

# High Performance Liquid Scintillation Analyzers



For Any Research, Drug  
Discovery or Environmental  
Application Challenging  
Your Lab

# For over 50 years, PerkinElmer top LSA instruments

Research and environmental labs around the world recognize and use two top brands for their liquid scintillation application needs—the **Tri-Carb**<sup>®</sup> family of liquid scintillation analyzers and the 1220 **QUANTULUS**<sup>™</sup> ultra low level liquid scintillation spectrometer, both from PerkinElmer.

**Why?** Our field-proven Tri-Carb and QUANTULUS analyzers have a strong reputation for high performance liquid scintillation counting and superior reliability. They are the most sensitive detectors on the market, with models capable of meeting the requirements of even the most demanding application.

PerkinElmer's 50 years of experience and innovation in liquid scintillation analysis result in unmatched service and applications expertise. Plus, we offer high quality, optimized liquid scintillation cocktails and counting supplies to complement your LSA and ensure optimum counting results with your application. You choose the LSA that's right for you, whatever your application needs — based on your budget today and the options you may want to add later.



# has provided to scientists around the world.

Proven technology and expertise are built into every PerkinElmer LSA.

When you need an LSA for your research or environmental lab turn to the industry leader in low level detection, PerkinElmer, the only source for the world's top brands—the **Tri-Carb** and the **QUANTULUS**. PerkinElmer's thoughtful design and product range let you choose the LSA that's right for you.

### Tri-Carb 3100TR

Top of the line, fully loaded LSA suited for the most demanding research applications. Can be expanded for environmental applications.

### Tri-Carb 2900TR

A moderately priced LSA for more sophisticated research applications and demanding DPM counting. More versatile than the 2800TR. Can be expanded for environmental applications.

### Tri-Carb 2800TR

An economical CPM/single label DPM instrument. The top choice for labs doing basic research applications, it can be expanded for more sophisticated applications.

### 1220 QUANTULUS

A dedicated environmental counter with proven unsurpassed performance measuring extremely low level man-made, cosmogenic and other natural radionuclides.

### Tri-Carb 3170TR/SL

A premium instrument for multi-user labs doing both low level environmental and routine counting of higher activity levels for research applications. Especially well suited for the detection of extremely low level alpha and beta radioactivity.



# The Tri-Carb family

—research systems with unmatched

The Tri-Carb family from PerkinElmer is a range of computer-controlled benchtop liquid scintillation analyzers most frequently cited in the scientific literature. They are the most versatile and sensitive instruments available for detecting small amounts of alpha, beta and gamma radioactivity.

The Tri-Carbs are the latest in LSA technology. Built on a modern Windows® operating system platform, their performance and reliability is unmatched by any other commercially available LSA.

Exclusive software and hardware features are built into every Tri-Carb LSA:

**Space saving integrated PC Control** for convenient networking, data reduction and data storage.

## High Dynamic Range Quench Monitoring

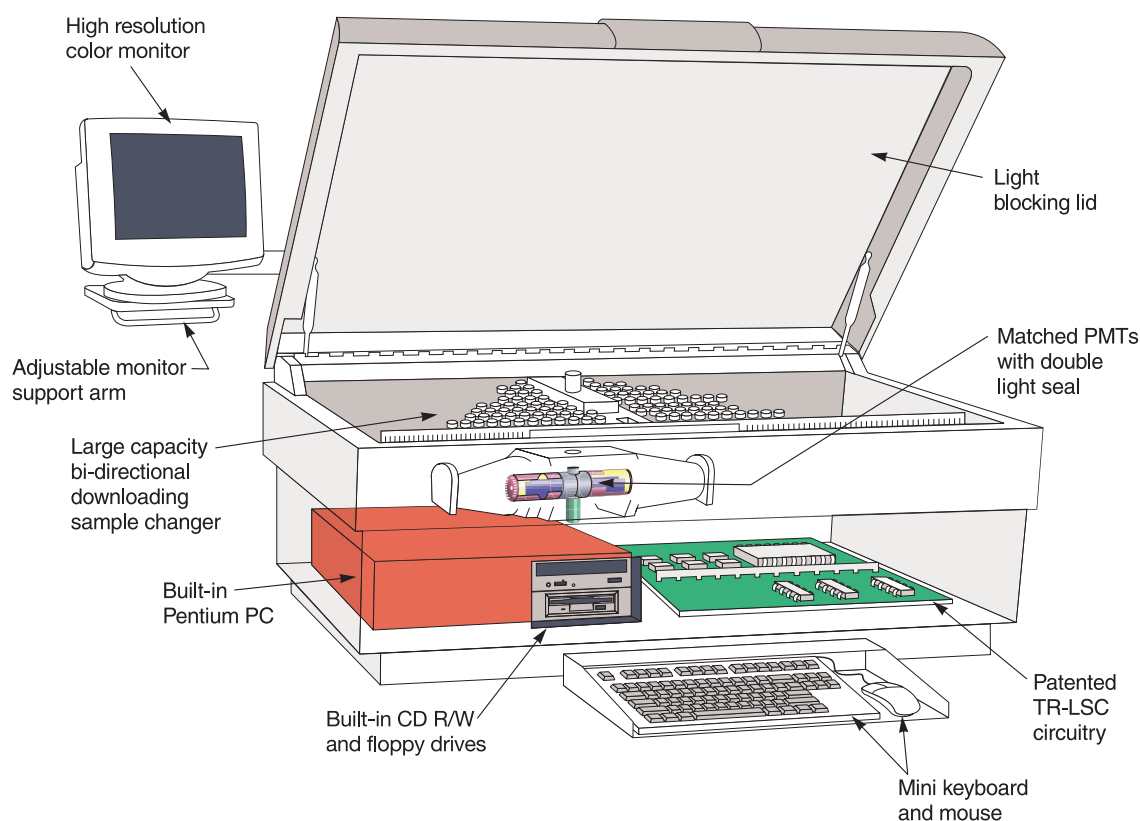
- Features a  $^{133}\text{Ba}$  source whose Compton spectral shift mimics quenching of low energy beta radionuclides.
- tSIE (transformed Spectral Index of the External Standard) quench monitor utilizes a large portion of the  $^{133}\text{Ba}$  spectrum for improved accuracy and precision and worry free DPM calculations even for low activity samples.

