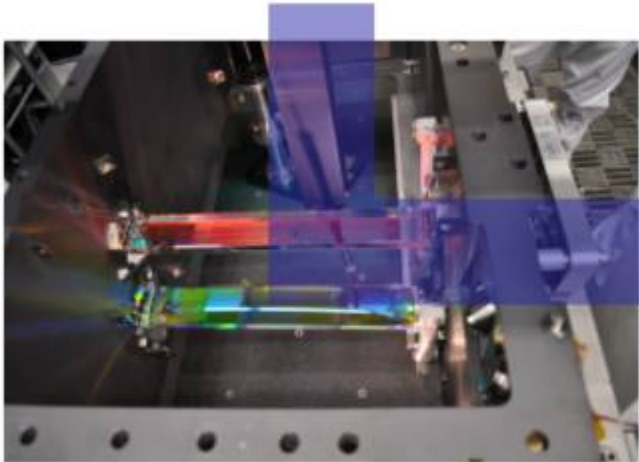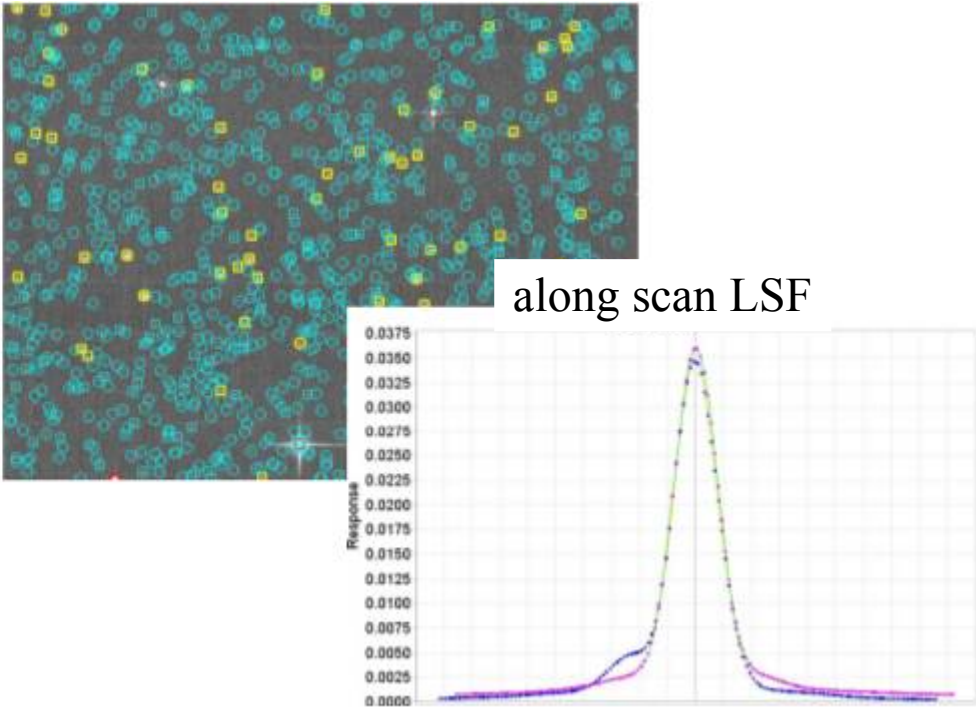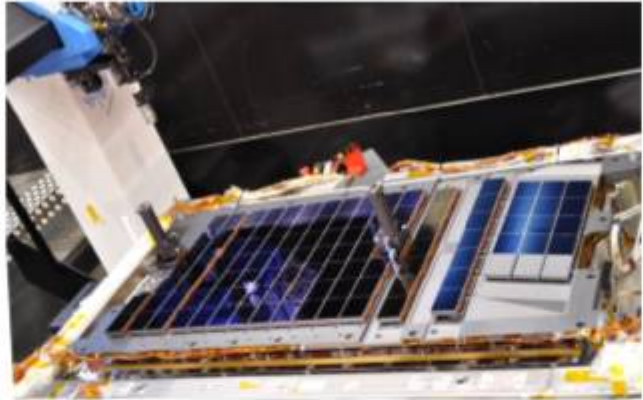# The Bulge with Gaia & MOONS

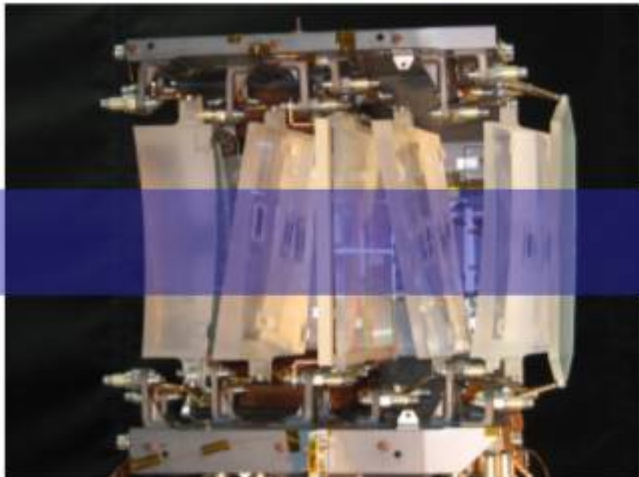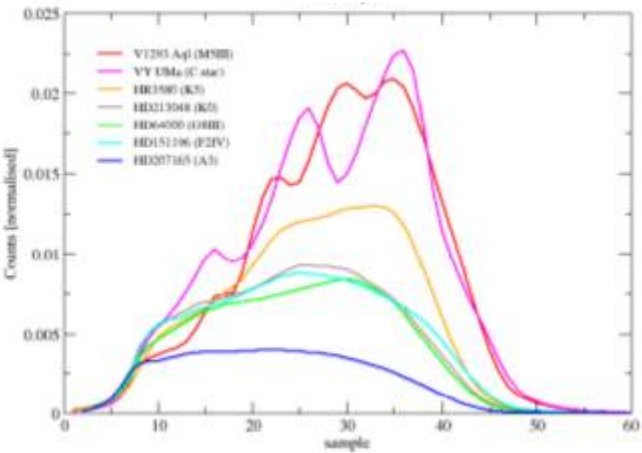Carine Babusiaux

