

# Scott Moreland

- MS Mathematics – University of Charleston
- USN – Chemistry and Radiological Controls
- GEL – 13 years commercial lab experience
  - Separation chemistry
  - Alpha Spectroscopy
  - Gamma Spectroscopy
- Joined ORTEC in Jan. 2006 as Product Manager for Counting Labs

# ***Gamma Spectroscopy*** **“Past, Present and Future”**

**Scott Moreland**

**Product Manager – Counting Labs**

**AMETEK AMT**

**ORTEC**





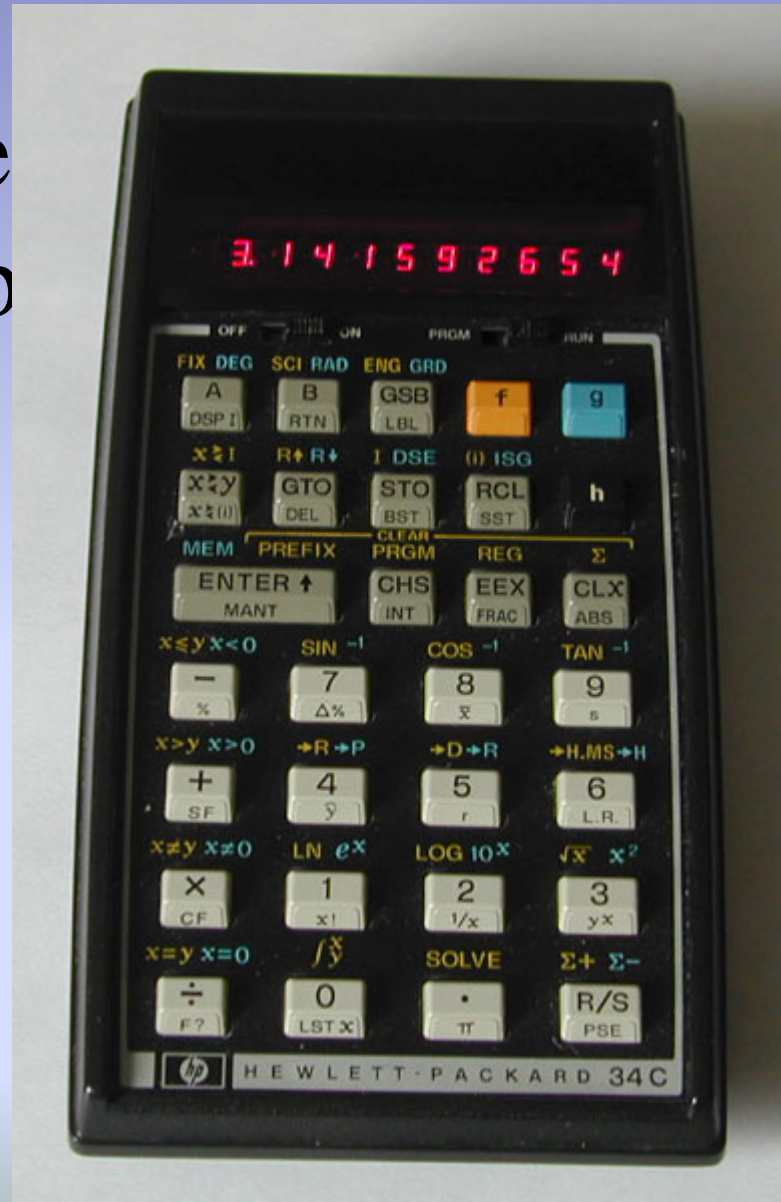
ORTEC®

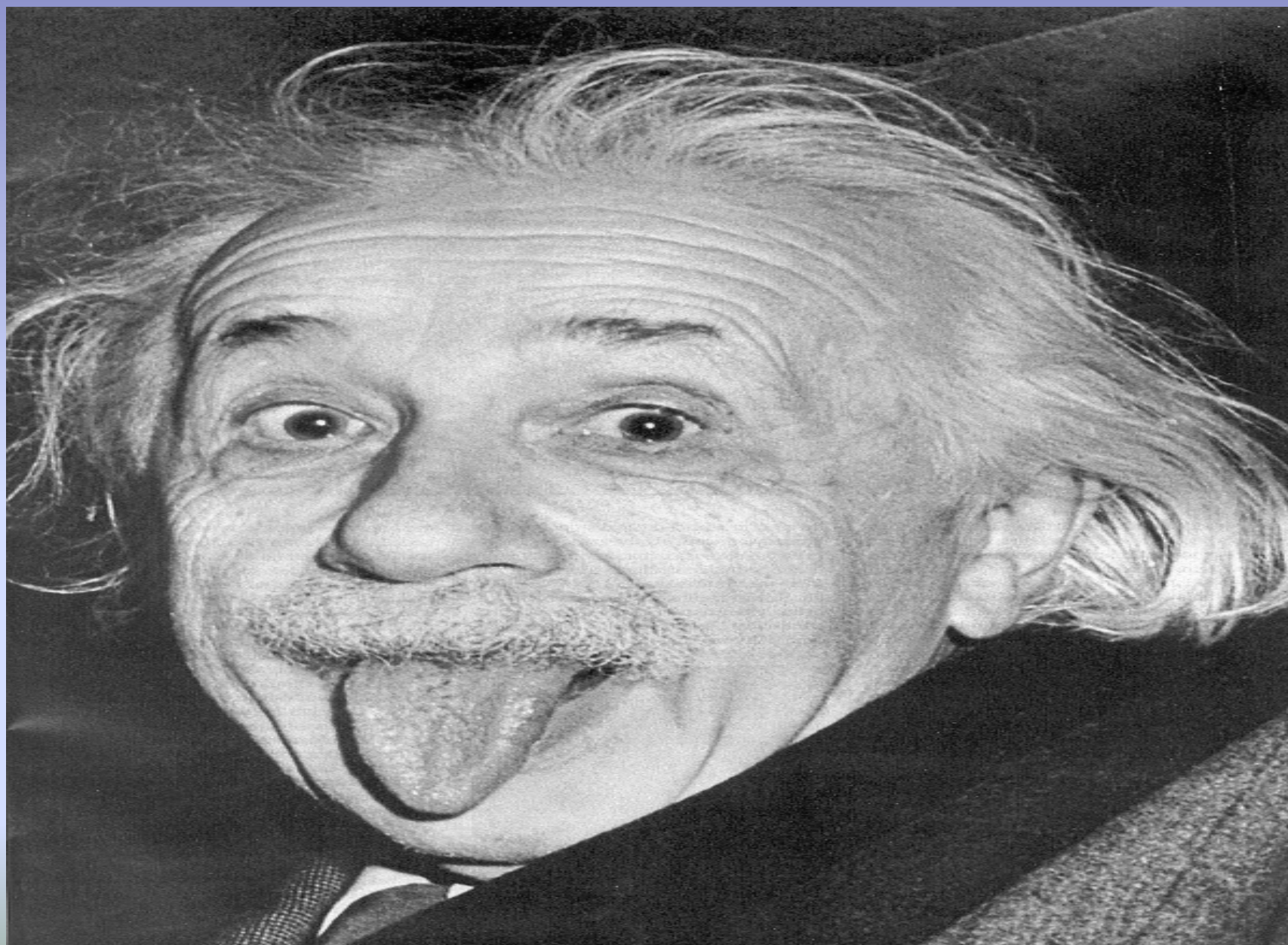
The latest technology was used for



Late  
sop

more  
s of





Fortunately,  
in the past two decades, there  
have been significant  
technological advances. Ametek,  
in keeping with those advances,  
has developed many software  
packages.

GammaVision is ORTEC's flagship gamma spectroscopy program.

