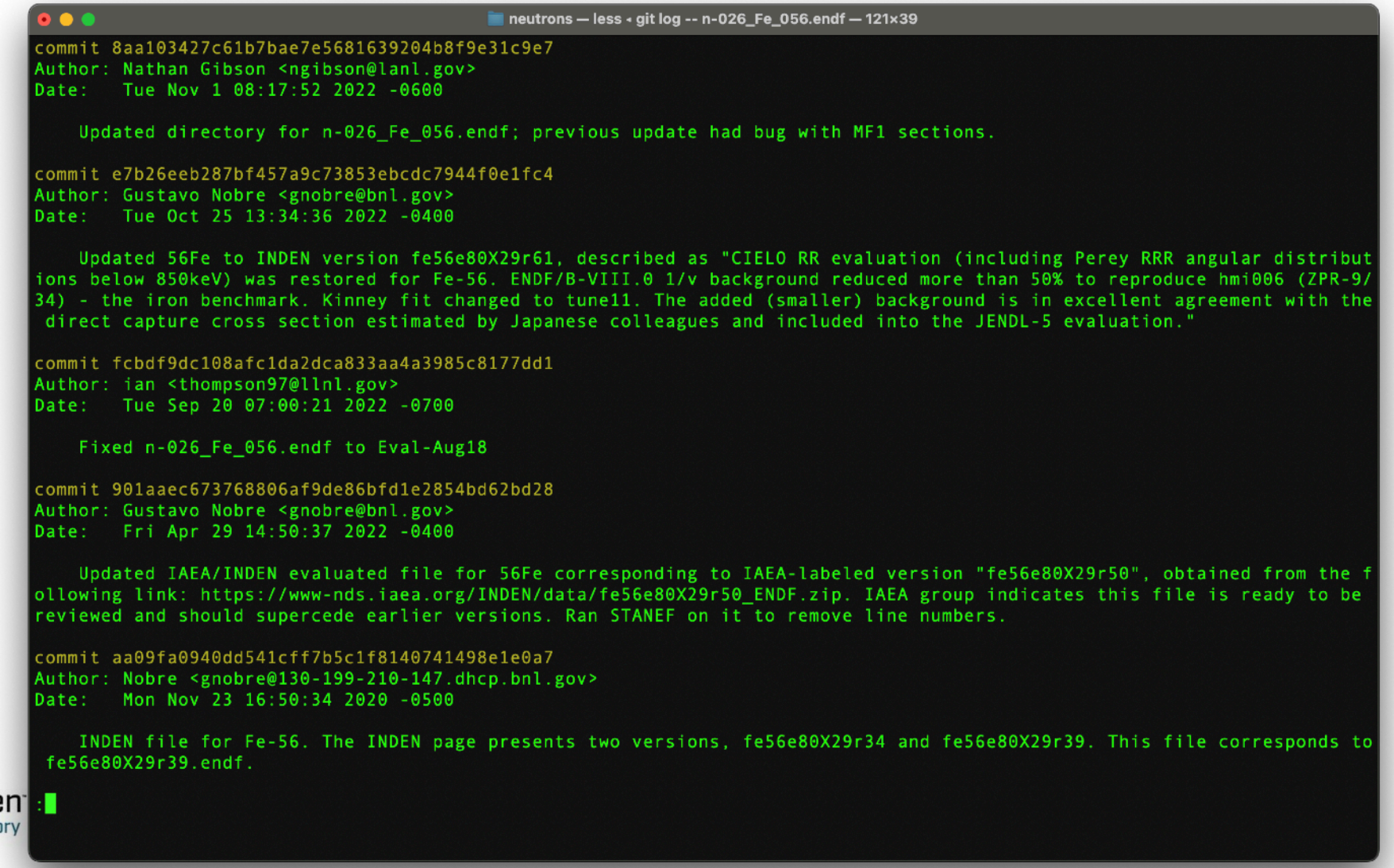
commit 66422c1047b9c583371cb3f6e8e0b0d3df269a37
Author: Gustavo Nobre <gnobre@bnl.gov>
Date:   Fri Apr 29 16:12:48 2022 -0400

    Updated IAEA/INDEN evaluated file for 54Fe corresponding to IAEA-labeled version "fe54e80p", obtained fr
om the following link: https://www-nds.iaea.org/INDEN/data/fe54e80p_ENDF.zip. IAEA group indicates this file
 is ready to be reviewed. Ran STANEF on it to remove line numbers. Note: Covariances for alpha emission are
missing when compared to VIII.0. Authors should check if this was intentional.

commit cf9e1d276c9ceb751cd895f06eae91c3705e7e42
Author: David Alan Brown <dbrown@bnl.gov>
Date:   Sat Nov 23 11:43:03 2019 -0500

    initial commit from project export
gustavonobre@LNE-170746 neutrons %
```

56Fe


neutrons — less ‹ git log -- n-026_Fe_056.endf — 121×39
commit 8aa103427c61b7bae7e5681639204b8f9e31c9e7
Author: Nathan Gibson <ngibson@lanl.gov>
Date: Tue Nov 1 08:17:52 2022 -0600
Updated directory for n-026_Fe_056.endf; previous update had bug with MF1 sections.
commit e7b26eeb287bf457a9c73853ebcdc7944f0e1fc4
Author: Gustavo Nobre <gnobre@bnl.gov>
Date: Tue Oct 25 13:34:36 2022 -0400
Updated 56Fe to INDEN version fe56e80X29r61, described as "CIELO RR evaluation (including Perey RRR angular distributions below 850keV) was restored for Fe-56. ENDF/B-VIII.0 1/v background reduced more than 50% to reproduce hmi006 (ZPR-9/34) - the iron benchmark. Kinney fit changed to tune11. The added (smaller) background is in excellent agreement with the direct capture cross section estimated by Japanese colleagues and included into the JENDL-5 evaluation."
commit fcbdf9dc108afc1da2dca833aa4a3985c8177dd1
Author: ian <thompson97@llnl.gov>
Date: Tue Sep 20 07:00:21 2022 -0700
Fixed n-026_Fe_056.endf to Eval-Aug18
commit 901aaec673768806af9de86bfd1e2854bd62bd28
Author: Gustavo Nobre <gnobre@bnl.gov>
Date: Fri Apr 29 14:50:37 2022 -0400
Updated IAEA/INDEN evaluated file for 56Fe corresponding to IAEA-labeled version "fe56e80X29r50", obtained from the following link: https://www-nds.iaea.org/INDEN/data/fe56e80X29r50_ENDF.zip. IAEA group indicates this file is ready to be reviewed and should supercede earlier versions. Ran STANEF on it to remove line numbers.
commit aa09fa0940dd541cff7b5c1f8140741498e1e0a7
Author: Nobre <gnobre@130-199-210-147.dhcp.bnl.gov>
Date: Mon Nov 23 16:50:34 2020 -0500
INDEN file for Fe-56. The INDEN page presents two versions, fe56e80X29r34 and fe56e80X29r39. This file corresponds to fe56e80X29r39.endf.
:

56Fe

- Minor fixes

neutrons — less ‹ git log -- n-026_Fe_056.endf — 121×39

```
commit 8aa103427c61b7bae7e5681639204b8f9e31c9e7
Author: Nathan Gibson <ngibson@lanl.gov>
Date:   Tue Nov 1 08:17:52 2022 -0600

    Updated directory for n-026_Fe_056.endf; previous update had bug with MF1 sections.

commit e7b26eeb287bf457a9c73853ebcdc7944f0e1fc4
Author: Gustavo Nobre <gnobre@bnl.gov>
Date:   Tue Oct 25 13:34:36 2022 -0400

    Updated 56Fe to INDEN version fe56e80X29r61, described as "CIELO RR evaluation (including Perey RRR angular distribut
ions below 850keV) was restored for Fe-56. ENDF/B-VIII.0 1/v background reduced more than 50% to reproduce hmi006 (ZPR-9/
34) - the iron benchmark. Kinney fit changed to tune11. The added (smaller) background is in excellent agreement with the
 direct capture cross section estimated by Japanese colleagues and included into the JENDL-5 evaluation."

commit fcbdf9dc108afc1da2dca833aa4a3985c8177dd1
Author: ian <thompson97@llnl.gov>
Date:   Tue Sep 20 07:00:21 2022 -0700

    Fixed n-026_Fe_056.endf to Eval-Aug18

commit 901aaec673768806af9de86bfd1e2854bd62bd28
Author: Gustavo Nobre <gnobre@bnl.gov>
Date:   Fri Apr 29 14:50:37 2022 -0400

    Updated IAEA/INDEN evaluated file for 56Fe corresponding to IAEA-labeled version "fe56e80X29r50", obtained from the f
ollowing link: https://www-nds.iaea.org/INDEN/data/fe56e80X29r50_ENDF.zip. IAEA group indicates this file is ready to be
reviewed and should supercede earlier versions. Ran STANEF on it to remove line numbers.

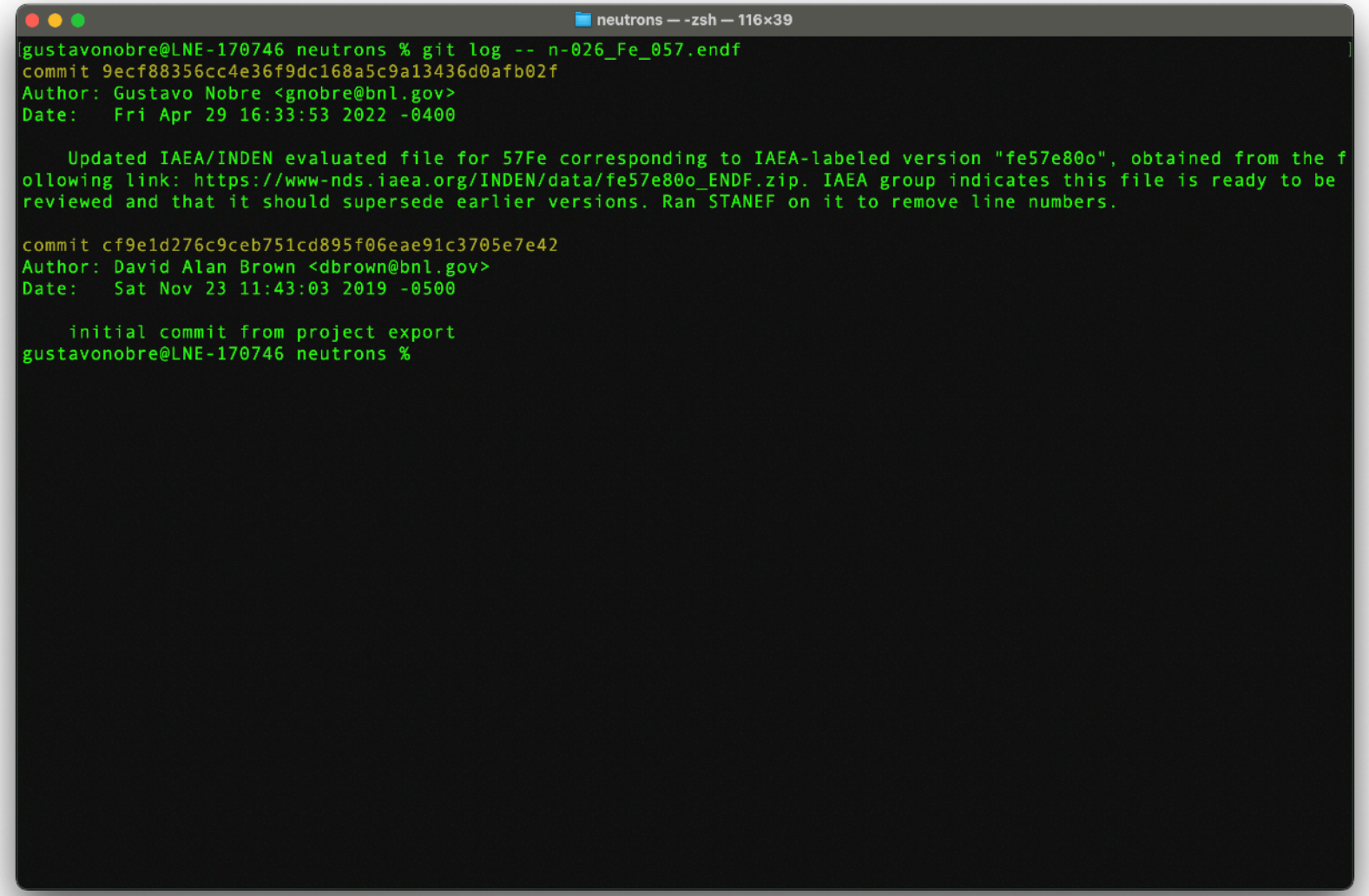
commit aa09fa0940dd541cff7b5c1f8140741498e1e0a7
Author: Nobre <gnobre@130-199-210-147.dhcp.bnl.gov>
Date:   Mon Nov 23 16:50:34 2020 -0500

    INDEN file for Fe-56. The INDEN page presents two versions, fe56e80X29r34 and fe56e80X29r39. This file corresponds to
 fe56e80X29r39.endf.

:
```

Brookhaven National Laboratory

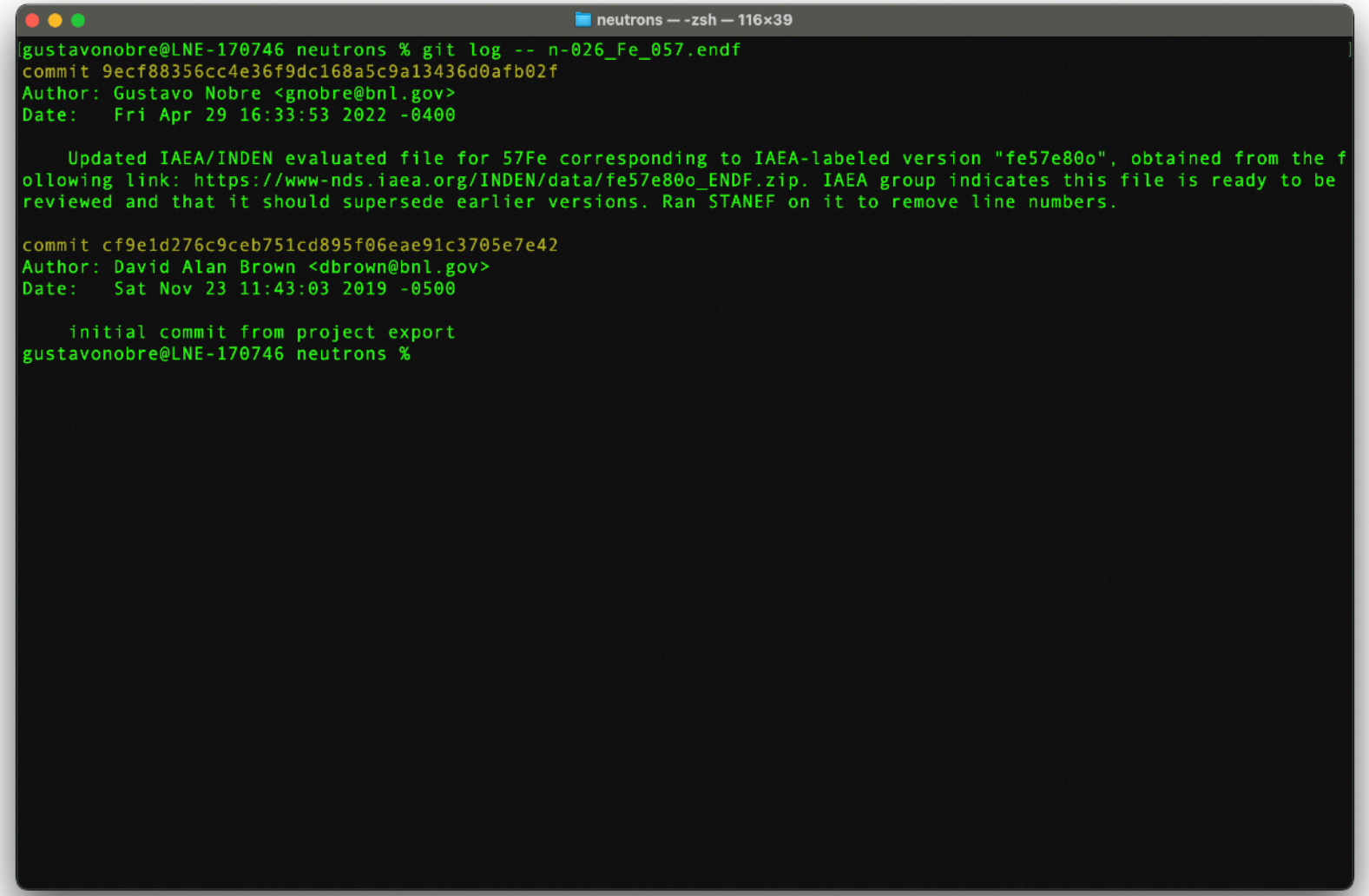
57Fe



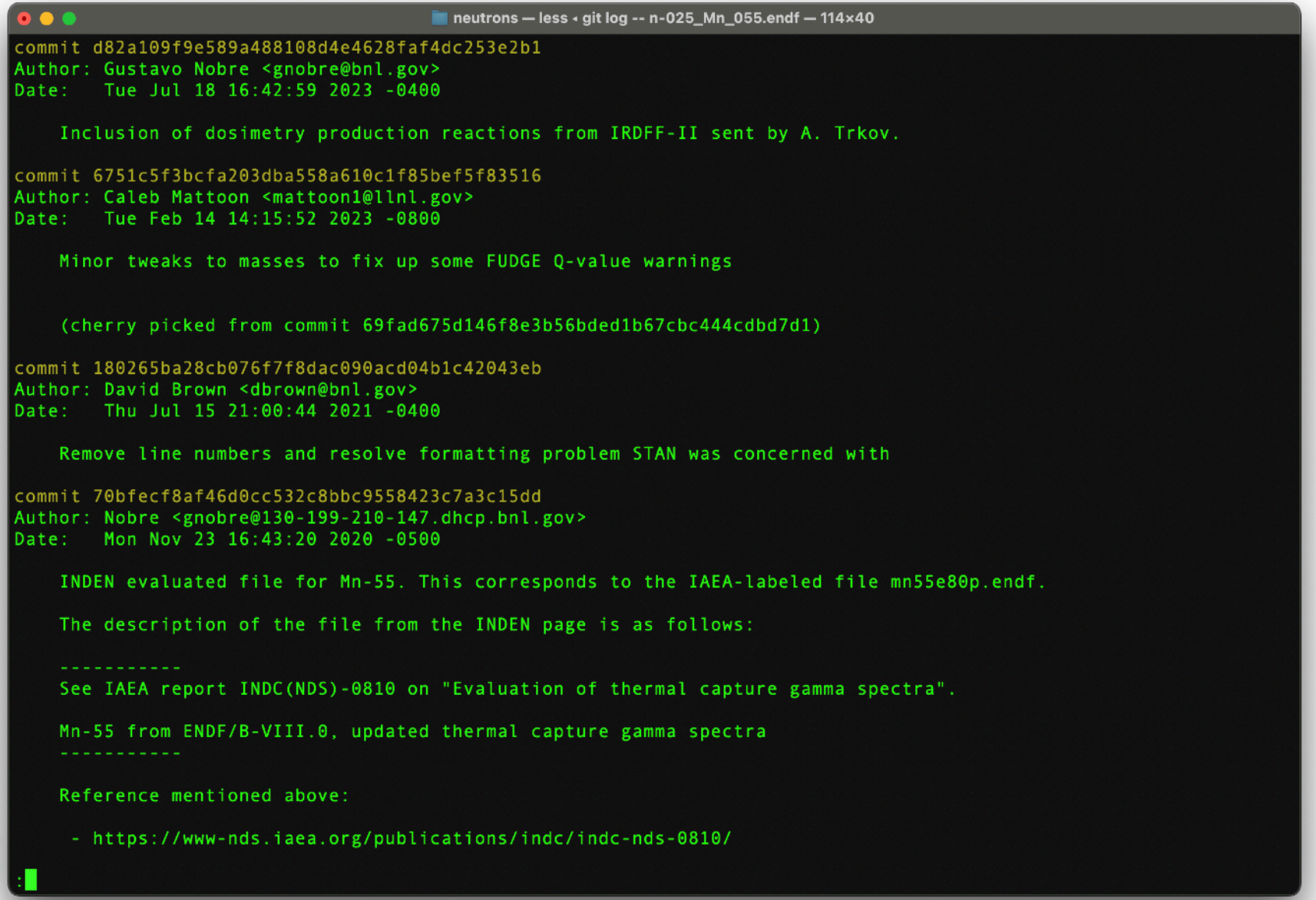
Brookhaven National Laboratory

57Fe

- No additional fixes



55Mn



Brookhaven National Laboratory

55Mn

- Minor fixes
- Tweaks to masses to fix Q-value warnings
- IRDFF cross sections

neutrons — less ‹ git l

```
commit d82a109f9e589a488108d4e4628faf4dc253e2b1
Author: Gustavo Nobre <gnobre@bnl.gov>
Date:   Tue Jul 18 16:42:59 2023 -0400

    Inclusion of dosimetry production reactions from IRDFF-II sent by A. Trkov.

commit 6751c5f3bcfa203dba558a610c1f85bef5f83516
Author: Caleb Mattoon <mattoon1@llnl.gov>
Date:   Tue Feb 14 14:15:52 2023 -0800

    Minor tweaks to masses to fix up some FUDGE Q-value warnings


    (cherry picked from commit 69fad675d146f8e3b56bded1b67cbc444cdbd7d1)

commit 180265ba28cb076f7f8dac090acd04b1c42043eb
Author: David Brown <dbrown@bnl.gov>
Date:   Thu Jul 15 21:00:44 2021 -0400

    Remove line numbers and resolve formatting problem STAN was concerned with

commit 70bfecf8af46d0cc532c8bbc9558423c7a3c15dd
Author: Nobre <gnobre@130-199-210-147.dhcp.bnl.gov>
Date:   Mon Nov 23 16:43:20 2020 -0500

    INDEN evaluated file for Mn-55. This corresponds to the IAEA-labeled file mn55e80p.endf.

    The description of the file from the INDEN page is as follows:

    -----------
    See IAEA report INDC(NDS)-0810 on "Evaluation of thermal capture gamma spectra".

    Mn-55 from ENDF/B-VIII.0, updated thermal capture gamma spectra
    -----------

    Reference mentioned above:

     - https://www-nds.iaea.org/publications/indc/indc-nds-0810/

:
```

Brookhaven National Laboratory

50Cr

neutrons — less ◂ git log -- n-024_Cr_050.endf — 74×39

```
commit 1a951edbd6b7ee8c27a9e82499e59eb682d586c9
Author: Caleb Mattoon <mattoon1@llnl.gov>
Date:   Wed Oct 11 15:58:10 2023 -0700

    Fix Cr50 MF=32, preserving relative uncertainties and correlations fro
m ENDF-VIII.0

commit b99dcfd4d5800cc96cf4a7e9a45d8a02c2584240
Author: Gustavo Nobre <gnobre@bnl.gov>
Date:   Wed Oct 4 14:22:26 2023 -0400

    Fixed resonance widths in file 32 for 50Cr, following Caleb's comment
https://git.nndc.bnl.gov/endf/library/neutrons/-/merge_requests/889#note_1
5957

commit a1abfc3f2ec57031feeec7653268a9f3bf22c50c
Author: Gustavo Nobre <gnobre@bnl.gov>
Date:   Mon Sep 25 16:13:16 2023 -0400

    Brought VIII.0 covariances to 50Cr file.

commit 39ba0745b3786e3a613138acdcfdda0bdecdc9b3
Author: Gustavo Nobre <gnobre@bnl.gov>
Date:   Mon Sep 18 11:13:10 2023 -0400

    Updated n-024_Cr_050.endf with exit distributions from KAERI/LANL. Sum
mary of MF/MT changes can be found in the file documentation section.

commit aa653dea41880f142157a154365095c56357c547
Author: Caleb M. Mattoon <mattoon1@llnl.gov>
Date:   Wed Mar 1 13:22:54 2023 -0800

    Remove extra line before first EDATE in documentation section for seve
ral Cr evaluations

commit f2ff62a3ca484d06b42ace574b92bae4cf677c6f
Author: Gustavo Nobre <gnobre@bnl.gov>
Date:   Wed Jan 11 17:00:53 2023 -0500
:
```

neutrons — less ◂ git log -- n-024_Cr_050.endf — 74×39

```
commit aa653dea41880f142157a154365095c56357c547
Author: Caleb M. Mattoon <mattoon1@llnl.gov>
Date:   Wed Mar 1 13:22:54 2023 -0800

    Remove extra line before first EDATE in documentation section for seve
ral Cr evaluations

commit f2ff62a3ca484d06b42ace574b92bae4cf677c6f
Author: Gustavo Nobre <gnobre@bnl.gov>
Date:   Wed Jan 11 17:00:53 2023 -0500

    Updated library name for 50Cr.