Paris, 17 Oct 2016

Gaia instruments and measurements
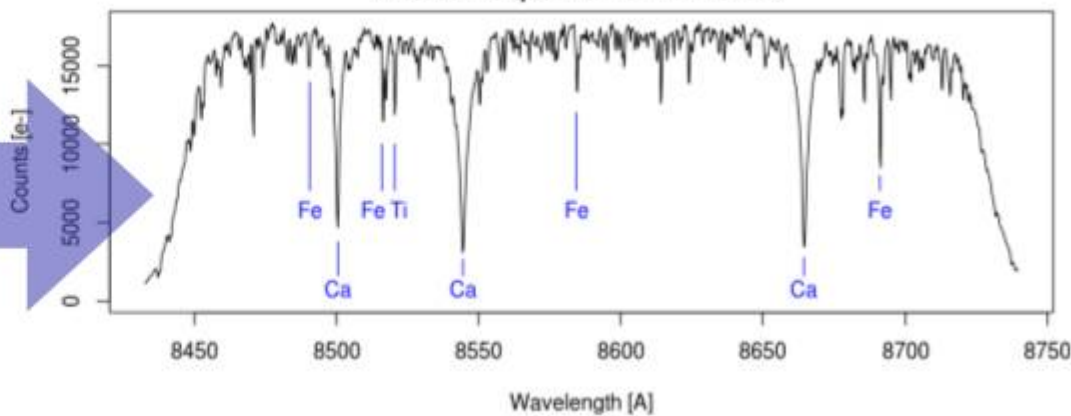

along scan LSF
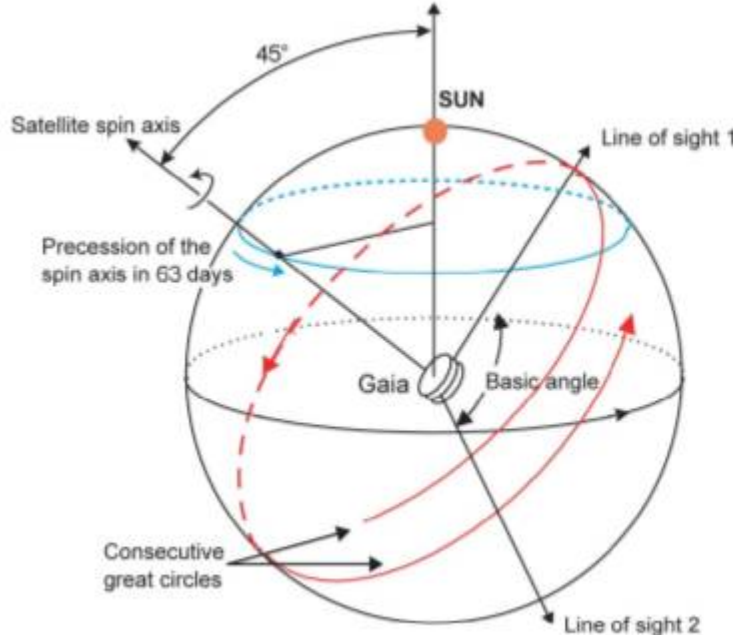
Gaia BP spectrophotometry
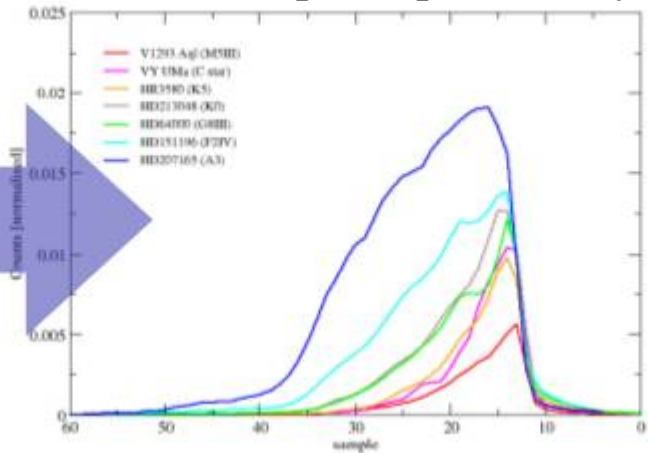
Gaia RP spectrophotometry

Gaia-RVS spectrum of HIP 86564

Figures:
ESA/Gaia/DPAC/Airbus DS

2

Gaia / MOONS complementarity

- **MOONS** can provide :
  - RV for 16<G<20 stars
  - chemical abundances for G>13

- **Gaia** can provide :
  - Target selection
  - Photometry
  - Distances
  - Proper motions

