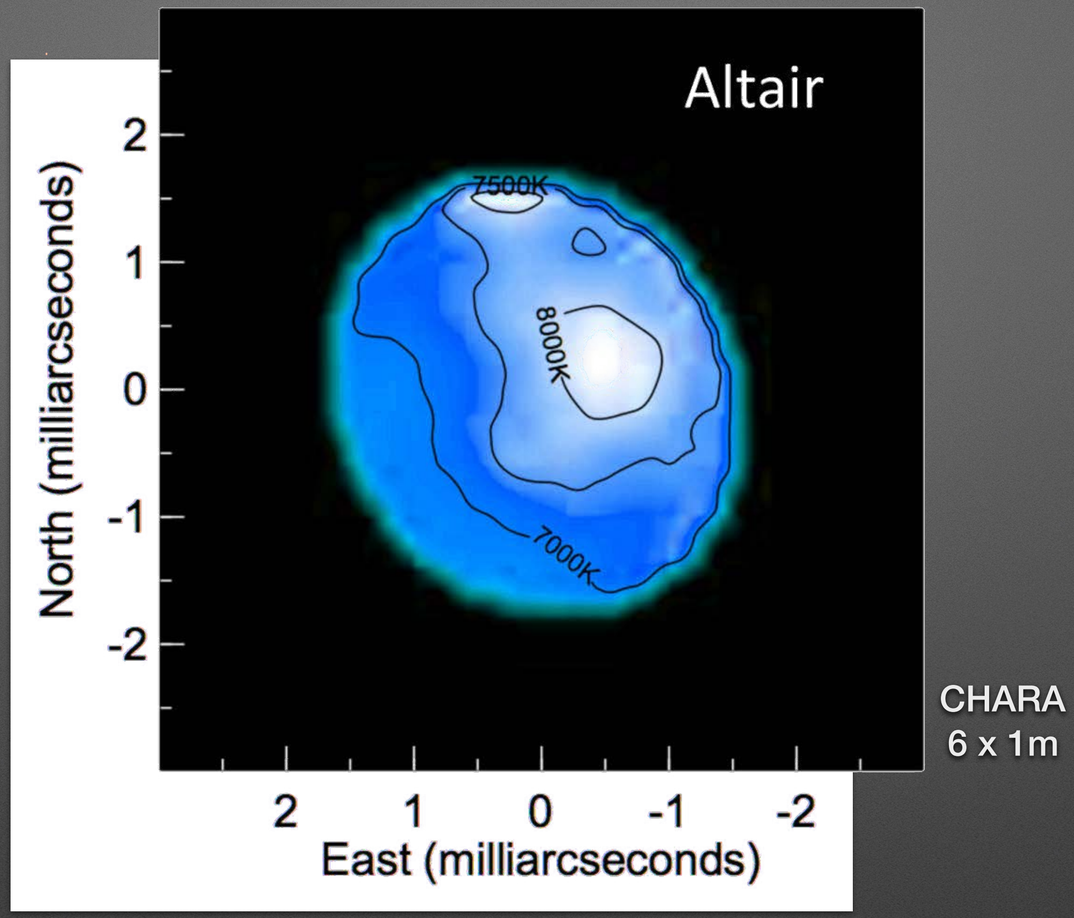


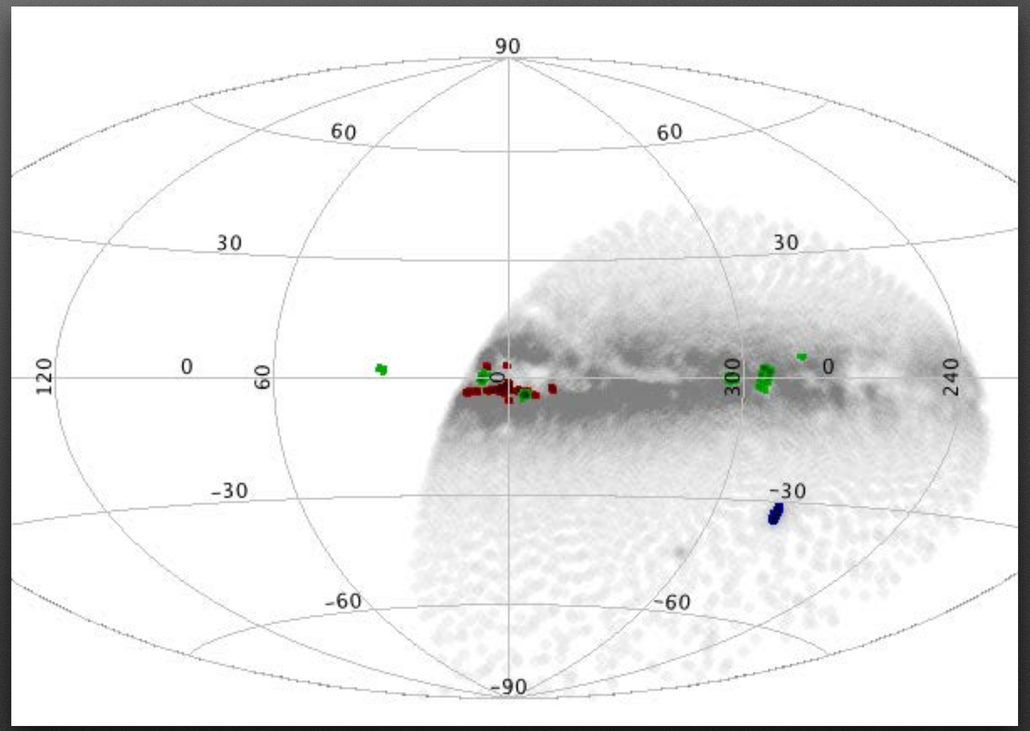
CHARA
6 x 1m

Proper motion separation of Be stars

In the Milky Way and the Magellanic Clouds

Proper motion separation of Be stars

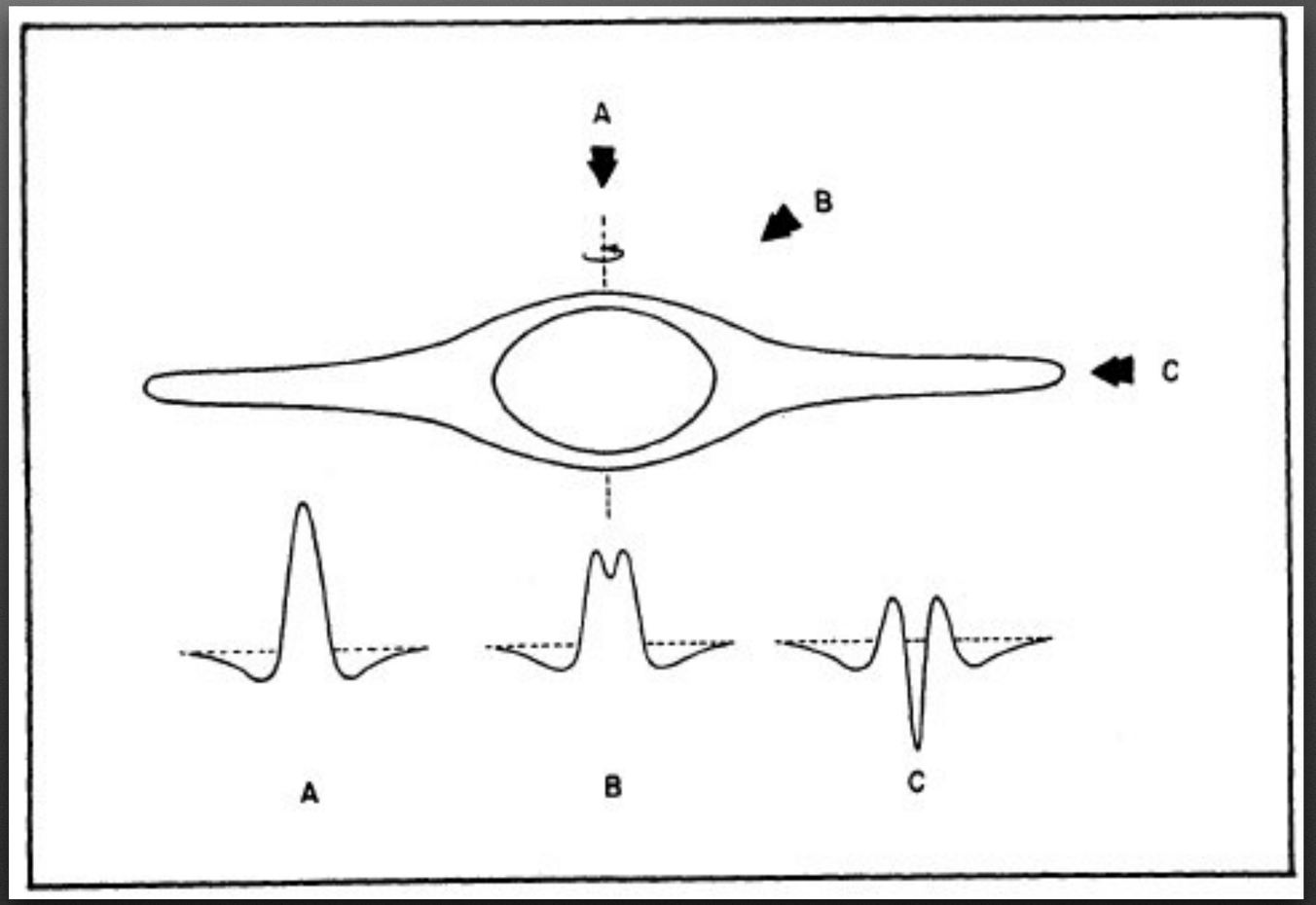
- Katherine Vieira, CIDA, Venezuela
- Alejandro García-Varela y Beatriz Sabogal, UNIANDES, Colombia
- 2015 - 2016
- Sabogal et al. (2005) MNRAS, 361: 1055
- Sabogal et al. (2008) A&A, 478: 659
- Sabogal et al. (2014) PASP, 126: 219
- SPM4 Catalogue, Girard et al. 2011, AJ, 142:15



Be stars

Many (~50%?) display variability

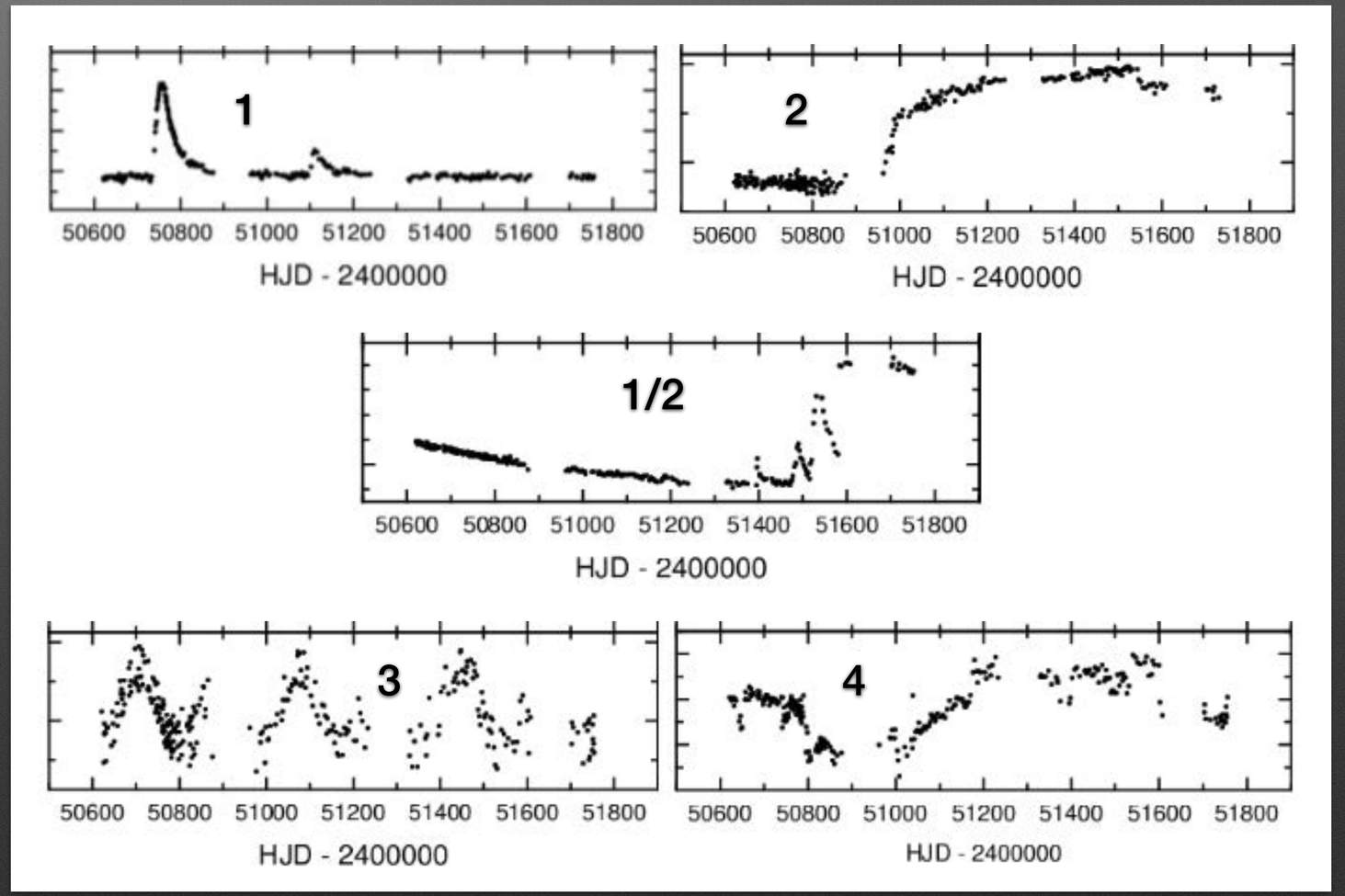
- Non-supergiant (III-V) B-type stars
- Have had Balmer emission lines, episodically from days to decades
- IR free-fee emission from flattened circumstellar gas envelope/disk
  - Rapid rotation (CBe)
  - Radiation-driven winds
  - Non-radial pulsation
  - Flare-like magnetic activity
  - Binary interaction



Variability selected Be stars candidates

- Type 1: outbursts
- Type 2: sudden luminosity jumps
- Type 1/2: 1 & 2
- Type 3: periodic or near periodic variations
- Type 4: random light curves

ΔI [mag] ~ 0.2 - 1



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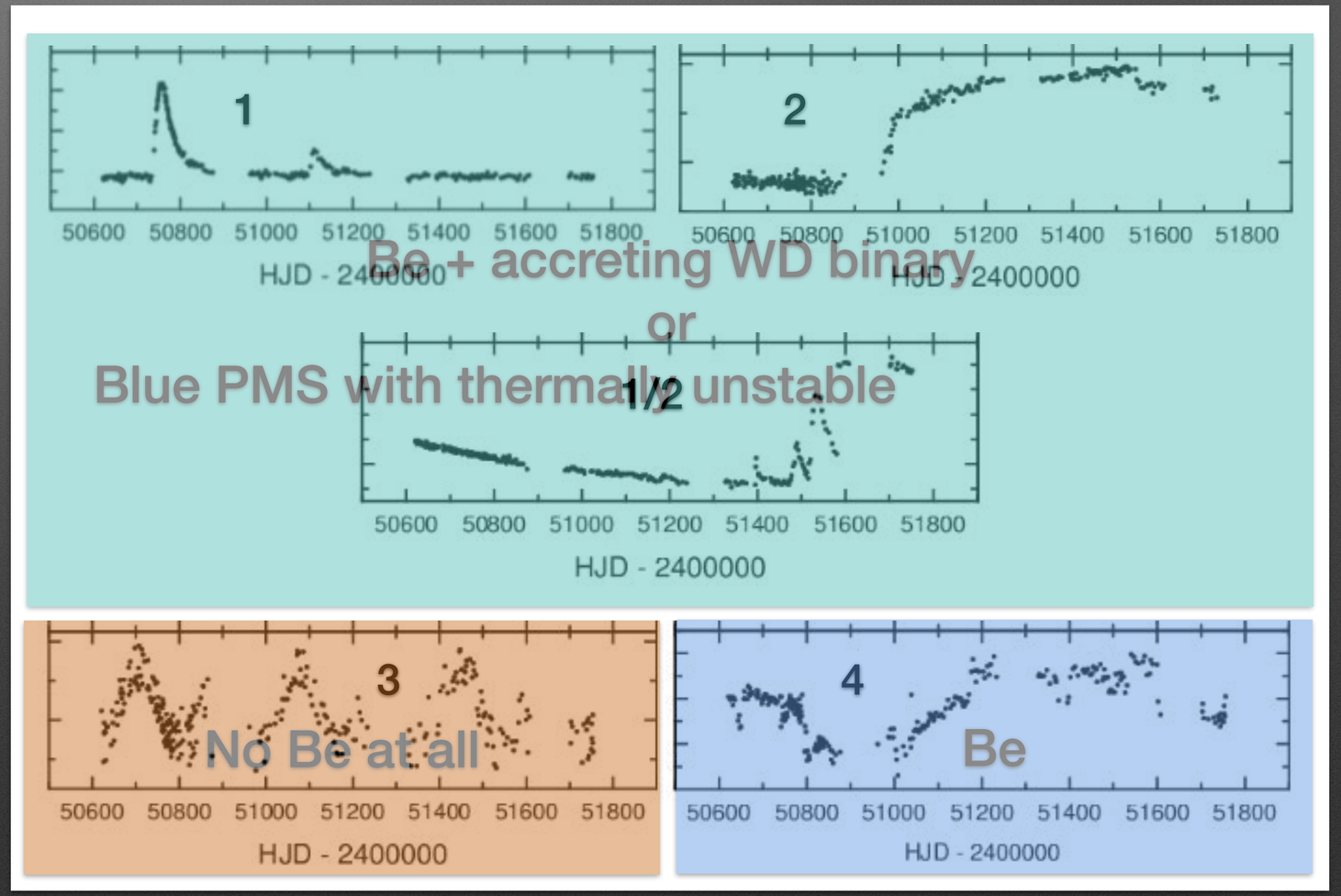
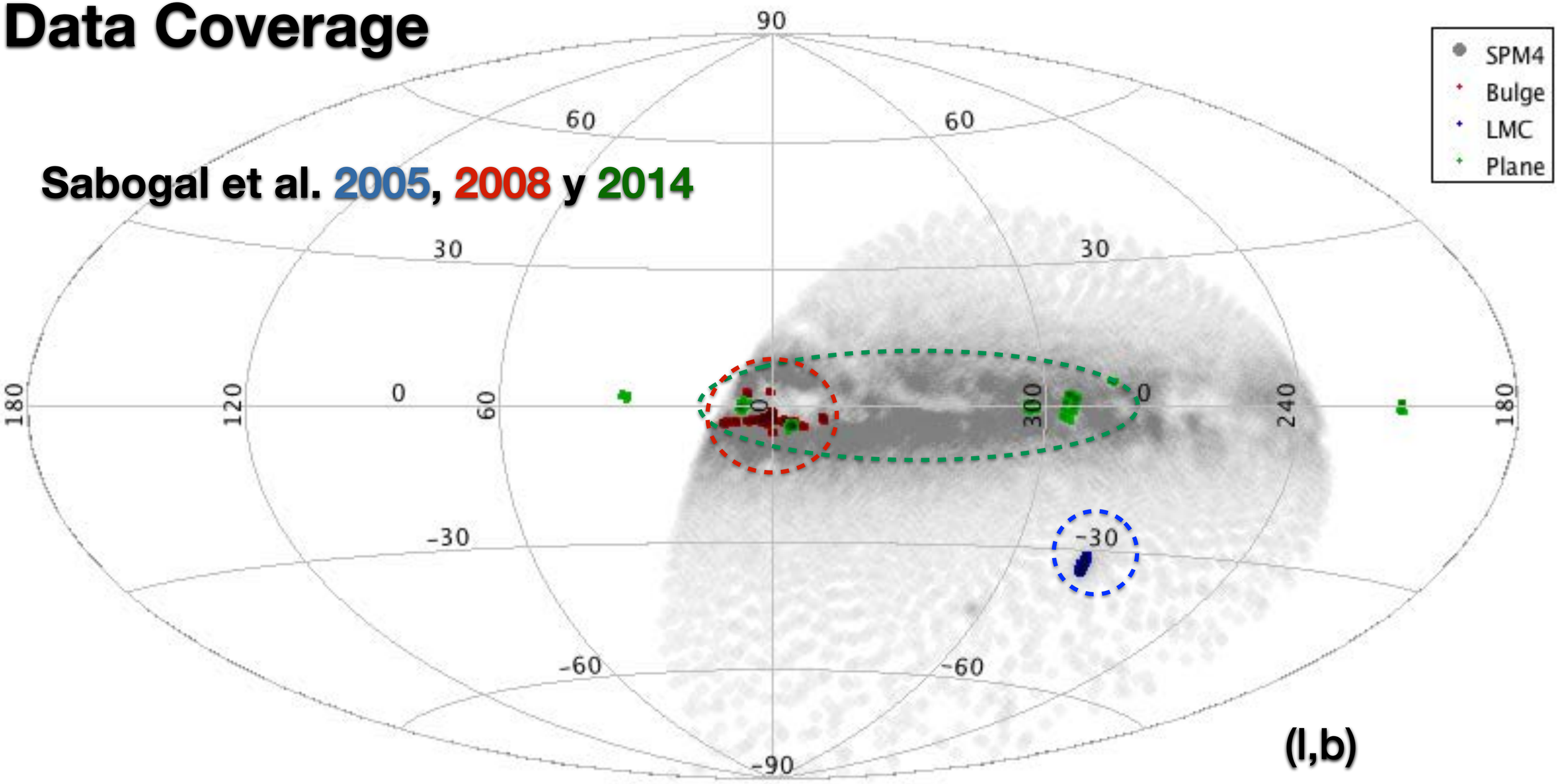


