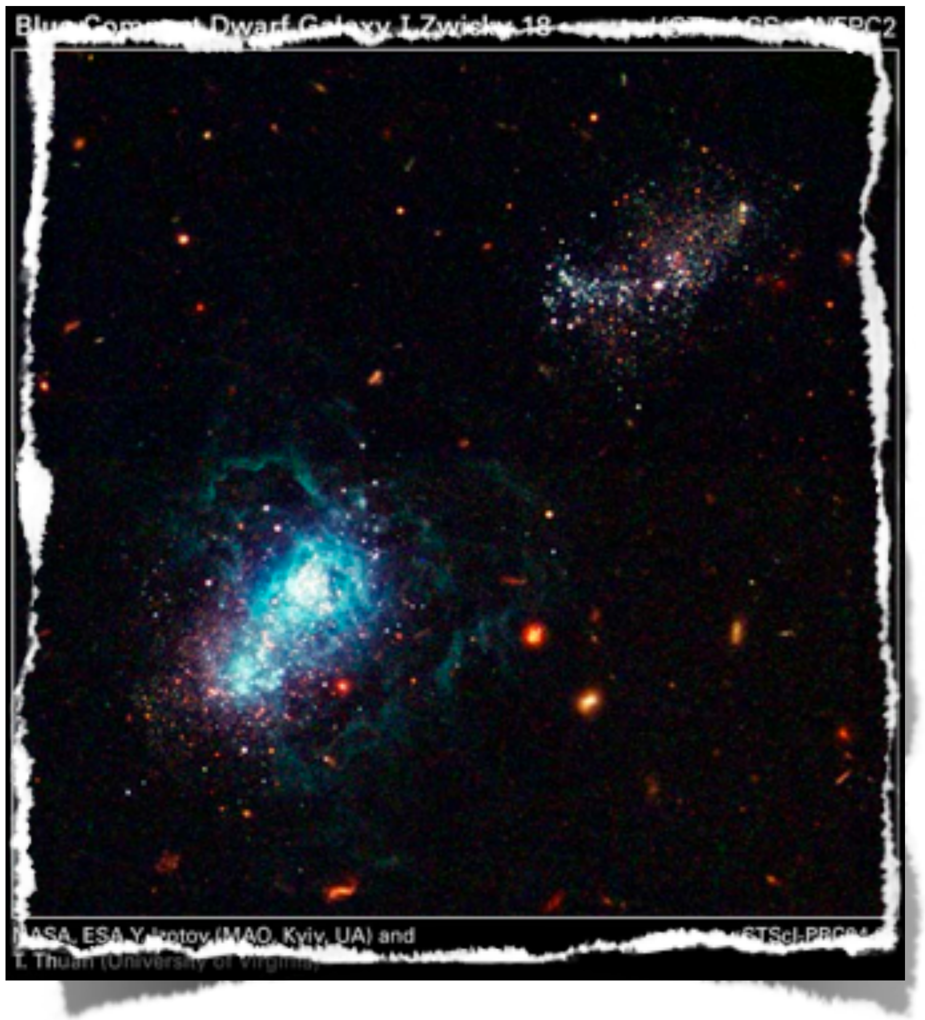
Blue Compact dwarf galaxies as seen by E-ELT



Giuliana Fiorentino
INAF-OA Bologna

P. Ciliegi (INAF-OABo), M. Monelli (IAC) & F. Annibali (INAF-OABo)

Date 28-02-2013, Munich

Outside the Local Group (LG)

★ **ALL YOU FIND IN THE LOCAL GROUP (i.e. 2 Giant Spirals, Spheroidal and Irregular galaxies, 1 dwarf Elliptical) +**

★ **BLUE COMPACTS**: late-type, PLENTY of gas and HII regions, ongoing star formation, ancient pop (how old?).

★ **GIANT ELLIPTICALS**: early-type, with little gas, minimal star formation, very ancient pop [see L. Schreiber and L. Greggio's posters].

Date 28-02-2013, Munich

Why Blue Compact dwarf Galaxies?

★ With their **high gas content and low metallicity**, they have been often considered as analogues to primeval galaxies (e.g., Izotov & Thuan 1999) although they always contain old stars (e.g., Tolstoy, Hill & Tosi 2009).

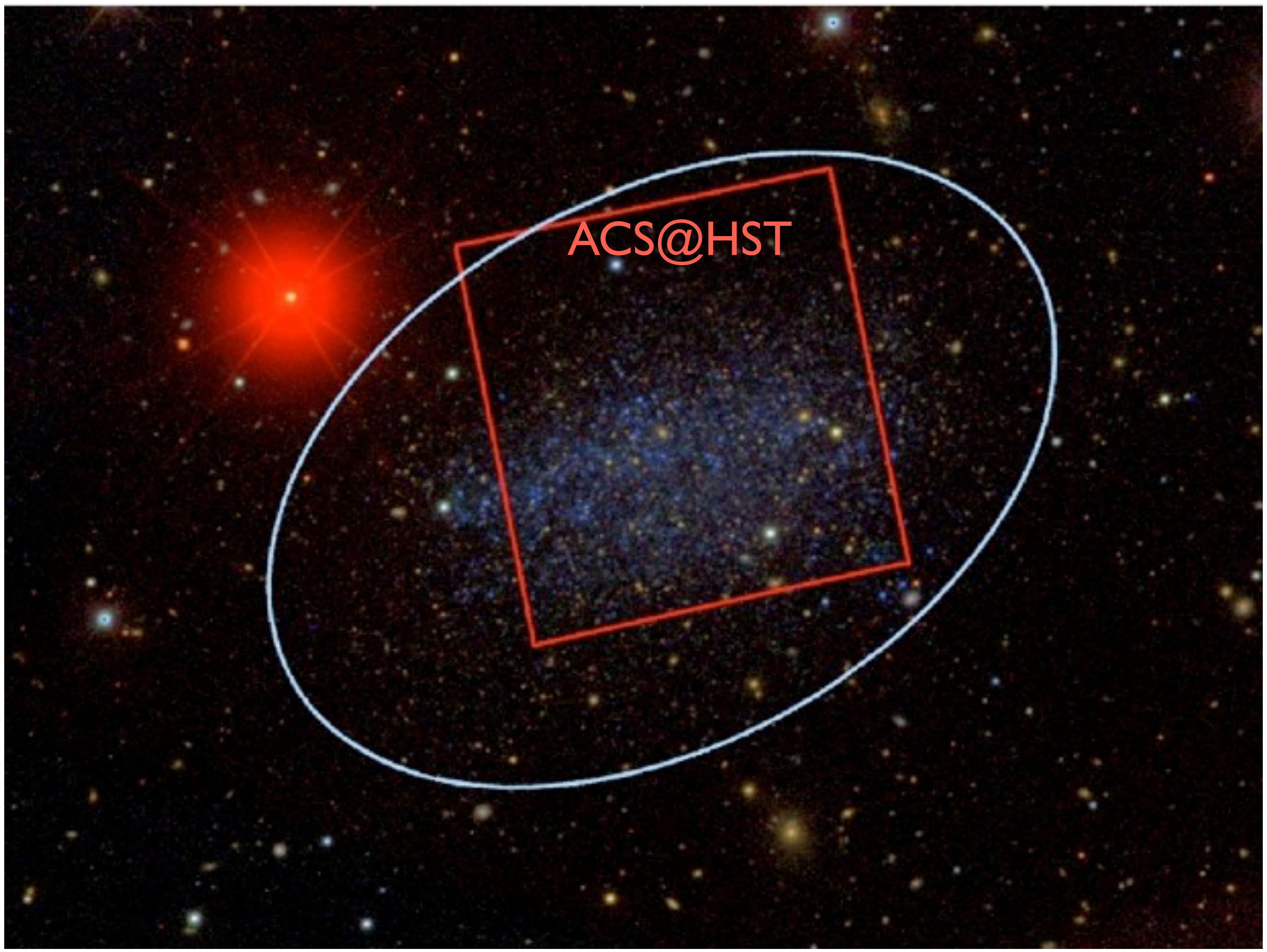
★ Being the most metal poor star forming galaxies, they are the preferred sites to infer the **primordial ^{4}He abundance** (e.g., Izotov, Thuan,& Lipovetsky 1997; Peimbert, Peimbert, & Ruiz 2000).

★How will they look like after the star burst? Will they become early-type dwarf galaxies?

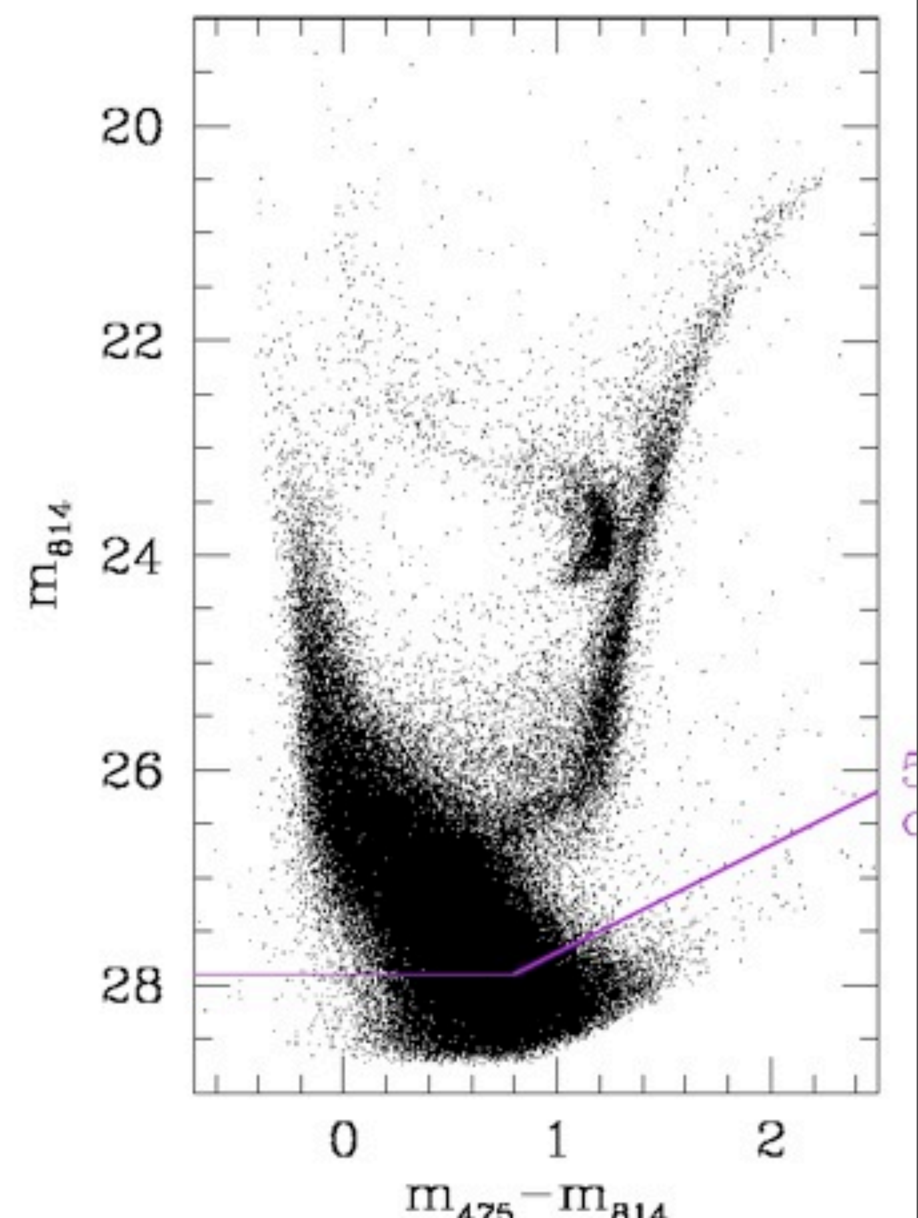
★The trigger mechanism of the stellar formation and the following chemical enrichment (e.g., Lelli et al. 2012, Lebouteiller et al. 2013).

HST-view within the LG: the case of LeoA

Cole et al. 2007 ACS@HST



10 arcmin



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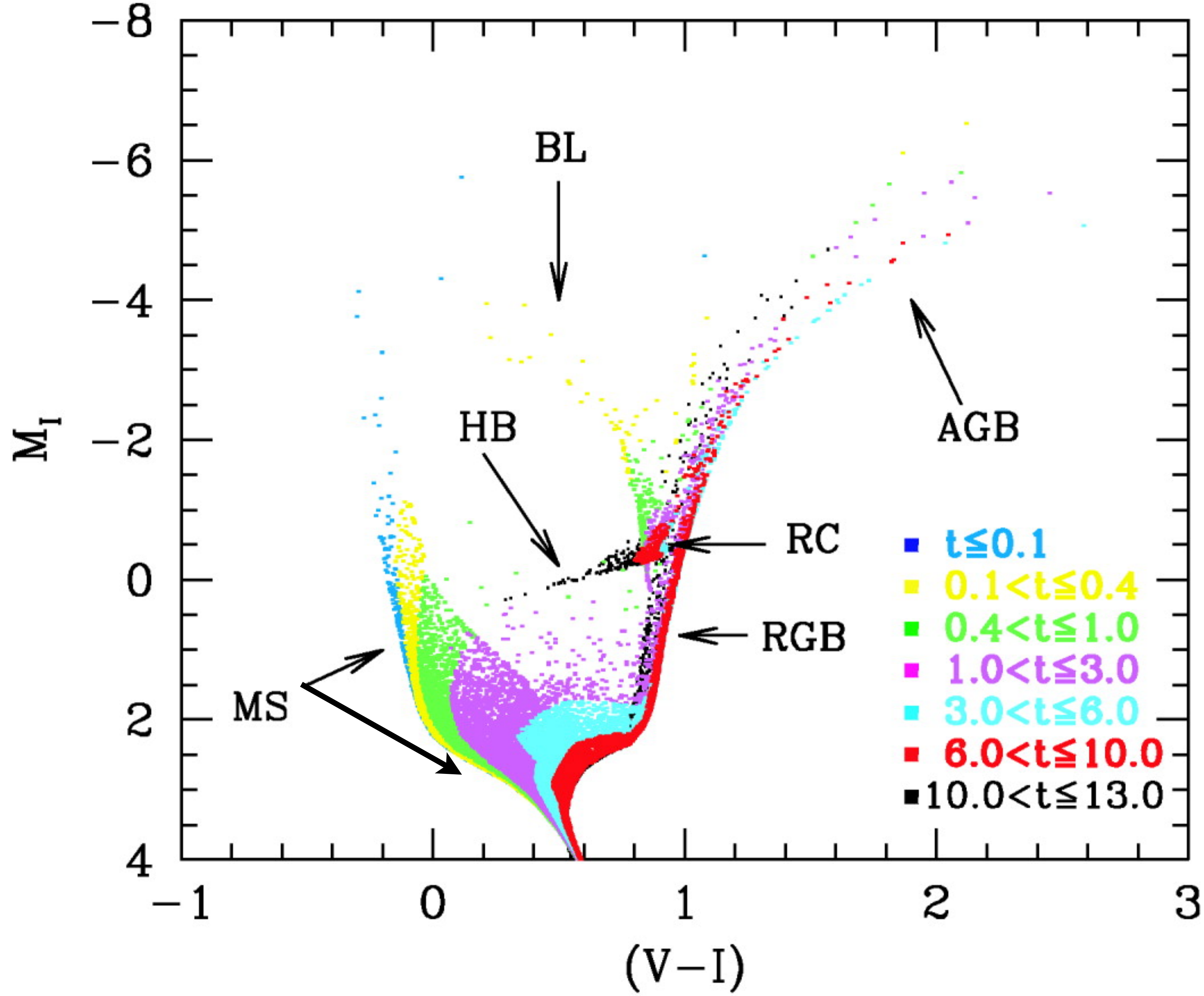
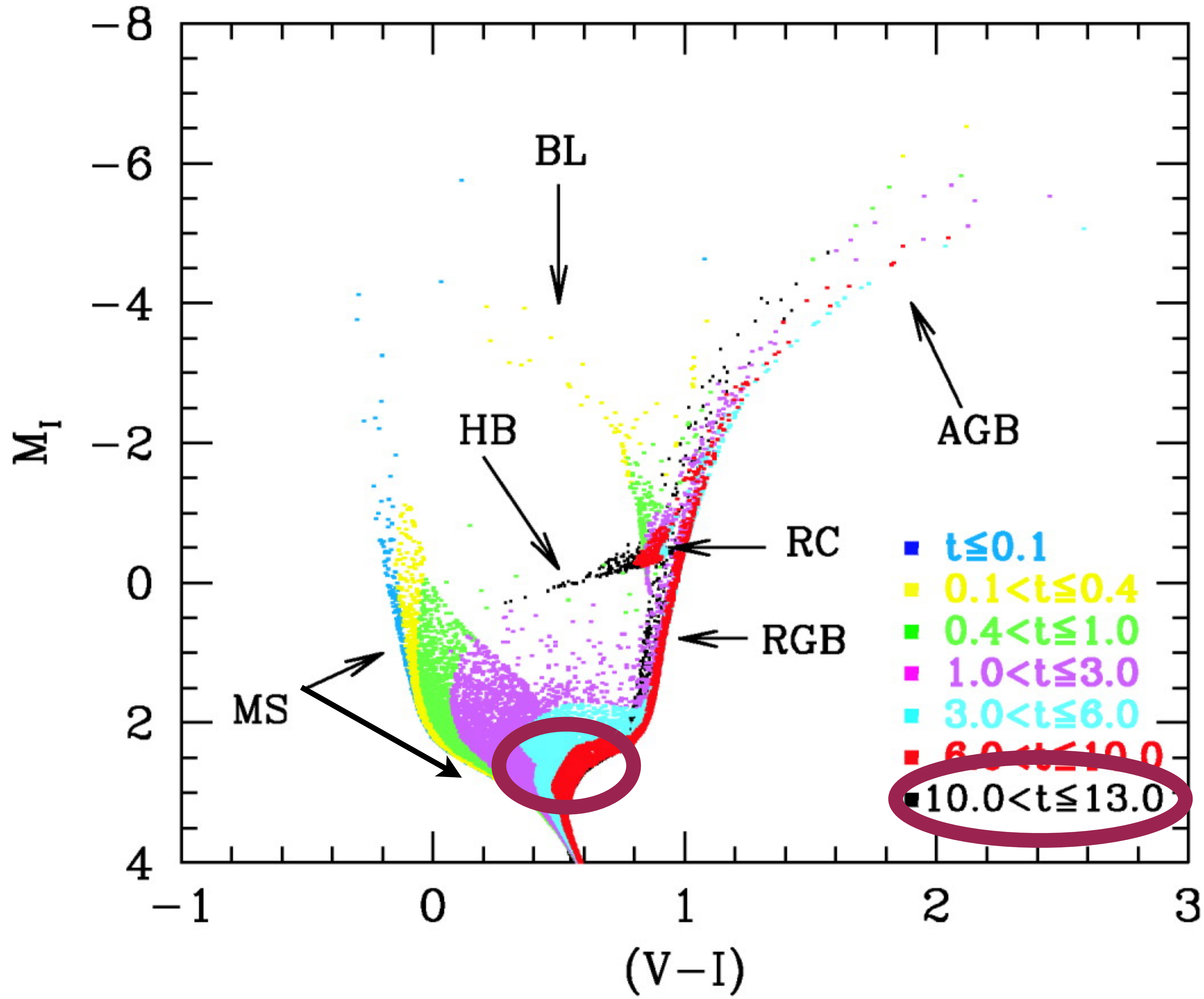
CMD analysis



