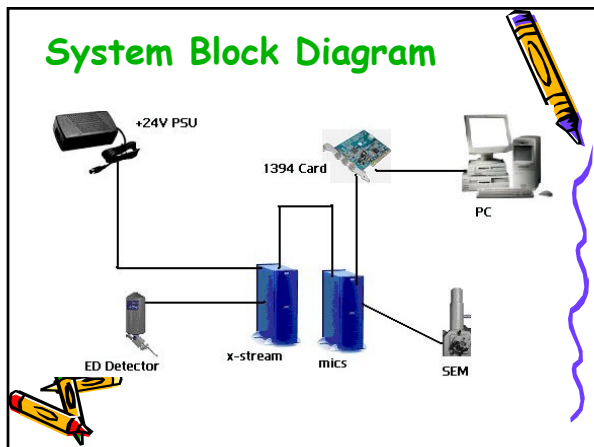


INCA ENERGY EDS TRAINING

Xiang Yang
EM Center @ SMU

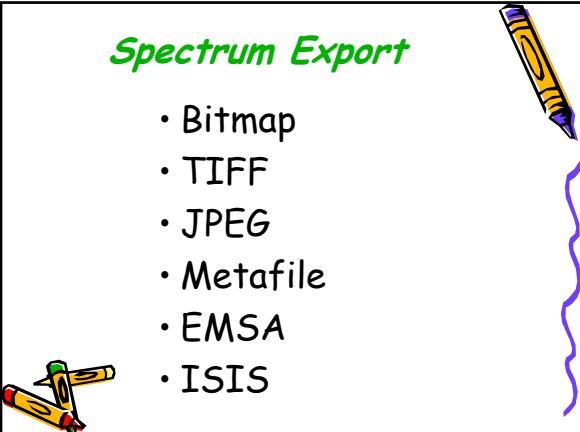


INCA Energy Software

The software interface is shown in two windows. The left window, titled 'Point & ID Navigator', displays a hierarchical tree structure for navigating through data points. The right window, titled 'Data tree', shows a list of data points with their corresponding IDs and values. A yellow crayon is shown on the right side of the software screenshots.

Spectrum Export

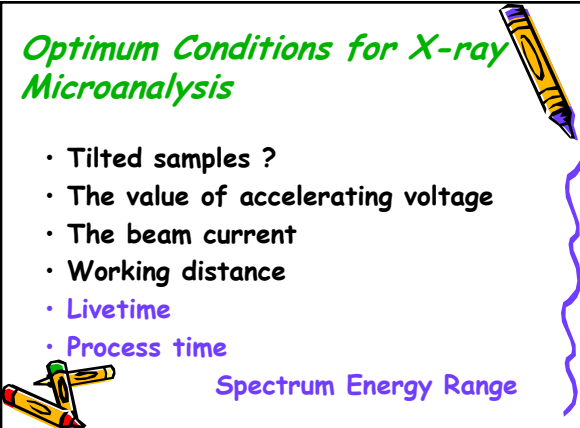
- Bitmap
- TIFF
- JPEG
- Metafile
- EMSA
- ISIS



Optimum Conditions for X-ray Microanalysis

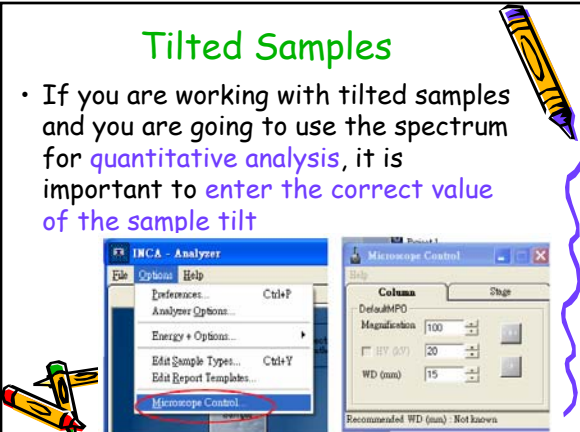
- Tilted samples ?
- The value of accelerating voltage
- The beam current
- Working distance
- Livetime
- Process time

Spectrum Energy Range



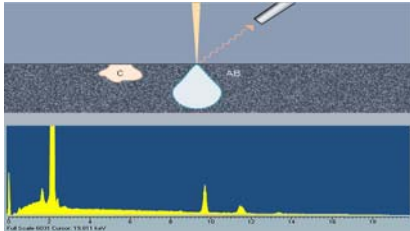
Tilted Samples

- If you are working with tilted samples and you are going to use the spectrum for **quantitative analysis**, it is important to **enter the correct value of the sample tilt**



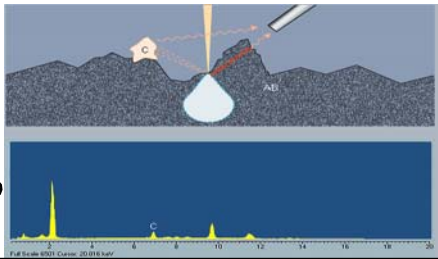
Polished sample

- Analysis from samples prepared in this way **will enable the optimum quantitative** accuracy to be achieved, thus providing the best estimate of sample composition.