- Hardware Control
- Spectrum Display
- Spectrum Analysis
- Network Support

# Hardware Control

- Automatic configuration of all MCBs
- Setup dialogs specific to the MCB
- Validity checking on your inputs
- Lockout of other users during changes
- Hardware settings saved in spectrum file

# Properties



About

Presets

MDA Preset

Amplifier

Amplifier 2

ADC

Stabilizer

High Voltage

Gain: 0.39

0.33

1.00



Fine:

0.3874

Coarse:

X1

Baseline Restore

Auto

Preamplifier Type

Resistor Feedback

Optimize

Start Auto

Stop Auto

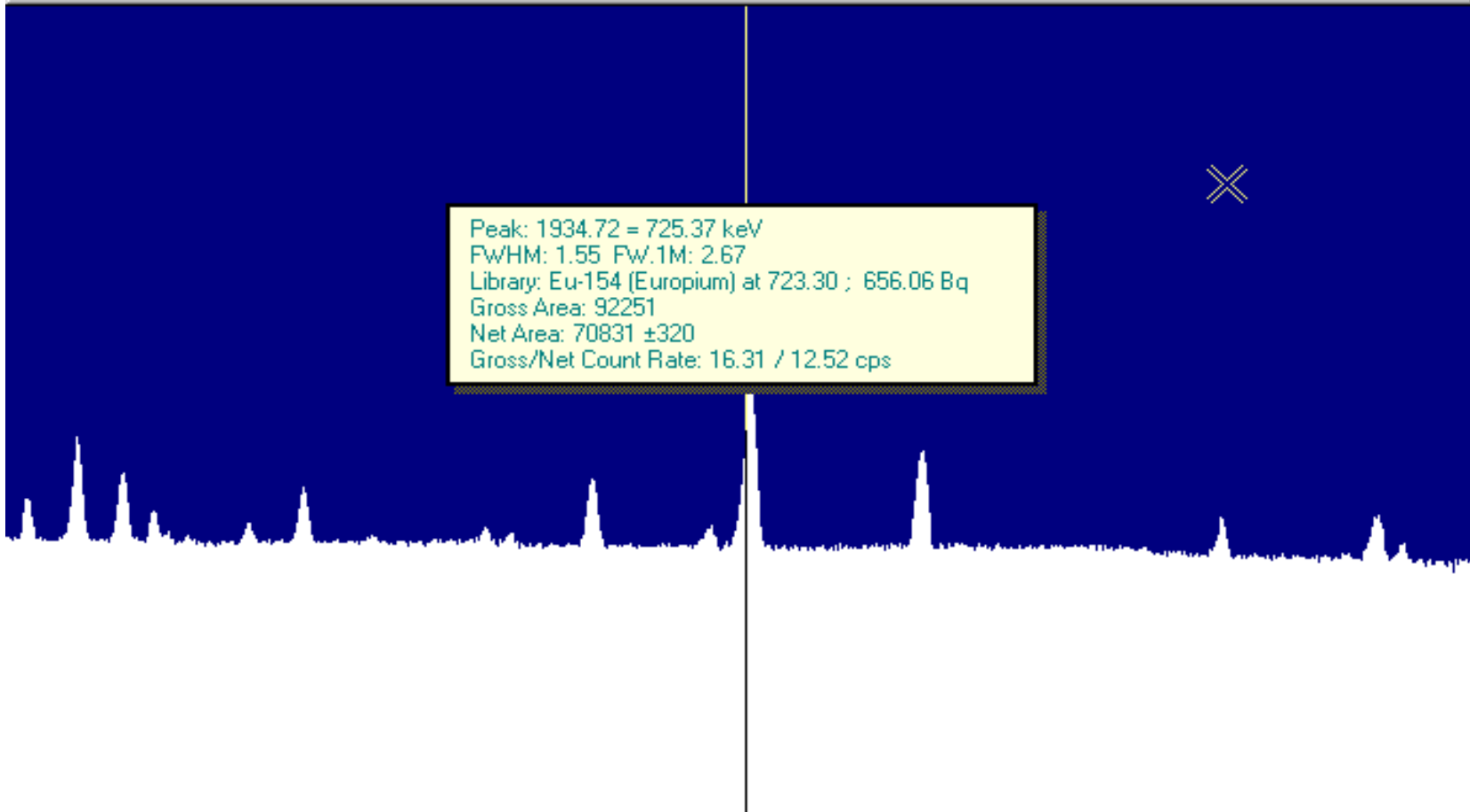
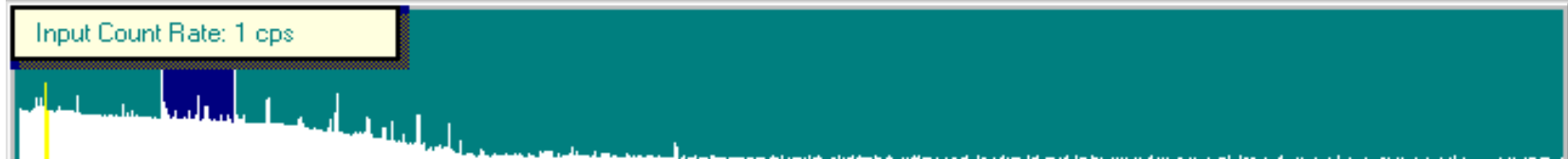
Input Polarity

(+)   (-)

Close

# Spectrum Display

- Full and expanded view
- Spectrum search buttons
- User control of colors and display mode
- Live spectrum during MCB changes
- Live input and peak parameters
- Complete “right click” menu



Peak: 1934.72 = 725.37 keV  
FWHM: 1.55 Fw.1M: 2.67  
Library: Eu-154 (Europium) at 723.30 ; 656.06 Bq  
Gross Area: 92251  
Net Area: 70831 ±320  
Gross/Net Count Rate: 16.31 / 12.52 cps

Pulse Ht. Analysis  
Start: 9:50:53 AM  
19-Jan-01  
Real: 5,792.80  
Live: 5,655.88  
Dead: %

Preset Limits  
Real:  
Live:  
Peak: 95,000  
Intg:  
Unct: %  
Mda: 120.0 Bq

ROI  
Peak  
Library

© ORTEC  
2:58:16 PM  
Wed 24-Jan-01

Marker: 1,933 = 724.73 keV 11,476 Cnts

# What did we do to make it easy for you?

- Interactive Analysis
- Calibration Wizard
- Absorption Correction
- Zero Dead Time
- True Coincidence Correction

# Interactive Analysis

- Graphic display of analysis results
- Singlets, multiplets, background
- All peak analysis details
- Adjust energy calibration
- Add or remove peaks

113K\* Log A 125 Buffer



**Analysis** ? X

Show Residuals

Shift (keV)  
0.00 OK

Library Peak

Add Delete

within Nuclide

Energy

Peak

Unknown

Multiplet

**Analysis Results Table**

Energy	FWHM	Area	Back...	Nuclide	Bq
582.30	1.38	49891	87220	Eu-154	33575.6719
591.70	1.41	274205	104003	Eu-154	31706.1836
600.77	1.40	364792	114499	Sb-125	10821.2100
606.82	1.39	102995	97459	Sb-125	11003.0791
613.30	1.29	5759	76252	Eu-154	32614.9590
625.20	1.45	16787	76199	Eu-154	32859.0469
636.15	1.42	219246	95936	Sb-125	11899.8184
649.40	1.33	4480	66360	Eu-154	35556.3203
665.07	1.33	2713	65873	<Unknown>	

