Micro Pioneer

Operation Manual

XRF-2000 Series

Revision 1.0
July 2009

IMPORTANT – PLEASE READ THIS FIRST!

PLEASE READ CAREFULLY THE OPERATION AND APPROPRIATE MAINTENANCE INSTRUCTIONS IN THIS MANUAL BEFORE ATTEMPTING TO OPERATE THE EQUIPMENT. NOTWITHSTANDING MICRO PIONEER'S LIMITED WARRANTY, MICRO PIONEER WILL NOT ASSUME ANY LIABILITY FOR INJURY, LOSS OR DAMAGE TO PERSONNEL, PROPERTY OR TO THE EQUIPMENT IF IT IS NOT CONNECTED OR OPERATED PROPERY.

SERVICE AND REPAIR OF THE SYSTEM SHOULD BE LIMITED TO QUALIFIED PERSONNEL ONLY. THE SYSTEM MUST BE DISCONNECTED FROM THE ELECTRICAL POWER SOURCE BEFORE SERVICING.

MICRO PIONEER RESERVES THE RIGHT TO MAKE CHANGES AND IMPROVEMENTS IF THE SYSTEM, AS WELL AS IN THE SPECIFICATIONS AND DESCRIPTIONS PROVIDED IN THIS MANUAL WITHOUT PRIOR NOTICE. FOR ADDITIONAL INFORMATION, PLEASE CONTACT:

Micro Pioneer

1414 Dae-Ryung Techno Town 8th
Kasan-Dong, Kumchun-Gu, Seoul, Korea
www.micropioneer.com
TEL : +82-2-2163-8650
micropioneer@micropioneer.com

Table of Content

1 Introduction

1.1 System Purpose

XRF-2000 systems are designed to measure the thickness of multi coating elements or to detect the elements in analyzed samples and determine their concentrations using X-Ray fluorescence (XRF).

The analysis performed by XRF-2000 series can by divided into three categories:

- Thickness measurement – measure the thickness of multilayer coating
- Qualitative analysis – Identification of the elements in a sample and inspection of the acquired spectra on a comparative basis.
- Quantitative analysis – Quantitative determination of the concentrations of the elements in a sample. This is performed after carrying out calibration procedures, using a pre-analyzed set of standards and empirical models, or via the fundamental parameters method.

The system software (XRayV4) runs under Windows XP, Vista or higher.

XRF-2000 Series

1.2 Principles of Operation

XRF-2000 Series systems utilize the phenomenon that when a sample is irradiated with x-ray radiation, the sample's atoms are excited. As the atoms return to their stable state, they emit x-ray photons (X-ray

Fluorescence – XRF).
Each element has its distinct characteristic emission lines. The energy of these lines are documented in tables and stored in the computer's memory. A given sample's elements are identified by comparing the lines in the acquired spectrum to the corresponding element lines listed in the system's database.

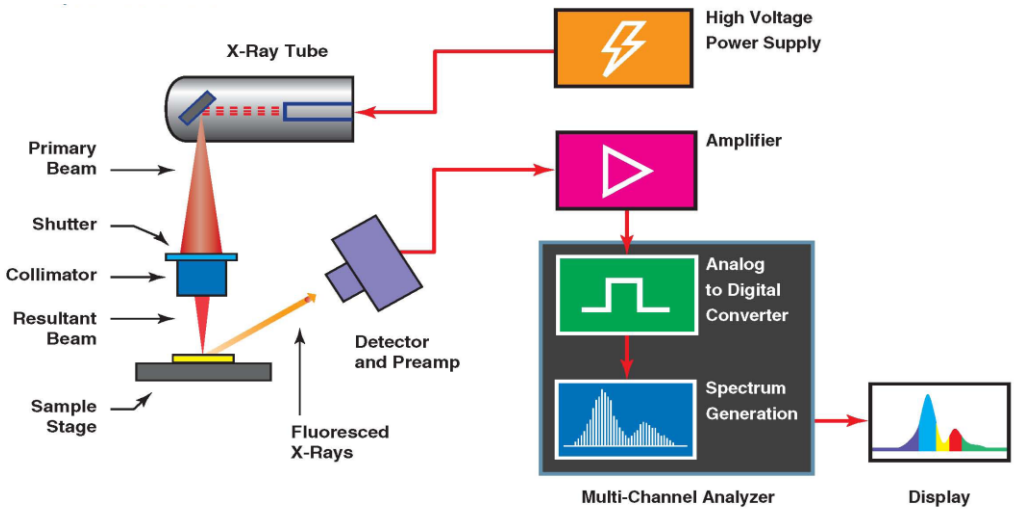
The intensity (magnitude) of the element's lines in the acquired spectrum is related to its concentration or thickness. Increasing the concentration or thickness of an element result is an increase in the intensity of the fluorescent radiation characteristic of that element. By using empirical or theoretical physical models, the system can provide precise qualitative and quantitative analysis or thickness measurement.

XRF-2000 Series systems employ a proportional counter or Si PIN diode detector to detect x-rays emitted from the sample. These detectors are capable of acquiring a spectrum containing many lines from many elements simultaneously. The counters or detectors convert the x-ray photons to proportional electric pulses. These signals are amplified and converted into a digital form by the Analog-to-Digital Converter (ADC). The data of the accumulated spectra are stored and displayed on the computer's monitor as a spectra histogram.

Besides characteristic lines, any observed spectrum also contains background signals, their characteristic dependent on many factors, especially excitation conditions. In order to reduce background and increase useful signal, X-ray high voltage and emission current can be varied, as well as utilizing changeable special filters. All these allow to optimize the spectrum of exciting X-ray beam for any given application.

ED-XRF analysis tools enjoy the following advantages:

- Broad concentration range from ppm (mg/Kg) levels up to 100%.
- Sensitivity to all the elements in the periodic table from Magnesium to Uranium.
- Fast response : Typical analysis time is usually under a few minutes.
- Simultaneous analysis of many elements.
- Non-destructive : The X-ray radiation does not leave any effects in the sample after analysis. Rare or precious samples are well as calibration standards can be tested an unlimited number of times without losing any of their authentic properties.
- Flexibility of sample form : The sample may be in solid, powder, liquid or thin film form; or even be a few layers of elements plated on a thick base substrate. In most cases, samples are analyzed with minimal preparations.



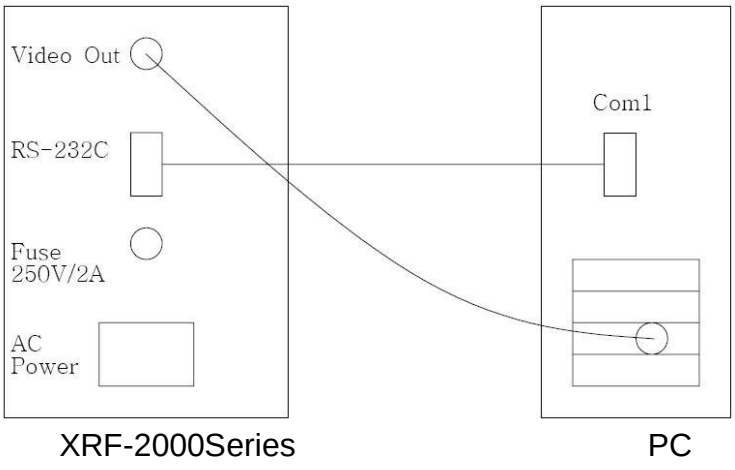
1.3 TYPICAL SPECIFICATIONS

Input Power
115/220 VAC, 50/60Hz, 150W (maximum) Typically 220VAC 0.5A

Power Cable
The power cable will be supplied by the local MP representative to meet IEC 224 or IEC 245 standards.
The inner wire diameter should be at least 0.75mm.

Fuses
On the Main Power : 2A
On the Controller Board : 2A

Power On/Off Switch
Once the AC input cable is connected from the system to the wall, system power up and shut-down should be done using the On/Off switch on the front right side of the system.



2. System Operation

2.1 Safety Considerations

Standard Procedures
All standard safety procedures for operating electrical machinery should apply to spectrometers of this series.

Each system is intended to be operated only as indicated in its User's manual.

Maintenance work inside the machine should be performed only by authorized personnel.

Power Source

This product is intended to operate from a power source that does not supply more than 230 volts RMS (in 220 volt version) or 120 volts RMS (in 115 volt version) between either supply conductors or between either supply conductor and ground. A protective ground connection by way of the grounding conductor in the power cord is essential for safe operation.

Grounding the Product

This product is grounded through the grounding conductor of the power cord. To avoid electrical shock, plug the power cord into a properly wired receptacle before connecting to the product input or output terminals. A protective ground connection by way of grounding conductor in the power cord is essential for safe operation.

Danger arising from loss of Ground

Upon loss of the protective –ground, all accessible conductive parts (including knobs and controls that may appear to be insulated) can render an electric shock.

Use the proper power cord

Use only the power cord and connector specified for your product and valid in the country where the machine in installed. Make sure that both are in good condition and do not use extension cables.

Use the proper fuse

To avoid fire hazard, use only a fuse of the correct type, voltage rating and current rating as specified.

2.2 Radiation Safety

XRF-2000 Series equipment is intrinsically safe from radiation hazards. Every machine is inspected prior to its delivery, ensuring that level of radiation anywhere around the sample chamber is not higher than the ambient radiation in the free environment. The instruments are equipped with safety magnetic switches to ensure that proper shielding is in place during x-ray operation, avoiding a possibility of exposure to radiation. Overriding safety features should not be done under any circumstances. These features have been installed for your safety.

Depending on the country, personnel operating X-ray instrumentation may have to be registered with the relevant health and radiation control authorities and may be required to wear dosimeters to monitor their exposure to radiation as well as to undergo annual medical examinations to safe guard their health. Local radiation control authorities may require that your instrument be registered with the relevant controlling bodies and that you carry out periodic radiation leak detection tests to ensure the ongoing safety in the utilization of the instrument.

You will need to check the relevant legislation and your compliance thereof with the correct controlling bodies in your country.

2.3 Site Preparation

INSTALLATION SITE

The system site should be free of excessive mechanical vibrations and strong acoustical noise. Strong electrical fields such as those generated by arc welding instruments, induction furnaces, large electric power lines, etc., can interfere with signals from the X-ray Detector and decrease its resolution.

Please do not hesitate to consult the service agent if you suspect that such problems exist.

PHYSICAL ENVIRONMENT

Keep the system and its vicinity clean and dust-free; circuit boards and components in the system and computer could fail due to an accumulation of conductive dust or from corrosion.

Avoid extreme temperatures or high humidity. The recommended operating temperature range is 20 - 25° C. Constant temperature assures the stability of system calibration.

2.4 Software Installation

Make sure your computer is correctly connected and then turn on the monitor and computer. XrayV4 is software of XRF-2000 series and updated periodically. You can download it from Micro Pioneer's web site www.micropioneer.com.
XRayV4 includes two folders as Net20 and Setup. Go to Setup Folder and double clicking the setup.exe will install the software. Typical location for installation is C:\XRayV4.

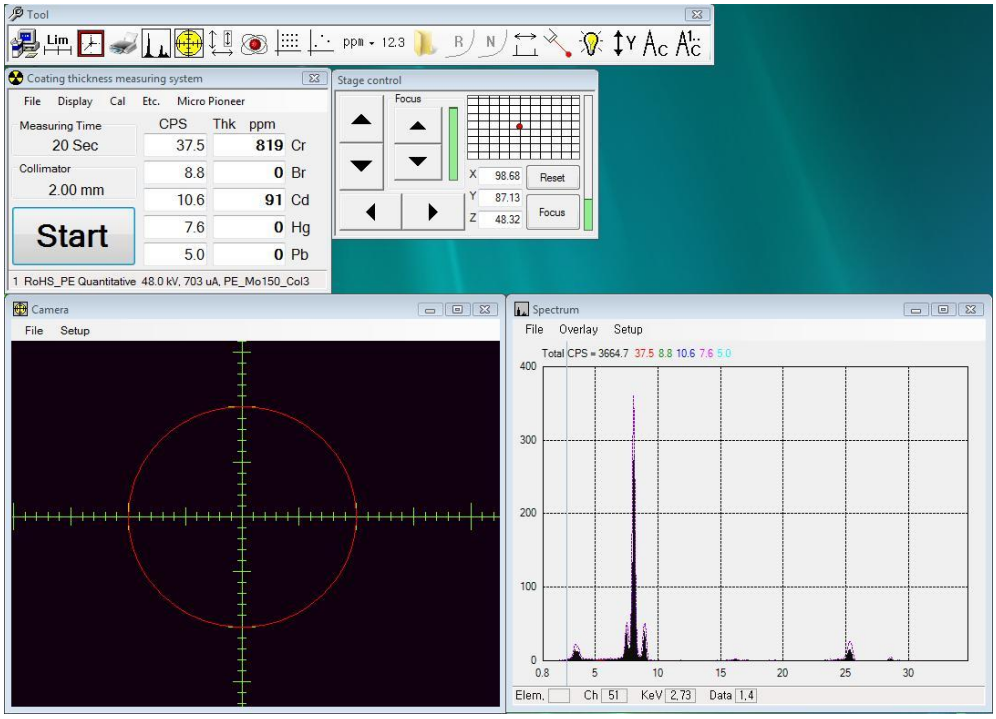
2.5 Running XRF-2000 software

① Turn on the XRF-2000 Series Machine.

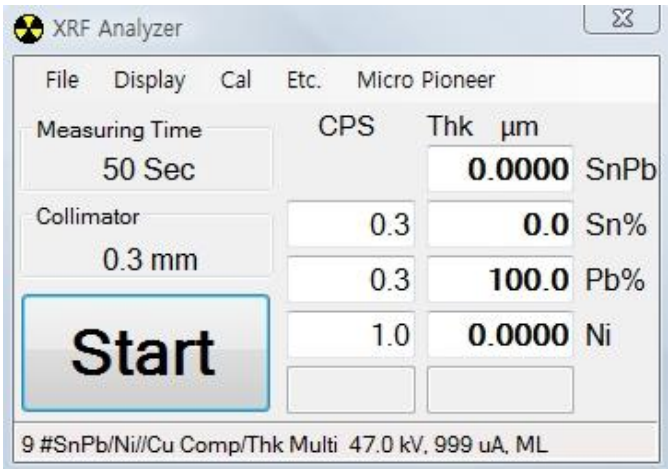
② Turn on the computer (if not already done) and click the XrayV4 icon on the desk top to active XrayV4.

③ Enter Password "t" and click on the opening message.

④ The main XRayV4 screen appears.

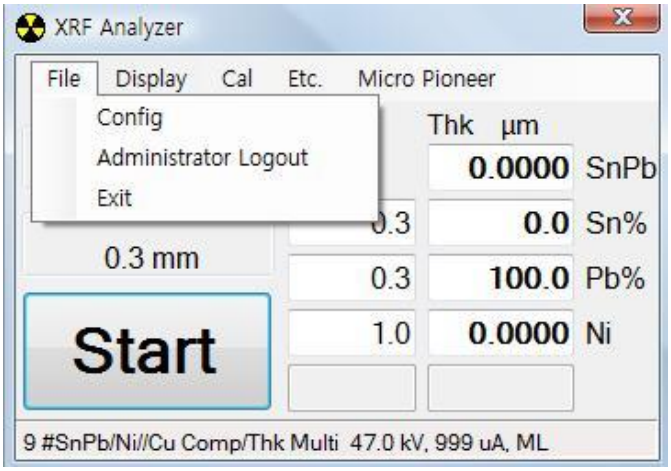


3. Main Measuring Window

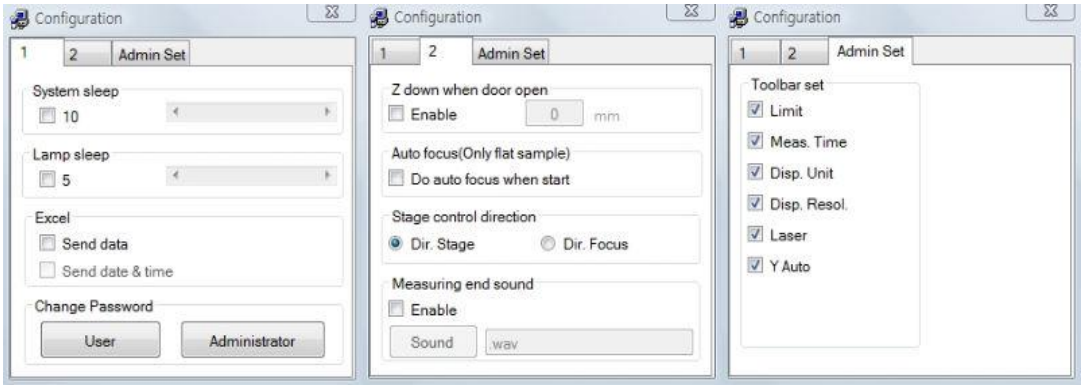


Display Measuring Time, Collimator Size, Start and Stop Button, CPS Information, Result of Thickness or Concentration and Measuring Mode. Start Button toggle start and stop to measuring.

3.1 File Menu

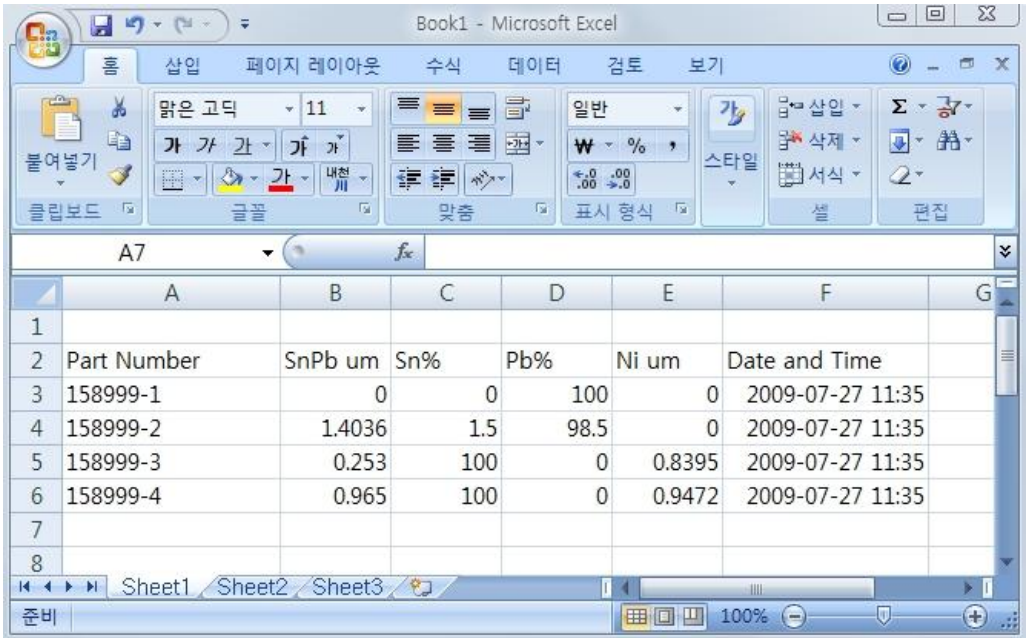


3.1.1 Config window



Menu 1

- System Sleep: Set sleep mode on/off for system with timer.
- Lamp Sleep: Set sleep mode on/off for LED of camera with timer.
- Excel
  - Send Data: ON/OFF data transfer to Excel. Excel file must be opened prior to data transfer.
  - Send Date & Time : ON/OFF date and time to Excel.



	A	B	C	D	E	F
1						
2	Part Number	SnPb um	Sn%	Pb%	Ni um	Date and Time
3	158999-1	0	0	100	0	2009-07-27 11:35
4	158999-2	1.4036	1.5	98.5	0	2009-07-27 11:35
5	158999-3	0.253	100	0	0.8395	2009-07-27 11:35
6	158999-4	0.965	100	0	0.9472	2009-07-27 11:35
7						
8						

Menu2

- Z down when door open: Enable Z axis down to specified distance when door is opened.
- Auto focus (Only flat Sample): Enable automatic focus prior to start measurement.
- Stage control direction: Dir. Stage moves stage same direction with stage control direction. Dir. Focus moves stage opposite direction with stage control direction.
- Measuring end sound : Specify music file(wav format) to hear when measuring is finished.

Admin Set

Set On/Off listed sub menu in Tool Bar. Default is checked all.

Change Password

Change the operator and administrator password.
Administrator password can be changed when administrator is logged in.

3.1.2 Administrator Login

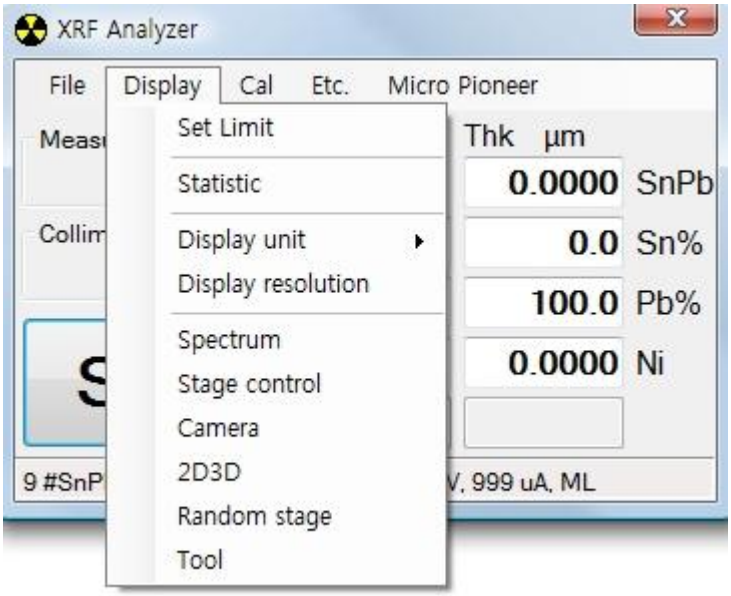
Login or Logout to administrator mode.

- Enable menu in administrator mode
  * Camera display window :
    Moving by Click, Adjust Beam position, Find Beam center, Capture-Input No
  * Main window & Main toolbar :
    Re Calibration, New Calibration, Y stage Auto, Measure data correction, Density compensation
  * Select Cal File :
    Delete/Edit Cal File and comment on Cal File.

3.1.3 Exit

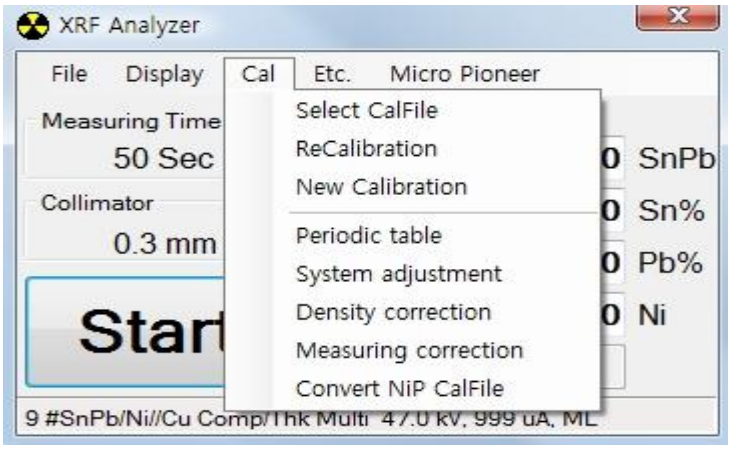
Quit the program

3.2 Display



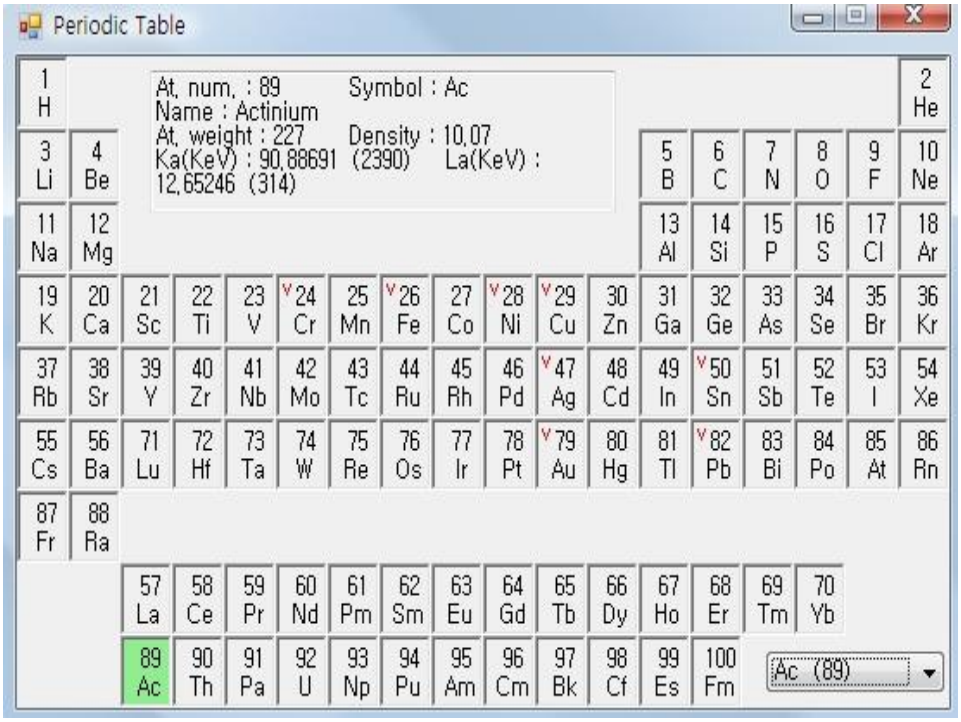
Toggle window on and off. Description of each window is described in Chapter 4.

3.3 Cal

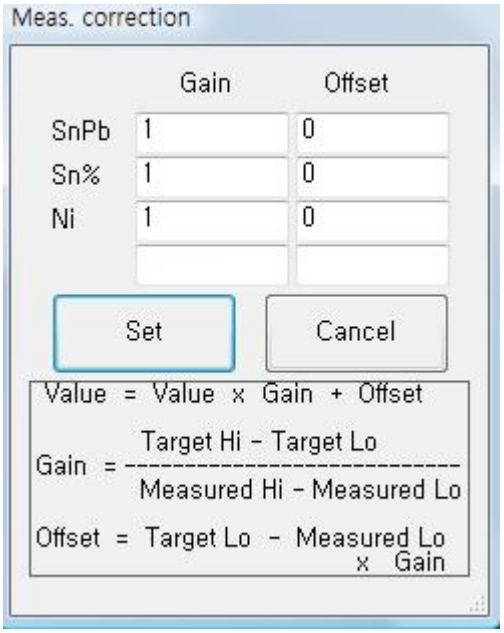


Description of function is described in Chapter 4 except the followings.

- Periodic Table : Show periodic table.

