



Science & Technology Facilities Council
UK Astronomy Technology Centre

EAGLE: Resolved Stellar Populations & simulations with Specsिम



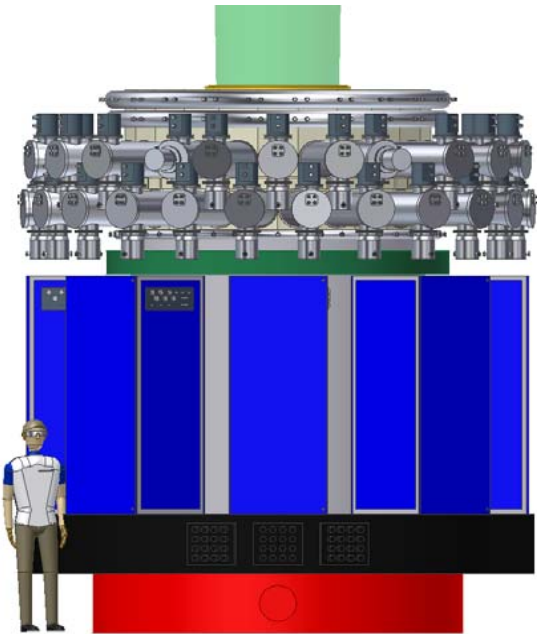
Chris Evans, William Taylor, Nuria Lorente (UKATC)

Jean-Gabriel Cuby (LAM)

DRM Workshop, May 2008



EAGLE Science Requirements



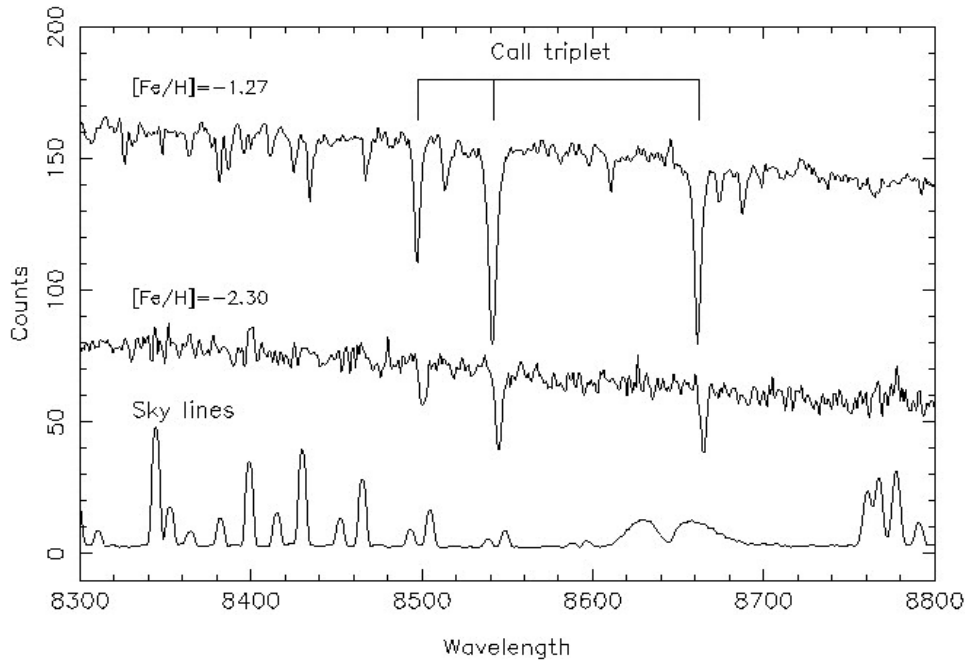
Parameter	Requirement
Patrol Field	5 arcmin diameter
IFU field-of-view	> 1.5 arcsec
Multiplex	> 20
Spatial Resolution	30%EE in 75mas (H-band)
Spectral resolution	4,000 & 10,000
Wavelength range	0.8-2.5 μm

More in Simon Morris' talk tomorrow...



Stellar Spectroscopy with EAGLE

- High-resolution ($R \sim 10,000$) spectroscopy of the Calcium Triplet @ 860nm.
→ kinematics & metallicities

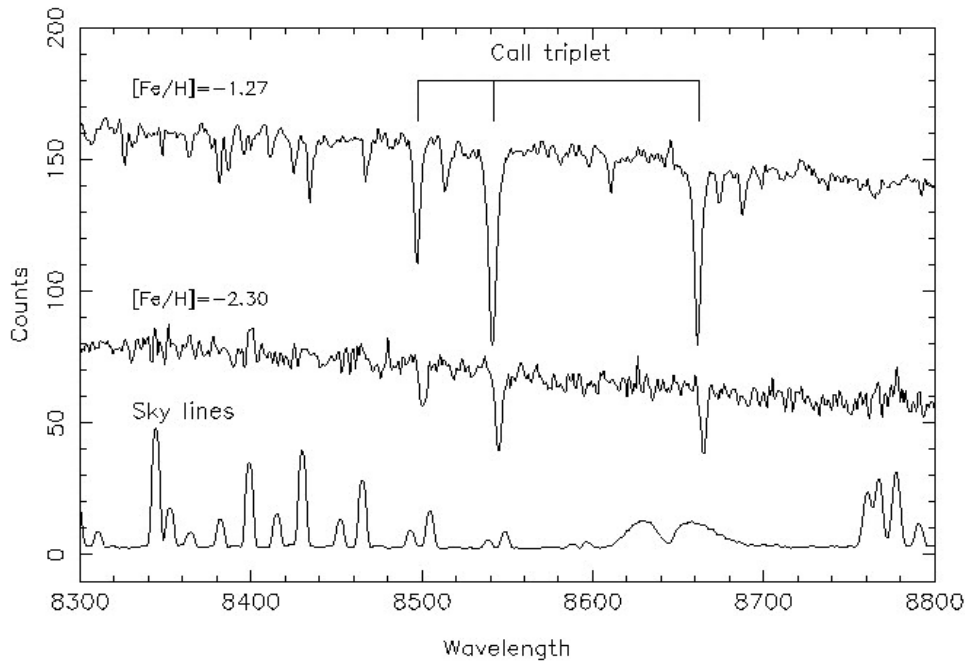


Tolstoy et al. (2001)



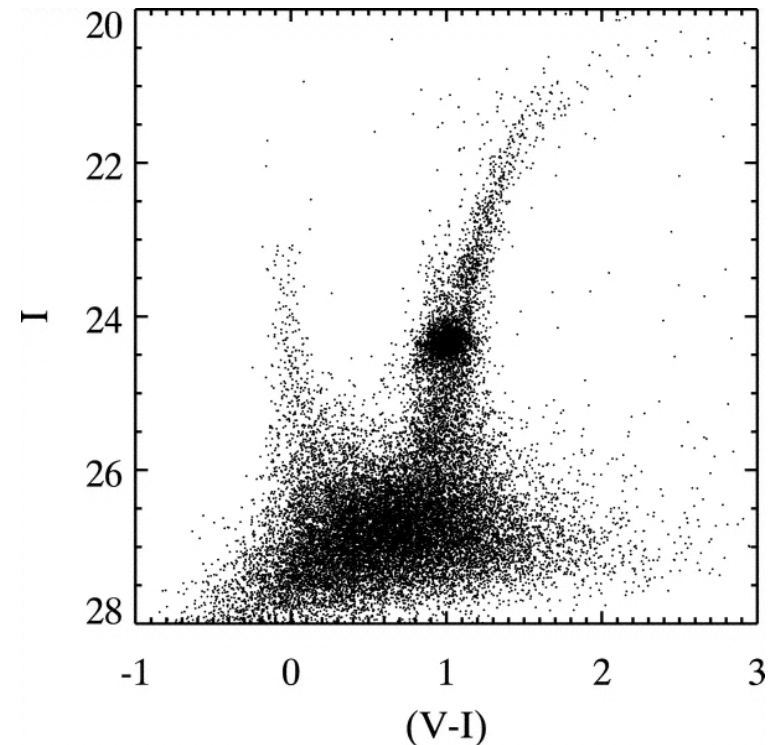
Stellar Spectroscopy with EAGLE

- High-resolution ($R \sim 10,000$) spectroscopy of the Calcium Triplet @ 860nm.
→ kinematics & metallicities