3D positions
3D velocities
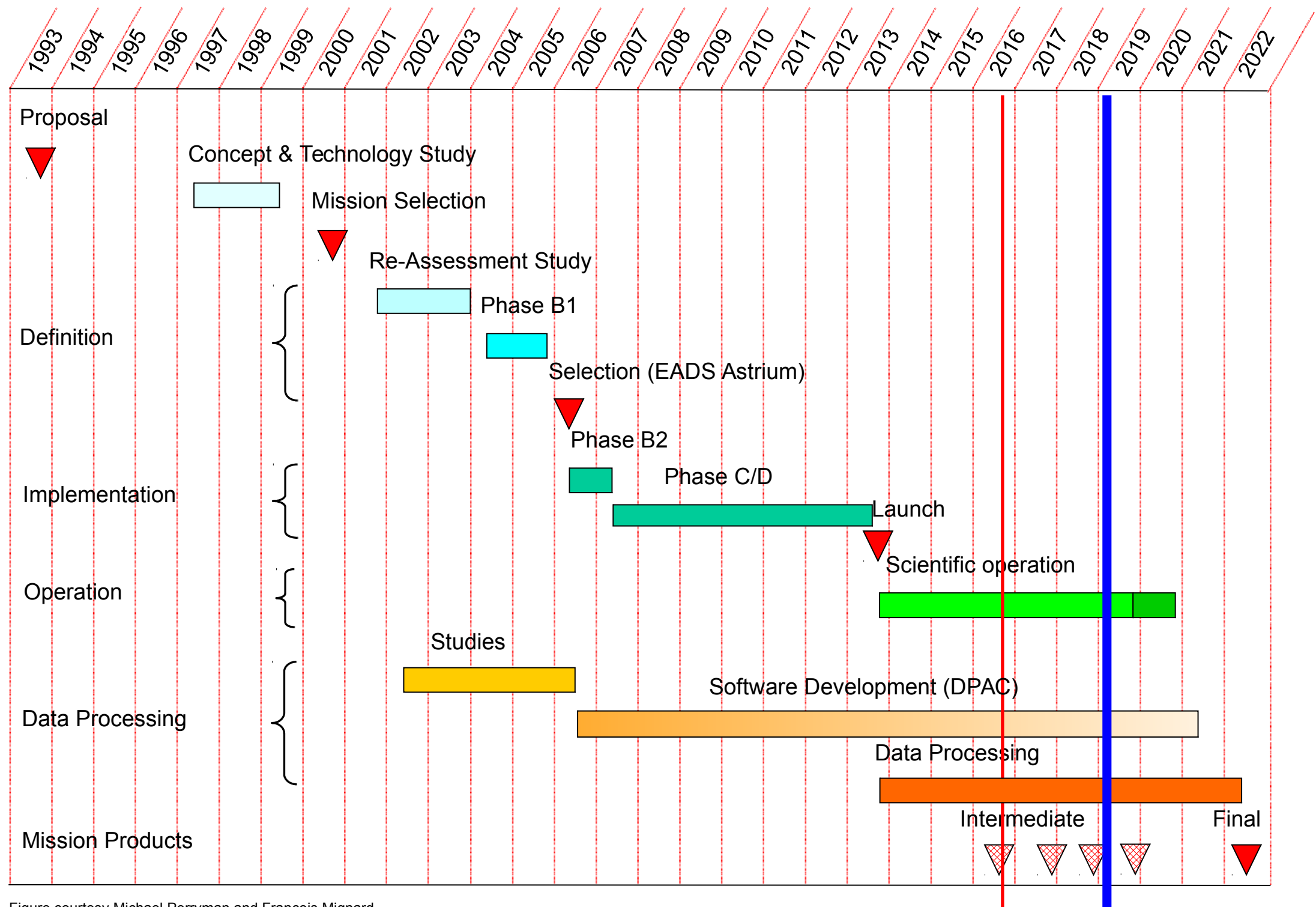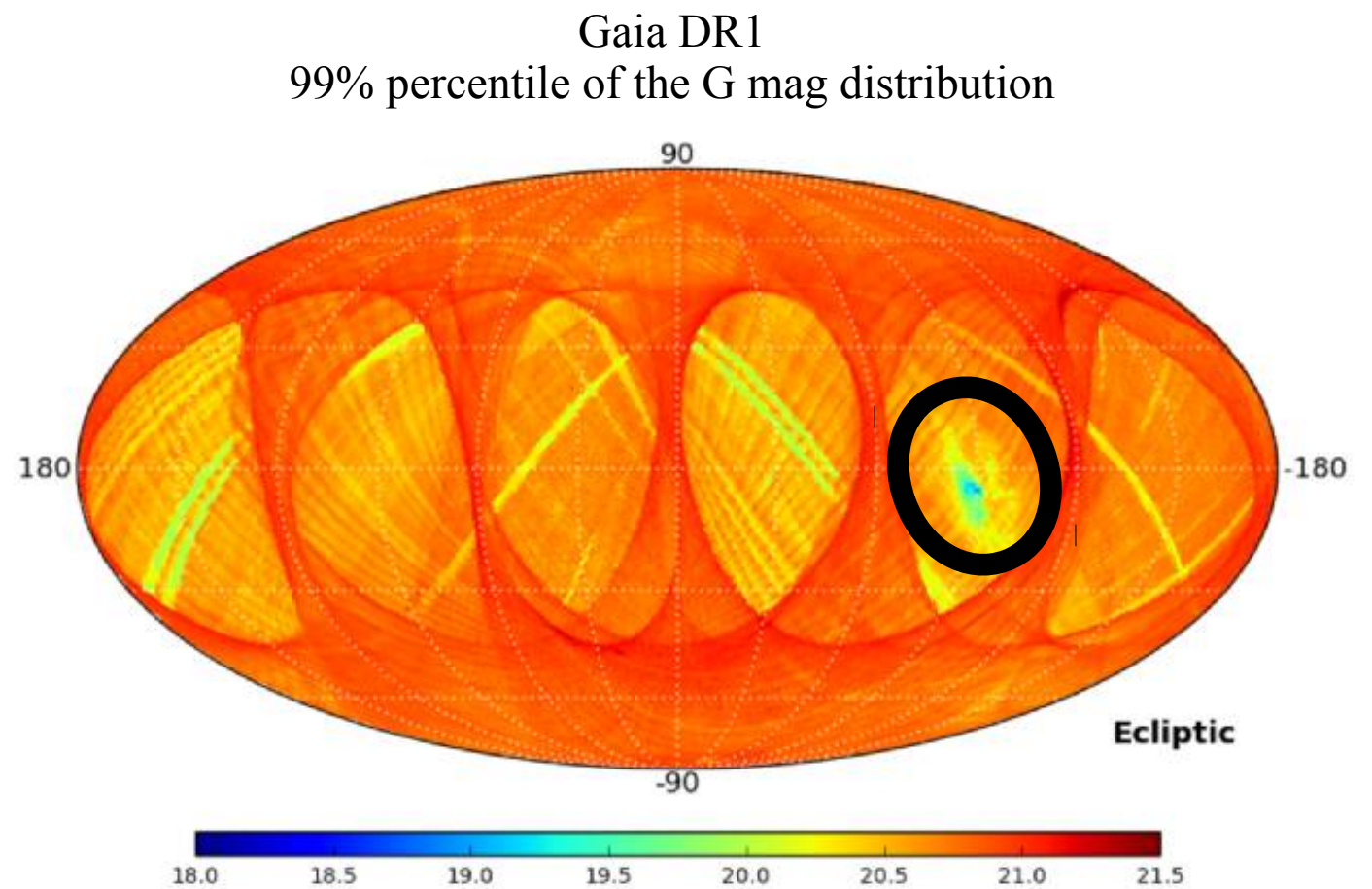Abundances
Ages

The Gaia / MOONS schedule

Figure courtesy Michael Perryman and François Mignard

The special case of the Bulge for Gaia...

- Crowding and Extinction

- Low number of transits

- On-board resources saturation

Gaia DR1
99% percentile of the G mag distribution

Simulation of a single observation completeness in Baade's Window (3 10^6 stars/deg^2)
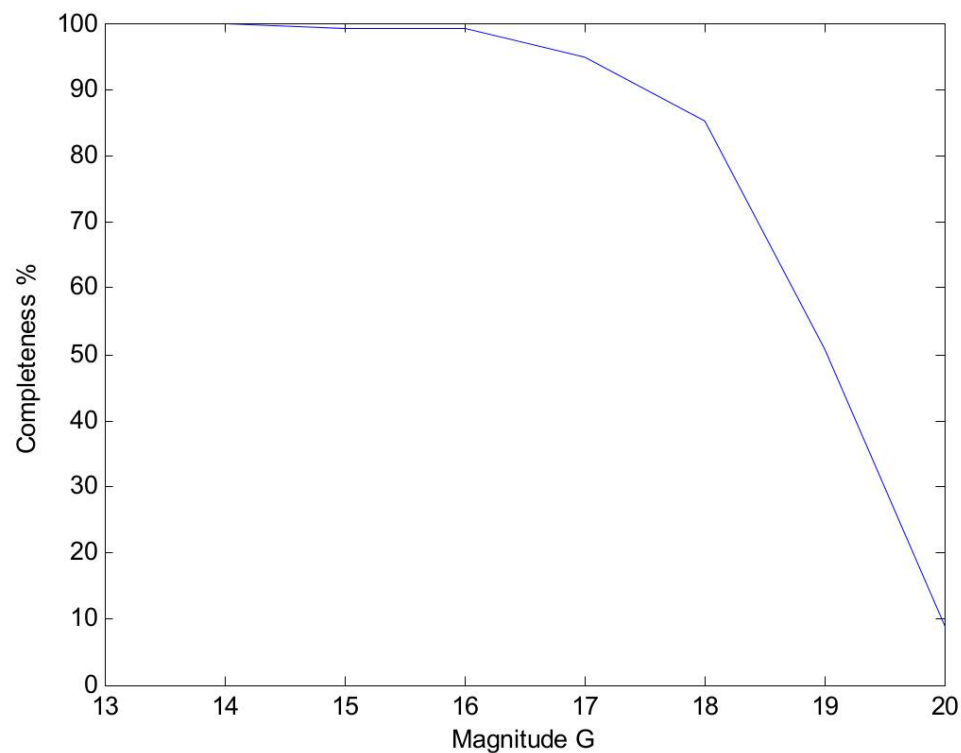
Densities in the bulge

