

X-Ray Tube Stability and Beam Integrity Characterization

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Characterization of X-ray tube stability and beam integrity now is simple and convenient using Amptek's XR-100T-CdTe Gamma Ray and X-Ray Detector and MCA8000A Multichannel Analyzer. Both short and long term stability can be measured in situ.

The XR-100T-CdTe Gamma Ray and X-Ray Detector, when used with the MCA8000A Multichannel Analyzer, makes for a powerful tool for characterizing short- and long-term stability of X-ray tubes and controllers. The use of the EXVC Collimator placed in front of the XR-100T-CdTe reduces the X-ray flux and avoids detector saturation. The detector can now look directly at the X-ray tube (see Figure 1, top) and take energy spectra at regular intervals to monitor its performance.

A Visual Basic program is provided that uses the DLL libraries that control the MCA8000A. This routine automatically saves a complete spectrum at user-defined intervals and, in addition, produces a file consisting of the "total counts" in each spectrum. This "total counts" file can then be plotted in a spreadsheet program.

For short-term stability investigations, the Visual Basic program is set up for a routine of 100 repeated spectra of 60 seconds each. The plot of the output X-rays (total counts file), as seen in Figure 1 (middle) shows that the X-ray tube and controller take about 12 minutes to warmup before they stabilize.

For long-term stability investigations, Figure 1, (bottom), shows the plot of the output X-rays (total counts file) over six hours. The inset in the plot is a graph of one of the spectra saved. Between the total counts file and the full spectrum at each point, a total analysis can be made of the X-ray tube stability and integrity. The plot also shows the average, predicted standard deviation, calculated standard deviation, and current stability. The total counts file enables these four calculations to be made easily in any spreadsheet program.

If the purity of the X-ray tube energy spectrum is known, and only stability is to be investigated, the Visual Basic program can be modified by the user to only create the "total counts" file and not to save the spectra for every counting period. On the other hand, if a particular part of the energy spectrum is to be investigated, the Visual Basic program can be modified by the user to only save and download to a file a specific region of interest (ROI).

A different way to measure stability of the X-ray flux of the tube is to set up the XR-100T-CdTe to detect the X-ray fluores-

cence (XRF) produced from a stationary target. A typical angle of "tube-target-detector" is about 45 degrees. In this configuration the EXVC collimator kit might not be necessary.

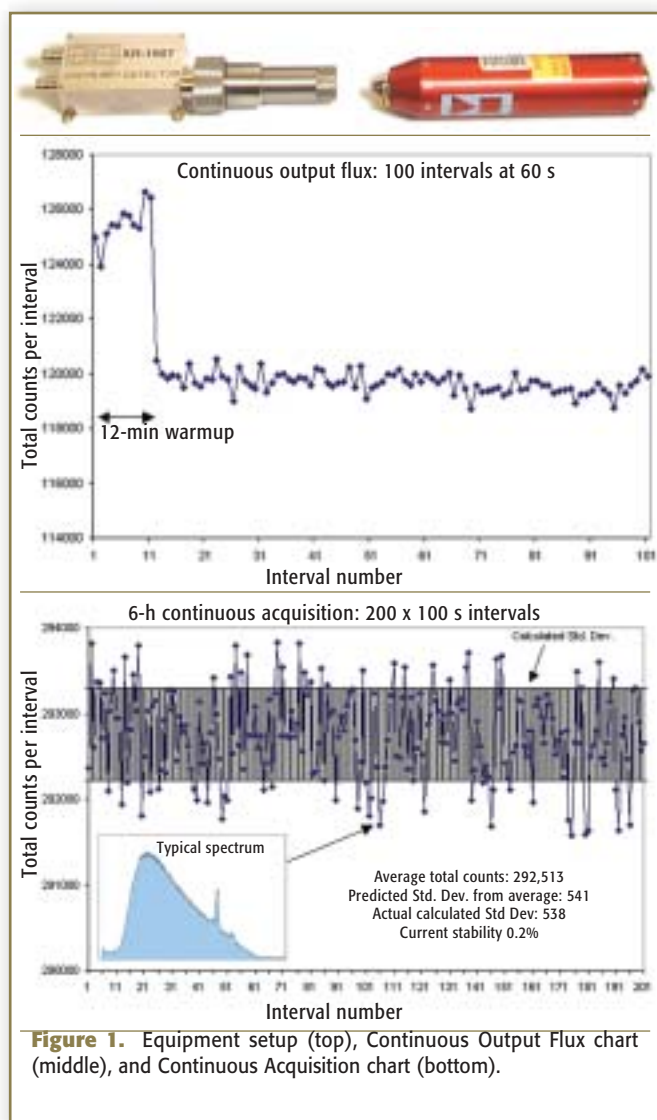


Figure 1. Equipment setup (top), Continuous Output Flux chart (middle), and Continuous Acquisition chart (bottom).

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