BRIGHTSPEC

Smart devices, professional solutions

NKS GammaAI 2025 Presentation

8 and 9 October 2025

DTU Lyngby Campus Denmark

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BrightSpec NV

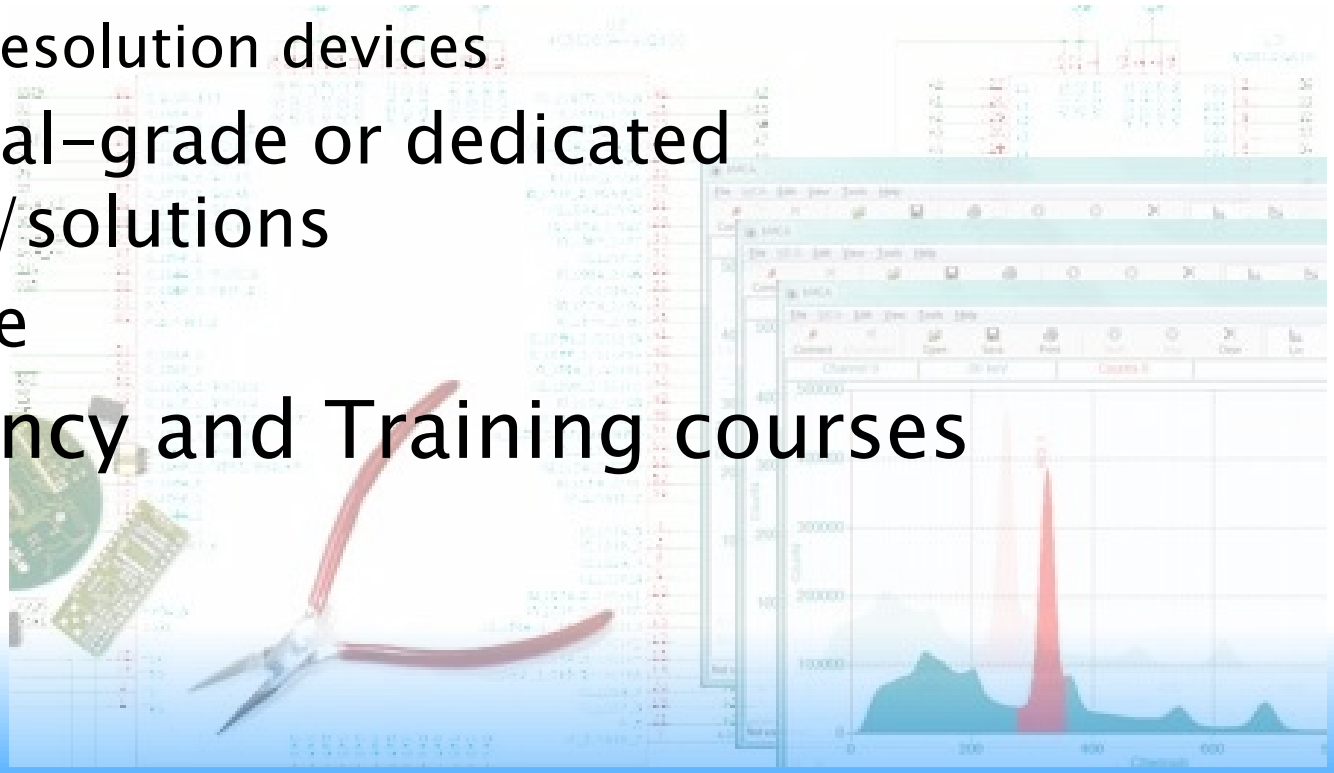
BRIGHTSPEC

Smart devices, professional solutions

- Founded in 2012.
- Company specialized in the field of nuclear instrumentation and X-rays
- Located in Belgium

BRIGHTSPEC

- BrightSpec provides advanced:
  1. Hardware. Spectrometry – DSP-based MCAs
     a) Medium energy resolution devices
     b) High resolution devices
  2. Industrial-grade or dedicated devices/solutions
  3. Software
- Consultancy and Training courses



Fields of application

- Gamma-ray counting
  - Industrial
- Gamma-ray spectrometry
  - NPP, Nuclear cycle Labs, Research, Academic, Industry, HLS, Environmental, Military applications, etc.
- X-ray spectrometry
  - Lab, Research, Academic, Art restoration and preservation, Material analysis, Industry, etc.

Products

- Devices
  - Single Channel Analyzers (SCA)
  - Multichannel analyzers (MCA)
- Software
  - Full-featured energy spectrum analysis and activity quantification software

BrightSpec Products

Gamma-ray counting

SCA: bPADs

- Intelligent, fully digital Single Channel Analyzers (SCA)
- Tube-base device
- Pre-Amplifier, Amplifier, Discriminator and Detector BIAS High Voltage
  - Detector HV up-to + 1500 Volts
- USB and\or external supply via plugable terminal block
  - 9 to 36 Volts
- Complete autonomous operation
- Low power consumption
    - 1 watt maximum

bPAD product line

bPAD

- Standard Single TTL output

bPAD-422

- Retrieve count rate and operates via RS-422/485 data connection
- Optional, TTL output

bPAD+

- TTL output
- Amplifier output

bPAD-VR

- Enhanced version
- TTL output
- Voltage signal output proportional to count rate (0-2.5 Volts)

bPAD – Applications

- Ideal for industrial applications
  - Industrial DAS
- Nuclear medicine
  - HPLC and UHPLC
  - Portals and unattended radiation monitors

