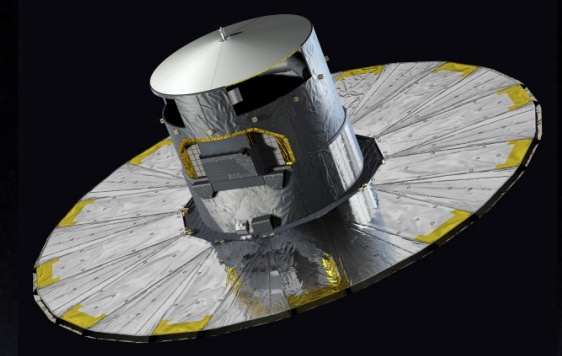


Globular Clusters with Gaia



by Elena Pancino



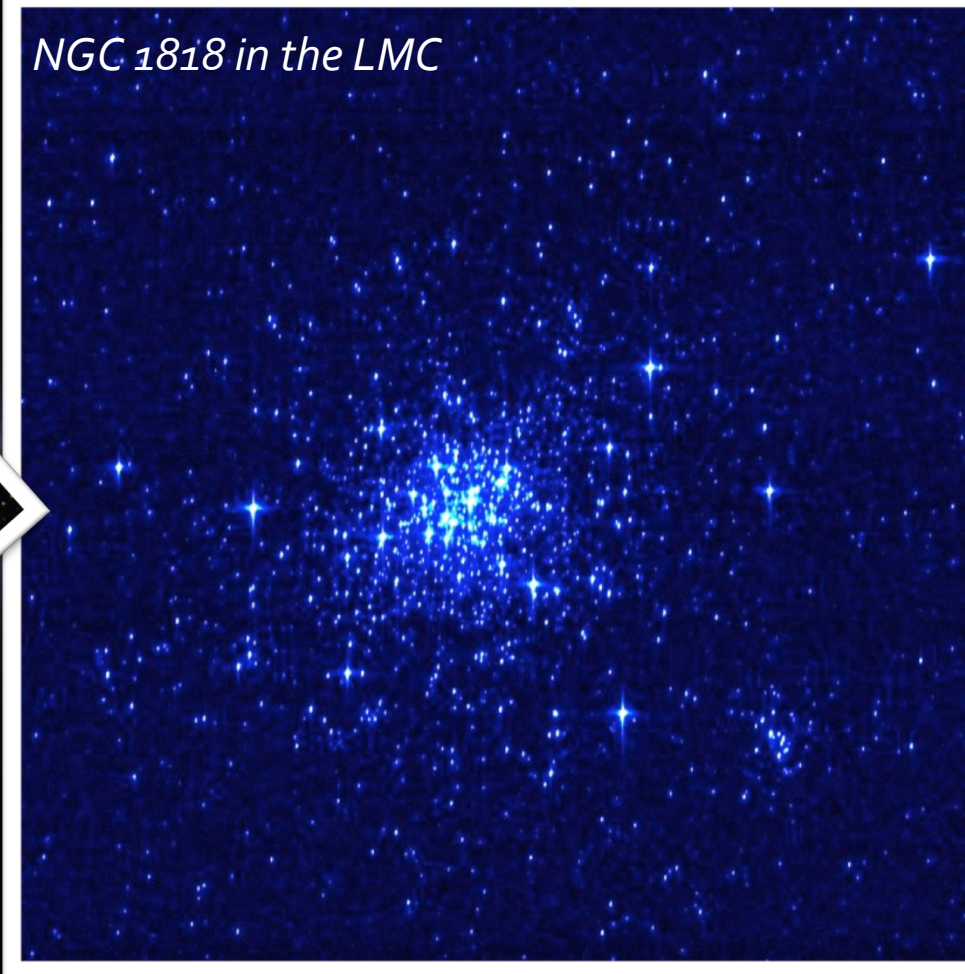
A space telescope

Gaia PSF is
 $0.177''$ in AF

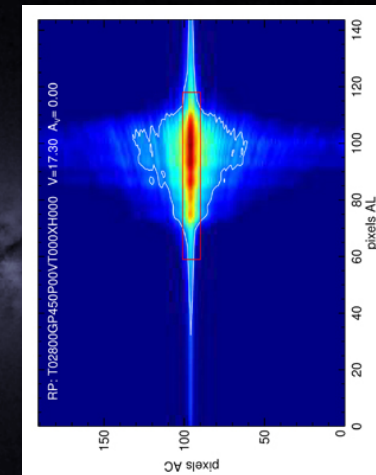
HST



NGC 1818 in the LMC

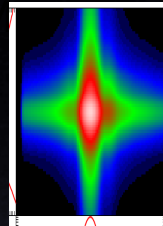


