Performance PerSPECtives

Waters 996 Photodiode Array Detector "No Compromise" Performance

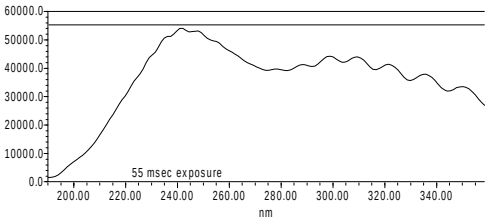
Maintain chromatographic sensitivity and spectral differentiation throughout lamp life

Waters Lamp Optimization Software

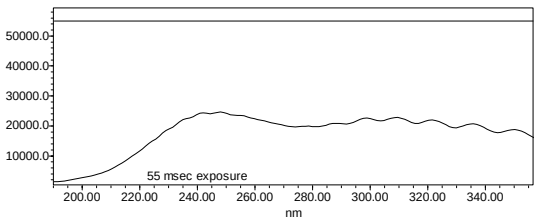
When a photodiode array detector lamp ages, chromatographic sensitivity may decrease and baseline noise levels increase due to reduced lamp energy. To prevent collecting unacceptable data, chromatographers often replace the detector lamp after a predetermined time interval (e.g., > 2000 hrs). By comparison, several manufactures' suggest a more "cost effective" approach to the problem of low lamp energy. Rather than replacing moderately aged lamps, they recommend changing the detector slit within the detector optics bench (e.g., replace a 50um with a 100um slit). This would effectively allow more of the available light to reach the flowcell. While use of a larger slit can effectively maintain acceptable signal-to-noise performance with an older lamp, it also affects the quality of the collected spectra (i.e. reduces true optical resolution) by focusing a wider band of light onto the collecting array of diodes (See pages 6 and 7 in Waters' Literature Piece WB062 (April 1998) entitled: "Waters 996 Photodiode Array Detector")

To assure consistent, "no-compromise" performance throughout the useful life of a 996 PDA detector lamp, Waters 996 Lamp Optimization Software automatically maintains a minimal noise level throughout the useful life of the lamp (i.e, while it still passes the lamp energy diagnostic tests). Waters Lamp Optimization Software automatically selects an appropriate exposure time for the photodiodes based on the lamp energy, mobile phase and wavelength range for the analysis. This optimization is performed before each injection, requires no adjustments to the detector operating current, diode resolution, or slit width. The data below demonstrates how Waters Lamp Optimization technology provides optimal chromatographic sensitivity for lamps of various energy states.

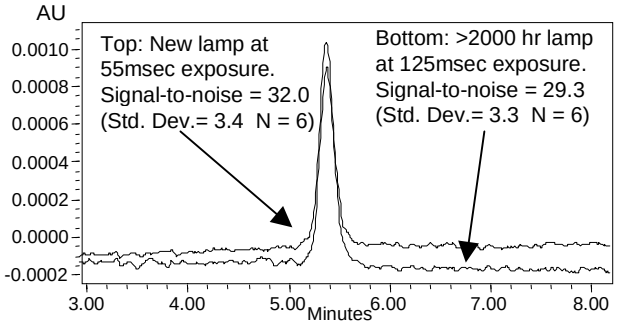
Energy Spectrum of New Lamp



Energy Spectrum of a >2000 hr Lamp



HPLC with New vs. a >2000 hr Lamp



System: Alliance ™ System operating in Automated Solvent Blending mode.
Column: Symmetry C18 (4.6 x 150mm)
Eluent A: HPLC grade water
Eluent B: HPLC grade methanol
Flow: 1.5 ml/min of 80%A / 20% B
Sample: 5ngs of caffeine injected
Temp: 30^{0}C
Detection: 220 - 350nm (1.2nm resolution)
272nm extracted
Lamp Optimization On
Standard Slit used (50um)