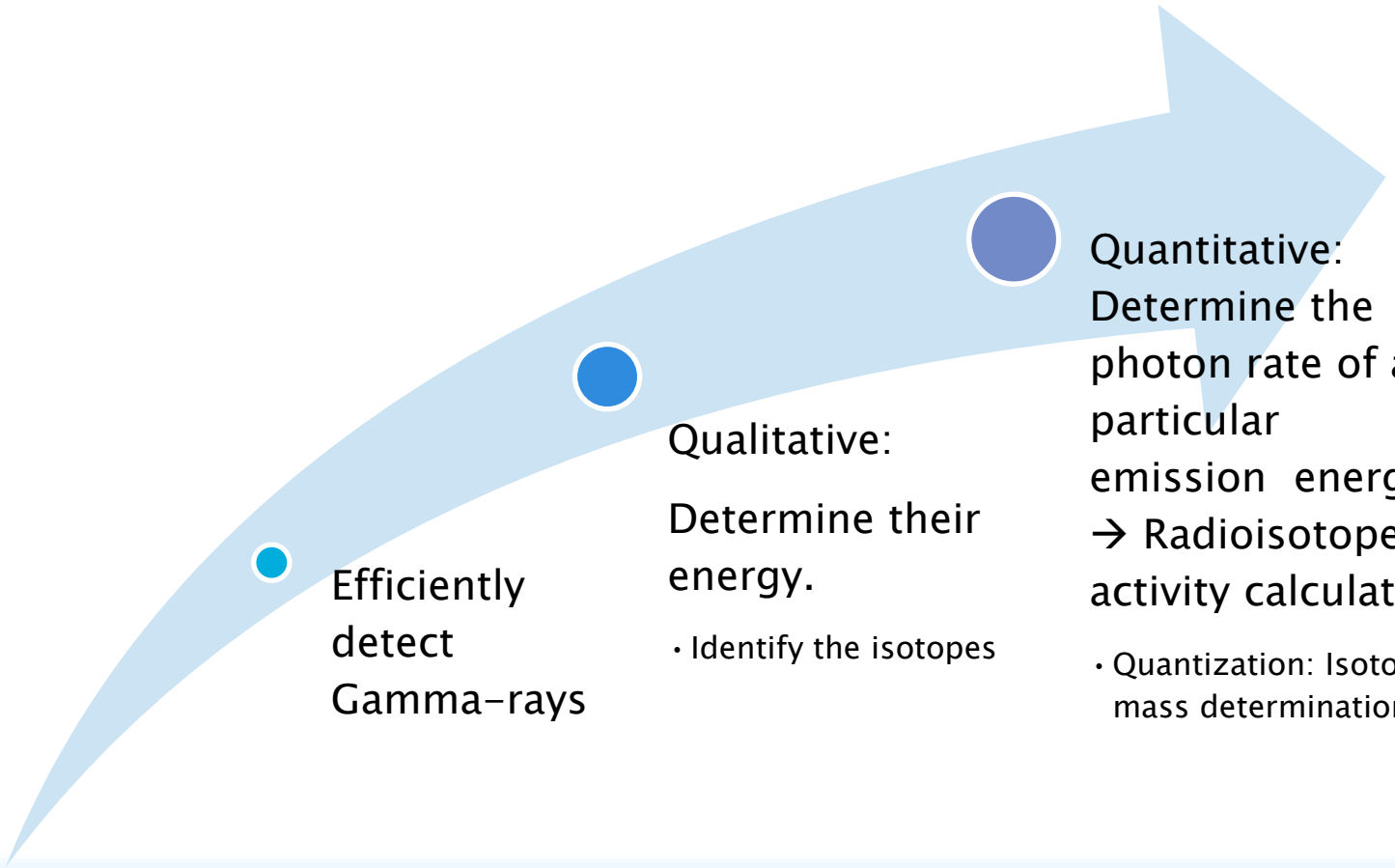
Custom made counters

- bPAC product line
- Pre-Amplifier, Amplifier and Comparator
- HV built-in
  - Up to – 2K Volts
  - Very fast gamma-ray counter > 30 Mcps
- Tuned to $CeBr_3$ scintillators
- Ethernet data communication
  - USB Hi-speed on request

BrightSpec Products

Spectrometry

Instrumentation for gamma-ray spectrometry



Spectrometry devices

- Categorization:
  - Medium or high energy resolution
  - Form factor
    - Tube-base
    - Desktop

MCAs by form factor

Tube base MCAs

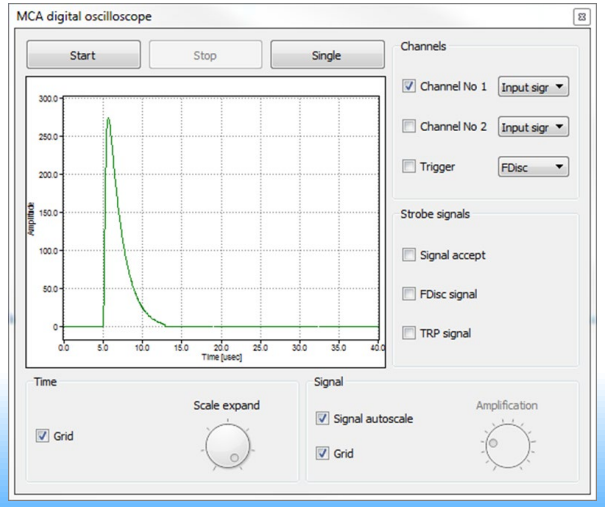
- All are encapsulated into a single, round and compact case
- Contains Preamplifier, Amplifier, Digital shaper, digital pulse processor, MCA memory and HV detector BIAS
- Easy connection to standard JEDEC 14-pin PMT socket connection, no extra cables
- Only single cable connection to PC or Network

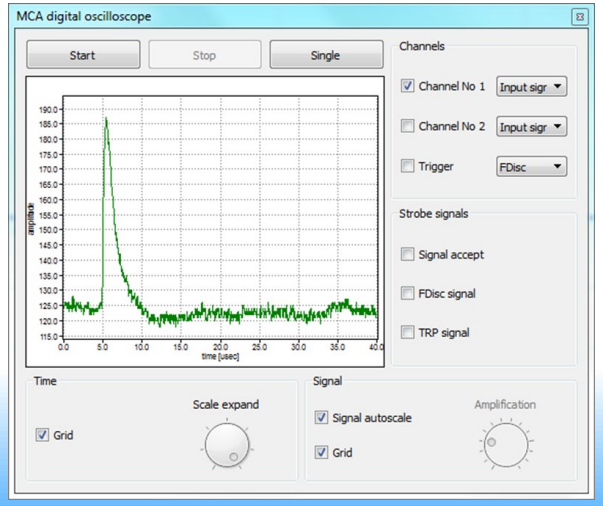
Desktop

- All functional modules encapsulated into an Aluminum box with connectors for several cables to the detector PMT.
- Contains Preamplifier, Amplifier, Digital shaper, DPP , MCA memory and HV detector BIAS . Additionally contains a programmable Input/Output (I/O) functionality
- Powered via standard USB connection to PC

Topaz-SiPM Product Line

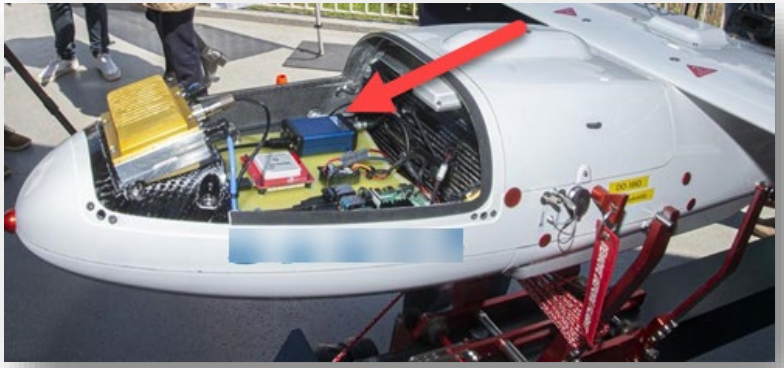
- Topaz-SiPM
  - **Miniature** sizes
  - USB and Ethernet data interface
  - Same specs as Topaz-pico, but different PreAmp and no HV BIAS
  - Linear PreAmp
  - Special algorithms for base-line restauration when using Si-arrays as PMTs