## Intelligent Sample Changer and Safe Gravity Feed Sample Loading

- Protocol system provides for unattended counting with automatic protocol recognition and termination.
- Sturdy cassette system that is permanently labeled for positive sample ID.
- Varisette feature (option on some models) allows direct counting of large and small vials in dedicated cassettes.

## SpectraBase Spectrum-Based Library Storage of Standards and Samples

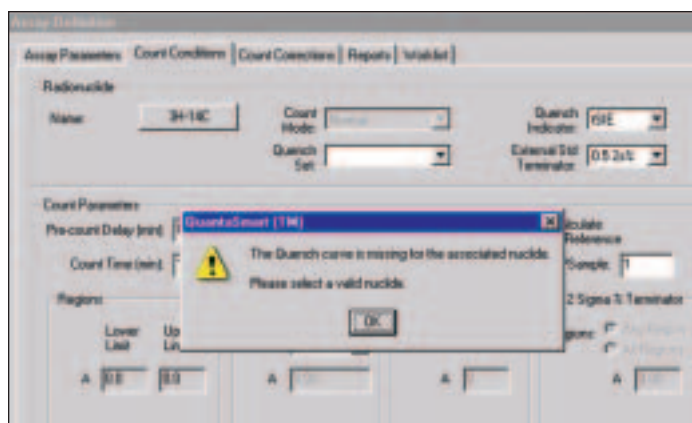
- Quench standards are conveniently stored in a spectral library for use with any assay.
- SpectraBase storage allows recall of sample data and quench standards for Replay reprocessing (optional feature on some models).



# sensitivity and performance.

## QuantaSmart™ Instrument and Data Reduction Software

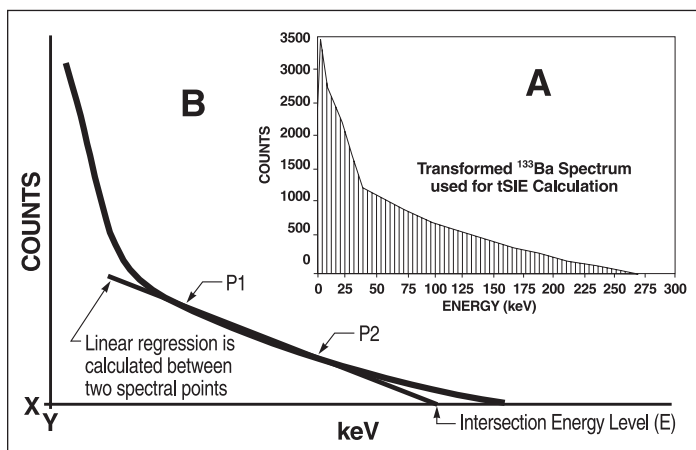
- Proven, simple-to-use intelligent software for the Windows XP operating system that warns the user of incomplete or incorrect setup.
- Enhanced Security option (21 CFR Part 11 compatible) for regulatory compliance. (This option is not available for the Tri-Carb 2800TR.)
- IPA (Instrument Performance Assessment) provides a historical record of instrument performance to support GLP compliance. (IPA is optional on some models.)