    (cherry picked from commit 0175d515dee2cb50404b90d60999d800c0bcb60d)

commit 7ae95ab17636b53bb3a13abd52c6fdc8c4d791d4
Author: Gustavo Nobre <gnobre@bnl.gov>
Date:   Fri May 27 10:01:34 2022 -0400

    Updated 50Cr file to BNL/IAEA version v2.3.2=v2.3.1, which has extende
d energy range up to 65MeV for FENDL.


    (cherry picked from commit 0035eadef52ba4287f56513edc625986ab848b40)

commit 3f8d3773a4ffd9fb9b331028304bdb44bde1e9c1
Author: Gustavo Nobre <gnobre@bnl.gov>
Date:   Thu May 26 16:36:51 2022 -0400

    "Preparing n-024_Cr_050.endf for review"

commit cf9e1d276c9ceb751cd895f06eae91c3705e7e42
Author: David Alan Brown <dbrown@bnl.gov>
Date:   Sat Nov 23 11:43:03 2019 -0500

    initial commit from project export
(END)
```

50Cr

- Minor fixes
- Exit distributions from KAERI
- Added covariances from VIII.0
- Fixed resonance width in MF=32
- Other fixes to MF=32

neutrons — less ‹ git log -- n-024_Cr_050.endf — 74×39

```
commit 1a951edbd6b7ee8c27a9e82499e59eb682d586c9
Author: Caleb Mattoon <mattoon1@llnl.gov>
Date:   Wed Oct 11 15:58:10 2023 -0700

    Fix Cr50 MF=32, preserving relative uncertainties and correlations fro
m ENDF-VIII.0

commit b99dcfd4d5800cc96cf4a7e9a45d8a02c2584240
Author: Gustavo Nobre <gnobre@bnl.gov>
Date:   Wed Oct 4 14:22:26 2023 -0400

    Fixed resonance widths in file 32 for 50Cr, following Caleb's comment
https://git.nndc.bnl.gov/endf/library/neutrons/-/merge_requests/889#note_1
5957

commit a1abfc3f2ec57031feeec7653268a9f3bf22c50c
Author: Gustavo Nobre <gnobre@bnl.gov>
Date:   Mon Sep 25 16:13:16 2023 -0400

    Brought VIII.0 covariances to 50Cr file.

commit 39ba0745b3786e3a613138acdcfdda0bdecdc9b3
Author: Gustavo Nobre <gnobre@bnl.gov>
Date:   Mon Sep 18 11:13:10 2023 -0400

    Updated n-024_Cr_050.endf with exit distributions from KAERI/LANL. Sum
mary of MF/MT changes can be found in the file documentation section.

commit aa653dea41880f142157a154365095c56357c547
Author: Caleb M. Mattoon <mattoon1@llnl.gov>
Date:   Wed Mar 1 13:22:54 2023 -0800

    Remove extra line before first EDATE in documentation section for seve
ral Cr evaluations

commit f2ff62a3ca484d06b42ace574b92bae4cf677c6f
Author: Gustavo Nobre <gnobre@bnl.gov>
Date:   Wed Jan 11 17:00:53 2023 -0500
:
```

```
Author: Caleb M. Mattoon <mattoon1@llnl.gov>
Date:   Wed Mar 1 13:22:54 2023 -0800

    Remove extra line before first EDATE in documentation section for seve
ral Cr evaluations

commit f2ff62a3ca484d06b42ace574b92bae4cf677c6f
Author: Gustavo Nobre <gnobre@bnl.gov>
Date:   Wed Jan 11 17:00:53 2023 -0500

    Updated library name for 50Cr.


    (cherry picked from commit 0175d515dee2cb50404b90d60999d800c0bcb60d)

commit 7ae95ab17636b53bb3a13abd52c6fdc8c4d791d4
Author: Gustavo Nobre <gnobre@bnl.gov>
Date:   Fri May 27 10:01:34 2022 -0400

    Updated 50Cr file to BNL/IAEA version v2.3.2=v2.3.1, which has extende
d energy range up to 65MeV for FENDL.


    (cherry picked from commit 0035eadef52ba4287f56513edc625986ab848b40)

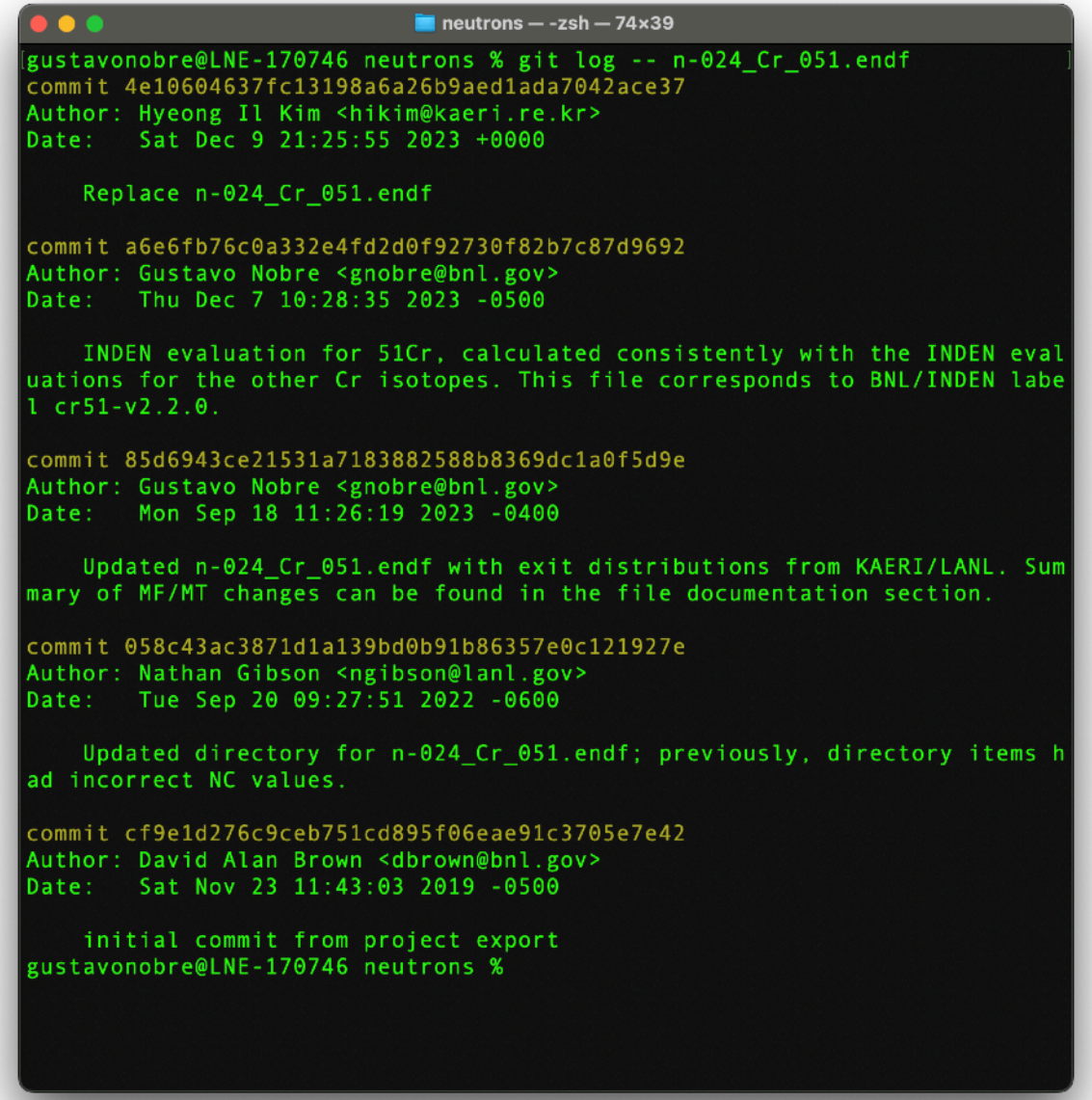
commit 3f8d3773a4ffd9fb9b331028304bdb44bde1e9c1
Author: Gustavo Nobre <gnobre@bnl.gov>
Date:   Thu May 26 16:36:51 2022 -0400

    "Preparing n-024_Cr_050.endf for review"

commit cf9e1d276c9ceb751cd895f06eae91c3705e7e42
Author: David Alan Brown <dbrown@bnl.gov>
Date:   Sat Nov 23 11:43:03 2019 -0500

    initial commit from project export
(END)
```

51Cr


neutrons — -zsh — 74×39
gustavonobre@LNE-170746 neutrons % git log -- n-024_Cr_051.endf
commit 4e10604637fc13198a6a26b9aed1ada7042ace37
Author: Hyeong Il Kim <hikim@kaeri.re.kr>
Date: Sat Dec 9 21:25:55 2023 +0000
Replace n-024_Cr_051.endf
commit a6e6fb76c0a332e4fd2d0f92730f82b7c87d9692
Author: Gustavo Nobre <gnobre@bnl.gov>
Date: Thu Dec 7 10:28:35 2023 -0500
INDEN evaluation for 51Cr, calculated consistently with the INDEN eval
uations for the other Cr isotopes. This file corresponds to BNL/INDEN labe
l cr51-v2.2.0.
commit 85d6943ce21531a7183882588b8369dc1a0f5d9e
Author: Gustavo Nobre <gnobre@bnl.gov>
Date: Mon Sep 18 11:26:19 2023 -0400
Updated n-024_Cr_051.endf with exit distributions from KAERI/LANL. Sum
mary of MF/MT changes can be found in the file documentation section.
commit 058c43ac3871d1a139bd0b91b86357e0c121927e
Author: Nathan Gibson <ngibson@lanl.gov>
Date: Tue Sep 20 09:27:51 2022 -0600
Updated directory for n-024_Cr_051.endf; previously, directory items h
ad incorrect NC values.
commit cf9e1d276c9ceb751cd895f06eae91c3705e7e42
Author: David Alan Brown <dbrown@bnl.gov>
Date: Sat Nov 23 11:43:03 2019 -0500
initial commit from project export
gustavonobre@LNE-170746 neutrons %

51Cr

- Minor fixes
- Exit distributions from KAERI

neutrons — -zsh — 74×39

```
gustavonobre@LNE-170746 neutrons % git log -- n-024_Cr_051.endf
commit 4e10604637fc13198a6a26b9aed1ada7042ace37
Author: Hyeong Il Kim <hikim@kaeri.re.kr>
Date:   Sat Dec 9 21:25:55 2023 +0000

    Replace n-024_Cr_051.endf

commit a6e6fb76c0a332e4fd2d0f92730f82b7c87d9692
Author: Gustavo Nobre <gnobre@bnl.gov>
Date:   Thu Dec 7 10:28:35 2023 -0500

    INDEN evaluation for 51Cr, calculated consistently with the INDEN eval
uations for the other Cr isotopes. This file corresponds to BNL/INDEN labe
l cr51-v2.2.0.

commit 85d6943ce21531a7183882588b8369dc1a0f5d9e
Author: Gustavo Nobre <gnobre@bnl.gov>
Date:   Mon Sep 18 11:26:19 2023 -0400

    Updated n-024_Cr_051.endf with exit distributions from KAERI/LANL. Sum
mary of MF/MT changes can be found in the file documentation section.

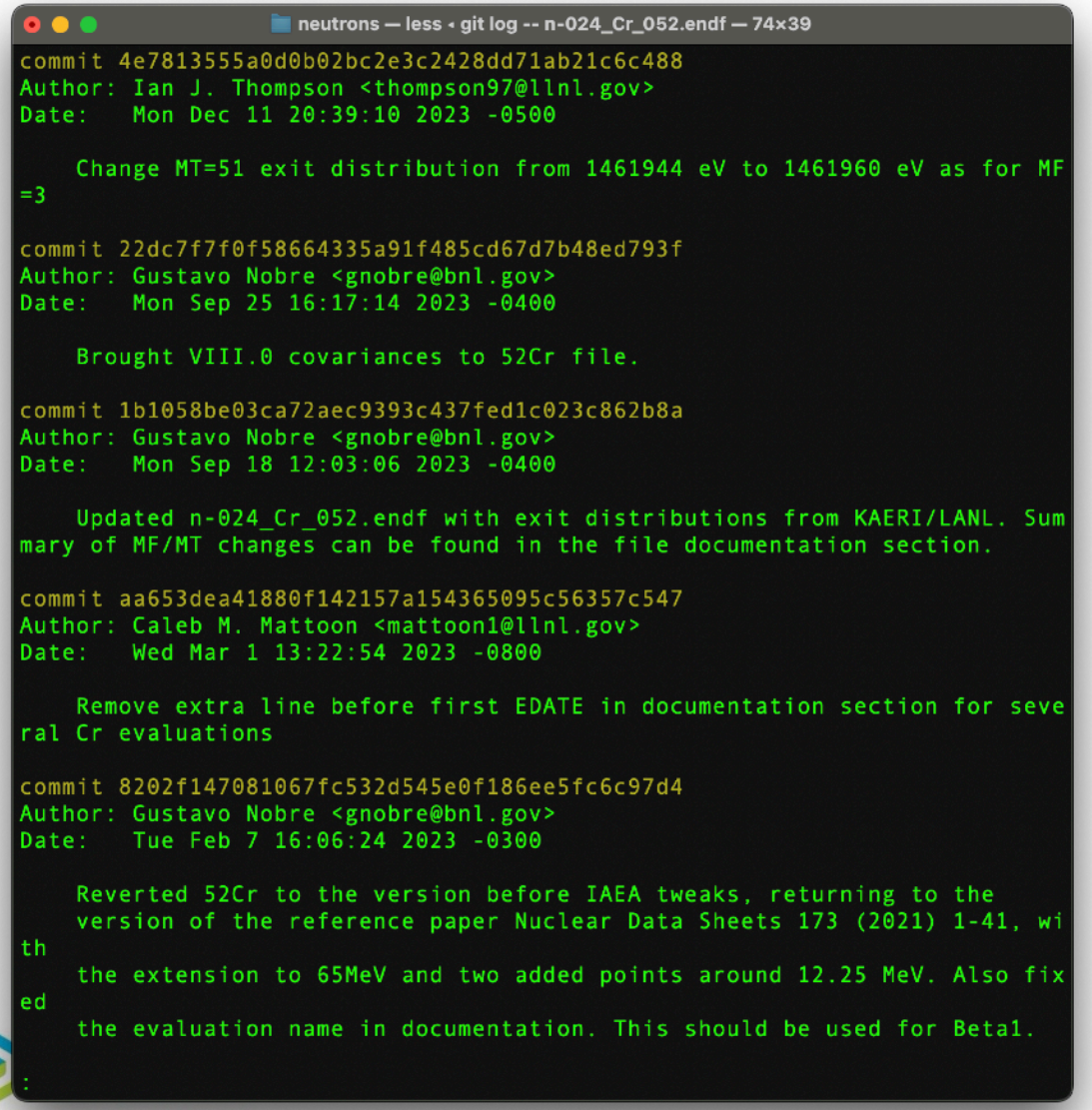
commit 058c43ac3871d1a139bd0b91b86357e0c121927e
Author: Nathan Gibson <ngibson@lanl.gov>
Date:   Tue Sep 20 09:27:51 2022 -0600

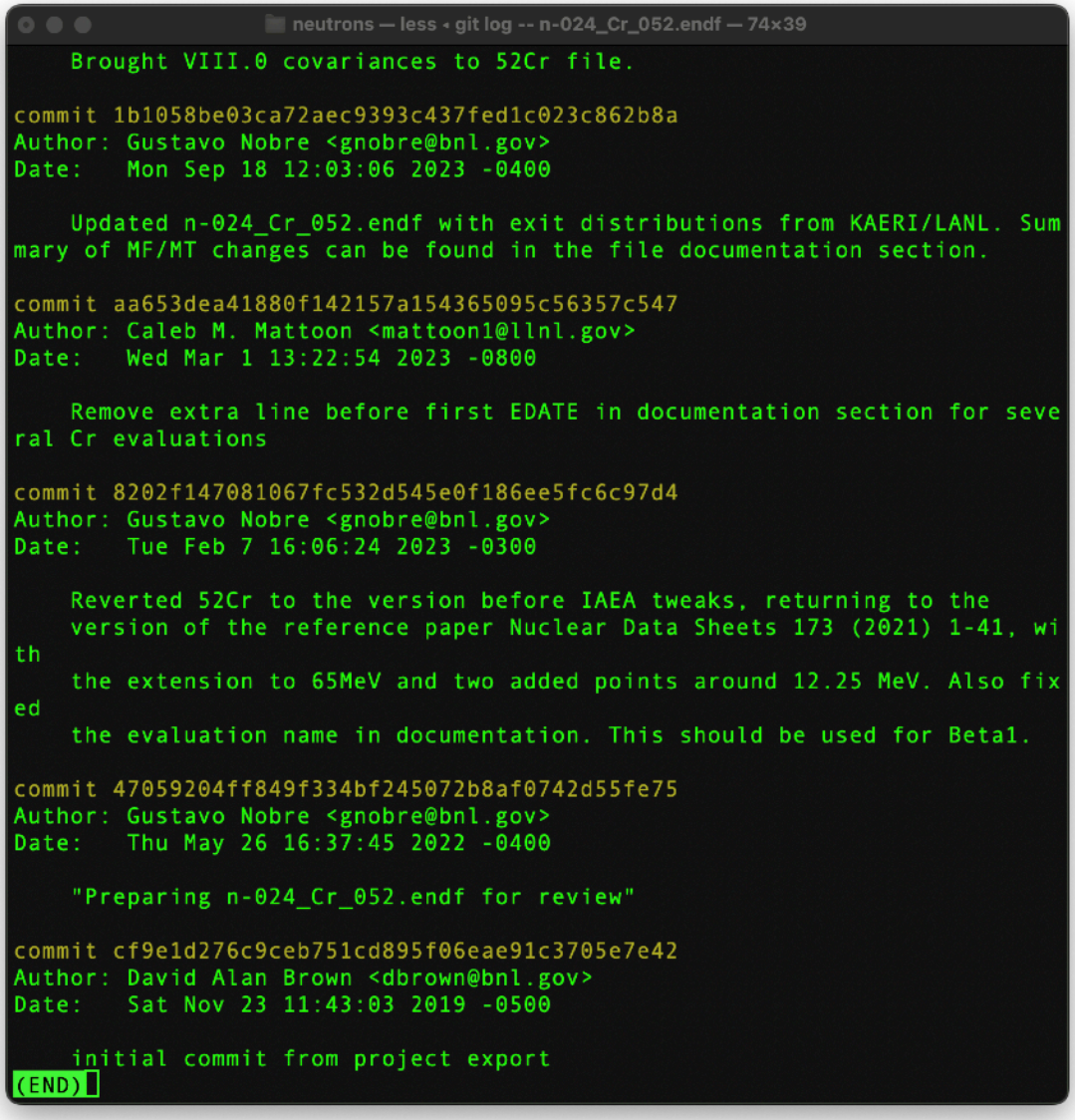
    Updated directory for n-024_Cr_051.endf; previously, directory items h
ad incorrect NC values.

commit cf9e1d276c9ceb751cd895f06eae91c3705e7e42
Author: David Alan Brown <dbrown@bnl.gov>
Date:   Sat Nov 23 11:43:03 2019 -0500

    initial commit from project export
gustavonobre@LNE-170746 neutrons %
```

52Cr


neutrons — less ‹ git log -- n-024_Cr_052.endf — 74×39
commit 4e7813555a0d0b02bc2e3c2428dd71ab21c6c488
Author: Ian J. Thompson <thompson97@llnl.gov>
Date: Mon Dec 11 20:39:10 2023 -0500
Change MT=51 exit distribution from 1461944 eV to 1461960 eV as for MF =3
commit 22dc7f7f0f58664335a91f485cd67d7b48ed793f
Author: Gustavo Nobre <gnobre@bnl.gov>
Date: Mon Sep 25 16:17:14 2023 -0400
Brought VIII.0 covariances to 52Cr file.
commit 1b1058be03ca72aec9393c437fed1c023c862b8a
Author: Gustavo Nobre <gnobre@bnl.gov>
Date: Mon Sep 18 12:03:06 2023 -0400
Updated n-024_Cr_052.endf with exit distributions from KAERI/LANL. Summary of MF/MT changes can be found in the file documentation section.
commit aa653dea41880f142157a154365095c56357c547
Author: Caleb M. Mattoon <mattoon1@llnl.gov>
Date: Wed Mar 1 13:22:54 2023 -0800
Remove extra line before first EDATE in documentation section for several Cr evaluations
commit 8202f147081067fc532d545e0f186ee5fc6c97d4
Author: Gustavo Nobre <gnobre@bnl.gov>
Date: Tue Feb 7 16:06:24 2023 -0300
Reverted 52Cr to the version before IAEA tweaks, returning to the version of the reference paper Nuclear Data Sheets 173 (2021) 1-41, with the extension to 65MeV and two added points around 12.25 MeV. Also fixed the evaluation name in documentation. This should be used for Beta1.
:


neutrons — less ‹ git log -- n-024_Cr_052.endf — 74×39
Brought VIII.0 covariances to 52Cr file.
commit 1b1058be03ca72aec9393c437fed1c023c862b8a
Author: Gustavo Nobre <gnobre@bnl.gov>
Date: Mon Sep 18 12:03:06 2023 -0400
Updated n-024_Cr_052.endf with exit distributions from KAERI/LANL. Summary of MF/MT changes can be found in the file documentation section.
commit aa653dea41880f142157a154365095c56357c547
Author: Caleb M. Mattoon <mattoon1@llnl.gov>
Date: Wed Mar 1 13:22:54 2023 -0800
Remove extra line before first EDATE in documentation section for several Cr evaluations
commit 8202f147081067fc532d545e0f186ee5fc6c97d4
Author: Gustavo Nobre <gnobre@bnl.gov>
Date: Tue Feb 7 16:06:24 2023 -0300
Reverted 52Cr to the version before IAEA tweaks, returning to the version of the reference paper Nuclear Data Sheets 173 (2021) 1-41, with the extension to 65MeV and two added points around 12.25 MeV. Also fixed the evaluation name in documentation. This should be used for Beta1.
commit 47059204ff849f334bf245072b8af0742d55fe75
Author: Gustavo Nobre <gnobre@bnl.gov>
Date: Thu May 26 16:37:45 2022 -0400
"Preparing n-024_Cr_052.endf for review"
commit cf9e1d276c9ceb751cd895f06eae91c3705e7e42
Author: David Alan Brown <dbrown@bnl.gov>
Date: Sat Nov 23 11:43:03 2019 -0500
initial commit from project export
(END)

52Cr

- Minor fixes
- Reverted to publication version, before resonance tweaks
- Exit distributions from KAERI
- Added covariances from VIII.0
- Fixed minor issue with MT=51 exit distribution

neutrons — less ‹ git log -- n-024_Cr_052.endf — 74×39

```
commit 4e7813555a0d0b02bc2e3c2428dd71ab21c6c488
Author: Ian J. Thompson <thompson97@llnl.gov>
Date:   Mon Dec 11 20:39:10 2023 -0500

    Change MT=51 exit distribution from 1461944 eV to 1461960 eV as for Mr
=3

commit 22dc7f7f0f58664335a91f485cd67d7b48ed793f
Author: Gustavo Nobre <gnobre@bnl.gov>
Date:   Mon Sep 25 16:17:14 2023 -0400

    Brought VIII.0 covariances to 52Cr file.

commit 1b1058be03ca72aec9393c437fed1c023c862b8a
Author: Gustavo Nobre <gnobre@bnl.gov>
Date:   Mon Sep 18 12:03:06 2023 -0400

    Updated n-024_Cr_052.endf with exit distributions from KAERI/LANL. Sum
mary of MF/MT changes can be found in the file documentation section.

commit aa653dea41880f142157a154365095c56357c547
Author: Caleb M. Mattoon <mattoon1@llnl.gov>
Date:   Wed Mar 1 13:22:54 2023 -0800

    Remove extra line before first EDATE in documentation section for seve
ral Cr evaluations

commit 8202f147081067fc532d545e0f186ee5fc6c97d4
Author: Gustavo Nobre <gnobre@bnl.gov>
Date:   Tue Feb 7 16:06:24 2023 -0300

    Reverted 52Cr to the version before IAEA tweaks, returning to the
    version of the reference paper Nuclear Data Sheets 173 (2021) 1-41, wi
th
    the extension to 65MeV and two added points around 12.25 MeV. Also fix
ed
    the evaluation name in documentation. This should be used for Beta1.

:
```

```
    Updated n-024_Cr_052.endf with exit distributions from KAERI/LANL. Sum
mary of MF/MT changes can be found in the file documentation section.

commit aa653dea41880f142157a154365095c56357c547
Author: Caleb M. Mattoon <mattoon1@llnl.gov>
Date:   Wed Mar 1 13:22:54 2023 -0800

    Remove extra line before first EDATE in documentation section for seve
ral Cr evaluations

commit 8202f147081067fc532d545e0f186ee5fc6c97d4
Author: Gustavo Nobre <gnobre@bnl.gov>
Date:   Tue Feb 7 16:06:24 2023 -0300

    Reverted 52Cr to the version before IAEA tweaks, returning to the
    version of the reference paper Nuclear Data Sheets 173 (2021) 1-41, wi
th
    the extension to 65MeV and two added points around 12.25 MeV. Also fix
ed
    the evaluation name in documentation. This should be used for Beta1.

