Processing Covariance Data

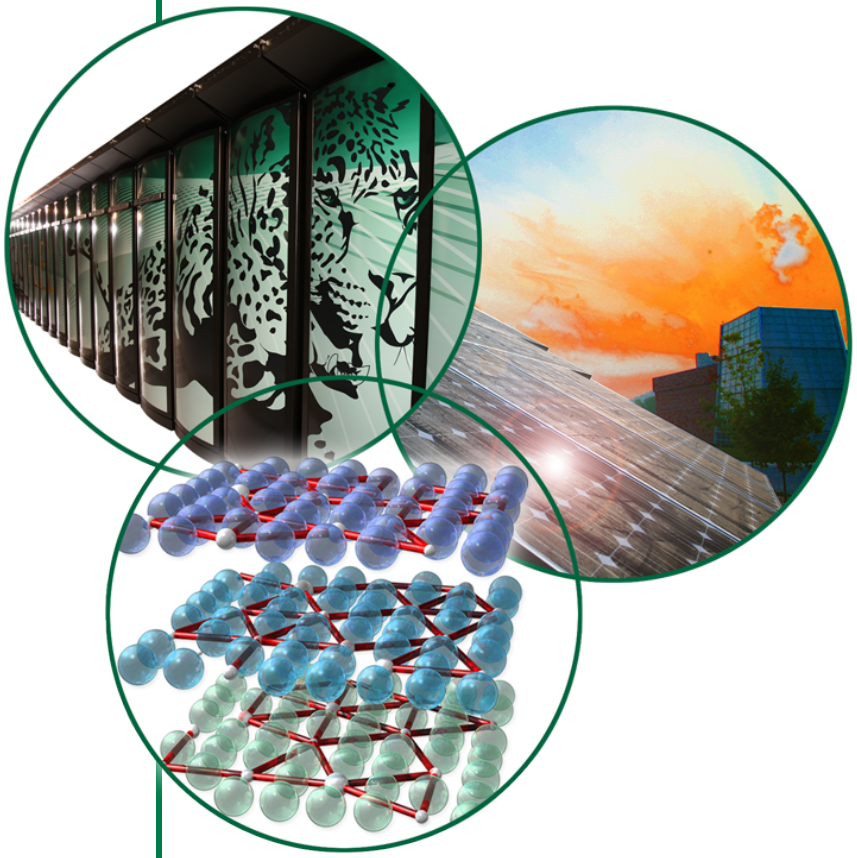
Dorothea Wiarda

Michael Dunn

Luiz Leal

Herve Derrien

CSEWG MEETING



U.S. DEPARTMENT OF ENERGY

OAK RIDGE NATIONAL LABORATORY

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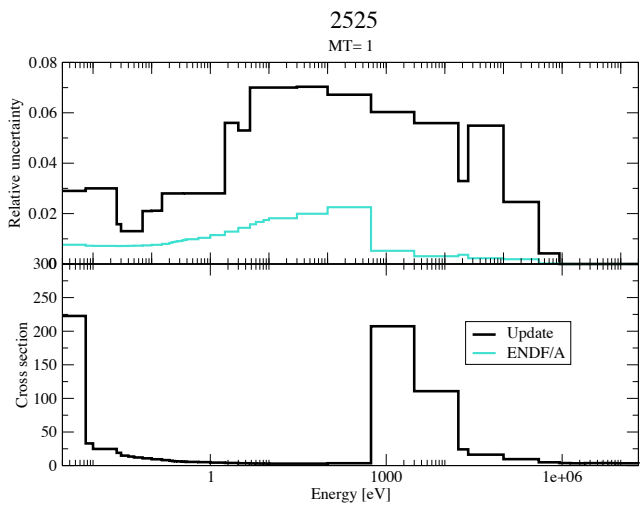
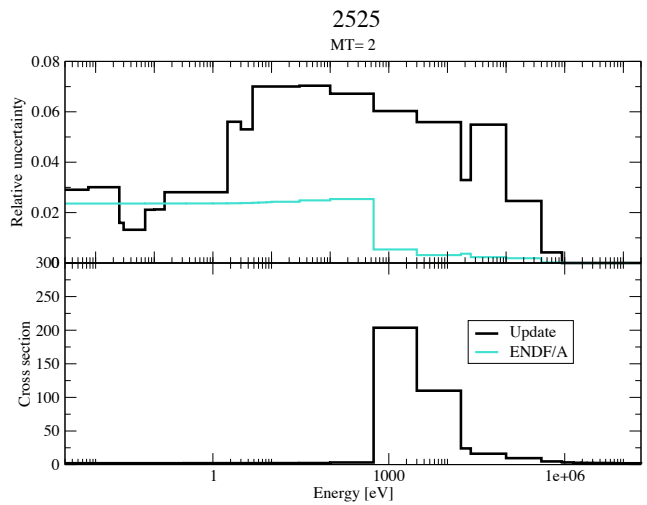
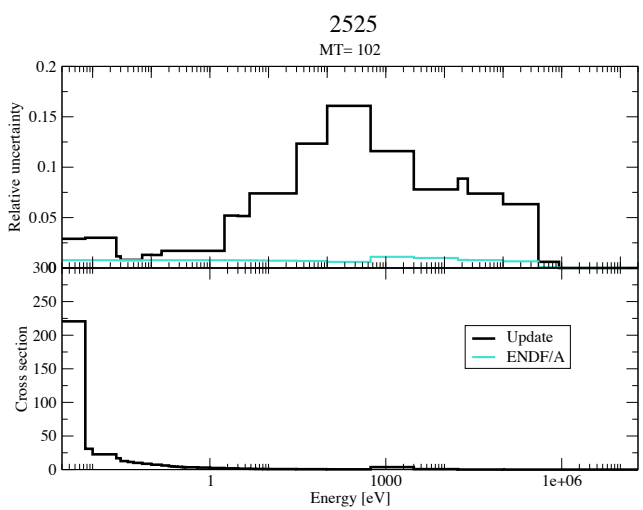
Updated Mn55

