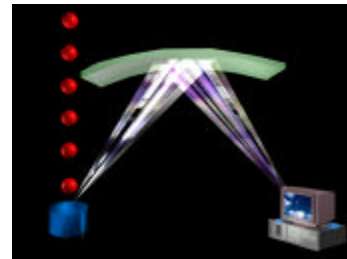

Probe for Windows 95/98/NT (32 bit) v. 4.52

User's Guide to Getting Started

By Daniel T. Kremser, Ph.D.



Contents

USER'S GUIDE TO GETTING STARTED.....	1
ACKNOWLEDGEMENTS.....	1
DISCLAIMER	1
CONVENTIONS USED IN THIS GUIDE	1
CREATING THE DEFAULT STANDARD DATABASE FILE.....	1
CREATING STANDARD POSITION FILES	20
BEAM AND DETECTOR STABILITY.....	42
BRASS ALLOY RUN.....	51
INTRODUCTION.....	51
OPENING PROBE FOR WINDOWS.....	52
CREATING A NEW RUN.....	55
PARAMETER INITIALIZATION.....	58
<i>Analytical Standard Selection</i>	<i>58</i>
<i>Nominal Beam Current Measurement</i>	<i>60</i>
<i>Creating a New Sample.....</i>	<i>61</i>
<i>Setting Analytical Conditions</i>	<i>64</i>
<i>Element, X-Ray Line and Spectrometer Parameters Selection</i>	<i>65</i>
<i>Setting Count Times</i>	<i>74</i>
MANUAL PEAKING USING THE ACQUIRE! WINDOW.....	75
MANUAL COUNT ACQUISITION USING THE ACQUIRE! WINDOW	81
<i>Wavescan Acquisitions.....</i>	<i>85</i>
OFF-PEAK ADJUSTMENTS FROM THE PLOT! WINDOW	89
LOADING STANDARD POSITION FILES.....	98
AUTOMATION ACTIONS.....	108
<i>Confirm Standard Positions</i>	<i>108</i>
<i>Calibrate Peak Positions.....</i>	<i>111</i>
<i>Acquire Standard Samples</i>	<i>114</i>
ANALYZE STANDARD DATA.....	117
UNKNOWN SAMPLE DATA COLLECTION AND ANALYSIS	121
OUTPUT OF ANALYZED DATA	125
CLOSING THE CURRENT RUN AND PROBE FOR WINDOWS.....	129
SILICATE SAMPLE RUN.....	131
INTRODUCTION.....	131
OPENING PROBE FOR WINDOWS.....	132
CREATING A NEW RUN	135

PARAMETER INITIALIZATION.....	138
<i>Analytical Standard Selection</i>	138
<i>Nominal Beam Current Measurement</i>	140
<i>Creating a New Sample</i>	141
<i>Setting Analytical Conditions</i>	144
<i>Element, X-Ray Line, and Spectrometer Parameters Selection</i>	145
<i>Editing Acquisition Options</i>	151
<i>Modifying Standard Assignments</i>	156
<i>Setting Count Times</i>	162
LOADING STANDARD POSITION FILES.....	164
AUTOMATION ACTIONS.....	174
<i>Confirm Standard Positions</i>	174
<i>Calibrate Peak Positions</i>	177
<i>Acquire Standard Samples</i>	180
EVALUATE STANDARD COUNT DATA	183
ASSIGN MAN BACKGROUND CALIBRATIONS	188
ANALYZE STANDARD SAMPLES.....	193
SPECTRAL INTERFERENCE ASSIGNMENTS	202
UNKNOWN SAMPLE DATA COLLECTION AND ANALYSIS	209
DIGITIZED SAMPLE DATA COLLECTION AND ANALYSIS	220
PLOTTING ANALYSIS DATA.....	232
CLOSING THE CURRENT RUN AND PROBE FOR WINDOWS	236

Acknowledgements

The author would like to thank John Donovan, Don Leshner, and Dave Stanford for critical comments, technical assistance and their friendship over the years. Their expertise has made this manual better.

Disclaimer

IN NO EVENT SHALL DAN KREMSEMER OR ADVANCED MICROBEAM BE LIABLE TO ANY PARTY FOR DIRECT, INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, INCLUDING LOST PROFITS, ARISING OUT OF THE USE OF THIS DOCUMENTATION, EVEN IF DAN KREMSEMER OR ADVANCED MICROBEAM HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

DAN KREMSEMER AND ADVANCED MICROBEAM SPECIFICALLY DISCLAIMS ANY WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. THIS DOCUMENTATION PROVIDED HEREUNDER IS ON AN "AS IS" BASIS, AND DAN KREMSEMER AND ADVANCED MICROBEAM HAVE NO OBLIGATIONS TO PROVIDE MAINTENANCE, SUPPORT, UPDATES, ENHANCEMENTS, OR MODIFICATIONS.

Conventions Used in this Guide

The computer operating system employed here is Microsoft Windows NT (v. 4.0, service pack 4) running on a Pentium PC base. The software version of PROBE FOR WINDOWS (32 bit) is 4.52.

The following conventions are used in this document; **Menu Commands** and **Dialog Box (Windows) Names and buttons** are bold-faced whenever they occur in the text. *Dialog Box Options* are italicized and FILE NAMES are capitalized.

Several tips for saving time/steps include:

Context sensitive HELP is available in any window by pressing the F1 key.

Pressing <Enter> on the keyboard is identical to clicking the **OK** button.

Pressing the <Esc> key on the keyboard is identical to clicking the **Cancel** command.

To select a range of items in *Multi-Select* list boxes, click on the first item, move to the last and hold the <Shift> key down while clicking on the last item.

To select individual items in *Multi-Select* list boxes, hold down the <Ctrl> key down while clicking on the item.

De-select items in *Multi-Select* list boxes by holding the <Ctrl> key down and clicking the item.

Creating the Default Standard Database File

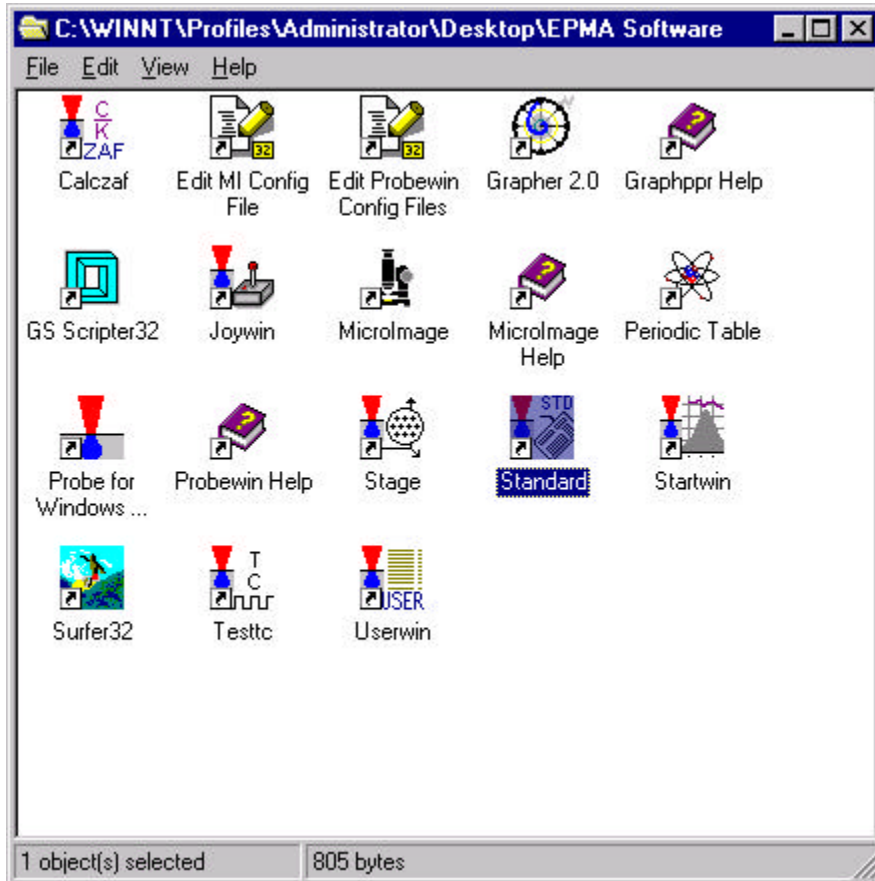
PROBE FOR WINDOWS requires a database of microprobe standards for use in quantitative analysis. This standard database can store up to 1000 standards each with up to 32 elements per standard. All standard information is stored in a file designated STANDARD.MDB. MDB is an abbreviation for Microsoft DataBase and represents a Microsoft Access v. 3.5 database file. In addition to the default standard database, three other standard databases are supplied as ASCII files. These are:

DHZ.DAT	Deer, Howie and Zussman
ORE.DAT	Dana's Mineralogy (Sulfides)
SRM.DAT	NIST standard reference alloys and glasses

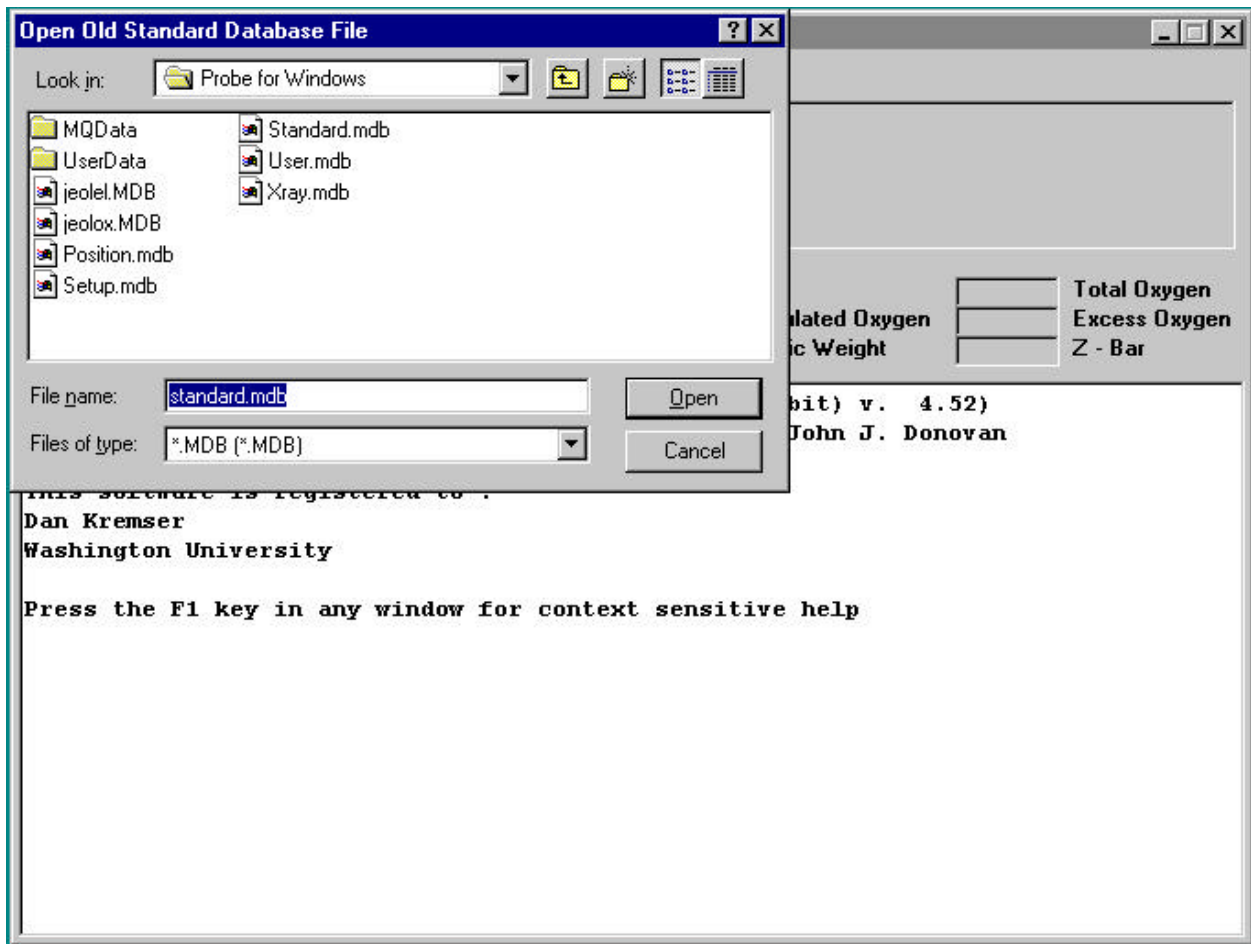
The DHZ.DAT file is a database of all of the analyses listed in the first edition of “Rock Forming Minerals” by Deer, Howie and Zussman. The ORE.DAT file is a database composed of sulfide minerals from Dana’s Mineralogy entered in ideal formulas. The SRM.DAT file is a database of SRM (Standard Reference Materials) alloys and glasses from the NIST SRM catalog. All of these database files can be used for reference and matching purposes but must first be imported into a PROBE FOR WINDOWS standard database file (see User’s Guide and Reference documentation) using the **File | Import** command.

The following procedure illustrates how to create a new default standard database and enter standard compositions into it. To import standard compositions from 16 bit PROBE FOR WINDOWS see the User's Guide and Reference documentation.

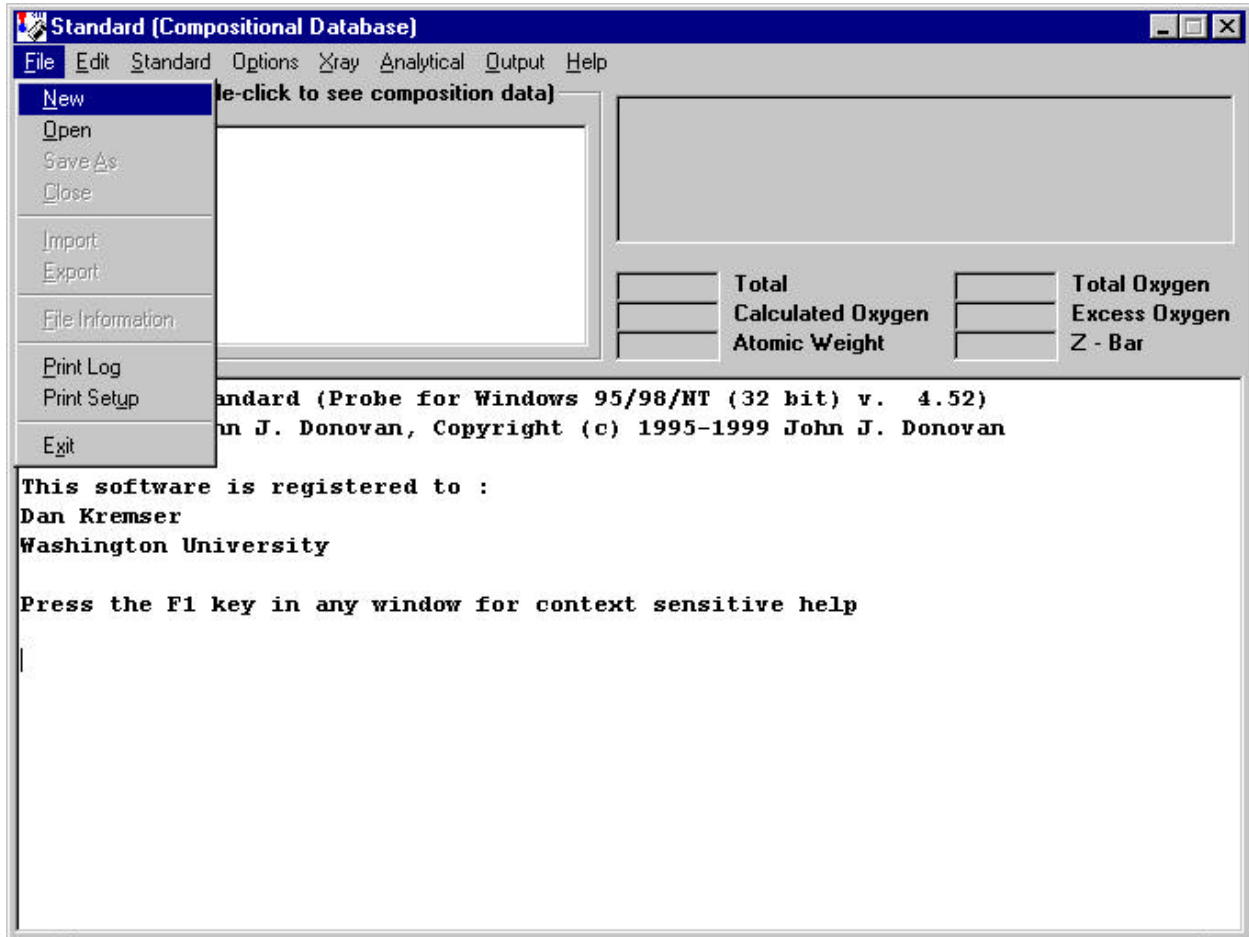
From the Desktop, double click on the yellow EPMA Software folder. Then double click on the **Standard** icon in the EPMA Software group.



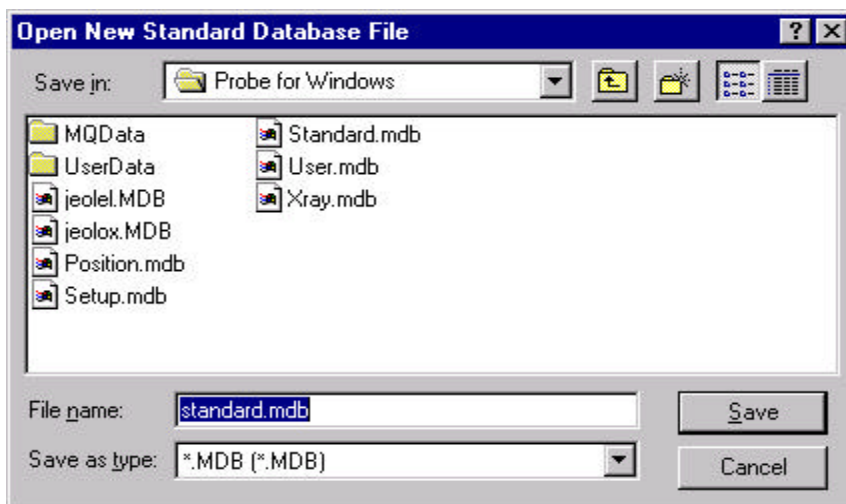
This action launches the STANDARD (Compositional Database) program and opens the **Open Old Standard Database File** dialog box. To create a new standard database, click on the **Cancel** button to close the **Open Old Standard Database File** dialog box.



Select **File** from the menu bar and then click on **New** from the menu.



This opens the **Open New Standard Database File** dialog box.



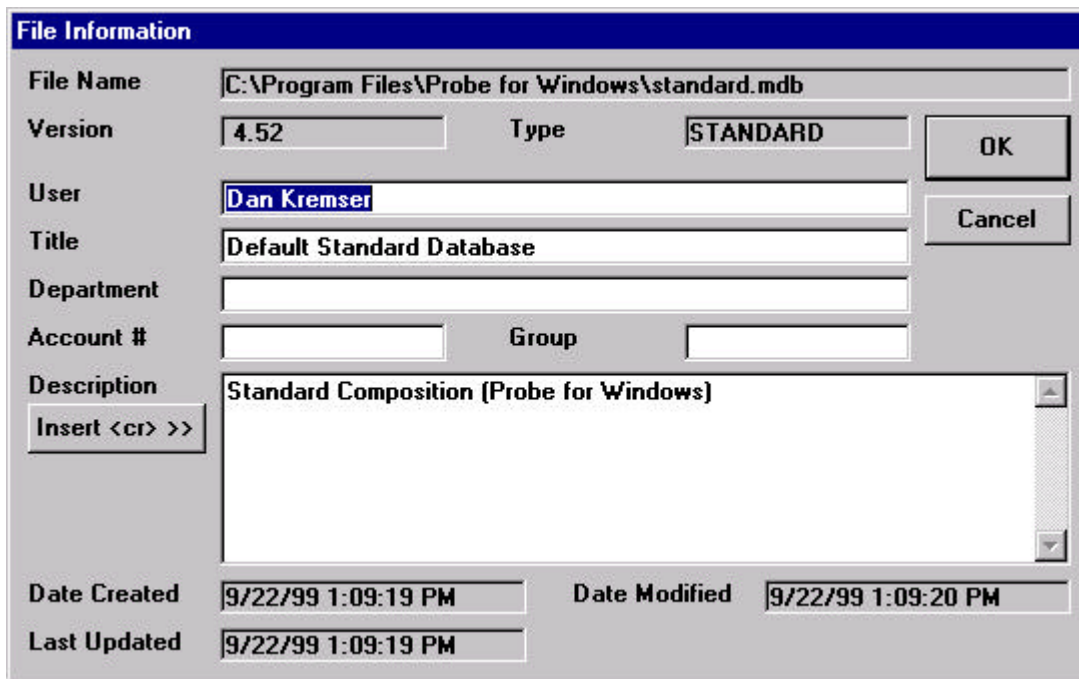
Click the **Save** button to open a new default standard database (STANDARD.MDB).

The **Open New Standard Database File** window appears.

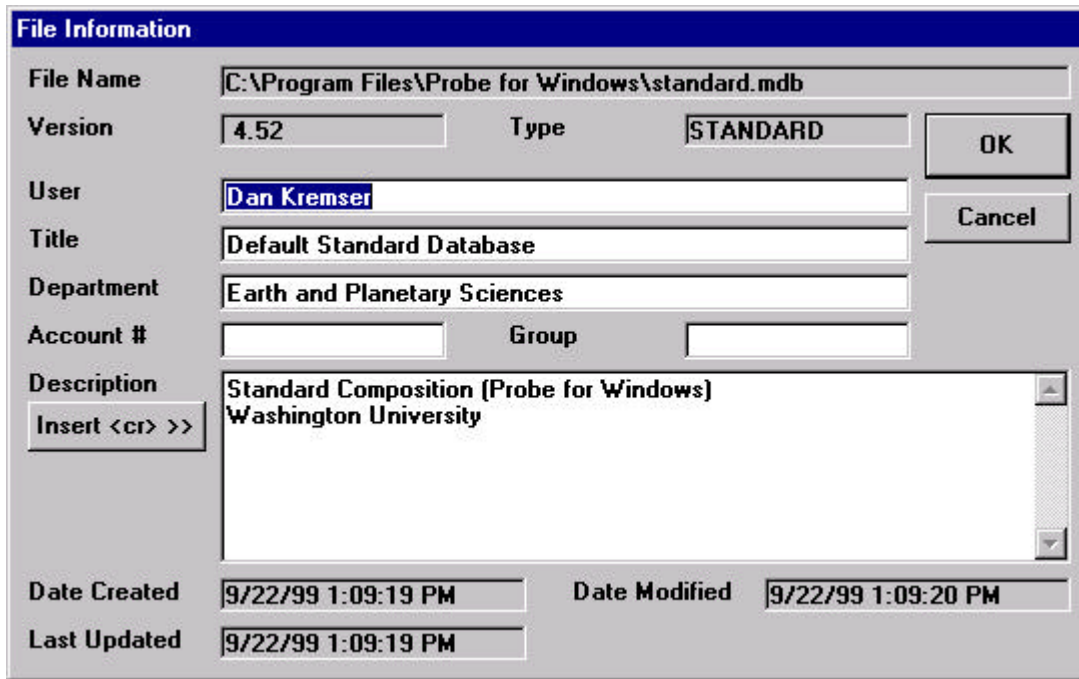


Click the **Yes** button to confirm overwriting the existing default database. Note: the supplied demonstration files JEOLEL.MDB and JEOLX.MDB will no longer be usable after this operation.

The **File Information** window opens.



Enter the relevant information into the *User*, *Title*, and other *Description* text boxes shown in the **File Information** dialog box displayed below. Use the <tab> key to move between text boxes. Click the **Insert <cr> >>** button to insert a carriage return in the *Description* field text.



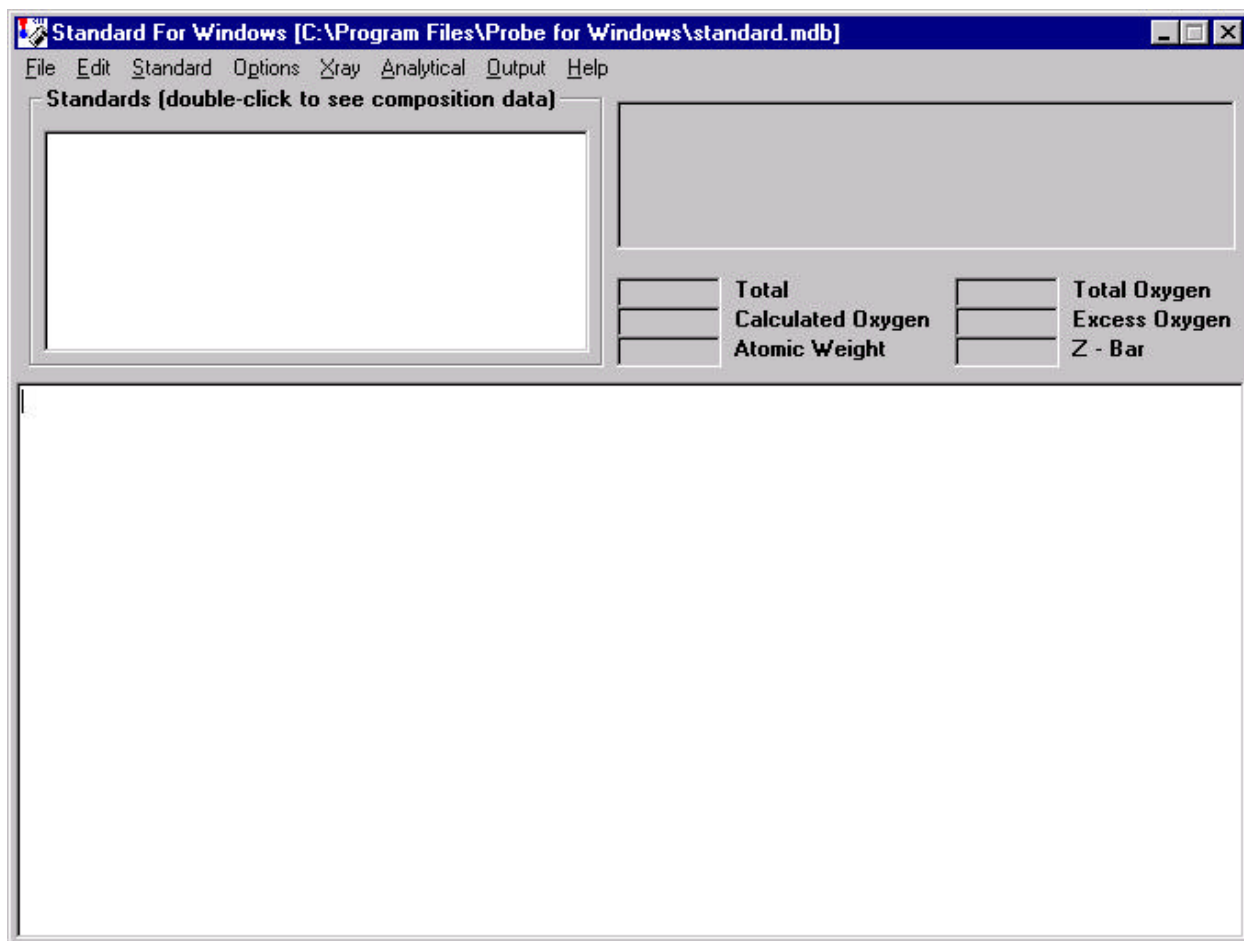
The image shows a 'File Information' dialog box with the following fields and values:

File Name	C:\Program Files\Probe for Windows\standard.mdb		
Version	4.52	Type	STANDARD
User	Dan Kremser		
Title	Default Standard Database		
Department	Earth and Planetary Sciences		
Account #		Group	
Description	Standard Composition (Probe for Windows) Washington University		
Date Created	9/22/99 1:09:19 PM	Date Modified	9/22/99 1:09:20 PM
Last Updated	9/22/99 1:09:19 PM		

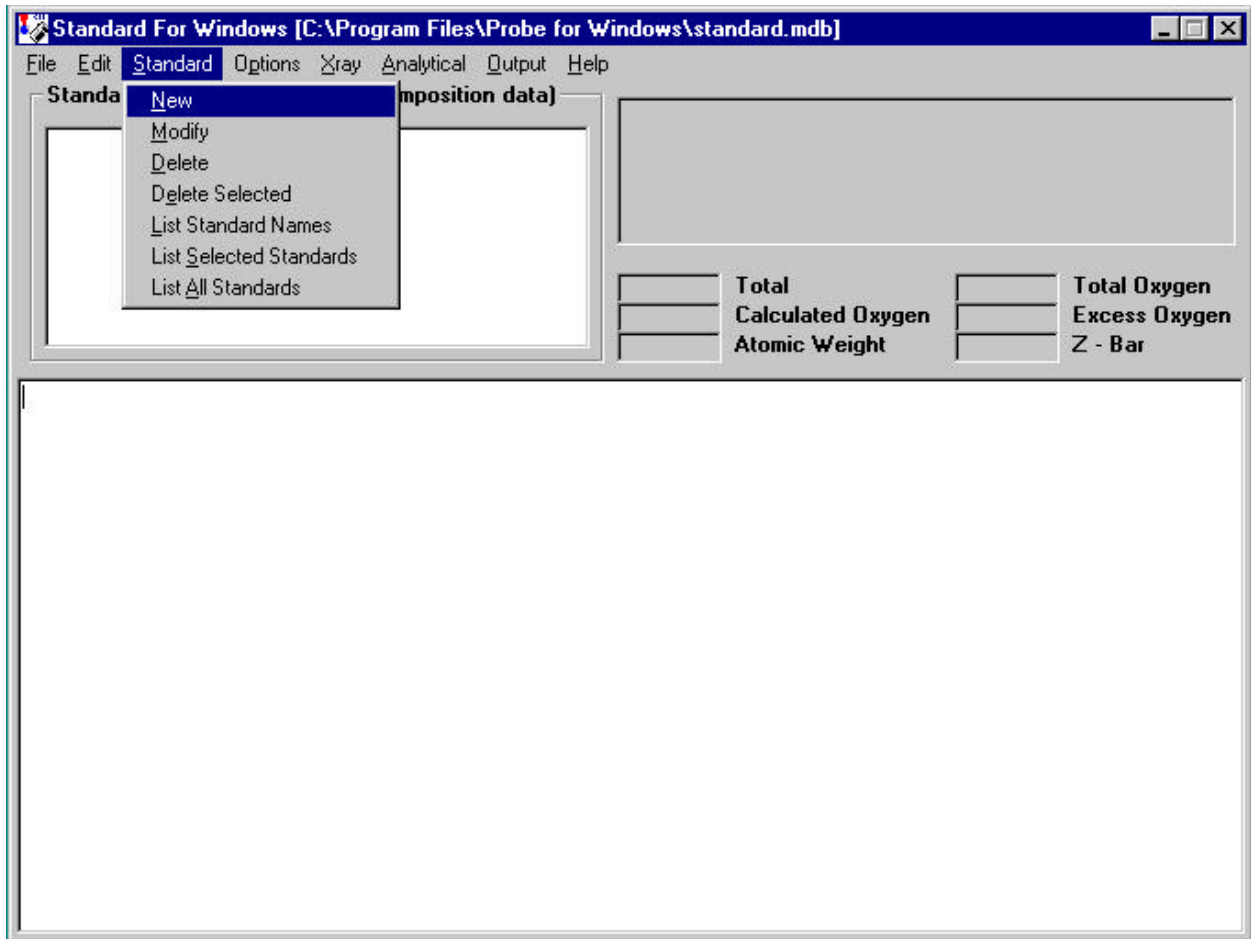
Buttons: OK, Cancel, Insert <cr> >>

When finished, click the **OK** button.

The user now has an empty database ready to accept standard composition data.



To enter standards into this database, select **Standard** from the menu bar and click on **New** from the menu.



This action opens the **Standard Composition** dialog box. Type in the appropriate *Sample Number*, *Standard Name*, and *Standard Description* into the text boxes. The software automatically loads the next available number by default. Choose standard numbers that will allow grouping of standards into various functional sets. Standard numbers may range from 1 to 32768, however to avoid conflict with the supplied NIST SRM, DHZ, and Dana ORE sample databases select numbers below 2000.

Standard Composition

Sample Number, Name and Description

1 Standard Name
 Insert <cr> >> Standard Description

OK
 Cancel

Click Element Row to Edit Element Composition and/or Cations (click empty row to add)

Channel	Element	X-Ray	Cations	Oxygens	Elemental	Oxide	Atomic

Enter Composition In: Oxide Percent Elemental Percent

Display Composition As: Oxide Standard Elemental Standard

Current Column Totals: Elemental .000, Oxide .000, Atomic .000

Total Oxygen From Cations: .000

Update Excess | Enter Excess Oxygen: .000 | Enter Atom Formula Composition

Click the *Elemental Percent* and *Elemental Standard* buttons under *Enter Composition In* and *Display Composition As* respectively, as necessary. All standard compositions are saved in the standard database as elemental concentrations. If oxygen is present in the standard then one must enter oxygen as an element and its concentration into the standard entry. See the silicate example in this manual for details.

The first example will illustrate the entry of an elemental metal standard. Click on any empty row in the spreadsheet. This opens the **Element Properties** dialog box. In the *Element* field either type in the first element in the standard or use the drop-down list box to select the element symbol. Continue by choosing the correct *X-Ray Line*, *Cations*, and *Oxygens*. The *X-Ray Line* is used for modeling purposes only. When entering properties and concentrations for elements in elemental mode, the program grays out the *Cations* and *Oxygens* text boxes, no editing of these text boxes are necessary.

Standard Composition

Sample Number, Name and Description

529 Copper Metal

Insert <cr> >> pure metal standard
supplied by JEOL with microprobe

OK Cancel

Click Element Properties

Enter Element Properties and Concentration For :

Element	X-Ray Line	Cations	Oxygens
cu	ka	2	1

on In Elemental Weight Percent

OK Cancel Clear

Enter Composition In Display Composition As

Oxide Percent Oxide Standard

Elemental Percent Elemental Standard

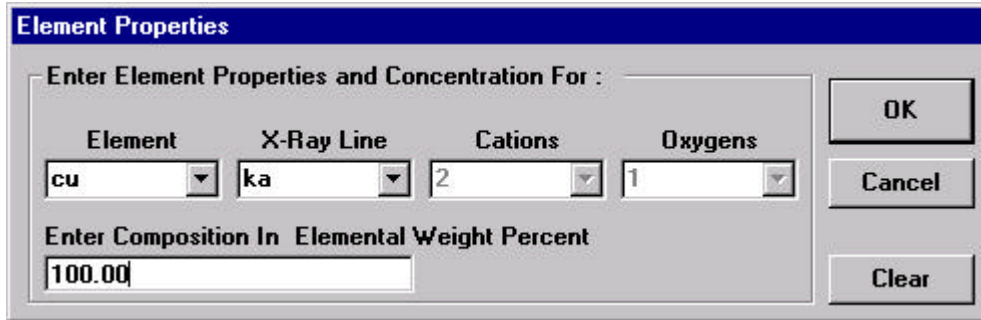
Current Column Totals

Elemental	Oxide	Atomic
.000		.000

Total Oxygen From Cations

Update Excess Enter Excess Oxygen Enter Atom Formula Composition

Enter the elemental weight percent for cu into the *Composition* text box. Finish by clicking the **OK** button of the **Element Properties** dialog box.



Element Properties

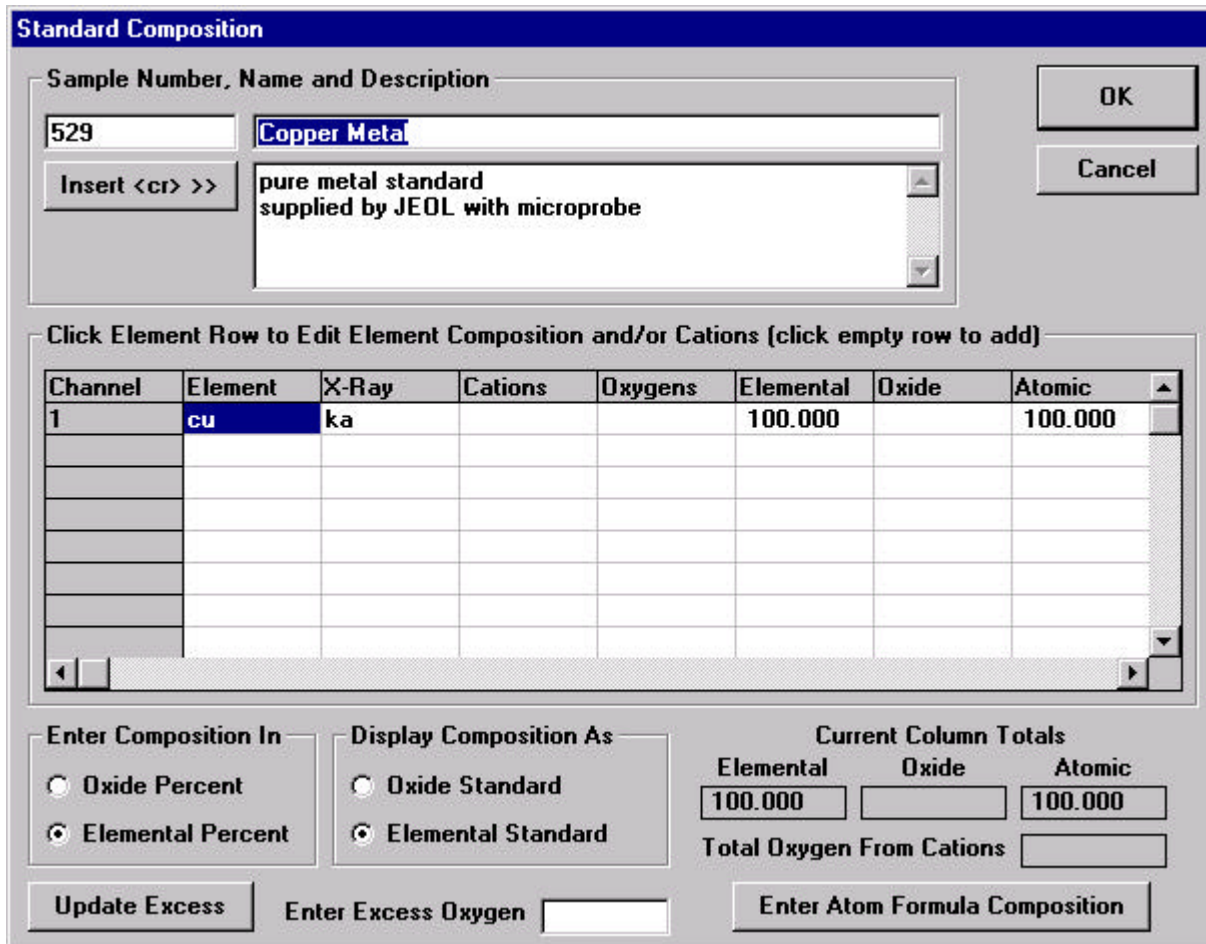
Enter Element Properties and Concentration For :

Element: X-Ray Line: Cations: Oxygens:

Enter Composition In Elemental Weight Percent

Buttons: OK, Cancel, Clear

The program returns to the **Standard Composition** dialog box.



Standard Composition

Sample Number, Name and Description

Sample Number: Name:

Description:

Buttons: OK, Cancel

Click Element Row to Edit Element Composition and/or Cations (click empty row to add)

Channel	Element	X-Ray	Cations	Oxygens	Elemental	Oxide	Atomic
1	cu	ka			100.000		100.000

Enter Composition In: Oxide Percent Elemental Percent

Display Composition As: Oxide Standard Elemental Standard

Current Column Totals

Elemental	Oxide	Atomic
<input type="text" value="100.000"/>	<input type="text"/>	<input type="text" value="100.000"/>

Total Oxygen From Cations:

Buttons: Update Excess, Enter Excess Oxygen , Enter Atom Formula Composition

If there are more elements (compound standards) in the standard, click the next empty *Element* row and repeat the data entry process. When all elements are entered, click the **OK** button on the **Standard Composition** dialog box. This concludes the entry of a standard into the standard database and results in the following log window output.

Standard For Windows [C:\Program Files\Probe for Windows\standard.mdb]

File Edit Standard Options Xray Analytical Output Help

Standards (double-click to see composition data)

529 Copper Metal

St 529 Copper Metal
TakeOff = 40 KiloVolts = 15
pure metal standard
supplied by JEOL with microprobe

100.000	Total	.000	Total Oxygen
.000	Calculated Oxygen	.000	Excess Oxygen
63.546	Atomic Weight	29.000	Z - Bar

St 529 Copper Metal
TakeOff = 40 KiloVolts = 15
pure metal standard
supplied by JEOL with microprobe
Elemental Composition

Elemental Wt. % Total:	100.000	Average Total Oxygen:	.000
Average Calcu. Oxygen:	.000	Average Excess Oxygen:	.000
Average Atomic Weight:	63.546	Average Atomic Number:	29.000

ELEM: Cu
XRAY: ka
ELWT: 100.000
KFAC: 1.0000
ZCOR: 1.0000
ATWT: 100.000

Many standards contain oxygen in their compositions. Since all standard compositions are saved to the standard database as elemental concentrations, it is necessary to enter the oxygen concentration if oxygen is present in the compound. This applies to all standards, even those which are entered and/or displayed as oxide concentrations. The following example illustrates a silicate (oxygen bearing) standard entry into the database.

From the main Standard log window, select **Standard** from the menu bar and click on **New** from the menu choices. This action opens the **Standard Composition** dialog box. Type in the appropriate *Sample Number*, *Standard Name*, and *Standard Description* into the text boxes. Click the *Oxide Percent* and *Oxide Standard* buttons under the *Enter Composition In* and *Display Composition As* boxes.

Standard Composition

Sample Number, Name and Description

81 Albite (Amelia)

Insert <cr> >> Natural specimen from Amelia, VA
Source: Ed Olsen, Univ of Chicago

OK

Cancel

Click Element Row to Edit Element Composition and/or Cations (click empty row to add)

Channel	Element	X-Ray	Cations	Oxygens	Elemental	Oxide	Atomic

Enter Composition In Display Composition As

Oxide Percent Oxide Standard

Elemental Percent Elemental Standard

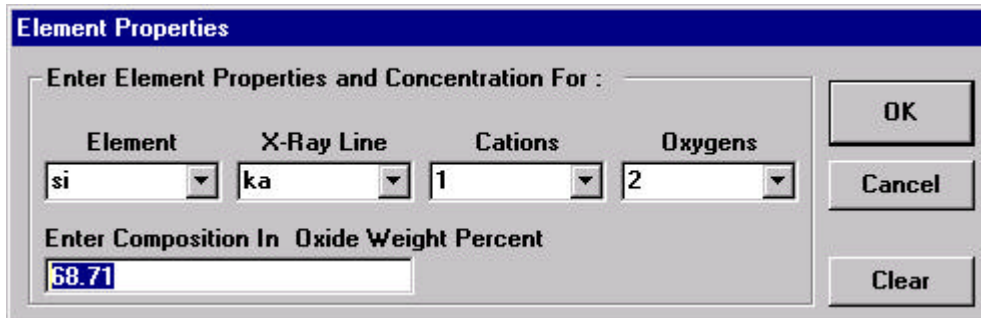
Current Column Totals

Elemental	Oxide	Atomic
.000	.000	.000
Total Oxygen From Cations		.000

Update Excess Enter Excess Oxygen .000 Enter Atom Formula Composition

Click on any empty row in the spreadsheet.

This opens the **Element Properties** dialog box. In the *Element* field either type in the first element in the standard or use the drop-down list box to select the element symbol. Continue by choosing the correct *X-Ray Line*, *Cations*, and *Oxygens*. Finally, enter the weight percent for SiO₂ into the *Enter Composition In Oxide Weight Percent* text box.



Element Properties

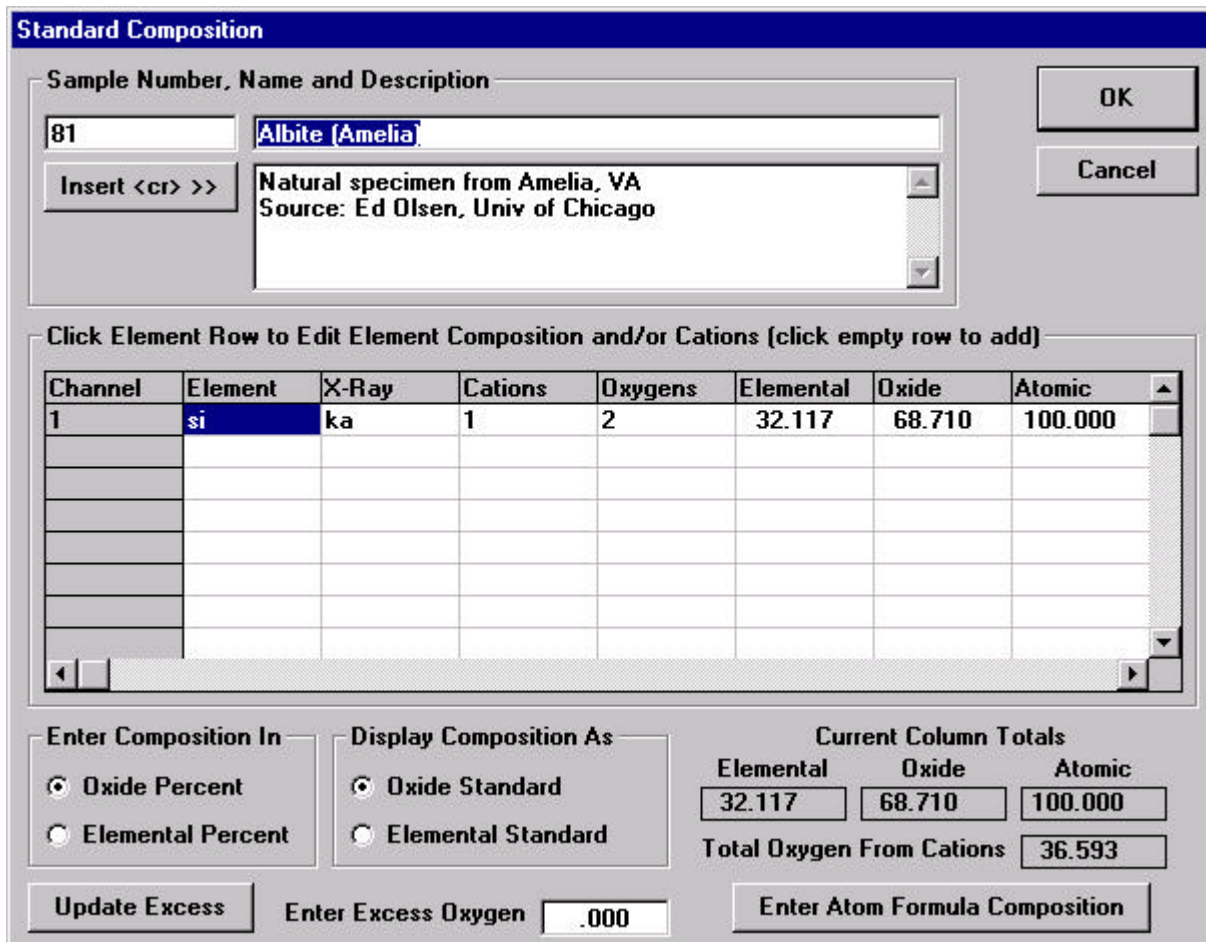
Enter Element Properties and Concentration For :

Element: si X-Ray Line: ka Cations: 1 Oxygens: 2

Enter Composition In Oxide Weight Percent: 68.71

Buttons: OK, Cancel, Clear

Finish by clicking the **OK** button of the **Element Properties** dialog box. This results in the following **Standard Composition** dialog box.



Standard Composition

Sample Number, Name and Description

81 Albite (Amelia)

Natural specimen from Amelia, VA
Source: Ed Olsen, Univ of Chicago

Click Element Row to Edit Element Composition and/or Cations (click empty row to add)

Channel	Element	X-Ray	Cations	Oxygens	Elemental	Oxide	Atomic
1	si	ka	1	2	32.117	68.710	100.000

Enter Composition In: Oxide Percent Elemental Percent

Display Composition As: Oxide Standard Elemental Standard

Current Column Totals

Elemental	Oxide	Atomic
32.117	68.710	100.000
Total Oxygen From Cations		36.593

Update Excess Enter Excess Oxygen: .000 Enter Atom Formula Composition

Buttons: OK, Cancel

Note: to facilitate the data entry for the oxygen concentration of standard compositions which are entered as oxide concentrations, the program will display a running total in the text box designated *Total Oxygen From Cations*.

Continue the data entry process for the remaining elements (as oxides).

Standard Composition

Sample Number, Name and Description

81 Albite (Amelia)

Insert <cr> >> Natural specimen from Amelia, VA
Source: Ed Olsen, Univ of Chicago

OK

Cancel

Click Element Row to Edit Element Composition and/or Cations (click empty row to add)

Channel	Element	X-Ray	Cations	Oxygens	Elemental	Oxide	Atomic
1	si	ka	1	2	32.117	68.710	60.006
2	al	ka	2	3	10.320	19.500	20.071
3	na	ka	2	1	8.680	11.700	19.811
4	k	ka	2	1	.083	.100	.111

Enter Composition In

Oxide Percent Oxide Standard

Elemental Percent Elemental Standard

Current Column Totals

Elemental	Oxide	Atomic
51.200	100.010	100.000
Total Oxygen From Cations		48.810

Update Excess Enter Excess Oxygen .000 Enter Atom Formula Composition

To complete the standard entry into the standard database, enter oxygen as the last element in the standard. Click on any empty row in the spreadsheet. This opens the **Element Properties** dialog box. In the *Element* field type in the element symbol for oxygen. Check for the appropriate *X-Ray Line*, *Cations*, and *Oxygens*. Finally, enter the running total from the *Total Oxygen From Cations* text box into the *Enter Composition in Oxide Weight Percent* text box.

The screenshot displays the 'Standard Composition' software interface. The main window is titled 'Standard Composition' and contains the following elements:

- Sample Number, Name and Description:**
 - Sample Number: 81
 - Name: Albite (Amelia)
 - Description: Natural specimen from Amelia, VA
Source: Ed Olsen, Univ of Chicago
- Buttons:** OK, Cancel
- Element Properties Dialog Box:**
 - Title: Element Properties
 - Enter Element Properties and Concentration For :
 - Fields: Element (o), X-Ray Line (ka), Cations (1), Oxygens (0)
 - Enter Composition In Oxide Weight Percent: 48.81
 - Buttons: OK, Cancel, Clear
- Current Column Totals:**

Elemental	Oxide	Atomic
51.200	100.010	100.000
Total Oxygen From Cations		48.810
- Enter Composition In / Display Composition As:**
 - Enter Composition In: Oxide Percent, Elemental Percent
 - Display Composition As: Oxide Standard, Elemental Standard
- Other Fields:**
 - Update Excess
 - Enter Excess Oxygen: .000
 - Enter Atom Formula Composition

Click the **OK** button of the **Element Properties** dialog box.

The following **Standard Composition** dialog box illustrates the completed five element silicate standard, Albite.

Standard Composition

Sample Number, Name and Description

81 Albite (Amelia)

Insert <cr> >> Natural specimen from Amelia, VA
Source: Ed Olsen, Univ of Chicago

OK

Cancel

Click Element Row to Edit Element Composition and/or Cations (click empty row to add)

Channel	Element	X-Ray	Cations	Oxygens	Elemental	Oxide	Atomic
1	si	ka	1	2	32.117	68.710	23.072
2	al	ka	2	3	10.320	19.500	7.717
3	na	ka	2	1	8.680	11.700	7.617
4	k	ka	2	1	.083	.100	.043
5	o	ka	1	0	48.810	.000	61.550

Enter Composition In

Oxide Percent Oxide Standard

Elemental Percent Elemental Standard

Current Column Totals

Elemental Oxide Atomic

100.010 100.010 100.000

Total Oxygen From Cations 48.810

Update Excess Enter Excess Oxygen .000 Enter Atom Formula Composition

The compositional data of any standard entered into the standard database may be reviewed by simply double-clicking on the standard of interest from the scrollable *Standards* list box. The following window contains two standards with the compositional data of Albite displayed in the log window in oxide form.

The screenshot shows a window titled "Standard For Windows [C:\Program Files\Probe for Windows\standard.mdb]". The menu bar includes File, Edit, Standard, Options, Xray, Analytical, Output, and Help. A list box on the left shows "81 Albite (Amelia)" and "529 Copper Metal". The main area displays details for "St 81 Albite (Amelia)", including "TakeOff = 40 KiloVolts = 15", "Natural specimen from Amelia, VA", and "Source: Ed Olsen, Univ of Chicago". A summary table is shown below the details:

100.010	Total	48.810	Total Oxygen
48.810	Calculated Oxygen	.000	Excess Oxygen
20.178	Atomic Weight	10.712	Z - Bar

The log window at the bottom displays the following text:

```

St 81 Albite (Amelia)
TakeOff = 40 KiloVolts = 15
Natural specimen from Amelia, VA
Source: Ed Olsen, Univ of Chicago
Oxide and Elemental Composition

Elemental Wt. % Total: 100.010    Average Total Oxygen: 48.810
Average Calcu. Oxygen: 48.810    Average Excess Oxygen: .000
Average Atomic Weight: 20.178    Average Atomic Number: 10.712

ELEM:   SiO2   Al2O3   Na2O   K2O    O
XRAY:   ka     ka     ka     ka     ka
OXWT:   68.710  19.500  11.700  .100   .000
ELWT:   32.117  10.320  8.680   .083  48.810
KFAC:   .2532   .0790   .0499   .0007  .2550
ZCOR:   1.2685  1.3059  1.7377  1.1563  1.9142
ATWT:   23.072  7.717   7.617   .043   61.550
  
```

To modify a particular standard, select the standard in the *Standards* list box. Click **Standard** from the menu bar and select **Modify** from the menu. Edit the appropriate fields in the **Standard Composition** window as described previously.

After entering all of the standard compositions in your standard collection, save this important file (STANDARD.MDB) to another directory on the hard disk and likewise to a floppy for archival purposes.

Note: the takeoff, kilovolt, x-ray and cation ratio parameters displayed here are used only for nominal calculations of the k-factors and ZAF corrections within the program STANDARD. The PROBE FOR WINDOWS quantitative analysis will calculate the quantitative standard k-factors based on the actual conditions.

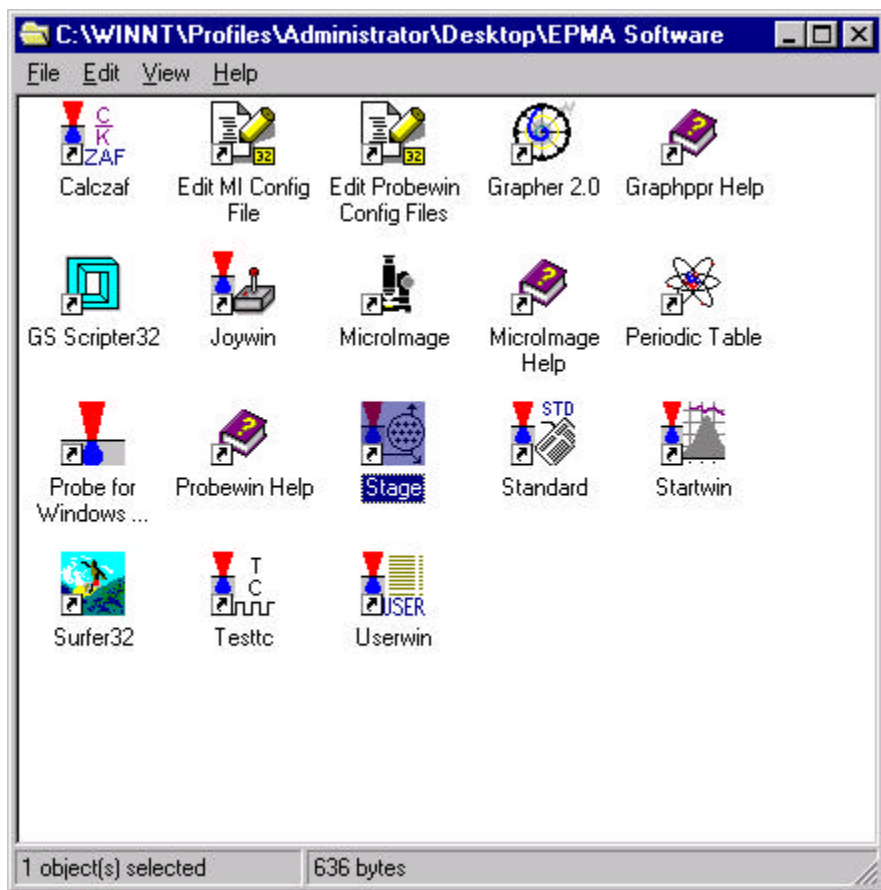
Creating Standard Position Files

Program STAGE.EXE is used to digitize your standard mounts to create pre-digitized standard coordinate files. These files are necessary for automated acquisition and standardization. The standard coordinates are digitized in three dimensions (X, Y, and Z) as well as the W stage position (multi-position specimen stages only) and are typically referenced to three physical fiducial marks on the standard mount surface. These coordinate files should be digitized with the standard mount located in the position where it is typically found.

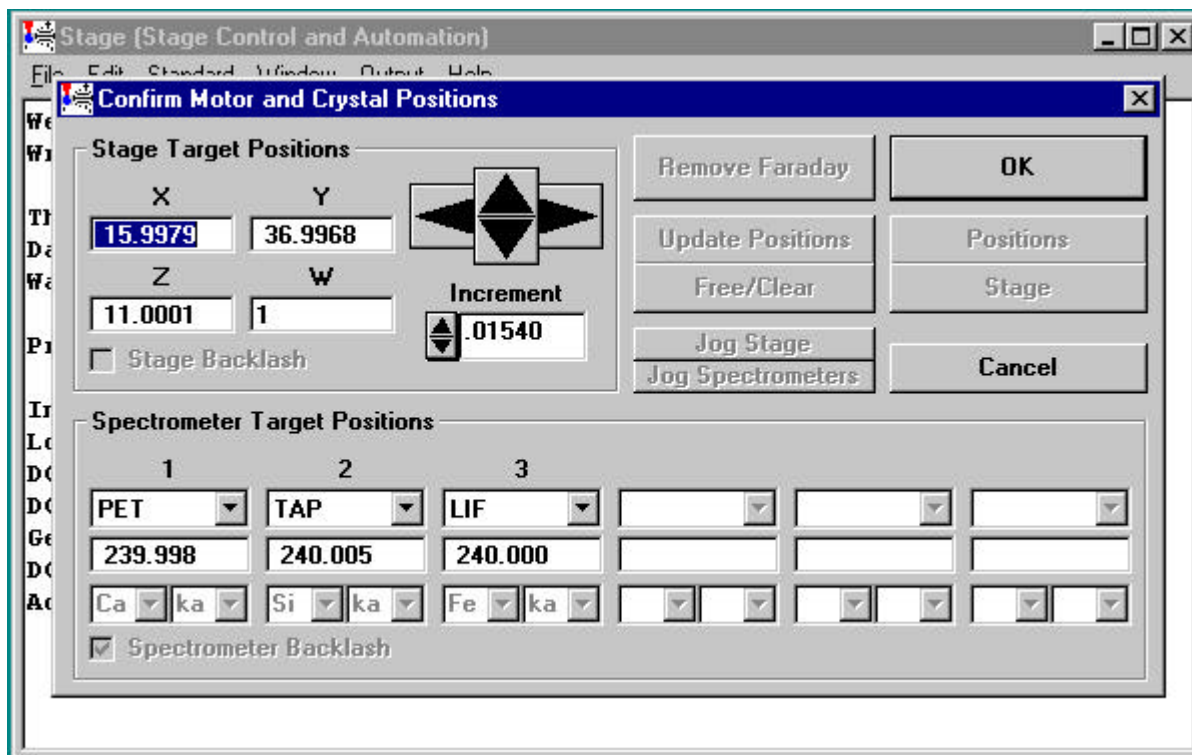
The following procedure illustrates how to create a new standard position file. In this example, four carbonate standards will be digitized. These standards must already be entered into the standard database using program STANDARD.

When creating digitized standard files for standard mounts containing more than 42 standards, a slightly different procedure than outlined below must be followed. Concise instructions on how to bypass the current 42 standard limit in the STAGE digitize feature are outlined in the reference documentation. To find these instructions, open the PROBEWIN.HLP program from the EPMA Software folder. Click the **Search** button and type in digitize in the text box. Highlight the topic entitled *Digitizing Standard Mounts with More Than 42 Standards* and click the **Display** button.

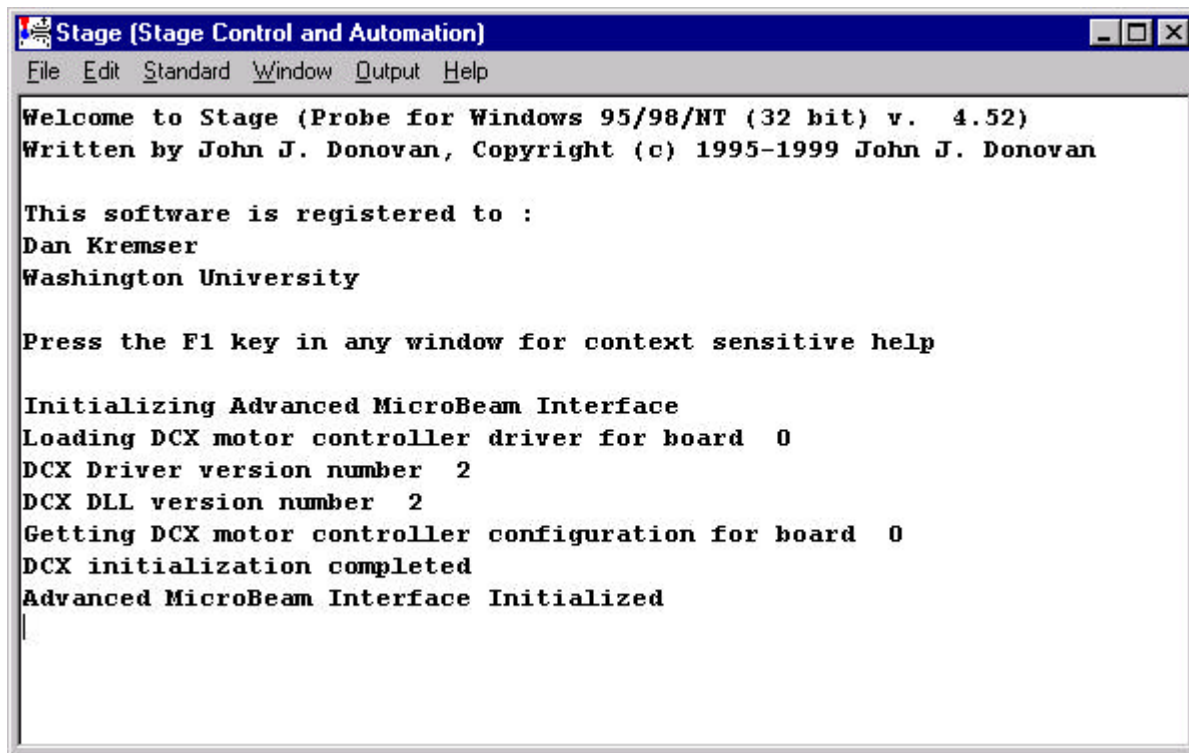
Open STAGE (Stage Control and Automation) by double clicking on the **Stage** icon in the EPMA Software group.



This starts the STAGE program and brings up the **Confirm Motor and Crystal Positions** dialog box. Confirm that all of the motors (stage and spectrometer positions) and crystal designations are correctly calibrated. If there is disagreement between the mechanical positions (actual) and the software values, adjust the software values. Use the <tab> key to move between the *Target Positions* text boxes. Click the **OK** button to close the **Confirm Motor and Crystal Positions** dialog box when done.



The following display illustrates the STAGE log window.



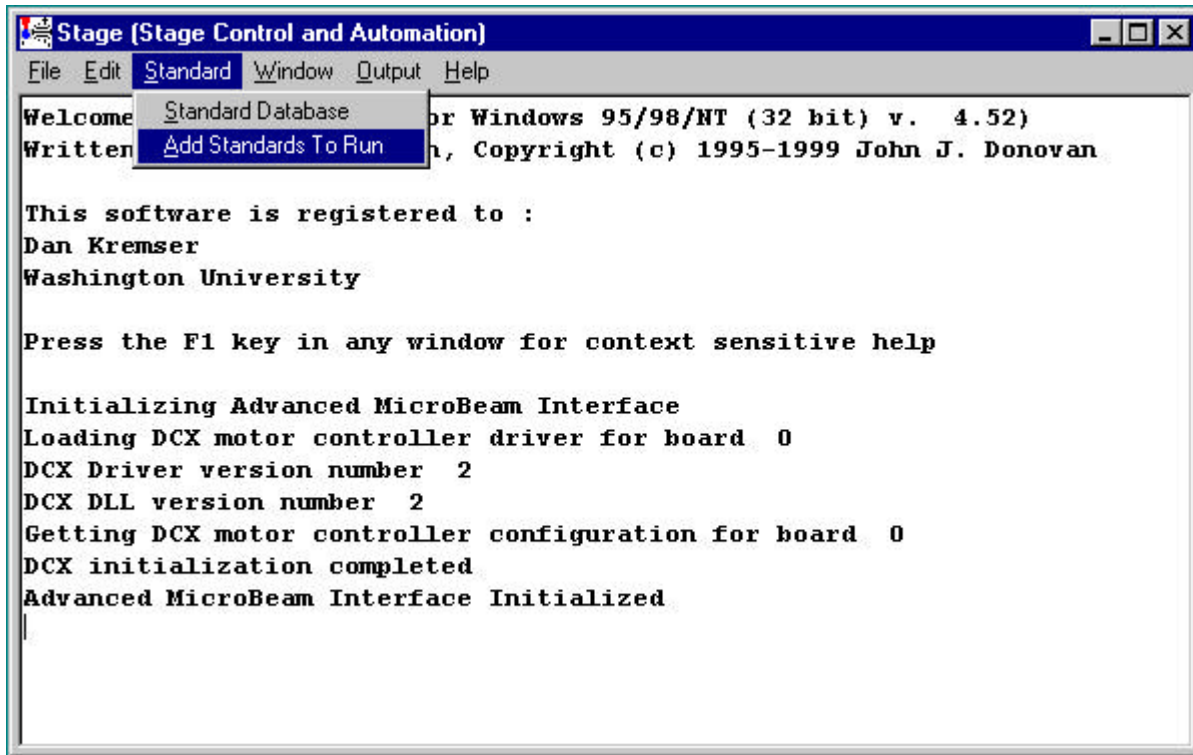
```
Stage (Stage Control and Automation)
File Edit Standard Window Output Help
Welcome to Stage (Probe for Windows 95/98/NT (32 bit) v. 4.52)
Written by John J. Donovan, Copyright (c) 1995-1999 John J. Donovan

This software is registered to :
Dan Kremser
Washington University

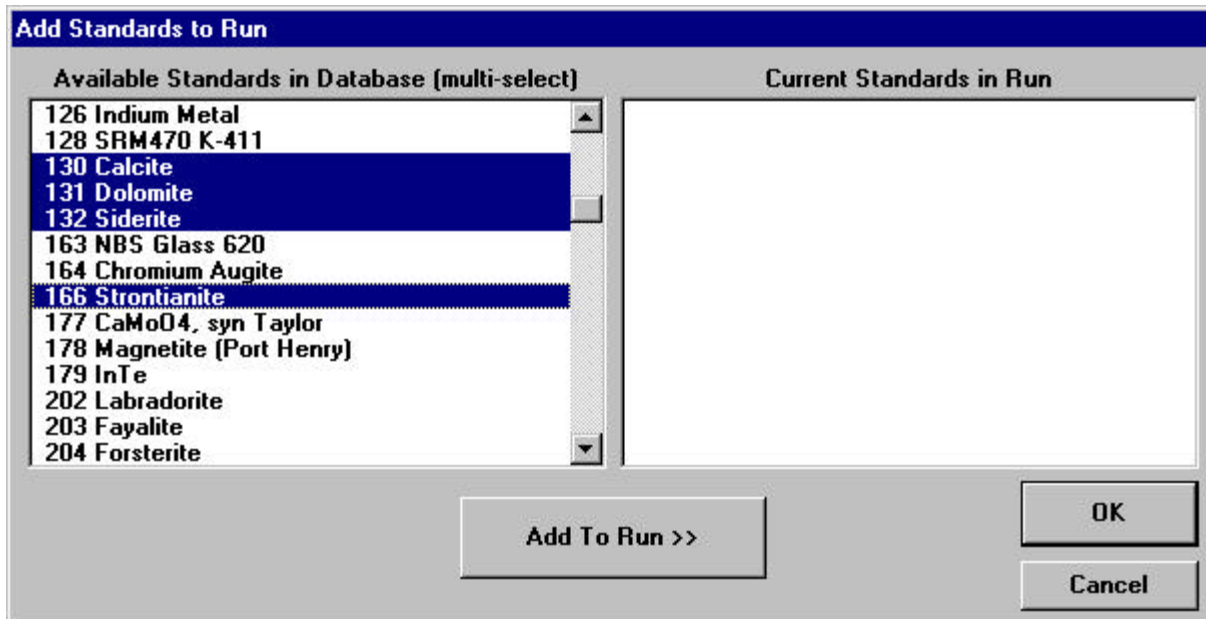
Press the F1 key in any window for context sensitive help

Initializing Advanced MicroBeam Interface
Loading DCX motor controller driver for board 0
DCX Driver version number 2
DCX DLL version number 2
Getting DCX motor controller configuration for board 0
DCX initialization completed
Advanced MicroBeam Interface Initialized
```

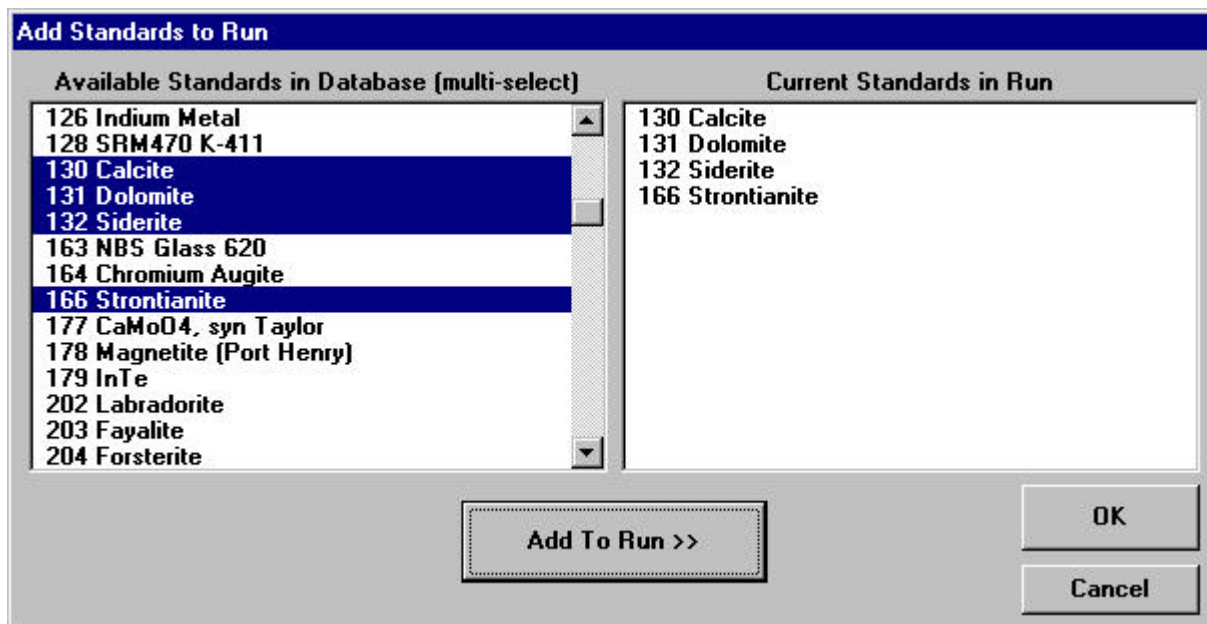
Select **Standard** from the menu bar and click on **Add Standards to Run** from the menu choices.



This action opens the **Add Standards to Run** dialog box. Click on the name of each of the standards in the standard block to be digitized from the *Available Standards in Database* list box.

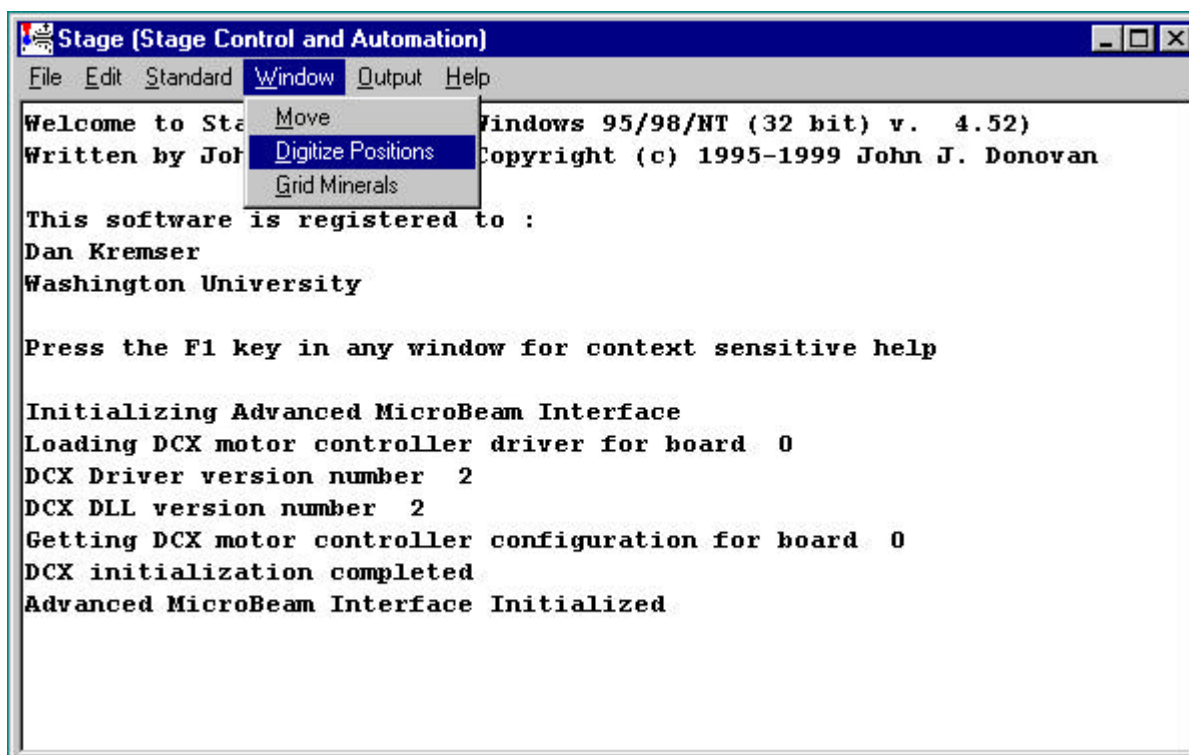


Click the **Add to Run >>** button to add these standards to be digitized. Standards may be added one at a time or one may multi-select standards by holding down the <Ctrl> button on the keyboard as standards are selected.

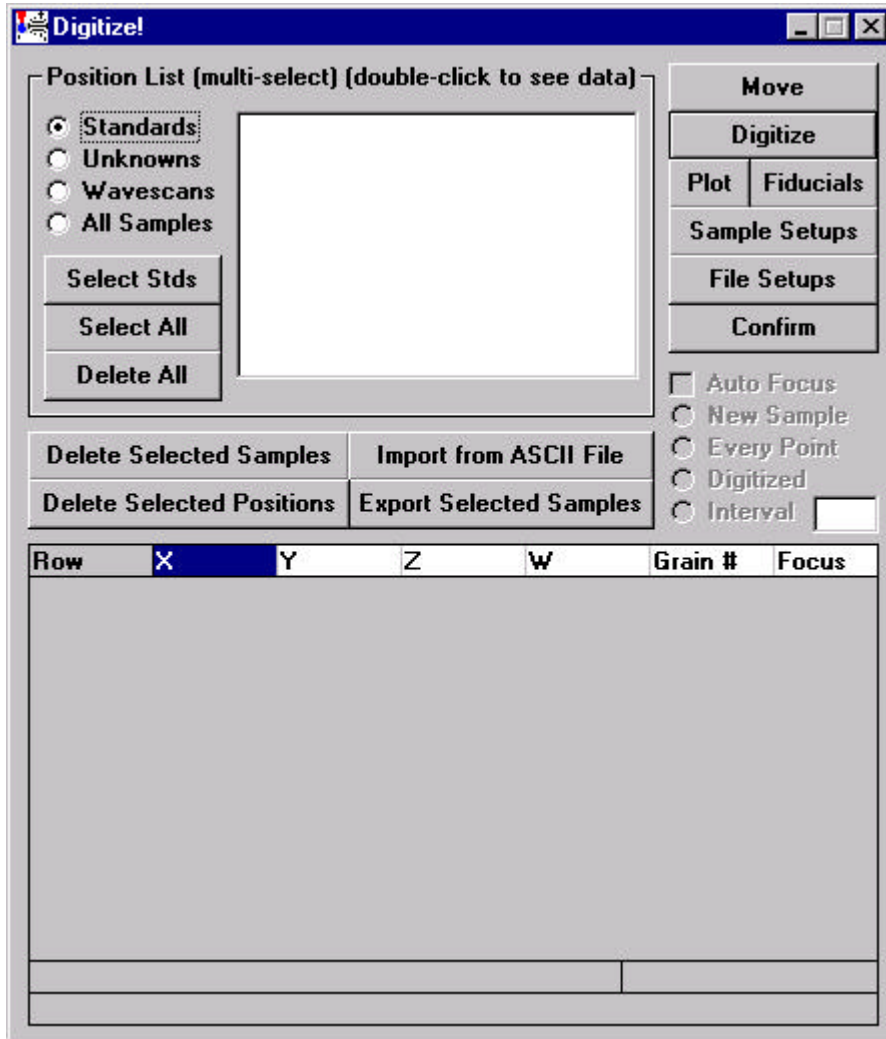


Click the **OK** button of the **Add Standards to Run** dialog box when finished.

Select **Window** from the menu bar and choose **Digitize Positions** from the menu choices.

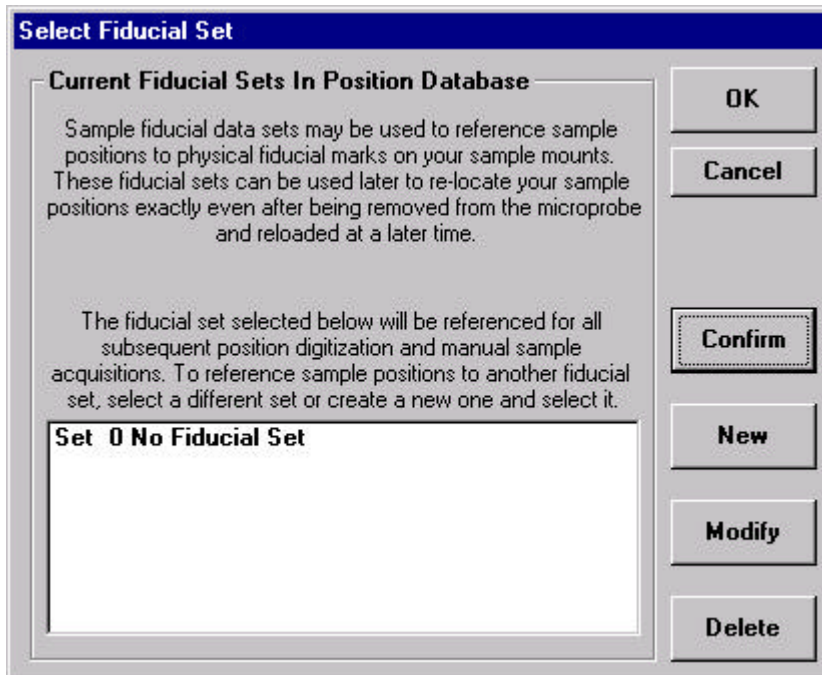


This action opens the **Digitize!** dialog box.

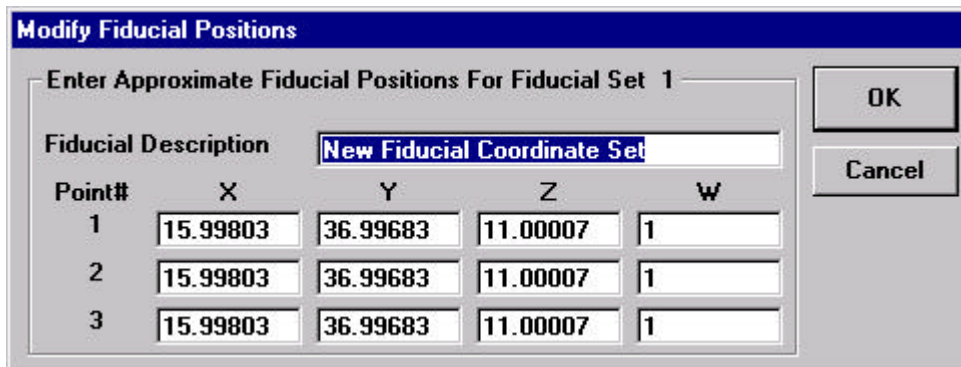


Click the **Fiducials** button.

This opens the **Select Fiducial Set** window.



Click the **New** button. This opens the **Modify Fiducial Positions** window. The current stage coordinates are loaded by default.



Type in a *Fiducial Description*. Enter the nominal coordinates or move to each of the three fiducial marks on the standard mount, determining their approximate coordinates, and enter those values into the appropriate fields. On JEOL 733 microprobes, the W stage position needs to be recorded as well. The following window results.

Point#	X	Y	Z	W
1	9.5	36.0	10.9	4
2	22.5	36.1	10.9	4
3	15.8	49.1	10.9	4

Click the **OK** button when done. This creates a new entry in the **Select Fiducial Set** list box as shown below.

Sample fiducial data sets may be used to reference sample positions to physical fiducial marks on your sample mounts. These fiducial sets can be used later to re-locate your sample positions exactly even after being removed from the microprobe and reloaded at a later time.

The fiducial set selected below will be referenced for all subsequent position digitization and manual sample acquisitions. To reference sample positions to another fiducial set, select a different set or create a new one and select it.

Set 0 No Fiducial Set
Set 1 Carbonate Standard Block

Select (highlight) the new fiducial set and click the **Confirm** button to initiate a precise centering of the three fiducial marks.

The **Modify Fiducial Positions** window opens displaying the originally entered fiducial coordinates. Click the **OK** button to confirm.

