MIRION TECHNOLOGIES

IN-VIVO COUNTING

2275

Combination Actinide (Uranium/Plutonium) Lung Counter and Scanning Fission Product Counter

The Model 2275 Lung Counter provides accurate and reliable measurements of uranium, plutonium and americium in the lungs.

FEATURES

- Lung detector positioner mechanism with six degrees of freedom
- Lung positioner accommodates up to four detector crystals in two Mirion ACT-II™ cryostat packages
- Digital Signal Analyzers for high resolution signal processing
- Sliding bed for easy subject/patient loading
- 7.6 x 12.7 x 40.6 cm (3 x 5 x 16 in.) scanning sodium iodide detector for whole body counting
- Apex-InVivo™ software for system analysis and control
- Lung Counting option for automatic chest wall thickness correction
- Turnkey system delivered calibrated and ready to count

SYSTEM OPTIONS

- Detector Anti-Compton shields to reduce subject generated background
- Automatic Liquid Nitrogen fill system
- 15 cm (6 in.) or 10 cm (4 in.) thick low background steel shield
- Select 2000, 2800, or 3800 mm^2 area low or broad energy detectors for high resolution lung counting

DESCRIPTION

The Model 2275 unit is a lung and whole body counting system. For more than 20 years Mirion has designed and fabricated the systems and components to meet the challenges associated with actinide lung counting and general whole body counting. Mirion is constantly surveying technological advances that improve system ergonomics and detection capability. The 2275 Lung and Whole Body Counter is one of the company's two resulting standard lung counting systems.

The Model 2275 Lung Counter provides accurate and reliable measurements of uranium, plutonium and americium in the lungs. The 2275's scanning whole body counter provides fast, accurate measurements of fission and activation products in the body.

The standard 2275 system is sold as a turnkey system and includes all of the hardware (except the low background shield), software and service needed to produce a system that is ready for immediate use when installation is completed. The basic 2275 Lung and Whole Body Counter requires a 4π low background shield with shielding equivalent to a minimum of 10 cm of low background steel. The customer may supply the shield or may select either a 10 or 15 cm thick low background steel shield option for the 2275 Lung Counter. The system proposal will include factory integration and either factory or on-site calibration services, as well as, on-site installation and training services.

The standard system design includes a lung counting detector positioning mechanism, a subject bed and a scanning whole body counting mechanism. The lung counting detector positioning mechanisms features six degrees of positioning freedom to allow accurate placement of the detectors over the lungs for improved detection limits. If the customer elects to supply the shield or shielded room for the system, then the calibration will be provided at the customer's site after installation in the shield.

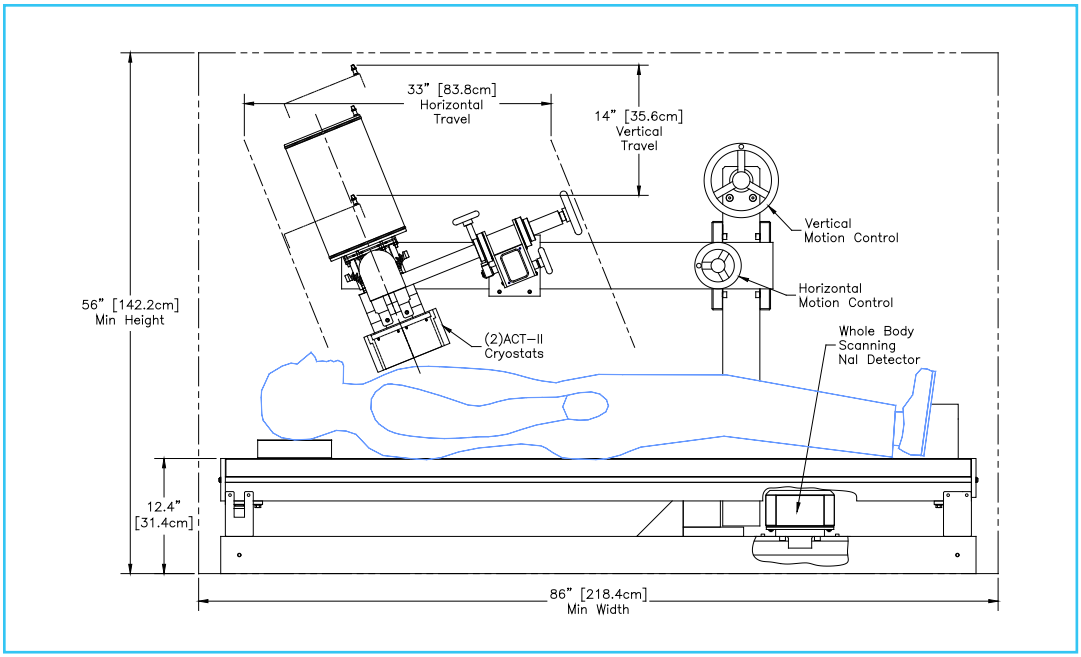
The lung counting detector positioning mechanism accommodates two Mirion ACT-II cryostat assemblies. Each ACT-II cryostat assembly can be configured with two broad or low energy detector crystals of 2000 mm^2, 2800 mm^2 or 3800 mm^2 surface areas. Mirion will work with the user during the proposal process to recommend the optimal crystal size and type based on the customer's detection requirements and budget. Please refer to the Mirion low and broad energy germanium detector specification sheets for additional detailed information on detector performance and design.

