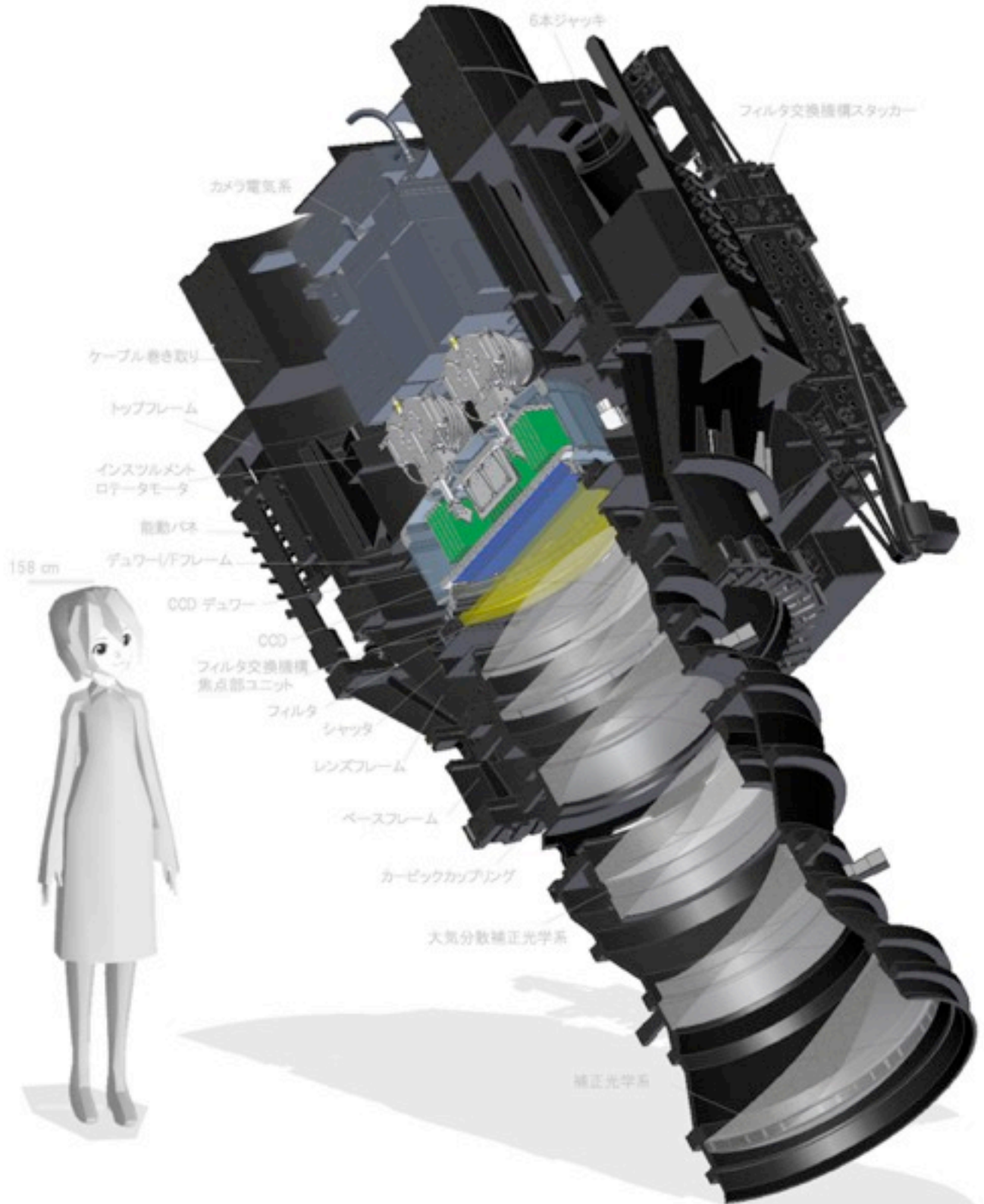
Hyper Suprime-Cam

開発の現状と戦略枠観測

Hyper Suprime-Cam

Larger Camera on 8.2 m Subaru Telescope

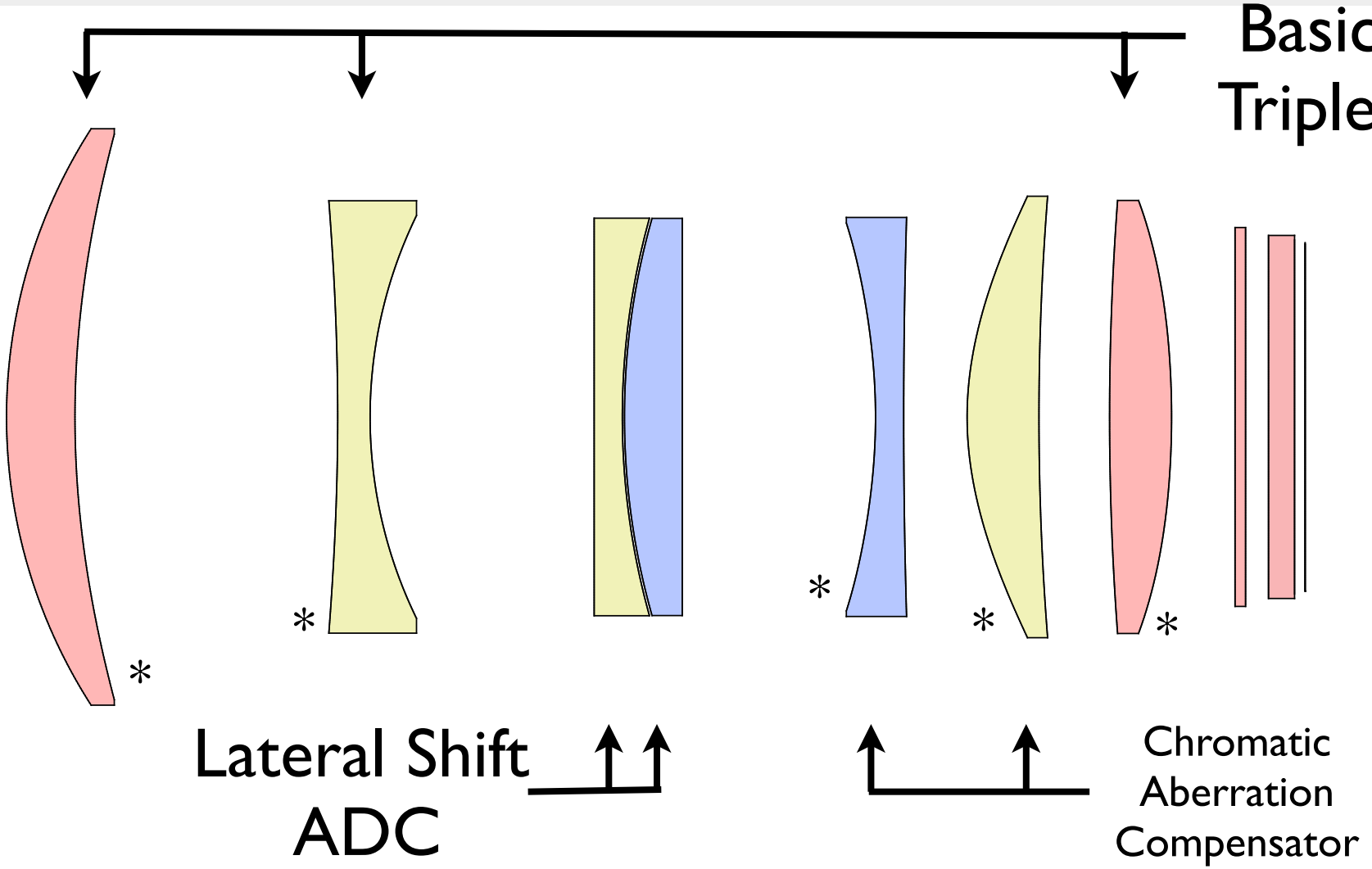

6本ジャッキ
フィルタ交換機構スタッカー
カメラ電気系
ケーブル巻き取り
トップフレーム
インスツルメント
ロテータモータ
駆動バネ
デュワーI/Fフレーム
158 cm
CCD デュワー
CCD
フィルタ交換機構
焦点部ユニット
フィルタ
シャッタ
レンズフレーム
ベースフレーム
カービックカップリング
大気分散補正光学系
補正光学系

