

# ISOTOPIC Version 4 Release Notes

## 1.0 Introduction

ISOTOPIC Version 4 represents a SUBSTANTIAL move forward from previous versions of this program. In concept, the program has not changed. Its purpose is, as before, waste assay of containers and surfaces, but great attention has been given to simplifying the operation, improving reporting and responding to customer requests and suggestions. These release notes summarize the major changes.

## 2.0. User interface improvements and simplifications

As is well known, ISOTOPIC's roots were as a "post-processor" of results data from an analysis package such as GammaVision. In the first version of ISOTOPIC, in fact, it was completely separate from GammaVision, and had to run on GammaVision results files. This could be confusing, because some of the features of GammaVision were not applicable to ISOTOPIC. (There are many examples, but perhaps a simple one is GammaVision's geometry correction function. This was never relevant to the ISOTOPIC analysis, because ISOTOPIC's very purpose is to "correct" or "adjust" from the calibration geometry (e.g., point source at 30 cm from the detector) to the the sample geometry (e.g., 55 gallon drum)).

Version 3.X "ISOPLUS" integrated the functions and added the M-1 soil methodology so that two separate programs were not needed, but there were still entries which were redundant and confusing.

In version 4, careful consideration has been given to the way in which the USER would like to work. Parameter entry has been carefully rationalised so that parameters on a single page are more logically related. Where possible previous multiple pages have been combined, redundant data entry has been removed. Previously a Wizard configured the container, whereas the analysis parameters were set using GammaVision-like analysis "settings." Many, even experienced GammaVision users, found this combination of a wizard and a settings menu to be non-intuitive. Now a single wizard started under analysis settings-configuration defines the container configuration and all settings for the scan, including numbers of detectors, acquisition times, and analysis settings. This Wizard involves 4-6 steps total to set up the complete scan.

ALMOST EVERY SETUP SCREEN in the container mode of version 4 has changed. In ISOTOPIC 3.1 container mode, there were no fewer than 12 (twelve) screens to achieve what is now covered in 5 screens (e.g., Figures 1, 2, and 3).

Soil mode (M-1 method) screen changes are relatively minor. A small degree of reorganization has been carried out to make it more logical.

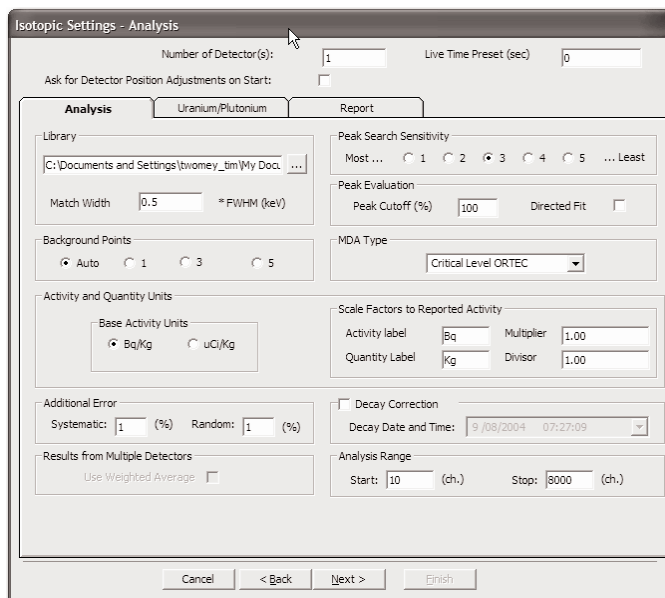


Figure 1.

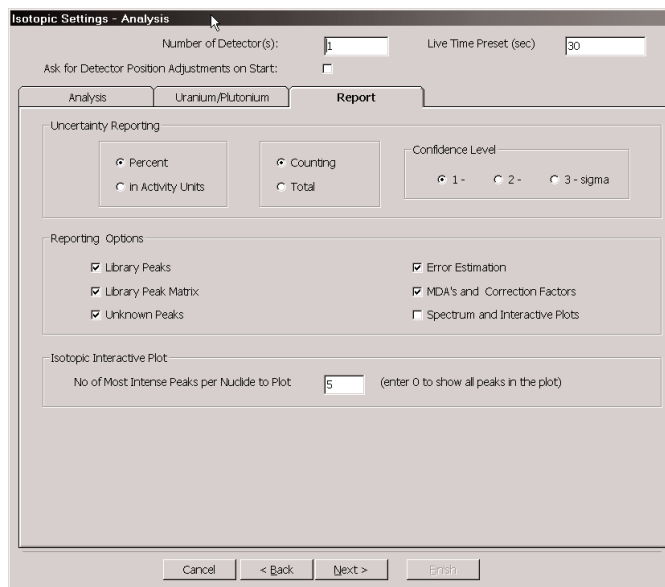


Figure 3.