Tolstoy et al. (2001)

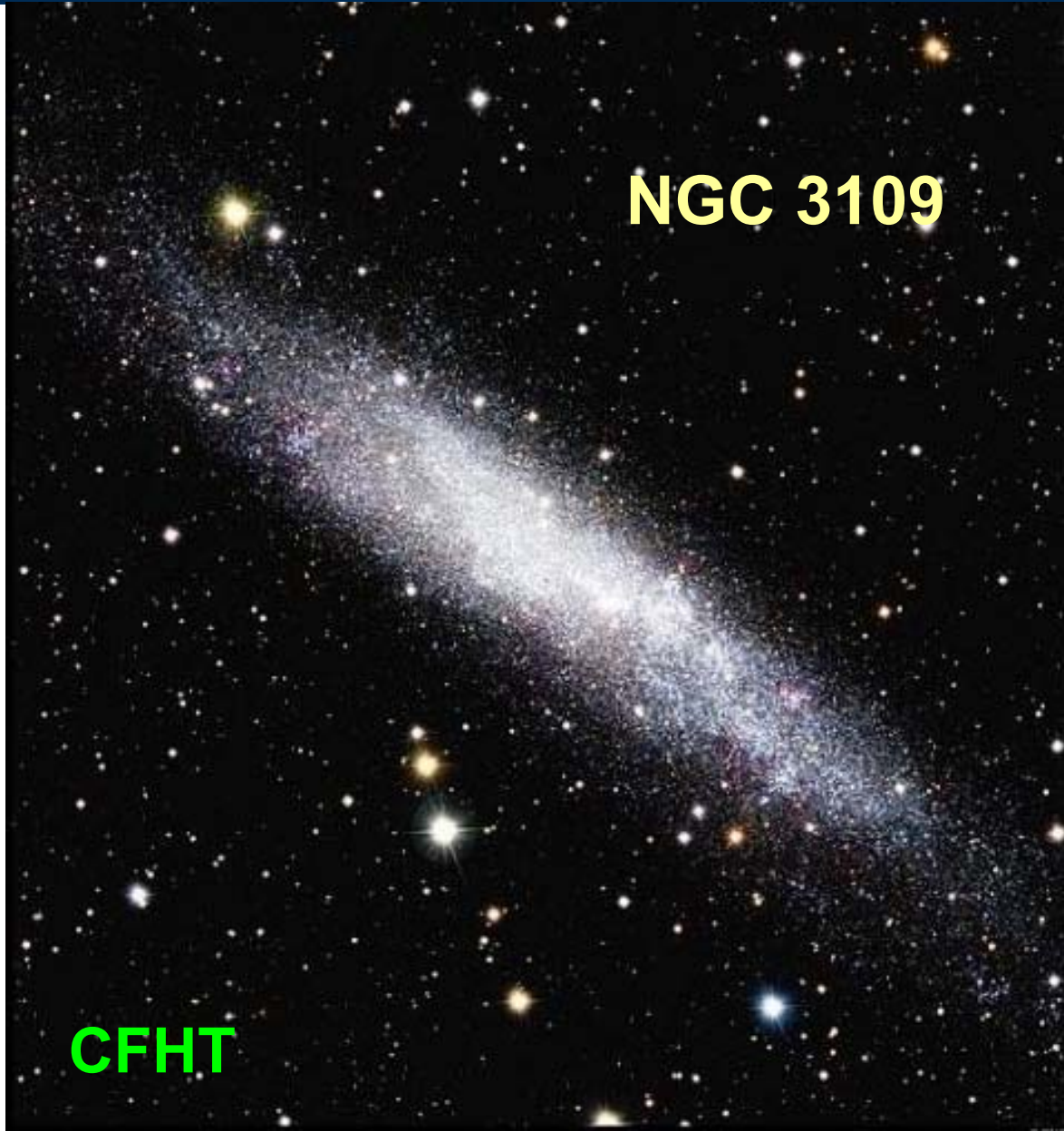
ACS photometry in M33



Barker et al. (2007)



