LVis 4 & tRAYcy

the basis for a new approach to gamma spectrometry.

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What is LVis?

LVis is a software for **comprehensive operation and management** in a nuclear counting lab performing quantitative sample analyses!

LVis simplifies the setup and operation of spectrometers in counting laboratories and bundles extensive functionalities into a **single application**.

It uses **proven spectrum analysis techniques** and combines them with **automatically on-the-fly calculated corrections** for geometry and true coincidence summing using ORTEC's own algorithm **tRAYcy**.

ONE PLATFORM. ONE WORKFLOW. RELIABLE RESULTS.

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What are LVis Key Features?

- Full Hardware Support
- Automated Measurements
- GV Analysis Engines
- Automated Calibration
- tRAYcy MC Modelling
- Centralized Data Management
- Lab Journal
- Quality Assurance
- Interactive Peak Editor
- Full Traceability
- GMP Compliant
- Data Import and Export
- Standards Compliant

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What is tRAYcy?

tRAYcy is a "full Monte-Carlo" ray tracing code like MCNP/Geant4 with a clear focus on spectroscopy.

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What is tRAYcy?

tRAYcy is a “full Monte-Carlo” ray tracing code like MCNP/Geant4 with a clear focus on spectroscopy.

Capable of:

- Geometry/ Attenuation correction
- Summing correction
- Mathematical calibration
- Spectrum generation
- Detector optimization

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tRAYcy Detector

a digital twin in LVis

tRAYcy is a “full Monte-Carlo” ray tracing code like MCNP/Geant4 with a clear focus on spectroscopy.

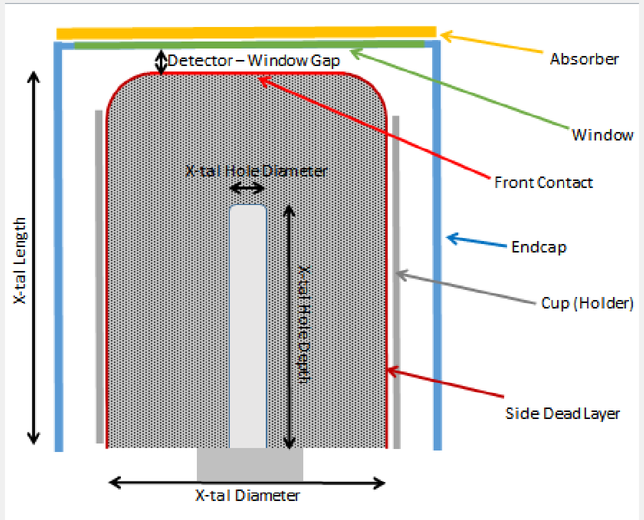
Detector details

Crystal

X-tal material:	Germanium
X-tal diameter [mm]:	69.9
X-tal length [mm]:	73.4
Bulletizing radius [mm]:	8.5
Top dead layer [mm]:	1.05
Side dead layer [mm]:	1.05
X-tal hole (cavity) diameter [mm]:	8.9
X-tal hole (cavity) length [mm]:	59.7

Housing

End cap material:	Aluminum
End cap diameter [mm]:	83
End cap thickness [mm]:	1
Mount cup material:	Aluminum
Mount cup thickness [mm]:	0.8
Window material:	Aluminum
Window-to-X-tal gap [mm]:	4
Window thickness [mm]:	1
Window diameter [mm]:	81



