Schemes for 4m Telescope for Dome A
-----KDUST

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- **Entrance pupil diameter : 4000mm**
- **Plate scale requirement : ??**
- **Wavelength range : 0.38μm-1μm(optical）**

  0.95μm-2.5μm（near-infrared）
- **Diffraction limited at λ=0.5876μm : 0.074";**

Diffraction limited image spot	G λ0=0.477	R λ0=0.623	I λ0=0.763	Z λ0=1.02	J λ0=1.25	H λ0=1.6	K λ0=2.2
	0.06"	0.079"	0.096"	0.128"	0.157"	0.201"	0.277"

1. R-C design

1) primary f-ratio：1.2

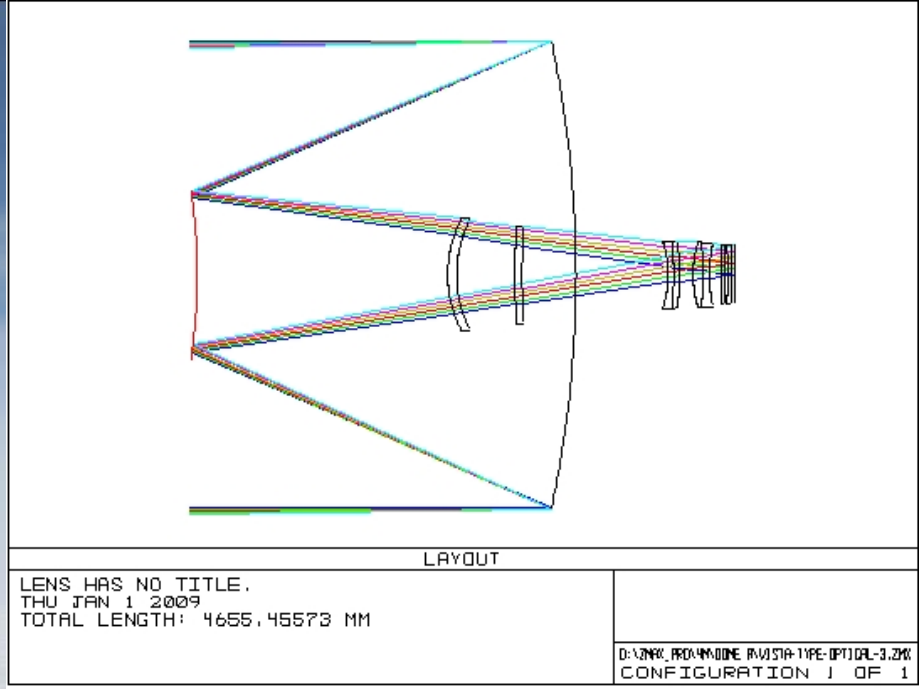
system f-ratio：3.55

plate scale: 0.145"/10μm

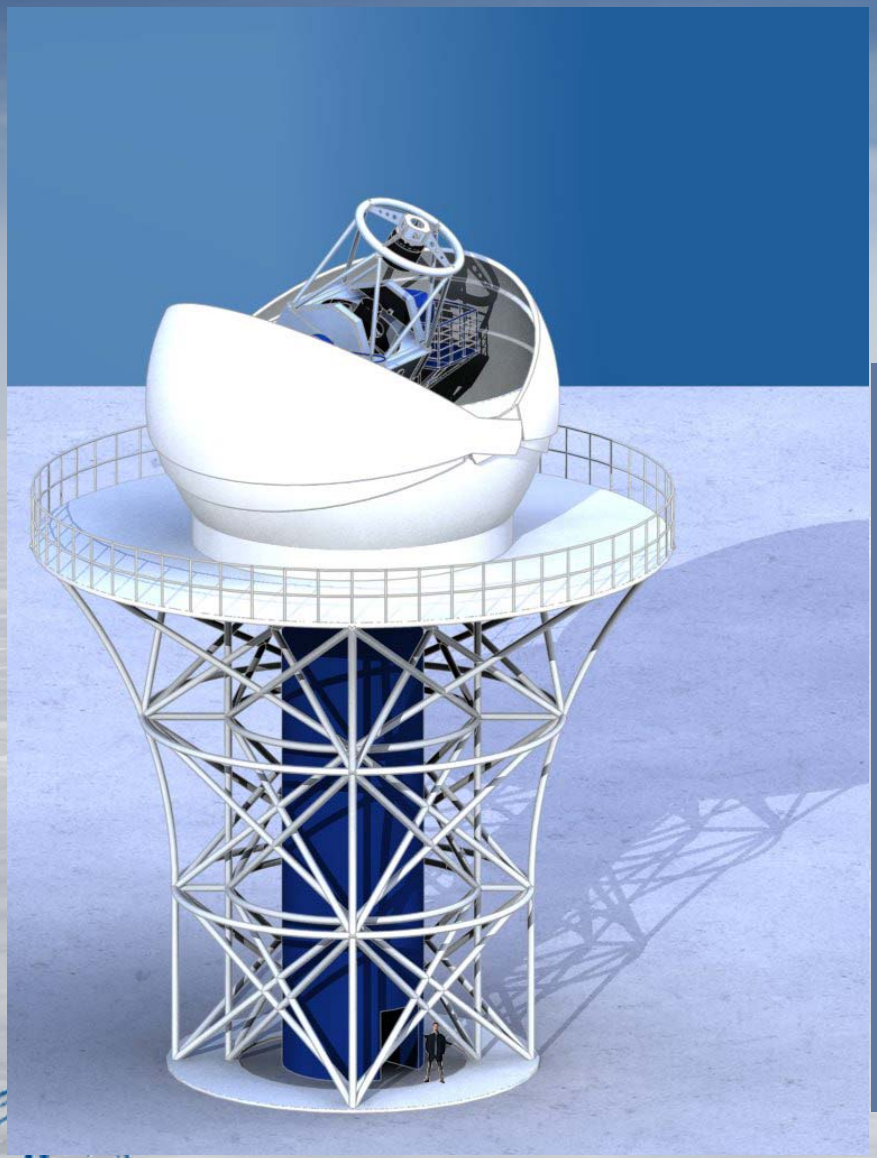
FOV：2°（Cas）/ 1°（Nas）

image plane diameter: 501mm(Cas);

