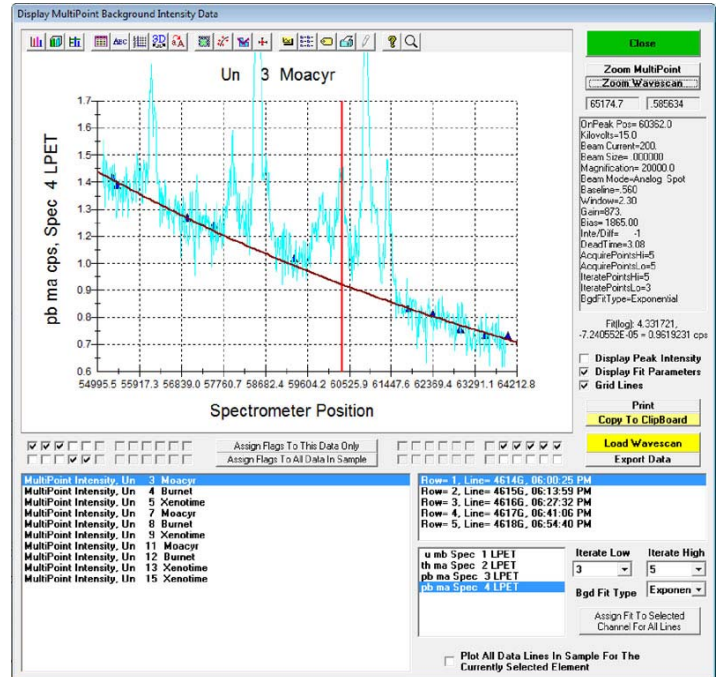


Short Guide to the Multi-Point Background

1) Introduction

The Multi-Point Background (MPB) feature allows you to acquire background intensity from up to 12 positions on both the high and low side of a peak instead of the classical two-point background acquisition. The principle is to 1) measure several backgrounds on each side of the peak, 2) iteratively determine the best background positions based on a fit model (linear, exponential or polynomial) to determine where the “true” background is present, and 3) interpolate the background value below the peak of interest to calculate the peak net intensity.

This MPB method is extremely useful when several peaks may potentially interfere with background position(s), or when a background needs to be defined as accurately as possible. Originally, this feature was requested for accurate U, Th and Pb analysis required for monazite dating at the University of Massachusetts, Amherst (M.L. Williams, M.J. Jercinovic and J. Allaz). This guide utilizes U and Pb measurement as an example, but any other elements may be considered. Only the setting and the processing of MPB are reviewed here, the rest of the setup for quantitative analysis is as described in Probe for EPMA help file, quick start manual and associated documents.



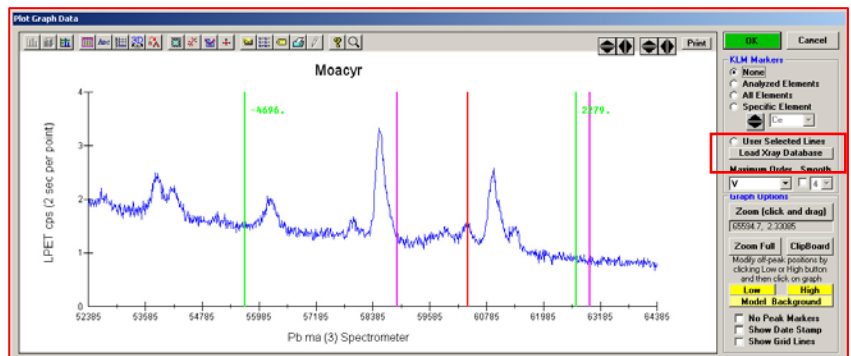
2) Setting MPB positions

Before setting up a MPB analysis, it is highly recommended to acquire a WDS step scan (using a count time per step top yield reasonable precision, say 5 to 30 seconds per point) to assist in determining the MPB positions.

There are two methods one can use the select the multi-point background positions. One can use the above wavescan sample to graphically specify the MPB positions using the Model Background dialog from the wavescan plot. Or one can manually enter the MPB positions determined from the above wavescan plot (or another method).