Point#	X	Y	Z	W
1	9.5	36	10.9	4
2	22.5	36.1	10.9	4
3	15.8	49.1	10.9	4

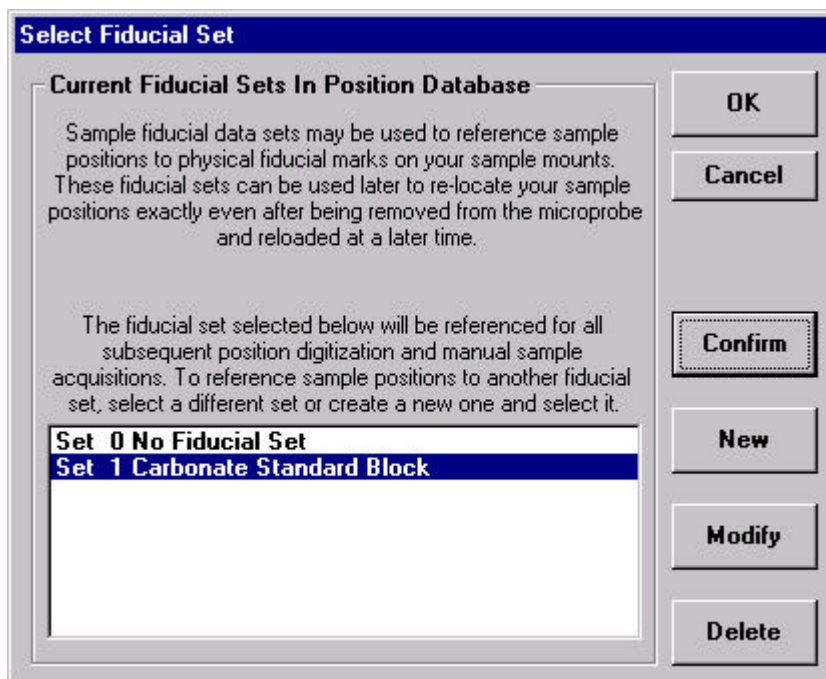
The computer then drives to each fiducial mark and displays the **FiducialVerifyFiducial** window. Adjust the stage position to center the fiducial mark and click the **OK** button.

Please adjust the stage position for fiducial # 1 to the exact center of the alignment mark. Click OK or <enter> when ready or click Cancel or <esc> to quit.

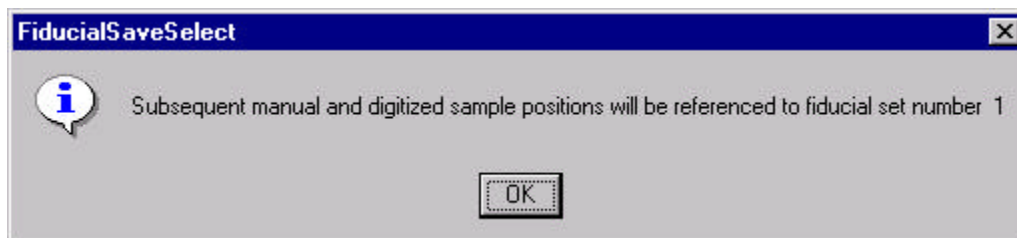
After centering the third fiducial mark and clicking the **OK** button, the **FiducialVerifyFiducials** window opens to display the specimen tilt in radians and degrees. A warning will be given if the sample is tilted at more than 0.5 degrees. Click this **OK** button.

Specimen tilt in radians:
 ThetaX = 3.33795E-04 ThetaY = -2.405603E-03 Theta = 2.428651E-03
 Specimen tilt in degrees:
 ThetaX = 1.912504E-02 ThetaY = -.1378309 Theta = .1391514

Closing the **FiducialVerifyFiducials** window returns to the **Select Fiducial Set** dialog box.

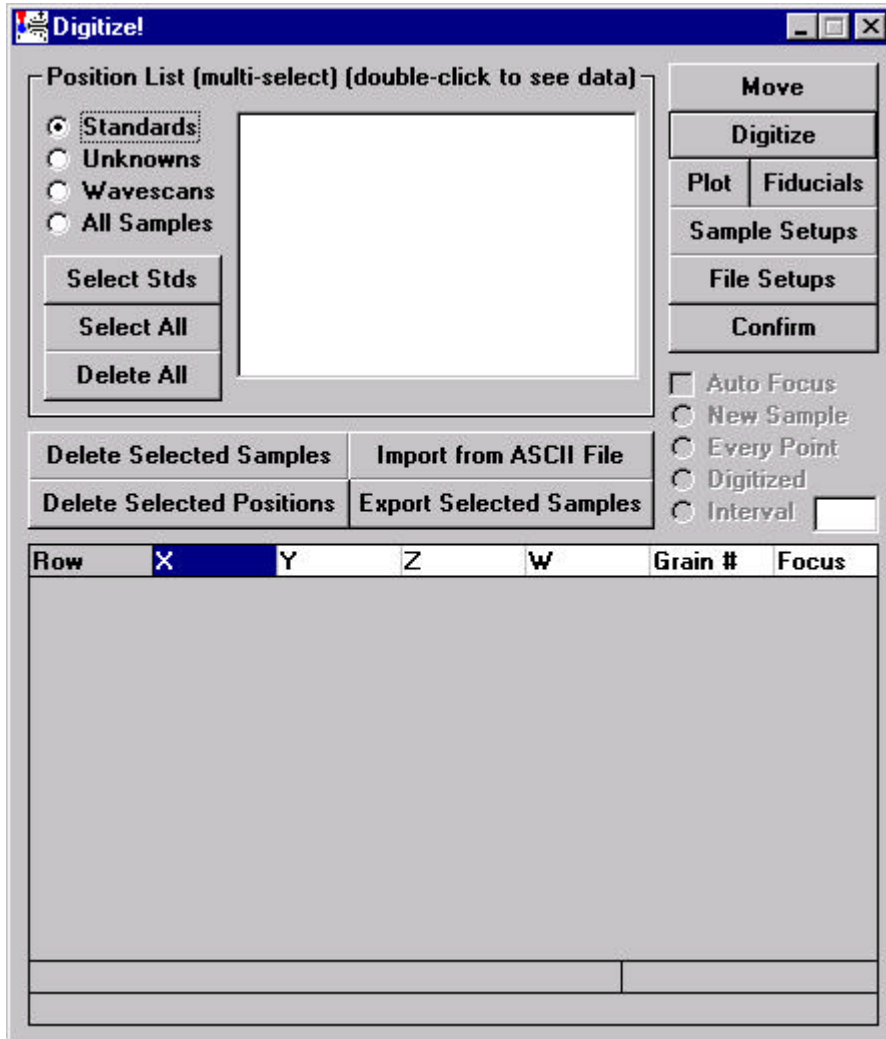


Finally, click the **OK** button on the **Select Fiducial Set** dialog box. This opens the **FiducialSaveSelect** window to confirm the currently selected fiducial set.



Click the **OK** button of the **FiducialSaveSelect** window.

The fiducial coordinate positions are recorded to disk and the **Digitize!** dialog box returns.



The position of each of the standards in this standard mount must now be digitized. Move to the first standard; either by turning the motor controls manually or using the joystick via the JOYWIN (Joystick Control for Stage and Spectrometers) program or use the **Move** button in the **Digitize!** window. Clicking the **Move** button opens the **Move Motors and Change Crystals** dialog box.

Type in the appropriate target coordinates in the *Stage Target Positions* boxes for the first standard. Use the <tab> key to move between entries.

Move Motors and Change Crystals

Stage Target Positions

X: 8.5 Y: 40.9

Z: 10.7 W: 4

Increment: .01540

Stage Backlash

Spectrometer Target Positions

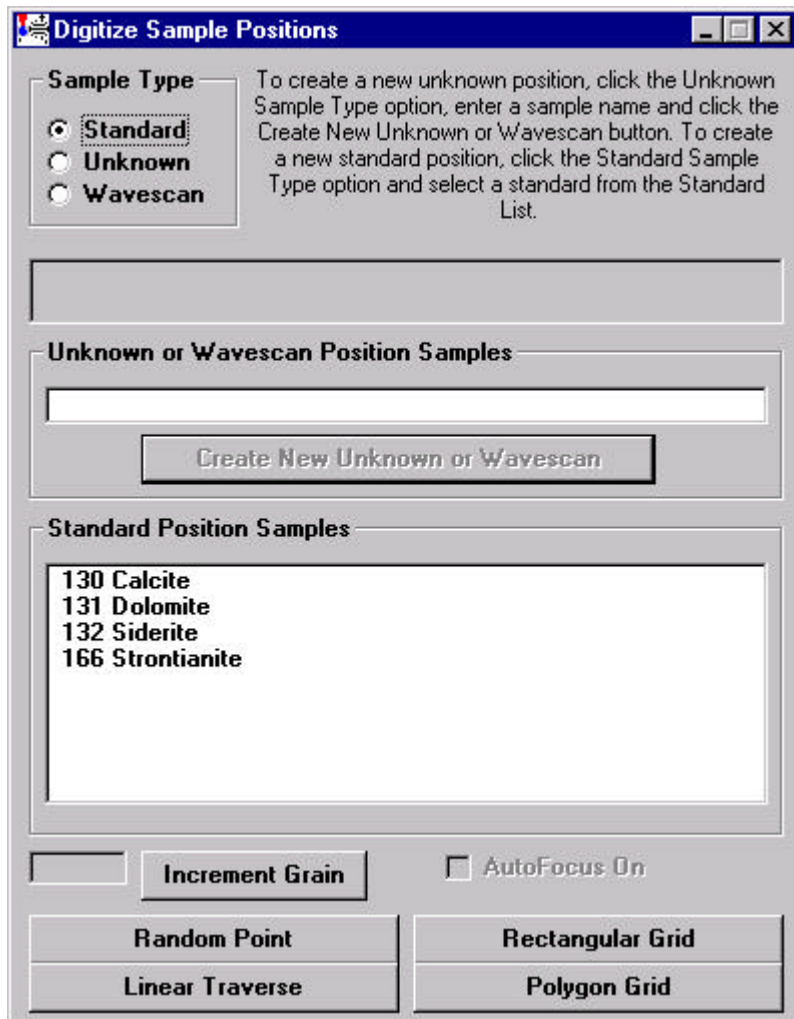
1	2	3			
PET	TAP	LIF			
239.998	240.005	240.000			
Ca ka	Si ka	Fe ka			

Spectrometer Backlash

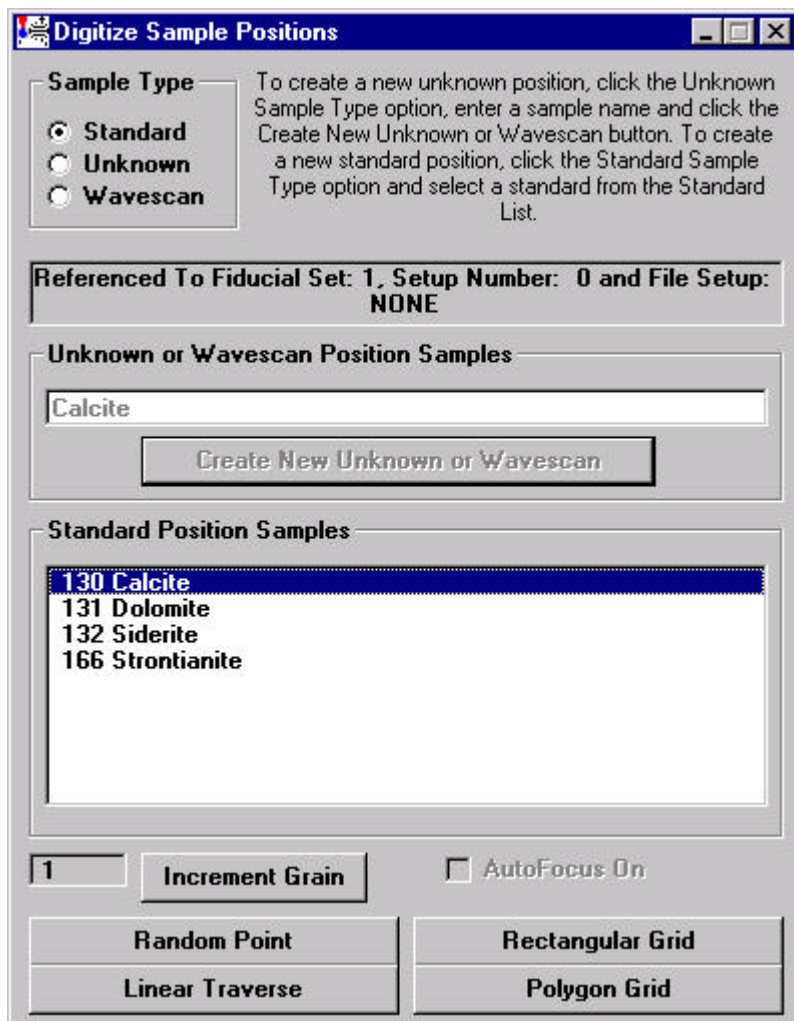
Buttons: Remove Faraday, Go, Update Positions, Positions, Free/Clear, Stage, Jog Stage, Jog Spectrometers, Close

Click **Go** or press <Enter> on the keyboard, this will drive the stage to the target positions. Check the position and optical focus.

Click the **Digitize** button of the **Digitize!** dialog box. This activates the **Digitize Sample Positions** dialog box. The *Standard Position Samples* list box contains the standards already added to the run.

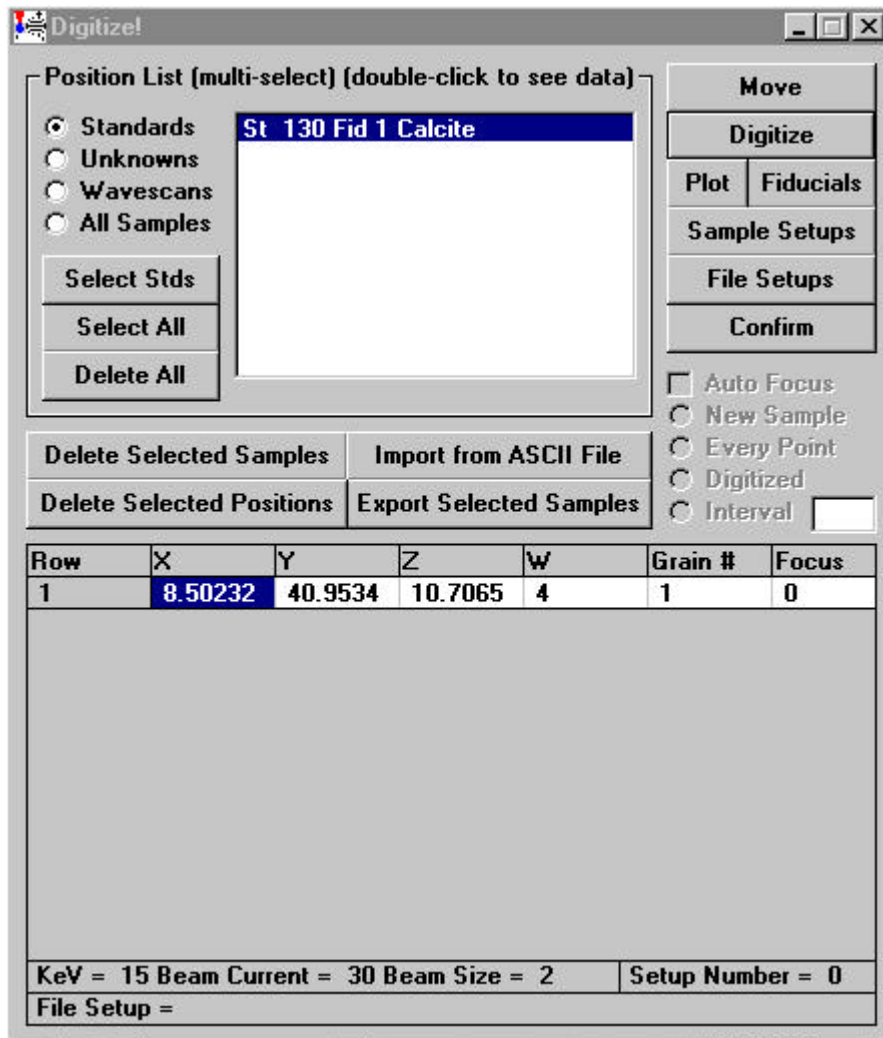


Select (highlight) the first standard to digitize from the *Standard Position Samples* list box. The standard will be added automatically to the **Digitize!** *Position List*.



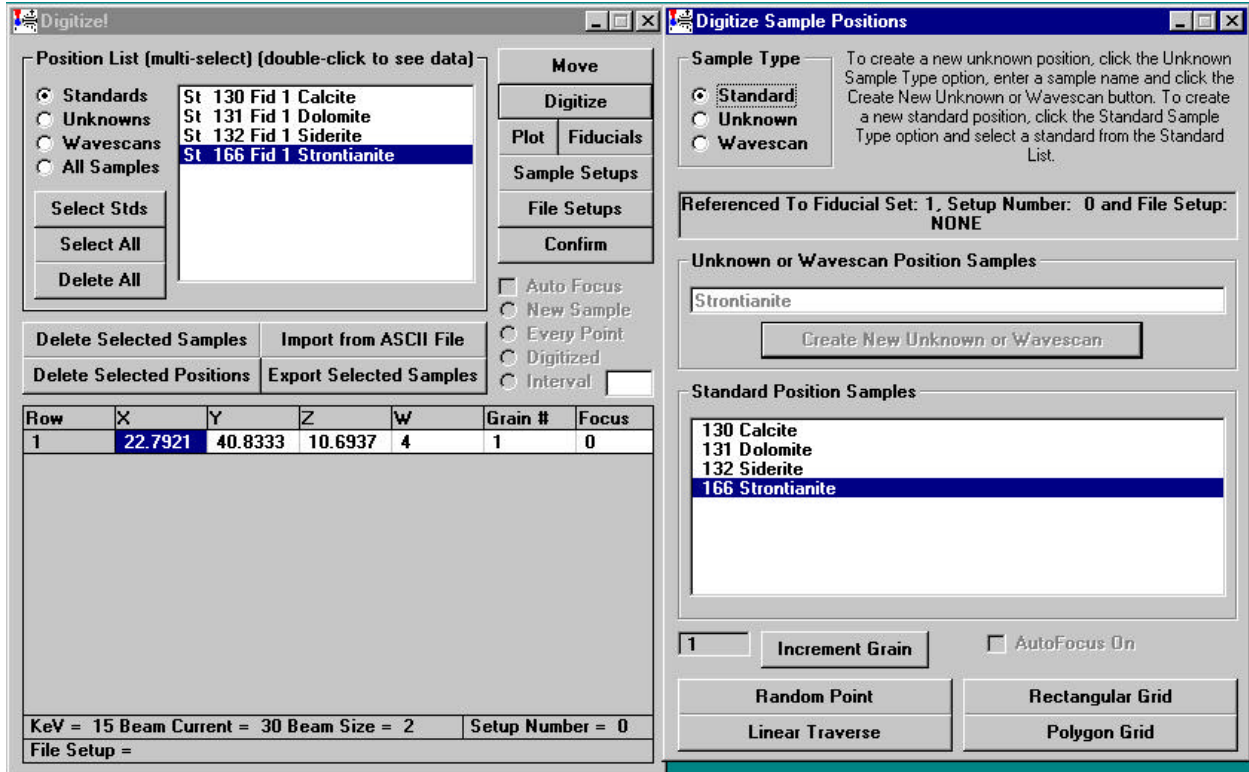
To digitize a random point on this standard, click the **Random Point** button of the **Digitize Sample Positions** dialog box to record the current coordinates (X, Y, Z, and W) for this grain.

The coordinates of this standard in the **Digitize!** dialog box, are seen below.



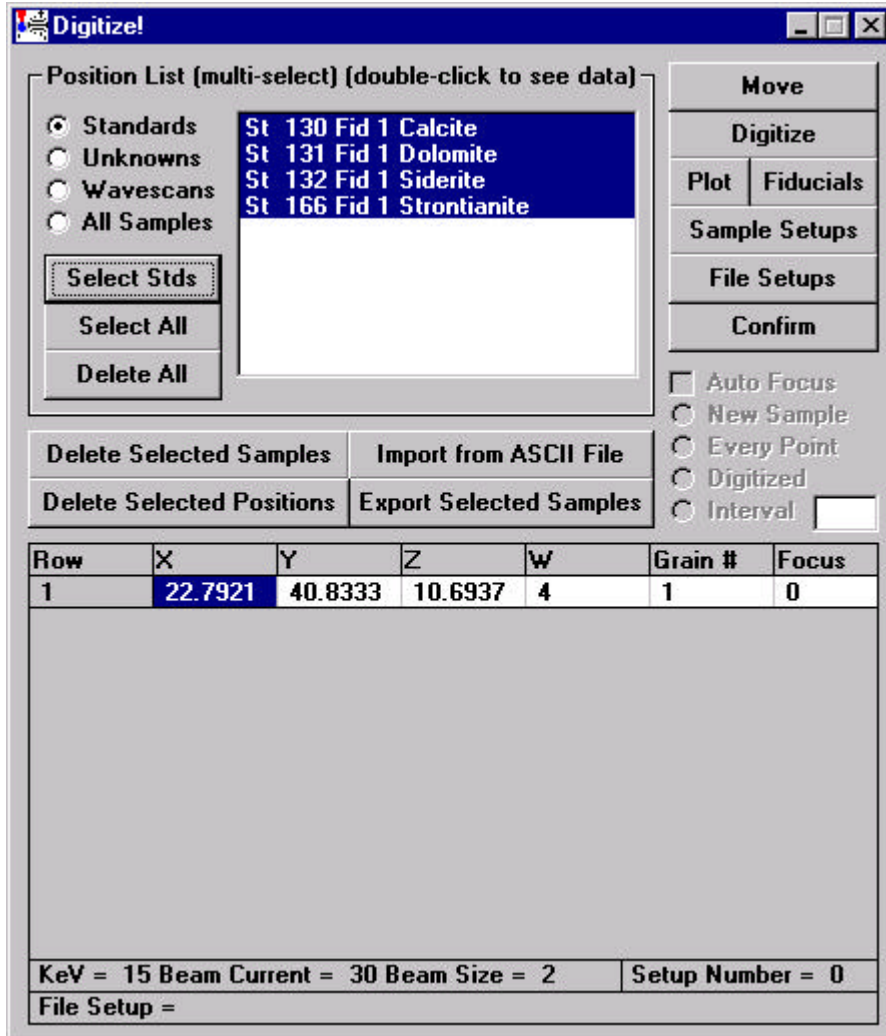
Note, that although only one position per standard need be digitized, if additional points are digitized, PROBE FOR WINDOWS will automatically utilize them. Otherwise, PROBE FOR WINDOWS will simply increment the stage X position for each additional acquisition required.

Move to the next standard, select the standard from the list box in the **Digitize Sample Position** window and click the **Random Point** button again. The standard position will be digitized. Continue until all of the remaining standards in the standard block are digitized. In this example the **Digitize!** and **Digitize Sample Positions** dialog boxes would appear as follows.



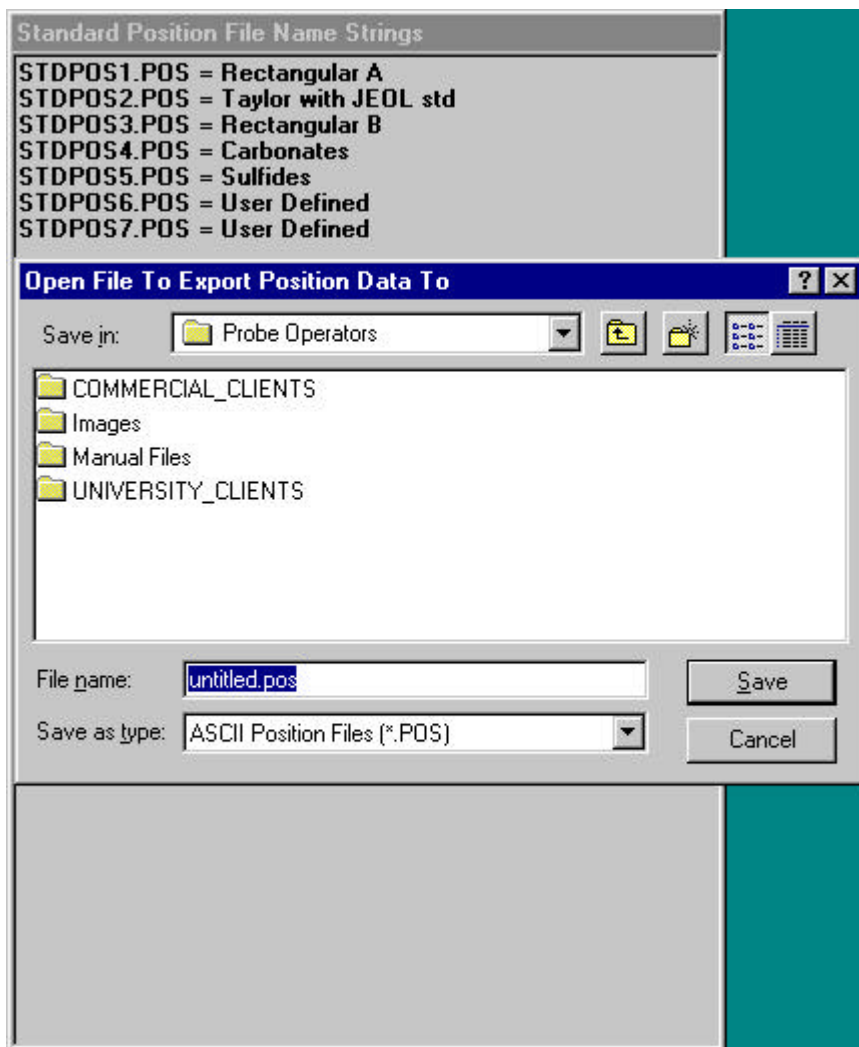
Close the **Digitize Sample Positions** dialog box by clicking the **Close** button in the upper right corner.

Finally, store the new pre-digitized standard coordinates to disk as an ASCII position file (.POS). Select all of the standards using the **Select Stds** button of the **Digitize!** dialog box.



Click the **Export Selected Samples** button.

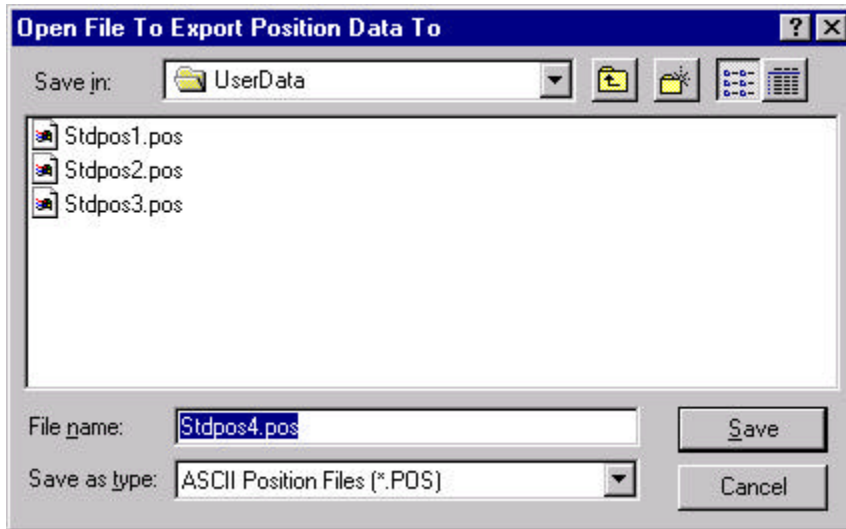
This action opens both the **Standard Position File Name Strings** and the **Open File To Export Position Data To** windows. The **Standard Position File Name Strings** listing is from the PROBEWIN.INI file. In this example the Carbonate Standard Block is designated as STDPOS4.POS.



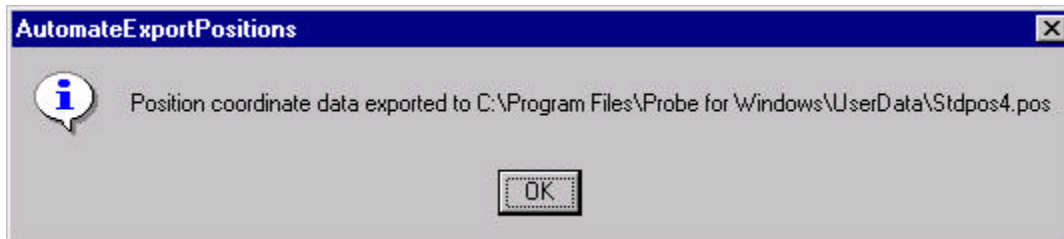
The default directory (set by Advanced MicroBeam Inc.) for the *Save in:* location is C:\Program Files\Probe for Windows\UserData. This is the normal location for *.POS files. The default *Save in:* location is specified by the UserDataDirectory keyword in the PROBEWIN.INI file.

At Washington University the default directory path was changed for convenience. For the export of position data files, edit the path to C:\Program Files\Probe for Windows\UserData.

Type in the appropriate *File name*: as designated in the **Standard Position File Name Strings** (from the PROBEWIN.INI file). Click the **Save** button of the **Open File To Export Position Data To** window.

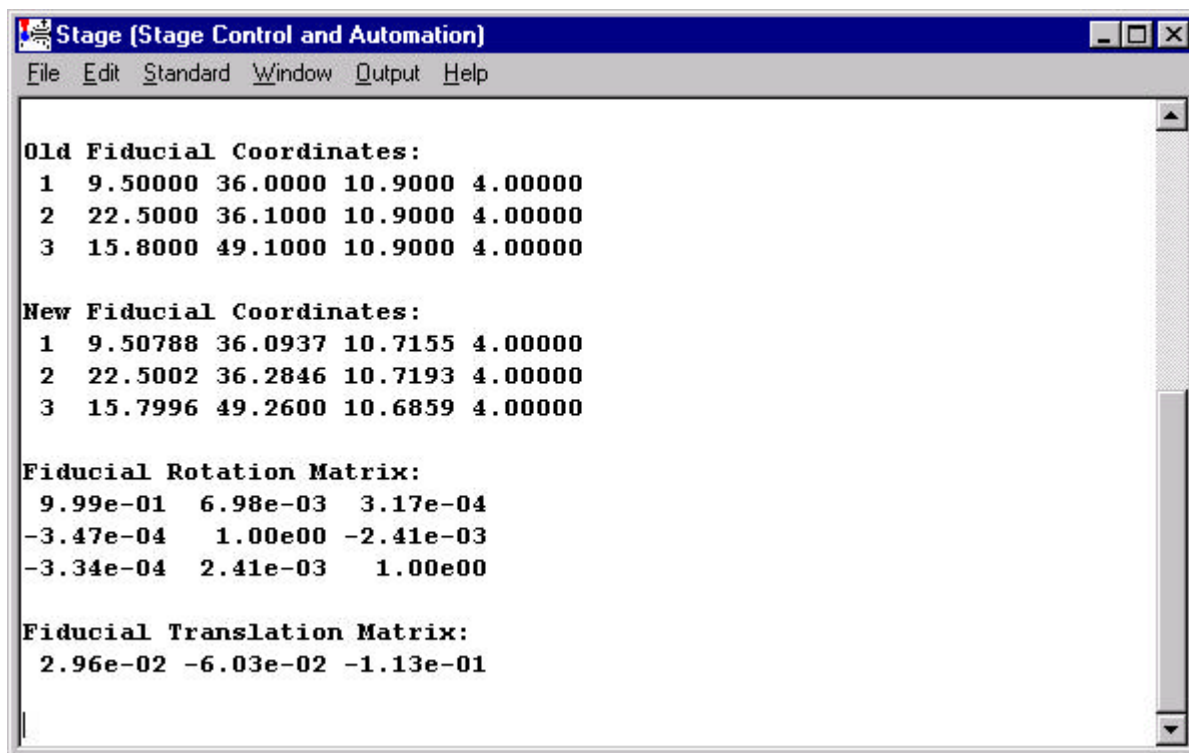


After the positions are written to disk, click the **OK** button to confirm the exported position coordinate data to disk in the **AutomateExportPositions** window.



Close the **Digitize!** dialog box by clicking the **Close** button.

Close STAGE by clicking the **File | Exit** menu.



After digitizing all of the standards on the standard mounts and creating various STDPOSx.POS files, save these files to another directory and to a backup floppy.

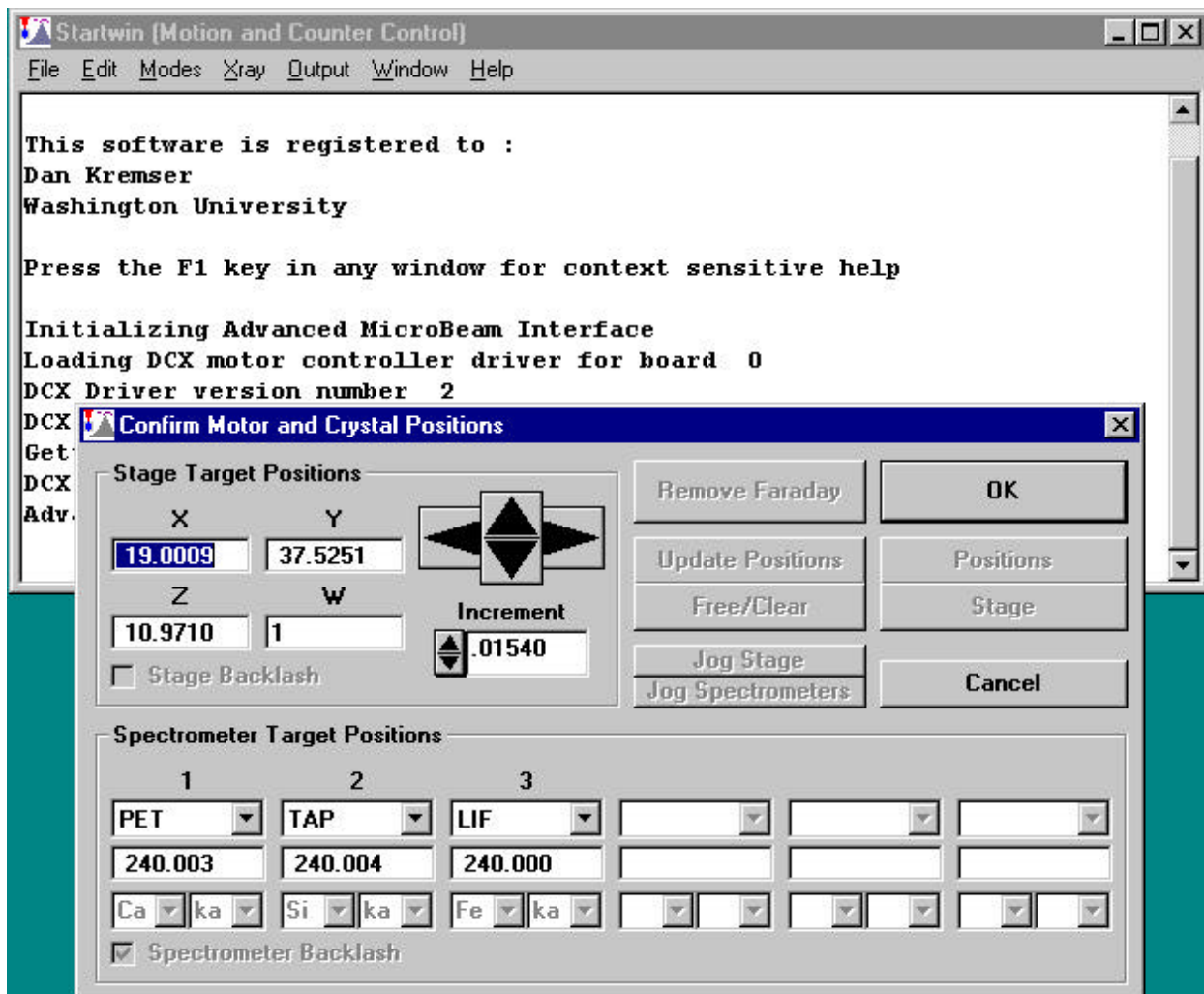
Beam and Detector Stability

Testing beam (drift) stability is an important step prior to acquiring any quantitative data. The following step-by-step procedure illustrates how to monitor and plot beam current with time.

From the Desktop, double click on the yellow EPMA Software folder. Then, double click on the **Startwin** icon in the EPMA Software group.

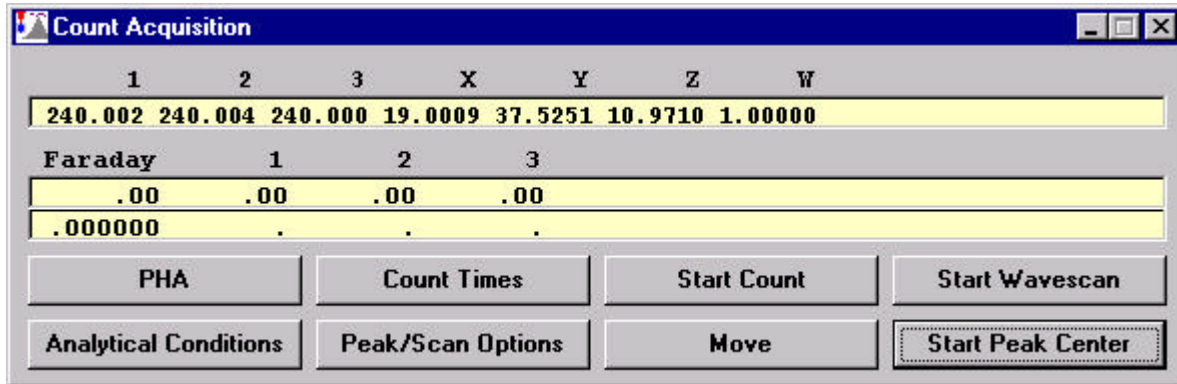


This action launches the STARTWIN (Motion and Counter Control) program and brings up the **Confirm Motor and Crystal Positions** dialog box. Confirm that all of the motors (stage and spectrometer positions) and crystal designations are correctly calibrated. If there is disagreement between the mechanical positions (actual) and the software values, adjust the software values. Use the <tab> key to move between the various *Target Positions* boxes.

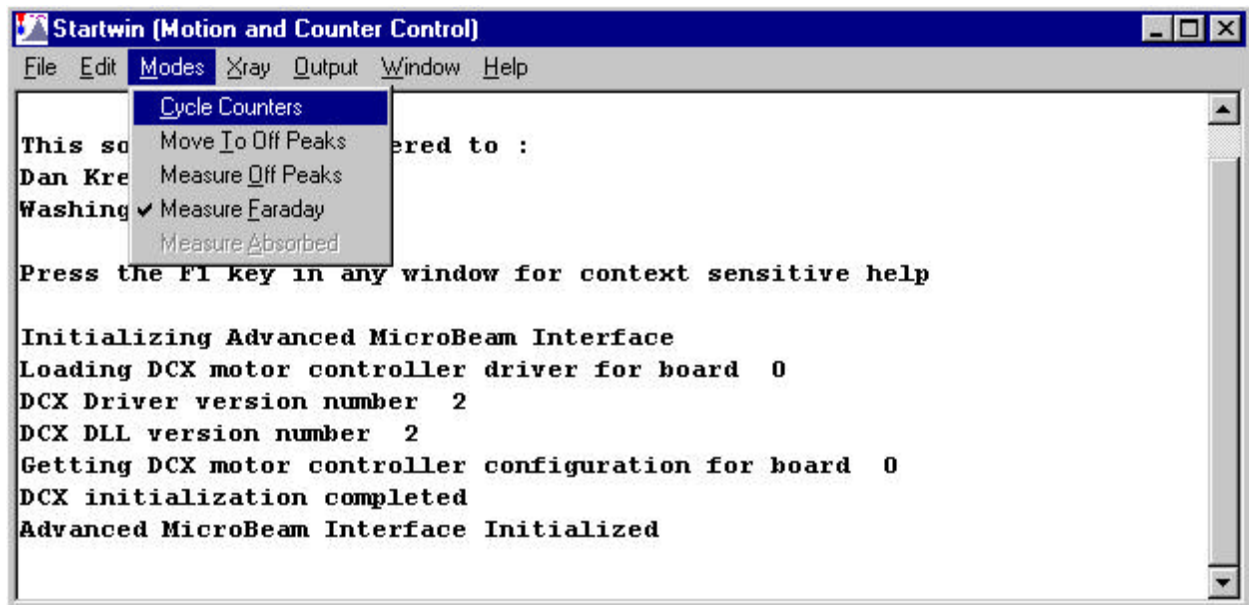


Click the **OK** button to close the **Confirm Motor and Crystal Positions** dialog box when done.

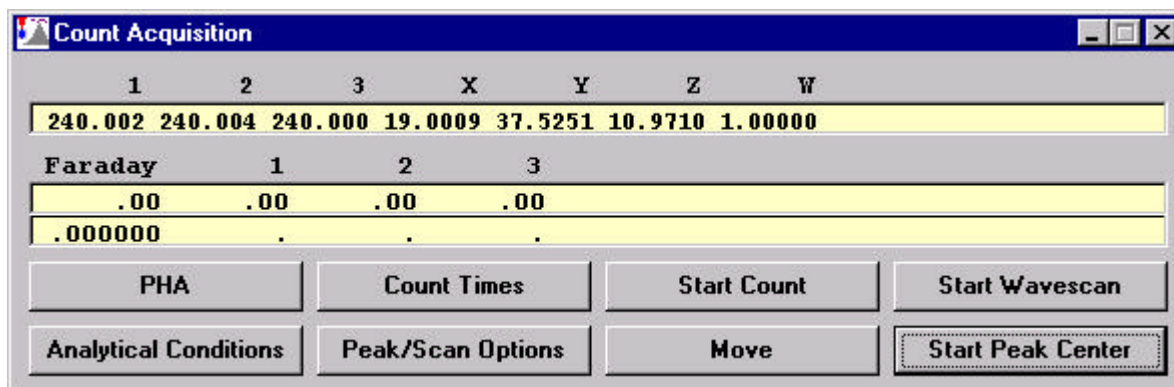
The **Count Acquisition** window opens.



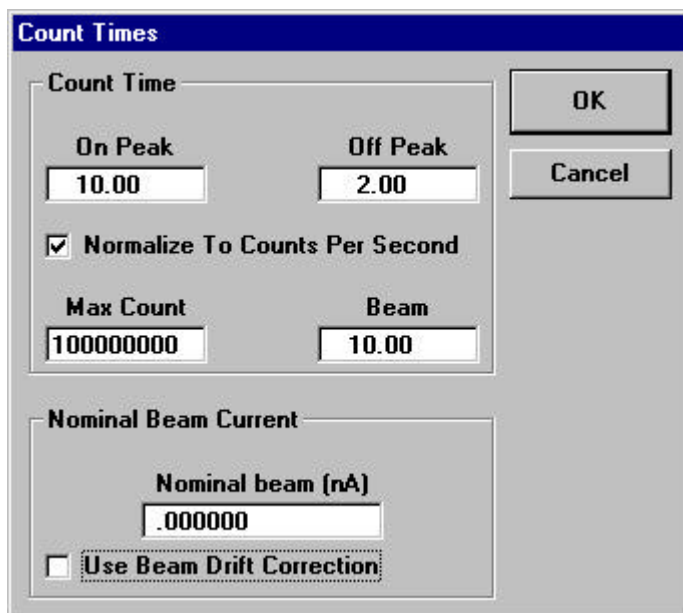
From the STARTWIN log window, select **Modes** from the menu bar and click on **Cycle Counters** from the menu choices. The **Measure Faraday** menu should also be selected.



Next, click the **Count Times** button in the **Count Acquisition** window.

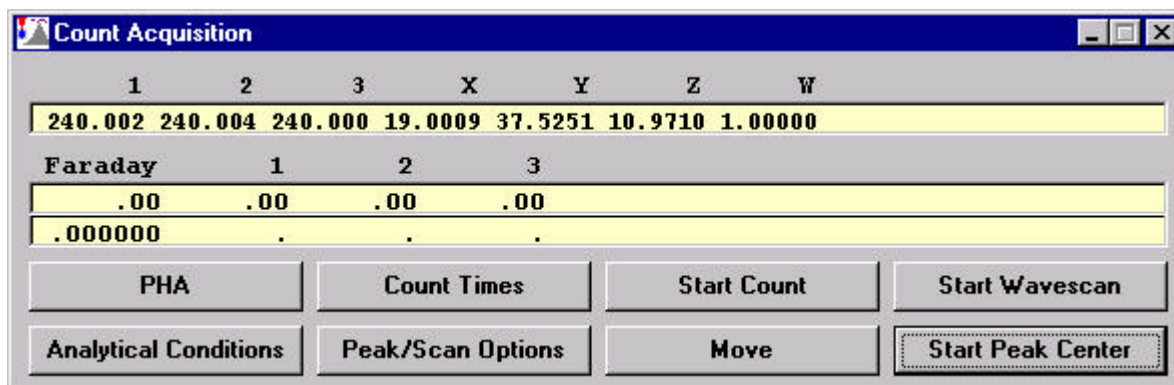


This opens the **Count Times** dialog box. Choose an *On Peak* count time, this will be the interval of time between successive beam measurements. Finally, disable the beam drift correction, confirm that the *Use Beam Drift Correction* box is unchecked.



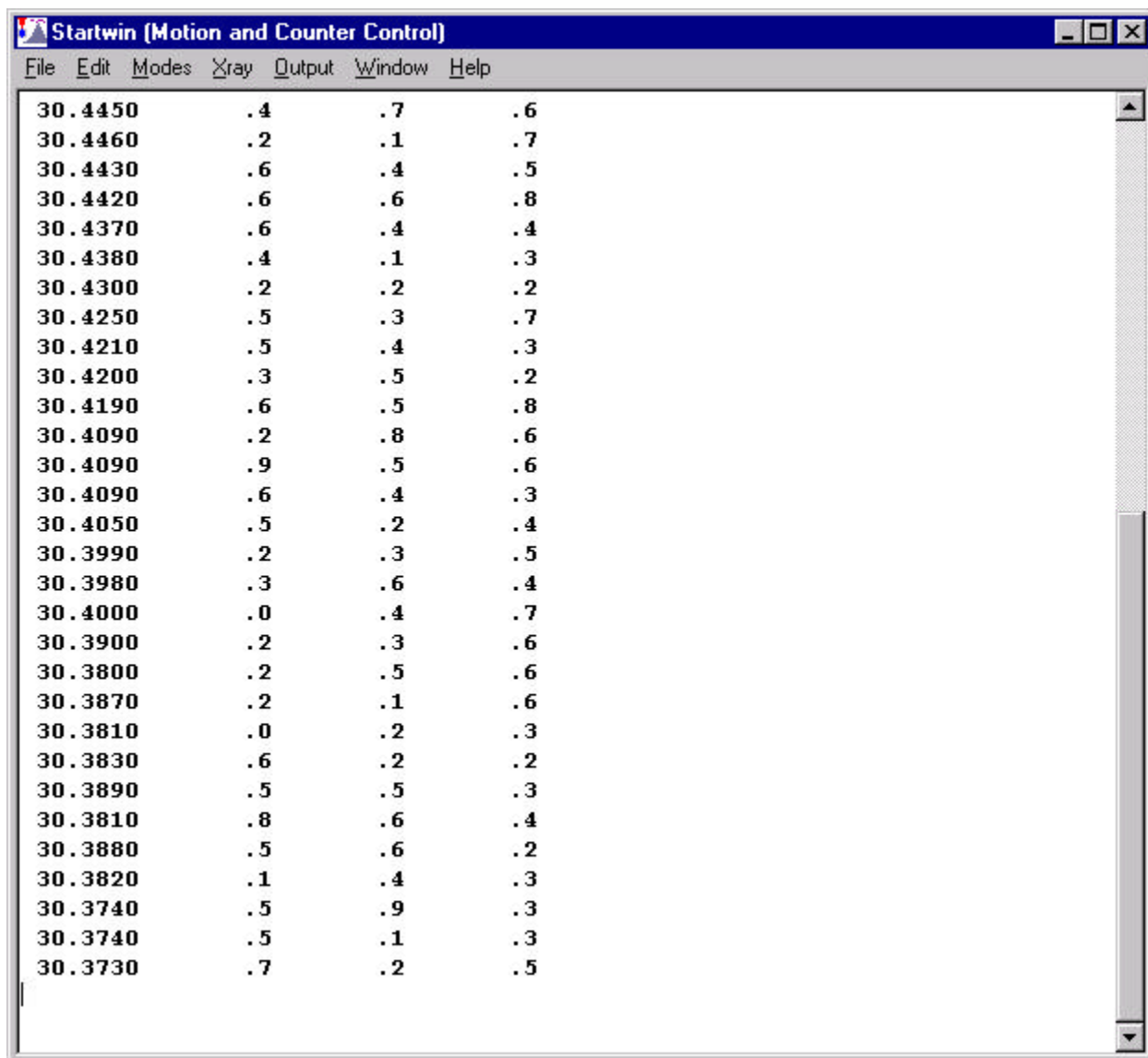
Click the **OK** button returning to the **Count Acquisition** window.

Click the **Start Count** button to initiate a continuous cycle of beam current measurements. In this example, a ten second scalar count will be done followed by a Faraday current measurement. This process repeats until the user cancels the loop.



When the user has acquired a suitable number of beam current measurements, click the **Cancel** button in the **Automation Status** window to stop the acquisition cycle.

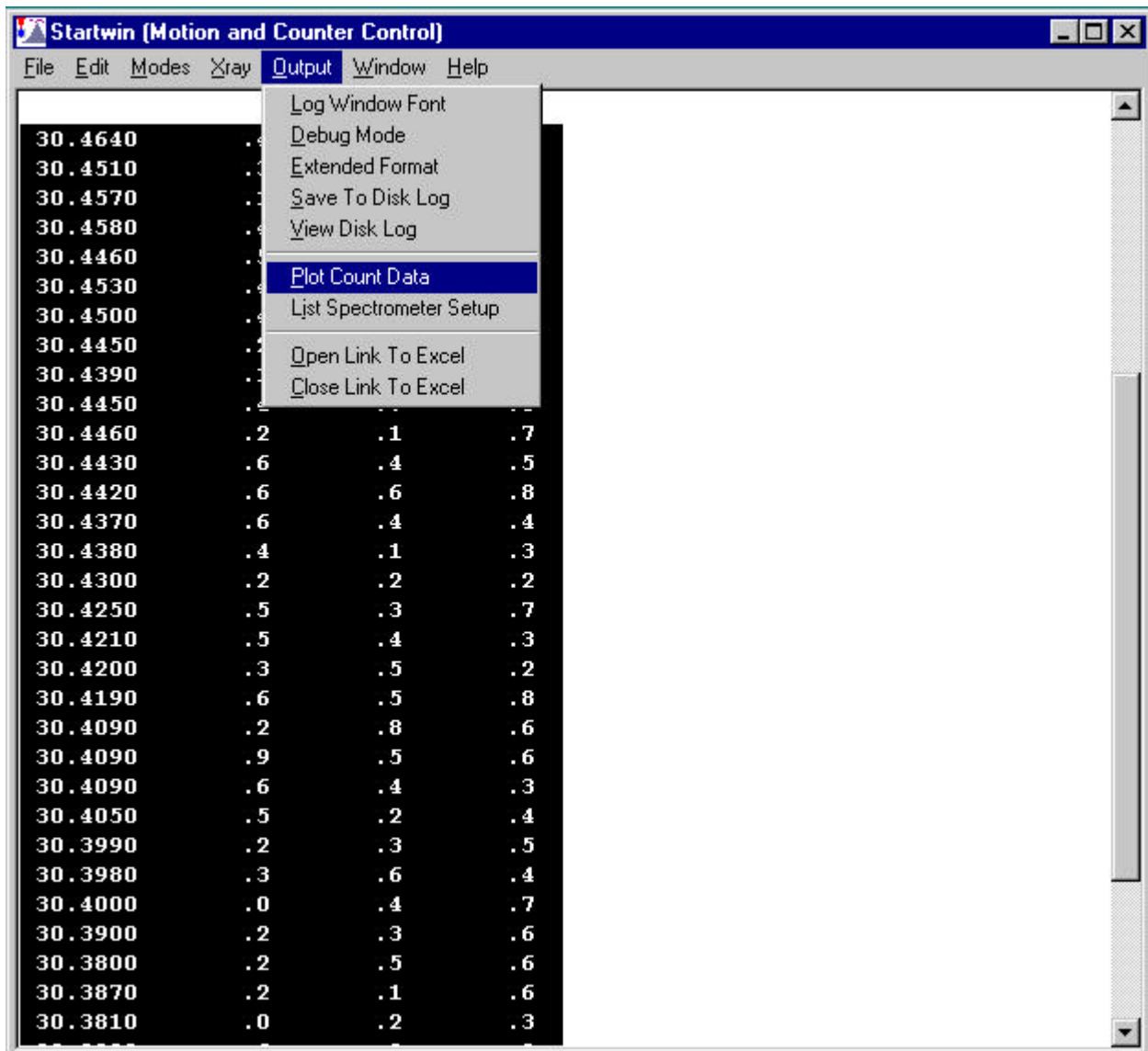
The STARTWIN log window will contain the beam current data acquired so far (in this example, reported in nanoamps). The other three columns represent counts in counts per second acquired by each spectrometer with the beam blanked (essentially detector/electronics noise).



The screenshot shows a window titled "Startwin (Motion and Counter Control)" with a menu bar containing "File", "Edit", "Modes", "Xray", "Output", "Window", and "Help". The main area displays a list of data points with four columns: a time stamp, a beam current value, and two spectrometer count rates.

30.4450	.4	.7	.6
30.4460	.2	.1	.7
30.4430	.6	.4	.5
30.4420	.6	.6	.8
30.4370	.6	.4	.4
30.4380	.4	.1	.3
30.4300	.2	.2	.2
30.4250	.5	.3	.7
30.4210	.5	.4	.3
30.4200	.3	.5	.2
30.4190	.6	.5	.8
30.4090	.2	.8	.6
30.4090	.9	.5	.6
30.4090	.6	.4	.3
30.4050	.5	.2	.4
30.3990	.2	.3	.5
30.3980	.3	.6	.4
30.4000	.0	.4	.7
30.3900	.2	.3	.6
30.3800	.2	.5	.6
30.3870	.2	.1	.6
30.3810	.0	.2	.3
30.3830	.6	.2	.2
30.3890	.5	.5	.3
30.3810	.8	.6	.4
30.3880	.5	.6	.2
30.3820	.1	.4	.3
30.3740	.5	.9	.3
30.3740	.5	.1	.3
30.3730	.7	.2	.5

Evaluating the trend between beam current and time may best be viewed in graphical format rather than in looking at a long series of numbers. Use the mouse to select the data set to graph. Then, select **Output** from the menu bar and click **Plot Count Data** from the drop-down menu choices.



This opens the **Display Data** window.

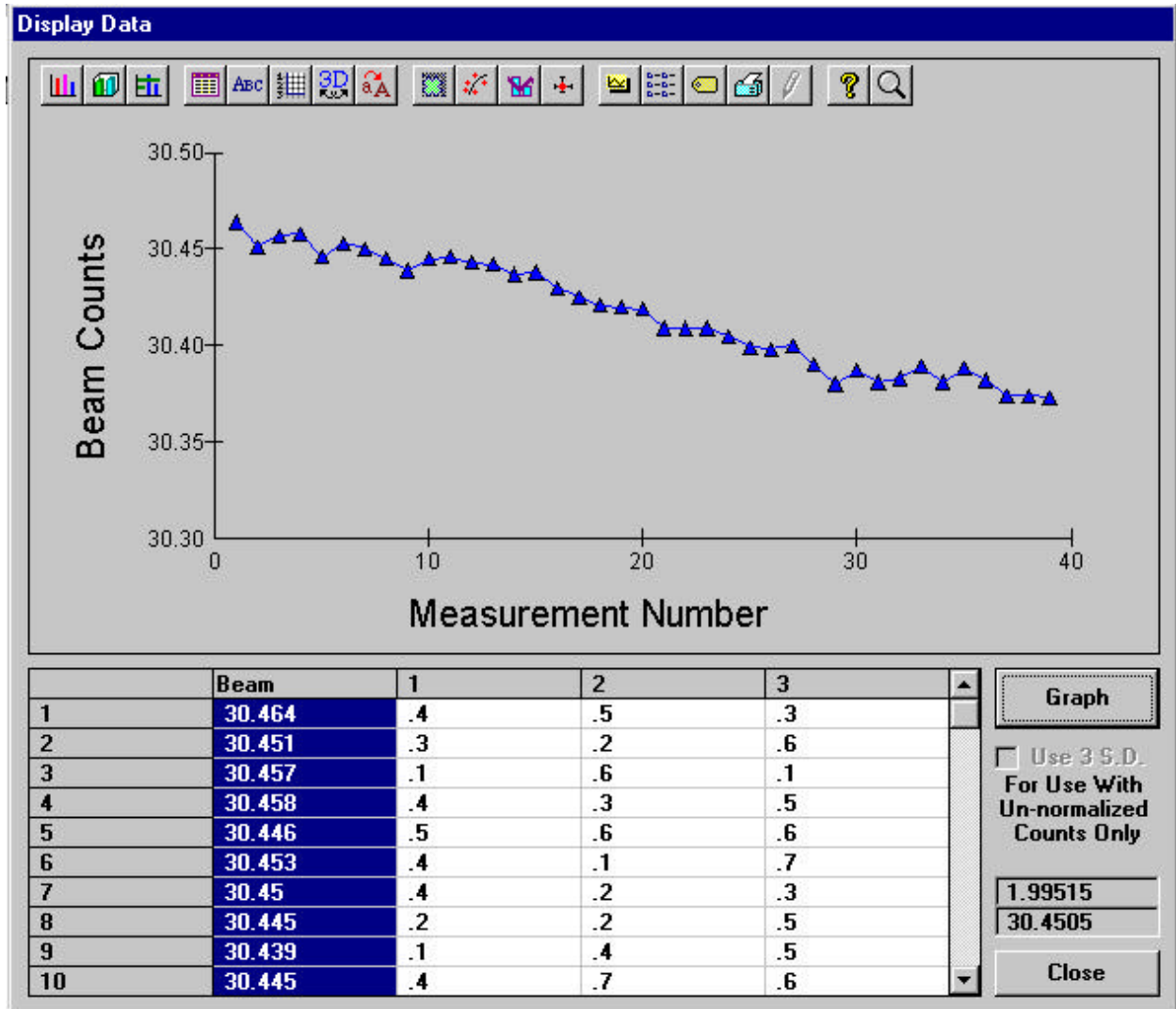
The screenshot shows a software window titled "Display Data". At the top is a toolbar with various icons for data manipulation. Below the toolbar is a large empty gray area. At the bottom of the window is a data table with 10 rows and 5 columns. The columns are labeled "Beam", "1", "2", and "3". The data is as follows:

	Beam	1	2	3
1	30.464	.4	.5	.3
2	30.451	.3	.2	.6
3	30.457	.1	.6	.1
4	30.458	.4	.3	.5
5	30.446	.5	.6	.6
6	30.453	.4	.1	.7
7	30.45	.4	.2	.3
8	30.445	.2	.2	.5
9	30.439	.1	.4	.5
10	30.445	.4	.7	.6

To the right of the table is a vertical scroll bar. Further right is a "Graph" button. Below the "Graph" button is a checkbox labeled "Use 3 S.D. For Use With Un-normalized Counts Only". Below the checkbox are two empty text input fields. At the bottom right is a "Close" button.

While all data columns were selected by the mouse operation previously, the user may plot a single column of data by clicking the column label of the desired data and then clicking the **Graph** button.

Below, Beam Counts versus Measurement Number (time) are graphed and the overall beam stability with time may be judged.



Click the **Close** button to return to the STARTWIN log window.

Brass Alloy Run

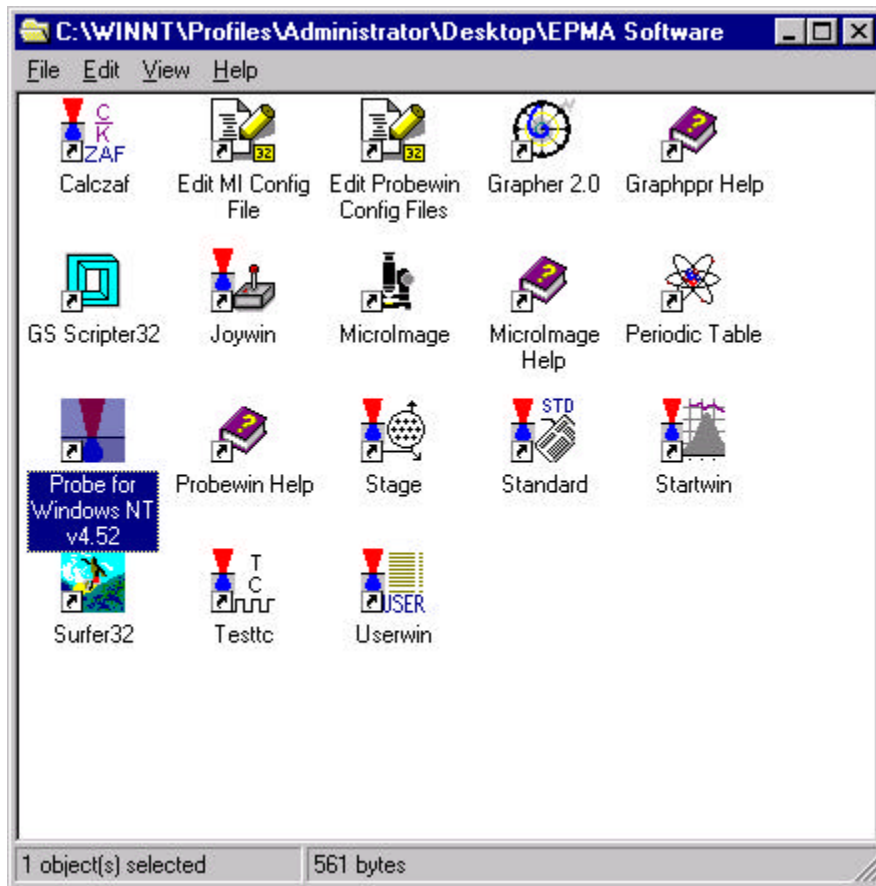
Introduction

This document illustrates step by step how to set up a new PROBE FOR WINDOWS quantitative run and how to analyze an unknown two element alloy sample. This documentation was produced on a three spectrometer JEOL 733 electron microprobe. Your particular run may look very different depending on the specific configuration of your microprobe. This document should be used in conjunction with the User's Guide and Reference documentation and on-line help.

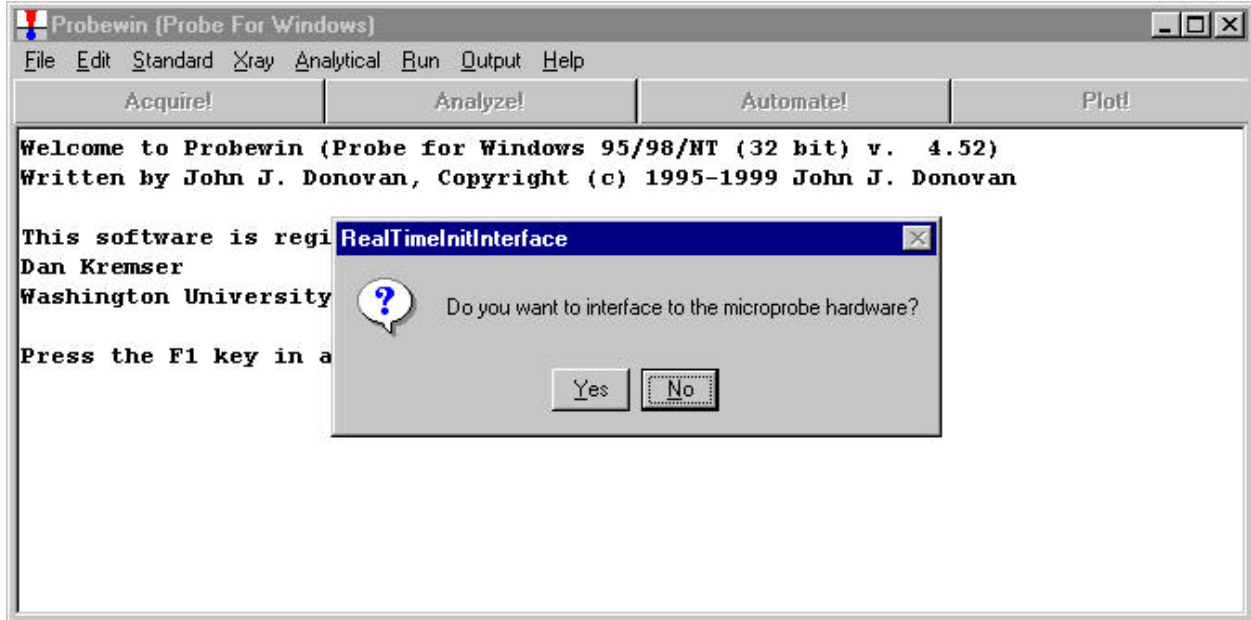
This run will demonstrate some of the basic features of the PROBE FOR WINDOWS program. These include the use of manual and automated spectrometer peaking, manual and automated standard count acquisition and manual unknown sample acquisition. The use of pre-digitized standard positions, the unique wavescan option, off-peak adjustment capabilities and data output methods will be illustrated.

Opening Probe for Windows

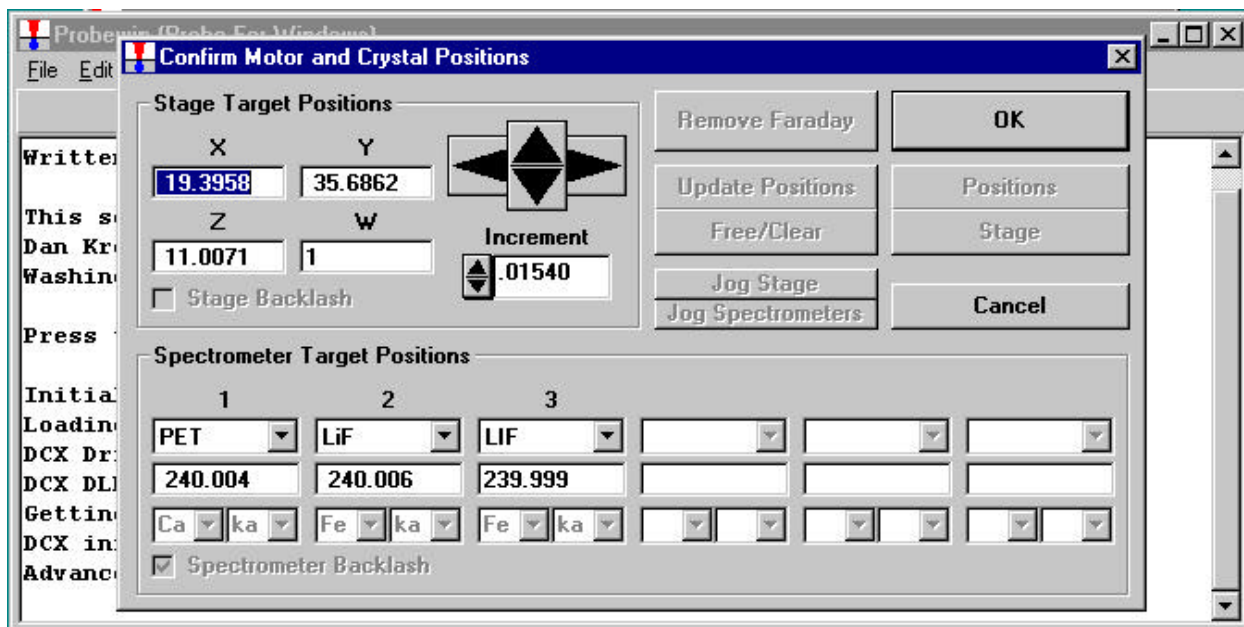
From the Desktop, double-click on the yellow EPMA Software folder opening the EPMA Software group. Double click on the **Probe for Windows ...** icon.



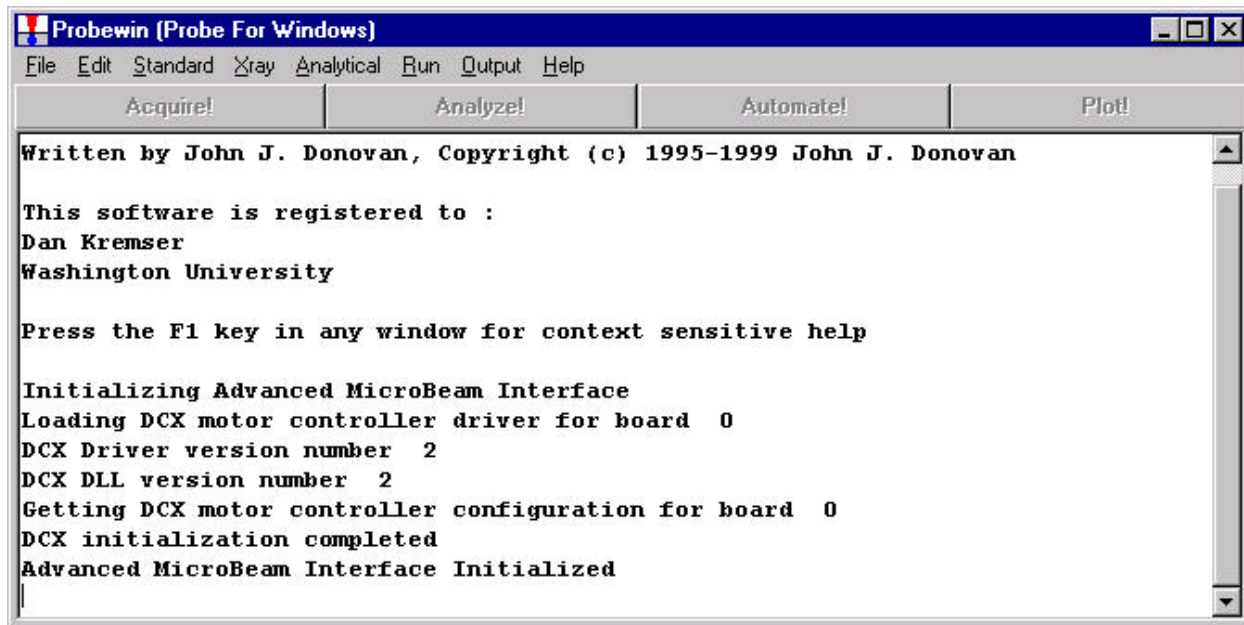
Upon launching PROBEWIN (PROBE FOR WINDOWS), the main log window appears along with the **RealTimeInitInterface** window as illustrated below. To collect real time data click the **Yes** button. The program can also be run off-line without the microprobe interface to re-process previously acquired data or on another computer.



This action causes the **Confirm Motor and Crystal Positions** dialog box to open. Confirm that all of the motors (stage and spectrometer positions) and crystal designations are correctly calibrated. If there is disagreement between the mechanical positions (actual) and the software values, adjust the software values. Use the <tab> key to move between the *Target Positions* text boxes. Click the **OK** button after you have finished to close the **Confirm Motor and Crystal Positions** dialog box.

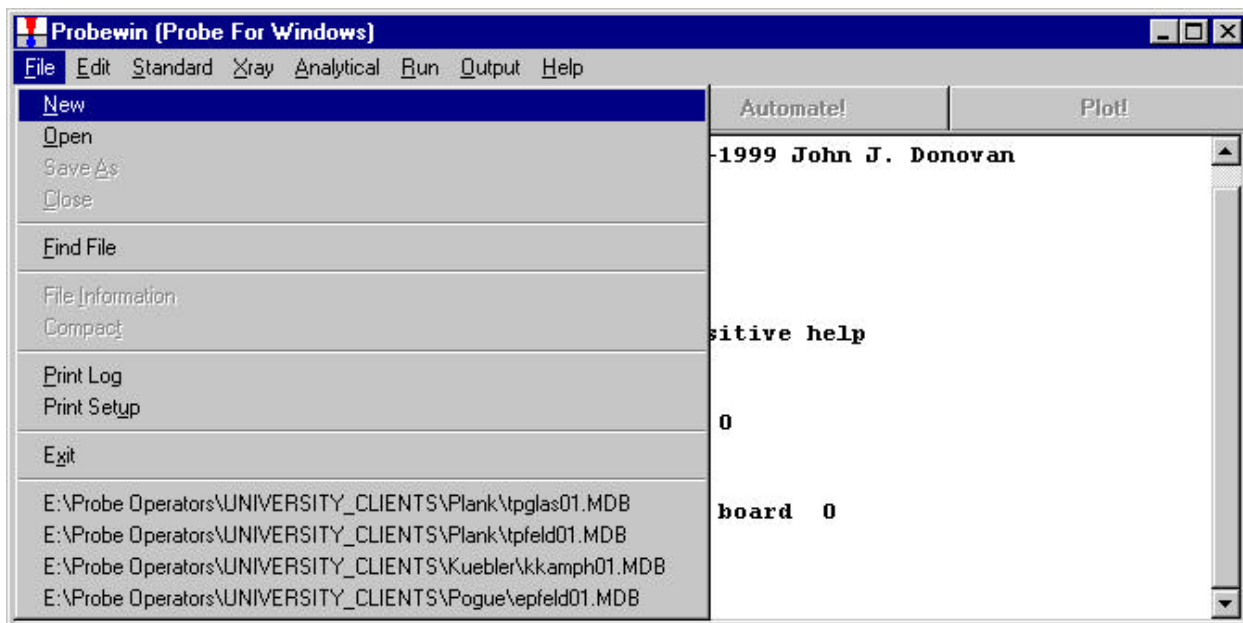


The main PROBE FOR WINDOWS log window is now visible as seen below.

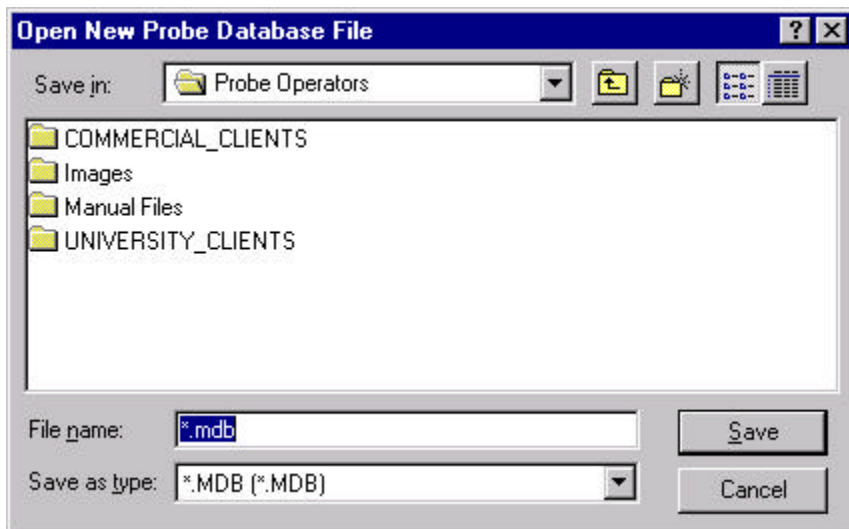


Creating a New Run

To create a new sample run, select **File** from the menu bar and click **New** from the menu.



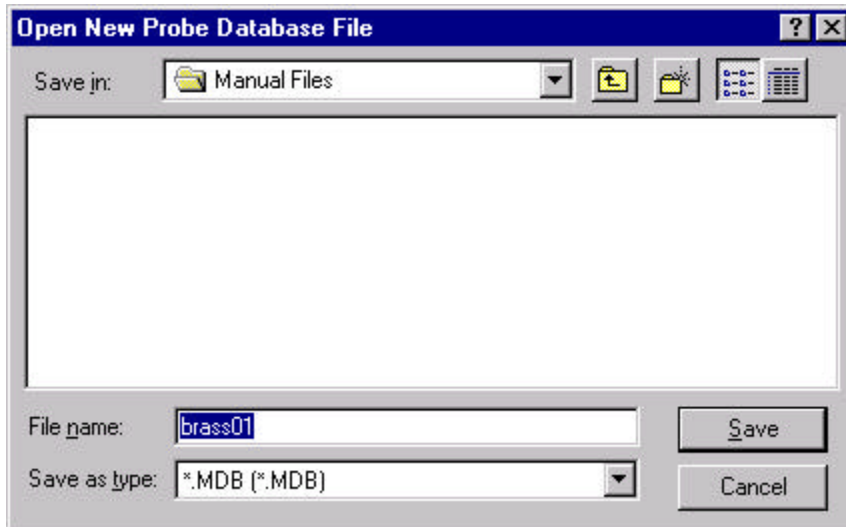
The **Open New Probe Database File** dialog box opens.



Change the *Save in:* location (directory) if desired and type an appropriate run name into the *File name* text box.

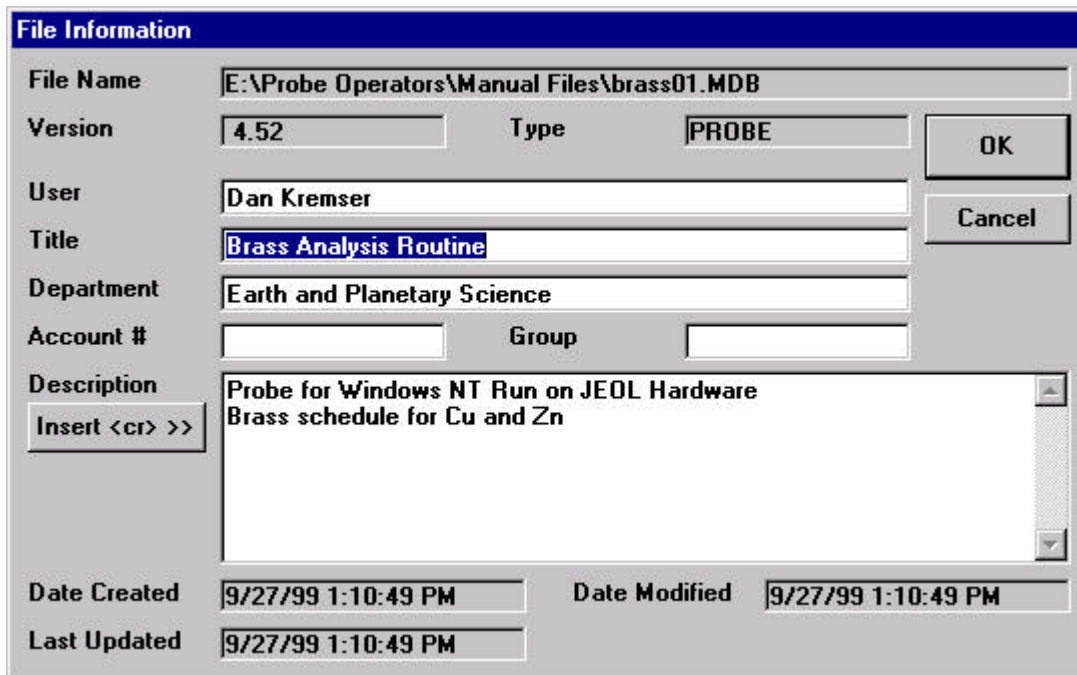
The initial *Save in:* location is specified by the `UserDataDirectory` keyword in the `PROBEWIN.INI` file. File names longer than 8 characters are now supported.

The screen capture of the first window in this section indicates that other probe runs (previous four listed) are already established. Any of the existing old runs maybe re-opened to acquire additional data or used as a “setup” file for starting a new run. In this example, a new file designated BRASS01.MDB will be created in the Manual Files directory.

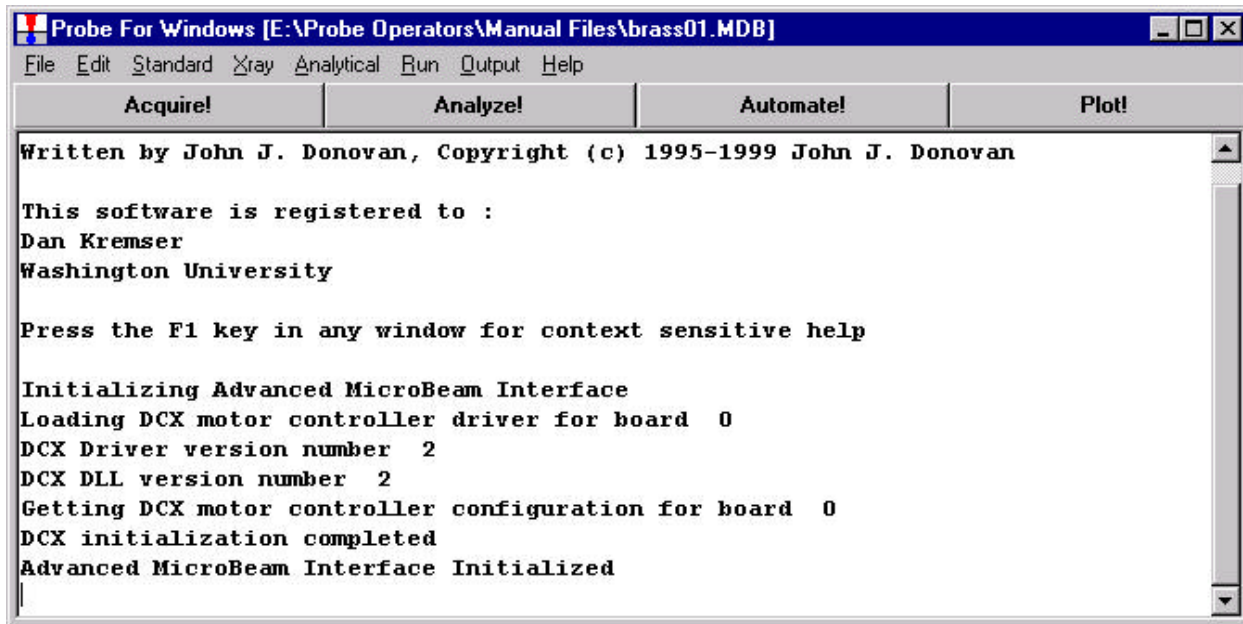


Close the **Open New Probe Database File** window by clicking the **Save** button. This action opens the **File Information** dialog box.

Enter the relevant information for the new run into the *User*, *Title*, and other *Description* text boxes. Use the <tab> key to move between text boxes. When finished, click the **OK** button.



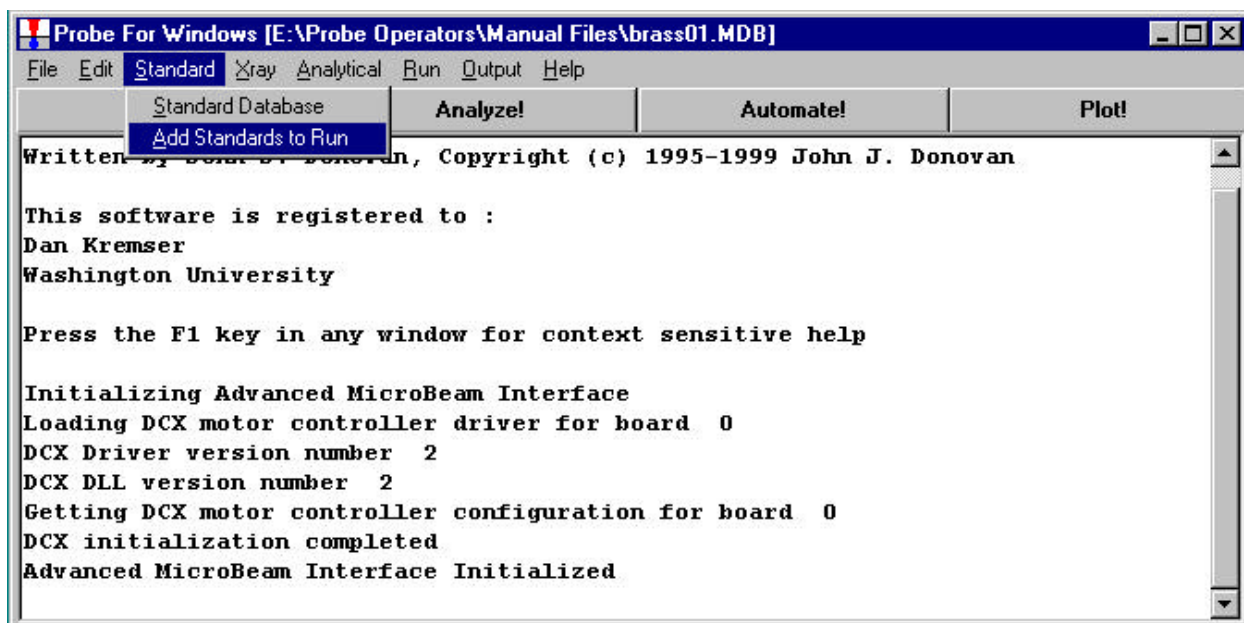
This returns the program to the main PROBE FOR WINDOWS log window. Now the four main Probe buttons: **Acquire!**, **Analyze!**, **Automate!**, and **Plot!** become active.



