

SpectrumViewer

Quick Start Guide

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Background

- Originally created as a tool for distribution to analysts associated with the NNSA Megaports Initiative, and others without access to the LANL PeakEasy code.
- Subsequently extended with additional capabilities and tools
 - Read and write more spectral formats
 - Ability to display and edit more header information
 - Display and compare data by energy or channels
 - Spectral manipulation tools
 - Spectral smoothing
 - Multiply spectral data by a constant
 - Smear spectral resolution
 - Gain shift
 - Correct spectrum for NaI intrinsic nonlinearity
 - ...

Basic operations and controls

- How to open a spectrum...
 - The primary spectrum
 - This is the spectrum that you want to learn more about.
 - A background spectrum
 - This is a system background spectrum preferably acquired for at least one hour in the same vicinity as the primary spectrum when only naturally occurring radioactive materials (NORM) is present.
 - A reference spectrum
 - This is a spectrum of a known suspect material.

Opening the primary spectrum

The screenshot shows the Spectrum Viewer application window. The 'File' menu is circled in red. A red arrow points from the 'File' menu to the 'Drop Primary Spectrum Here' box in the Primary Spectrum section, which is also circled in red. Another red arrow points from the 'Drop Primary Spectrum Here' box to the plotting area. A third red arrow points from the 'Drop Primary Spectrum Here' box to the 'Drop Reference Spectrum Here' box. The plotting area is a semi-log graph with 'Counts' on the y-axis (0.1 to 100) and 'Energy (keV)' on the x-axis (0 to 3000). The status bar at the bottom shows acquisition details: Acquisition Date: 21/12/2012 @ 06:06:06, Live Time (s): 0.00, Real Time (s): 0.00, DeadTime: 00.0 %, Channels: 65536, Offset Multiplier: 1.0000.

File Edit Background Spectrum Reference Spectrum Graph Options Help

Scale: Semi-Log Linear Grid: None Coarse Fine Drag: Rubber Band Zoom Vertical and Horizontal

Primary Spectrum

Drop Primary Spectrum Here

Primary Spectrum #

< 1 of 1 >

Background Spectrum

Drop Background Spectrum Here

Clear Background Spectrum

Reference Spectrum

Drop Reference Spectrum Here

Clear Reference Spectrum

Isotope Lines

Show Lines

No Source Selected

Calibration Lines

Show Lines

No Source Selected

Zero (keV) keV/Channel

0.0 1.0

Zero Offset

Gain Adjust

Counts

Energy (keV)

Sample ID Sample_ID

Offset Multiplier 1.0000

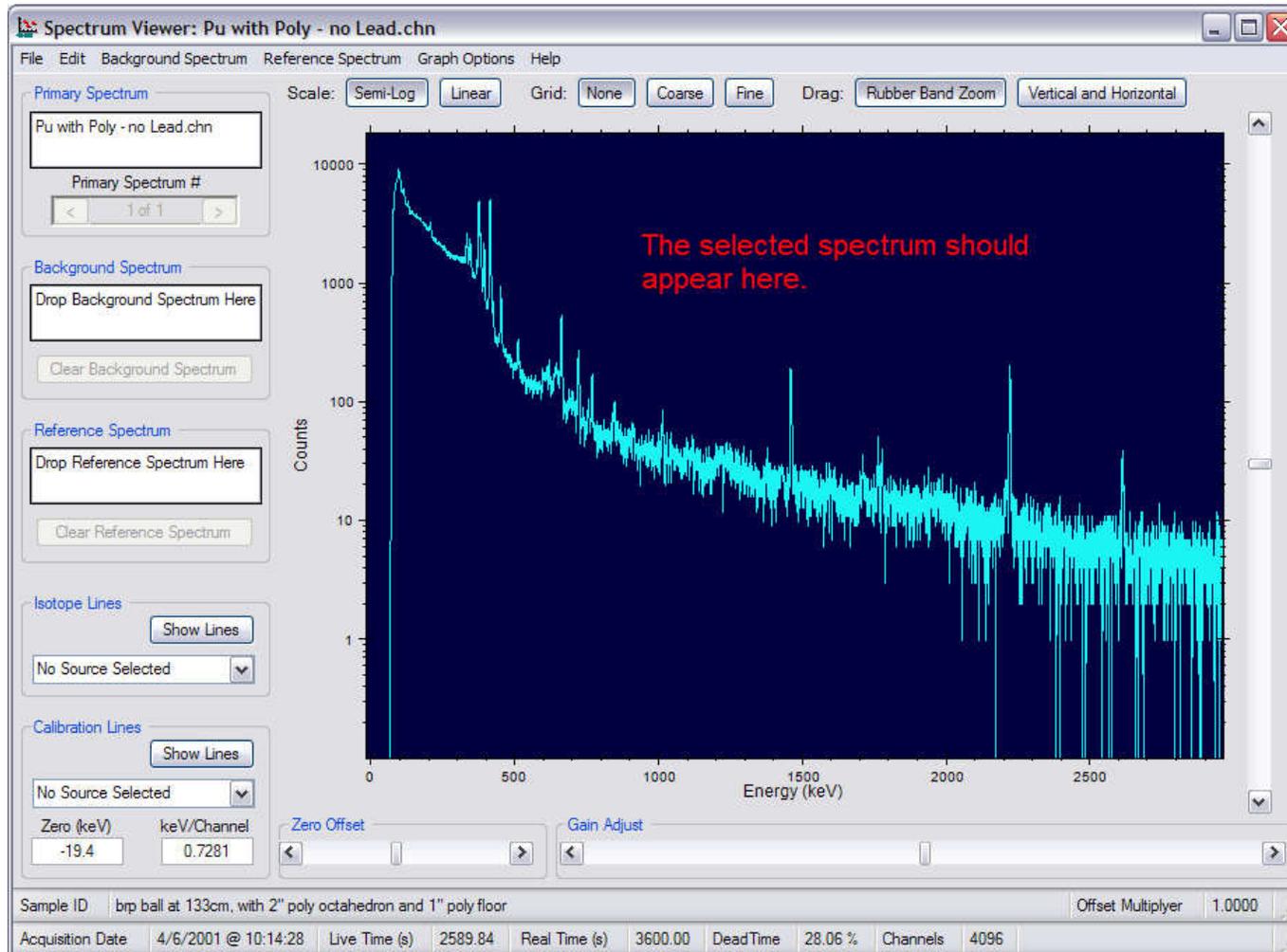
Acquisition Date 21/12/2012 @ 06:06:06 Live Time (s) 0.00 Real Time (s) 0.00 DeadTime 00.0 % Channels 65536

The spectrum to be viewed may be selected from the File-Open Spectrum... menu item.

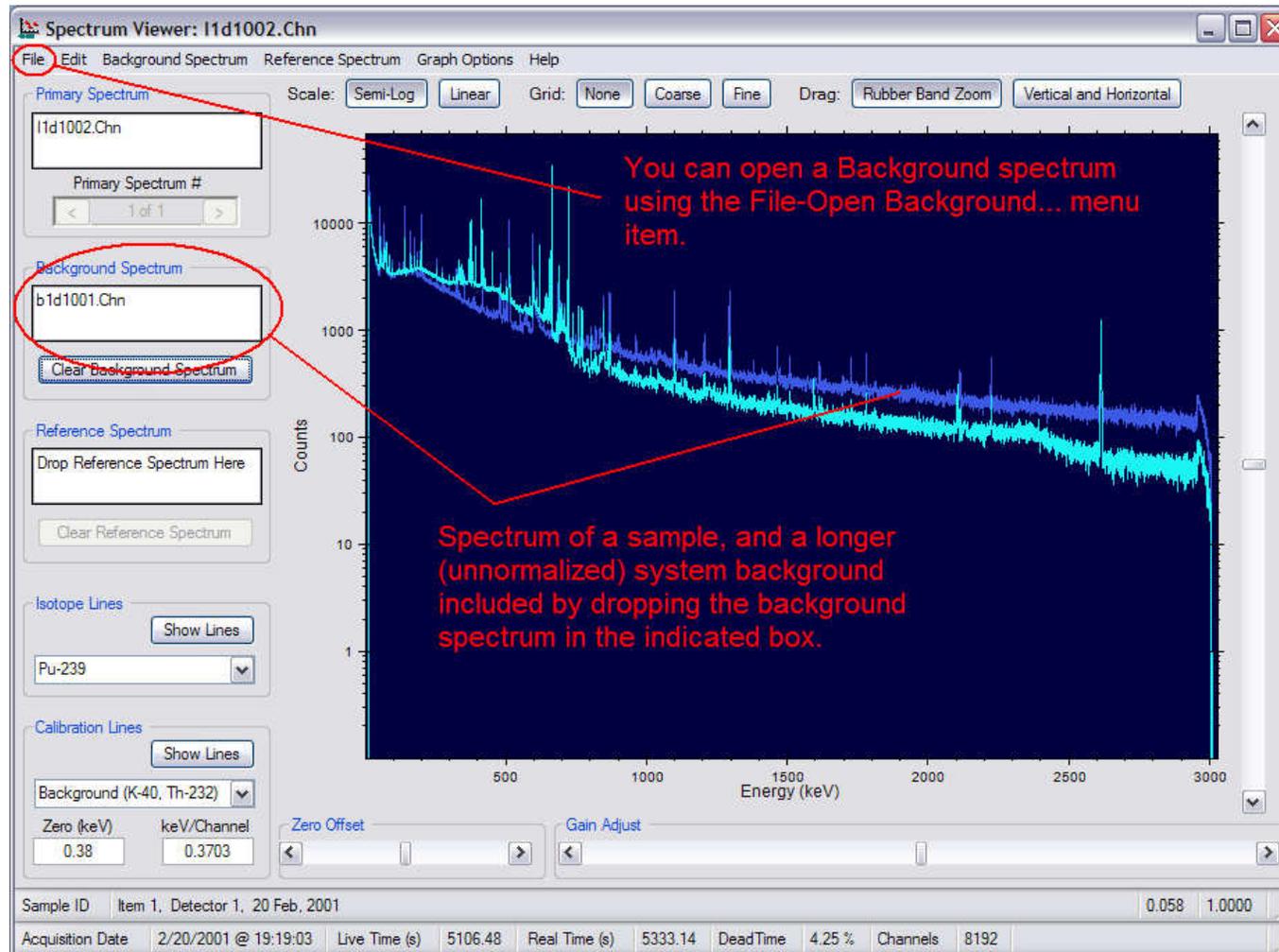
You may also "Drag and drop" the selected spectrum into the indicated box.

You may also Drag and drop" the selected spectrum directly into the plotting area. Note: this method only works for the primary spectrum.

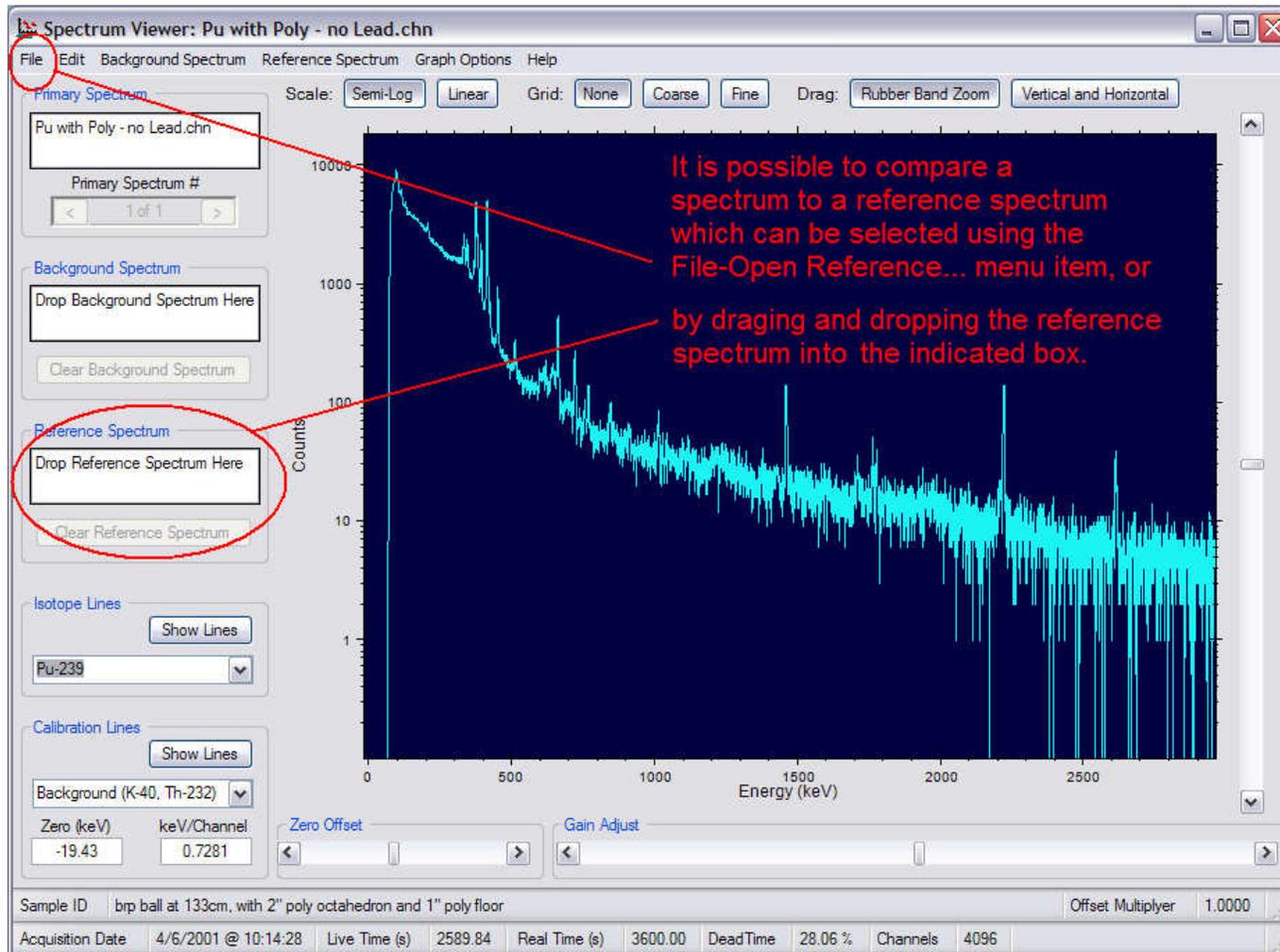
A plot of the primary spectrum



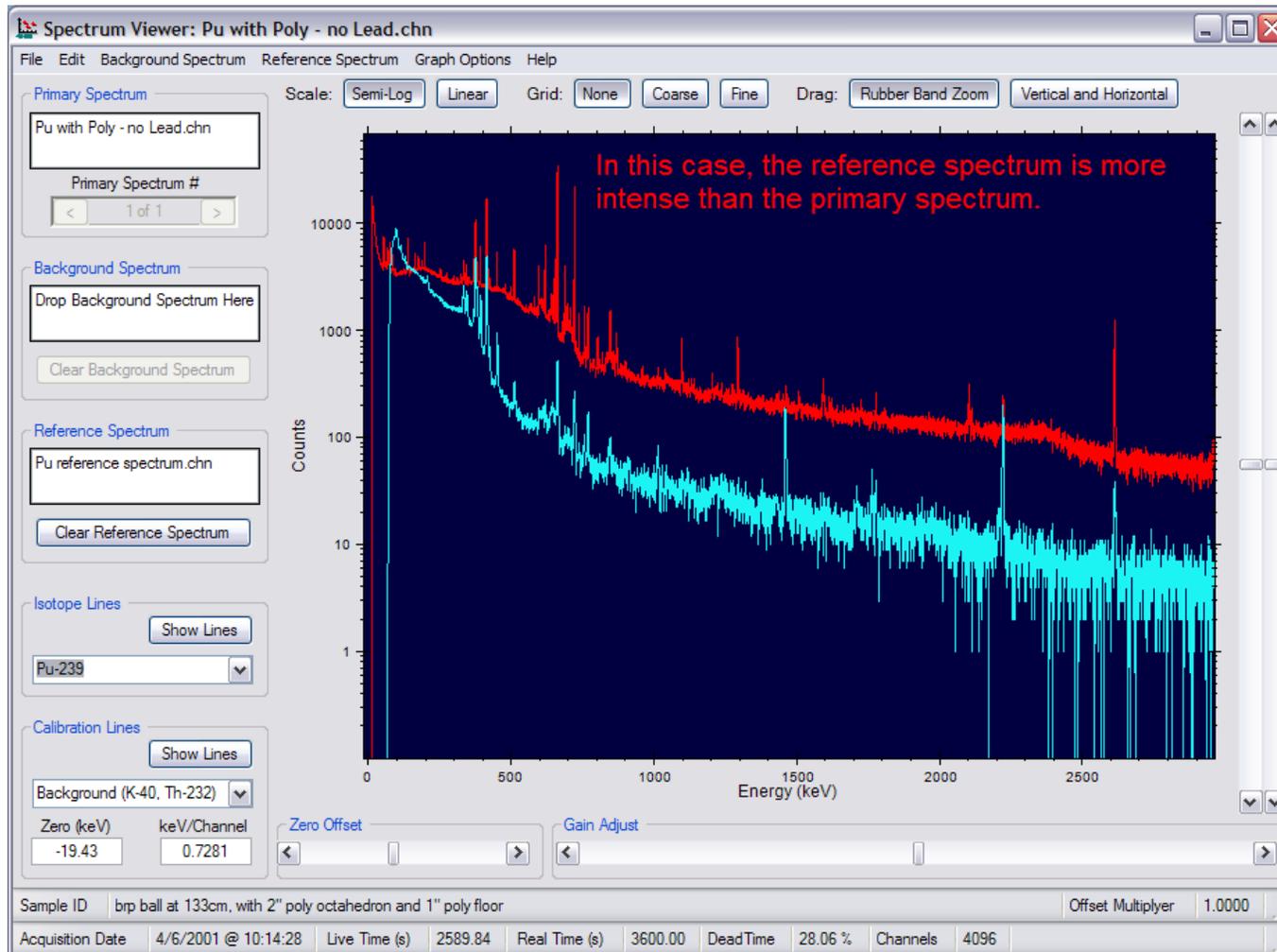
Opening a background spectrum



Opening a reference spectrum...