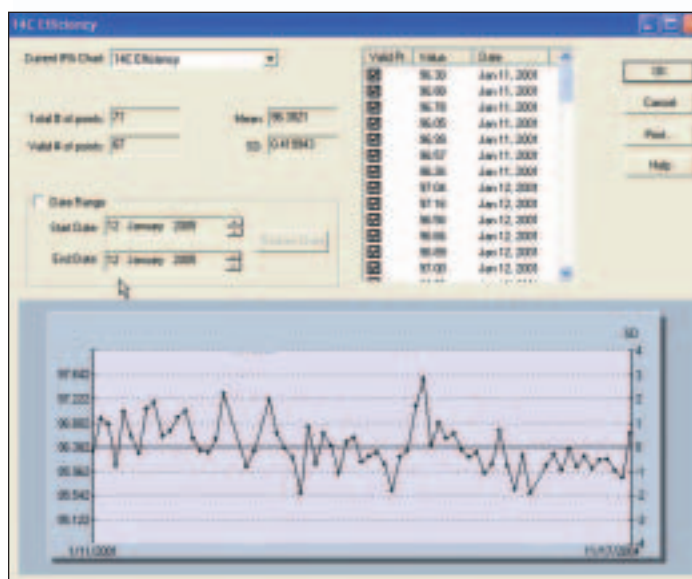
Common operator error warning.

tSIE Dynamic Range				
Sample	<sup>3</sup> H % EFF	% Rec	% CV	tSIE
1	58.47	99.94	0.362	815.2
2	55.78	99.77	0.200	725.9
3	44.49	100.23	0.224	472.2
4	24.77	99.82	0.304	231.1
5	18.07	99.42	0.303	177.1
6	10.81	99.60	0.318	119.8
7	6.15	99.29	0.640	83.59
8	3.32	99.00	0.381	58.75

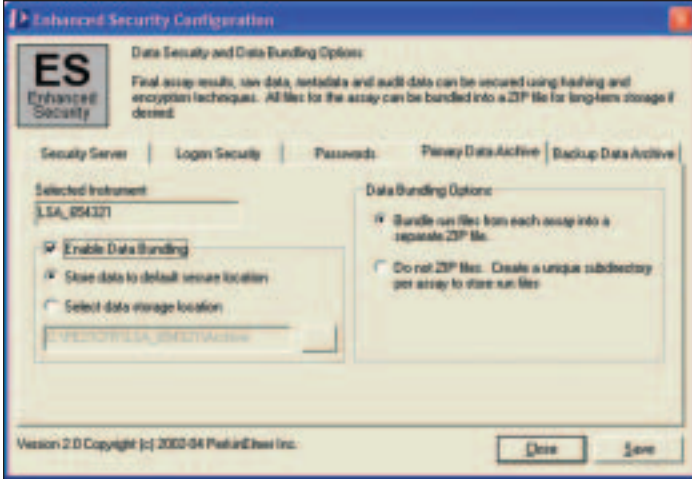
tSIE is an accurate monitor of quench for low energy beta radionuclides like <sup>3</sup>H.



The tSIE value is the intersection energy level (E) of the regression multiplied by the instrument calibration factor. tSIE is ideal for accurate quench determination of difficult-to-measure low energy beta radionuclides.



