

Increasing Sample Throughput Using the Agilent Cary 6000i UV-Vis-NIR



Introduction

The Agilent Cary 6000i UV-Vis-NIR spectrophotometer offers the sensitivity of a narrow band InGaAs detector in the NIR range (800–1800 nm) combined with a short wavelength NIR diffraction grating. A combination that is superior to any commercially available instrument measuring over a similar range.

Performance benefits of the Cary 6000i include:

- A larger photodynamic linear range (capable of measuring absorbances up to 8 in the NIR)
- Superior signal-to-noise (S/N) achieved with significantly less averaging, resulting in greater sample throughput
- Superior spectral resolution

Rapid data acquisition and increased sample throughput

The narrow band InGaAs detector provides around 100 times better sensitivity than other commercially available wide band InGaAs or PbS detector instruments. This means that spectra can be acquired in a fraction of the time due to significantly less signal averaging being required.

Results and discussion

To demonstrate the high signal-to-noise and excellent spectral resolution of the Cary 6000i, Figure 1 shows water vapor spectra collected on the Cary 6000i and an Agilent Cary 5000 UV-Vis-NIR (using a PbS detector in the NIR). The Cary 5000 is considered the “best-in-class” commercially available PbS NIR instrument that is currently available.

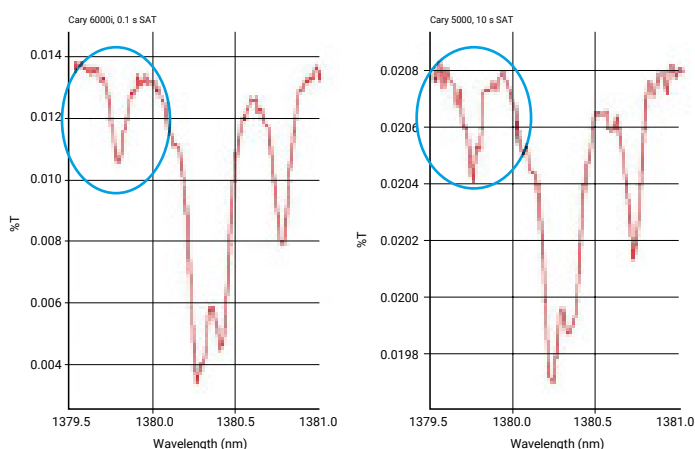


Figure 1. Water vapor spectra collected using the (left) Agilent Cary 6000i and (right) Agilent Cary 5000 spectrophotometers. Noise and resolution (peak shape) are better on the Cary 6000i and the spectrum was collected in one hundredth of the time

A Signal Averaging Time (SAT) of 10 s was used on the Cary 5000 compared to 0.1 s on the Cary 6000i. Also, a spectral bandwidth (SBW) of 0.05 nm was used on the Cary 5000 compared to 0.02 nm on the Cary 6000i. The S/N achieved is significantly better on the 6000i, which uses 100 times less averaging with 2.5 times reduced SBW.

To put this in perspective, a typical spectrum requiring 5 s averaging/data point, collected every 1 nm over the NIR range of 800–1800 nm (1000 data points) can take approximately 160 minutes to collect (including a baseline collection) on the Cary 5000. The Cary 6000i would require 1.5 minutes

(based on a 0.05 s SAT). Also, as the sensitivity of the Cary 5000 is better than that of other commercially available PbS-based instruments, the time required to collect data over this wavelength range on other spectrophotometers can be significantly greater.

Sophisticated software

The Agilent Cary WinUV Scan Application also provides a unique feature to further decrease measurement time while maintaining the required S/N and spectral resolution. Known as “Signal-to-Noise mode”, this function is best used for samples that vary dramatically in signal intensity across the wavelength range. Where other instruments require using the longest averaging time for the entire scan, the unique signal-to-noise feature in the Cary WinUV software enables much faster spectrum acquisition with the desired S/N across the wavelength range. This is because the instrument will only average for longer periods at the “high absorbing/low %R or %T” wavelengths and will use much less averaging at “lower absorbing/high %R or %T” wavelengths.

Figure 2 demonstrates how easy it is to apply the signal-to-noise mode. By entering the acceptable S/N and a timeout

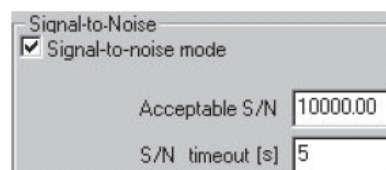


Figure 2. Selection of signal-to-noise mode in the Agilent Cary WinUV Scan Application software used to control all Agilent Cary 4/5/6/7000 series systems.

period, the instrument will average at each wavelength until the S/N is met or the timeout period has elapsed, before moving onto the next wavelength. This can reduce the scan time by a further 50%.

Conclusion

The benefits of increased sensitivity and signal-to-noise mode can lead to substantial time savings and reduced measurement costs per sample, particularly when running multiple samples on a daily or weekly basis using the Agilent Cary 6000i UV-Vis-NIR spectrophotometer.

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