



GAMMA WASTE ASSAY

ISOXSHLD

ISOCS™ Shield Systems

This ISOCS (In Situ Object Counting System) Shield has been designed as the optimum in convenience and functionality for in situ gamma spectroscopy with a germanium detector.



Figure 1
The ISOCS Shield Systems and all of their available components installed on an RDC Ge Detector with a Big MAC Dewar. (See Figure 3 for more details.)

FEATURES

- Portable Germanium detector shield system for in situ assays
- Includes 25 mm and 50 mm thick lead shields
- Reduces interfering 1000 keV radiation by a factor of 7.5 (25 mm) and 60 (50 mm)
- Modular design for easy handling
- Epoxy paint on all exterior surfaces for ease of cleaning
- Includes 30°, 90°, and 180° collimators (each thickness) plus solid end caps for background measurements
- Includes a rear shield set (requires RDC option on detector)
- Wheeled mounting stand with brakes for ease in moving the shield from one sample to the next
- Large wheels for easy movement: 40 cm (16 in.) at rear, 20 cm (8 in.) in front
- Upper and lower detector mounting positions, with 180° detector rotation at either location
- Easy to assemble and to change detector positions
- Built-in laser aiming device
- Components from 25 mm and 50 mm shields may be combined to build a sample counting chamber

DESCRIPTION

This ISOCS (In Situ Object Counting System) Shield (Figure 1) has been designed as the optimum in convenience and functionality for in situ gamma spectroscopy with a germanium detector.

The system is supplied with both 25 mm and 50 mm lead shielding which gives the user the ability to utilize the sensitivity and low background capabilities of a laboratory grade germanium spectrometer directly on site, regardless of where that site is located.

Unshielded, the detector has a nearly 360° field of view, and can be used for 4π counting of the walls/floors/contents of an entire room. The field of view can be reduced (Figure 2) by adding the shield and collimators to provide fields of view of 30°, 90°, and nearly 180° by simply sliding the appropriate shield components on the mounting rails. In addition, a completely shielded sample chamber can be assembled by combining the components from the two systems.

Its standard wheeled mounting frame makes it easy to move the shield to the assay site, and the individual rear wheel brakes keep it at the desired location.

The mounting frame features both an upper (for 1 meter detector/ground counting) and lower (normal) detector mounting location. The detector can be rotated 180° from down to up, and stopped at any position, not just a few fixed positions, for maximum

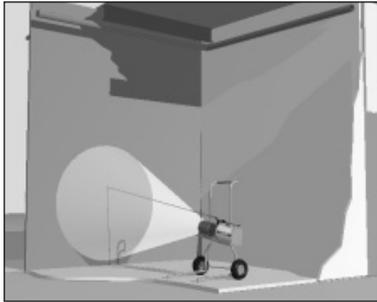


Figure 2
Using the ISOCS Shield System to assay a wall.

positioning flexibility. The detector holder even includes a laser pointer to aid in aiming the detector at remote objects.

Whatever the sample and wherever it's located, the ISOCS Shield System has the versatility and flexibility to count it.

THE DETECTOR

A major benefit of the ISOCS Shield System is the ability to use most any type or size of detector for the intended application required. While the most typical would be a coaxial germanium with a 30-80% relative efficiency, the shield can easily accommodate detectors as large as 100-120% relative efficiency, and even larger ones with minor modifications.

A wide variety of detector types are also supported. These include the Mirion BEGe™ Broad Energy detector for both low and high energy counting at the maximum efficiency, the REGe™ Reverse Electrode, LEGe™ Low Energy, and XtRa™ Extended Range Germanium, giving the ISOCS user the flexibility to match the detector's response to the types of samples that are anticipated.

To take maximum advantage of the ISOCS shield, the detector of choice should be mounted in a Remote Detector Chamber (RDC) cryostat. This allows the back shield to be used, minimizing any interfering radiation that may enter the rear of the detector.

This is very useful for emergency measurements, for D&D measurements, radioactive waste assay measurements, and applications inside Nuclear Power Plants.

Whichever type and size of detector is chosen, its energy response must be fully characterized by Mirion if it is to be used with the Model ISOXSW ISOCS Calibration Software as part of a complete in situ assay system. All of the physical dimensions of the ISOXSHLD are pre-loaded into the ISOCS software for easy selection.