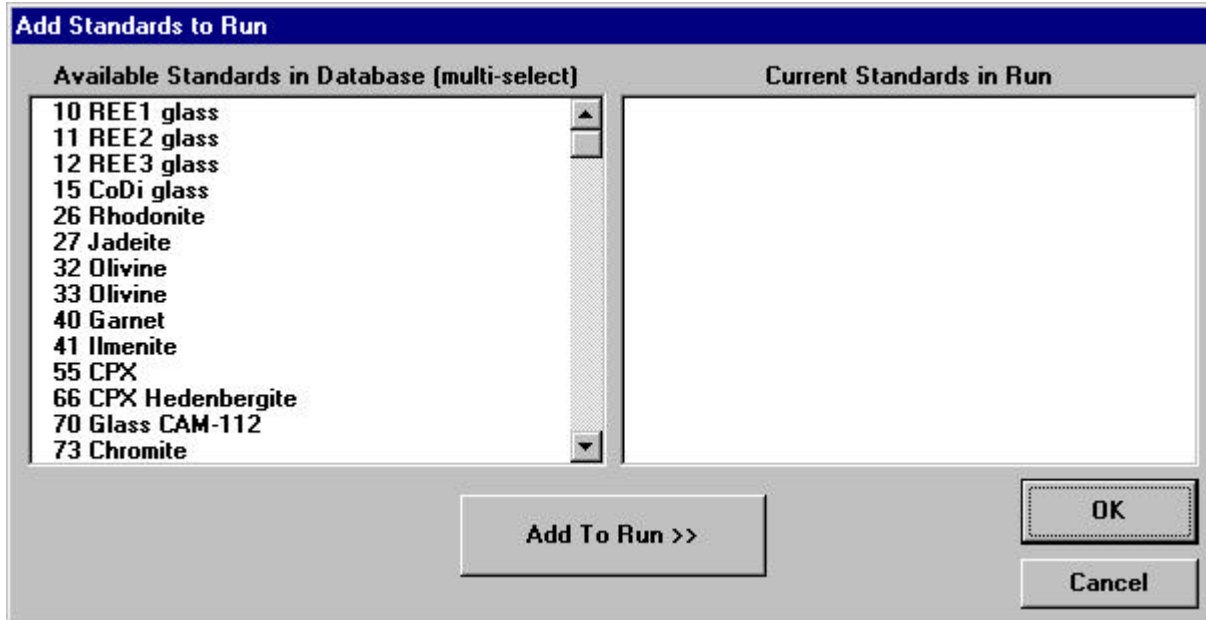
Parameter Initialization

Analytical Standard Selection

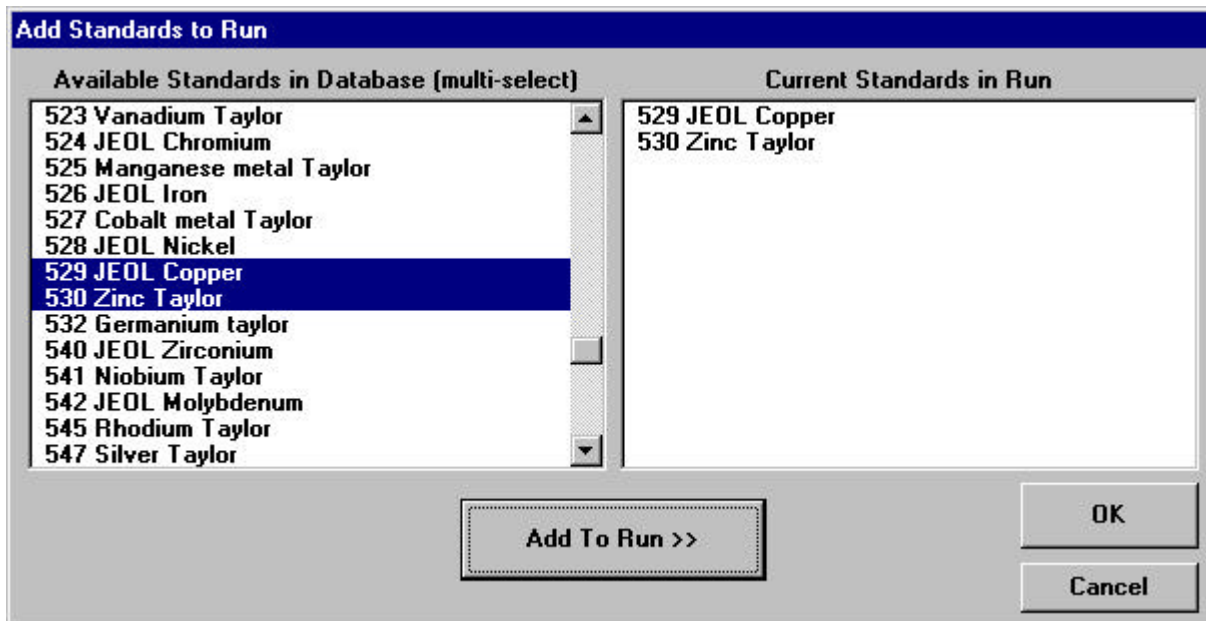
Select the analytical standards to be used in the new probe run. From the main PROBE FOR WINDOWS log window, click **Standard** from the menu bar and select **Add Standards to Run** from the menu.



This opens the **Add Standards to Run** dialog box.



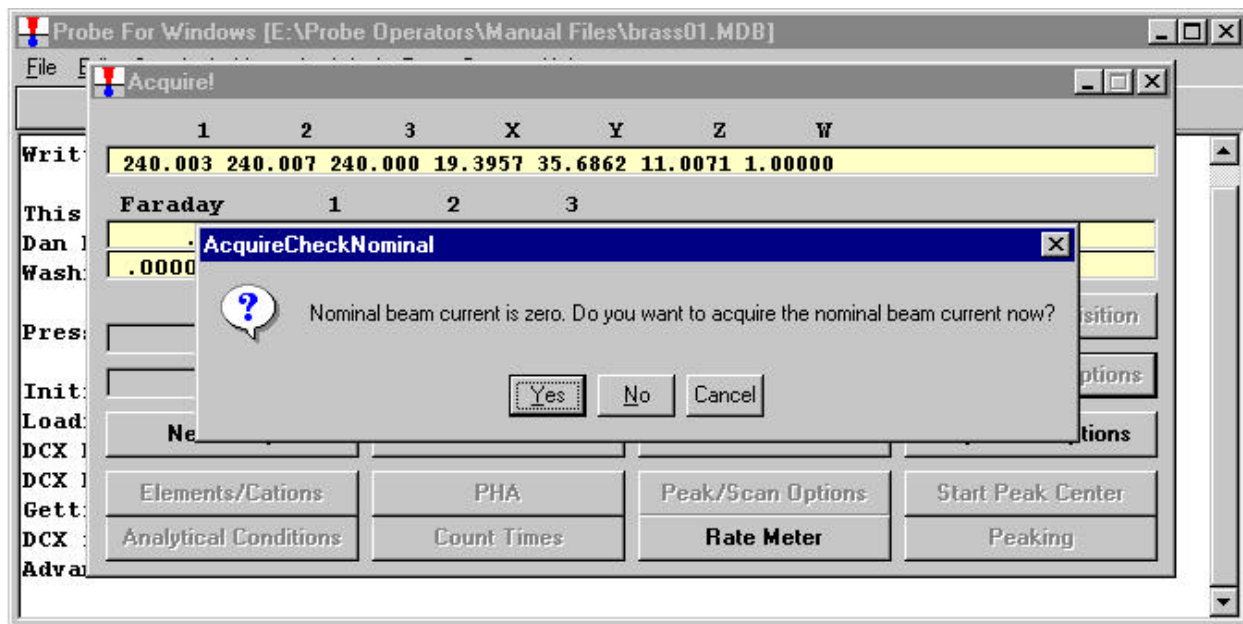
All previously entered standards in the default standard database are accessible. Scroll through the *Available Standards in Database* list box to find the copper and zinc metal standards to be used in this run. Select each and click the **Add To Run >>** button to add each to the *Current Standards in Run* list box.



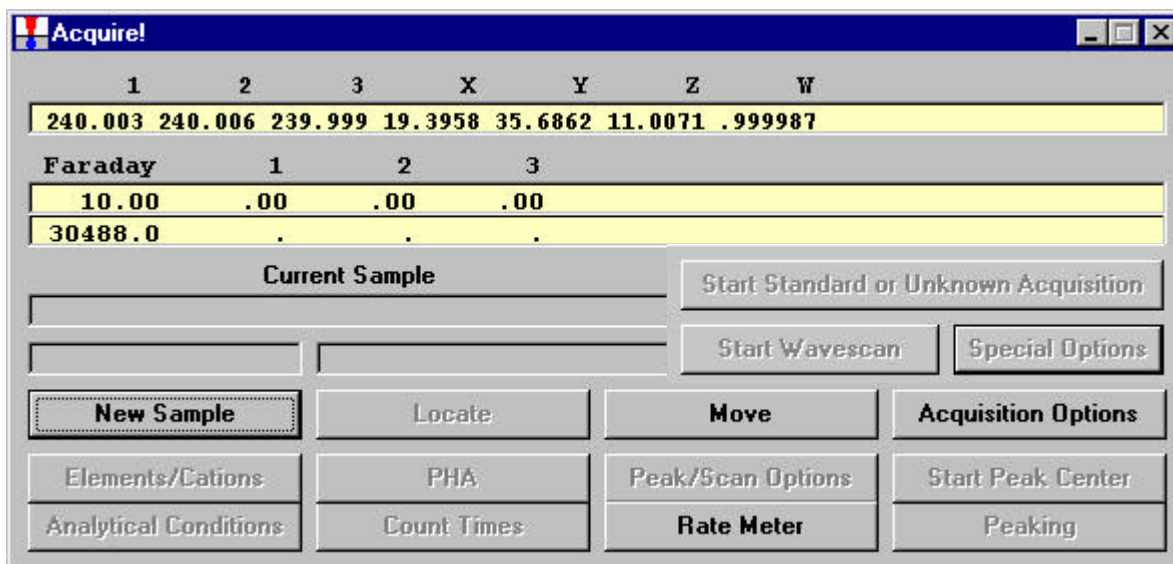
Click the **OK** button of the **Add Standards to Run** window when finished selecting standards. This returns the program to the main log window.

Nominal Beam Current Measurement

Click the **Acquire!** button. This action opens both the **Acquire!** dialog box and the **AcquireCheckNominal** window for the determination of the nominal beam current.



Click the **Yes** button of the **AcquireCheckNominal** window to establish a reference beam current reading. The beam (Faraday Cup counts on a JEOL 733 microprobe) is then measured. In this example the Faraday reading was taken for 10 seconds and recorded 30488 counts or 30.488 nA of beam current.



Creating a New Sample

Click the **New Sample** button of the **Acquire!** dialog box. This opens the **New Sample** dialog box.

New Sample

New Sample Type

Standard

Unknown

Wavescan

OK Cancel

Load Element Setup

Load Sample Setup

Load File Setup

Note that a new standard sample element setup is always based on the last unknown sample in the run. To change the analyzed elements in a run, first create a new unknown sample and make any necessary changes to the element setup.

New Sample Name

unknown sample

New Sample Description

Insert <cr> >>

To add standards to the standard list below, cancel this dialog, then click the Standard | Add Standards to Run menu items from the main menu

529 JEOL Copper

530 Zinc Taylor

Select *Unknown* from the *New Sample Type* buttons. Type an appropriate sample name and description into the *New Sample Name* and *New Sample Description* text boxes. This first sample will be used as a “template”, only to establish the analysis parameters.

New Sample

New Sample Type

Standard
 Unknown
 Wavescan

OK Cancel

Load Element Setup
Load Sample Setup
Load File Setup

Note that a new standard sample element setup is always based on the last unknown sample in the run. To change the analyzed elements in a run, first create a new unknown sample and make any necessary changes to the element setup.

New Sample Name
setup

New Sample Description
Insert <cr> >> Initial setup for two element brass analyses

To add standards to the standard list below, cancel this dialog, then click the Standard | Add Standards to Run menu items from the main menu

529 JEOL Copper
530 Zinc Taylor

Click the **OK** button of the **New Sample** dialog box.

The program returns to the **Acquire!** window. Notice that the first sample designated *Un 1 ** *setup* is now listed in the *Current Sample* text box. The * symbol indicating that no data has been collected for this sample yet.

The screenshot shows the 'Acquire!' window with the following data and controls:

	1	2	3	X	Y	Z	W
	240.003	240.006	239.999	19.3958	35.6862	11.0071	.999987
Faraday	1	2	3				
	10.00	.00	.00	.00			
	30488.0	.	.	.			

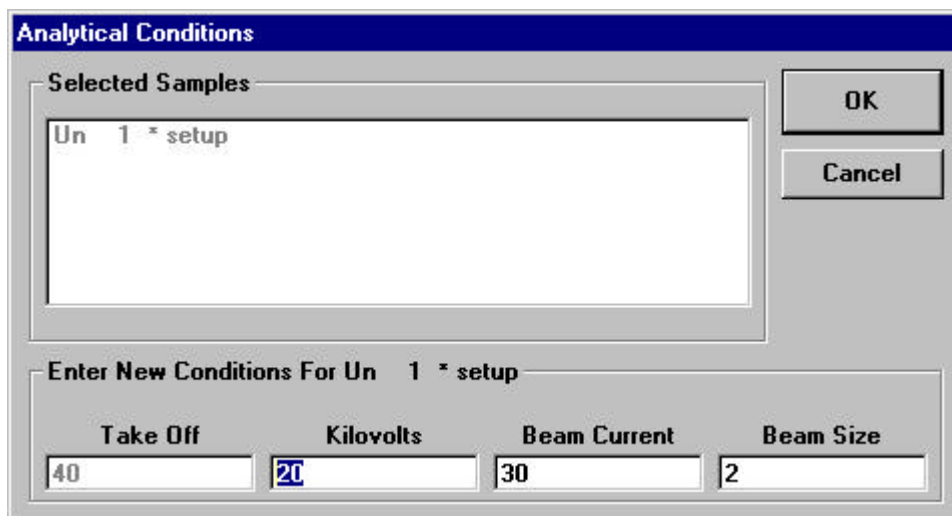
Current Sample: Un 1 * setup

Data Rows: 0 Good Data Rows: 0

Buttons: Start Standard or Unknown Acquisition, Start Wavescan, Special Options, New Sample, Locate, Move, Acquisition Options, Elements/Cations, PHA, Peak/Scan Options, Start Peak Center, Analytical Conditions, Count Times, Rate Meter, Peaking

Setting Analytical Conditions

Click the **Analytical Conditions** button to open the **Analytical Conditions** dialog box. Enter the appropriate numbers into the *Kilovolts*, *Beam Current*, and *Beam Size* text boxes for the currently *Selected Sample*. The *Kilovolts*, *Beam Current*, and *Beam Size* will need to be manually adjusted if a column digital interface is not present.



The image shows a software dialog box titled "Analytical Conditions". It has a blue header bar with the title. Below the header, there is a section labeled "Selected Samples" containing a list box with one entry: "Un 1 * setup". To the right of this list box are two buttons: "OK" and "Cancel". Below the "Selected Samples" section is another section labeled "Enter New Conditions For Un 1 * setup". This section contains four input fields with labels above them: "Take Off" (value: 40), "Kilovolts" (value: 20), "Beam Current" (value: 30), and "Beam Size" (value: 2). The "Kilovolts" field has a blue selection highlight over the number 20.

Click the **OK** button when done, returning to the **Acquire!** window.

Element, X-Ray Line and Spectrometer Parameters Selection

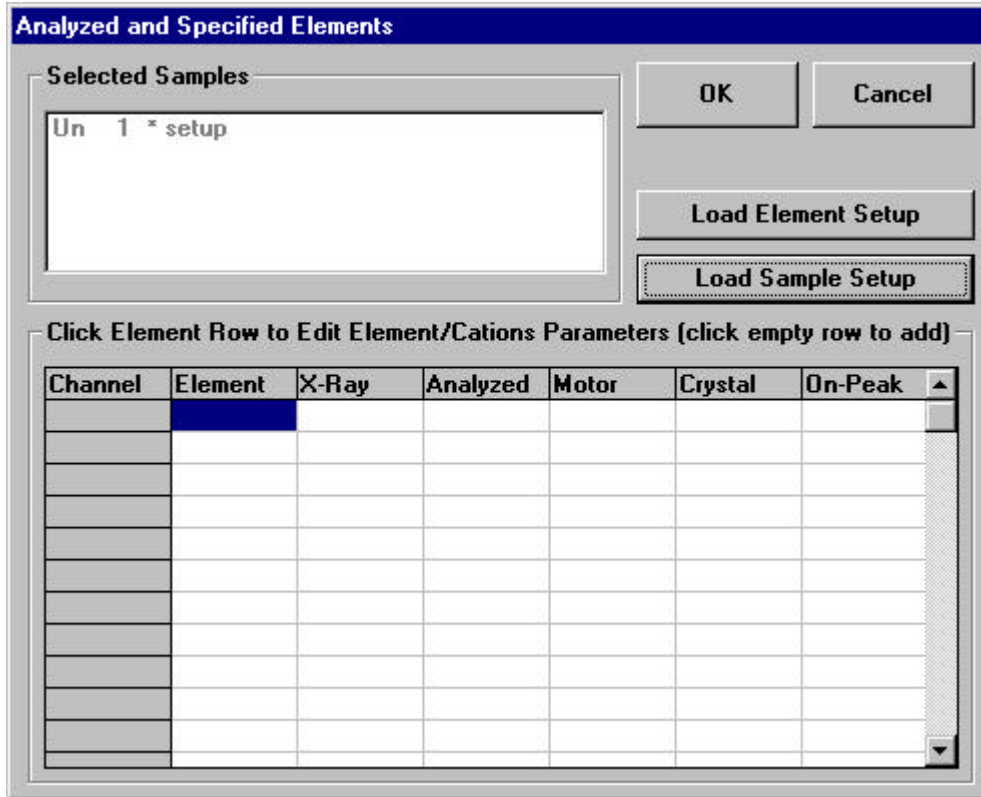
Next, the user specifies the elements to be analyzed. Click the **Elements/Cations** button.

The screenshot shows the 'Acquire!' software window. At the top, there is a table with columns labeled 1, 2, 3, X, Y, Z, and W. The first row of data is highlighted in yellow and contains the values: 240.003, 240.006, 239.999, 19.3958, 35.6862, 11.0071, and .999987. Below this table is another section with columns labeled Faraday, 1, 2, and 3. The first row of data in this section is also highlighted in yellow and contains the values: 10.00, .00, .00, and .00. The second row of data in this section contains the values: 30488.0, ., ., and ..

Below the data tables, there is a 'Current Sample' field containing the text 'Un 1 * setup'. To the right of this field is a button labeled 'Start Standard or Unknown Acquisition'. Below the 'Current Sample' field are two input fields: 'Data Rows: 0' and 'Good Data Rows: 0'. To the right of these fields are two buttons: 'Start Wavescan' and 'Special Options'. Below these fields and buttons is a grid of buttons:

New Sample	Locate	Move	Acquisition Options
Elements/Cations	PHA	Peak/Scan Options	Start Peak Center
Analytical Conditions	Count Times	Rate Meter	Peaking

This action opens the **Analyzed and Specified Elements** dialog box. Click on any empty row in the spreadsheet to enter the first element to analyze. The user may enter the analyzed elements in any order however, the analysis output will follow this order.



This opens the **Element Properties** dialog box.

Element Properties

Enter Element Properties For:

Element X-Ray Line Cations Oxygens

Leave the X-ray Line Blank to Indicate an Un-Analyzed Element (EDS, Specified, by Difference or Stoichiometry)

OK
Cancel
Delete

Off Peak Correction Type

Linear Average High Only Low Only Exponential

Parameters (note that Background Type can differ for Standards and Unknowns)

Background Type

Off Peak MAN

Off-Peak Entry

Absolute Position Relative Offset

Hi Off-Peak Interferences
Low Off-Peak Interferences

Spectrometer Crystal On-Peak High Off-Peak Low Off-Peak

.00000 .000000 .000000

BaseLine Window INTE/DIFF Gain Bias Deadtime (us)

.00 .00 DIFF .00 .00 .00

In the *Element* field either type in the first element to analyze or use the drop-down menu to select the element symbol. Certain default values listed in this window are based on parameters entered into the previously established configuration files.

Element Properties

Enter Element Properties For:

Element	X-Ray Line	Cations	Oxygens
cu	ka	2	1

X-Ray Line Blank to Indicate an Un-Analyzed S. Specified, by Difference or Stoichiometry)

ion Type

Average
 High Only
 Low Only
 Exponential

Parameters (note that Background Type can differ for Standards and Unknowns)

Background Type	Off-Peak Entry	Hi Off-Peak Interferences
<input checked="" type="radio"/> Off Peak <input type="radio"/> MAN	<input checked="" type="radio"/> Absolute Position <input type="radio"/> Relative Offset	Low Off-Peak Interferences

Spectrometer	Crystal	On-Peak	High Off-Peak	Low Off-Peak
		.00000	.000000	.000000

BaseLine	Window	INTE/DIFF	Gain	Bias	Deadtime (us)
.00	.00	<input type="checkbox"/> DIFF	.00	.	.00

Buttons: OK, Cancel, Delete

Under the *Enter Element Properties For* section (top of the **Element Properties** dialog box) choose the correct *X-Ray Line*, *Cations*, and *Oxygens* for the first element.

Element Properties

Enter Element Properties For:

Element	X-Ray Line	Cations	Oxygens
cu	ka	1	0

Leave the X-ray Line Blank to Indicate an Un-Analyzed Element (EDS, Specified, by Difference or Stoichiometry)

Off Peak Correction Type

Linear
 Average
 High Only
 Low Only
 Exponential

Parameters (note that Background Type can differ for Standards and Unknowns)

Background Type	Off-Peak Entry	
<input checked="" type="radio"/> Off Peak <input type="radio"/> MAN	<input checked="" type="radio"/> Absolute Position <input type="radio"/> Relative Offset	<input type="button" value="Hi Off-Peak Interferences"/> <input type="button" value="Low Off-Peak Interferences"/>

Spectrometer	Crystal	On-Peak	High Off-Peak	Low Off-Peak
2	LiF	107.220	110.410	104.030

Window	INTE/DIFF	Gain	Bias	Deadtime (us)
2	<input type="checkbox"/> DIFF	50.00	1700.	1.00

Continue by selecting the *Off Peak Correction Type* and *Background Type*. Two background correction methods are available to the user; off-peak and the MAN (mean atomic number) method (see the User's Guide and Reference documentation for a complete discussion of both types). Next, click the text box under *Spectrometer* and enter the appropriate spectrometer number that will be used to analyze the first element. The drop-down menu may also be used to select the spectrometer number. Choosing a spectrometer number loads various parameters from the configuration files. Each of these parameters in this window should be inspected and edited as needed (use the <tab> key to move between boxes). Accept the nominal *On-* and *Off-Peak* positions listed here. They can be changed later, if necessary.

The next screen shows the edited **Element Properties** dialog box for copper metal.

Element Properties

Enter Element Properties For:

Element	X-Ray Line	Cations	Oxygens
cu	ka	1	0

Leave the X-ray Line Blank to Indicate an Un-Analyzed Element (EDS, Specified, by Difference or Stoichiometry)

Off Peak Correction Type

Linear Average High Only Low Only Exponential

Parameters (note that Background Type can differ for Standards and Unknowns)

Background Type	Off-Peak Entry	
<input checked="" type="radio"/> Off Peak <input type="radio"/> MAN	<input checked="" type="radio"/> Absolute Position <input type="radio"/> Relative Offset	Hi Off-Peak Interferences Low Off-Peak Interferences

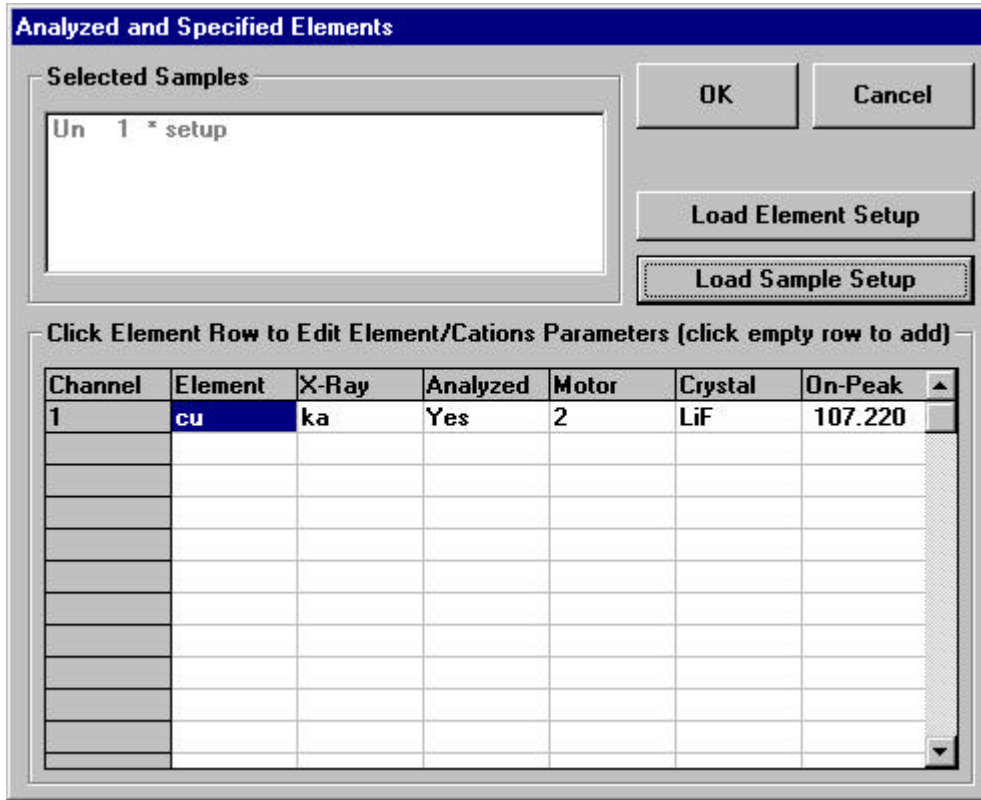
Spectrometer	Crystal	On-Peak	High Off-Peak	Low Off-Peak
2	LiF	107.220	110.410	104.030

BaseLine	Window	INTE/DIFF	Gain	Bias	Deadtime (us)
.50	10.00	<input type="checkbox"/> DIFF	50.00	1700.	1.00

Buttons: OK, Cancel, Delete

Click the **OK** button of the **Element Properties** dialog box to accept these element parameters for copper.

The program returns to the **Analyzed and Specified Elements** window with copper now entered into the *Element/Cations Parameters* table.



Enter the next element in the run by clicking on any empty row of the **Analyzed and Specified Elements** window. This opens the **Element Properties** dialog box again. Enter the appropriate *Element, Spectrometer* and adjust all other text boxes and buttons.

The completed **Element Properties** window for zinc is shown below.

Element Properties

Enter Element Properties For:

Element	X-Ray Line	Cations	Oxygens
zn	ka	1	0

Leave the X-ray Line Blank to Indicate an Un-Analyzed Element (EDS, Specified, by Difference or Stoichiometry)

Off Peak Correction Type

Linear Average High Only Low Only Exponential

Parameters (note that Background Type can differ for Standards and Unknowns)

Background Type	Off-Peak Entry	
<input checked="" type="radio"/> Off Peak <input type="radio"/> MAN	<input checked="" type="radio"/> Absolute Position <input type="radio"/> Relative Offset	Hi Off-Peak Interferences Low Off-Peak Interferences

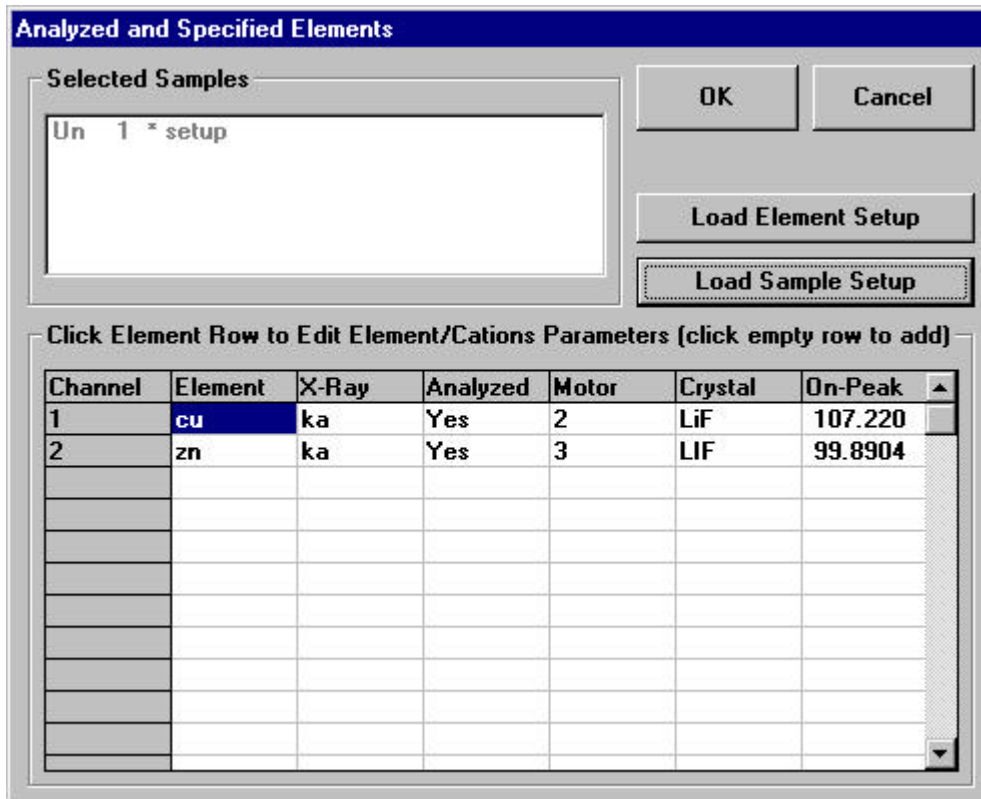
Spectrometer: 3 Crystal: LIF On-Peak: 99.8904 High Off-Peak: 103.195 Low Off-Peak: 96.5857

BaseLine: 1.00 Window: 10.00 INTE/DIFF: DIFF Gain: 200.00 Bias: 1700. Deadtime (us): 1.00

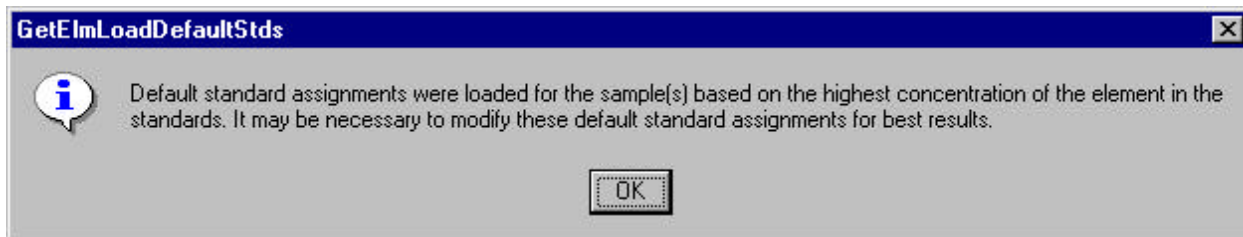
OK Cancel Delete

Click the **OK** button of the **Element Properties** to enter zinc into the *Element/Cations Parameters* table of the **Analyzed and Specified Elements** window.

Click the **OK** button of the **Analyzed and Specified Elements** window when done entering elements in the run.



The **GetElmLoadDefaultStds** window opens to inform the user that standard assignments have been made based on elemental concentrations. Standard assignments may be edited via the **Analyze!** window (see User's Guide and Reference documentation).



Click **OK** to return to the main **Acquire!** window.

Setting Count Times

Click the **Count Times** button of the **Acquire!** window. This opens the **Count Times** dialog box. Here various parameters relating to counting times can be adjusted. Initially *On-Peak* count time is set for 10 seconds and both *Hi-Peak* and *Lo-Peak* times are set for 2 seconds based on the configuration file defaults.

Channel	Element	Motor	Crystal	On-Peak	Hi-Peak	Lo-Peak	MaxCou	Factor	Wave	Peak	Quick
1	cu ka	2	LiF	10.00	2.00	2.00	100000	1	6.00	8.00	.50
2	zn ka	3	LIF	10.00	2.00	2.00	100000	1	6.00	8.00	.50

Faraday Count Time: Update Selected Elements

Nominal Beam (nA):

OK Cancel

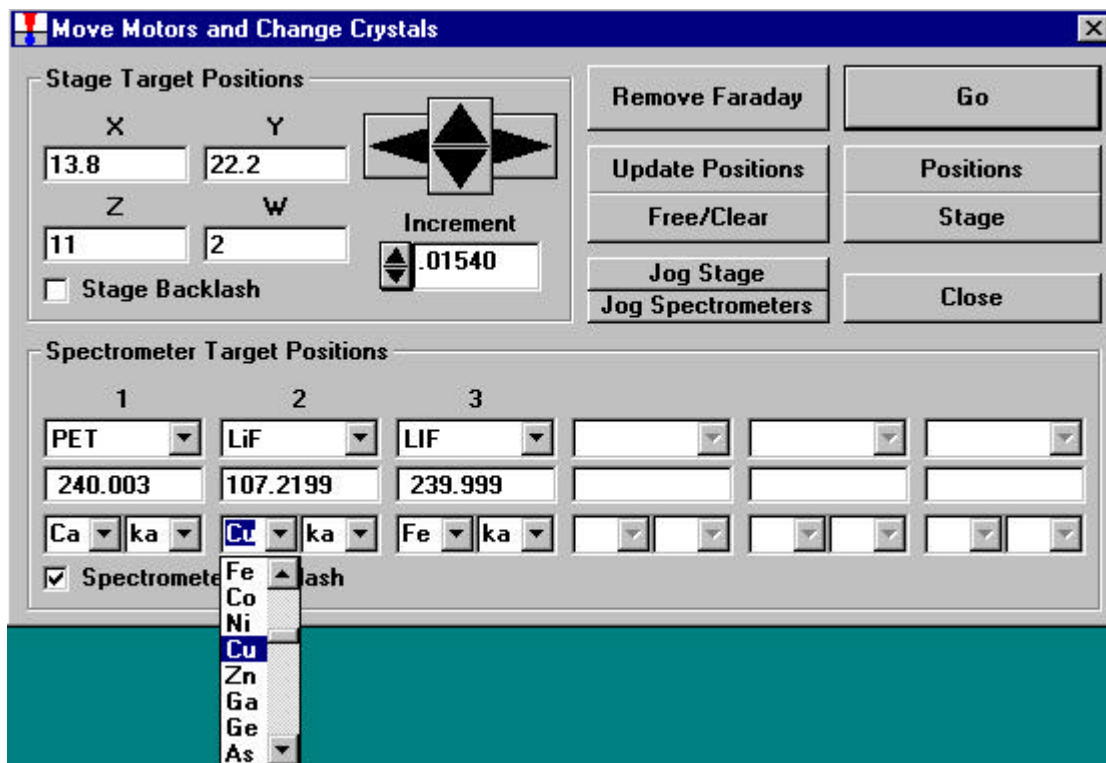
Click the **OK** button of the **Count Times** dialog box to accept these count times and return to the **Acquire!** window.

This completes the initial parameter setup phase for this new run.

Manual Peaking using the Acquire! Window

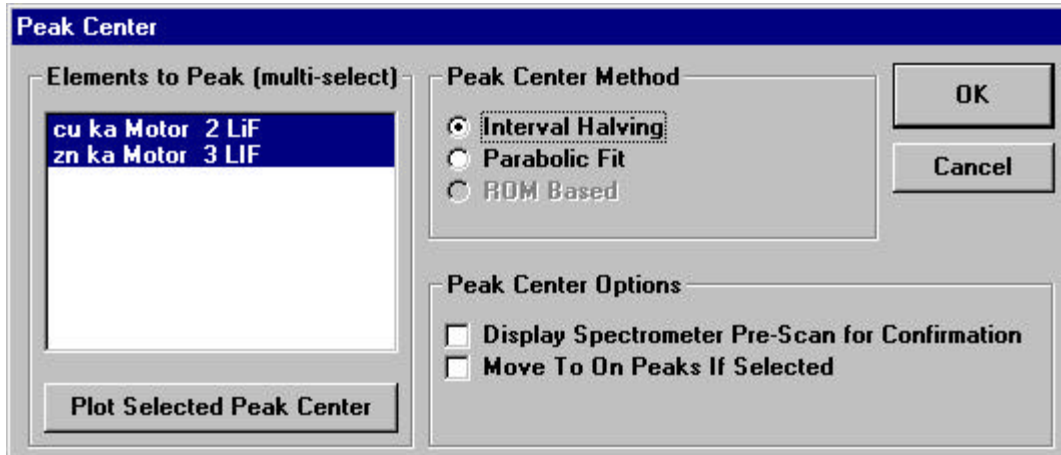
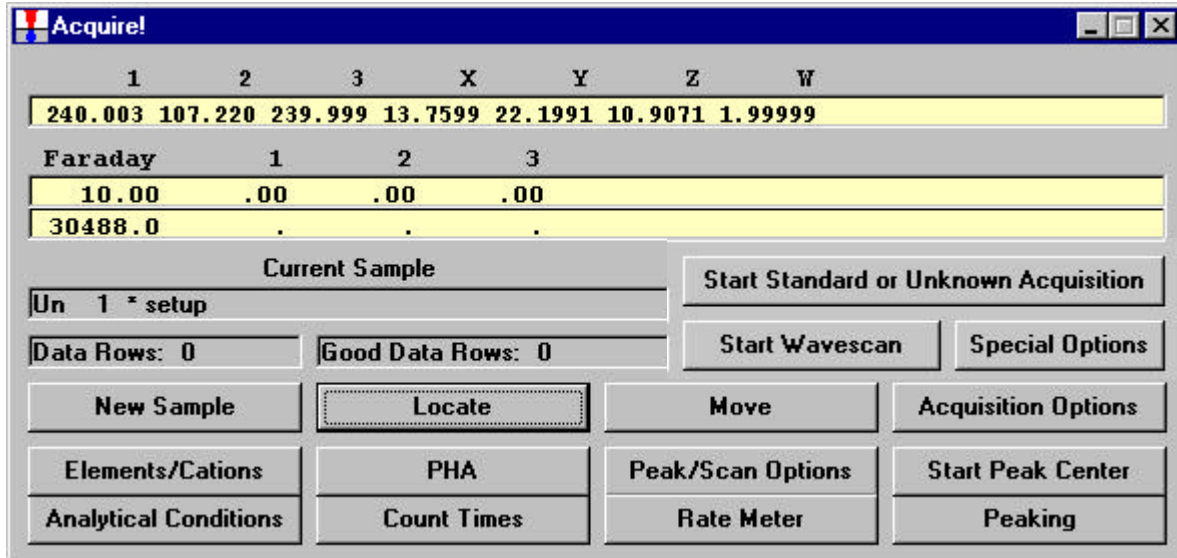
The user may now manually peak center the copper and zinc peak positions from the **Acquire!** window.

Move to the copper standard by clicking the **Move** button. This opens the **Move Motors and Change Crystals** dialog box. Enter the coordinates of copper metal standard into the *Stage Target Positions* text boxes. Inspect the spectrometer crystal type and position text boxes, edit if required. Alternatively, the user may select the element and x-ray line from the drop-down lists and send the spectrometer directly to the theoretical position. Finally, click the **Go** button.

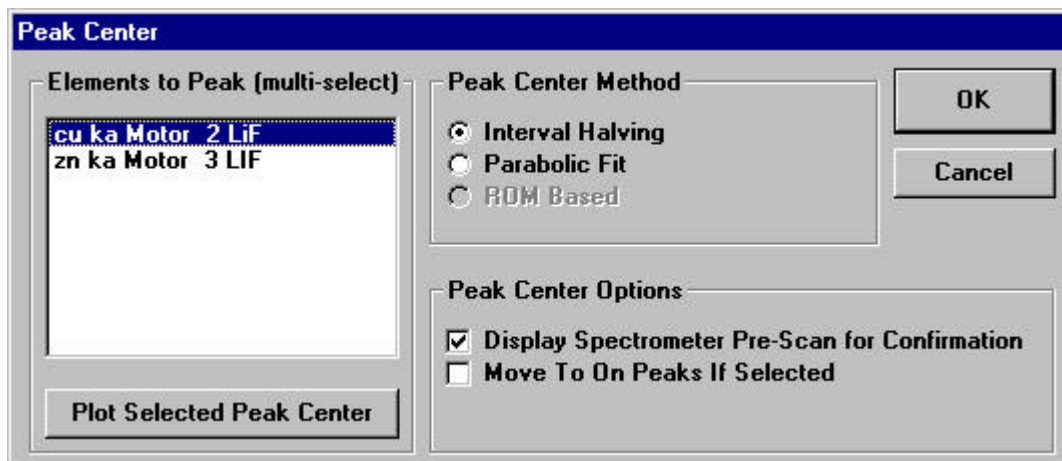


The stage motors will move the stage to the expected position of the copper metal standard. Inspect the final X, Y location of the standard, adjust if necessary and check the focus.

Click the **Peaking** button of the **Acquire!** window.

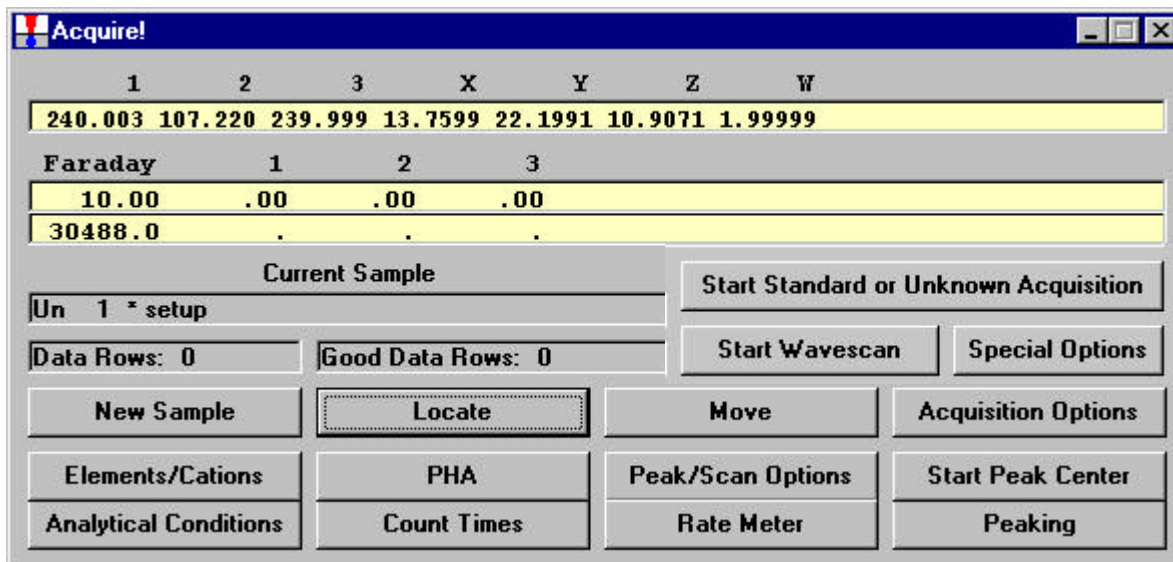


From the *Peak Center Method* group, choose *Interval Halving* (see User's Guide and Reference documentation for discussion of various Peak Center methods) and click *Display Spectrometer Pre-Scan for Confirmation* from the *Peak Center Options* choices. Finally, select the *cu ka Motor 2 LiF* selection under the *Elements to Peak* list box. The **Peak Center** window should appear as follows.



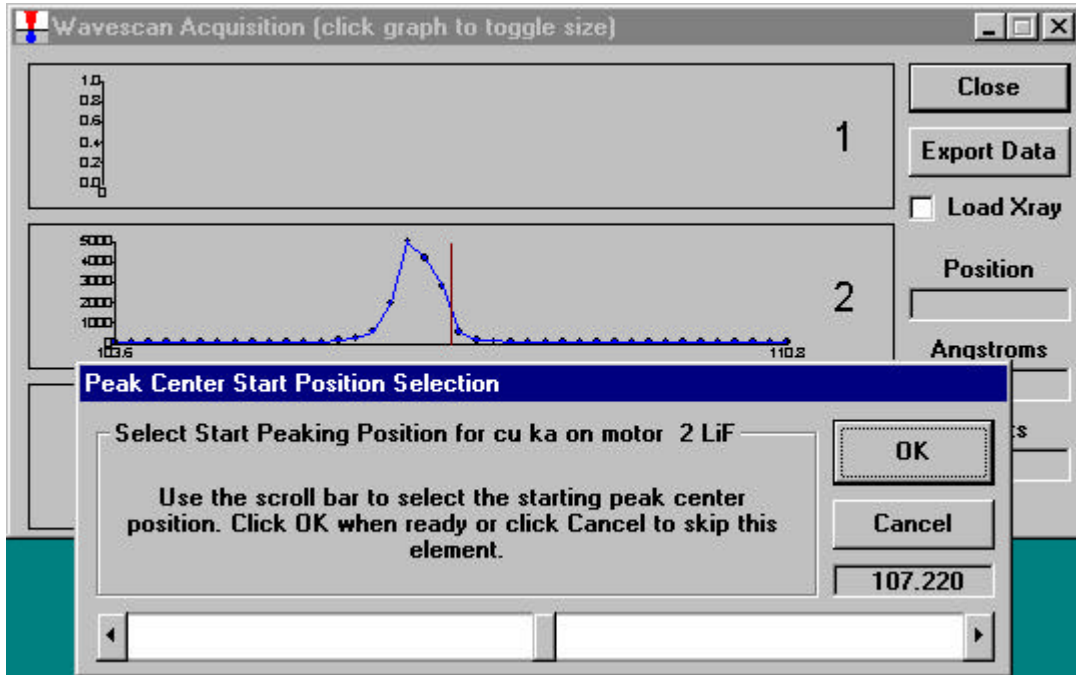
Click the **OK** button to close the **Peak Center** dialog box.

Click the **Start Peak Center** button in the **Acquire!** window.

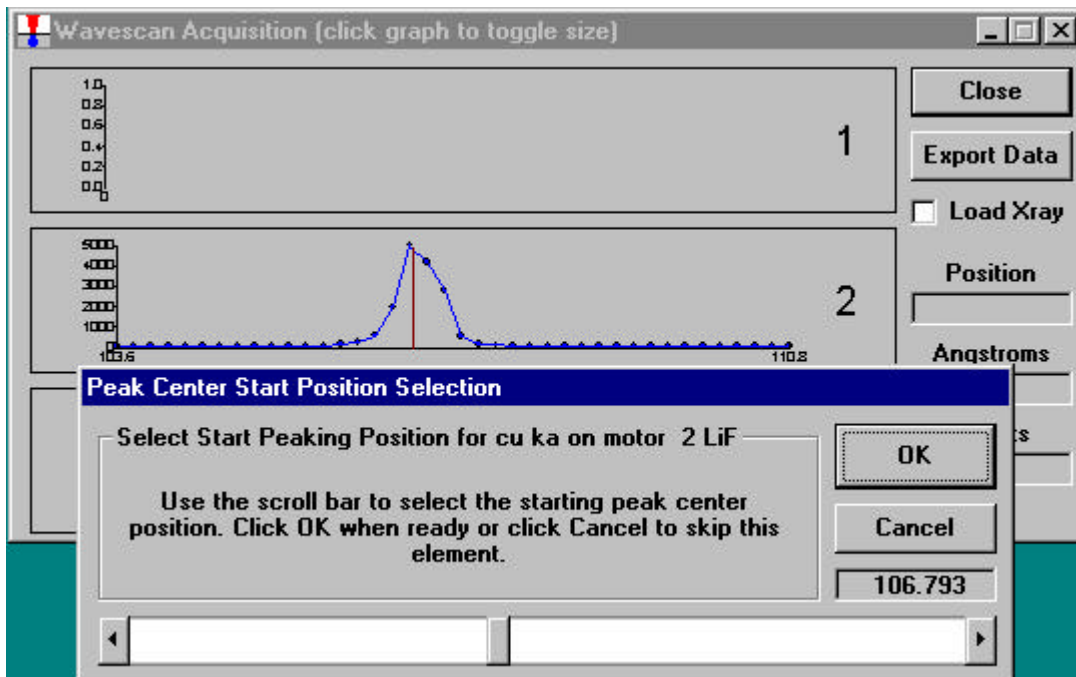


This action opens the **WaveScan** acquisition window. The spectrometer then performs a spectrometer peak pre-scan (40 step, user defined parameter) on spectrometer 2 in the copper K α region.

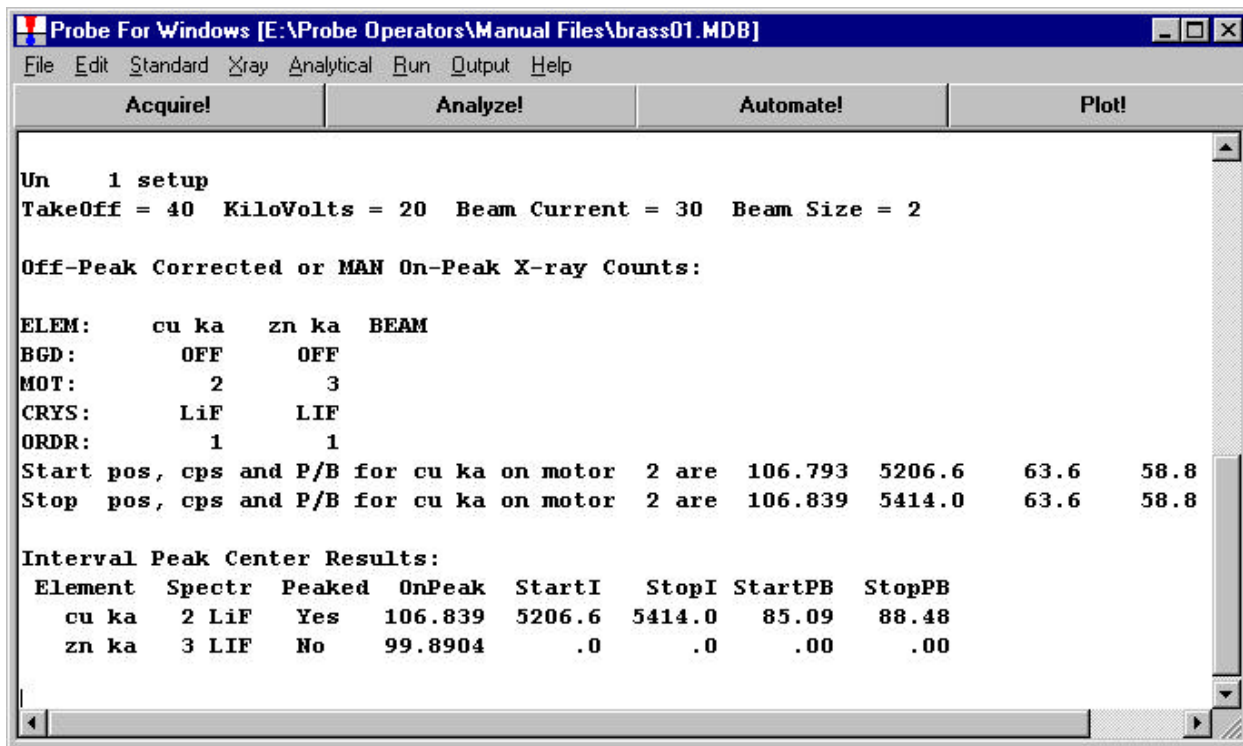
Upon completion of the spectrometer pre-scan the **Peak Center Start Position Selection** window opens.



Slide the scroll bar to move the vertical (red) peak line to match the actual x-ray maximum position. This selects a starting peak center position for the peaking routine.



Click the **OK** button when manually centered. This initiates a peak center routine to locate the precise peak center for copper $K\alpha$ x-rays. The results for copper appear in the main log window, displayed below.



Zinc $K\alpha$ may also be peaked in this manner. First click the **Move** button of the **Acquire!** window to access the **Move Motors and Change Crystals** dialog box. Enter the appropriate stage target positions for the zinc metal standard and click the **Go** button. When the stage motors stop moving, inspect the location, and adjust the optical focus if necessary. Close the **Move Motors and Change Crystals** window. Then click the **Peaking** button as in the copper example. **Remember** to highlight only *zn ka Motor 3 LIF* this time. Close the **Peak Center** window and finally click the **Start Peak Center** button of the **Acquire!** window.

The results for zinc K α appear below.

Probe For Windows [E:\Probe Operators\Manual Files\brass01.MDB]

File Edit Standard Xray Analytical Run Output Help

Acquire!		Analyze!		Automate!		Plot!		
Interval Peak Center Results:								
Element	Spectr	Peaked	OnPeak	StartI	StopI	StartPB	StopPB	
cu ka	2 LiF	Yes	106.839	5206.6	5414.0	85.09	88.48	
zn ka	3 LIF	No	99.8904	.0	.0	.00	.00	
Start pos, cps and P/B for zn ka on motor				3 are	99.7089	9062.1	51.9	42.
Stop pos, cps and P/B for zn ka on motor				3 are	99.7084	8999.6	51.9	42.
Interval Peak Center Results:								
Element	Spectr	Peaked	OnPeak	StartI	StopI	StartPB	StopPB	
cu ka	2 LiF	No	106.839	5206.6	5414.1	85.09	88.48	
zn ka	3 LIF	Yes	99.7084	9062.1	8999.6	192.04	190.72	

Manual Count Acquisition using the Acquire! Window

To acquire a single point of x-ray count data for a standard proceed as follows. From the **Acquire!** dialog box click the **New Sample** button. This opens the familiar **New Sample** window. Click on *Standard* from the *New Sample Type* buttons. This allows the user to specify a standard from the list now active at the bottom of the *New Sample* dialog box. Click *530 Zinc Taylor*, its name now appears under *New Sample Name*. Enter any relevant text under *New Sample Description*. Click the **OK** button when done.

New Sample

New Sample Type

Standard
 Unknown
 Wavescan

OK Cancel

Load Element Setup
Load Sample Setup
Load File Setup

Note that a new standard sample element setup is always based on the last unknown sample in the run. To change the analyzed elements in a run, first create a new unknown sample and make any necessary changes to the element setup.

New Sample Name
Zinc Taylor

New Sample Description
Insert <cr> >> counts on zinc metal standard

To add standards to the standard list below, cancel this dialog, then click the Standard | Add Standards to Run menu items from the main menu

529 JEOL Copper
530 Zinc Taylor

Check the optical focus on the zinc standard and click the **Start Standard or Unknown Acquisition** button of the **Acquire!** window. Notice that the current sample is displayed in the **Acquire!** window. The progress of all data acquisition may be viewed in the **Acquire!** window.

Clicking the **Start Standard or Unknown Acquisition** button initiates the data acquisition. The spectrometers for copper and zinc move to their respective peak positions and count on peak and off peak (both sides in this example) for times specified earlier in the **Count Times** window. The Faraday cup is also measured.

The **Acquire!** window and the main PROBE FOR WINDOWS log window appear as follows upon completion. Faraday cup counts (BEAM) are reported in total counts in the **Acquire!** window and in nanoamps in the main log window.

The screenshot shows the 'Acquire!' window with the following data and controls:

	1	2	3	X	Y	Z	W
	240.003	106.839	99.7084	25.9010	40.9985	10.8795	1.99999

Faraday	1	2	3	
	10.00	.00	2.00	2.00
	30458.0	.	142.	86.

Current Sample: St 530 Set 1 Zinc Taylor

Data Rows: 1 Good Data Rows: 1

Buttons: Start Standard or Unknown Acquisition, Start Wavescan, Special Options, New Sample, Locate, Move, Acquisition Options, Elements/Cations, PHA, Peak/Scan Options, Start Peak Center, Analytical Conditions, Count Times, Rate Meter, Peaking

File Edit Standard Tray Analytical Run Output Help

Acquire! Analyze! Automate! Plot!

```

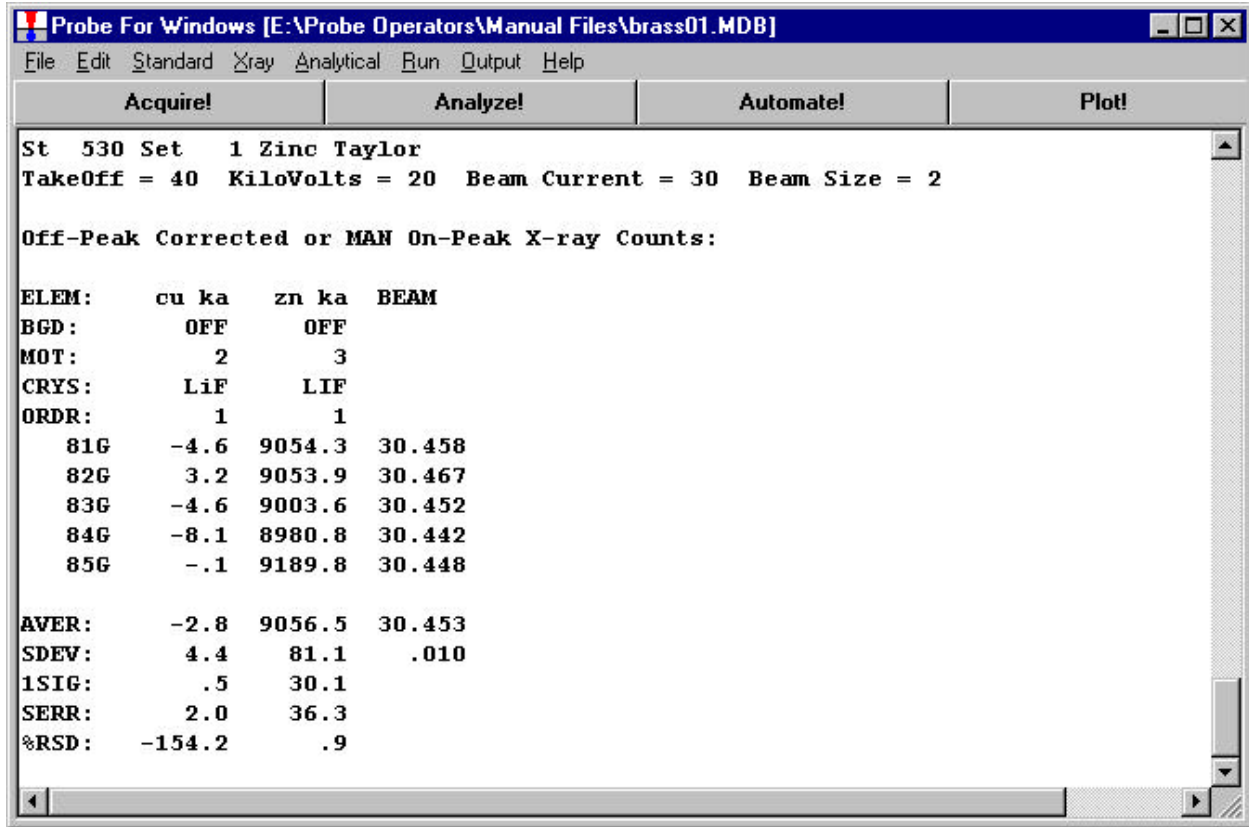
St 530 Set 1 Zinc Taylor
TakeOff = 40 KiloVolts = 20 Beam Current = 30 Beam Size = 2

Off-Peak Corrected or MAN On-Peak X-ray Counts:

ELEM:   cu ka   zn ka   BEAM
BGD:    OFF    OFF
MOT:    2      3
CRYS:   LiF    LIF
ORDR:   1      1
      81G  -4.6  9054.3  30.458

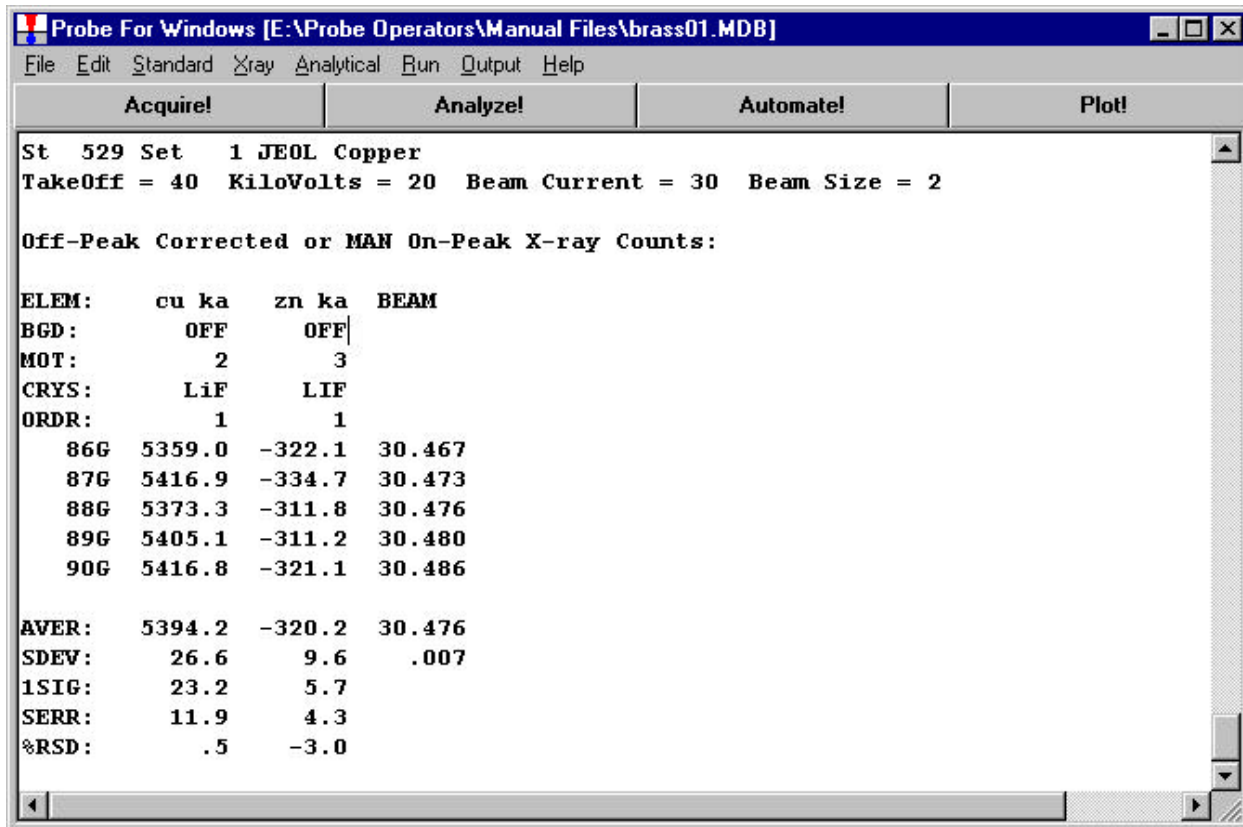
AVER:   -4.6  9054.3  30.458
SDEV:   .0    .0    .000
1SIG:   .7    30.1
SERR:   .0    .0
%RSD:   .0    .0
    
```

Repeated clicking of the **Start Standard or Unknown Acquisition** button acquires additional intensity data. The following log window illustrates the acquisition of five data points on the zinc metal standard.



Similarly, x-ray counts can be acquired on the copper metal standard. Move back to the copper standard position via the **Move** button and inspect the location and focus. Click the **New Sample** button, select the copper standard from the standard list, click the **OK** button when done.

Start collecting counts by clicking the **Start Standard or Unknown Acquisition** button. Repeating five times as with the zinc standard gives the following main log window output.



Inspection of the copper data reveals an interesting feature. All of the zinc off-peak corrected counts on the pure copper standard are very negative suggesting that a background position may be incorrectly set. This can be easily checked by moving to an alloy sample containing both elements of interest and performing a wavescan. A Cartridge Brass standard (NIST SRM 478) containing both elements may be used.

Wavescan Acquisitions

To perform a wavescan acquisition on the Cartridge Brass standard click the **Move** button in the **Acquire!** window to move to this standard.

Click the **New Sample** button. Select *Wavescan* under *New Sample Type*, edit the *New Sample Name* and *New Sample Description* text boxes.

New Sample

New Sample Type

Standard

Unknown

Wavescan

OK Cancel

Load Element Setup

Load Sample Setup

Load File Setup

Note that a new standard sample element setup is always based on the last unknown sample in the run. To change the analyzed elements in a run, first create a new unknown sample and make any necessary changes to the element setup.

New Sample Name

NIST 478

New Sample Description

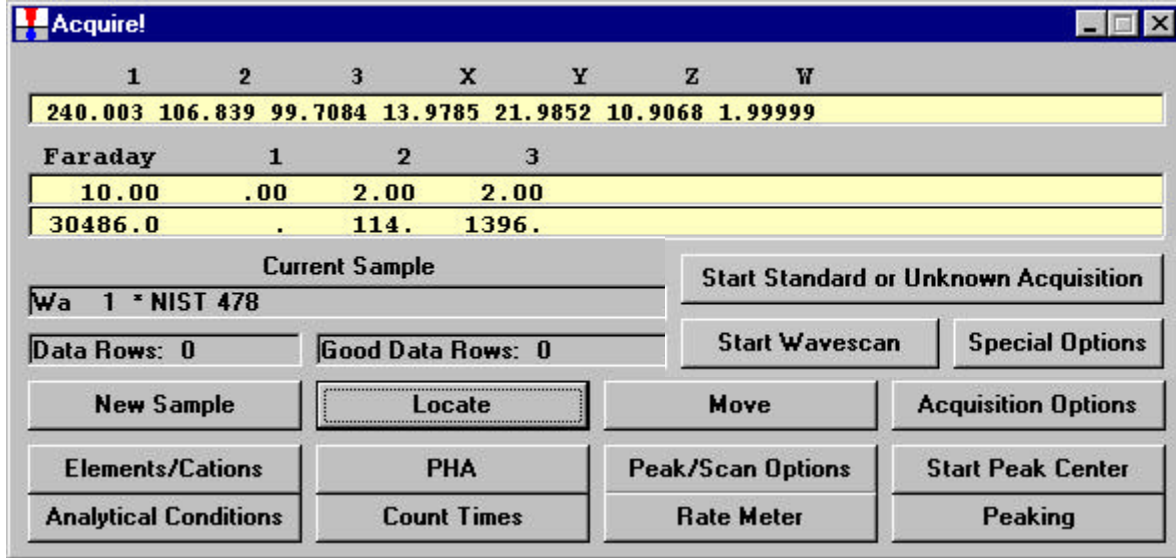
Insert <cr> >> Cartridge brass standard for background position check

To add standards to the standard list below, cancel this dialog, then click the Standard | Add Standards to Run menu items from the main menu

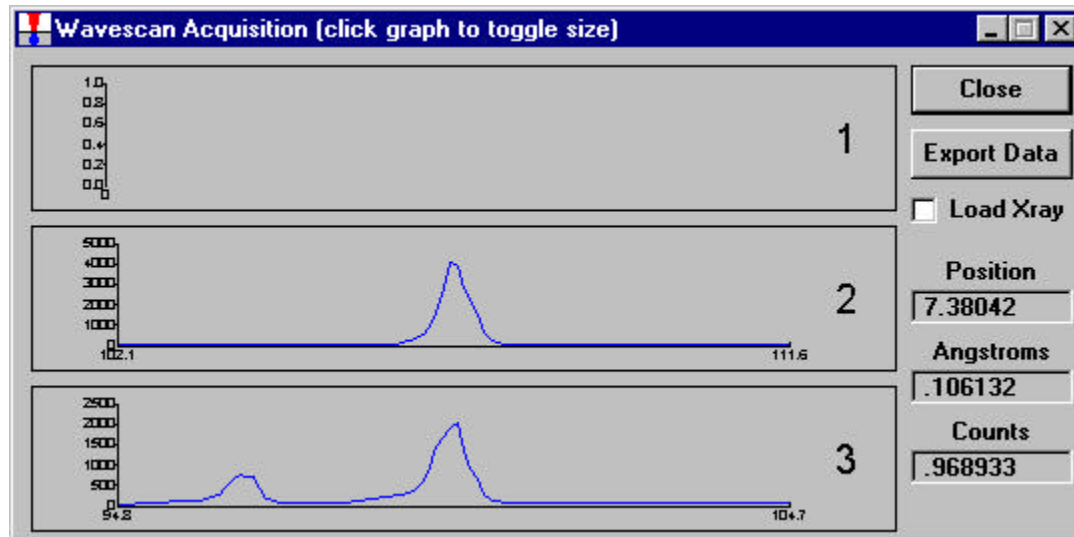
529 JEOL Copper
530 Zinc Taylor

Click **OK** when done.

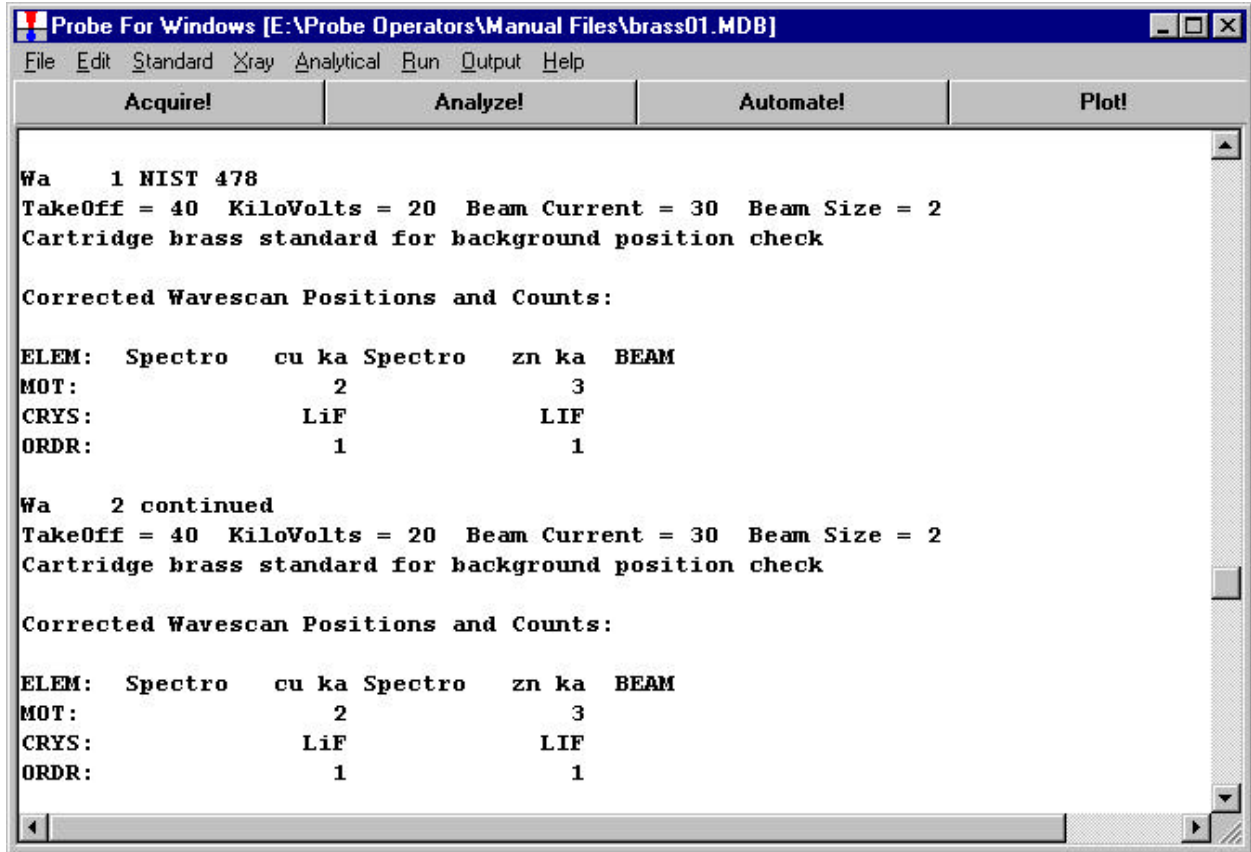
Click the **Start Wavescan** button of the **Acquire!** window.



example, simply copper and zinc. Graphical output of the completed scan via the **Wavescan Acquisition** window can be seen below.

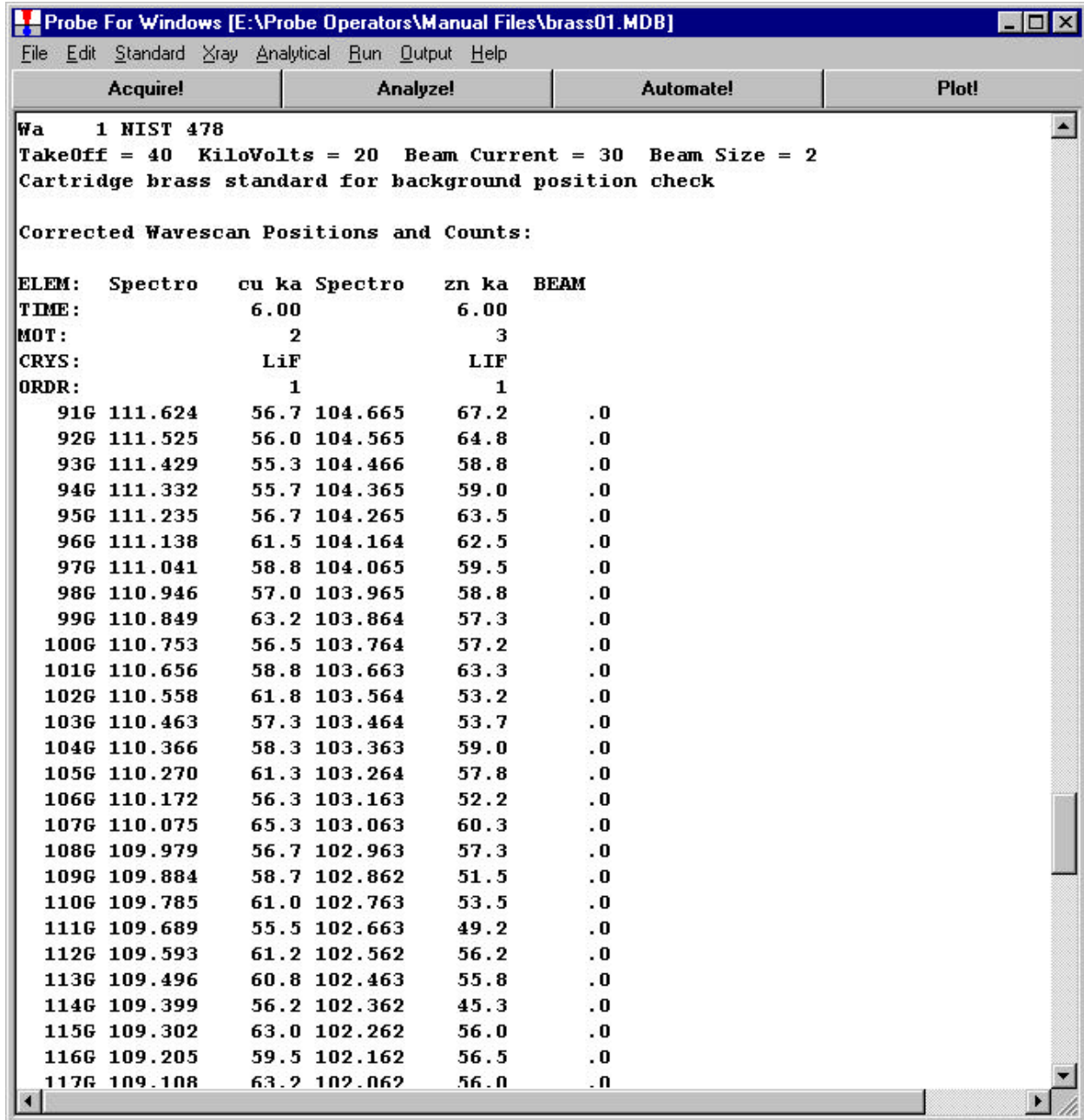


The wavescan labels appear in the main PROBE FOR WINDOWS log window.



The wavescan positions and counts may be displayed in the main log window by clicking the **Analyze!** button opening the **Analyze!** window. Select the *Wavescans* button, then click the **Select All** button and finally clicking the **Data** button.

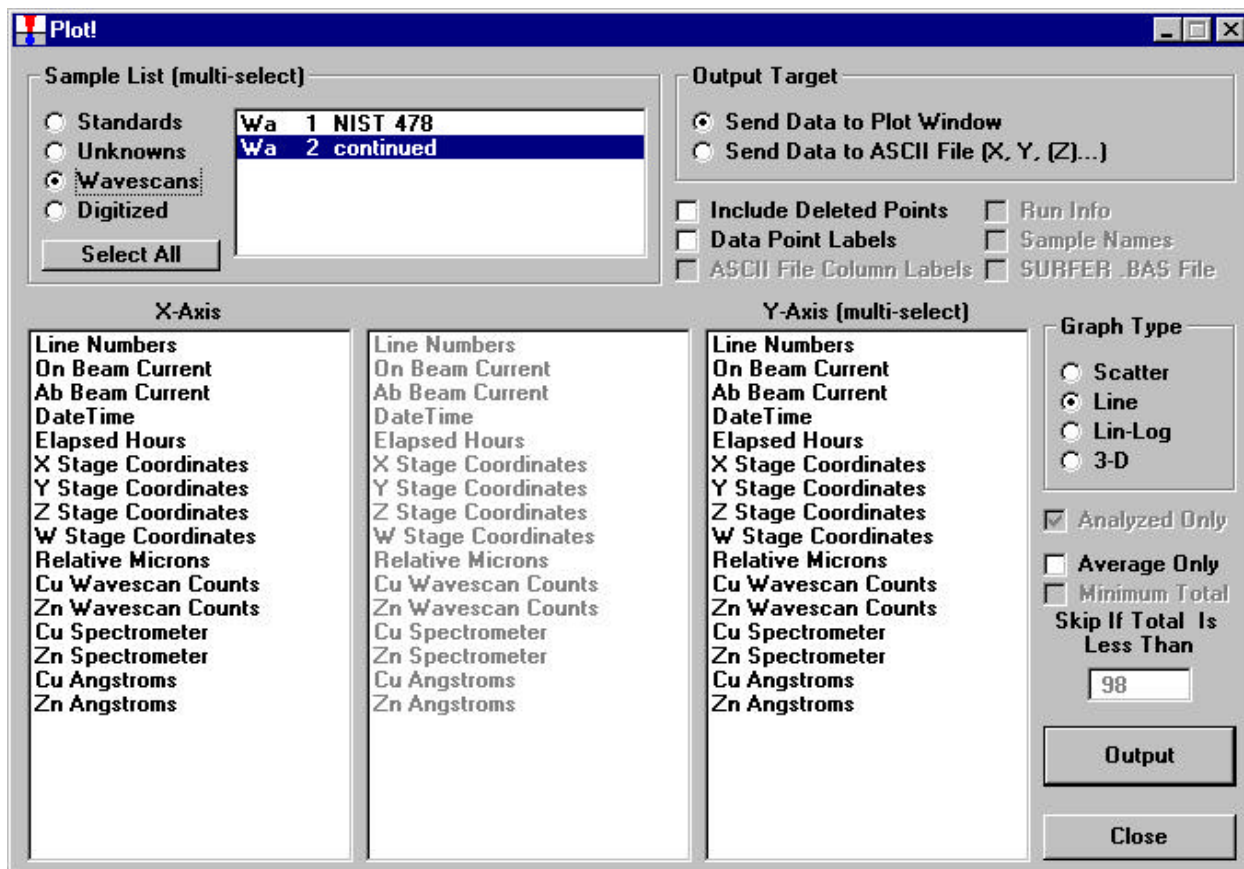
A portion of a very long list of data is illustrated below.



A more complete graphical display of these wavescans may be accomplished using the **Plot!** window.

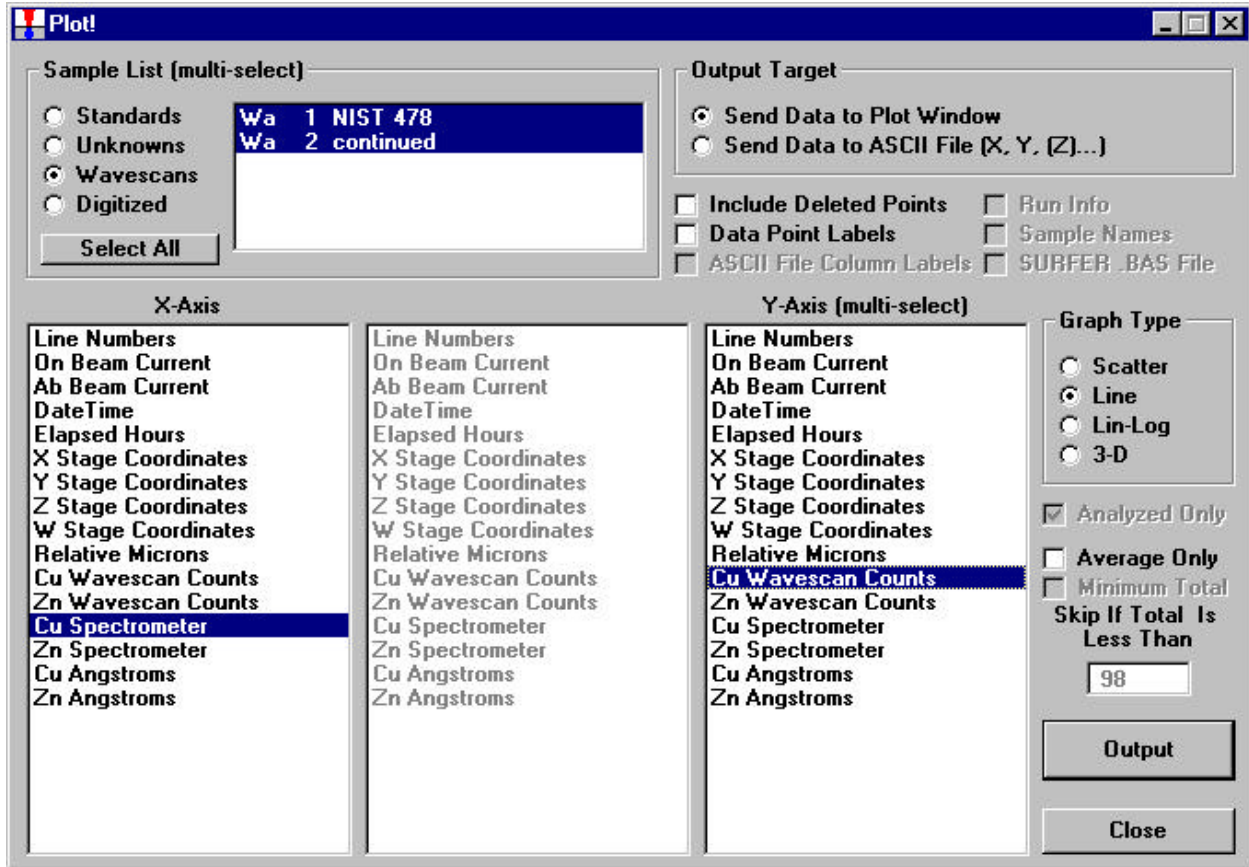
Off-Peak Adjustments from the Plot! Window

Click on the **Plot!** button under the main PROBE FOR WINDOWS log window. The **Plot!** dialog box opens.