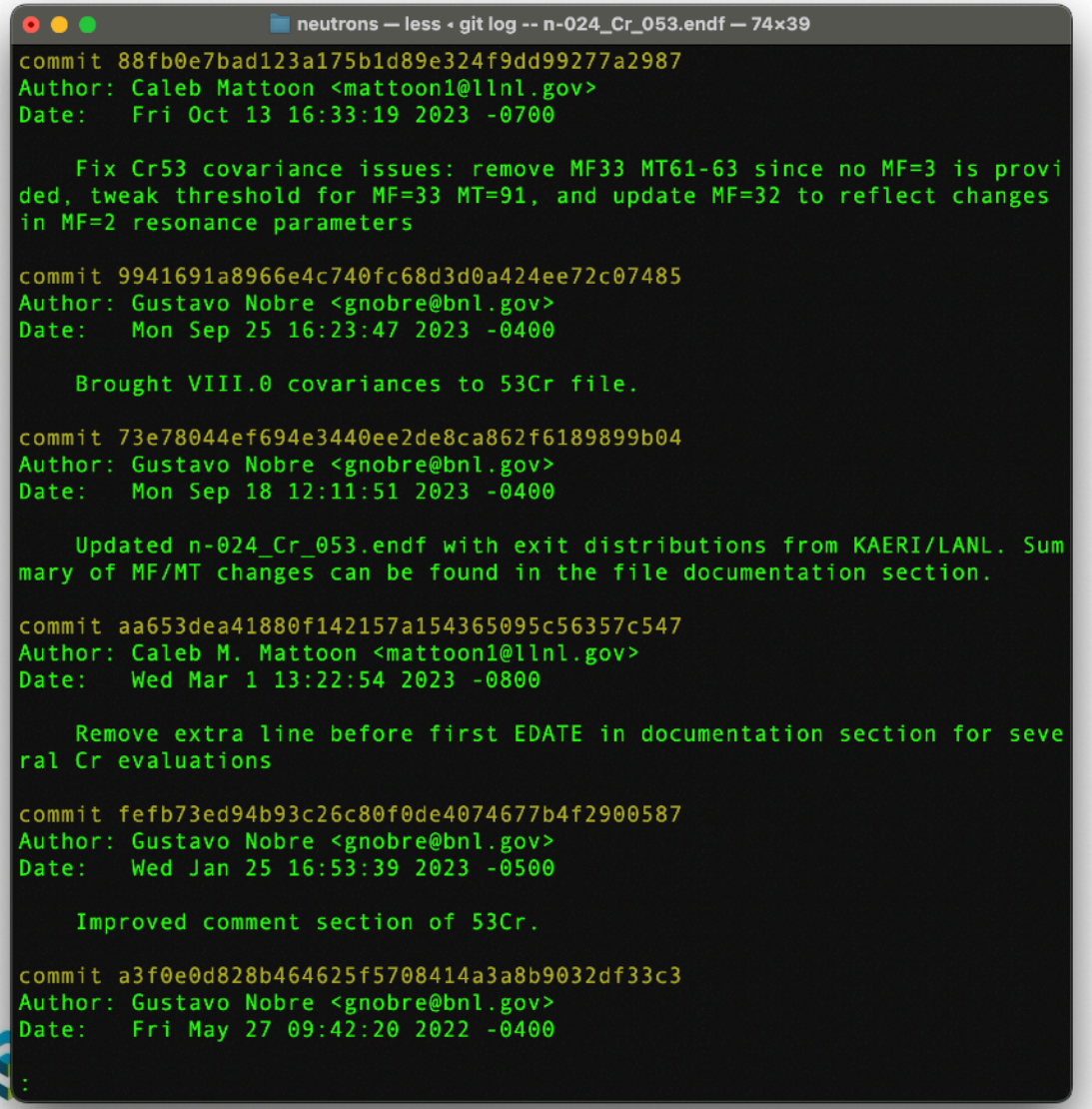
commit 47059204ff849f334bf245072b8af0742d55fe75
Author: Gustavo Nobre <gnobre@bnl.gov>
Date:   Thu May 26 16:37:45 2022 -0400

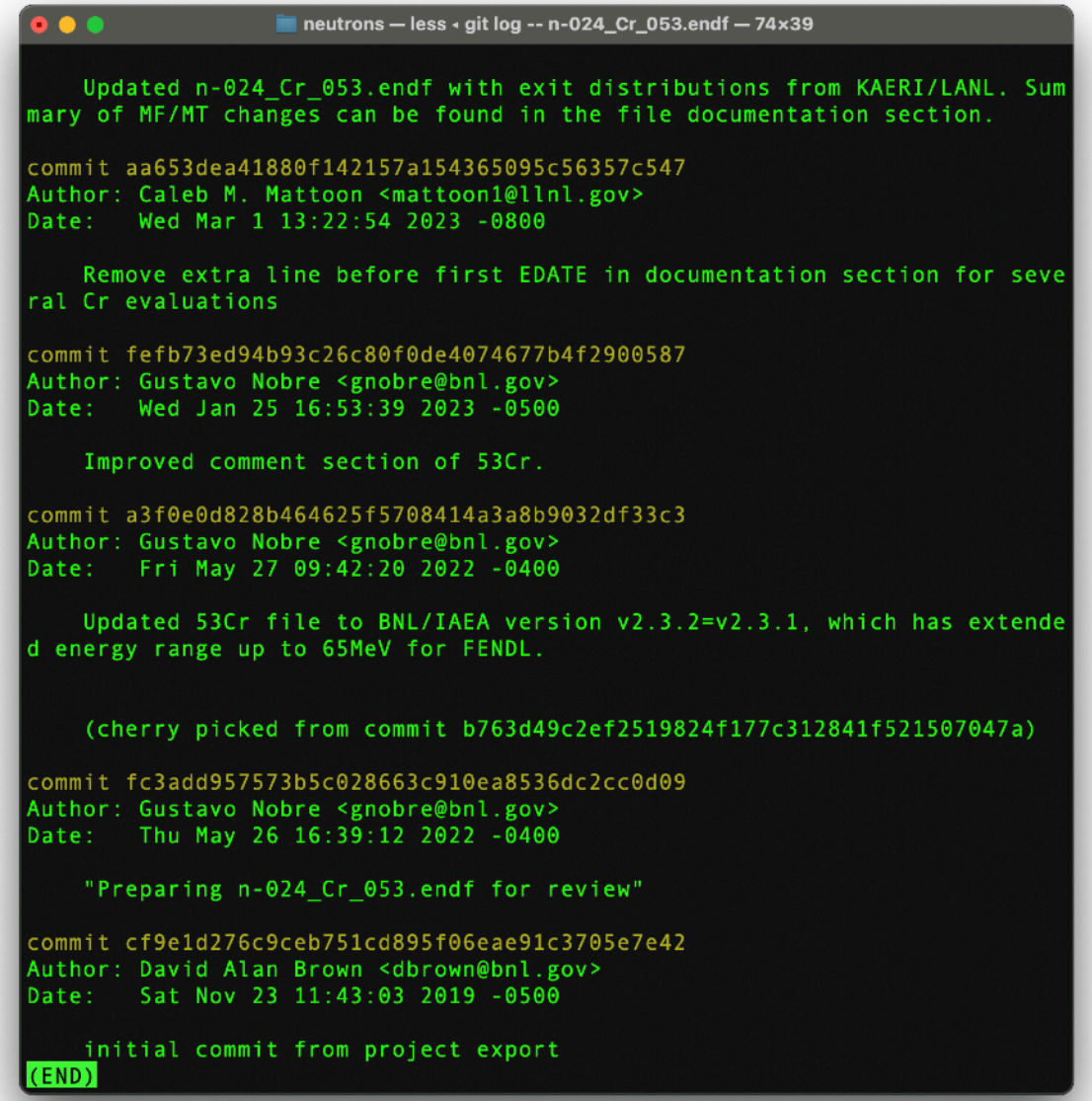
    "Preparing n-024_Cr_052.endf for review"

commit cf9e1d276c9ceb751cd895f06eae91c3705e7e42
Author: David Alan Brown <dbrown@bnl.gov>
Date:   Sat Nov 23 11:43:03 2019 -0500

    initial commit from project export
(END)
```

53Cr


neutrons — less ‹ git log -- n-024_Cr_053.endf — 74×39
commit 88fb0e7bad123a175b1d89e324f9dd99277a2987
Author: Caleb Mattoon <mattoon1@llnl.gov>
Date: Fri Oct 13 16:33:19 2023 -0700
Fix Cr53 covariance issues: remove MF33 MT61-63 since no MF=3 is provided, tweak threshold for MF=33 MT=91, and update MF=32 to reflect changes in MF=2 resonance parameters
commit 9941691a8966e4c740fc68d3d0a424ee72c07485
Author: Gustavo Nobre <gnobre@bnl.gov>
Date: Mon Sep 25 16:23:47 2023 -0400
Brought VIII.0 covariances to 53Cr file.
commit 73e78044ef694e3440ee2de8ca862f6189899b04
Author: Gustavo Nobre <gnobre@bnl.gov>
Date: Mon Sep 18 12:11:51 2023 -0400
Updated n-024_Cr_053.endf with exit distributions from KAERI/LANL. Summary of MF/MT changes can be found in the file documentation section.
commit aa653dea41880f142157a154365095c56357c547
Author: Caleb M. Mattoon <mattoon1@llnl.gov>
Date: Wed Mar 1 13:22:54 2023 -0800
Remove extra line before first EDATE in documentation section for several Cr evaluations
commit fefb73ed94b93c26c80f0de4074677b4f2900587
Author: Gustavo Nobre <gnobre@bnl.gov>
Date: Wed Jan 25 16:53:39 2023 -0500
Improved comment section of 53Cr.
commit a3f0e0d828b464625f5708414a3a8b9032df33c3
Author: Gustavo Nobre <gnobre@bnl.gov>
Date: Fri May 27 09:42:20 2022 -0400
:


neutrons — less ‹ git log -- n-024_Cr_053.endf — 74×39
Updated n-024_Cr_053.endf with exit distributions from KAERI/LANL. Summary of MF/MT changes can be found in the file documentation section.
commit aa653dea41880f142157a154365095c56357c547
Author: Caleb M. Mattoon <mattoon1@llnl.gov>
Date: Wed Mar 1 13:22:54 2023 -0800
Remove extra line before first EDATE in documentation section for several Cr evaluations
commit fefb73ed94b93c26c80f0de4074677b4f2900587
Author: Gustavo Nobre <gnobre@bnl.gov>
Date: Wed Jan 25 16:53:39 2023 -0500
Improved comment section of 53Cr.
commit a3f0e0d828b464625f5708414a3a8b9032df33c3
Author: Gustavo Nobre <gnobre@bnl.gov>
Date: Fri May 27 09:42:20 2022 -0400
Updated 53Cr file to BNL/IAEA version v2.3.2=v2.3.1, which has extended energy range up to 65MeV for FENDL.
(cherry picked from commit b763d49c2ef2519824f177c312841f521507047a)
commit fc3add957573b5c028663c910ea8536dc2cc0d09
Author: Gustavo Nobre <gnobre@bnl.gov>
Date: Thu May 26 16:39:12 2022 -0400
"Preparing n-024_Cr_053.endf for review"
commit cf9e1d276c9ceb751cd895f06eae91c3705e7e42
Author: David Alan Brown <dbrown@bnl.gov>
Date: Sat Nov 23 11:43:03 2019 -0500
initial commit from project export
(END)

53Cr

- Minor fixes
- Exit distributions from KAERI
- Added covariances from VIII.0
- Fixes to MF=32/33

neutrons — less ‹ git log -- n-024_Cr_053.endf — 74×39

```
commit 88fb0e7bad123a175b1d89e324f9dd99277a2987
Author: Caleb Mattoon <mattoon1@llnl.gov>
Date:   Fri Oct 13 16:33:19 2023 -0700

    Fix Cr53 covariance issues: remove MF33 MT61-63 since no MF=3 is provi
ded, tweak threshold for MF=33 MT=91, and update MF=32 to reflect changes
in MF=2 resonance parameters

commit 9941691a8966e4c740fc68d3d0a424ee72c07485
Author: Gustavo Nobre <gnobre@bnl.gov>
Date:   Mon Sep 25 16:23:47 2023 -0400

    Brought VIII.0 covariances to 53Cr file.

commit 73e78044ef694e3440ee2de8ca862f6189899b04
Author: Gustavo Nobre <gnobre@bnl.gov>
Date:   Mon Sep 18 12:11:51 2023 -0400

    Updated n-024_Cr_053.endf with exit distributions from KAERI/LANL. Sum
mary of MF/MT changes can be found in the file documentation section.

commit aa653dea41880f142157a154365095c56357c547
Author: Caleb M. Mattoon <mattoon1@llnl.gov>
Date:   Wed Mar 1 13:22:54 2023 -0800

    Remove extra line before first EDATE in documentation section for seve
ral Cr evaluations

commit fefb73ed94b93c26c80f0de4074677b4f2900587
Author: Gustavo Nobre <gnobre@bnl.gov>
Date:   Wed Jan 25 16:53:39 2023 -0500

    Improved comment section of 53Cr.

commit a3f0e0d828b464625f5708414a3a8b9032df33c3
Author: Gustavo Nobre <gnobre@bnl.gov>
Date:   Fri May 27 09:42:20 2022 -0400

:
```

```
    Updated n-024_Cr_053.endf with exit distributions from KAERI/LANL. Sum
mary of MF/MT changes can be found in the file documentation section.

commit aa653dea41880f142157a154365095c56357c547
Author: Caleb M. Mattoon <mattoon1@llnl.gov>
Date:   Wed Mar 1 13:22:54 2023 -0800

    Remove extra line before first EDATE in documentation section for seve
ral Cr evaluations

commit fefb73ed94b93c26c80f0de4074677b4f2900587
Author: Gustavo Nobre <gnobre@bnl.gov>
Date:   Wed Jan 25 16:53:39 2023 -0500

    Improved comment section of 53Cr.

commit a3f0e0d828b464625f5708414a3a8b9032df33c3
Author: Gustavo Nobre <gnobre@bnl.gov>
Date:   Fri May 27 09:42:20 2022 -0400

    Updated 53Cr file to BNL/IAEA version v2.3.2=v2.3.1, which has extende
d energy range up to 65MeV for FENDL.


    (cherry picked from commit b763d49c2ef2519824f177c312841f521507047a)

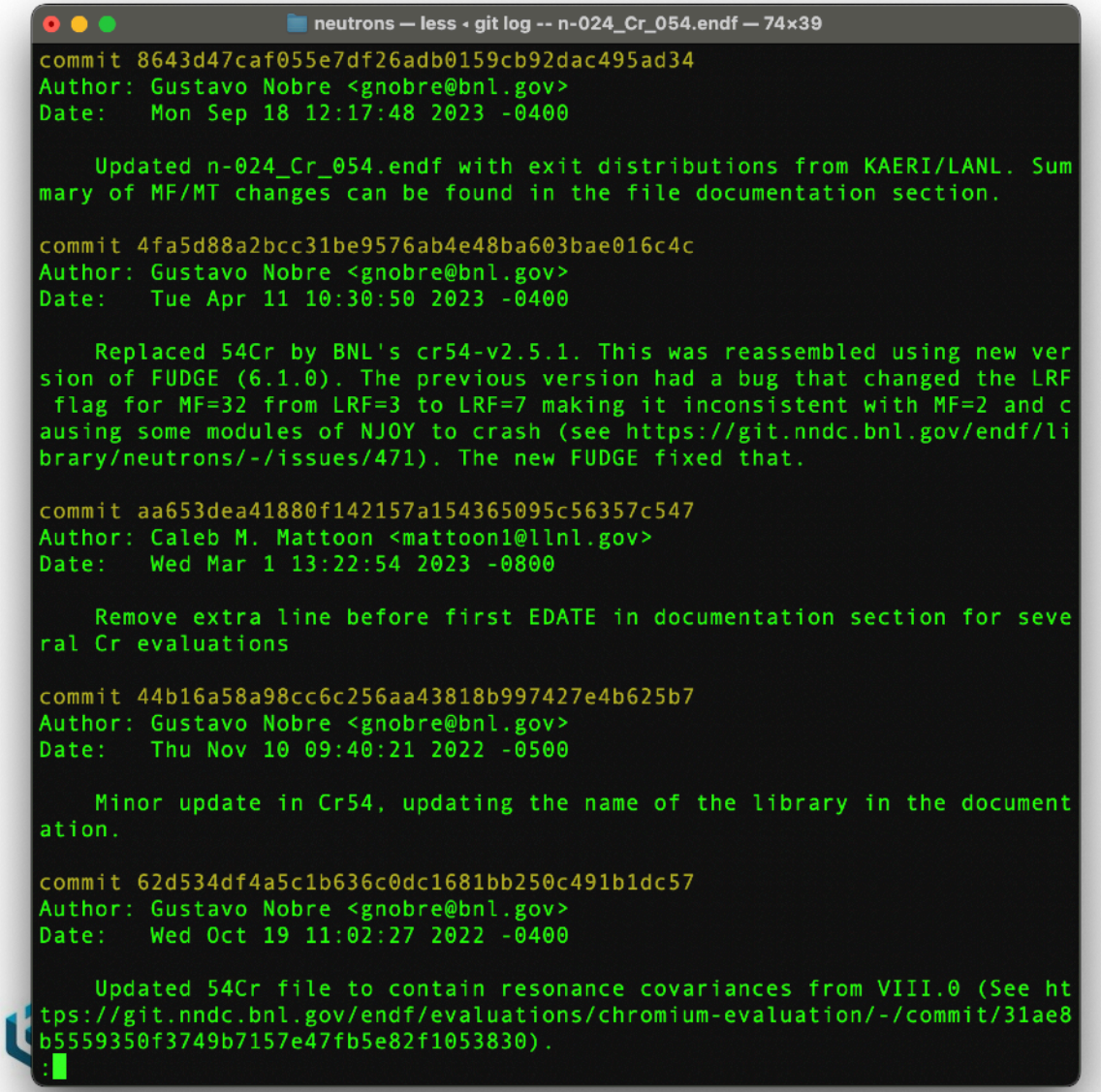
commit fc3add957573b5c028663c910ea8536dc2cc0d09
Author: Gustavo Nobre <gnobre@bnl.gov>
Date:   Thu May 26 16:39:12 2022 -0400

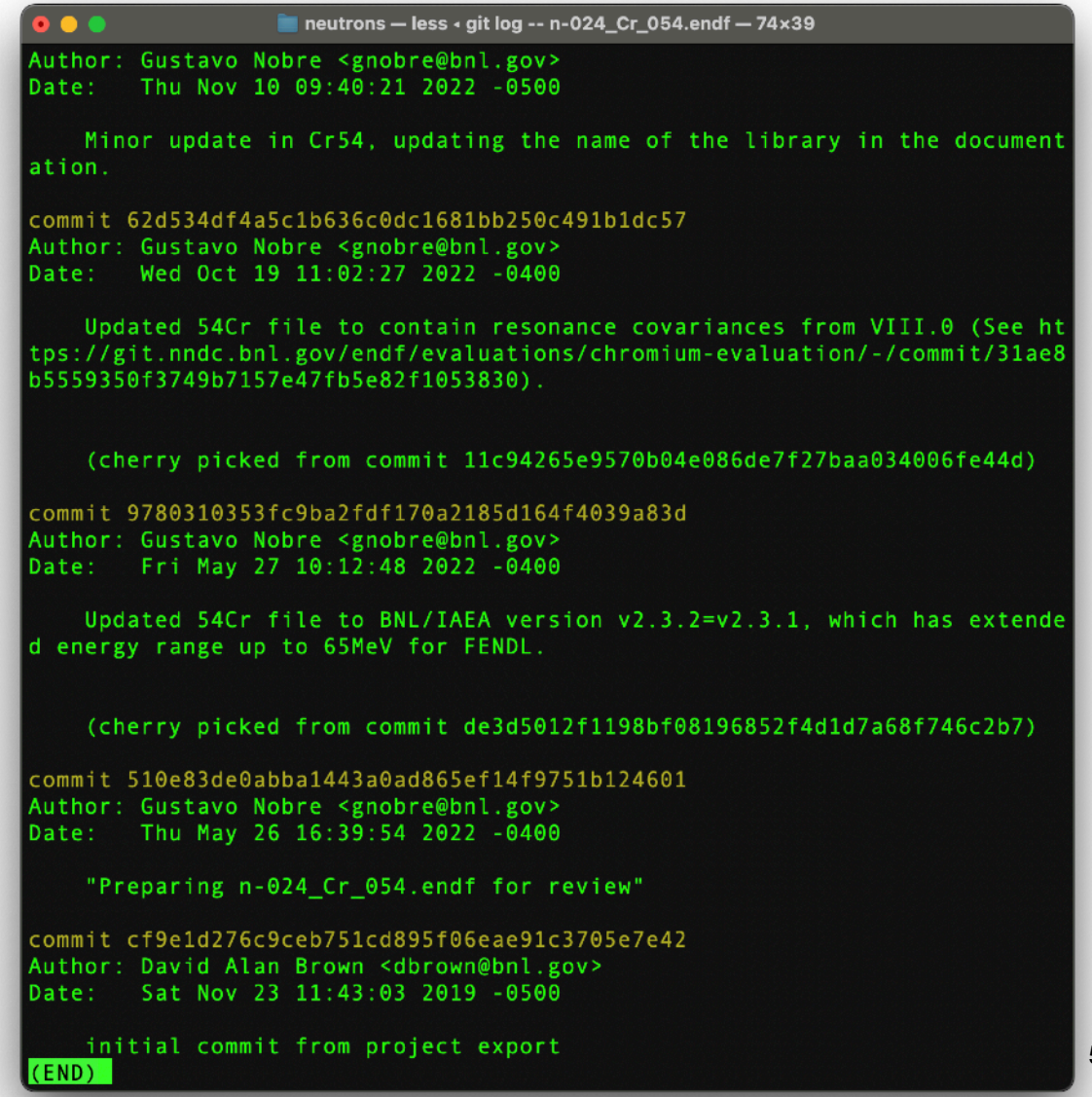
    "Preparing n-024_Cr_053.endf for review"

commit cf9e1d276c9ceb751cd895f06eae91c3705e7e42
Author: David Alan Brown <dbrown@bnl.gov>
Date:   Sat Nov 23 11:43:03 2019 -0500

    initial commit from project export
(END)
```

54Cr


neutrons — less ‹ git log -- n-024_Cr_054.endf — 74×39
commit 8643d47caf055e7df26adb0159cb92dac495ad34
Author: Gustavo Nobre <gnobre@bnl.gov>
Date: Mon Sep 18 12:17:48 2023 -0400
Updated n-024_Cr_054.endf with exit distributions from KAERI/LANL. Summary of MF/MT changes can be found in the file documentation section.
commit 4fa5d88a2bcc31be9576ab4e48ba603bae016c4c
Author: Gustavo Nobre <gnobre@bnl.gov>
Date: Tue Apr 11 10:30:50 2023 -0400
Replaced 54Cr by BNL's cr54-v2.5.1. This was reassembled using new version of FUDGE (6.1.0). The previous version had a bug that changed the LRF flag for MF=32 from LRF=3 to LRF=7 making it inconsistent with MF=2 and causing some modules of NJOY to crash (see https://git.nndc.bnl.gov/endf/library/neutrons/-/issues/471). The new FUDGE fixed that.
commit aa653dea41880f142157a154365095c56357c547
Author: Caleb M. Mattoon <mattoon1@llnl.gov>
Date: Wed Mar 1 13:22:54 2023 -0800
Remove extra line before first EDATE in documentation section for several Cr evaluations
commit 44b16a58a98cc6c256aa43818b997427e4b625b7
Author: Gustavo Nobre <gnobre@bnl.gov>
Date: Thu Nov 10 09:40:21 2022 -0500
Minor update in Cr54, updating the name of the library in the documentation.
commit 62d534df4a5c1b636c0dc1681bb250c491b1dc57
Author: Gustavo Nobre <gnobre@bnl.gov>
Date: Wed Oct 19 11:02:27 2022 -0400
Updated 54Cr file to contain resonance covariances from VIII.0 (See https://git.nndc.bnl.gov/endf/evaluations/chromium-evaluation/-/commit/31ae8b5559350f3749b7157e47fb5e82f1053830).
:


neutrons — less ‹ git log -- n-024_Cr_054.endf — 74×39
Author: Gustavo Nobre <gnobre@bnl.gov>
Date: Thu Nov 10 09:40:21 2022 -0500
Minor update in Cr54, updating the name of the library in the documentation.
commit 62d534df4a5c1b636c0dc1681bb250c491b1dc57
Author: Gustavo Nobre <gnobre@bnl.gov>
Date: Wed Oct 19 11:02:27 2022 -0400
Updated 54Cr file to contain resonance covariances from VIII.0 (See https://git.nndc.bnl.gov/endf/evaluations/chromium-evaluation/-/commit/31ae8b5559350f3749b7157e47fb5e82f1053830).
(cherry picked from commit 11c94265e9570b04e086de7f27baa034006fe44d)
commit 9780310353fc9ba2fdf170a2185d164f4039a83d
Author: Gustavo Nobre <gnobre@bnl.gov>
Date: Fri May 27 10:12:48 2022 -0400
Updated 54Cr file to BNL/IAEA version v2.3.2=v2.3.1, which has extended energy range up to 65MeV for FENDL.
(cherry picked from commit de3d5012f1198bf08196852f4d1d7a68f746c2b7)
commit 510e83de0abba1443a0ad865ef14f9751b124601
Author: Gustavo Nobre <gnobre@bnl.gov>
Date: Thu May 26 16:39:54 2022 -0400
"Preparing n-024_Cr_054.endf for review"
commit cf9e1d276c9ceb751cd895f06eae91c3705e7e42
Author: David Alan Brown <dbrown@bnl.gov>
Date: Sat Nov 23 11:43:03 2019 -0500
initial commit from project export
(END)

54Cr

- Minor fixes
- Added resonance covariances from VIII.0, after a FUDGE update
- Exit distributions from KAERI

neutrons — less ‹ git log -- n-024_Cr_054.endf — 74×39

