

Written by:

Donald Whitney  
~1983

## ACCURACY OF AVAILABLE LENS MEASURING EQUIPMENT

The accuracy which can be achieved in measuring lens power with a focimeter is affected by many factors. One of the most fundamental of these is diffraction, and it can be shown that, for apertures commonly employed in conventional instruments (6.35 to 7 mm) the Rayleigh Limit results in an uncertainty in focus of just under  $\pm 0.03$  diopters.<sup>1</sup>

Chromatic aberration, spherical aberration, and depth-of-curve (SAG) with respect to the lens positioning tube aperture, each contribute to further uncertainty.

All of the above factors are present even in an instrument which is in perfect calibration. In practice, focimeters are seldom in calibration to closer than 0.02 or 0.03 diopters, and this adds to the uncertainty of any given reading.

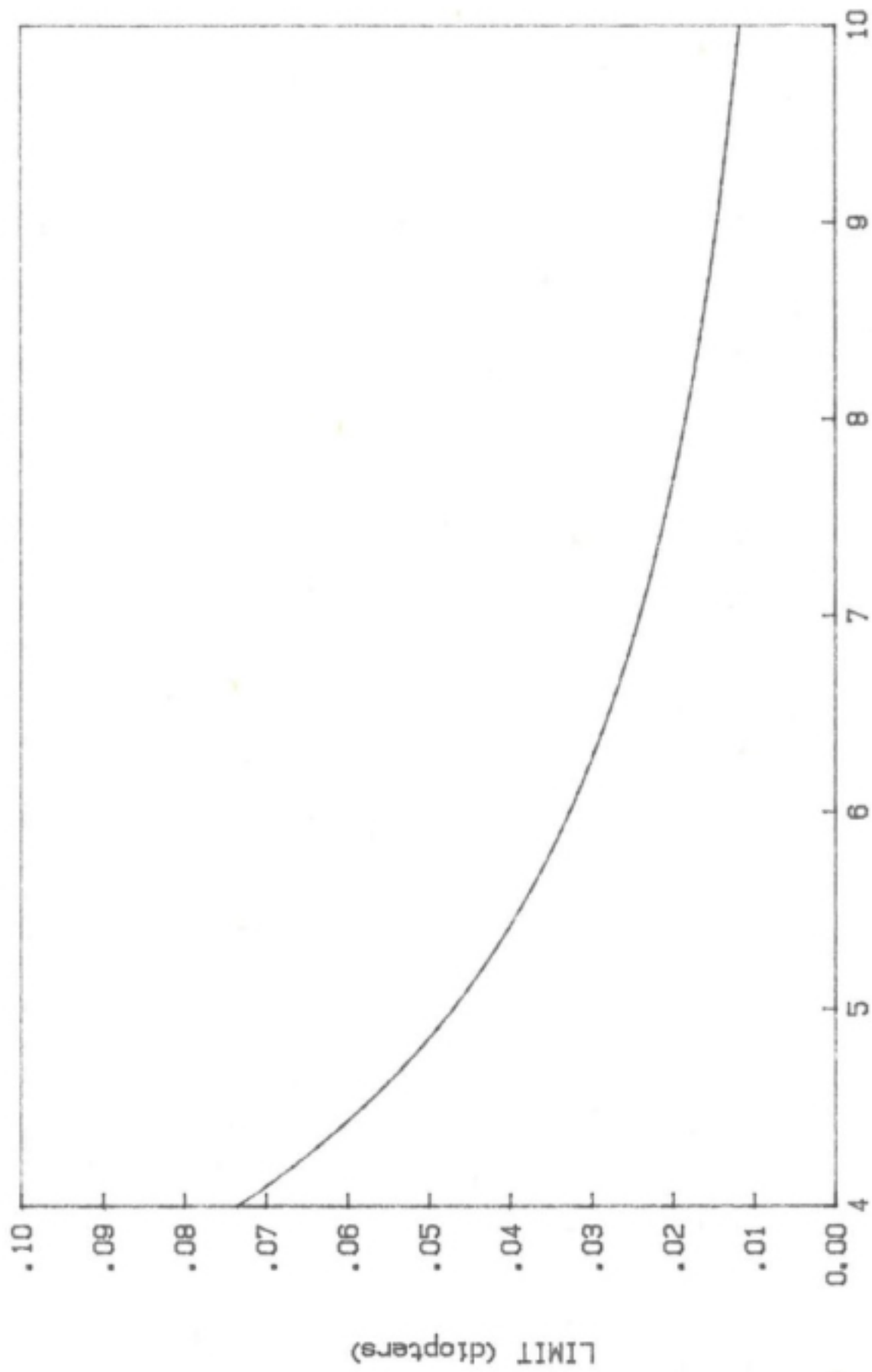
Finally, we must admit to the existence of human error. Well trained observers, given adequate time, do remarkably well most of the time, but few such observers would be willing to guarantee an accuracy of better than 0.03 diopters.

It is sometimes thought that the recent development of semi-automatic or automatic lens measuring instruments has overcome the problems related to focimeter accuracy, and this view appears to some to be supported by digital readouts in increments of 0.01 diopters. However, such confidence is not supported by the facts. The accuracy of these instruments is affected by most of the factors which limit the conventional focimeter, and by some additional factors which are unique to a given automatic design. Dirt or scratches on a lens surface can cause some automatic instruments to give erroneous readings. Some instruments are 'fooled' into giving wrong readings if the base curve of the lens under test is significantly different from that which was assumed by the designer of the instrument.

In summary, it would seem unreasonable to expect the accuracy of focimeter readings to exceed  $\pm 0.03$  diopters, and it must be recognized that focimeter errors will exceed this value in a significant number of instances.

<sup>1</sup> See Figure on next page

FOCIMETER DIFFRACTION LIMIT



FOCIMETER APERTURE (mm)

LIMIT (diopters)