Digikröm Series Monochromator, AD111 PMT Detector Zero & Calibration Instruction

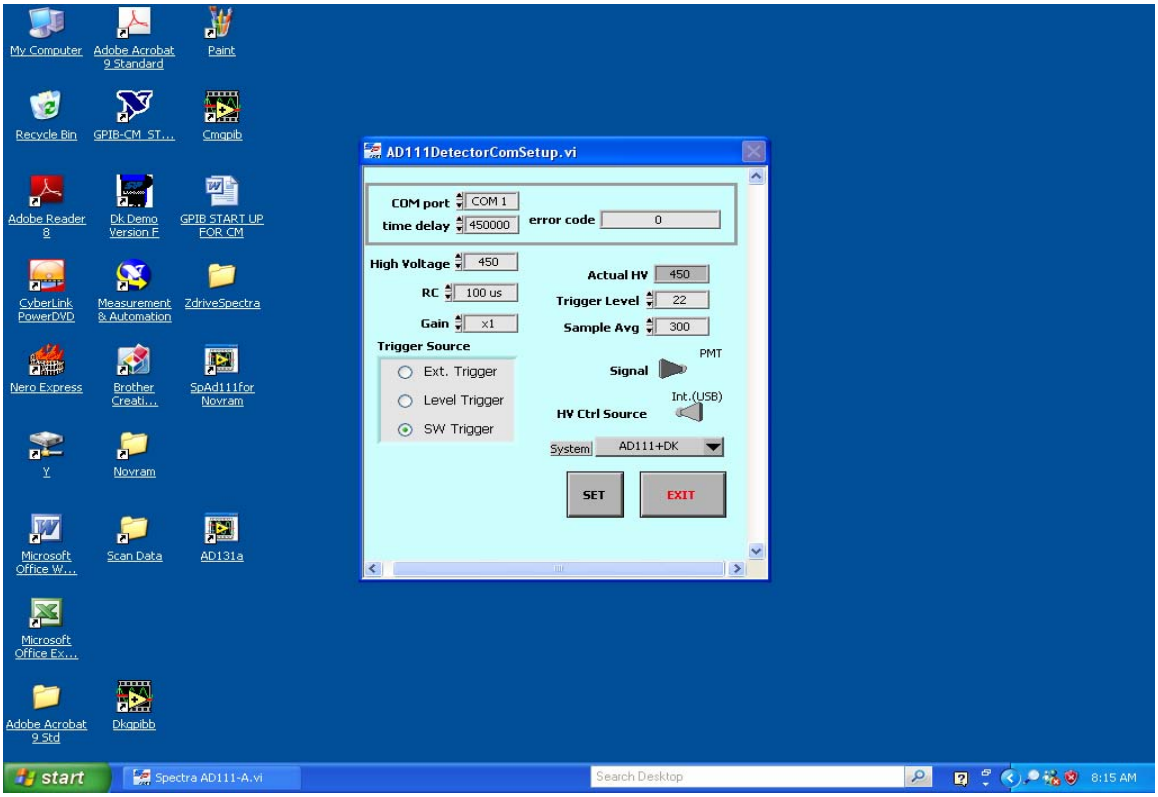
May, 2015

Spectral Products
2659-A Pan American Frwy., NE Albuquerque, NM 87107 Tel (505) 343-9700 Fax (505) 343-9705
www.spectralproducts.com

