UT-BATTELLE

Compact Covariance Matrix Proposal

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Current ENDF covariance formats for resonance parameters

- **Make unrealistic distinction between long-range and short-range covariances**
- **Can be used for entire covariance matrix, by pretending everything is short range**
- **Are often sufficient for our purposes**
- **Occasionally will lead to extremely large files (when number of resonances is large)**

Proposal: What to do instead of storing all elements of covariance matrix

for those situations where the matrix is too big

- **Convert to uncertainties plus correlation matrix**
- **Store all uncertainties**
- **Drop correlation coefficients smaller than 2% in absolute value**
- **Convert others to nearest % [but see footnote]**
- **Store non-zero values as signed two-digit integers**

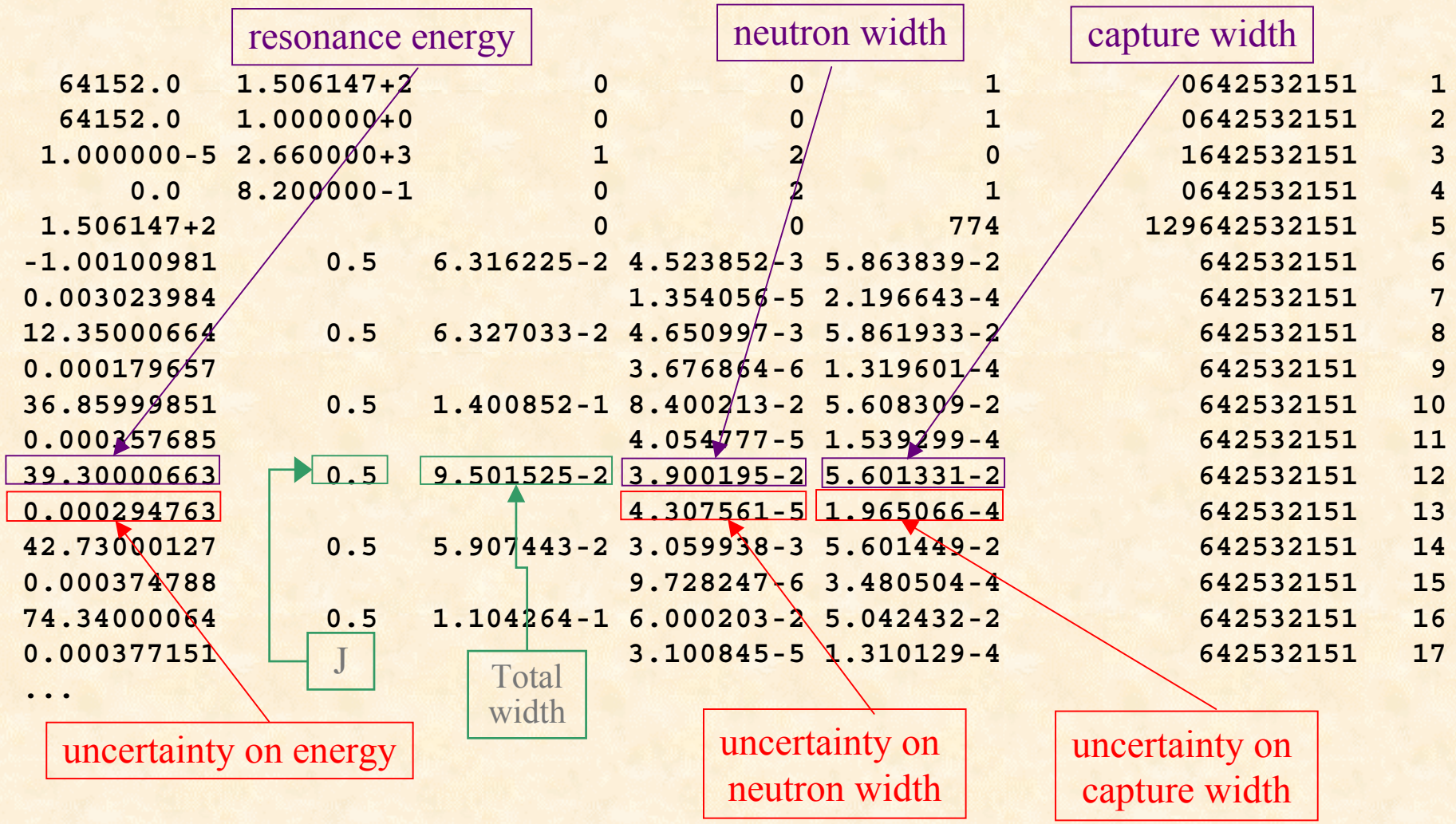
➔ "compact covariance matrix"