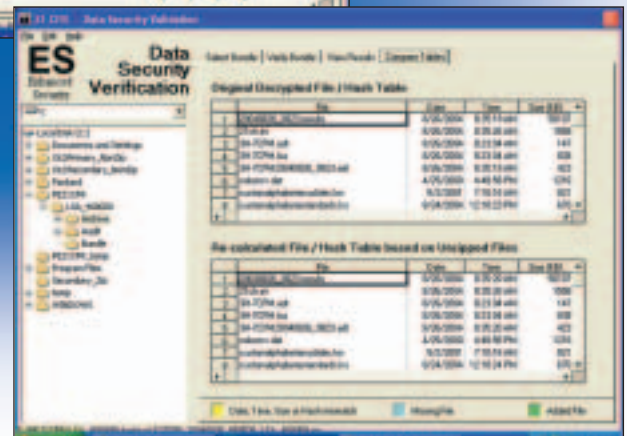
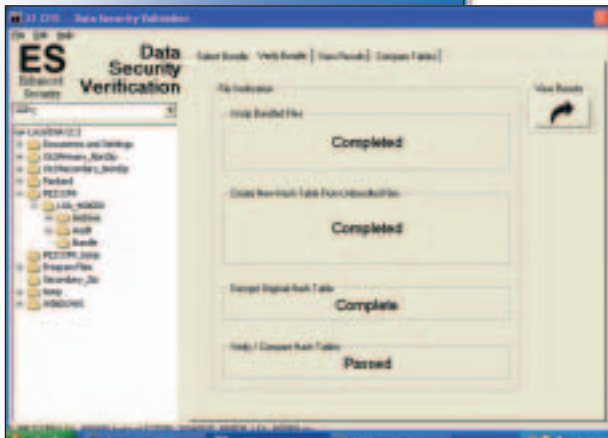
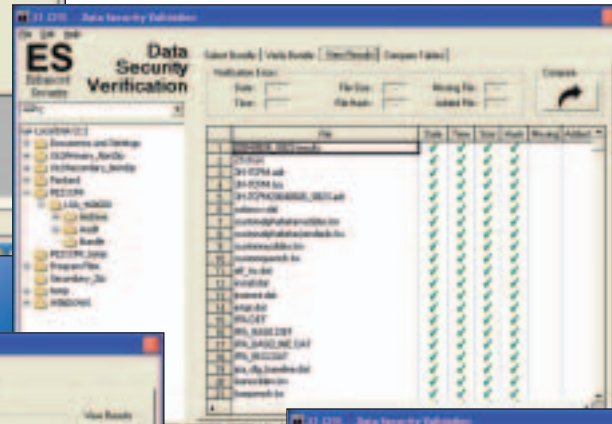
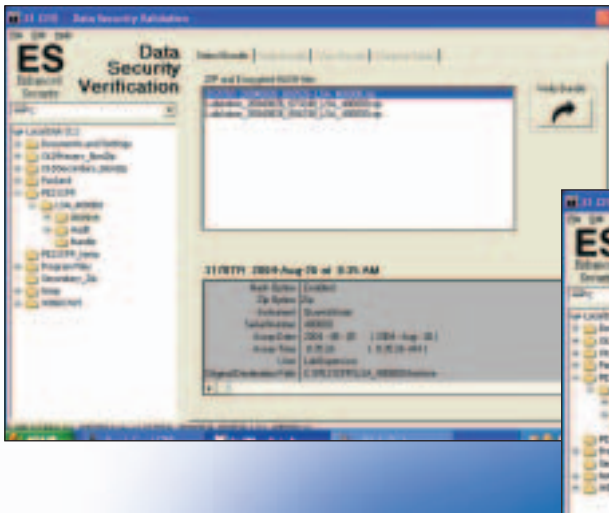
Historical stored IPA data.



The Enhanced Security configuration program provides the ability to configure logon security passwords and provides options for secure data storage of all data associated with an assay (data bundles).

### QuantaSmart Enhanced Security option (21 CFR Part 11 compatibility)

- There are three features to the Enhanced Security option that are compatible with 21 CFR Part 11 requirements:
  - **Instrument access security.** Instrument access security is a way of limiting an instrument's use only to people who are authorized to use it.
  - **Data security & verification.** Data verification allows you to be sure that your data has not been tampered with.
  - **Audit logs.** An audit log is a record of events that occur on an instrument.
- Enhanced Security is seamlessly integrated into the QuantaSmart™ software and makes use of the Windows operating system security settings and is easy to implement.
  - Setup accounts and user passwords using the Windows operating system.
  - Use the 21 CFR Part 11 Configuration program to enable the Enhanced Security feature and implement settings for secure data storage.
  - Data are stored as data bundles (all data related to an assay or protocol) in a secured location and can be verified with the Data Security Verification software.



Data bundles can be checked for changes with the unique data verification program.

# A range of Tri-Carb LSAs...

Choose the Tri-Carb LSA that best meets your applications requirements now. Expand the system later with features that satisfy your future research or environmental analysis needs.

## Tri-Carb 2800TR Liquid Scintillation Analyzer Affordable and Powerful for Basic Research

The Tri-Carb 2800TR economizes on price, not performance. The 2800TR is ready to go for basic research CPM/single label DPM applications and can be expanded for more demanding applications. When you choose the 2800TR, you spend your budget dollars on only what you need—the basics—yet you get all the performance advantages of a more fully loaded Tri-Carb— all at a truly superb price.

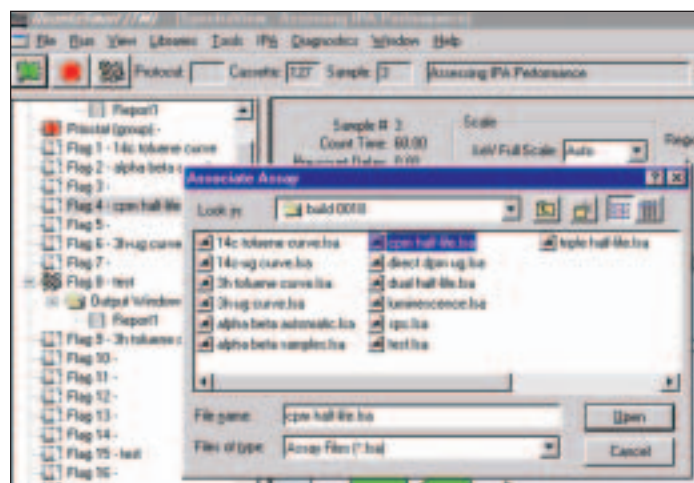
### Standard Features

- Complete system with built-in Pentium® PC, monitor and printer.
- Logical, easy-to-use QuantaSmart instrument software for the Windows XP operating system.
- TR-LSC electronic background discrimination.
- Live spectral display and plotting.
- Sample nuclide library with preset or user-defined radionuclide settings for 3 separate regions.
- Direct DPM for easy single label DPM without the need to store quench standards.
- 15 user acquisition protocols with the ability to define unlimited assays.
- Chemiluminescence detection (correction optional).
- Single photon counting for bioluminescence assays.
- Easy networking with optional Ethernet adapter.

