SpectrumViewer

Quick Start Guide

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Background

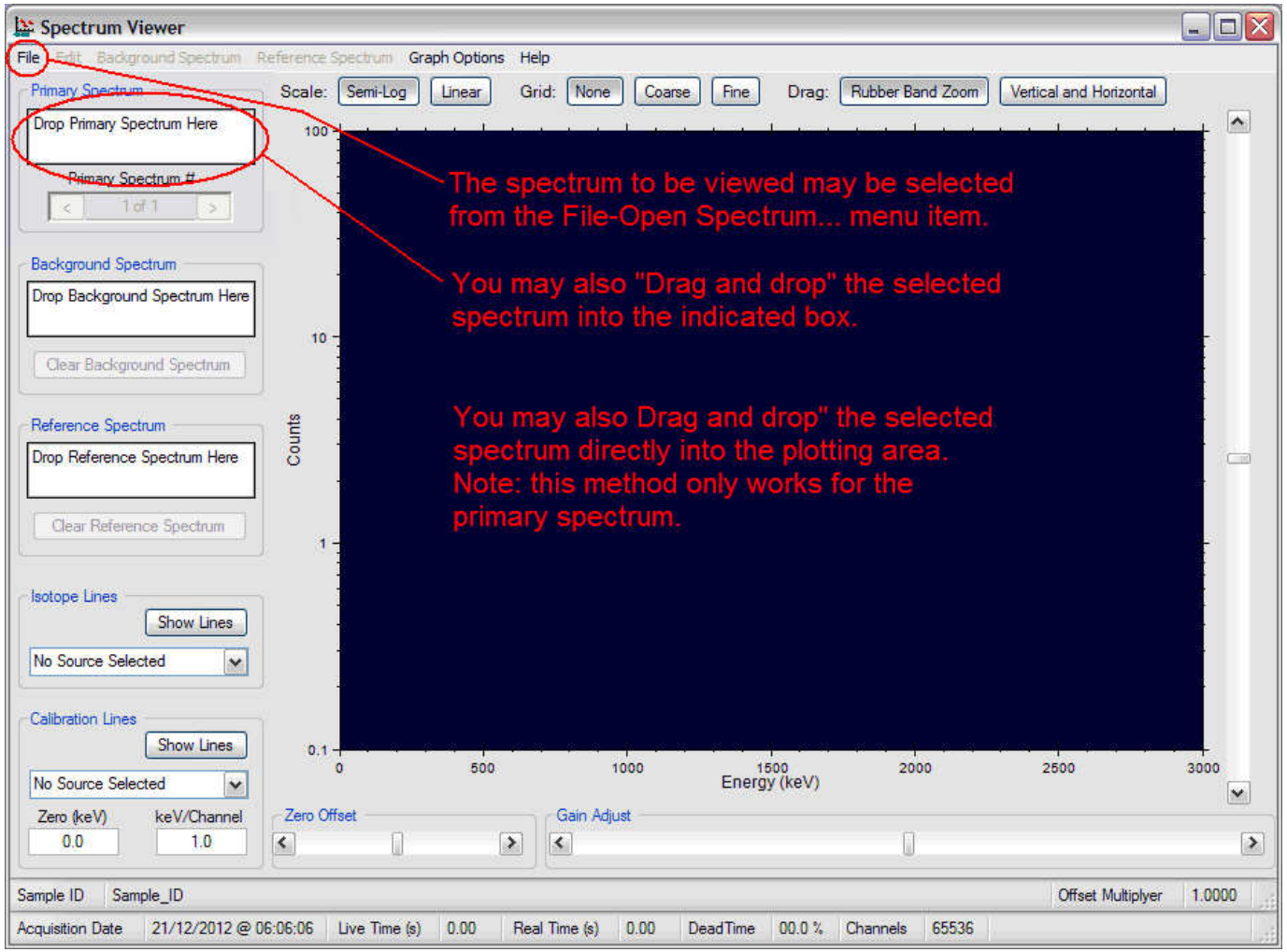
- Originally created as a tool for distribution to analysts associated with the NNSA Megaports Initiative, and others without access to the LANL PeakEasy code.

- 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
    - …

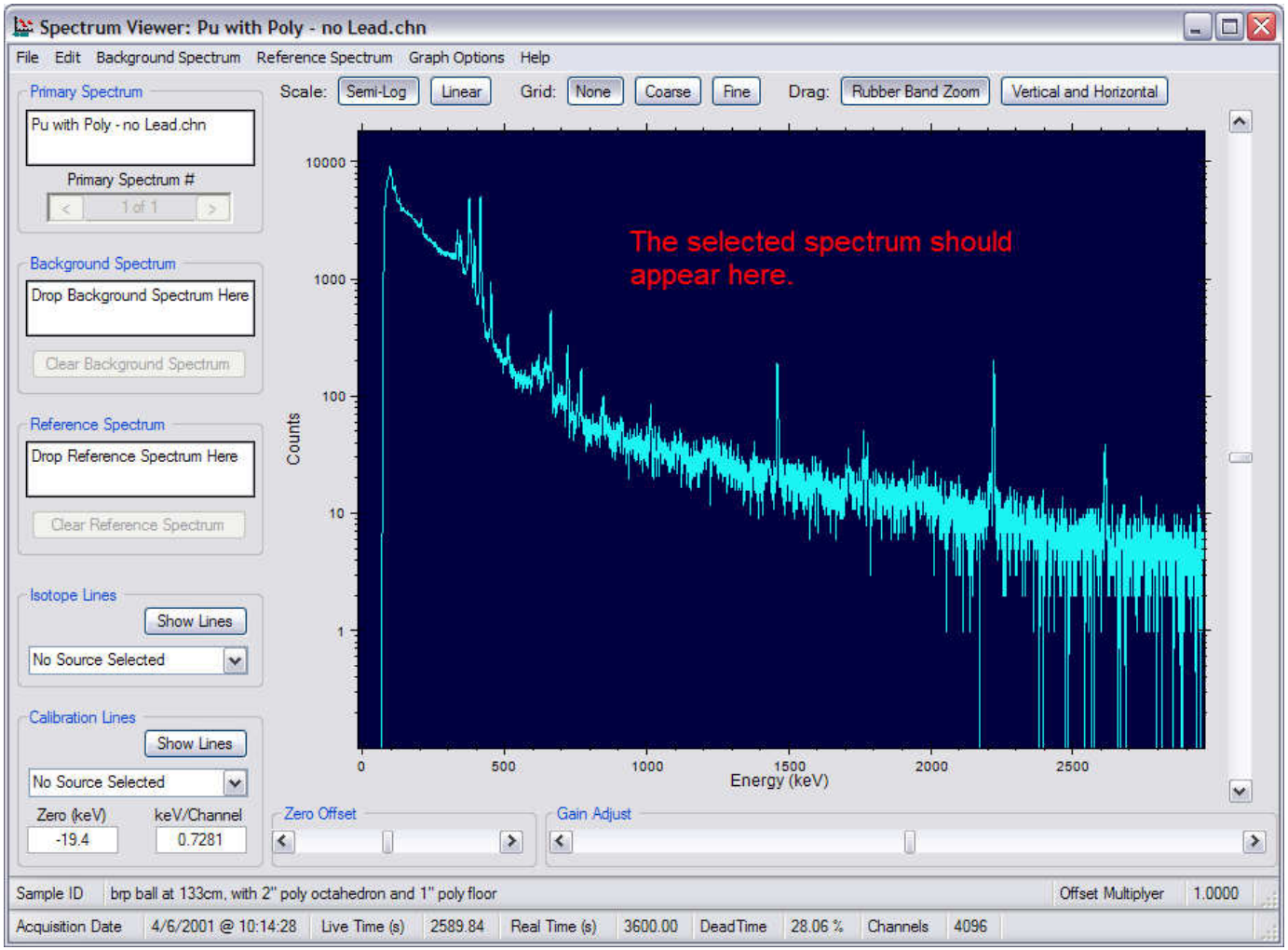
Basic operations and controls

- 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.

