# Magnetism Reflectometer
# Data Reduction Manual

*Revised 12/17/2008*

A U.S. Department of Energy Multilaboratory Project

SPALLATION NEUTRON SOURCE

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# Magnetism Reflectometer
# Data Reduction Manual

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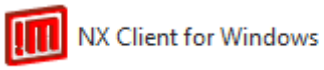
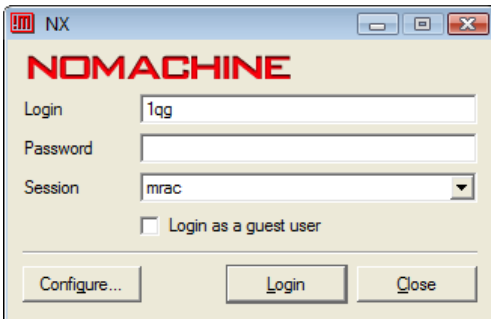
Magnetism Reflectometer Data Reduction Manual

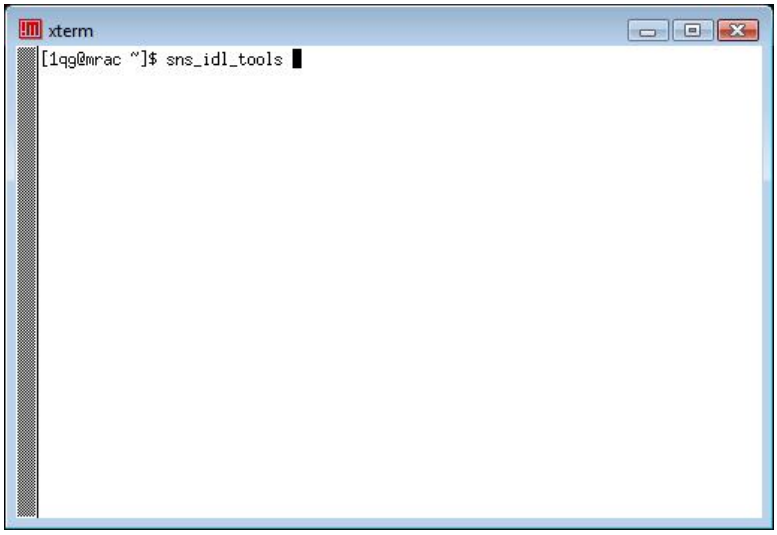
Data reduction on the Magnetism Reflectometer begins by connecting to the analysis computer mrac.sns.gov using software that supports *X-Windows* connections via the *SSH* port (port 22), also known as *X11 tunneling*. On a system with *NX Client* installed, start the application from the **start menu**:



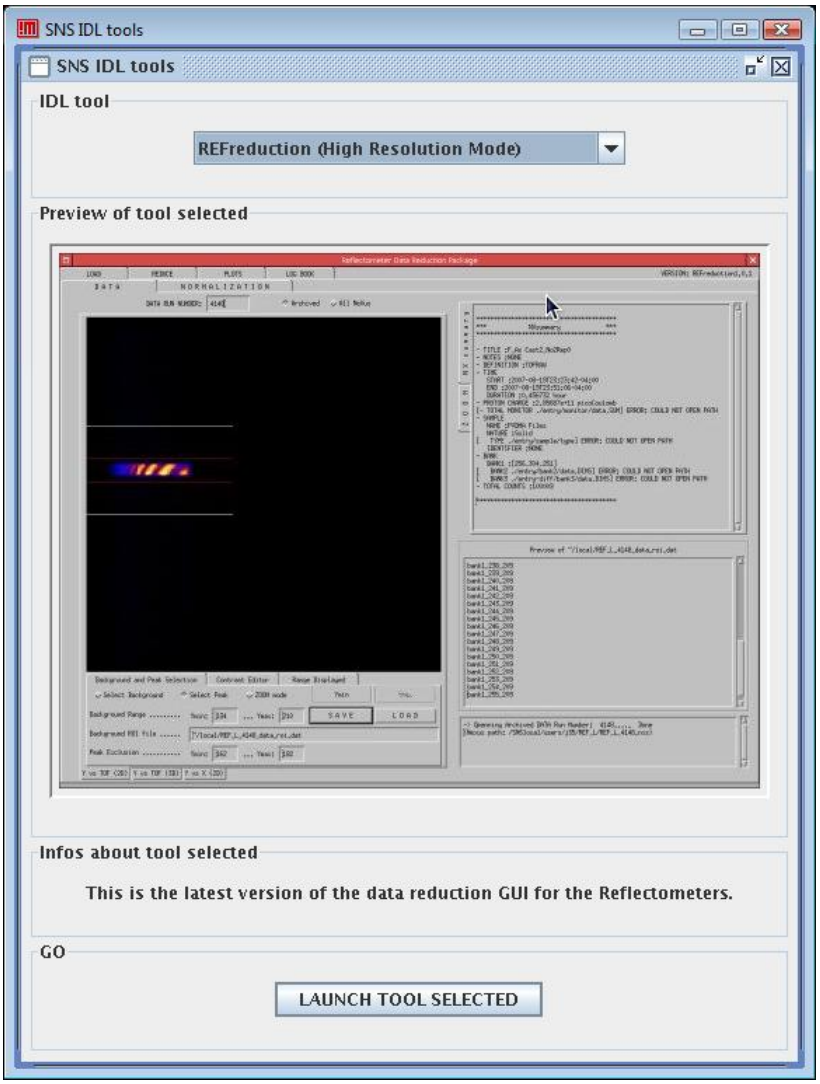

The NX Client Login window will appear:




Enter your XCAMS username and password. Please note that you must already have requested access to the beam line 4A analysis computer (mrac) prior to logging in. Once you have successfully connected to mrac a terminal window (also referred to as a shell) will appear:

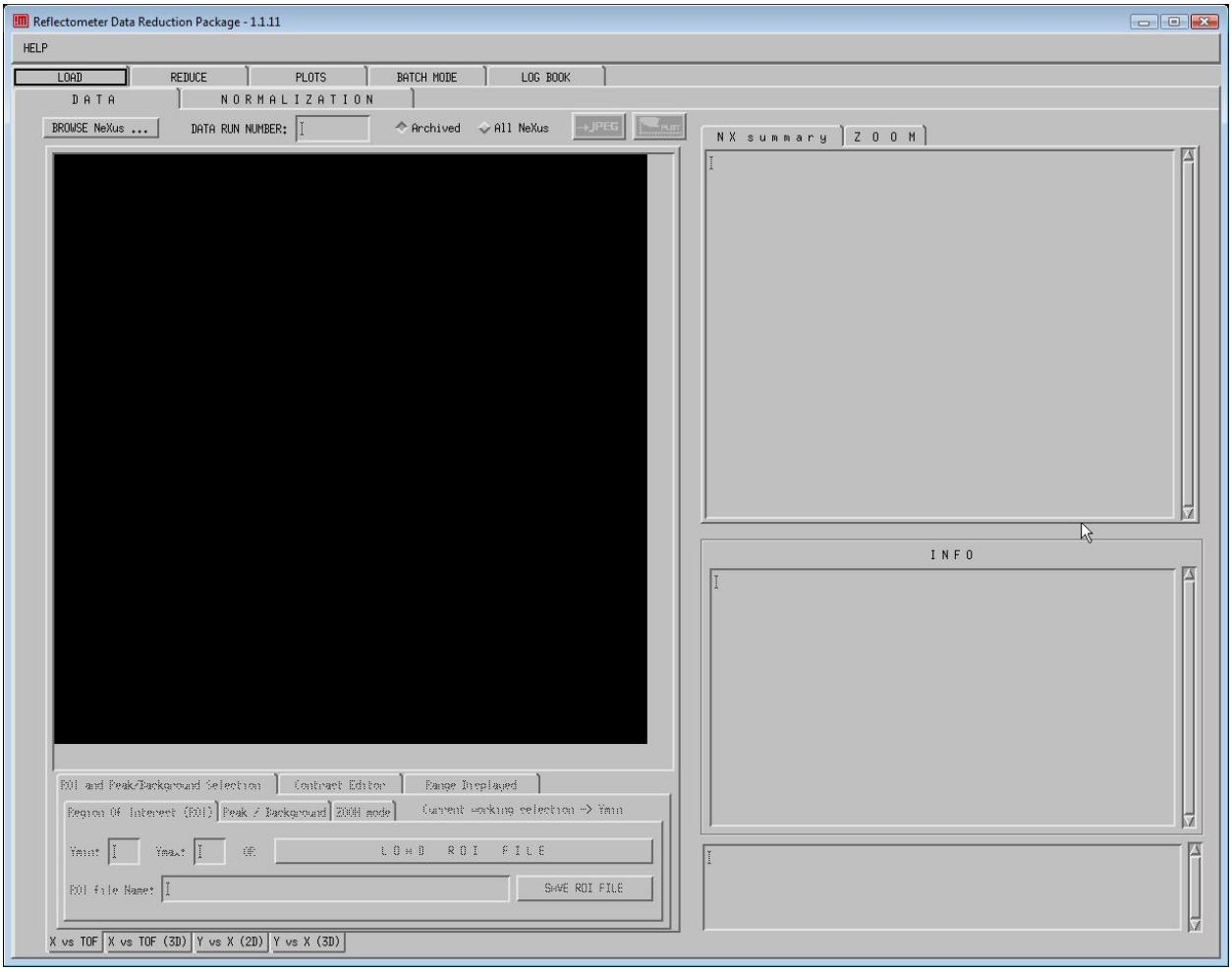


Type the command shown above (sns_idl_tools) with the "&" symbol at the end (so you type *sns_idl_tools&*). You will be asked which tool you wish to run:

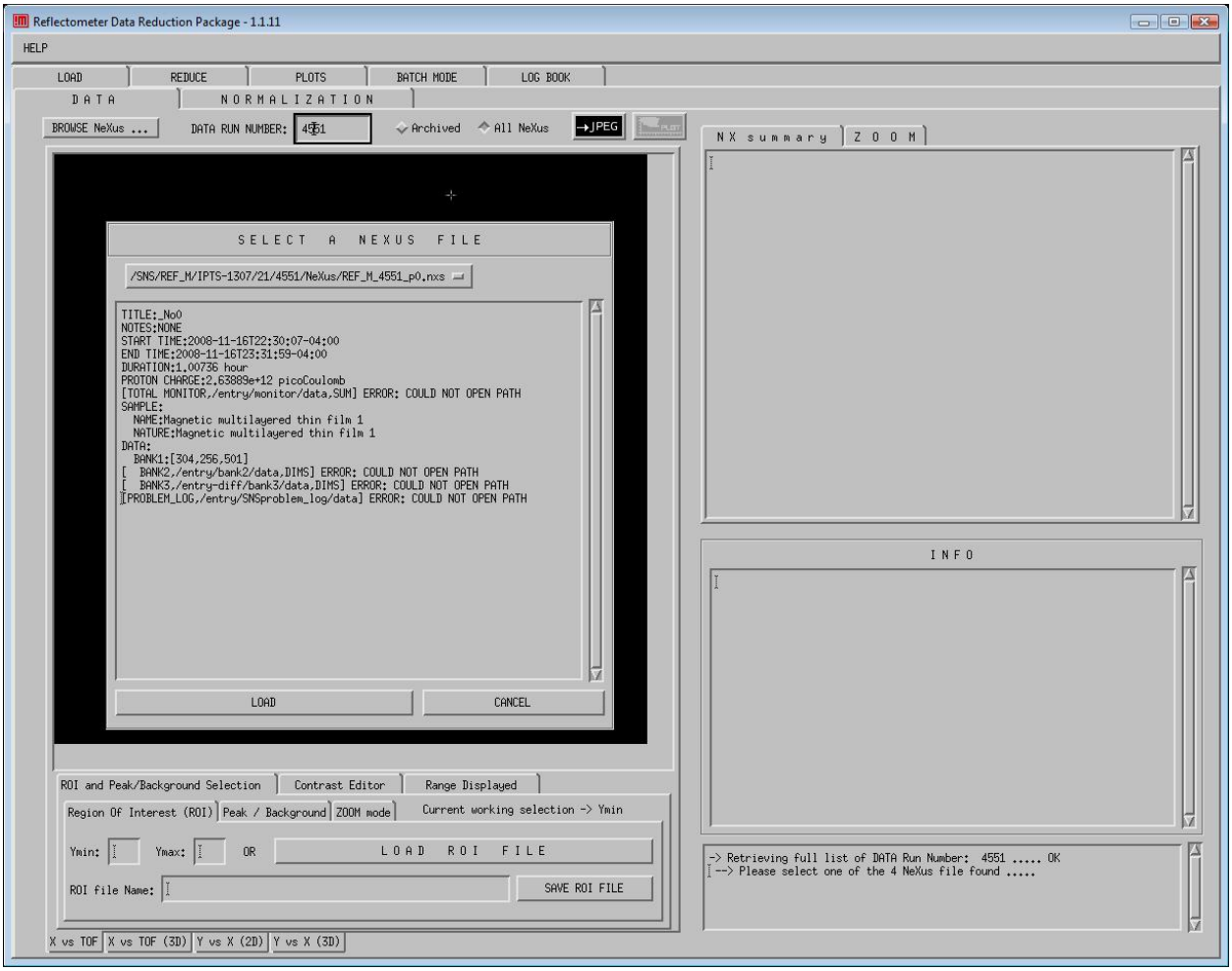



Select REFreduction (High Resolution Mode) from the pull down list at the top of the tool, and click the button labeled LAUNCH TOOL SELECTED. You will see the *IDL* startup widow:

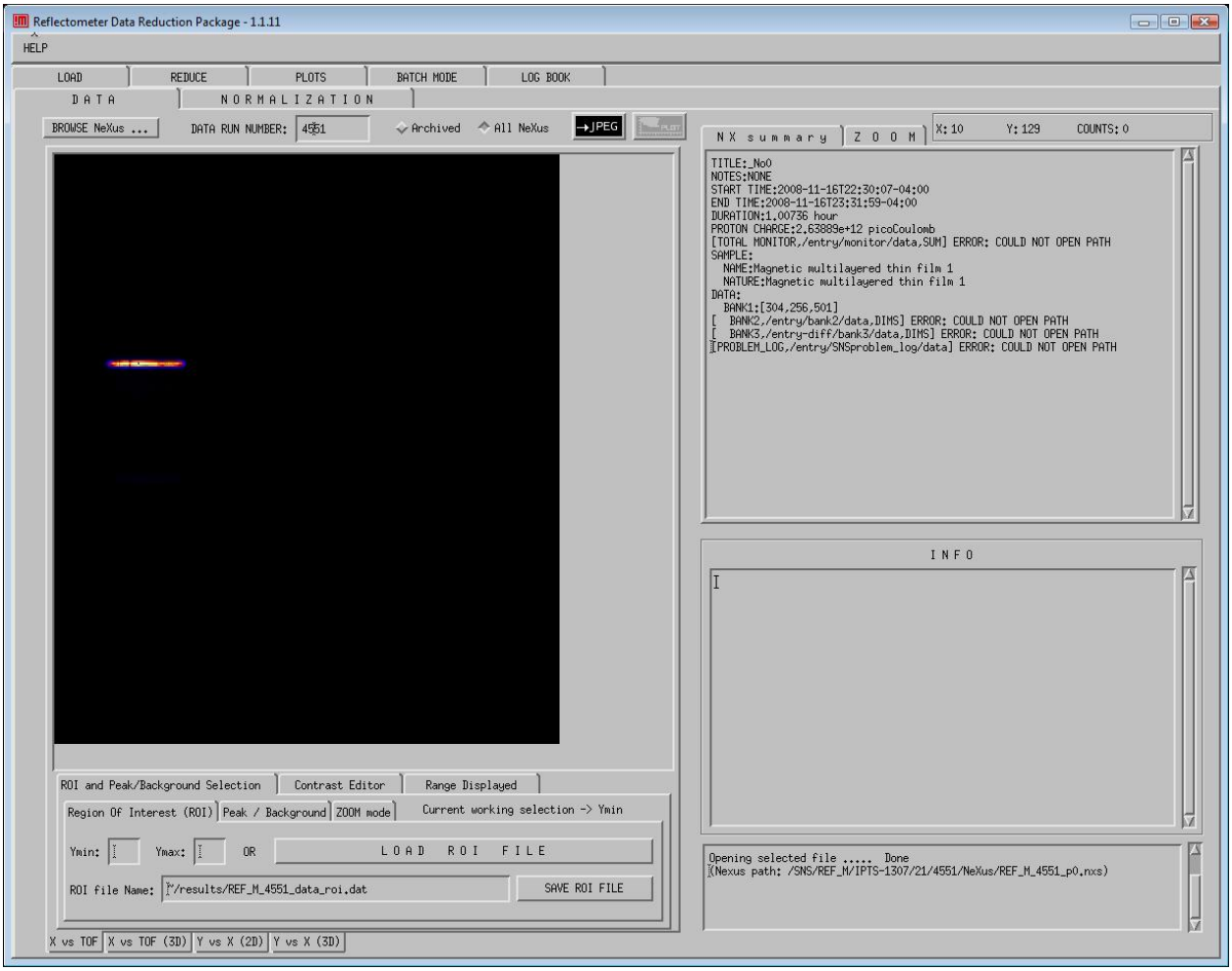
Click anywhere on the *IDL* window to continue:



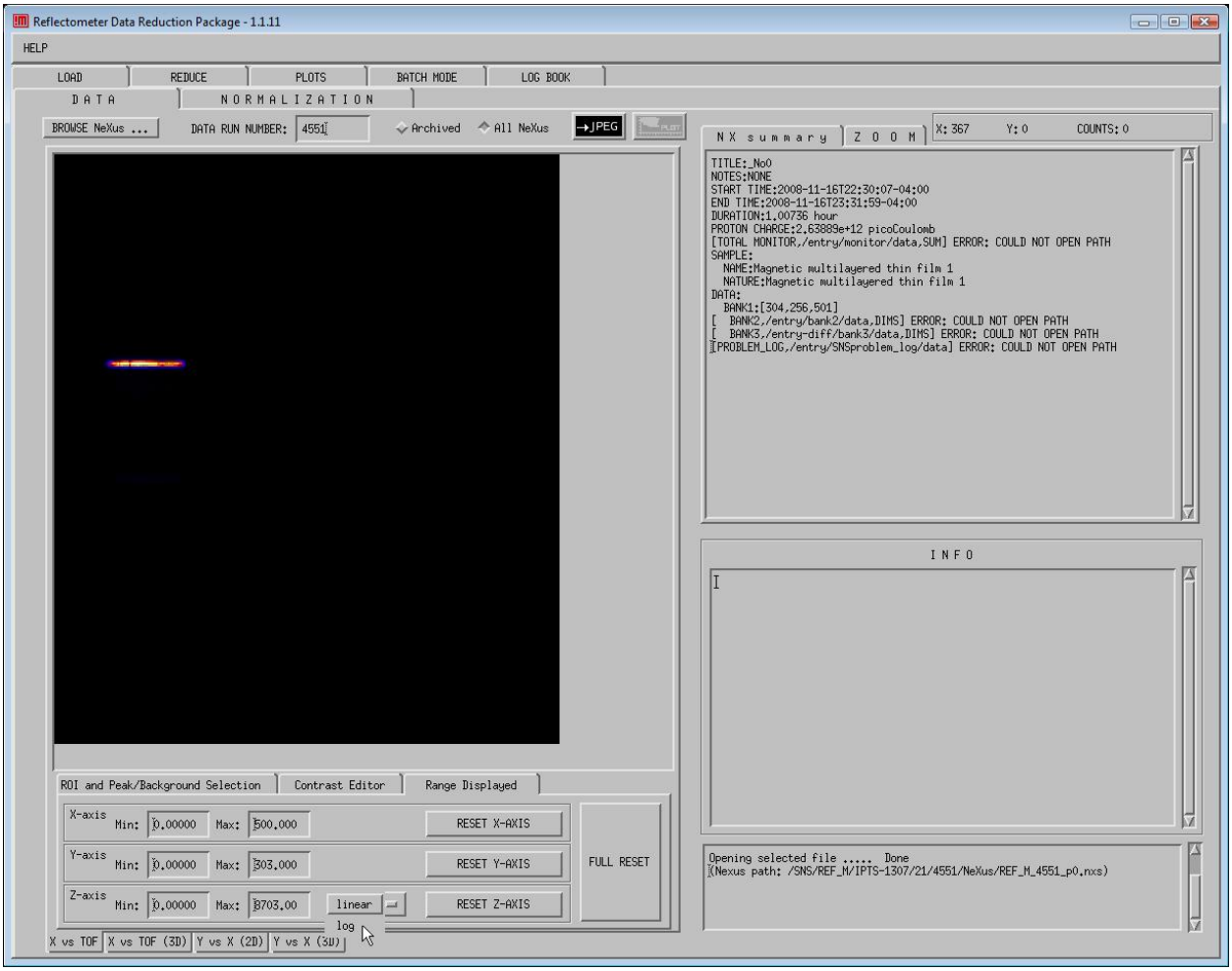

Notice that the button labeled Archived is selected. Click the button labeled All NeXus. Now type in the run number you wish to analyze and press the Enter key on the keyboard. You will see a window asking you to select a NEXUS file. For polarized data each run file contains multiple NEXUS files; one corresponding to each spin state collected. Currently the maximum number of spin states possible in a single run file is two. These are distinguished by the suffix on the NEXUS file name (p0 for spin flipper OFF, and p1 for spin flipper ON). Select which spin state you wish to analyze and press the button labeled LOAD. Note that four spin states appear in the NEXUS file pull down list. Files ending with p2 and p3 are not yet supported, and are not present.



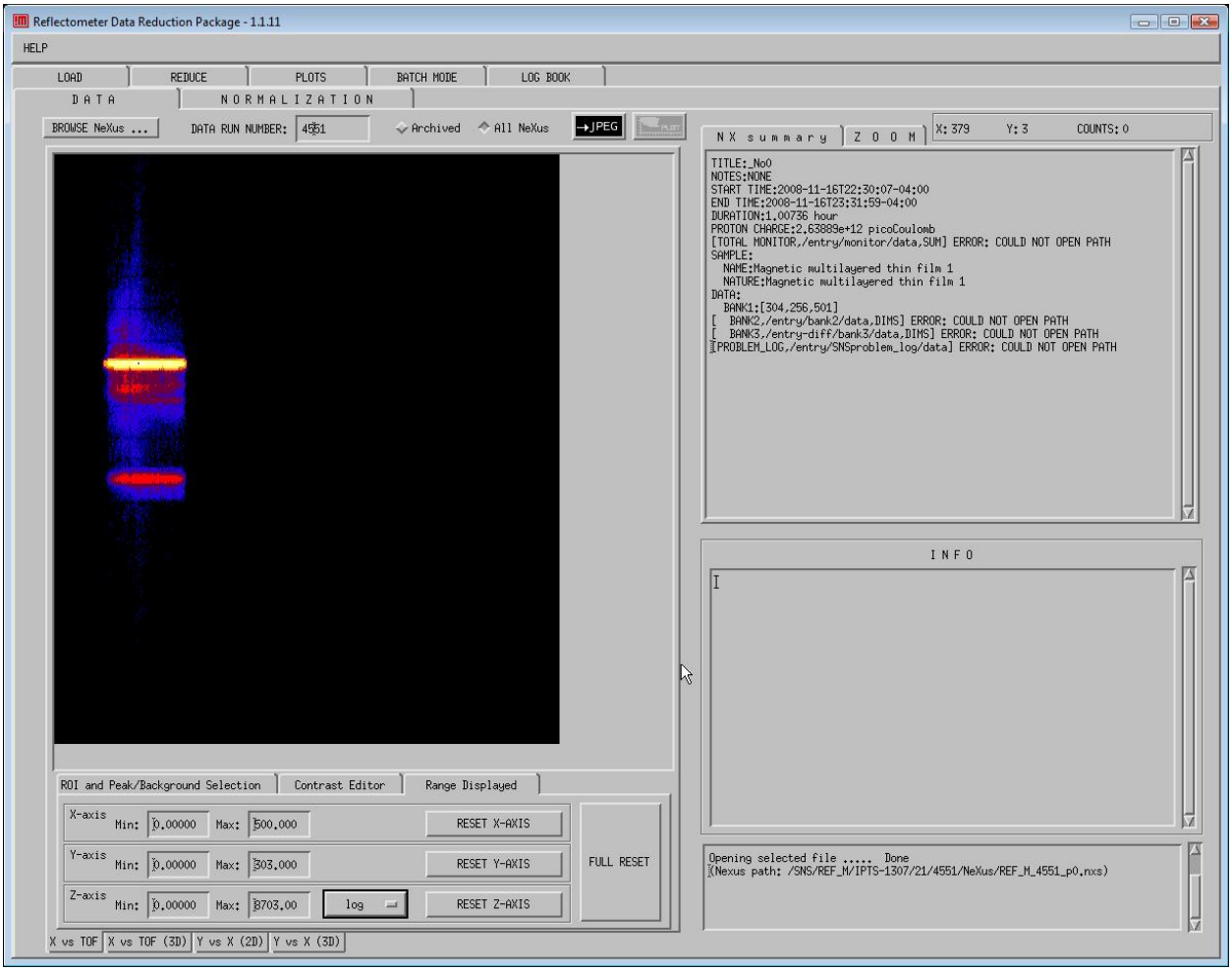

Once the data has finished loading you will see the two dimensional position map of the requested NEXUS file:



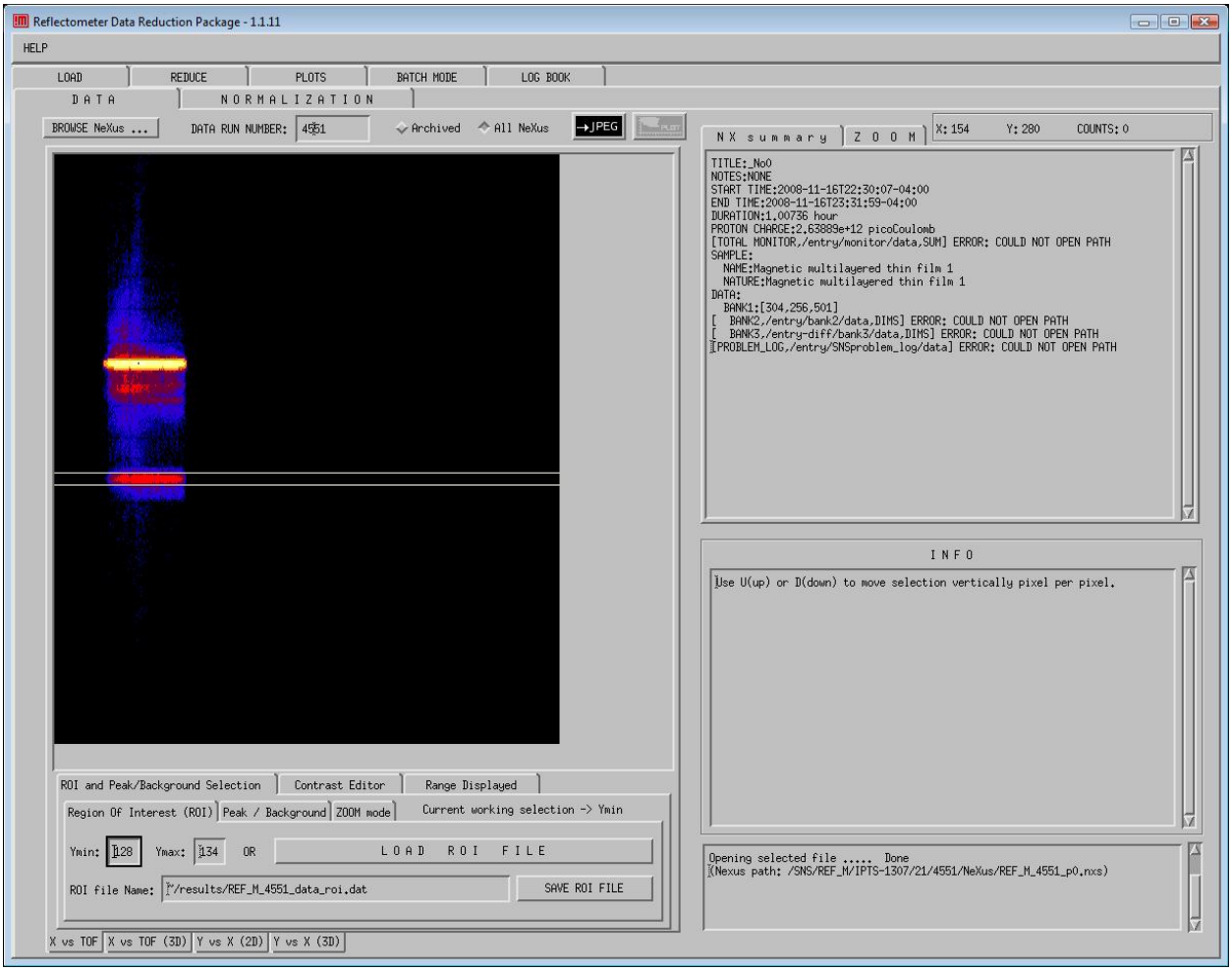

This is a linear scale contour plot of the neutron intensity as a function of spatial position on the detector. It is instructive to view the data in Log scale. Click the tab labeled Range Displayed, and then change the display from linear to log by clicking the button labeled linear and select log instead:



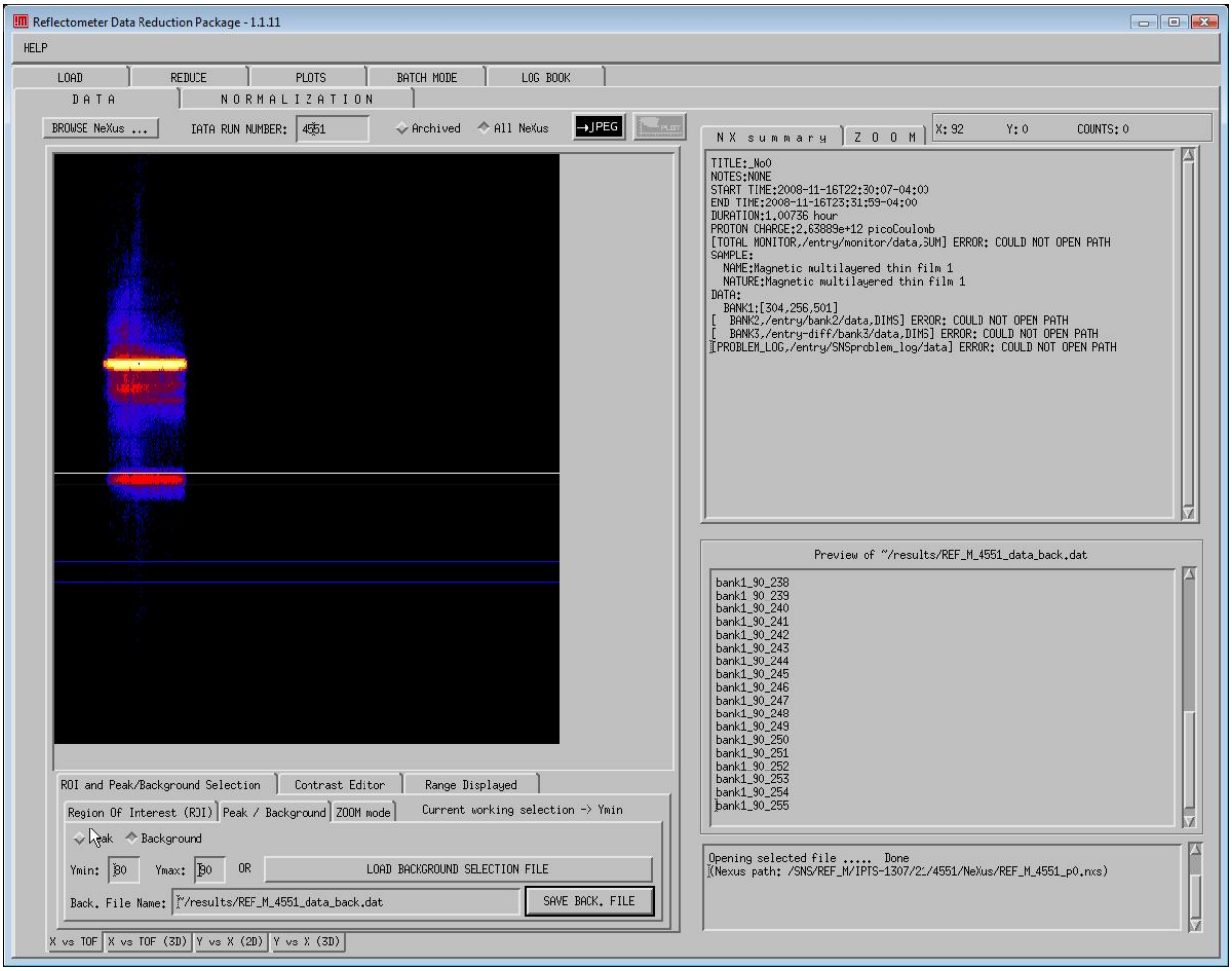

Now your display shows significantly more features:



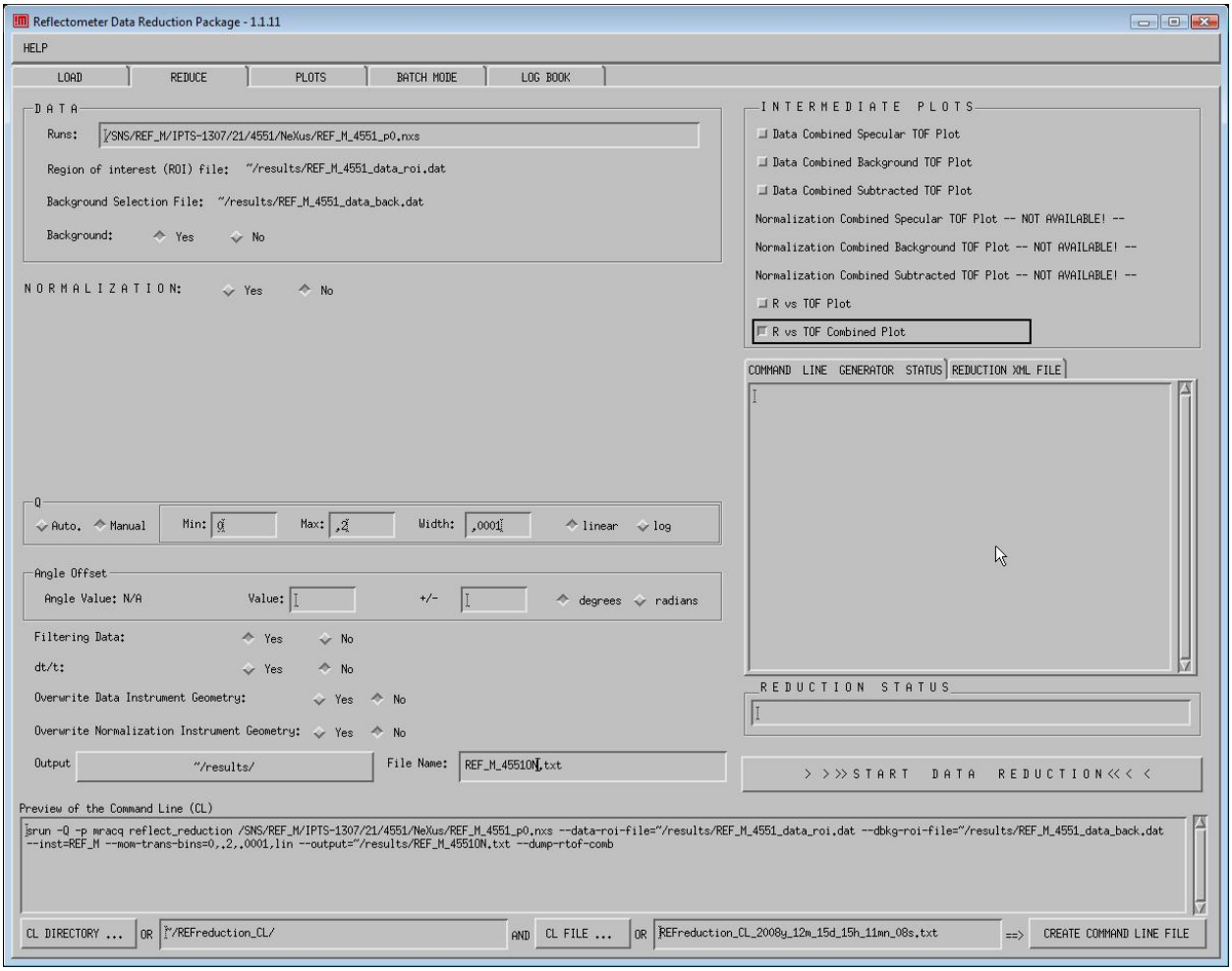

Note that in this orientation the edge of the transmitted beam is on top and the reflected beam is on the bottom. In the linear plot the remnant of the direct beam was intense enough to obscure the reflected signal when the data was contoured. Click on the tab labeled ROI and Peak/Background Selection. Make sure the Region of Interest (ROI) sub-tab is selected. Now it's time to define signal and background regions. While still in the ROI tab, note that to the right of the sub-tabs the words "Current working selection -> Ymin" this means that if you place the mouse cursor in the data window and press the let mouse button that the computer will record the x-channel corresponding to the mouse position as the ymin channel. This channel will be indicated by a white line, and the Ymin box will display the channel you selected. You can change your selection by changing the number in the box. Clicking the right mouse button toggles the selection between ymin and ymax. The current working selection will display which of the two you have selected. Once you are satisfied with the selection for ymin, press the right mouse button to toggle to ymax, and repeat the process used for ymin. When you are satisfied with the selection of both, click the button labeled SAVE ROI FILE. Note that you may type channel numbers into either the ymin or ymax box regardless of the current working selection. This setting only affects channels selected using the mouse. The data window now looks like this:



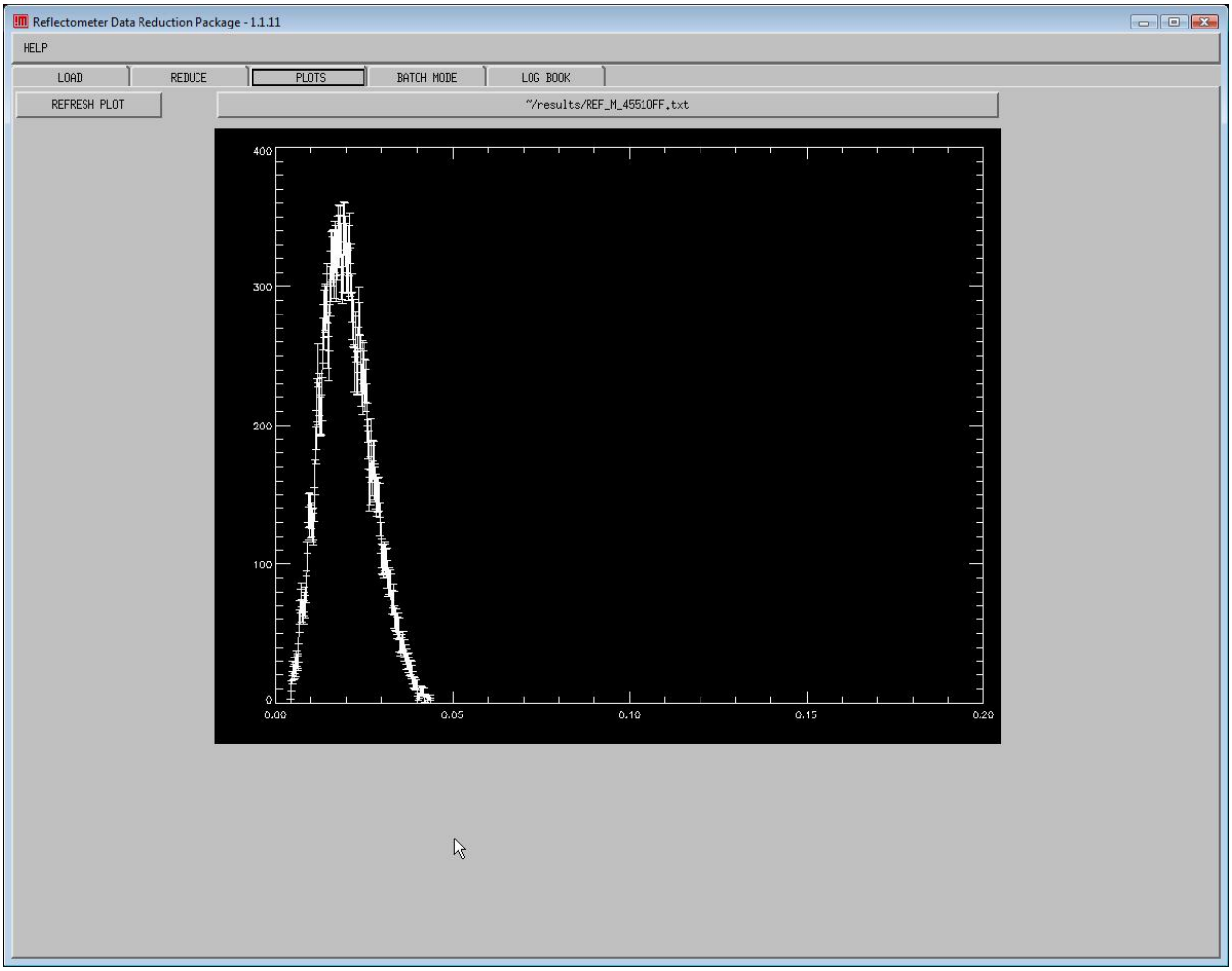

Now click the Peak/Background sub-tab. Note the two buttons: Peak and Background. Click the one labeled Background. Using the procedure that we used for selecting the reflected signal, select a region that will be used for background subtraction. Remember to pick a region that contains only background. Once you are satisfied with the background region information, click the button labeled SAVE BACK. FILE. The data window now looks like this:




Now we are ready to reduce the data. Click on the tab labeled REDUCE. You will see the data reduction window:

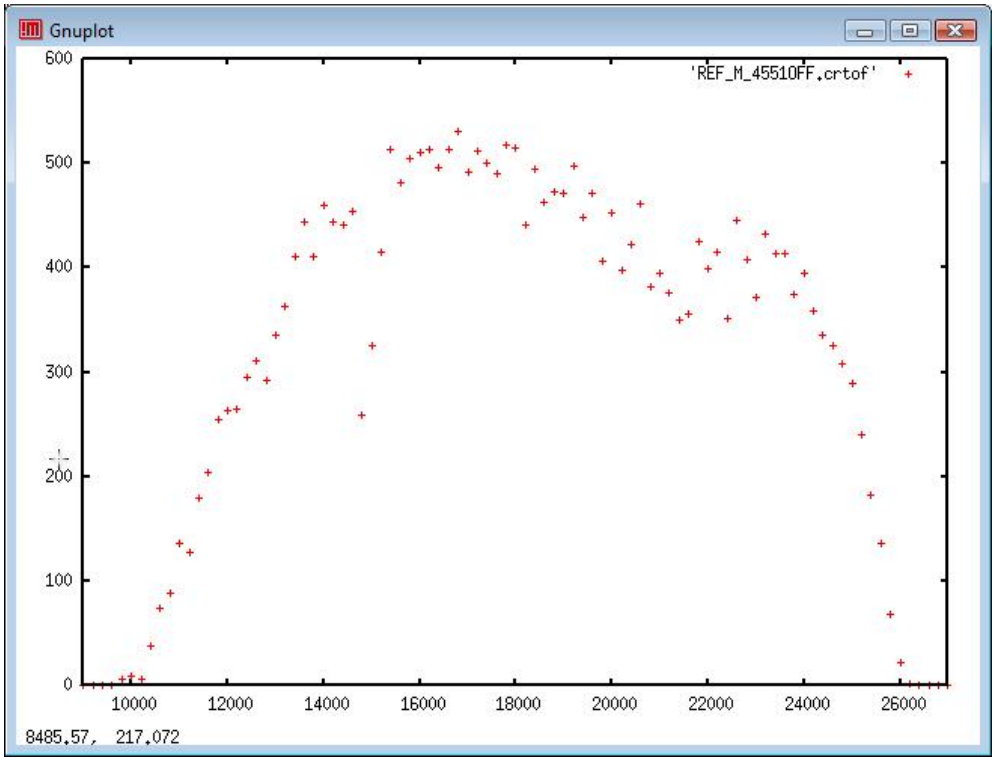


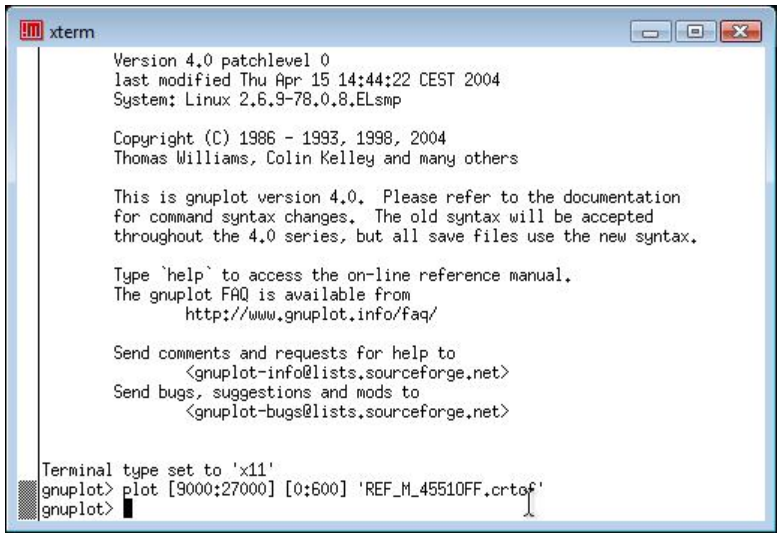

Make sure the Background button is set to Yes, and the NORMALIZATION button is set to No. In this configuration you will only be generating an Intensity versus TOF Combined plot, so make sure that button is selected under Intermediate Plots. Enter any numbers in the Q Min Max and Width fields. These numbers will not be used since we are not normalizing, but something must be in these fields or the program will complain. In this example I have entered 0, .2 and .0002. Note the file name that is automatically generated. I don't like this file name, in part because it does not distinguish one spin state from another, so I am going to change it to something more useful. Make sure you leave the suffix for the file name as *.txt*. Some people like to enter the signal and background information in the title. I prefer to enter it as a comment line in the file later; the choice is yours. If the START DATA REDUCTION button is active you are ready to reduce your data; if it is inactive there is something you still need to do. The window above the button will contain instructions on what is needed. Once the program is happy press the START DATA REDUCTION button. When the status is DONE your reduction is completed. Note the output directory listed, since this is where your data is stored. Click the Plot tab to get a coarse look at your data:




From this you can see the max intensity of this data. Don't pay any attention to the X-axis. Our time of flight range will usually be from about 9000 to about 27000 microseconds.

Once the *IDL* software has finished, you may use *gnuplot* to view the data; type "**gnuplot**" to start the program and get to the *gnuplot* command line. *Gnuplot* is a versatile plotting package. Obtaining a simple plot requires only the command "**plot '*filename*'** ". Note that since your data files will be in the "**~results**" subdirectory (in my case **/SNS/users/1qg/results**) you should change your working directory to your version of that with the command "**cd ~/results**" prior to starting *gnuplot*. Also note that we do not use the *.txt* file for data analysis; we use the additional, *.crtof* file for analysis. You will notice that if you simply type **plot 'REF_M_4551OFF.crtof'** that the x and y axes may not be very well suited to your actual data. This is easily remedied by modifying your plot request to include x and y axis ranges. From the initial plot we notice a better the y range would be 0 to 400, and the xrange of 9000 to 27000 The modified plot request is now ***plot [9000:27000] [0:400] 'REF_M_4551OFF.crtof'***. Some minor tweaking after the initial look (***plot [9000:27000] [0:600] 'REF_M_4551OFF.crtof'***) yields:




It is usually a good idea to take a quick look at your data prior to transferring it from the analysis computer to a personal computer. If the plot looks OK, then it's time to analyze the other spin state (p1). Go back to REFreduction and click the Load tab. Everything should look as it did before. Click in the DATA RUN NUMBER field and, without changing the run number, press the enter key on the keyboard. You will get the window asking you to select which spin state you want to analyze. This time select *p1* instead of *p0* and click LOAD. Once the file is loaded you can go right to the REDUCE tab. Everything is still the same, except that it has auto

generated a file name again, which you should change in the same manner as before. Start the data reduction and view the output as before. No need to save ROI or BACK files again, since they do not change. We will also need to analyze a transmission run (a run with no sample, collecting only the direct beam) if we want to generate a reflectivity file. In this example the transmission run number is 4547. We may also have several runs at different sample angle which will be analyzed in the same way, selecting the appropriate channel range for each angle. In this example we have additional runs 4552 and 4553. Note that each sample angle usually has a corresponding transmission run, which I don't show here (the collimation of the transmission run should match the collimation of the data run).