Aparicio & Gallart 2004

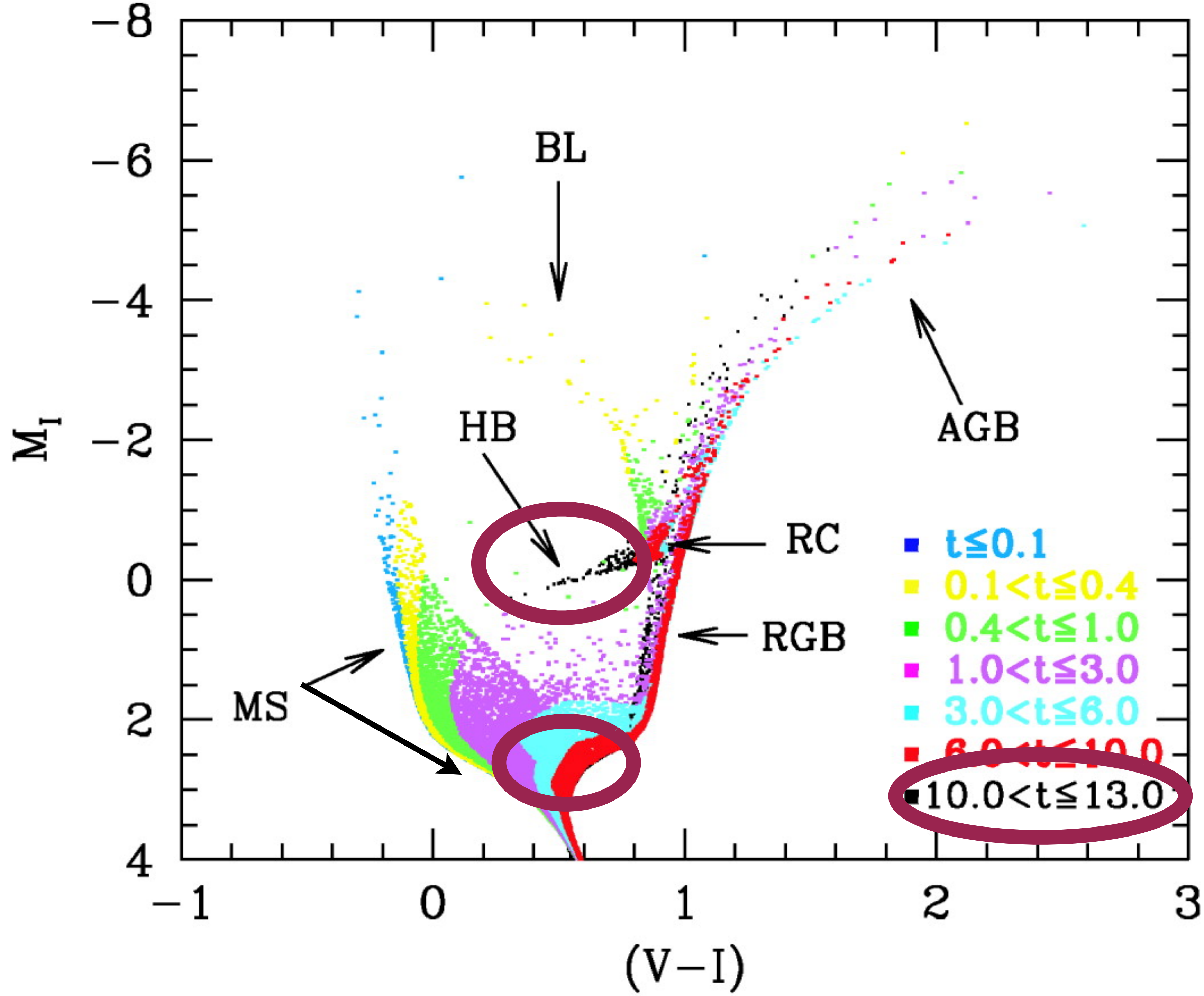
Date 28-02-2013, Munich

CMD analysis



Aparicio & Gallart 2004

CMD analysis



Aparicio & Gallart 2004

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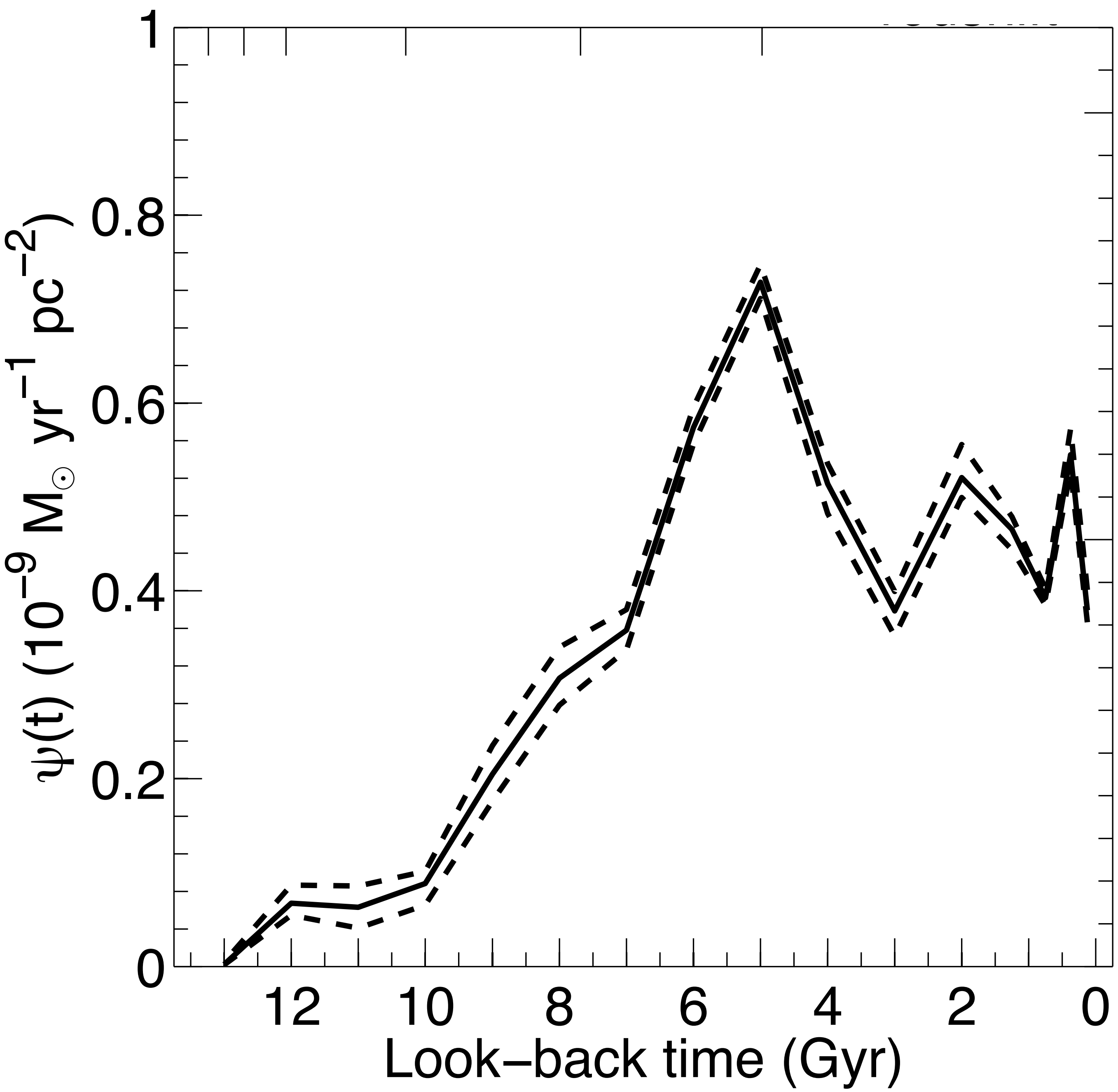
Leo A Star Formation History