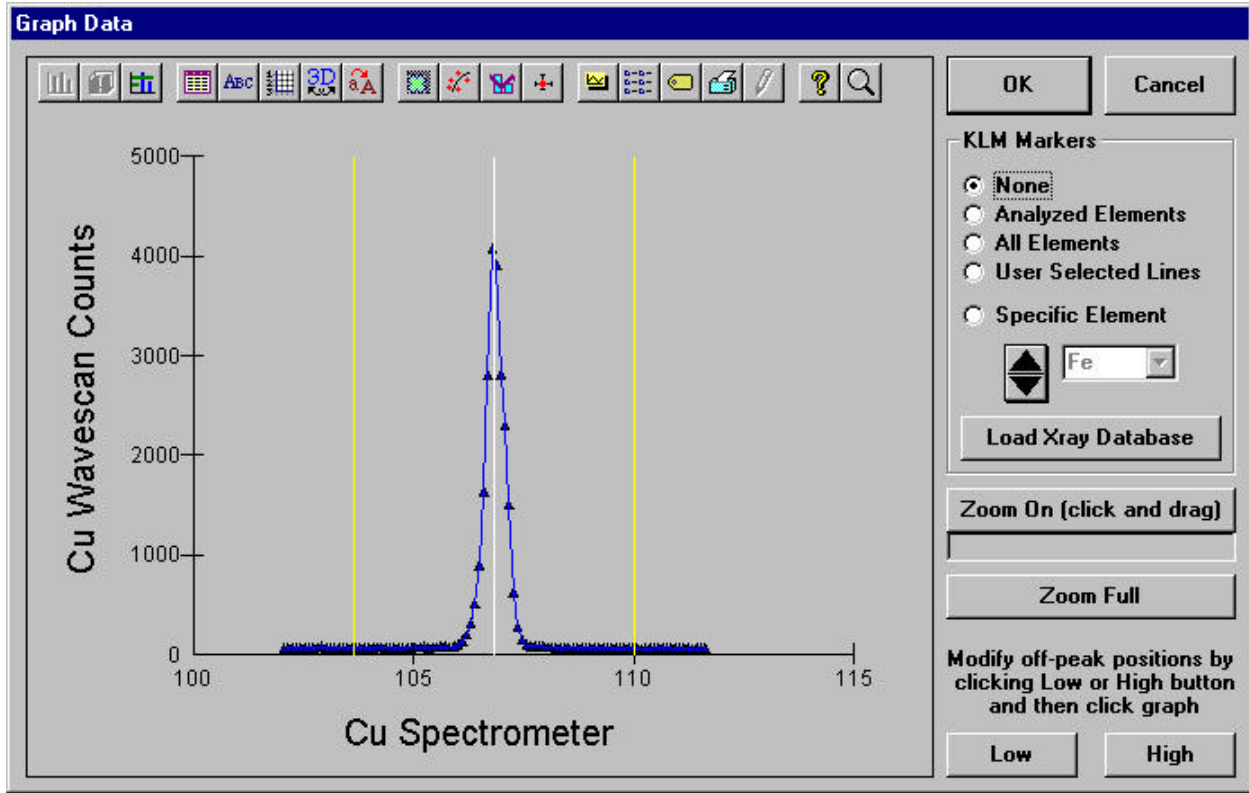


Under *Sample List* the *Wavescans* button should be clicked. Use the mouse to select both wavescan data samples. Since each sample can only accommodate 50 data points, a complete wavescan of 100 points is continued in two sample numbers.

Click on *Cu Spectrometer* from the X-Axis list and *Cu Wavescan Counts* from the Y-Axis list selections. Choose a *Graph Type*, click the *Line* button and an *Output Target* of *Send Data to Plot Window*. Finally, click the **Output** button to view the graph.

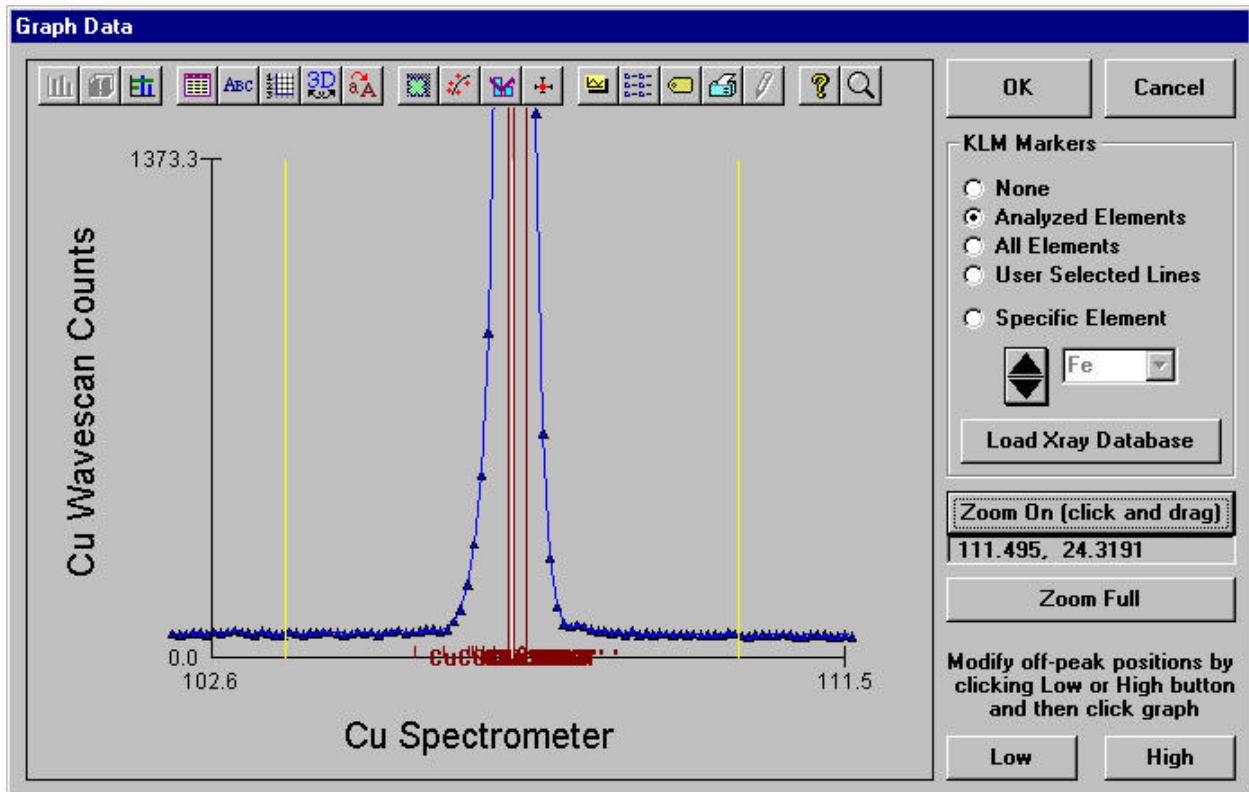


The program then loads the selected data into the **Graph Data** window.



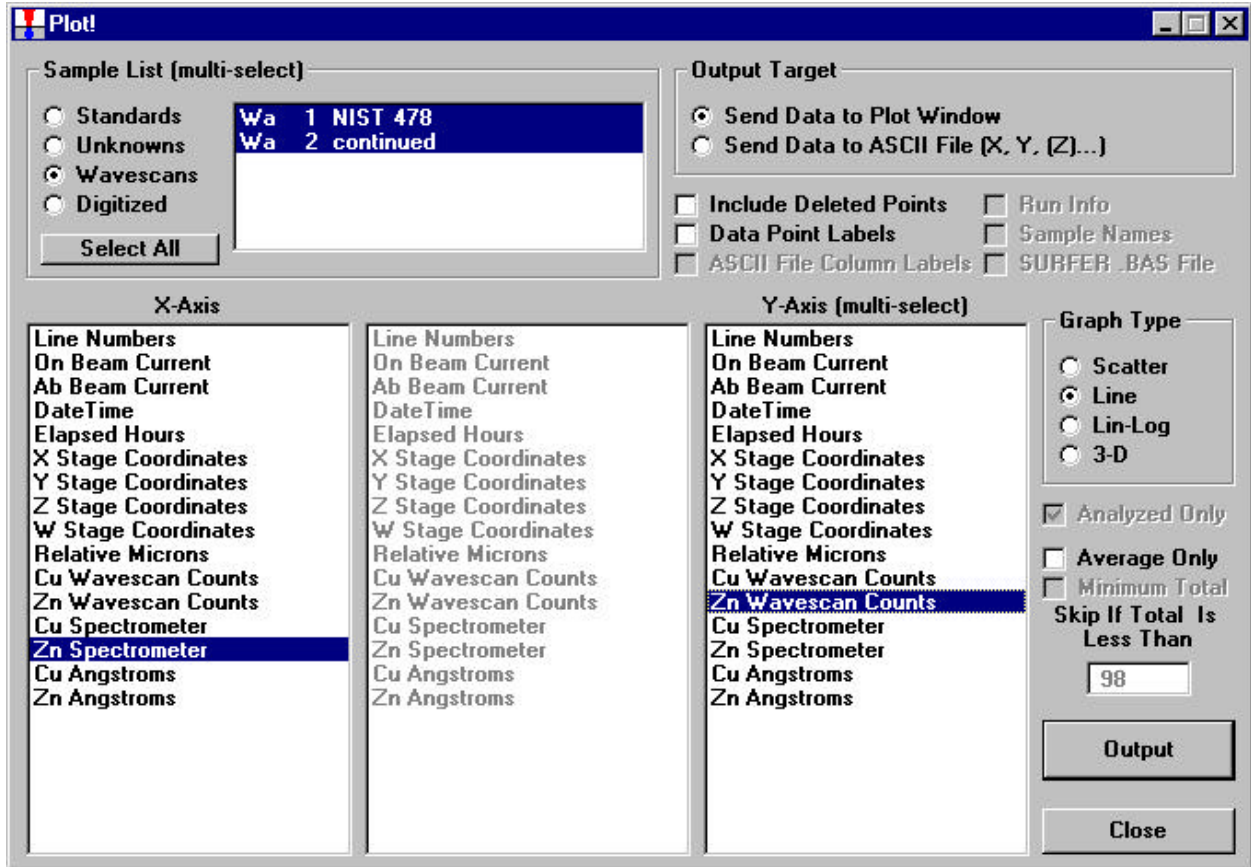
The **Graph Data** module allows a more robust treatment of the wavescan data. The plot of Cu Spectrometer position versus Cu Wavescan Counts is graphed as well as the locations of the on-peak and both off-peaks (vertical lines). Various options are available for evaluation of the data. Besides click and drag *Zoom* capabilities, a large selection of *KLM Markers* options may be enabled.

With the **Zoom On** button active, simply click and drag the mouse over the region the user wishes to magnify. The *Analyzed Elements* button of the *KLM Markers* may be selected, painting the various x-ray line positions for all analyzed elements into this plot.

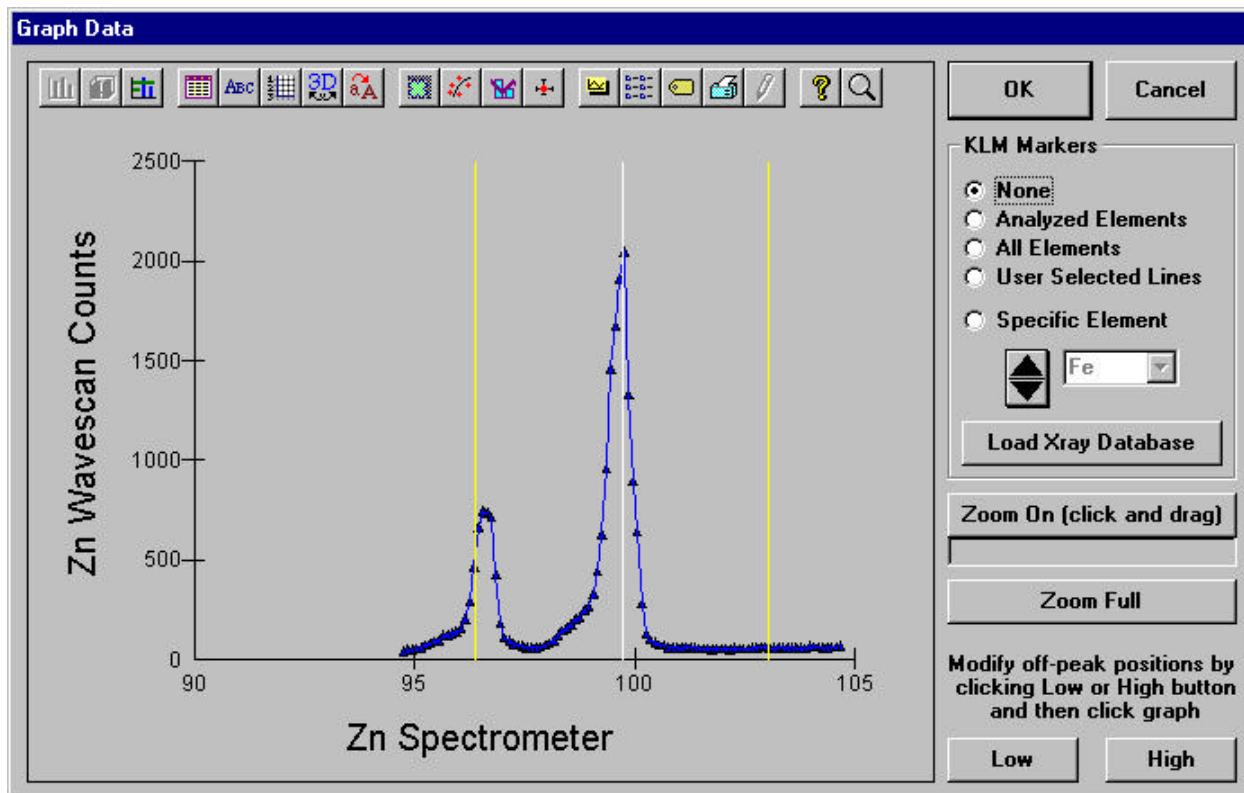


The default choices for both copper background positions (yellow vertical lines) appear sound as no analyzed element lies nearby and the background counts near these peaks are low. Click the **OK** button of the **Graph Data** window to return to the **Plot!** dialog box.

Next, the user evaluates the same data set for zinc. From the **Plot!** dialog box, select *Zn Spectrometer* from the *X-Axis* list and *Zn Wavescan Counts* from the *Y-Axis* list selections. Click the **Output** button.



The **Graph Data** window for the zinc data set is shown below. Two peaks are visible and the user observes that the low background position lies on top of the smaller unknown peak.



Use either the *KLM Markers* or the NIST x-ray database via the **Load Xray Database** button to evaluate the unknown peak. To open the NIST x-ray database, first click the *User Selected Lines* button, then click the **Load Xray Database** button opening the NIST x-ray line catalog.

The **Xray Database** window opens and the user may select or multi-select any x-ray line to plot on the **Graph Data** window, simply highlight a line(s) and click the **Graph Selected** button.

Xray Database

NIST Xray Lines (multi-select)

Xray Line	Angstroms	Energy	Intensity	Reference
Cu SKB''	1.38499	8.95207	1.00000	
Tl LI	1.38500	8.95201	5.78000	C
Os SLA^X	1.38589	8.94624	1.00000	
Yb LB9	1.38710	8.93846	.610000	C
Cu SKB7	1.38730	8.93719	1.00000	
Ra LG1 II	1.38920	17.8499	2.50000	
Cu SKB10	1.39130	8.91145	1.00000	
Os LA1	1.39150	8.91020	100.000	C
Hf LB4	1.39240	8.90444	10.1900	C
Cu KB1	1.39240	8.90444	13.4100	C
Cu KB3	1.39240	8.90444	6.84000	C
Cu SKB'	1.39351	8.89735	1.00000	
Np LB1 II	1.39581	17.7653	12.5000	
Cu SKB	1.39842	8.86611	1.00000	
Lu LB3	1.40170	8.84536	13.1000	C
Cu SKB1^4	1.40243	8.84077	1.00000	
Os LA2	1.40250	8.84031	11.3700	C
Zr KB1 II	1.40343	17.6689	3.75000	
Zr KB3 II	1.40443	17.6563	3.75000	
Cu SKBN	1.40774	8.80742	1.00000	
Cu SKBN	1.40854	8.80241	1.00000	

Graph Selected

Close

Highlight Element

cu

Load New Range

Minimum Intensity

.5

Start Angstroms

1.29683

Stop Angstroms

1.512533

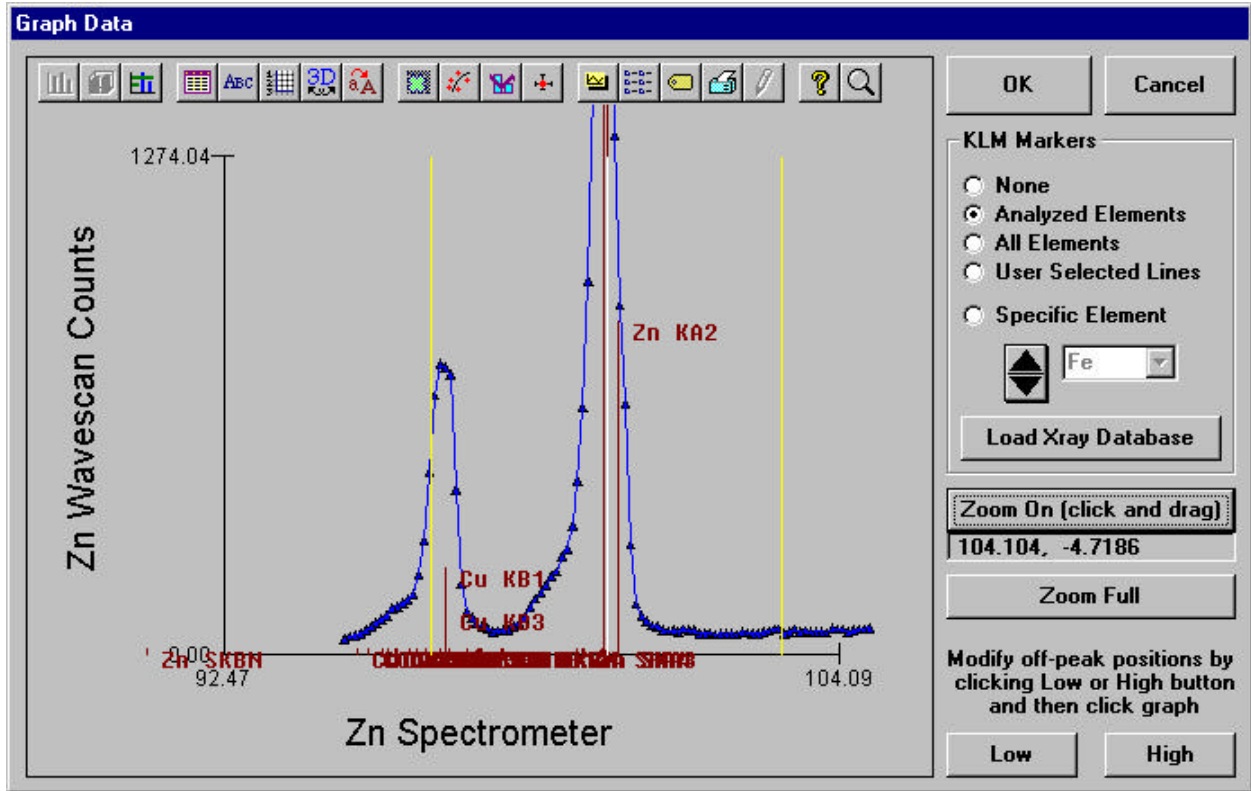
KeV

20

Copy to Clipboard

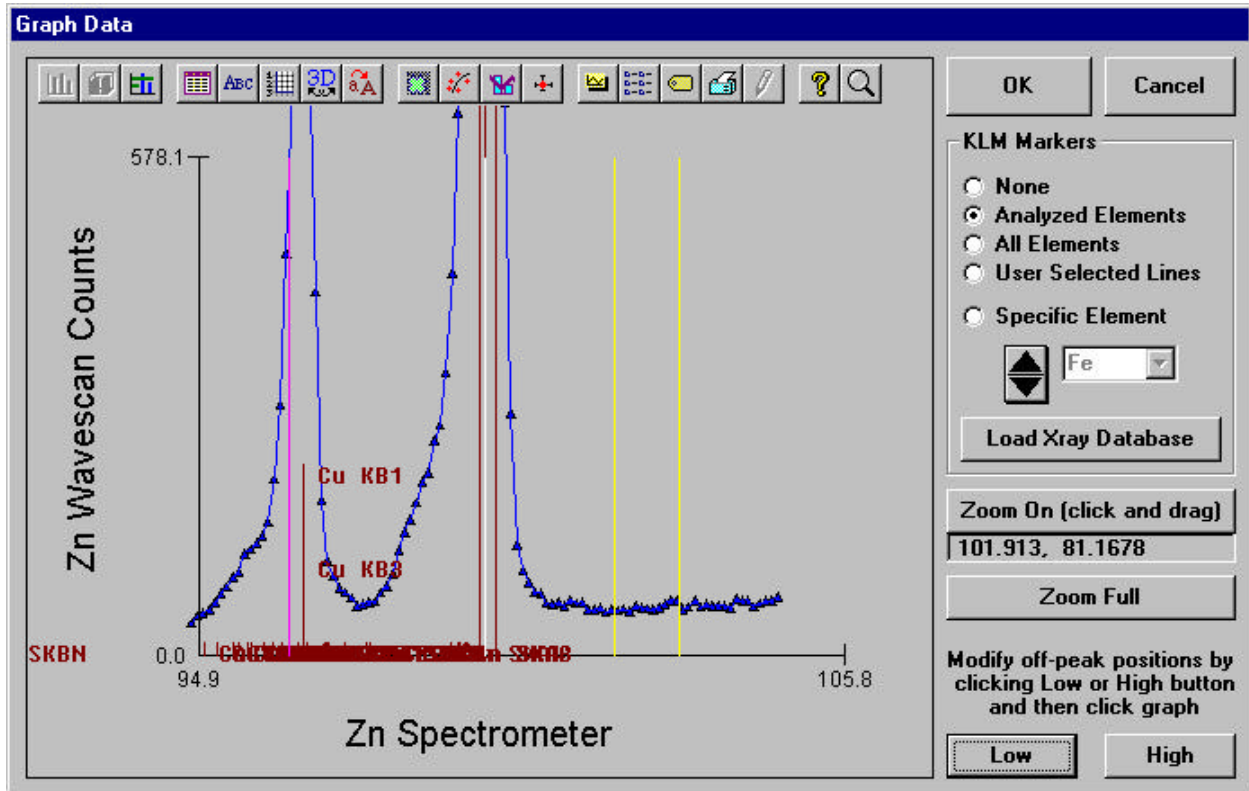
Copy Selected to Clipboard

Examination of the data suggests that the second peak is due to the copper $K\beta$ line. It is apparent that the low background position for zinc needs to be adjusted away from the copper $K\beta$ line.

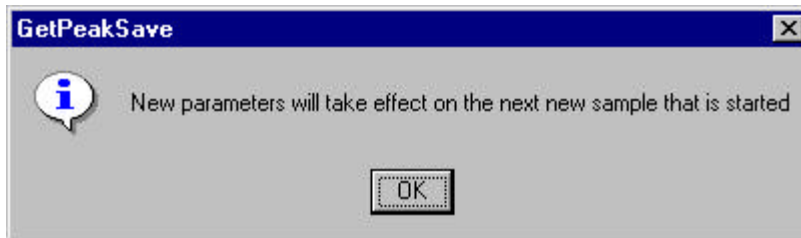


The user adjusts the low off-peak position by clicking the **Low** button, creating a crosshair on the **Graph Data** window. At any place on the plot the Zn Spectrometer position and Zn Wavescan Counts may be read, the values appear in the box below the two-way **Zoom On/ Hot Hit On** button. Move the crosshair to a new low background position and click the mouse. A new vertical line appears.

In the screen capture below both background positions are now on the same side (high side) of the peak avoiding all of the complicated x-ray structure around the low side of the zinc $K\alpha$ line. Alternatively, if the user scanned further out on the low side (to lower L number) of the copper $K\beta$ line, a suitable position for the low background may also be found.



Click the **OK** button to update this background position in the run and close the **Graph Data** window. The **GetPeakSave** window appears and the user is notified that new parameters (off-peak position) will take effect on the next new sample.

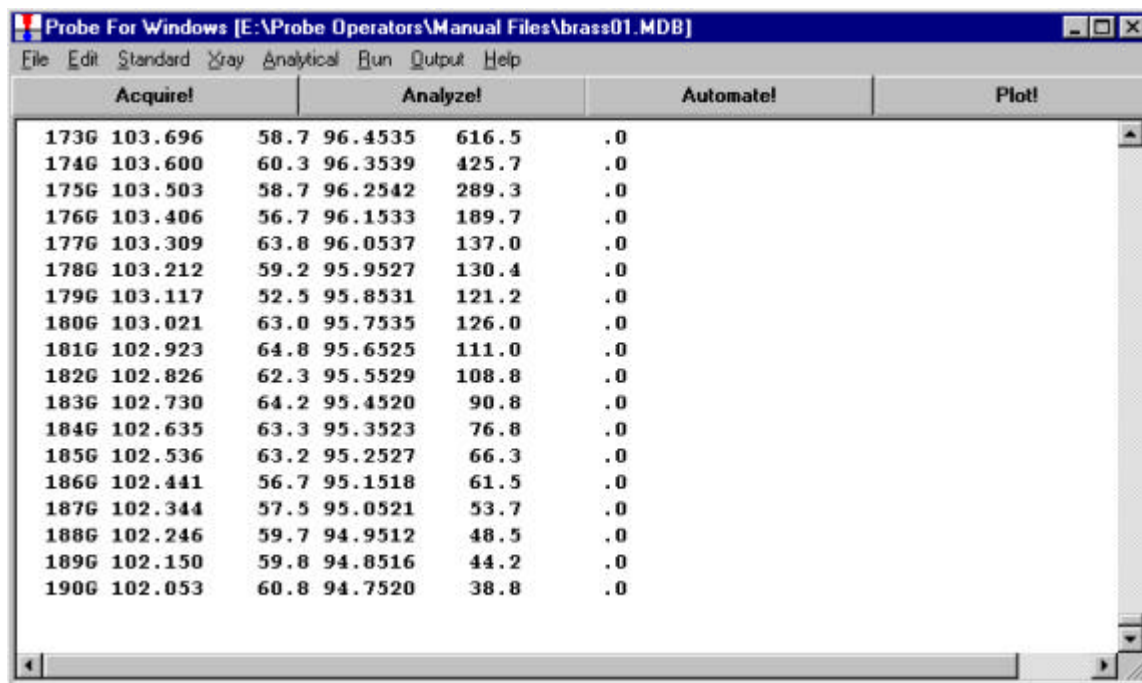


Click this **OK** button, returning to the **Plot!** window.

Finally, click the **Close** button to exit the **Plot!** window returning to the main PROBE FOR WINDOW log window.

Loading Standard Position Files

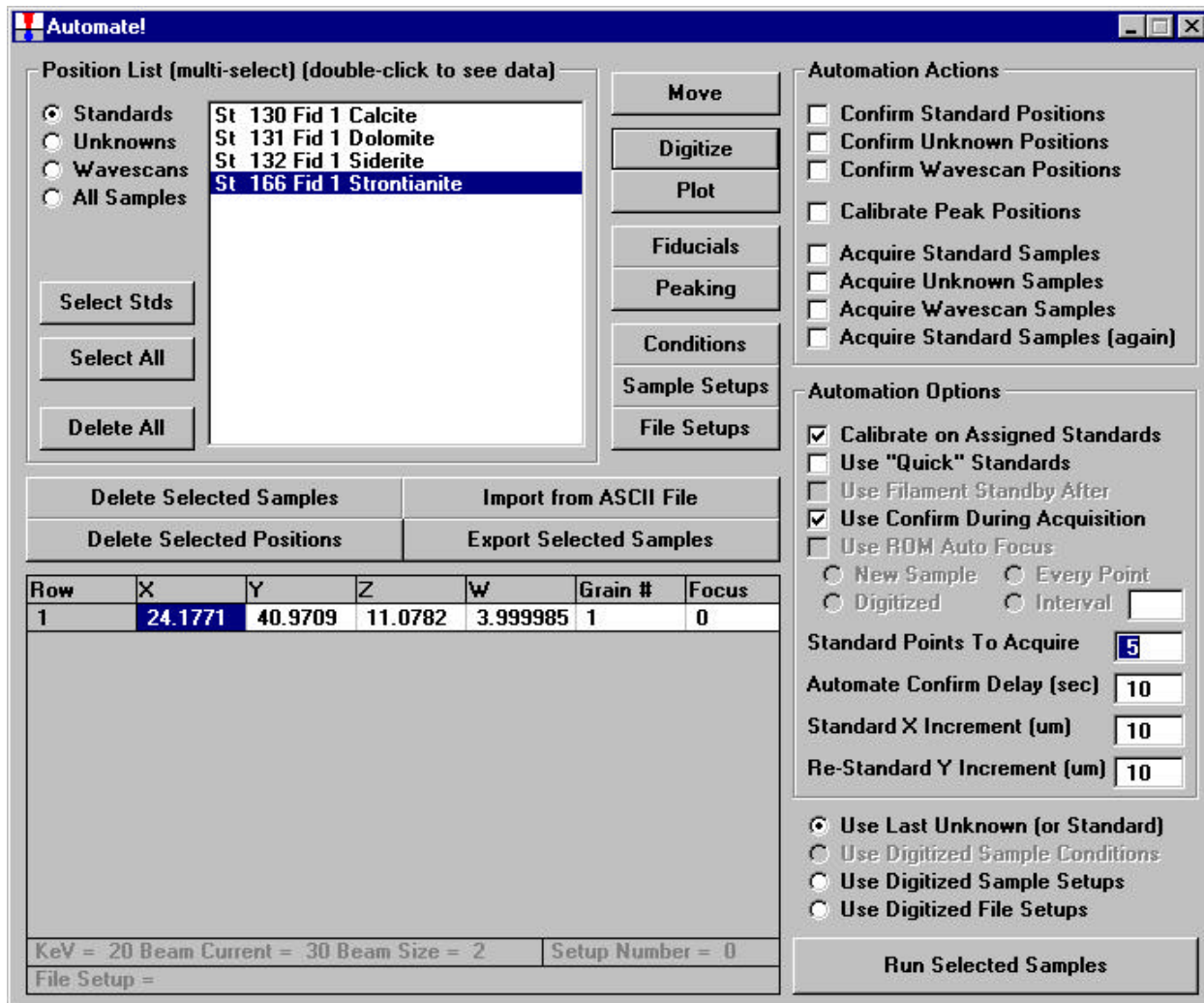
To run analytical standards using automation, requires that the computer know the physical location of all the standards for this run. Click the **Automate!** button from the main PROBE FOR WINDOWS log window.



The screenshot shows the 'Probe For Windows' application window. The title bar reads 'Probe For Windows [E:\Probe Operators\Manual Files\brass01.MDB]'. The menu bar includes 'File', 'Edit', 'Standard', 'X-ray', 'Analytical', 'Run', 'Output', and 'Help'. Below the menu bar are four buttons: 'Acquire!', 'Analyze!', 'Automate!', and 'Plot!'. The main area contains a table with 18 rows of data. Each row starts with a sample ID (e.g., 173G) followed by a numerical value, and then four columns of data. The last column in each row contains a value of .0.

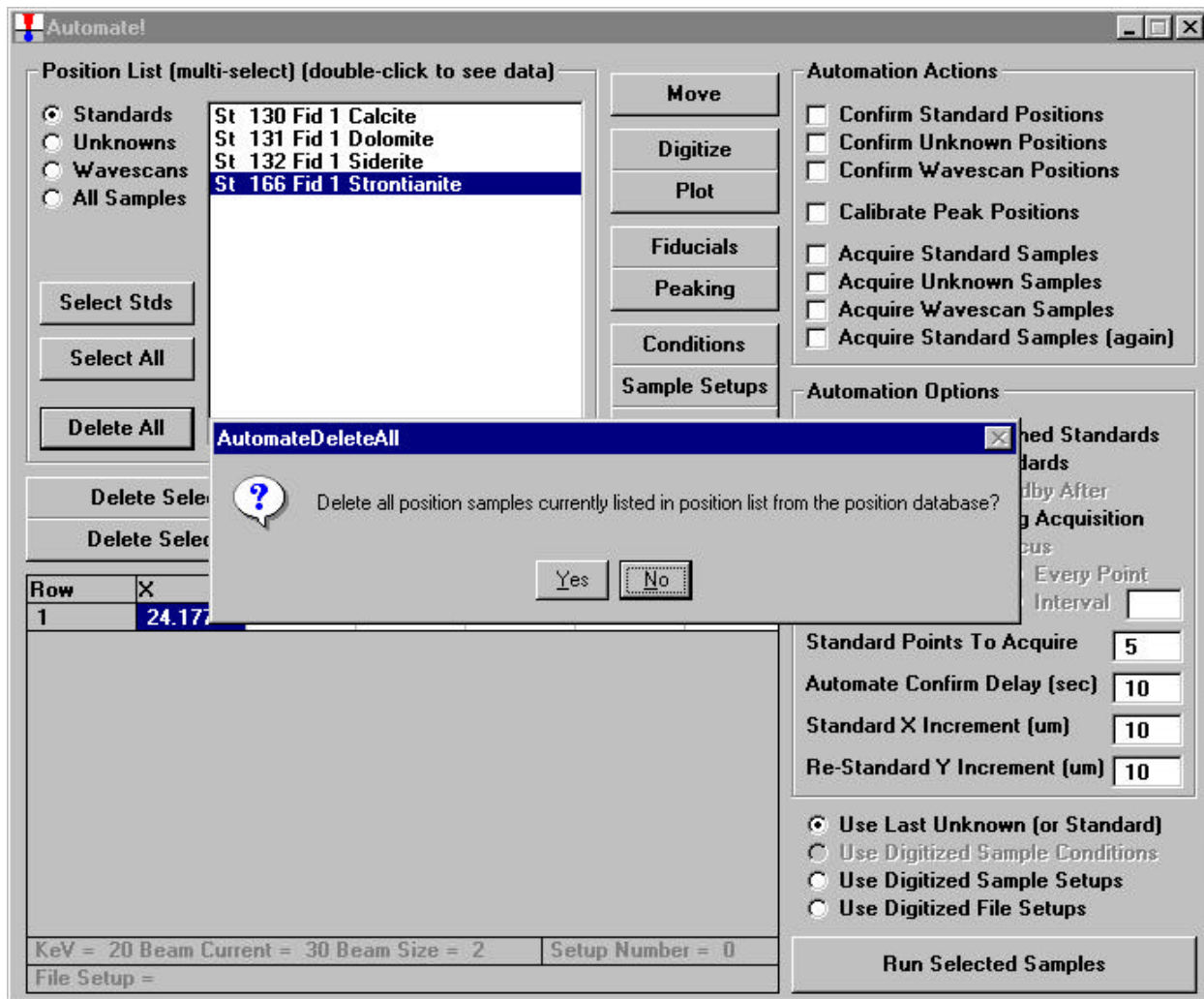
	Acquire!	Analyze!	Automate!	Plot!
173G	103.696	58.7 96.4535	616.5	.0
174G	103.600	60.3 96.3539	425.7	.0
175G	103.503	58.7 96.2542	289.3	.0
176G	103.406	56.7 96.1533	189.7	.0
177G	103.309	63.8 96.0537	137.0	.0
178G	103.212	59.2 95.9527	130.4	.0
179G	103.117	52.5 95.8531	121.2	.0
180G	103.021	63.0 95.7535	126.0	.0
181G	102.923	64.8 95.6525	111.0	.0
182G	102.826	62.3 95.5529	108.8	.0
183G	102.730	64.2 95.4520	90.8	.0
184G	102.635	63.3 95.3523	76.8	.0
185G	102.536	63.2 95.2527	66.3	.0
186G	102.441	56.7 95.1518	61.5	.0
187G	102.344	57.5 95.0521	53.7	.0
188G	102.246	59.7 94.9512	48.5	.0
189G	102.150	59.8 94.8516	44.2	.0
190G	102.053	60.8 94.7520	38.8	.0

This opens the **Automate!** dialog box shown below.

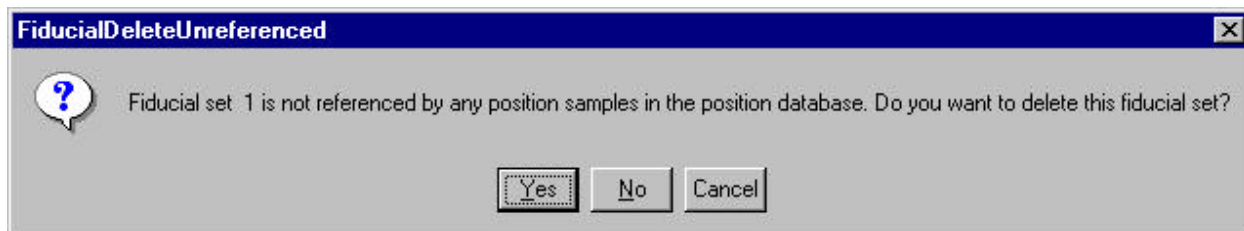


The last set of digitized standards used is visible in the *Position List* list box of the **Automate!** window. Currently, the four carbonate standards digitized for an earlier section of this manual are listed. These will be deleted and replaced by the appropriate standard position file(s). Normally, after initial setup, several sets of digitized standard positions would be visible in this list. Typically, the user would not delete these but rather append other position files to the list.

Click the **Delete All** button. This opens the **AutomateDeleteAll** window, seen below. Click the **Yes** button of the **AutomateDeleteAll** window to clear the *Position List* list box of all displayed position samples.

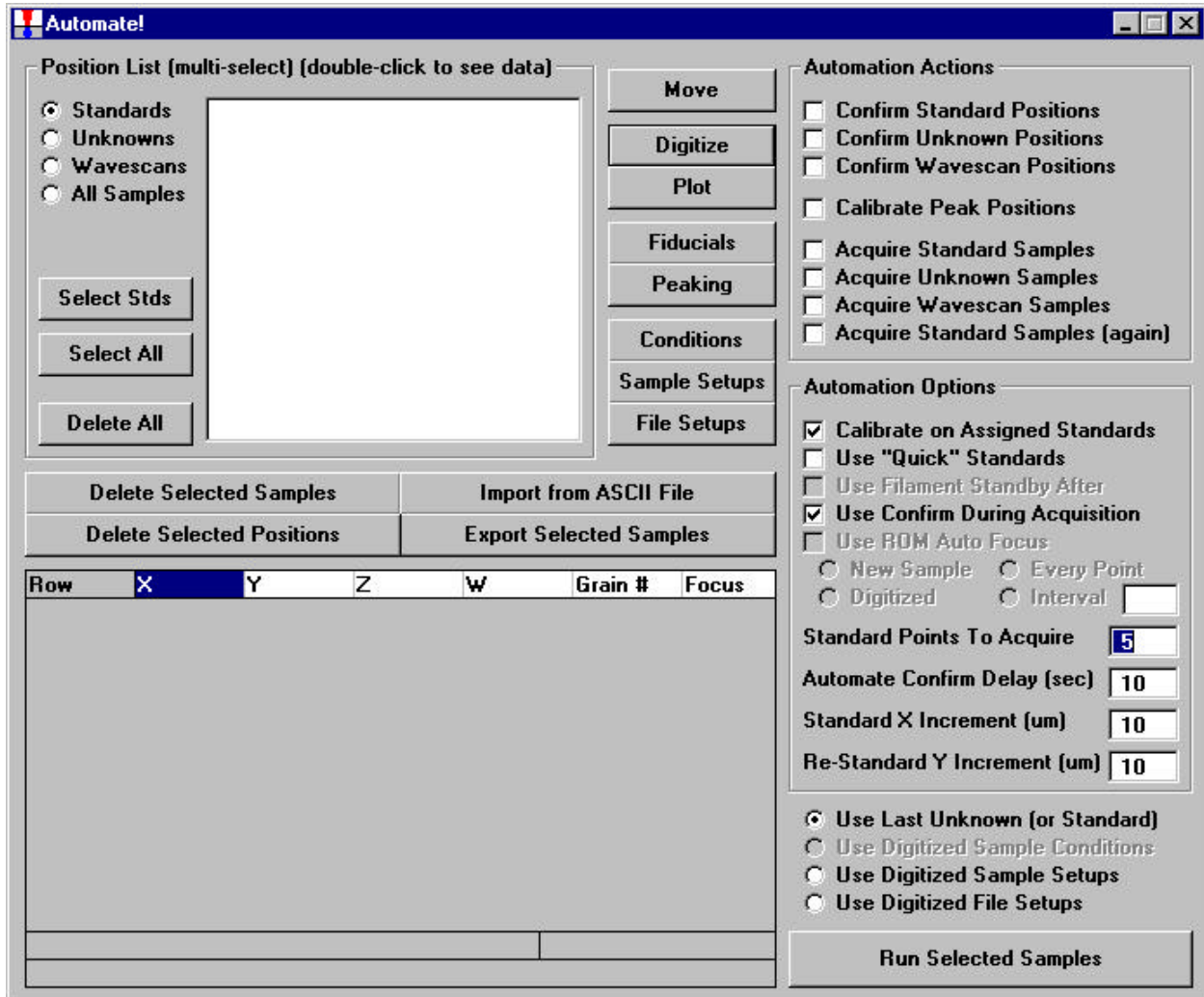


The **FiducialDeleteUnreferenced** window opens.

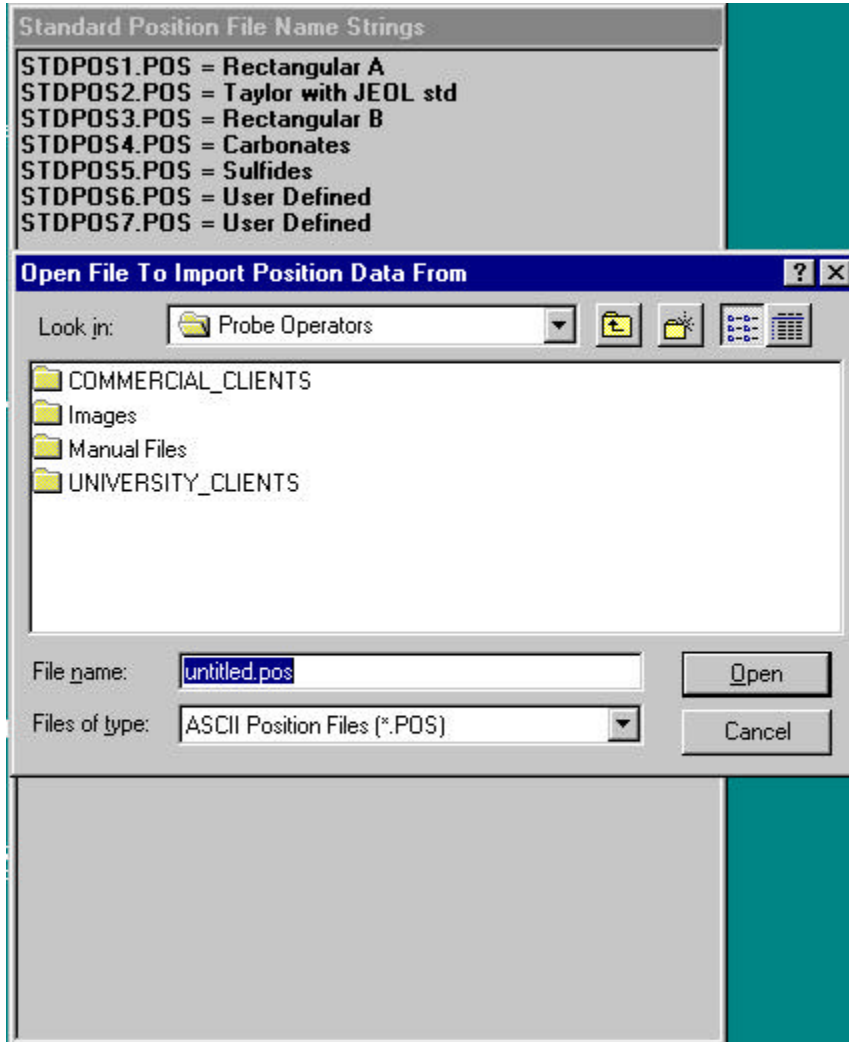


Click the **Yes** button to clear the fiducial coordinate set from the position database.

Click the **Import from ASCII File** button of the **Automate!** dialog box to import position samples from a previously saved ASCII file.

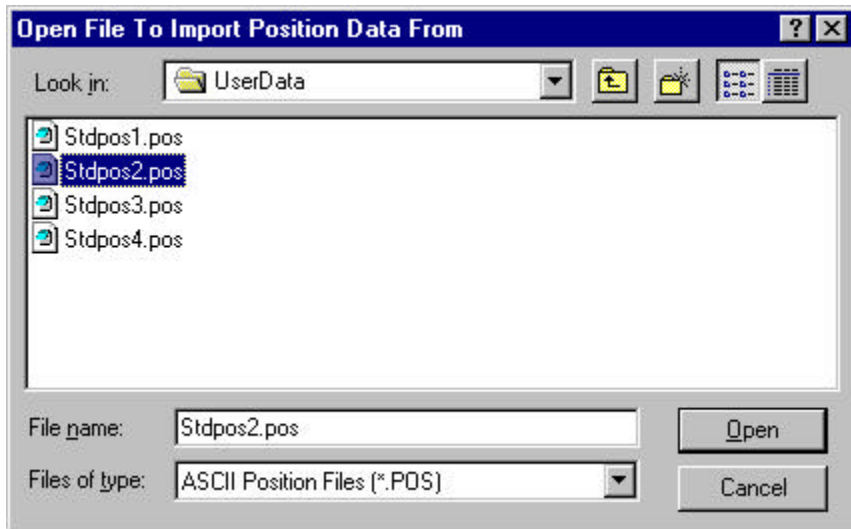


This action opens both the **Standard Position File Name Strings** and the **Open File To Import Position Data From** windows. The former window is based on the name strings in the PROBEWIN.INI file. It is assumed that the user has previously digitized all standard blocks and created STDPOSx.POS files. The metal standards to be used in the brass analysis are digitized in STDPOS2.POS.

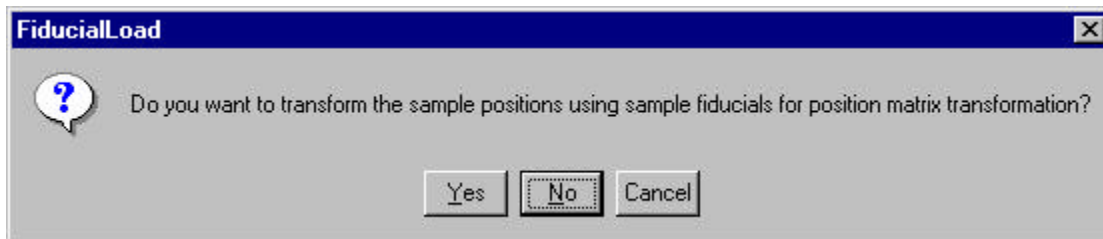


The *.POS files are located in C:\Program Files\Probe for Windows\UserData directory. Edit the *Look in:* location.

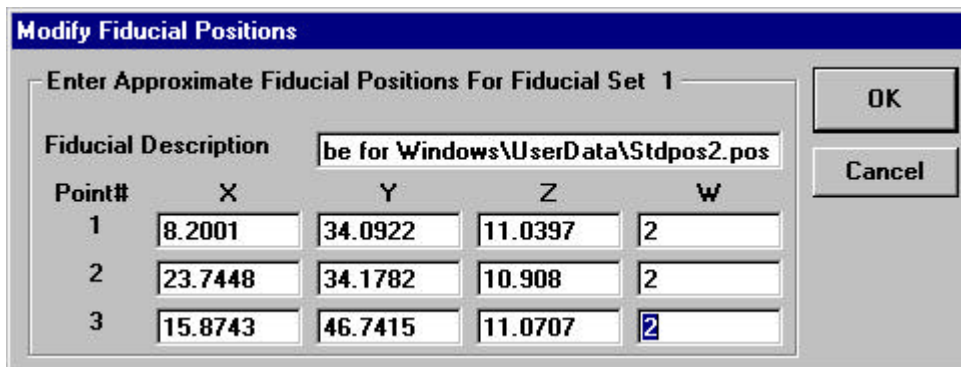
Type in the appropriate file name in the *File name* text box or simply highlight the file in the list and click the **Open** button.



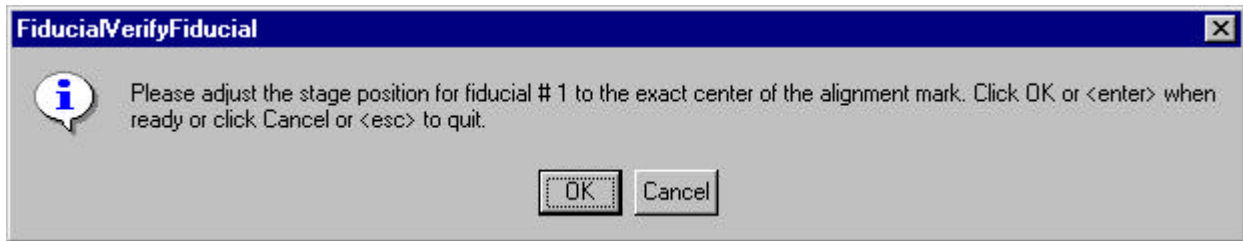
This action opens the **FiducialLoad** window. Click the **Yes** button to do a fiducial transformation on this pre-digitized standard block to obtain an accurate set of standard positions.



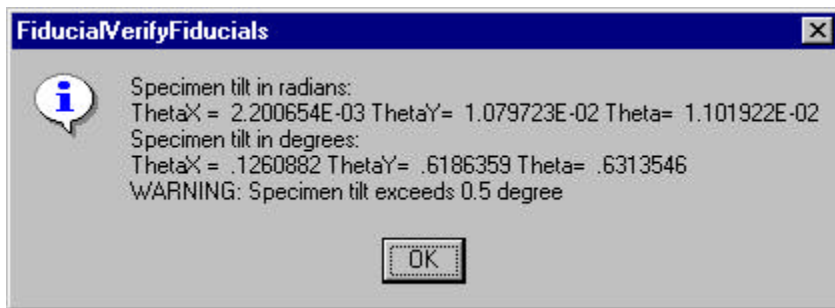
The **Modify Fiducial Positions** window opens. Normally the user would simply accept the defaults or edit the position text boxes for each point, including the appropriate stage location number (JEOL 733 use appropriate W stage position). When done, click the **OK** button.



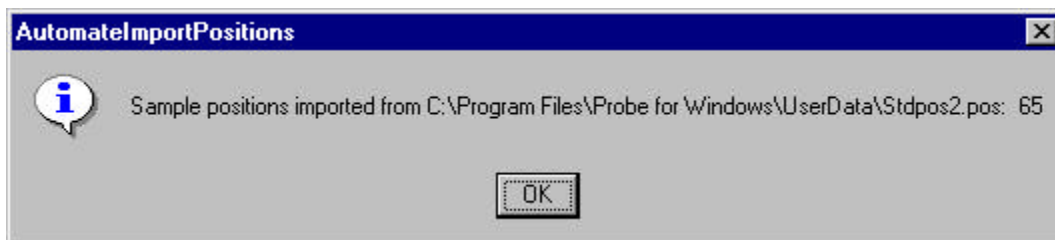
This action causes the stage motors to drive to the first fiducial coordinate in its lookup table. The **FiduciaVerifyFiducial** window appears. Adjust the stage motors to center the first fiducial mark, click the **OK** button.



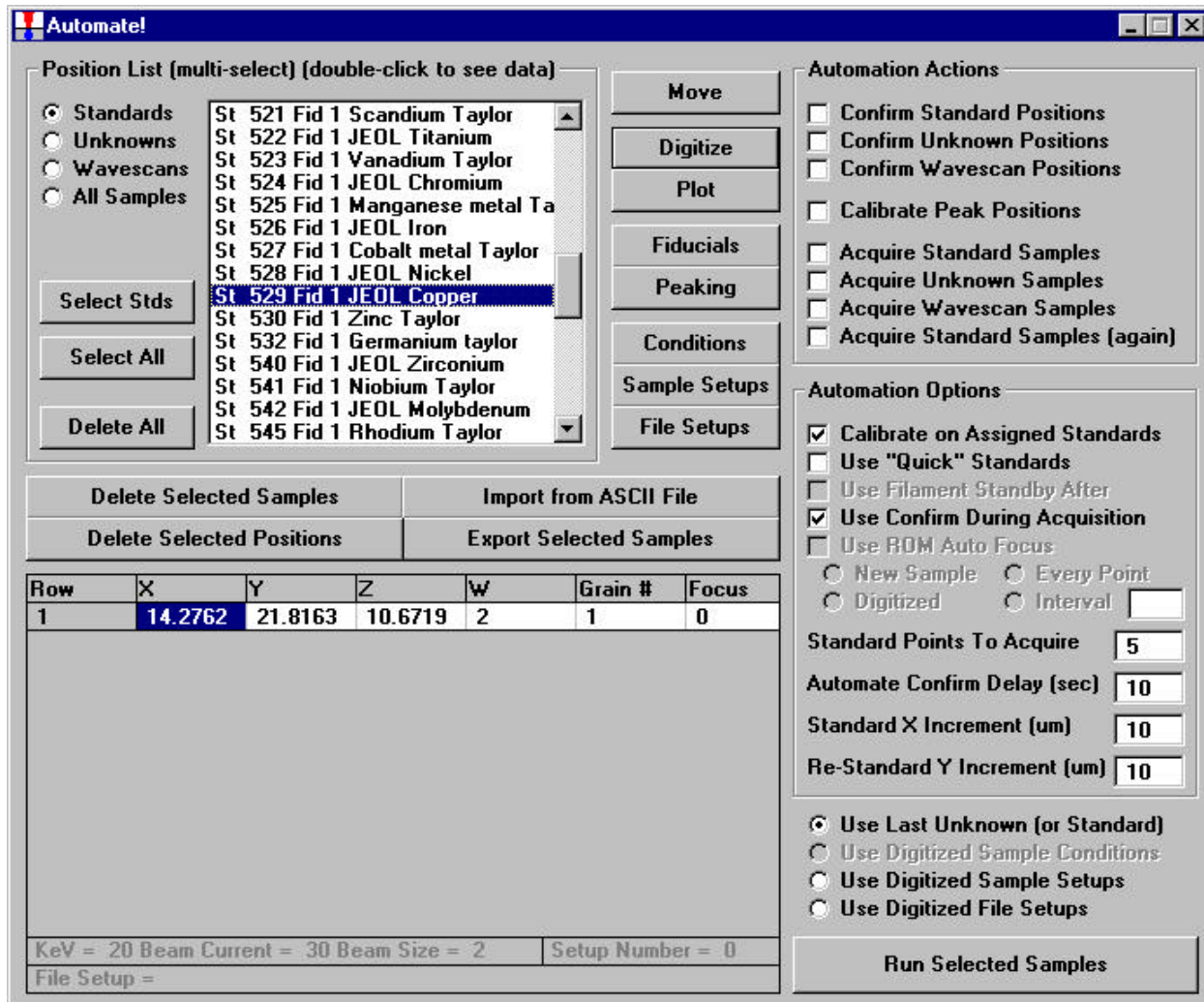
The computer will drive to each of the three fiducial marks for centering. Clicking the **OK** button after the third fiducial mark opens the **FiducialsVerifyFiducials** window. Click this **OK** button.



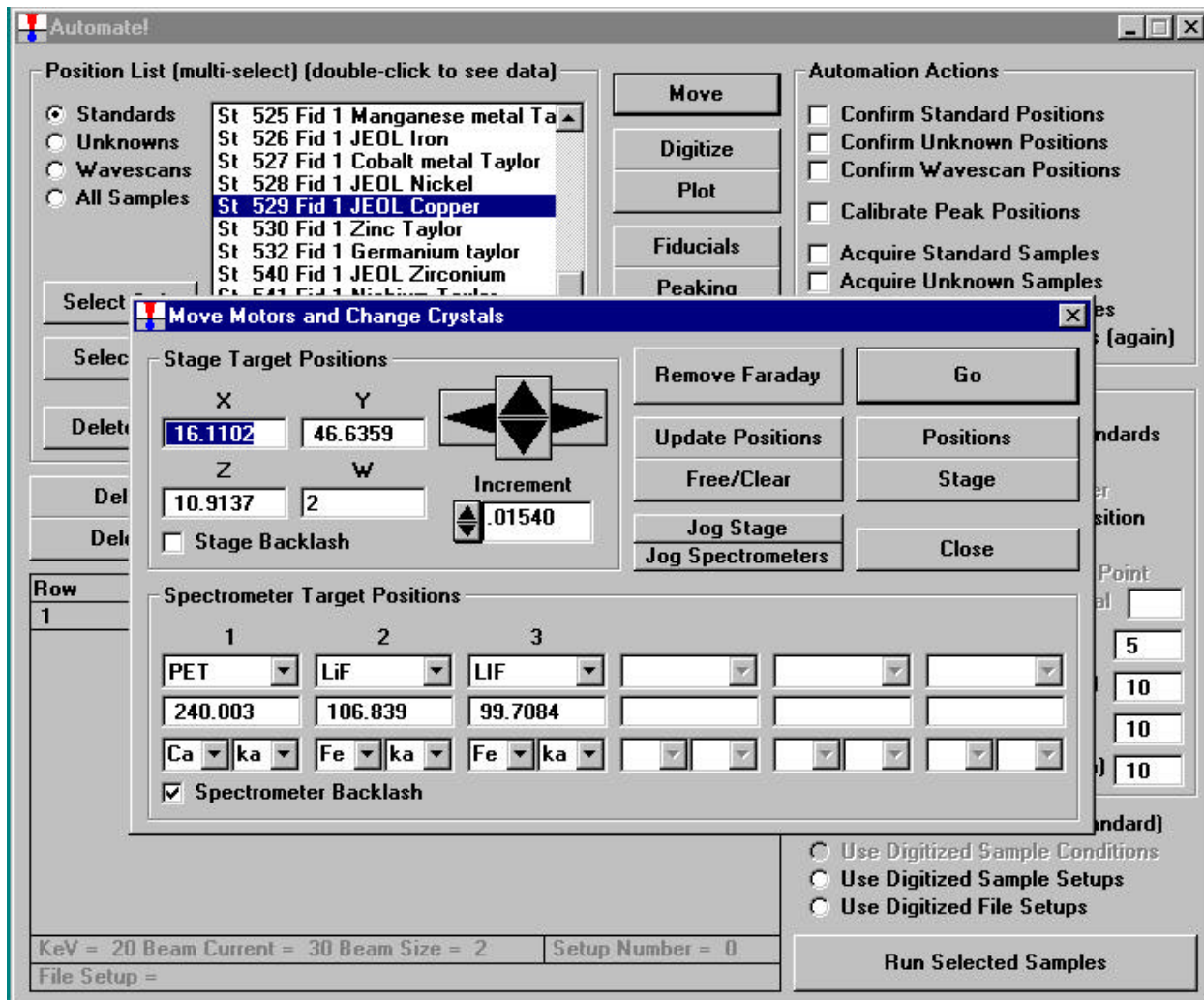
The program then imports and updates the position coordinates of all of the standards in the pre-digitized standard position file. The **AutomateImportPositions** window opens. Click the **OK** button returning to the **Automate!** window.



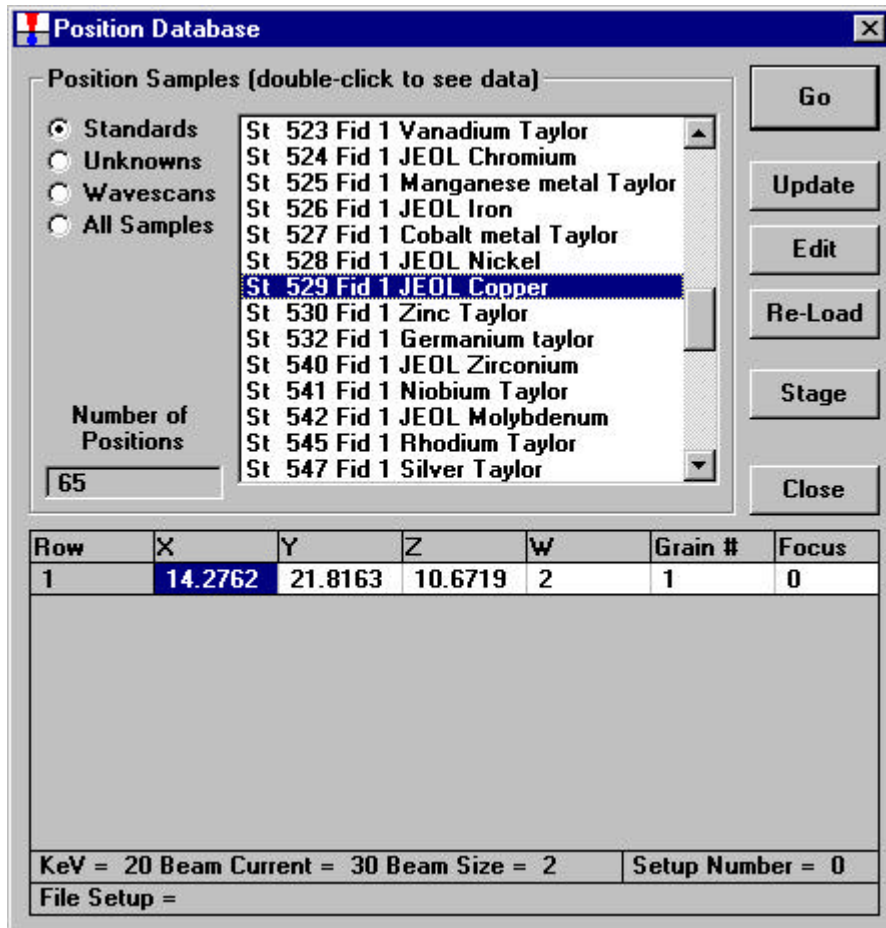
The **Automate!** window would appear as below. The currently transformed standard position file is listed in the *Position List* list box. In this example, the copper standard, number 529, has been highlighted and its coordinates are visible. If an additional standard position file (standard block) is required for use in the automation, the same procedure would be followed.



All of the standards listed in the *Position List* list box may now be accessed by the program during any automation action. For instance, it is now possible to have the computer drive to any standard on this block. The user may click the **Move** button of the **Automate!** window opening the **Move Motors and Change Crystals** dialog box. Then, click the **Positions** button.



This opens the **Position Database** dialog box. From here any sample that has been digitized can be located by simply selecting it and clicking the **Go** button.



Once the stage motors drive the stage to the chosen standard, exit the **Position Database** by clicking the **Close** button. Likewise, the user may close the **Move Motors and Change Crystals** window by clicking its **Close** button, returning to the **Automate!** window.

Automation Actions

Confirm Standard Positions

All of the basic peak centering and x-ray count acquisition procedures may be automated. This is accomplished via the **Automate!** window.

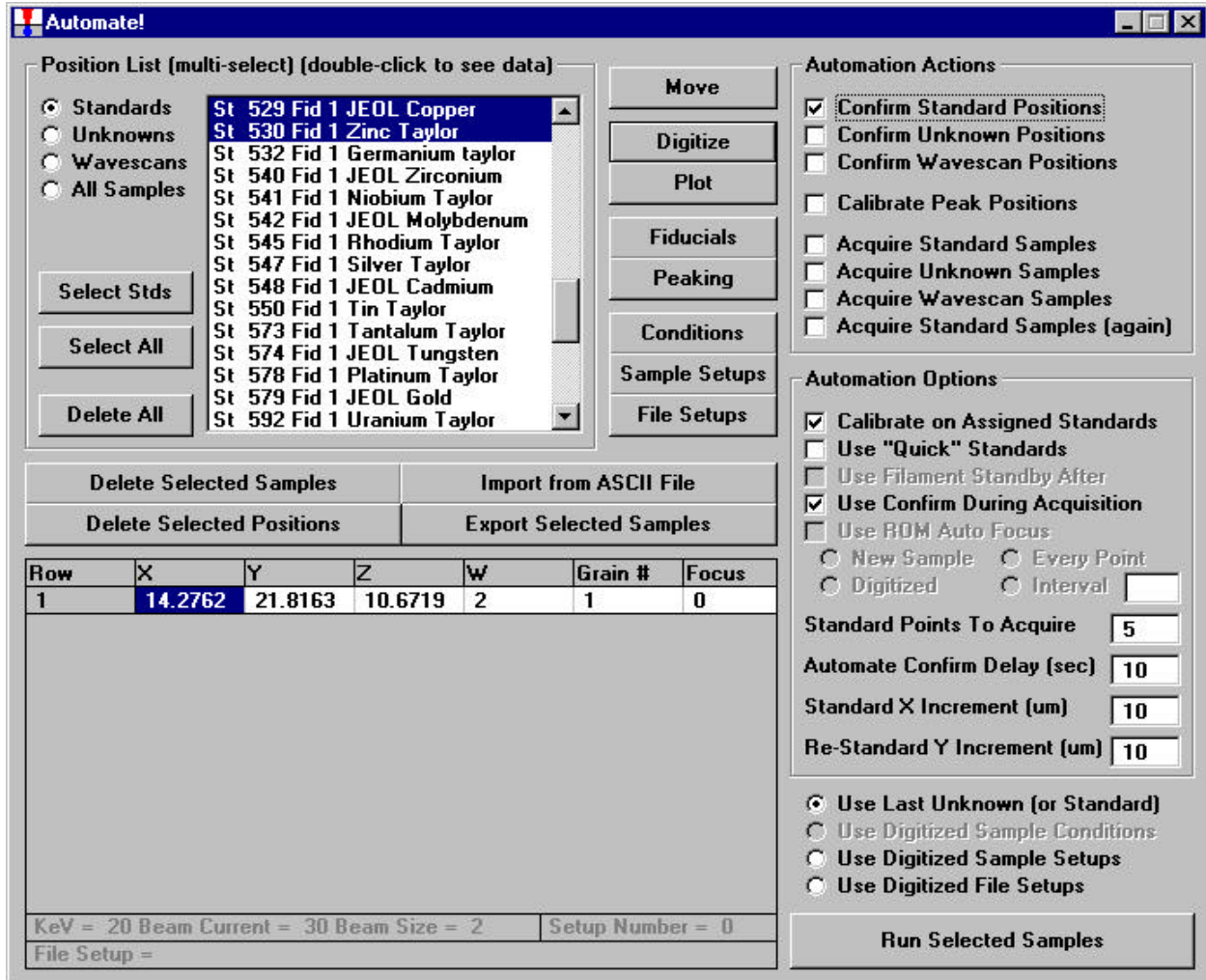
Click the **Select Stds** button of the **Automate!** dialog box. All standards that have been added to the current run will be highlighted in the *Position List* list box. In this example, the two standards copper (529) and zinc (530) metal are highlighted.

The screenshot shows the Automate! dialog box with the following components:

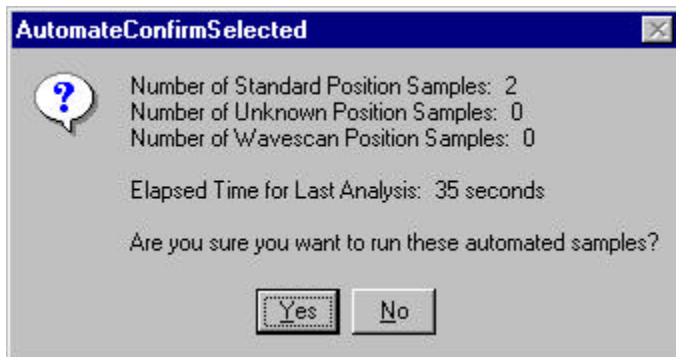
- Position List (multi-select) (double-click to see data)**: A list of standards with radio buttons for selection. The first two, "St 529 Fid 1 JEOL Copper" and "St 530 Fid 1 Zinc Taylor", are selected.
- Automation Actions**: A group of checkboxes for various actions, all of which are currently unchecked.
- Automation Options**: A group of checkboxes and radio buttons for automation settings. "Calibrate on Assigned Standards" and "Use Confirm During Acquisition" are checked.
- Buttons**: "Move", "Digitize", "Plot", "Fiducials", "Peaking", "Conditions", "Sample Setups", "File Setups", "Select Stds", "Select All", "Delete All", "Delete Selected Samples", "Import from ASCII File", "Delete Selected Positions", "Export Selected Samples", and "Run Selected Samples".
- Table**: A table with columns for Row, X, Y, Z, W, Grain #, and Focus. The first row is highlighted.
- Footer**: Displays "KeV = 20 Beam Current = 30 Beam Size = 2" and "Setup Number = 0".

Row	X	Y	Z	W	Grain #	Focus
1	14.2762	21.8163	10.6719	2	1	0

The user might start by checking the location and focus of each standard selected for the automated analysis. Click the box for *Confirm Standard Positions* under *Automation Actions*. Click the **Run Selected Samples** button.

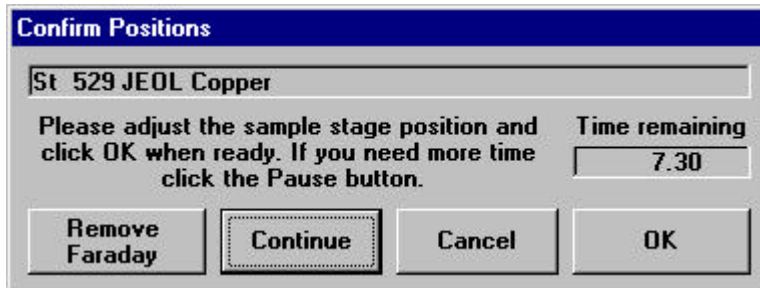


The **AutomateConfirmSelected** window opens informing the user that two standards were chosen and asks if the user wants to run these automated samples, click **Yes**.

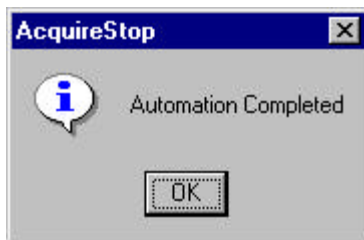


The program then sends the stage motors to the fiducial transformed coordinates for the first selected standard and opens the **Confirm Positions** window. Clicking the two-way **Pause/Continue** button suspends the 10 second countdown (user defined in the PROBEWIN.INI file). Adjust the stage motors (X , Y, and Z) to a new, clean analysis position. Click the **OK** button of the **Confirm Positions** window when done, sending the stage to the next standard to confirm its position. Again, the **Confirm Positions** window opens, allowing the user to pause the countdown and adjust the sample position.

If more than one position is digitized, the software moves to the first position and updates all positions for that sample by the same X, Y, and Z offset.



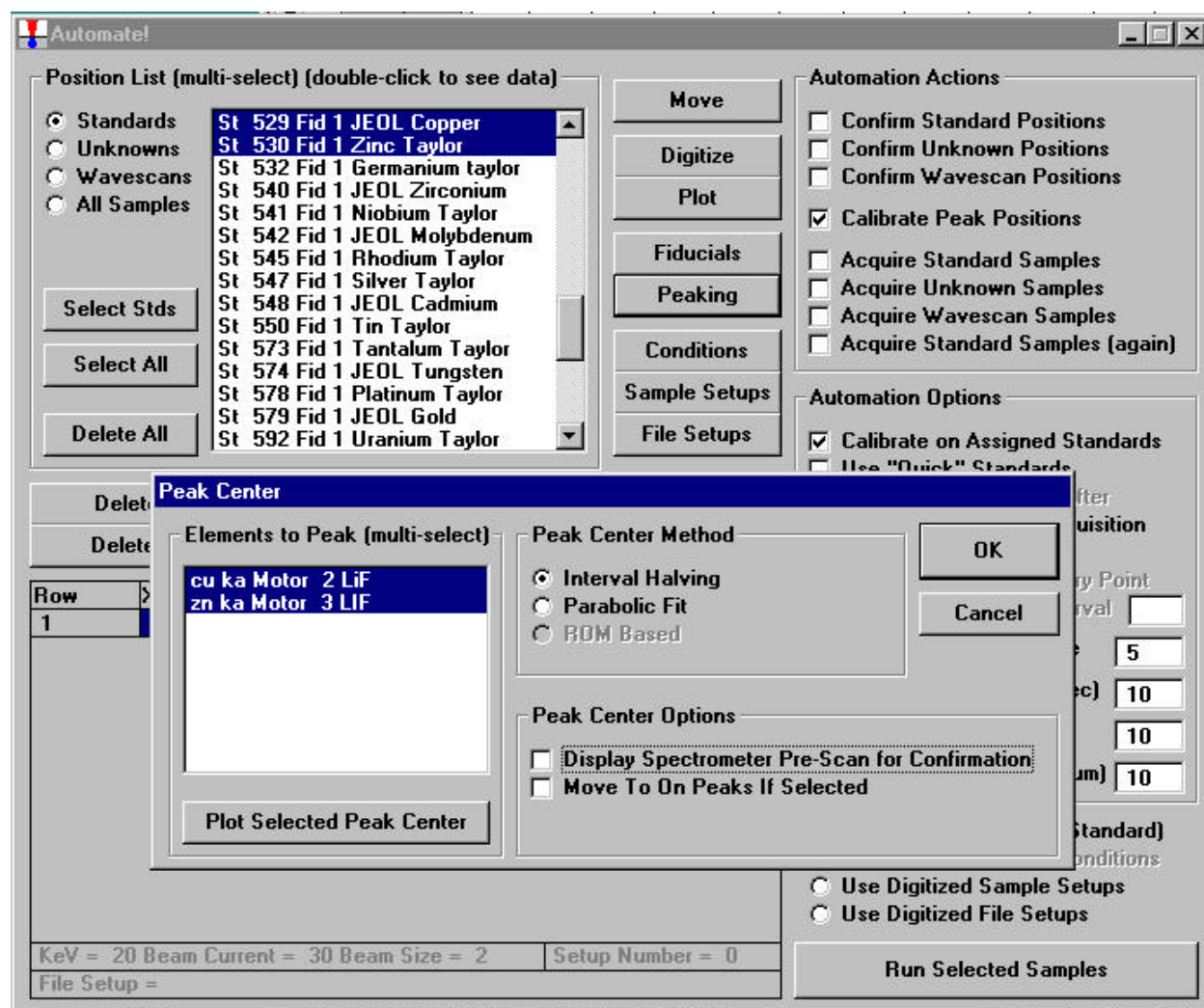
After the final standard is confirmed, the **AcquireStop** window appears. Click this **OK** button returns to the **Automate!** dialog box.



Calibrate Peak Positions

X-ray peaking may be automated from the **Automate!** window as follows. Under *Automation Actions* click only the *Calibrate Peak Positions* box. Under *Automation Options* click the *Calibrate on Assigned Standards* box. This option causes the program to attempt a peak center on a standard position sample if the standard is assigned as the primary standard for that element. If the element has no assigned standard, then the program will attempt to assign one automatically based on the highest concentration of the elements present among the standards in the run.

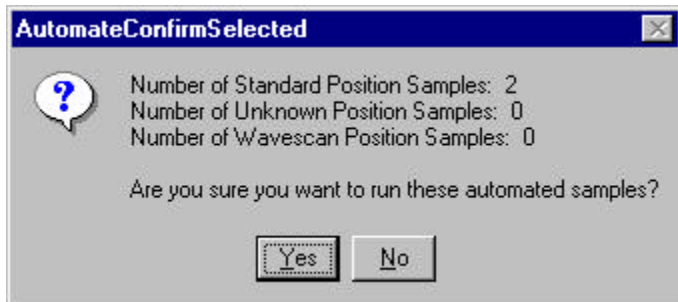
Next, click the **Peaking** button to open the **Peak Center** dialog box.



In the **Peak Center** dialog box, highlight (select) all of the elements in the *Elements to Peak* list box, and click on a *Peak Center Method*. A spectrometer pre-scan is useful if that element has not been run recently or if maintenance has occurred on the spectrometer. Click the **OK** button of the **Peak Center** window.

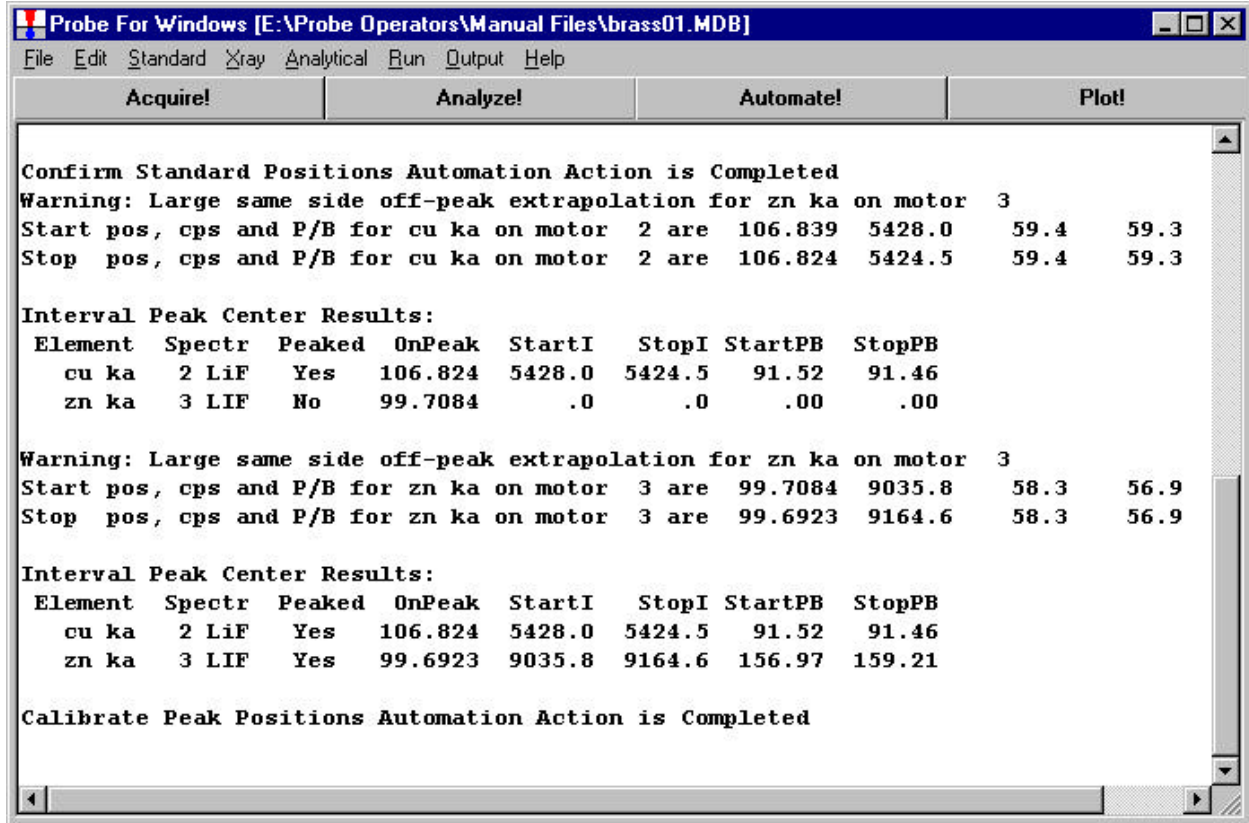
Click the **Run Selected Samples** button from the **Automate!** window.

This opens the **AutomateConfirmSelected** window. To run these automated samples, click **Yes**.



The stage motors move to the position coordinates of the first standard in the *Position List* list box. If the *Use Confirm During Acquisition* box under *Automation Options* is checked then the computer automation will pause at each standard (**Confirm Positions** window will open) for some user defined amount of time to allow the operator to adjust the stage position and focus. The spectrometers go through the peaking routine to peak center the spectrometer position to the intensity maximum for all the elements assigned to that standard. After finding a new peak position and reporting the results to the main log window, the stage motors move on to the coordinates of the next standard highlighted in the *Position List* list box. Once situated on this standard, the spectrometers peak center those elements assigned to it. This procedure continues until all standards are done. When all automation action is complete, the **AcquireStop** window appears and requests the user to click the **OK** button.

The following summary of the peak automation for the two standards is found in the main log window.



Acquire Standard Samples

The next step is to calibrate the analytical standards in preparation for unknown samples. The user may automate the entire acquisition of x-ray counts on all standards as follows.

From the **Automate!** dialog box and under *Automation Actions*, click only on the *Acquire Standard Samples* box. Under *Automation Options*, select the number of *Standard Points To Acquire* and whether to use the *Confirm During Acquisition* feature. In this example, five standard points are entered along with a *Standard X Increment* of 10 um. as well as the *Confirm During Acquisition* option. Click the **Run Selected Samples** button.

