



Key features of bGamma

BrightSpec NV

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V. Osorio

SUMMARY



Unique

- Unique features → feature not existing in any commercial software



Few

- Outstanding → remarkable implementation of this feature



Highlight

- Highlight → Feature that, as a result of its implementation, could position this product at the top of the selection list even when other similar products would have this feature realized as well.

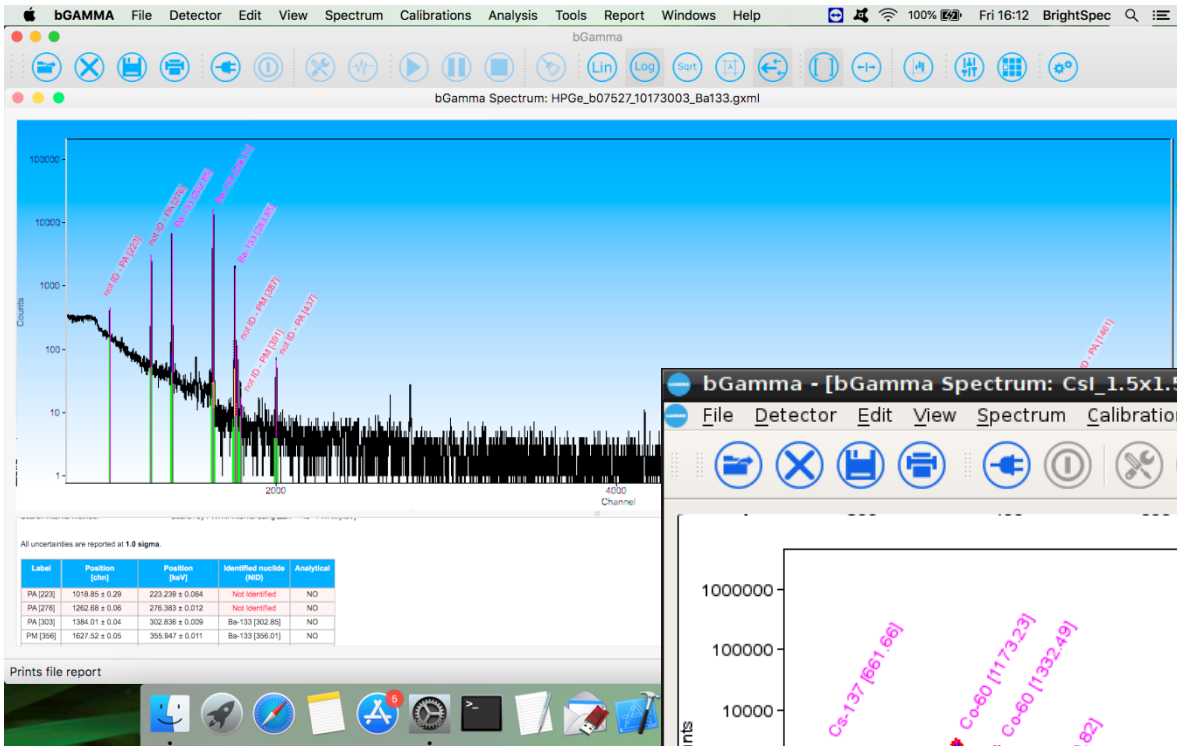
Platform independent

Unique

- Run seamlessly in any Operating system
 - MS Windows:
 - XP, 7, 8 and 10.
 - Linux
 - mac OS
- Wide hardware support
 - X86 (32-bit) μ Processor
 - 64-bit μ Processor
 - ARM μ Processor



