

TESTING THE LENSES OF CAMPANI, LENS-MAKER FOR CASSINI

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Firenze, Italy

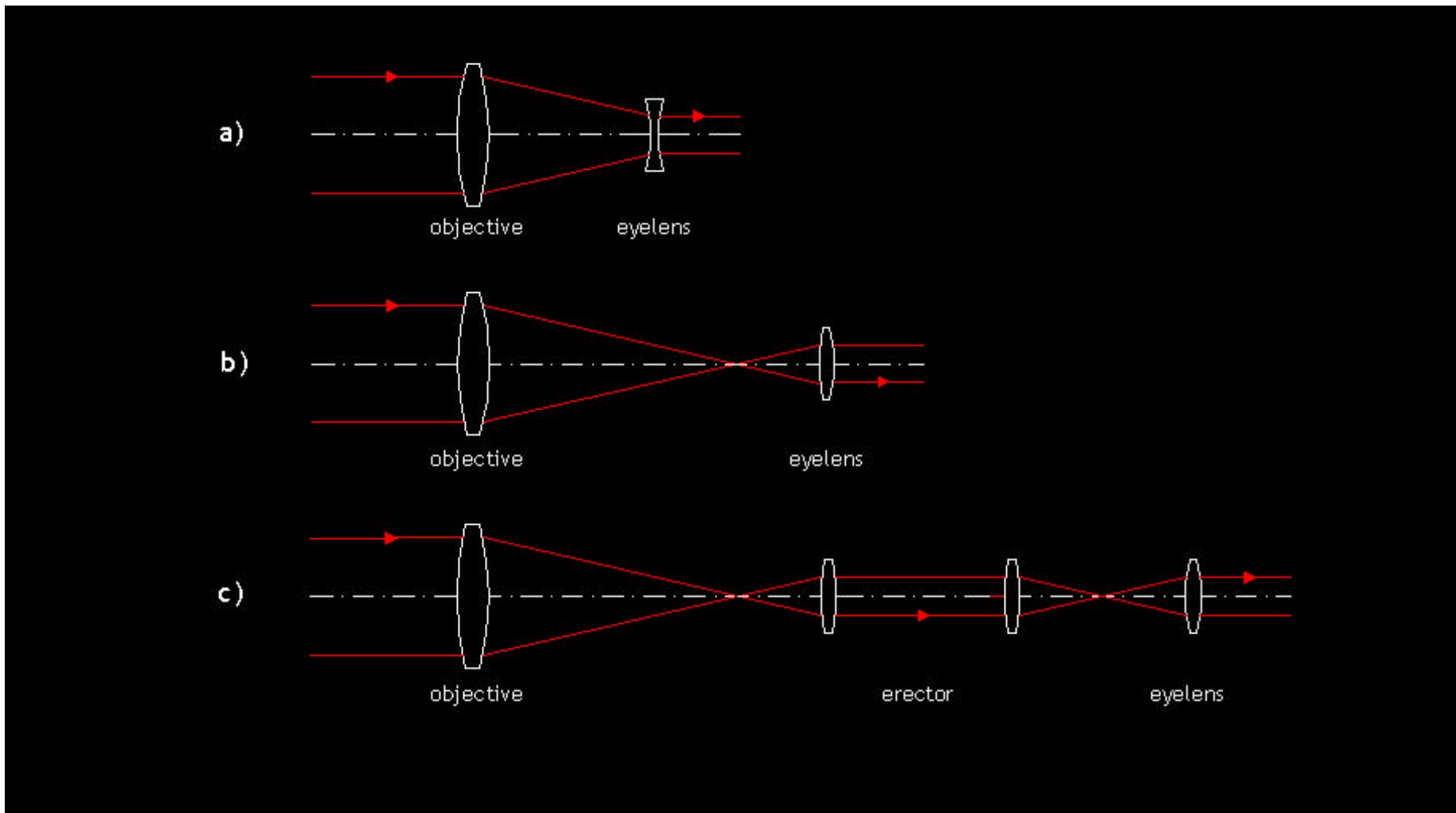
Giuseppe Campani (1635-1715)

1635	Born in Castel San Felice, near Spoleto
~1659	Rome. Early practice in optical polishing
1663-64	Achievement of top professional renown
to 1715	Excellence production of optical instruments

Instruments preserved at

- Conservatoire des Arts et Métiers, Paris
- Observatoire National, Paris
- Istituto e Museo di Storia della Scienza, Florence
- Museo della Specola, Bologna
- ...

Optical shop equipment preserved at
Physics Institute, University of Bologna



Schematic layout of refracting telescopes:
(a) Galilean, (b) Keplerian (or astronomical), (c) terrestrial.

TELESCOPES INSPECTED

ID	Year	Objective Diameter	Objective foc.length	Objective f-number	Diffr. lim. resolution	Magnif.	No. of draw tubes
IMSS							
Firenze							
2551	1664	47 mm(*)	1.89 m	40 (*)	2.9 arcsec (*)	29-36	8
3185	1665	111 mm	11.16 m	100	1.2 arcsec	112-223	10
2556	1666	65 mm(+)	3.02 m	46 (+)	2.1 arcsec (+)	36	6
Specola							
Bologna							
28	1700	75 mm	4.10 m	55	1.8 arcsec		6
29	1714	93 mm	8.20 m	88	1.5 arcsec	80	7

(*) Stopped down to 29 mm diameter, resulting in f/65, and 4.6 arcsec diffraction limited resolution.

(+) Stopped down to 40 mm diameter, resulting in f/76, and 3.4 arcsec diffraction limited resolution..

