Parameters of the Kottamia 1.88m Telescope

1- Optical specifications:

Optical system	
Diameter of M1 (D1) Radius curvature of M1 (R1) Conic coefficient of M1 (K1) Normalized central hole	1888.00 (1930 total diameter) -18277.00 -1.000 0.15250
Diameter of M2 (D2): Radius of curvature of M2 (R2): Conic coefficient of M2 (K2):	483.00 -7380.00 -3.012377
normalized back distance Focal length of telescope Distance M1-M2 Distance M2-focal plane	0.1094271 33984.00 6990.00 7990.00

2- Main mirror support system:

2-1 Radial support System:

The mirror is supported by 16 counterweighted radial support units. The units are fixed on the inner edge of the cell. The pivots are ball bearings. The counterweight moment is adapted for the actual mirror weight. A spherical plug on the front end of the support lever is intervened in an exactly worked hole in a flange which is mounted onto the mirror pads. At the mirror edge, 16 INVAR pads are glued.
The radial position of the mirror in the cell is defined by three units attached to the mirror edge at angular distance of 3 x 120 degree. Two fixation points are "hard" points i.e. they are fixed adjustable stops. The third point gives a "soft" pressure to the mirror edge by using a spring.

2-2 Axial Support System:

The mirror is supported axially at 18 support points. These points are distributed on an inner ring with 6 supports and an outer ring with 12 supports (Fig.1). Three points are fix and adjustable units, which define the axial position of the mirror (Fig. 2). The support units are counterweighted lever systems with flexural pivots. The counterweight moment will be adapted for the actual mirror weight. Floating base disks disposed between the mirror backside and the support systems prevent radial pressure from the supports to the mirror.

90 kg
18 | 1620
182

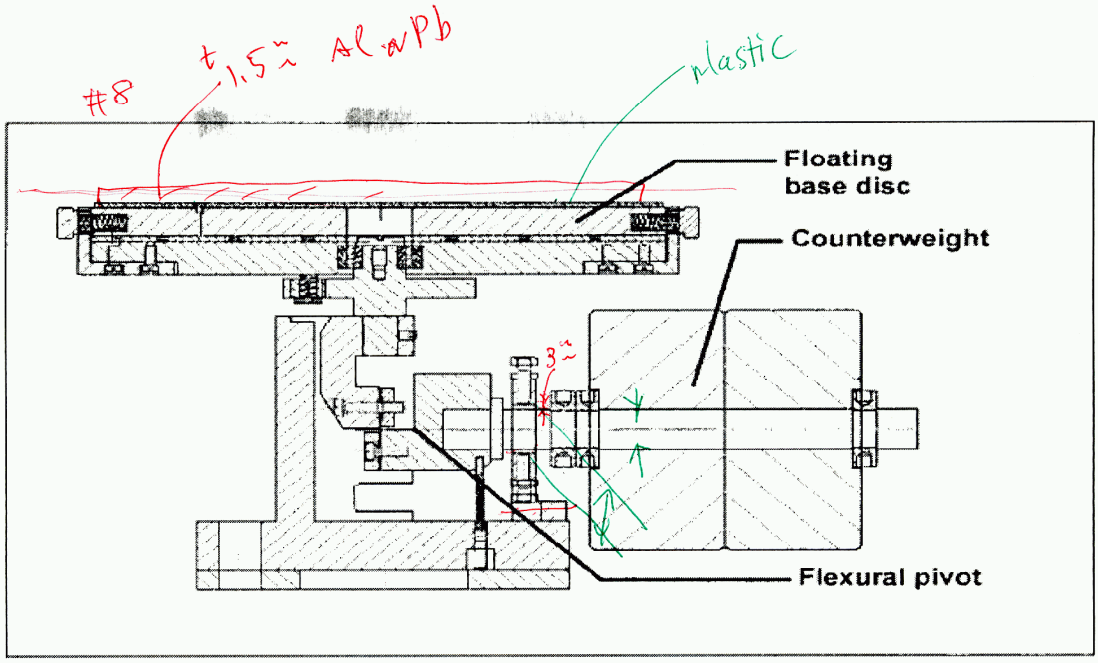

Fig. 1—Axial support point (see drawing 161499:001.14(1)).