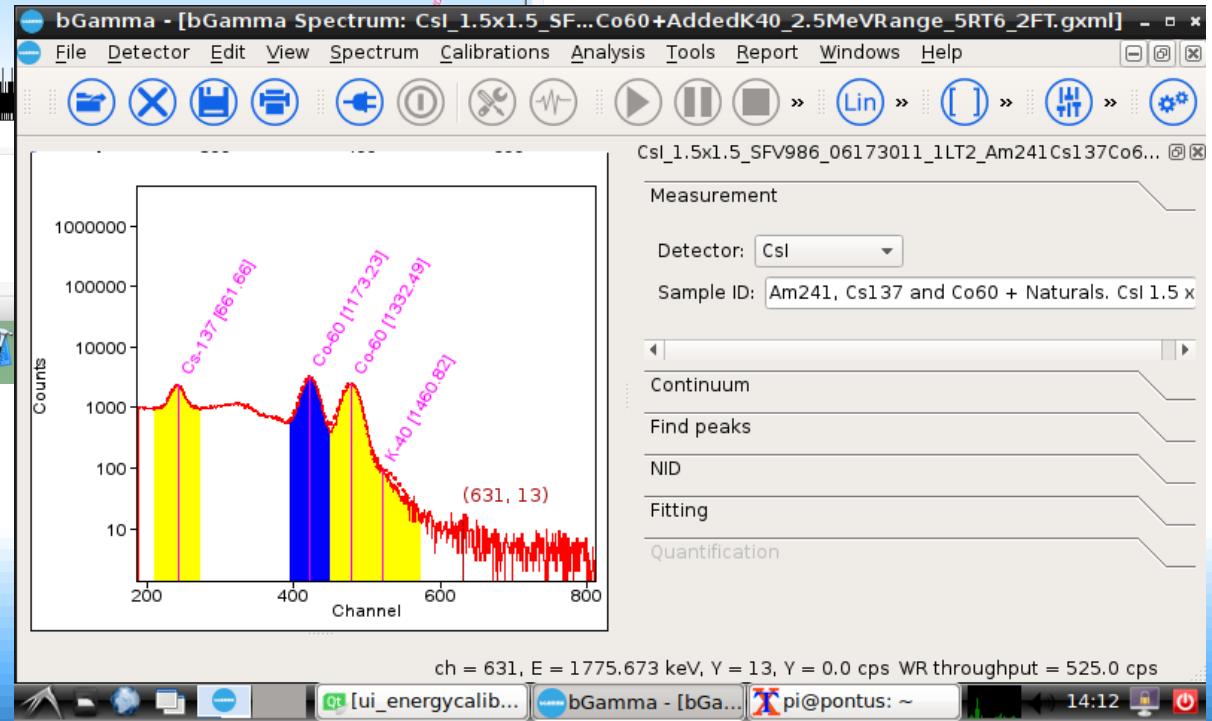
Platform independent



mac OS

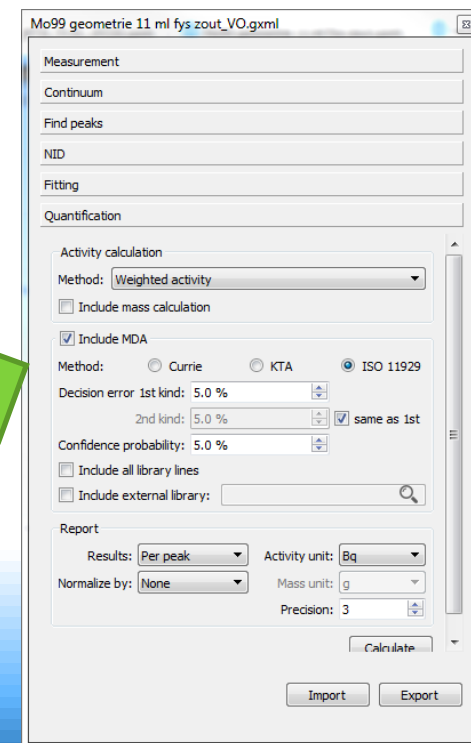


Raspberry Pi



Generic software

- Multipurpose and generic software for gamma-ray
 - Analysis of **ANY** type of Gamma-ray spectra independently of the detector used for its measurements
 - Low-medium-high energy resolution detectors
 - BGO, CsI, NaI(Tl), CeBr₃, Srl₂, LaBr₃
 - HPGe, Si(Li) and CdZnTl
 - All analysis parameters are at hand and saved as “model”.
 - Models can be imported for quick spectrum analysis





MultiDocument

- Allows working with many spectra at same time
 - Can mix spectra being acquired (hardware control) with spectra from saved files
 - Use of docking and floating windows

The screenshot displays the bGamma software interface with several docked windows:

- Top Panel:** A menu bar (File, Detector, Edit, View, Spectrum, Calibrations, Analysis, Tools, Report, Windows, Help) and a toolbar with icons for Open, Close, Save, Print, Connect, Disconnect, Set, Oscilloscope, Start, Pause, Stop, Clear, Lin, Log, Sqrt, Grds, Cursors, Work region, Full, Residuals, Calibrate, Nuclides, and Full analysis.
- Left Column:**
 - Window 1:** "bGamma Spectrum: HPGe_b07527_10173003_Ba133.gxml". Shows a spectrum from 200 to 550 keV with peaks labeled: (365, 332), Ba-133 [223.24], Ba-133 [276.40], Ba-133 [302.85], Ba-133 [356.01], Ba-133 [380.85], Ba-214 [386.76], Pb-214 [391], and no ID - Pb [437]. Includes a residuals plot below.
 - Window 2:** "bGamma Spectrum: bGamma_02123002.gxml". Shows a spectrum from 0 to 1000 keV with peaks labeled: (161, 140) and PM [804]. Includes a "Data Acquisition" table below.
 - Window 3:** "bGamma Spectrum: NaI3x3_S2AA4805_Cs137+Naturals_2...". Shows a spectrum from 0 to 2000 keV with peaks labeled: Co-137 [137], Bi-214 [809.32], K-40 [1460.82], and Bi-214 [1764.49]. Includes a "Sample report" table below.
- Middle Column:**
 - Window 4:** "bGamma Spectrum: KCL770gr_NaI_2x2_in3x3Marinelli.gx...". Shows a spectrum from 0 to 3000 keV with peaks labeled: X-ray escape (K-40) [511.02], (211, 497.4), Annihilation [511], Escape (K-40) [1460.82], and K-40 [1460.82]. Includes a "Peak find report" table below.
 - Window 5:** "bGamma Spectrum: LEGE_TecnubelAm241Co60Cs137_1...". Shows a spectrum from 1100 to 1500 keV with peaks labeled: Co-60 [1173.23], Co-60 [1332.49], and K-40 [1460.82].
- Right Column:**
 - Window 6:** "bGamma_02123002.gxml". A control panel for the selected spectrum, including sections for Measurement, Continuum, Find peaks, NID, Fitting (with a dropdown for "Non-linear least squares" and "Report uncertainties in:" options), and Quantification.
 - Window 7:** "MCA Digital oscilloscope". Shows a digital oscilloscope view of a signal peak with controls for Start, Stop, Single, Channels, Strobe signals, and Signal.