The screenshot shows the 'Automate!' dialog box with the following configuration:

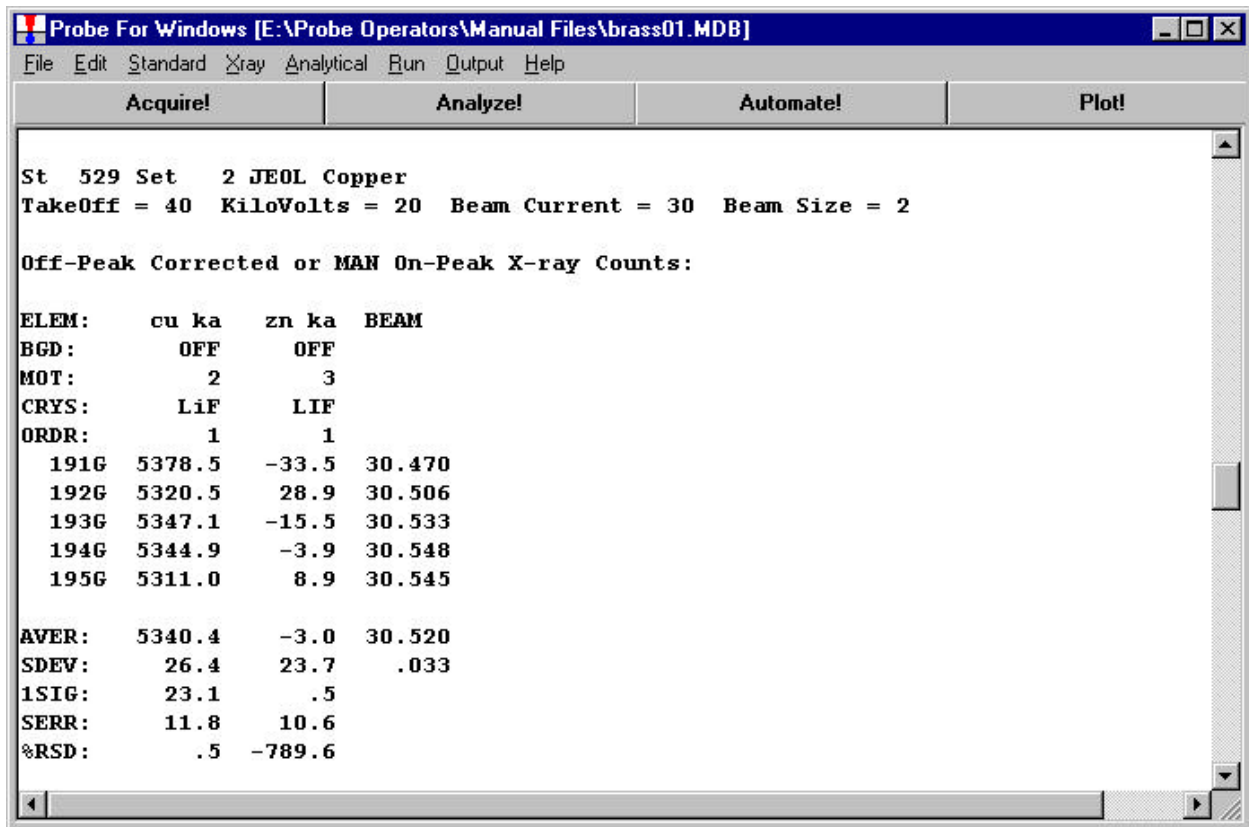
- Position List (multi-select) (double-click to see data):**
 - Standards (selected): St 529 Fid 1 JEOL Copper, St 530 Fid 1 Zinc Taylor, St 532 Fid 1 Germanium taylor, St 540 Fid 1 JEOL Zirconium, St 541 Fid 1 Niobium Taylor, St 542 Fid 1 JEOL Molybdenum, St 545 Fid 1 Rhodium Taylor, St 547 Fid 1 Silver Taylor, St 548 Fid 1 JEOL Cadmium, St 550 Fid 1 Tin Taylor, St 573 Fid 1 Tantalum Taylor, St 574 Fid 1 JEOL Tungsten, St 578 Fid 1 Platinum Taylor, St 579 Fid 1 JEOL Gold, St 592 Fid 1 Uranium Taylor
- Automation Actions:**
 - Confirm Standard Positions:
 - Confirm Unknown Positions:
 - Confirm Wavescan Positions:
 - Calibrate Peak Positions:
 - Acquire Standard Samples:
 - Acquire Unknown Samples:
 - Acquire Wavescan Samples:
 - Acquire Standard Samples (again):
- Automation Options:**
 - Calibrate on Assigned Standards:
 - Use "Quick" Standards:
 - Use Filament Standby After:
 - Use Confirm During Acquisition:
 - Use ROM Auto Focus:
 - Focus Mode: New Sample, Every Point, Digitized, Interval
 - Standard Points To Acquire: 5
 - Automate Confirm Delay (sec): 10
 - Standard X Increment (um): 10
 - Re-Standard Y Increment (um): 10
 - Use Last Unknown (or Standard):
 - Use Digitized Sample Conditions:
 - Use Digitized Sample Setups:
 - Use Digitized File Setups:
- Buttons:** Move, Digitize, Plot, Fiducials, Peaking, Conditions, Sample Setups, File Setups, Select Stds, Select All, Delete All, Delete Selected Samples, Import from ASCII File, Delete Selected Positions, Export Selected Samples, Run Selected Samples
- Table:**

Row	X	Y	Z	W	Grain #	Focus
1	25.9765	41.4673	10.8772	1.999985	1	0
- Footer:** KeV = 20 Beam Current = 30 Beam Size = 2 Setup Number = 0 File Setup =

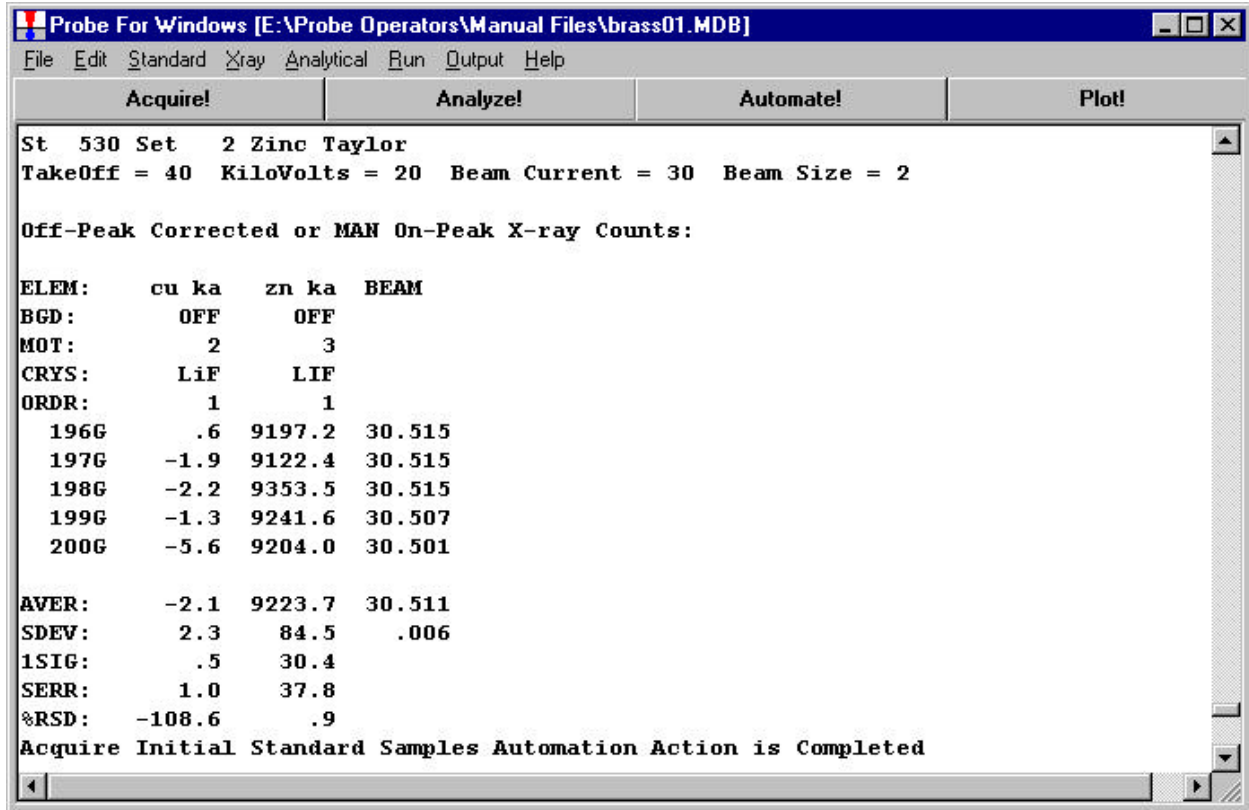
The **AutomateConfirmSelected** window opens again, informing the user that two standards are chosen and asks if you want to run these automated samples, click **Yes**.

The stage moves to the coordinates of the first standard in the *Position List* list box, the **Confirm Positions** window opens, allowing a readjustment of the stage position and optical focus. A complete analysis (all elements in the current sample) are measured, x-rays are counted on peak and at both background positions for times specified in the **Count Times** window. Finally, the Faraday cup is measured. The stage jogs 10 um in the X direction and this procedure is repeated for the number of points specified in the *Automation Options* section of the **Automate!** dialog box. After completing data collection on the first standard, the stage travels to the next standard in the list and acquires five complete analyses on that standard. After finishing the automation schedule the familiar **AcquireStop** window opens and requires the user to click the **OK** button thereby returning to the **Automate!** window.

The log window results for the copper standard x-ray count acquisition is seen below.

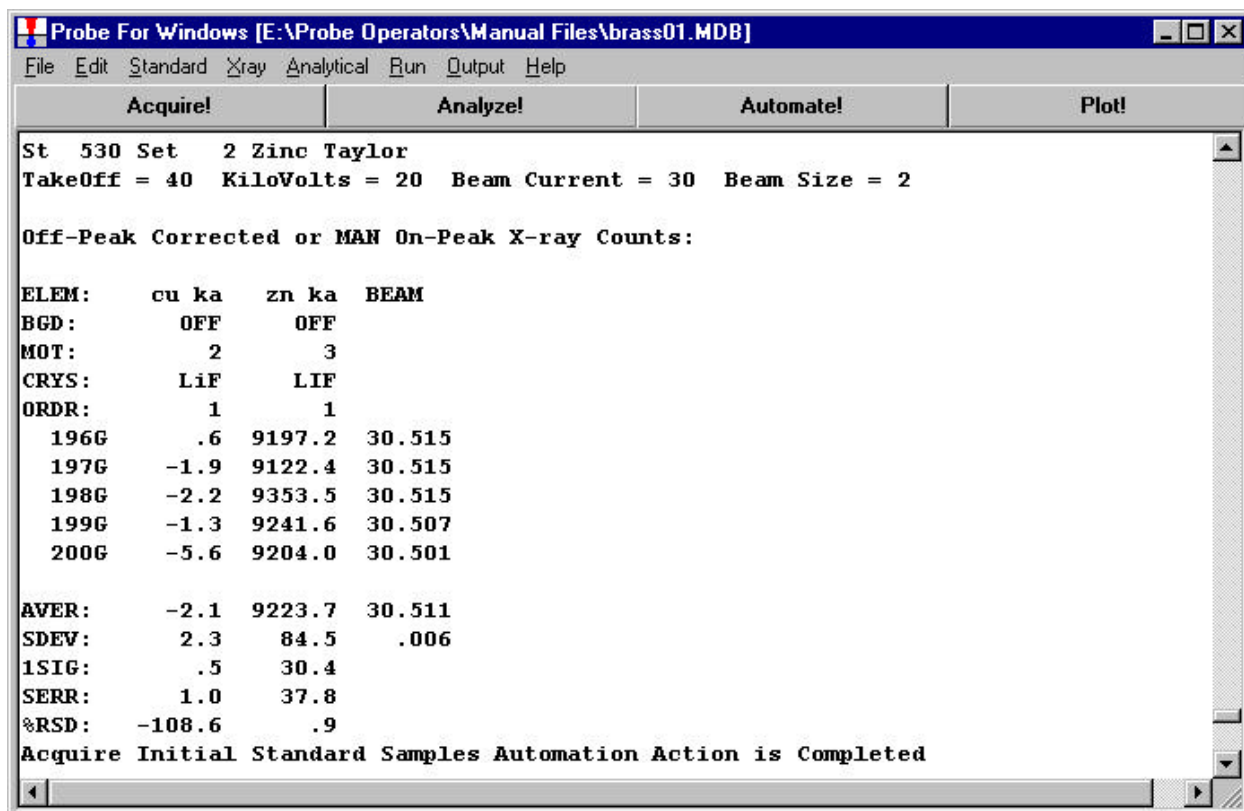


The log window results for the zinc standard x-ray count acquisition is displayed below.

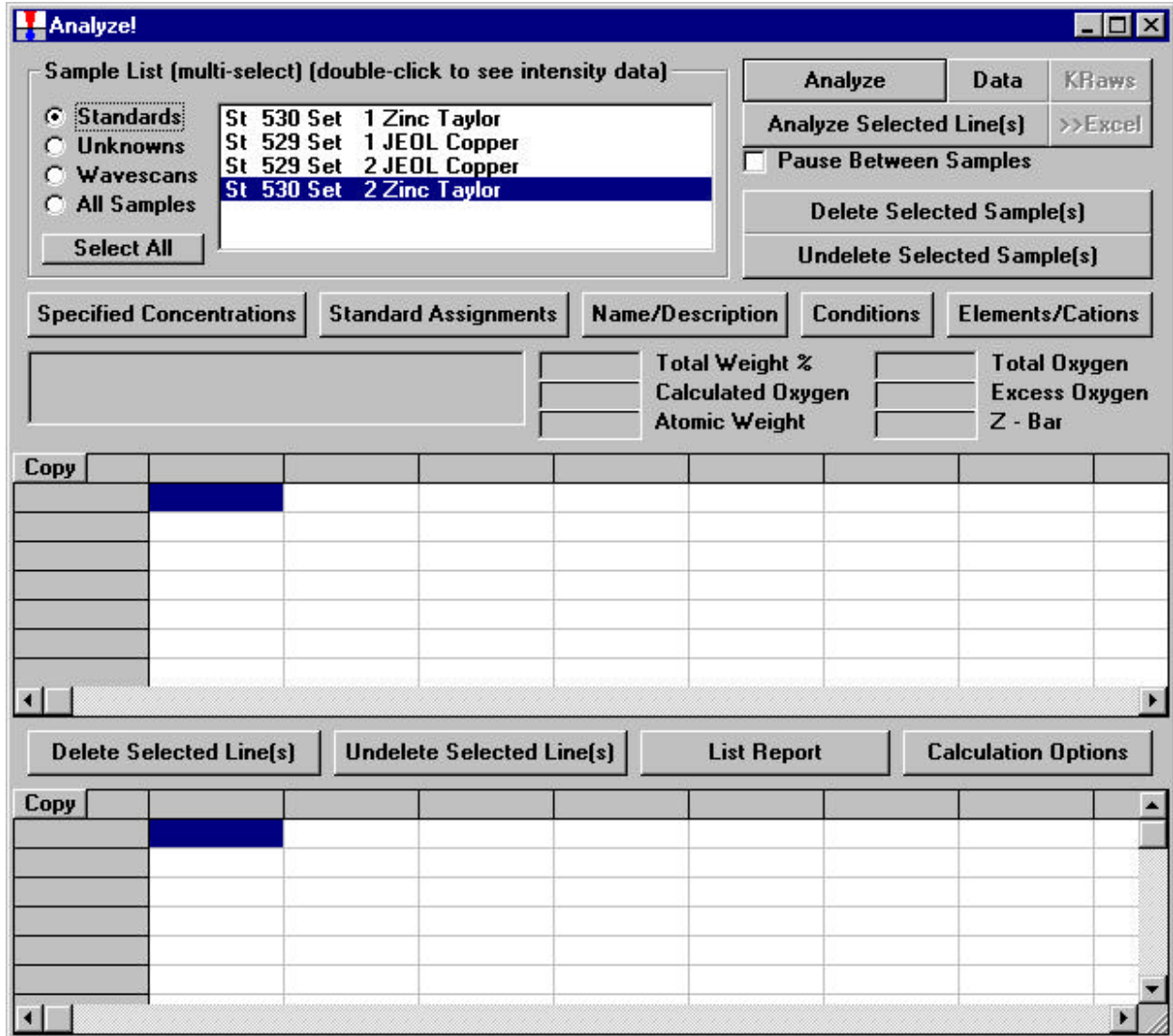


Analyze Standard Data

After standard data is acquired it is useful to analyze the data to check for agreement among standards and for possible interferences. Click the **Analyze!** button in the main PROBE FOR WINDOWS log window.



This opens the **Analyze!** dialog box.



The *Sample List* list box contains the standards acquired so far. To examine the data acquired on the two standards run under automation, first choose the copper metal, selecting *St 529 Set 2 JEOL Copper* and click the **Analyze!** button.

The results for the five automated standard analyses of the copper metal are shown below. Each individual line (191G to 195G) is illustrated along with the *Average*, *Std Dev* and a variety of other statistical parameters for the acquired points (see User's Guide and Reference documentation for additional details).

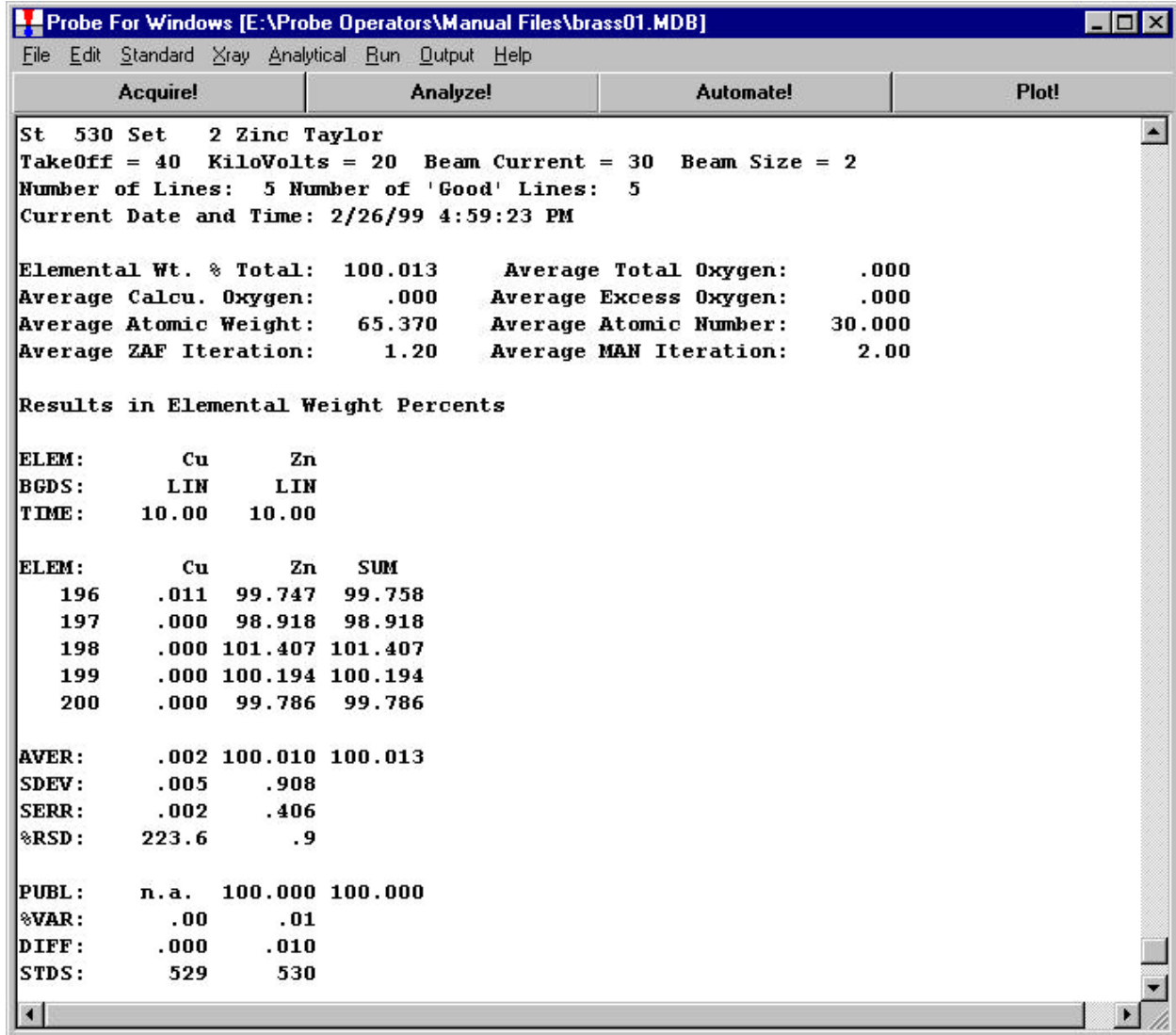
The screenshot shows the 'Analyze!' software interface. At the top, there is a 'Sample List (multi-select) (double-click to see intensity data)' section with radio buttons for 'Standards', 'Unknowns', 'Wavescans', and 'All Samples'. The 'Standards' option is selected, and a list of samples is shown: 'St 530 Set 1 Zinc Taylor', 'St 529 Set 1 JEOL Copper', 'St 529 Set 2 JEOL Copper' (highlighted), and 'St 530 Set 2 Zinc Taylor'. To the right of this list are buttons for 'Analyze', 'Data', 'KRaw', 'Analyze Selected Line(s)', 'Pause Between Samples', 'Delete Selected Sample(s)', and 'Undelete Selected Sample(s)'. Below the sample list are tabs for 'Specified Concentrations', 'Standard Assignments', 'Name/Description', 'Conditions', and 'Elements/Cations'. The 'Name/Description' tab is active, showing parameters for 'St 529 Set 2 JEOL Copper': 'TakeOff = 40 KiloVolts = 20 Beam Current = 30 Beam Size = 2'. To the right of these parameters are numerical values: '100.076 Total Weight %', '.000 Calculated Oxygen', '63.547 Atomic Weight', '.000 Total Oxygen', '.000 Excess Oxygen', and '29.001 Z - Bar'. Below this is a table titled 'Results in Elemental Weight Percent' with columns for 'Copy', 'Cu', 'Zn', and 'Total'. The table contains rows for 'Average', 'Std Dev', 'Published', 'Std Err', '%Rel SD', 'Minimum', and 'Maximum'. The 'Published' row shows '100.000' for Cu and 'n.a.' for Zn. Below this table are buttons for 'Delete Selected Line(s)', 'Undelete Selected Line(s)', 'List Report', and 'Calculation Options'. At the bottom, there is another table with columns for 'Copy', 'Cu', 'Zn', and 'Total', showing individual analysis results for lines 191 G through 195 G. Line 191 G is highlighted with a blue background.

Copy	Cu	Zn	Total
Average:	99.994	.082	100.076
Std Dev:	.488	.136	.414
Published:	100.000	n.a.	100.000
Std Err:	.218	.061	.185
%Rel SD:	.5	165.9	.4
Minimum:	99.450	.000	99.547
Maximum:	100.693	.314	100.693

Copy	Cu	Zn	Total
191 G	100.693	.000	100.693
192 G	99.617	.314	99.931
193 G	100.126	.000	100.126
194 G	100.084	.000	100.084
195 G	99.450	.097	99.547

If the sample that has been run is a standard, the program will show a *Published* line as well in the analysis output. This is the weight percent value for the element as entered in the standard database. If an element is not found in the standard database it is shown as n.a. or not analyzed.

Selecting *St 530 Set 2 Zinc Taylor* and clicking the **Analyze** button exports the following data (zinc metal standard numbers) to the main PROBE FOR WINDOWS log window.



Both standards look ok, the user may move on to analyze unknowns.

Unknown Sample Data Collection and Analysis

To collect x-ray data on an unknown sample, minimize the **Analyze!** window and/or bring forward the **Acquire!** dialog box to start a new sample.

Click the **Move** button on the **Acquire!** window to drive the stage to the coordinates of the first unknown sample.

Click the **New Sample** button to activate the **New Sample** dialog box. Enter an appropriate sample name and description into the *New Sample Name* and *New Sample Description* text boxes. Check that the *Unknown* button under *New Sample Type* is checked and then click the **OK** button.

New Sample

New Sample Type

Standard

Unknown

Wavescan

OK Cancel

Load Element Setup

Load Sample Setup

Load File Setup

Note that a new standard sample element setup is always based on the last unknown sample in the run. To change the analyzed elements in a run, first create a new unknown sample and make any necessary changes to the element setup.

New Sample Name

NIST 478

New Sample Description

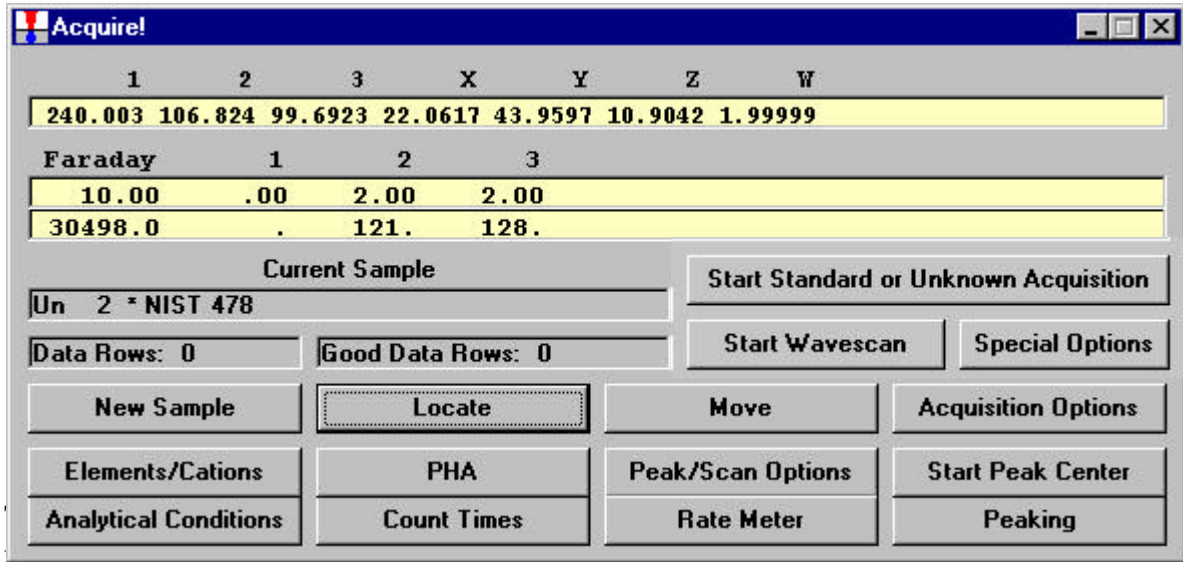
Insert <cr> >> Brass as unknown

To add standards to the standard list below, cancel this dialog, then click the Standard | Add Standards to Run menu items from the main menu

529 JEOL Copper

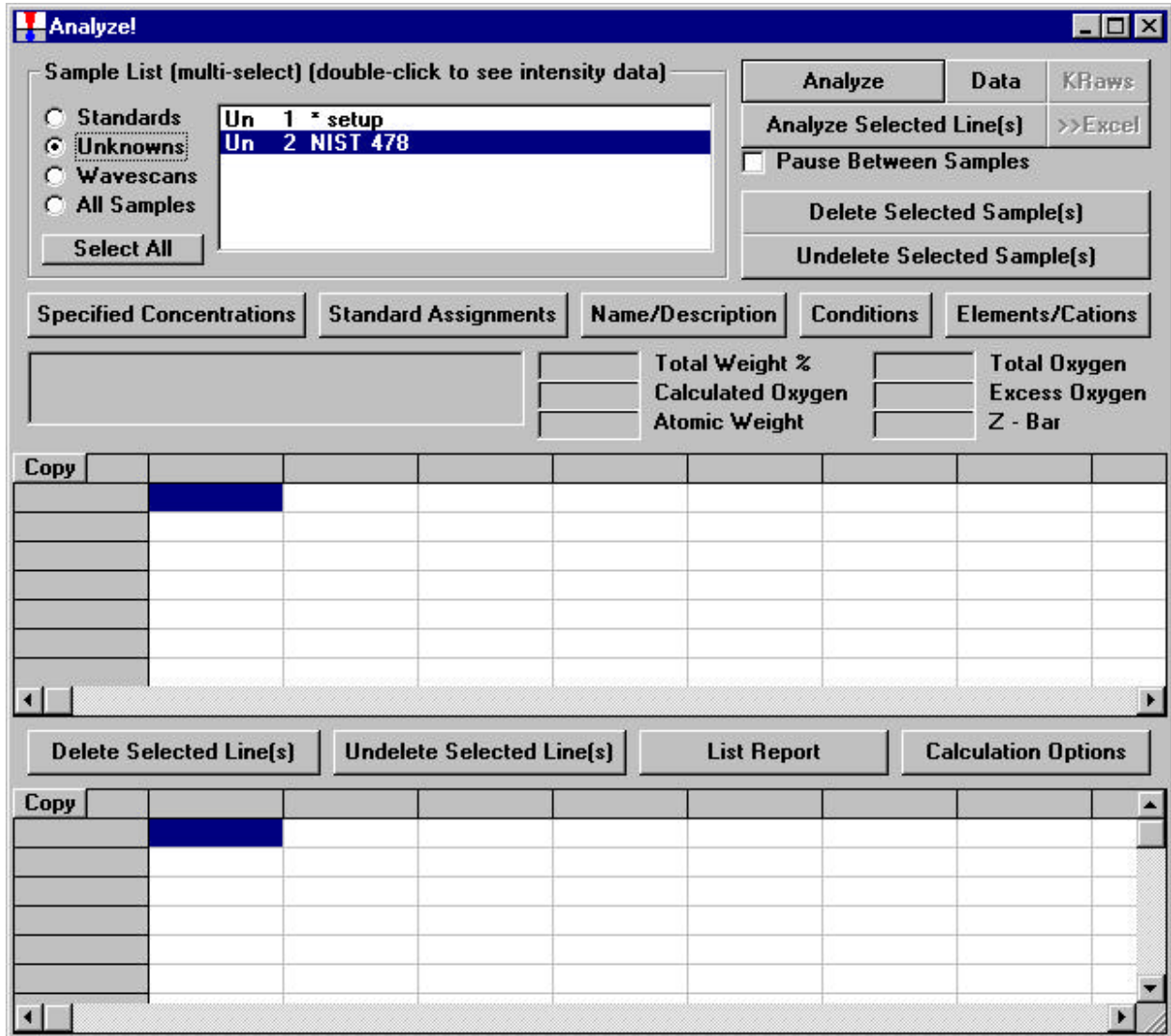
530 Zinc Taylor

To start acquiring x-ray counts on the first unknown sample (NIST 478), simply click the **Start Standard or Unknown Acquisition** button of the **Acquire!** window.

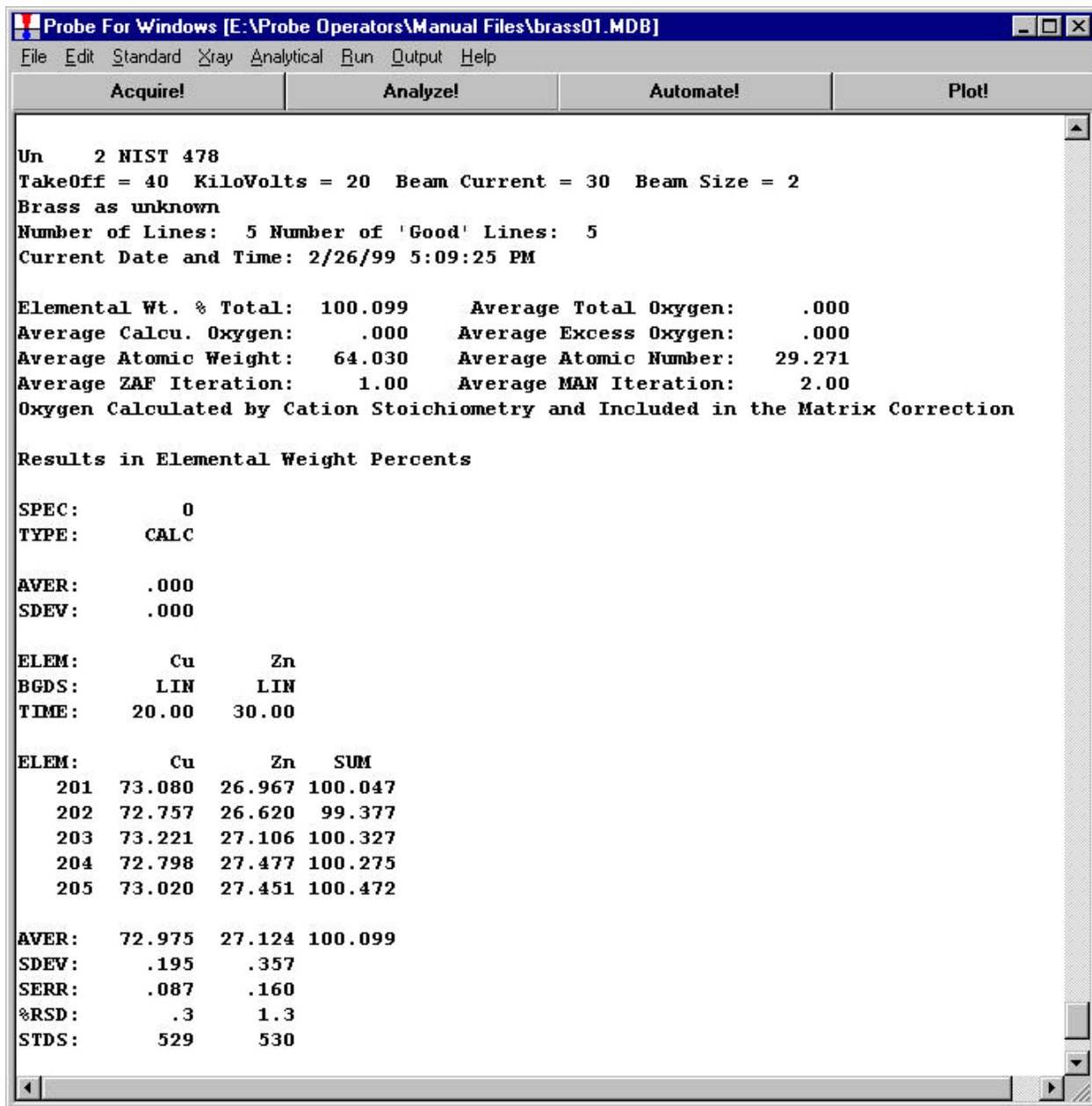


ata

Next, the **Analyze!** dialog box is reopened or simply brought forward. Click the *Unknowns* button under the *Sample List* buttons and highlight (select) *Un 2 NIST 478*.



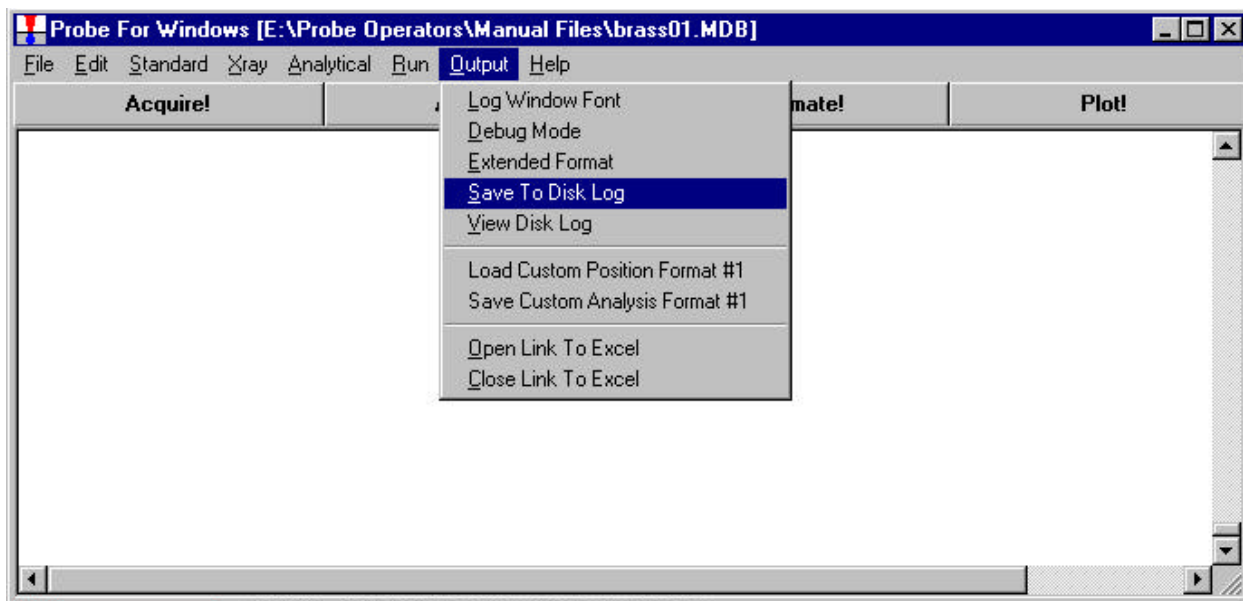
Clicking the **Analyze** button calculated the results for these five points and those values are viewed below, as displayed in the main log window.



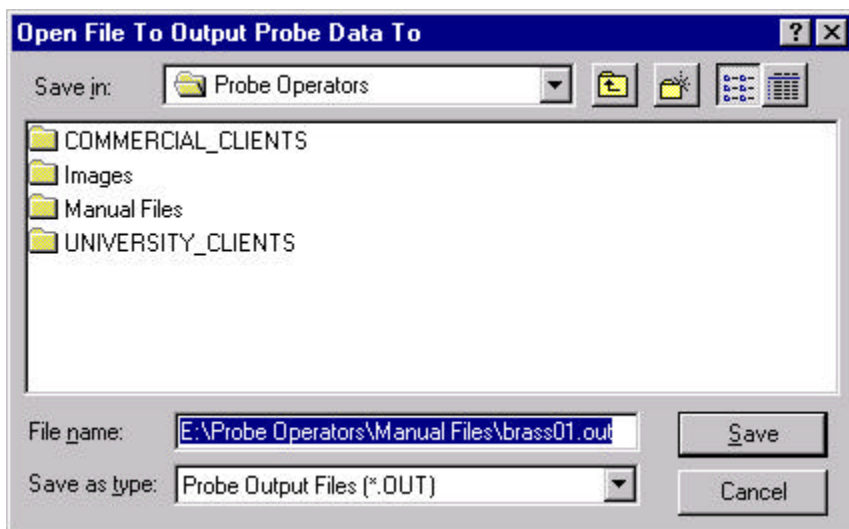
The certified values for NIST 478 are 72.85 wt% copper and 27.10 wt% zinc. This sample can also be used as a secondary standard to check the quality of the standardization. If the sample is a standard sample, the analysis printout will list several other output lines (see page 120, zinc metal). The published, “PUBL” weight percent value for the element as entered in the default standard database and the percent variance, “% VAR” from the published value for each element compared to the actual measured average for the standard are listed. After this is a line labeled “DIFF” which is the difference between the “AVER” and “PUBL” values. These parameters give the user an easy way to evaluate the quality of the standardization.

Output of Analyzed Data

Before closing the run, the user decides to output the data to an ASCII file for importing to another application such as Excel and to the laser printer for a hardcopy. From the main PROBE FOR WINDOWS log window, select **Output** from the menu bar and click **Save to Disk Log** from the menu.

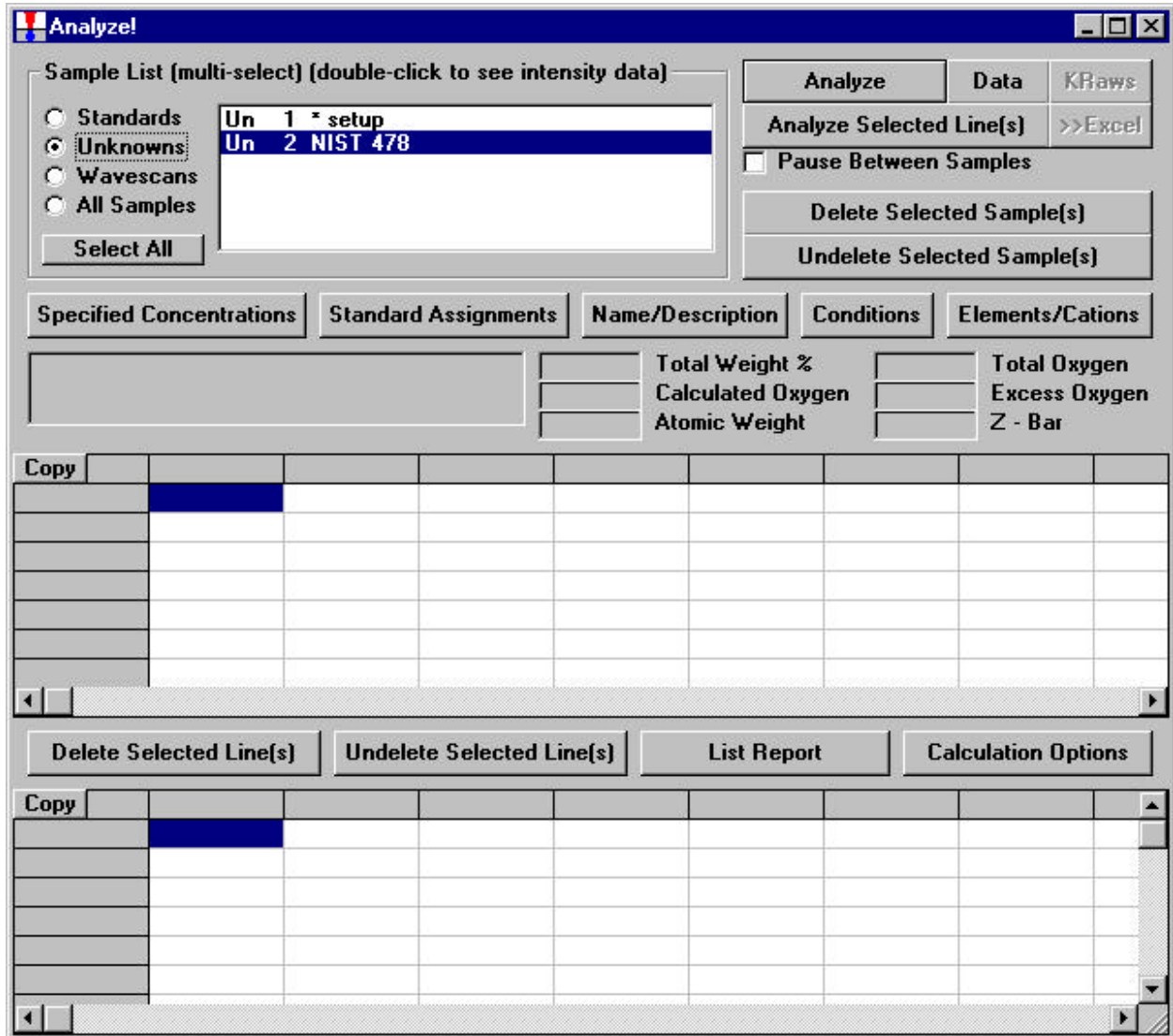


This opens the **Open File To Output Probe Data To** dialog box. Type in a *File name*. This output file has the extension .OUT. Note that all raw data is always automatically saved in the .MDB run file for future re-calculation and /or output. Click **OK** when finished.



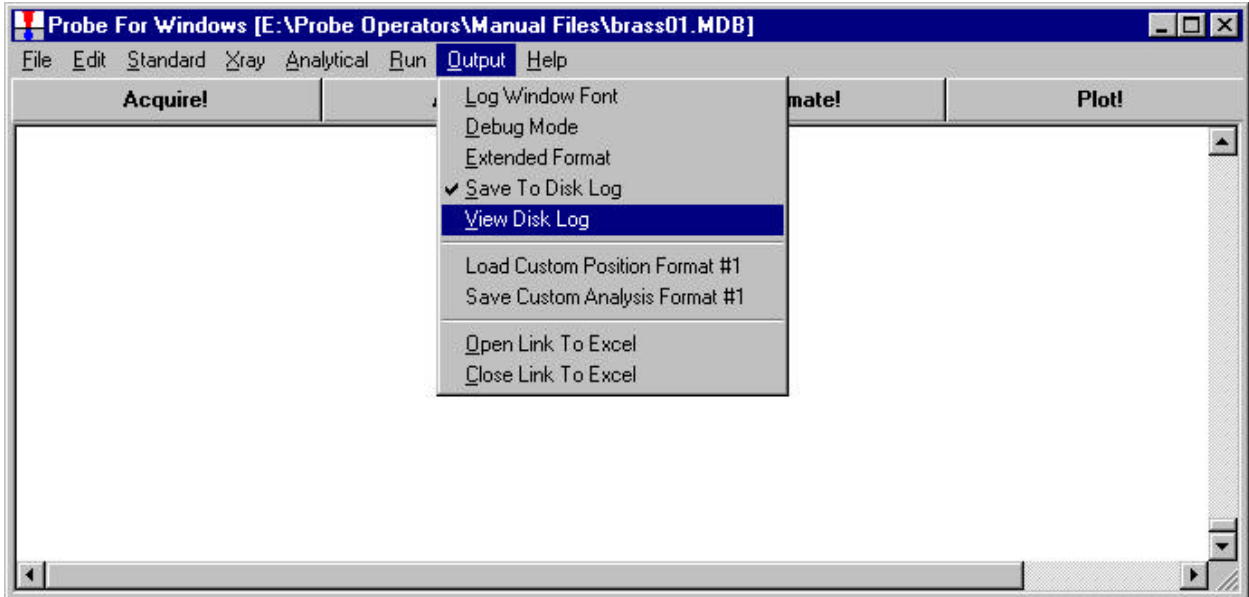
Select the **Analyze!** button in the main PROBE FOR WINDOWS log window, to bring forward the **Analyze!** dialog box.

Select from the *Sample List* of the **Analyze!** window the samples to be output to this file.



Click the **Analyze** button to reanalyze the samples.

When the program finishes recalculating data to the file, return to the main PROBE FOR WINDOWS log window. Select **Output** from the menu bar again and click **View Disk Log** from the menu.



This opens the file editor. This example utilizes the **Programmer's File Editor**, seen below. A number of text file editors may be used. To utilize a specific editor such as Notepad or Textpad, edit the FileViewer keyword in the PROBEWIN.INI file.

```

Programmer's File Editor
File Edit Options Template Execute Macro Window Help

temp.out

Probe for Windows Microanalysis
Database File: E:\Probe Operators\Manual Files\brass01.MDB
Database File Type: PROBE
DataFile Version Number: 4.3
Program Version Number: 4.3
Database File User Name: Dan Kremser
Database File Description: Probe for Windows NT Run on JEOL Hardware
Brass schedule for Cu and Zn
Current Date and Time: 2/26/99 5:17:03 PM

Un 2 NIST 478
TakeOff = 40 KiloVolts = 20 Beam Current = 30 Beam Size = 2
Brass as unknown
Number of Lines: 5 Number of 'Good' Lines: 5
Current Date and Time: 2/26/99 5:17:03 PM

Elemental Wt. % Total: 100.099 Average Total Oxygen: .000
Average Calcu. Oxygen: .000 Average Excess Oxygen: .000
Average Atomic Weight: 64.030 Average Atomic Number: 29.271
Average ZAF Iteration: 1.00 Average MAN Iteration: 2.00
Oxygen Calculated by Cation Stoichiometry and Included in the Matrix Correction

Results in Elemental Weight Percents

```

The user might note that the output file is designated TEMP.OUT rather than the BRASS01.OUT specified earlier in the **Open File To Output Probe Data To** window. When the user wishes to view the disk log, the program closes the active log, creates a copy called TEMP.OUT, reopening the original (BRASS01.OUT) for further log writing, and allows the user to view the copy. Each time the user reopens the disk log and assuming new information has been appended, the editor will prompt that the TEMP.OUT file has been altered on disk by another application. Do you want to load this new version? Select the **Yes** button to view the additional material.

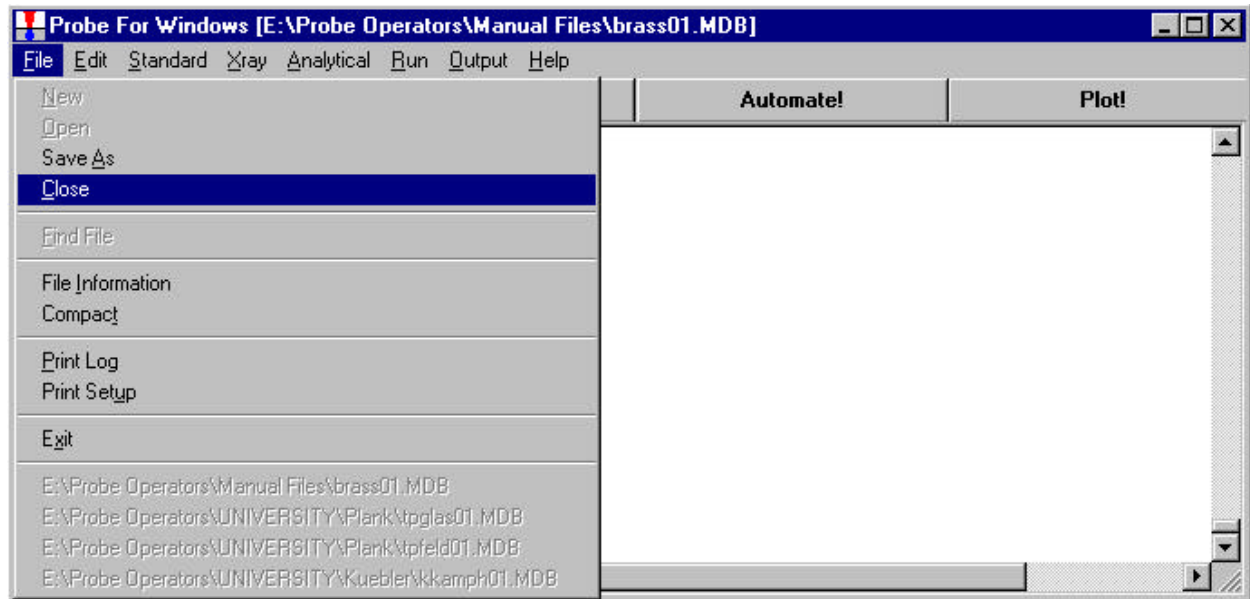
Also, if the user types a comment (to annotate output) into the main PROBE FOR WINDOWS log window, this comment string is echoed into the active disk log. Be aware that the comments entered will be placed at the current end position of the active log window.

The user may now direct the log data to a laser printer for hard copy viewing by selecting **File** from the **Programmer's File Editor** menu bar and clicking on **Print** in the drop-down menu.

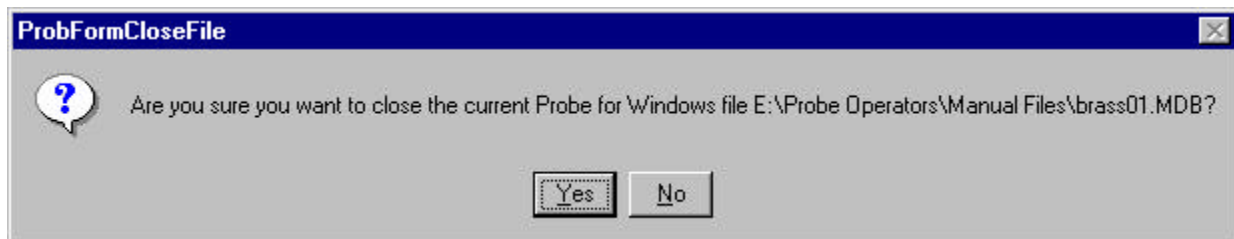
Exit the file editor and return to the main PROBE FOR WINDOWS log window.

Closing the Current Run and Probe for Windows

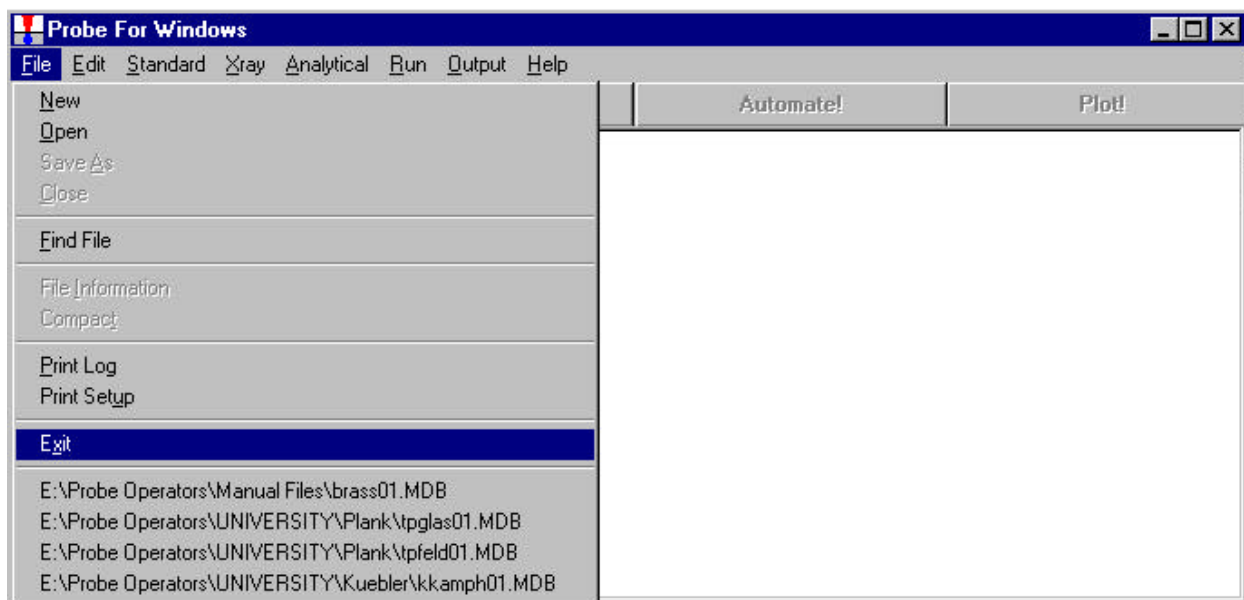
The user ends the analysis session from the main PROBE FOR WINDOWS log window. Select **File** from the menu bar and click **Close** from the menu selections.



This opens the **ProbFormCloseFile** window, click **Yes** to close this file.



Close PROBE FOR WINDOWS by selecting **File** from the menu bar and clicking **Exit**.



Silicate Sample Run

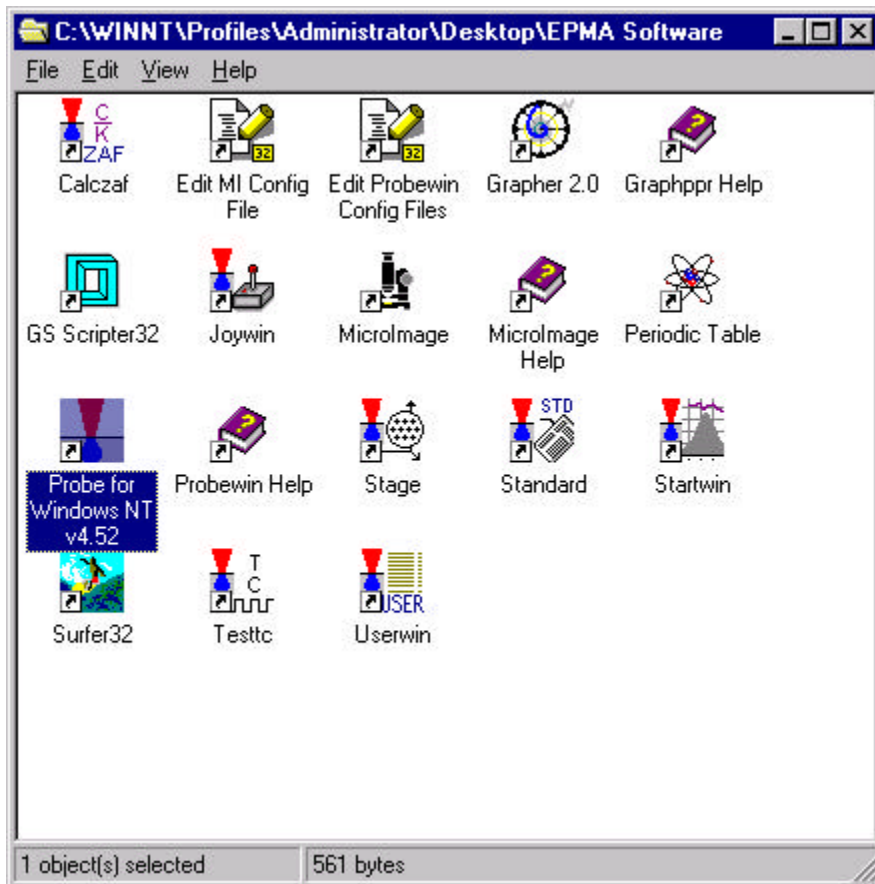
Introduction

This document illustrates step by step how to set up a new PROBE FOR WINDOWS quantitative run and how to analyze an unknown ten element silicate sample. This documentation was produced on a three spectrometer JEOL 733 electron microprobe. Your particular run may look very different depending on the specific configuration of your microprobe. This document should be used in conjunction with the User's Guide and Reference documentation and on-line help.

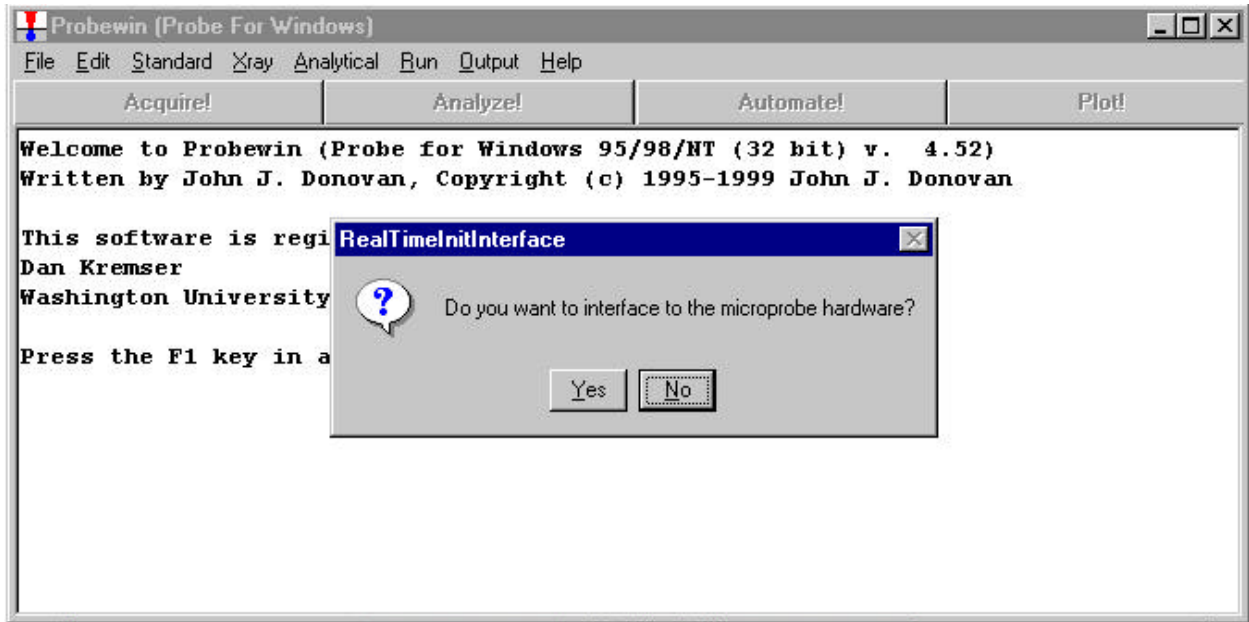
This run will demonstrate some of the powerful features of the PROBE FOR WINDOWS program. These include the use of pre-digitized standard mounts, automated spectrometer peaking, non-linear MAN (mean atomic number) background corrections, automated spectral interference corrections, automated standard acquisitions and digitizing unknown sample acquisitions.

Opening Probe For Windows

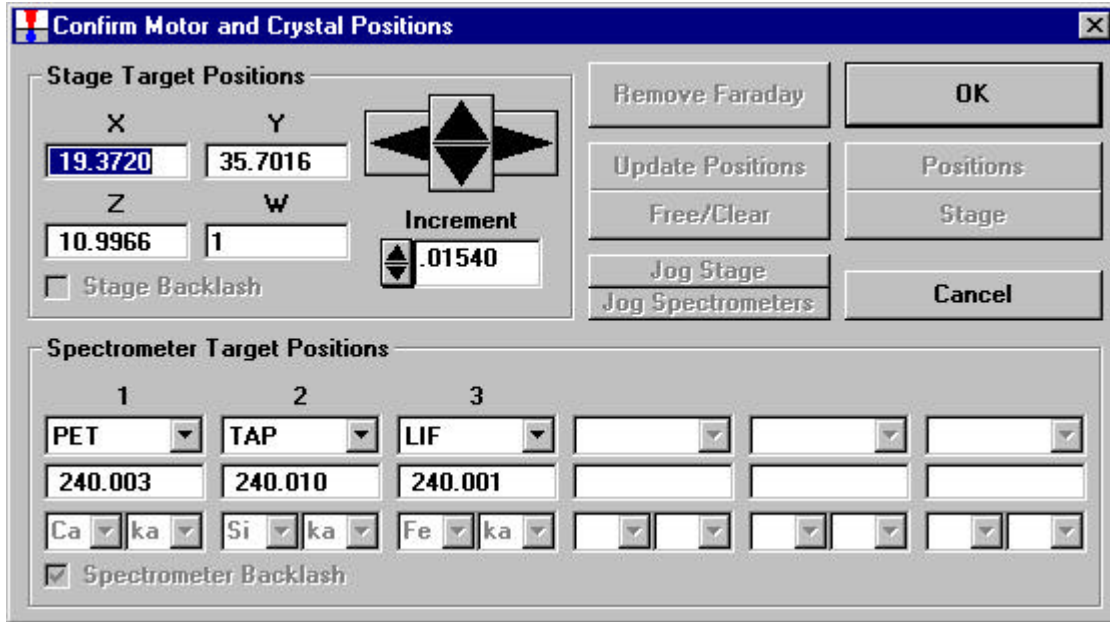
From the Desktop, double-click on the yellow EPMA Software folder opening the EPMA Software group. Double click on the **Probe for Windows ...** icon.



Upon launching PROBEWIN (PROBE FOR WINDOWS), the main log window appears along with the **RealTimeInitInterface** window as illustrated below. To collect real time data click the **Yes** button. The program can also be run off-line without the microprobe interface to re-process previously acquired data or on another computer.

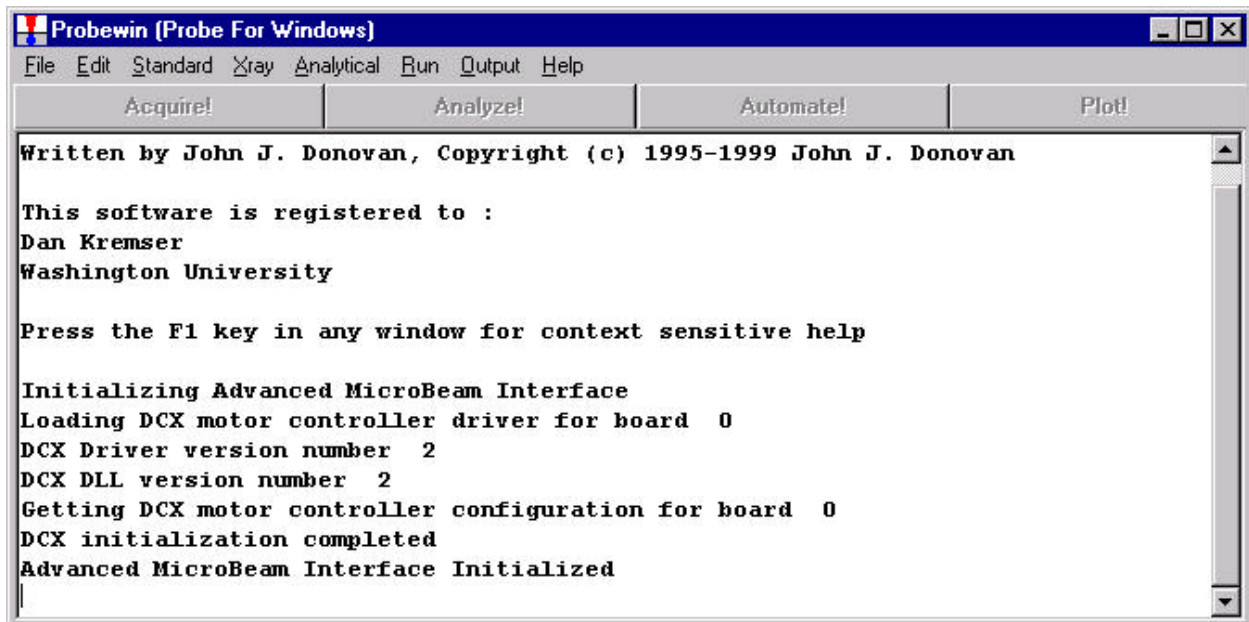


This action causes the **Confirm Motor and Crystal Positions** dialog box to open. Confirm that all of the motors (stage and spectrometer positions) and crystal designations are correctly calibrated. If there is disagreement between the mechanical positions (actual) and the software values, adjust the software values. Use the <tab> key to move between the *Target Positions* text boxes.



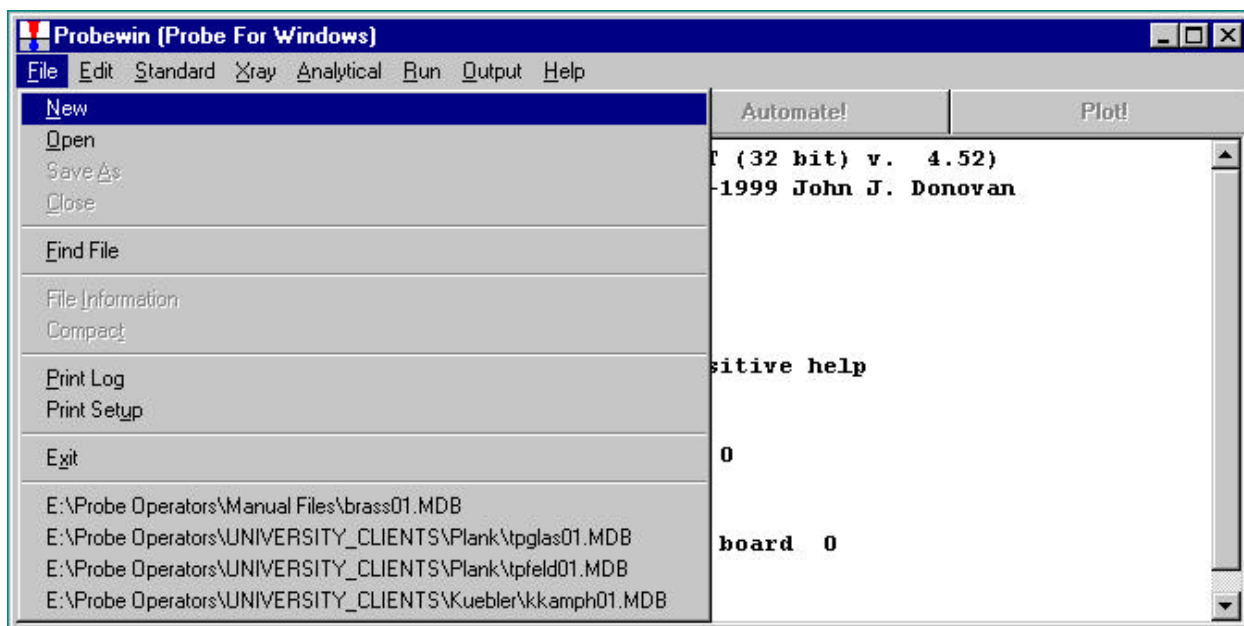
Click the **OK** button after you have finished to close the **Confirm Motor and Crystal Positions** dialog box.

The main PROBE FOR WINDOWS log window is now visible as seen below.

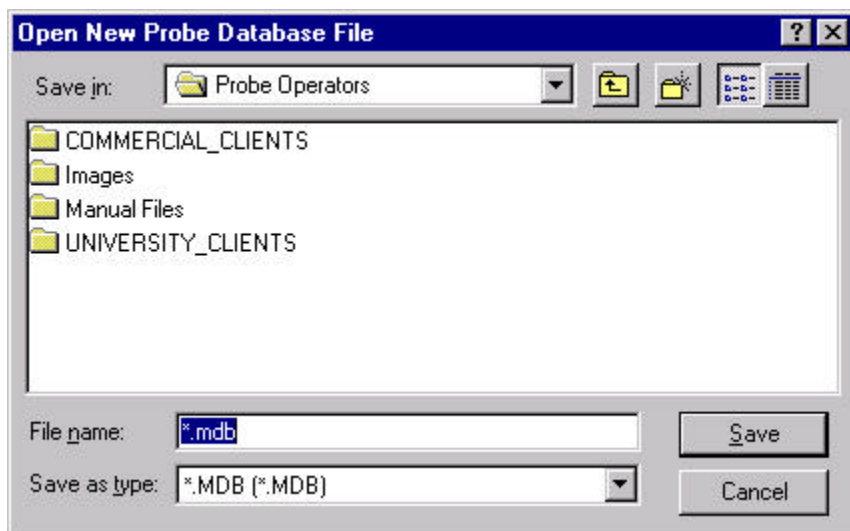


Creating a New Run

To create a new sample run, select **File** from the menu bar and click **New** from the menu.



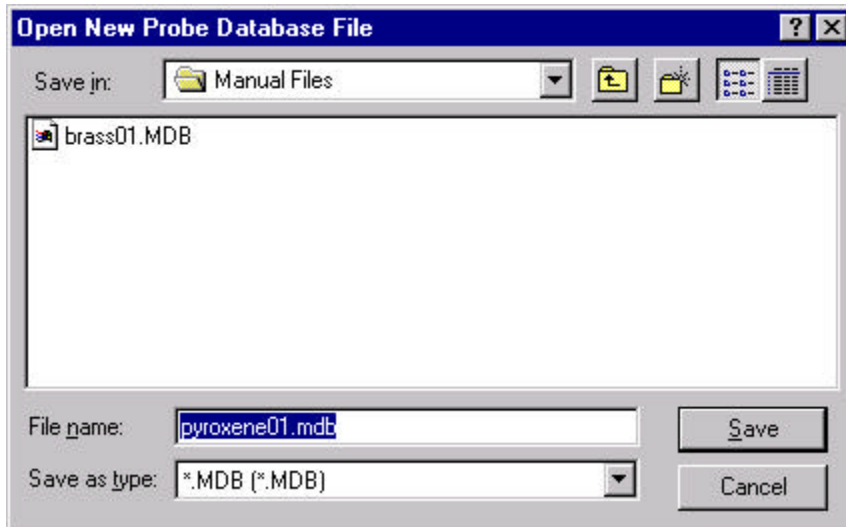
The **Open New Probe Database File** dialog box opens.



Change the *Save in:* location (directory) and type in an appropriate run name into the *File name* text box.

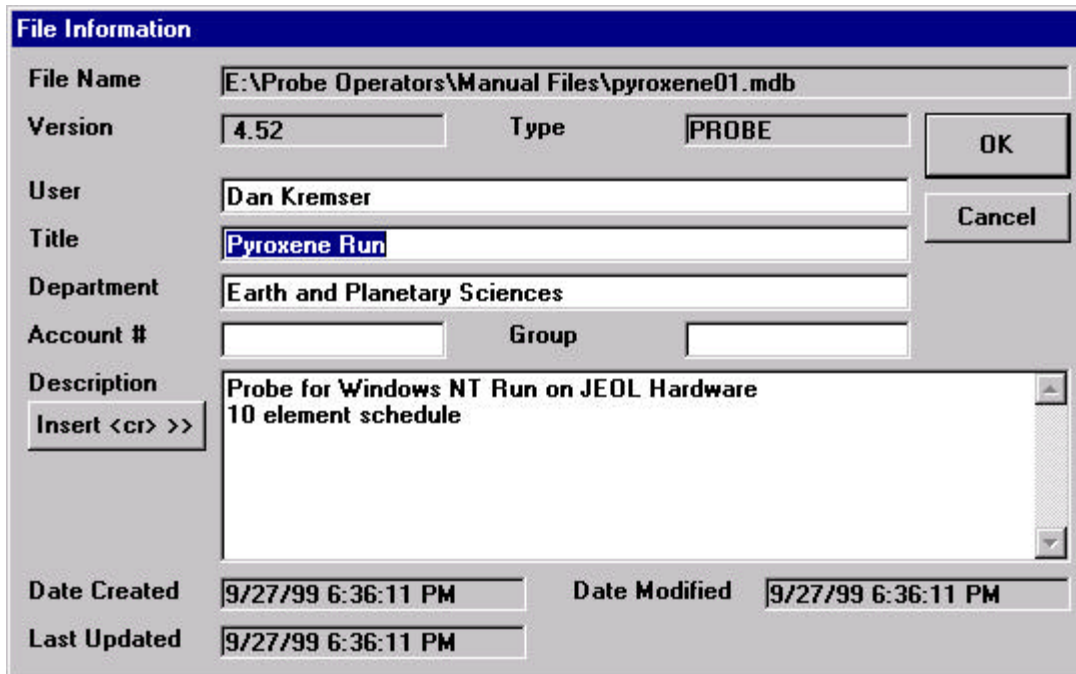
The initial *Save in:* location is specified by the UserDataDirectory keyword in the PROBEWIN.INI file. File names longer than 8 characters are now supported.

The screen capture of the first window in this section indicates that other probe runs (previous four listed) are already established. Any of the existing old runs maybe re-opened to acquire additional data or used as a “setup” file for starting a new run. In this example, a new file designated PYROXENE01.MDB will be created in the Manual Files directory.

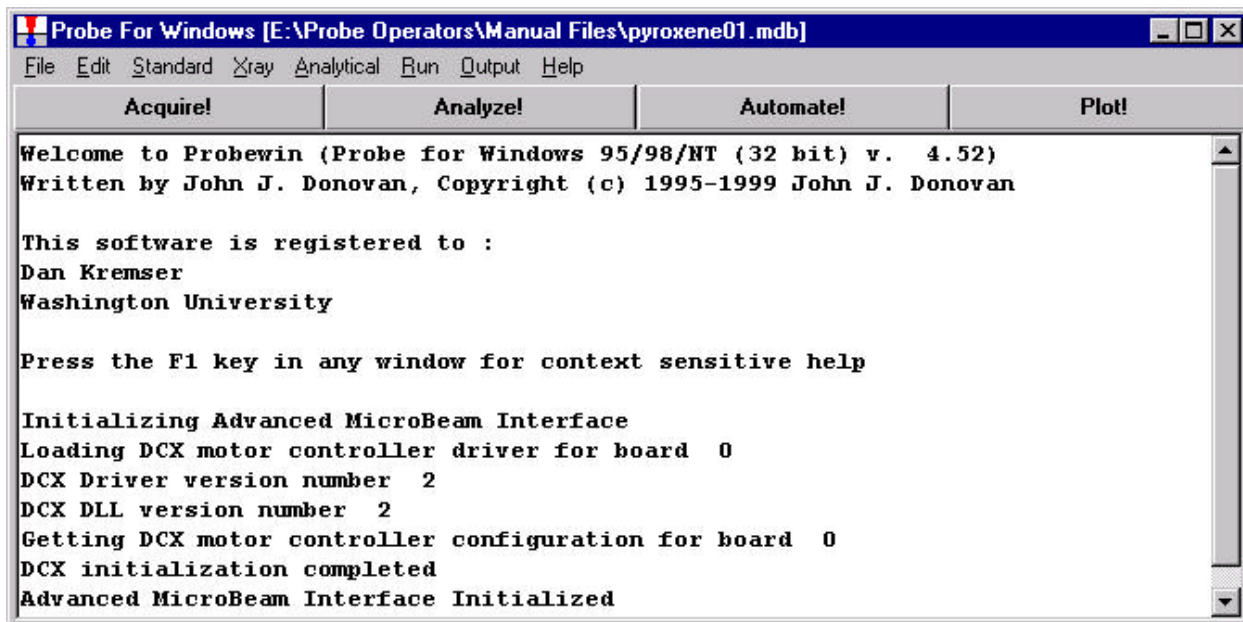


Close the **Open New Probe Database File** window by clicking the **Save** button. This action opens the **File Information** dialog box.

Enter the relevant information for the new run into the *User*, *Title*, and other *Description* text boxes. Use the <tab> key to move between text boxes. When finished, click the **OK** button.



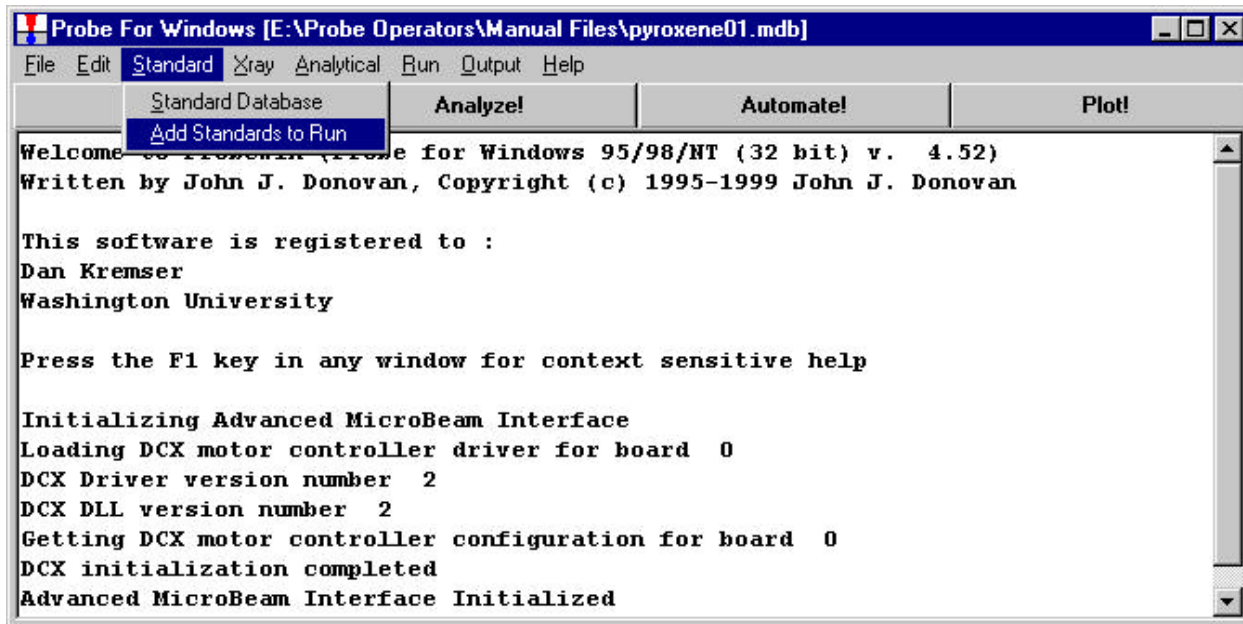
This returns the program to the main PROBE FOR WINDOWS log window. Now the four main Probe buttons: **Acquire!**, **Analyze!**, **Automate!**, and **Plot!** become active.



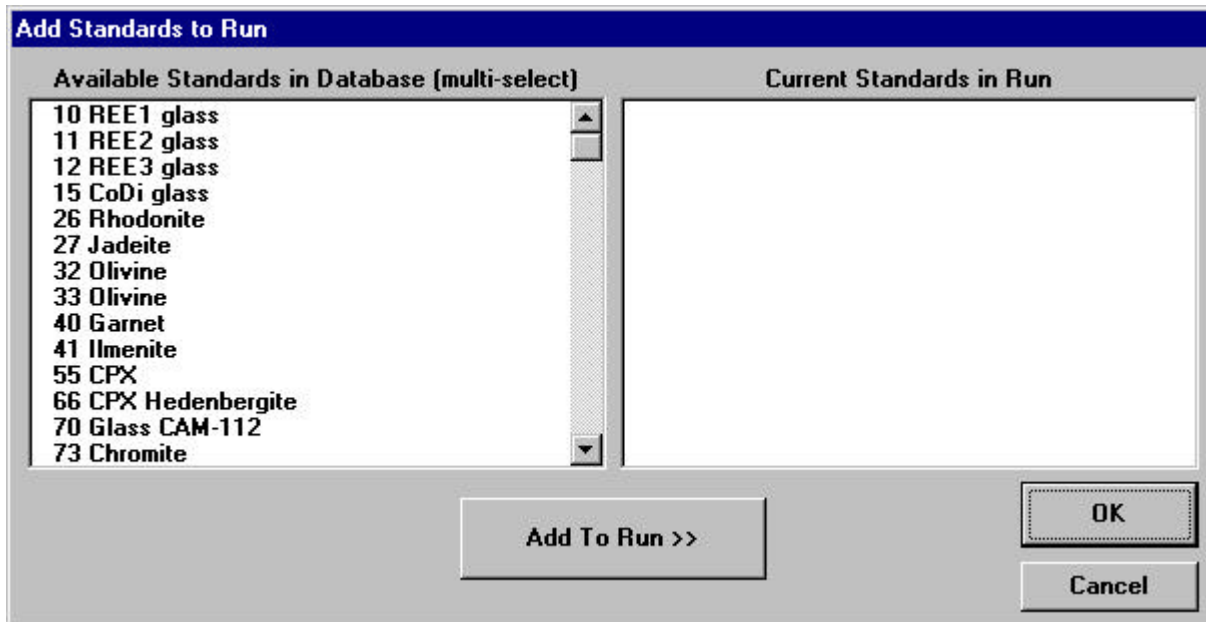
Parameter Initialization

Analytical Standard Selection

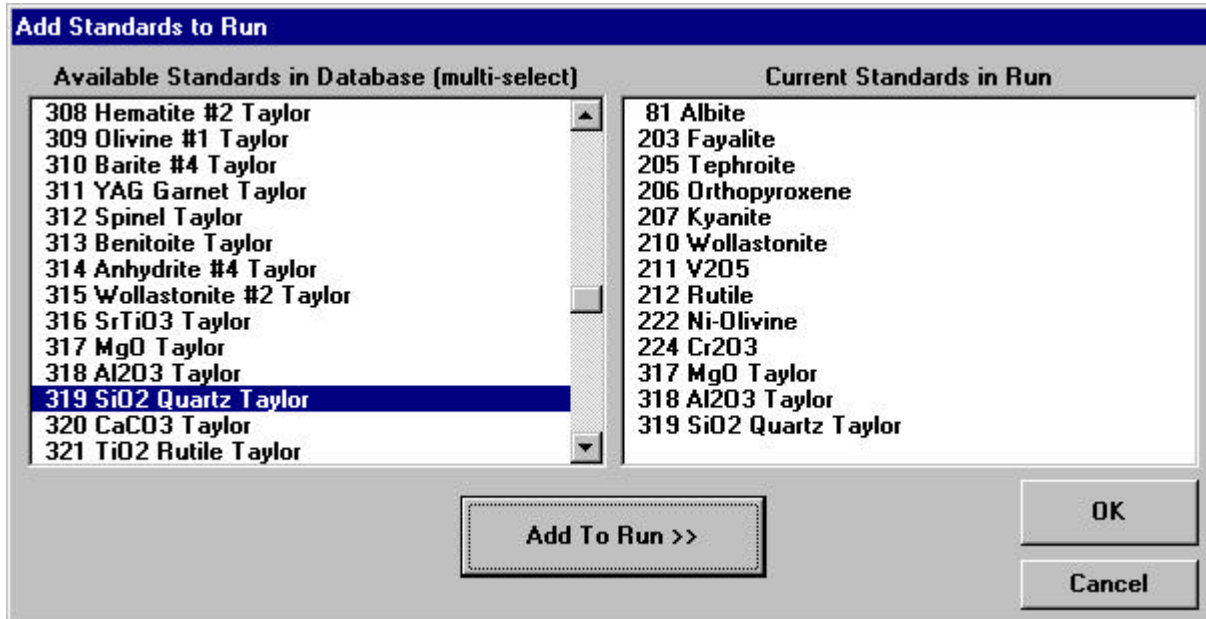
Select the analytical standards to be used in the new probe run. From the main PROBE FOR WINDOWS log window click **Standard** from the menu bar and select **Add Standards to Run** from the menu.



This opens the **Add Standards to Run** dialog box.



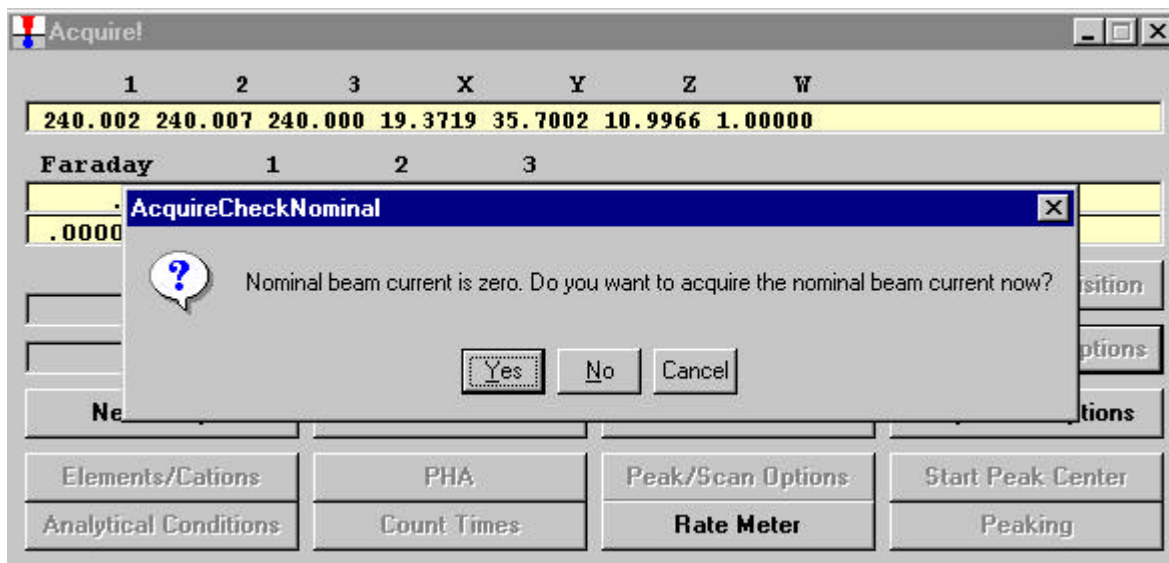
All previously entered standards in the default standard database are accessible. Scroll through the *Available Standards in Database* list box to find the standards to be used in this run. Select both primary analytical standards and the MAN background standards. Some standards may be run as both. Select each and click the **Add To Run >>** button to add each to the *Current Standards in Run* list box.