- Low extinction: high densities, resource issue
- High extinction: no crowding but bulge stars too faint
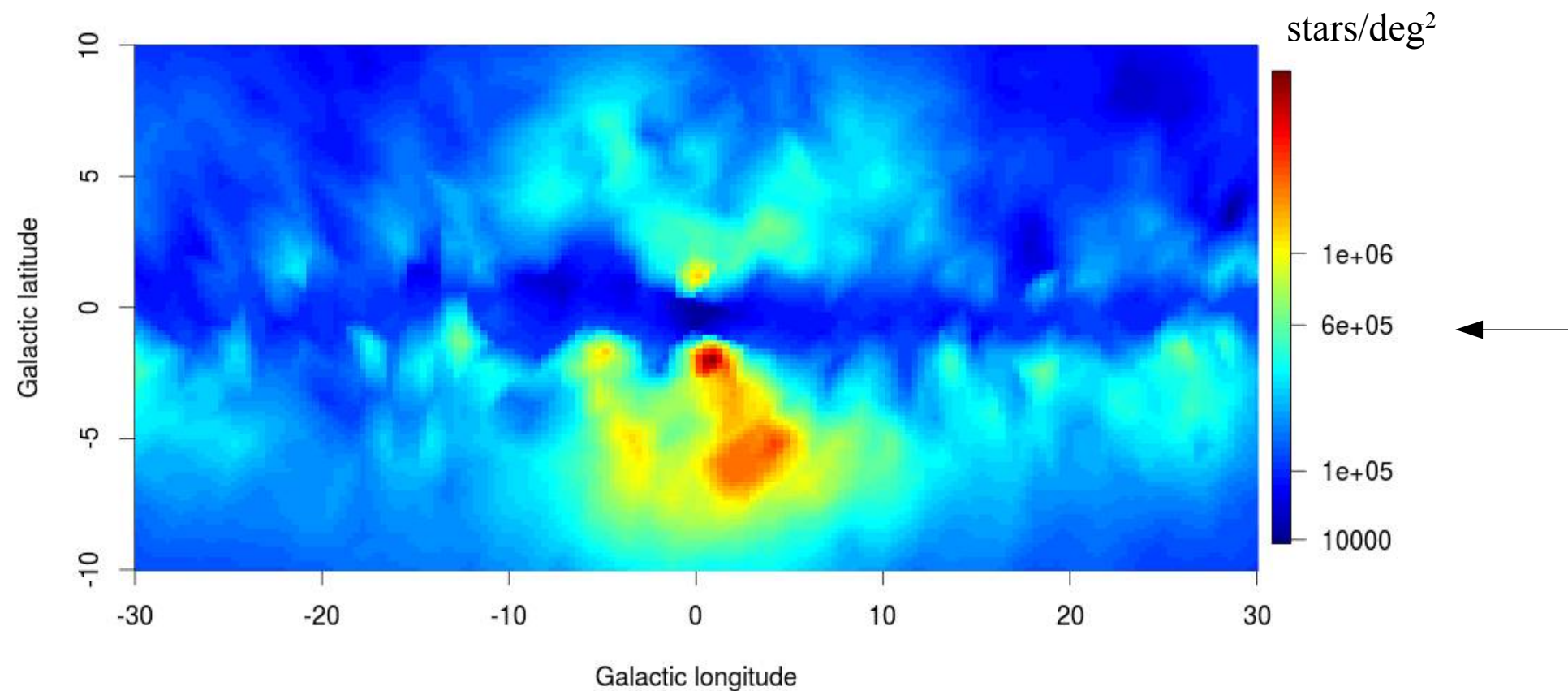
MOONS H versus Gaia G