Key Elements

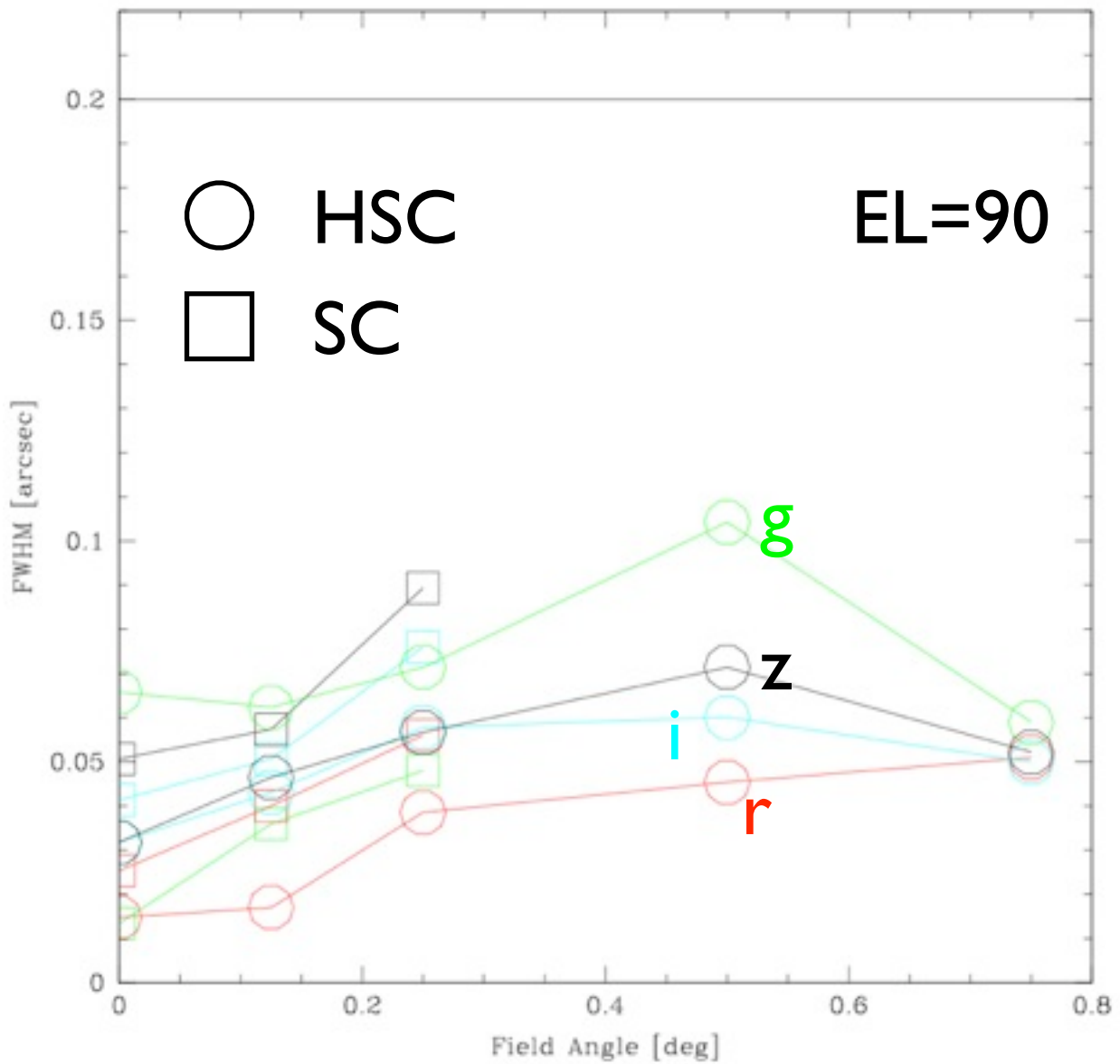
- Sharp Lens: < 0''.2 FWHM

- Large Number of CCDs
  : to pave ø 50 cm focal plane

New Wide Field Corrector

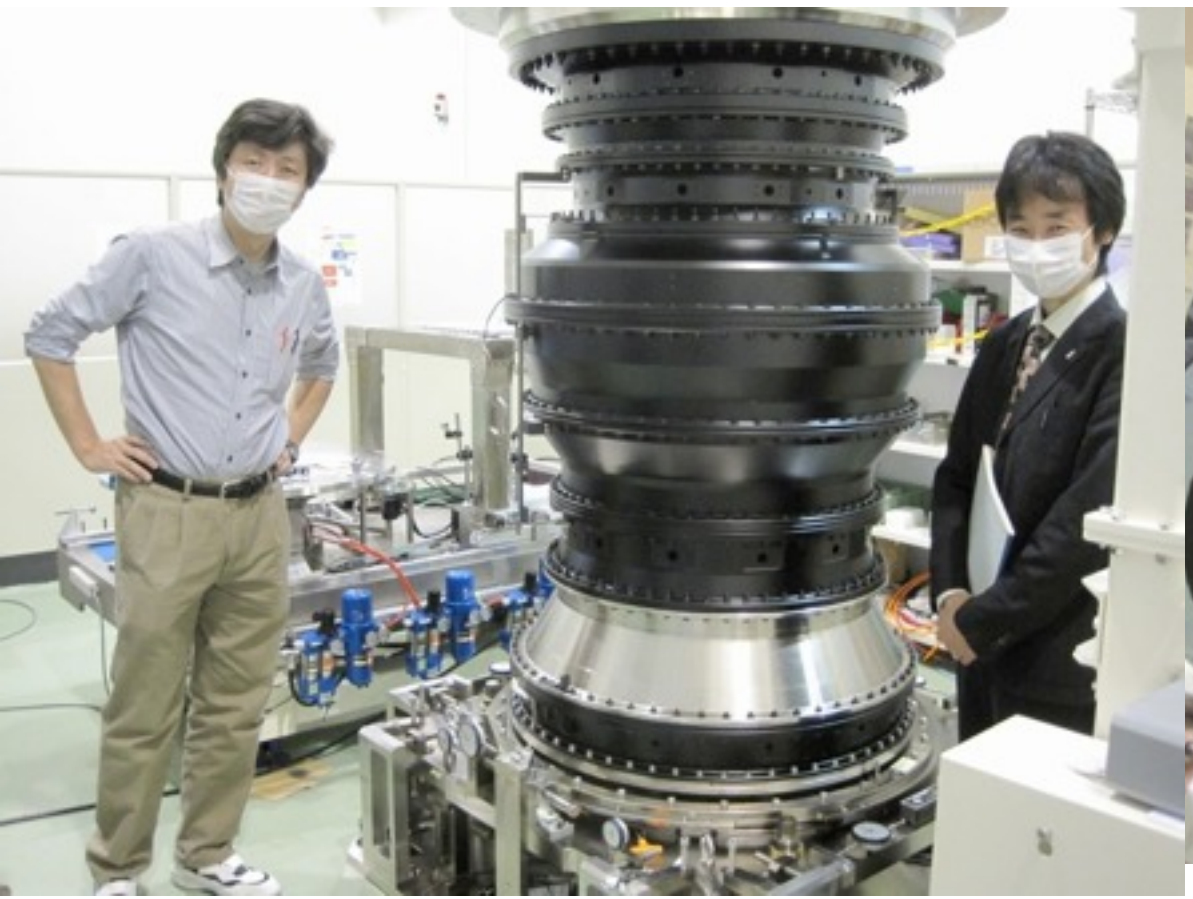


WFC Designed Performance



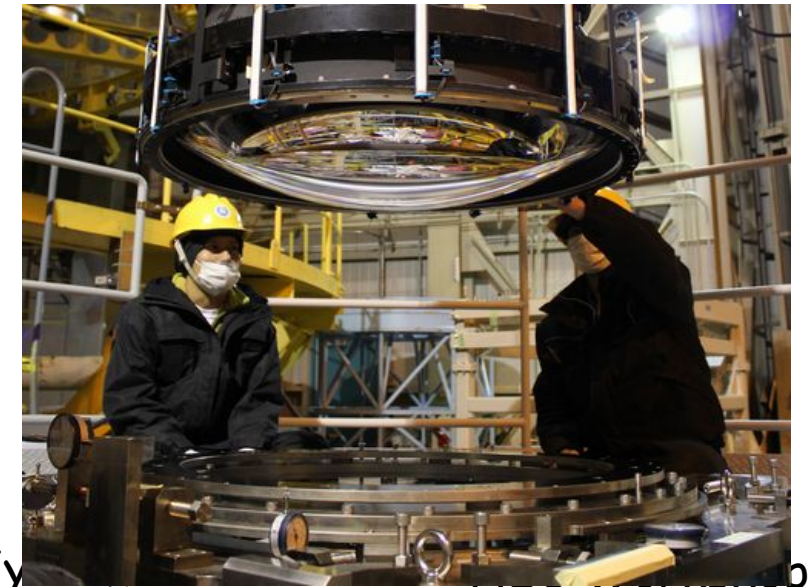
0".2 (FWHM) is allocated including manufacturing error

Wide Field Corrector

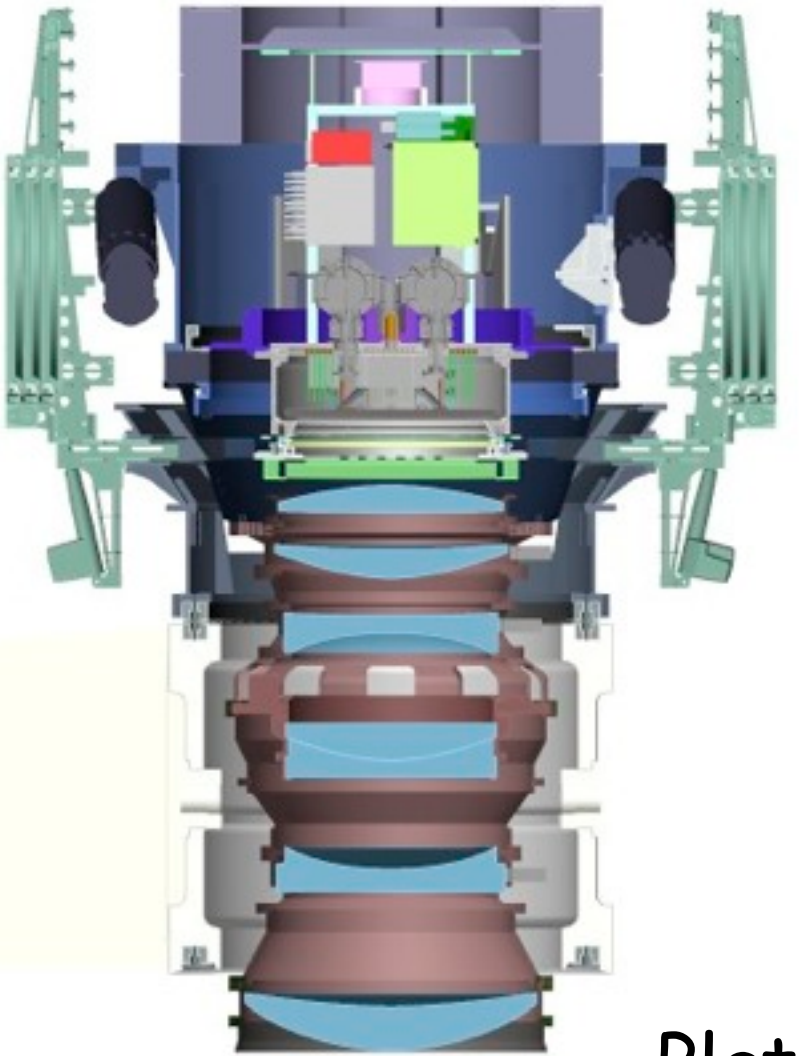


Estimated <u>Worst</u> Performance over the field of view <~ 0".18 FWHM in r (spec: 0''.2)

WFC docking with PFU:June '12



Structure and optics alignment



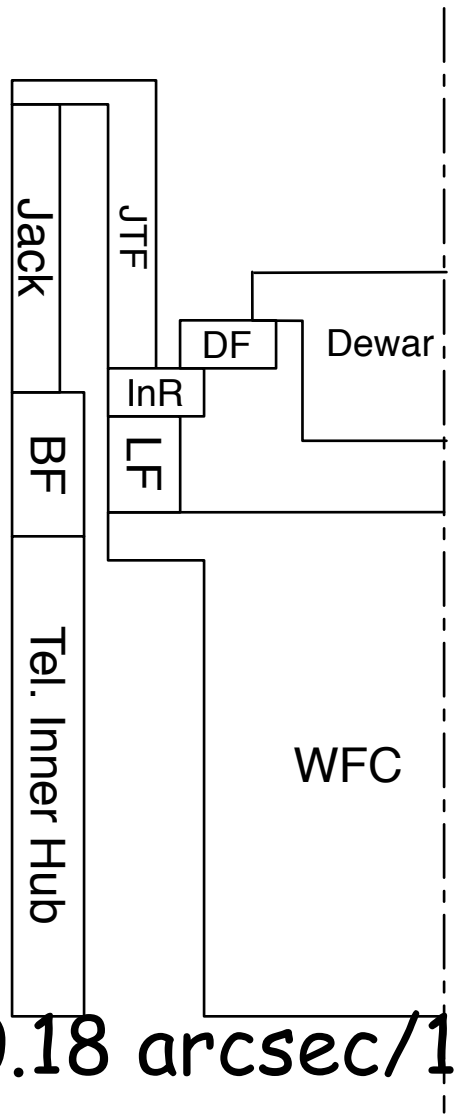
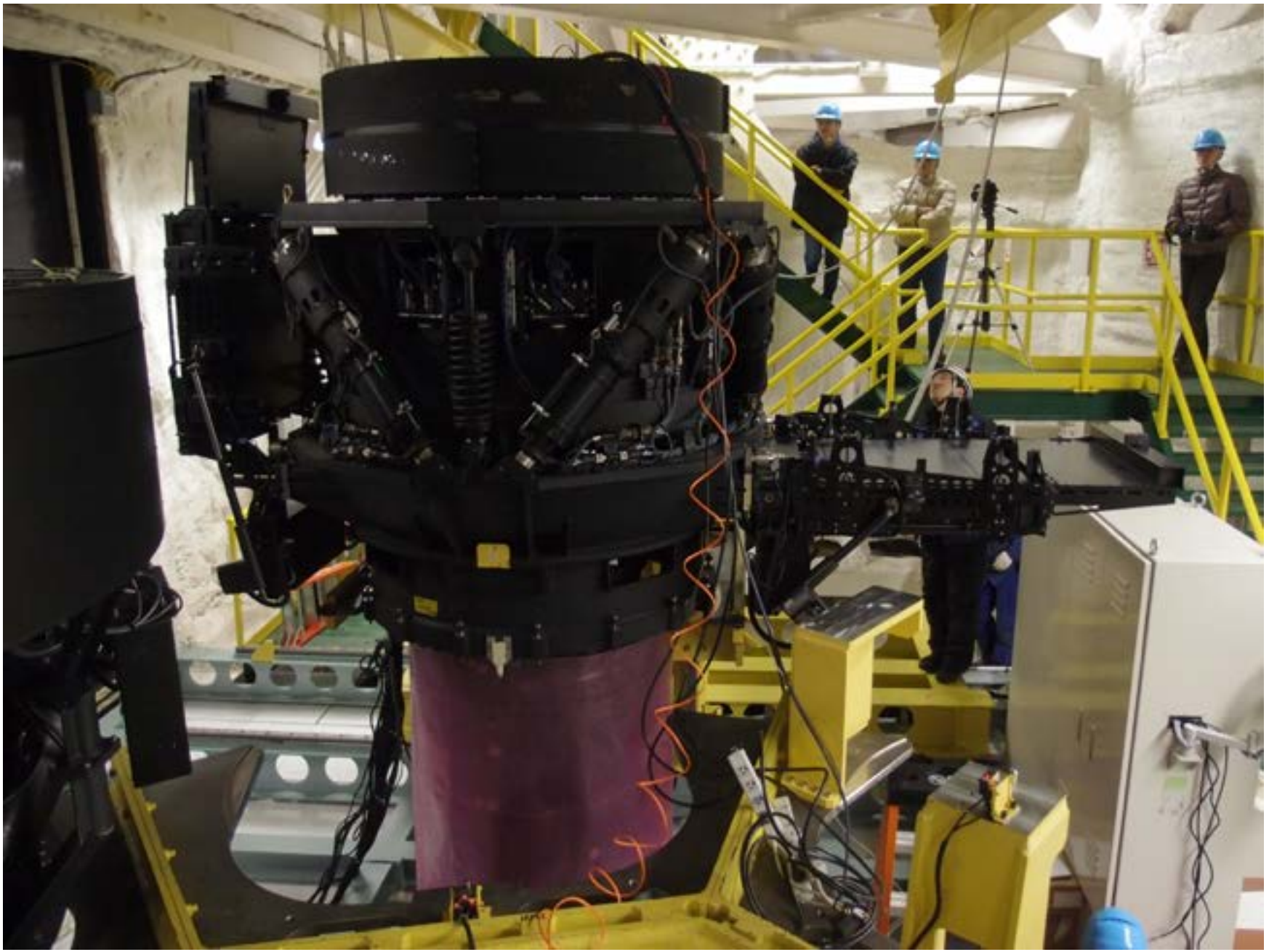