Pulse Ht. Analysis

Start: 7:08:00 PM  
30-May-85

Real: 30,890.98  
Live: 28,800.00  
Dead: 6.77 %

ROI

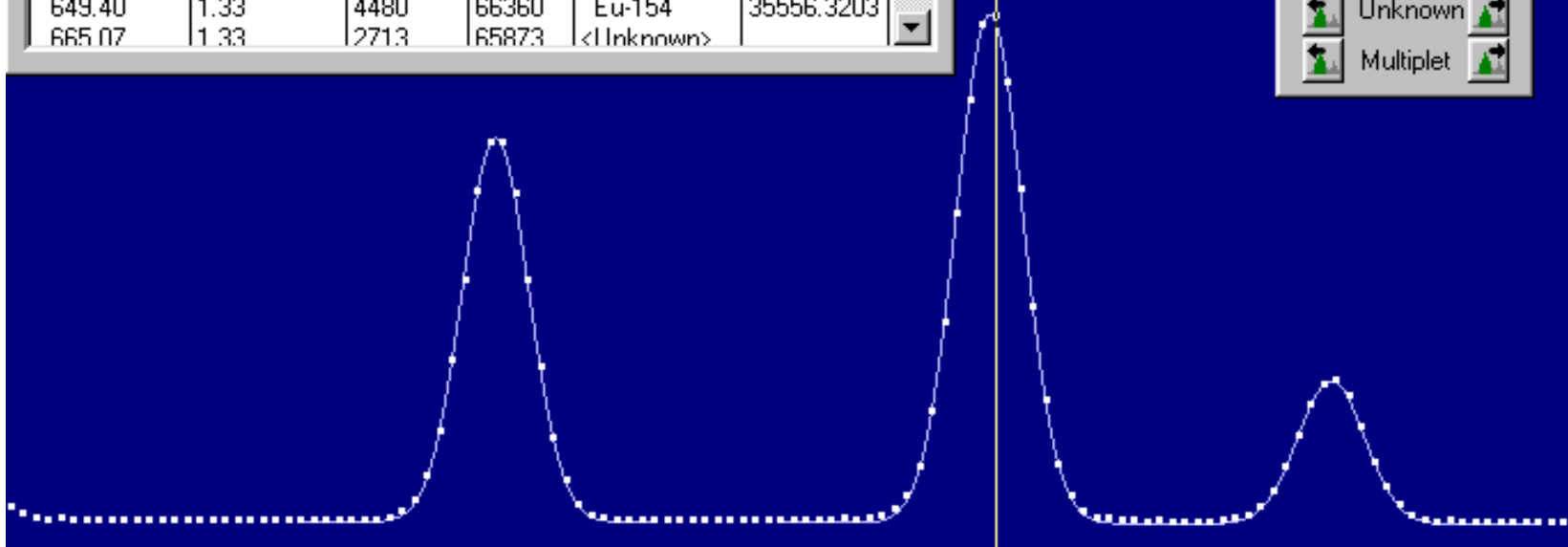
Ins Del

Peak

Info

Library

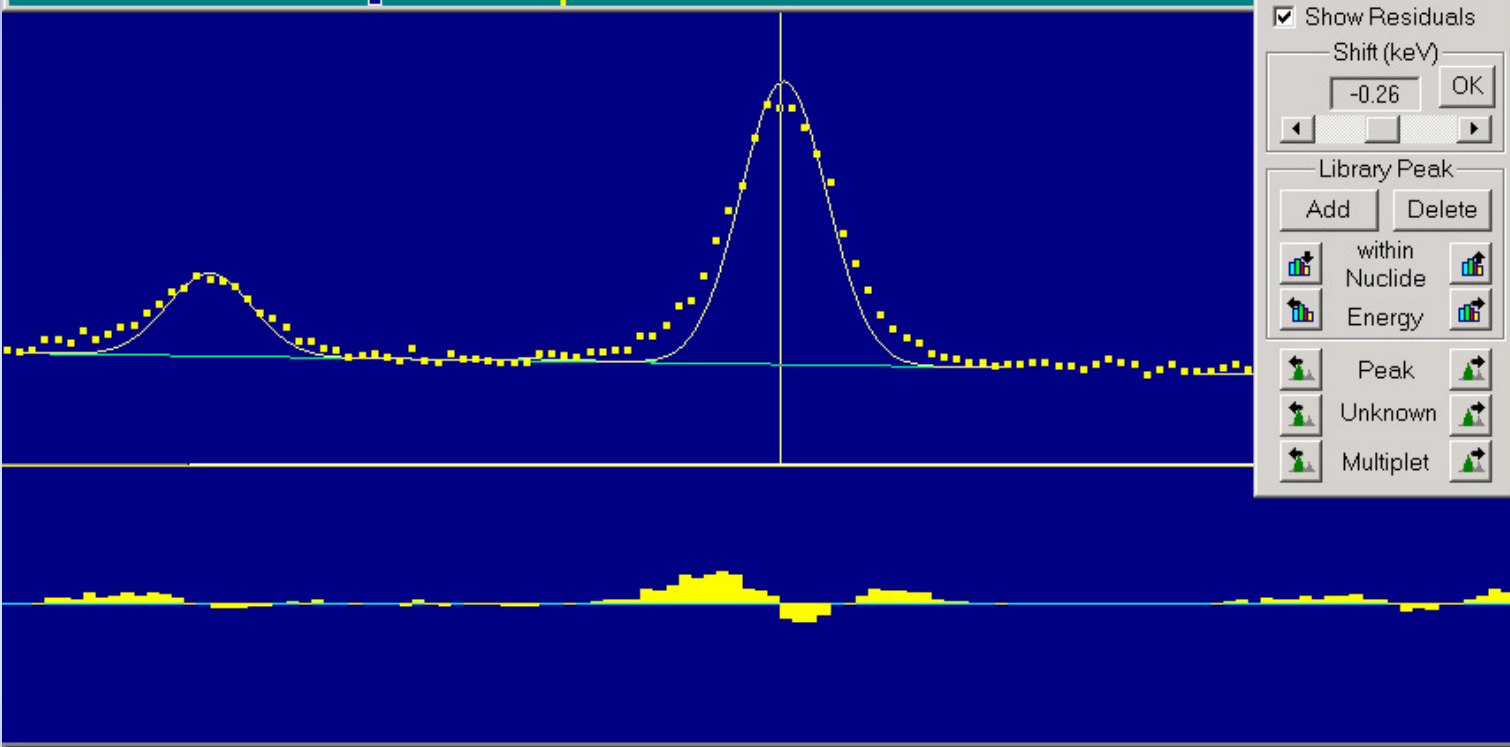
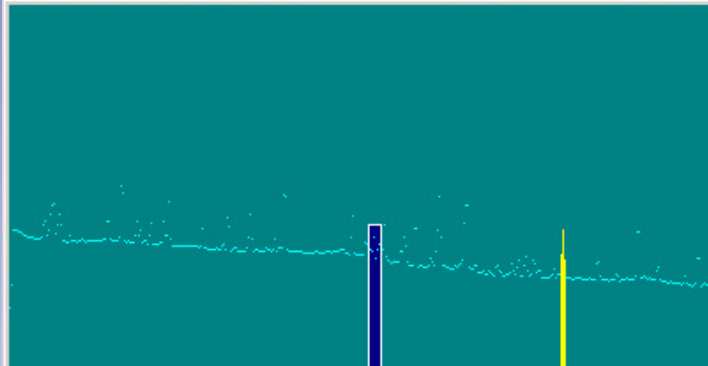
© ORTEC  
3:01:37 PM  
Wed 24-Jan-01



Marker: 2,649 = 600.73 keV 58,383 Cnts  
Analysis Results -- ESC or Close Sidebar to Cancel

Analysis Results Table

Energy	FWHM	Area	Background	Nuclide	E
755.21	1.96	15980	38101	<Unknown>	
763.13	1.57	6049	24711	Tl-208	31289.052
768.36	1.57	141	23720	Bi-214	273.1798
772.10	1.58	20846	25088	Ac-228	122150.12
782.00	1.59	8280	21807	<Unknown>	
785.42	1.59	10601	23524	Bi-212	51454.863



Analysis ? X

Show Residuals

Shift (keV)

-0.26 OK

Library Peak

Add Delete

within Nuclide

Energy

Peak

Unknown

Multiplet

Pulse Ht. Analysis

Start: 3:50:34 PM  
3/23/2001

Real: 1,406.72

Live: 500.00

Dead: 64.46 %

ROI

Ins

Del

Peak

Info

Library

© ORTEC  
4:27:36 PM  
Sat 3/2/2002

Marker: 3,904 = 772.43 keV 3,072 Cnts

Analysis Results - ESC or Close Sidebar to Cancel

6 Nuclide Peaks; 2 Unknown Peaks

All the  
 peak  
 analysis  
 details --  
 more than  
 you want to  
 know.

The screenshot shows a software window titled "Details" with a list of peak analysis parameters. The window includes a "Peak" button with a peak icon and a "Close" button. The parameters listed are:

```

Energy = 772.1
Centroid = 772.1
Center = 3904.27
mlo, mhi = 3887 3922
multilo, hi = 3844 3922
Fwhm = 7.963 ( 1.58 keV)
Fw10m = 14.33 ( 2.84 keV)
Fw04m = 17.52 ( 3.47 keV)
Area = 20846.6
Background = 25088
Counts = 20846.6
FirstNet = 24226
FirstBackground = 31554
Uncertainty = 0.012784
Abundance = 122150
MDA = 4340.83
fwPeakFlag1,2,3 = 0x2000 0x0005 0x0000
Lo, HiWidth = 3 3
BackLo, Hi = 963.333 837.333
SlopeAbove = -1.56017
qfParaBack = 0 0 0
irpNuclide, ... = 5 2 8 6 0 6
    
```

# Calibration Wizard

- Totally automatic -- energy, efficiency & TCC
- Use certificate files and gamma-ray libraries
- Reduces errors in most important step
- Controls spectrum acquisition
- guides you through the total process

# Calibration

Energy -- Uses patented auto method

Efficiency -- Uses one of several formulas

TCC -- Uses special method

## Calibration Wizard



Please select the types of calibration to perform

Energy Calibration:  Keep Current  Create New  Read From File

Efficiency Calibration:  Keep Current  Create New  Read From File

TCC Calibration:  Keep Current  Create New  Read From File

< Back

Next >

Cancel

Help

## Efficiency Calibration Wizard



Please enter the following information for the efficiency calibration

Certificate File: Mike\Sept2000Sampling\s1835D.Eft

Browse

Edit

Library: C:\User\4275-1417.mdb

Browse

Edit

Source Label: Mixed Gamma with Cs134

Count Time: 10000.00

Seconds.