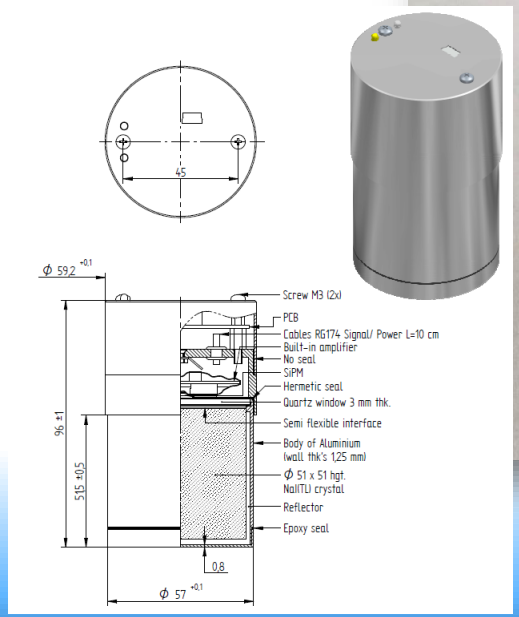
Miniature MCAs: Topaz-SiPM applications

- Ideal as advanced spectroscopy component for applications or setups that require compactness or light weights.
  - Unmanned Aerial Vehicles (UAV) or Unmanned Ground Vehicles (UGV)
    - Drones
  - Robotic arms
  - Hand-held instruments



New Development: Integrated MCA product line

- Single board
- Miniature PCB, integrated into detector encapsulation
- Up-to 4K MCA, 32-bit depth.
- Same operational specs as Topaz-SiPM
- **USB data interface**
- Fully digital and application-tuned DSP algorithms

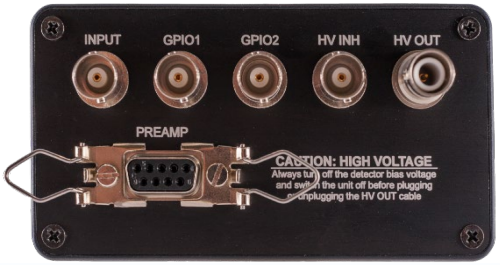


BrightSpec Products

High resolution spectrometry

High resolution MCA

- Topaz-HR
  - High-resolution MCA for gamma-ray spectrometry. Mainly used with Hyper Pure Ge (HPGe) detectors
  - Can be used with other semiconductors detectors, such as CdZnTe, Si(Li) and PIPS



Topaz-HR Specifications

- 14-bit flash ADC at 50 Ms/sec.
- 100 MHz DSP
- 200 MHz CPU
- Up to 16 k channels, 32-bit channel depth
- Up to 6kV Bias, 350 μAmp automatic ramping
- PreAmp power ±12 Volts (250 mAmp) and ±24 Volts (150 mAmp)
- External "Inhibit" signal input
- Two programmable I/O ports
- LIST and TLIST modes in addition to PHA and MCS.
  - 32K events buffer size of 32-bits each
  - < 30 nsec pulse resolution
- High speed USB, up to 490 Mbit/sec

BrightSpec MCA Summary Table

	bMCA-U	bMCA-E	Topaz-pico	Topaz-SiPM	Topaz-X	Topaz-HR
Device						
Case format	Tube-base 14-pin PMT socket	Tube-base 14-pin PMT socket	Desktop / case	Miniature case	Desktop / miniature case	Desktop / case
Data connection	Full speed USB 2.0 ~ 1.2 Mb/sec	Ethernet 10/100	Full speed USB 2.0 ~ 1.2 Mb/sec	Full speed USB 2.0 ~ 1.2 Mb/sec Or Ethernet 10/100	High-speed USB 480 Mb/sec	High-speed USB 480 Mb/sec
Acquisition modes	PHA and MCS	PHA and MCS	PHA and MCS	PHA and MCS	PHA, MCS, LIST and TLIST	PHA, MCS, LIST and TLIST
Programmable I/O ports	none	none	one port	one port	two ports	two ports
Sampling rate	25 Ms/s, 12-bit	25 Ms/s, 12-bit	25 Ms/s, 12-bit	25 Ms/s, 12-bit	50 Ms/s, 14-bit	50 Ms/s, 14-bit
DSP	50 Mhz. Trapezoidal shaper	50 Mhz. Trapezoidal shaper	50 Mhz. Trapezoidal shaper	50 Mhz. Trapezoidal shaper	100 Mhz. Trapezoidal shaper	100 Mhz. Trapezoidal shaper
CPU	40 MHz	40 MHz	40 MHz	40 MHz	200 MHz	200 MHz
Max. no of channels/ channel depth	4096, 32-bits	4096, 32-bits	4096, 32-bits	4096, 32-bits	16 384, 32-bits	16 384, 32-bits
Detector HV Bias	≤ + 1500 Volts	≤ + 1500 Volts	≤ + 1500 Volts	None	None	≤ ± 6000 Volts
Typical detectors	Scintillators: NaI(TL), CsI(Tl), $LaBr_3$, $CeBr_3$, SrI_2, BGO and plastic, e.g. PVT	Scintillators: NaI(TL), CsI(Tl), $LaBr_3$, $CeBr_3$, SrI_2, BGO and plastic, e.g. PVT	Scintillators: NaI(TL), CsI(Tl), $LaBr_3$, $CeBr_3$, SrI_2, BGO and plastic, e.g. PVT	Scintillators with SiPM, such as: NaI(TL), CsI(Tl), $LaBr_3$, $CeBr_3$	Silicon Drift Detectors (SDD) and PIPS	HPGe, CdZnTe, Si(Li), SDD and PIPS
Typical field/ Energy resolution	Gamma-ray spectrometry. Medium resolution	Gamma-ray spectrometry. Medium resolution	Gamma-ray spectrometry. Medium resolution	Gamma-ray spectrometry. Medium resolution	X-ray spectrometry. ED XRF. Charge particles. High resolution	Gamma and X-ray spectrometry. High resolution
Dimensions (LxWxH)	52 (H) x 56 (D) mm	68 (H) x 56 (D) mm	107 x 72 x 19 mm	70 x 45 x 26 mm (USB) 86 x 55 x 26 mm (ETH)	86 x 70 x 18 mm	126 x 106 x 56 mm

