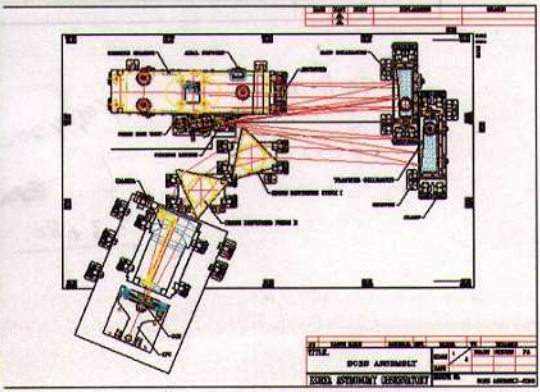
BOES : BOao Echelle Spectrograph

Kim, Kang Min(金剛民)

Bohyunsan Optical Astronomy Observatory (BOAO,普賢山天文臺)

Korea Astronomy Observatory (KAO, 韓國天文硏究院)



1. Key Performance

1) High Resolution ($\lambda/\Delta\lambda$) => 27k, 40k, (100k)

Throughput = R*S = 117k (")

R = 40k for 200 μm(2.9") fiber * 2ea

27k for 300 μm(4.3") fiber * 2ea

(100k for 80 μm(1.15") fiber * 1ea)

2) Wide Wavel. Range => 0.36 to ~ 1.1 μm in one shot

3) High efficiency

=> Quasi-Littrow (0.6°) config. No Vignetting

=> Lens system Camera, high QE CCD, STU fiber

2. BOES Specification

- Cass. Interf. Module (CIM)
- Fiber
- BOES

1) Cass. Interf. Module (CIM)

- Flat Source : 100W (BG24A+BG39+KG3) + 10W THL
- Wavel. Calibration : ThAr(+IRC), ThNe, FeNeArHe

- Slit Monitoring : Photometric PXL Camera
- Iodine Cell
- Long Slit (~ 3′) Spectrograph

2) Fiber : STU, 16 m

2 * 200 μm(2.9″), 2 * 300 μm(4.3″), 1 * 80 μm(1.15″)

V grooves + Teflon + Zebra Al tube + Thermal Brake

3) BOES (in Spectrograph Room)

- Dual White Pupil Design + Quasi Littrow Mounting
- Collimator(f=1,088 mm) : Φ136mm Beam Width

  two off-axis parabola (Φ600mm f/1.8) + Ag coating
- Echelle : blΘ = 76.05° -> R4.03, 41.59 gr/mm, ϒ=0.6°

  Mosaic (204 x 400mm x 2 = 814mm)
- Exposure Meter : OAP + Fiber + PM + Photon Cnt
- Prism(BSL7Y) : 55°, 265 x 286mm ⇦ Δn < 1x10^-6
- Camera : Φ250mm(f/1.54), 6 spher. lenses, 10° FOV
- BBAR Solgel coating on Prisms + 3 CaF2 lenses
- CCD : EEV 2k x 4k (15 μm)
- Dewar : Continuous Flow Cryostat + 150ℓ liquid N_2
- Environment : T = 20 +/- 0.5 °C, Humidity < 50 %

  All optics fixed (Camera focusing Translation)

3. Expected Performance :

Wvlt(μm)	0.36	0.38	0.40	0.45	0.55	0.70	0.80	1.0
Atm(X=1)	0.53	0.60	0.68	0.75	0.82	0.91	0.93	0.95
Tel	0.74	0.74	0.74	0.74	0.74	0.71	0.67	0.78
Fiber	0.40	0.50	0.62	0.70	0.72	0.74	0.75	0.78
Coll+ mirror	0.88^4	0.86^4	0.92^4	0.93^4	0.96^4	0.98^4	0.98^4	0.98^4
Echelle	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65
Prism	0.90	0.94	0.95	0.96	0.96	0.95	0.94	0.885
Camera	0.75	0.82	0.84	0.87	0.91	0.88	0.86	0.82
CCD	0.57	0.76	0.80	0.89	0.88	0.75	0.55	0.09
BOES	**0.023**	**0.046**	**0.092**	**0.140**	**0.185**	**0.180**	**0.125**	**0.023**
HES	**0.007**	**0.010**	**0.030**	**0.050**	**0.057**	**0.040**	**0.025**	**0.008**

- BOAO 1.8m Tel size : 36% of Lick 3 m Tel.

