Telemetry Budget:

Scientific Impact of Selection Criteria

A. Vallenari, G. Bertelli, E.Nasi, S. Ragaini, S.Pasetto

Padova Observatory

Telemetry Problem

- Telemetry budget: 0.25 Mbit/s (RVS-YV-001)
- Ncrit=number of objects filling the CCD/sq deg
- In crowded areas, Ncrit objects are sampled

Pixel/obj	rows/spectr	Ncrit	C=3	C=6	Tave	Tp
1388	2	6450	43%	80%	2	4
781 *	1	11470	61%	89%	1	3

* half of the spectrum, half of the times for V > 16

Tave=1 N=2400 stars/sq deg

Selection criteria

- N of pixel/ spectrum
  half rows: 20% gain: Ncrit is larger
  selection on Ca lines ….

  To improve: Nobject < Ncrit

- Magnitude criteria: V <Vlim

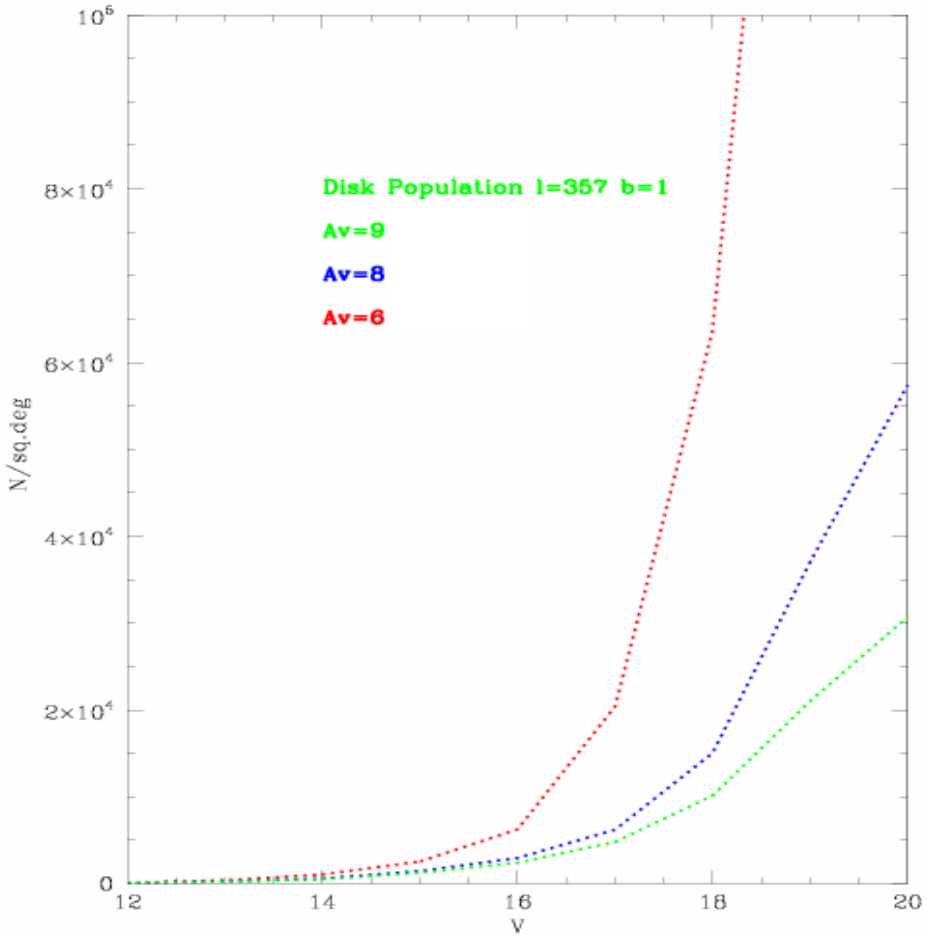
- Categories: Spectral type,MS, AGB, RGB