BrightSpec Products

Software Development Kit

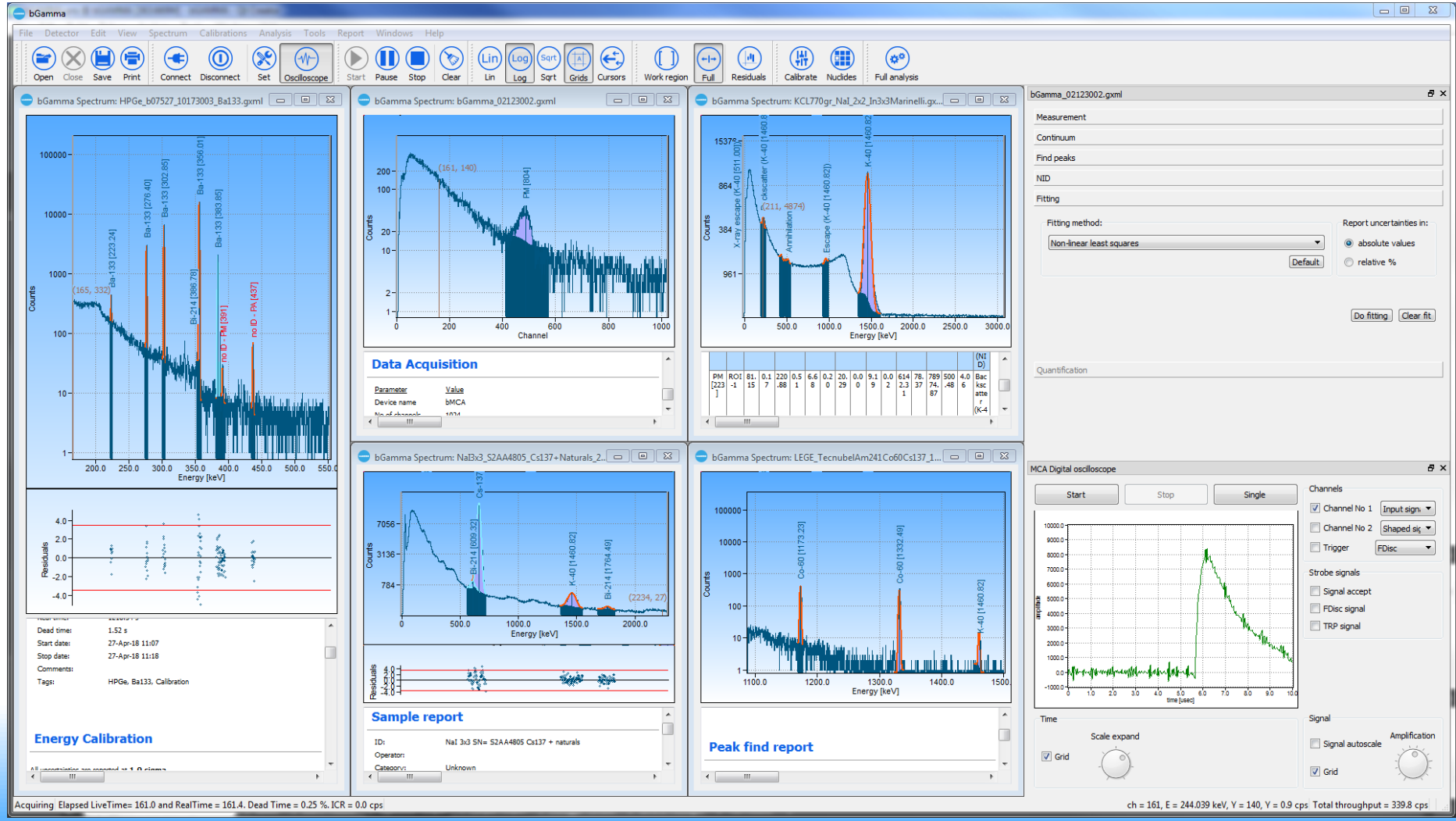
Software support for MCAs

- For all spectrometric acquisition devices (MCAs)
  - Software development kit (SDK)
    - Upon request
    - Full documentation and coding examples on several development environments and programming languages
      - C++, C#, Visual Basic, Fortran, Python
    - Multiplatform
      - Windows (x86 32 and 64-bit) SDK
      - Linux (x86 32 and 64-bit) SDK
        - x86
        - ARM-version
      - Android
        - Standardly not included into SDK

BrightSpec Products

Software for gamma-ray spectrometry

bGamma


bGamma
File Detector Edit View Spectrum Calibrations Analysis Tools Report Windows Help
Open Close Save Print Connect Disconnect Set Oscilloscope Start Pause Stop Clear Lin Log Sqrt Grids Cursors Work region Full Residuals Calibrate Nuclides Full analysis
bGamma Spectrum: HPGe_b07527_10173003_Ba133.gxml
Ba-133 [223.24]
Ba-133 [276.40]
Ba-133 [302.85]
Ba-133 [356.01]
Ba-133 [383.85]
Bi-214 [386.78]
no ID - PM [391]
no ID - PA [437]
(165, 332)
Counts
Energy [keV]
Residuals
Dead time: 1.52 s
Start date: 27-Apr-18 11:07
Stop date: 27-Apr-18 11:18
Comments:
Tags: HPGe, Ba133, Calibration
Energy Calibration
bGamma Spectrum: bGamma_02123002.gxml
(161, 140)
PM [804]
Counts
Channel
Data Acquisition
Parameter Value
Device name bMCA
bGamma Spectrum: KCL770gr_NaI_2x2_In3x3Marinelli.gx...
X-ray escape (K-40 [511.00])
Cascatter (K-40 [1460.82])
Annihilation
Escape (K-40 [1460.82])
K-40 [1460.82]
(211, 4874)
Counts
Energy [keV]
bGamma Spectrum: NaI3x3_S2AA4805_Cs137+Naturals_2...
Cs-137
Bi-214 [609.32]
K-40 [1460.82]
Bi-214 [1764.49]
(2234, 27)
Counts
Energy [keV]
Residuals
Sample report
ID: NaI 3x3 SN= S2AA4805 Cs137 + naturals
Operator:
Category: Unknown
bGamma Spectrum: LEGE_TecnubelAm241Co60Cs137_1...
Co-60 [1173.23]
Co-60 [1332.46]
K-40 [1460.82]
Counts
Energy [keV]
Peak find report
bGamma_02123002.gxml
Measurement
Continuum
Find peaks
NID
Fitting
Fitting method:
Non-linear least squares
Default
Report uncertainties in:
absolute values
relative %
Do fitting
Clear fit
Quantification
MCA Digital oscilloscope
Start
Stop
Single
Channels
Channel No 1
Channel No 2
Trigger
Input sign
Shaped sig
FDisc
Strobe signals
Signal accept
FDisc signal
TRP signal
Time
Scale expand
Grid
Signal
Signal autoscale
Amplification
Grid
Acquiring Elapsed LiveTime= 161.0 and RealTime = 161.4. Dead Time = 0.25 %. ICR = 0.0 cps
ch = 161, E = 244.039 keV, Y = 140, Y = 0.9 cps Total throughput = 339.8 cps

bGamma

- Outstanding features
  - Multi-platform. Run seamlessly in:
    - MS Windows: 7, 8, 10 and 11