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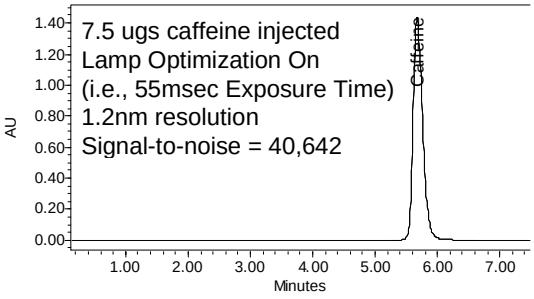
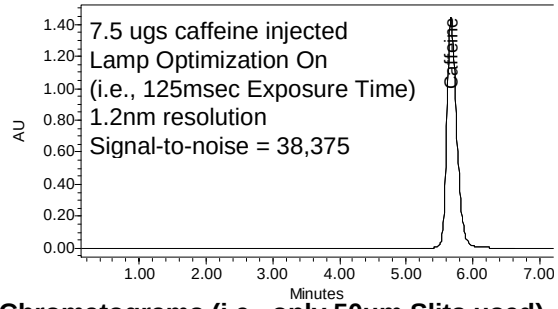
Effect of Slit Width on Spectral Differentiation

While changing detector slits can help maintain signal-to-noise performance, the spectra of compounds collected with the same lamp but with different slits, can vary significantly. Shown immediately below are data collected at 1.2nm resolution using a new vs. a >2000hr lamp, both configured with a 50um slit. Examination of the overlaid spectra at the peak apex for each separation shows little variation (i.e., Match Angle = 0.085degrees compared to Match Threshold = 1.002degrees). By comparison, data collected with the same lamp but at two different slit configurations *showed a significant degree of spectral variation* (Match Angle = 3.016 degrees compared to Match Threshold = 1.003 degrees). *This means that existing spectral libraries can be rendered invalid by changing the detector slit width ! Reliable spectral comparisons would only be possible after new spectral libraries were created using the current slit width configuration.* **These combined data reinforce how Waters Lamp Optimization Software helps maintain chromatographic sensitivity and spectral differentiation throughout the useful life of the PDA lamp and provide increased confidence in purity analysis and library searches.**

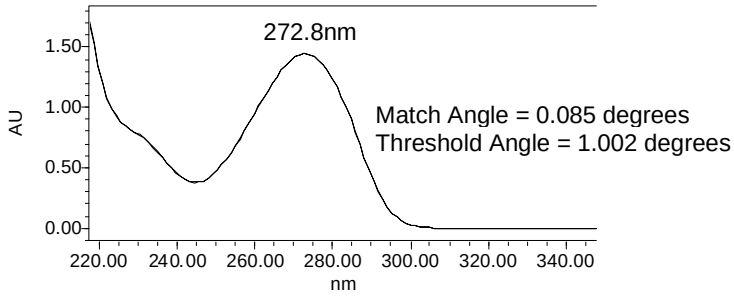
Analysis with New Lamp and 50um Slit



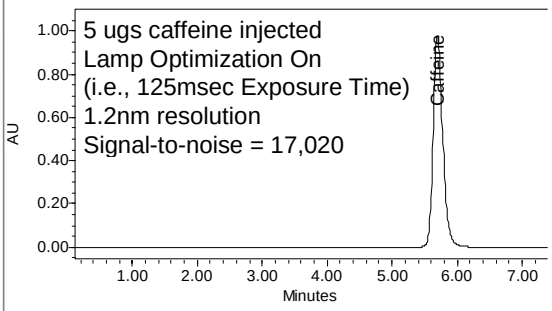
Analysis with a >2000 hr Lamp and 50um Slit



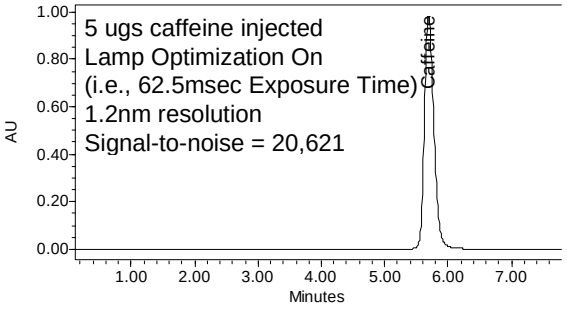
Overlaid Peak Apex Spectra from Above Chromatograms (i.e., only 50um Slits used)



Analysis with a >2000 hr Lamp and 50um Slit



Analysis with a >2000 hr Lamp and 100um Slit



Overlaid Peak Spectra from Above Chromatograms (i.e., 50 vs. 100um Slit data)