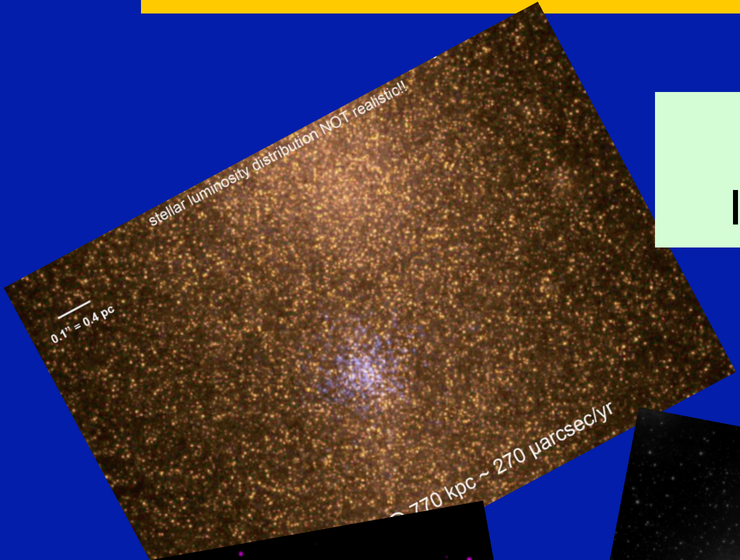
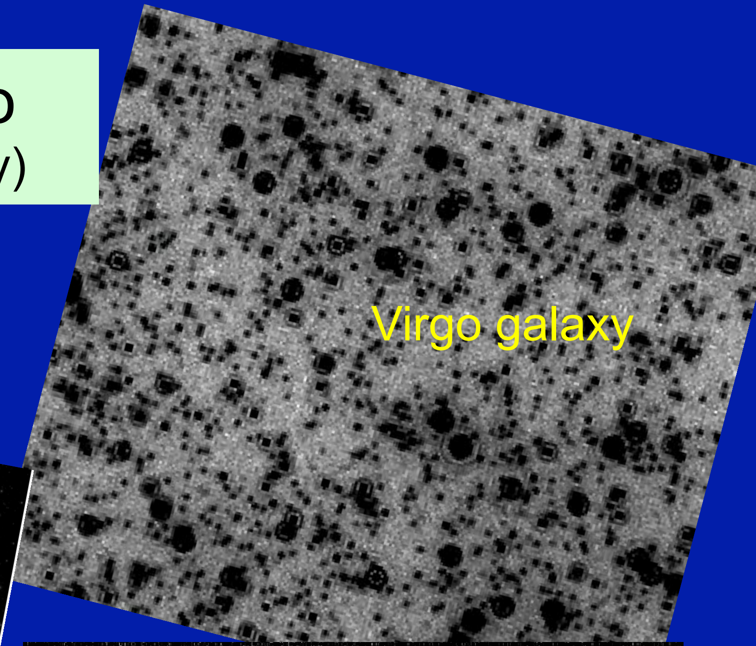
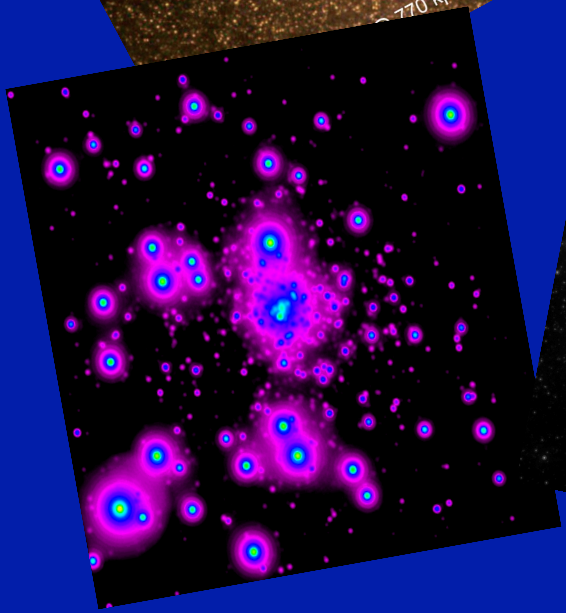
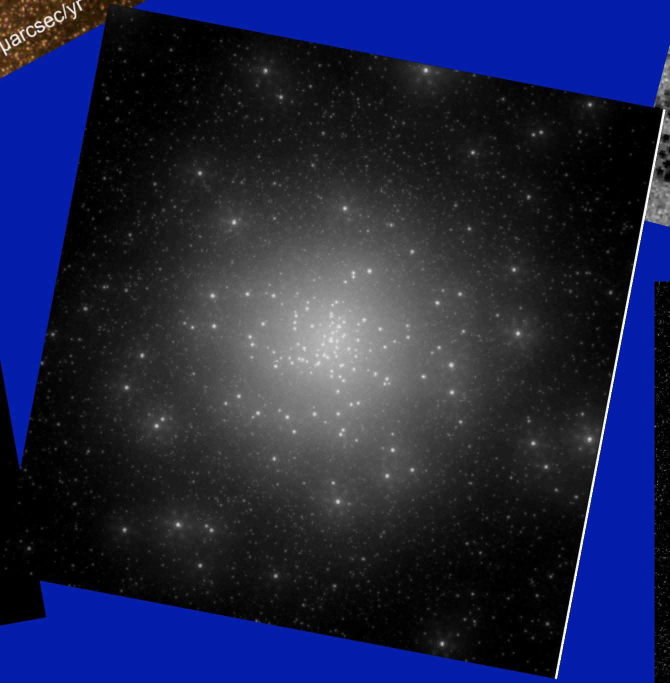
MICADO consortium meeting
Science Cases & Simulations

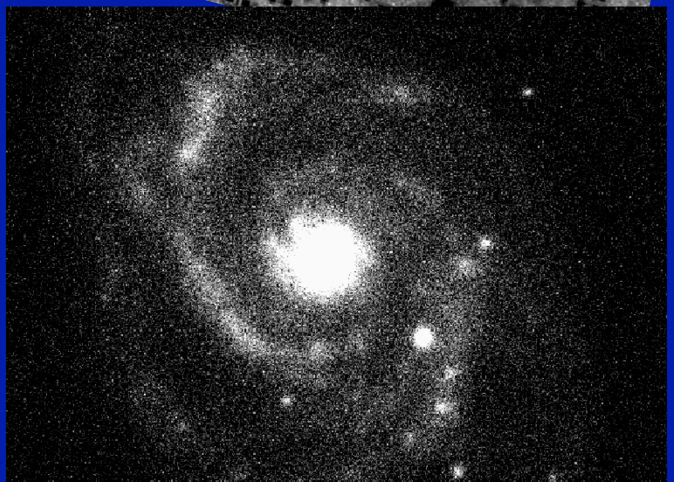
Renato Falomo
INAF – Padova (Italy)







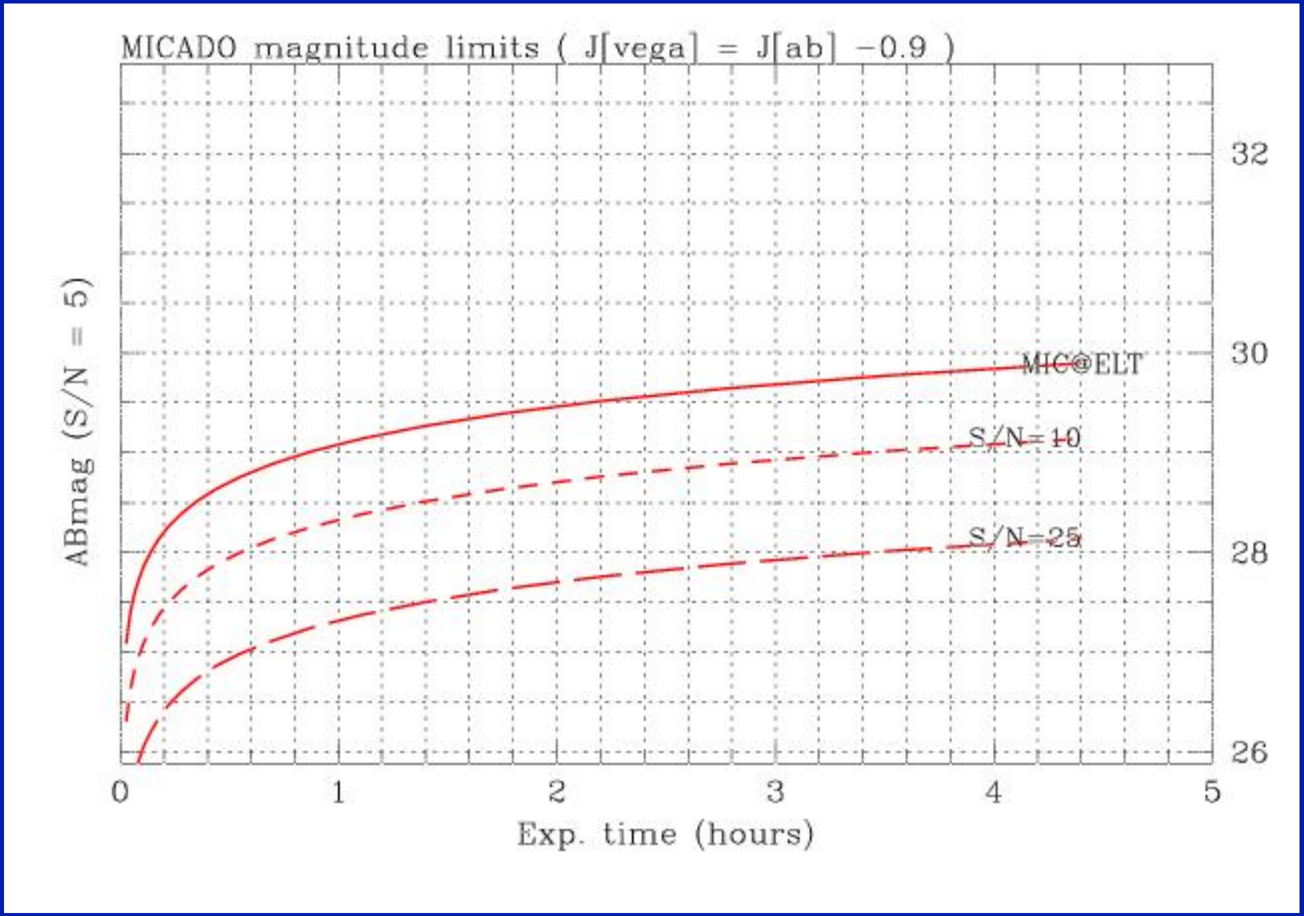




Garching 10 March 2014

MICADO - Expected performance

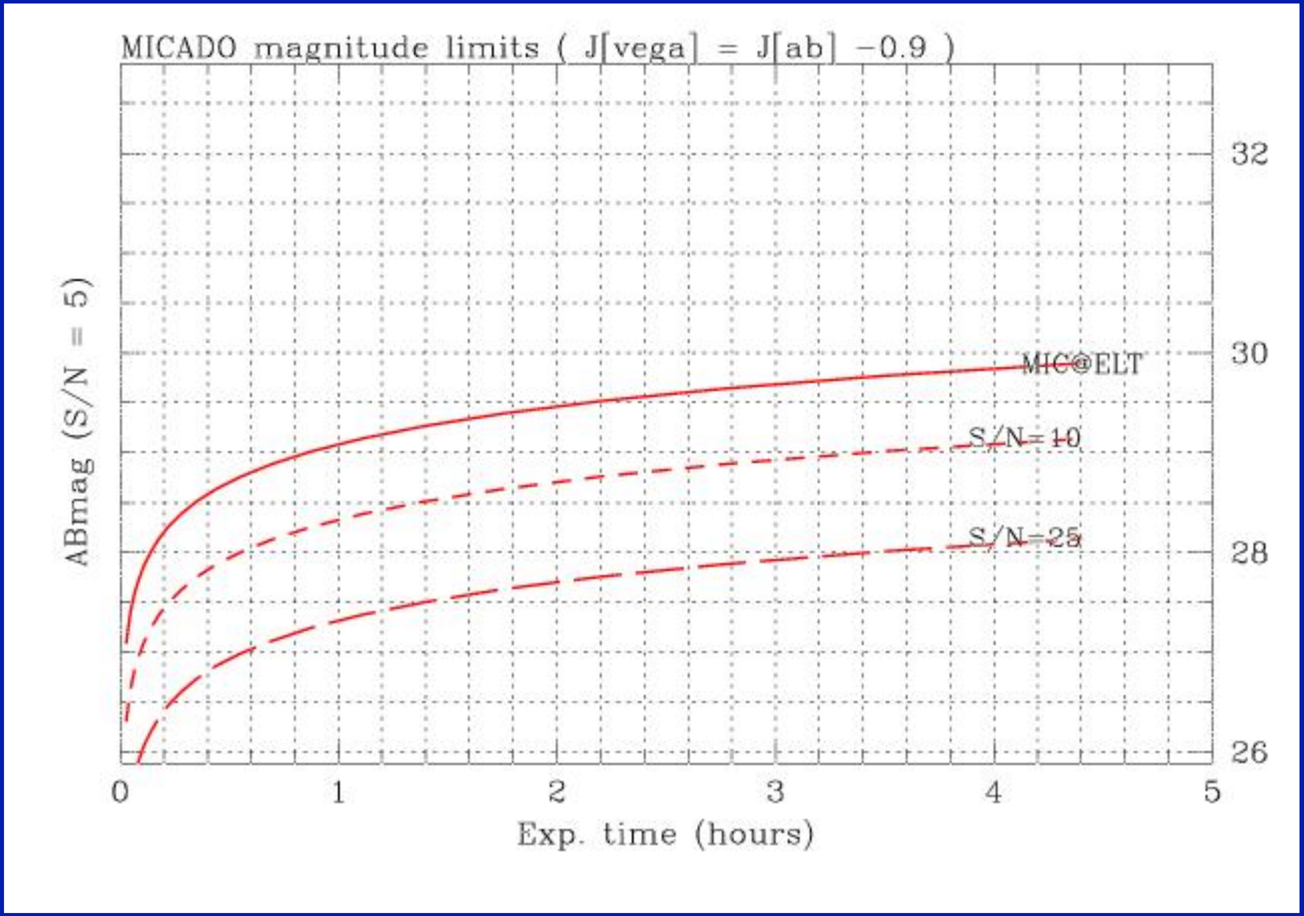
AB mag limits for isolated point sources