- Coordinates

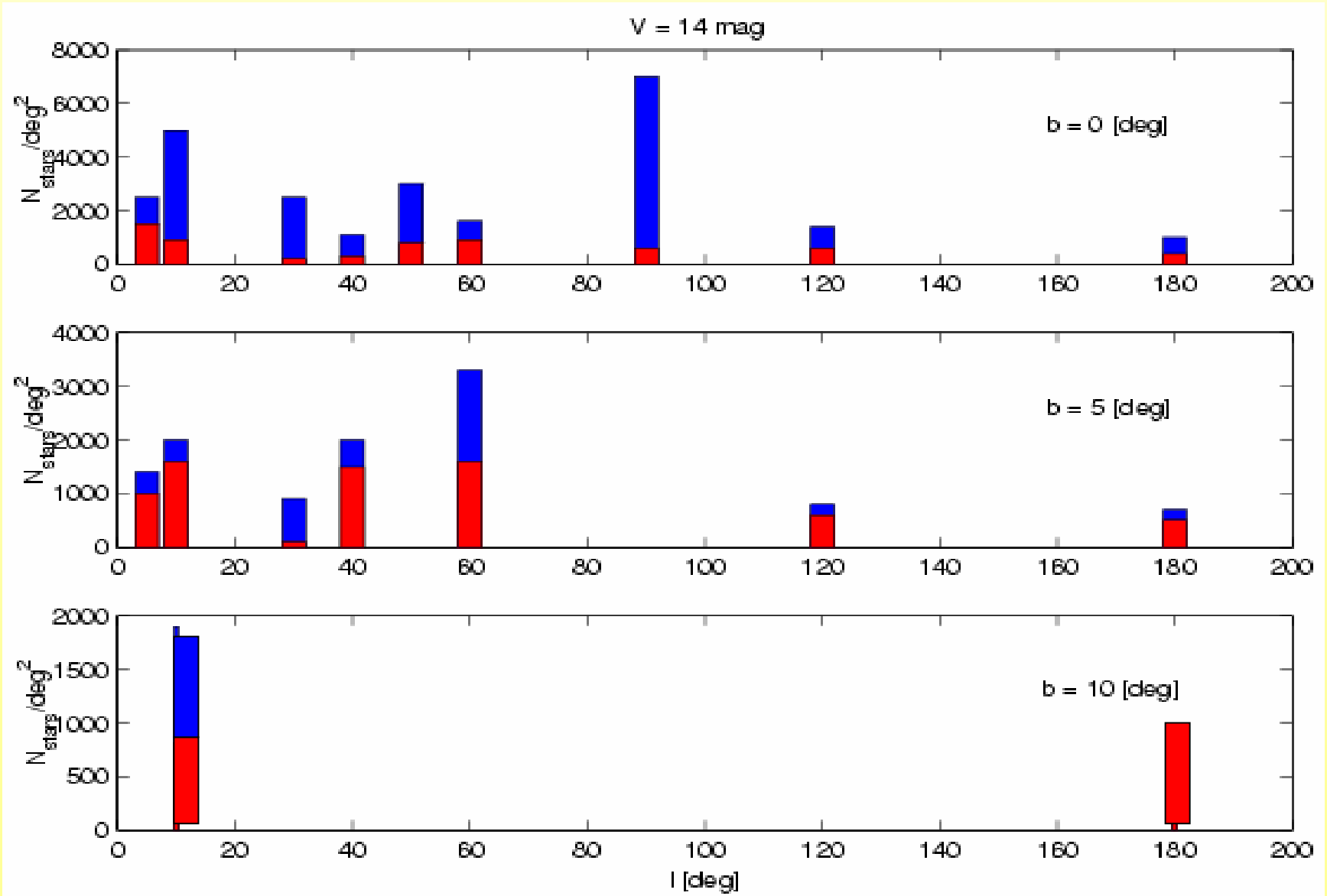
RVS Performances in Crowded Regions

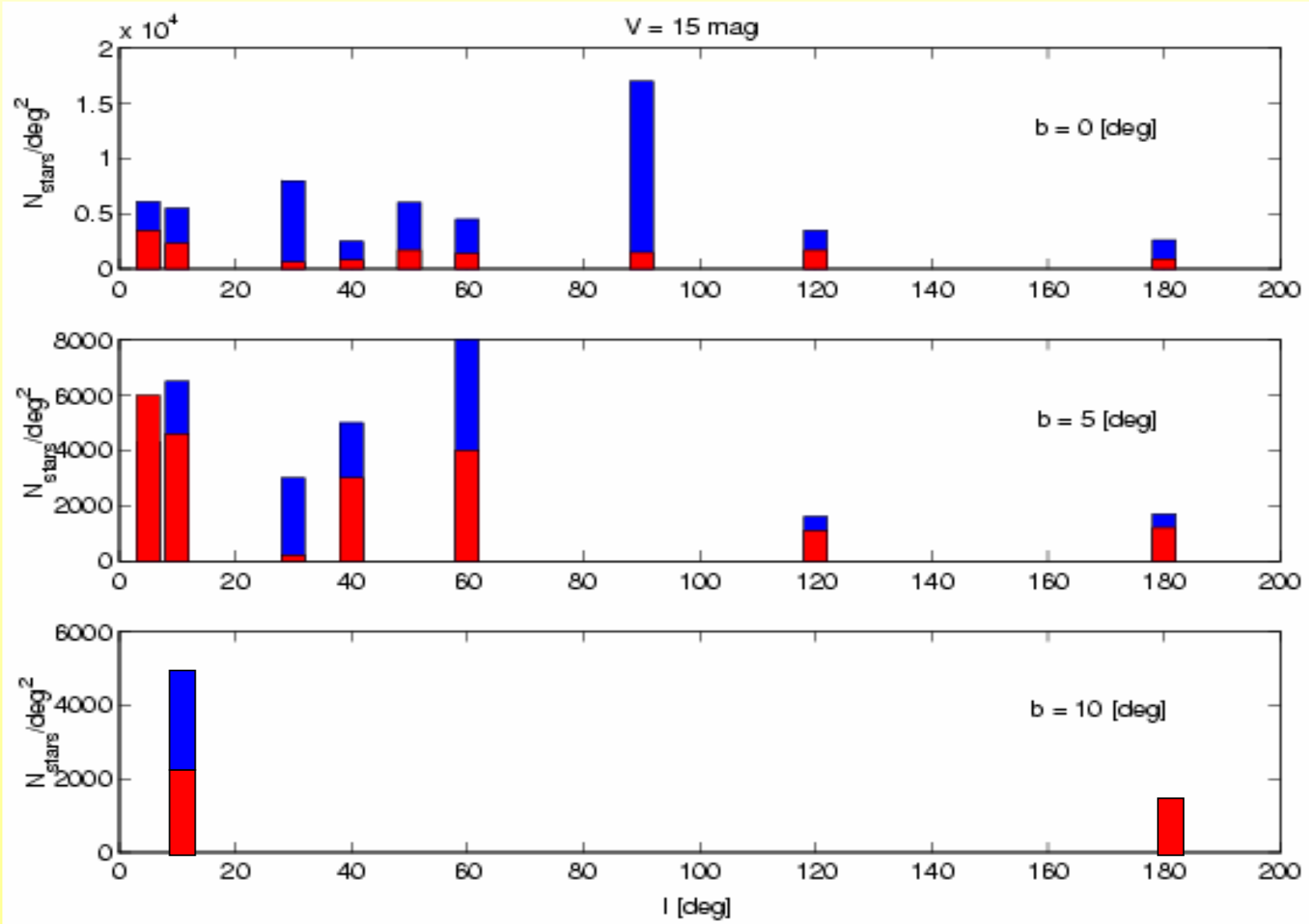
- Performances still to be assessed
- Simulations shows that the crowding rises the background level of the spectra (Zwitter 2004)
- Limiting magnitude as a function of the N of objects at V=17
- N=10 000 V<16.5
- N=20 000 V<16
- N=40 000 V<15 (?)

