



Genie EFFTran

User interface for Genie2000™/EFFTRAN based
calculation routines

Nikola Markovic
Sven Poul Nielsen

Gamma spectrometry at DTU Nutech Radioecology

- 17 HPGe detectors
- > 1000 samples/year (1000-2000)



Gamma spectrometry at DTU Nutech Radioecology





Routine gamma analysis

Currently using in-house developed software:

- Performs very good on intercomparisons
- Hard for maintenance
- Not easy to use
- ...
- Outdated

Nielsen, S.P., Pálsson, S.E., 1998.
An intercomparison of software for processing Ge γ -ray spectra. NIM A

```
Shortcut to Det952mm spektre.cmd
Spektrum behandling vers. 3.1, Jan. 2004

File A: (Not used)

=> Dataindlaesning og behandling af spektre
Uaelg fast maalings-nr.....[ - ]
Areal og udbytte af toppe
Nummer- og isotopsortering
Isotop-sammenfatning
Middel (vaegtet) af isotoper
Beregn isotopforhold
Henfalds-beregning
Udskriv formatteret output af records
Ret fil
Liste over spektre m.v.
Spektrumtabel
Tabeller - kalibrering, coincidens, isotoper
Printer-udskrift ( eller log-fil)....[ PRN ]
Overskrift til printer el. logfil:
'C-BASE version 4.0, Jul.2003 (WIN32)'
Command ( DOS )
Filhaandtering

-----
ESC or '.': prev. menu  F1 or ?: help  ENTER selects:
```

```
Shortcut to Det952mm spektre.cmd
Spektrum behandling

File A: (Not used)

Data indlaesning ( spektrum)
Indsaet praeue- og spektrum data
Justering/plot af energikalibrering ( K-40 pos.)
Spektrum flytning
Baggrunds-spektrum subtraktion
Udglat spektre

Adder spektre paa fil
Middelspektrum fra fil
Talletid i middelspektrum...[ 1000]
Nulstil lave talletal .....[ < 0]

=> Komprimer spektre
Expander komprimerede spektre
Gnuplot - output
Printer-plot
Filhaandtering

-----
ESC or '.': prev. menu  F1 or ?: help  ENTER selects:
```

Routine gamma analysis

New calibration in 2016.

Need for a new analysis system.

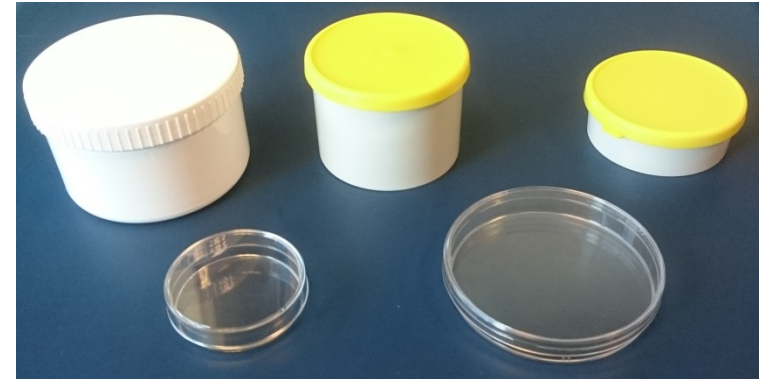
Some of the requirements:

- Versatile (different bakers and filling heights)
- Fast and easy to use (without too much training)
- Minimize human input
- Keeping the track of input parameters
- Accurate and precise

Decided for:

Genie2000

Combination with EFFTRAN for efficiency transfer and true coincidence summing (TCS) corrections



Bakers used for gamma spectrometry (+ Marinelli and well)

Vidmar, T., 2005. EFFTRAN - A Monte Carlo efficiency transfer code for gamma-ray spectrometry. NIM A

Vidmar, T., Kanisch, G., Vidmar, G., 2011. Calculation of true coincidence summing corrections for extended sources with EFFTRAN. ARI

Bruggeman, M., Vidmar, T., Amouriq, F., Verheyen, L., 2014. Efficiency calibration of BEGe and extended range detectors. ARI



Input window 1:

- .CNF file selection
- Detector selection

data_input User: nikmar on: NTECHRI-L13423

Nutech Gamma Eval v.0.1 beta

Sample ID:

Select Genie2000 CAM file:

Select detector:



Input window 2:

- All sample parameters

Baker geometry,
sample composition,
mass, filling height ...

data_input_two_material 106684.CNF 16684 DET001 User: nikmar on: NTECHRI-L13423

Nutech Gamma Eval v.0.1 beta

Select geometry:

Sample quantity: g

Sample quantity uncertainty:

Sample reference date:

Sample reference time:

Sample description:

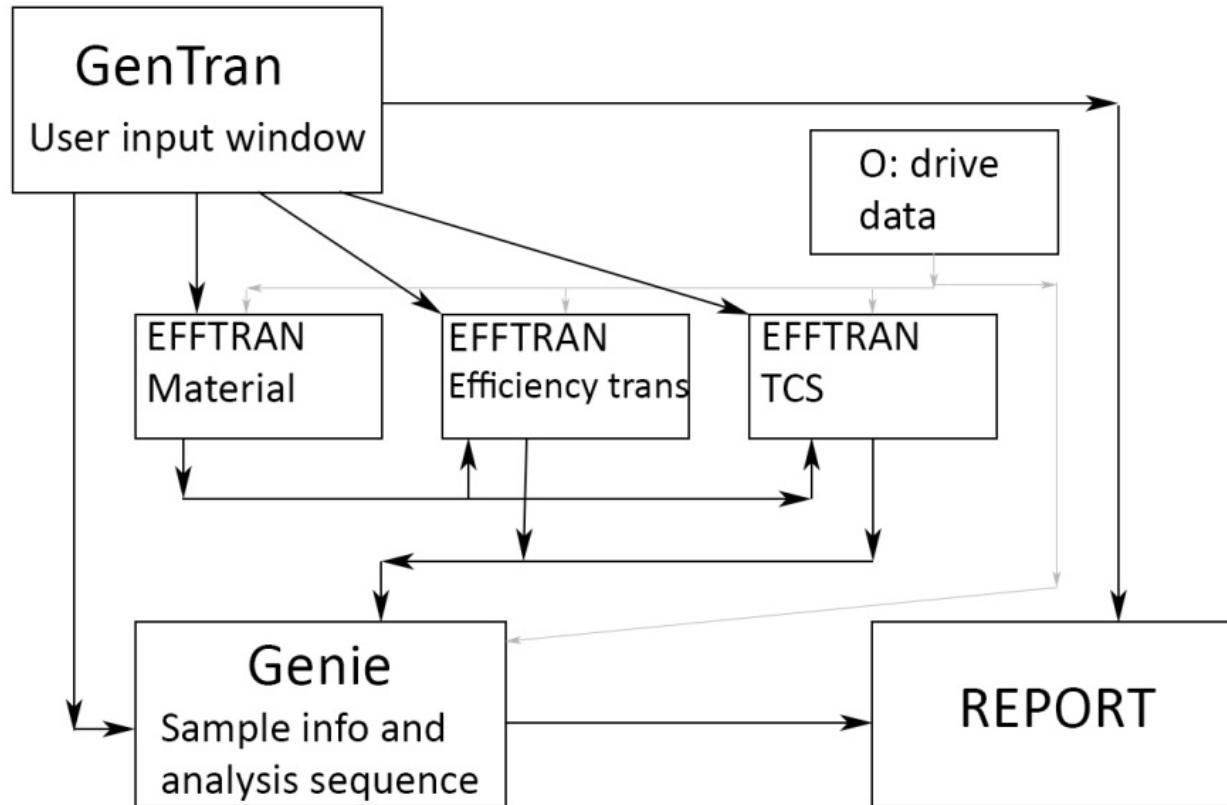
Select composition:

Sample mass (g):

Filling height (mm):

Inhibit acquisition time decay correction

Data flow



EFFTRAN: efficiency transfer (geometry + self-absorption) and TCS correction

Genie2000: peak identification, background subtraction, nuclide identification in Analysis Sequence (using batch commands)

- 7 All data (calibrations, background spectra, detector description, ASF ...) on local O drive



Conclusions and perspectives

- This a very simple solution, not a complete one.

It has disadvantages but the advantage is that it can be set-up (installed) in only a few minutes if the calibrations and geometry files are ready.

Easy to change the analysis (change peak search algorithm, add interactive peak fit ...) as it is based on Genie analysis sequence file (ASF).

- Old software – up to 20 minutes per sample
Now – around 2 minutes
- Unbroken traceability chain

- Need for better reporting (database interfacing)
- EFFTRAN for well detectors would be great

Full system (benchmark):

