Stellar populations in the CFHTLS

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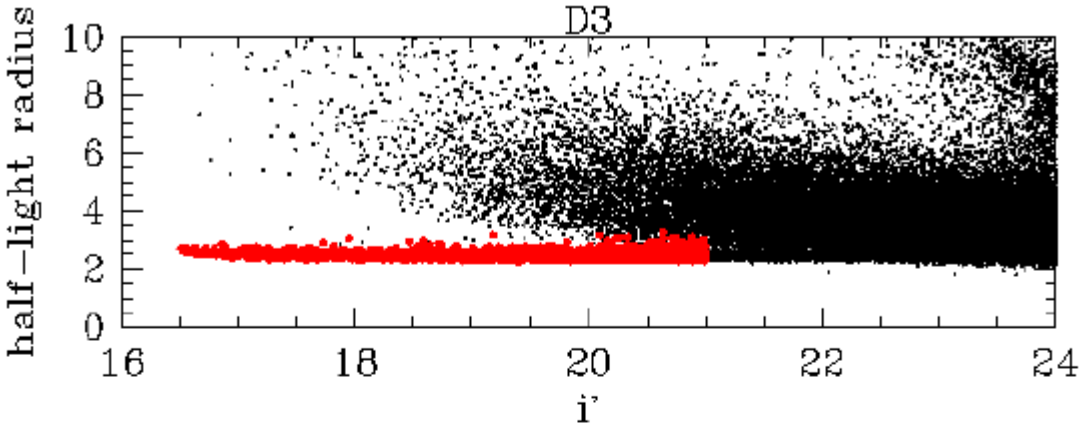
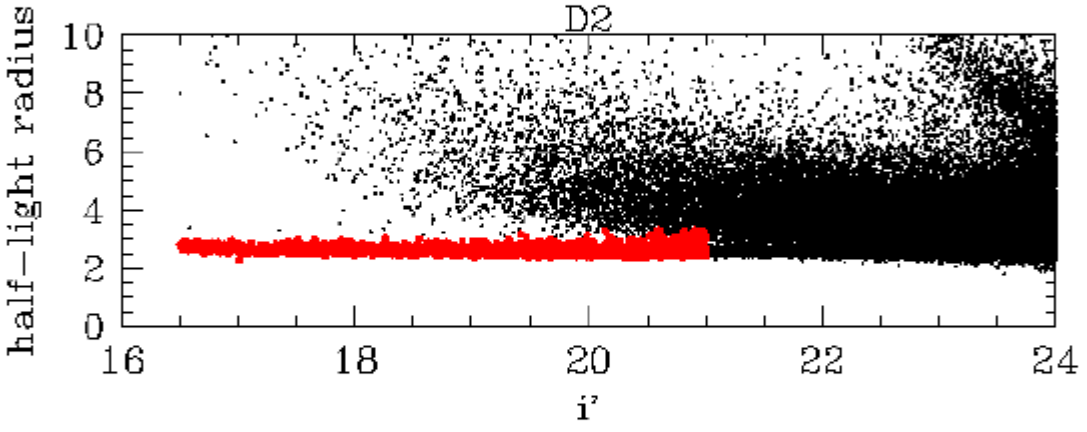
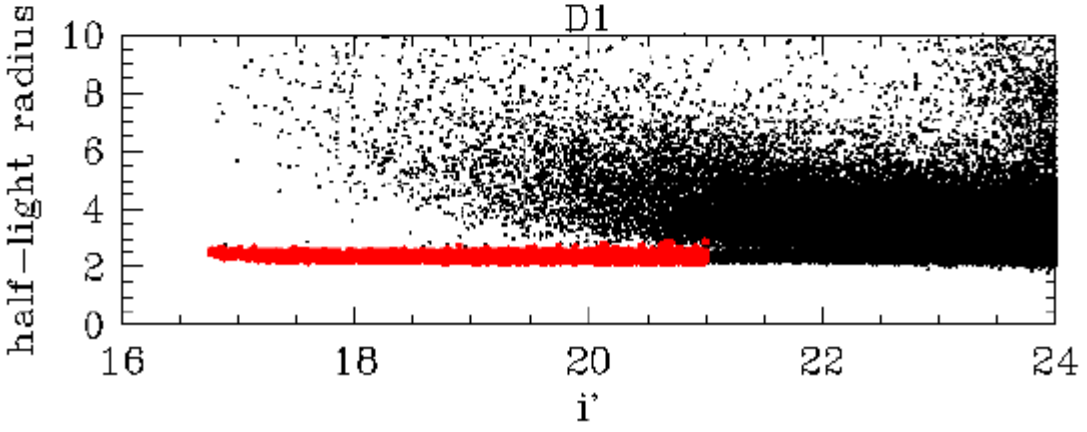
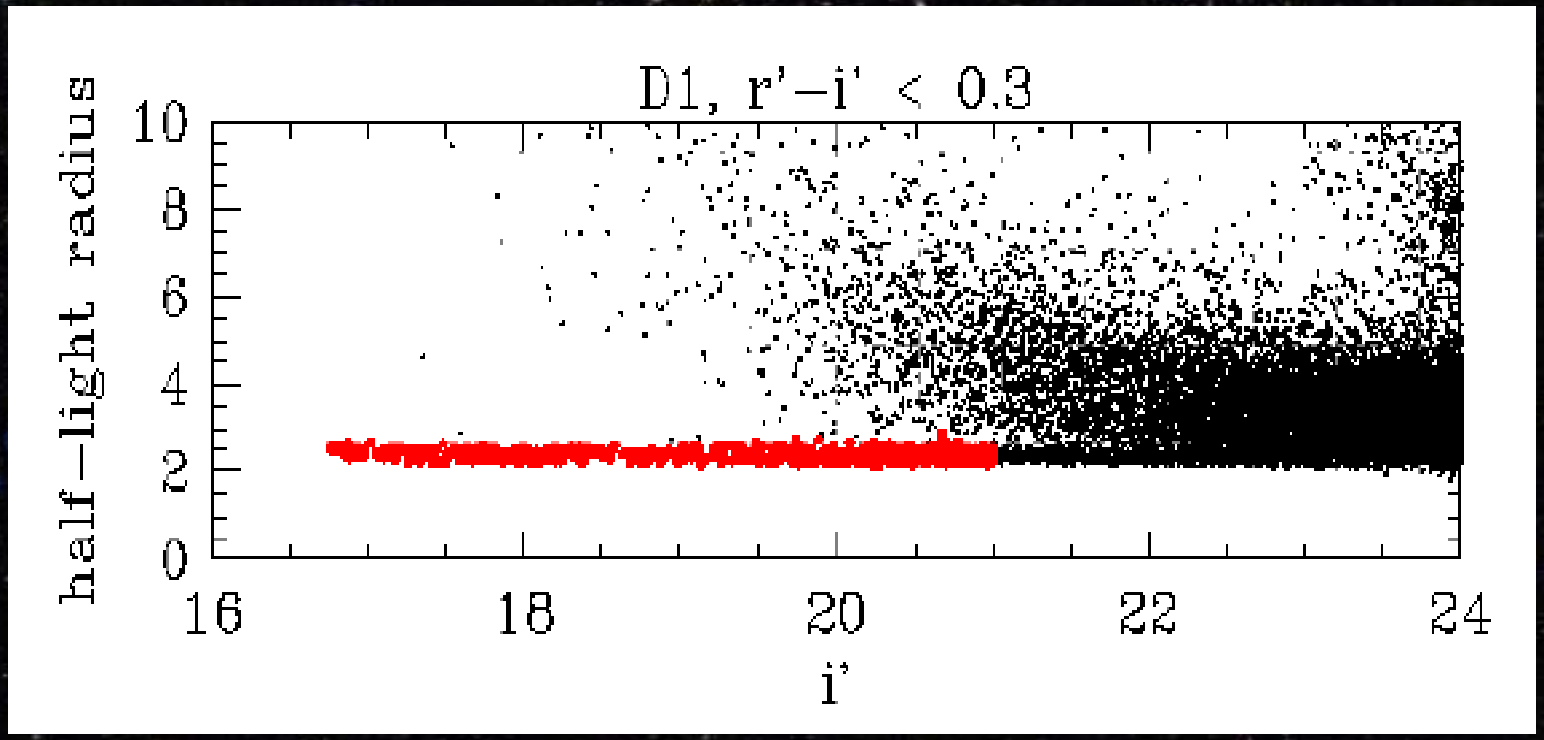
B. Goldman (MPIA) and TERAPIX

