

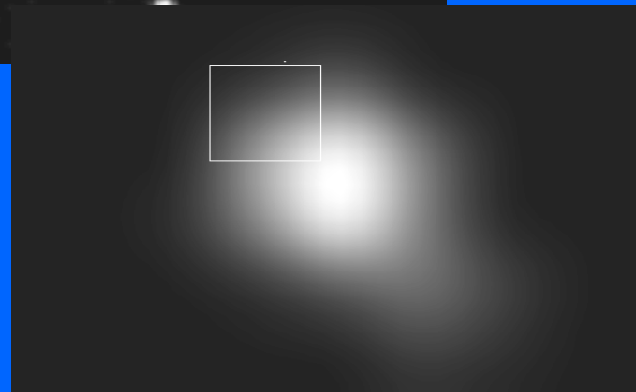
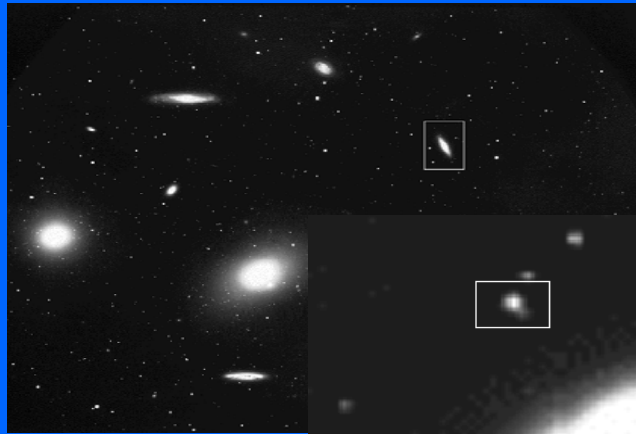
# Simulations of Clusters at Large Distances

**Peter Linde<sup>1</sup> and Arne Ardeberg<sup>2</sup>**

<sup>1</sup>Malmö University/Lund Observatory

<sup>2</sup>Lund Observatory

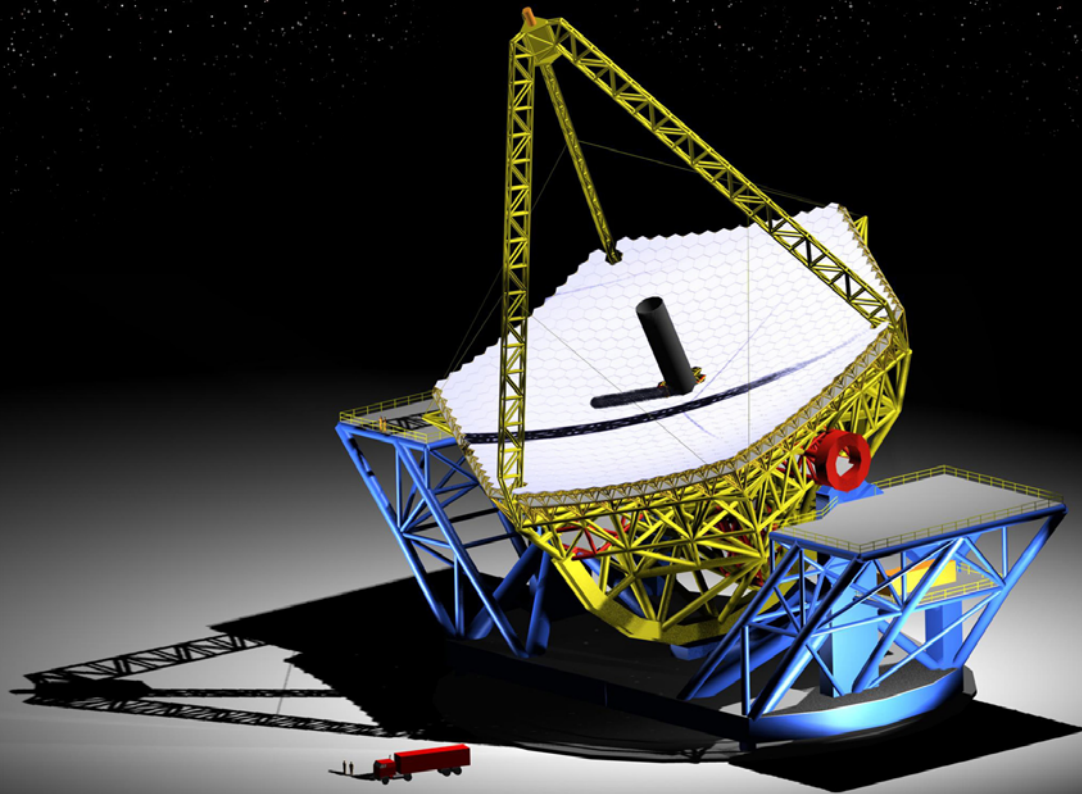
# Scenario: What can we see in distant galaxies with an ELT?



