Instructions for Using XRS-FP to Process X-Ray Tube Spectra

Introduction

Amptek's CdTe X-ray detectors are commonly used to characterize the spectra measured from X-ray tubes. To provide the best results, the raw spectra should be processed to correct for two physical effects: (a) escape of secondary X-rays from the Cd and Te atoms and (b) loss of efficiency due to attenuation in the Be window and transmission through the detector.

To correct for these effects, Amptek provides "Escape Peak Adjustment Software", which is a limited version of the XRS-FP software package[1]. The full blown XRS-FP software, is very powerful and used for analyzing characteristic X-ray spectra during X-ray fluorescence analysis. This less expensive version limits the analysis features to those required for implementing the two corrections. There are many parameters and options in XRS-FP but most are unimportant for these corrections.

This document explains the key steps and parameters needed to use the limited XRS-FP software for correcting X-ray tube spectra measured with Amptek CdTe detectors.
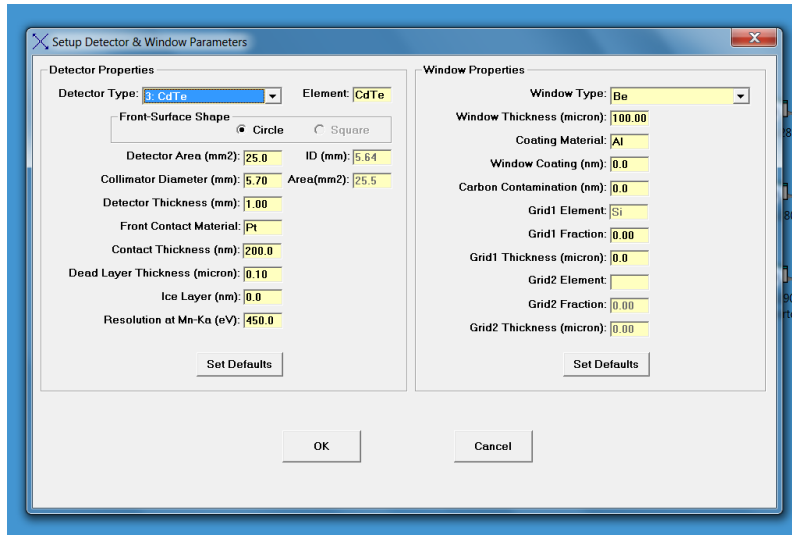
1. Setup

1. Install XRS-FP normally from Amptek's CD. Download the file "XRSFP_Setup_Amptek.exe", run as an administrator, and follow the prompts.

2. Connect the security plug to a USB port. If the computer is on the Internet, then appropriate USB drivers will be downloaded from the Microsoft update site. Depending on your OS, you may or may not see an indicator of driver installation.

3. When the software is installed and the security plug driver is installed, launch XRS-FP.

4. Select "Expert Mode" in XRS-FP.

5. Open the file called "CdTe Tube Analysis.TFR". This has default parameters for this analysis.

6. Go to the Setup menu and select Detector. Verify the following:

    a. Detector Type = CdTe (it will automatically update the Element)

    b. Detector Area = Does not matter, put in 25 mm2 for reference.

    c. Detector thickness = 1 mm.

    d. Resolution = 450 eV.

    e. Window Type = Be

    f. Thickness = 100 um

    g. You can also enter the data for the contract (200 nm Pt). This will only affect the efficiency correction at low energies.

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[1] Technically, one obtains the full XRS-FP software but uses a security plug that only enables those features needed to correct X-ray tube spectra. Note that XRS-FP and not FP**2**, should be used.
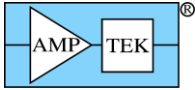
7. Go to Setup menu and select Geometry

   a. Set all angles to zero.

   b. Set all distances to zero except the "sample to detector" distance. Enter the distance between the tube and the detector. This is not critical but will be used to estimate air attenuation at low energies.

8. In the Setup Processing menu,

   a. There is a "Low Energy Start" value; set this to 5.0 keV. No corrections will be applied below this threshold. Correction factors are large and somewhat uncertain at low energies, so you may see anomalies at low energy.

   b. Make sure the "Auto Adjust" box is unchecked.
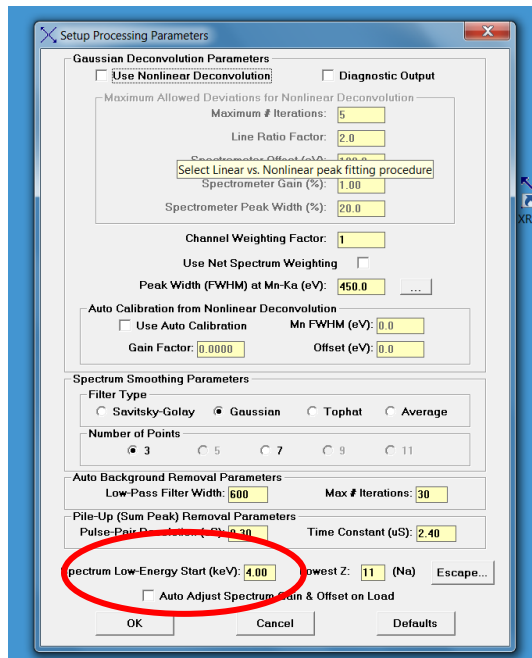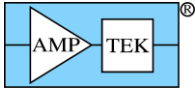
Measure the spectrum

1. You can use either the DPPMCA software or XRS-FP software to record the raw spectrum. Use of the spectrometer and these software packages for acquisition is discussed elsewhere.