OK Cancel

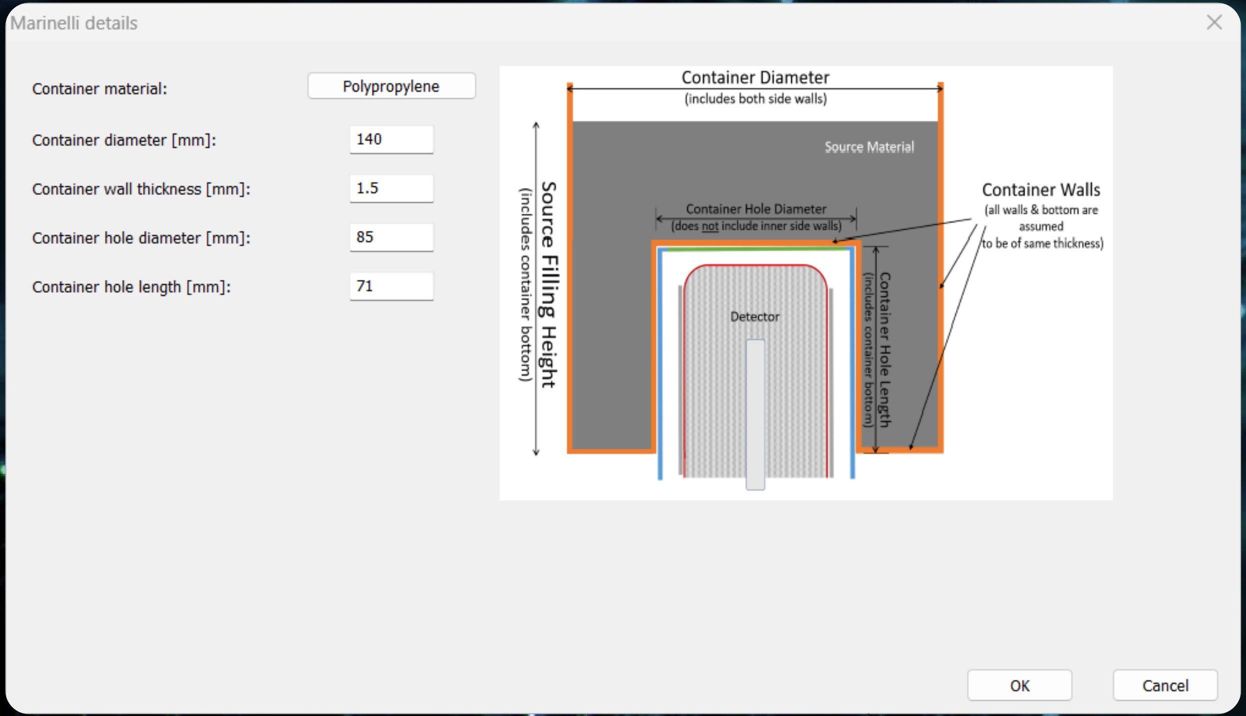
tRAYcy hardware properties

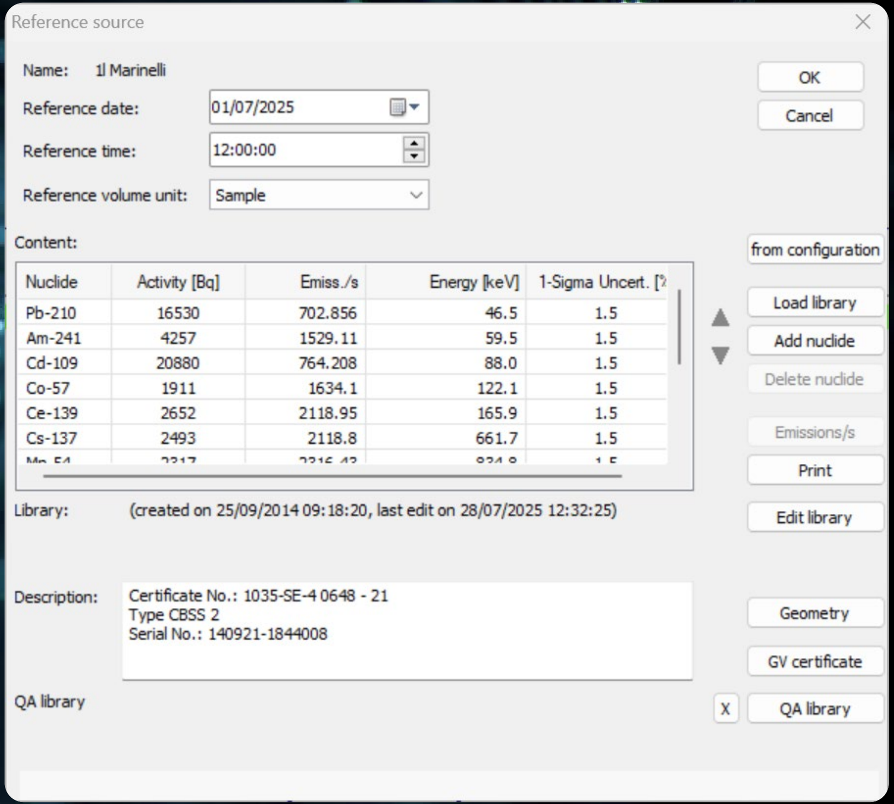
Conversion gain:	8192		
FWHM [keV] at	122 keV: 0.75	1332 keV:	1.8
Rise time [µs]:	12		
Flat top time [µs]:	0.8		
Gain (0.1…10):	0.6666	-> 0 - 3000 keV	

OK Cancel

tRAYcy Detector

a digital twin in LVis





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tRAYcy Detector

a digital twin in LVis

LVis/tRAYcy live demo

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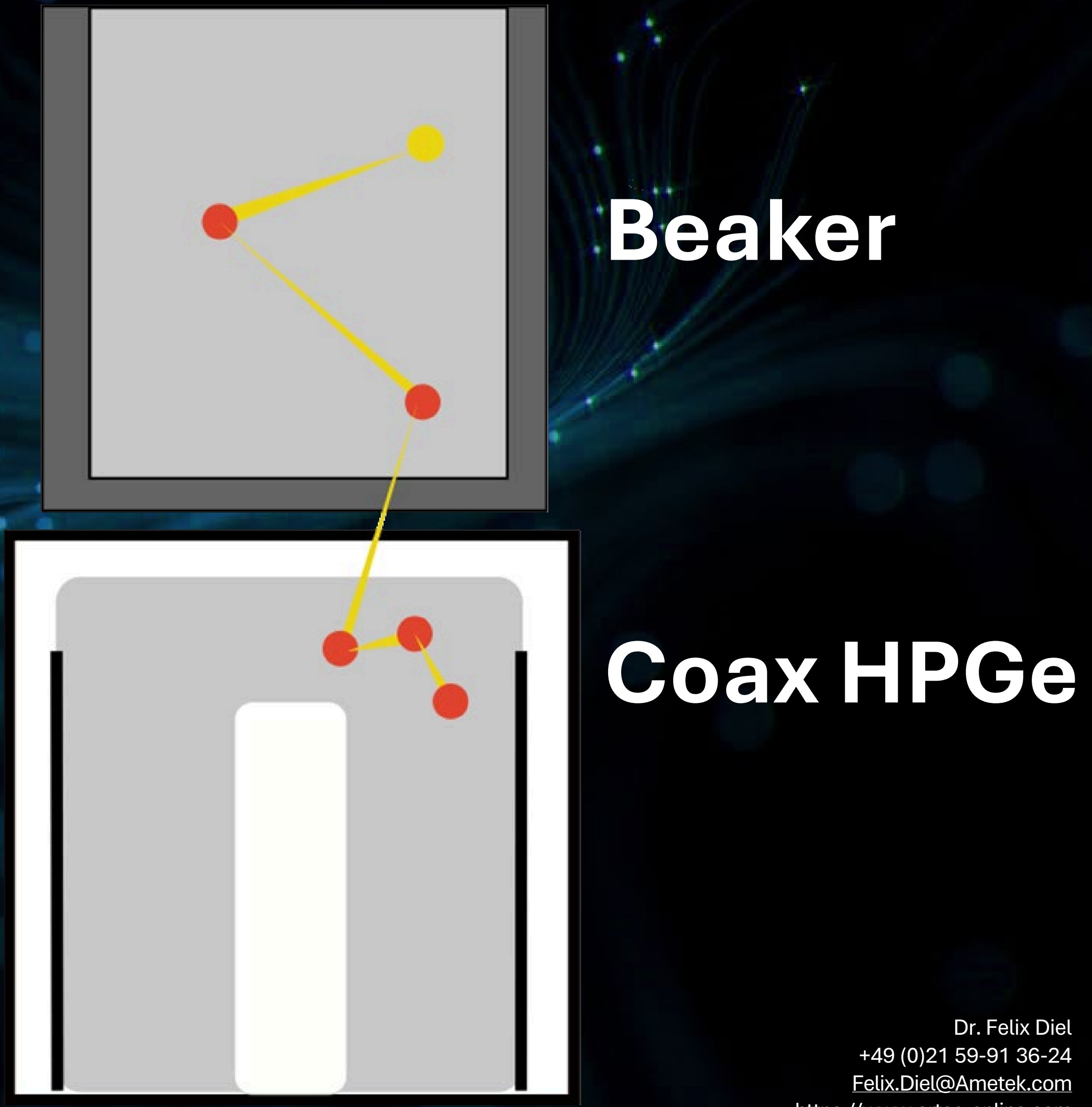
tRAYcy - full Monte-Carlo ray tracing

- Scene constructed of primitives
  - cyllinders/rings/spheres/..

