**Technical Note – Measuring narrowband filters with LightMachinery Spectrometers**

November 2022

Improvements in modern optical coating technology have enabled manufacturers of optical filters to produce narrowband filters with pass bands that are significantly narrower than 1 nm (FWHM). As the filter technology improves, accurately measuring the filter performance requires spectrometers with higher and higher resolution capabilities. LightMachinery manufactures a range of etalon-based cross-dispersion spectrometers that can easily meet this challenge.

In Figure 1 below, we show the spectrum provided by the manufacturer of an 830 nm narrowband filter. The manufacturer quotes the FWHM of this filter as 0.7 nm.

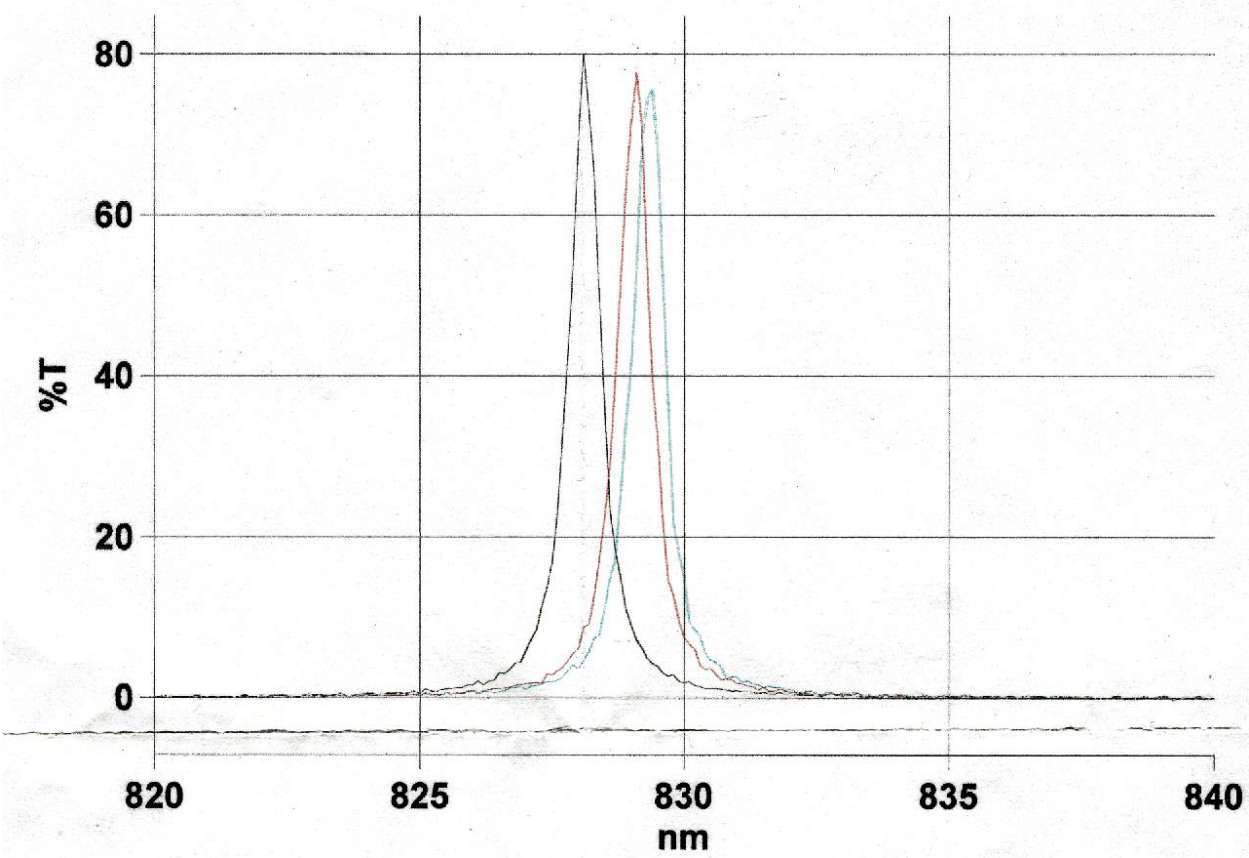


Figure 1 – Spectra provide by the manufacturer of an 830 nm narrowband filter.

