ORTEC®

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PINS3-CF

Portable Chemical and Explosive Identification System

Portable Isotopic Neutron Spectroscopy System for the Identification of Chemical Warfare Agents, Explosives, and Toxic Industrial Chemicals without the need for Liquid Nitrogen.



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The ORTEC PINS3-CF is a Portable Isotopic Neutron Spectroscopy (PINS) non-destructive assessment system that analyzes and provides on-site identification information about the contents of unidentified or suspect chemicals inside thick steel unopened containers. The system is designed to identify chemicals inside a container without the need for disassembly, contact, physical sampling or breech, and is being deployed as part of national counter-terrorist equipment assets for providing a safe means of identifying the contents of "suspect" packages.

The PINS3-CF is simple and easy to use with the addition of the ORTEC trans-SPEC-N mechanically cooled high purity germanium spectrometer. The trans-SPEC-N has been specifically designed and tested to replace existing liquid nitrogen cooled detectors currently used for neutron chemical assay systems and provides the necessary field spectroscopy readings for non-intrusive chemical identification.

PINS3-CF provides significant advantages over previous liquid nitrogen designed systems by eliminating the logistical and safety problems associated with the storage and transport of liquid nitrogen, equipment handling, maintenance, and training.



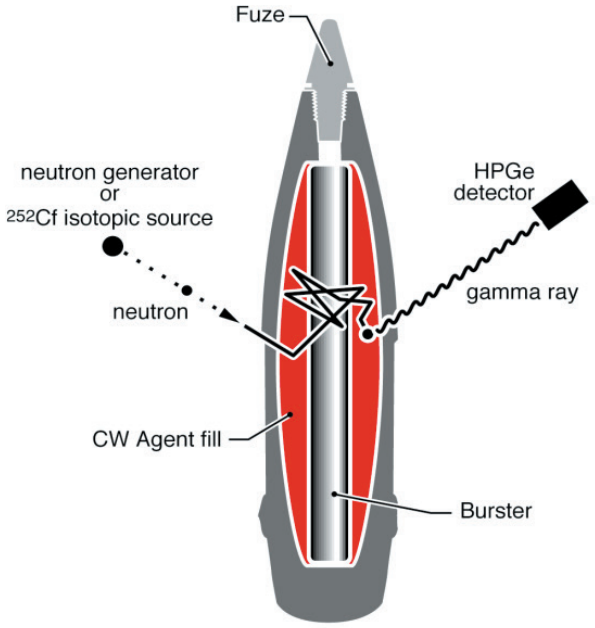
PINS Applications

- Munitions – Artillery, Mortar, Rockets, Bombs, Land mines.
- Containers – Gas cylinders, Storage tanks, Bags, Brief cases, Parcels.
- Chemicals – Chemical war heads, Explosives, Gases, Smoke.

Benefits	Features
• Requires no disassembly while taking samples of the materials or during inspection of the container. • Users have limited exposure to the material of interest. • Limited exposure accidents — users are not handling special materials. • Simple, fast setup and operation. • Longer operational times require less battery changes. • Prepackaged for easy shipping and handling. • Reduces risk to the public, workers and emergency response personnel by rapidly obtaining detailed information and distributing it to the appropriate authorities and responders.	• No liquid nitrogen required. • Uses a mechanically cooled, field deployable gamma spectrometer (ORTEC trans-SPEC-N). • Auto analysis of chemicals and explosives. • Ruggedized laptop with Chemical Analysis and Identification software. • 12 hour runtime with external rechargeable battery. • Lightweight measurement stand. • Uses a small Californium-252 neutron source. • USB and Power cables. • Safety kit. • Hardened wheeled transport case.

PINS Overview

The Portable Isotopic Nuclear Spectroscopy (PINS) Chemical Identification System identifies dangerous compounds and mixtures non-destructively. The test object need not be opened or touched, providing significant safety benefits. As shown, PINS probes a test object with neutrons that excite the atomic nuclei within, causing the excited nuclei to produce gamma rays. The energy intensity pattern or spectrum of these gamma rays is unique for each chemical element, and by analyzing the gamma-ray spectrum, the PINS software identifies the chemical elements inside the test object and determines if the object contains a chemical warfare agent, a military explosive, a fill (such as sand), or a smoke generating chemical.



How It Works

PINS3-CF uses neutrons produced by fission of the radioisotope Californium-252 (Cf-252). The standard PINS3-CF 5-microgram Cf-252 source produces ten million neutrons per second. The source emits neutrons omni-directionally, and approximately 1,000 neutrons per second strike each square centimeter of the test object surface. Since neutrons are a very penetrating form of radiation, most pass through the test object casing and interact with the chemicals inside.

