MF6/MT18 format status

P(nu), P(nu_g) and multiplicity-dependent spectra

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MF6 MT18: including P(nu) and P(nug)

```
[MAT, 6, MT/  ZA, AWR,   JP, LCT,   NK,   0]HEAD
          <TAB1 and LAW-dependent structure for product 1>
               ---------------------------
          <repeat TAB1 and LAW-dependent structures>
          <for the rest of the NK subsections      >
               ---------------------------
[MAT, 6, MT/ 0.0, 0.0,   0,   0,   0,   0]SEND
```

```
[MAT, 6, MT/ ZAP, AWP, LIP, LAW,  NR,  NP/ E_int  / y_i(E)]TAB1
          <LAW-dependent structure for product 1>
```

- NK is the sum of neutron and gamma sections (numax+1+nugmax+1)
- JP=10*JPP+JPN
- ZAP and AWP is either 1 for neutrons or 0 for gammas
- Neutrons are listed first
- LIP used to identify the type of spectrum. Suggested to identify multiplicity

JP flag

JPX=0 This option indicates that the spectrum averaged over multiple outgoing particles and the average multiplicity is given. In this case, the usual MF=6 interpretation of y_i and f_i would hold. As this is fission, the multiplicity is already given in MF=1/MT=456 for neutrons and MF=18/MT=12 for photons and the outgoing distributions in MT=18/MF=4 & 5 for neutrons or MT=18/MF=14 & 15 for photons. Allowing either neutron or photon datasets here would require duplicating data, potentially creating synchronization errors. Therefore, NKN=0 no neutron data given and if NKP=0 no photon data is given. Indeed, this entire file (MT=18/MF=6) can be omitted if NK=NKP+NKN=0.

JPX=1 This option indicates that the average spectrum is given as well as the probability functions $P_i(\nu_i, E)$ for particle i. In this case, y_i stores the probability function $P_i(\nu_i, E)$, but the usual MF=6 interpretation of f_i holds. To use this option,

- Set NKN= $(\nu_{n,\max} + 1)$ for JPN≥ 1 & JPP=0, NKP= $(\nu_{\gamma,\max} + 1)$ for JPP≥ 1 & JPN=0 and NK=NKN+NKP= $(\nu_{n,\max} + 1) + (\nu_{\gamma,\max} + 1)$ for JPN,JPP≥ 1.
- For $\nu_i = 0$, set product 1 as follows: LIP=0, LAW=0 (unspecified) and store $P_i(\nu_i = 0, E)$ in y_i.
- For each additional ν_i, use LIP=0 and LAW< 0 and $P_i(\nu_i, E)$ for y_i. LAW< 0 signals to the processing codes to look to MF=4 & 5 for the neutron's outgoing energy spectrum and angular distribution and to MF=14 & 15 for gamma's outgoing energy spectrum and angular distribution.

JPX=2 This indicates that the probability functions $P_i(\nu_i, E)$ and the spectra $\overline{\chi}_i(\nu_i, E, E'_i)$ are given. In this case, y_i stores the probability function $P_i(\nu_i, E)$, and f_i stores the spectrum $\overline{\chi}_i(\nu_i, E, E'_i)$ for the ν_i particles of type i. To use this option,

- Set NKN or NKP as above for JPX=1.
- For $\nu_i = 0$, set product 1 as follows: LIP=0, LAW=0 (unspecified) and store $P_i(\nu_i = 0, E)$ in y_i. As there are no particles emitted in this case, the emitted spectrum is undefined.
- For each additional ν_i, use LIP=0 and LAW> 0 and $P_i(\nu_i, E)$ for y_i. Use $\overline{\chi}_i(\nu_i, E, E'_i)$ as the f_i for this "product" and represent it with the appropriate LAW.

Updated manual

Prompt fission spectrum decomposition

$$\sum_{\nu=0}^{\nu_{max}} P(\nu, E) = 1 \qquad \sum_{\nu=0}^{\nu_{max}} \nu\, P(\nu, E) = \bar{\nu}$$

$$\bar{\chi}(E, E') = \frac{1}{\bar{\nu}} \sum_{\nu=1}^{\nu_{max}} P(\nu, E) \sum_{k=1}^{\nu} \chi_{\nu}(k, E, E') = \frac{1}{\bar{\nu}} \sum_{\nu=1}^{\nu_{max}} P(\nu, E)\, \nu \bar{\chi}_{\nu}(E, E')$$

Issue with interpolation: consistency with 1/456 and/or 12/18

A. Trkov:

$$\tilde{P}(\nu, E) = \frac{\nu}{\bar{\nu}} P(\nu, E)$$

P. Talou:

Save parameters of a function
(new format/too late)