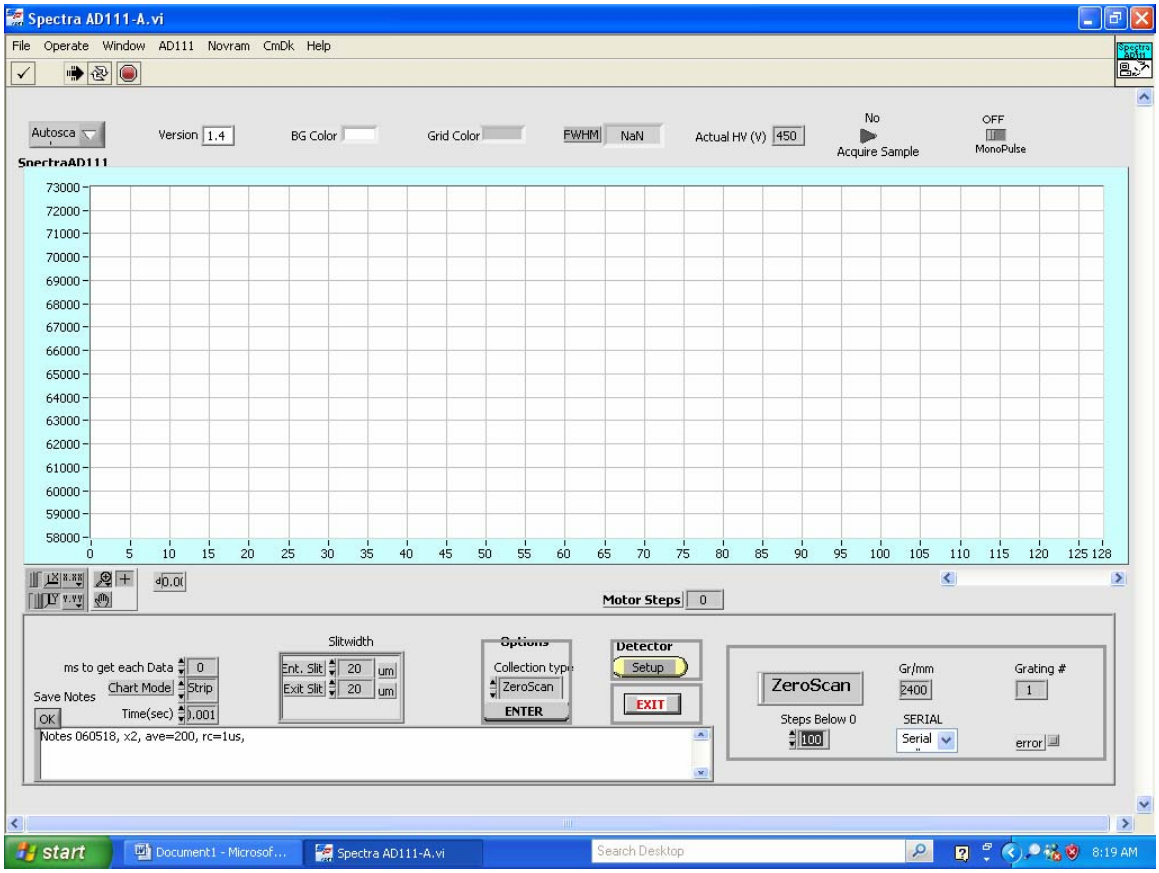
I. Introduction

1. The purpose of this manual is to provide a step by step tutorial type of document allowing the user to quickly **Z**ero and **C**alibrate their DK series monochromators' gratings, while familiarizing themselves with the operation of both the AD111 detector system and monochromator.
2. Often after shipment, it is necessary to re-zero the monochromators' gratings as some shifting of optical components is inevitable. Extremely minute shifts in the optical path can result in what seems to be quite large shifts in wavelength at the monochromator exit.
3. It is extremely important to first establish the **Z**ero order offset of each grating ***BEFORE*** attempting to **C**alibrate the grating. The algorithm for each grating is based on the **Z**ero offset value programmed into Ram (Novram).
4. Under most circumstances, once **Z**ero order is established, no further calibration is necessary as the **C**alibration offset is based off of the **Z**ero offset as stated above.
5. For **Z**ero and **C**alibrate functions, it is most accurate if a point source, such as a HeNe laser, or a spectral line source, such as Spectral Products ASC series of calibration lamps is used. While **Z**ero is possible if using a broadband source, **C**alibration would be quite inaccurate unless a notch filter is used in conjunction with the source.
6. For this tutorial, it is assumed communication has already been established with both the monochromator and AD111 detector.

II. Zeroing and Calibrating a Grating

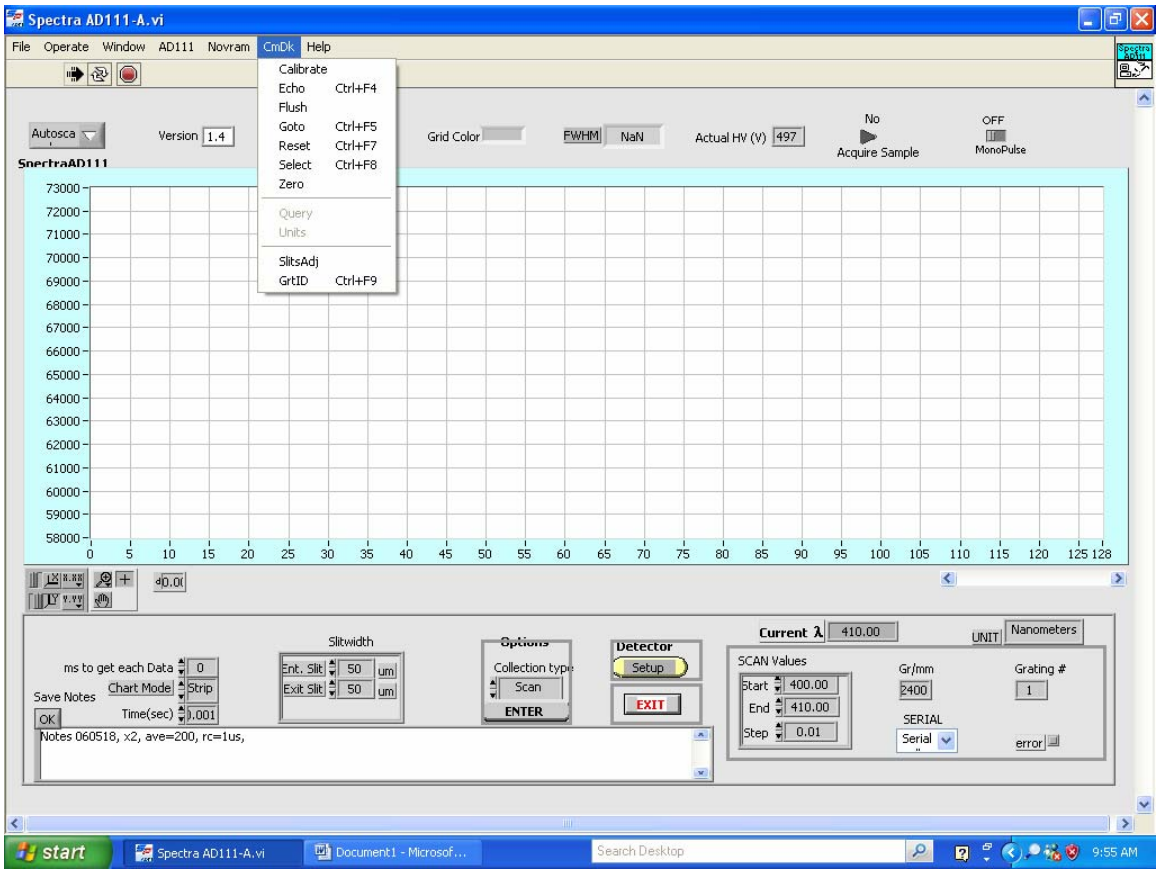


1. The first screen to pop up when opening the AD111 program is shown above. Several things to look for in this screen are:
    a. High Voltage – User input value of 0-1000 volts. Be aware that the higher the voltage applied to the PMT increases the noise level of the detector.
    b. Gain – User input value of 0-10. Again, higher gain results in increased noise level.
    c. Sample Average – User input value of 1-300. The higher the number of samples taken results in a smoother waveform profile.
    d. RC – There are 4 settings for the RC time constant. The faster RC results in the smoothest waveforms.
    e. System – The AD111 can be used as a stand alone system or with a monochromator. This tutorial is for use with DK monochromators.
2. Press **S**et and then **E**xit when satisfied with your settings.