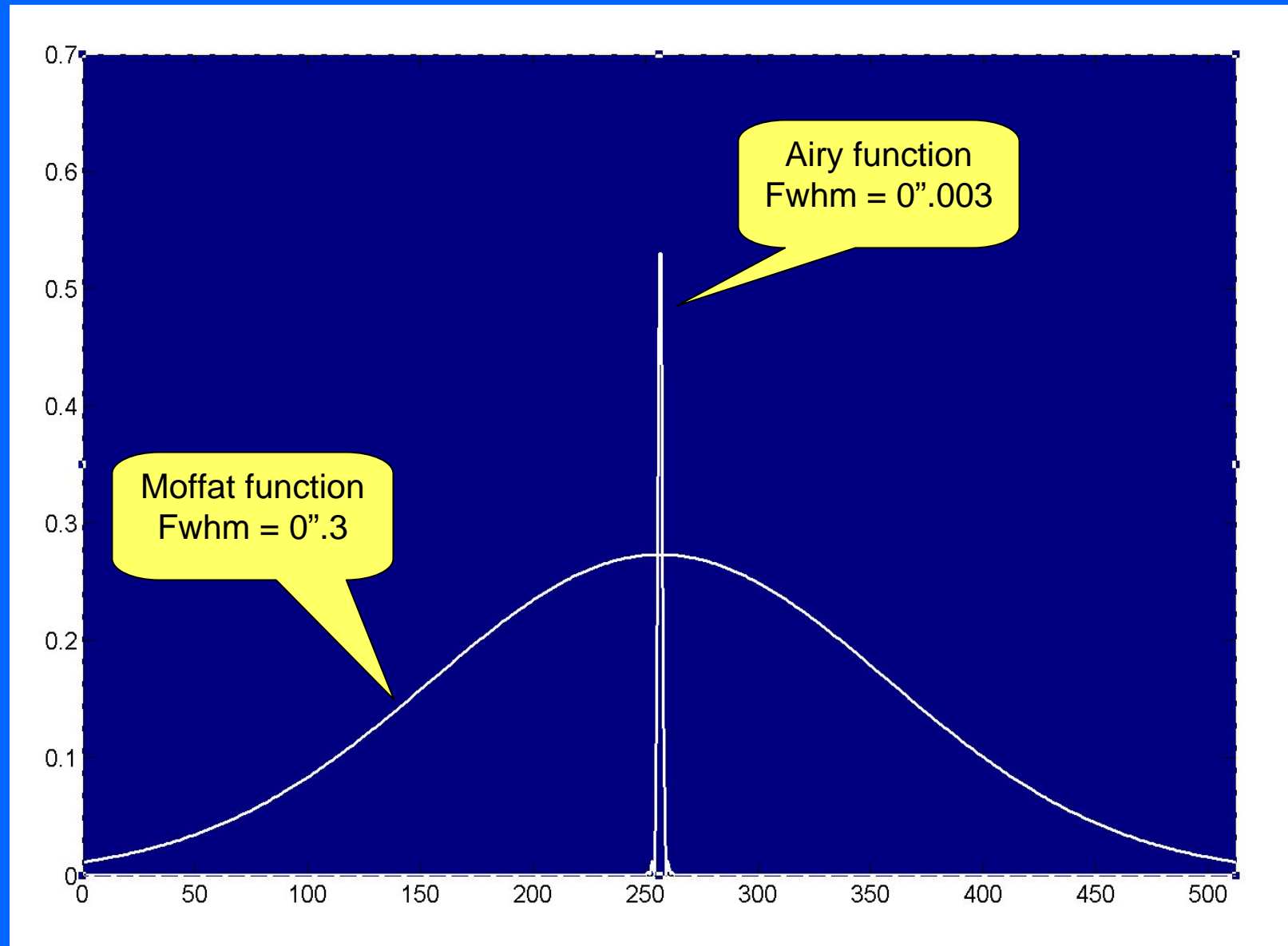
# Age and metallicity tools

	Age	Metallicity	Needed accuracy
• Strömgren $m_1$ - index	none	good	high
• Colour-magnitude diagram	good	some	medium
• Luminosity function	some	none	moderate