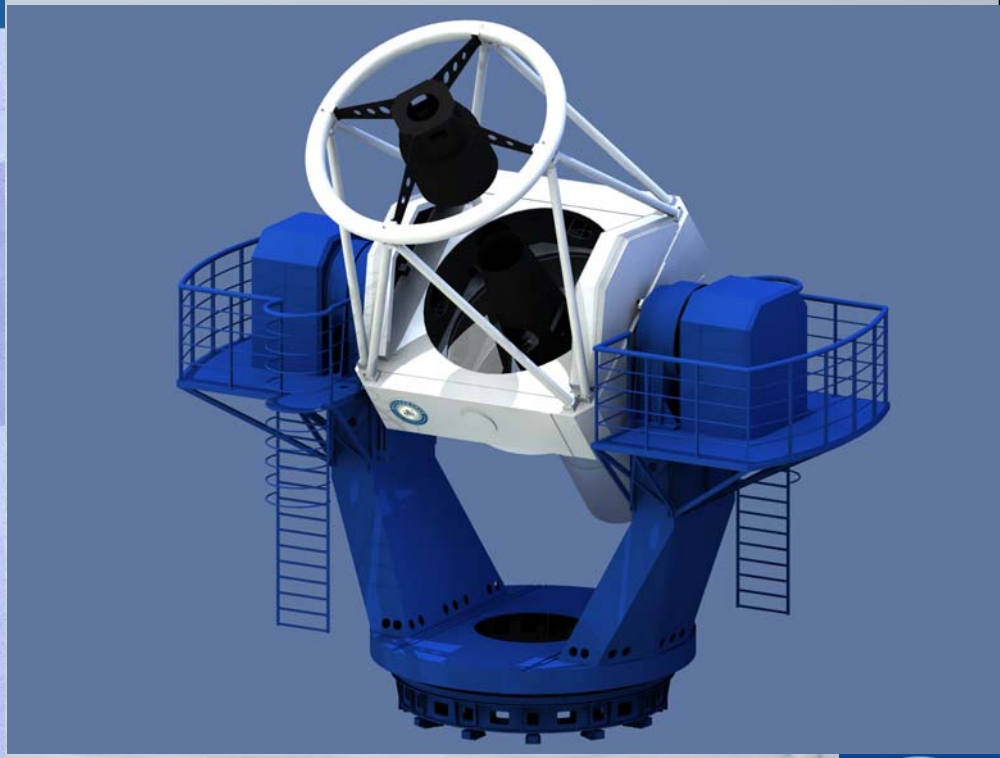
252mm(Nas）



Cas focus (0.38μm-1μm)						
half FOV	0	0.2°	0.4°	0.6°	0.8°	1°
80% geometric encircled energy	0.25"	0.23"	0.22"	0.23"	0.32"	0.55"
Nas focus(0.95μm-3μm)						
half FOV	0	0.1°	0.2°	0.3°	0.4°	0.5°
80% geometric encircled energy	0.13"	0.18"	0.26"	0.29"	0.26"	0.27"



mounted on the 15m high tower with fully opened dome



2) primary f-ratio： 1.5

system f-ratio： 4.48

focal length: 17925mm

plate scale : 0.115"/10μm

optical length: 5830mm

image plane diameter: 628mm(Cas); 313mm(Nas）

a	0	0.1	0.2	0.3	0.5	0.75	0.85	1
b	0.076	0.076	0.078	0.083	0.106	0.167	0.23	0.368

a: Half Field of view (unit:°);

b: 80% geometric encircled energy under 0.38μm-1μm (unit: ")

a	0	0.1	0.2	0.3	0.4	0.5		
c	0.046	0.083	0.122	0.118	0.104	0.19		

a: Half Field of view (unit:°);

c: 80% geometric encircled energy under 0.95μm-2.5μm (unit: ")