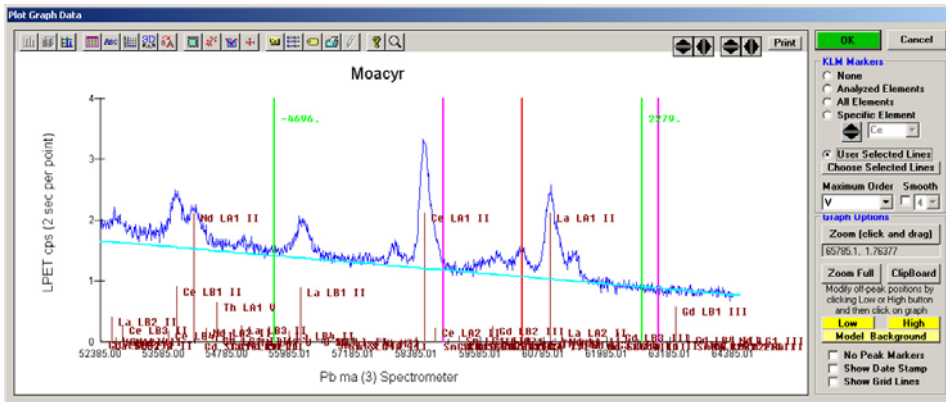
Graphical selection of MPB positions

To select MPB positions graphically, first display the wavescan from the “Plot!” window by selecting “Wavescans” from the “Sample List” options, then select the wavescan to plot, then select the element spectrometer and intensity items, then click “Output”. You should see something like the plot on the right:



Then adjust the size and shape of the

“Plot Graph Data” window and select the KLM markers that you want displayed (if desired). The KLM markers could be simply the “Analyzed Elements” or the “User Selected Lines” option marked in red outline.



Strip Line	Angstroms	Energy	Intensity	Reference
U SLA3-Z IV	5.57225	8.98020	5.60000	JD
Ba LA2 II	5.57238	4.45000	9.08000	JD
Ca LK8 IV	5.57248	4.40000	7.14300	JD
Ca SK8 IV	5.57276	8.93700	6.40000	JD
U SLA2-Z IV	5.57290	8.93700	5.57290	JD
Ce SK8 II	5.57709	4.44500	0.00000	JD
Zr LB2 II	5.58744	2.21300	1.77000	ES
U SLA5 IV	5.58839	8.97400	6.40000	JD
Nd SLG1 III	5.58854	6.65570	5.00000	JD
U SLA2-Z III	5.58987	6.95200	5.00000	JD
Au SM3 IV	5.59221	2.21710	1.00000	ES
Cu SK4 IV	5.59394	8.95700	6.40000	JD
Pb LB1 V	5.60899	11.86300	10.22000	JD
Au SM2 I	5.60937	2.21220	1.00000	ES
Hg SMA4 IV	5.60963	2.21180	1.00000	ES
Lu LB3 IV	5.60970	8.94500	8.28200	JD
U LK2 IV	5.61020	8.94000	2.27700	JD
Hg SMA3 I	5.61223	2.20920	1.00000	ES
La LB1 II	5.61401	4.41700	23.7500	JD
Au SM1 I	5.61452	2.20820	1.00000	ES
Tb SLR2-Z IV	5.61797	8.92940	6.40000	JD
Hg SMA2 IV	5.61981	2.20630	1.00000	ES
Eu LB6 III	5.62122	6.61700	7.00000	JD
Pb LK3 III	5.62284	6.61510	1.00000	JD
Au MB IV	5.62420	2.20450	59.4430	ES
Nd SLG1 IV	5.62637	6.61460	6.40000	JD
Cu SK8 IV	5.63122	8.93700	6.40000	JD
Hg SMA1 I	5.63297	2.20130	1.00000	ES
Zr LB3 IV	5.63314	2.20100	5.21300	ES
U LK2 III	5.63420	4.40110	3.35000	JD
Nd LK1 III	5.63472	6.61010	3.95000	JD