Popular options include Single/Dual color corrected DPM, IPA, Replay sample reprocessing, and worklisting for positive sample ID.



Tri-Carb 2800TR



Associate assay dialogue. Unlimited assays can be defined and simply associated with the numeric protocols in the protocol tree for counting.

### Direct DPM results for <sup>3</sup>H and <sup>14</sup>C

Radionuclide/ Cocktail	tSIE	Direct DPM	Actual DPM	% Recovery
<sup>14</sup> C in toluene measured in large glass vials	691 422 255	120,701 120,999 123,389	120,300 120,300 120,300	100.33 100.58 102.75
<sup>14</sup> C in Ultima Gold measured in small glass vials	535 277	37,259 38,419	38,100 38,100	97.79 100.84
<sup>3</sup> H in toluene measured in large glass vials	705 428 152	245,390 246,980 248,408	247,009 247,009 247,009	99.34 99.99 100.57
<sup>3</sup> H in Ultima Gold measured in small glass vials	509 253	46,299 47,251	45,536 45,536	101.67 103.87
<sup>3</sup> H in Ultima Gold measured in small plastic vials	592 258	45,907 44,782	45,536 45,536	100.81 98.34





Worklisting provides positive sample identifications.

Tri-Carb 2900TR

<b>Tri-Carb System Configurations</b>				
<b>Tri-Carb Feature</b>	<b>2800TR</b>	<b>2900TR</b>	<b>3100TR</b>	<b>3170TR/SL</b>
Built-in Pentium computer/monitor/printer/CD R/W	S	S	S	S
QuantaSmart Software for Windows XP operating system	S	S	S	S
TR-LSC background electronics	S	S	S	S
Live spectral display and plotting	S	S	S	S
Enhanced Security (21 CFR Part 11 Compatibility)	NA	O	O	O
Direct DPM	S	S	S	S
Varisette sample changer	O	O	S	S
Single/dual/color corrected DPM	O	S	S	S
Replay sample recall and reprocessing	O	S	S	S
Group Priostat automatic priority interrupt	S	S	S	S
Luminescence correction	O	O	S	S
Single photon counting for bioluminescence assays	S	S	S	S
Triple Label DPM	O	O	S	S
Sample Priostat manual special function interrupt	NA	O	S	S
HSCM (High Sensitivity Count Mode)	O	O	S	NA
ULLCM (Ultra Low Level Count Mode)	NA	O	O	S
BGO detector guard	NA	NA	NA	S
Alpha/Beta discrimination	NA	O	O	O
No. of user acquisition protocols with unlimited assays	15, 60 optional	30, 60 optional	60	60

S = standard    O = Optional    NA = Not Available

# For environmental labs — only Perkin Tri-Carb 3170TR/SL measure up.

Choose the environmental

The Tri-Carb 3170TR/SL and the 1220 QUANTULUS are unmatched in low level performance, when extremely high sensitivity, low background counting is a must for demanding environmental applications. Applications range from radiocarbon dating of archaeological samples; H-3, radon, radium and uranium measurements in drinking water; strontium in food; C-14 in food, alcohol and biofuels; to evaluations of H-3 and C-14 emissions from nuclear power plants; monitoring of radioactivity during decommissioning of nuclear reactors; and tracer measurements in oil exploration.

## Tri-Carb 3170TR/SL Liquid Scintillation Analyzer

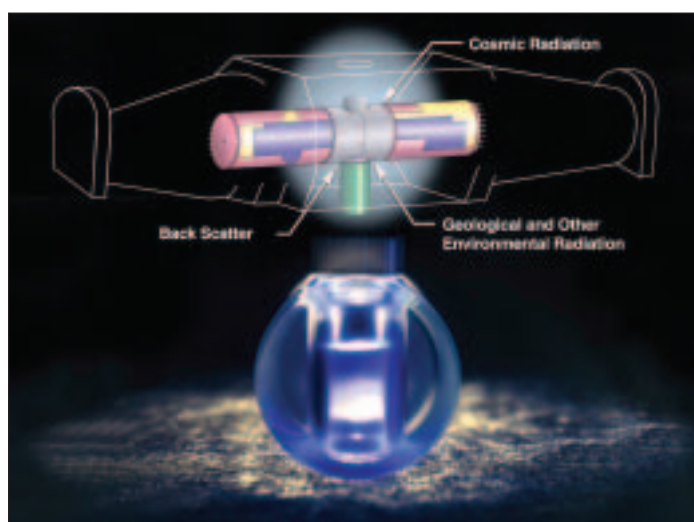
Premium LSA for Environmental and Research Use