Include systematic uncertainties in File 33

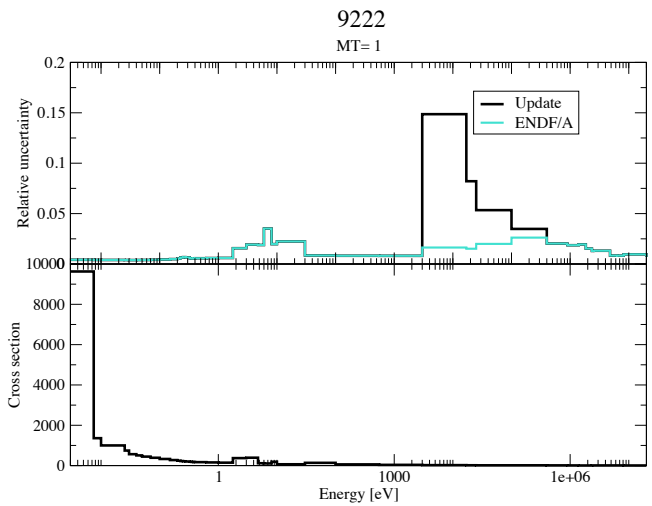


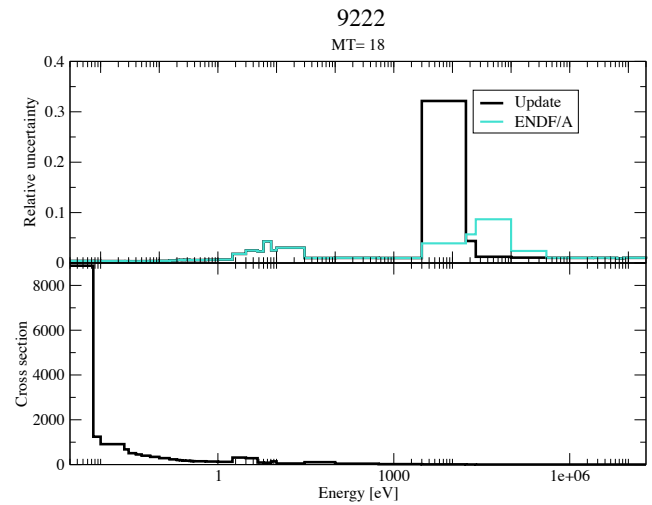


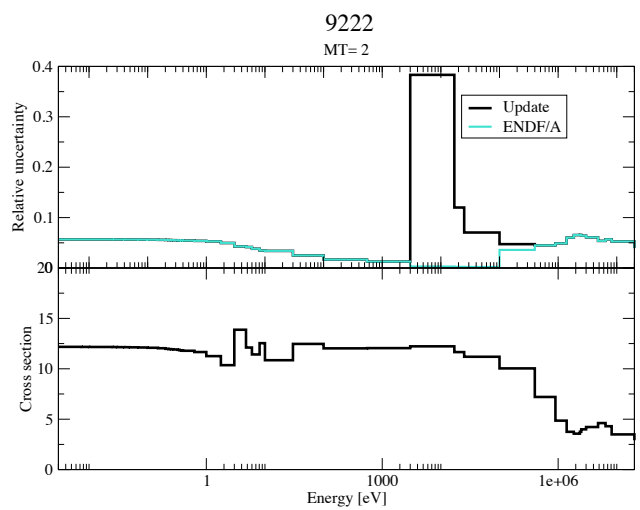


Updated U233

Substitute URR covariance matrices generated by:
P.Talou, T.Kawano and P.G.Young







Process ENDF/A Files containing covariance matrices

Al27 and all W isotopes have tab and/or non-ascii characters in File 1. Therefore, the text record fails to be read correctly. This was corrected before processing

Point-wise cross section data and group averaged cross section with 44 groups where generated with NJOY at 0 K and a flux of 1/E.

- Reconr does not process Resolved Resonance Data with lrf=7

PUFF and ERRORR are run using a flux of 1/E.

ERRORR has two options in generating covariance matrices:

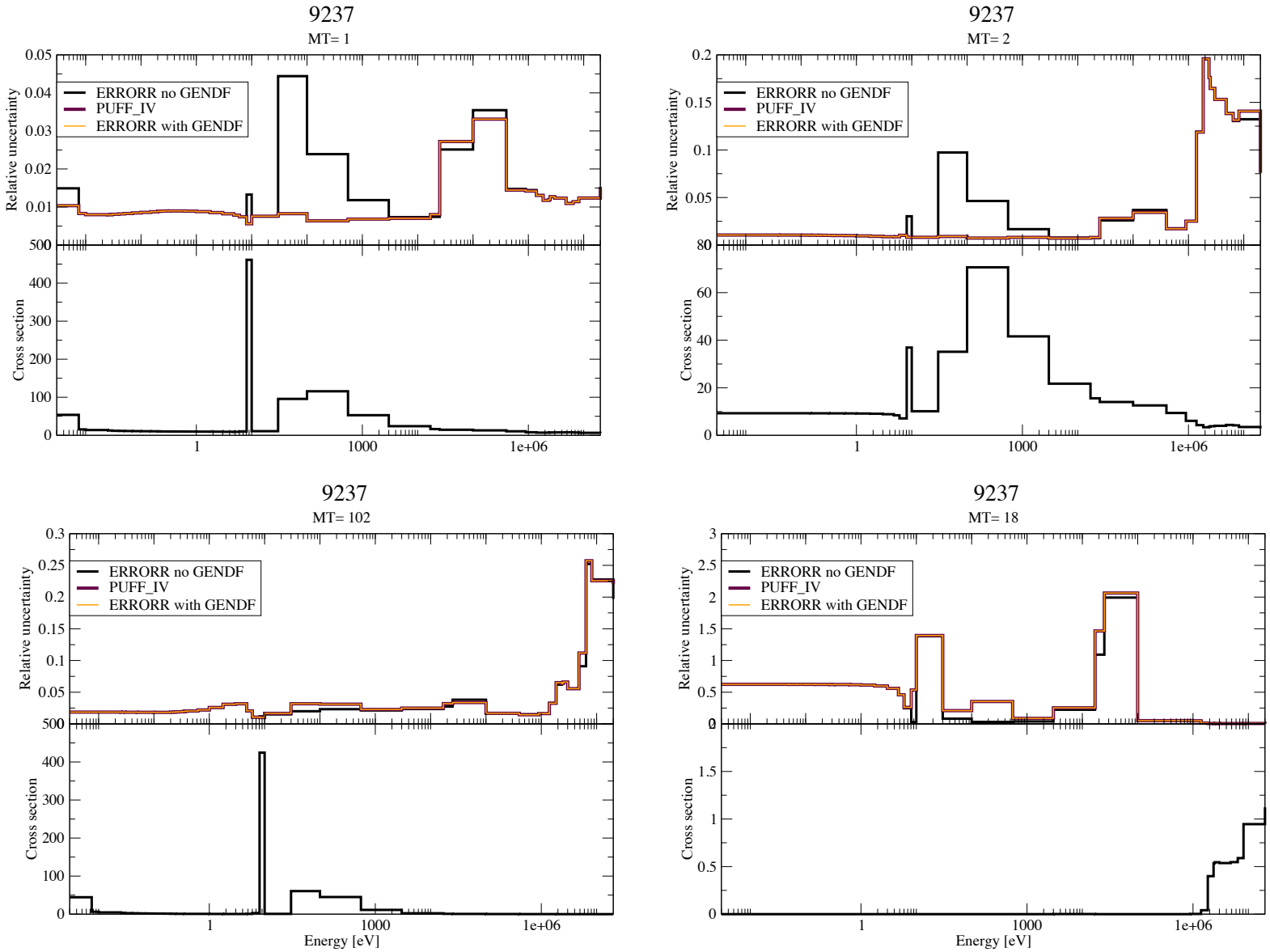
- Group averaged cross sections are read from a GENDF file
- Group averaged cross sections are calculated on the super grid.
- ERRORR does not process files containing only File 32.