  ⇨ Efficiency of BOES ≃ HES

- Limiting Magnitude with 60min exposure (at 5500A)

  m_v = 10.5 (S/N ~ 100), 16 (S/N~ 10)

- V*r* resolution : 10 ~ 20 m/s

4. Budget : $1.2M

Echelle (Richardson) : $175k

Camera (Ohara, Corning, ESO, HJ, Cleveland, Pilot) : $220k

Prisms (Ohara, Zygo, Cleveland) : $200k

Collimators (SESO) : $70k

CIM+ BOES Optomechanics (Korea) : $200k

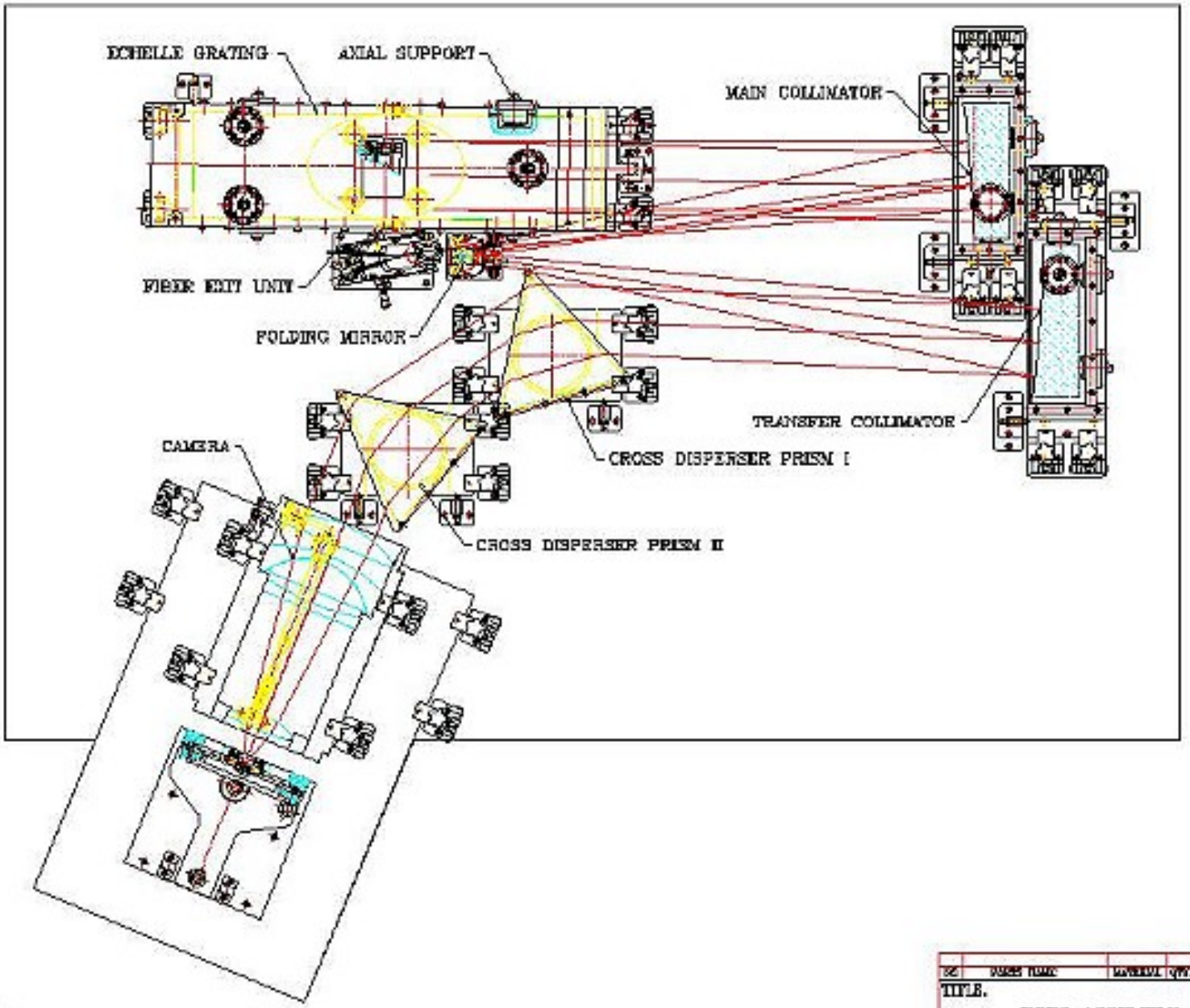
