

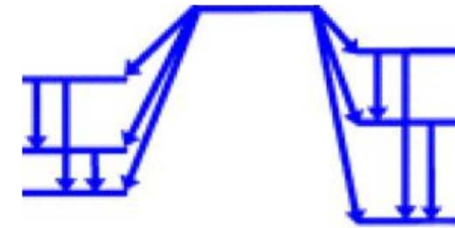
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ICRM GSWG

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2 APPROACHES:

- MONTE CARLO - PENELOPE

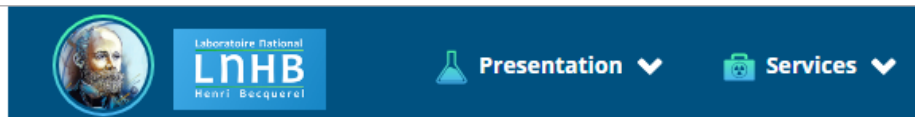
- ETNA



MONTE CARLO

- PENELOPE / PENNUC module
 - Input file including the whole decay schema
 - Code run twice
 - With coincidences (W)
 - Without coincidences (WO)
 - Correction factor : ratio of efficiencies W/WO for each energy

Pennuc files



Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh
Cs	Ba		Hf	Ta	W	Re	Os	Ir
Fr	Ra		Rf	Db	Sg	Bh	Hs	Mt
La	Ce	Pr	Nd	Pm	Sm			
Ac	Th	Pa	U	Np	Pu			

Sor

Atomic number

Nuclide	Z	In	UpDate	Typ
Ba-133	¹³³ Ba	56	8	24/03/2016
Ba-137m	^{137m} Ba	56	99	24/07/2003
Ba-140	¹⁴⁰ Ba	56	8	24/03/2016