    - Linux

    - macOS

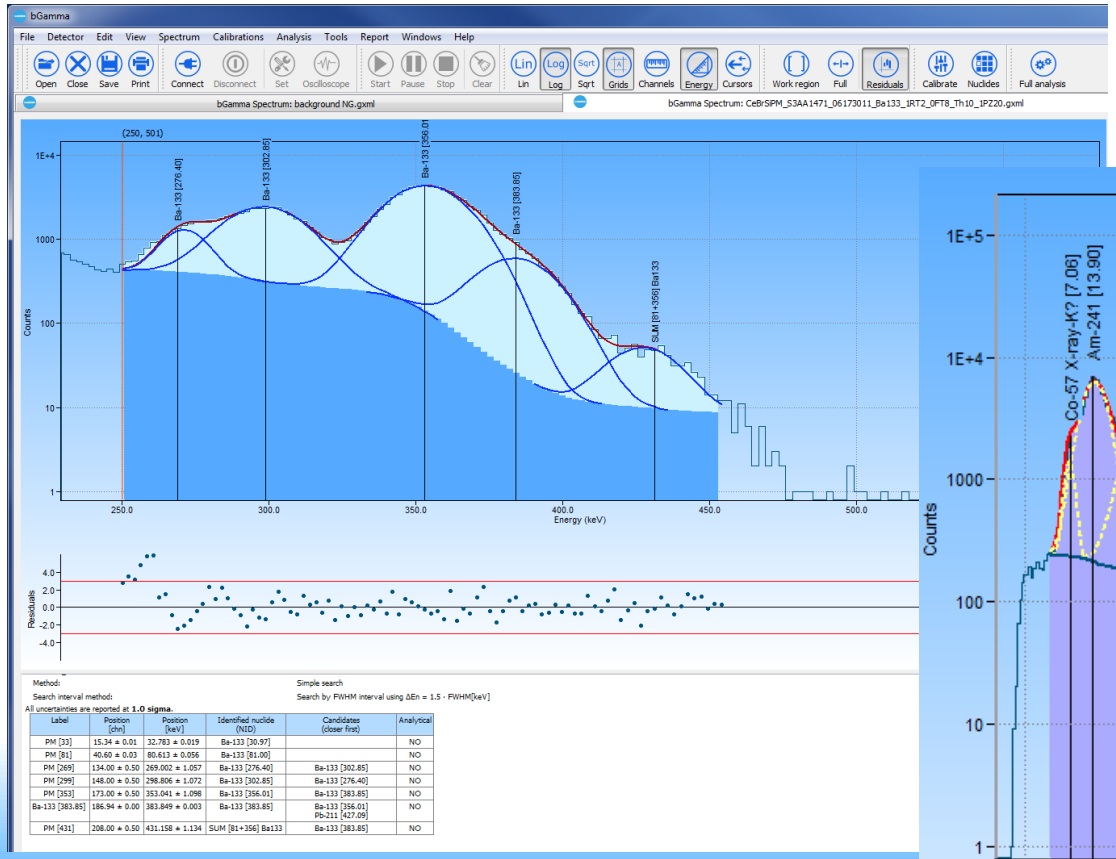
  - Wide hardware support
    - Intel μProcessor
    - ARM μProcessor
    - 32-bit and 64-bits

bGAMMA

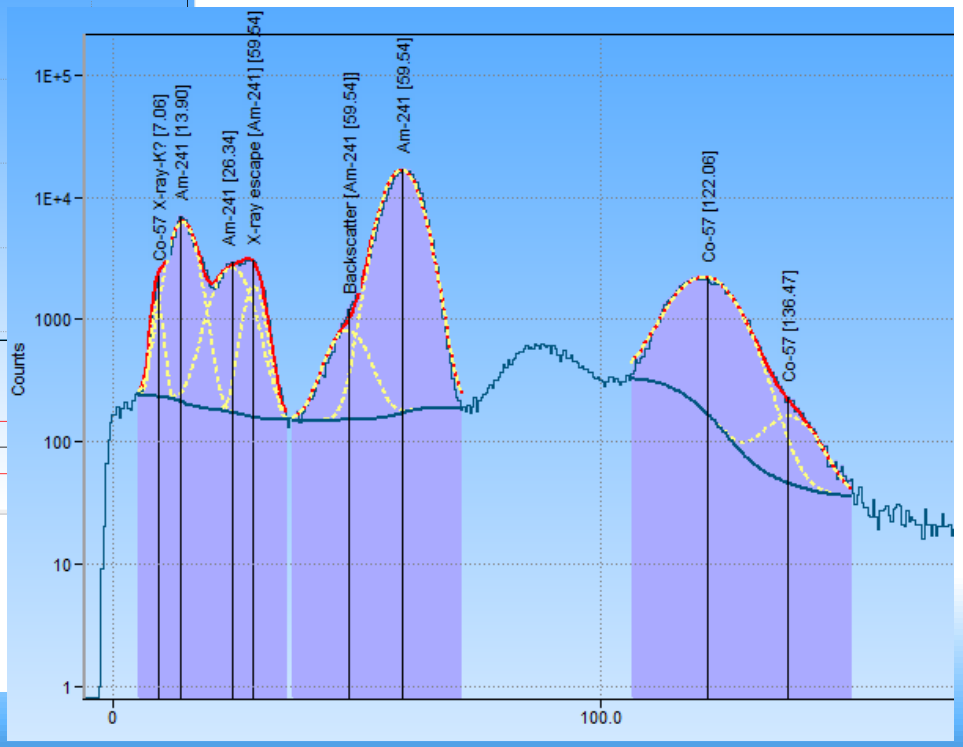
- Multi-document
- Modern and advanced GUI
  - Real-time data synchronization
- Analysis of any gamma-ray spectra independently of the detector used for its recording
- Multiple peak fitting algorithms
  - Bayesian fitting
- Extensive uncertainty propagation
  - Inclusion of Co-variance into calculations
- MDA reporting
  - Standard Currie, KTA and ISO 11929
- TCS corrections with visual feedback
- HTML-reports → use of colors, tables and plots
- User management
- QA\QC module
- Files browser
- File batch analysis with comprehensive export results