```
commit 8643d47caf055e7df26adb0159cb92dac495ad34
Author: Gustavo Nobre <gnobre@bnl.gov>
Date:   Mon Sep 18 12:17:48 2023 -0400

    Updated n-024_Cr_054.endf with exit distributions from KAERI/LANL. Sum
mary of MF/MT changes can be found in the file documentation section.

commit 4fa5d88a2bcc31be9576ab4e48ba603bae016c4c
Author: Gustavo Nobre <gnobre@bnl.gov>
Date:   Tue Apr 11 10:30:50 2023 -0400

    Replaced 54Cr by BNL's cr54-v2.5.1. This was reassembled using new ver
sion of FUDGE (6.1.0). The previous version had a bug that changed the LRF
 flag for MF=32 from LRF=3 to LRF=7 making it inconsistent with MF=2 and c
ausing some modules of NJOY to crash (see https://git.nndc.bnl.gov/endf/li
brary/neutrons/-/issues/471). The new FUDGE fixed that.

commit aa653dea41880f142157a154365095c56357c547
Author: Caleb M. Mattoon <mattoon1@llnl.gov>
Date:   Wed Mar 1 13:22:54 2023 -0800

    Remove extra line before first EDATE in documentation section for seve
ral Cr evaluations

commit 44b16a58a98cc6c256aa43818b997427e4b625b7
Author: Gustavo Nobre <gnobre@bnl.gov>
Date:   Thu Nov 10 09:40:21 2022 -0500

    Minor update in Cr54, updating the name of the library in the document
ation.

commit 62d534df4a5c1b636c0dc1681bb250c491b1dc57
Author: Gustavo Nobre <gnobre@bnl.gov>
Date:   Wed Oct 19 11:02:27 2022 -0400

    Updated 54Cr file to contain resonance covariances from VIII.0 (See ht
tps://git.nndc.bnl.gov/endf/evaluations/chromium-evaluation/-/commit/31ae8
b5559350f3749b7157e47fb5e82f1053830).
:
```

```
Author: Gustavo Nobre <gnobre@bnl.gov>
Date:   Thu Nov 10 09:40:21 2022 -0500

    Minor update in Cr54, updating the name of the library in the document
ation.

commit 62d534df4a5c1b636c0dc1681bb250c491b1dc57
Author: Gustavo Nobre <gnobre@bnl.gov>
Date:   Wed Oct 19 11:02:27 2022 -0400

    Updated 54Cr file to contain resonance covariances from VIII.0 (See ht
tps://git.nndc.bnl.gov/endf/evaluations/chromium-evaluation/-/commit/31ae8
b5559350f3749b7157e47fb5e82f1053830).


    (cherry picked from commit 11c94265e9570b04e086de7f27baa034006fe44d)

commit 9780310353fc9ba2fdf170a2185d164f4039a83d
Author: Gustavo Nobre <gnobre@bnl.gov>
Date:   Fri May 27 10:12:48 2022 -0400

    Updated 54Cr file to BNL/IAEA version v2.3.2=v2.3.1, which has extende
d energy range up to 65MeV for FENDL.


    (cherry picked from commit de3d5012f1198bf08196852f4d1d7a68f746c2b7)

commit 510e83de0abba1443a0ad865ef14f9751b124601
Author: Gustavo Nobre <gnobre@bnl.gov>
Date:   Thu May 26 16:39:54 2022 -0400

    "Preparing n-024_Cr_054.endf for review"

commit cf9e1d276c9ceb751cd895f06eae91c3705e7e42
Author: David Alan Brown <dbrown@bnl.gov>
Date:   Sat Nov 23 11:43:03 2019 -0500

    initial commit from project export
(END)
```

63Cu

neutrons — less ‹ git log -- n-029_Cu_063.endf — 52×40

```
commit 3b460b5f7eb799eab706573ca99fef5fcff1037b
Author: Gustavo Nobre <gnobre@bnl.gov>
Date:   Wed Nov 29 09:50:09 2023 -1000

    Update to 63Cu to include exit distributions fro
m KAERI/LANL. File sent
    by H.I. Kim on November 28, 2023.

commit f63bb09a6e20e6750b1565de73512dbc3140f14e
Author: Caleb Mattoon <mattoon1@llnl.gov>
Date:   Fri Oct 27 17:09:32 2023 -0700

    Fix some FUDGE checker warnings: recompute MF=3
cross section from summands, move the MF=16 photon d
istribution threshold to match cross section, add un
itbase interpolation to a bunch of MT=5 MF=6 product
s

commit 1cc82ced773866db405056146e1c52b8ff9e3ca0
Author: Jason Thompson <jason.thompson@unnpp.gov>
Date:   Thu Oct 26 14:18:18 2023 +0000

    Fixing poorly normalized PDFs in MT=2 at 9 MeV t
hrough 15 MeV. (FIZCON complained about 9-12MeV, but
 the next few had similar issues to a small degree.)

    (cherry picked from commit a006aaac204687144d517
d0bd593fb5290b3d5d1)

commit 595f8aaf215fe61cd64f8379a565d83d4434de86
Author: McDonnell, Jordan <mcdonnelljd@ornl.gov>
Date:   Mon Aug 14 15:16:50 2023 +0000

    Resolve "Large negative eigenvalue in 63Cu MF=32
"

commit 511bd64a21358c73f90a00049aa9cc0731d4d4bb
Author: JayT <jason.thompson@unnpp.gov>
Date:   Tue Aug 8 12:10:37 2023 -0600
:
```

neutrons — less ‹ git log -- n-029_Cu_063.endf — 52×40

```
    added 7MeV tabulated distrubution to Cu63 ESAD

commit b950438a81584ec868bd80dbf3c5b3873b2cf117
Author: JayT <jason.thompson@unnpp.gov>
Date:   Tue Aug 8 05:57:11 2023 -0600

    Changed break point between Legendre and tabualt
ed data in ESAD and zeroed the negative PDFs

commit 0fd5321f074648eca915c9c066dc45e74d45d66d
Author: Wim Haeck <whaeck@gmail.com>
Date:   Mon Aug 7 13:58:02 2023 -0600

    Fixed MF32 MT151

commit ca001bb04dcd74e863db423f1fd0904089e7da2c
Author: Wim Haeck <whaeck@gmail.com>
Date:   Mon Aug 7 13:05:36 2023 -0600

    Correcting index in MF1 MT451

commit 6a65aa9ae3c529723b8c2c1d9d124d87e5cfadef
Author: Gustavo Nobre <gnobre@bnl.gov>
Date:   Thu Jun 15 17:20:40 2023 -0400

    Fixed (n,2n) threshold energy.

commit fe55025b67d3b50ac8f7961a92a37141082245ad
Author: Caleb Mattoon <mattoon1@llnl.gov>
Date:   Tue Jun 6 16:56:37 2023 -0700

    Fix some FUDGE warnings for Cu63: remove extra z
ero-probability outgoing energies from distributions
, fix some masses to better match Q-values.

commit 5bebe0f1aef24c26c1dffc98767b35f4d78fff7f
Author: Nathan Gibson <ngibson@lanl.gov>
Date:   Tue Nov 1 08:17:52 2022 -0600
:
```

neutrons — less ‹ git log -- n-029_Cu_063.endf — 52×40

```
Author: Nathan Gibson <ngibson@lanl.gov>
Date:   Tue Nov 1 08:17:52 2022 -0600

    Updated directory for n-029_Cu_063.endf; previou
s update had bug with MF1 sections.

commit 2f077d9b11d32a73b3b4aae10977d56e29503054
Author: Gustavo Nobre <gnobre@bnl.gov>
Date:   Wed Oct 5 09:34:37 2022 -0400

    Ran dos2unix on version cu63ane6k09aRR

commit 4db079090b2fce1af25f97eb4d64004cf766f8b6
Author: Gustavo Nobre <gnobre@bnl.gov>
Date:   Wed Oct 5 09:32:07 2022 -0400

    New recommended version from INDEN (cu63ane6k09a
RR). Description: Cu-63(n,a) from iRDFF-II adopted.
New evaluation of Cu-63 (IAEA/JSI/ORNL) validated in
 criticality and leakage benchmarks.

commit a39d7325b737364b7048fb2e6d86680651f2c095
Author: Gustavo Nobre <gnobre@bnl.gov>
Date:   Thu Apr 28 10:56:36 2022 -0400

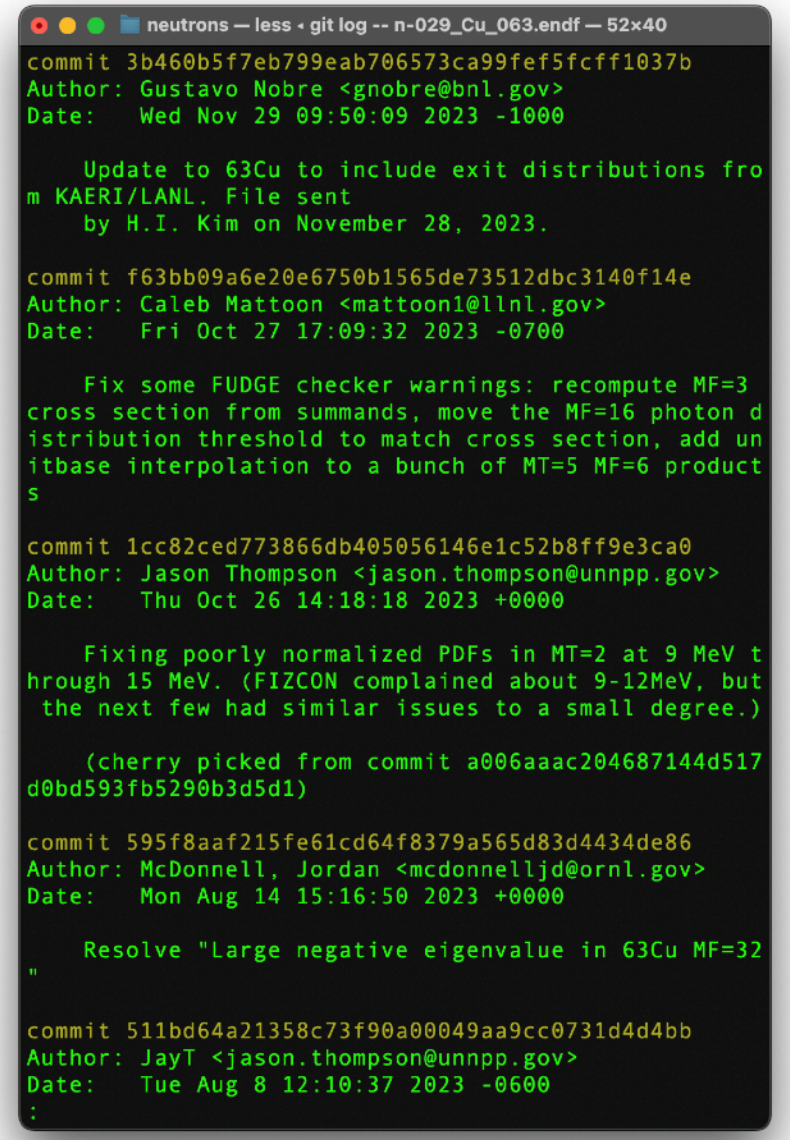
    INDEN evaluation of 63Cu (file labeled as cu63an
e6k09RR in INDEN website). Ran STANEF on it to remov
e line numbers. Also, FIZCON complained about the th
reshold value of (n,2n), so I changed it slightly to
 1.103790+7 (line 4189). More details can be found i
n issue tracker #424 of the neutron sublibrary repos
itory (https://git.nndc.bnl.gov/endf/library/neutron
s/-/issues/424).

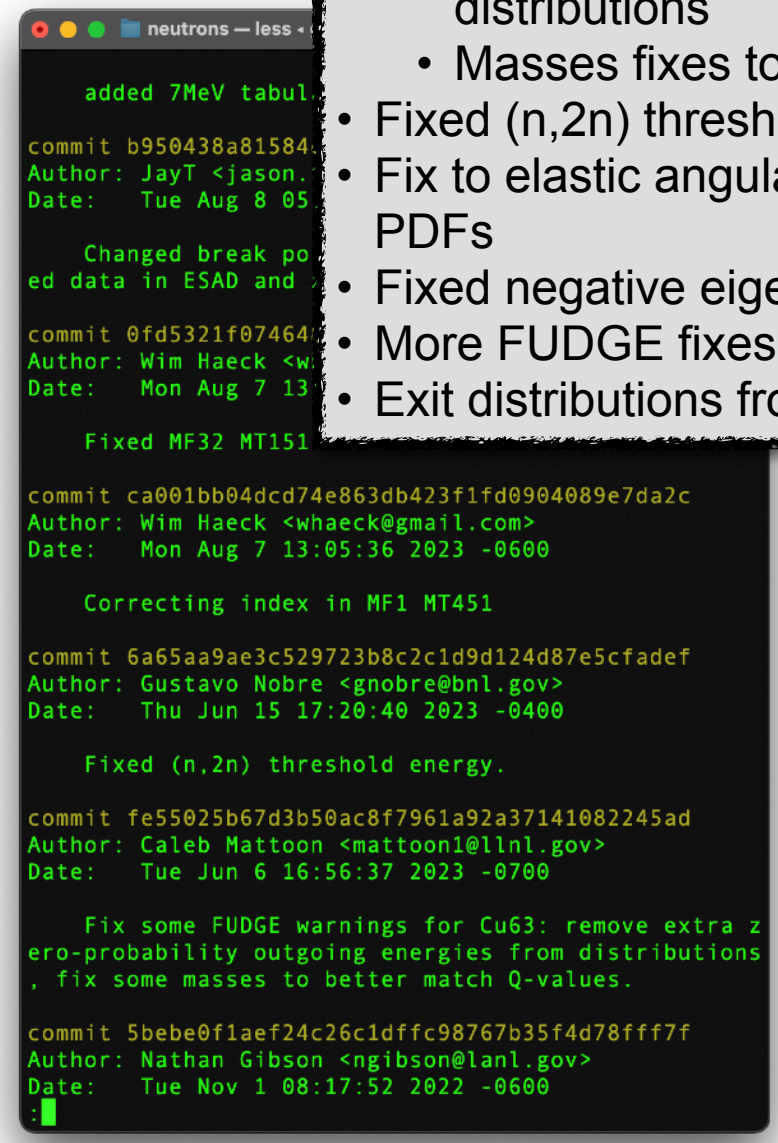
commit cf9e1d276c9ceb751cd895f06eae91c3705e7e42
Author: David Alan Brown <dbrown@bnl.gov>
Date:   Sat Nov 23 11:43:03 2019 -0500

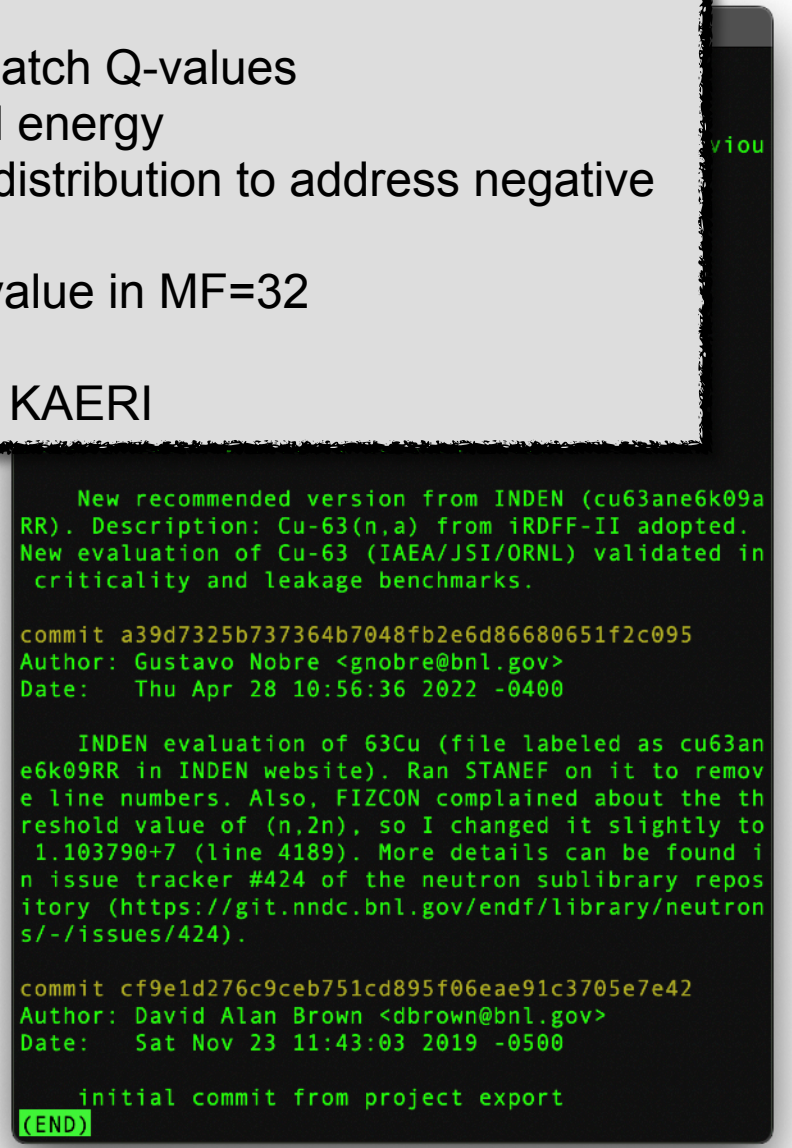
    initial commit from project export
(END)
```

63Cu

- Directory and other minor fixes
- Fixed FUDGE warnings:
  - spurious outgoing energies in some exit distributions
  - Masses fixes to match Q-values
- Fixed (n,2n) threshold energy
- Fix to elastic angular distribution to address negative PDFs
- Fixed negative eigenvalue in MF=32
- More FUDGE fixes
- Exit distributions from KAERI







65Cu

neutrons — less ◂ git log -- n-029_Cu_065.endf — 52×40

```
commit e02cbd6a2fe2fb38f365ec0afb74c176b1c8d850
Author: Caleb Mattoon <mattoon1@llnl.gov>
Date:   Wed Nov 29 13:51:49 2023 -0800

    Minor fix to improve energy balance in MT=749 ph
otons for Cu-65

commit 3550d4bc78c4c7b096584ed8a318ef0d7a75f882
Author: Gustavo Nobre <gnobre@bnl.gov>
Date:   Wed Nov 29 10:02:41 2023 -1000

    Update to 65Cu to include exit distributions fro
m KAERI/LANL. He also
    mentioned fixing some interpolation flags in MF/
MT=6/51-88 that were
    causing CHECKR to crash. File sent
    by H.I. Kim on November 28, 2023.

commit 644c89f286126f722347b6fee70d8f7f6d15aedc
Author: Caleb Mattoon <mattoon1@llnl.gov>
Date:   Thu Nov 2 12:05:08 2023 -0700

    Additional fixes to Cu65 to fix FUDGE warnings:
add unitbase interpolation to MT=5 outgoing product
distributions, update masses to better match tabulat
ed Q-values, minor fix to MT=107 alpha distribution
to improve energy balance

commit b3cd0edd6550ddc5601d12ce494b7ae46e50d31b
Author: Caleb Mattoon <mattoon1@llnl.gov>
Date:   Wed Nov 1 17:05:01 2023 -0700

    Renormalize discrete gammas for MTs 16, 22 and 9
1. Fixes FIZCON warning

commit 6d8d837e3f0f1611b5083a03ec2b1f49557b1557
Author: McDonnell, Jordan <mcdonnelljd@ornl.gov>
Date:   Mon Aug 14 15:17:29 2023 +0000

:
```

neutrons — less ◂ git log -- n-029_Cu_065.endf — 52×40

```
commit 6d8d837e3f0f1611b5083a03ec2b1f49557b1557
Author: McDonnell, Jordan <mcdonnelljd@ornl.gov>
Date:   Mon Aug 14 15:17:29 2023 +0000

    Resolve "Negative Cross Section in 65Cu"

commit 08a98368ad253d85d9b3cde73d74d42c3eaa7c5a
Author: Wim Haeck <whaeck@gmail.com>
Date:   Mon Aug 7 13:58:09 2023 -0600

    Fixed MF32 MT151

commit a32e056f8e484b0cdd1aa87c7c605457322a8097
Author: Caleb Mattoon <mattoon1@llnl.gov>
Date:   Tue Jun 6 17:06:19 2023 -0700

    Fix some FUDGE warnings for Cu65: remove extra z
ero-probability outgoing energies from distributions
, fix (n,2n) threshold.

commit 9155cd6b6d62fa406486ae0f34b789bf04348369
Author: Nathan Gibson <ngibson@lanl.gov>
Date:   Tue Sep 20 09:27:54 2022 -0600

    Updated directory for n-029_Cu_065.endf; previou
sly, directory items had incorrect NC values.

commit 27971dcf0123dc80b397591fef681b6bd20ffc26
Author: Gustavo Nobre <gnobre@bnl.gov>
Date:   Wed Sep 7 10:45:56 2022 -0400

    Ran dos2unix and removed line numbers from 65Cu
file.

commit 74cb841b4228a7f2b3f7d85f01974c28a67ffc62
Author: Gustavo Nobre <gnobre@bnl.gov>
Date:   Wed Sep 7 10:37:31 2022 -0400

