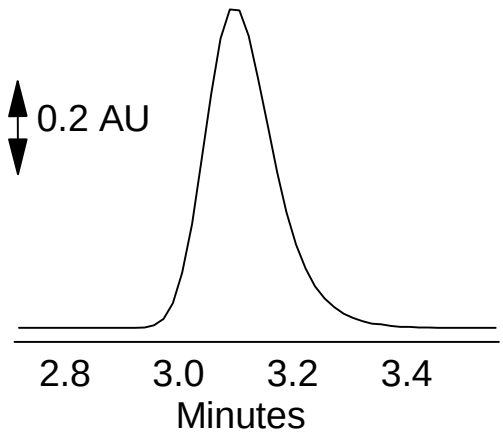
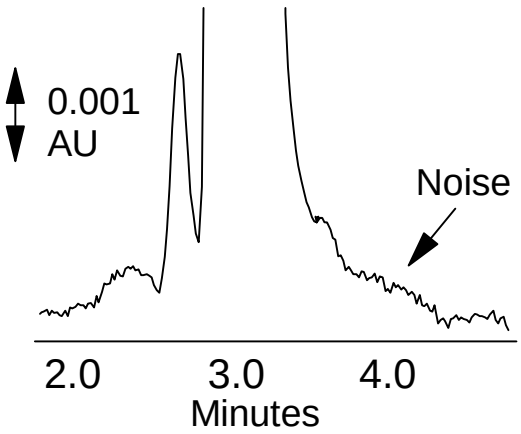
Performance PerSPECtives

Signal-to-Noise in UV/Visible Detectors

Signal-to-noise, the peak height to baseline noise ratio, determines a detector's sensitivity. Baseline noise is only critical when monitoring small peaks.





High sensitivity HPLC detectors are required for quantitation of low concentrations of analyte, and for the detection of impurities, degradation products, byproducts, or metabolites. With photodiode array detectors, high sensitivity is required to perform spectral analyses, peak identification and peak purity, on those same peaks.

As one tries to detect smaller absorbances the baseline noise becomes more significant. Therefore, to increase sensitivity, one must maximize the signal and minimize the noise for an increased signal-to-noise ratio.

System:	Waters 600 Solvent Delivery
Autosampler:	Waters 717
Columns:	Waters Nova-Pak C18 3.9x75mm
Mobile Phase:	40:60 Acetonitrile:Water
Detector:	Waters 996 Photodiode Array
Wavelengths:	190-350 nm, monitored 220 nm
Resolution:	1.2 nm
Sample:	Ethinylestradiol

Waters

Waters Corporation 34 Maple Street Milford, MA 01757 508 478-2000

★ Factors that affect detector signal

Detector sensitivity determines the limits of detection and quantitation. Sensitivity can be defined as signal-to-noise (S/N) ratio, the peak height to the baseline noise. The higher the S/N ratio, the greater the sensitivity.

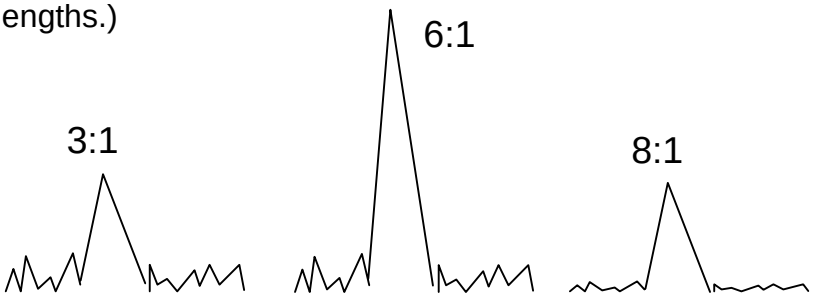
The S/N ratio can be increased by increasing the signal. Factors which increase the signal include:

1. Increased sample concentration (Sample preparation is usually time consuming.)
2. Increased injection volume (Limited by the column capacity.)
3. Longer flow cell path length (Detector response is directly proportional to path length.)
4. Smaller flow cell volume (Less band spreading.)
5. Wavelength selection (Lambda maximum has more response than other wavelengths.)

★ Factors affecting detector noise

The S/N ratio can be increased by decreasing the noise. Factors which decrease noise include:

1. Lamp optimization (Decrease in lamp energy increases noise.)
2. Flow cell design (Waters Taper-Cell and Taperbeam Cell capture more of transmitted light reducing noise.)
3. Transparent mobile phases (Absorbance from mobile phases increases noise.)



Examples of various signal to noise ratios for chromatographic peaks. There are two ways to increase signal to noise ratios: increase signal or decrease noise.