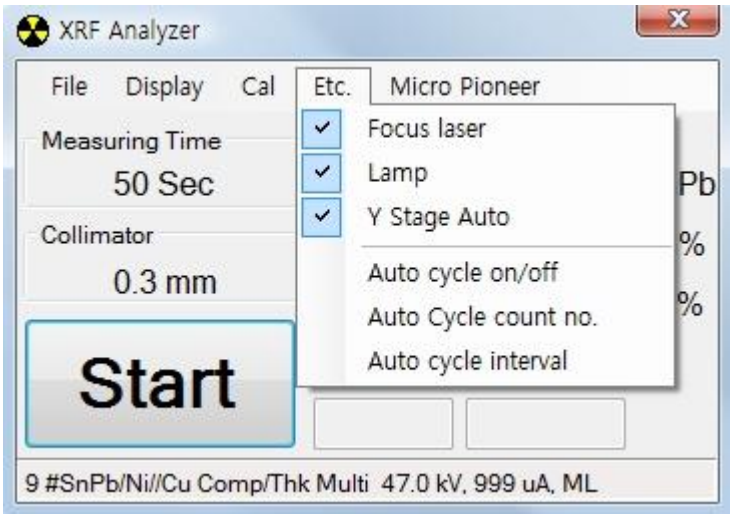


- Measuring Correction : Make user correction



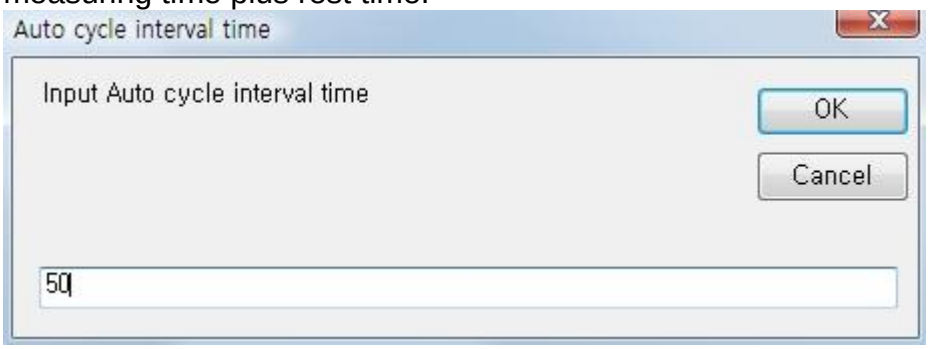
Gain=1 Offset=0 is default value which means measuring correction is not effected to result.

3.4 Etc



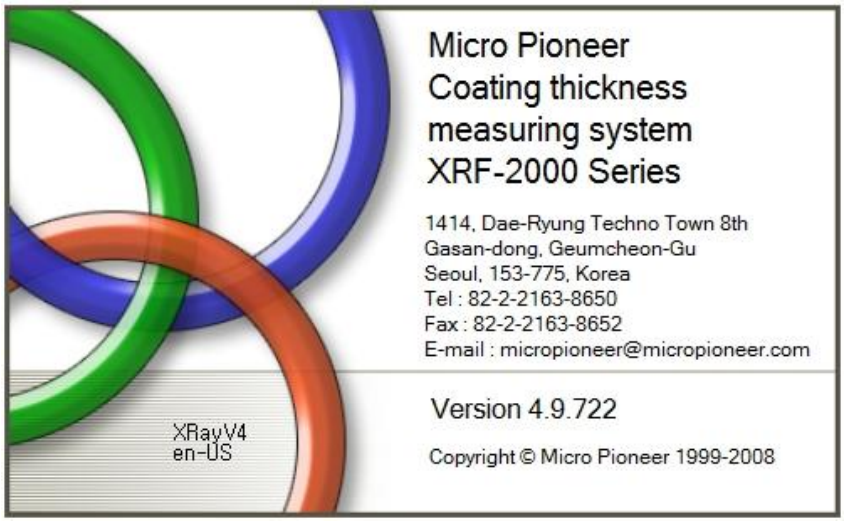
Description of function is described in Chapter 4 except the followings.

- Auto cycle interval : Input Auto cycle interval time. The interval time is measuring time plus rest time.



3.5 Micro Pioneer

Display Micro Pioneer company information and software version.

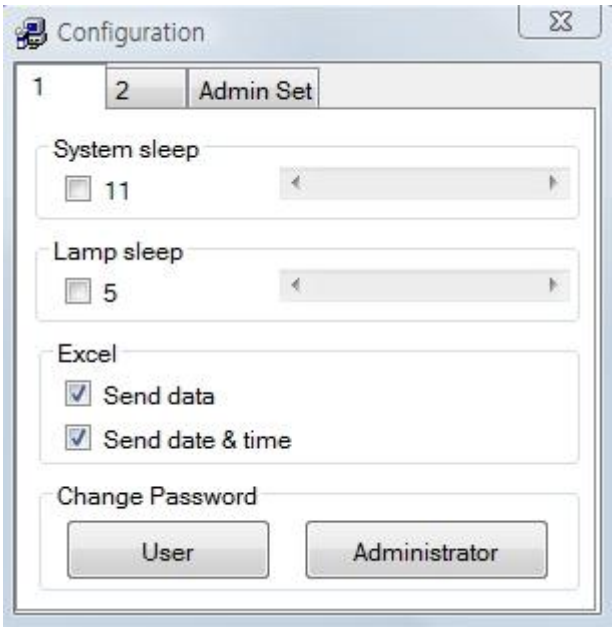


4. Main Toolbar

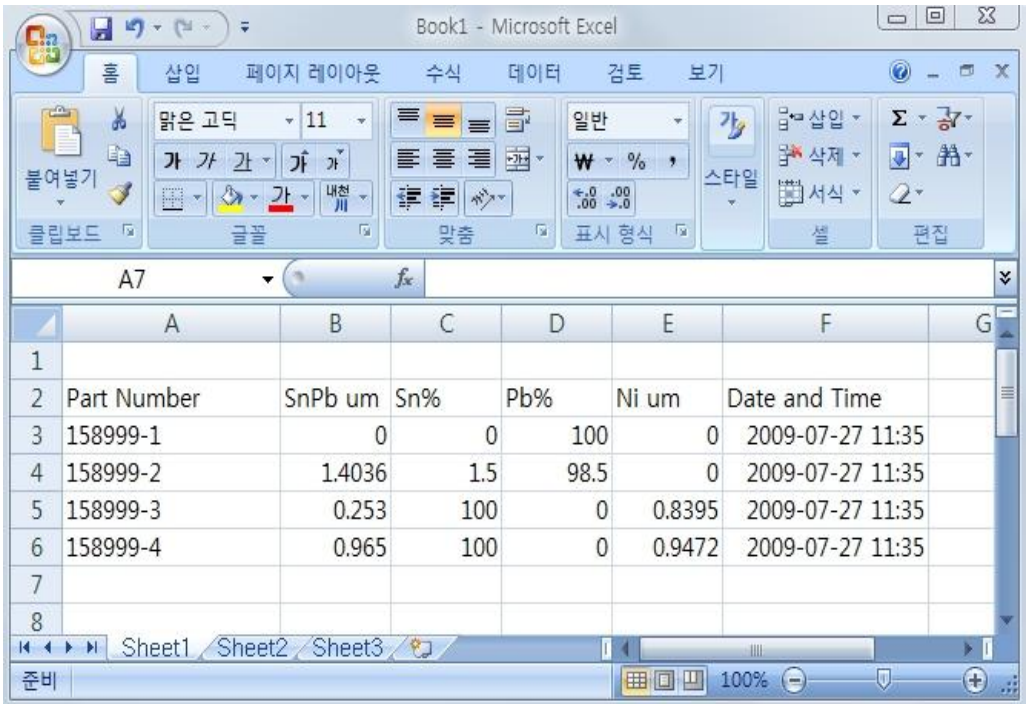
	Set Sleep Mode, Laser Focus, Send to Excel, Change Password
Lim	Set control limit
	Set measuring time
	Display statistic window
	Display PHA windows
	Display Camera window
	Display Stage control window
	Display Atom list window
	Display 2D & 3D measure window
	Display Random stage window
µm	Set measuring unit
12.3	Set Display decimal point
	Select calibration file
R	Display ReCalibration window
N	Display New Calibration window
	Display System adjust window
	ON/OFF the Focus Laser
	ON/OFF the illumination lamp
Y	ON/OFF the Y-Stage Push-Pull function. ON : Door open - Stage move to forward.
	ON/OFF the Auto-Cycle function
	Set number of Auto-Cycle count

4.1 System Configuration

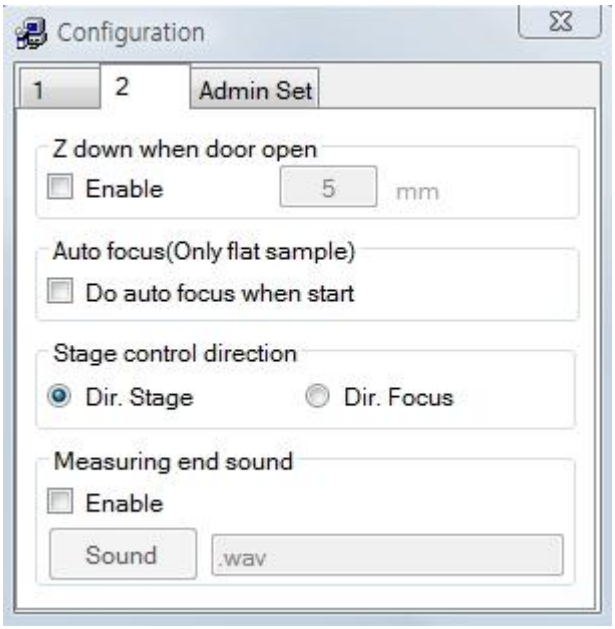
4.1.1 Menu 1



- System Sleep: Set sleep mode on/off for system with timer.
- Lamp Sleep: Set sleep mode on/off for LED of camera with timer.
- Excel
  - ◆ Send Data: ON/OFF data transfer to Excel. Excel file must be opened prior to data transfer.
  - ◆ Send Date & Time : ON/OFF date and time to Excel.



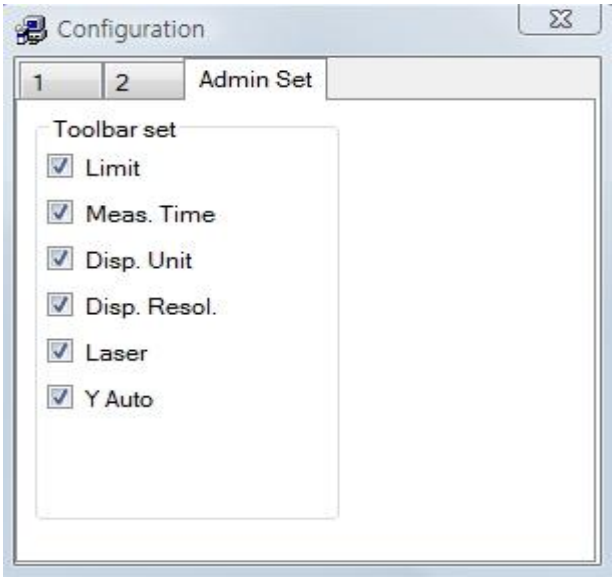
4.1.2 Menu2



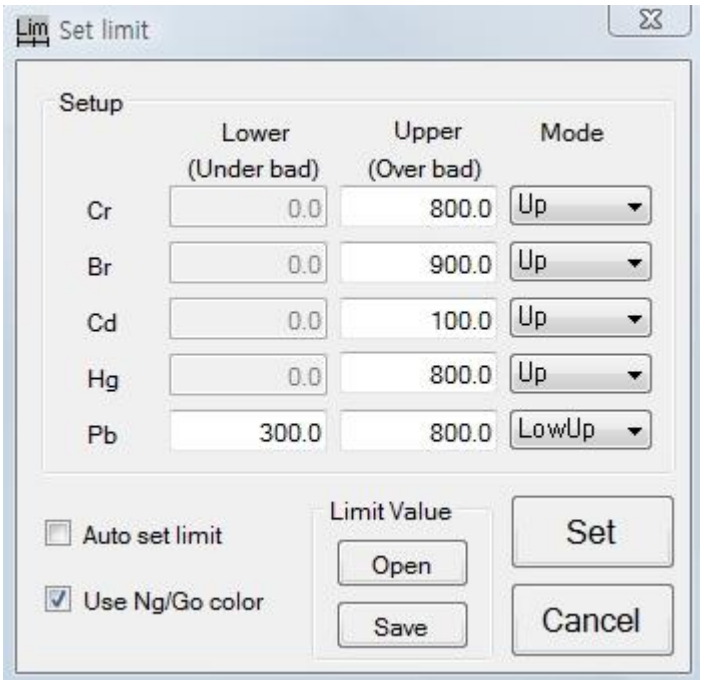
- Z down when door open: Enable Z axis down to specified distance when door is opened.
- Auto focus (Only flat Sample): Enable automatic focus prior to start measurement.
- Stage control direction: Dir. Stage moves stage same direction with stage control direction. Dir. Focus moves stage opposite direction with stage control direction.
- Measuring end sound: Specify music file(wav format) to hear when measuring is finished.

4.1.3 Admin Set

Set On/Off listed sub menu in Tool Bar. Default is checked all.

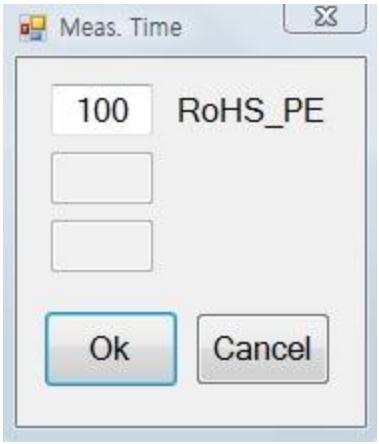


4.2 Lim Set Limit



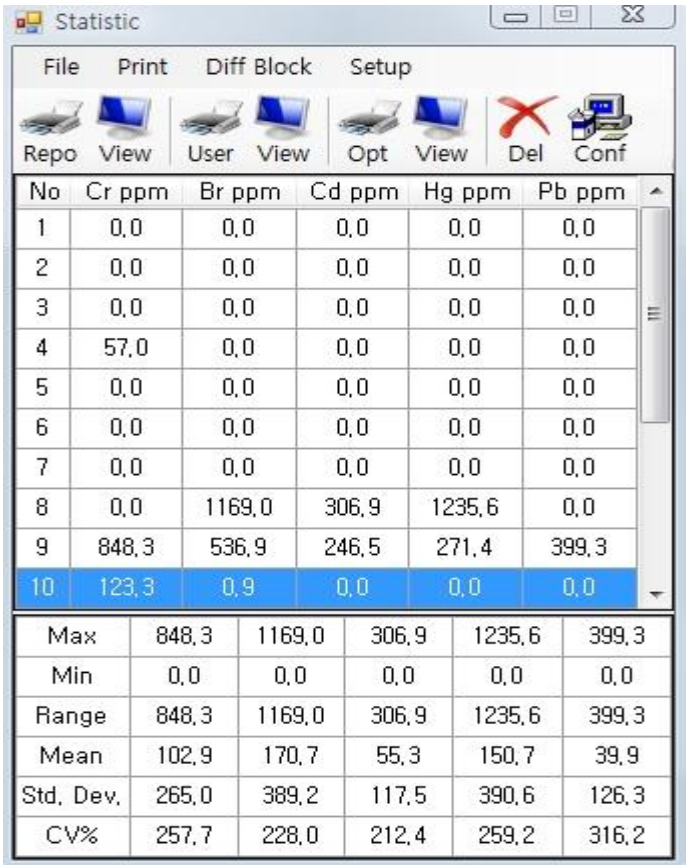
- ✓ Lower : Lower limit value for Low Mode
- ✓ Upper : Upper limit value for Up Mode
- ✓ Mode
  - ◆ Low : Measured data is bigger than 'Lower value' means good
  - ◆ UP : Measured data is lower than 'Upper value' means good
  - ◆ LowUp : Measured data is between 'Lower value' and 'Upper Value' means good.
  - ◆ Auto Set Limit : Set the limit value automatically from measured data.
  - ◆ Use Ng/Go Color : Display the data result as a color, Green means good, Red means no good.
  - ◆ Open/Save : Open or Save the limit value file.
  - ◆ Set : Apply limit value.
  - ◆ Cancel : Cancel limit value.

4.3  Set Measuring Time



Enter measuring time and click OK or press enter key.

4.4  View Statistic Window

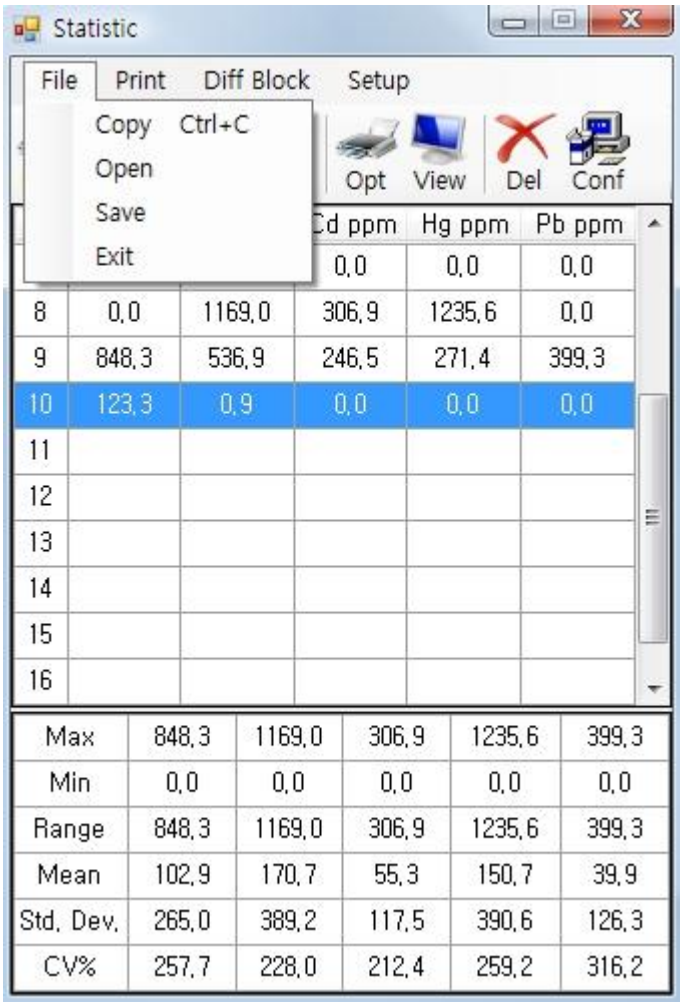


No	Cr ppm	Br ppm	Cd ppm	Hg ppm	Pb ppm
1	0,0	0,0	0,0	0,0	0,0
2	0,0	0,0	0,0	0,0	0,0
3	0,0	0,0	0,0	0,0	0,0
4	57,0	0,0	0,0	0,0	0,0
5	0,0	0,0	0,0	0,0	0,0
6	0,0	0,0	0,0	0,0	0,0
7	0,0	0,0	0,0	0,0	0,0
8	0,0	1169,0	306,9	1235,6	0,0
9	848,3	536,9	246,5	271,4	399,3
10	123,3	0,9	0,0	0,0	0,0

Max	848,3	1169,0	306,9	1235,6	399,3
Min	0,0	0,0	0,0	0,0	0,0
Range	848,3	1169,0	306,9	1235,6	399,3
Mean	102,9	170,7	55,3	150,7	39,9
Std. Dev.	265,0	389,2	117,5	390,6	126,3
CV%	257,7	228,0	212,4	259,2	316,2

Statistic Window displays thickness or concentration of sample up to 60 samples and statistical information. Also provide a function of preview, print, user defined print form, adding comment and open/save.

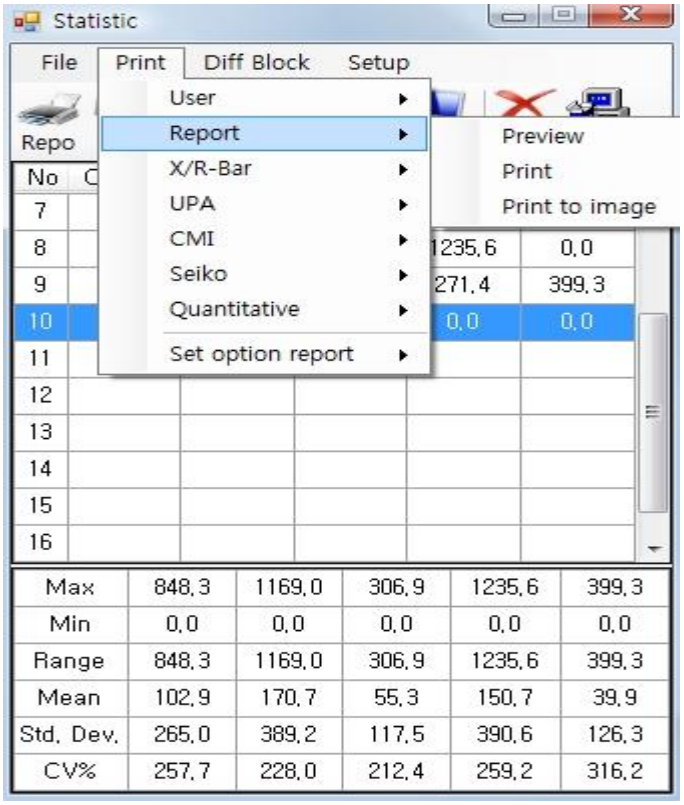
4.4.1 File Menu



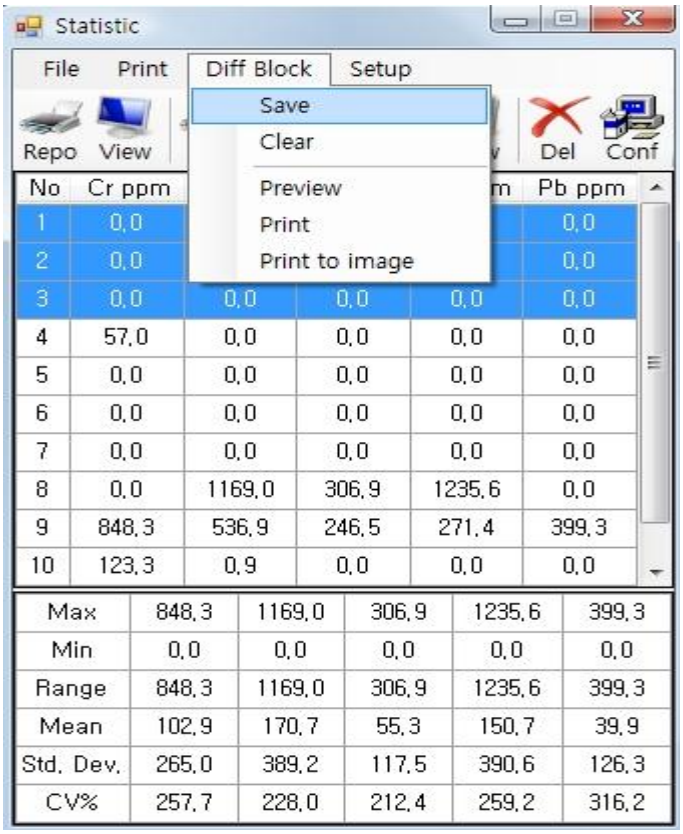
- Copy: Copy data to clip board as a text and to paste to notepad etc.
- Open: Open saved data file.
- Save: Save data file as default (*.sdt), old version(*.n001) and text(*.txt) format.

4.4.2 Print Menu

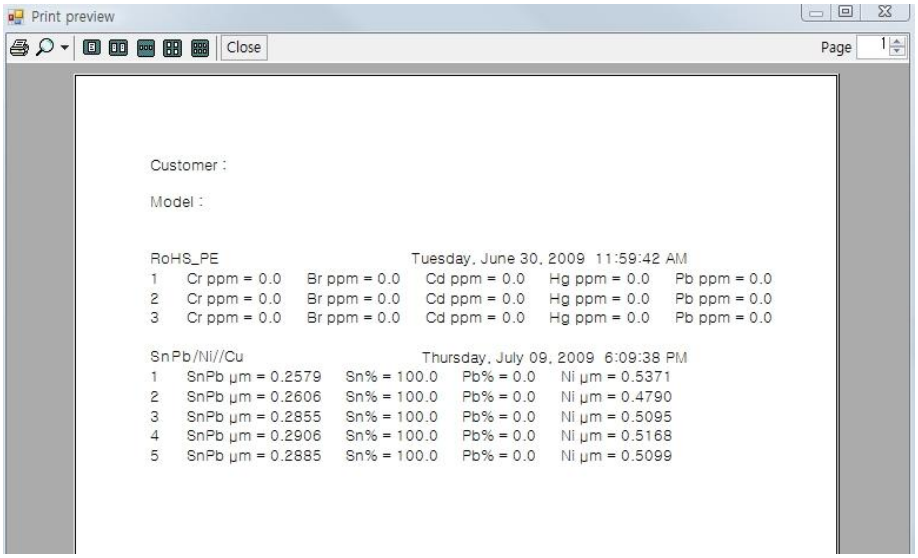
- Select a different type of print form such as UPA type, CMI type etc.
- Each menu has a preview mode, direct print mode and print to image mode.
- Set option report menu fix the print form as one of the various.



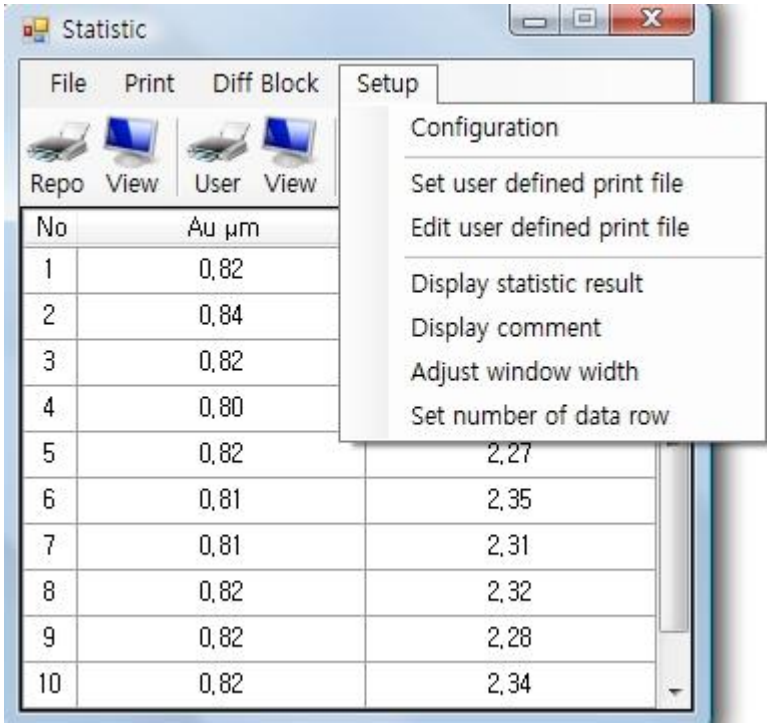
4.4.3 Diff Block Menu



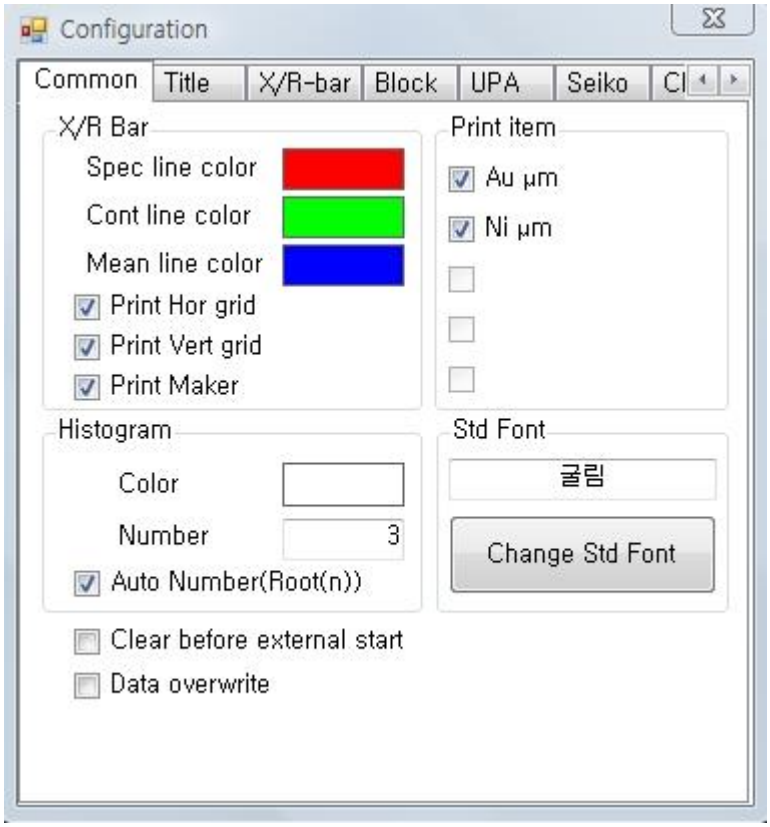
- This Menu allows printing a different applications' results in same format on same paper.
- Select Cal file and analyze sample and drag result and Save, go another Cal file and analyze sample and drag result and Save.
- The results from different application are printed in same format.