Footnote: convert to nearest %

- **Conversion is as follows:**

$$0.99 < C \leq 1.00 \rightarrow M=+99 \rightarrow C\approx+0.995$$
$$0.98 < C \leq 0.99 \rightarrow M=+98 \rightarrow C\approx+0.985$$
$$\ldots$$
$$0.02 < C \leq 0.03 \rightarrow M=+\ 2 \rightarrow C\approx+0.025$$
$$-0.02 \leq C \leq 0.02 \rightarrow M=\ \ 0 \rightarrow C\approx\ 0.000$$
$$-0.02 \leq C < 0.03 \rightarrow M=-\ 2 \rightarrow C\approx-0.025$$
$$\ldots$$
$$-0.98 \leq C < 0.99 \rightarrow M=-98 \rightarrow C\approx-0.985$$
$$-0.99 \leq C < 1.00 \rightarrow M=-99 \rightarrow C\approx-0.995$$

Example: Beginning of ENDF file 32 for ^{152}Gd



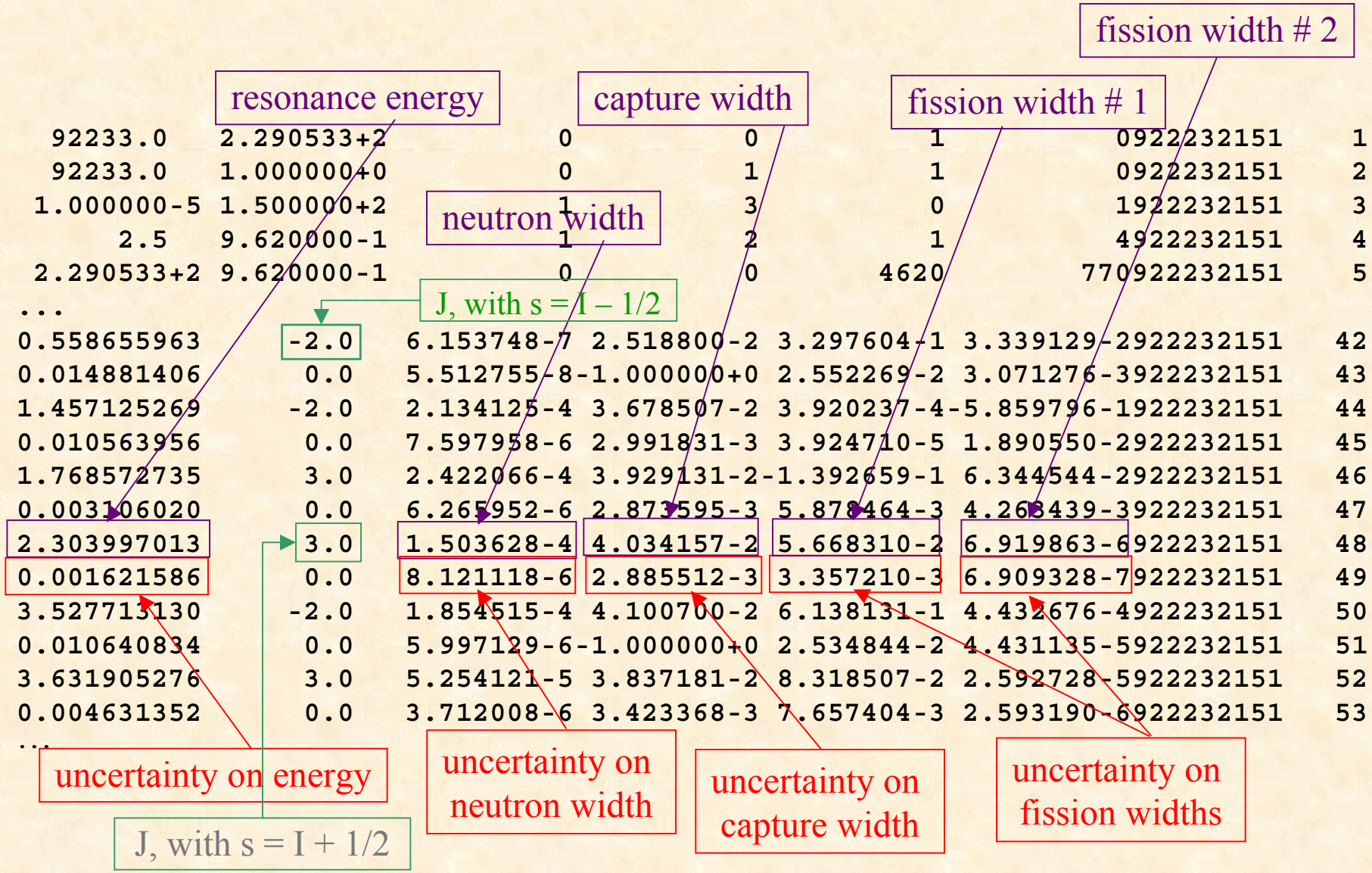
Example, continued: Correlation coefficients portion of ENDF file 32