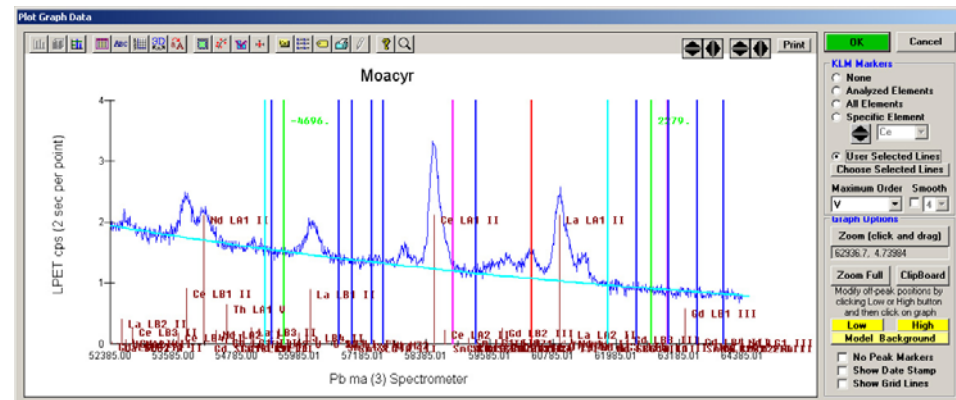
For the latter option, click the “Choose Selected Lines” button to select the lines to display.

The “Periodic Table” button makes it easy to only select the specific elements you want to display in the “Plot Graph Data” window.

Once the selected lines or elements are selected simply click the “Graph Selected” button to plot the desired lines on the wavescan graph and seen to the left:

Now use the “Model Background” button to open the “Model Background” dialog to graphically display the background fitting options as seen here and then change the “Off-Peak Background Type” from “Linear” to “MultiPoint”.

By selecting the “Low MultiPoint” and/or “High MultiPoint” drop down lists and using the “+/-” buttons one can control the placement of the MultiPoint backgrounds simply by clicking with the mouse as shown to the right.



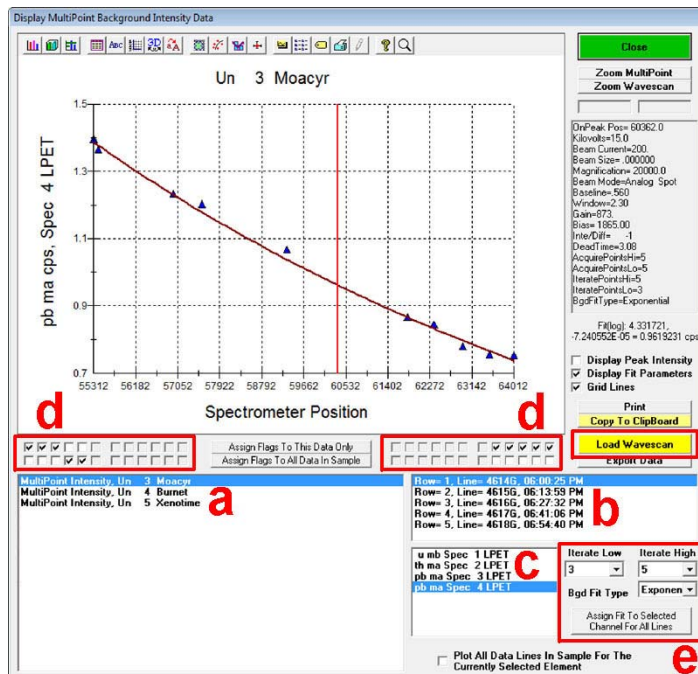
Once you are finished you may end up with a selection of MPB positions as shown in the graph to the left.

Remember, these MPB positions are nominal in the sense that the intensities at these positions will be acquired but they will only be used in the iterated MultiPoint background fit to calculate the interpolated background intensity under the peak, if they meet the background model fit criteria.

3) Re-Processing MPB

Once the MPB sample intensities have been acquired, the user can simply analyze the data from the Analyze! window with no further interaction. The program will automatically optimize the acquired MPB intensities to determine the best fit using the selected fit model (linear, exponential or polynomial). However, sometimes it is interesting to graphically evaluate the MPB fitting manually.