When low level environmental counting is done (especially in glass vials) in a multi-user lab that also routinely counts higher activity levels for research applications, choose the Tri-Carb 3170TR/SL. The 3170TR/SL provides a high sample capacity for maximum throughput, yet accommodates the needs of environmental counting with minimum counter optimization. It is especially well suited for the detection of extremely low level alpha and beta radioactivity and handles the most demanding environmental, ADME, and food adulteration applications.

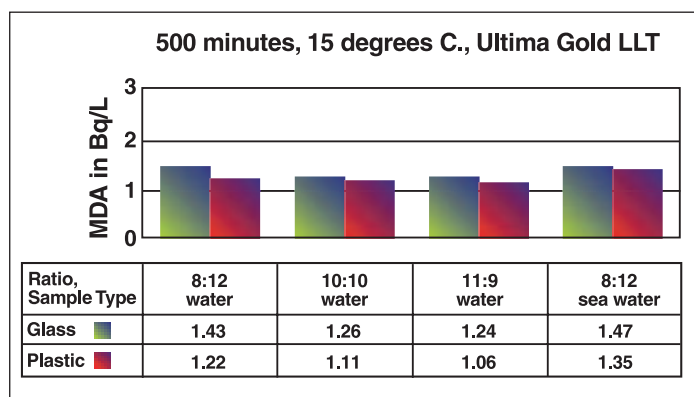
In the Tri-Carb 3170TR/SL, a unique BGO (Bismuth Germanium Oxide) detector guard completely surrounds the sample. The BGO guard works in conjunction with patented TR-LSC background reduction electronics to further lower the instrument background, raising sensitivity to accurately measure near background sample activity. This Surround TR-LSC design is designed to use ordinary glass or plastic vials so counting is easy and inexpensive.

### Standard Features

- All the sophisticated features of the 3100TR.
- BGO sample detector guard surrounds the sample for superior background reduction.
- Temperature control allows for very reproducible counting.
- Transportable, space saving bench top design.
- Measures <sup>3</sup>H water samples to less than 2Bq/L.
- <sup>14</sup>C benzene samples can be dated to over 51,000 years.



Surround TR-LSC technology eliminates background by using the sample chamber as the detector guard. Background events interact with the BGO guard and are rejected by TR-LSC before they interfere with sample counts.



Produce very low <sup>3</sup>H detection levels in water using a compact counter under normal laboratory conditions. (Data acquired at Scottish Research and Reactor Center, East Kilbride, Scotland.)

# Elmer's 1220 QUANTULUS and

counter most suited to your applications.

## The 1220 QUANTULUS Ultra Low Level Liquid Scintillation Spectrometer

### Superior Dedicated Environmental System

When you need a dedicated environmental ultra low level liquid scintillation spectrometer that provides optimal counting performance in a setting where throughput is less important, choose the 1220 QUANTULUS. Its superior background reduction capabilities let you conduct analyses in your lab not normally possible except in underground facilities. The QUANTULUS provides the lowest possible  $^3\text{H}$  backgrounds with the highest beta and/or alpha liquid scintillation sensitivity and counting performance. It provides superior alpha/beta discrimination counting, especially when counting samples containing mixed alpha/beta/gamma (e.g., in the presence of quench and/or high beta activity). It is ideal for applications such as radiocarbon dating, optimal Cerenkov counting, and measurement of fallout radionuclides in food or radionuclides in active or decommissioned nuclear power plants. QUANTULUS software runs in an external PC on Windows 95, NT4 or XP platforms. Raw data is saved to a PC hard drive or a network drive and processed later with the instrument's spectrum analysis software.

QUANTULUS active and passive shielding of environmental radiation stops most gamma radiation and all cosmic radiation. This means that variable cosmic particle flux does not affect sample count rates and allows very long counting times of ultra low activity samples without any atmospheric pressure correction. In addition, superior background reduction capabilities are not sample quench or cocktail dependent.\*

\*For best alpha counting results, PerkinElmer recommends Ultima Gold™ AB and OptiPhase™ HiSafe 3.

### Standard Features

#### Sample Detector Assembly

- Two specially selected low noise, low background PMTs are used for sample counting.
- Sample chamber is fully enclosed inside the guard detector (described below), and the sample and guard detectors are optically isolated and separated from each other.
- Unique vial holder shutter seal assures against light leaks.



