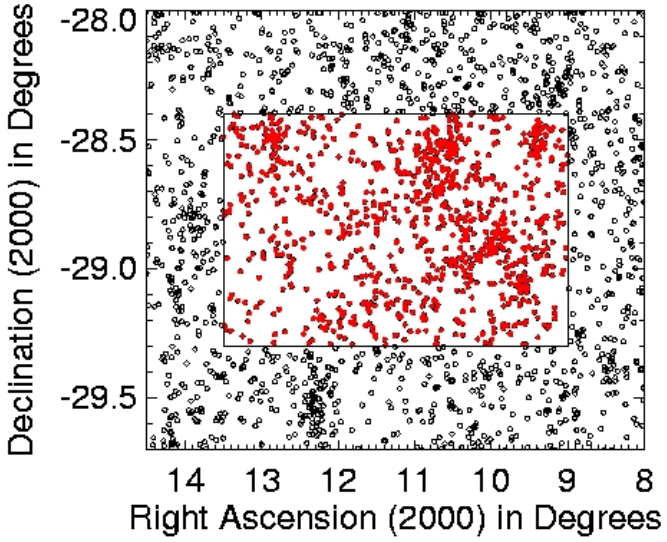
2dF Supercluster (z=0.11) Study: ASTROWISE Pilot Project.

Geert Sikkema, Kapteyn Institute, Groningen
Edwin Valentijn, Kapteyn Institute, Groningen
Reynier Peletier, Kapteyn Institute,Groningen
Phillippe Heraudeau, Argelander Institute, Bonn

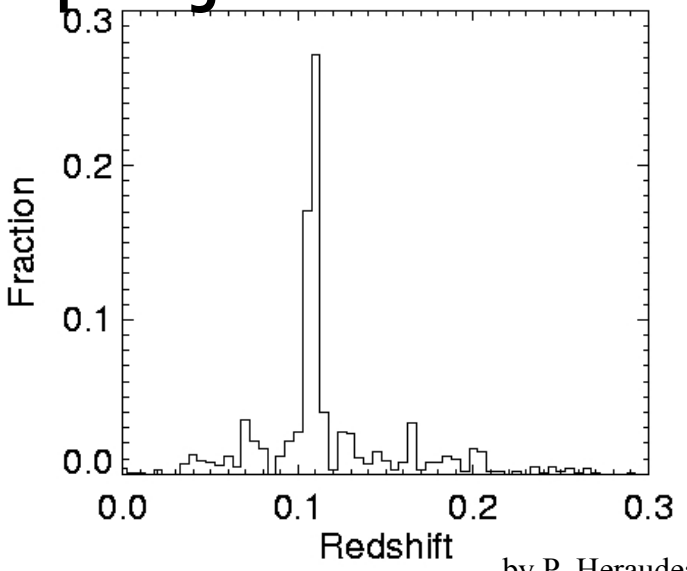
OUTLINE

- Presentation of the Project (Data + Goals)
- Some Data Reduction Issues
- Data Selection
- Sample Definitions
- Morphological Parameters of Galaxies
- Results

Observing a 2dfGRS region in VRI. WFI pilot project

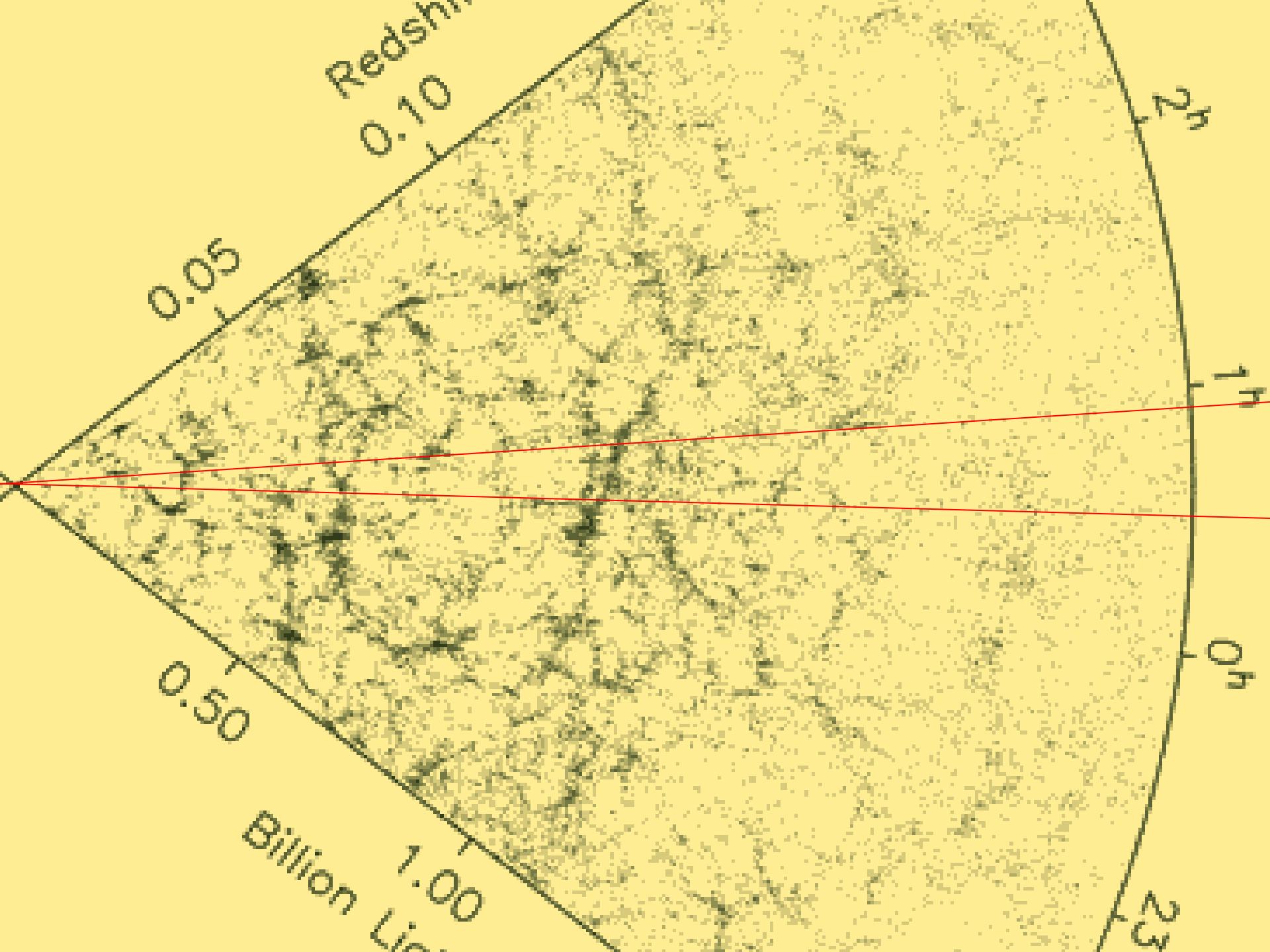


by P. Heraudeau



by P. Heraudeau

-) 16 WFI pointings, 4 square degree; ~1000 redshifts from 2dfGRS.
-) Limiting mag in I: 25 mag/arcsec^2
-) Photometric in I band (Seeing 0.65”-0.85”); Cirrus in V band (variable seeing: 0.85”-1.5”)
-) 4 Abell (3 observed by XMM REFLEX survey(kindly provided by Boehringer), near z ~0.11
-) GOAL: properties/morphological parameters of galaxies vs environment;
-) Data reductions completed with ASTRO-WISE.


