Genie EFF**Tran**

User interface for Genie2000™/EFFTRAN based calculation routines

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Gamma spectrometry at DTU Nutech Radioecology

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

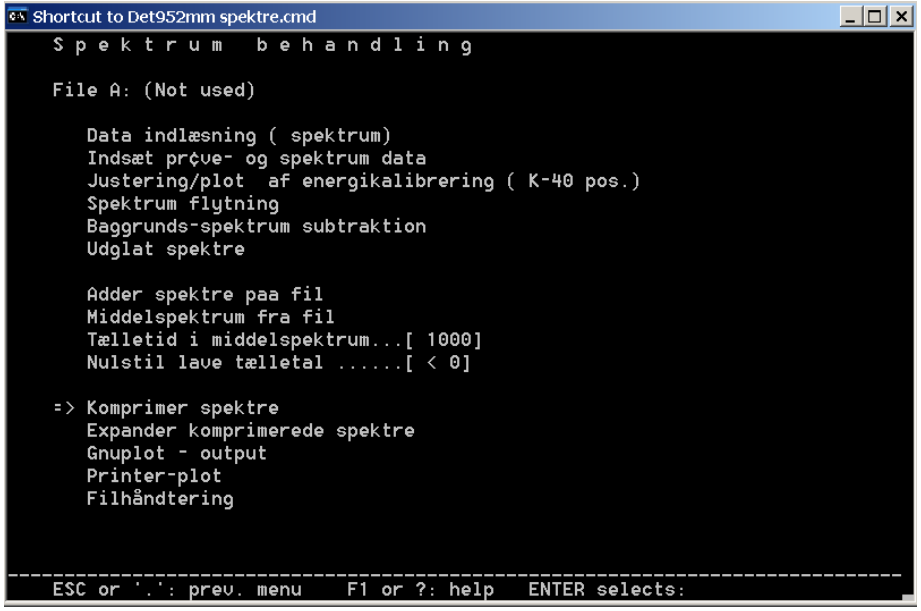
Gamma spectrometry at DTU Nutech Radioecology

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- Outdated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

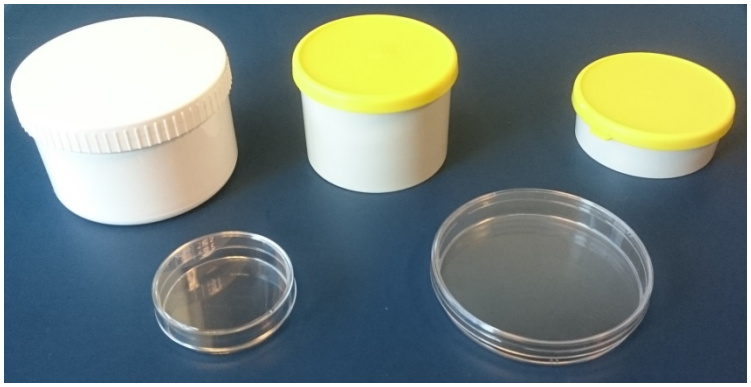
Routine gamma analysis

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



Bakers used for gamma spectrometry (+ Marinelli and well)

Decided for:

Genie2000

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

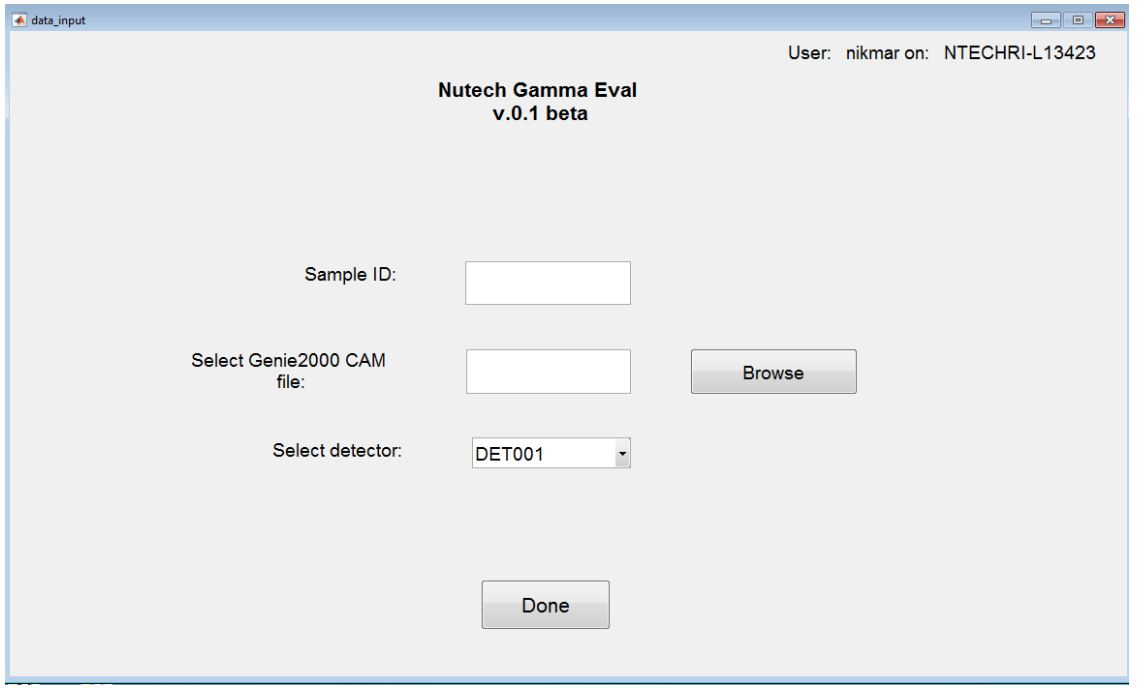
Vidmar, T., 2005. EFFTRAN - A Monte Carlo efficiency transfer code for gamma-ray spectrometry. NIM A