In Figure 2, we show the spectrum of the same filter taken using a LightMachinery HN-8995-1. This spectrometer has a specified resolution of 2 pm at the 830 nm measurement wavelength, but for this measurement the resolution was reduced to 5 pm to provide a better signal-to-noise ratio.

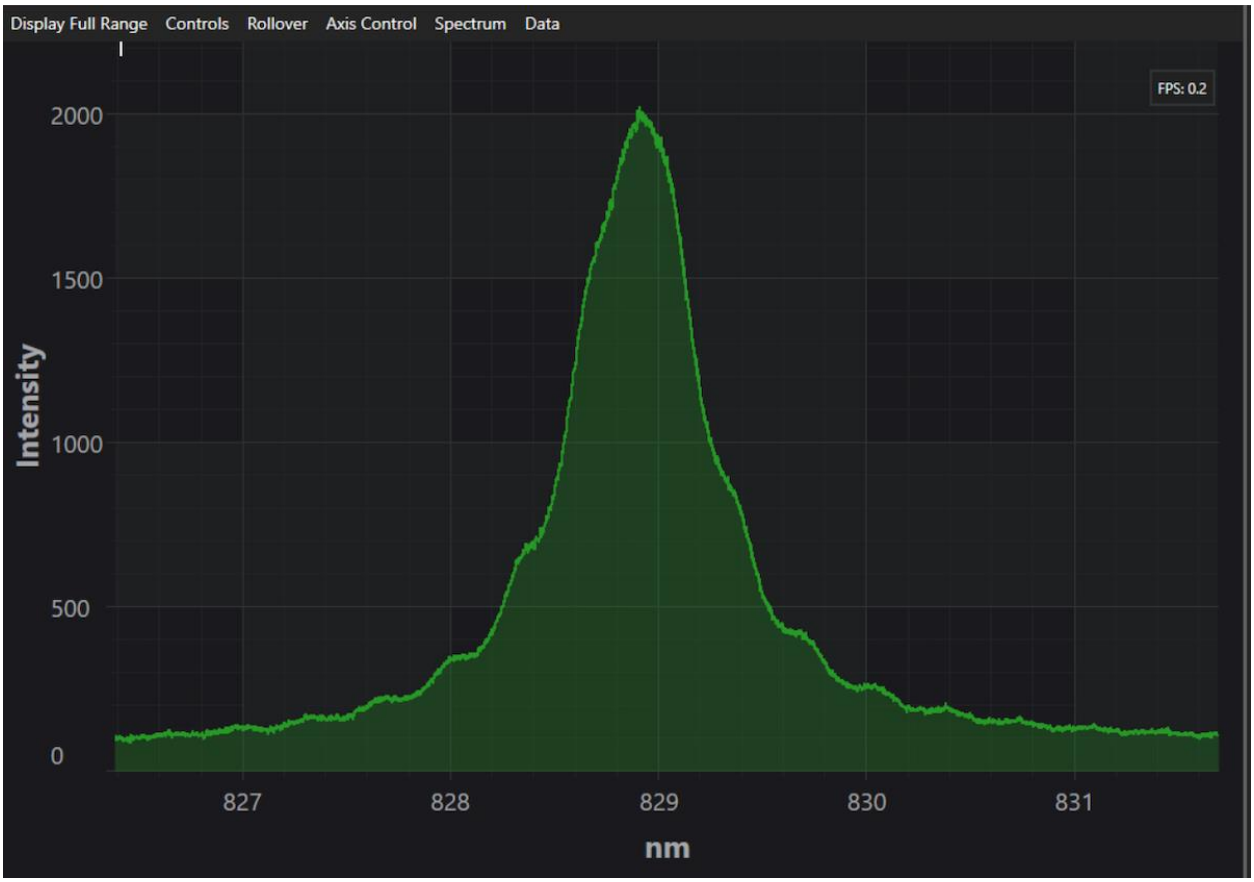


Figure 2 – Spectrum of the same filter taken with a LightMachinery spectrometer operating with a resolution of 5 pm FWHM. Measured FWHM is 0.685 nm.

Note the additional structure and small ripples in the transmission spectrum that were not obvious in the spectra provided by the manufacturer. Also, the measured FWHM of 0.685 nm is much more accurate than the manufacturer's estimate of 0.7 nm.

LightMachinery also manufactures a broadband (700 to 1050 nm) HN-9353 spectrometer with a nominal resolution of 40 pm at 830 nm. As shown in Figure 3, 40 pm resolution is more than sufficient for the measurement of this narrowband filter.