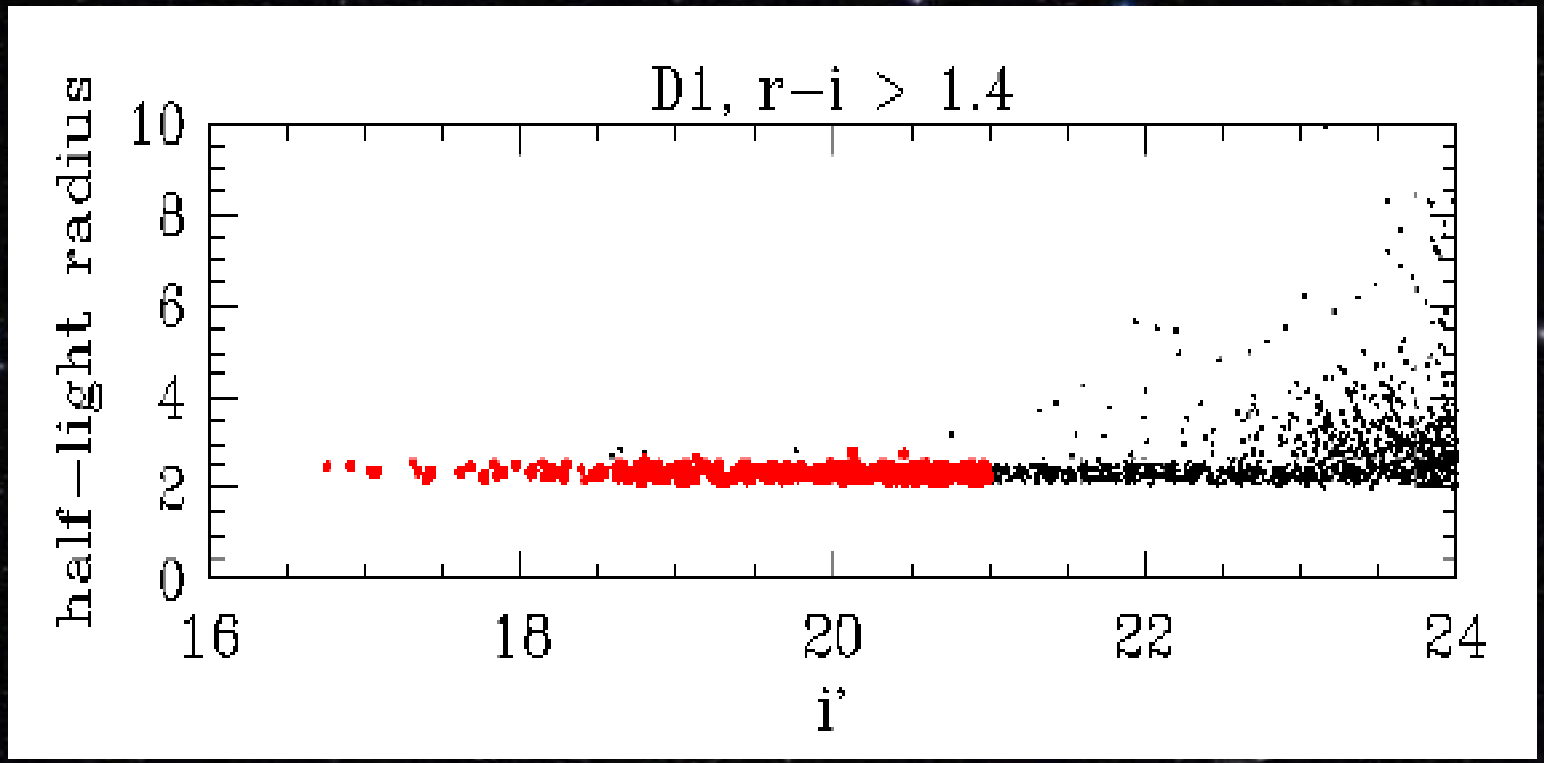
- Star/Galaxy separation
- Residual galaxy contamination
- Stellar libraries
- Photometric calibration
- Stellar populations


D3
half−light radius
10
8
6
4
2
0
16
18
20
22
24
i'


D2
half−light radius
10
8
6
4
2
0
16
18
20
22
24
i'


D1
half−light radius
10
8
6
4
2
0
16
18
20
22
24
i'

