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U.S. DEPARTMENT OF ENERGY

GABS:
For decay-scheme-normalizing factor (NR) and γ-ray absolute intensity

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GABS

- GABS calculates a decay-scheme-normalizing factor (NR) and %Iγ from relative Iγ intensities per 100 decays of the parent nucleus.
- Eddie Browne, LBNL, initially wrote the program and it was perhaps used only by local and a few other network members until 2007.
- Probably since 2008, the code was made available through "ENSDF analysis and utility codes" at NNDC web site
- In 2009, Eddie Browne modified the program to list %Iγ in 2 G record – and named as "GABS2009".
- At 21st NSDD (2015 in Vienna) meeting – the network adopted the policy to include %Iγ in 2 G record – following many years of discussions about it's need
- Current GABS program rewritten by Tibor Kibedi in FORTRAN90 from initial FORTRAN77 version

Use/Method

Can be used:

1. To obtain normalization radiation factor (NR) and %Iγ
2. To verify normalization, given by author/s

Method:

[1] E. Browne, *Calculated Uncertainties of Absolute γ-ray Intensities and Decay Branching Ratios Derived from Decay Schemes,* published in *Nucl. Instr. Meth.* **A249**, 462 (1986).

To deduce NR and %Iγ - appropriate flags for input γ intensities are needed.

Procedure

- Prepare Input file:
  - ✓Adjust BR field, as of the assumption
  - ✓Identify γ rays feeding G.S. directly* and
  - ✓Use flag ‘X’ or ‘Y’ in col 79

*For cascade γ rays see example in the GABS Manual

- New output file:
  - ✓ Restore BR, if changed in input file
  - ✓Document all assumptions for NR comments, including 20% DRI, if any.

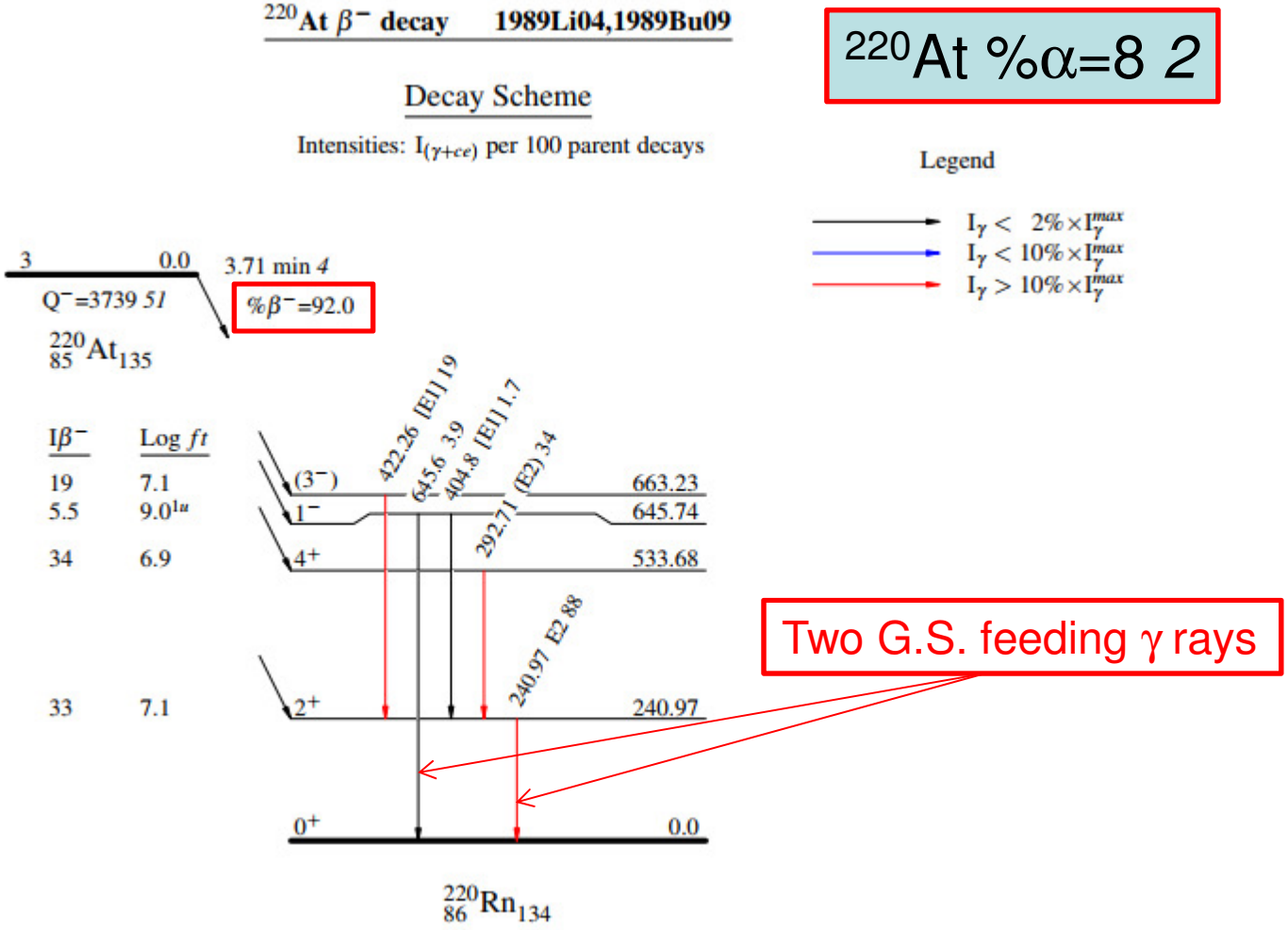
Current manual: (notes for ‘X’ and ‘Y’ will be revised soon by T. Kebedi)