1220 QUANTULUS

### Anticoincidence Guard Detector and Lead Radiation Shield

- The asymmetric passive radiation shield is made of low radioactivity lead that surrounds the detector assembly.
- The head of the piston is made of copper and is a part of passive shielding.
- Active shielding against cosmic particles and environmental gamma radiation is enforced by an asymmetric guard counter.
- The guard is optically isolated from and operates in anticoincidence with the sample detector.

### Additional Background Reduction Devices

- Pulse Amplitude Comparator (PAC) and high bias.
- RF suppression and Static eliminator.

### Temperature Control

- The instrument's cooling unit uses four Peltier elements to maintain the interior of the instrument and the sample chamber at a temperature within 12 °C of the ambient temperature (electronics are not cooled).

### Random Access Sample Changer and Conveyor

- 60-sample capacity (3 racks of 20 samples each) with pre-programmed access.
- Accepts 3 mL–20 mL vials or other vials sizes (down to 0.3 mL) with adapters.

### Pulse Shape Analysis (PSA) and Pulse Amplitude Comparison (PAC)

- Improved PSA circuit combines very sensitive alpha/beta discrimination with the active detector guard for excellent background discrimination to enable measurement of alpha emitters in the presence of a 100,000 fold excess of beta radiation.
- Allows simultaneous acquisition and sensitive discrimination of pure alpha and beta spectra from mixed radiations of a sample and can also be used for background reduction in beta counting.

- PAC and high bias provide additional background reduction by comparing pulse heights from each PMT to determine background induced events.

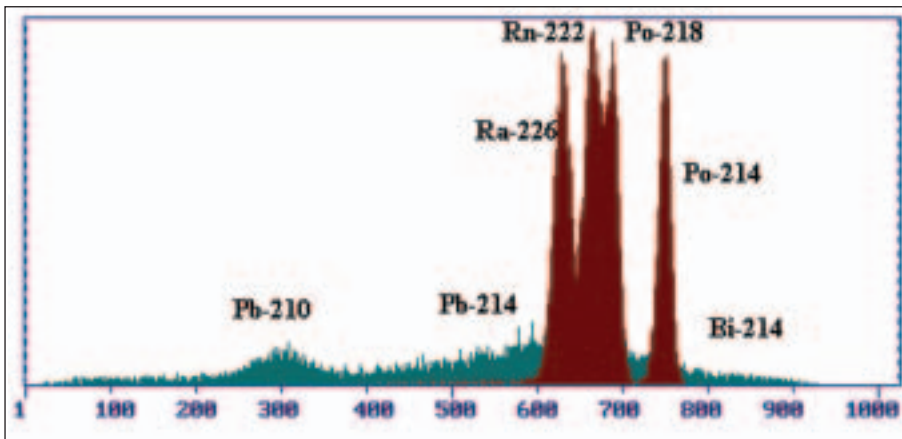
### Two dual programmable multichannel analyzers (MCAs)

- Provide multiple counting parameters and comprehensive spectral analysis capability.

### Software for Windows 95, NT4 and XP operating systems

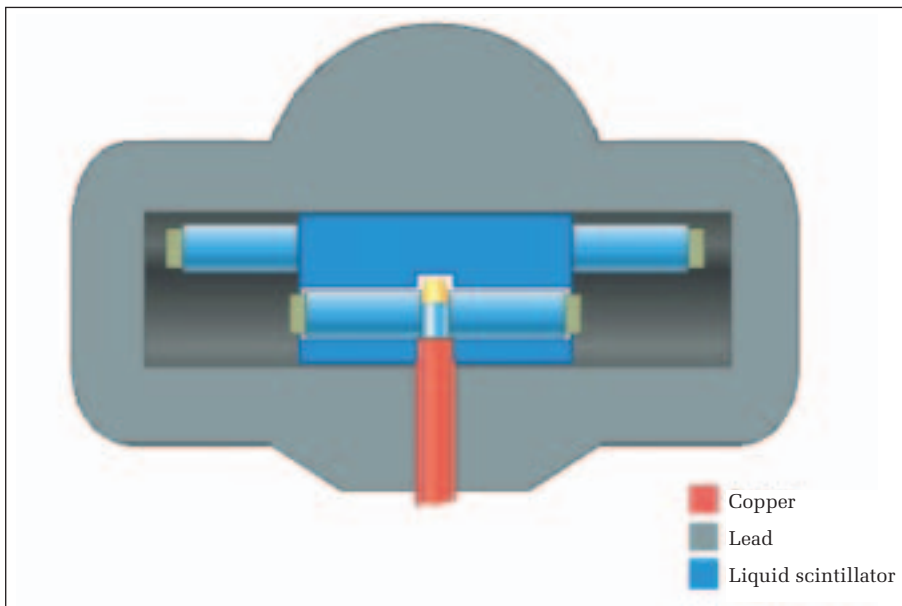
- WinQ graphical user interface offers an unlimited number of protocols.
- EASY View spectrum analysis software displays up to 6 spectra simultaneously and allows spectral arithmetic, DPM calculations, statistical analyses and radiocarbon age dating.