3) primary f-ratio： 1.7

system f-ratio： 5.03

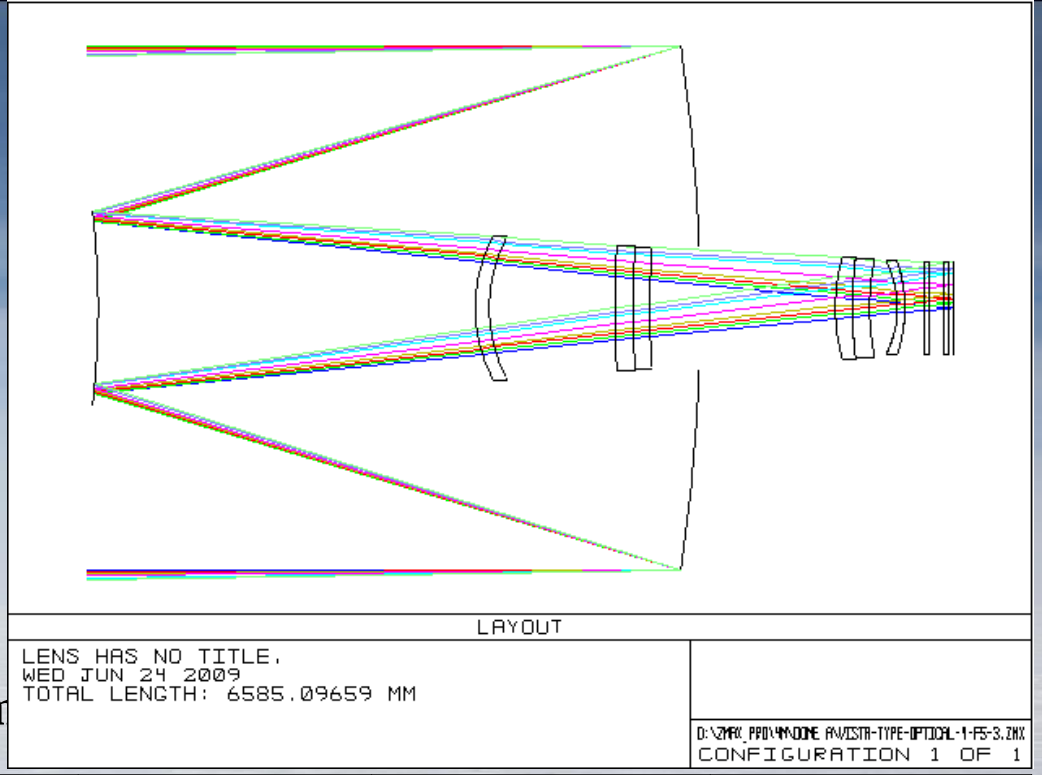
Focal length: 20127mm

Plate scale : 0.1"/10μm

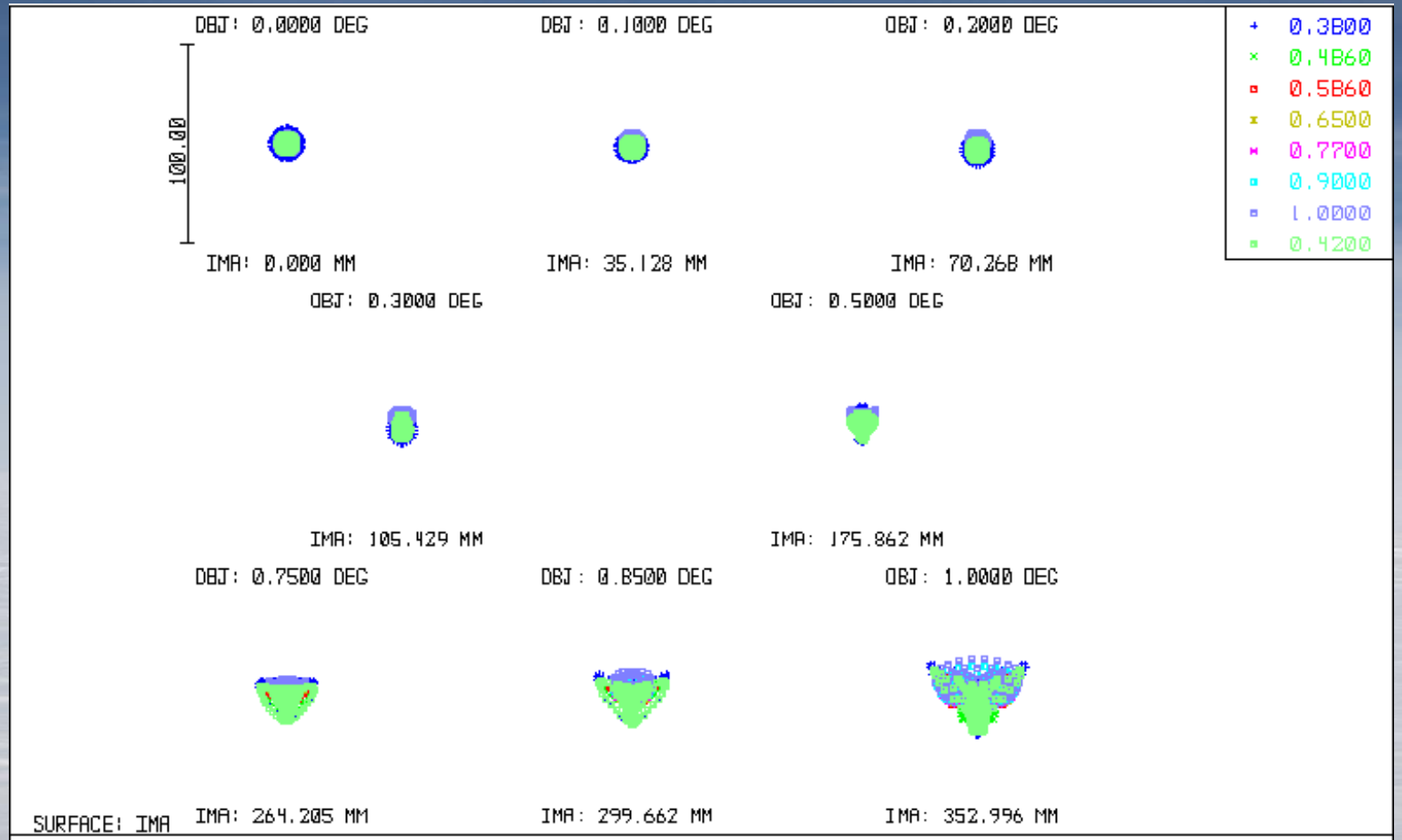
Optical length: 6585.1mm

Linear obstruction:

36.8% (effective diameter: 3.72m



	Primary	secondary	ADC (optical)	Asperical lens corrector (optical/near-infrared)	Image plane (optical/near-infrared)
Diameter(mm)	4005.2	1472.6	948/780	704/379	706/357
Max.deviation from BFS(mm)	0.218	0.154		1.06/0.135	



SPOT DIAGRAM

LENS HAS NO TITLE.
WED JUN 24 2009 UNITS ARE MICRONS.