Stellar Spectroscopy with EAGLE



NGC 3109

DM = 25.54

d = 1.3 Mpc

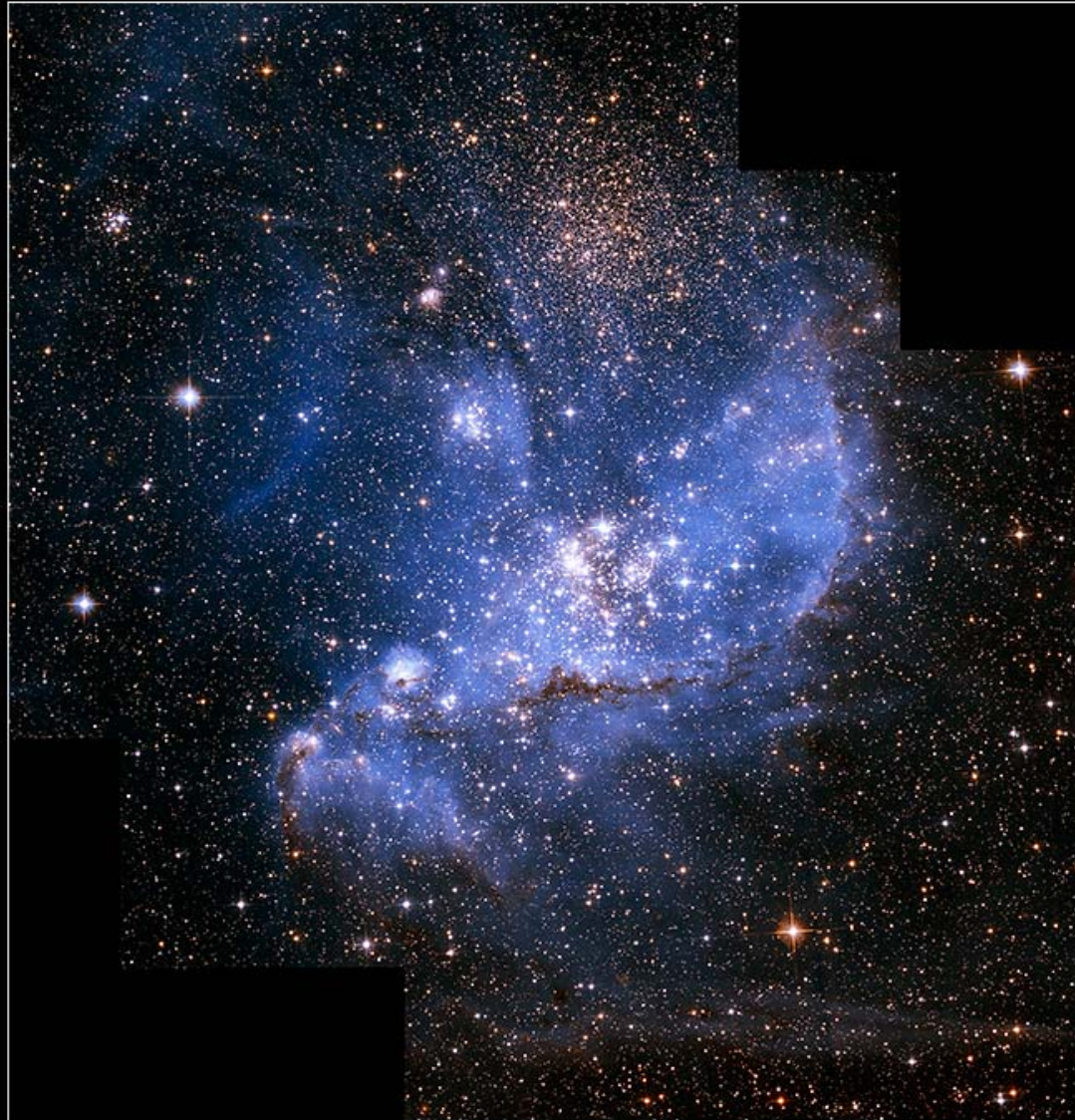
CFHT



Cluster template

NGC 346 in the Small Magellanic Cloud

HST • ACS



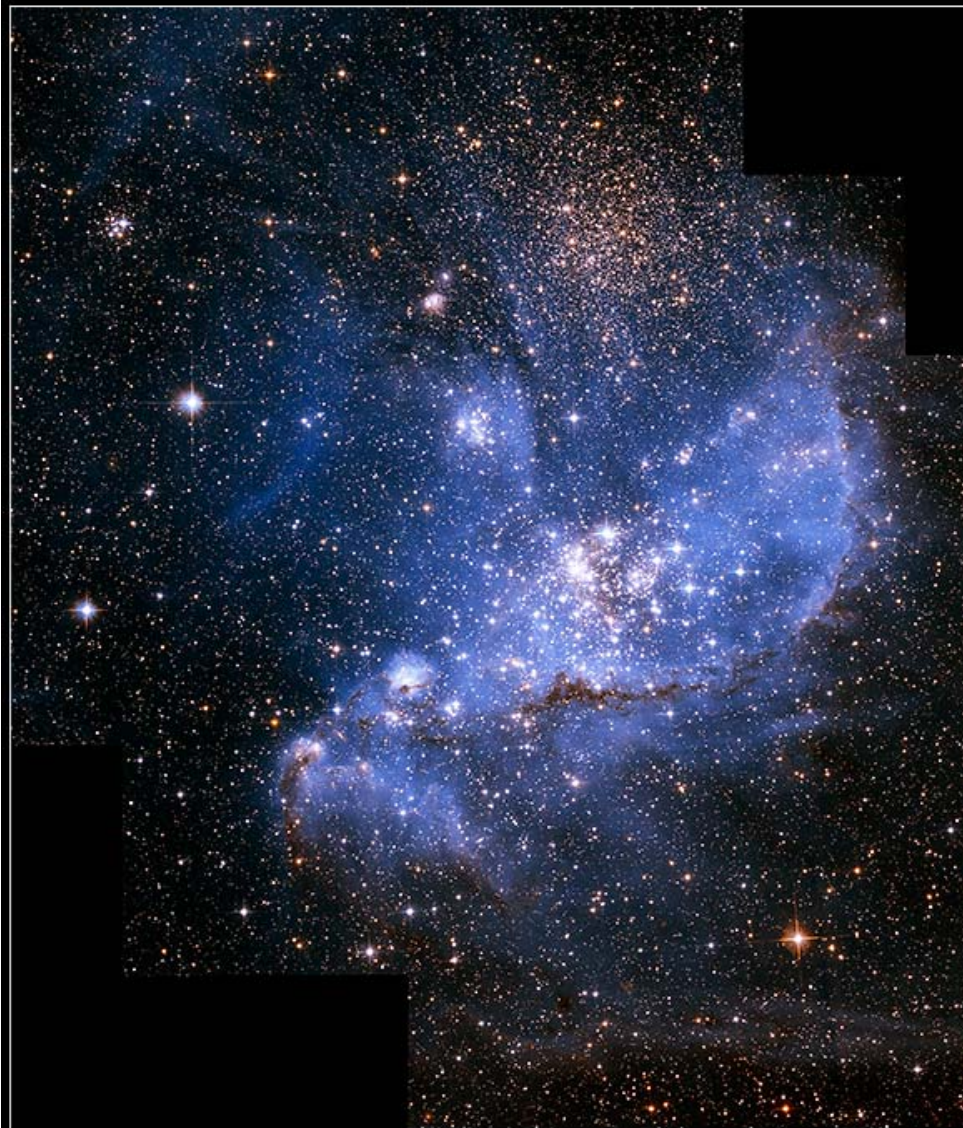
- NGC346: Largest HII region in the SMC



Cluster template

NGC 346 in the Small Magellanic Cloud

HST • ACS

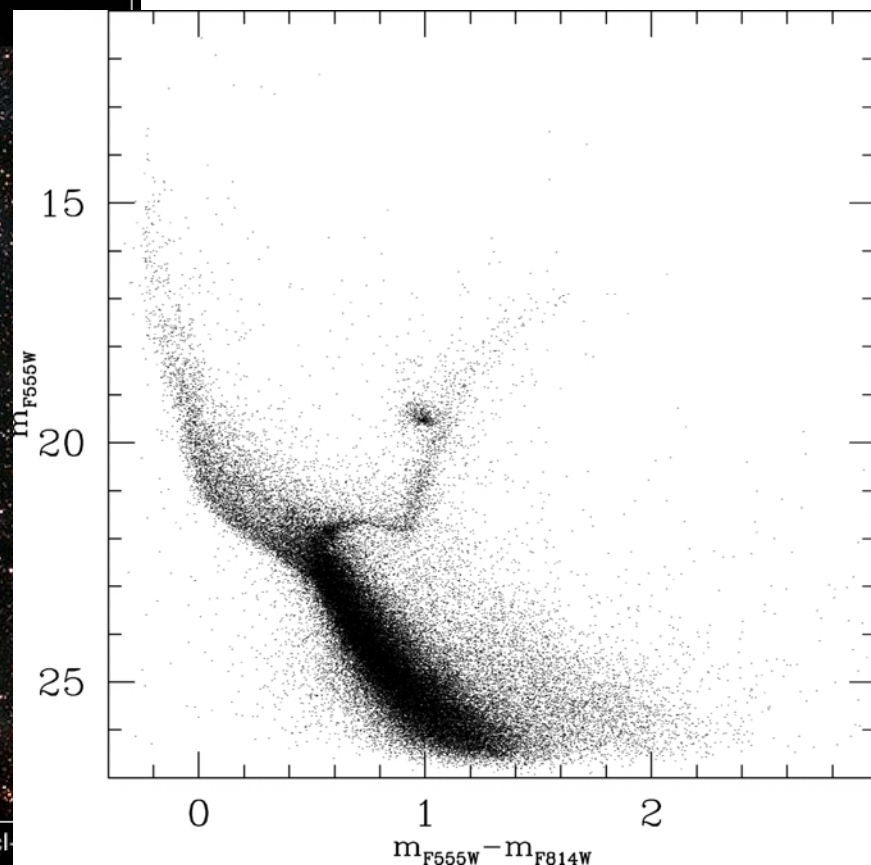


NASA, ESA and A. Nota (STScI)

STScI

- NGC346: Largest HII region in the SMC

- Scale population to 1.3 Mpc





Specsim

- **Spectral simulator developed to model observations with JWST-MIRI**
- **Now adapted for use with the E-ELT**



Specsim

SpecSim

File Options Import Help

Spectral Range: Exposure Time (s): GO Abort

Exposure: A Channels 1-2: 960

Channel: 1 2 Channels 3-4: 480 Sampling: Medium

Extended source, broad line - Total Spectral Response - Channel 1A

Flux (photons/s)

λ (microns)

Transmission definitions: Plot Refresh

- Inputs/BOL_Contam.dat
- Inputs/DetQE_Ch12.dat
- Inputs/DetQE_Ch34.dat
- Inputs/Dichroic_Ch1a.dat
- Inputs/Dichroic_Ch1b.dat