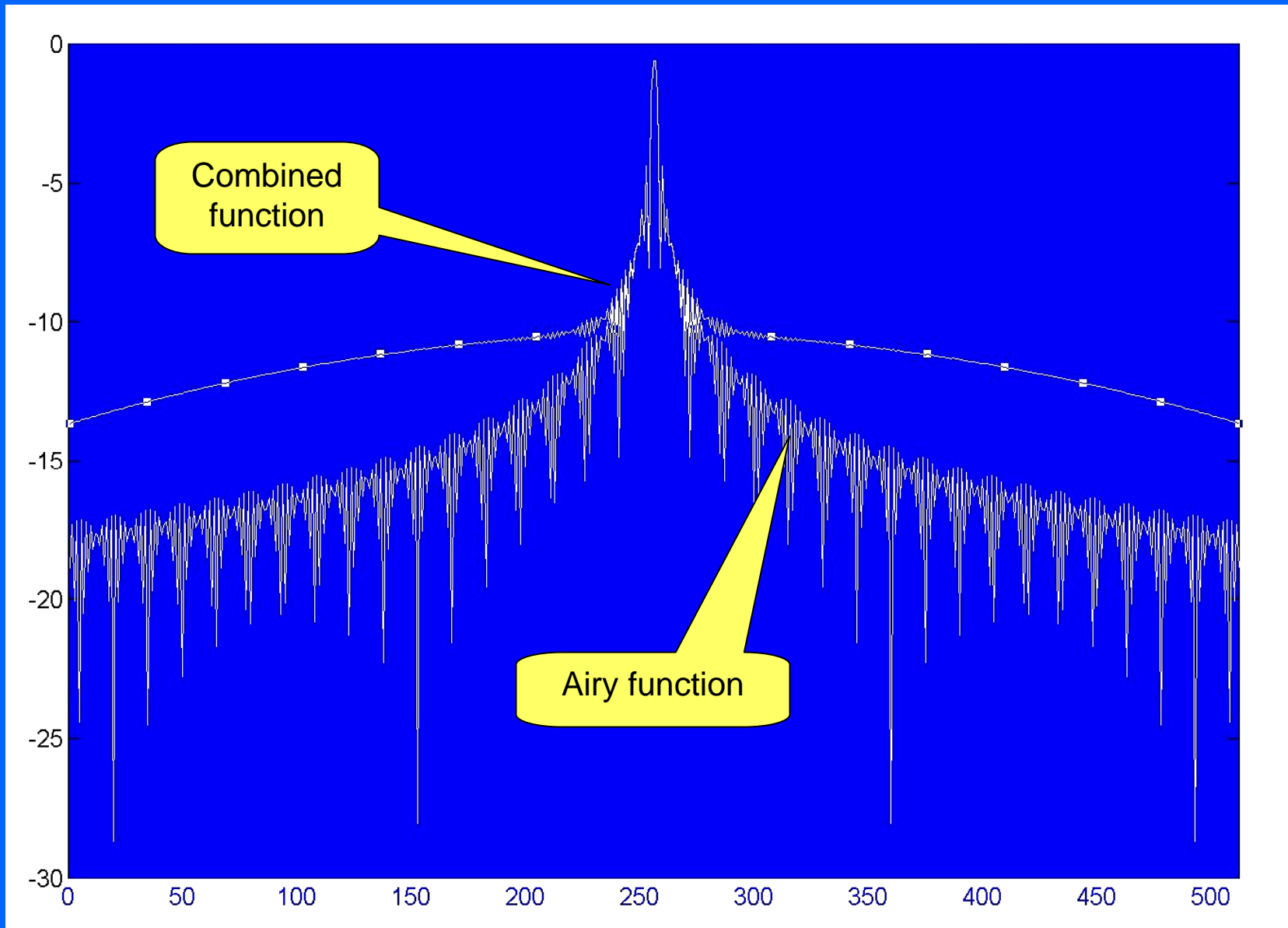
# Euro50



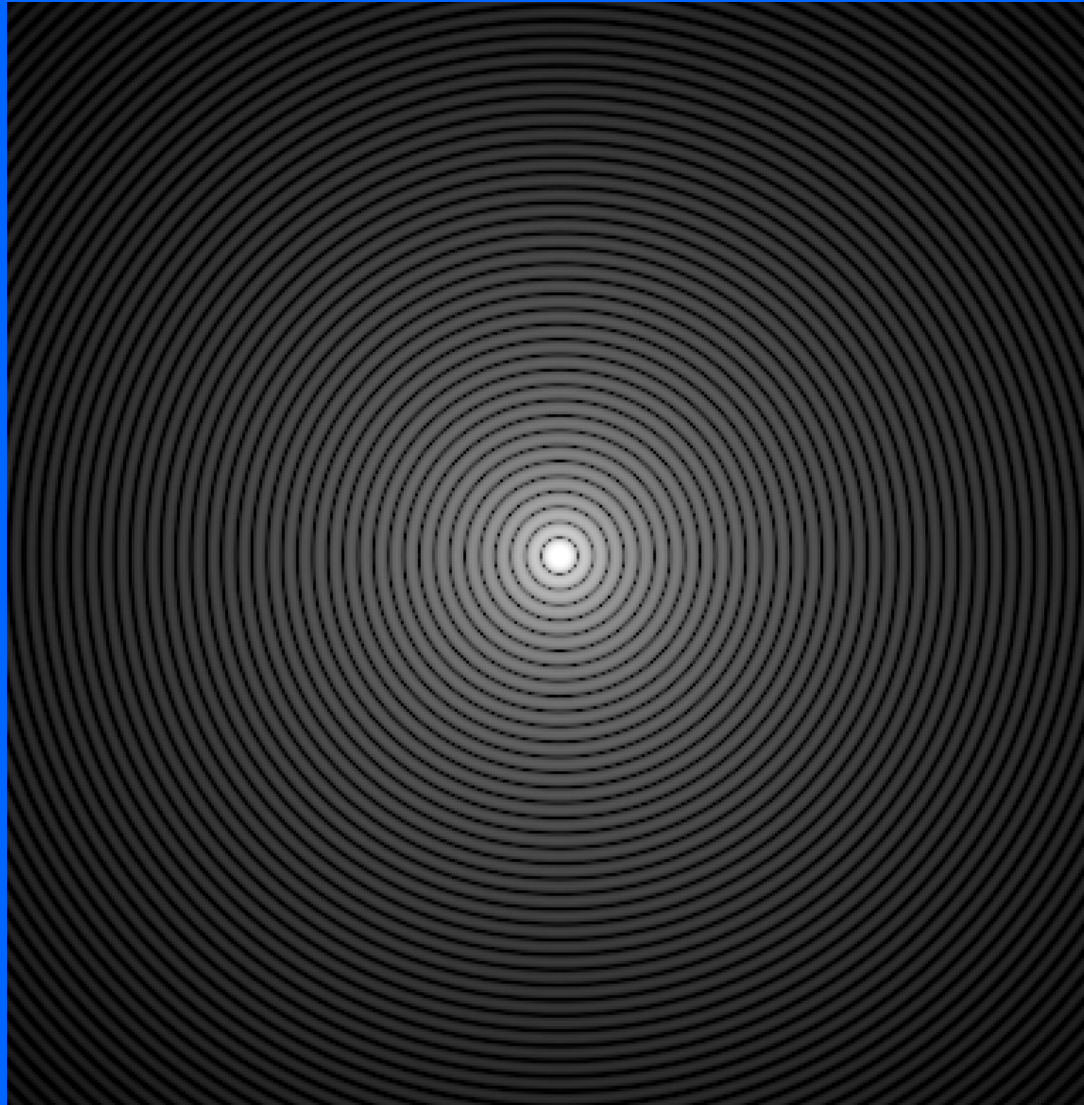
# Seeing and diffraction limited PSF



# Seeing and diffraction limited PSF (log scale)



# Diffraction limited point spread function



0.01 arcsec

50 m Airy-function, log scaled

# Seeing limited point spread function



0.01 arcsec

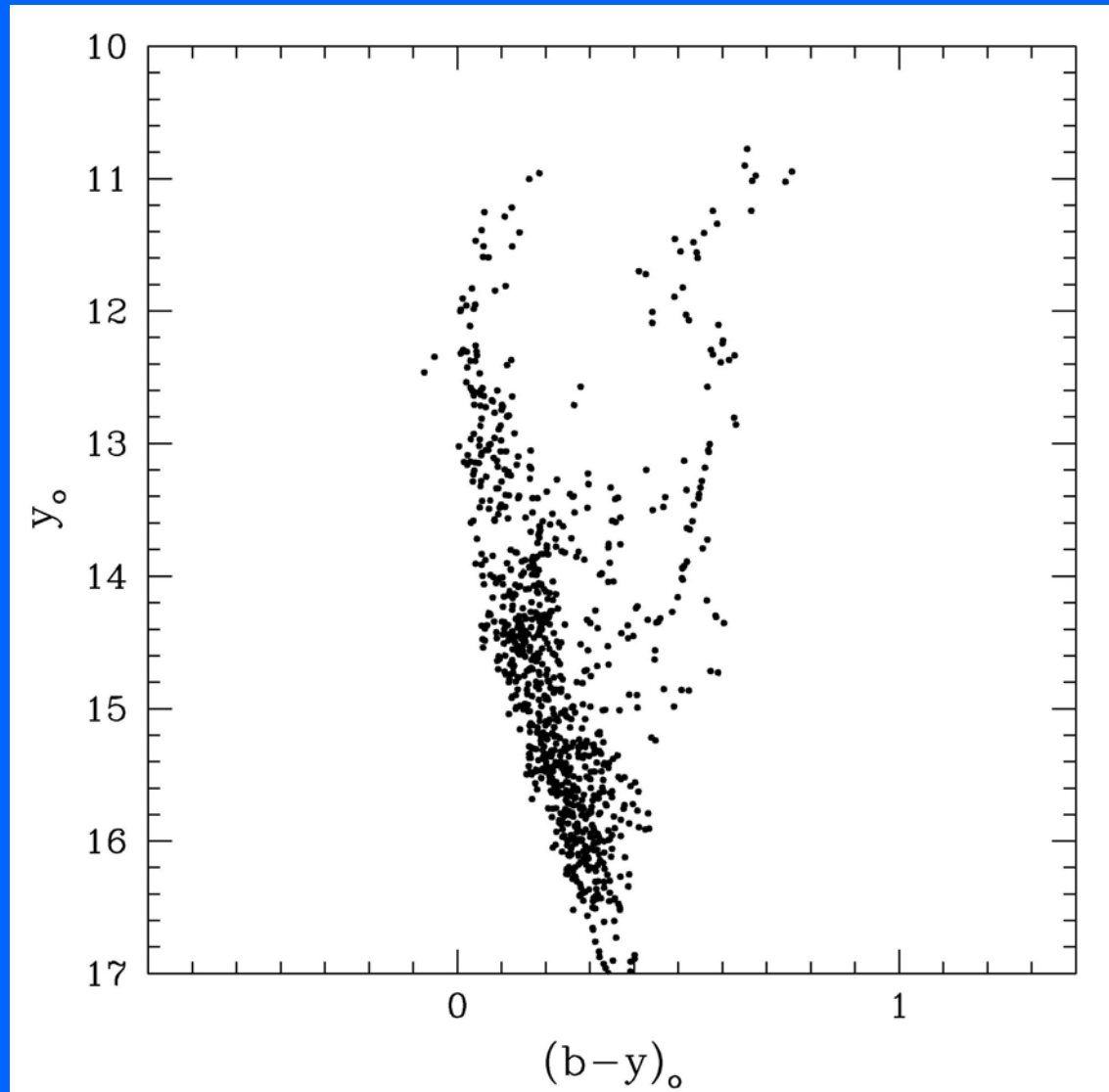
Seeing disk, (log scaled)