TELESCOPES OF CAMPANI AT IMSS, FLORENCE



N. 2551



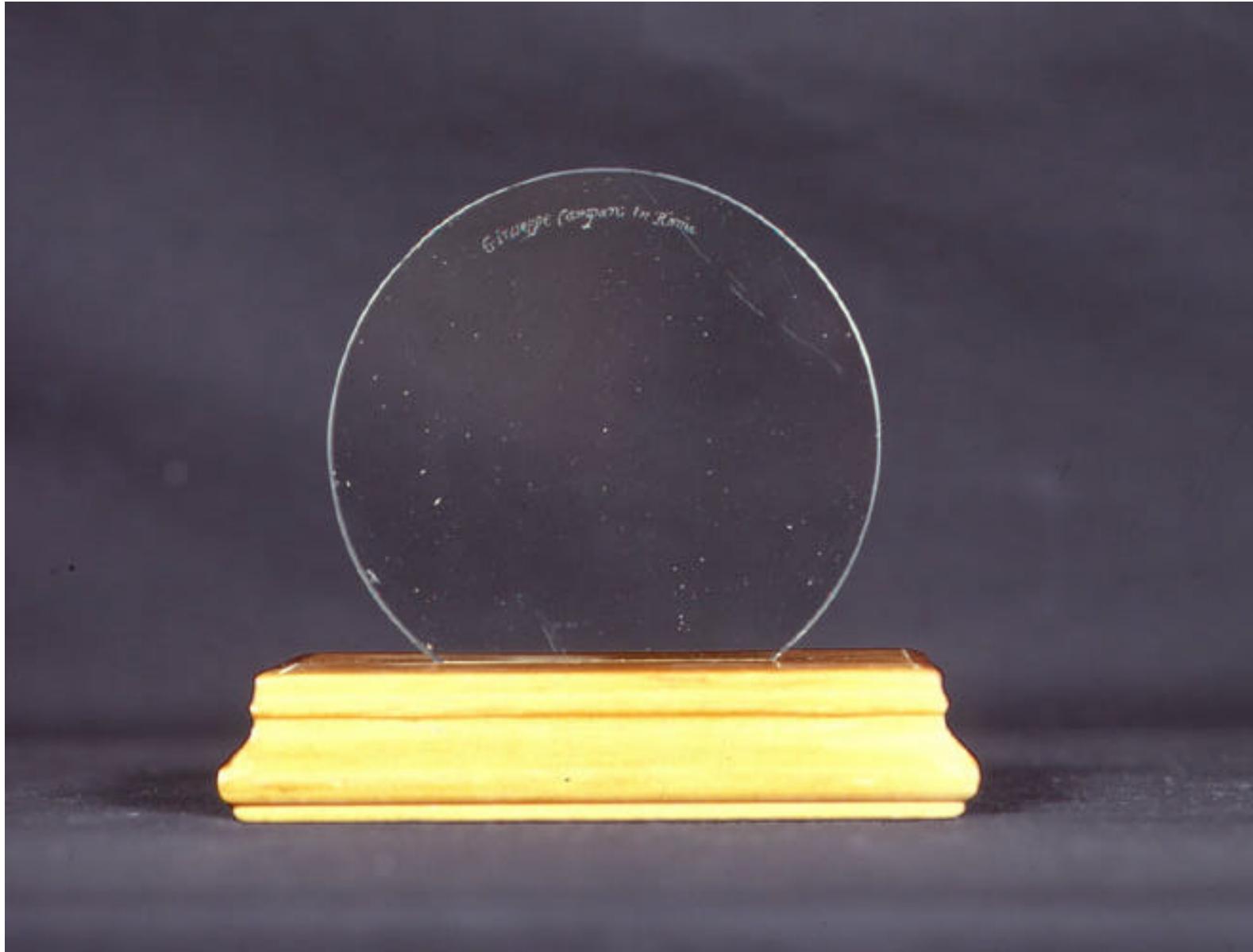
N. 3185



N. 2556



Optics by Campani. Museo della Specola, Bologna.



Objective by Campani. Diameter 13.8 cm, edge thickness 0.5 cm, focal length 12.1 m. Museo della Specola, Bologna.



Objective lens by Evangelista Torricelli (~1645). Diameter 11 cm, focal length about 6 m. Physics Museum of the University of Naples.





Telescope by Campani (~1700). 6 draw tubes.
Objective: diameter 7.5 cm, focal length 4.1 m.
Museo della Specola, Bologna.



Telescope by Campani (~1714). Octagonal, 7 draw tubes.
Objective: diameter 9.3 cm, focal length 8.2 m.
Museo della Specola, Bologna.



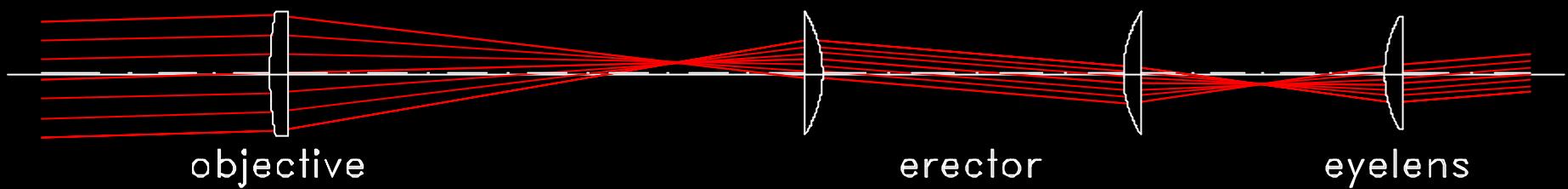
ISTITUTO NAZIONALE DI OTTICA APPLICATA (INOA), FLORENCE:
OPTICAL TESTING LABORATORY

INSTRUMENT

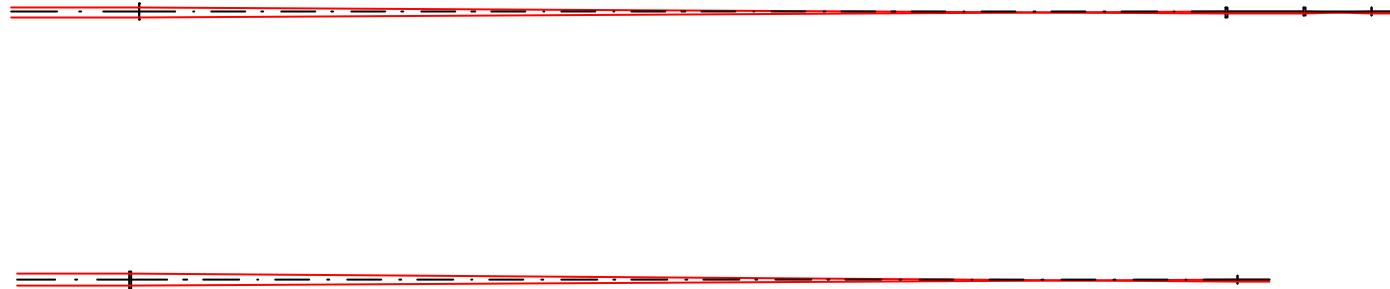
- Laser Fizeau interferometer
- Nomarski microscope
- Laser and white light microinterferometers
- Spectrophotometer

TEST

- Regularity of lens surfaces
- Optical quality of transmitted wavefront
- Microtopography of lens surfaces
- Glass spectral transmittance



Schematic layout of a terrestrial telescope



Optical layout on scale of Campani telescope IMSS 2551.
Upper: with erector unit (terrestrial configuration)
Lower: erector unit removed (astronomical configuration)