J(AB) = 30 in 5h (S/N=5)

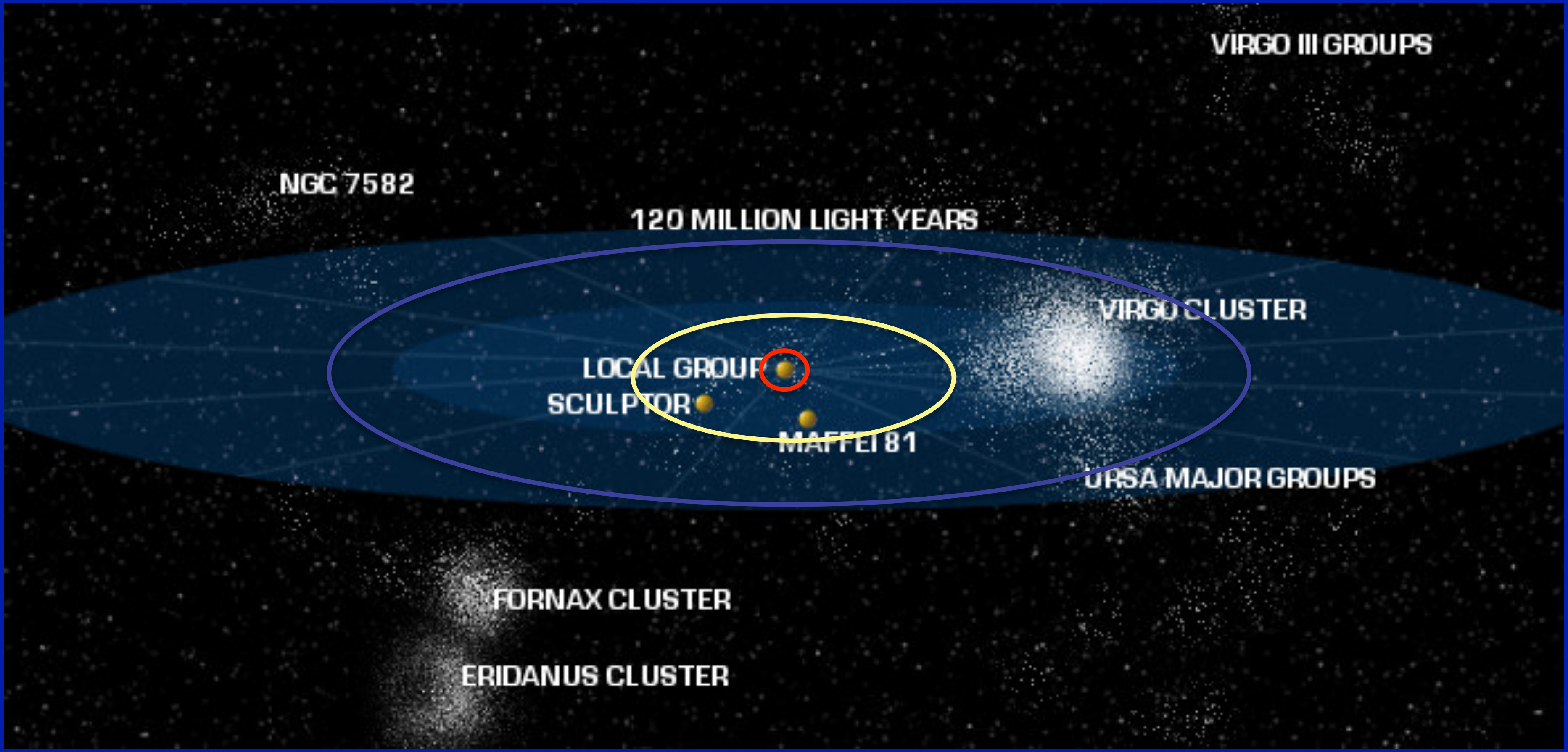
MICADO - Expected performance

AB mag limits for isolated point sources



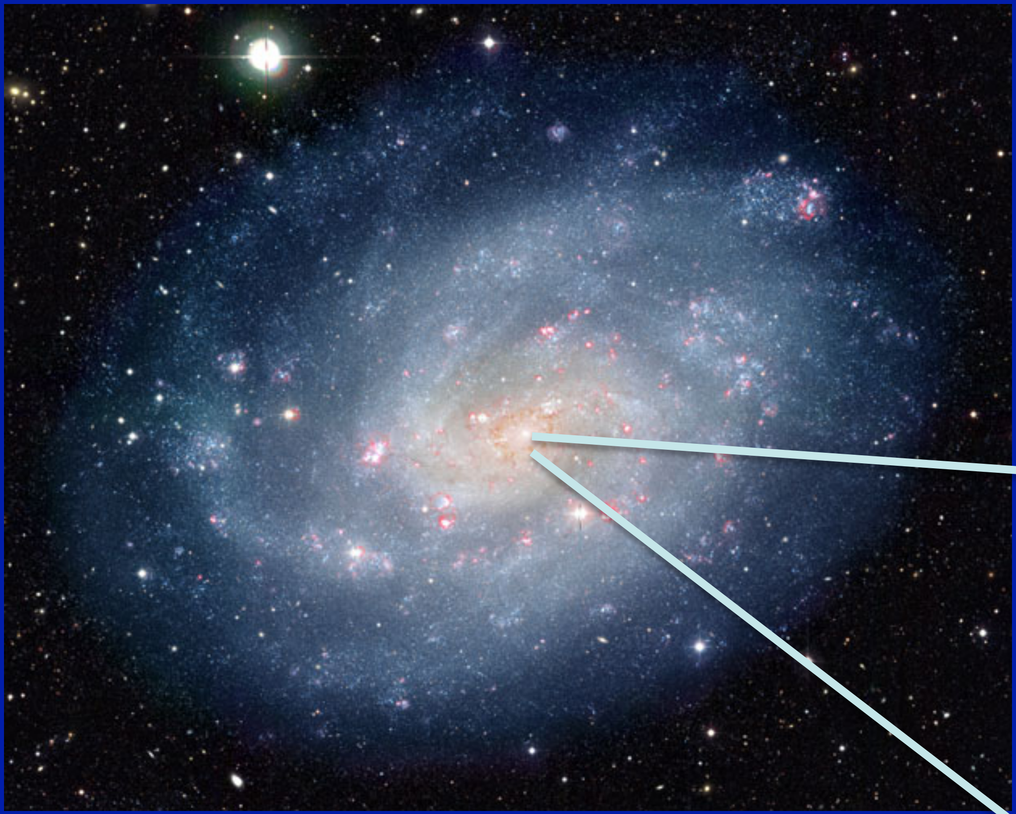
K(AB) = 29.5 in 5h (S/N=5)

THE GALAXIES AROUND US

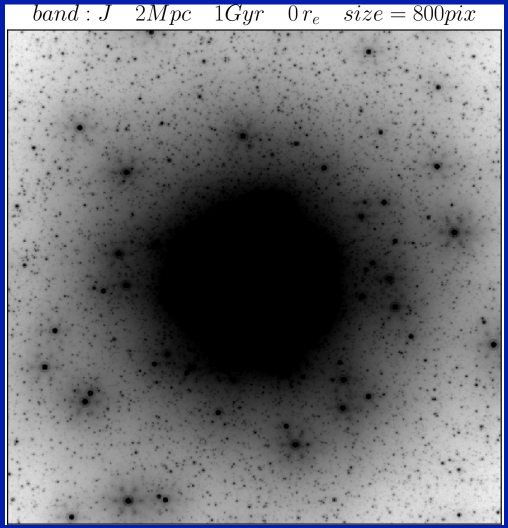


MICADO will be able to resolve stars in distant galaxies and explore their centers

E-ELT simulation of NGC 300 core



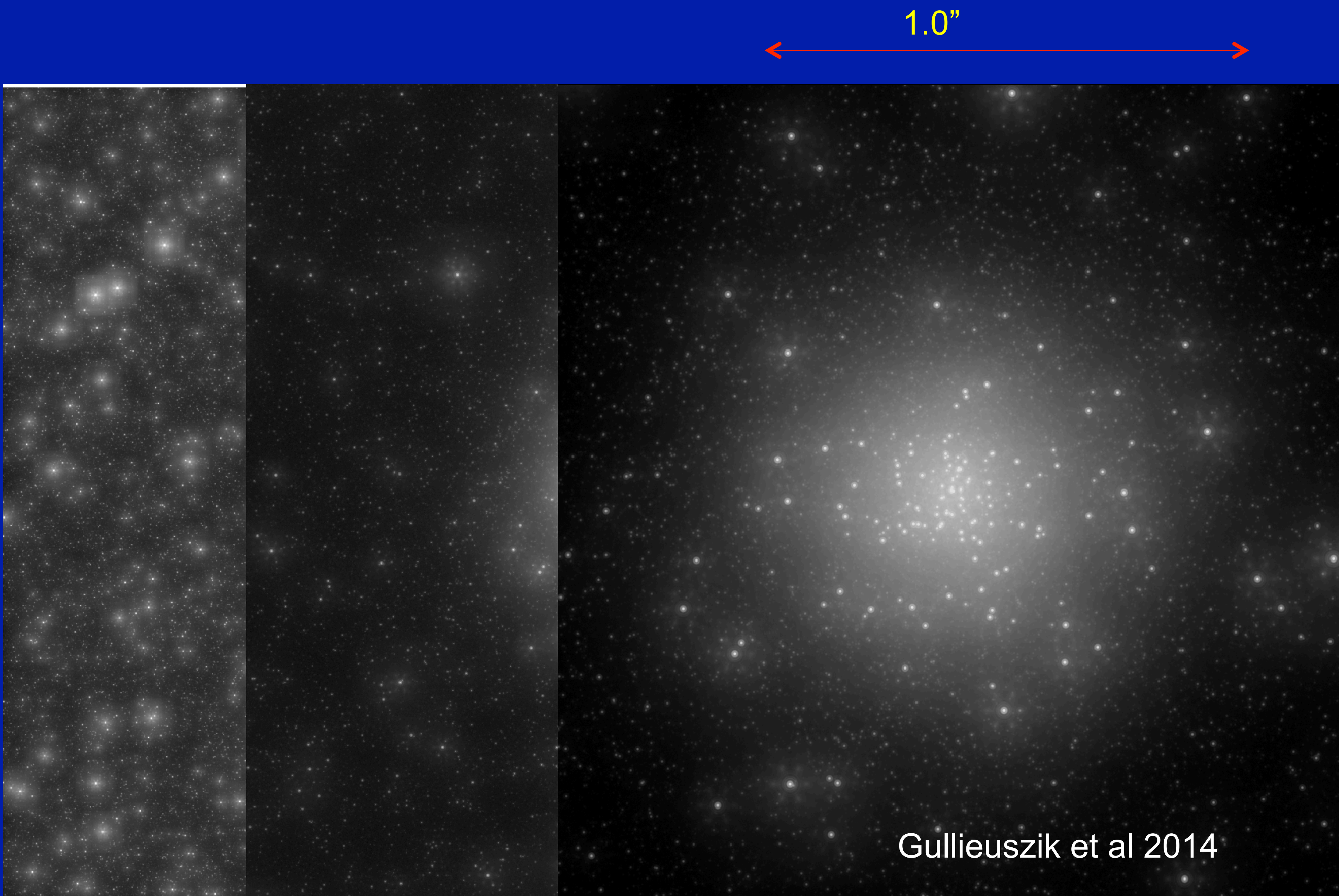
NGC 300
D = 2 Mpc
NSC (king profile)
Rc = 0.095"
Rt = 2.87"



