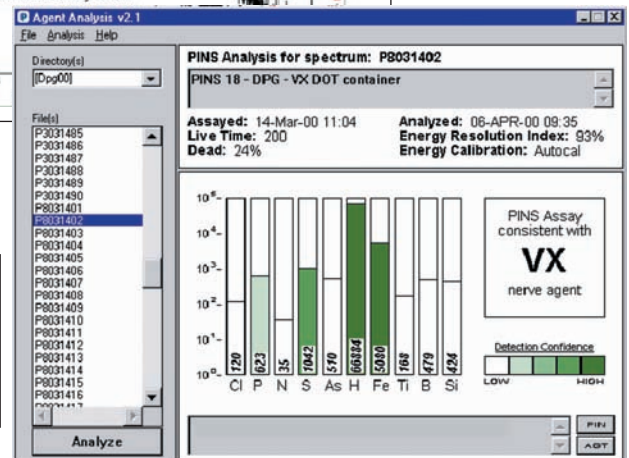
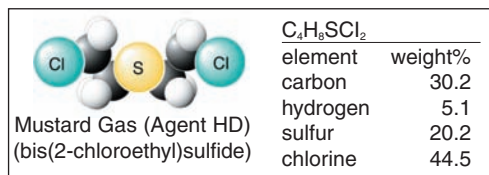
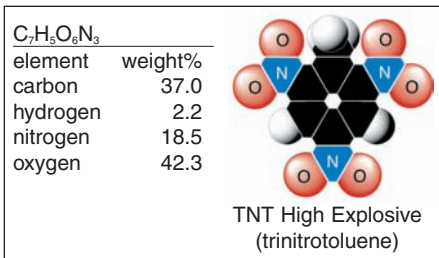
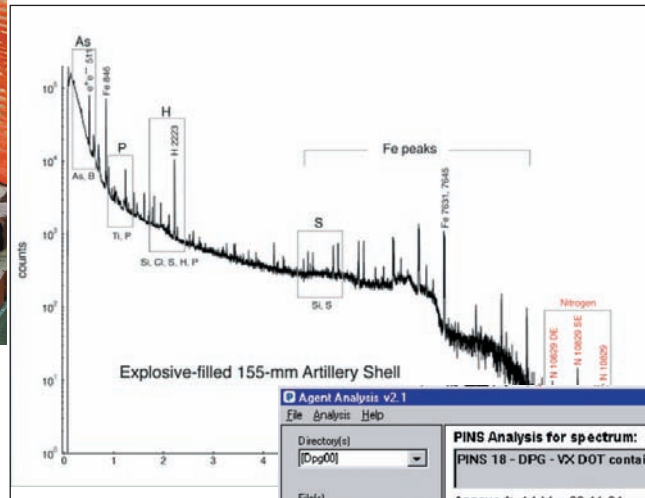


Second Generation Neutron-Based NDE System for Identification of Chemical Warfare Agents, Explosives, and Toxic Industrial Chemicals



- Second Generation Non-Destructive Chemical Identification Tool
- Identifies chemical contents of munitions and other containers safely and reliably by non-destructive and non-contact method: no direct sampling or need to breach container or overpack required
- Highly penetrating neutron radiation passes through even the thickest metal containers to expose the contents
- Chemical fingerprinting algorithms developed over thousands of real world examples
- Latest Portable Spectrometer – digiDART – brings digital signal processing, "SMART" detector technology and more compact packaging to PINS
- More compact and simple to assemble
- Improved Usability over previous versions
- Suitable for both military or civil defense use
- Assay times: 100 to 1000 seconds

Portable Isotopic Neutron Spectroscopy (PINS) is an R&D 100 award-winning technology employed originally to identify the contents of old munitions suspected of containing chemical agents. PINS Systems have been deployed world-wide since their introduction 10 years ago. Increasingly, PINS systems are being deployed as part of national counter-terrorist equipment providing a non-contact and non-destructive means of identifying the contents of "suspect" packages. WHILE PINS EMPLOYS A NUCLEAR TECHNIQUE (NEUTRON INTERROGATION), ITS PURPOSE IS NON-NUCLEAR: IDENTIFICATION OF CHEMICAL COMPOSITION. In miniPINS the original functionality and performance is retained, but in an easier to use, smaller, lighter and improved format made possible by improvements in software and in new digital electronics. PINS technology undergoes continuous developmental improvement under a collaborative agreement between ORTEC and Idaho National Engineering and Environmental Laboratory, U.S.A. (INEEL).¹



Figure 1. miniPINS inspects an old artillery munition.