0.05
0.10
0.50
1.00
2h
1h
0h

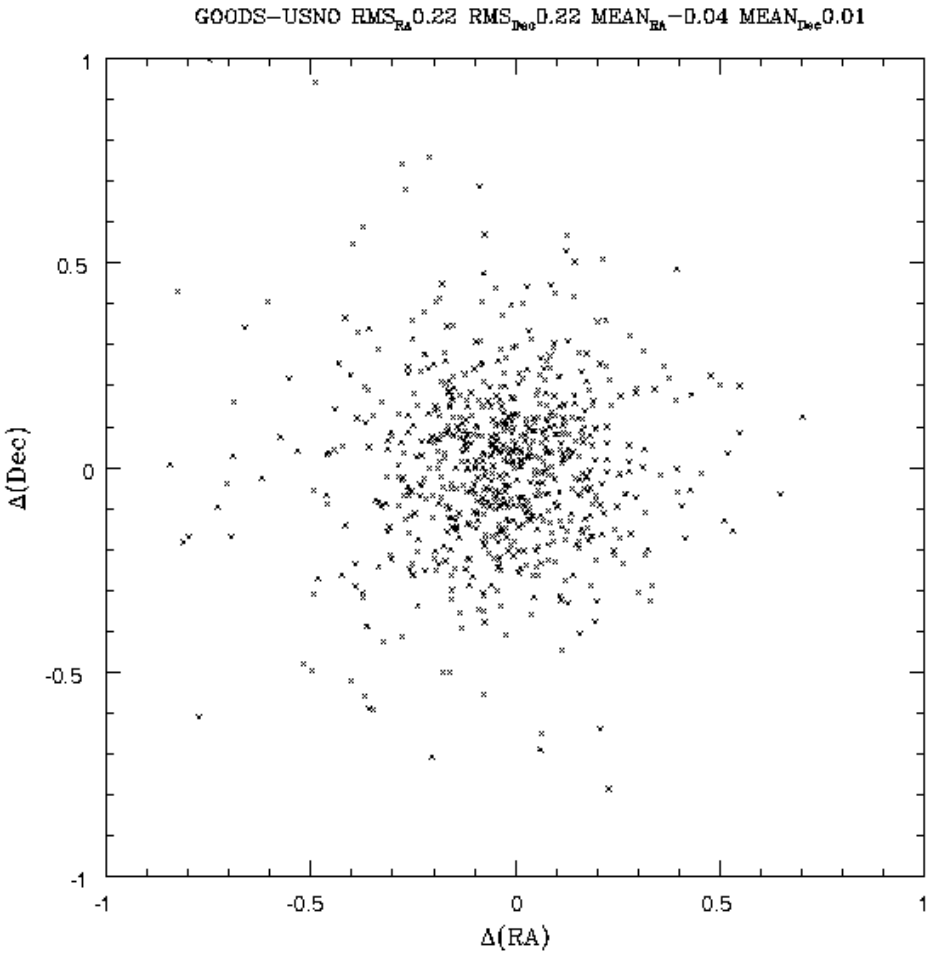
Some Data Reductions Issues

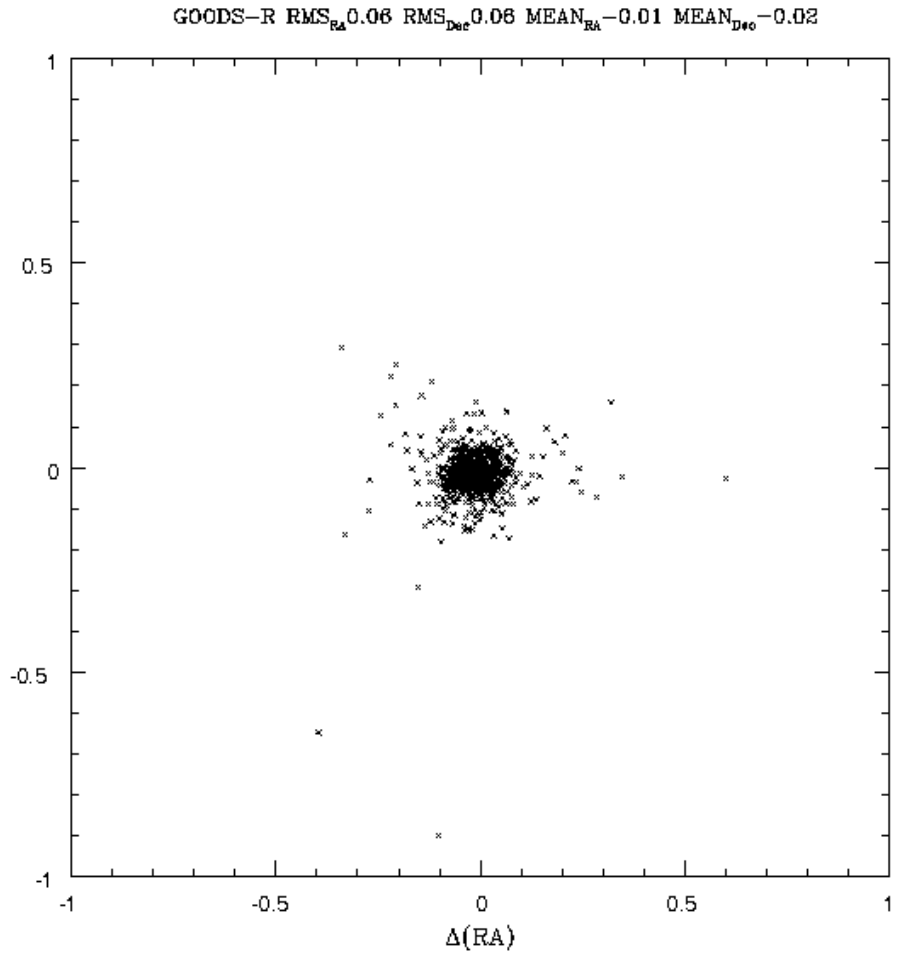
-) Astrometry
-) Photometry

Data Reduction Issues

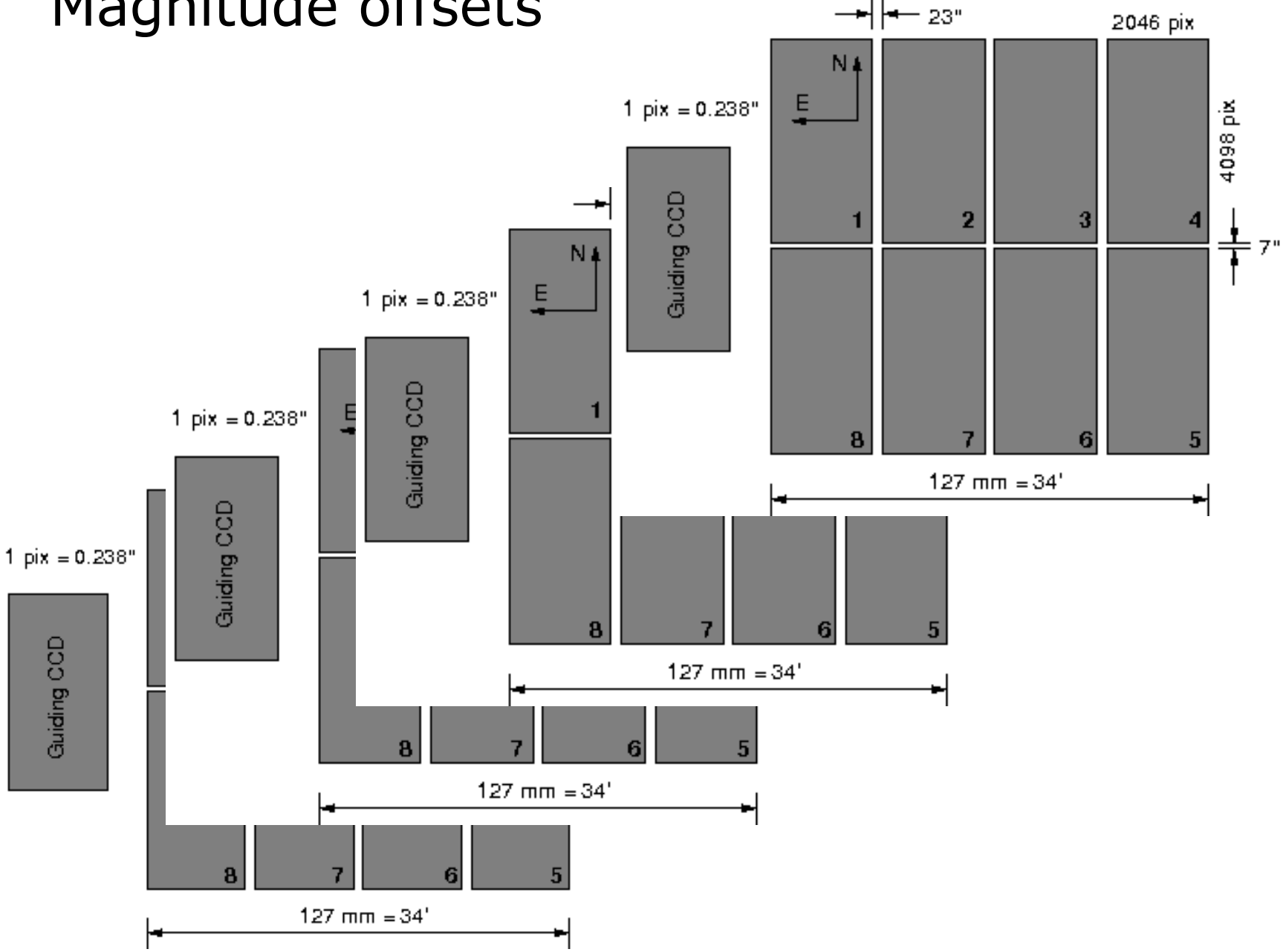
- Astrometry (before recent update; local)
- Photometry (non photometric conditions in V)