Clear Data Before Start

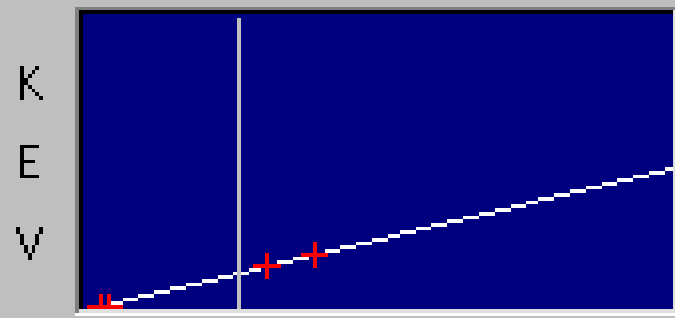
< Back

Next >

Cancel

Help

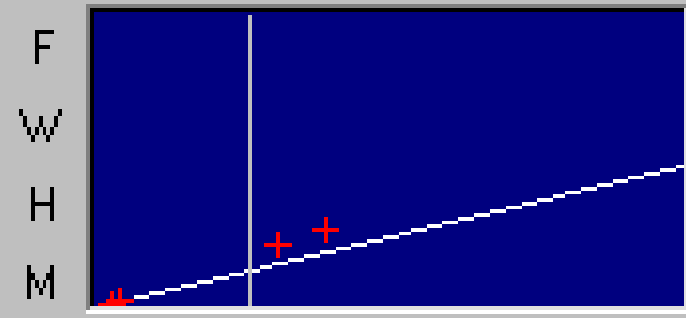
### Finish Calibration Wizard



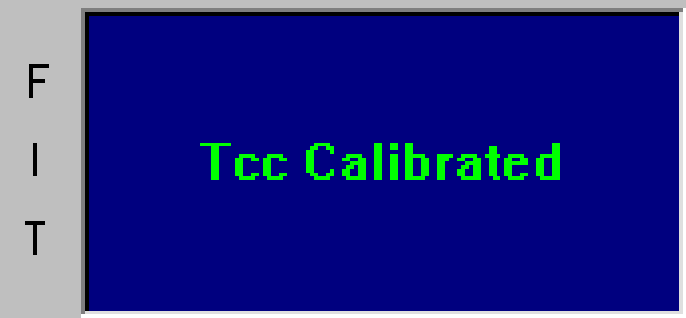
CHANNEL



ENERGY



ENERGY



ENERGY

Edit Energy

Save Calibration

Edit Efficiency

< Back

Finish

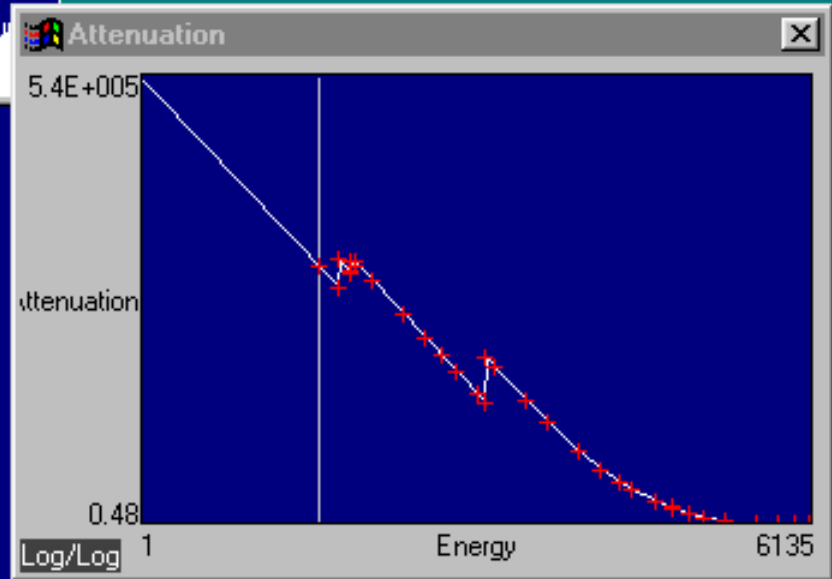
Cancel

Help

# Absorption Correction

- Any number of materials
- Built-in, user-expandable database
- Graphical display of attenuation
- Internal or external correction

Input Count Rate: 1 cps



**Attenuation Work...**

Absorber: Pb [Add] [Edit]

Density: 11.34 g/cm<sup>3</sup> [Calculate]

Attenuation:

Linear [0] 1/cm

Mass at: [0] keV [Enter]

Table:

37 Energies

[Delete Energy]

[Delete Absorber]

[Save...]

Pulse Ht. Analysis

Start: 9:50:53 AM  
19-Jan-01

Real: 5,792.80  
Live: 5,655.88  
Dead: %

Preset Limits

Real:  
Live:  
Peak: 95,000  
Intg:  
Unct: %  
Mda: 120.0 Bq

[ROI] [Peak] [Library]

**Attenuation Table**

Energy (keV)	Lin Atten (1/cm)
500.00	1.8313E+000
600.00	1.4159E+000
800.00	1.0067E+000
1000.00	8.0607E-001
1022.00	7.9022E-001
1250.00	6.6684E-001
1500.00	5.9273E-001
2000.00	5.2284E-001
3000.00	4.8057E-001

Zero Dead Time with Uncertainty  
in  
DSPEC Plus

Zero Dead Time (ZDT™) corrects the spectrum (not the counting time) for dead time losses

Patent granted December 2001

All digital control, automatic —  
no adjustments

# Properties

About

Presets

MDA Preset

Amplifier

Amplifier 2

ADC

Stabilizer

High Voltage

Gate

Off

Conversion Gain

16384

ZDT Mode

Off

Lower Level Disc

50

Upper Level Disc

16383

Off

NORM\_CORR

CORR\_ERR

Real Time

5792.80

Live Time

5655.88

Count Rate

16

Close

Also called Loss Free Counting (LFC)

Correctly collects the spectrum when the count rate varies during the count time.

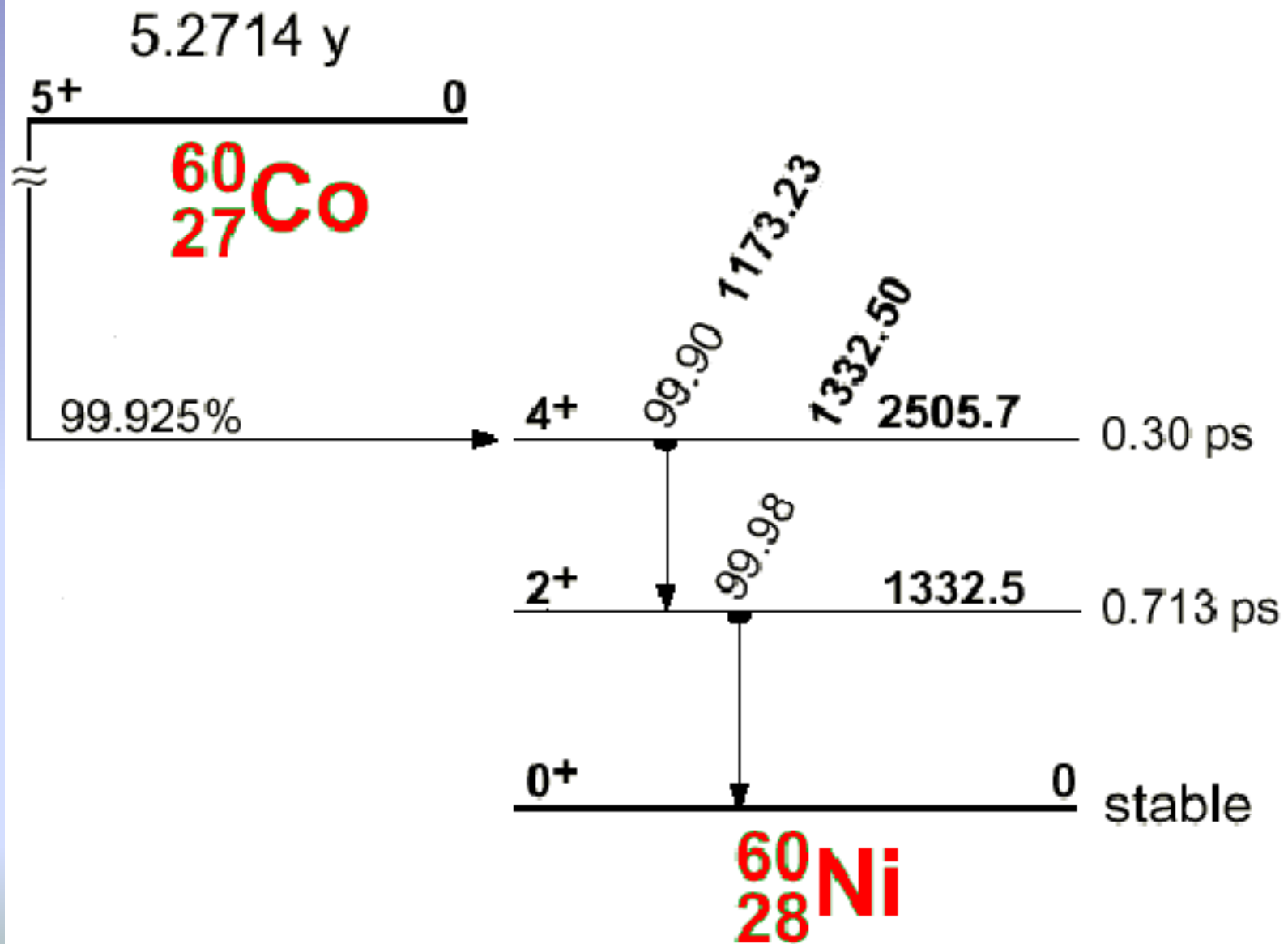
ZDT spectrum does not obey Poisson statistics, so the channel-by-channel variance is collected in a separate, uncertainty spectrum (UNC)