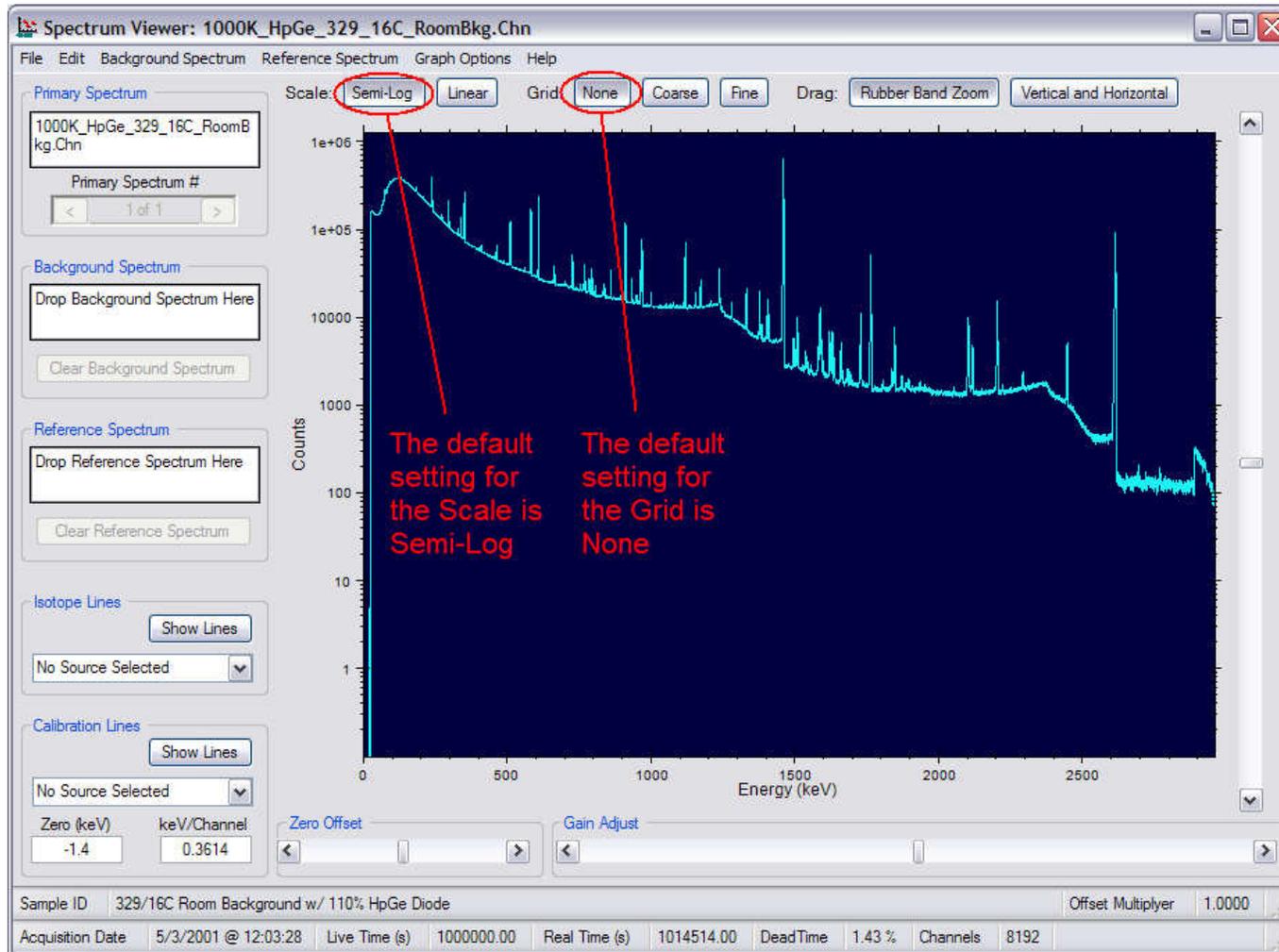
Opening a reference spectrum...



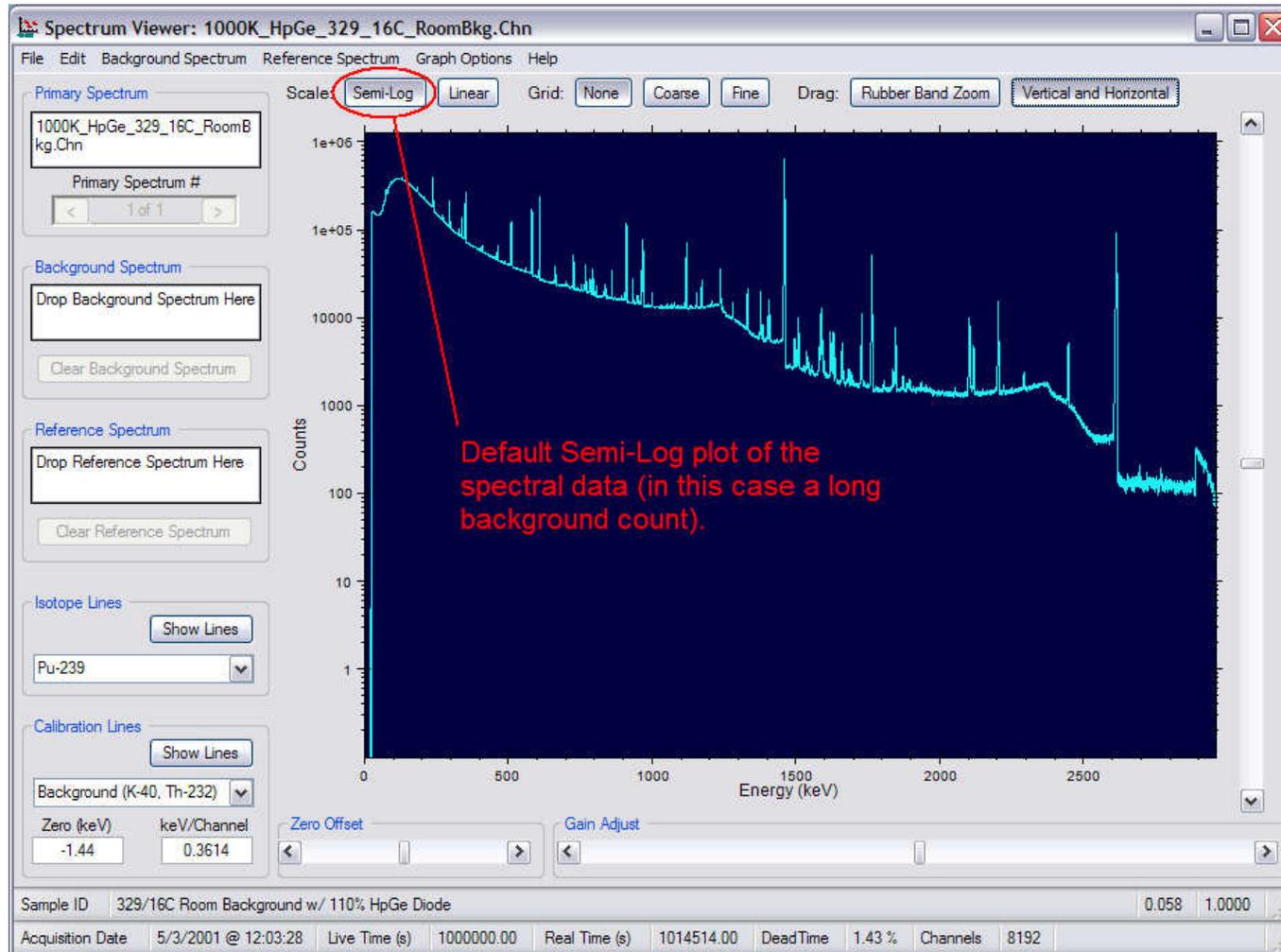
Basic controls

- Display Options
 - Display Mode (Scale)
 - Semi-Log (Default)
 - Linear
 - Grids
 - None
 - Coarse
 - Fine

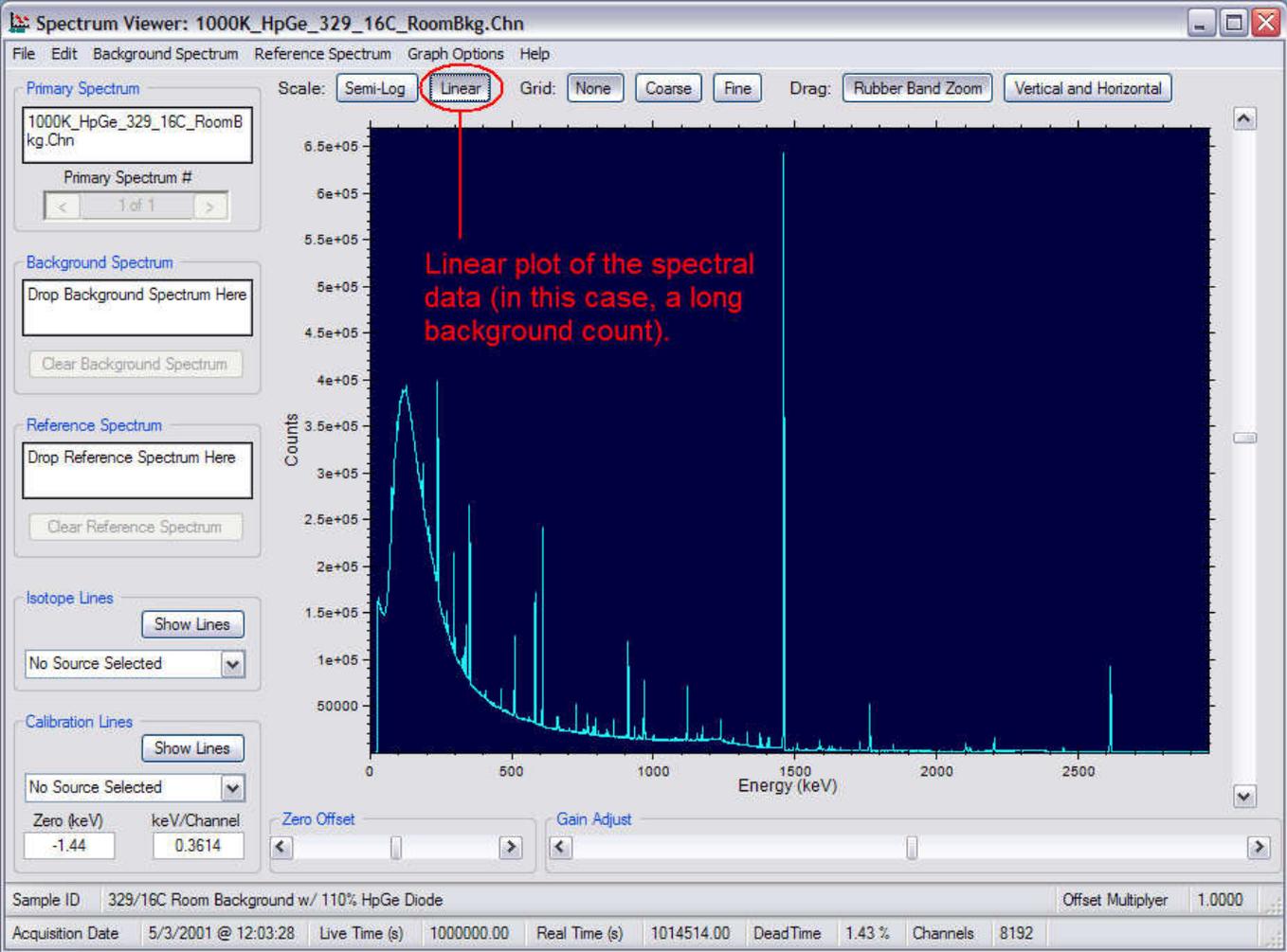
Default settings for the display options