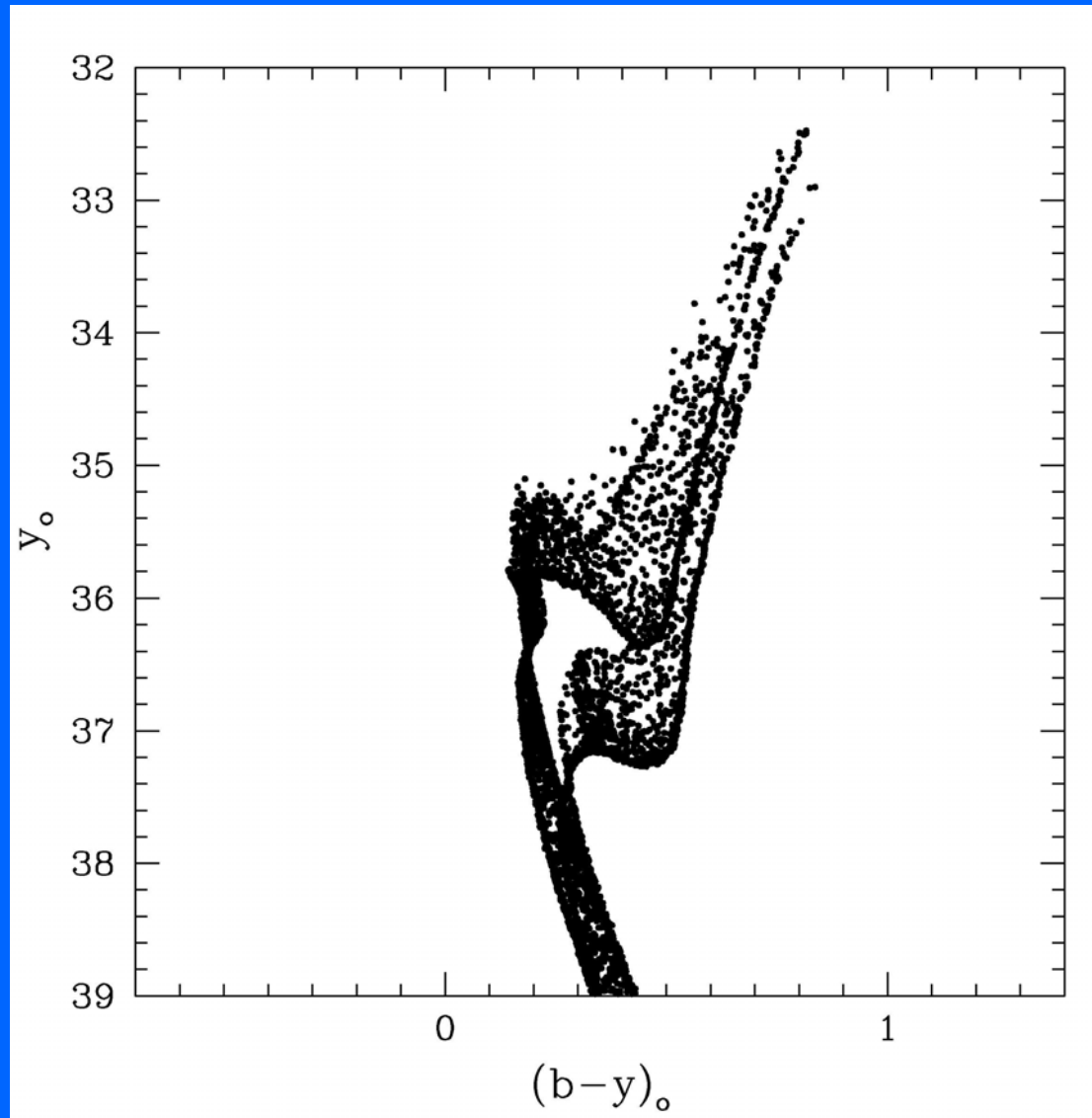
# Simulated stellar population

- NGC6192, age 100 Myr, used as template
- Background population:
  - 65 % 3 Gyr,  $[Me/H] = -0.3$
  - 35 % 9 Gyr,  $[Me/H] = -1.1$
  - stellar density set to appr mimic LMC halo

# Assumed CMD for open cluster



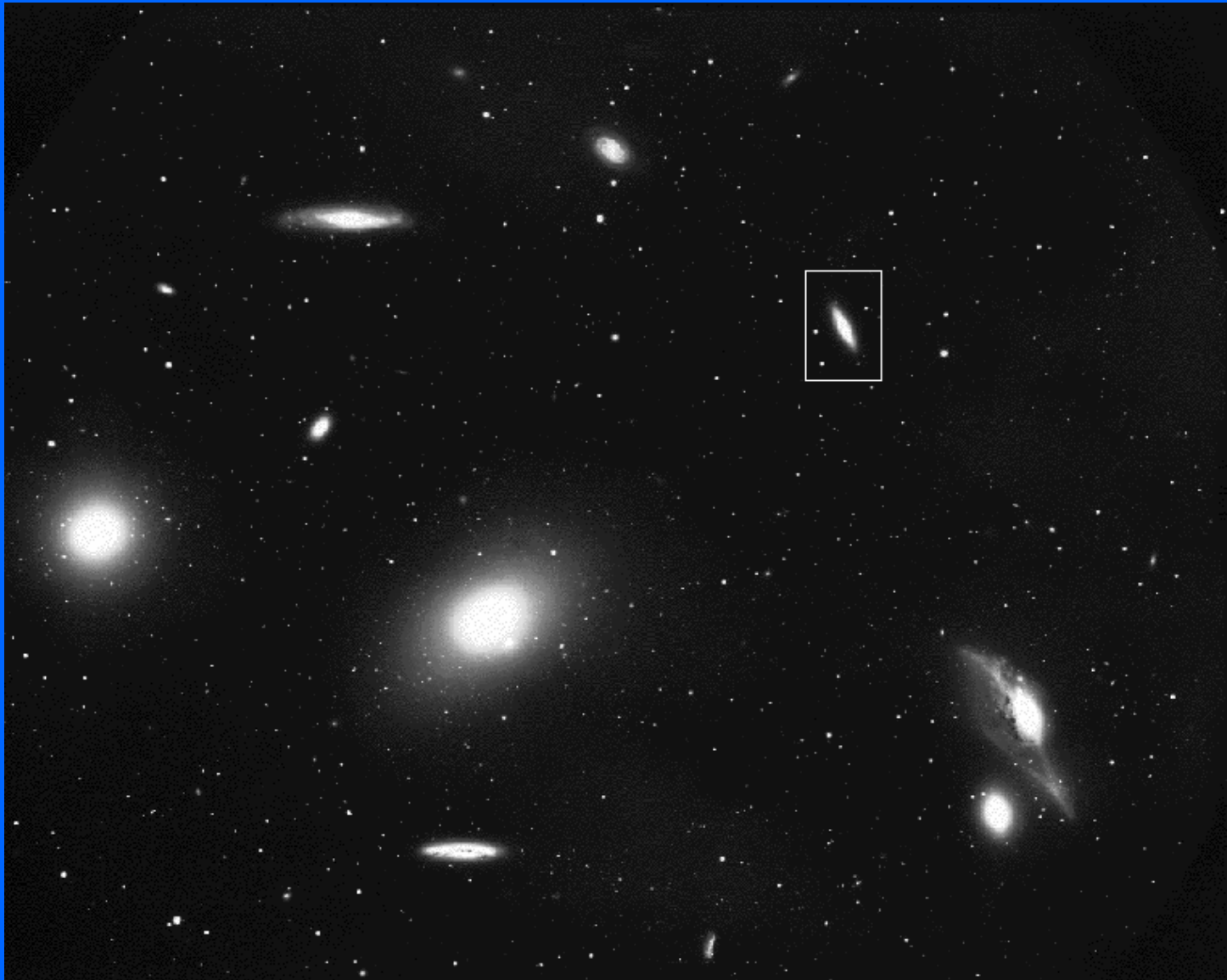
# Assumed CMD for background population



# Simulation parameters

- Strömgren vby images simulated
- Exposure: 200 000 sec / passband
- Strehl ratio: 0.7
- Circular aperture PSF
- 0".003 arcsec resolution in all passbands
- 0".3 arcsec seeing limited PSF
- Image size: 2048x2048 pixels
- Image scale: 0."001 / pixel
- FOV: 2"x2"