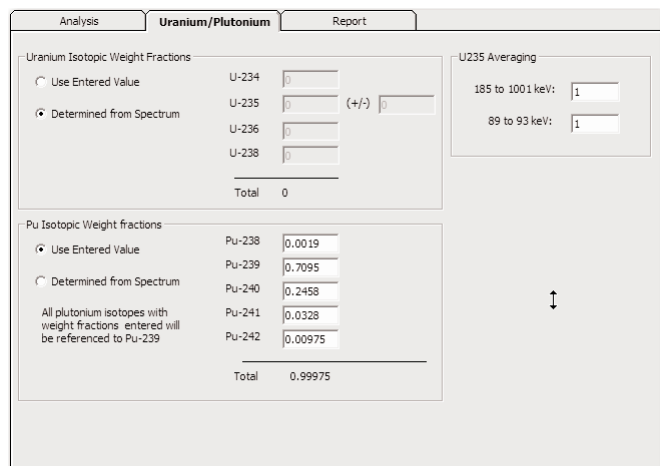


Figure 2.

### 3.0 Analysis Improvements

In the interests of clarity, it is no longer possible to run a complete analysis in supervisor mode. It was previously possible to use ISOTOPIC “as if it was GammaVision.” This has proven to be more confusing than useful. A new set of “rules” now applies, which are clearer, much more logical, and less prone to error.

- There is only one way to analyze and that is the ISOTOPIC way, in operator mode. No analysis is possible in supervisor mode, except for interactive reanalysis.
- If you wish to do GammaVision analysis, you need GammaVision.
- If ISOTOPIC is used to re-analyze spectra previously gathered with a GammaVision system, the only parameters from the spectrum used by ISOTOPIC will be the spectral data and the energy calibration. All other GammaVision corrections and parameters will be ignored. The ISOTOPIC parameters used will be provided on the output report.
- For convenience, configurations can be adjusted in either Supervisor or Operator Mode. The user does not need to switch to Supervisor Mode to make a configuration or analysis change.
- GammaVision and ISOTOPIC CAN co-exist “happily” on the same system.
- ISOTOPIC 4 has a new database structure. It does not read Version 3.X database files.

### 4.0 “Close Geometry” Corrections

ISOTOPIC 4 has been enhanced to be able to take account of counting in very close geometries such as might be seen in some drum scanning situations. The initial assumption of ISOTOPIC is that of a “Point Detector.” At close geometries this approximation no longer holds. This limitation can be overcome if you know the detector dimensions and the type of material (N or P) this can now be entered on the Detector Setup screen (Figure 4).

All, (more than 20) other user-reported issues have been resolved.

### 5.0 Report Improvements

A great deal of work has gone into the report. In order that the user is NEVER unable to determine why a result is the way it is, ANY parameter or quantity which can be changed is reported at least on the “full” ISOTOPIC Output Report.

A series of check boxes in the setup provides report options (Figure 3). The Crystal Reports option for completely custom reports is still provided, but the standard options are now such that the need for custom reporting should be the exception rather than the rule.

Figure 5 shows the header. ALL analysis parameter file details are given in the header. The user can see exactly how the analysis has been performed.

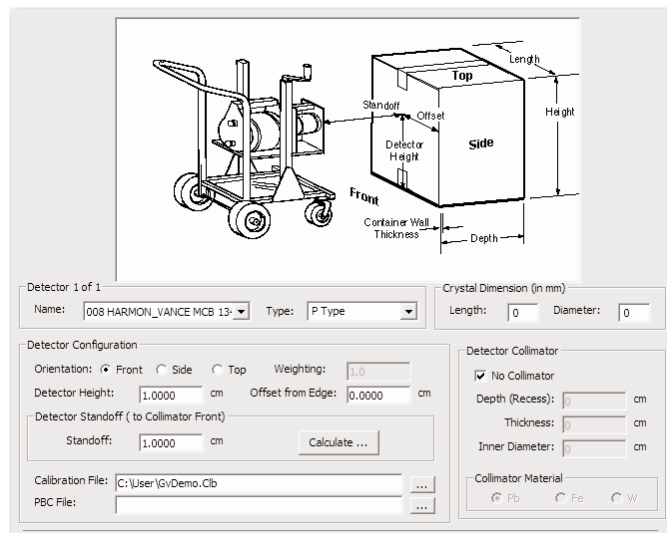


Figure 4.