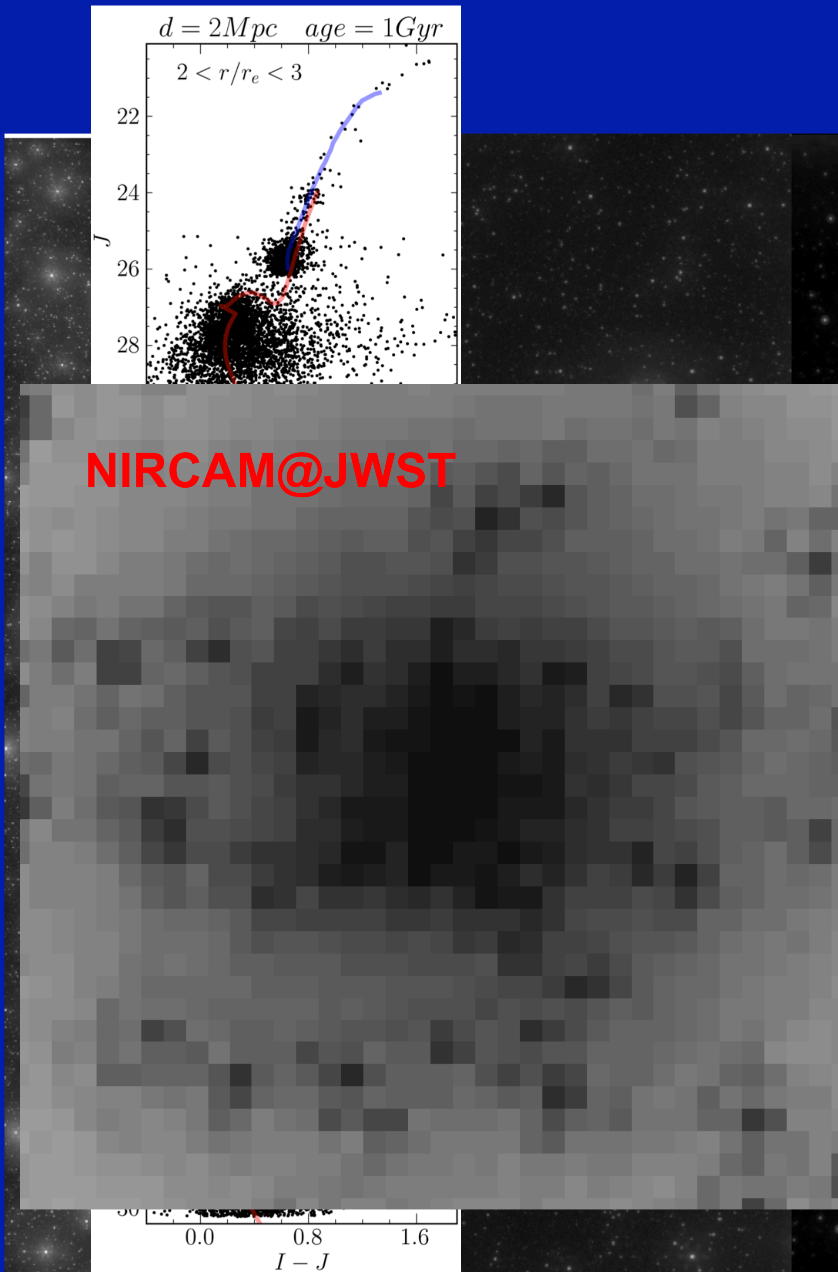
E-ELT + MICADO

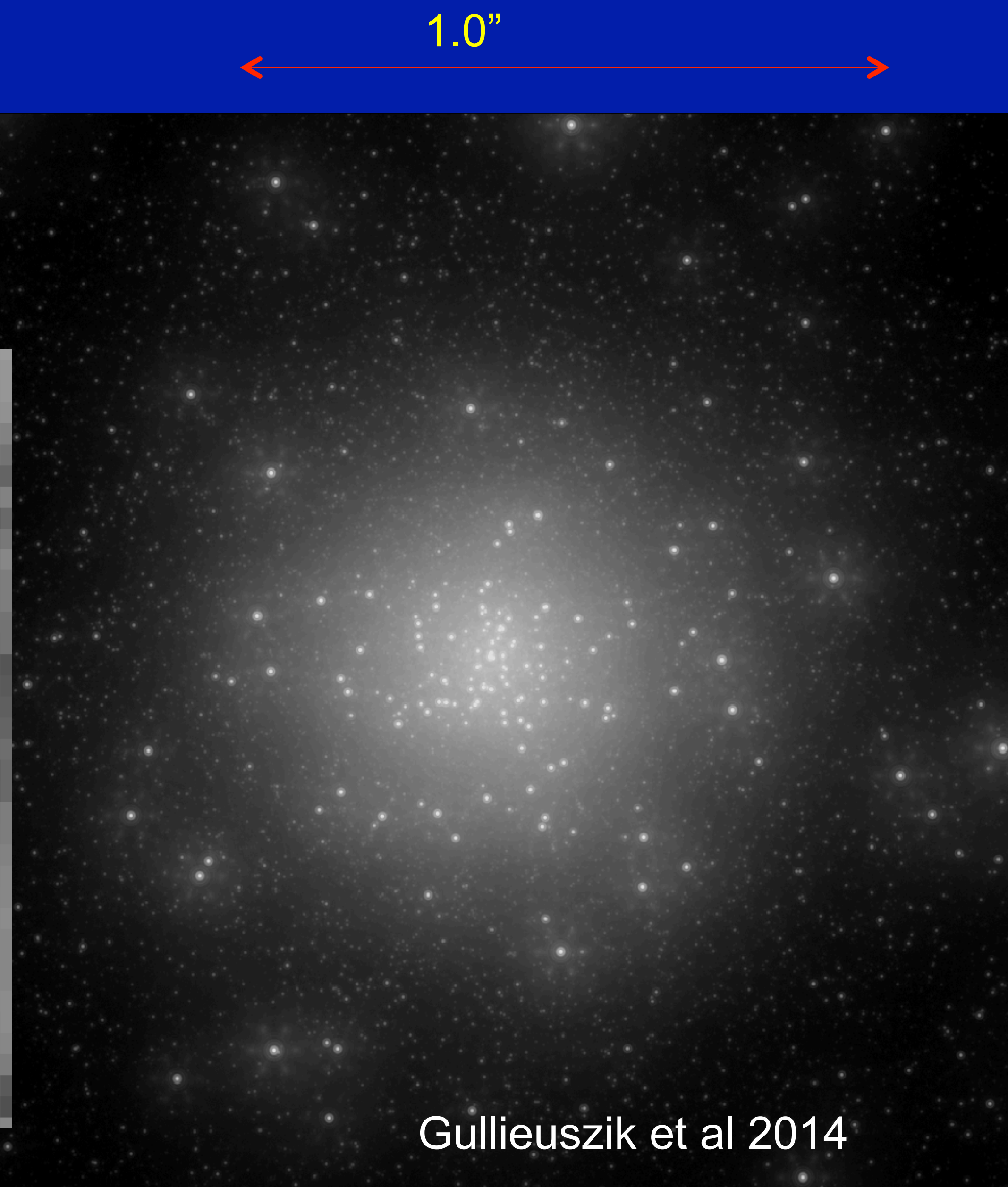
Exp = 3 h
Filter J

E-ELT simulation of NGC 300 core



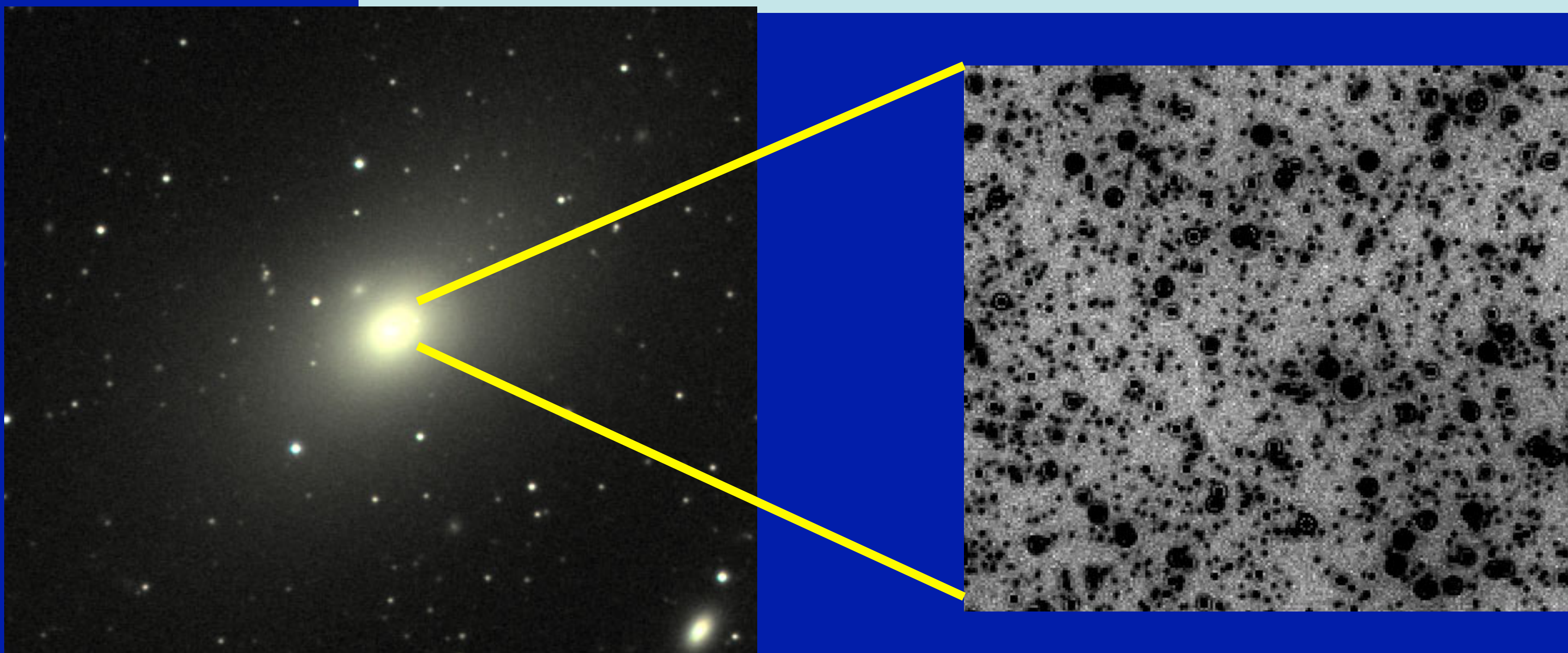
E-ELT simulation of NGC 300 core






VIRGO - the closest rich cluster of galaxies
VIRGO cluster (DM = 31)

The study of the resolved stellar population in distant galaxies is one the main science drivers for the realization of ELTs

