



“N”

Proposal to retain ~~“X”~~ in column 79 of the  
G-record to preserve the list of transitions  
used for normalization with GABS

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# Proposal to retain "X" in column 79 on G-records

- ❑ The uncertainty of absolute gamma-ray intensities could be overestimated for transitions used for normalisation if they are calculated from the ENSDF files using NR, BR and RI
- ❑ GABS will calculate the absolute photon intensities, %IG correctly when it is used in the "F" mode
- ❑ Column 79 in the gamma-records will be blanked in the output file. Unless it is documented, the list of transitions used for the normalisation is not preserved

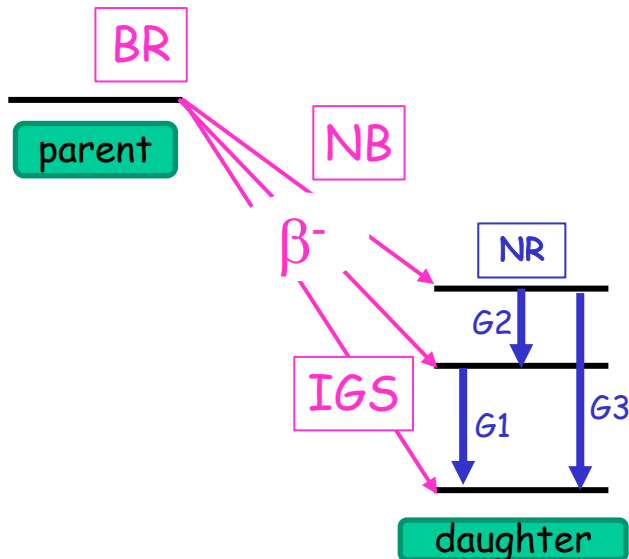
Proposal: retain "X" in column 79 and modify java-NDS to put a G-comment of: "g-ray used for normalisation" for each of these transitions

- ❑ Column 79 on the G-record is not used by any other program. Only GABS, java-GLSC and java-NDS need to be modified
- ❑ Why "X"? Replace "X" with "N" for normalisation

# GABS - calculating absolute $\gamma$ -ray intensities and decay branching ratios derived from decay schemes

## NORMALISATION RECORD:

- ❑ **NR**: Multiplier for converting relative photon intensity (RI in the GAMMA record) to photons per 100 decays of the parent through the decay branch
- ❑ **BR**: Branching ratio multiplier for converting intensity per 100 decays through this decay branch to intensity per 100 decays of the parent nuclide.
- ❑ **NB**: Multiplier for converting relative  $\beta$  and EC intensities (IB in the B- record; IB, IE, TI in the EC record) to intensities per 100 decays through this decay branch.
- ❑ **IGS**: fraction (%) of direct  $\beta$  and EC feeding to the g.s.

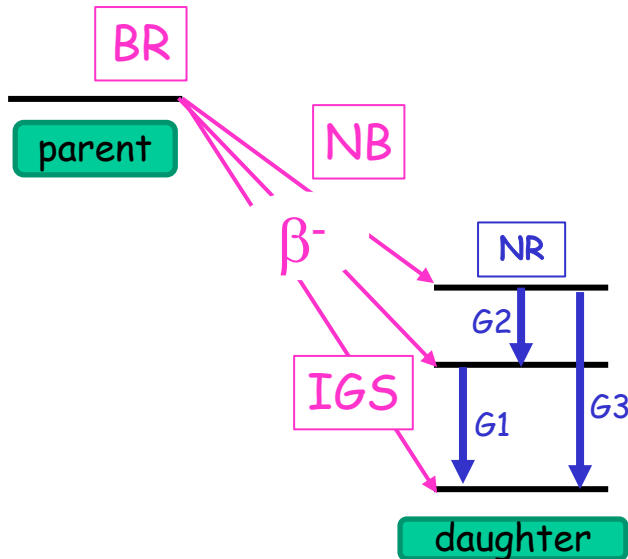


## GABS calculates

- ❑ Single Data Set: NR from RI, CC, TI (if given) , BR and IGS
- ❑ Multiple Data Set: NR and BR from RI, CC, TI (if given) , and IGS

# GABS - calculating absolute $\gamma$ -ray intensities and decay branching ratios derived from decay schemes

## Simple decay scheme



1986Br21 uses  $G$ , the fraction of NOT populating the g.s.