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:

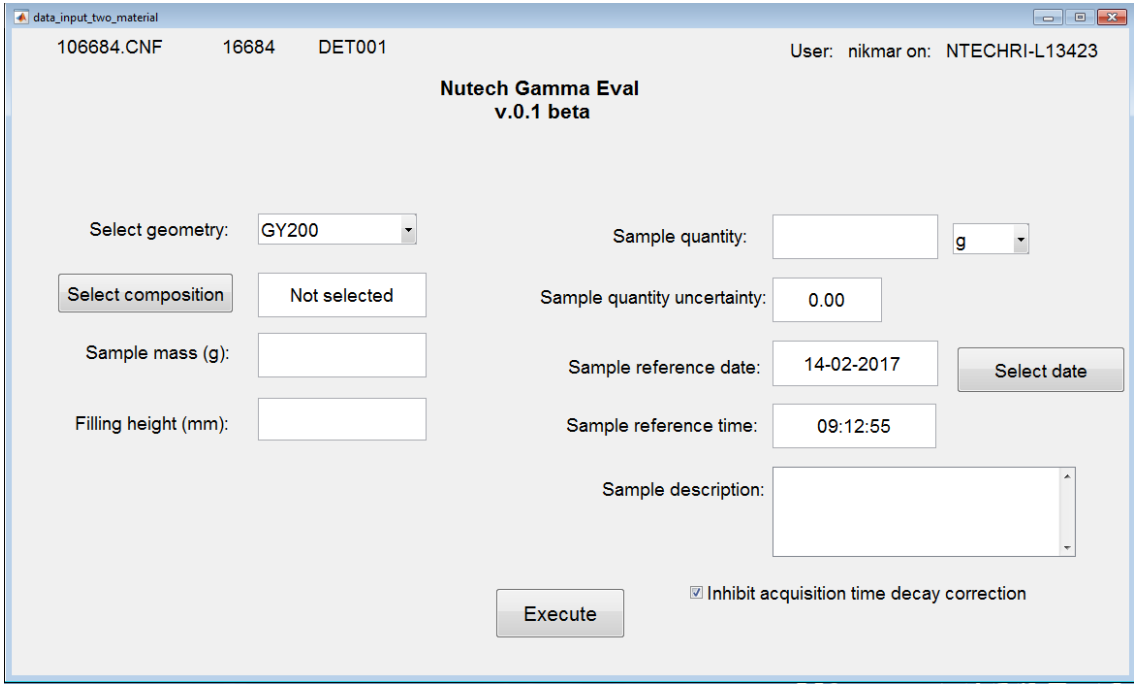
- .CNF file selection
- Detector selection