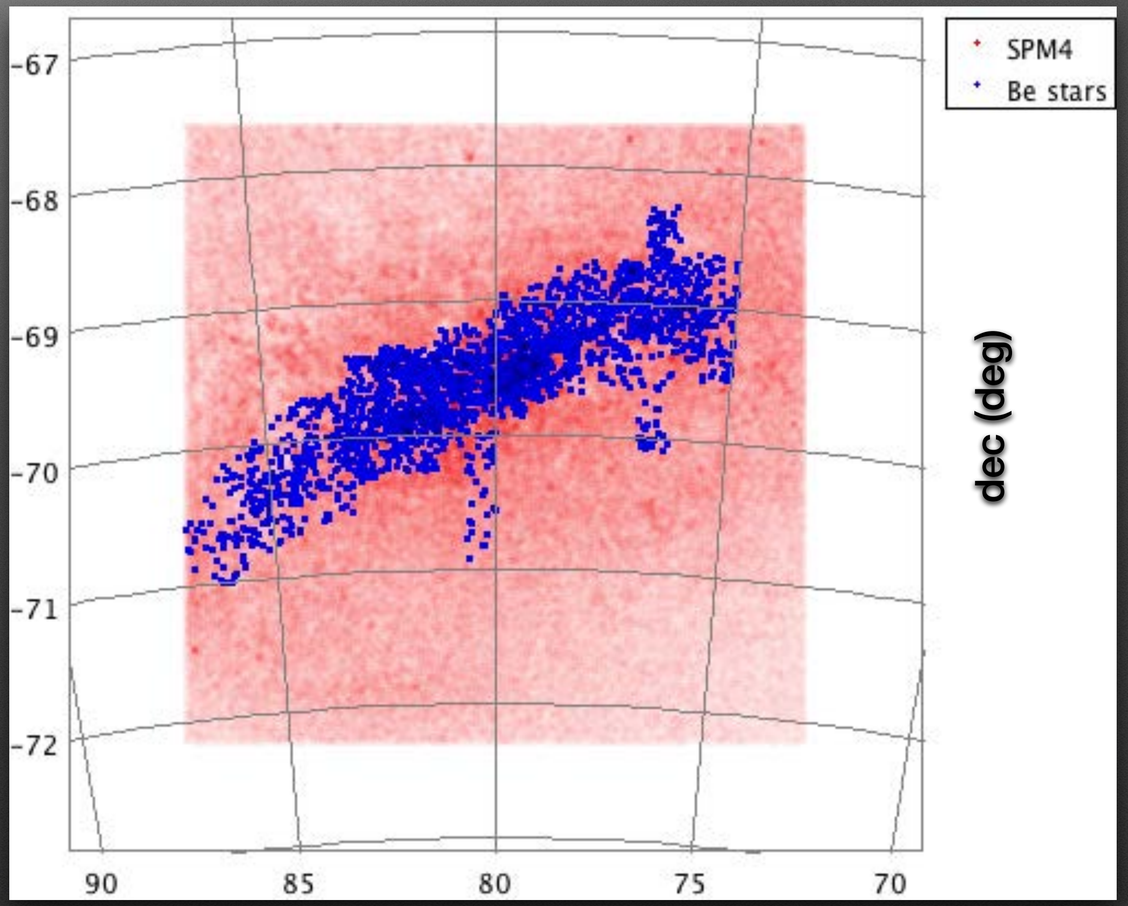
Data Coverage

Sabogal et al. 2005, 2008 y 2014



Be stars towards the LMC

- 2446 Be stars candidates,
  4 repeated entries discarded
- 2442 Be stars candidates x SPM4 (V_{lim}=17.5)
  = 1480 stars within 3 arcsec (60%)
  - 1442 Be x 1 SPM4
  - 5 Be x 2 SPM each ⇒ closest in V mag
  - (33 x 2 Be) x 1 SPM each ⇒ closest in sep
- 68 stars with n=i=0 labeled as *false* SPM4



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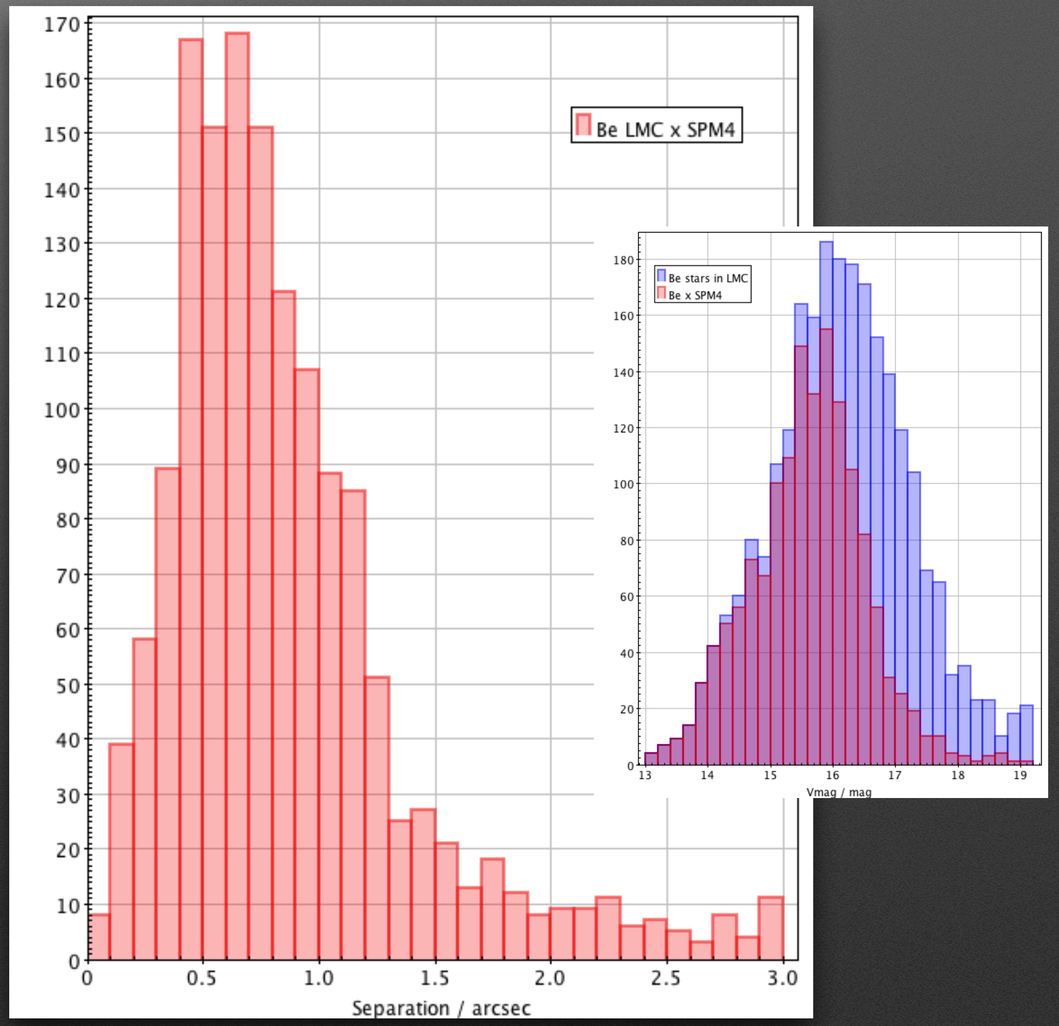

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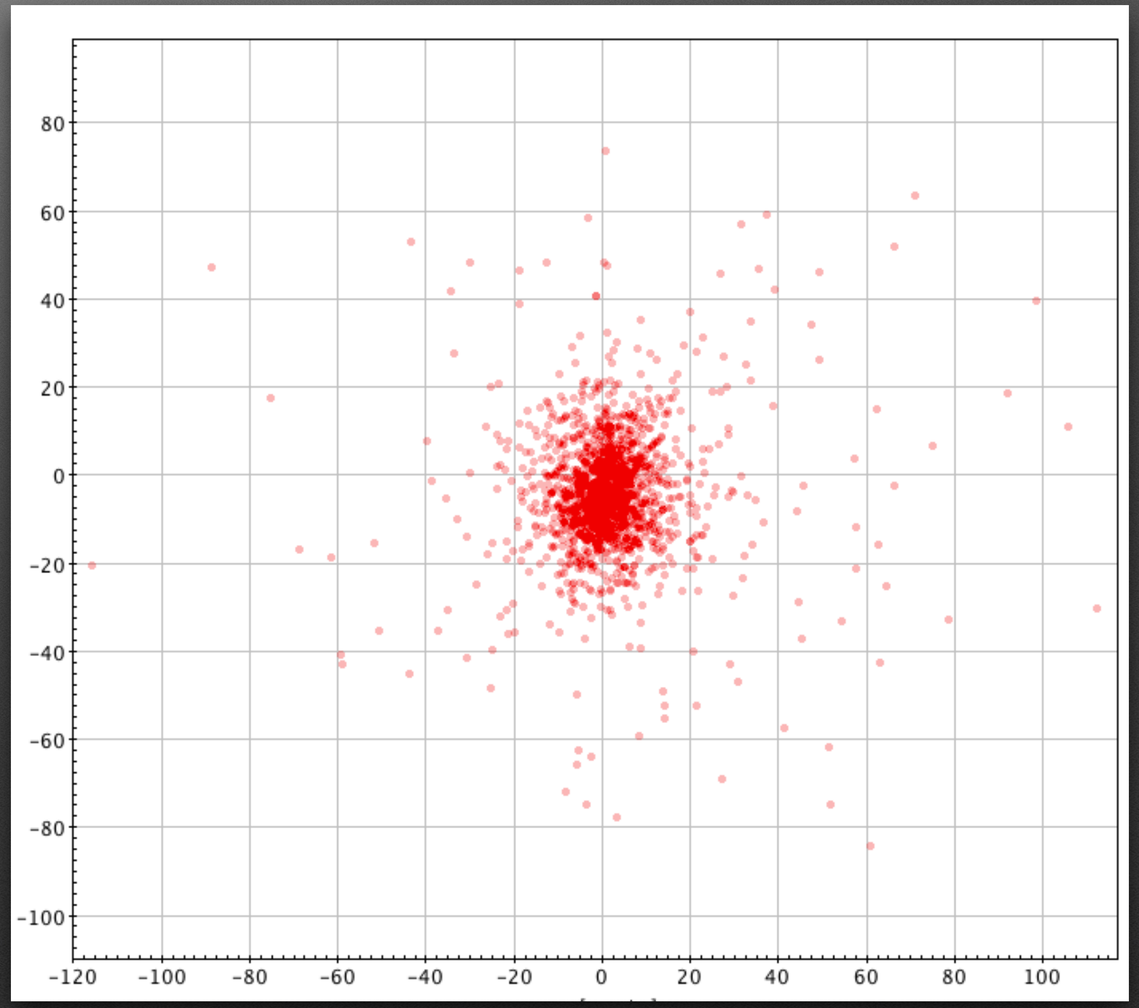
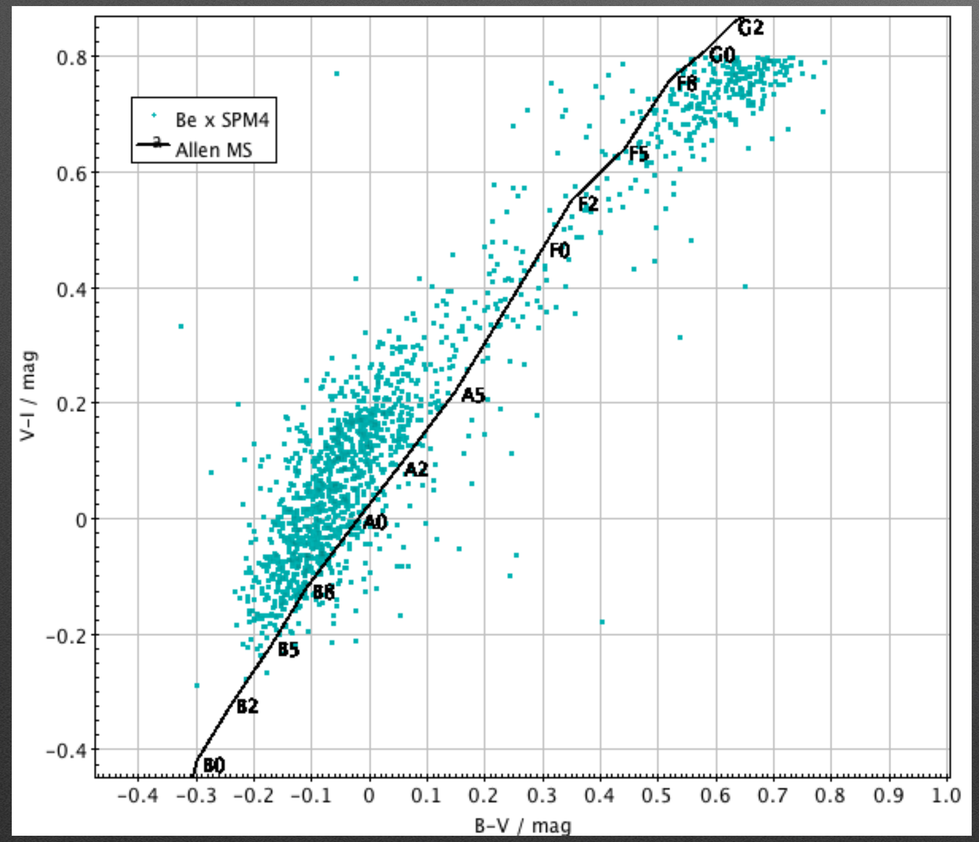
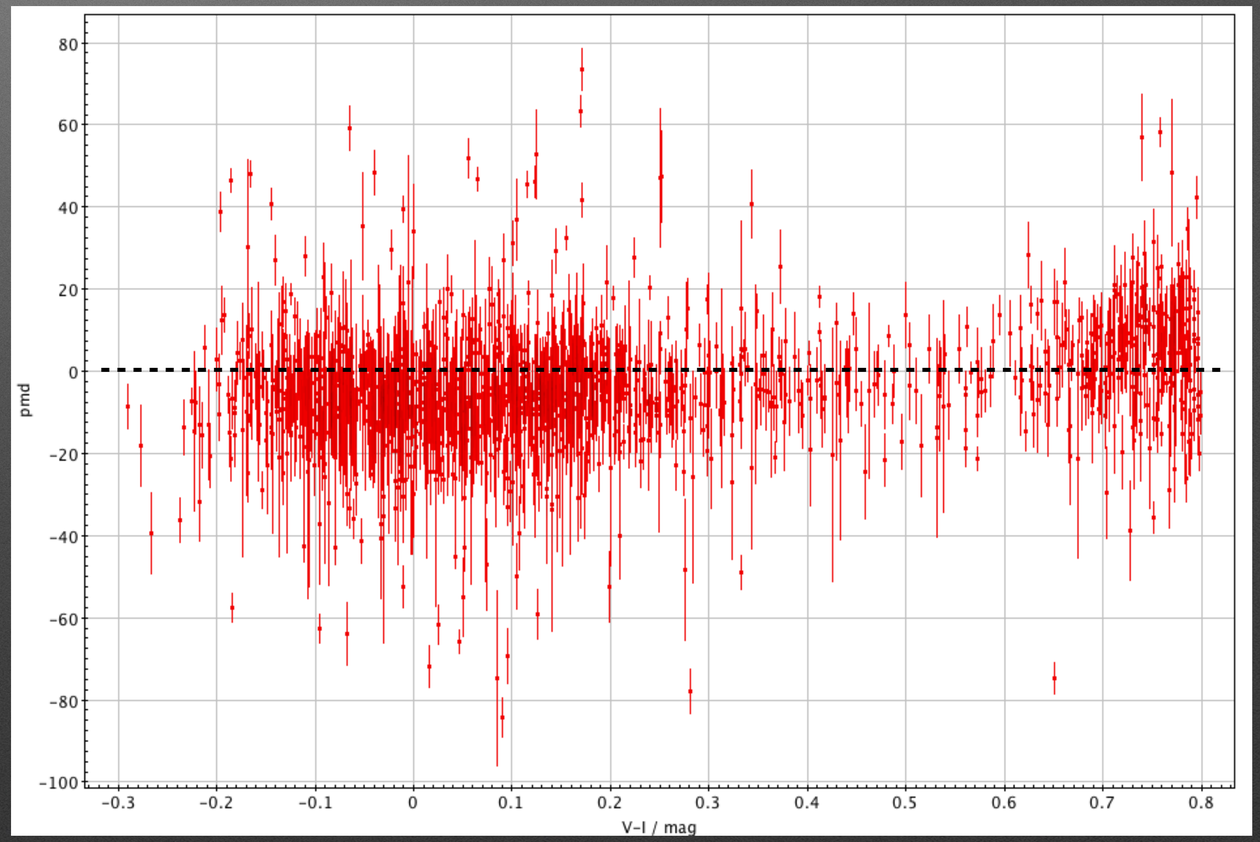
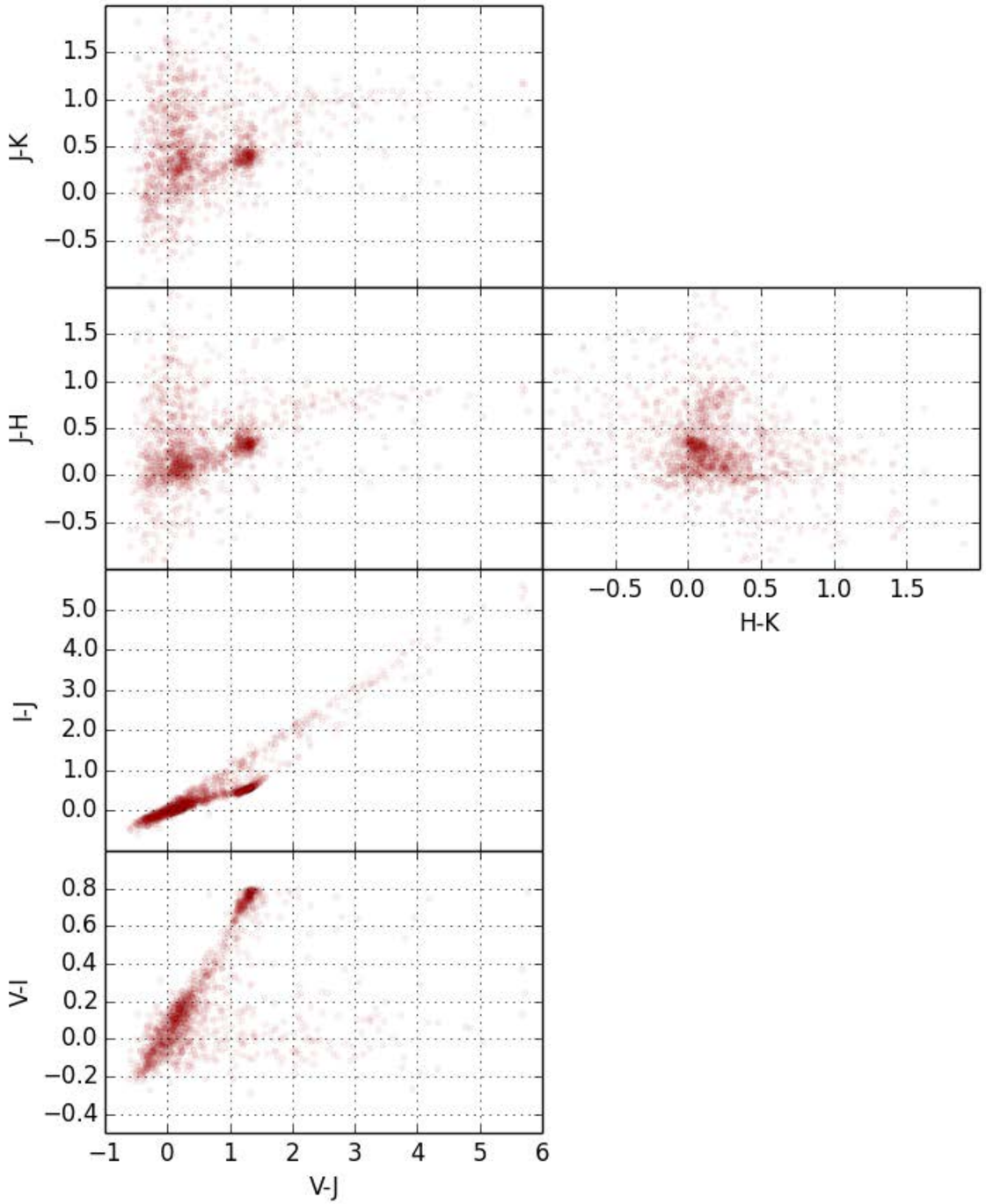


