Double Monochromators: Additive or Subtractive?

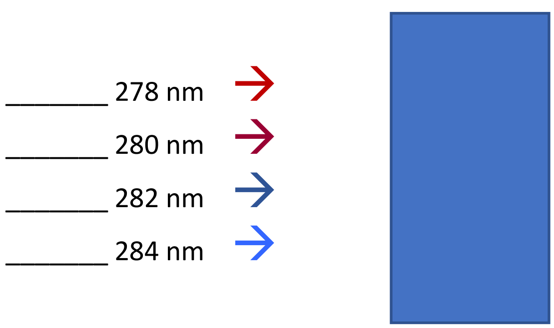
If you are like us, you never considered ‘additive’ or ‘subtractive.’ All your experience is with additive, unless you do Raman spectroscopy.

However, two key attributes of the subtractive are very desirable: the production of a homogenous output beam and zero temporal dispersion[1]. These attributes are perfectly suited to Raman spectrometers. These attributes are also advantageous for absorbance, fluorescence, and CD spectrophotometers, *particularly if the sample is non-homogeneous such as materials and suspensions.*

Additive:

Cary, Jasco, and nearly all other absorbance, fluorescence, and CD spectrophotometers use “additive” double monochromators. The second dispersive element (grating or prism) further disperses the light produced by the first (grating or prism).

In the additive monochromator, the measurement beam has spatially separated wavelengths. Here is a crude representation of 6 nm bandpass light entering your cuvette:



Clearly, if the sample is a solid or a suspension, literally different experiments are happening along the length or breadth of the sample, unintentionally: one portion sees 278 nm light, another 282 nm light, etc.

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[1] The length of time for the incoming light to exit the monochromator is independent of the wavelength.

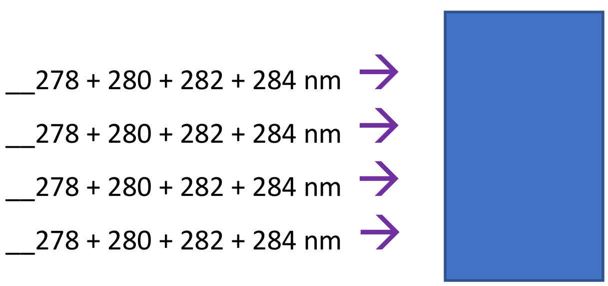
Subtractive:

When inventing the patented DeSa rapid-scanning monochromator, Richard DeSa unwittingly created a subtractive double monochromator. The patent reviewer in Washington, DC was the first to point this out. The resulting OLIS RSM 1000 series of instruments were so good that when it came time to create a smaller, non-rapid-scanning double monochromator, Dr. DeSa intentionally created it as a subtractive, too.

These are the monochromators used in the RSM 1000, DSM 1000 and DSM 20, DSM 245 series of OLIS spectrophotometers.

In the subtractive double monochromator, the measurement beam – independent of the spectral bandpass – recombines all of the wavelengths to produce a homogeneous blend of all wavelengths.

Here is a crude representation of 6 nm bandpass light entering your cuvette:



What one portion of the sample sees is identical in every way to what all other portions of the sample sees. You are conducting one experiment.

Is this the reason to purchase an OLIS? Perhaps, for some. But, for all of us, it is another example of how component choices lead to enhanced performance. Our history and our product line establish that we embrace every technological advantage to improve your results.