Astrometric quality

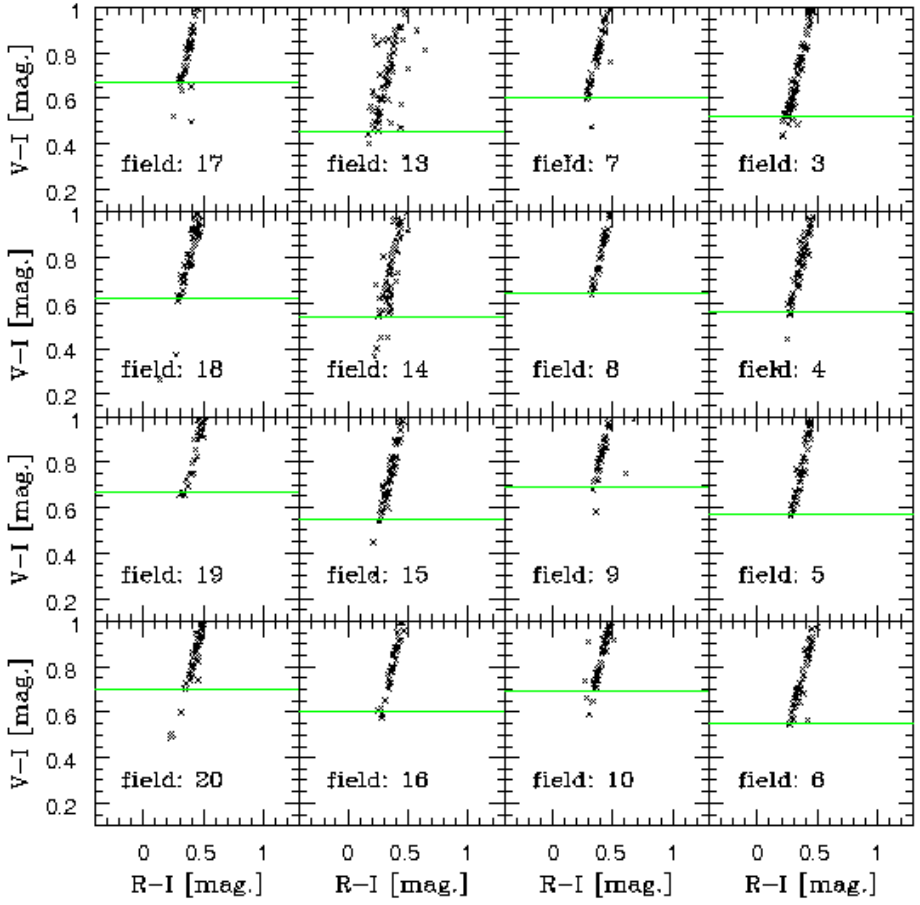


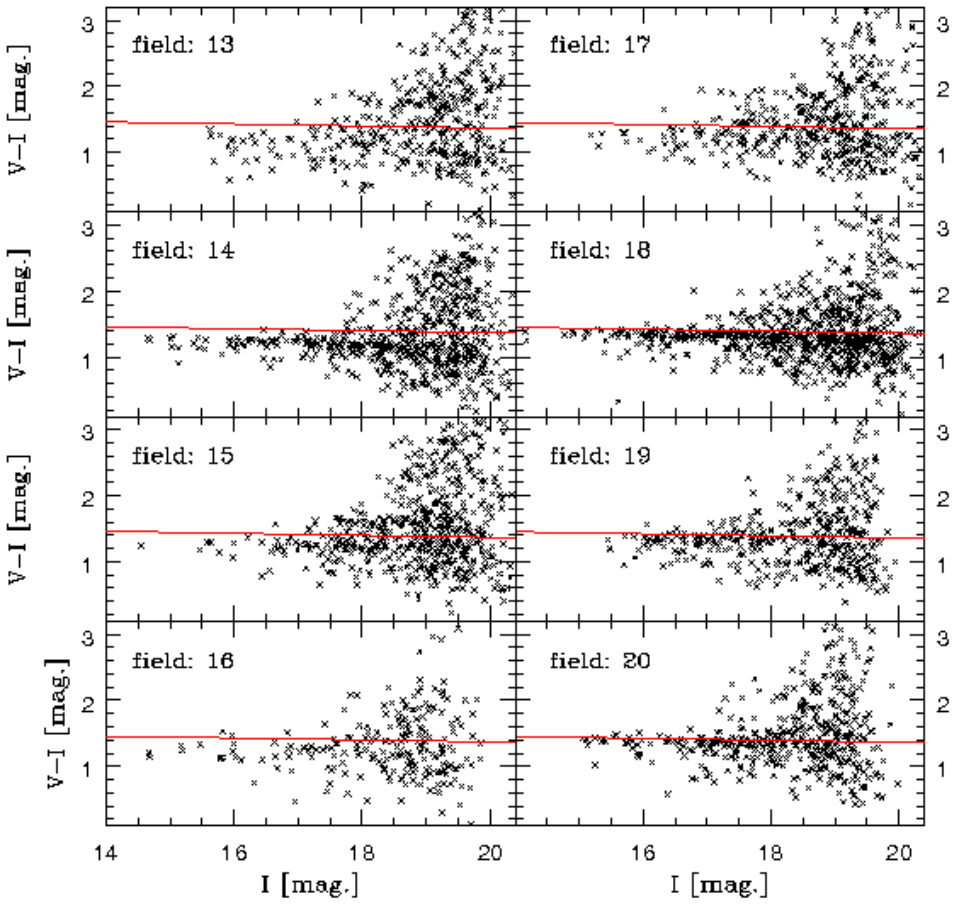


Magnitude offsets



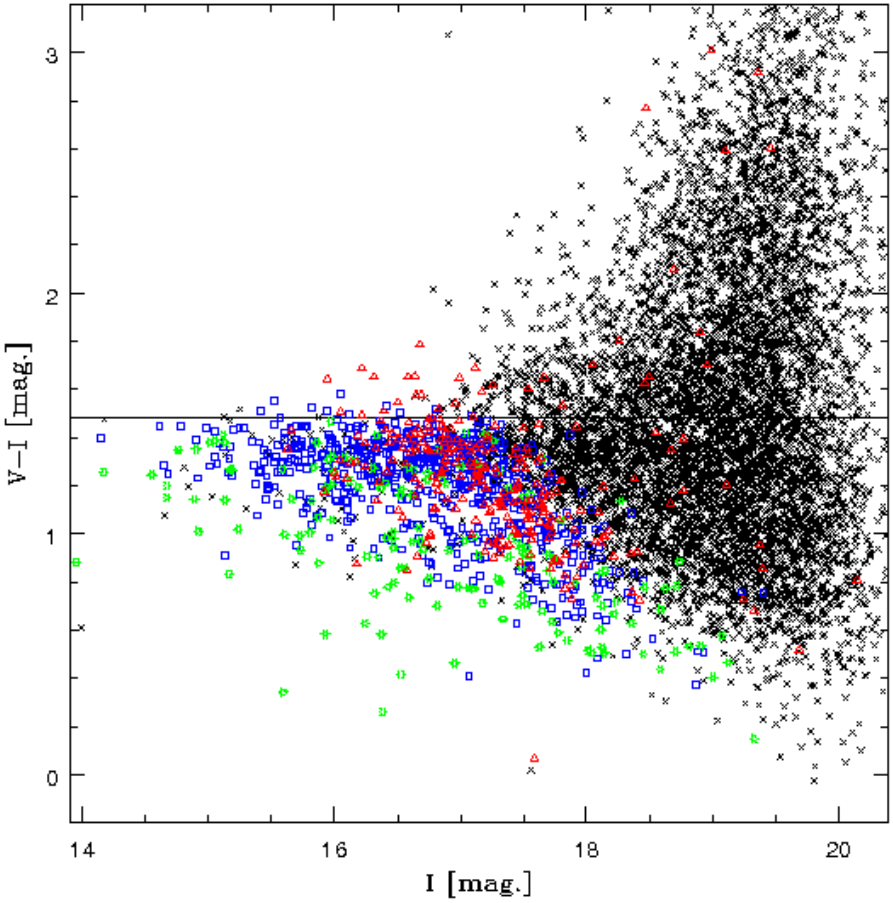
Magnitude Off-sets

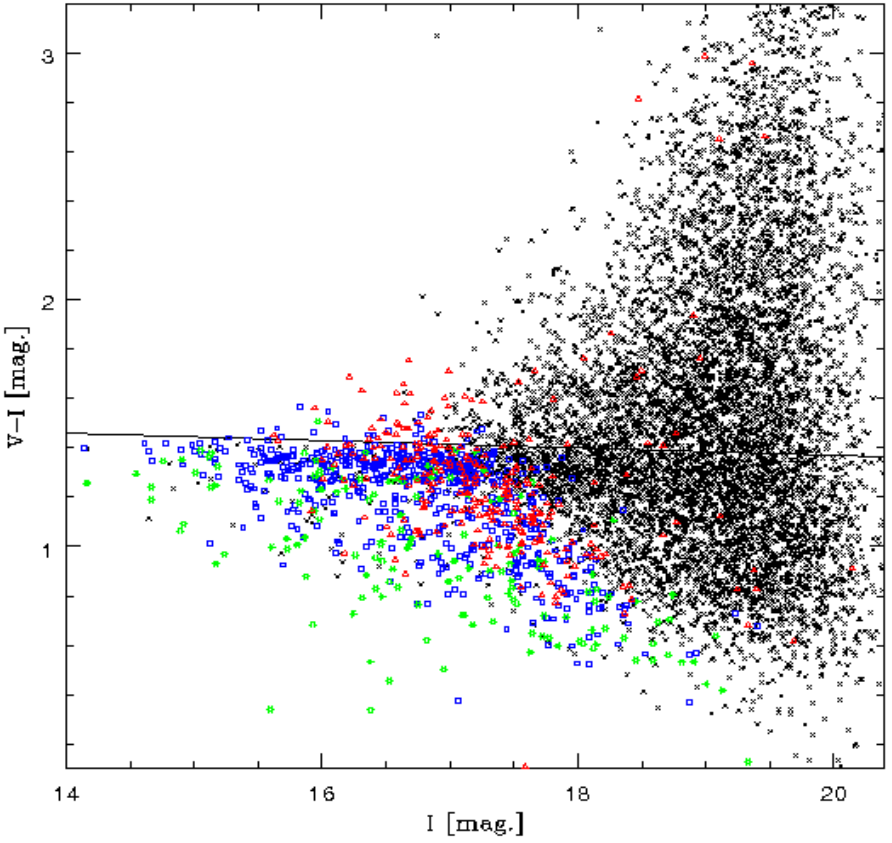




Make use of stellar locus: saturation/class_star reliability

Magnitude Corrections: Before and After





Sample Selection

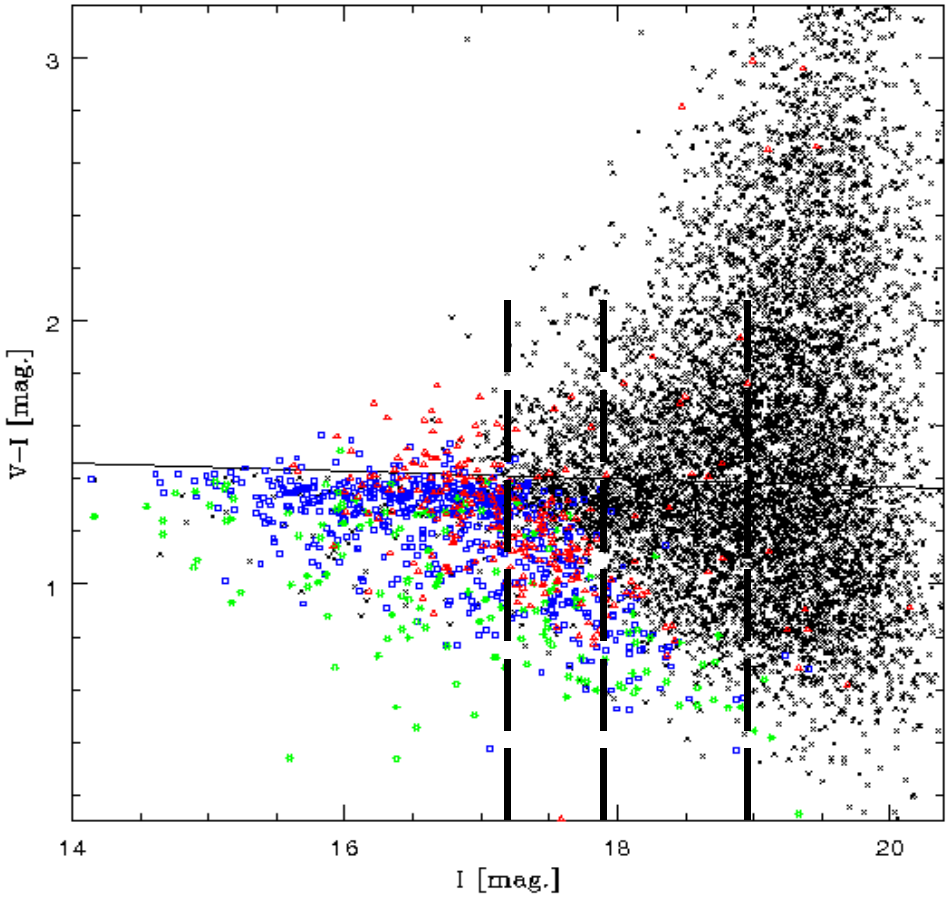
- 2D sample (includes also galaxies without z; density considerations); magnitude limit for completeness depends on density: 3 subsamples:
  - 18.8 2700 objects == -19.3 (compl limit for all fields: derive density map)
  - 17.8 1100 objects get reliable quantities (bar signature, asym etc)
  - 17.3 700 objects still 100 unknown redshifts
- 3D sample (only redshifts: 602)

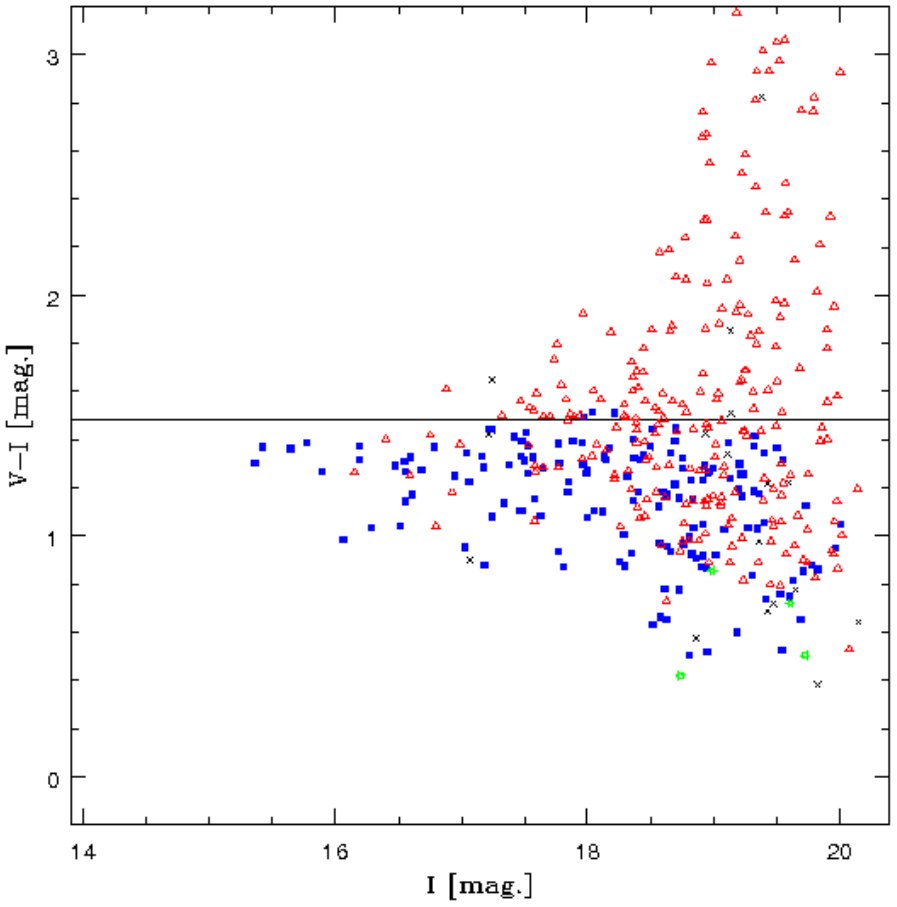
Sample Selection: 1st order

- SExtractor: > 100 pixels; Flags < 4
  CLASS_STAR < 0.10

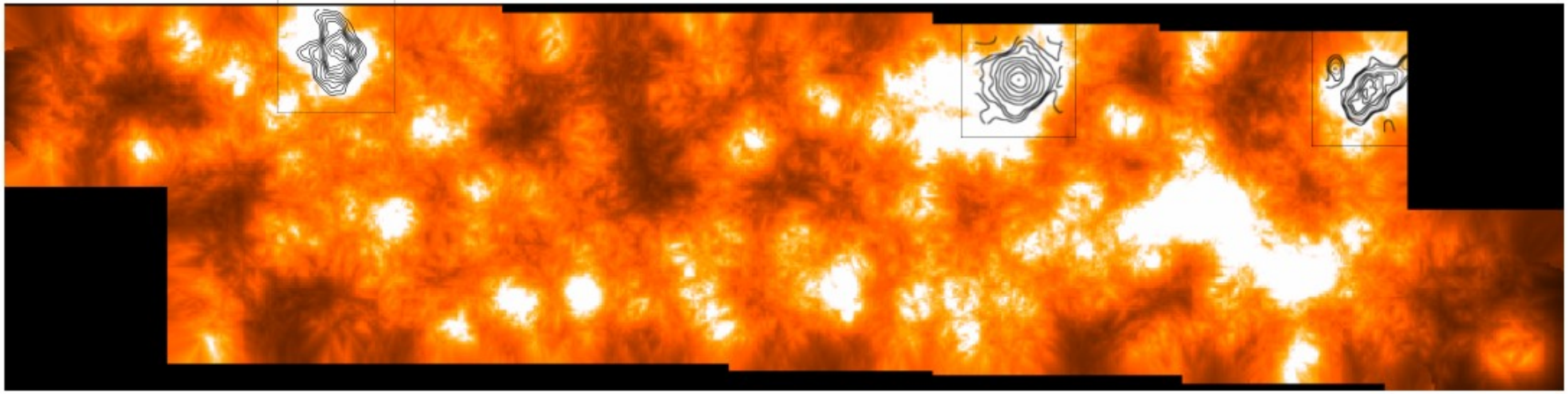
Data Selection: Colour Cut + Redshifts

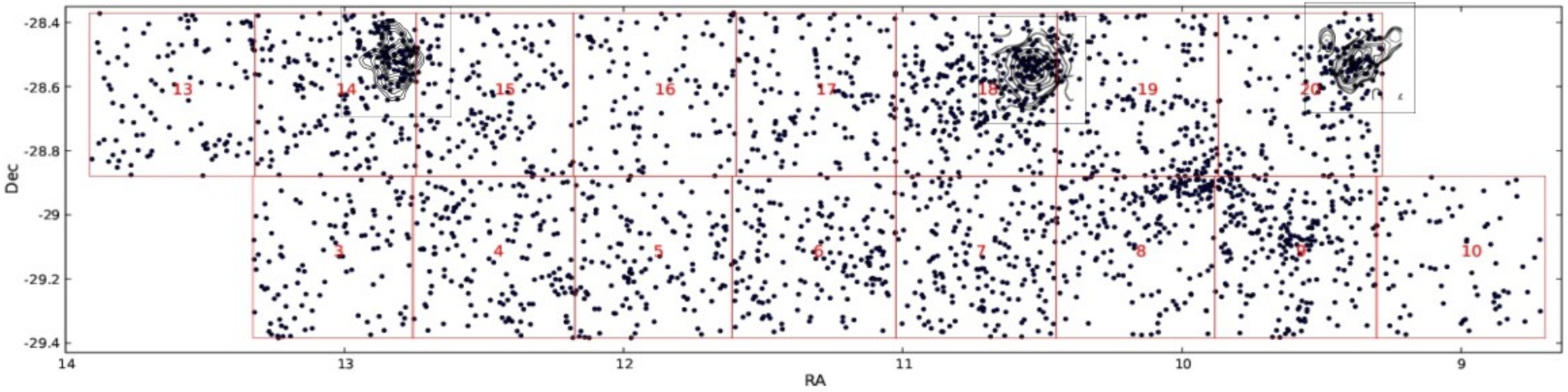
4500 galaxies // 2700 galaxies < 18.8 in I band ~ < -19.3 @ z=0.11



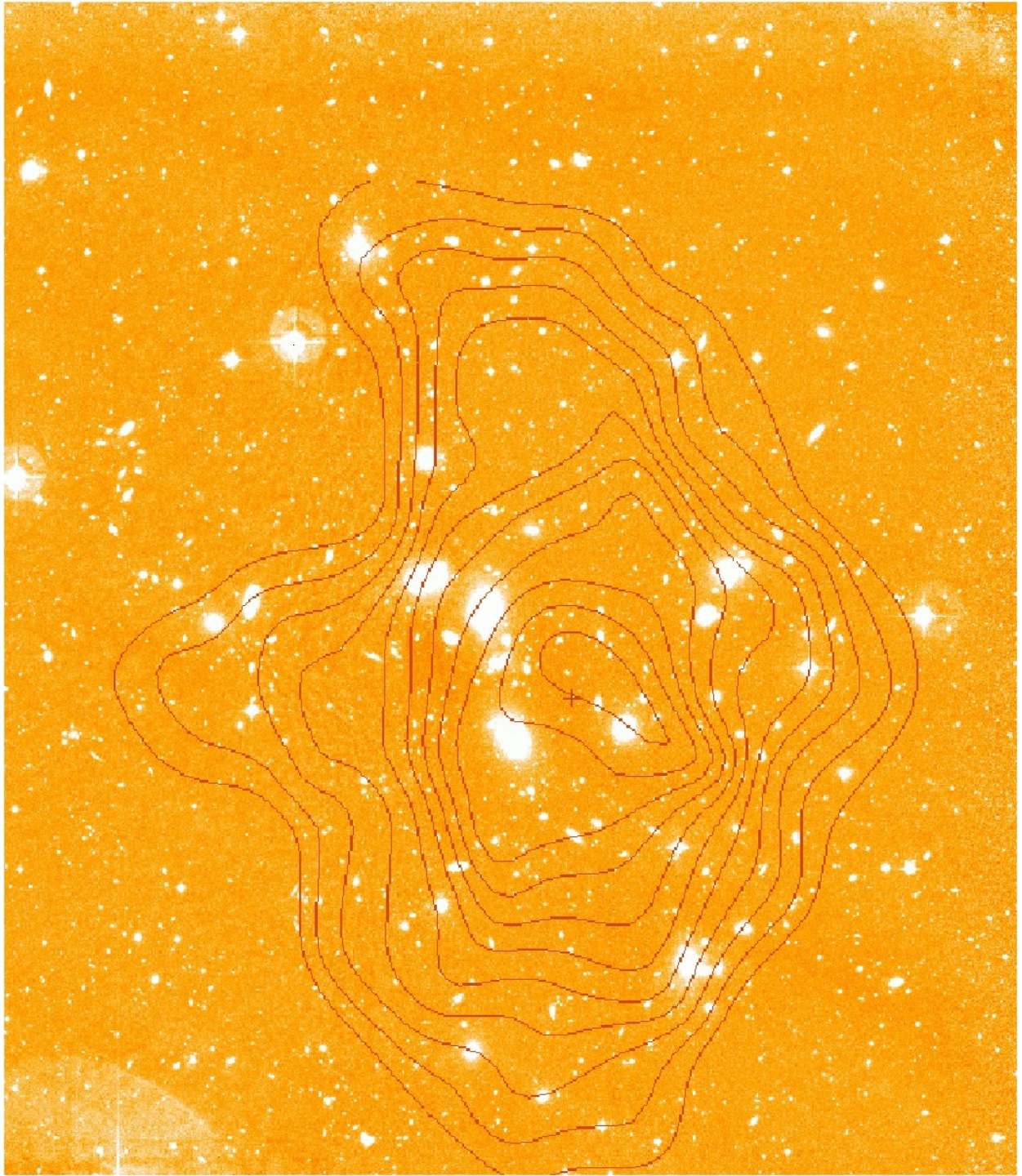


2D Density Map I < 18.8 + colour cut
2700 objects (X-ray)