First hints of pm differences

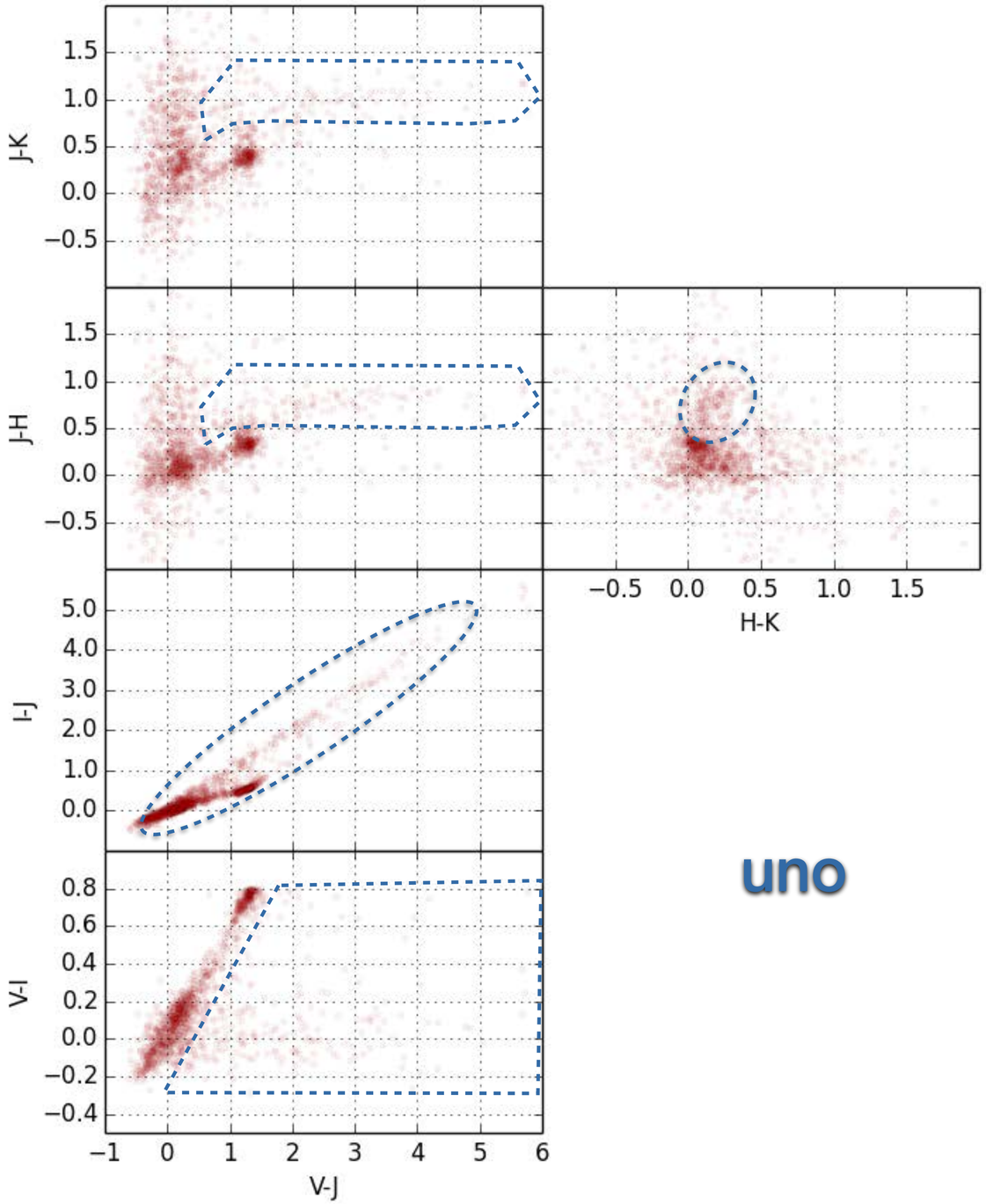




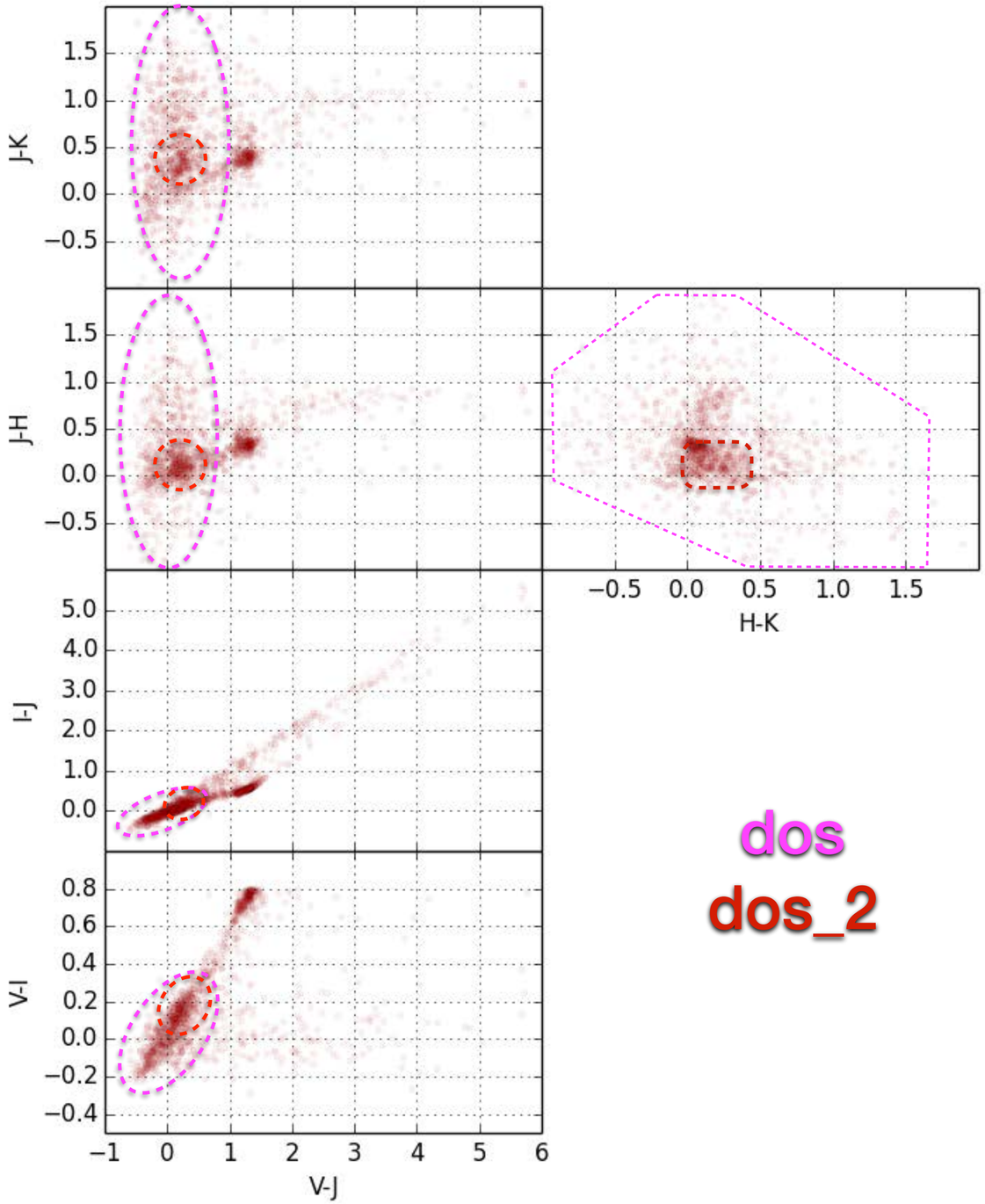


VIJHK color-color diagrams

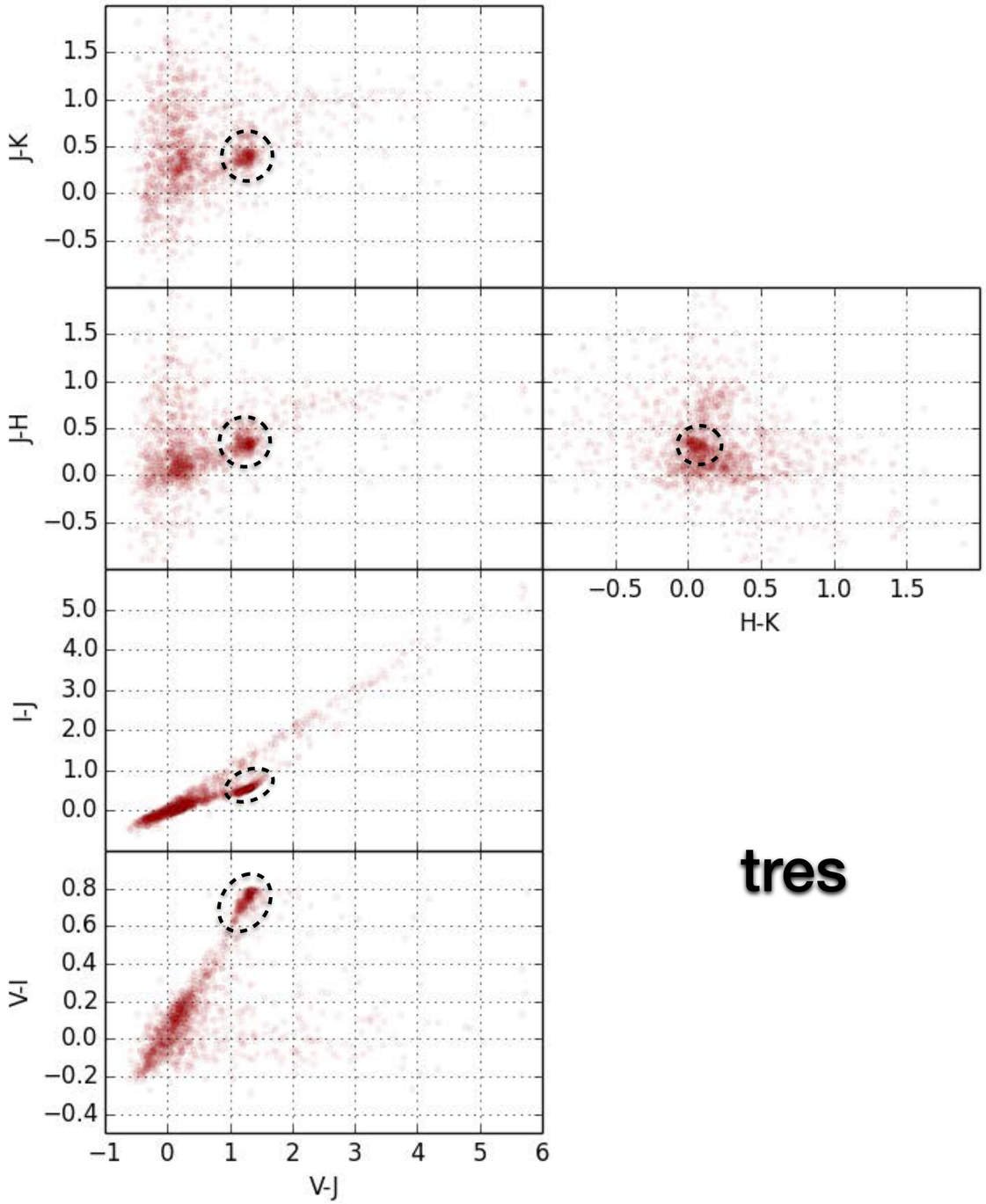
1448 estrellas con JHK 2MASS en SPM4



VIJHK color-color diagrams



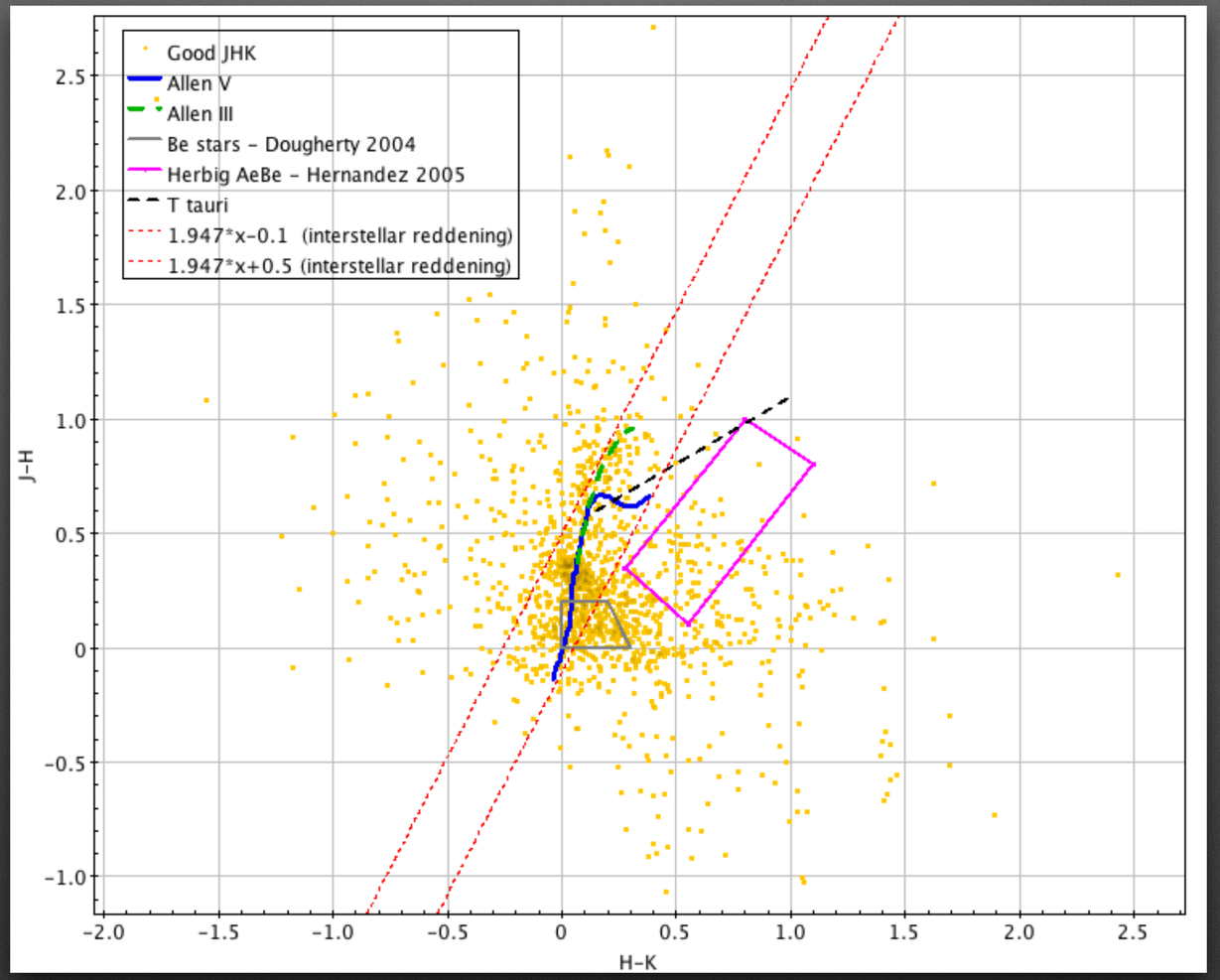
VIJHK color-color diagrams



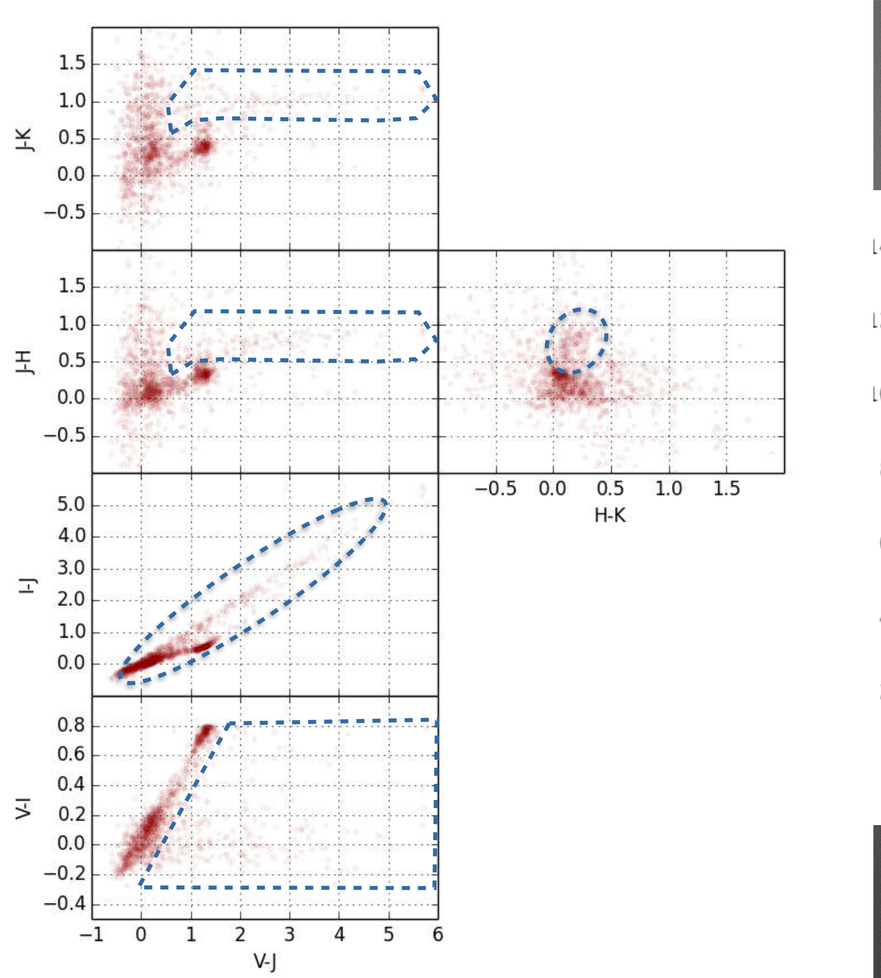
tres

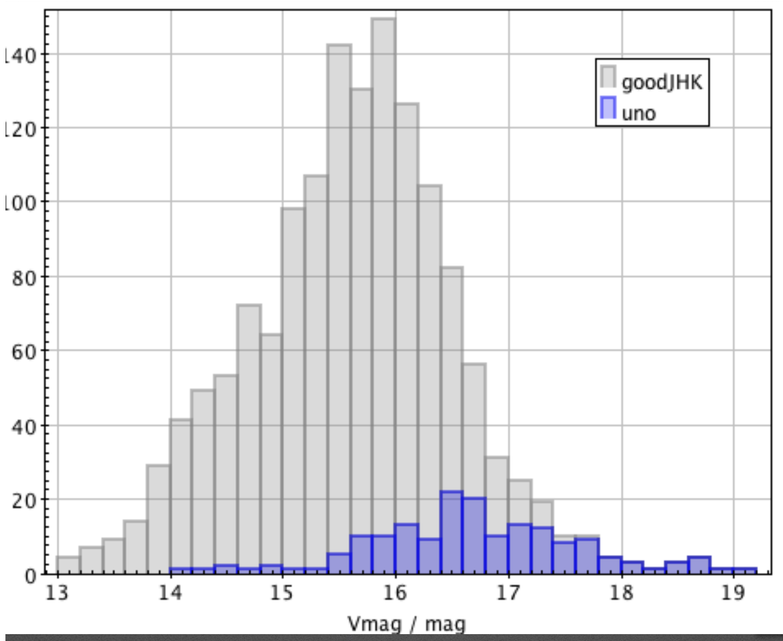
VIJHK color-color diagrams

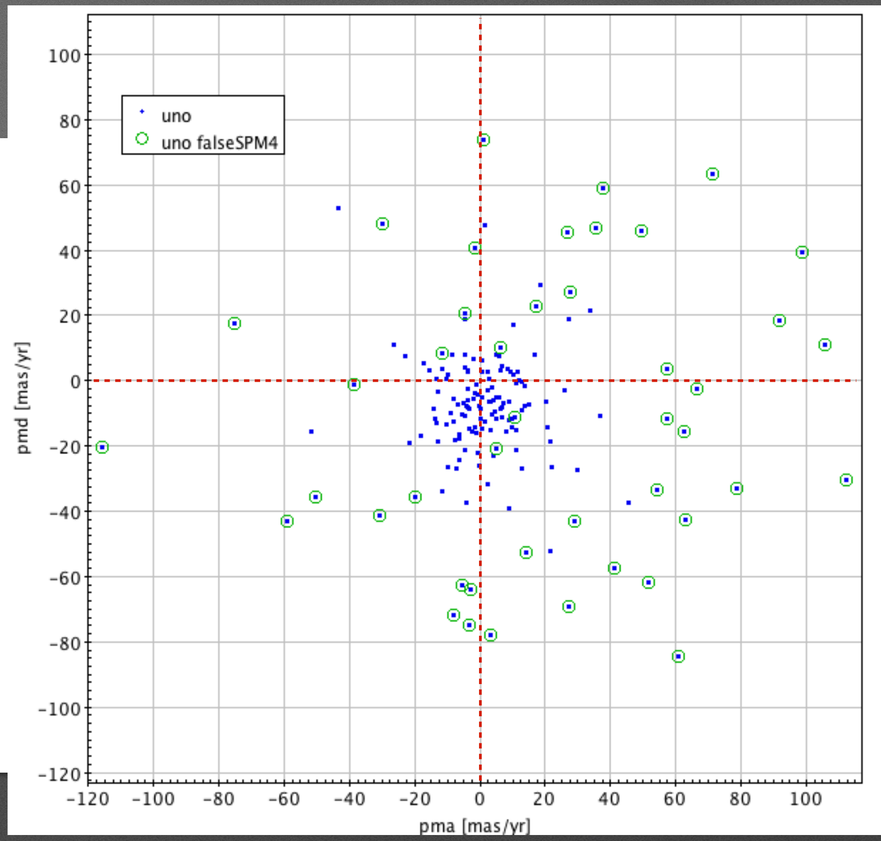
Paul et al. 2012
MNRAS 421:3622



J-H vs H-K





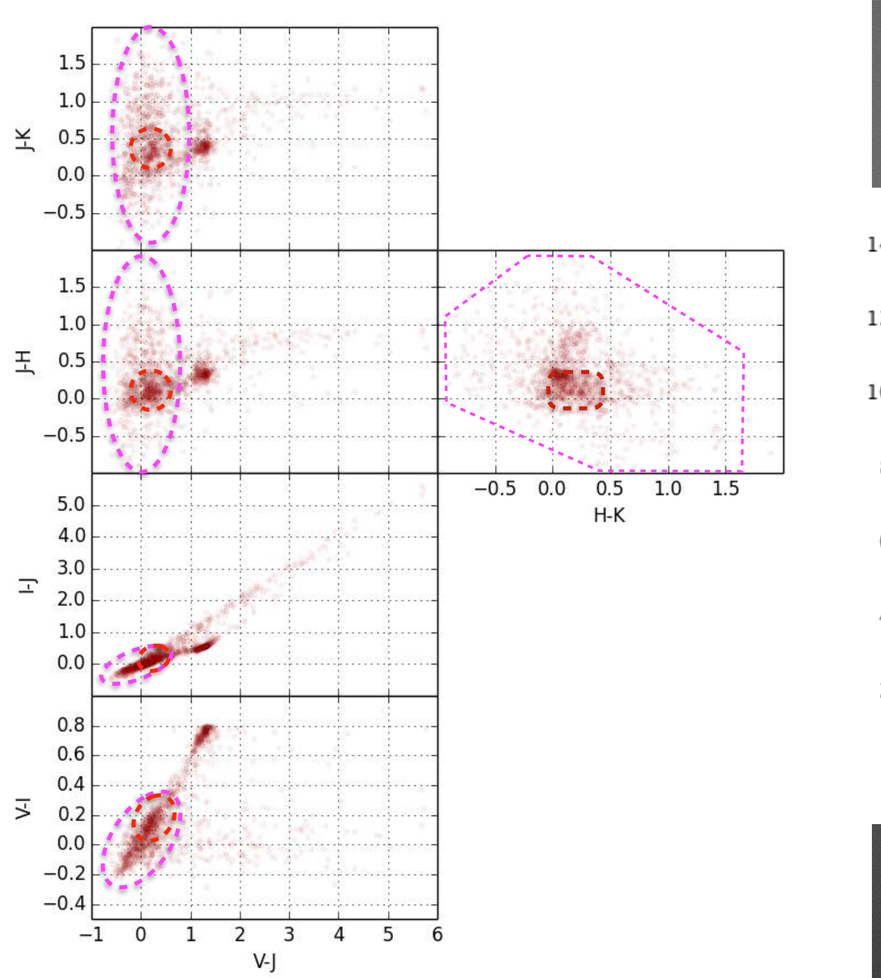


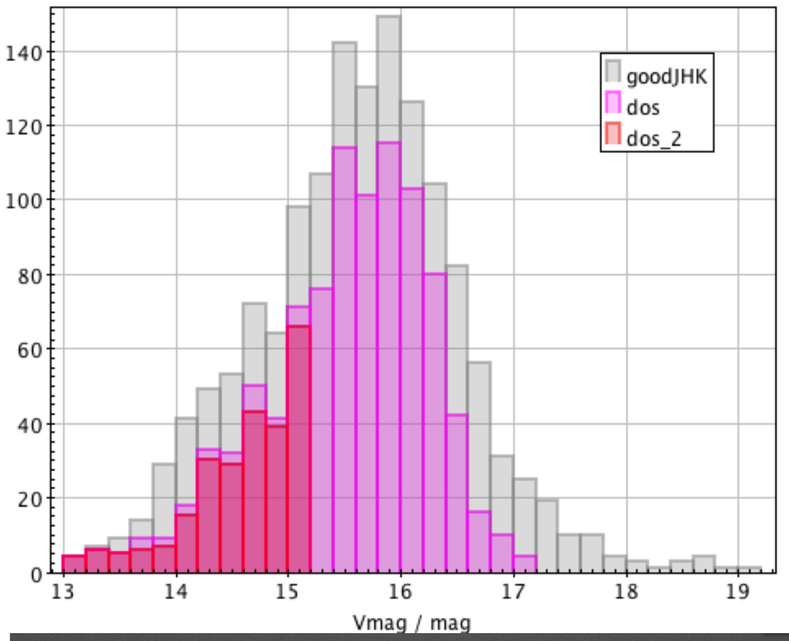
uno

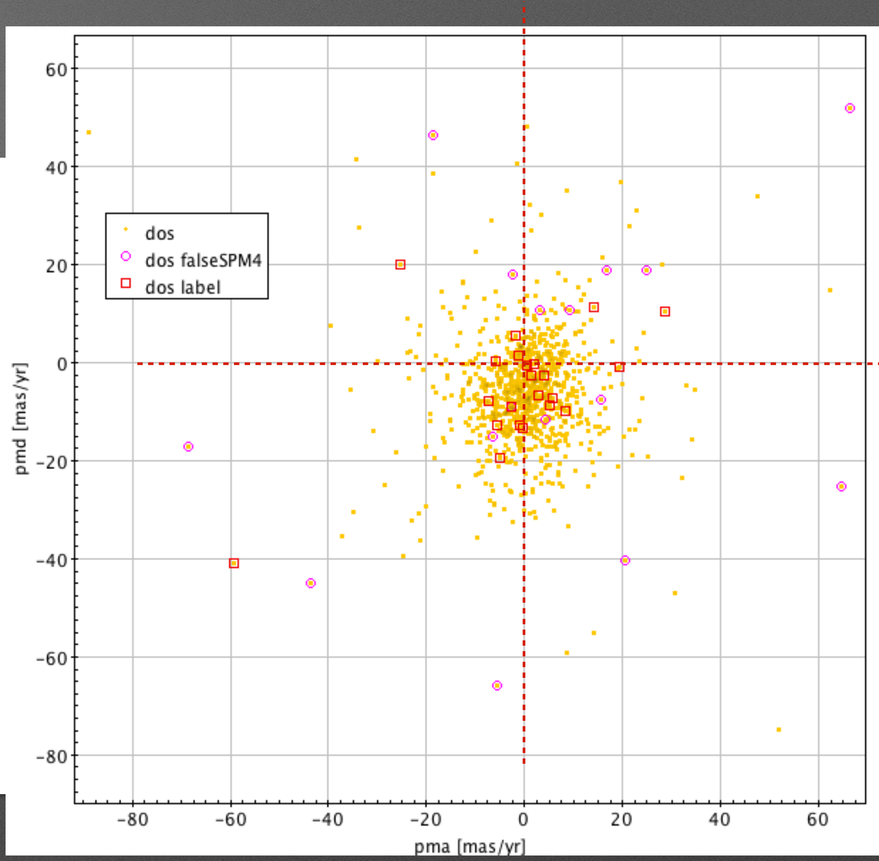
V-I ≤ 0.59 (V-J)-0.4

Very faint V magnitudes 14 - 16.5 - 19

pmd < 0







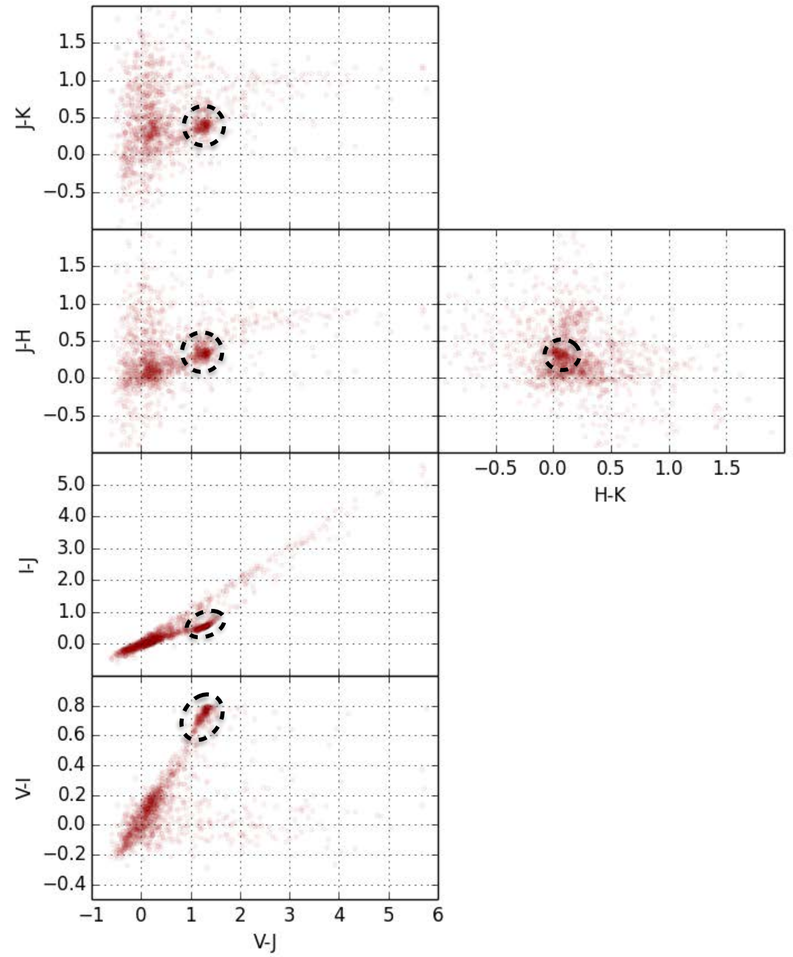
dos & dos_2

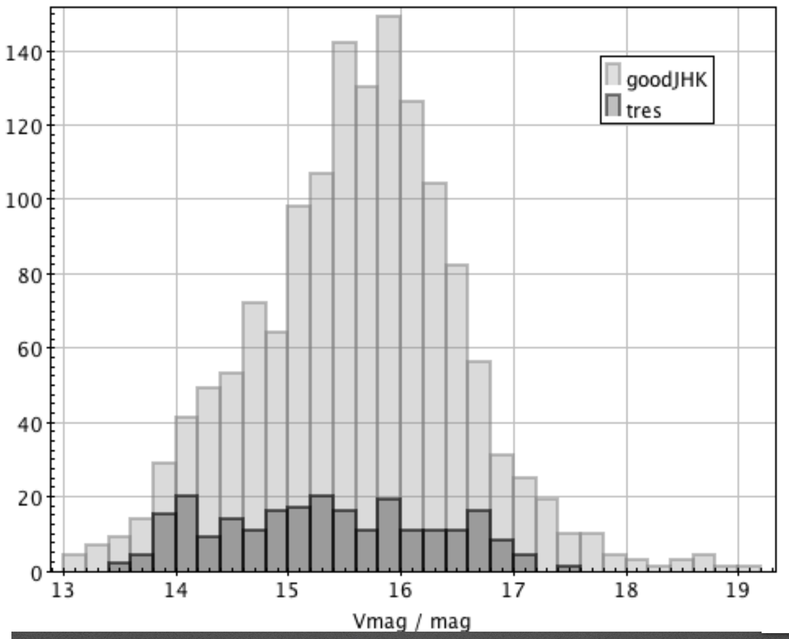
V-J ≤ 0.7

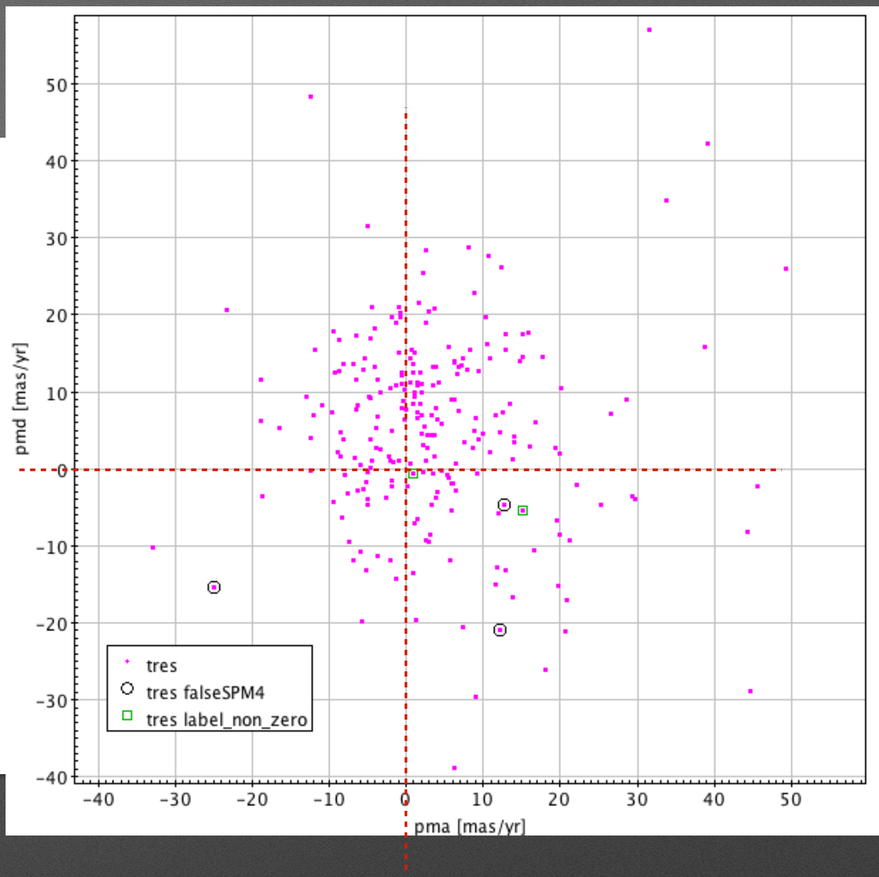