The 2275 system's scanning mechanism is designed to accommodate a 7.6 x 12.7 x 40.6 cm (3 x 5 x 16 in.) sodium iodide detector for whole body counting. Both the scanning mechanism and the sodium iodide detector are included in the standard system. The whole body scanning detector is located under the subject or patient bed. The Apex-InVivo software included with this system will allow the system to be configured to perform both the lung and whole body counts simultaneously or independently.

Mirion offers both a standard 10 and a 15 cm thick, low background steel shield as an option for the 2275 Lung and Whole Body Counting System. These shields come with overlapping double entry/exit doors, internal lighting, an oxygen sensor, and a subject panic button, as well as shield penetrations for detector cables, liquid nitrogen fill lines, music system cables and closed circuit video cables.

Mirion also offers an optional set of detector anti-Compton shields, an automatic liquid nitrogen filling system, a music system and a closed circuit television system for use with the 2275 Lung and Whole Body Counting System. Mirion highly recommends the use of the anti-Compton shields around the germanium detectors. These lead shields reduce spectral background due to bremsstrahlung interactions from the naturally occurring 40K within the subject. These background reductions can be used to improve detection capabilities and reduce count times.

The 2275 system is designed to make routine radiation protection monitoring for actinides in the lungs and fission and activation products in the body fast, reliable and accurate. The system does however allow the user to make various non-standard measurements using the 2275 system's germanium detector positioning mechanism. The positioning mechanism's six degrees of freedom allow the user to position the high resolution germanium detectors over individual organs other than the lungs, e.g. liver or thyroid. This allows the germanium arrays to be used for detailed analysis of radioactivity found during scanning body counts or for research projects.



SYSTEM OPERATION

In normal or routine counting situations the subject or patient lays on the 2275 bed. Then the system operator positions the germanium detector array over the subject's lungs and in uniform contact with the subject's upper chest. The shield door is then closed and the count started. Then the operator fills in a brief demographics screen about that count (name, ID number, reason for count, etc.). The rest is completely automatic.

The software turns on the high voltage for both the germanium and sodium iodide detectors, it controls the scanning mechanism for the sodium iodide detector and begins the data acquisition and spectral displays. When the count is done, the spectral data is stored, analyzed, the results displayed and/or printed, and any appropriate warning messages are generated to the operator. Then the program and counter are ready for the next person.

SPECIFICATIONS

Power

- Specify: 110/220 V ac, 50 or 60 Hz
- Requirements: Vary depending upon computer and electronics

Environmental

- Temperature: Stable to within ± 1 °C
- Humidity: Non-condensing
- Background Radiation: Normal background assumed
- General: Clean, dust free area

Performance

- Energy range: 10-2000 keV for the high purity germanium detectors, 80-2000 keV for the scanning sodium iodide
- The standard system energy calibrations covers 17 keV to 300 keV for the lung counter and 88 keV to 1.8 MeV for the scanning sodium iodide detector
- Typical count time: 30 minutes for lung counting and 5 minutes for whole body counting
- Typical Lower Limit of Detection (LLD): 4-6 Bq (0.1-0.15 nCi) for ^{235}U with a four detector 2800 mm^2 LEGe array, and 40-80 Bq (1-2 nCi) for ^{137}Cs and ^{60}Co for the scanning sodium iodide detectors

Actual system detection limits may vary according to final system configuration and environmental background at the individual customer's facility.

SHIELDS (Optional)

10 cm (4 in.) Thick Low Background Steel Shield

- Inside dimensions: 218 x 142 x 122 cm (86 x 56 x 48 in.) W x H x D
- Weight: 13 500 kg (30 000 lb)
- Floor space required:
  - Doors closed: 277 x 150 cm (109 x 59 in.)
  - Doors open: 290 x 264 cm (114 x 104 in.)
- Height WITH BASE: 198 cm (78 in.)
- Floor load: 690 kPa (100 psi)

15 cm (6 in.) Thick Low Background Steel Shield

- Inside dimensions: 218 x 142 x 122 cm (86 x 56 x 48 in.) W x H x D
- Weight: 21 750 kg (48 000 lb)
- Floor space required:
  - Doors closed: 292 x 160 cm (115 x 63 in.)
  - Doors open: 312 x 274 cm (123 x 108 in.)
- Height WITH BASE: 203 cm (80 in.)
- Floor load: 690 kPa (100 psi)

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