4.4.4 Setup Menu



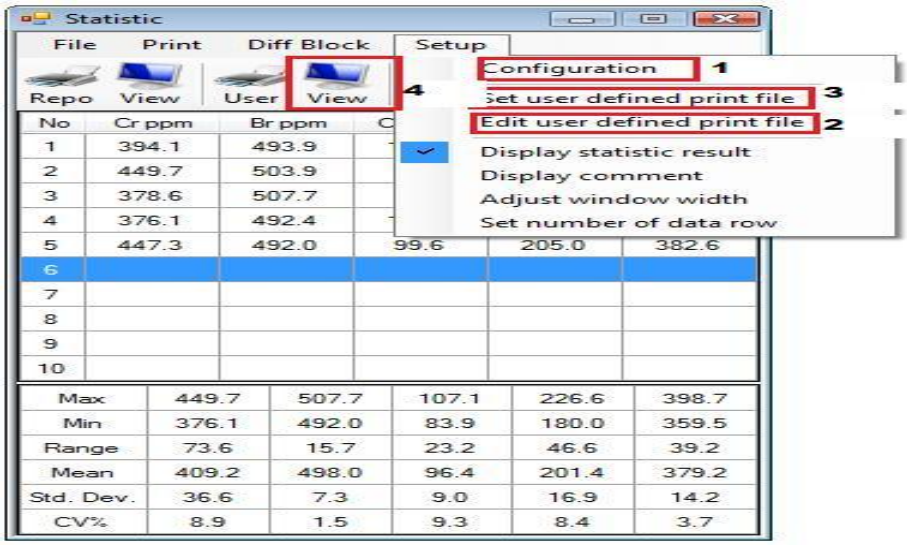
4.4.4.1 Configuration



All option for print form is able to define in configuration menu, such as customer name, company logo and others. Company logo must saved in C:\XRayV4\User directory as Logo.bmp.

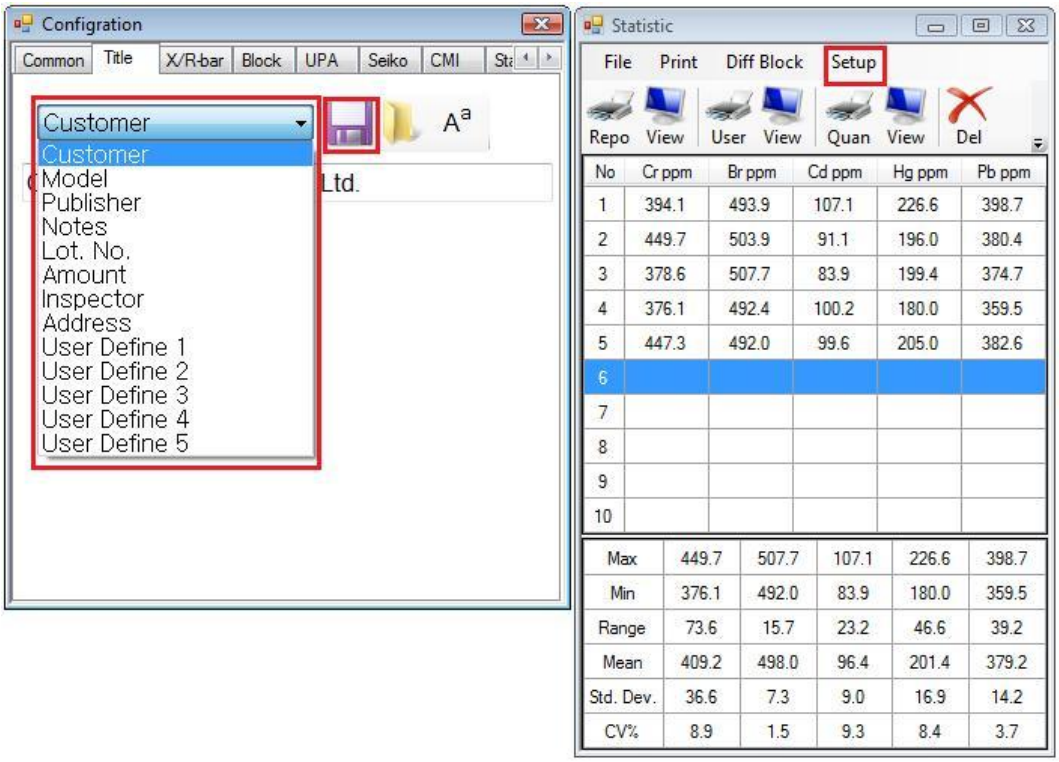
4.4.4.2 Edit User Defined Print File

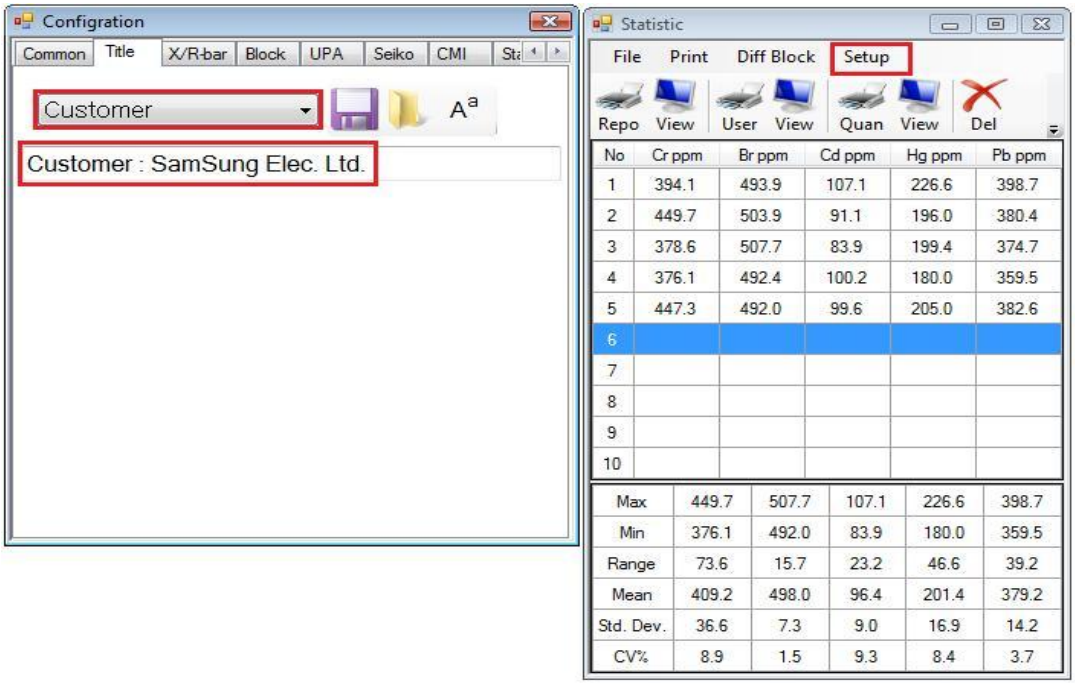
1) Open the Statistic Window



The sequence of creating the user defined print form is Configuration -> Edit user defined print file -> Save edited Edit user defined print file -> Set Edit user defined print file -> View and repeat until the completion.

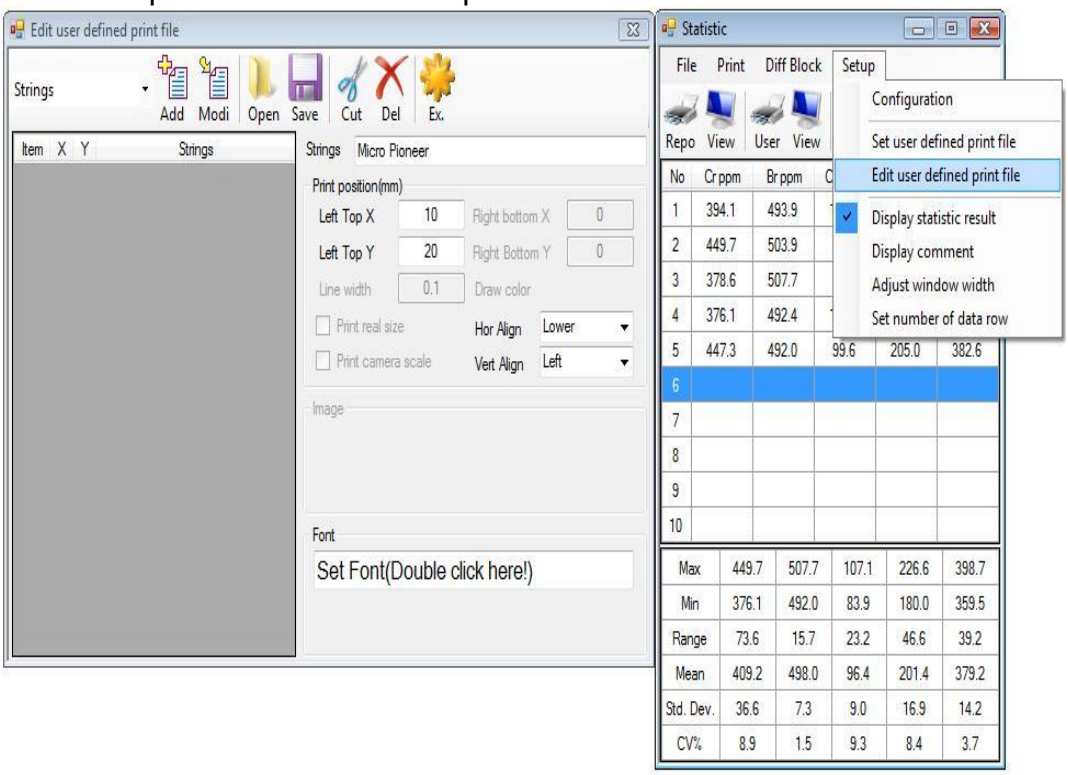
2) Configuration
Go to Setup -> Configuration and specify necessary field as follows



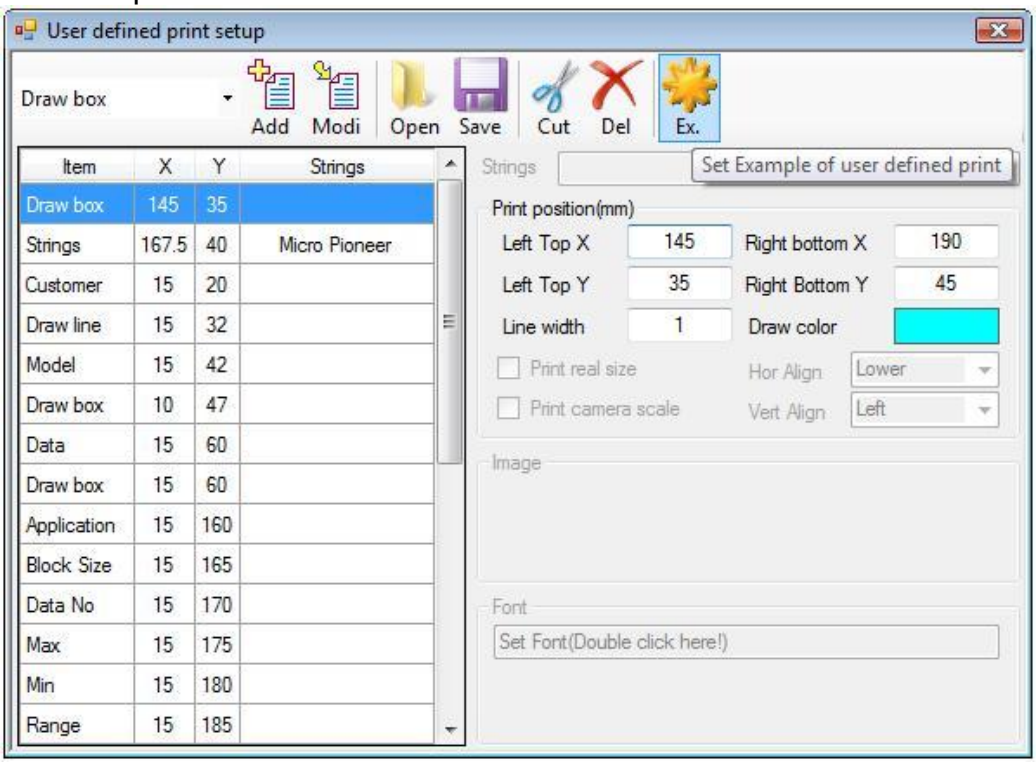


3) Edit user defined print file

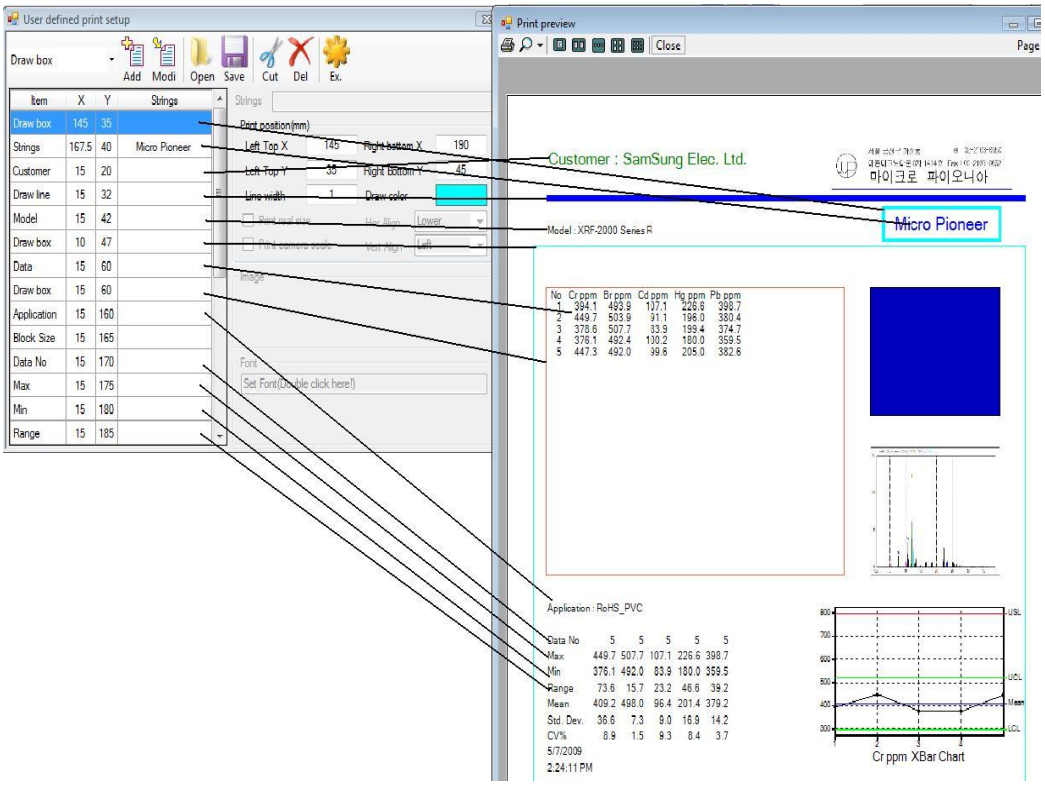
Go to setup -> Edit user defined print file.

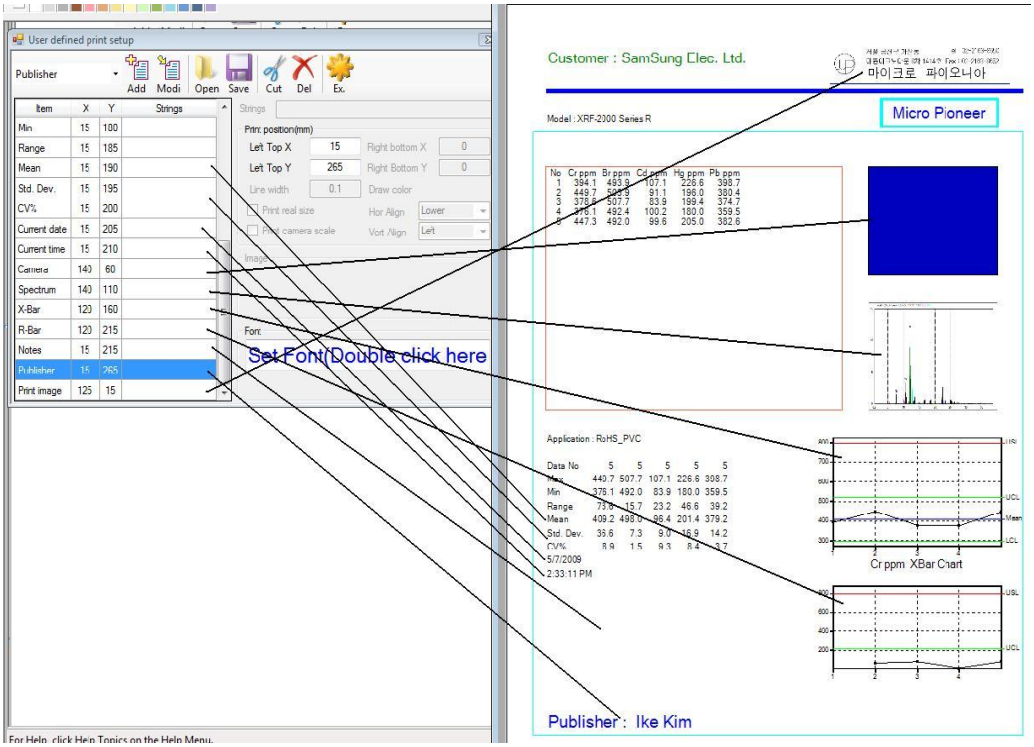


Then blank setup table will appear as above. Click Ex. Icon to open the standard print form.



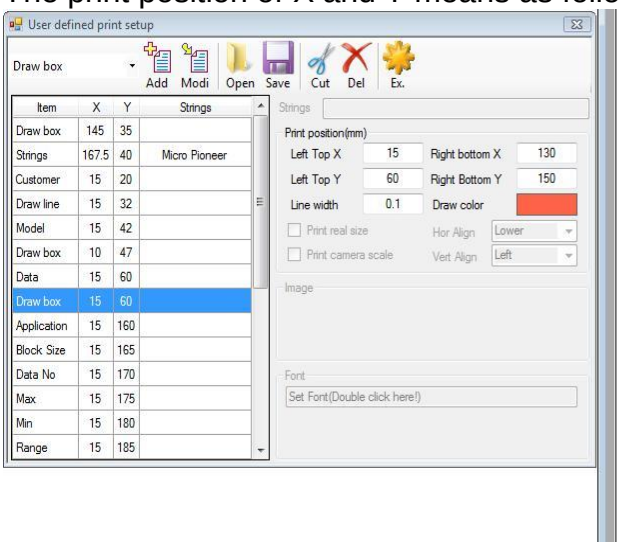
The relation between setup table and hard copy of the user defined print file is as follows.

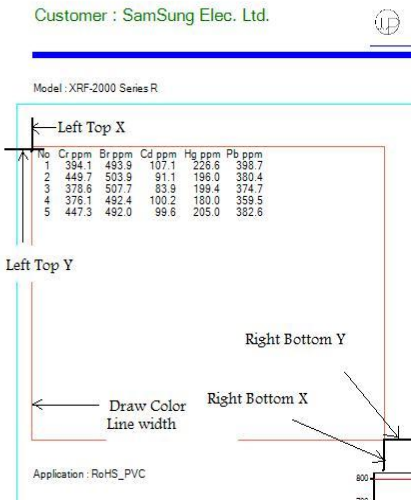




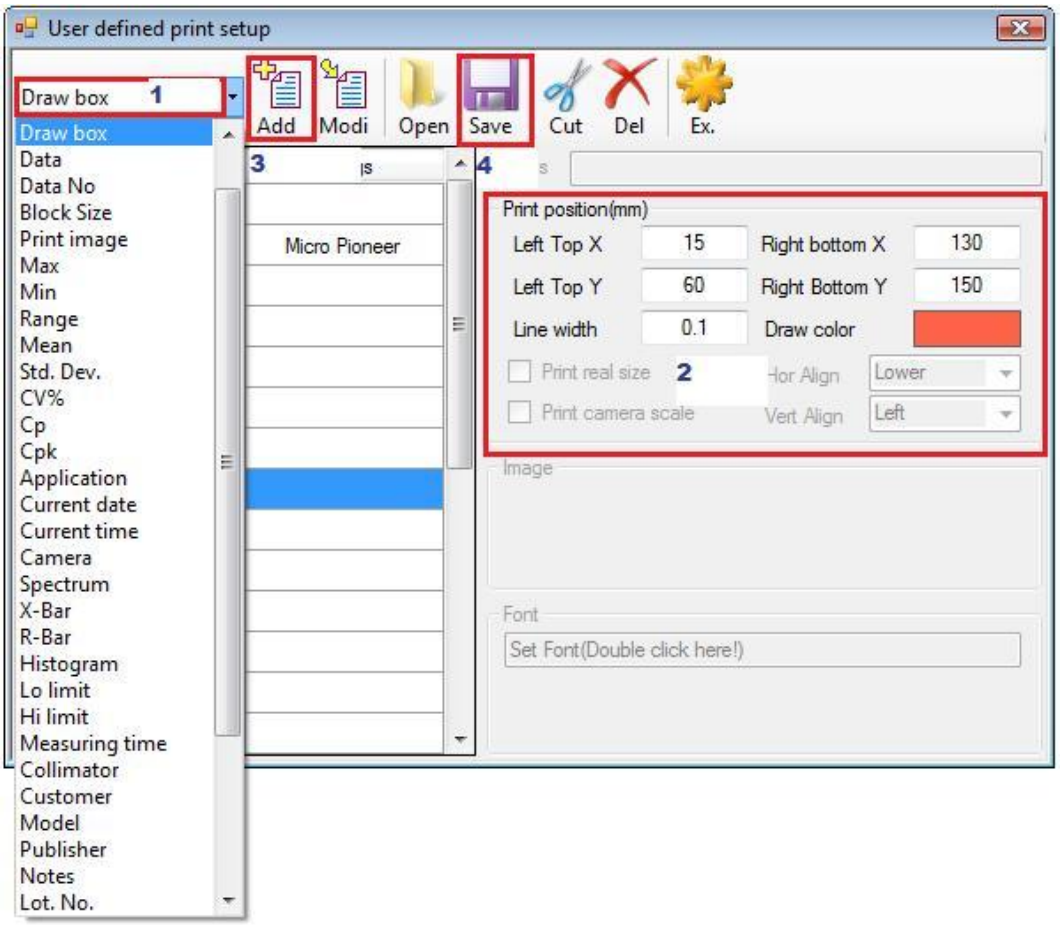
The Company Logo must be saved in C:/XRay4/User folder as Logo.bmp.

The print position of X and Y means as follows.

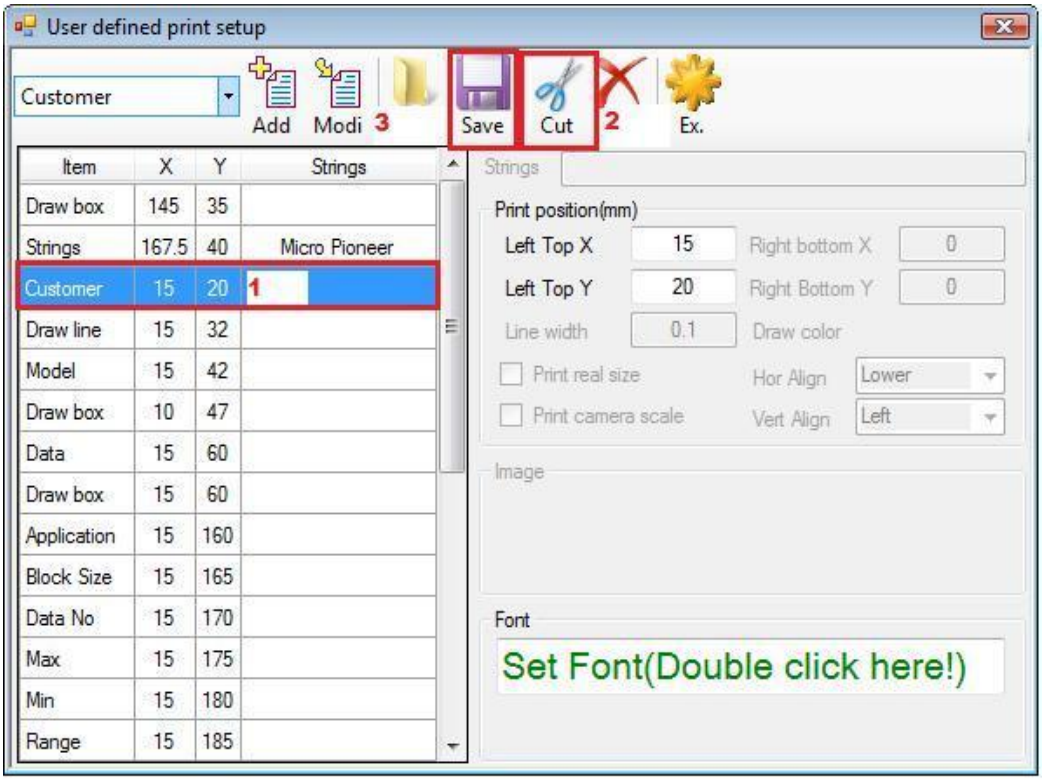




4) Add/Delete Item

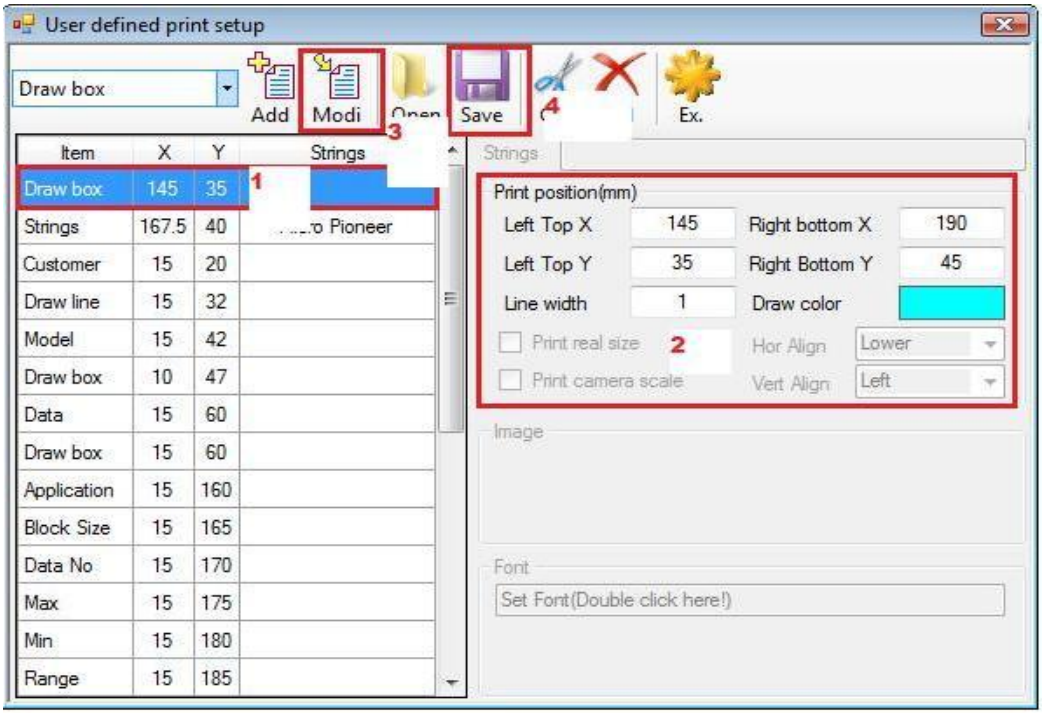


ADD -Select item to add, specify print position and click Add Icon then save to user defined print file(*.UDP).