2. If you use DPPMCA, you must then calibrate the energy spectrum in DPPMCA. You will need known energies and may want to do this before taking the spectrum to be analyzed. Energy calibration is discussed in DPPMCA's help file. NOTE: Make sure to enter the energies in keV and to write "keV" into the units box.
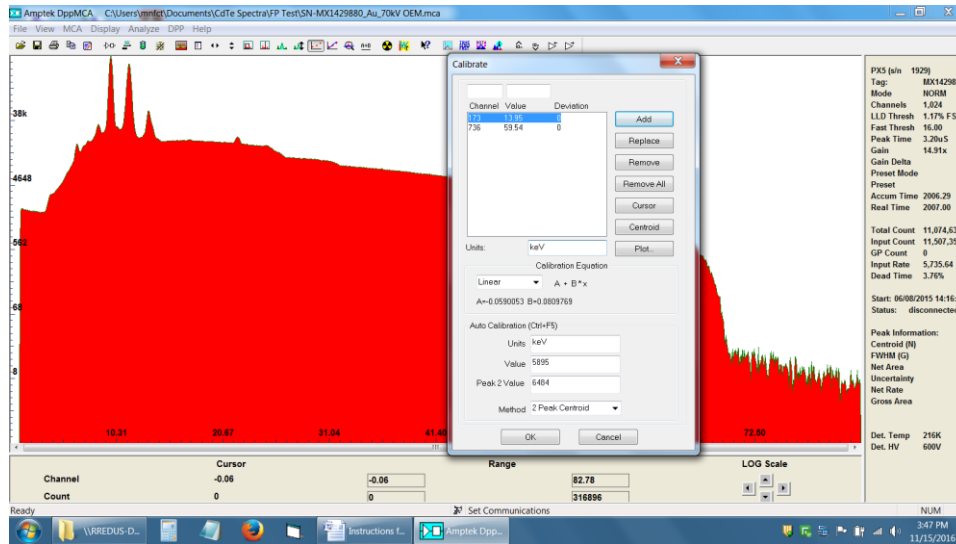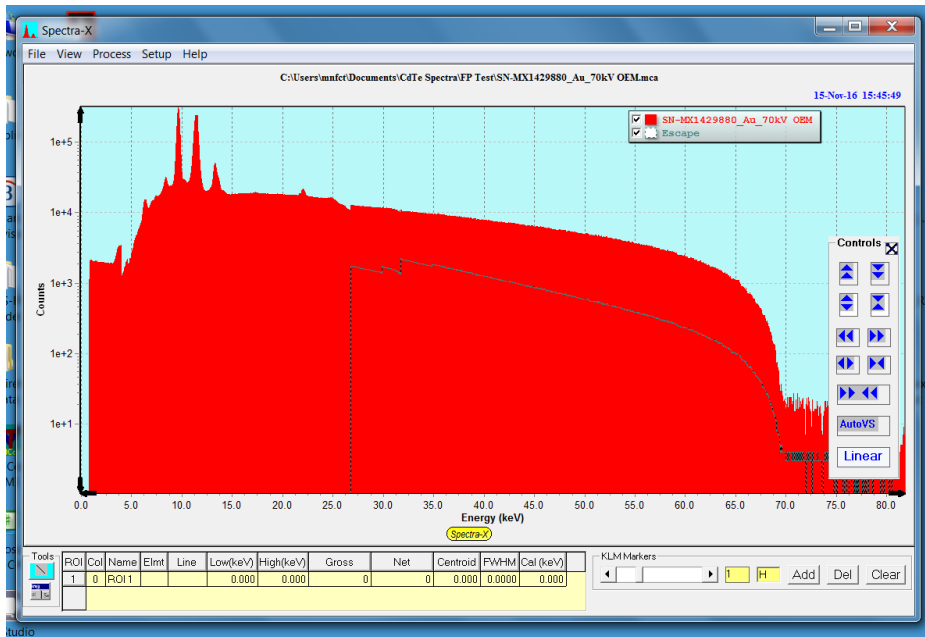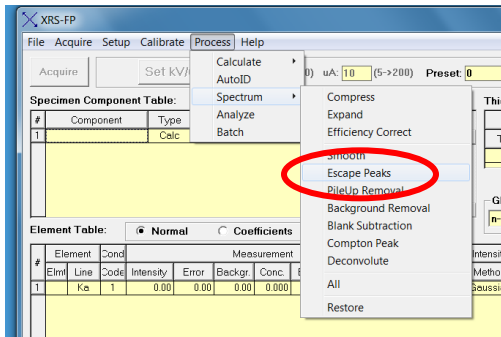