Hidalgo et al. in preparation, courtesy of LCID group

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HST-view beyond the LG

Effect of distance on the resolution of individual stars

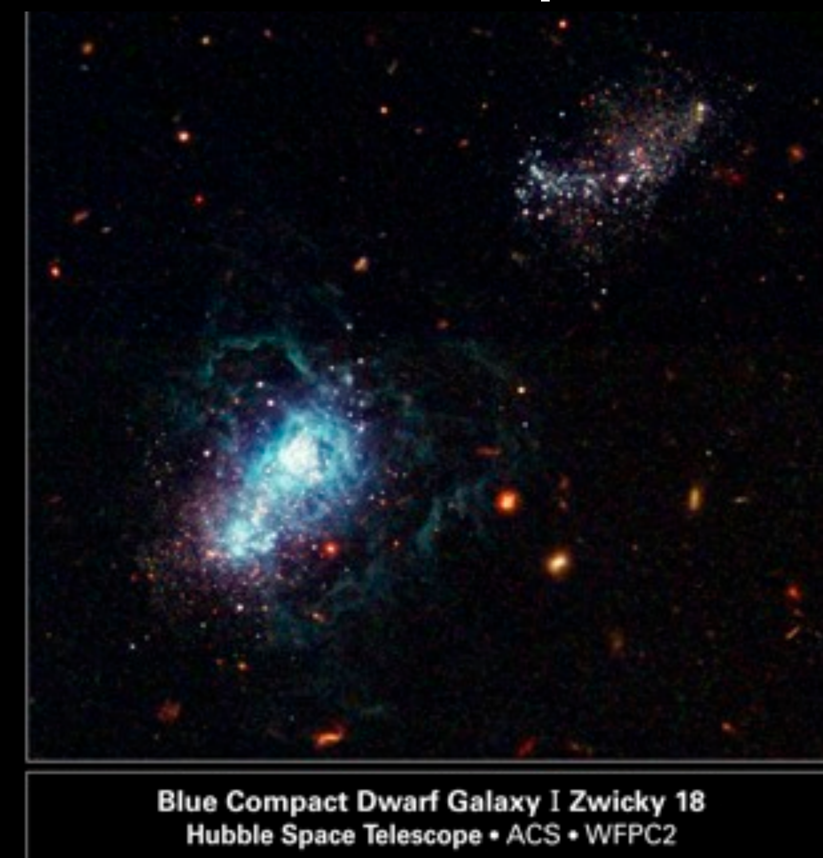
d<< 1 Mpc

LMC: $\mu \sim 18.5$

d~ 5 Mpc

NGC1705: $\mu \sim 28.$

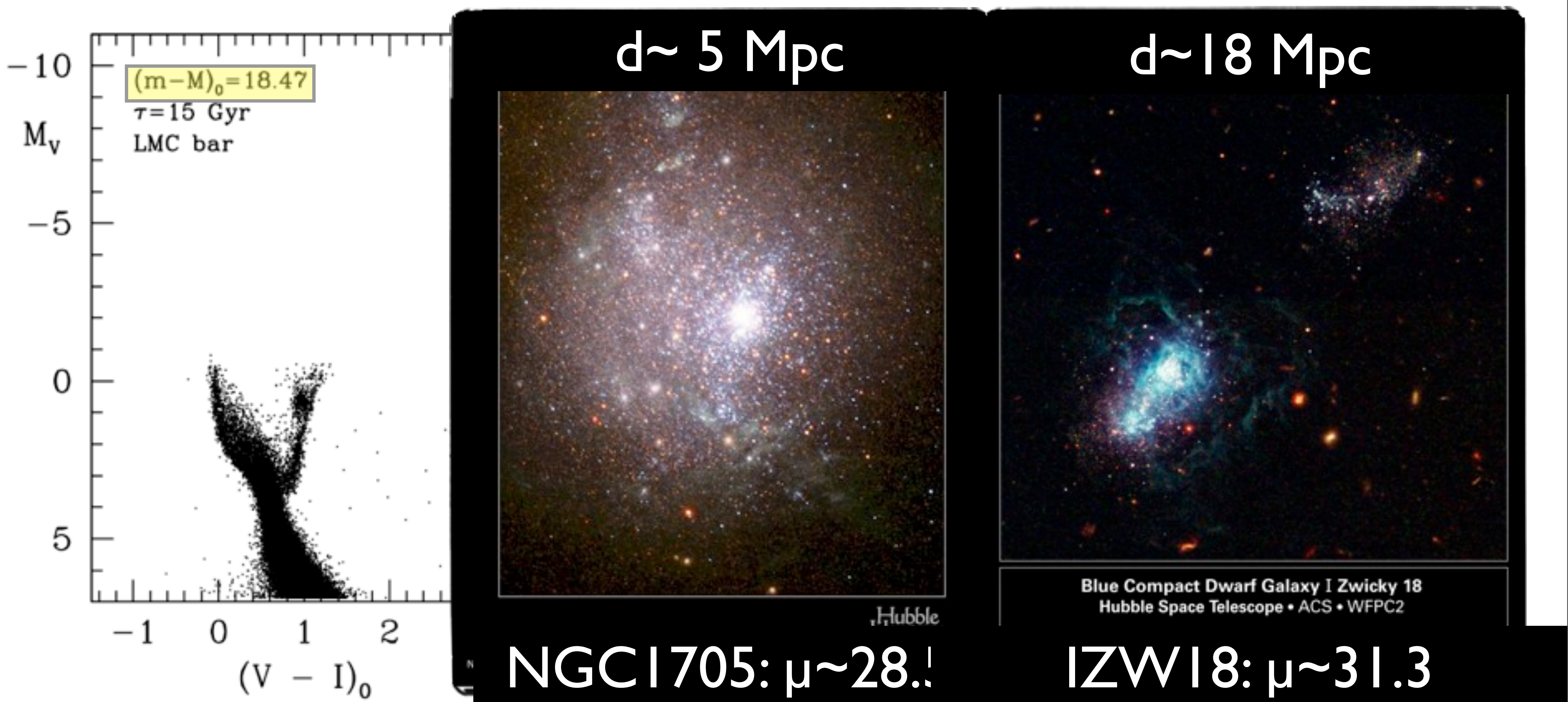
d~18 Mpc



IZW18: $\mu \sim 31.3$

HST-view beyond the LG

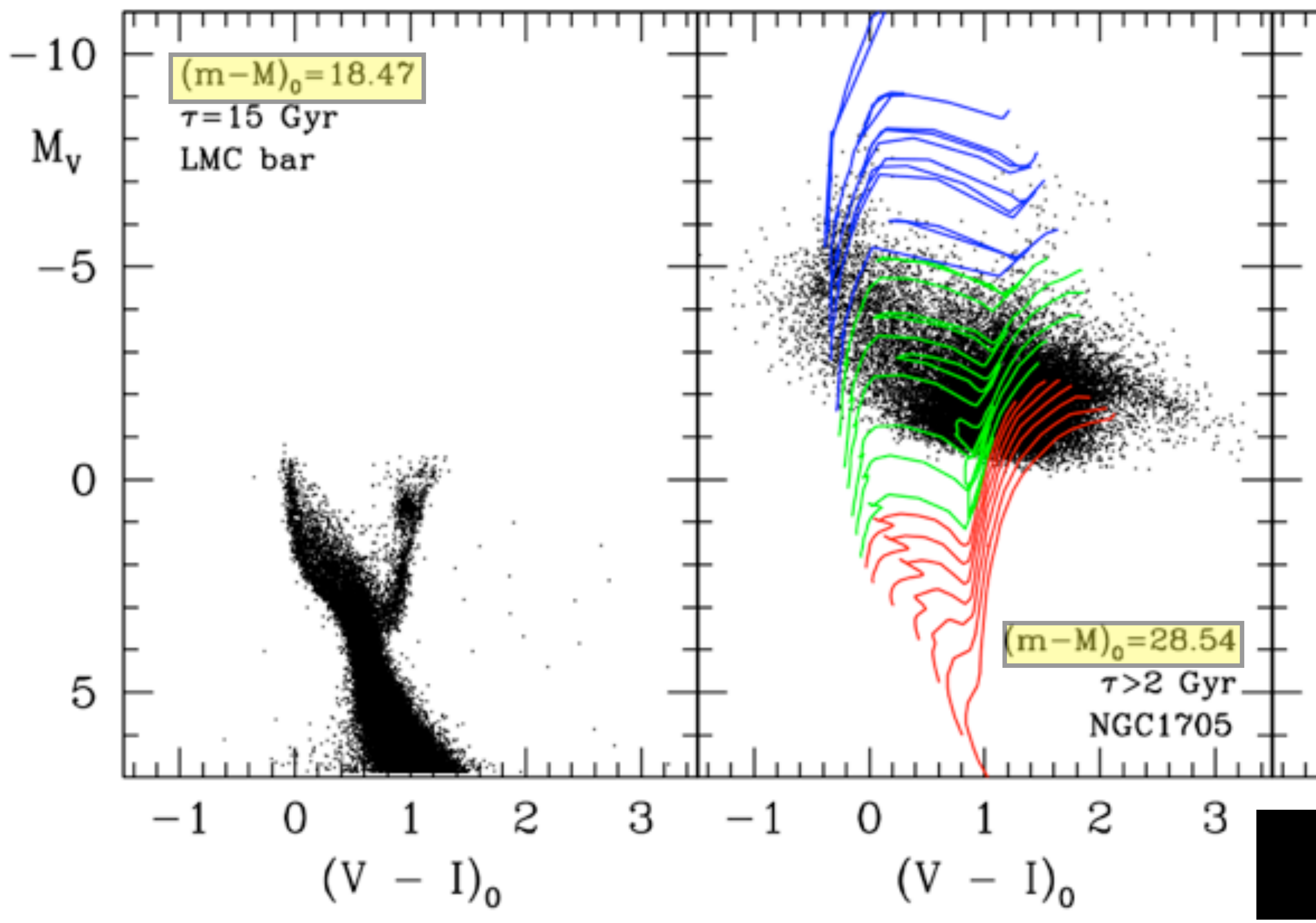
Effect of distance on the resolution of individual stars

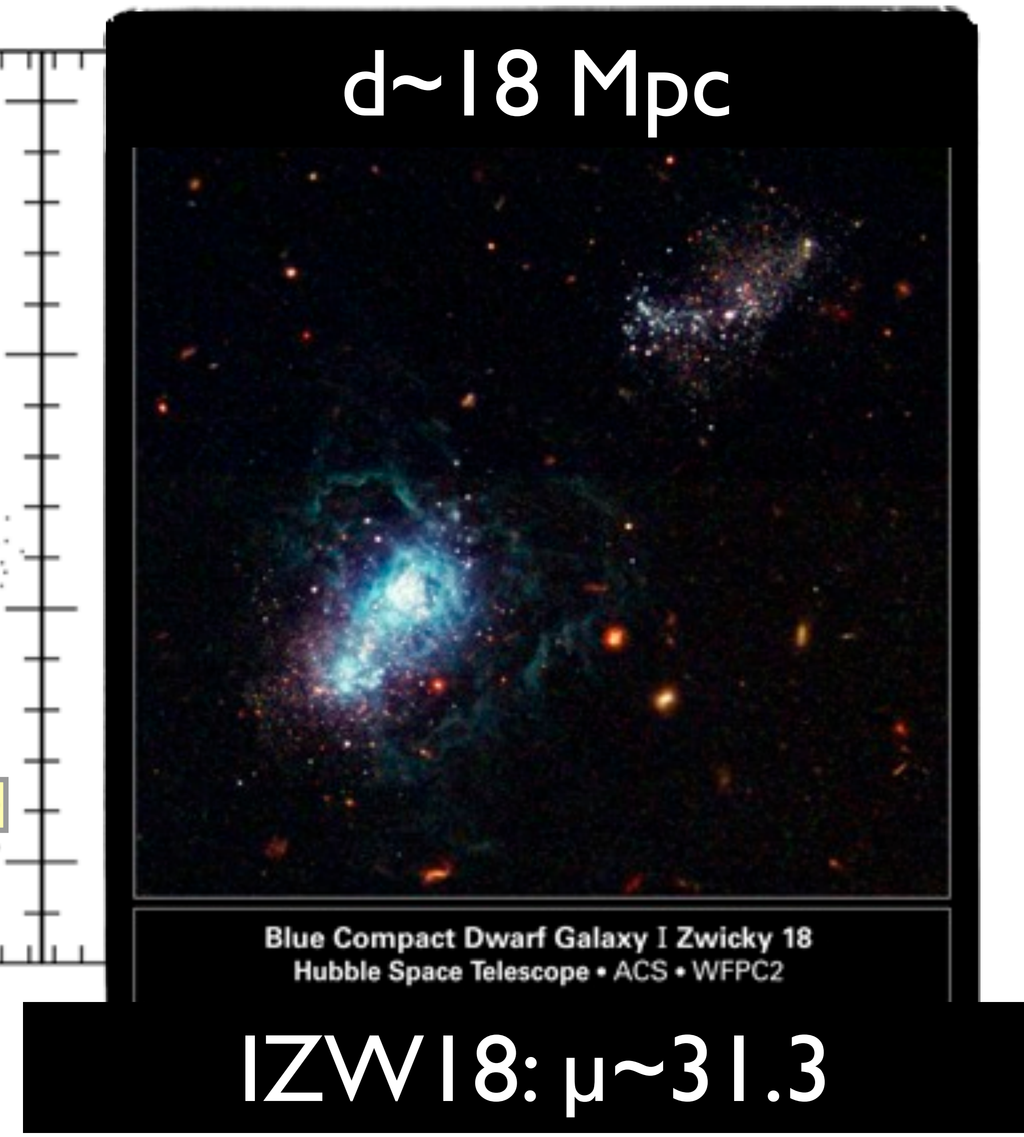


CMDs from HST/WFPC2. Distances: 50 Kpc (LMC), 5 Mpc (NGC1705) and 18 Mpc (IZw18), from Cignoni & Tosi 2010.

HST-view beyond the LG

Effect of distance on the resolution of individual stars





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HST-view beyond the LG

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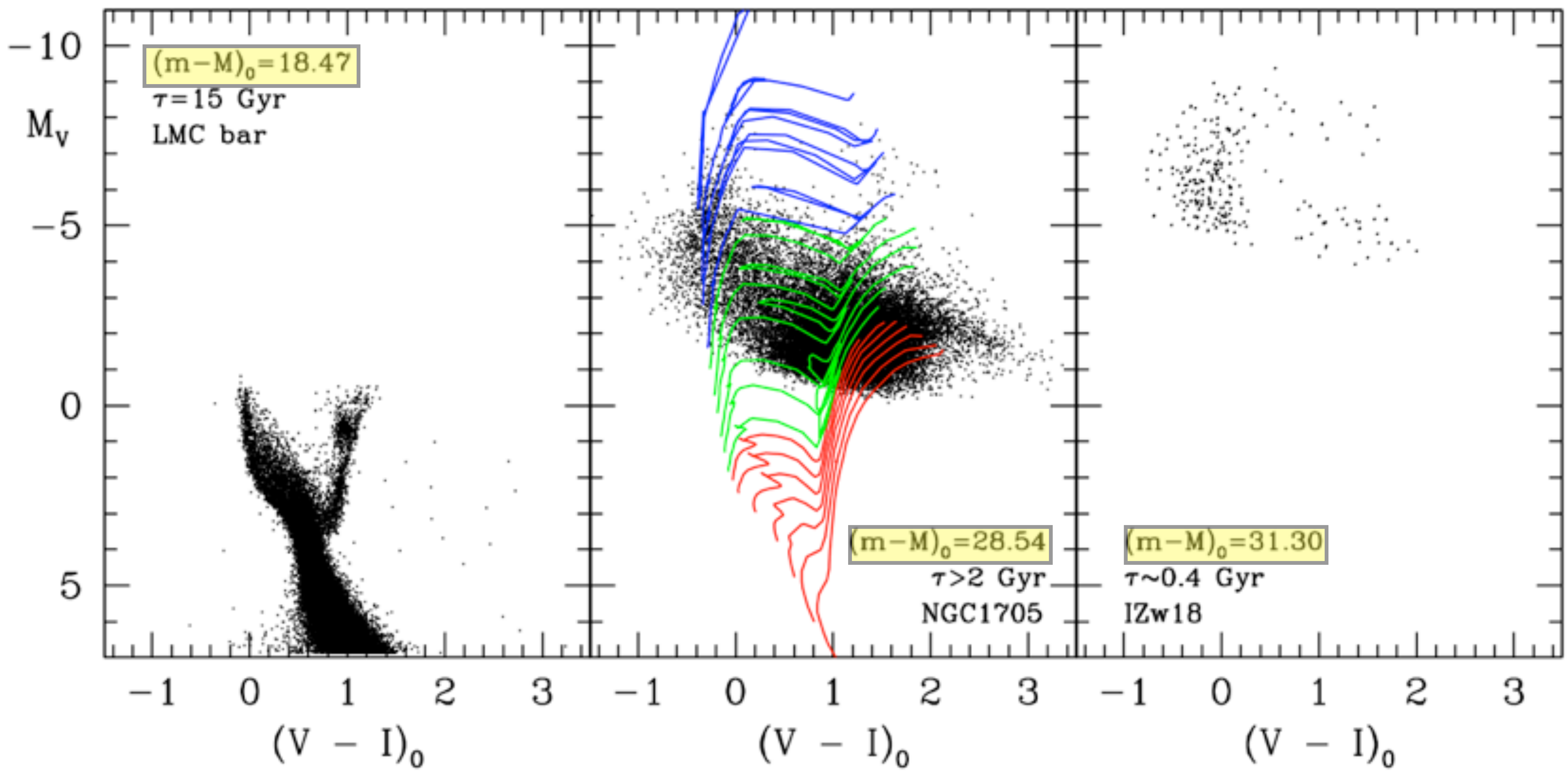

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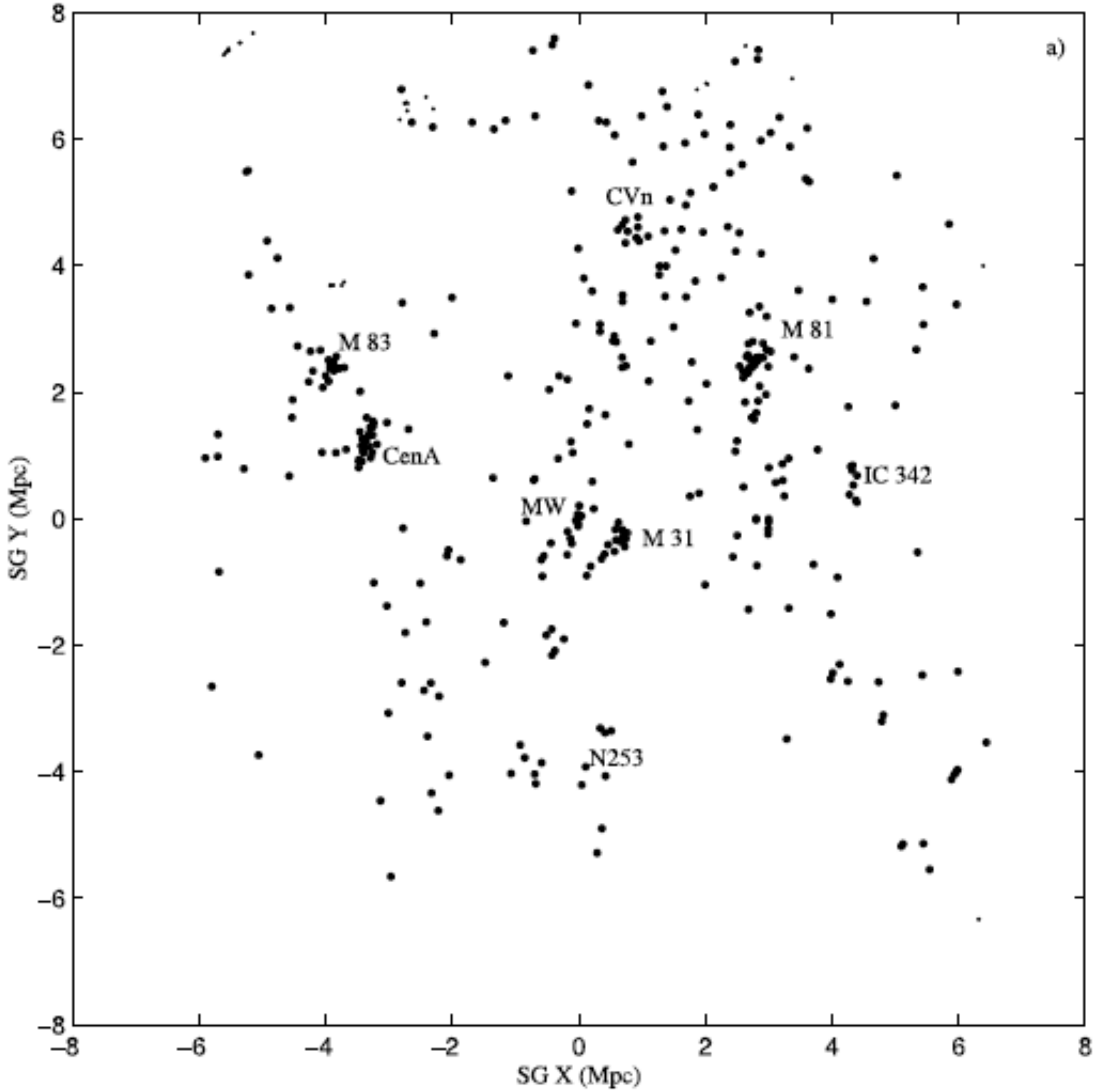
Summarizing the HST-view

complete sample of galaxies in our Local Universe (d≤8 Mpc)

Karachentsev et al. 2004



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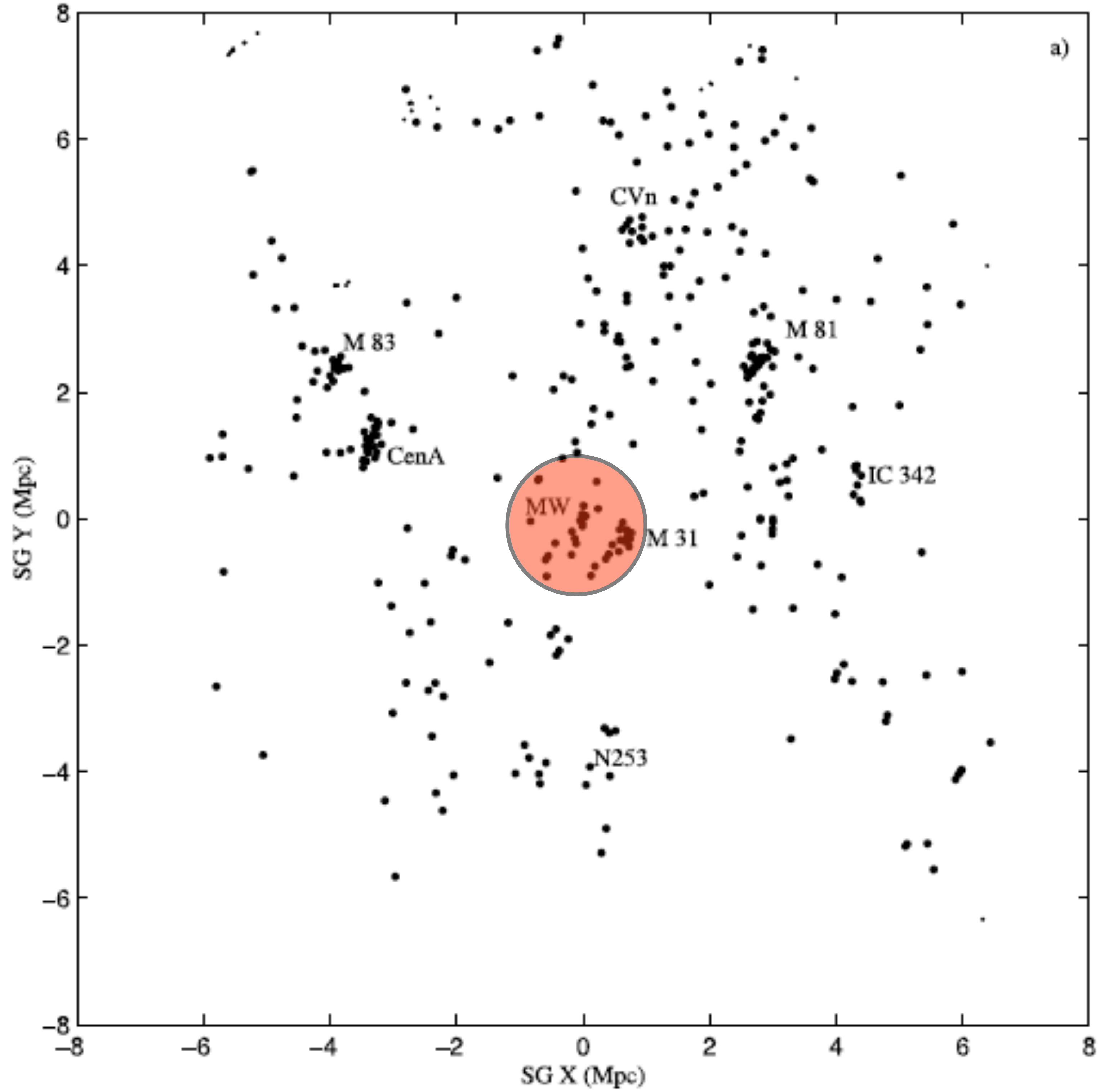