V-J ≤ 0.5 & V ≤ 15.2

Brighter V magnitudes 13 - 17.5 - 17

pmd < 0







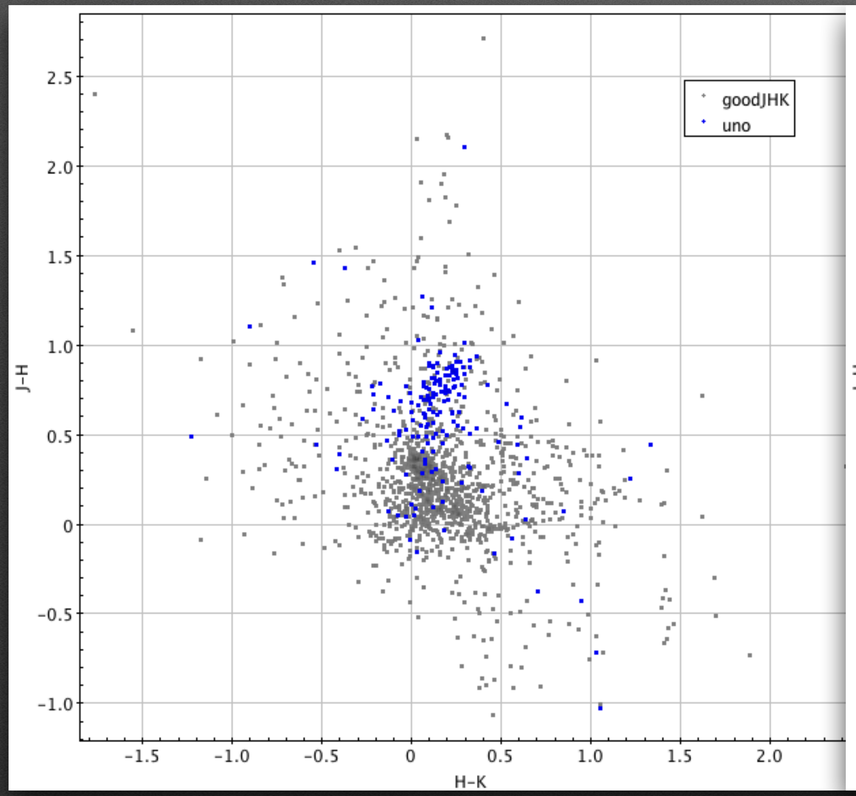
tres

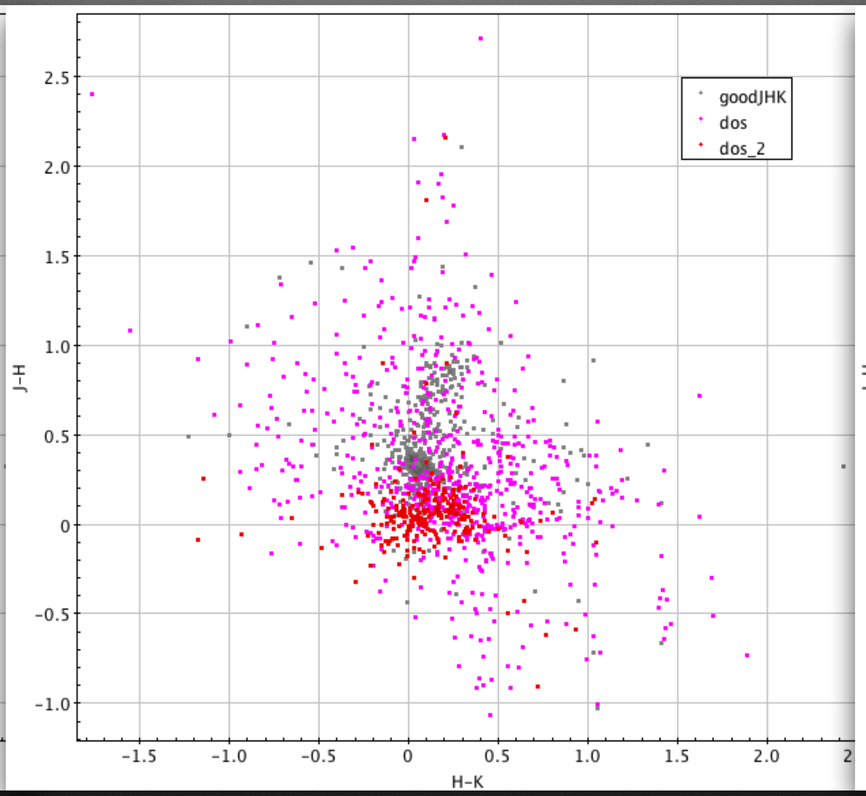
V-I ≥ 0.55 , 1 ≤ V-J ≤ 1.7 &

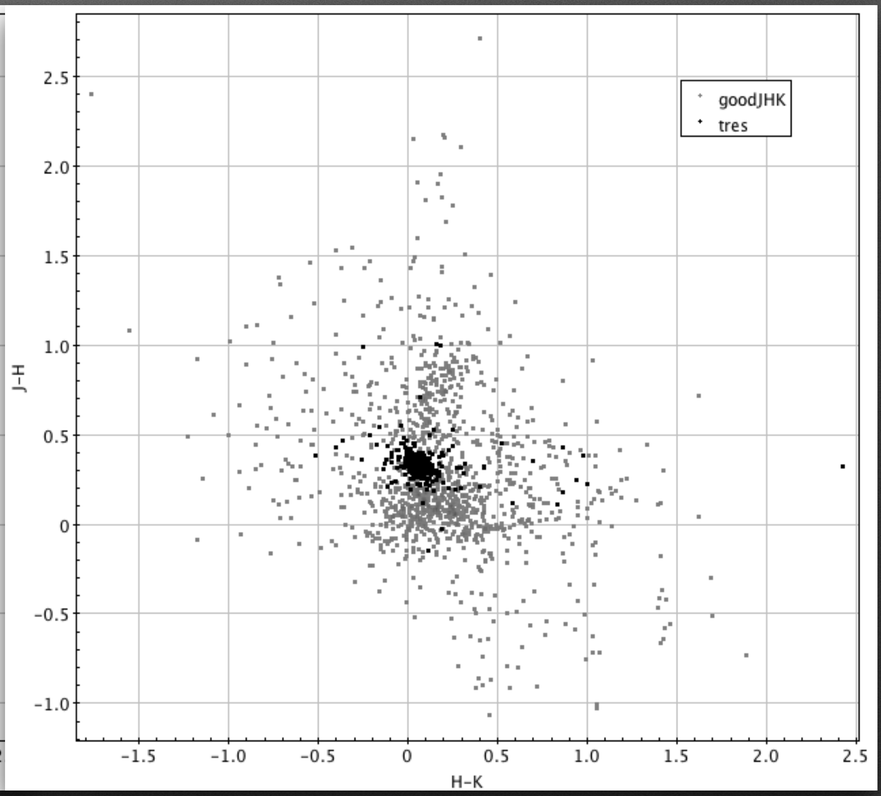
Type = 4

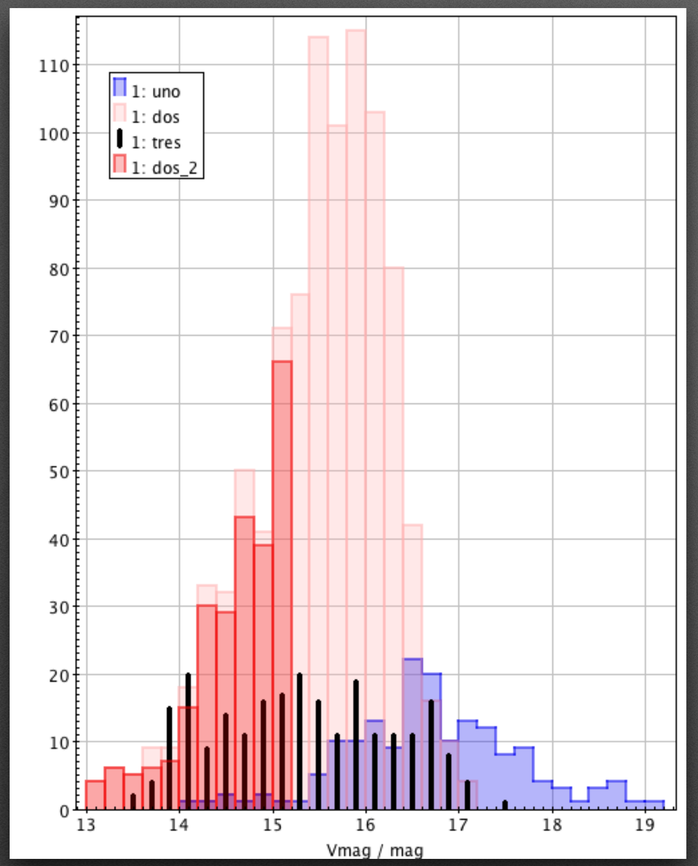
Brighter V magnitudes 13.5 - 17.2

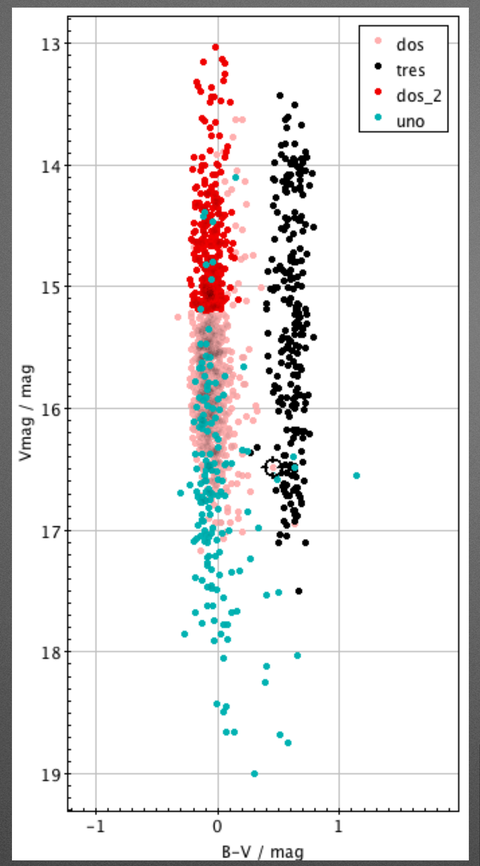
pmd > 0

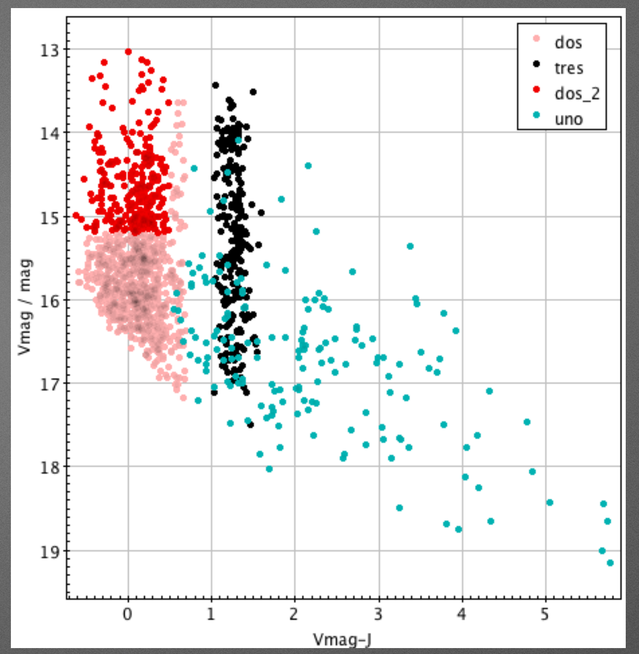

goodJHK
uno
J-H
H-K

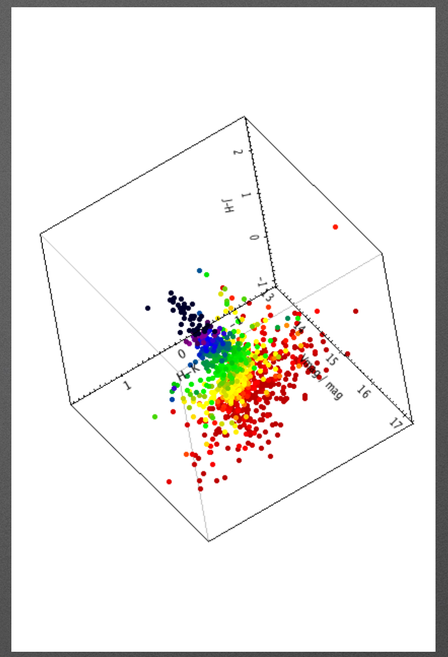

goodJHK
dos
dos_2
J-H
H-K

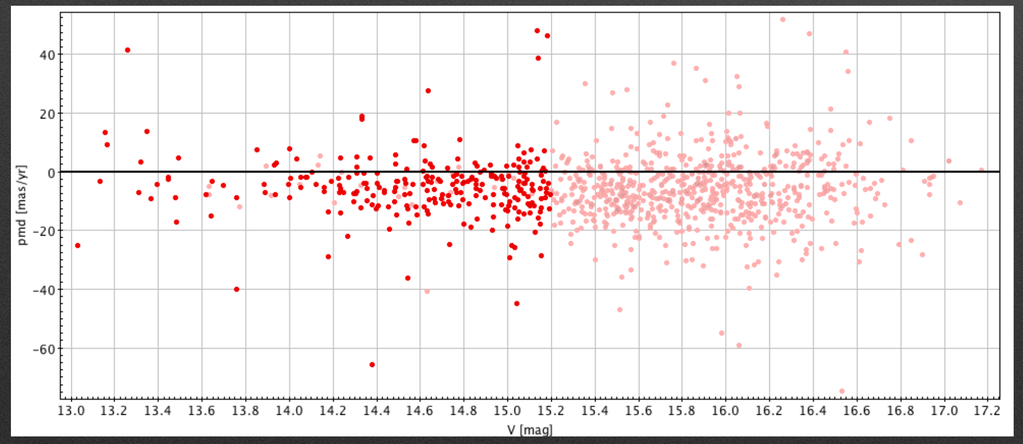

goodJHK
tres
J-H
H-K

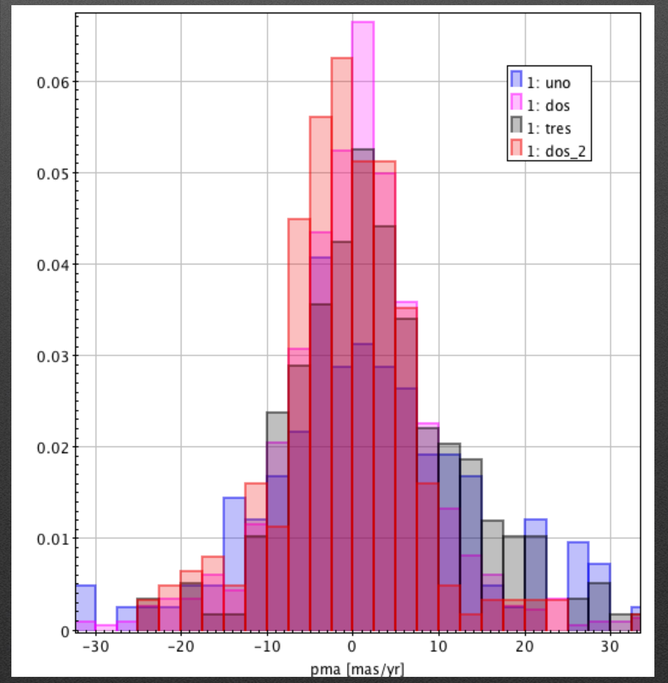

1: uno
1: dos
1: tres
1: dos_2
Vmag / mag

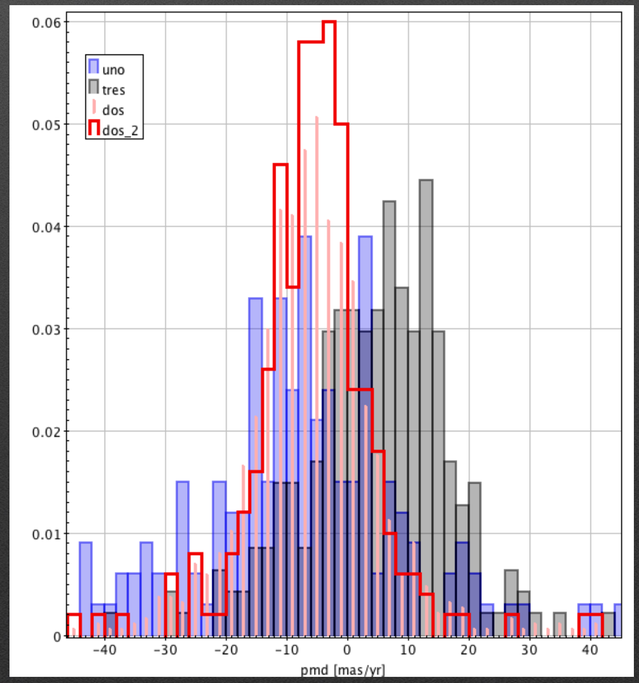

dos
tres
dos_2
uno
Vmag / mag
B-V / mag

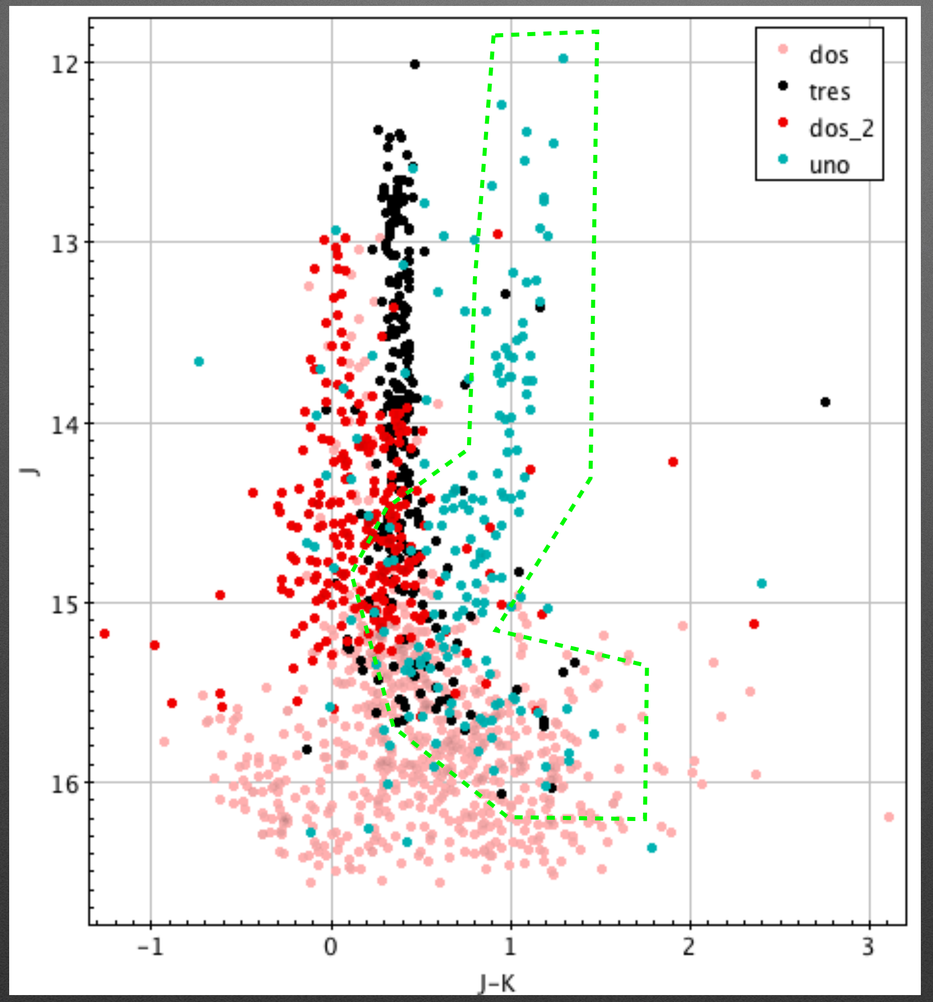

dos
tres
dos_2
uno
Vmag / mag
Vmag-J

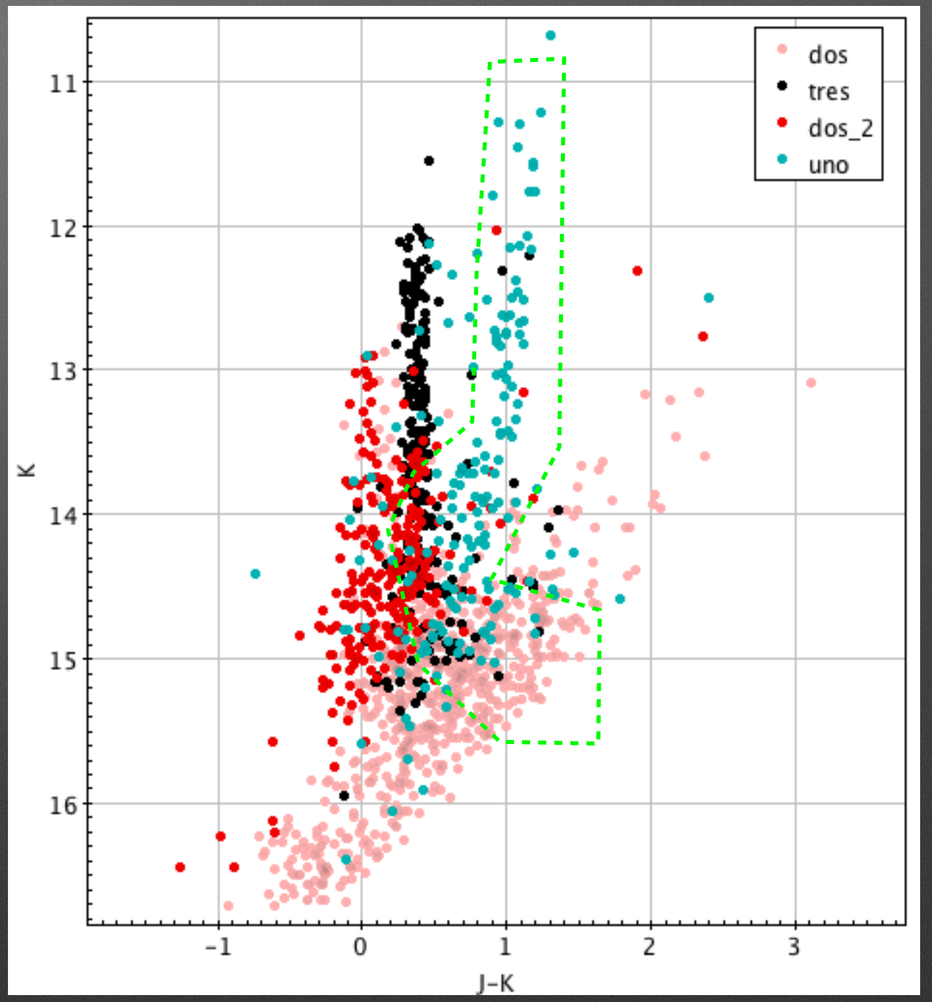

J-H
Vmag / mag


pmd [mas/yr]
V [mag]


1: uno
1: dos
