

000152

BOL | ROE | N | 0030.10

Optical Design of BOL

Eli Atad , ROE , 12 November 1997

TELESCOPE SPECIFICATION

The Bolometer Imager is designed with the telescope using the following parameters:

Focal length: 28500 mm

Fnumber: 8.68

Unvignetted FOV: circular 0.5 degrees diameter

Stop at secondary mirror

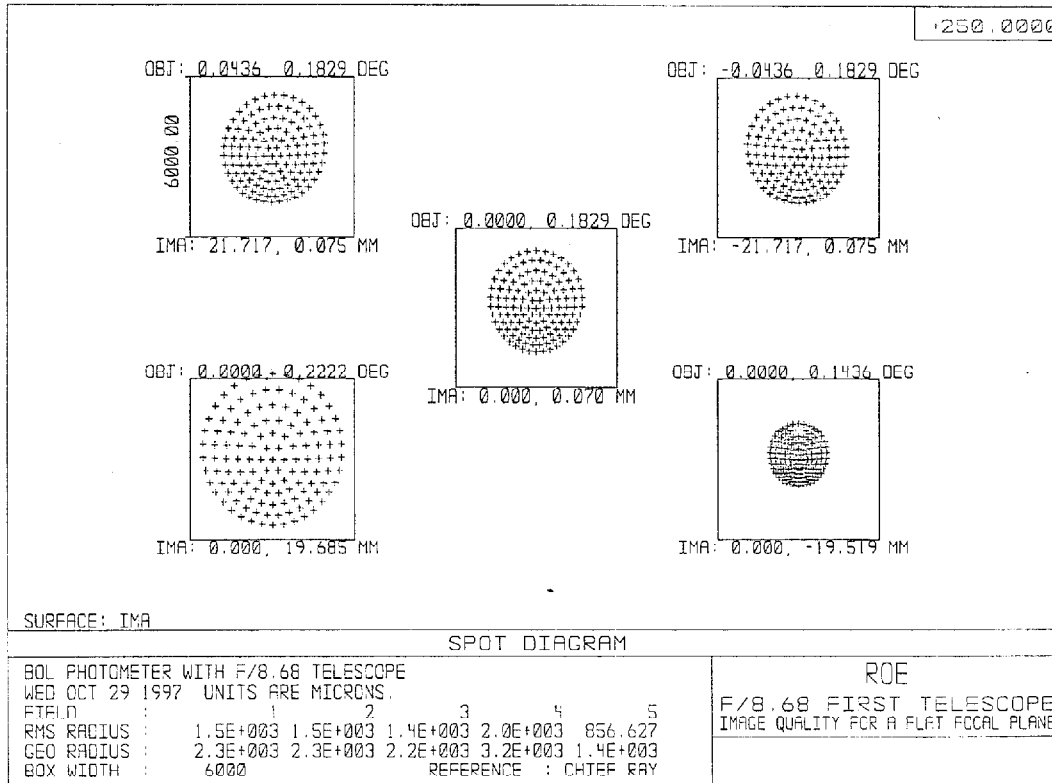
Back focal length: 975 mm (measured from pole of primary mirror); the distance between the focal plane and the pole of BOL M3 is 170 mm and 202 mm from the optical bench.

The optical axis of BOL is decentered by 91 mm relative to the telescope optical axis.