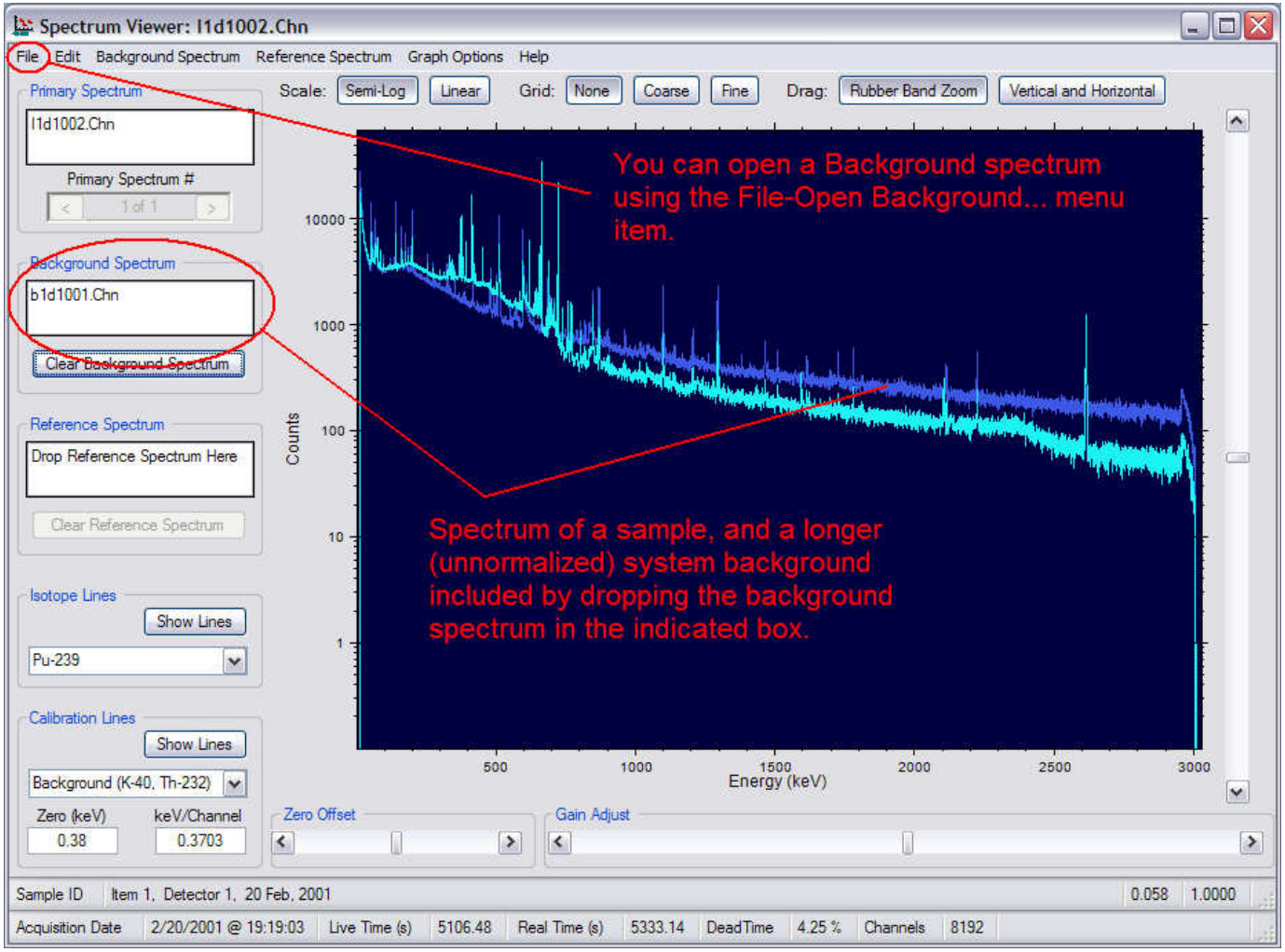
Opening the primary spectrum



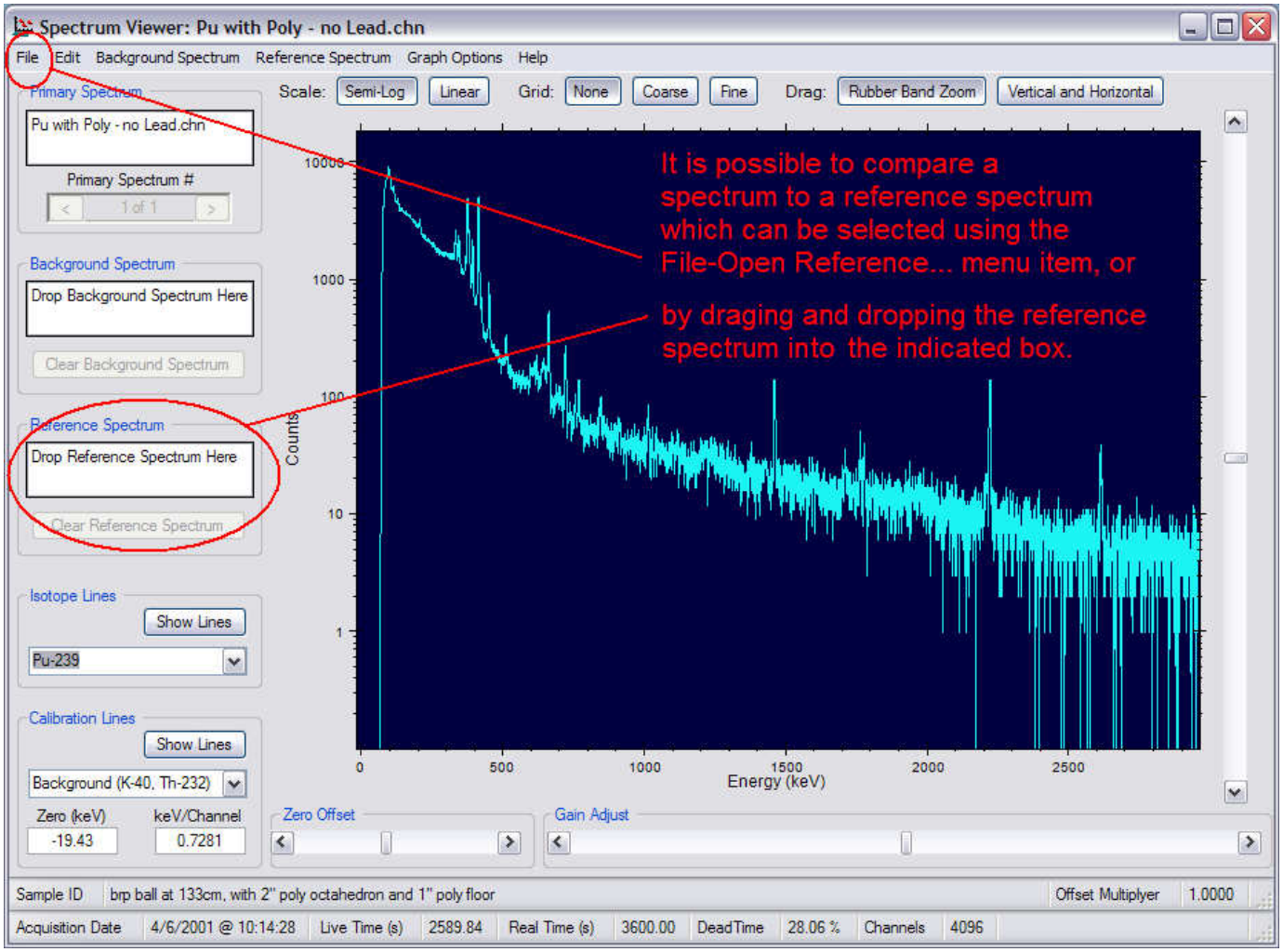
A plot of the primary spectrum



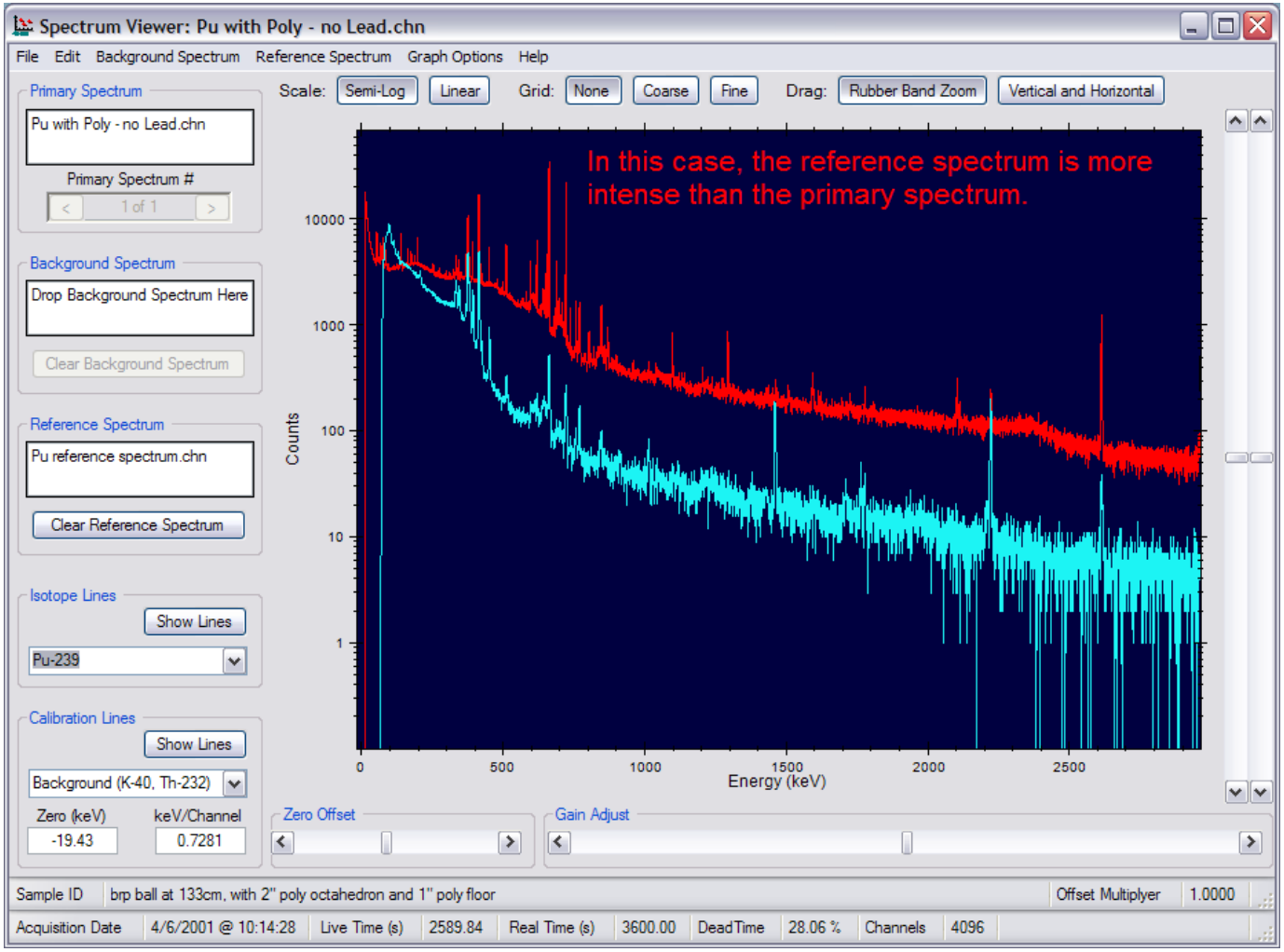
Opening a background spectrum



Opening a reference spectrum…



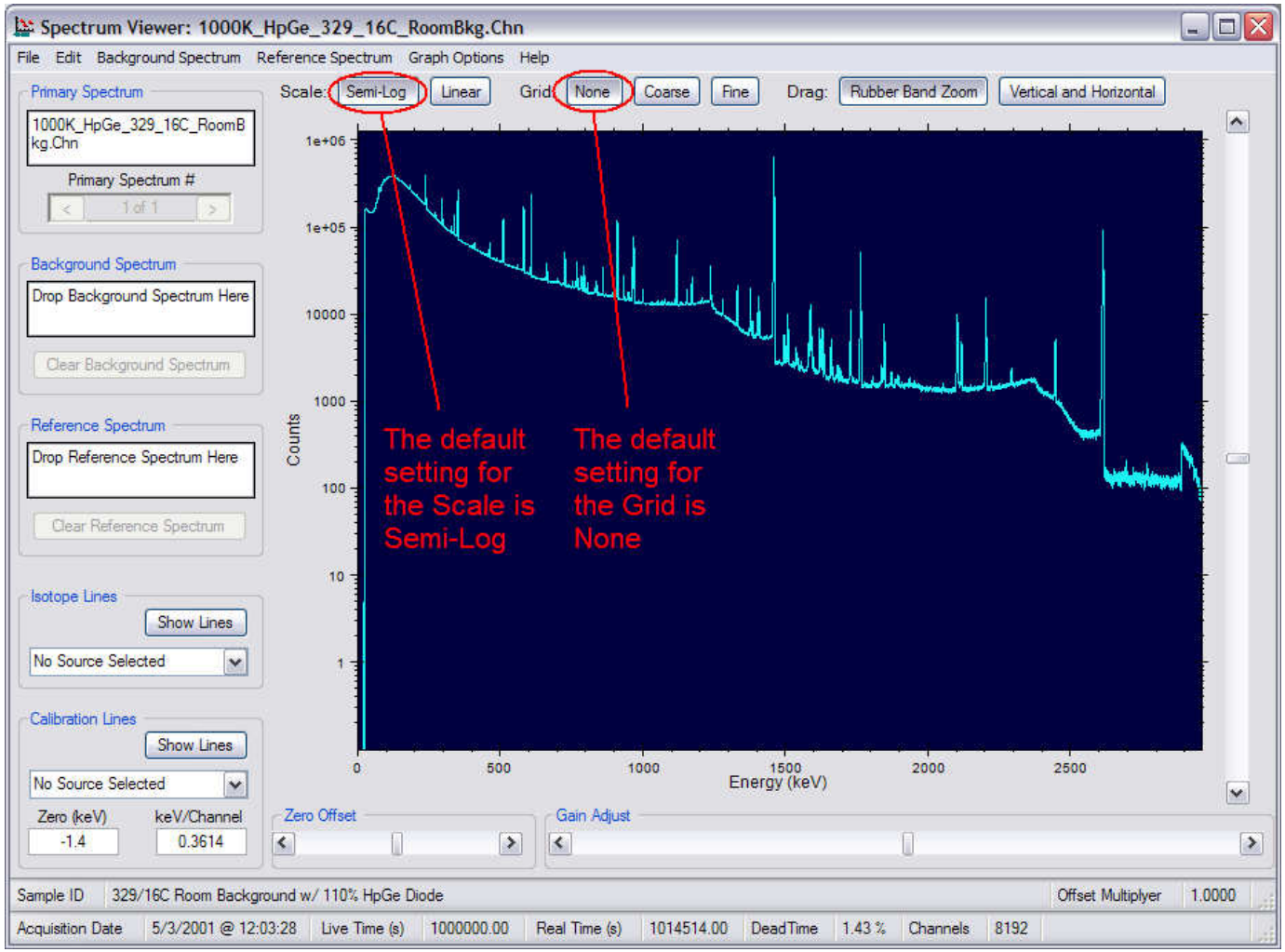
Opening a reference spectrum…



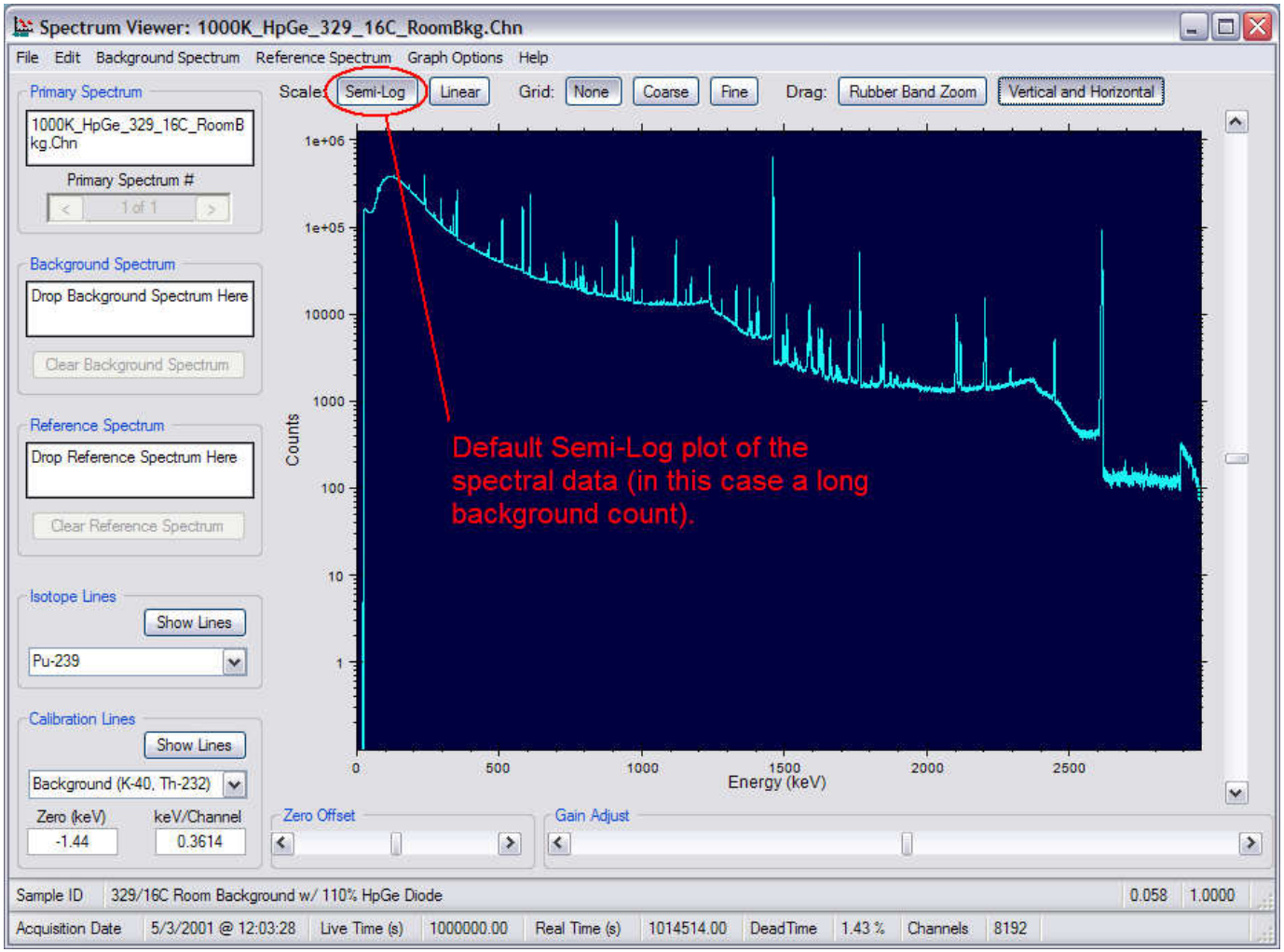
Basic controls

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

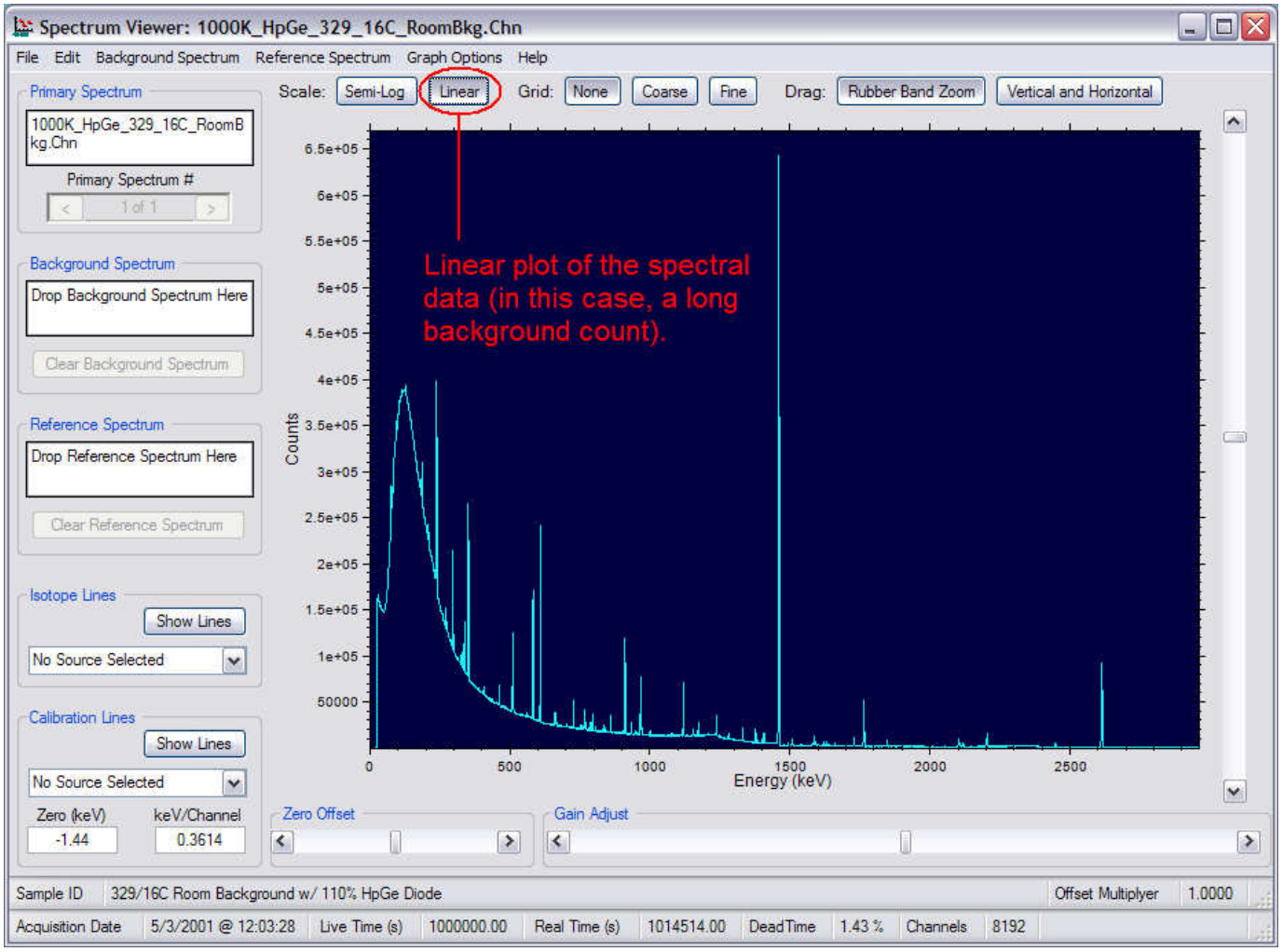
Default settings for the display options