1 Mpc:
MS Toff detection and
low-res spectroscopy

Date 28-02-2013, Munich

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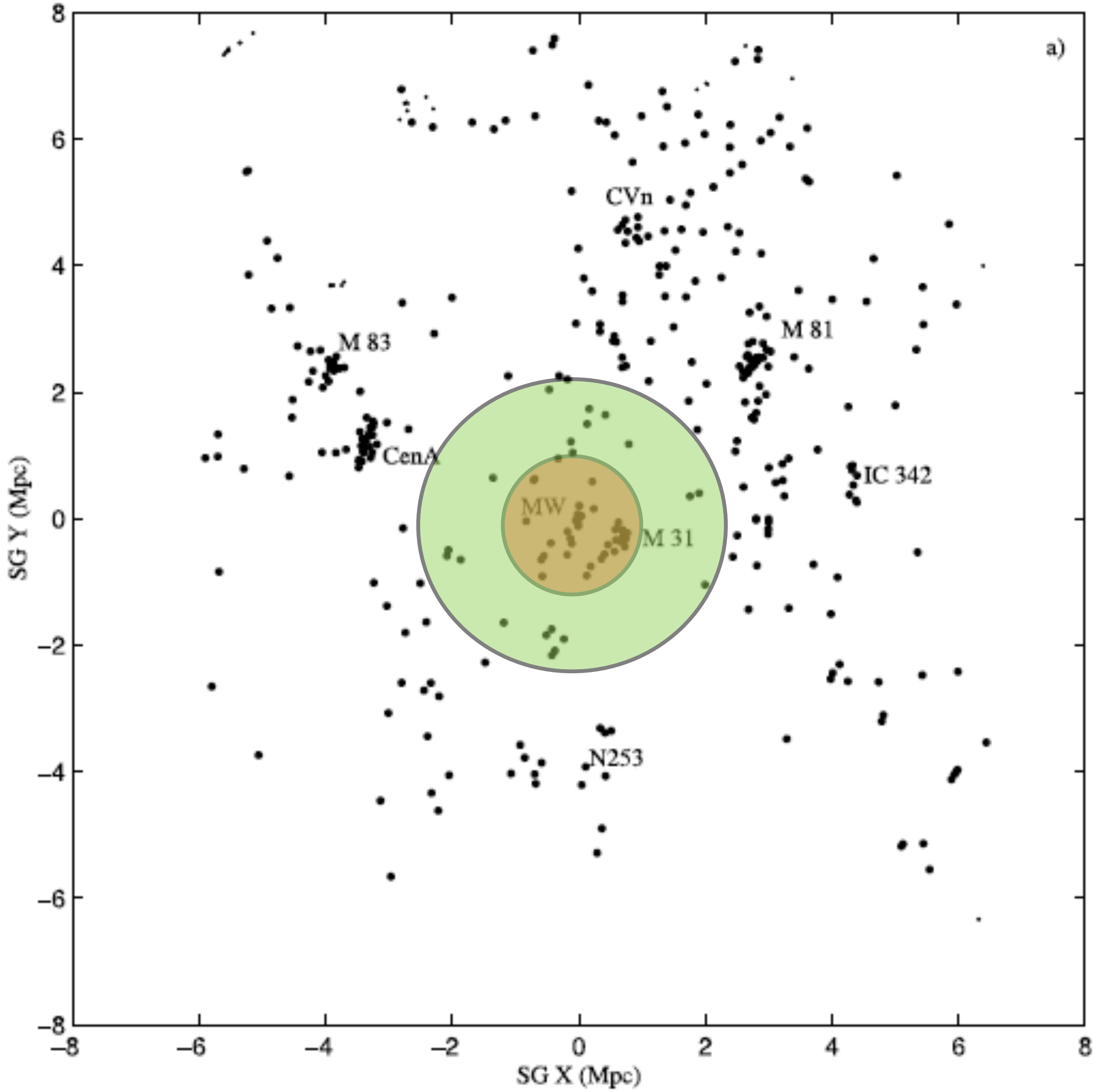

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HB detected out to ~ 2.5 Mpc

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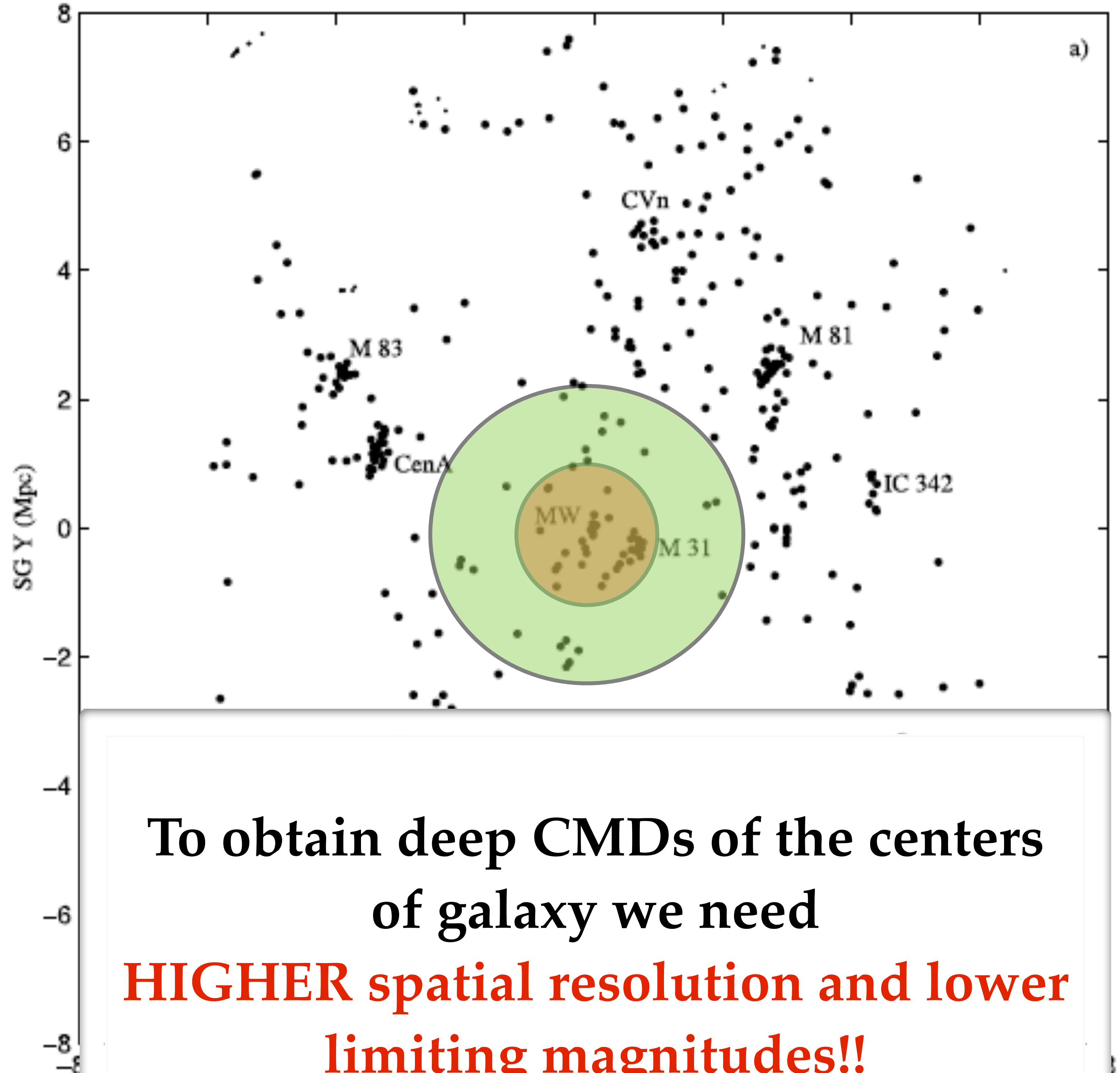


To obtain deep CMDs of the centers of galaxy we need
HIGHER spatial resolution and lower limiting magnitudes!!

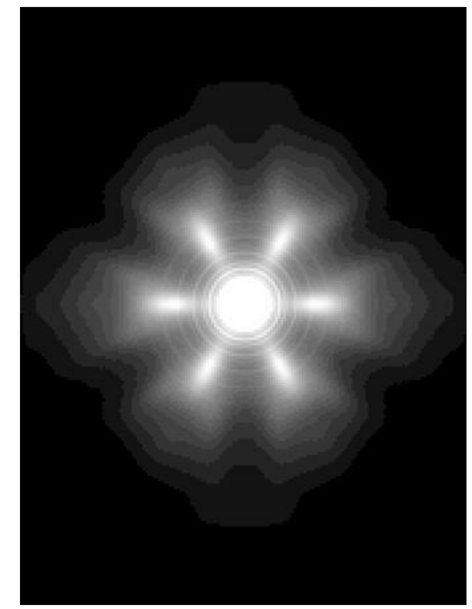
1 Mpc:
MS Toff detection and low-res spectroscopy

HB detected out to ~ 2.5 Mpc

Date 28-02-2013, Munich

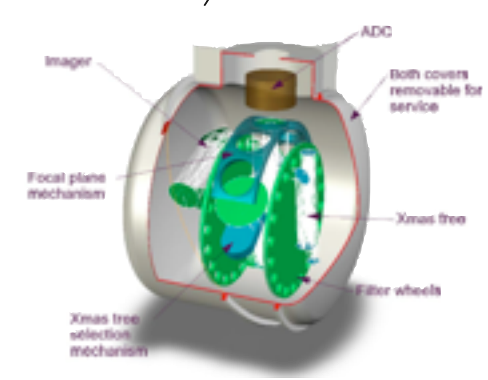
E-ELT cam simulations

PSFs from MAORY (Diolaiti et al. 2009)



Pixel scale=3mas
FOV = 53"x53"

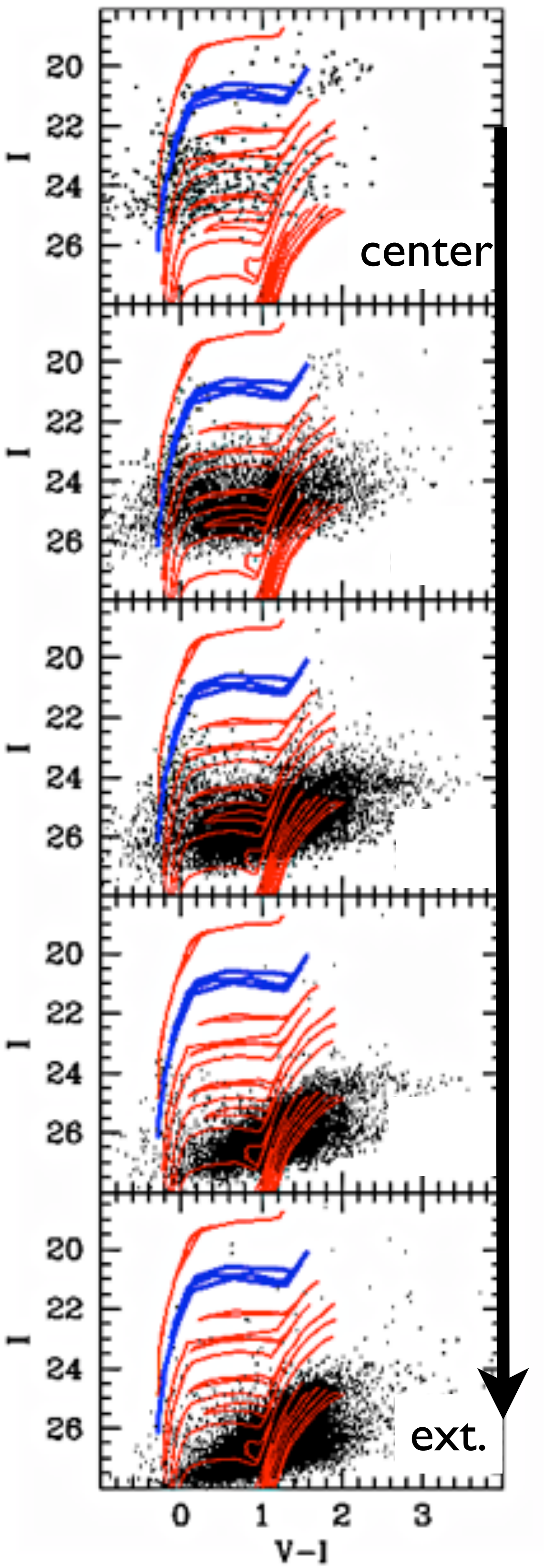
from MICADO (Davies et al. 2009)



Date 28-02-2013, Munich

Simulation inputs

Annibali et al. 2003, 2009



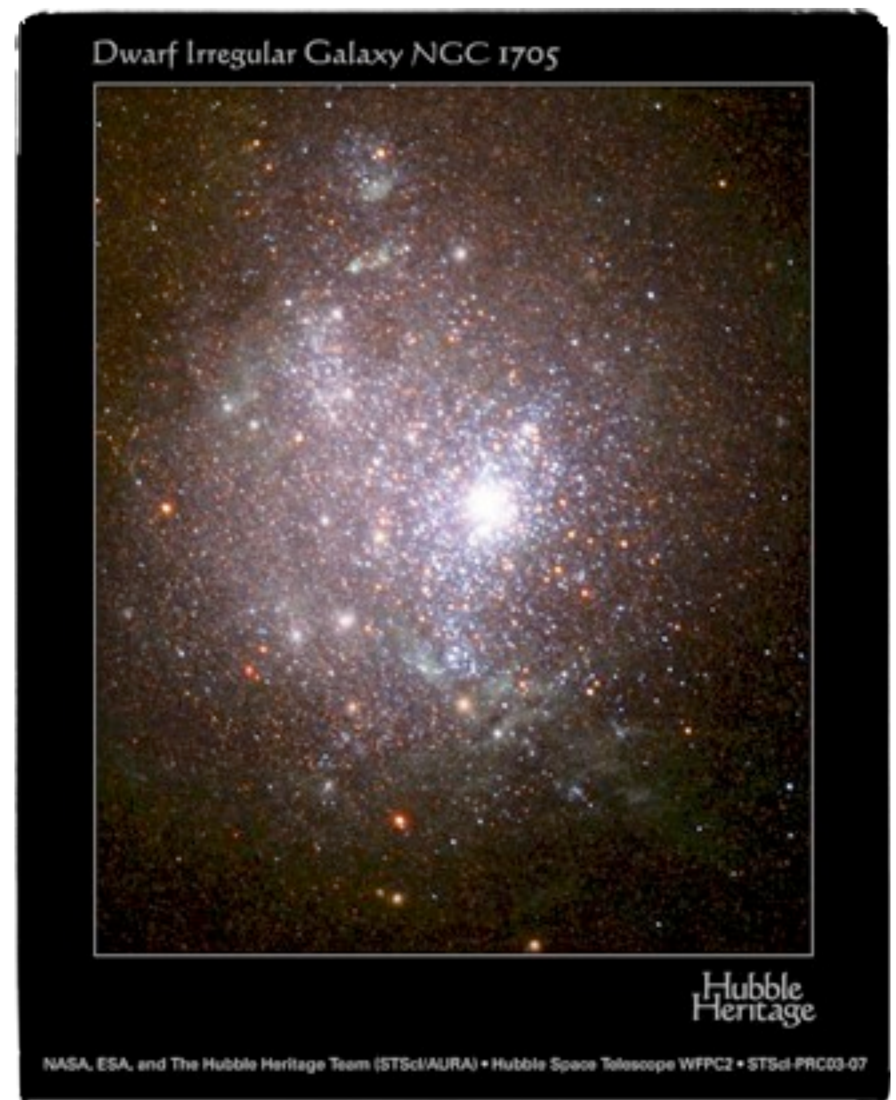
New MAORY PSF can be downloaded from the http://www.bo.astro.it/maory/Maory/Welcome.html). We use only the central structure of the PSFs and we choose a seeing of 0.6 arcsec.

E-ELT with D=39.3m. We have simulated images using the current value for the collecting area: 1016 m^2, according to the E-ELT construction proposal , i.e. 798 hexagons with a side t=0.7 m.

The SKY_I,J,H,K = 19.7,16.5,14.4,13.5 mag/$arcsec^2$. Thus, we are not accounting for the instrumental thermal background.