    New version of the INDEN 65Cu file, correspondin
:
```

neutrons — less ◂ git log -- n-029_Cu_065.endf — 52×40

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Author: Gustavo Nobre <gnobre@bnl.gov>
Date:   Wed Sep 7 10:37:31 2022 -0400

    New version of the INDEN 65Cu file, correspondin
g to cu65ane5k05 in IAEA labeling, published in thei
r website on 09-May-2022. Their log reads "(recommen
ded) New evaluation of Cu-65 (IAEA/JSI/ORNL) validat
ed in criticality and leakage benchmarks"

commit cdb3b342880e3650f52b376eac76de26b2befa89
Author: Gustavo Nobre <gnobre@bnl.gov>
Date:   Fri Apr 29 11:34:13 2022 -0400

    INDEN evaluation of 65Cu (file labeled as cu65an
e5k02 in INDEN website). Ran STANEF on it to remove
line numbers. Also, FIZCON points out errors in the
(n,2n) channel in MF=6 (SECTION DOES NOT SPAN THE SA
ME ENERGY RANGE AS FILE   3, MT=  16). This still ne
eds to be fixed. More details can be found in issue
tracker #424 of the neutron sublibrary repository (h
ttps://git.nndc.bnl.gov/endf/library/neutrons/-/issu
es/424).

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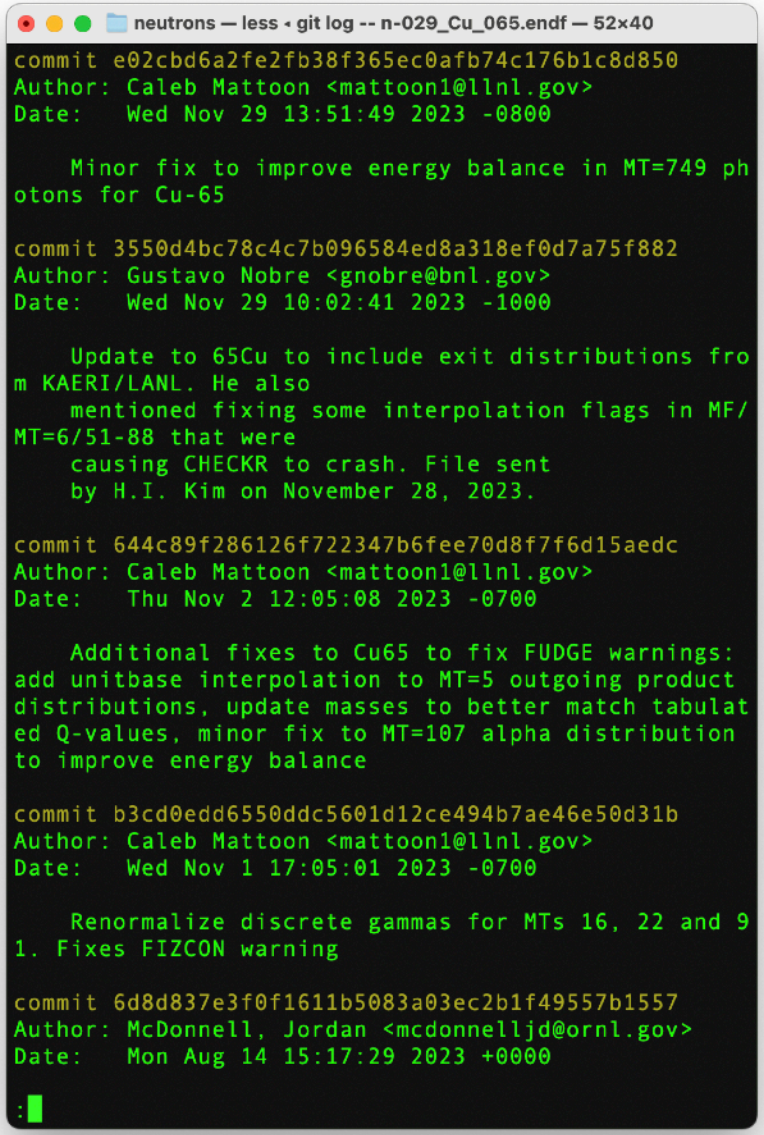

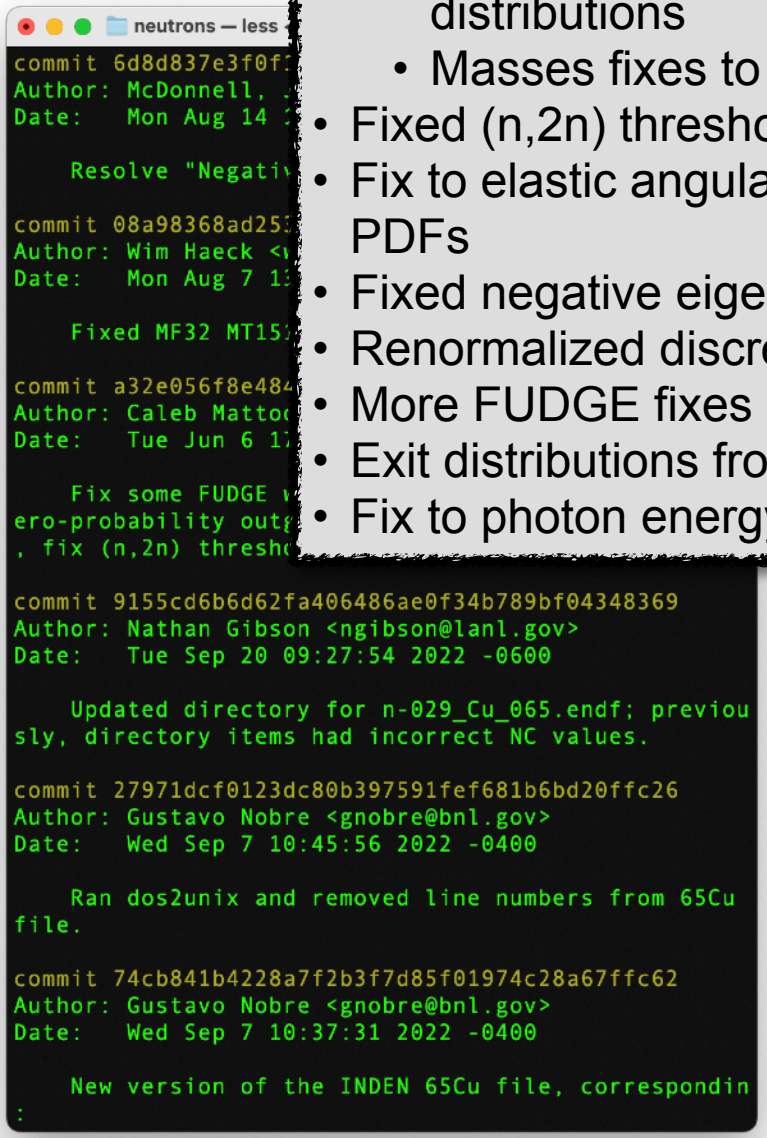

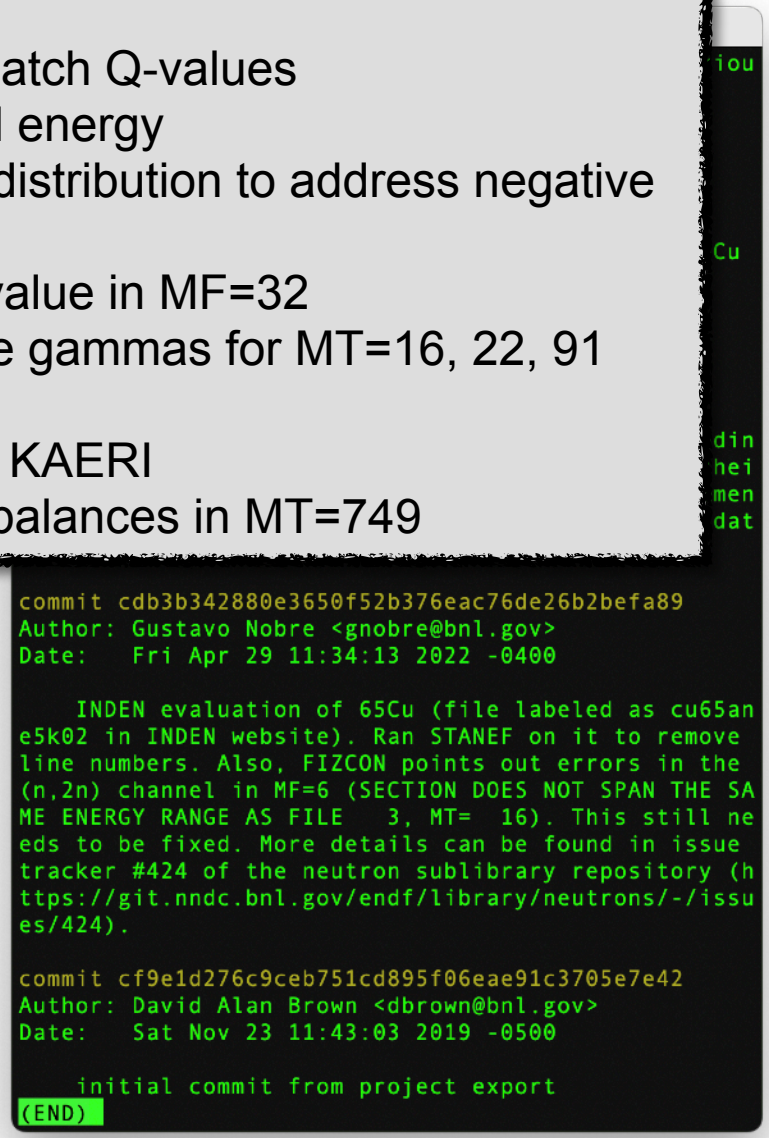

Release Timeline

Release timeline

ENDF/B VIII.1

Feb 2023
- Covariances ready for validation

25-27 Apr 2023
- Mini-CSEWG - LLNL
- 28 April: Classified day

Apr 15 2023
- 1st iteration of text for paper due

Aug 1 2023
- Deadline for draft text and figures for Big Paper

Aug 4 2023
- Release of Beta2

Feb 2024
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Apr-May 2024
- Paper is published

2023

2024

Apr 18 2023
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Dec 2023
- Release of Beta3
- **Freeze** list of files changed
- **Freeze** mean values and benchmark results

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- Release first beta version for general testing, containing updates for neutrons (^{239}Pu, INDEN, et al.), alphas, FPY

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ENDF/B VIII.1

- Cov

- **Challenges:**
  - Burnup/criticality balance in Pu
  - Performance issues with Pb, ^{9}Be, ^{233}U
  - Conflicting evaluations
  - A few last-minute unplanned contributions
- "*We're **not** in a hurry for the **wrong** answer*"
- Always good to not underestimate the importance of due diligent tests:
  - Validation turnaround time of 2-3 months

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and

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Mini-CSEWG

- Spring
- Virtual (?)
- Review Beta3 validation results
- Bless release

Future plans

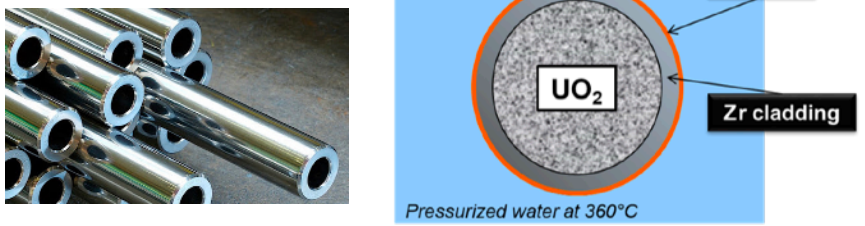
… or, There must be life after VIII.1!

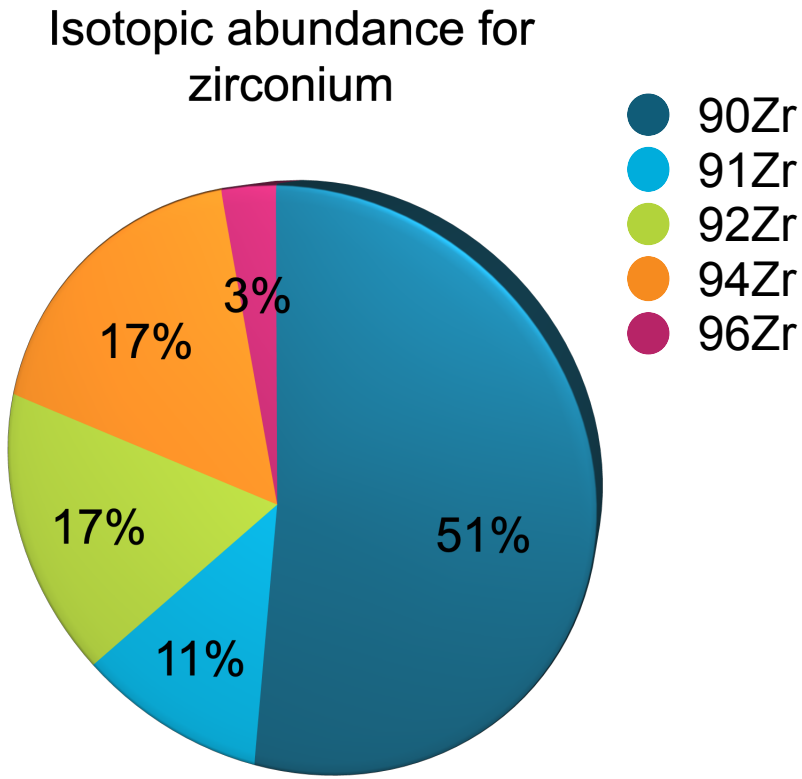
Next evaluations planned at BNL

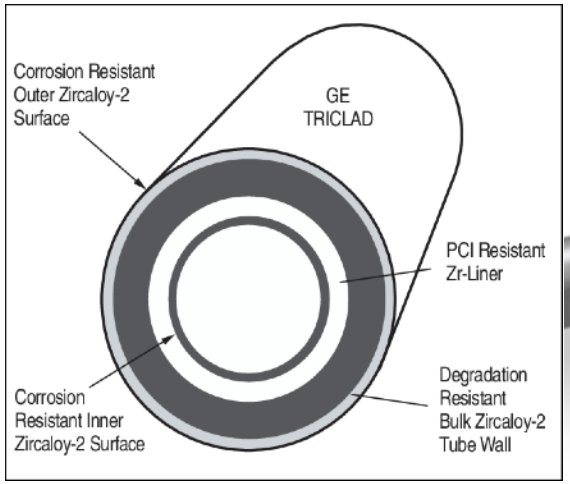
- After CIELO Fe evaluation, we did a study of which isotopes had measured data that were more recent than the last evaluation (at that time)
- Focusing on structural materials, we came up with a list of potential priorities for re-evaluations: Cr, Al, Zr, Ni, Ti, V, Co…