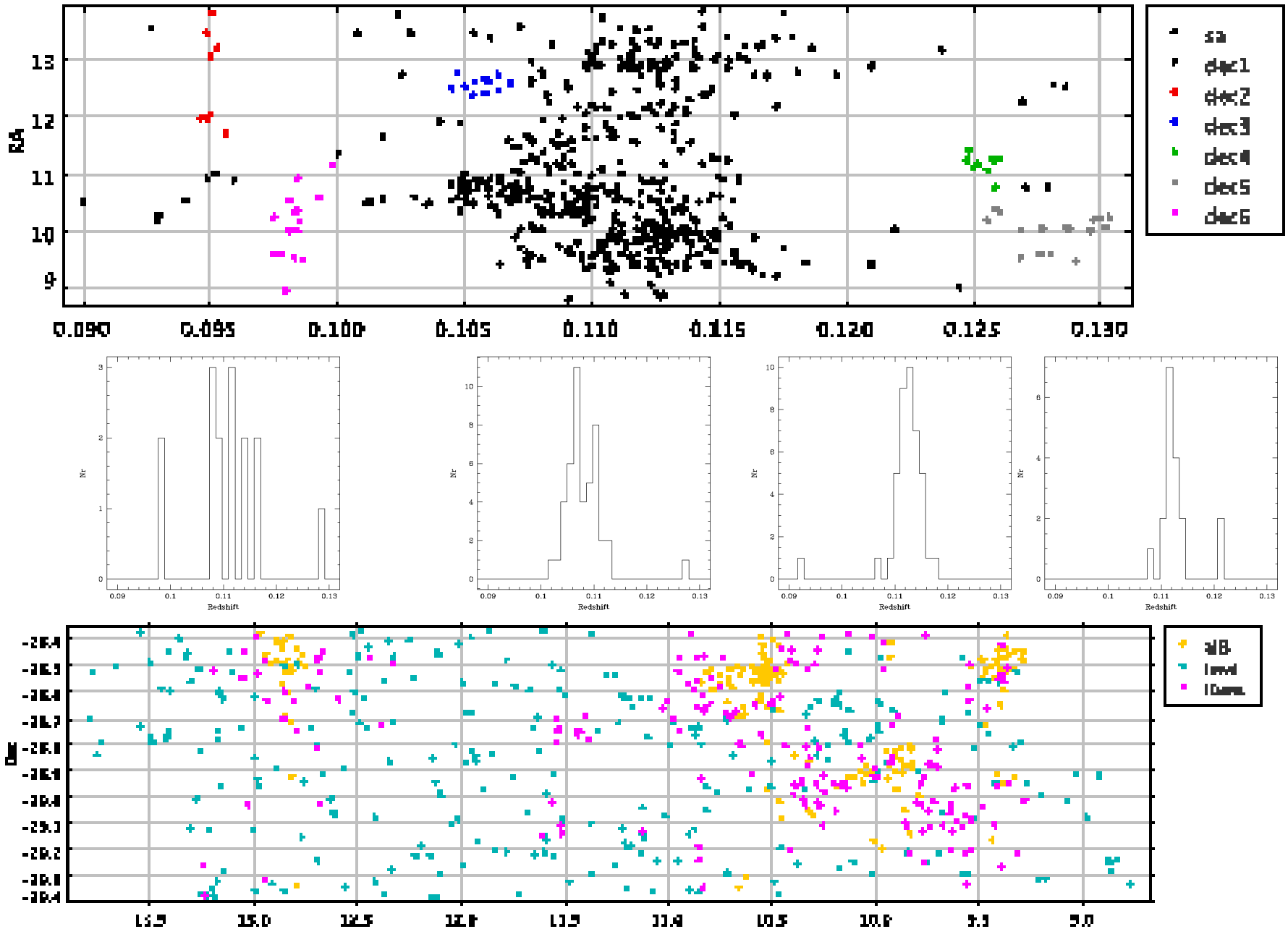




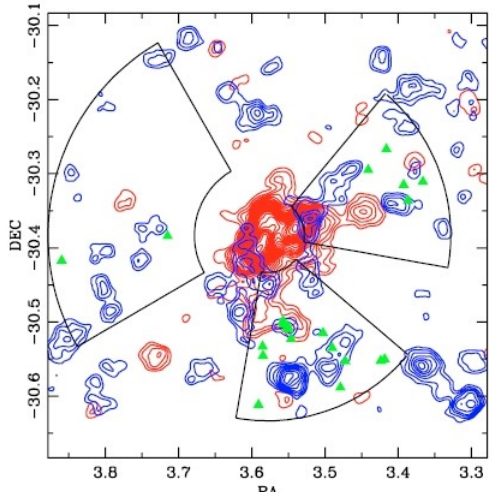
30 Mpc

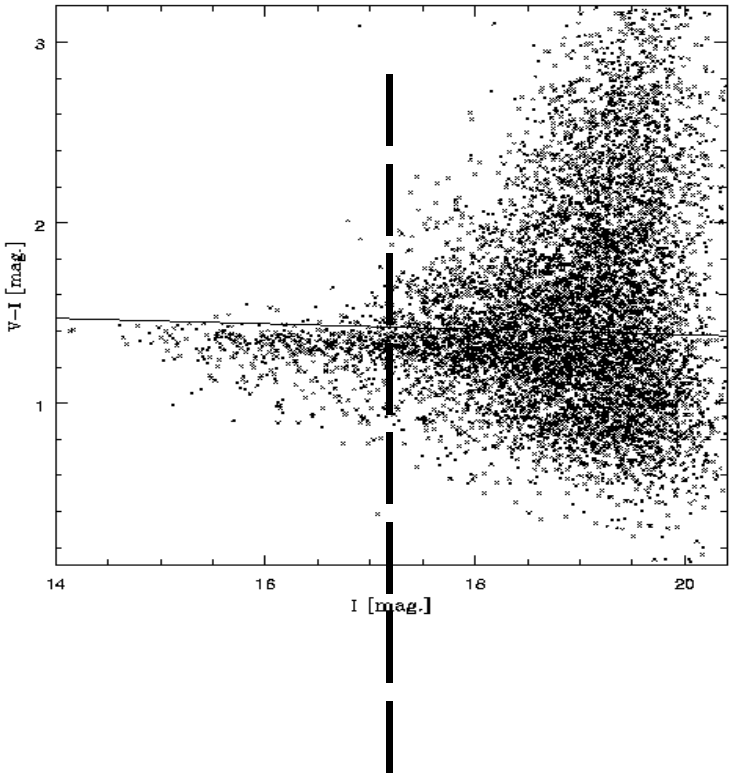


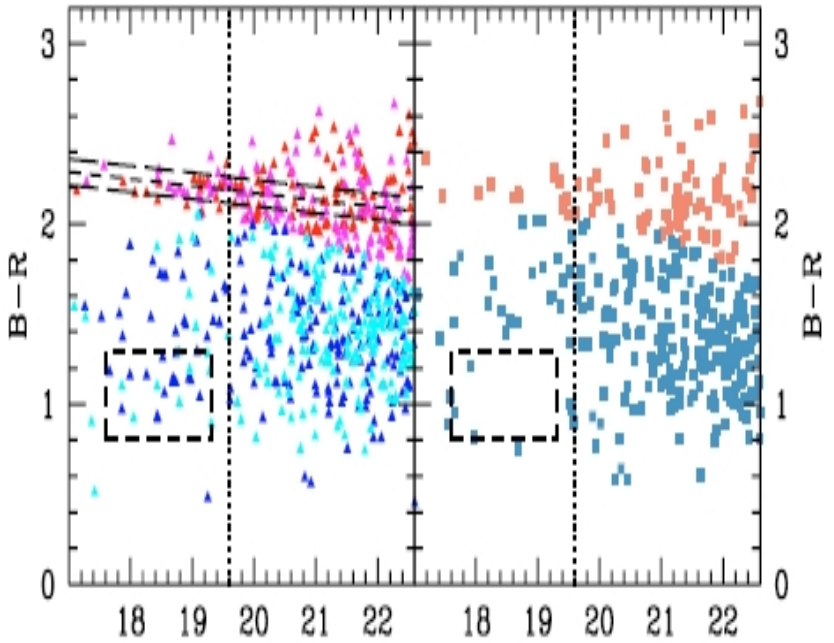
3D Densities



BRAGLIA QUICK ***COMPARISON***
Cluster at z=0.3







CLASSIFICATION

Spirals / Ellipticals / Edge-on disks / S0s?

-)By Eye (spiral structure)
-)Sersic (n < 2.5 = disk dominated)
-)Both
-)other parameters??

	Ell_visibl	Spi_visib
Ell_sersic	160	94
Spi_sersi	11	115
‘edge-on’		161

ClassificationMorphology vs Structural (Sersic)

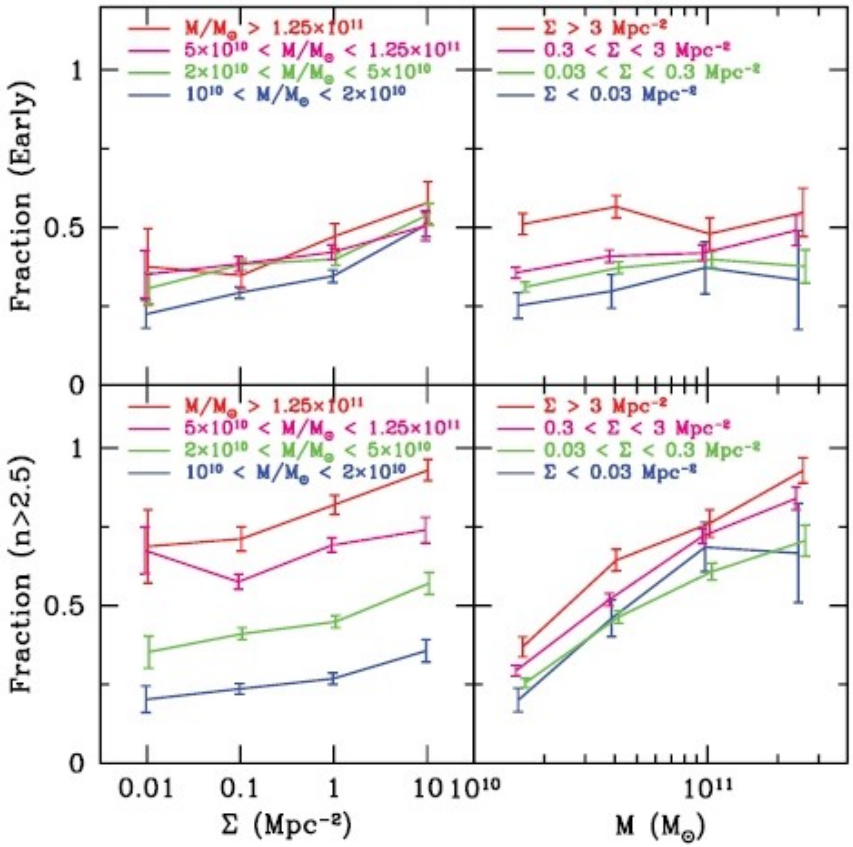


FIG. 3.—*Top left*: Relation between morphology and environment for galaxies in four different mass bins. *Top right*: Relation between morphology and galaxy mass for different density bins. *Bottom left*: Relation between structure (Sérsic parameter n) and local surface density for galaxies in different mass bins. *Bottom right*: Relation between structure and galaxy mass in different density bins. Morphology depends mostly on environment, not on galaxy mass. Structure, on the other hand, depends mainly on galaxy mass, and only weakly on environment.