Computational algorithms

- Outstanding peak fitting and multiplet deconvolution

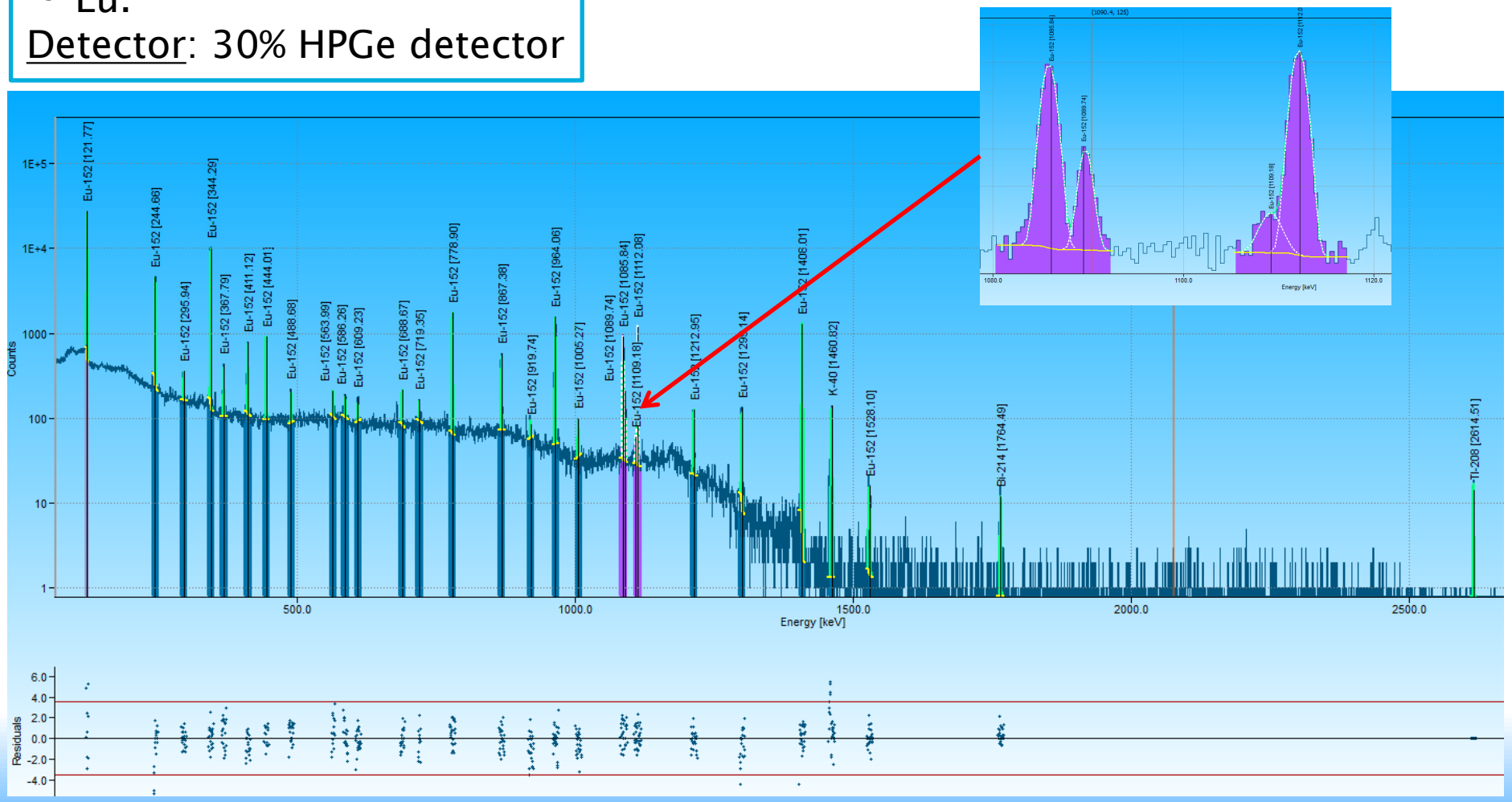


Label	Position [chn]	Position [keV]	Identified nuclide (NID)	Candidates (closer first)	Analytical
PM [33]	15.34 ± 0.01	32.783 ± 0.019	Ba-133 [30.97]		NO
PM [81]	40.60 ± 0.03	80.613 ± 0.056	Ba-133 [81.00]		NO
PM [269]	134.00 ± 0.50	269.002 ± 1.057	Ba-133 [276.40]	Ba-133 [302.85]	NO
PM [299]	148.00 ± 0.50	298.806 ± 1.072	Ba-133 [302.85]	Ba-133 [276.40]	NO
PM [353]	173.00 ± 0.50	353.041 ± 1.098	Ba-133 [356.01]	Ba-133 [383.85]	NO
Ba-133 [383.85]	186.94 ± 0.00	383.849 ± 0.003	Ba-133 [383.85]	Ba-133 [356.01] Pb-211 [427.09]	NO
PM [431]	208.00 ± 0.50	431.158 ± 1.134	SUM [81+356] Ba133	Ba-133 [383.85]	NO