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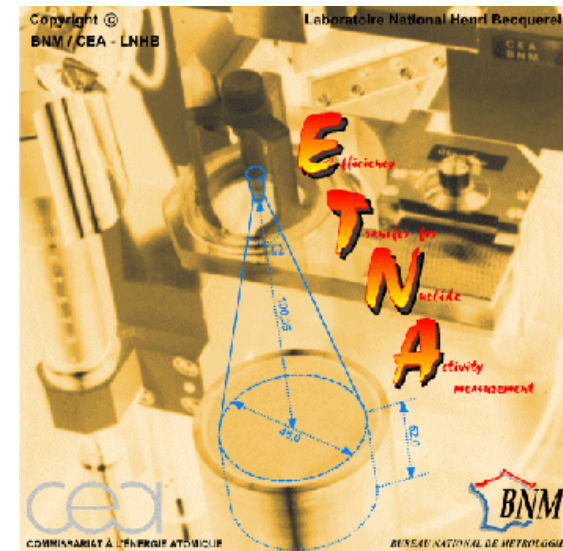
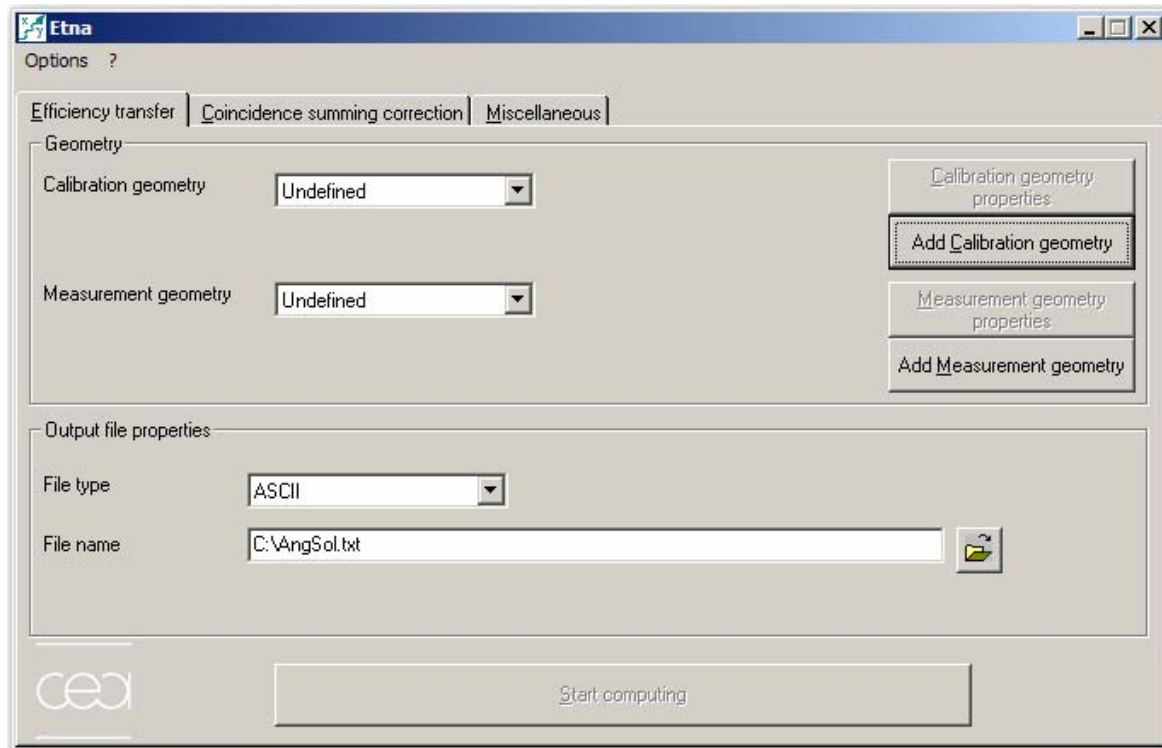
PAR BA133
AZP 133 ; 56
NDA 1
COM ***** Evaluation Date: 28/05/2015 *****
COM ===== Daughter Separator =====
DAU CS133
DDE 1 ; ; 4 ; 15
Q 517.3 ; 1
COM ----- Branch Separator -----
CK 0.573 ; 0.006 ; 4 ; 80.28869999999999 ; 1 ; 0
CL1 0.2144 ; 0.0037 ; 4 ; 80.28869999999999 ; 1 ; 0
CM 0.0664 ; 0.001 ; 4 ; 80.28869999999999 ; 1 ; 0
COM ----- Branch Separator -----
CK 0.1117 ; 0.0039 ; 3 ; 133.4509 ; 1 ; 0
CL1 0.0254 ; 0.0009 ; 3 ; 133.4509 ; 1 ; 0
CM 0.00748 ; 0.00027 ; 3 ; 133.4509 ; 1 ; 0
COM ----- Branch Separator -----
CK 0.00249 ; 0 ; 2 ; 356.6879 ; 1 ; 1
CL1 0.000111 ; 0 ; 2 ; 356.6879 ; 1 ; 1
CM 0.000111 ; 0 ; 2 ; 356.6879 ; 1 ; 1
COM ----- Branch Separator -----
CK 0.00588 ; 0 ; 1 ; 436.3021 ; 1 ; 1
CL1 0.000259 ; 0 ; 1 ; 436.3021 ; 1 ; 1
CM 0.000259 ; 0 ; 1 ; 436.3021 ; 1 ; 1
COM ----- Branch Separator -----
CK 0.00000385 ; 0 ; 0 ; 517.3 ; 1 ; -2
CL1 0.0000009 ; 0 ; 0 ; 517.3 ; 1 ; -2
CM 0.00000025 ; 0 ; 0 ; 517.3 ; 1 ; -2
COM ----- Level Separator - T1/2 in seconds -----
LED 437.0113 ; 0.0013 ; 21 ; 1.5E-10 ; ; 4
GA 0.0214 ; 0.0006 ; 53.1622 ; 0.0018 ; 3
EK 0.1023 ; 0.0032 ; 17.1776 ; 0.0018 ; 3
EL1 0.01252 ; 0.0004 ; 47.4479 ; 0.0018 ; 3
EL2 0.00152 ; 0.00047 ; 47.8028 ; 0.0018 ; 3
EL3 0.0009 ; 0.0006 ; 48.1503 ; 0.0018 ; 3
EM 0.00308 ; 0.00027 ; 52.2133 ; 0.0018 ; 3