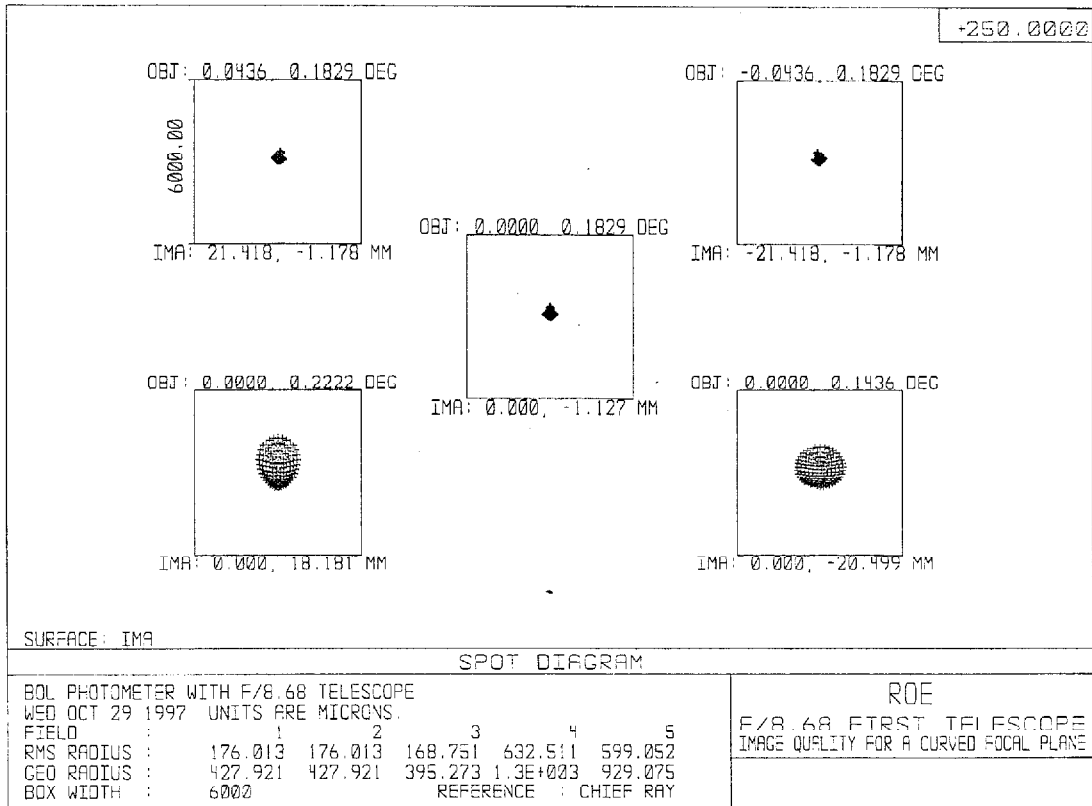
TELESCOPE OPTICAL DESIGN /IMAGE QUALITY

The radius of curvature of the telescope focal plane is 158.3 mm which has to be taken into account in the design of Bolphot . A spot diagram at the telescope focal plane is shown below:

SPOT DIAGRAM:



SPOT DIAGRAM OF FIRST TELESCOPE (CURVED FOCAL PLANE)



Photometer / Imager (designed with 3.5 m; F/8.68 FIRST)

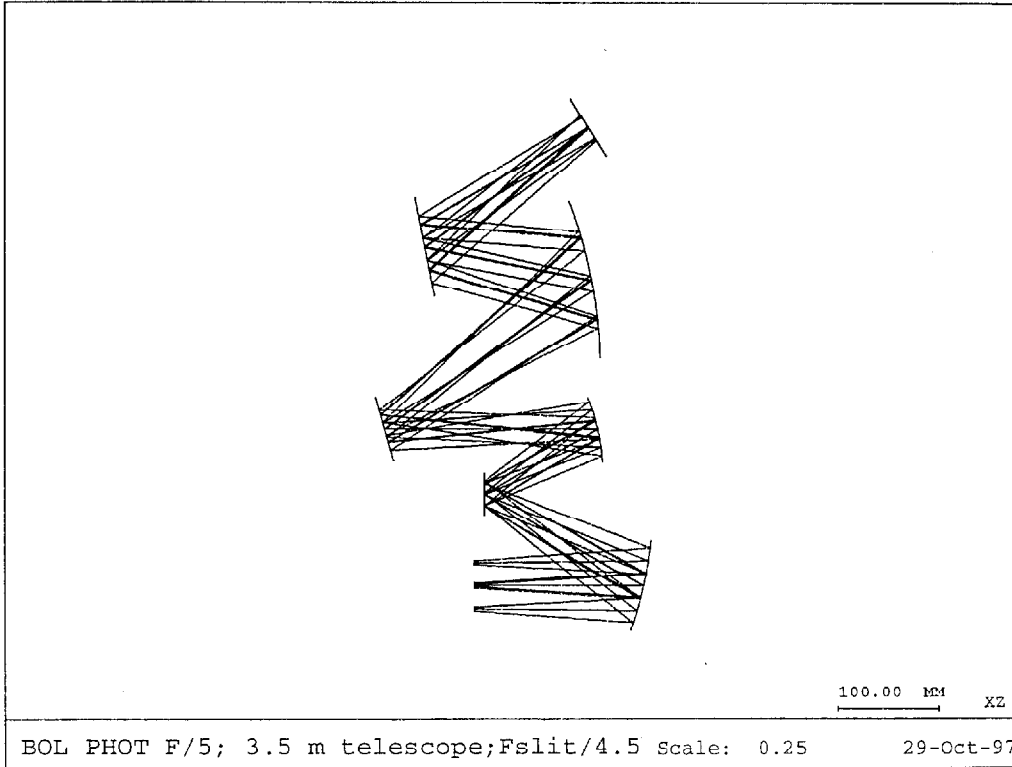
- Working wavelengths: 200-600 microns
 - Fnumber: F/5
 - Field of View: 5 arcmin
 - Chopper in the instrument and placed at the image of FIRST secondary mirror which is the stop of the telescope.
 - Has to fit with the spectrometer in the 690*410*410 mm space envelope.
 - A physical cold stop at 4K to reduce background radiation.
 - The photometer will share the same foreoptics as the spectrometer (one chopper only, weight) ,providing an f/4.5 beam for the eventual slit .
 - 3 arrays of detectors optimized for 3 separate wavelengths: 250, 350,480 microns .
 - No Filter wheel .
-

