the side of the dish, we can reconfirm that the coin is indeed on the bottom of the pan. This is an optical illusion caused by a difference in the refractive index of the water. This phenomenom occurs because the apparent distance is shorter in a medium with a higher refractive index (water) than that with the lower refractive index (air). The simple experiment is a graphic illustration of what occurs when light rays change speed and direction when they pass from air through a glass lens to a prism beam splitting assembly and then onto the photoconductive target. As is to be expected, this optical phenomenon affects any aberrations in the optical path. To counter this phenomenon, glass compensation is designed into each lens to null any elongation of the light path caused by refractive index differences. If this practice was not initiated, there would be an increase in spherical aberration and longitudinal chromatic aberration.

The Canon Guide Book of Optics for Television System provides a precise explanation of the principle behind glass compensation correction for a television zoom lens:

"For example when there is a difference in glass thickness, compensation an over-correction of spherical aberration occurs at the entrance surfaces of the prism beam splitting assembly inserted in a convergent optical path, and under correction of spherical aberration occurs at the exit surfaces. The further the rays are from the optical axis, the greater is the spherical aberration, so the glass block as a whole gives rise to an over-correction. The lens is therefore designed to leave spherical aberration under-corrected, to cancel out the over-correction of the glass block. When the thickness of the glass block differs from the design value, balance is lost, spherical aberration occurs and the modulation transfer function degrades."[3]

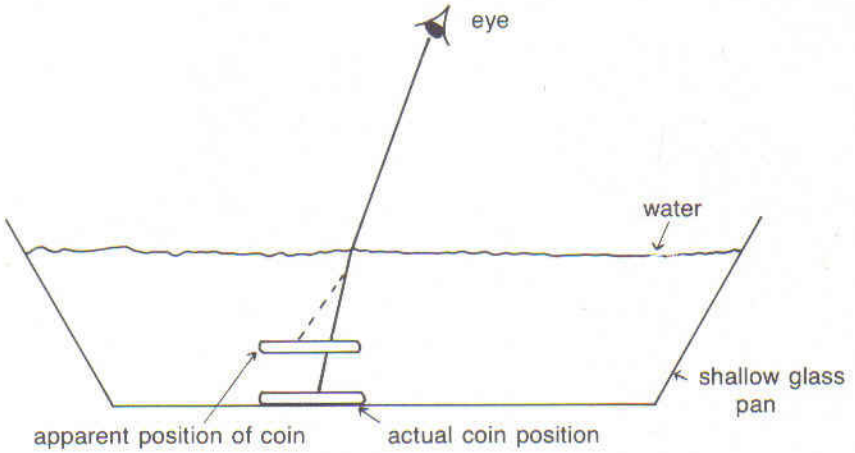

Diagram 2: Optical elongation caused by glass block.

Spherical aberration is simply expressed as an aberration that causes the various wavelengths that constitute light to be focussed on different image planes. The end result would appear as tracking error when closely examined using a reference chart.

Note: Spherical aberration is almost totally lost at two or three stops above full aperture. This fact alone is a good reason why you should not operate with your lens wide open. When you do that, you effectively increase the chances that any optical distortions will degrade your image. To further reinforce the point being made, I offer the theory of light distribution through a lens. The f stop number is