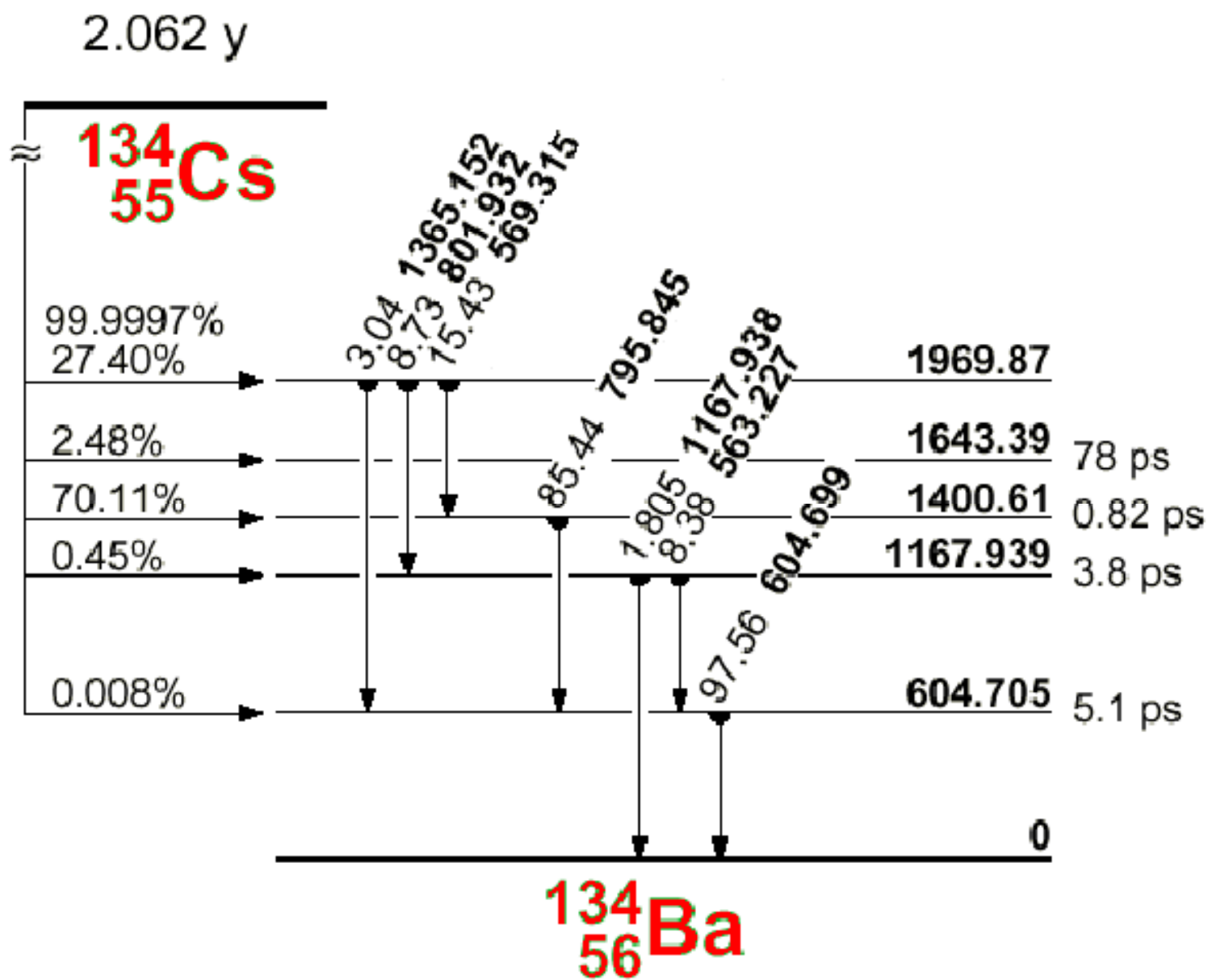
$$N_i \pm \sqrt{v_i}$$

GammaVision uses both the ZDT  
and the UNC spectrum to  
calculate the correct uncertainty  
for peak area and activity results

# True Coincidence Correction

True Coincidence Summing (TCS) is the summing in the detector of cascade gamma rays.





TCS causes incorrect full-energy peak areas; thus incorrect efficiencies and activities

ANSI N42.14 gives a procedure for measuring the impact of TCS on the results (up to 40%)

True Coincidence Correction (TCC)  
is the correction of the activity of  
nuclides with TCS

Previously unknown peaks (sum  
peaks) are used in the analysis

GammaVision uses the proven method of Blaauw, et al, for TCC.

ORTEC has the exclusive worldwide license for this method.

TCC depends on the detector and the detector-source geometry.

# What do I do?

- Just click one box
- Nuclides in the library
- Calibration

## Analysis Options



Sample | System | Decay | Report | Analysis | Corrections | Isotopes

## Analysis Method

## Program

WAN32 Analysis

Add

Edit

Delete

## Additional Error

## Systematic

1.00000 %

## Random

1.00000 %

## Peak Stripping

Library Based  Manual Based 

Second Library:

Browse...

Third Library:

Browse...