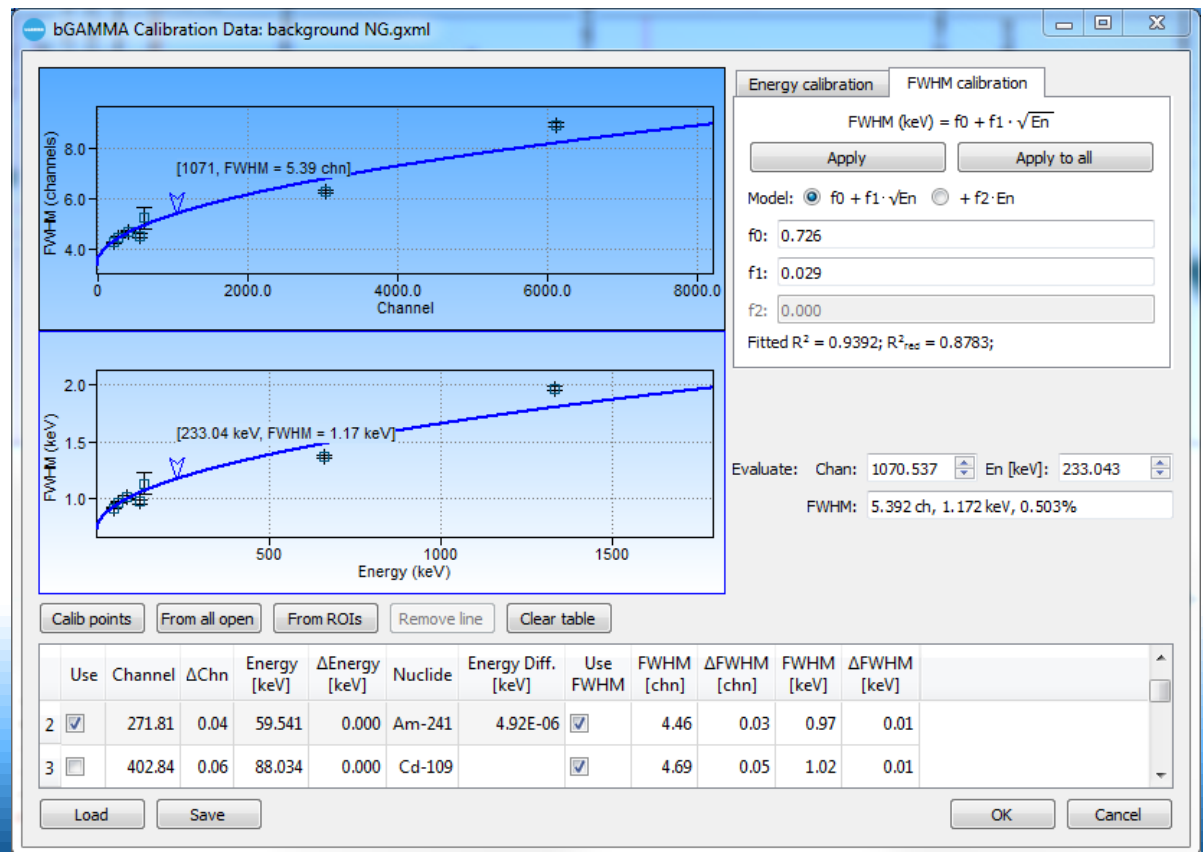
At the bottom of the interface, a status bar reads: "Acquiring Elapsed LiveTime: 161.0 and RealTime = 161.4. Dead Time = 0.25 %. ICR = 0.0 cps". The bottom right corner shows: "ch = 161, E = 244.039 keV, Y = 140, Y = 0.9 cps. Total throughput = 339.8 cps".