CAMPANI TELESCOPE IMSS 2551: OPTICAL SPECIFICATIONS

Optics Element	Front radius (mm)	Back radius (mm)	Full diameter (mm)	Aperture diameter (mm)	Focal length (mm)	f/#
Objective	1960	-1960	47	29	1890	65
Erector lens I	76	-76	29		68.9	
Erector lens II					64.2	
Eyepiece					58.4	

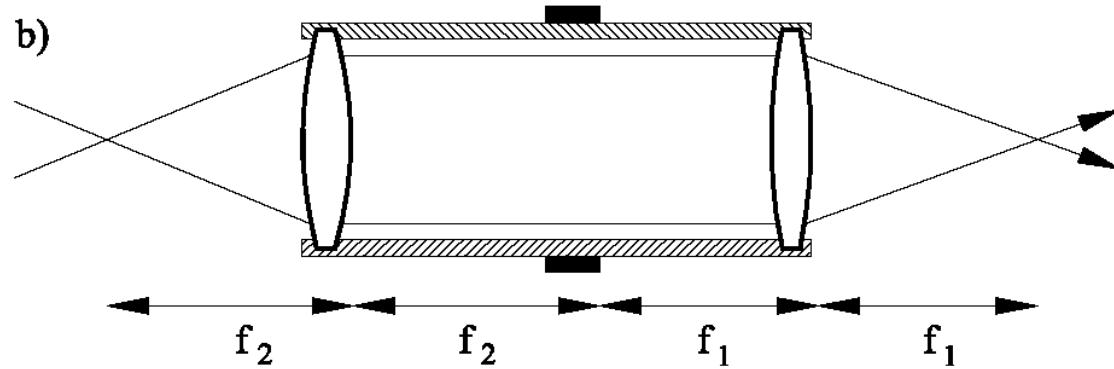
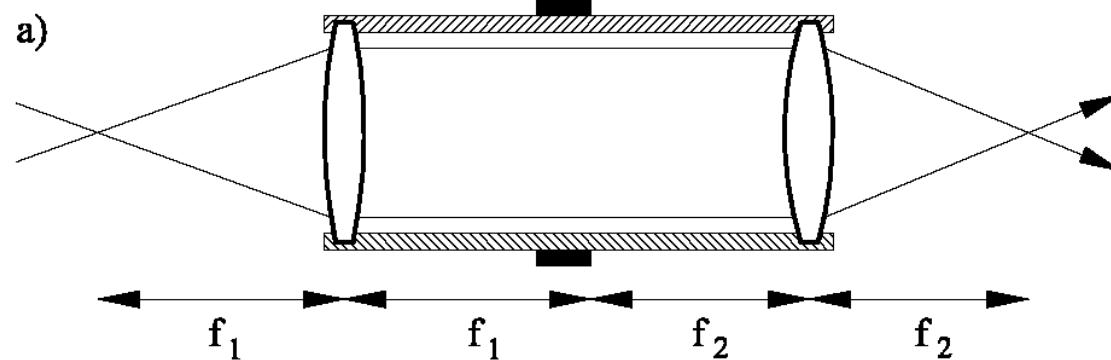
CONFIGURATION PARAMETERS

Resolution	4.6 arcsec	(diffraction limit)
Semi-field of view	~25 arcmin	
Magnification	29	(0.9X erector)
	36	(1.1X erector)
Exit pupil diameter	1 mm	
Eye relief	55 mm	

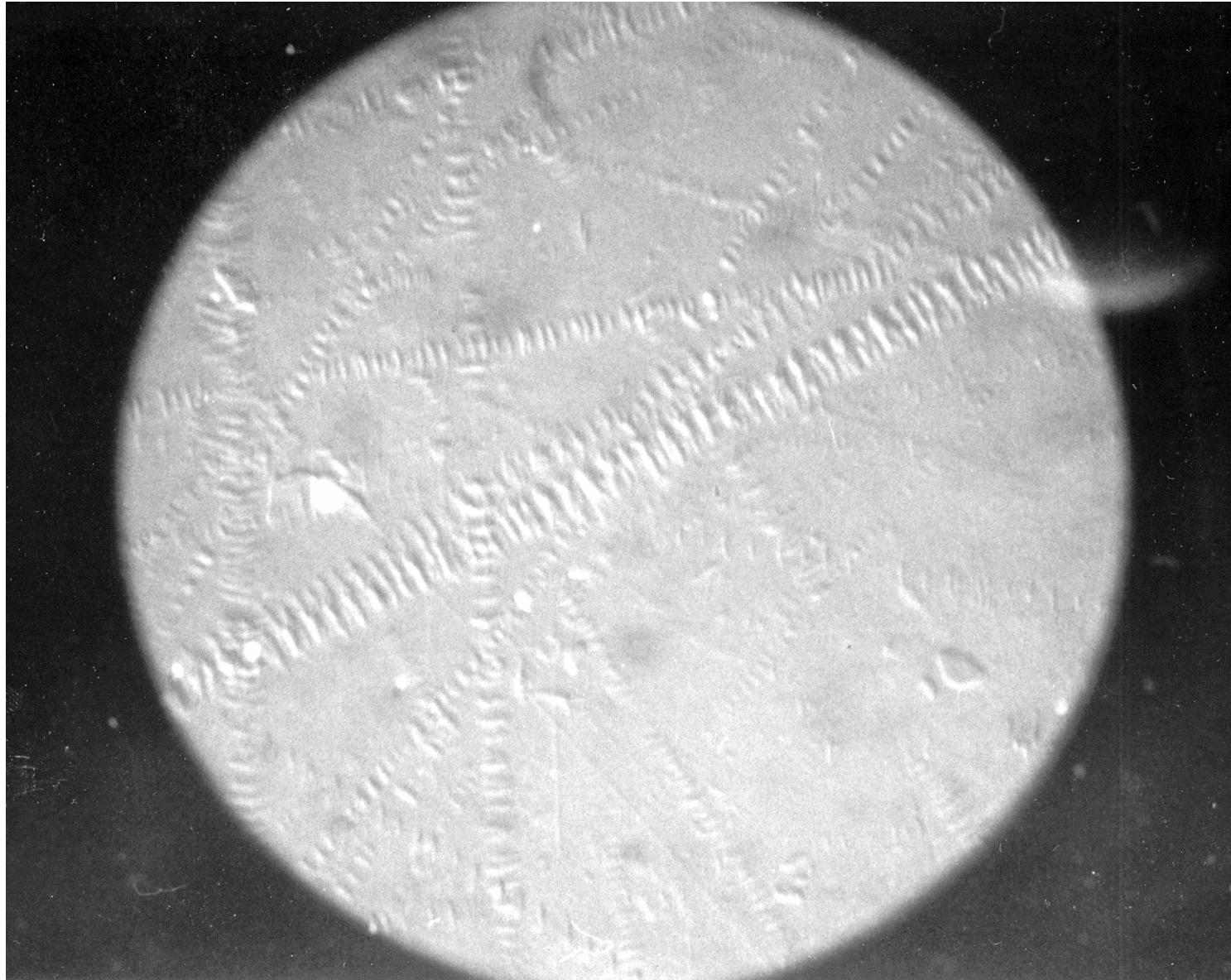
Reversible erector of Campani, with all components (IMSS 2551).