In-field measurements require portability, reliability, and ease of use. The performance of the ORTEC PINS and miniPINS systems, has been verified in real-world use by the U.S. Army, which has successfully identified, in the field, hundreds of suspect munitions from burial sites and firing ranges. PINS readily and clearly distinguished between cylinders containing high explosives, cylinders containing blister agents and others filled with nerve gas. Recent international events have demonstrated the value of having such an instrument in the fight against terrorism. PINS systems have been deployed in support of a variety of security operations at more than 40 sites in the U.S.A. and elsewhere. MiniPINS represents a number of experience-based improvements. The physics, of course has not changed!

Principle of Operation: The Physics

PINS is a novel application of a well-understood technique, involving the interrogation of a container, using neutrons from a small moderated source (the general arrangement is shown in Figure 2). The neutrons pass through the wall of the container and collide with the atomic nuclei of the contents.

The ensuing nuclear reactions ("neutron capture" and "inelastic scattering") produce gamma rays, which when appropriately detected and recorded, produce a gamma-ray spectrum. The gamma-ray spectrum peaks are found at channel numbers corresponding to energies associated with specific nuclear de-excitations characteristic of the chemical element concerned. The relative heights of the peaks are related to the ratios of the elements inside the container. These energies and ratios are in themselves UNIQUELY characteristic of the contents of the container, whether high explosive, nerve gas, or other. In this way, with a "library" of known signatures, it is possible to determine unambiguously the contents of the container.

The extent to which the result is "certain" is illustrated by a real world example, in which a PINS system was used to confirm the contents of a compressed gas cylinder found buried in the ground. (Figure 3.)

It can be clearly seen that the spectrum from the container and the spectrum from a cylinder known to contain HF are an excellent match. This "fingerprinting" approach is the essence of the method.

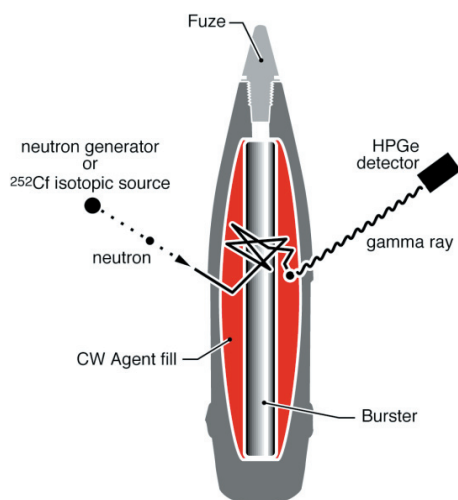


Figure 2. The Physics.

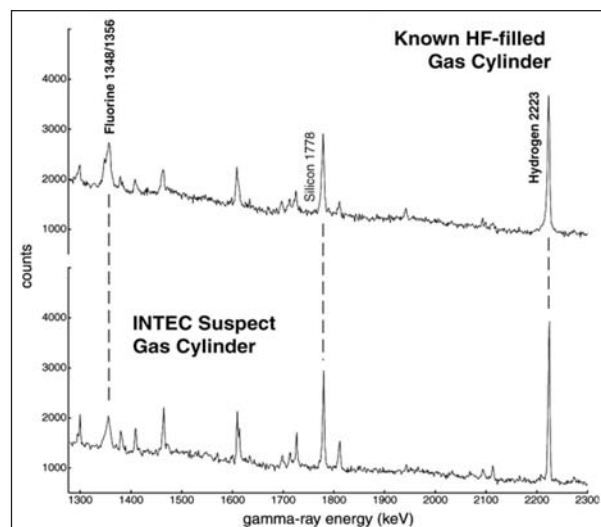


Figure 3. Suspect Container Compared to Known HF Gas Spectrum.

¹CRADA 93-ST-12.

miniPINS

Portable Isotopic Neutron-Spectroscopy Chemical Assay System

Range of Applications

PINS and miniPINS have been demonstrated highly effective in the identification of chemical constituents in a wide variety of containers and forms:

Munitions and Containers

- Artillery projectiles: 75 mm to 175 mm
- Mortar projectiles: 3-, 4-inch Stokes, 4.2 inch
- M-55 rockets, inside S/F tubes and overpacked
- "Weteye," MC-1, M-70, M-79 bombs, cluster bomblets
- Land mines, Livens projectors
- Gas cylinders, DOT 500X ton containers

Chemicals

- CW agents: CG, CK, HD, HN3, GA, GB, L, VX
- Explosives: ANFO, Composition B, RDX, TNT
- Gases: acetylene, arsine, chlorine, phosgene, phosphine
- Smoke: FM, FS, HC, WP
- Practice: sand, water/antifreeze

Suspect Containers

- Bags
- Brief Cases
- Parcels

miniPINS In Operation

The miniPINS software is simple to use. Once the spectrum has been collected and stored, the PINS software analyzes the spectrum to determine the container's contents. (Figure 4.)

The software employs a logic decision-tree to achieve the identification result. (Figure 5.)

