FAQ -- SAM12 Small Articles Monitor

Q1. **What are the highlight features of the SAM12 ?**

A1. The SAM12 provides complete articles coverage using large area scintillation detectors. Four detectors are identical and are located above and below and on the left and right of the sample chamber. Optionally two extra detectors may be specified in the front and rear.
SAM12 can be provided with one entry door, or with two doors (front and back). It can be fitted with 1" or 2" or lead shielding for improved sensitivity.
SAM12 has a large touch-screen colour LCD and really easy set-up via embedded Windows XP.
Innovative features include:

Quickscan, Quick Background, Cobalt Co-incidence Monitoring (CCM), Natural Background Reduction (NBR), internal database logging and optimised ^{60}Co alarms, USB connectivity for memory stick, printer and keyboard.

Q2. **How is the SAM12 calibrated using threshold settings ?**

A2. Five energy thresholds are factory set in the SAM12:-
T1 is the lowest, set just above the noise level.
T2 is set at the ^{137}Cs peak energy 662keV
T3 is set for higher energy levels (>700keV).
T4 is set just above the ^{60}Co peak energy 1.3MeV
T5 is set just below Cosmic energy levels.

The optimum working voltages for each scintillation detector are set during HV scanning to a specific T1/T2 ratio. The SAM12 is then calibrated against a ^{137}Cs reference source at the centre of the detector measuring volume. This is precise and once calibrated against ^{137}Cs the SAM12 is also fully calibrated for ^{60}Co.
It is not strictly necessary to recalibrate against ^{60}Co, but during final SAM12 factory testing, calibration certificates are provided for both nuclides.

Q3. **What is NBR, and how does it work?**

A3. NBR (Natural Background Rejection) is a proprietary energy ratio technique used in many Thermo Fisher Scientific instruments. When the SAM12 NBR software function is enabled, algorithms compare the energy spectra of artificial manmade nuclides such as ^{137}Cs and ^{60}Co, with the empirically derived natural energy spectra of long-life nuclides including ^{238}U and ^{232}Th.
During a measurement cycle with NBR operating, the count-rate in each of 5 energy windows accumulated in the required monitoring time. This is compared with the typical contribution of N.O.R.M. (Naturally Occurring Radioactive Material), and the proportion due to N.O.R.M. is displayed in any alarm result triggered. The NBR ratios and parameter limits are set up during SAM12 manufacture, and should only be changed in consultation with Thermo Fisher Scientific.

Q4. **How does the Cobalt Co-incidence Monitoring (CCM) option work ?**

A4. When this function is enabled, the SAM12 monitors the energy window above ^{137}Cs (T3) and below ^{60}Co (T4). Only higher energy measurements and higher energy backgrounds are analysed in this channel. Because the typical background countrate at these higher energies is less, the statistics for the ^{60}Co are much better.
Additionally, because the two high energy peaks of ^{60}Co [1.17MeV and 1.33MeV] occur within a short time of each other, the SAM12 co-incidence electronics detects only “co-incident” events. This enables a rapid assessment of the contribution from ^{60}Co, which is shown in the measurement results.

Q5. **How does the Quick Background option work ?**

A5. The SAM12 normally measures background in 10 second samples and rolls this into a simple 100sec rolling average.
When the user opens the front door to monitor a sample, the previous rolling measurements are frozen and used in background subtraction algorithms. However, after several items have been sequentially monitored the SAM12 will request a background update, then measuring a further 100sec background.
If Quick Background is selected, the SAM12 algorithm compares current background statistics with the selected alarm settings, and only counts for a background time to meet current settings. Normally much less than 100secs.

Q6. How does the Quickscan option work ?

A6. The maximum and minimum monitoring times are set via the Parameter 2 menu. The SAM12 compares the actual foreground countrate with the background and alarm statistics set, and measures the user for a time between maximum and minimum.
If Quickscan is enabled a user may monitor for a much shorter time than the maximum if the SAM12 detects a “really clean” or a “really dirty” statistical situation. The SAM12 will then monitor for the Quickscan time, repeating this as necessary. The user may adjust the Quickscan period to suit the local conditions. Typically this can be reduced to 5% or 10% of the maximum monitoring time – but normally a minimum of 10 seconds.

Q7. Can I reduce false alarms ?

A7. Several factors can contribute to unexpected false alarms.
Background *attenuation and scatter* within the sample may be significant:-
consider using the attenuation menu options.
It is always advisable to site the SAM12 in the lowest practical background location.
As the SAM12 is usually assessing a quite small alarm count in a larger background count, then *alarm thresholds* may be set too low:-
consider adjusting the alarm level to a more realistic setting.
Avoid moving active samples/materials adjacent to the SAM12 as this may cause *background fluctuations*, so the monitor may detect changing conditions.

Q8: **Why does my instrument sometimes fall outside the variance test limits?**

A.8. The variance test may be used soon after the SAM12 is installed to confirm the background stability of the detectors. Check that the variance limits are set to the recommended default values before using this function:
25 counting cycles;
25 second count period;
Upper variance 1.5;
Lower variance 0.67

Apparent failure may be due to changing background conditions, so it is recommended to carry out this testing overnight or when the SAM12 is not in normal use. It may be necessary to repeat the variance test for marginal failures.

In high background environments it may be appropriate to amend the default values.

Q9. **What is the best way to utilise the Waste Stream function?**

A9. The SAM12 is initially calibrated against a standard range of nuclides, such as ^{137}Cs, ^{60}Co, ^{133}Ba, ^{57}Co. Depending on the possible radioactive waste to be monitored, it may be appropriate to calibrate against other nuclides such as ^{235}U and ^{238}U.
Once calibrated against basic nuclides, the Waste streaming function may be selected. For instance, if a sample of waste has been analysed and is likely to contain around 20% of ^{60}Co and 10% of ^{137}Cs plus a mix of unknown nuclides, it is simple to enter this range into the waste stream function. The SAM12 will automatically estimate the efficiency of the detectors based on the initial calibrations and the proportion of each in the mix.
The user will have to decide on the alarm settings.

Q10: **How is the external weigh platform used?**

A10. The optional external weigh platform is connected to the SAM12 via one USB port.
When selected and configured via the SAM12 menu option, the weigher provides indications for Specific Activity after sample monitoring.
The user is reminded to weigh the sample prior to positioning inside the measuring volume, to close the front door and then to press the Start button.
The sample weight is shown on screen and the Specific activity stored in the Results datalog. Optionally results may be printed out via a USB label printer.

Q11: What software is used in SAM12?

A11.

- The database used is SQL Server Express
- This database is setup for single user access. Remote access to the database is disabled.
- The operating system is Windows XP Embedded. This operating system only includes the components of the WinXP operating system that are essential to operation of these products.
- The instrument application is run from within WinXP user mode. The application should not be run from within Administrator mode.
- Security patches to the operating system will be provided by ThermoFisher, after an in-house review. Patches will be provided where appropriate and essential.
- Updates to SQL Server Express will be provided by ThermoFisher, after an in-house review. Updates will be provided where appropriate and essential.

Q12: How is remote access provided?

A12.

- VNC Server is installed on every product. Remote access to the desktop is only possible through VNC.
- The IP address plus a security password are needed to access the SAM12.