Delete – Select item to delete and click Cut Icon then save to user defined print file(*.UDP).

5) Edit Item



Edit – Select item to edit and change the print option such as position, color, Font and line width etc. and click Modi Icon then save to user defined print file(*.UDP).

6) Sample of User Print Form

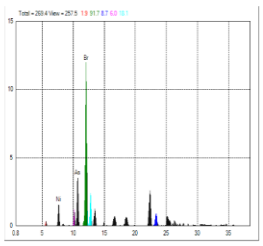
Customer : SamSung Elec. Ltd.

서울 금천구 가산동 Tel : 02-2163-8650
대륭테크노타운 8차 1414호 Fax : 02-2163-8652
마이크로 파이오니아

Micro Pioneer

Model : XRF-2000 Series R

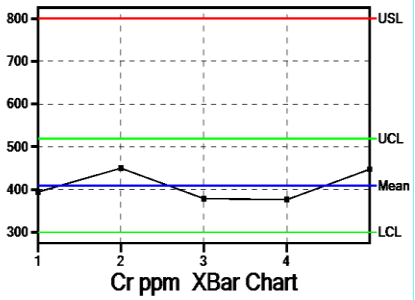
No	Cr ppm	Br ppm	Cd ppm	Hg ppm	Pb ppm
1	394.1	493.9	107.1	226.6	398.7
2	449.7	503.9	91.1	196.0	380.4
3	378.6	507.7	83.9	199.4	374.7
4	376.1	492.4	100.2	180.0	359.5
5	447.3	492.0	99.6	205.0	382.6



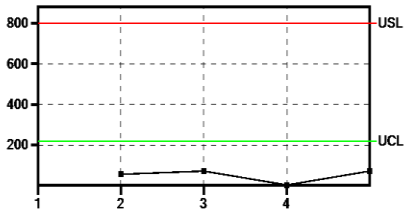
Application : RoHS_PVC

Data No	5	5	5	5	5
Max	449.7	507.7	107.1	226.6	398.7
Min	376.1	492.0	83.9	180.0	359.5
Range	73.6	15.7	23.2	46.6	39.2
Mean	409.2	498.0	96.4	201.4	379.2
Std. Dev.	36.6	7.3	9.0	16.9	14.2
CV%	8.9	1.5	9.3	8.4	3.7

5/7/2009
3:15:53 PM



Cr ppm XBar Chart



Publisher : Ike Kim

4.5  PHA Display window

4.5.1 Qualitative Analysis

The objective of qualitative analysis is to identify the elemental component of unknown substances. The first step in qualitative analysis is spectra acquisition. Following spectra acquisition, the spectra must be manipulated and studied to best determine additional spectra acquisition and/or the qualitative answer desired. This covers guidelines for qualitative analysis including various spectral manipulations.

Setting acquisition parameters

(High Voltage and Tube Current setting in CAL File)

Since the purpose of qualitative analysis is to identify the components in a sample, acquisition parameters should be selected to optimize the identification CAL File. This is done by maximizing the spectral range covered by the excitation-detection system as well as obtaining sufficient sensitivity to identify even trace amounts of the elements present in sample. This is accomplished by optimizing the X-Ray levels. Total CPS on PHA display is a good indication of this optimized level. Voltage(KV) and current(uA) settings, combined, should allow for CPS of 3,000 or less.

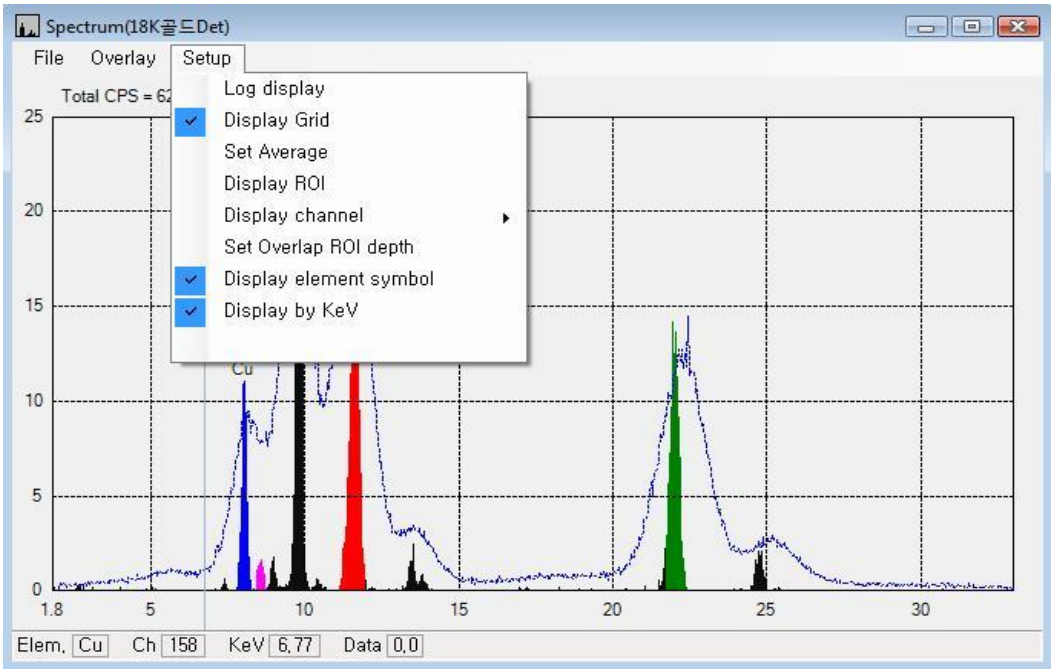
Guidelines to excitation parameter efficiencies

The following are guidelines to help achieve good qualitative analysis.

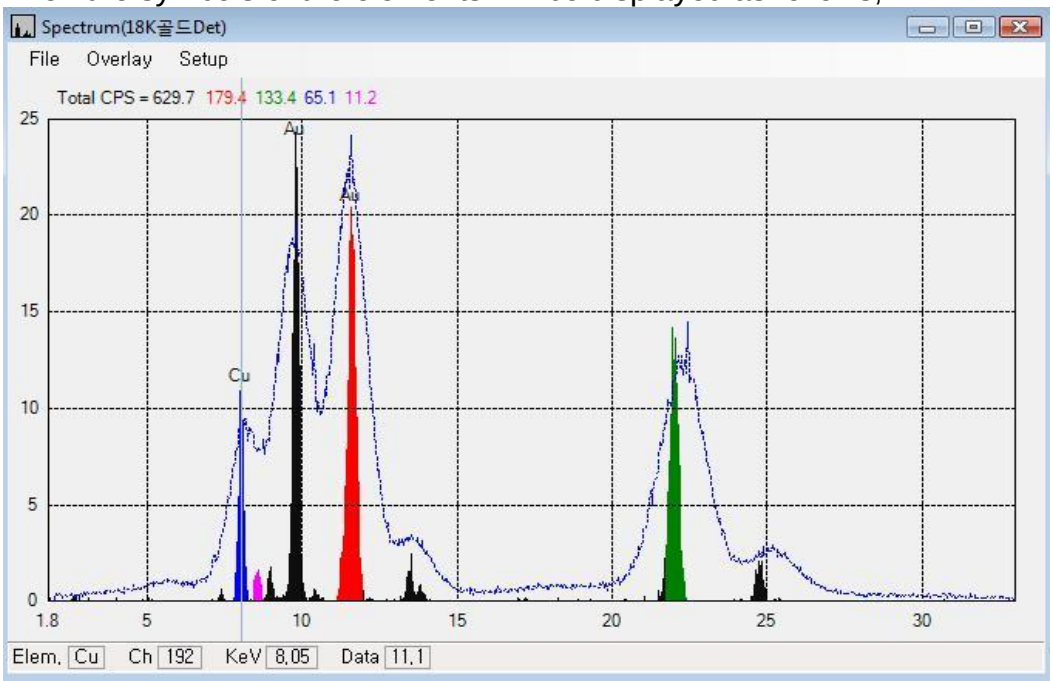
1. Set the uA setting to achieve satisfactory CPS values, between 2K and 3K. If this is not achievable with the smallest uA setting use collimator to ensure that the count rate is within acceptable CPS limits.
2. For more specific excitation conditions, the use of filters to modify the exciting radiation is recommended. Filters modify the exciting radiation and may selectively enhance the excitation of certain analytes within the sample.

4.5.2 Editing and Manipulating Spectra

Automatic identification of peaks can be performed after spectra have been acquired. Click the Setup pull-down menu. Click Display element symbol in the PHA Display Window.

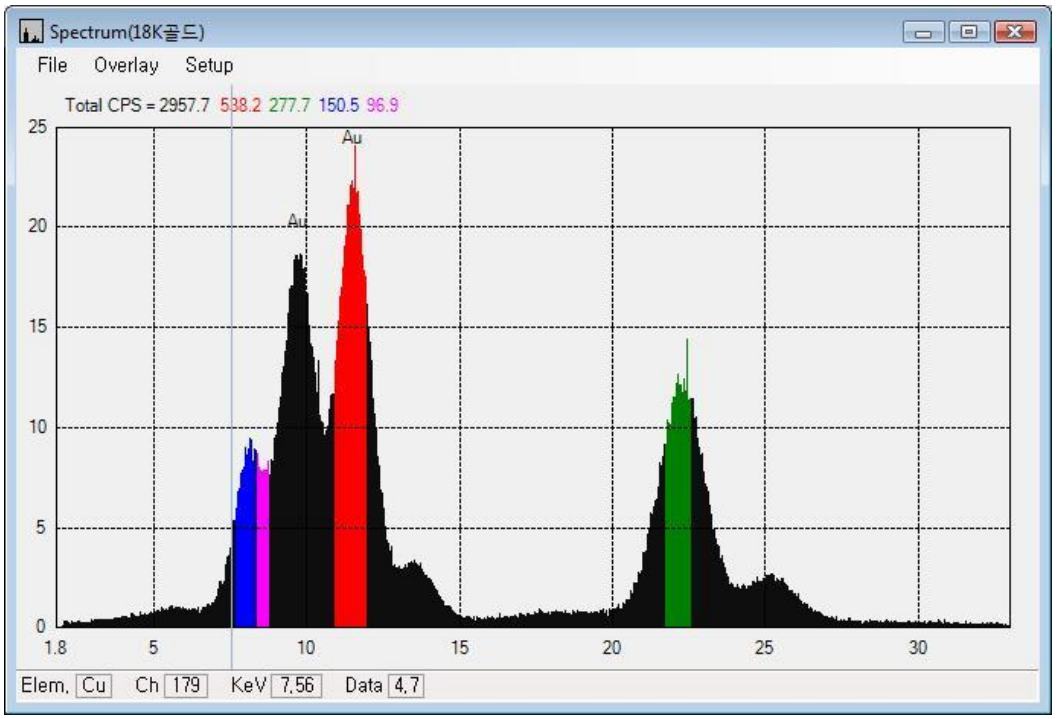


Then the symbols of the elements will be displayed as follows;

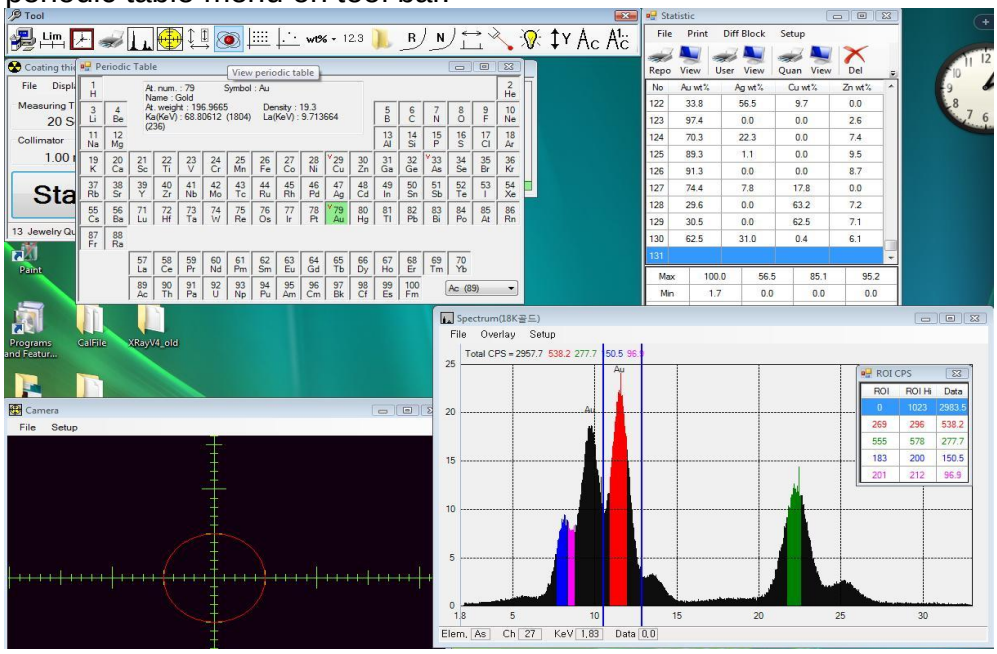


The overwrapped spectrum is acquired by proportional counter and main spectrum is acquired by Si PIN detector for 18K Gold alloy. These spectra show the different resolution for the same sample since resolution of counter is around 1,200eV and PIN detector is 149eV. If the peak is not identified automatically move cursor to center of the spectrum then the bottom of the window display the possible element, channel, KeV and Data(CPS) as shown in above. The Green peak on right side is peak for Silver K-a(22.16KeV) but it is not identified automatically because the center of the sliver K-a moved to the left (called peak shift) as 21.96KeV. Therefore the

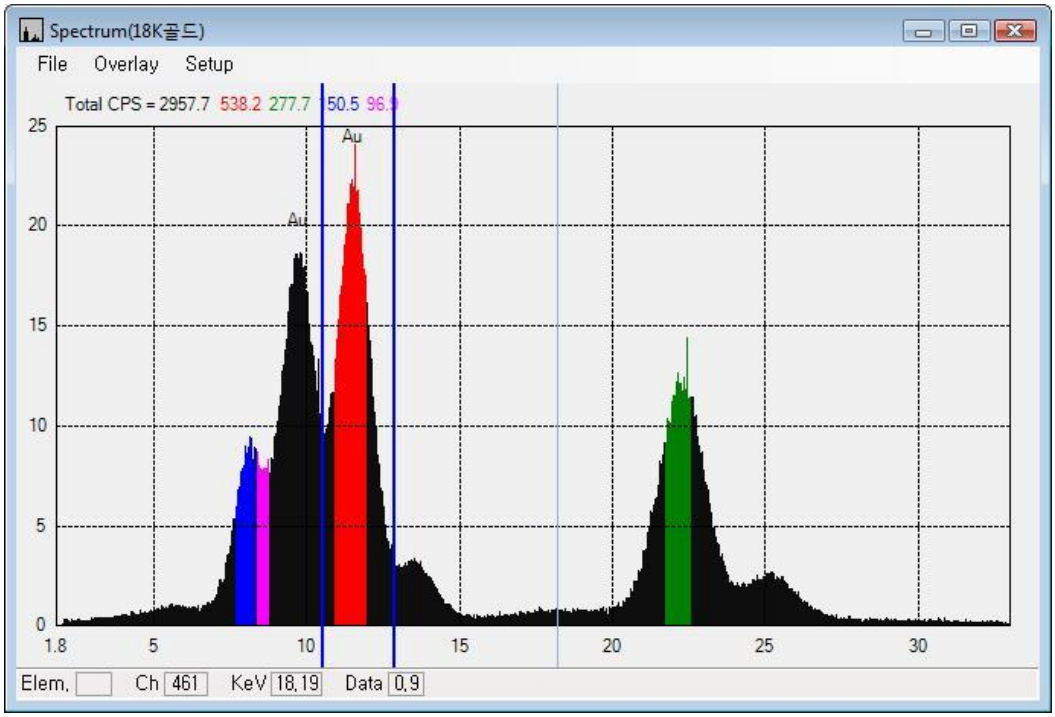
right two peaks should be determined as K-a and K-b of the Silver by operator because there are no other possible elements regarding its energy of the X-Ray. Using the proportional counter, it will be looked like as follows;



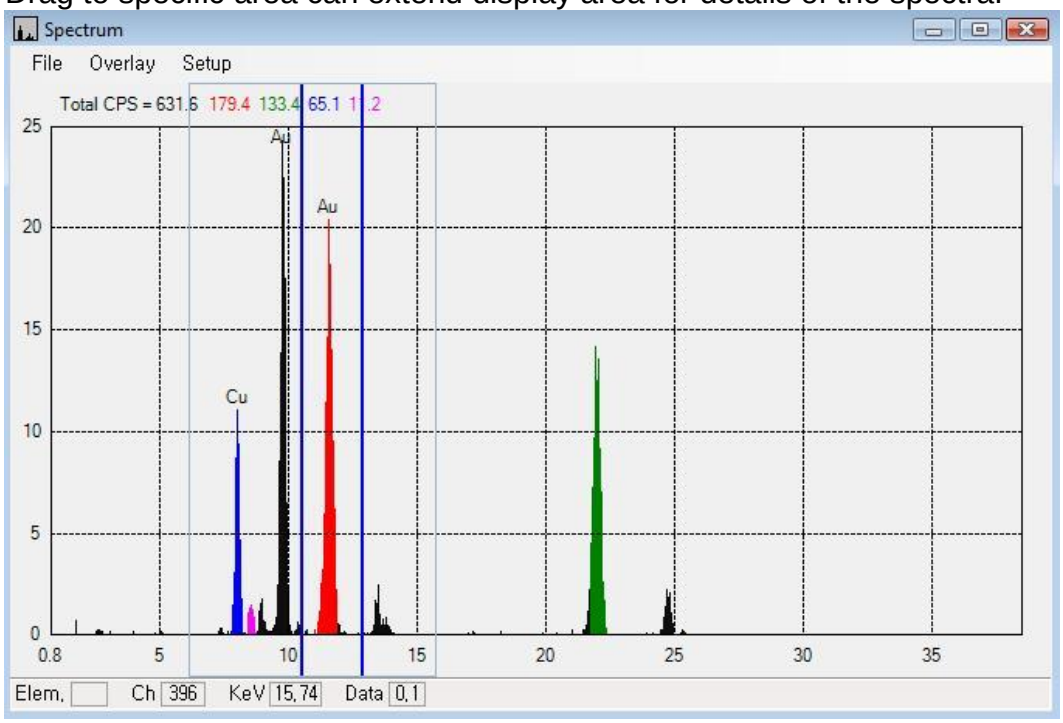
Because of wide resolution of the proportional counter, Cu and Zinc are overwrapped each other. Sometimes this is very confused to identify the peak. So if there is a peak in certain ROI(Region of Interest) it is possible to exist overwrapped peak by neighborhood elements. View periodic table menu on tool bar provides useful function to identify the spectra. Click View periodic table menu on tool bar.

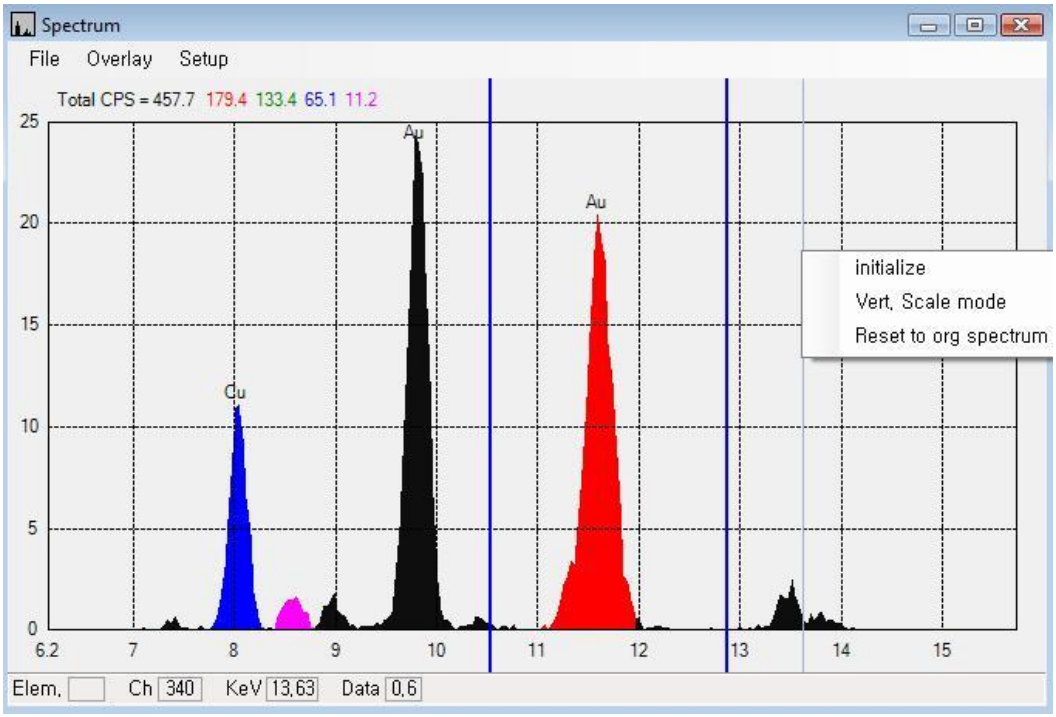


Clicking specific element shows its information such as Atomic number, Energy Value etc. and two vertical lines(blue lines) which is ROI low and ROI High are placed on the PHA monitor window. Below is example of clicking Au.



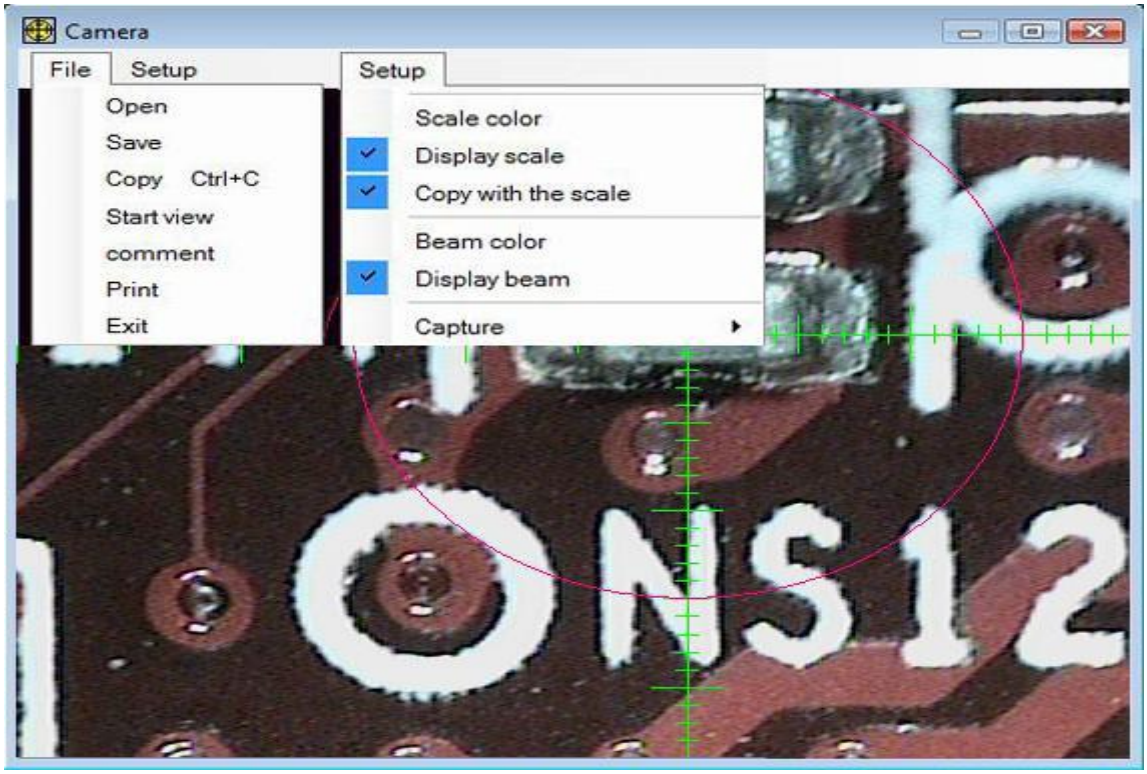
Drag to specific area can extend display area for details of the spectra.





Click Right button shows menus to initialize, expend/reduce the vertical scale.