## Analysis

## Peak Cutoff

100.0000 %

True  
Coincidence  
Correction Directed Fit 

OK

Cancel

Help

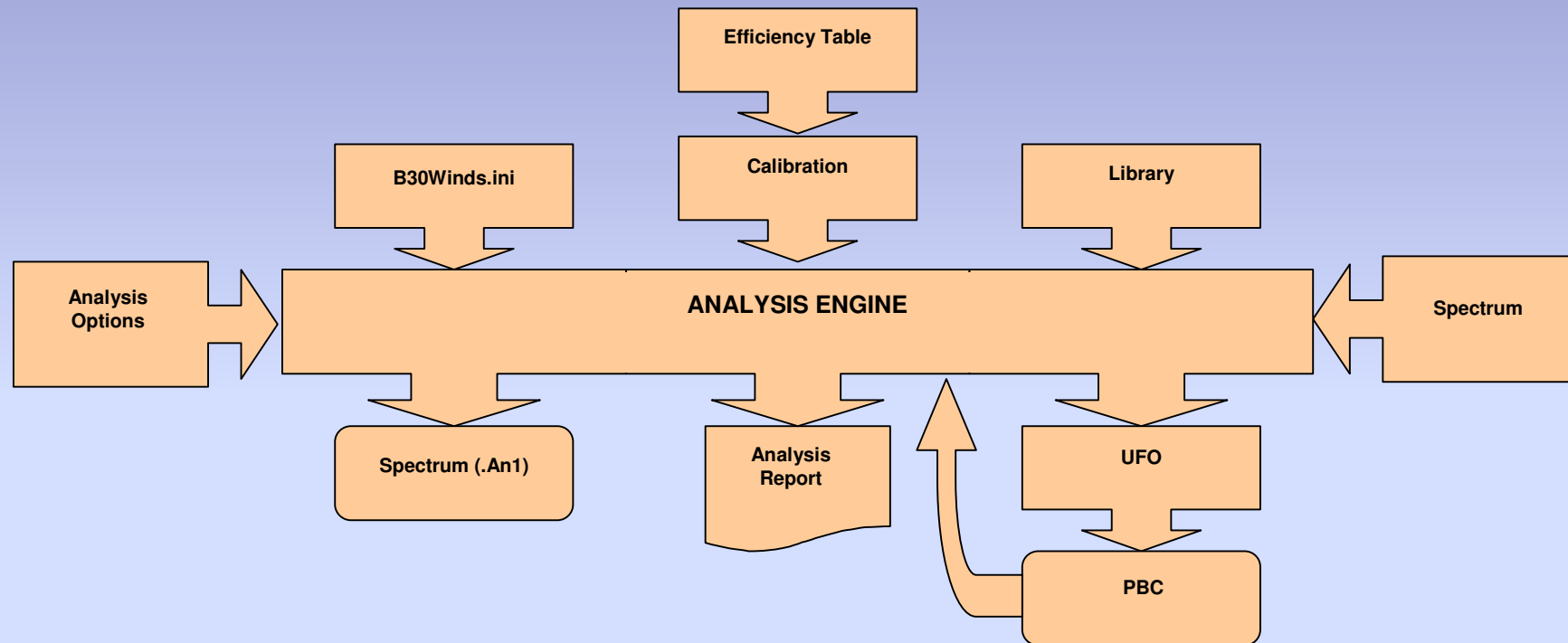
# Remember

The cascade tests of N42.14 predict the impact of cascade summing

The cascade summing methods of Blaauw as implemented in GammaVision are an easy way to correct for true coincidence effects.

This allows the counting of samples in the geometries (both simple and volume sources) with the best efficiency, on the largest detectors possible.

# GammaVision's Core Purpose?



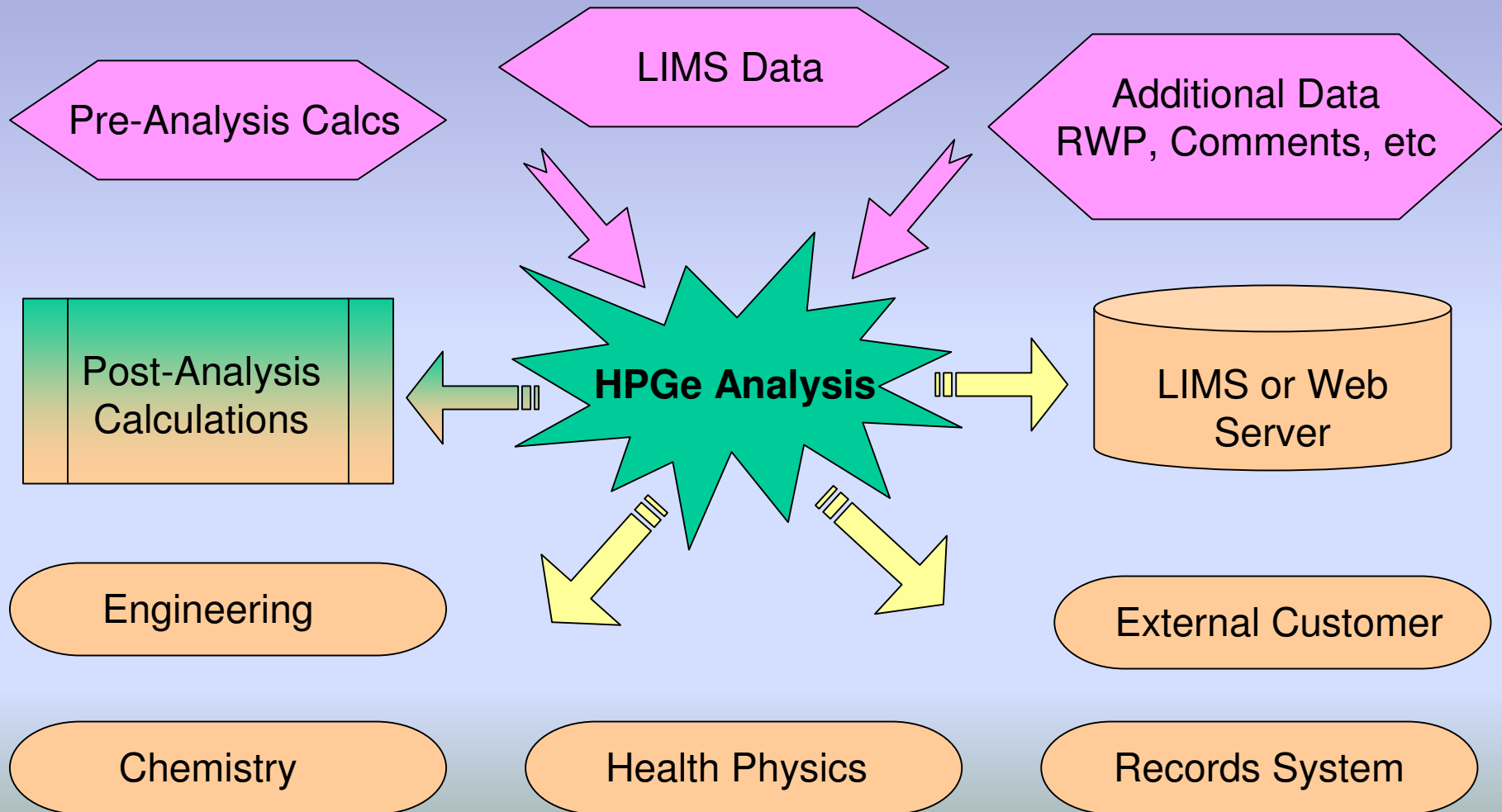
***It's all about the Analysis!***

## ***A quick summary of the some benefits of GammaVision***

- Total Coincidence Summing correction
- Corrections for interfering isotopes (peak stripping)
- Corrections for sample self absorption
- Library for common absorbers
- Easy to build Job files for acquisition and quantification automation

*The Analysis is a Key Component...*

*...but it may not be the “Complete Solution”*



***How would you rate your lab?***

***Efficient?***

***Secure Data?***

***Accurate?***

***Reliable?***

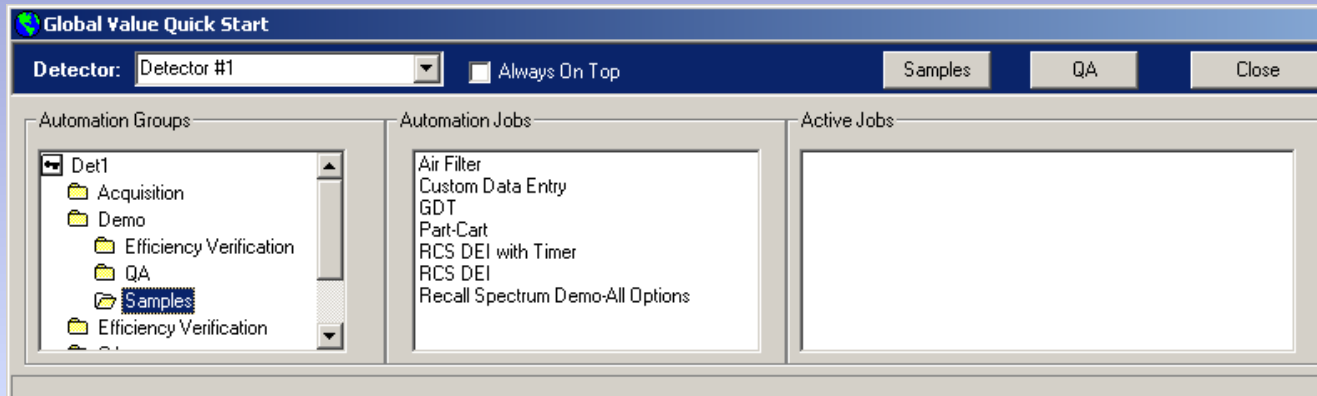
***Maybe a **Global** approach to counting  
lab operations would add **Value!*****

## ***Global Value ...***

**GammaVision Productivity Add-On to Optimize:**

- Analysis Automation**
- Custom reporting**
- Quality Assurance**
- Data Management**
- Data Sharing**

