Previous model number: 3800

G3850
Tomographic Gamma Scanner

Introduction

The G3850 Tomographic Gamma Scanner (TGS) uses transmission corrected, single photon emission computerised axial tomography to determine the spatial distribution and quantity of radionuclides in a drum or can. This High Resolution Gamma-ray Spectroscopy technique (HRGS) represents a considerable advance over the segmented gamma scanning technique by implementing a simple translation axis in addition to vertical scanning and rotation axes. The TGS was developed by the Los Alamos National Laboratory (LANL) in the early 1990s for the United States' Department of Energy.

A ^{75}Se transmission source allows the determination of a 3-D spatial map of the attenuation coefficient at any energy by interpolating between the gamma-ray peaks of ^{75}Se at several energies. Once the attenuation coefficient maps have been established for the sample, emission tomography is used to determine the distribution of selected radioisotopes within the sample. Two pass (transmission followed by emission) measurements are performed.

The segmented gamma scanning technique produces an average linear attenuation coefficient for each horizontal segment of the sample can or drum. The tomographic gamma scanning technique provides source (emission) images for each segment in addition to this average linear attenuation coefficient. The typical spatial resolution for the emission image from the TGS is about 50 mm (1.97 in) for drums and 30 mm (1.18 in) for cans.

The TGS is capable of correcting for errors that arise from lumps below the resolution of the tomographic gamma scanning technique using a comprehensive multi energy lump correction algorithm. This is appropriate for samples such as plutonium pyrochemical salts that may contain pieces of plutonium metal approximately 2 mm (0.079 in) in diameter. The multi energy lump correction algorithm is not available with the segmented gamma scanning technique.

The TGS uses a single calibration constant to determine the isotope mass of a wide range of material and matrix types. The attenuation and source distribution matrix is known more accurately for the TGS than the Segmented Gamma Scanner so biases due to matrix and source distribution are significantly reduced by the TGS.

Isotopic ratio analysis of plutonium is performed using PC/FRAM code. An 8k channel spectrum is obtained for isotopic analysis during the TGS scans. Typically, the ANTECH TGS is also able to perform SGS analysis.

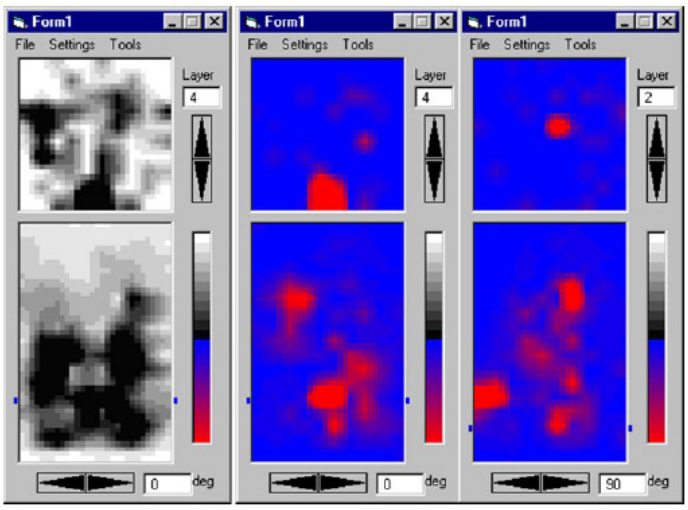
The TGS Drum Scanner meets both US Nuclear Safeguards, and DOE WIPP measurement and QA requirements using ANTECH Master SGS software.

Features

- Automatic gamma-ray energy calibration using the ^{75}Se transmission source
- Manual or automatic drum loading
- Mobile operator control console is compatible with both Drum TGS and UGS for cans and can be local or remote from the instrument
- Automation of 3 axes of motion
- Adjustable collimator that can accommodate drums or cans

Benefits

- One instrument provides total assay result combining TGS measurement of uranium, plutonium and other radionuclides with plutonium isotopic ratio analysis using LANL PC/FRAM code
- Incorporates Tomographic Gamma Scanner (TGS), Segmented Gamma Scanner (SGS) and Plutonium Isotopic Ratio Measurement capability in one instrument
- TGS technique meets WIPP measurement and QA requirements
- Accuracy and precision sufficient to meet safeguards, shipping and disposal requirements
- Extends range of SGS technique to heterogenous samples; for homogeneous samples the ANTECH TGS can operate as an SGS using ANTECH Master SGS software
- Measures samples with ^{241}Am content that cannot be measured using neutron techniques
- A single calibration constant can be employed for each radionuclide determined due to the bias reduction inherent in the TGS technique
- Provides tomographic maps of absorbers and sources in heterogeneous matrices



Emission and transmission plot for a drum - black indicating dense material, red indicating active material.

Specification

Digital MCA	Based on the ORTEC DSPec Plus
Overall instrument envelope (H x W x D)	1785 mm x 1512 mm x 1835 mm (70.28 in x 59.53 in x 72.24 in)
Dimensions (H x W x D)	2200 mm (pillar) x 1800 mm x 2100 (86.61 in x 70.87 in x 72.24 in)
Sample drum and can size	Variable to a maximum of 200 litres and is also able to measure 340 litre (85 gallon) overpack drums alternative turntable plate
HPGe efficiency	50%
Accuracy	Typically better than 10% for measurement of cans and 20% for matrices with average density 2 g/cm^3, better than 10% for metal scrap matrices
Ethernet	Ethernet communication from operator computer console
Transmission source	30-200 mCi ^{75}Se
Dead time source	^{109}Cd
TGS analysis	Typically 4800 4k channel spectra for each measurement
Isotopic analysis	One 8k channel emission spectrum
Software	User friendly software runs under Windows platform and is compliant with Nuclear Software QA requirements of NQA-1 (required for WIPP certification)
Measurement time	Typically less than one hour; increased accuracy and precision can be achieved by extending the measurement time