Outstanding GUI



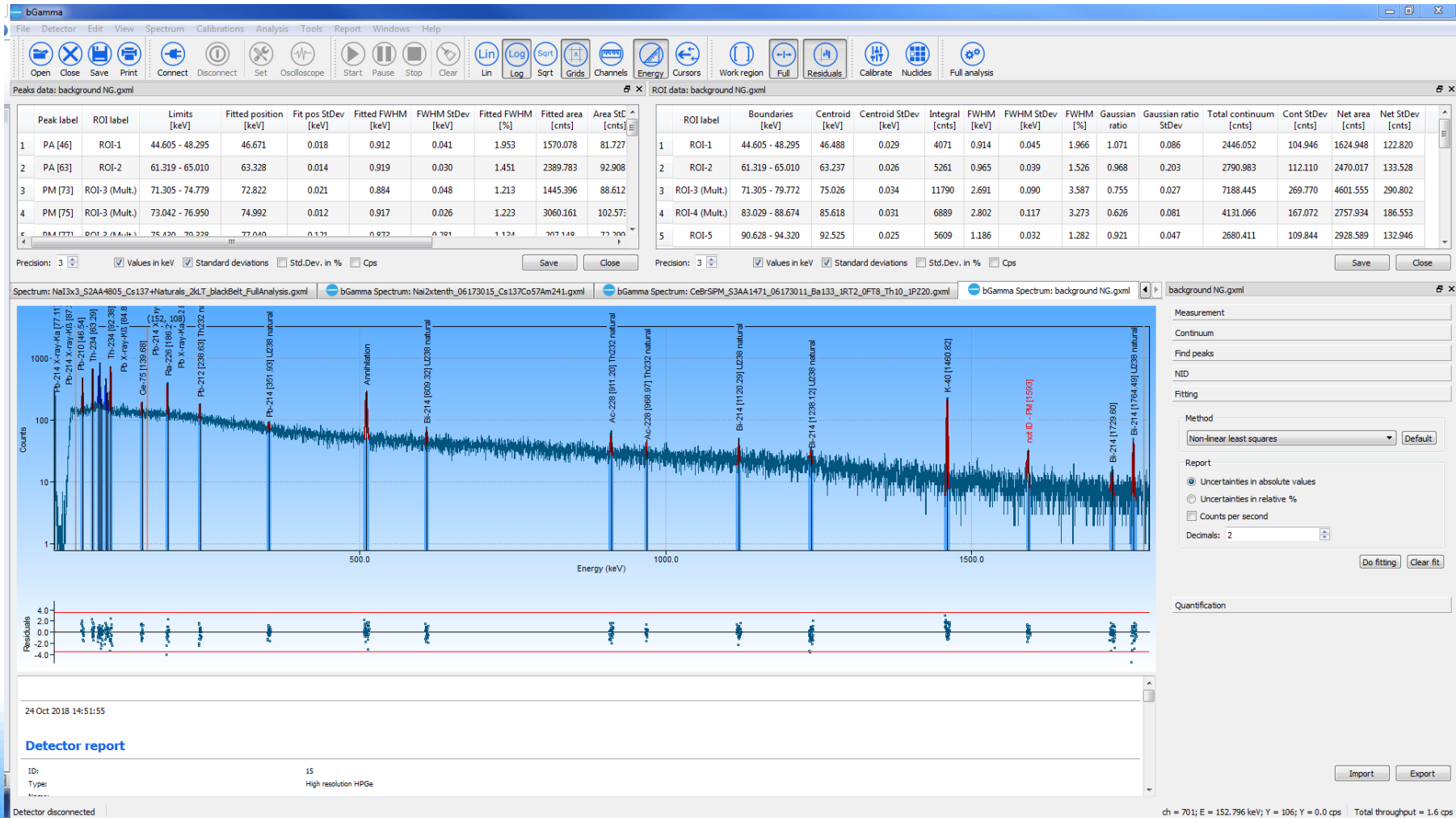
- Modern, comprehensive, powerful graphical user interface (GUI).
 - Nearly any analysis or calculation step is provided with visual feedback

Shape Calibration



Outstanding GUI

- Peaks and ROI results data at hand.
- Each spectrum plot with residuals and its individual report panel



Accurate calculations



Unique

- All... absolutely all and any calculated magnitude is reported with corresponding uncertainty value
- **Co-variances** are taking into account for uncertainty calculations