4.6  Camera display window



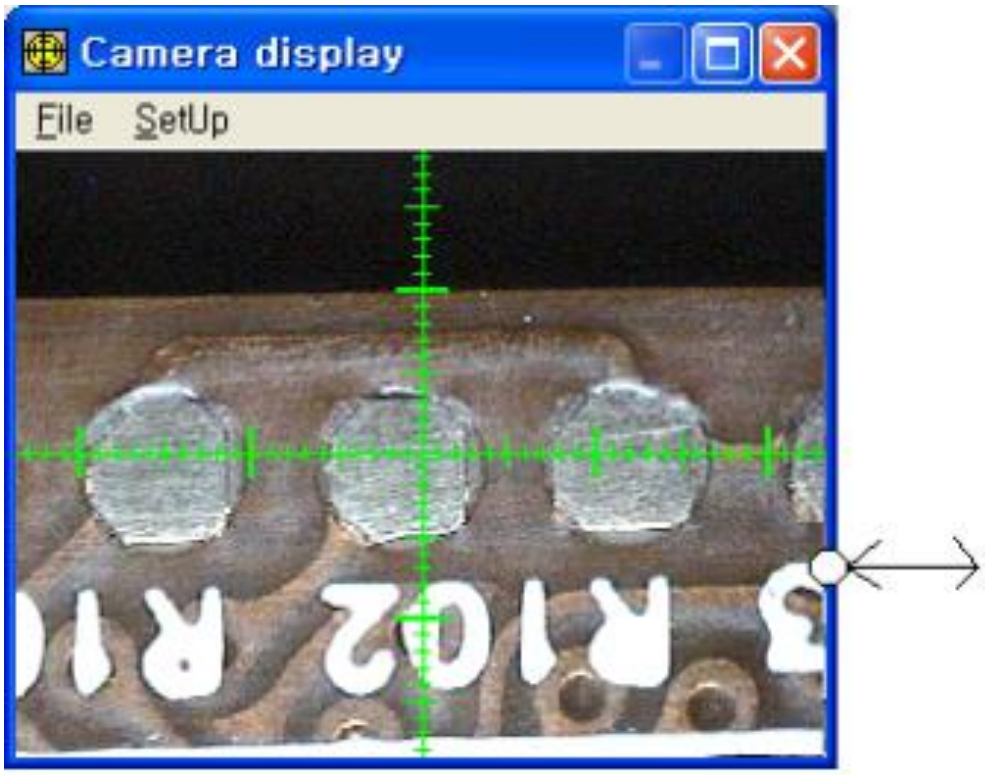
- ✓ Open/Save: Save sample image as bmp or jpg format.
  - ◆ Open 'BMP' , 'JPG' , 'GIF' format.
- ✓ Copy: Copy sample image to clipboard.
- ✓ Start view: Start capturing sample image.
- ✓ Comment: Enter comment text to print.
- ✓ Print: Print sample image.
- ✓ Scale color: Modify scale color.
- ✓ Display scale: ON/OFF scale line.
- ✓ Copy with Scale: Copy to sample with scale to clipboard.
- ✓ Beam color: Modify Beam display color.
- ✓ Display beam : ON/OFF beam display
- ✓ Capture: Select image source device(Capture Card).

  The following menus are in Administrator Mode
- ✓ Adjust scale position: Adjust center of scale line manually.
- ✓ Find beam center: Automatically find the beam position.

- ✓ Moving stage by clicking camera window
  - ◆ Click where you want to measure.
  - ◆ Left click to move XY axis, Right click for Z focus.

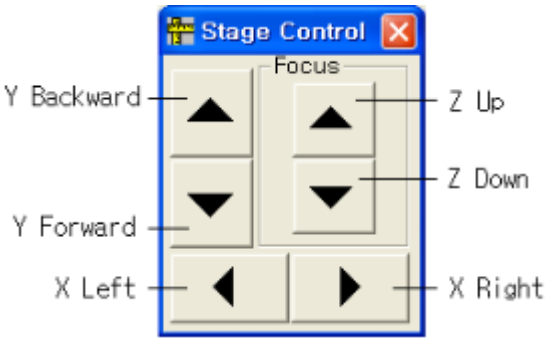
- ✓ Change the camera window size

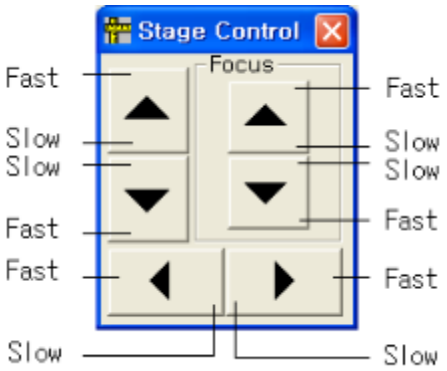
  To change the camera window size, hold and drag right side or corner of the camera window.

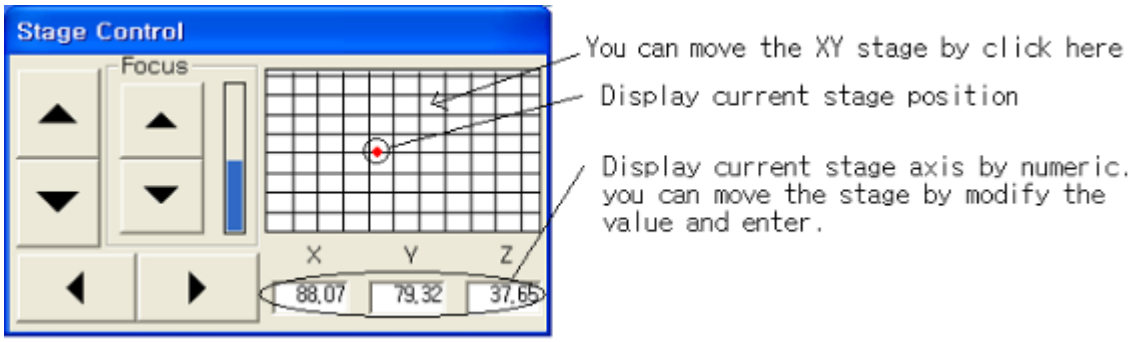


4.7 Stage Control Window

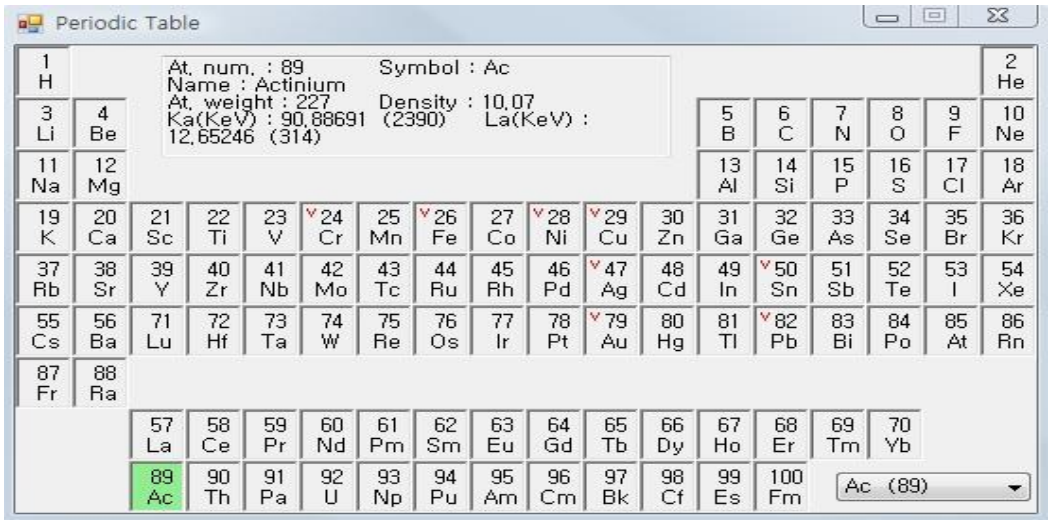
Moving speed will be changed by the mouse operation. Left button is slow speed control. The speed will be changed by the clicked position. The inner position is slow speed and outer position is fast speed. Right button is fast speed control by using acceleration and deceleration method.





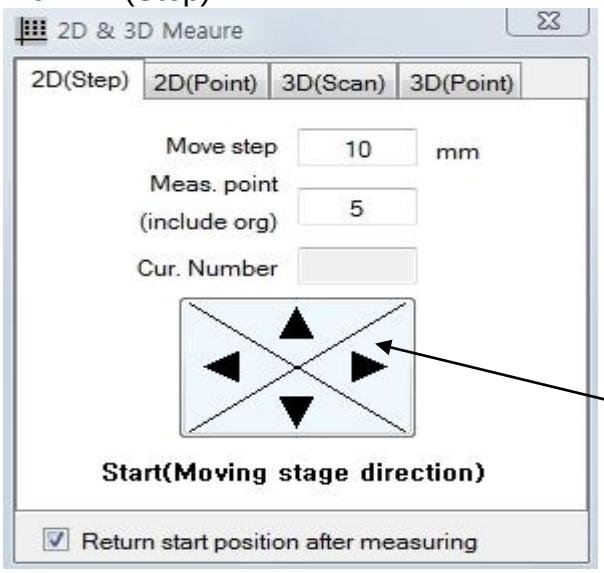


4.8 Periodic Table



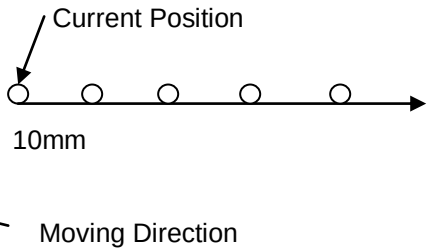
4.9 2D&3D Measure Window

4.9.1 2D(Step)

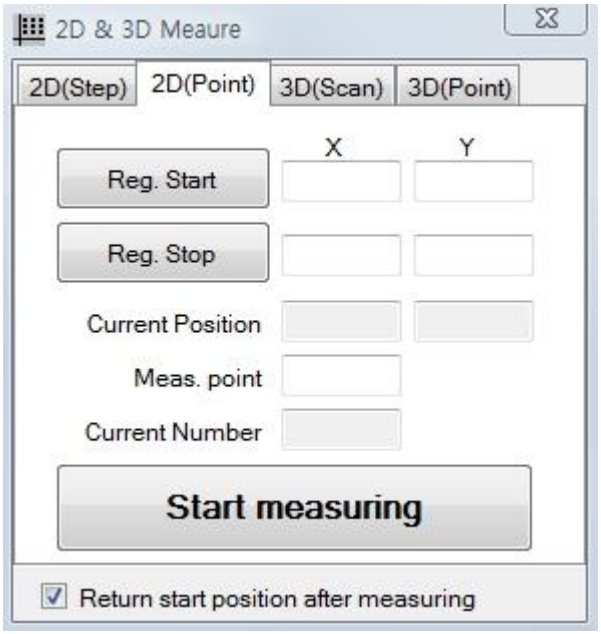


5 times analysis at intervals of 10mm from current position.

Clicking direction starts to mesure.



4.9.2 2D(Point)



Move Sample to start position and Click Reg. Start Button.

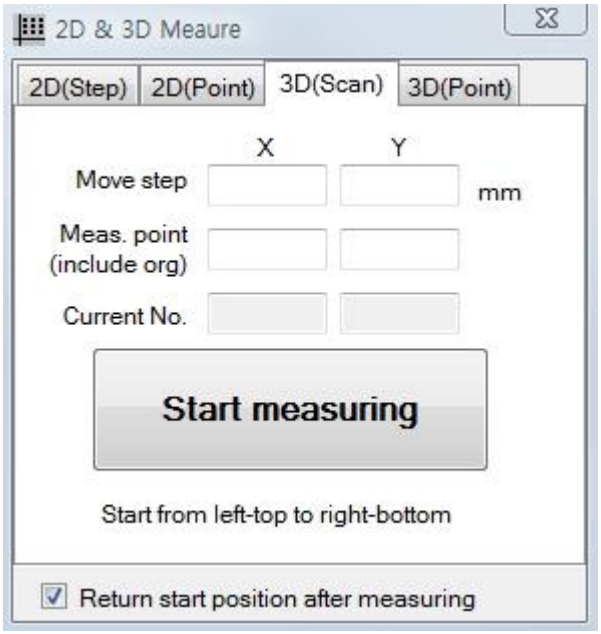
Move Sample to end position and Click Reg. Stop Button

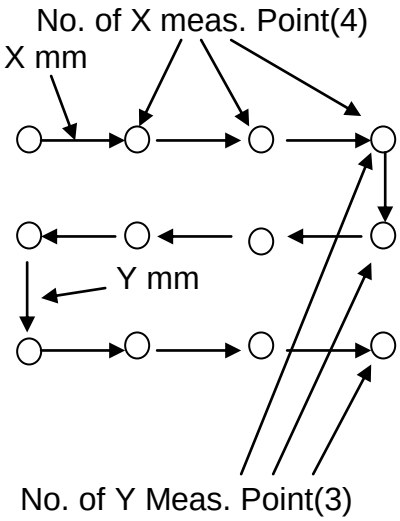
Enter Number of Analysis

Click Start measuring.

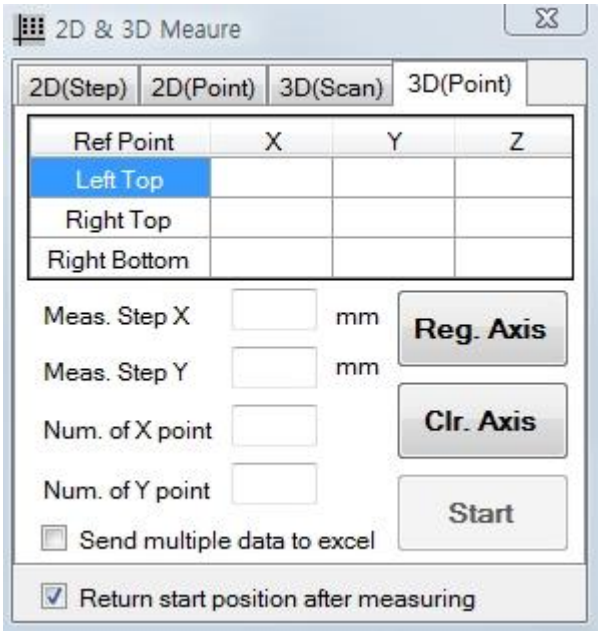
Moving distance = (Start - Stop) / (Meas. point - 1)

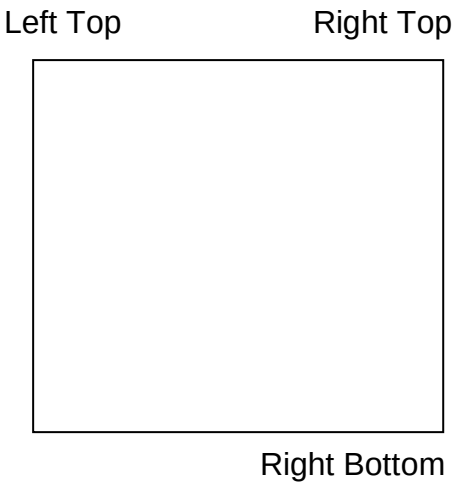
4.9.3 3D(Scan)





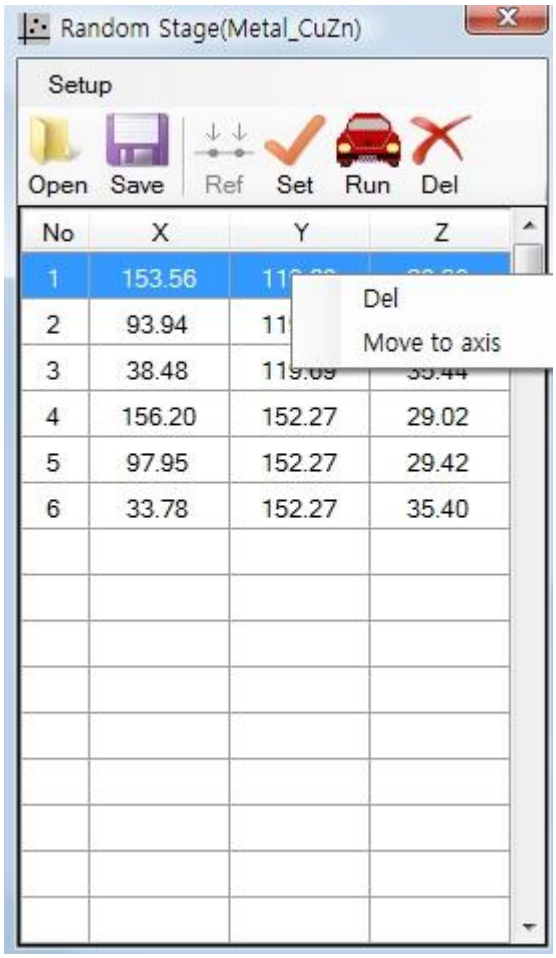
4.9.4 3D(Point)





- ✓ Place camera position and cursor to left top and click Reg. Axis Button.
- ✓ Place camera position and cursor to right top and click Reg. Axis Button.
- ✓ Place camera position and cursor to right bottom and click Reg. Axis Button.
- ✓ Enter No. of point for X, Y. Then moving distance for X and Y are calculated by system.
- ✓ Click Start button.

4.10 Random Stage

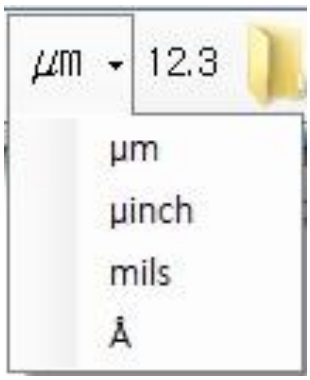


- ✓ Open/Save : Open/Save position data file.
- ✓ Set: Register the axis data.
- ✓ Run: Start the measuring.
- ✓ Del: Clear all axis data.

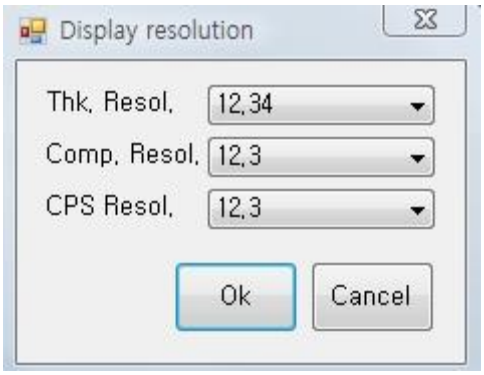
Clicking right mouse button menu

- ✓ Del : delete the selected axis data.
- ✓ Move To axis: Move the stage to selected axis data.
- ✓ Z axis can be used only type H model.

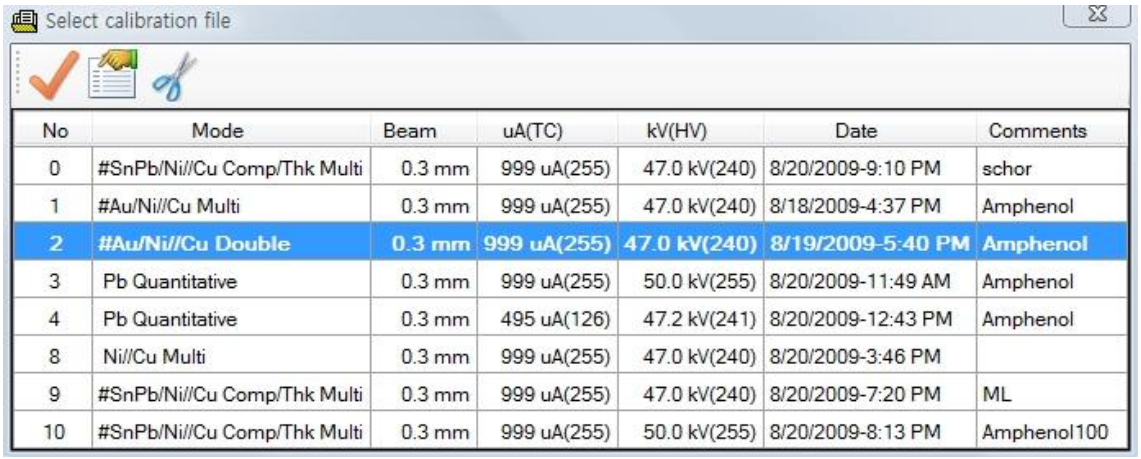
4.11 Set Display Unit



4.12 12.3 Set Display Resolution



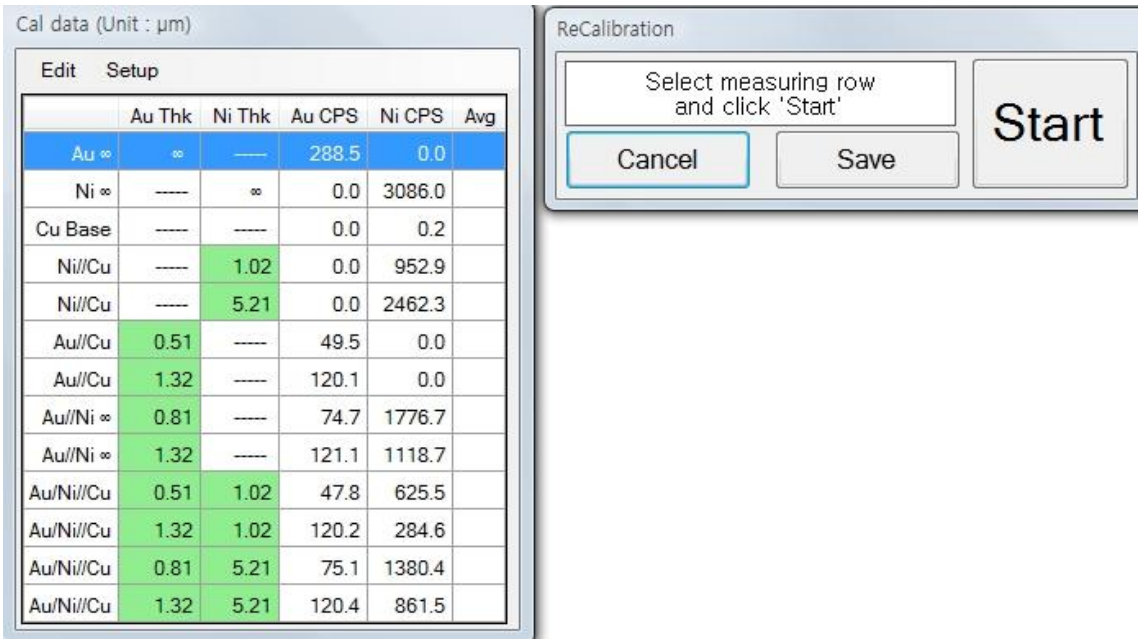
4.13 Cal File Select Window



No	Mode	Beam	uA(TC)	kV(HV)	Date	Comments
0	#SnPb/Ni//Cu Comp/Thk Multi	0.3 mm	999 uA(255)	47.0 kV(240)	8/20/2009-9:10 PM	schor
1	#Au/Ni//Cu Multi	0.3 mm	999 uA(255)	47.0 kV(240)	8/18/2009-4:37 PM	Amphenol
2	**#Au/Ni//Cu Double**	**0.3 mm**	**999 uA(255)**	**47.0 kV(240)**	**8/19/2009-5:40 PM**	**Amphenol**
3	Pb Quantitative	0.3 mm	999 uA(255)	50.0 kV(255)	8/20/2009-11:49 AM	Amphenol
4	Pb Quantitative	0.3 mm	495 uA(126)	47.2 kV(241)	8/20/2009-12:43 PM	Amphenol
8	Ni//Cu Multi	0.3 mm	999 uA(255)	47.0 kV(240)	8/20/2009-3:46 PM	
9	#SnPb/Ni//Cu Comp/Thk Multi	0.3 mm	999 uA(255)	47.0 kV(240)	8/20/2009-7:20 PM	ML
10	#SnPb/Ni//Cu Comp/Thk Multi	0.3 mm	999 uA(255)	50.0 kV(255)	8/20/2009-8:13 PM	Amphenol100

- ✓ Set: Use the selected cal file.
- ✓ Edit comment: Edit the comment of selected cal file.
- ✓ Delete: Delete the selected cal file.
- ✓ Opened File(Using file) can not be edited.

4.14 Recalibration Window



	Au Thk	Ni Thk	Au CPS	Ni CPS	Avg
Au ∞	∞	-----	288.5	0.0	
Ni ∞	-----	∞	0.0	3086.0	
Cu Base	-----	-----	0.0	0.2	
Ni//Cu	-----	1.02	0.0	952.9	
Ni//Cu	-----	5.21	0.0	2462.3	
Au//Cu	0.51	-----	49.5	0.0	
Au//Cu	1.32	-----	120.1	0.0	
Au//Ni ∞	0.81	-----	74.7	1776.7	
Au//Ni ∞	1.32	-----	121.1	1118.7	
Au/Ni//Cu	0.51	1.02	47.8	625.5	
Au/Ni//Cu	1.32	1.02	120.2	284.6	
Au/Ni//Cu	0.81	5.21	75.1	1380.4	
Au/Ni//Cu	1.32	5.21	120.4	861.5	

- Recalibration procedure.

1) Manual axis calibration.
- Set one calibration standard (ex: Au Inf.) on the stage.
- Adjust position and focus.
- Select desired (ex: Au Inf.) row on 'Calibration Data' window.
- Click 'START' button on Recalibration window.
- Click 'START' button again. Then average data will be used for calibration data.

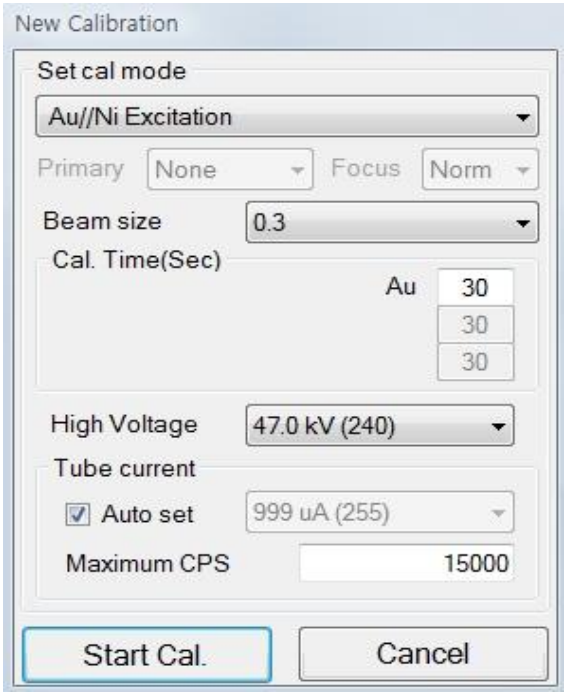
2) Automatic axis calibration.
- Set all calibration standards on the stage.
- Adjust position and focus.
- Double click the desired (ex: Au Inf.) axis row then axis data will be registered.
- Register all of calibration standard axis data.
- Click the 'START' button.

3) Click the Right button of mouse will be display the pop-up menu.

