CALENDF-2001 – The user point of view

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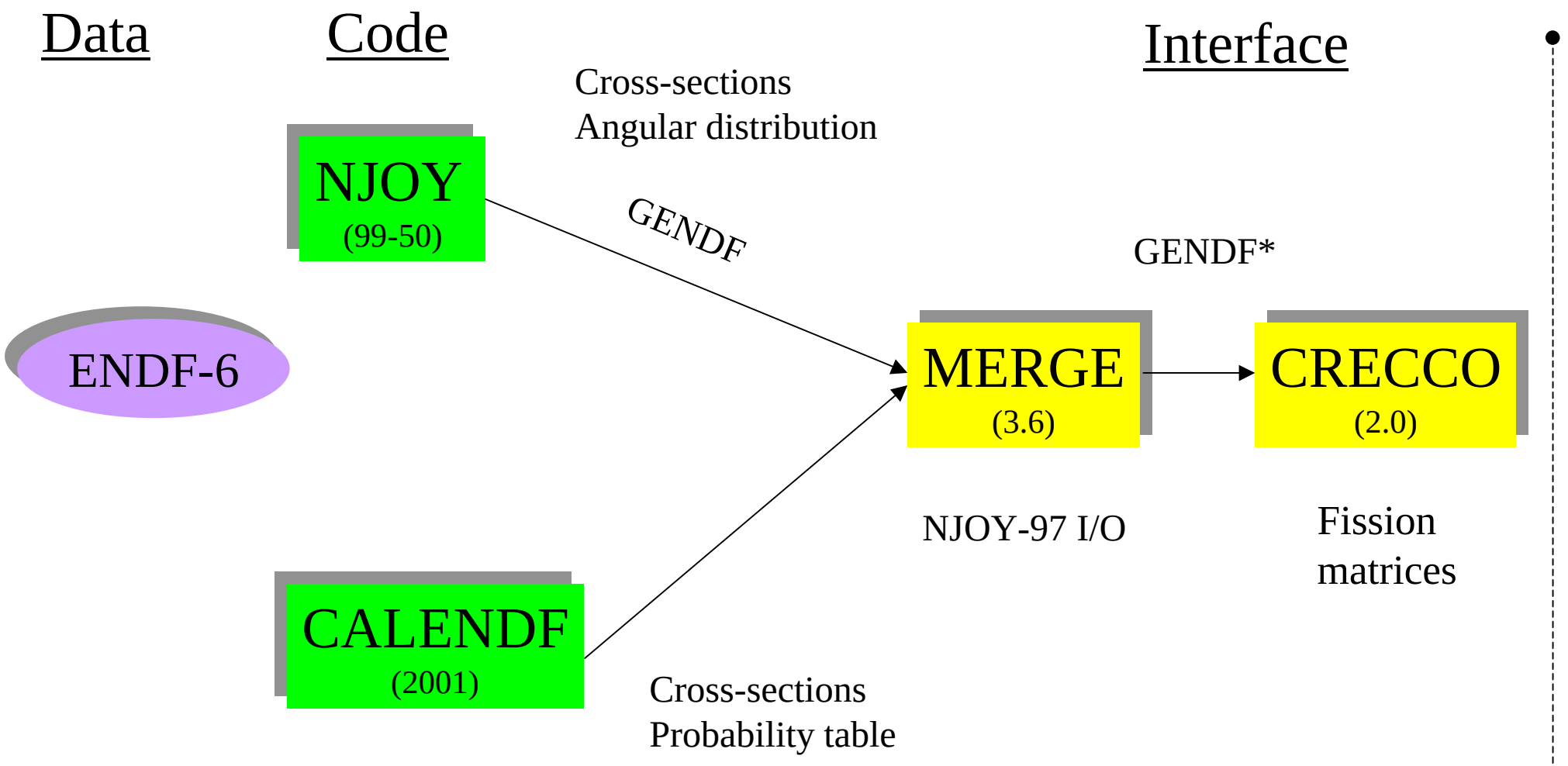
CALENDF-2001

- Probability tables means a natural discretisation of the cross section data to describe the resolved energy range
- The CALENDF approach is based on Gauss quadrature as a probability table definition

➔This approach introduces mathematical rigorousness, procuring a better accuracy and some treatments that would be prohibited under other table definition such as group condensation and interpolation

ECCO group library scheme



CALENDF P.T. are used by the neutronic codes ERANOS, APOLLO and TRIPOLI

JECCOLIB

- Temperatures

293.2 573.2
973.2 1473.2
2973.2 5673.2

- GENDF*
  - MF 1 Header
  - MF 3 Cross sections
  - MF 5 Fission spectra
  - MF 6 Scatter matrices
  - MF 50 Sub group data