1: tres
1: dos_2
pma [mas/yr]


uno
tres
dos
dos_2
pmd [mas/yr]


dos
tres
dos_2
uno
J
J-K
12
13
14
15
16
−1
0
1
2
3


dos
tres
dos_2
uno
K
J-K
11
12
13
14
15
16
−1
0
1
2
3

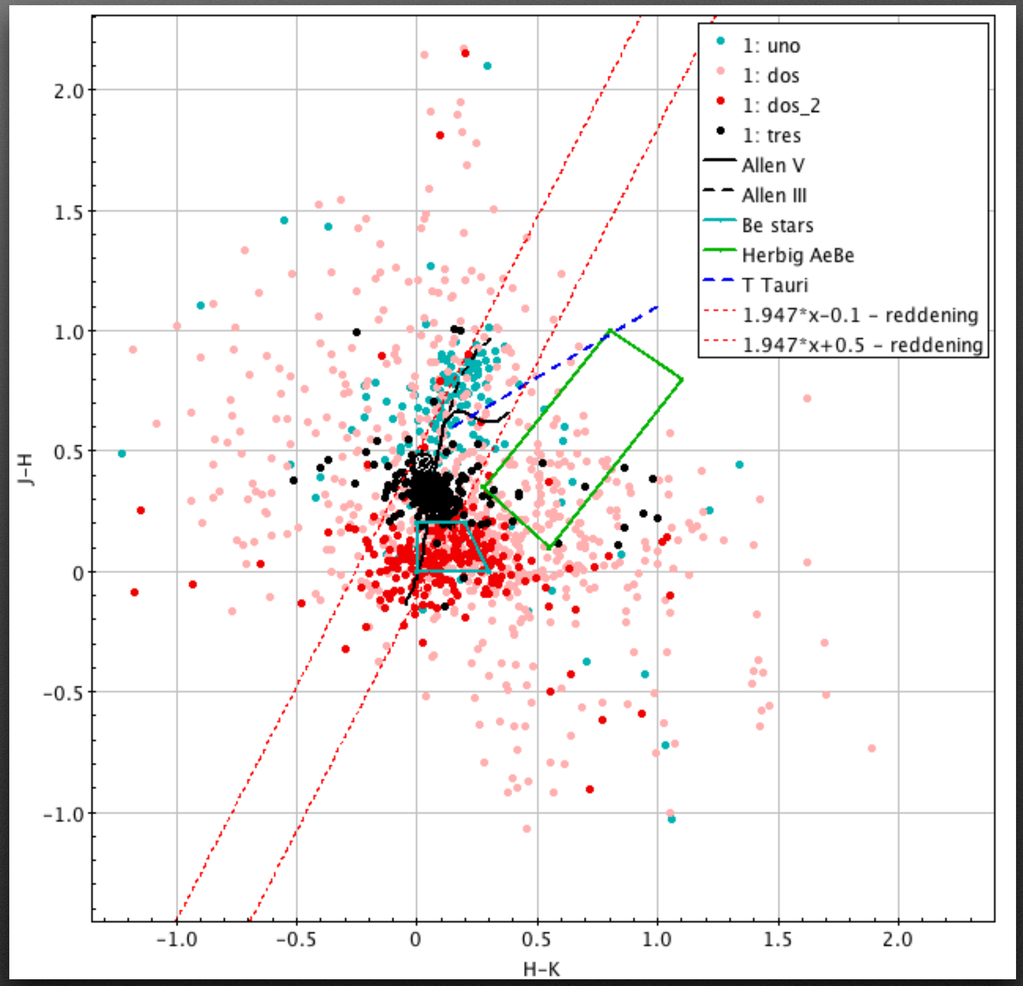
LMC Be stars samples

- Be stars candidates segregated into three distinctive populations

1. B giants stars in the LMC but with IR colors of KM giants?

2. Most probable Be stars in the LMC

3. Stars in the Milky Way (FGK dwarfs, < 1 kpc)



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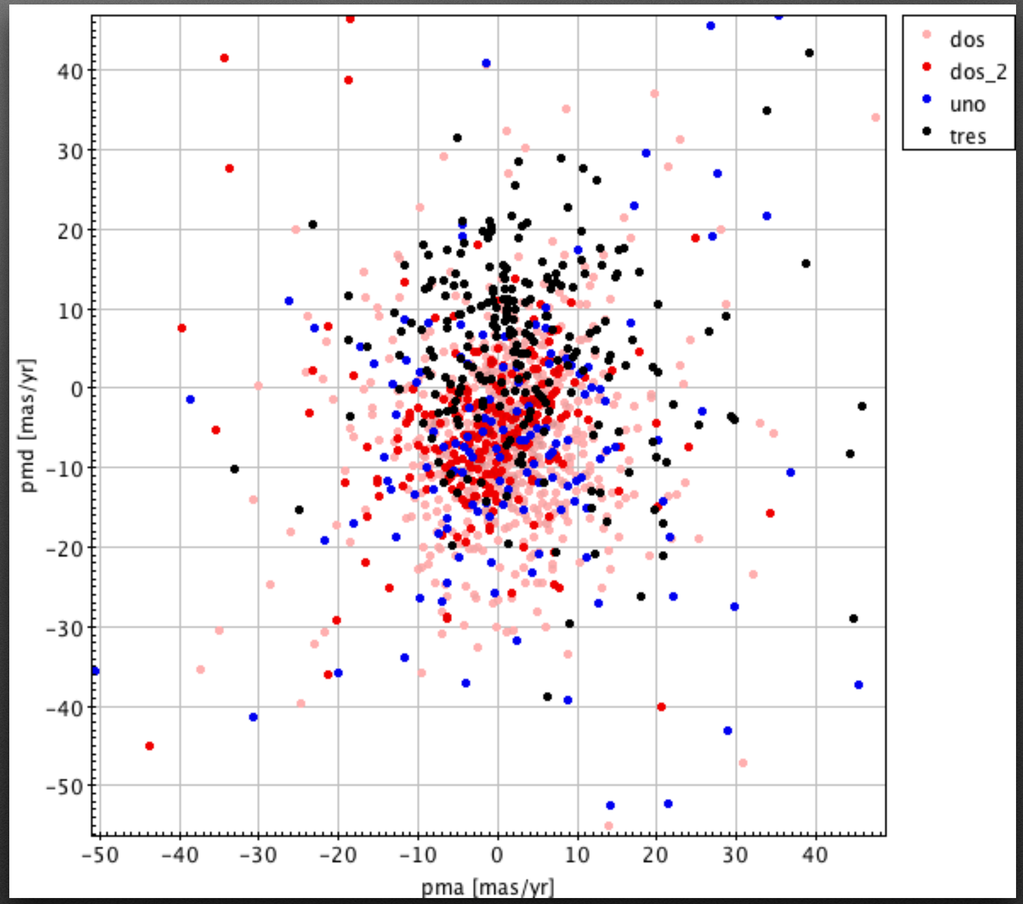
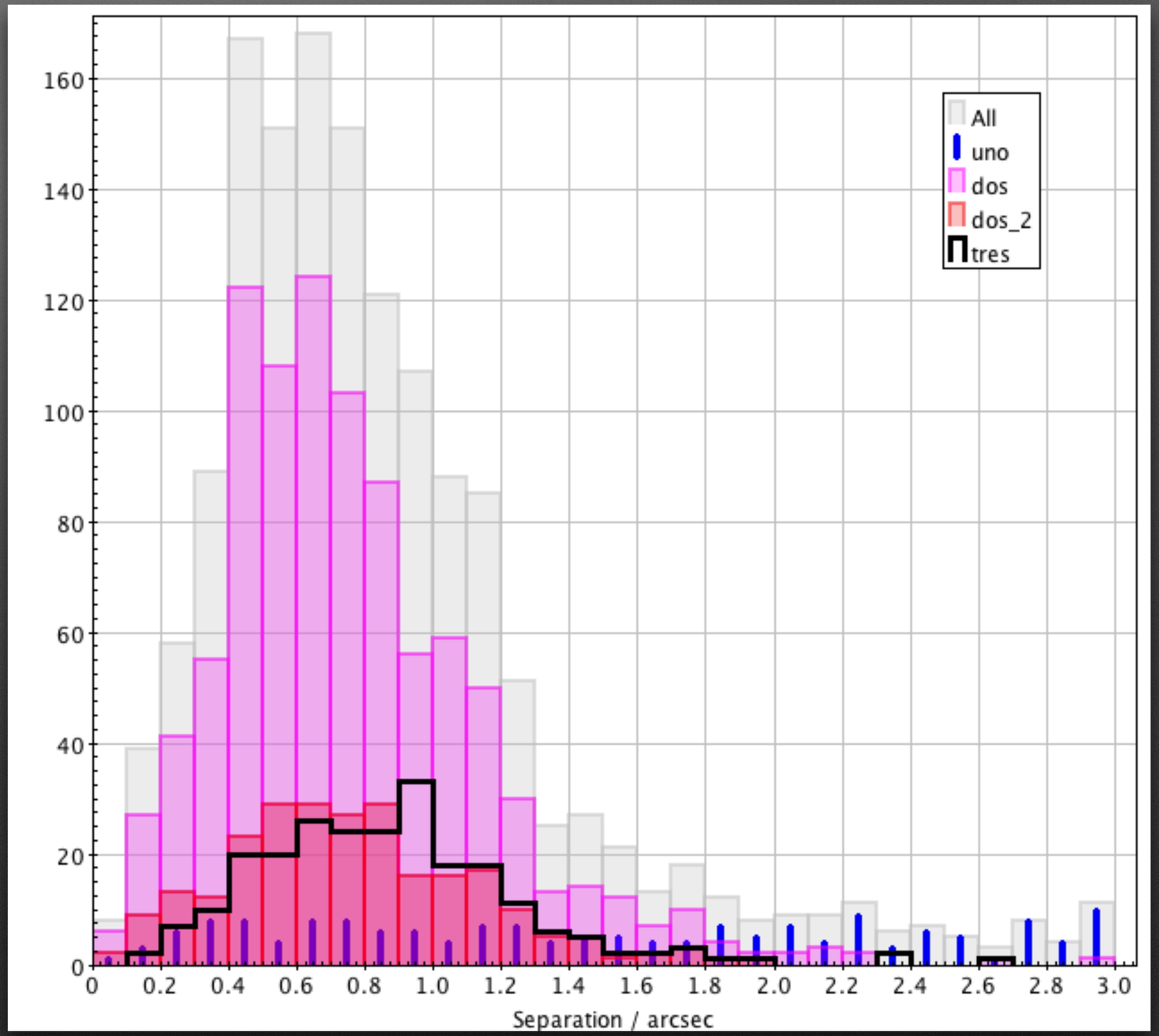


“uno” are most probably mismatches to red giants!

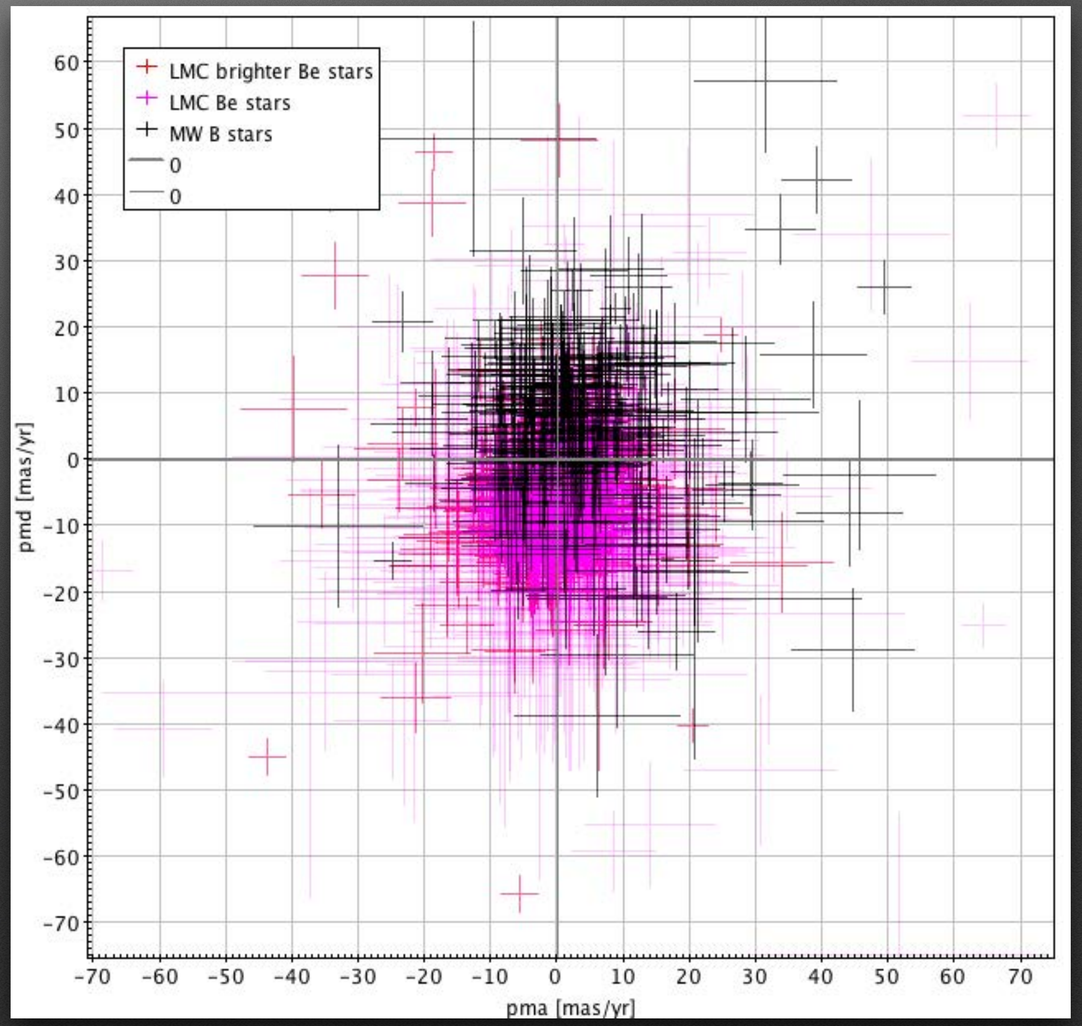


Conclusions

- Be stars candidates segregated into th~~ee~~ two distinctive populations

2. Most probable Be stars in the LMC

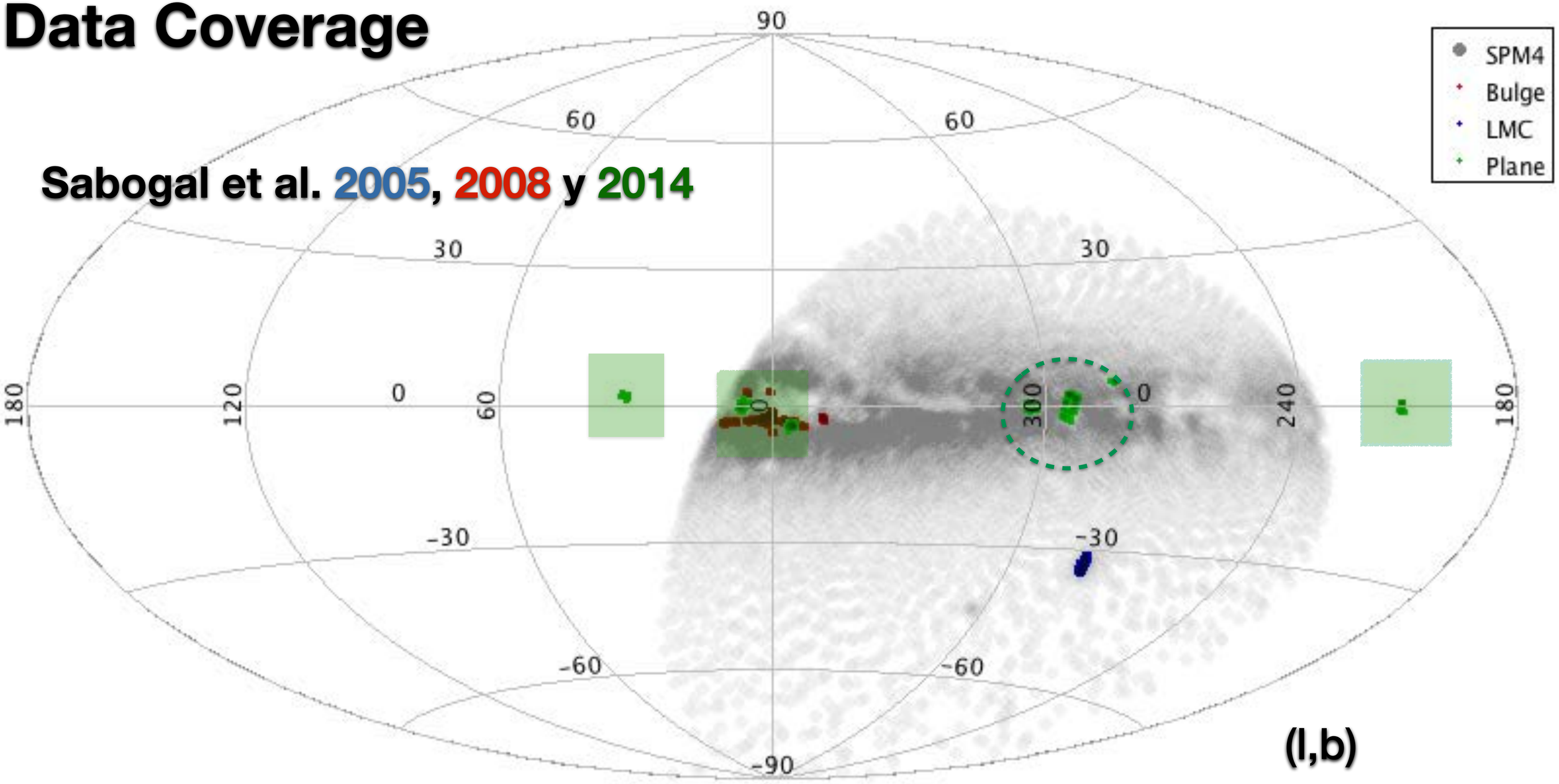
3. Most probable FGK dwarf stars in the MW