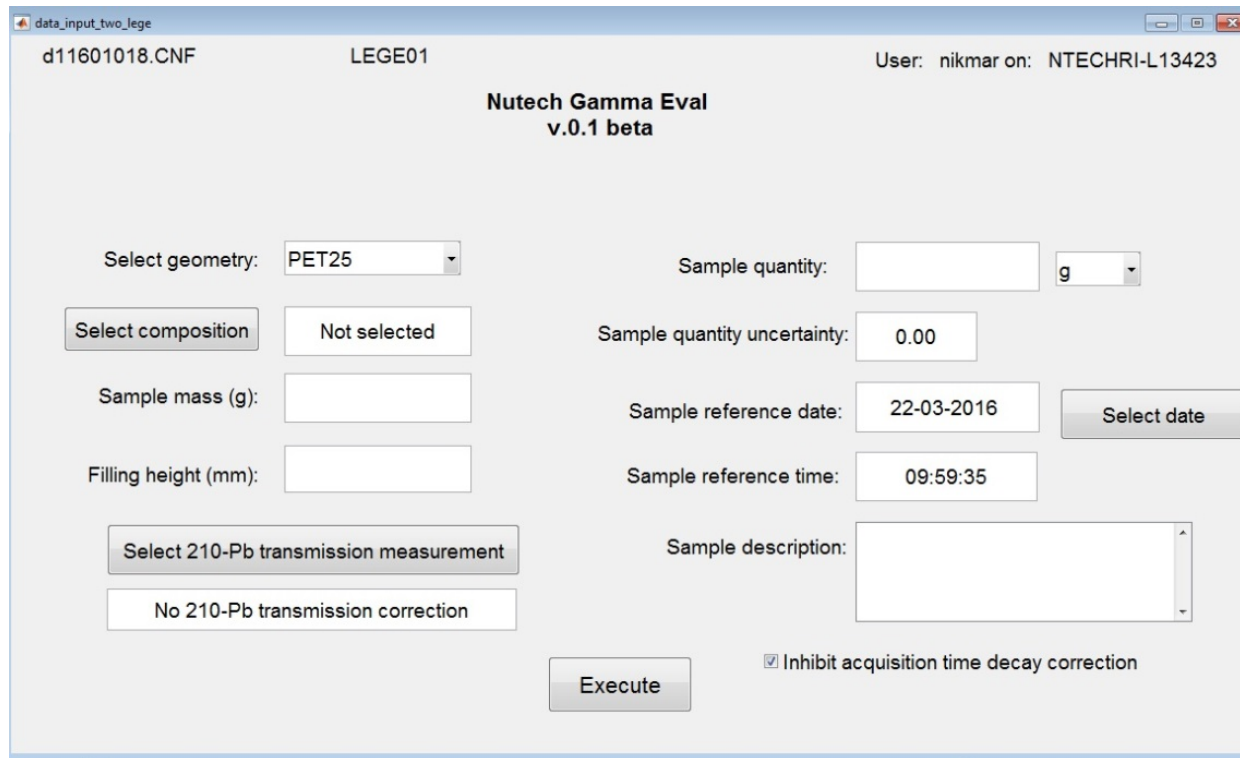
Bruggeman, M., Verheyen, L., Vidmar, T., 2014. A dedicated LIMS for routine gamma-ray spectrometry. ARI

Filling height – density calculation



Uncertainty in volume measurement is big but we decided to use it as it is still lower than using the assumed density.

Self-absorption – transmission source



data_input_two_lege

d11601018.CNF LEGE01 User: nikmar on: NTECHRI-L13423

**Nutech Gamma Eval
v.0.1 beta**

Select geometry: PET25

Sample quantity: g

Select composition: Not selected

Sample mass (g):

Sample quantity uncertainty: 0.00

Filling height (mm):

Sample reference date: 22-03-2016

Sample reference time: 09:59:35

Select 210-Pb transmission measurement: No 210-Pb transmission correction

Sample description:

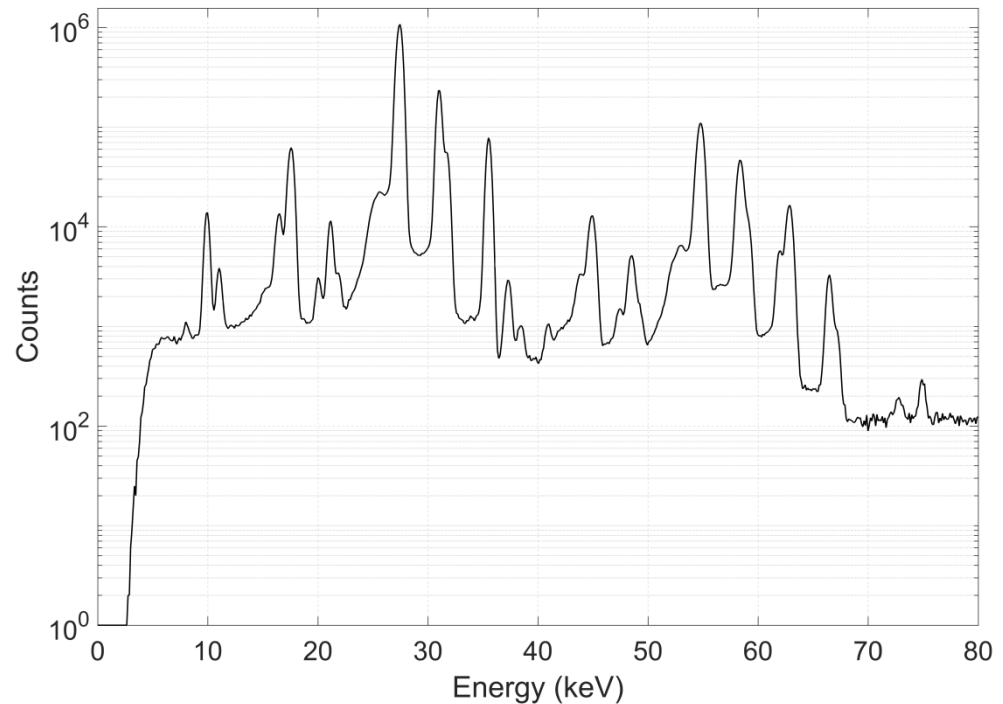
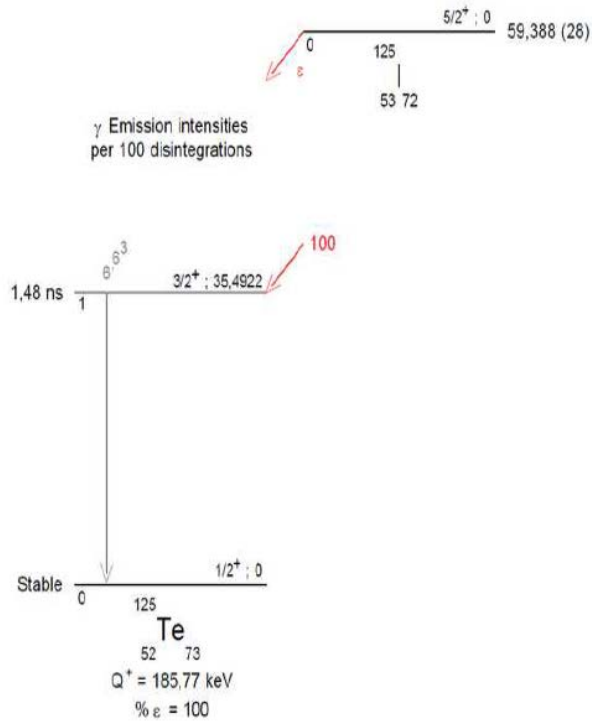
Inhibit acquisition time decay correction

For unknown sample matrix transmission measurement with point source is used - Cutshall method.

EFFTAN - use the same sample composition as calibration solution.
Works only for single-gamma emitters.

EFFTRAN X-ray-gamma TCS

- Tested with ^{125}I standardised point source.
- Using EFFTRAN with dead layer set to 0 -> TCS factor = 1.33
- Calculated based on the source activity TCS = 1.34
- Used on BEGe detectors for different filling heights in LSC vials.



TCS correction for calibration solution

Detector:		DET09						DET10					
Baker (volume cm3):		PET25_5			GY200_58			PET25_10			GY200_58		
		Efftran	LABSOCS		Efftran	LABSOC S		Efftran	LABSOC S		Efftran	LABSOC S	
ID	E(keV)	Correction factor			Diff(%)			Correction factor			Diff(%)		
AM-241	59.5	1.01	1.00	1.20	1.01	1.00	0.67	1.01	1.00	1.04	1.01	1.00	0.67
CD-109	88.0	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
CO-57	122.1	1.02	1.01	0.83	1.01	1.00	0.49	1.02	1.02	0.03	1.01	1.01	0.39
CO-57	136.5	0.90	0.94	-4.26	0.95	0.98	-2.34	0.92	0.91	0.47	0.95	0.97	-2.05
CE-139	165.9	1.25	1.21	2.53	1.17	1.14	2.19	1.23	1.23	0.24	1.17	1.15	2.07
CR-51	320.1	1.00	1.00	0.04	1.00	1.00	0.02	1.00	1.00	0.03	1.00	1.00	0.02
SN-113	391.7	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
SR-85	514.0	1.08	1.05	2.75	1.04	1.02	1.75	1.06	1.08	-1.30	1.04	1.02	1.46
CS-137	661.7	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
MN-54	834.8	1.00	1.00	0.08	1.00	1.00	0.03	1.00	1.00	0.05	1.00	1.00	0.03
Y-88	898.0	1.29	1.26	2.78	1.18	1.15	2.13	1.26	1.30	-3.18	1.18	1.15	1.94
ZN-65	1115.5	1.01	1.00	0.69	1.00	1.00	0.27	1.00	1.00	0.49	1.00	1.00	0.26
CO-60	1173.2	1.20	1.19	0.91	1.14	1.14	0.68	1.19	1.19	-0.20	1.14	1.13	0.94
CO-60	1332.5	1.21	1.20	0.98	1.15	1.14	0.78	1.20	1.20	-0.17	1.15	1.14	1.05
Y-88	1836.1	1.33	1.28	4.00	1.21	1.17	2.75	1.30	1.32	-1.64	1.20	1.17	2.58