Neutrons from the source excite the nuclei they encounter by inelastic scattering or by neutron capture. In either case, the excited nuclei decay to their ground states by gamma-ray emission, and the gamma rays are characteristic of the emitting nucleus. That is, the gamma-ray energies and intensities vary, often strongly, from one nucleus to another. For example, the hydrogen nucleus emits a 2.2-MeV gamma ray under neutron bombardment, while a phosphorus nucleus emits a 1.3-MeV gamma ray.

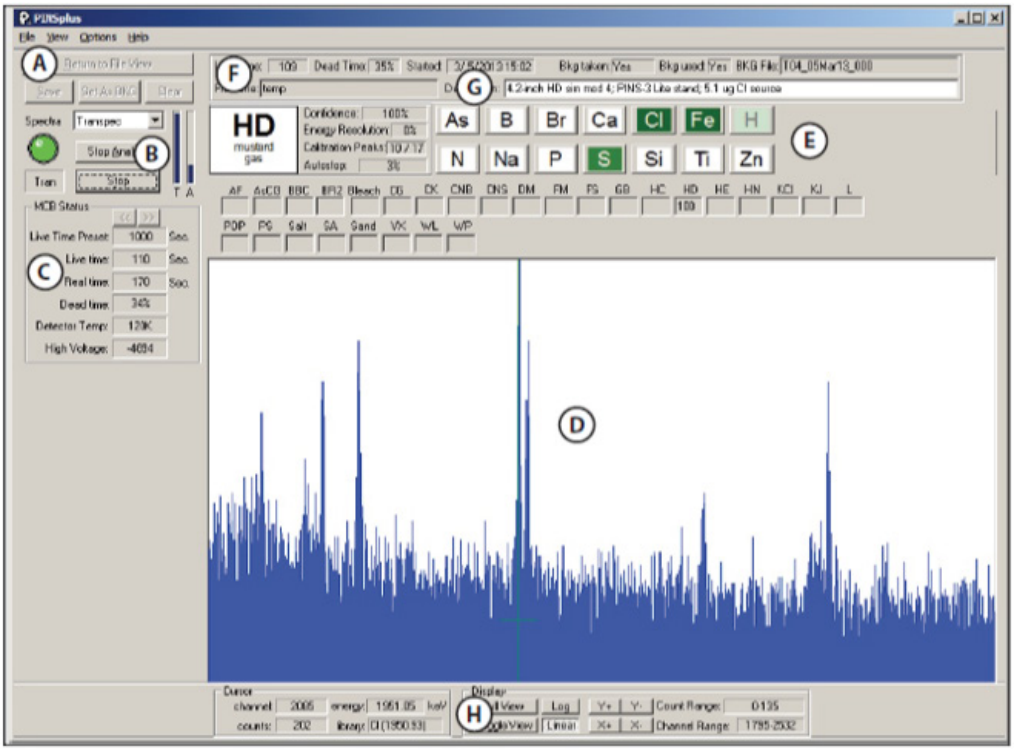
The neutron-induced gamma rays are measured by a high-purity germanium (HPGe) spectrometer and sorted into a spectrum by the spectrometer electronics. By analysis of the spectrum, the chemical elements excited by the neutrons are determined, and the chemical substance inside the test object can be identified.