"X" - if DRI is blank, the program assigns 20% uncertainty to the relative γ-ray intensity,

"Y" - the original value of DRI, including a blank, will be used in the calculations.

Earlier manual: The program assigns 20% uncertainty to relative γ-ray intensities (unless a "Y“ instead of an "X" is used in column 79) if DRI values are missing from the input data. Transitions for which these guidelines are not appropriate, most often the "nominal“γ ray with RI set to 100 (without uncertainty), are those which one would designate "Y".

An Example: ^{220}At β^- decay

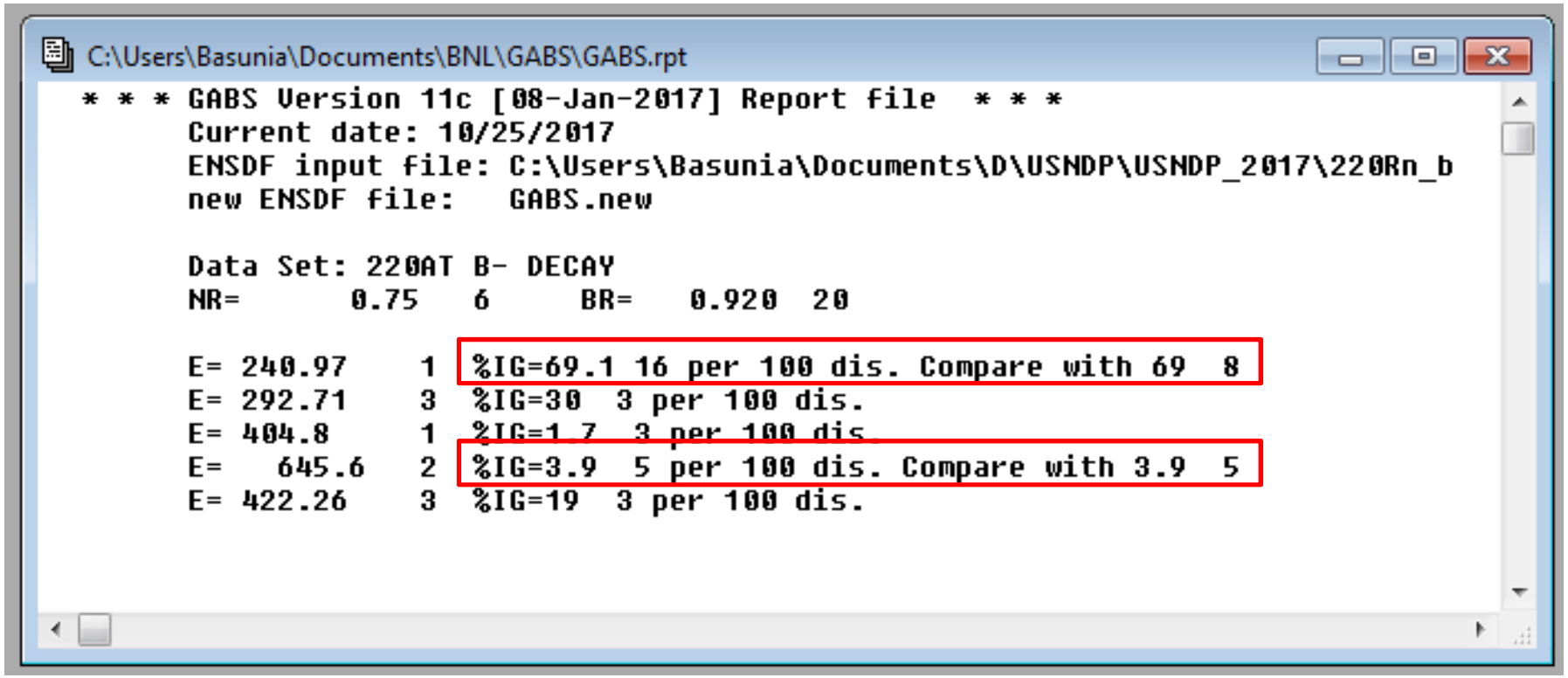


An Example: Input ENSDF file for GABS

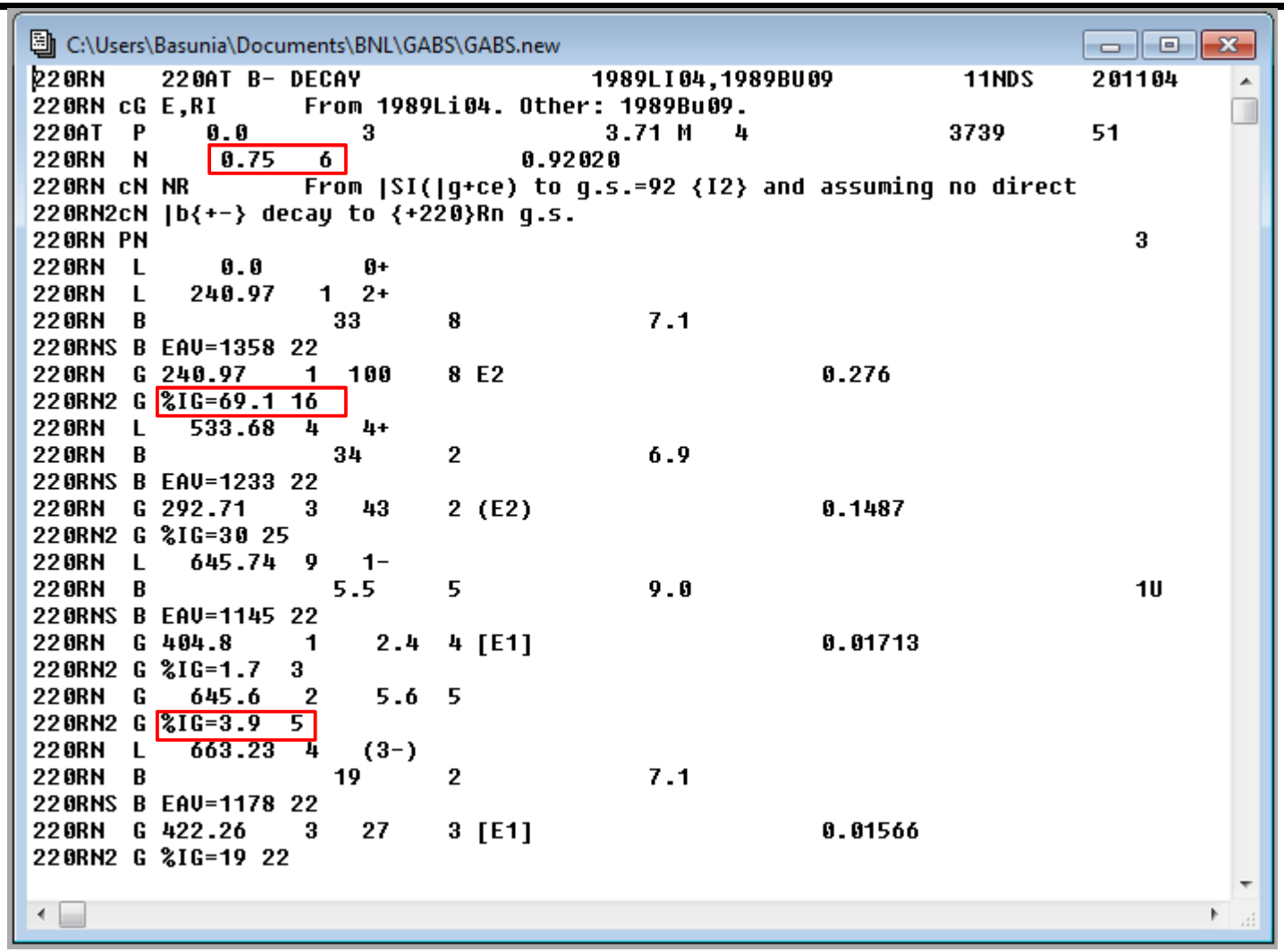
C:\Users\Basunia\Documents\D\USNDP\USNDP_2017\220Rn_b

```
220RN    220AT B- DECAY                  1989LI04,1989BU09          11NDS    201104
220RN cG E,RI      From 1989Li04. Other: 1989Bu09.
220AT  P    0.0        3                  3.71 M   4                3739      51
220RN  N                              0.92020