- Ray sampling
  - homogeneous positions and directions
  - samples photon/electron/alpha cascades from level populations across decay chains

- Ray tracing (for each ray)
  - Considers photo/compton/pair interaction
  - Traces the ray until it has deposited its full energy or leaves the scene
  - Records total energy loss and energy loss in the active detector volume
  - Traces photons/electrons/positrons/alphas
  - Takes signal processing into account

➢ True and random summing peaks and single and double escape peaks emerge naturally



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tRAYcy Decay Data

NuDat 3.0

Brookhaven National Laboratory

International Atomic Energy Agency
Nuclear Data Services
Секция Ядерных Данных МАГАТЭ

Nucléide - Lara
Library for gamma and alpha emissions

Laboratoire National
LNHB
Henri Becquerel

Australian National University

BRICC CONVERSION COEFFICIENT CALCULATOR
Research School of Physics
ANU College of Science

NIST

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tRAYcy Decay Data

```
137BA    137CS B- DECAY                 1983BE18,1996BI23,1997WAZZ07NDS    200709
137BA  H TYP=ERR$AUT=J. Tuli$DAT=10-Feb-2008$COM=fixed logft values$
137BA  H TYP=ERR$AUT=J. Tuli$DAT=17-Dec-2007$COM=fixed typos noted by PNPI$
137BA  H TYP=FUL$AUT=E. BROWNE, J. K. TULI$CIT=NDS 108,2173 (2007)$
137BA2 H CUT=1-Oct-2006$
137BA c  Measured: E(|b{+-}) (1983Be18,1978Ch22,1968Wo02,1966Hs02,1958Yo01),