Photometer/Imager Optical Data:

Component	Radius of Curv (mm)	Separation (mm)	y- Tilt (degrees)	CA Diameter (mm)
telescope FP f/8.68 (20K) (7.237"/mm)	Plano	170		48.0
M3 (sphere)	340.00	180.00	14.0	72.5
M4 (chopper)	Plano	128.83	28.0	24.0
M5 (toroid)	176.416 195.718	84.467	14.0	53.5
Cold reimaged Focal plane f/4.5 (4K)	Plano	129.18		27.5
M6	Plano	100.34	17.0	40.0
cold stop (2K)	Plano	150.00		46.5
M7 (toroid)	347.126 403.739	170.00	22.0	93.5
M8 (dichroic)	Plano	198.00	22.0	70.0
Detector/f/5 (12.56"/mm)				25.0

OPTICAL LAYOUT OF BOLPHOT :

16:31:09



BOL PHOT F/5; 3.5 m telescope; Fslit/4.5 Scale: 0.25 29-Oct-97

IMAGE QUALITY

Encircled Energy Diameters (mm) and Strehl ratios:

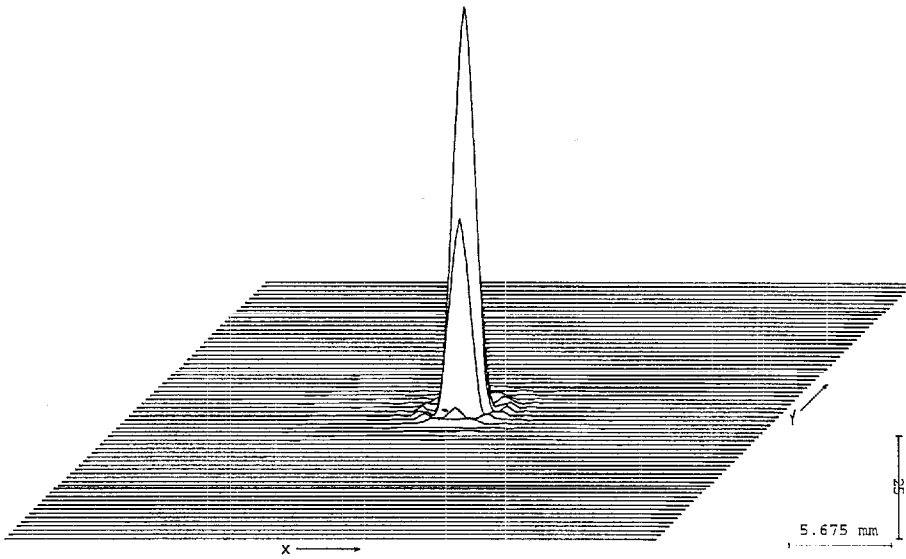
Wavelength (μm)	250	350	480
Airy disk (80%) (mm)	2.5	3.5	4.8
Geometrical spots (mm)			
80% on-axis	0.24	0.24	0.24
off-axis	1.98	1.98	1.98
Strehl ratios			
on-axis	1.0	1.0	1.0
off-axis	0.80	0.90	0.95

THROUGHPUT : 0.89 (without filters)

(assuming 0.98 reflectivity per mirror)

PSF BOLPHOT

On-axis and Off-axis

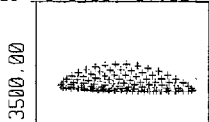


BOL PHOT F/5; 3.5 m telescope; #slit/4.5	DIFFRACTION INTENSITY SPREAD FUNCTION	WAVELENGTH WEIGHT 250000.0 NM 1
POSITION 1 29-Oct-97	FLD(0.00, 1.00)MAX; (0.0, 0.2)DEG DEFOCUSING: 0.000000 MM	