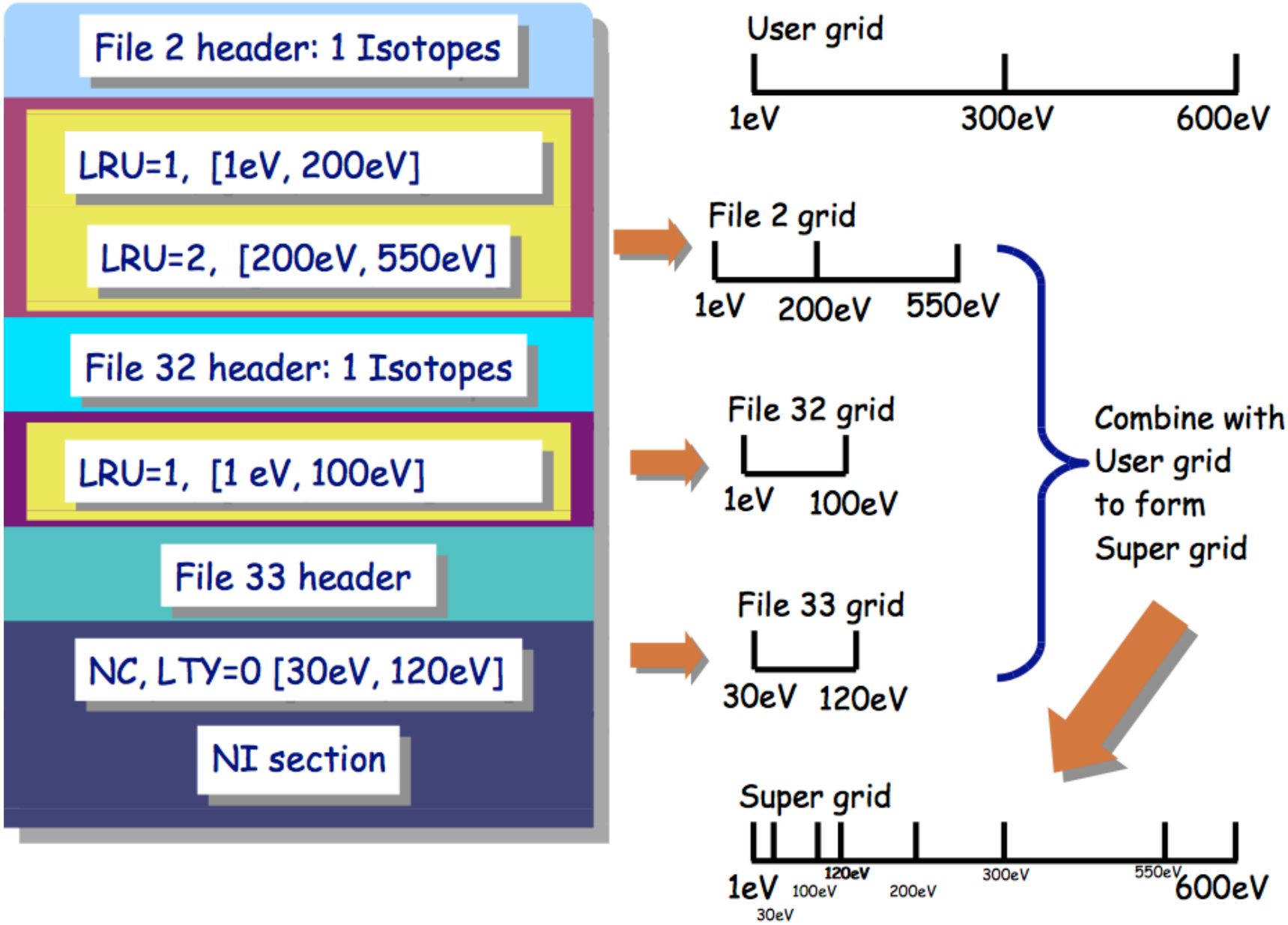
Covariance matrices are compared with module COVCOMP.

- Cl35, Cl37, Cr53, K39, K41 and Na23 only contain File 32 and do not allow a direct comparison.
- Ti50 has an LTY=0 section that sums over non-existent constituent covariance matrices. (The list was corrected before processing).
- Ni58 did not process through ERROR

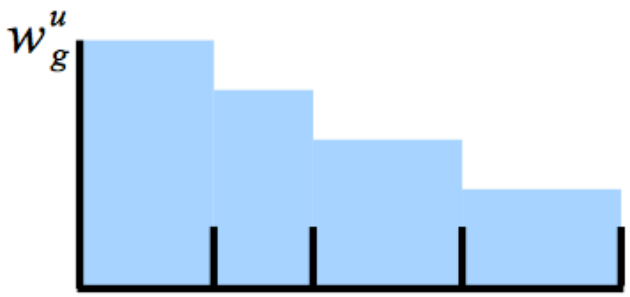
The following evaluations contain a File 32:
Cl35, Cl37
F19
Cr52, Cr53
Gd152, Gd153, Gd154, Gd155, Gd156, Gd157, Gd158, Gd160
K39, K41
Mn55
Na23
Ni58, Ni60
Ti46, Ti47, Ti49
Th232
W182, W183, W184, W186