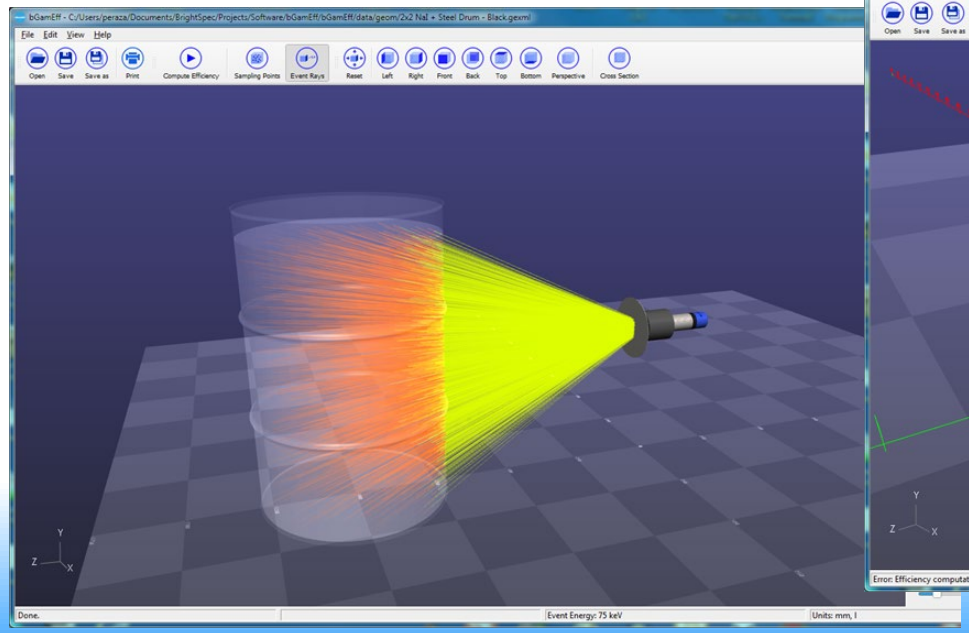
Example of fitted spectra

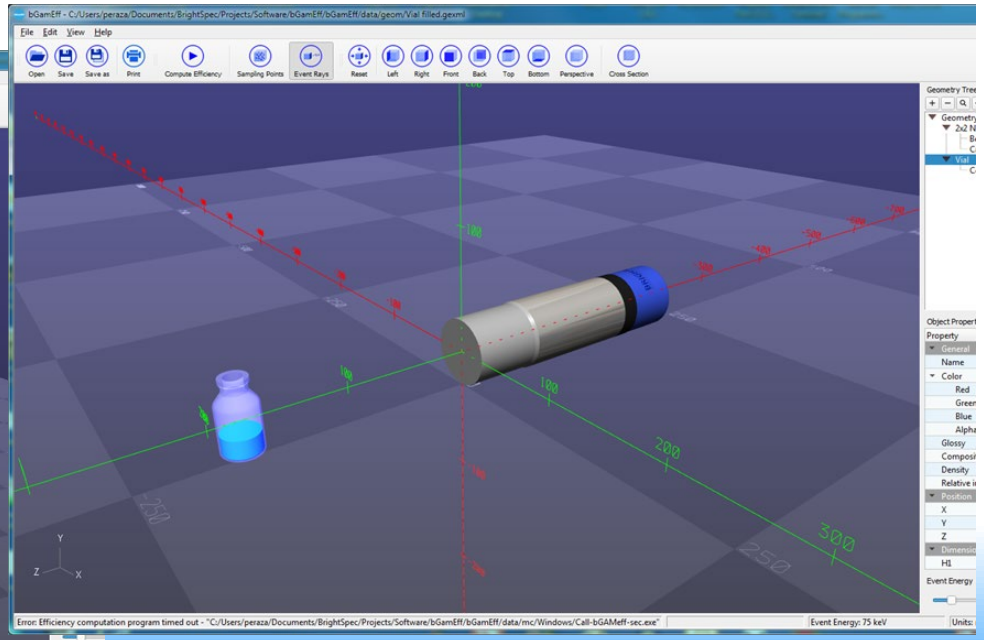
^{152}Eu.
Detector: 30% HPGe detector



bGamEff

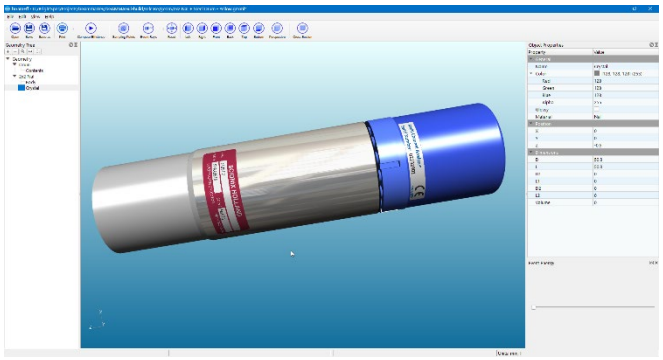
- Setup modeling and full photo-efficiency calculation using Monte Carlo model
- Includes a modern 3D object editor

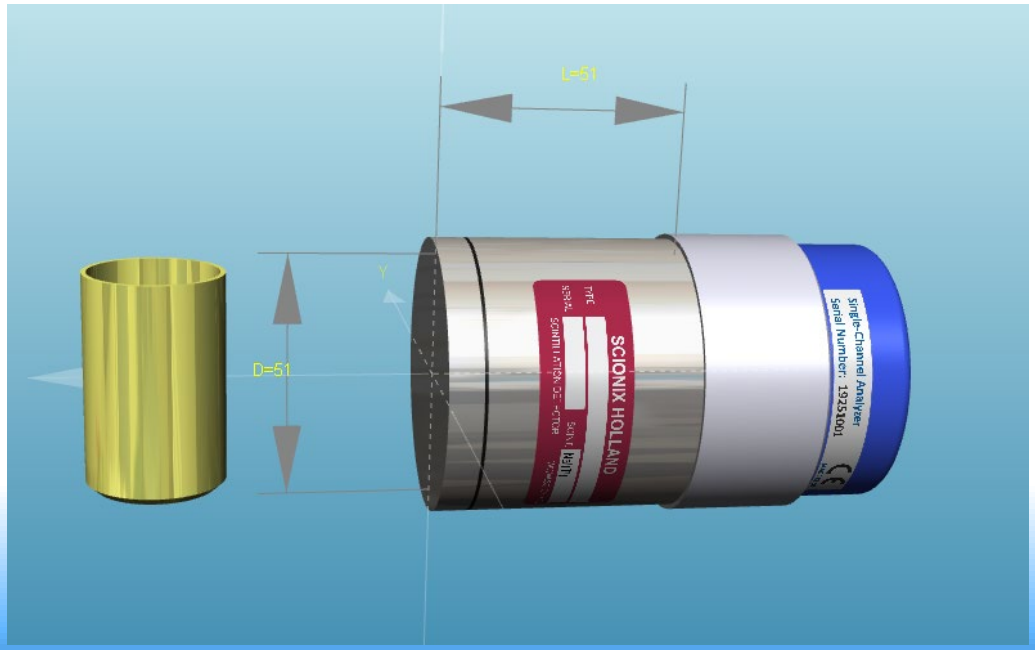




bGamEff

- Includes a modern 3D object editor
  - Allow to compose and visually edit any setup
  - Unlimited modeling and object insertion
  - Multiple radioactive sources/objects
  - Import of drawing files (*.stl)
  - Shows object's dimensions
  - View sampling points and gamma-rays