Plate scale 0.18 arcsec/15 μm

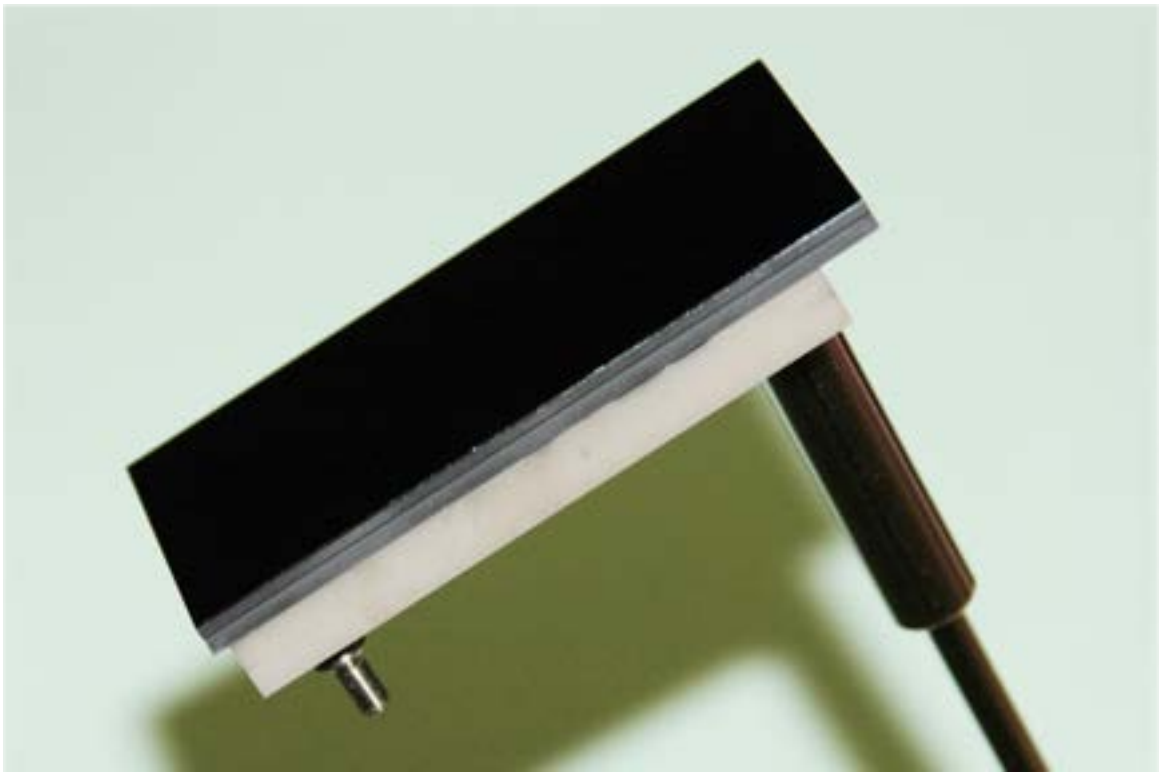
~ a few μm precision required for 3 tons camera