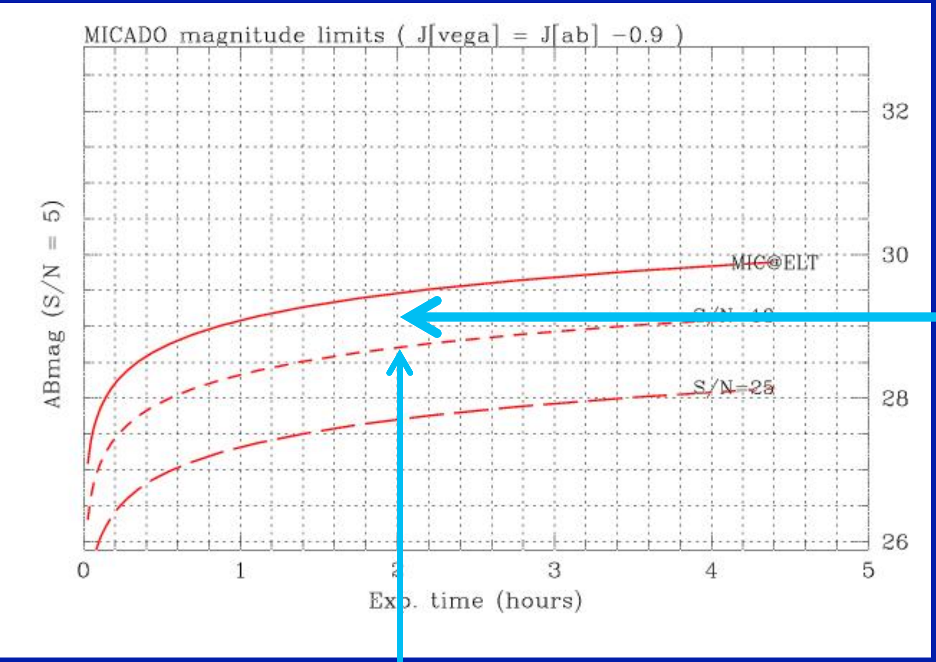


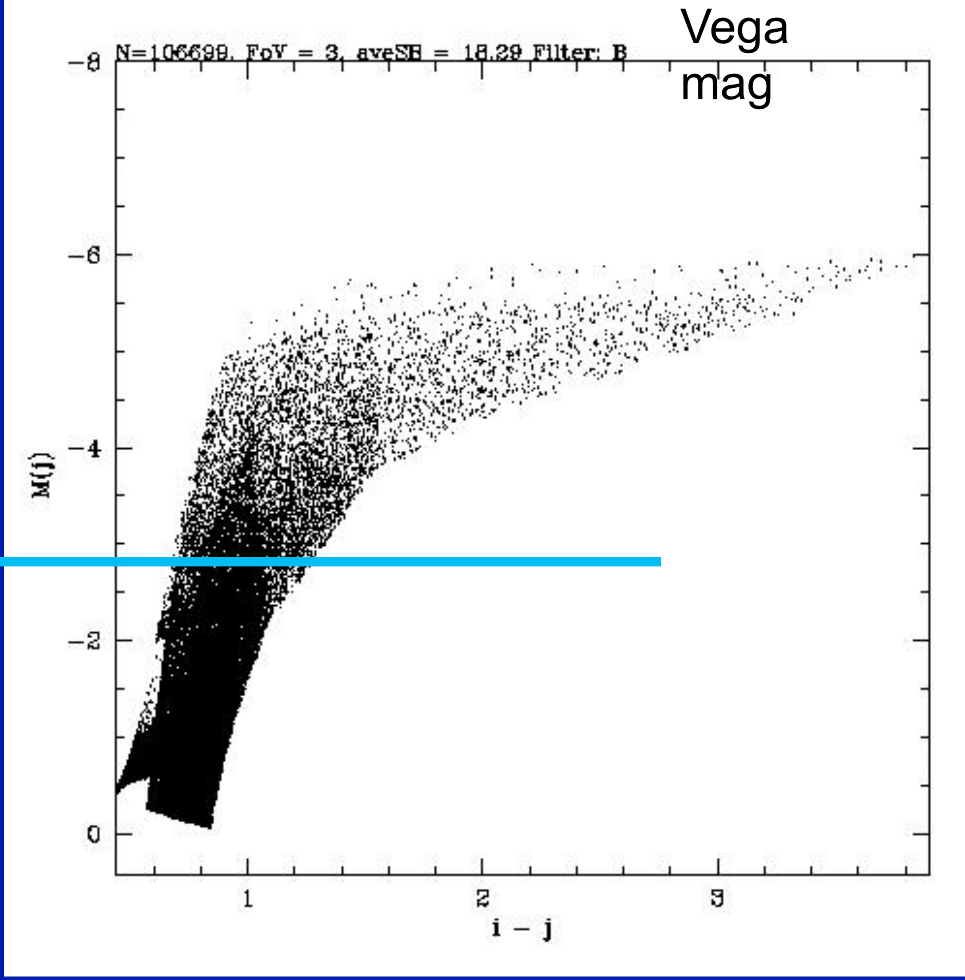
Reconstruction of the star formation history for a stellar system by analyzing its color-magnitude diagram (CMD) is a fundamental tool for understanding its age and chemical composition.

Greggio et al 2012, PASP 124, 653

The SP of the E galaxy in Virgo

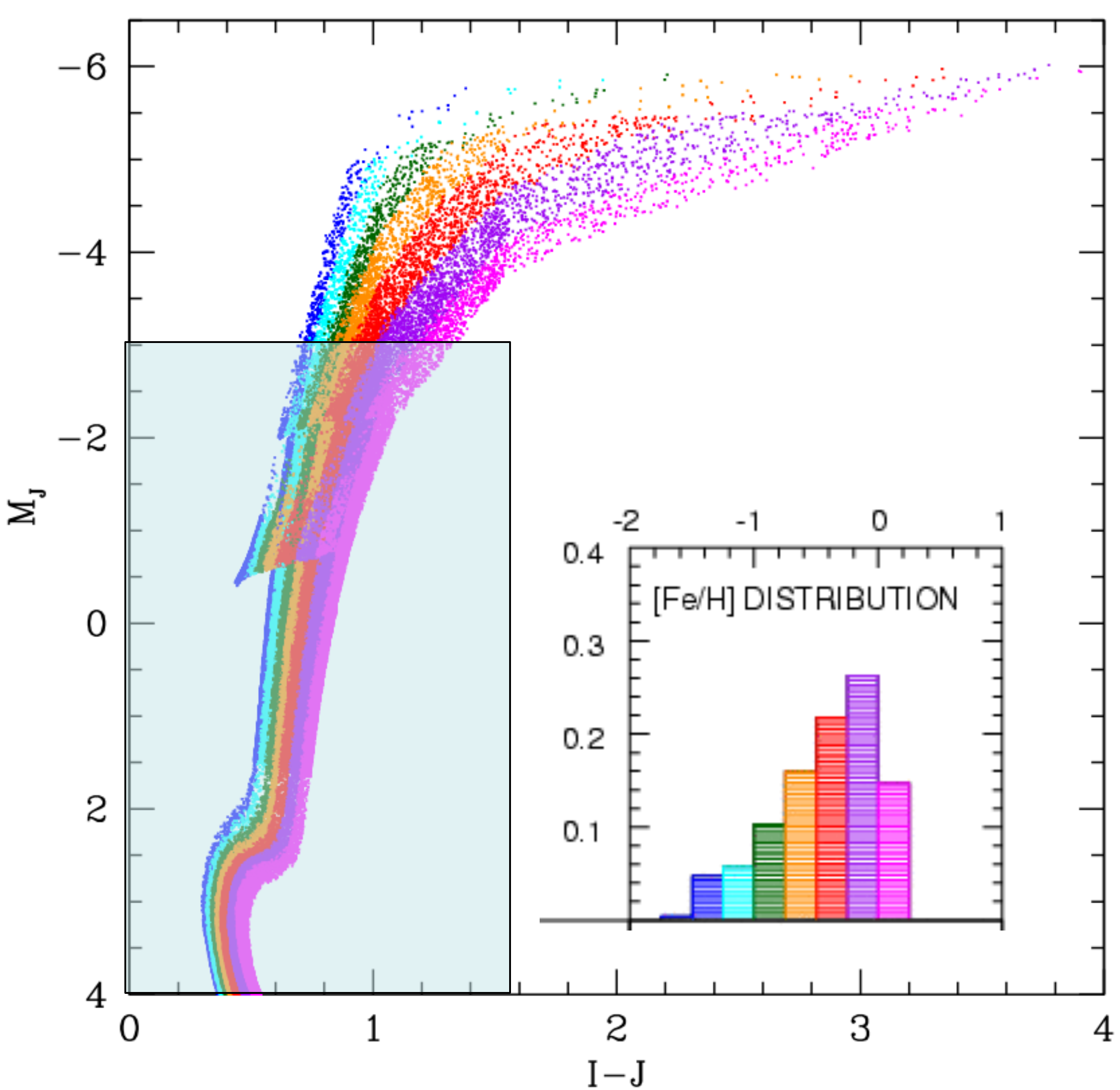
Virgo DM = 31





2h integration

Stellar population of giant Elliptical galaxy



OLD Stellar Population

Code YZVAR by G.P. Bertelli

(Padova tracks database) :

Greggio et al 2012

PUBLICATIONS OF THE ASTRONOMICAL SOCIETY OF THE PACIFIC, 124:653–667, 2012 July

Resolved Stellar Population of Distant Galaxies in the ELT Era

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ABSTRACT. The expected imaging capabilities of future Extremely Large Telescopes (ELTs) will offer the unique possibility to investigate the stellar populations of distant galaxies from the photometry of the stars in very
e two representative science cases
ıs of distant galaxies. Specifically,
distance of 4.6 Mpc) and case (2)
distance of 18 Mpc). We generate
entative instrumental setup, i.e., a
discussed in detail, showing how
it is approached. We find that (1)
wn to $I \sim 28.5$, $J \sim 27.5$, allowing
Virgo to within ~0.1 dex; (2) the
7.0, enabling reconstruction of the
xes. For the latter case, we discuss
istory from the analysis of their

Monthly Notices of the ROYAL ASTRONOMICAL SOCIETY

MNRAS **437,** 2966–2979 (2014) doi:10.1093/mnras/stt2124
Advance Access publication 2013 November 30

Studying the metallicity gradient in Virgo ellipticals with European-Extremely Large Telescope photometry of resolved stars

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[2] *INAF, Osservatorio Astronomico di Padova, Vicolo dell'Osservatorio 5, I-35122 Padova, Italy*
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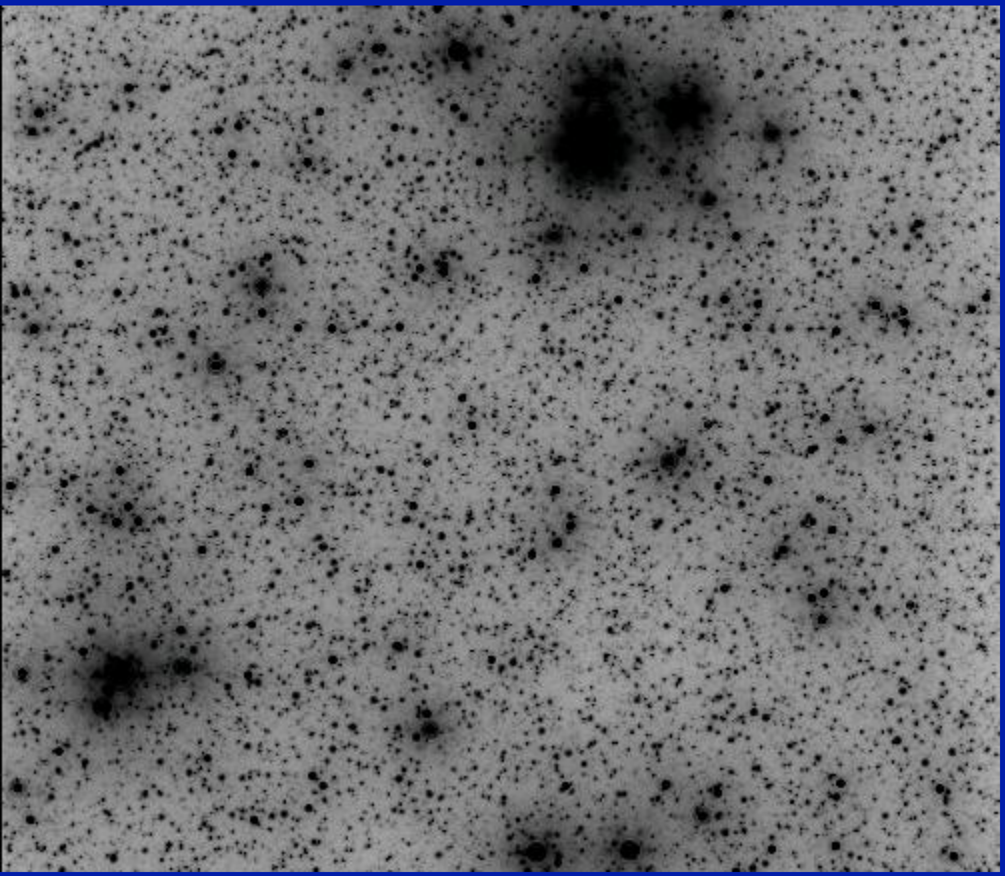
ABSTRACT

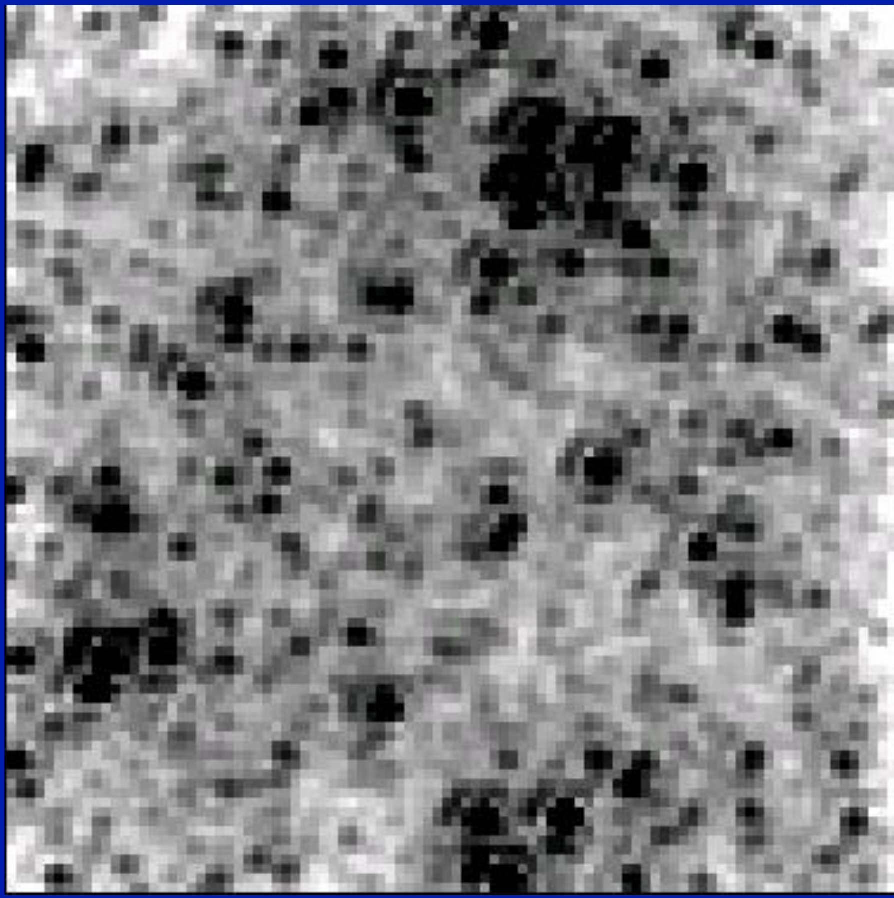
The next generation of large aperture ground-based telescopes will offer the opportunity to perform accurate stellar photometry in very crowded fields. This future capability will allow one to study in detail the stellar population in distant galaxies. In this paper we explore the effect of photometric errors on the stellar metallicity distribution derived from the colour distribution