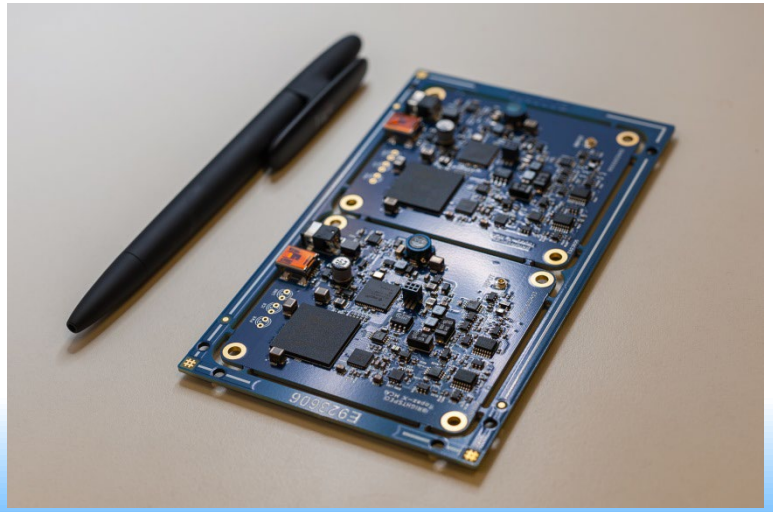


BrightSpec Products

X-ray spectrometry

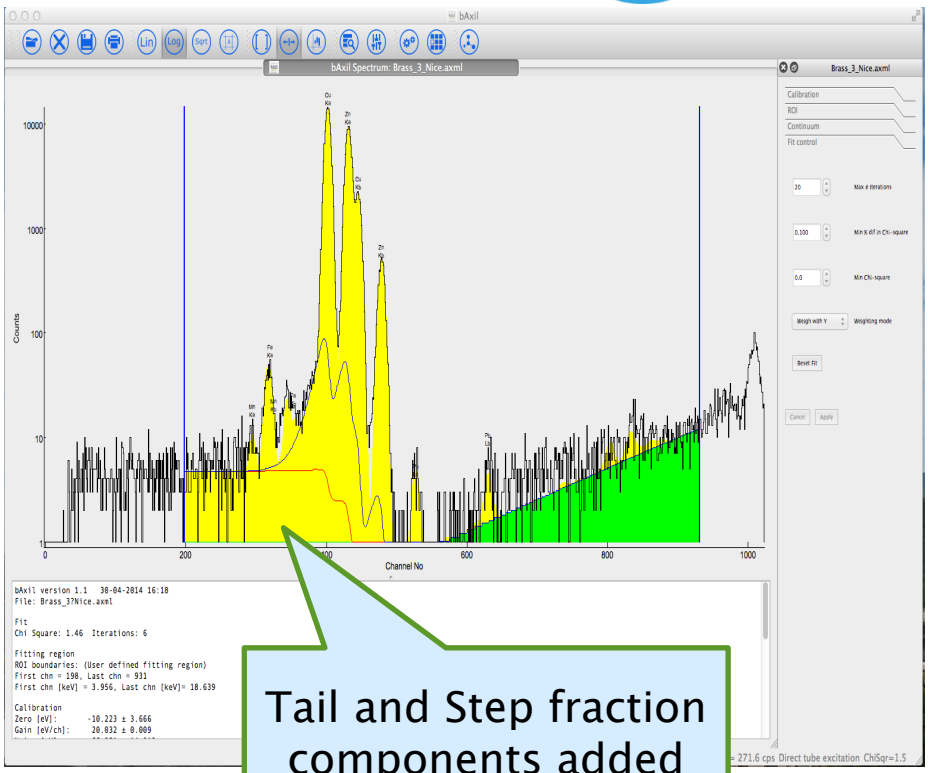
High resolution MCA: Topaz-X

- TOPAZ-X. Compact MCA
  - Boxed or
  - PCB version (OEMs)
- Fully digital MCA
- Desktop, miniature MCA
- **Does not include detector bias HV power supply**
- Ideal for X-ray spectrometry
  - Silicon drift detectors (SDDs)
- Powered over USB or external low noise power adaptor



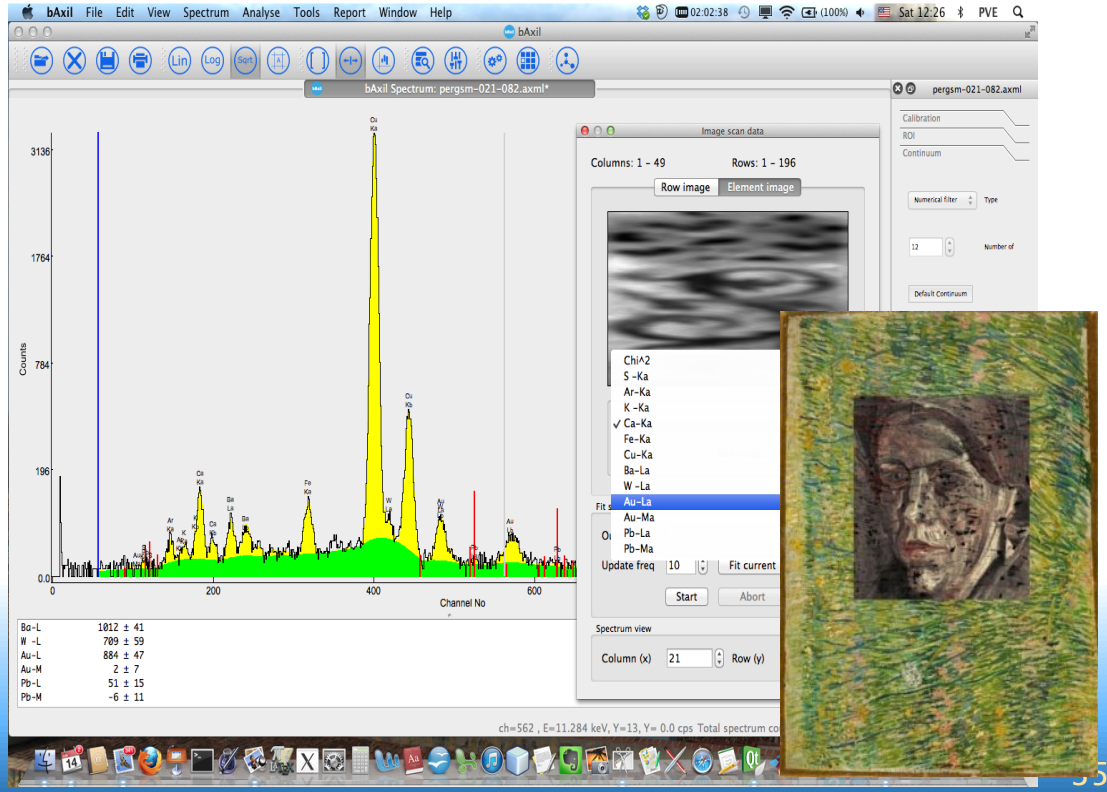
X-Ray spectrometry

- State of the art spectrum analysis software
  - Multi Platform (Ms Windows, Linux, mac OS)
  - Two peak shapes
  - Gaussian or Voight profile
  - Several continuum models
  - Tail and Step components to peak shapes
  - Fitting of Coherent and Incoherent peaks
  - Modern GUI
  - Quantitative calculations using several methods
    - Fundamental parameter standard-less or using standard-based calibrations
    - Linear regression method



X-Ray spectrometry

- Special fitting engine for image scan analysis
  - Using “Hybrid” fitting model
    - Combines linear and non-linear spectrum fitting techniques
  - Data compression algorithm with spectrum visualization capabilities



At BrightSpec … we sincerely

BRIGHTSPEC

Smart devices, professional solutions

- Thank you
- Check our WEB site or contact us for more information and products

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