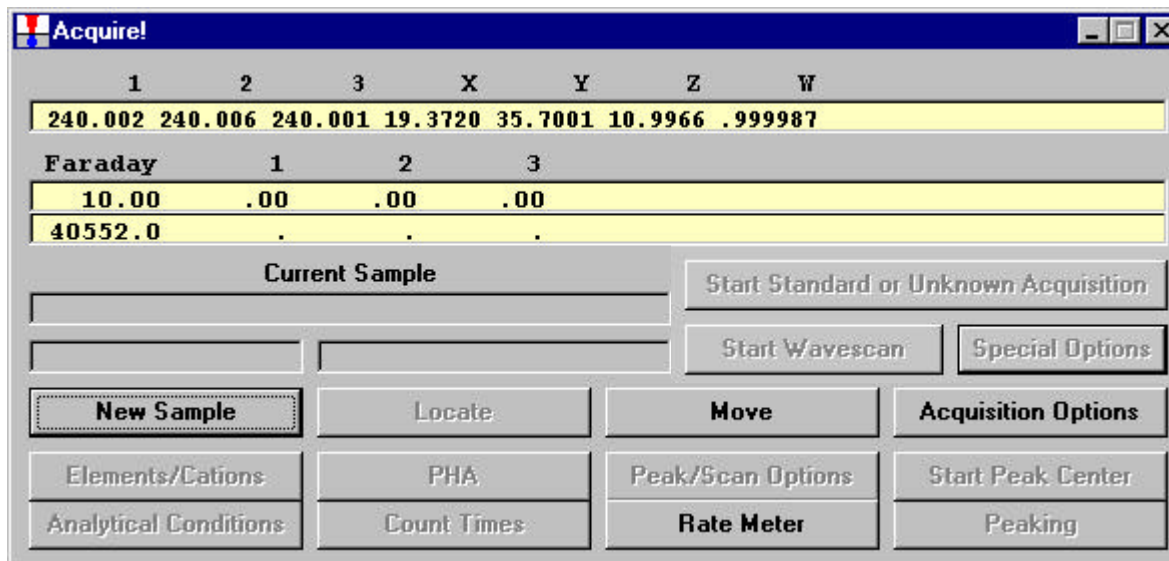
Click the **OK** button of the **Add Standards to Run** window when finished selecting standards. This returns the program to the main log window.

Nominal Beam Current Measurement

Click the **Acquire!** button. This action opens both the **Acquire!** dialog box and the **AcquireCheckNominal** window for the determination of the nominal beam current.



Click the **Yes** button on the **AcquireCheckNominal** window to establish a reference beam current reading. The beam (Faraday Cup counts on a JEOL 733 microprobe) is then measured. In this example the Faraday reading was taken for 10 seconds and recorded 40552 counts or 40.552 nA of beam current.



Creating a New Sample

Click the **New Sample** button of the **Acquire!** dialog box. This opens the **New Sample** dialog box.

New Sample

New Sample Type

Standard
 Unknown
 Wavescan

OK Cancel

Load Element Setup
Load Sample Setup
Load File Setup

Note that a new standard sample element setup is always based on the last unknown sample in the run. To change the analyzed elements in a run, first create a new unknown sample and make any necessary changes to the element setup.

New Sample Name
unknown sample

New Sample Description
Insert <cr> >>

To add standards to the standard list below, cancel this dialog, then click the Standard | Add Standards to Run menu items from the main menu

81 Albite
203 Fayalite
205 Tephroite
206 Orthopyroxene
207 Kyanite
210 Wollastonite
211 V205

Select *Unknown* from the *New Sample Type* buttons. Type an appropriate sample name and description into the *New Sample Name* and *New Sample Description* text boxes. This first sample will be used only to establish the analysis parameters.

New Sample

New Sample Type

Standard
 Unknown
 Wavescan

OK Cancel

Load Element Setup
Load Sample Setup
Load File Setup

Note that a new standard sample element setup is always based on the last unknown sample in the run. To change the analyzed elements in a run, first create a new unknown sample and make any necessary changes to the element setup.

New Sample Name
setup

New Sample Description
Insert <cr> >> parameter initialization for 10 element pyroxenes

To add standards to the standard list below, cancel this dialog, then click the Standard | Add Standards to Run menu items from the main menu

81 Albite
203 Fayalite
205 Tephroite
206 Orthopyroxene
207 Kyanite
210 Wollastonite
211 V205

Click the **OK** button of the **New Sample** dialog box.

The program returns to the **Acquire!** window. Notice that the first sample designated *Un 1 * setup* is now listed in the *Current Sample* text box. The * symbol indicating that no data has been collected for this sample yet.

The screenshot shows the 'Acquire!' software window. At the top, there is a table with columns labeled 1, 2, 3, X, Y, Z, and W. The first row of data is highlighted in yellow and contains the values: 240.002, 240.006, 240.001, 19.3720, 35.7001, 10.9966, and .999987. Below this table is a section labeled 'Faraday' with columns 1, 2, and 3. The first row of data is highlighted in yellow and contains the values: 10.00, .00, .00, and .00. Below the Faraday section is a row of data highlighted in yellow with the value 40552.0. Below the data is a 'Current Sample' text box containing 'Un 1 * setup'. To the right of the text box is a button labeled 'Start Standard or Unknown Acquisition'. Below the text box are two more buttons: 'Start Wavescan' and 'Special Options'. Below these buttons is a grid of buttons: 'New Sample', 'Locate', 'Move', 'Acquisition Options', 'Elements/Cations', 'PHA', 'Peak/Scan Options', 'Start Peak Center', 'Analytical Conditions', 'Count Times', 'Rate Meter', and 'Peaking'.

1	2	3	X	Y	Z	W
240.002	240.006	240.001	19.3720	35.7001	10.9966	.999987

Faraday

1	2	3	
10.00	.00	.00	.00

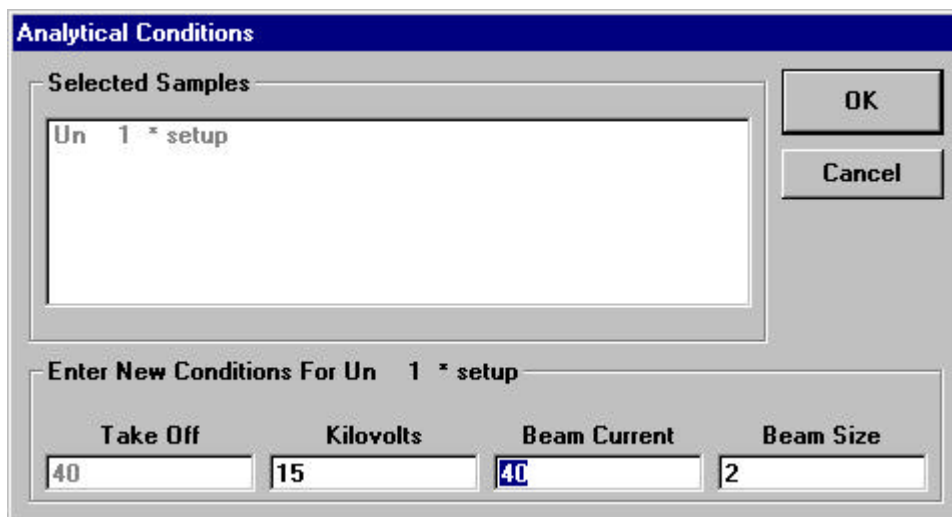
40552.0

Current Sample: Un 1 * setup

Buttons: Start Standard or Unknown Acquisition, Start Wavescan, Special Options, New Sample, Locate, Move, Acquisition Options, Elements/Cations, PHA, Peak/Scan Options, Start Peak Center, Analytical Conditions, Count Times, Rate Meter, Peaking

Setting Analytical Conditions

Click the **Analytical Conditions** button to open the **Analytical Conditions** dialog box. Enter the appropriate numbers into the *Kilovolts*, *Beam Current*, and *Beam Size* text boxes for the currently *Selected Sample*. The *Kilovolts*, *Beam Current*, and *Beam Size* will need to be manually adjusted if a column digital interface is not present.



The image shows a software dialog box titled "Analytical Conditions". It has a blue header bar with the title. Below the header, there is a section labeled "Selected Samples" containing a list box with one entry: "Un 1 * setup". To the right of this list box are two buttons: "OK" and "Cancel". Below the "Selected Samples" section is another section labeled "Enter New Conditions For Un 1 * setup". This section contains four input fields with labels above them: "Take Off" (value: 40), "Kilovolts" (value: 15), "Beam Current" (value: 40), and "Beam Size" (value: 2). The "Beam Current" field has a blue highlight around the number 40.

Click the **OK** button when done, returning to the **Acquire!** window.

Element, X-Ray Line, and Spectrometer Parameters Selection

Next, the user specifies the elements to be analyzed. Click the **Elements/Cations** button.

The screenshot shows the 'Acquire!' software interface. At the top, there is a table with columns labeled 1, 2, 3, X, Y, Z, and W. The first row of data is highlighted in yellow and contains the values: 240.002, 240.006, 240.001, 19.3720, 35.7001, 10.9966, and .999987. Below this table, there are two more rows of data, also highlighted in yellow. The first row is labeled 'Faraday' and has columns 1, 2, and 3 with values 10.00, .00, and .00. The second row has values 40552.0, ., ., and ..

Below the table, there is a section labeled 'Current Sample' with a text input field containing 'Un 1 * setup'. To the right of this field is a button labeled 'Start Standard or Unknown Acquisition'. Below the 'Current Sample' field are two more input fields: 'Data Rows: 0' and 'Good Data Rows: 0'. To the right of these fields are two buttons: 'Start Wavescan' and 'Special Options'.

At the bottom of the interface, there is a grid of buttons. The buttons are arranged in four rows and four columns:

New Sample	Locate	Move	Acquisition Options
Elements/Cations	PHA	Peak/Scan Options	Start Peak Center
Analytical Conditions	Count Times	Rate Meter	Peaking

This action opens the **Analyzed and Specified Elements** dialog box. Click on the first empty row under the *Element* column to enter the first element to analyze. The user may enter the analyzed elements in any order however, the analysis output will follow this order.

Analyzed and Specified Elements

Selected Samples

Un 1 * setup

OK Cancel

Load Element Setup

Load Sample Setup

Click Element Row to Edit Element/Cations Parameters (click empty row to add)

Channel	Element	X-Ray	Analyzed	Motor	Crystal	On-Peak

This opens the **Element Properties** dialog box. In the *Element* field either type in the first element to analyze or use the drop-down menu to select the element symbol. Certain default values listed in this window are based on parameters entered into the previously established configuration files.

Element Properties

Enter Element Properties For:

Element: X-Ray Line: Cations: Oxygens:

X-Ray Line Blank to Indicate an Un-Analyzed Element (S, Specified, by Difference or Stoichiometry)

Background Type

Average High Only Low Only Exponential

Parameters (note that Background Type can differ for Standards and Unknowns)

Background Type

Off Peak MAN

Off-Peak Entry

Absolute Position Relative Offset

Hi Off-Peak Interferences

Low Off-Peak Interferences

Spectrometer: Crystal: On-Peak: High Off-Peak: Low Off-Peak:

BaseLine: Window: INTE/DIFF: DIFF Gain: Bias: Deadtime (us):

Under the *Enter Element Properties For* section (top of the **Element Properties** dialog box) choose the correct *X-Ray Line*, *Cations*, and *Oxygens* for the first element.

Element Properties

Enter Element Properties For:

Element	X-Ray Line	Cations	Oxygens
si	ka	1	2

Leave the X-ray Line Blank to Indicate an Un-Analyzed Element (EDS, Specified, by Difference or Stoichiometry)

Off Peak Correction Type

Linear
 Average
 High Only
 Low Only
 Exponential

Parameters (note that Background Type can differ for Standards and Unknowns)

Background Type

Off Peak
 MAN

Off-Peak Entry

Absolute Position
 Relative Offset

Hi Off-Peak Interferences

Low Off-Peak Interferences

Spectrometer	Crystal	On-Peak	High Off-Peak	Low Off-Peak
1		.00000	.000000	.000000
2				
3				

Window	INTE/DIFF	Gain	Bias	Deadtime (us)
	<input type="checkbox"/> DIFF	.00	.	.00

There are two common methods for performing a background correction on wavelength dispersive x-ray data; off-peak backgrounds and MAN (mean atomic number) background corrections. The off-peak method entails measuring the background on each element in the sample of interest with the spectrometer adjusted to a position, typically on each side of the analytical peak. This method while somewhat time-consuming can accurately determine the background contribution for major, minor and trace element concentrations.

The MAN method relies on the fact that most of the background (continuum) production in the sample is directly proportional to the average atomic number of the sample. The MAN correction is an empirical calibration curve method involving the measurement of standards of known composition (hence average atomic number). If many samples are to be analyzed for their major and minor element concentrations then substantial time may be saved using the MAN method. However, if the user is required to measure high atomic number samples and/or trace concentrations, more accurate data may be obtained with off-peak background corrections.

Continue by selecting *MAN* for the *Background Type*. Selecting *MAN* deactivates the *Off Peak Correction Type* buttons as well as the *High* and *Low Off-Peak* boxes. Next, click the text box under *Spectrometer* and enter the appropriate spectrometer number that will be used to analyze the first element. The drop-down menu may also be used to select the spectrometer number. Choosing a *Spectrometer* and *Crystal* loads various parameters from the configuration files. Each of these parameters in this window should be inspected and edited as needed (use the <tab> key to move between boxes).

The next screen shows the edited **Element Properties** dialog box for silicon.

Element Properties

Enter Element Properties For:

Element	X-Ray Line	Cations	Oxygens
si	ka	1	2

Leave the X-ray Line Blank to Indicate an Un-Analyzed Element (EDS, Specified, by Difference or Stoichiometry)

Off Peak Correction Type

Linear
 Average
 High Only
 Low Only
 Exponential

Parameters (note that Background Type can differ for Standards and Unknowns)

Background Type	Off-Peak Entry	Interferences
<input type="radio"/> Off Peak <input checked="" type="radio"/> MAN	<input checked="" type="radio"/> Absolute Position <input type="radio"/> Relative Offset	<input type="button" value="Hi Off-Peak Interferences"/> <input type="button" value="Low Off-Peak Interferences"/>

Spectrometer	Crystal	On-Peak	High Off-Peak	Low Off-Peak
1	PET	228.074	230.906	225.241

BaseLine	Window	INTE/DIFF	Gain	Bias	Deadtime (us)
.50	10.00	<input type="checkbox"/> DIFF	50.00	1700.	1.00

Click the **OK** button of the **Element Properties** dialog box to accept these element parameters for silicon.

The program returns to the **Analyzed and Specified Elements** window with silicon now entered into the *Element/Cations Parameters* table.

Analyzed and Specified Elements

Selected Samples

Un 1 * setup

OK Cancel

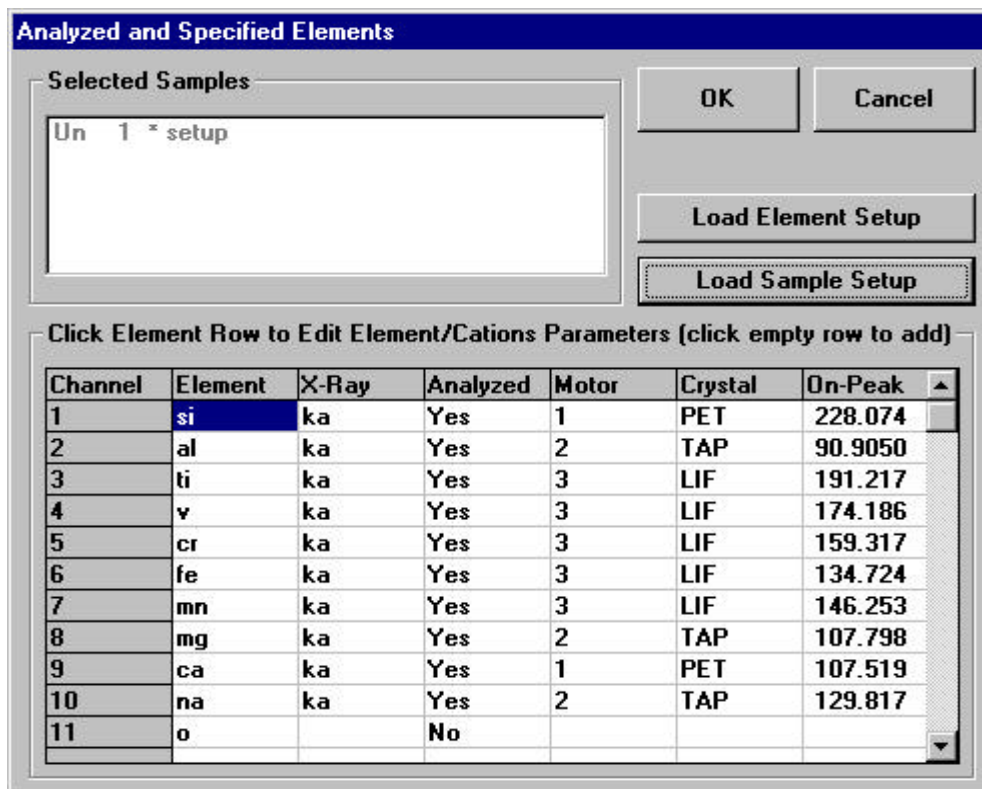
Load Element Setup

Load Sample Setup

Click Element Row to Edit Element/Cations Parameters (click empty row to add)

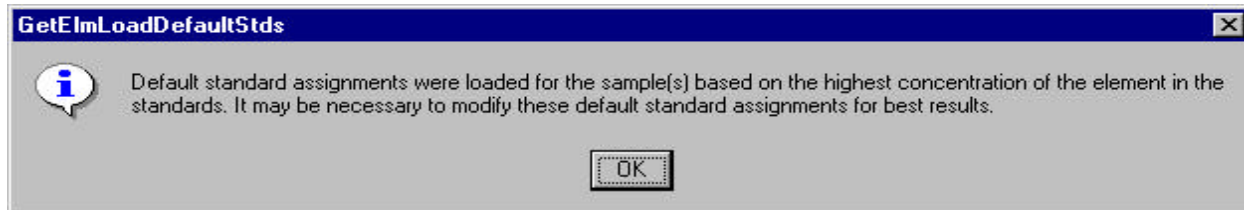
Channel	Element	X-Ray	Analyzed	Motor	Crystal	On-Peak
1	si	ka	Yes	1	PET	228.074

Enter the next element in the run by clicking on the next empty *Element* row of the **Analyzed and Specified Elements** window. This opens the **Element Properties** dialog box again. Enter the appropriate *Element*, *Spectrometer*, *Crystal* and adjust all other text boxes and buttons. Repeat the element entry process until all of the elements are listed in the **Analyzed and Specified Elements** window. The remaining nine element entries are not shown here to save space. Finally, oxygen is added to the element list as a not analyzed element for subsequent formula calculations. This is done by entering o (for oxygen) in the *Element* text box and leaving the *X-Ray Line* text box empty. See User's Guide and Reference documentation for more details.



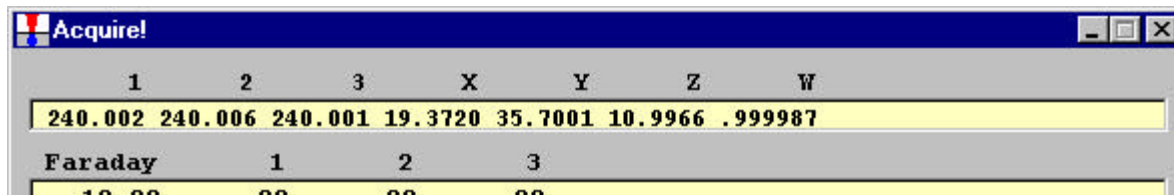
Click the **OK** button of the **Analyzed and Specified Elements** window when done entering elements in the run.

The **GetElmLoadDefaultStds** window opens to inform the user that standard assignments have been made based on the highest concentration of the element in the standard. The user will edit these choices shortly. Click **OK** to return to the main **Acquire!** window.



Editing Acquisition Options

The user may change the element acquisition order of the spectrometers by clicking the **Acquisition Options** button in the **Acquire!** dialog box.



This opens the **Acquisition Options** dialog box.

Acquisition Options

Click Element Row to Edit Acquisition Options

Channel	Element	Motor	Crystal	Order	Std Bgd	Unk Bgd	EDS
1	si ka	1	PET	1	Off Peak	MAN	
2	al ka	2	TAP	1	Off Peak	MAN	
3	ti ka	3	LIF	1	Off Peak	MAN	
4	v ka	3	LIF	2	Off Peak	MAN	
5	cr ka	3	LIF	3	Off Peak	MAN	
6	fe ka	3	LIF	4	Off Peak	MAN	
7	mn ka	3	LIF	5	Off Peak	MAN	
8	mg ka	2	TAP	2	Off Peak	MAN	
9	ca ka	1	PET	2	Off Peak	MAN	
10	na ka	2	TAP	3	Off Peak	MAN	

Acquisition Order

Channel Number
 Ascending Angstroms
 Descending Angstroms
 User Defined Order Number

Spectrometer BackLash

BackLash Correction on Spectrometers

Stage BackLash (only with automation)

BackLash Correction on Standards
 BackLash Correction on Unknowns
 BackLash Correction on Wavescans

Automation Error Reporting

E-mail Notification of Errors

Acquisition Motion

Asynchronous
 Synchronous

Miscellaneous Options

Return to On Peaks After Acquisition
 Blank Beam After Acquisition
 Measure Beam On Sample Acquisitions
 Measure Beam On Wavescans
 Measure Absorbed Current
 Use Automatic Analysis
 Beam Off During Spectrometer Motion
 Acquire EDS Weight Percents
 Use Automated PHA Control
 Load Standard Data From File Setup

OK

Cancel

To change the order that the spectrometer measures an element, select the *User Defined Order Number* button under *Acquisition Order* and click the row of the element to edit.

This opens the **Acquisition Properties** dialog box, seen below. Here, the user will re-define na to be counted on the first spectrometer pass due to its susceptibility to being volatilized by long exposure to the electron beam. In samples containing volatile elements the user may wish to consider running the volatile element calibration routine (see User's Guide and Reference documentation and/or Advanced Topics manual).

The screenshot shows the 'Acquisition Options' dialog box. At the top, it says 'Click Element Row to Edit Acquisition Options'. Below this is a table with columns: Channel, Element, Motor, Crystal, Order, Std Bgd, Unk Bgd, and EDS. The row for 'na ka' (Channel 10) is selected, and its 'Order' is 3. The 'Acquisition Properties' sub-dialog is open over this row, titled 'Enter Acquisition Options For: na ka'. It contains several sections: 'Acquisition Order' with radio buttons for 'Channel Number', 'Ascending Angstrom', 'Descending Angstrom', and 'User Defined Order' (selected); 'Spectrometer BackLash' with a checked 'BackLash Correction' box; 'Stage BackLash (only)' with three unchecked 'BackLash Correction' boxes; 'Automation Error Report' with an unchecked 'E-mail Notification' box; 'Background Type for Standards' with radio buttons for 'Off Peak' (selected) and 'MAN (mean atomic number)'; 'Background Type for Unknowns' with radio buttons for 'Off Peak' and 'MAN (mean atomic number)' (selected); and 'EDS Acquisition Option (specified elements only)' with an unchecked 'Acquire Specified Element using EDS' box. A note at the bottom of the sub-dialog reads: 'Make sure that the Acquire EDS Weight Percents check box is checked in the Acquisition Options Dialog to acquire EDS/WDS data'. The sub-dialog has 'OK' and 'Cancel' buttons.

Channel	Element	Motor	Crystal	Order	Std Bgd	Unk Bgd	EDS
2	al ka	2	TAP	1	Off Peak	MAN	
3	ti ka	3	LIF	1	Off Peak	MAN	
4	v ka	3	LIF	2	Off Peak	MAN	
5	cr ka	3	LIF	3	Off Peak	MAN	
6	fe ka	3	LIF	4	Off Peak	MAN	
7	mn ka	3	LIF	5	Off Peak	MAN	
8	mg ka	2	TAP	2	Off Peak	MAN	
9	ca ka	1	PET	2	Off Peak	MAN	
10	na ka	2	TAP	3	Off Peak	MAN	
11	o						

Edit the *Spectrometer Order Number* for all elements to change the acquisition order. Further, the user wishes to use the same background correction method for both standards and unknowns, edit the *Background Type for Standards* to *MAN* for each element. Click the **OK** button returning to the **Acquisition Options** window. For spectrometer efficiency and element volatilization issues the user redefines the acquisition order as seen below.

Acquisition Options

Click Element Row to Edit Acquisition Options

Channel	Element	Motor	Crystal	Order	Std Bgd	Unk Bgd	EDS
1	si ka	1	PET	1	MAN	MAN	
2	al ka	2	TAP	3	MAN	MAN	
3	ti ka	3	LIF	1	MAN	MAN	
4	v ka	3	LIF	2	MAN	MAN	
5	cr ka	3	LIF	3	MAN	MAN	
6	fe ka	3	LIF	5	MAN	MAN	
7	mn ka	3	LIF	4	MAN	MAN	
8	mg ka	2	TAP	2	MAN	MAN	
9	ca ka	1	PET	2	MAN	MAN	
10	na ka	2	TAP	1	MAN	MAN	

Acquisition Order

Channel Number
 Ascending Angstroms
 Descending Angstroms
 User Defined Order Number

Acquisition Motion

Asynchronous
 Synchronous

Miscellaneous Options

Return to On Peaks After Acquisition
 Blank Beam After Acquisition
 Measure Beam On Sample Acquisitions
 Measure Beam On Wavescans
 Measure Absorbed Current
 Use Automatic Analysis
 Beam Off During Spectrometer Motion
 Acquire EDS Weight Percents
 Use Automated PHA Control
 Load Standard Data From File Setup

Spectrometer BackLash

BackLash Correction on Spectrometers

Stage BackLash (only with automation)

BackLash Correction on Standards
 BackLash Correction on Unknowns
 BackLash Correction on Wavescans

Automation Error Reporting

E-mail Notification of Errors

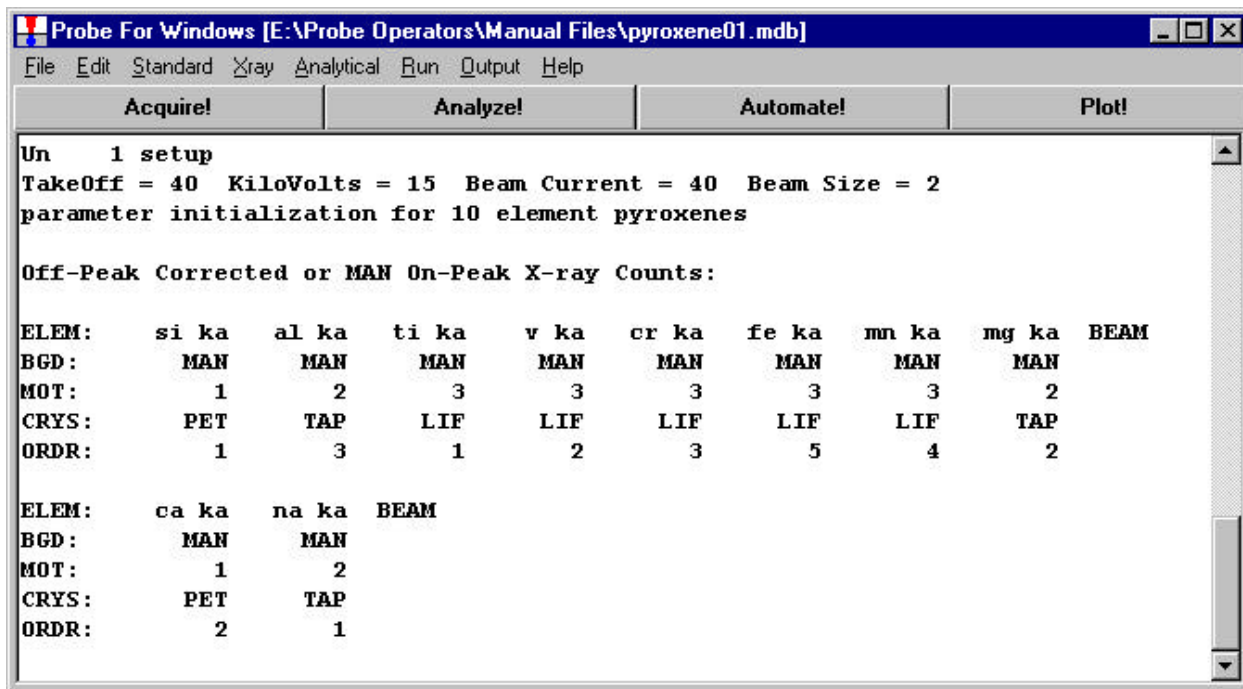
OK

Cancel

Click the **OK** button of the **Acquisition Options** window to return to the **Acquire!** dialog box.

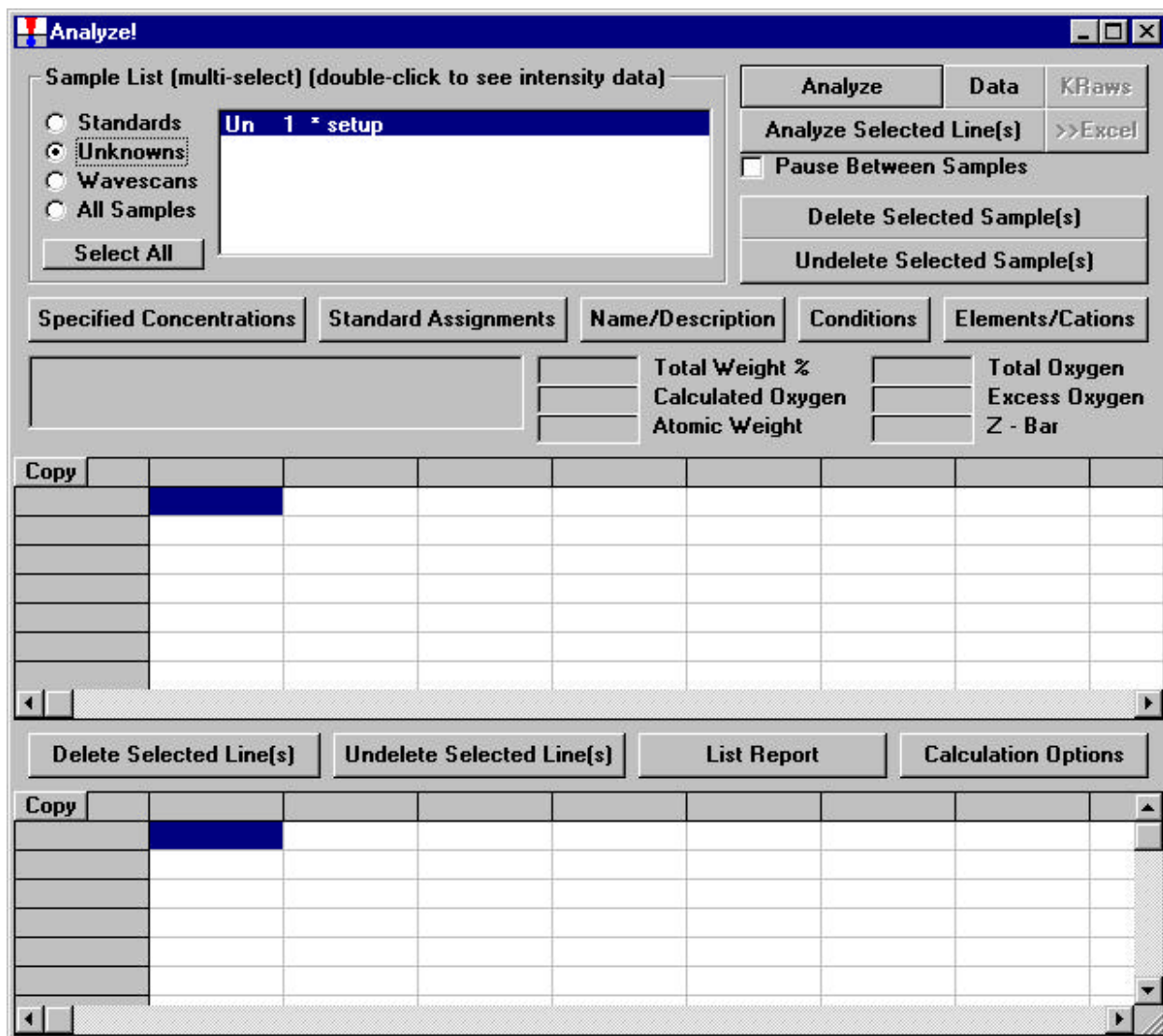
Modifying Standard Assignments

The standard assignments chosen by PROBE FOR WINDOWS may be inspected and edited by clicking the **Analyze!** button from the main log window.



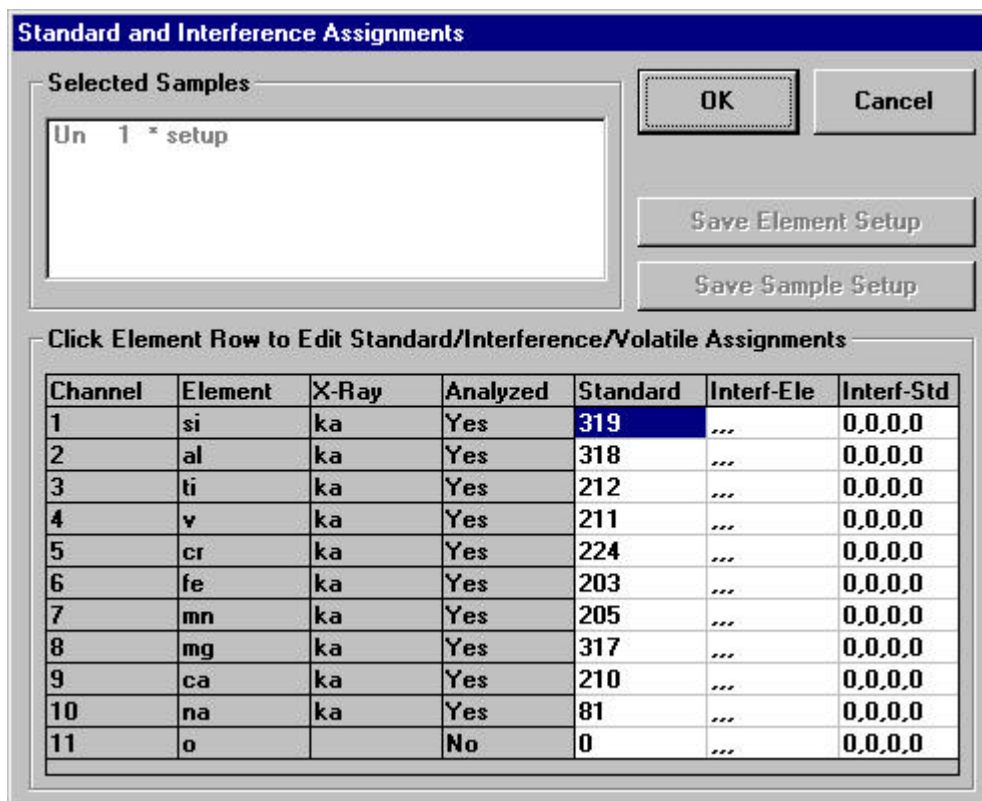
The program automatically wraps element data output to eight elements per line. If the extended format menu is checked (activated from the **Output** menu) then the data is written out (in log window and to disk file, if enabled) as far as necessary to the right.

This opens the **Analyze!** dialog box.



Click the **Standard Assignments** button.

The **Standard and Interference Assignments** dialog box opens.



The dialog box titled "Standard and Interference Assignments" features a "Selected Samples" list containing "Un 1 * setup". It includes "OK", "Cancel", "Save Element Setup", and "Save Sample Setup" buttons. Below is a table for editing assignments.

Channel	Element	X-Ray	Analyzed	Standard	Interf-Ele	Interf-Std
1	si	ka	Yes	319	...	0,0,0,0
2	al	ka	Yes	318	...	0,0,0,0
3	ti	ka	Yes	212	...	0,0,0,0
4	v	ka	Yes	211	...	0,0,0,0
5	cr	ka	Yes	224	...	0,0,0,0
6	fe	ka	Yes	203	...	0,0,0,0
7	mn	ka	Yes	205	...	0,0,0,0
8	mg	ka	Yes	317	...	0,0,0,0
9	ca	ka	Yes	210	...	0,0,0,0
10	na	ka	Yes	81	...	0,0,0,0
11	o		No	0	...	0,0,0,0

Click the row of the element that the user wishes to change the standard assignment for.

This opens the **Assignment Properties** dialog box. The default standard assignments are based on the highest concentration of the element in the standards currently in the run. In addition to standard assignments, the user may assign spectral interference corrections and volatile element calibrations from this window.

Assignment Properties

Enter Standard Assignments For: si ka

Element	X-Ray	Assigned Standard
si	ka	319 SiO2 Quartz Taylor

OK
Cancel

Interference Standard Assignments

1st			Remove
2nd			Remove
3rd			Remove
4th			Remove

Calculate Interferences

The standard used for the interference correction must contain a known concentration of the interfering element and none of the interfered element, nor any other interfering elements.

Volatile Element Calibration Sample Assignment (select an unknown sample for calibration fit)

Un 1 * setup	<p>Volatile element correction calibration samples should be acquired using the "Volatile" button in the Acquire window.</p> <p>Volatile element calibrations using an assigned calibration sample are specified here. Volatile element self calibrations are assigned to themselves.</p> <p>Display Volatile Fit Remove Volatile Fit</p> <p>Volatile Correction Fit Slope Coefficient</p>
--------------	---

No Volatile Correction

Click the *Assigned Standard* menu box. A scrollable list of all standards added to the current run are displayed. Select a new standard for element si.

Assignment Properties

Enter Standard Assignments For: si ka

Element	X-Ray	Assigned Standard
si	ka	206 Orthopyroxene
		81 Albite
		203 Fayalite
		205 Tephroite
		206 Orthopyroxene
		207 Kyanite
		210 Wollastonite
		211 V205
		212 Rutile

Interference Standard As

1st

2nd

3rd

4th

Calculate Interferences

The standard used for the interference correction must contain a known concentration of the interfering element and none of the interfered element, nor any other interfering elements.

Volatile Element Calibration Sample Assignment (select an unknown sample for calibration fit)

Un 1 * setup

Volatile element correction calibration samples should be acquired using the "Volatile" button in the Acquire window.

Volatile element calibrations using an assigned calibration sample are specified here. Volatile element self calibrations are assigned to themselves.

Display Volatile Fit Remove Volatile Fit

Volatile Correction Fit Slope Coefficient

No Volatile Correction

Click the **OK** button returning to the **Standard and Interference Assignments** dialog box.

Repeat these editing steps until all necessary element standard assignments have been modified. In this example, the standard assignments for si, al, and mg are edited, resulting in the following window.

Standard and Interference Assignments

Selected Samples

Un 1 * setup

OK Cancel

Save Element Setup

Save Sample Setup

Click Element Row to Edit Standard/Interference/Volatile Assignments

Channel	Element	X-Ray	Analyzed	Standard	Interf-Ele	Interf-Std
1	si	ka	Yes	206	---	0,0,0,0
2	al	ka	Yes	207	---	0,0,0,0
3	ti	ka	Yes	212	---	0,0,0,0
4	v	ka	Yes	211	---	0,0,0,0
5	cr	ka	Yes	224	---	0,0,0,0
6	fe	ka	Yes	203	---	0,0,0,0
7	mn	ka	Yes	205	---	0,0,0,0
8	mg	ka	Yes	206	---	0,0,0,0
9	ca	ka	Yes	210	---	0,0,0,0
10	na	ka	Yes	81	---	0,0,0,0
11	o		No	0	---	0,0,0,0

Click the **OK** button of the **Standard and Interference Assignments** dialog box returning to the **Analyze!** window.

Setting Count Times

Click the **Count Times** button of the **Acquire!** window.

The **Acquire!** window displays a data table with columns labeled 1, 2, 3, X, Y, Z, and W. The first row contains the values: 240.002, 240.006, 240.001, 19.3720, 35.7001, 10.9966, .999987. Below this is a **Faraday** section with columns 1, 2, 3 and values 10.00, .00, .00, .00. A **Current Sample** field shows "Un 1 * setup" and a **Nominal Beam (nA)** field shows "40552.0". The interface includes several buttons: "Start Standard or Unknown Acquisition", "Start Wavescan", "Special Options", "New Sample", "Locate", "Move", "Acquisition Options", "Elements/Cations", "PHA", "Peak/Scan Options", "Start Peak Center", "Analytical Conditions", "Count Times", and "Rate Meter".

The **Count Times** dialog box contains a table with the following data:

Channel	Element	Motor	Crystal	On-Peak	Hi-Peak	Lo-Peak	MaxCou	Factor	Wave	Peak	Quick
1	si ka	1	PET	10.00	2.00	2.00	100000	1	6.00	8.00	.50
2	al ka	2	TAP	10.00	2.00	2.00	100000	1	6.00	8.00	.50
3	ti ka	3	LIF	10.00	2.00	2.00	100000	1	6.00	8.00	.50
4	v ka	3	LIF	10.00	2.00	2.00	100000	1	6.00	8.00	.50
5	cr ka	3	LIF	10.00	2.00	2.00	100000	1	6.00	8.00	.50
6	fe ka	3	LIF	10.00	2.00	2.00	100000	1	6.00	8.00	.50
7	mn ka	3	LIF	10.00	2.00	2.00	100000	1	6.00	8.00	.50
8	mg ka	2	TAP	10.00	2.00	2.00	100000	1	6.00	8.00	.50
9	ca ka	1	PET	10.00	2.00	2.00	100000	1	6.00	8.00	.50
10	na ka	2	TAP	10.00	2.00	2.00	100000	1	6.00	8.00	.50

Below the table, there is a **Faraday Count Time** field set to 10.00, an **Nominal Beam (nA)** field set to 40.5520, and an **Update Selected Elements** checkbox. **OK** and **Cancel** buttons are also present.

To edit the count times for any element click that row in the spreadsheet. This opens the **Count Time Properties** dialog box.

Count Time Properties

Enter Count Time Properties For: si ka

On-Peak Time	Hi-Peak Time	Lo-Peak Time
10.00	2.00	2.00

Wave Scan Time	Peaking Time	Quick Scan Time
6.00	8.00	.50

Unknown Maximum Count : 100000000

Use the Unknown Maximum Count to specify a desired statistical significance instead of a fixed count time. If the total counts acquired exceeds the Unknown Maximum Count the acquisition will be considered complete.

Unknown Count Time Factor : 1

Use the Unknown Count Factor to automatically change the counting time for on, hi and lo count times for unknown samples relative to standards. For example, if the on-peak time is 10 and the Unknown Count Factor is 2, then the standards will count 10 seconds on-peak and the unknowns will count 20 seconds on-peak.

OK

Cancel

Edit the *Count Time* text boxes with new times. To adjust the count times on unknowns, change the *Unknown Count Time Factor*. This is the multiplicity factor for acquiring unknown sample elements relative to the count times specified for the standards.

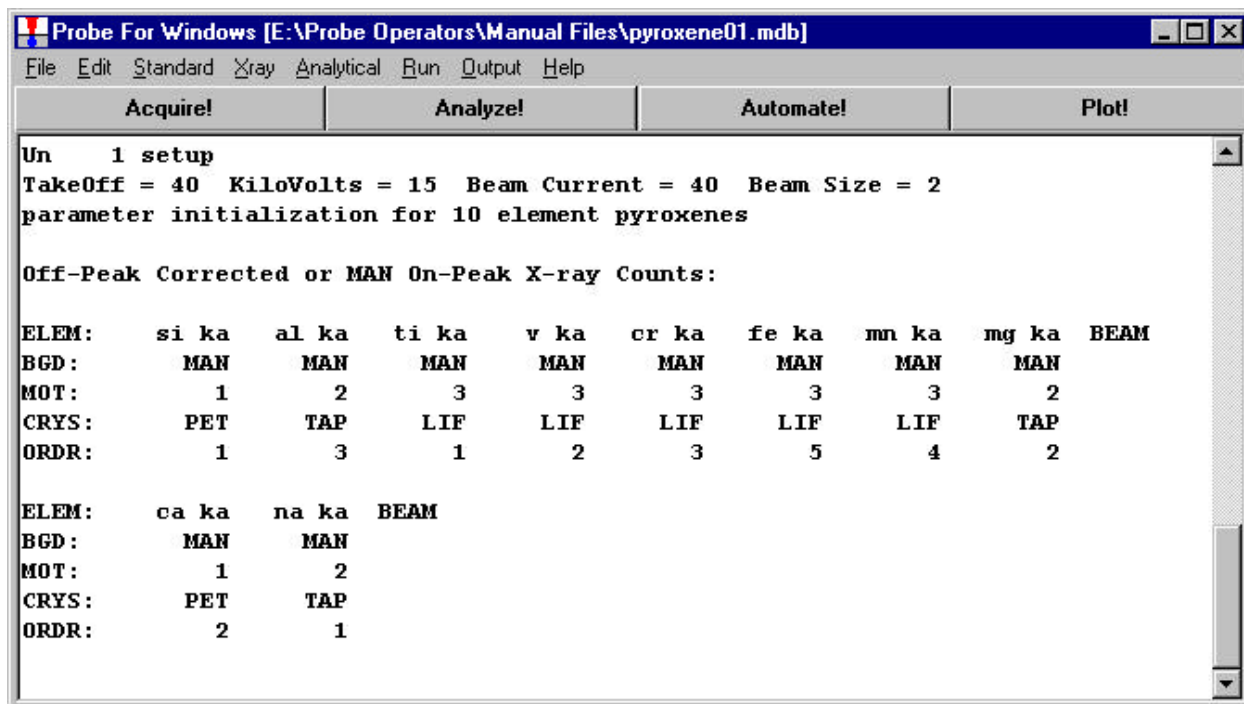
The *Unknown Maximum Count* text box is used to specify a statistics based count time. This feature is most useful if the user wishes to count for 30 seconds or 40000 counts whichever comes first. For samples with high count rate elements, the actual analysis time would be shorter.

Click the **OK** button of the **Count Time Properties** window.

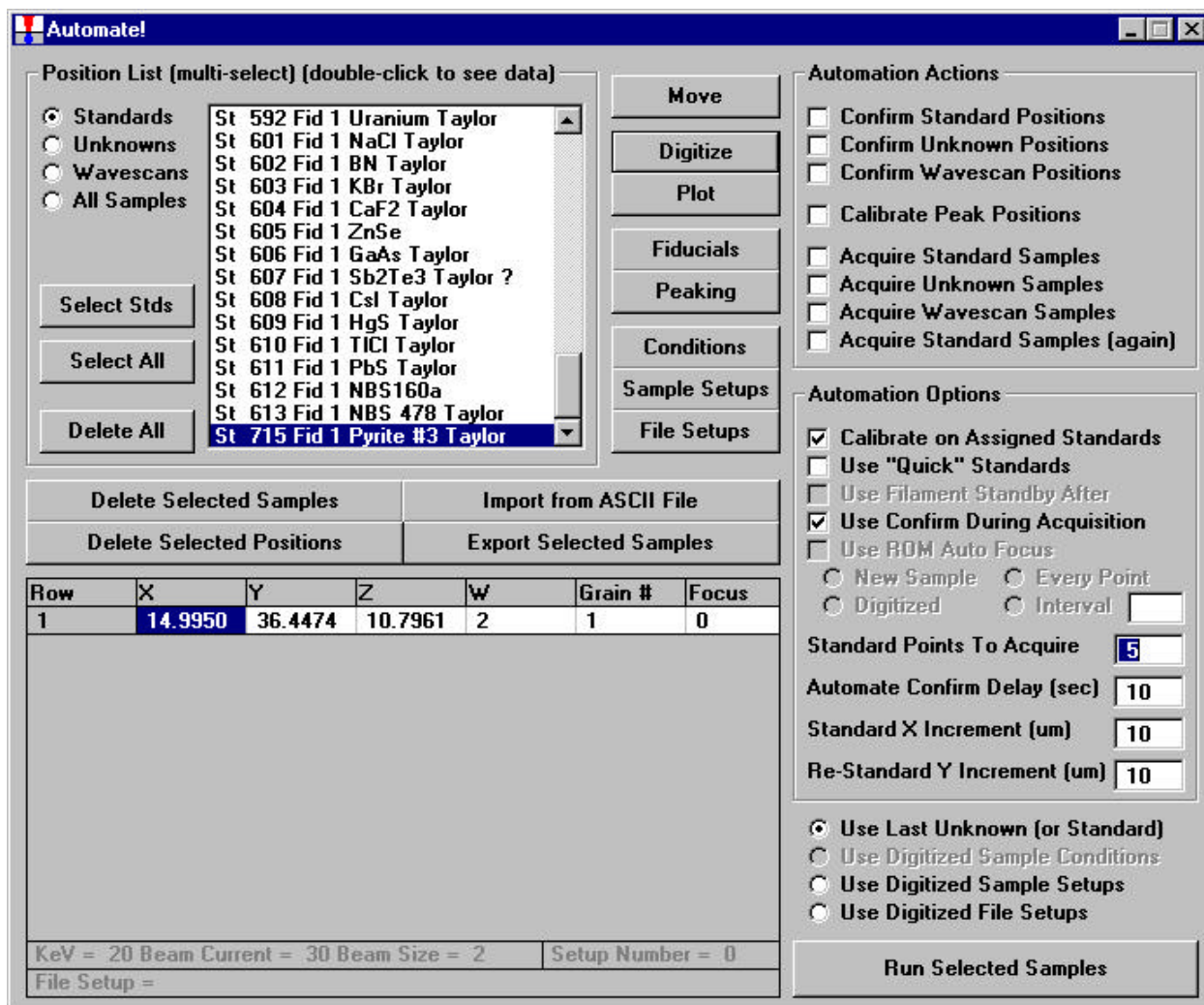
Finally, click the **OK** button of the **Count Times** dialog box to accept any modified count times and return to the **Acquire!** window.

Loading Standard Position Files

To run analytical standards using automation, requires that the computer know the physical location of all the standards for this run. Click the **Automate!** button from the main PROBE FOR WINDOWS log window.

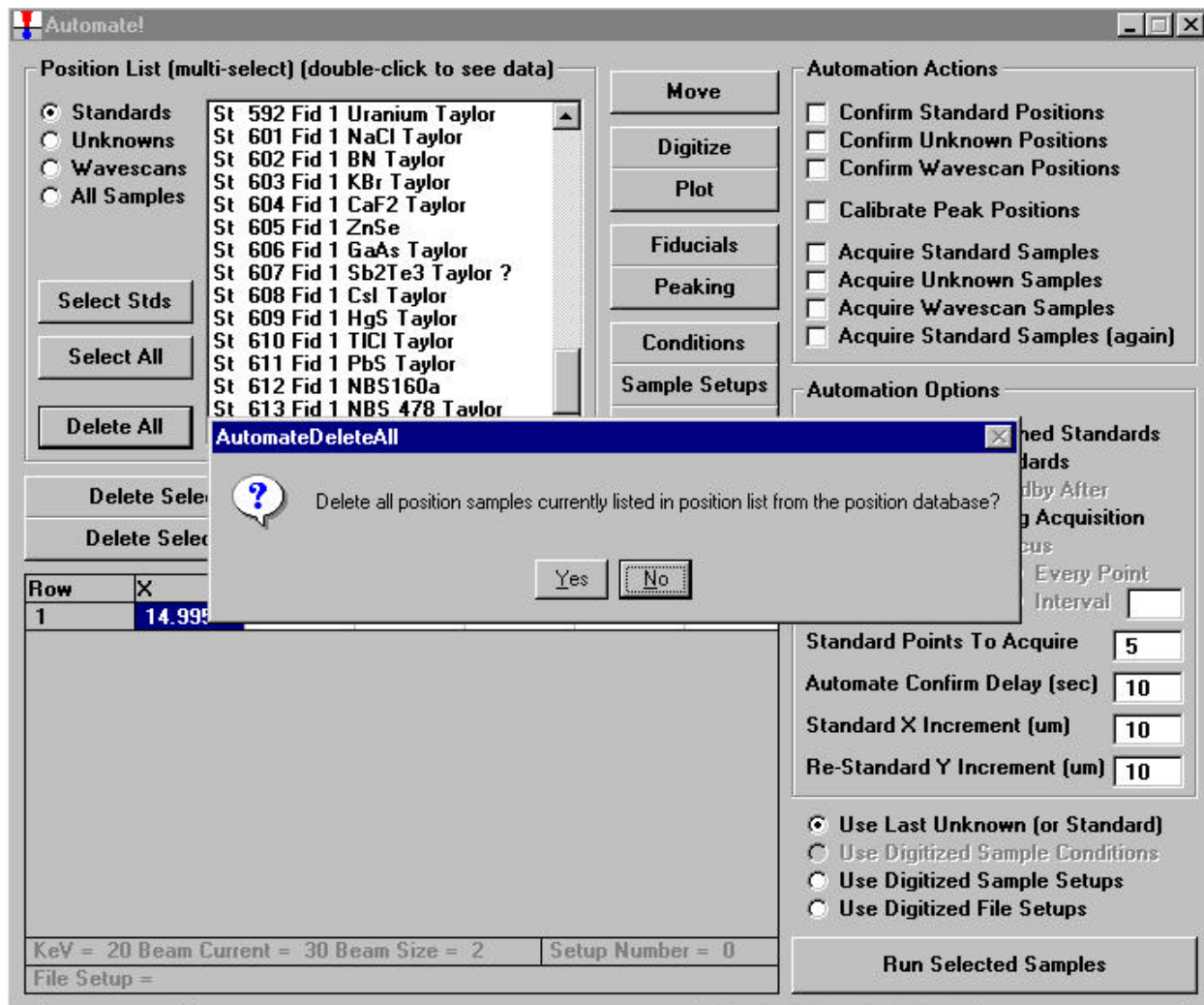


This opens the **Automate!** dialog box shown below.

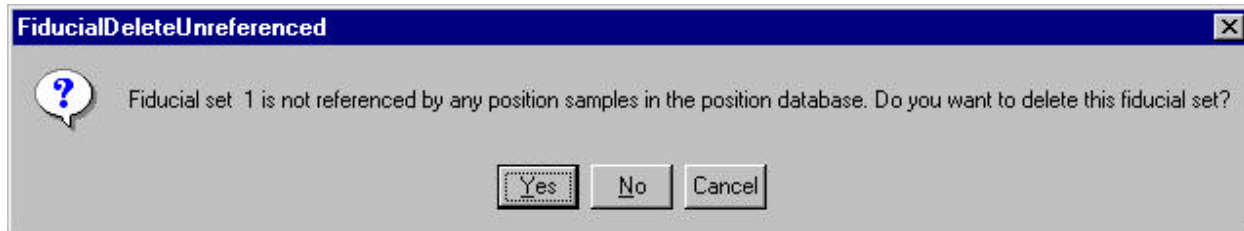


The last set of digitized standards used is visible in the *Position List* list box of the **Automate!** window. Currently, the standard block for the brass alloy run digitized previously are listed. These will be deleted and replaced by the appropriate standard position file(s).

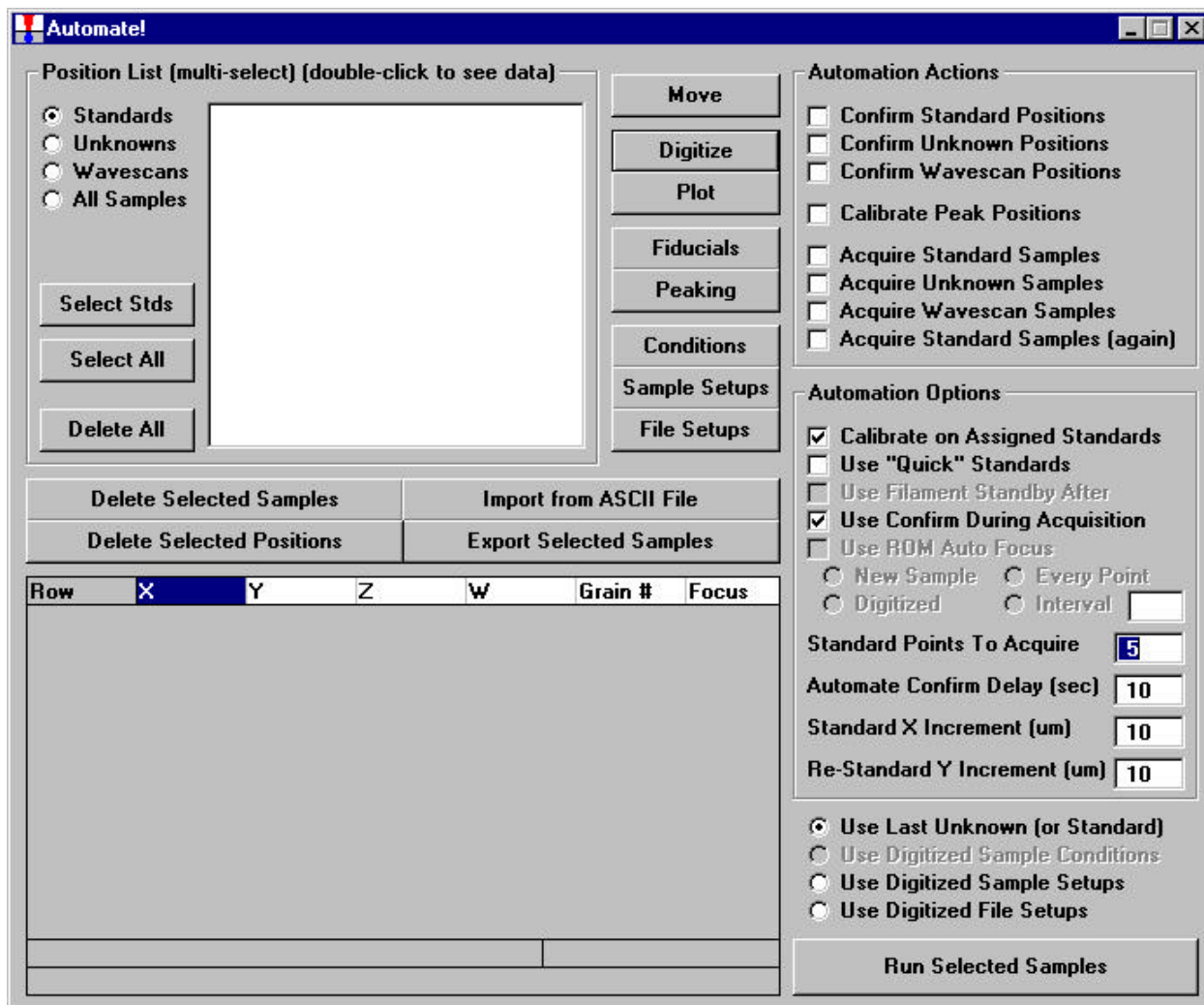
Click the **Delete All** button. This opens the **AutomateDeleteAll** window. Click the **Yes** button of the **AutomateDeleteAll** window to clear the *Position List* list box of all displayed position samples.



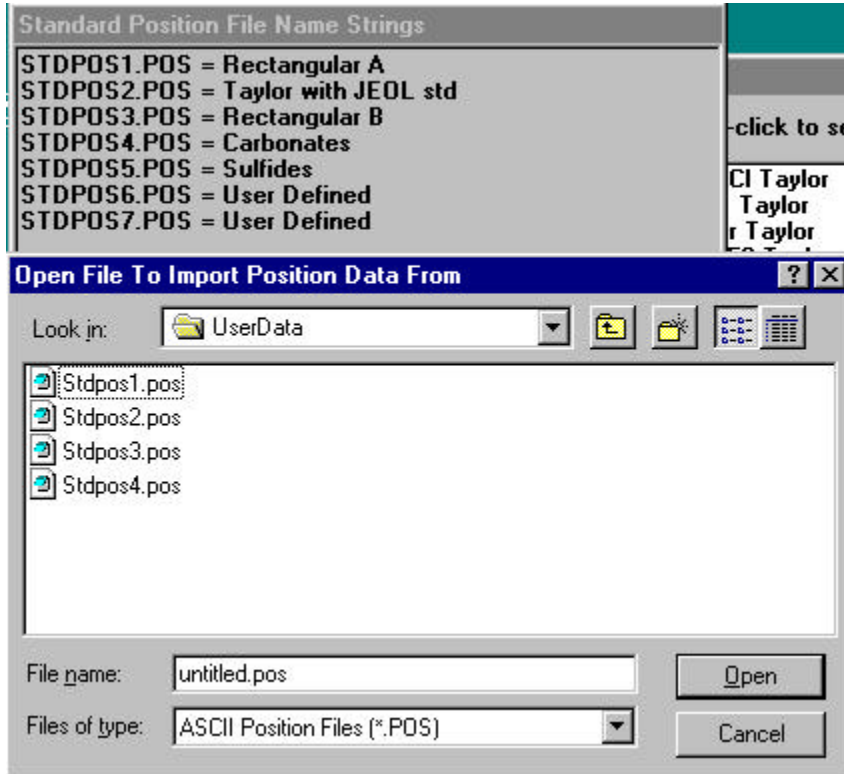
The **FiducialDeleteUnreferenced** window opens. Click the **Yes** button to clear the fiducial coordinate set from the position database.



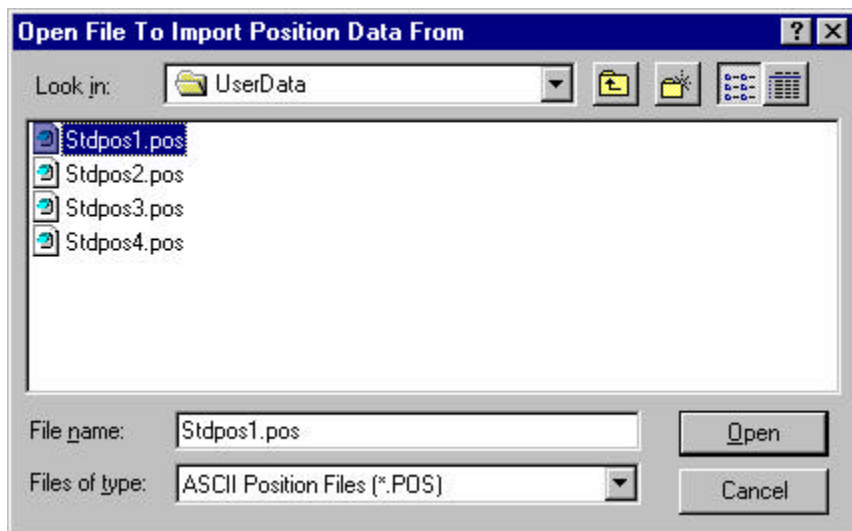
Click the **Import from ASCII File** button of the **Automate!** dialog box to import position samples from a previously saved ASCII file.



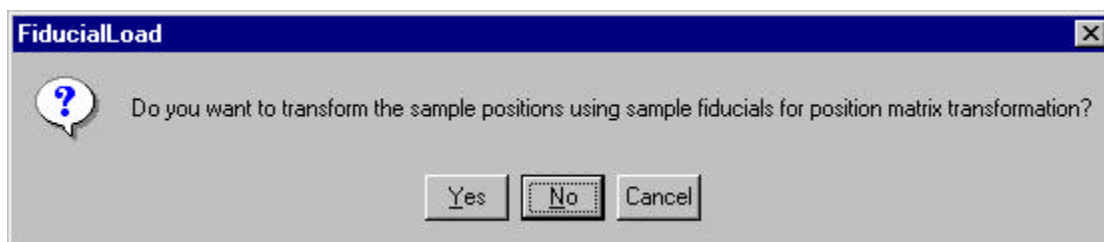
This action opens both the **Standard Position File Name Strings** and the **Open File To Import Position Data From** windows. The former window is based on the name strings in the PROBEWIN.INI file. The user has previously digitized all standard blocks and created STDPOSx.POS files. Three STDPOSx.POS files are typically loaded for silicate runs; STDPOS1.POS, STDPOS2.POS, and STDPOS3.POS. The default location for *.POS files is at C:\Program Files\Probe for Windows\UserData.



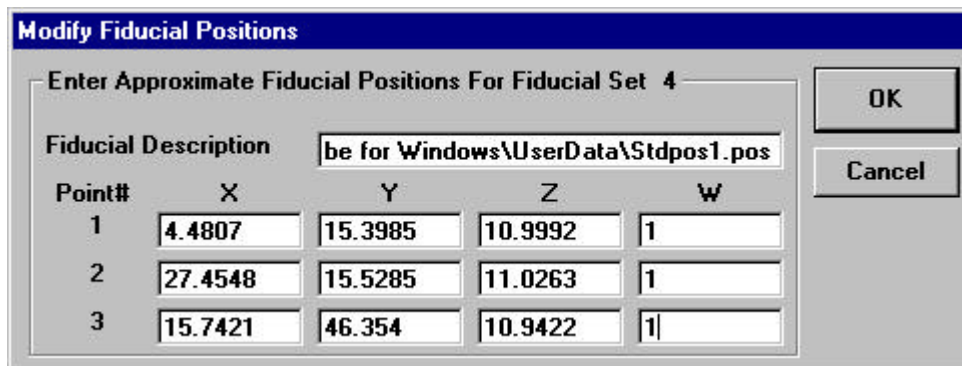
Type in the appropriate file name in the *File name* text box or simply highlight the file in the list and click the **Open** button.



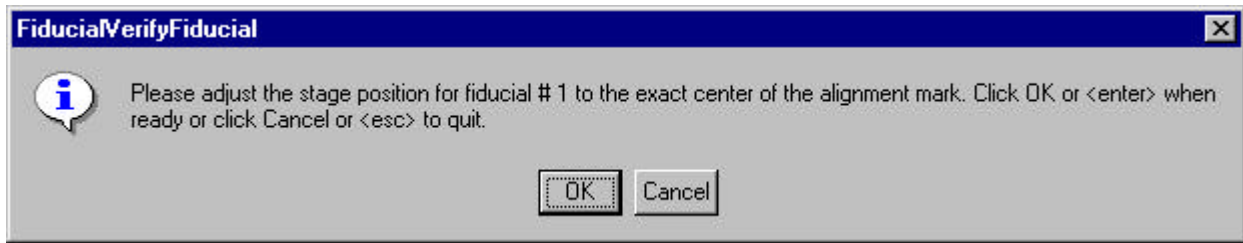
This action opens the **FiducialLoad** window. Click the **Yes** button to do a fiducial transformation on this pre-digitized standard block to obtain an accurate set of standard positions.



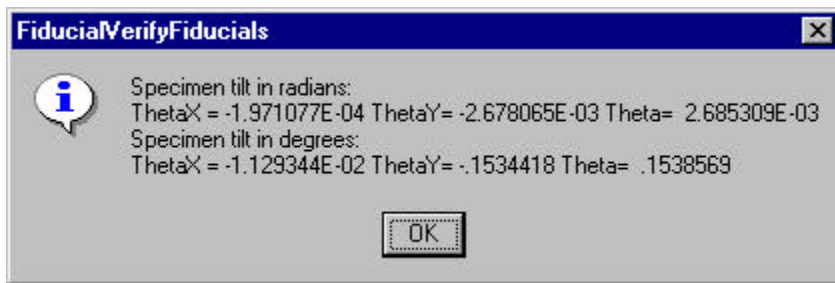
The **Modify Fiducial Positions** window opens. Normally the user would simply accept the defaults or edit the position text boxes for each point, including the appropriate stage location number (JEOL 733 use appropriate W stage position). When done, click the **OK** button.



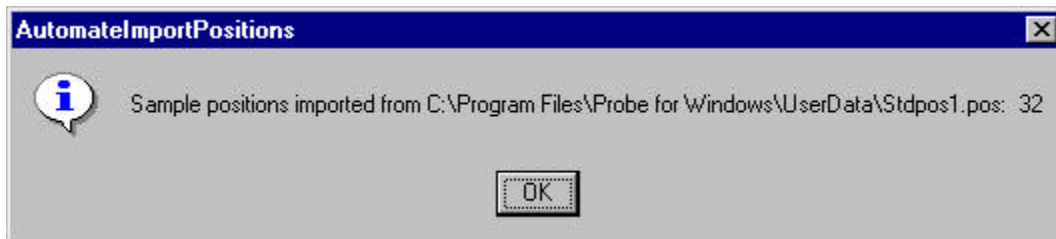
This action causes the stage motors to drive to the first fiducial coordinate in its lookup table. The **FiduciaVerifyFiducial** window appears. Adjust the stage motors to center the first fiducial mark, click the **OK** button.



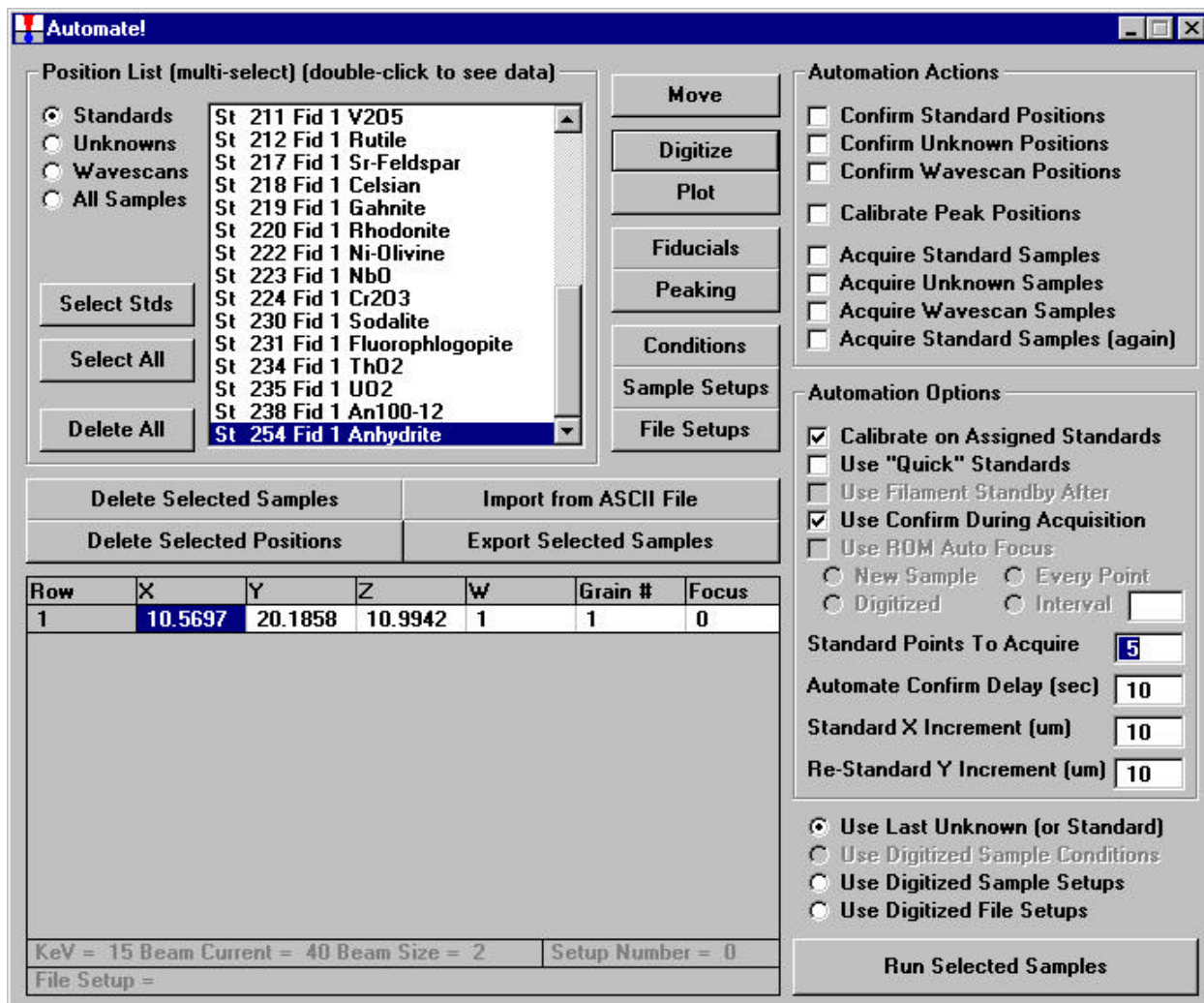
The computer will drive to each of the three fiducial marks for centering. Clicking the **OK** button after the third fiducial mark opens the **FiducialsVerifyFiducials** window. Click this **OK** button.



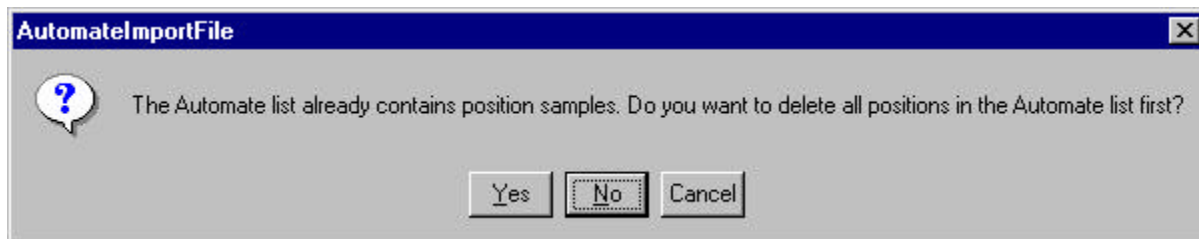
The program then imports and updates the position coordinates of all of the standards in the pre-digitized standard position file. The **AutomateImportPositions** window opens. Click the **OK** button returning to the **Automate!** window.



The **Automate!** window would appear as below. The currently transformed standard position file is listed in the *Position List* list box.

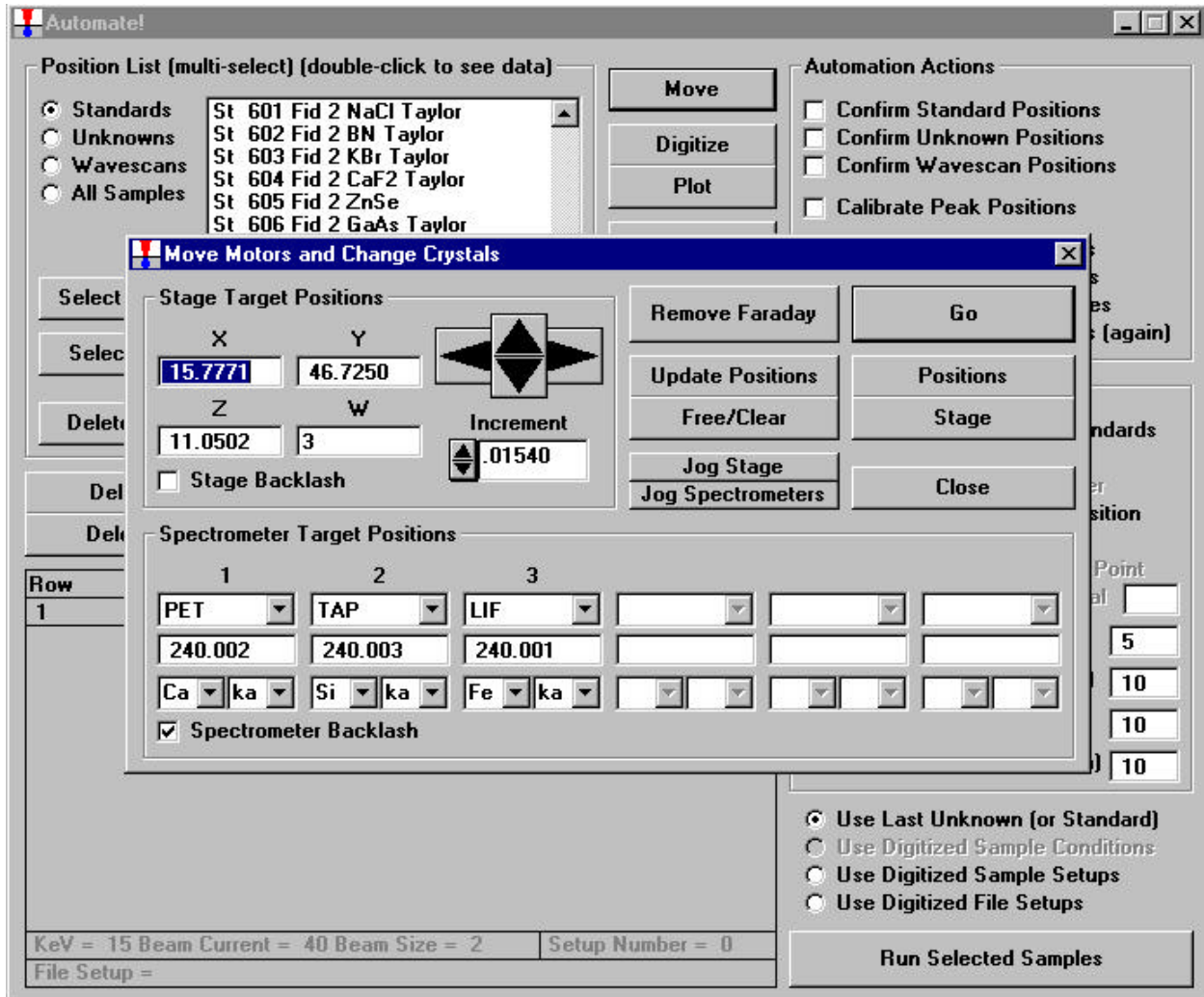


Repeat the same loading procedure for the other two standard position files required for use in the automation. After clicking the **Import from ASCII File** button, the **AutomateImportFile** window opens.

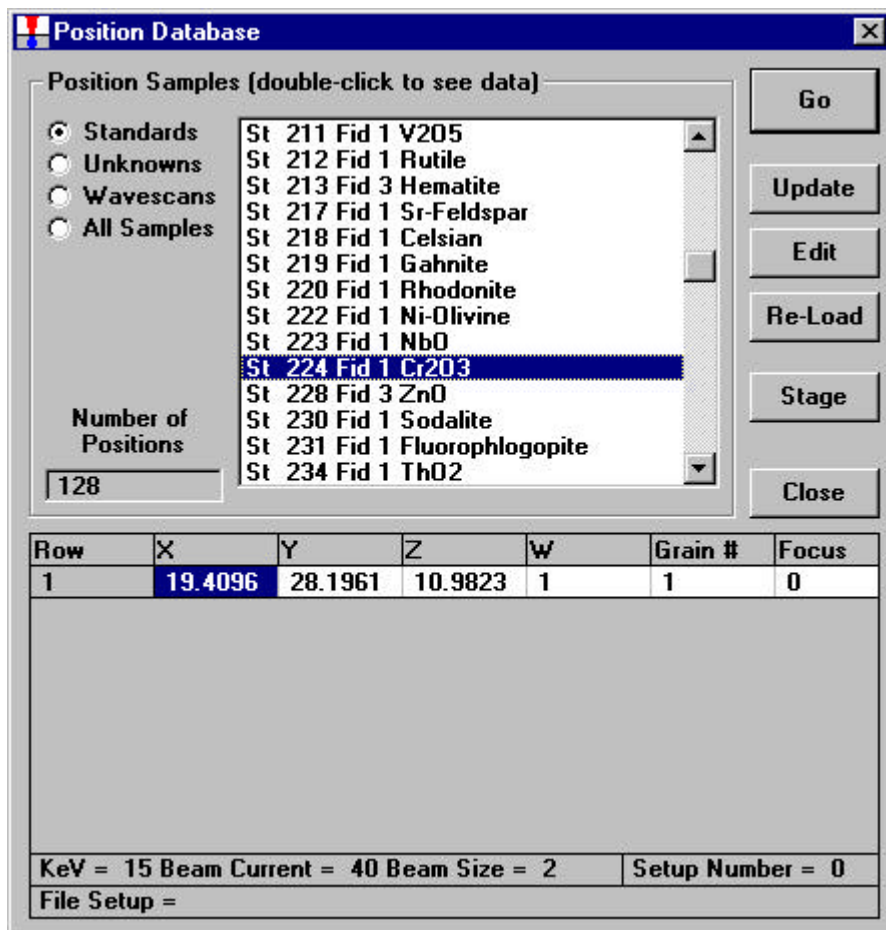


Typically, when using more than one standard mount, the user would not delete all positions in the *Position List*, instead appending the additional position files to the first file.

All of the standards loaded are listed in the *Position List* list box of the **Automate!** window. These may now be accessed by the program during any automation action. For instance, it is now possible to have the computer drive to any standard located on the three blocks. The user may click the **Move** button of the **Automate!** window opening the **Move Motors and Change Crystals** dialog box. Then, click the **Positions** button.



This opens the **Position Database** dialog box. From here any sample that has been digitized can be located by simply selecting it and clicking the **Go** button.



Once the stage motors drive the stage to the chosen standard, exit the **Position Database** by clicking the **Close** button. Likewise, the user may close the **Move Motors and Change Crystals** window by clicking its **Close** button, returning to the **Automate!** window.

This concludes the initial parameter setup portion of PROBE FOR WINDOWS.

Automation Actions

Confirm Standard Positions

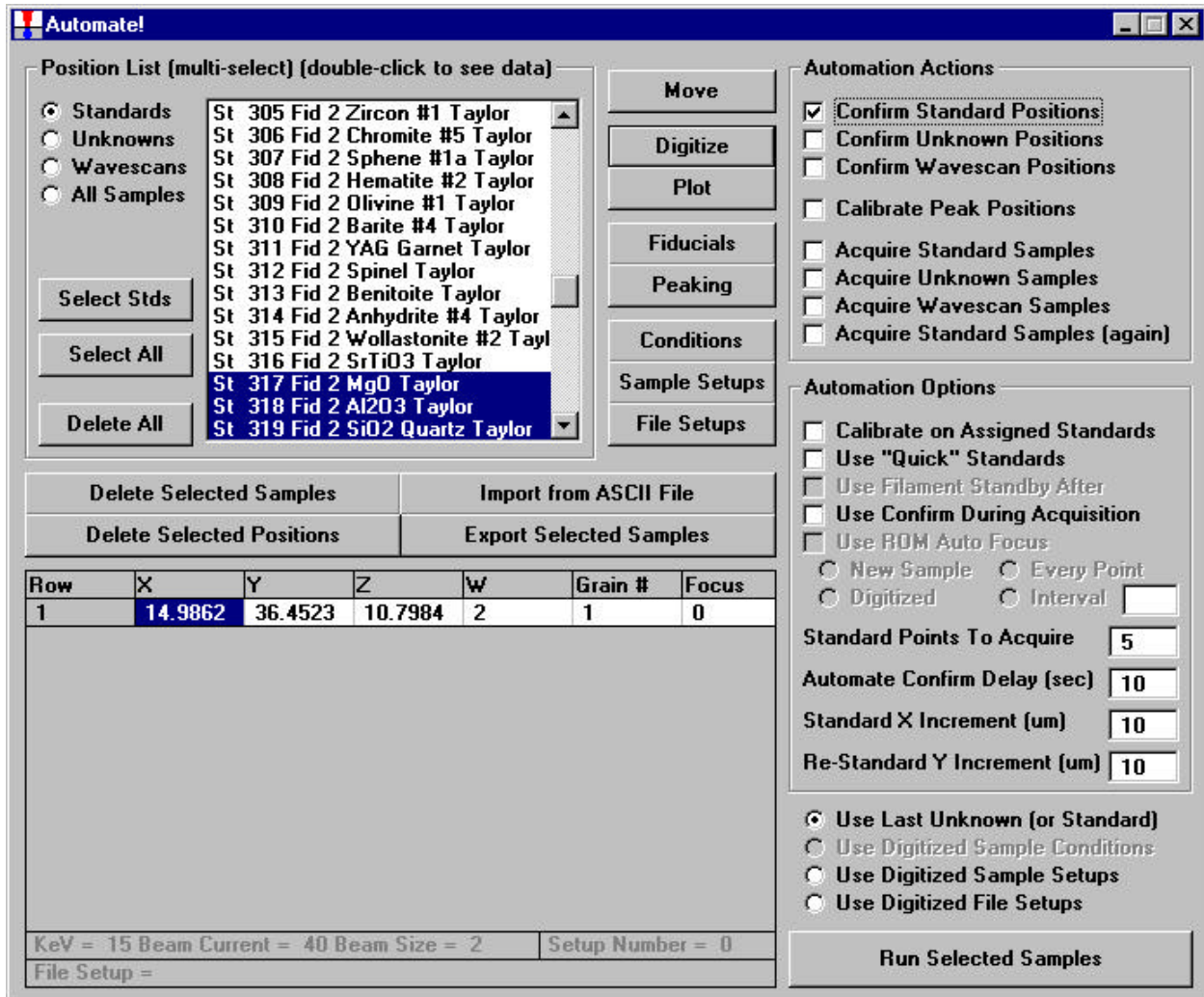
All of the basic peak centering and x-ray count acquisition procedures may be automated. This is accomplished via the **Automate!** window.

Click the **Select Stds** button of the **Automate!** dialog box. All standards that have been added to the current run will now be highlighted in the *Position List* list box.