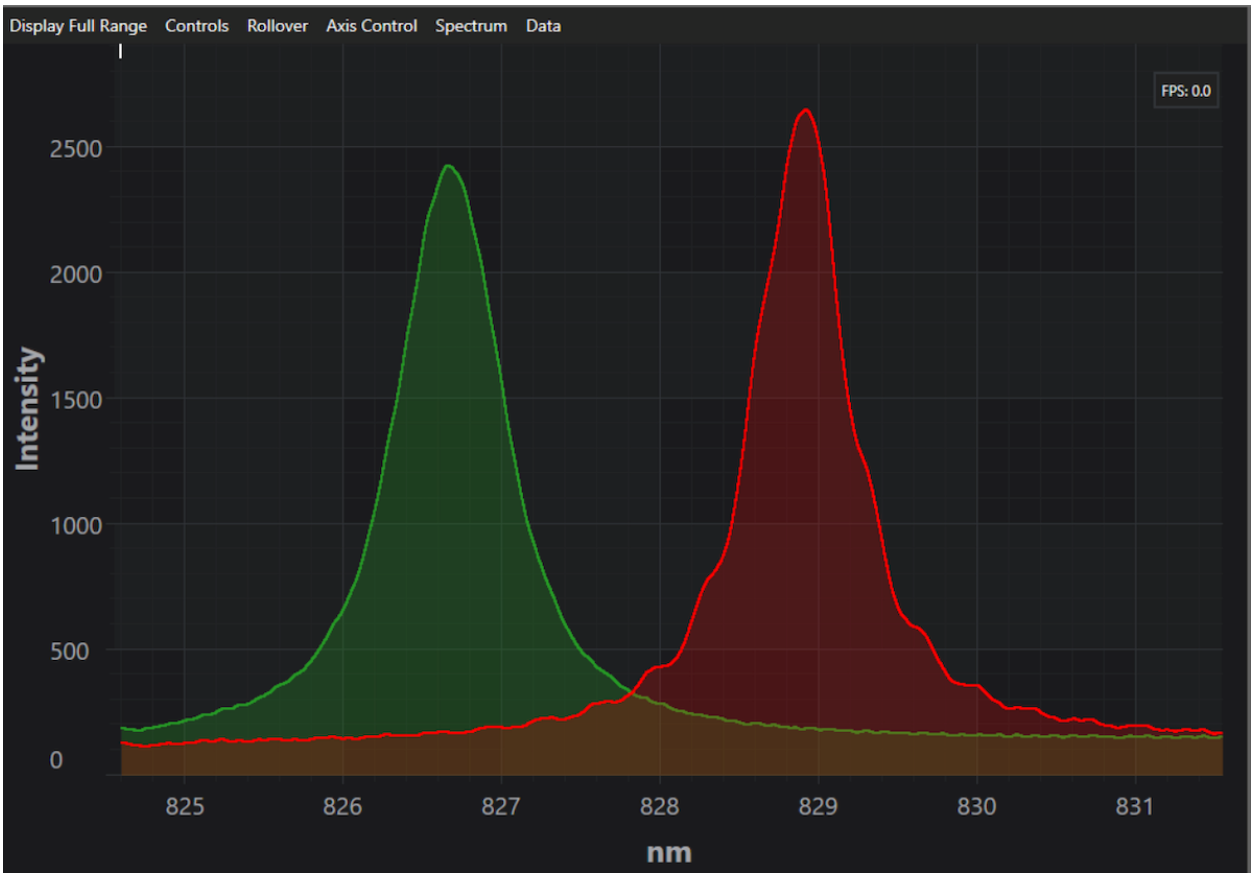


Figure 3 – Spectrum of the narrowband filter taken with a HN spectrometer similar to the HN-9353 model (resolution 40 pm at 830 nm). The red spectrum was taken with the filter mounted exactly normal to the optical beam, while the filter was slightly tilted to give a 2.23 nm shift for the green spectrum.

The LightMachinery range of cross-dispersion spectrometers is ideally suited to measurements of narrowband optical filters, or any optical element with narrow wavelength features. Details of LightMachinery spectrometers can be found at the link below, or please contact us to determine the spectrometer that best suits your application.

https://lightmachinery.com/spectrometers/