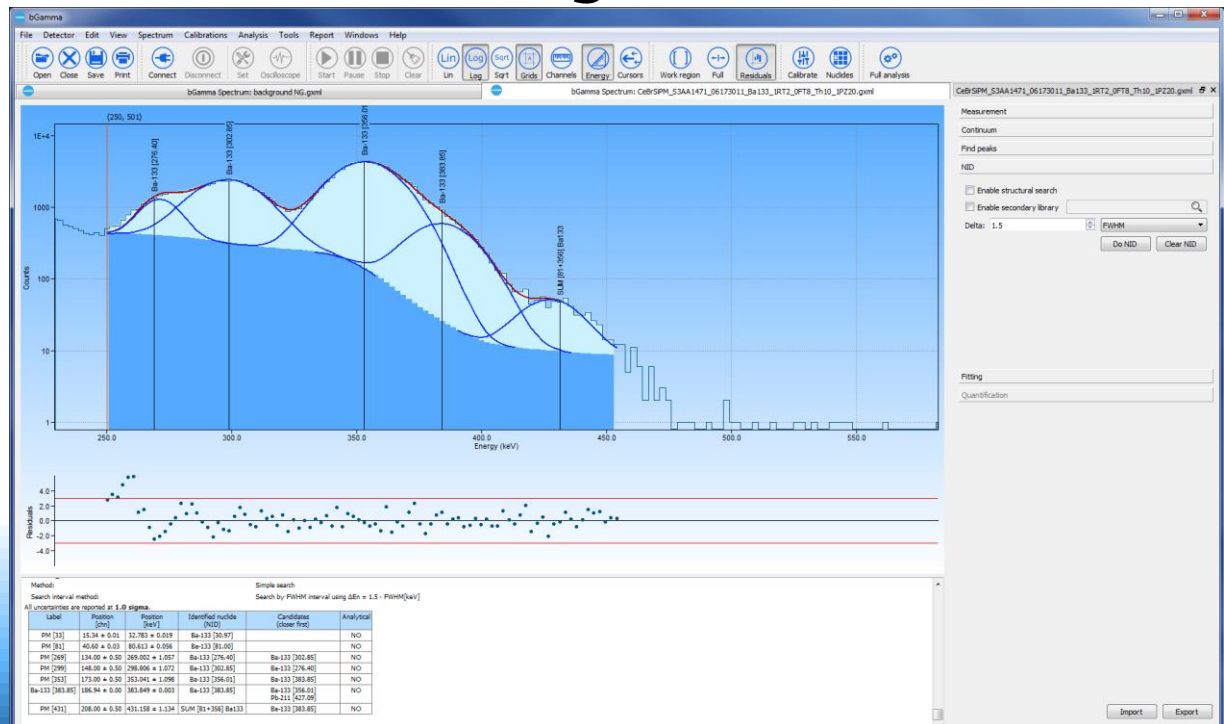
Unique

Manual or Visual operation

- Ability to insert/remove peaks and ROIs by several methods

Few

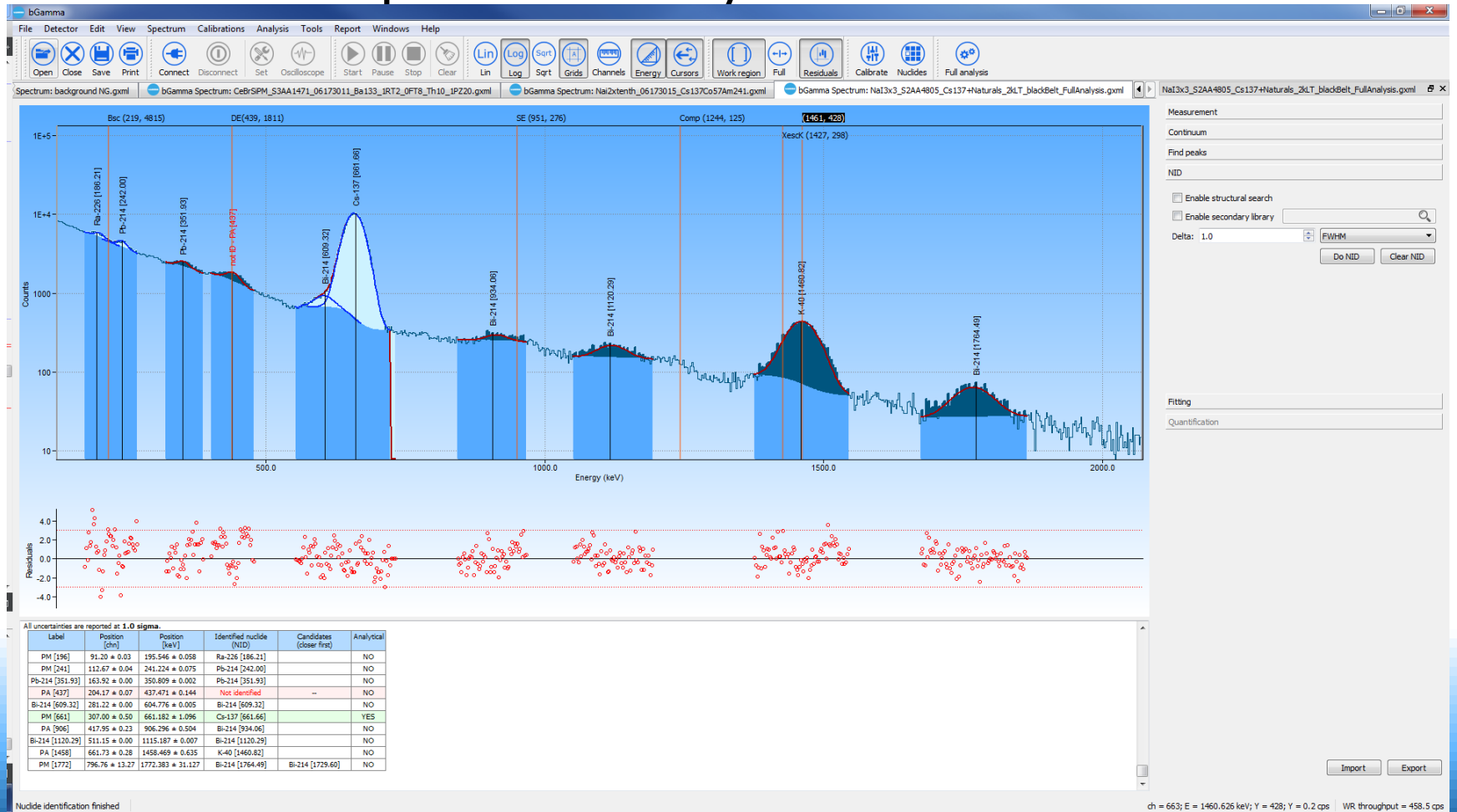
- Visually via GUI
- By nuclide library
- Automatic by mathematical algorithms



Manual or Visual operation

- Use of Multi-cursors

- The use of “Spectroscopy-aware” cursors make easier the spectrum analysis and visual NID



