Waters
THE SCIENCE OF WHAT'S POSSIBLE.™

# ACQUITY UPLC PDA and PDA eλ Detectors

## Unrivalled photodiode array sensitivity with 2D and 3D operation

### OPTIMIZED FOR UPLC SEPARATIONS

**Waters® brings two photodiode array detectors to your lab: The ACQUITY UPLC® PDA Detector for routine analysis and method development and the ACQUITY UPLC PDA eλ Detector for spectral information in the visible range.**

Both detectors deliver the highly sensitive spectral information you need to make better decisions about your analysis. Enhanced software control provides flexibility for simultaneous 2D and 3D operation in Empower™ or MassLynx™ Software.

### The ACQUITY UPLC PDA and PDA eλ detectors provide:

- Superior trace impurity detection and quantification while maintaining maximum chromatographic sensitivity
- Independent optimization of data rate and filtering constants
- ACQUITY UPLC light-guiding flow cell and flow cell options
- Superior linear range with constant optical bandpass
- Spectral analysis up to 500 nm with the ACQUITY PDA Detector
- Spectral analysis up to 800 nm with the ACQUITY eλ PDA Detector
- Uncomplicated method development
- Easy instrument setup


*ACQUITY PDA eλ Detector's expanded wavelength range provides for highly sensitive spectral information in the visible region.*

## GET THE DATA YOU NEED WITH WAVELENGTH OPTIONS

The ACQUITY UPLC PDA and PDA eλ detectors allow your laboratory to detect and quantify lower concentrations of sample analytes and compare spectra across ultraviolet and visible wavelengths (up to 500 and 800 nm respectively). The detectors have data rates of up to 80 Hz, noise specifications as low as ±3 µAU, and an extended linear dynamic range.

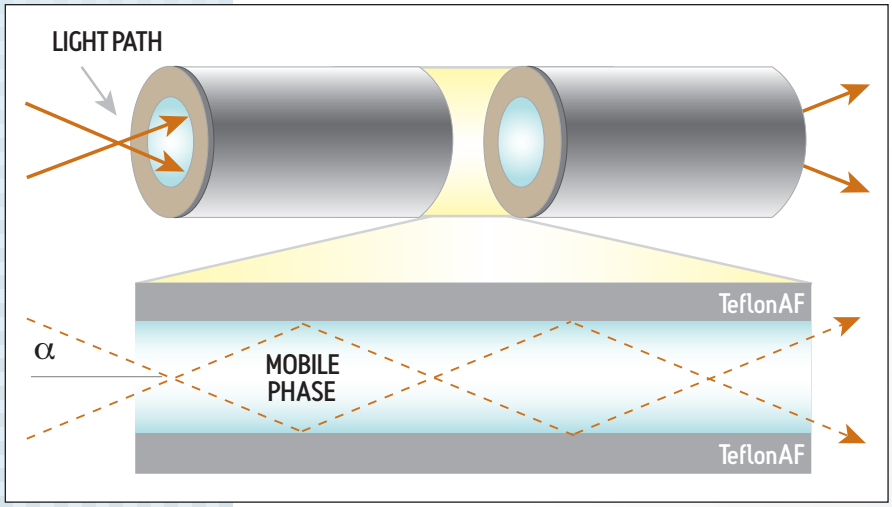
The detectors together with the ACQUITY UPLC System, can fulfill multiple UPLC®/MS detection strategy requirements for the identification of components that are difficult to resolve by conventional HPLC-based methods.

## PHOTODIODE ARRAY TECHNOLOGY

### Light-guiding flow cell technology

Small-bore, high-capacity ACQUITY UPLC Columns produce small volume peaks. To avoid band spreading and maintain concentration, the detector flow cell volume must be correspondingly low. To achieve the required volume reduction with conventional absorbance detector flow cells, the pathlength must be reduced, which, as predicted by Beer's law, results in a loss of sensitivity.

Waters has specifically designed a low volume light-guiding flow cell for the ACQUITY UPLC PDA Detector that has optimum path length and high light throughput. The cell is comprised of Teflon AF, which utilizes total internal reflection principles, to improve light transmission efficiency by eliminating internal absorption.