EN 0.00074 ; 0.00006 ; 53.0182 ; 0.0018 ; 3
GA 0.0713 ; 0.0006 ; 276.3989 ; 0.0012 ; 2
EK 0.00328 ; 0.00006 ; 240.4146 ; 0.0021 ; 2
EL1 0.00035 ; 0.000006 ; 270.6849 ; 0.0021 ; 2
EL2 0.0001362 ; 0.0000024 ; 271.0398 ; 0.0021 ; 2
EL3 0.0001138 ; 0.0000019 ; 271.3873 ; 0.0021 ; 2
EM 0.0001257 ; 0.0000021 ; 275.4503 ; 0.0021 ; 2
EN 0.0000294 ; 0.0000005 ; 276.2552 ; 0.0021 ; 2
GA 0.6205 ; 0.0019 ; 356.0129 ; 0.0007 ; 1
EK 0.01309 ; 0.00019 ; 320.0288 ; 0.0017 ; 1
EL1 0.00144 ; 0.000025 ; 350.2991 ; 0.0017 ; 1
EL2 0.000403 ; 0.000006 ; 350.654 ; 0.0017 ; 1
EL3 0.0003096 ; 0.0000044 ; 351.0015 ; 0.0017 ; 1
EM 0.000447 ; 0.000006 ; 355.0645 ; 0.0017 ; 1
EN 0.0001052 ; 0.0000015 ; 355.8694 ; 0.0017 ; 1
COM ----- Level Separator - T1/2 in seconds -----
LED 383.8491 ; 0.0012 ; 21 ; 4.4E-11 ; 1.1E-11 ; 3
GA 0.0045 ; 0.00005 ; 223.2368 ; 0.0013 ; 2
EK 0.000376 ; 0.000007 ; 187.2524 ; 0.002 ; 2
EL1 0.0000457 ; 0.0000008 ; 217.5227 ; 0.002 ; 2
EL2 0.00000306 ; 0.0000008 ; 217.8776 ; 0.002 ; 2
EL3 0.00000089 ; 0.0000007 ; 218.2251 ; 0.002 ; 2
EM 0.00001017 ; 0.00000021 ; 222.2881 ; 0.002 ; 2
EN 0.000002445 ; 0.000000045 ; 223.093 ; 0.002 ; 2
GA 0.1831 ; 0.0011 ; 302.8508 ; 0.0005 ; 1
EK 0.00683 ; 0.00012 ; 266.8666 ; 0.0016 ; 1
EL1 0.000828 ; 0.000014 ; 297.1369 ; 0.0016 ; 1
EL2 0.0000465 ; 0.0000008 ; 297.4918 ; 0.0016 ; 1
RT.3 0.00001091 ; 0.0000003 ; 297.8393 ; 0.0016 ; 1
    