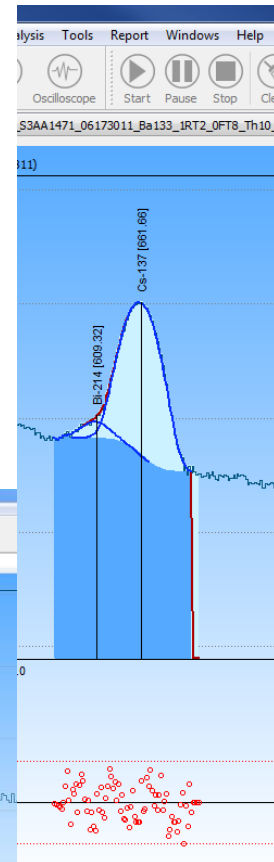
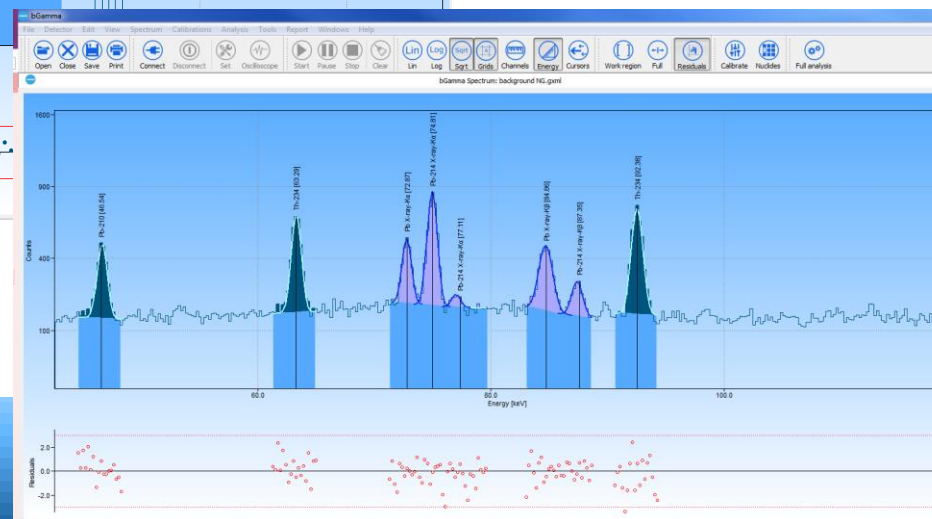
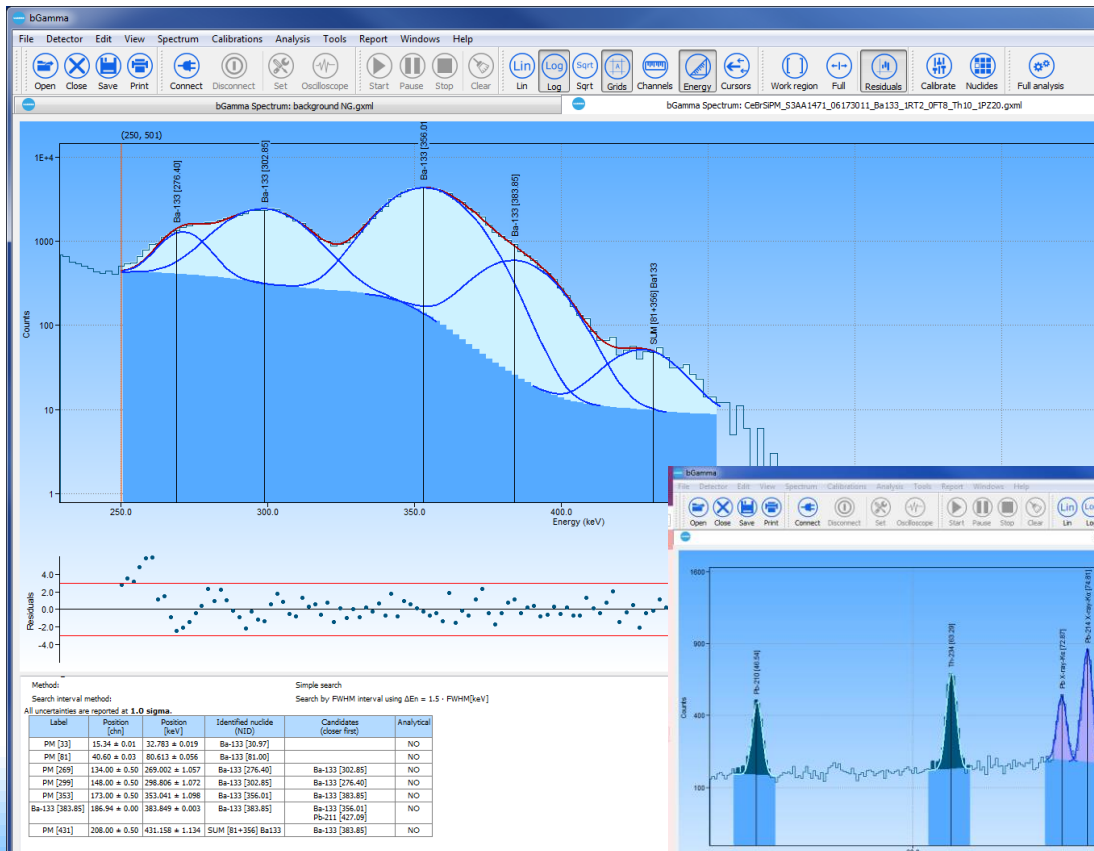
Computational algorithms

- Large selection of computational algorithms, included in the standard version of the software
 - Continuum models
 - By entire spectrum or per individual peaks
 - Extensive ROI calculations
 - Peak search and marking
 - 7 peak search methods
 - 4 peak marking and ROI identification algorithms
 - Three (3) peak fitting algorithms
 - Includes Bayesian peak fitting
- This wide range of choices warrants the success of the spectrum analysis from any type of detector, energy range and/or energy resolution

Highlight

Computational algorithms

- Outstanding peak fitting and multiplet deconvolution
 - With visual feedback (residuals plot)
 - And Statistical qualifiers in the report (e.g. colored χ^2)




Computational algorithms

- Implements **Bayesian peak fitting**
 - Minimum input parameters
 - Does NOT rely on shape (FWHM) calibration





Import files

- Can open files from:
 - IAEA (*.spe)
 - Canberra, binary (*.chn) 
 - NO need of Canberra VDM or run time libraries installation
 - Ortec (*.chn)
 - ANSI N42.42
 - Including latest edition N42.42.2012
 - Generic text file



Reports

- bGamma produces colored, rich-formatted and aligned reports
- HTML-based reports

15 Oct 2018 11:17:17

Peak fitting results report

Method used: Non-linear least squares

All uncertainties are reported at 1.0 sigma.