Iodine Cell (Vogt) : $20k

CCD + Dewar (EEV, SDSU, ESO) : $100k

Fiber(Polymicro), V grooves(Korea) etc : $40k

Electronics, environments etc (Korea) $125k

Consulting (Steven S Vogt in Lick Obs) : $70k



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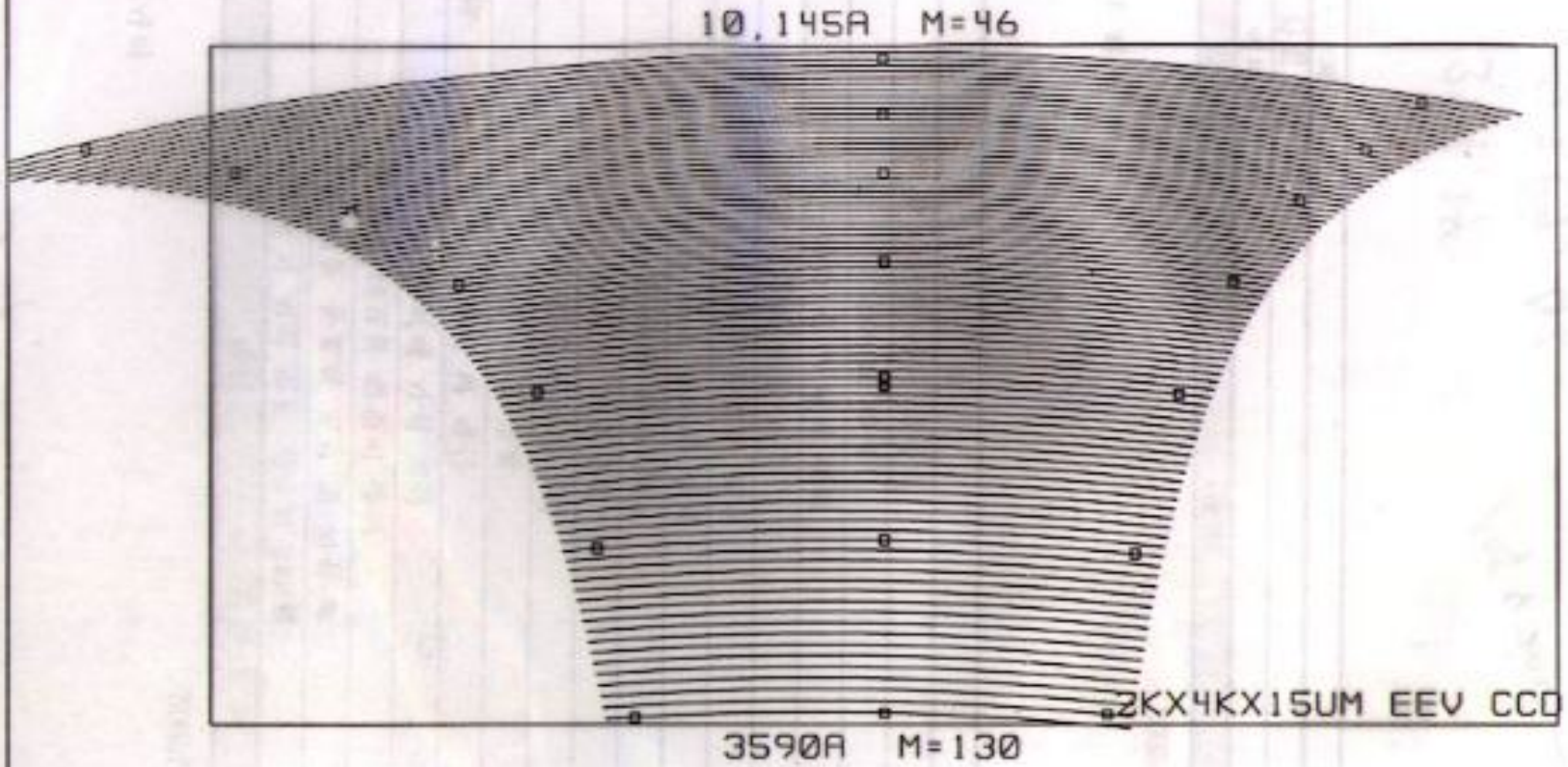
TITLE. BOES ASSEMBLY				SCALE 1/3	MATV	STRUCT	P.I.	
				DATE				
KOREA ASTRONOMY OBSERVATORY				DRAWING NO.				