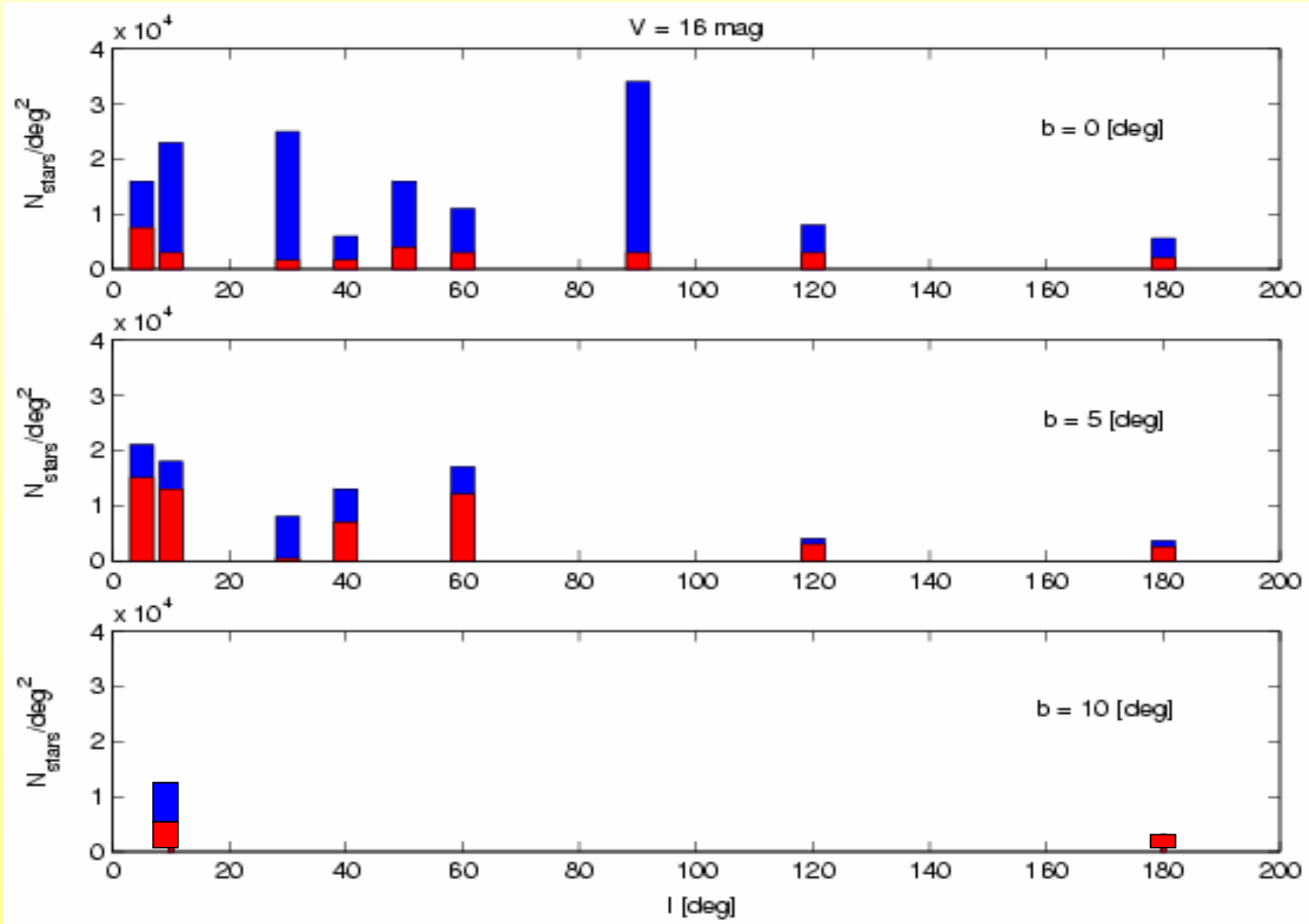
Disk Stars at b < 10



Density at low Galactic b




V = 15 mag
x 10^4
N_stars/deg^2
b = 0 [deg]
b = 5 [deg]
b = 10 [deg]
l [deg]