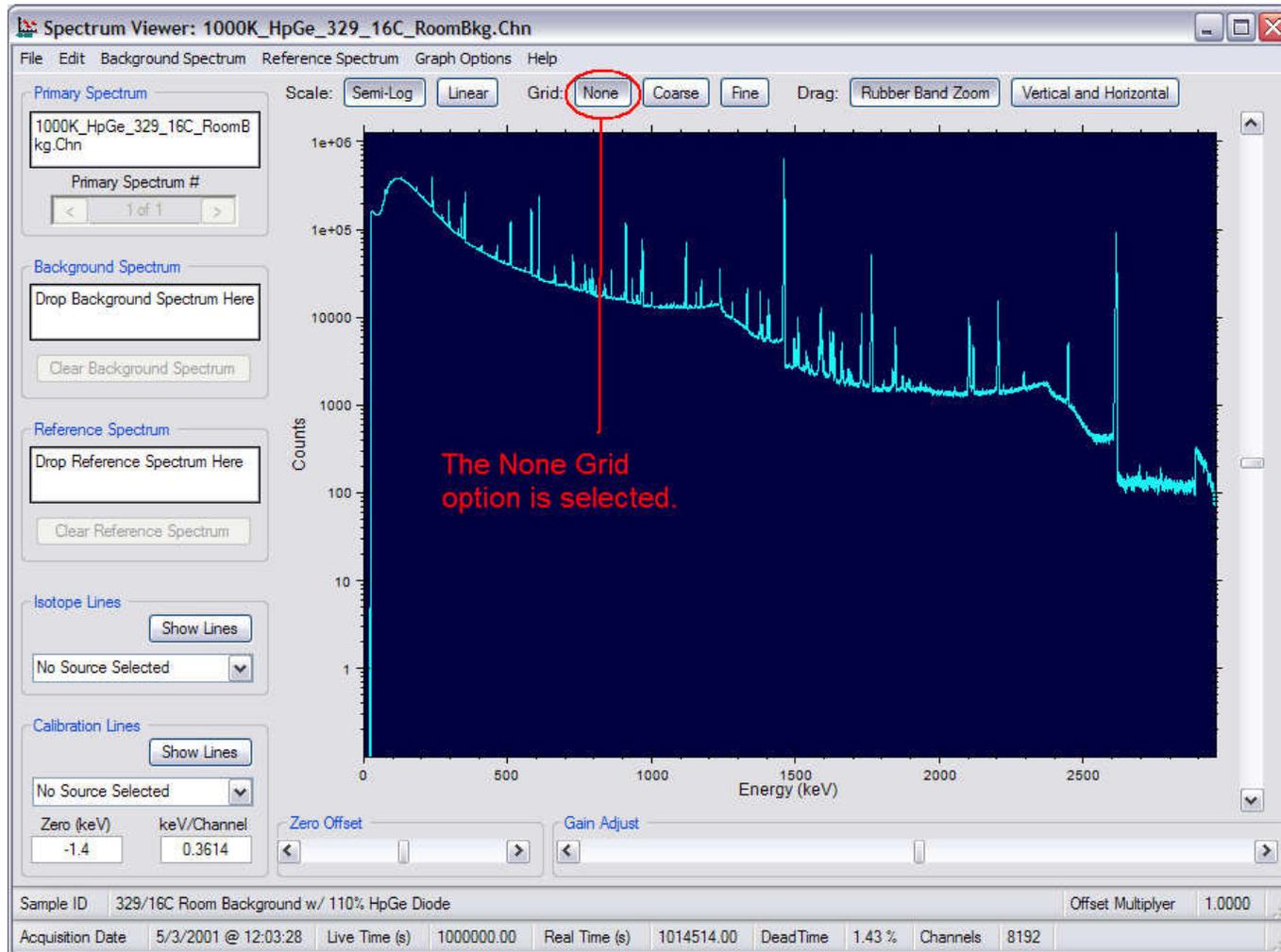
Spectral data plotted in Semi-Log mode



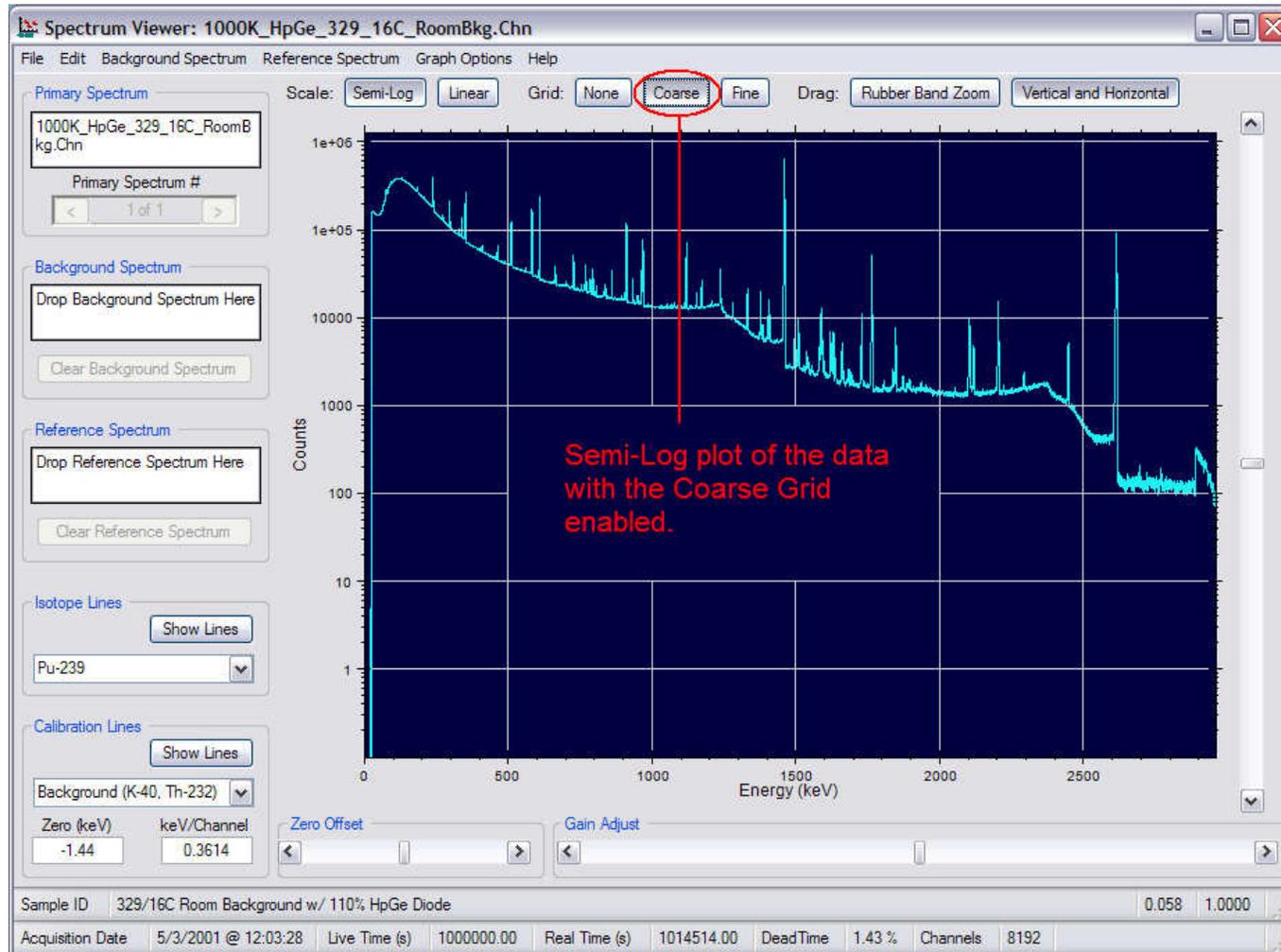
Spectral data plotted in Linear mode



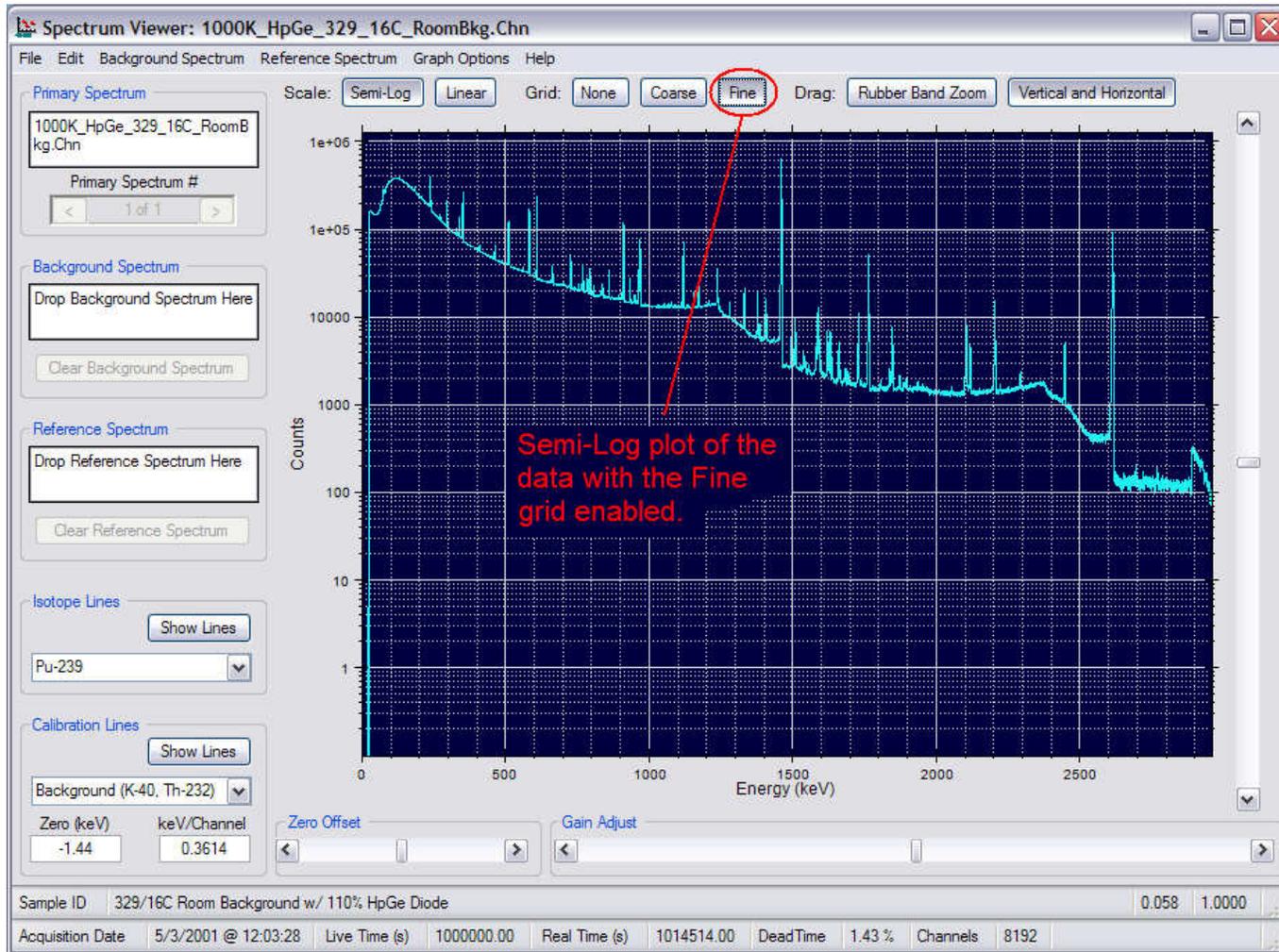
Plot with the None grid option selected



Plot with the Coarse grid option selected



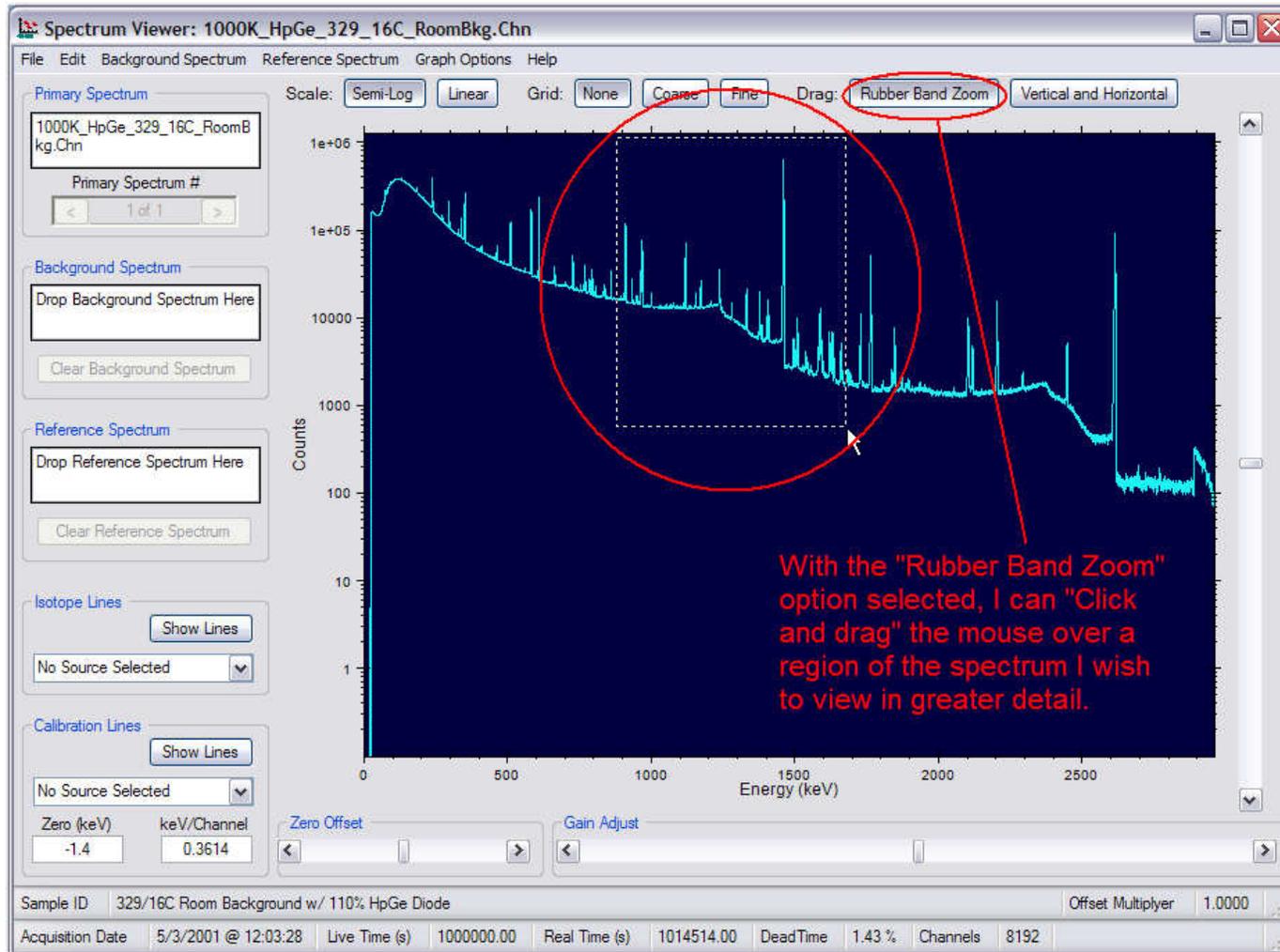
Plot with the Fine grid option selected



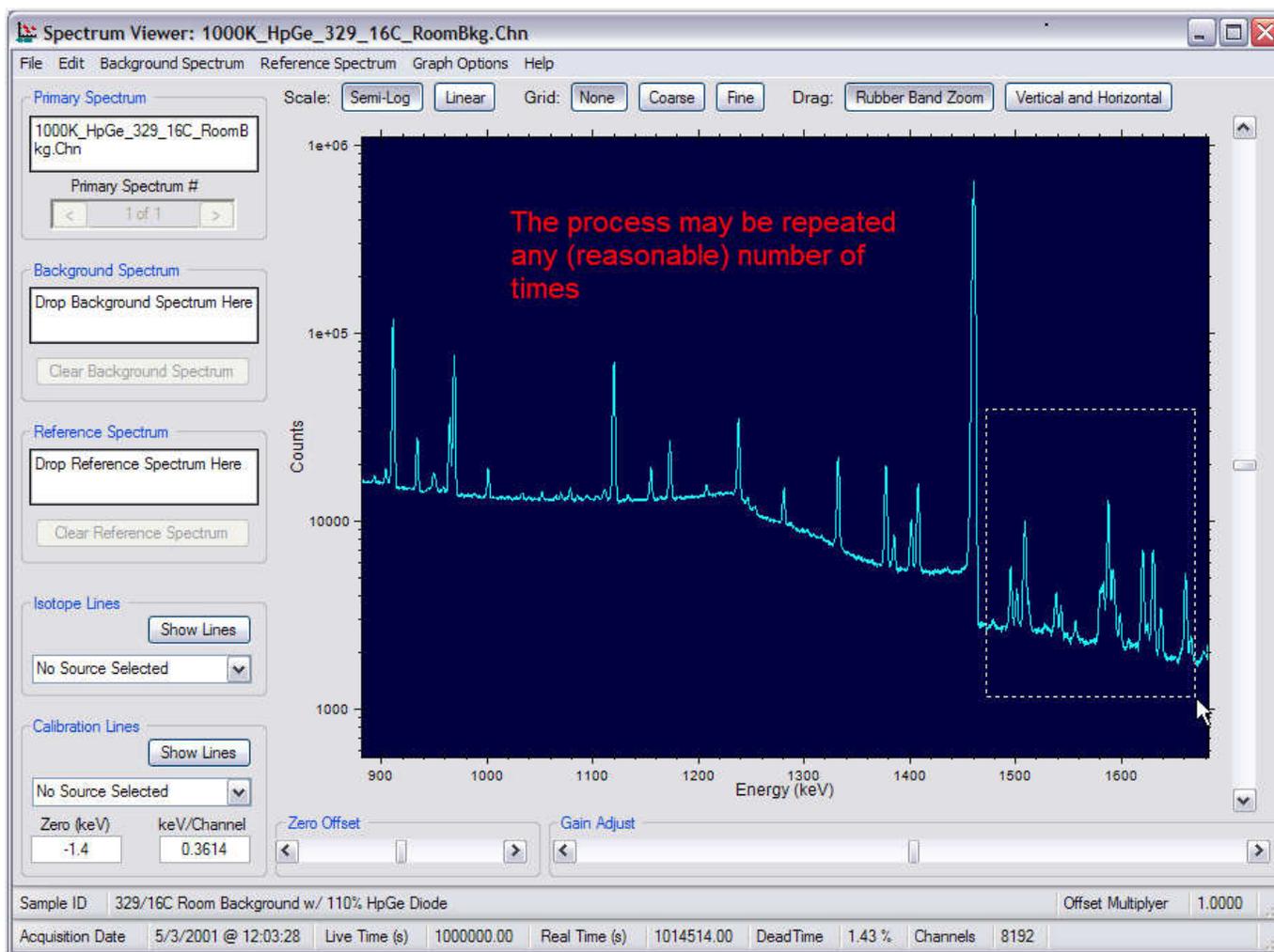
Basic controls

- Clicking and Dragging with the Mouse
 - “Zoom” --- Expanding a portion of the displayed spectrum
 - “Pan” --- Using the mouse to move around an expanded region to another portion of the spectrum It is like scanning a large page with a small magnifying glass.