PINS Deployments

In more than ten years of deployment, PINS systems have been used extensively world wide, often in classified applications, by military and counter-terrorist organizations. Many demonstrations of PINS technology have taken place. Selected user names are available on request.

miniPINS System Components

MiniPINS incorporates the very latest in Ge detector technology:

The ORTEC digiDART is a DSP-based MCA with stability up to 10 times better than the previous analog systems. The "SMART" detector electronics provides continuous state-of-health monitoring of detector performance, ensuring the quality and reliability of the result. More information on these exciting products is available on request or from www.ortec-online.com.

The miniPINS system comprises:

- ORTEC High-Resolution Ge Detector with SMART electronics
- digiDART Portable Digital Spectrometer
- Notebook Computer
- PINS Software
- Support Table and Shields
- Neutron Source (available separately)
- Safety Signs and Tools
- 30-liter Storage-Fill Dewar

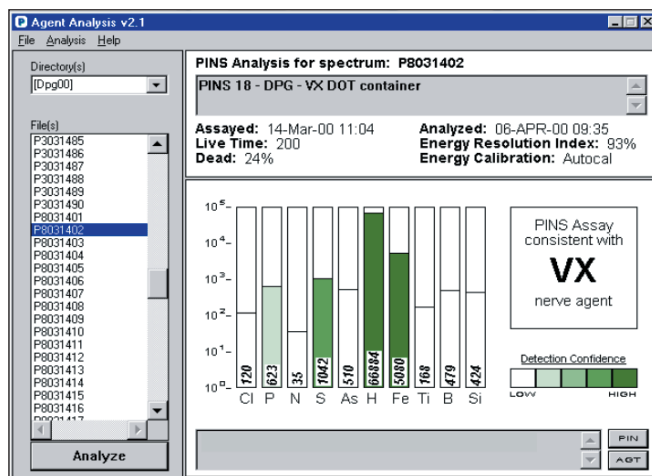


Figure 4. Results Screen.

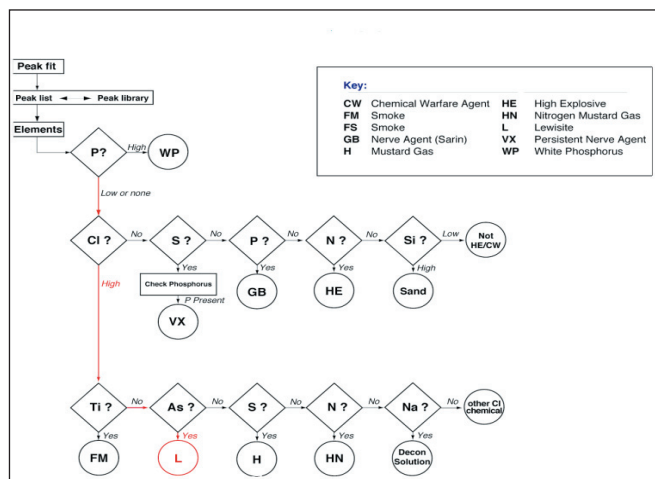


Figure 5. Decision Tree Logic.

miniPINS

Portable Isotopic Neutron-Spectroscopy Chemical Assay System

miniPINS Equipment Inventory

Box	Contents	Components
Mother Dewar	Refill Dewar with Stand	30-liter storage-fill dewar with stand plate mounted Legs (3)
Detector	HPGe Detector, digiDART, Cables and Laptop Computer	HPGe Detector with 1.2L Dewar, MCA, Connecting Cables and Laptop Computer
Table	Measurement Table Assembly	Table top Set of 3 Long leg extensions Set of 3 Short leg extensions Detector slide adapter Bismuth collimator Polystyrene source holder Tungsten shield

All components are shipped in custom fitted, foam-lined polystyrene boxes.

(A neutron survey meter is recommended, and can be added on request)

Supplies

MiniPINS is a portable system. The digiDART Digital Portable Spectrometer operates from internal batteries for 8 hours. The internal batteries may be recharged from the line.

The digiDART supplies power to the Ge detector; the latter, although totally portable in its "all attitude" 1.2-liter cryostat/dewar, must be refilled with liquid nitrogen every 18 hours. The lifetime of the notebook computer without battery swap or recharge depends on the model chosen.



Figure 6. miniPINS and Shipping Containers.

Shipping Weight

Total shipping weight for 3 containers: 201 lb (91.17 kg)

Ordering Information

Model	Description	Available From
PINS-2	Complete miniPINS system MINUS neutron source	ORTEC
100	Neutron Source, 252Cf, 5 μg ($\pm 5\%$), in holder, ready to install. (Requires appropriate license.)	Frontier Technology Corporation 1641 Burnett Drive Xenia, OH 45385 U.S.A.
50240	Source Shipping Container (5-gallon drum "pail")	Frontier Technology Corporation

Specifications subject to change
050707

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