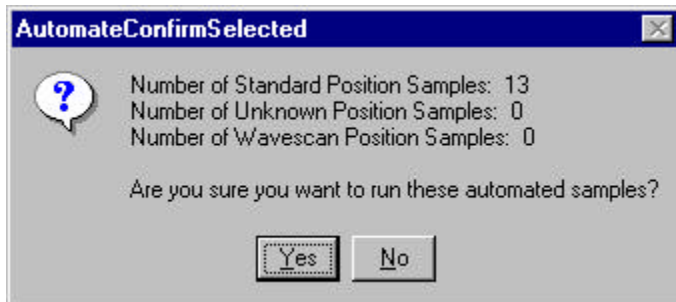
The screenshot shows the **Automate!** window with the following components:

- Position List (multi-select) (double-click to see data)**: A list of standards with radio buttons for selection. The **Select Stds** button is active, and the list is highlighted. The list includes: St 305 Fid 2 Zircon #1 Taylor, St 306 Fid 2 Chromite #5 Taylor, St 307 Fid 2 Sphene #1a Taylor, St 308 Fid 2 Hematite #2 Taylor, St 309 Fid 2 Olivine #1 Taylor, St 310 Fid 2 Barite #4 Taylor, St 311 Fid 2 YAG Garnet Taylor, St 312 Fid 2 Spinel Taylor, St 313 Fid 2 Benitoite Taylor, St 314 Fid 2 Anhydrite #4 Taylor, St 315 Fid 2 Wollastonite #2 Tayl, St 316 Fid 2 SrTiO3 Taylor, St 317 Fid 2 MgO Taylor, St 318 Fid 2 Al2O3 Taylor, St 319 Fid 2 SiO2 Quartz Taylor.
- Automation Actions**: A panel with checkboxes for: Confirm Standard Positions, Confirm Unknown Positions, Confirm Wavescan Positions, Calibrate Peak Positions, Acquire Standard Samples, Acquire Unknown Samples, Acquire Wavescan Samples, and Acquire Standard Samples (again).
- Automation Options**: A panel with checkboxes for: Calibrate on Assigned Standards, Use "Quick" Standards, Use Filament Standby After, Use Confirm During Acquisition, and Use ROM Auto Focus. It also includes radio buttons for New Sample, Every Point, Digitized, and Interval.
- Standard Points To Acquire**: A numeric input field set to 5.
- Automate Confirm Delay (sec)**: A numeric input field set to 10.
- Standard X Increment (um)**: A numeric input field set to 10.
- Re-Standard Y Increment (um)**: A numeric input field set to 10.
- Use Last Unknown (or Standard)**: A radio button that is selected.
- Use Digitized Sample Conditions**: A radio button.
- Use Digitized Sample Setups**: A radio button.
- Use Digitized File Setups**: A radio button.
- Run Selected Samples**: A button at the bottom right.
- Position List Table**: A table with columns Row, X, Y, Z, W, Grain #, and Focus. The first row is highlighted with X=14.9862, Y=36.4523, Z=10.7984, W=2, Grain #=1, Focus=0.
- KeV = 15 Beam Current = 40 Beam Size = 2 Setup Number = 0**: A status bar at the bottom.
- File Setup =**: A status bar at the bottom.

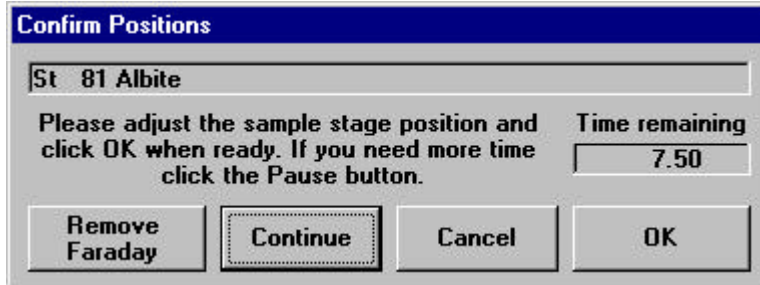
The user might start by checking the location and focus of each standard selected for the automated analysis. Click the box for *Confirm Standard Positions* under *Automation Actions*. Click the **Run Selected Samples** button.



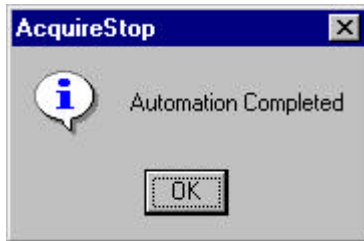
The **AutomateConfirmSelected** window opens informing the user that thirteen standards were chosen and asks if you want to run these automated samples, click **Yes**.



The program then sends the stage motors to the fiducial transformed coordinates for the first selected standard and opens the **Confirm Positions** window. Clicking the two-way **Pause/Continue** button suspends the 10 second countdown (user defined in the PROBEWIN.INI file). Adjust the stage motors (X, Y, and Z) to a new, clean analysis position. Click the **OK** button of the **Confirm Positions** window when done, sending the stage to the next standard to confirm its position. Again, the **Confirm Positions** window opens, allowing the user to pause the countdown and adjust the sample position.



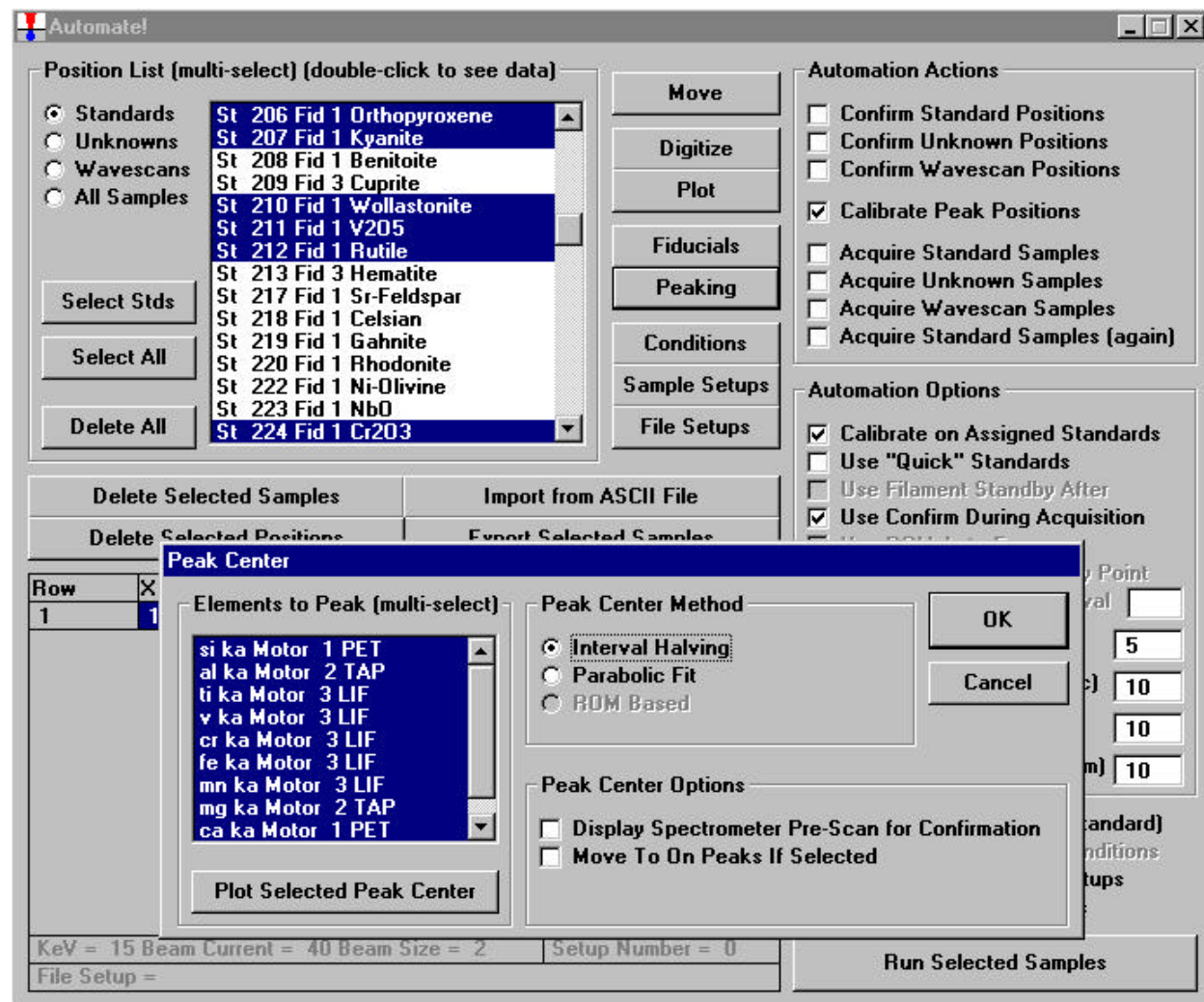
After the final standard is confirmed, the **AcquireStop** window appears. In this example standards on several standard blocks are located and confirmed. Click this **OK** button returning to the **Automate!** dialog box.



Calibrate Peak Positions

X-ray peaking may be automated from the **Automate!** window as follows.

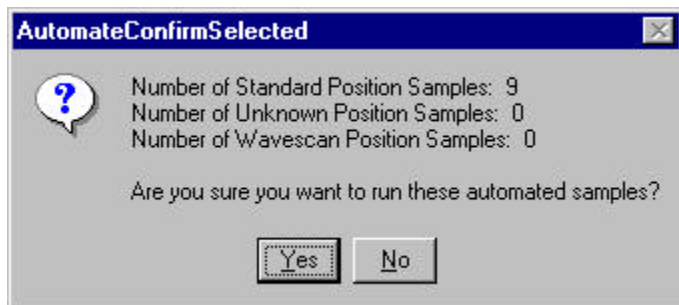
The **Select Stds** button from the previous step highlighted all of the standards added to the current run. Presently the *Position List* list box in the **Automate!** window contains both the analytical and MAN background standards for the current run. Since x-ray peak centering is only done on the primary analytical standards, either re-select the primary analytical standards or de-select the additional MAN background standards from the *Position List* list box. Under *Automation Actions* click only the *Calibrate Peak Positions* box. Under *Automation Options* click the *Calibrate on Assigned Standards* and *Use Confirm During Acquisition* boxes. Finally, click the **Peaking** button to open the **Peak Center** dialog box.



In the **Peak Center** dialog box, select all the elements from the *Elements to Peak* list box, next click on a *Peak Center Method*. A spectrometer pre-scan is useful if that element has not been run recently or if maintenance has occurred on the spectrometer. Click the **OK** button of the **Peak Center** window.

Click the **Run Selected Samples** button from the **Automate!** window.

This opens the **AutomateConfirmSelected** window. To run these automated samples, click **Yes**.



The stage motors move to the position coordinates of the first standard highlighted in the *Position List* list box and the **Confirm Positions** window opens. This window allows the user to readjust if necessary the stage motors (X, Y, and Z) to a new, clean analysis position. Click the **OK** button of the **Confirm Positions** window when done and the spectrometers go through the peaking routine to peak center the spectrometer position to the x-ray maximum for all the elements assigned to that standard. After finding a new peak position and reporting the results to the main log window, the stage motors move on to the coordinates of the next standard highlighted in the *Position List* list box. Once situated on this standard, the spectrometers peak center those elements assigned to it. This procedure continues until all standards are done. When all automation action is complete, the **AcquireStop** window appears and requests the user to click the **OK** button.

The following summary of the peak center automation for the primary standards is found in the main log window.

Interval Peak Center Results:

Element	Spectr	Peaked	OnPeak	StartI	StopI	StartPB	StopPB
si ka	1 PET	Yes	228.117	4225.4	4865.8	334.68	385.41
al ka	2 TAP	Yes	90.3930	2702.3	22623.9	26.19	219.25
ti ka	3 LIF	Yes	191.136	1413.3	1969.5	185.34	258.30
v ka	3 LIF	Yes	174.110	1882.5	2519.9	212.11	283.93
cr ka	3 LIF	Yes	159.153	2912.3	4182.9	194.15	278.86
fe ka	3 LIF	Yes	134.537	2869.4	4393.0	127.53	195.24
mn ka	3 LIF	Yes	146.078	2610.1	3786.4	147.57	214.07
mg ka	2 TAP	Yes	107.490	3120.5	12125.9	67.02	260.42
ca ka	1 PET	Yes	107.476	10986.9	11071.5	254.77	256.73
na ka	2 TAP	Yes	129.703	1546.3	2160.4	79.81	111.50

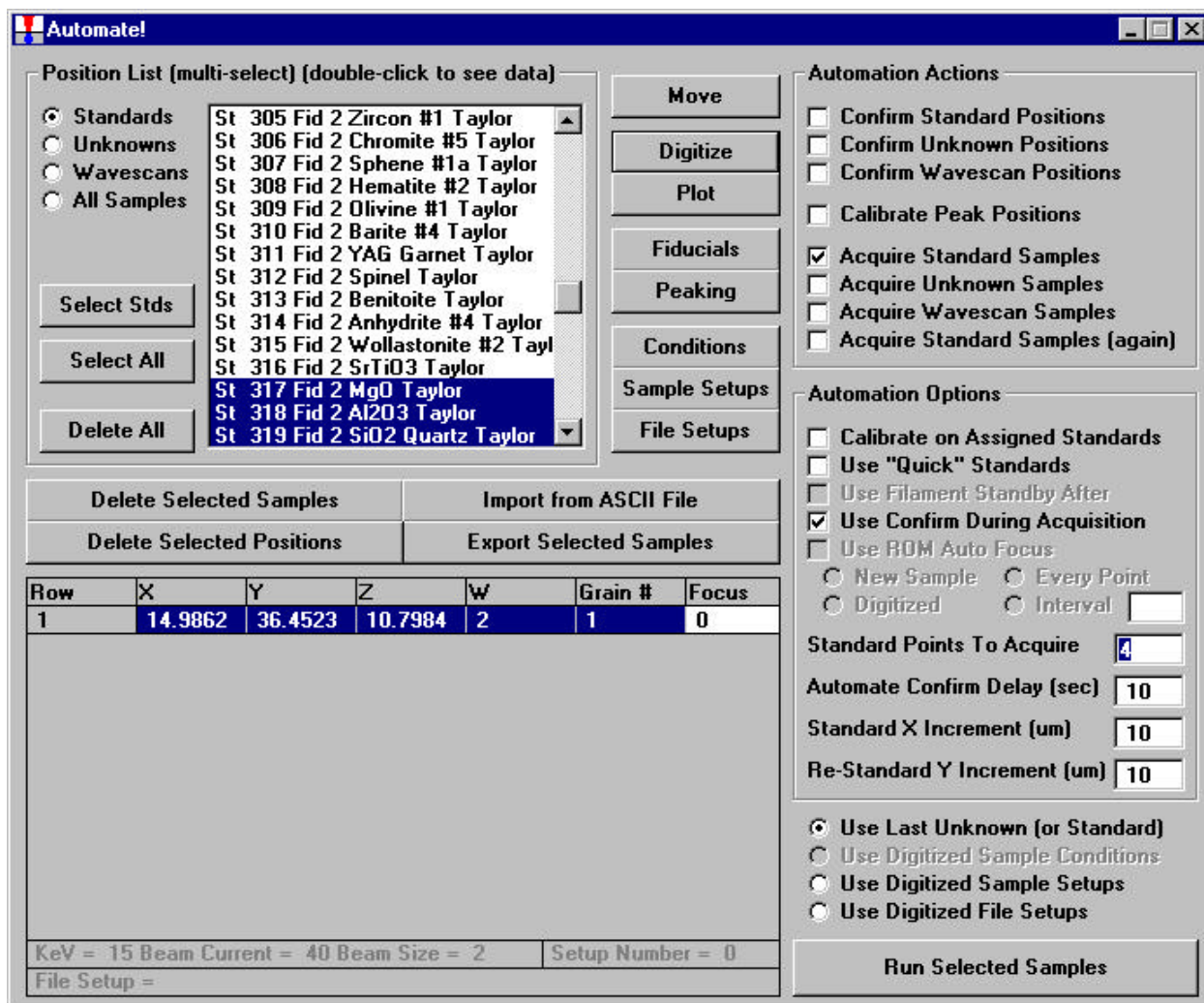
Calibrate Peak Positions Automation Action is Completed

All elements were peak centered using the Interval Halving method. The new peak locations (OnPeak) along with the start and stop intensities in counts per second and peak-to-backgrounds are listed. The final on-peak intensities (StopI) are valuable for adjusting count time parameters for your standardizations to improve statistics.

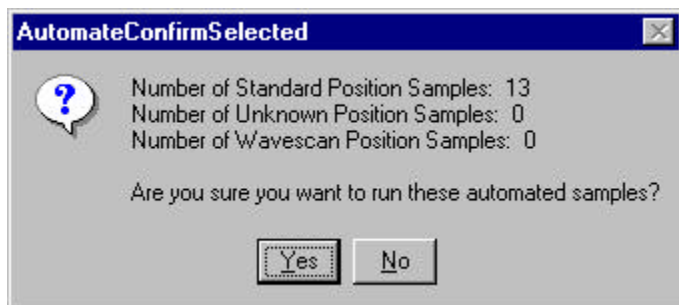
Acquire Standard Samples

The next step is to calibrate the analytical and MAN background standards in preparation for unknown samples. The user may choose to run both types of standards together or separate them. In the latter case, the MAN background standards would normally be acquired first since backgrounds drift less than peak intensities.

Here, the user will automate the entire acquisition of x-ray counts on all standards. Click the **Select Stds** button in the **Automate!** dialog box. This selects all current standards in the run, highlighting them in the *Position List* list box. Next, under *Automation Actions*, click only on the *Acquire Standard Samples* box. From the *Automation Options* choices select the number of *Standard Points To Acquire* and whether to *Use Confirm During Acquisition*. In this example, four standard points are chosen along with a *Standard X Increment* of 10 um. Finally, click the **Run Selected Samples** button.



The familiar **AutomateConfirmSelected** window opens again, informing the user that thirteen standards are chosen and asks if you want to run these automated samples, click **Yes**.



The stage moves to the coordinates of the first highlighted standard in the *Position List* list box. If the *Use Confirm During Acquisition* box is checked then the **Confirm Positions** window will open. A complete analysis is acquired on all elements in the current sample, x-rays are counted on peak only for times specified in the **Count Times** window. Finally, the Faraday cup is measured. The stage jogs 10 um in the X direction and this procedure is repeated for the number of points specified in the *Standard Points To Acquire* text box of the **Automate!** dialog box. After completing data collection on the first standard, the stage travels to the next highlighted standard in the list box and acquires four complete analyses on that standard. This procedure is repeated for all selected standards. After finishing the automation schedule the **AcquireStop** window opens and requires the user to click the **OK** button thereby returning to the **Automate!** window.

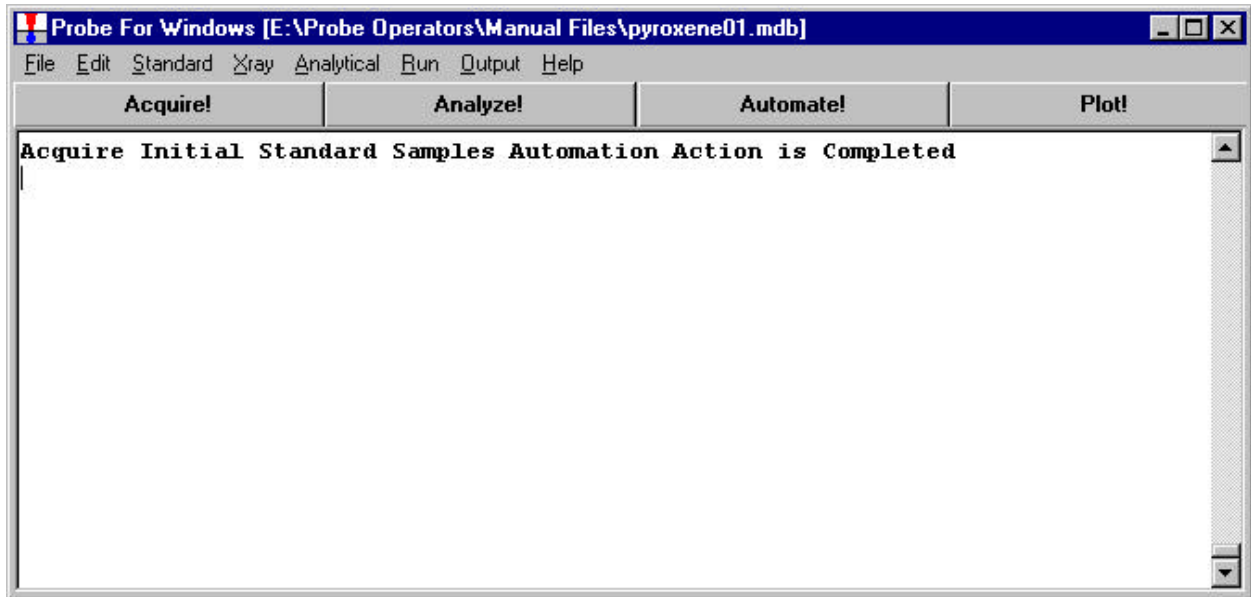
The following log window illustrates typical on-peak x-ray count data (in cps) for the Taylor Quartz standard.

Probe For Windows [E:\Probe Operators\Manual Files\pyroxene01.mdb]									
Acquire!		Analyze!			Automate!		Plot!		
St 319 Set 1 SiO2 Quartz Taylor									
TakeOff = 40 KiloVolts = 15 Beam Current = 40 Beam Size = 2									
Off-Peak Corrected or MAN On-Peak X-ray Counts:									
ELEM:	si ka	al ka	ti ka	v ka	cr ka	fe ka	mn ka	mg ka	BEAM
BGD:	MAN	MAN	MAN	MAN	MAN	MAN	MAN	MAN	
MOT:	1	2	3	3	3	3	3	2	
CRYS:	PET	TAP	LIF	LIF	LIF	LIF	LIF	TAP	
ORDR:	1	3	1	2	3	5	4	2	
49G	9374.5	70.7	2.7	3.7	5.9	10.8	6.6	35.1	40.463
50G	9309.0	72.1	2.5	4.4	4.4	10.6	7.5	32.2	40.468
51G	9342.3	72.8	1.7	4.0	5.7	8.9	9.5	33.8	40.497
52G	9365.9	77.6	2.0	3.0	4.7	11.6	7.2	35.8	40.471
AVER:	9347.9	73.3	2.2	3.8	5.2	10.5	7.7	34.2	40.475
SDEV:	29.3	3.0	.5	.6	.7	1.1	1.3	1.6	.015
1SIG:	30.6	2.7	.5	.6	.7	1.0	.9	1.8	
SERR:	14.6	1.5	.2	.3	.4	.6	.6	.8	
%RSD:	.3	4.1	20.6	15.6	14.2	10.9	16.3	4.6	
ELEM:	ca ka	na ka	BEAM						
BGD:	MAN	MAN							
MOT:	1	2							
CRYS:	PET	TAP							
ORDR:	2	1							
49G	34.3	17.0	40.463						
50G	31.6	16.9	40.468						
51G	30.1	19.0	40.497						
52G	33.3	18.1	40.471						
AVER:	32.3	17.8	40.475						
SDEV:	1.8	1.0	.015						
1SIG:	1.8	1.3							
SERR:	.9	.5							
%RSD:	5.7	5.6							
Acquire Initial Standard Samples Automation Action is Completed									

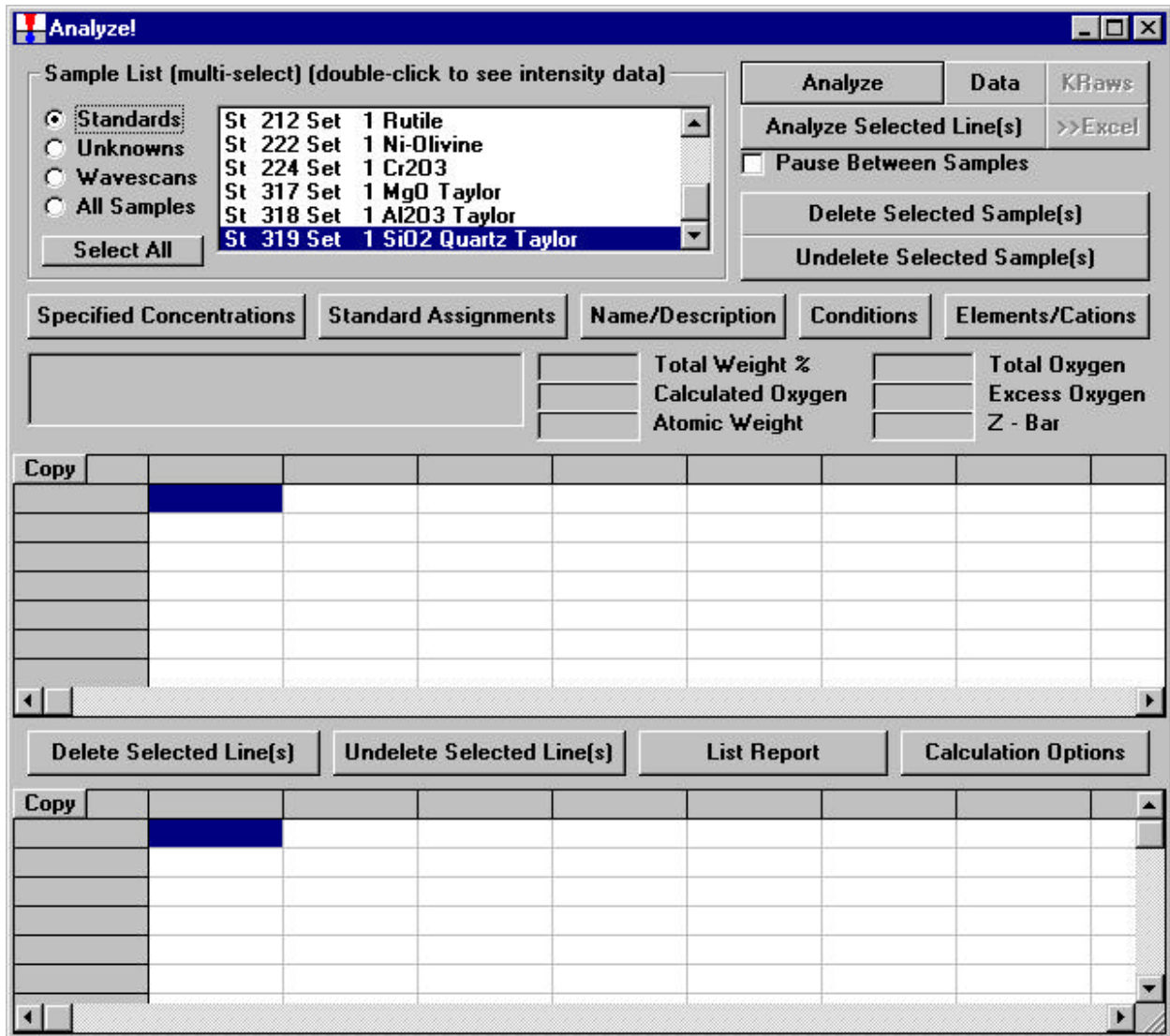
In addition to the four individual lines of count data, the *AVER*, *SDEV*, *1SIG*, *SERR*, and *%RSD* are calculated. The *AVER* (average) is the average intensity reading of each element column. The *SDEV* (standard deviation) is the range of these results, *1SIG* (one sigma) is the predicted standard deviation, and the *SERR* (standard error) is essentially the precision of the average. The *%RSD* number is the *SDEV* divided by the *AVER* times 100. See the User's Guide and Reference documentation for exact equations. The output of the raw data counts for the remaining twelve standards are not shown here to save space.

Evaluate Standard Count Data

After all the standard data is acquired it is useful to examine the raw on-peak counts to check for and delete any obviously bad data points. Click the **Analyze!** button in the main PROBE FOR WINDOWS log window.



This opens the **Analyze!** dialog box.



The *Sample List* list box contains the list of the standards that data has been acquired on. To examine the raw count data acquired on any standard run under automation, first select the standard of interest and click the **Data** button.

The raw count data for the four automated standard analyses of the Tephroite standard are shown below. Each individual line (9G to 12G) is illustrated along with the *Average*, *Std Dev*, *OneSigma*, *Std Err*, *%Rel SD*, *Minimum* and *Maximum* of the acquired points. This count data is also printed to the log window.

Analyze!

Sample List (multi-select) (double-click to see intensity data)

- Standards
 - St 81 Set 1 Albite
 - St 203 Set 1 Fayalite
 - St 205 Set 1 Tephroite**
 - St 206 Set 1 Orthopyroxene
 - St 207 Set 1 Kyanite
 - St 210 Set 1 Wollastonite
- Unknowns
- Wavescans
- All Samples

Select All

Analyze Data KRows

Analyze Selected Line(s) >>Excel

Pause Between Samples

Delete Selected Sample(s)

Undelete Selected Sample(s)

Specified Concentrations Standard Assignments Name/Description Conditions Elements/Cations

St 205 Set 1 Tephroite
 TakeOff = 40 KiloVolts = 15 Beam Current =
 40 Beam Size = 2
 Intensities in Counts Per Second

.000	Total Weight %	.000	Total Oxygen
.000	Calculated Oxygen	.000	Excess Oxygen
.000	Atomic Weight	.000	Z - Bar

Copy	si ka MAN	al ka MAN	ti ka MAN	v ka MAN	cr ka MAN	fe ka MAN	mn ka MAN	mg ka MAN	ca ka MAN	na ka MAN	Beam
Average:	2496.0	89.4	3.6	5.8	10.3	26.6	3821.9	101.9	53.9	22.9	40.5
Std Dev:	15.9	1.6	.7	.4	.6	.7	39.7	3.1	3.2	1.7	.0
OneSigma:	15.8	3.0	.6	.8	1.0	1.6	19.5	3.2	2.3	1.5	
Std Err:	7.9	.8	.3	.2	.3	.4	19.8	1.6	1.6	.8	
%Rel SD:	.6	1.8	19.1	6.4	6.2	2.8	1.0	3.1	6.0	7.4	
Minimum:	2474.2	87.7	2.7	5.3	9.8	25.9	3763.2	97.5	51.0	20.7	40.4
Maximum:	2512.0	91.3	4.1	6.1	11.1	27.5	3849.4	104.2	58.5	24.4	40.5

Delete Selected Line(s) Undelete Selected Line(s) List Report Calculation Options

Copy	si ka MAN	al ka MAN	ti ka MAN	v ka MAN	cr ka MAN	fe ka MAN	mn ka MAN	mg ka MAN	ca ka MAN	na ka MAN	Beam
9 G	2497.3	91.3	4.1	6.1	9.8	25.9	3841.6	102.1	58.5	24.4	40.5
10 G	2474.2	88.6	4.1	5.6	11.1	26.1	3833.5	97.5	53.3	22.5	40.4
11 G	2500.5	87.7	2.7	6.0	10.5	27.5	3763.2	104.2	52.7	24.1	40.4
12 G	2512.0	89.9	3.3	5.3	9.8	27.0	3849.4	103.9	51.0	20.7	40.5

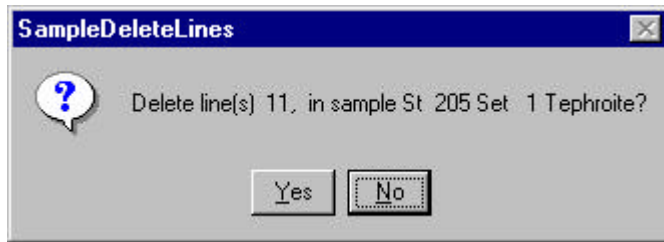
Examine the raw count data for each standard. If more than one sample/standard is selected for analysis, select the *Pause Between Samples* check box. When this box is checked, the program will automatically pause after displaying each analysis until the user clicks the **Cancel** or **Next** buttons on the **Analysis Status** window. If there are any bad data points, use the **Delete Selected Line(s)** button to flag a line of data as bad. In the Tephroite standard, seen below, line 11G (good) is deemed a bad data point since its cps value is very low compared to the other three lines. Click on the line number, highlighting the line. Next click the **Delete Selected Line(s)** button.

The screenshot shows the 'Analyze!' software window. At the top, there are buttons for 'Analyze', 'Data', and 'KRaw'. Below these are buttons for 'Analyze Selected Line(s)', '>>Excel', 'Pause Between Samples', 'Delete Selected Sample(s)', and 'Undelete Selected Sample(s)'. A 'Sample List' section contains radio buttons for 'Standards', 'Unknowns', 'Wavescans', and 'All Samples', with a list of standards including 'St 203 Set 1 Fayalite', 'St 205 Set 1 Tephroite', 'St 206 Set 1 Orthopyroxene', 'St 207 Set 1 Kyanite', 'St 210 Set 1 Wollastonite', and 'St 211 Set 1 V205'. Below this is a 'Specified Concentrations' section with a table for 'St 205 Set 1 Tephroite' showing parameters like 'TakeOff = 40 KiloVolts = 15 Beam Current = 40 Beam Size = 2' and various concentration values. The main data table is titled 'Intensities in Counts Per Second' and has columns for 'Copy', 'si ka MAN', 'al ka MAN', 'ti ka MAN', 'v ka MAN', 'cr ka MAN', 'fe ka MAN', 'mn ka MAN', 'mg ka MAN', 'ca ka MAN', 'na ka MAN', and 'Beam'. The table shows statistical data (Average, Std Dev, OneSigma, Std Err, %Rel SD, Minimum, Maximum) and a list of lines (9 G, 10 G, 11 G, 12 G) with their corresponding values. Line 11 G is highlighted in blue. At the bottom, there are buttons for 'Delete Selected Line(s)', 'Undelete Selected Line(s)', 'List Report', and 'Calculation Options'.

Copy	si ka MAN	al ka MAN	ti ka MAN	v ka MAN	cr ka MAN	fe ka MAN	mn ka MAN	mg ka MAN	ca ka MAN	na ka MAN	Beam
Average:	2496.0	89.4	3.6	5.8	10.3	26.6	3821.9	101.9	53.9	22.9	40.5
Std Dev:	15.9	1.6	.7	.4	.6	.7	39.7	3.1	3.2	1.7	.0
OneSigma:	15.8	3.0	.6	.8	1.0	1.6	19.5	3.2	2.3	1.5	
Std Err:	7.9	.8	.3	.2	.3	.4	19.8	1.6	1.6	.8	
%Rel SD:	.6	1.8	19.1	6.4	6.2	2.8	1.0	3.1	6.0	7.4	
Minimum:	2474.2	87.7	2.7	5.3	9.8	25.9	3763.2	97.5	51.0	20.7	40.4
Maximum:	2512.0	91.3	4.1	6.1	11.1	27.5	3849.4	104.2	58.5	24.4	40.5

Copy	si ka MAN	al ka MAN	ti ka MAN	v ka MAN	cr ka MAN	fe ka MAN	mn ka MAN	mg ka MAN	ca ka MAN	na ka MAN	Beam
9 G	2497.3	91.3	4.1	6.1	9.8	25.9	3841.6	102.1	58.5	24.4	40.5
10 G	2474.2	88.6	4.1	5.6	11.1	26.1	3833.5	97.5	53.3	22.5	40.4
11 G	2500.5	87.7	2.7	6.0	10.5	27.5	3763.2	104.2	52.7	24.1	40.4
12 G	2512.0	89.9	3.3	5.3	9.8	27.0	3849.4	103.9	51.0	20.7	40.5

This opens the **SampleDeleteLines** window.



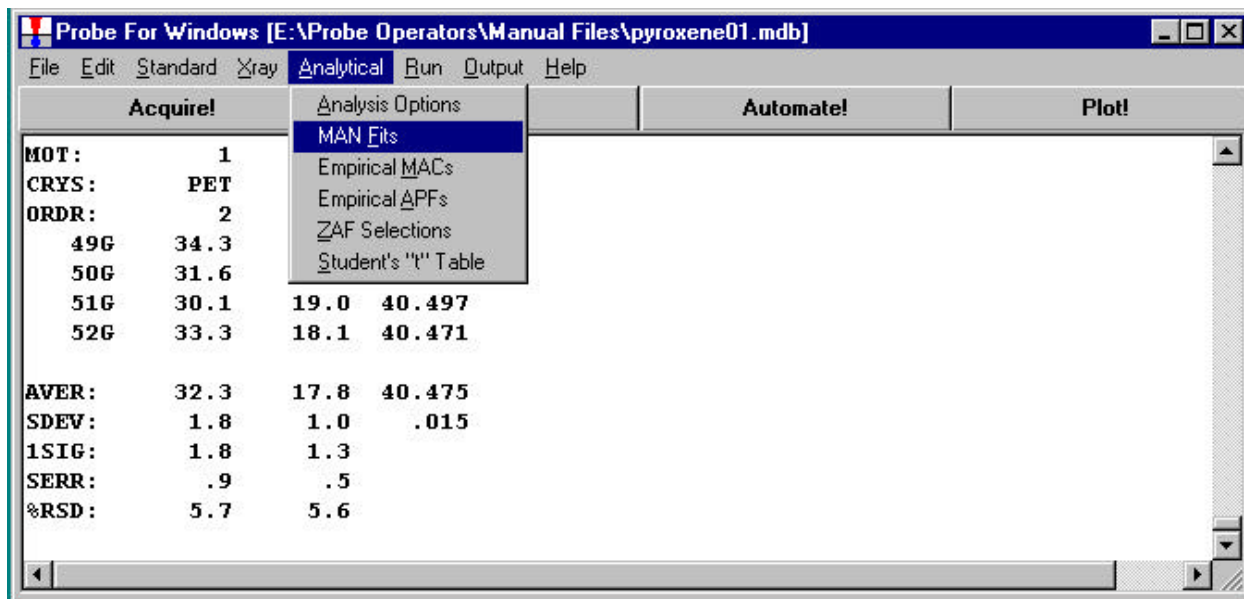
Click the **Yes** button. The computer will flag this line with a B (bad) and ignore this data for any subsequent calculations.

Click the **Data** button again to re-analyze the remaining data lines for statistical parameters. Remember one can always undelete data lines with the **Undelete Selected Line(s)** button.

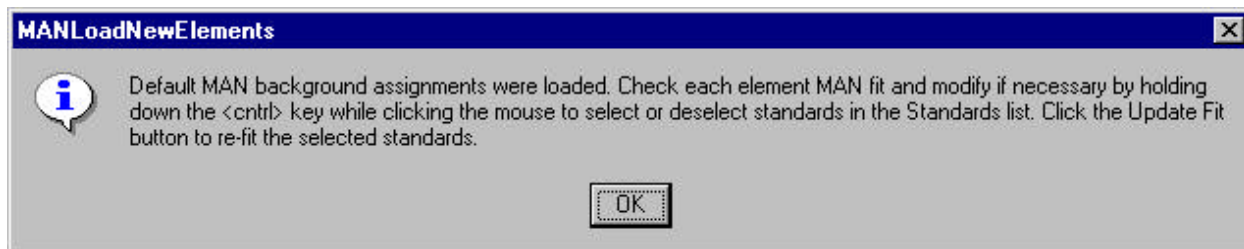
At this point, the user has collected all standardization data and is ready to make MAN background assignments.

Assign MAN Background Calibrations

From the main PROBE FOR WINDOWS log window, select **Analytical** from the menu bar and click **MAN Fits** from the menu choices.



This opens the **MANLoadNewElements** window.



Click the **OK** button.

This opens the MAN Assignment and Fit dialog box.

MAN Assignment and Fit

Use Off-Peak Elements For MAN Fit Use MAN Correction On Off-Peak Elements

si ka 1 PET
cps

Z-bar

Intercept = -10.307 Slope = 1.98038 Curvature = -.04084 Max % Deviation = 6.682782

Click Channel Row to Plot MAN Fit

Chann	Eleme	X-Ray	Motor	Crysta	Order	AbsCc
1	si	ka	1	PET	2nd	Yes
2	al	ka	2	TAP	2nd	Yes
3	ti	ka	3	LIF	2nd	Yes
4	v	ka	3	LIF	2nd	Yes
5	cr	ka	3	LIF	2nd	Yes
6	fe	ka	3	LIF	2nd	Yes

Standards (multi-select)

- 211 V2O5
- 212 Rutile
- 222 Ni-Olivine
- 224 Cr2O3
- 317 MgO Taylor
- 318 Al2O3 Taylor
- 319 SiO2 Quartz Taylor

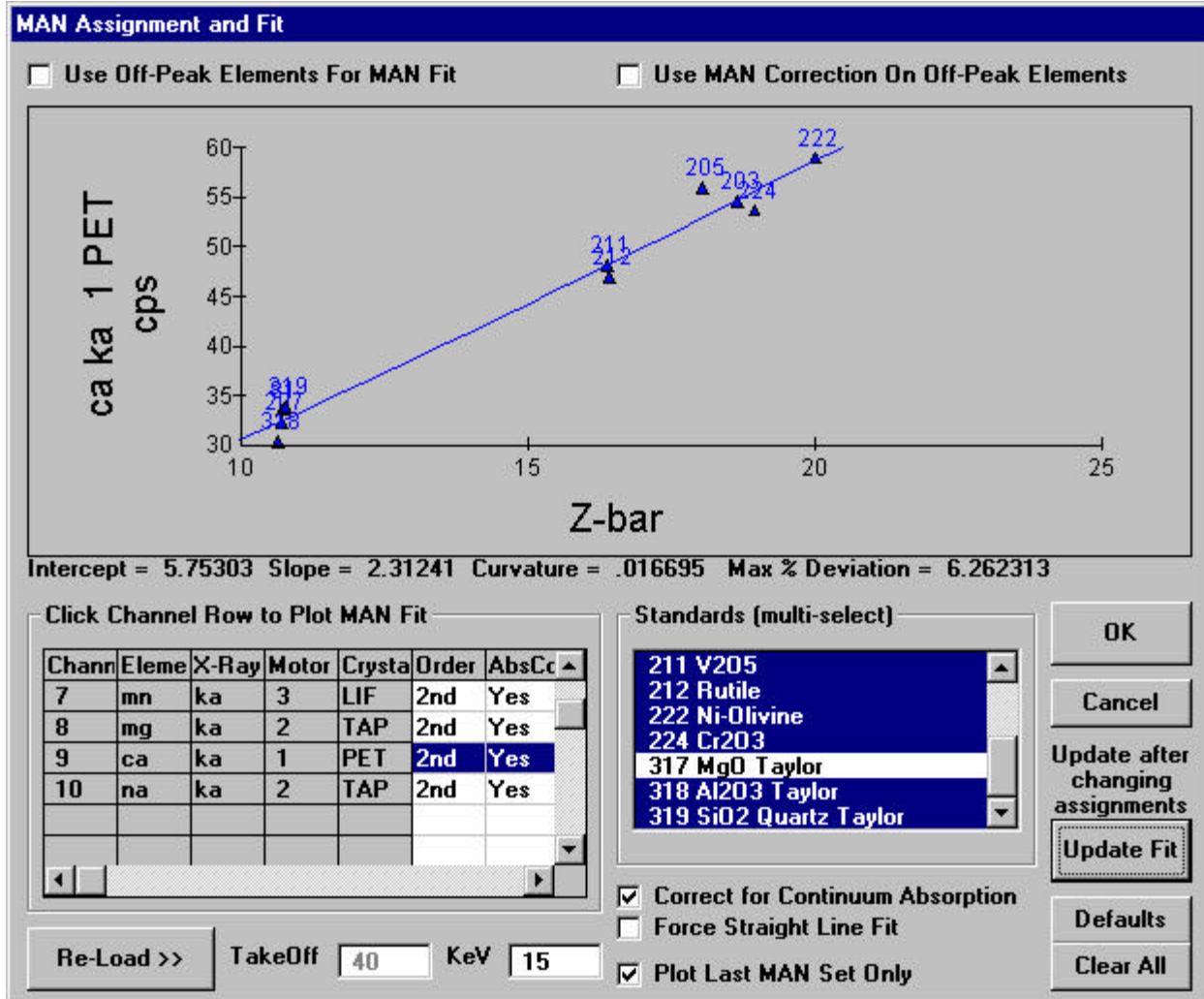
Correct for Continuum Absorption
 Force Straight Line Fit
 Plot Last MAN Set Only

Re-Load >> TakeOff KeV

OK
Cancel
Update after changing assignments
Update Fit
Defaults
Clear All

From this dialog box, the user may display and modify the MAN background assignments and fits used for the background correction of all elements in the current run. The advantage of this method is that it requires only a simple calibration of the analyzing channel over a range of atomic number. Substantial time may be saved when many samples are to be analyzed. However, if measuring high atomic number samples and/or trace concentrations, the off-peak background correction technique is usually superior.

For each element, select standards from the *Standards* list box that do not contain the element itself. In this way the measured background counts can be plotted as a function of the average atomic number (Z-bar). Choose at least five standards per element and compute a second-order polynomial or force a straight line fit (if deemed appropriate) between background counts and MAN for each. For further details and suggestions, see the User's Guide and Reference documentation. Several fits (ca, na, and v) are illustrated respectively, below.



MAN Assignment and Fit

Use Off-Peak Elements For MAN Fit Use MAN Correction On Off-Peak Elements

Intercept = 68.6687 Slope = -8.1268 Curvature = .444921 Max % Deviation = 19.24221

Click Channel Row to Plot MAN Fit

Chann	Eleme	X-Ray	Motor	Crysta	Order	AbsCc
7	mn	ka	3	LIF	2nd	Yes
8	mg	ka	2	TAP	2nd	Yes
9	ca	ka	1	PET	2nd	Yes
10	na	ka	2	TAP	2nd	Yes

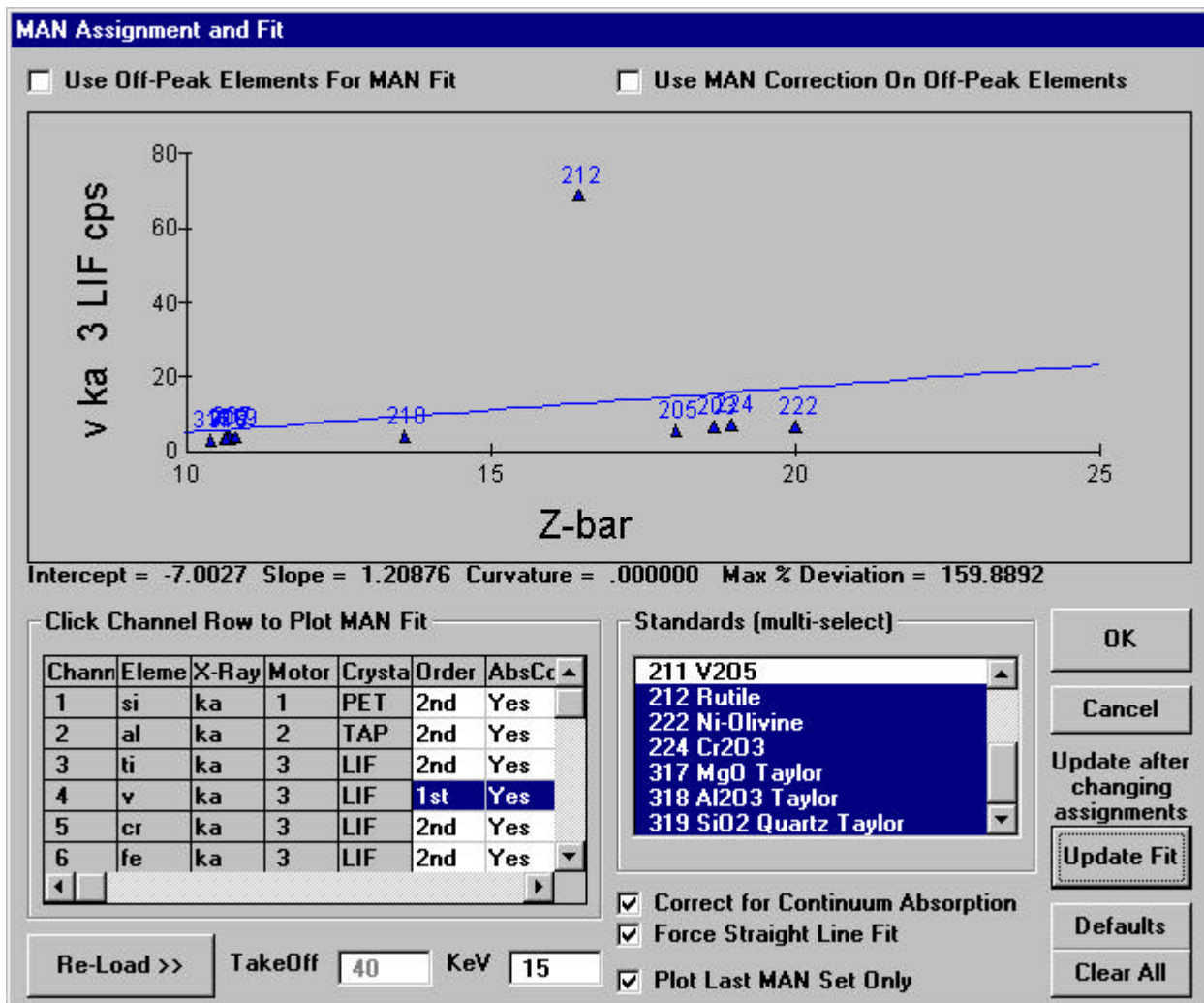
Standards (multi-select)

- 211 V205
- 212 Rutile
- 222 Ni-Olivine
- 224 Cr2O3
- 317 MgO Taylor
- 318 Al2O3 Taylor
- 319 SiO2 Quartz Taylor

Correct for Continuum Absorption
 Force Straight Line Fit
 Plot Last MAN Set Only

Re-Load >> TakeOff KeV

OK Cancel Update after changing assignments Update Fit Defaults Clear All



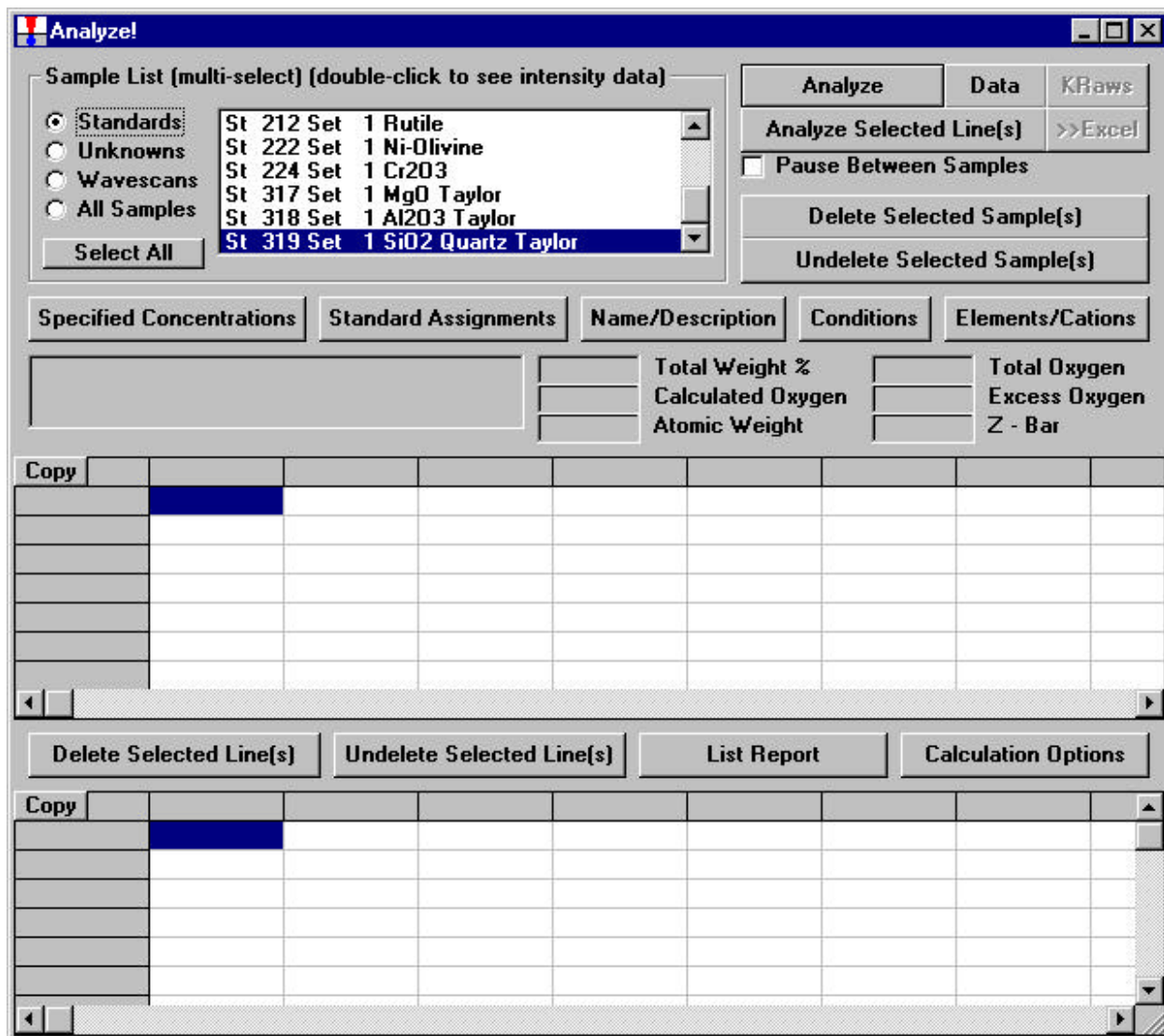
The V plot above illustrates another effect in WDS analysis; spectral interferences. The well-known transition metal interferences are easily visible in these types of plots. The $K\beta$ x-ray line for the element of atomic number x interferes with the $K\alpha$ x-ray line of element $x+1$ (Ti with V, V with Cr, Cr with Mn and Mn with Fe). Above, standard 212 is pure TiO_2 with no V_2O_3 but an apparent V x-ray signal is seen. The 212 standard is removed and the MAN background fit updated by clicking the **Update Fit** button. All of these interferences will be examined shortly.

When done adjusting individual elements, click the **OK** button to store the updated MAN background corrections.

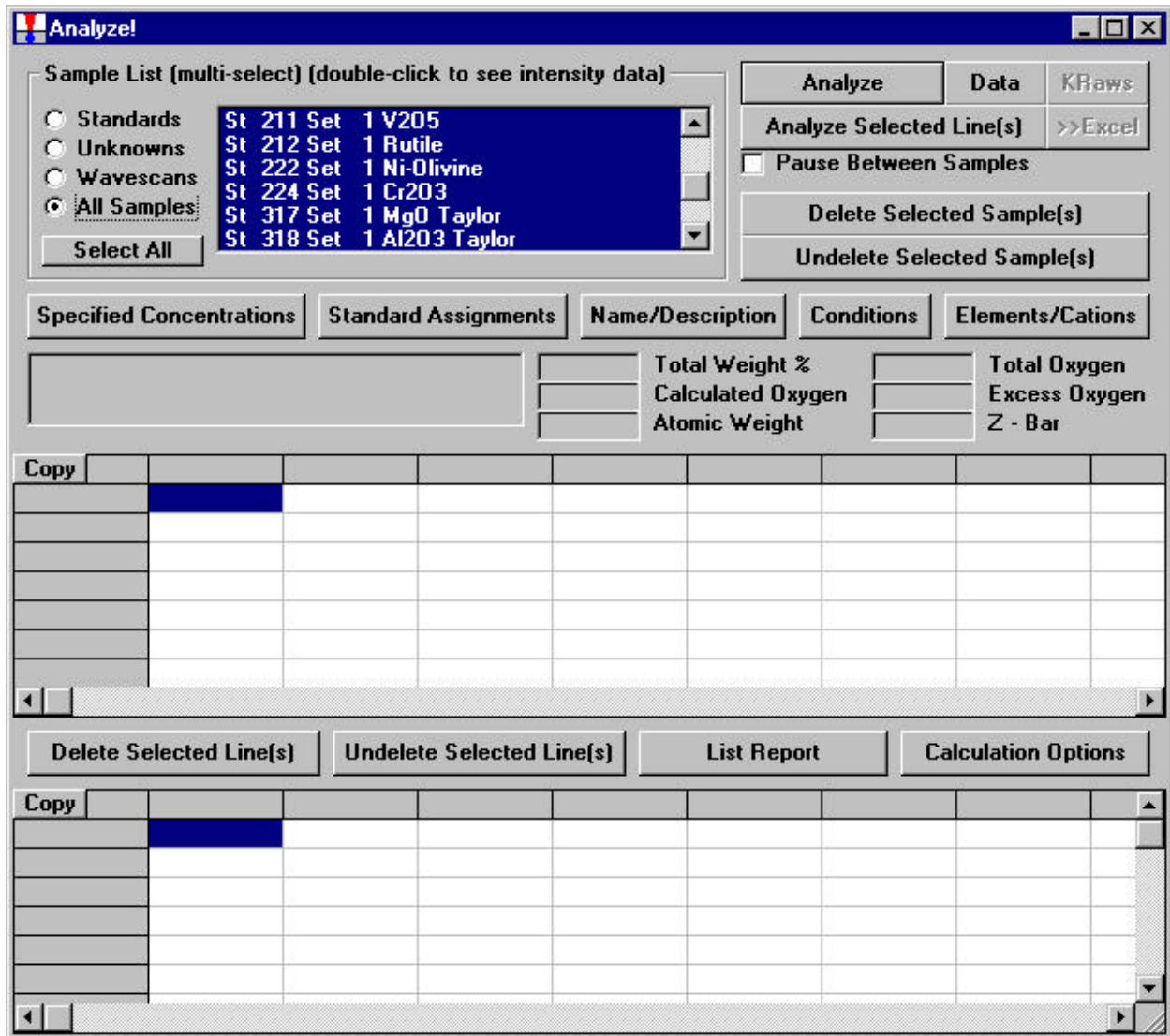
Analyze Standard Samples

The user will now analyze all of the standard data re-calculating the x-ray counts to compositions in oxide weight percent. Since the program treats all samples as unknowns, the results of the standards provides a valuable check on the quality of the analysis.

Click the **Analyze** button in the main PROBE FOR WINDOWS log window. This opens the **Analyze!** dialog box.



Under *Sample List* select the *All Samples* button. Click the **Select All** button highlighting all standards.



Click the **Calculation Options** button in the **Analyze!** window.

This action opens the **Calculation Options** dialog box.

Calculation Options

Selected Samples

- St 81 Set 1 Albite
- St 203 Set 1 Fayalite
- St 205 Set 1 Tephroite
- St 206 Set 1 Orthopyroxene
- St 207 Set 1 Kyanite
- St 210 Set 1 Wollastonite

EDS Data Options

- Do Not Use EDS Element Data
- Use EDS Element Data

Calculations Options

- Display Results As Oxides
- Calculate Atomic Percents
- Calculate Detection Limits and Homogeneity
- Element By Difference
- Stoichiometry To Calculated Oxygen
- Stoichiometry To Another Element
- Calculate with Stoichiometric Oxygen
- Calculate as Elemental

Formula and Mineral Calculations

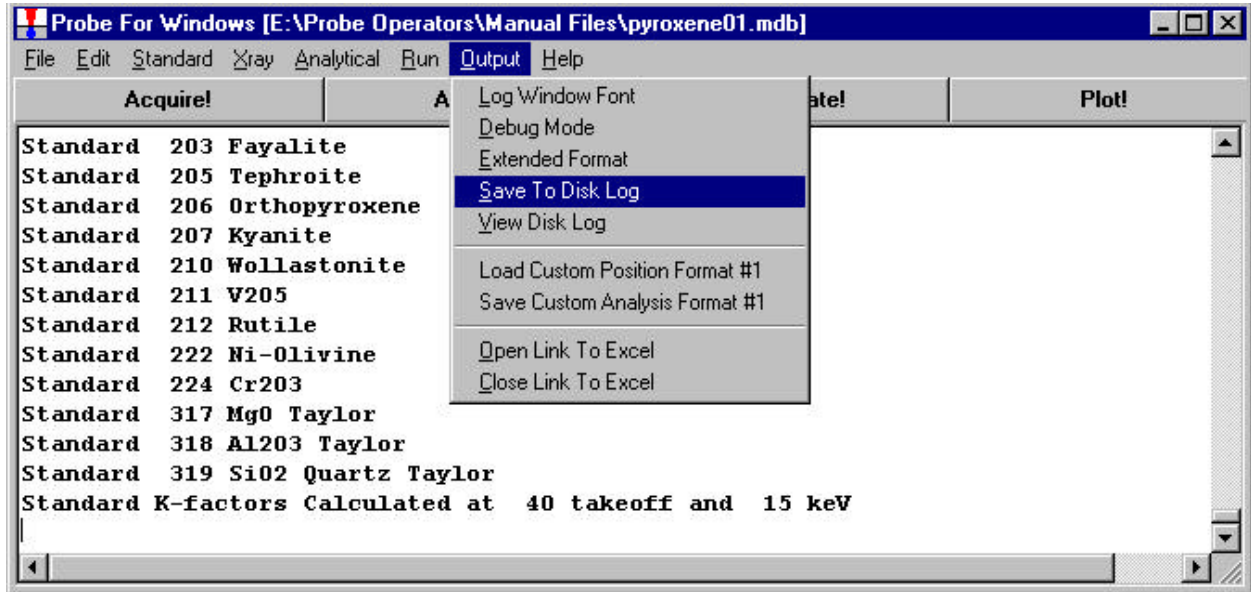
- Calculate Formula Based On
- None
- Olivine
- Feldspar
- Pyroxene
- Garnet

Add specified oxygen from the Elements/Cations button

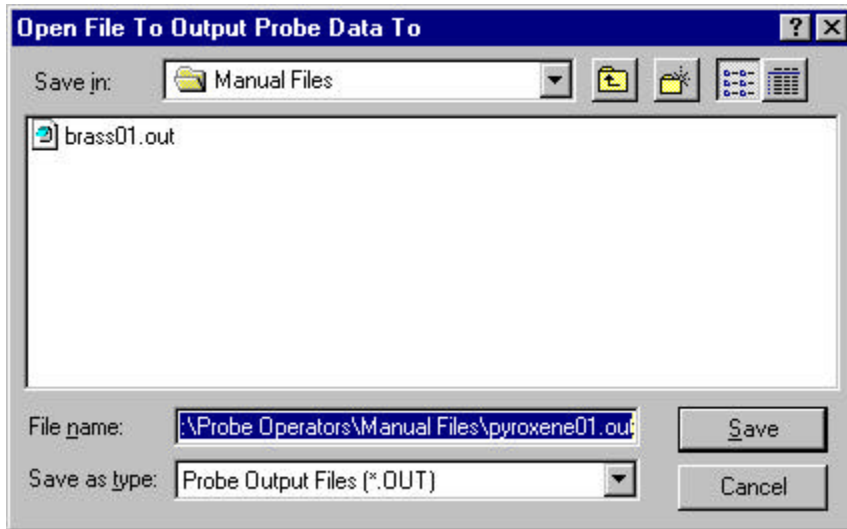
Under *Calculations Options* click the *Display Results As Oxides* box. Elemental results are always calculated and output to the log window. Click the **OK** button to output data in oxide form.

Analyzing all of the data on the standards will create a large amount of output, possibly overflowing the log window buffer, depending on the value specified in the LogWindowBufferSize parameter in the PROBEWIN.INI file. The size of the log window buffer is limited only by the amount of memory available. Setting this parameter to 512000 bytes is roughly equivalent to 300 pages of average density text. In some cases saving all log window output to a user specified text file for viewing with a text editor or printing to a laser printer may be best.

Select **Output** from the menu bar in the main log window and click **Save to Disk Log**.



This opens the **Open File To Output Probe Data To** dialog box. The *Save in:* location will be the directory specified for the original file name (PYROXENE01.MDB). All subsequent files created by the user will use this location. Edit the *File name* if desired. The default output file has the extension .OUT. Note that the raw data is always saved in the .MDB run file for future re-calculation and /or output. Click **Save** when finished.



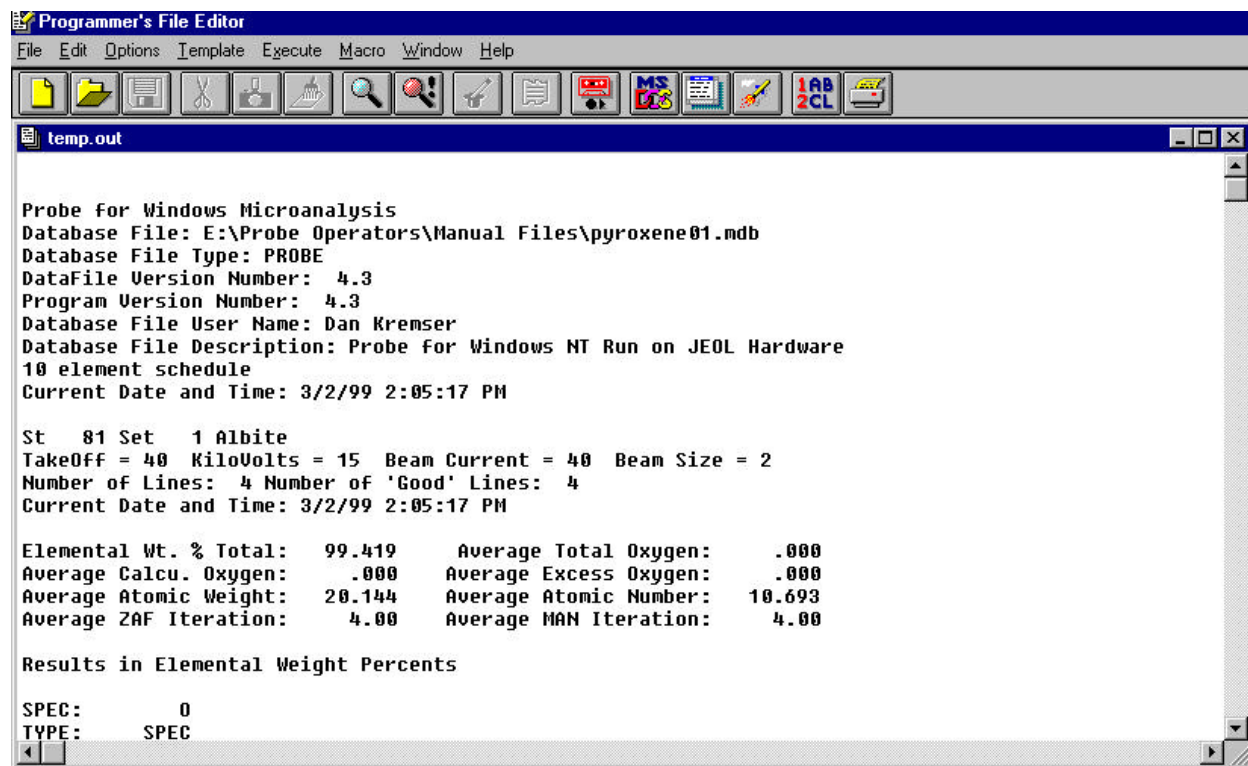
Select the **Analyze!** button in the main PROBE FOR WINDOWS log window, to bring forward the **Analyze!** dialog box. Click the **Select All** button highlighting all standards again. Then click the **Analyze** button. This will analyze all selected standard data into the specified text file.

To view this data return to the main PROBE FOR WINDOWS log window and select **Output** from the menu bar again and click **View Disk Log** from the menu.

The screenshot shows the 'Probe For Windows' application window with the title bar 'Probe For Windows [E:\Probe Operators\Manual Files\pyroxene01.mdb]'. The menu bar includes 'File', 'Edit', 'Standard', 'Xray', 'Analytical', 'Run', 'Output', and 'Help'. The 'Output' menu is open, displaying options: 'Log Window Font', 'Debug Mode', 'Extended Format', 'Save To Disk Log' (checked), 'View Disk Log' (highlighted), 'Load Custom Position Format #1', and 'Save Custom Analysis Format #1'. Below the menu, a data table is visible with columns for 'Acquire!', 'A', 'Plot!', and 'SUM'. The table contains data for elements SiO2, Al2O3, TiO, MnO, and MgO across samples 49, 50, 51, and 52. Summary statistics (AVER, SDEV, SERR, %RSD) are provided for both the individual elements and a combined set of CaO and Na2O.

Acquire!	A	Plot!	Plot!	Plot!	Plot!	Plot!	Plot!	Plot!	Plot!
ELEM:	SiO2	Al2O3	TiO		MnO	MgO	SUM		
49	98.670	.000	.04	0	.000	.000	99.421		
50	98.019	.000	.02	0	.000	.000	99.111		
51	98.352	.000	.00	0	.040	.000	99.275		
52	98.585	.002	.00	2	.000	.000	99.353		
AVER:	98.406	.000	.01	3	.010	.000	99.290		
SDEV:	.291	.001	.02	6	.020	.000			
SERR:	.146	.000	.01	3	.010	.000			
%RSD:	.3	200.0	119.0		105.6	128.4	200.0	200.0	.0
ELEM:	CaO	Na2O	SUM						
49	.013	.000	99.421						
50	.002	.000	99.111						
51	.000	.002	99.275						
52	.009	.000	99.353						
AVER:	.006	.001	99.290						
SDEV:	.006	.001							
SERR:	.003	.001							
%RSD:	105.3	200.0							

This opens the file editor. This example utilizes the **Programmer's File Editor**, seen below. A number of text file viewers may be used. To utilize a specific editor such as Textpad or Word, edit the FileViewer keyword in the PROBEWIN.INI file.



The user may now scroll through the analyzed standards using the text editor or may direct the file data to a laser printer by selecting **File** from the **Programmer's File Editor** menu bar and clicking on **Print** in the drop-down menu.

Since all elements were acquired on all standards, examination of the oxide weight percents will provide a check on the quality of the calibration. Several of the standard compositions will be displayed. The first example is the Orthopyroxene standard displayed in the **Analyze!** window below. This is the primary standard for magnesium and silicon. Both elements show excellent agreement with the published standard database values.

The screenshot shows the 'Analyze!' software window. At the top, there's a 'Sample List (multi-select) (double-click to see intensity data)' section with radio buttons for 'Standards', 'Unknowns', 'Wave scans', and 'All Samples'. The 'Standards' list includes 'St 01 Set 1 Albite', 'St 203 Set 1 Fayalite', 'St 205 Set 1 Tephroite', 'St 206 Set 1 Orthopyroxene' (selected), 'St 207 Set 1 Kyanite', and 'St 210 Set 1 Wollastonite'. Below this are buttons for 'Analyze', 'Data', 'KRows', 'Analyze Selected Line(s)', 'Pause Between Samples', 'Delete Selected Sample(s)', and 'Undelete Selected Sample(s)'. A 'Select All' button is also present.

Below the sample list are tabs for 'Specified Concentrations', 'Standard Assignments', 'Name/Description', 'Conditions', and 'Elements/Cations'. The 'Standard Assignments' tab is active, showing parameters for 'St 206 Set 1 Orthopyroxene': 'TakeOff = 40 KiloVolts = 15 Beam Current = 40 Beam Size = 2'. Summary statistics include: '99.879 Total Weight %', '.000 Total Oxygen', '.000 Calculated Oxygen', '.000 Excess Oxygen', and '20.081 Atomic Weight' with '10.653 Z - Bar'.

The main data table is titled 'Results in Oxide Weight Percent' and has columns for 'Comp', 'SiO2', 'Al2O3', 'TiO2', 'V2O3', 'Cr2O3', 'FeO', 'MnO', 'MgO', 'CaO', 'Na2O', 'O', and 'Total'. The 'Average' row shows values: 59.721, .123, .000, .010, .003, .017, .005, 39.845, .061, .009, .073, 99.879. The 'Std Dev' row shows: 200, .058, .000, .009, .006, .019, .004, .244, .009, .005, .170, .186. The 'ZAF Cor.' row shows: 1.3216, 1.5440, 1.1972, 1.2109, 1.1900, 1.2033, 1.2219, 1.3555, 1.1139, 1.7092. The 'Std Err.' row shows: .116, .039, .000, .005, .003, .011, .002, .141, .005, .003, .098, .107. The '3*Rel SD.' row shows: .3, 55.4, 87.4, 88.5, 173.2, 109.0, 86.6, .6, 13.9, 62.1, 231.9, .2. The 'Minimum' row shows: 59.578, .080, .000, .000, .000, .000, .000, 39.615, .055, .003, -1.22, 99.768. The 'Maximum' row shows: 59.958, .202, .000, .017, .010, .037, .008, 40.102, .071, .014, .195, 100.093.

Below the table are buttons for 'Delete Selected Line(s)', 'Undelete Selected Line(s)', 'List Report', and 'Calculation Options'. A second table is shown below these buttons, with columns for 'Comp', 'SiO2', 'Al2O3', 'TiO2', 'V2O3', 'Cr2O3', 'FeO', 'MnO', 'MgO', 'CaO', 'Na2O', 'O', and 'Total'. The rows are: '13 G' (59.578, .080, .000, .017, .010, .014, .000, 39.819, .055, .008, .185, 99.768), '14 G' (59.958, .007, .000, .000, .000, .000, .007, 40.102, .056, .003, -1.22, 100.093), '15 B' (empty), and '16 G' (59.659, .202, .000, .013, .000, .037, .008, 39.615, .071, .014, .157, 99.776).

The analysis of the Rutile standard reveals several interesting points; 1) the TiO₂ concentration is very close to the published value of 99.26 and 2) an apparent 2.1 weight percent concentration of V₂O₃ is found! This sample has no vanadium, here the user sees the notorious Ti-V spectral interference. This interference overestimates the amount of V₂O₃ in the sample resulting in the total exceeding 100%. This will be corrected for (shortly) using the automatic interference correction routine.

The screenshot shows the 'Analyze' software interface. At the top, there's a 'Sample List (multi-select)' with radio buttons for 'Standards', 'Unknowns', 'Wave scans', and 'All Samples'. The 'Standards' list includes 'St 210 Set 1 Wollastonite', 'St 211 Set 1 V2O5', 'St 212 Set 1 Rutile', 'St 222 Set 1 Ni-Divine', 'St 224 Set 1 Cr2O3', and 'St 317 Set 1 MgO Taylor'. Below this are buttons for 'Analyze', 'Data', 'KRows', 'Analyze Selected Line(s)', 'Pause Between Samples', 'Delete Selected Sample(s)', and 'Undelete Selected Sample(s)'. There are also tabs for 'Specified Concentrations', 'Standard Assignments', 'Name/Description', 'Conditions', and 'Elements/Cations'. A summary section shows parameters for 'St 212 Set 1 Rutile' such as 'TakeOff = 40 KiloVolts = 15 Beam Current = 40 Beam Size = 2', 'Total Weight %', 'Calculated Oxygen', 'Atomic Weight', 'Total Oxygen', 'Excess Oxygen', and 'Z - Bar'. The main part of the interface is a table with columns for 'Copy', 'SiO2', 'Al2O3', 'TiO2', 'V2O3', 'Cr2O3', 'FeO', 'MnO', 'MgO', 'CaO', 'Na2O', 'O', and 'Nb2O5'. The table contains rows for 'Average', 'Std Dev', 'ZAF Corr.', 'Std Err.', 'ZRef SD', 'Minimum', and 'Maximum'. Below this table are buttons for 'Delete Selected Line(s)', 'Undelete Selected Line(s)', 'List Report', and 'Calculation Options'. At the bottom, there's another table with columns for 'Copy', 'Al2O3', 'TiO2', 'V2O3', 'Cr2O3', 'FeO', 'MnO', 'MgO', 'CaO', 'Na2O', 'O', 'Nb2O5', and 'Total', showing data for copies 29 B, 30 G, 31 G, and 32 G.

Copy	SiO2	Al2O3	TiO2	V2O3	Cr2O3	FeO	MnO	MgO	CaO	Na2O	O	Nb2O5
Average:	.011	.100	99.317	2.108	.230	.166	.002	.000	.000	.007	-.692	.170
Std Dev:	.012	.003	.377	.022	.030	.033	.004	.000	.000	.004	.167	.000
ZAF Corr:	1.2238	1.4625	1.0789	1.1024	1.1654	1.1423	1.1725	1.7756	.8418	2.5295		
Std Err:	.007	.002	.218	.013	.017	.019	.002	.000	.000	.002	.097	.000
ZRef SD:	112.0	3.2	.4	1.0	12.9	20.0	173.2	.0	173.2	56.9	-24.2	.0
Minimum:	.000	.097	98.890	2.083	.206	.128	.000	.000	.000	.003	-.833	.170
Maximum:	.025	.103	99.602	2.126	.263	.191	.006	.000	.000	.011	-.507	.170

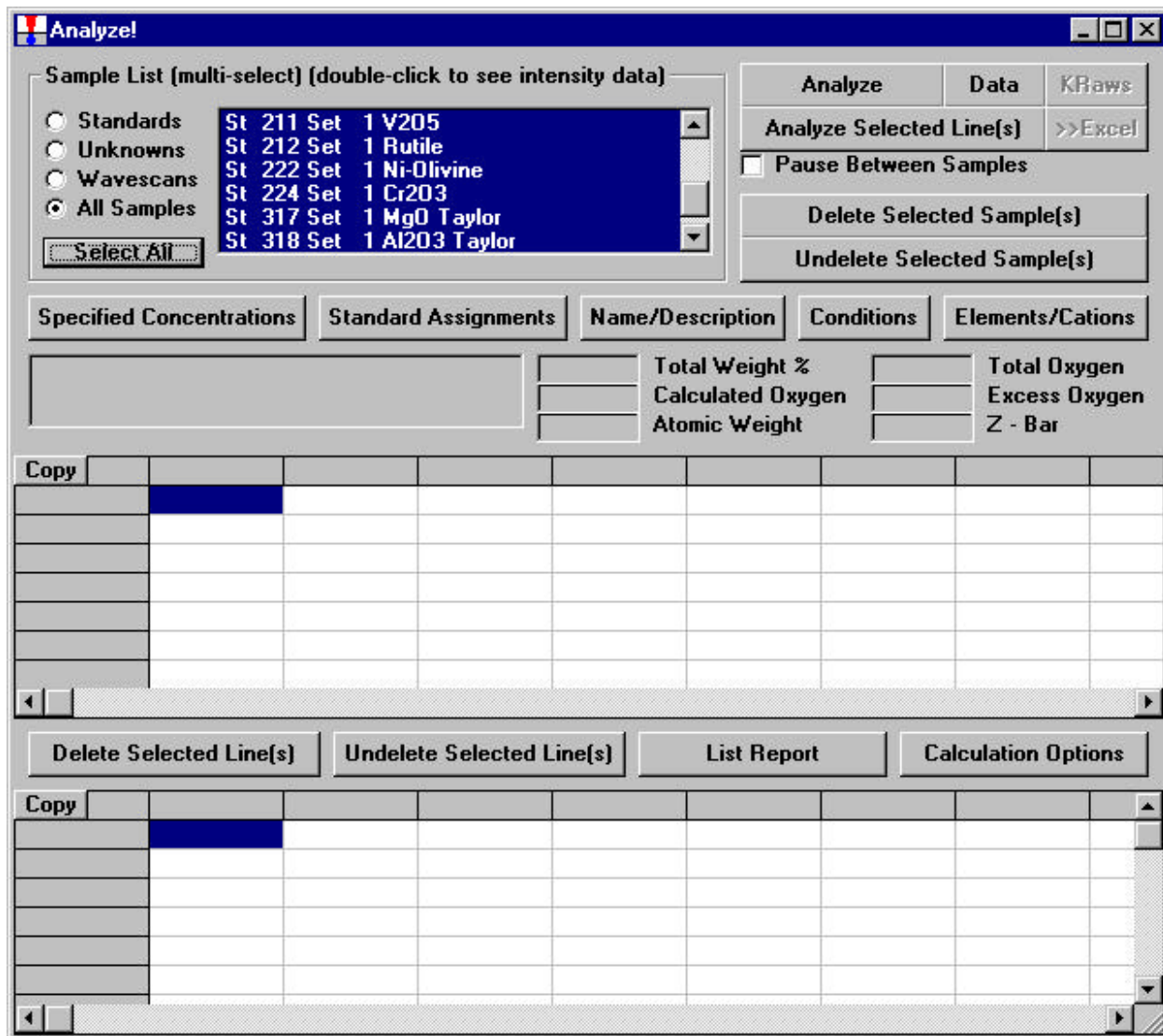
Copy	Al2O3	TiO2	V2O3	Cr2O3	FeO	MnO	MgO	CaO	Na2O	O	Nb2O5	Total
29 B												
30 G	.097	98.890	2.126	.221	.128	.000	.000	.000	.008	-.507	.170	101.132
31 G	.103	99.602	2.114	.263	.191	.000	.000	.000	.011	-.833	.170	101.647
32 G	.102	99.460	2.093	.206	.178	.006	.000	.000	.003	-.735	.170	101.401

All of the data lines gathered on the standards are examined and appear close to their standard database values. To save space they will not be reproduced here.

Spectral Interference Assignments

PROBE FOR WINDOWS allows the user to select a fully quantitative correction for spectral interferences. The program can only correct for interferences if both the interfered and interfering elements are analyzed for. Further, data for an interference calibration standard must be acquired that contains a major concentration of the interfering element and none of the interfered element or any other elements that interfere with the interfered element.

Select the *All Samples* button in the *Sample List* and click the **Select All** button in the **Analyze!** window.



Next, click the **Standard Assignments** button.

Clicking this button opens the **Standard and Interference Assignments** dialog box.

Standard and Interference Assignments

Selected Samples

- Un 1 * setup
- St 81 Set 1 Albite
- St 203 Set 1 Fayalite
- St 205 Set 1 Tephroite
- St 206 Set 1 Orthopyroxene
- St 207 Set 1 Kyanite

OK Cancel

Save Element Setup

Save Sample Setup

Click Element Row to Edit Standard/Interference/Volatile Assignments

Channel	Element	X-Ray	Analyzed	Standard	Interf-Ele	Interf-Std
1	si	ka	Yes	206	...	0,0,0,0
2	al	ka	Yes	207	...	0,0,0,0
3	ti	ka	Yes	212	...	0,0,0,0
4	v	ka	Yes	211	...	0,0,0,0
5	cr	ka	Yes	224	...	0,0,0,0
6	fe	ka	Yes	203	...	0,0,0,0
7	mn	ka	Yes	205	...	0,0,0,0
8	mg	ka	Yes	206	...	0,0,0,0
9	ca	ka	Yes	210	...	0,0,0,0
10	na	ka	Yes	81	...	0,0,0,0
11	o		No	0	...	0,0,0,0

Click on the element row to edit the *Interference Assignments*.

The **Assignment Properties** dialog box opens. Select the first *interference element* for this element and the corresponding *standard* that contains a known amount of the interfering element but none of the interfered element.

Assignment Properties

Enter Standard Assignments For: v ka

Element	X-Ray	Assigned Standard
v	ka	211 V205

OK
Cancel

Interference Standard Assignments

Order	Element	Standard	Action
1st	ti	212 Rutile	Remove
2nd			Remove
3rd			Remove
4th			Remove

Calculate Interferences

The standard used for the interference correction must contain a known concentration of the interfering element and none of the interfered element, nor any other interfering elements.

Volatile Element Calibration Sample Assignment (select an unknown sample for calibration fit)

Un 1 * setup	<p>Volatile element correction calibration samples should be acquired using the "Volatile" button in the Acquire window.</p> <p>Volatile element calibrations using an assigned calibration sample are specified here. Volatile element self calibrations are assigned to themselves.</p> <p>Display Volatile Fit Remove Volatile Fit</p> <p>Volatile Correction Fit Slope Coefficient</p>
No Volatile Correction	

Click the **OK** button when finished.

The **Standard and Interference Assignments** window will appear as below.

Standard and Interference Assignments

Selected Samples

- Un 1 * setup
- St 81 Set 1 Albite
- St 203 Set 1 Fayalite
- St 205 Set 1 Tephroite
- St 206 Set 1 Orthopyroxene
- St 207 Set 1 Kyanite

OK Cancel

Save Element Setup

Save Sample Setup

Click Element Row to Edit Standard/Interference/Volatile Assignments

Channel	Element	X-Ray	Analyzed	Standard	Interf-Ele	Interf-Std
1	si	ka	Yes	206	...	0,0,0,0
2	al	ka	Yes	207	...	0,0,0,0
3	ti	ka	Yes	212	...	0,0,0,0
4	v	ka	Yes	211	ti,...	212,0,0,0
5	cr	ka	Yes	224	...	0,0,0,0
6	fe	ka	Yes	203	...	0,0,0,0
7	mn	ka	Yes	205	...	0,0,0,0
8	mg	ka	Yes	206	...	0,0,0,0
9	ca	ka	Yes	210	...	0,0,0,0
10	na	ka	Yes	81	...	0,0,0,0
11	o		No	0	...	0,0,0,0

Repeat these editing steps for all of the other element interferences, resulting in the following **Standard and Interference Assignments** window.