The erector is mechanically symmetrical but optically asymmetrical. Near the middle of the tube there is a cardboboard ferrule that fixes the position of the erector within the smallest draw tube of the telescope. On either side next to this ferrule is an inscription in ink. One side reads "When this part is inside the tube the object is seen larger"; the other side reads "When this part is inside the tube the object is seen more brightly".



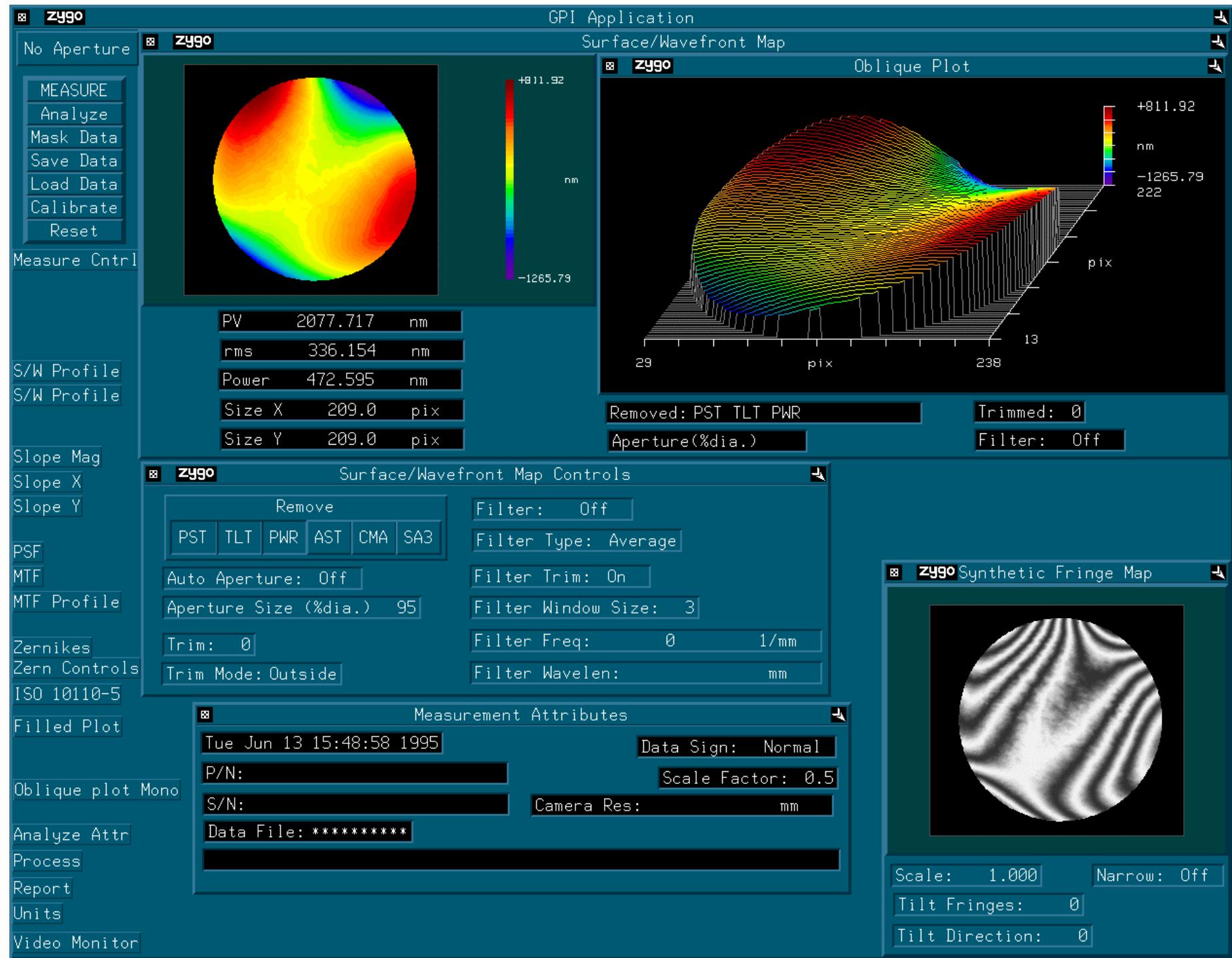
Schematic layout of the Campani reversible erector:
(a) Magnification f_2/f_1
(b) Magnification f_1/f_2