Gaia - BP



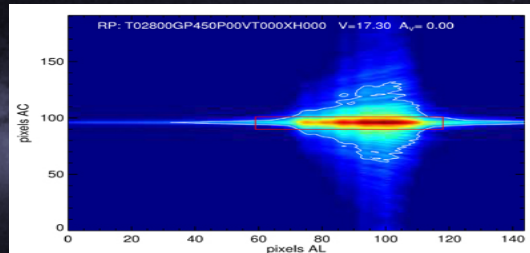
Window sizes

AF



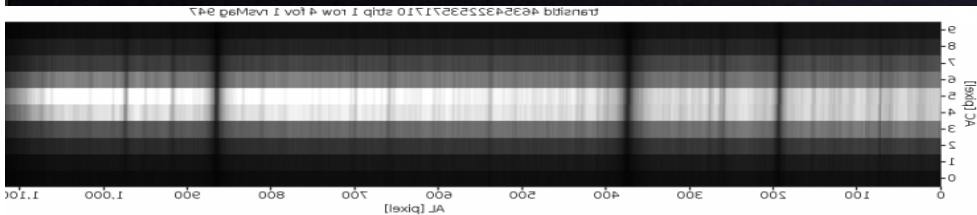
Along Scan $1.06''$ ($0.71''$ for $G > 16$)
Across Scan $2.12''$

BP/RP



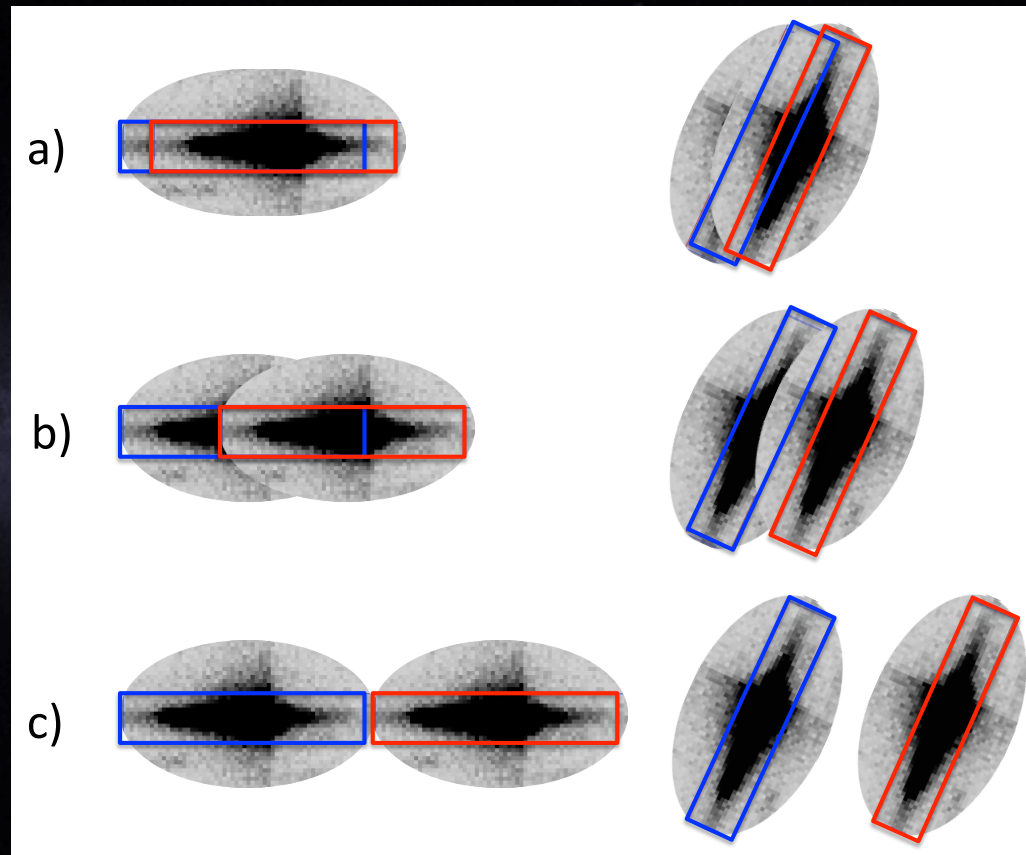
Along Scan $3.54''$
Across Scan $2.12''$

