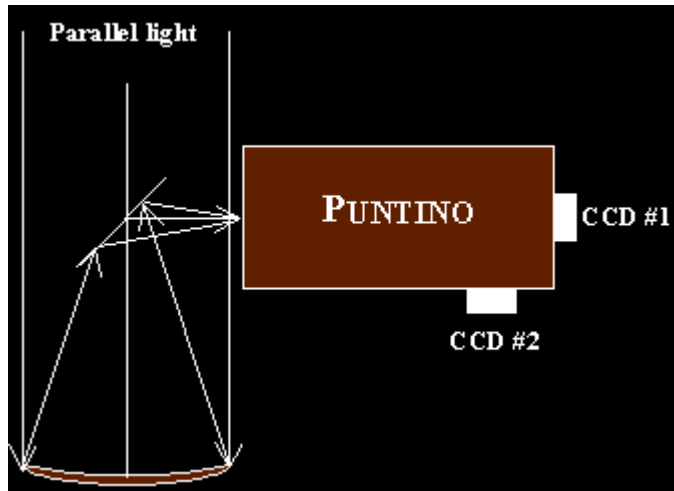


Shack-Hartmann wavefront sensor test of a telescope at Newtonian focus



Setup: A telescope tested at the Newtonian focus using parallel light. The aberrations of the SH system itself are removed by taking a calibration frame, with a calibration source placed at the focus of **Puntino**. The incident light illuminating the system should be aberration free. In the case of an astronomical telescope, a natural star is used.

It is not necessary to use parallel light for the test. The measured aberrations will then no longer refer to those for parallel light, but to one particular optical configuration that is used for the test.

Instrument

Puntino

Focal ratio range: $f/1$ to $f/300$.

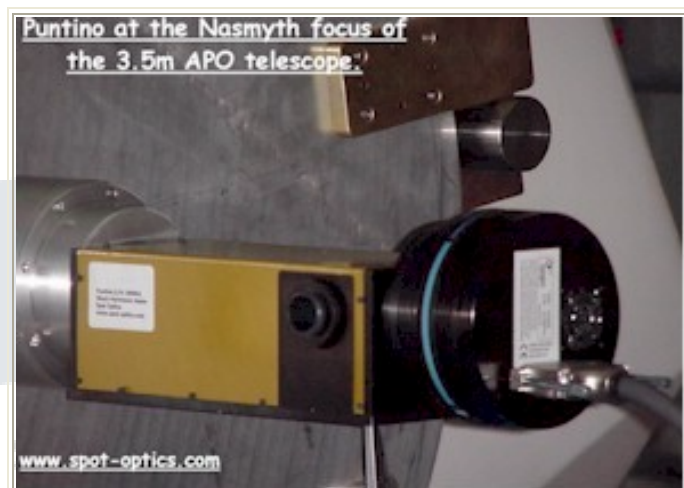
Output information

Along with the Zernike coefficients, the wavefront and optical quality, **Sensoft** gives diagnostics for correcting defocus, coma (alignment of the two elements) and spherical aberration (by changing the separation between the mirrors). These corrections can be based on analytical formulae, or on a lookup table provided by the user for any optical element in the system.

Information of dome and mirror seeing can be obtained by examining the plot of the **residuals**.

How the test is done

1. Mount Puntino on the telescope, either on-axis or off-axis.
2. Under remote control from the PC, take the reference calibration frame, using the inbuilt light source.
3. Point the telescope to a star (about 6-7th magnitude) using the star catalog in Sensoft. Take a 30 second exposure (to integrate out external seeing).
4. Do the Analysis using Sensoft. The results are ready in about 10 seconds.
5. Take multiple SH frames for reducing noise due to air-effects. Run Analysis. Sensoft automatically computes the average values.
6. Align the telescope using the indications given by Sensoft.
7. Find the correct focal plane using the indications given by Sensoft.
8. Correct support problems using the plots of the wavefront/mirror surface.
9. Look at the image obtained with CCD#2 for estimating seeing, or for having a look at the out-of-focus image of the pupil.



Instrument	Puntino
Focal ratios covered	f/5 to f/300 standard.
Sampling on the telescope pupil	25x25 spots standard. Up to 65x65 available.
Analysis Software	Sensoft
Remote control from PC	Completely automated. Frequent reference calibration frames can be taken to compensate for temperature changes in the dome.
CCD#1 for SH	16-bit cooled CCD.
CCD#2 for finder	8-bit fast read-out CCD (up to 1 megapixel per second). Can be used for monitoring the seeing. Can also be used for recording out of focus image of the pupil for identifying turned-down edges, zones etc.