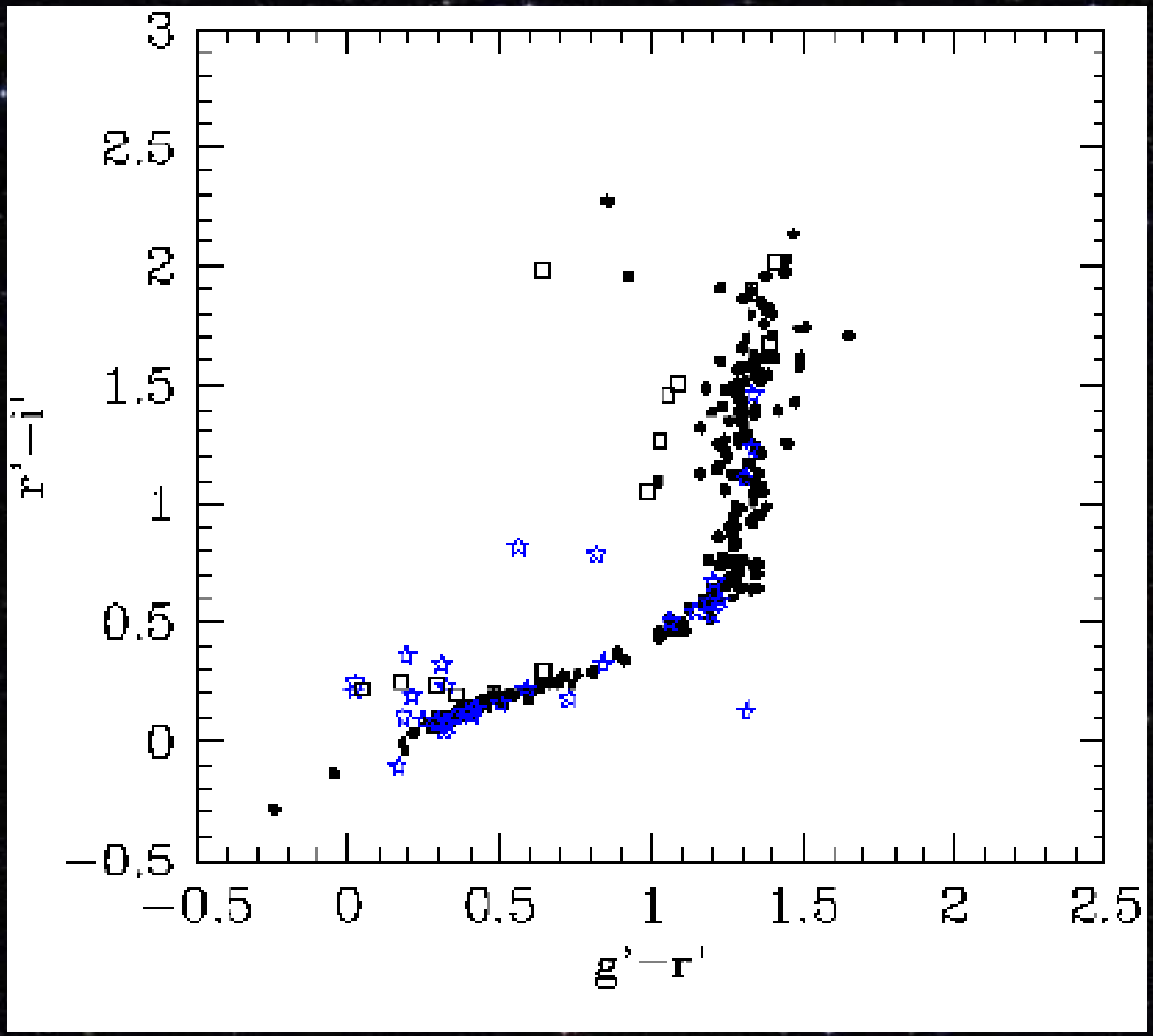

D1, r'−i' < 0.3
half−light radius
i'
0
2
4
6
8
10
16
18
20
22
24


D1, r−i > 1.4
half−light radius
i'
0
2
4
6
8
10
16
18
20
22
24

Residual galaxy contamination

Schultheis et al. (2006) VVDS/D1

Objects morphologically classified as stars



. Stars

* Galaxies

sq blend

i'<22

r'-i'	
<0.5	23.5%
>0.5	6.5%

i'<21

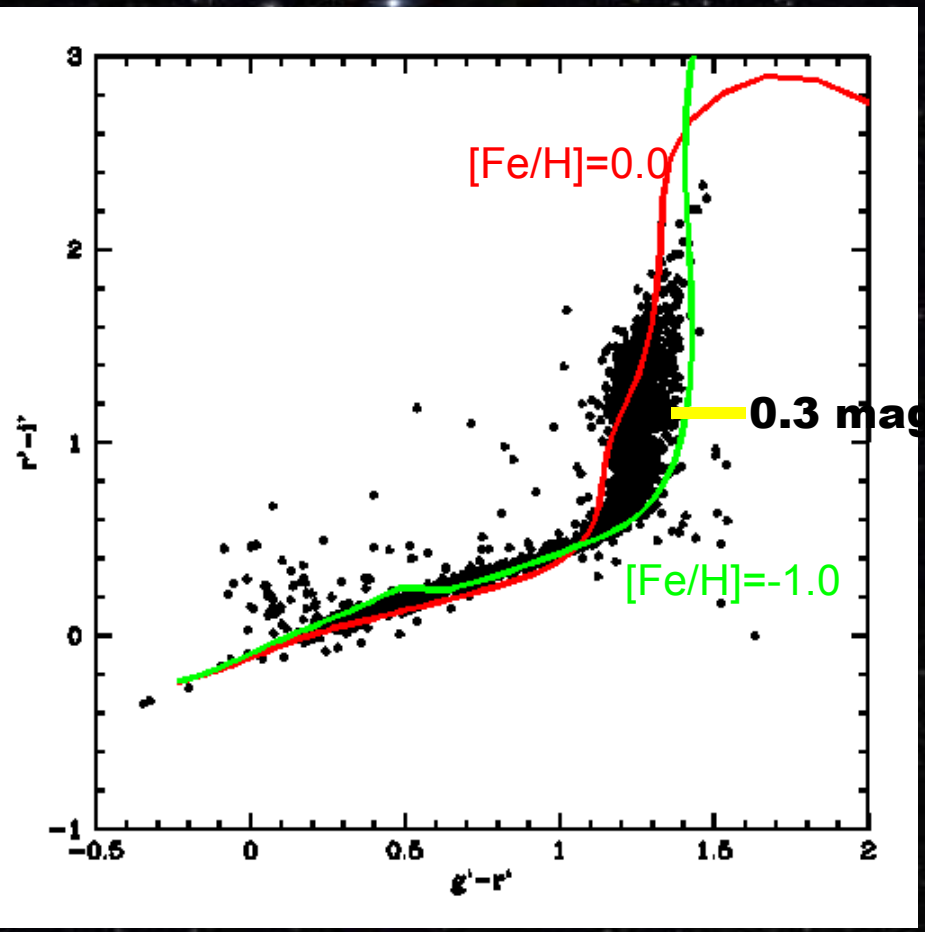
r'-i'	
<0.5	13%
>0.5	3%

Stellar libraries

Basel 3.1 (Lejeune et al.): T_{eff} > 4000 K

NextGen (Hauschildt et al.) T_{eff} < 4000 K

Schultheis et al. (2006)



Model grid with **[Fe/H]=0.0, -1.0 et -2.0**

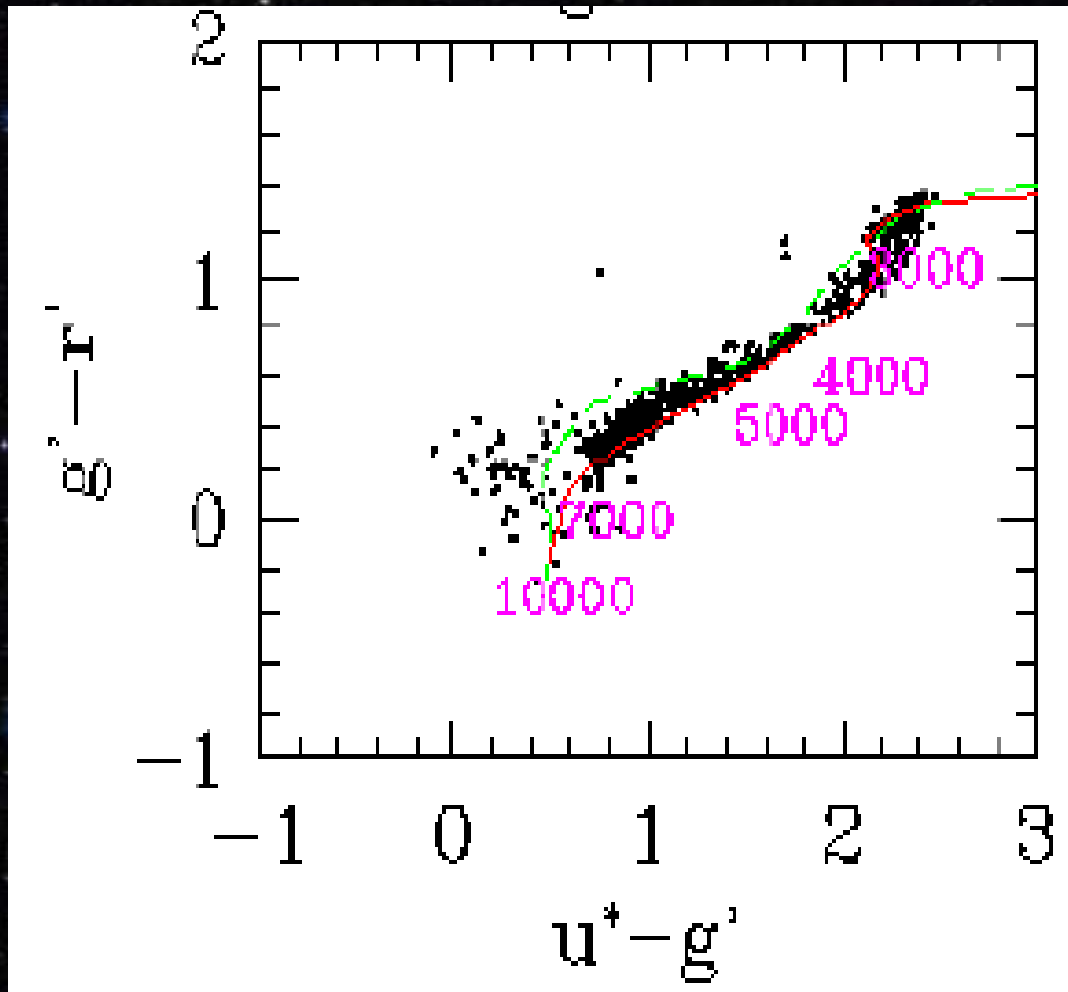
→ affects colour, e.g. 0.3 mag!

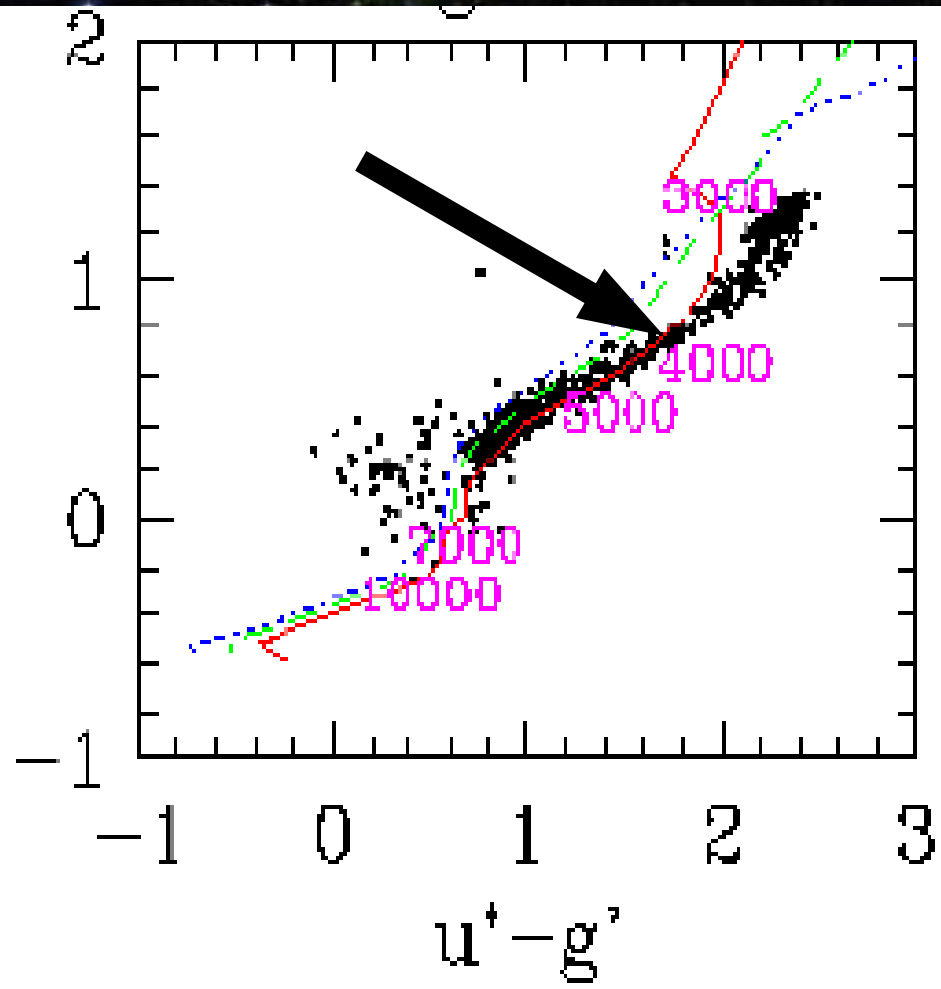
Much more precise than Pickles library (1998) (only for Z=0.0)