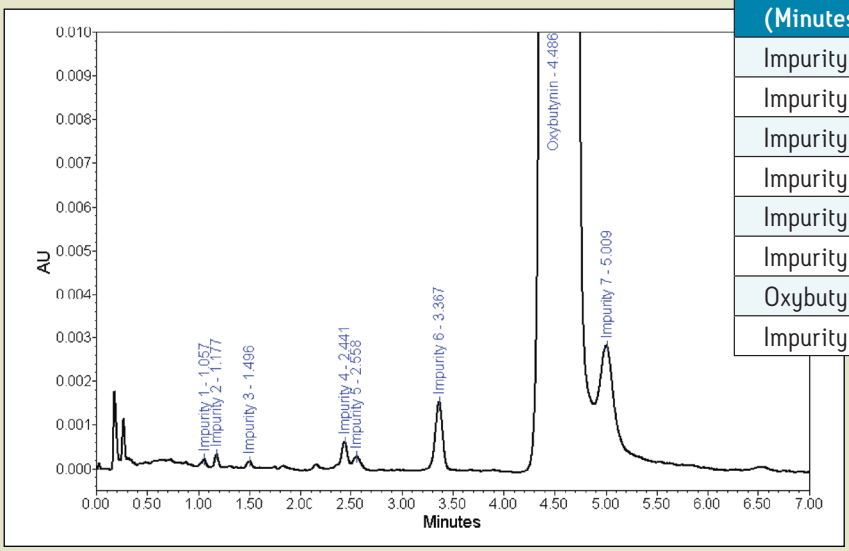

*Light rays entering the liquid core of the flow cell are internally reflected when they meet the Teflon AF boundary. These rays are transmitted through the cell without loss, except for absorption by the sample.*

## Unique lamp optimization software

- Designed to automatically maximize signal-to-noise in both the visible and UV spectra with the use of a single Deuterium lamp.
- Extends the useful life of the lamp for consistent results over time.

## PDA for trace impurity detection

- Offers exceptional signal-to-noise ratios, high optical and digital resolution, and high-sensitivity library matching.
- Enables the ACQUITY UPLC System to map low levels of compounds and determine trace impurity levels within the compound's peak.
- Eliminates the need to compromise optical bandpass and linear range simply to reduce noise.



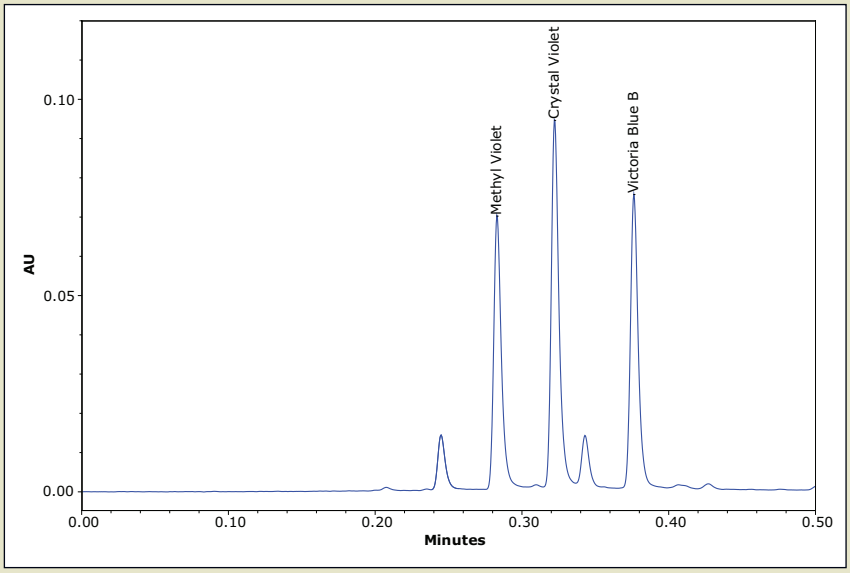

| Compound (Minutes) | Retention Time | Area % | Signal-to-Noise |
|---|---|---|---|
| Impurity 1 | 1.005 | 0.004 | 7 |
| Impurity 2 | 1.175 | 0.004 | 11 |
| Impurity 3 | 1.495 | 0.003 | 6 |
| Impurity 4 | 2.439 | 0.012 | 20 |
| Impurity 5 | 2.557 | 0.008 | 10 |
| Impurity 6 | 3.366 | 0.044 | 56 |
| Oxybutynin | 4.484 | 99.845 | 70927 |
| Impurity 7 | 5.007 | 0.081 | 65 |

*The ACQUITY UPLC PDA Detector allows quantitation of impurities at levels down to 0.004%.*