RVS



Along Scan $74.8''$
Across Scan $1.77''$

Blend types

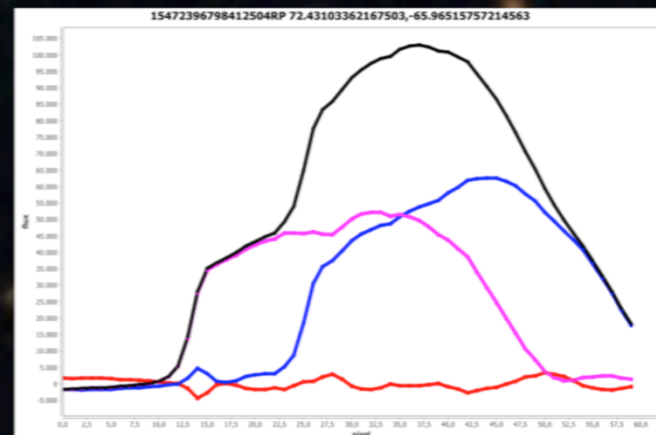
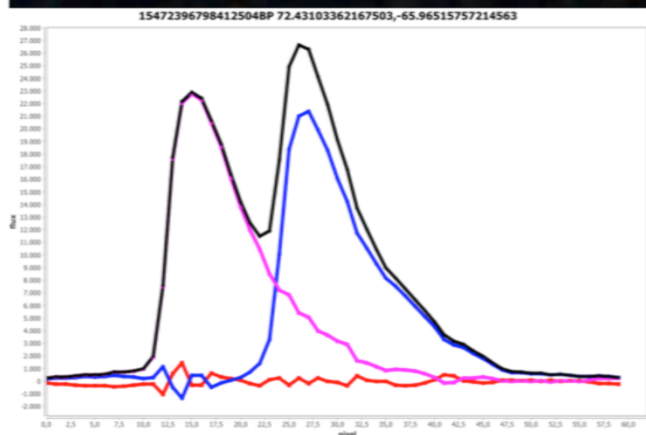


- ★ Classic blends – $D < 0.17''$
 - ★ Closer than the PSF
- ★ Gaia blends – case a)
 - ★ always same window
- ★ Contaminants – case c)
 - ★ when flux falls in window

BP/RP deblending

HD 270801

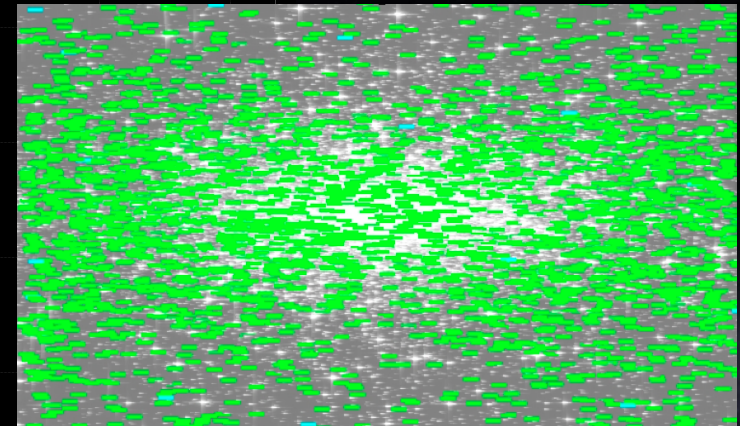
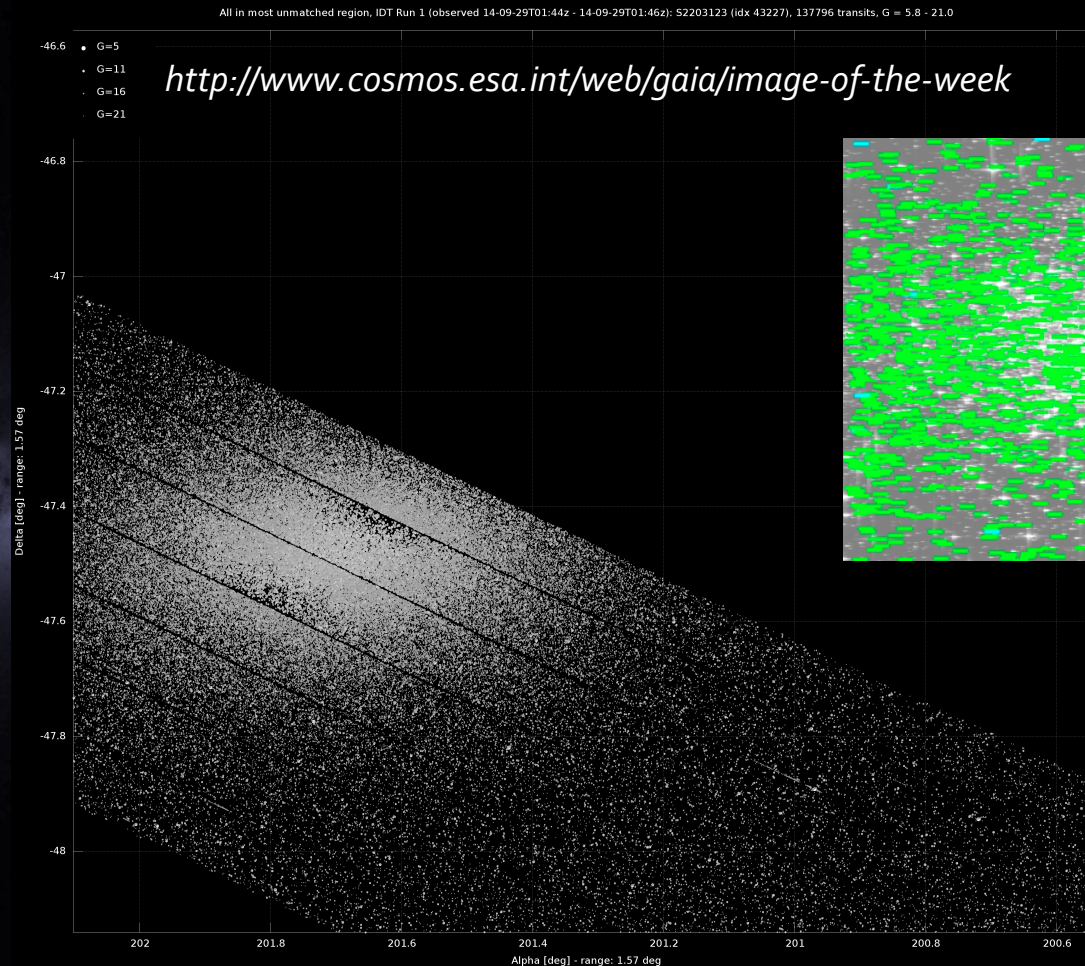
Blind algorithm testing on many blended stars, without prior information on positions, and recovery of >90% of double stars in the Tycho catalogue



