

LASER FOCUSING OBJECTIVE THEORY

• Focusing Objective Theory

Some focusing applications may require a higher degree of aberration correction than can be achieved in single lenses such as Bestforms. Whether correction over larger apertures, several wavelengths or a wider field is needed, it may be necessary to use multi-element lens objective.

Aberration Correction

A Bestform lens singlet is corrected for minimal spherical aberration. However, other aberrations will become prevalent in such a lens as field angles, aperture size, numerical aperture or wavelength bandwidth is increased. Coma and astigmatism are the two most important. Both are dependent on field angle. Using a combination of differing optical materials and computer controlled lens design software, many lens objectives can be made relatively aberration free. Depending on the F/# and degree of achromaticity, most on-axis focusing applications can be satisfied with objectives having three lenses or less.

Single Line Objectives

All Special Optics Single Line Focusing Objectives are corrected for astigmatism and coma over the specified spectral range. However, they are not corrected for chromatic aberrations. These lenses are well suited for use with Solid State and Gas Lasers where only one wavelength is in use, or when shifts in focal length can be tolerated as the wavelength must be specified when ordering to indicate the appropriate anti-reflection coatings.

Achromatic Objectives

An advantage of additional lens elements is the ability to combine lenses of different materials and optical properties to correct for chromatic aberrations. Achromatic Focusing Objectives are aberration corrected at two wavelengths simultaneously. A doublet consisting of two lenses of different materials can be designed such that the effective focal length and performance will be the same at two separate wavelengths.

Apochromatic Objectives

Special low dispersion glasses allow for the design of lenses which are chromatically corrected for a range of wavelengths. Such lenses are referred to as having minimal secondary spectrum. Camera lenses are an extreme example of apochromatic lenses.