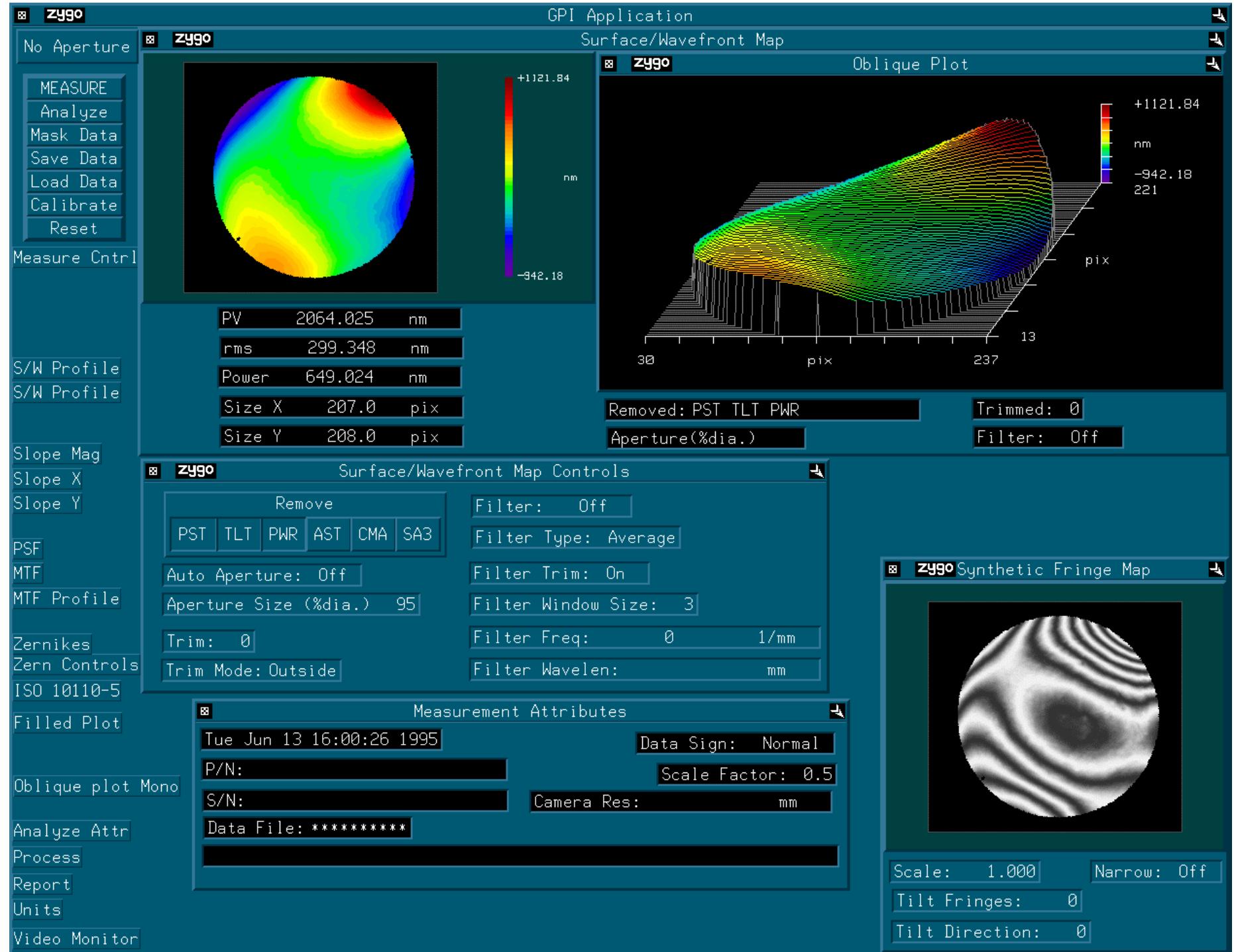


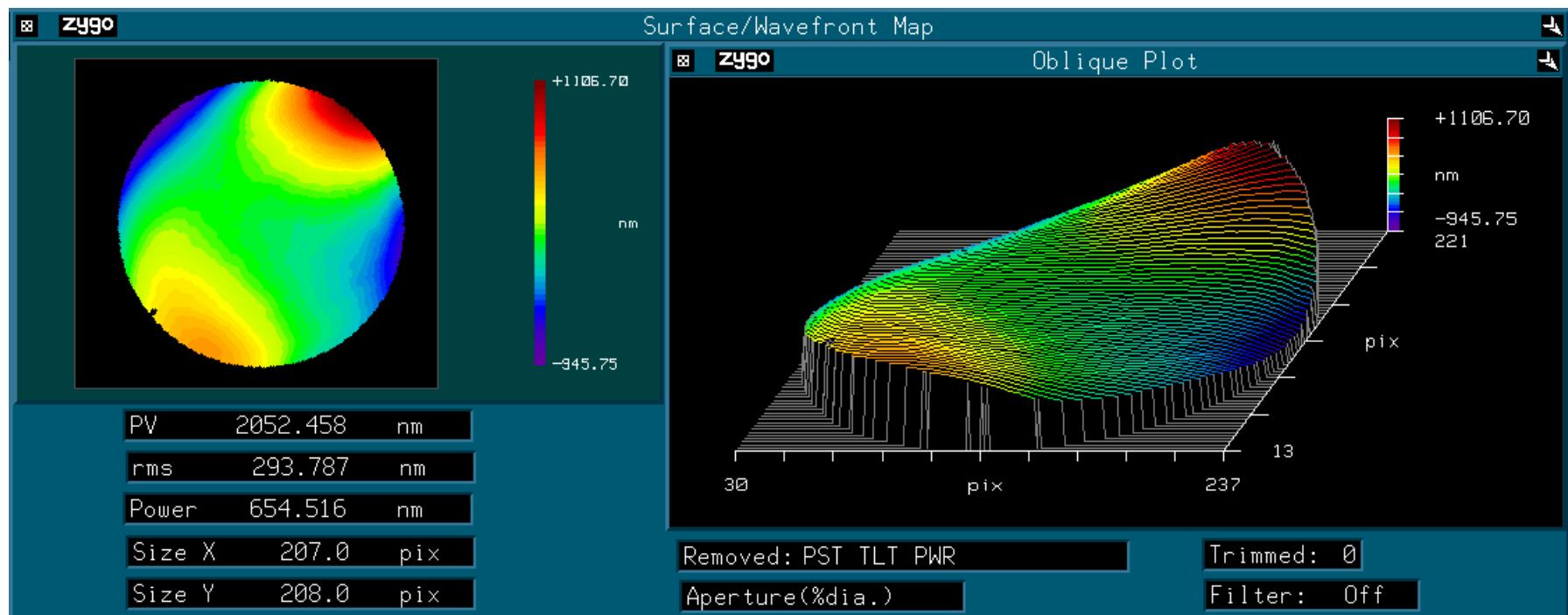
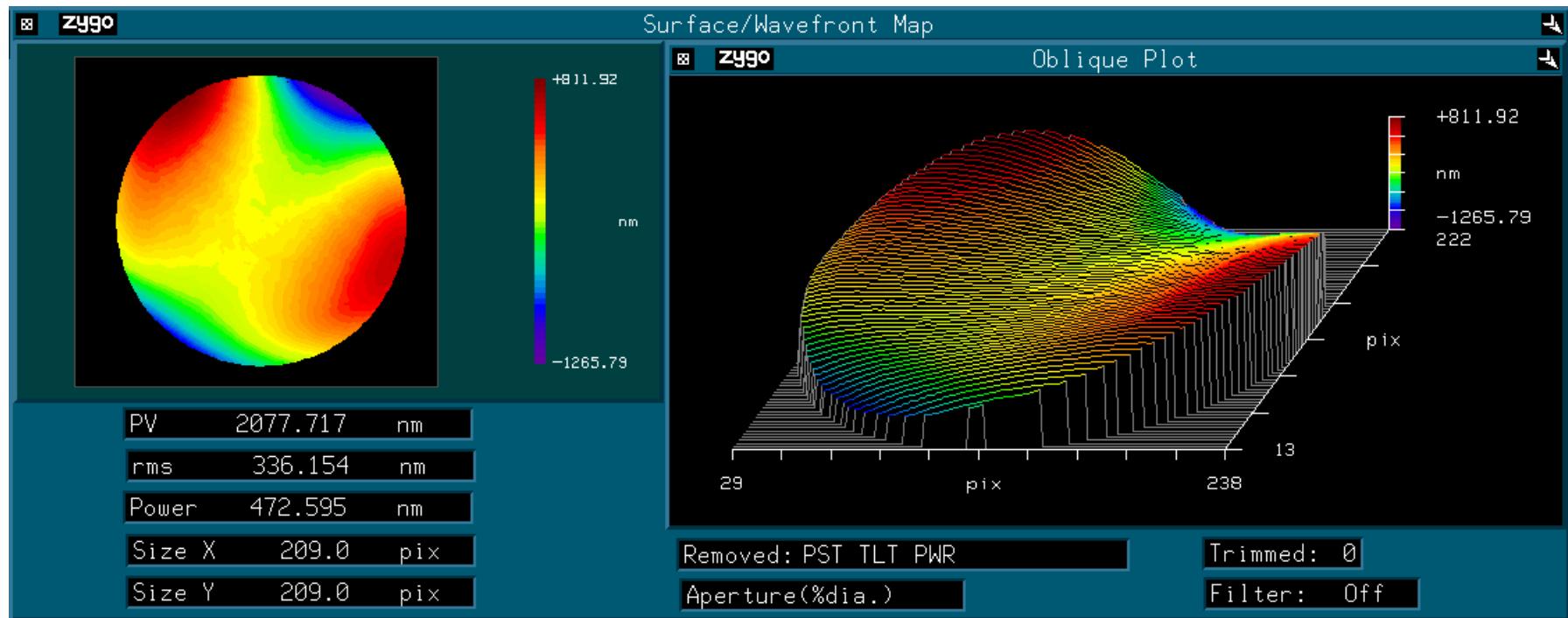
Sample Nomarski micrograph of a lens surface polished by Campani. The area inspected is ~250 μm diameter. Typical marks resembling tire treads in sand are visible.