# Visiting the Virgo cluster



KPNO 4m, field 60'x45', 20 Mpc

Magnification=1

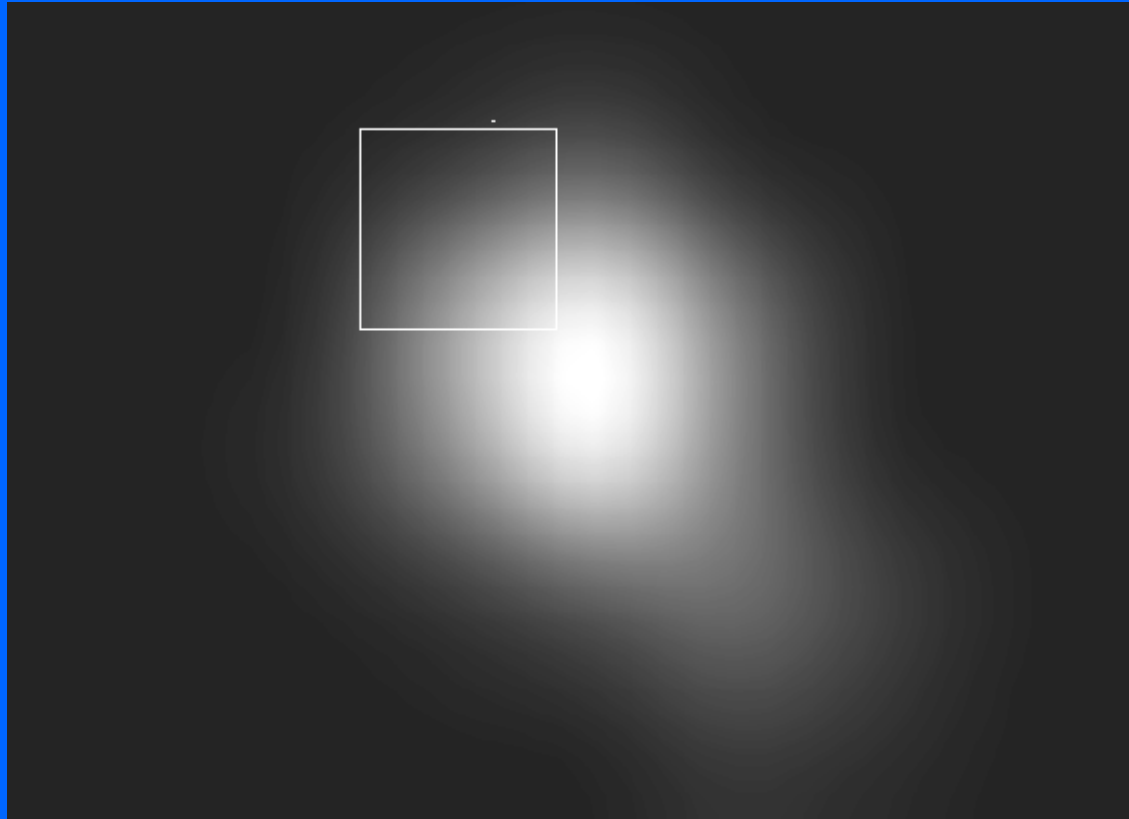
# Visiting the Virgo cluster



NGC 4425, KPNO 4m, field 6'x4'

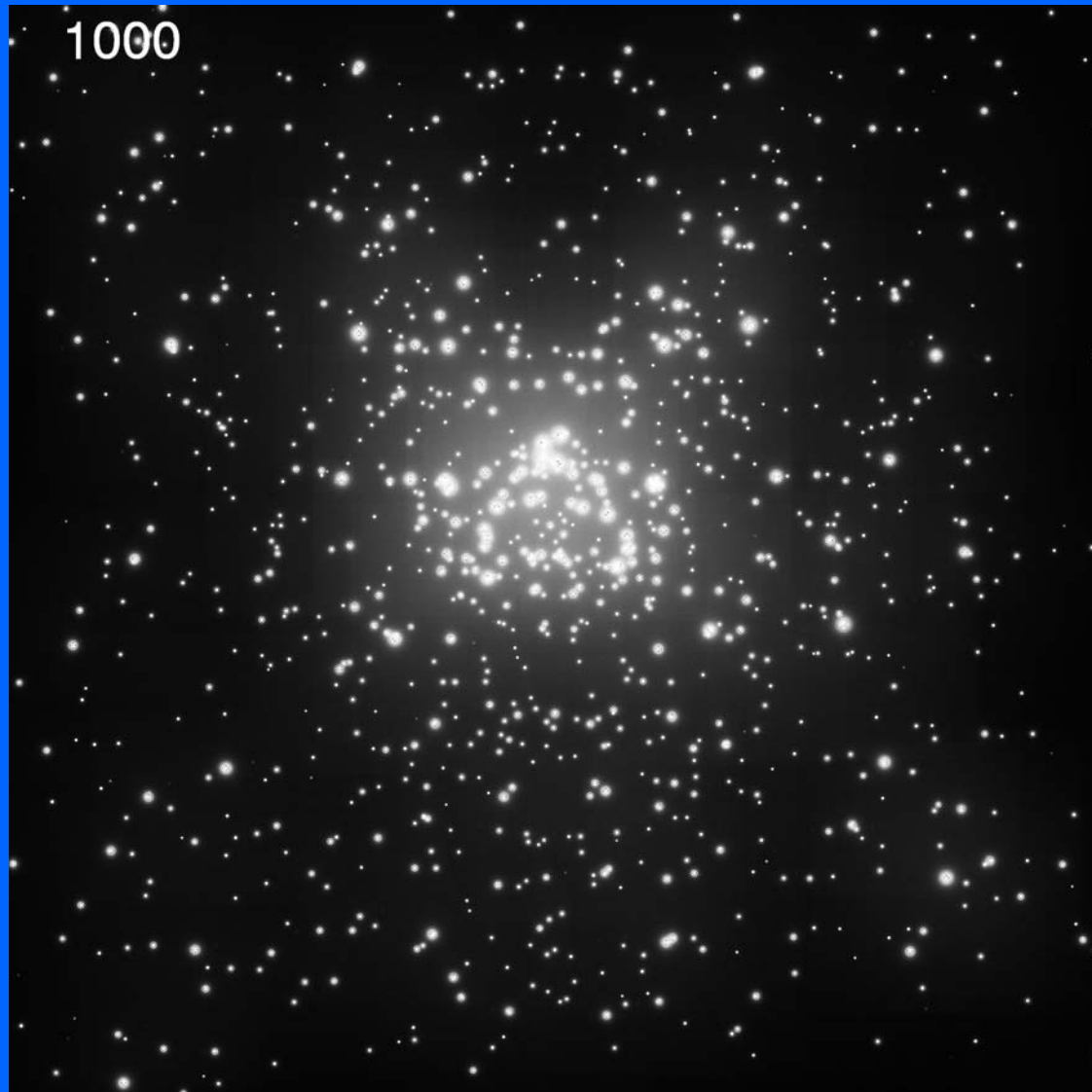
Magnification=10

# Visiting the Virgo cluster



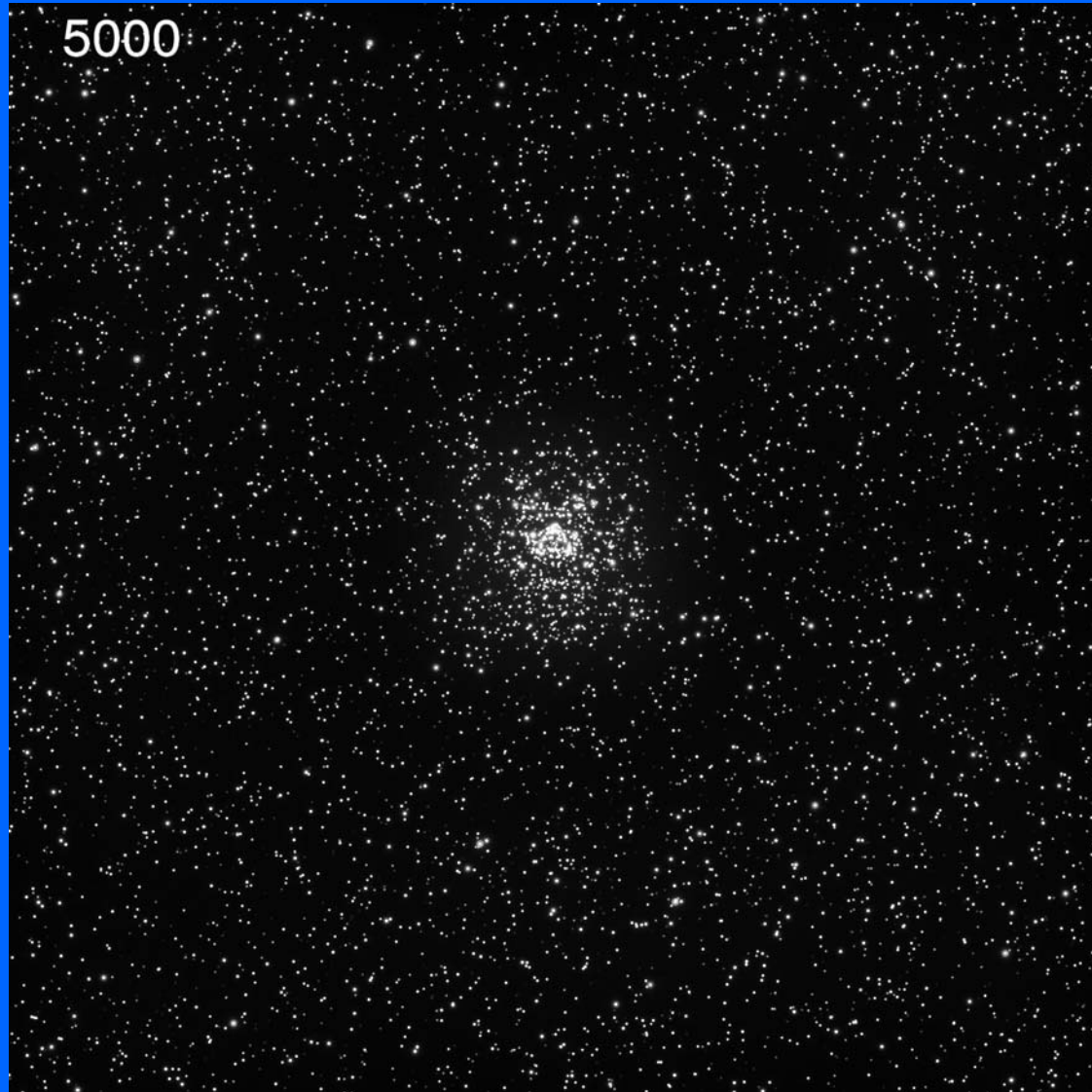
NGC 4425 dwarf, KPNO 4m, field 40''x25'' Magnification=100