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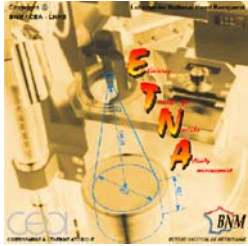
ETNA

(Efficiency Transfer for Nuclide Activity measurement)

ETNA is a software for computing efficiency transfer and coincidence summing corrections for gamma-ray spectrometry.

The software has been developed at the Laboratoire National Henri Becquerel and is available upon request.

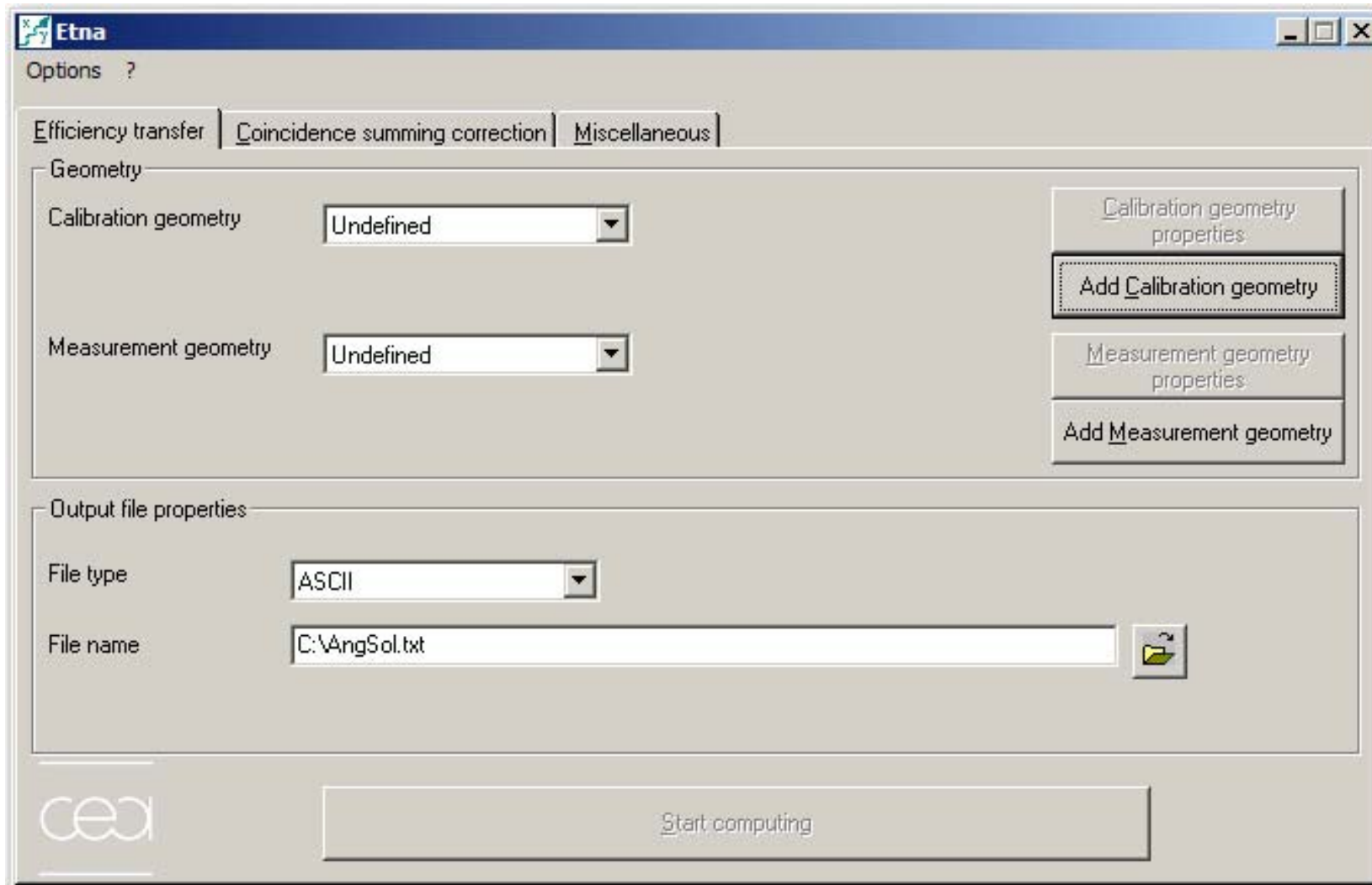




ETNA

- Transfer of efficiency
 - Semi-empirical method (from a reference efficiency)
 - Coaxial cylindrical geometry (point, disk, cylinder. Marinelli)
- Coincidence summing corrections
 - Knowledge of the efficiency (total and full-energy peak)
 - Possibility of efficiency transfer
 - Decay scheme from Nucleide
- Data management
 - Decay scheme
 - Attenuation coefficients

ETNA main window



ETNA – Coincidence tab

Options ?

Efficiency transfer | Coincidence summing correction | Miscellaneous

Nuclide: Ba133 Daughter nuclide: Cs133

Geometry

Calibration geometry: G1 SP reference *Source ponctuelle à 10 cm*

Measurement geometry: G1 SP reference *Source ponctuelle à 10 cm*

Measurement geometry different from calibration geometry

Output file properties

File type: ASCII

File name: C:\Corco.txt

Simplified computing Complete computing

Start computing

CEC BNM

Calculation with efficiency transfer

The screenshot shows the 'Options' dialog box in the Etna software. The 'Efficiency transfer' tab is selected. The 'Nuclide' is set to Ba133 and the 'Daughter nuclide' is Cs133. Under the 'Geometry' section, the 'Calibration geometry' is 'G1 SP reference' (Source ponctuelle à 10 cm) and the 'Measurement geometry' is 'G1-SG50 à 10 cm', which is circled in red. The checkbox 'Measurement geometry different from calibration geometry' is checked. Under 'Output file properties', the 'File type' is ASCII and the 'File name' is C:\Corco.txt. At the bottom, there are radio buttons for 'Simplified computing' (selected) and 'Complete computing', a 'Start computing' button, and logos for CEA and BNM.

Options ?

Efficiency transfer | Coincidence summing correction | Miscellaneous

Nuclide: Ba133 Daughter nuclide: Cs133

Geometry

Calibration geometry: G1 SP reference *Source ponctuelle à 10 cm*

Measurement geometry: G1-SG50 à 10 cm

Measurement geometry different from calibration geometry

Output file properties

File type: ASCII

File name: C:\Corco.txt

Simplified computing Complete computing

Start computing

CEA BNM

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ETNA

- Requires efficiency calibration
- 1st step : Monte Carlo simulation for a point source (reference efficiency)

- 2 options « simplified » and « complete »

In the « simplified » option, first the efficiency for the volume source is computed, then the CS calculation is run as for a point source

In the « complete » option, CS are performed through integrals on source volume

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Laboratoire National Henri Becquerel

CEA
BNM

E
Efficiency

T
Samples for

N
Nucleic

A
Activity
MEASUREMENT

Thank you for your attention !

cea
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BUREAU NATIONAL DE METROLOGIE