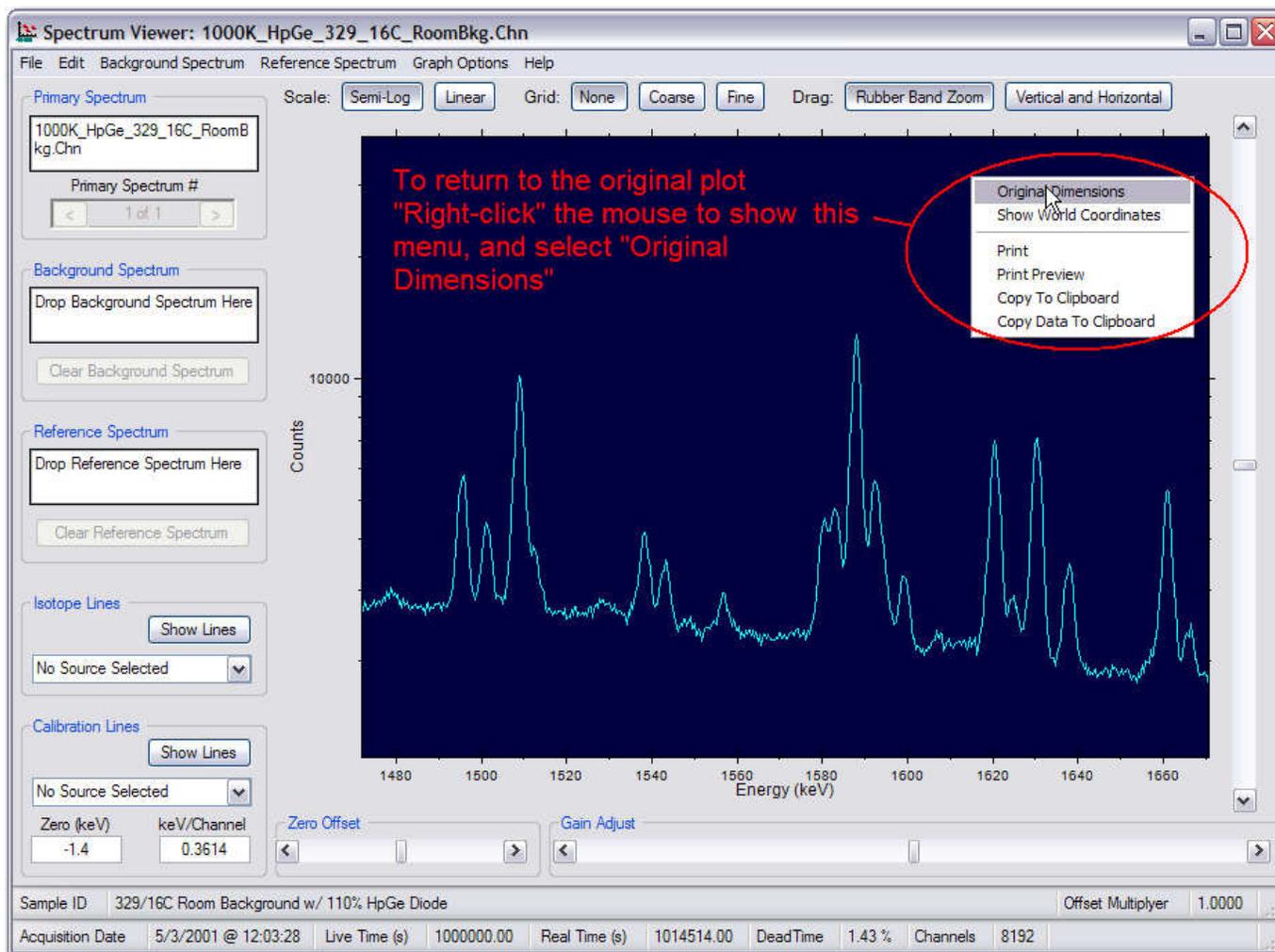
Rubber Band Zoom



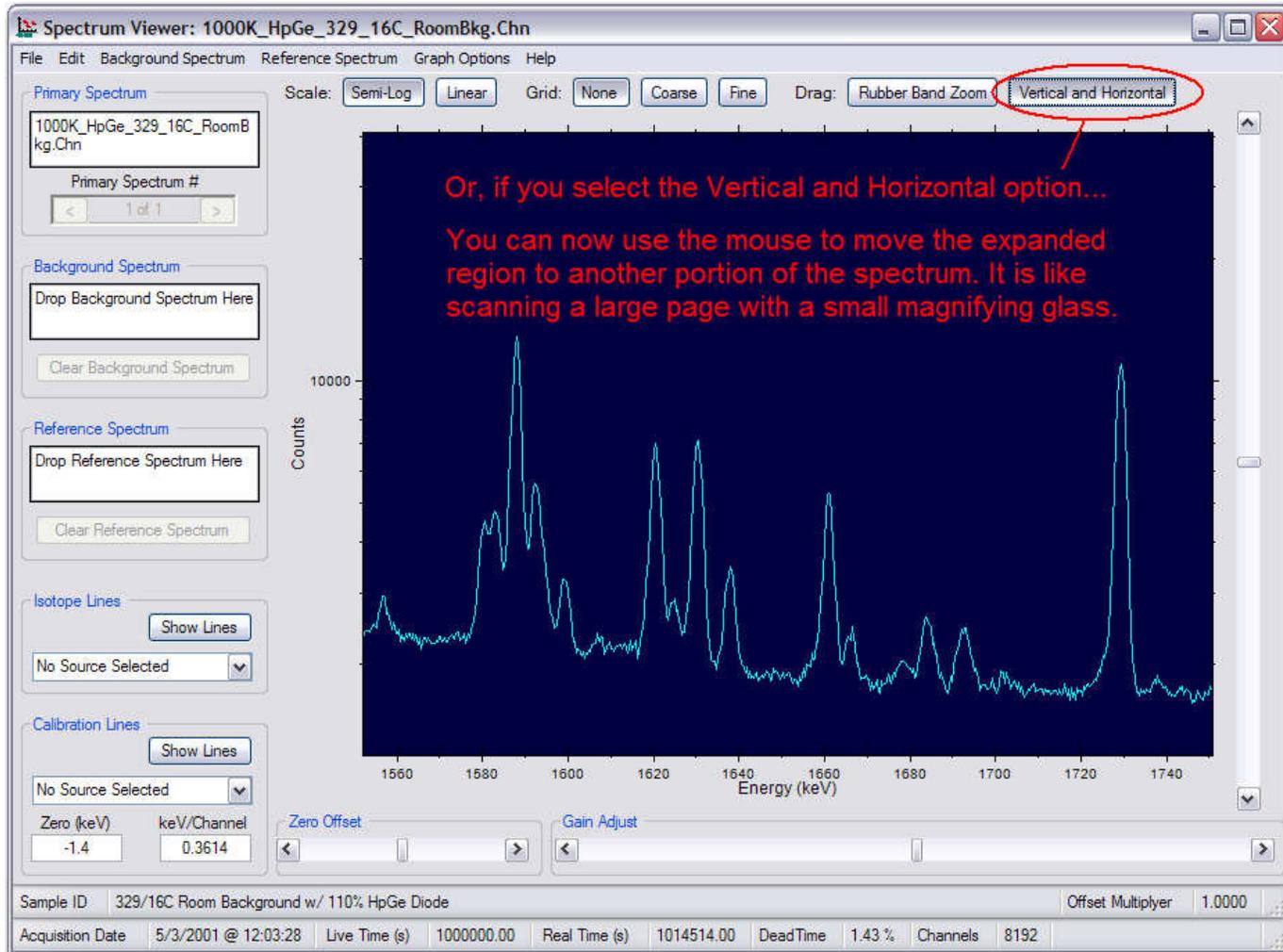
Rubber Band Zoom



Rubber Band Zoom



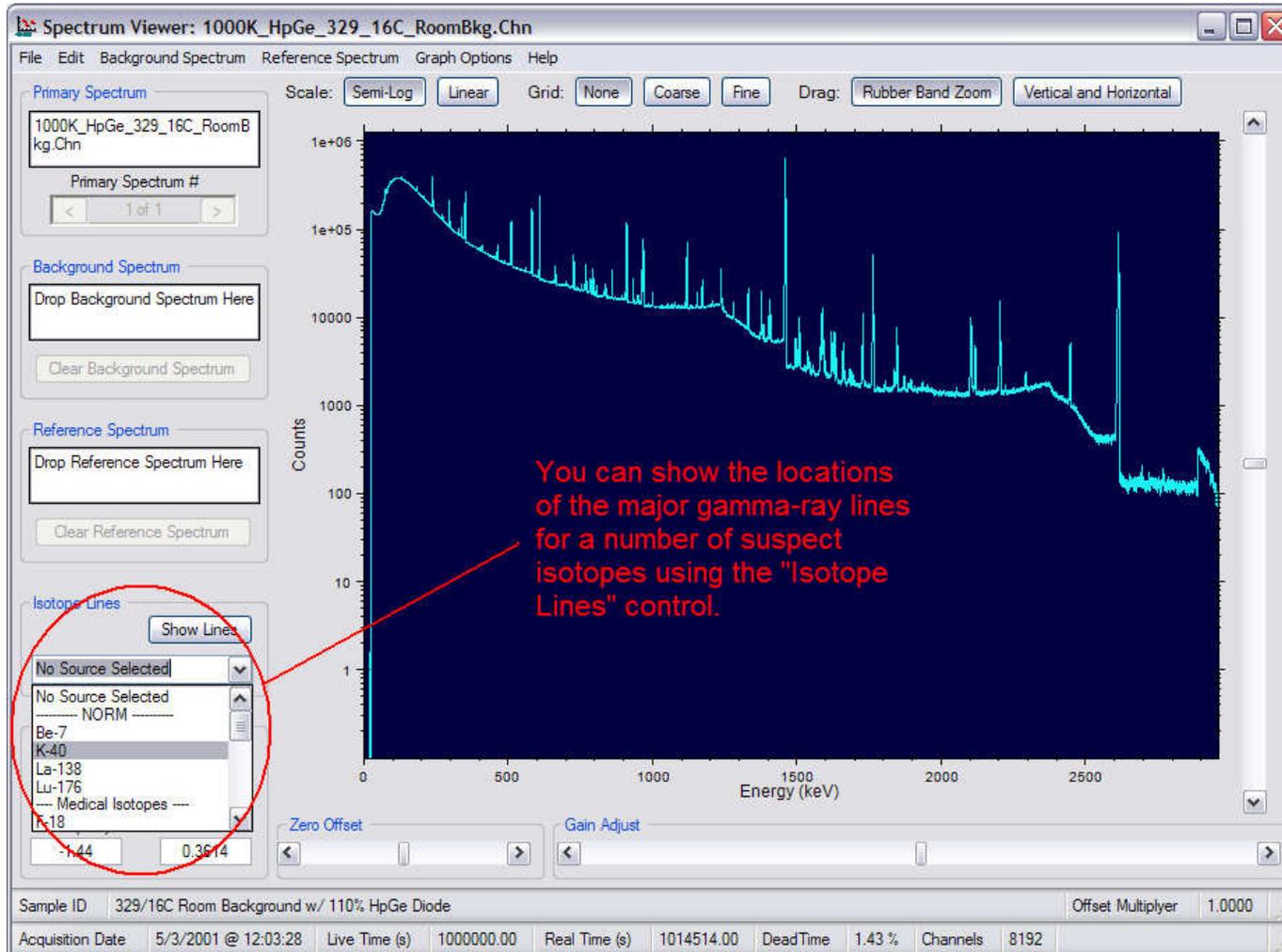
Vertical and Horizontal “Pan”