No Extinction

Red Clump

G2V

→ nice parallaxes and proper motions for all targets

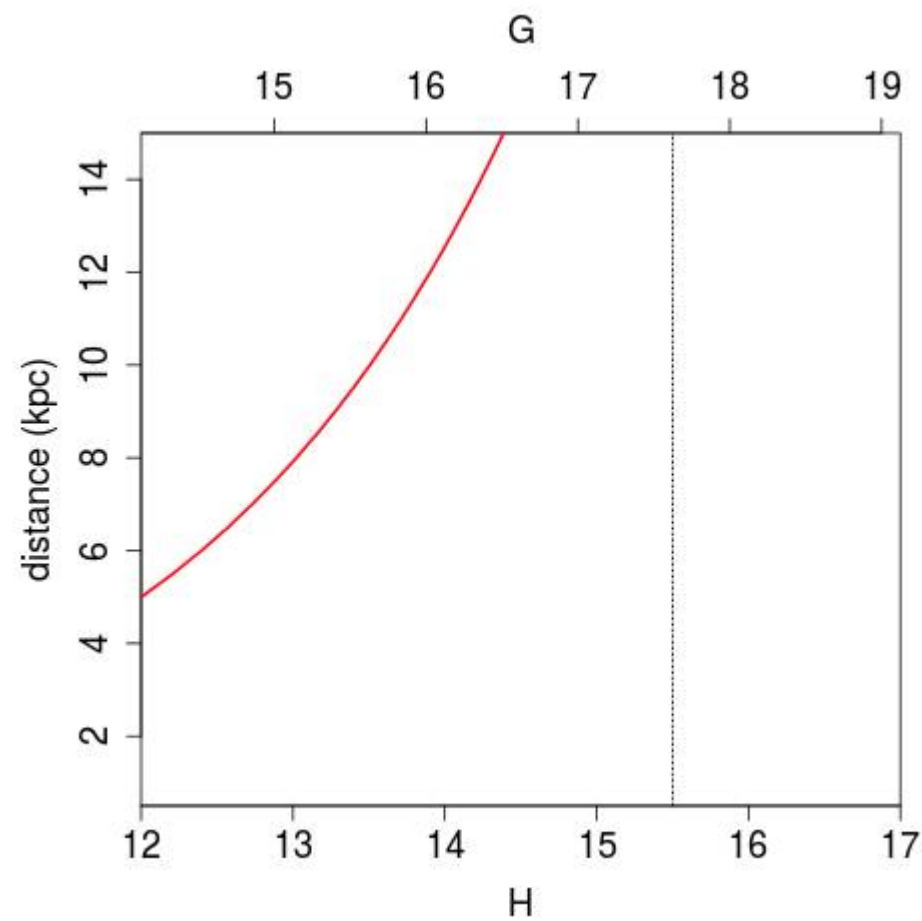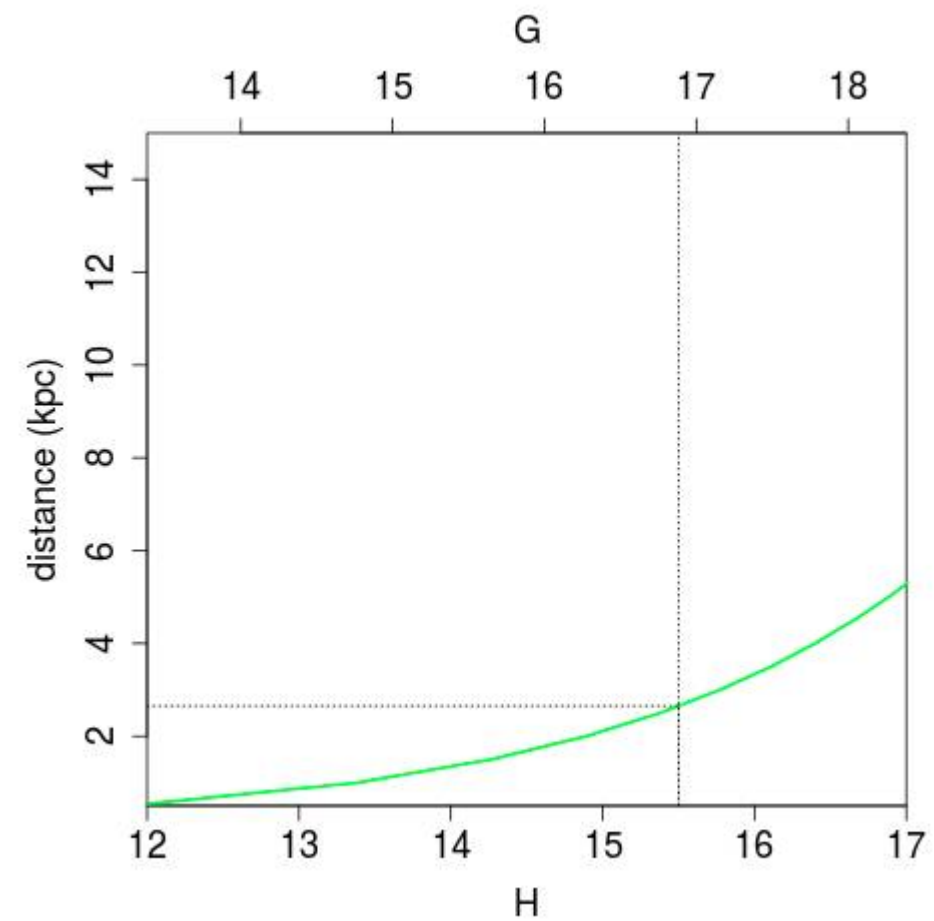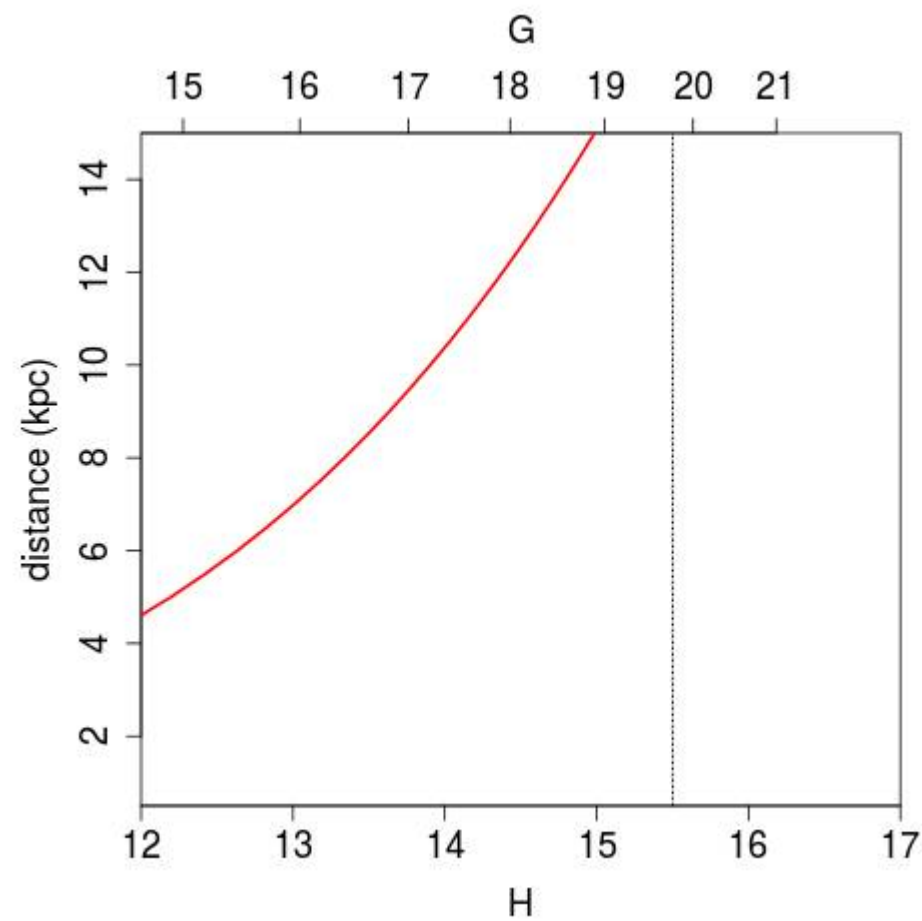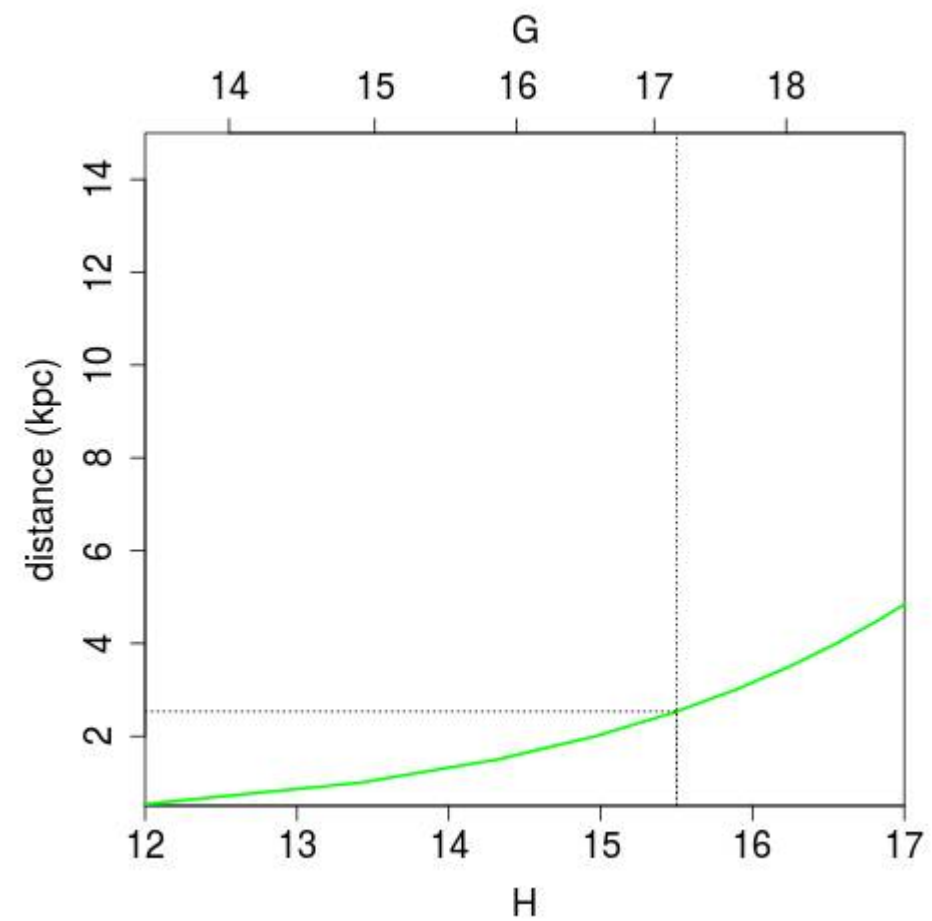Av= 0.22 mag/kpc
(intermediate latitude)