- Reactions

Total: mt1

- Five partials bundles

Elastic 2: mt2

Inelastic 4: mt4 (22,23,28,29,32-36)
(n, n'-n'α-n'3α-n'p-n'2α…)

N,xN 15: mt16,17 (24,25,30) 37 (41,42)
(n, 2n-3n-2nα-3nα,n,2n2α-n,4n-2np-3np)

Fission 18: mt18 (n, f-nf-2nf)

Absorption 101: mt102-109, 111 (116)
(n, γ-p-d-t-He-α-2α-3α-2p…)

CALENDF-2001

- NJOY 97-114 and 99-50
  - with upcad ✔
- CALENDF 2001
  - Fortran 90/95 (SUN, IBM, MS Window and DEC alpha) ✔
  - HTML user manual ✔
  - QA ✔
  - Many changes in format, usage ✔ and some in physics:

- Test cases
- Group boundaries hard coded (Ecco33, Ecco1968, Xmas172, Trip315, Vitj175)
- Probability table and effective cross sections comparison
- Increased accuracy

-Resonance energies samplings (600 → 1100) ✔
-Improved resonance grid ✔
-Improved Gaussian quadrature table ✔
-Two micro flux weighting per group
- total = partials sum # MT=1 ✔

CALENDF-2001

- CALENDF-2001 is composed of modules, each performing a set of specific tasks
- Each module is call specifically by a code word followed by a set of options and/or instructions particular to the task in hand
- Input and output streams are module specific
- Dimensional options have been made available to the user
- Sometimes complex input variables are exemplified in the User Manual

- As always, QA test cases are a good starting point for new user

CALENDF-2001 input data

```
CALENDF
  ENERgies 1.0E-5   20.0E+6
  MAILlage READ
  XMAS172
  SPECtre  (borne inferieure, ALPHA)
  1    zones
  0.     -1.
  TEFF  300.
  NDIL 1
  1.0E+10
  NFEV  9  9437 './jeff30n9437_1.asc'
  SORTies
    NFSFRL  0 './pu2394E.sfr'
    NFSF   12 './pu2394E.sf'
    NFSFTP 11 './pu2394E.sft'
    NFTP   10 './pu2394E.tp'
  IPRECI  4
  NIMP 0   80
```

Energy ranges

Group structure

Weighting spectrum

Temperature

Dilution

Mat. and ENDF file

Output stream name - unit

Calculational accuracy indice

Output dumps on unit 6 indices

CALENDF-2001 input data

```
REGROUTP
    NFTP 10 './pu2394E.tp'
    NFTPR 17 './pu2394E.tpr'
  NIMP 0  80
REGROUSF
    NFSF 12 './pu2394E.sf'
    NFSFR 13 './pu2394E.sfdr'
   NIMP 0 80
REGROUSF
    NFSF 11 './pu2394E.sft'
    NFSFR 14 './pu2394E.sftr'
   NIMP 0 80
COMPSF
    NFSF1 13  './pu2394E.sfdr'
    NFSF2 14  './pu2394E.sftr'
    NFSFDR 20 './pu2394E.err'
    NFSFDA 21 './pu2394E.era'
   NIMP 0 80
END
```

