偏光/多色掃天についての考察

名大理　佐藤修二

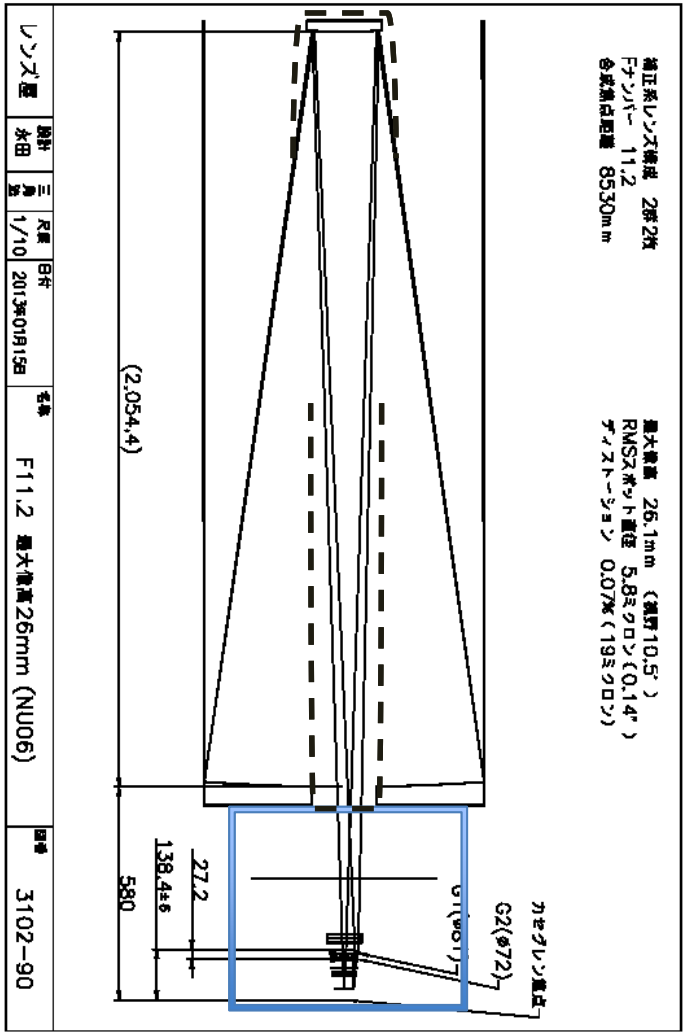
広視野+多色+偏光

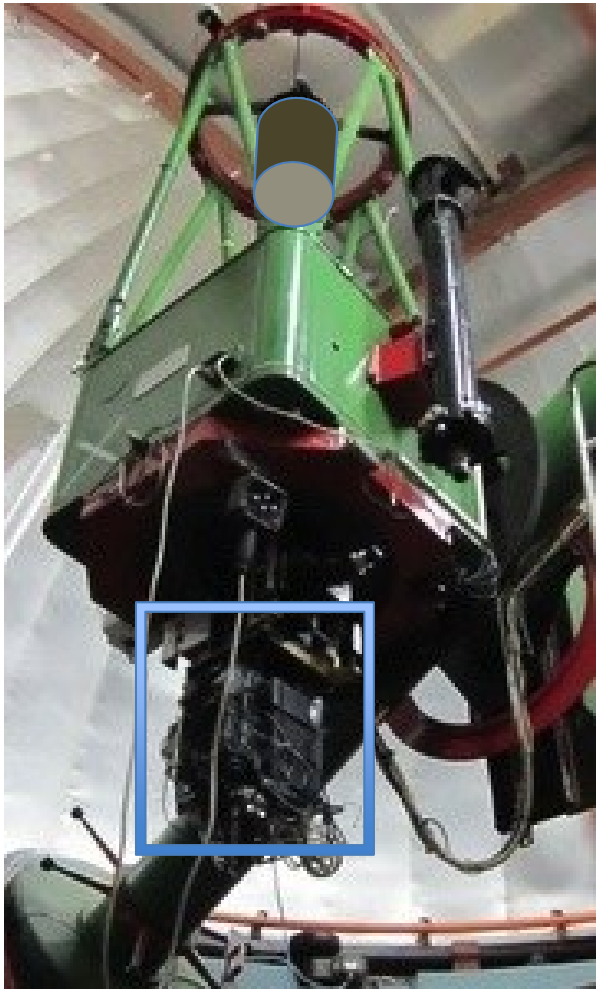
研究課題名	可視－赤外６色偏光に基づく磁場構造の研究
研究期間	平成２４年度　～　平成２６年度