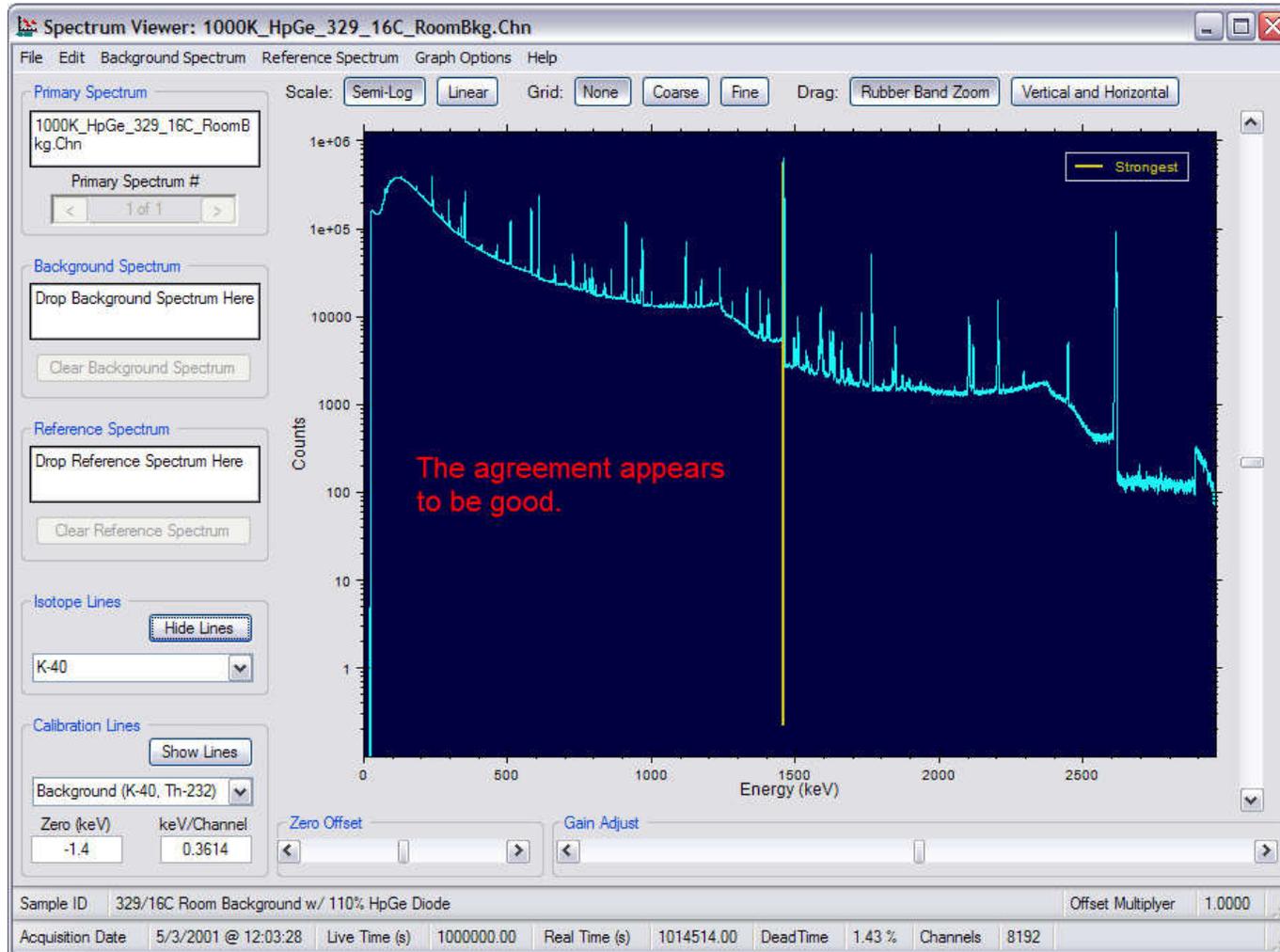
Known energy lines

- Isotope (suspect) lines
- Energy calibration lines

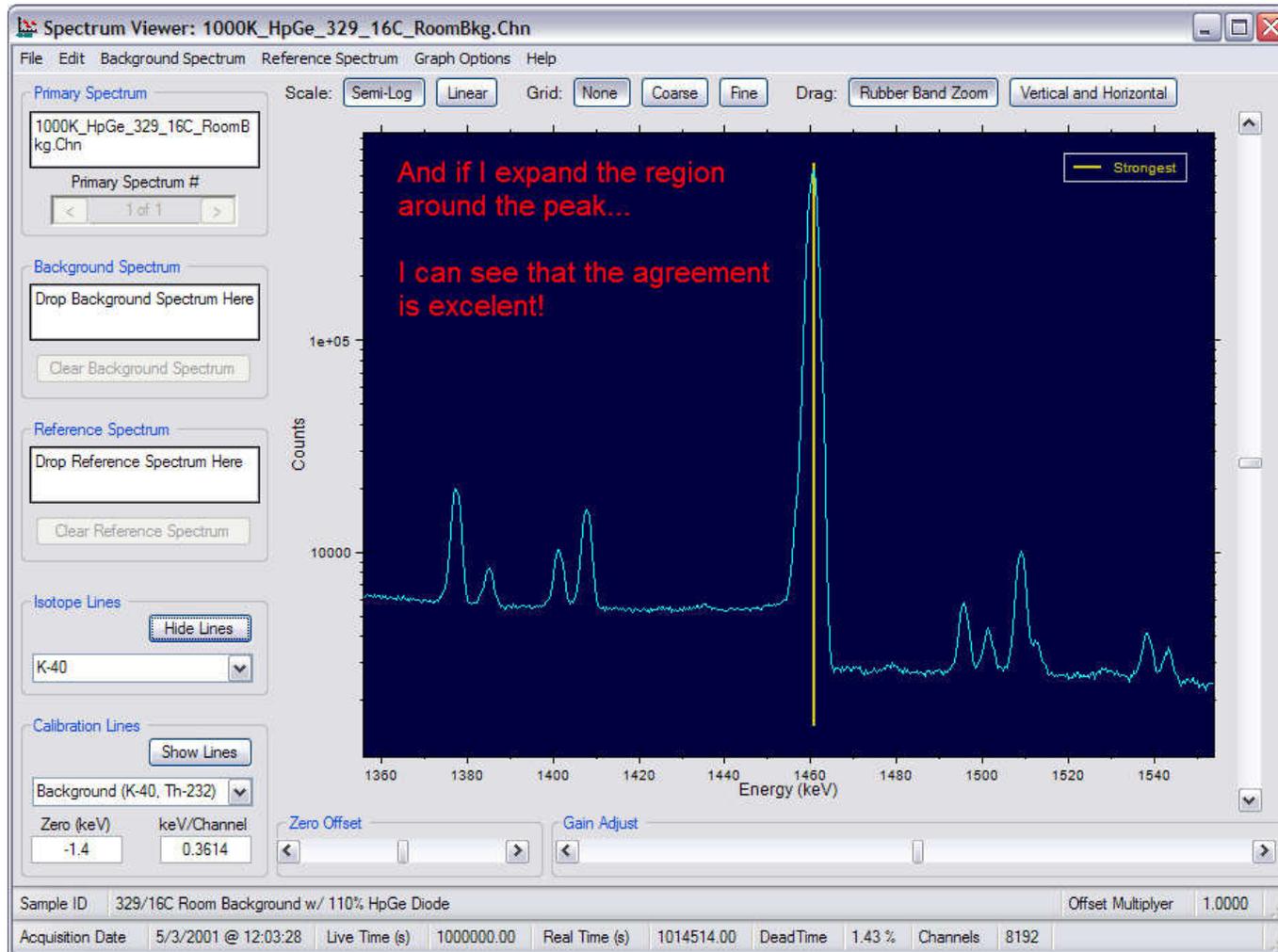
Isotope lines



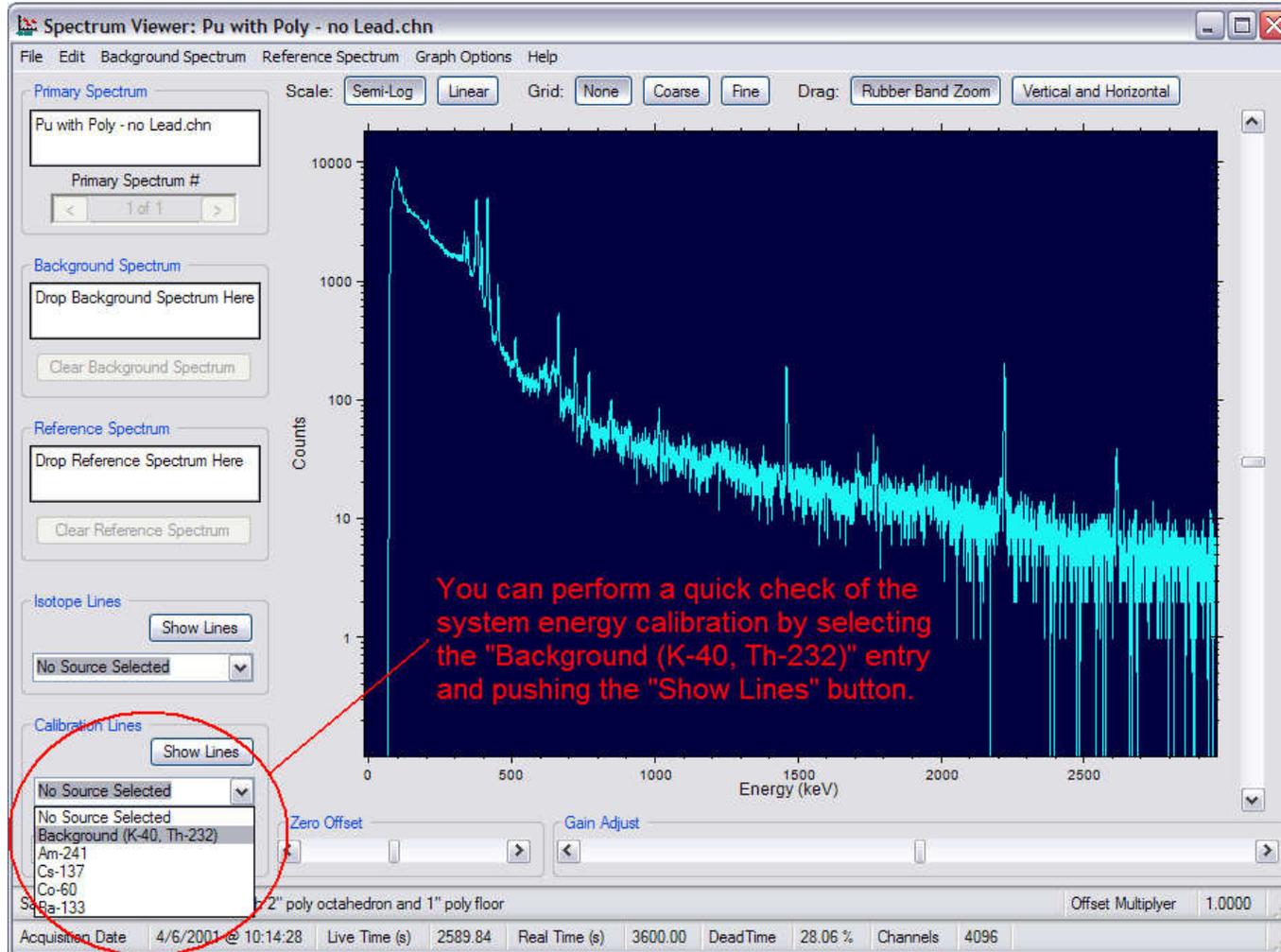
Isotope lines



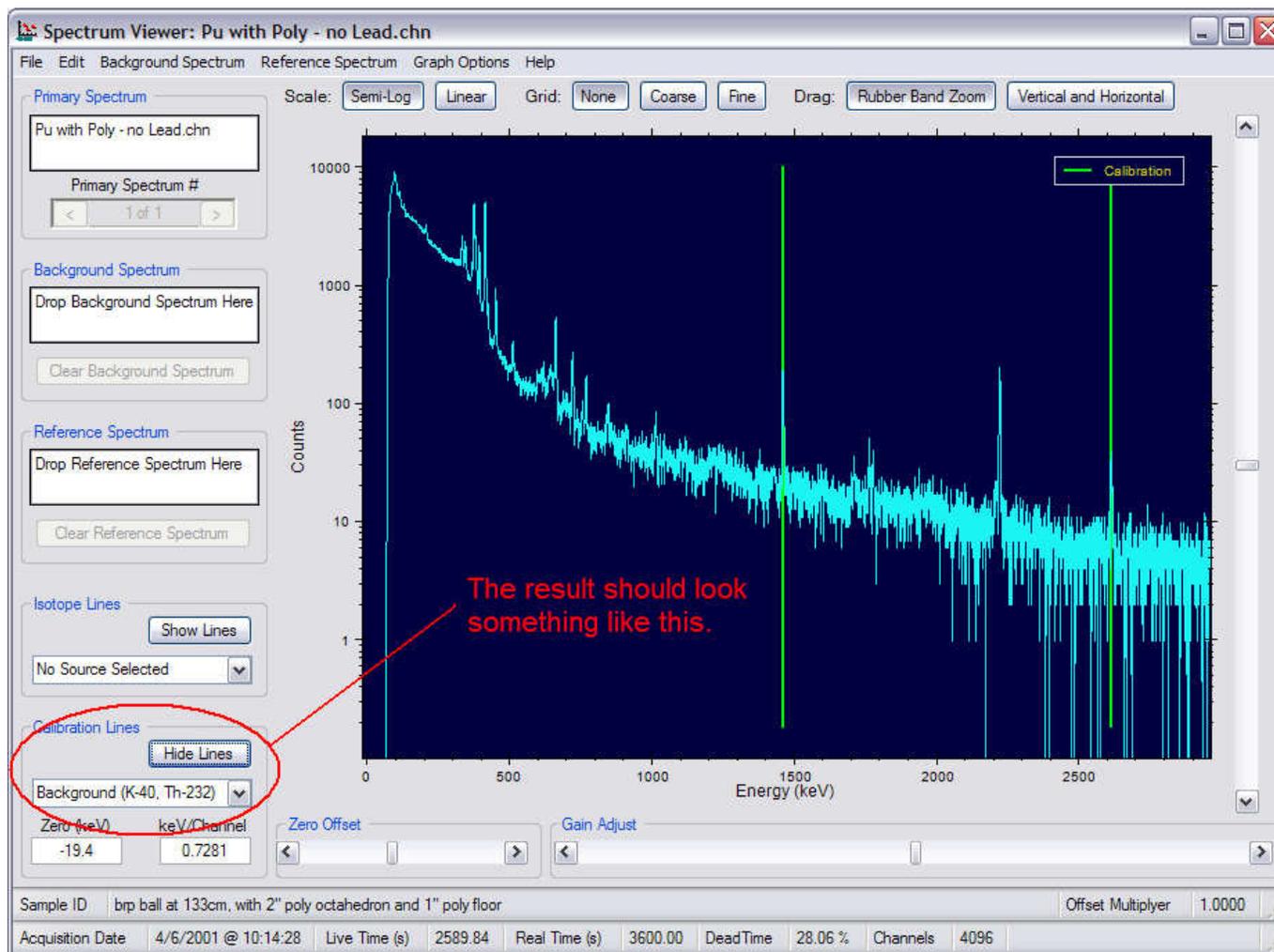
Isotope lines



Energy calibration check...



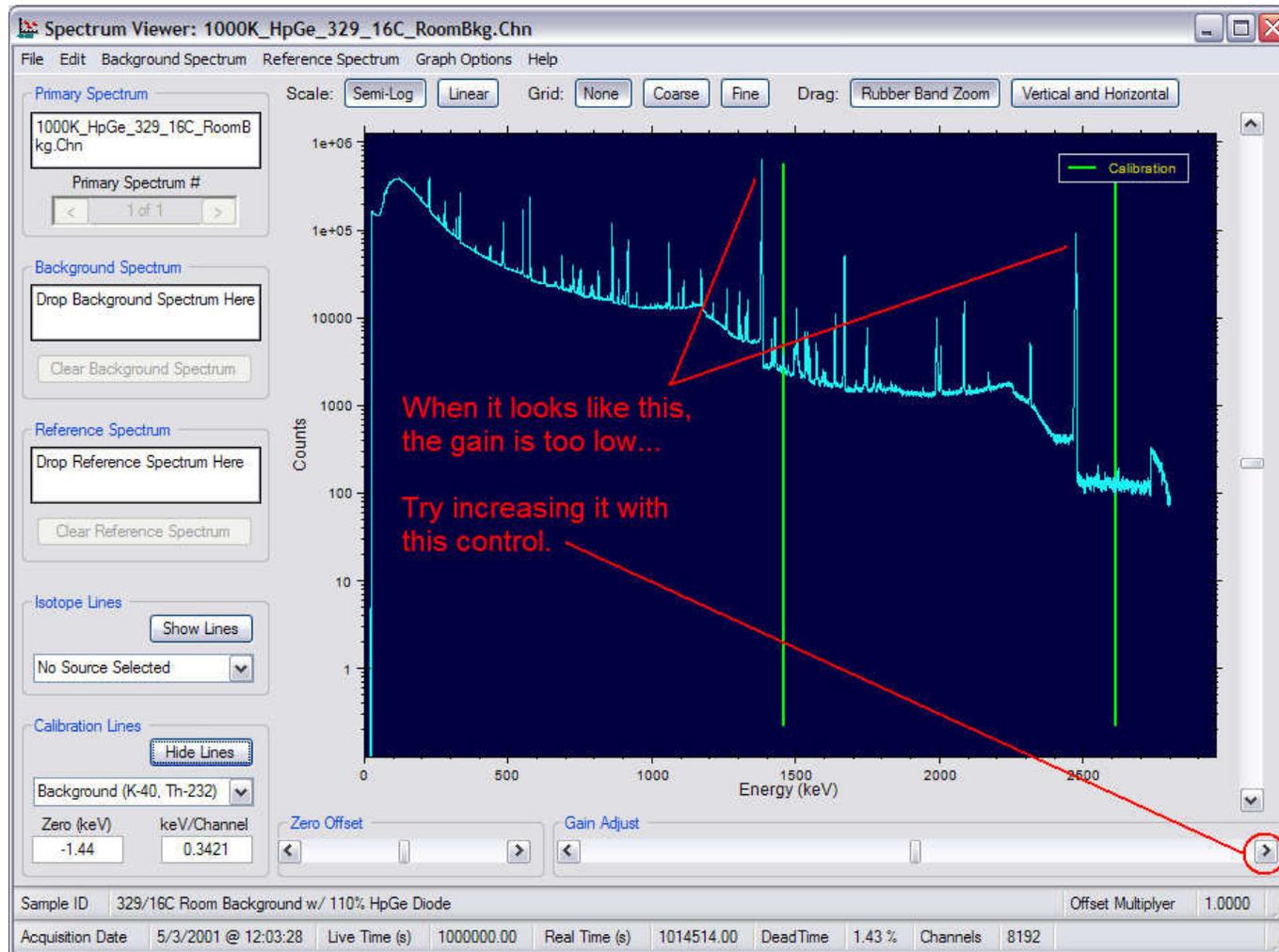
Energy calibration check...



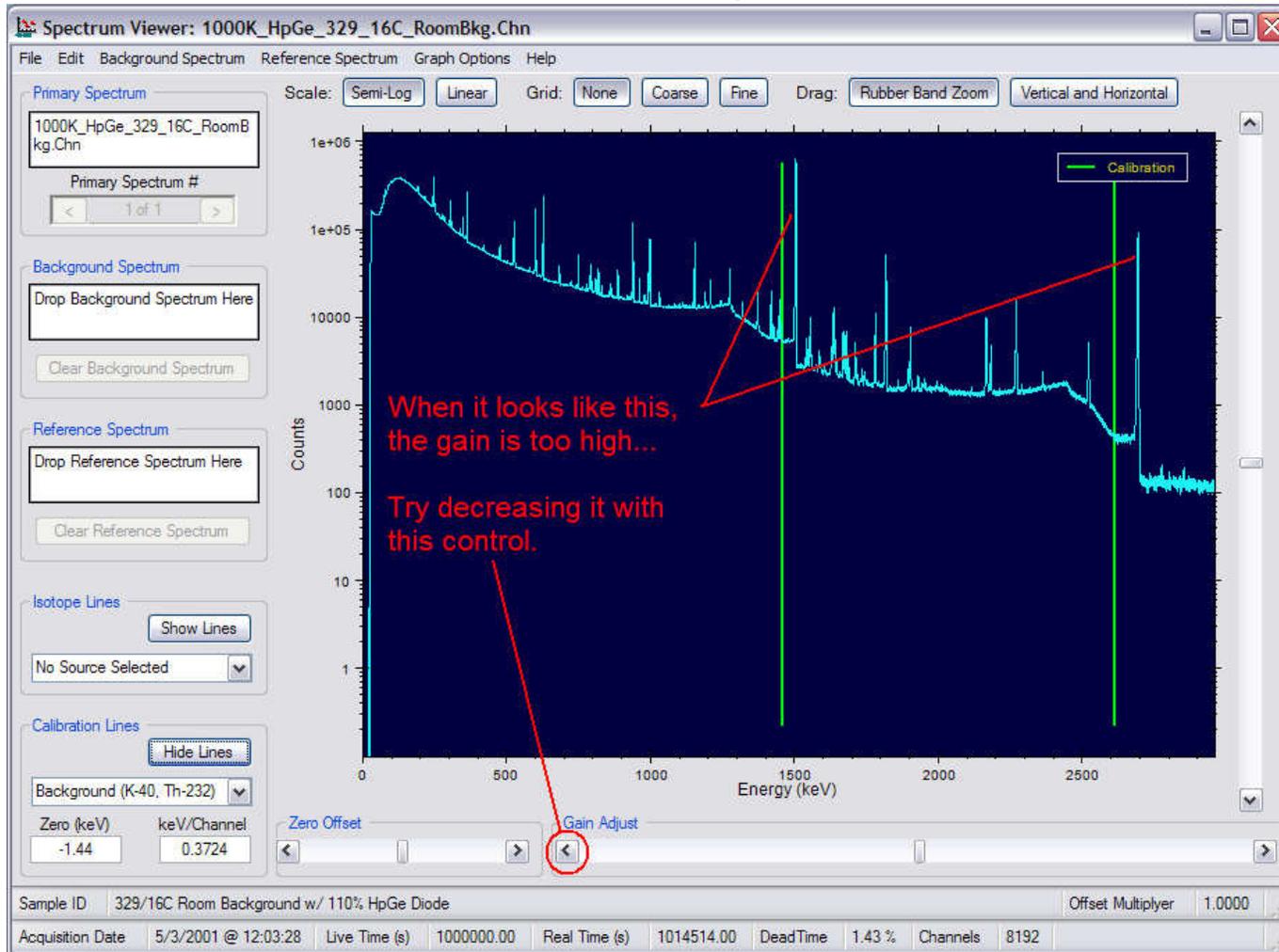
Energy calibration check...

- If there is not good agreement between the actual and expected locations of the calibration markers (green lines) and the associated peaks in the spectrum, this is a serious problem.
- The first priority is to have the instrument recalibrated.
- Then, there is the possibility that the spectrum has an incorrect energy calibration. Here, you really only have two options.
 - Acquire a new spectrum if at all possible.
 - Change the energy calibration in the existing spectrum.