The view of resolved of stellar populations

Disk galaxy (young SP) M(J) = -23 , HLR = 5 kpc

Distance = 3 Mpc   R/HLR = 1 (128 000 stars)



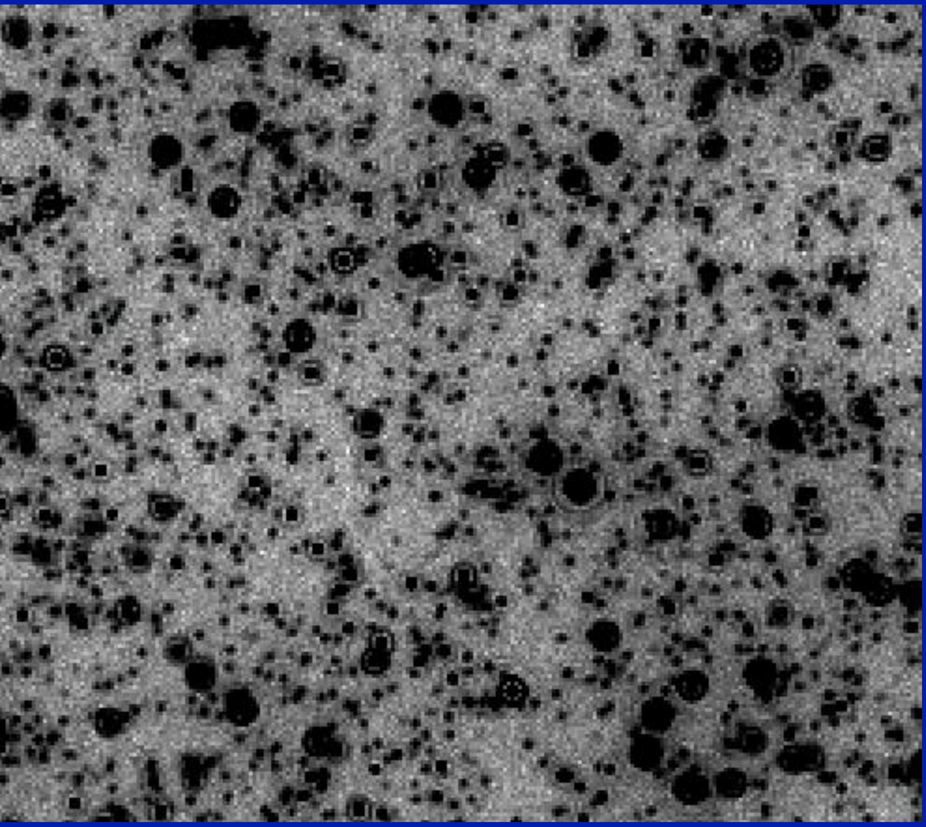


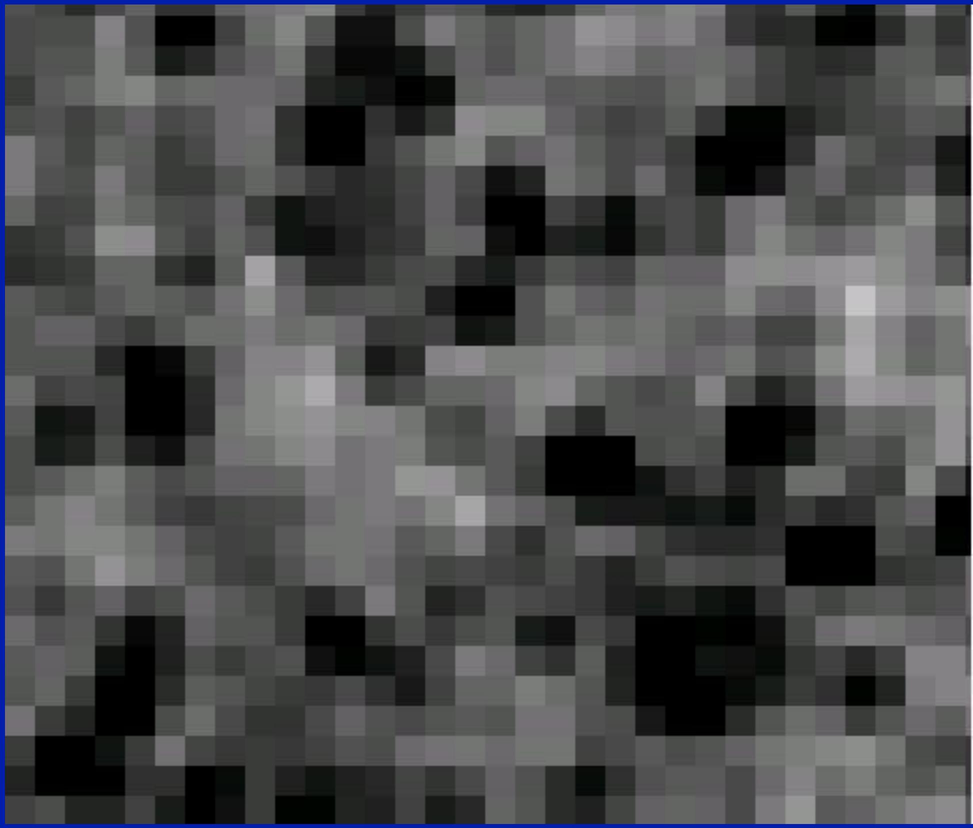
MICADO E-ELT   FoV = 3''   NIRCam JWST

The view of resolved of stellar populations

Elliptical galaxy (old SP) M(J) = -23 , HLR = 5 kpc

Distance = 18.3 Mpc   R/HLR = 1





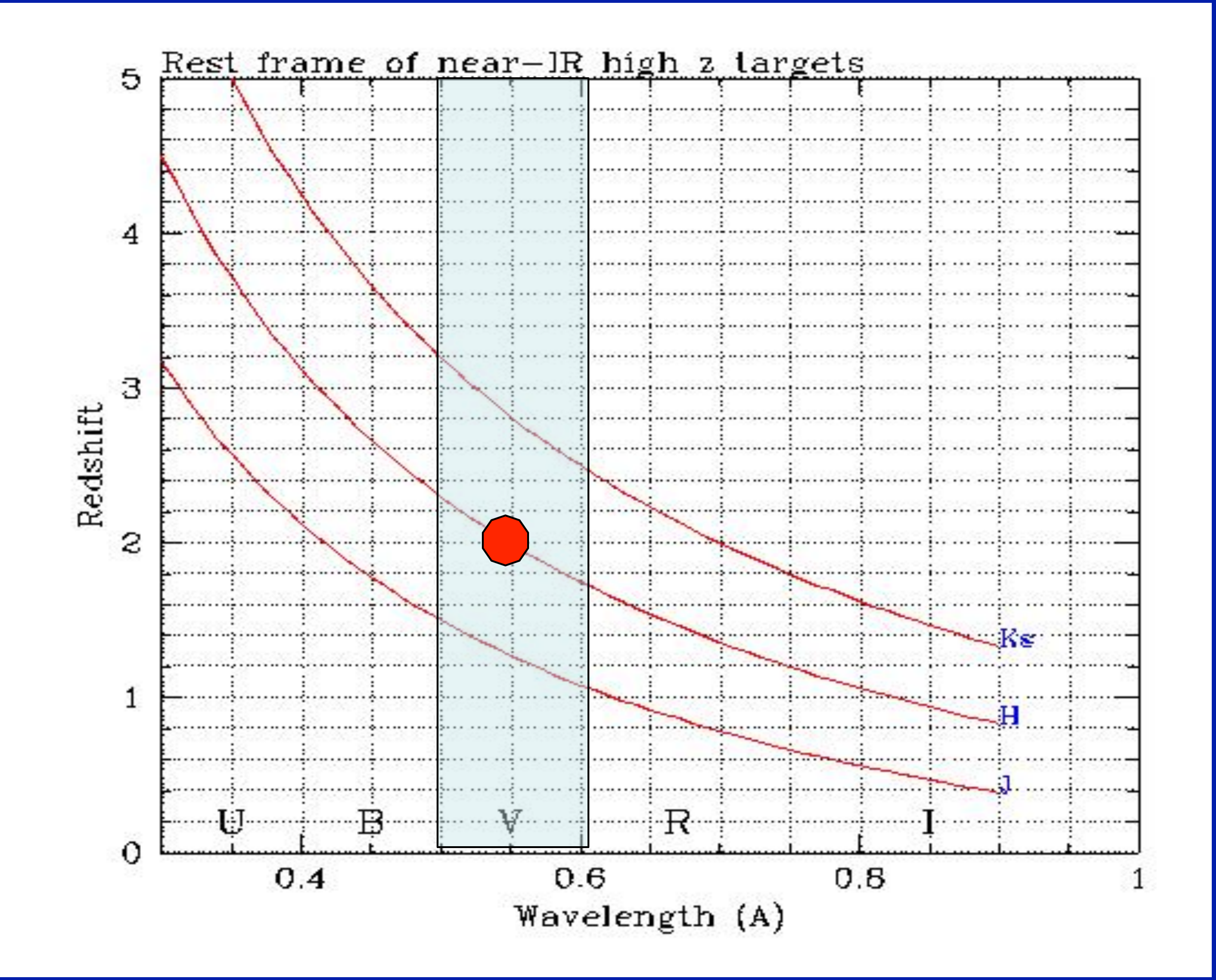
MICADO E-ELT

FoV = 1''