New Prime Focus Unit



Detector

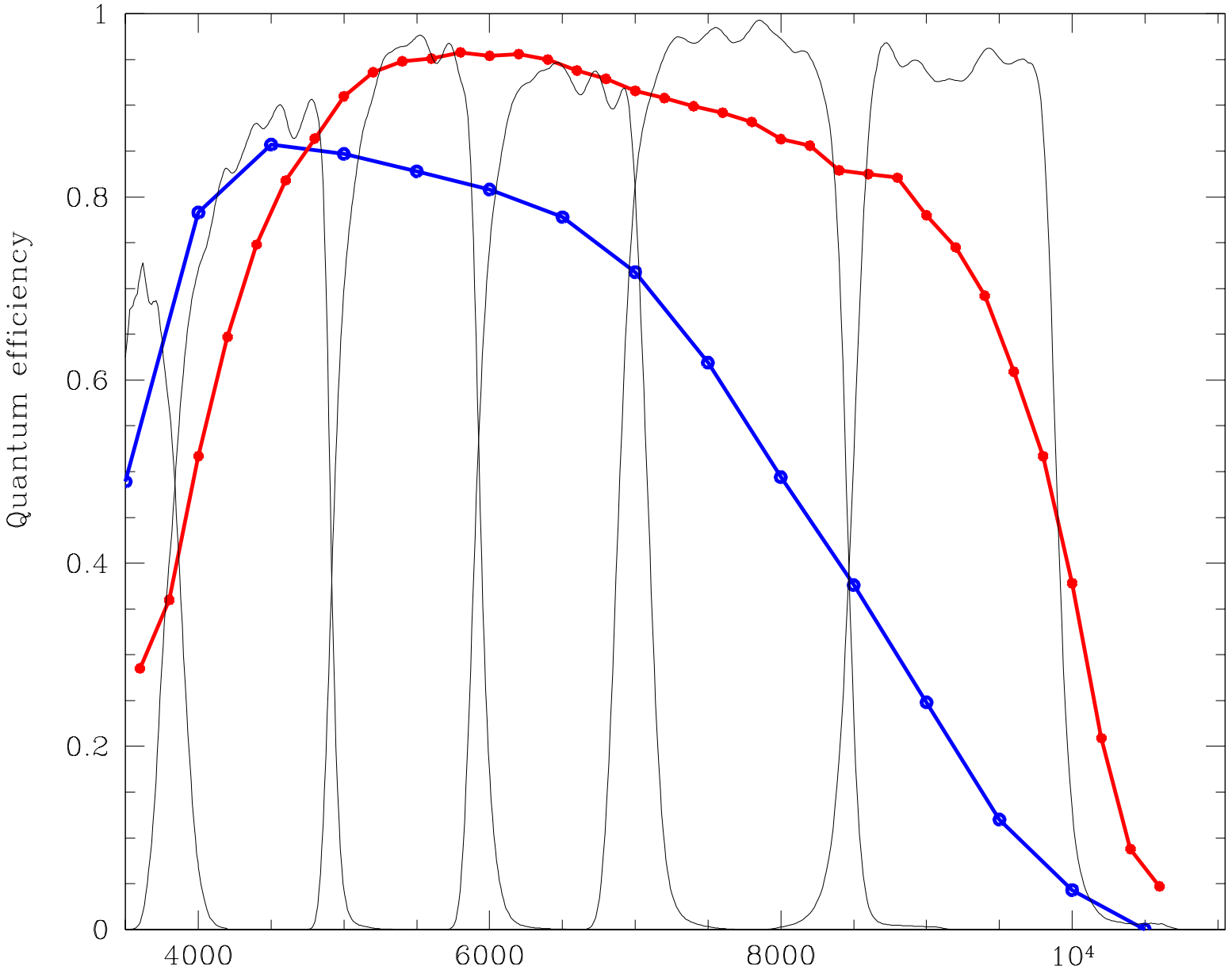
Collaboration with Hamamatsu



- 2k4k 15μm
- Fully depleted CCD
- High resistivity Si
- 200 μm thick

Kamata et al. SPIE 8453-69

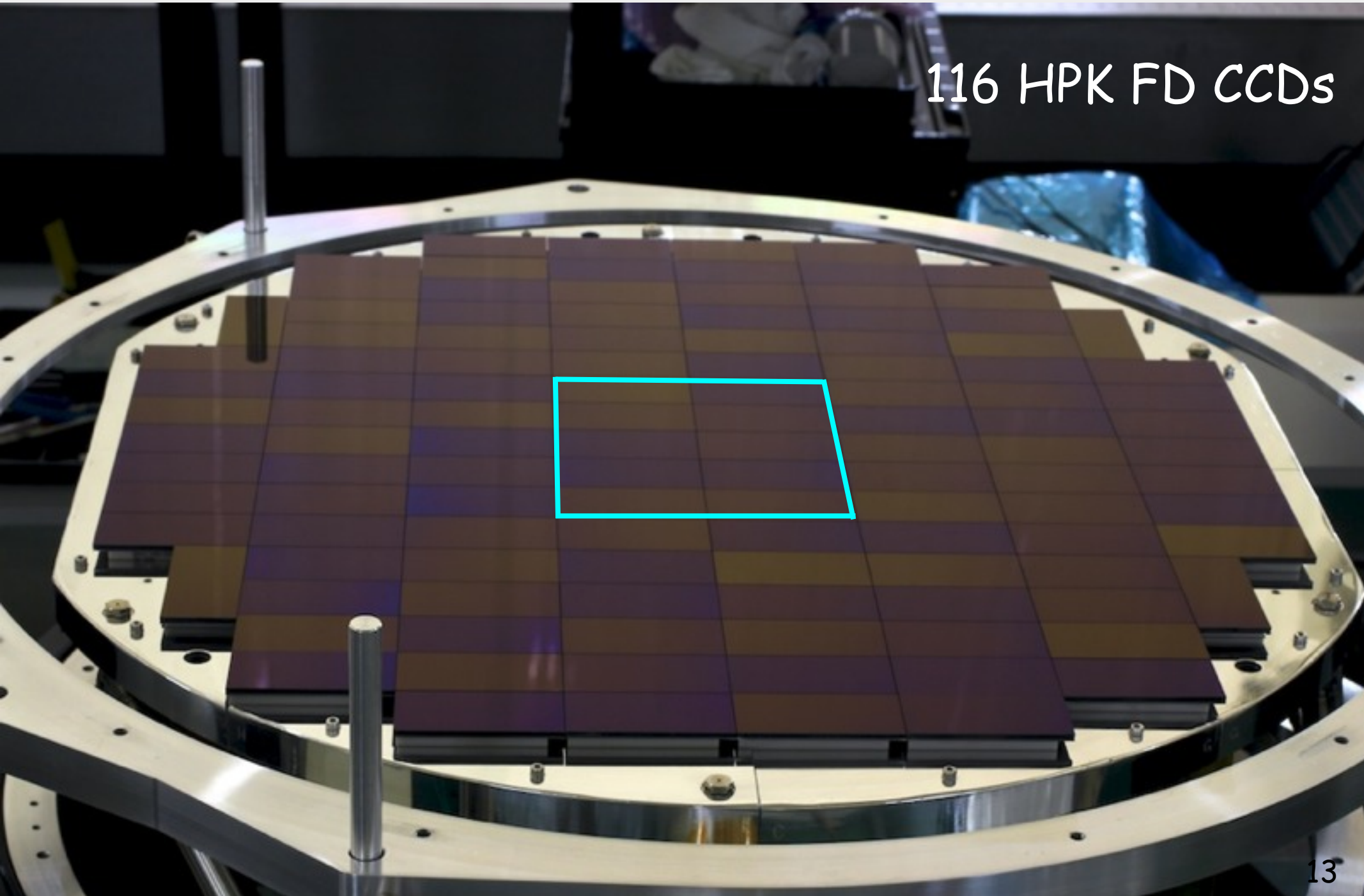
Optical Quantum Efficiency



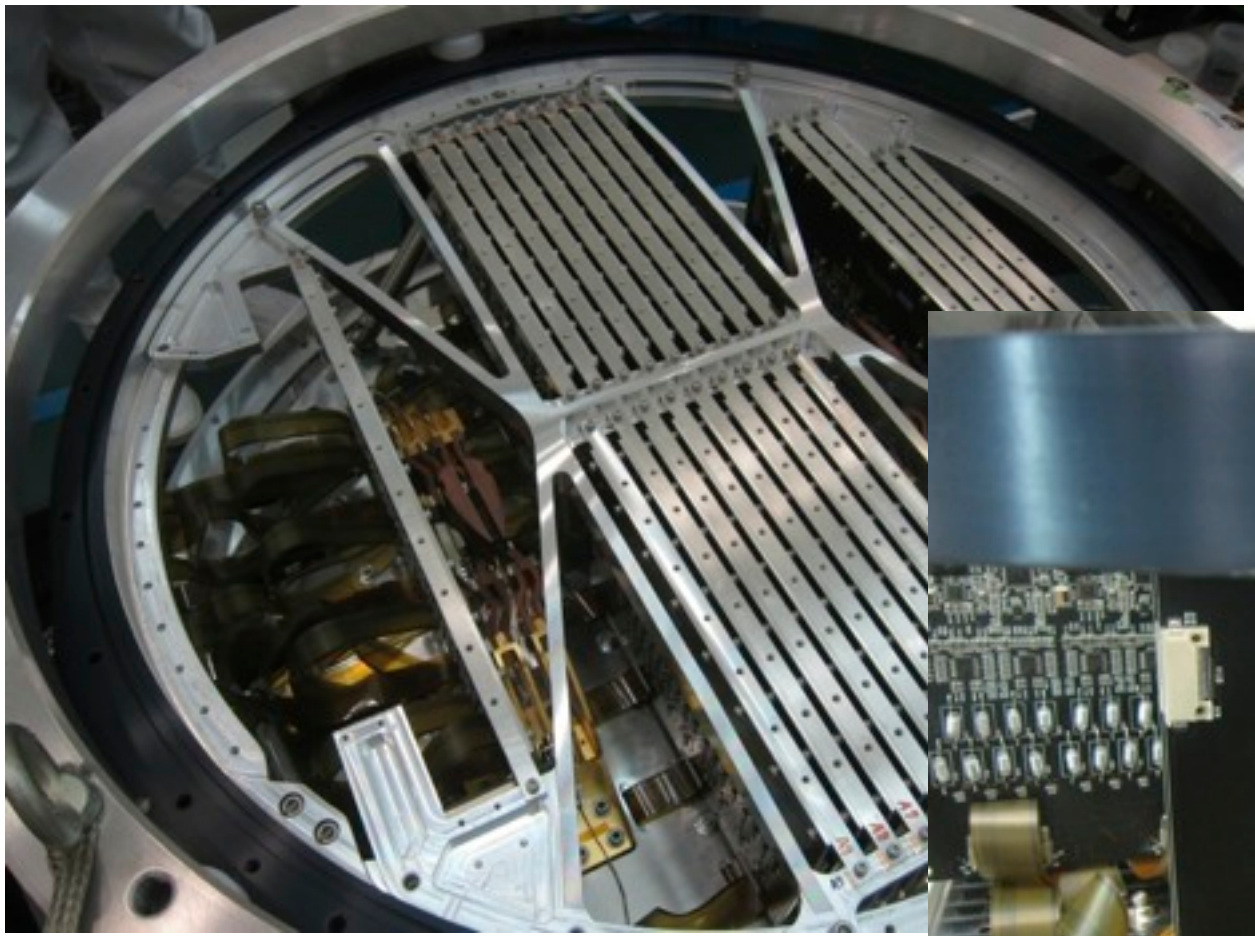
Hamamatsu FDCCD

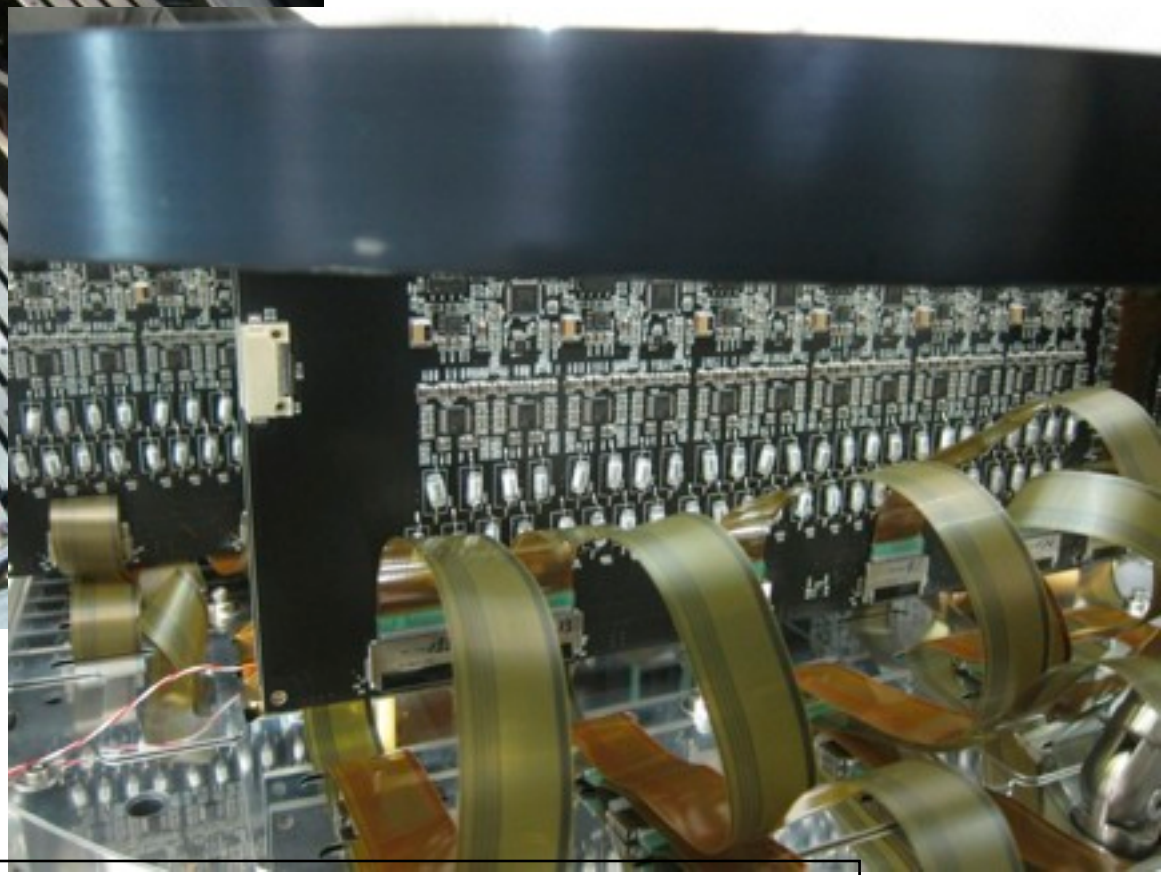
(previous) e2v CCD

HSC Focal Plane



In-Dewar Electronics Assembly





Nakaya et al. SPIE 8453-101

HSC Dewar

Vacuum Maintenance

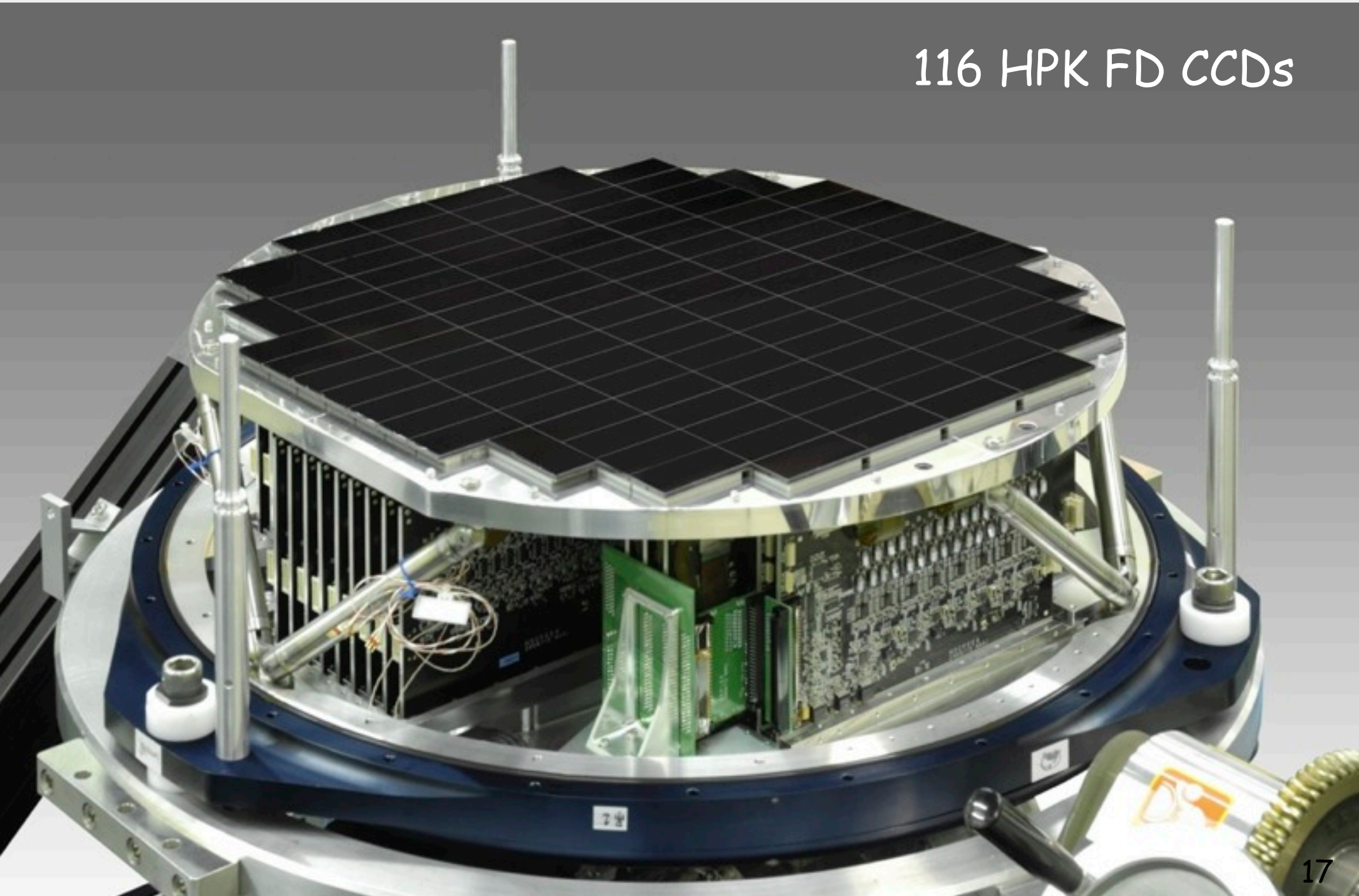
- Achieved Vacuum: P <~ 1 x 10^-5 Torr
- With electronics powered on (outgas)
- Life time of the ion pump: 8,000 hours
  - (cf 80,000 hours @ 10^-6 Torr)
  - Maint. cycle: ~ 2 year (14 nights/month)