Red Clump

G2V

→ proper motions for all targets

MOONS H versus Gaia G

Av= 0.7 mag/kpc
(low latitude)
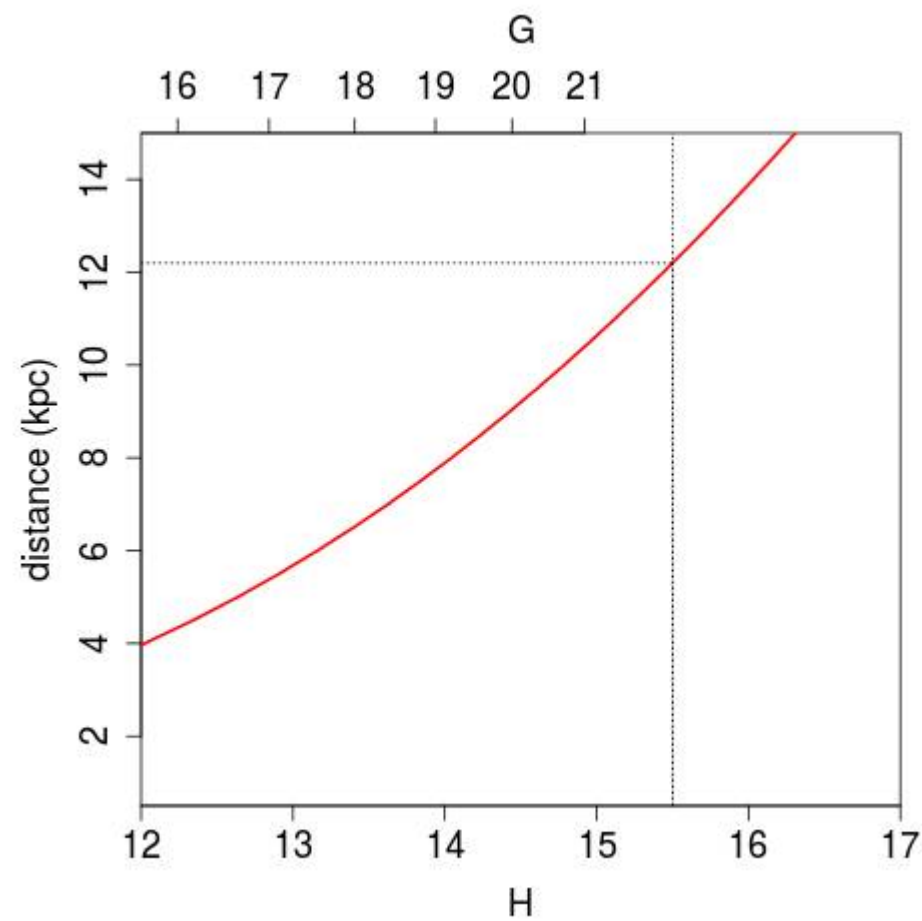
Red Clump
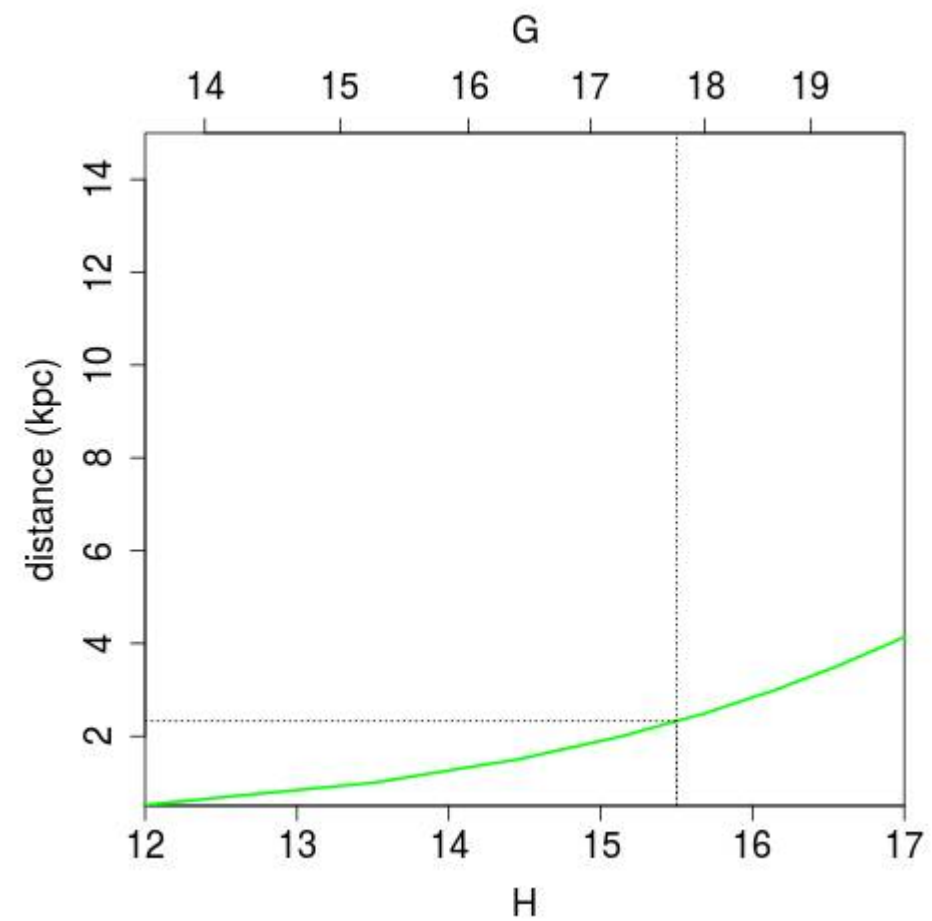
G2V