科研費B　可視—赤外6色偏光に基づく磁場構造の研究

撮像⇔掃天

10°□⇔10000°□

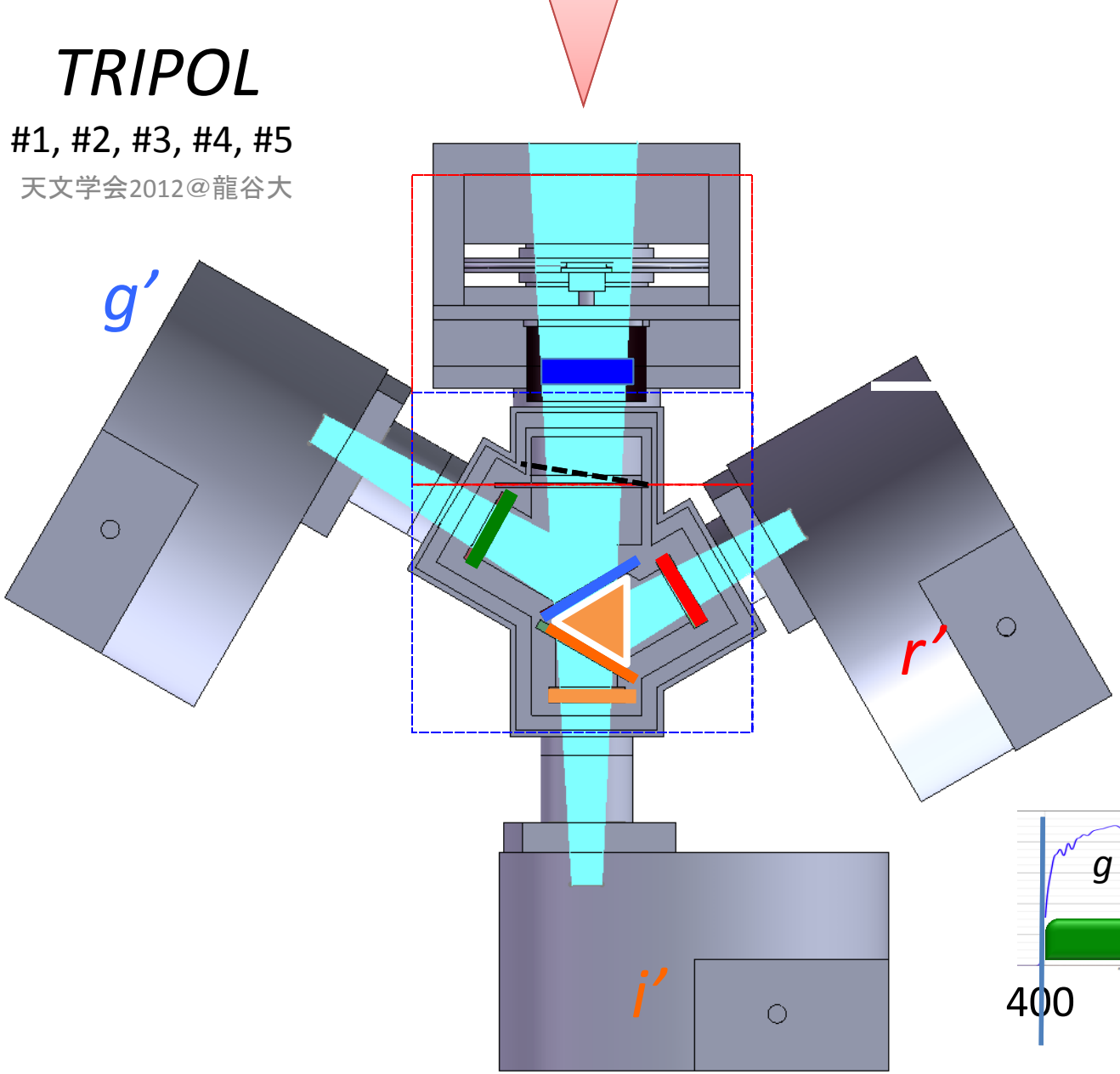

補正系レンズ構成 2群2枚
Fナンバー 11.2
合成焦点距離 8530mm
最大像高 26.1mm (視野10.5')
RMSスポット直径 5.8ミクロン(0.14")
ディストーション 0.07%(19ミクロン)
カセグレン焦点
G2(φ72)
G1(φ61)
27.2
138.4±6
580
(2,054.4)
設計 永田
三角法
尺度 1/10
日付 2013年01月15日
名称 F11.2 最大像高26mm (NU06)
図番 3102-90
レンズ図