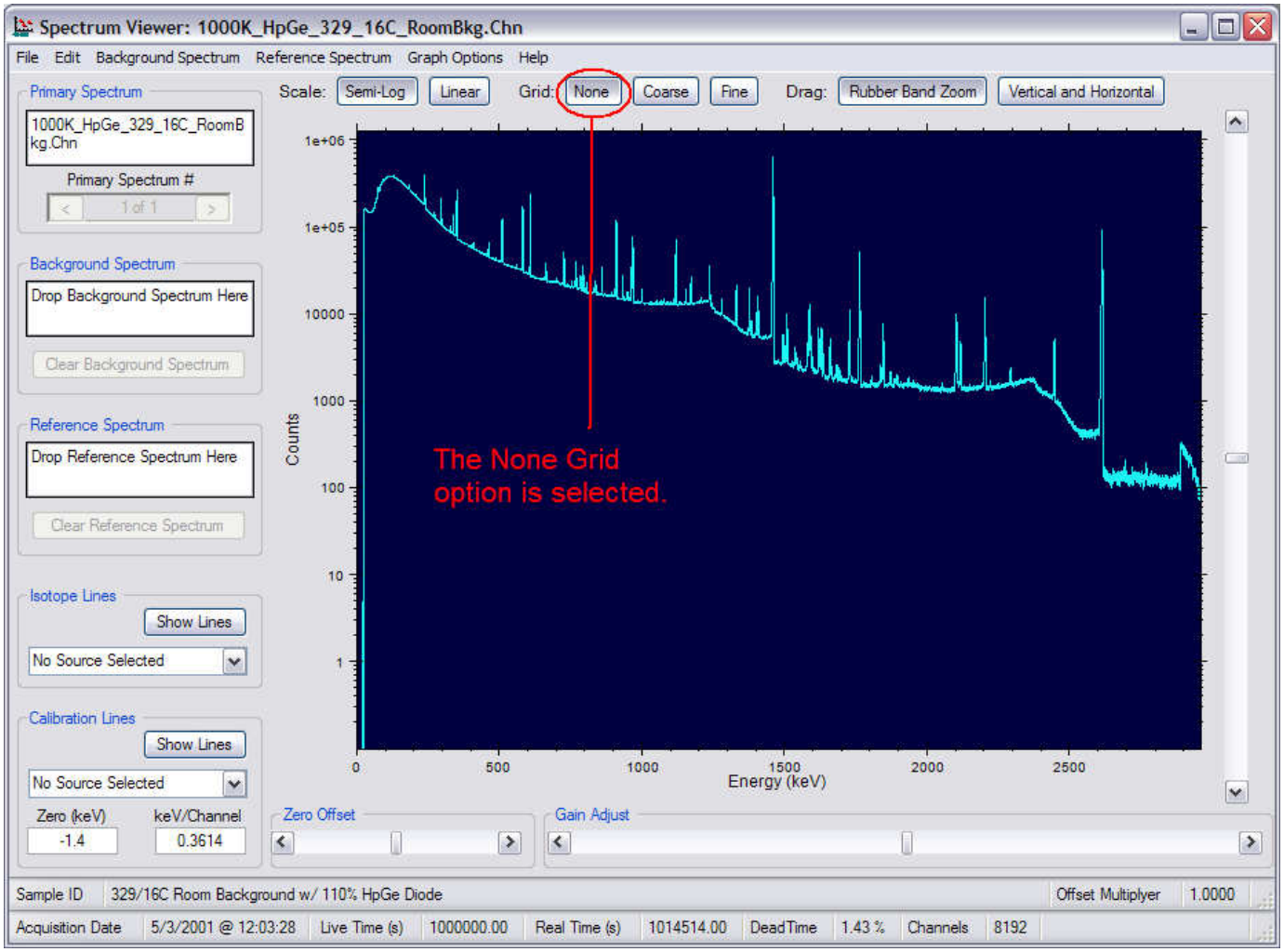
Spectral data plotted in Semi-Log mode



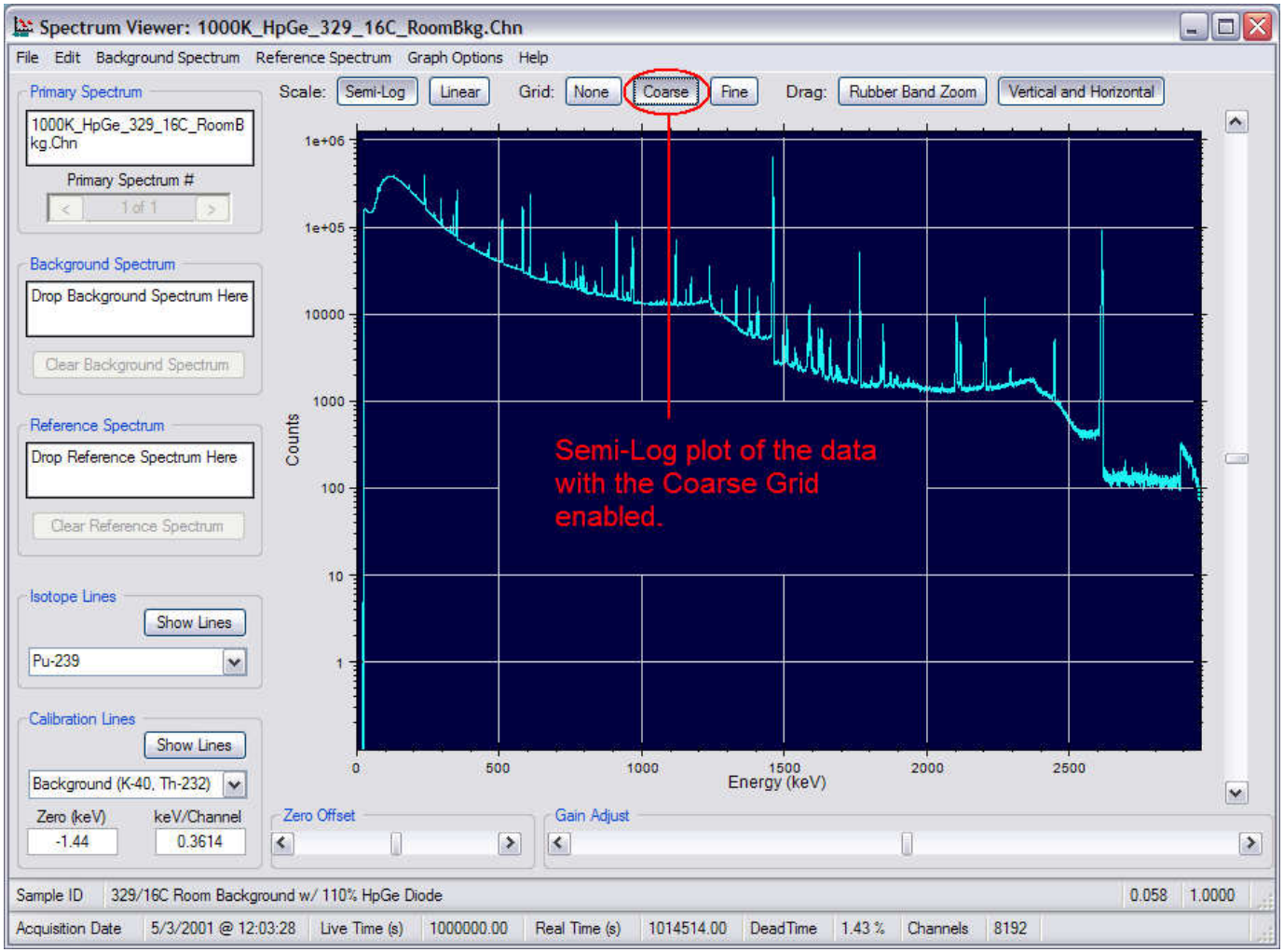
Spectral data plotted in Linear mode



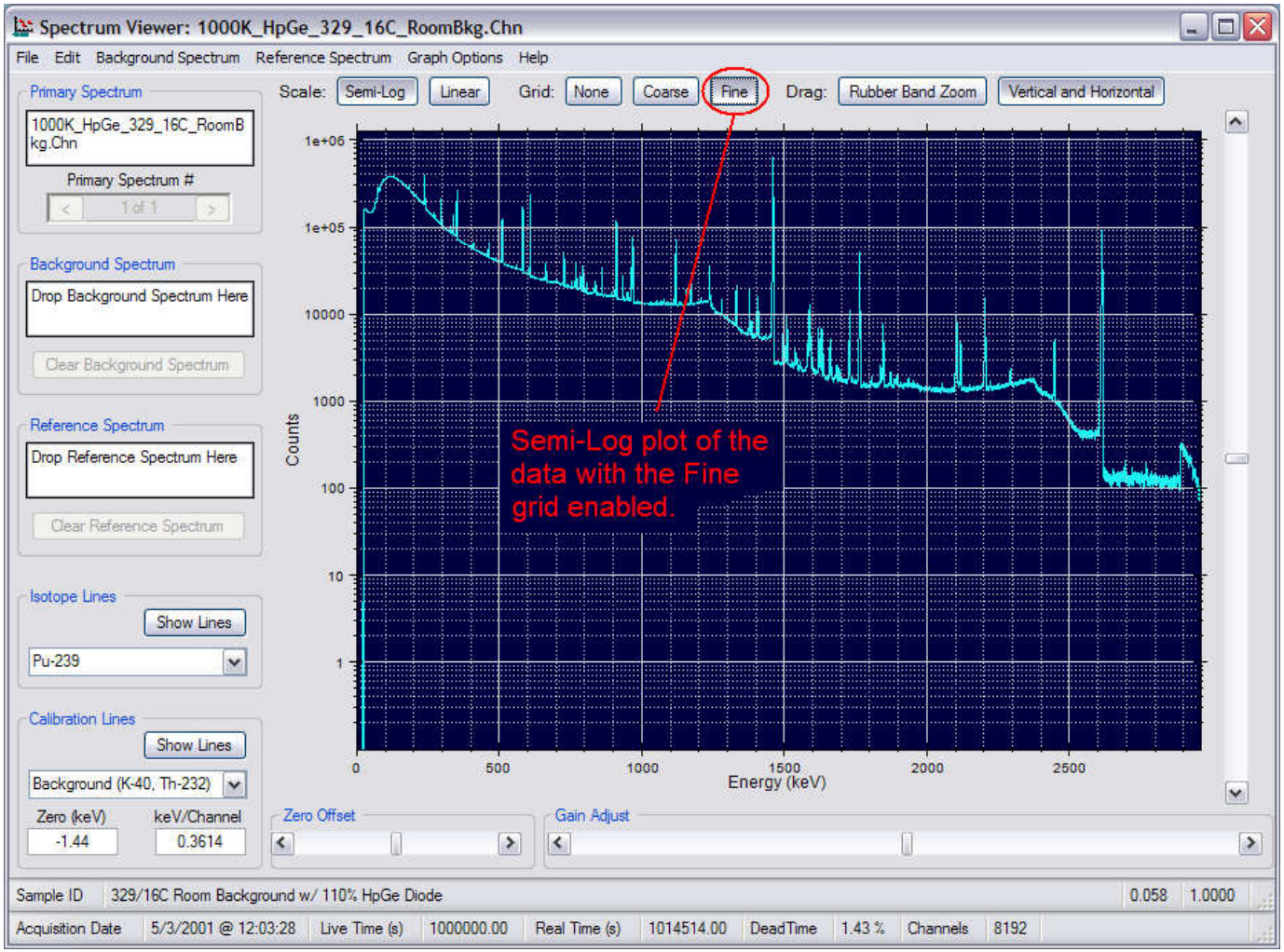
Plot with the None grid option selected



Plot with the Coarse grid option selected



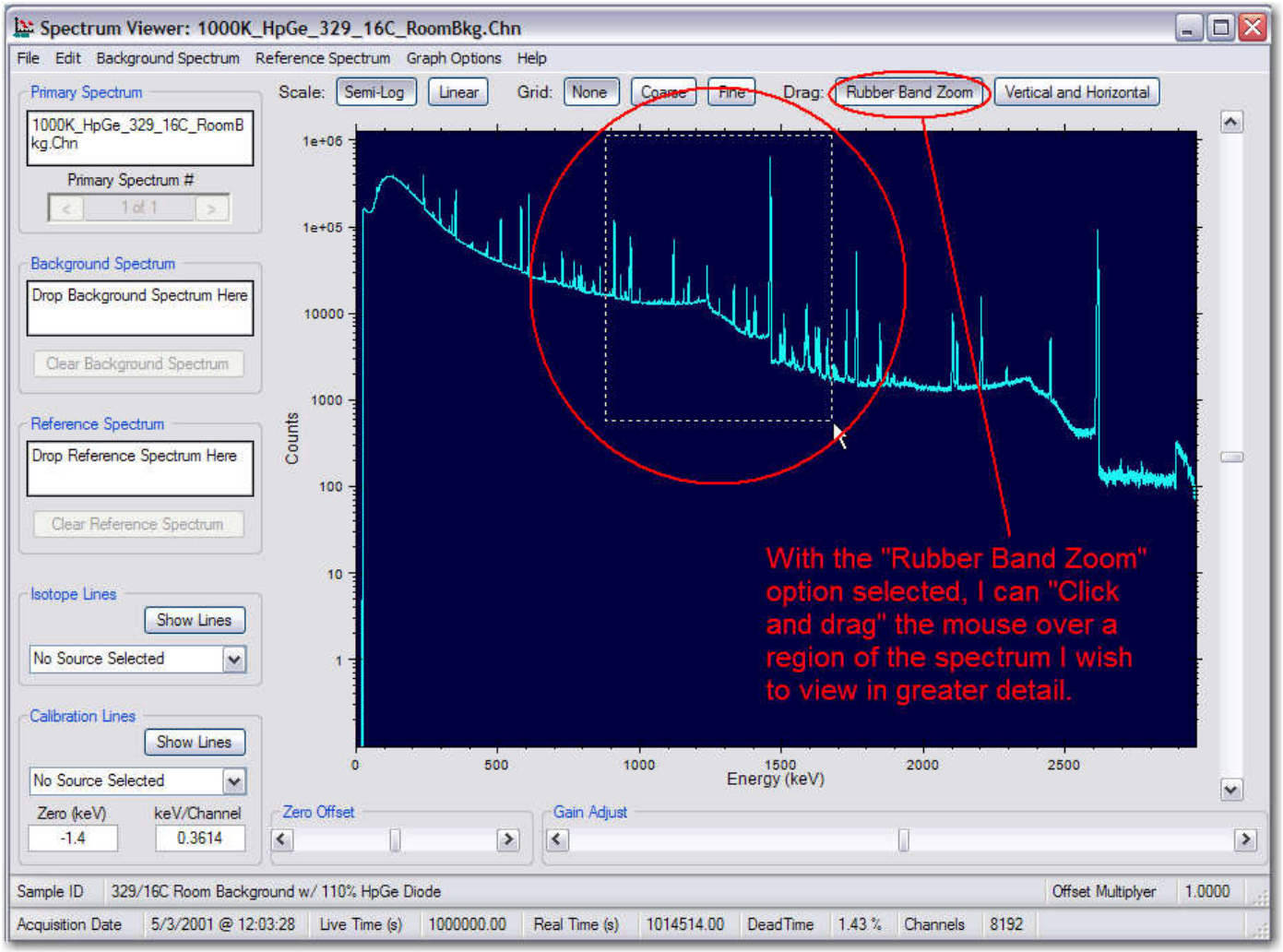
Plot with the Fine grid option selected



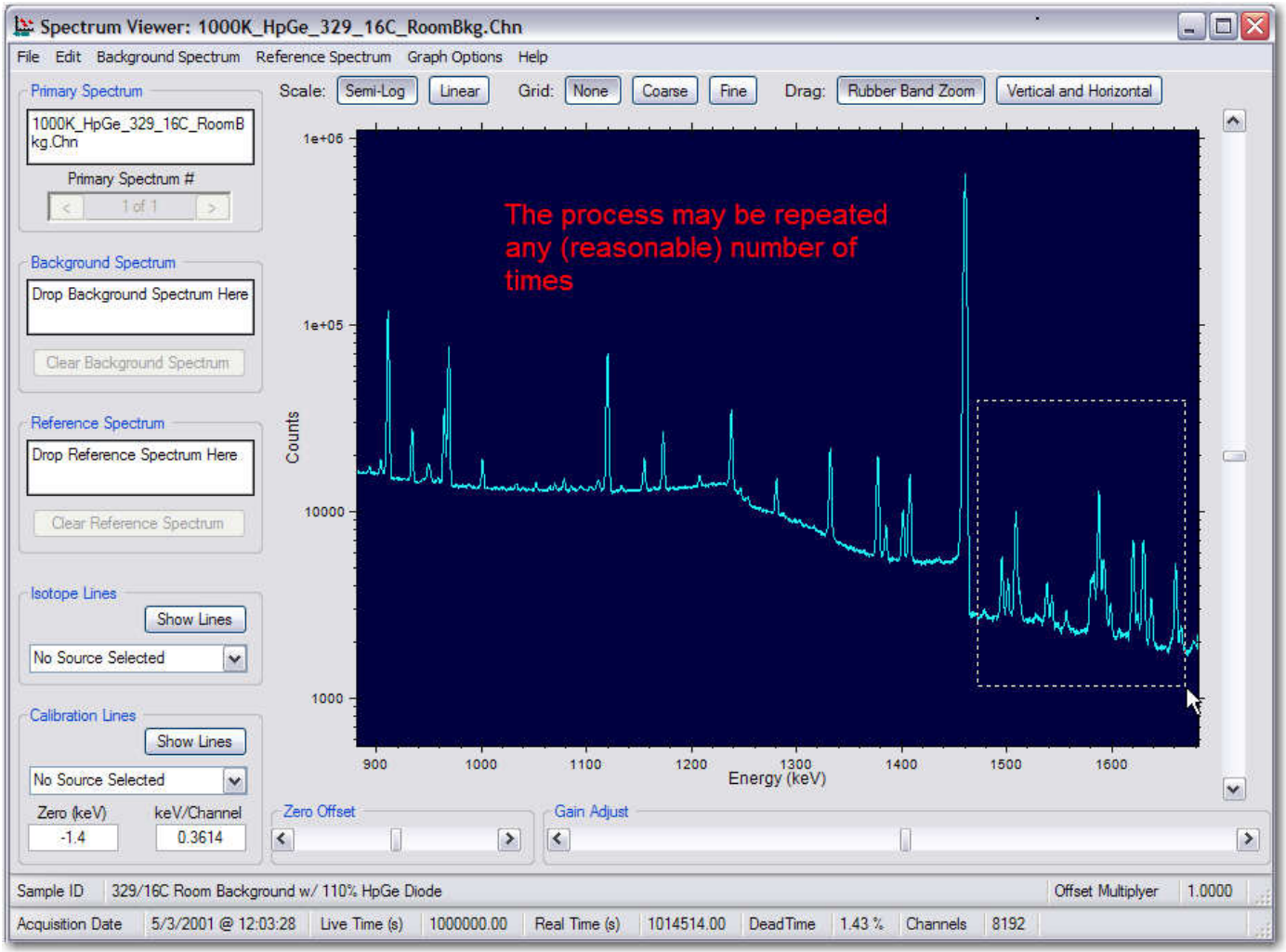
Basic controls

- 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.