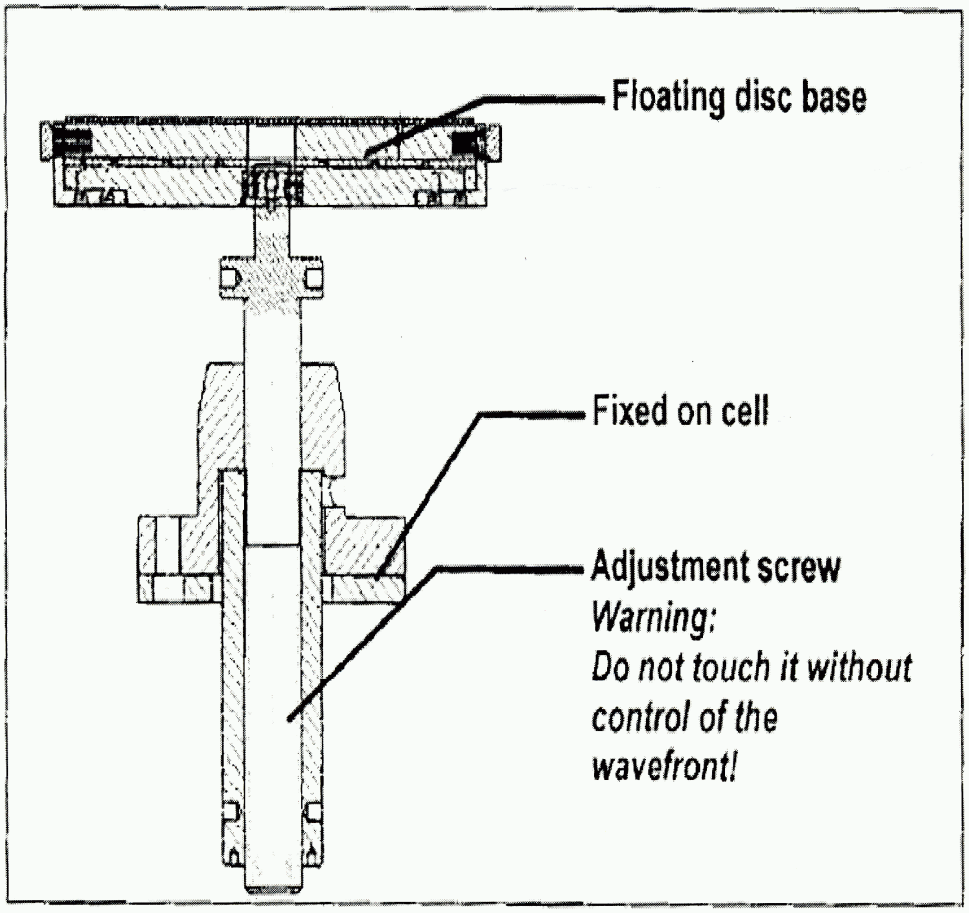

Fig. 2—Axial fixation point (see drawing 161499:005.14(2))

3- Determination of the optimal support circle diameters d1 and d2 with spot concentration as a criterion for evaluation

Data:
Weight of M1: 1620 kg
Density: 2.53×10^{-3} kg mm^{-3}
Modulus of elasticity: E = 9210.6 kpmm
ν = 0.243
Radius of M1 r_a = 965 mm
Radius of inner hole r_i = 94 mm

Mathematical model
Circular plate with central hole and with variable thickness under influence of its own weight is supported by two support circles with load distributed as 1/3 and 2/3 of the weight on 6 and 12 support pints respectively.

This gives:
Optimal support circle radii:

$k1 = 0.368750 * r_a$ ==== $d_i = 711.69$ +/- 1 mm
$k2 = 0.8350 * r_a$ ==== $d_A = 1611.55$ +/- 1 mm

Geometrical-optical spot concentration: $d_{100\%} = 0.06$ arcsec with $\lambda = 633$ nm, the Deformation (optimal support): rms Def = λ / 167

4- Results of June 1999' inspection of Kottamia 1.88m support system problem

- 2 disks of the RFPs are found free moving in the cell. (The middle screws of each one are broken).
- 2 radial pads (no. 12 and 13) are found free in the bottom of the cell. One of them contains a small piece of the mirror at the upper edge with size 1.3cmx0.9cm and depth 0.2cm.
- All counter weights of the RSS are found moving!!!
- 25.4cm is the distance (vertical) between the backside of the mirror and the base of the cell.
- Cell is dismounted on Aug 30th 1999.
- The brass diaphragm disks are found deformed as the systems no. 12 and 13.
- With 0.05mm gauge thickness, no clearness was found between each pad and the mirror side.
- Because of the deformation noticed in the brass diaphragm disks, Zeiss team decided not to dismantle the mirror from its cell. This is based on safety reasons as they mentioned.
- A mark in a thin dust layer covering the surface of M1 pointing little bit north of the east was noticed while the free pads are no. 12 and 13.
- Zeiss team left the mirror M1, in its cell dismounted and covered it with a wooden and plastic cover.
- The 2-free pads and the 2-broken lateral disks were taken by Zeiss for further inspection and lab tests and will be return back to NRIAG within one month.