FIELD	:	1	2	3	4	5	6	7	8
RMS RADIUS	:	3.164	3.172	3.199	3.258	3.642	5.696	7.431	11.466
GEO RADIUS	:	7.732	9.515	10.942	11.878	12.080	15.476	20.565	28.780

SCALE BAR : 100 REFERENCE : CENTROID

D:\ZMAX_PRO\4M\DOME A\VISTA-TYPE-OPTICAL-4-F5-3.ZMX
CONFIGURATION 1 OF 1

		80% geometric encircled energy under different wavelength range at best focal planes (unit: ")			
		G λ0=0.477	R λ0=0.623	I λ0=0.763	Open 0.38-1
Half Field of view (unit:°)	0	0.05	0.047	0.056	0.087
	0.1	0.05	0.048	0.055	0.086
	0.2	0.055	0.049	0.054	0.08
	0.3	0.06	0.054	0.054	0.08
	0.5	0.099	0.06	0.05	0.087
	0.75	0.149	0.075	0.089	0.133
	0.85	0.17	0.12	0.152	0.175
	1	0.227	0.25	0.3	0.29
Diffraction limited FOV		±0.3°	±0.75°	±0.75°	
Diffraction limited FOV with ADC (Z=60°)			±0.44° (tilted surface: -0.56° /-0.78°)	±0.55° (tilted surface: -0.67° /-0.8°)	

		80% geometric encircled energy under different wavelength range at best focal planes (unit: ")				
		Z λ 0=1.02	J λ 0=1.25	H λ 0=1.6	K λ 0=2.2	Open 0.95-2.5
Half Field of view (unit:°)	0	0.042	0.04	0.037	0.024	0.037
	0.1	0.066	0.063	0.054	0.043	0.067
	0.2	0.098	0.094	0.076	0.058	0.1
	0.3	0.104	0.096	0.073	0.053	0.094
	0.4	0.08	0.072	0.067	0.087	0.086
	0.5	0.077	0.076	0.091	0.167	0.153
Diffraction limited FOV		Full FOV(±0.5°)				