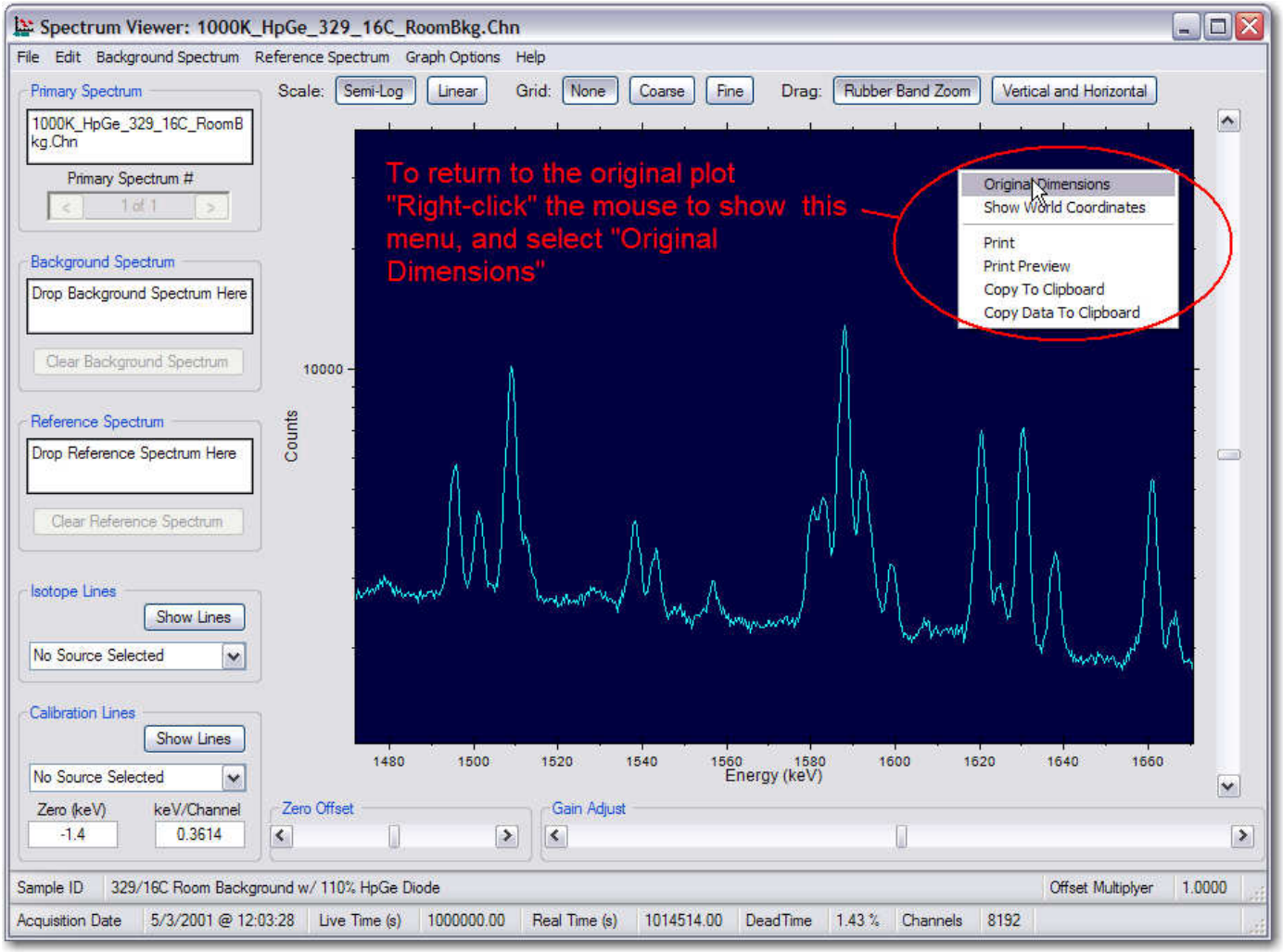
Rubber Band Zoom



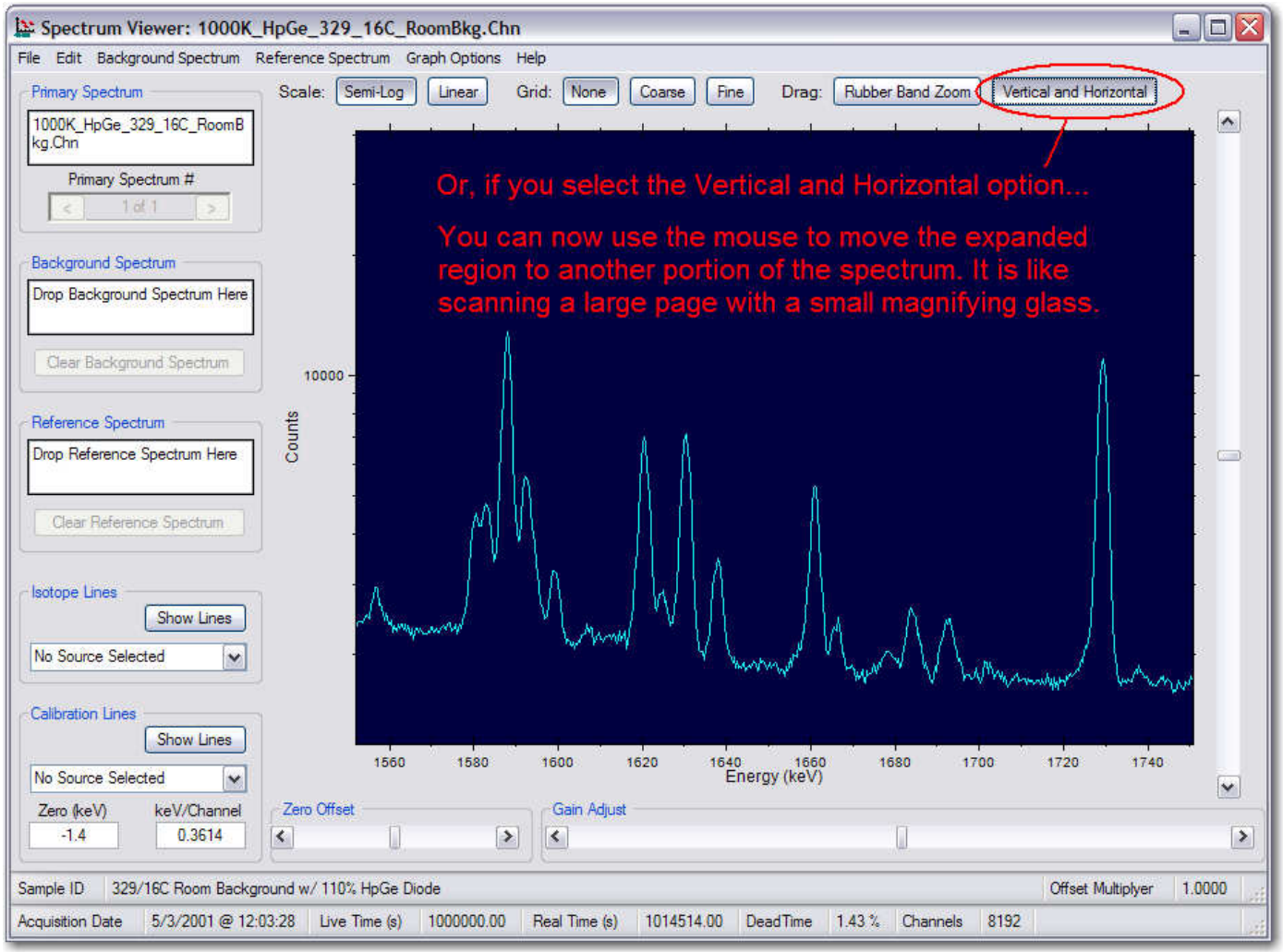
Rubber Band Zoom



Rubber Band Zoom



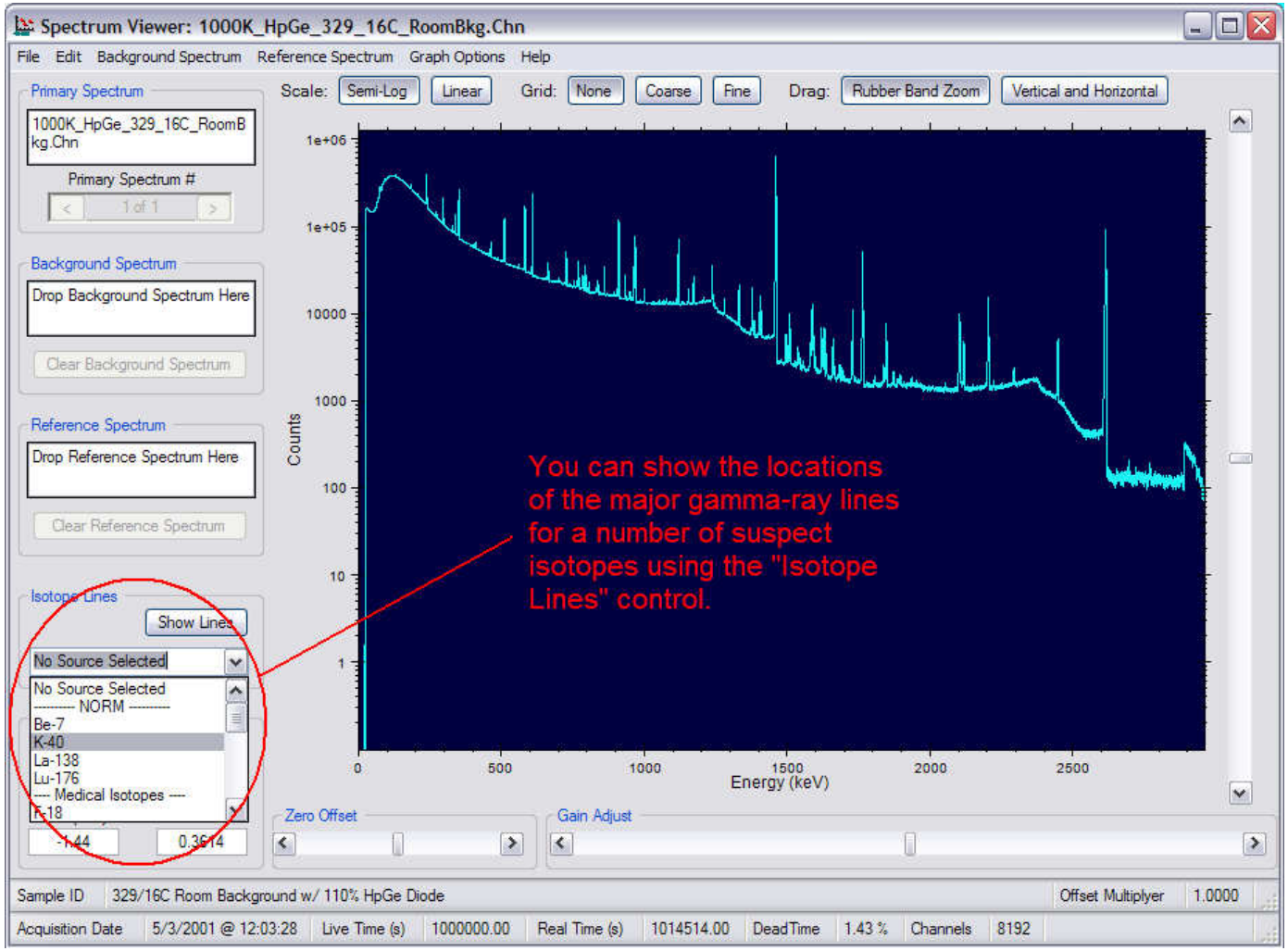
Vertical and Horizontal “Pan”



