The RONCHI Test

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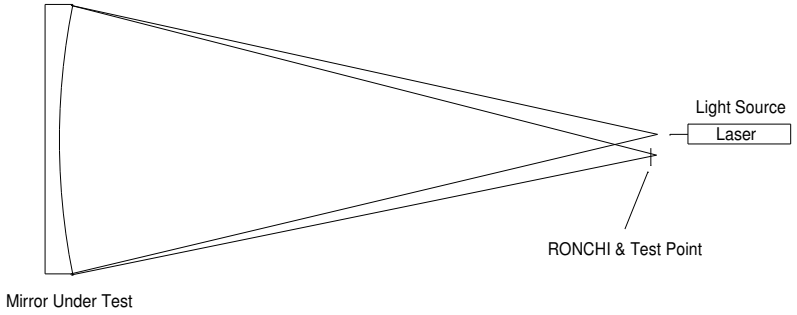
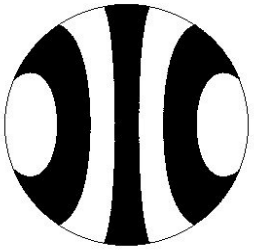
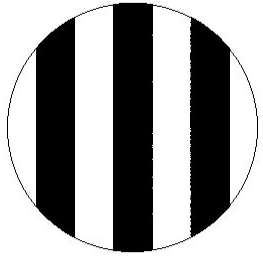
The Ronchi test is one of the easiest optical tests to understand, it is also one of the most accurate. With just a little knowledge of the principles involved you can easily determine the optical quality of a telescope mirror down to 1/20 wave.

A Ronchi grating is a series of perfectly straight lines printed on either glass or plastic film. Both the band width and the distance between the bands are the same. When the Ronchi grating is placed near the focus of a converging beam of light, any imperfections in the optical system will show as deviations from the perfectly straight lines on the Ronchi grating. You can tell from a glance exactly what problems exist on the surface of the mirror under test. Anything other than perfectly straight lines is a less than perfect mirror.



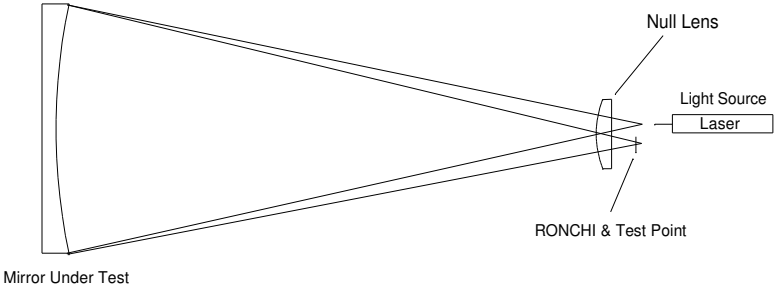
Testing A Mirror At The Radius



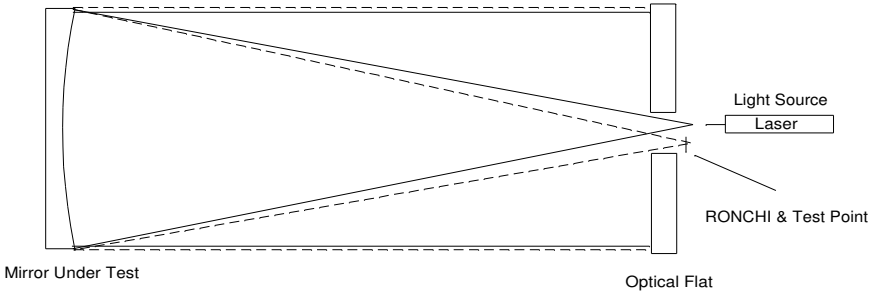


10" f/5 Parabolic Mirror **10" f/5 Spherical Mirror**
Both Mirrors Tested At The Radius

While testing a parabolic mirror at it's radius will show zones and turned edges, there is no easy way to tell it the mirror is properly corrected. For true accuracy a null test is a must.

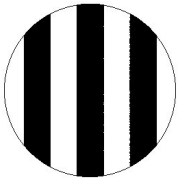


Testing A Mirror Using A Null Lens



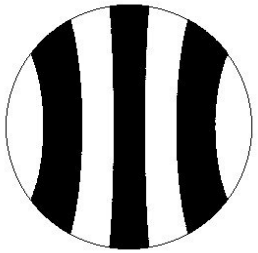
Testing A Mirror Using An Optical Flat

Of all the types of null tests, the preferred method is called double-pass autocollimation. By using a full aperture optical flat the parabolic mirror is tested against itself. This test is twice as accurate as any other test since the light path bounces off the mirror twice.