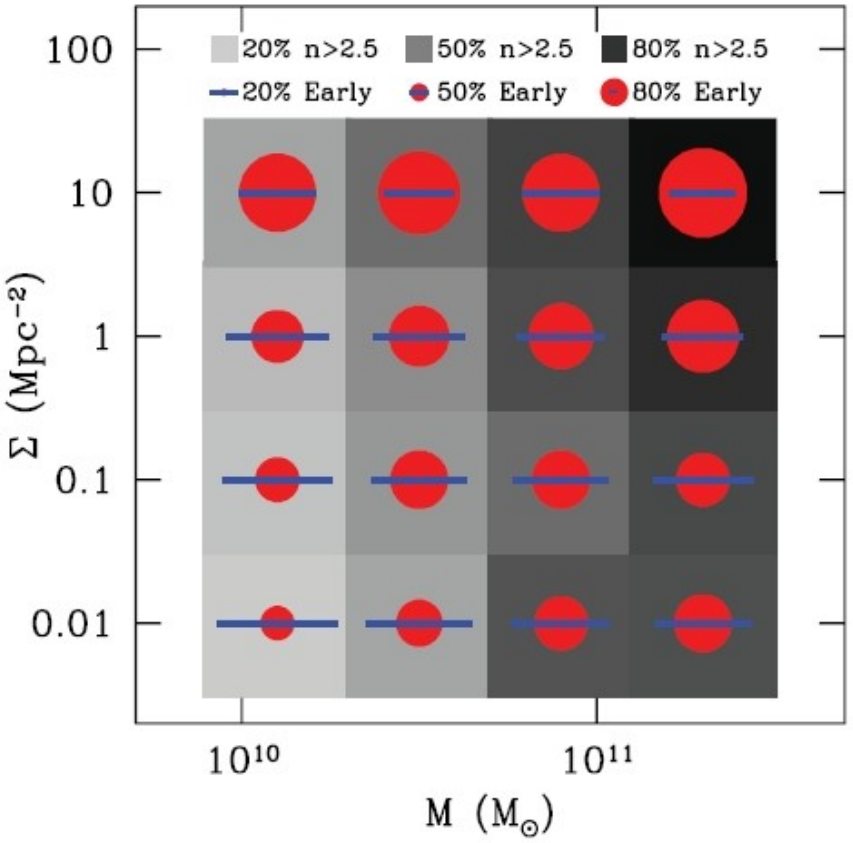
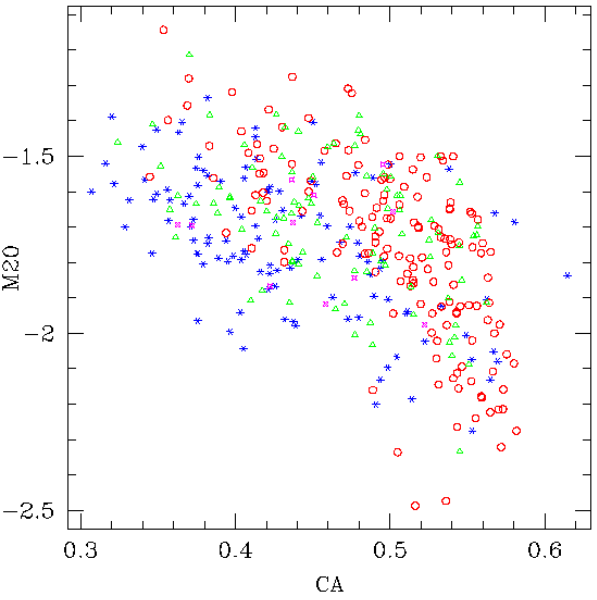
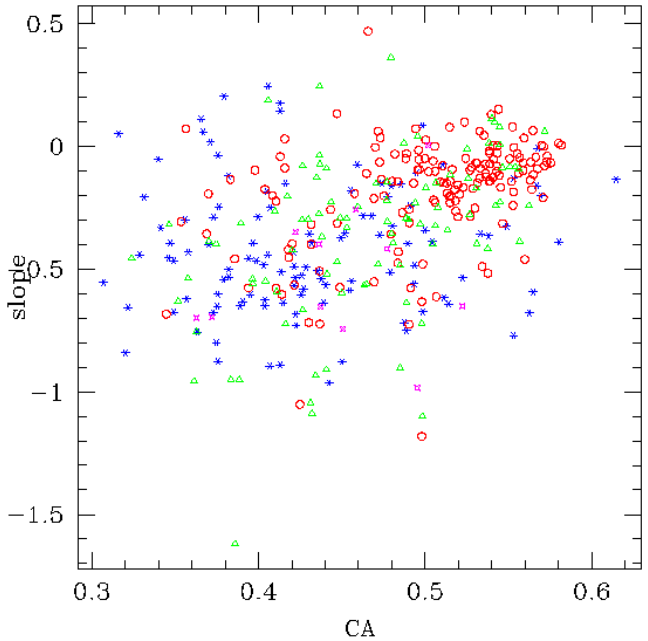


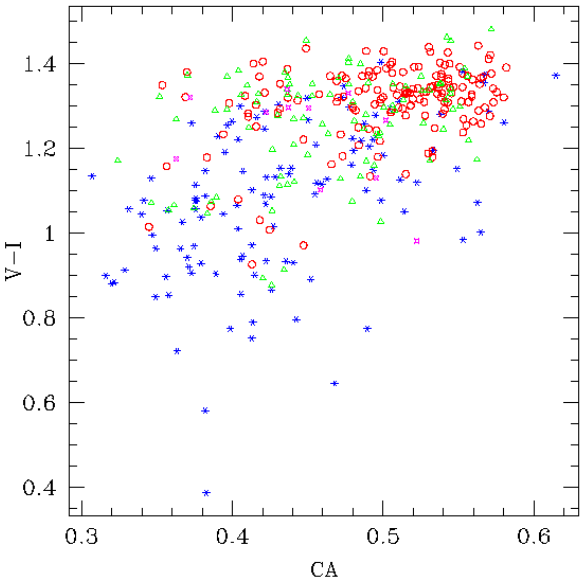
FIG. 4.—Graphical illustration of the result that morphology mainly depends on environment, and structure mainly on mass. The size of the filled, red circles (increasing from bottom to top) corresponds to the early-type galaxy fraction; the gray scale of the background (increasing from left to right) corresponds to the fraction of galaxies with $n > 2.5$.

Galaxy Parameters I=17.8: limit to get reliable values for parameters.

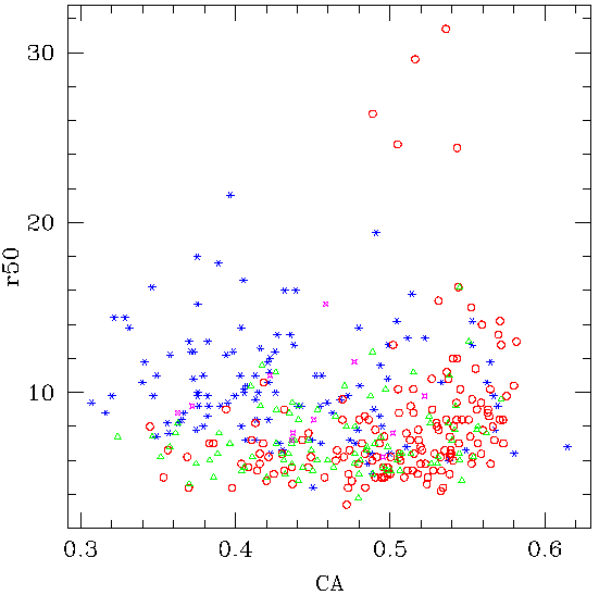
- Concentration and morphology like parameters (all in elliptical apertures):
  - C (Abraham 1996): …..
  - C (Bershady et al. 2001): r80/r20
  - Gini (Abraham 2002): flux distributionamong pixels
  - Sersic: fitting 1D gaussian convolved Sersic curves to outer parts (> 3x PSF radius = 1.2” = 2kpc at z=0.11)
  - Asymmetry (Conselice et al. 2003) subtract 180 deg rotated image)
  - M20 (2^{nd} moment flux 20% brightest pixels)
  - Visual Classifier
  - Ellipticity (SExtractor)
  - d23 (meaningful because all galaxies at similar distance)
  - Effective radius: r50
  - Average surface brightness within r50
- Colour/ Star Formation Indicator
  - V-I,
  - slope V-I,
  - 2dF SF parameter (only 3D sample) based on emission line spectra -5 - +5
- density (2d+3d)