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CCD:
Dimension: 2154colsx2048rows with square pixel of size 13.5 micron.

	Focal length	F-ratio	scale
Newronian focus	9138.5 mm	4.87	22.54 arcsec/mm (0.3arcsec/pixel)
cassegrain focus	33984 mm	18	6.09 arcsec/mm (0.083arcsec/pixel)

The test observation of 6th May 2008 was done at the Newtonian focus, while that of 10/11 September was done at the Casegrain focus.

Zeiss's report

Kottan a people wrote.

Results of Wed 15/4/2009 inspection of KT M1 support system

We describe here the results of inspecting KT M1 support system according to the recommendations of Dr. Fisher outlined in his report based on focus test observations taken by KT.

Before dismounting the cell, the Axial Support System (ASS) was checked from the back of the cell.

- The back side of M1 was settled on all of the ASS points except the free points No. 8 and No. 9. It is possible to insert 2 thin paper sheets and one paper between the mirror back and the floating disks No. 8 and No. 9 respectively. It was possible to rotate the floating pads of No. 8 and No.9.

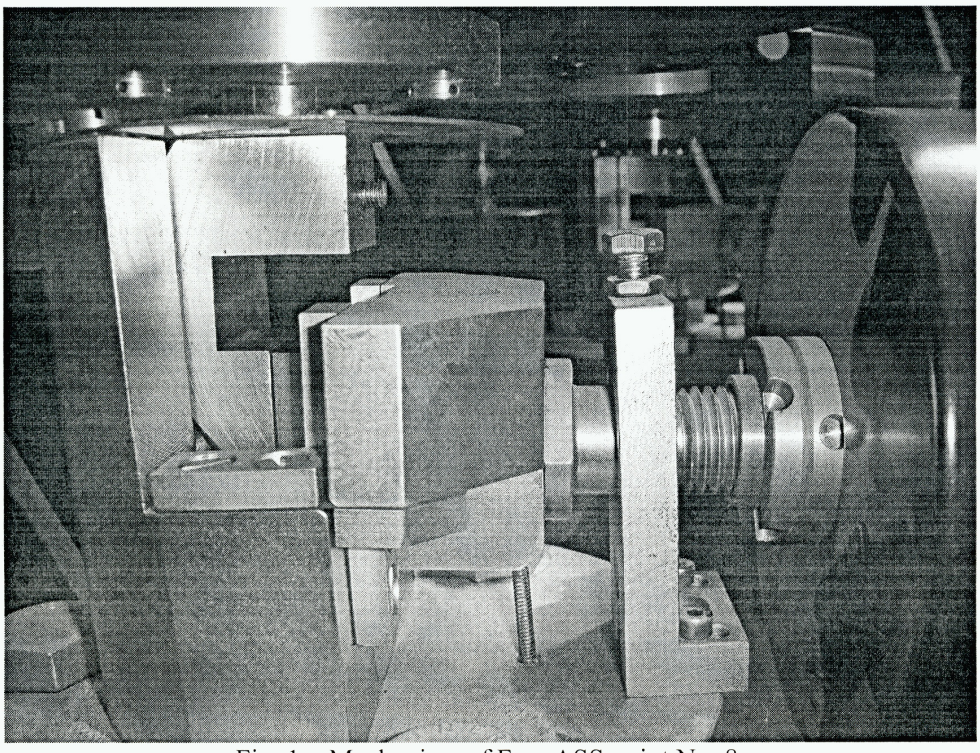

Fig. 1 – Mechanism of Free ASS point No. 8.

After dismounting the cell, we inspected the Radial Support System (RSS):

- The 2 fixed radial points (Hard) are found with clearness of about 5 papers sheets between each of them and the mirror edge.
- The flexible radial point was found stacked to the mirror edge.
- The links of the free 16 points of the RSS are found correctly connected to the mirror and there was a small amount of movement at the contour weight of each one.