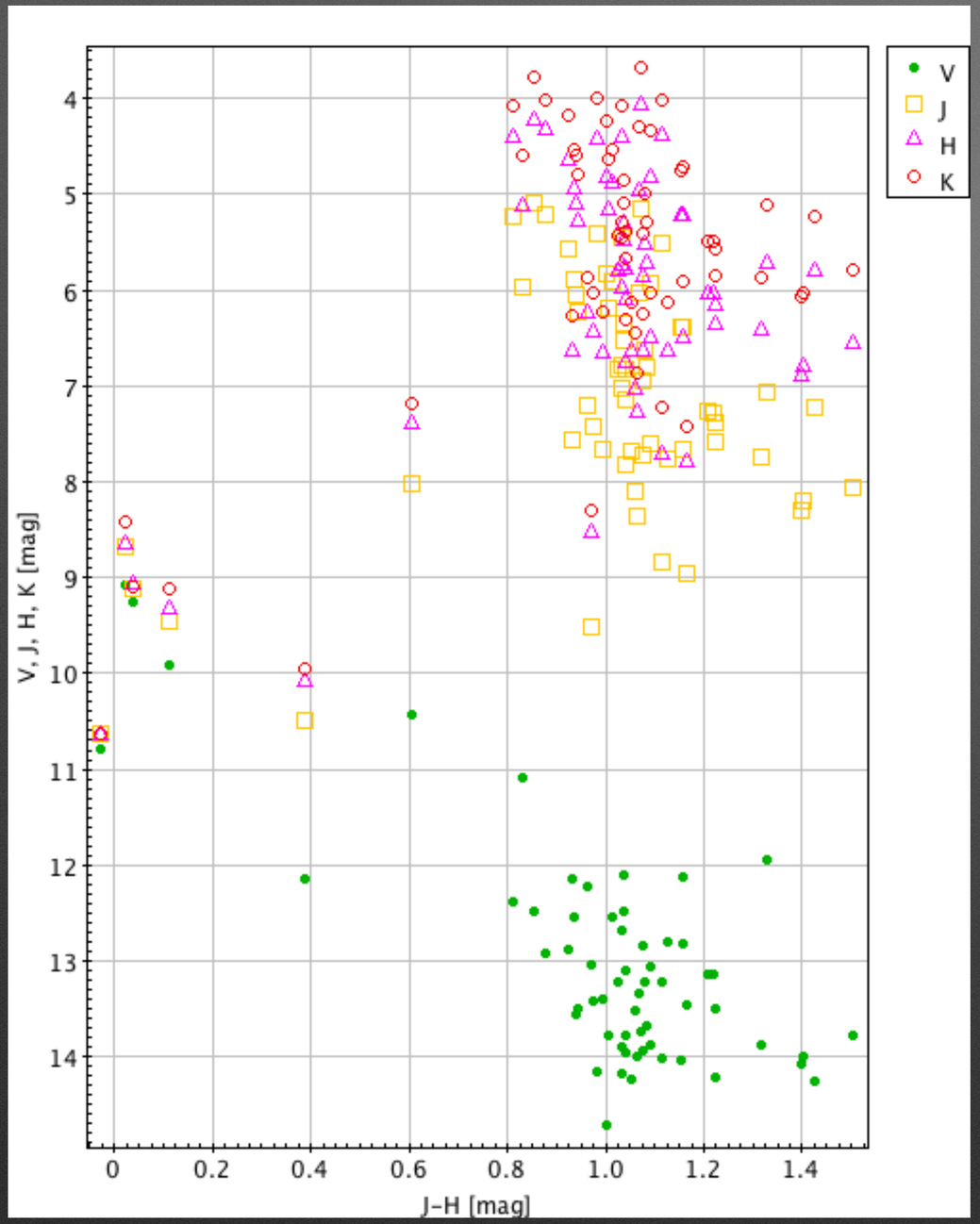


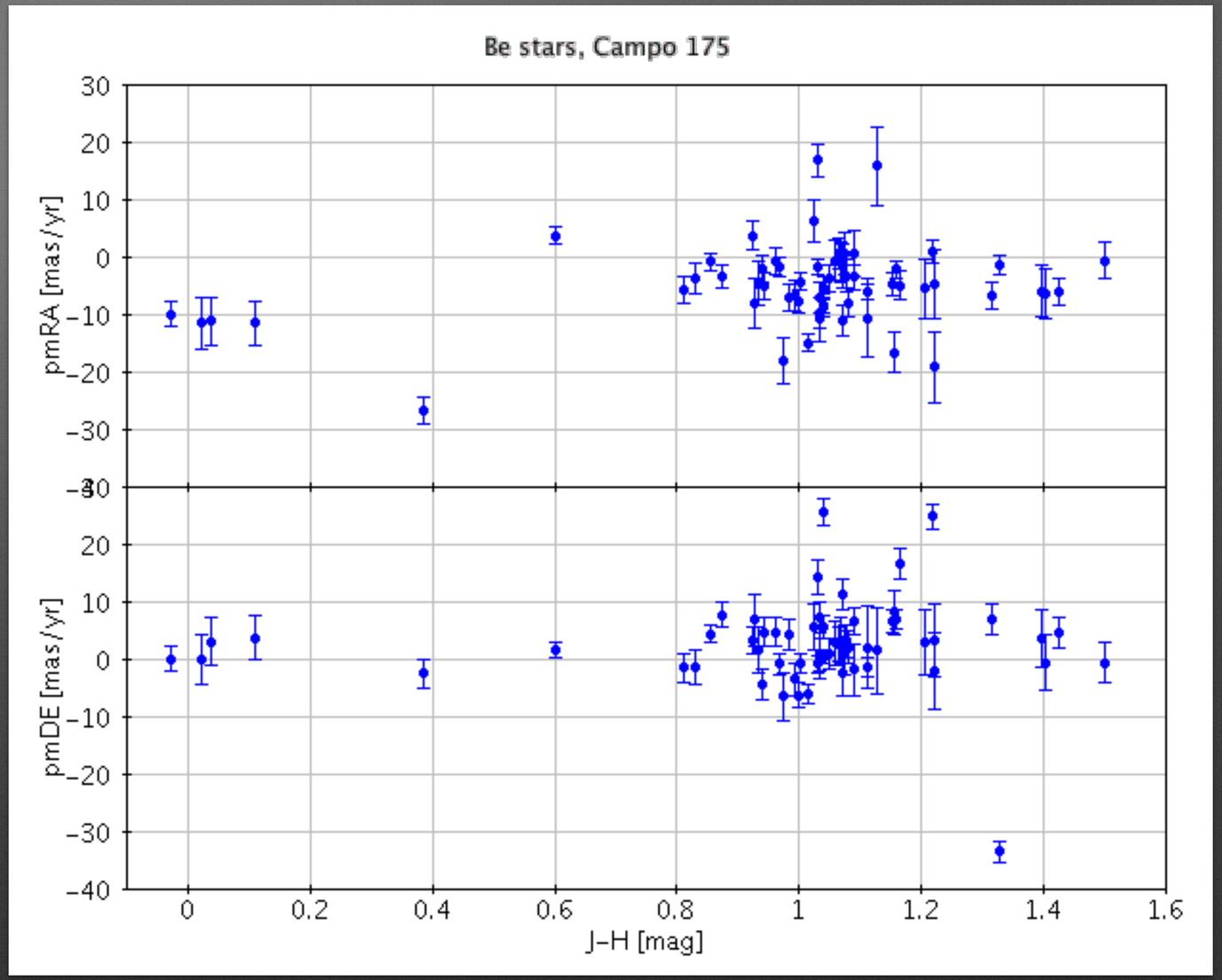
Do I still have time?

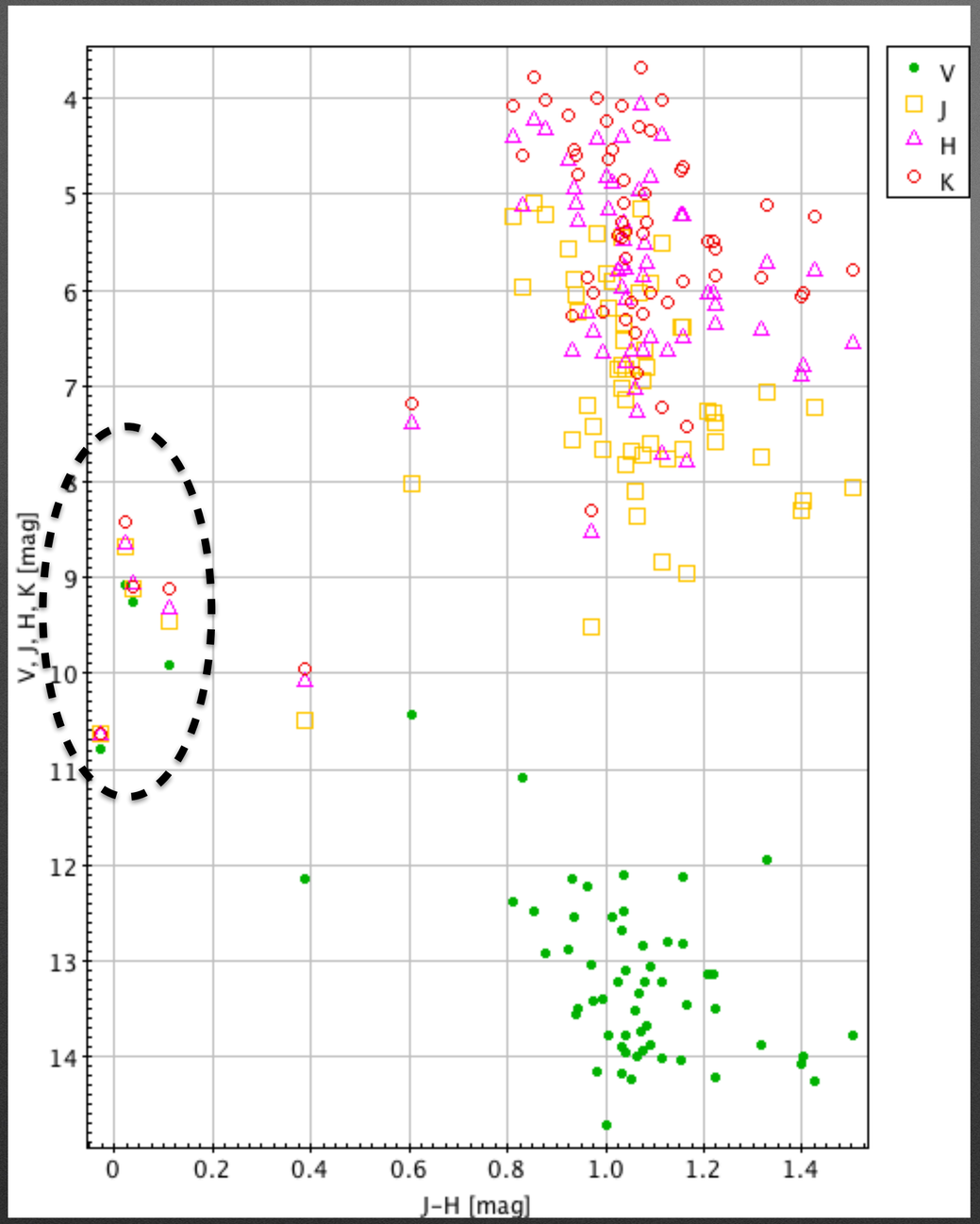
Data Coverage

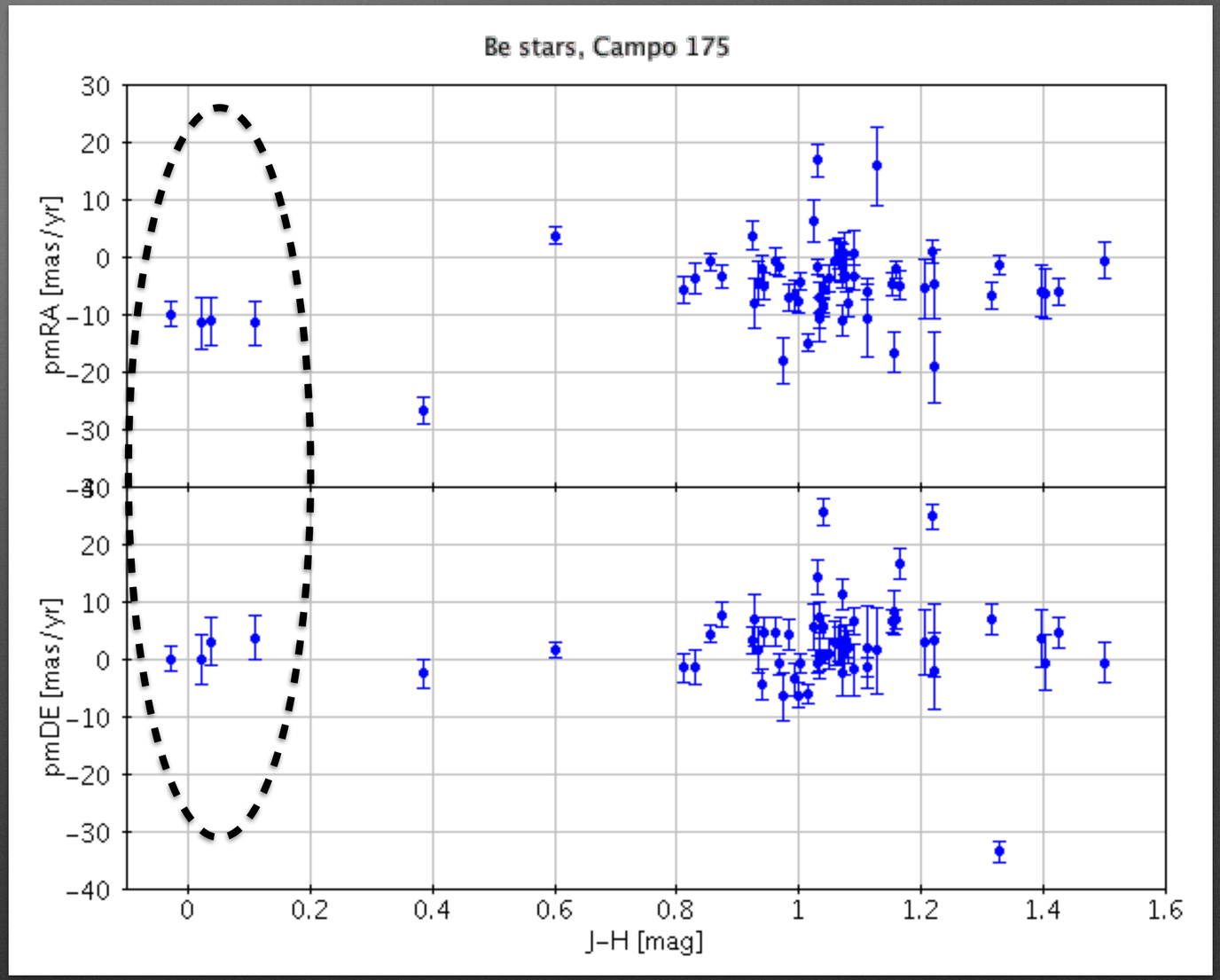
Sabogal et al. 2005, 2008 y 2014

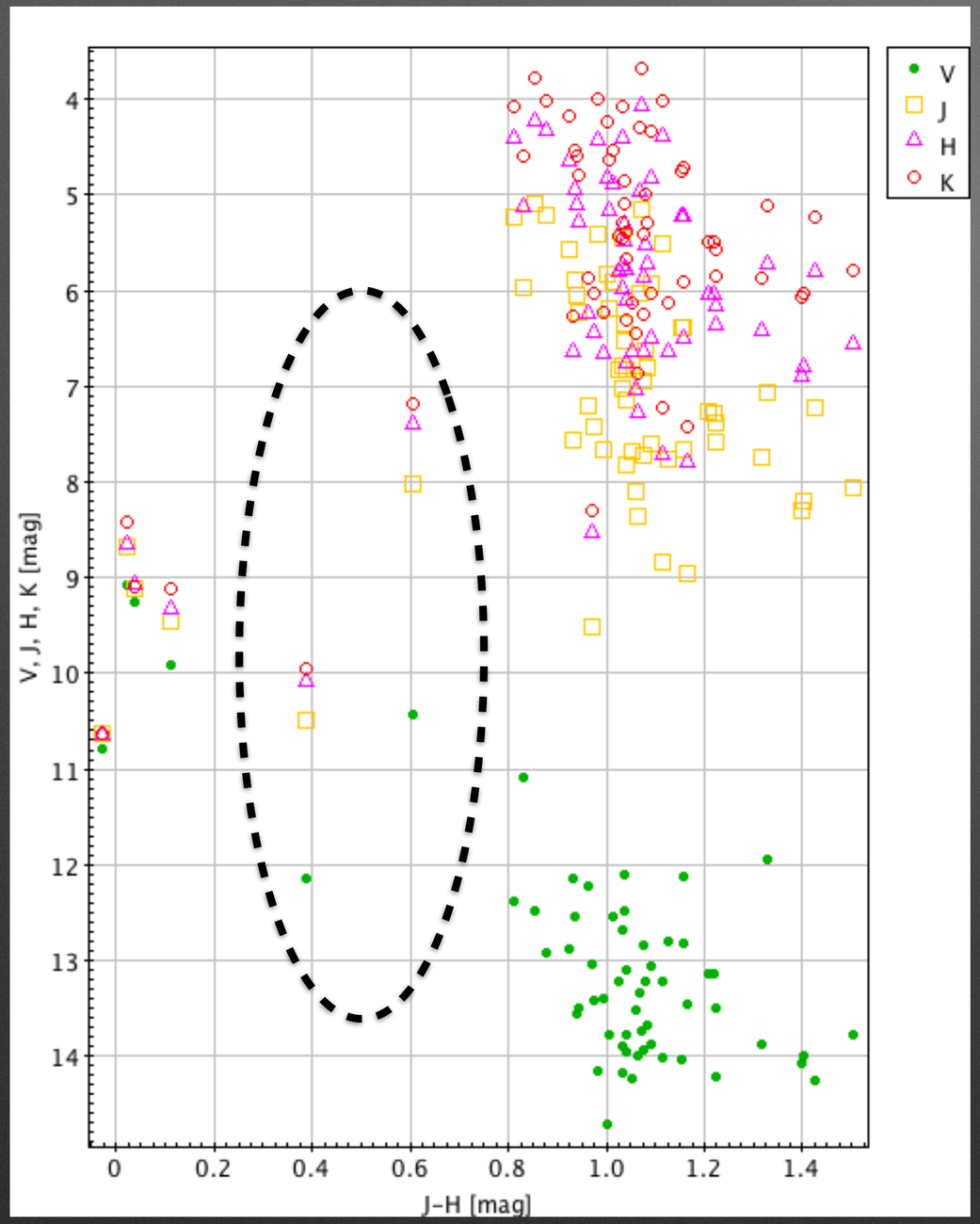


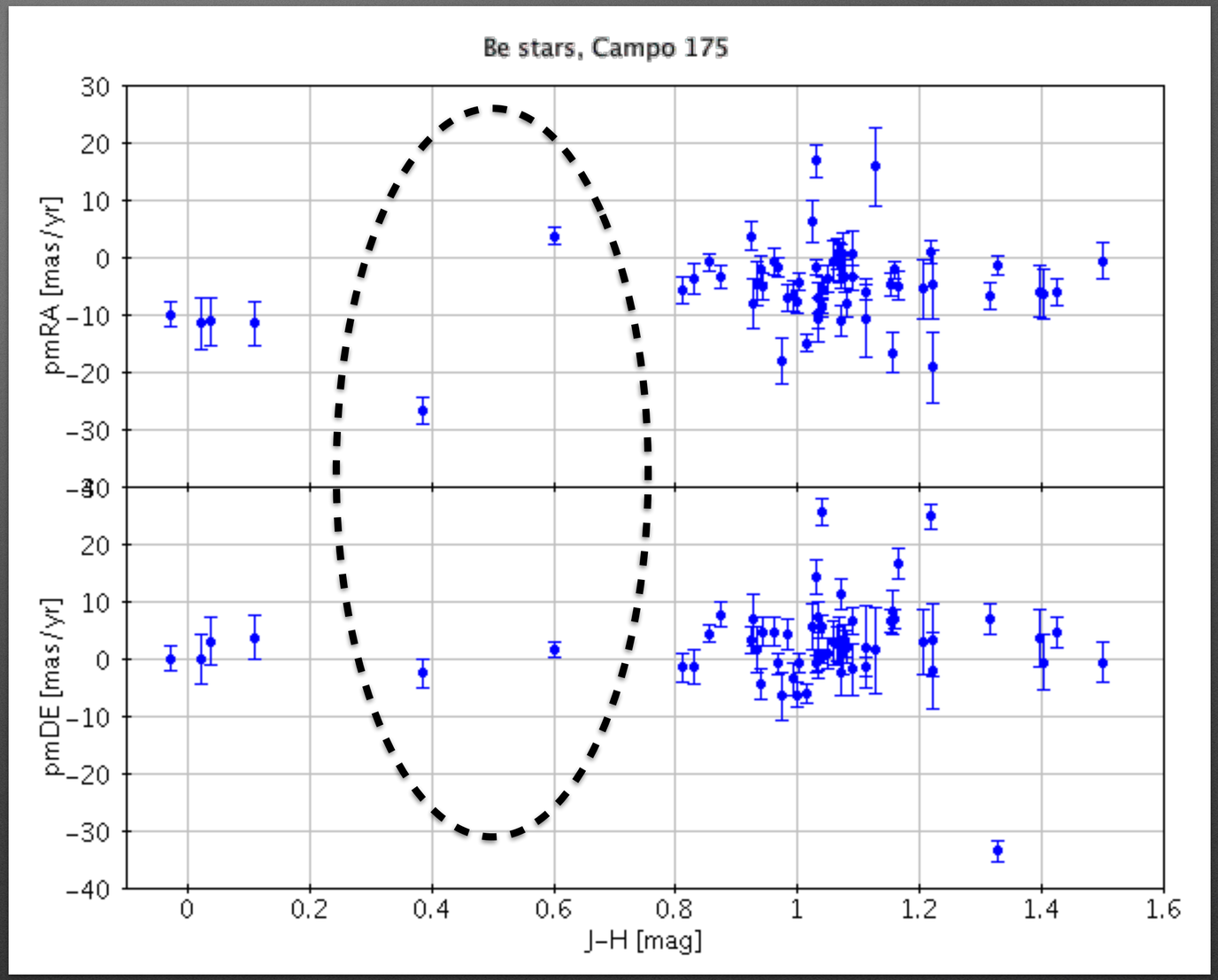

V
J
H
K
V, J, H, K [mag]
J–H [mag]