GABS: Fractional g.s. feeding, IGS

$$G = \frac{100 - IGS}{100}$$

## Definitions:

- ❑ Total transition intensity:  $TI = RI * (1 + CC)$
- ❑ Absolute  $\gamma$ -photon intensity:  $\%IG = NR * BR * RI$  per 100 decays
- ❑ NR and BR not independent quantities:

GABS: Calculates NR only!

$$TI = RI * (1 + CC)$$

$$N = NR * BR$$

$$100 = BR \times [IGS + NR \times \sum_i TI(i)]$$

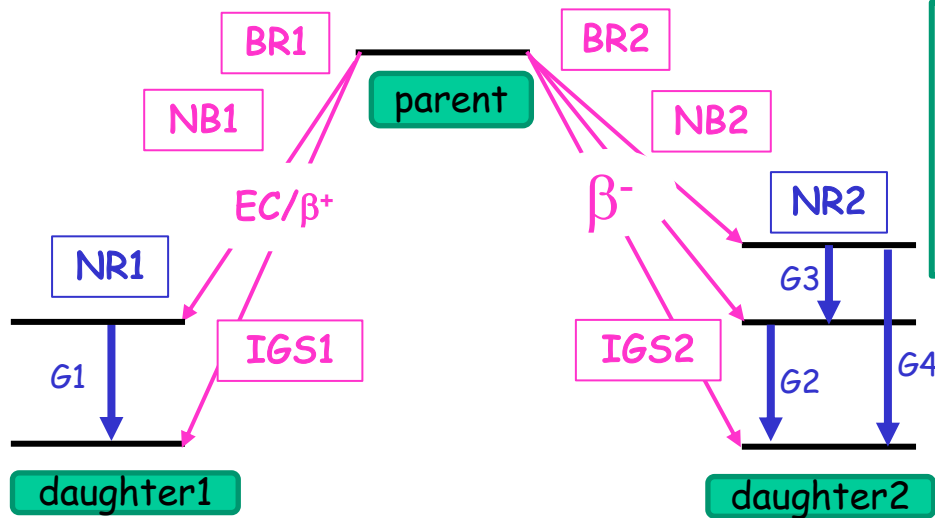
$$NR = \frac{100 - IGS}{100 \times \sum_i TI(i)}$$

$$\%IG = RI * NR * BR$$

# GABS - calculating absolute $\gamma$ -ray intensities and decay branching ratios derived from decay schemes

Complex decay scheme with g.s. feeding

Assuming all RI`s are on the same scale or from the same experiment



$$100 = \sum_j BR(j) \times [IGS(j) + NR(j) \times \sum_i TI(i, j)]$$

$$\sum_j BR(j) = 1$$

$$BR(j) \times NR(j) = BR(k) \times NR(k)$$

GABS: Calculates NR(i) & BR(i)

Caution: Strong correlation between input parameters

New equations derived for uncertainties in NR, BR and %IG

$$BR(i) = \frac{\frac{100 - IGS(i)}{100} \sum_j TI(j, i)}{\sum_k \frac{100 - IGS(k)}{100} \sum_j TI(j, k)}$$

$$N = NR(i) \times BR(i) = \frac{100}{\sum_k \frac{100 - IGS(k)}{100} \sum_j TI(j, k)}$$

## Gamma-rays for normalisation

- ❑ Must feed to the ground state
- ❑ RI or TI must be given; DRI or DTI could be blank, but  $\sum(DTI(i)^2) > 0!$
- ❑ "X" in column 79
- ❑ Gamma-cascade: 'C' in column 80 on N-record
- ❑ IGS= on "2 N" record to specify  $\alpha$ ,  $\beta$ , EC decay branch feeding to g.s.; given in %.

## New functions added

- F NR and BR will be obtained from a fit (using G's marked with "X"; normal execution)
- C Calculate %TI using NR & BR from the N-record
- M Mark transitions going to the g.s. with "X" (DRI>0) or "Y" (DRI=0)

## Usage

**gabs -F ENSDF file**

**gabs ?** for quick help

Command: **gabs ?**

===== GABS Version 12 [22-Apr-2020] =====

Usage with command line arguments:

GABS <Mode> <InputFile>

InputFile ENSDF file, G-rays marked with "X" in column 79

Blank DRI or DTI allowed, but  $\sum[i] DTI(i)**2$  should not be zero

Mode to control execution

- F** NR and BR (multiple data set only!) will be calculated from G`s marked with "X" and direct feeding to the ground state (IGS)  
Output: report (\*.rpt), new ensdf (\*.new)
- C** Calculate TI using NR and BR from the N-record in the input file  
Output: report (\*.rpt), new ensdf (\*.new)
- M** Lists transitions going to the g.s. and  $RI > 0$  or  $TI > 0$  with "X" ( $DRI > 0$  or  $DTI > 0$ ) or "Y" (blank or limits in DRI or DTI)  
Total RI and TI for g.s. transitions also calculated  
Output: report (\*.rpt), GABS input (\*.in)