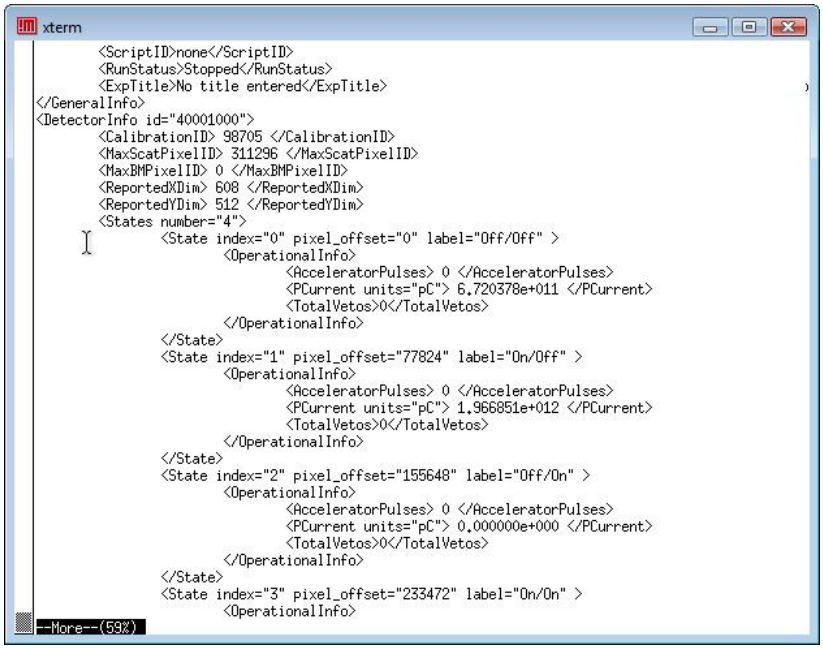
Some additional information you will need before starting to calculate reflectivity files:

Proton Charge for each spin state

The center channel of the reflected signal and transmitted signal for each angle.

The actual sample angle is calculated by taking the difference between the reflected center channel and transmitted center channel, divided by 116.7 (in the current detector position there are 116.7 channel between the transmitted and reflected signal for a sample angle of one degree).

The proton charge for each spin state can be obtained from the preNexus data. For example, run 4551 stores it's preNexus data in directory */SNS/REF_M/IPTS-1307/21/4551/preNeXus/*, and the file containing the proton charge information is *REF_M_4551_runinfo.xml*.

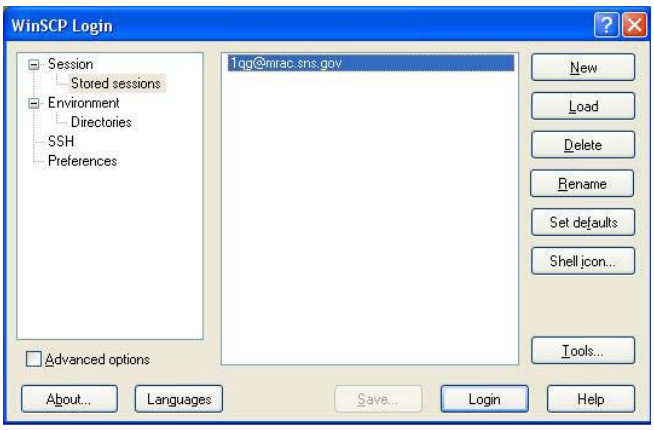


```
xterm
        <ScriptID>none</ScriptID>
        <RunStatus>Stopped</RunStatus>
        <ExpTitle>No title entered</ExpTitle>
</GeneralInfo>
<DetectorInfo id="40001000">
        <CalibrationID> 98705 </CalibrationID>
        <MaxScatPixelID> 311296 </MaxScatPixelID>
        <MaxBMPixelID> 0 </MaxBMPixelID>
        <ReportedXDim> 608 </ReportedXDim>
        <ReportedYDim> 512 </ReportedYDim>
        <States number="4">
                <State index="0" pixel_offset="0" label="Off/Off" >
                        <OperationalInfo>
                                <AcceleratorPulses> 0 </AcceleratorPulses>
                                <PCurrent units="pC"> 6.720378e+011 </PCurrent>
                                <TotalVetos>0</TotalVetos>
                        </OperationalInfo>
                </State>
                <State index="1" pixel_offset="77824" label="On/Off" >
                        <OperationalInfo>
                                <AcceleratorPulses> 0 </AcceleratorPulses>
                                <PCurrent units="pC"> 1.966851e+012 </PCurrent>
                                <TotalVetos>0</TotalVetos>
                        </OperationalInfo>
                </State>
                <State index="2" pixel_offset="155648" label="Off/On" >
                        <OperationalInfo>
                                <AcceleratorPulses> 0 </AcceleratorPulses>
                                <PCurrent units="pC"> 0.000000e+000 </PCurrent>
                                <TotalVetos>0</TotalVetos>
                        </OperationalInfo>
                </State>
                <State index="3" pixel_offset="233472" label="On/On" >
                        <OperationalInfo>
--More--(59%)
```

Scroll down in the file until you find the lines that say *State index="0"* and *State index="1"*. These correspond to the *p0* and *p1* NEXUS files we analyzed. The values stored as *PCurrent* are

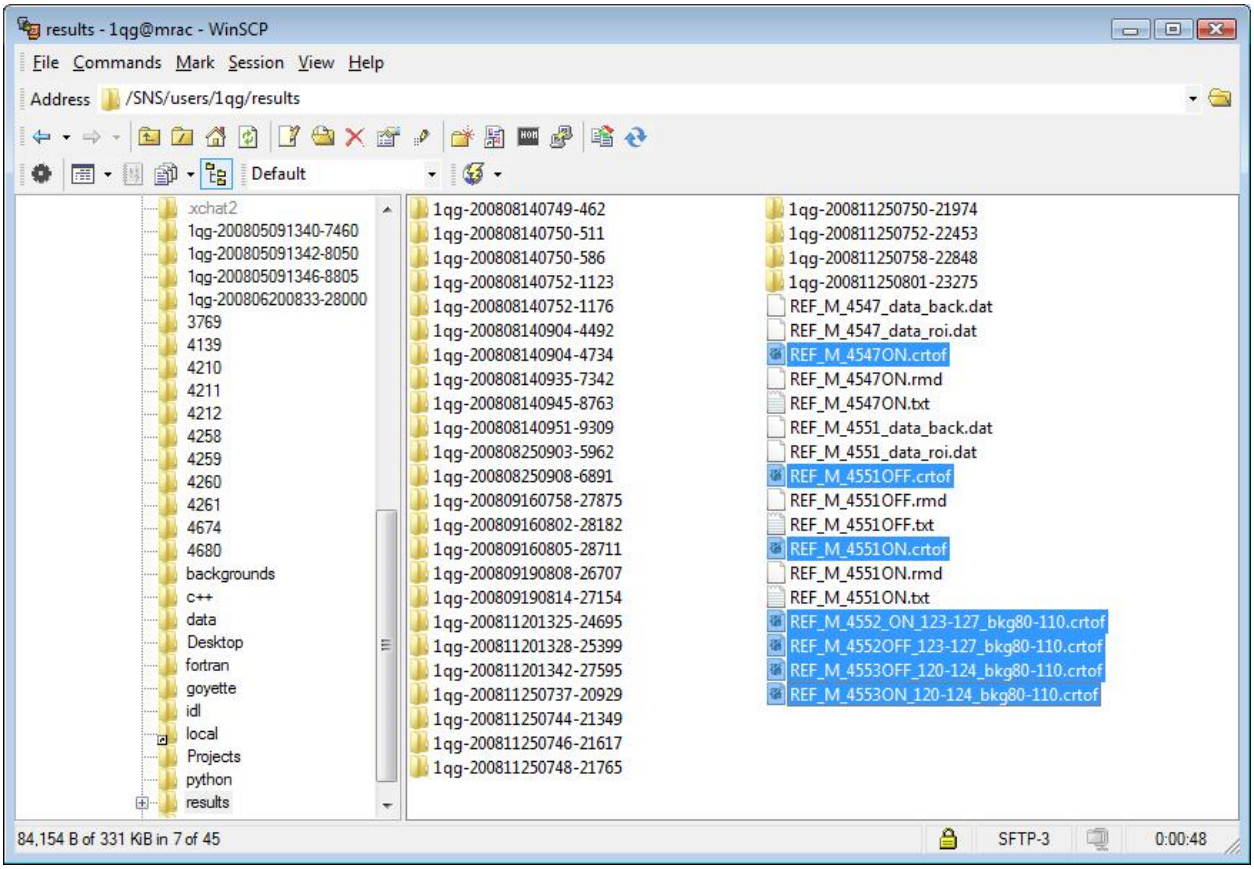
the proton charge for each of the spin states.  Remember that the other two spin states are not used yet.

If you are satisfied with the files, you can use *WinSCP* (or some other secure copying package) to transfer it to your computer. You will need to define a session for mrac.sns.gov:



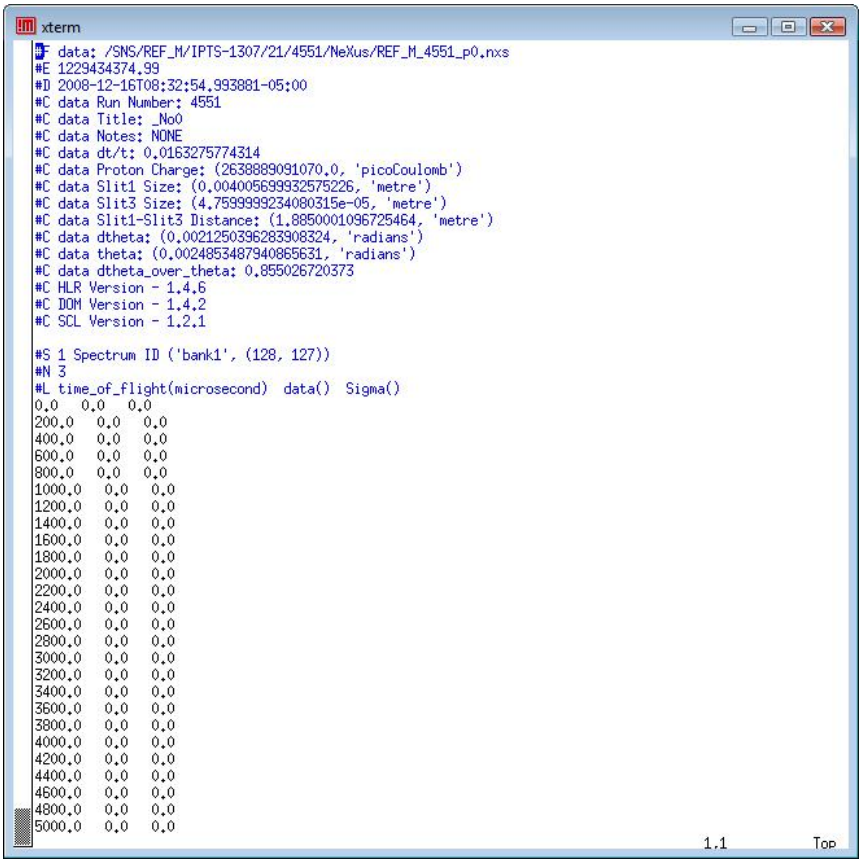

Click Login and you will be prompted for your **XCAMS** password:

Once you have the connection established, change to the directory containing the data files and select the desired file.  Right click on the desired file and select **Copy**:




Pick the destination for the data file:

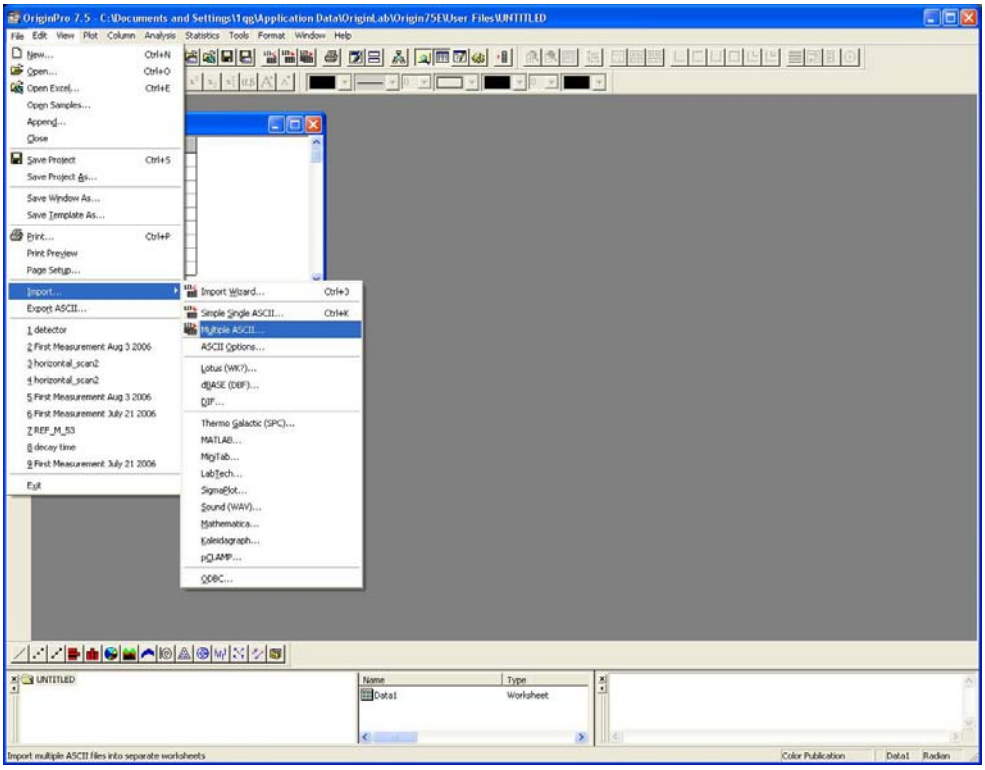
The data file may now be viewed or manipulated on your PC:



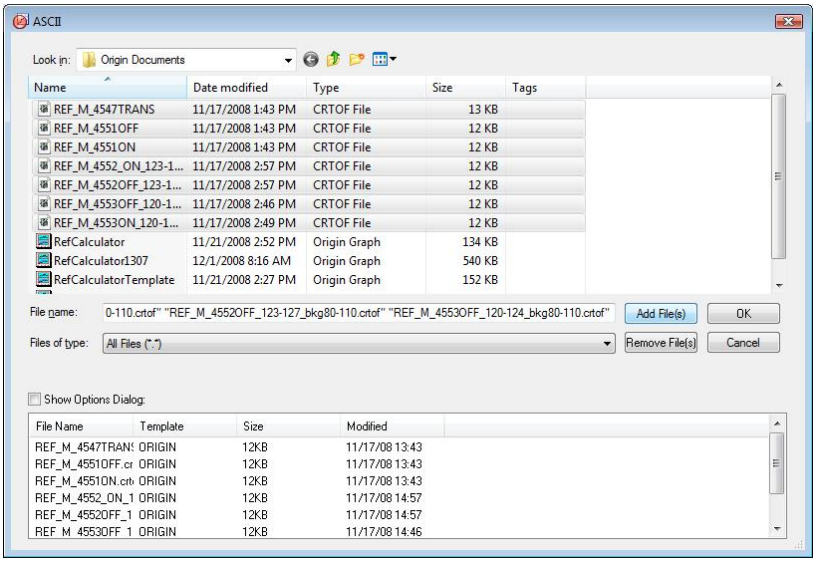
```
xterm
#F data: /SNS/REF_M/IPTS-1307/21/4551/NeXus/REF_M_4551_p0.nxs
#E 1229434374.99
#D 2008-12-16T08:32:54.993881-05:00
#C data Run Number: 4551
#C data Title: _No0
#C data Notes: NONE
#C data dt/t: 0.0163275774314
#C data Proton Charge: (2638889091070.0, 'picoCoulomb')
#C data Slit1 Size: (0.004005699932575226, 'metre')
#C data Slit3 Size: (4.7599999234080315e-05, 'metre')
#C data Slit1-Slit3 Distance: (1.8850001096725464, 'metre')
#C data dtheta: (0.0021250396283908324, 'radians')
#C data theta: (0.0024853487940865631, 'radians')
#C data dtheta_over_theta: 0.855026720373
#C HLR Version - 1.4.6
#C DOM Version - 1.4.2
#C SCL Version - 1.2.1

#S 1 Spectrum ID ('bank1', (128, 127))
#N 3
#L time_of_flight(microsecond)  data()  Sigma()
0.0   0.0   0.0
200.0   0.0   0.0
400.0   0.0   0.0
600.0   0.0   0.0
800.0   0.0   0.0
1000.0   0.0   0.0
1200.0   0.0   0.0
1400.0   0.0   0.0
1600.0   0.0   0.0
1800.0   0.0   0.0
2000.0   0.0   0.0
2200.0   0.0   0.0
2400.0   0.0   0.0
2600.0   0.0   0.0
2800.0   0.0   0.0
3000.0   0.0   0.0
3200.0   0.0   0.0
3400.0   0.0   0.0
3600.0   0.0   0.0
3800.0   0.0   0.0
4000.0   0.0   0.0
4200.0   0.0   0.0
4400.0   0.0   0.0
4600.0   0.0   0.0
4800.0   0.0   0.0
5000.0   0.0   0.0
                                                    1,1          Top
```

All the lines beginning with the "#" symbol are comment lines containing information about conditions under which the file was collected. Prior to starting *Origin*, save a copy of the template under a different name, preferably a name which includes the proposal number. Open the REFCalculatorTemplate copy. You will see seven workbooks that are minimized at the bottom of the Origin window. The workbooks labeled Book1 through Book4 are set up for importing data for up to four different sample angles. The RunInfo workbook is set up to hold information for individual runs. The workbook labeled Calc is set up to read information from Books1-4 and RunInfo and to calculate Reflectivity and Q. The workbook R –vs- Q is a plot window to automatically plot the calculated data in Calc. The workbook labeled Import, which is the only workbook open, is for the initial import of data from the files we just copied using WinSCP. With the Import workbook selected, select **Import, Multiple ASCII** from the **File** menu:




Select the desired files:




And click Add Files. Then click OK. The Import workbook will be replaced by a number of workbooks equal to the number of imported files, each of which will be labeled with the name of the imported file. In this example, we have seven files.

The first thing we want to do, after we save the project (save the project often), is start combining some of the imported files. We have four books (Book1 – Book4) with nine columns

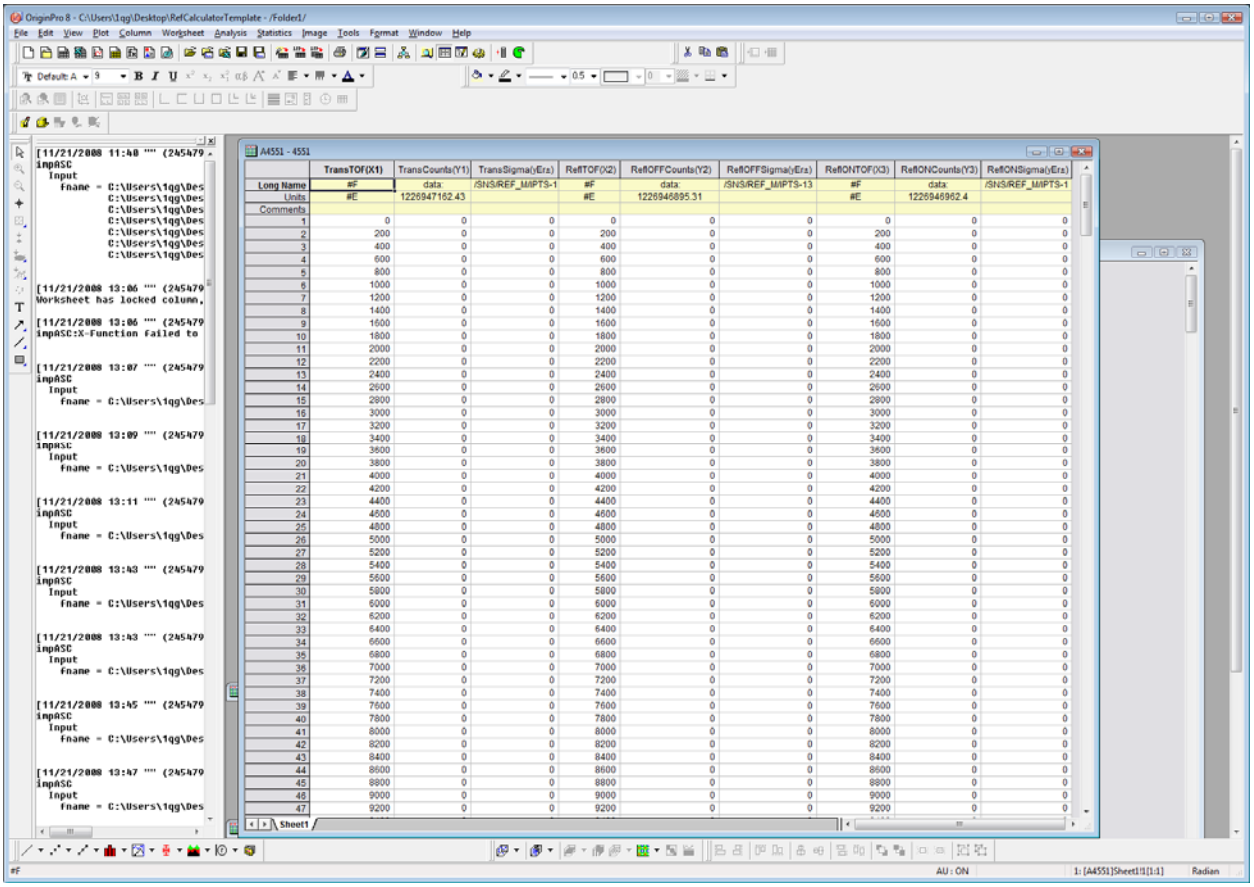
each and we will start by copying the three columns of transmitted data into the first three columns of each workbook we are going to use. Since we have three angles we are only going to use three workbooks. We now have:

Book1

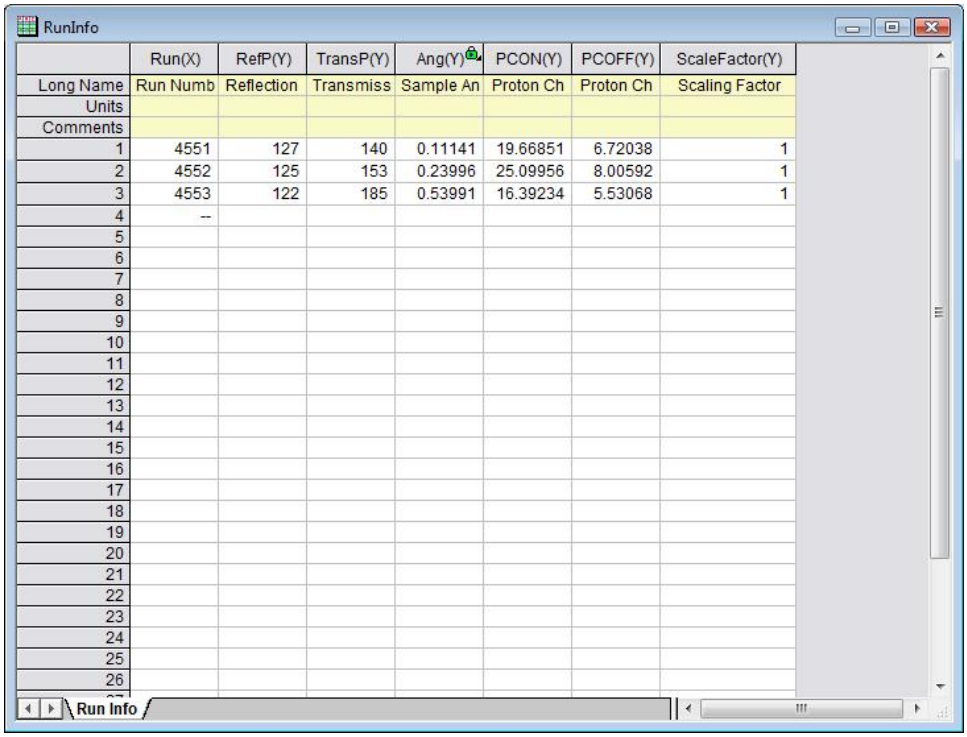
| | TransTOF(X) | TransCounts(Y) | TransSigma(yEr±) | D(Y) | E(Y) | F(Y) | G(Y) | H(Y) | I(Y) |
|---|---|---|---|---|---|---|---|---|---|
| Long Name | #F | data: | /SNS/REF_M/IPTS-1 | | | | | | |
| Units | #E | 1226947162.43 | | | | | | | |
| Comments | | | | | | | | | |
| 1 | 0 | 0 | 0 | -- | -- | -- | -- | -- | -- |
| 2 | 200 | 0 | 0 | -- | -- | -- | -- | -- | -- |
| 3 | 400 | 0 | 0 | -- | -- | -- | -- | -- | -- |
| 4 | 600 | 0 | 0 | -- | -- | -- | -- | -- | -- |
| 5 | 800 | 0 | 0 | -- | -- | -- | -- | -- | -- |
| 6 | 1000 | 0 | 0 | -- | -- | -- | -- | -- | -- |
| 7 | 1200 | 0 | 0 | -- | -- | -- | -- | -- | -- |
| 8 | 1400 | 0 | 0 | -- | -- | -- | -- | -- | -- |
| 9 | 1600 | 0 | 0 | -- | -- | -- | -- | -- | -- |
| 10 | 1800 | 0 | 0 | -- | -- | -- | -- | -- | -- |
| 11 | 2000 | 0 | 0 | -- | -- | -- | -- | -- | -- |
| 12 | 2200 | 0 | 0 | -- | -- | -- | -- | -- | -- |
| 13 | 2400 | 0 | 0 | -- | -- | -- | -- | -- | -- |
| 14 | 2600 | 0 | 0 | -- | -- | -- | -- | -- | -- |
| 15 | 2800 | 0 | 0 | -- | -- | -- | -- | -- | -- |
| 16 | 3000 | 0 | 0 | -- | -- | -- | -- | -- | -- |
| 17 | 3200 | 0 | 0 | -- | -- | -- | -- | -- | -- |
| 18 | 3400 | 0 | 0 | -- | -- | -- | -- | -- | -- |
| 19 | 3600 | 0 | 0 | -- | -- | -- | -- | -- | -- |
| 20 | 3800 | 0 | 0 | -- | -- | -- | -- | -- | -- |
| 21 | 4000 | 0 | 0 | -- | -- | -- | -- | -- | -- |
| 22 | 4200 | 0 | 0 | -- | -- | -- | -- | -- | -- |
| 23 | 4400 | 0 | 0 | -- | -- | -- | -- | -- | -- |
| 24 | 4600 | 0 | 0 | -- | -- | -- | -- | -- | -- |
| 25 | 4800 | 0 | 0 | -- | -- | -- | -- | -- | -- |
| 26 | 5000 | 0 | 0 | -- | -- | -- | -- | -- | -- |
| 27 | 5200 | 0 | 0 | -- | -- | -- | -- | -- | -- |
| 28 | 5400 | 0 | 0 | -- | -- | -- | -- | -- | -- |
| 29 | 5600 | 0 | 0 | -- | -- | -- | -- | -- | -- |
| 30 | 5800 | 0 | 0 | -- | -- | -- | -- | -- | -- |
| 31 | 6000 | 0 | 0 | -- | -- | -- | -- | -- | -- |
| 32 | 6200 | 0 | 0 | -- | -- | -- | -- | -- | -- |
| 33 | 6400 | 0 | 0 | -- | -- | -- | -- | -- | -- |
| 34 | 6600 | 0 | 0 | -- | -- | -- | -- | -- | -- |
| 35 | 6800 | 0 | 0 | -- | -- | -- | -- | -- | -- |
| 36 | 7000 | 0 | 0 | -- | -- | -- | -- | -- | -- |
| 37 | 7200 | 0 | 0 | -- | -- | -- | -- | -- | -- |
| 38 | 7400 | 0 | 0 | -- | -- | -- | -- | -- | -- |
| 39 | 7600 | 0 | 0 | -- | -- | -- | -- | -- | -- |
| 40 | 7800 | 0 | 0 | -- | -- | -- | -- | -- | -- |
| 41 | 8000 | 0 | 0 | -- | -- | -- | -- | -- | -- |
| 42 | 8200 | 0 | 0 | -- | -- | -- | -- | -- | -- |
| 43 | 8400 | 0 | 0 | -- | -- | -- | -- | -- | -- |
| 44 | 8600 | 0 | 0 | -- | -- | -- | -- | -- | -- |
| 45 | 8800 | 0 | 0 | -- | -- | -- | -- | -- | -- |
| 46 | 9000 | 0 | 0 | -- | -- | -- | -- | -- | -- |

Sheet1

In each of our three workbooks that are nine columns wide. Now we finish populating one workbook with the data from run 4551, flipper OFF data first and flipper ON data second. Finally, change the work book name (both the short name and the long name, using the same name for both) to reflect the run number of the associated data (A4551 for run number 4551, A4552, etc.). Note that you do not need to change the workbook names, but it may help keep track of which workbook holds which data set. Also note that when entering data into Book1-Book4 and in the RunInfo workbook that the automatic calculations already entered in the Calc workbook require the information in Book1 to be associated with line 1 in RunInfo, and likewise for Book2 (and line 2 in RunInfo) through Book4. So where you place individual data sets is not as critical as matching the book number (or workbook name if you change the workbook name) to the proper line in RunInfo.




Fill in the other two work books with the data for runs 4552 and 4553. Now we have three workbooks with the data for each sample angle. Switch to the RunInfo workbook and fill in the appropriate run number, channel numbers (ReflP for the center channel of the reflected beam, and TransP for the center channel of the transmitted beam, the angle will be calculated automatically) and proton charges for each sample angle. Enter all the scaling factors of 1 for now. Note that the proton charge was entered in units of $10^{11}$ pC (the proton charges in the preNeXus data for run 4551 were $6.72038 \times 10^{11}$ pC and $1.966851 \times 10^{12}$ pC, but I entered them as 6.72038 and 19.66851 in the RunInfo workbook).

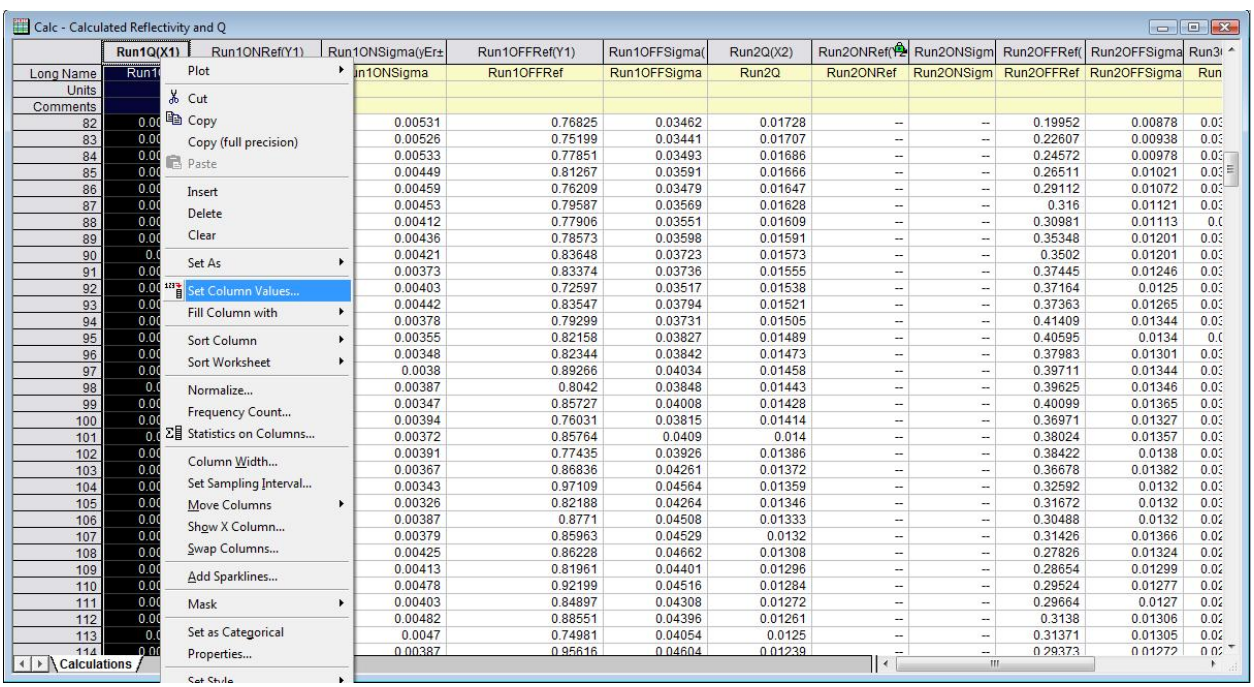


RunInfo

| | Run(X) | RefP(Y) | TransP(Y) | Ang(Y) | PCON(Y) | PCOFF(Y) | ScaleFactor(Y) |
|---|---|---|---|---|---|---|---|
| Long Name | Run Numb | Reflection | Transmiss | Sample An | Proton Ch | Proton Ch | Scaling Factor |
| Units | | | | | | | |
| Comments | | | | | | | |
| 1 | 4551 | 127 | 140 | 0.11141 | 19.66851 | 6.72038 | 1 |
| 2 | 4552 | 125 | 153 | 0.23996 | 25.09956 | 8.00592 | 1 |
| 3 | 4553 | 122 | 185 | 0.53991 | 16.39234 | 5.53068 | 1 |
| 4 | -- | | | | | | |

Run Info

Now switch to the Calc workbook. Right click on the first column and click Set Column Value:



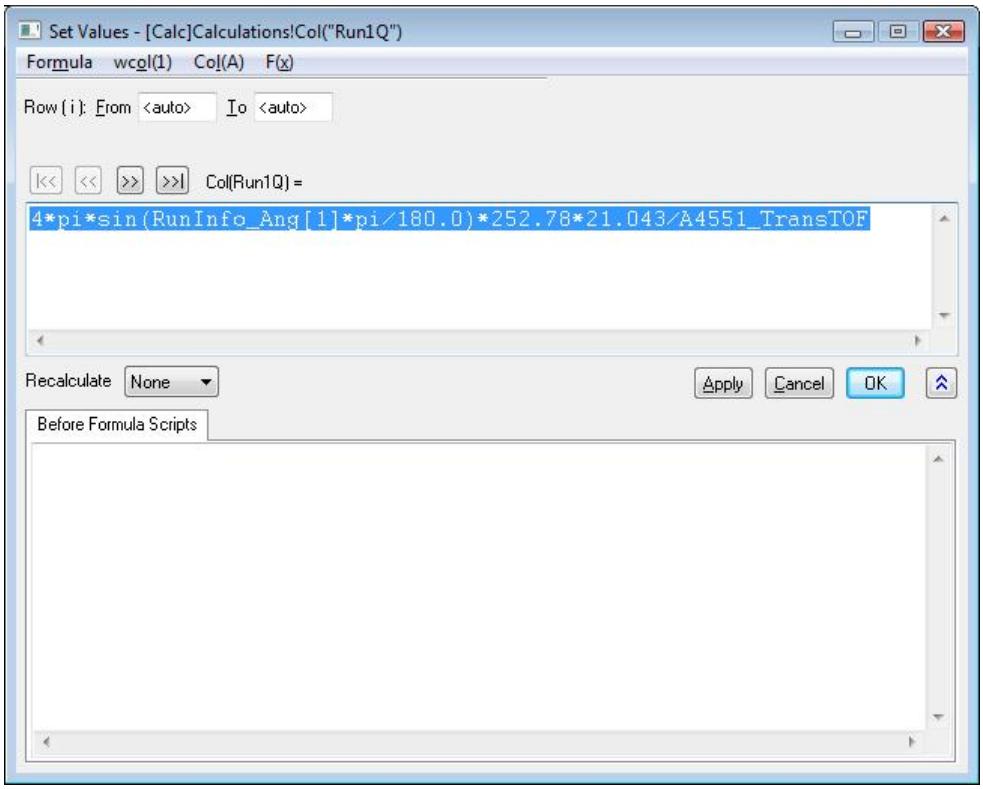
Calc - Calculated Reflectivity and Q

| | Run1Q(X1) | Run1ONRef(Y1) | Run1ONSigma(yEr± | Run1OFFRef(Y1) | Run1OFFSigma( | Run2Q(X2) | Run2ONRef( | Run2ONSigm | Run2OFFRef( | Run2OFFSigma | Run3 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Long Name | Run1 | | in1ONSigma | Run1OFFRef | Run1OFFSigma | Run2Q | Run2ONRef | Run2ONSigm | Run2OFFRef | Run2OFFSigma | Run |
| Units | | | | | | | | | | | |
| Comments | | | | | | | | | | | |
| 82 | 0.00 | | 0.00531 | 0.76825 | 0.03462 | 0.01728 | -- | -- | 0.19952 | 0.00878 | 0.03 |
| 83 | 0.00 | | 0.00526 | 0.75199 | 0.03441 | 0.01707 | -- | -- | 0.22607 | 0.00938 | 0.03 |
| 84 | 0.00 | | 0.00533 | 0.77851 | 0.03493 | 0.01686 | -- | -- | 0.24572 | 0.00978 | 0.03 |
| 85 | 0.00 | | 0.00449 | 0.81267 | 0.03591 | 0.01666 | -- | -- | 0.26511 | 0.01021 | 0.03 |
| 86 | 0.00 | | 0.00459 | 0.76209 | 0.03479 | 0.01647 | -- | -- | 0.29112 | 0.01072 | 0.03 |
| 87 | 0.00 | | 0.00453 | 0.79587 | 0.03569 | 0.01628 | -- | -- | 0.316 | 0.01121 | 0.03 |
| 88 | 0.00 | | 0.00412 | 0.77906 | 0.03551 | 0.01609 | -- | -- | 0.30981 | 0.01113 | 0.0 |
| 89 | 0.00 | | 0.00436 | 0.78573 | 0.03598 | 0.01591 | -- | -- | 0.35348 | 0.01201 | 0.03 |
| 90 | 0.0 | | 0.00421 | 0.83648 | 0.03723 | 0.01573 | -- | -- | 0.3502 | 0.01201 | 0.03 |
| 91 | 0.00 | | 0.00373 | 0.83374 | 0.03736 | 0.01555 | -- | -- | 0.37445 | 0.01246 | 0.03 |
| 92 | 0.00 | | 0.00403 | 0.72597 | 0.03517 | 0.01538 | -- | -- | 0.37164 | 0.0125 | 0.03 |
| 93 | 0.00 | | 0.00442 | 0.83547 | 0.03794 | 0.01521 | -- | -- | 0.37363 | 0.01265 | 0.03 |
| 94 | 0.00 | | 0.00378 | 0.79299 | 0.03731 | 0.01505 | -- | -- | 0.41409 | 0.01344 | 0.03 |
| 95 | 0.00 | | 0.00355 | 0.82158 | 0.03827 | 0.01489 | -- | -- | 0.40595 | 0.0134 | 0.0 |
| 96 | 0.00 | | 0.00348 | 0.82344 | 0.03842 | 0.01473 | -- | -- | 0.37983 | 0.01301 | 0.03 |
| 97 | 0.00 | | 0.0038 | 0.89266 | 0.04034 | 0.01458 | -- | -- | 0.39711 | 0.01344 | 0.03 |
| 98 | 0.0 | | 0.00387 | 0.8042 | 0.03848 | 0.01443 | -- | -- | 0.39625 | 0.01346 | 0.03 |
| 99 | 0.00 | | 0.00347 | 0.85727 | 0.04008 | 0.01428 | -- | -- | 0.40099 | 0.01365 | 0.03 |
| 100 | 0.00 | | 0.00394 | 0.76031 | 0.03815 | 0.01414 | -- | -- | 0.36971 | 0.01327 | 0.03 |
| 101 | 0.0 | | 0.00372 | 0.85764 | 0.0409 | 0.014 | -- | -- | 0.38024 | 0.01357 | 0.03 |
| 102 | 0.00 | | 0.00391 | 0.77435 | 0.03926 | 0.01386 | -- | -- | 0.38422 | 0.0138 | 0.03 |
| 103 | 0.00 | | 0.00367 | 0.86836 | 0.04261 | 0.01372 | -- | -- | 0.36678 | 0.01382 | 0.03 |
| 104 | 0.00 | | 0.00343 | 0.97109 | 0.04564 | 0.01359 | -- | -- | 0.32592 | 0.0132 | 0.03 |
| 105 | 0.00 | | 0.00326 | 0.82188 | 0.04264 | 0.01346 | -- | -- | 0.31672 | 0.0132 | 0.03 |
| 106 | 0.00 | | 0.00387 | 0.8771 | 0.04508 | 0.01333 | -- | -- | 0.30488 | 0.0132 | 0.02 |
| 107 | 0.00 | | 0.00379 | 0.85963 | 0.04529 | 0.0132 | -- | -- | 0.31426 | 0.01366 | 0.02 |
| 108 | 0.00 | | 0.00425 | 0.86228 | 0.04662 | 0.01308 | -- | -- | 0.27826 | 0.01324 | 0.02 |
| 109 | 0.00 | | 0.00413 | 0.81961 | 0.04401 | 0.01296 | -- | -- | 0.28654 | 0.01299 | 0.02 |
| 110 | 0.00 | | 0.00478 | 0.92199 | 0.04516 | 0.01284 | -- | -- | 0.29524 | 0.01277 | 0.02 |
| 111 | 0.00 | | 0.00403 | 0.84897 | 0.04308 | 0.01272 | -- | -- | 0.29664 | 0.0127 | 0.02 |
| 112 | 0.00 | | 0.00482 | 0.88551 | 0.04396 | 0.01261 | -- | -- | 0.3138 | 0.01306 | 0.02 |
| 113 | 0.0 | | 0.0047 | 0.74981 | 0.04054 | 0.0125 | -- | -- | 0.31371 | 0.01305 | 0.02 |
| 114 | 0.00 | | 0.00387 | 0.95616 | 0.04604 | 0.01239 | -- | -- | 0.29373 | 0.01272 | 0.02 |

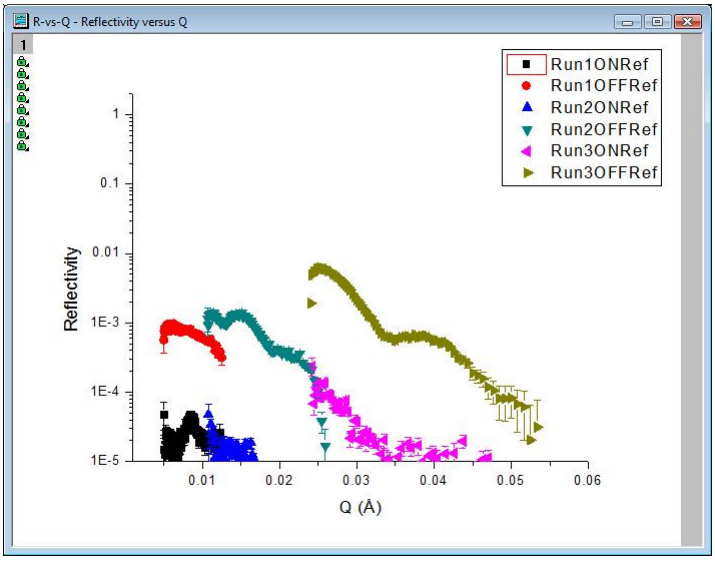
Plot
Cut
Copy
Copy (full precision)
Paste
Insert
Delete
Clear
Set As
Set Column Values...
Fill Column with
Sort Column
Sort Worksheet
Normalize...
Frequency Count...
Statistics on Columns...
Column Width...
Set Sampling Interval...
Move Columns
Show X Column...
Swap Columns...
Add Sparklines...
Mask
Set as Categorical
Properties...
Set Style

Calculations

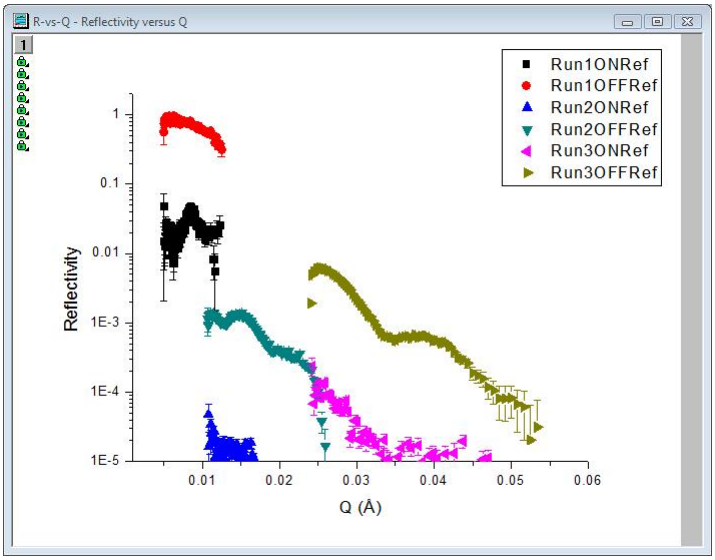
You will get the Set Values Window



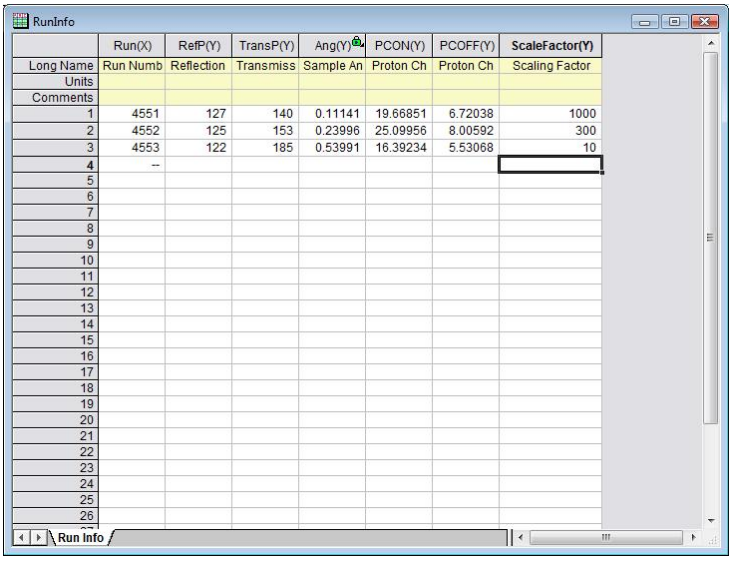

If you have not changed the column labels the only thing you will have to change is the workbook name. In this example Run1 is A4551, Run2 is A4552 and Run3 is A4553. Change the workbook name, click Apply and then use the right arrow to move across the workbook and change the workbook names in the equation to the appropriate workbook. If everything is correct (and the Recalculate value is set to Auto), the calculations for Q and R should automatically populate the calculated columns. If not, change something in the line and then change it back again and click Apply and the column should recalculate. Once all the data is populated, the plot will look like this:




Now let's put in real scaling factors (remember they are all still set to 1). The low angle data (the data with the total reflection plateau) should be scaled so the plateau for flipper OFF is 1. Switch to the RunInfo workbook and, while still observing the plot window, change the scale factor until the Run1OFF curve reaches. In this case, a scale factor of 1000 gets close.



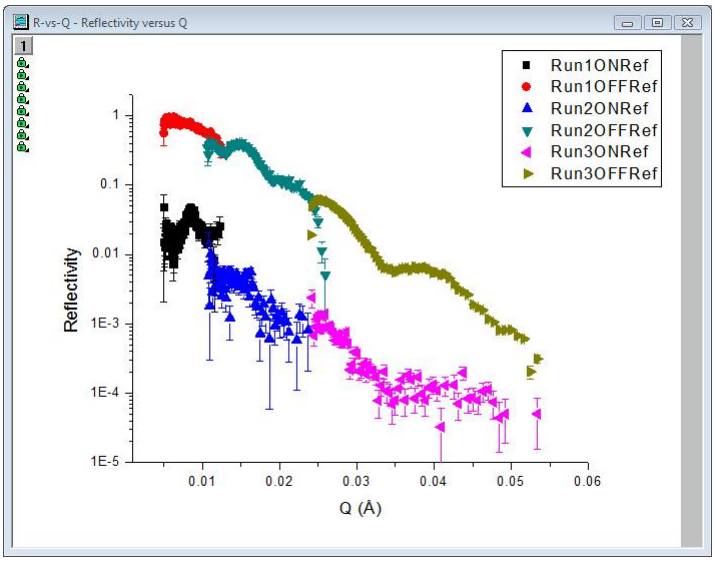

Now change the scaling factors for the remaining angles. Our final set of parameters:



RunInfo

| | Run(X) | RefP(Y) | TransP(Y) | Ang(Y) | PCON(Y) | PCOFF(Y) | ScaleFactor(Y) |
|---|---|---|---|---|---|---|---|
| Long Name | Run Numb | Reflection | Transmiss | Sample An | Proton Ch | Proton Ch | Scaling Factor |
| Units | | | | | | | |
| Comments | | | | | | | |
| 1 | 4551 | 127 | 140 | 0.11141 | 19.66851 | 6.72038 | 1000 |
| 2 | 4552 | 125 | 153 | 0.23996 | 25.09956 | 8.00592 | 300 |
| 3 | 4553 | 122 | 185 | 0.53991 | 16.39234 | 5.53068 | 10 |
| 4 | -- | | | | | | |

Gives us a good first pass at properly scaled data.




Don’t forget to save the project often.