383MM EFL F/1.6 DIOPTRIC CAMERA



ECHELLE SET ANGLE: -76.0500

KOREAN ECHELLE SPECTRAL FORMAT PLOT

KOREA7041-1-1.ZMX
WED MAY 17 2000

BOES

BOHYUNSAN OPT. ASTRON. OBS.
KOREA ASTRONOMY OBSERVATORY

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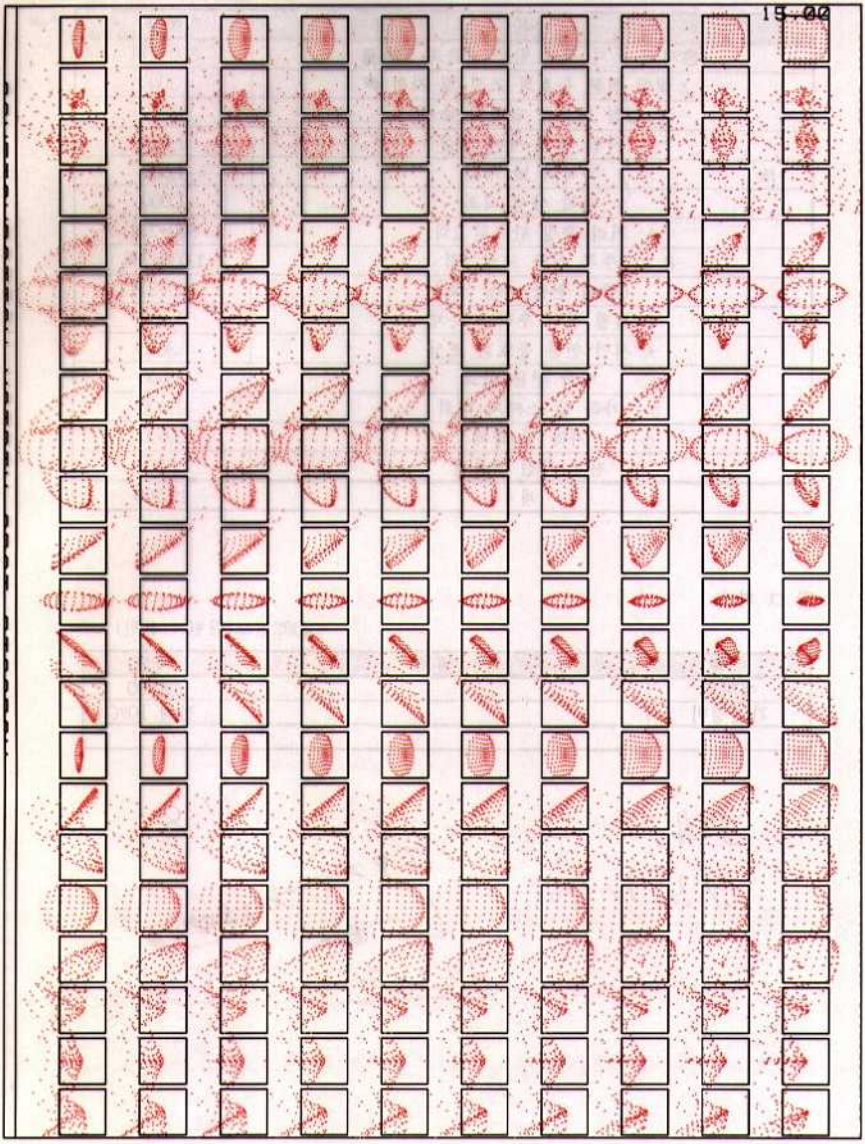