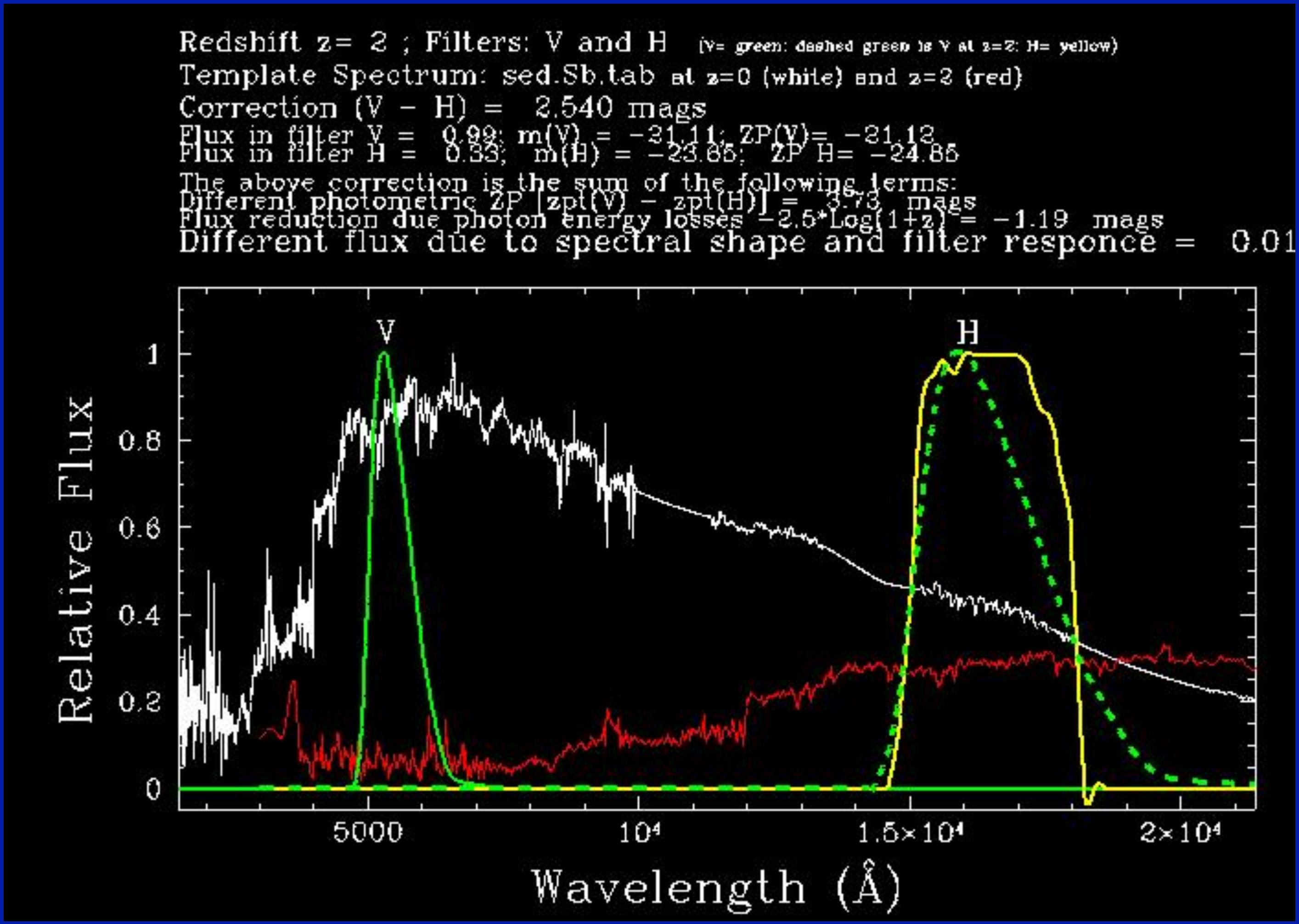
NIRCam JWST

GALAXIES with MICADO @ EELT

MICADO view of high z galaxies

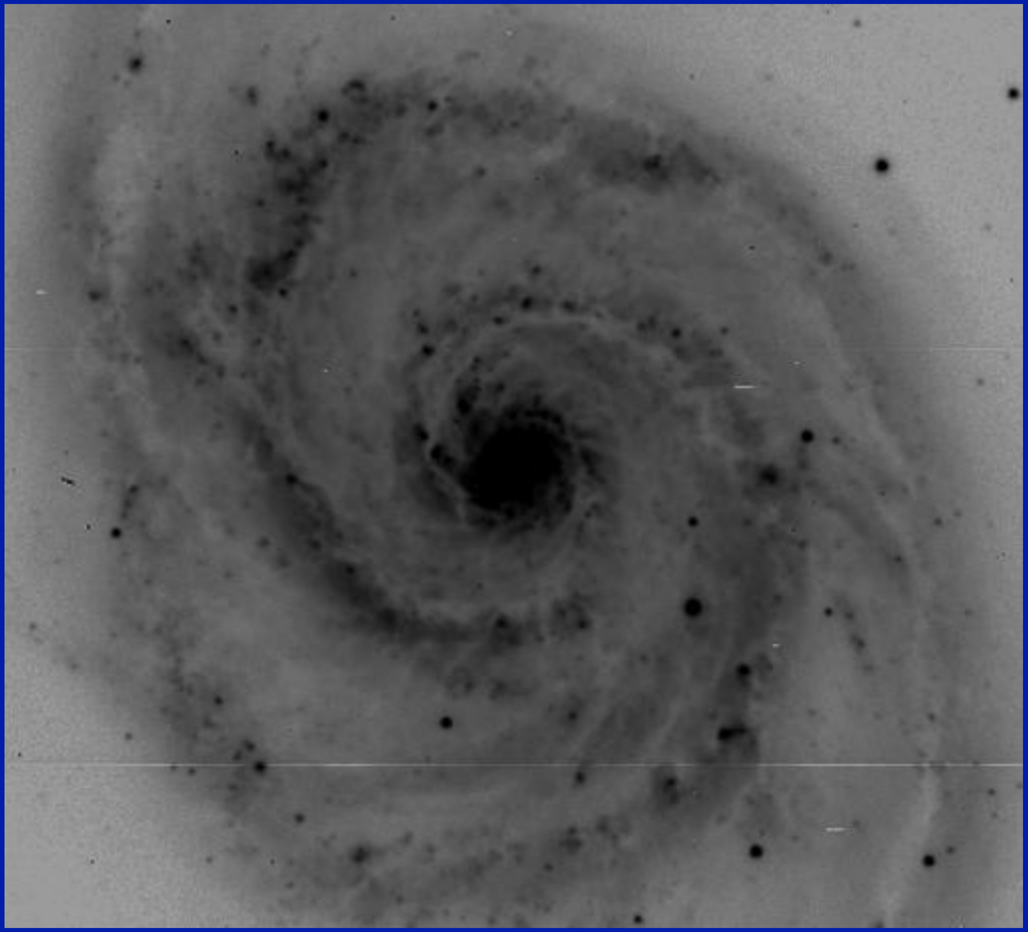


MICADO view of high z galaxies



MICADO view of high z galaxies

Example 1



Galaxy template -→ simulated images

M(V) = -21
Re = 5 kpc

Redshift : 1-5

SB dimming $(1+z)^4$

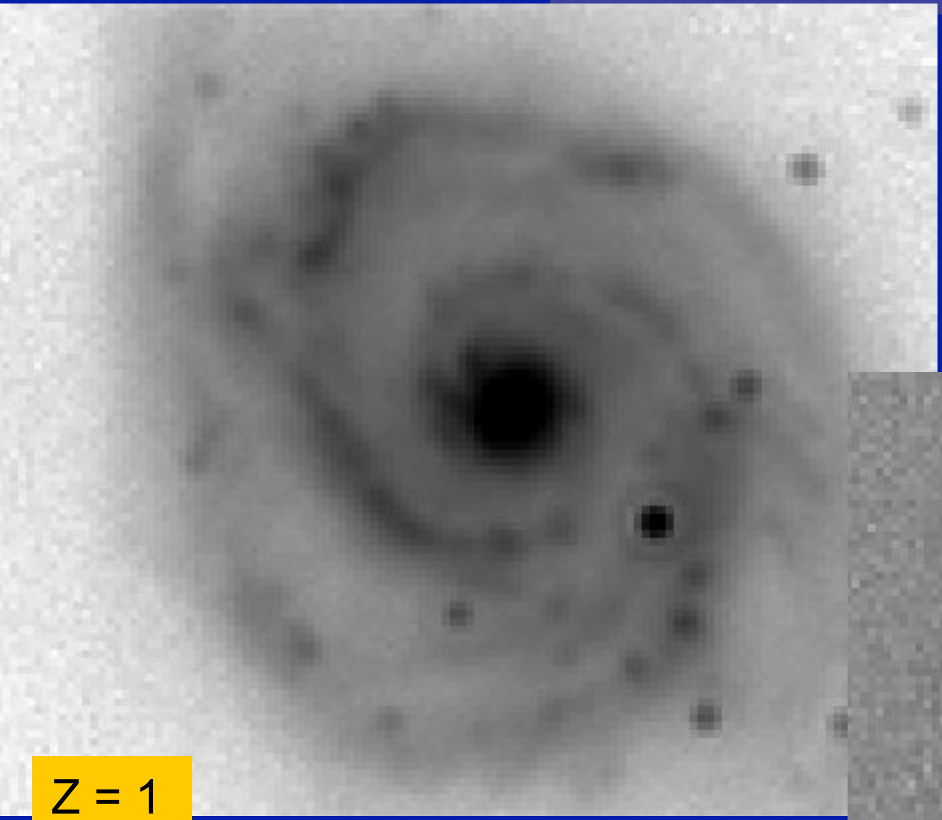
Size evolution helps to detect high z galaxies

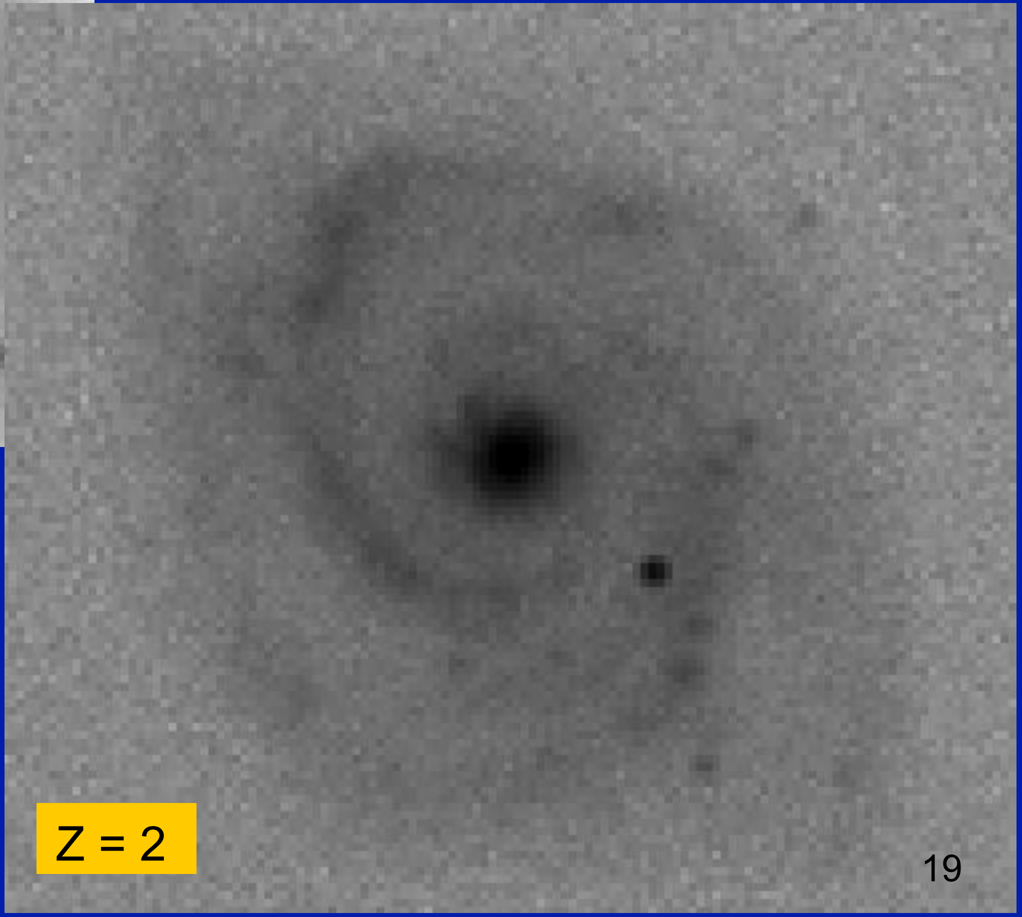
Include k-correction & filter tranfsormation