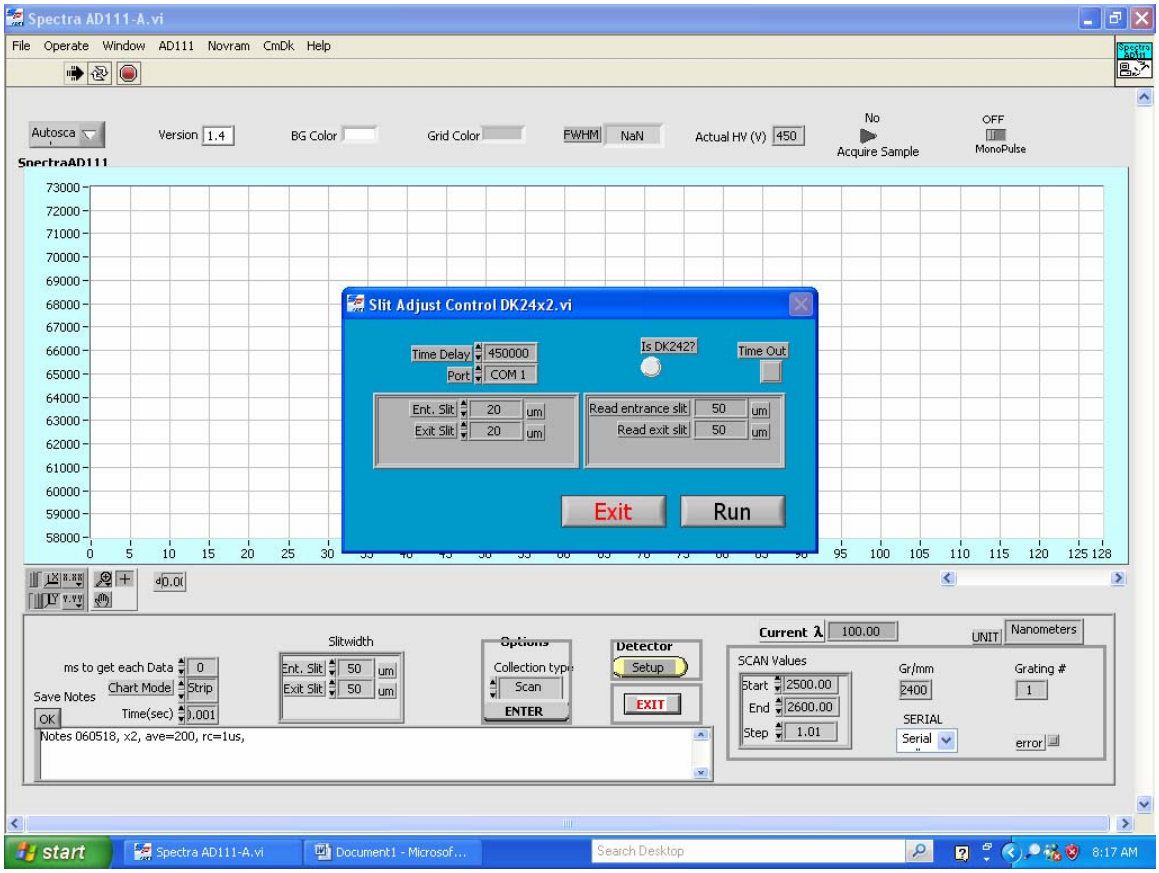


1. The screen above is the next one you will see after detector parameters are set. Several things about this screen:
    a. Slitwidth – This is informational only. The monochromator slit width can not be changed in this window.
    b. Options, Collection Type – This is user selected between Zero Scan or Wavelength Scan.
    c. Detector – Pressing this button will open the detector parameters window.
    d. Steps Below 0 – this is user input 1-300 motor steps. During a **Z**ero scan, the monochromator will step the grating this value below the last programmed **Z**ero offset. The grating will step the same number of motor steps above the last programmed **Z**ero.
    e. This same window indicates type of scan, grating grooves/mm, the grating I.D. number within the monochromator, and the monochromator serial number.
    f. EXIT – this button removes the power to the AD111. If this is pressed, you must restart the system.