2. LAMOST-type design

-----based on Prof.Ya-nan Wang's design

1) schmidt focus

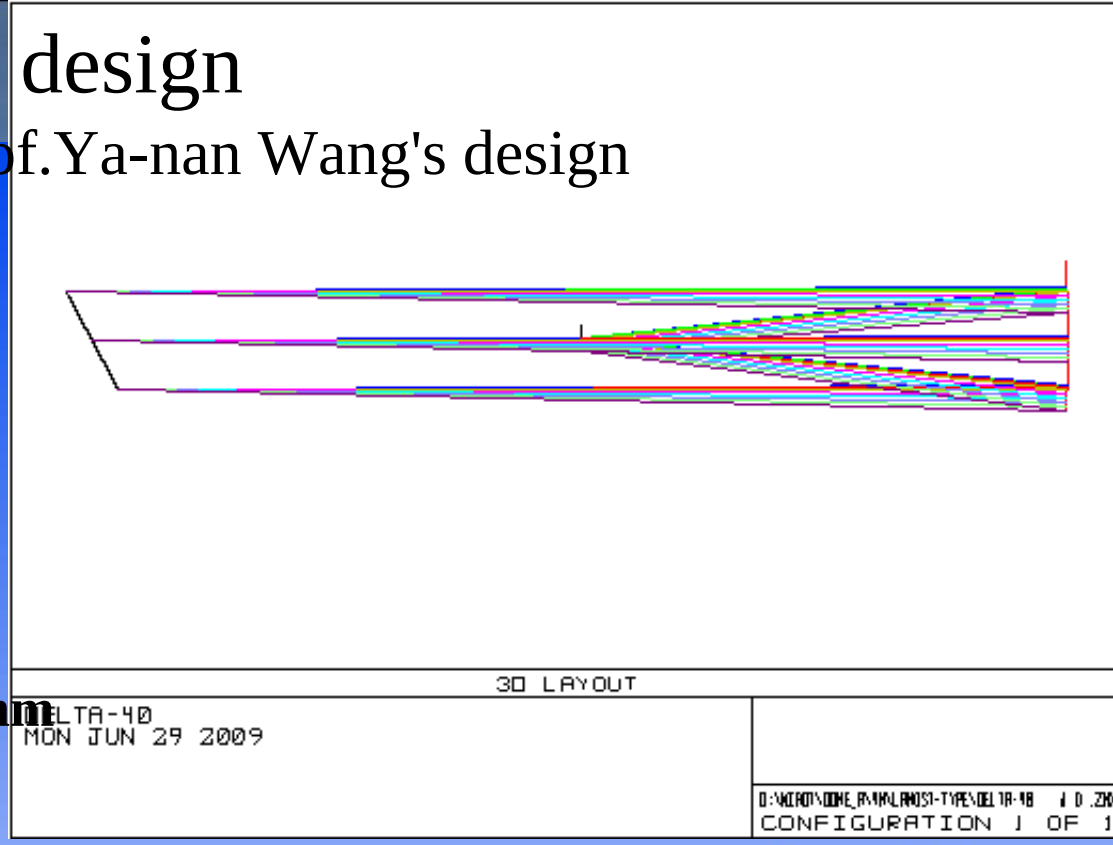
system f-ratio: 5

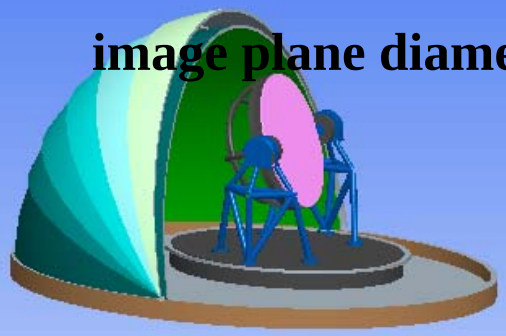
plate scale: 0.1"/10μm

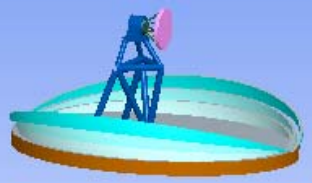
optical length: 40m

FOV：3°

image plane diameter: 1050mm







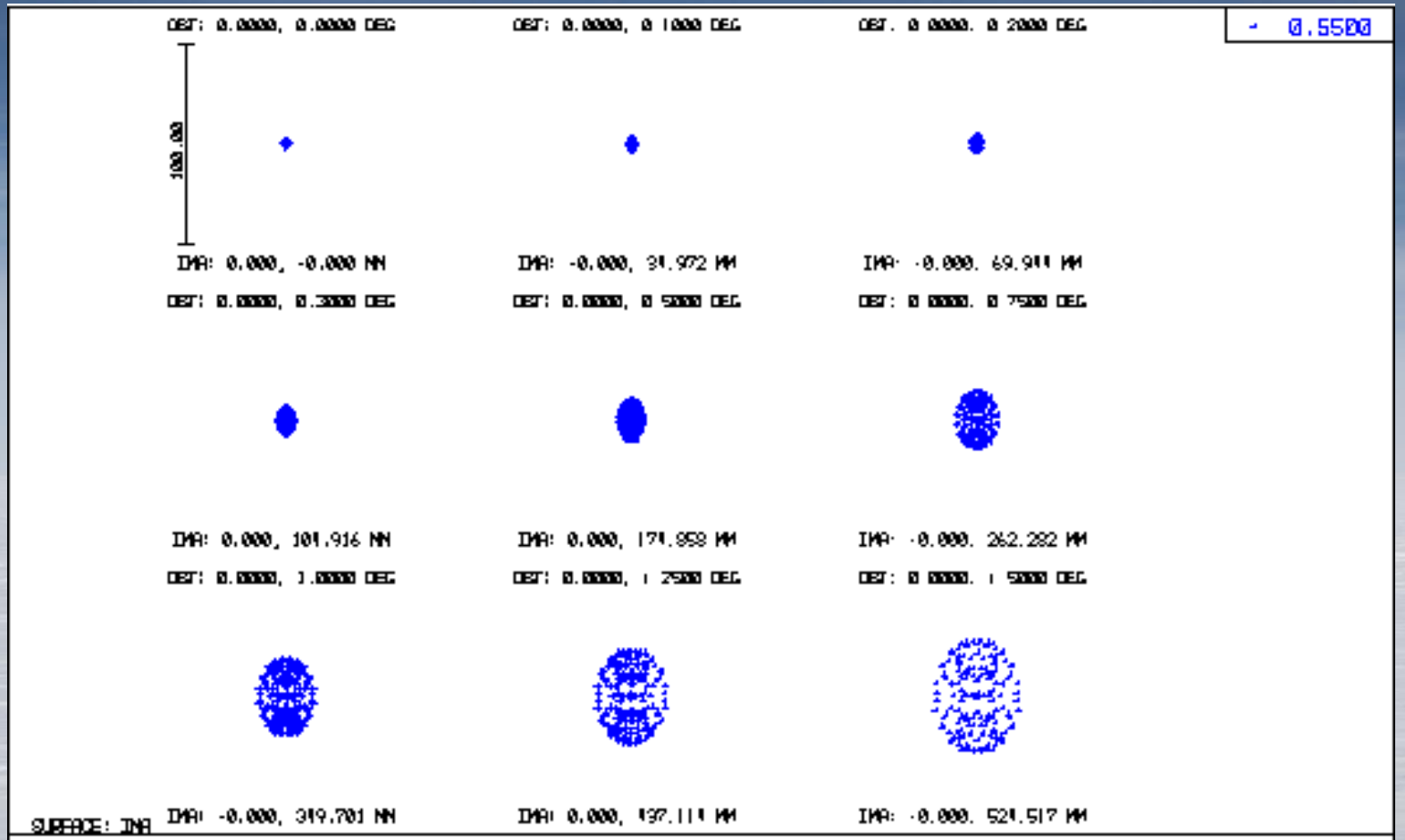
Suppose the telescope is:

horizontally deployed and schmidt plate is a monolithic mirror with diameter 4.5m

- effective entrance diameter varies from 4.489m to 3.614m

(considering the focal plane block, the effective diameter is from 4.364m to 3.458m)

- Primary mirror diameter is about 6.085m



SPOT DIAGRAM

DELTA-40
MON JUN 29 2009 UNITS ARE MICRONS.