Example: JPN=1 and JPP=1

```
 9.223500+4 2.330248+2         11          0         56          09228 6 18
 1.000000+0 1.000000+0          0          0          1         229228 6 18
         22          2                                            9228 6 18
 1.000000-5 3.817884-2 5.000000+5 3.428548-2 1.000000+6 3.116930-29228 6 18
 1.500000+6 2.761014-2 2.000000+6 2.434288-2 2.500000+6 2.134849-29228 6 18
 3.000000+6 1.854712-2 4.000000+6 1.390180-2 5.000000+6 9.546429-39228 6 18
 6.000000+6 6.033709-3 7.000000+6 3.660794-3 8.000000+6 2.471095-39228 6 18
 9.000000+6 1.613662-3 1.000000+7 1.051794-3 1.100000+7 6.837755-49228 6 18
 1.200000+7 4.405975-4 1.300000+7 2.744386-4 1.400000+7 1.639486-49228 6 18
 1.500000+7 9.544946-5 2.000000+7 7.144631-6 2.500000+7 6.927065-79228 6 18
 3.000000+7 5.338292-8                                            9228 6 18
 1.000000+0 1.000000+0          0         -5          1         229228 6 18
         22          2                                            9228 6 18
 1.000000-5 1.605149-1 5.000000+5 1.510252-1 1.000000+6 1.429648-19228 6 18
 1.500000+6 1.331807-1 2.000000+6 1.235745-1 2.500000+6 1.141573-19228 6 18
 3.000000+6 1.047219-1 4.000000+6 8.740858-2 5.000000+6 6.858005-29228 6 18
 6.000000+6 5.053576-2 7.000000+6 3.588973-2 8.000000+6 2.725382-29228 6 18
 9.000000+6 2.011503-2 1.000000+7 1.475440-2 1.100000+7 1.075457-29228 6 18
 1.200000+7 7.756523-3 1.300000+7 5.432451-3 1.400000+7 3.670901-39228 6 18
 1.500000+7 2.421633-3 2.000000+7 3.135936-4 2.500000+7 4.717257-59228 6 18
 3.000000+7 5.643180-6                                            9228 6 18
```

LAW<0: look for the spectrum in MF5 (neutrons) and MF15 (photons)

Example JPN=1 and JPP=2

```
 0.000000+0 0.000000+0          0          0          1         229228 6 18
         22          2                                            9228 6 18
 1.000000-5 1.057797-3 1.000000+6 2.288868-4 2.000000+6 0.000000+09228 6 18
 3.000000+6 3.038176-4 4.000000+6 1.801776-4 5.000000+6 0.000000+09228 6 18
 6.000000+6 4.980726-5 7.000000+6 7.701545-5 8.000000+6 0.000000+09228 6 18
 9.000000+6 6.705273-5 1.000000+7 5.606544-5 1.100000+7 0.000000+09228 6 18
 1.200000+7 3.666197-5 1.300000+7 2.744603-5 1.400000+7 0.000000+09228 6 18
 1.500000+7 1.286589-5 1.600000+7 1.106171-5 1.700000+7 0.000000+09228 6 18
 1.800000+7 9.187529-6 1.900000+7 8.052606-6 2.000000+7 0.000000+09228 6 18
 3.000000+7 5.650443-7                                            9228 6 18
 0.000000+0 0.000000+0          0          1          1         229228 6 18
         22          2                                            9228 6 18
 1.000000-5 5.879624-3 1.000000+6 1.719723-3 2.000000+6 0.000000+09228 6 18
 3.000000+6 2.025959-3 4.000000+6 1.288339-3 5.000000+6 0.000000+09228 6 18
 6.000000+6 4.221620-4 7.000000+6 6.287373-4 8.000000+6 0.000000+09228 6 18
 9.000000+6 5.540422-4 1.000000+7 4.732953-4 1.100000+7 0.000000+09228 6 18
 1.200000+7 3.267141-4 1.300000+7 2.546359-4 1.400000+7 0.000000+09228 6 18
 1.500000+7 1.329930-4 1.600000+7 1.158163-4 1.700000+7 0.000000+09228 6 18
 1.800000+7 9.674664-5 1.900000+7 8.559761-5 2.000000+7 0.000000+09228 6 18
 3.000000+7 7.863344-6                                            9228 6 18
 0.000000+0 0.000000+0          1          2          1          29228 6 18
          2          2                                            9228 6 18
 0.000000+0 1.000000-5          0          0        592        2969228 6 18
 1.000000-5 0.000000+0 1.000000+4 1.107088-7 3.000000+4 3.321263-79228 6 18
 5.000000+4 5.535439-7 7.000000+4 7.749624-7 9.000000+4 9.963810-79228 6 18
 1.100000+5 1.217795-6 1.300000+5 1.290769-6 1.500000+5 1.398886-69228 6 18
 1.700000+5 1.049633-6 1.900000+5 1.150249-6 2.100000+5 1.473374-69228 6 18
 2.300000+5 8.199414-7 2.500000+5 8.630149-7 2.700000+5 7.311250-79228 6 18
 2.900000+5 1.019560-6 3.100000+5 7.560036-7 3.300000+5 8.683659-79228 6 18
```

Life is complicated

The evaluation is a mix of experiment and theoretical simulations, and multiplicity-dependent spectra come from theory only => need to be adjusted