MICADO view of high z galaxies

SIMULATION

Size 0.3 “

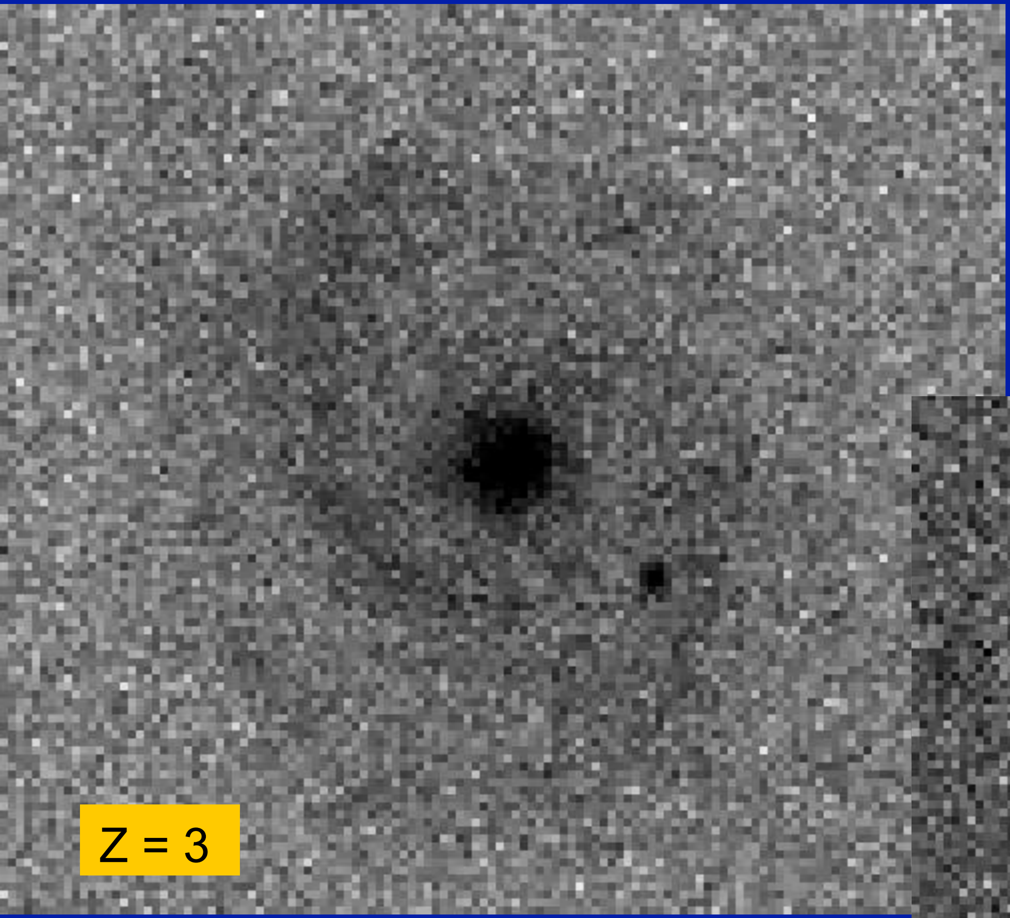


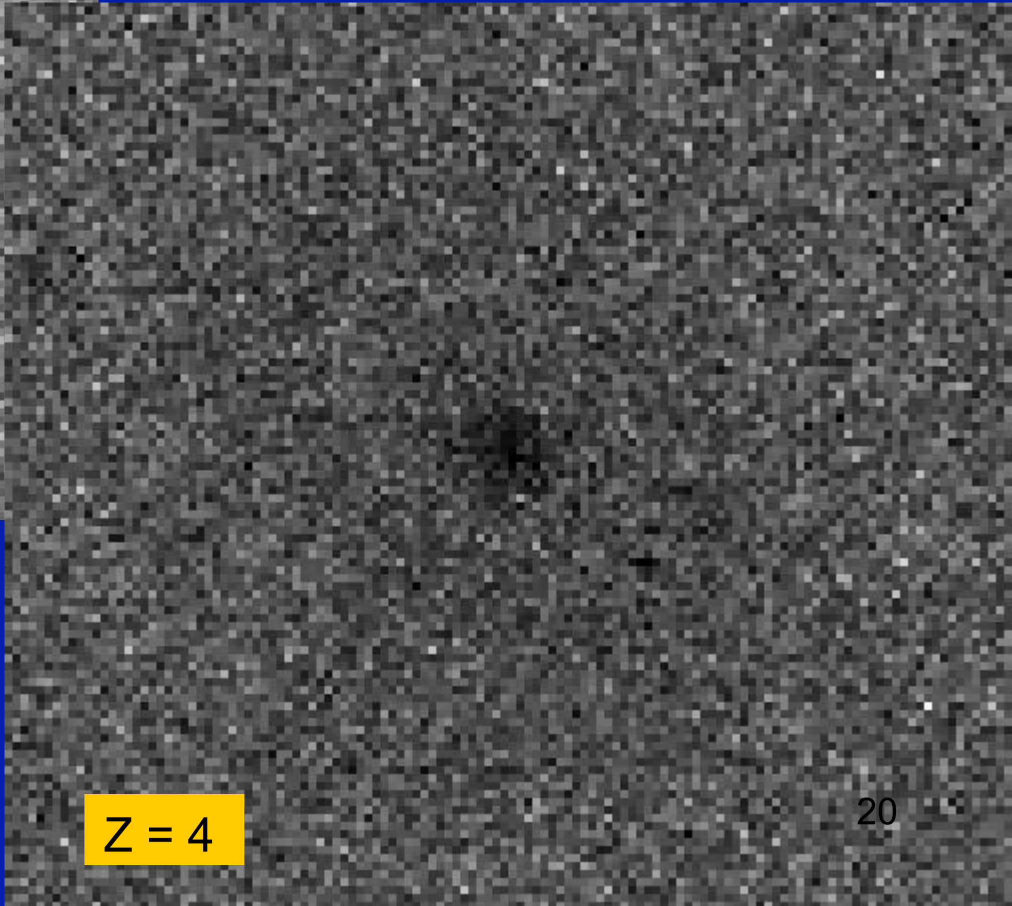


MICADO view of high z galaxies

SIMULATION

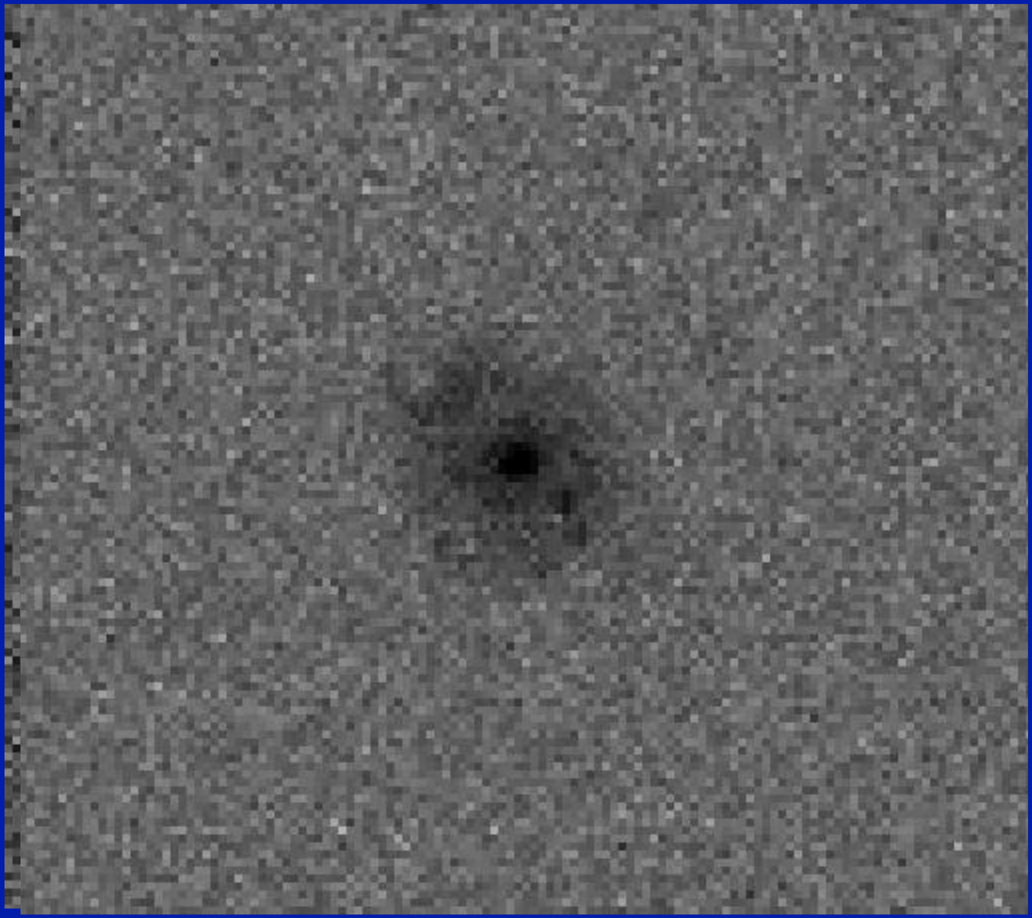
Size 0.3 "