# Quick Start



- **Central Launch Pad for Global Value to run GammaVision Automation Jobs and Launch the Analysis and QA Administration programs**
- **Mini-Windows Explorer interface runs as a thick toolbar**
- **Prevents running simultaneous Jobs on the same detector**
- **MDI style interface using separate instances of GammaVision**

# Sample Admin

- Easy access to Analysis Reports
- Electronic Editing and Review
- Report Output to MS Word or Text/PDF files

The screenshot displays the 'Global Value Sample Administration - [Analysis Editor]' software interface. The interface is divided into several sections:

- Header:** Shows 'Current User: Admin' and 'User Group: Administrator'.
- Form Fields:** Includes 'Detector: Detector #1', 'Spectrum: 1\_00001', and 'Filter By: Unreviewed'. There are also fields for 'Analyst', 'Reviewer', and 'Publisher' with a 'Signature' and 'Date' field.
- Analysis Report Section:** Contains 'Sample Data' and 'Analysis Data' tabs. The 'Sample Data' tab shows:
  - Description: Unit Vent
  - Comments: Building: Level: Room:
  - Report Template: Part-Cat
  - Collection Start: 10/17/2000 22:03
  - Collection Stop: 10/24/2000 23:07
  - Quantity: 19270000 cc
  - Acq Start: 10/25/2000 02:04:15
  - Report Date: 3/30/2005 12:40
  - Live Time: 600 seconds
  - Real Time: 600 seconds
  - Dead Time: 0 %
  - Libraries: 1\_47mmFilter\_1.lib, 1\_CharcoalCat\_1.lib
- Analysis Data Section:** Shows 'R-Type: E5-5' and 'Sample Type: RP'. It lists 'RWP: 2005-0001, 2005-0005' and 'Rad Monitor' settings.
- Report Preview Section:** Shows a preview of the analysis report with the following content:
 

Chemistry Department

Sample Description: Unit Vent

RWP: 2005-0001, 2005-0005

Detector: Countroom #4      Spectrum: 1\_00001  
Volume: 1.927E+07 cc      Sample Pump: HP-AS-204

Sample Start: 10/17/2000 22:03      Acquired: 10/25/2000 02:04:15  
Sample Stop: 10/24/2000 23:07      Report Created: 3/30/2005 12:40

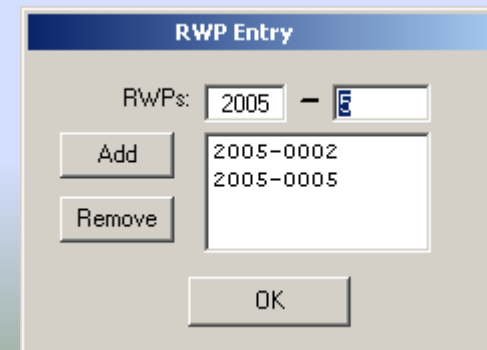
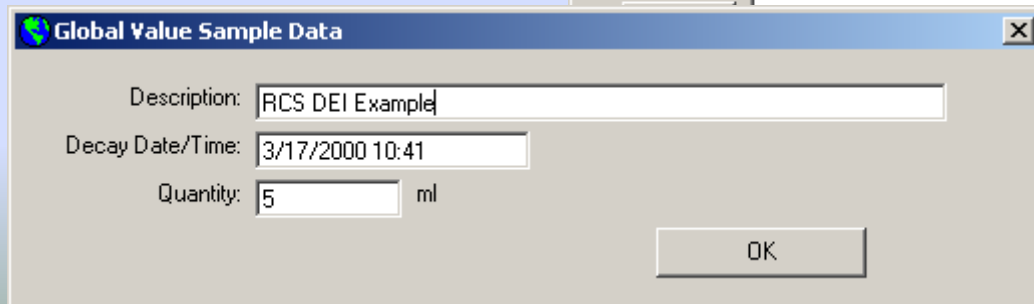
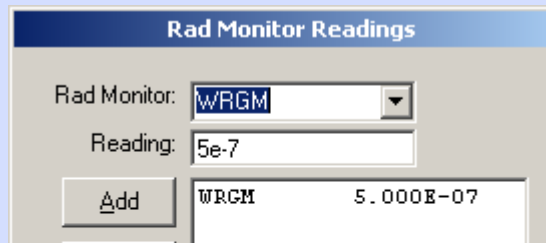
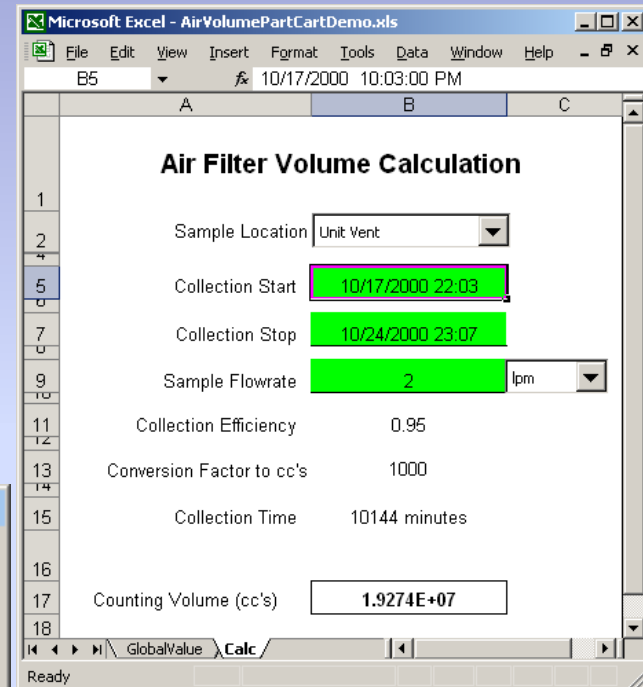
Performed by: Admin      Reviewed by:

Efficiency: Detector #1 47mm Filter Shelf 1  
Library: AirFilter.Lib
- Table Section:** A table showing analysis results for various nuclides.
 

Analysis #	Nuclide	Activity	Uncertainty	MDA	Edited	Energy	Identification
1	Cs-137	1.1516E-12	2.887E+01	7.8300E-13	No	81.20	
1	Co-58	1.0440E-12	3.162E+01	8.5100E-13	No		
1	Cs-134	<1.0425E-12	0.000E+00	0.0000E+00	No		
1	Co-60	<2.3098E-12	0.000E+00	0.0000E+00	No		
1	Mn-54	<1.0206E-12	0.000E+00	0.0000E+00	No		
1	Fe-59	<2.0780E-12	0.000E+00	0.0000E+00	No		
1	Ce-141	<4.2842E-13	0.000E+00	0.0000E+00	No		
1	Ce-144	<2.8802E-12	0.000E+00	0.0000E+00	No		
1	Zn-65	<2.7007E-12	0.000E+00	0.0000E+00	No		
2	I-131	1.5453E-12	2.791E+01	1.0000E-12	No		
2	I-133	<6.1821E-12	0.000E+00	0.0000E+00	No		

# Sample Data Inputs

- Simplified Data Entry
- User-defined forms and calculations in Excel
- Sample Specific Data prompts for Description, Decay, Quantity, RWPs, Rad Monitors, Sampler ID, Unit #, Comments





# Quality Assurance

- Individual Peak and Background QA Parameters (Unlimited Points)
- Various QA Parameters: FWHM, Channel and Energy Centroid, Peak Area, Intensity, Uncertainty, Activity OR the % Difference from a target value
- QA Charts with slide show feature
- Customizable Reports
- Lab Notebook
- Electronic Report Review
- MS Word and Excel Integration
- Automated Statistical Evaluation

My Nuclear Power Station  
Chemistry Department  
Daily Quality Control Check

Spectrum: 1\_000276 Record Type: Q6-444  
 Acquired: 17-Feb-2005 08:32:49  
 Detector: DSpecJr