Completeness

One Gaia
passage in
 ω Centauri

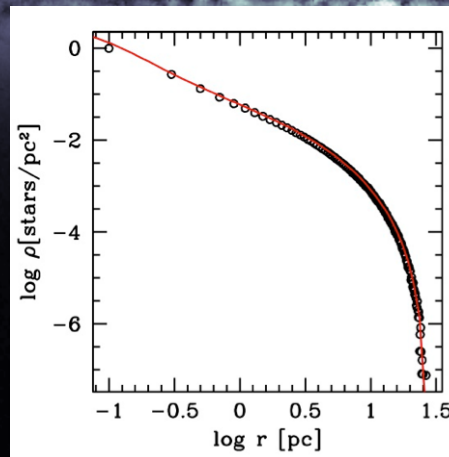
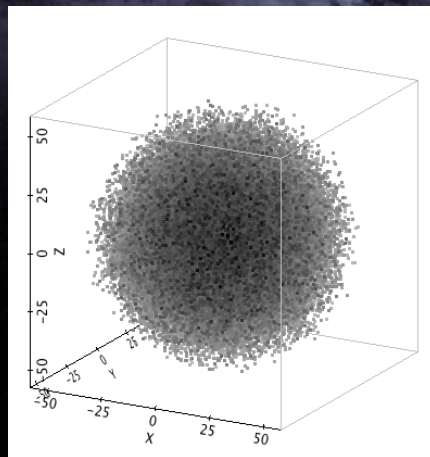
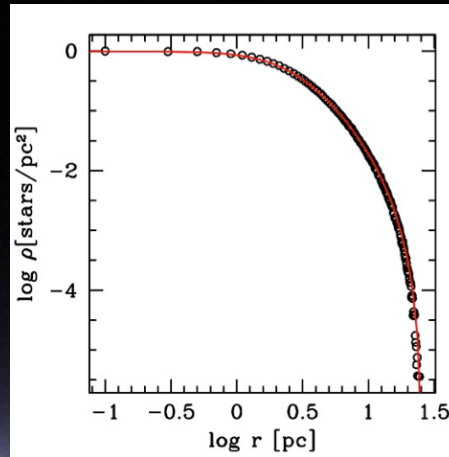
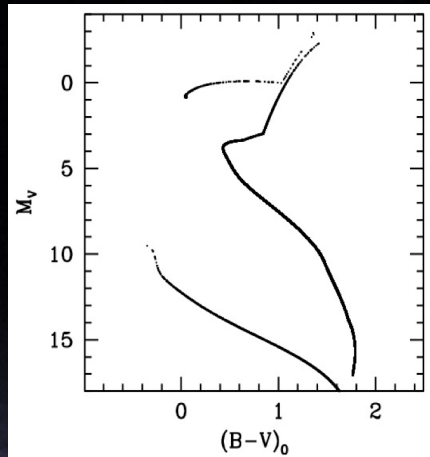
Expected
end-of-mission
completeness
in ω Cen
should be
 $V > 16$ mag
in the center