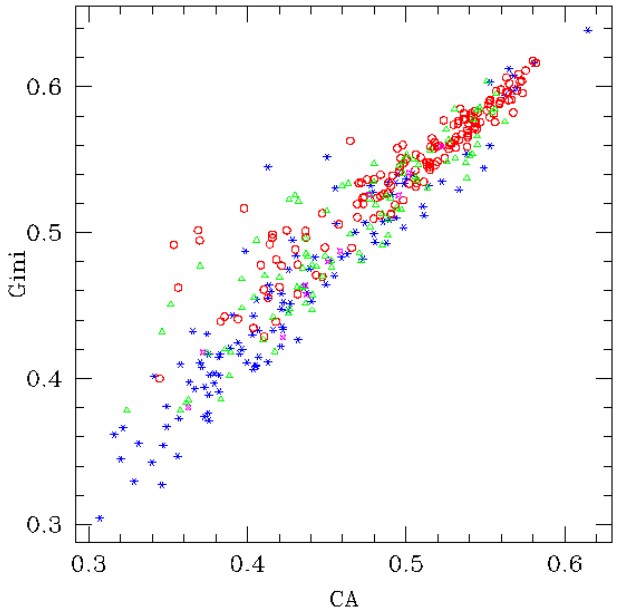


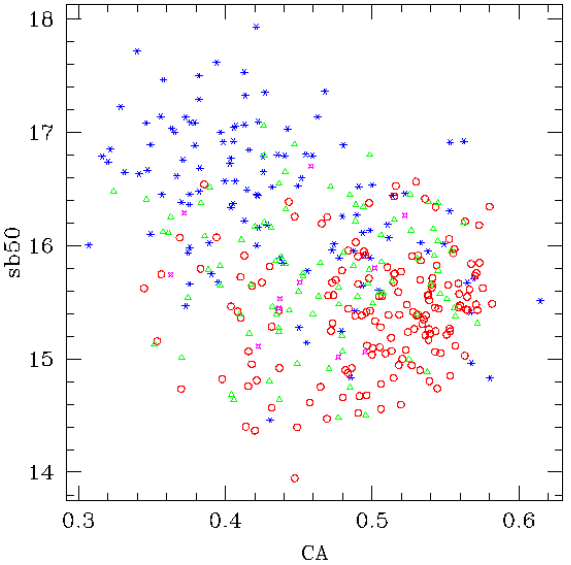


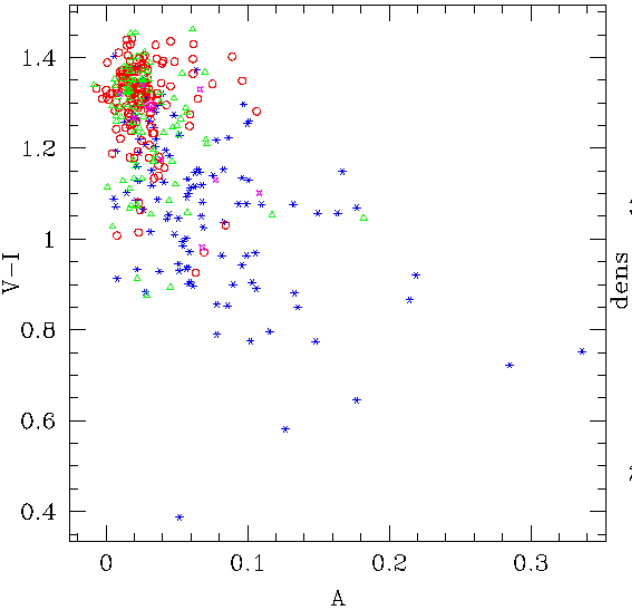


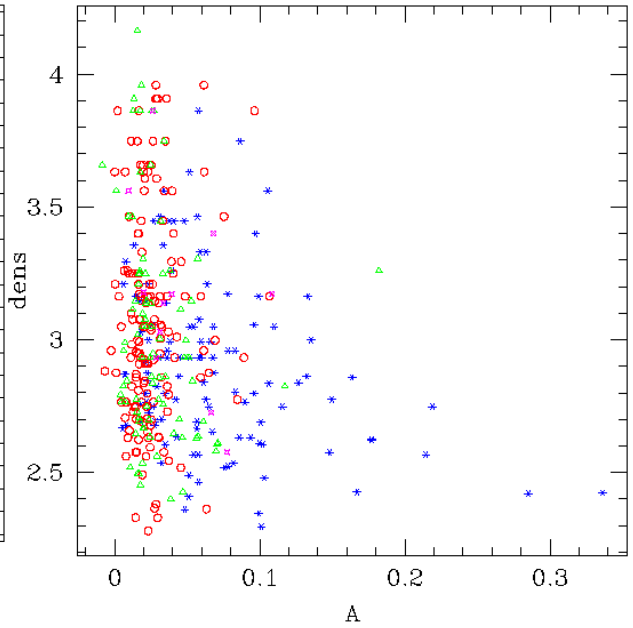
Concentration

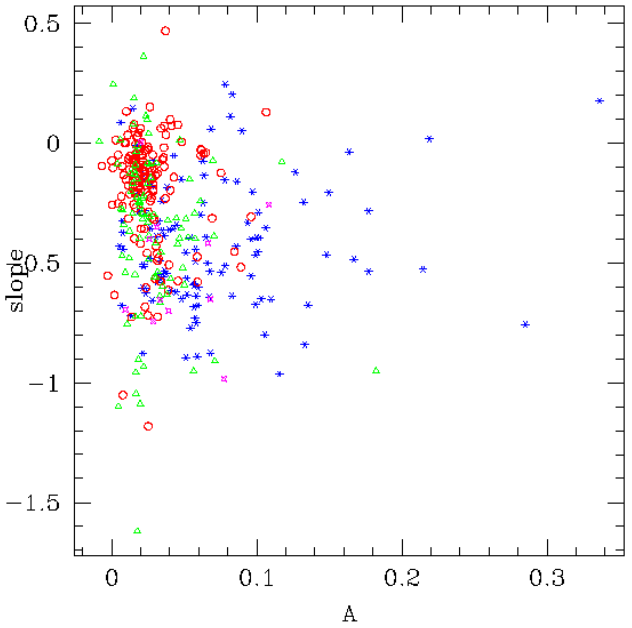




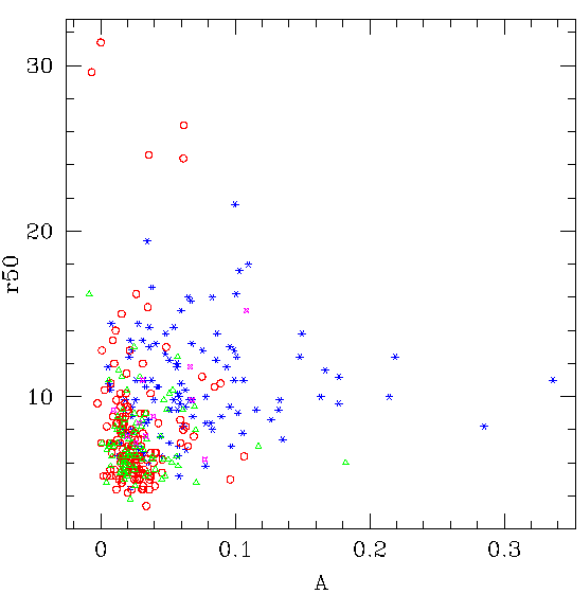


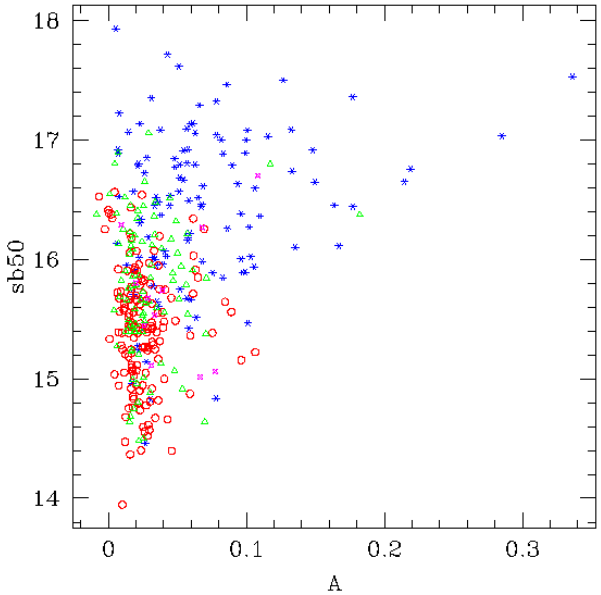


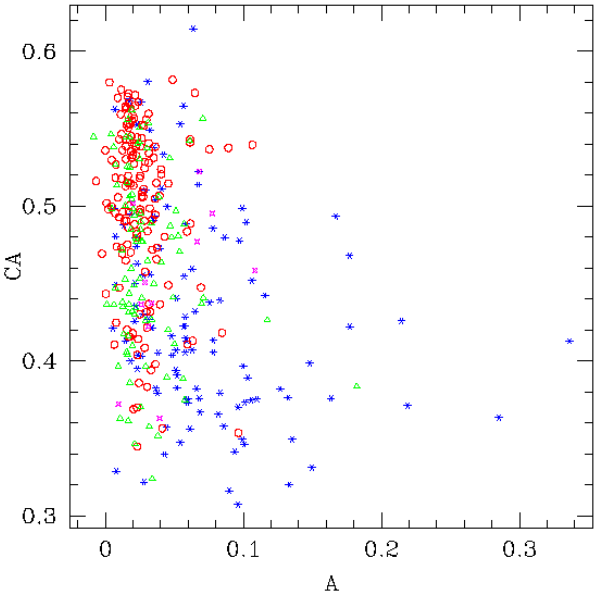


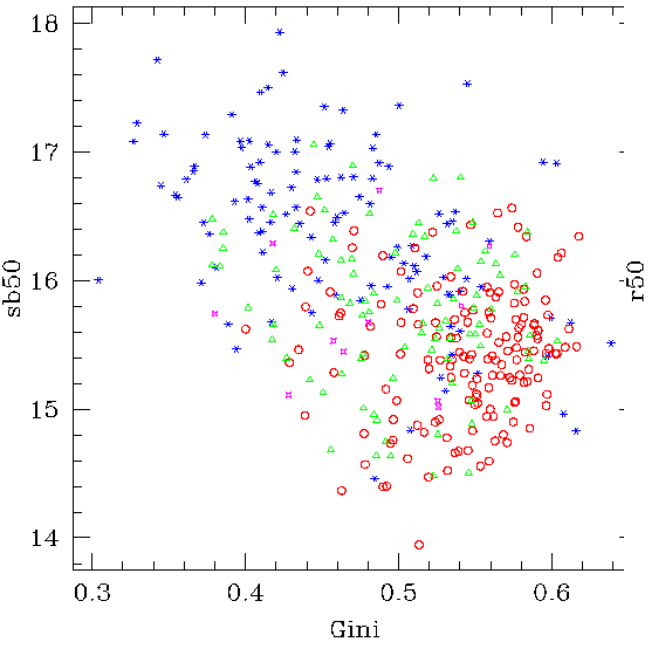


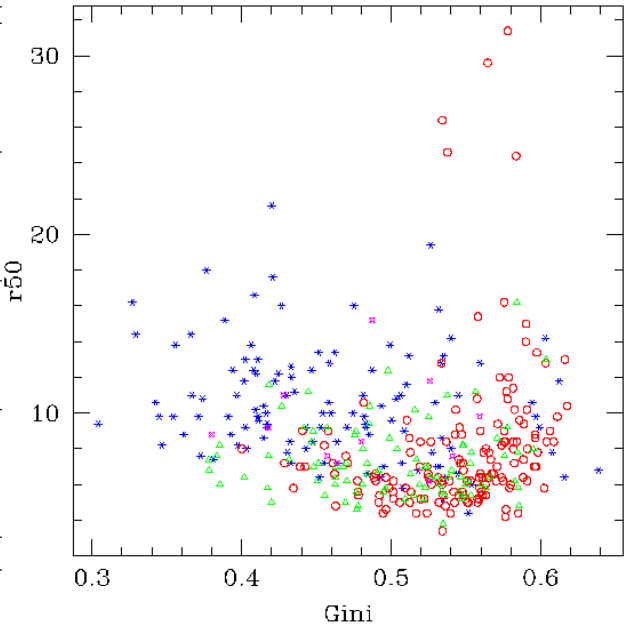
Asymmetry

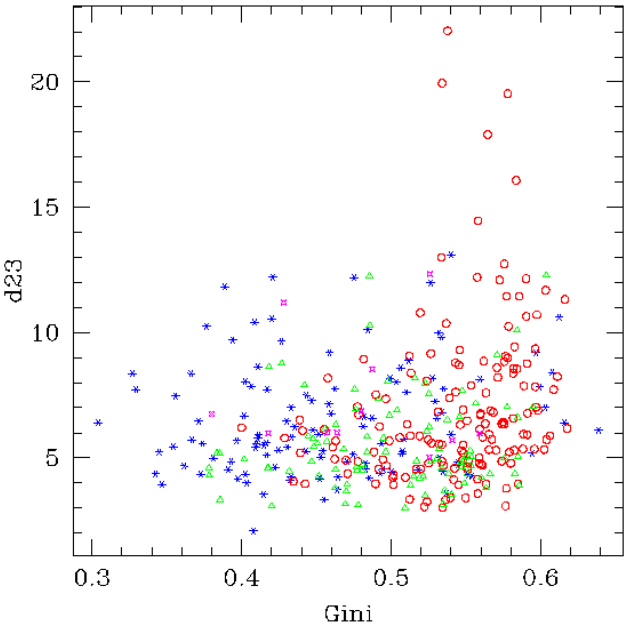




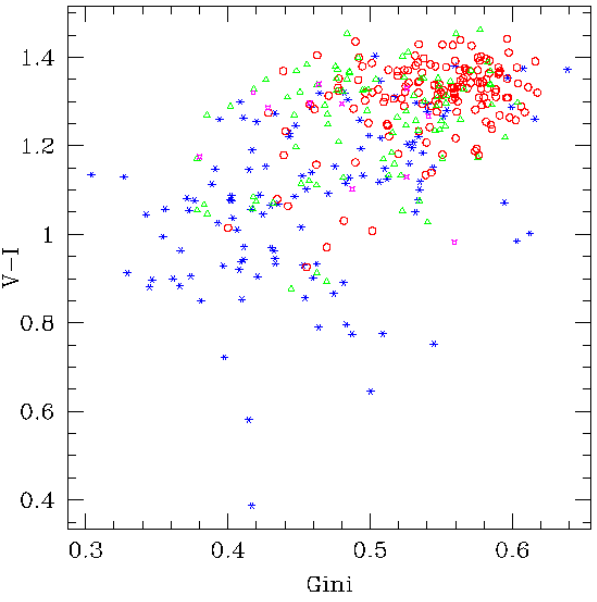


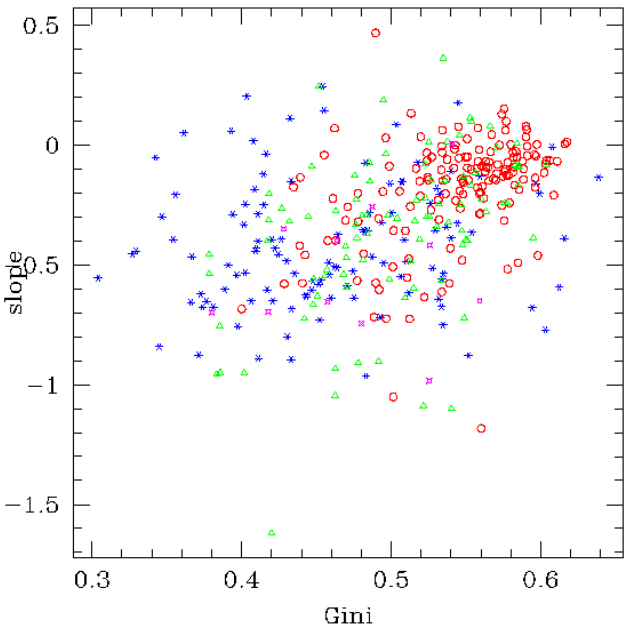


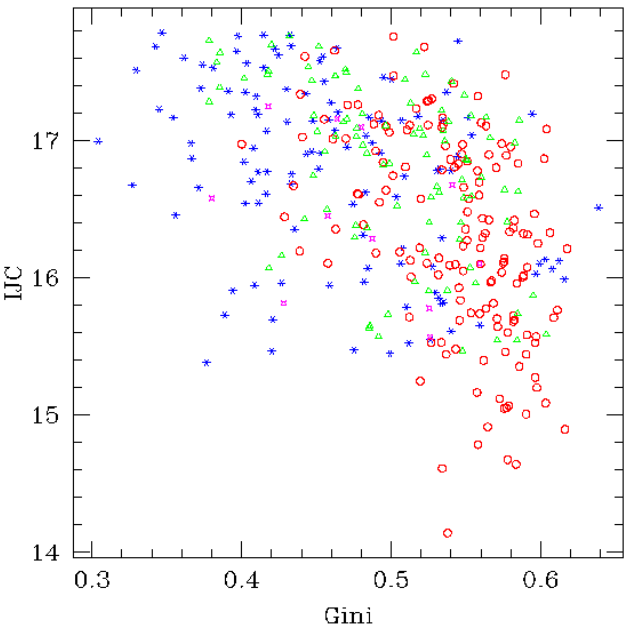


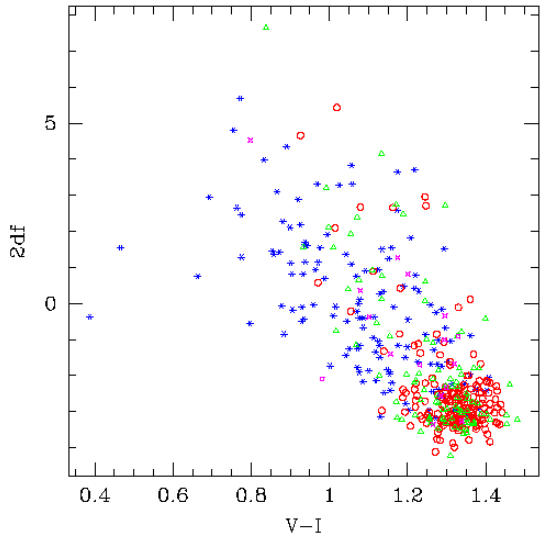


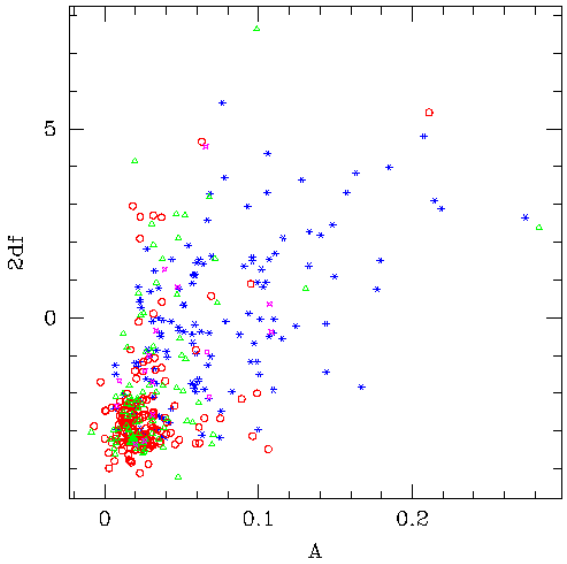
GINI

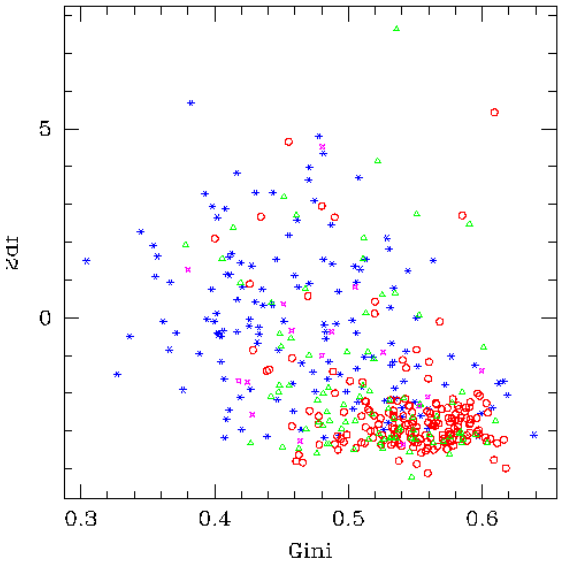


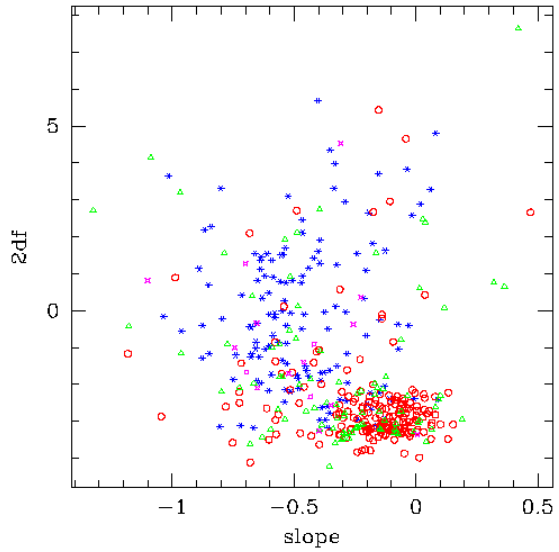


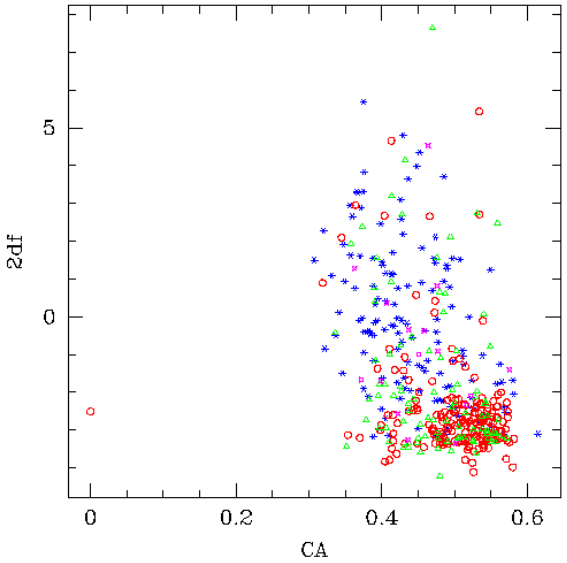


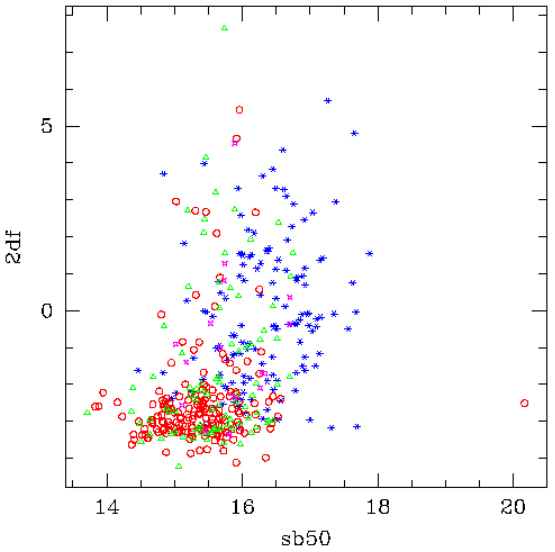












2dF Star Formation Parameter

Morphology Density Relation (Visual Classification)

- ell/(ell+spirals+disks)
  - 2D_3 0.45 0.48 0.50 0.63 // 94 189 131 122
  - 3D 0.42 0.39 0.49 0.66 // 138 97 87 125
- ell/(ell+spirals)
  - 2D_3 0.62 0.68 0.71 0.79 // 69 133 93 98
  - 3D 0.59 0.60 0.68 0.85 // 100 63 63 97
- ell/(ell+disks)
  - 2D_3 0.63 0.62 0.63 0.76 // 68 147 104 101