Peak label	Related ROI	Position Std.Dev. [chn]	Position Std.Dev. [keV]	FWHM Std.Dev. [chn]	FWHM Std.Dev. [keV]	FWHM Std.Dev. [%]	Area Std.Dev. [cnts]	Continuum Std.Dev. [cnts]	Fit χ^2 [aunits]	Identified nuclide (NID)
PA [46]	ROI-1	212.52 0.08	46.67 0.02	4.20 0.19	0.91 0.04	1.95 0.09	1570.08 81.73	2446.05 104.95	0.57	Pb-210 [46.54]
PA [63]	ROI-2	289.25 0.06	63.33 0.01	4.23 0.14	0.92 0.03	1.45 0.05	2389.78 92.91	2790.98 112.11	0.65	Th-234 [63.29]
PM [73]	ROI-3 (Multiplet)	332.99 0.10	72.82 0.02	4.07 0.22	0.88 0.05	1.21 0.07	1445.40 88.61	7188.45 269.77	0.36	Pb X-ray-Ka [72.87]
PM [75]		342.98 0.06	74.99 0.01	4.23 0.12	0.92 0.03	1.22 0.03	3060.16 102.57	7188.45 269.77	0.36	Pb-214 X-ray-Ka [74.81]
PM [77]		352.46 0.56	77.05 0.12	4.02 1.30	0.87 0.28	1.13 0.37	207.15 72.30	7188.45 269.77	0.36	Pb-214 X-ray-Ka [77.11]
PM [85]	ROI-4 (Multiplet)	387.91 0.12	84.75 0.03	6.01 0.25	1.30 0.05	1.54 0.06	2026.04 97.82	4131.07 167.07	0.46	Pb X-ray-KB [84.86]
PM [88]		400.25 0.21	87.43 0.04	4.89 0.40	1.06 0.09	1.21 0.10	718.39 71.45	4131.07 167.07	0.46	Pb-214 X-ray-KB [87.35]
PA [93]	ROI-5	423.99 0.06	92.58 0.01	4.88 0.14	1.06 0.03	1.15 0.03	3017.33 100.59	2680.41 109.84	1.14	Th-234 [92.38]
PA [144]	ROI-6	658.61 0.38	143.53 0.08	4.48 0.89	0.97 0.19	0.68 0.13	311.92 67.62	2330.19 102.59	0.40	Ge-75 [139.68]
PA [185]	ROI-7	852.25 0.11	185.60 0.02	4.35 0.25	0.94 0.06	0.51 0.03	1168.76 77.24	2604.89 114.10	0.36	Ra-226 [186.21]
PA [238]	ROI-8	1095.49 0.35	238.47 0.08	4.70 0.81	1.02 0.18	0.43 0.07	336.93 63.97	2140.51 103.60	0.32	Pb-212 [238.63] Th232 natural
PA [351]	ROI-9	1615.83 1.26	351.63 0.27	8.27 2.24	1.80 0.49	0.51 0.14	168.16 57.36	1586.99 93.45	0.21	Pb-214 [351.93] U238 natural
PM [511]	ROI-10	2348.03 0.15	511.02 0.03	11.96 0.32	2.60 0.07	0.51 0.01	3015.46 96.05	1990.47 141.12	0.74	Annihilation
PA [609]	ROI-11	2798.66 0.62	609.22 0.14	6.31 1.44	1.37 0.31	0.23 0.05	188.83 47.25	1045.90 79.35	0.25	Bi-214 [609.32] U238 natural
PA [911]	ROI-12	4181.72 0.64	911.07 0.14	8.14 1.47	1.78 0.32	0.20 0.04	225.13 44.94	861.17 80.35	0.54	Ac-228 [911.20] Th232 natural
PM [969]	ROI-13	4446.17 0.79	968.86 0.17	5.73 1.74	1.25 0.38	0.13 0.04	99.72 34.22	407.92 32.00	0.27	Ac-228 [968.97] Th232 natural
PA [1120]	ROI-14	5137.35 0.67	1120.03 0.15	8.56 1.53	1.87 0.33	0.17 0.03	201.86 40.03	672.28 73.39	0.35	Bi-214 [1120.29] U238 natural
PA [1238]	ROI-15	5676.49 1.55	1238.07 0.34	7.87 3.58	1.72 0.78	0.14 0.06	73.72 36.67	780.67 81.46	0.26	Bi-214 [1238.12] U238 natural
PA [1461]	ROI-16	6693.02 0.10	1460.91 0.02	8.94 0.20	1.96 0.04	0.13 0.00	1904.11 58.98	243.16 46.80	1.27	K-40 [1460.82]
PM [1593]	ROI-17	7294.77 0.50	1593.01 0.11	8.98 1.03	1.97 0.23	0.12 0.01	216.10 29.93	229.94 37.20	0.33	Not identified
PA [1731]	ROI-18	7920.95 1.25	1730.60 0.27	11.55 2.87	2.54 0.63	0.15 0.04	93.75 26.03	258.99 50.87	0.36	Bi-214 [1729.60]
PA [1766]	ROI-19	8079.82 0.31	1765.53 0.07	9.46 0.64	2.08 0.14	0.12 0.01	385.51 32.06	239.78 48.95	0.50	Bi-214 [1764.49] U238 natural



Reports

- Reports contain colored and well formatted tables
 - Colors are used to flag statistically doubtful calculation results
- Dedicated reports for specific sections
- Reports can includes plots images (e.g. spectrum plot with fitting results)
- Report templates can be created , using HTML commands, for more specific or user-defined spectrum analysis reports
 - HTML markup is widely supported and easy translatable to other applications (e.g. MS Explorer)
 - No need to learn dedicated or specific scripting languages and/or commands
- Reports can be exported into PDF

Nuclide library



- Broader meaning of nuclide library
- bGamma includes the whole decay radiation data from 3386 nuclides
 - NuDat decay data files
 - Recommended and maintained by INDC and BNL (USA)
- Any radiation is always at hand
 - No need for getting out of the analysis to “search” for the correct nuclear radiation or edit the nuclear library file.
 - Spectrum analysis steps are fully reproducible, since it does not contain links to external nuclear data files
 - Provision of “fast radiation search”, tagged isotopes or isotope radiations, etc.