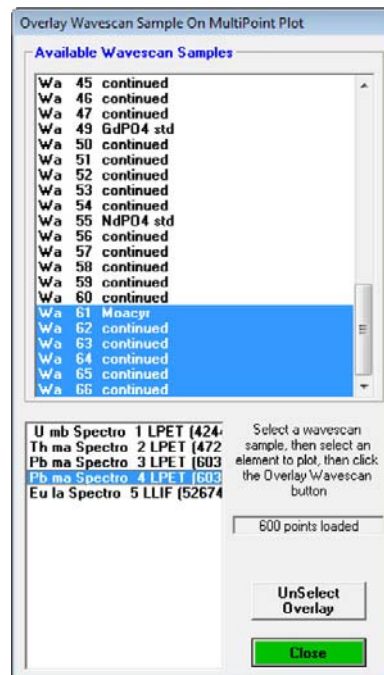
To see how the MPB intensities are being fitted by the program (and to manually override the program optimization if desired), simply open the MPB results window in the “Run / Display Multipoint Background Intensities” menu...



- a) Select an unknown to check the background.
- b) Select an analysis line in this unknown.
- c) Select an element to show the results of the MPB acquisition. In this example, the Pb M α on spectrometer 4 is selected. The program will automatically fit the MPB intensities based on the selected fit model and display the iterated best fit. This is done by iteratively removing one point at a time (the one with the highest fit variance) from the measured MPB intensities until only the number of iterated points specified remains.
- d) Check top or bottom boxes below the plot to force including or excluding a value, respectively. Once you are pleased with the MPB fit options, click on “Assign Flags To This Data Only” or “Assign Flags To All Data In Sample” buttons to validate your choice for the current or for all measurements in the sample, respectively. In this example, we have excluded the two backgrounds situated on the left side of the peak (indicated with a red vertical line), while all other values are included.
- e) Enter the number of points to iterate from high and low background in the “Iterate Low (and High)” boxes. The default value is the one you entered in your setup. Naturally, the number of points you excluded may limit this value, i.e. if you exclude 2 of 5 points you cannot iterate more than 3 points. You can also modify the fit type in the “Bgd Fit Type” list.
- f) Click on the “Assign Fit To Selected Channel For All Lines” button to validate your choice. This will apply the number of iteration points and the background fit type to ALL measurements of this specific element from the current analysis (here, applied to analysis rows 1 to 5).
- g) By default, a fitting curve will be interpolated using the number of points you entered in “Iterate Low (or High)”. Only the lowest value will be used to fit this curve. If a point is anomalously low, use the checkbox below the graph to exclude this point.
- h) The window on the right of the plot summarizes the analysis setup. On the bottom of this window, the interpolated background intensity value is given (i.e. background value at the peak position).

i) If you have acquired a wavescan, you may overlay it on the MPB results to obtain a plot similar to the one displayed at the beginning of this document:

- Click on “Load Wavescan” and select the wavescan you want: click the first line of the wavescan, hold [shift] key and click the last entry named “continued” to select the entire wavescan.
 - In the lower box, select the element on which you want to overlay a wavescan (here Pb M α on SP 4) and click on “Close”.
 - To remove the overlay, click on “Unselect overlay” button.
- You can copy the plot results to the clipboard or export the data for the current plot in a text file.
 - To export all MPB data from your current run to a single ASCII file or Excel spreadsheet, choose the “Output / Save Multi-Point Position and Intensity Data” menu.



Note: The plot window in the MultiPoint plot dialog works as any other plot window in Probe for EPMA. You can zoom in by clicking-and-dragging, change plot setting with the buttons on the top... You can also zoom on the multipoint values or on the wavescan using on of the buttons “Zoom Multipoint” or “Zoom Wavescan”

Note: A versatility of the MPB feature is that you can still come back to your element setup (after analysis) and change the background setting from MPB to the normal off-peak background interpolation using linear or exponential or... Then, Probe for EPMA will re-calculate the background using the total MPB intensities on low and high side of the peak and get a two point linear or exponential fit.

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05/2010