  - 3D 0.61 0.53 0.64 0.74 // 97 72 67 110

Some Results for non-inclined 3D sample 220 elliptical galaxies < 17.3 in I; low density < 5x background, high density @ > 5x background (about 1.5 virial radius

	hd	ld
Blue ellipticals	0.07	0.18

	hd	hd_b	ld	ld_b
C	3.14	2.77	3.13	2.77
CA	0.48	0.45	0.50	0.45
M20	-1.80	-1.51	-1.73	-1.59
Gini	0.53	0.50	0.54	0.51
Ell	0.25	0.24	0.24	0.23
A	0.02	0.03	0.03	0.05
slope	-0.18	-0.41	-0.20	-0.48
sb50	15.5	15.6	15.4	15.6
sersic	0.42	0.40	0.46	0.53
IJC	16.2	16.8	16.4	16.8
2df	-3.0	-1.4	-2.6	-0.3

Some Results for non-inclined 2D sample 123 spiral galaxies < 17.3; low density < 5x background, high density @ > 5x background (about 1.5 virial radius)

	hd	ld
Red Spirals	0.55	0.26

	hd	hdr	ld	ldr
C	2.82	3.08	2.80	3.13
CA	0.43	0.47	0.42	0.47
M20	-1.75	-1.78	-1.79	-1.80
Gini	0.46	0.50	0.45	0.50
Ell	0.25	0.27	0.26	0.30
A	0.07	0.04	0.09	0.04
slope	-0.52	-0.31	-0.48	-0.34
sb50	16.3	15.9	16.4	15.8
IJC	16.5	16.5	16.5	16.4
2df	0.4	-1.9	0.2	-1.9

TBD:similar tables for other divisions

BARS and TRUNCATIONS – Preliminary Results

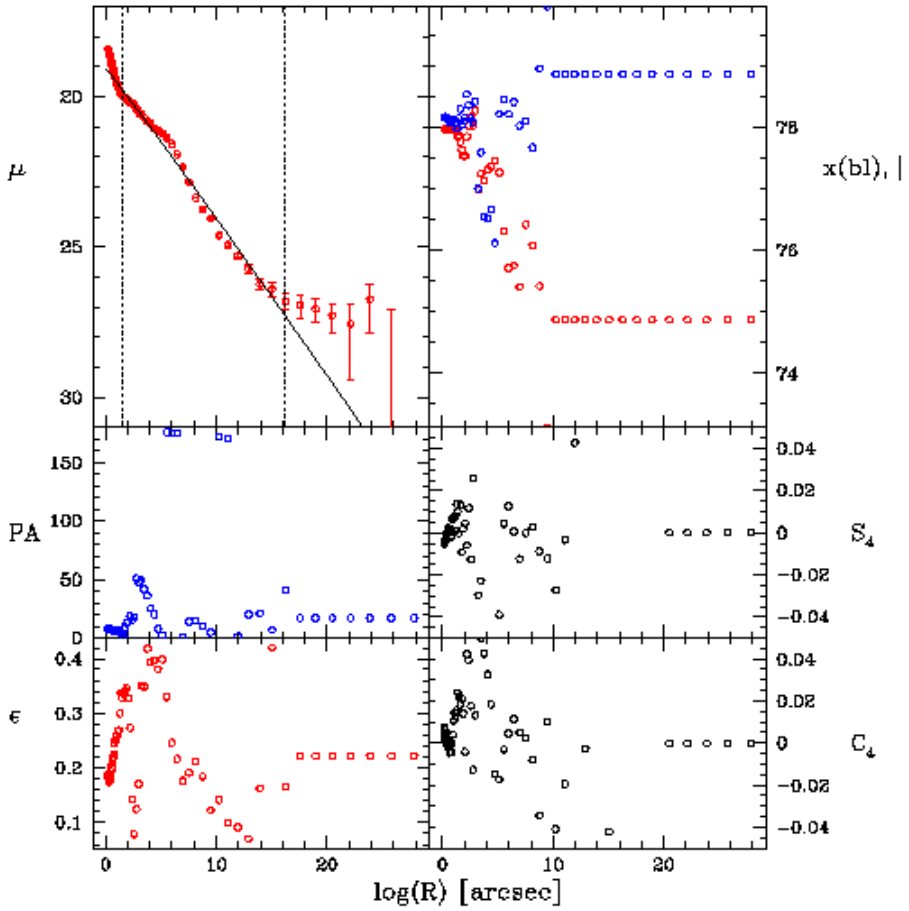
- For the first time bars and truncations in disk-dominated galaxies were studied in a continuous area at this redshift (i.e. z=0.11 +/-0.02).
- Methods
- Types of bars
- Types of truncations