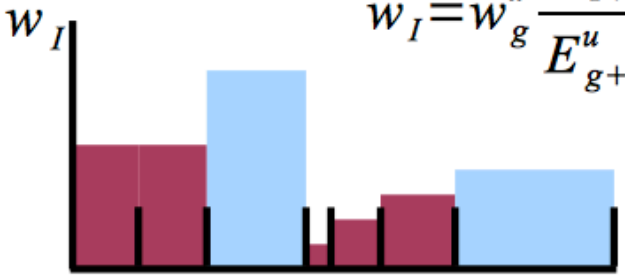
U238 with 1/E flux at 0 K




File 2 header: 1 Isotopes
LRU=1, [1eV, 200eV]
LRU=2, [200eV, 550eV]
File 32 header: 1 Isotopes
LRU=1, [1 eV, 100eV]
File 33 header
NC, LTY=0 [30eV, 120eV]
NI section
User grid
1eV
300eV
600eV
File 2 grid
1eV
200eV
550eV
File 32 grid
1eV
100eV
File 33 grid
30eV
120eV
Combine with User grid to form Super grid
Super grid
1eV
30eV
100eV
120eV
200eV
300eV
550eV
600eV

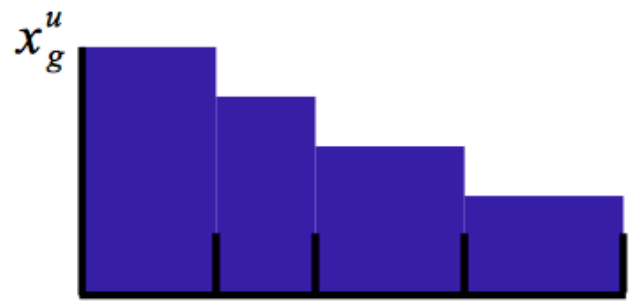
Weight function

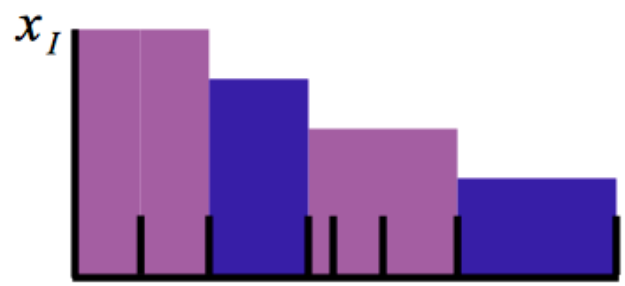




$$w_I = w_g^u \frac{E_{I+1} - E_I}{E_{g+1}^u - E_g^u}$$

Cross section on super grid





$$x_I = \frac{1}{w_I} w_g^u x_g^u \frac{E_{I+1} - E_I}{E_{g+1}^u - E_g^u}$$

$$x_g^u = \frac{1}{w_u^g} \int_{E_g^u}^{E_{g+1}^u} w(E)\sigma(E)\,dE$$

$$w_g^u = \int_{E_g^u}^{E_{g+1}^u} w(E)\,dE$$

Comparison

b10	for reaction	525	107	for group	10	values are	1.027700E-02	1.088358E-02	5.902285E-02
b10	for reaction	525	801	for group	9	values are	2.465300E-03	1.455992E-02	4.905944E+00
cr52	for reaction	2431	91	for group	1	values are	3.228500E-02	3.257069E-02	8.848848E-03
cr52	for reaction	2431	91	for group	2	values are	2.823700E-02	2.926462E-02	3.639272E-02
cr52	for reaction	2431	91	for group	3	values are	1.264400E-01	1.330979E-01	5.265670E-02
cr52	for reaction	2431	91	for group	4	values are	4.328500E+04	5.607691E+04	2.955276E-01
cr52	for reaction	2431	102	for group	10	values are	2.795000E-02	2.753879E-02	1.471250E-02
gd152	for reaction	6425	1	for group	15	values are	2.033400E-02	1.807450E-02	1.111194E-01
gd152	for reaction	6425	2	for group	15	values are	2.370700E-02	2.161930E-02	8.806256E-02
gd152	for reaction	6425	2	for group	17	values are	1.662300E-01	1.659371E-01	1.762090E-03
gd152	for reaction	6425	2	for group	18	values are	5.534400E-02	5.512102E-02	4.029067E-03
gd152	for reaction	6425	102	for group	15	values are	5.920600E-02	5.329609E-02	9.981954E-02
gd153	for reaction	6428	1	for group	16	values are	5.769300E-02	5.610732E-02	2.748487E-02
gd153	for reaction	6428	1	for group	19	values are	1.574400E-02	1.572714E-02	1.071163E-03
gd153	for reaction	6428	102	for group	19	values are	6.464500E-02	6.455266E-02	1.428455E-03
gd153	for reaction	6428	103	for group	10	values are	1.609400E-01	1.900017E-01	1.805746E-01
gd154	for reaction	6431	1	for group	15	values are	9.482000E-03	1.388731E-02	4.645967E-01
gd154	for reaction	6431	2	for group	15	values are	1.266700E-02	1.790546E-02	4.135516E-01
gd154	for reaction	6431	2	for group	19	values are	3.965300E-02	4.026366E-02	1.540002E-02
gd154	for reaction	6431	2	for group	20	values are	4.538700E-02	4.588667E-02	1.100909E-02
gd154	for reaction	6431	103	for group	5	values are	3.482600E-06	2.879079E-03	8.257038E+02
gd154	for reaction	6431	107	for group	12	values are	7.166300E-03	1.722509E-01	2.303624E+01
gd155	for reaction	6434	1	for group	16	values are	4.917900E-02	4.699237E-02	4.446260E-02
gd155	for reaction	6434	2	for group	16	values are	5.500000E-02	4.848787E-02	1.184023E-01
gd155	for reaction	6434	103	for group	9	values are	1.283500E-02	3.800019E-01	2.860669E+01
gd156	for reaction	6437	1	for group	15	values are	5.901900E-02	4.995079E-02	1.536490E-01
gd156	for reaction	6437	2	for group	15	values are	1.032300E-01	6.779324E-02	3.432797E-01
gd157	for reaction	6440	1	for group	16	values are	3.306800E-02	3.253640E-02	1.607593E-02
gd157	for reaction	6440	2	for group	16	values are	4.073100E-02	3.883896E-02	4.645212E-02
gd157	for reaction	6440	102	for group	16	values are	3.413100E-02	3.369774E-02	1.269399E-02
gd157	for reaction	6440	103	for group	5	values are	3.649800E-01	8.001071E-01	1.192194E+00
gd157	for reaction	6440	103	for group	6	values are	5.667200E-03	5.000000E-01	8.722699E+01
gd157	for reaction	6440	103	for group	7	values are	1.082000E-03	3.409643E-01	3.141241E+02
gd158	for reaction	6443	107	for group	8	values are	1.052200E-01	1.866787E-01	7.741747E-01
gd160	for reaction	6449	1	for group	14	values are	2.242600E-02	2.069251E-02	7.729837E-02
gd160	for reaction	6449	2	for group	14	values are	2.352800E-02	2.181430E-02	7.283673E-02
gd160	for reaction	6449	102	for group	14	values are	8.518600E-02	7.092573E-02	1.674016E-01
gd160	for reaction	6449	103	for group	3	values are	1.770200E-01	5.426464E-01	2.065453E+00
gd160	for reaction	6449	107	for group	5	values are	1.417900E-01	4.920645E-01	2.470375E+00
gd160	for reaction	6449	107	for group	6	values are	4.760000E-02	4.926549E-01	9.349892E+00
gd160	for reaction	6449	107	for group	7	values are	3.881700E-03	1.505492E-01	3.778436E+01
ir191	for reaction	7725	103	for group	7	values are	8.904800E-02	1.082977E-01	2.161719E-01