Sample Name: Uranium from ISPRA			
Spectrum File Name: C:\User\Uranium from ISPRA Buf00460.Ani			
Acquisition information			
Start time	3/6/2001 12:54:38 PM		
Live time:	2500	Real time:	2570
Detector:	DSPE-044No detector	Dead time (%):	2.72
Calibration			
File name	C:\User\Uranium from ISPRA.Cib		
Energy calibration	Created	3/6/2001 11:29:29 AM	
	Zero offset	0	
	Gain	0.1249744	
	Quadratic	0	
Efficiency calibration	Created	3/6/2001 10:17:51 AM	
	Type	Quadratic	
	Uncertainty Above Knee	20.91%	
	Uncertainty Below Knee	9.19%	
	Coefficients (Above the Knee)	-24.71316, 5.465302, -0.4830579	
	Coefficients (Below the Knee)	0, 0, 0	
	Detector calibration point-source reference distance	30.0 cm	
Library			
Main analysis library	C:\User\Uranium only.Lib		
Library match width	0.5		
Analysis parameters			
Start channel:	20	Stop channel:	16000
Peak cutoff (%):	50.0	Peak search sensitivity:	3
MHA type:	ORTEC Traditional	Background type:	Auto
Base Activity Units:	Bq/Kg	Activity scaling factor:	1.000E+0/1.000E+0
Activity Label:	Bq/g	Quantity Label:	
Random error (%):	0.0	Systematic error (%):	0.0
Directed fit:	No	Uncertainty in percent:	Yes
Counting uncertainty only:	Yes	Confidence level (sigma):	1
UZ35 89-93 keV averaging:	1	UZ35 186/1001 keV averaging:	1
Spectral corrections			
Decay correct to date:	No	Decay correction date/time:	N/A
PBC correction:	No	PBC File:	N/A

Figure 5.

Figure 6 shows the peak attribution sections of the report, identical to the way this information is presented in GammaVision. (The report here has been abbreviated by omitting most of the peaks in the analysis.)

Figure 7 shows the configuration summary. Once again, like in the analysis header, all relevant information is presented on configuration, container and matrix. The corrections summary is also presented here.

Figure 8 shows the results section. If uranium is found (as in this example), grams of uranium is computed.

Figure 9 shows peak correction factors, MDA correction factors, and uncertainty estimates. Finally, the isotope peak plot (Figure 10) and spectral plot (Figure 11) may be included in the output report.

### Summary

Version 4.0 of ISOTOPIC should be welcomed by new and old users alike. It is easier to use, has better reporting and is more robust than previous version of this product.

Unknown peaks								
Channel	Energy	Bkg Counts	Net Counts	CPS	1 Sigma	FWHM (keV)	Suspect	Flags
108.70	13.56	6721	6266	2.556	2.93	14.913	PB-214	s
144.72	18.06	7687	287	0.115	43.54	7.634	MO-99	D
155.61	19.42	9604	299	0.120	45.24	7.637	TC-99M	D
543.67	67.92	5682	269	0.107	51.89	1.648	C-99M	s
559.82	74.93	9487	5373	2.199	2.90	7.786	PB-214	D
659.24	87.37	11628	1195	0.478	13.19	7.819	PB-214	D
757.48	94.64	16110	11789	4.716	1.78	7.828	PA-234	D
787.68	98.41	17320	21344	8.538	1.73	7.105	PA-234	M

Library peaks								
Nuclide	Channel	Energy	Bkg Counts	Net Counts	CPS	1 Sigma	FWHM (keV)	Flags
U-235	202.34	25.26	4132	116	0.046	90.47	2.564	s
U-238	393.52	49.15	4237	493	0.197	31.98	1.639	s
U-234	430.00	53.71	2779	-27	-0.011	334.13	0.000	s

Library peak matrix						
Nuclide	Ave. activity	Energy	Activity	Codes	MDA	Comments
U-234	6.445E+6	53.71	0.000E+0	&	1.999E+6	G
		120.93	6.445E+6	(	4.913E+6	GK

Figure 6.