SPOT DIAGRAMS:

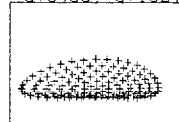
+250.0000

OBJ: 0.0436, 0.1829 DEG



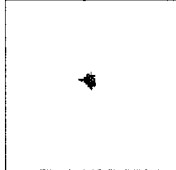
IMA: 13.303, -0.518 MM

OBJ: -0.0436, 0.1829 DEG



IMA: -12.402, -0.921 MM

OBJ: 0.0000, 0.1829 DEG



IMA: 0.030, -0.628 MM

OBJ: 0.0000, 0.2222 DEG



IMA: -0.365, 9.485 MM

OBJ: 0.0000, 0.1436 DEG



IMA: 0.603, -10.710 MM

SURFACE: IMA

SPOT DIAGRAM

BOL PHOTOMETER WITH F/8.68 TELESCOPE

WED OCT 29 1997 UNITS ARE MICRONS.

FIELD : 1 2 3 4 5

RMS RADIUS : 734.361 790.754 90.699 598.377 641.184

CEO RADIUS : 1.4E+003 1.5E+003 210.850 1.3E+003 1.2E+003

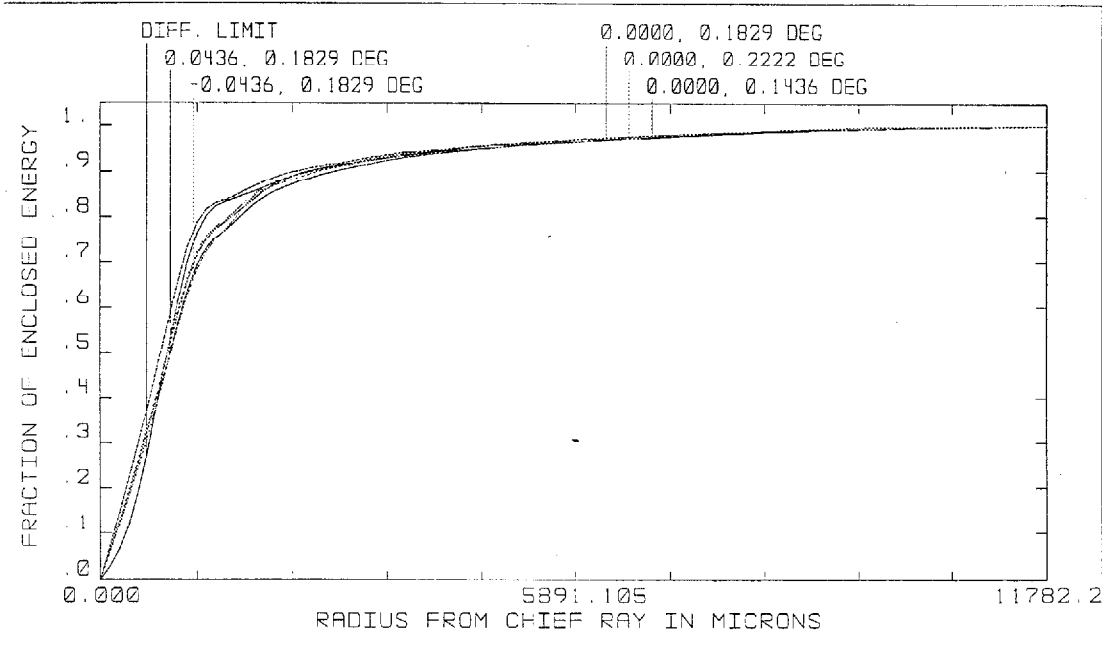
BOX WIDTH : 3500 REFERENCE : CHIEF RAY

ROE

BOLPHOT WITH F/8.68 FIRST

C:\ZEMAX\ZEMAX\BOL\BOLPHNEW.ZMX

ENCIRCLED ENERGY (Diff.Limit at 250 microns)



FFT DIFFRACTION ENCIRCLED ENERGY

BOL PHOTOMETER WITH F/8.68 TELESCOPE
WED OCT 29 1997
WAVELENGTH: POLYCHROMATIC

ROE
BOLPHOT WITH F/8.68 FIRST
C:\ZEMAX\ZEMAX\BOL\BOLPHNEW.ZMX