137BA2c  shape of the |b spectra (1983Be18,1978Ch22,1978Gr09,1969Sc23,1966Hs02),
137BA3c  longitudinal polarization of |b (1975Do14), internal bremsstrahlung
137BA4c  (1977We04,1975Ba20)
137BA c  1996Bi23, 1997WaZZ: measured 283|g, HPGe
137BA cG            1997WaZZ, 1996Bi23 looked for but did not find a transition
137BA2cG from the 661 level to the 283.5 level.
137BA cG            2007Ni04: Measured
137BA2cG |a(K)exp(127.5 keV E3 in {+134}Cs)/|a(K)exp(661.7 keV M4 in
137BAxcG {+137}Cs)=30.01 {I15}
137BA cG            2007Ya02: Measured K x-ray ratios obtained in decay vs
137BA2cG photo-ionization. Values agreed with previous measurements and theory.
137BA3cG Other: 2006Ha36
137BA cL J          Adopted values
137CS  P 0.0         7/2+               30.08 Y   9            1175.63   17
137BA  N 1.0                   1.0       1.0
137BA PN                                                                    3
137BA  L 0.0         3/2+
137BA  B 1176        15.3      2          12.079 17
137BAS B EAV=416.26 8
137BA cB E          from 1966Hs02, 1176 {I3} (1958Yo01), 1176 {I15} (1983Be18)
137BA cB IB$from 100-I|b(661 level).
137BA2cB Others: 5.45 {I1} (1983Be18), 5.3 {I4} (1968Wo02), 5.4 {I3} (1969Ha05),
137BA3cB 6.0 {I5} (1966Hs02), 7.6 {I8} (1958Yo01)
137BA cB            Shape: |DJ=2(no) (1966Hs02,1969Sc23,1978Gr09)
137BA  L 283.50     101/2+
137BA  B            0.00058 8          16.61 6                             2U