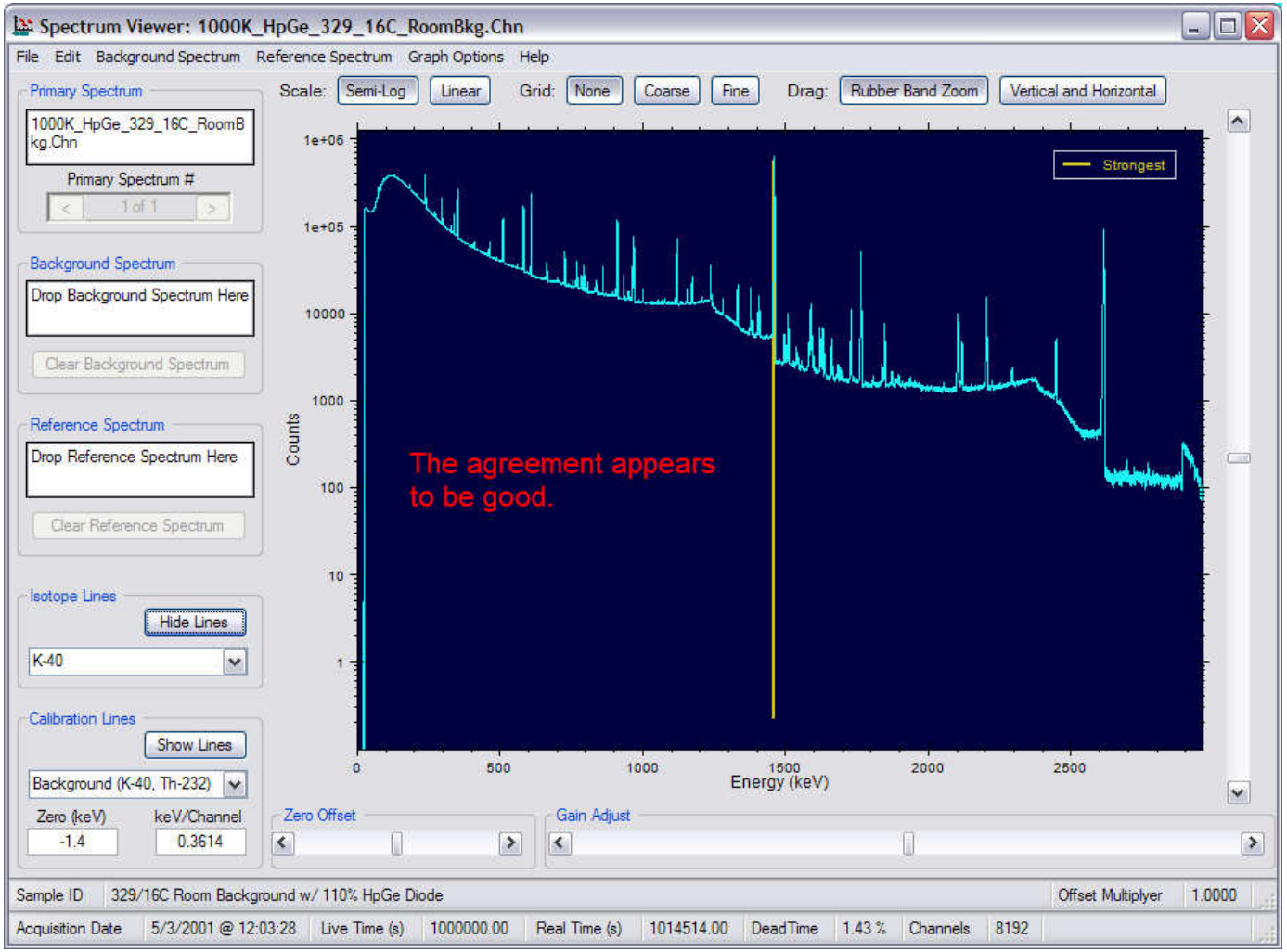
Known energy lines

- Isotope (suspect) lines
- Energy calibration lines

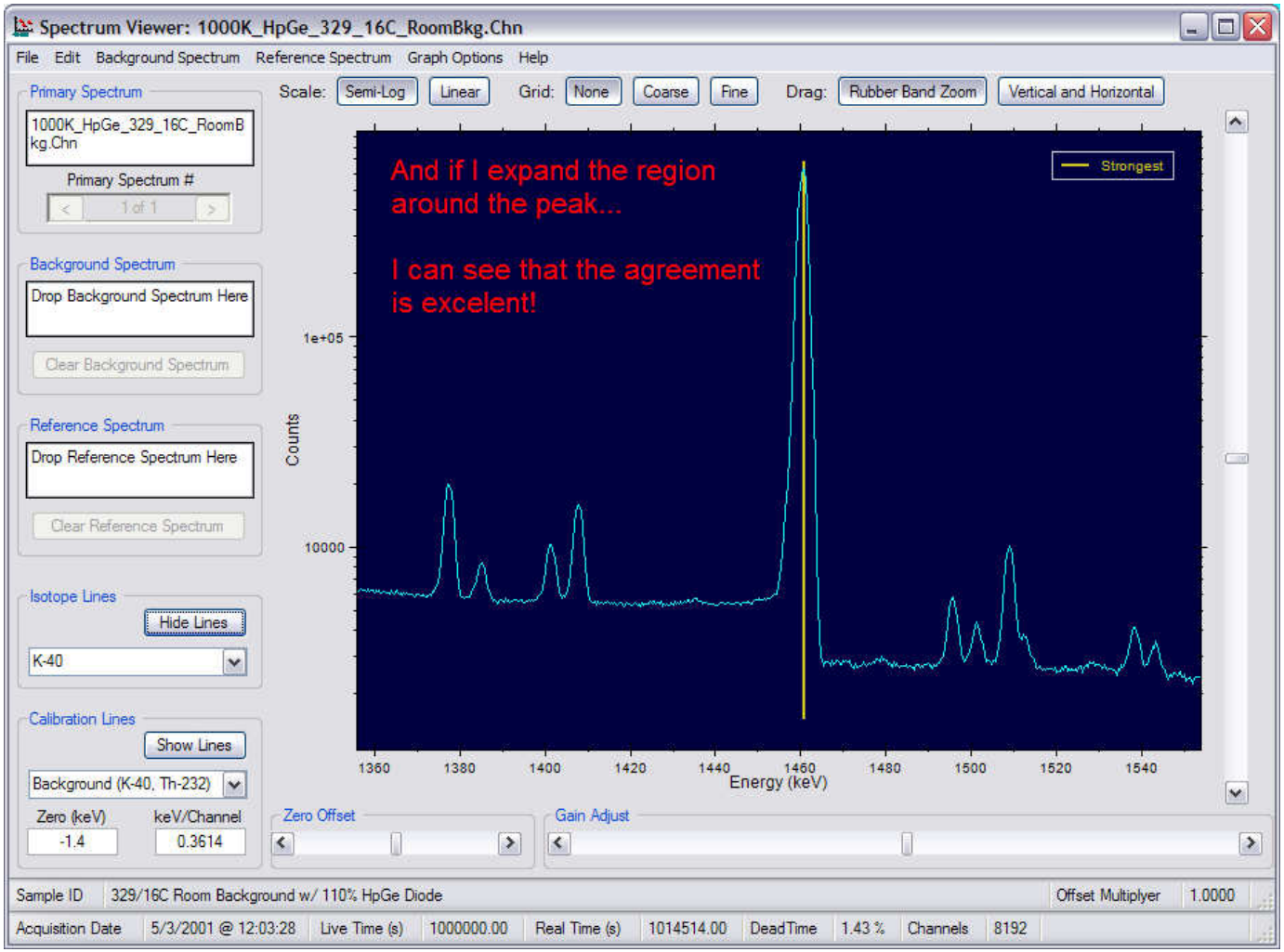
Isotope lines



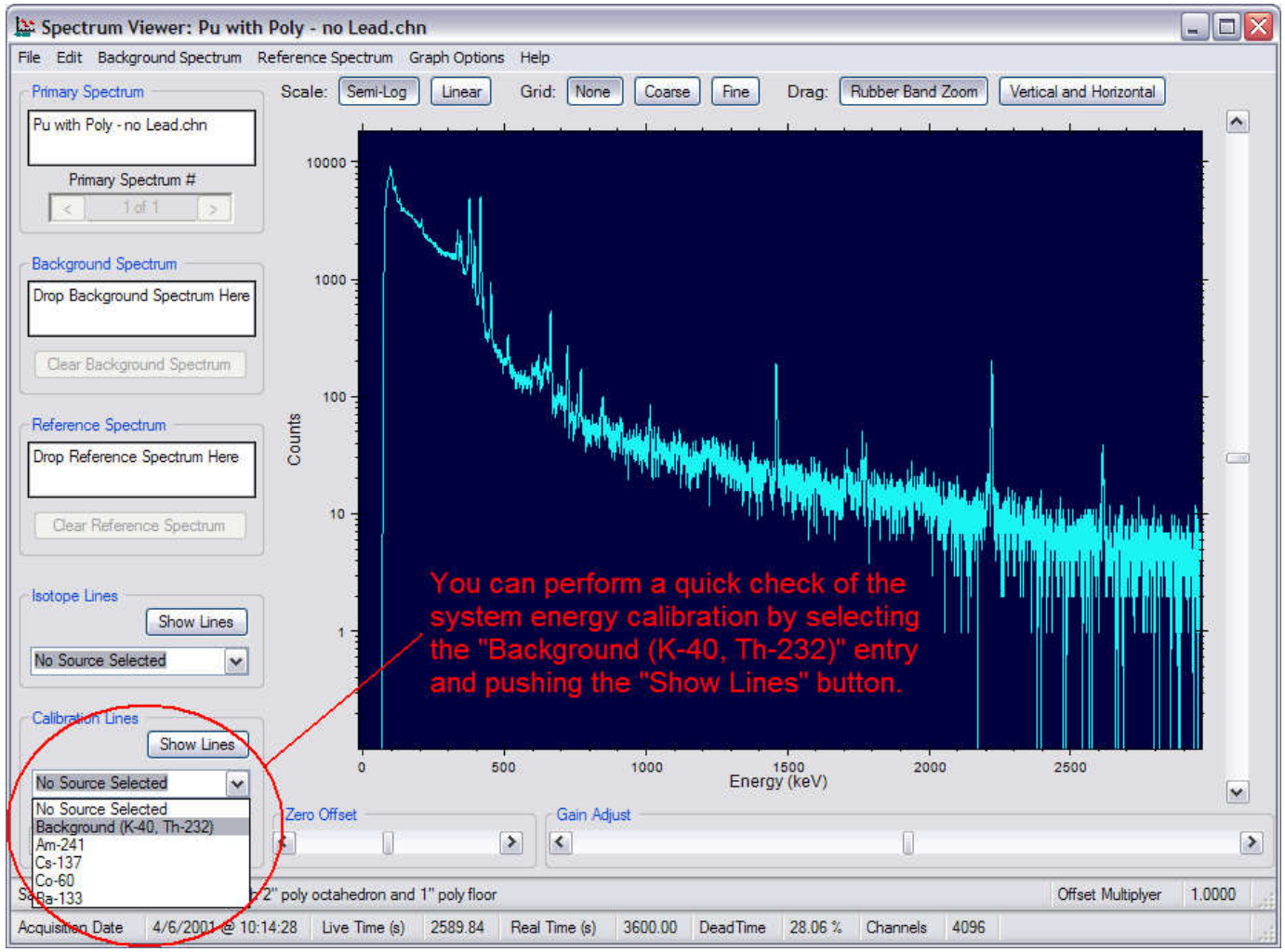
Isotope lines



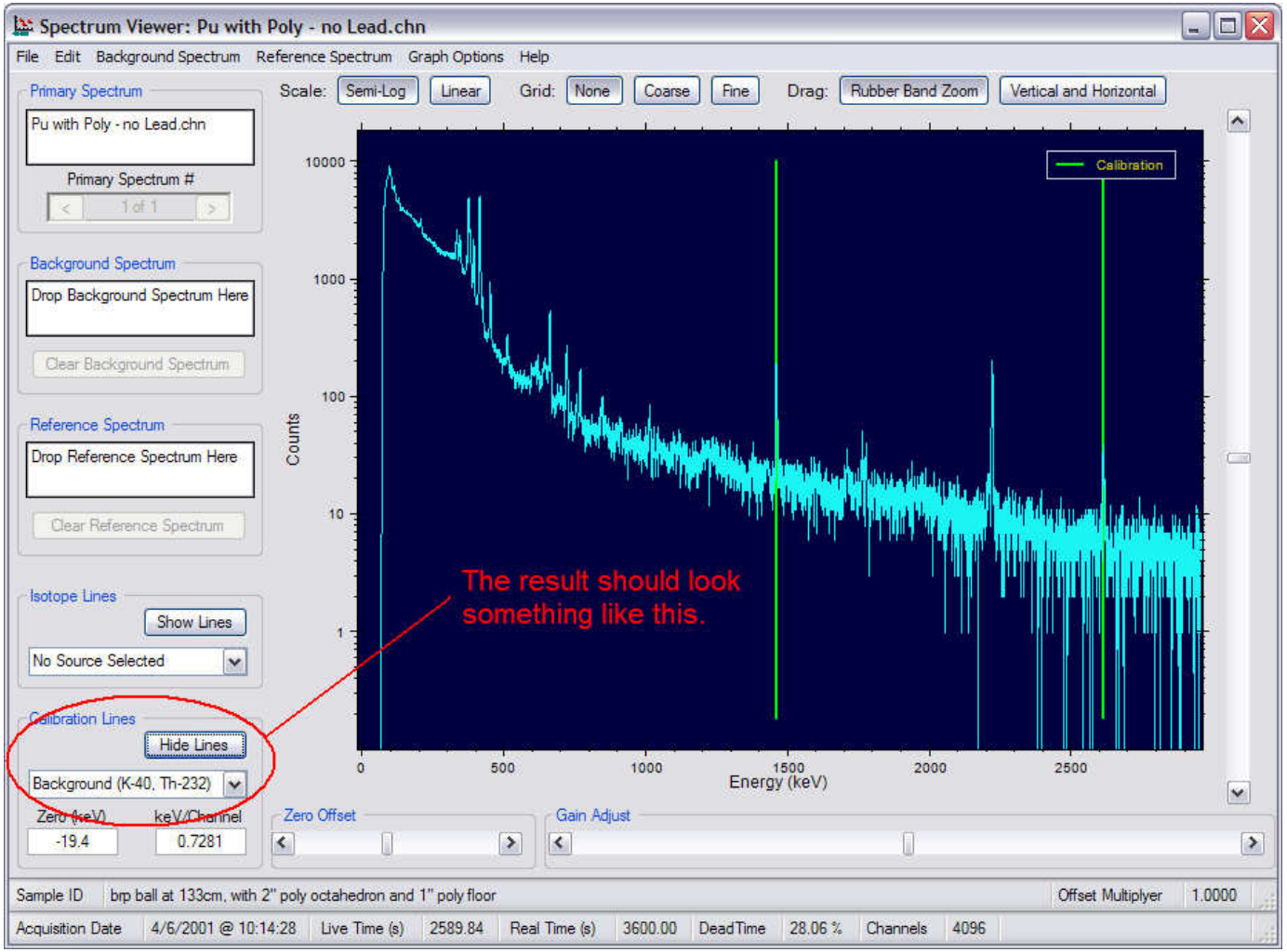
Isotope lines



Energy calibration check…