- Those conclusions remain more or less valid
- After finishing Cr, the natural next one would be Zr:
    - Improvement in benchmarks
    - Leveraging collaboration and experience gained with Fe, Cr

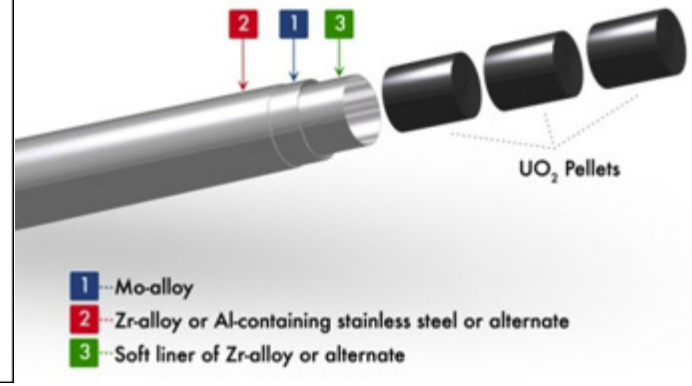
Introduction

- Other structural materials have been recently re-evaluated:
  - Fe (IAEA, JSI, BNL)
  - Cr (BNL, ORNL, IAEA, JSI)
  - Cu (LANL,ORNL)
- Applications:
  - Cladding
  - Zircaloy
  - Zirconium-Niobium alloy
  - Zirconium is used in fuel rods cladding due to its corrosion-resistance and low thermal neutron absorption cross-section. It is also considered in advanced reactor design studies as a moderator (in the form of zirconium hydride) and as inert matrix fuel material. The ENDF/B-VI.8 files evaluated in the 1970's relied heavily on experimental data and lacked quantities such as double-differential cross sections and gamma production.









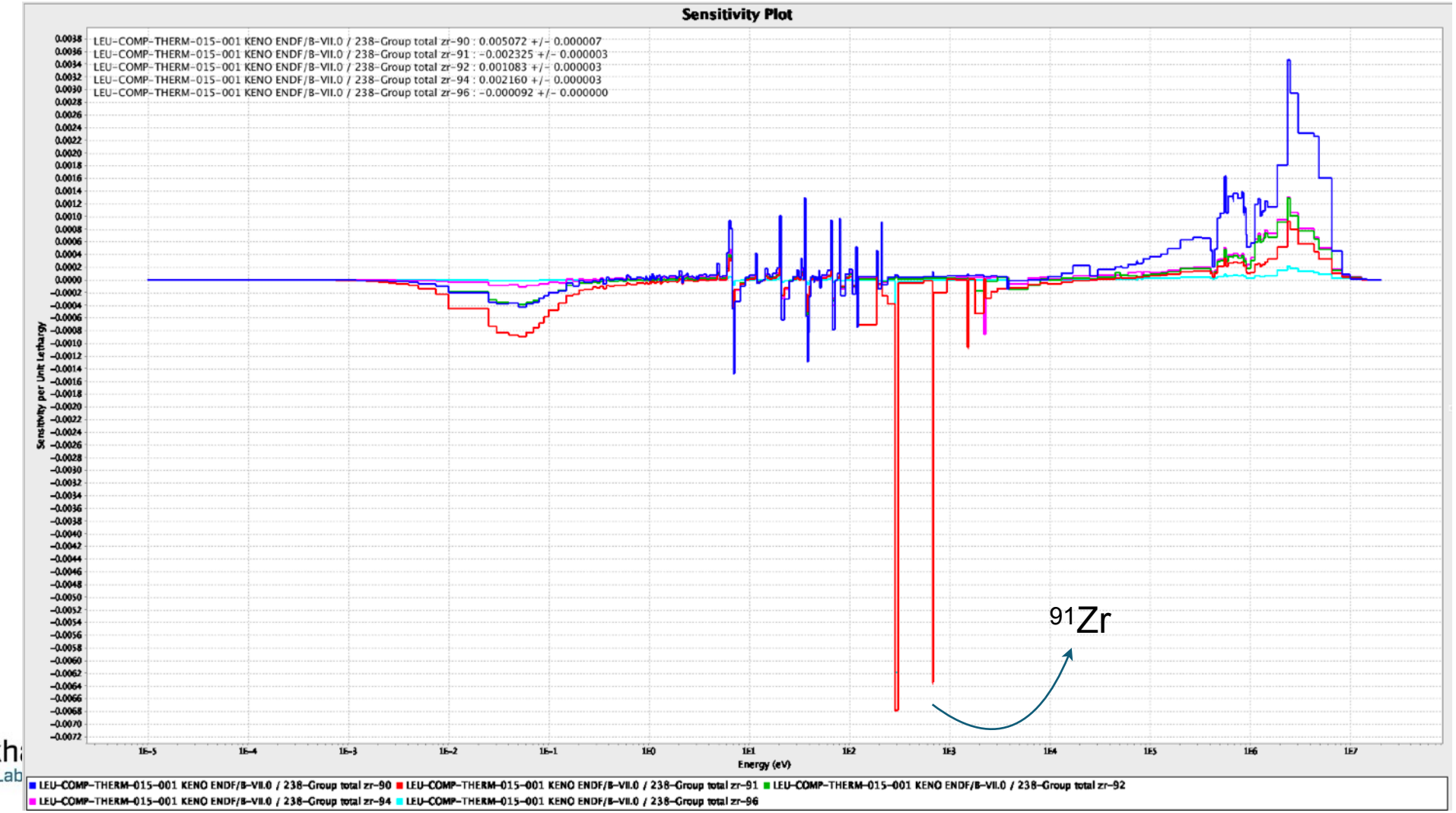
Brookhaven National Laboratory

Critical benchmarks sensitive to Zr

Searched DICE, critical/subcritical benchmarks sensitive to Zircalloy and Zirconium-Niobium Alloy

- LCT-015-001 — LCT-015-165
- LCT-020-001 — LCT-020-007
- LCT-021-001 — LCT-021-006
- LCT-026-001 — LCT-026-006
- LCT-030-001 — LCT-030-012
- LCT-031-001 — LCT-031-006
- LCT-036-001 — LCT-036-069
- LCT-053-001 — LCT-053-014
- LCT-060-001 — LCT-060-026
- LCT-061-001 — LCT-061-010
- LCT-064-001 — LCT-061-007
- LCT-070-001 — LCT-070-012
- LCT-071-001 — LCT-071-004
- LCT-072-001 — LCT-072-009
- LCT-073-001 — LCT-073-014
- LCT-075-001 — LCT-075-006
- LCT-079-001 — LCT-079-010
- LCT-081-001
- LCT-085-001 — LCT-085-013
- LCT-087-001 — LCT-087-025
- LCT-094-001 — LCT-094-011
- LMT-001-001 — LMT-001-005
- LMT-002-001 — LMT-002-006
- LMT-003-001 — LMT-003-015
- LMT-005-001 — LMT-005-012
- LMT-006-001 — LMT-006-010
- LMT-007-001 — LMT-007-012
- UCT-001-002 — UCT-001-004
- UCT-004-001
- MCT-002-001 — MCT-002-006
- MCT-004-001 — MCT-004-011
- MCT-006-001 — MCT-006-050
- MCT-007-001 — MCT-007-027
- MCT-008-001 — MCT-008-028

Critical benchmarks sensitive to Zr



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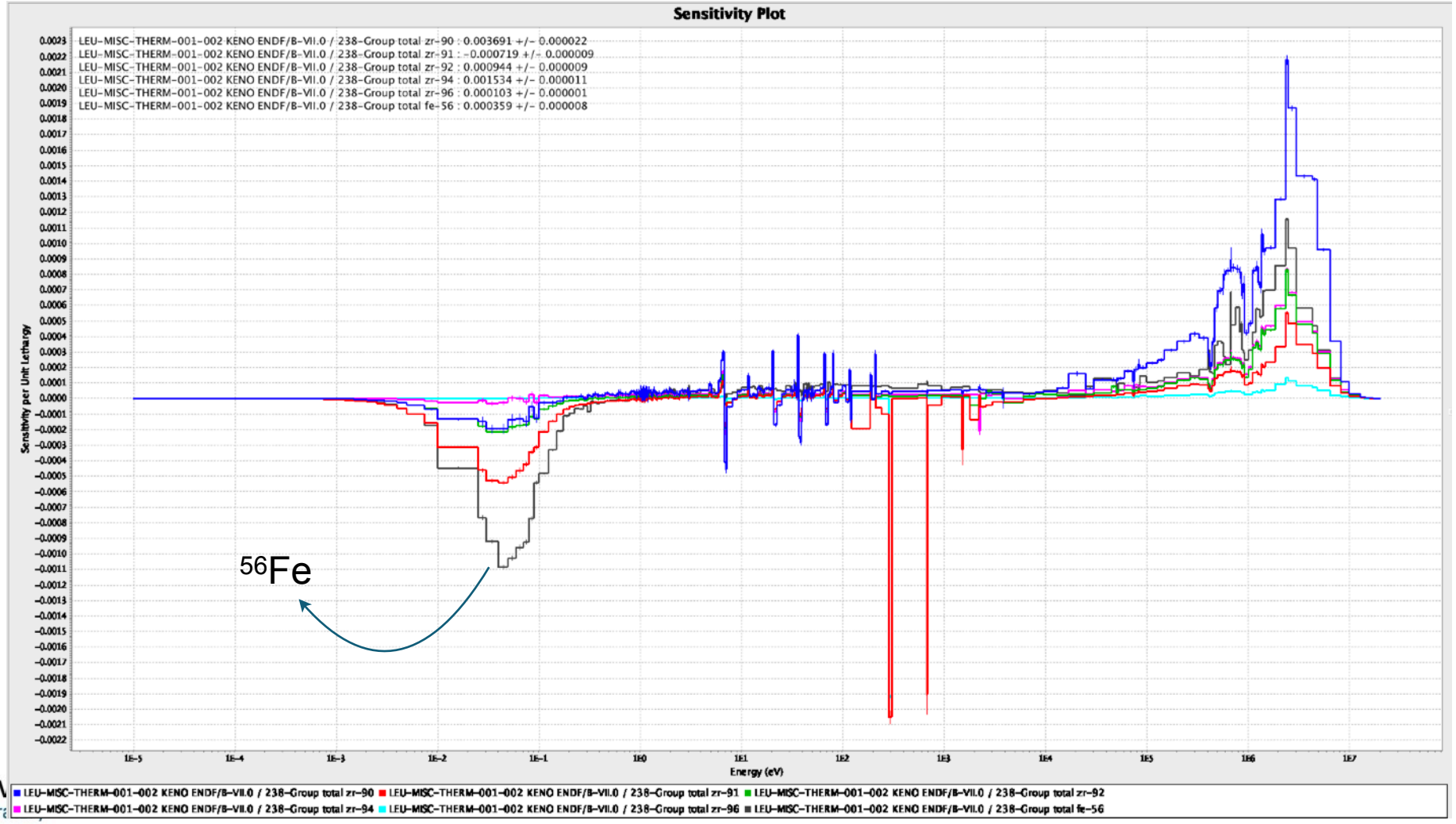
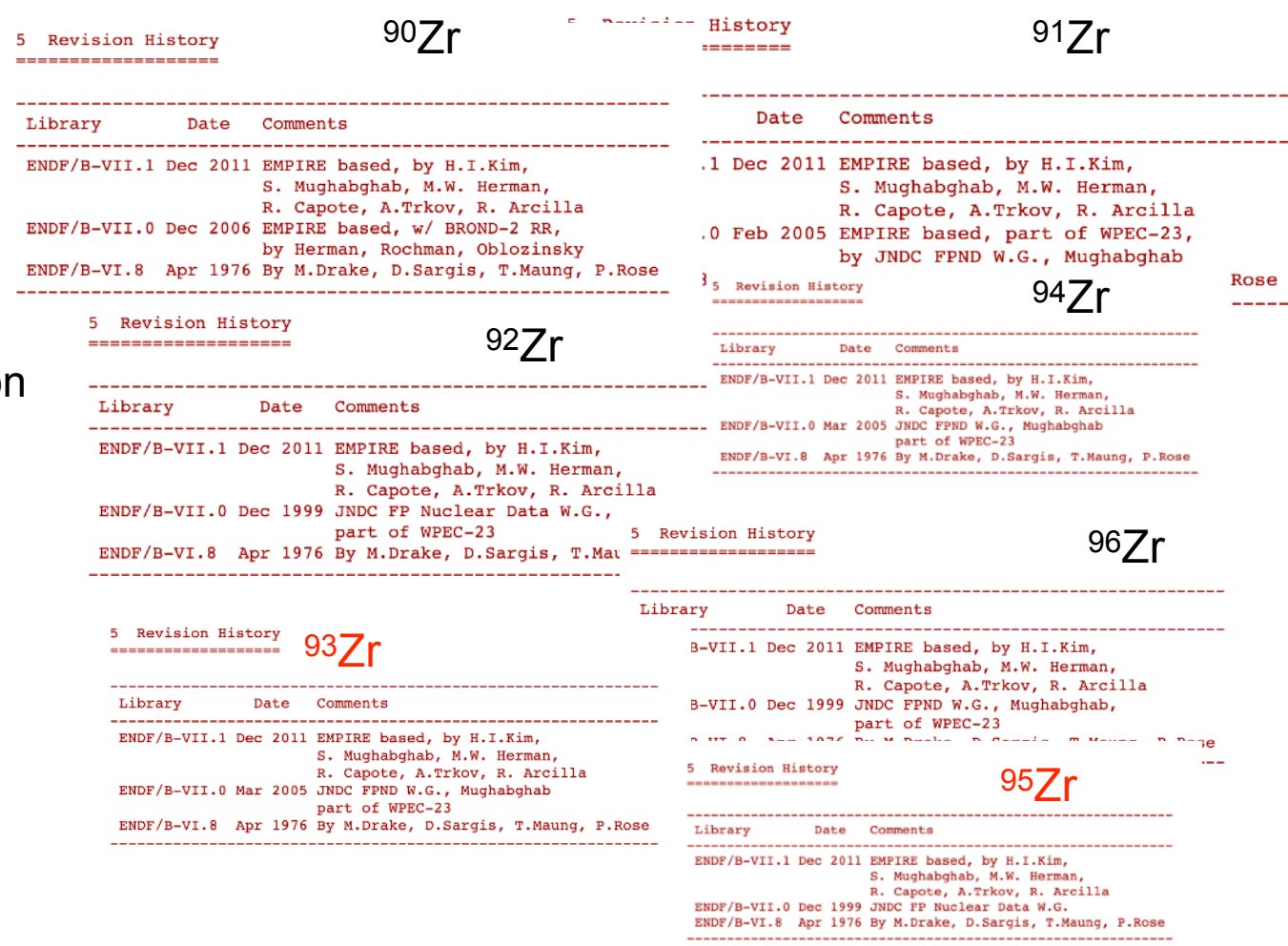


History lesson

- All isotopes have more or less the same history:
  - VI.8: Eval. by Drake et al. (1976) - relied heavily on exp. data and lacked quantities such as double-differential cross sections and gamma production
  - VII.0: Basically EMPIRE based with some other contributions (~2006,1999)
  - VII.1: H.I. Kim's evaluation (2011)
- Kim's evaluation was a long and winding road….
  - Resonances from S. Mughabghab
  - EMPIRE-based, with soft-rotor OMP (for ^{90}Zr, not clear about the other isotopes)
  - Tuning of total x.s. to fit fluctuations
  - Kim had to leave and Dave inherited it just a few months before library release
  - Dave replaced EMPIRE ang. dist. by JENDL ones.
  - Roberto tweaked LDs



- Dave worked further on Zr in 2012 but had to stop when he became library manager
- Gustavo started working on Zr again a couple of years ago but had to stop, again library manager