→ Implantation in the population synthesis model of Besancon model

NextGen

BaSeL

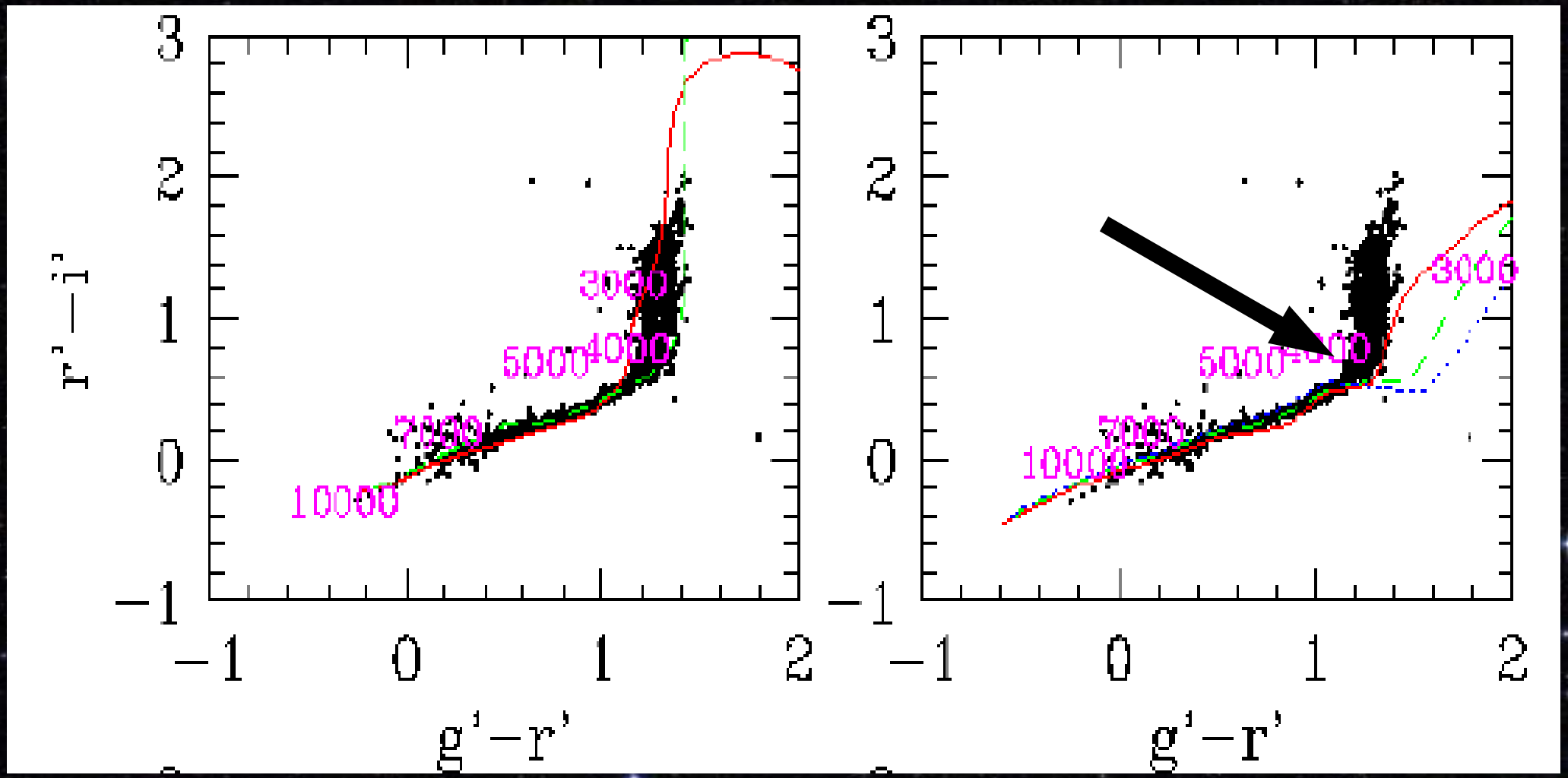




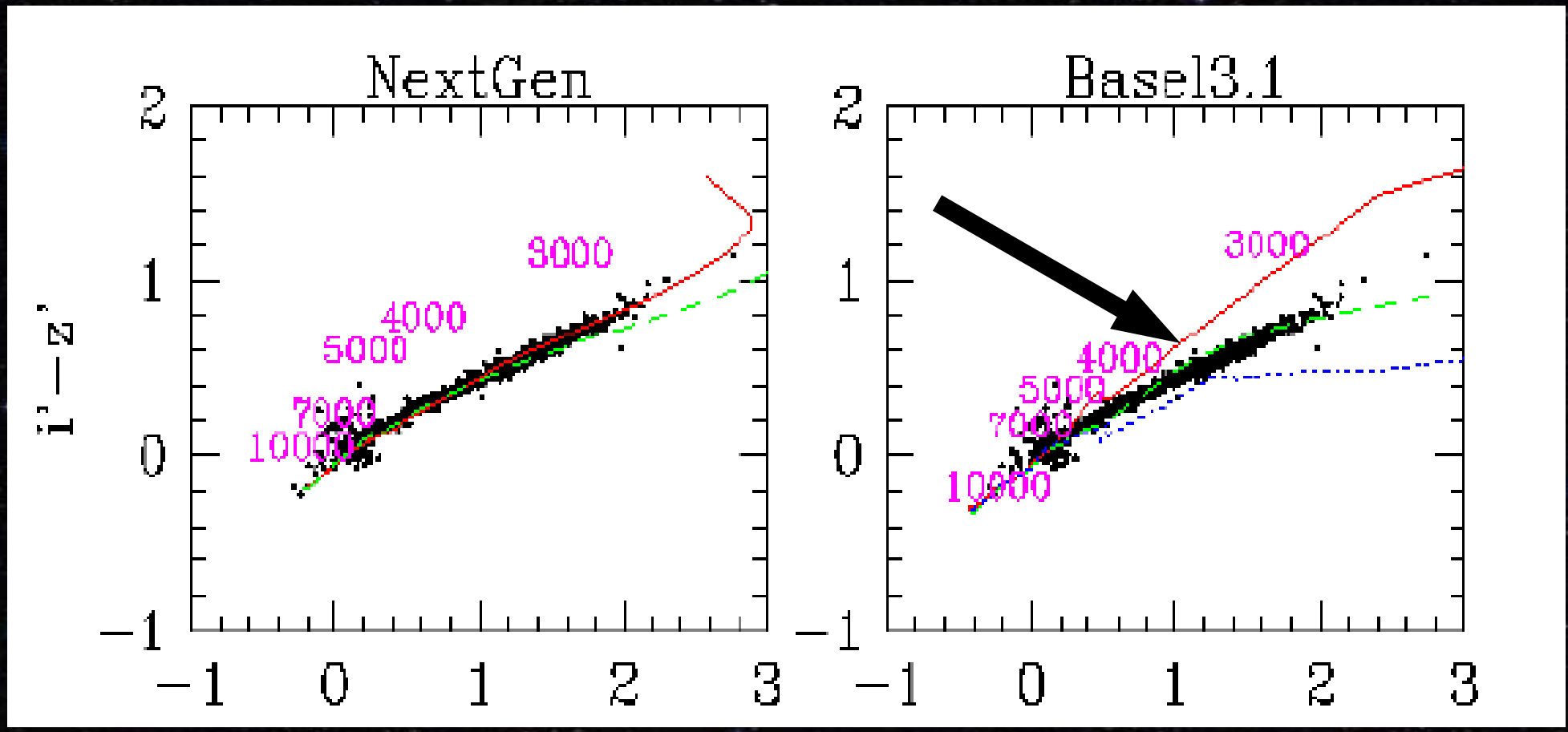
[Fe/H]=0 [Fe/H]=-1 [Fe/H]=-2.

NextGen

BaSeL



[Fe/H]=0 [Fe/H]=-1 [Fe/H]=-2.