General Configuration Info			
Configuration name:	Recall	Has Collimator:	NO
Orientation:	Side	Height:	10.0 cm
Detector standoff:	20.0 cm	Collimator depth/recess:	N/A
Database:	C:\User\Ortec\OB.mdb		

Container			
Type:	Cylinder	Material:	Fe
Thickness (entered):	0.10 cm	Thickness (effective):	0.10 cm
Height:	20.0 cm	Fill Height:	20.0 cm
Diameter:	20.0 cm	Container density:	7.60 g/cc
Tare weight:	5.0 kg		
Sample weight:	1.847 kg		

Matrix			
Material:	Combustible	Density (initial estimated):	0.300 g/cc
U total fraction (initial estimated):	0.0	Pu total fraction (initial estimated):	0.0
Thickness	19.80 cm		
Weight fraction of U (eff.)	0.0		
Volume	6.16E+3 cc		
Gross weight	6.847E+0 kg		
Net weight	1.847E+0 kg		
Density (measured)	0.300 g/cc		
Density (adjusted)	0.300 g/cc		

Corrections	
Total attenuation correction factor for the 185.7-keV gamma ray	1.531
Total attenuation correction factor for the 1001.0-keV gamma ray	1.233
Geometry correction factor	1.24

Figure 7.

Uranium Analysis	
Grams of uranium	3.800E+3
Weight% U-235 (186 to 1001-keV region)	0.3 (+/-) 0.1032
U235 Enrichment calculated (%)	0.297 (+/-) 0.103

Isotopic results			
Nuclide	Weight(g)	Activity (Bq)	% Uncertainty (1Sigma)
U-235	1.19E+01	9.024E+05	25.295
U-238	3.832E+03	4.722E+07	24.791
U-234	5.999E-02	1.381E+07	45.905

Total activity	
Total Activity	6.19E+07 Bq
Total Alpha Activity	6.19E+07 Bq

Figure 8.

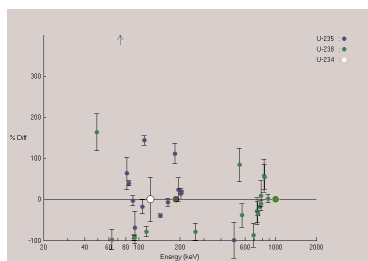


Figure 10.

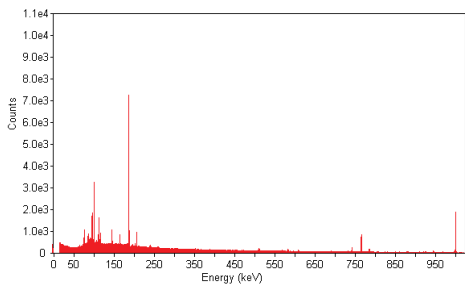


Figure 11.

Peak Correction Factors							
Energy (KeV)	Nuclide	Activity* Bq	Air	Container (Inner)	Matrix	Activity Bq	Act(Geo.) Bq
49.15	U-238	1.424E+07	1.005	4.487	1.546	9.93E+07	1.23E+08
63.28	U-238	2.441E+05	1.005	2.136	1.500	7.86E+05	9.73E+05

Gamma-Ray Data Sorted by Nuclide				
Nuclide	Energy (KeV)	Energy Diff(KeV)	Activity (Bq.)	Interference present
U-235	25.26	0.39	0.00E+0	No
U-235	72.69	0.01	2.38E+7	No

MDA Correction Factor Summary									
Nuclide	Energy (KeV)	Input MDA (Bq.)	Air mu/CF	Container mu/CF	2nd Container mu/CF	Matrix mu/CF	Collimator mu/CF	Decay	Activity** (Bq.)
U-234	120.93	4.91E+6	0.141/1.00	0.249/1.22	0.000/1.00	0.152/ 1.42	0.000/ 1.00	1.00E+0	1.05E+7
U-235	185.72	2.04E+3	0.126/1.00	0.146/1.12	0.000/1.00	0.135/ 1.37	0.000/ 1.00	1.00E+0	3.88E+3
U-238	1001.06	9.51E+4	0.063/1.00	0.059/1.05	0.000/1.00	0.069/ 1.18	0.000/ 1.00	1.00E+0	1.46E+5

Estimate of Uncertainty (1 Sigma)				
Nuclide	Count Stat.	Peak Fit	Matrix	Geometry
U-235	0.5	5.0	06.0	24.1
U-238	0.7	5.0	03.2	24.1
U-234	38.2	5.0	06.7	24.1

Enrichment Errors (1 Sigma)		
Item	Error in percent	
U-235 (185.7 keV)	24.8	
U-238 (1001.0 keV)	24.3	
Total	34.7	

Figure 9.