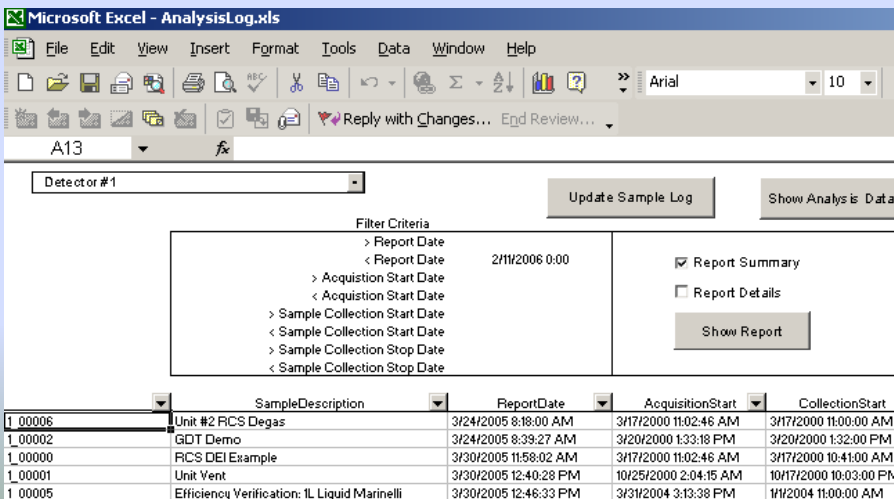
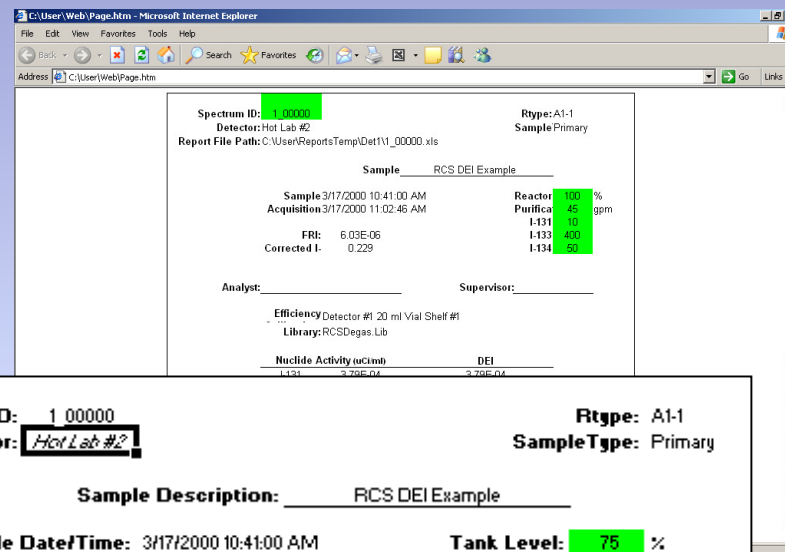
Place Instrument Out of Service if any of the following conditions occur:  
 1) Any parameter is Out of Control  
 2) The same parameter is Out of Tolerance twice consecutively  
 3) Any QA Peak is not found

	Target	L_Ctrl	L_Tol	Measured	H_Tol	H_Ctrl	Results
QA-122 Channel	244.00	243.00	243.50	243.87	244.50	245.00	PASS
Energy	122.00	121.50	121.75	122.11	122.25	122.50	PASS
FWHM	1.00	0.80	0.90	0.83	1.10	1.20	Low OOT
Activity	4.81E-2	4.40E-2	4.60E-2	4.95E-2	5.00E-2	5.20E-2	PASS
ActivityDiff	0.048	-7.500	-5.000	-3.098	5.000	7.500	PASS
QA-1332 Channel	2665.00	2663.00	2664.00	2664.53	2666.00	2667.00	PASS



# Excel Add-In

- Unlimited Custom Calculations using multiple samples
- Data filtering and sorting
- Post results to the Web using Excel's functionality
- Functions available in Worksheet Cells or VBA Code



**Spectrum ID:** 1.00000  
**Detector:** Hot Lab #2  
**Rttype:** A1-1  
**SampleType:** Primary

**Sample Description:** RCS DEI Example

**Sample Date/Time:** 3/17/2000 10:41:00 AM  
**Acquisition Date/Time:** 3/17/2000 11:02:46 AM  
**Tank Level:** 75 %  
**Tank Volume:** 319000 Gallons

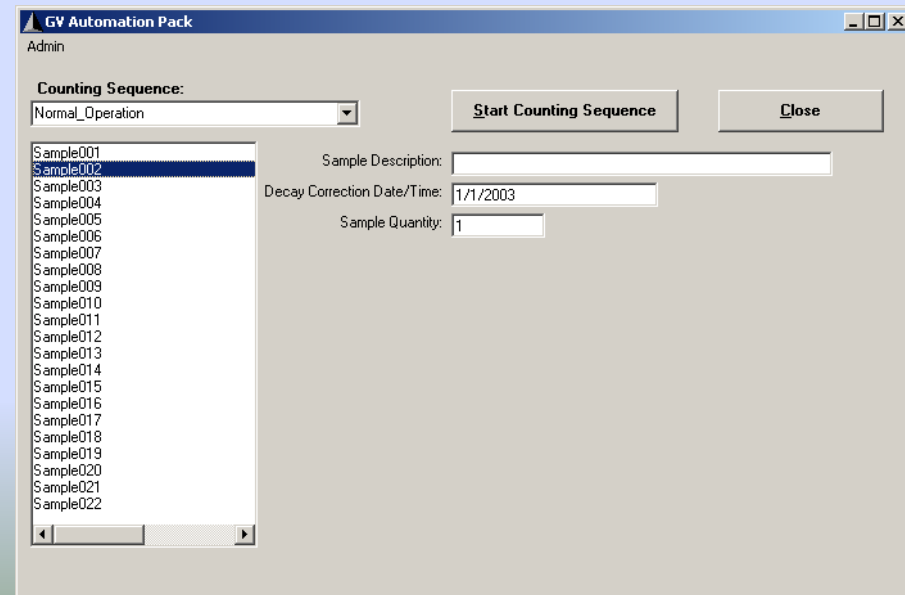
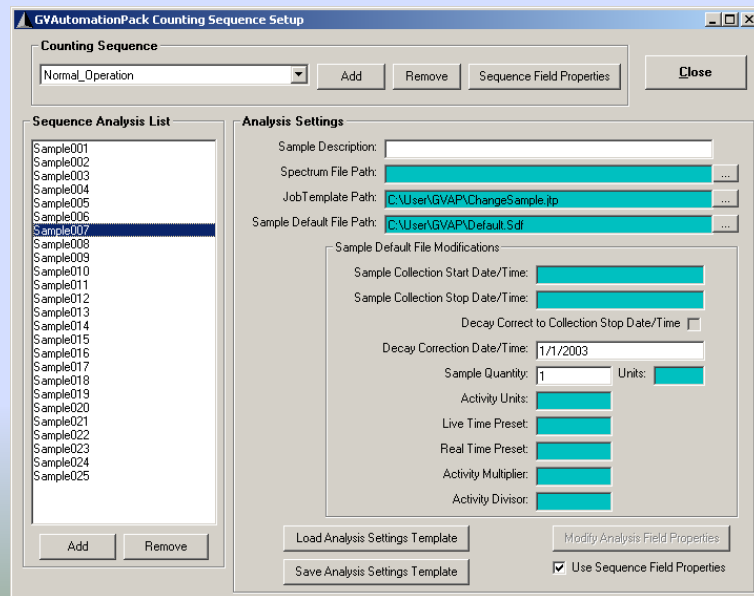
**Analyst:** \_\_\_\_\_  
**Supervisor:** \_\_\_\_\_

**Efficiency Calibration:** Detector #1 20 ml Vial Shelf #1  
**Library:** RCSDegas.Lib

Nuclide	Nuclide Activity (uCi/ml)	Total Tank Activity (uCi)
I-131	3.79E-04	4.58E-01
I-132	2.24E-03	2.70E+00
I-133	2.21E-03	2.67E+00
I-134	3.30E-03	3.98E+00
I-135	2.52E-03	3.04E+00
Cs-134	5.42E-04	6.54E-01
Cs-137	5.29E-04	6.39E-01
Co-58	9.45E-05	1.14E-01
W-187	5.07E-03	6.13E+00
Ag-110m	4.00E-03	4.83E+00
<b>Total</b>	<b>2.09E-02</b>	<b>2.52E+01</b>

# GVAutomationPack

- Sample Changer Automation software
- Pre-define Analysis Sequences
- User-defined Custom Interfacing based on required user inputs



## Where do we go in the future?

- That is primarily driven by you.
- As Product Manager, I am responsible for giving direct input to upper management for future product development.
- Feedback from you, is a vital part of this process.

## Other ORTEC software products

- AlphaVision – Alpha spectroscopy
- Isotopic - In-situ measurements
- Renaissance – Whole body counting
- ScintiVision – NaI applications

On behalf of ORTEC,  
Thank you.

Don't forget about our MS101  
Alpha Spectroscopy class coming  
to NPL. Contact your ORTEC  
sales representative  
for details.

# CHEERS