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ir193  for reaction 7731  103  for group    5 values are         1.836000E-04        2.879079E-03        1.468126E+01
li6  for reaction  325  105  for group    5 values are         1.885500E-02        2.226041E-02        1.806103E-01

mn55  for reaction 2525    1  for group   11 values are         3.407200E-03        4.206872E-03        2.347005E-01
mn55  for reaction 2525    2  for group   11 values are         3.415800E-03        4.208652E-03        2.321131E-01
mn55  for reaction 2525  102  for group   11 values are         4.886300E-03        6.136231E-03        2.558031E-01

ni60  for reaction 2831    1  for group   10 values are         2.514700E-02        2.546397E-02        1.260469E-02
ni60  for reaction 2831    2  for group   10 values are         2.514700E-02        2.546410E-02        1.260980E-02

pu240  for reaction 9440    2  for group    9 values are         1.856800E-01        1.861677E-01        2.626562E-03
pu240  for reaction 9440    4  for group    9 values are         3.998800E-01        4.009640E-01        2.710813E-03

th232  for reaction 9040    1  for group    1 values are         4.231100E-02        4.308060E-02        1.818913E-02
th232  for reaction 9040    1  for group    2 values are         5.941900E-03        6.387979E-03        7.507344E-02
th232  for reaction 9040    1  for group   14 values are         3.423000E-03        2.263920E-03        3.386153E-01
th232  for reaction 9040    1  for group   15 values are         1.424500E-02        1.238805E-02        1.303582E-01
th232  for reaction 9040    2  for group   14 values are         3.125200E-03        2.503850E-03        1.988193E-01
th232  for reaction 9040  102  for group   14 values are         3.294500E-02        1.423884E-02        5.677995E-01
th232  for reaction 9040  102  for group   15 values are         5.953500E-02        2.154418E-02        6.381257E-01

Ti46, ti47, ti49
PUFF_IV is systematic higher

ti50  for reaction 2237    1  for group   10 values are         2.107700E-02        2.021054E-02        4.110943E-02
ti50  for reaction 2237    2  for group   10 values are         2.108000E-02        2.021285E-02        4.113618E-02
ti50  for reaction 2237  102  for group   12 values are         2.230100E-01        1.868683E-01        1.620632E-01

w180  for reaction 7425    1  for group    9 values are         5.707700E-02        5.591496E-02        2.035912E-02
w180  for reaction 7425    1  for group   10 values are         6.339000E-02        6.239630E-02        1.567607E-02
w180  for reaction 7425  851  for group    4 values are         2.592000E-01        5.132453E-01        9.801129E-01
w180  for reaction 7425  855  for group    6 values are         6.255000E-01        9.491575E-01        5.174381E-01
w180  for reaction 7425  855  for group    7 values are         1.922100E-02        7.832440E-01        3.974939E+01

w182  for reaction 7431    1  for group    1 values are         1.497200E-02        1.567785E-02        4.714444E-02
w182  for reaction 7431  856  for group   12 values are         3.662200E-03        5.160028E-01        1.398997E+02
w182  for reaction 7431  856  for group   13 values are         2.270000E-04        6.767170E-01        2.980133E+03
w182  for reaction 7431  856  for group   14 values are         3.050200E-05        4.892778E-01        1.603984E+04
w182  for reaction 7431  856  for group   15 values are         1.176500E-05        5.161462E-01        4.387033E+04

w183  for reaction 7434  102  for group   15 values are         2.276300E-02        2.203327E-02        3.205790E-02
w183  for reaction 7434  855  for group    5 values are         2.392500E-02        7.167155E-01        2.895676E+01
w183  for reaction 7434  856  for group   11 values are         4.772000E-04        3.895816E-01        8.153906E+02
w183  for reaction 7434  856  for group   12 values are         2.138200E-05        5.160028E-01        2.413158E+04
w183  for reaction 7434  856  for group   13 values are         1.577900E-05        6.767170E-01        4.288620E+04
w183  for reaction 7434  856  for group   14 values are         9.383300E-06        4.892778E-01        5.214247E+04
w184  for reaction 7437    1  for group    1 values are         1.706700E-02        1.675400E-02        1.833964E-02

w184  for reaction 7437    1  for group   14 values are         9.181200E-03        8.169531E-03        1.101892E-01
w184  for reaction 7437    2  for group   14 values are         9.404000E-03        8.372243E-03        1.097146E-01
w184  for reaction 7437  102  for group   14 values are         1.971100E-02        1.092623E-02        4.456788E-01
w184  for reaction 7437  855  for group    4 values are         4.876900E-03        5.132453E-01        1.042401E+02
w184  for reaction 7437  856  for group   11 values are         3.773300E-03        3.262842E-01        8.547184E+01