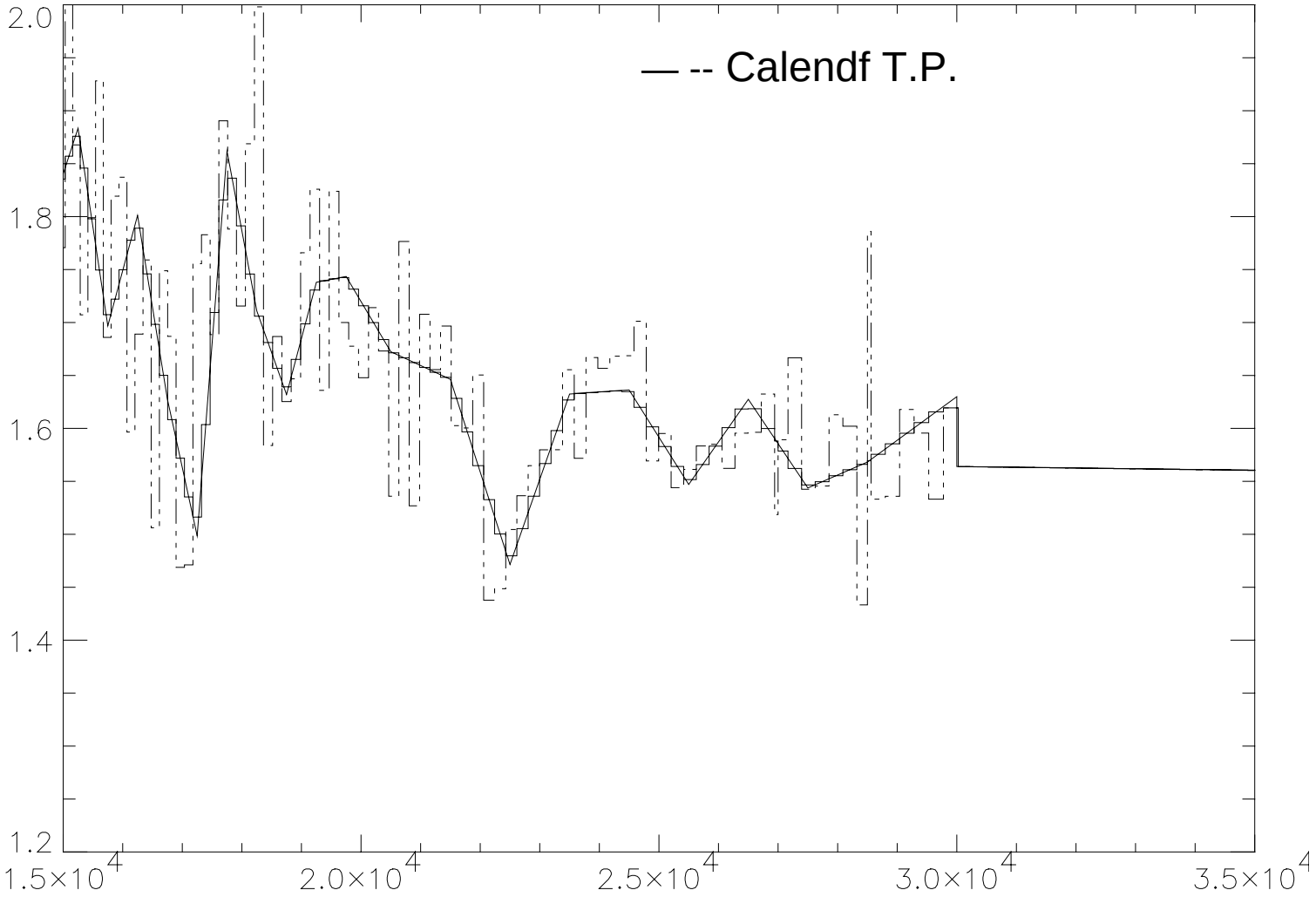
Regroup probability tables computed on several zones of a singular energy group

Regroup effective cross section computed on several zones of a singular energy group

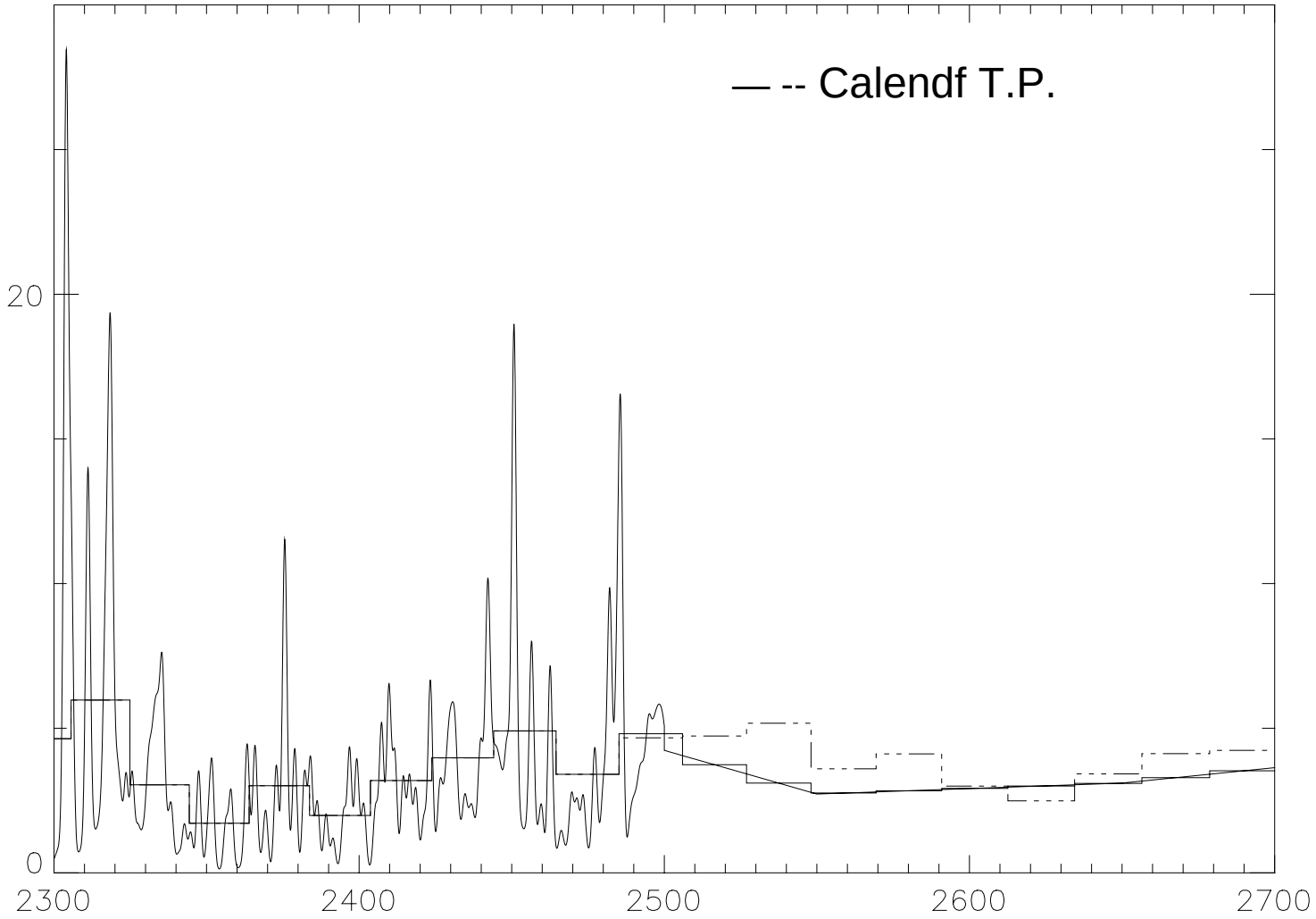
Idem but for the cross section computed from the probability tables