Unpolished sample

- For many samples, satisfactory results may be obtained without polishing. However, where accuracy is critical it is important to be aware of the limitations and possible errors that could occur.



Accelerating Voltage

- **20kV is a good starting point**, particularly if the sample is unknown. This kV will excite most X-ray lines from most elements and these will be automatically identified in the spectrum.
- **Choose a lower kV if you are concerned about:**
 1. Accuracy of quantification of light elements since the lower penetration into the sample will reduce the absorption correction.
 2. Analysis of a small particle, inclusion or a film less than 10 μm in depth since a smaller excitation volume will enhance the contribution from these features.

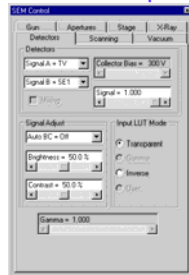


Beam Current + spot size

Goal:

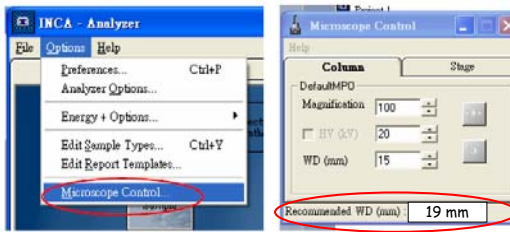
Get an acquisition rate of 2 ~ 3 Kcps

- Spot Size for X-Ray analysis: 460 to 500
- Filament: at saturated current (3.2-3.3 A)



Working distance

- Working distance, in mm, is the desired value for performing X-ray microanalysis.
- Working distance is specific to the geometry of the detector mount on the SEM chamber

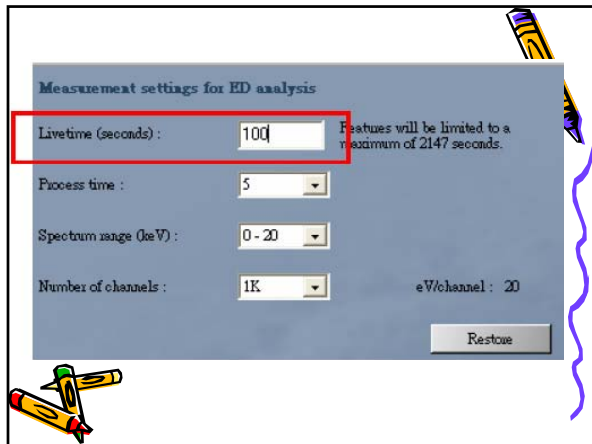


Livetime

- Livetime: this is the time for which the system is processing counts into the spectrum.
- The livetime clock runs slower than the real time clock so that the acquisition for '100' live seconds takes longer than 100 real seconds. This time is extended to compensate for the output rate being less than the input rate by the degree of Deadtime.

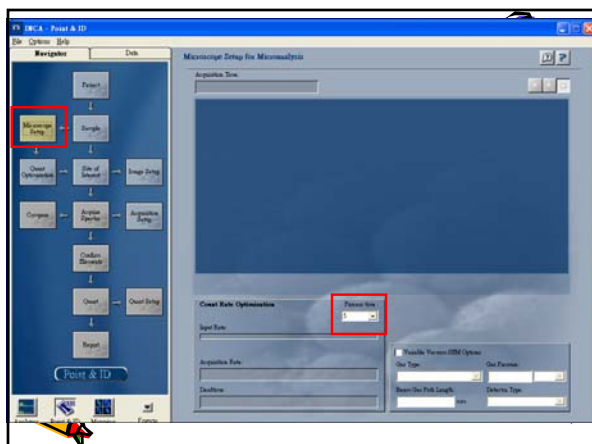
In order to get a better counts in total spectrum (over 250,000 cps), live time is recommended at 100 s when the acquisition counts is around 2-3 k cps





Process time

- Process time: the length of time spent reducing noise from the X-ray signal coming from the ED detector during processing.
- The longer the Process time, the lower the noise.
- If noise is minimized, the resolution of the peak displayed in the spectrum is improved, in other words, the peak is narrower and it becomes easier to separate or resolve, from another peak that may be close by in energy.
- The default/recommended Process Time is 5.



Spectrum Energy Range

Spectrum range keV	Number of Channels	eV/channel
0-40	2K	20
0-40	1K	40
0-20	2K	10
0-20	1K	20
0-10	2K	5
0-10	1K	10

Measurement settings for ED analysis

Livetime (seconds): Features will be limited to a maximum of 2147 seconds.