w186  for reaction 7443    1  for group    1 values are         1.144400E-02        1.176936E-02        2.843081E-02
w186  for reaction 7443  851  for group    4 values are         1.867600E-01        5.952316E-01        2.187147E+00
w186  for reaction 7443  851  for group    5 values are         2.325600E-02        7.167155E-01        2.981852E+01
w186  for reaction 7443  855  for group    3 values are         1.788700E-02        6.721151E-01        3.657562E+01
w186  for reaction 7443  856  for group    8 values are         4.458900E-01        7.881864E-01        7.676700E-01
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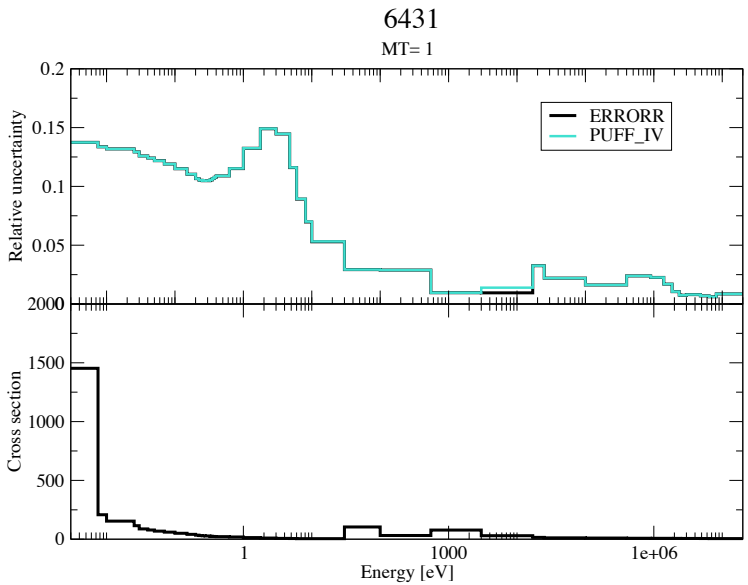
Gd154


6431
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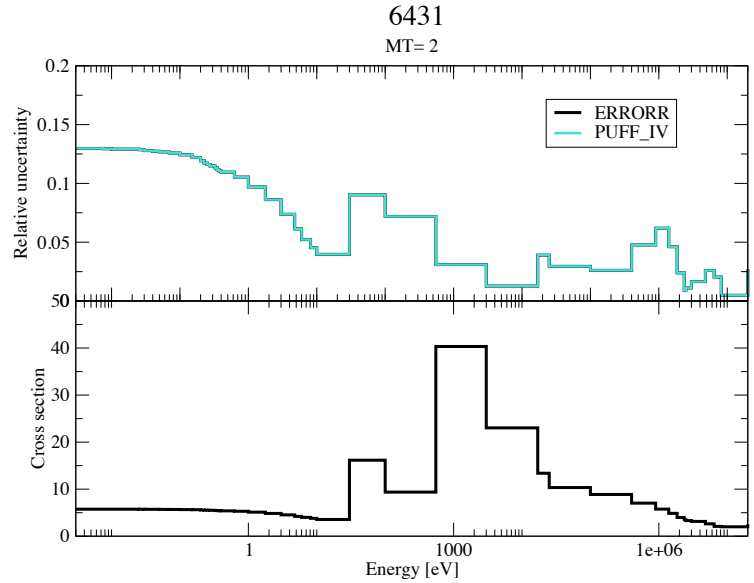
ERRORR
PUFF_IV
Relative uncertainty
Cross section
Energy [eV]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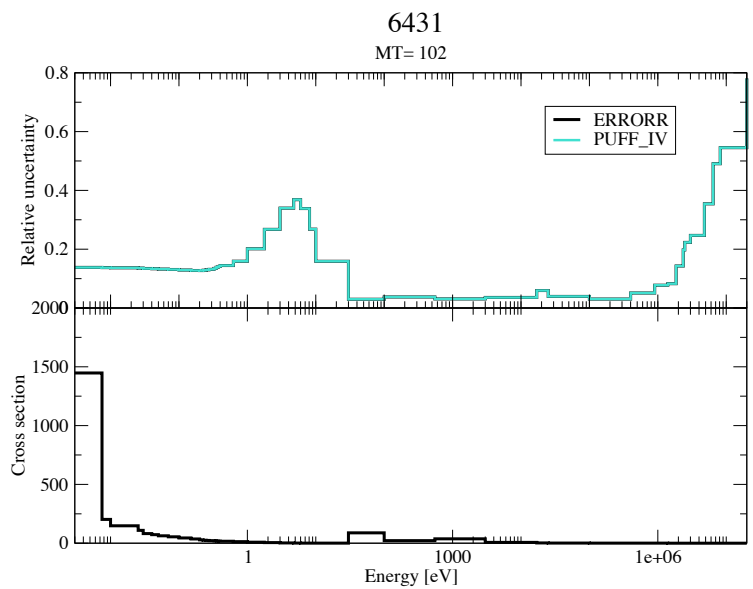
ERRORR
PUFF_IV
Relative uncertainty
Cross section
Energy [eV]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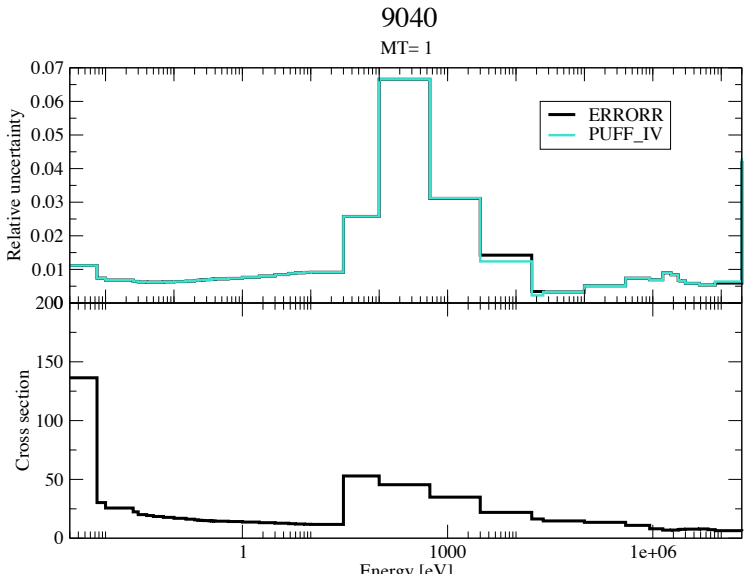
MT= 102
ERRORR
PUFF_IV
Relative uncertainty
Cross section
Energy [eV]