137BA cB IB$from I|g. 2007Se05 have recomputed logf2UT=16.45 {I12},
137BA2cB I|b=8.7|*10{+-4} {I20}, superseding their earlier value of 13.5
137BAxcB (2006SeZY)
137BAS B EAV=334.65 8
137BA  G 283.5       15.8E-4  8
137BA cG E,RI$E|g from 1997Wa37, %I|g average of 5.3|*10{+-4} {I14} (1996Bi23),
137BA2cG 6.1|*10{+-4} {I10} (1997Wa37)
137BA  L 661.659     311/2-             2.552 M   1                         M
137BA cL T$from adopted levels
137BA  B 514.03      2394.7    2          9.625   2                         1U
137BAS B EAV=174.32 6
137BA cB E          from 1983Be18. Others: 513.89 {I26} (1978Ch22),
137BA2cB 511.63 {I84} (1968Wo02), 514 {I1} (1966Hs02), 514 {I3} (1958Yo01)
137BA cB IB$from I|g. Others: 94.6 {I3} (1968Wo02), 94.0 {I5} (1966Hs02), 92.4
137BAxcB {I8} (1958Yo01). I|b=94.6, log| {If{+1u}t}=8.5 (2006SeZY)
137BA cB
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NuDat 3.0

Brookhaven National Laboratory

International Atomic Energy Agency
Nuclear Data Services
Секция Ядерных Данных МАГАТЭ

Nucléide - Lara
Library for gamma and alpha emissions

Laboratoire National
LNHB
Henri Becquerel

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ollege of Science

NIST

tRAYcy Detector

a digital twin in LVis

LVis/tRAYcy live demo

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tRAYcy in LVis

where we are

Feature	tRAYcy status	LVis status
Efficiency transfer	implemented	implemented