PINS in Operation

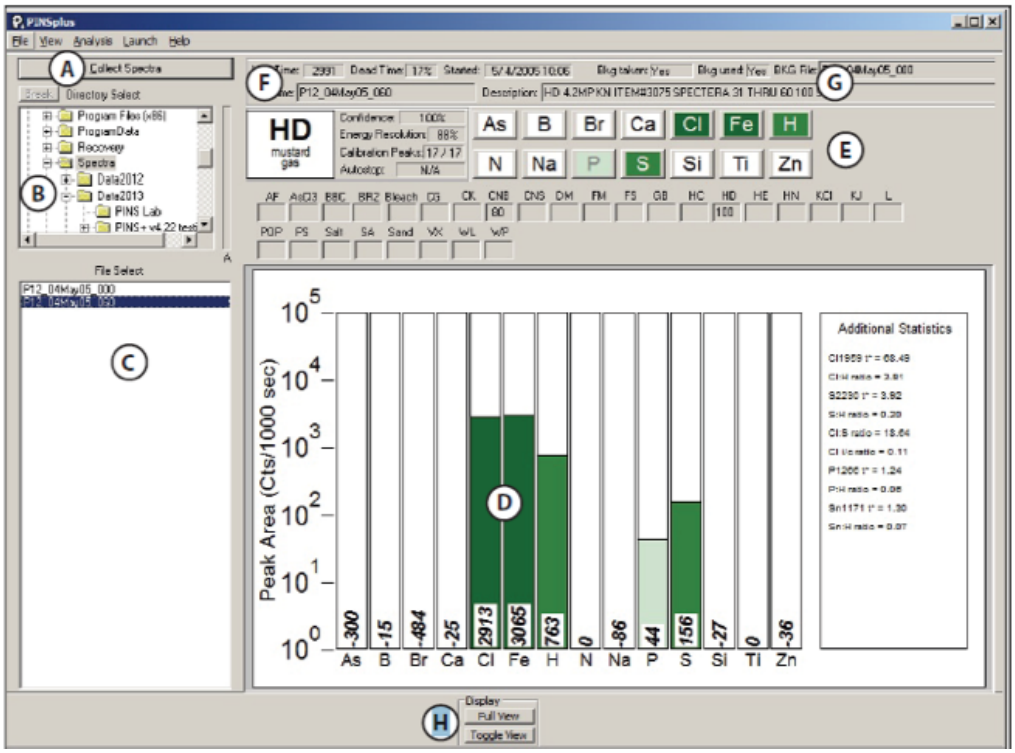
Developed for field deployment, the PINS3-CF is both portable and rugged. Its components include a mechanically cooled spectrometer with integrated multichannel analyzer, a small radioactive californium neutron source, a stand and shielding for the detector, and a laptop computer for user interface. Customized software displays the data in real time as it is gathered and offers powerful options for monitoring and analysis. The laptop computer serves as the PINS3-CF control panel. The computer allows the user to initialize the instrument, start and stop data acquisition by the gamma-ray spectrometer, and display and analyze the resulting gamma-ray spectra. Connecting cables 82 feet (25 meters) long allow the computer to be set up at a safe distance from the radiation exclusion area, and also provide communication between the computer and the gamma-ray spectrometer.

PINS3-CF

Portable Chemical and Explosive Identification System



A) Return to file View Button
B) Analysis Box
C) MCA Status Box
D) Spectra Display
E) Element Browse Buttons
F) Analysis Information Box
G) Assay Information Box
H) Toggle View Button



A) Collect Spectra Button
B) Folder Browser
C) Results Display
D) Element Browse Buttons
E) Analysis Information Box
F) Assay Information Box
G) Toggle View Button

trans-SPEC-N Mechanically Cooled High Purity Germanium Spectrometer



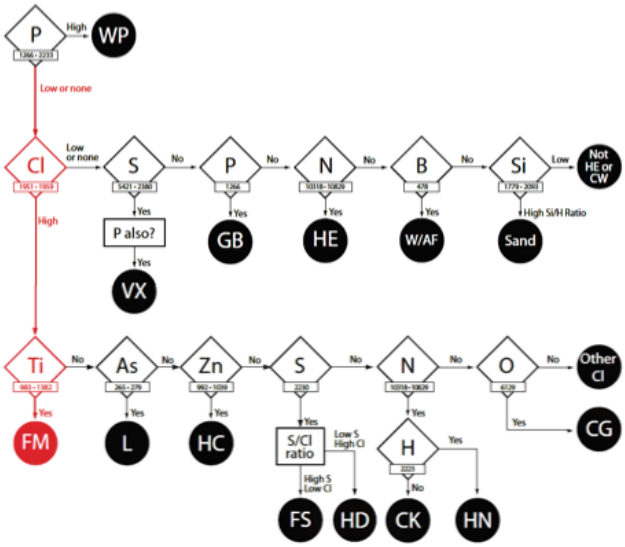
Unlike the liquid-nitrogen-cooled HPGe spectrometers used in previous PINS systems, PINS3-CF uses the trans-SPEC-N mechanically-cooled HPGe spectrometer, requiring no liquid nitrogen. The electrical power required to cool the spectrometer detector is approximately 30 watts. The trans-SPEC-N lithium ion battery can keep the detector cold for 10 to 12 hours and the external battery can be "hot-swapped" for extended field use of the instrument. The trans-SPEC-N provides a flexible and modular solution to support field inspections of chemical and explosive threats with the following additional features:

- No LN_2 — Miniature, high-reliability, "run-forever" Stirling-cycle cooler eliminates the need for LIQUID NITROGEN; detector element is encapsulated in high reliability, low loss, all-metal sealed cryostat.
- High Sensitivity — Large (>50% relative efficiency) HPGe detector.
- High Stability — Digital electronics give you the solution for the toughest analysis in the toughest conditions.
- Bright and Clear — VGA resolution display with touch sensitive operator screen.
- All-in-one Integrated Package — Rugged and compact with no interconnections — easy to setup and go.
- Smart — Nuclide ID and activity calculation for nine Regions of Interest (ROI).
- Well Connected — USB 2.0 and Wireless.
- 802.11 Communications, built-in GPS, and Secure Digital Input/Output (SDIO) storage of acquired spectra.
- Flexible — A variety of power sources can be used, including internal battery, supplemental external battery, automobile battery (any 12 V DC), and line power; all with automatic switchover.

