Program GABS

ENSDF decay data - core datasets

ENSDF

Applications

Basic NP Research

Simulations

ENDF, JEFF, JENDL …

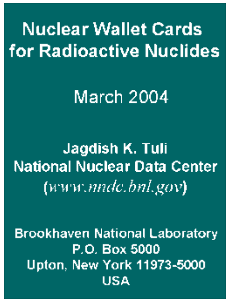
ORTEC & CANBERRA

MIRD

RIPL

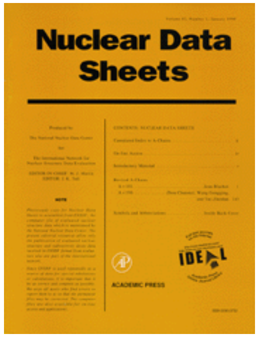
PGAA

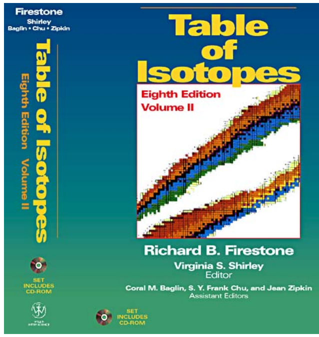
RNAL

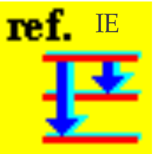


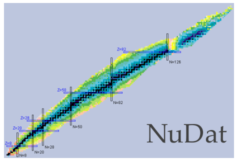
Monte-Carlo Codes
MCNP, GEANT, EGS4