[Fe/H]=0 [Fe/H]=-1 [Fe/H]=-2.

BUT:

- For low temperatures (Teff < 4000 K):
large discrepancy between stellar libraries
- Few observational libraries for cool stars
- Limited grid in metallicity and gravity

Together with G. Bruzual:

Calculation of colours (MEGACAM, WIRCAM) for a large grid of stellar libraries (synthetic and observational):
0.1 dex grid in Z

→ Detailed comparison for whole Teff,Z, log g parameter space

Photometric calibration of CFHTLS (T0003)

Absolute photometric calibration:

- Cross-identification for each field in DEEP and WIDE with SDSS
- 22 fields in WIDE (W1, W3)
- 2 fields in DEEP
- Only stars with i* < 21 (limit for star/galaxy separation)
- Using transformation of SNLS group (Regnault et al.)

see also presentation by N. Regnault !

Photometric calibration of CFHTLS (T0003)

Results:

- Only comparison with fields in g',r' and i'
- **Excellent agreement:** < 0.03 mag in g',r', i'
- Indirect verification of colour transformations of Regnault et al.
- Still missing: u*
- Extension to fainter i' limit? I' < 22?
- BUT: only for a limited number of fields

Comparison with large grid of stellar libraries in the MEGACAM filter system for all fields (DEEP,WIDE)

Relative calibration of CFHTLS (T0003)

- Use of overlap regions of WIDE
- To get good statistics: stars + galaxies with i' < 21
- Results: (for W1)
- Δ g ~ 0.03 mag, Δ r ~ 0.02 mag, Δ i ~ 0.03 mag

- WIDE (T0003): photometric calibration is better than 0.03 mag (g',r',i')
- Stellar astrophysics: important to determine stellar parameters (T_{eff}, log g, Z) !!!

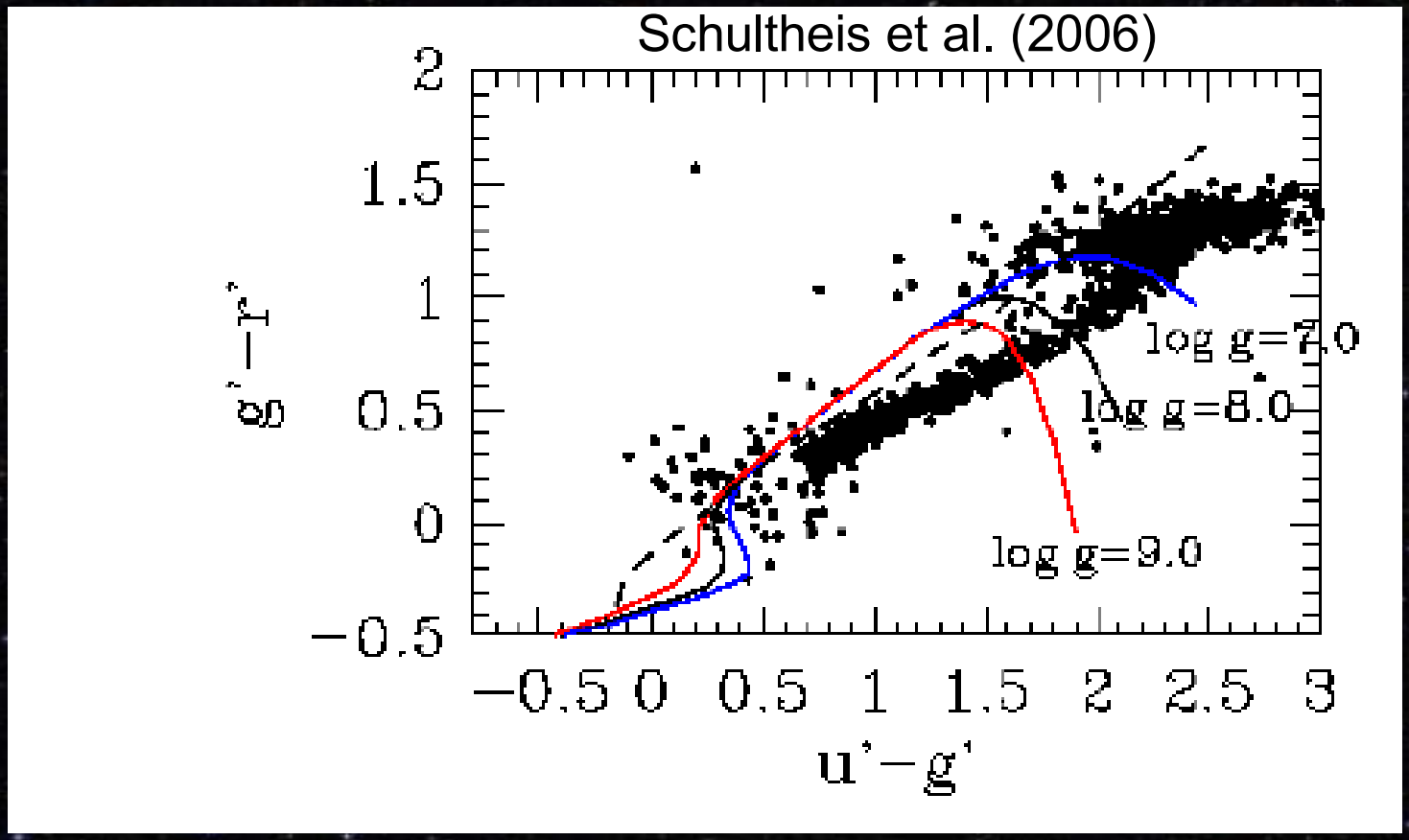
Global map of all overlapping regions for WIDE

Stellar populations with CFHTLS

White dwarfs models : Bergeron et al. 2001

u-g vs g-r: excellent indicator of white dwarfs (Harris et al.2003)

In the fields D1,D2,D3: several WD candidates



DA
DB

BUT: contamination with stars on the horizontal branch (RR Lyrae)

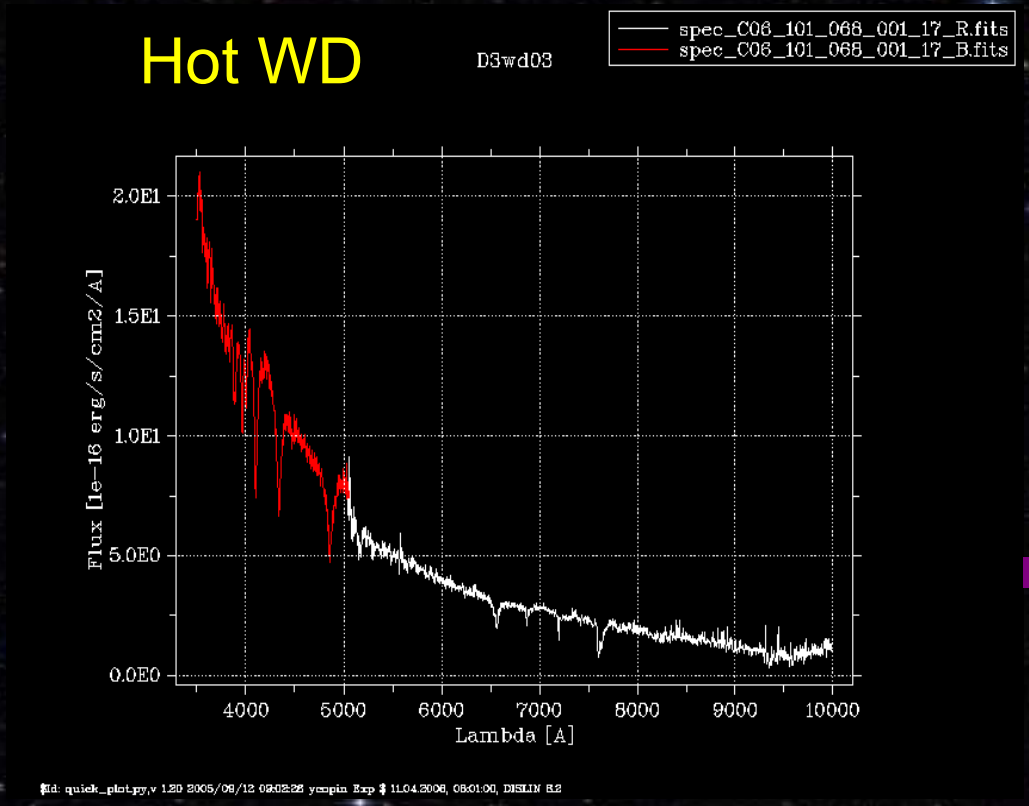
Proper motions + variability

Spectroscopic follow-up of 4 white dwarf candidates (N. Regnault)