Process time:

Spectrum range (keV):

Number of channels: eV/channel: 20

Spectrum Energy Range

- The appropriate energy range should be selected in conjunction with the current microscope accelerating voltage.
- If the accelerating voltage is above 10 kV, in order to view lines, which may be excited above 10 keV, the 20 keV range should be chosen.
- Below 10KV, it may be more appropriate to choose the 10 keV range since no lines above 10keV will be excited.

Can EDS work under Low Vacuum mode?

- Generally, the pressure is adjusted in the chamber until charging just stops.
- Gas molecules can cause scattering of the beam and therefore, X-rays can be detected from other areas of the sample. Care should be taken in interpretation of the spectrum.



Basic Procedures

- Input project information (1 project = multi-samples)
- Input Sample information (1 sample = multi-spectra)
- Setup microscope to reach counts
- Quant Optimization
- Acquire Spectrum
- Confirm Elements
- Quantization
- Report



Project Information

1. Enter a name easily Project and add it to the Workspace. Current projects will remain open.

2. Change the name of your Project by typing here. The list above will display all the currently open Projects.

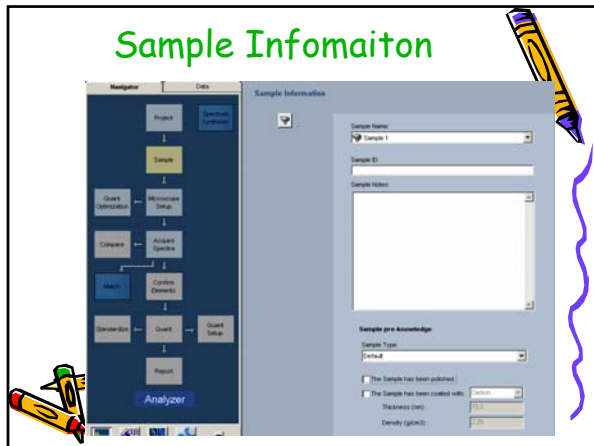
3. Your Workflows Right-click on a workflow here and it will be the Project Owner.

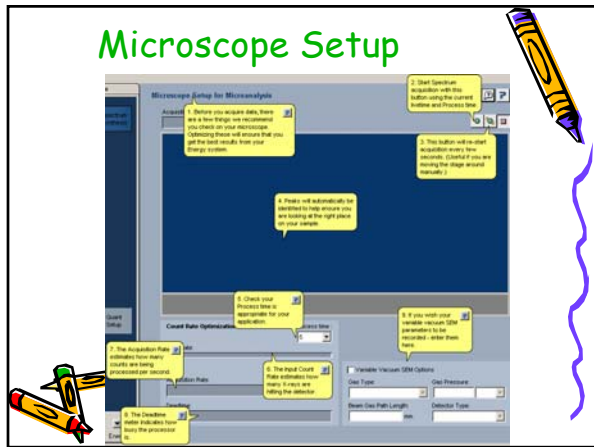
4. Use this space to record important details about the Customer of this Project, e.g. contact address, telephone numbers.

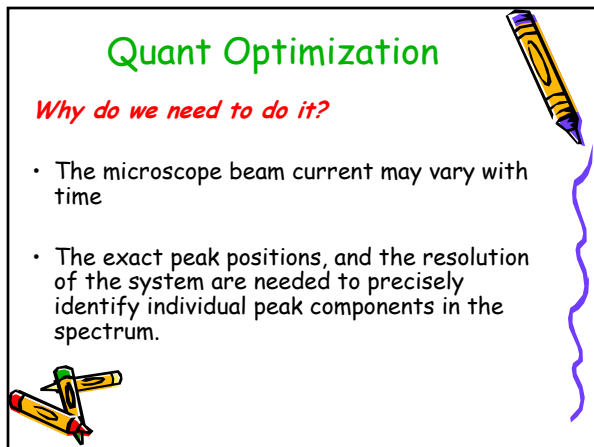
5. Record notes about the Project here.