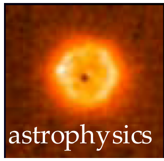
ORIGEN, CINDER90











NUBASE

RADWARE

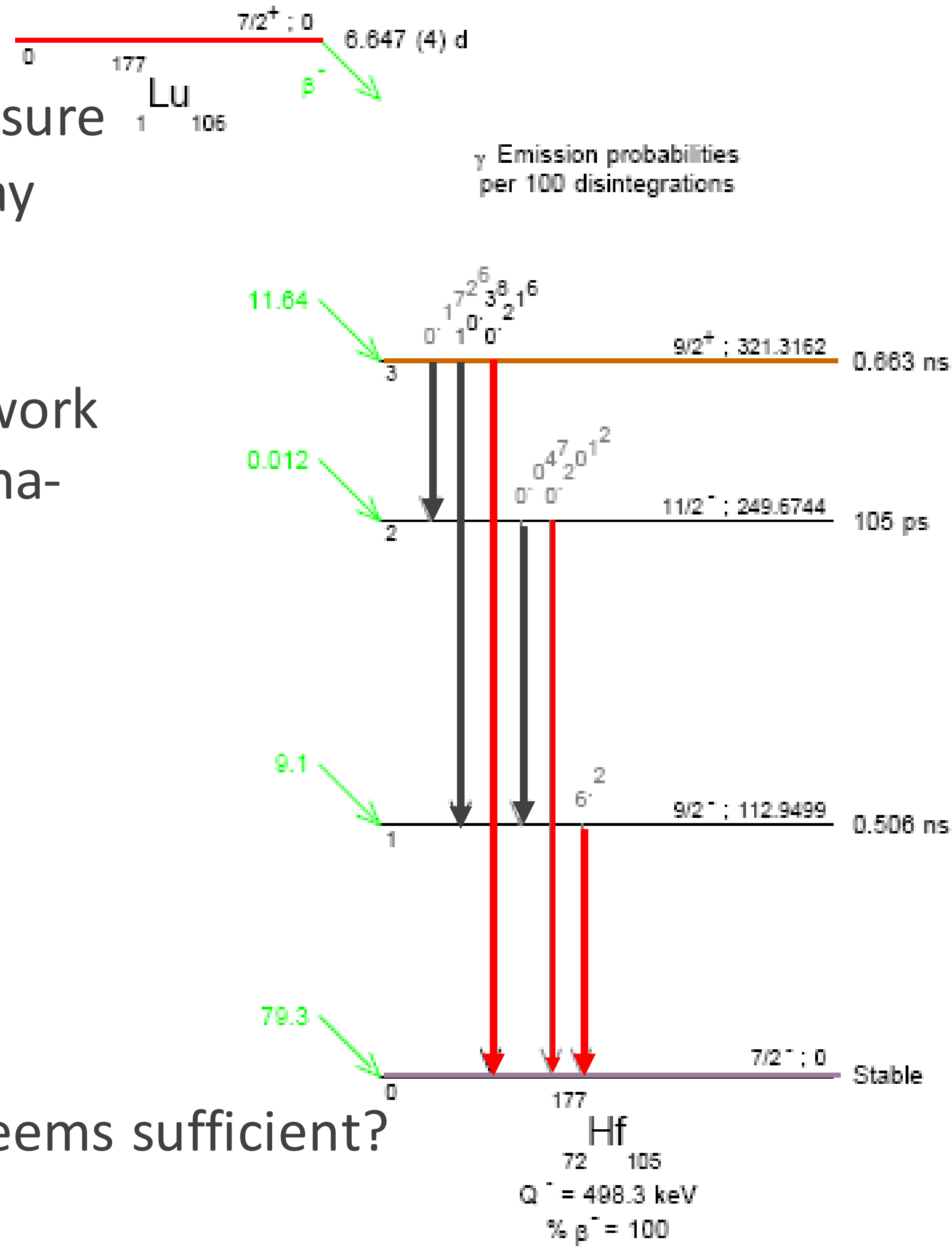
- for any applications one needs absolute emission (γ, β, α, CE, etc.) probabilities, e.g. **% per decay of the parent**
  - ✓ %α decay involves discrete radiations – no problem
  - ✓ %γ and %β are mostly determined from the decay scheme, while CE, X-ray, Auger are deduced from %Iγ and ICC