*The ACQUITY UPLC System with the ACQUITY UPLC PDA Detector.*

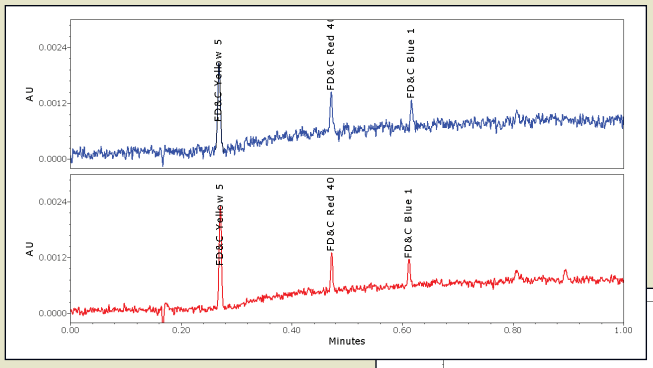
## ACQUITY UPLC PDA eλ Detector for spectral exposure optimization

- Increases the sensitivity of low-level analytes in the visible region.
- Improves noise performance in lower energy regions of the deuterium spectrum while maintaining optimal performance across the entire range.



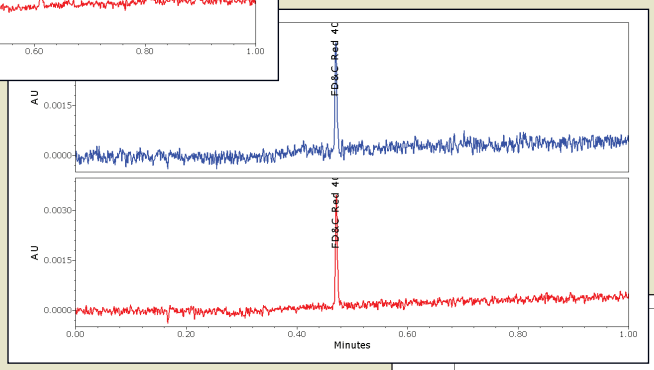

*UPLC separation of extracted ball point pen ink components in 30 seconds at 600 nm with the ACQUITY UPLC eλ Detector.*

**FD&C Yellow 5 @ 417 nm (1.4X Improvement)**

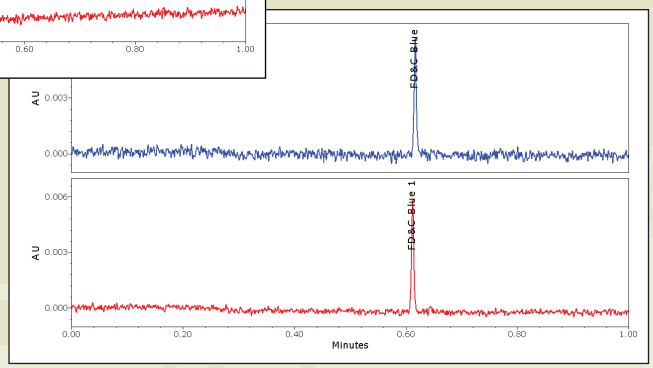



Spectral Exposure Optimization ON
Spectral Exposure Optimization OFF

**FD&C Red 40 @ 507 nm (1.9X Improvement)**




**FD&C Blue 1 @ 629 nm (1.9X Improvement)**



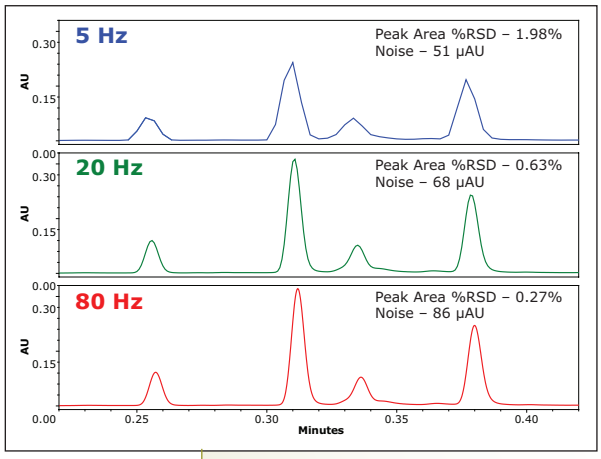

*Sensitivity improvements up to 4X are observed using spectral exposure optimization. For three FD&C dyes, sensitivity improvements ranged from **1.4** to **1.9** with the ACQUITY UPLC PDA eλ Detector.*