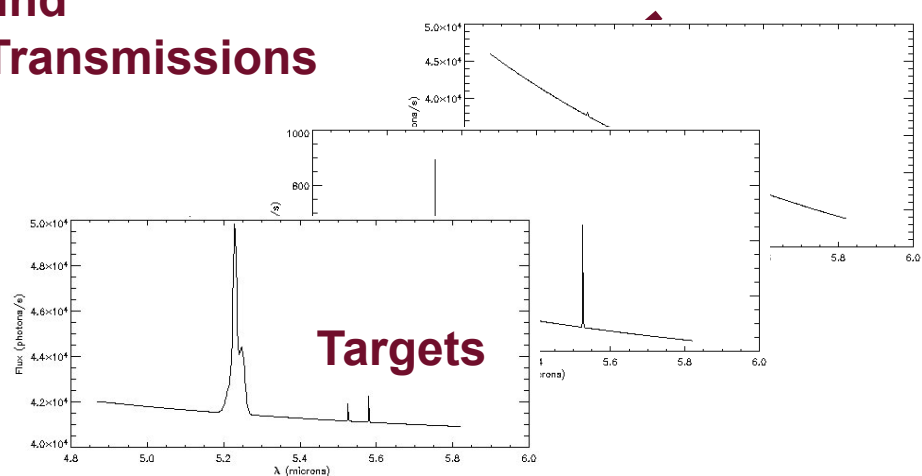
Target definitions: Remove

- Field 1: Point source, 2 narrow lines
- Field 1: Extended source, broad line

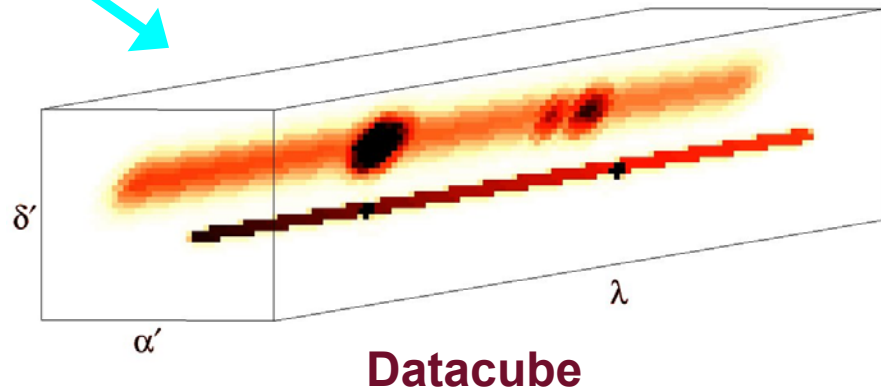
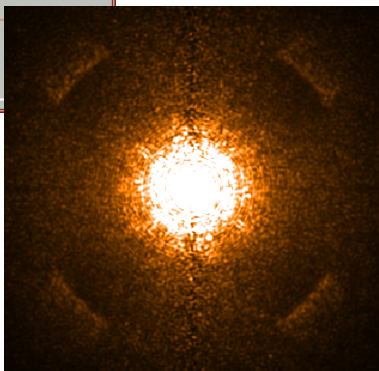
Log:

```
Writing Outputs/MIRISpecsim_20060424-002_sky-1A.fits
Applying Inputs/BOL_Contam.dat to channel 1A
Applying Inputs/DetQE_Ch12.dat to channel 1A
Applying Inputs/DetQE_Ch34.dat to channel 1A
Applying Inputs/Dichroic_Ch1a.dat to channel 1A
Applying Inputs/Mirrors_Ch1.dat to channel 1A
```

**Sky Background
Atmospheric Transmissions**

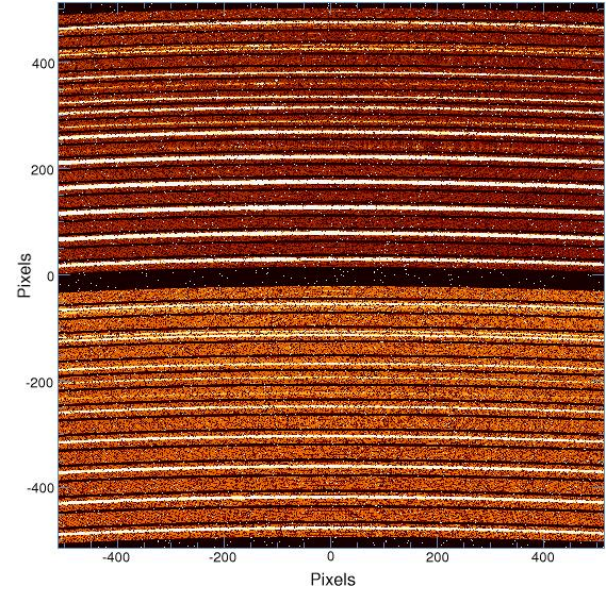
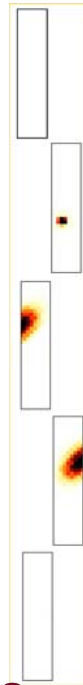
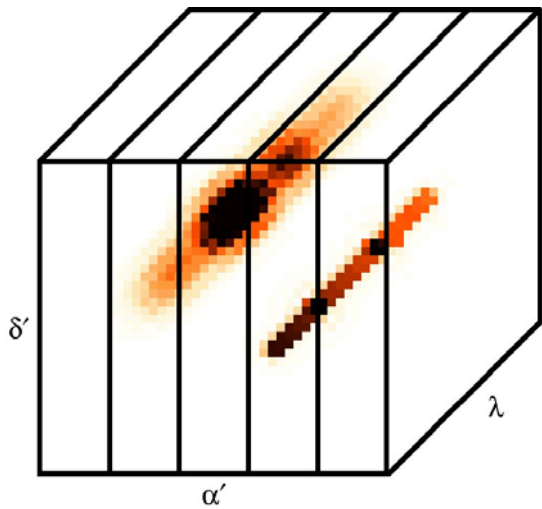