GC simulation
with GIBIS

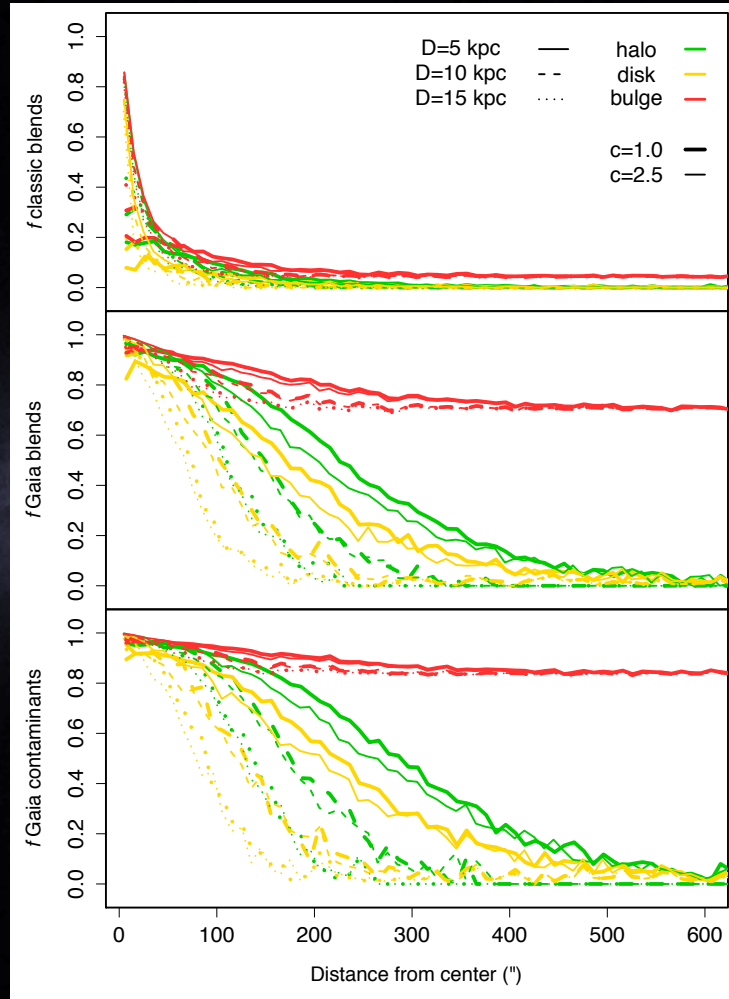
$\sim 10^6$ stars/sqdeg

1. Simulations



- ★ Concentration
 - ★ Normal GC ($c=1.0$)
 - ★ Core collapsed ($c=2.5$)
- ★ Distance
 - ★ 5 kpc
 - ★ 10 kpc
 - ★ 15 kpc
- ★ Background (Besancon)
 - ★ halo
 - ★ disk
 - ★ bulge
- ★ Eighteen clusters

2. Evaluation



- ★ Self-blending in the cores
 - ★ Worse for $c=2.5$
 - ★ Worse with distance
 - ★ Mostly classic blends

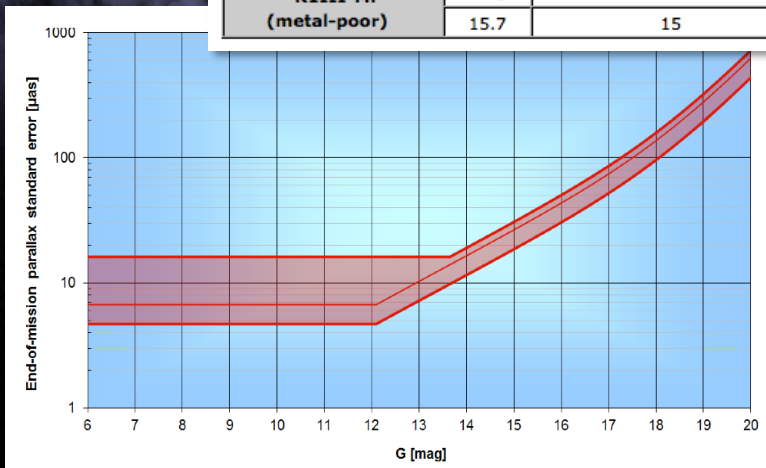
Critical: central arcminute

- ★ Field-bending everywhere
 - ★ Overwhelming for bulge case
 - ★ Gaia blends = can be corrected