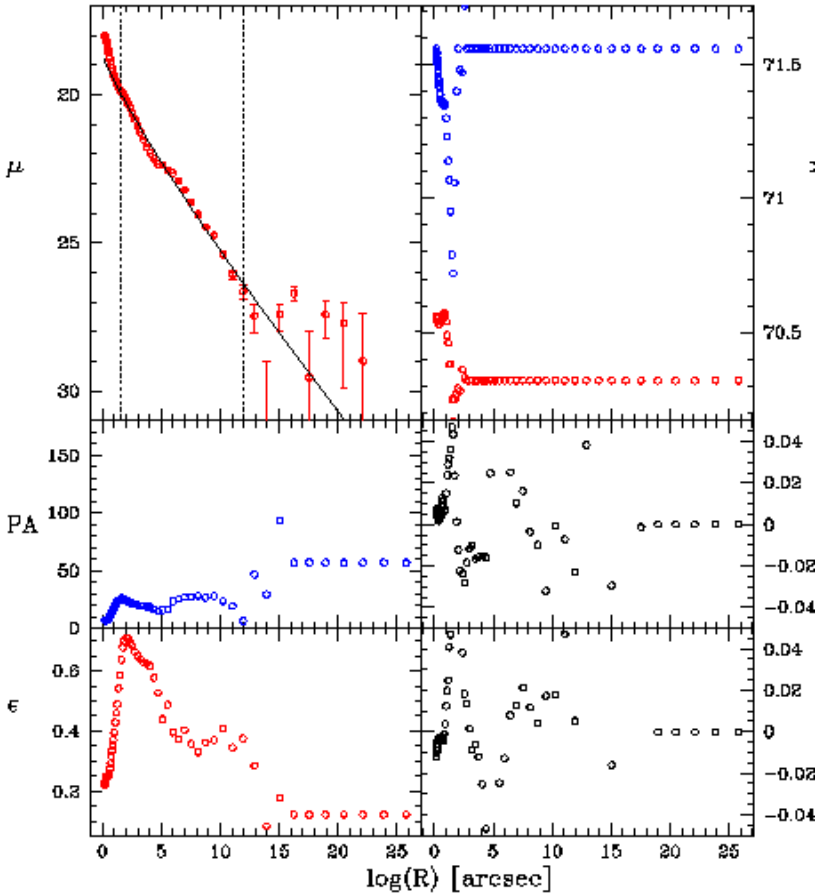
BARS Technique

-) use spiral sample

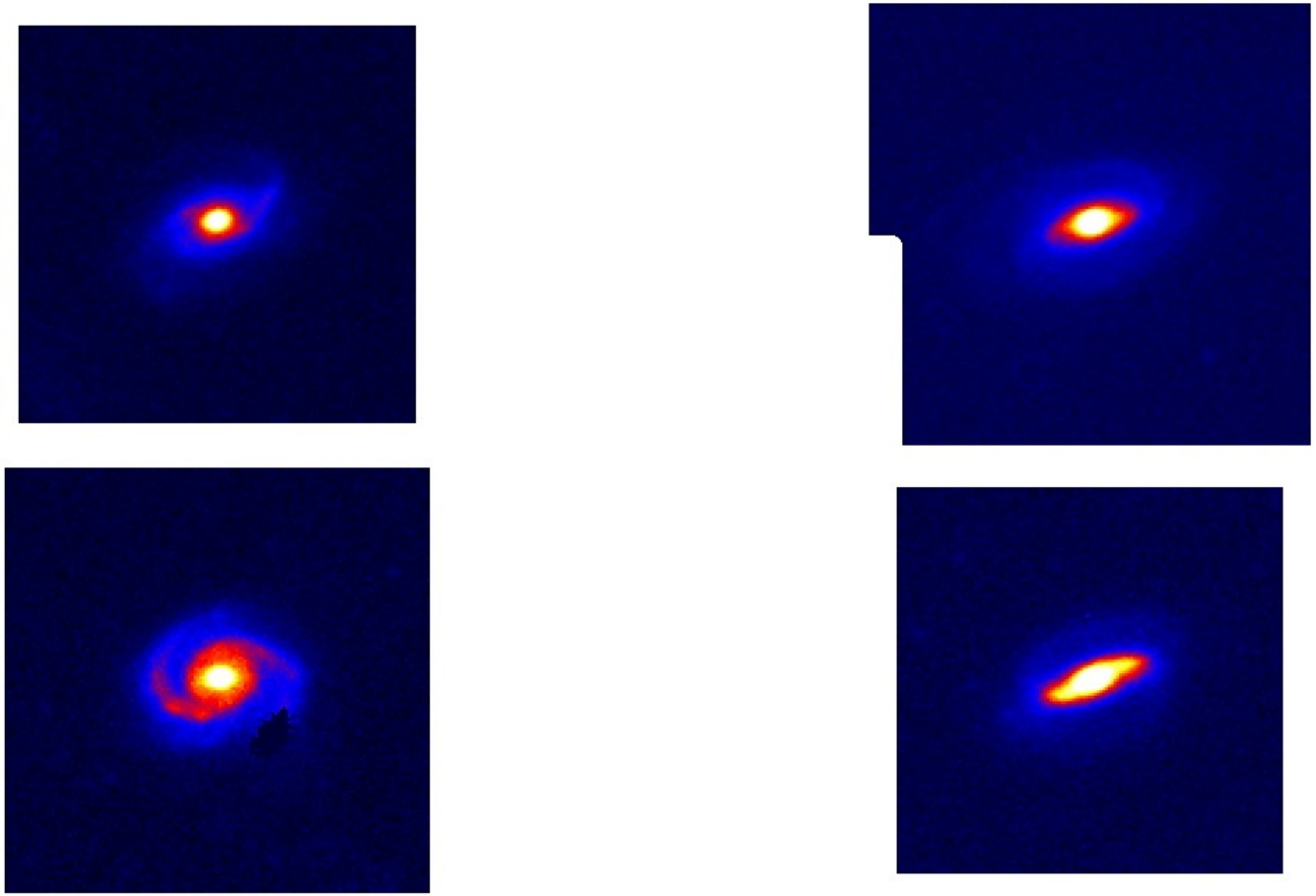
-) ellipse fitting program: GALPHOT, (build in ASTROWISE)

-) let Ellipticity and PA vary, sensitive from minor axis = 3x PSF radius (only large bars >= 3kpc)





BARS – Preliminary Results

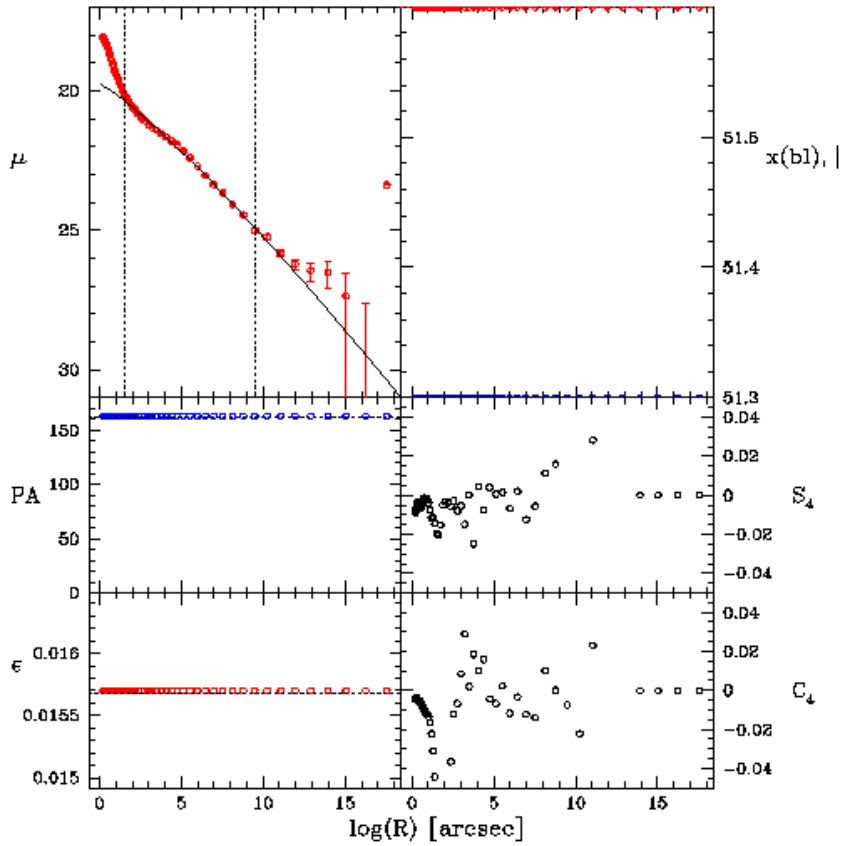


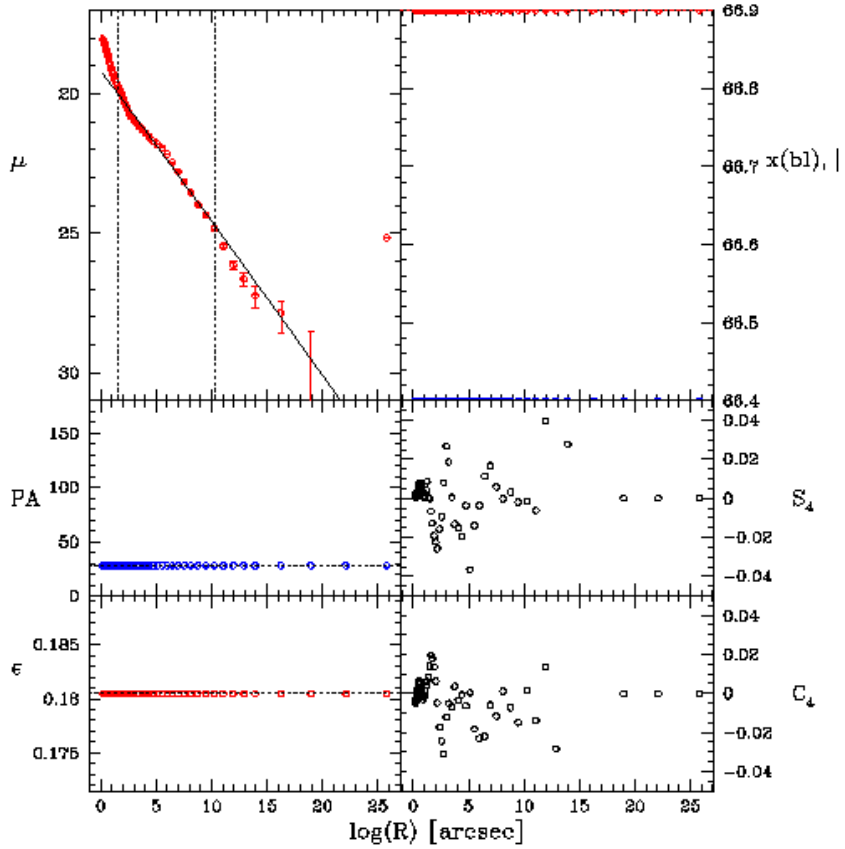
TRUNCATIONS Technique

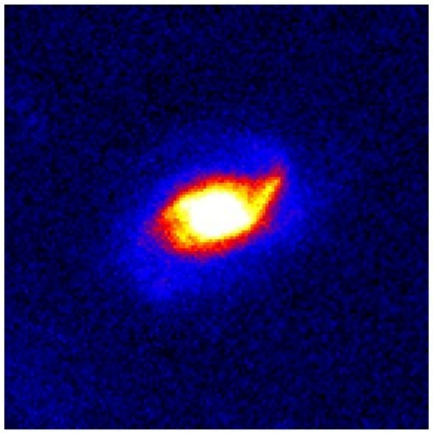
-) use spiral sample

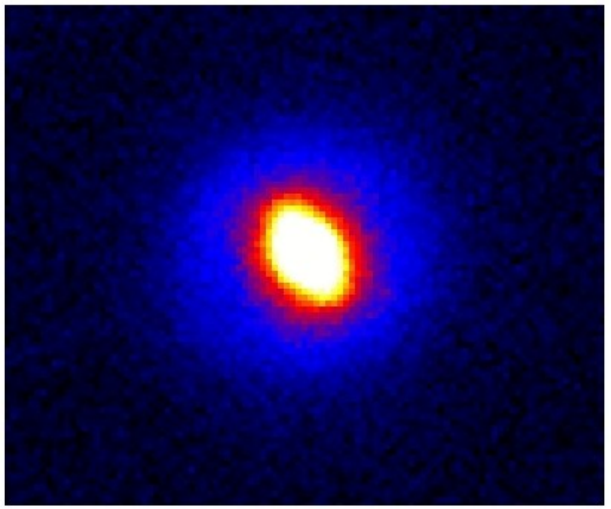
-) ellipse fitting program GALPHOT, (build in ASTROWISE)

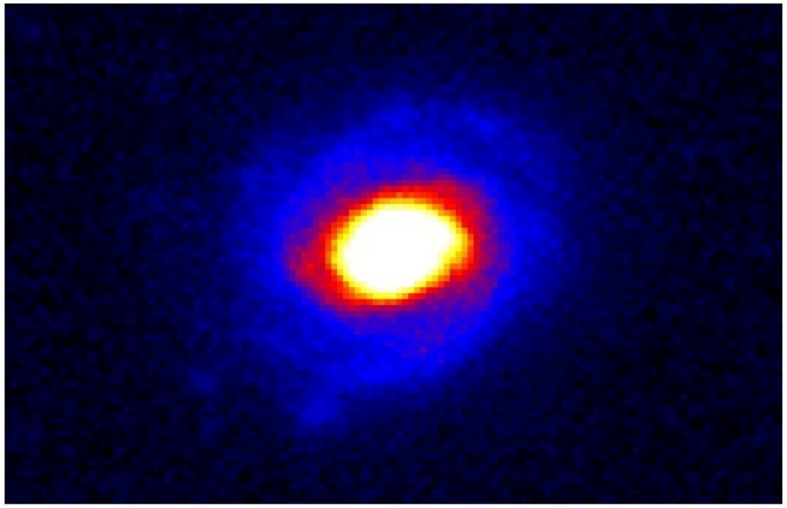
-) Ellipticity and PA fixed, analyse light profile

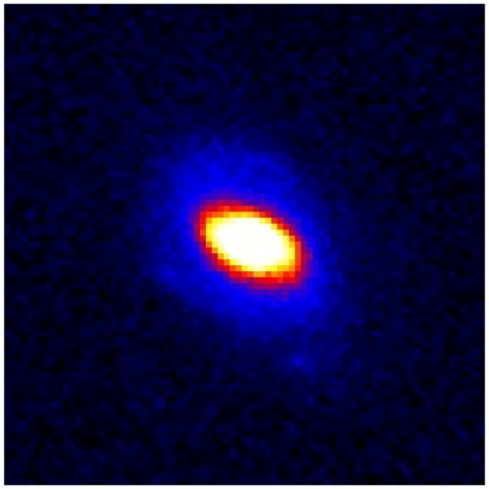












BARS and TRUNCATIONS – Preliminary Results

- Bars occur at similar frequencies in field regions and high density regions (contrary to earlier results).
- Bars may be larger and more frequent at my redshift z-0.11. (This is in contradiction with Yogee 2006 (using similar absolute magnitude limit)), but in agreement with the results of Sheth et al. 2007.

BARS and TRUNCATIONS – Preliminary Results

- Frequency of truncations in low density regions and in high density regions is similar.
- Truncations in high density regions tend to be stronger: i.e. a larger change in slope of the surface brightness near the break radius is observed in high density regions.
- We find many more non-truncated disk galaxies compared to the study of Pohlen \& Trujillo (2007). This is very likeley explained by our much lower resolution.

TBD

- Link available REFLEX X-ray data with galaxy parameters
- Now only discussed colour outliers (well known). Also analyse outliers vs environment for the other quantities like asymmetry or concentration: f.i. concentrated spirals vs non-concentrated ellipticals etc. etc. as a ***FUNCTION of ENVIRONMENT***
- Get more redshifts to get better fainter completeness levels → 19.3 in I == 5x more objects (2700). Especially in the low density regions
- Braglia blue galaxies at z=0.3 vs. my few blue galaxies predicted in simulations (i.e. Millenium run)
- Intepretation.