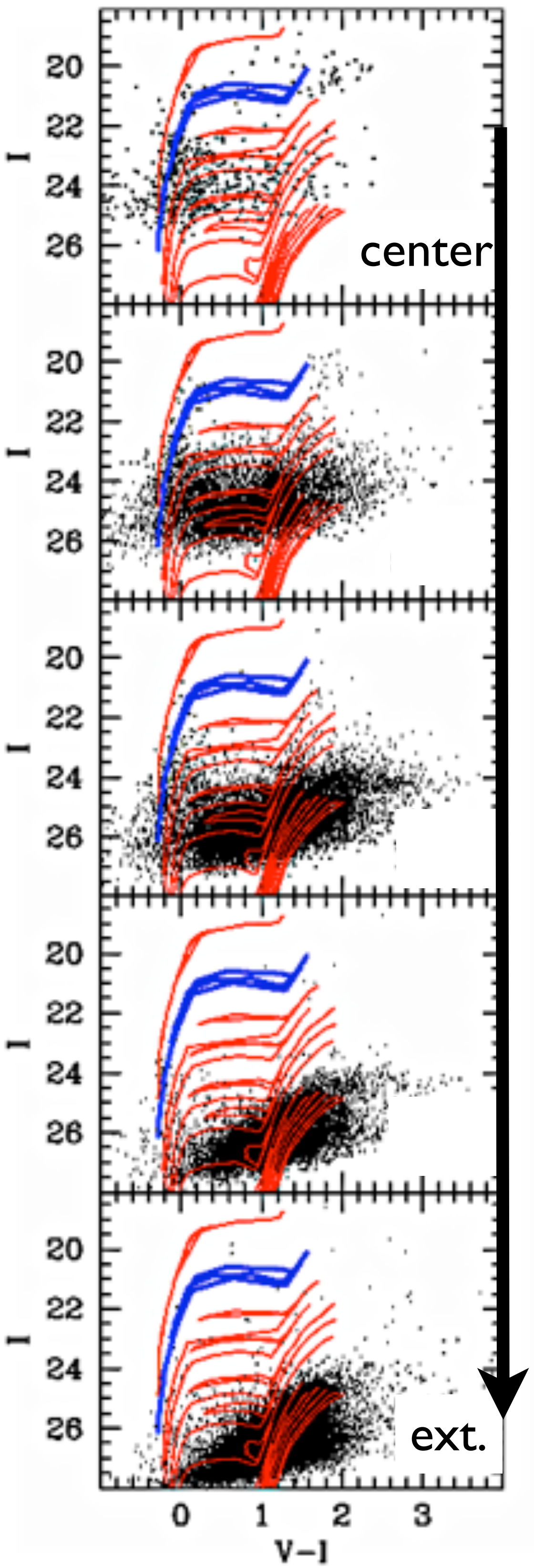
FOV=9"x9", $EXPTIME_{TOT}$= 3600 sec divided according to the ESO E-ELT ETC. I-band: N_{EXP}=40 EXPTIME=90 sec; JHK-band: N_{EXP}=60 EXPTIME=60 sec.

The enclosed energies for IJHKs bands are EE=7.8%, 21.2%, 32.3% and 43.9%, respectively, assuming a box of 12 mas (reference area).



Simulation inputs

Annibali et al. 2003, 2009



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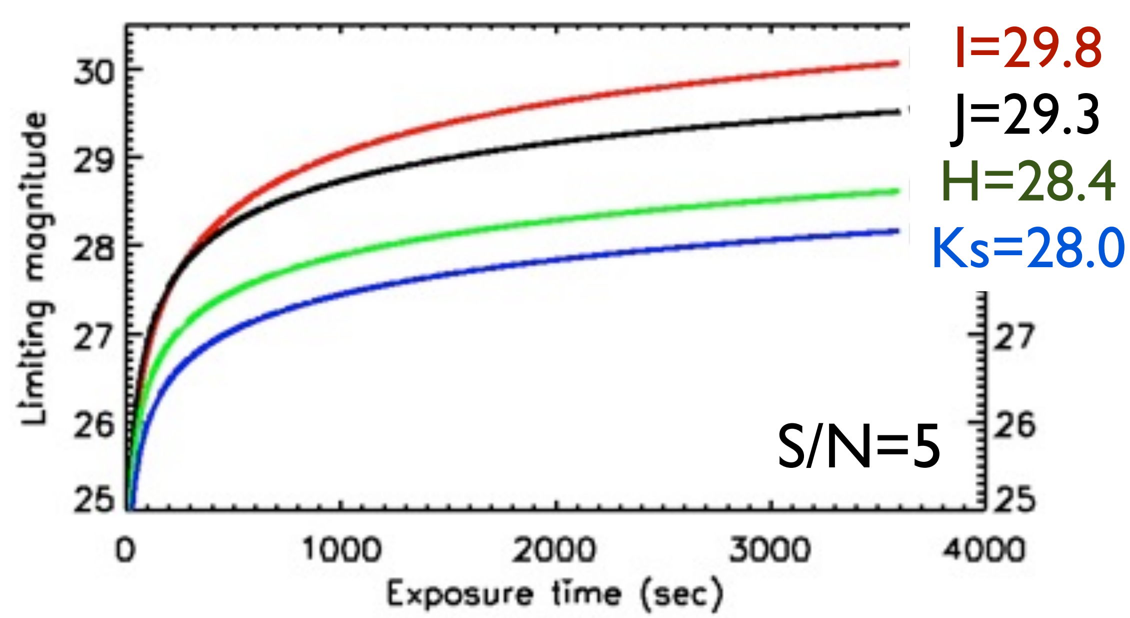

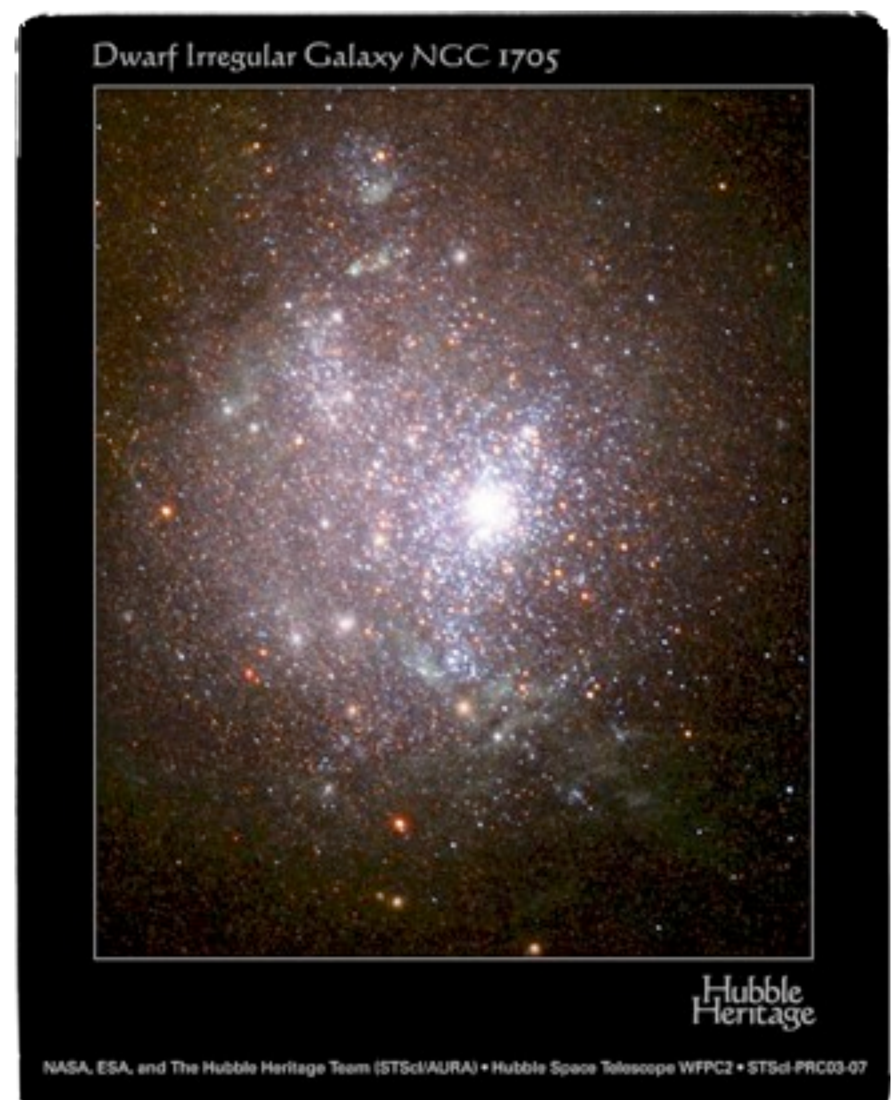

Date 28-02-2013, Munich

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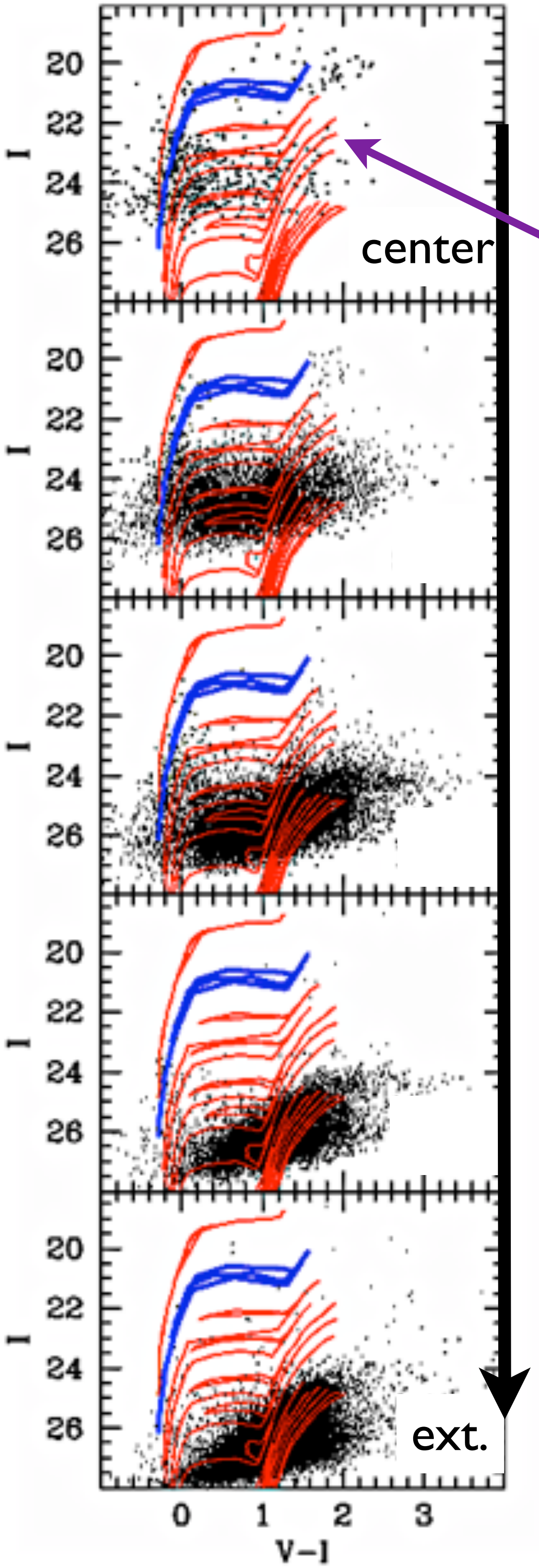
Annibali et al. 2003, 2009



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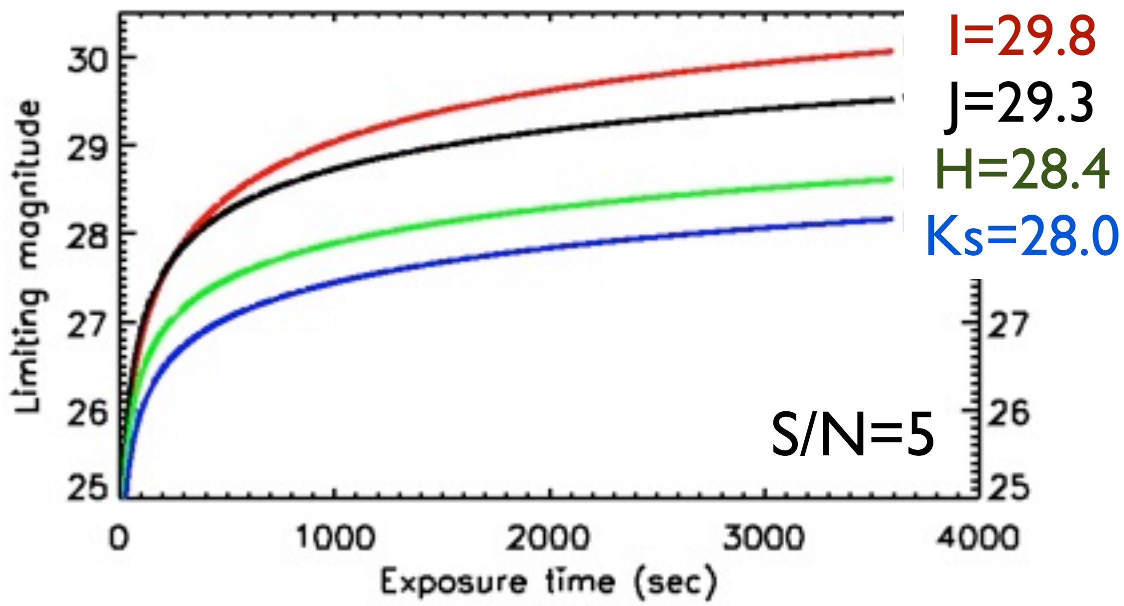