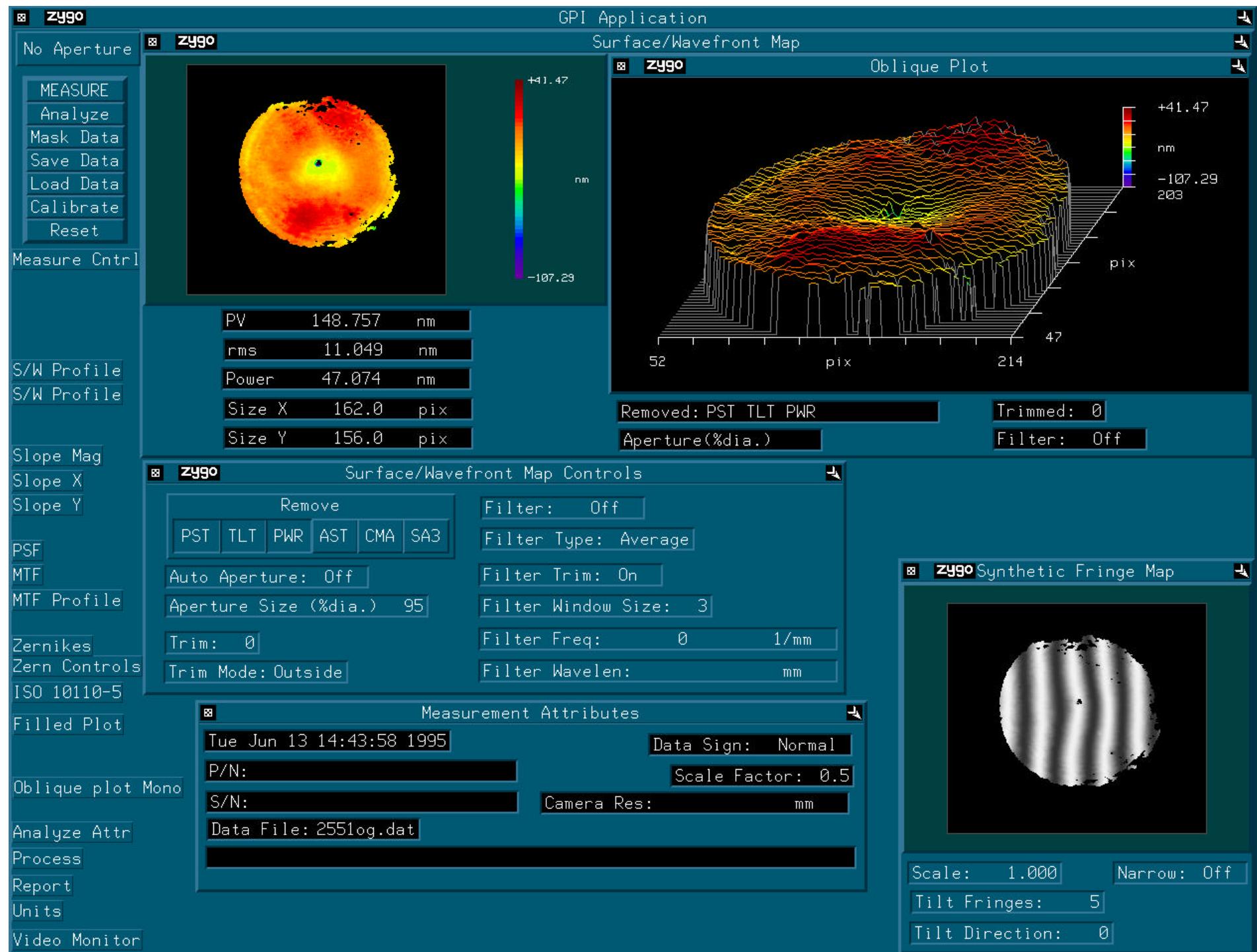


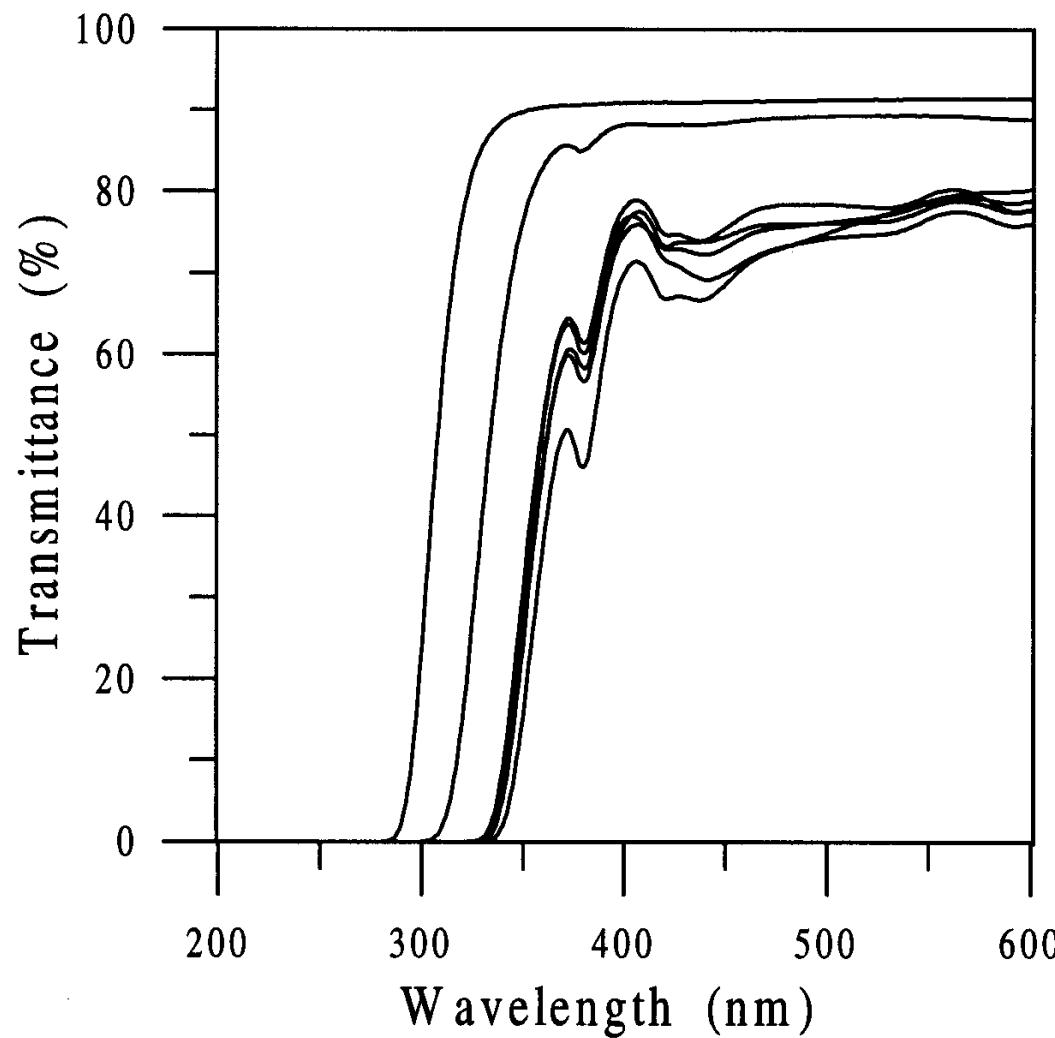
0.28 mm x 0.20 mm sample Nomarski micrograph
of a lens surface polished by Campani.