Brookhaven National Laboratory

Current status of Zr

- **The original plan**: Measurements at GEEL, resonance evaluations by RPI
- Challenge: All GEEL activity for new measurements is suspended.
- Current status of experimental isotopic measurements and evaluation in the resonance region (see Yaron Danon's talk) :

- 90Zr:
  - Measurements
  - Evaluation
- 91Zr:
  - Measurements
  - Evaluation
- 92Zr:
  - Measurements
  - Evaluation
- 94Zr:
  - Measurements
  - Evaluation
- 96Zr:
  - Measurements
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Current status of Zr

- **The original plan**: Measurements at GEEL, resonance evaluations by RPI
- Challenge: All GEEL activity for new measurements is suspended.
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Brookhaven National Laboratory

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Brookhaven National Laboratory

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    - New release of EMPIRE coming soon: which should make the life of a beginner a bit easier…

The plan - Fast region

- Good starting point from previous EMPIRE input files but not perfect:
  - Definition of NLD parameters have changed since 2011 so they will have to be refitted - I already began this
  - There are some new data since then
  - Need to assess which measurements to consider from older data sets
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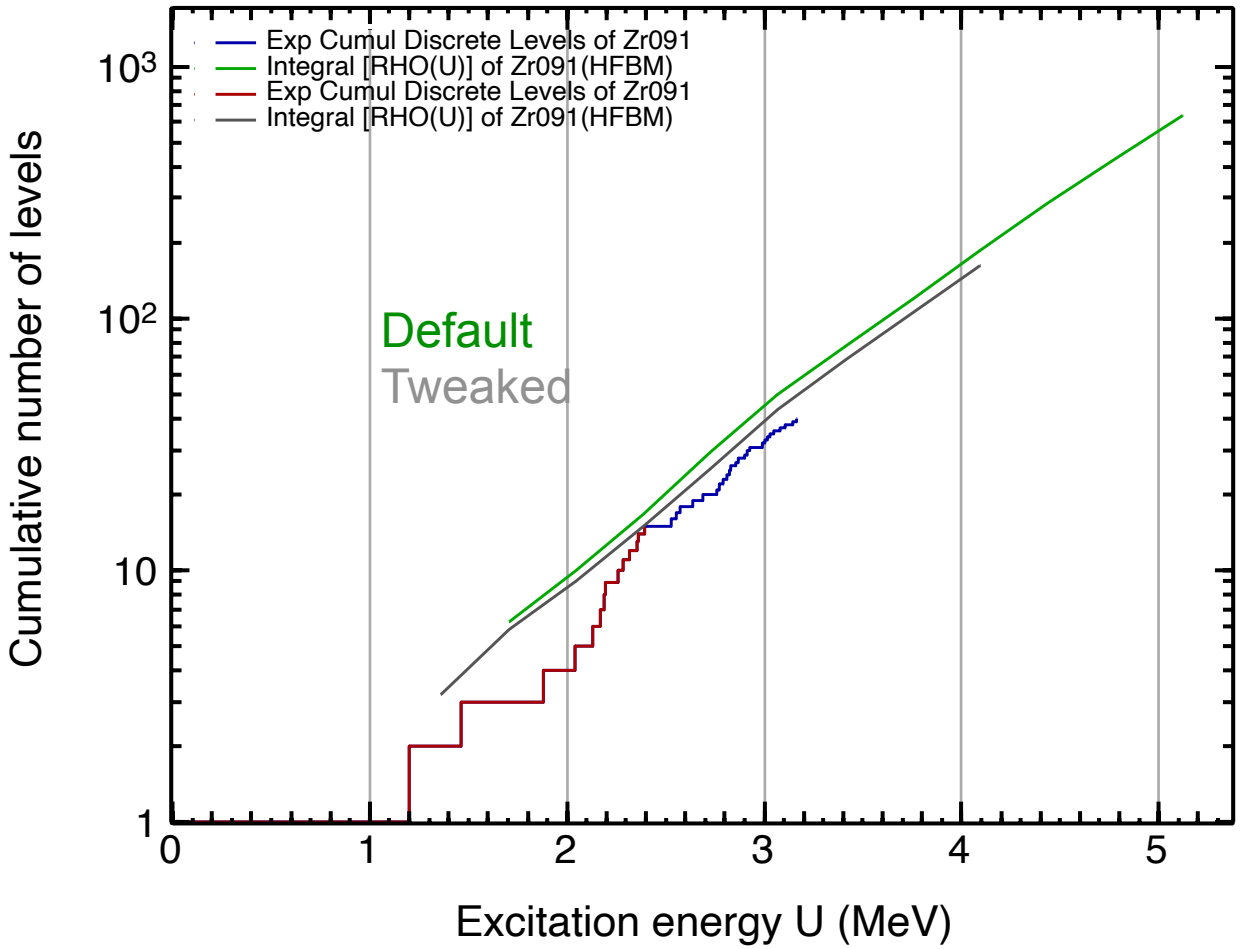
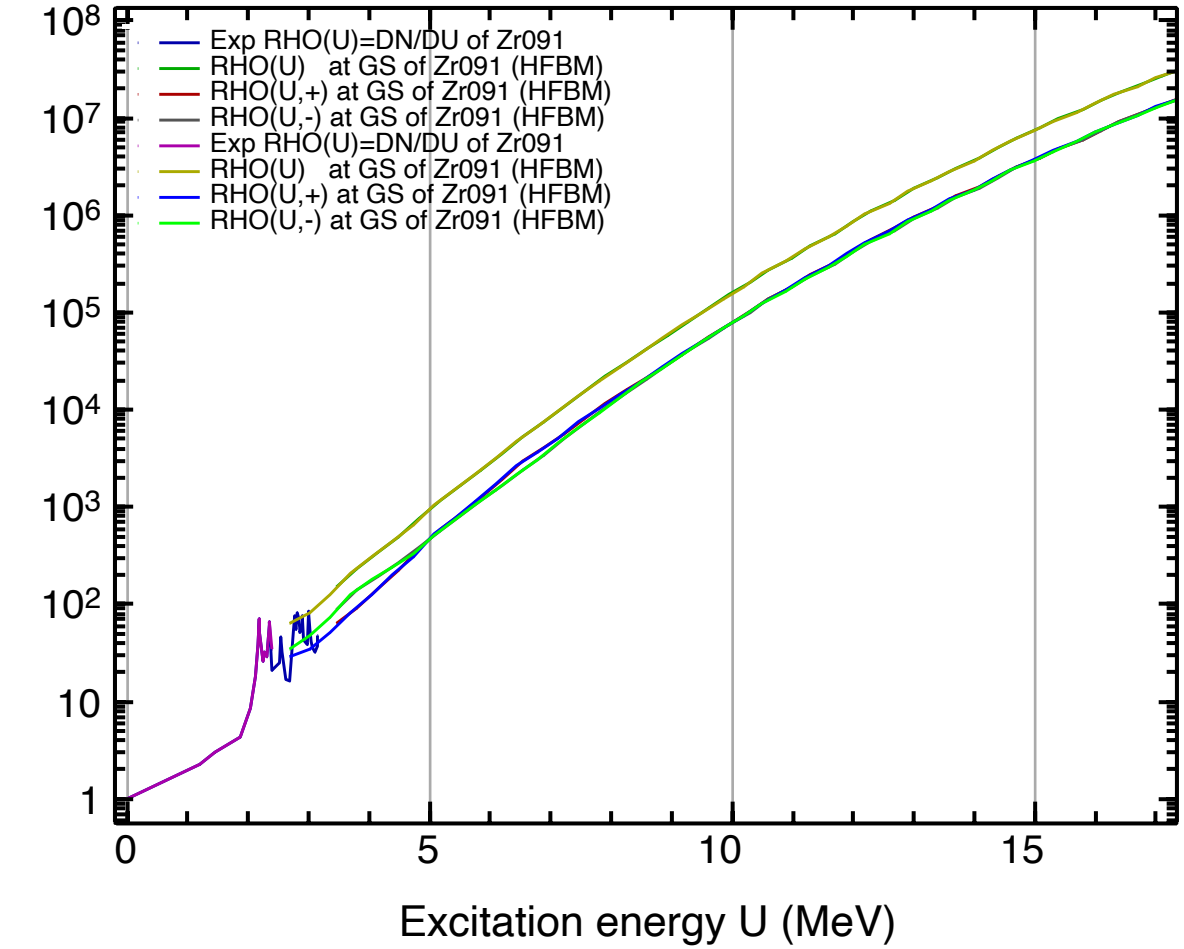
Note: We will also combine efforts from Devin Barry, Dave Brown, and possibly ORNL to work on **URR**

Preliminary level-density fits





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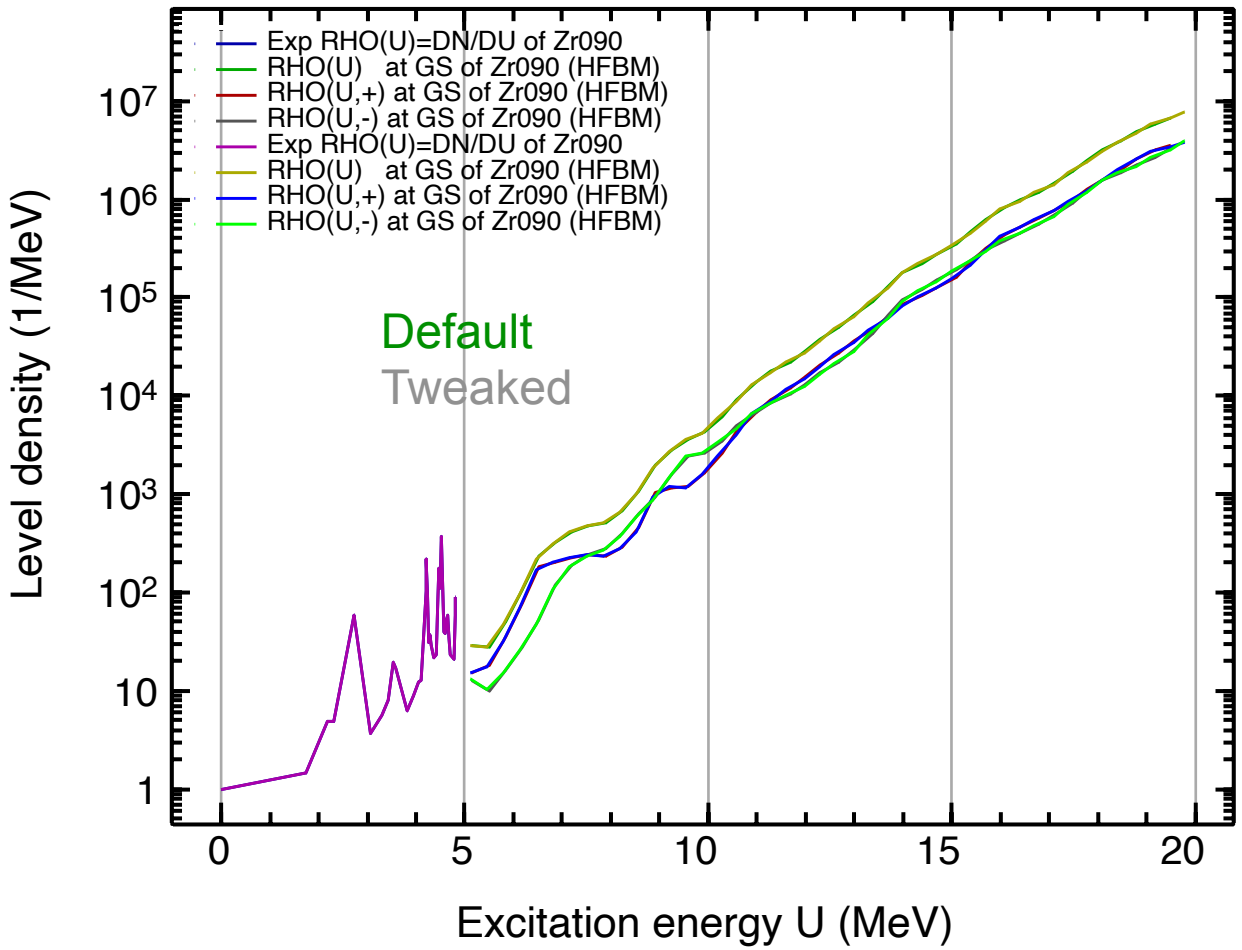

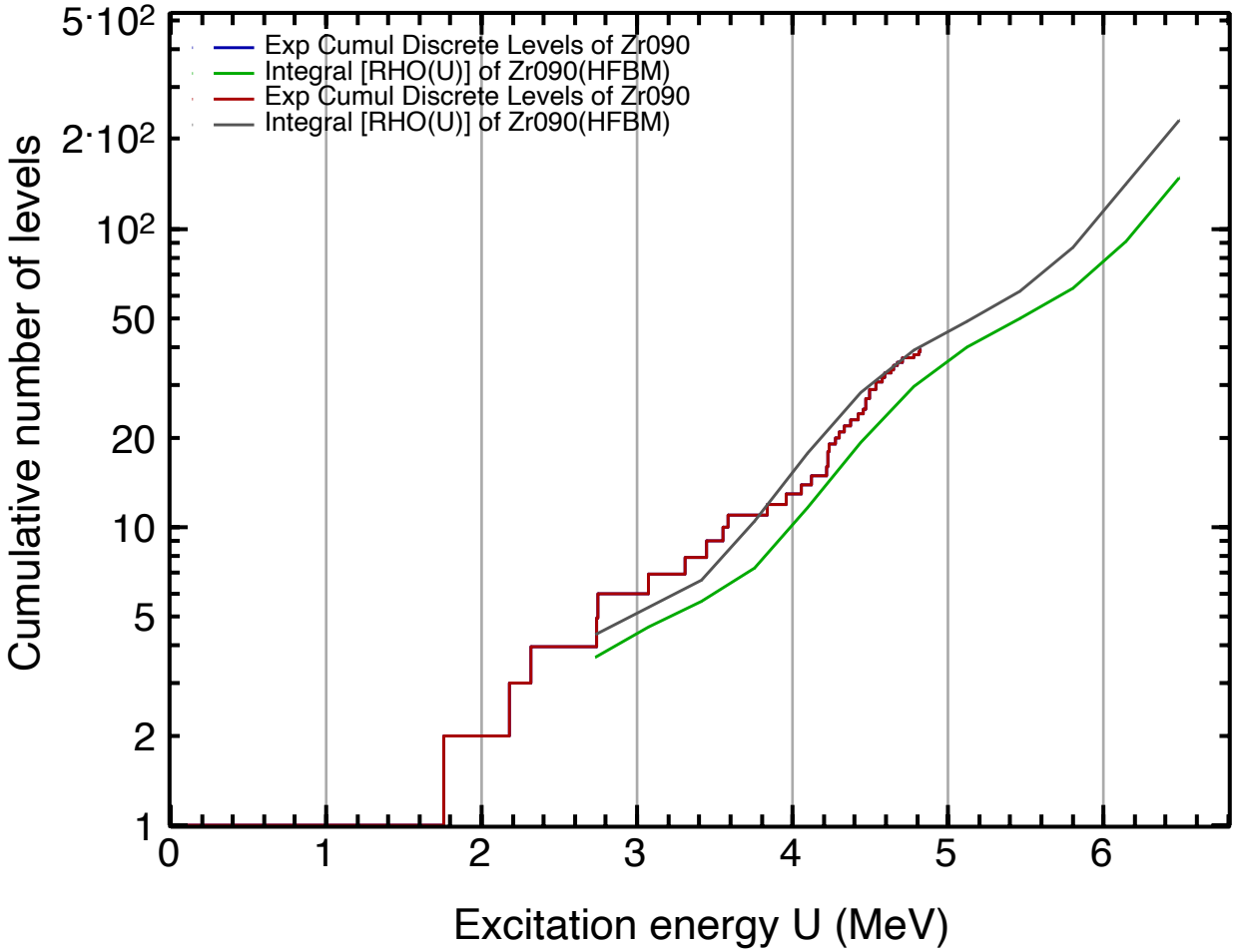

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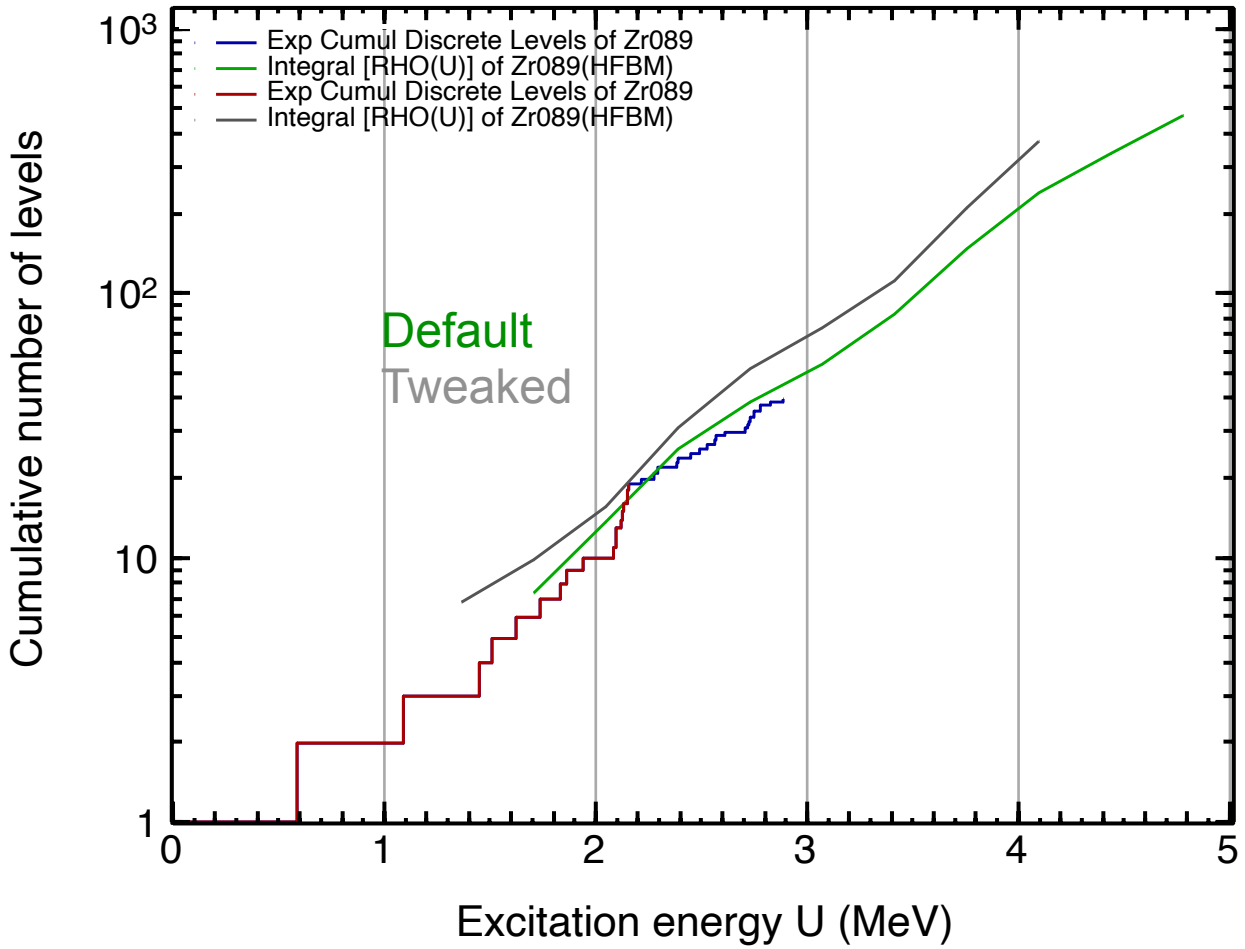

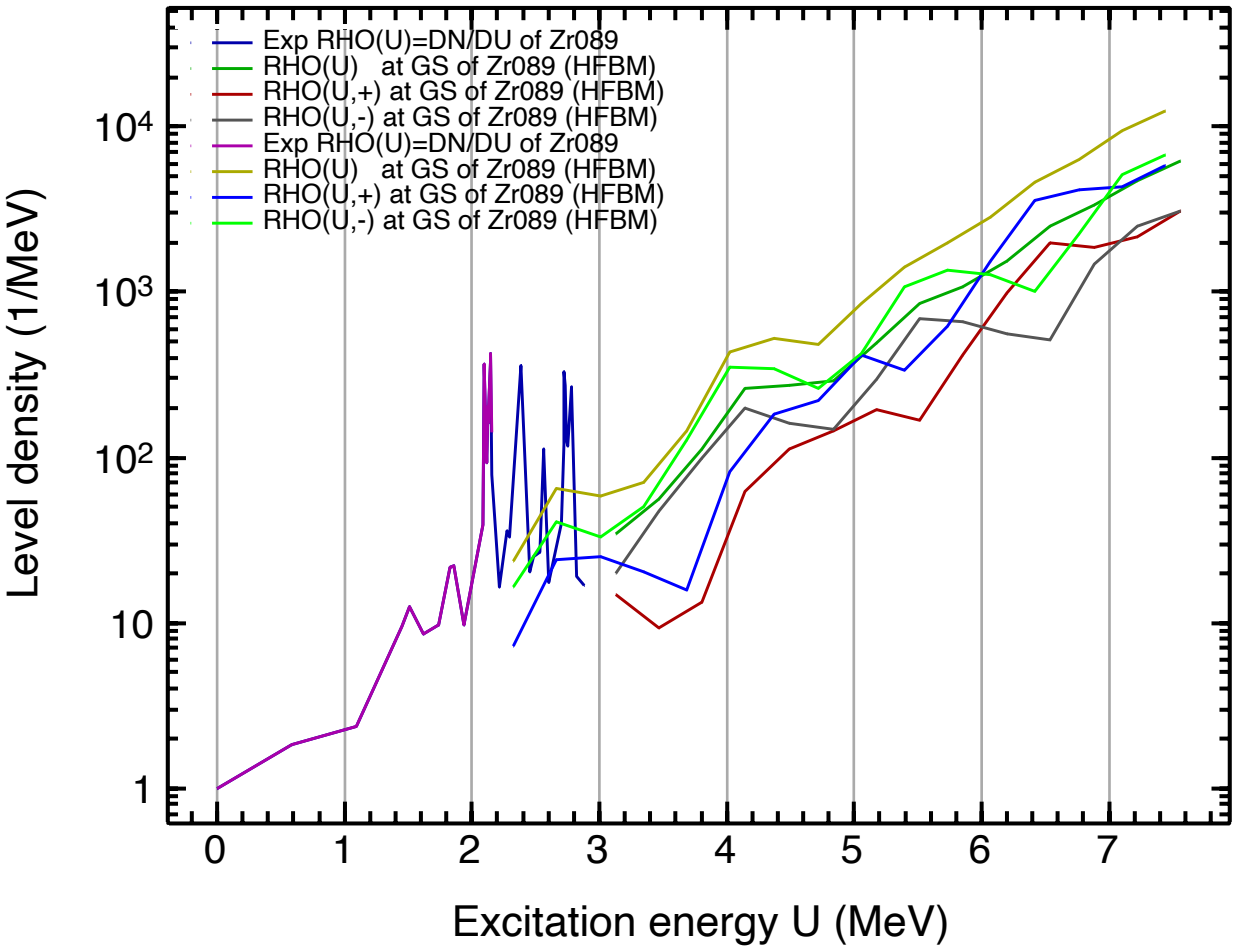

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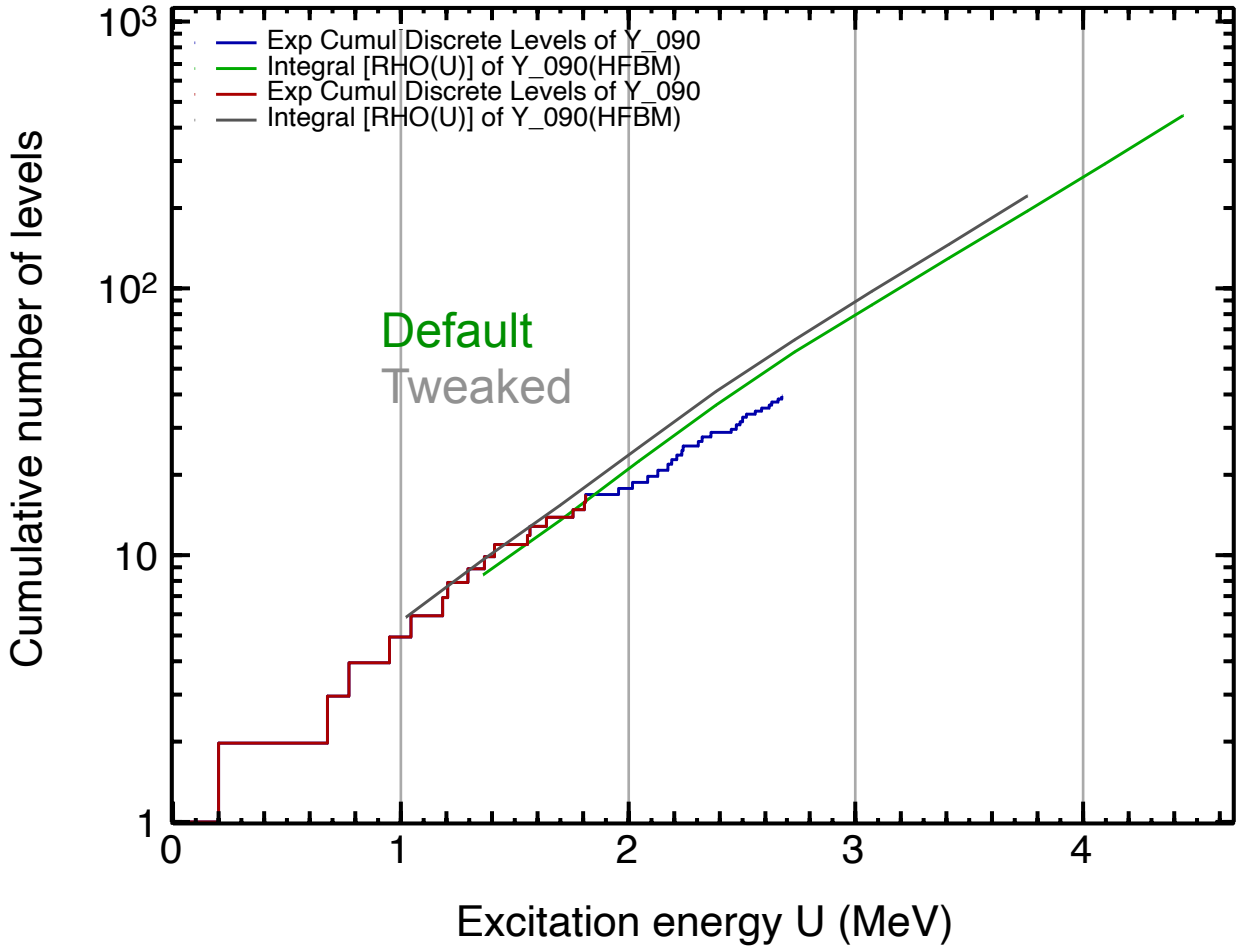

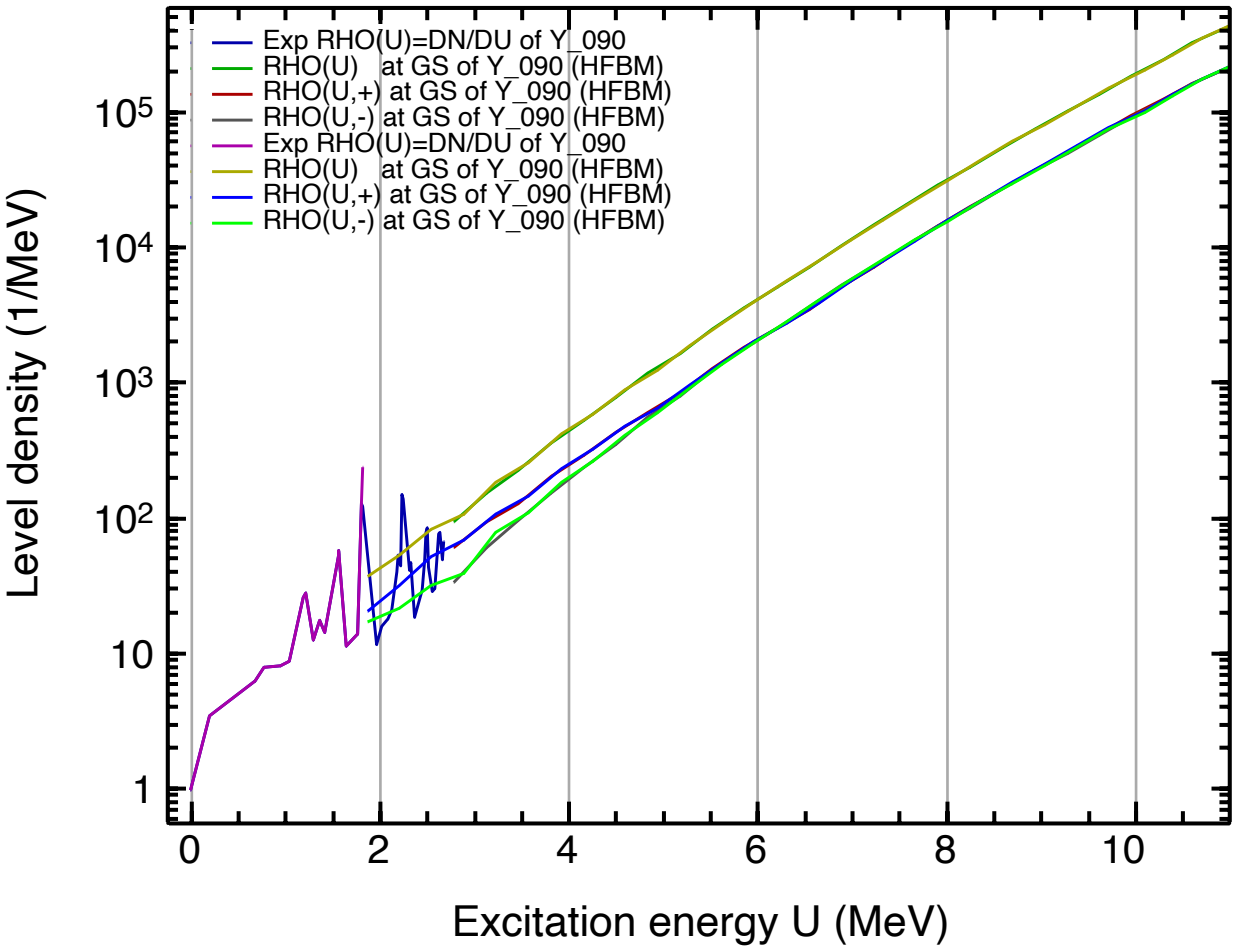

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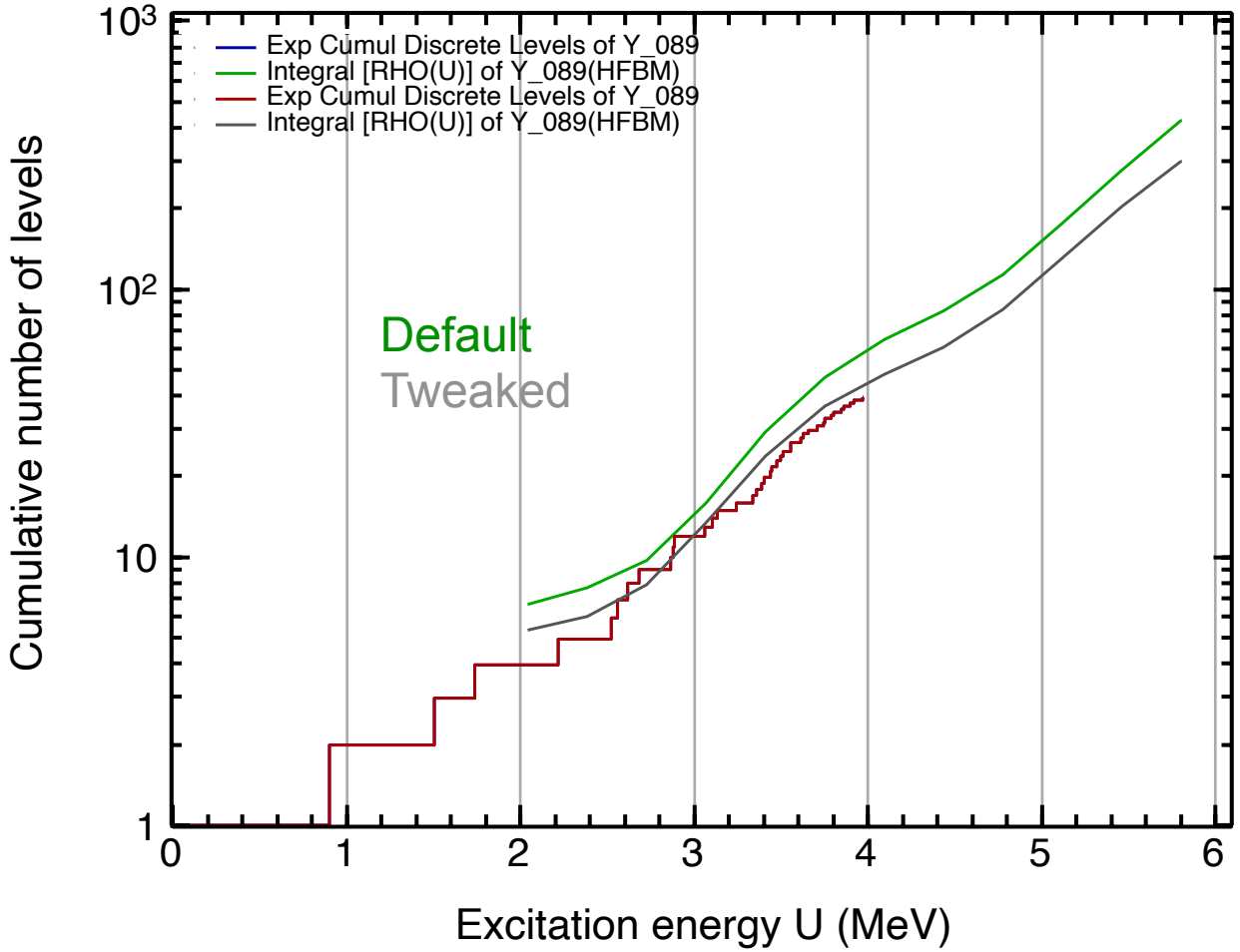
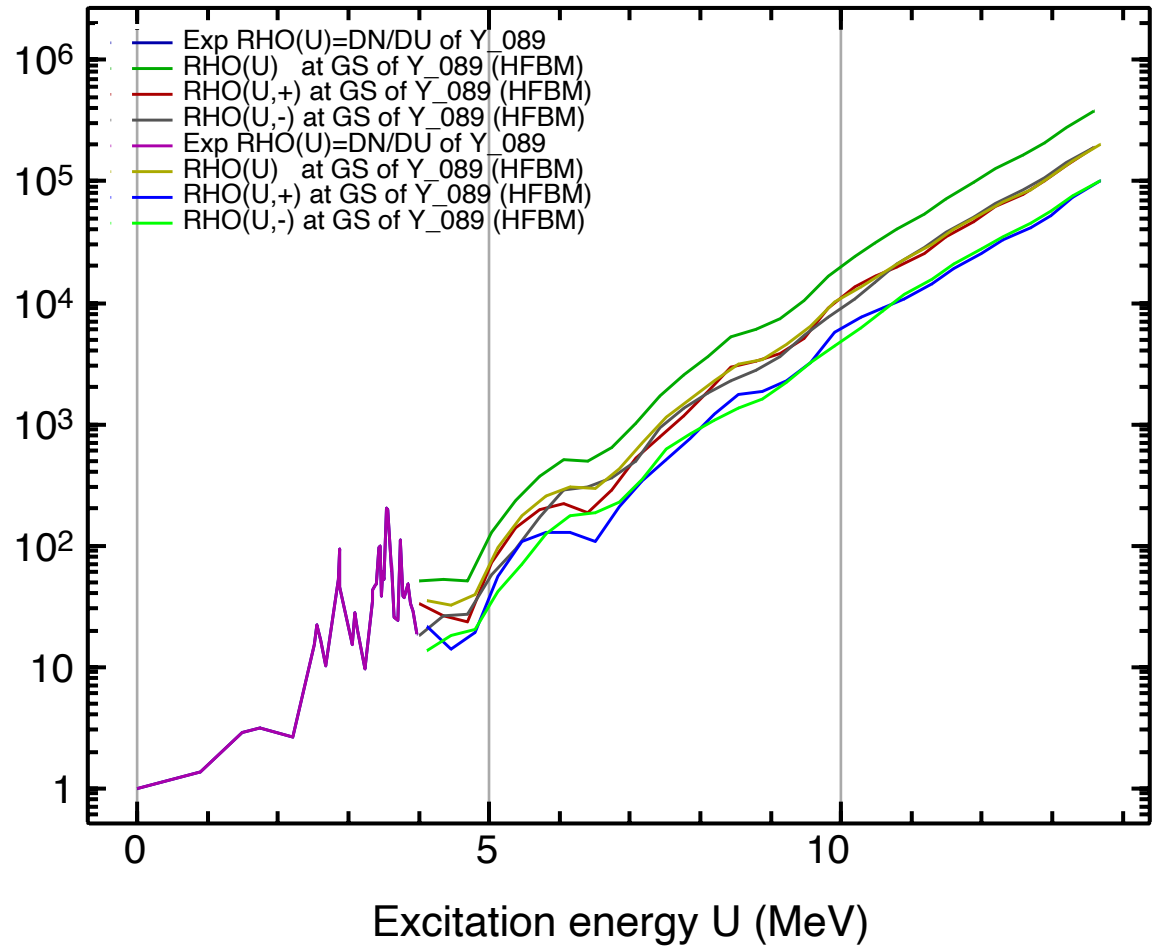
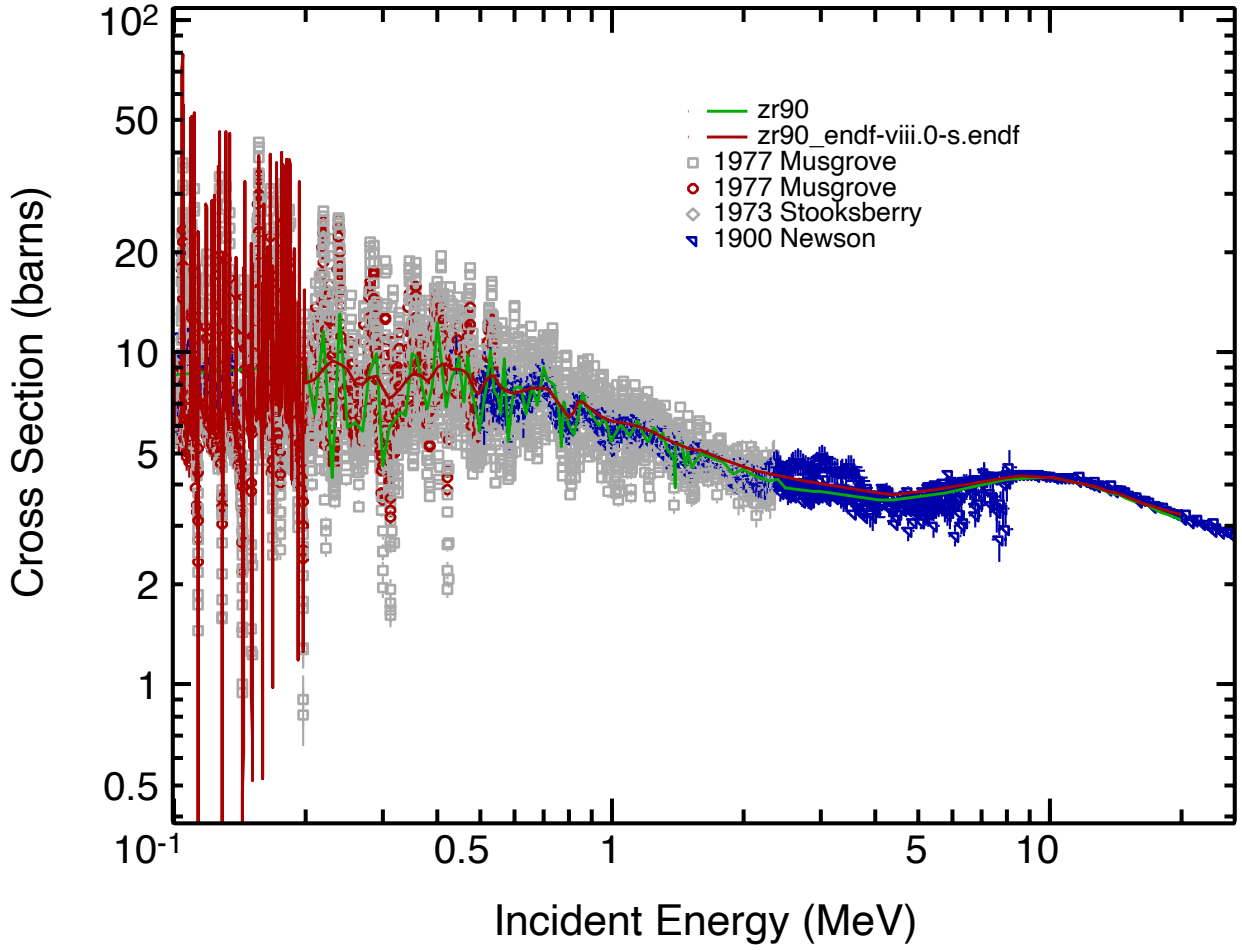
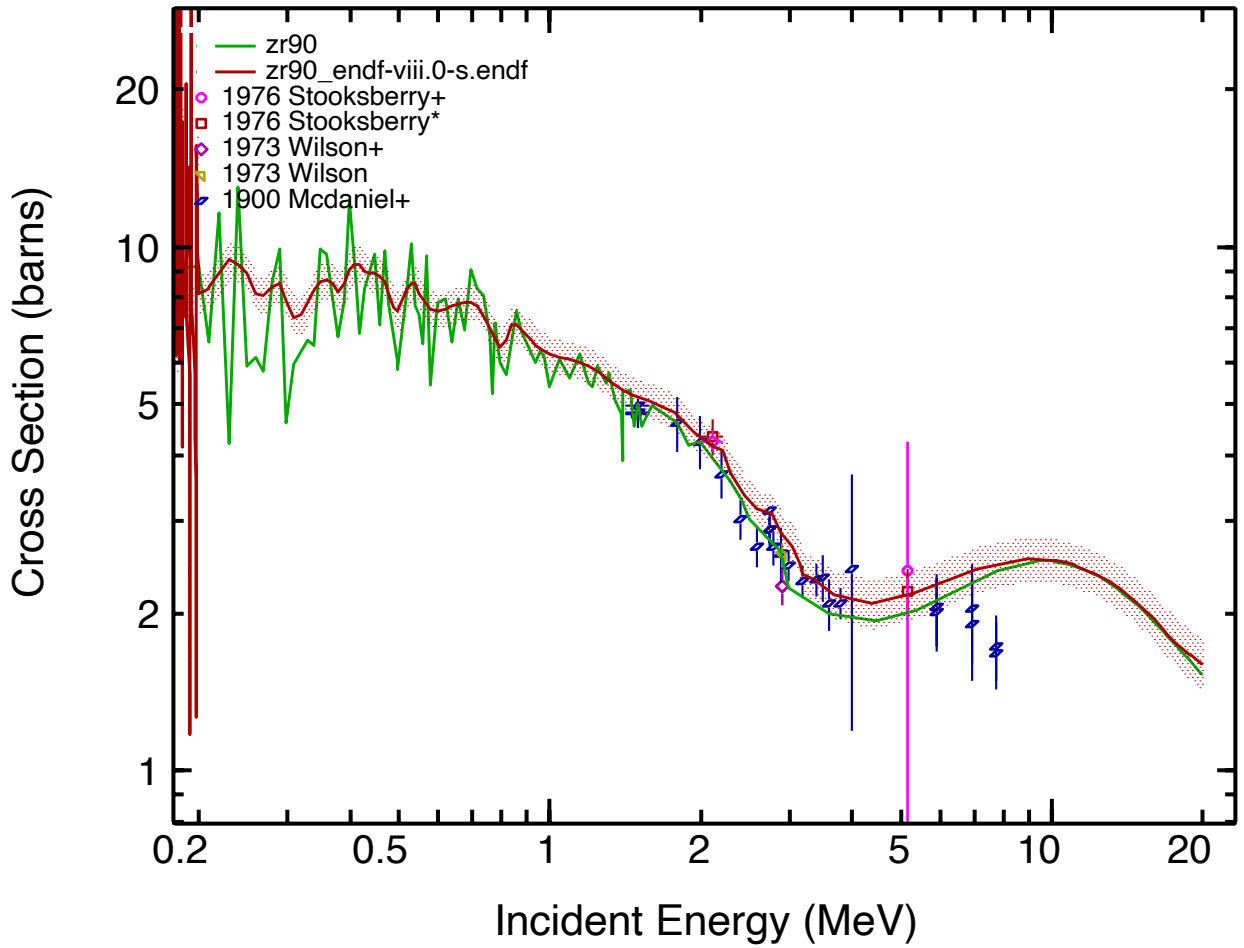




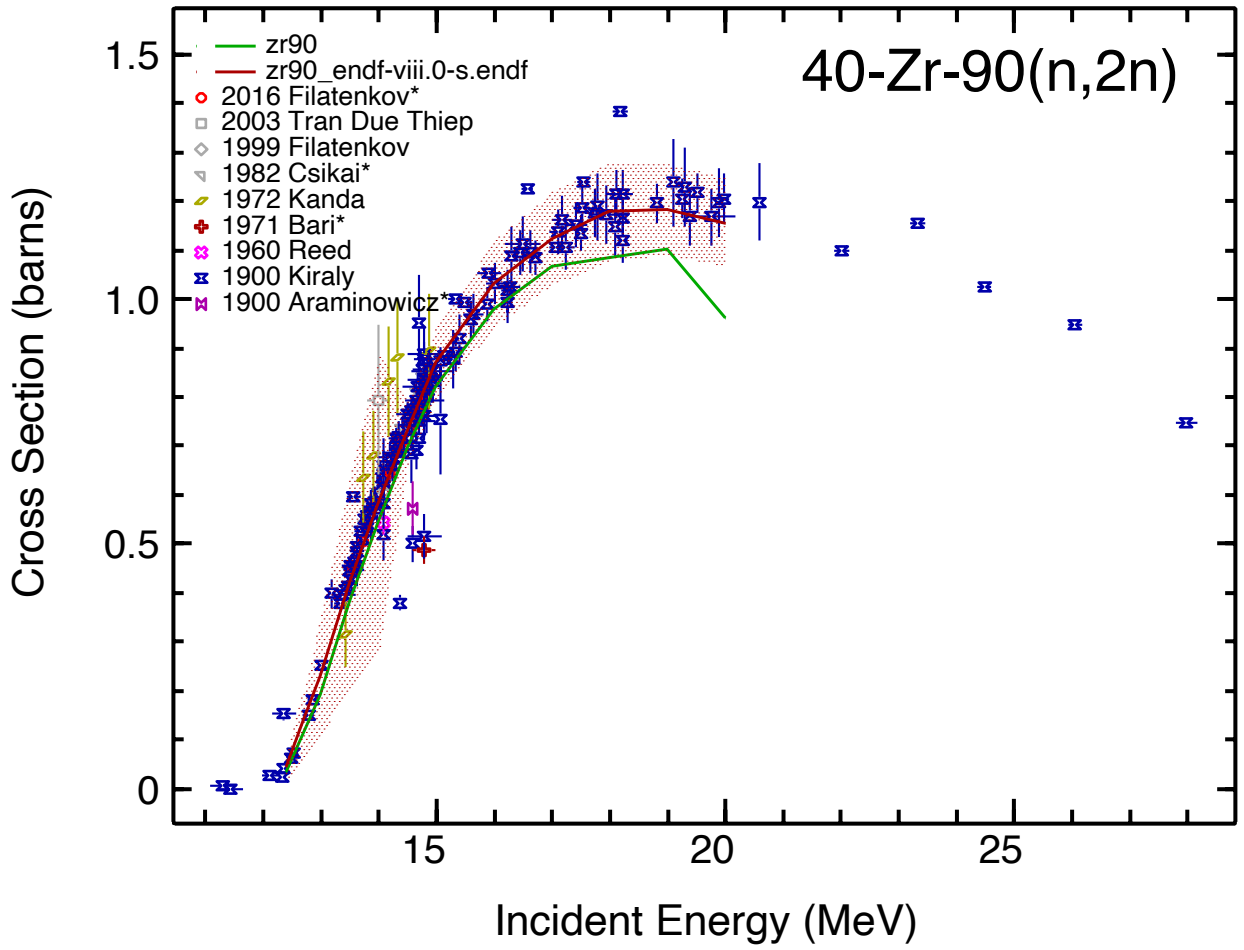
Some plots…


zr90
zr90_endf-viii.0-s.endf
1977 Musgrove
1977 Musgrove
1973 Stooksberry
1900 Newson
Cross Section (barns)
Incident Energy (MeV)
10^2
50
20
10
5
2
1
0.5
10^-1
0.5
1
5
10

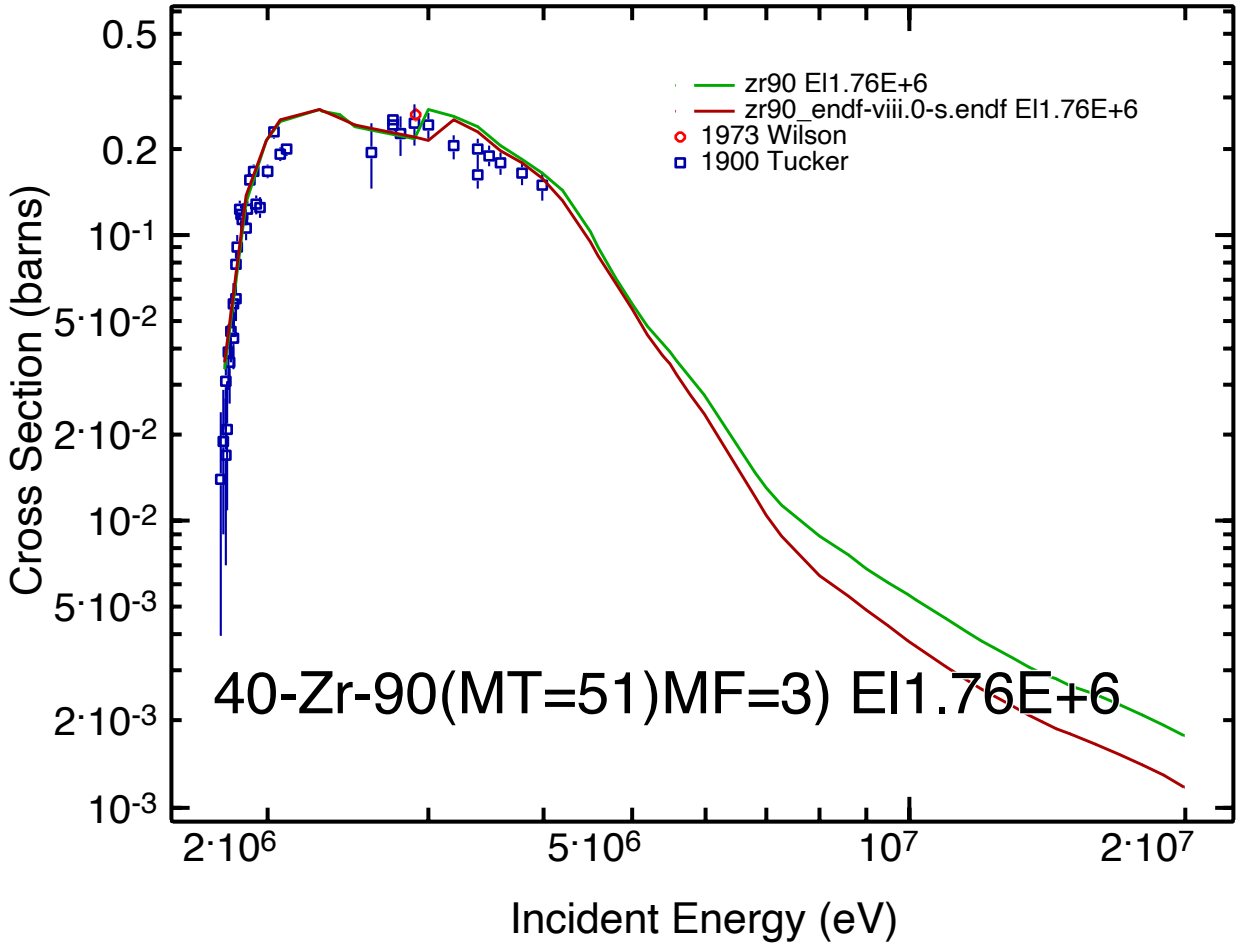
Some plots…


zr90
zr90_endf-viii.0-s.endf
1976 Stooksberry+
1976 Stooksberry*
1973 Wilson+
1973 Wilson
1900 Mcdaniel+
Cross Section (barns)
20
10
5
2
1
0.2
0.5
1
2
5
10
20
Incident Energy (MeV)

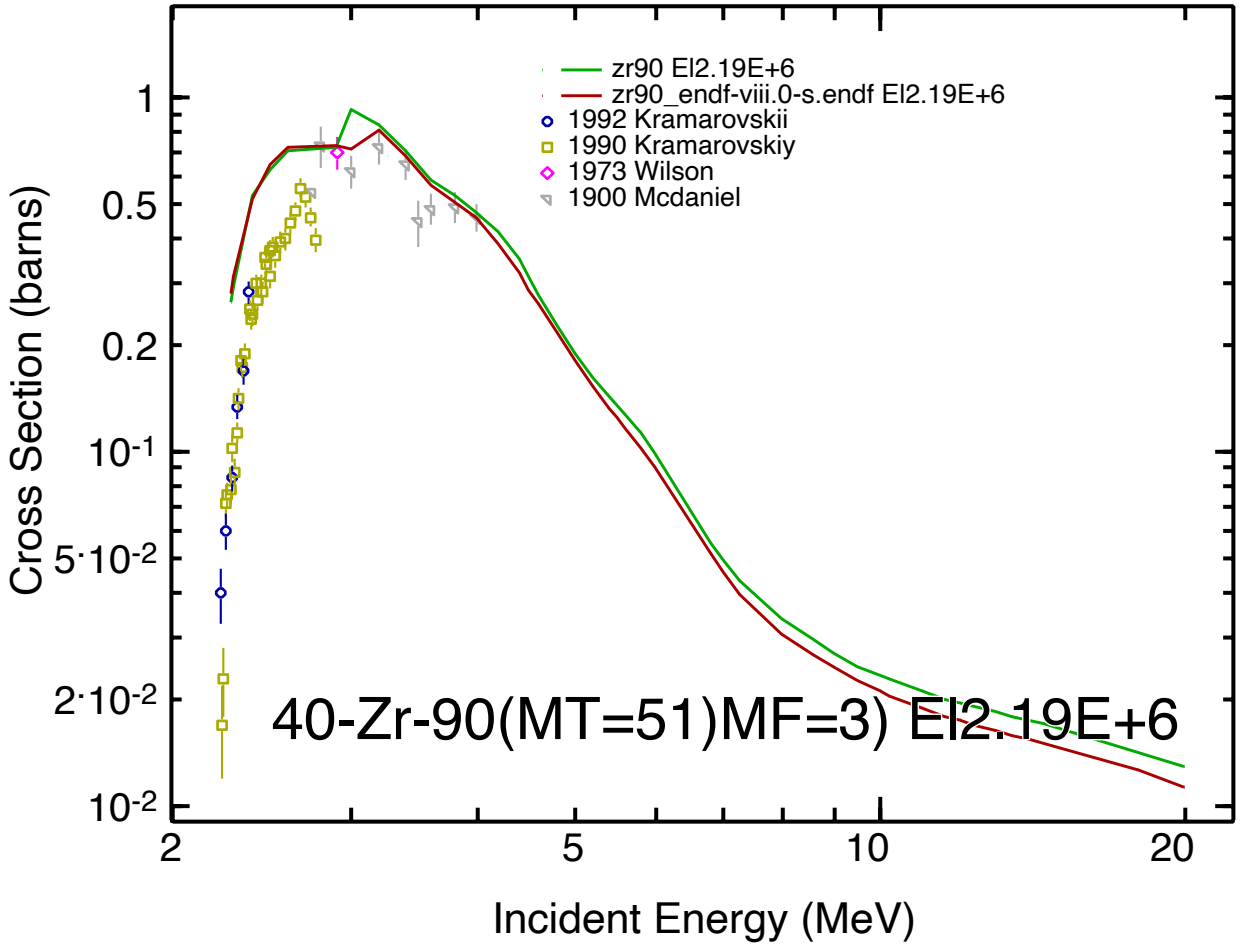
Some plots…


zr90
zr90_endf-viii.0-s.endf
2016 Filatenkov*
2003 Tran Due Thiep
1999 Filatenkov
1982 Csikai*
1972 Kanda
1971 Bari*
1960 Reed
1900 Kiraly
1900 Araminowicz*
40-Zr-90(n,2n)
Cross Section (barns)
Incident Energy (MeV)
0
0.5
1.0
1.5
15
20
25

Some plots…


zr90 El1.76E+6
zr90_endf-viii.0-s.endf El1.76E+6
1973 Wilson
1900 Tucker