position pointers

Correlation coefficients *100

```
    0.0          0.0            0          387          340          340642532151  264
 2     1 -83                                                          642532151  265
 3     1 -75 37                                                       642532151  266
 5     1 -34 44 13 35                                                 642532151  267
 6     1  17-18-10 -3-25                                              642532151  268
 8     1 -35 42 15  2 23 -8                                           642532151  269
 9     1  10-11 -6    -6     4-17                                     642532151  270
10     8 -25  5                                                       642532151  271
11     1  -9 12  3     4    10-66  9 33                               642532151  272
12     1   3 -4              -5 12-30 -4-19                          642532151  273
14     8  -9       -6     2                                          642532151  274
15     8   3 -4       -9-11-28                                       642532151  275
16     8  -2                                                         642532151  276
17     1 -14 17  5     7 -3                4            23          642532151  277
18     1   3 -3                                           -19       642532151  278
19    17  -3                                                        642532151  279
20     8  -2                          -9    20                      642532151  280
21    19 -12  9                                                      642532151  281
22     8  -2                          -5                            642532151  282
23     1 -15 19  6     7 -3                3          5 -2          642532151  283
23    19   9 20    27                                               642532151  284
 ...
```

Example: Beginning of ENDF file 32 for ^{233}U




```
  92233.0    2.290533+2          0          0          1          0922232151     1
  92233.0    1.000000+0          0          1          1          0922232151     2
 1.000000-5  1.500000+2          1          3          0          1922232151     3
      2.5    9.620000-1          1          2          1          4922232151     4
 2.290533+2  9.620000-1          0          0       4620          770922232151   5
...
0.558655963     -2.0    6.153748-7 2.518800-2 3.297604-1 3.339129-2922232151    42
0.014881406      0.0    5.512755-8-1.000000+0 2.552269-2 3.071276-3922232151    43
1.457125269     -2.0    2.134125-4 3.678507-2 3.920237-4-5.859796-1922232151    44
0.010563956      0.0    7.597958-6 2.991831-3 3.924710-5 1.890550-2922232151    45
1.768572735      3.0    2.422066-4 3.929131-2-1.392659-1 6.344544-2922232151    46
0.003106020      0.0    6.265952-6 2.873595-3 5.878464-3 4.268439-3922232151    47
2.303997013      3.0    1.503628-4 4.034157-2 5.668310-2 6.919863-6922232151    48
0.001621586      0.0    8.121118-6 2.885512-3 3.357210-3 6.909328-7922232151    49
3.527713130     -2.0    1.854515-4 4.100700-2 6.138131-1 4.432676-4922232151    50
0.010640834      0.0    5.997129-6-1.000000+0 2.534844-2 4.431135-5922232151    51
3.631905276      3.0    5.254121-5 3.837181-2 8.318507-2 2.592728-5922232151    52
0.004631352      0.0    3.712008-6 3.423368-3 7.657404-3 2.593190-6922232151    53
...
```