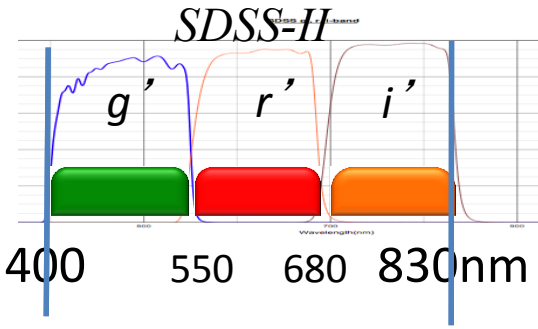


TRIPOL

#1, #2, #3, #4, #5

天文学会2012＠龍谷大

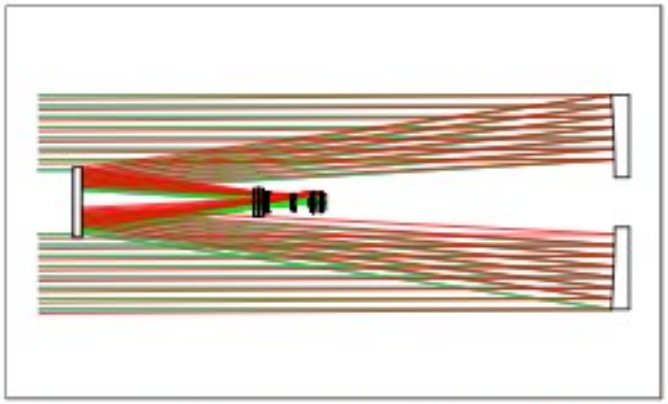




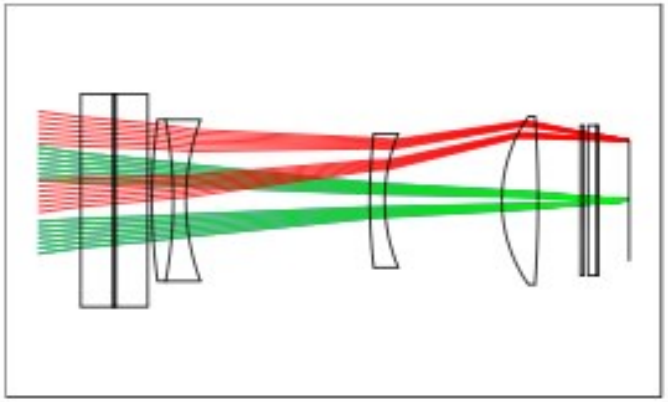
75cm/F5.5~30’□

（2） B案

副鏡の手前に平面鏡を設置し、主鏡からの光束をそのまま使用します。



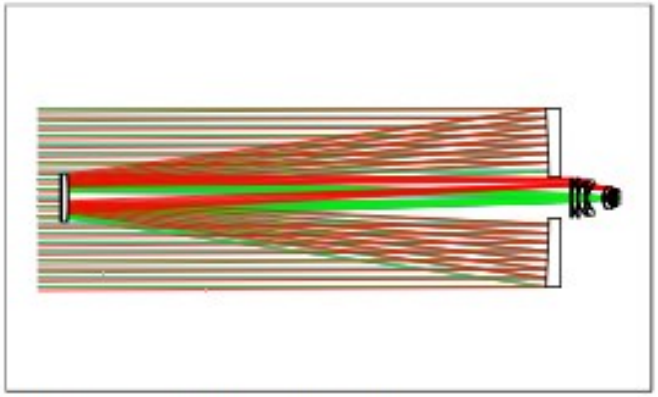
補正光学系例。レンズ最大径はφ79mm で足りますが、平面鏡は面精度λ/4 と、傾き調整精度 30″ が必要です。