FIELD :	1	2	3	4	5	6	7	8	9
RMS RADIUS :	0.757	1.485	2.641	3.862	6.362	9.536	12.750	16.088	19.284
GEO RADIUS :	1.313	3.861	4.589	6.333	9.806	11.198	18.603	23.111	27.732

SCALE BAR : 100 REFERENCE : CENTROID

D:\ZEMAX\DONE_AVAN\ANOST-TYPE\DELTA-40 Æ 0.20X
CONFIGURATION 1 OF 1

		80% geometric encircled energy (unit: ")			
		δ =0°	δ =-40°	δ =-90°	
Half Field of view (unit:°)	0	0.02	0.021	0.021	
	0.1	0.023	0.04	0.088	
	0.2	0.03	0.071	0.17	
	0.3	0.034	0.105	0.252	
	0.5	0.049	0.172	0.416	
	0.75	0.072	0.255	0.628	
	0.85	0.082	0.288	0.71	
	1	0.095	0.34	0.834	
	1.25	0.119	0.432	1.04	
	1.5	0.144	0.514	1.25	
Diffraction limited FOV	G	±0.62°	±9.9'	±3.9'	
	R	±0.81°	±13'	±5.4'	
	I	±1°	±16'	±6.6'	
	Z	±1.34°	±22'	±9'	

2) Schimdt-Cassegrain with ADC

Focal f-ratio : 14.8

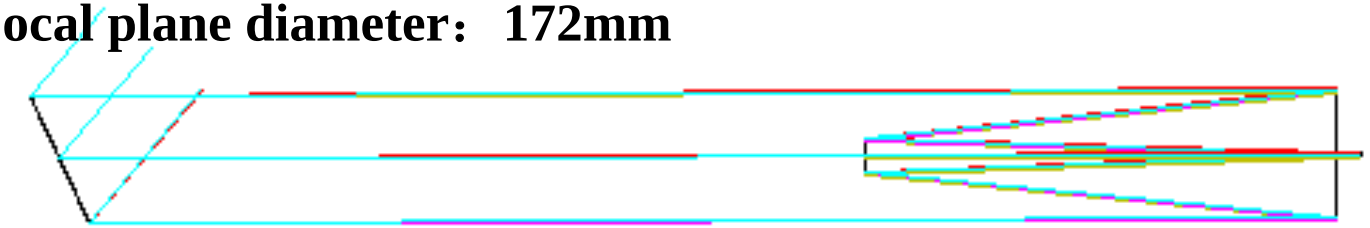
Focal length: 59431mm

Plate scale : 0.0035"/10μm

Optical length: 40733mm

Field of view: 10' (diffraction limited)