PSF





Specsim

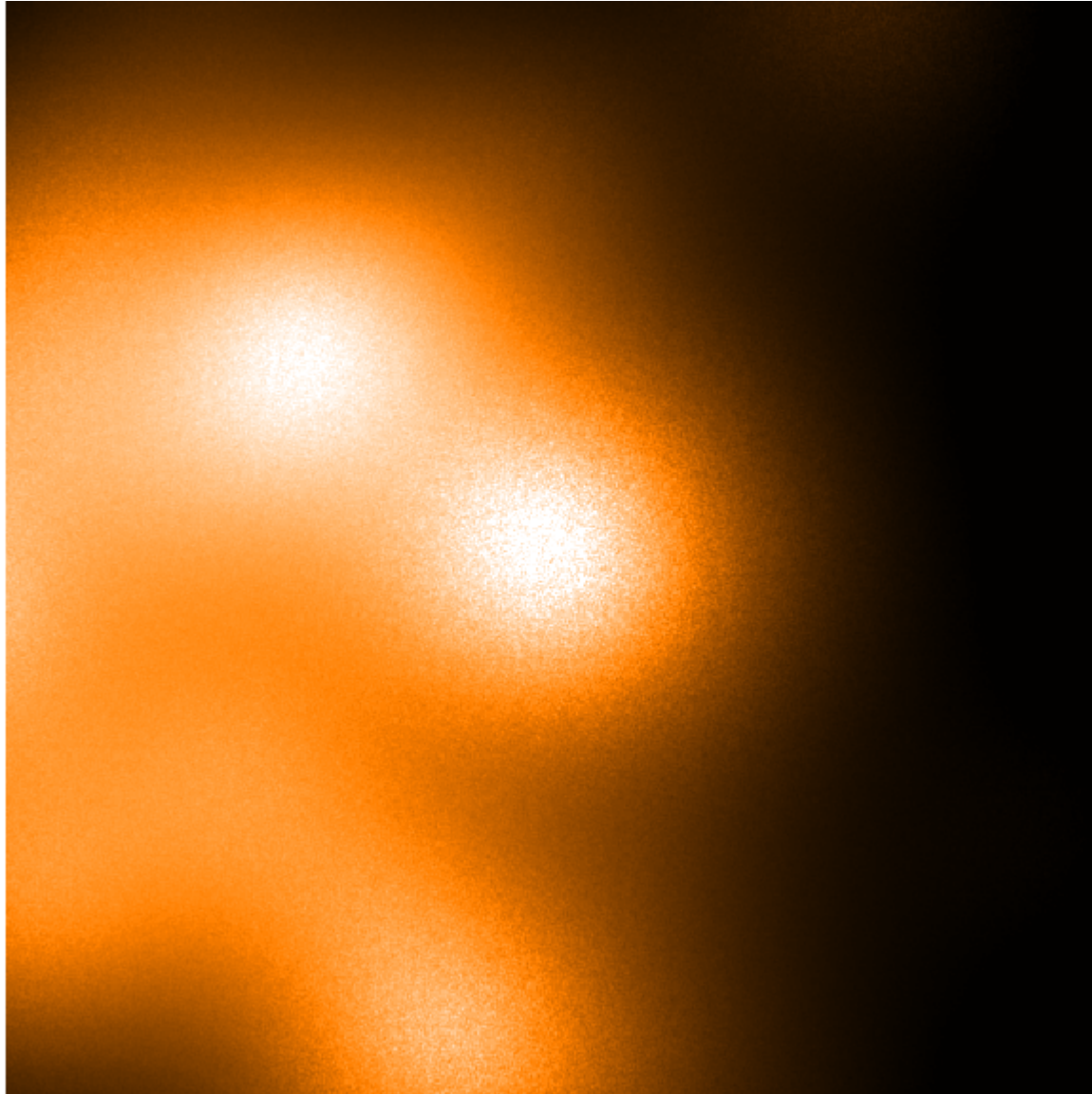


Transmission Functions

**Cosmic Rays
Noise
Exposure Time**



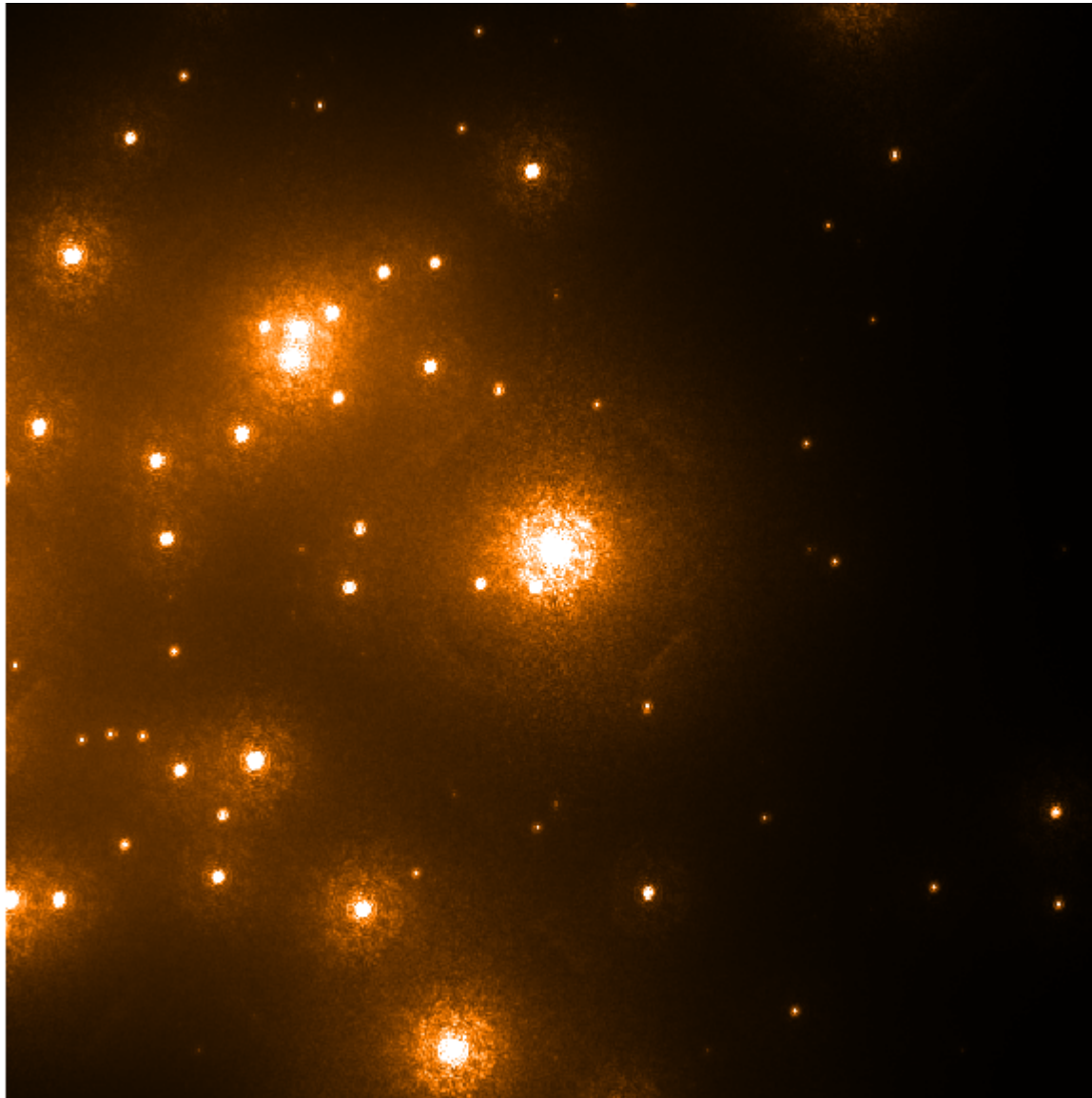
I-band Sky-cube Images: GLAO



- 1.6x1.6 arcsec
- GLAO PSF
[Miska LeLouarn/ESO]
- 5xLGS @ $r = 3$ arcmin



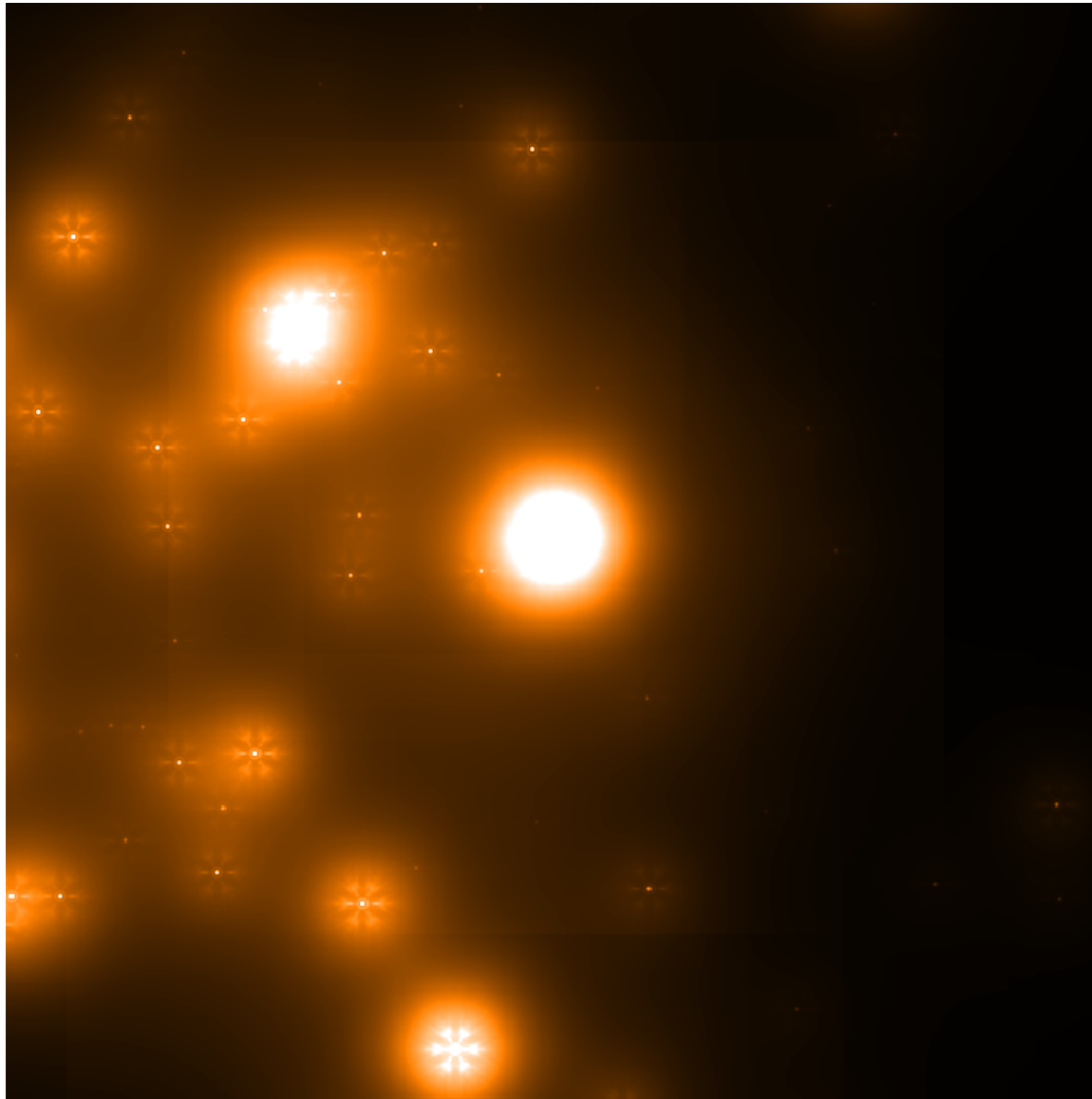