220RN cN NR        From |SI(|g+ce) to g.s.=92 {I2} and assuming no direct
220RN2cN |b{+-} decay to {+220}Rn g.s.
220RN PN                                                                      3
220RN  L     0.0        0+
220RN  L   240.97    1  2+
220RN  B              33       8              7.1
220RNS B EAV=1358 22
220RN  G 240.97     1  100     8 E2                        0.276                X
220RN  L   533.68   4   4+
220RN  B              34       2              6.9
220RNS B EAV=1233 22
220RN  G 292.71     3   43     2 (E2)                      0.1487
220RN  L   645.74   9   1-
220RN  B              5.5      5              9.0                             1U
220RNS B EAV=1145 22
220RN  G 404.8      1    2.4   4 [E1]                      0.01713
220RN  G   645.6    2    5.6   5                                              X
220RN  L   663.23   4   (3-)
220RN  B              19       2              7.1
220RNS B EAV=1178 22
220RN  G 422.26     3   27     3 [E1]                      0.01566
```

An Example: New output file



An Example: New output file



Different Scenarios

Notes

- In the above example file – if 240.97 keV γ-ray intensity had only 100 and no uncertainty, then use of 'Y' in column 79 is recommended instead of 'X'
- If ^{220}At had a 100% β^- branch, but lets say – had a 8(2)% G.S. β^- feeding - then the input file for GABS would be the same as in slide 6, but in the new output file – one would need to change the 'BR' back to 1.0 again.
- If there would have been missing DRI for the 645.6 keV Eγ - document – 'X' would assume 20% uncertainty – should be noted as assumption in comments for NR.

Use 'Y' flag only for highest intensity γ line and no DRI (often RI = 100), with the assumption that authors propagated DRI of the strongest γ line to DRI of other γ lines

To run multiple files for a parent with both β^- and EC+β^+ decay branching – see examples in GABS Manual

Acknowledgement:

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Thank You