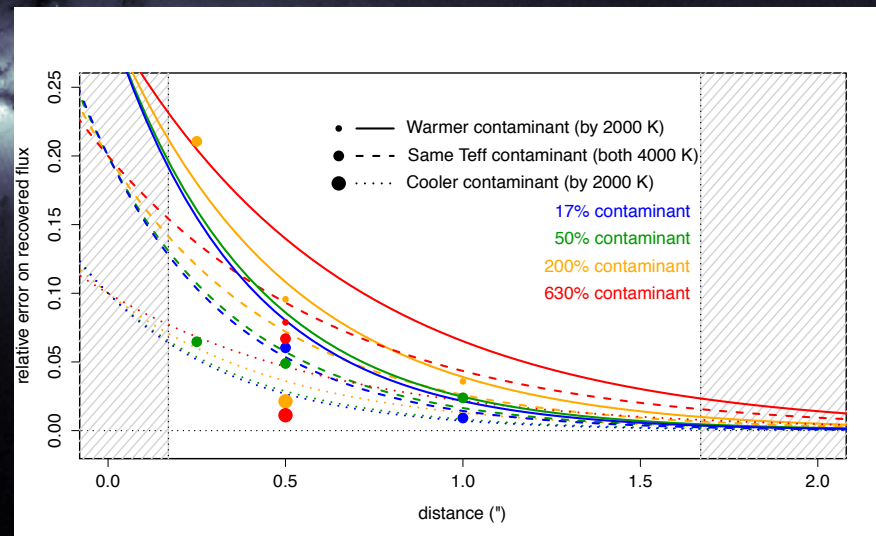
3. Performances

	B1V			G2V			M6V		
G [mag]	G	BP	RP	G	BP	RP	G	BP	RP
15	1	4	4	1	4	4	1	7	4
18	2	8	19	2	13	11	2	89	6
20	6	51	110	6	80	59	6	490	24

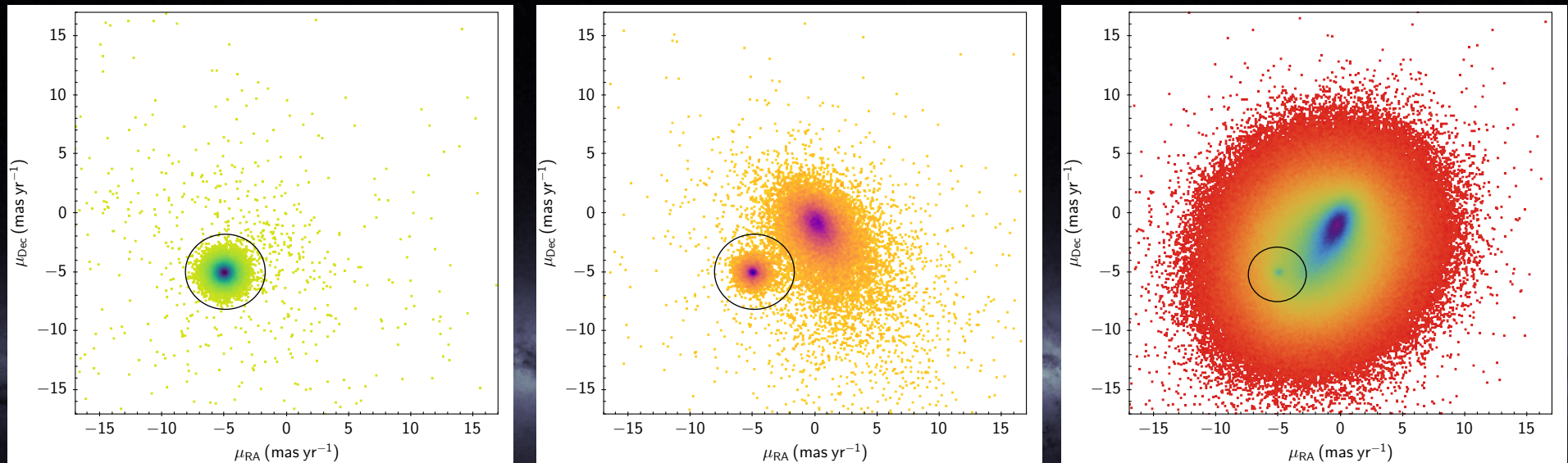
Spectral type	V [mag]	Radial-velocity error [km s ⁻¹]
B1V	7.5	1
	11.3	15
G2V	12.3	1
	15.2	15
K1III-MP (metal-poor)	12.8	1
	15.7	15