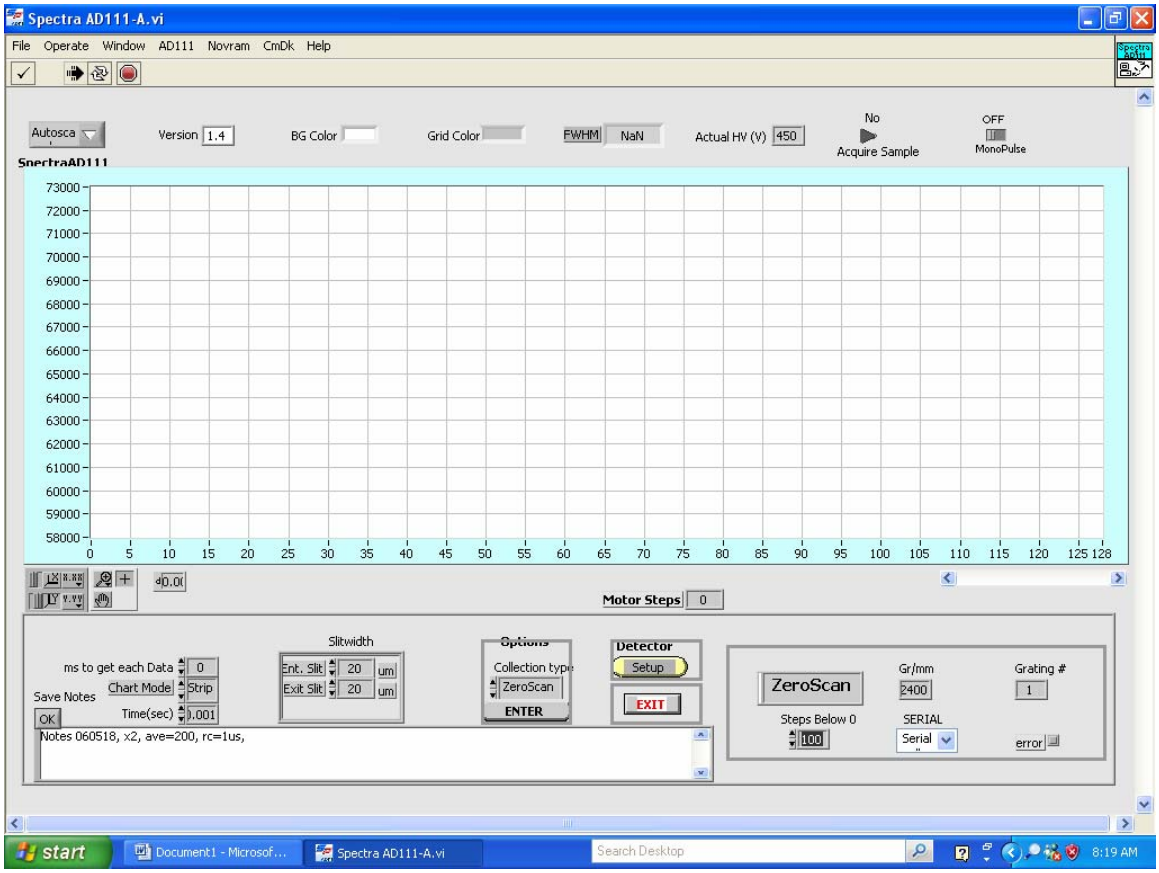
S



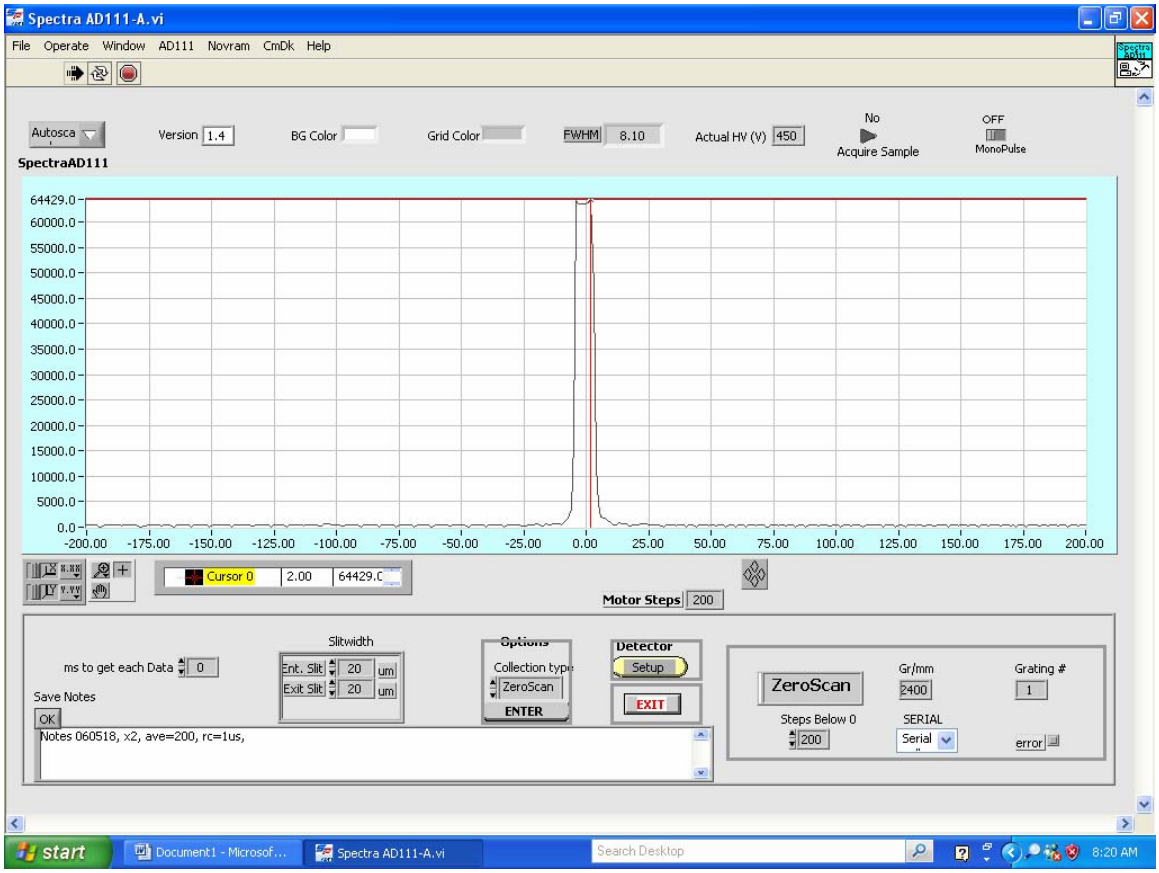
1. Pressing the CmDk button will open the drop down menu shown above. Options relevant to this tutorial are:
    a. Calibrate – Calibrates the grating to a known wavelength. Note: this command changes the offset value stored in Ram.
    b. Goto – Instructs the grating to slew to user defined wavelength. Note that this command only instructs the grating to move to a wavelength. It ***DOES NOT*** take a wavelength scan.
    c. Reset – Can be used to reset the grating to default (100nm).
    d. Select – User input to select grating if more than one is installed.
    e. Zero – Calibrates the Zero order of the grating. Note: this command changes the offset value stored in Ram.
    f. SlitsAdj – User input of 10-3000um slit widths. Can be adjusted separately, but it is recommended to have equal entrance and exit slit widths.



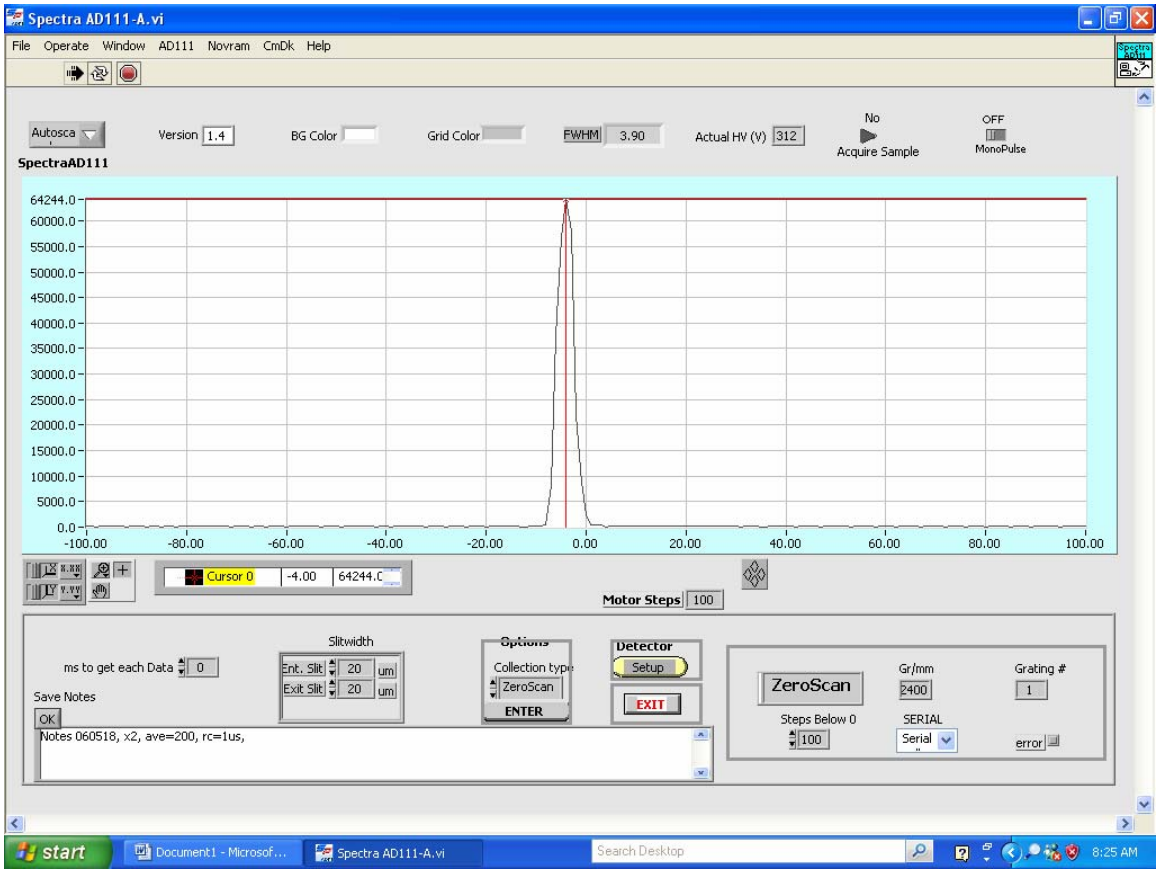
1. Pressing the SlitsAdj will give the pop up window shown above. For **Z**ero and **C**alibration purposes, narrower slits will result in more accurate results. At power on, the DK defaults the slit width to 50um. For calibration at Spectral Products, 10-20um slits are routinely used.
2. These values can be changed either by use of the arrow buttons or by highlighting the value inside the box and typing in a new value.
3. Press Run to change to the desired value, then Exit to close the popup window and continue.