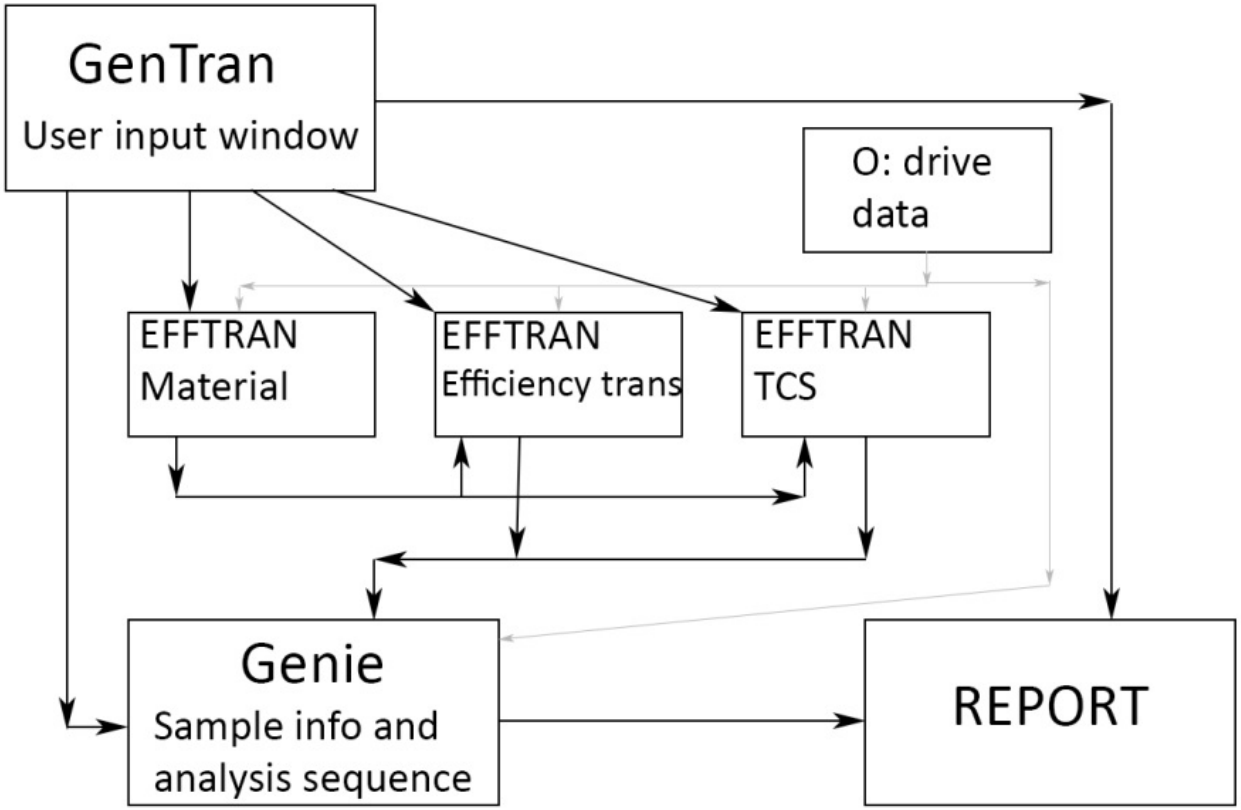
Input window 2:

- All sample parameters

Baker geometry, sample composition, mass, filling height …



Data flow



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

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

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

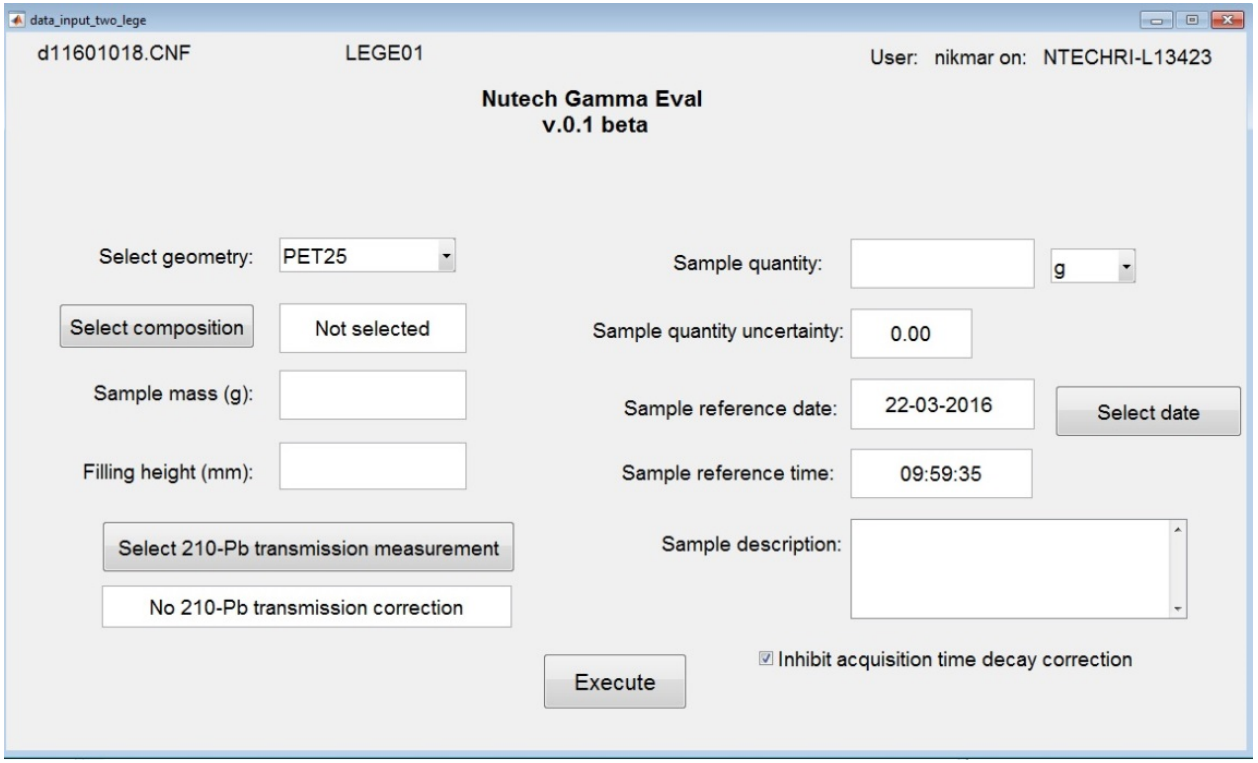
Full system (benchmark):