3. Save the .MCA file.

Processing the spectrum

1. Go to the File menu in XRS-FP and Open the saved .MCA file.
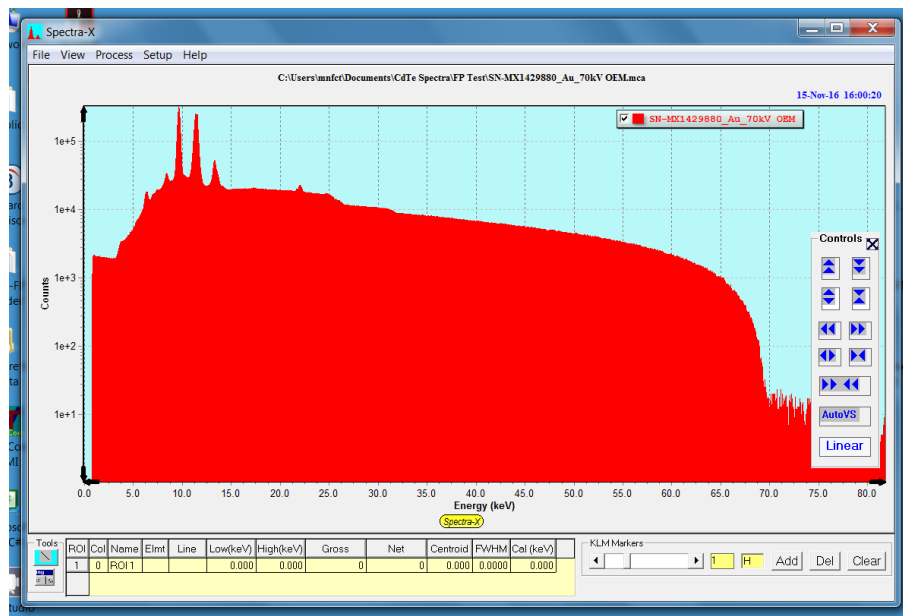
Raw spectrum after it has been read into XRS-FP, on a log scale. There are two steps visible at the Cd and Te K edges.
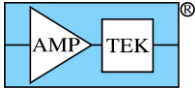
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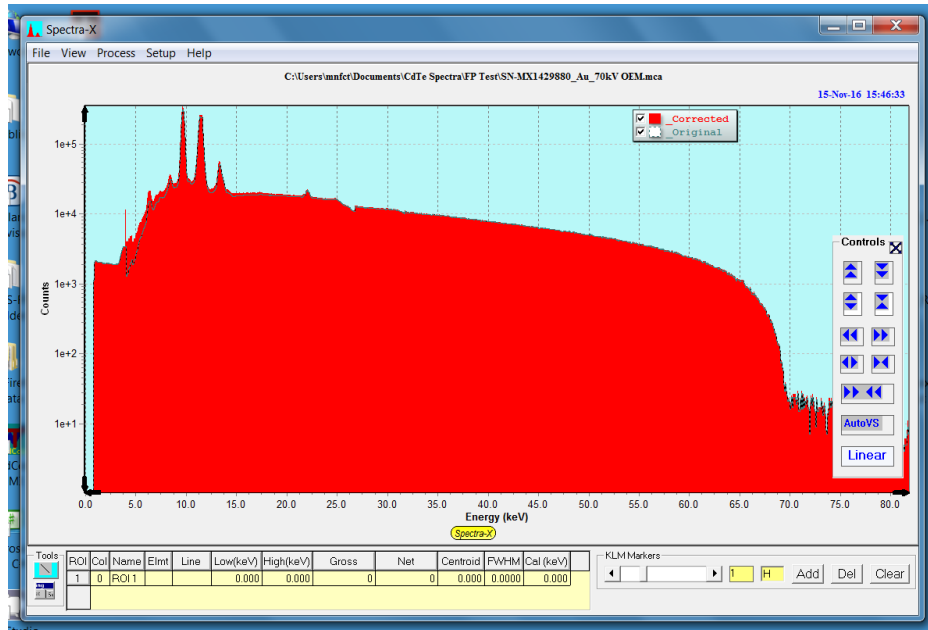2. Go to Process and Select "Escape Peaks".

Result of escape peak correction. The filled red spectrum shows the correction result, while the black trace shows the correction.

3. Go to Process and Select "Efficiency Correction".
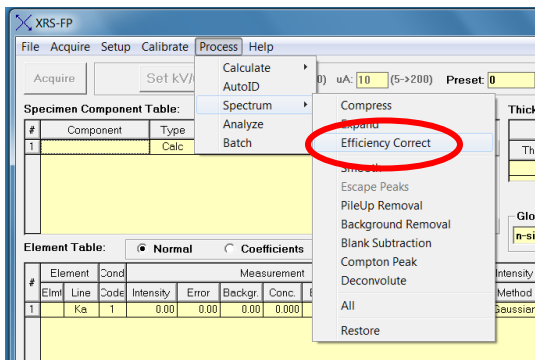
Result of efficiency correction. In this case, where the maximum energy is 70 keV, the detector is almost 100% efficiency so there is little correction.

4. Go to File, Save As, and save this as a .MCA file. It can now be opened in DPPMCA.