# Simulated open cluster, distance 1 Mpc





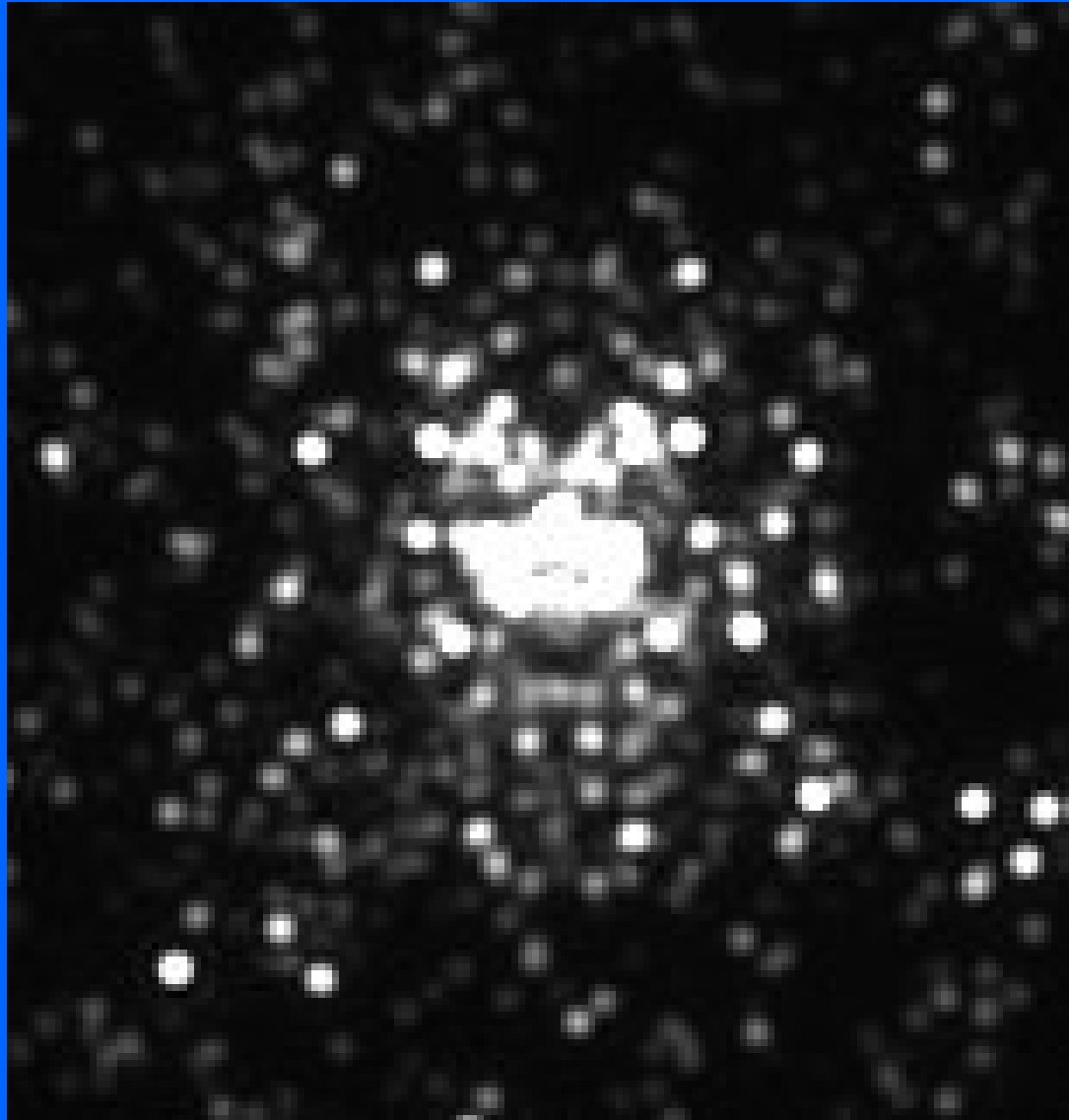
# Simulated open cluster, distance 5 Mpc