Th232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PUFF_IV
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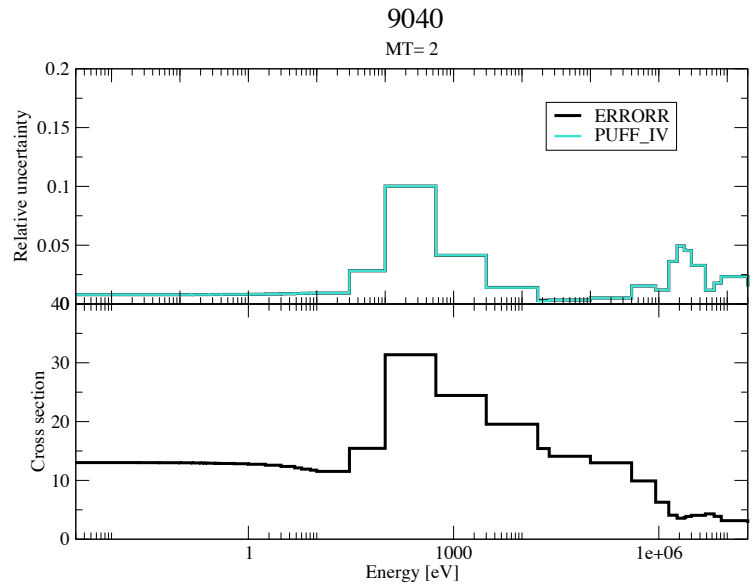
Cross section
Energy [eV]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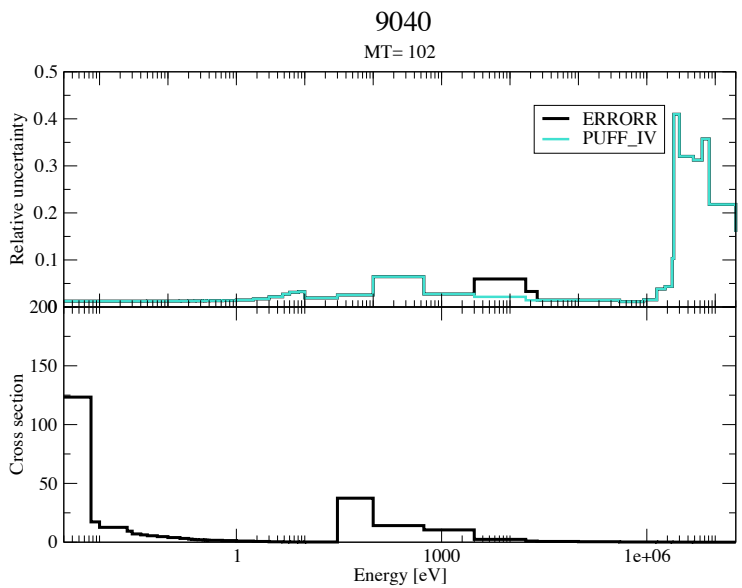
PUFF_IV
Relative uncertainty
Cross section
Energy [eV]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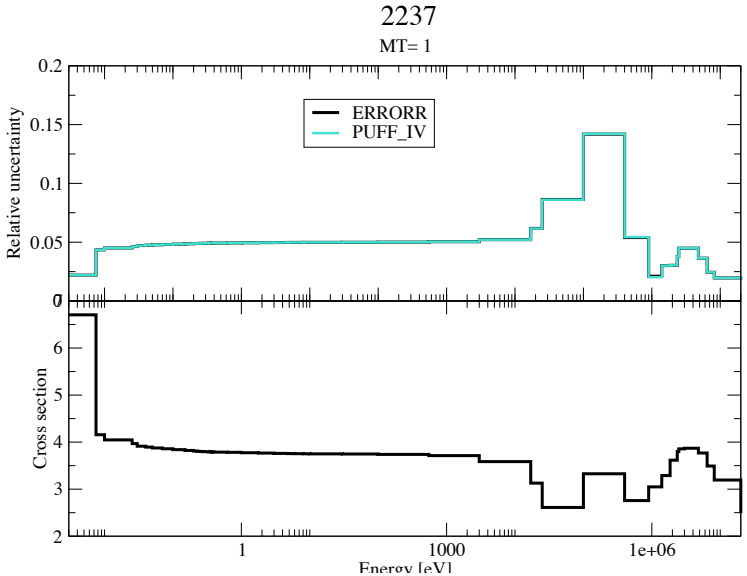
Relative uncertainty
Cross section
Energy [eV]