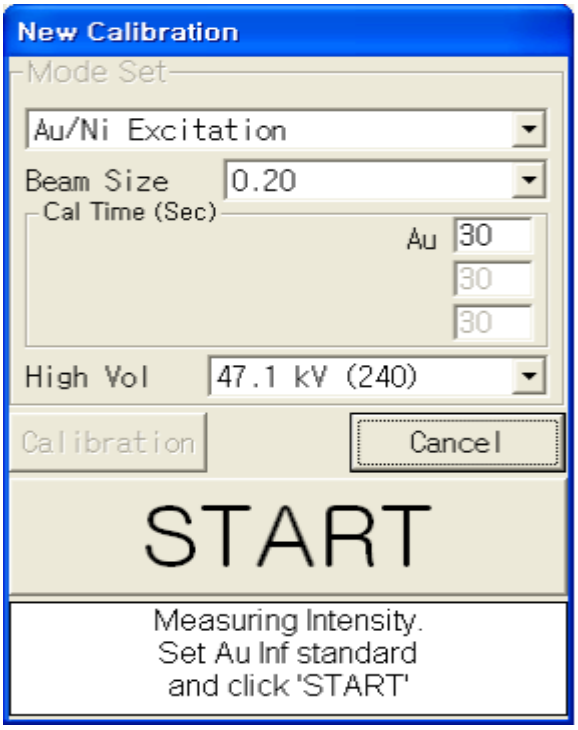
- Clear CPS: Clear CPS for selected row data.
- Print: Print all cal data

4.15  New Calibration

4.15.1 Thickness Calibration



New calibration will use pre-defined cal mode. Click Start Cal. button, next window will be displayed.



Follow the message of window and the next is same as Recalibration.

4.15.2 Example of Calibration

: Enter or modify the thickness and composition value.

Calibration Data

	Au Thk	Au CPS	Avg	X	Y	Z
Au Inf	Inf	787.6	0			
Ni Base	-----	8.9	0			
Au/Ni #1	0.24	81.3	0			
Au/Ni #2	0.89	232.5	0			

Calibration Data

	Au Thk	Ni Thk	Au CPS	Ni CPS	Avg	X	Y	Z
Au Inf	Inf	-----	2100.1	259.6	0			
Ni Inf	-----	Inf	58.9	1317.2	0			
Cu Base	-----	-----	51.9	286.7	0			
Ni/Cu	-----	3.05	55.3	604.9	0			
Ni/Cu	-----	8.94	57.0	962.6	0			
Au/Cu	0.48	-----	383.9	274.0	0			
Au/Cu	2.16	-----	1182.4	257.7	0			
Au/Ni	0.99	-----	709.0	669.4	0			
Au/Ni	1.88	-----	1108.9	440.5	0			
Au/Ni/Cu	0.58	2.08	451.4	412.4	0			
Au/Ni/Cu	2.08	2.87	1155.7	311.6	0			
Au/Ni/Cu	1.14	6.07	763.8	441.4	0			
Au/Ni/Cu	2.16	8.74	1173.9	365.6	0			

Calibration Data

	Sn Thk	Pb Thk	SnPb Thk	% Sn	Sn CPS	Pb CPS	Avg	X	Y	Z
Sn Inf	Inf	-----	-----	100%	5423.0	55.0	0			
Pb Inf	-----	Inf	-----	0%	137.2	2925.0	0			
Cu Base	-----	-----	-----	-----	676.0	40.0	0			
SnPb Inf	-----	-----	Inf	60.0%	2484.0	1404.0	0			
Sn/Cu	1.37	-----	-----	100%	885.0	33.6	0			
Sn/Cu	4.55	-----	-----	100%	1352.0	32.0	0			
Sn/Cu	5.80	-----	-----	100%	1535.0	32.0	0			
Sn/Cu	5.80	-----	-----	100%	1529.0	31.0	0			
Pb/Cu	-----	4.42	-----	0%	459.0	1727.0	0			
Pb/Cu	-----	7.76	-----	0%	372.0	2268.0	0			
SnPb/Cu	-----	-----	2.41	94.0%	1117.0	94.0	0			
SnPb/Cu	-----	-----	5.03	94.0%	1503.0	136.0	0			
SnPb/Cu	-----	-----	2.41	94.0%	1123.0	96.0	0			
SnPb/Cu	-----	-----	5.08	94.0%	1503.0	136.0	0			

Calibration Data

	Sn Thk	Pb Thk	SnPb Thk	% Sn	Sn CPS	Pb CPS	Avg
Sn Inf	Inf	-----	-----	100%	5582.1	0.0	0
Pb Inf	-----	Inf	-----	0%	1.3	3449.8	0
Cu Base	-----	-----	-----	-----	0.0	0.0	0
SnPb Inf	-----	-----	Inf	58.0%	2577.8	1643.1	0
Sn/Cu	10.50	-----	-----	100%	1931.8	6.3	0
Sn/Cu	19.20	-----	-----	100%	2916.2	4.4	0
Pb/Cu	-----	4.19	-----	0%	0.0	1995.1	0
Pb/Cu	-----	9.22	-----	0%	16.5	2861.1	0
SnPb/Cu	-----	-----	8.74	91.0%	1507.1	279.0	0
SnPb/Cu	-----	-----	13.40	89.0%	2011.7	423.9	0

X	Y	Z

Calibration Data (unit = micron)

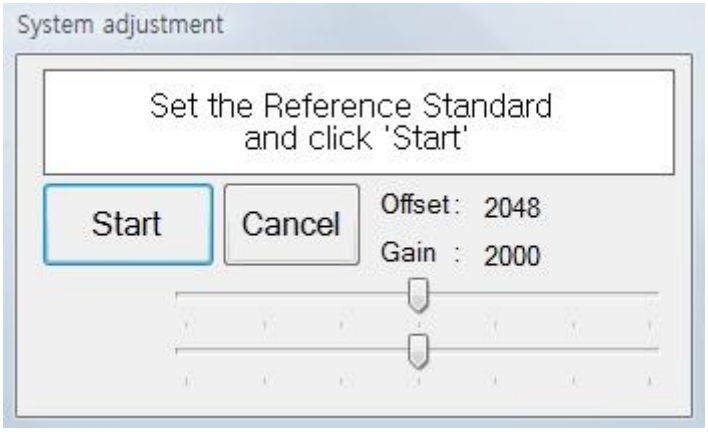
	Cr Thk	Ni Thk	Cu Thk	Cr CPS	Ni CPS	Cu CPS	Avg
Cr ∞	∞	----	----	1897.3	5.6	0.7	
Ni ∞	----	∞	----	1.0	6006.4	22.8	
Cu ∞	----	----	----	0.0	16.4	7515.5	
Plstc ∞	----	----	----	0.3	5.5	0.0	
Cu/Plstc	----	----	5.54	264.1	1647.4	852.4	
Ni/Cu/Plstc	----	5.03	5.54	129.3	2721.4	1117.0	
Cr/Ni/Cu/Plstc	0.67	5.03	5.54	151.2	214.9	2471.3	

Atom list

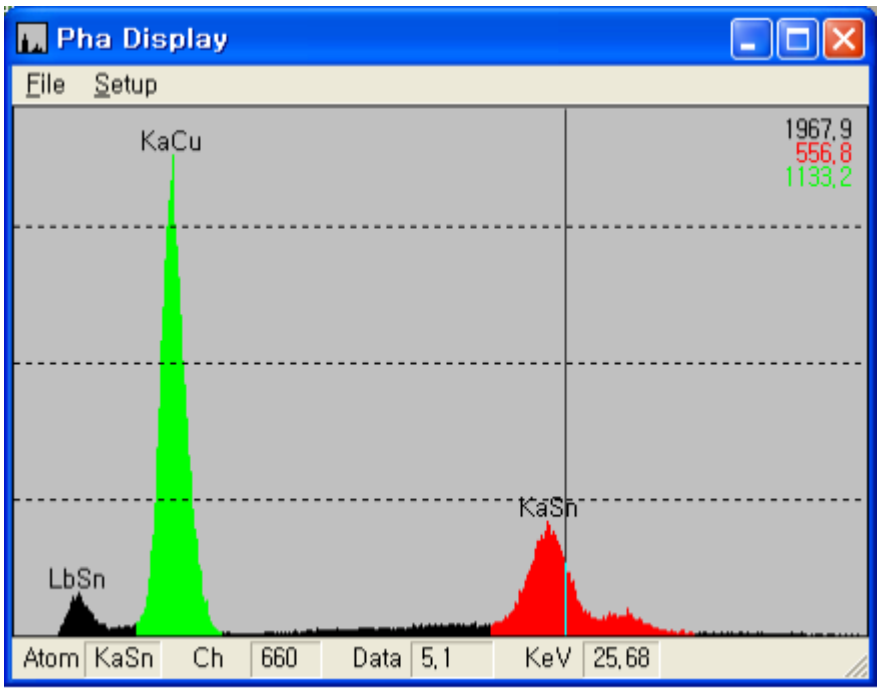
No	Sym	Densi	RoiL	RoiU	Kalph	Lalph	Lbeta	KalPk	LalPk	LbePk
21	Sc	3.00	49	119	4.090			87		
22	Ti	4.50	59	133	4.510			98		
23	V	5.80	70	147	4.950			110		
24	Cr	7.19	81	163	5.410			122		
25	Mn	7.43	85	179	5.900			135		
26+	Fe	7.86	89	195	6.400			148		
27	Co	8.90	119	213	6.930			162		
28+	Ni	8.90	133	215	7.480			177		
29+	Cu	8.96	147	250	8.050			192		
30	Zn	7.14	161	269	8.640			208		
31	Ga	5.91	176	289	9.250			224		
32	Ge	5.32	192	310	9.890			241		
33	As	5.72	208	332	10.540			258		
34	Se	4.80	225	354	11.220			276		

Search Sc

4.16 System Adjustment Window



'System adjustment' adjusts gain and offset of PHA system.
Load Reference standard on the stage and adjust XY & focus.
Click 'START' button to adjust.
Below window is the Adjusted PHA display window.



4.17 Focus Laser

On/Off Focus Laser.

4.18  Lamp
On/Off Lamp for Camera.

4.19  Set Y Stage Auto Move
Analysis position moves to near door side when cover is opened and moves to analysis position automatically when cover is closed.

4.20  Auto Cycle Measurement
Enable statistical Measurement.

4.21  Auto Cycle Number
Number of Analysis for Auto Cycle Measurement.

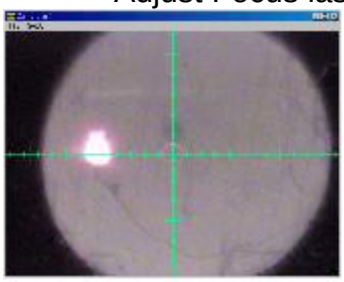
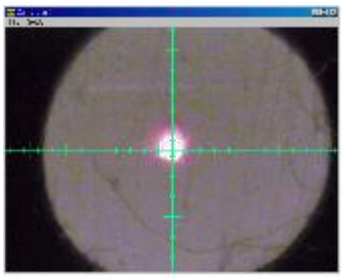
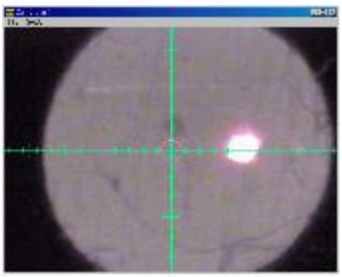
5. **How To Measure**

5.1 Loading Sample

- Open the door. The stage will move forward when 'Push Pull' () function is ON.
- Load sample at laser beam position on the stage.
- Close the door. The stage will move backward.
- Adjust the sample by using stage control window.

5,2 Adjust Focus

- Adjust Focus laser to vertical scale line.

5.3 Select Cal File and Click Start Button.

Appendix

A. Regression Models

#1: Ci = Ao + Ai * Ii.

A simple linear relation between the intensity (Ii) of element "i" and its concentration (Ci). This model is applicable when the concentration of the analyzed elements is expected to vary over a relatively small range, and the influence of other elements on the analyzed element may be negligible. A good example is a trace analysis of heavy elements in organic samples or metal alloys. This model requires only two different standards to enable the program to determine the free regression coefficients Ai and Bi, but more than 3 or 4 are actually needed for good precision and higher confidence in the analysis results.

#2: Ii = Ao + Ai *Ii + Sum (Aij*Cj)

Where N is the number of interfering elements. This model accounts for inter-element influence or peak overlap. The model includes N + 1 free regression coefficients Aij, Bi and Ai (which are determined by the program). A minimum of N + 1 independent standards is required for the determination of Ai, Bi and Aij, but as many as $(N + 1)^2$ is actually recommended for better confidence. The main disadvantage of using model 2 is that it does not resemble a physical model.

#3: Ci = Ao + Ai Ii + Sum (Aij*Ij)

Almost equivalent to model 2: no significant advantage, but the concentration of interfering elements need not be known.

#4: Ci = Ao + Ai*Ii + Ii*Sum (Aj*Cj) (i<>j)

The very popular, modified Traill-Lachance model. It provides a high degree of accuracy over a wide range of concentrations and compensates for interelement influence by the Aij coefficients.

#5: Ci = Ao + Ai*Ii + Ii*Sum (Aj*Ij) (i<>j)

A modified Lucas-Tooth and Price model. It is applicable within a smaller dynamic range than model 4, but it has the advantage that only the concentration of the analyzed element appears in the equation. This means that the remainder of the concentrations in the standards don't have to be known or specified.

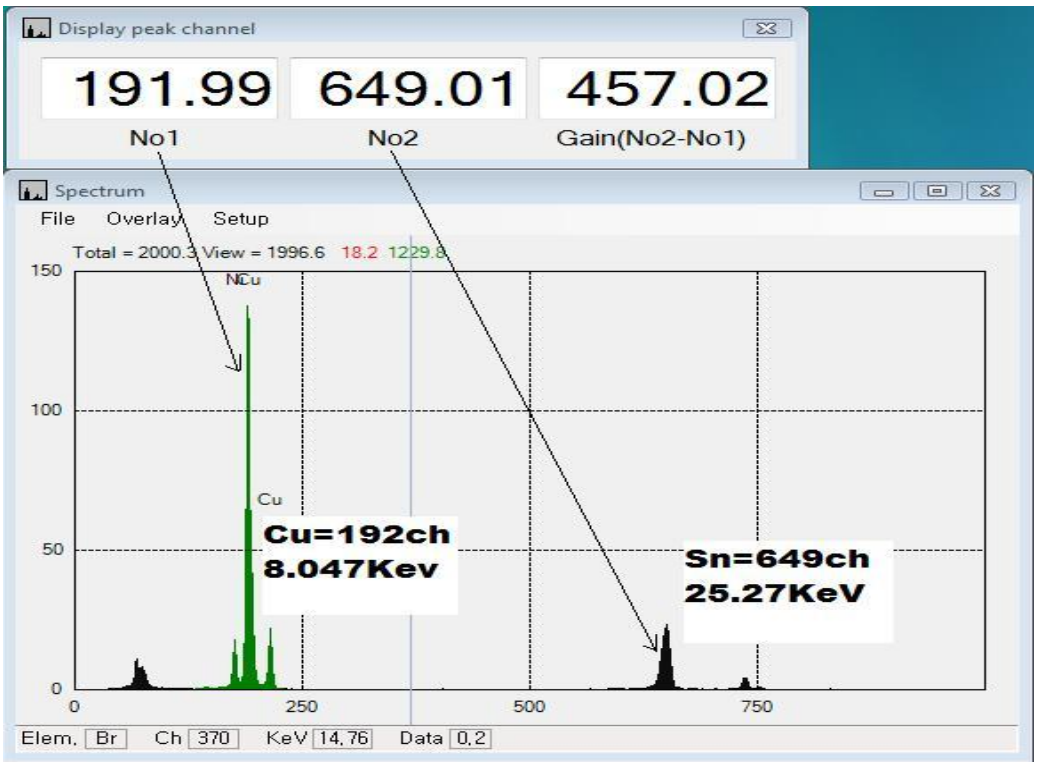
#6: $Ci = Ao + A_1Ii + A_2 Ii^2$

A quadratic model which may be more accurate when the concentration range of the analyzed element is wide and self-absorption is significant. It does not, however, account for any interelement influence.

B. System Adjust (Gain Calibration with Reference Standard)

1. General
System Adjust is for positioning to the right energy location of the known peaks in MCA channel using Reference Standard which is contained Cu and Sn.

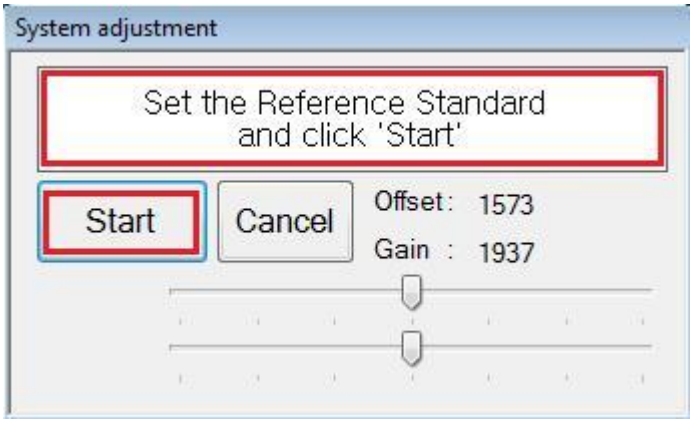
2. Concept of the system adjust
Reference Standard contains two elements, Cu and Sn. The energy of the Cu is 8.047Kev (Channel 192) Sn is 25.27 KeV (Channel 649). A good example of the System Adjust likes the following figure.



To display Peak Channel Information, place cursor on the Spectrum Screen then press Alt+P simultaneously.

3. Automatic System Adjust
Basically System Adjust is performed automatically by clicking the following icon on the tool window.

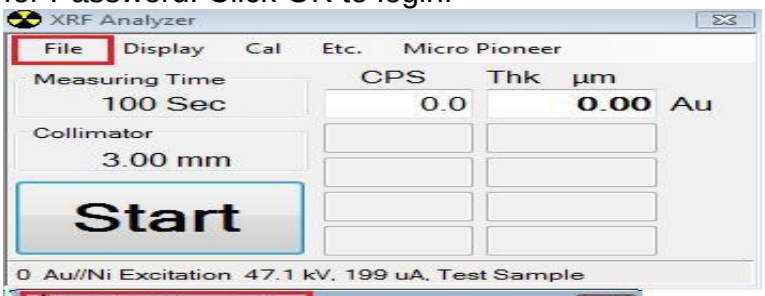
Load the reference standard on the stage then click the start button.



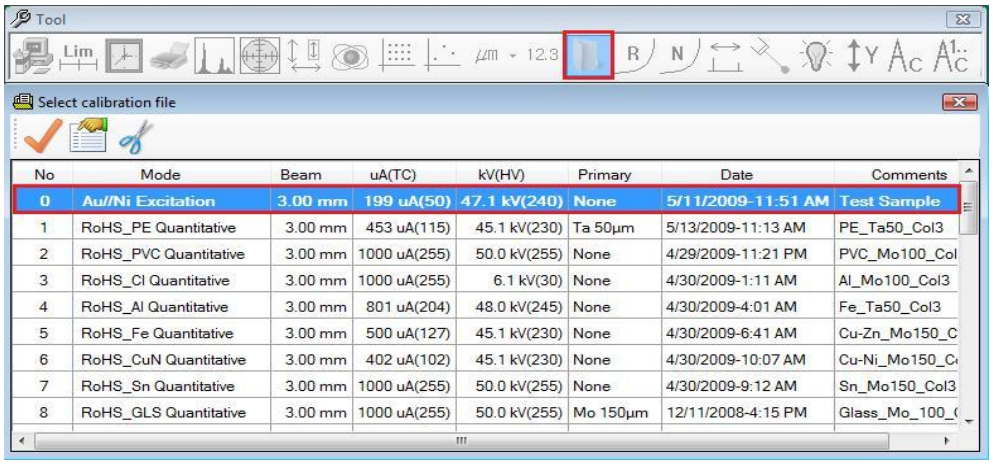
System will turn on X-Ray several times and adjust the value of the Offset and Gain automatically to find proper position for Cu and Sn peaks.

4. Manual System Adjust
Sometimes automatic system adjust is not able to have a good result as described in above with some reason. Then just follow the next.

4.1 Administrator Login
Go to File -> Administrator Login in XRF Analyzer window and type “t” for Password. Click OK to login.

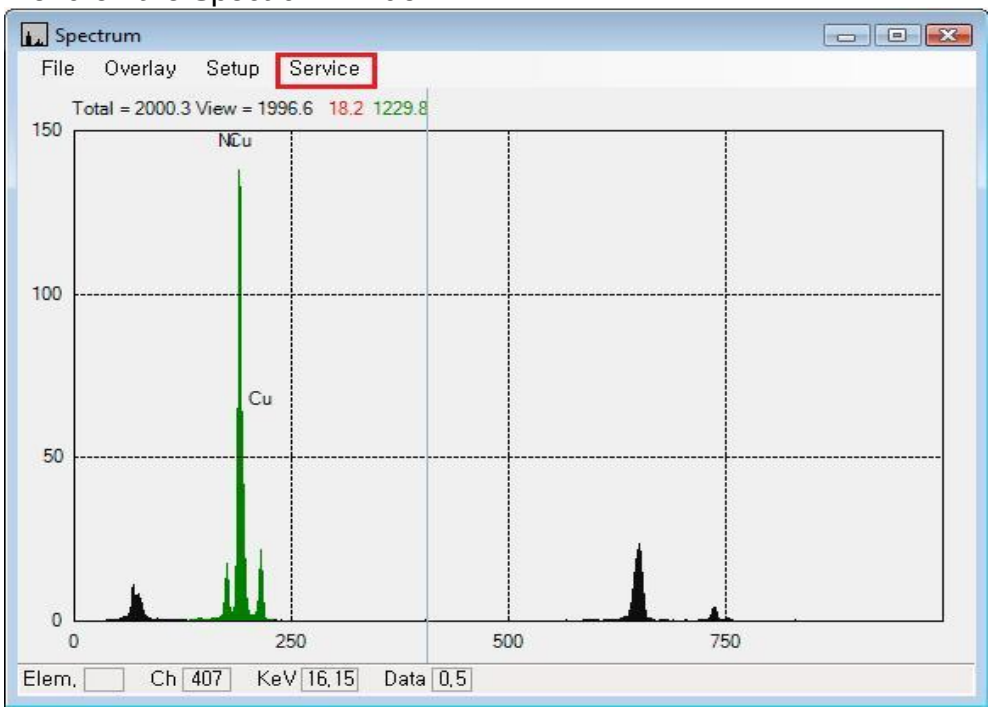


4.2 Select Cal file 0 Au/Ni Excitation



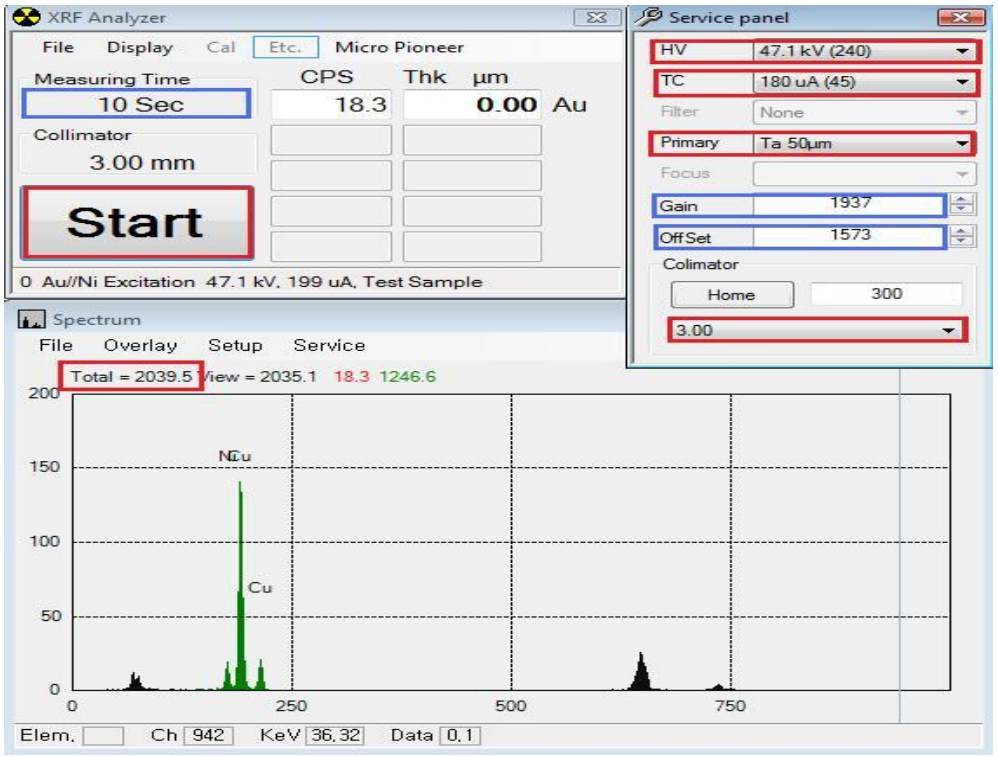
4.3 Get Service Menu

Place cursor on the XRF Analyzer window then press Alt+Cntrl+Shif simultaneously then type “pioneer” and Press Enter key. Click Service menu on the Spectrum window.



4.4 Set Acquisition Parameter

Set the acquisition parameter in service panel as follows.

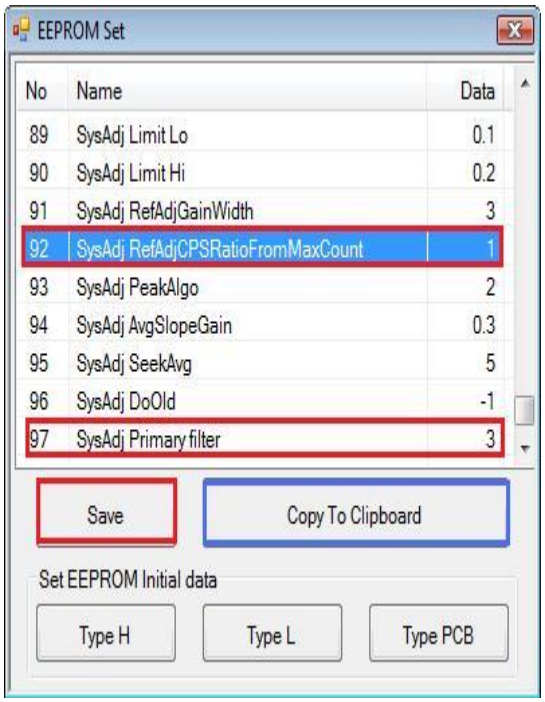


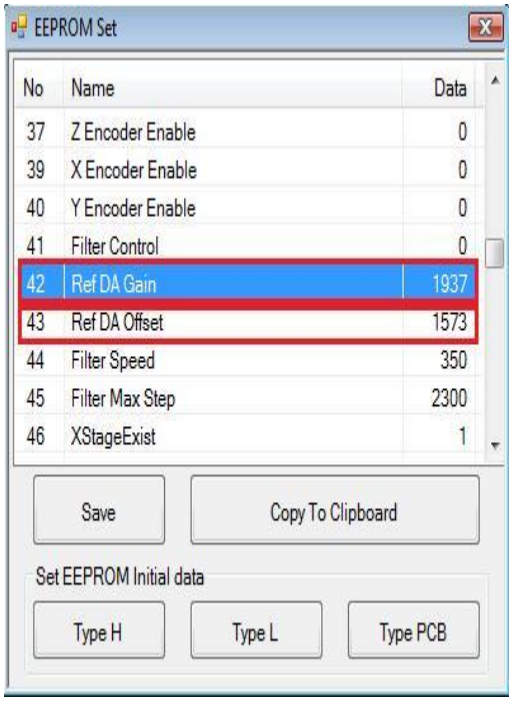
Set HV 47.1, TC 180, Primary Ta50um and Collimator 3 then Start with 10 Sec measuring time. Get the total CPS around 2,000 by increasing or decreasing the TC value. If no peaks in this step, try to decrease TC value because more than 3,000 CPS is hard to detect peaks. When you get the proper CPS, adjust Gain and Offset value to place the both peaks of Cu and Sn in proper position as shown in step 2. Record Gain and Offset values and keep it. Close Service Panel.