V = 16 mag
x 10^4
N_stars/deg^2
b = 0 [deg]
b = 5 [deg]
b = 10 [deg]
l [deg]
0
20
40
60
80
100
120
140
160
180
200
1
2
3
4

Density/sq deg from GSC2 (Drimmel 2003)

l	b	V=14	V=15	V=16	V=17.5
5	0	1500-2500	3500-6150	7500-16000	60000
5	5	1150-1400	6000-4300	15000-21000	60000
10	0	900-5000	2300-5500	3000-23000	50000
10	5	1600-2000	4600-6400	13000-18000	60000
10	10	816 –1900	2200-4900	5900-11900	40000
120	0	600-1400	1700-3500	3000-8000	20000
180	0	400-1000	900-2600	2100-5600	10000
180	5	500-700	1200-1700	2500-3600	8000
180	10	500-600	1200-1400	2500-3100	6000

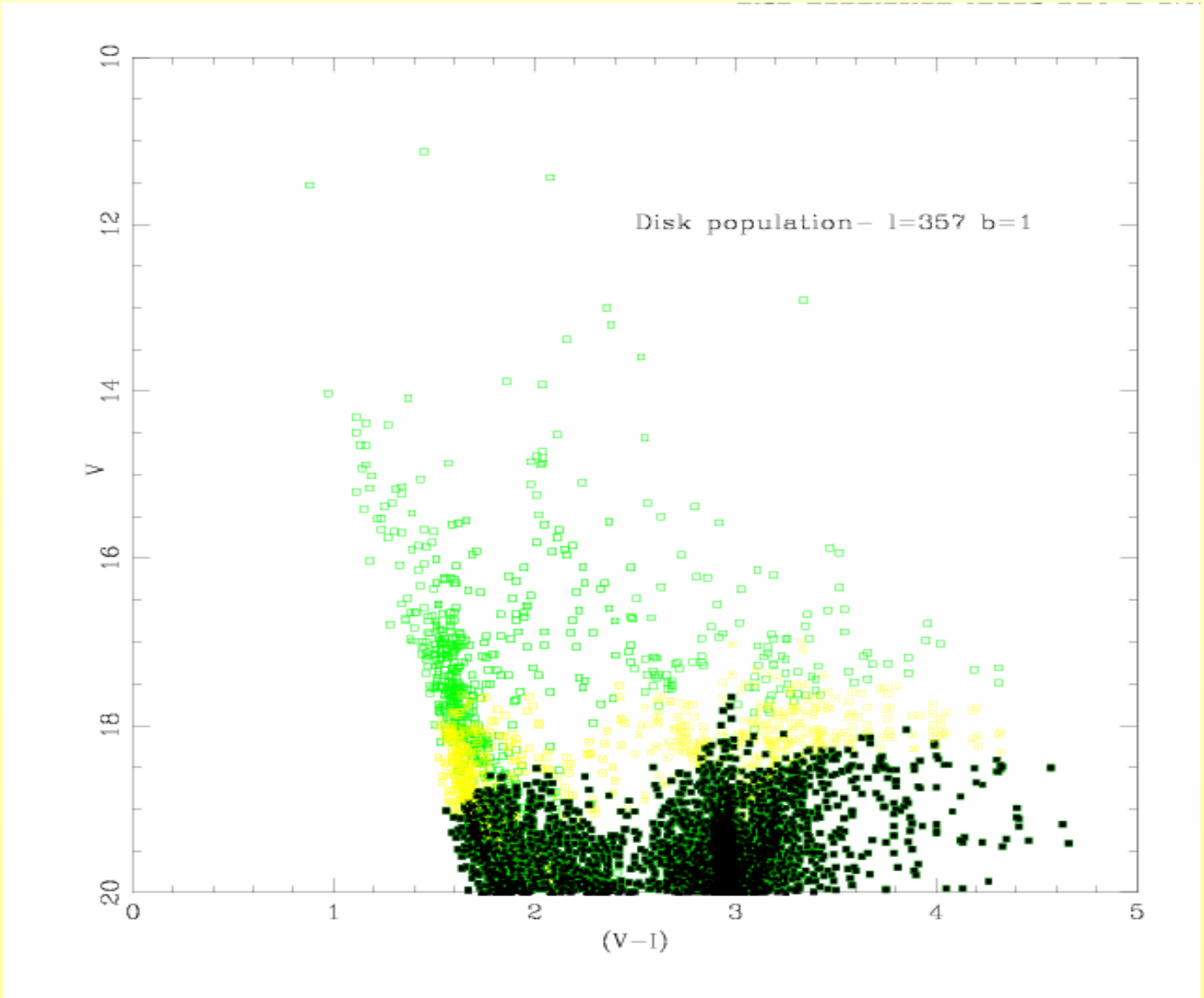
Thin disk limit

l=0, b<10 N(V<17.5)=40000

- crowding limit V=15 N(V<15)=3000-5000

- Tp=1.5 Mb/s if 782 px/spect

l=90-120 b=0; N(V<16)=3000-8000
l=90-120 b=5 N(V<16)=3000-10000
l=120-180 b=0 N(V<16)=2000-8000
l=120-180 b=5 N(V<16)=2000-3000