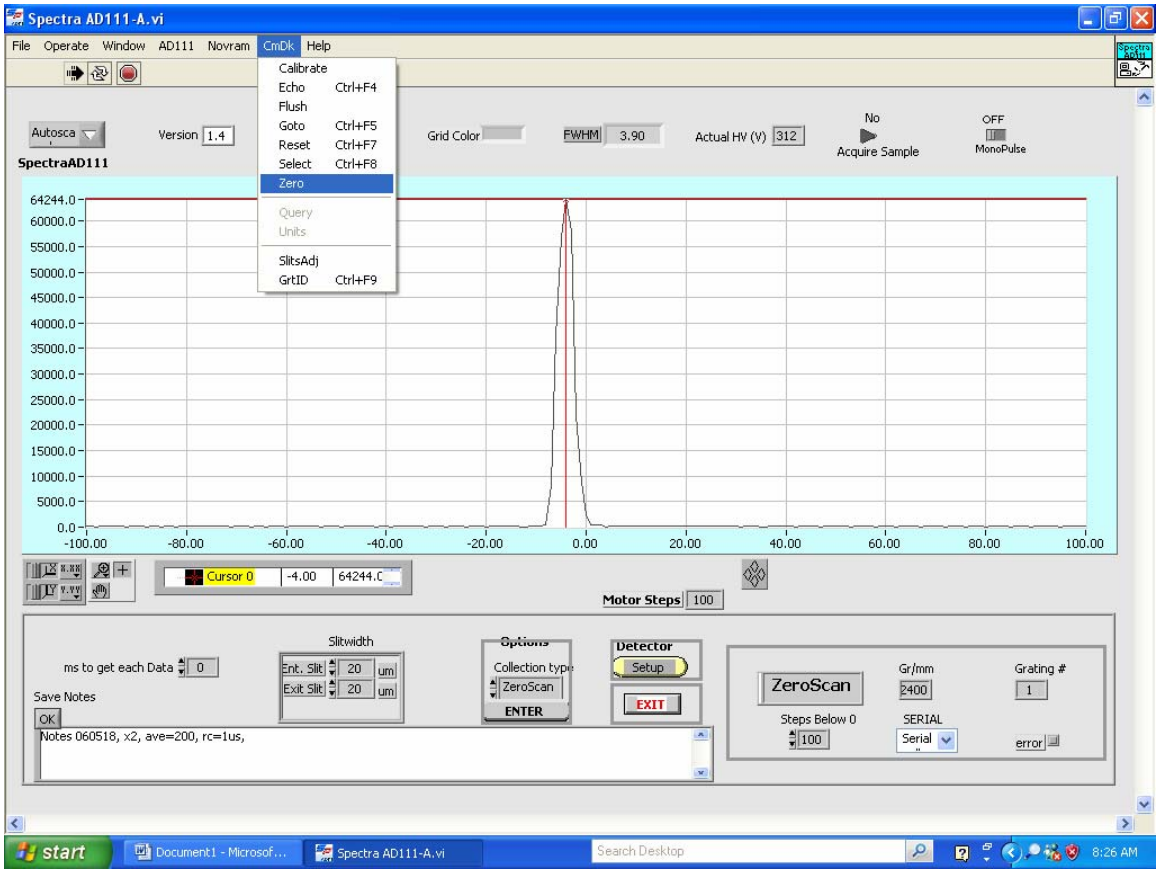
1. Click on the Scan/ZeroScan box in the Collection Type window and select ZeroScan.
2. Enter the desired length of **Z**ero scan you would like to run (1-300 motor steps).
3. Press Enter in the Collection Type window to start the **Z**ero scan. The Motor Steps box will indicate the real time progress of the scan.



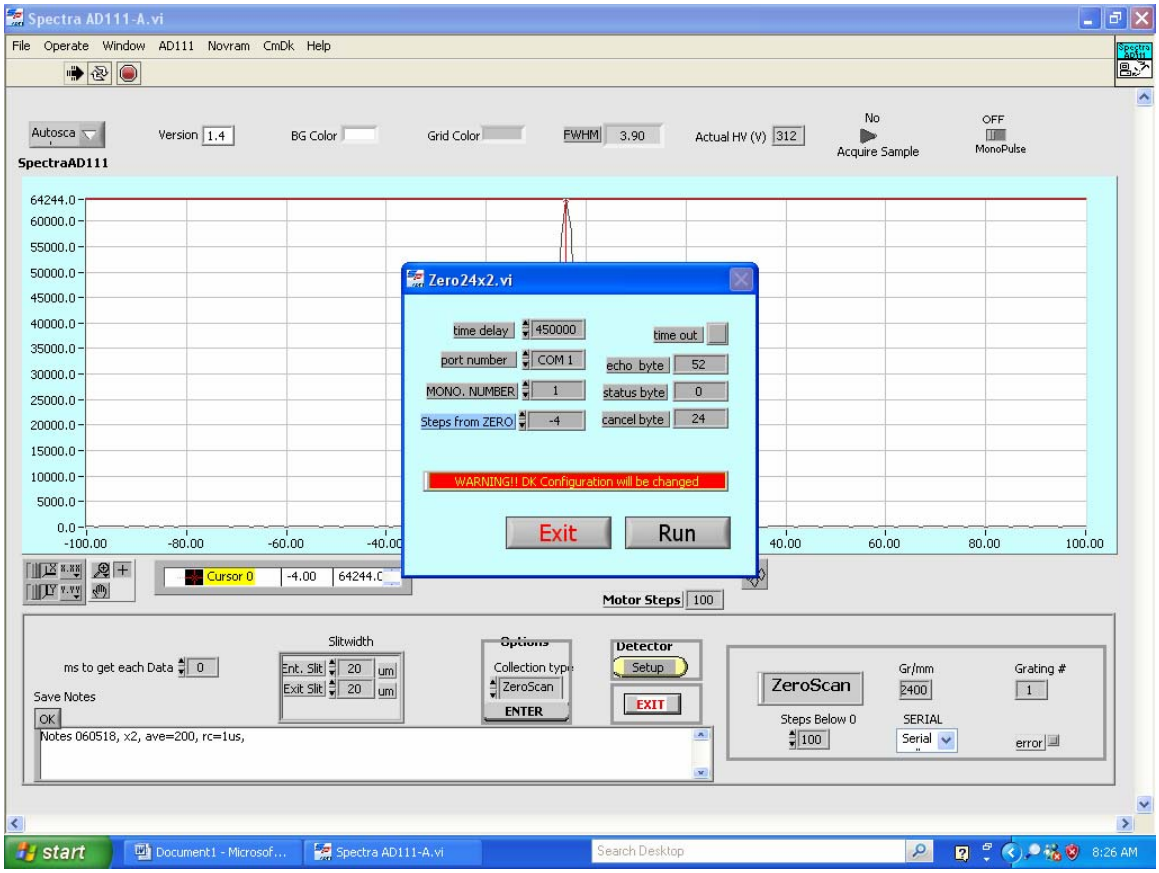
1. At the conclusion of the scan, if no waveform is present you can:
    a. Raise the high voltage on the PMT.
    b. Conduct a longer scan.
    c. Open slits to a wider setting.
    d. Increase source output
    e. Any combination of the above.
2. If your waveform looks like the one shown, the PMT is saturated. This is shown with a flat top several steps long. In this case either:
    a. Lower the high voltage.
    b. Narrow the slits.
    c. Decrease the source output.
    d. Any combination of the above.