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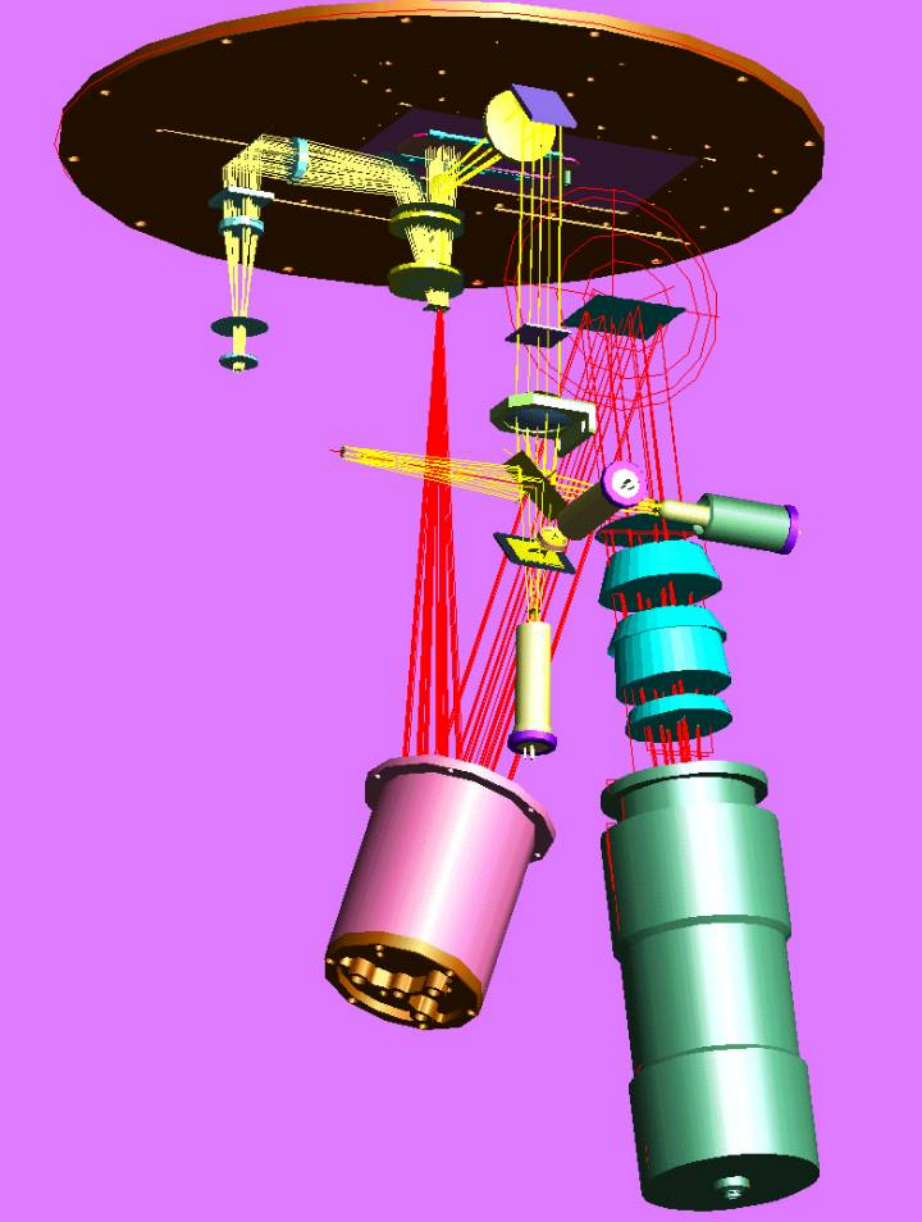
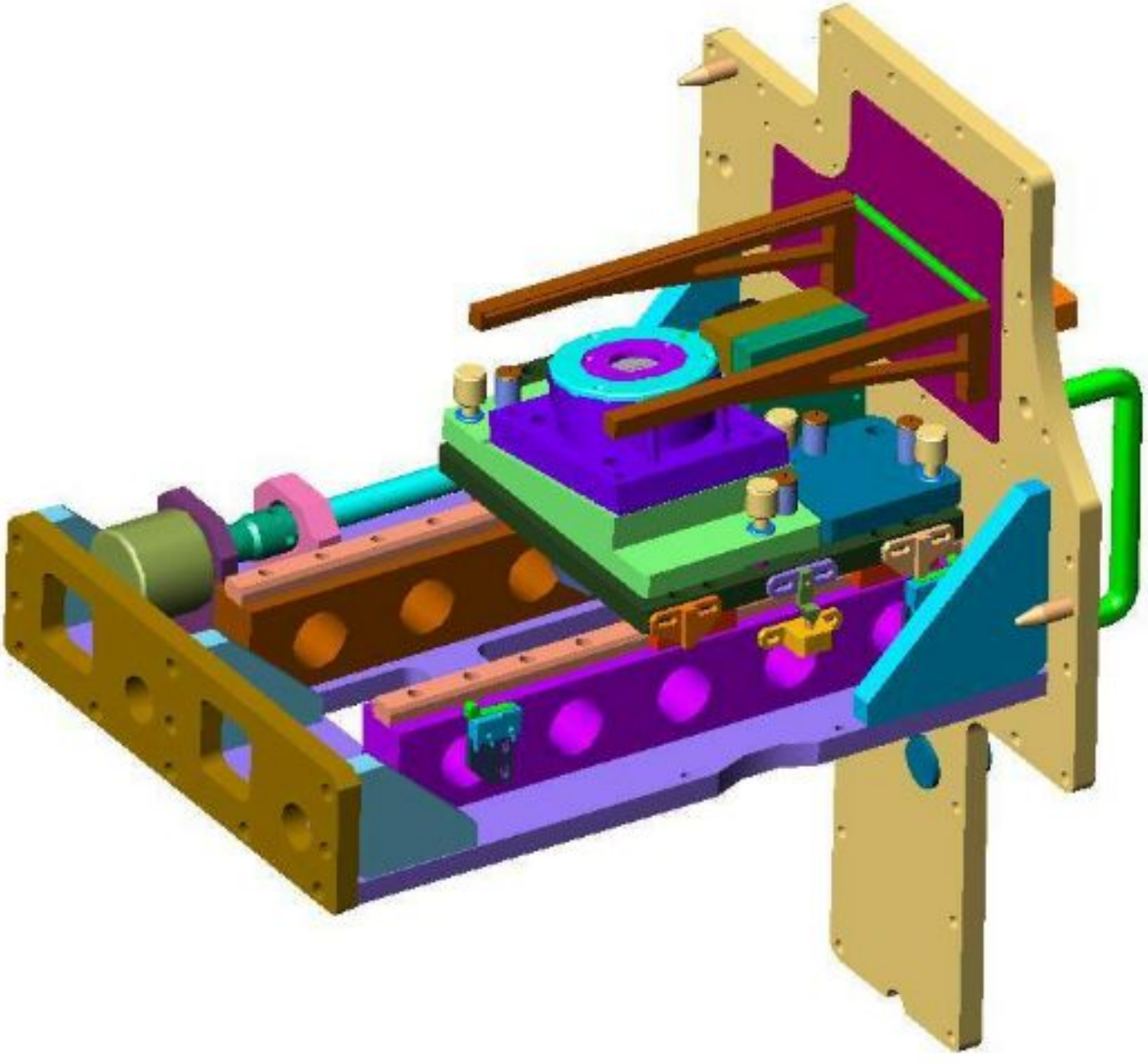
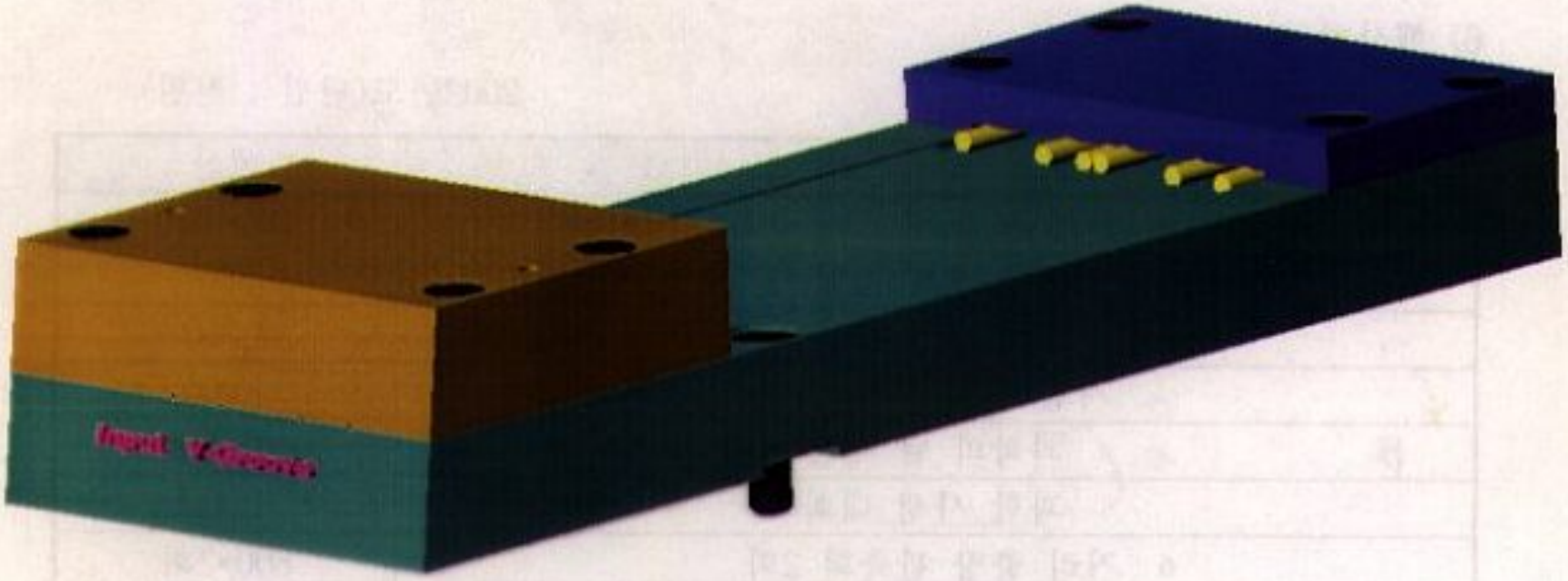