Disk population– l=357 b=1
V
(V–I)
10
12
14
16
18
20
0
1
2
3
4
5

Thin disk targets (l=0,b<10)

Star	Mv	Av	d(V<15)	d(V<16)	d(V<17.5)
• Cepheids	-4	0-10	>15,0.6 Kpc	>15,1	
• OB V	-5; 0	0-10	>15-1;10-0.15	>15,0.4	
• A-K V	0 ;8	0-8;0-1	10-0.25;0.25-0.15	15-0.4;0.4-0.25	0.8
• M-LV	8;10	0-1	0.10,0.06	0.4-0.25;015-0.1	0.5
• RGB	-3;0	0-8	>15-1	>15-1.5	
• Red Clump	0.5	0-8	8-0.15	12-0.3	
• AGB	-3;0	0-8	>8-1; 0.25-0.15	>15-1.5;15-0.4	

Thin disk targets (l=120-180,b<5)

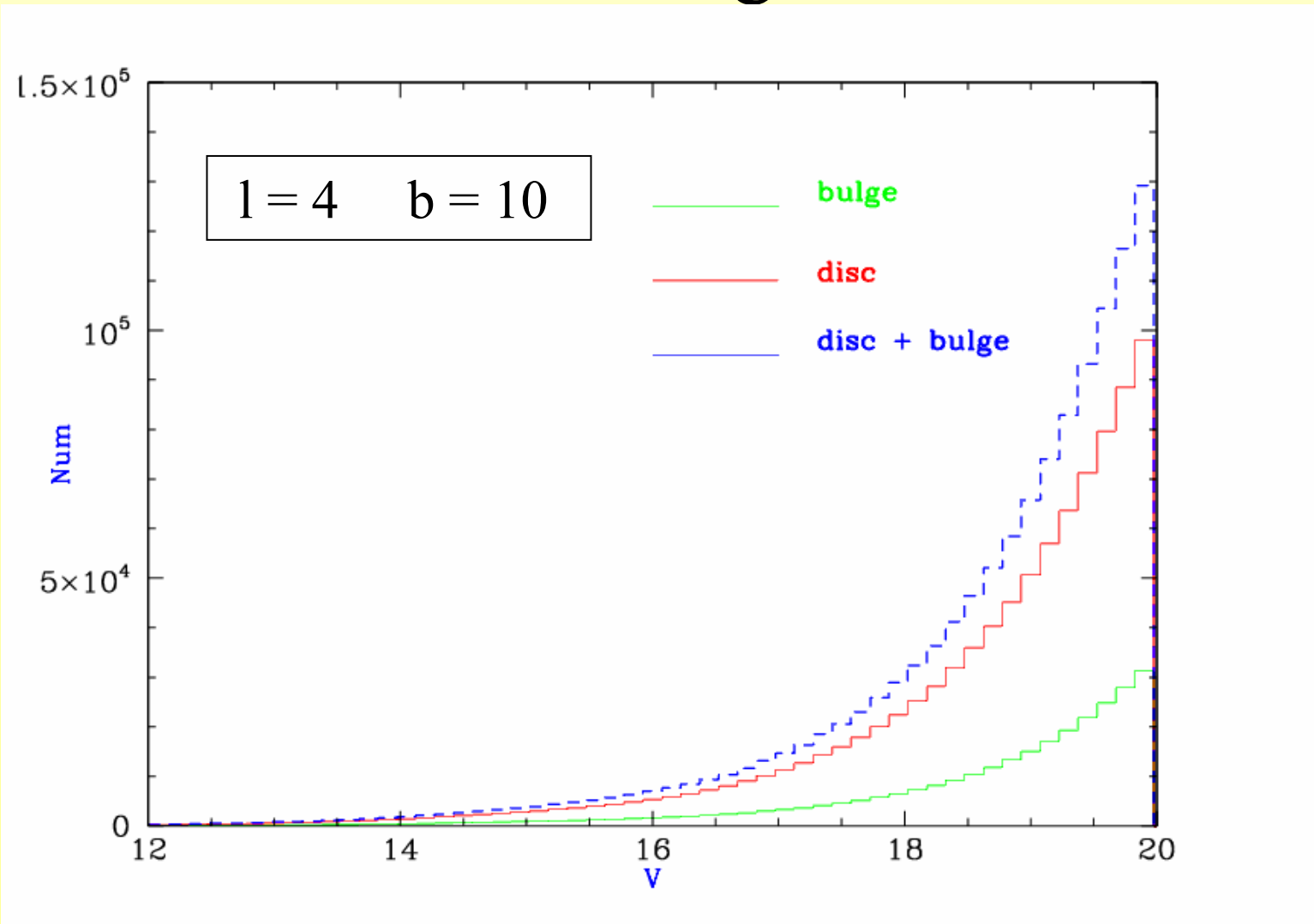
Star	Mv	Av	d(V<15)	d(V<16)
• Cepheids	-4	0-3	>15 Kpc	>15
• OB V	-5; 0	0-3	>15; 15-2.5	>15; 15-4
• A-K V	0 ;8	0-3;0-1	10-2.5;0.25-0.15	15-4;0.4-0.25
• M-LV	8;10	0-1	0.10,0.06	0.4-0.25;0.15-0.1
• RGB	-3;0	0-3	>15;10	>15;15
• Red Clump	0.5	0-3	8-2	12-3
• AGB	-3;0	0-3	>15-10; 10-2.5	>15-15;15-4