Changing the energy calibration with the Gain Adjust controls



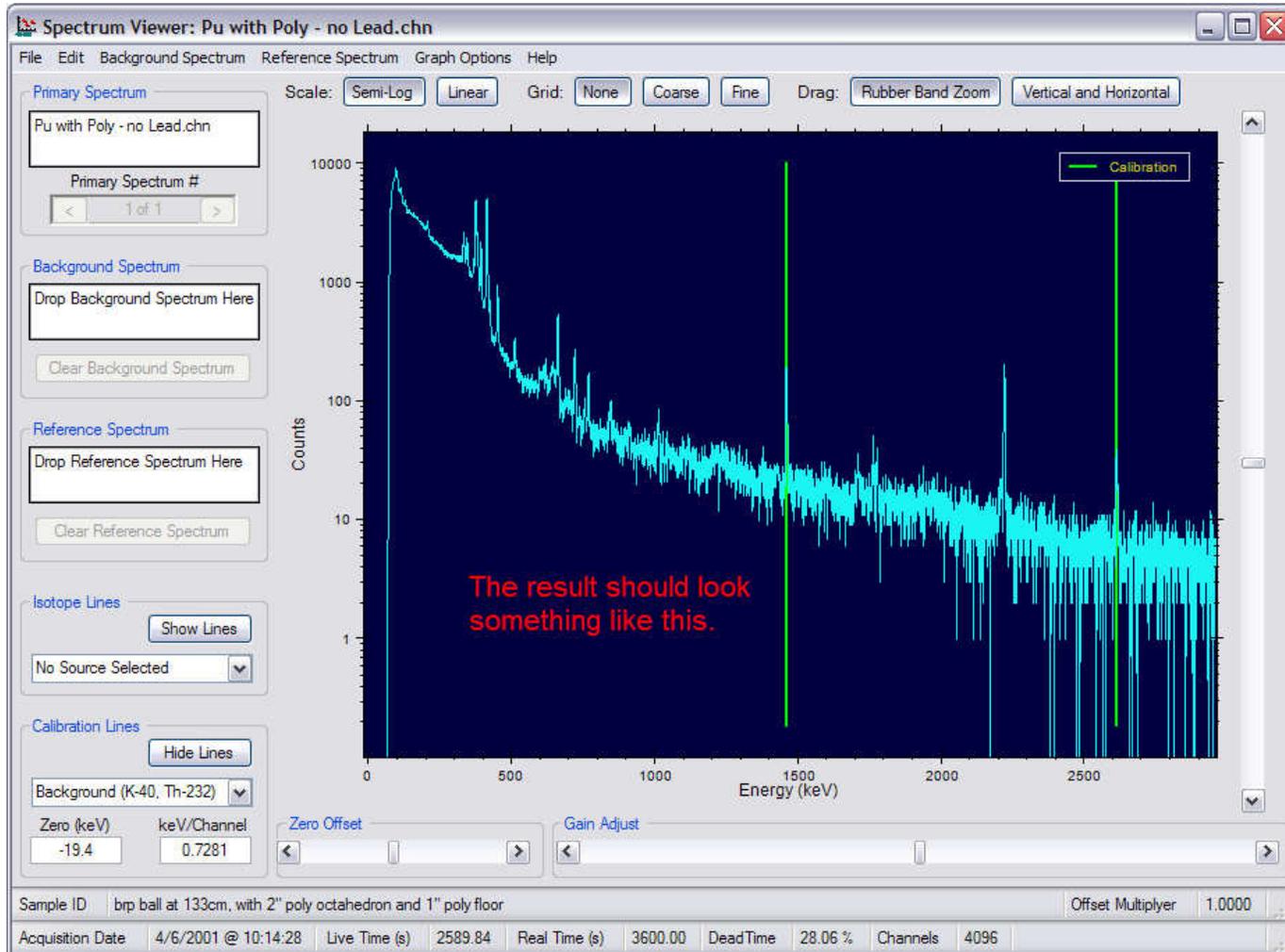
Changing the energy calibration with the Gain Adjust controls



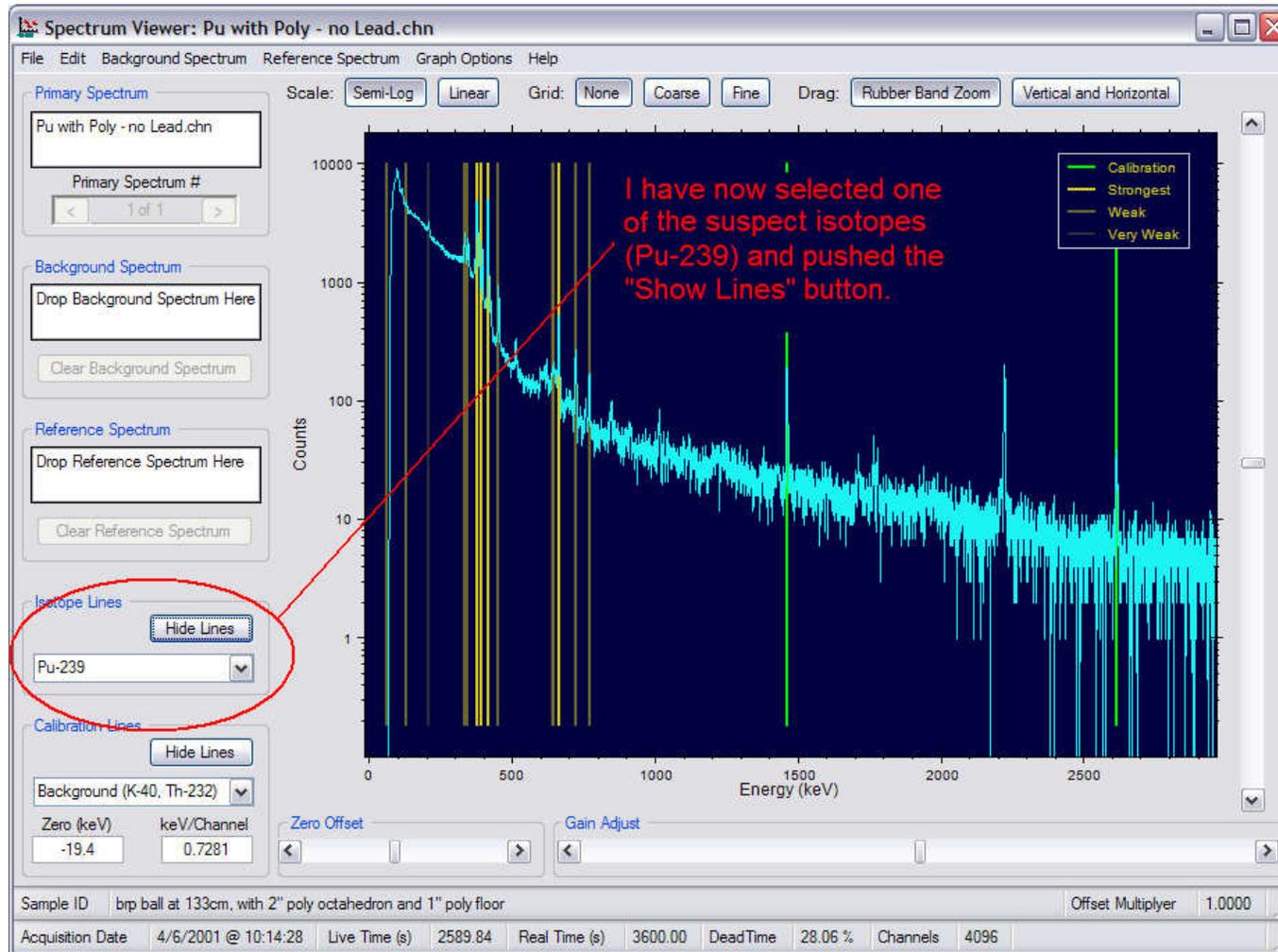
Analysis Methods

- First, a quick energy calibration check
- Comparison to known energy lines
- Comparison to a reference spectrum
- Comparison to a background spectrum

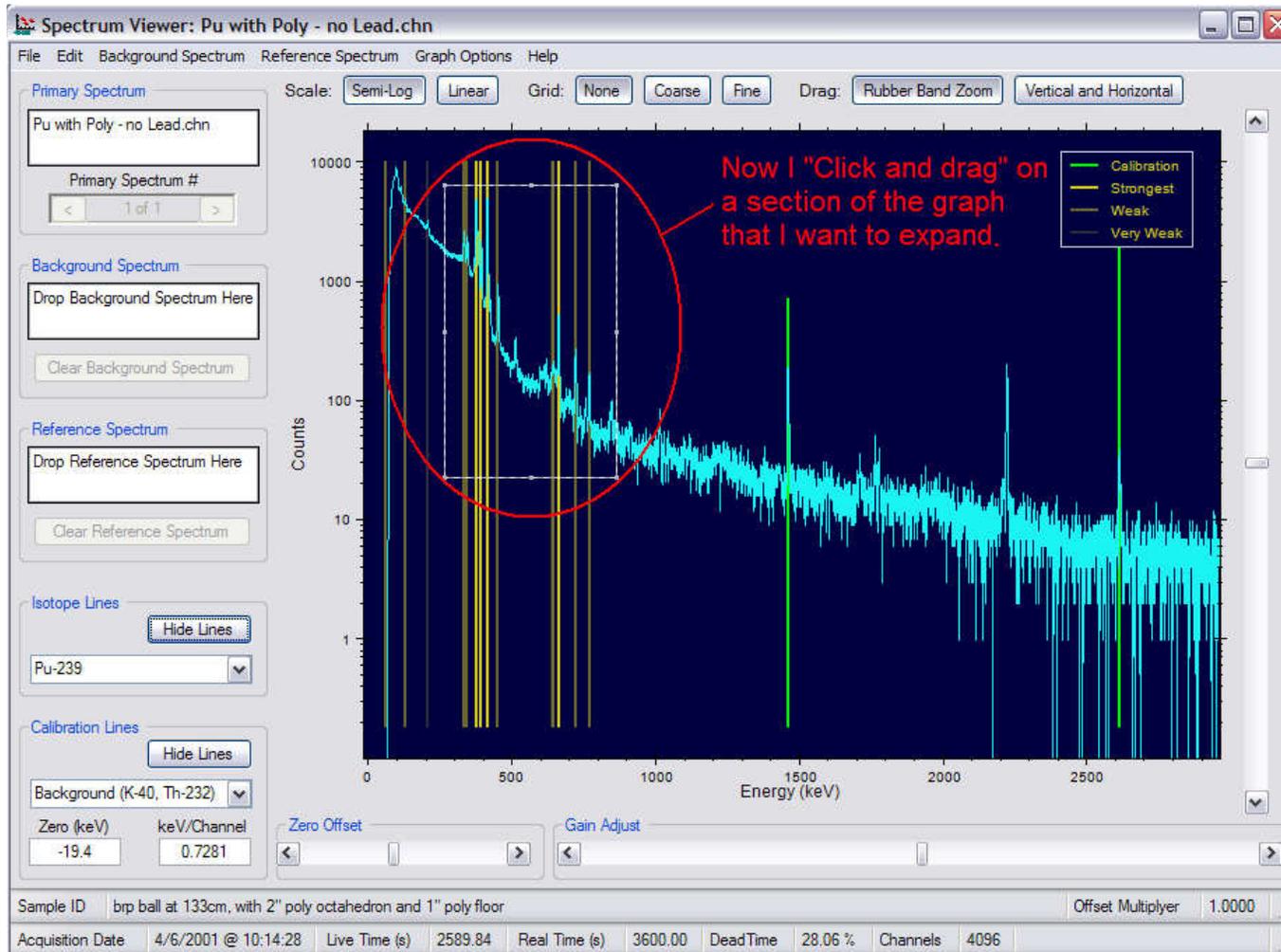
Quick energy calibration check



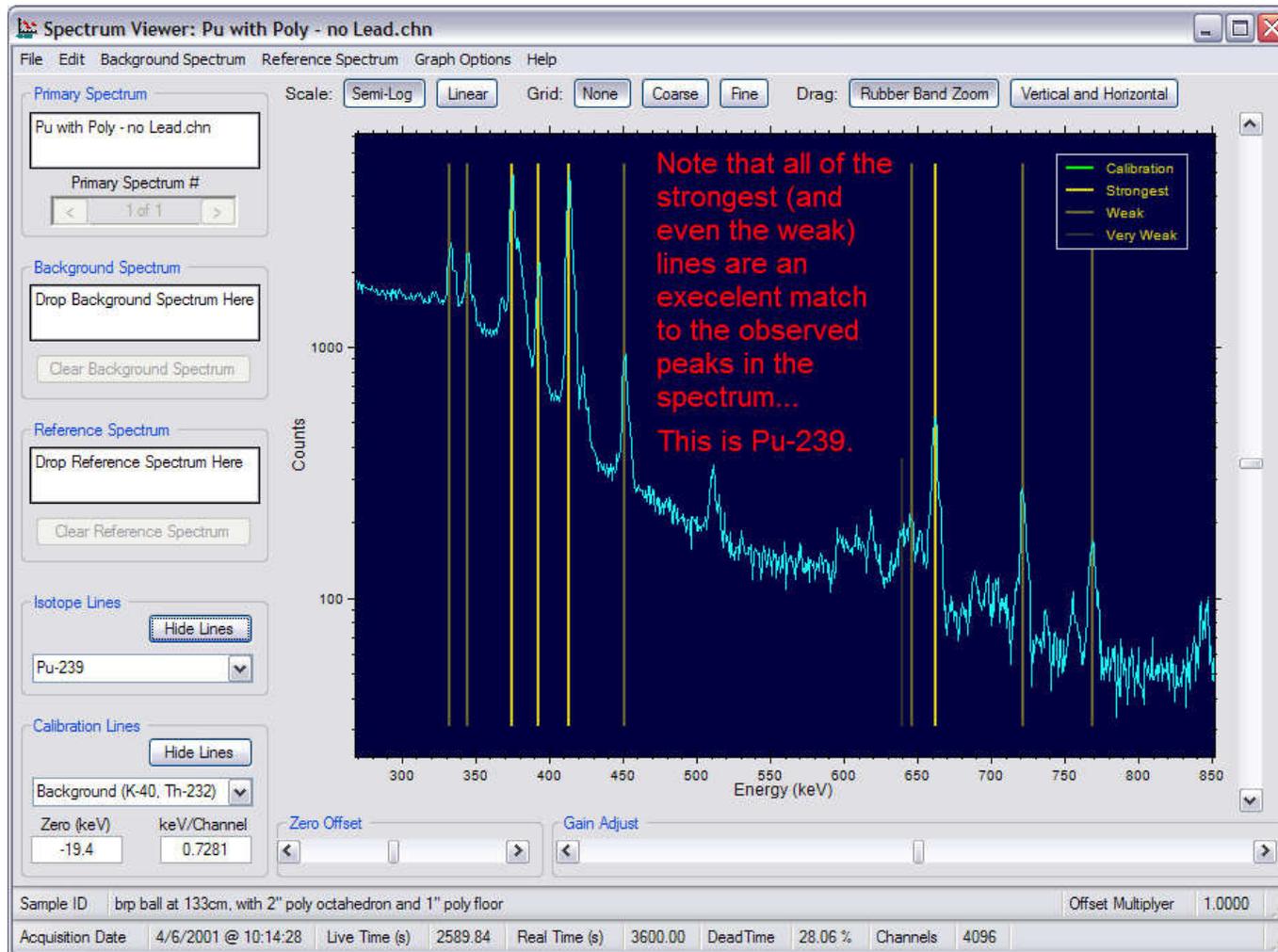
Comparison to known energy lines...



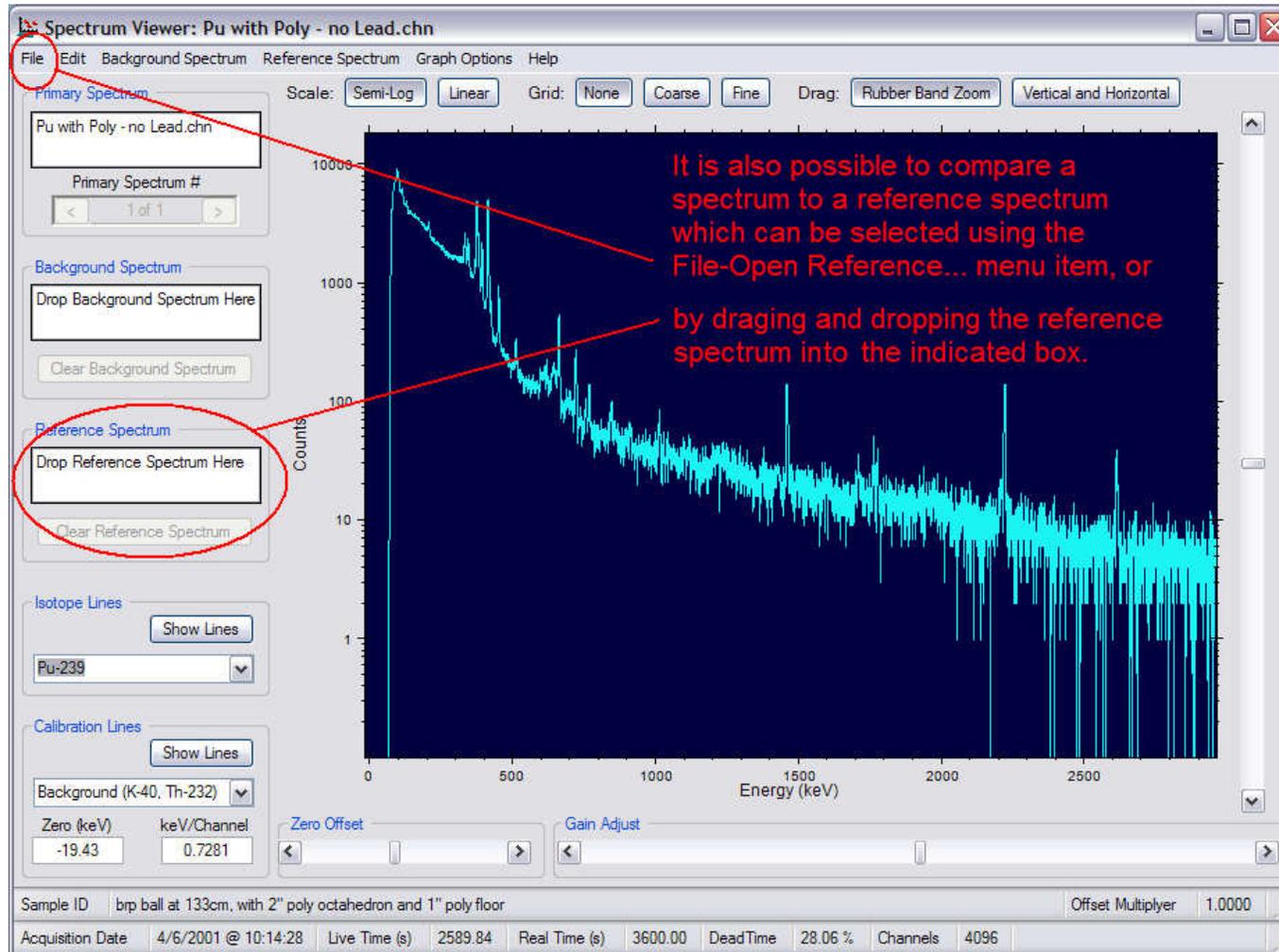
Comparison to known energy lines...