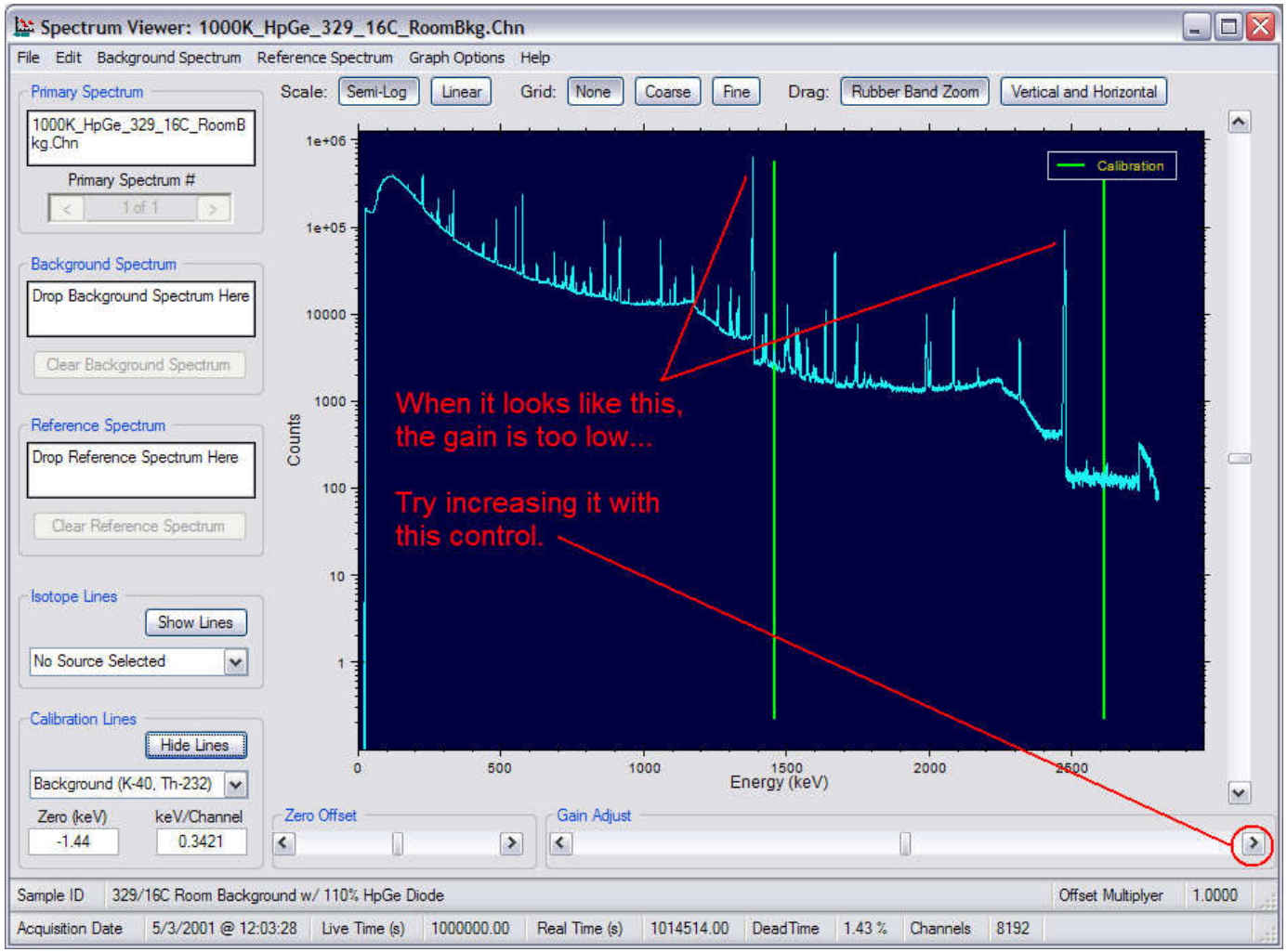
Energy calibration check…



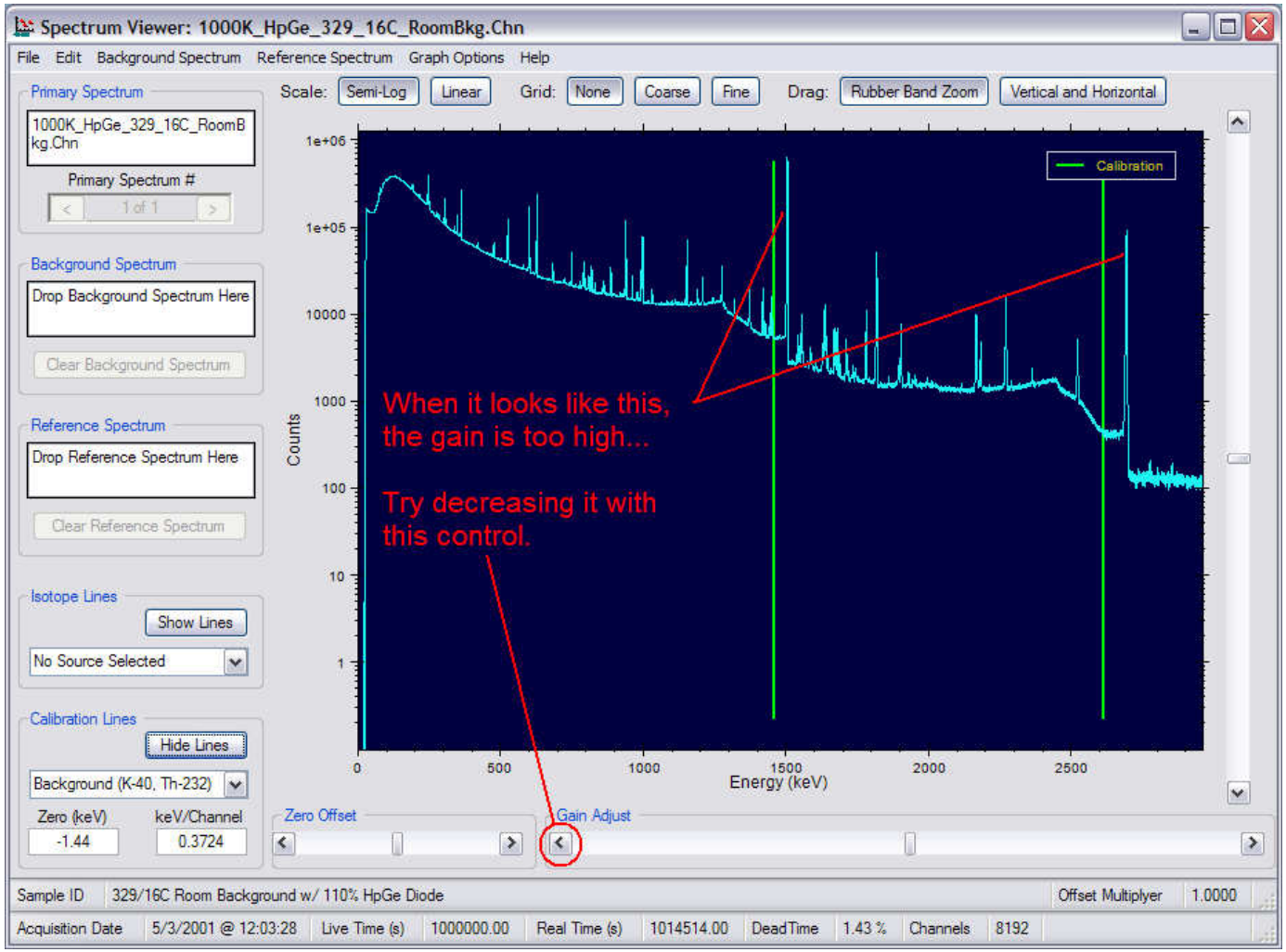
Energy calibration check…

- 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



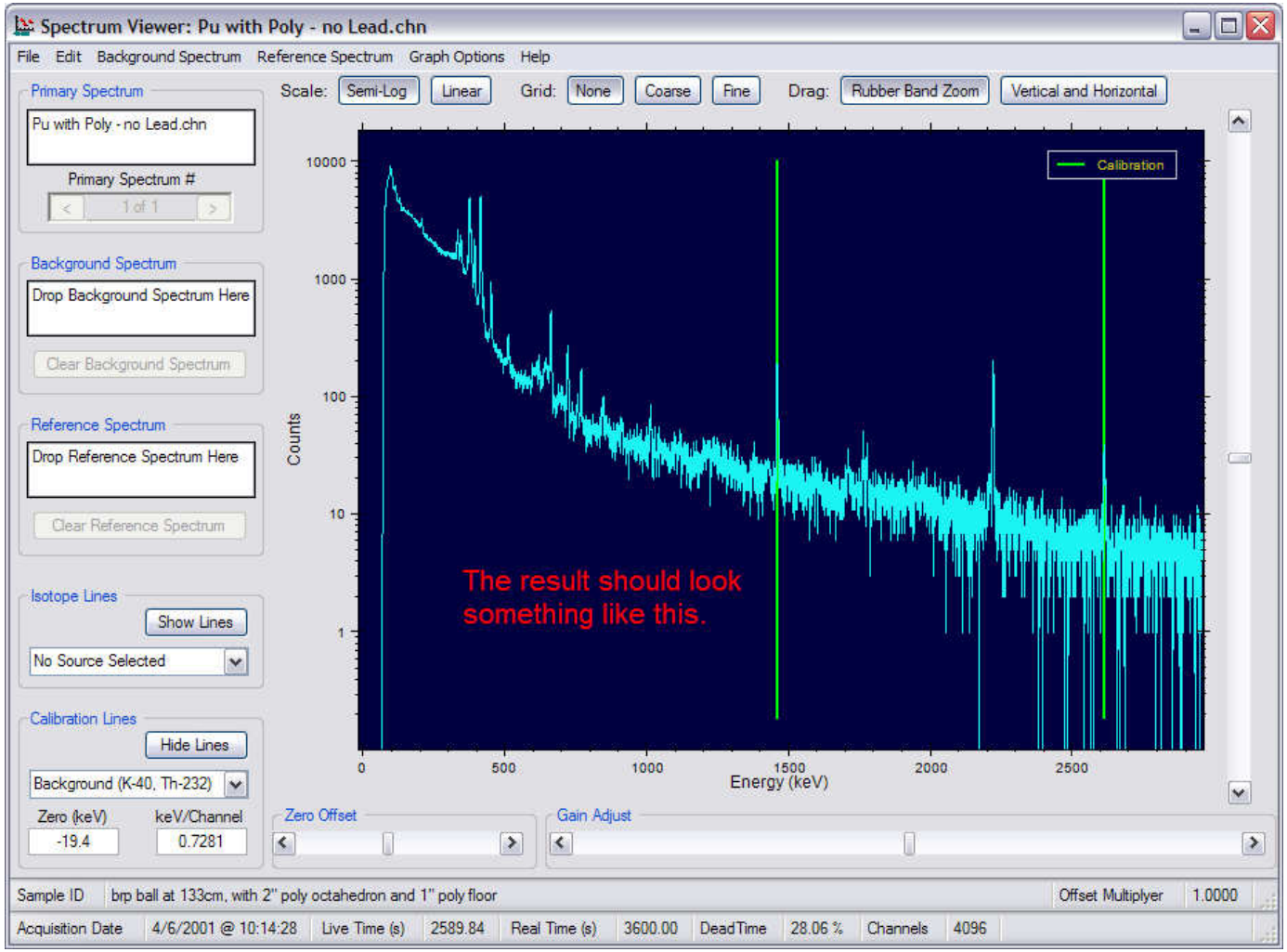
Changing the energy calibration with the Gain Adjust controls