2. 設計光路

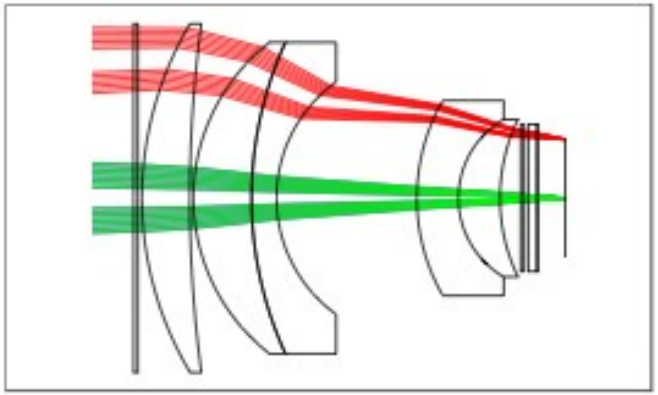
（1） A案

カセグレン光学系と補正光学系



補正光学系例。レンズ最大径はφ168mm になります。

（注）本図のλ/8 板は、φ168 で描いています。



75cm/F11 ~ 15’□

6-color (*g' r' i' J H Ks*) Camera

IRSF 1.4 m telescope

Field of view 7.5'□

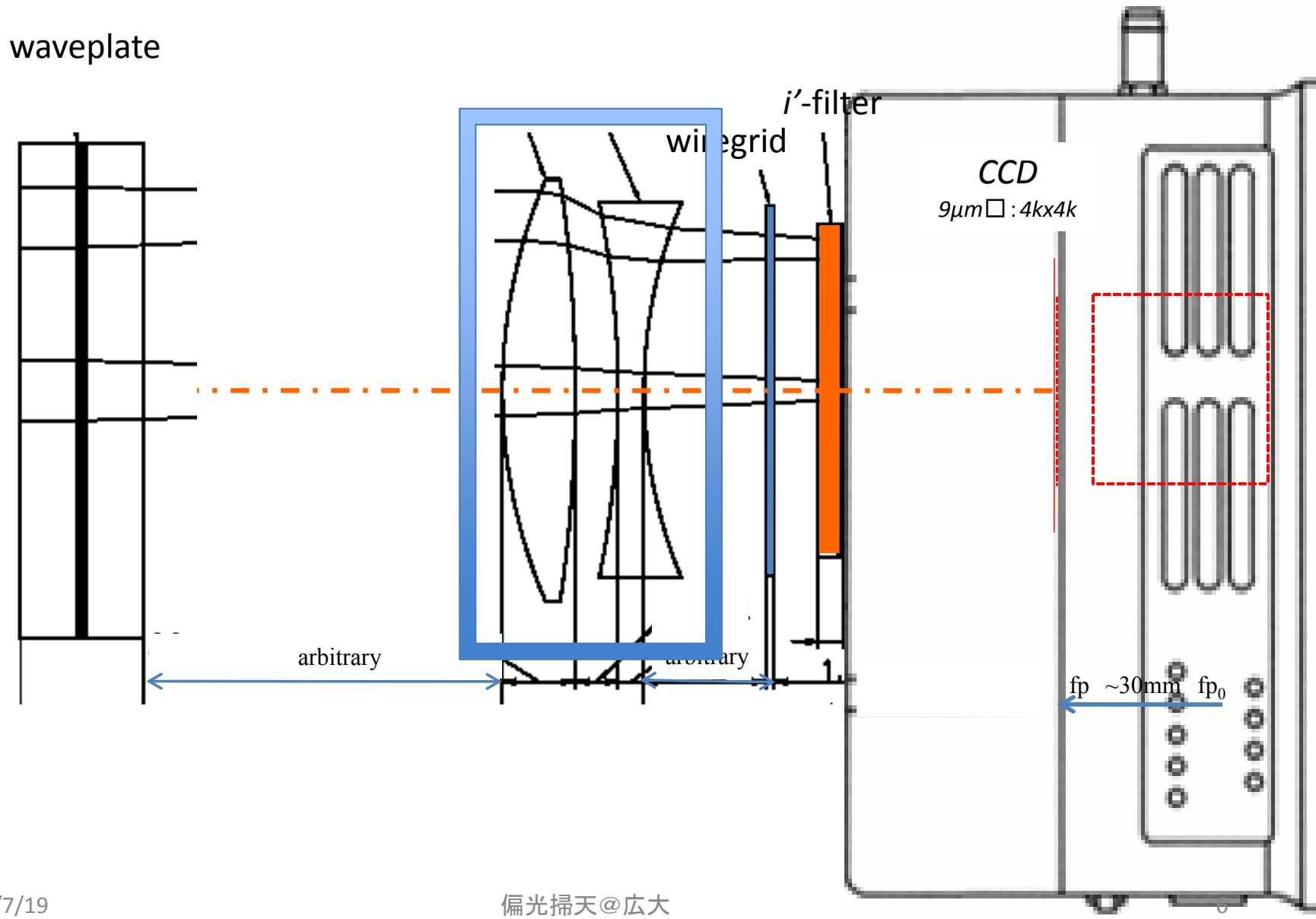
i-Pol. Camera

SAAO 75cm telescope

Field of view 15' □

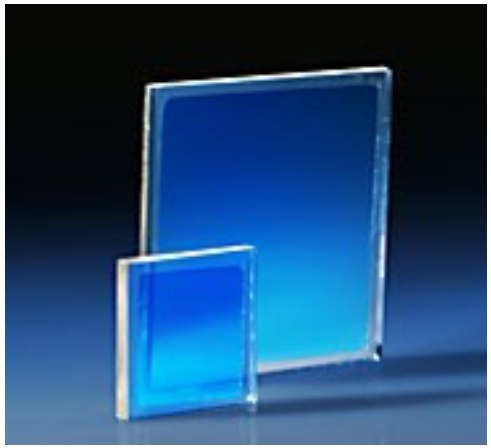
Limiting mag. ~19 mag [S/N]~10 60 sec @i'-band