1. In this case, the high voltage was lowered to give a waveform with a discernable peak.
2. The peak is centered at -4 motor steps. This, as well as peak intensity is indicated in the Cursor 0 box located directly under the scan area of the screen.



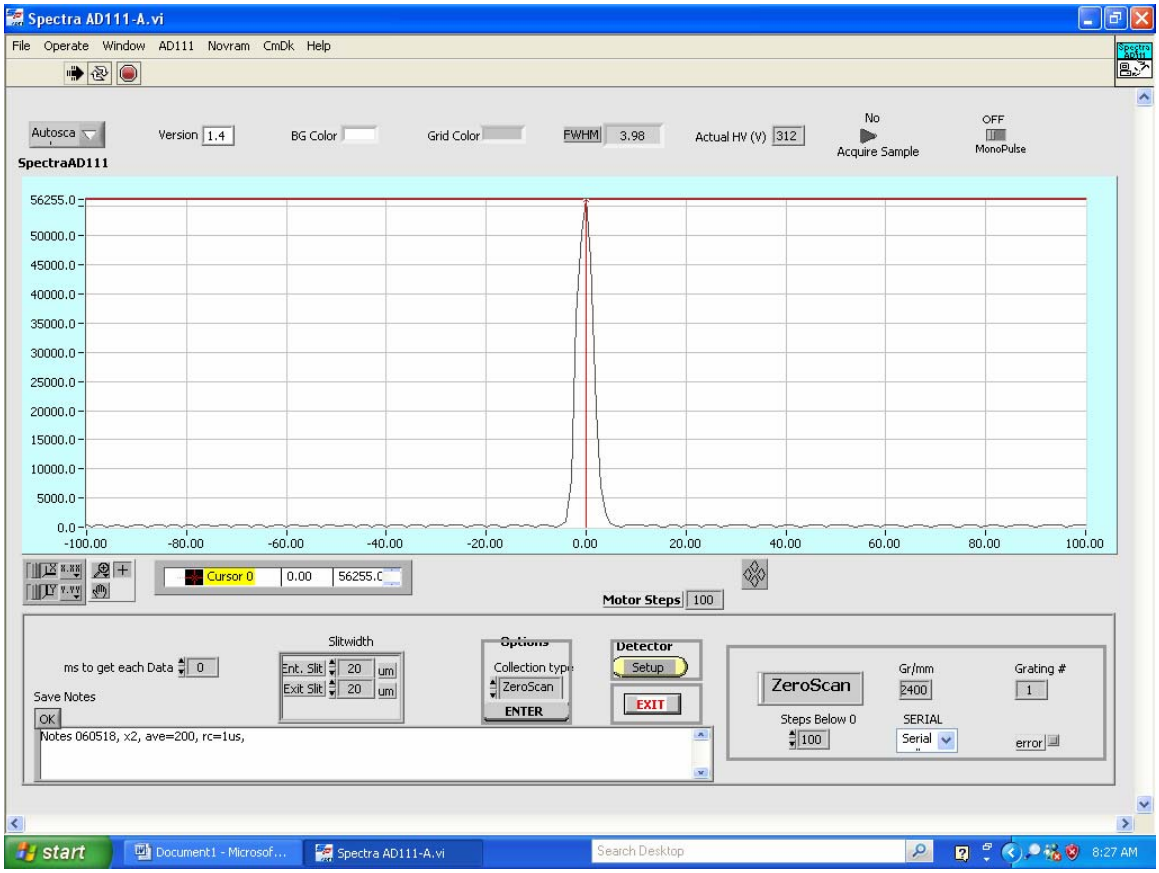
1. To **Z**ero the grating to its new offset, click the CmDk button.
2. Select the **Z**ero option. A new pop up window will appear as below.



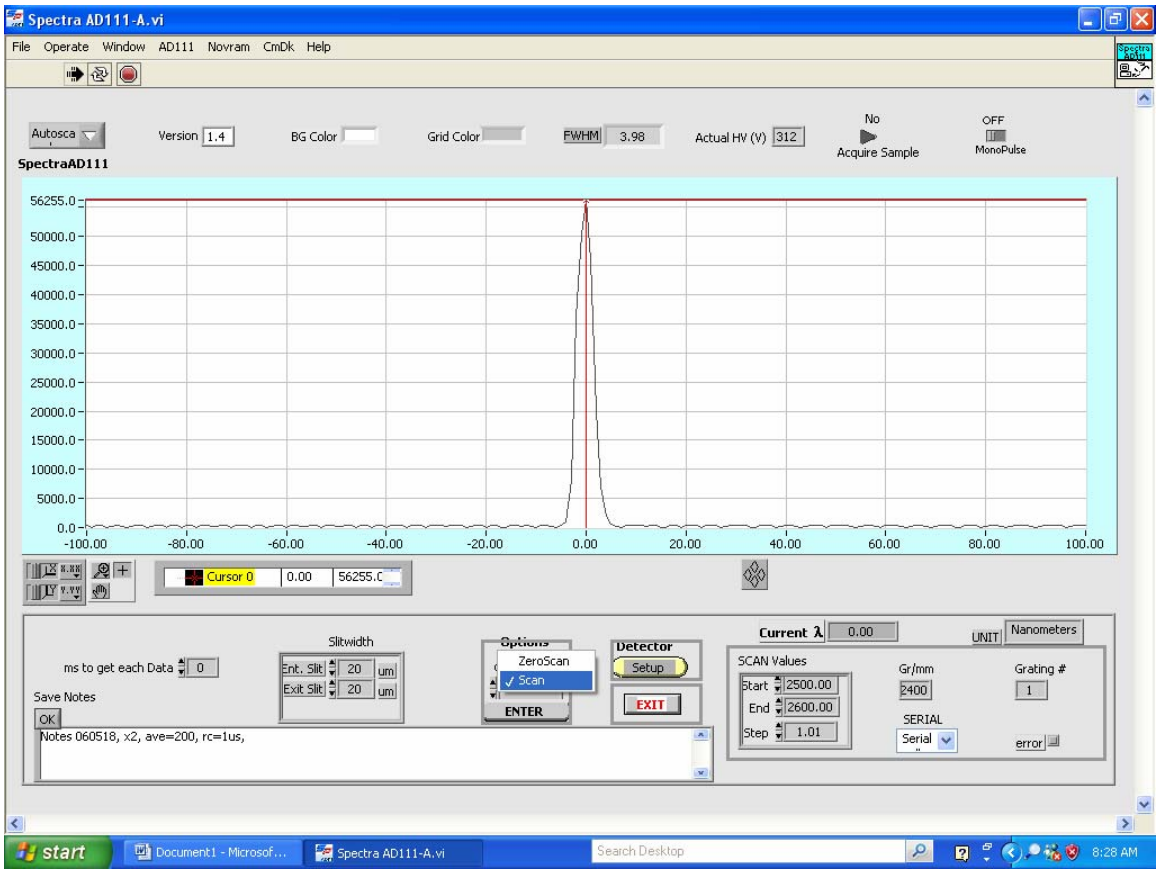
1. Enter -4 in the Steps from **Z**ero box.
2. Press Run to enter the value.
3. Press Exit to return to the scan screen.