MICADO view of high z galaxies

SIMULATION

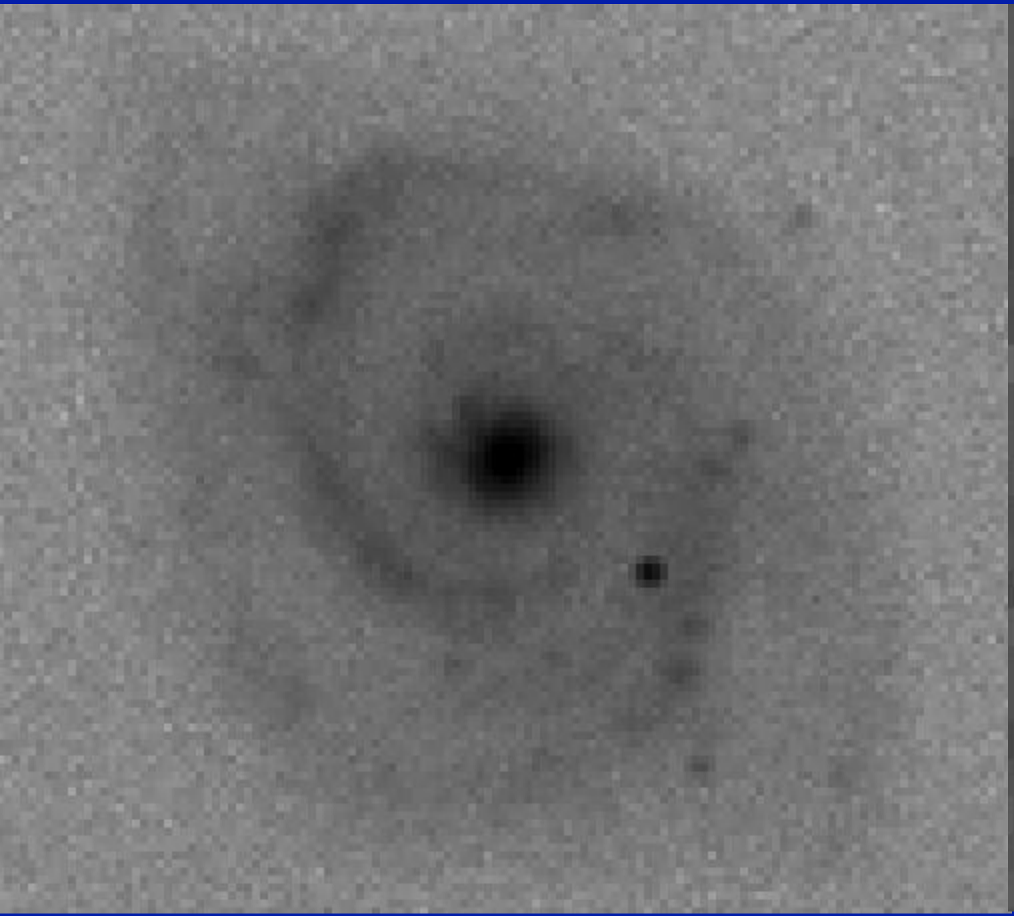


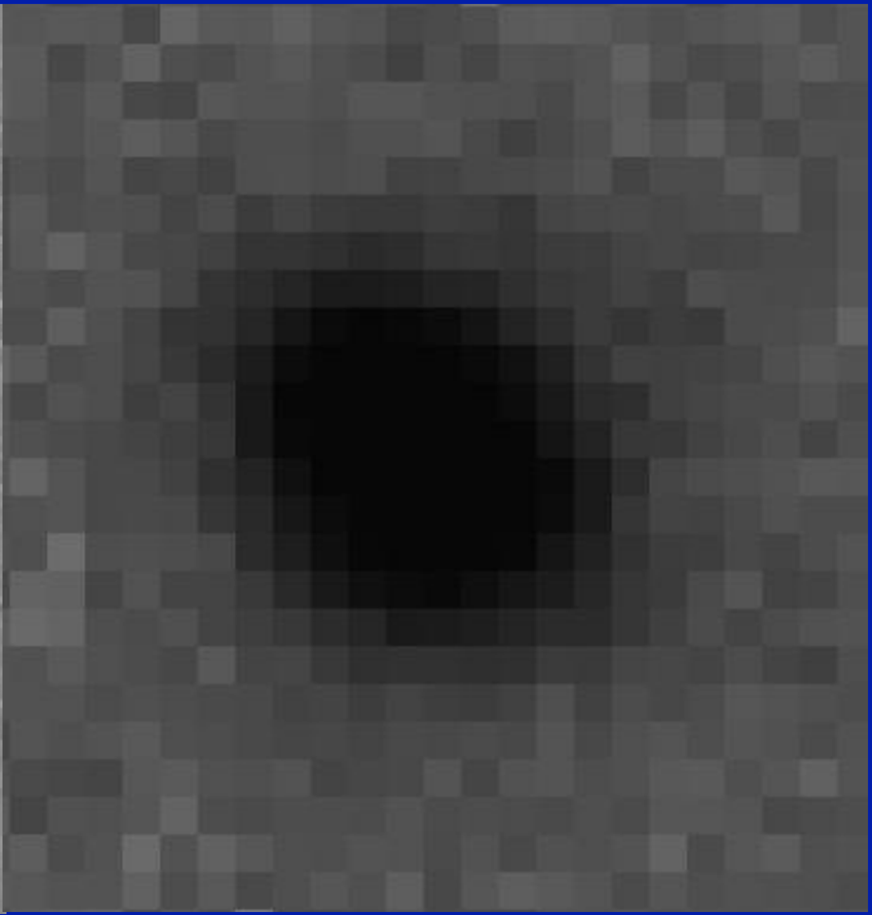
Z = 4   size = 0.1“

Including size evolution

Spiral galaxy at z = 2 Re 5kpc (0.3”)
H band -- 5h

SIMULATION





MICADO@ELT

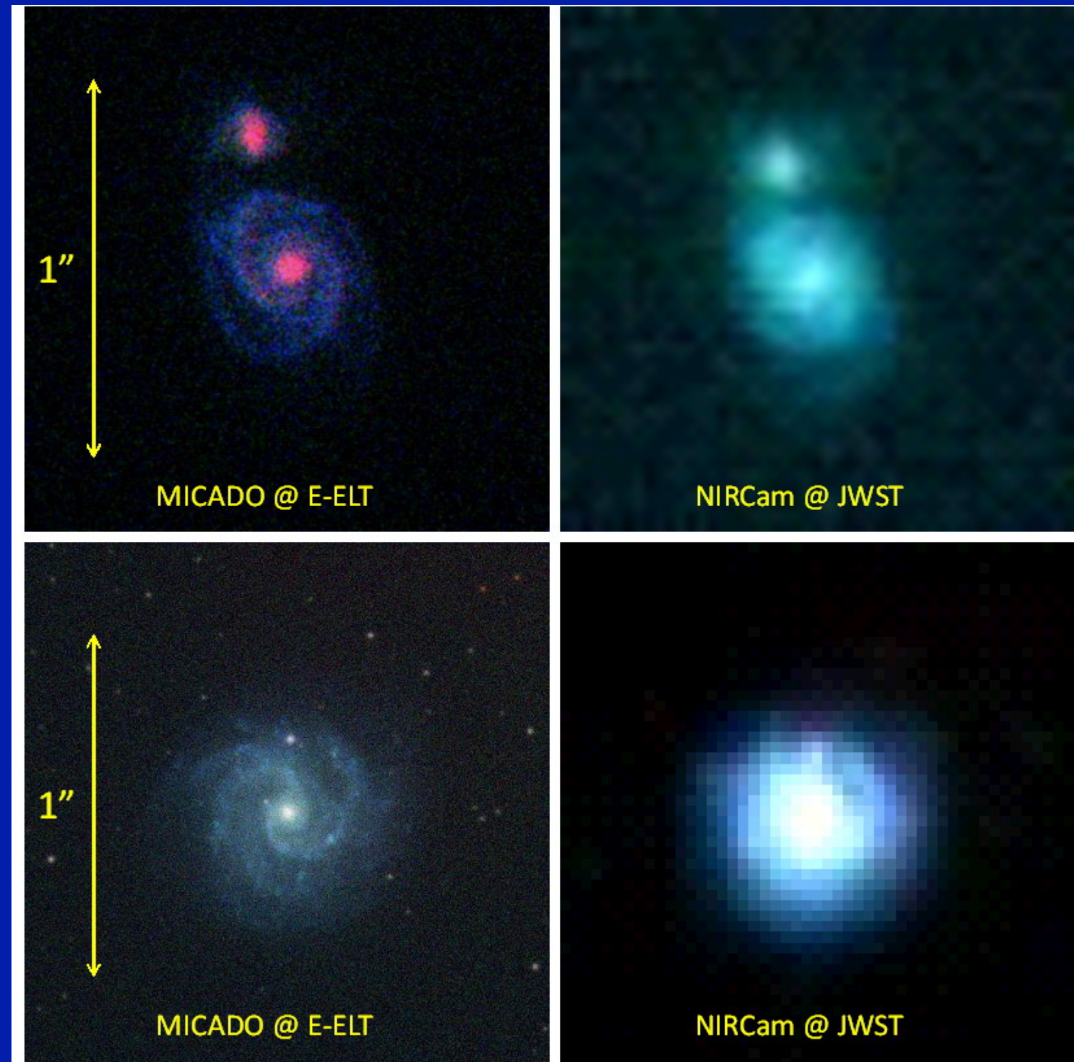
NIRcam@JWST

Color View of High Z Galaxies

JWST will select samples & measure basic galaxy properties

MICADO will provide the details of their structure to answer:
What are the physical processes driving their evolution?

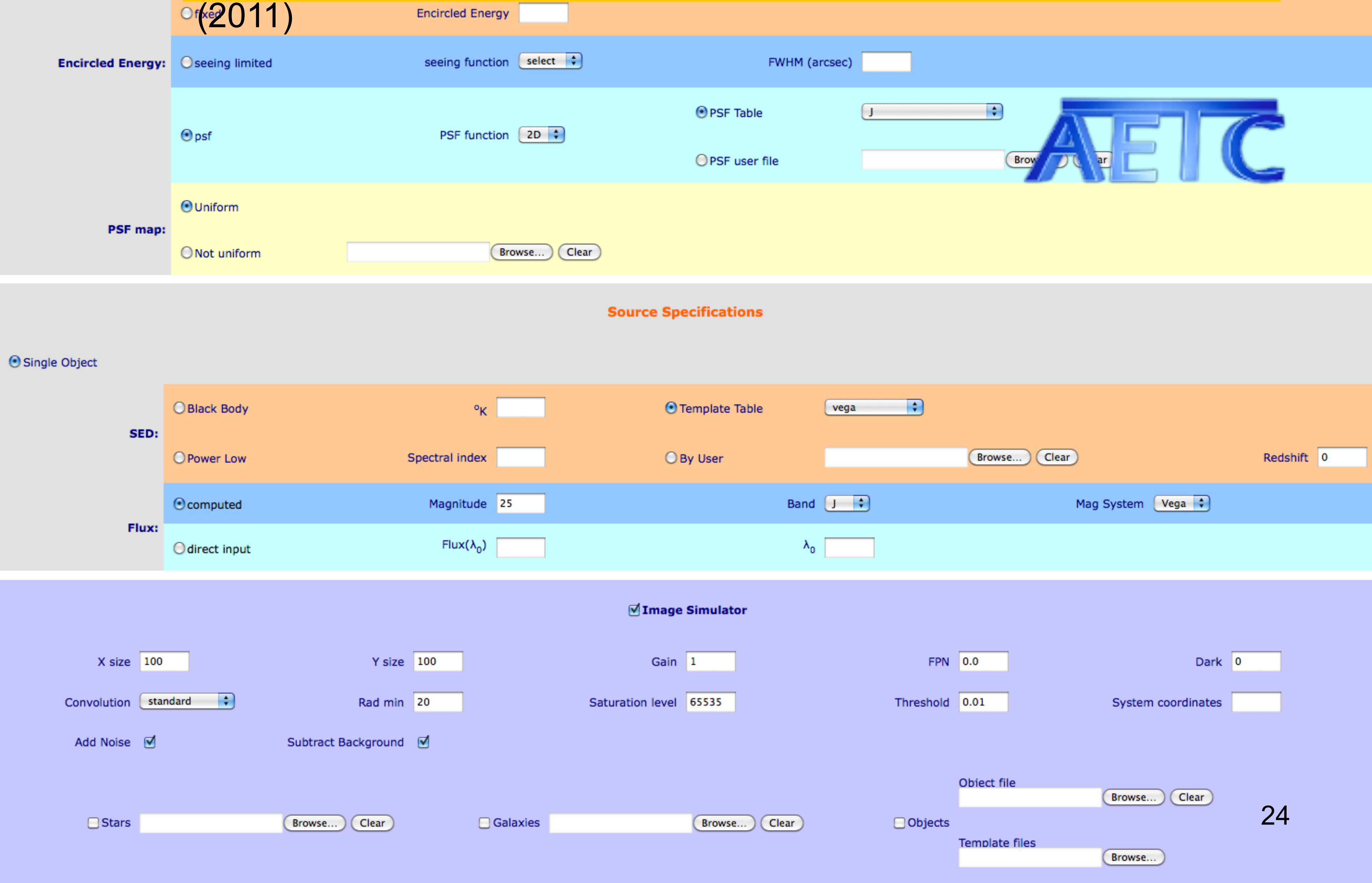
obvious synergies with
ALMA
HARMONI
EAGLE
for kinematics (rotation curves, clump dispersions) & gas content



combined JHK images of local templates (BVR bands) shifted to z=2 (top) and z=1 (bottom), with R_{eff}=0.5” and Mv=-21.   5hrs integration.

The simulation tool : AETC

Falomo, R., Fantinel, D., Uslenghi, M 2011 Proc. SPIE 8135, 813523 (2011)



The simulation tool : AETC

Falomo, R., Fantinel, D., Uslenghi, M 2011 Proc. SPIE 8135, 813523 (2011)

-03 09:49:12

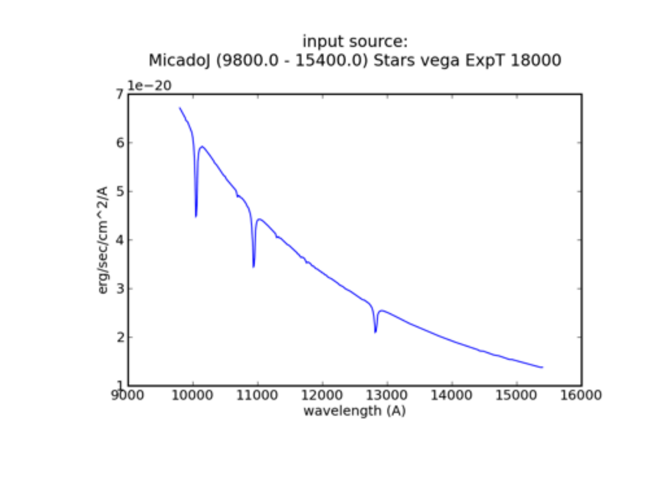
Input configuration

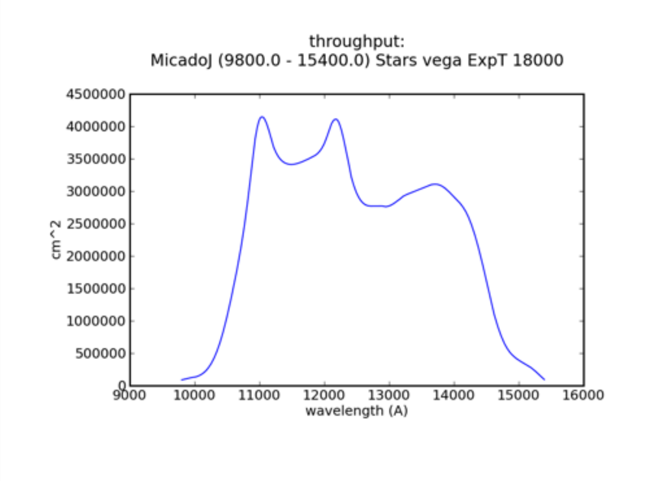
Object: MicadoJ
Primary mirror diameter: 3900 cm
Plate scale: 0.003 arcsec/pixel
Number of reflections: 5
Fraction of obstruction: 0.28
Observation band: J 9800.0 - 15400.0 Å
Photometric system: UBVRI_Johnson
Mirror reflectivity: 1
Instrument efficiency: 1
Detector efficiency: 0.4
Sky Brightness: mag: 16.3, band: J, mag system: Vega
Exposure time: 18000sec
Number of exposure: 180
Readout noise: 5e-
Aperture Ø: 0.012 arcsec
Encircled Energy: 0.19 (psf function: 2D, psf file: ELT_Micado_seeing0.6 J)
Air Mass: 1
Atmospheric Absorption: Rayleigh: at 2000m
Single Object - SED: Stars vega (900.0 - 100000.0) Å
Input: mag: 25, band: J, mag system: Vega
Star file: No Star file
Galaxy file: No Galaxy file
Object file: No Object file

Aperture Output Signals:

Collecting area: 11009347 cm^2
S/N area: 12.6 px
Source: 8.328477e+05 ph/aper/expT
Effective wavelenght: 12200.0 Å
Extinction at λeff: 0.0
Background : 1.588126e+06 ph/aper/expT (7.02 ph/sec/px)
StoN 535.23
Zero Point 30.97

Sensitivity Graphs





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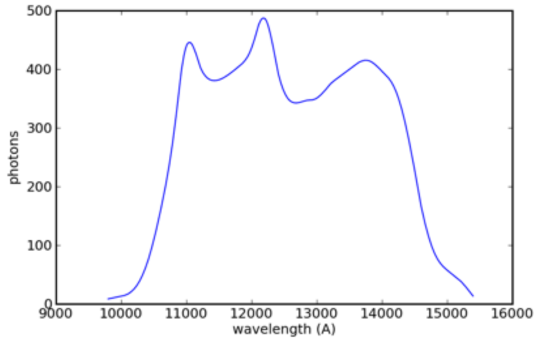
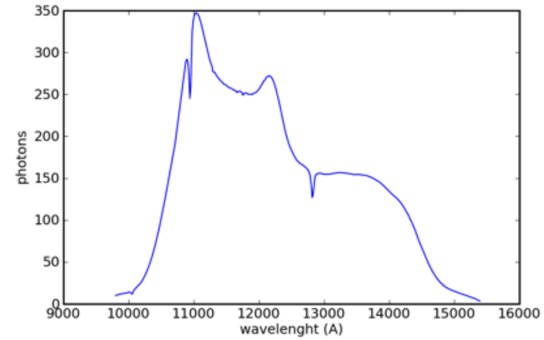
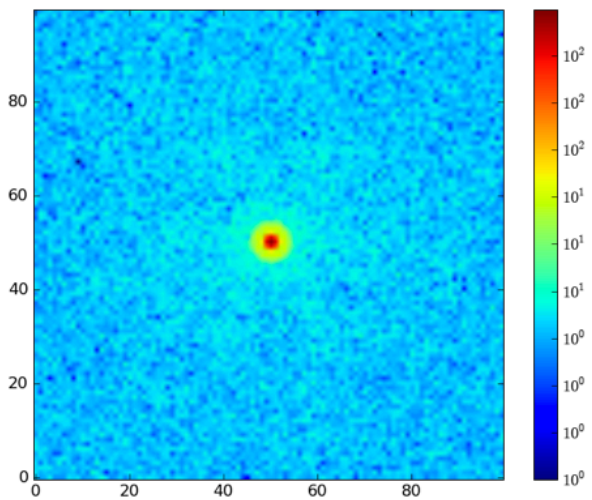




http://aetc.oapd.inaf.it

Preview Image



AETC

x size: 100
y size: 100
gain: 1
FPN: 0.0
dark: 0
convolution: standard
rad min: 20
saturation level: 65535
threshold: 0.01
add noise: yes
subtract background: yes

SAVE Image (fits)