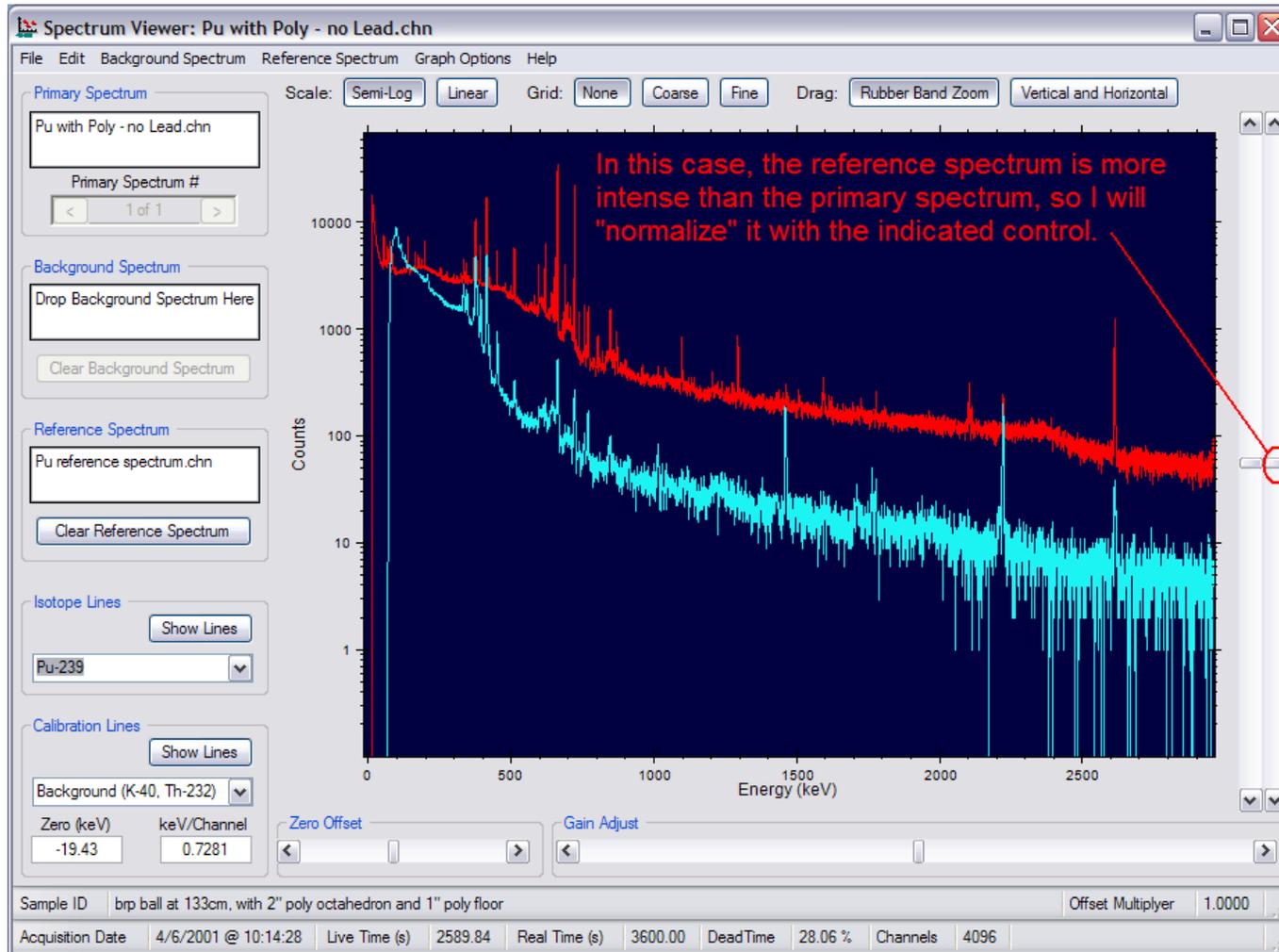
Comparison to known energy lines...



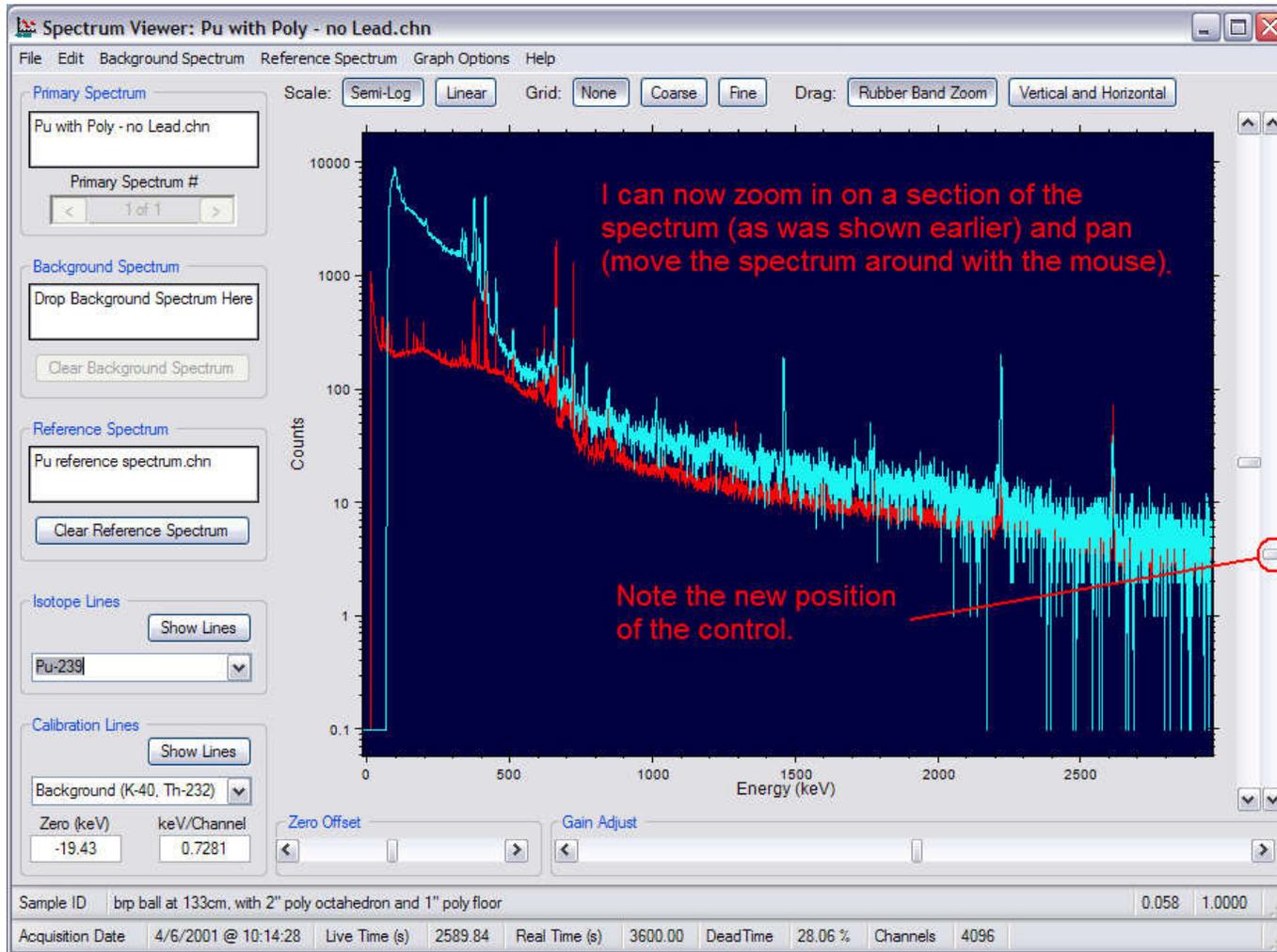
Comparison to a reference spectrum...



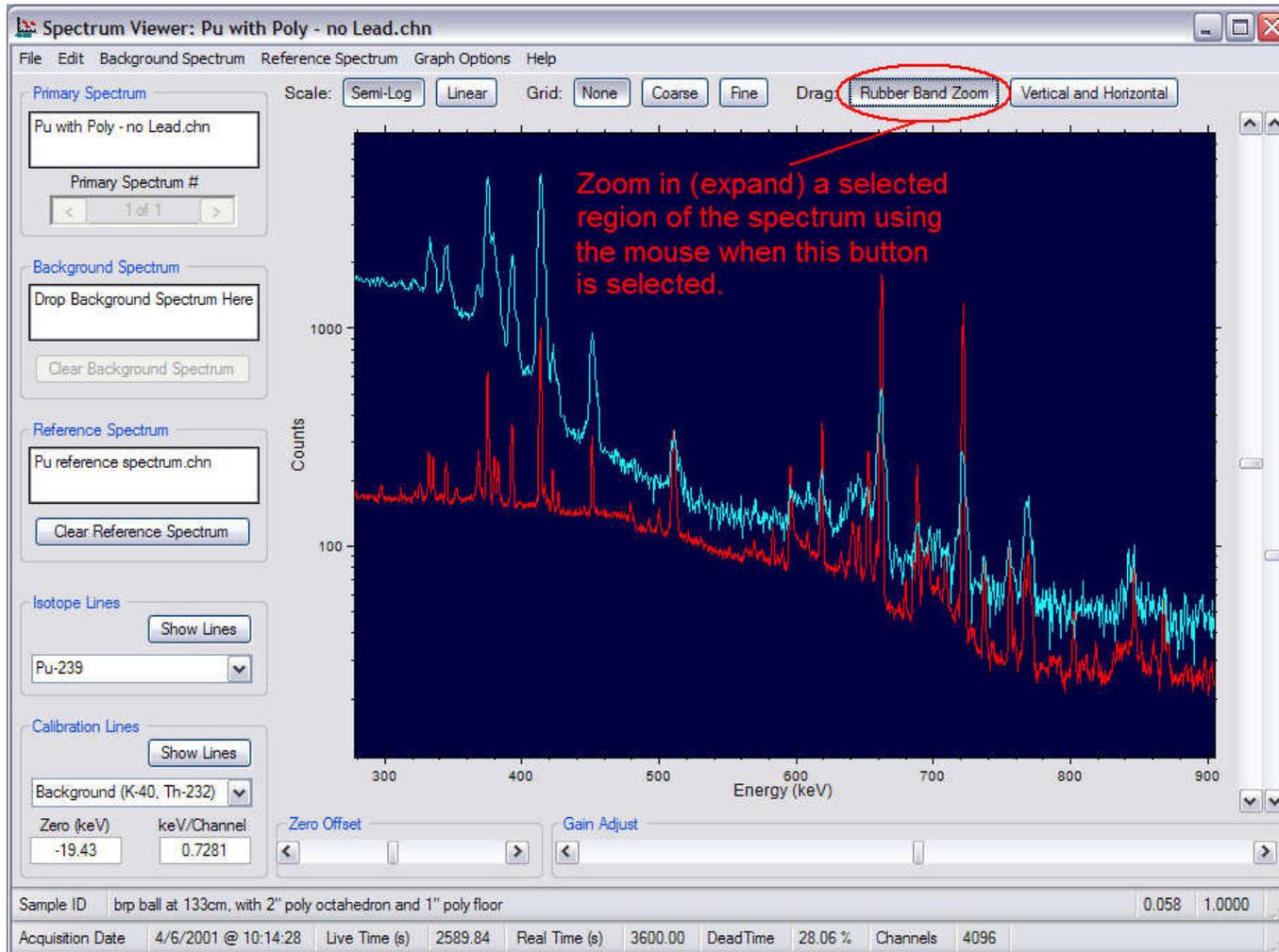
Comparison to a reference spectrum...



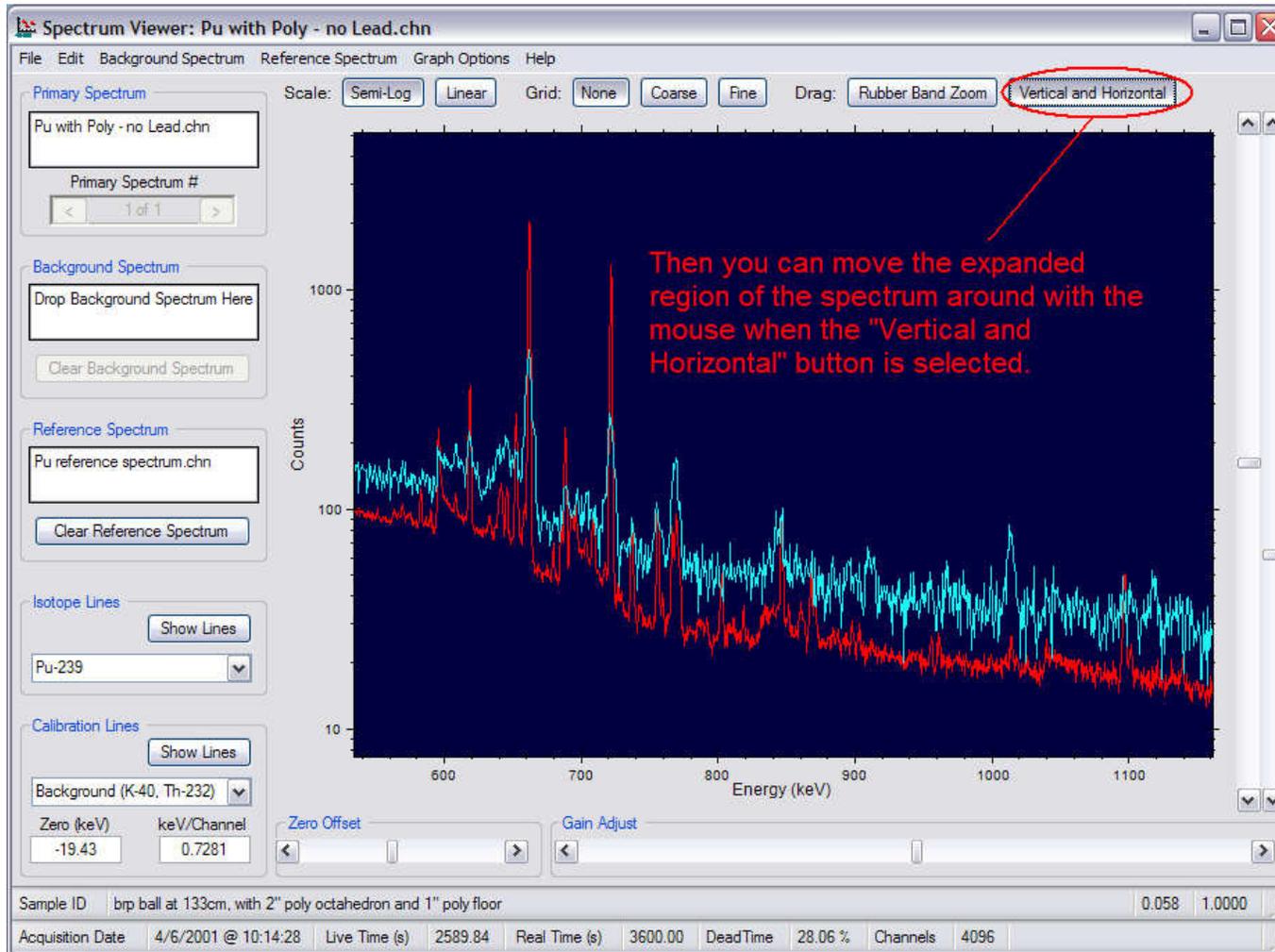
Comparison to a reference spectrum...



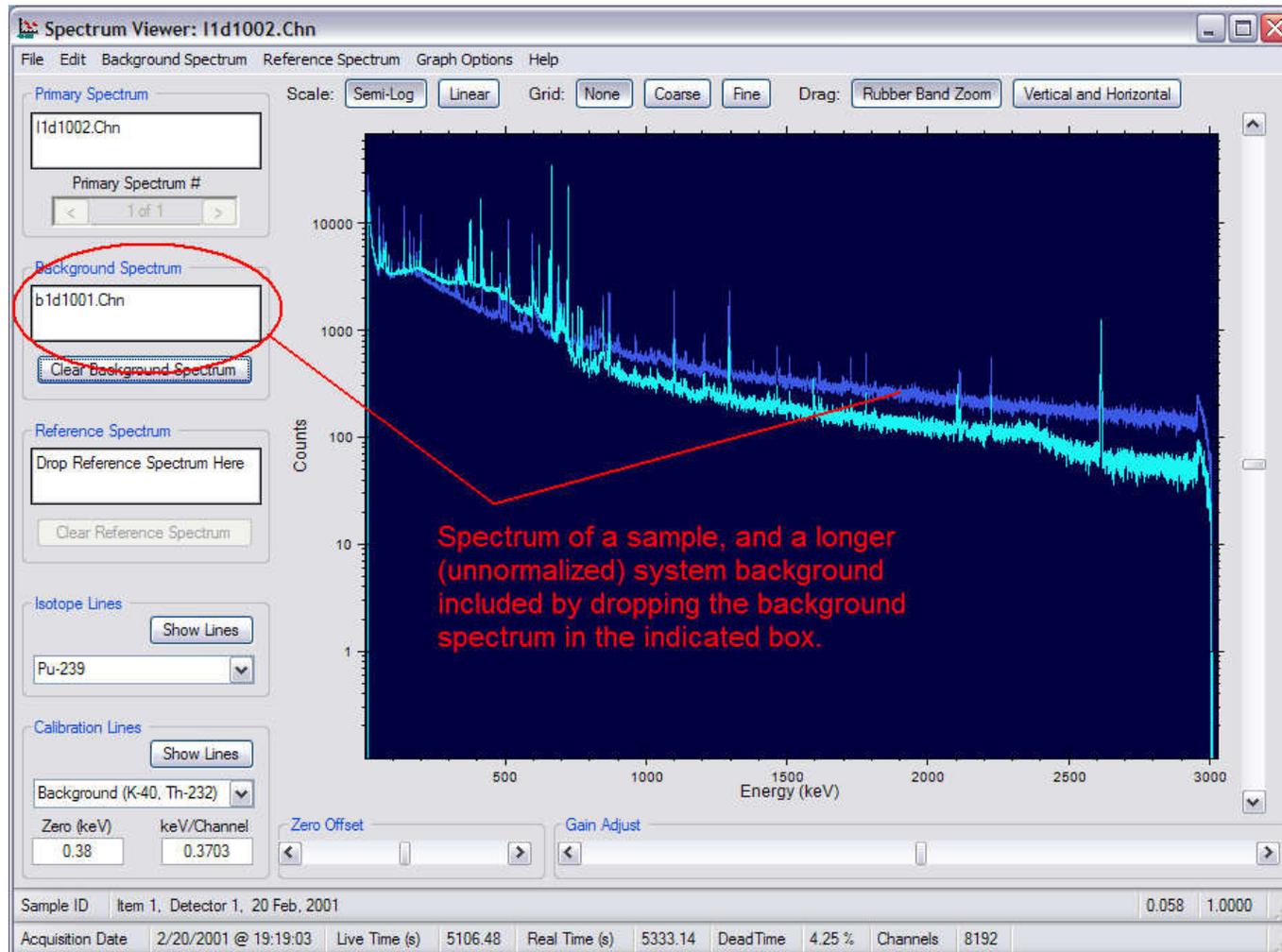
Comparison to a reference spectrum...