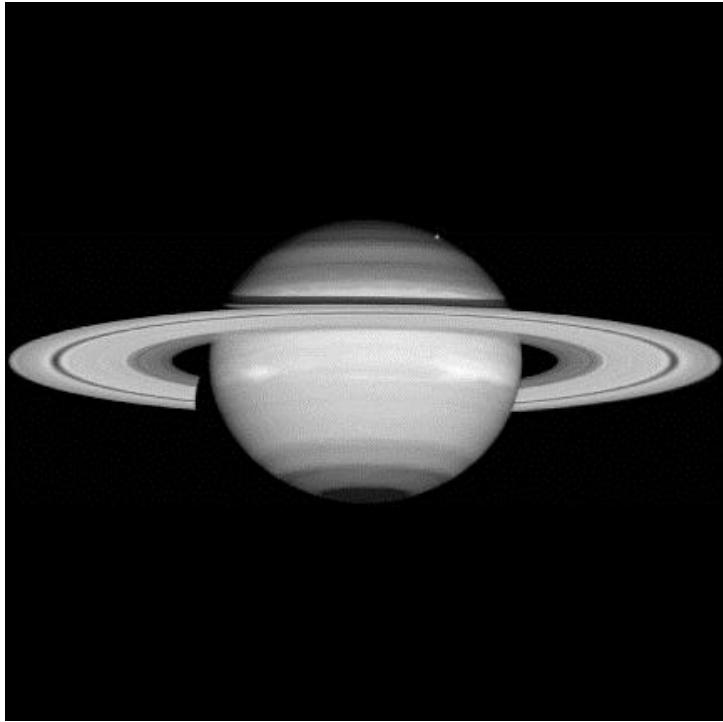




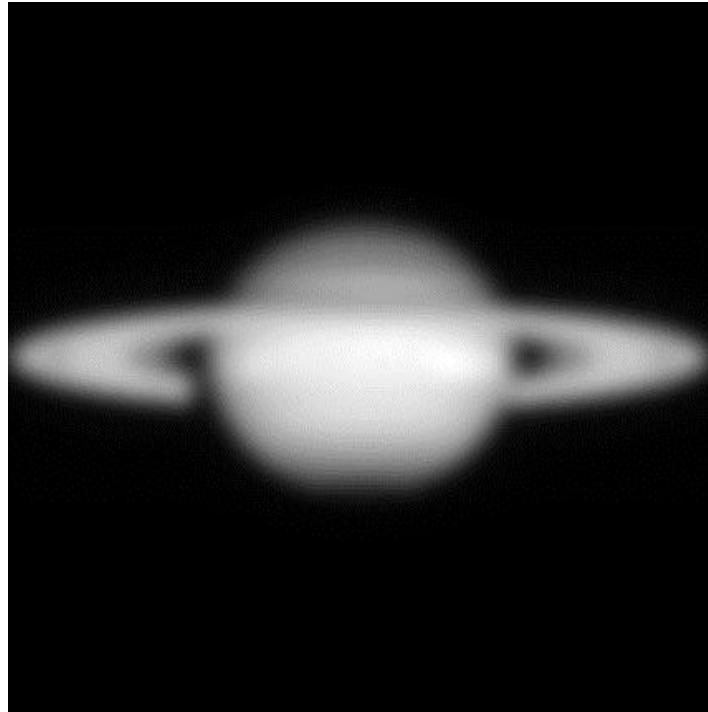




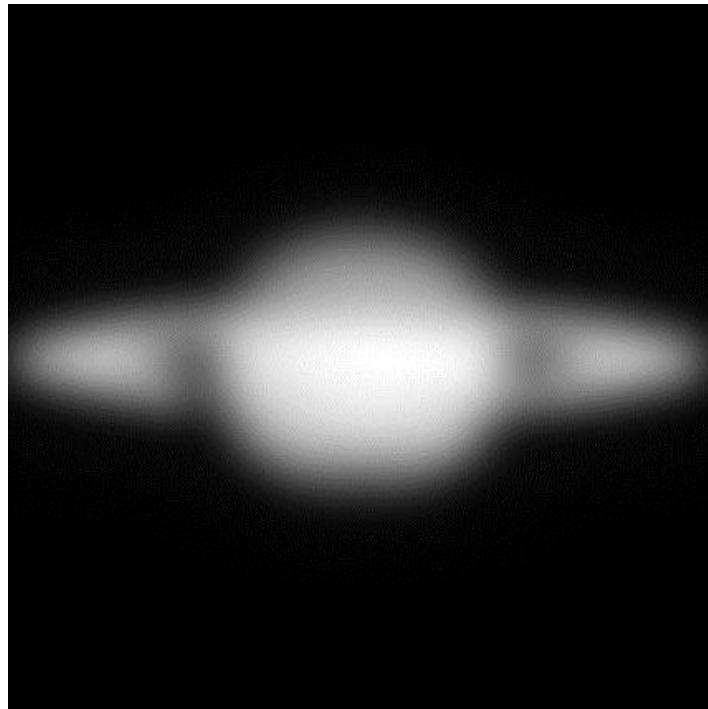
Spectral transmission curves for some of the lenses at the Specola Museum of Bologna, and for two modern glasses used for reference (upper curves)



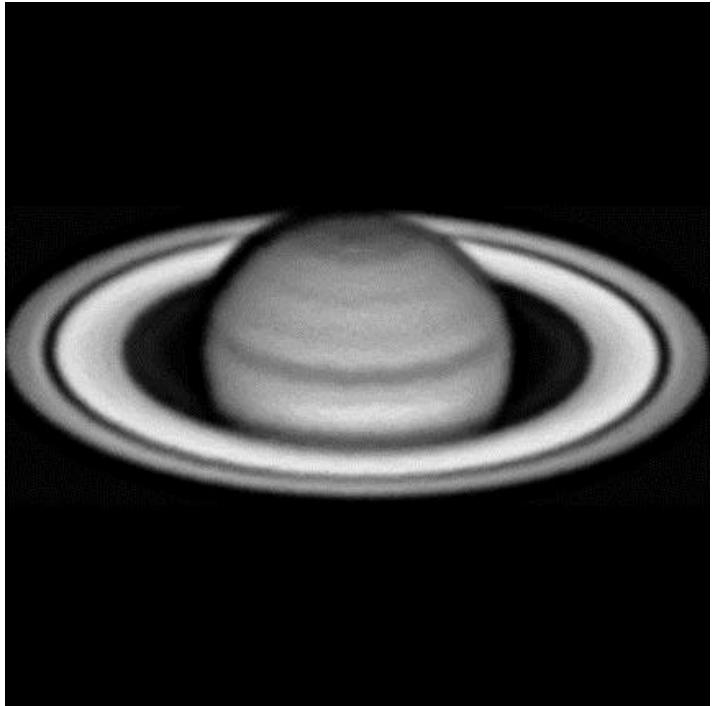