Then the mirror is lifted up from the cell.

- It was possible to move up and down the counter weights of the 15 free points of the ASS. When moving a counterweight up and down a voice is heard when reaching its limits. The tone of this voice is similar for all counterweights except for No.8 (Fig.1) where a different (damped) tone is noticed when reaching its upper limit.
- All of the counterweights are started to move up when applying 80 kg weight to the support pad of each one except No. 2, 7, 8 and 9 whose counterweights are started to move up by applying 85, 90, 85, and 85 kg respectively.
- The 3 fixed axial points are found stable.
- The counterweights of the RSS are found moving freely.
- The collars are found secure. For all free ASS points, it is noticed that the outer collars are not at the same distance from the end of the counter arms on the same ring (Fig. 2). This probably means that the weights are not equidistance from their pivots. This is for both inner and outer rings.

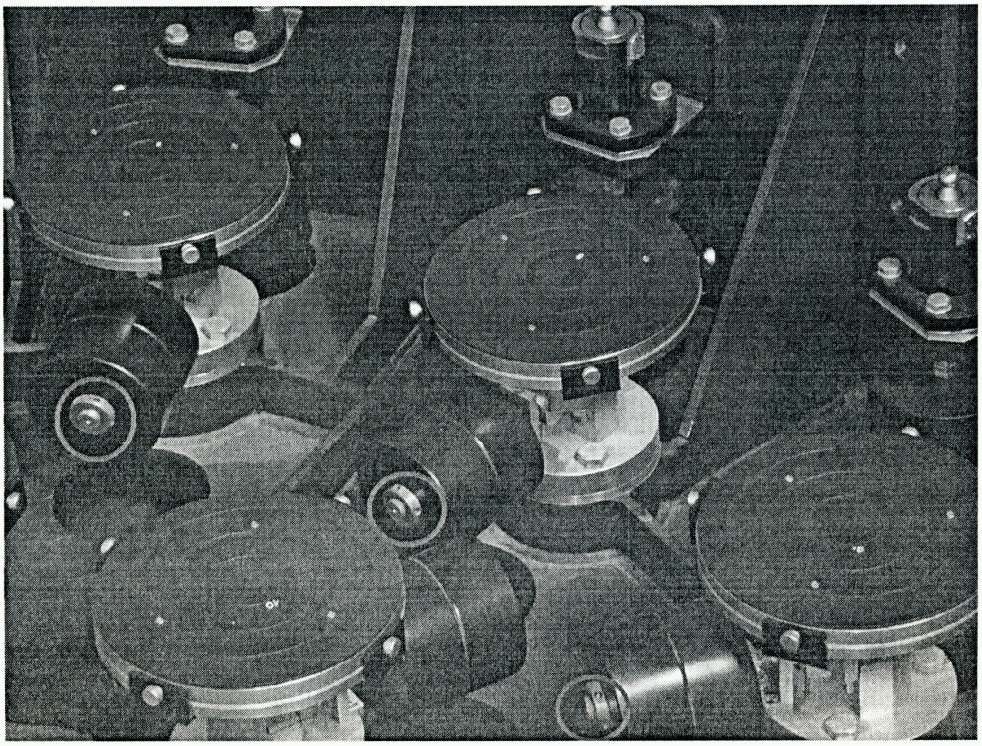

Fig.2 – Outer collars are not equidistance from the counter arm.

The mirror is put back again in the cell. After about an hour we test the clearness issue and found no clearness between mirror back and any of the floating pads of ASS. After mounting the cell to the telescope the clearness issue is retested and the 2 papers clearness is found again between mirror back and the floating pad of the free axial point No. 8!!!

NOTE:
About 7 months ago the mirror is dismounted from the cell for re-coating. After coating, the mirror is installed properly in its cell and mounted to the telescope. Then we tested the clearness between the mirror back and the floating disks of the ASS. We did not find any clearness except for the axial fixed point AF3 on the East. This point is then adjusted such that there is no clearness.

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D2w	Clear Aperture Diameter of the Secondary Mirror	553.69	}
F2	Focal Length of the Secondary Mirror	2938.81	} MODAS
R2	Radius of Curvature of the Secondary Mirror	5877.62	}

Repairing is started by Zeiss in 2nd December 2002