I-band Sky-cube Images: LTAO



- 1.6x1.6 arcsec
- LTAO PSF
[Miska LeLouarn/ESO]
- 5xLGS @ $r = 45$ arcsec
- 1xLGS @centre



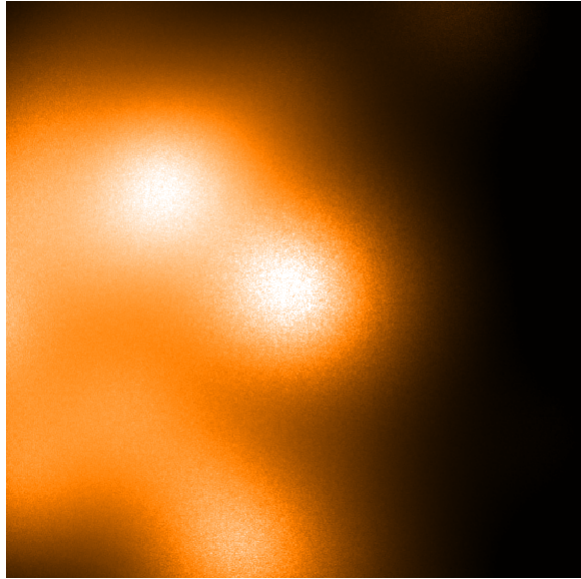
I-band Sky-cube Images: MOAO



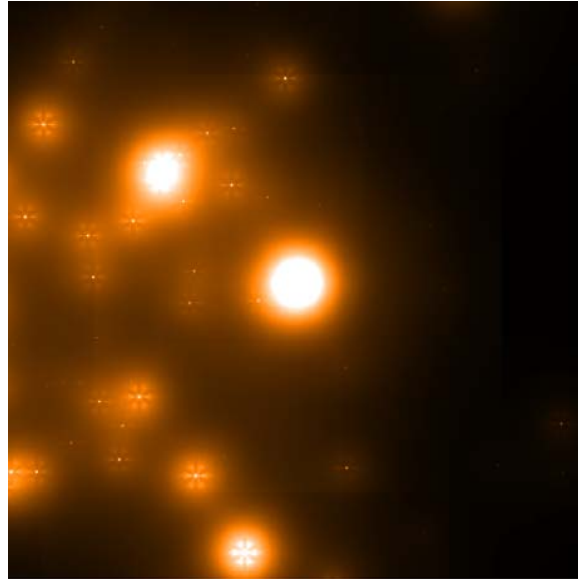
- 1.6x1.6 arcsec
- MOAO PSF
[ONERA, Paris]
- 6xLGS @ $r = 3.4$ arcmin