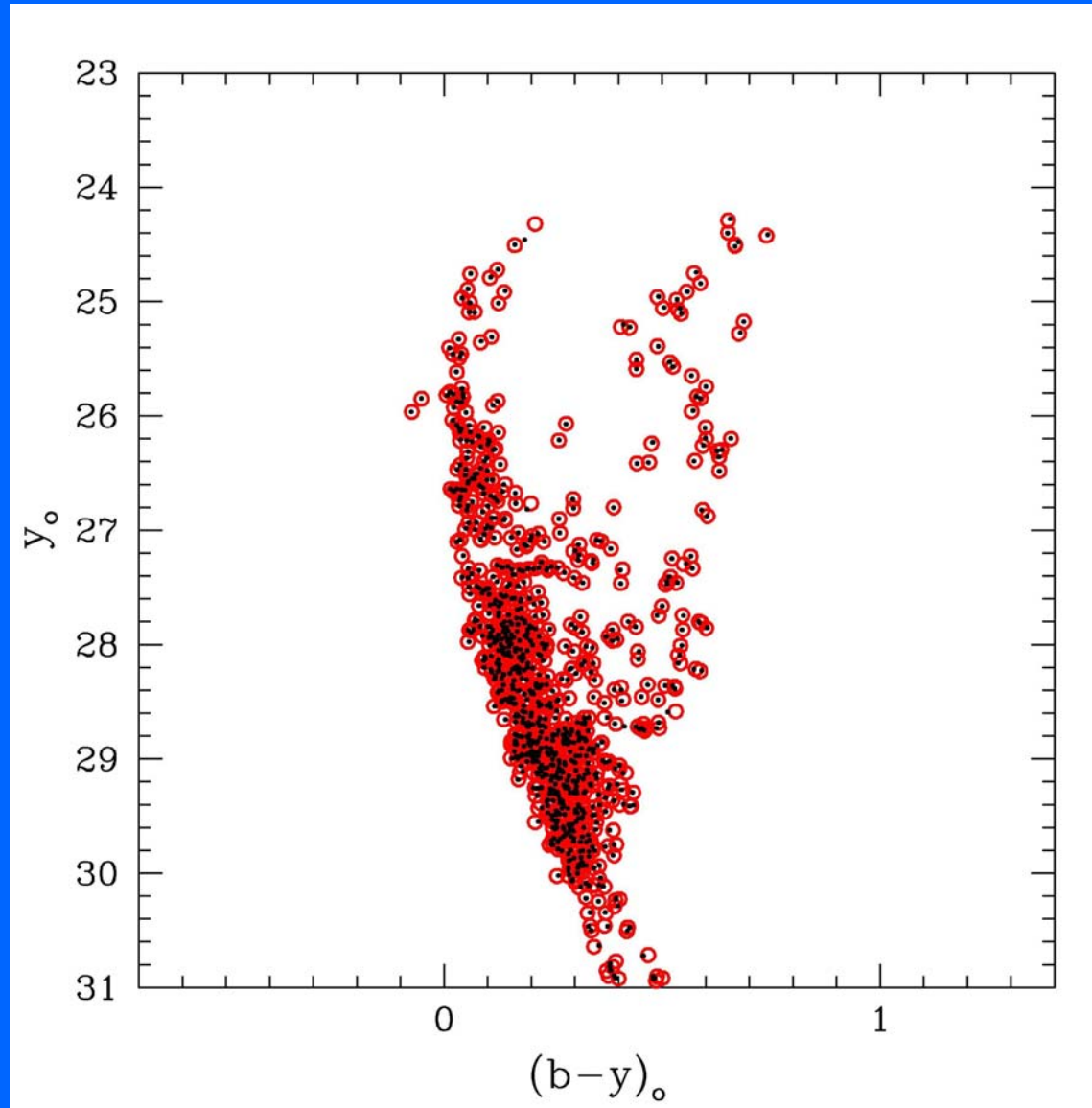
Simulated open cluster, distance 20 Mpc



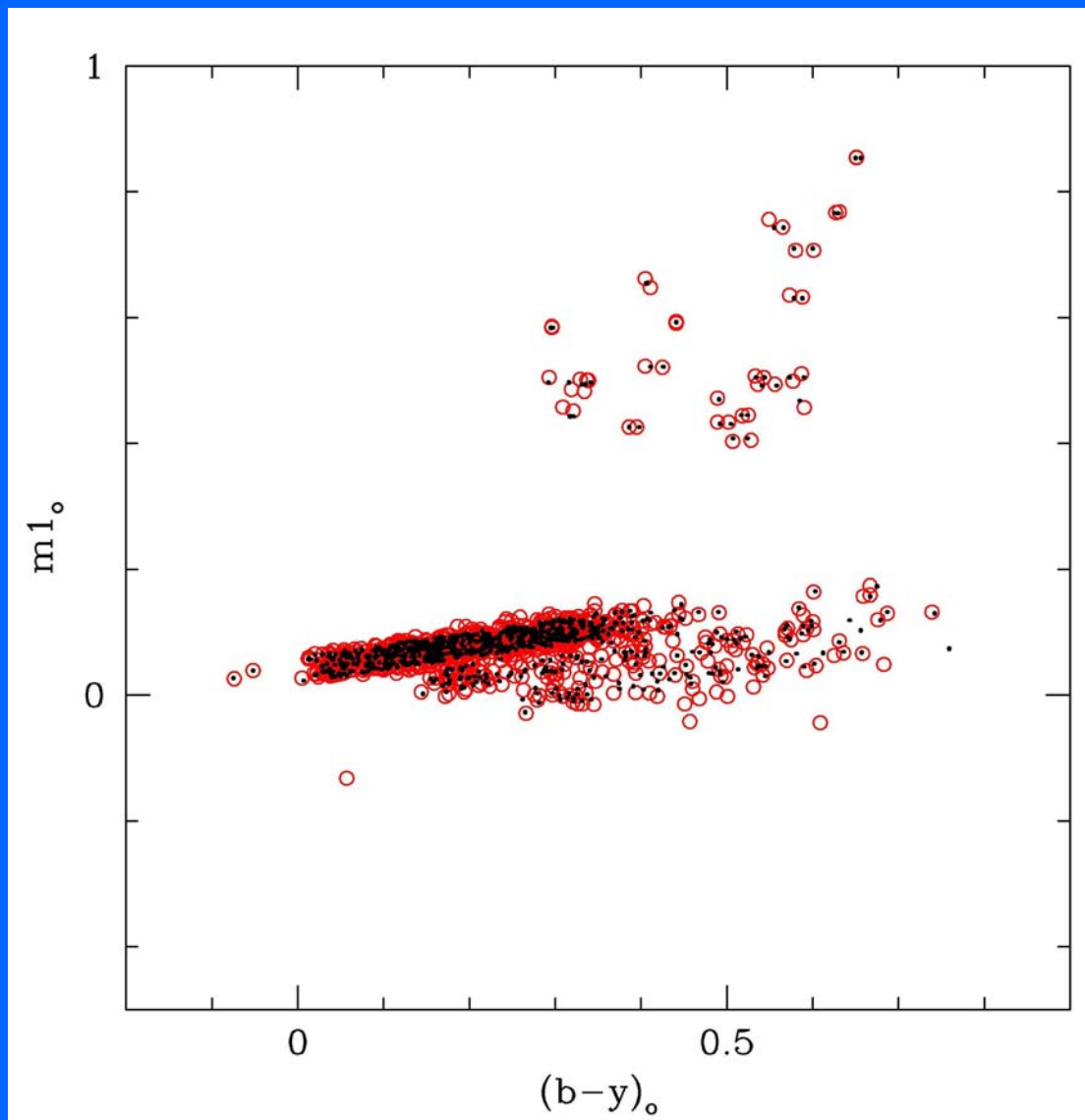
Open cluster, distance 20 Mpc, central part



# Colour-magnitude diagram: 1 Mpc



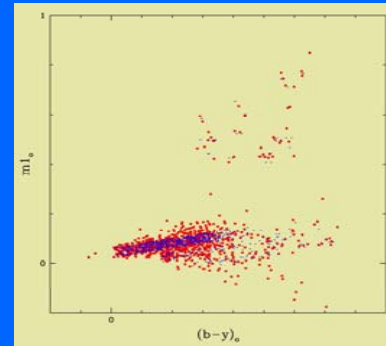
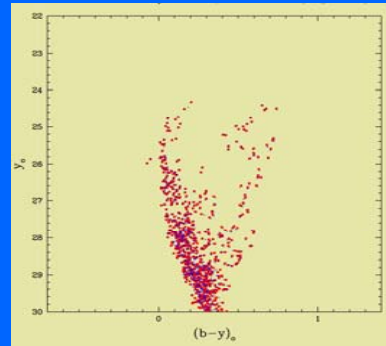
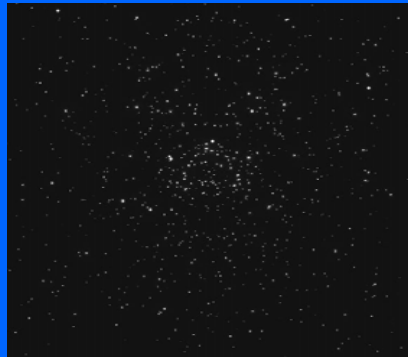
# Metallicity-diagram: 1 Mpc