- ★ Gaia quantities
- ★ Gaia science performances
- ★ Crowding worsening

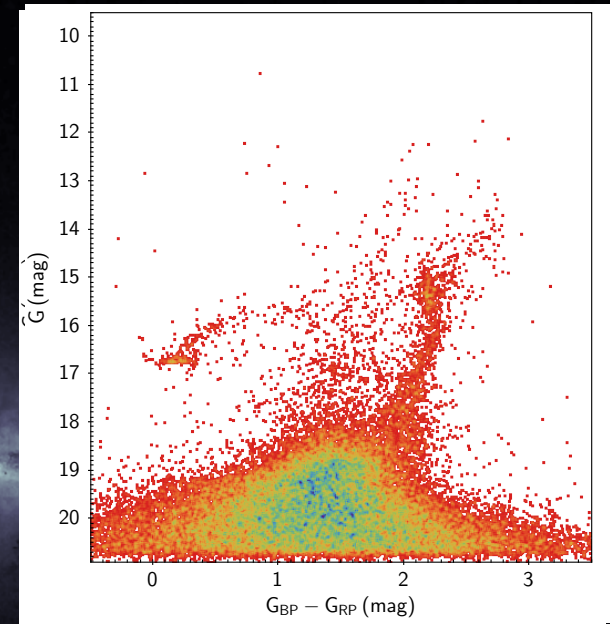
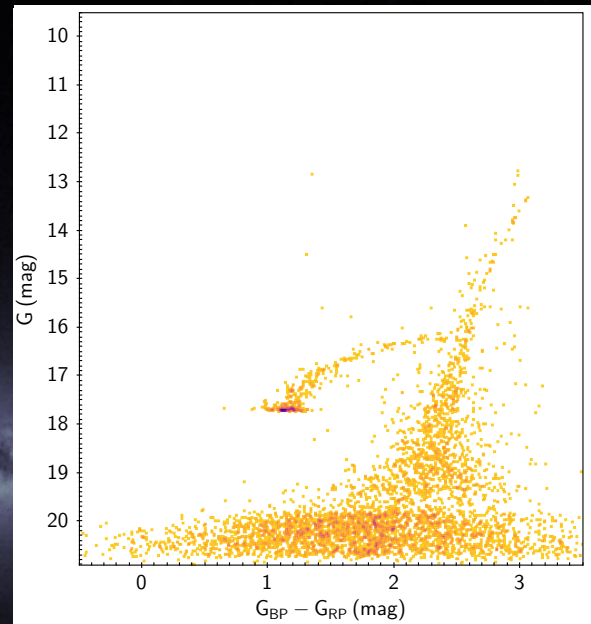
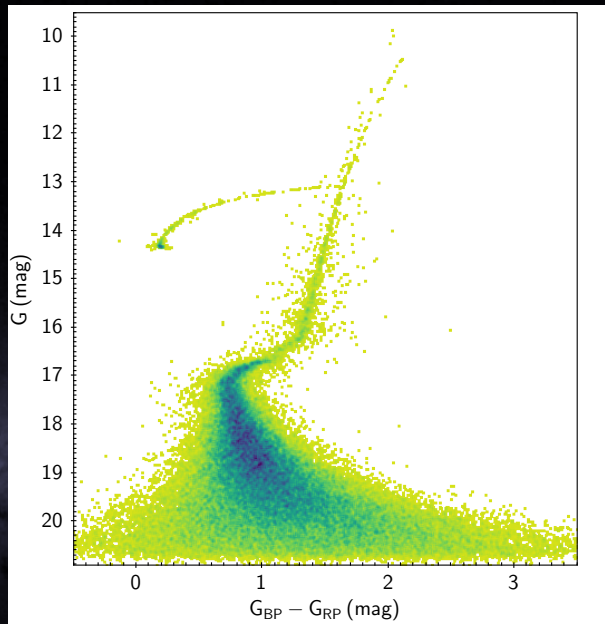