TCS correction	implemented	implemented
Spectrum generation	implemented	implemented
Mathematical calibration	implemented	in testing
Well detector support	implemented	coming soon
Parameter optimization	implemented	coming soon
2.5D object support	implemented	coming soon
Full 3D scene support	implemented	coming soon
tRAYcy Analysis Engine	in testing	
Arbitrary 3D object support	coming soon	coming soon

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tRAYcy in LVis

where we are going

New decay data manager and library tool

Cs-137

Element:	Caesium (Z = 55 N = 82)
Half Life (T 1/2):	3.01e+1 ± 9.00e-2 (years)
Decay Constant (λ):	0.0230 (1/s)
Specific Activity:	0.0230 (Bq/g)
Decay Data Updated on:	January 31, 2025
Possible Parent:	Xe-137

Decay Mode: B-

Child:	Ba-137
Branching Ratio (%):	100.00
Q (keV):	1175.63 ± 0.17
Fluorescence Yields:	K: 0.9 ± 0.004 | L: 0.11 ± 5.000

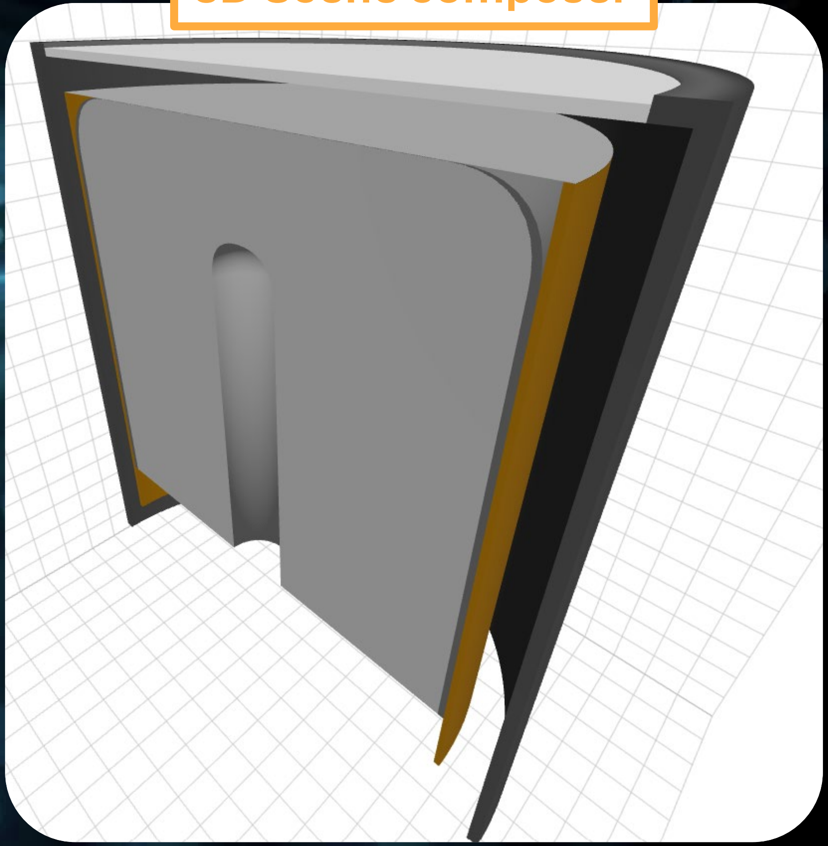
Gammas

Energy (keV)	Intensity (%)
661.657 ± 0.003	85.100 ± 0.200
283.5 ± 0.1	0.0005800 ± 0.0000008

X-Rays

Energy (keV)	Intensity (%)
32.194 ± 0.000	3.640 ± 0.100
31.817 ± 0.000	1.9900 ± 0.0500
4.47 ± 0.00	0.9100 ± 0.0400
36.378 ± 0.000	0.67200 ± 0.01800

3D Scene composer



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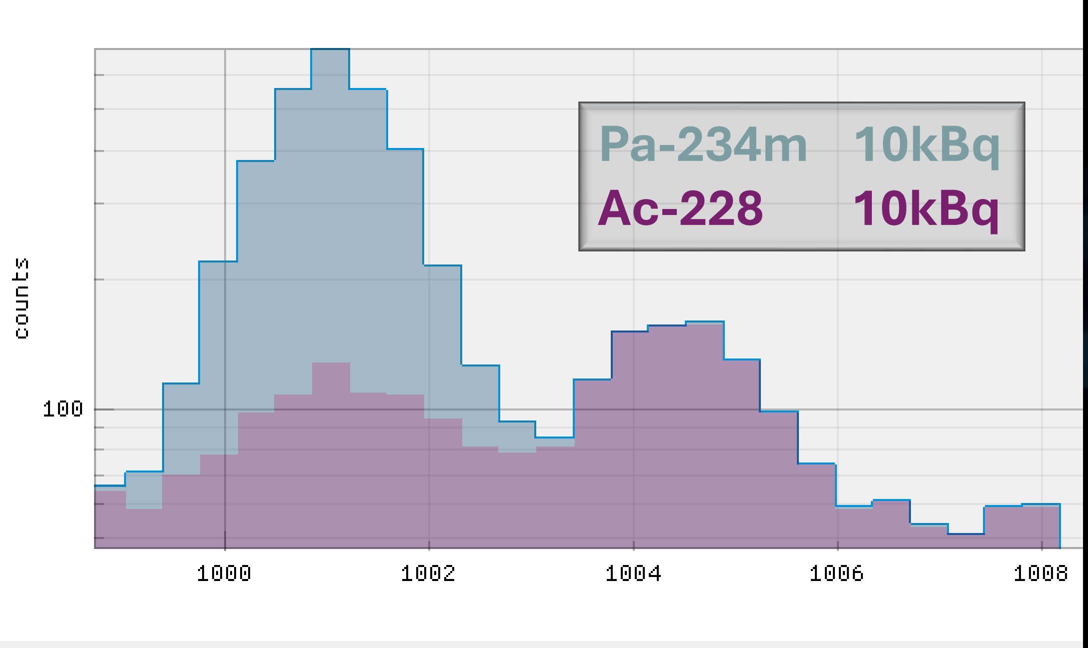
Q & A



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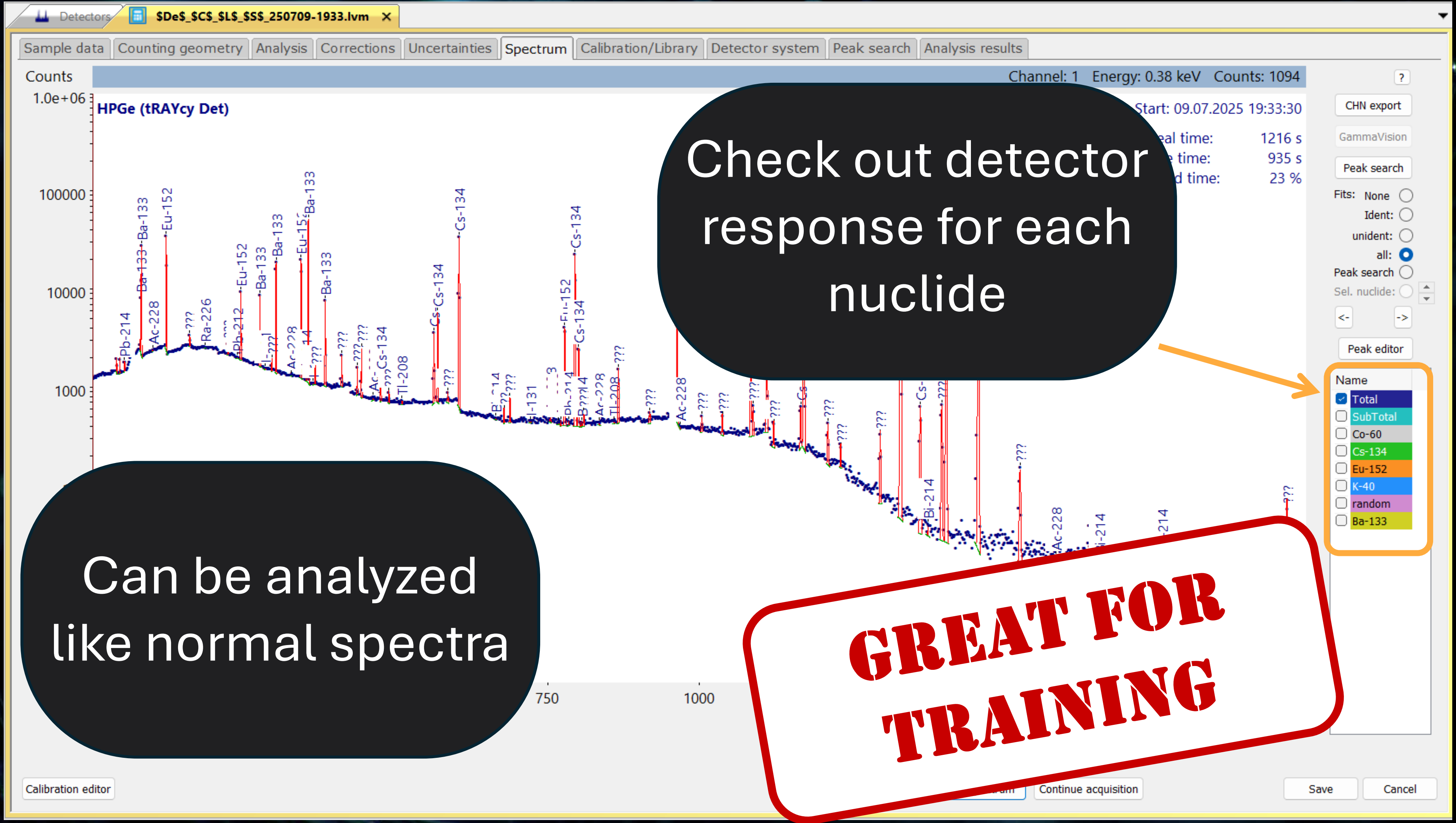
tRAYcy Detector Simulation



