

Spectrometer Settings

Spectrometer Settings

Method, Spectrometer tab

Method - Ni

General | Sequence | Spectrometer | Flame | Calibration | QC

Ni

Measurement Mode: Absorption Cook Book

Number of Resamples: 3 High Resolution

Fast Resamples Background Correction: D2 Quadline

Measurement Time: (s) 4.0

Wavelength: (nm) 232.0

Lamp Current: (%) 75 Flier Rejection

Bandpass: (nm) 0.1 Use Flier Rejection

Optimize Spectrometer Parameters Rejection Limit: (%) 95

Signal: Continuous RSD Test

Transient Peak Measurement Use Test

Measure From (s): 0.00 To: 4.00 If RSD greater than 0 %

AND signal greater than 0.1 Abs


Then Flag and Continue

OK Cancel Help

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Measurement Mode: Absorption

Number of Resamples: 3

Fast Resamples

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Lamp Current: (%) 75

Bandpass: (nm) 0.1

Optimize Spectrometer Parameters

Signal: Continuous

Transient Peak Measurement

Measure From (s): 0.00 To: 4.00

High Resolution

Background Correction:

Flier Rejection

Use Flier Rejection

Rejection Limit: (%)

RSD Test

Use Test

If RSD greater than

AND signal greater than

Then

Absorbance or Emission

Number or readings to be averaged

If checked, no reference measurement between readings.

The width of the spectrum that the detector will measure

This feature allows the system to optimize the lamp current, band pass, measurement time and in some cases the wavelength, to obtain the most appropriate conditions for your particular analysis, based on the absorbance signal measured from a typical sample solution .

Spectrometer Settings

The screenshot shows a software window titled "Method - Ni" with several tabs: General, Sequence, Spectrometer, Flame, Calibration, and QC. The "Spectrometer" tab is active. The settings for the Spectrometer are as follows:

- Measurement Mode: Absorption
- Number of Resamples: 3
- Fast Resamples:
- Measurement Time: (s) 4.0
- Wavelength: (nm) 232.0
- Lamp Current: (%) 75
- Bandpass: (nm) 0.1
- Optimize Spectrometer Parameters:
- Signal: Continuous
- Transient Peak Measurement: Measure From (s): 0.00, To: 4.00

A "Cook Book" window is open, displaying information for Nickel (Ni). The window has tabs for Spectrometer, Flame, and Furnace. The "Spectrometer" tab is selected. The information displayed is:

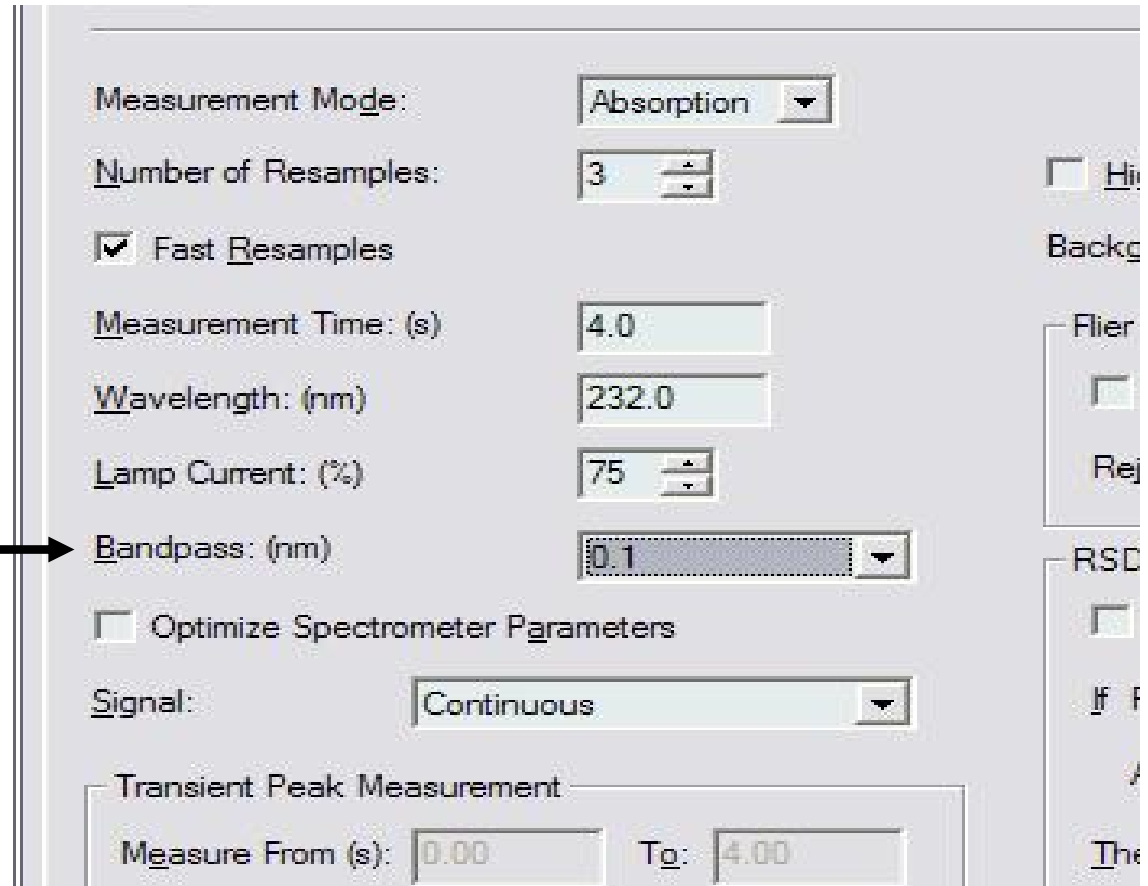
nickel		Ni	
Atomic no.	28	Atomic mass	58.71
Primary wavelength	232.0nm	Bandpass	0.2nm
Lamp current		Performance	
normal use	75%	flame characteristic concentration	0.05mg/L
best sensitivity	50%	furnace characteristic mass	3.6pg
best precision	100%		
Emission wavelength	341.5nm		
Secondary wavelengths		Sensitivity reduction	
305.1nm		4X	
231.1nm		2X	
341.5nm		2X	
234.6nm		4X	
346.2nm		8X	
351.5nm		12X	
303.8nm		12X	
233.8nm		25X	

The Cook Book displays helpful information on an element-by-element basis. Other elements are accessed through the Cookbook Index

Spectrometer Settings

There are two main implications regarding changing the bandpass:

- 1) Opening the bandpass will allow more radiation to reach the detector. This will improve the signal-to-noise ratio. However:
- 2) Opening the bandpass may let more than one wavelength reach the detector. These additional wavelengths may not be absorbed by the analyte; in this case there will be a reduction in linear range because non-absorbed lines reach the detector unattenuated by the analyte.



The screenshot shows a software interface for spectrometer settings. The 'Bandpass: (nm)' field is highlighted with a dotted border and has an arrow pointing to it from the text on the left. Other settings include: Measurement Mode: Absorption; Number of Resamples: 3; Fast Resamples: checked; Measurement Time: 4.0 s; Wavelength: 232.0 nm; Lamp Current: 75%; Optimize Spectrometer Parameters: unchecked; Signal: Continuous; Transient Peak Measurement: Measure From (s): 0.00, To: 4.00.

The objective, then, is to use a bandpass as wide as possible in order to give the best signal-to-noise ratio; but not so wide that more than the primary wavelength passes to the detector.

Spectrometer Settings

The bandpass is also implicated in performing background correction with the deuterium arc.

Looking at the diagram we can see that the arc will emit radiation over the entire bandpass (a). Not so for the hollow cathode lamp which emits radiation for only a very narrow range of the bandpass. Background will attenuate both the arc and the HCL radiation by the same amount (b). Analyte will effectively only attenuate the HCL radiation (c).