Standard and Interference Assignments

Selected Samples

- Un 1 * setup
- St 81 Set 1 Albite
- St 203 Set 1 Fayalite
- St 205 Set 1 Tephroite
- St 206 Set 1 Orthopyroxene
- St 207 Set 1 Kyanite

OK Cancel

Save Element Setup

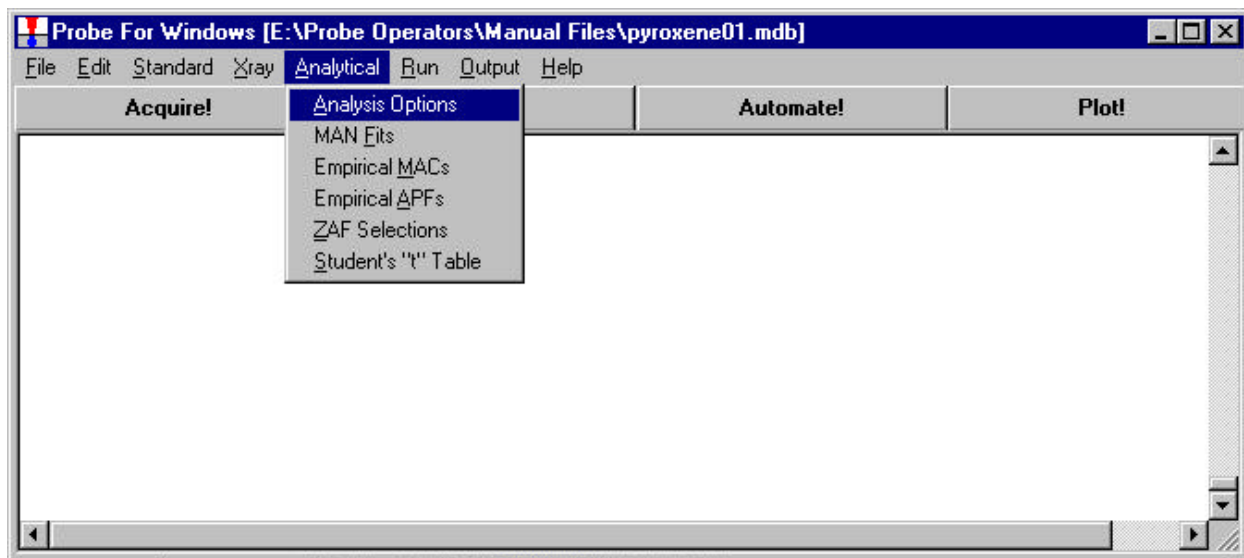
Save Sample Setup

Click Element Row to Edit Standard/Interference/Volatile Assignments

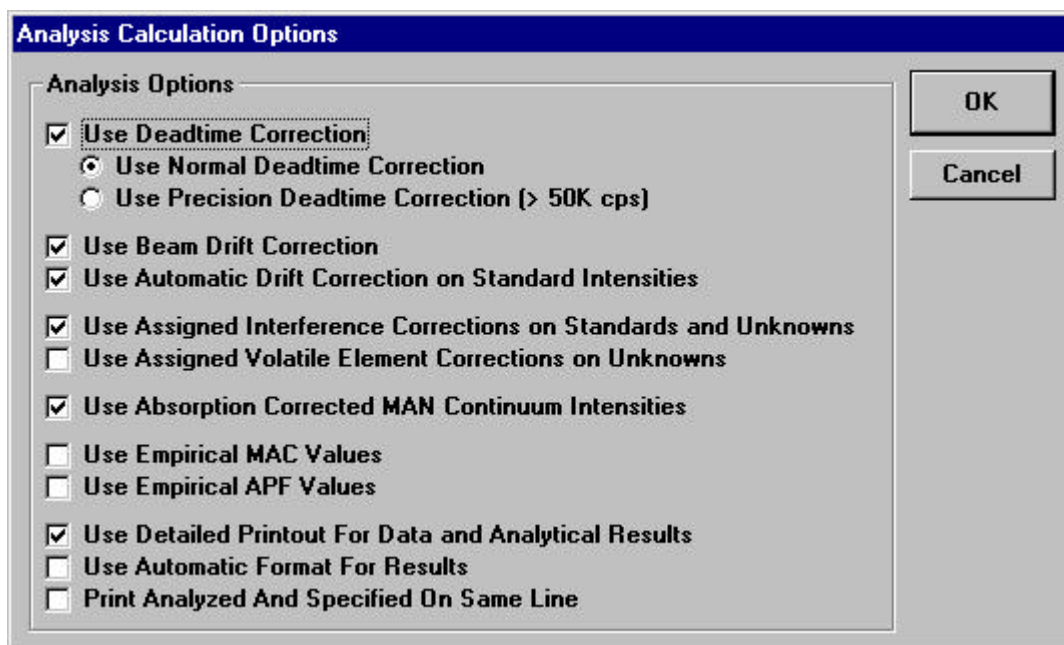
Channel	Element	X-Ray	Analyzed	Standard	Interf-Ele	Interf-Std
1	si	ka	Yes	206	...	0,0,0,0
2	al	ka	Yes	207	...	0,0,0,0
3	ti	ka	Yes	212	...	0,0,0,0
4	v	ka	Yes	211	ti,...	212,0,0,0
5	cr	ka	Yes	224	v,...	211,0,0,0
6	fe	ka	Yes	203	mn,...	205,0,0,0
7	mn	ka	Yes	205	cr,...	224,0,0,0
8	mg	ka	Yes	206	...	0,0,0,0
9	ca	ka	Yes	210	...	0,0,0,0
10	na	ka	Yes	81	...	0,0,0,0
11	o		No	0	...	0,0,0,0

Click the **OK** button when finished returning to the **Analyze!** window.

Next, the user might check the analysis options that are currently assigned. From the main PROBE FOR WINDOWS log window, select **Analytical** from the menu bar and click **Analysis Options** from the menu choices.



This opens the **Analysis Calculation Options** window. Check that the appropriate boxes are marked.



Click the **OK** button returning to the main log window.

The user then reanalyzes the standards (**Analyze** button in the **Analyze!** window), utilizing the spectral interference correction routine. The results for the Rutile standard are dramatic; the apparent 2.1 wt% V₂O₃ concentration has been replaced with an average 0.01 wt% content (which is below the detection limit).

The screenshot shows the 'Analyze!' software window. The 'Sample List' section shows 'St 212 Set 1 Rutile' selected. The 'Specified Concentrations' section shows 'St 212 Set 1 Rutile' with parameters: TakeOff = 40 KiloVolts = 15 Beam Current = 40 Beam Size = 2. The 'Results in Oxide Weight Percent' table is as follows:

Copy	Al2O3	TiO2	V2O3	Cr2O3	FeO	MnO	MgO	CaO	Na2O	O	Nb2O5	Total
Average:	.102	99.440	.009	.232	.168	.002	.000	.000	.009	-.071	.170	100.072
Std Dev:	.003	.377	.015	.030	.033	.004	.000	.001	.004	.166	.000	.260
ZAF Cor:	1.4619	1.0802	1.1038	1.1681	1.1433	1.1734	1.7740	.8423	2.5261			
Std Err:	.002	.218	.009	.017	.019	.002	.000	.000	.002	.096	.000	.150
%Rel SD:	3.2	.4	164.0	12.9	19.8	173.2	.0	173.2	48.5	-233.2	.0	.3
Minimum:	.098	99.013	.000	.208	.130	.000	.000	.000	.004	-.208	.170	99.783
Maximum:	.104	99.726	.027	.265	.193	.007	.000	.001	.013	.114	.170	100.288

The 'Delete Selected Line(s)' button is highlighted. Below the table, the 'List Report' button is also visible. The bottom table shows the following data:

Copy	SiO2	Al2O3	TiO2	V2O3	Cr2O3	FeO	MnO	MgO	CaO	Na2O	O	Nb2O5
29 B												
30 G	.000	.098	99.013	.027	.222	.130	.000	.000	.000	.009	.114	.170
31 G	.025	.104	99.726	.001	.265	.193	.000	.000	.000	.013	-.208	.170
32 G	.009	.103	99.582	.000	.208	.180	.007	.000	.001	.004	-.120	.170

The user is ready to move on to unknown samples.

Unknown Sample Data Collection and Analysis

To collect x-ray data on an unknown sample, minimize the **Analyze!** window and/or bring forward the **Acquire!** dialog box to start a new sample.

Click the **Move** button on the **Acquire!** window to drive the stage to the coordinates of the first unknown sample.

Click the **New Sample** button to activate the **New Sample** dialog box. Check that the *Unknown* button under *New Sample Type* is marked. Enter an appropriate sample name and description into the *New Sample Name* and *New Sample Description* text boxes. Finally, click the **OK** button.

New Sample

New Sample Type

Standard
 Unknown
 Wavescan

OK Cancel

Load Element Setup
Load Sample Setup
Load File Setup

Note that a new standard sample element setup is always based on the last unknown sample in the run. To change the analyzed elements in a run, first create a new unknown sample and make any necessary changes to the element setup.

New Sample Name
Pyroxene #164

New Sample Description
Insert <cr> >> count time check

To add standards to the standard list below, cancel this dialog, then click the Standard | Add Standards to Run menu items from the main menu

81 Albite
203 Fayalite
205 Tephroite
206 Orthopyroxene
207 Kyanite
210 Wollastonite
211 V205

To start acquiring x-ray counts on the first unknown sample, simply click the **Start Standard or Unknown Acquisition** button of the **Acquire!** window.

The screenshot shows the 'Acquire!' software window. At the top, there is a table with columns labeled 1, 2, 3, X, Y, Z, and W. The first row of data is highlighted in yellow and contains the values: 240.002, 240.006, 240.001, 10.6934, 35.5725, 11.1046, and 2.99999. Below this table is another section with columns labeled Faraday, 1, 2, and 3. The first row of data in this section is also highlighted in yellow and contains the values: 10.00, 10.00, 10.00, and 10.00. The second row of data in this section contains the values: 40471.0, 332., 774., and 116..

Below the data tables, there is a 'Current Sample' field containing the text 'Un 2 * PyroXene #164'. To the right of this field is a button labeled 'Start Standard or Unknown Acquisition'. Below the 'Current Sample' field are two input fields: 'Data Rows: 0' and 'Good Data Rows: 0'. To the right of these fields are two buttons: 'Start Wavescan' and 'Special Options'. Below these are four buttons: 'New Sample', 'Locate' (which is highlighted with a dotted border), 'Move', and 'Acquisition Options'. At the bottom, there are two rows of buttons. The first row contains 'Elements/Cations', 'PHA', 'Peak/Scan Options', and 'Start Peak Center'. The second row contains 'Analytical Conditions', 'Count Times', 'Rate Meter', and 'Peaking'.

Pyroxene #164, a chromium augite, is run once to obtain representative count rate information for the adjustment of element count times using the **Count Times** button to improve statistics and lower detection limits. Four random spots are then acquired (a **New Sample** is started) on the same pyroxene.

New Sample

New Sample Type

Standard

Unknown

Wavescan

OK Cancel

Load Element Setup

Load Sample Setup

Load File Setup

Note that a new standard sample element setup is always based on the last unknown sample in the run. To change the analyzed elements in a run, first create a new unknown sample and make any necessary changes to the element setup.

New Sample Name

Pyroxene #164

New Sample Description

Insert <cr> >> Four random spots

To add standards to the standard list below, cancel this dialog, then click the Standard | Add Standards to Run menu items from the main menu

81 Albite

203 Fayalite

205 Tephroite

206 Orthopyroxene

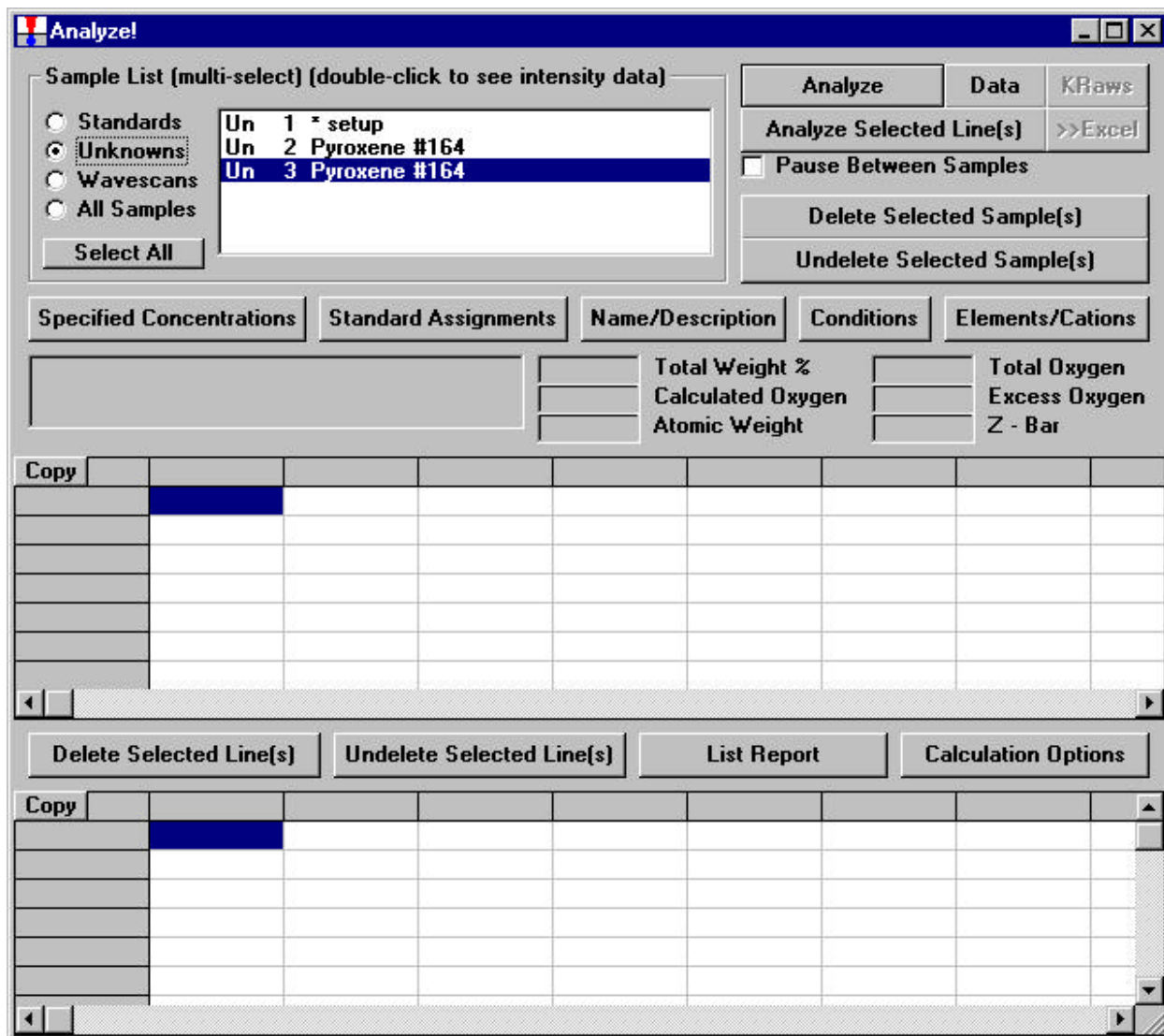
207 Kyanite

210 Wollastonite

211 V205

The **Start Standard or Unknown Acquisition** button in the **Acquire!** window is clicked four times, to acquire four data points.

Next, the **Analyze!** dialog box is reopened or simply brought forward. Click the *Unknowns* button and select *Un 3 Pyroxene #164*.



Click the **Calculation Options** button.

This opens the **Calculation Options** dialog box.

Make the following changes; under *Calculations Options* check *Display Results as Oxides*, *Calculate Detection Limits and Homogeneity*, and *Calculate with Stoichiometric Oxygen*. Under *Formula and Mineral Calculations* check the *Calculate Formula Based On* box. Select *Pyroxene* and enter *6 Atoms of Oxygen* in the other two text boxes.

Calculation Options

Selected Samples

Un 3 Pyroxene #164

OK Cancel

EDS Data Options

Do Not Use EDS Element Data
 Use EDS Element Data

Calculations Options

Display Results As Oxides
 Calculate Atomic Percents
 Calculate Detection Limits and Homogeneity
 Element By Difference
 Stoichiometry To Calculated Oxygen
 Stoichiometry To Another Element

Calculate with Stoichiometric Oxygen
 Calculate as Elemental

Atoms Of [] To Oxygen
Atoms Of [] To []

Formula and Mineral Calculations

Calculate Formula Based On
 None Olivine Feldspar Pyroxene Garnet

6 Atoms Of 0 Add specified oxygen from the Elements/Cations button

Click the **OK** button closing the **Calculation Options** window, returning to the **Analyze!** dialog box.

Clicking the **Analyze** button calculated the results for these four points and those values are viewed below, as copied from the text editor.

Un 3 Pyroxene #164
 TakeOff = 40 KiloVolts = 15 Beam Current = 40 Beam Size = 2
 Four random spots
 Number of Lines: 4 Number of 'Good' Lines: 4
 Current Date and Time: 3/2/99 5:50:23 PM

Elemental Wt. % Total: 99.452 Average Total Oxygen: 43.832
 Average Calcu. Oxygen: 43.832 Average Excess Oxygen: .000
 Average Atomic Weight: 21.746 Average Atomic Number: 12.383
 Average ZAF Iteration: 3.00 Average MAN Iteration: 4.00
 Oxygen Calculated by Cation Stoichiometry and Included in the Matrix Correction

Results in Elemental Weight Percents

SPEC: 0
 TYPE: CALC
 AVER: 43.832
 SDEV: .141

ELEM:	Si	Al	Ti	V	Cr	Fe	Mn	Mg
BGDS:	MAN	MAN	MAN	MAN	MAN	MAN	MAN	MAN
ABS%:	-20.93	-28.32	-3.15	-2.06	-1.43	-.53	-.83	-32.30
TIME:	10.00	20.00	30.00	30.00	30.00	30.00	30.00	40.00

ELEM:	Si	Al	Ti	V	Cr	Fe	Mn	Mg	SUM
54	23.345	4.050	.332	.016	.608	3.684	.087	10.364	99.414
55	23.528	4.050	.306	.046	.608	3.626	.084	10.386	99.776
56	23.230	4.026	.276	.033	.627	3.678	.110	10.399	99.185
57	23.352	4.034	.314	.018	.634	3.712	.097	10.356	99.432

AVER:	23.364	4.040	.307	.028	.619	3.675	.094	10.376	99.452
SDEV:	.123	.012	.023	.014	.013	.036	.012	.020	
SERR:	.061	.006	.012	.007	.007	.018	.006	.010	
%RSD:	.5	.3	7.5	49.3	2.1	1.0	12.5	.2	
STDS:	206	207	212	211	224	203	205	206	

STKF:	.2112	.2706	.5519	.5083	.6408	.4982	.4894	.1774	
STCT:	4872.5	23252.8	1851.9	2467.5	4164.4	4400.5	3826.7	12205.5	

UNKF:	.1823	.0282	.0026	.0002	.0053	.0309	.0008	.0701	
UNCT:	4206.0	2420.2	8.6	1.1	34.1	272.6	6.1	4826.2	
UNBG:	7.1	69.3	2.2	4.1	6.3	12.8	9.0	41.6	

ZCOR:	1.2815	1.4345	1.1938	1.2087	1.1795	1.1908	1.2112	1.4796	
KRAW:	.8632	.1041	.0047	.0005	.0082	.0619	.0016	.3954	
PKBG:	595.82	35.90	4.85	1.28	6.40	22.30	1.67	117.06	
INT%:	.00	.00	.00	-23.19	-.14	.00	-1.30	.00	

ELEM:	Ca	Na
BGDS:	MAN	MAN
ABS%:	-3.20	-46.94
TIME:	40.00	30.00

ELEM:	Ca	Na	SUM
54	12.482	.631	99.414
55	12.466	.656	99.776
56	12.503	.625	99.185
57	12.469	.632	99.432

AVER:	12.480	.636	99.452
SDEV:	.017	.013	
SERR:	.008	.007	
%RSD:	.1	2.1	

STDS: 210 81
 STKF: .3205 .0500
 STCT: 11337.2 2170.0
 UNKF: .1149 .0033
 UNCT: 4063.9 143.0
 UNBG: 35.6 19.2
 ZCOR: 1.0863 1.9327
 KRAW: .3585 .0659
 PKBG: 115.28 8.44
 INT%: .00 .00

Results in Oxide Weight Percents

SPEC: O
 TYPE: CALC

AVER: .000
 SDEV: .000

ELEM:	SiO2	Al2O3	TiO2	V2O3	Cr2O3	FeO	MnO	MgO	SUM
54	49.943	7.652	.553	.024	.889	4.739	.112	17.186	99.414
55	50.334	7.653	.510	.067	.889	4.665	.108	17.223	99.776
56	49.698	7.607	.461	.049	.916	4.732	.142	17.245	99.185
57	49.959	7.623	.524	.027	.927	4.775	.125	17.173	99.432
AVER:	49.983	7.634	.512	.042	.905	4.728	.122	17.207	99.452
SDEV:	.263	.023	.039	.021	.019	.046	.015	.033	
SERR:	.131	.011	.019	.010	.010	.023	.008	.016	
%RSD:	.5	.3	7.5	49.3	2.1	1.0	12.5	.2	

ELEM:	CaO	Na2O	SUM
54	17.465	.851	99.414
55	17.443	.884	99.776
56	17.495	.842	99.185
57	17.446	.852	99.432
AVER:	17.462	.857	99.452
SDEV:	.024	.018	
SERR:	.012	.009	
%RSD:	.1	2.1	

Results Based on 6 Atoms of o

SPEC: O
 TYPE: CALC

AVER: 6.000
 SDEV: .000

ELEM:	Si	Al	Ti	V	Cr	Fe	Mn	Mg	SUM
54	1.821	.329	.015	.001	.026	.145	.003	.934	10.016
55	1.827	.327	.014	.002	.026	.142	.003	.932	10.013
56	1.818	.328	.013	.001	.026	.145	.004	.940	10.021
57	1.822	.328	.014	.001	.027	.146	.004	.934	10.016
AVER:	1.822	.328	.014	.001	.026	.144	.004	.935	10.017
SDEV:	.004	.001	.001	.001	.001	.002	.000	.004	
SERR:	.002	.000	.001	.000	.000	.001	.000	.002	
%RSD:	.2	.2	7.4	49.1	2.3	1.2	12.8	.4	

ELEM:	Ca	Na	SUM
54	.682	.060	10.016
55	.678	.062	10.013
56	.686	.060	10.021
57	.682	.060	10.016
AVER:	.682	.061	10.017
SDEV:	.003	.001	
SERR:	.002	.001	
%RSD:	.4	1.8	

Pyroxene Mineral End-Member Calculations

	Wo	En	Fs
54	38.7	53.0	8.2
55	38.7	53.2	8.1
56	38.7	53.1	8.2
57	38.7	53.0	8.3
AVER:	38.7	53.1	8.2
SDEV:	.0	.1	.1

Detection limit at 99 % Confidence in Elemental Weight Percent (Single Line):

ELEM:	Si	Al	Ti	V	Cr	Fe	Mn	Mg
54	---	---	.029	.028	.025	---	.026	---
55	---	---	.029	.028	.025	---	.026	---
56	---	---	.029	.028	.025	---	.026	---
57	---	---	.029	.028	.025	---	.026	---
AVER:	---	---	.029	.028	.025	---	.026	---
SDEV:	---	---	.000	.000	.000	---	.000	---
SERR:	---	---	.000	.000	.000	---	.000	---

ELEM:	Ca	Na
54	---	.011
55	---	.011
56	---	.011
57	---	.011
AVER:	---	.011
SDEV:	---	.000
SERR:	---	.000

Percent Analytical Error (Single Line):

ELEM:	Si	Al	Ti	V	Cr	Fe	Mn	Mg
54	.5	.5	7.3	57.4	3.7	1.2	15.7	.2
55	.5	.5	7.7	27.5	3.7	1.2	16.1	.2
56	.5	.5	8.2	35.8	3.6	1.2	12.8	.2
57	.5	.5	7.5	53.7	3.6	1.2	14.3	.2
AVER:	.5	.5	7.7	43.6	3.7	1.2	14.7	.2
SDEV:	.0	.0	.4	14.3	.0	.0	1.5	.0
SERR:	.0	.0	.2	7.2	.0	.0	.8	.0

ELEM:	Ca	Na
54	.3	1.7
55	.3	1.7
56	.2	1.7
57	.3	1.7
AVER:	.3	1.7

SDEV: .0 .0
 SERR: .0 .0

Range of Homogeneity in +/- Elemental Weight Percent (Average of Sample):

ELEM:	Si	Al	Ti	V	Cr	Fe	Mn	Mg
60ci	.063	.007	.009	.001	.005	.017	.002	.010
80ci	.106	.011	.015	.002	.009	.028	.004	.017
90ci	.152	.016	.022	.003	.013	.041	.006	.025
95ci	.205	.021	.029	.004	.018	.055	.008	.034
99ci	.377	.039	.054	.008	.032	.101	.014	.062

ELEM:	Ca	Na
60ci	.009	.006
80ci	.015	.010
90ci	.021	.014
95ci	.028	.019
99ci	.052	.036

Test of Homogeneity at 1.0 % Precision (Average of Sample):

ELEM:	Si	Al	Ti	V	Cr	Fe	Mn	Mg
60ci	yes	yes	no	no	yes	yes	no	yes
80ci	yes	yes	no	no	no	yes	no	yes
90ci	yes	yes	no	no	no	no	no	yes
95ci	yes	yes	no	no	no	no	no	yes
99ci	no	yes	no	no	no	no	no	yes

ELEM:	Ca	Na
60ci	yes	yes
80ci	yes	no
90ci	yes	no
95ci	yes	no
99ci	yes	no

Level of Homogeneity in +/- Percent (Average of Sample):

ELEM:	Si	Al	Ti	V	Cr	Fe	Mn	Mg
60ci	.3	.2	2.9	4.8	.9	.5	2.5	.1
80ci	.5	.3	4.9	8.1	1.5	.8	4.2	.2
90ci	.6	.4	7.0	11.6	2.1	1.1	6.0	.2
95ci	.9	.5	9.5	15.7	2.9	1.5	8.1	.3
99ci	1.6	1.0	17.5	28.8	5.2	2.7	14.8	.6

ELEM:	Ca	Na
60ci	.1	.9
80ci	.1	1.6
90ci	.2	2.3
95ci	.2	3.1
99ci	.4	5.6

Detection Limit in Elemental Weight Percent (Average of Sample):

ELEM:	Si	Al	Ti	V	Cr	Fe	Mn	Mg
60ci	---	---	.014	.009	.008	---	.008	---
80ci	---	---	.024	.014	.014	---	.013	---
90ci	---	---	.035	.021	.020	---	.018	---
95ci	---	---	.047	.028	.027	---	.025	---
99ci	---	---	.087	.051	.049	---	.045	---

Projected Detection Limits (99% CI) in Elemental Weight Percent (Average of Sample):

ELEM:	Si	Al	Ti	V	Cr	Fe	Mn	Mg
TIME:	.16	.31	.47	.47	.47	.47	.47	.63
PROJ:	---	---	.692	.410	.395	---	.361	---
TIME:	.31	.63	.94	.94	.94	.94	.94	1.25
PROJ:	---	---	.489	.290	.279	---	.255	---
TIME:	.63	1.25	1.88	1.88	1.88	1.88	1.88	2.50
PROJ:	---	---	.346	.205	.197	---	.180	---
TIME:	1.25	2.50	3.75	3.75	3.75	3.75	3.75	5.00
PROJ:	---	---	.245	.145	.140	---	.128	---
TIME:	2.50	5.00	7.50	7.50	7.50	7.50	7.50	10.00
PROJ:	---	---	.173	.102	.099	---	.090	---
TIME:	5.00	10.00	15.00	15.00	15.00	15.00	15.00	20.00
PROJ:	---	---	.122	.072	.070	---	.064	---
TIME:	10.00	20.00	30.00	30.00	30.00	30.00	30.00	40.00
PROJ:	---	---	.087	.051	.049	---	.045	---
TIME:	20.00	40.00	60.00	60.00	60.00	60.00	60.00	80.00
PROJ:	---	---	.061	.036	.035	---	.032	---
TIME:	40.00	80.00	120.00	120.00	120.00	120.00	120.00	160.00
PROJ:	---	---	.043	.026	.025	---	.023	---
TIME:	80.00	160.00	240.00	240.00	240.00	240.00	240.00	320.00
PROJ:	---	---	.031	.018	.017	---	.016	---
TIME:	160.00	320.00	480.00	480.00	480.00	480.00	480.00	640.00
PROJ:	---	---	.022	.013	.012	---	.011	---
TIME:	320.00	640.00	960.00	960.00	960.00	960.00	960.00	1280.00
PROJ:	---	---	.015	.009	.009	---	.008	---
TIME:	640.00	1280.00	1920.00	1920.00	1920.00	1920.00	1920.00	2560.00
PROJ:	---	---	.011	.006	.006	---	.006	---

ELEM:	Ca	Na
60ci	---	.009
80ci	---	.014
90ci	---	.021
95ci	---	.028
99ci	---	.051

Projected Detection Limits (99% CI) in Elemental Weight Percent (Average of Sample):

ELEM:	Ca	Na
TIME:	.63	.47
PROJ:	---	.411
TIME:	1.25	.94
PROJ:	---	.291
TIME:	2.50	1.88
PROJ:	---	.206
TIME:	5.00	3.75
PROJ:	---	.145
TIME:	10.00	7.50
PROJ:	---	.103
TIME:	20.00	15.00
PROJ:	---	.073
TIME:	40.00	30.00
PROJ:	---	.051
TIME:	80.00	60.00
PROJ:	---	.036
TIME:	160.00	120.00
PROJ:	---	.026
TIME:	320.00	240.00
PROJ:	---	.018
TIME:	640.00	480.00
PROJ:	---	.013
TIME:	1280.00	960.00

PROJ: --- .009
TIME: 2560.00 1920.00
PROJ: --- .006

Analytical Sensitivity in Elemental Weight Percent (Average of Sample):

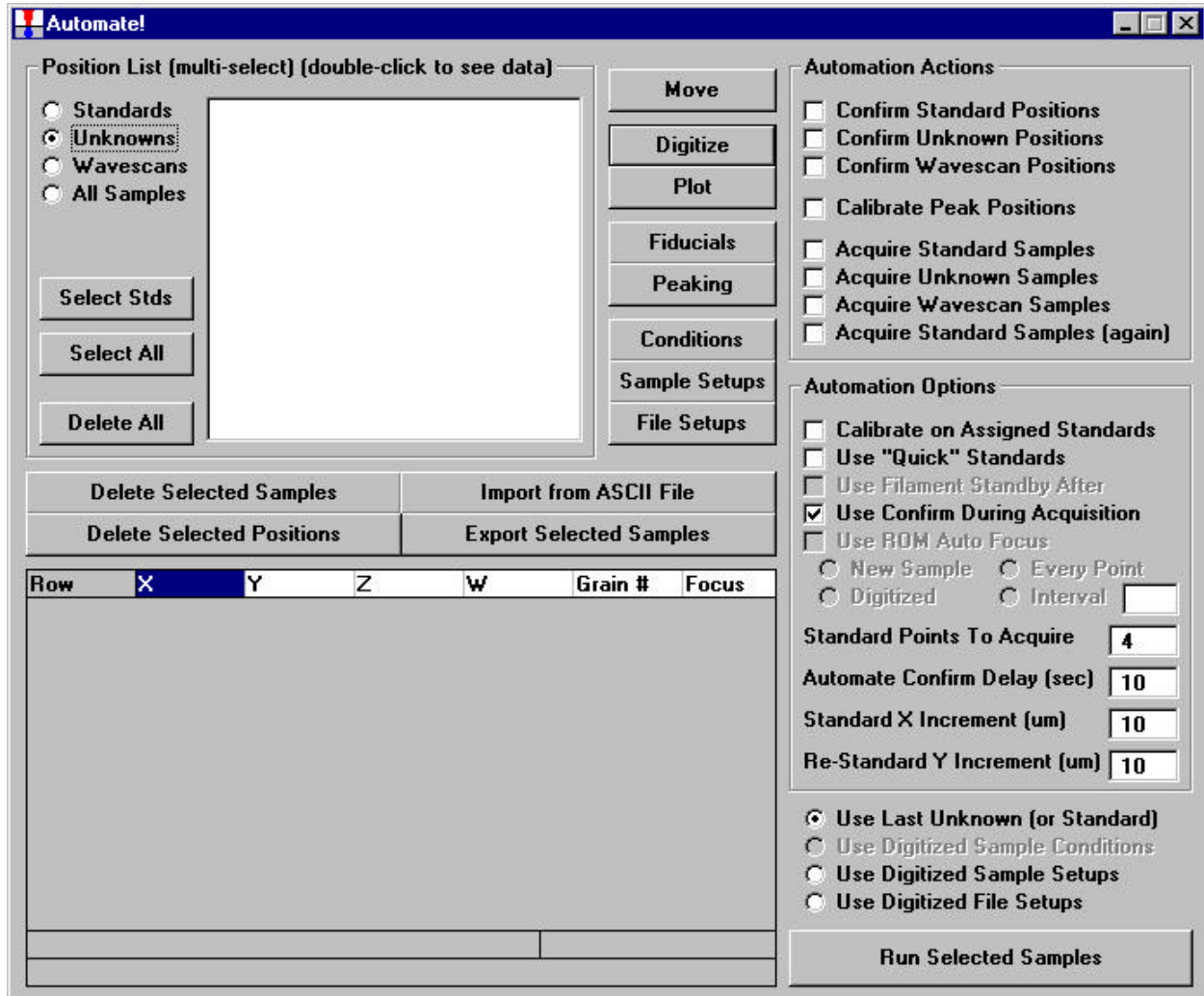
ELEM:	Si	Al	Ti	V	Cr	Fe	Mn	Mg
60ci	.089	.009	.013	.002	.008	.024	.003	.015
80ci	.149	.015	.021	.003	.013	.040	.006	.025
90ci	.215	.022	.031	.005	.019	.057	.008	.035
95ci	.290	.030	.041	.006	.025	.078	.011	.048
99ci	.532	.055	.076	.012	.046	.143	.020	.088

ELEM:	Ca	Na
60ci	.012	.008
80ci	.021	.014
90ci	.030	.020
95ci	.040	.027
99ci	.074	.050

The user may obtain a large amount of information besides elemental and oxide weight percent data; these expanded capabilities include formula and mineral end member calculations, an extended set of detection limit and statistics including homogeneity and analytical sensitivity. See the User's Guide and Reference documentation for calculation details.

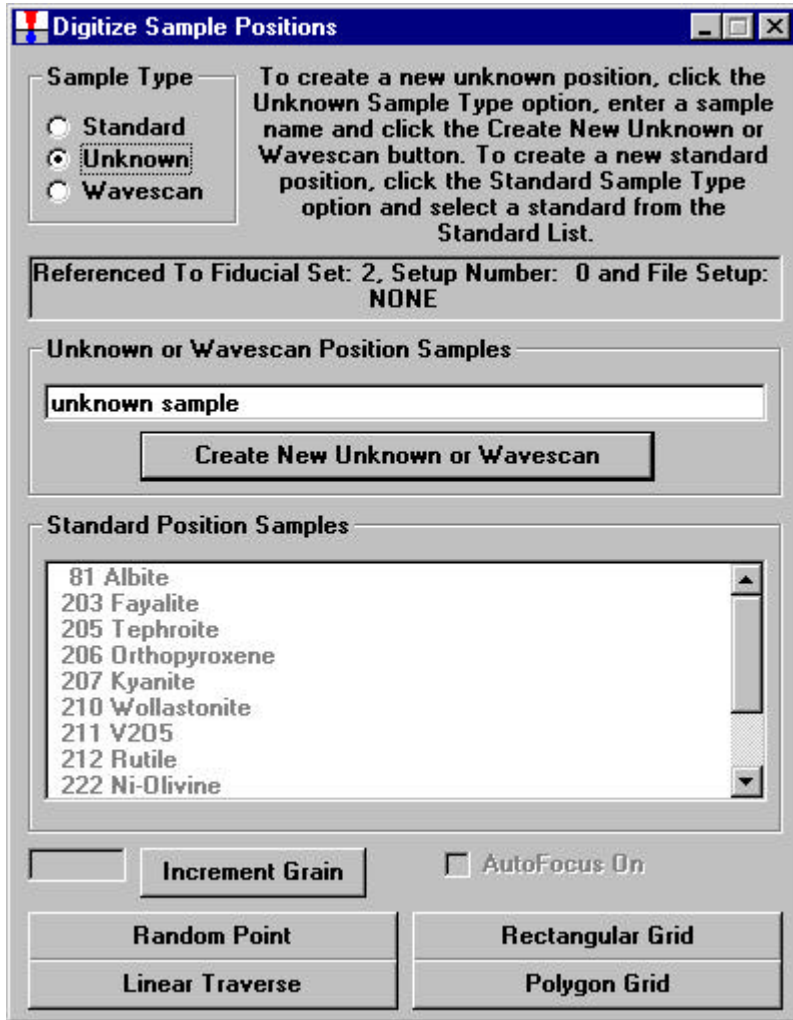
Digitized Sample Data Collection and Analysis

Next the user will perform a digitized traverse across an unknown pyroxene grain. The user can digitize standards, unknowns or wavescan positions based on random points, linear traverse or rectangular or polygon gridded areas. Check that the *Unknowns* button is clicked.

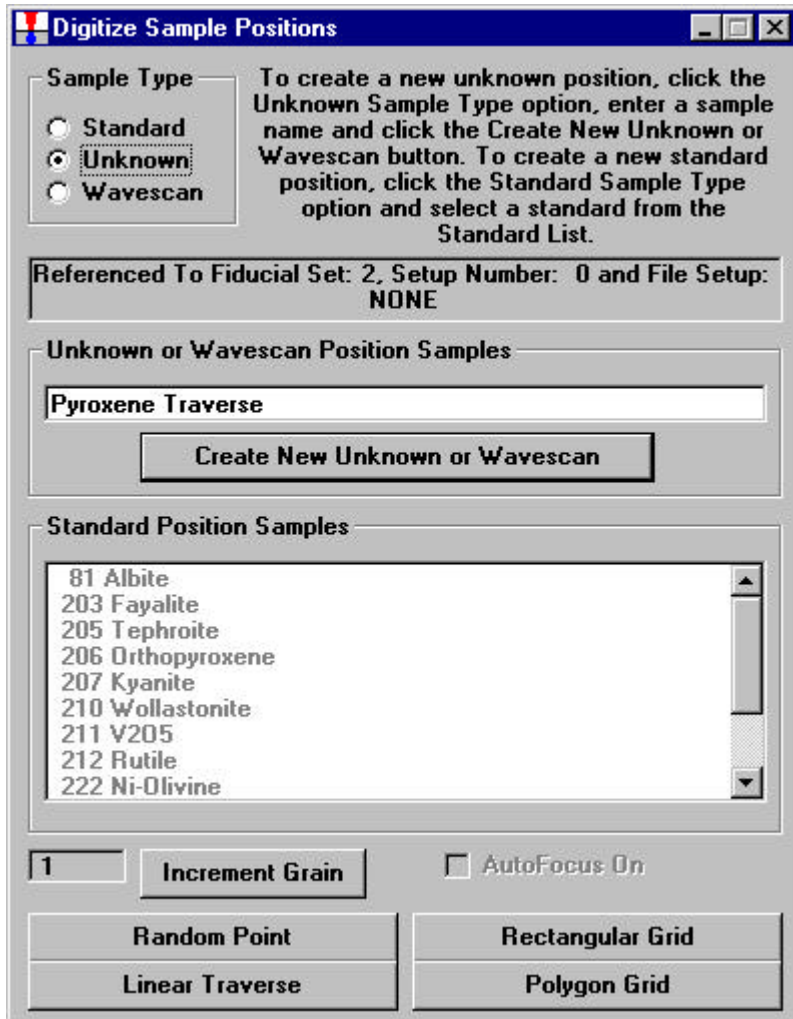


Click the **Digitize** button in the **Automate!** window.

This opens the **Digitize Sample Positions** dialog box.



To create an unknown digitized sample click *Unknown* under *Sample Type* and enter a sample name in the *Unknown or Wavescan Position Samples* text box. Next, click the **Create New Unknown or Wavescan** button. The unknown sample will now appear in the *Position List* list box of the **Automate!** window.



Finally, click the **Linear Traverse** button to create a traverse of digitized points. Other options are rectangular and polygon grids.

The **Linear Traverse Parameters** dialog box opens.

Linear Traverse Parameters

Enter Stage Coordinates For Traverse End Points

X Start Position	<input type="text" value="10.7353"/>	X Stop Position	<input type="text" value="10.7353"/>
Y Start Position	<input type="text" value="35.5725"/>	Y Stop Position	<input type="text" value="35.5725"/>
Z Start Position	<input type="text" value="11.1038"/>	Z Stop Position	<input type="text" value="11.1038"/>

Total Distance Distance in Microns

Traverse Interpolate Position Options

Use Number Of Points Per Traverse
 Use Step Size In Microns Per Step

Number Of Points

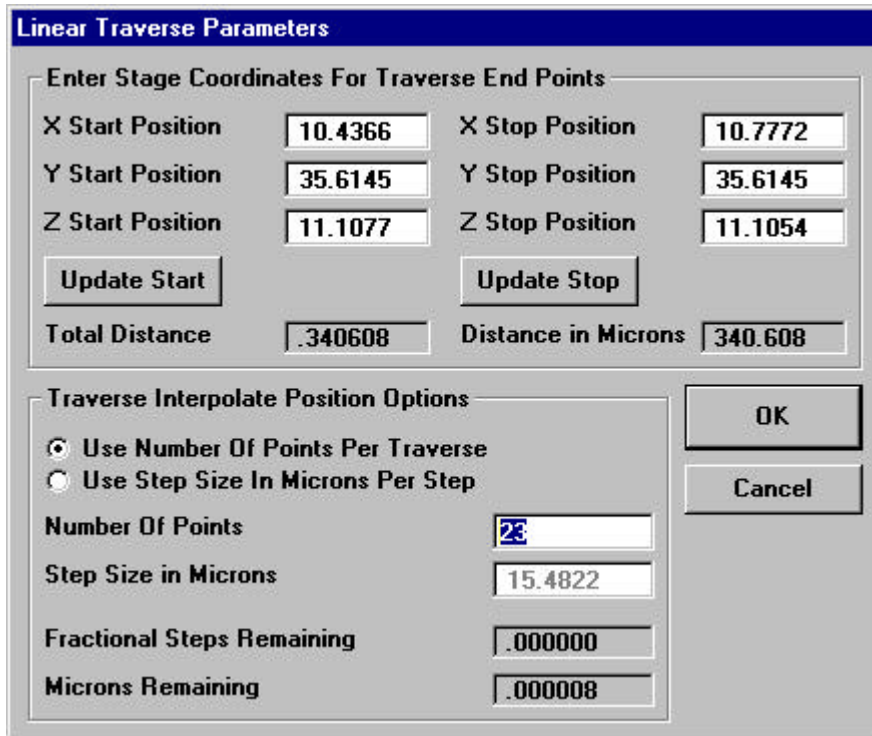
Step Size in Microns

Fractional Steps Remaining

Microns Remaining

Move to the start position of the linear traverse, click the **Update Start** button. Move to the stop position and click the **Update Stop** button. The total distance is displayed.

Select the *Use Number of Points Per Traverse* or *Use Step Size in Microns Per Step* button and adjust the text boxes appropriately.



The dialog box is titled "Linear Traverse Parameters" and is divided into two main sections. The top section, "Enter Stage Coordinates For Traverse End Points", contains six text boxes for X, Y, and Z start and stop positions, two "Update" buttons, and two summary text boxes for total distance and distance in microns. The bottom section, "Traverse Interpolate Position Options", contains two radio buttons, four text boxes for "Number Of Points", "Step Size in Microns", "Fractional Steps Remaining", and "Microns Remaining", and two "OK" and "Cancel" buttons.

Enter Stage Coordinates For Traverse End Points			
X Start Position	10.4366	X Stop Position	10.7772
Y Start Position	35.6145	Y Stop Position	35.6145
Z Start Position	11.1077	Z Stop Position	11.1054
Update Start		Update Stop	
Total Distance	.340608	Distance in Microns	340.608

Traverse Interpolate Position Options	
<input checked="" type="radio"/> Use Number Of Points Per Traverse	
<input type="radio"/> Use Step Size In Microns Per Step	
Number Of Points	23
Step Size in Microns	15.4822
Fractional Steps Remaining	.000000
Microns Remaining	.000008

Click the **OK** button returning to the **Automate!** window.

Now all of the calculated analysis positions have been digitized and listed. Under *Automation Actions* click the *Acquire Unknown Samples* button.

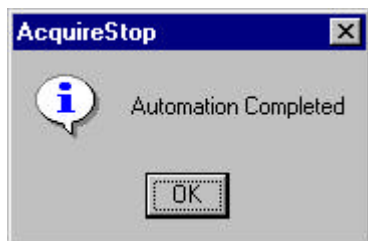
The screenshot shows the Automate! software interface. On the left, there is a 'Position List (multi-select) (double-click to see data)' section with radio buttons for 'Standards', 'Unknowns', 'Wavescans', and 'All Samples'. Below these are buttons for 'Select Stds', 'Select All', and 'Delete All'. The main list area shows a table with columns: Row, X, Y, Z, W, Grain #, and Focus. The first row is highlighted and contains the text 'Un 1 Fid 2 Pyroxene Traverse'. To the right of the list are buttons for 'Move', 'Digitize', 'Plot', 'Fiducials', 'Peaking', 'Conditions', 'Sample Setup', and 'File Setup'. Below the list are buttons for 'Delete Selected Samples', 'Delete Selected Positions', 'Import from ASCII File', and 'Export Selected Samples'. At the bottom left, there are fields for 'KeV = 15', 'Beam Current = 40', 'Beam Size = 2', and 'Setup Number = 0'. On the right side, there are two sections: 'Automation Actions' and 'Automation Options'. 'Automation Actions' includes checkboxes for 'Confirm Standard Positions', 'Confirm Unknown Positions', 'Confirm Wavescan Positions', 'Calibrate Peak Positions', 'Acquire Standard Samples', 'Acquire Unknown Samples' (checked), 'Acquire Wavescan Samples', and 'Acquire Standard Samples (again)'. 'Automation Options' includes checkboxes for 'Calibrate on Assigned Standards', 'Use "Quick" Standards', 'Use Filament Standby After', 'Use Confirm During Acquisition' (checked), and 'Use RDM Auto Focus'. Below these are radio buttons for 'New Sample' and 'Every Point', and 'Digitized' and 'Interval'. There are also input fields for 'Standard Points To Acquire' (4), 'Automate Confirm Delay (sec)' (10), 'Standard X Increment (um)' (10), and 'Re-Standard Y Increment (um)' (10). At the bottom right is a 'Run Selected Samples' button.

Row	X	Y	Z	W	Grain #	Focus
12	10.6069	35.6145	11.1065	2.999987	1	0
13	10.6224	35.6145	11.1064	2.999987	1	0
14	10.6379	35.6145	11.1063	2.999987	1	0
15	10.6533	35.6145	11.1062	2.999987	1	0
16	10.6688	35.6145	11.1061	2.999987	1	0
17	10.6843	35.6145	11.1060	2.999987	1	0
18	10.6998	35.6145	11.1059	2.999987	1	0
19	10.7153	35.6145	11.1058	2.999987	1	0
20	10.7308	35.6145	11.1057	2.999987	1	0
21	10.7462	35.6145	11.1056	2.999987	1	0
22	10.7617	35.6145	11.1055	2.999987	1	0
23	10.7772	35.6145	11.1054	2.999987	1	0

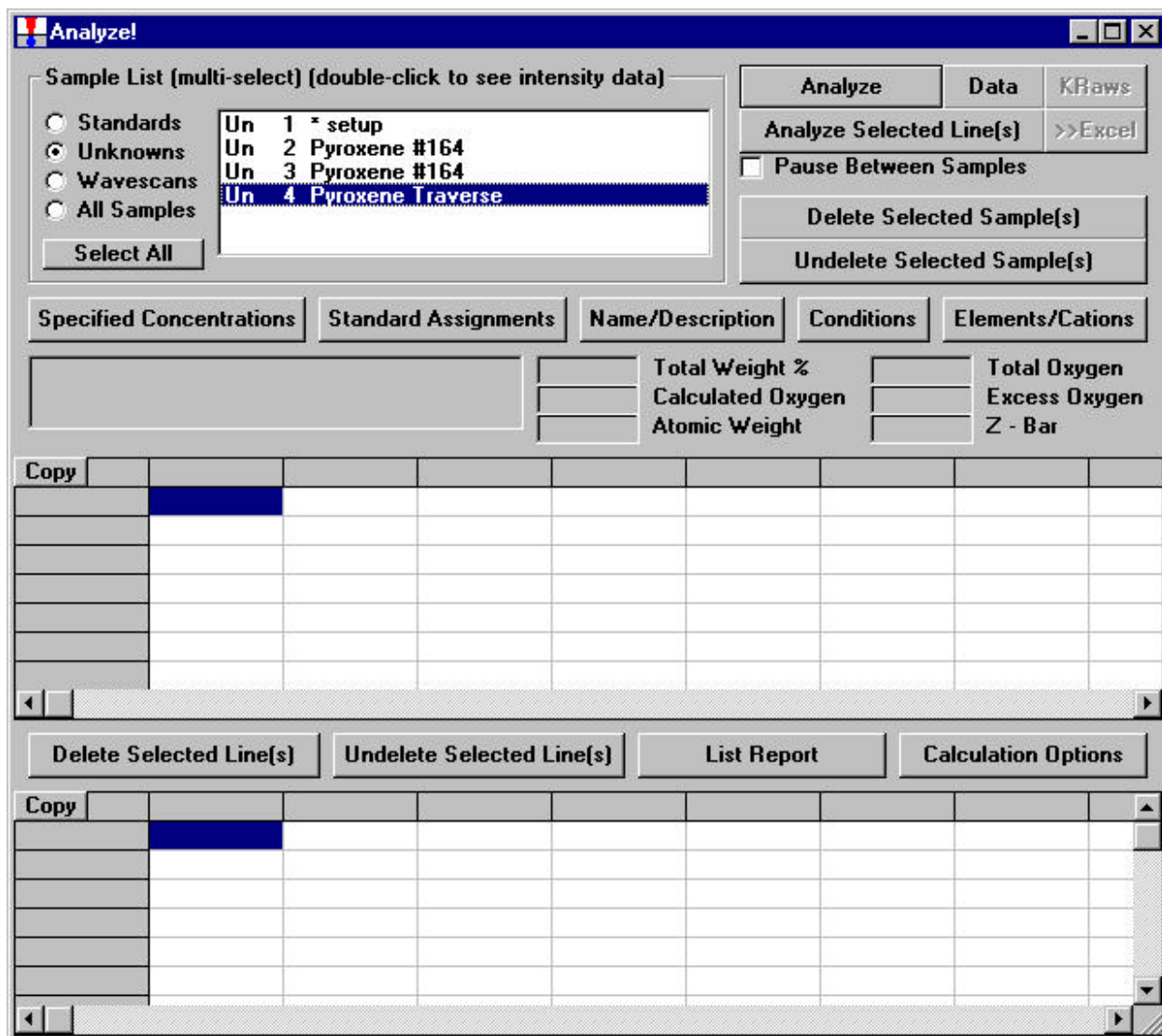
Click **Run Selected Samples** button to initiate the traverse. The **AutomateConfirmSelected** window opens, click **Yes**.

The screenshot shows the AutomateConfirmSelected dialog box. It has a question mark icon in a speech bubble. The text inside reads: 'Number of Standard Position Samples: 0', 'Number of Unknown Position Samples: 1', 'Number of Wavescan Position Samples: 0', 'Elapsed Time for Last Analysis: 188 seconds', and 'Are you sure you want to run these automated samples?'. At the bottom are 'Yes' and 'No' buttons.

When the traverse is completed the familiar **AcquireStop** window appears. Click the **OK** button returning the user to the **Automate!** dialog box.



To analyze the data obtained from the traverse, the user opens the **Analyze!** window and selects the *Un 4 Pyroxene Traverse* unknown sample in the *Sample List*.



Again, save the log window output to the text editor. Click the **Analyze** button to calculate compositions and finally view the disk log in the text editor. A portion is shown below.

```
Un 4 Pyroxene Traverse
TakeOff = 40 KiloVolts = 15 Beam Current = 40 Beam Size = 2
```

Traverse across grain

Number of Lines: 23 Number of 'Good' Lines: 23

Current Date and Time: 3/2/99 7:49:52 PM

Elemental Wt. % Total: 99.372 Average Total Oxygen: 43.828
Average Calcu. Oxygen: 43.828 Average Excess Oxygen: .000
Average Atomic Weight: 21.738 Average Atomic Number: 12.377
Average ZAF Iteration: 3.00 Average MAN Iteration: 4.00
Oxygen Calculated by Cation Stoichiometry and Included in the Matrix Correction

Results in Elemental Weight Percents

SPEC: O
TYPE: CALC

AVER: 43.828
SDEV: .109

ELEM:	Si	Al	Ti	V	Cr	Fe	Mn	Mg
BGDS:	MAN	MAN	MAN	MAN	MAN	MAN	MAN	MAN
ABS%:	-20.88	-28.28	-3.15	-2.06	-1.43	-.53	-.83	-32.28
TIME:	10.00	20.00	30.00	30.00	30.00	30.00	30.00	20.00

ELEM:	Si	Al	Ti	V	Cr	Fe	Mn	Mg	SUM
58	23.353	4.003	.283	.019	.594	3.728	.093	10.347	99.132
59	23.482	4.013	.292	.020	.607	3.668	.102	10.316	99.545
60	23.441	3.999	.345	.010	.614	3.625	.111	10.362	99.385
61	23.407	3.981	.282	.026	.616	3.623	.102	10.315	99.211
62	23.366	3.997	.301	.019	.602	3.598	.069	10.373	99.241
63	23.555	3.961	.300	.009	.626	3.705	.098	10.374	99.613
64	23.473	3.981	.308	.015	.593	3.701	.110	10.398	99.439
65	23.356	4.015	.299	.027	.598	3.707	.099	10.345	99.316
66	23.286	4.021	.316	.021	.586	3.618	.083	10.324	99.059
67	23.446	3.987	.287	.006	.628	3.688	.095	10.299	99.360
68	23.312	4.026	.272	.029	.568	3.644	.088	10.276	98.900
69	23.447	4.012	.337	.026	.583	3.627	.098	10.376	99.576
70	23.456	4.025	.287	.009	.585	3.680	.102	10.308	99.352
71	23.282	4.009	.265	.025	.590	3.643	.094	10.353	98.987
72	23.546	3.992	.282	.021	.602	3.679	.094	10.311	99.598
73	23.564	4.004	.299	.015	.573	3.590	.087	10.297	99.446
74	23.492	3.974	.309	.014	.576	3.624	.084	10.315	99.305
75	23.560	4.016	.295	.015	.612	3.640	.096	10.331	99.637
76	23.624	3.985	.272	.026	.590	3.630	.094	10.337	99.739
77	23.440	4.012	.280	.004	.625	3.692	.100	10.336	99.503
78	23.553	4.021	.284	.015	.613	3.688	.088	10.303	99.597
79	23.410	4.018	.269	.031	.590	3.670	.107	10.290	99.243
80	23.450	3.968	.287	.029	.620	3.644	.101	10.284	99.368

AVER:	23.448	4.001	.293	.019	.600	3.657	.095	10.329	99.372
SDEV:	.093	.019	.020	.008	.017	.038	.010	.033	
SERR:	.019	.004	.004	.002	.004	.008	.002	.007	
%RSD:	.4	.5	6.8	42.0	2.9	1.0	10.0	.3	
STDS:	206	207	212	211	224	203	205	206	

STKF:	.2112	.2706	.5519	.5083	.6408	.4982	.4894	.1774	
STCT:	4872.5	23252.8	1851.9	2467.5	4164.4	4400.5	3826.7	12205.5	

UNKF:	.1831	.0279	.0025	.0002	.0051	.0307	.0008	.0698	
UNCT:	4223.6	2398.0	8.2	.8	33.0	271.3	6.2	4805.4	
UNBG:	7.1	69.4	2.2	4.1	6.3	12.8	9.0	41.6	

ZCOR:	1.2808	1.4337	1.1940	1.2089	1.1797	1.1909	1.2113	1.4793	
KRAW:	.8668	.1031	.0045	.0003	.0079	.0616	.0016	.3937	

PKBG:	598.50	35.57	4.68	1.18	6.23	22.21	1.68	116.59
INT%:	.00	.00	.00	-30.47	-.10	.00	-1.24	.00

ELEM:	Ca	Na
BGDS:	MAN	MAN
ABS%:	-3.21	-46.92
TIME:	20.00	30.00

ELEM:	Ca	Na	SUM
58	12.369	.638	99.132
59	12.512	.636	99.545
60	12.404	.628	99.385
61	12.476	.629	99.211
62	12.504	.649	99.241
63	12.410	.628	99.613
64	12.360	.636	99.439
65	12.453	.650	99.316
66	12.499	.638	99.059
67	12.480	.632	99.360
68	12.420	.646	98.900
69	12.513	.649	99.576
70	12.445	.627	99.352
71	12.445	.647	98.987
72	12.507	.630	99.598
73	12.449	.657	99.446
74	12.469	.621	99.305
75	12.467	.633	99.637
76	12.530	.631	99.739
77	12.535	.618	99.503
78	12.458	.628	99.597
79	12.462	.631	99.243
80	12.532	.644	99.368

AVER:	12.465	.636	99.372
SDEV:	.049	.010	
SERR:	.010	.002	
%RSD:	.4	1.6	
STDS:	210	81	

STKF:	.3205	.0500
STCT:	11337.2	2170.0

UNKF:	.1147	.0033
UNCT:	4058.2	143.0
UNBG:	35.5	19.2

ZCOR:	1.0865	1.9321
KRAW:	.3580	.0659
PKBG:	115.18	8.44
INT%:	.00	.00

Results in Oxide Weight Percents

SPEC: O
 TYPE: CALC

AVER: .000
 SDEV: .000

ELEM:	SiO2	Al2O3	TiO2	V2O3	Cr2O3	FeO	MnO	MgO	SUM
58	49.960	7.564	.472	.028	.868	4.796	.120	17.158	99.132
59	50.237	7.583	.486	.030	.887	4.719	.132	17.107	99.545
60	50.149	7.556	.575	.015	.898	4.664	.143	17.183	99.385
61	50.076	7.522	.471	.039	.900	4.661	.132	17.106	99.211
62	49.989	7.552	.502	.029	.880	4.629	.089	17.201	99.241
63	50.392	7.484	.500	.014	.915	4.767	.126	17.203	99.613
64	50.217	7.521	.514	.022	.867	4.761	.142	17.242	99.439
65	49.967	7.585	.498	.039	.874	4.768	.128	17.155	99.316
66	49.816	7.597	.528	.030	.856	4.654	.108	17.120	99.059
67	50.160	7.534	.478	.009	.918	4.745	.123	17.078	99.360
68	49.874	7.607	.453	.043	.830	4.688	.113	17.041	98.900
69	50.162	7.580	.562	.038	.851	4.667	.126	17.207	99.576
70	50.180	7.606	.478	.013	.854	4.735	.132	17.095	99.352
71	49.809	7.575	.443	.037	.862	4.686	.121	17.169	98.987
72	50.373	7.542	.470	.030	.879	4.733	.121	17.099	99.598
73	50.412	7.565	.498	.023	.838	4.618	.112	17.076	99.446
74	50.258	7.509	.516	.021	.842	4.663	.108	17.105	99.305
75	50.403	7.589	.492	.022	.895	4.683	.124	17.133	99.637
76	50.539	7.529	.454	.038	.862	4.670	.121	17.142	99.739
77	50.146	7.580	.468	.006	.913	4.749	.129	17.140	99.503
78	50.388	7.598	.474	.021	.896	4.745	.114	17.086	99.597
79	50.082	7.591	.449	.046	.863	4.722	.139	17.064	99.243
80	50.168	7.498	.479	.043	.906	4.688	.131	17.054	99.368

AVER: 50.163 7.560 .490 .028 .876 4.705 .123 17.129 99.372
 SDEV: .200 .036 .033 .012 .026 .049 .012 .054
 SERR: .042 .007 .007 .002 .005 .010 .003 .011
 %RSD: .4 .5 6.8 42.0 2.9 1.0 10.0 .3

ELEM:	CaO	Na2O	SUM
58	17.306	.860	99.132
59	17.506	.857	99.545
60	17.356	.847	99.385
61	17.457	.848	99.211
62	17.495	.875	99.241
63	17.365	.846	99.613
64	17.295	.857	99.439
65	17.425	.876	99.316
66	17.489	.860	99.059
67	17.462	.852	99.360
68	17.379	.871	98.900
69	17.508	.875	99.576
70	17.413	.845	99.352
71	17.413	.872	98.987
72	17.499	.850	99.598
73	17.418	.886	99.446
74	17.447	.837	99.305
75	17.443	.853	99.637
76	17.532	.851	99.739
77	17.539	.833	99.503
78	17.431	.847	99.597
79	17.436	.851	99.243
80	17.535	.867	99.368

AVER: 17.441 .857 99.372
 SDEV: .069 .014
 SERR: .014 .003
 %RSD: .4 1.6
 Results Based on 6 Atoms of o

SPEC: O
 TYPE: CALC

AVER: 6.000
 SDEV: .000

ELEM:	Si	Al	Ti	V	Cr	Fe	Mn	Mg	SUM
58	1.826	.326	.013	.001	.025	.147	.004	.935	10.015
59	1.828	.325	.013	.001	.026	.144	.004	.928	10.013
60	1.827	.325	.016	.000	.026	.142	.004	.933	10.011
61	1.829	.324	.013	.001	.026	.142	.004	.931	10.013
62	1.825	.325	.014	.001	.025	.141	.003	.936	10.017
63	1.832	.321	.014	.000	.026	.145	.004	.932	10.010
64	1.829	.323	.014	.001	.025	.145	.004	.936	10.013
65	1.824	.326	.014	.001	.025	.146	.004	.934	10.017
66	1.823	.328	.015	.001	.025	.142	.003	.934	10.017
67	1.829	.324	.013	.000	.026	.145	.004	.928	10.012
68	1.827	.328	.012	.001	.024	.144	.004	.931	10.015
69	1.825	.325	.015	.001	.024	.142	.004	.933	10.015
70	1.829	.327	.013	.000	.025	.144	.004	.929	10.012
71	1.824	.327	.012	.001	.025	.144	.004	.937	10.018
72	1.832	.323	.013	.001	.025	.144	.004	.927	10.011
73	1.834	.324	.014	.001	.024	.141	.003	.926	10.009
74	1.832	.323	.014	.001	.024	.142	.003	.930	10.010
75	1.831	.325	.013	.001	.026	.142	.004	.928	10.010
76	1.834	.322	.012	.001	.025	.142	.004	.928	10.009
77	1.827	.325	.013	.000	.026	.145	.004	.931	10.014
78	1.832	.326	.013	.001	.026	.144	.004	.926	10.009
79	1.828	.327	.012	.001	.025	.144	.004	.929	10.013
80	1.830	.322	.013	.001	.026	.143	.004	.927	10.013

AVER: 1.829 .325 .013 .001 .025 .143 .004 .931 10.013
 SDEV: .003 .002 .001 .000 .001 .002 .000 .003
 SERR: .001 .000 .000 .000 .000 .000 .000 .001
 %RSD: .2 .6 6.7 42.1 2.9 1.0 9.9 .4

ELEM:	Ca	Na	SUM
58	.678	.061	10.015
59	.683	.060	10.013
60	.678	.060	10.011
61	.683	.060	10.013
62	.684	.062	10.017
63	.676	.060	10.010
64	.675	.061	10.013
65	.681	.062	10.017
66	.686	.061	10.017
67	.682	.060	10.012
68	.682	.062	10.015
69	.683	.062	10.015
70	.680	.060	10.012
71	.683	.062	10.018
72	.682	.060	10.011
73	.679	.062	10.009
74	.681	.059	10.010
75	.679	.060	10.010
76	.682	.060	10.009
77	.684	.059	10.014

78	.679	.060	10.009
79	.682	.060	10.013
80	.685	.061	10.013

AVER:	.681	.061	10.013
SDEV:	.003	.001	
SERR:	.001	.000	
%RSD:	.4	1.7	

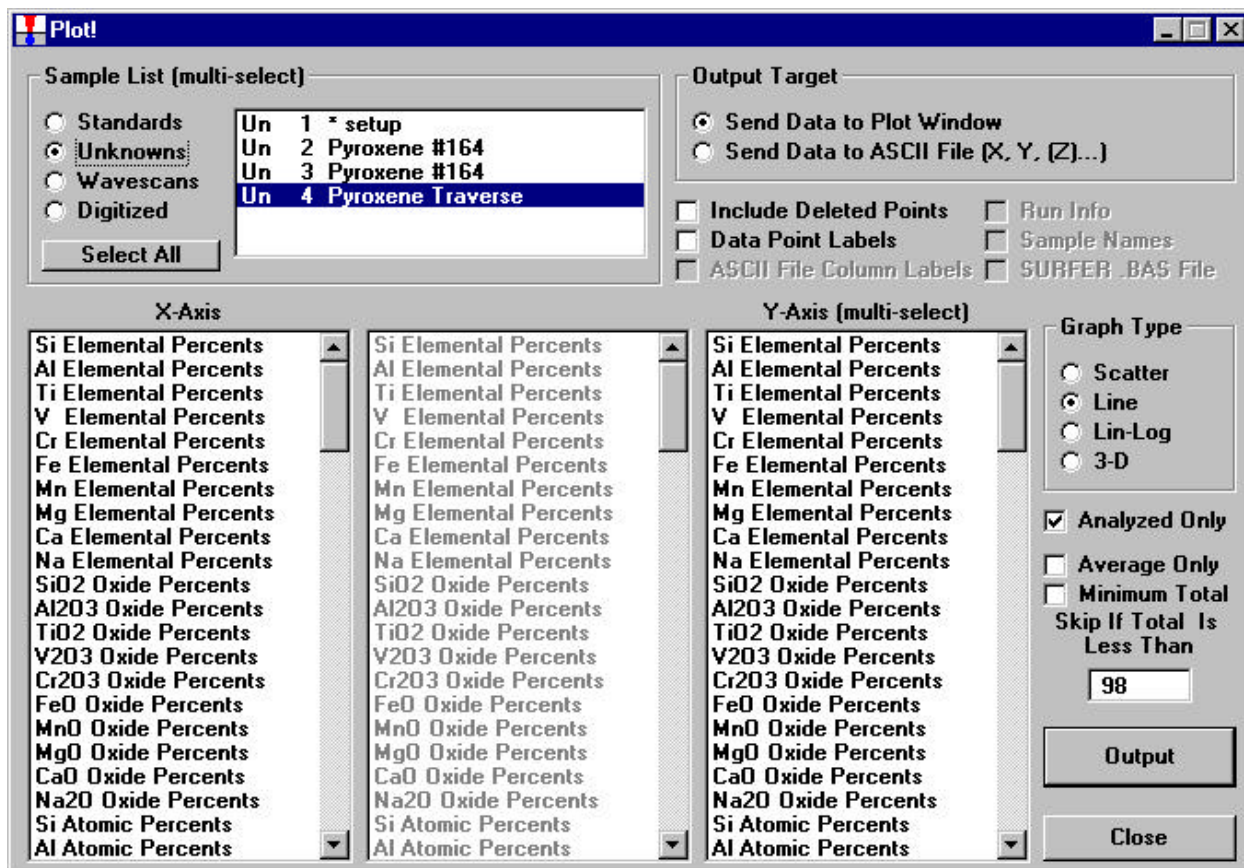
Pyroxene Mineral End-Member Calculations

	Wo	En	Fs
58	38.5	53.1	8.3
59	38.9	52.9	8.2
60	38.7	53.2	8.1
61	38.9	53.0	8.1
62	38.8	53.1	8.0
63	38.6	53.2	8.3
64	38.4	53.3	8.3
65	38.7	53.0	8.3
66	38.9	53.0	8.1
67	38.9	52.9	8.2
68	38.8	53.0	8.2
69	38.8	53.1	8.1
70	38.8	53.0	8.2
71	38.7	53.1	8.1
72	38.9	52.9	8.2
73	38.9	53.1	8.0
74	38.9	53.0	8.1
75	38.8	53.0	8.1
76	38.9	53.0	8.1
77	38.9	52.9	8.2
78	38.8	52.9	8.2
79	38.9	52.9	8.2
80	39.0	52.8	8.1

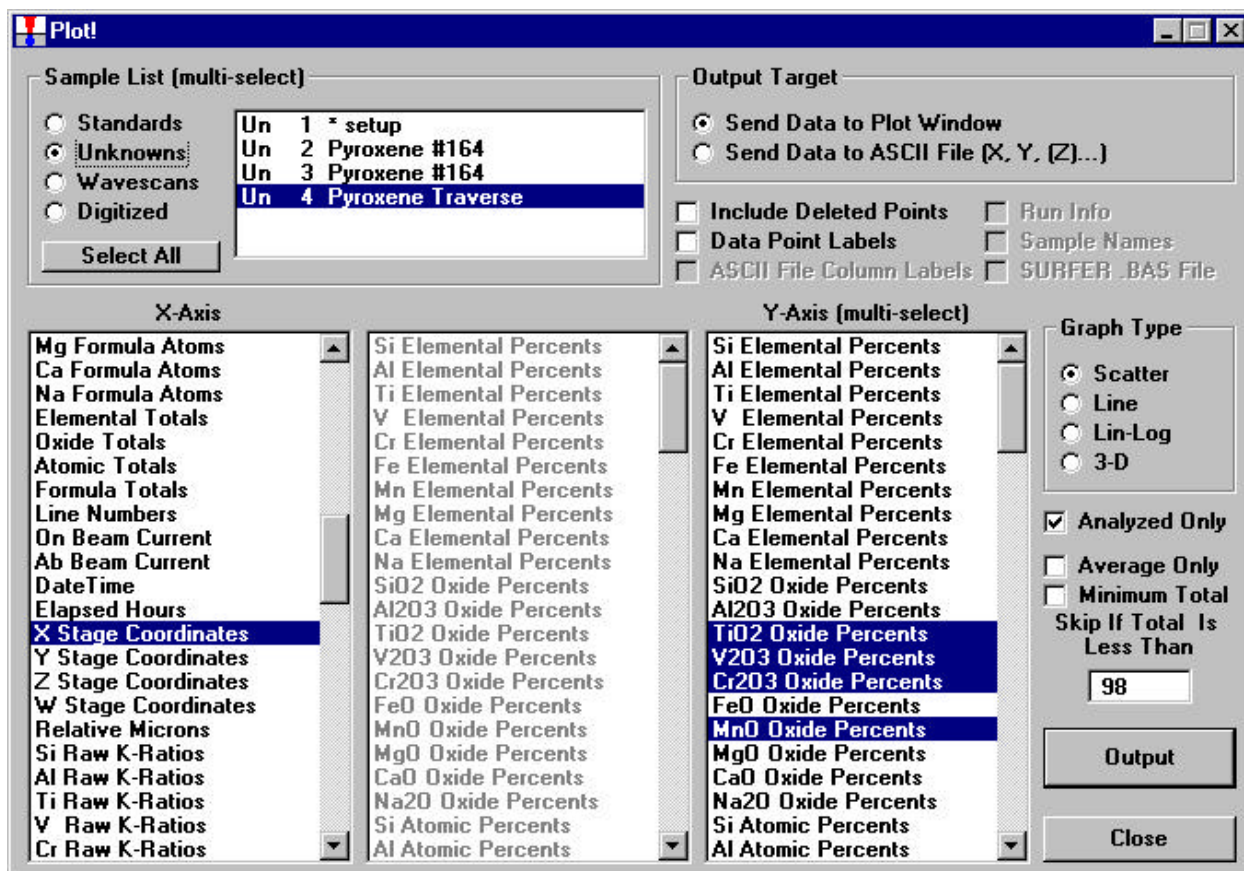
AVER:	38.8	53.0	8.2
SDEV:	.1	.1	.1

Plotting Analysis Data

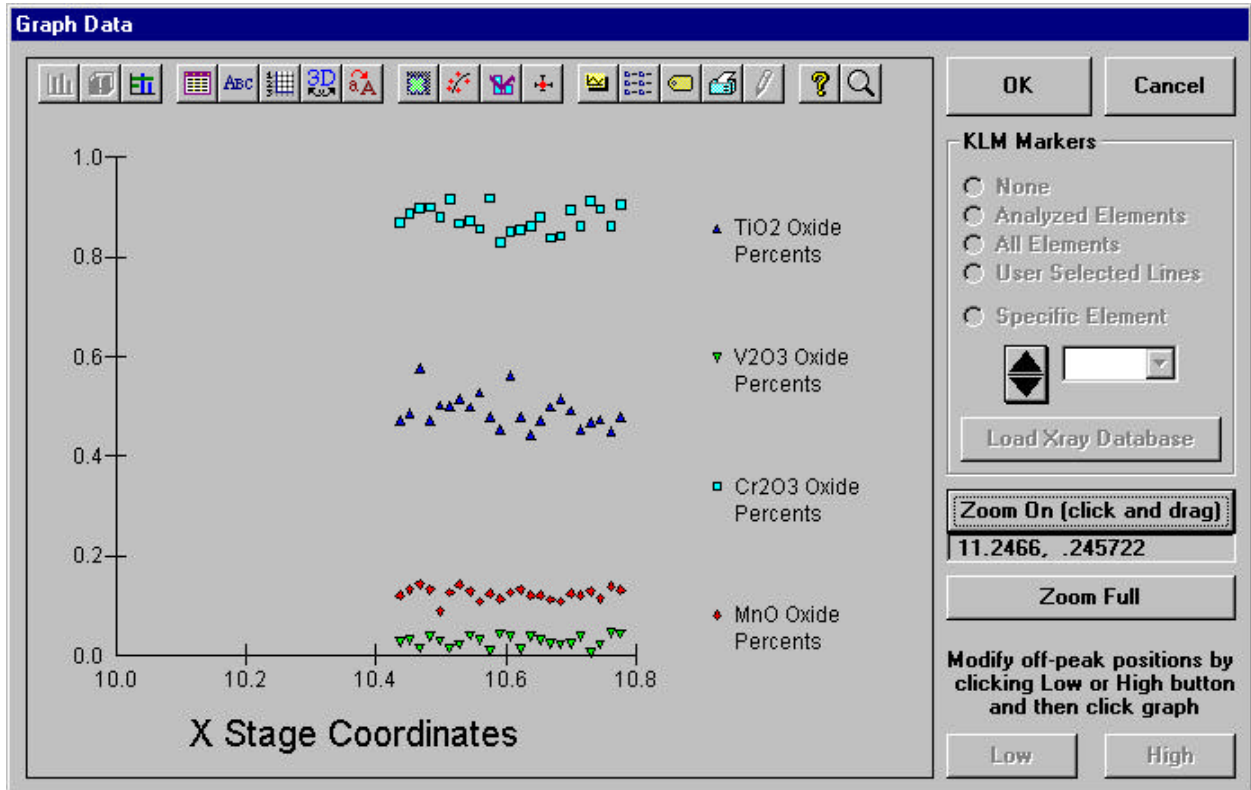
The user may wish to examine the traverse data in a graphical presentation. Click the **Plot!** button in the main PROBE FOR WINDOWS log window. This opens the **Plot!** dialog box.



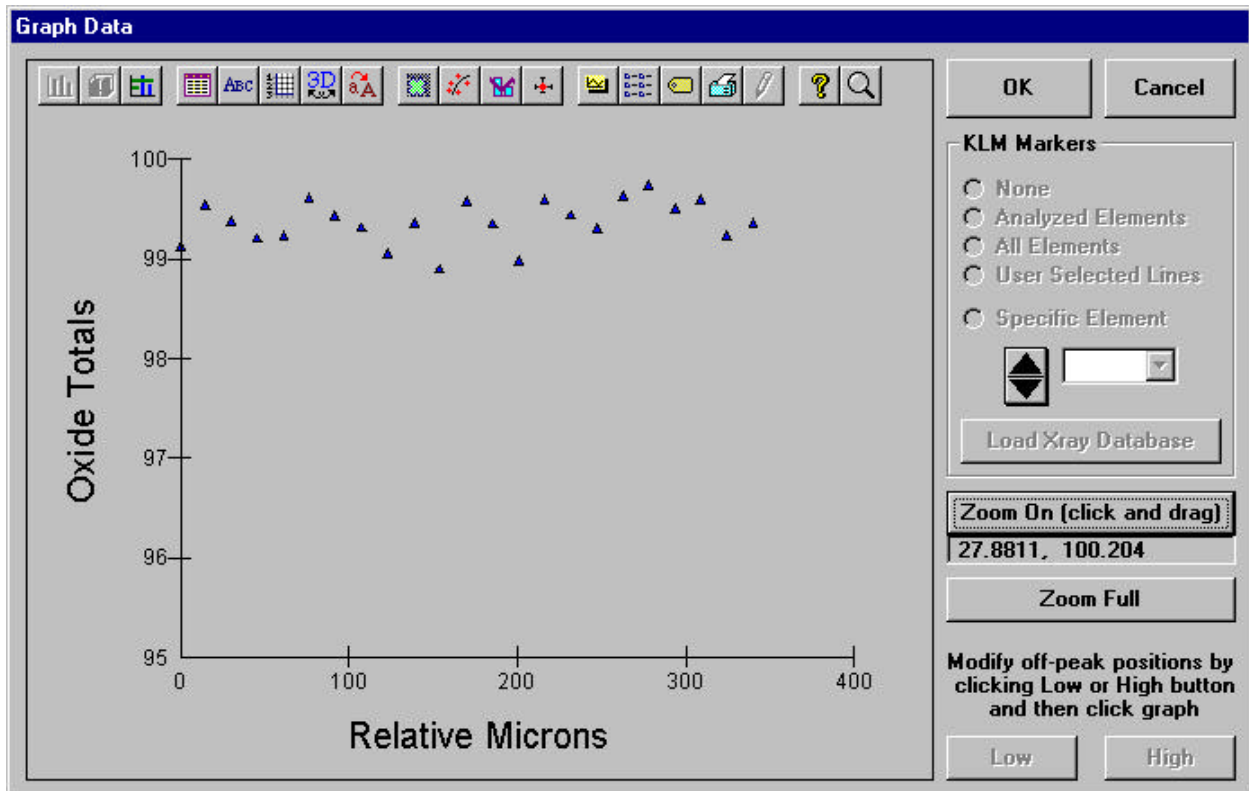
First, choose the pertinent samples from the *Sample List* list box. Select the required *X-Axis*, *Y-Axis* (and *Z-Axis*) items from the axis lists. Choose a *Graph Type* and the button *Send Data to Plot Window*. Finally, click the **Output** button.



Here the user selects the *X-Stage Coordinates* for the *X-Axis* and multi-selects the TiO_2 , V_2O_3 , Cr_2O_3 and MnO *Oxide Percents* for the *Y-Axis*. This graph is displayed below. Furthermore, the weight percent concentration of any point may be read directly off the plot using the two-way **Hot Hit On/Zoom On** button.

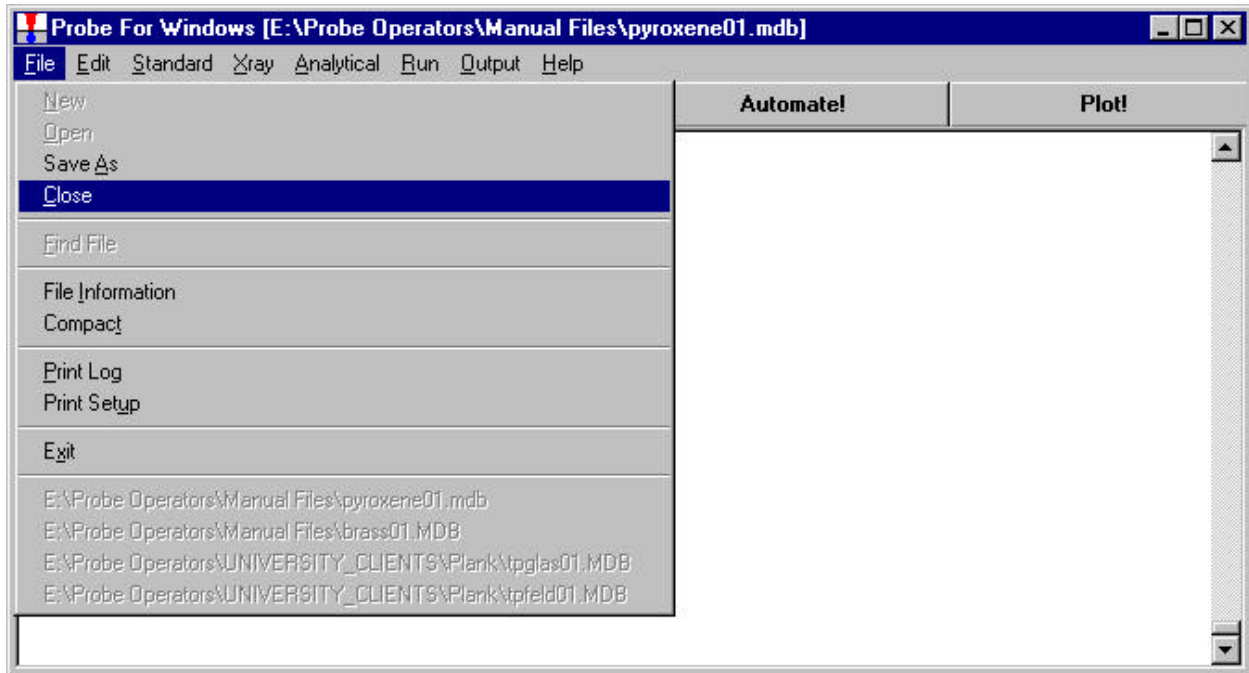


Another graph of interest is *Relative Microns* (traverse steps) versus *Oxide Totals*.

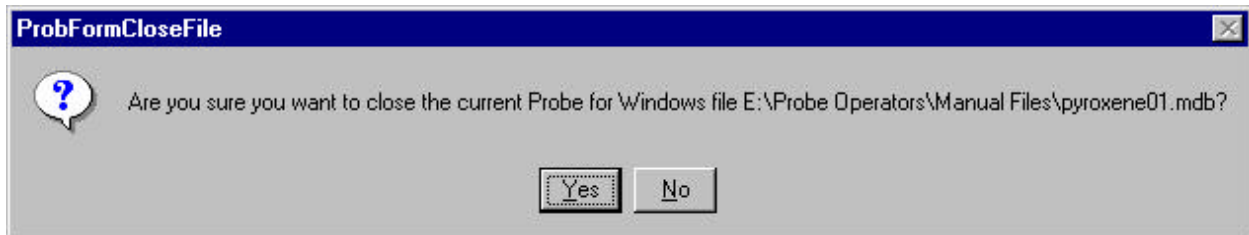


Closing the Current Run and Probe for Windows

The user ends the analysis session from the main PROBE FOR WINDOWS log window. Select **File** from the menu bar and click **Close** from the menu selections.



This opens the **ProbFormCloseFile** window, click **Yes** to close this file.



Close PROBE FOR WINDOWS by selecting **File** from the menu bar and clicking **Exit**.