- ✓ what actually the authors measure and report are the relative γ-ray emission probabilities (Iγ)

- ✓ crucial part of the evaluation work is to convert the relative gamma-ray emission probabilities to absolute ones

$$NR = \frac{(100 - I_{\beta 0})}{\sum I_{\gamma i} \times (1 + \alpha_{Ti})}$$

$$\%I_{\gamma i} = NR \times I_{\gamma i}$$



providing NR, $I_{\beta 0}$ and relative Iγ seems sufficient?

If $I\gamma_1$=100 +/- 10

$I\gamma_2$= 60 +/- 6

$I\gamma_3$= 50 +/- 5

$I_{\beta 0}$=79.4 +/- 0.5 %

$$NR = \frac{(100 - I_{\beta 0})}{\sum I_{\gamma i} \times (1 + \alpha_{Ti})}$$

NR = 0.098 +/- 0.006

$\%I\gamma_i$ = NR x $I\gamma_i$

$\Delta^2(\%I\gamma_i) = \Delta^2(NR) + \Delta^2(I\gamma_i)$

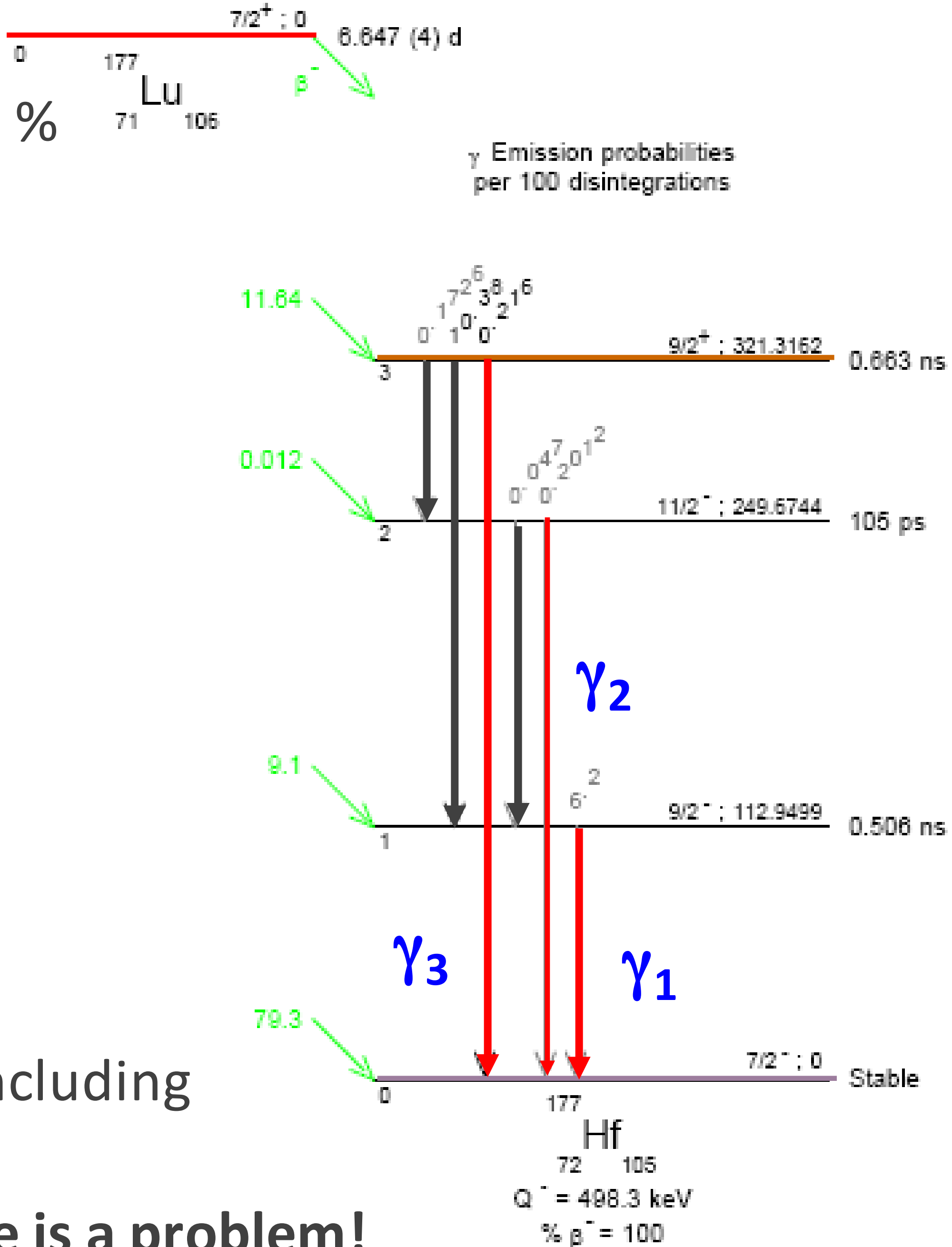
$\%I\gamma_1$= 9.8 +/- 1.2 – unc. 12.2 %