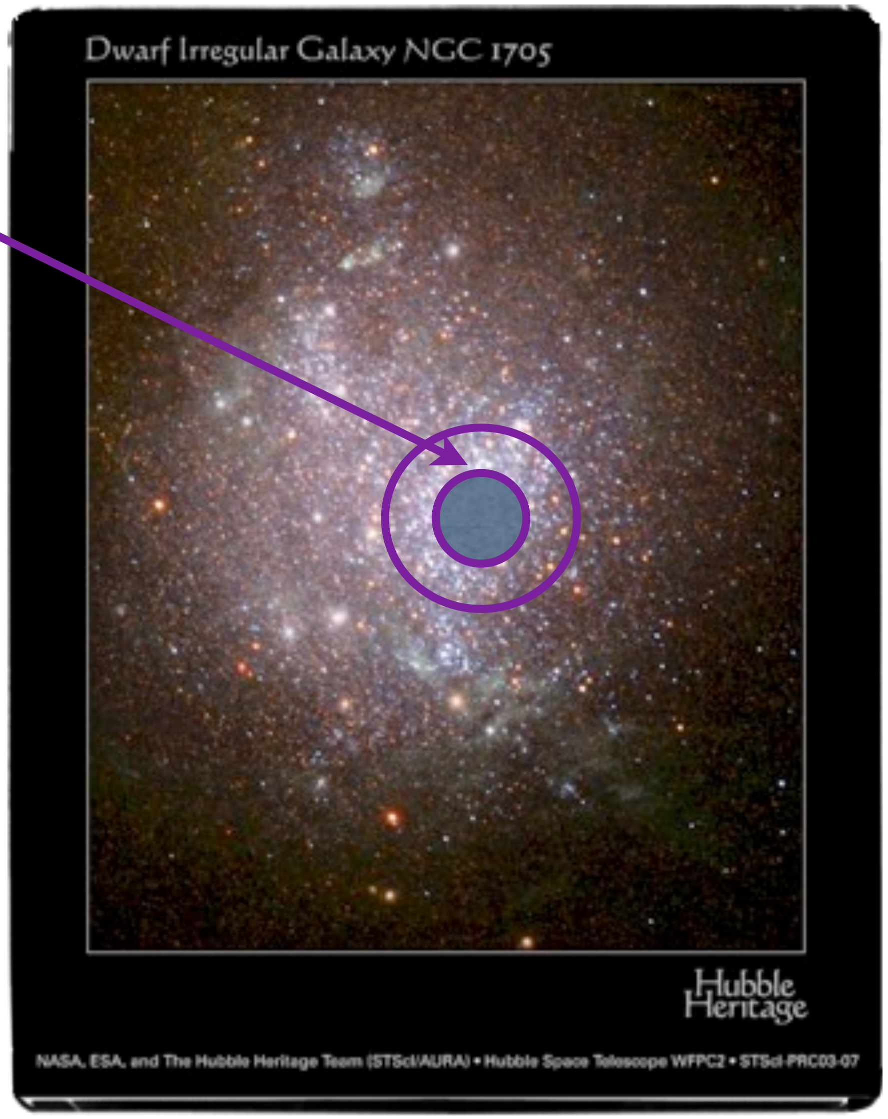

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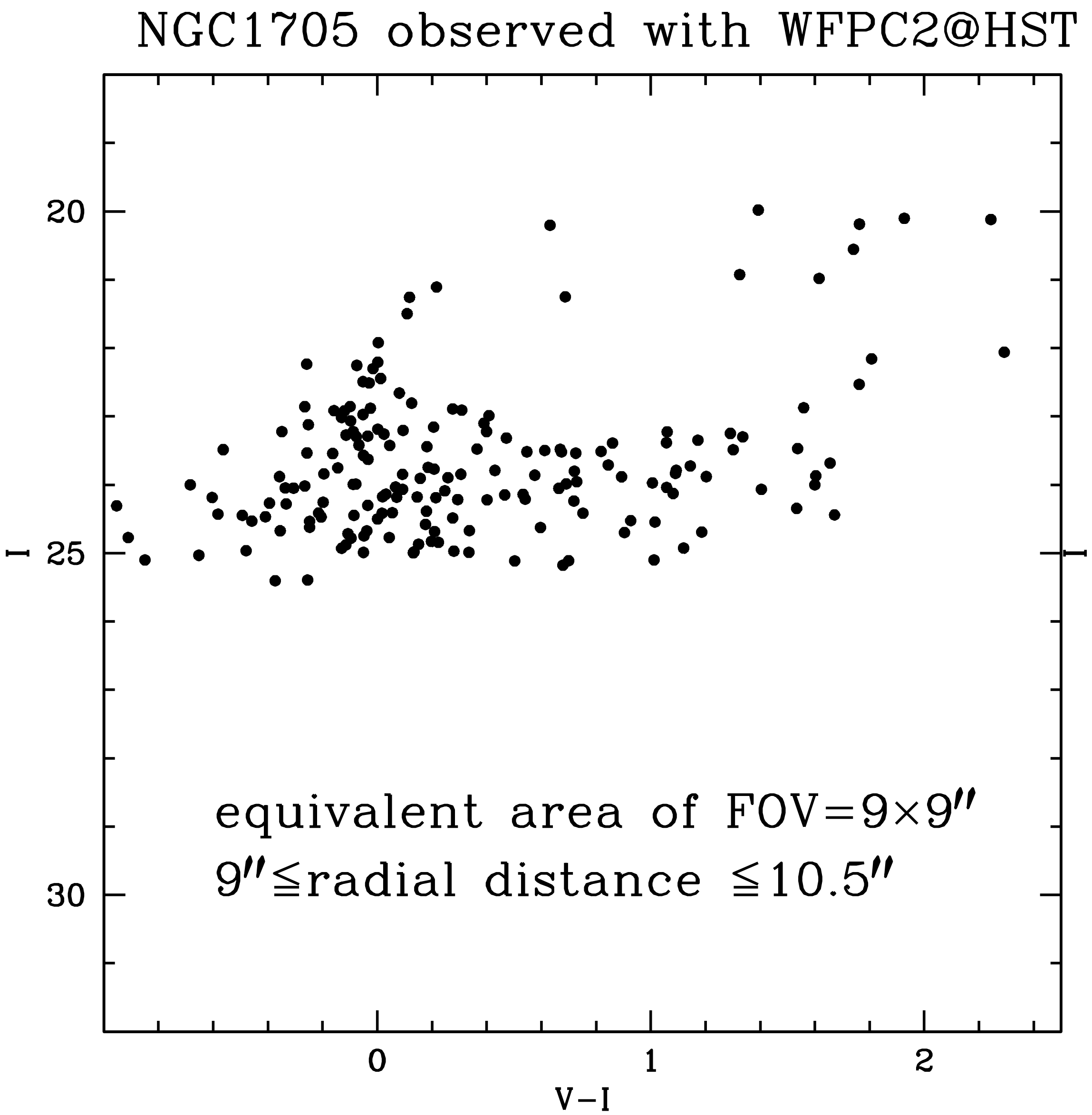
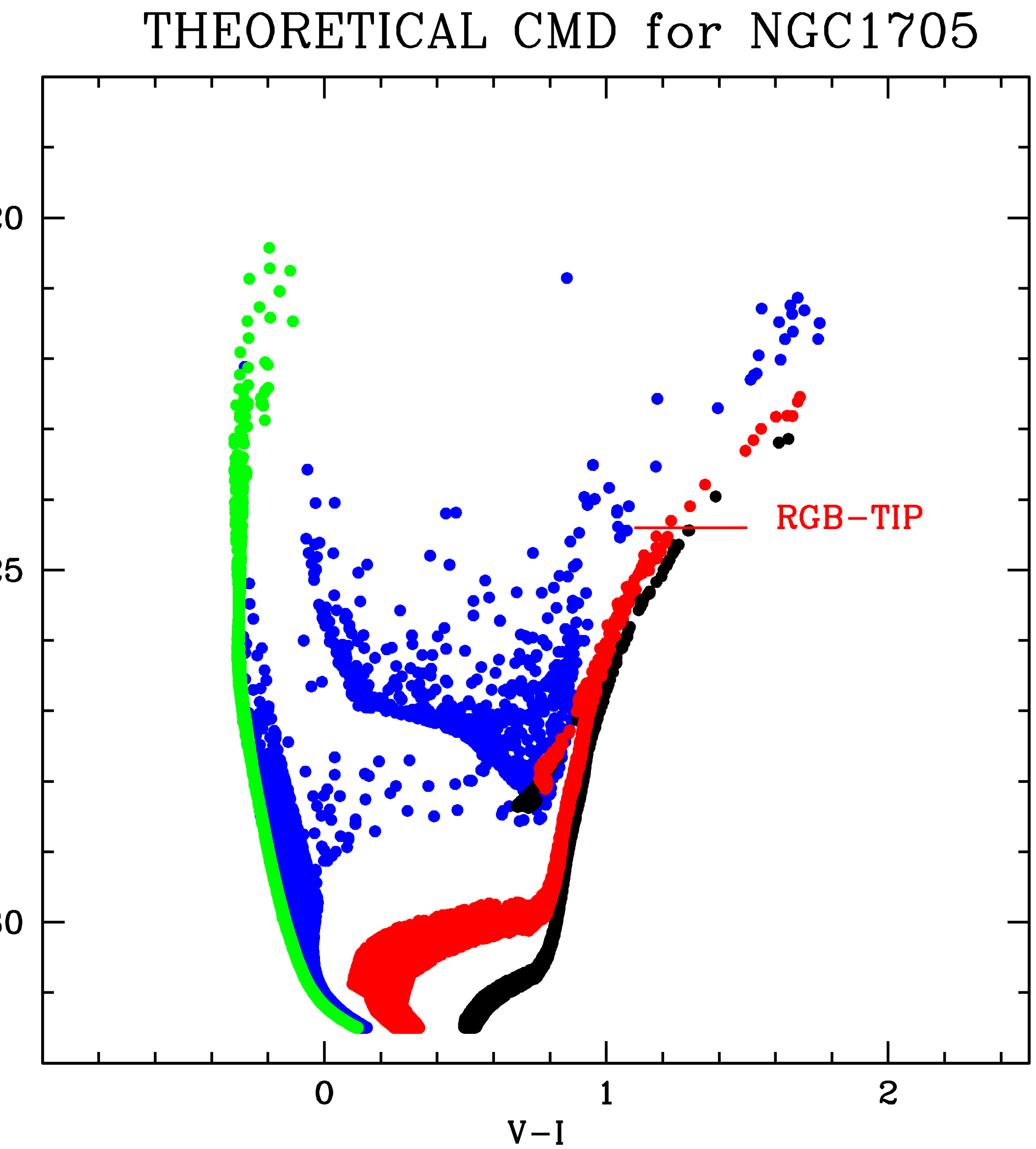
Stellar population

The synthetic stellar population has been derived using IACstar code (Aparicio et al. 2004) based on information from real data.





Z=0.0004

age ≤ 10Myr

age ≤ 500Myr

age ~ 3-5 Gyr

age ~ 12 Gyr

d(from the center) ~ 10” → μ_V ~ 21 mag/arcsec^2

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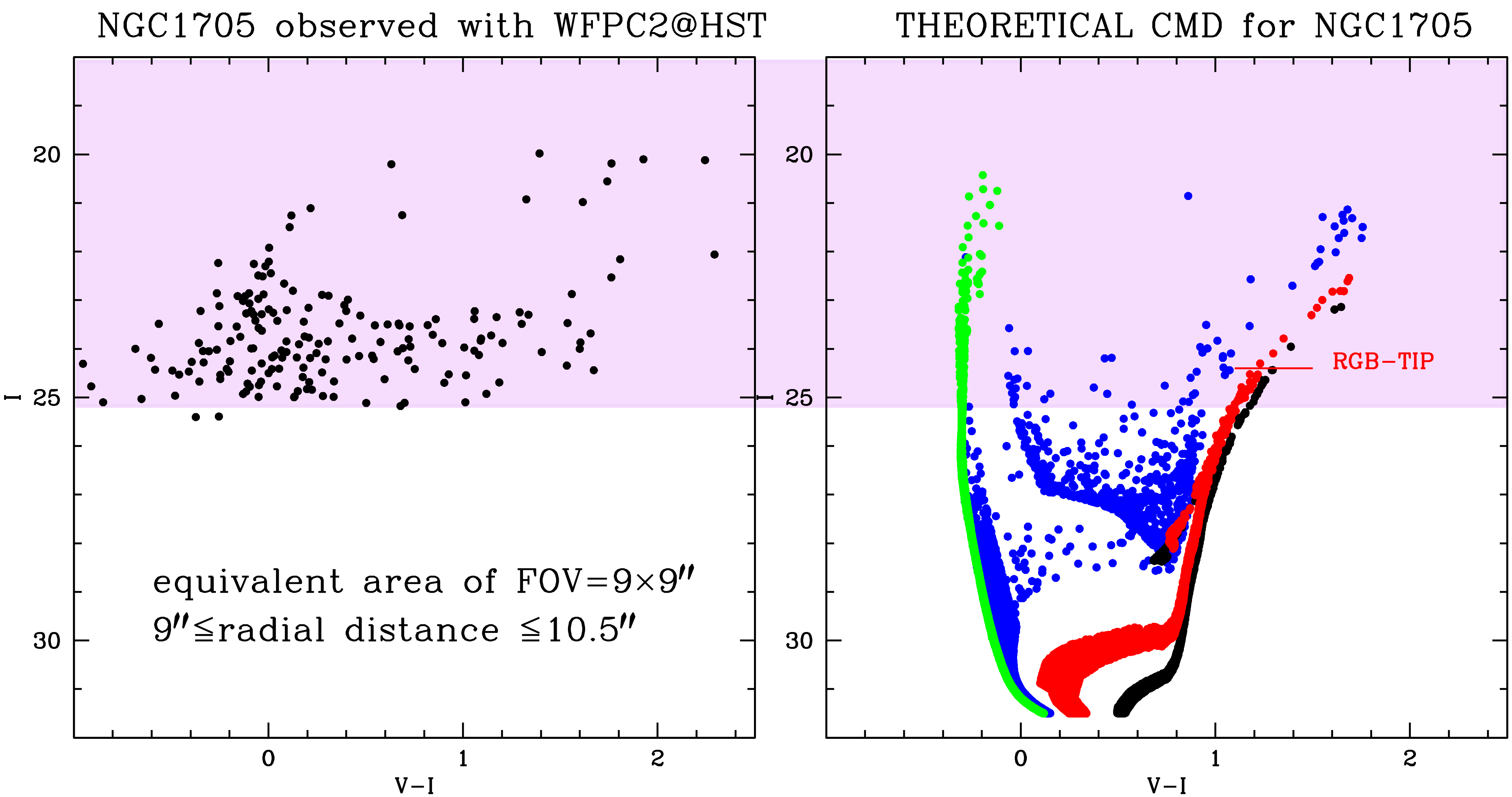

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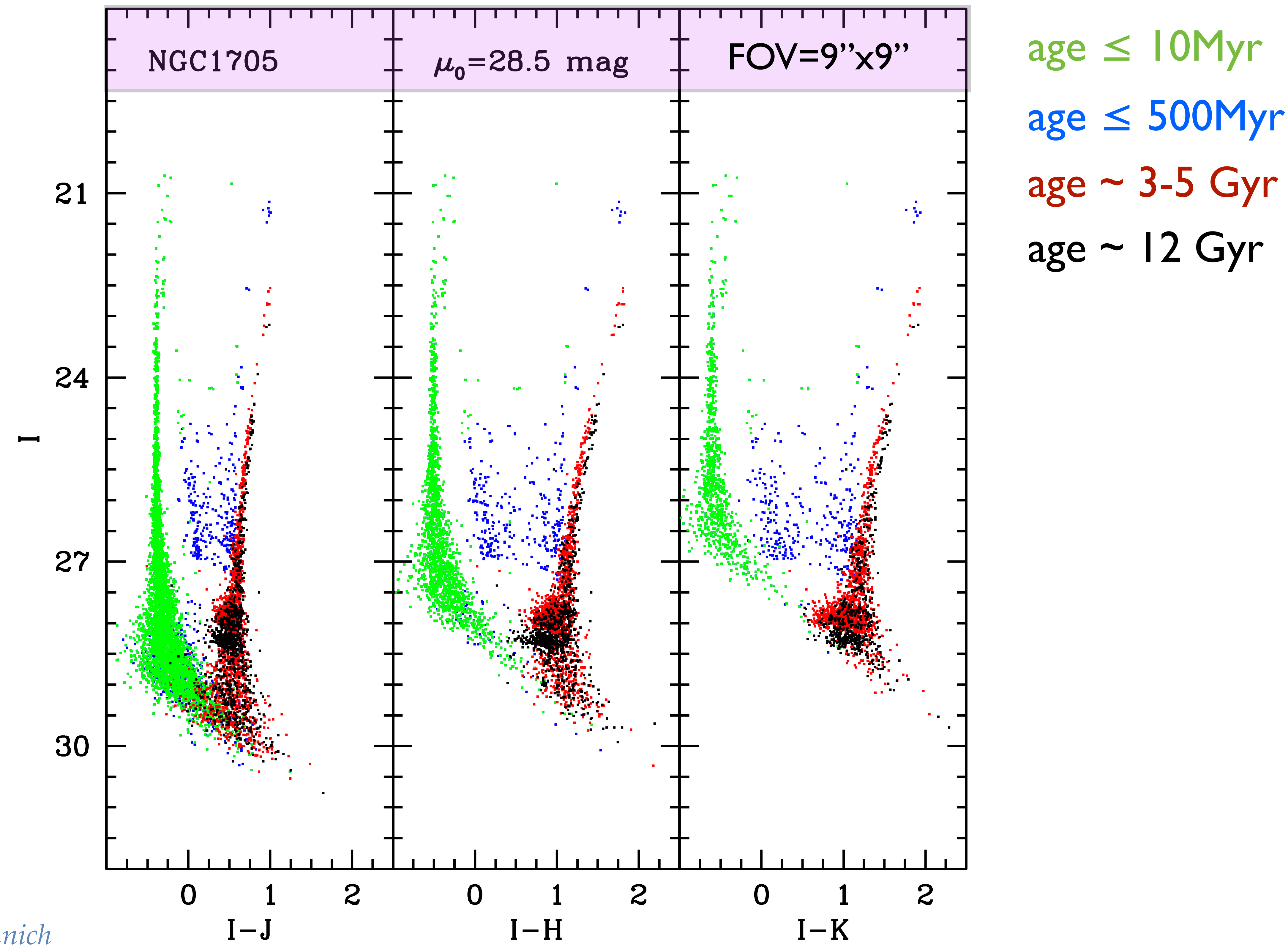
Date 28-02-2013, Munich

NGC1705 CMDs

CMD Extracted from Starfinder (Diolaiti et al. 2000)



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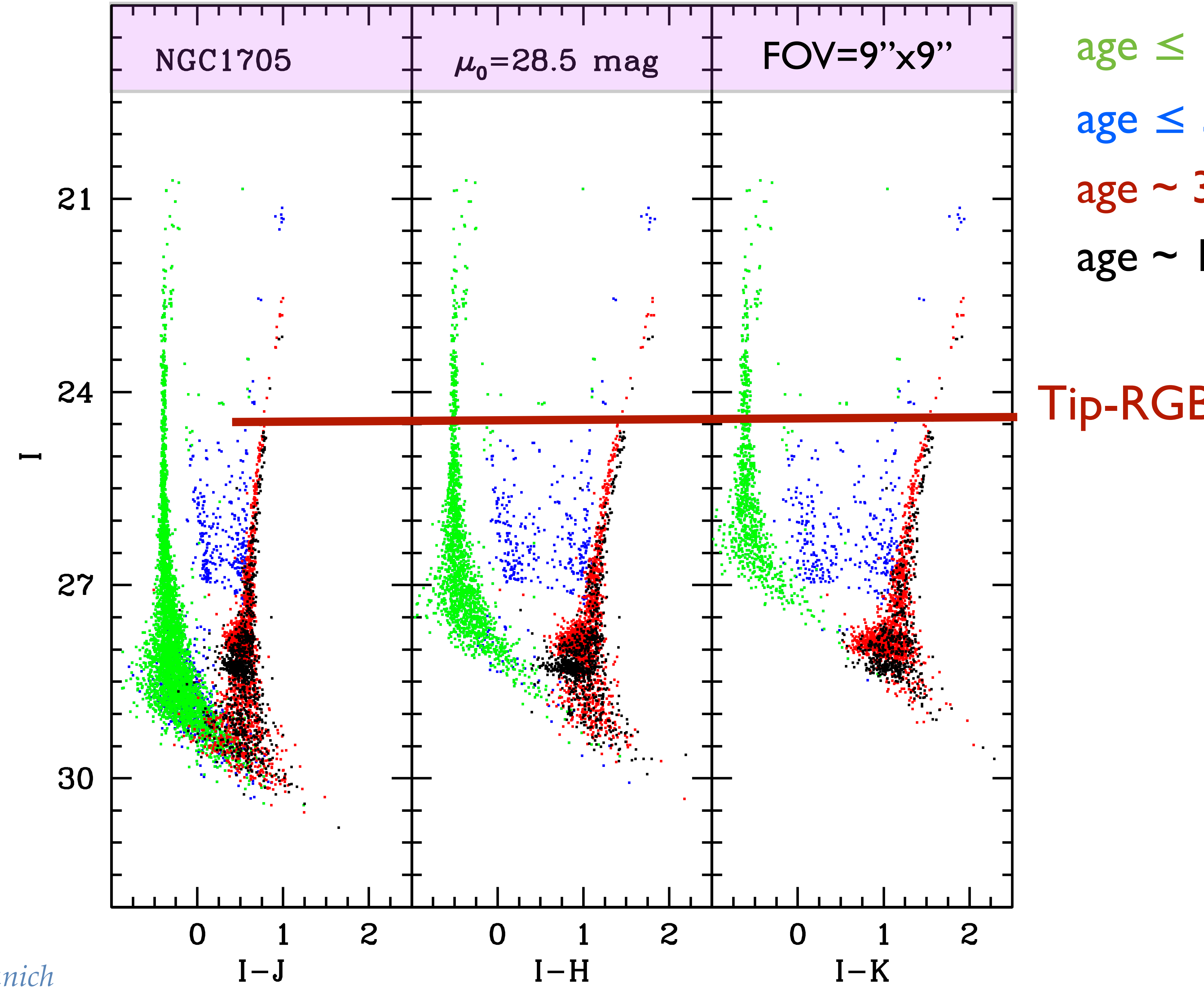