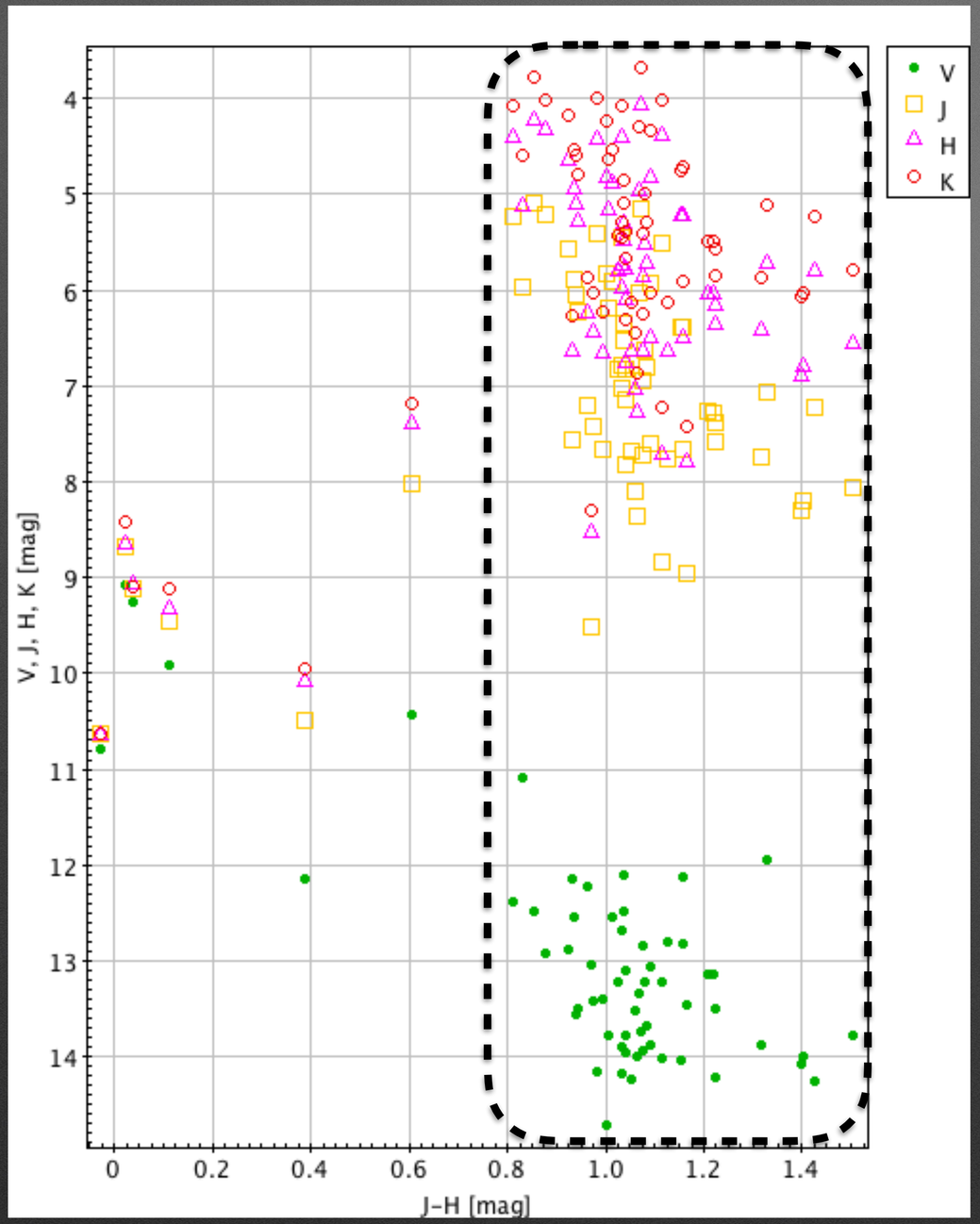

Be stars, Campo 175
pmRA [mas/yr]
pmDE [mas/yr]
J–H [mag]

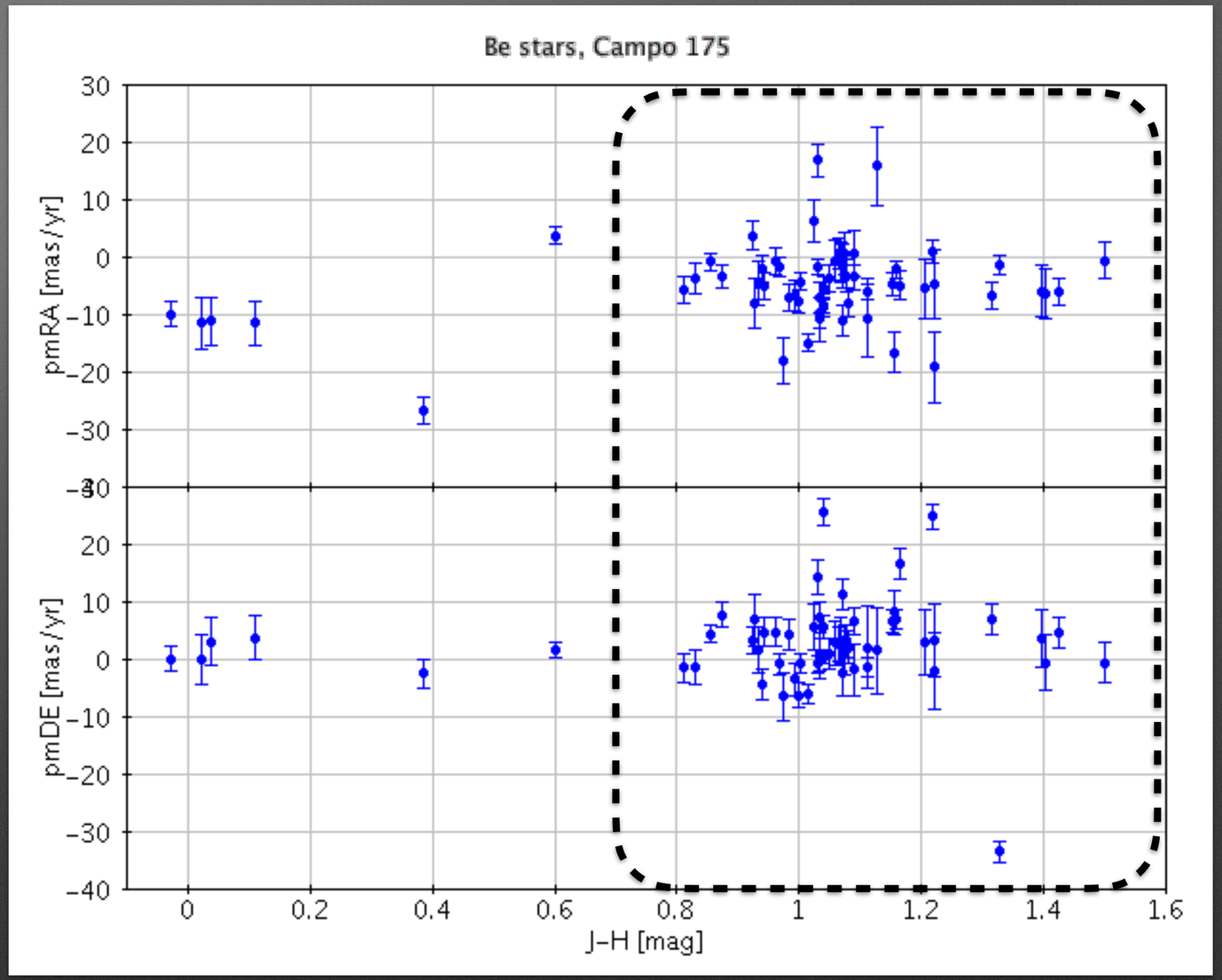

V
J
H
K
V, J, H, K [mag]
J–H [mag]


Be stars, Campo 175
pmRA [mas/yr]
pmDE [mas/yr]
J–H [mag]


V
J
H
K
V, J, H, K [mag]
J–H [mag]


Be stars, Campo 175
pmRA [mas/yr]
pmDE [mas/yr]
J–H [mag]

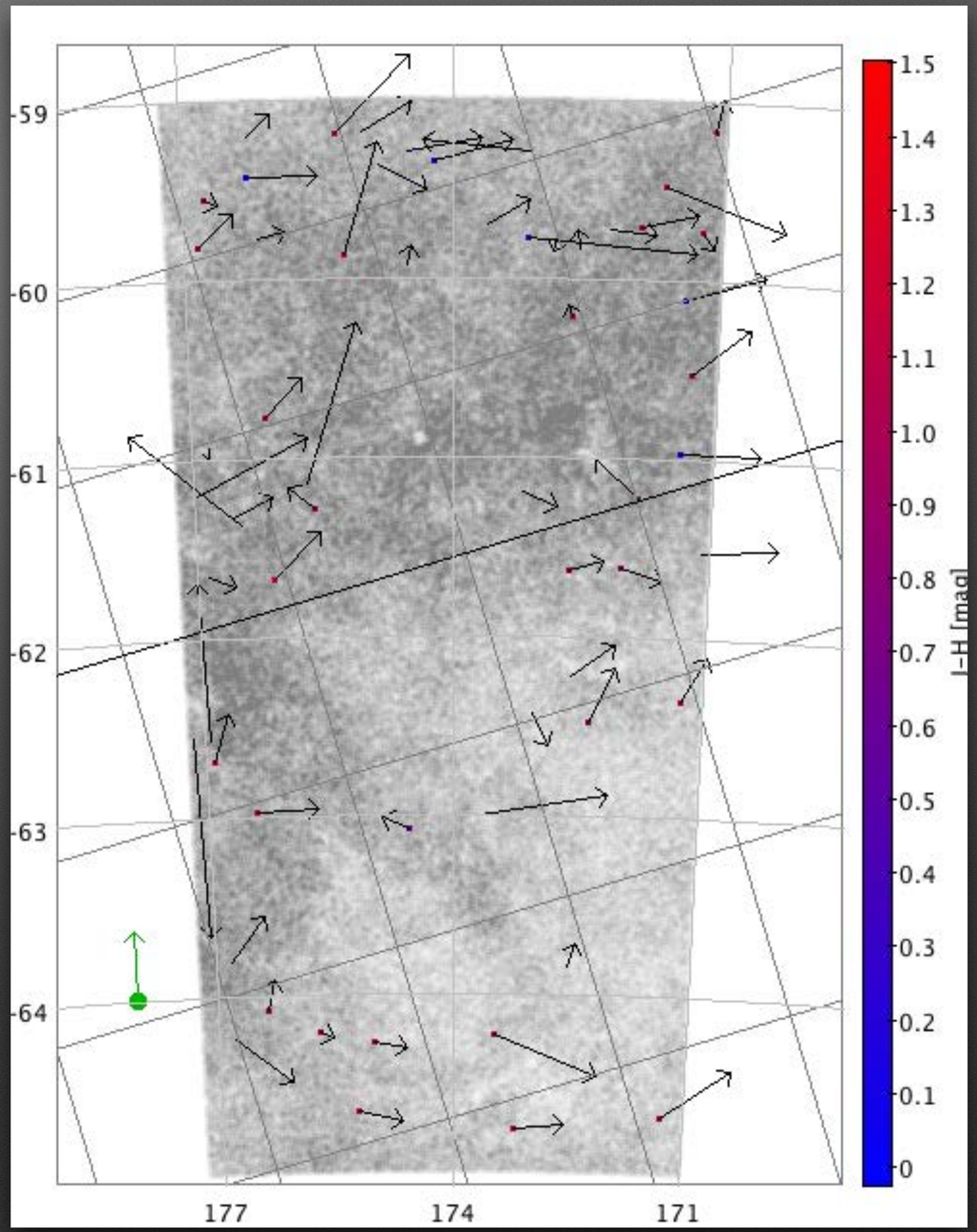

V
J
H
K
V, J, H, K [mag]
J–H [mag]


Be stars, Campo 175
pmRA [mas/yr]
pmDE [mas/yr]
J–H [mag]

Be stars
in the Galactic plane

Field at RA~175 deg (Campo 175)

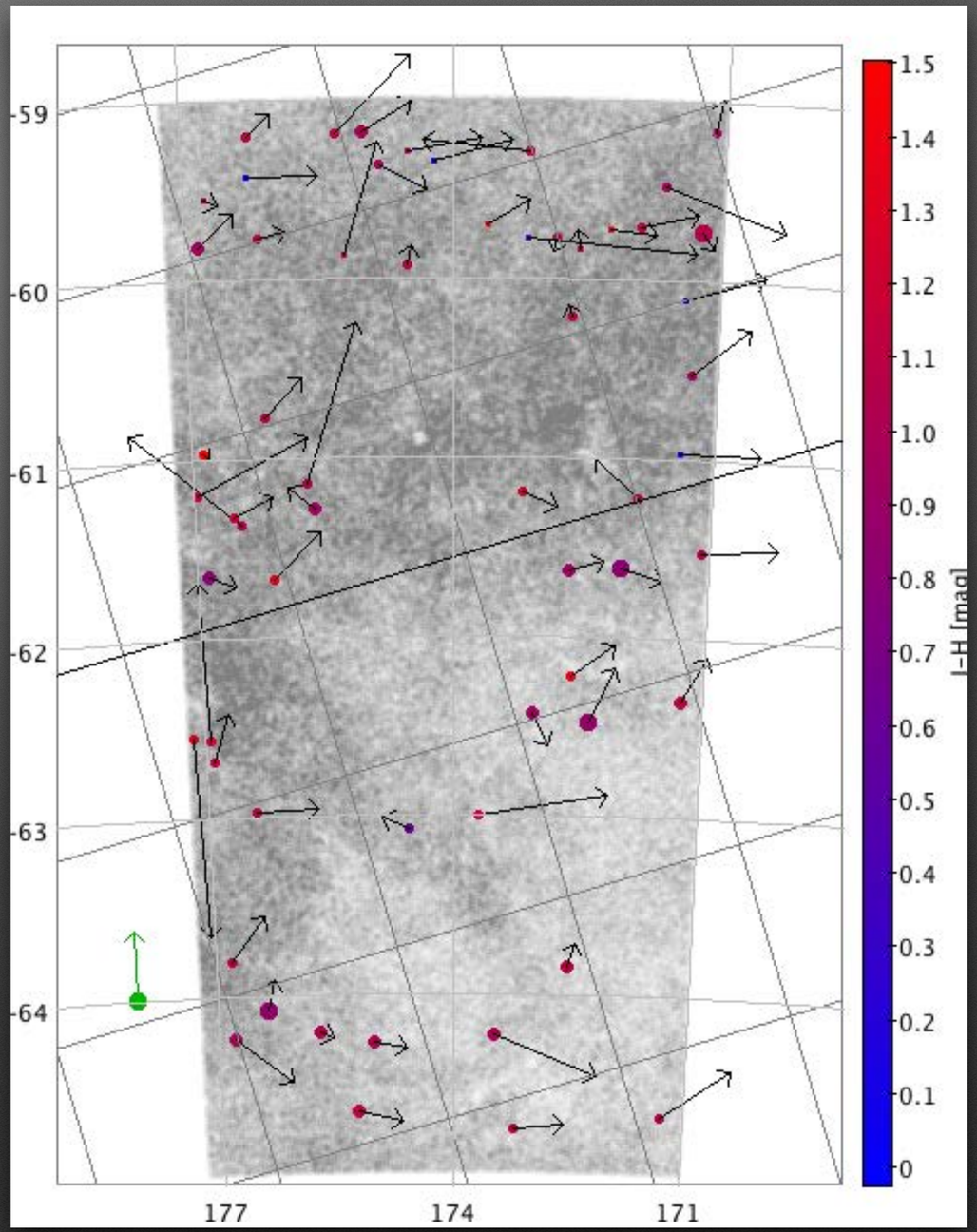
V = 5 mag
(pma,pmd)=(0,10) mas/yr



Be stars
in the Galactic plane

Field at RA~175 deg (Campo 175)

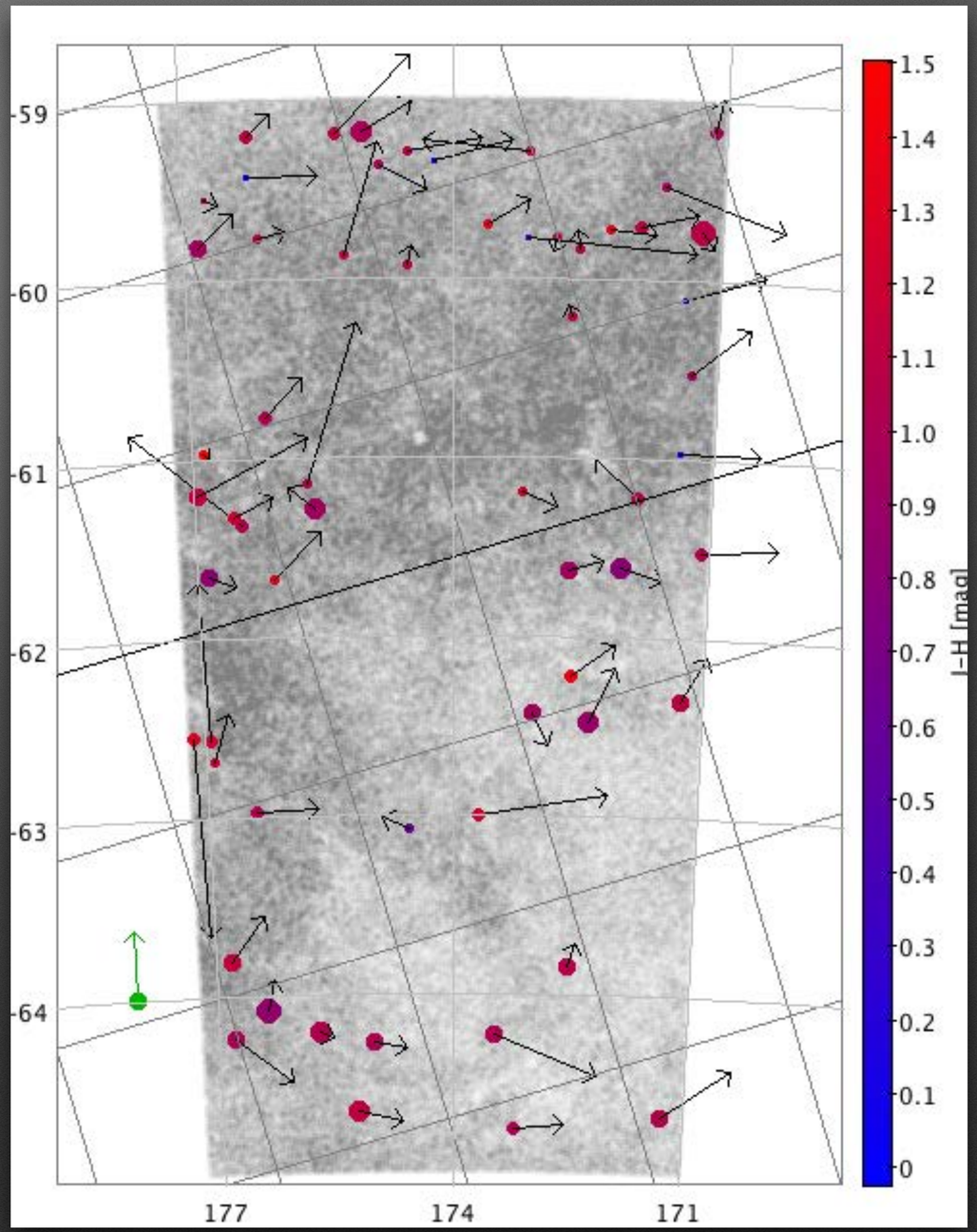
J = 5 mag
(pma,pmd)=(0,10) mas/yr



Be stars
in the Galactic plane

Field at RA~175 deg (Campo 175)