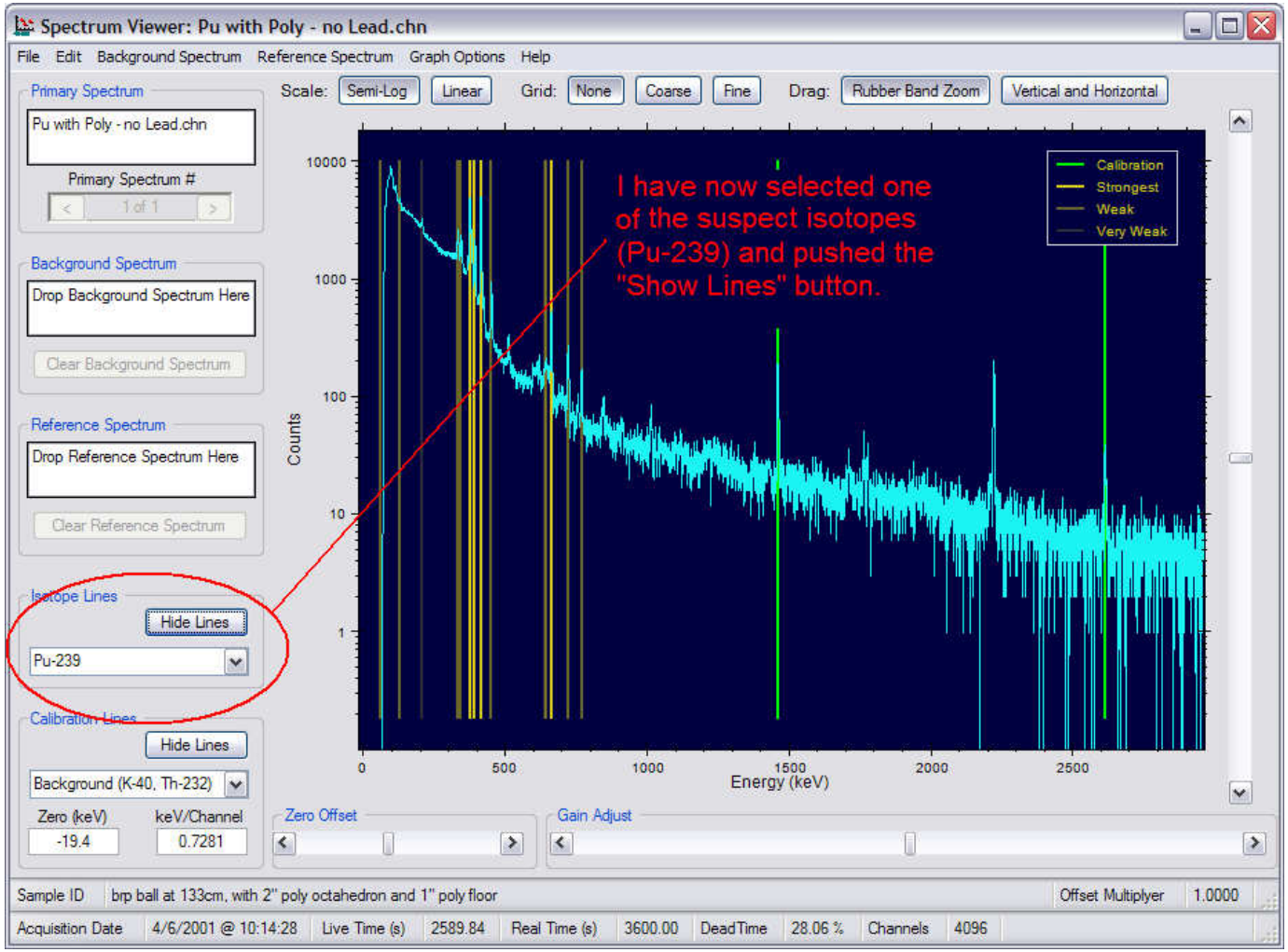
Analysis Methods

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

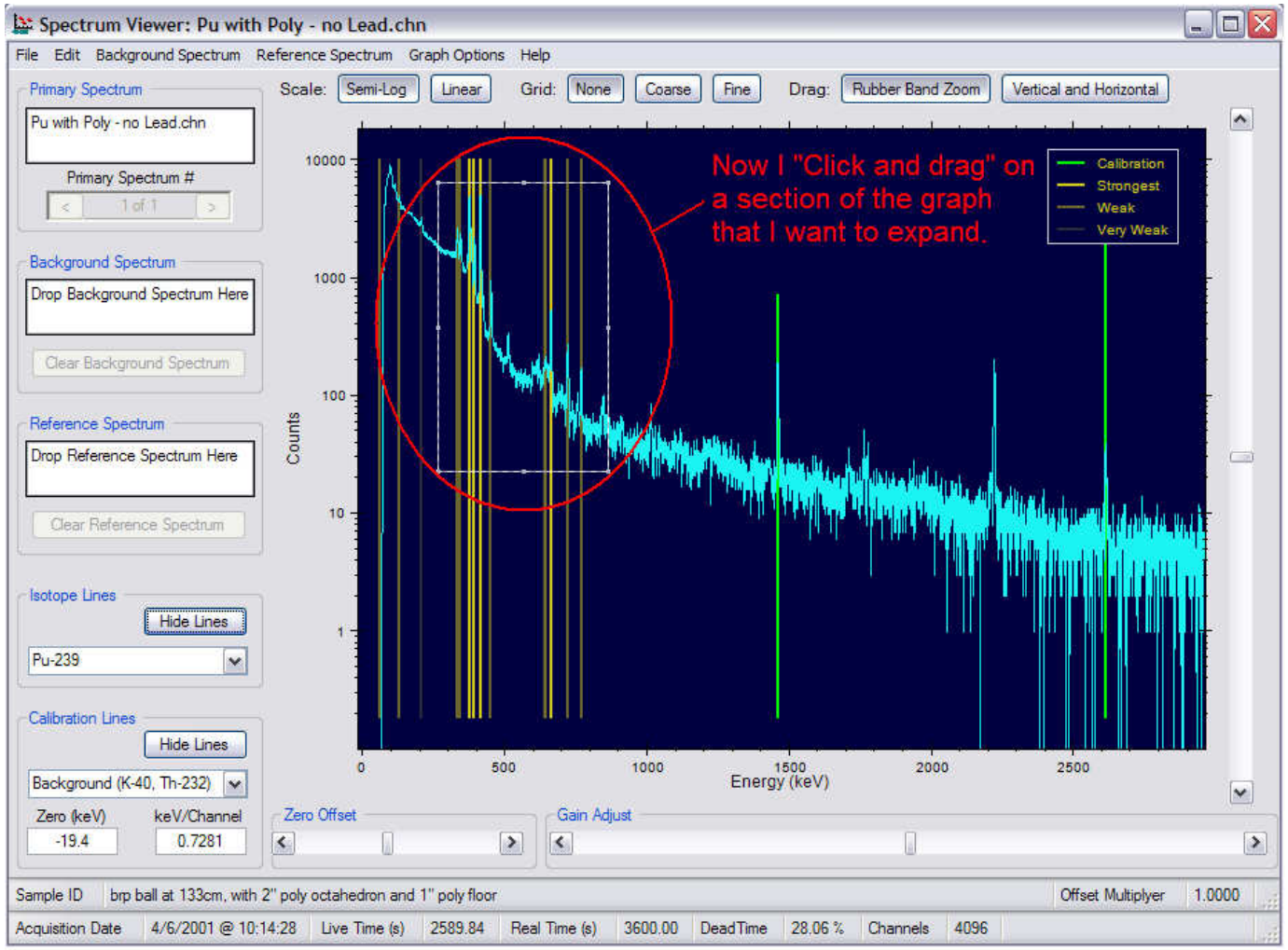
Quick energy calibration check



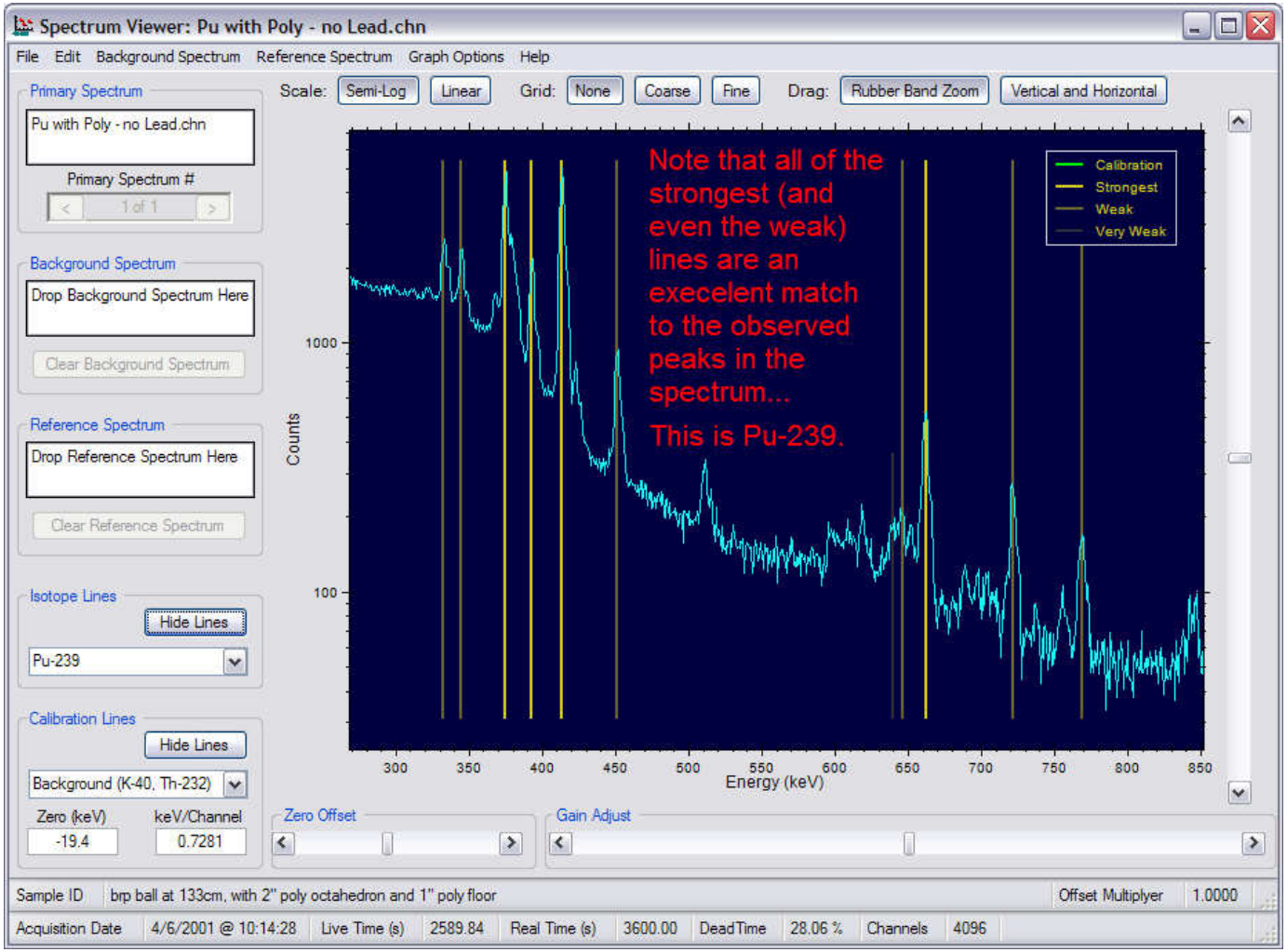
Comparison to known energy lines…



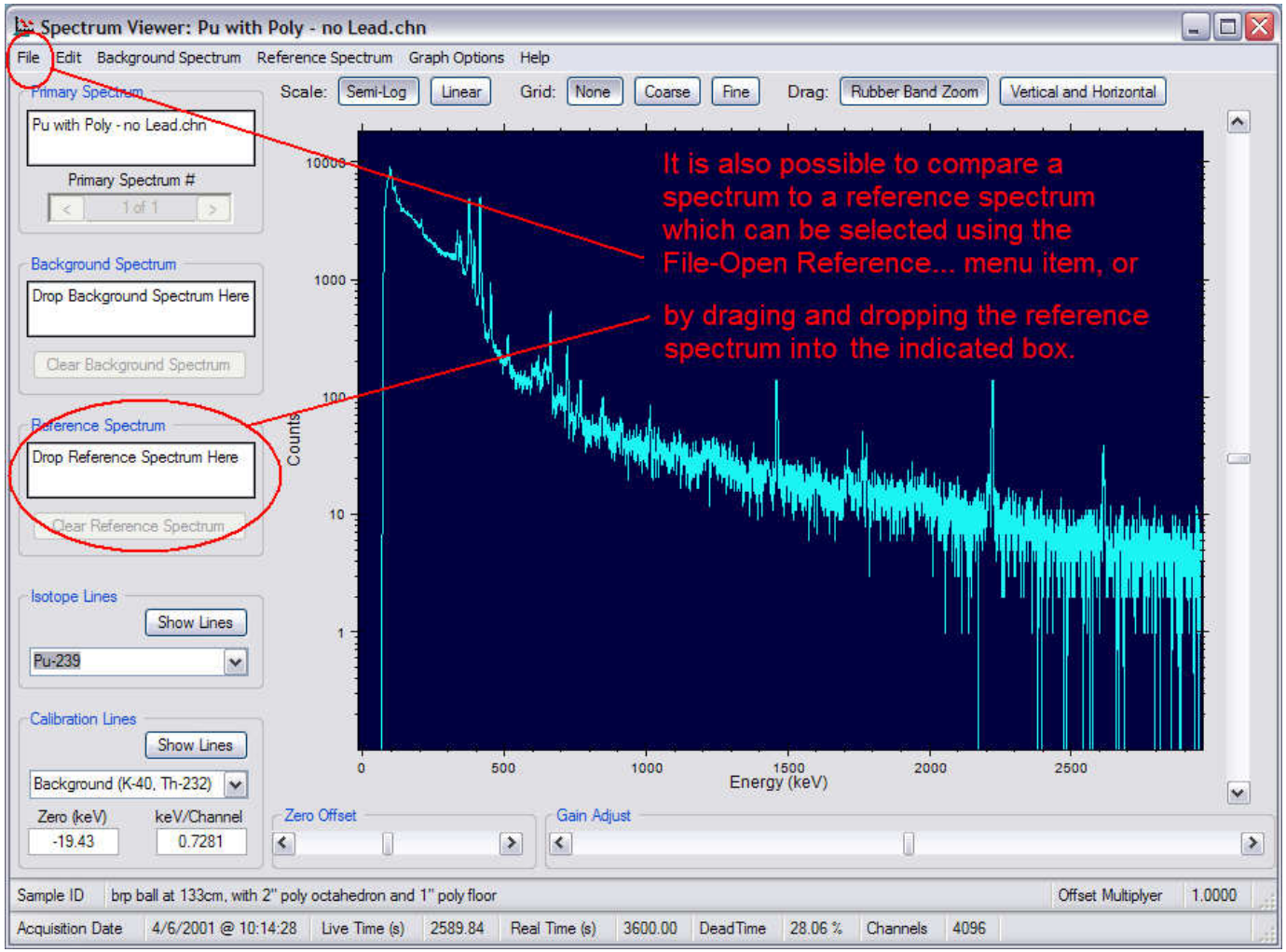
Comparison to known energy lines…



Comparison to known energy lines…



Comparison to a reference spectrum…



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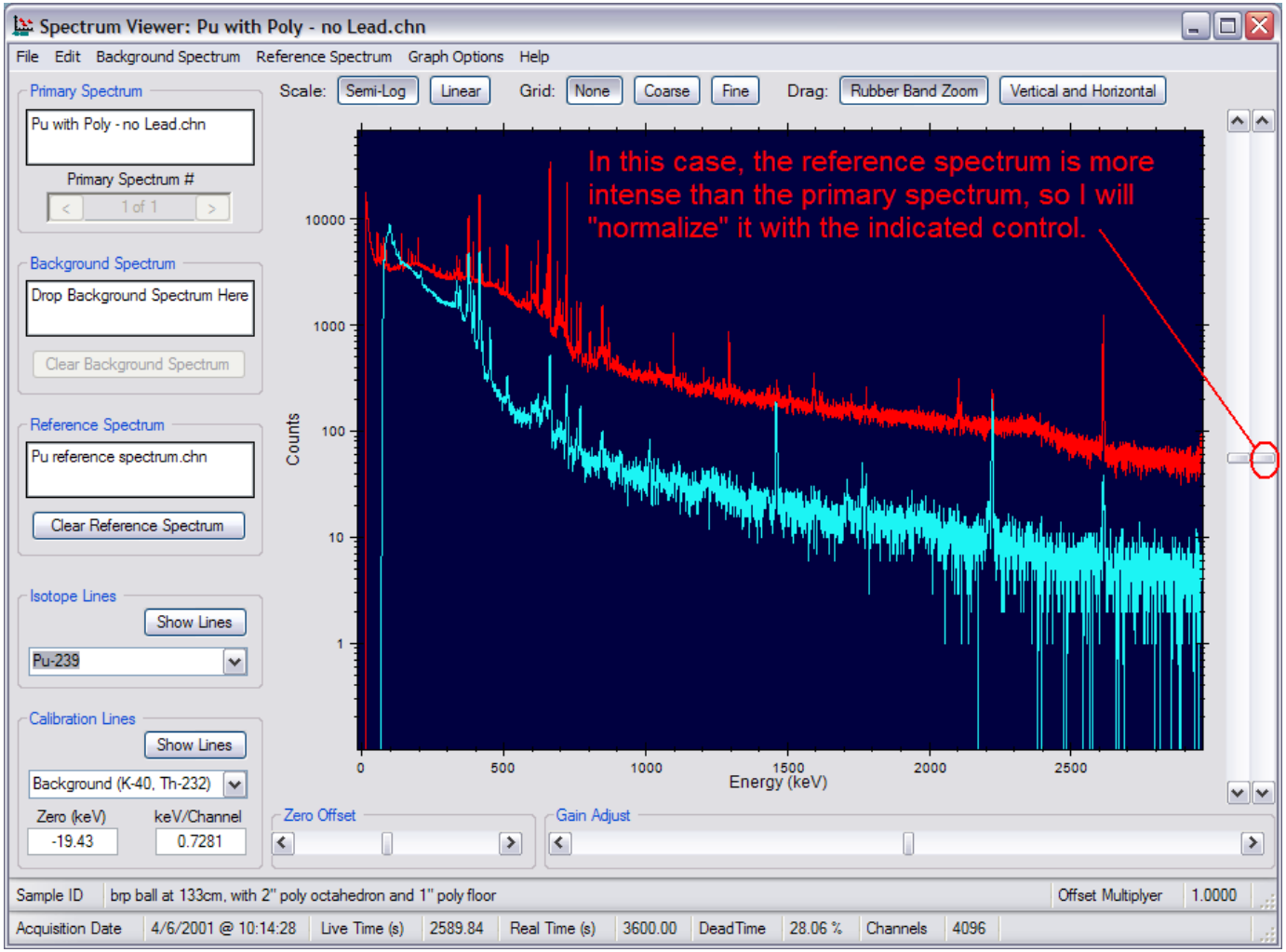

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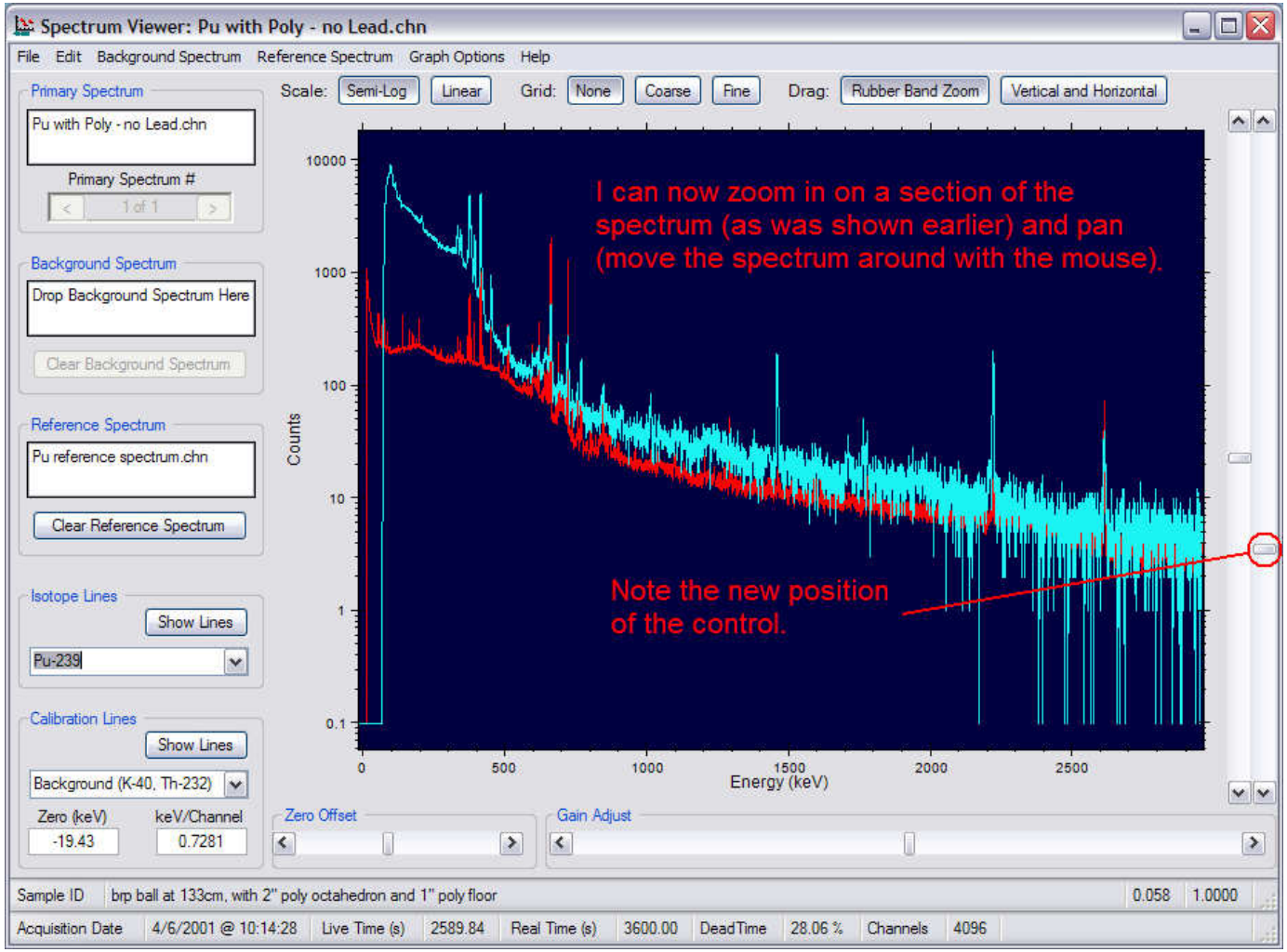
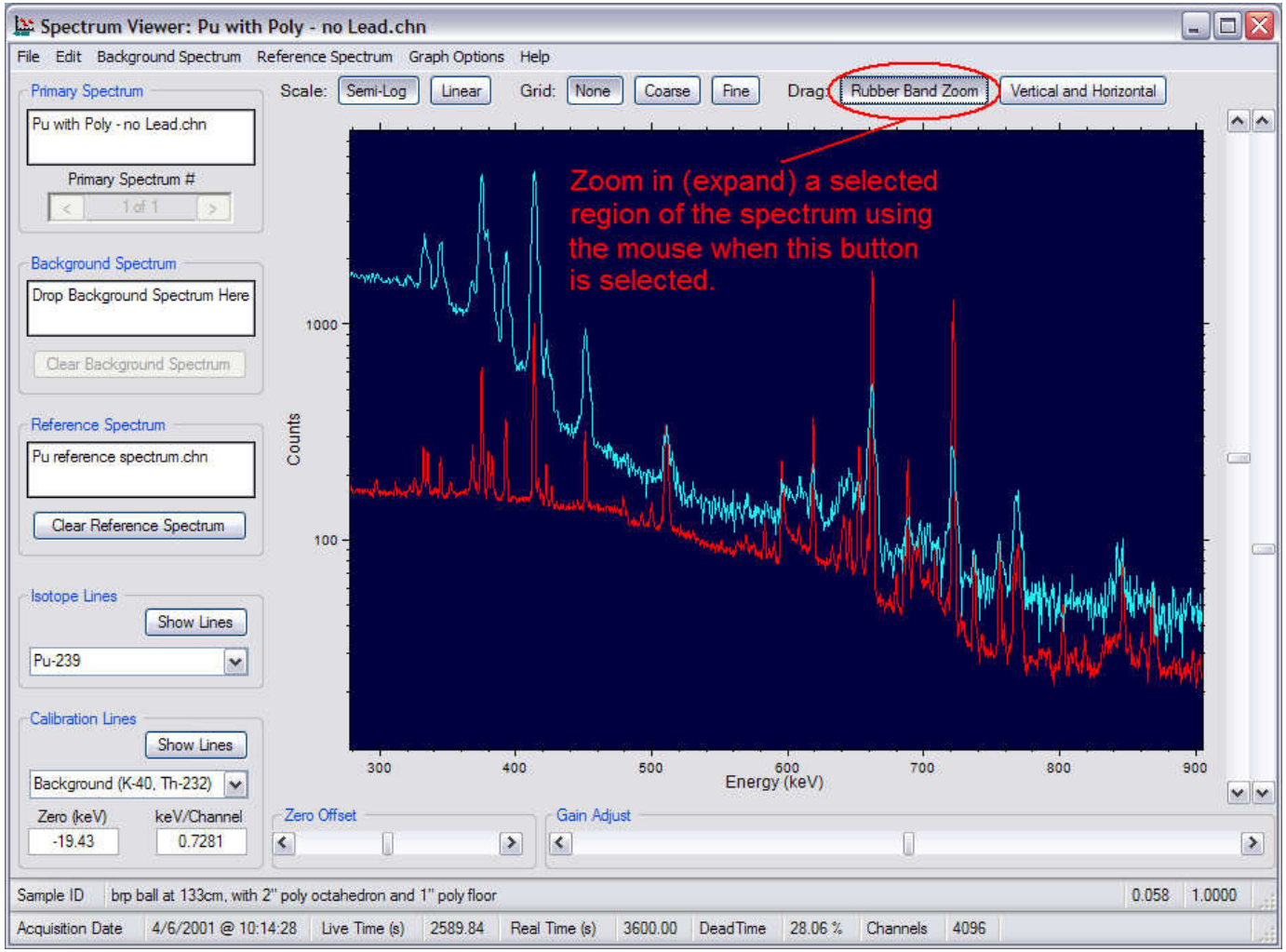