Use of u-g/g-r diagram

3 spectra: 1 WD

Hot WD

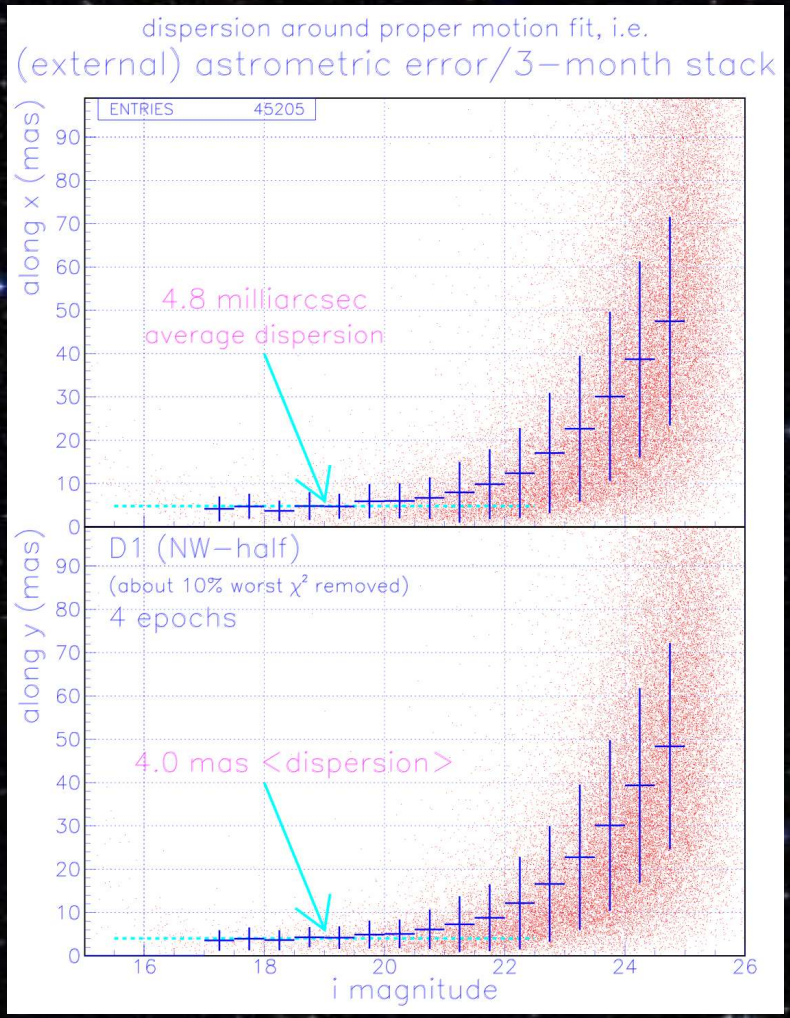


Use of proper motions

Proper motion search for halo white dwarfs

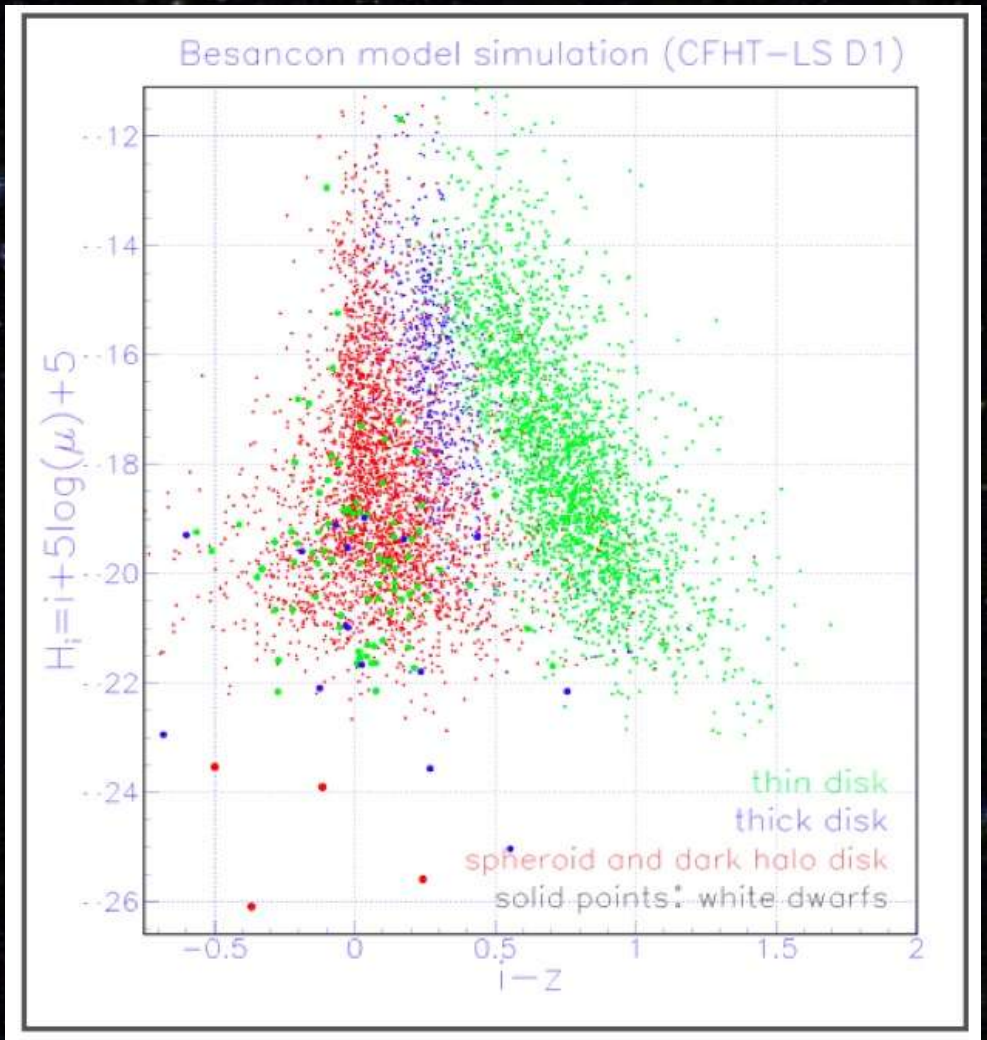
- Stack of images over 3 months
- 6 epochs (4 in T0003)
- 1.6 mag increase in depth
- Swarp+ Sextraxtor+Scamp
- Precision of 5 mas/frame/axis
- Expected precision:
- For i' ~ 21: 0.5 mas/yr
- For i' ~ 25: 3 mas/yr

Goldman et al. (2006)