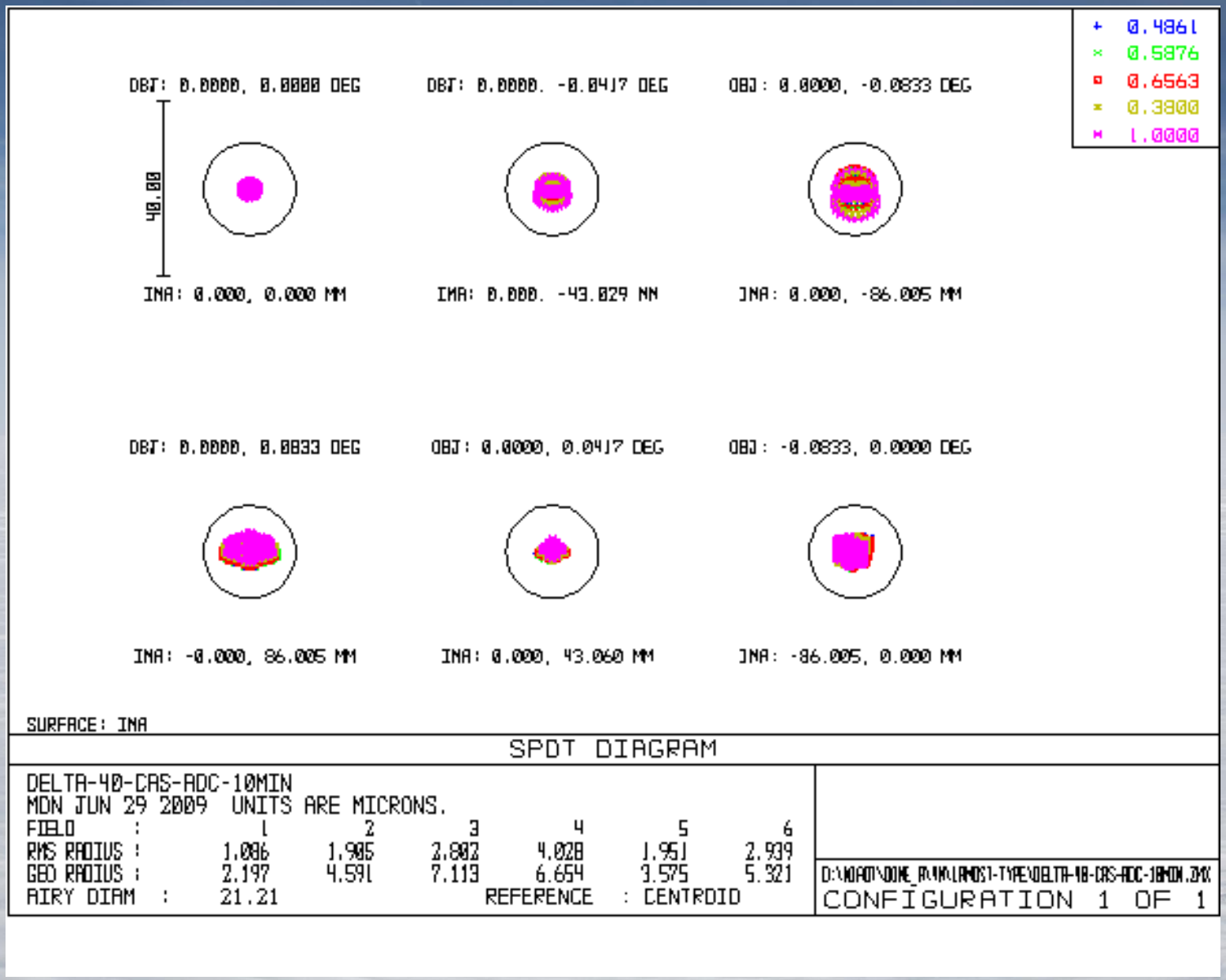
Focal plane diameter： 172mm



3D LAYOUT

DELTA-40-CAS-ADC-10MIN
MON JUN 29 2009

CONFIGURATION 1 OF 1


0.4861
0.5876
0.6563
0.3800
1.0000
OBJ: 0.0000, 0.0000 DEG
OBJ: 0.0000, -0.0417 DEG
OBJ: 0.0000, -0.0833 DEG
40.00
IMA: 0.000, 0.000 MM
IMA: 0.000, -43.029 MM
IMA: 0.000, -86.005 MM
OBJ: 0.0000, 0.0833 DEG
OBJ: 0.0000, 0.0417 DEG
OBJ: -0.0833, 0.0000 DEG
IMA: -0.000, 86.005 MM
IMA: 0.000, 43.060 MM
IMA: -86.005, 0.000 MM
SURFACE: IMA
SPOT DIAGRAM
DELTA-40-CAS-ADC-10MIN
MON JUN 29 2009 UNITS ARE MICRONS.
FIELD : 1 2 3 4 5 6
RMS RADIUS : 1.086 1.905 2.882 4.028 1.951 2.939
GEO RADIUS : 2.197 4.591 7.113 6.654 3.575 5.321
AIRY DIAM : 21.21 REFERENCE : CENTROID
CONFIGURATION 1 OF 1