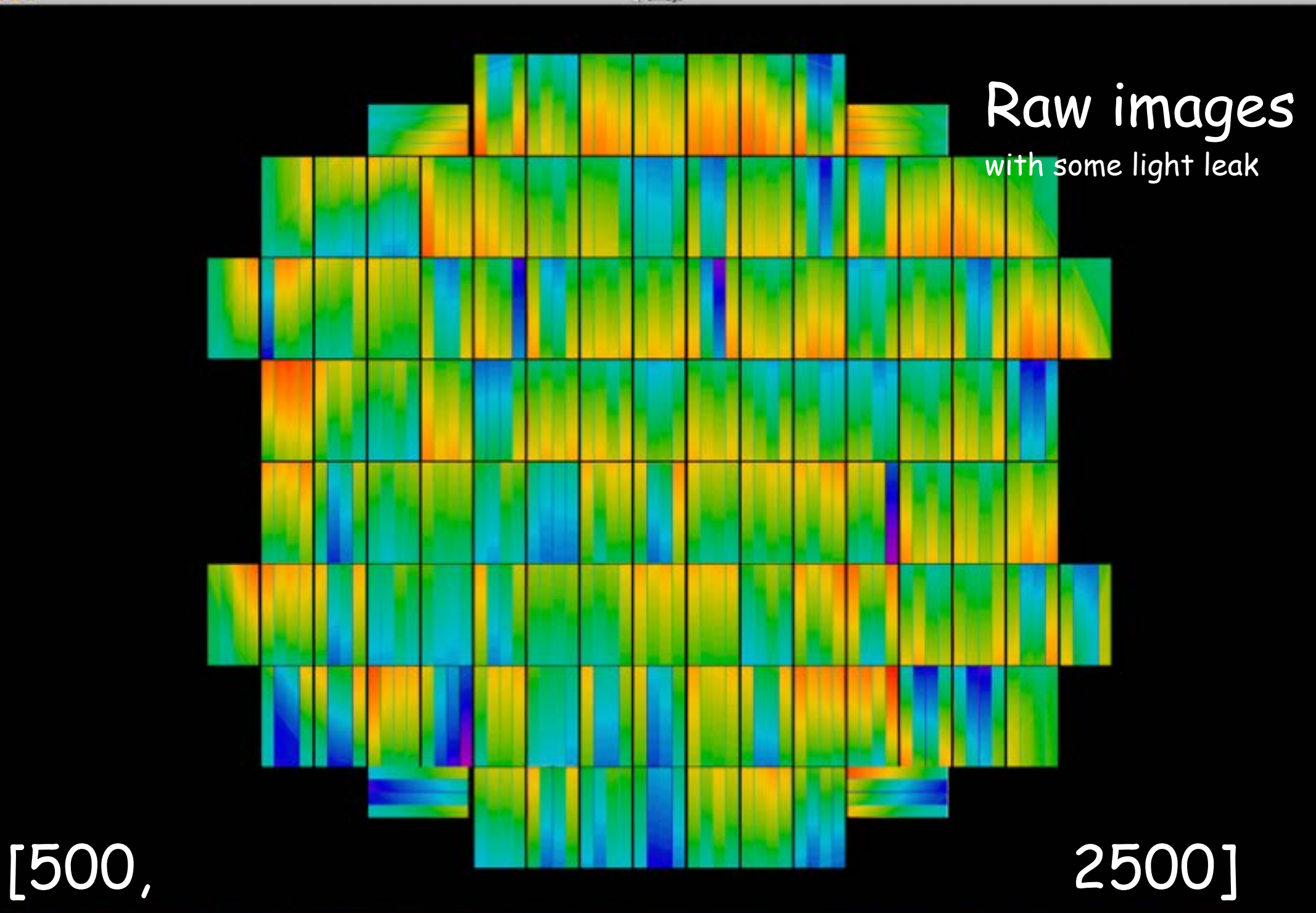
cf. VacuumTemp20110927.pdf

Assembling Dewar

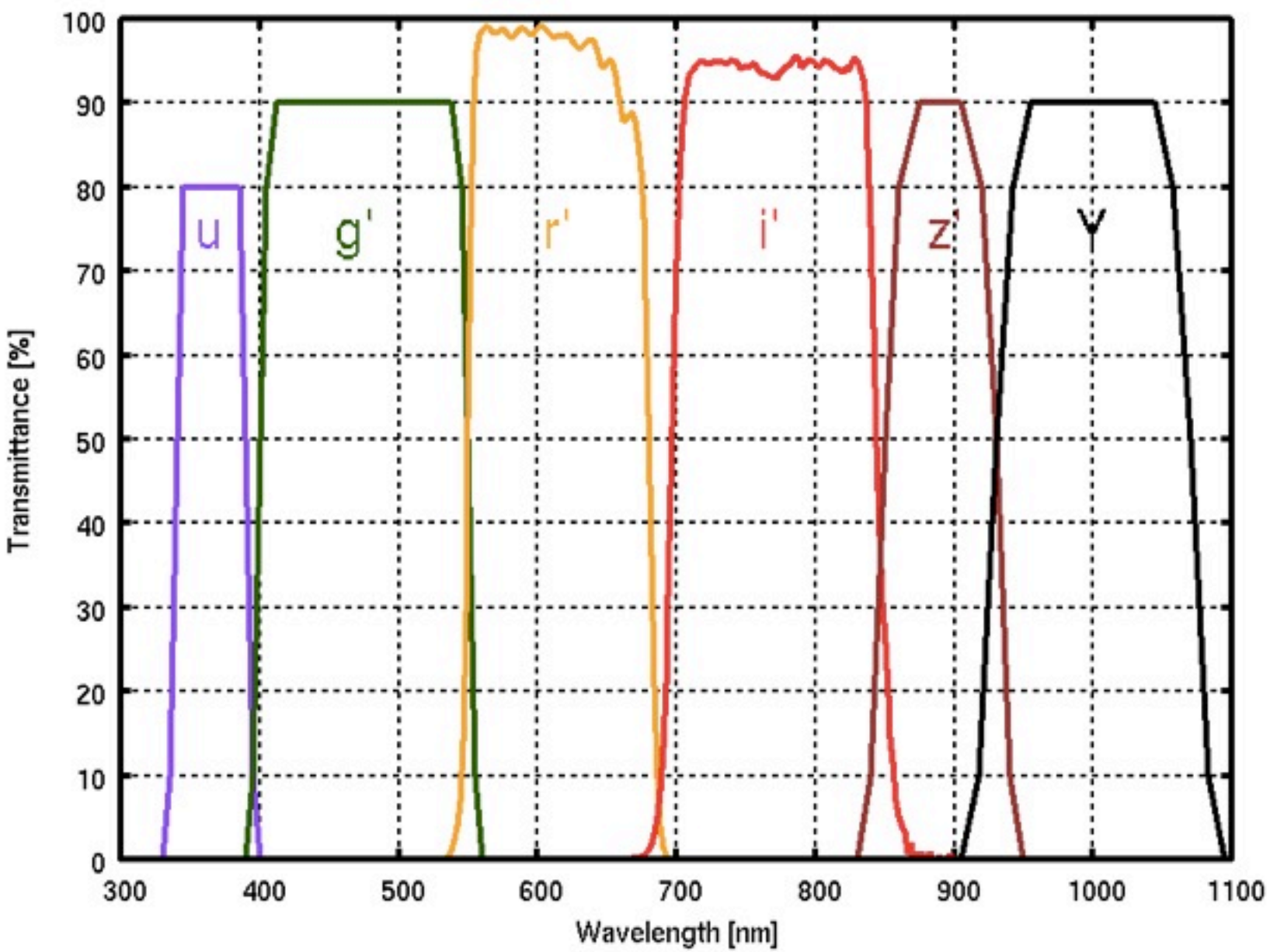
Komiyama et al. 2010
Obuchi et al. 8446-256

HSC Focal Plane




Raw images
with some light leak
[500,
2500]

Filter Plan

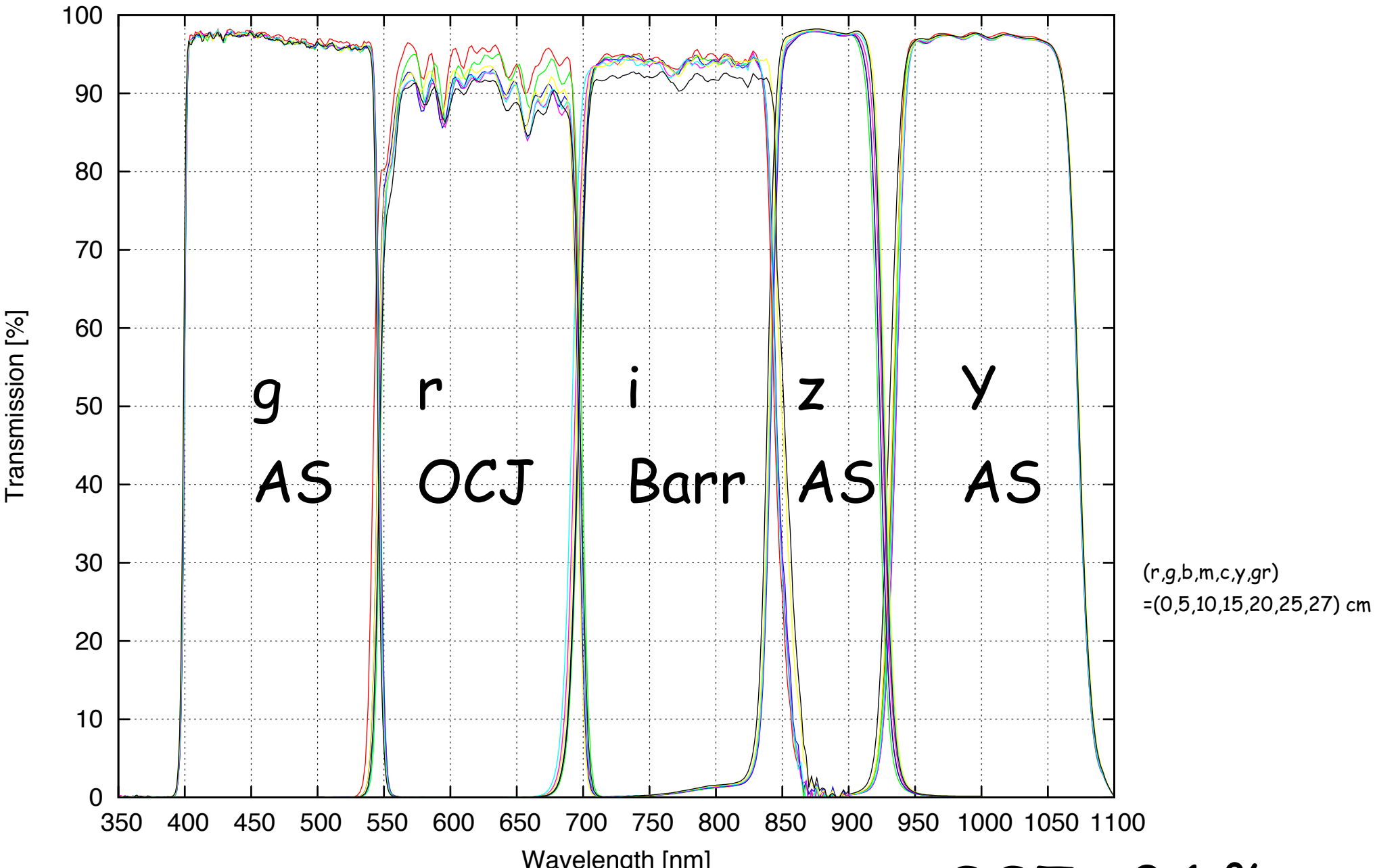

u
g'
r'
i'
z'
Y
Transmittance [%]
Wavelength [nm]
0
10
20
30
40
50
60
70
80
90
100
300
400
500
600
700
800
900
1000
1100

Filter

Kawanomoto et al. 2008

i - filter : Barr

Filter in the Cabinet



OOT < 0.1 %

Narrow Band Filter Set

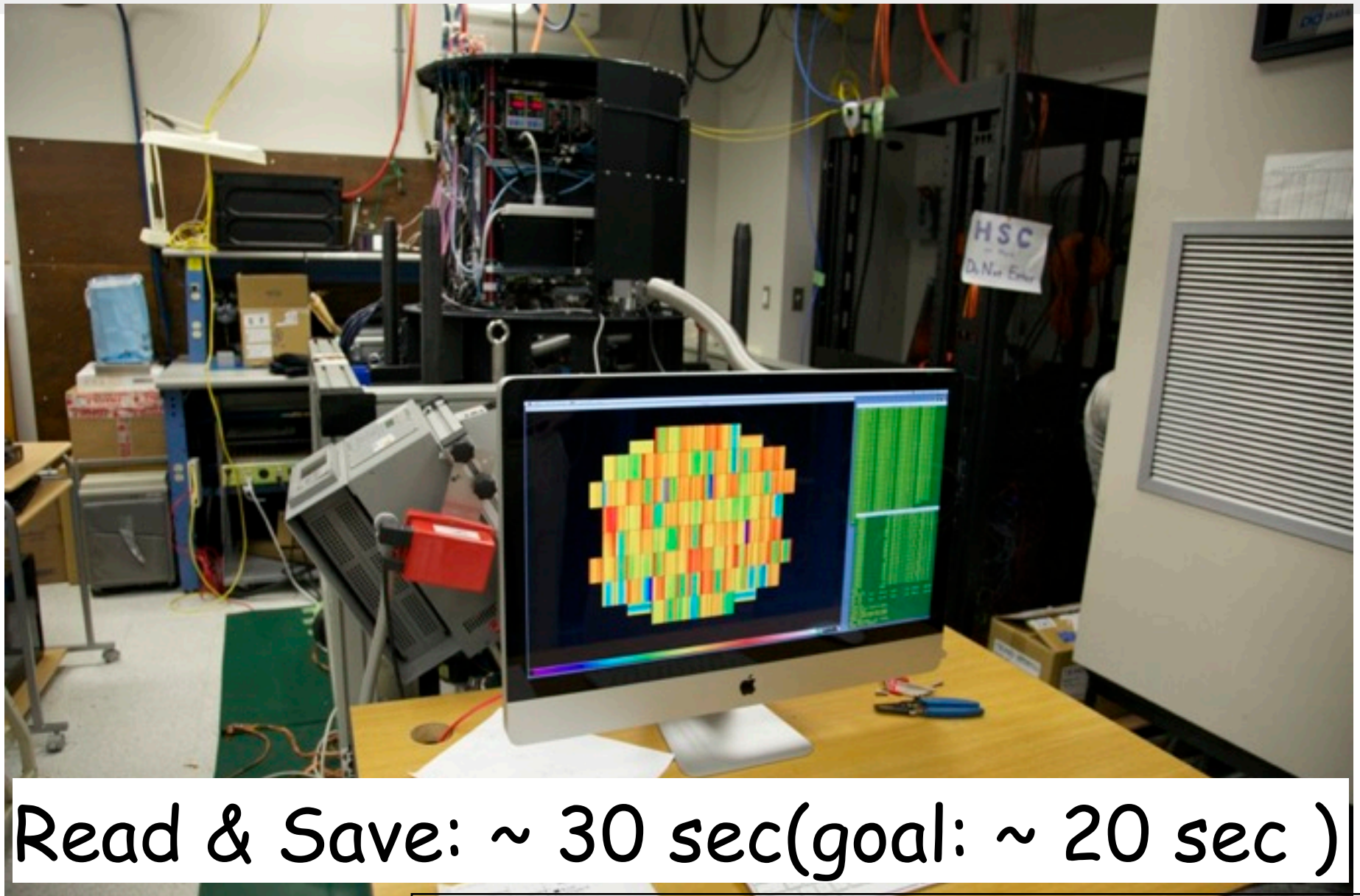
- ML(hscfilter@anela)における話し合いで製作フィルターを決め、観測所、SACに提案
  （Chair: 東大 嶋作）
- 技術サポートはHSC Project (川野元)
- 予算は各自獲得
- フィルターは観測所に寄付　誰でも使える