Saturn: high resolution image



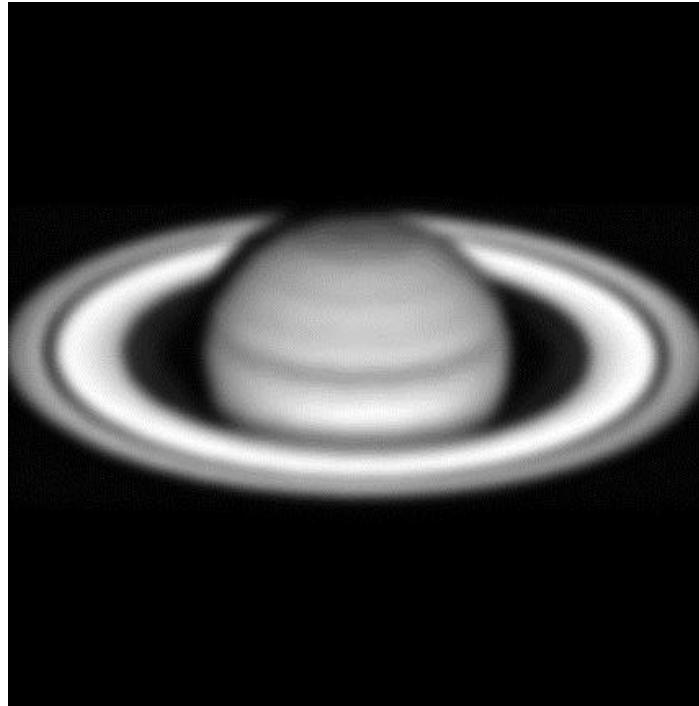
2 arcsec
resol.



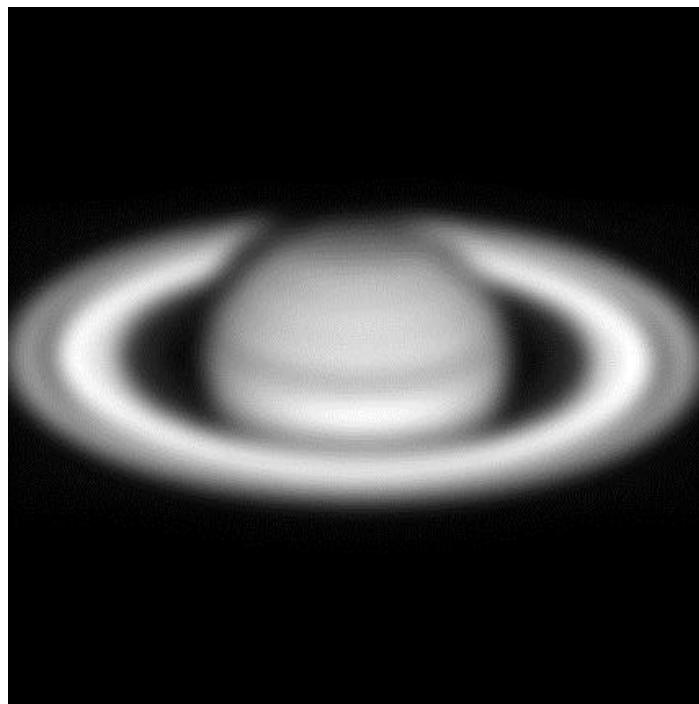
4 arcsec
resol.



Saturn: high resolution image



1 arcsec
resol.



2 arcsec
resol.

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ACKNOWLEDGMENTS

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