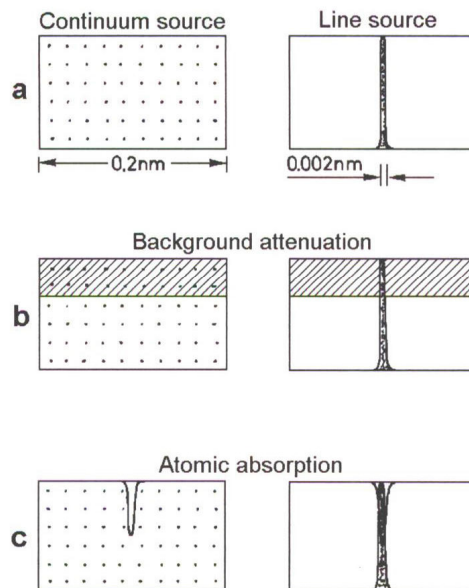


Figure 3-15. Mode of function of continuum source background correction. **a** – The radiant intensity, represented schematically by dots, for the continuum source is distributed over the entire width of the spectral band isolated by the slit (e.g. 0.2–2 nm), while for the line source it is limited to a few picometers. **b** – Broad band background attenuates the radiation emitted by both sources to equal degrees. **c** – Atomic absorption, which again is limited to a few picometers, in the first approximation attenuates only the radiation from the line source.

From *Atomic Absorption Spectrometry*, B. Welz and M. Sperling, Wiley-VCH

Spectrometer Settings

Consider a bandpass of 200 pm (0.200 nm). The emission from the D₂ arc will fill the entire bandpass because it is a broadband emitter. Analyte atoms will not absorb much of this radiation because they only absorb over a very small spectral range ~0.002 nm. The maximum, therefore, that the analyte will change the D₂ emission is only 1 %; i.e. 0.002 nm out of the 0.200 nm. Background absorbers on the other hand will absorb the D₂ arc over the entire bandpass. Effectively, then, the D₂ light is only absorbed by background and not by the analyte. The HCL light on the other hand is absorbed by both analyte and background

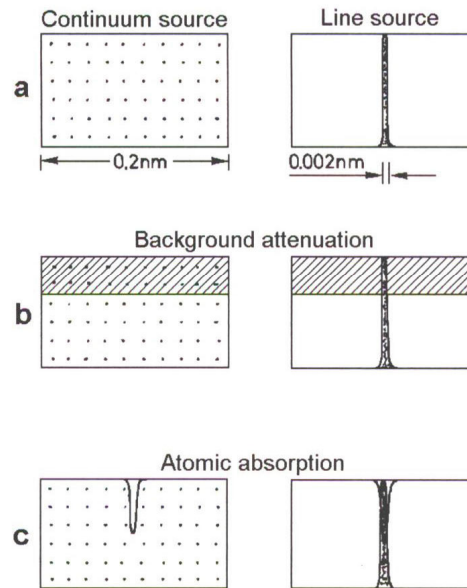


Figure 3-15. Mode of function of continuum source background correction. **a** – The radiant intensity, represented schematically by dots, for the continuum source is distributed over the entire width of the spectral band isolated by the slit (e.g. 0.2–2 nm), while for the line source it is limited to a few picometers. **b** – Broad band background attenuates the radiation emitted by both sources to equal degrees. **c** – Atomic absorption, which again is limited to a few picometers, in the first approximation attenuates only the radiation from the line source.

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Absorbance or Emission

Some elements can easily be run in the emission mode. Group 1A elements –Li, Na, K, Rb, Cs-- emit light at relatively low temperatures and are often run by emission.

- In emission mode, there is no HCL. Emission is made from solutions containing the analyte
- The burner head is rotated 90° yielding the shortest path length across the burner.

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General | Sequence | Spectrometer | Flame | Calibration | QC



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Fast Resamples

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Wavelength: (nm) 232.0

Lamp Current: (%) 75

Bandpass: (nm) 0.1

Optimize Spectrometer Parameters

Signal: Continuous

Transient Peak Measurement

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High Resolution

Background Correction:

Flier Rejection

Use Flier Rejection

Rejection Limit: (%)

RSD Test

Use Test

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AND signal greater th

Then