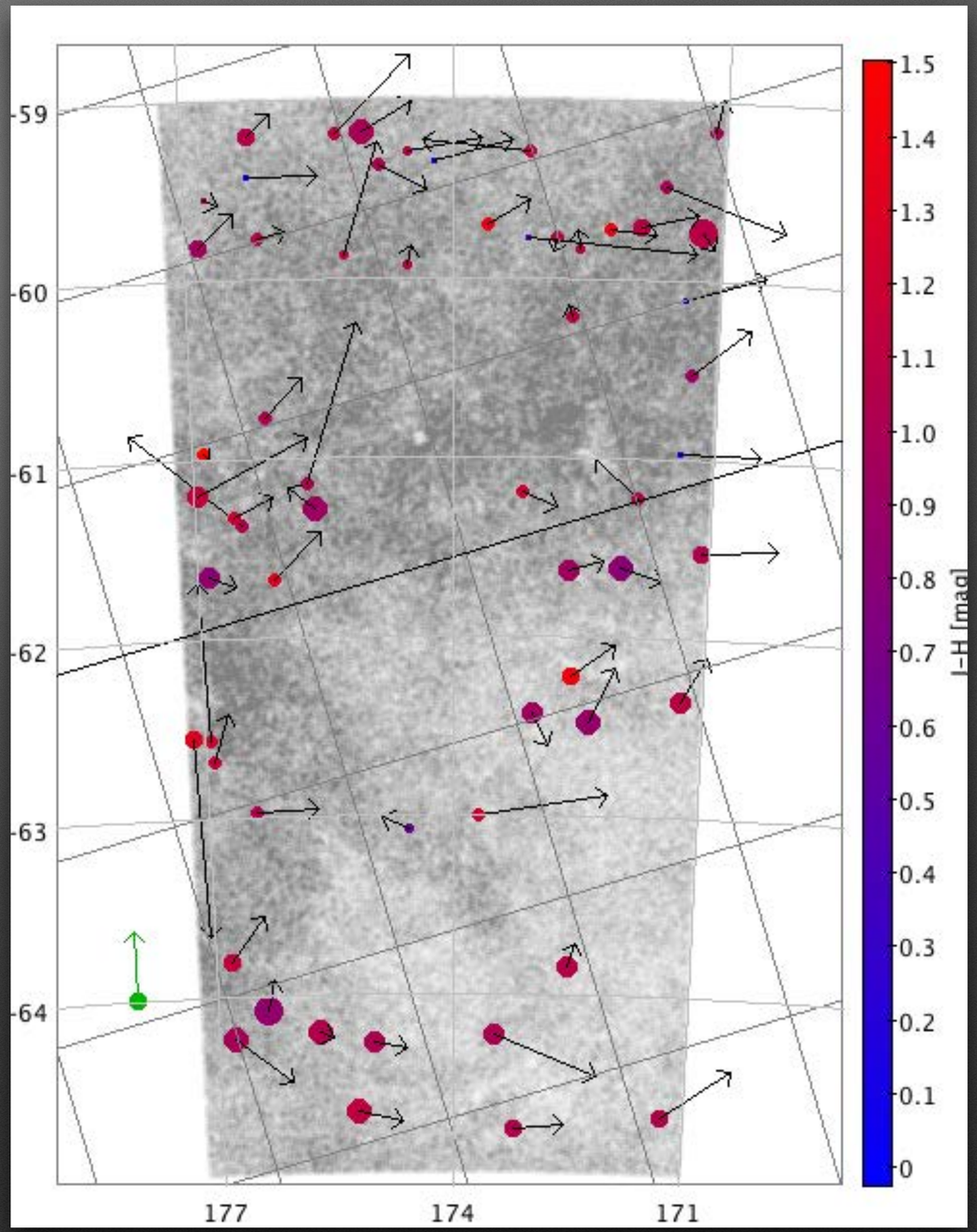
H = 5 mag
(pma,pmd)=(0,10) mas/yr



Be stars
in the Galactic plane

Field at RA~175 deg (Campo 175)

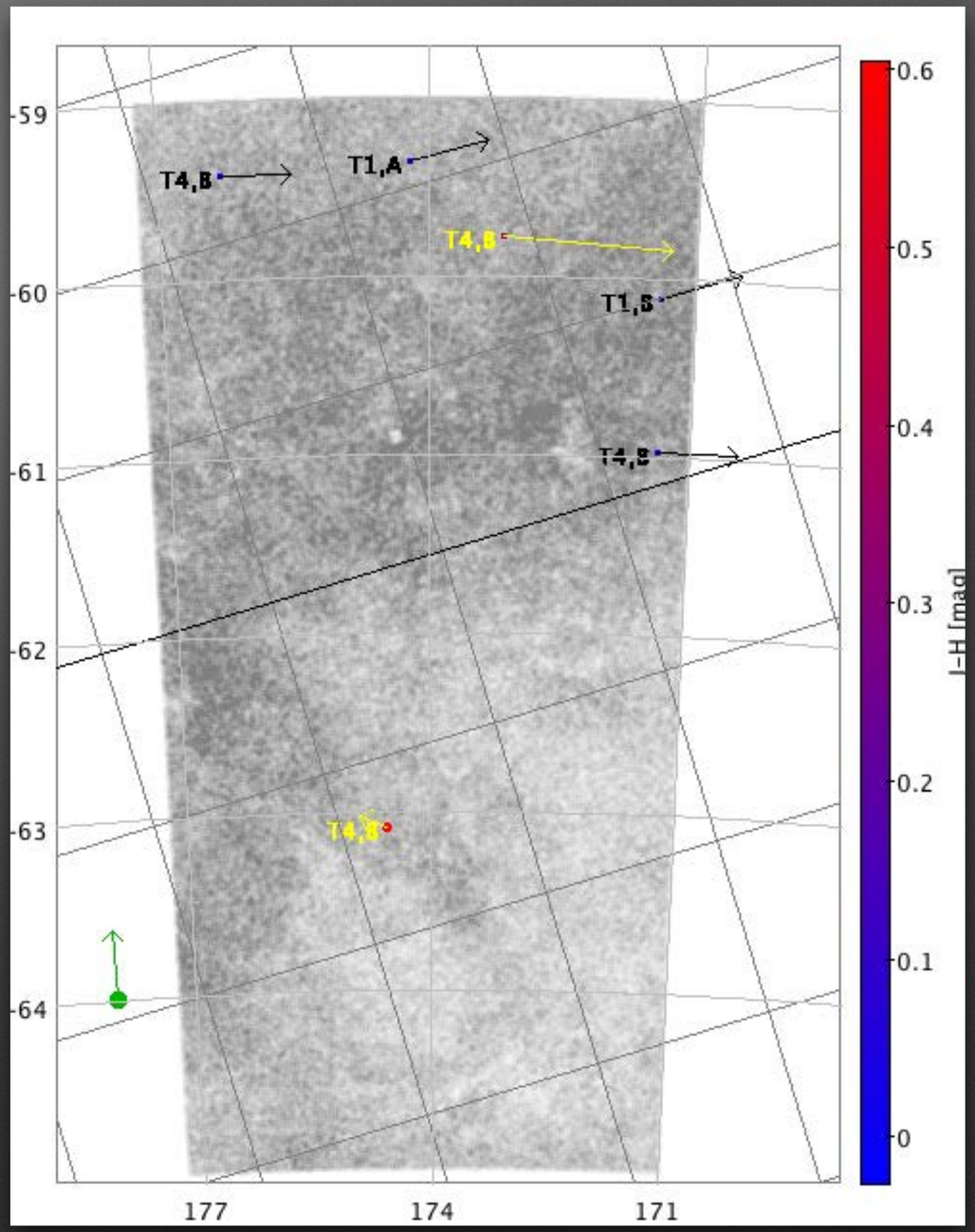
K = 5 mag
(pma,pmd)=(0,10) mas/yr

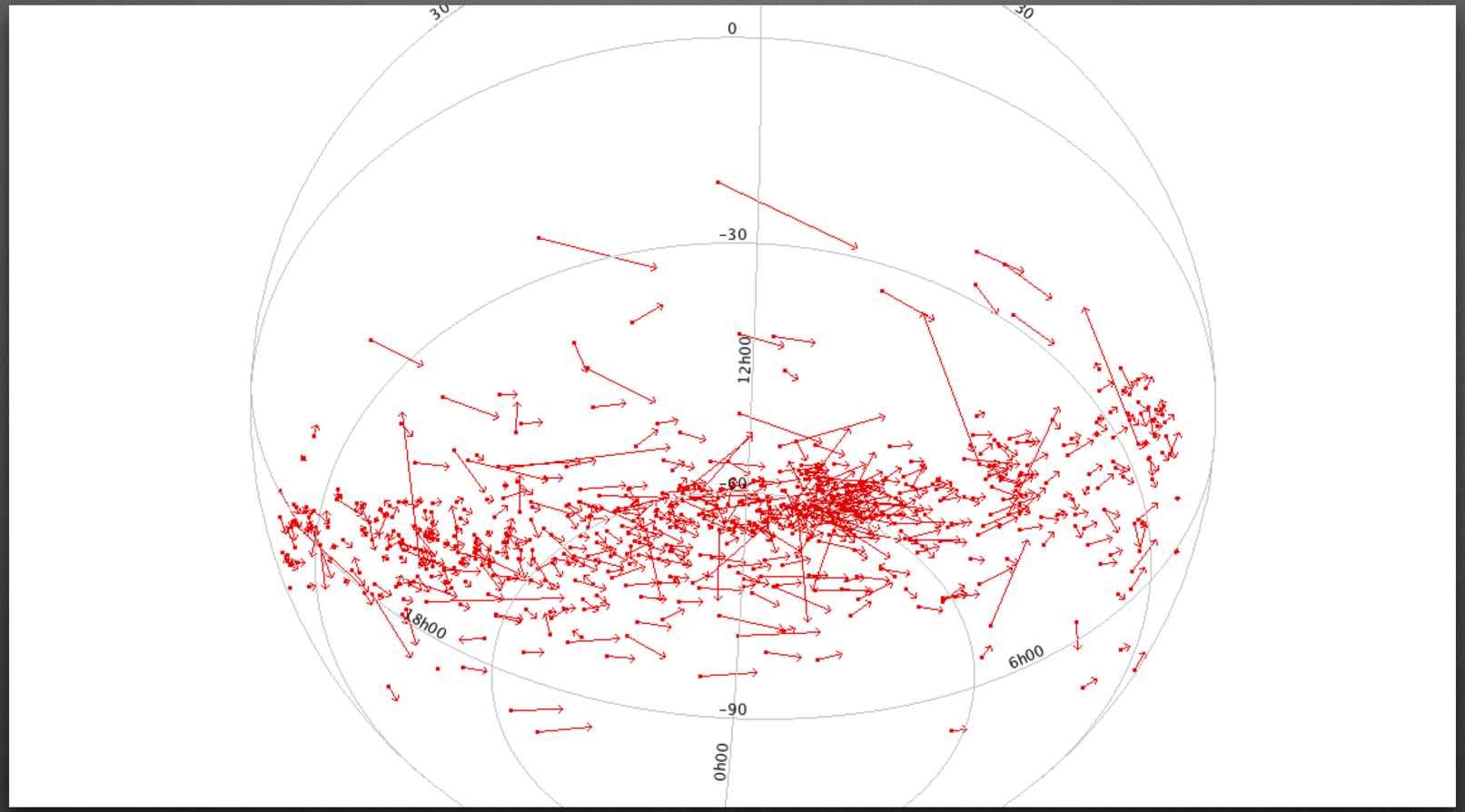


Be stars
in the Galactic plane

Field at RA~175 deg (Campo 175

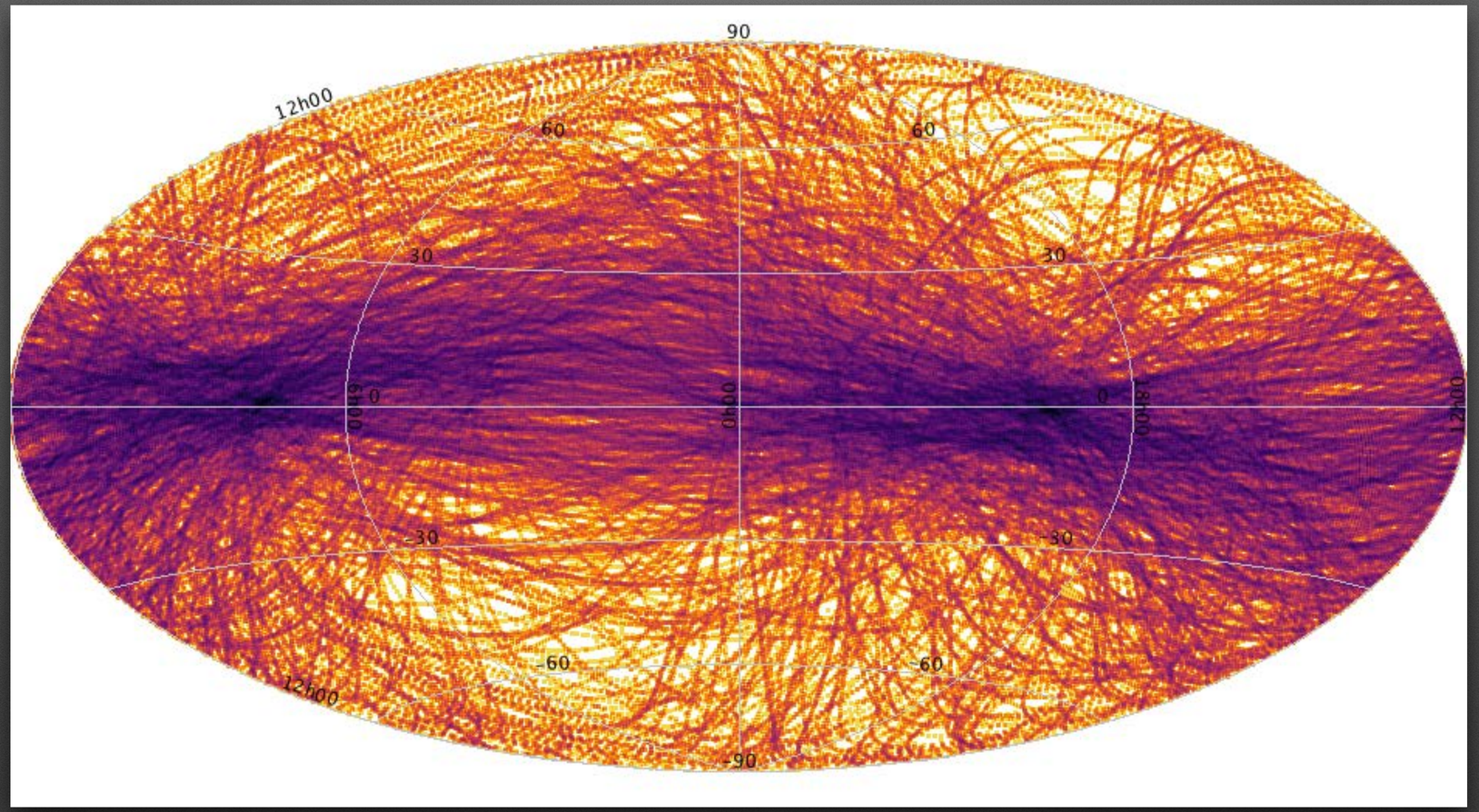
V = 5 mag
(pma,pmd)=(0,10) mas/yr





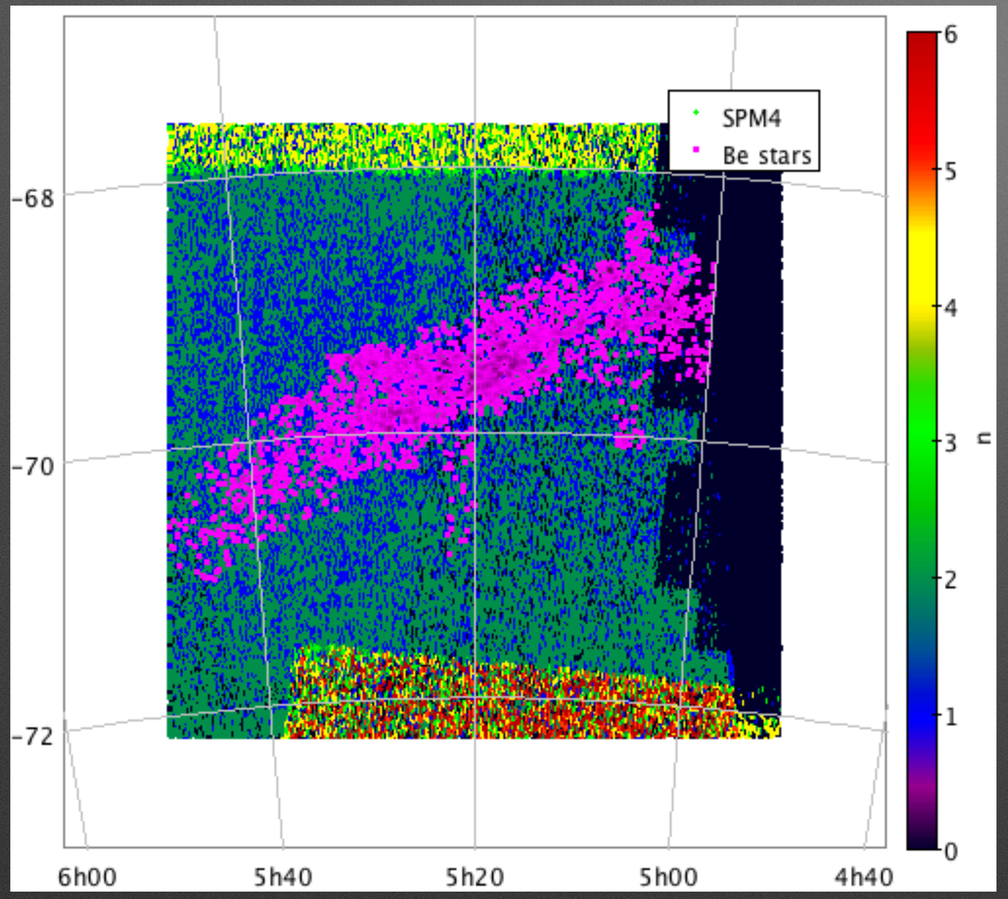
Be stars candidates

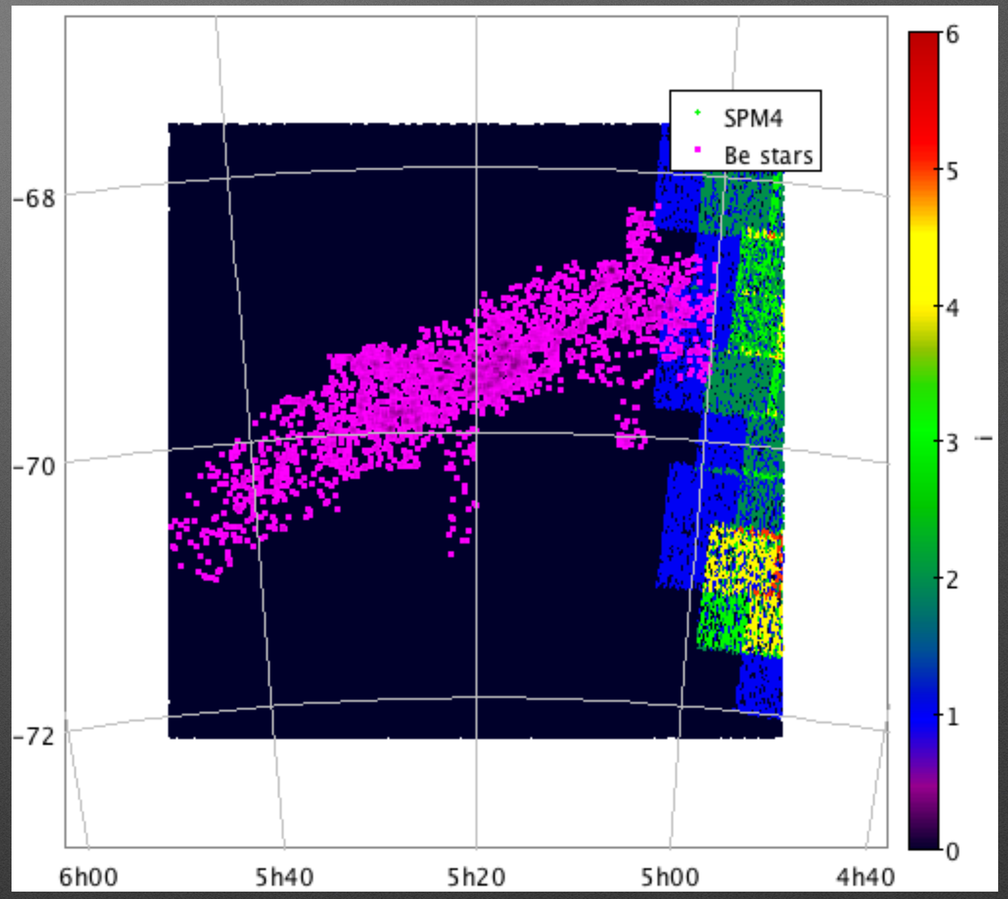
P. Zhang et al. / New Astronomy 10 (2005) 325–352



Gracias

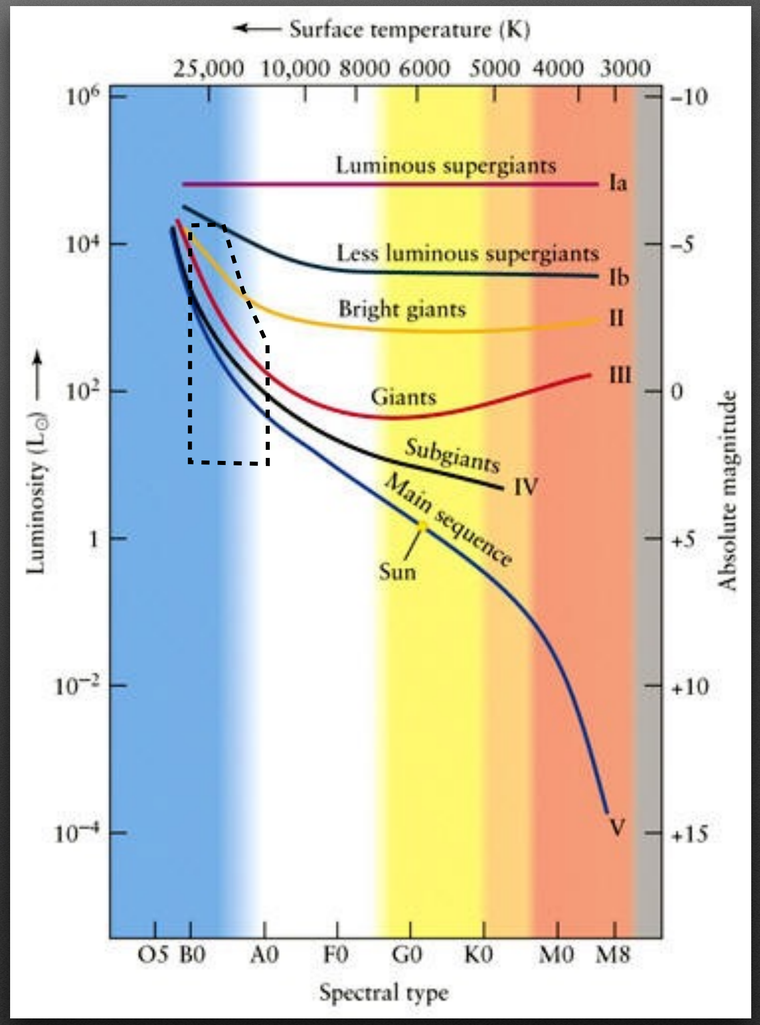
VII Reunión de Astronomía Dinámica en Latinoamérica ADeLA


SPM4
Be stars
-68
-70
-72
6h00
5h40
5h20
5h00
4h40
6
5
4
3
2
1
0
n


SPM4
Be stars
-68
-70
-72
6h00
5h40
5h20
5h00
4h40
6
5
4
3
2
1
0
i

Be stars

- Spectral types B
- Mostly main sequence (V) but also subgiants (IV) and giants (III)
- UV and IR excess
- Photometric variation
- Be stars are redder in infrared and brighter in visual magnitude than normal B stars



Other catalogs to study

- Jaschek & Egret (1982, 1995)
- Mendoza (1958)
- Schild (1966)