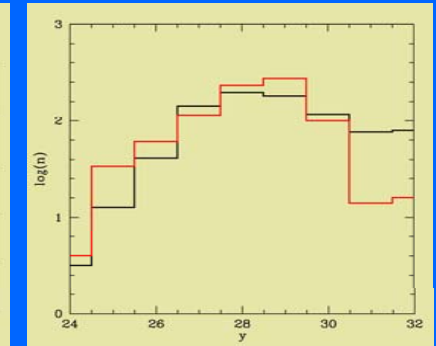
# NGC6192

Image size: 2048X2048 pixels  
pixel size: 1 milliarcsec

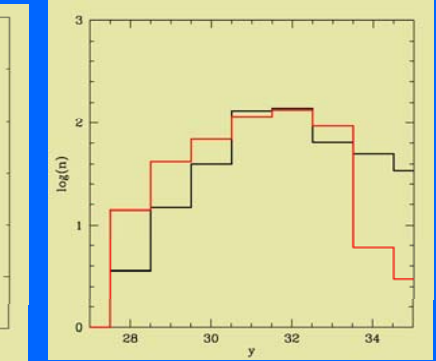
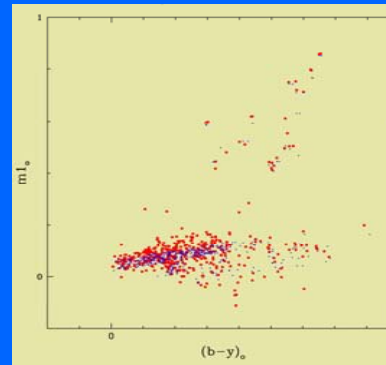
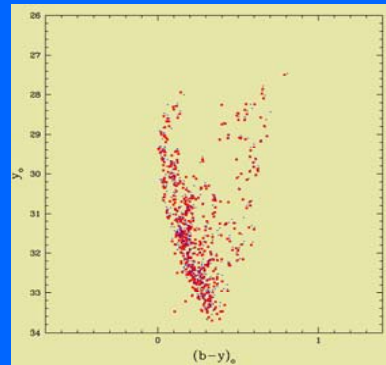
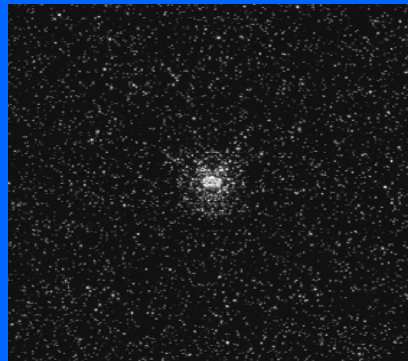


# Luminosity function

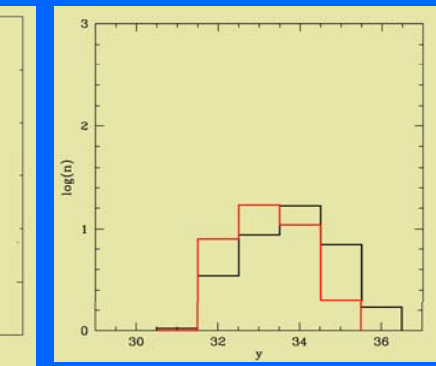
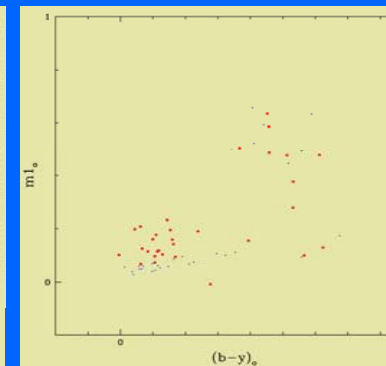
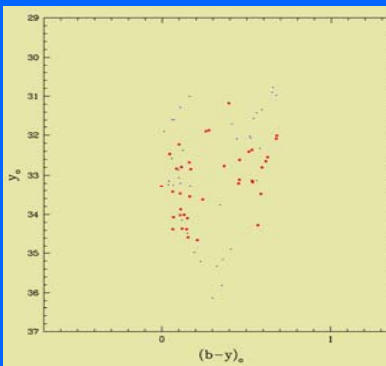
Black curve background population, red curve cluster population



1 Mpc



5 Mpc

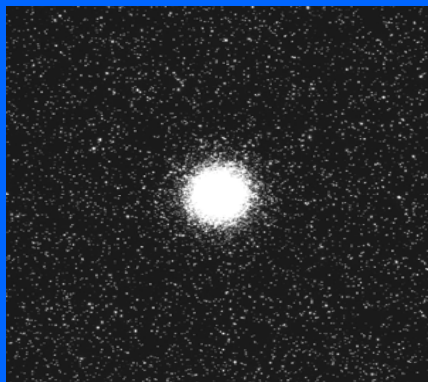


20 Mpc

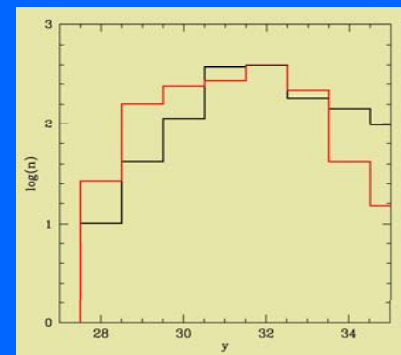
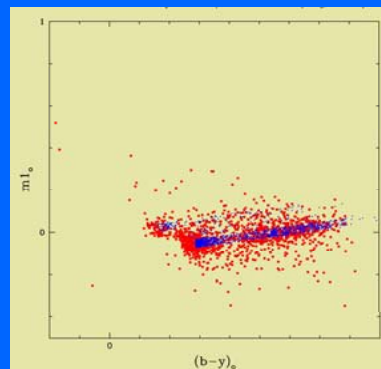
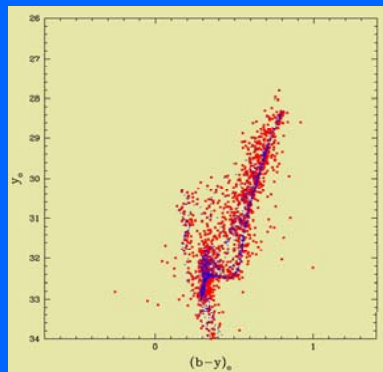
## Globular

Synthetic, 50 000 stars

5 Mpc



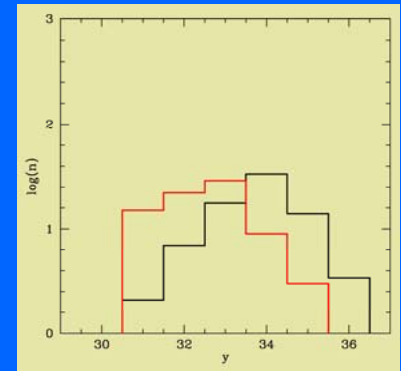
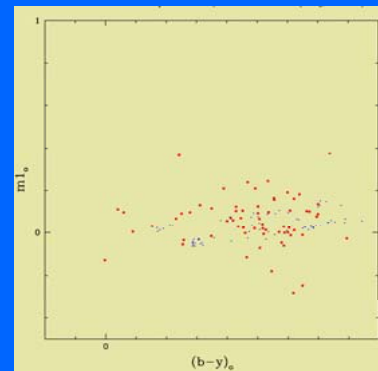
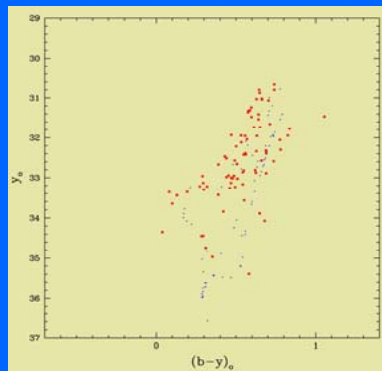
Exposure in  $y$ : 55 hours



20 Mpc



Exposure in  $y$ : 55 hours



# Some conclusions

- Good CMD precision to more than 10 Mpc
- Reasonable  $m_1$  – values out to 10 Mpc
- Crowding more serious than photon starvation
- Natural background less important than PSF scattered light
- But: photometric analysis can be further optimised