Note: there is no grating reset when issuing a **Z**ero command.

Spectral Products
2659-A Pan American Frwy., NE Albuquerque, NM 87107 Tel (505) 343-9700 Fax (505) 343-9705
www.spectralproducts.com



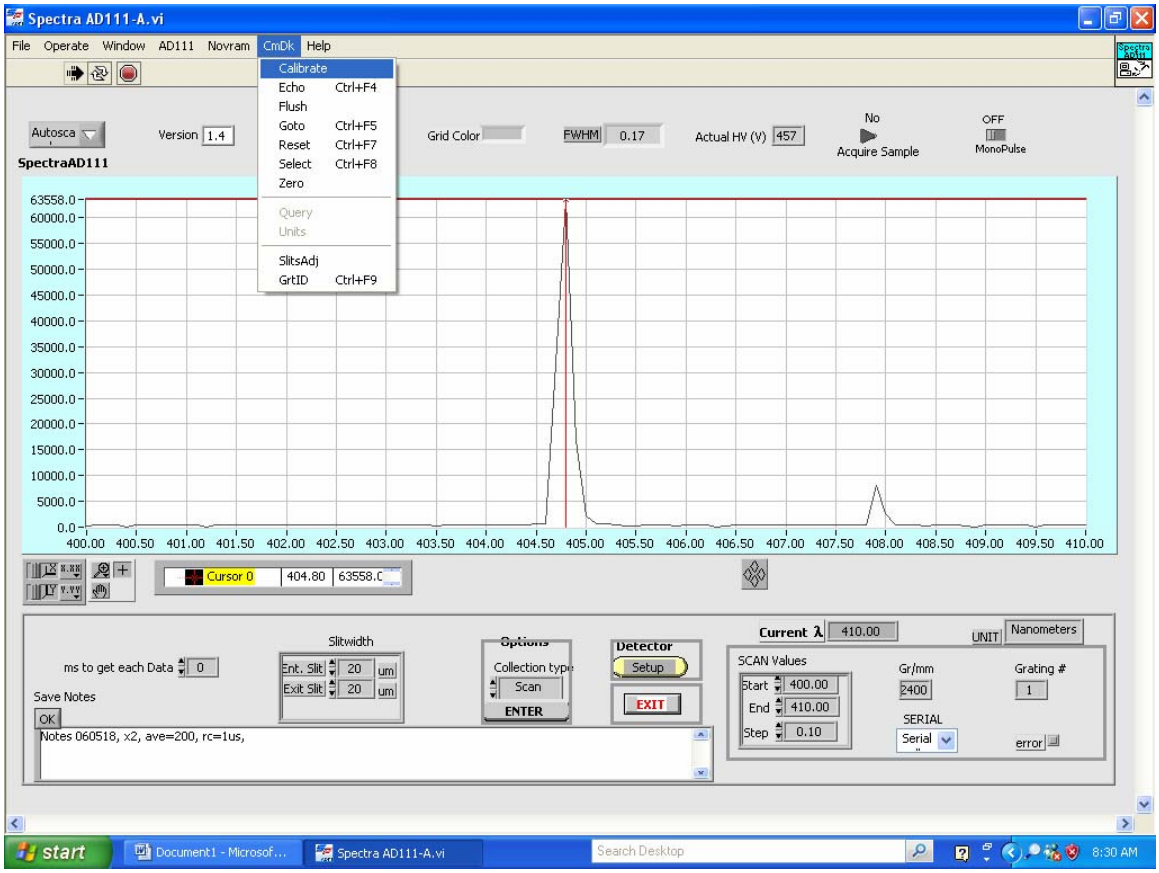
1. Press the Enter button to run the **Z**ero scan once again to check the new grating **Z**ero offset.
2. It may be necessary to repeat the above procedure if the **Z**ero wavelength was far from the desired offset. In this case, **Z**ero is now set perfectly.
3. Once satisfied with the position of the **Z**ero waveform, you can now take a wavelength scan and calibrate to your wavelength of interest if necessary.



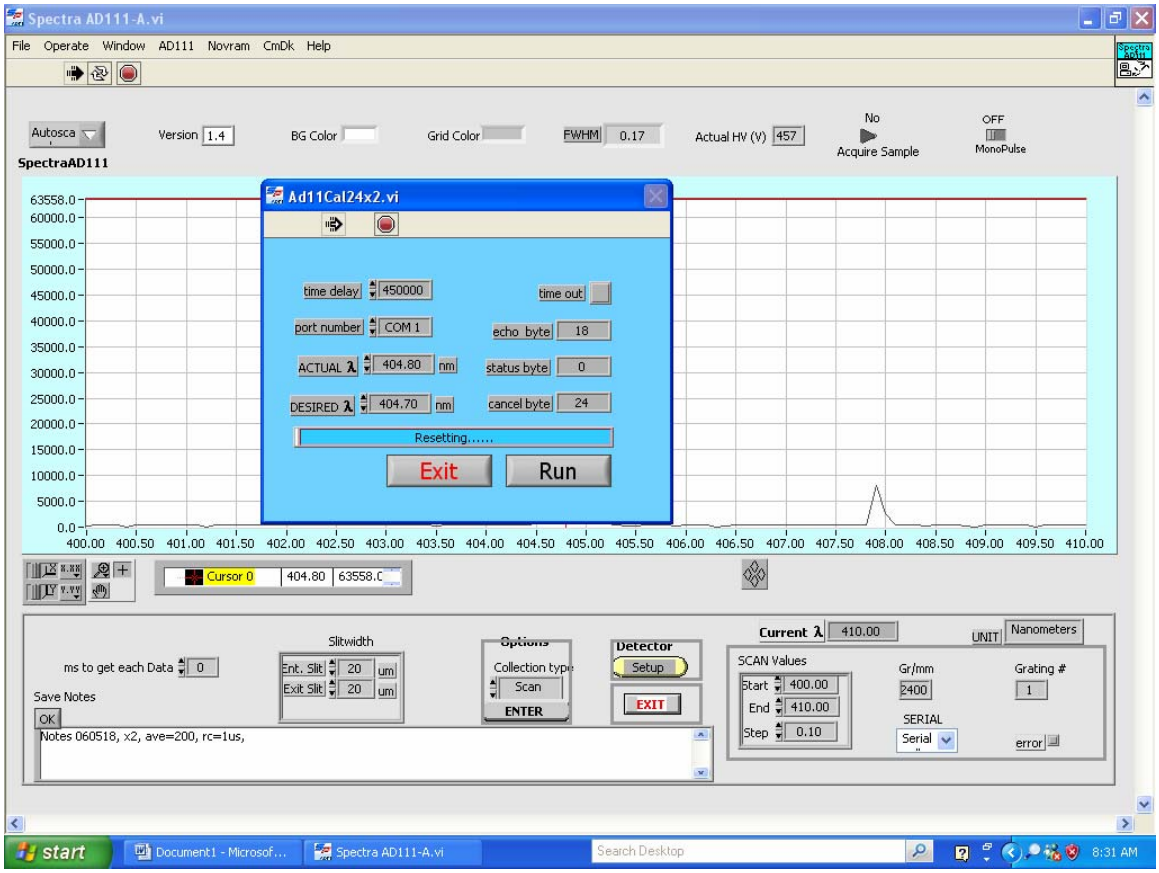
1. In the Collection Type box, select Scan. You will notice the information window to the right has changed.
2. Enter the wavelength you would like your scan to start and end in the appropriate boxes.
3. Enter the step size you would like to scan. As a rule, the smallest step size acceptable for the grating in use will yield the most accurate reading. Minimum step size is determined by grating g/mm. Following is a list of common gratings & minimum step size:

Grating	uStep	½ step
2400 g/mm	.01 nm	.1 nm
1200 g/mm	.01 nm	.1 nm
600 g/mm	.02 nm	.2 nm
300 g/mm	.04 nm	.4 nm
150 g/mm	.08 nm	.8 nm
100 g/mm	.12 nm	1.2 nm
75 g/mm	.16 nm	1.6 nm
50 g/mm	.24 nm	2.4 nm

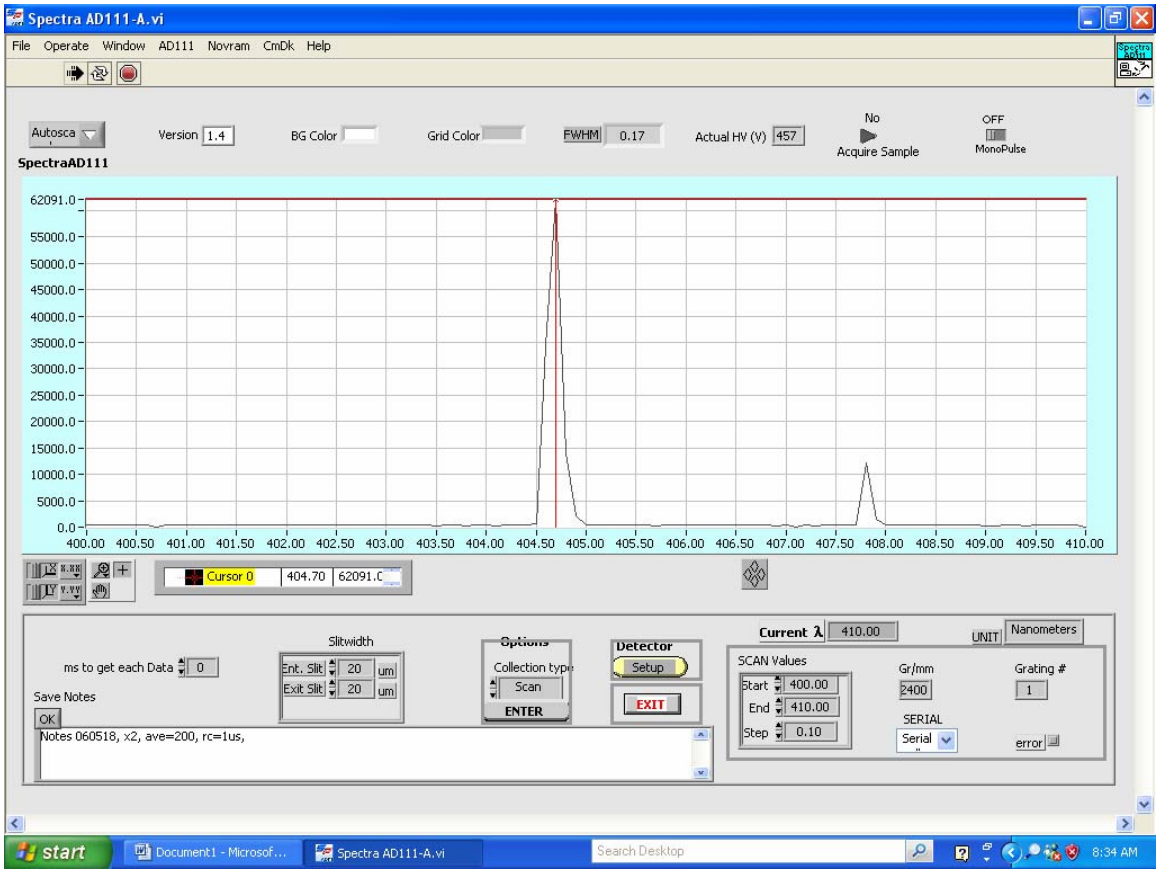
Spectral Products
2659-A Pan American Frwy., NE Albuquerque, NM 87107 Tel (505) 343-9700 Fax (505) 343-9705
www.spectralproducts.com



1. Note that this monochromator is a ½ step. Most DK series monochromators are uStep. The difference between the two types is the uStep is approximately 10 times more precise in its step and thus calibration can be made to a finer wavelength (i.e. 404.66nm vs. 404.7nm)
2. In the scan above, the grating was scanned from 400-410nm to look at the 404.66nm Hg line. The line was found at 404.80nm as indicated in the Cursor 0 box.
3. Open the CmDk drop down menu and select **C**alibrate if you wish to calibrate the grating. A new pop up window will appear as below.



1. Enter the actual wavelength. This is the wavelength of the peak scanned – in this case the peak was found at 404.80nm.
2. Enter the desired wavelength. This is the wavelength you would like to **C**alibrate the peak to be – in this case 404.66nm, but since we have a ½ step machine, we enter 404.70nm.
3. Press the Run button to program the monochromator with the new calibration offset.
4. The monochromator will now go through a reset as the new offset is written to Ram and a new grating map is built.
5. Once the reset is complete, press Exit to return to the scan window.



1. Scan the same wavelength set to ensure the new offset was taken correctly.