Hardware control

- Within bGamma you can connect, set and control any BrightSpec hardware for data acquisition
- Provision of an auto-updated applet, according to connected hardware capabilities
 - Extensive counting preset modes
- Provision of a dockable digital oscilloscope for hardware troubleshooting

Device settings

Acquisition mode
 PHA MCS

PHA MCS GPIO
 Time Counts External
 Live time Real time
Time [sec] 600.0
Counts 1000
Start channel 4
End channel 4095
Select Roi (none)

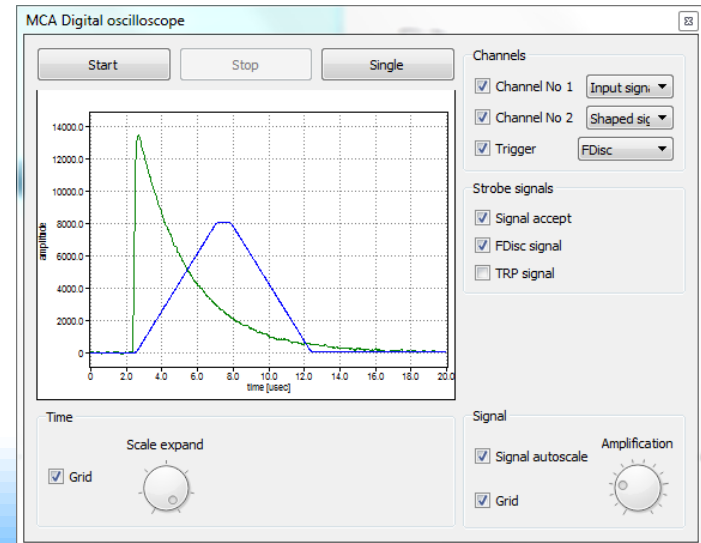
MCA
No of channels 1024
LLD 4 ULD 4095

Amplifier
Coarse gain x 1
Fine gain 1.0000
Input polarity Positive Negative

Digital settings Advanced
Threshold [chn] 7
Rise time [usec] 3.20
Flat top [usec] 1.00
Pole Zeros [units] 1.80
 Digital BLR Pile-up reject

High voltage
Status HV Off
High voltage value [volts] 640.0
 HV On

Buttons: Close, Export, Load, Save into device, Apply, Info



SUMMARY OF FEATURES

Brief summary of most important application features



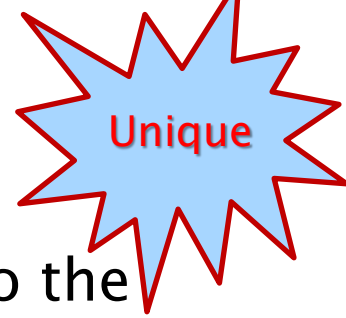


Unique

Unique features

- OS-independent
 - **The only software in the market that runs on MS Windows (XP, 7, 8 and 10), Linux and mac OS**
 - With wide support of μ Processors:
 - X86, 64-bit and ARM
- Inclusion of **Bayesian** peak fitting algorithms
 - Allows the possibility to fit spectra with minimum input data (e.g. calibrations)
 - Mark/insert a peak and fit straight-away

Unique features



- Entire nuclear decay radiation data embedded into the application.
 - Fast access to any decay radiation
 - ALL decay radiations are quickly at hand
 - No need for external nuclear library files
 - Spectrum analysis goes smoother. No need for endless cycles of exiting application or spectrum analysis process to edit/search nuclide library for specific radiations.
 - No links to external files (e.g. nuclide library file) which can be missing and therefore impossible to recreate the spectrum analysis
- Every calculated magnitude is reported with its uncertainties
- Covariance inclusion on the uncertainties treatment
- Outstanding Graphical User Interface
 - Many features (see previous slides)
 - Possibility to view all calculated parameters and magnitudes in tables and most of them updated on “real time” even while data acquisition is performed



Few

Outstanding feature

- Can analyze any gamma-ray spectrum. Independently of the detector used, energy resolution or energy range
- Easy but comprehensive methods for energy and shape calibrations, with provision of visual feedback
- Calculation of MDAs following ISO11929 standard (up-to latest revision), with clear results and recommendations



Highlighted features

- HTML-formatted reports
 - Including tables with colored cells for data results warnings
- Import of foreigner file formats, like Canberra CNF does not need any extra files or libraries to be installed
 - Imports N42.42 (up to latest edition)
- Simple and “automatically updated” window for hardware control
- Spectrum analysis parameters can be exported\imported as Model.
- Fats and intuitive operations within an outstanding GUI.
 - Peaks insert\delete, multi-cursor, nuclide search, etc.
 - Residuals plots, model parameters at hand, etc.