名前	発注者	CW[nm]	CW誤差[±%]	FWHM[nm]	FWHM誤差[±%]
NB515	東北大学	514.52	0.3	8.0	10.0
NB718	愛媛大学	718.0	0.3	10.2	10.0
NB816	愛媛大学	816.0	0.3	11.6	10.0
NB921	東京大学	921.0	0.3	13.1	10.0
NB101	東京大学	1009.5	0.3	9.0	10.0

NB387, NB527, NB946, NB973も手続き中

Uraguchi et al. SPIE 8453-232

Camera Readout Test



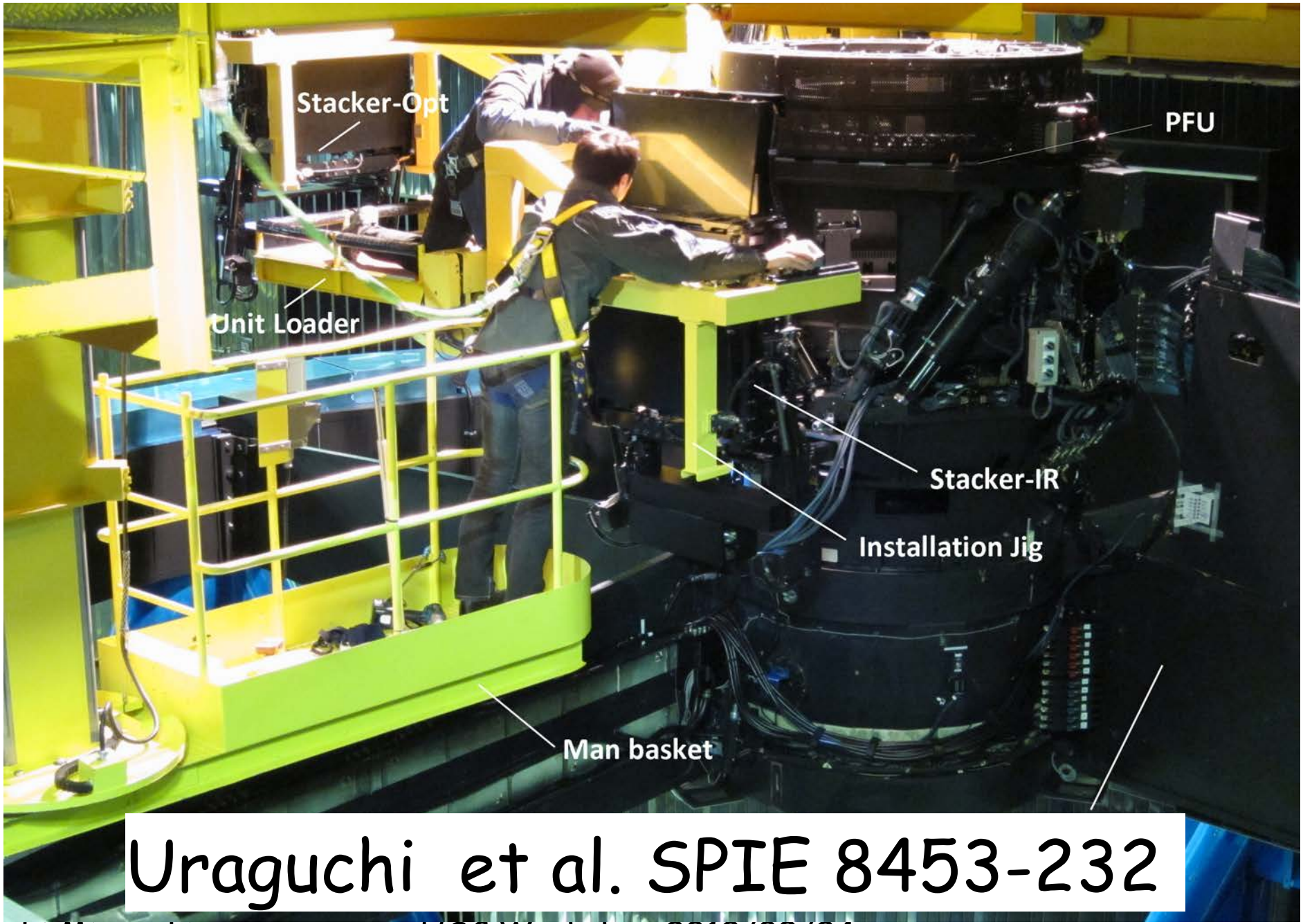
Read & Save: ~ 30 sec(goal: ~ 20 sec)

Utsumi et al. SPIE 8453-231

Camera Unit Installation Done

Mounting on Subaru

FEU Attachment

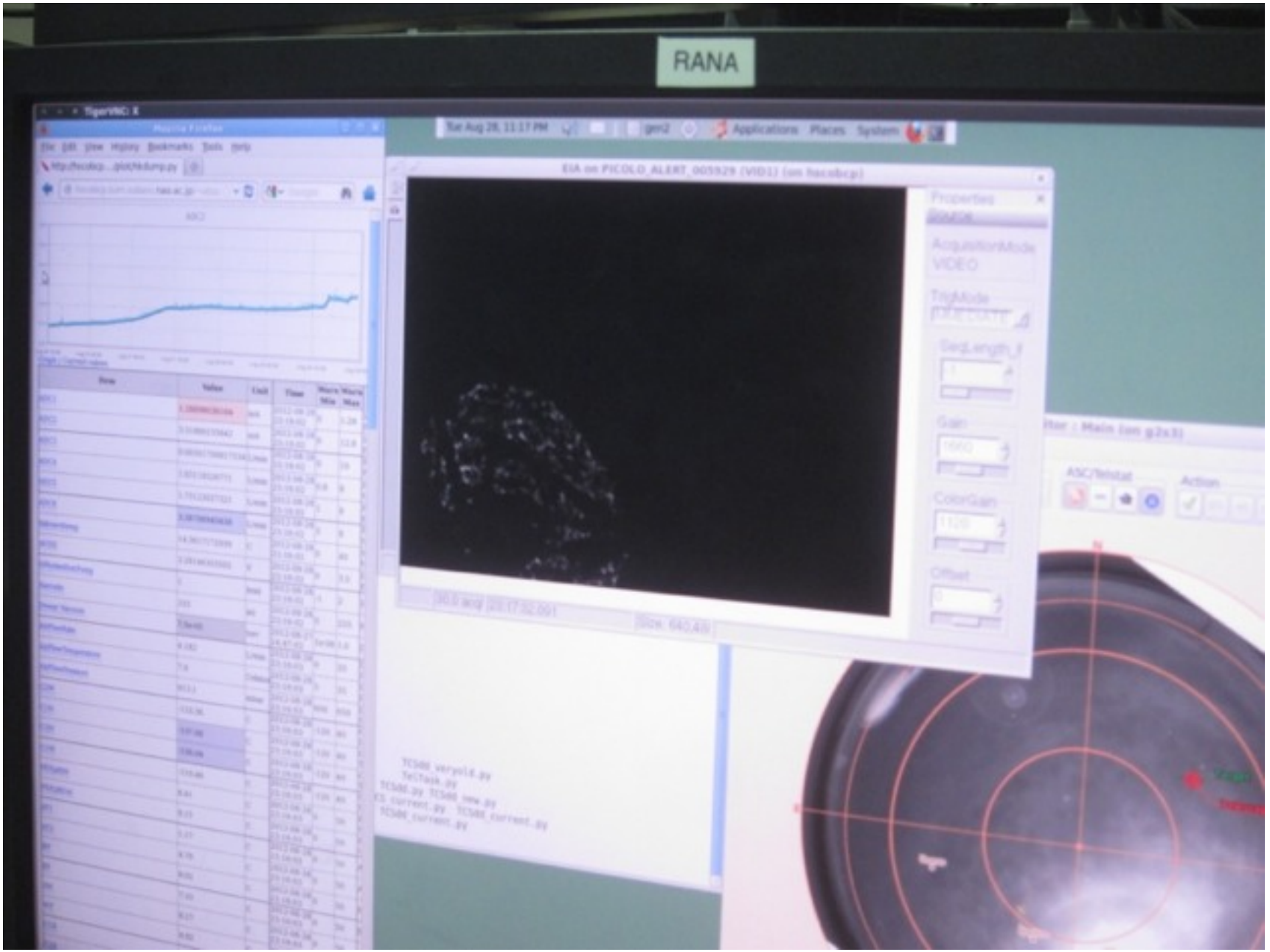


Uraguchi et al. SPIE 8453-232

Engineering First Light

- 2012/08/28 ~
  - Auto Guider, Pointing Analysis System, Mirror Analysis Systemのsoftware/hardwareの機能確認
  - 新規HardwareはHSC project、Softwareは三菱電機、全体監修を観測所が分担