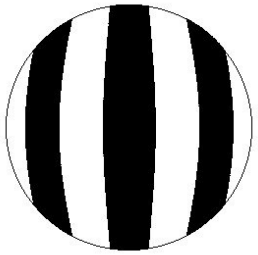


10" f/5 Parabolic Mirror Tested Using A Null Configuration

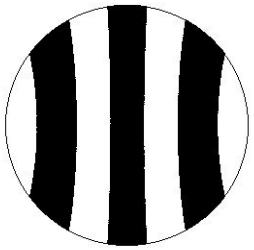
The following pictures are computer generated Ronchi bands showing spherical aberration from 1 wave to 1/20th wave, both inside and outside of focus.



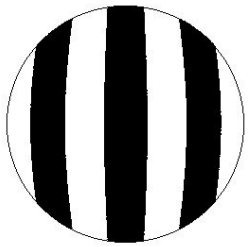
1 Wave Outside Of Focus



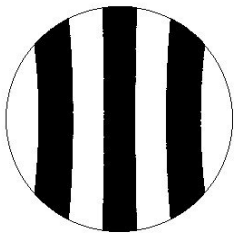
1 Wave Inside Of Focus



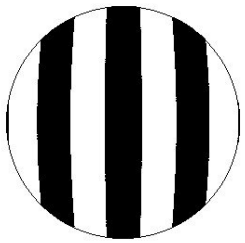
.5 Wave Outside Of Focus



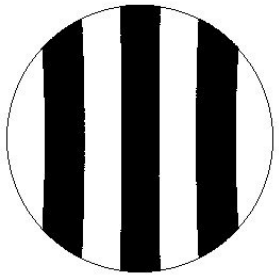
.5 Wave Inside Of Focus



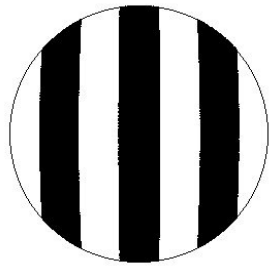
.25 Wave Outside Of Focus



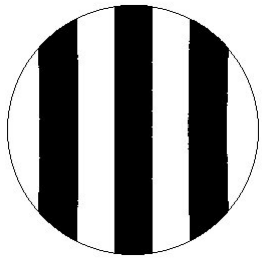
.25 Wave Inside Of Focus



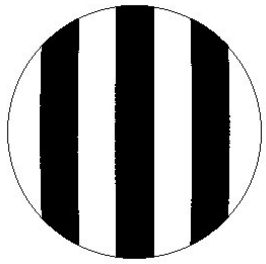
.1 Wave Outside Of Focus



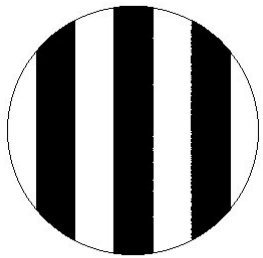
.1 Wave Inside Of Focus



.05 Wave Outside Of Focus

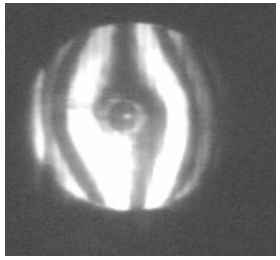


.05 Wave Inside Of Focus

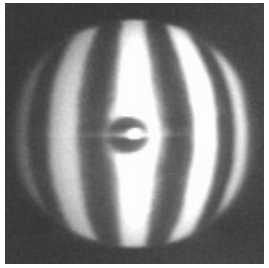


Perfect!

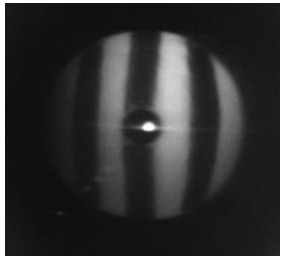
The following are actual pictures of a 15" f/4.5 mirror.
The light source is visible through the hole in the flat mirror.



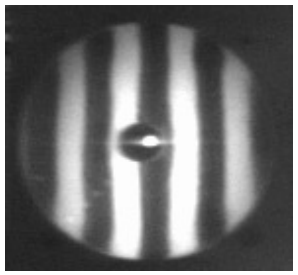
2 Waves Undercorrected and 1 Wave Of Astigmatism
A Very Bad Mirror!!



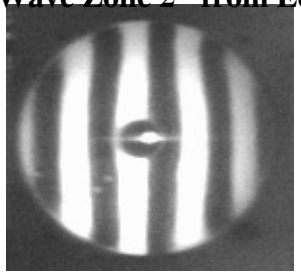
1 Wave Undercorrected



1/4 Wave Undercorrected

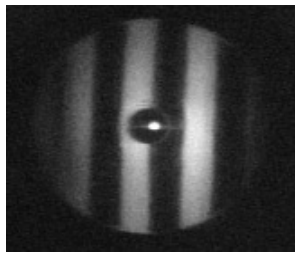


1/4 Wave Zone 2" from Edge



1/4 Wave Undercorrected Mirror With ½ Wave Turned Down Edge

A Good Mirror Except For A 1/4 Wave Low In The Center



Excellent Mirror!