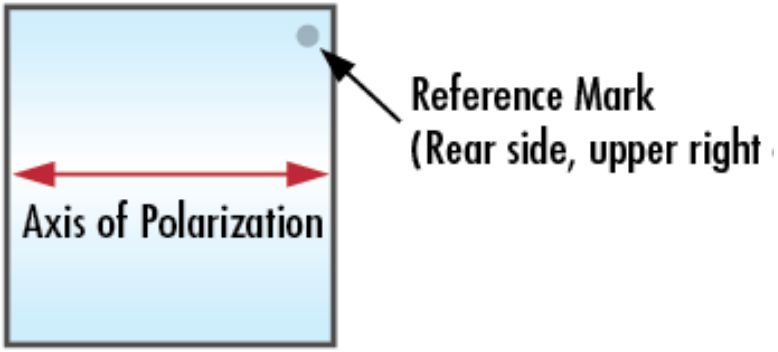
~14 mag Δp~0.3% 240 sec @i'-band

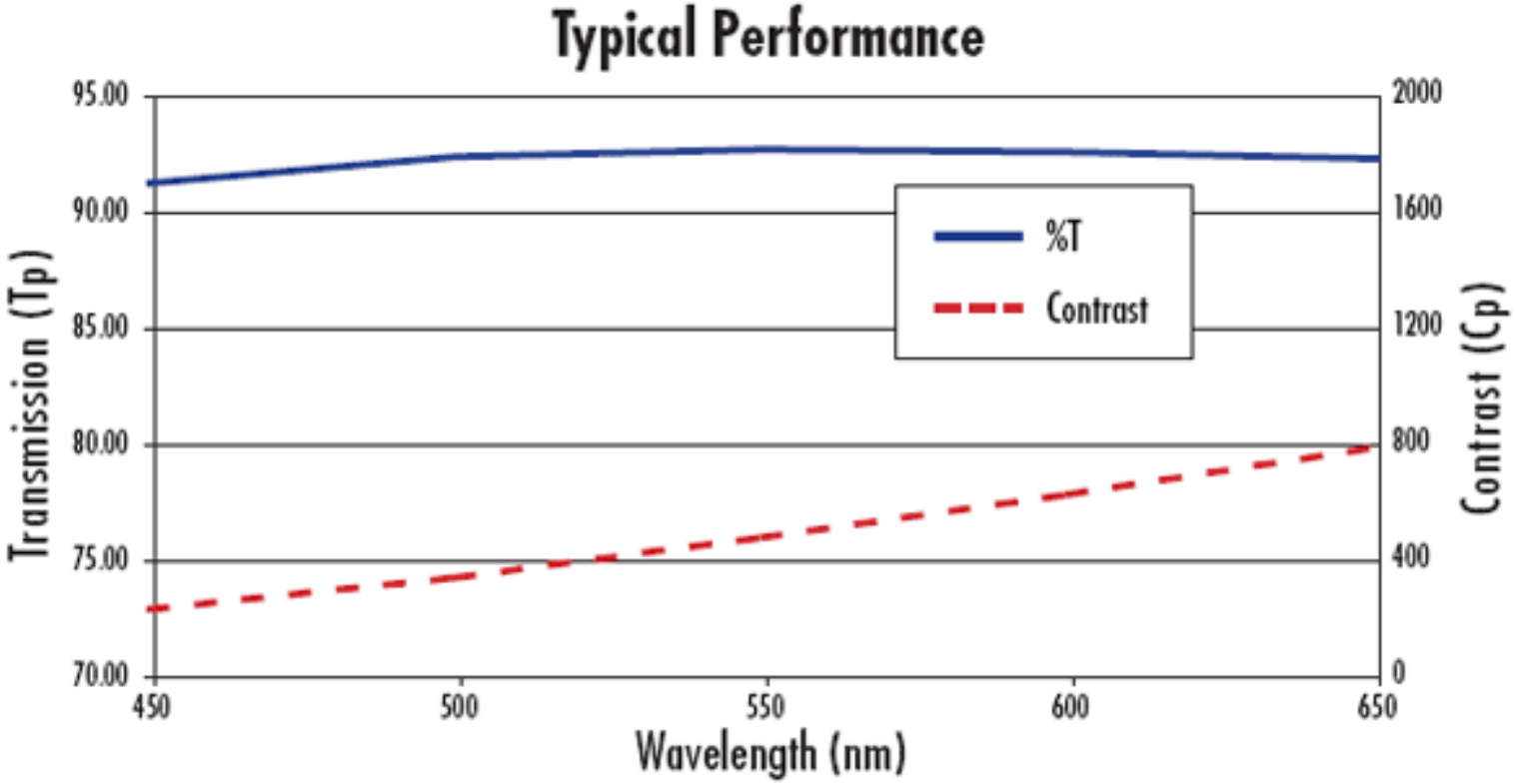

waveplate
i'-filter
wire grid
CCD
9μm□ : 4kx4k
arbitrary
arbitrary
fp ~30mm fp0

Wire Grid Polarizer

Edmund #46-636





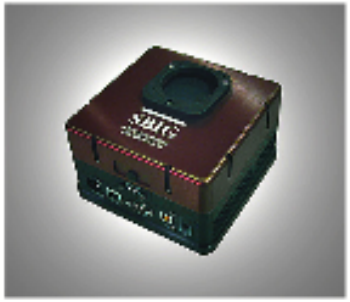


SBIG ASTRONOMICAL INSTRUMENTS

a division of Aplegen, Inc.

STX-16803

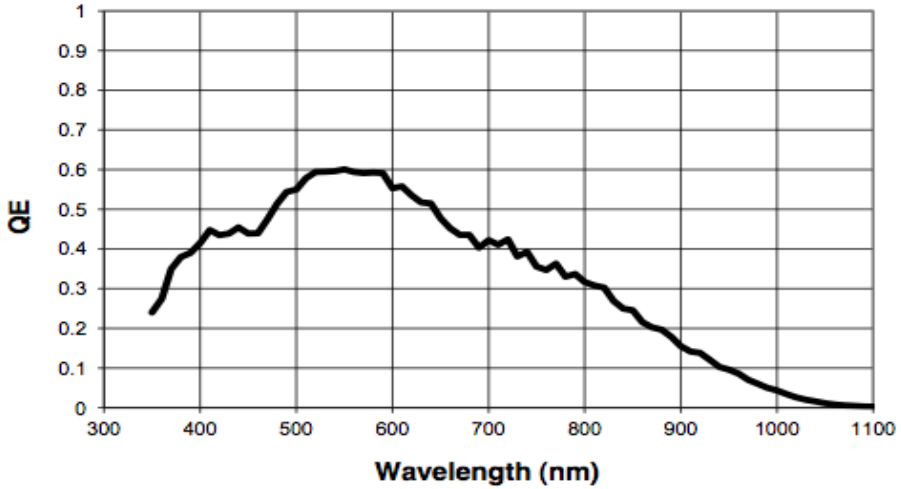
SBIG's New STX Series



The STX features include:

- 16 Megapixel KAF-16803 CCD with High QE and ABG
- 4096 x 4096 pixels at 9u
- Both Ethernet and USB 2.0 interface
- 12VDC Operation (Operates from 9 - 14VDC)
- Full Frame Image Buffer
- Multiple A/D Channels
- Image and Guide While Downloading
- Internal and External Self-Guiding (with Remote Head)
- Simultaneous Dual CCD Guiding
- Differential Guiding (patent pending)
- Continuous Guiding During Autograb
- Adaptive Optics Control with Internal or External Guider
- -50 degrees C Delta Cooling with Air Only
- Water Cooling Ready
- Even-illumination Mechanical Shutter
- User Rechargeable Desiccant Plug
- Variable Speed Fan Control
- Focus Mechanism for Tracking CCD
- Opto-isolated Relays for Telescope Control
- Tracking Relay LED Indicators
- Power Management with LED Indicators

KAF-16803 Spectral Response (No Cover Glass)



6-color Simultaneous
6色同時撮像器

“TRIPOL”[#6] を 南アフリカIRSF/SIRIUS に、
3-band [g’ r’ i’] を付加して
視野7. 5分角の6色 [*g’r’i’//J H Ks*]同時撮像カメラ
とする