4.5 EEPROM Set

Place cursor on the XRF Analyzer window then press Alt+Cntrl+Shif simultaneously then type “pioneer” and press “E” key. Then EEPROM Set window will appear. Make sure or edit the following items.

- 42 Ref DA Gain enter recorded value in step 4.4
- 43 Ref DA Offset enter recorded value in step 4.4
- 83 Max CPS for new cal(kCPS) 2 ; means 2000cps
- 92 SysAdj RefAdjCPSRatioFromMaxCount 1 ; means max cpsx1
- 97 SysAdj Primary filter 3 ; means Ta-50um

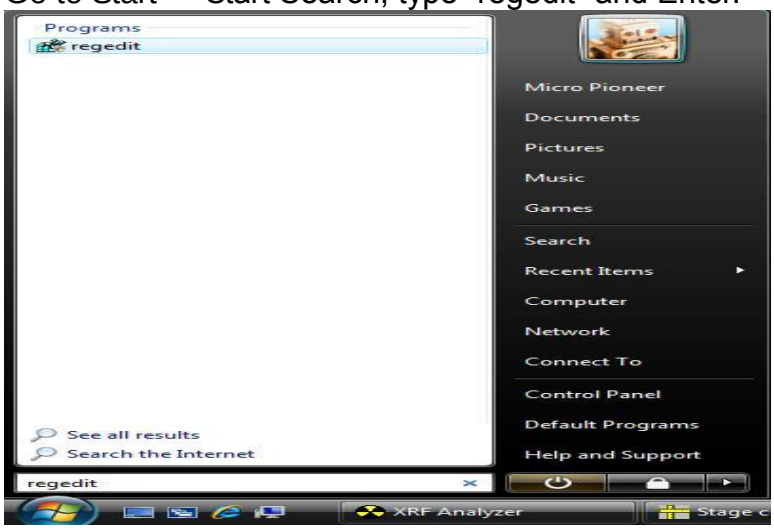




Click the Copy To Clipboard and paste to Notepad for making text file.
Send EEPROM Set' status to micropionerr@micropioneer.com
Click Save and close the EEPROM Set window.

5. Recalibrate System Adjust
   Perform Step3 Automatic System Adjust again.

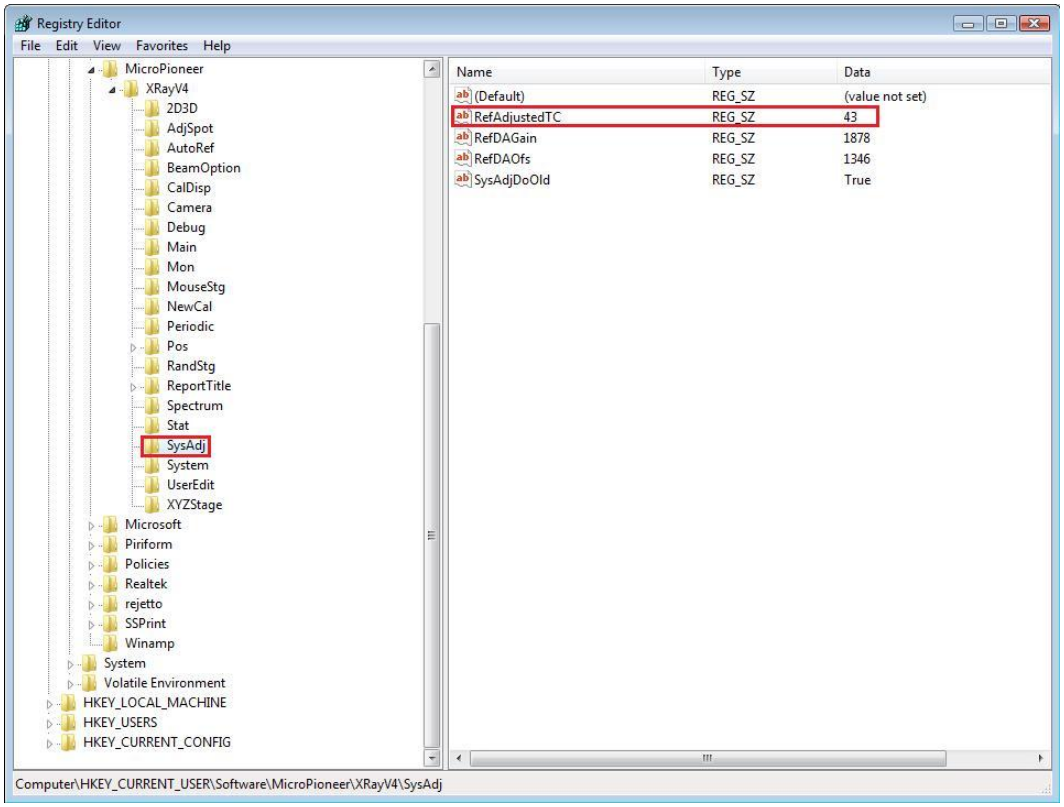
6. Registry Check
   Sometimes system adjust is not able to perform due to wrong set in registry.
   6.1 Go to Start -> Start Search, type "regedit" and Enter.



6.2 Edit Registry as follows;

1) HKEY_CURRENT_USER/Software/MicroPioneer/XRayV4/AutoRef/AutoRefIntevalTime ->
   10,240,-
   (to change System Adjust Interval=10min after power on and every 240min, - means repeat)

2) HKEY_CURRENT_USER/Software/MicroPioneer/XRayV4/Mon/Mon2KVFlag ->
   False
   (Set not to check High Voltage 2KV for the proportional Counter)

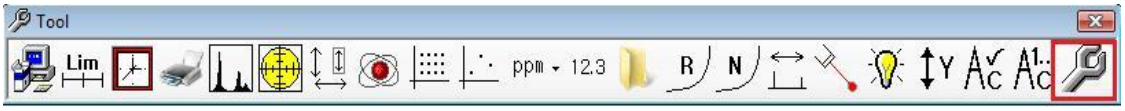


6.3 Regarding System Adjust, verify the following;
HKEY_CURRENT_USER/Software/MicroPioneer/XRayV4/SysAdj/RefAdjustedTC ->20
It is not fixed value but sometimes it goes to 255 which means maximum Tube Current so when the system adjust has problem, this value must be checked and corrected.

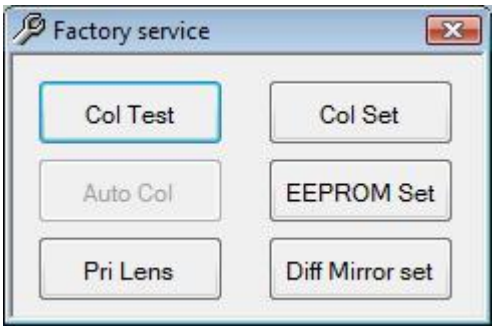
6.4 Close Registry Edit Window

C. Collimator and Primary Filter Setting

1. Getting Factory Service
   Place cursor on the XRF Analyzer window then press Alt+Cntrl+Shif simultaneously then type “pioneer” and “ok” key. Then Factory Service Menu will appear on the Tool Box.



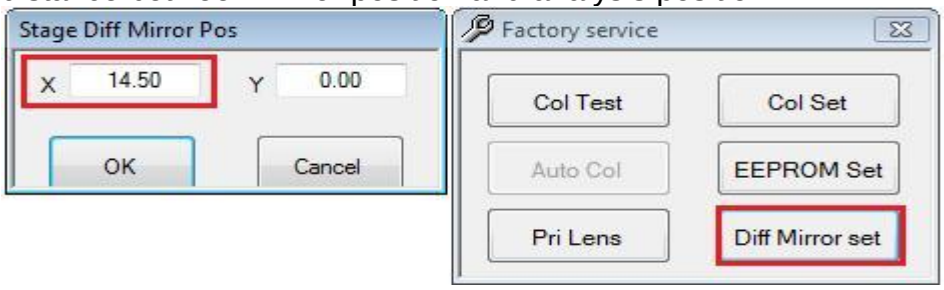
   Click Factory Service menu then Factory Service Window will appear.



2. EEPROM Set
   Click the EEPTOM Set Icon and Make sure or edit the following items.
   - 41 Filter Control 0
   - 75 Filter protect 0

   Click the Save icon to Exit.

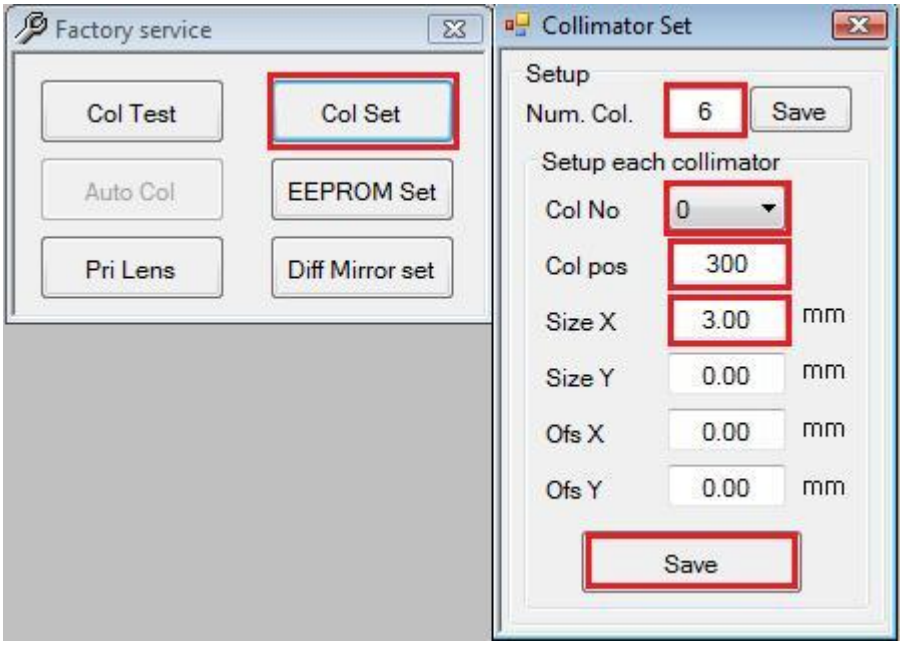
3. Diff Mirror Set
   Click Diff Mirror set icon in factory service window. X value is the distance between mirror position and analysis position.



4. Collimator Set
   - Click the Col Set Icon on Factory Service Window.
   - Enter 6 in Number of Collimator and Click Save.
   - Select Collimator No. and enter Collimator Position and Size X.
   - The Circular collimator needs only Size X and Rectangular

Collimator needs both Size X and Y value.

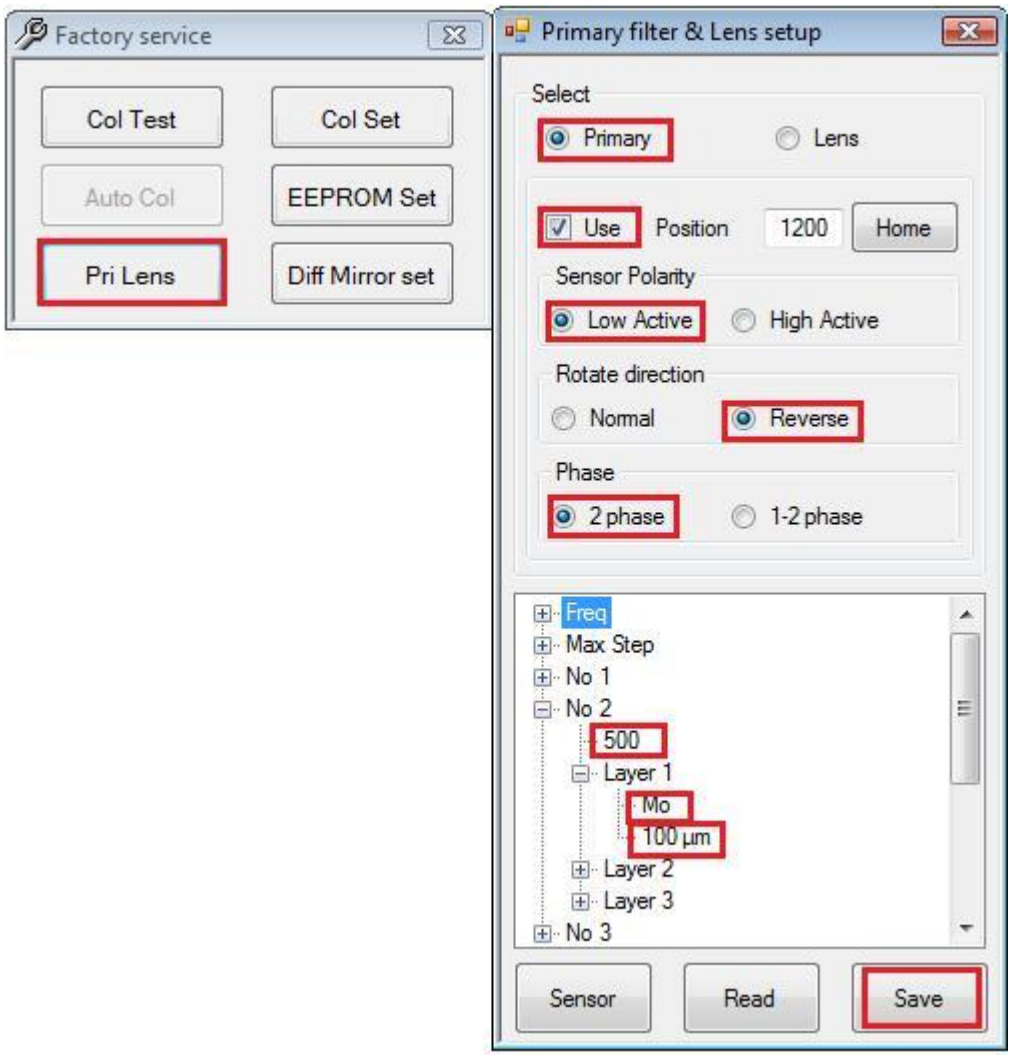
- Save to Exit.



Standard system's default values for collimators are as follows.

Col no	Col pos	Size X	Size Y
0	100	3.0	
1	1353	0.4	
2	2606	1.0	
3	3866	0.2	
4	5110	0.1	
5	6366	0.05	0.4

5. Primary Filter Set
   - Click Pri Lens Icon in Factory Service Window.
   - Make sure all settings in Primary filter & Lens setup window as shown in next figure.
   - Some system needs to change to Normal or Reverse depends on position of Filter motor in Rotate direction window.



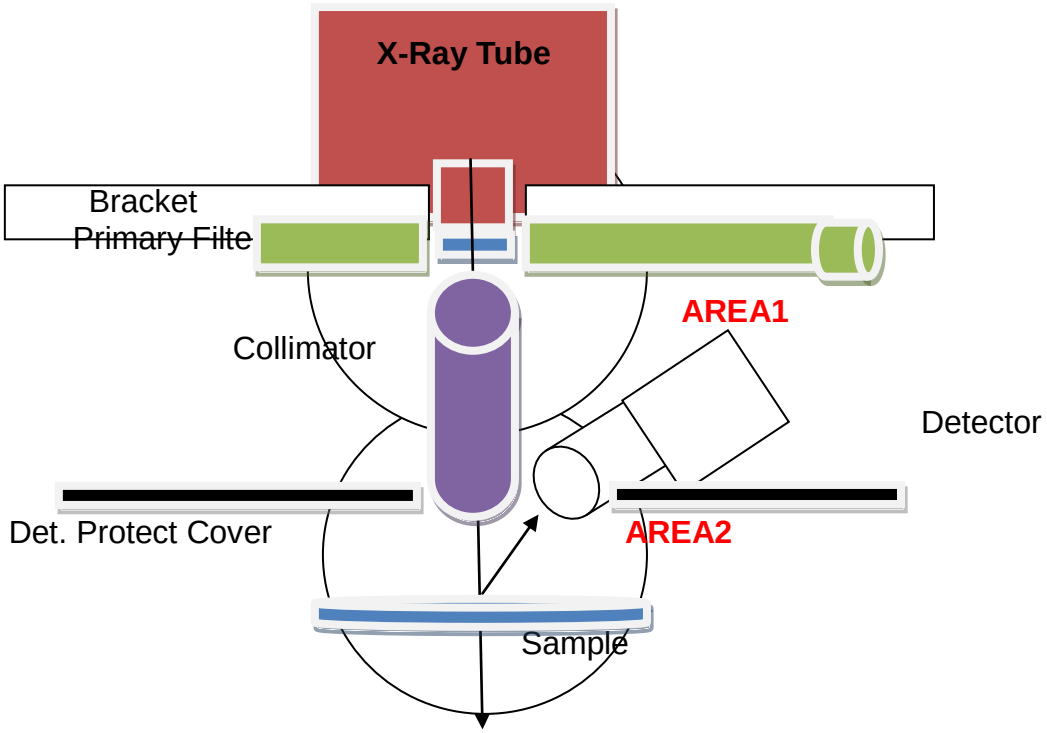
Standard system's default values for Filters are as follows.

Filter No.	position	Layer1
1	150	None 0
2	490	Mo 100
3	790	Mo 150
4	1140	Ta 50
5	1490	Ti 50
6	1820	Ni 100
7	2200	Al 50

Save to exit.

D. Low CPS Problem

The Path of X-ray must be aligned and empty space without primary filter from the X-Ray tube to the Detector.



It seems like the X-ray is not able to reach the sample because CPS is too low on your screen shot, if the X-Ray tube is working properly possible cause is one of the followings.

1) Still the collimator and filter has no good path for the X-Ray (Area1).
   - Look and check this area after remove X-Ray Tube Assembly
2) If Area1 is clear, Detector protect cover is wrong position (Area2). The cover is shading the last part of the collimator or detector.
   - Remove detector protect cover and try to acquire the spectrum but be careful about Be window of the detector.
3) Remember, more than 2,000 CPS is not good for the MCA function, so acquire with small tube current at the beginning.

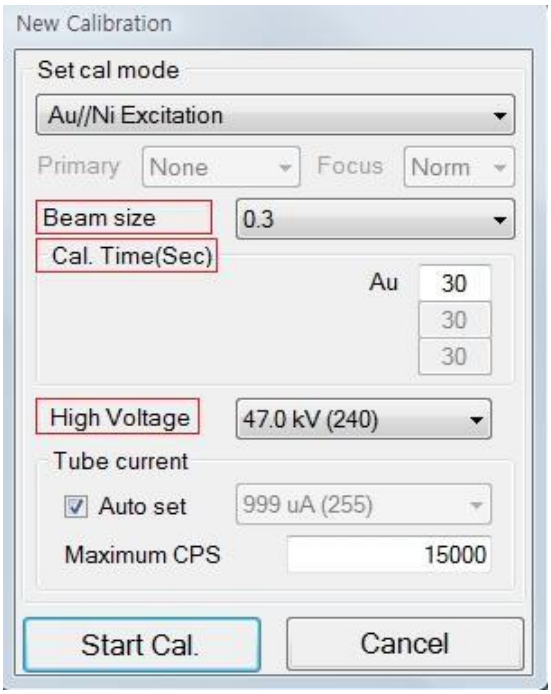
E. Installation and pre operation of XRF-2000 Series R

1. Unzip the XRayV4.zip file.
2. Install the XRayV4 software by executing the Setup.exe in XRayV4/Setup folder.
3. Copy CalFile folder from Demo Unit and paste into C:/XRay4 where XRayV4 software installed, overwrite it.
4. Edit Registry as follows;
   3) HKEY_CURRENT_USER/Software/MicroPioneer/XRayV4/AutoRef/AutoRefIntevalTime ->
      10,240,-
      (to change System Adjust Interval=10min after power on and every 240min, - means repeat)

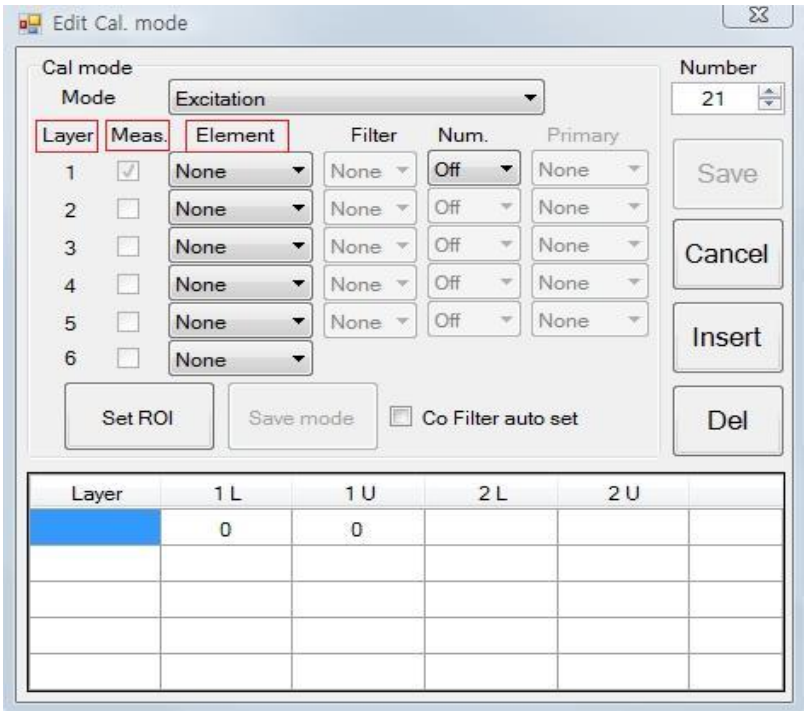
   4) HKEY_CURRENT_USER/Software/MicroPioneer/XRayV4/Mon/Mon2KVFlag ->
      False
      (Set not to check High Voltage 2KV for the proportional Counter)
5. Run XRayV4 program for the RoHS Analyzer. Password=”t”, click opening message.
6. Go to File -> Administrator Login, enter Password “t”
7. There are 7 Cal File PE, PVC, Cl in Plastic (Halogen Free), Al, Fe, Cu, and Sn for RoHS application. Basic Analysis time is 300 sec for all applications.
8. For recalibration with bad result, Click ‘R” icon on the tool window then load standard sample that we provided on the stage platform, and Start and Save. The calibration needs only one standard sample.
9. To print result report, go to Display -> Statistic -> Print -> Quantitative -> Preview or others.

F. Creating a new CAL. File

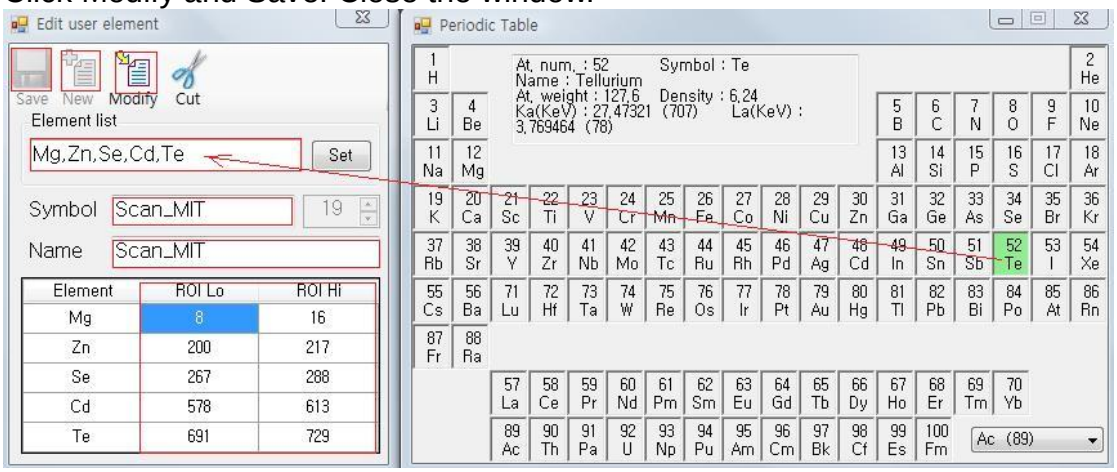
1. Click  Icon on Tool bar.
2. Click three points of Beam size, Cal. Time and High Voltage (Indicated red box area).



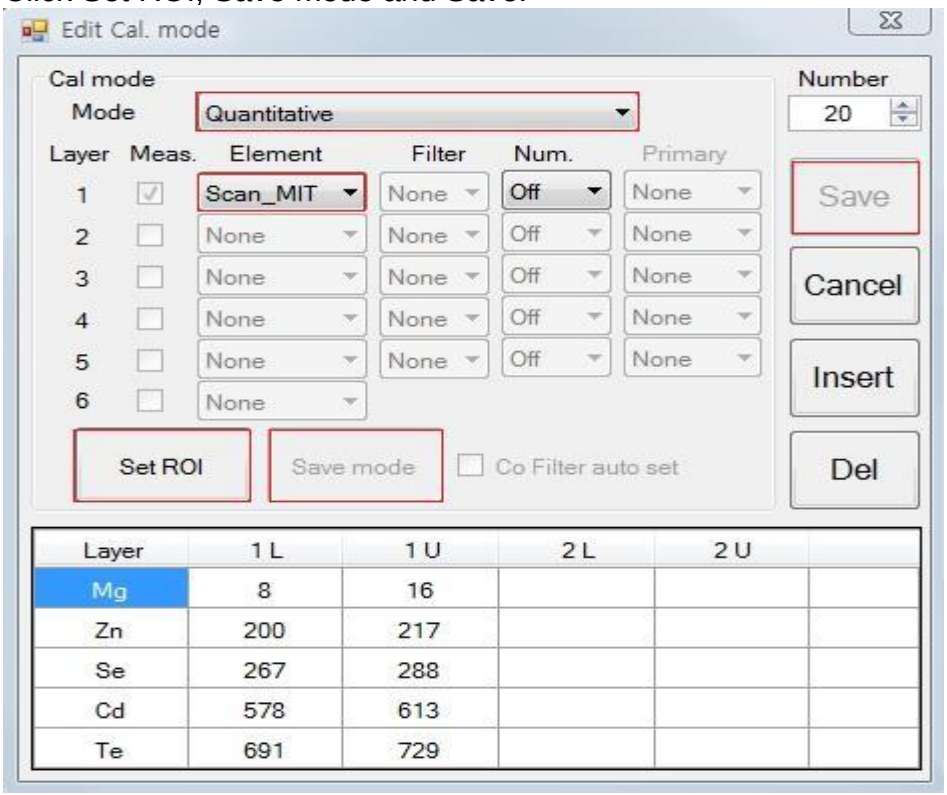
3. Click three point of Layer, Meas, and Element (Indicated red box area).



