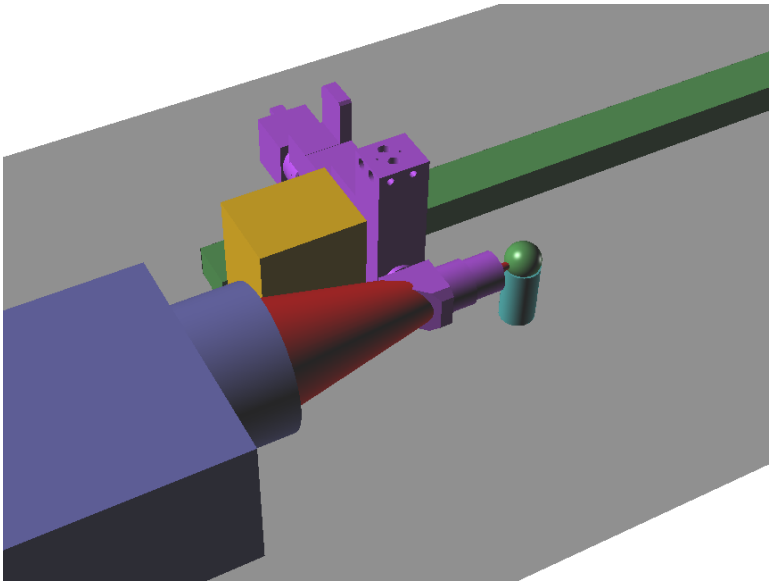
PSM Application Note

Aligning optical elements to a common axis

It is sometimes necessary to align a series of optical elements, lenses and mirrors, to a single, straight optical axis. What is required is a means of moving either the optical bench on which the elements are mounted along a straight line, or moving an autostigmatic microscope along the same line. Provided the length of the optical assembly is not too long, the table of a common milling machine is good for moving the optical bench, or a coordinate measuring machine is a good way to move the microscope where very good precision is required.

A simple, and less expensive, way of accomplishing the same thing is to align the components on an optical table using a straight edge as a guide. First, establish what the height of the optical axis above the table should be. This is usually governed by a component of the set up that has no height adjustment so everything else must be brought to that height. For example, suppose you want to align a group of components prior to checking the wavefront with an interferometer. Since most interferometers do not have height adjustments, the focus of the transmission sphere would set the height above the table. To see how the approach works view the picture below.



The interferometer (blue) produces a cone of light (red). The ball (green) is adjusted on its post (light blue) so the ball center is at the focus of the transmission sphere. The microscope with a right angle attachment (violet) is then moved into the beam and adjusted so the objective focus is at the center of the ball by means of the xyz stage (gold) that rides against a straight edge (dark green). Once this is done the microscope and stage can be slid along the straight edge and the focus of the objective will define an optical axis that lies on the focus of the interferometer transmission sphere.

In this way, any optical component put in the interferometer light cone can be adjusted using the microscope as the gauge so that the component's optical axis lies on the axis defined by the straight edge and the table top by adjusting the component until its centers of curvature are centered on the microscope objective focus. The precision of the method depends only on the table flatness and the straightness of the straight edge.