解像力　0.4秒角
視野　7.5分角

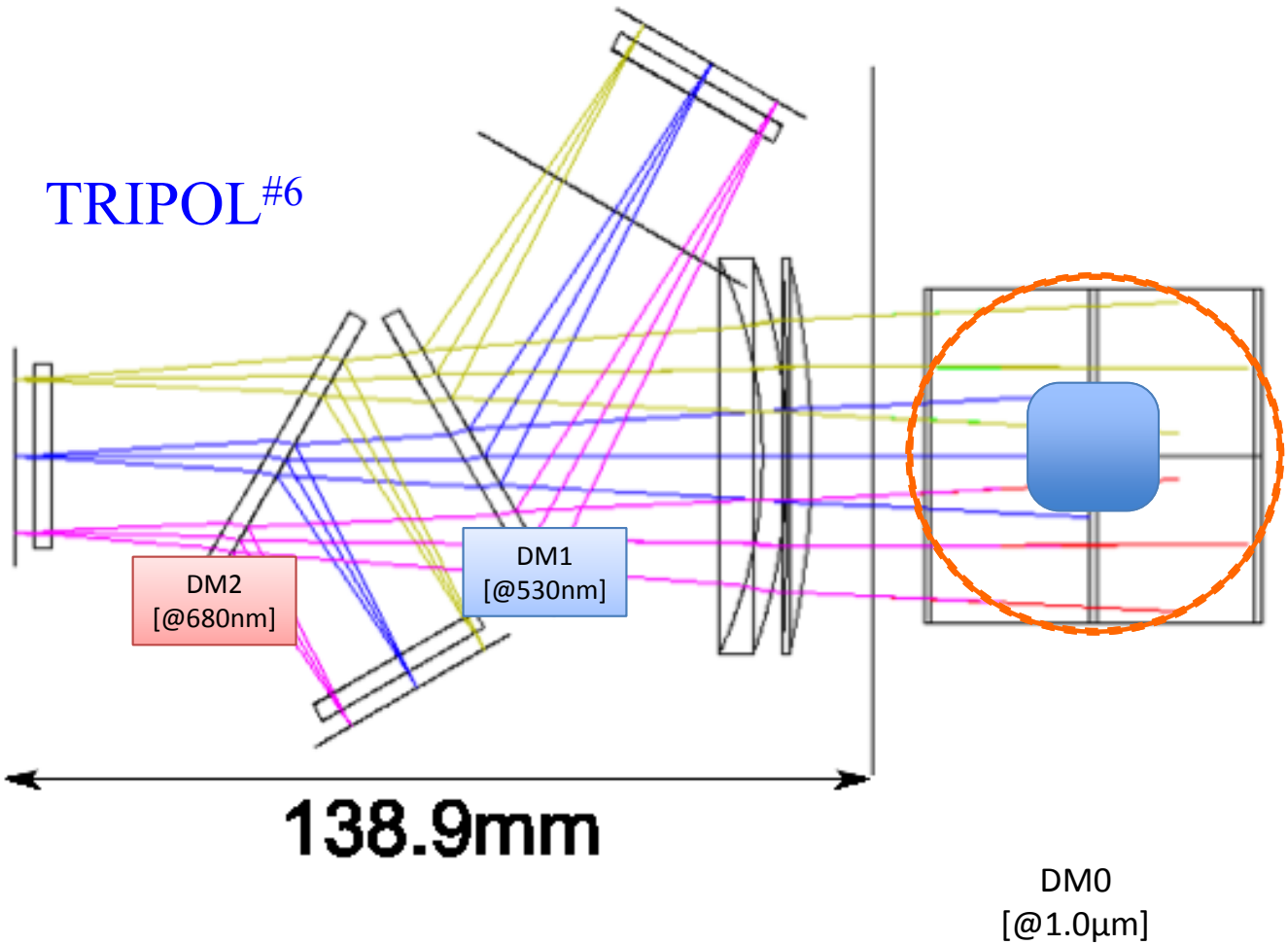
光学要素

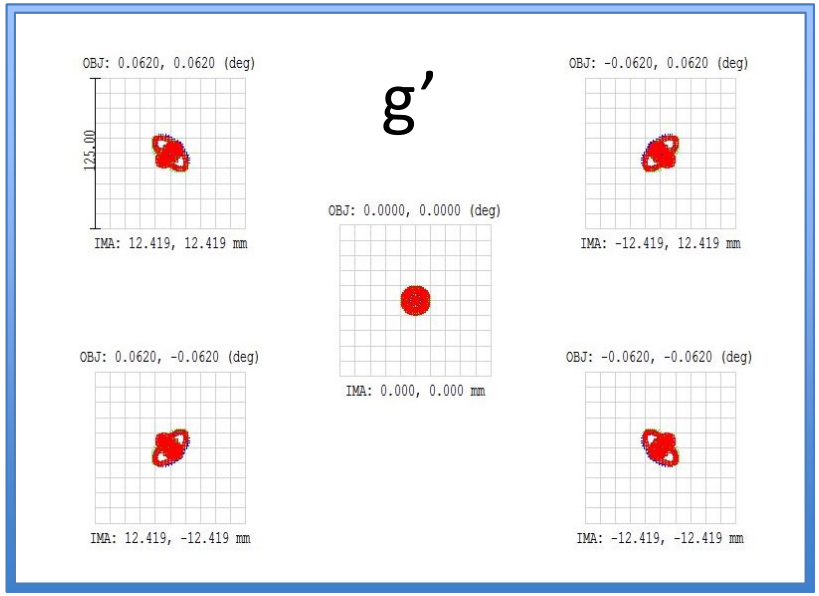
ダイクロイックミラー＝＞F変換レンズ＝＞TRIPOL

1) DM　2) Optics　3) TRIPOL$^{\#6}$　4）CCD

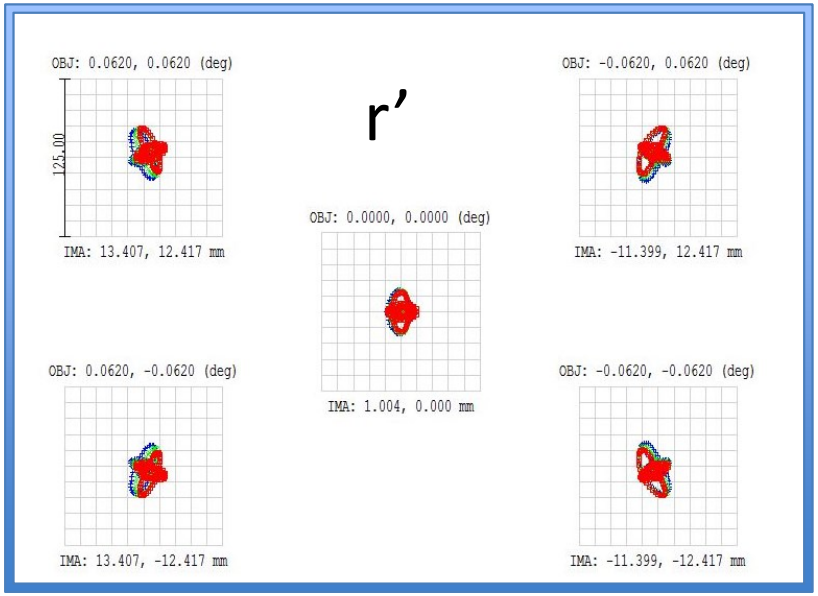
光学要素　ダイクロイックミラー＝＞F変換レンズ + TRIPOL

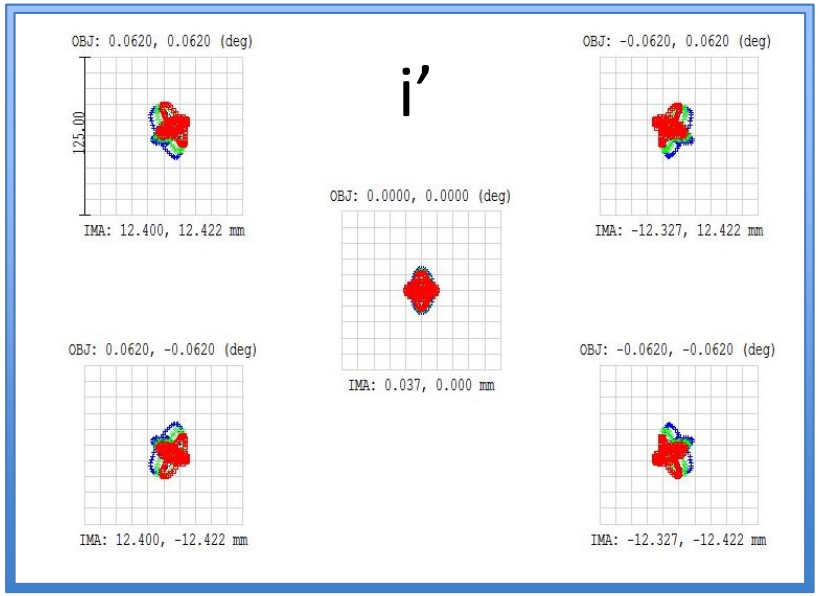
1) DM　2) Optics　3) TRIPOL#6　4）CCD



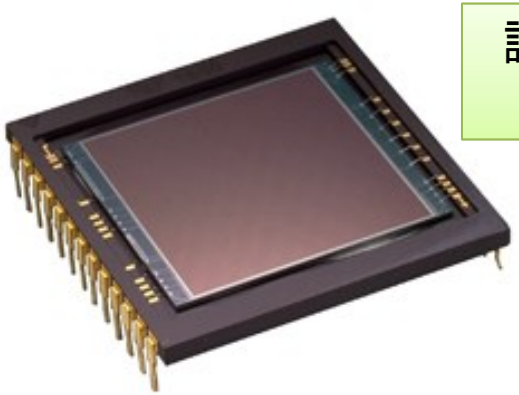

g’
OBJ: 0.0620, 0.0620 (deg)
125.00
IMA: 12.419, 12.419 mm
OBJ: -0.0620, 0.0620 (deg)
IMA: -12.419, 12.419 mm
OBJ: 0.0000, 0.0000 (deg)
IMA: 0.000, 0.000 mm
OBJ: 0.0620, -0.0620 (deg)
IMA: 12.419, -12.419 mm
OBJ: -0.0620, -0.0620 (deg)
IMA: -12.419, -12.419 mm

25μm
~1pix
~ 0.5”