Check out detector response for each nuclide

Can be analyzed like normal spectra

GREAT FOR TRAINING

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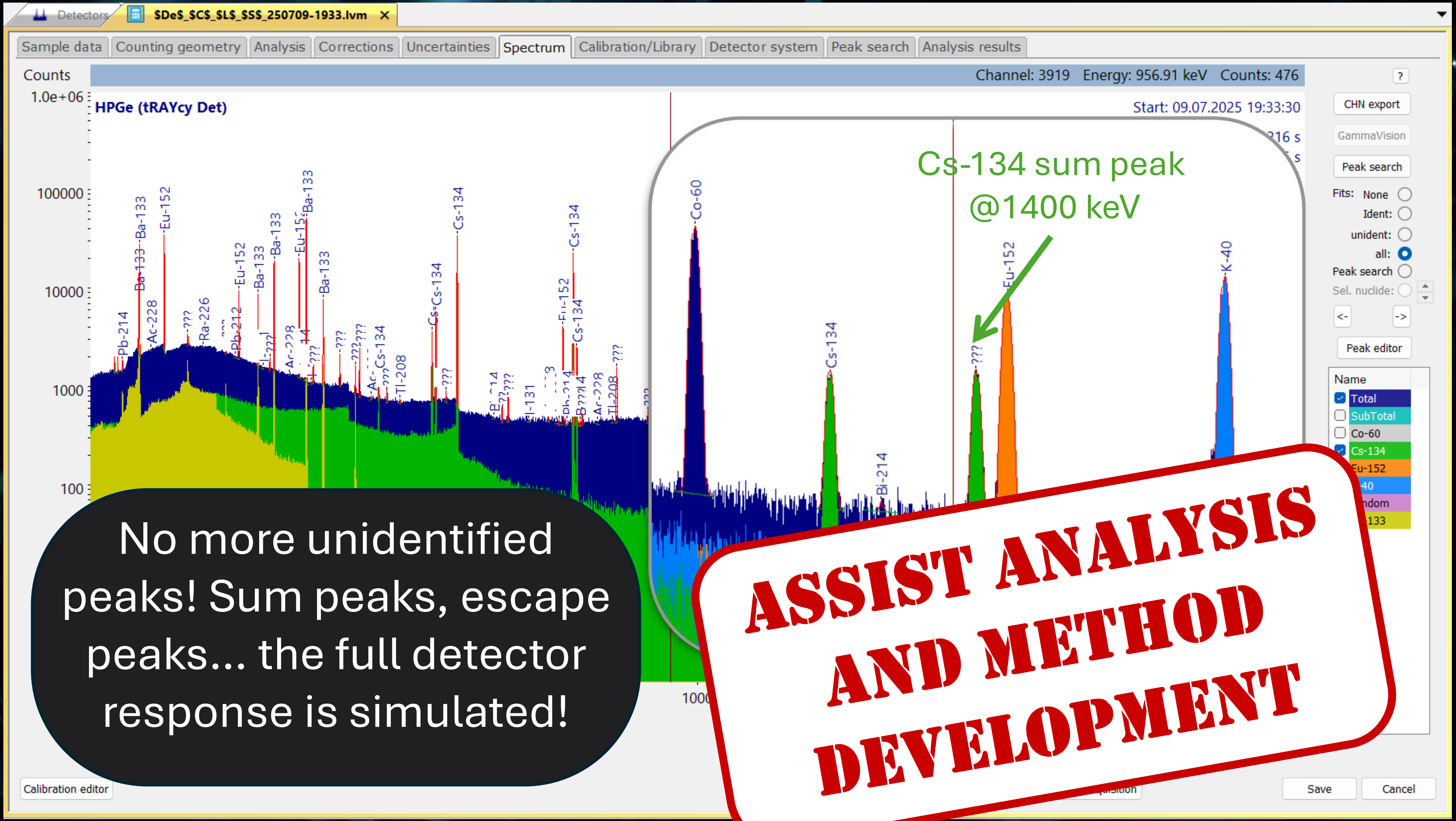
tRAYcy Detector Simulation



No more unidentified peaks! Sum peaks, escape peaks… the full detector response is simulated!

ASSIST ANALYSIS AND METHOD DEVELOPMENT

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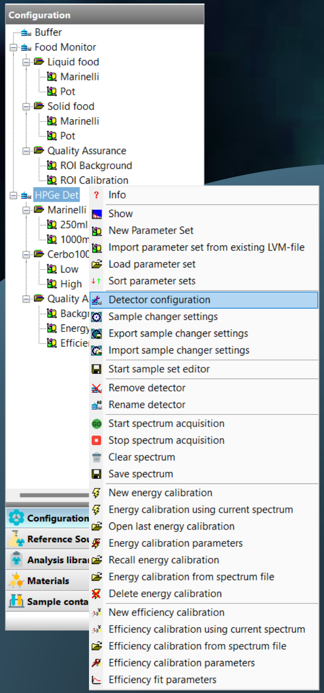

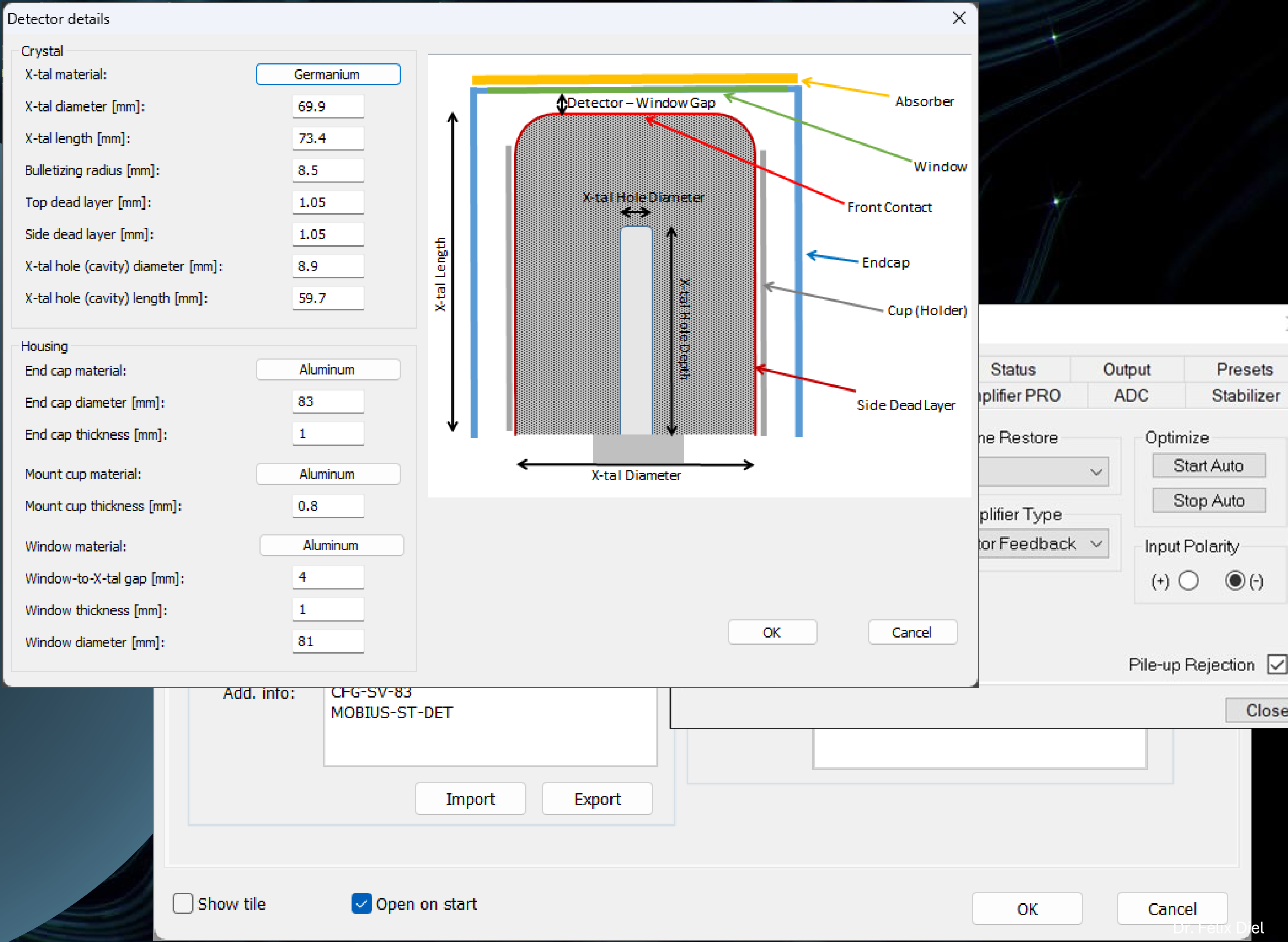

The detector system: MCB Properties and Detector details

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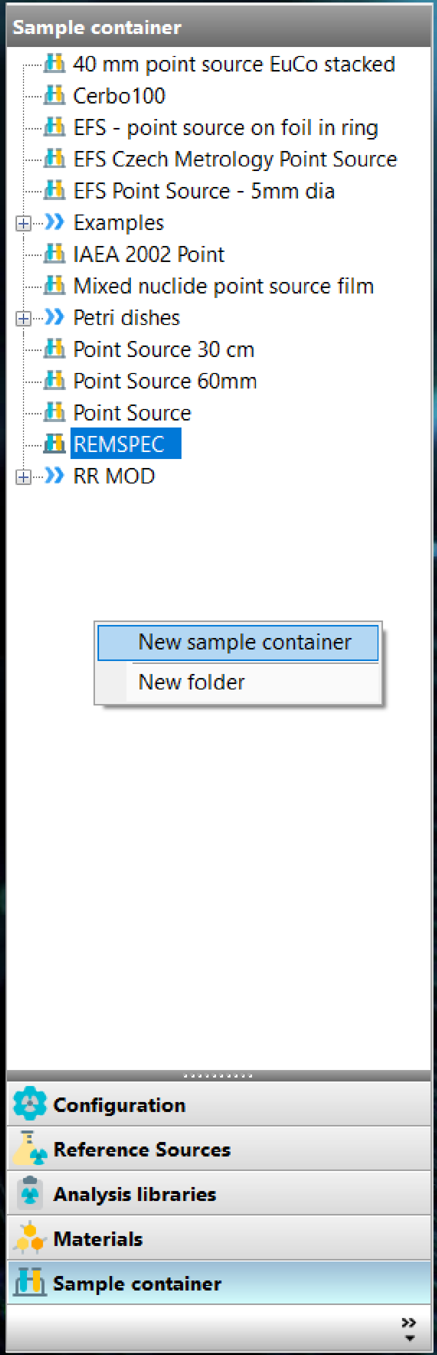

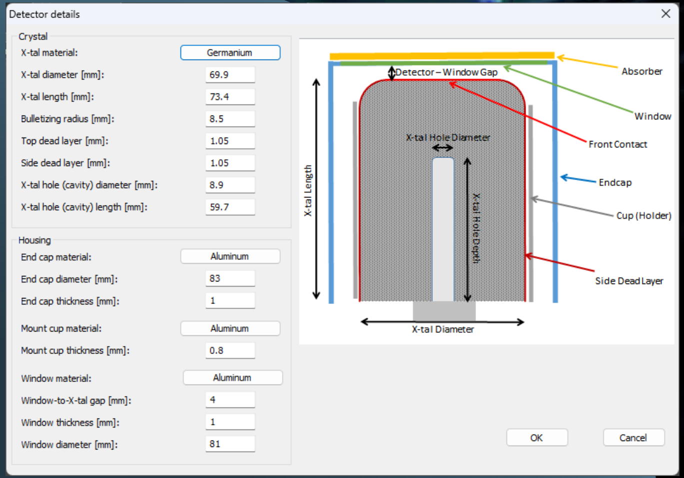

Then define the container

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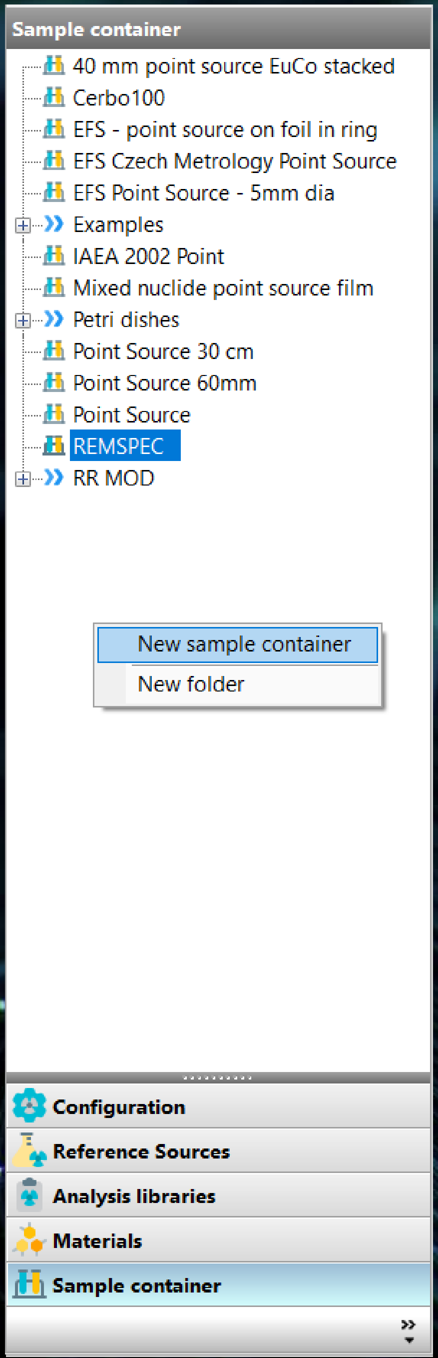
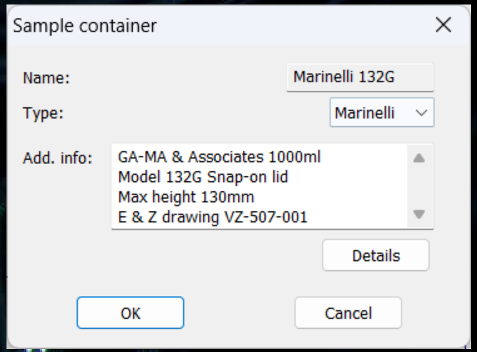
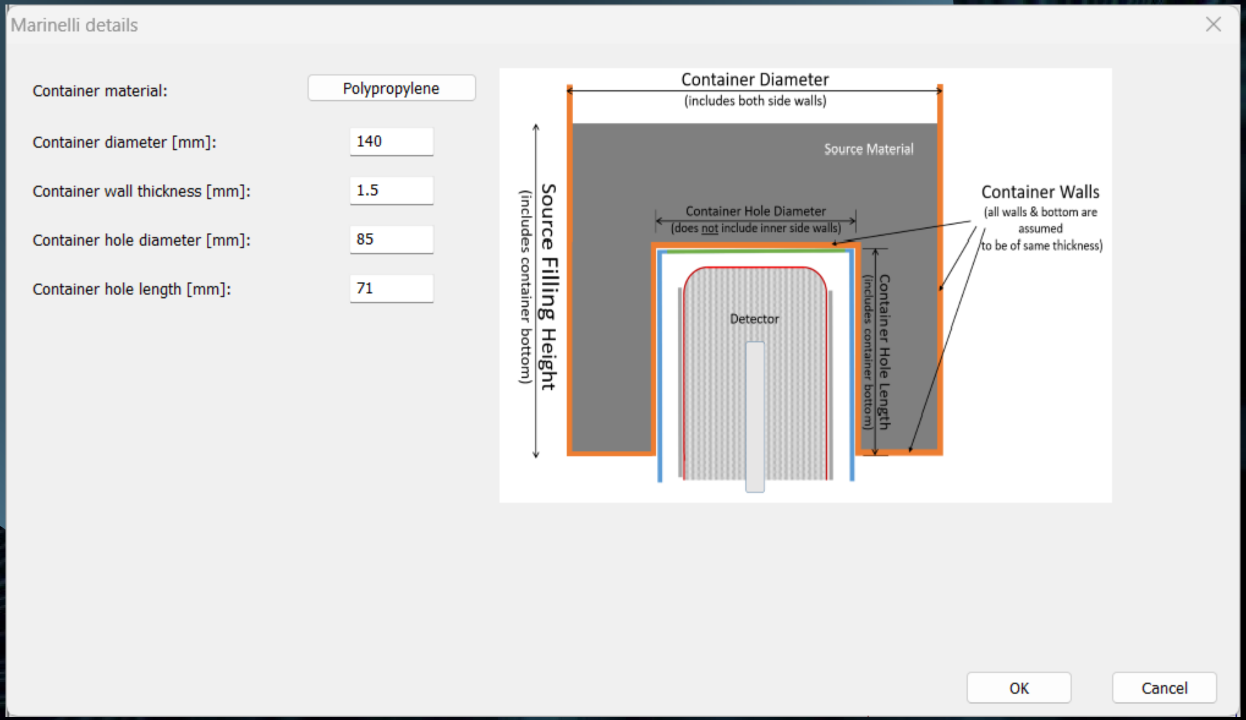


Define the container geometry





LVis includes more than 50 common Marinelli, vial and beaker geometries

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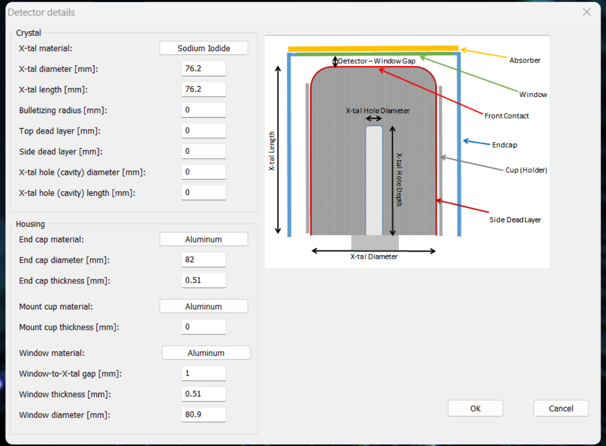
tRAYcy Detector Simulation

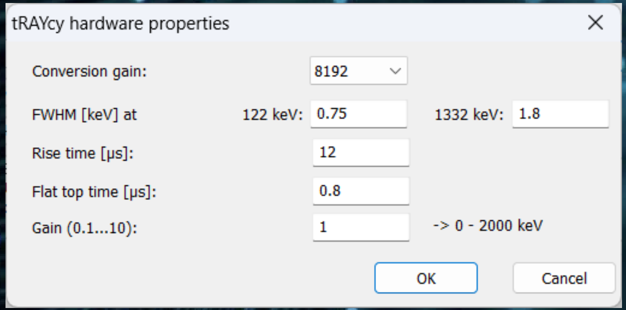
- Create a realistic spectrum via Monte Carlo simulation -

Define the tRAYcy detector in the LVis configuration

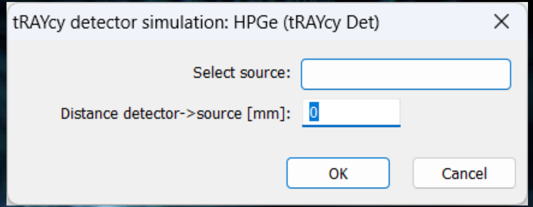


Many detector definitions for various ORTEC detector models included in LVis

Define the "hardware" settings