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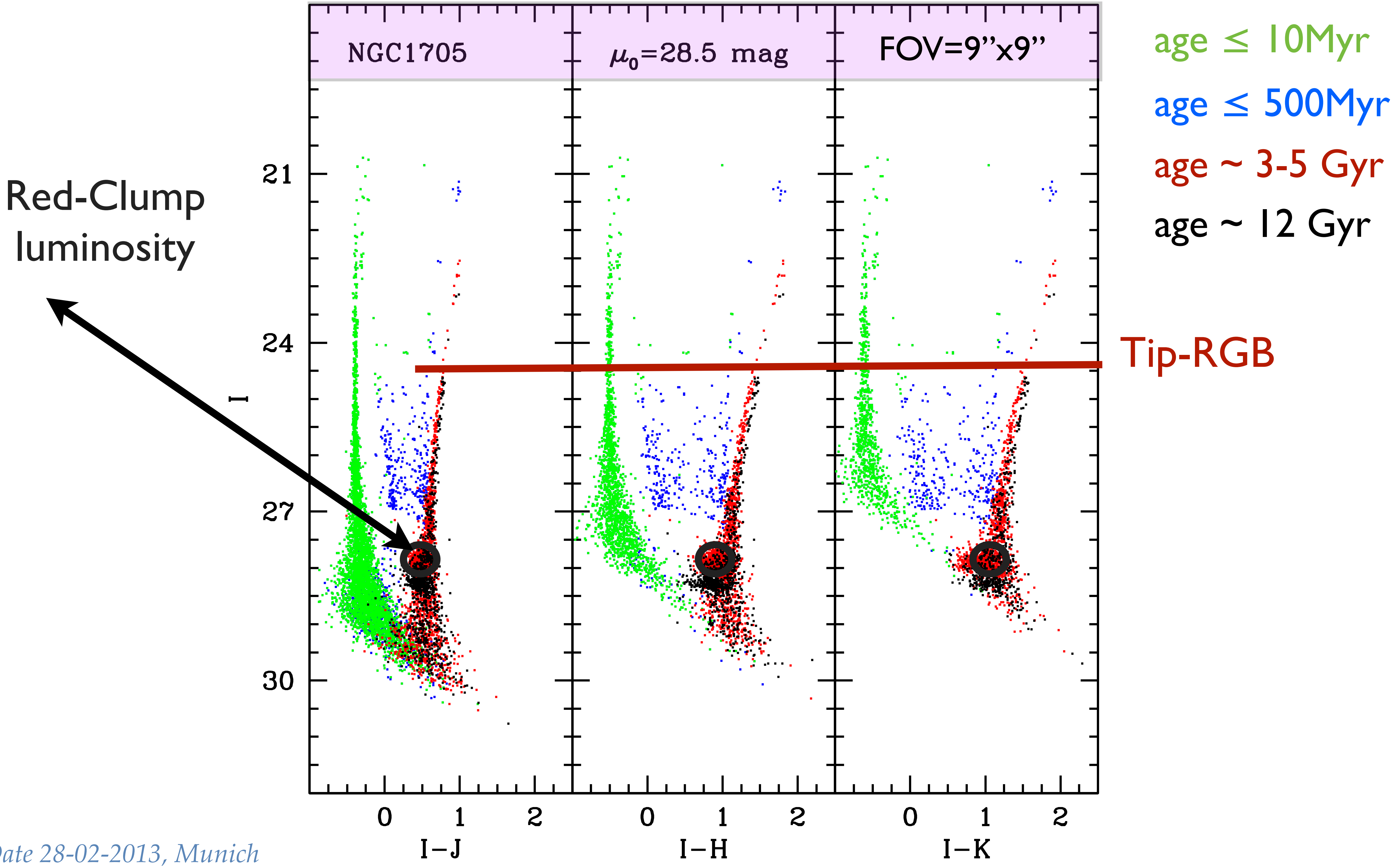
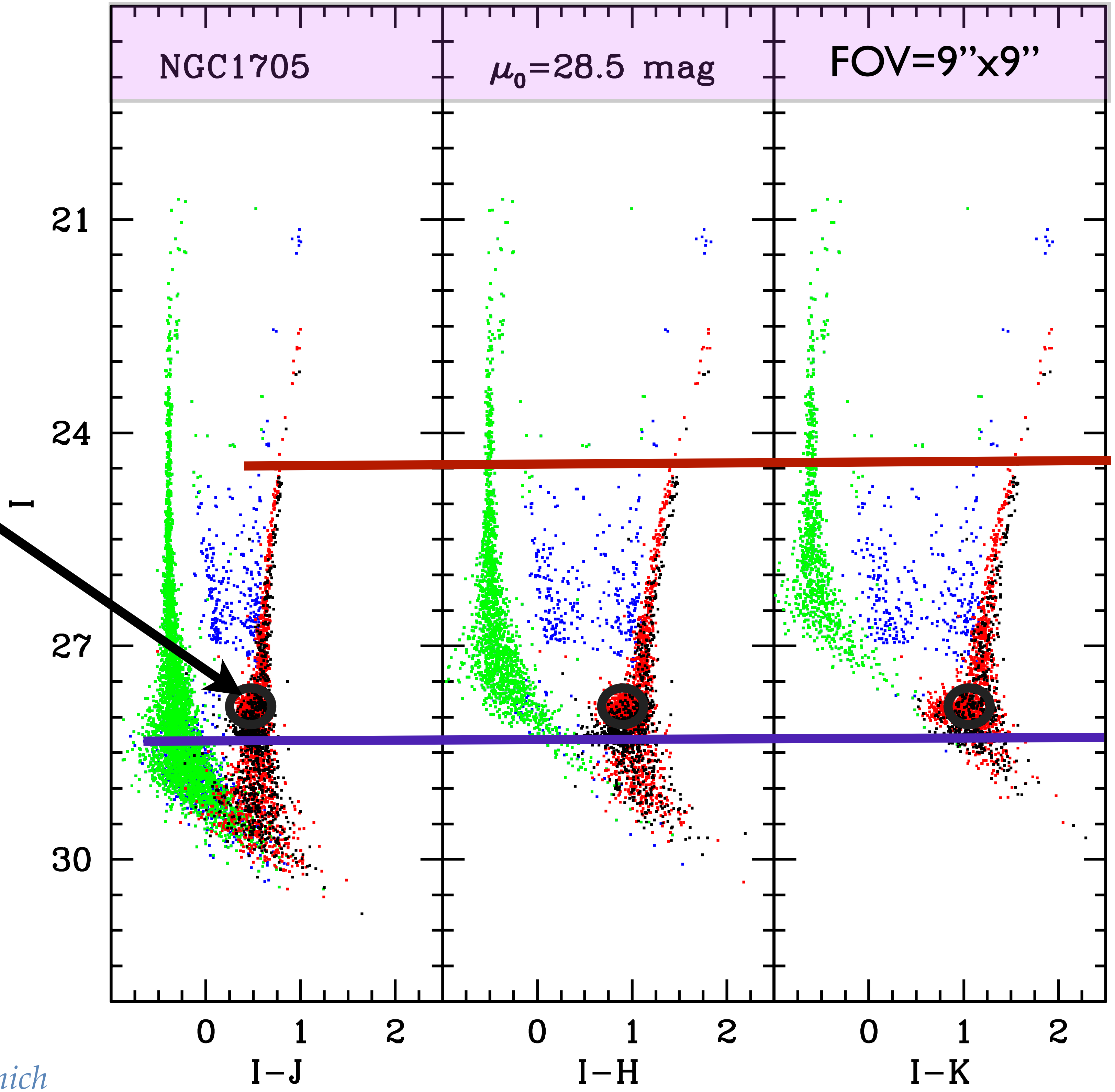


Date 28-02-2013, Munich

NGC1705 CMDs

CMD Extracted from Starfinder (Diolaiti et al. 2000)

Red-Clump luminosity



age ≤ 10Myr

age ≤ 500Myr

age ~ 3-5 Gyr

age ~ 12 Gyr

Tip-RGB

HB luminosity

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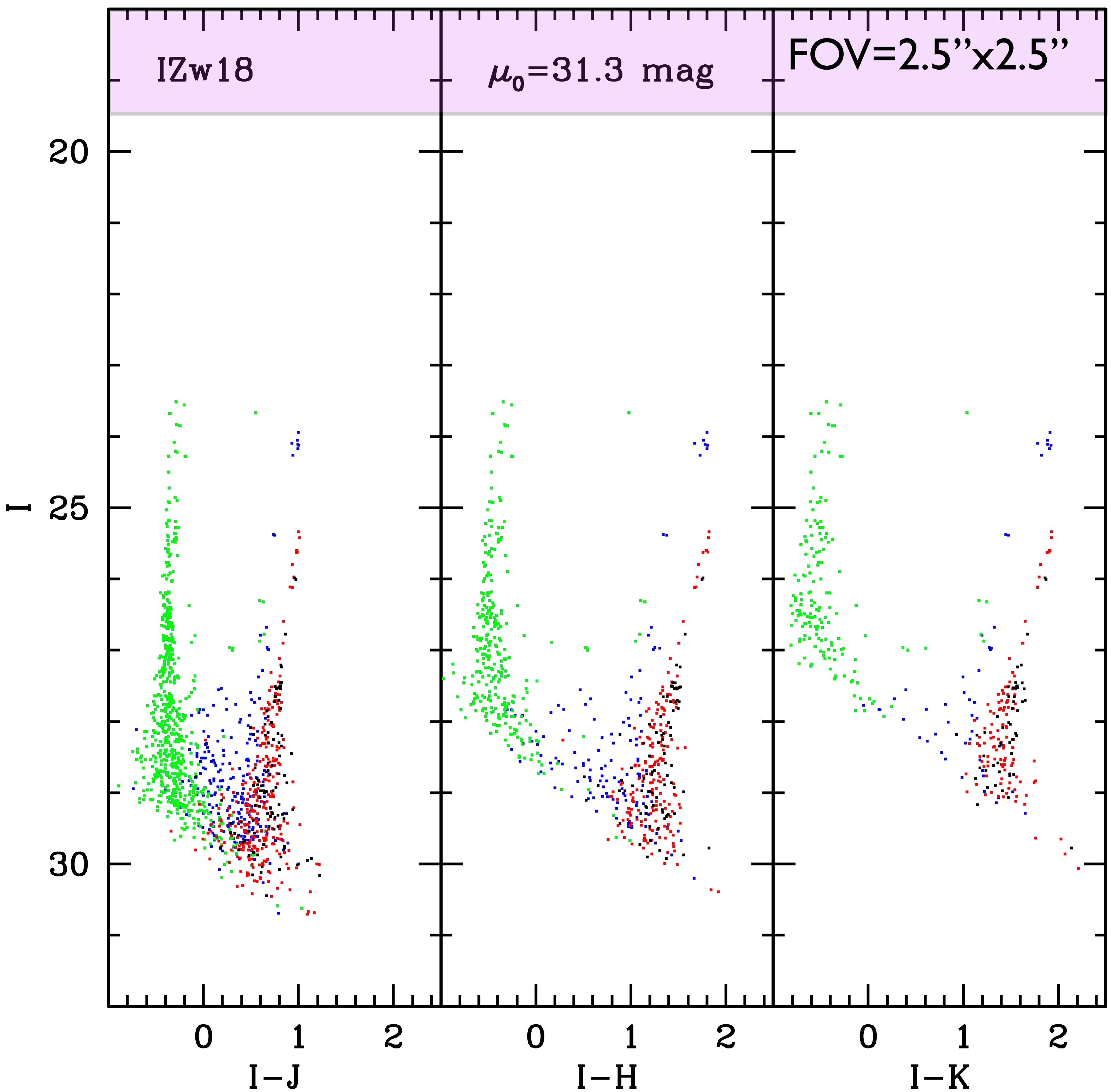
IZw18 CMDs

CMD Extracted from Starfinder (Diolaiti et al. 2000)



age ≤ 10Myr

age ≤ 500Myr

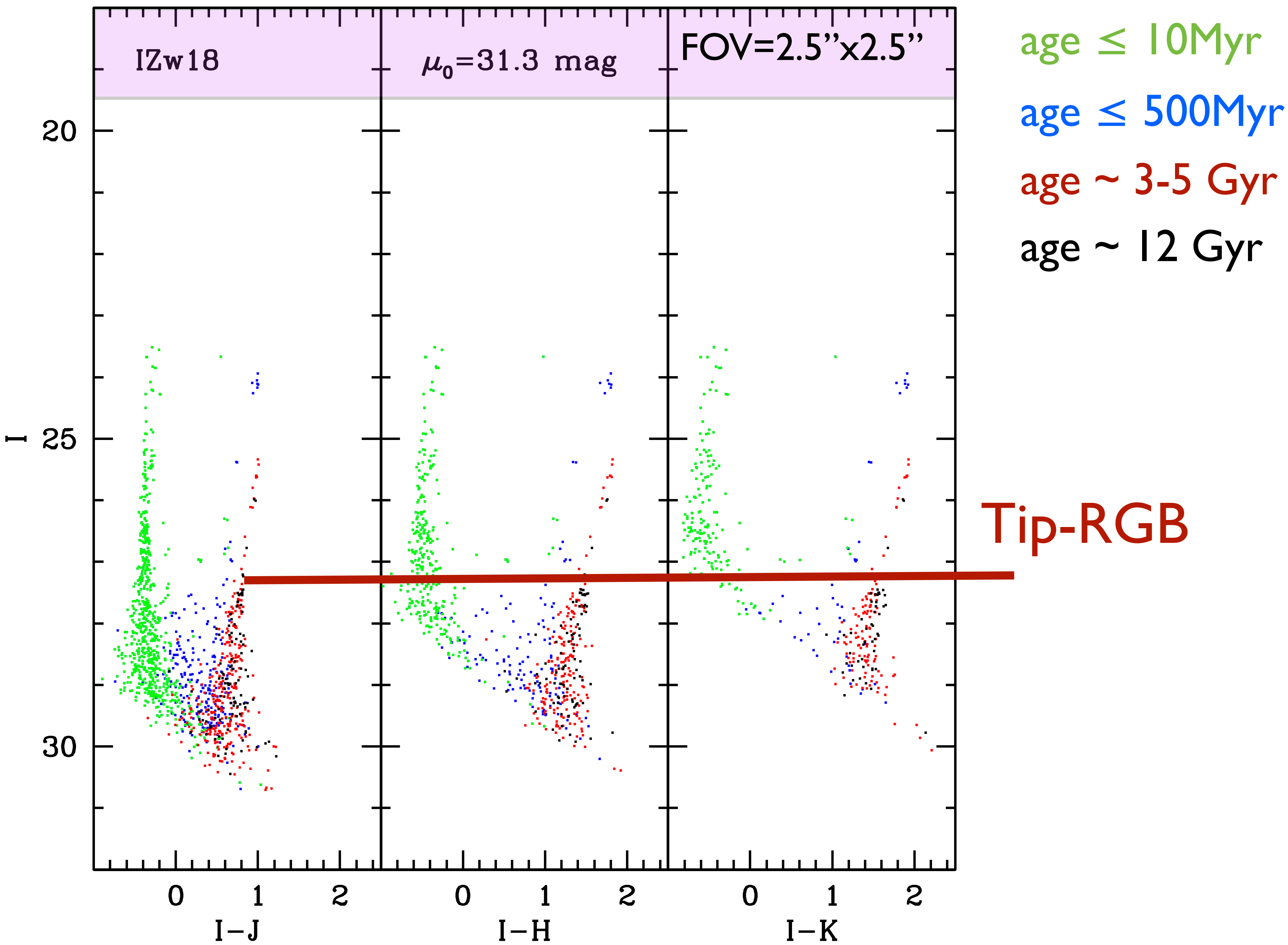
age ~ 3-5 Gyr

age ~ 12 Gyr

Date 28-02-2013, Munich

IZw18 CMDs

CMD Extracted from Starfinder (Diolaiti et al. 2000)



