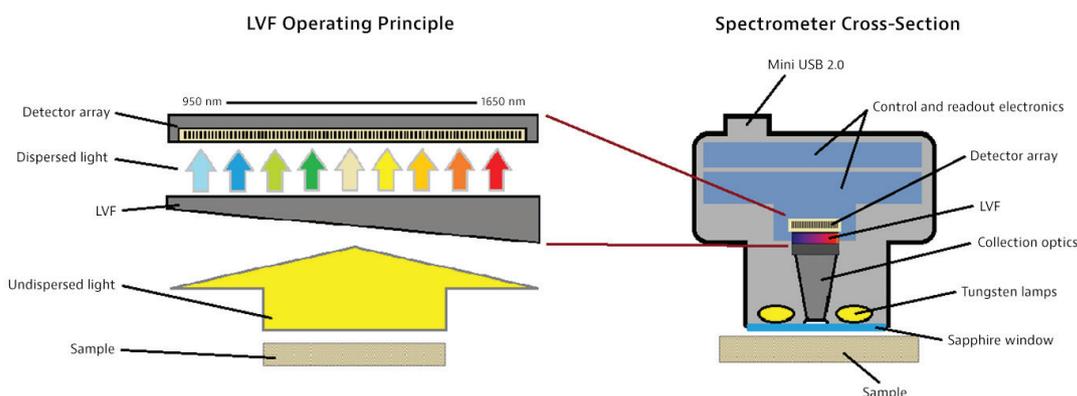


# Instrument Baseline Stability

The ultra-compact MicroNIR™ spectrometer acts more like a sensor than as a traditional scanning or grating-based spectrometer. It features Viavi Solutions linear variable filter (LVF) technology used in many space missions and other optical systems across the visible, NIR, and IR spectral regions. Because the technology has been qualified for use in space, the optical stability of the filter is unsurpassed in the market today. The following images show the working principles of LVF technology and the MicroNIR spectrometer.



Because the dispersing element of the spectrometer is transmission based (passive) and features no moving components, the static system design is highly stable and repeatable over extended periods of time and from system to system. Traditional spectrometers often require frequent updating of the 100% reference and dark current measurements to maintain spectral reproducibility over time. Reference measurements represent a snapshot in time of a known

reference standard. Unfortunately, despite reference standards being a stable and standard material, reference scans collected can vary from scan to scan due to subtle changes in sample heterogeneity and standard placement to the spectrometer. In addition, changes in lamp intensity and environmental temperature over time can also impact instrument stability.

To investigate the stability of the MicroNIR, spectra of a NIST SRM 2036 wavelength accuracy standard was monitored on a MicroNIR 1700 spectrometer using a single 100% reference measurement over the course of 30 days. For each acquired spectrum, the dark current was updated before the scan was collected using an auto-zero feature where the lamps are cycled off, a dark reading is collected, and lamps are turned on again for the spectral acquisition. In total, 12,839 spectra were collected on 10 different days over the 30-day period. Data on each of the 10 days were collected at random periods of time to replicate how they may be used at a client site. During data acquisition, 2 scans were collected per minute, so the scans represented in this study show over 106 hours of operation over the 30 days. Figure 2 below shows all of the absorbance spectra collected.

As seen in Figure 3, use of a baseline correction removes virtually all spectral variance across the 950-1650 nm region of the MicroNIR 1700. Figure 4 below shows the variance by pixel of the 12,839 scans of the original and SNV-corrected spectra collected over the 30-day period.



Figure 2. Absorbance spectra of 12,839 spectra of NIST SRM 2036

The NIST SRM 2036 standard is a wavelength accuracy standard and not a photometric standard, so some variation can be expected in the spectra due to sample placement on the MicroNIR spectrometer. Figure 3 below shows the same set of absorbance spectra with a standard normal variate (SNV) baseline correction being applied. SNV is a transformation usually applied to spectroscopic data, to remove scatter effects by centering and scaling each individual spectrum (for example, a sample-oriented standardization).

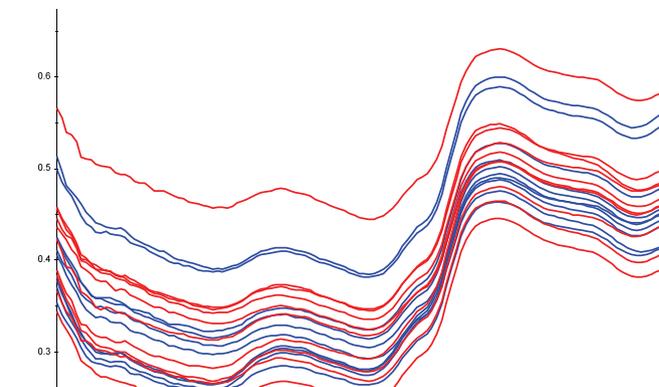


Figure 4. Variance-per-pixel of NIST SRM 2036 over 30 days

Every chemometric application is unique and because each calibration model is different, the influence of baseline stability should be studied for each calibration model. The result is a better understanding of the real effect that the time between reference measurements has on model performance.

The data presented herein demonstrates the baseline stability achievable with the MicroNIR 1700 over a 30-day period, which lends confidence in the ability to run the MicroNIR 1700 for an extended period of time with very little instrument change.



Figure 3. SNV-corrected absorbance spectra of NIST SRM 2036



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