- NO NEED TO SELECT ON MAGNITUDE for b>5

Thick disk targets at low b

Star	Mv	Av	d(V<15)	d(V<16)
(l=0,b<10)				
G-KV	3.5	0-4	2-0.3	3-0.5
RGB	-3;2	0-8	>15,1	>15,1.5
HB	0.5	0-8	8,0.2	12,0.3
AGB	-3;0.5	0-8	>15,1	>15,1.5
(l>90,b<10)				
G-KV	3.5	0-4	2-0.3	3-0.5
RGB	-3;2	0-3	>15,10	>15
HB	0.5	0-3	8-2	12-3
AGB	-3;0.5	0-3	>15-1.9	>15-3

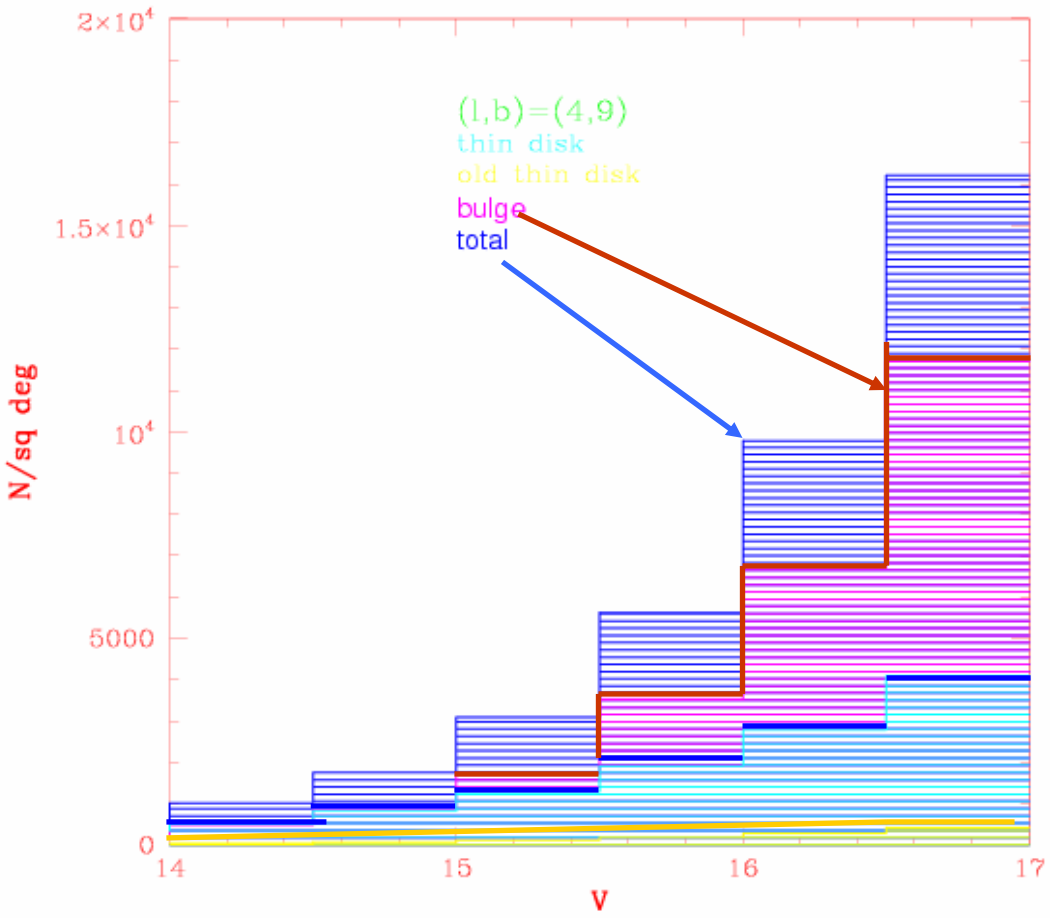
The bulge


1.5×10^5
10^5
5×10^4
0
Num
12
14
16
18
20
V
l = 4 b = 10
bulge
disc
disc + bulge

The external bulge

l	b	N / Sq deg (V<17) 2MASS
-14	-4	32535
-14	-10	8000
4	-8	28600
4	8	24000
4	-9	20000
4	9	17060
4	-10	15400
4	10	13300
30	-4	26000
30	-10	7000