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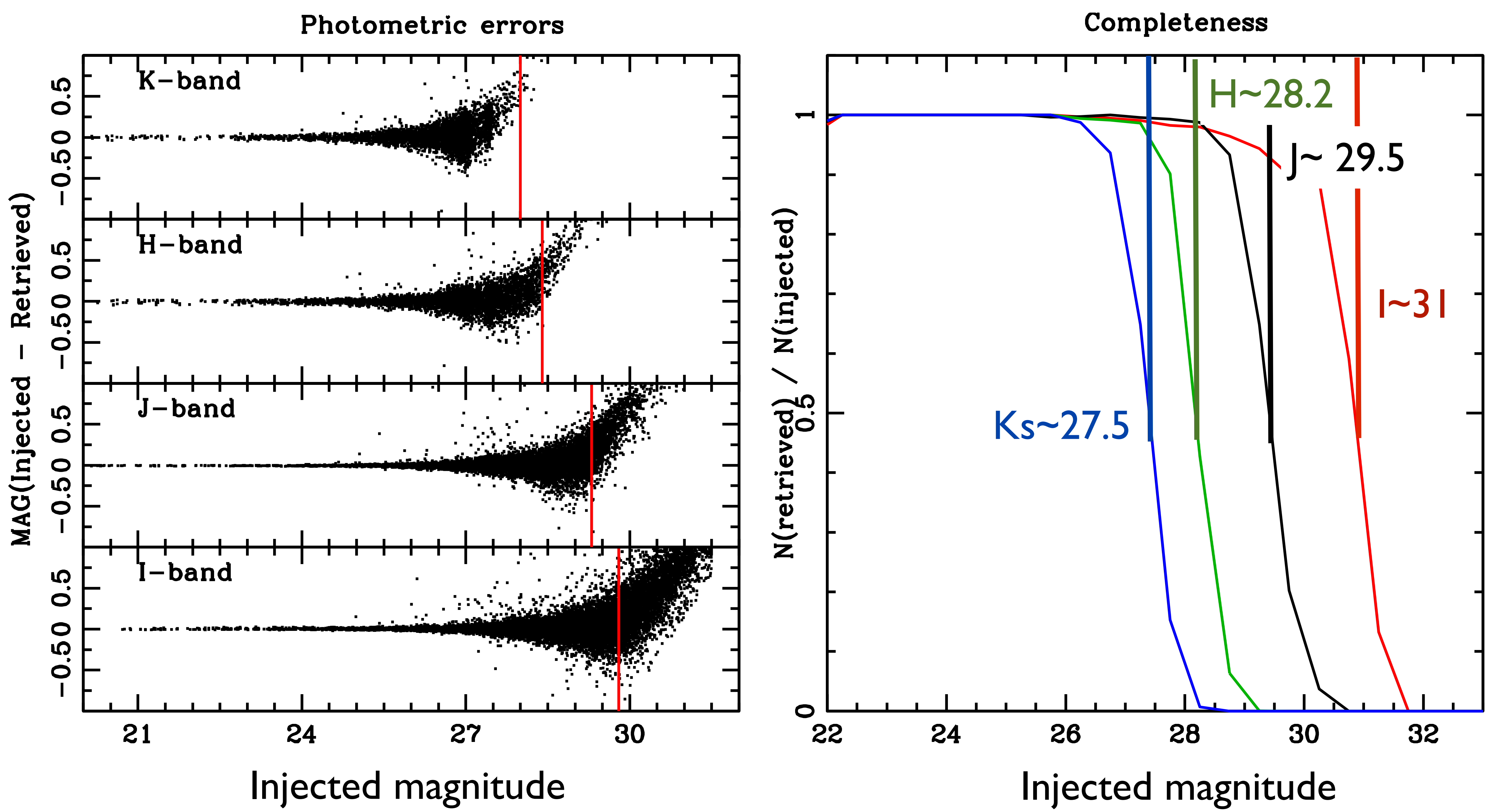
Phot. Errors & Completeness

NGC1705 => μ_0=28.5 mag

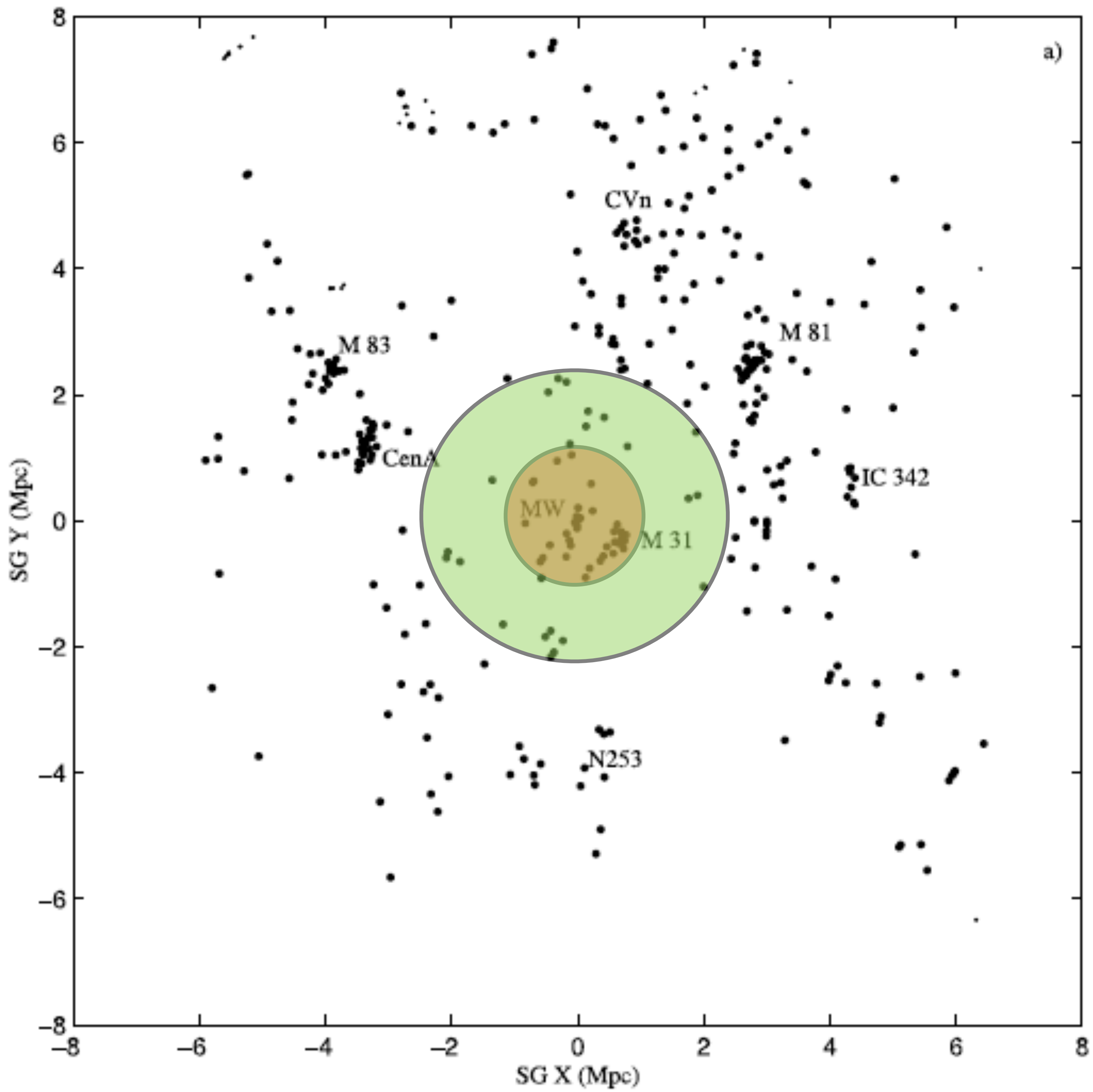


in I band => many false detections!!

Date 28-02-2013, Munich

E-ELT view of our Local Universe

Karachentsev et al. 2004



<u>HST-view</u>

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MS Toff detection and low-res spectroscopy

HB detected out to ~ 2.5 Mpc

Date 28-02-2013, Munich

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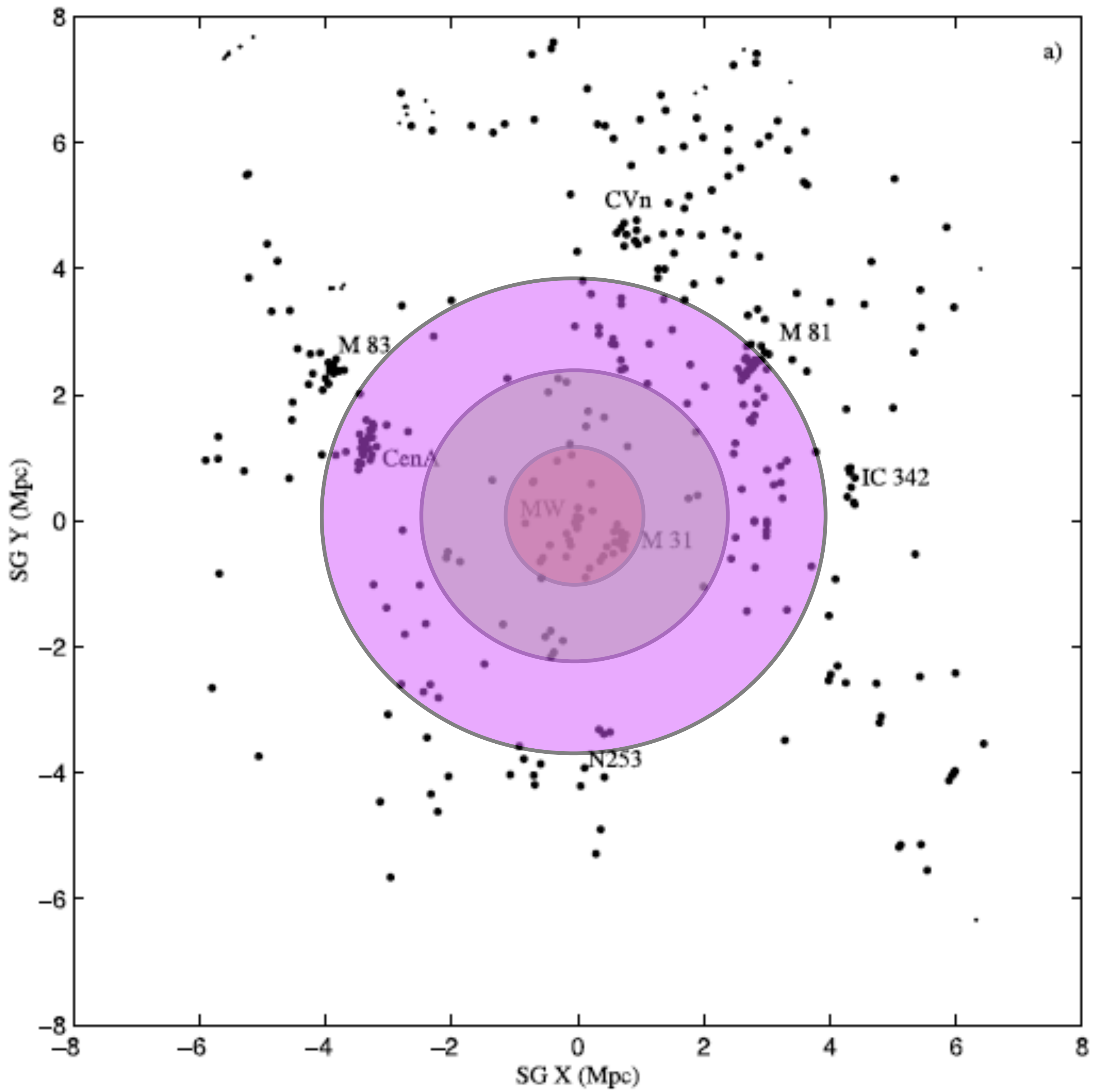
Karachentsev et al. 2004



HST-view

1 Mpc:

MS Toff detection and low-res spectroscopy

HB detected out to ~ 2.5 Mpc

E-ELT-view

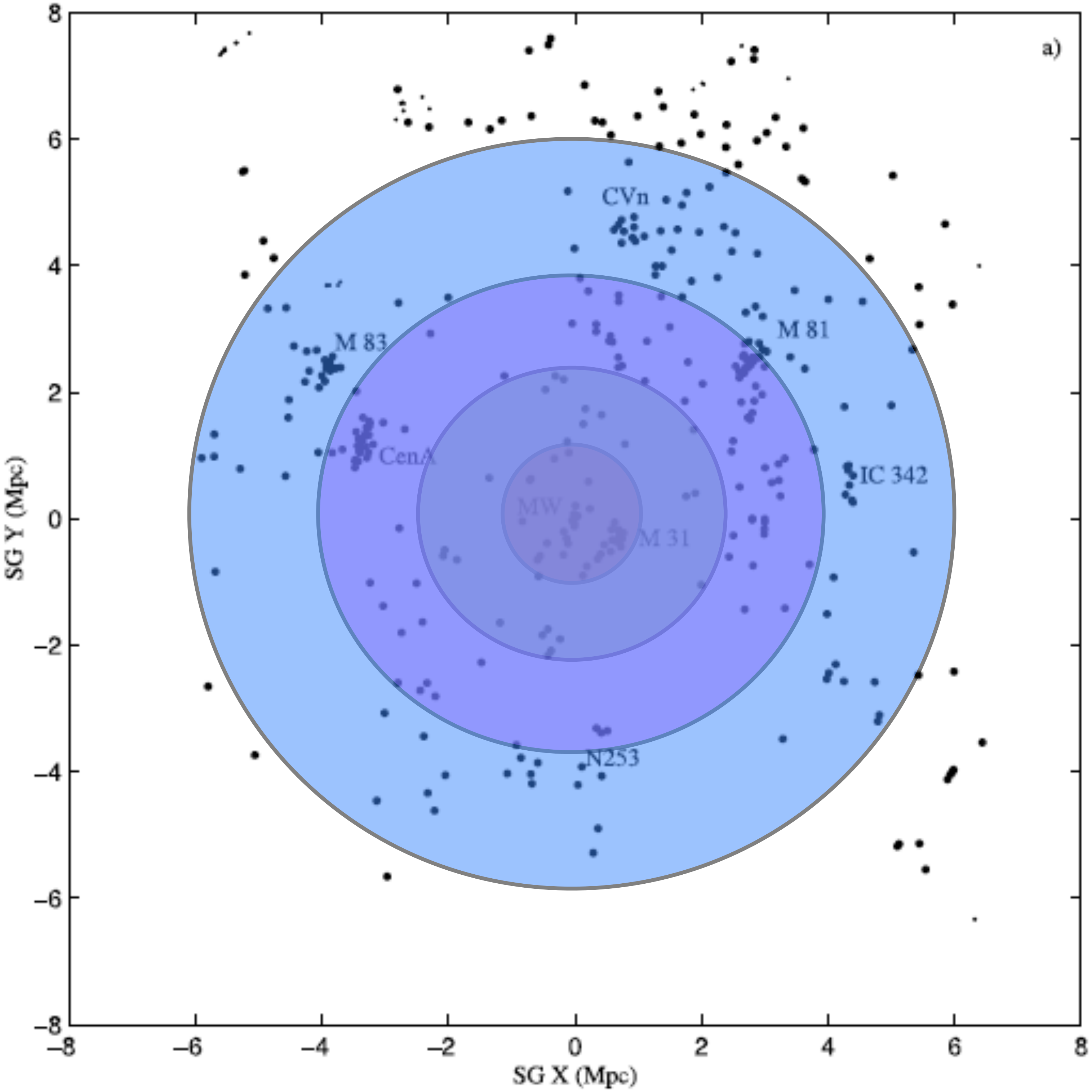
4 Mpc:

MS Toff detection and low-res spectroscopy

Date 28-02-2013, Munich

E-ELT view of our Local Universe

Karachentsev et al. 2004



HST-view
1 Mpc:
MS Toff detection and
low-res spectroscopy

HB detected
out to ~ 2.5 Mpc

E-ELT-view
4 Mpc:
MS Toff detection and
low-res spectroscopy

HB detected
out to ~ 6 Mpc

Date 28-02-2013, Munich

Conclusions

The high resolution power provided by E-ELT will allow us to resolve Blue Compact galaxies deep enough to constrain their ancient stellar population in our Local Universe and to understand their evolutionary link, if any, to nearby Irregular and Spheroidal dwarf galaxies.

The photometry of MAORY+MICADO-like images: feasible with the current photometric packages, however, to obtain deeper CMDs we need to push advances in technology AND to improve photometric packages to analyze MCAO data! (see L. Schreiber's poster)

The filter combination to study Blue Compact Galaxies: I-J seems to be fundamental!!

Background influence: H-band seems much more promising than Ks in Resolved Stellar Populations studies; the advances in technology could help!!

looking for the future...

THANKS!

Date 28-02-2013, Munich

Metropolitan Museum of art, NY city

Anish Kapoor. British, born in India, 1954

Untitled, 2007

Stainless steel