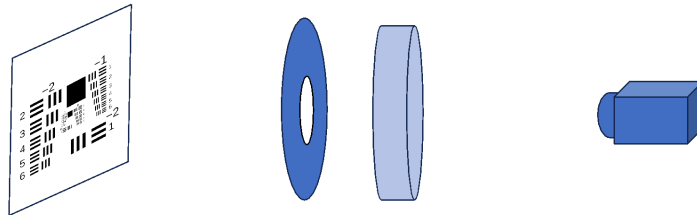


Design and Engineering of Modern Beam Diagnostics

Optics Demo / Lab

1. Target with single lens



- a. Calibration vs. Resolution

Calibration is the ratio of distance in the object (mm) to distance in the camera (pixels) due to the magnification of the optics. This is not the same as the actual pixel size of the camera. Resolution is the width in the camera of an infinitely thin line in the object. The resolution contains contributions from the diffraction limit, distortions from an imperfect lens, and the pixel size of the camera. The line seen in the camera image is a convolution of the lines in the object with these resolution sources.

 - i. Measure the calibration factor using one of the line groups.
 - ii. Measure the resolution using one of the blurry line groups and deconvolving.
 - b. Modulation Transfer Function (MTF) vs. Sigma -- MATLAB (Air force target)
 - i. Measure the modulation $((\text{peak} - \text{valley}) * 2 / (\text{peak} + \text{valley}))$
 - ii. Compare with above rms using the OpticalResolutions.m function.
 - c. Changing aperture; Diffraction limit
 - i. Measure modulation vs. aperture
2. Grid with single short focal length lens
 - a. Observe geometric effects with aperture and anti-aperture
 3. Transport line with two slower lenses and a compound objective
 - a. Difference in light collection between just a compound objective and a transport line
 4. Off-axis parabolic mirror
 - a. Sensitivity to exact point source