Compare the effective cross section files
-Relative difference as the Log of the ratio
-Absolute difference as the ratio

PU-239 MT 18



PU-239 MT 18



CALENDF TPR

NOR = table order

NPAR = partials

```
 ZA= 94239. MAT=9490 TEFF= 293.0 1968 groupes de 1.0000E-5 A 1.9640E+7 IPRECI=4
 IG    1 ENG=1.947734E+7 1.964033E+7 NOR= 1 I=  0 NPAR=5 KP=   2 101  18   4  15
  1.000000+0  6.115624+0  3.168116+0  1.724428-3  2.239388+0  2.630841-1
  4.402475-1
------
------
 IG 1000 ENG=4.962983E+3 5.004514E+3 NOR= 6 I= -5 NPAR=4 KP=   2 101  18   4   0
  3.531336-2  1.001996+1  8.673775+0  4.299923-1  8.187744-1  4.878567-2
  3.248083-1  1.299016+1  1.116999+1  5.483423-1  1.174122+0  4.879677-2
  4.085168-1  1.686617+1  1.278619+1  1.593832+0  2.388719+0  4.880138-2
  1.616318-1  2.349794+1  1.635457+1  3.590329+0  3.454910+0  4.884996-2
  4.310538-2  3.445546+1  2.438486+1  4.303144+0  5.670905+0  4.876728-2
  2.662435-2  4.254442+1  2.965644+1  7.196256+0  5.593669+0  4.874651-2
```

I = first negatif moment

2 101 18 4

Probability

CALENDF SFR

```
ZA= 94239. MAT=9490 TEFF= 293.0 1968 gr. de 1.0000E-5 a 1.9640E+7 IP=4 NDIL= 1
   SDIL= 1.00000E+10
 IG    1 ENG=1.947734E+7 1.964033E+7 NK= 1 NOR= 1 NPAR=5 KP=   2 101  18   4  15
   SMOY=  6.115624+0  3.168116+0  1.724428-3  2.239388+0  2.630841-1  4.402475-1
 SEF(0)=  6.115624+0
 SEF(1)=  3.168116+0
 SEF(2)=  1.724428-3
 SEF(3)=  2.239388+0
 SEF(4)=  2.630841-1
 SEF(5)=  4.402475-1
- - -
- - -
IG 1000 ENG=4.962983E+3 5.004514E+3 NK= 1 NOR= 6 NPAR=4 KP=   2 101  18   4   0
   SMOY=  1.787921+1  1.364190+1  1.801794+0  2.337908+0  4.880425-2
 SEF(0)=  1.787921+1
 SEF(1)=  1.364190+1
 SEF(2)=  1.801794+0
 SEF(3)=  2.337908+0
 SEF(4)=  4.880425-2
```

Conclusions

Agenda

- Beta test version of CALENDF-2001 for this summer
- Distribution to beta tester

- Improved version !!
- Full release for this Autumn through the OECD/NEA and RSICC