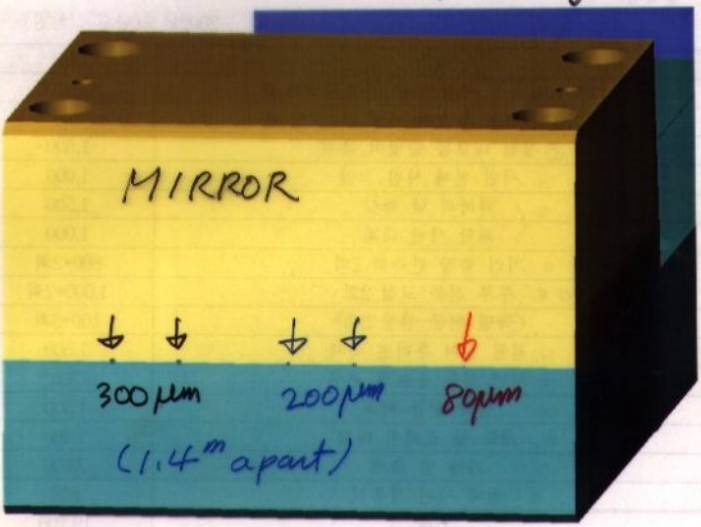


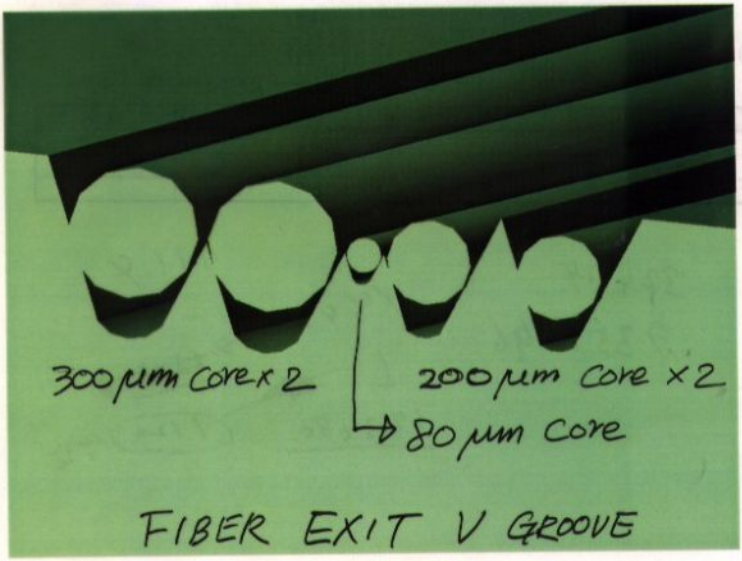


FIBER INPUT

FIBER EXIT

DETAILED VIEW OF FIBER INPUT V groove

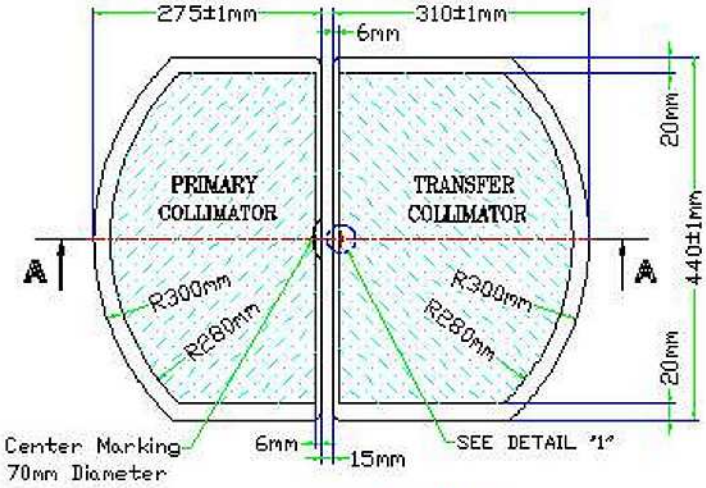


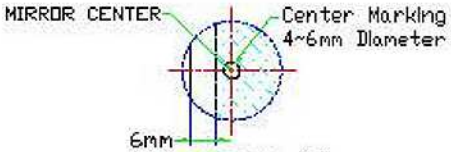


FIBER EXIT V GROOVE

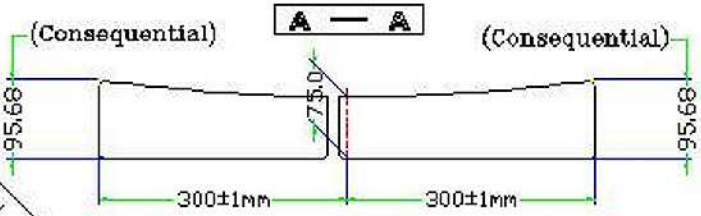
DATE	PART	SIGN	EXPLANATION	REASON
	△			
	△			

FRONT VIEW





DETAIL "1"
SCALE-1:5



NO	PARTS NAME	MATERIAL	QTY.	MAKER	WT.	REMARKS

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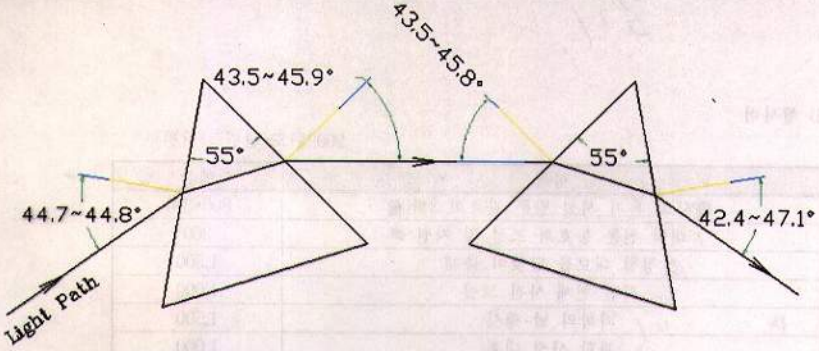
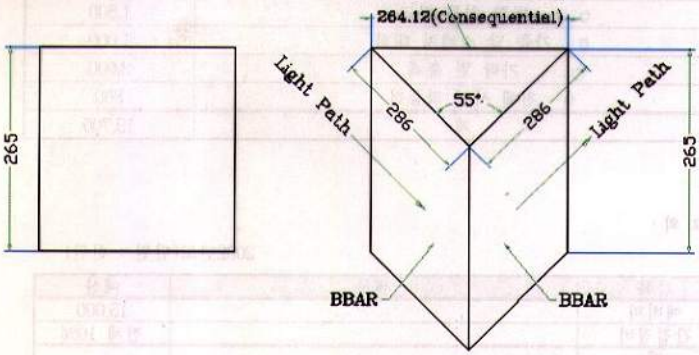
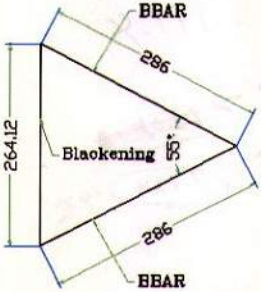
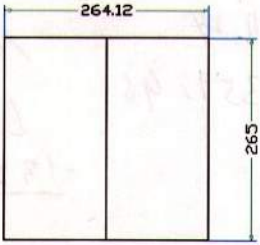
		SCALE	1/6			
KOREA ASTRONOMY OBSERVATORY		DRAWING NO.				