## DETECTION AND RESOLUTION OPTIMIZED WITHOUT COMPROMISE

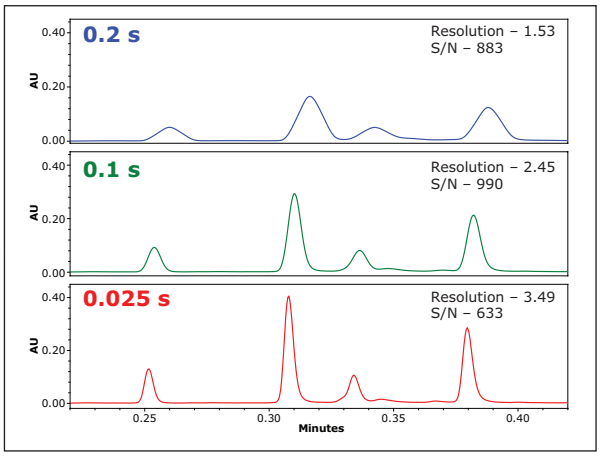
### Optical and digital resolution

The detectors operate at a fixed optical resolution of 1.2 nm, providing high-quality spectral resolution. The low detector noise performance allows you to operate at maximum digital resolution and not sacrifice linearity.

**Optimize Data Rate**

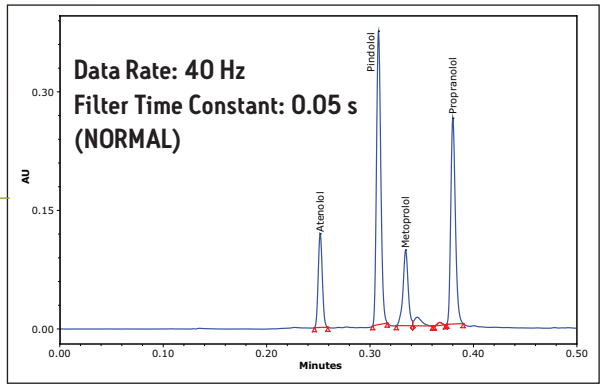



**Optimize Filter Time**



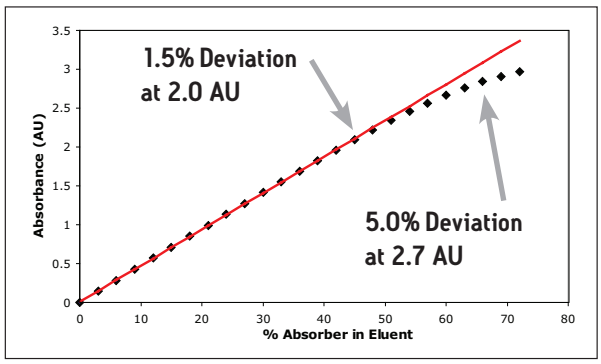

*Independent optimization of data rate and filter time constant results in the best combination of sensitivity, repeatability, and resolution for the detection of analytes in any UPLC separation.*

**Optimized Method**




### Superior linearity

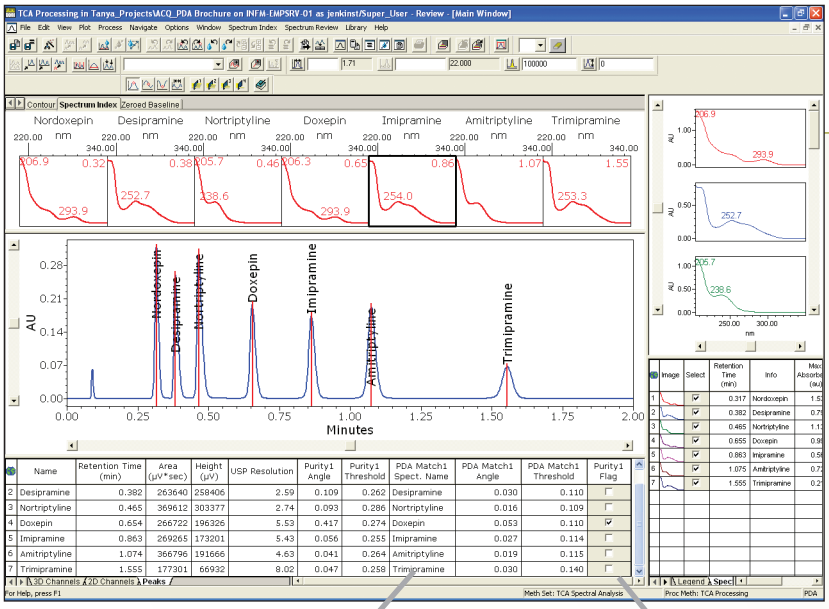
Wide linear dynamic range allows for simultaneous quantification of high- and low-level components within a single chromatographic separation.