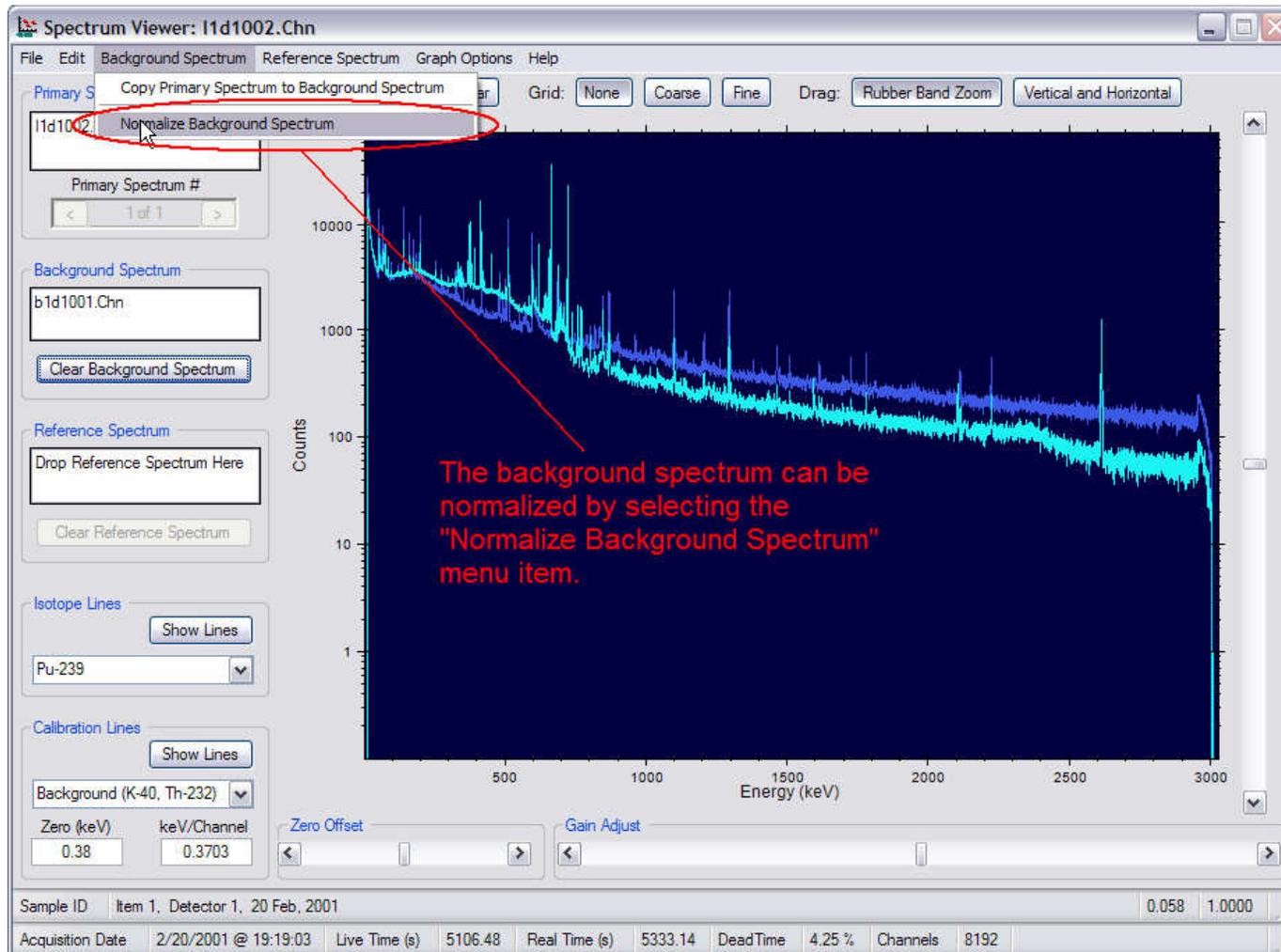
Comparison to a reference spectrum...



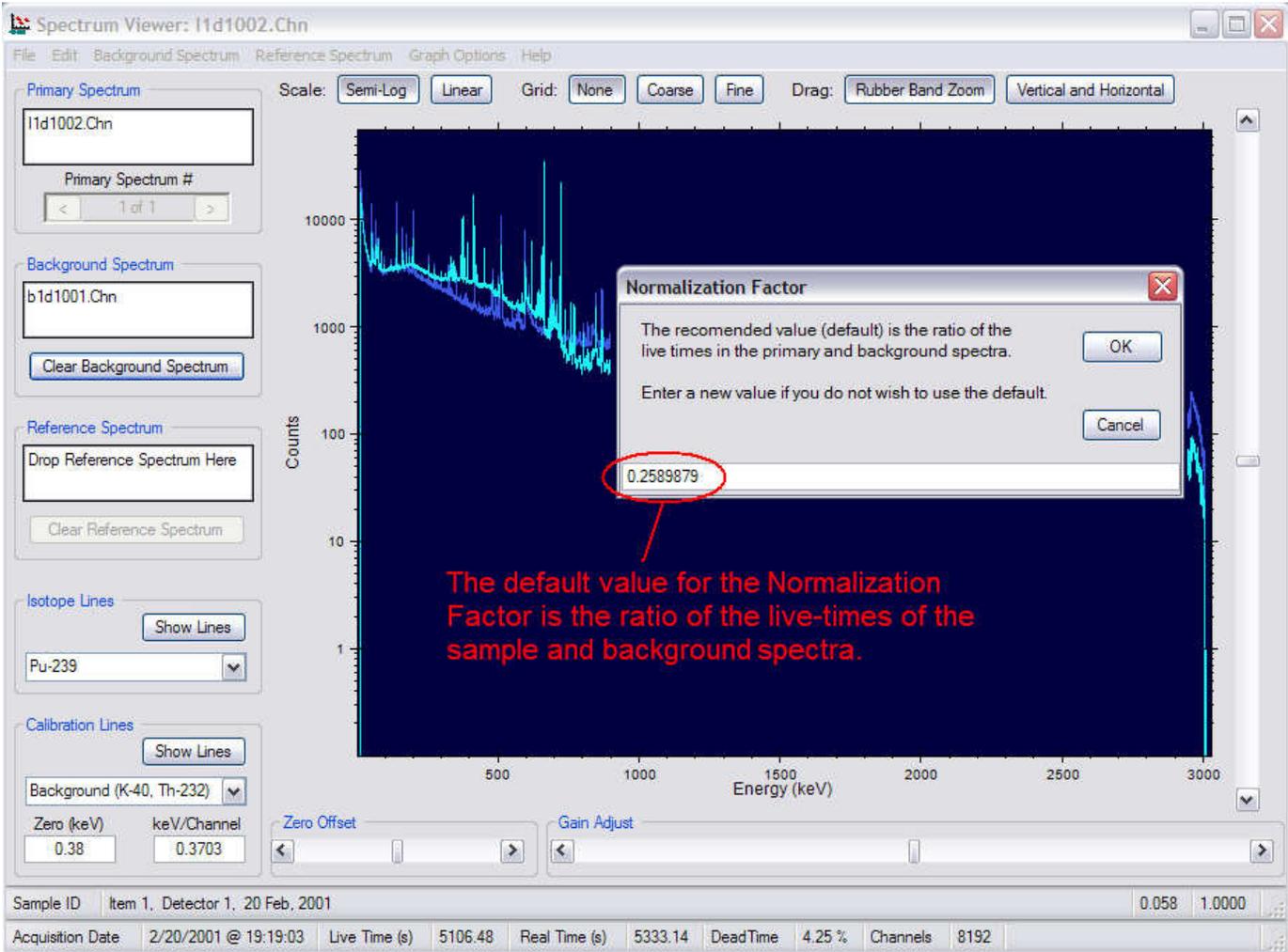
Comparison to a background spectrum...



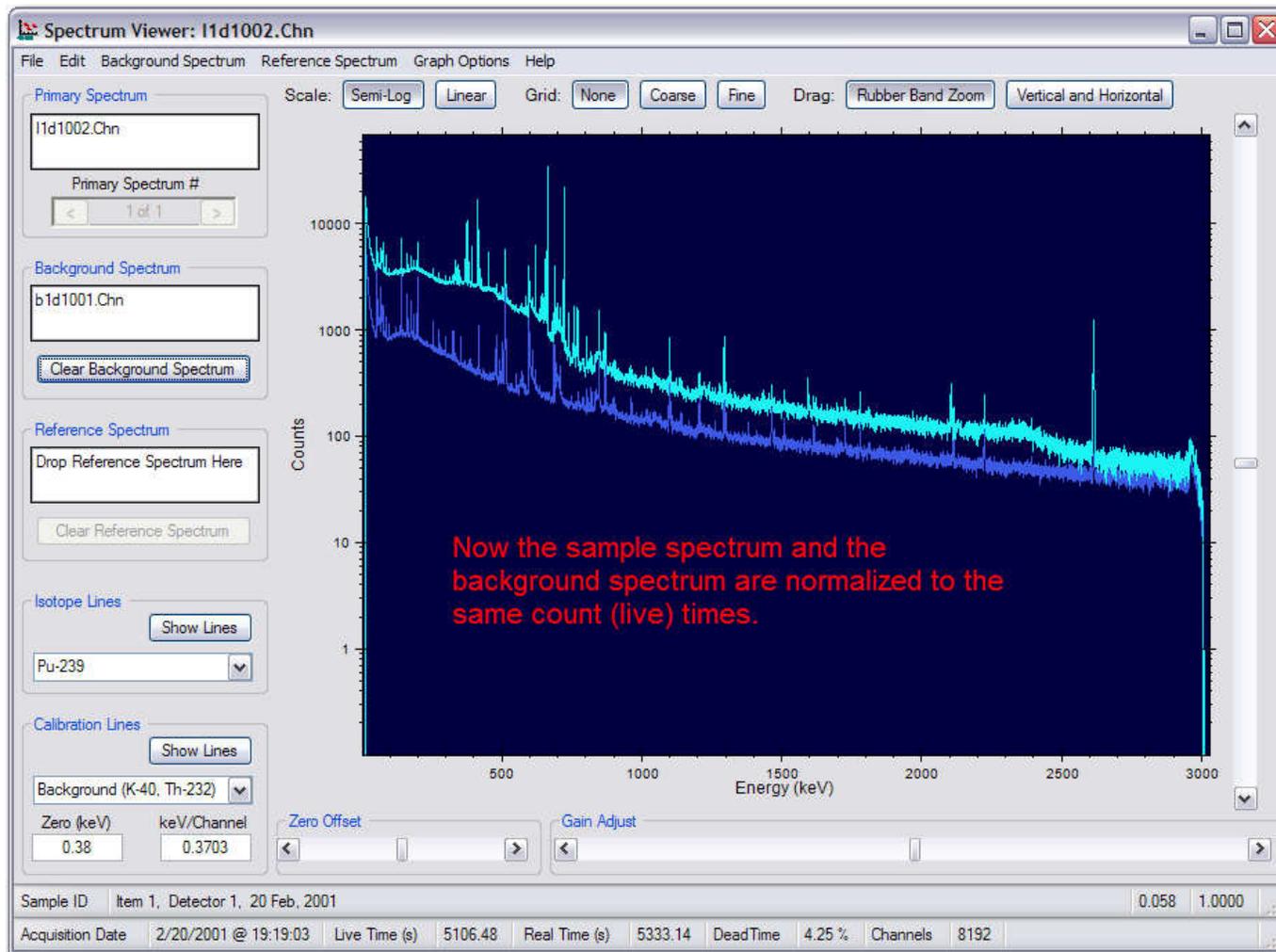
Comparison to a background spectrum...



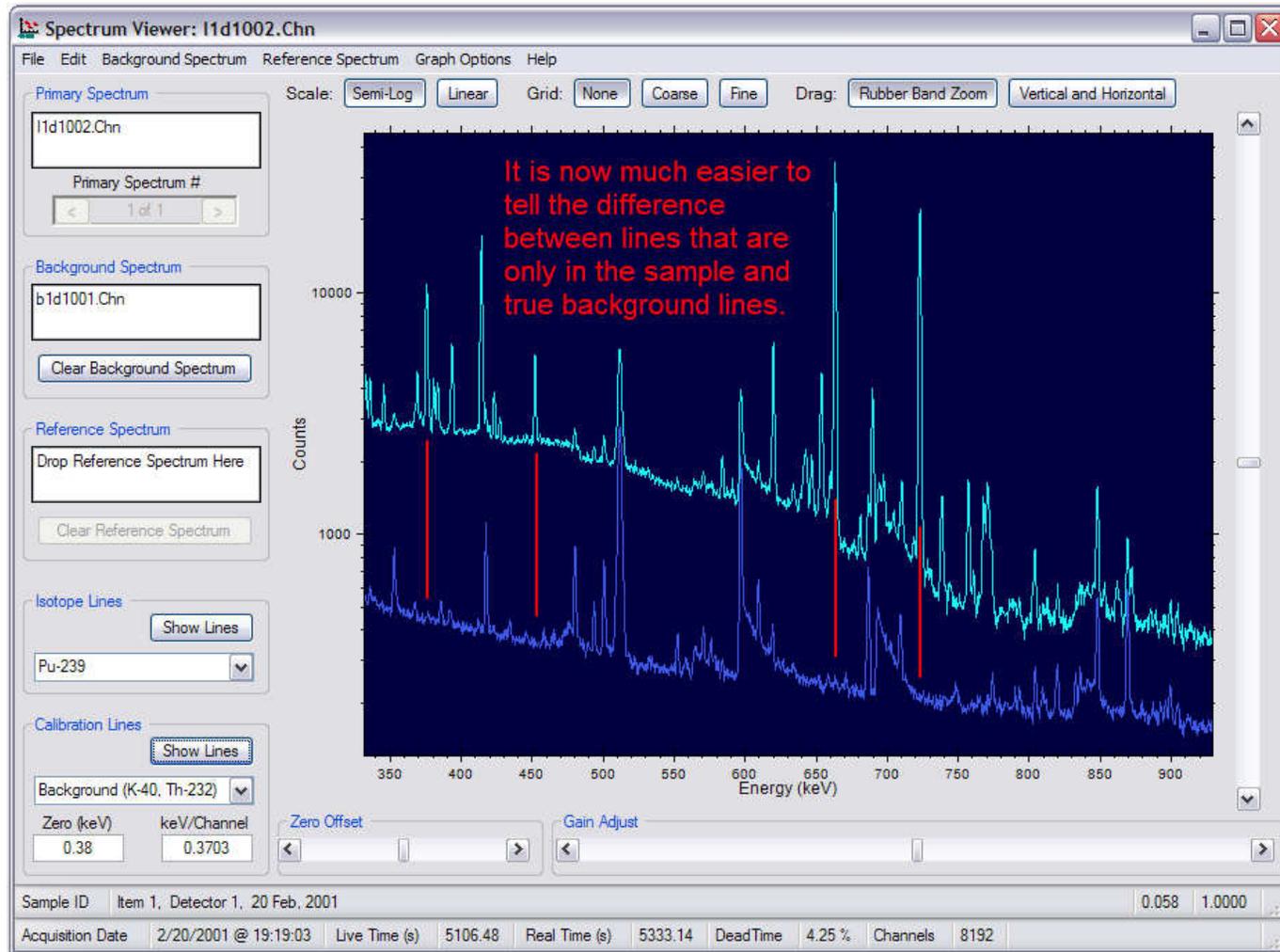
Comparison to a background spectrum...



Comparison to a background spectrum...



Comparison to a background spectrum...



Analysis Strategy

- Check the energy calibration.
- Look for neutron features in the spectrum:
 - Neutron capture lines
 - H
 - Cd
 - “Shark Fin” features.
- Compare the primary spectrum with the known isotope lines of SNM and other materials of interest (Pu-239, U-235, U-233, and Np-237).
- If you get a match, compare with applicable reference spectrum.

Summary

- Basic controls and operations of the Spectrum Viewer software
- Three types of spectra
 - Primary
 - Background
 - Reference
- Check the energy calibration
- Comparison of primary spectrum to ...
 - Known isotope lines
 - Reference spectra
- Analysis strategy