**Highly accurate SQP(E) quench monitor** with low activity  $^{152}\text{Eu}$  external standard.



### Aqueous low quench radium sample measured in QUANTULUS

The anti-coincidence guard is active during Pulse Shape Analysis allowing alpha/beta separation in ultra low level mode. QUANTULUS discovers alpha emitters even in 100,000 excess of beta radiation.



### Anticoincidence Guard Detector and Lead Radiation Shield

The instrument's unique guard is an external radiation event detector with its own phototubes. QUANTULUS also features extensive passive shielding.

# PerkinElmer Liquid Scintillation Cocktails and Vials

## Designed for PerkinElmer LSAs.

### Safer and Classic Liquid Scintillation Cocktails

A complete range of safer and classical cocktails is available that is unmatched in quality, batch-to-batch consistency and performance. PerkinElmer is the only provider of both general purpose and specialty cocktails and vials to fit almost every LSA application. The Ultima Gold™ and OptiPhase™ families of safer LSC cocktails have become the clear choice, worldwide, for high performance, safety and value.

#### Key Features

- High flash points for greater safety.
- Biodegradable to comply with concerns about disposal.
- Expiry dates are clearly indicated to satisfy GLP.
- Broad range includes cocktails for both general and specialist areas of LSC.
  - Ultima Gold and OptiPhase HiSafe 2 for routine counting applications.
  - Ultima Gold XR and OptiPhase HiSafe 3 for large volume and/or concentrated samples.
  - Ultima Gold AB for alpha/beta separation.
  - Ultima Gold LLT and OptiPhase TriSafe for counting low levels of Tritium in water.
  - Ultima Gold F and OptiScint HiSafe for samples in organic solvents.

Popular traditional cocktails and reagents are also still available. These include:

- Hionic-Fluor™ for use with Soluene®-350 in solubilization studies.
- Monophase®-S, Permafluor® E+ and Carbo-Sorb® E for use with the PerkinElmer Sample Oxidizer.

### Glass, Plastic, Copper-Teflon® Counting Vials and Other Supplies

To complement the range of LSC cocktails, PerkinElmer also offers:

- Comprehensive range of vials available in glass, plastic and copper-Teflon®.
  - Sizes from 3 mL up to 20 mL.
  - Anti-static versions of every plastic vial.
- Standards and supplies.
  - $^3\text{H}$  and  $^{14}\text{C}$  Ultima Gold and toluene based quench standards for library storage of quench curves.
  - Internal standard kits of  $^3\text{H}$  and  $^{14}\text{C}$ .
- Dispensette III for accurate and reproducible cocktail dispensing.
- Application support services.



# Dedicated Worldwide Support Network

People and applications supporting performance excellence.

PerkinElmer is recognized worldwide for advanced instrumentation systems and outstanding customer support. We continue to be your partner in life science research providing instruments for scintillation, gamma, and microplate counting; quantitative imaging; and liquid handling. We are committed to providing the best instrument application support, field service, and telephone support. We are proud of our tradition of working with laboratories to accelerate the pace of life science research.

## People Putting Technology to Work for You — All Over the World

With over 10,000 instrument installations worldwide, we provide researchers with a total solution of high quality instrumentation and application expertise. We have more than 300 highly trained service engineers in more than 60 countries. This makes PerkinElmer the largest, most well trained liquid scintillation analyzer instrument service organization in the world.

## Tri-Carb and QUANTULUS Bibliography and Application Notes

PerkinElmer's instruments are the most cited liquid scintillation analyzers worldwide. Our current application bibliography, available on request, cites over 1,000 articles in open scientific literature, describing results of research conducted using liquid scintillation analyzers. We continually publish application papers from researchers and our own application specialists help inform researchers about the latest in liquid scintillation technology. PerkinElmer products are designed and manufactured under an ISO 9001 certified system. They are designed, built, and tested in conformance with appropriate CSA, FCC, and IEC standards.

## LSA Reliability and Performance You Can Count On

Make the only choice, the Tri-Carb and the QUANTULUS LSAs, only from PerkinElmer. You'll get superior low level sensitivity and performance for every research or environmental application challenging your lab. For more information or for help placing an order, call 1-800-762-4000 or visit [www.perkinelmer.com/LSAS](http://www.perkinelmer.com/LSAS).



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business card slits**



**PerkinElmer Life and  
Analytical Sciences**  
710 Bridgeport Avenue  
Shelton, CT 06484-4794 USA  
Phone: (800) 762-4000 or  
(+1) 203-925-4602  
[www.perkinelmer.com](http://www.perkinelmer.com)



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