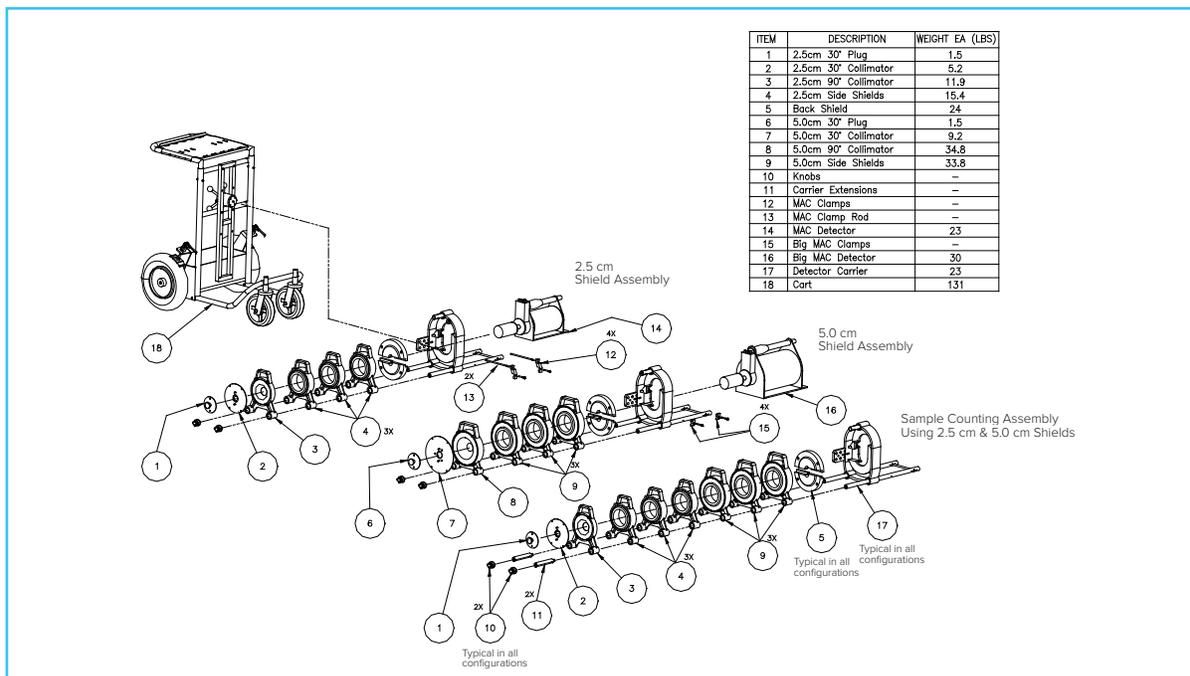


Figure 3
The components of the complete ISOCS Shield System.

THE CRYOSTAT

The ISOCS Shield System is designed to accommodate either the Mirion MAC (Multi-attitude Cryostat) or Big MAC cryostat. The MAC cryostat provides two days LN₂ holding time and may be operated in any orientation with no LN₂ spillage or reduction in capacity. It can fit within the optional 702 shipping case, along with the PC and InSpector™ MCA. Alternatively, the Big MAC cryostat, with a five day holding time, may be used if LN₂ filling is inconvenient.

THE DETECTOR SUPPORT FRAME

The ISOCS Shield System (Figures 1 and 3) includes a wheeled mounting frame that is used both for transporting the system about a site and for sample assay. The frame features upper (for 1 meter downward looking orientation) and lower (for sideupward looking) mounting positions for the detector and shield.

In either of the two positions, the detector may be freely rotated about its mounting axis, providing maximum flexibility in detector positioning. No tools are required for detector rotation or shield assembly.

To aid in positioning the detector, particularly when assaying a remote object like an overhead coolant pipe (See Figure 4b), a battery operated low power laser aiming device is built into the shield's mounting assembly handle.

THE SHIELDS AND COLLIMATORS

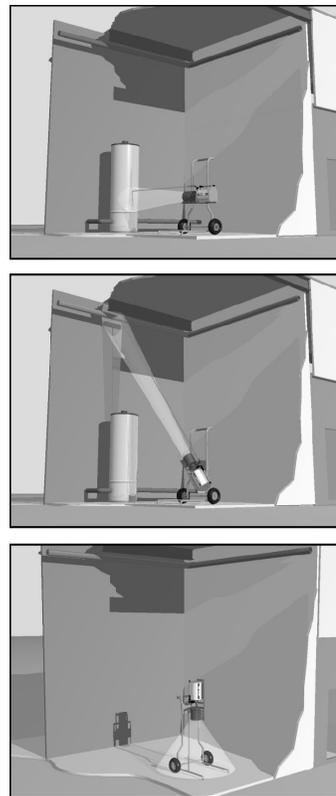
The two shield assemblies supplied with the ISOCS Shield System are essentially identical except for the thickness of the lead, 25 mm (1 in.) and 50 mm (2 in.), from which they are made.