→ red clump out of Gaia reach

Av= 1.4
Baade's Window

Red Clump

G2V

APOGEE
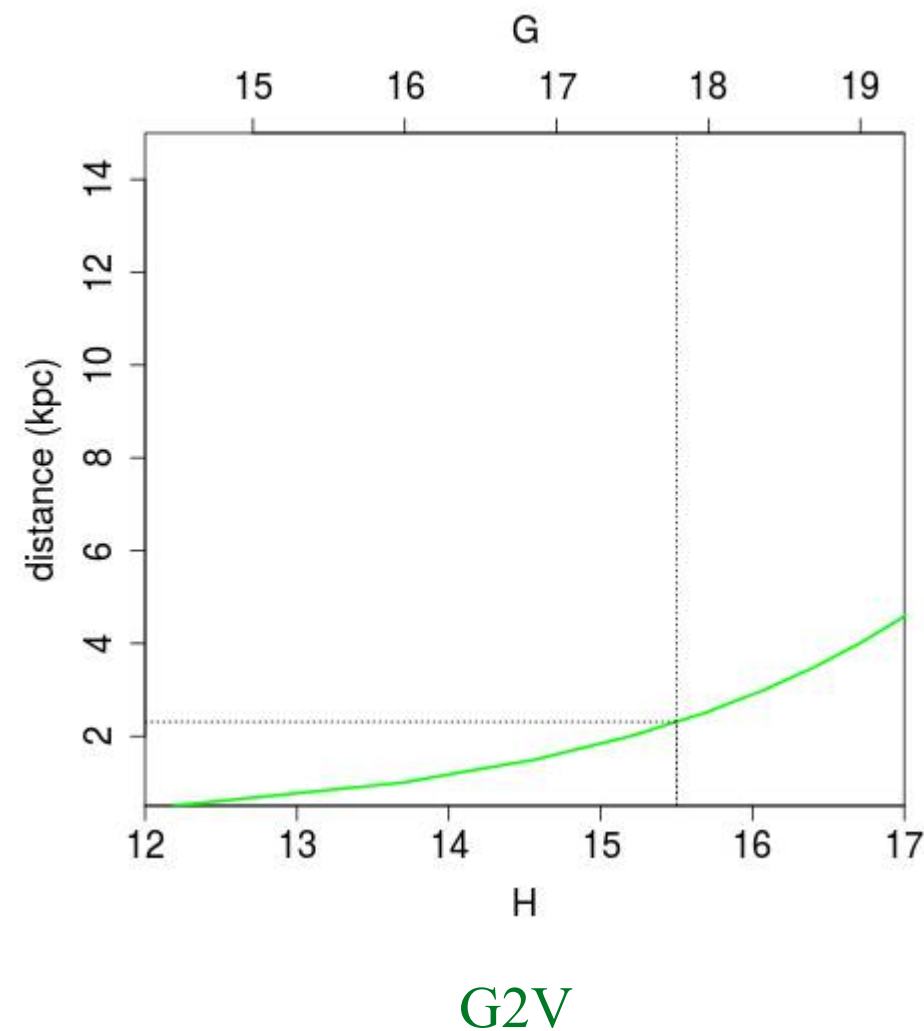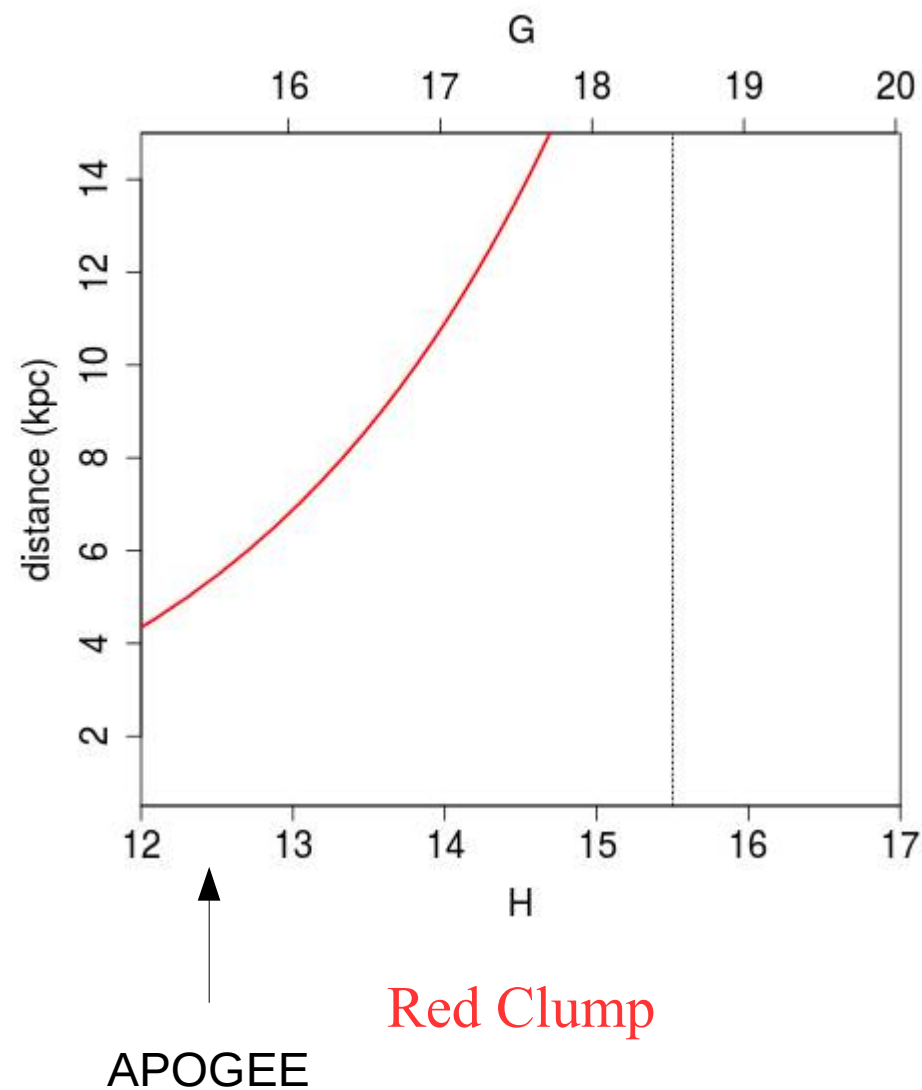
$\rightarrow$ good proper motions : $\sigma_\mu = 4$ km/s at 8 kpc for G=18.5