4. *Proper motions*



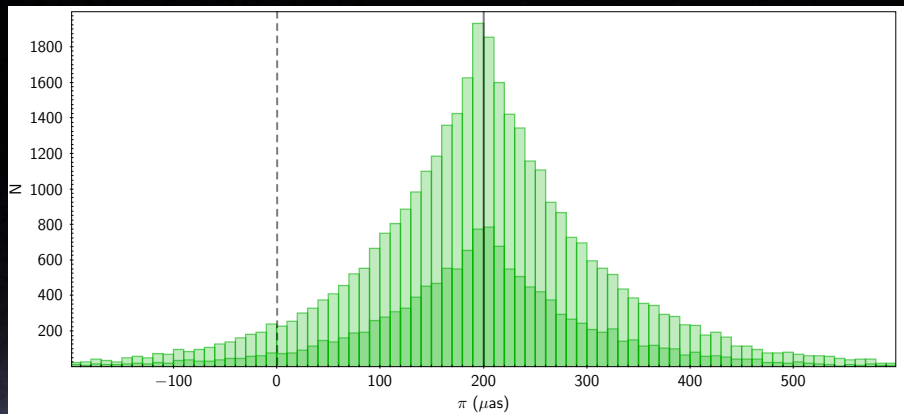
★ The proper motions are not very different from the uncrowded ones, and can be used to select members reliably in most cases

5. Photometry

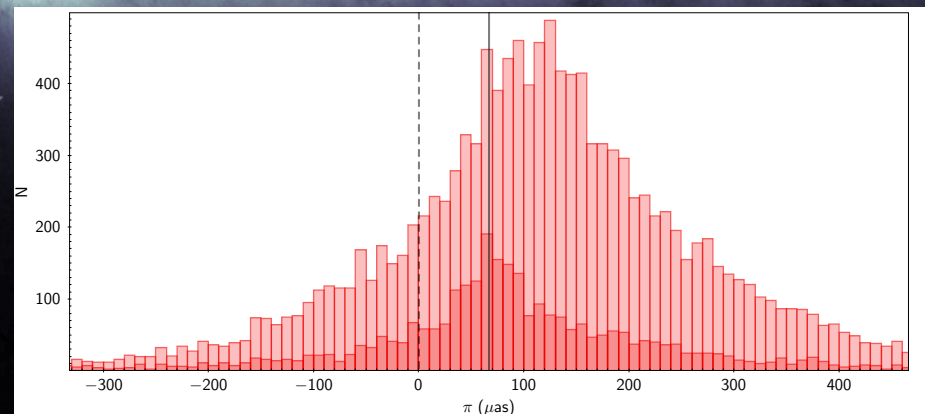
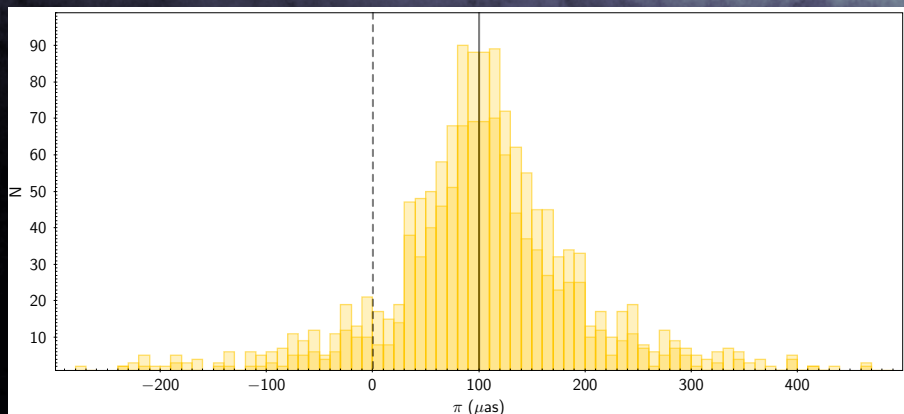


- ★ BP/RP errors degrade fast with G magnitude
- ★ Space quality for bright stars – GB quality for intermediate mags
- ★ Reddening and background degrade photometry a lot

5. Parallaxes



- ★ Negative parallaxes are expected
- ★ Good sampling of distributions
- ★ Blends do bias the distribution



Conclusions

- ★ GC **global properties** determined extremely well
 - ★ <1% proper motions
 - ★ 1% distances
 - ★ Radial velocities (LOS) ~1 km/s
- ★ GC internal properties also determined very well
 - ★ **Central arcminute** critical for self-blending / completeness
 - ★ **Background** is a photometry killer at all radial distances
 - ★ Gaia challenge on more realistic **simulations of M4**



Crowding evaluation

Courtesy: Anthony Brown