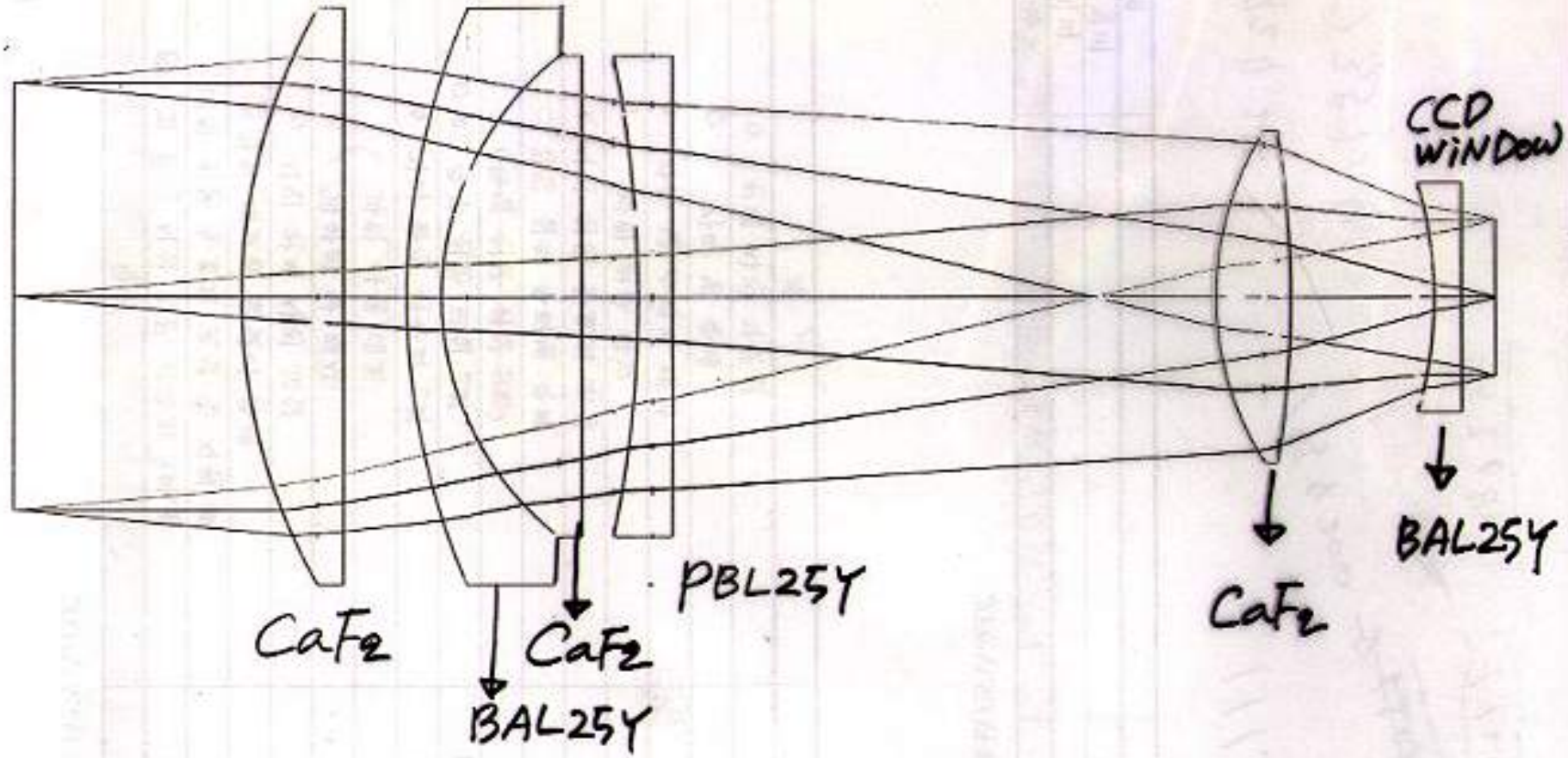








CROSS DISPESE PRISM



3D LAYOUT

KCAM704R.ZMX
WED JUL 5 2000

BOES
BOHYUNSAN OPT. ASTRON. OBS.
KOREA ASTRONOMY OBSERVATORY

F:\USER\KMKIM\NEWB\KCAM804.ZMX

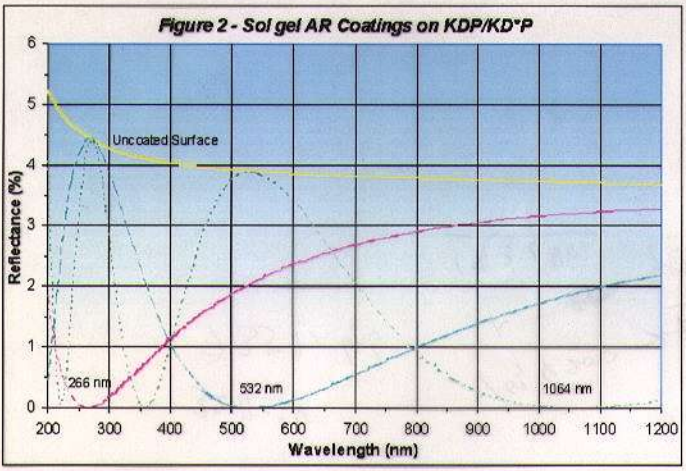


그림 1 Sol/Gel 코팅시의 반사율

그림 2 결합 완료된 CCD 카메라

Continuous Flow Cryostat