*Wide linear dynamic range is demonstrated by the linearity plot of propyl paraben at 257 nm.*

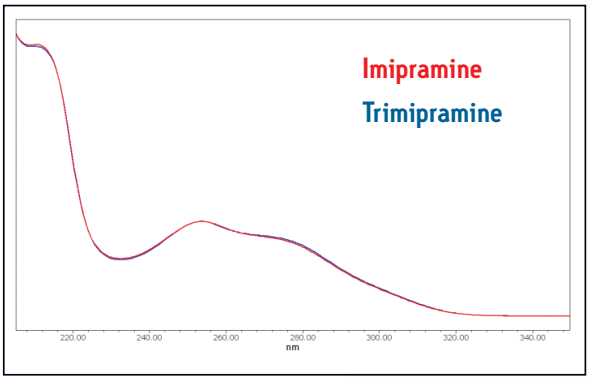
## Definitive compound identification

While most PDA detectors distinguish between compounds possessing comparatively large spectral differences, the ACQUITY UPLC PDA detectors differentiate between the spectra of closely-related compounds.



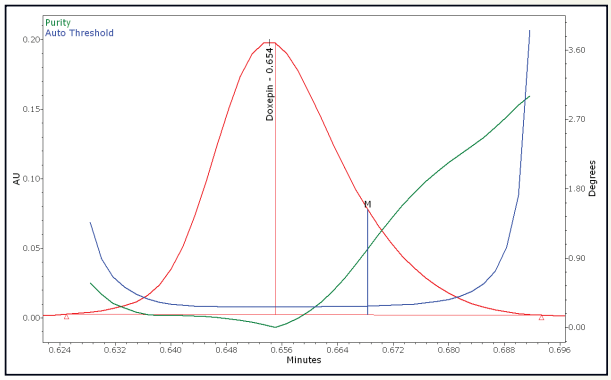

**Spectral analysis of a series of highly-related tricyclic antidepressants**

### Library Matching




*A. Powerful spectral contrast algorithms are able to distinguish between compounds, which differ only by one methyl group.*

### Peak Purity




*B. Peak purity easily detects a co-elution of one of the peaks and highlights the point of maximum impurity.*

## Reliable co-elution detection

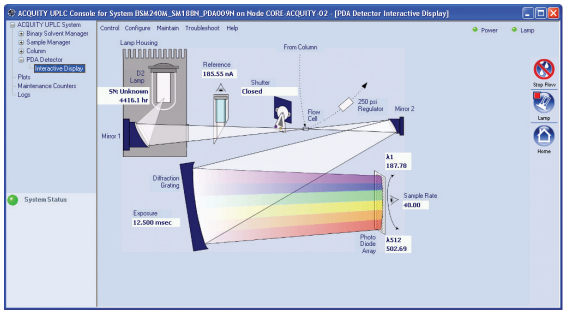
The ACQUITY UPLC PDA detectors combined with Empower Software, employ powerful capabilities for determining spectral homogeneity, yielding confidence in method specificity.

## Console software

The detectors are equipped with a customizable instrument console, for both Empower and MassLynx software, enabling users to easily stay in control of their data. Instrument setup, status monitoring, and diagnostics are easily accessible through an intuitive, easy-to-learn interface.

The console interface:

- Uses a simple navigational approach, for easy system implementation and instrument usability.
- Allows for quick and easy access to critical instrument parameters, enabling the detector to be easily controlled, monitored, and diagnosed.


***Instrument console:***
*ACQUITY UPLC PDA Detector interactive display.*

## POWERFUL PDA DATA PROCESSING WITH EMPOWER SOFTWARE

### Demonstrate peak homogeneity

Visualize any differences in spectra by using the Spectrum Index Plot to display apex spectrum and other peak spectra – all corrected for noise and normalized in a color-coded overlay plot.

### Quantify peak purity

For a more quantitative analysis, the Purity Angle Plot mathematically compares the apex spectrum of the peak to that of every data point across a peak. With adjustments to noise and background solvent absorbance, spectral differences and potential impurities become virtually impossible to miss.

### Confirm peak identity

The Library Match function automatically identifies each peak in a sample by mathematically comparing unknown peaks to the reference spectra stored in the library. Once initiated, the library automatically searches for the closest spectral match and reports findings indicating the degree to which it matches. Numerous libraries can be created, stored, searched, and shared among network users.

### Document wavelength monitoring choices

Automatically select and store maximum absorbancies for each peak. Documentation of the λ-max will justify wavelength selection to auditors.

### Construct a multi-wavelength chromatogram

Select and store maximum absorbancies for each peak to automatically construct a multi-wavelength chromatogram, resulting in a meticulous record of all the compounds detected.

### Diagnostic tool and confirm method compliance

Routinely diagnose fluidic performance and confirm method compliance in UPLC/MS.

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