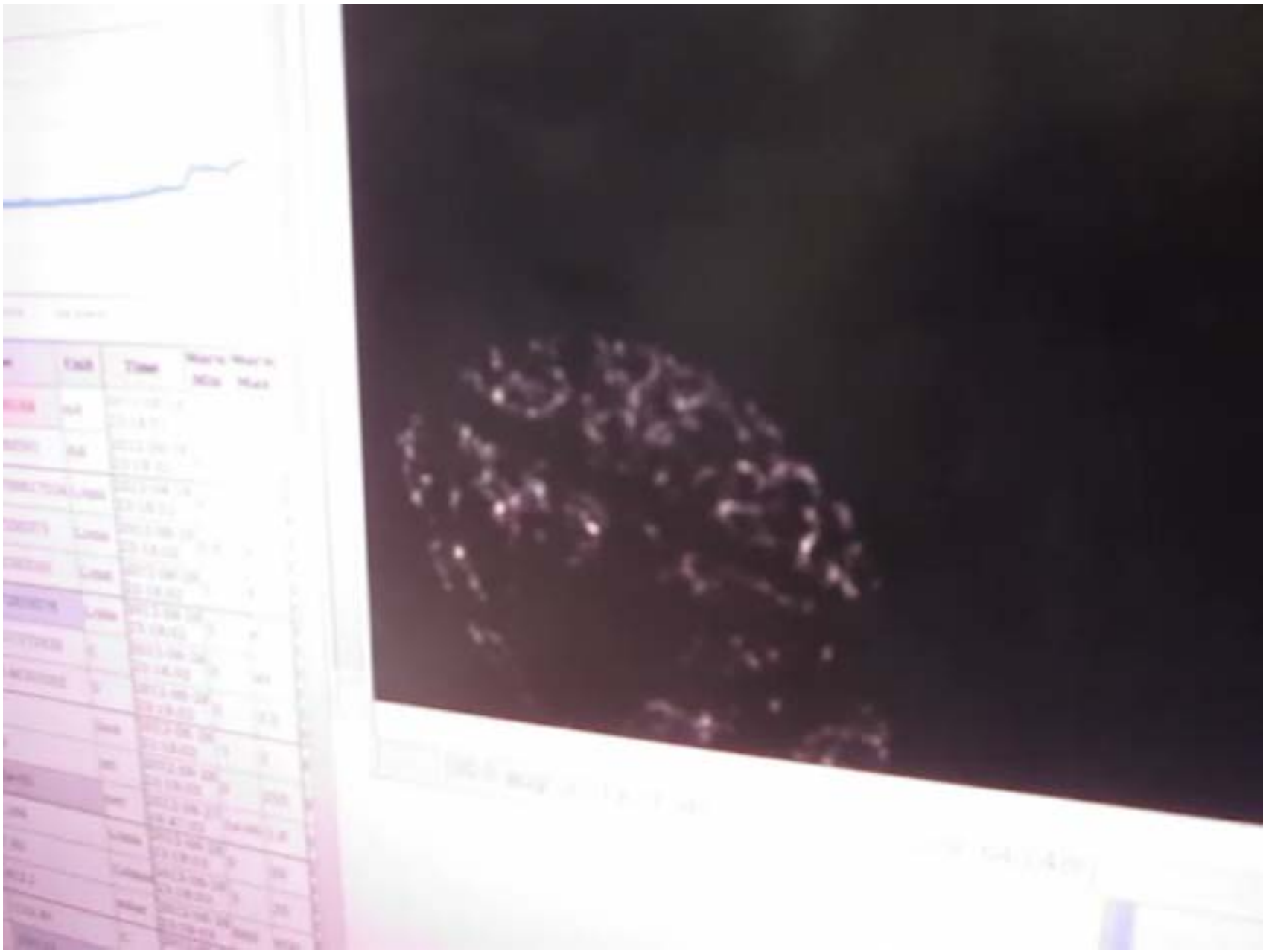
HSC First Light



2012/08/28
~ 23:17
Vega
with Video
Camera for
SHAG

Perr <~ 20''

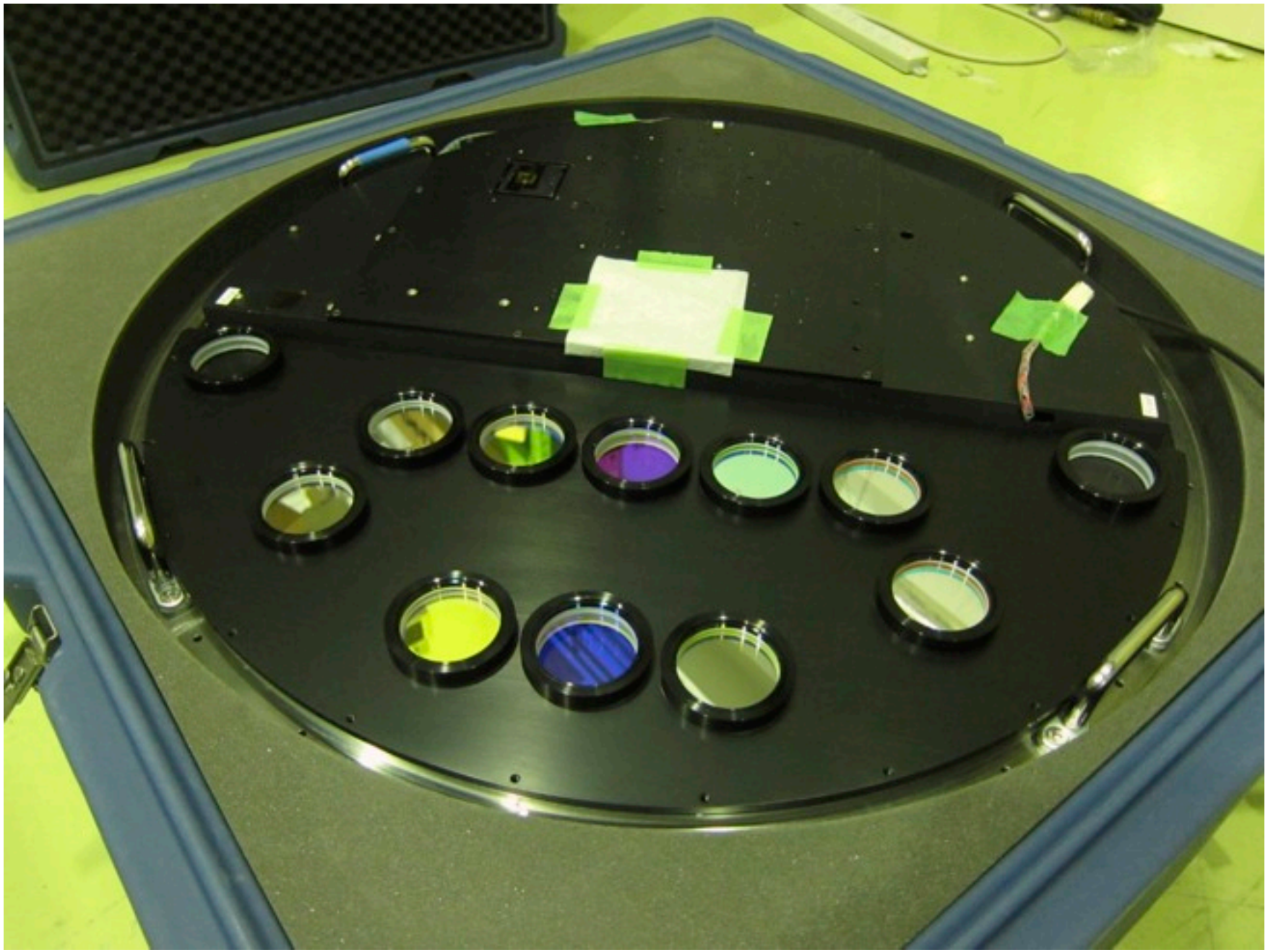
HSC First Light



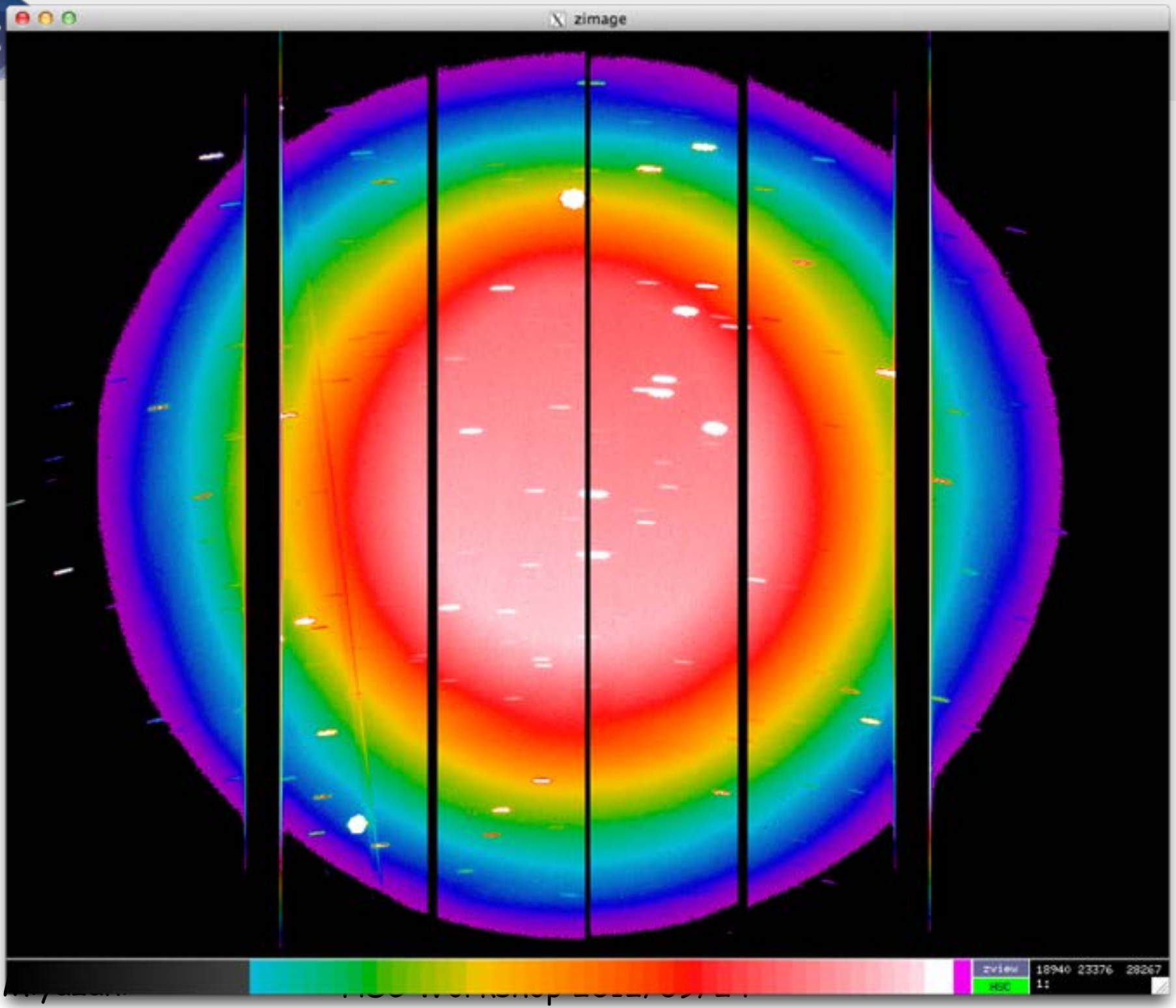
HSC First Light

HSC First Light

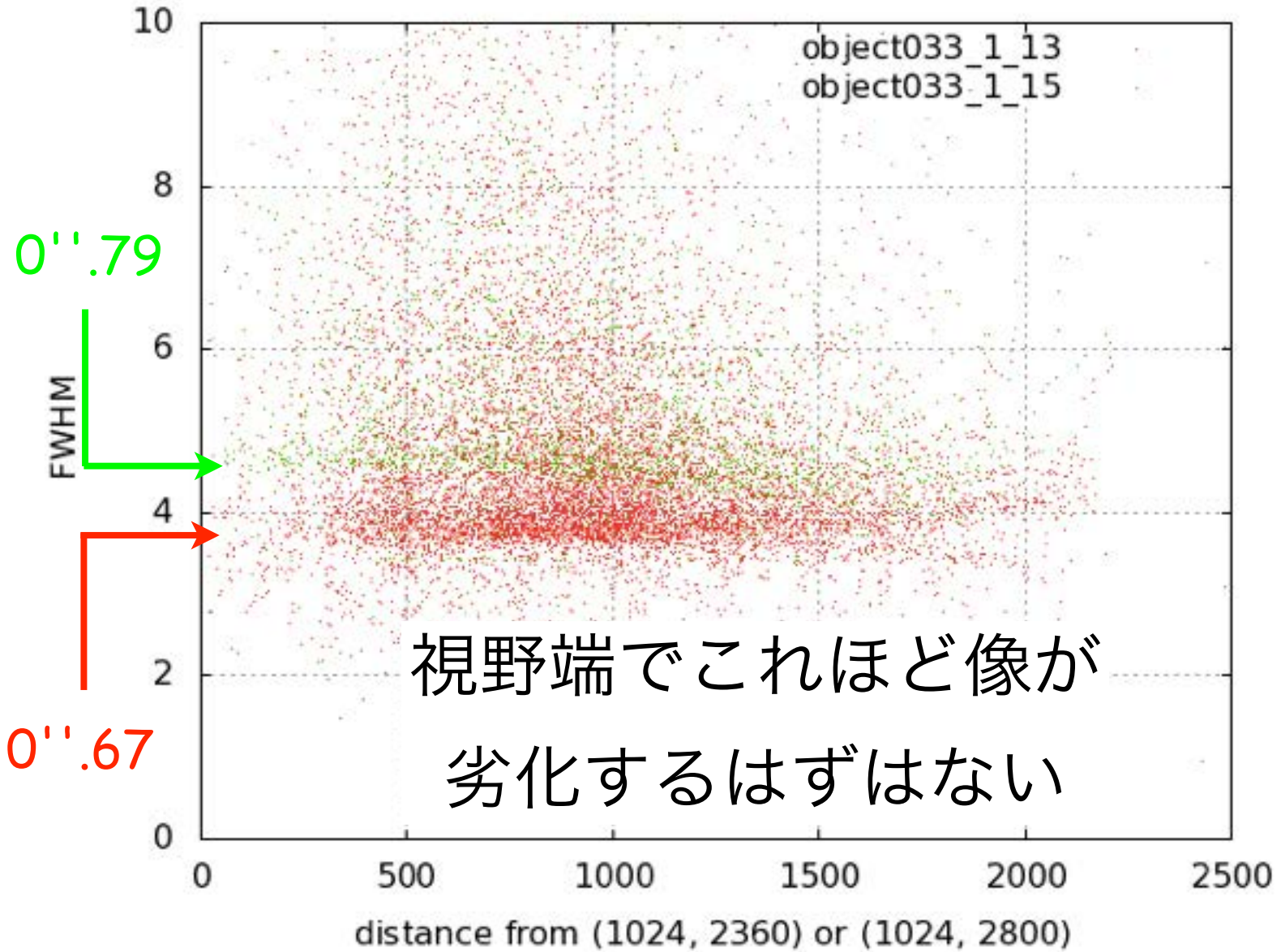
SH Filter



HSC First Light


zimage
zview
18940 23376 28267
HSC
1:

Main Camera Image Analysis



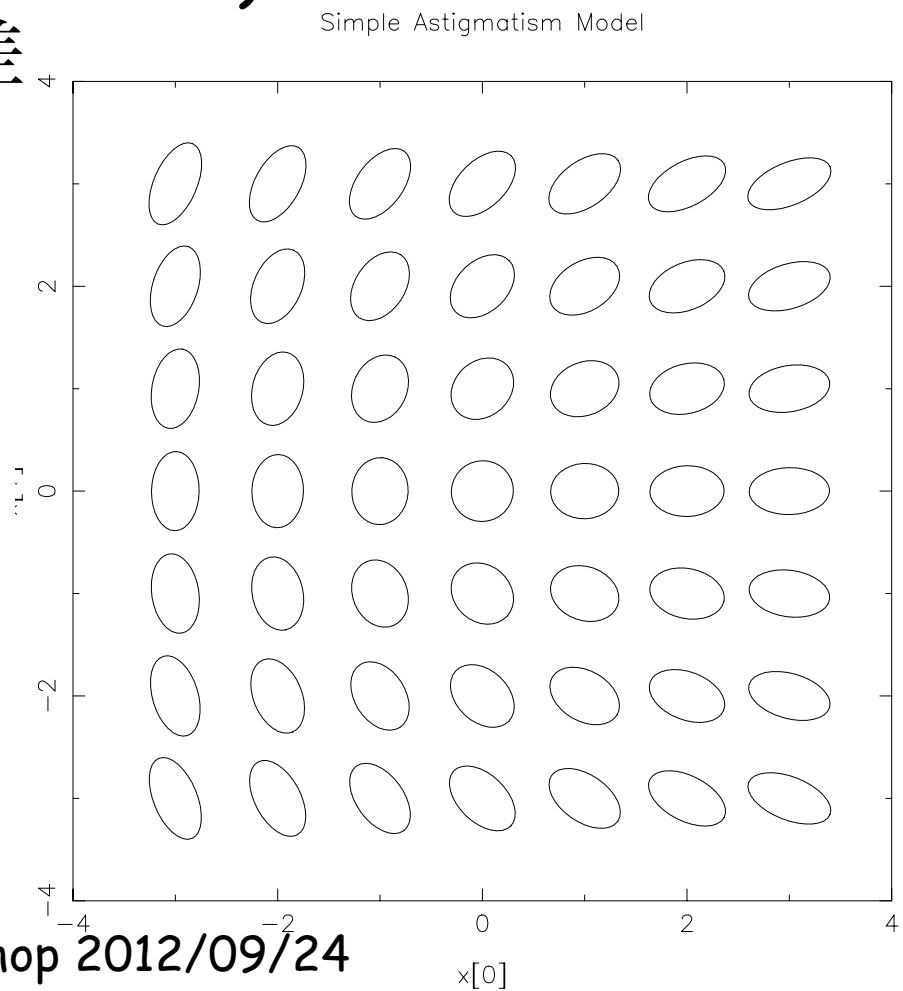
Field Angle

green: 43'

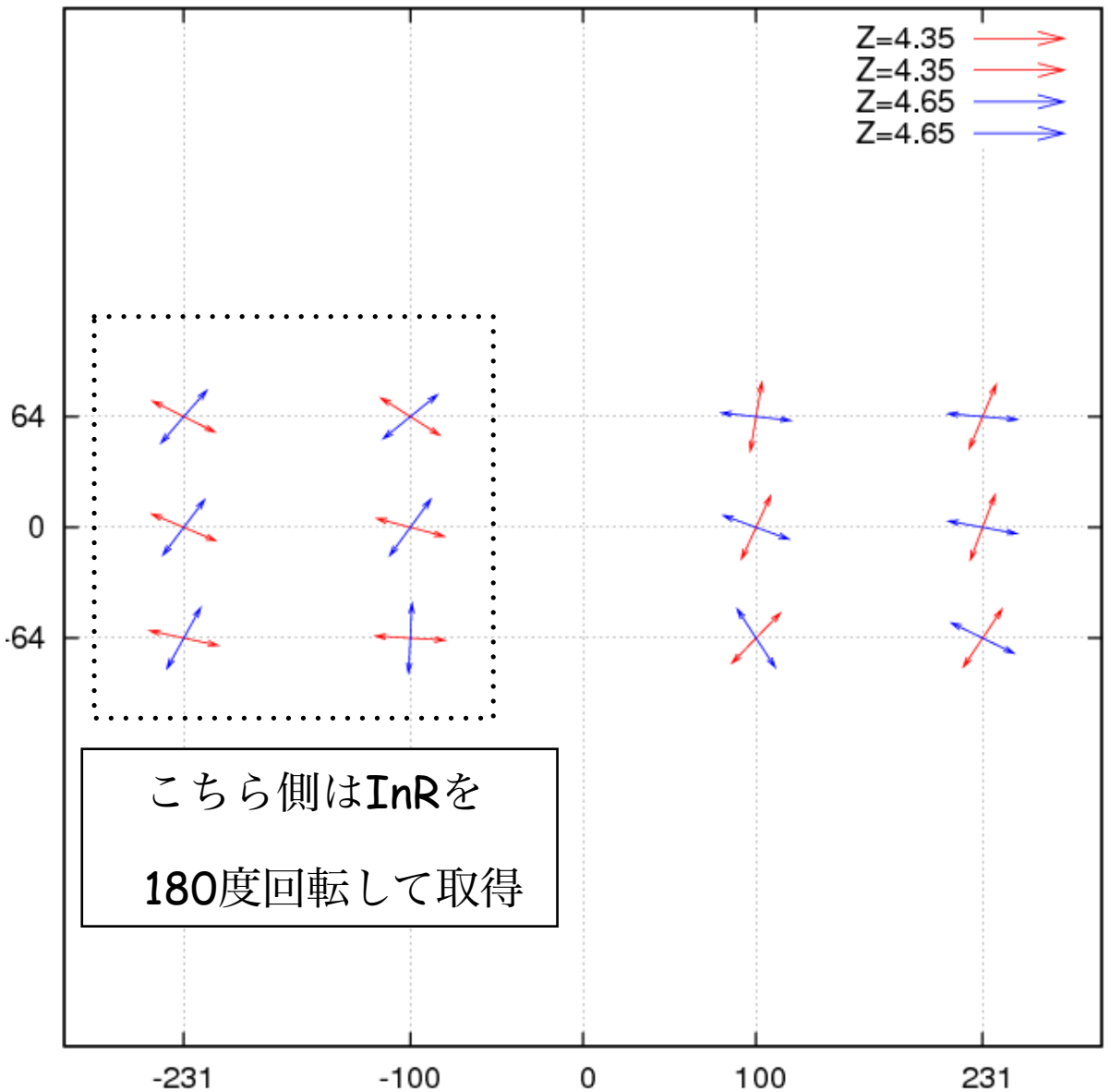
red: 19 '

Main Camera Image Analysis

- Distortionによるplate scaleの変化
  - 6％くらい
- (HSC Camera Unit + WFC)のM1光軸に対する傾きによる非点収差



Main Camera Image Analysis

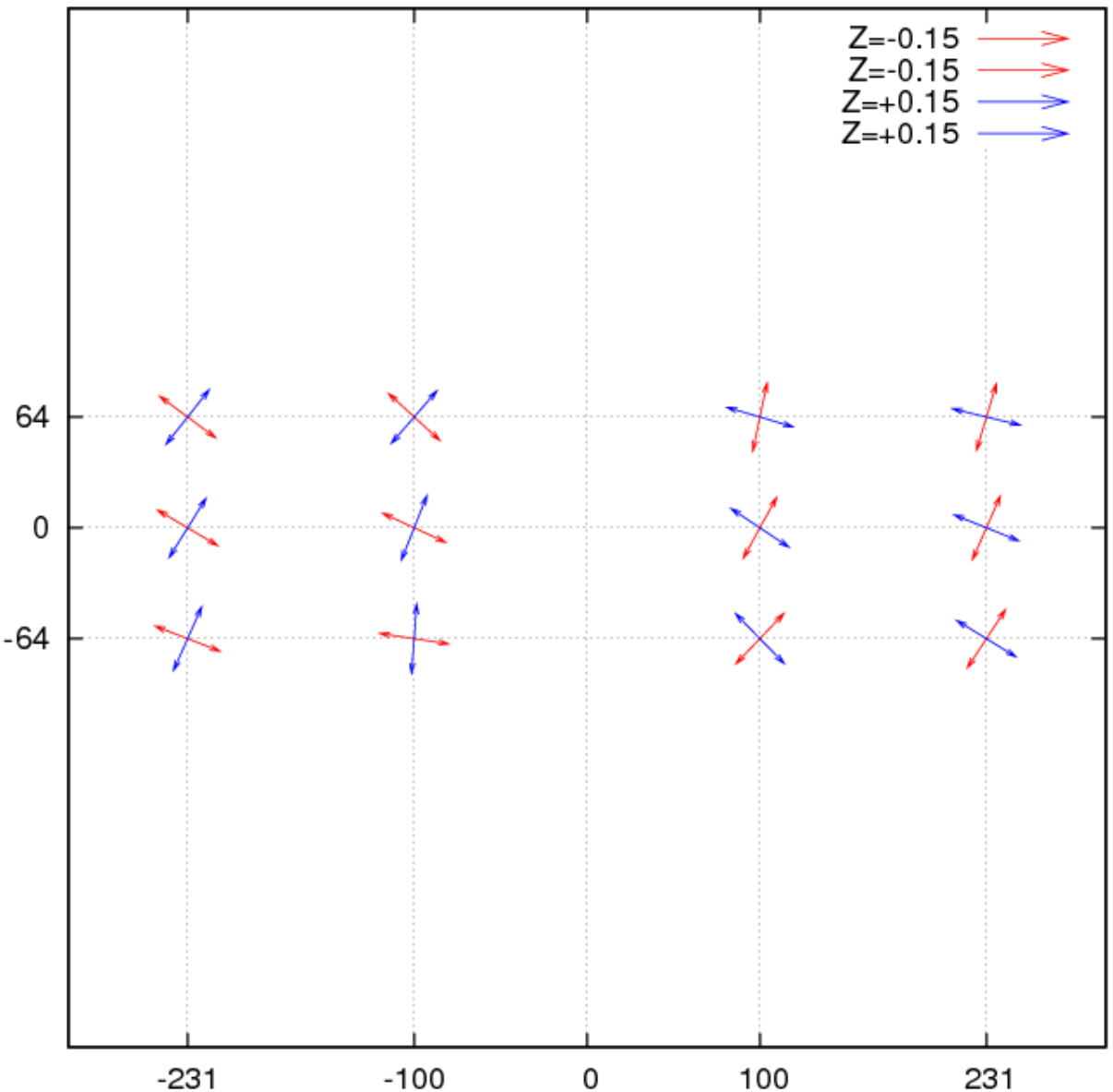


150 μm off-focus

画像の星像の伸び

直交 -> 非点収差

Main Camera Image Analysis



zemaxで生成した星像

を解析

theta_x = 2'.4

theta_y = 1'.8

回転させるとよくあう

像の大きさの変化も再現

次回試験観測で確認す

る予定

Main Camera Image

M56 10 sec r-band ~0''.58 FWHM

~ 2000 pix

~ 4000 pix (10 arcmin)