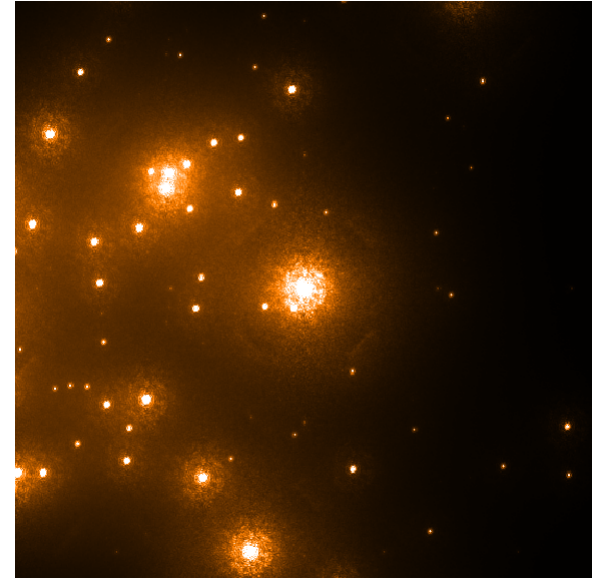
I-band Sky-cube Images



GLAO



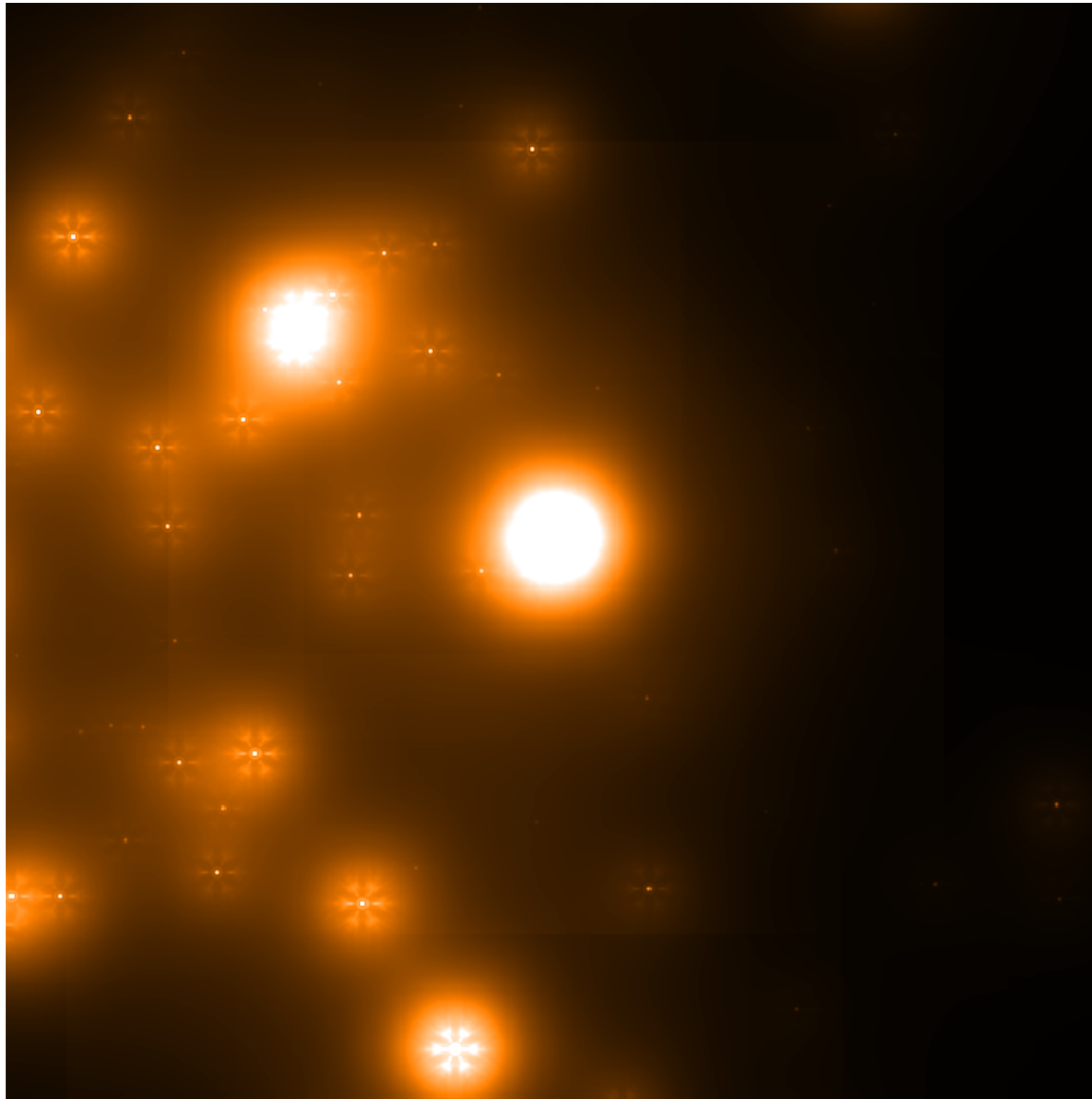
MOAO



LTAO



I-band Sky-cube Images: MOAO



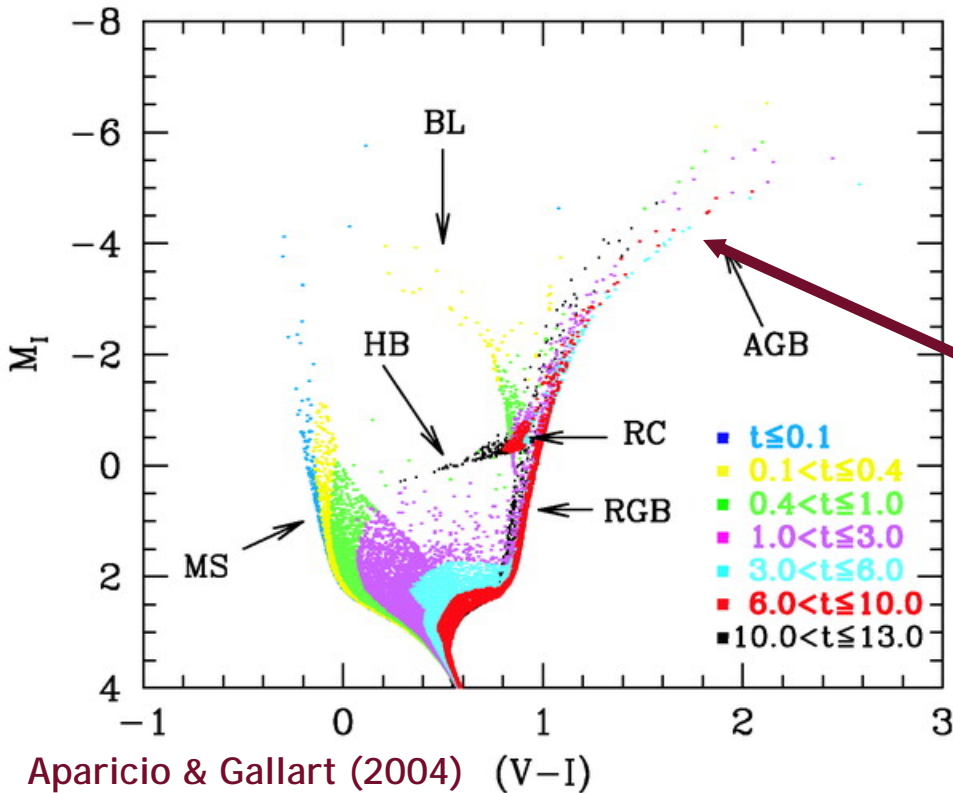
Input to EAGLE Phase A requirements:

- Ensquared energy (EE)
- Crosstalk/form of PSF

Next step is to include CaT templates...



Sensitivities @1.3 Mpc with EAGLE



DM = 25.54

Sensitivities: @ R=10,000

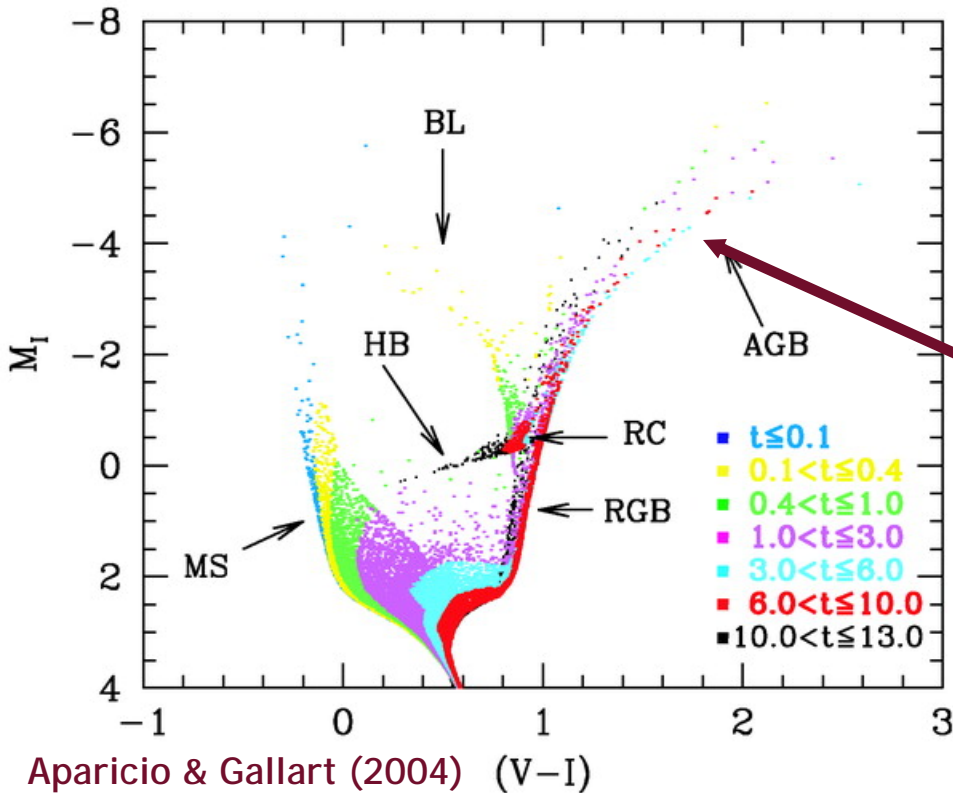
TRGB: $M_I \sim -4 \rightarrow I \sim 21.5$

**ONERA simulations give
30% EE in ~ 175 mas in I-band**

Aparicio & Gallart (2004) ($V-I$)