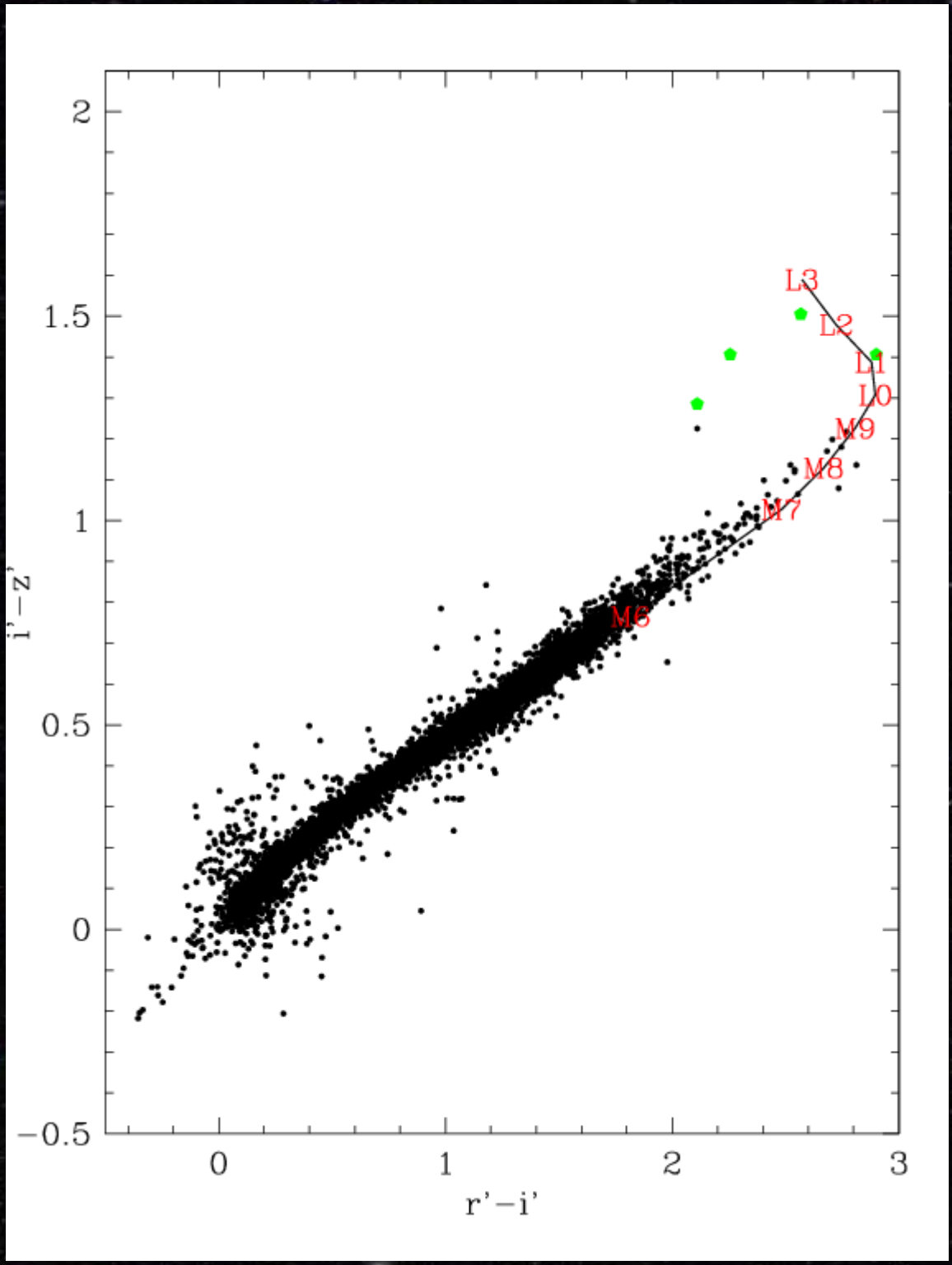


- Proper motions are most reliable for star/galaxy separation
- Star/Galaxy separation possible for i' > 21
- Distinction of Galactic populations
- Detection of Halo White dwarfs (4 WDs expected in D1, 11 for all DEEP fields (if 2% contribution to dark halo)
- Detection of brown dwarfs

Goldman et al. (2006)

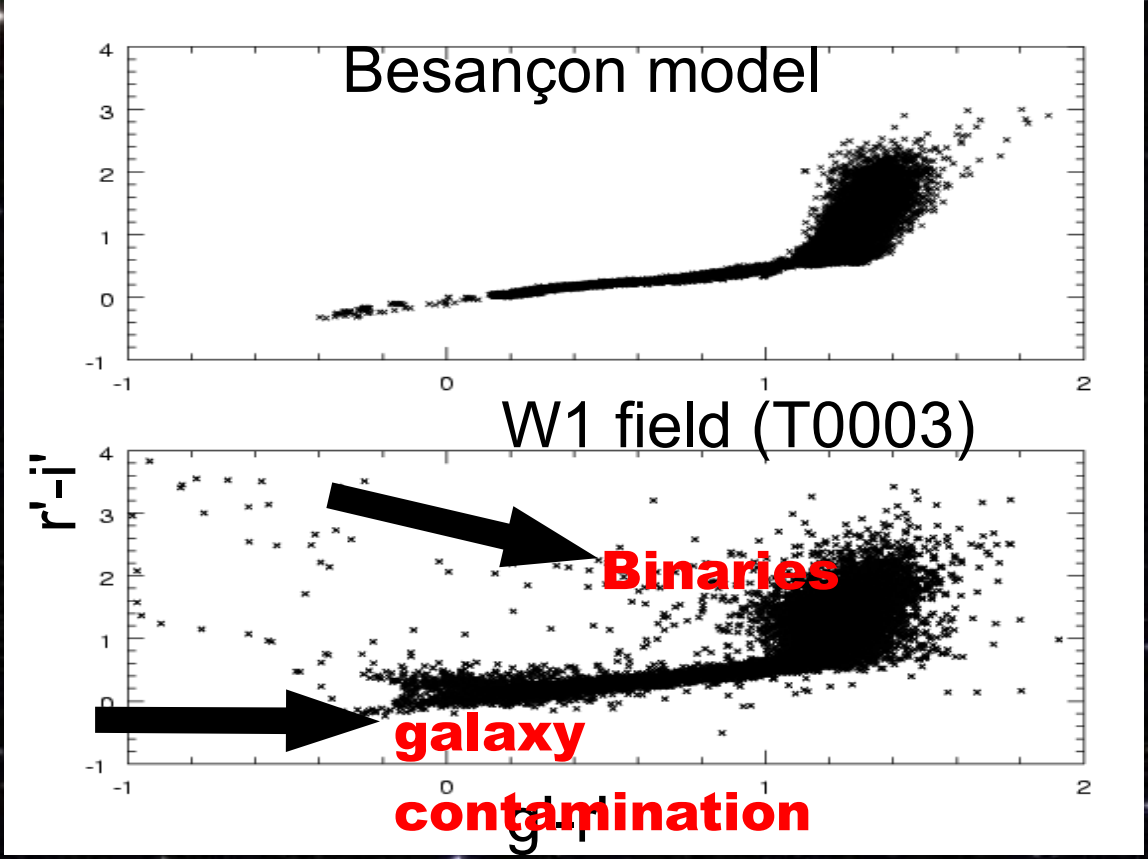


Brown dwarfs (NextGen)