40-Zr-90(MT=51)MF=3) El1.76E+6
Cross Section (barns)
Incident Energy (eV)
0.5
0.2
10-1
5·10-2
2·10-2
10-2
5·10-3
2·10-3
10-3
2·106
5·106
107
2·107

Some plots…


zr90 El2.19E+6
zr90_endf-viii.0-s.endf El2.19E+6
1992 Kramarovskii
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1973 Wilson
1900 Mcdaniel
Cross Section (barns)
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2
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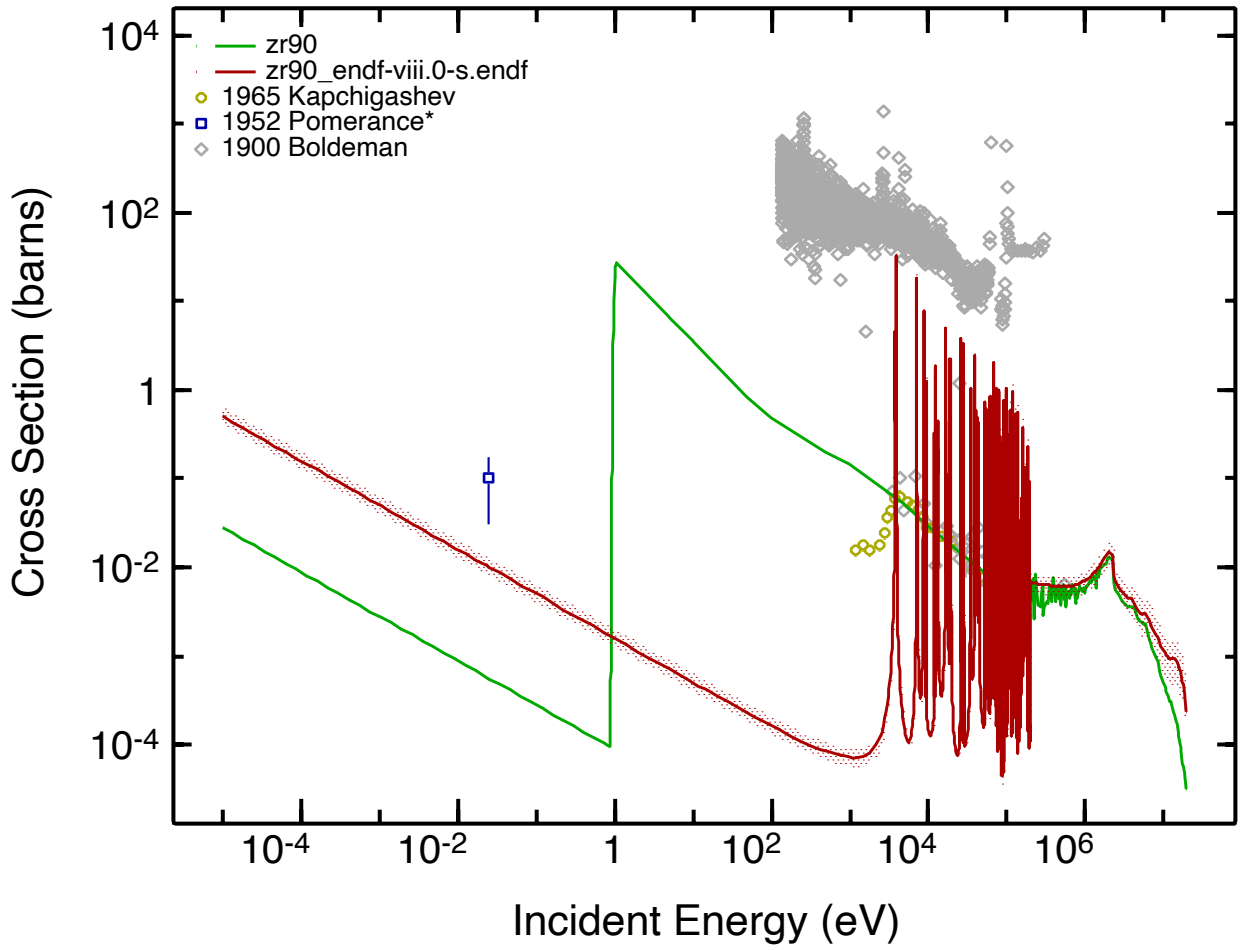
40-Zr-90(MT=51)MF=3) El2.19E+6

Some plots…


zr90
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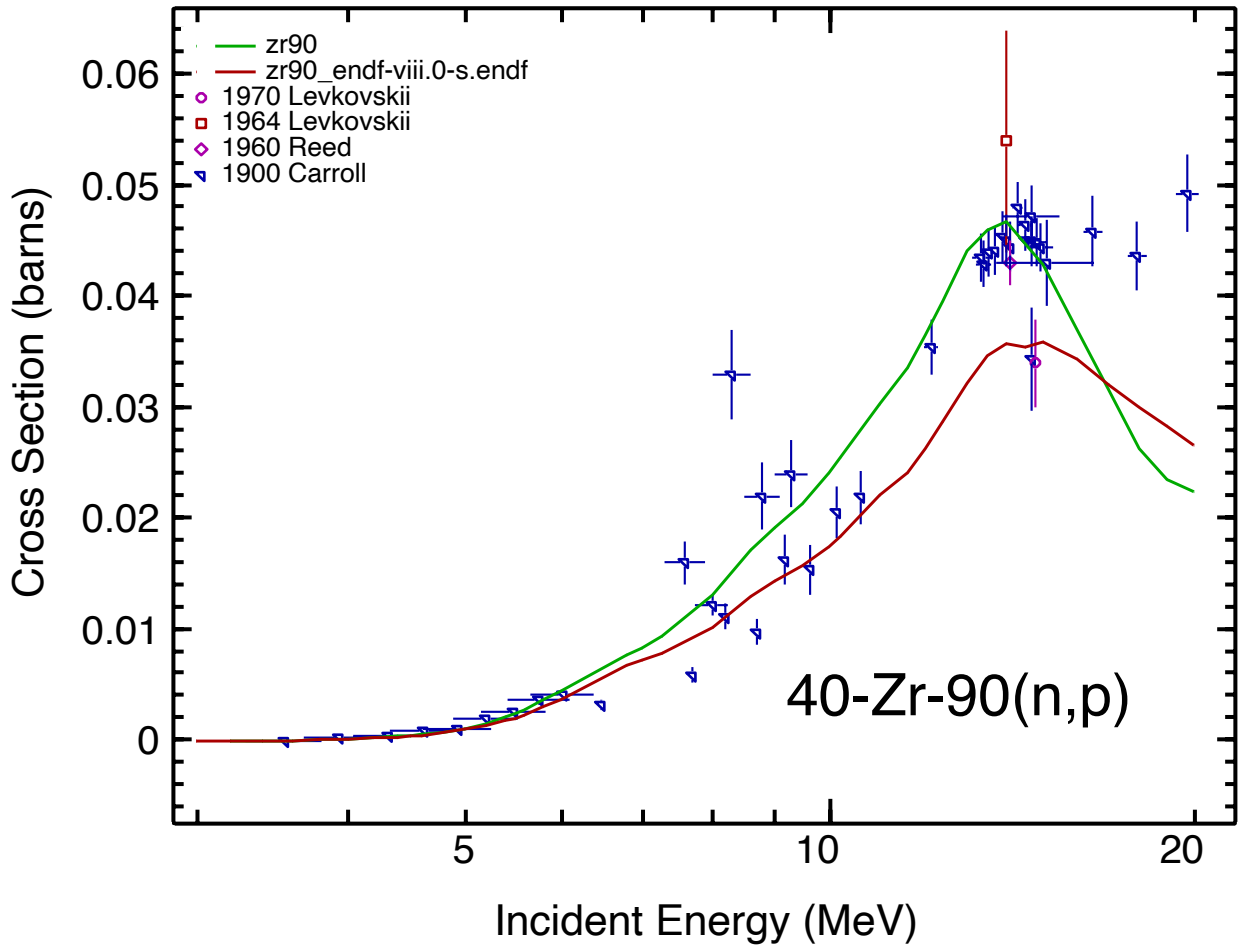
1965 Kapchigashev
1952 Pomerance*
1900 Boldeman
Cross Section (barns)
Incident Energy (eV)
10^4
10^2
1
10^-2
10^-4
10^-4
10^-2
1
10^2
10^4
10^6

Some plots…


zr90
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1970 Levkovskii
1964 Levkovskii
1960 Reed
1900 Carroll
40-Zr-90(n,p)
Cross Section (barns)
Incident Energy (MeV)
0
0.01
0.02
0.03
0.04
0.05
0.06
5
10
20

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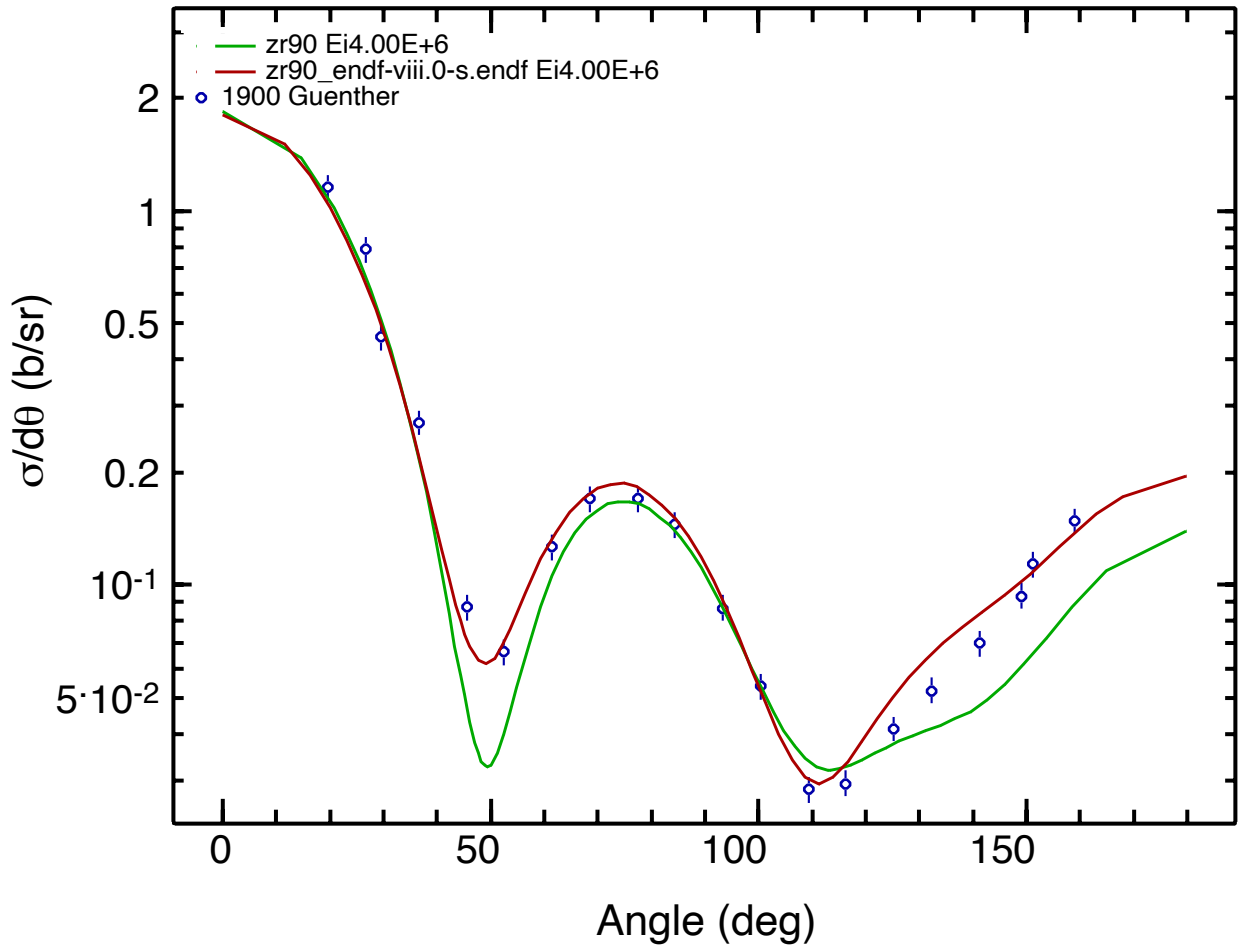
zr90 Ei4.00E+6
zr90_endf-viii.0-s.endf Ei4.00E+6
1900 Guenther
2
1
0.5
0.2
10-1
5·10-2
σ/dθ (b/sr)
0
50
100
150
Angle (deg)

Conclusions

Conclusion

- Infrastructure development
  - Set up evaluation review process
  - Tracking issues
  - ADVANCE CI/CD system is live
- Process for the next ENDF/B release is moving along
  - Multiple Beta versions released
  - Most recent (Beta2) released in august, being broadly tested
  - Finishing the next one (Beta3): **release is imminent!!**
    - Validation feedback from Beta1.1/Beta2 is generally positive with specific improvement needs (that are already being addressed)
    - Expect to have addressed main issues with Beta2, and additional issues in upcoming Beta3
    - Beta3 should be very close to final release
- Collaborative effort on evaluation, review and issue fixing have been very successful
- Updated timeline to ensure the optimal quality of the final ENDF/B-VIII.1 release

Conclusion

- Zirconium is an important structural material present in fuel rod cladding, *et al.*
- It impacts many criticality benchmarks
- Existing files are old and poor
- We have now a realistic plan to deliver ^{90,91}Zr evaluations: Greg Siemers
- We have a good starting point: Kim's evaluation, improved by Dave, Roberto and Andrej
- Plan:
  - "Modernize" old EMPIRE inputs
  - Leverage the experience we have acquired with other structural materials, especially concerning critical impact of minor isotopes, high-energy fluctuations
  - Review resonances: Resolved and Unresolved
  - Incorporate new data
- We hope to have more results for the next meeting!

Acknowledgements

This work was supported by the Nuclear Criticality Safety Program, funded and managed by the National Nuclear Security Administration for the U.S. Department of Energy. Additionally, work at Brookhaven National Laboratory was sponsored by the Office of Nuclear Physics, Office of Science of the U.S. Department of Energy under Contract No. DE-SC0012704 with Brookhaven Science Associates, LLC.