Press "Start spectrum acquisition" and then select a reference source



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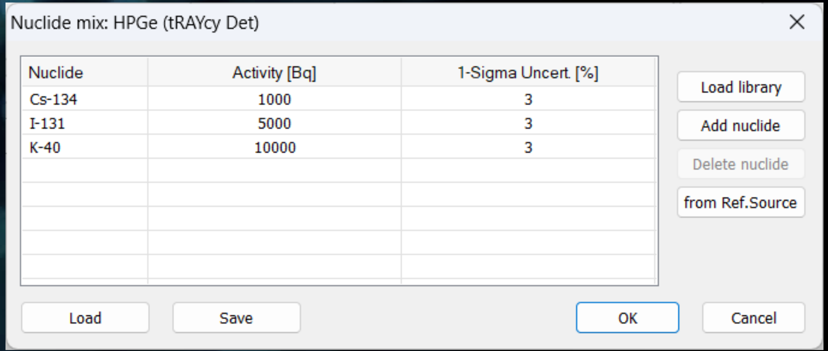

Create/select a routine and start a parameterized sample count

Specify the nuclide mix

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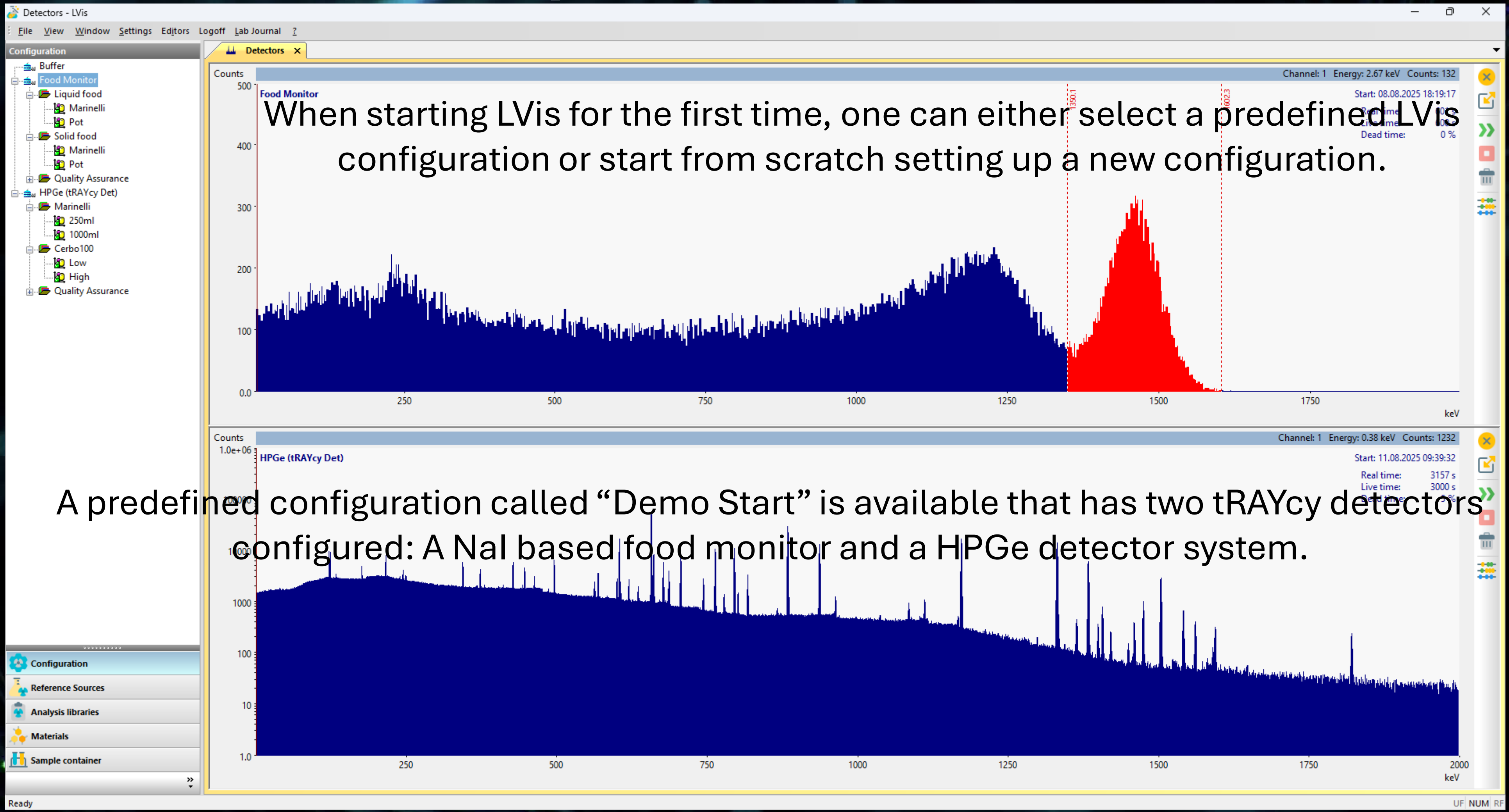
tRAYcy Detector Simulation

- Create a realistic spectrum via Monte Carlo simulation -



When starting LVis for the first time, one can either select a predefined LVis configuration or start from scratch setting up a new configuration.

A predefined configuration called “Demo Start” is available that has two tRAYcy detectors configured: A NaI based food monitor and a HPGe detector system.

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tRAYcy Detector Simulation

tRAYcy simulates the spectrum…

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tRAYcy Comparison

Features	LabSocs ISocs	InterWinner WinnerTrack	Angle	tRAYcy/LVis
Efficiency Transfer	⊗ **Not really** Always need a characterization	√	√	√
Summing Correction	√	√	√	√
Spectrum Generation	⊗	⊗	⊗	√
Sourceless Calibration	√	√	⊗	**Not implemented yet** Release 2
Supported Isotopes	200	~200	211	> 2000
Arbitrary 3D Geometries	√	√	⊗	**Not implemented yet** Release 2 & 3
Detector Characterization	√	√	⊗	**Not implemented yet** GeDat
We own the code	⊗	⊗	⊗	√

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