Comparison to a reference spectrum…



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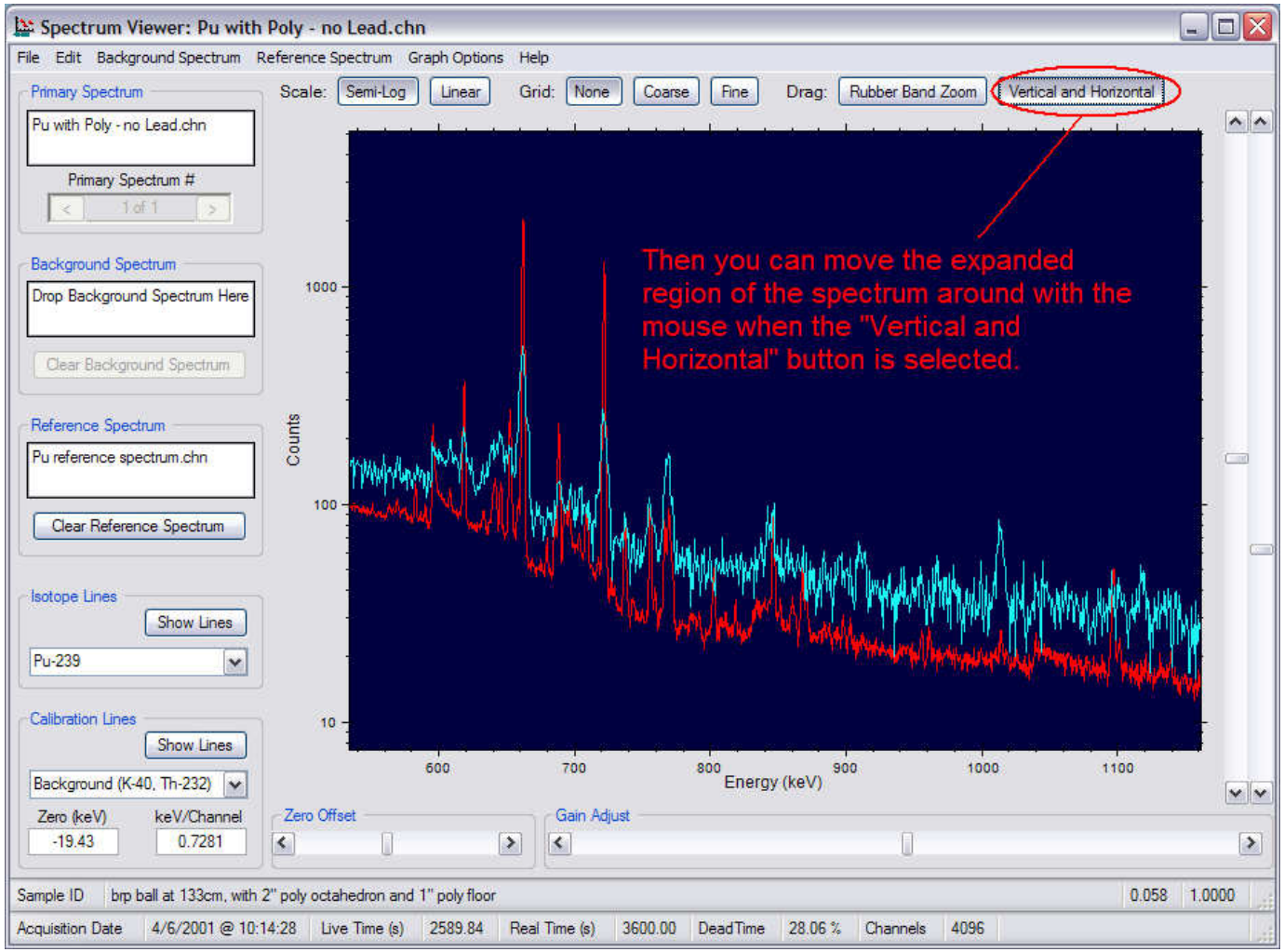
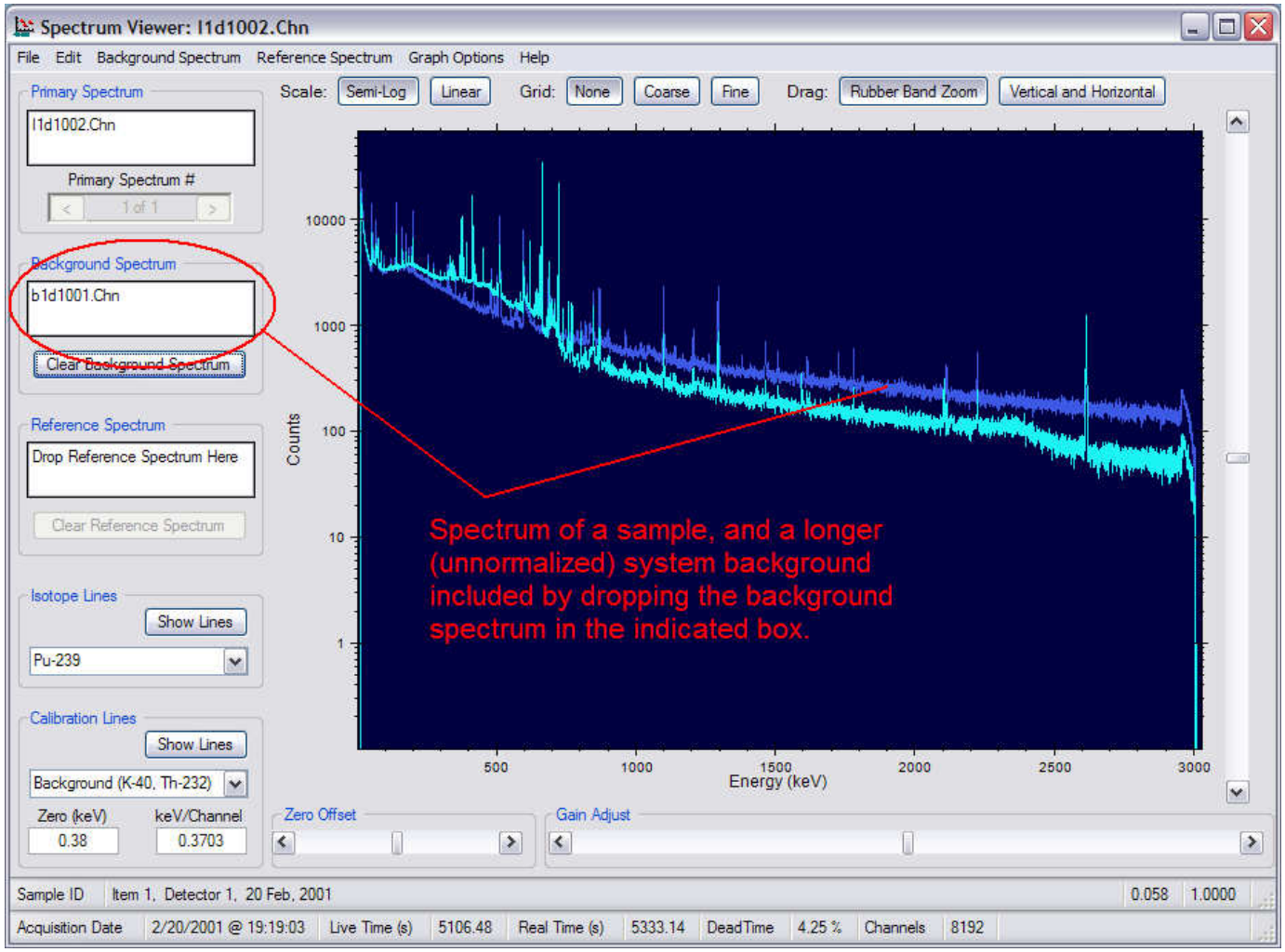
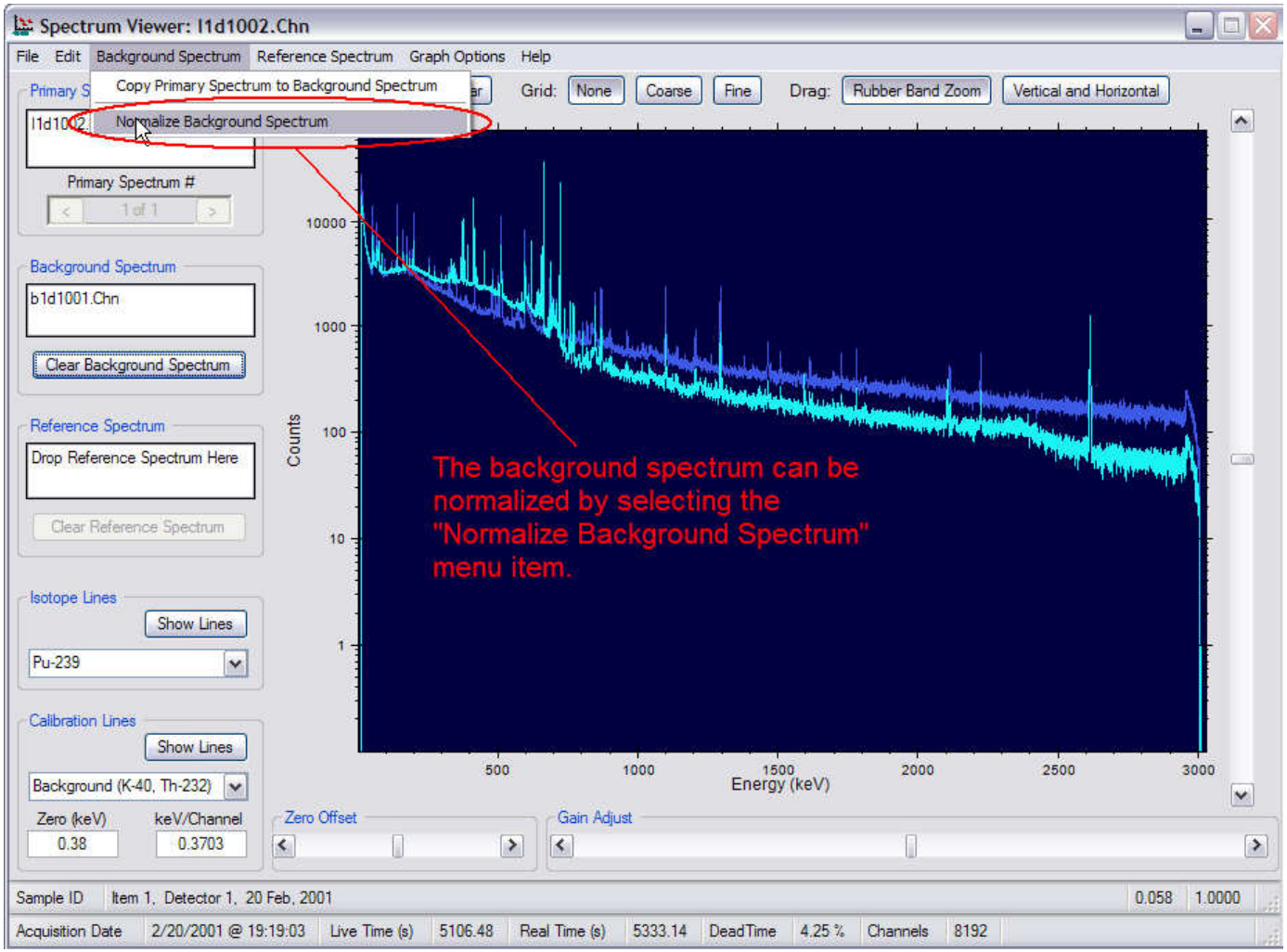


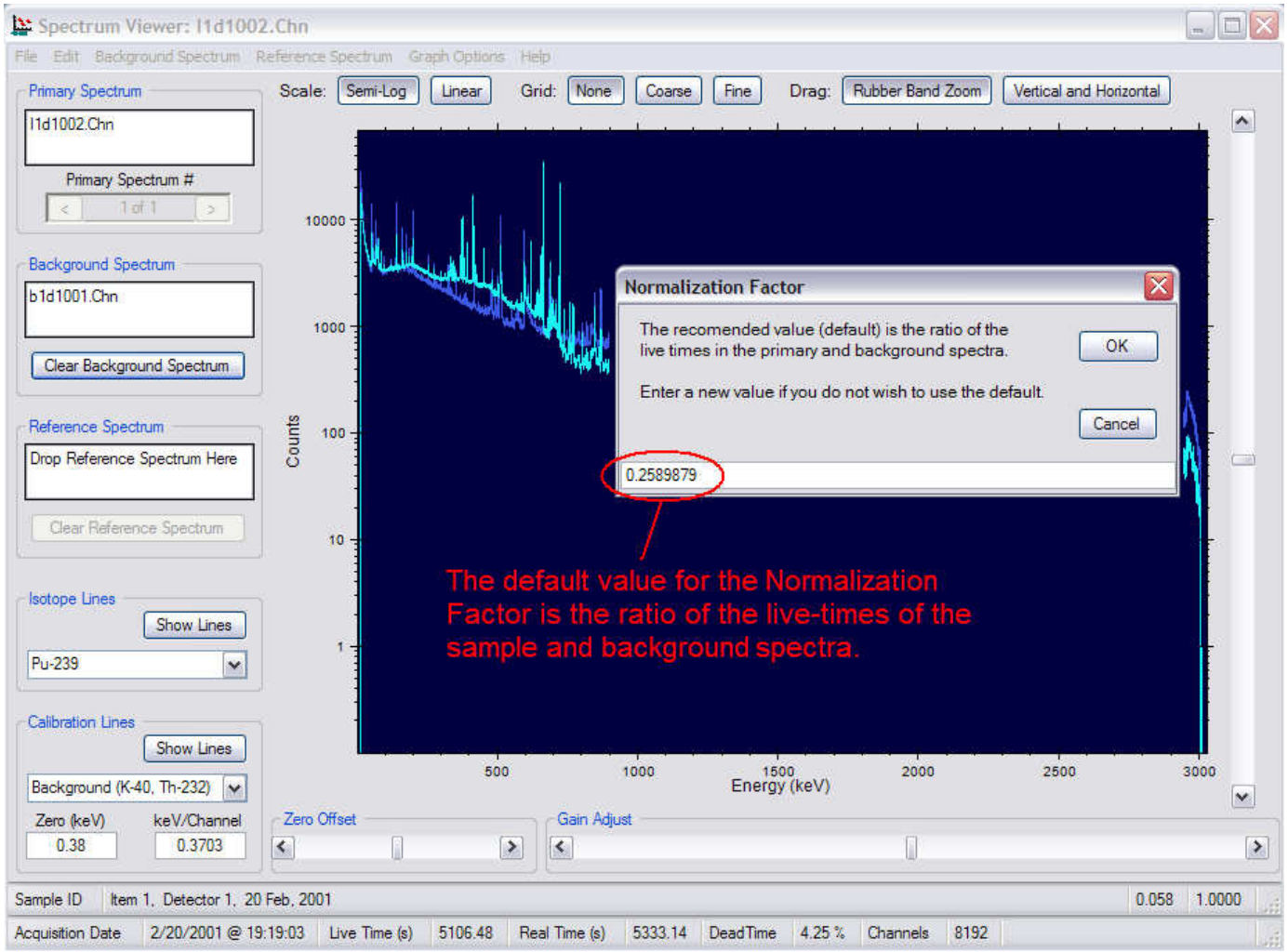
Comparison to a background spectrum…



Comparison to a background spectrum…



Comparison to a background spectrum…



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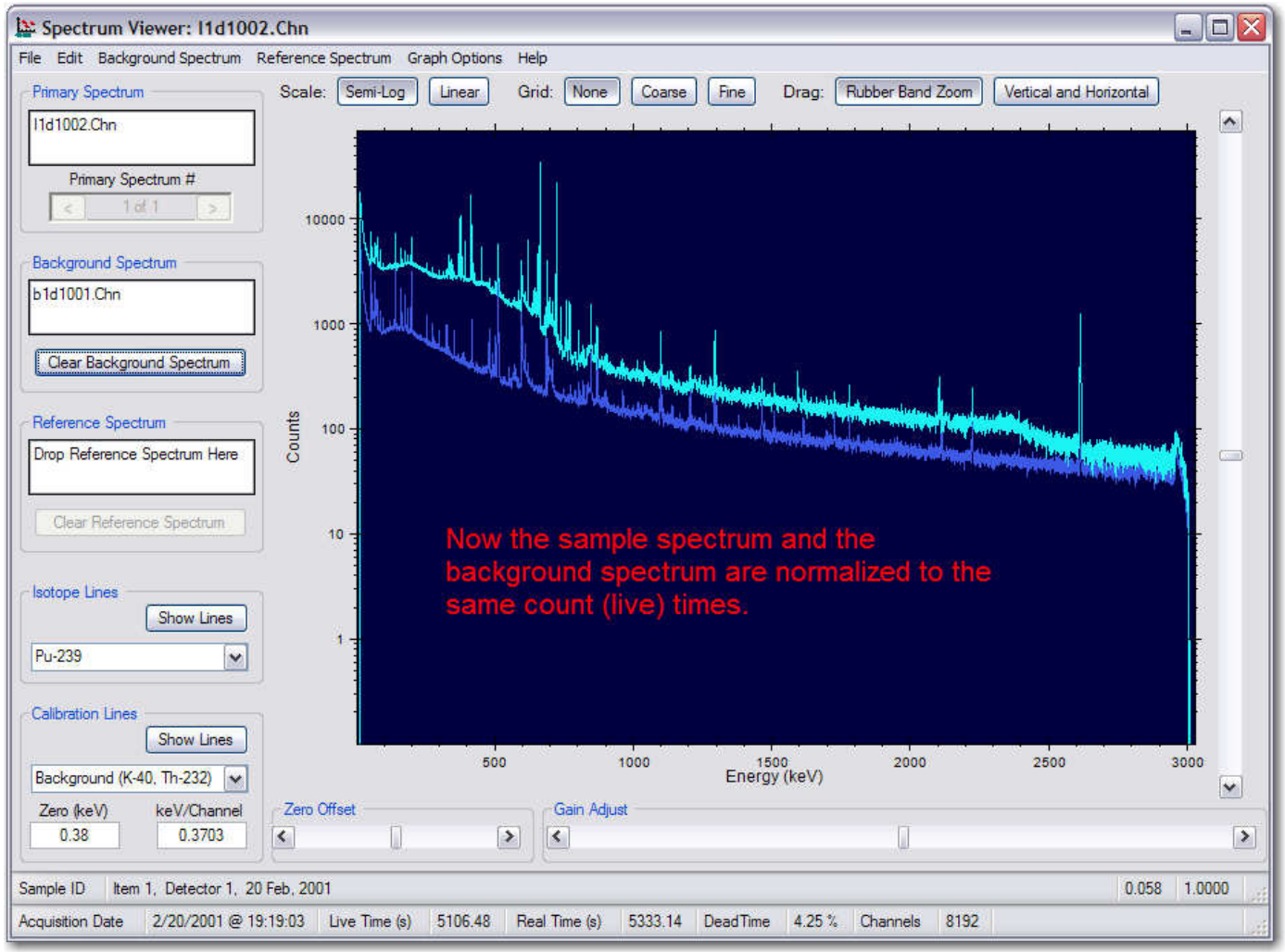
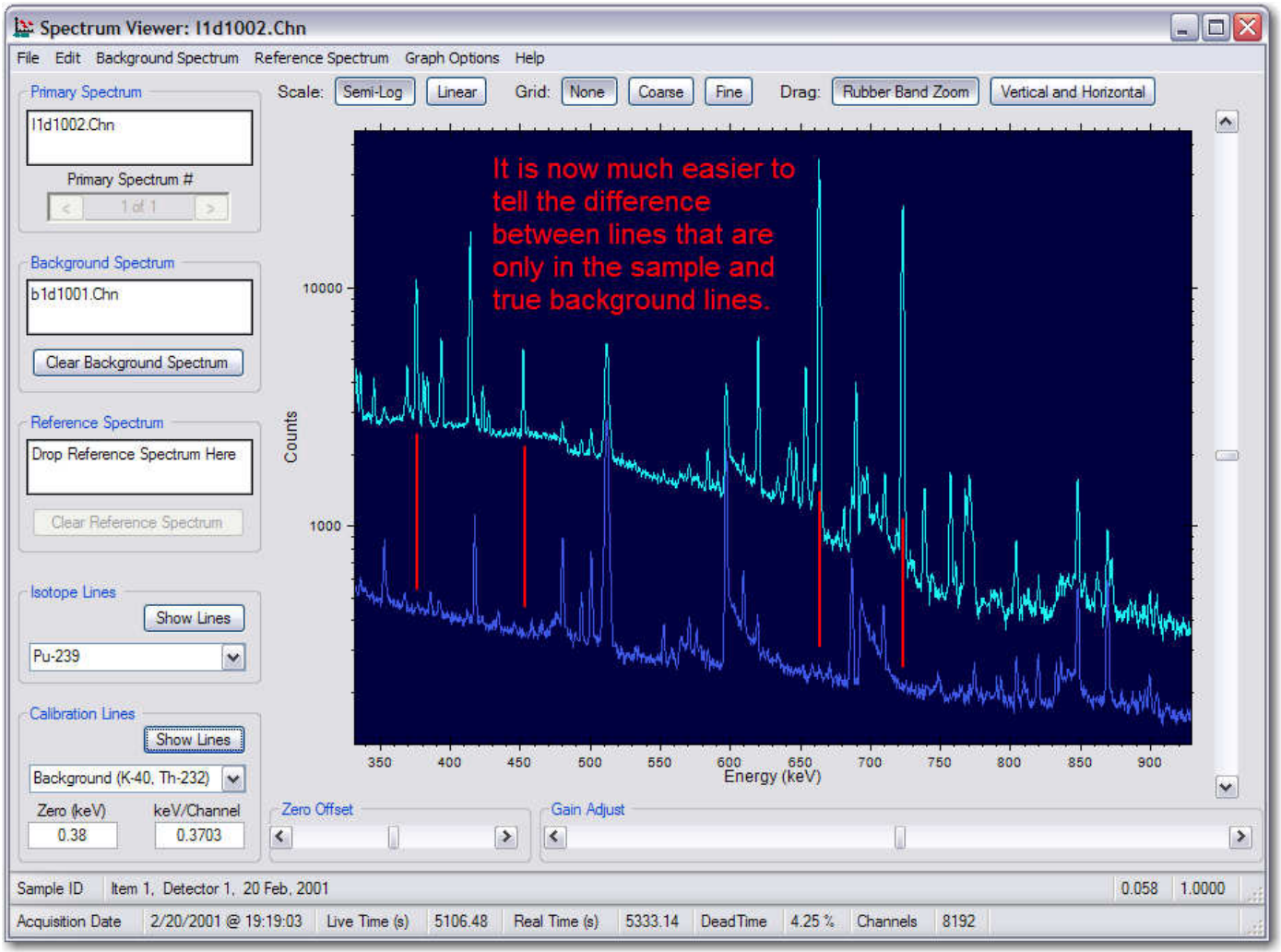


Comparison to a background spectrum…



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