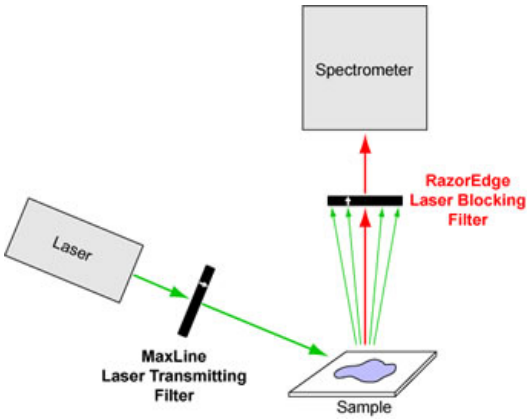
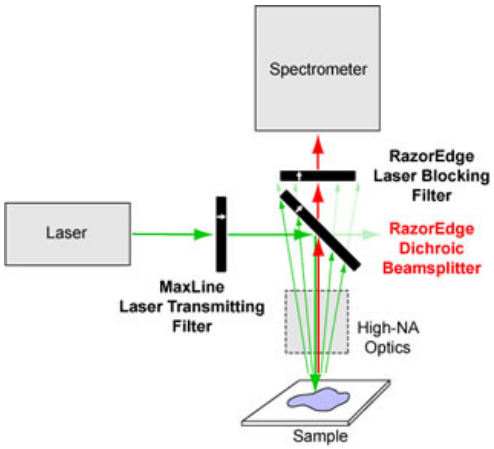
Technical Information:

RazorEdge® Filter Layouts

Filters play a crucial role in enabling high-fidelity Raman spectroscopy measurements. In many simple laboratory layouts the only filters needed are a laser-transmitting filter to clean-up the laser spectral output and a laser-blocking filter to ensure that no Rayleigh-scattered laser light reaches the detection system (see Filter Types for Raman Spectroscopy Applications). However, in many high-performance Raman systems – such as those with microscopic imaging capabilities or highly sensitive remote probes – expensive and/or complex focusing and collection optics are used to couple the system to the sample region. For these systems it is desirable for the excitation laser beam and the Raman-shifted signal light to share a common light path. The illustrations below show how this layout can be accomplished with an ultrasteep dichroic beamsplitter used in conjunction with a laser-blocking filter. Semrock's RazorEdge Dichroic™ beamsplitter filters are ideal for these applications.



In the standard Raman spectroscopy layout, the laser excites the sample directly, and a laser-blocking filter (such as the ultrasteep RazorEdge filter) is positioned between the sample and the spectrometer with light incident at or near normal incidence – its job is to block the scattered laser light and pass the Raman-shifted signal light as close as possible to the laser wavelength and with as much transmission as possible. RazorEdge filters are ideal for this configuration.



In focusing or imaging systems that utilize high-NA collection optics, for example, it is convenient for the incident laser beam and collected signal light to share a common path. To meet this requirement, a two-filter solution is ideal: a 45° beamsplitter reflects the laser light and directs it through the optics to the sample, while efficiently transmitting the returning Raman-shifted signal light; a laser-blocking filter at normal incidence is used in conjunction with the beamsplitter to completely block the undesired laser light from the spectrometer.

In order for the two-filter configuration shown above right to work, the 45° beamsplitter must be as steep as the laser-blocking filter. Traditionally thin-film filters could not achieve very steep edges at 45° because of the "polarization splitting" problem – the edge position tends to be different for different polarizations of light. However, through continued innovation in thin-film filter technology, Semrock has been able to achieve ultrasteep 45° beamsplitters with the same steepness of our renowned RazorEdge laser-blocking filters: the transition from the laser line to the passband of the filter is guaranteed to be less than 1% of the laser wavelength (for U-grade filters)!