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



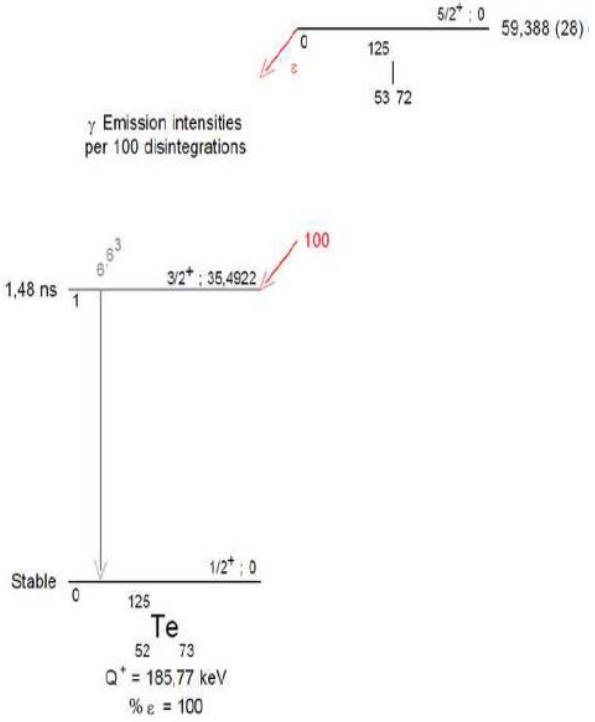
For unknown sample matrix transmission measurement with point source is used - Cutshall method.

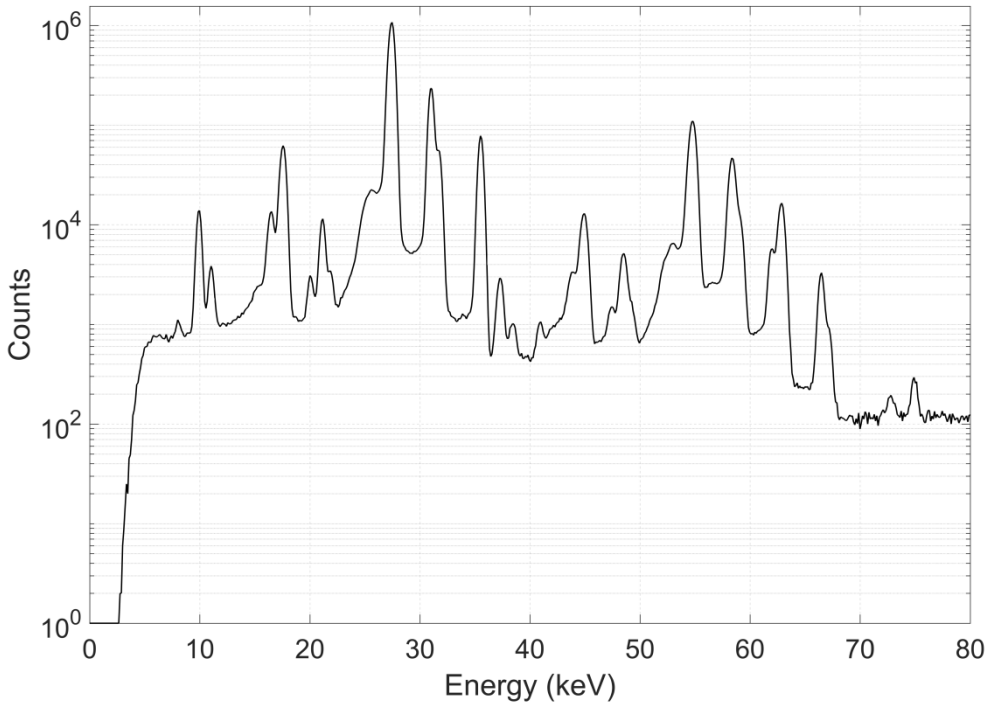
EFFTAN - use the same sample composition as calibration solution.
Works only for single-gamma emitters.

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	LABSOCS		Efftran	LABSOCS		Efftran	LABSOCS	
ID	E(keV)	Correction factor		Diff(%)	Correction factor		Diff(%)	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