Ti50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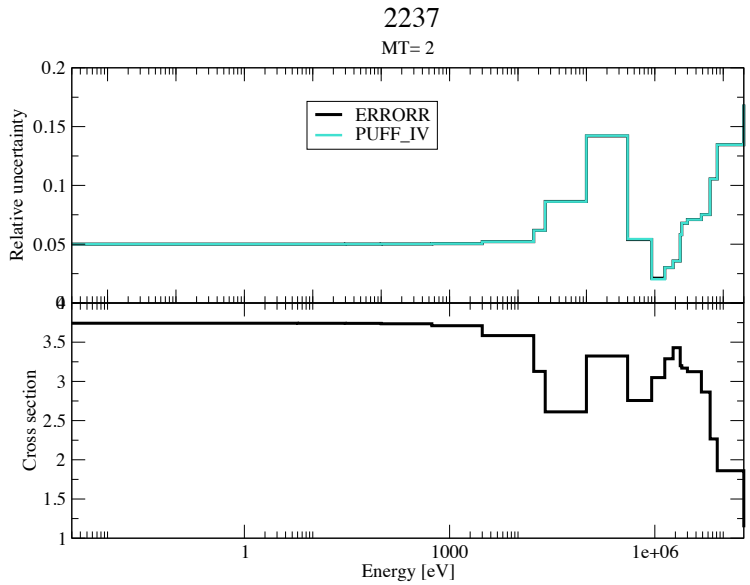
PUFF_IV
Relative uncertainty
Cross section
Energy [eV]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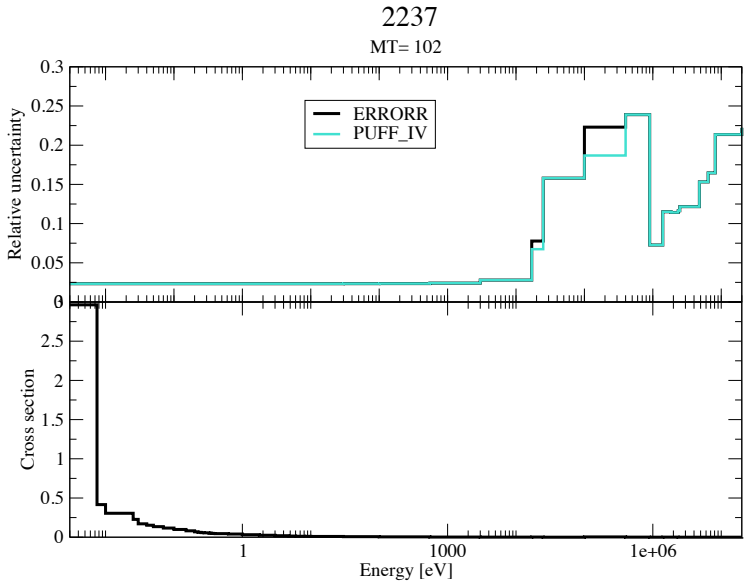
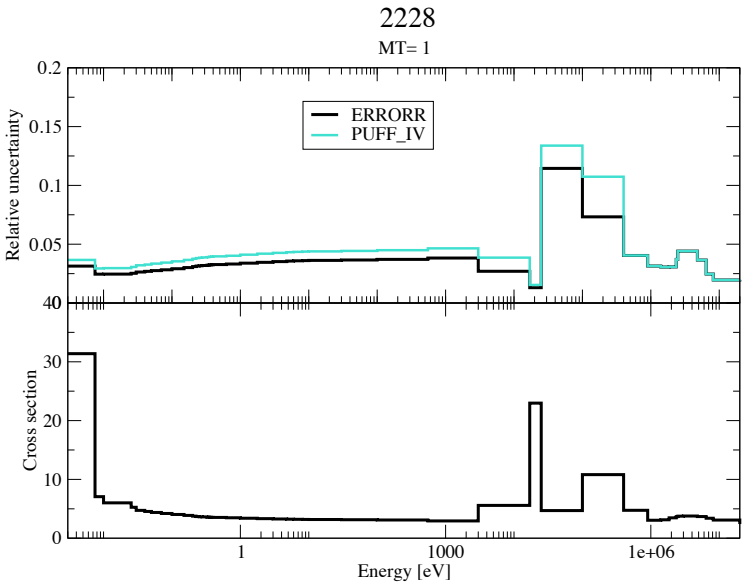
PUFF_IV
Relative uncertainty
Cross section
Energy [eV]

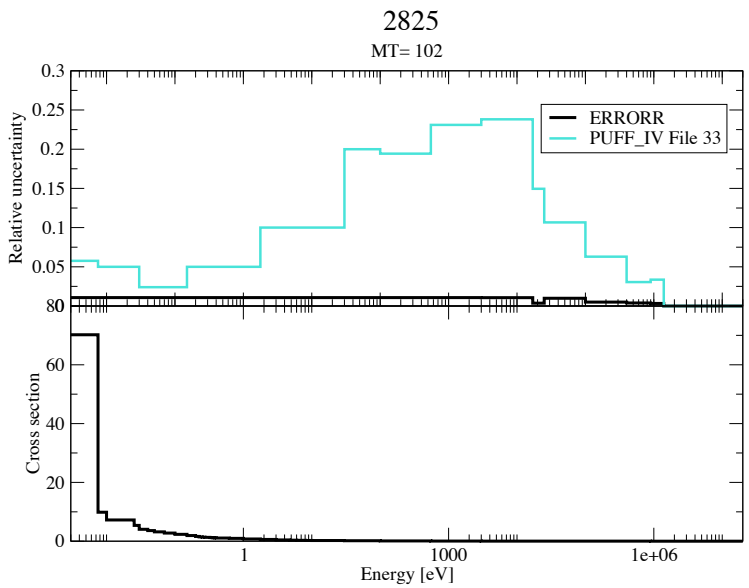

2237
MT= 102
ERRORR
PUFF_IV
Relative uncertainty
Cross section
Energy [eV]

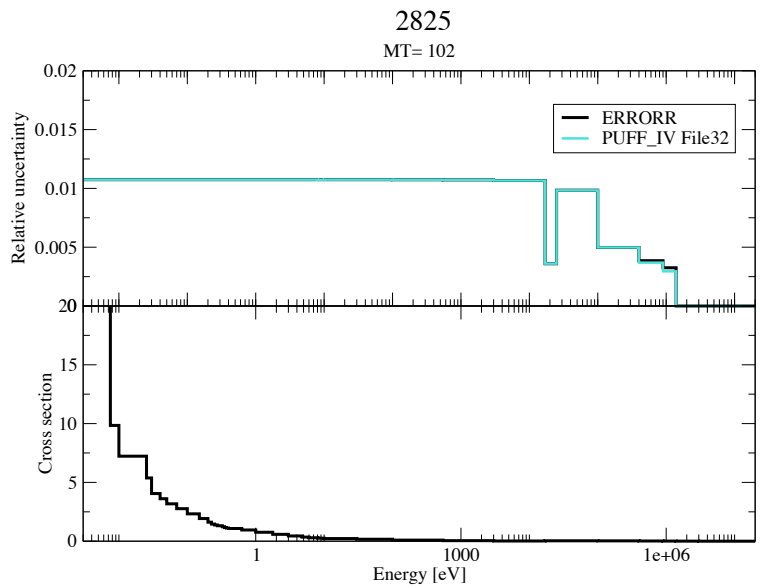
Differences found in some of the Ti

Ti47



Ni58


2825
MT= 102
Relative uncertainty
Cross section
Energy [eV]
ERRORR
PUFF_IV File 33


2825
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Relative uncertainty
Cross section
Energy [eV]
ERRORR
PUFF_IV File32