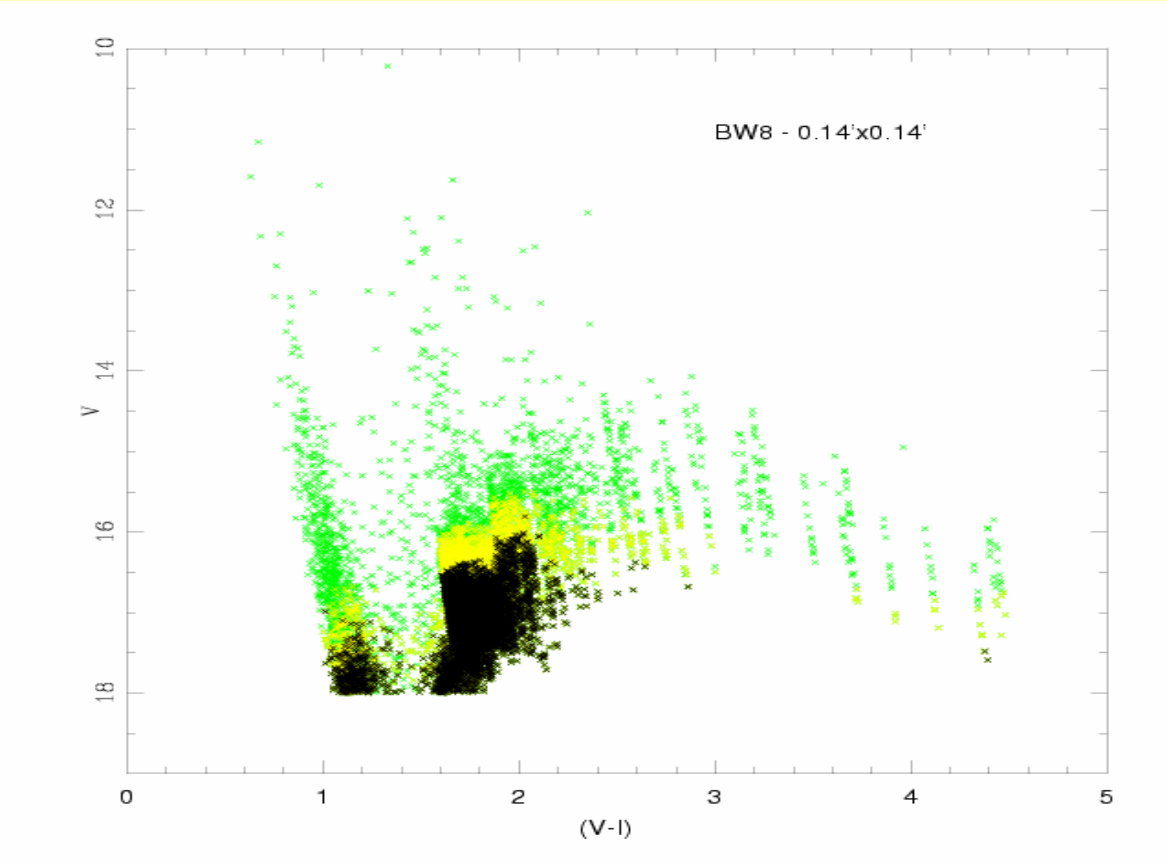
- Crowding limited
- The bulge is visible with RVS at V=16-16.5 at least from l>-10, |b|>4
- The inner bulge is unvisible (V<15)



Number/deg^2

	Disk	Bulge
V=15	1000	2000
V=16	2000	3500
V=16.5	3000	6000

Target stars in the Bulge



bulge:
AGB-RGB stars V<16.5
Bulge: Clump V<16.5

Disk: MS V<16.5
Disk: Clump V<16.5

$\sigma\pi/\pi<10\%$ **(green)**
$\sigma\pi/\pi<15\%$ **(yellow)**
$\sigma\pi/\pi<15$–20% **(black)**

Target stars in the Bulge

- AGB-RGB : $\sigma\pi/\pi<10\%$: **SFR, shape**

Mv=-2.2-- -0.5 Av=1.5-2 d=5-13 V=15 marginally

d=8-15 V=16 YES

- Clump: $\sigma\pi/\pi<10–20\%$: **shape, orientation**

Mv=0 - 1 Av=1.5-2 d=5-10 Mv=16.5 marginally

Bulge targets outside BW

(l=0,b<10)

Star	Mv	Av	d(V<15)	d(V<16)
RGB	-3; 2	2-8		
HB	0.5	2-8		
AGB	-3;0.5	2-8		

(l>10,b<10)

RGB	-3;2	0-3		
HB	0.5	0-3		
AGB	-3;0.5	0-3		

Selection on Categories:

GAIA BBP-MBP

- BBP-4B-5B
- Spectral range 425-965 nm: 5 filters (4B)
- 4B+ 510nm (5B)
- NO TELEMETRY PROBLEM
- Crowding:

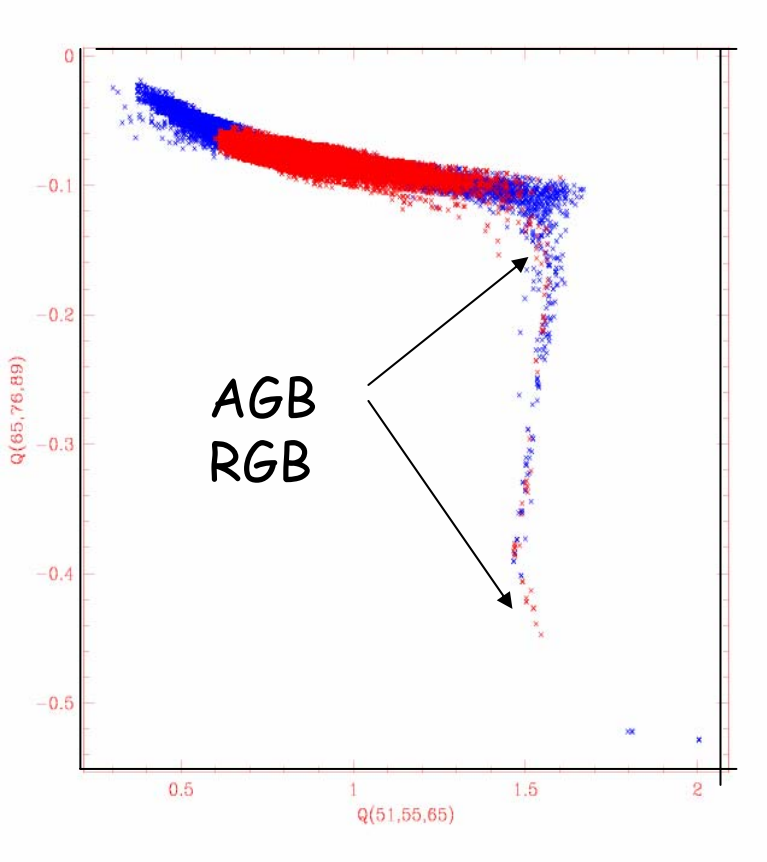
  MPB: 50-100 000 stars per sq deg: large part of the
- inner disk (GSCII data)

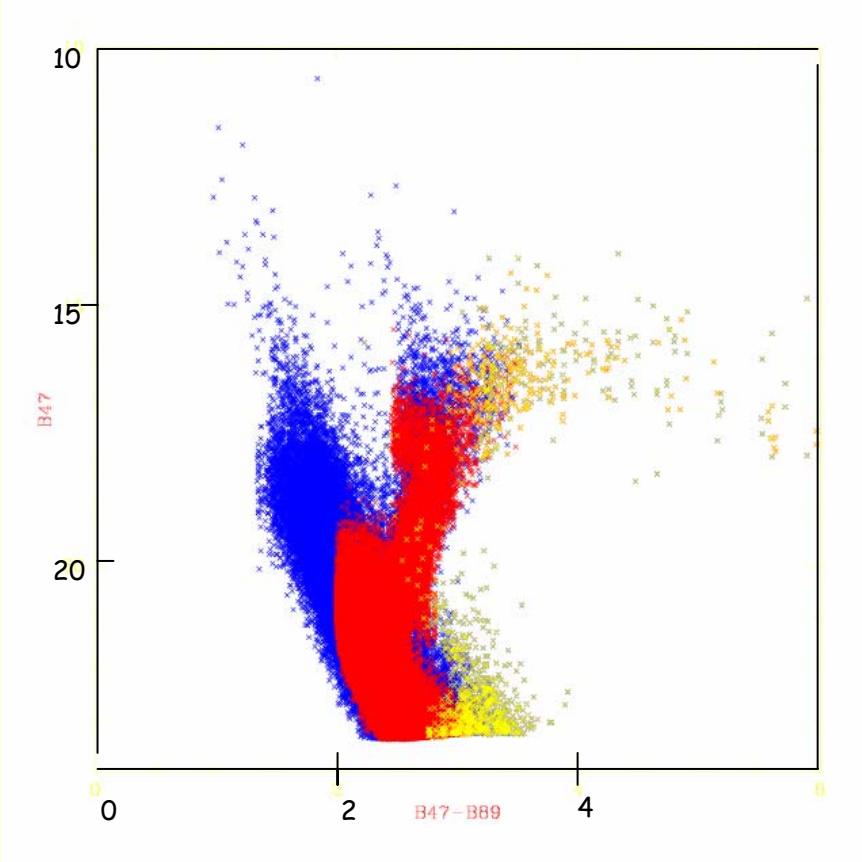
  BBP: 3 x 10^6 stars per sq deg : inner disk and bulge

MBP,BBP:The inner bulge:outside of the BW

l	b	N / Sq deg (V<20) OGLE	A_V
-11,07	-2,78	245000	3,00
-6,64	-4,62	444000	2,20
-2,32	-3,56	486000	2,70
0,37	2,95	218000	4,50
5,1	-3,29	562000	2,60
5,23	2,81	434000	3,40
10,48	-3,78	295000	2,75

- Unvisible to the MBP, visible to BBP





The reddening-free parameters Q(M51,B55,B65) and Q(B65,B76,B89) allow to separate AGB and bright RGB stars

Selecting only AGB-RGB stars?
Selecting only MS stars?

Selecting on spectral type:

- Is the pre-processing feasible?
- A catalog is needed
- No serendipity discoveries
- The regions are anyhow crowding limited

Selecting on areas: crowding limited

Conclusions

- GAIA observations in low b regions in the disk are crowding limited
- Selecting objects V<15 for l=0-90, b<10
  and V<15.5-16 for l=90-180 possibly
  decrease the Tp of a factor 2.
- Thin disk MS stars (Mv=8) are visible at maximum at d=200 pc
- Turnoff thick disk stars (Mv=3.5) are visible at maximum at d=2 Kpc
- Red clump stars can be used as disk tracers up to 8 Kpc
- Spiral arm tracers in low reddening windows