Auto Analysis of Chemicals

The PINS data acquisition program records and displays the incoming spectra measurements from the trans-SPEC-N. It also analyzes the spectrum being recorded every 10 seconds, fitting the peaks of interest, re-calibrating the energy scale, and performing a chemical analysis. The new chemical analysis method, based on the shown decision tree logic, attempts to identify the chemical inside the object under test. The new probabilistic method traces through every path in the decision tree, and computes a score for each possible content chemical. The chemical with the highest score is chosen as the content chemical.

The new chemical analysis method is faster and more accurate, plus it is easier to expand the list of chemicals that PINS can identify automatically. Currently, the PINS auto analysis software recognizes the chemicals shown to the right.



Chemicals Automatically Identified by PINS

Chemical Warfare Agents
BR-2
CG
CK
GB
HD
HN
VX
WL

Explosives

Practice Fills
Bleach
POP
Sand
Water-antifreeze

Riot Agents
CA
CNB
CNS

Smoke Chemicals
FM
FS
HC
WP

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Specifications

Gamma-Ray HPGe Spectrometer	
Model	ORTEC trans-SPEC-N
Relative Efficiency	>50% typical (ANSI/IEEE 325-1996)
Energy Resolution	<1600 eV @ 122 keV and ≤2.5 keV @ 1332 keV (FWHM Warranted at optimum settings and detector type)
Multichannel Analyzer (MCA)	Built in digital signal processing MCA
MCA Channels	Up to 16k
Dimensions	15.5 in. L x 6.55 in. W x 13.75 in. H (39.4 cm L x 16.3 cm W x 34.9 cm H)
Weight	24.4 lb. (11.1 kg)
Input Power	10–17 V DC @ 30 Watt
Internal Battery Life	>3 hours @ 77°F (25°C) for a cold detector
External Battery	Extends operating time to 12 hours @ 77°F (25°C) for a cold detector
Initial Cooldown Time	<10 hours @ 77°F (25°C)
Laptop Computer	
Model	Panasonic Toughbook CF-31
Operating System	Microsoft Windows 7
Hard Disk Drive Capacity	320 GB
Battery Operation Time	12.5 hours
Charging Time	4.5 hours
Dimensions	11.9 in. x 11.5 in. x 2.9 in. (30.2 cm x 29.2 cm x 7.3 cm)
Weight	8.2 lb. (3.7 kg)
Operating Temperature Range	14–22
Cf-252 Neutron Source	
Model	Frontier Technology Corporation Model 100
Radioisotope	Californium-252
Source Mass	5 micrograms
Source Activity	2.5 millicurie, 92.5 megabequerel
Neutron Maxwellian, Temperature Spectrum	Parameter = 1.42 MeV
Mean Neutron Energy	2.1 MeV
Construction	Solid metal-cermet alloy source, double stainless steel encapsulation
Special Form Certification	U.S. Department of Transportation (US DOT)
Shipping Container	Frontier Technology Corporation Model 50240 (5 gallon drum)
Shipping Container Certification	US DOT Type A, Specification 7A

Ordering Information

Model	Description
PINS3-CF	Portable Chemical and Explosives Identification System. Includes trans-SPEC-N HPGe Gamma Spectrometer, Laptop, PINS Chemical and Explosives Analysis and Identification Software, measurement table assembly, safety signs and tools, external DC power supply, and ruggedized, wheeled transport and shipping container.
PINS3-CF-RN.	Portable Chemical and Explosives Identification System. Includes trans-SPEC-N HPGe Gamma Spectrometer, Laptop, PINS Chemical and Explosives Analysis and Identification Software, Radiological and Nuclear Identification Software, measurement table assembly, safety signs and tools, external DC power supply, and ruggedized, wheeled transport and shipping container.
SIMULANTS-12	Calibration and Training Simulants. Qty 1 EA: CG, HE (Comp. B), HE (HMX), PoP, FS, GB, HC, HD, WP, L, VX, and Sand. Includes HazCom labels and 3 shipping drums.
PINS3-SW-UPG	PINS3 Software Upgrade to Latest Version. Requires previous purchase of PINS3 System and ITAR approval. Software will be delivered via AMEFEX Secure File Transfer. Includes MAESTRO software.



All of the system components fit into two ruggedized cases designed to handle the shock and vibration of impacts during movement and handling.

Notes

1) Neutron source is not included. Customer must purchase neutron source directly from supplier. ORTEC will provide details of supplier, model, and specifications to customer upon receipt of purchase order.

2) Periodic detector annealing is recommended as part of a routine maintenance program for any HPGe detector operating in a high neutron environment. The scheduling of this maintenance will be dependent on the utilization and intensity of the high energy neutron source.

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Specifications subject to change
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