The components of the complete shield system, together with a detector in an RDC cryostat attached to a Big MAC Dewar, can be seen in Figure 3.

Each shield consists of the following modules:

BACKSHIELD SECTIONS: These two elements connect together and shield the rear of a detector mounted in an RDC cryostat. Its location is behind the detector chamber (Figures 5a and 5b). This shield is 35 mm thick and is used for both side shield sets.

MAIN BODY MODULES: These make up the side walls of the shield. There are three with the 25 mm shield; and three with the 50 mm shield. When counting Marinelli beakers, only 1 or 2 modules are used (Figure 6a).



4a: Assaying tanks or drums.

4b: Assaying pipes.

4c: Traditional soil and floor assay.

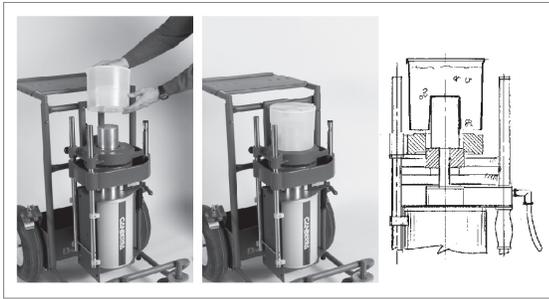
Figure 4
The flexible ISOCS Shield System adapts to most any in situ counting geometry.



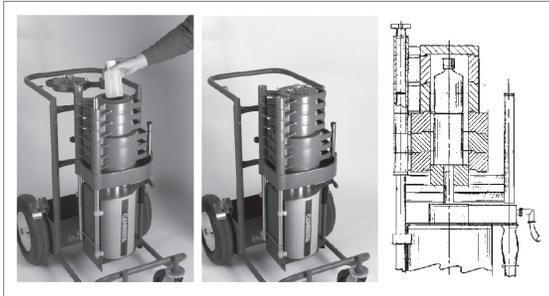
5a: The detector and mounting assembly. Note that the detector has the RDC chamber and that the backshield is installed.

5b: The same detector with the 50 mm Shield and a 90° Collimator installed.

Figure 5
Details of the ISOCS Shield and Mounting System.



6a: Configured for a Marinelli beaker.



6b: Configured for a traditional sample.

Figure 6

The ISOCS Detector and Shield can be configured for counting both Marinelli beakers and traditionally packaged samples.

COLLIMATORS: Includes collimators for 0°, 30° and 90° fields of view. With no collimators installed, the detector endcap is even with the side shield and field of view is nearly 180°.

A conical section reduced the field of view to 90°, and another conical section reduces it further to 30°. A final conical section completely closes the opening for the “0°” field of view, which is used for performing background runs and for use as a chamber closure when counting packaged samples (See Figure 6b).

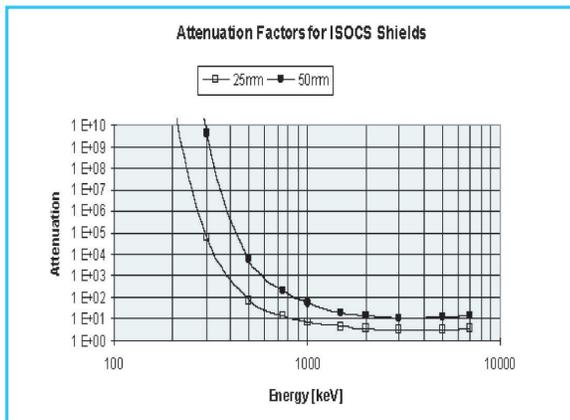
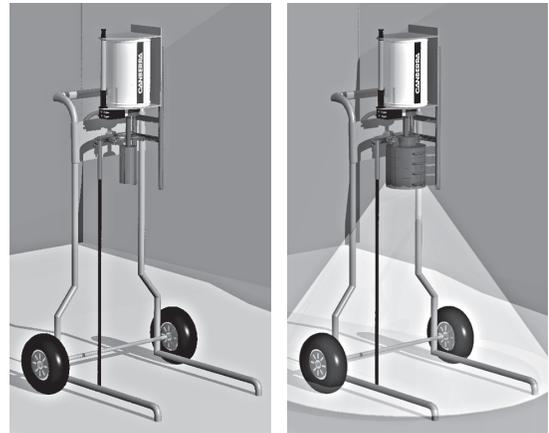


Figure 8

Attenuation vs. Energy for the ISOCS Shields.