4. Click New and click and pull the element to be analyzed to element list box.
   Enter Symbol and Name for reference. Edit ROI value as shown.
   Click Modify and Save. Close the window.

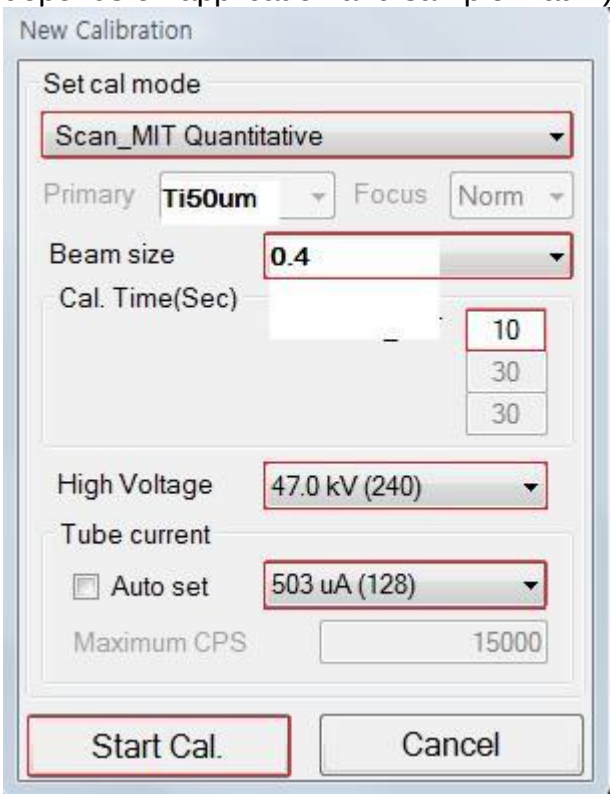


5. Set mode to Quantitative, Element to Scan_MIT that you just saved in step 4.
   Click Set ROI, Save mode and Save.

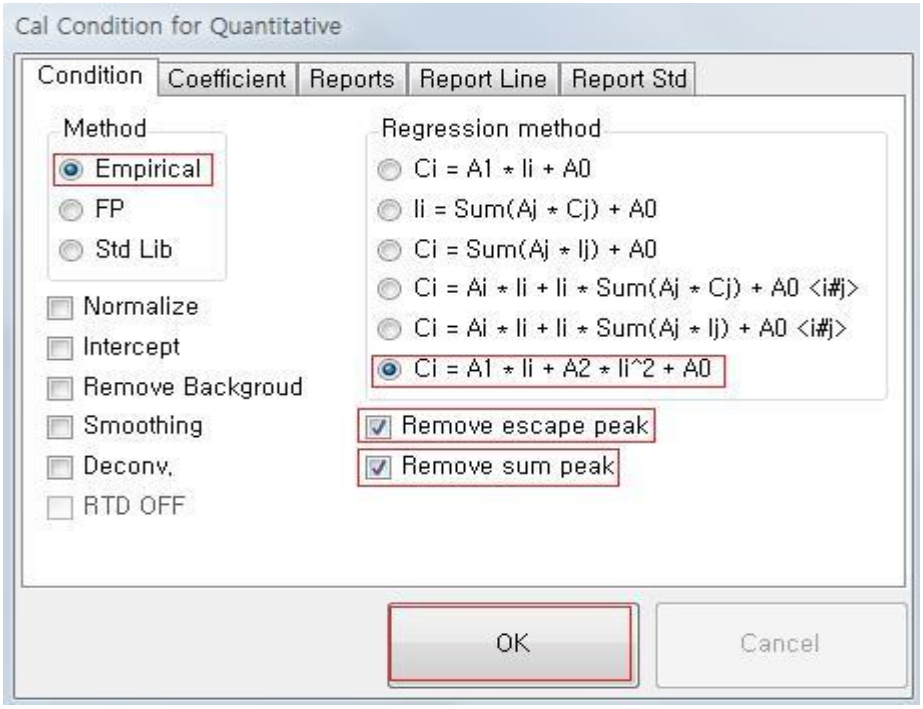


Then back to first window for new calibration as below.

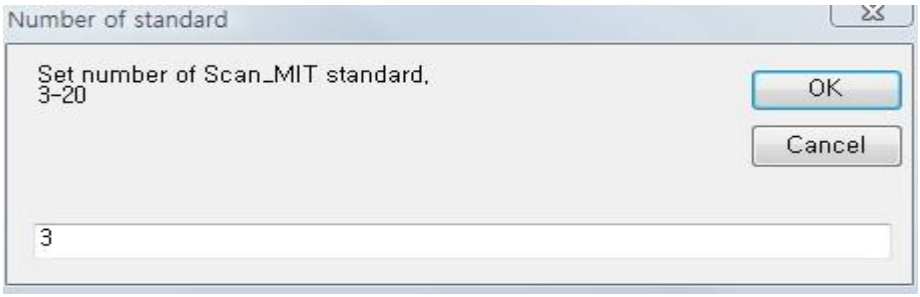
6. Set cal mode to Scan_MIT Quantitative, Primary to Ti50um, Beam size to 0.4, Cal time to 10sec (Because actual calibration will be performed later), HV to 47KV, TC to 503uA(This parameter should be pre decided depends on application and sample matrix). The click Start Cal. Button.



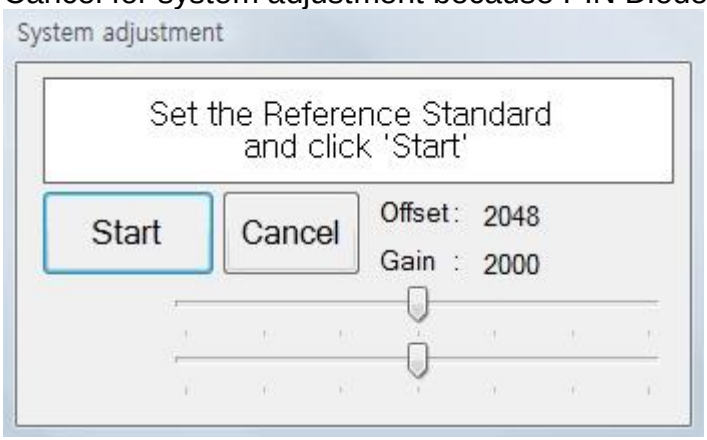
7. Set Cal Condition as shown and click OK.



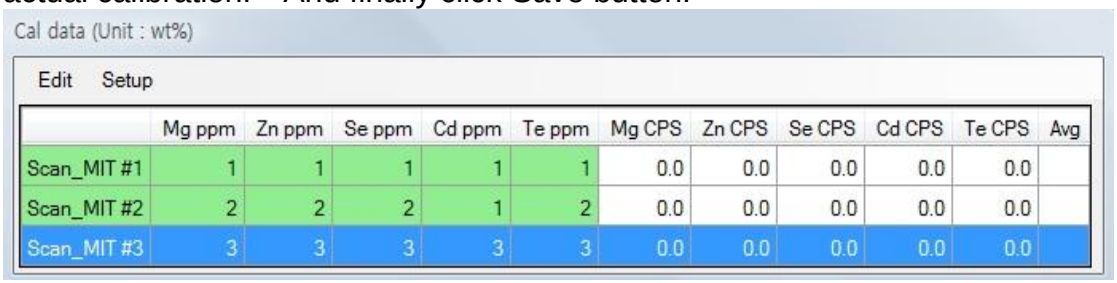
8. Click OK.



9. Cancel for system adjustment because PIN Diode detector is stable.



10. Go setup->Calibration unit ->wt%, and enter any value for standard concentration and load any sample on the stage and click Start button three times. The purpose in this step is to save the CAL. File without the actual calibration. And finally click Save button.

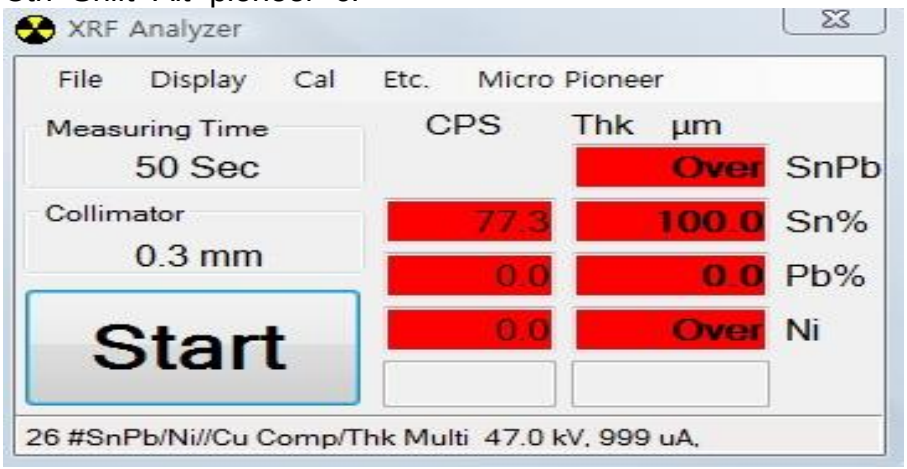


	Mg ppm	Zn ppm	Se ppm	Cd ppm	Te ppm	Mg CPS	Zn CPS	Se CPS	Cd CPS	Te CPS	Avg
Scan_MIT #1	1	1	1	1	1	0.0	0.0	0.0	0.0	0.0	
Scan_MIT #2	2	2	2	1	2	0.0	0.0	0.0	0.0	0.0	
Scan_MIT #3	3	3	3	3	3	0.0	0.0	0.0	0.0	0.0	

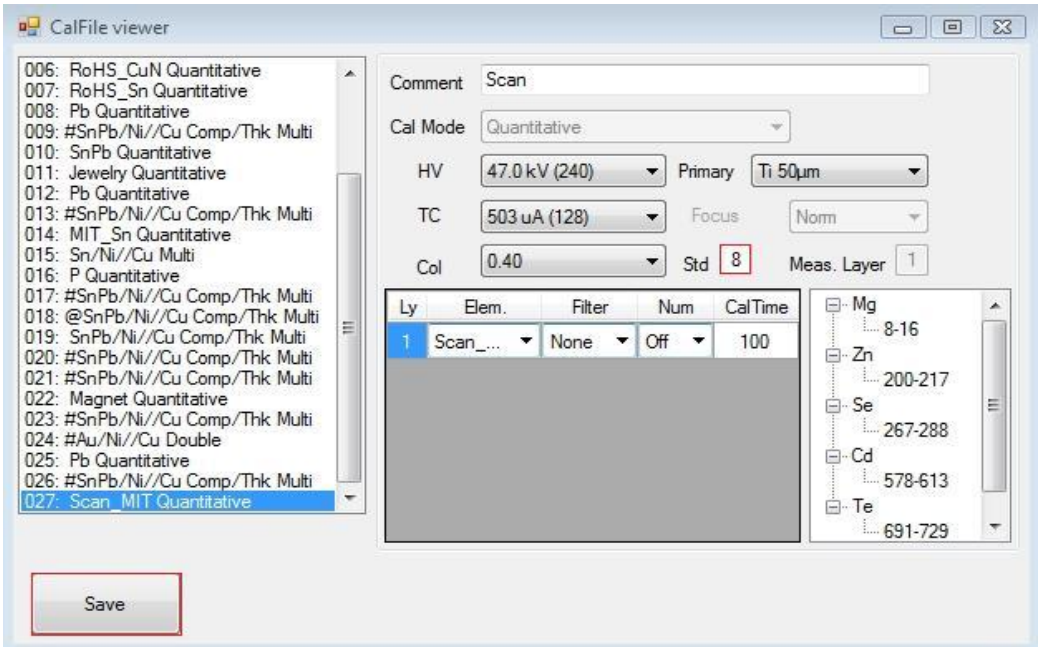
11. Click  Select Calibration file menu on tool bar and select another file to modify current file. (Any of other file such as Pb Quantitative)

21	#SnPb/Ni//Cu Comp/Thk Multi	0.3 mm	999 uA(255)	47.0 kV(240)	8/24/2009-6:47 PM	
22	Magnet Quantitative	0.3 mm	601 uA(153)	18.1 kV(92)	8/26/2009-5:20 PM	
23	#SnPb/Ni//Cu Comp/Thk Multi	0.3 mm	999 uA(255)	47.0 kV(240)	8/27/2009-1:49 PM	
24	#Au/Ni//Cu Double	0.3 mm	999 uA(255)	47.0 kV(240)	8/27/2009-5:32 PM	
25	Pb Quantitative	0.3 mm	503 uA(128)	47.0 kV(240)	8/27/2009-6:08 PM	
26	#SnPb/Ni//Cu Comp/Thk Multi	0.3 mm	999 uA(255)	47.0 kV(240)	8/28/2009-10:51 AM	
27	Scan_MIT Quantitative	0.3 mm	503 uA(128)	47.0 kV(240)	9/8/2009-5:05 PM	Scan

12. Click Start and Stop button in Main Window. Type Ctrl+Shift+Alt+pioneer+c.



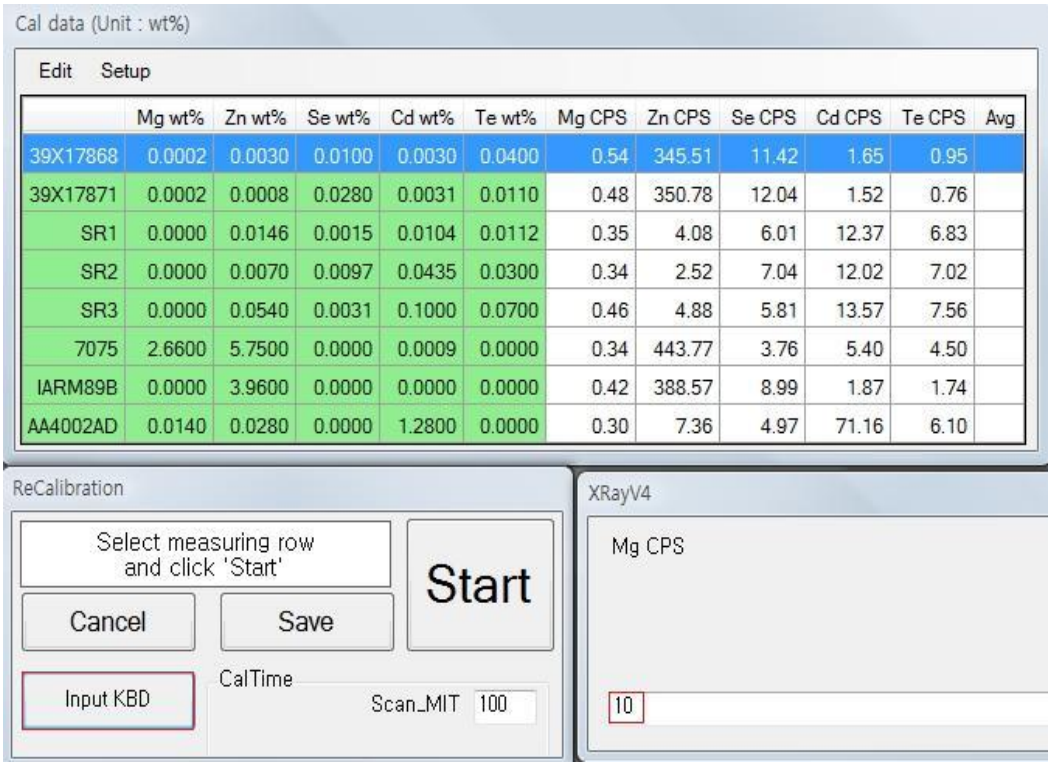
13. Change number of the standard and make sure all the parameters are same as shown below. Then click Save Button.



14. Click  Select Calibration file menu on tool bar and select modified and saved file to recalibrate.

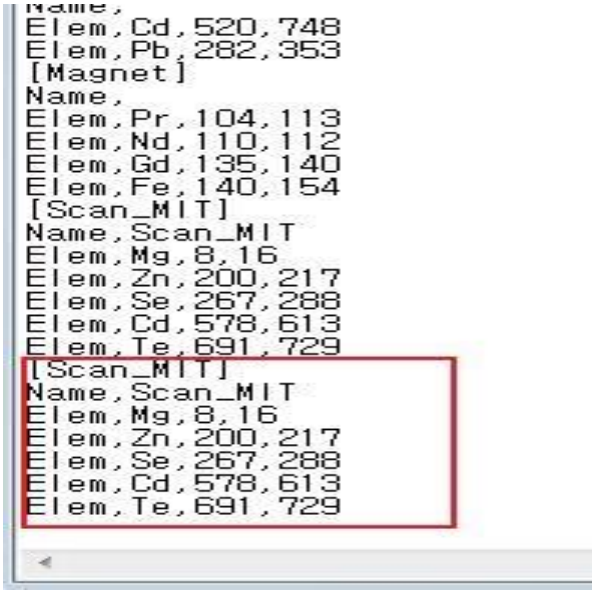
21	#SnPb/Ni//Cu Comp/Thk Multi	0.3 mm	999 uA(255)	47.0 kV(240)	8/24/2009-6:47 PM	
22	Magnet Quantitative	0.3 mm	601 uA(153)	18.1 kV(92)	8/26/2009-5:20 PM	
23	#SnPb/Ni//Cu Comp/Thk Multi	0.3 mm	999 uA(255)	47.0 kV(240)	8/27/2009-1:49 PM	
24	#Au/Ni//Cu Double	0.3 mm	999 uA(255)	47.0 kV(240)	8/27/2009-5:32 PM	
25	Pb Quantitative	0.3 mm	503 uA(128)	47.0 kV(240)	8/27/2009-6:08 PM	
26	#SnPb/Ni//Cu Comp/Thk Multi	0.3 mm	999 uA(255)	47.0 kV(240)	8/28/2009-10:51 AM	
27	Scan_MIT Quantitative	0.3 mm	503 uA(128)	47.0 kV(240)	9/8/2009-5:05 PM	Scan

15. Enter Cal data as shown and click Input KBD button then enter CPS for all standards. Click Save button.



	Mg wt%	Zn wt%	Se wt%	Cd wt%	Te wt%	Mg CPS	Zn CPS	Se CPS	Cd CPS	Te CPS	Avg
39X17868	0.0002	0.0030	0.0100	0.0030	0.0400	0.54	345.51	11.42	1.65	0.95	
39X17871	0.0002	0.0008	0.0280	0.0031	0.0110	0.48	350.78	12.04	1.52	0.76	
SR1	0.0000	0.0146	0.0015	0.0104	0.0112	0.35	4.08	6.01	12.37	6.83	
SR2	0.0000	0.0070	0.0097	0.0435	0.0300	0.34	2.52	7.04	12.02	7.02	
SR3	0.0000	0.0540	0.0031	0.1000	0.0700	0.46	4.88	5.81	13.57	7.56	
7075	2.6600	5.7500	0.0000	0.0009	0.0000	0.34	443.77	3.76	5.40	4.50	
IARM89B	0.0000	3.9600	0.0000	0.0000	0.0000	0.42	388.57	8.99	1.87	1.74	
AA4002AD	0.0140	0.0280	0.0000	1.2800	0.0000	0.30	7.36	4.97	71.16	6.10	

16. After created and recalibrate CAL File, find UserElem.Lst file in C:\XRayV4\CaFile and open that file in NotePad.
Inside red line, there is user element information that created by user. Without this information, opening CAL .File may have problem. Editing and Appending or Deleting are allowed by Notepad or other text editor.



17. ROI Data Table

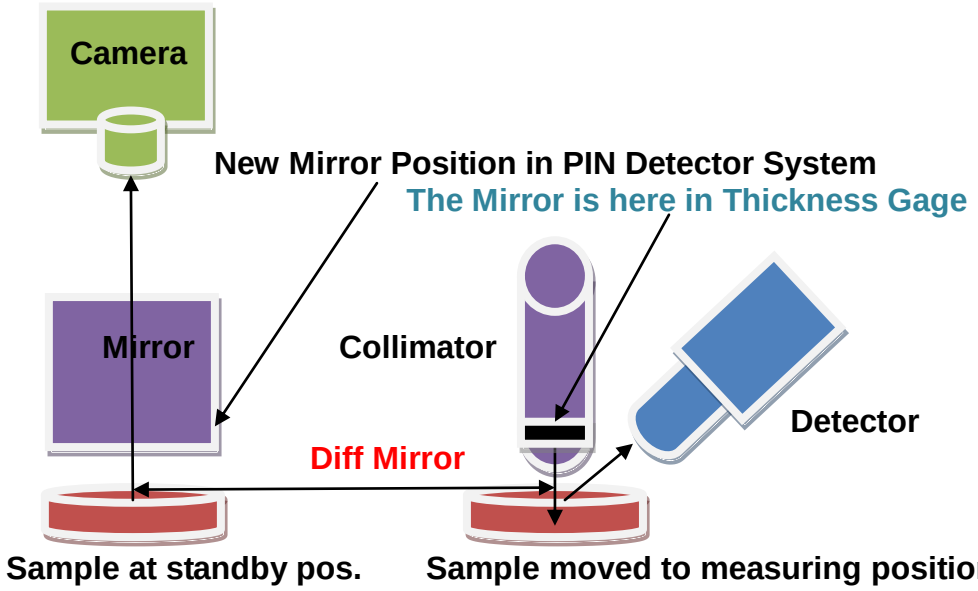
Elm	Line	eV Low	eV High	Center	CH Low	CH High	CH Center
Na	Ka	916	1165	1040	2	10	6
Mg	Ka	1126	1381	1260	8	16	12
Al	Ka	1356	1617	1480	14	22	18
Si	Ka	1606	1873	1720	21	29	24
P	Ka	1877	2152	2020	28	37	32
S	Ka	2166	2449	2310	35	45	40
Cl	Ka	2476	2767	2620	43	53	48
Ar	Ka	2807	3106	2960	52	62	57
K	Ka	3159	3466	3310	61	72	66
Ca	Ka	3533	3848	3690	71	82	76
Sc	Ka	3927	4252	4090	81	93	87
Ti	Ka	4342	4677	4510	92	105	98
V	Ka	4780	5123	4950	104	117	110
Cr	Ka	5237	5590	5410	116	129	122
Mn	Ka	5716	6079	5900	128	143	135
Fe	Ka	6216	6589	6400	142	156	148
Co	Ka	6738	7121	6930	155	171	162
Ni	Ka	7280	7673	7480	169	186	177
Cu	Ka	7845	8248	8050	184	201	192
Zn	Ka	8431	8844	8640	200	217	208
Ga	Ka	9038	9463	9250	216	234	224
Ge	Ka	9667	10102	9890	232	251	241
As	Ka	10320	10765	10540	249	269	258
Se	Ka	10992	11449	11240	267	288	277
Br	Ka	11689	12156	11920	285	307	295
Kr	Ka	12408	12887	12650	304	327	314
Rb	Ka	13149	13638	13390	324	347	334
Sr	Ka	13913	14414	14160	344	368	354
Y	Ka	14701	15212	14960	364	389	375
Zr	Ka	15512	16035	15780	386	412	397
Nb	Ka	16346	16881	16620	407	434	419

Mo	Ka	17204	17751	17480	430	458	442
Tc	Ka	18130	18689	18370	454	483	466
Ru	Ka	18993	19562	19280	477	507	490
Rh	Ka	19923	20504	20220	501	532	515
Pd	Ka	20878	21471	21180	526	558	540
Ag	Ka	21859	22464	22170	552	585	567
Cd	Ka	22863	23480	23180	578	613	594
In	Ka	23892	24521	24210	605	641	621
Sn	Ka	24949	25590	25270	633	670	649
Sb	Ka	26030	26683	26360	662	699	678
Te	Ka	27138	27803	27470	691	729	707
I	Ka	28271	28948	28620	720	760	738
Xe	Ka	29457	30146	29780	752	793	769
Cs	Ka	30619	31320	30970	782	825	800
Ba	Ka	31883	32548	32200	815	858	833
La	La	4482	4819	4650	96	109	102
Ce	La	4669	5010	4650	101	114	102
Pr	La	4861	5206	5030	106	119	112
Nd	La	5055	5404	5230	111	124	117
Pm	La	5254	5607	5430	116	130	123
Sm	La	5457	5814	5640	122	135	128
Eu	La	5665	6026	5850	127	141	134
Gd	La	5876	6241	6050	133	147	139
Tb	La	6089	6460	6270	138	153	145
Dy	La	6307	6682	6490	144	159	151
Ho	La	6530	6909	6720	150	165	157
Er	La	6792	7175	6950	157	172	163
Tm	La	6987	7374	7180	162	178	169
Yb	La	7218	7609	7410	168	184	175
Lu	La	7455	7852	7650	174	191	181
Hf	La	7697	8098	7900	180	197	188
Ta	La	7942	8347	8150	187	204	195
W	La	8191	8600	8400	193	211	201
Re	La	8444	8857	8650	200	218	208

Os	La	8700	9119	8910	207	225	215
Ir	La	8961	9384	9170	214	232	222
Pt	La	9227	9654	9440	221	239	229
Au	La	9495	9926	9720	228	247	236
Hg	La	9768	10205	9990	235	254	244
Tl	La	10045	10486	10260	242	262	251
Pb	La	10326	10771	10540	249	269	258
Bi	La	10610	11061	10840	257	277	266
Po	La	10900	11355	11130	264	285	274
At	La	11194	11653	11430	272	293	282
Rn	La	11491	11956	11720	280	301	289
Fr	La	11794	12263	12030	288	310	298
Ra	La	12101	12574	12340	296	318	306
Ac	La	12410	12889		304	327	-22
Th	La	12724	13207		312	335	-22
Pa	La	13047	13534		321	344	-22
U	La	13366	13859		329	353	-22

G. Stage Moving for the Pin Diode Detector

1) Stage moves automatically after START : This is normal.



In PIN detector system, to improve the sensitivity of detector, the mirror is located in beside collimator. Standby position provides a good path for the camera to fine the measuring area and measuring position provides a goo path to avoid attenuation of the X-Ray Energy. This will effect to detect light element such as Al, Si, S, P etc.

There is distance different in x-axis between standby and measuring position called “Diff Mirror”. The Diff Mirror can be adjusted in Factory Service Mode.
To adjust go to Factory Service Mode (Alt+Shit+Cntl+pioneerok) -> Click Diff Mirror set -> Enter X value in millimeter unit -> click OK

2) Calibration for Quantitative Analysis
Right Click XRayV4 icon on desktop -> Properties -> suffix “quan” next to XRayV4.exe, then the calibration of quantitative analysis will be activated.

3) Create a registry key
In registry editing mode go to HKEY_CURRENT_USER -> Software -> MicroPioneer -> XRayV4
Right click on XRayV4 -> New -> Key -> Type “AutoRef” ->Enter
Right Click on AutoRef (just created folder) -> New -> String Value -> Type “AutoRefIntervalTime” -> Enter
Right Click on AutoRefIntevalTime (Just created String) -> Modify -> Enter Value data “10,240,-) -> OK

Where;
10 : System adjust(Reference) will be performed 10 min after power on.
240 : System adjust will be performed every 240 min(4 hours).
- : System adjust will be repeat (do not miss this)