Example, continued: Correlation coefficients portion of ENDF file 32

Position pointers

```
254  232   2    -9       -1        4    -1             2     4 922232151 1556
255  232  -5             1    -2 45   -10             6    16 922232151 1557
255  252  -1     1                                           922232151 1558
256  232  -1    -7      -13     1 18    -4             2    -6 922232151 1559
256  254  -1  7                                             922232151 1560
257  232   1    -7       19    10-14    -1    -1      -41    60 922232151 1561
257  254  -3 -2 54                                          922232151 1562
258  232  -1    -1      -38    -6 10    -5            26    -7 922232151 1563
258  255   6 55 41                                          922232151 1564
259  234 -11       20      6 23    -5           -38   -10      922232151 1565
259  254  -4-12 19  6-31                                    922232151 1566
260  234   1       -3    -1 -2                 8            922232151 1567
260  255   2 -1  6 -4  4                                    922232151 1568
261  234  -3       -2    -1  4                 7    -9      922232151 1569
261  254  -1  1 20 14  7 -1                                 922232151 1570
262  234  -1        5     1 -3     1           -2     7      922232151 1571
262  255   7-23-15-14 -2    -6                             922232151 1572
263  234   1       -1                          -1    -1      922232151 1573
263  255  -4  5     5  2        8                          922232151 1574
```

...

Correlation coefficients *100

Should the zeros be included?

- **Maybe it's easier for humans to read?**

Example, continued: Correlation coefficients portion of ENDF file 32

Position pointers

254	232	2	0	-9	0	0	-1	0	0	4	0	-1	0	0	0	0	2	0	4	922232151	1556
255	232	-5	0	0	0	0	1	0	-2	45	0	-10	0	0	0	0	6	0	16	922232151	1557
255	252	-1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	922232151	1558
256	232	-1	0	-7	0	0	-13	0	1	18	0	-4	0	0	0	0	2	0	-6	922232151	1559
256	254	-1	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	922232151	1560
257	232	1	0	-7	0	0	19	0	10	-14	0	-1	0	-1	0	0	-41	0	60	922232151	1561
257	254	-3	-2	54	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	922232151	1562
258	232	-1	0	-1	0	0	-38	0	-6	10	0	-5	0	0	0	0	26	0	-7	922232151	1563
258	255	6	55	41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	922232151	1564
259	234	-11	0	0	20	0	6	23	0	-5	0	0	0	0	-38	0	-10	0	0	922232151	1565
259	254	-4	-12	19	6	-31	0	0	0	0	0	0	0	0	0	0	0	0	0	922232151	1566
260	234	1	0	0	-3	0	-1	-2	0	0	0	0	0	0	8	0	0	0	0	922232151	1567
260	255	2	-1	6	-4	4	0	0	0	0	0	0	0	0	0	0	0	0	0	922232151	1568
261	234	-3	0	0	-2	0	-1	4	0	0	0	0	0	0	7	0	-9	0	0	922232151	1569
261	254	-1	1	20	14	7	-1	0	0	0	0	0	0	0	0	0	0	0	0	922232151	1570
262	234	-1	0	0	5	0	1	-3	0	1	0	0	0	0	-2	0	7	0	0	922232151	1571
262	255	7	-23	-15	-14	-2	0	-6	0	0	0	0	0	0	0	0	0	0	0	922232151	1572
263	234	1	0	0	-1	0	0	0	0	0	0	0	0	0	-1	0	-1	0	0	922232151	1573
263	255	-4	5	0	5	2	0	0	8	0	0	0	0	0	0	0	0	0	0	922232151	1574
...																					