$\%I\gamma_2$= 5.9 +/- 0.7

$\%I\gamma_3$= 4.9 +/- 0.6

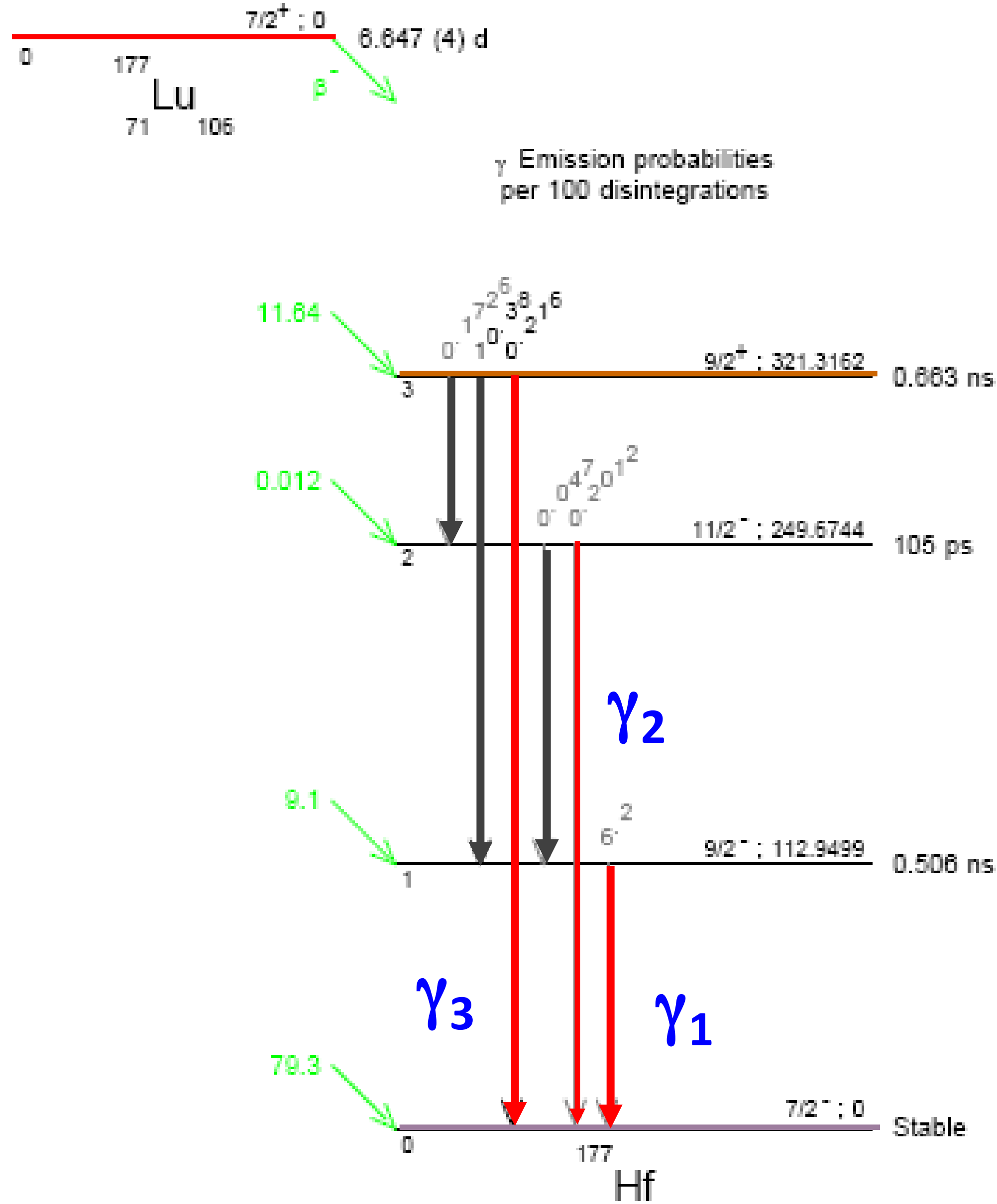
…………………………

this is what every user is doing, including NuDat & LiveChart



BUT – there is a problem!

$$\%I_{\gamma j} = \frac{(100 - I_{\beta 0})}{\sum I_{\gamma i} \times (1 + \alpha_{Ti})} \times I_{\gamma j}$$



- ✓ E. Browne, NIM A249 (1986)
- ✓ uncertainties package (python)
  www.pythonhosted.org/uncertainties/

%Iγ_1= 9.8 +/- 0.7 – unc. **7.1 %**
%Iγ_2= 5.9 +/- 0.5
%Iγ_3= 4.9 +/- 0.5

compared to: $\%I_{\gamma j} = NR \times I_{\gamma j}$

%Iγ_1= 9.8 +/- 1.2 – unc. **12.2 %**
%Iγ_2= 5.9 +/- 0.7
%Iγ_3= 4.9 +/- 0.6

may end up with a huge difference in cases where precision matters!

Consequences

- ✓ using NR and relative $I\gamma_{i,}$ the end-users may end up with incorrect uncertainties for the absolute γ-ray emission probabilities for gamma rays that were used in the normalization procedure
- ✓ the solution is to use the program GABS on your final decay dataset

Solution

%Iγ must be provided by the evaluators in the ensdf decay data sets, by correctly taking into account uncertainty propagations – we have the tool to do that – the (modified) **GABS** analysis program