6. Record appropriate keywords which will help you to search for this Project.









This bar shows the percentage of beam differs from the last measurement. It is recommended to wait until the number is between 93-103%

Status: Beam current is 101.583% of last value
Acquisition Time: 1.69115
Dead Time: 29%

Acquire A Spectrum

Acquire Spectra

Termination of acquisition | Spectrum conditions

Livetime (seconds): 100.00
 Preset integral: 1000

Lower limit (keV): 0.00
 Upper limit (keV): 0.00

Function keys enabled

Acquire Spectra - point & ID

Acquire Spectra - point & ID

1. Select your preference menu from the file of interest.
2. To acquire an X-ray spectrum, click one of these tools depending on whether you wish to acquire from a point or a region.
3. Select this tool if you want an indication of where the peaks are being generated from. (Point acquisition only).
4. Click on a feature or area of interest to start a new acquisition.
5. This tool estimates the incoming Acquisition Time.
6. The current Acquisition Rate is displayed here.
7. Element Peaks will be automatically identified during acquisition.
8. Press this button if you want to overwrite your spectrum with the new acquire.
9. Acquisition will stop after the set Live time (or you can use the stop button).
10. If the option is enabled, the Detector Hard Limit for the spectrum will be analysed.
11. Select this tool to show where all the spectra in this file of interest were acquired from.
12. After setting parameters for Live or Onfly, press this to enable the data.

Modes of Spectrum Acquisition



Click on this if you wish to acquire a spectrum from a point.



Click on this if you wish to acquire a spectrum from a rectangular region. By dragging the mouse, a rectangular region can be outlined on the image. A spectrum will acquire from this scanned area.



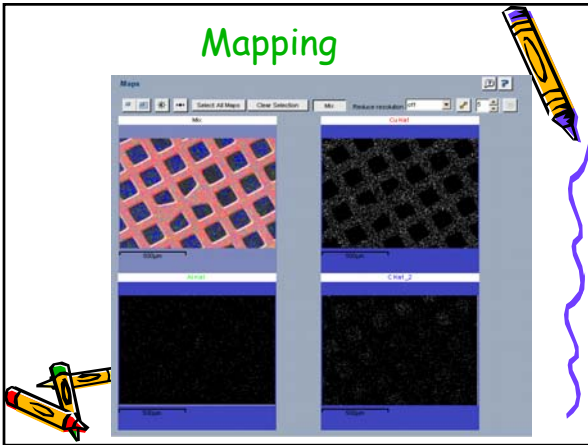
Click on this if you wish to acquire a spectrum from an automatically selected region. This region will be selected according to a grey level threshold.



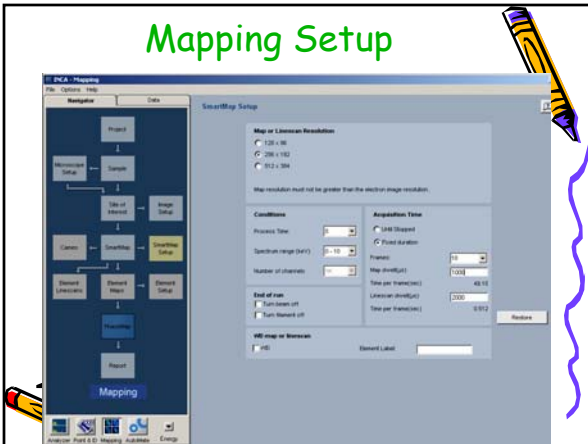
Holding down the mouse and clicking around the feature you wish to acquire over X-ray data will select the region for X-ray acquisition. Double-click with the mouse when you have completed dragging around the feature and this will automatically start X-ray acquisition from this region.



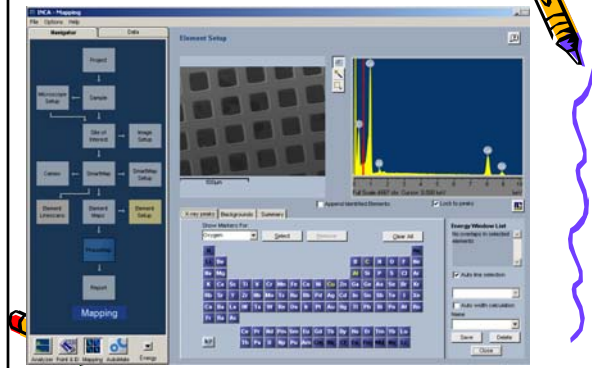
Mapping



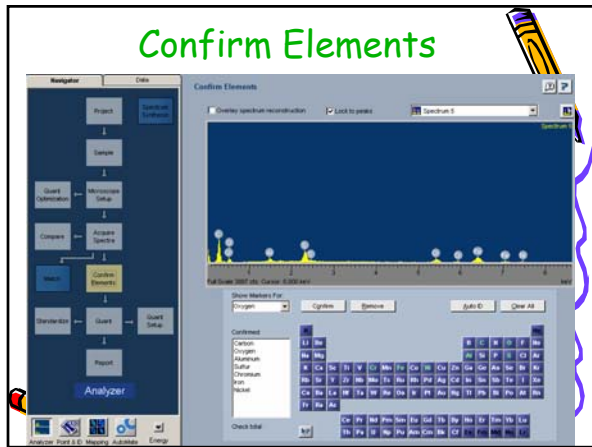
Mapping Setup



Mapping -- Element Setup



Confirm Elements



Quant