Correlation coefficients *100

Example, continued: Correlation coefficients portion of ENDF file 32

Position pointers

```
254  232   2    -9       -1        4    -1             2     4 922232151 1556
255  232  -5             1    -2 45   -10             6    16 922232151 1557
255  252  -1     1                                          922232151 1558
256  232  -1    -7      -13     1 18    -4             2    -6 922232151 1559
256  254  -1  7                                           922232151 1560
257  232   1    -7       19    10-14    -1    -1      -41    60 922232151 1561
257  254  -3 -2 54                                        922232151 1562
258  232  -1    -1      -38    -6 10    -5            26    -7 922232151 1563
258  255   6 55 41                                        922232151 1564
259  234 -11       20     6 23    -5            -38   -10      922232151 1565
259  254  -4-12 19  6-31                                  922232151 1566
260  234   1       -3    -1 -2                 8           922232151 1567
260  255   2 -1  6 -4  4                                  922232151 1568
261  234  -3       -2    -1  4                 7    -9     922232151 1569
261  254  -1  1 20 14  7 -1                              922232151 1570
262  234  -1        5     1 -3     1           -2     7     922232151 1571
262  255   7-23-15-14 -2    -6                           922232151 1572
263  234   1       -1                          -1    -1     922232151 1573
263  255  -4  5     5  2        8                        922232151 1574
 ...
```

Correlation coefficients *100

Example, continued: Correlation coefficients portion of ENDF file 32

Position pointers

```
254   232    2   0 -9   0   0 -1   0   0   4   0 -1   0   0   0   0   2   0   4 922232151 1556
255   232   -5   0   0   0   0   1   0 -2  45   0-10   0   0   0   0   6   0  16 922232151 1557
255   252   -1   0   1   0   0   0   0   0   0   0   0   0   0   0   0   0   0 922232151 1558
256   232   -1   0 -7   0   0-13   0   1  18   0 -4   0   0   0   0   2   0 -6 922232151 1559
256   254   -1   7   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0 922232151 1560
257   232    1   0 -7   0   0  19   0  10-14   0 -1   0 -1   0   0-41   0  60 922232151 1561
257   254   -3  -2  54   0   0   0   0   0   0   0   0   0   0   0   0   0   0 922232151 1562
258   232   -1   0 -1   0   0-38   0  -6  10   0 -5   0   0   0   0  26   0 -7 922232151 1563
258   255    6  55  41   0   0   0   0   0   0   0   0   0   0   0   0   0   0 922232151 1564
259   234  -11   0   0  20   0   6  23   0  -5   0   0   0   0-38   0-10   0   0 922232151 1565
259   254   -4-12  19   6-31   0   0   0   0   0   0   0   0   0   0   0   0   0 922232151 1566
260   234    1   0   0 -3   0 -1  -2   0   0   0   0   0   0   8   0   0   0   0 922232151 1567
260   255    2  -1   6 -4   4   0   0   0   0   0   0   0   0   0   0   0   0   0 922232151 1568
261   234   -3   0   0 -2   0 -1   4   0   0   0   0   0   0   7   0 -9   0   0 922232151 1569
261   254   -1   1  20 14   7 -1   0   0   0   0   0   0   0   0   0   0   0   0 922232151 1570
262   234   -1   0   0   5   0   1 -3   0   1   0   0   0   0 -2   0   7   0   0 922232151 1571
262   255    7-23-15-14  -2   0 -6   0   0   0   0   0   0   0   0   0   0   0   0 922232151 1572
263   234    1   0   0 -1   0   0   0   0   0   0   0   0   0 -1   0 -1   0   0 922232151 1573
263   255   -4   5   0   5   2   0   0   8   0   0   0   0   0   0   0   0   0   0 922232151 1574
 ...
```

Correlation coefficients *100