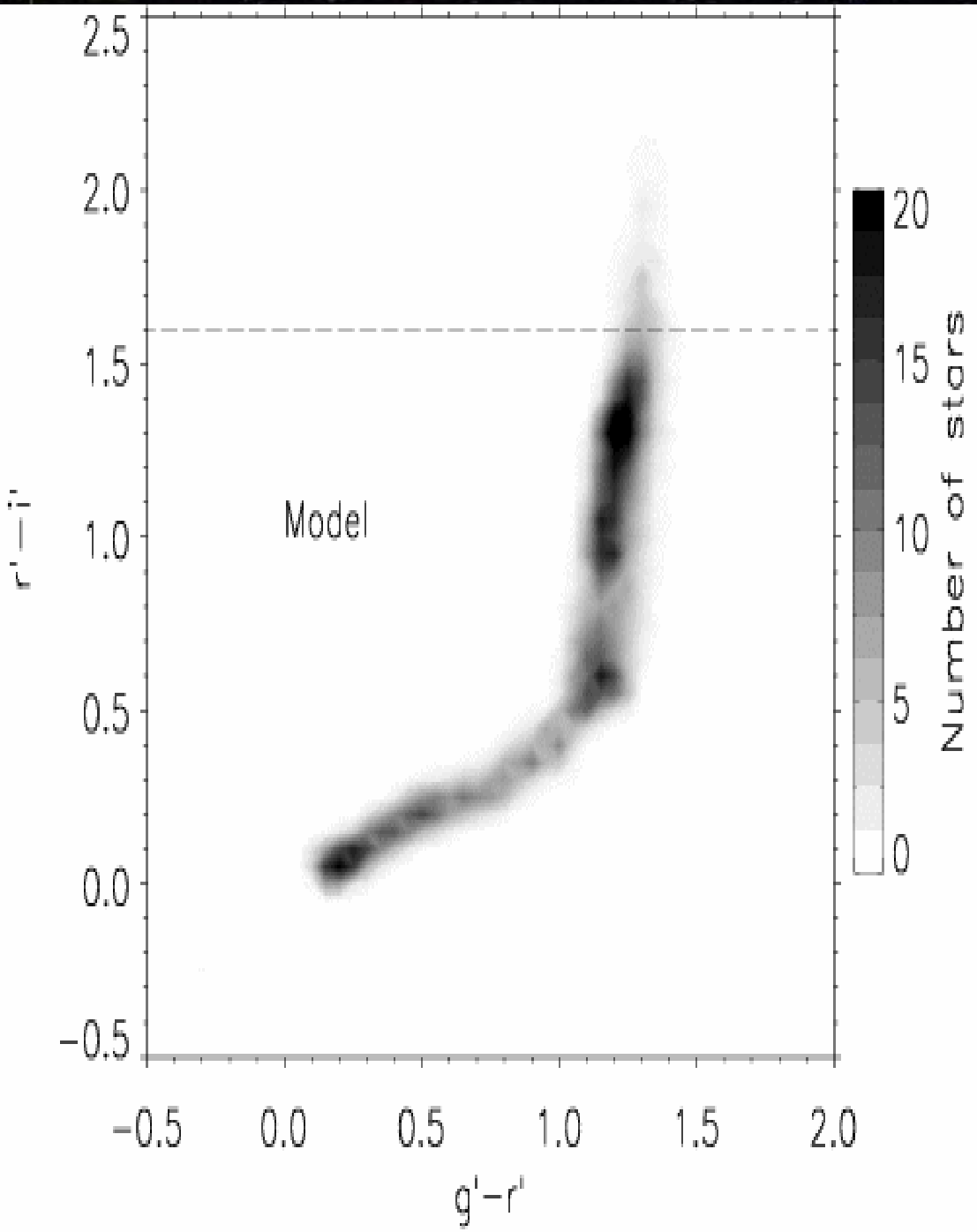
See X. Delfosse's talk

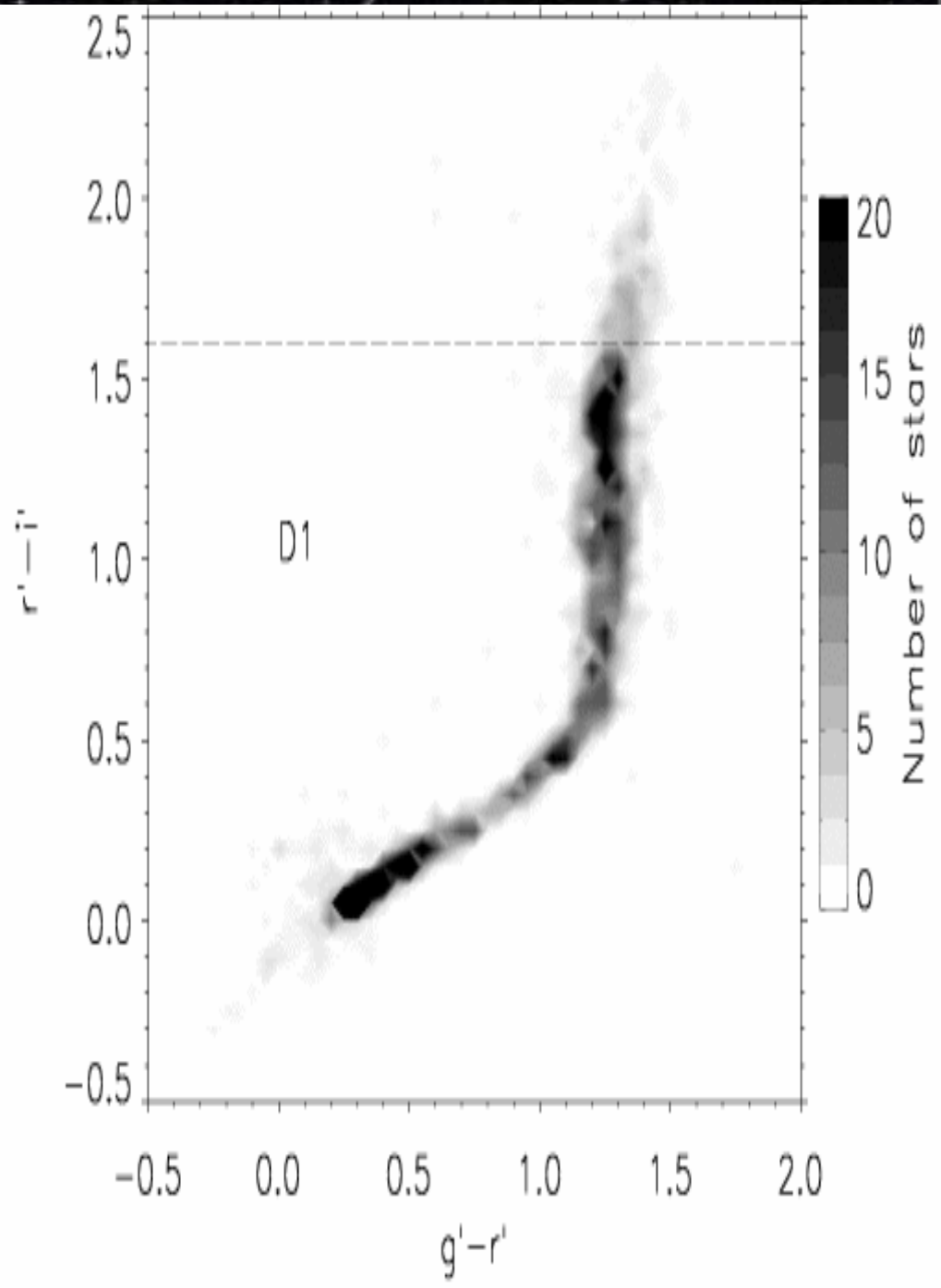
Total field of W1: 10.7 sq degree



Merged catalog for W1, W2 and W3
(taken overlaps into account)
Visual check of binaries

The IMF at low masses

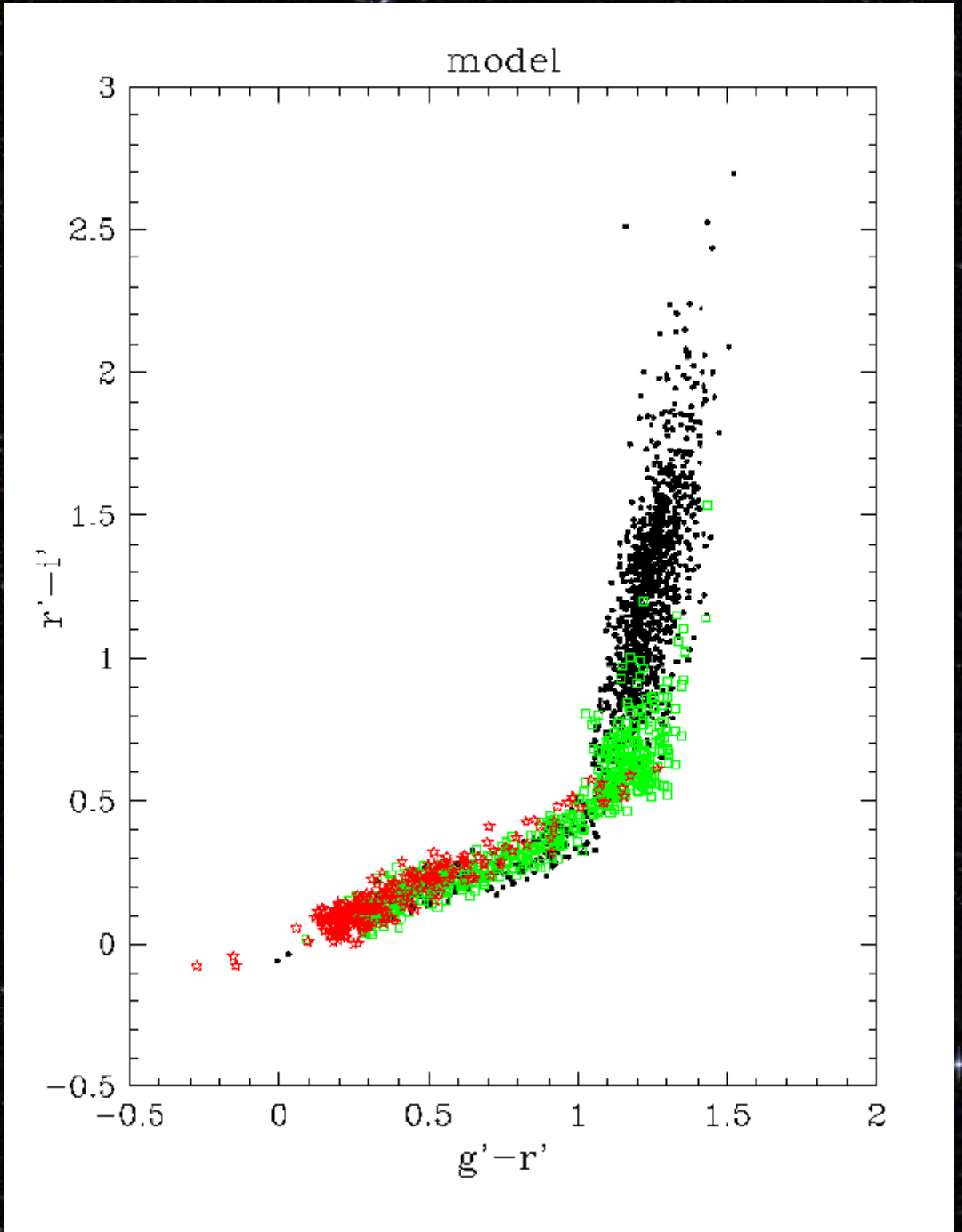




Stellar populations

From the Besançon model of the Galaxy

Spheroid
Thick disc
Thin disc



Future:

IMF

Better adjustement of IMF of low-mass stars with more precise stellar libraries

Binarity

Spheroid, thick disc

- Better star/galaxy separation (morphology/photometry)
- Density and IMF from the Wide and Very Wide

Proper motions

- Studies of WIDE and Very WIDE

Near-IR data: WIRCAM