Sensitivities @1.3 Mpc with EAGLE



DM = 25.54

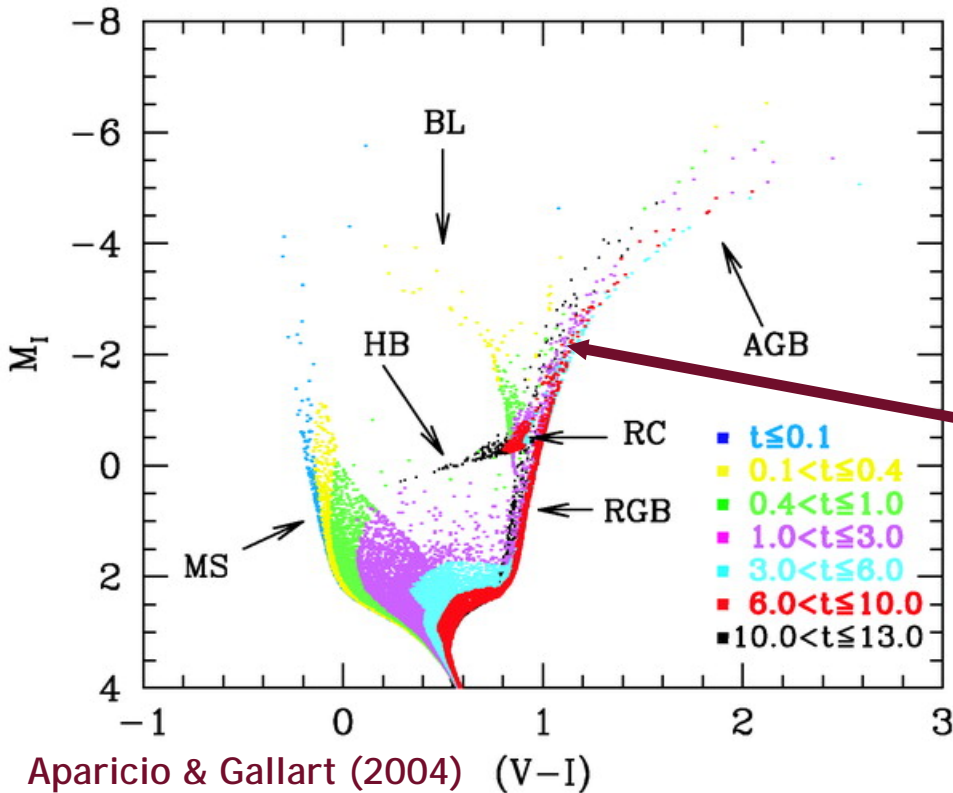
Sensitivities: @ R=10,000

TRGB: $M_I \sim -4 \rightarrow I \sim 21.5$

D	Total time (S/N>10)
8m	~6 hrs, cf KMOS [5 σ /8hrs]
30m	
42m	



Sensitivities @1.3 Mpc with EAGLE



DM = 25.54

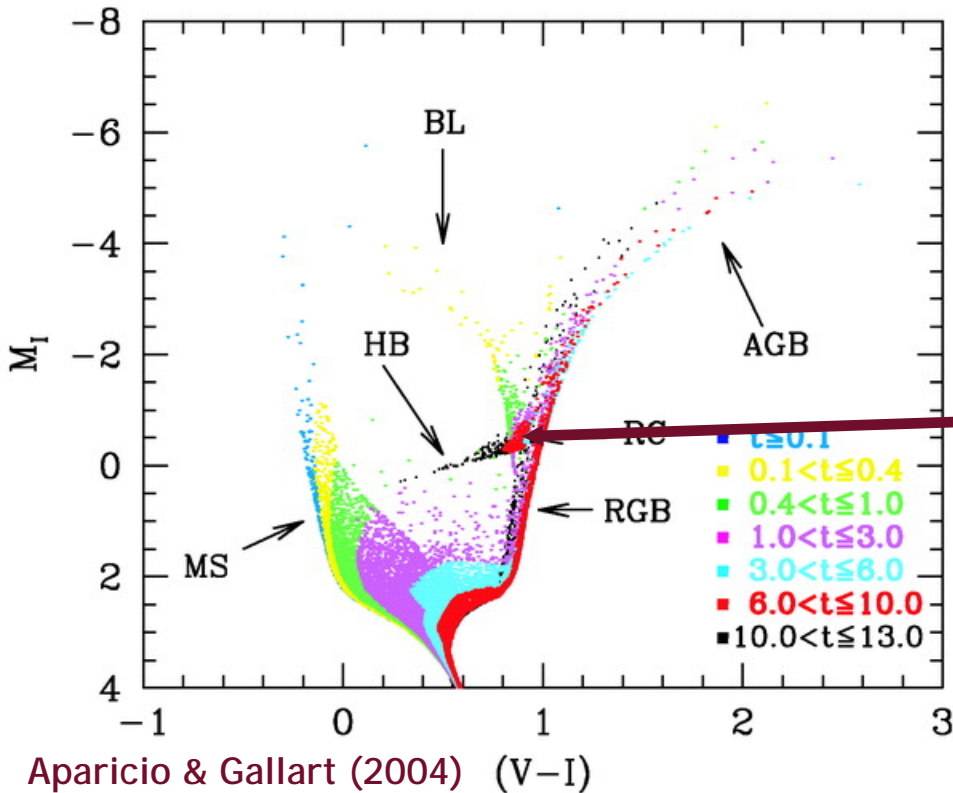
Sensitivities: @ R=10,000

Upper RGB: $M_I \sim -2 \rightarrow I \sim 23.5$

D	Total time (S/N~10)
8m	200 hrs
30m	3 hrs
42m	2 hrs



Sensitivities @1.3 Mpc with EAGLE



DM = 25.54

Sensitivities: @ R=10,000

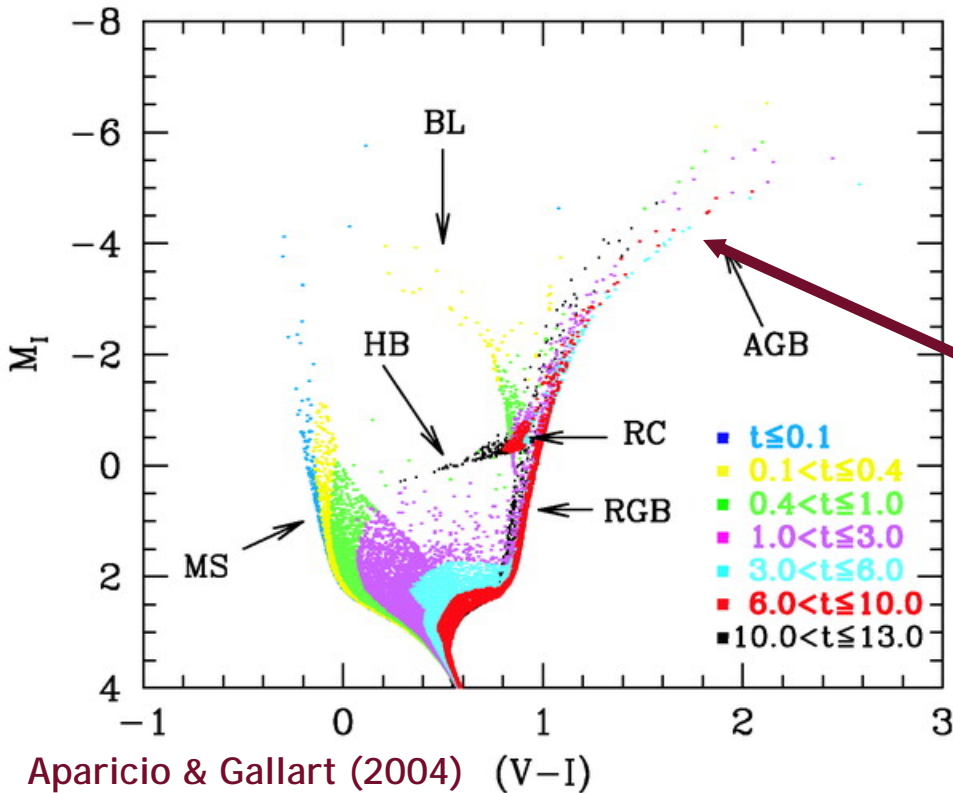
RC: $M_I \sim 0 \rightarrow I \sim 25.5$

D	Total time (S/N~10)
8m	10,000 hrs
30m	125 hrs
42m	50 hrs

cf. ESO E-ELT ETC, R~10,000, LTAO, 100mas \rightarrow 47.5 hours



Sensitivities @15.5 Mpc with EAGLE



DM = 30.9, M87 in Virgo

Sensitivities: @ R=4,000

TRGB: $M_I \sim -4 \rightarrow I \sim 26.9$

D	Total time (S/N~10)
30m	500 hrs
42m	250 hrs



Thank You