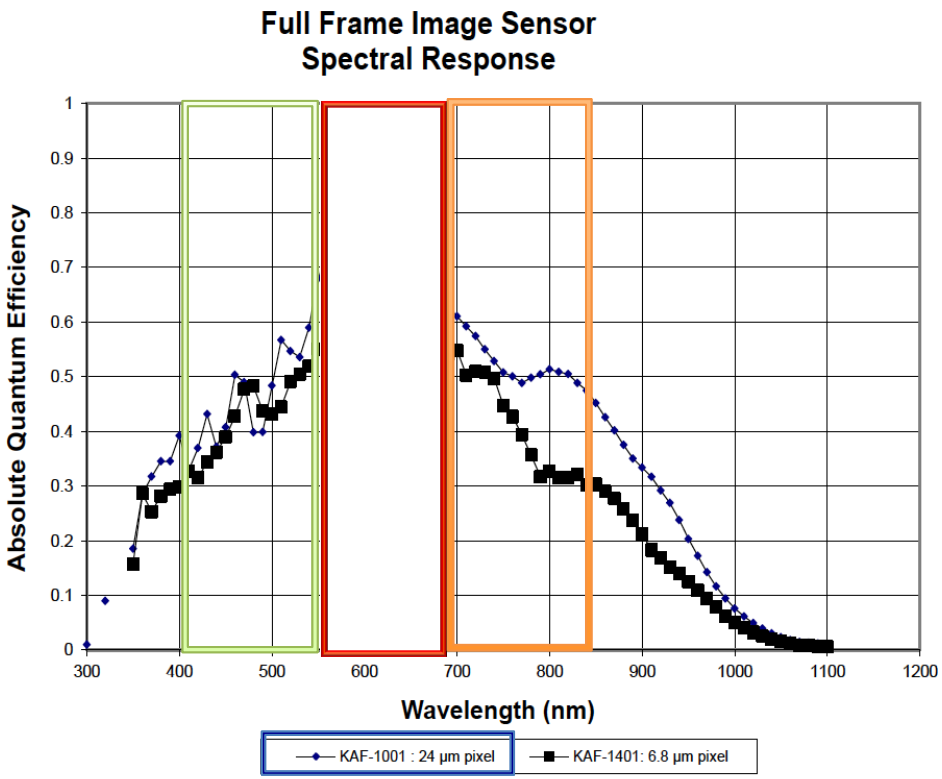

r’
OBJ: 0.0620, 0.0620 (deg)
125.00
IMA: 13.407, 12.417 mm
OBJ: -0.0620, 0.0620 (deg)
IMA: -11.399, 12.417 mm
OBJ: 0.0000, 0.0000 (deg)
IMA: 1.004, 0.000 mm
OBJ: 0.0620, -0.0620 (deg)
IMA: 13.407, -12.417 mm
OBJ: -0.0620, -0.0620 (deg)
IMA: -11.399, -12.417 mm


i’
OBJ: 0.0620, 0.0620 (deg)
125.00
IMA: 12.400, 12.422 mm
OBJ: -0.0620, 0.0620 (deg)
IMA: -12.327, 12.422 mm
OBJ: 0.0000, 0.0000 (deg)
IMA: 0.037, 0.000 mm
OBJ: 0.0620, -0.0620 (deg)
IMA: 12.400, -12.422 mm
OBJ: -0.0620, -0.0620 (deg)
IMA: -12.327, -12.422 mm

読み出し回路の開発
計測カメラ



KAF-1001



Parameter	Typical Value
Architecture	Full Frame CCD
Pixel Count	1024 (H) x 1024 (V)
Pixel Size	24 µm (H) x 24 µm (V)
Active Image Size	24.6 mm (H) x 24.6 mm (V)
Chip Size	28.6 mm (H) x 25.5 mm (V)
Optical Fill-Factor	100%
Saturation Signal High Sensitivity Output High Dynamic Range	 240,000 electrons 650,000 electrons
Output Sensitivity High Sensitivity Output High Dynamic Range	 11 µV/electron 2 µV/electron
Readout Noise (1 MHz)	15 electrons rms
Dark Current (25 °C, Accumulation Mode)	<30 pA/cm^2
Dark Current Doubling Rate	5–6 °C
Dynamic Range (Sat Sig/Dark Noise) High Sensitivity Output High Dynamic Range	 83 dB 97 dB
Quantum Efficiency (450, 550, 650 nm)	40%, 55%, 65%
Maximum Data Rate High Sensitivity Output High Dynamic Range	 5 MHz 2 MHz
Transfer Efficiency (2 MHz, to –40 °C)	>0.99997
Package	CERDIP Package (sidebrazed)
Cover Glass	Clear

3. 今後 2年　口径1m望遠鏡　3色（*g' r' i' h**）：視野15分角の実現

1m／F10　＝＞ 15分角~ 45mm□
{＝＞ {30分角~ 88mm□}}の設計
収束ビーム？　{平行ビーム？}

4. 全天サーベイ

4π立体角

2π立体角～20,000平方°/telescope x [N-S]

～ 4,000平方°/year x [5 years] : N-S

～ 20平方°/night x [200 nights] x 5 years : N-S

～ 4平方°/hour x [5 hours] : 200 nights x 5 years : N-S

全天 4π ～ 2°□/FoV x [5 hours] x 200 nights x 5 years : N-S

偏光/多色掃天に関するコメント

撮像30’□ ⇔ 掃天2°□

広視野多色偏光
=>1°□

おもしろい挑戦

練りに練った計画！
考察と実験

⇒ 何はともあれ光学系

平行ビームの要？
偏光素子？
望遠鏡を含めた光学系　既存の2m？　1mx2台？

“口径1mクラス”の望遠鏡
予備実験／実証

=> 15’□~ 45mm□
=> 30’□~ 90mm□
=> 1°□~ 180mm□
=>