7a: Unshielded and uncollimated.

7b: Shield and collimator installed.

Figure 7

When counting soil or floors, the ISOCS unit can be used uncollimated for maximum sensitivity, or collimated to reduce background and field of view.

Each module is manufactured from low background lead, and has an outer shell. All exposed lead and the outer shell have a durable baked epoxy coating for easy cleaning and decontamination.

Figures 8 and 9 show the radiation attenuation and background reduction of the various shields and collimators.

All of the sections are designed to slip onto the system’s mounting rails, as shown in Figures 3 and 5, without the use of tools.

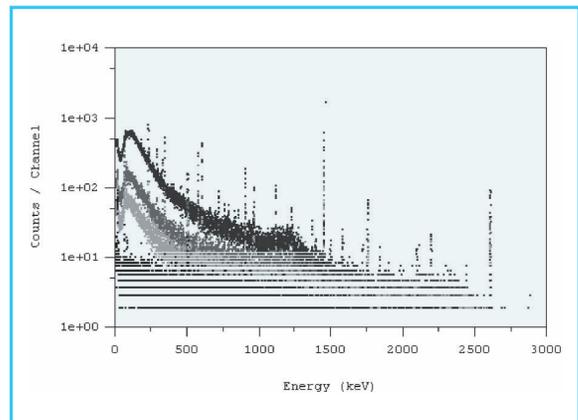


Figure 9

Background Radiation vs. Energy for the ISOCS 50 mm Shields. Data shown represents unshielded (top), side shield only (middle), 90° collimator and 30° collimator.

While the shields are normally used individually, the modules from the two may be easily combined to form a shielded sample chamber, as shown in Figure 6b. The 50 mm modules shield the detector, with the 25 mm modules forming the sample chamber. The sample size can be up to 10 cm diameter by 15 cm in height.

For assaying samples in Marinelli beakers, the configuration shown in Figure 6a is used. Note that this arrangement can be constructed from either the 25 mm or 50 mm shields.

For most every sample encountered in most any environment, the ISOCS Shield System provides the flexibility and performance for fast, accurate assays.



Figure 10
ISOCS shield ready to move to new location; all shield accessories fit into carrying tray on back; computer and MCA can be strapped down to tray on top.



Figure 11
Optional accessory item: Model INSITPOD for lightweight and portability.

SPECIFICATIONS

Detector requirements

- Type: Any type of Mirion liquid nitrogen cooled germanium detector with an end cap diameter of 10 cm (4 in.) or less and end cap length of 15 cm (6 in) or less. Contact factory for larger end caps or electrically cooled systems
- Cryostat with remote detector chamber: Not required, but strongly recommended, especially for projects with multiple radioactive sources in the area, e.g. D&D, or Nuclear Power Plant measurements. Greatest background reduction will be attained with the RDC-4 cryostat option
- Dewar: Either a MAC or Big MAC unit may be used. Big MAC unit is recommended for most applications because of the 5 day holding time

Frame and detector/shield holder

- Construction: Baked epoxy painted carbon steel (stand) and cast aluminum (shields). Includes instrument shelf and shield carrying tray (Figure 10). The system can be easily disassembled for access to small areas, or shipping. For mounting the detector onto other platforms, e.g. boom truck, crane, lift truck, Jeep, the detector/shield module can be used without the frame

Shields

- Material: 25 mm (1 in.) and 50 mm (2 in.) lead
- Finish: Cast aluminum exterior with epoxy paint on all exposed lead
- Body modules: Includes three 25 mm and three 50 mm modules
- Collimators: Includes 30° and 90° collimators. Custom sizes available
- End shields: Includes solid end shield for each thickness for background measurements
- Backshield: Includes a set at 35 mm for use with both lead shield sets

Fully assembled system: nominal values

- 74 cm wide x 102 cm high x 104 cm long (29 x 40 x 41 in.) fully assembled

Weight: nominal values, with full Big MAC cryostat

- Frame/detector/holder: 83 kg (184 lb)
- With all 25 mm shields: 123 kg (272 lb)
- With all 50 mm shields: 160 kg (354 lb)
- With both shield sets: 190 kg (419 lb)
- Heaviest shield module: 16.3 kg (36 lb)

Accessories to consider; see separate "ISOCS In Situ Accessories" specification sheet for more details

- Model INSITPOD Lightweight portable collapsible tripod for uncollimated in situ soil measurements (Figure 11)
- Model 7413 or 7413F Heavy duty tripod
- Model 7411 Submarine Housing to protect detector and allow performance of in situ measurements under water or in other hostile environments (e.g. heavy contamination)