3. 3-mirror design

1) **Primary f-ratio : 1.5**

Focal f-ratio : 2.01

Focal length: 8051mm

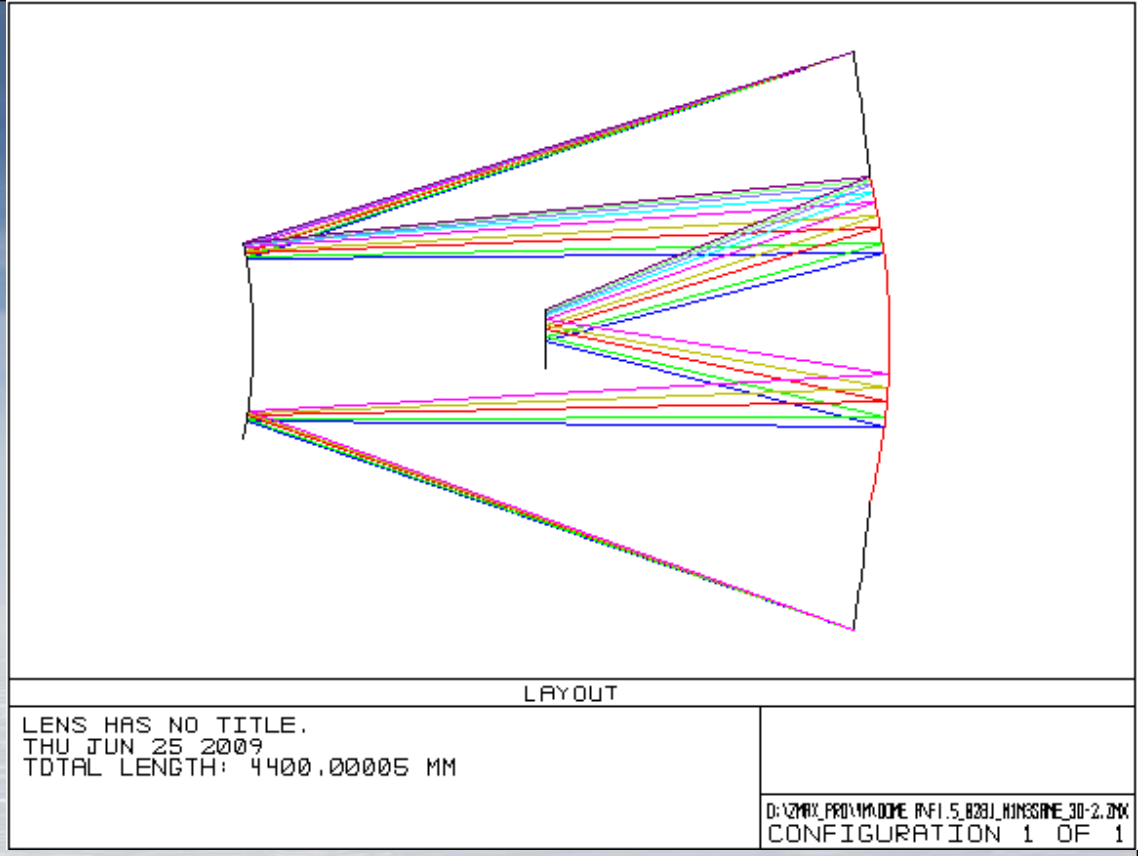
Plate scale : 0.256"/10μm

Optical length: 4400mm

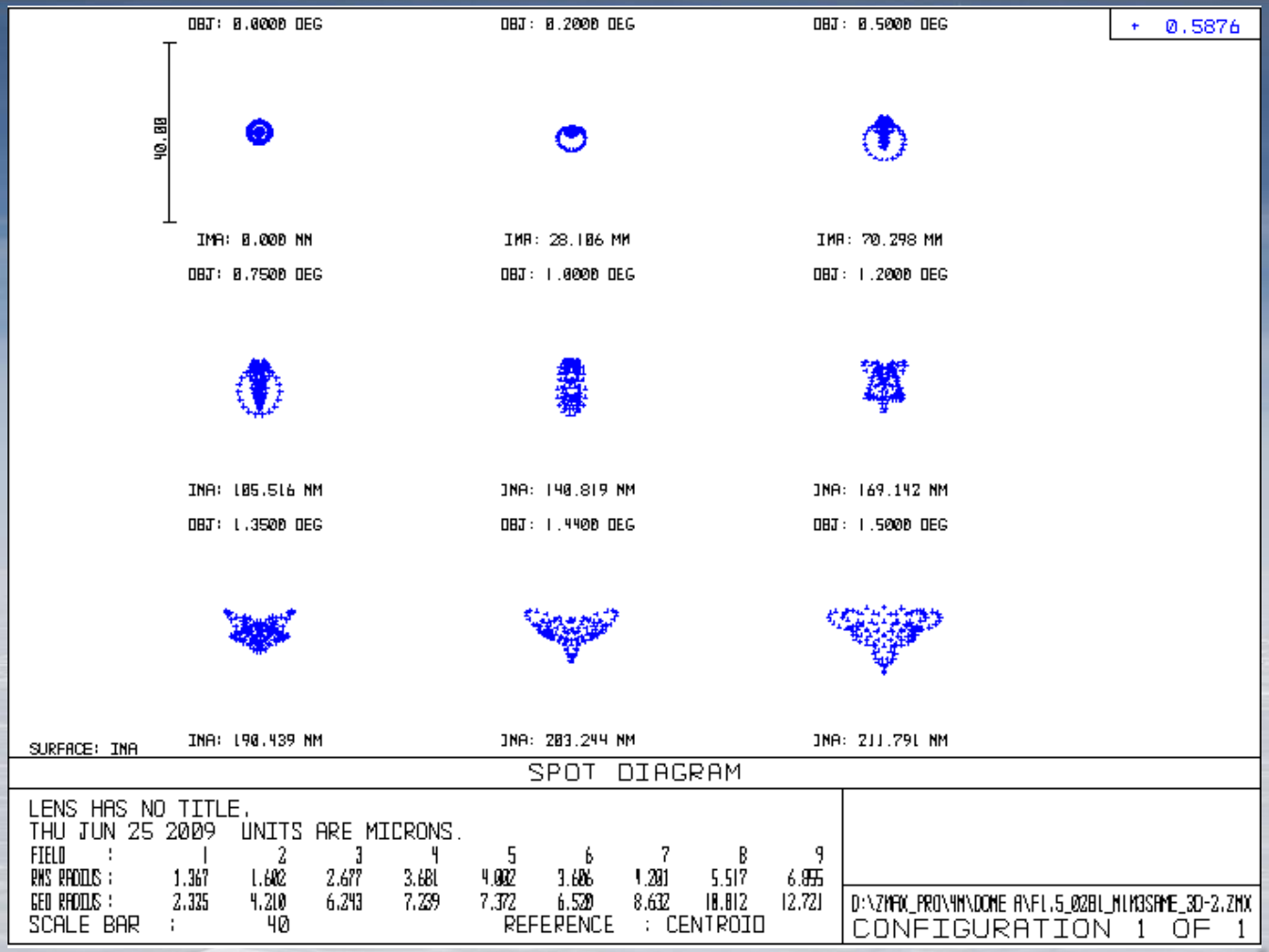
Field of view: 3°

Linear obstruction:

56.3% (effective diameter: 3.3m)



	Primary	secondary	tertiary	Image plane
Diameter(mm)	4009	1351	2254	424
Max.deviation from BFS(mm)	0.287	0.089	0.018	



a	0	0.2	0.3	0.5	0.75	1	1.25	1.5
b	0.062	0.059	0.074	0.138	0.207	0.233	0.238	0.445

a: Half Field of view (unit:°);

b: 80% geometric encircled energy (unit: ")

2) Primary f-ratio : 1.5

Focal f-ratio : 2.1

Focal length: 8473mm

Plate scale : 0.243"/10μm

Optical length: 4368mm

Field of view: 2°

Linear obstruction:

45.9% (effective diameter: 3.55m)

	Primary	secondary	tertiary	Image plane
Diameter(mm)	4006	1277	1834	296.4
Max.deviation from BFS(mm)	0.291	0.093	0.0037	

a	0	0.1	0.2	0.3	0.5	0.75	0.85	1
b	0.054	0.055	0.062	0.073	0.097	0.105	0.11	0.136

a: Half Field of view (unit:°);

b: 80% geometric encircled energy (unit: ")

problems with 3-mirror system

(Compared with LAMOST-type telescope)

- three big aspheric mirror ;
- heavy light obstruction;
- fast f-ratio leads to low sampling resolution;
- focal expander is needed for the ADC design;
- focal expander is needed for fiber instruments;

If select LAMOST-type, the light obstruction is relatively lower and both the optical manufacuter and the alignment will be quite easier, the Schmidt-Cas system can also deliver diffraction limited image in about 10arcmin.

Along with the Xinglong Lamost, they can do the full sky survey

Thank you !