The extinction factor in the Bulge

H magnitude of a Red Clump star at 8 kpc
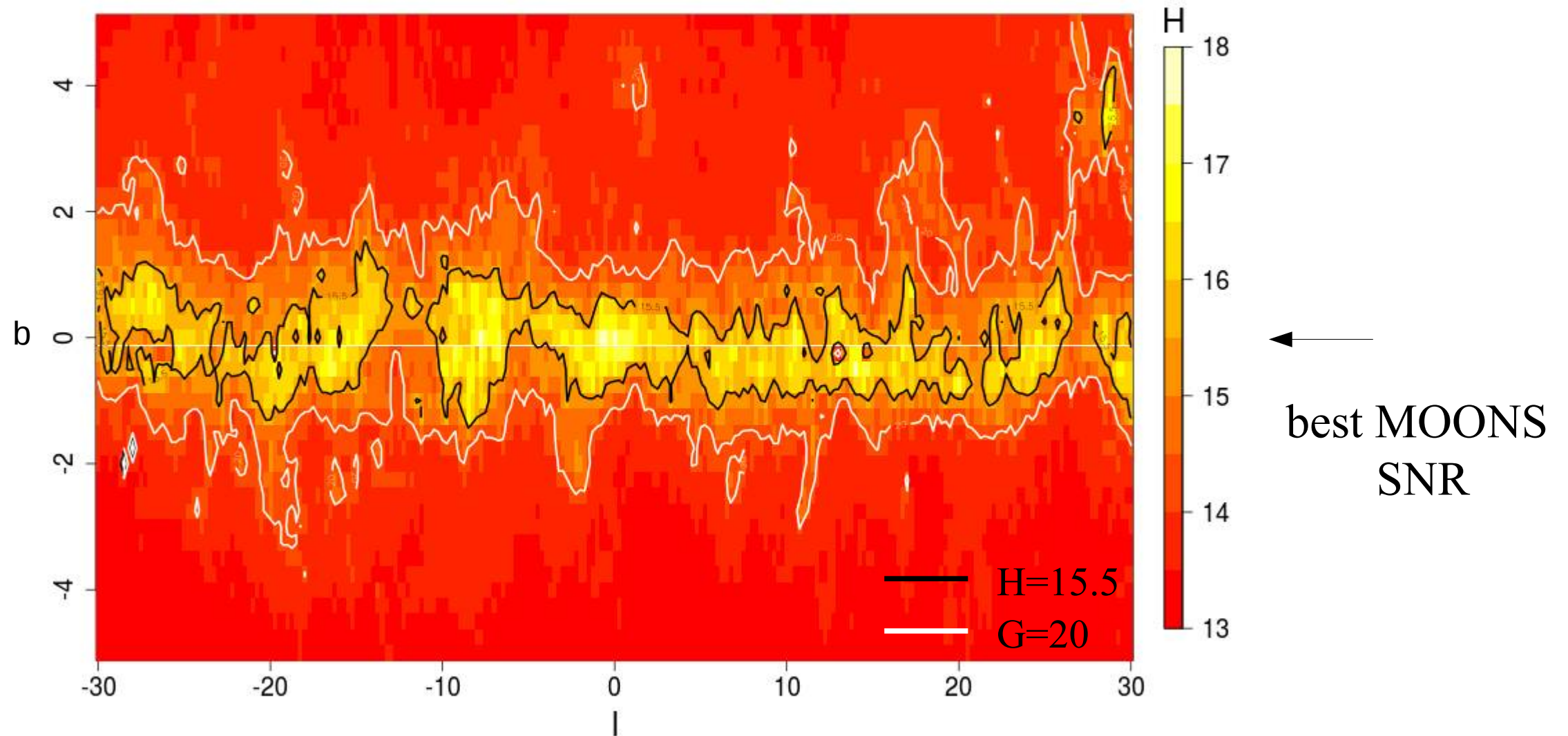
best MOONS
SNR

Extinction map from Marshall et al. 2006, A&A 453, 635

G=20 at 8kpc : σ_μ = 15 km/s

H magnitude of a Red Clump star at 8 kpc

GES fields

GIBS fields

best MOONS SNR

H=15.5
G=20
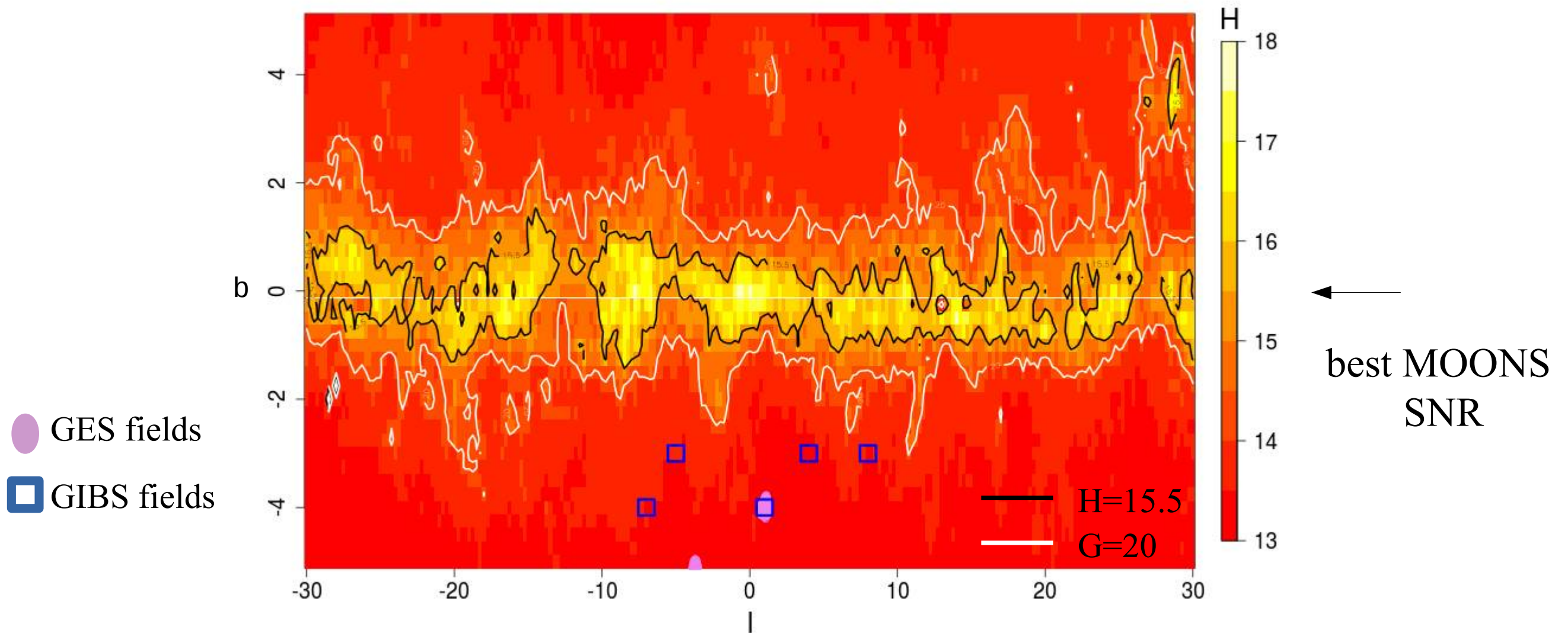
Extinction map from Marshall et al. 2006, A&A 453, 635

G=20 at 8kpc : $\sigma_\mu = 15$ km/s

Conclusion

Large sky coverage with a perfect and unique synergy
MOONS / GAIA in the bulge (and outside!)

Target selection can be prepared from DR2

MOONS + **Gaia**

$\rightarrow$ targets + distances + proper motions + Vr + abondances

$\rightarrow$ 6D dynamics + abundances

$\rightarrow$ bulge star formation history

Gaia Data Releases

- DR2 (22 months of data)

  α, δ, π, μ_α, μ_δ, G, G_{BP}, G_{RP} for > 1 billion stars
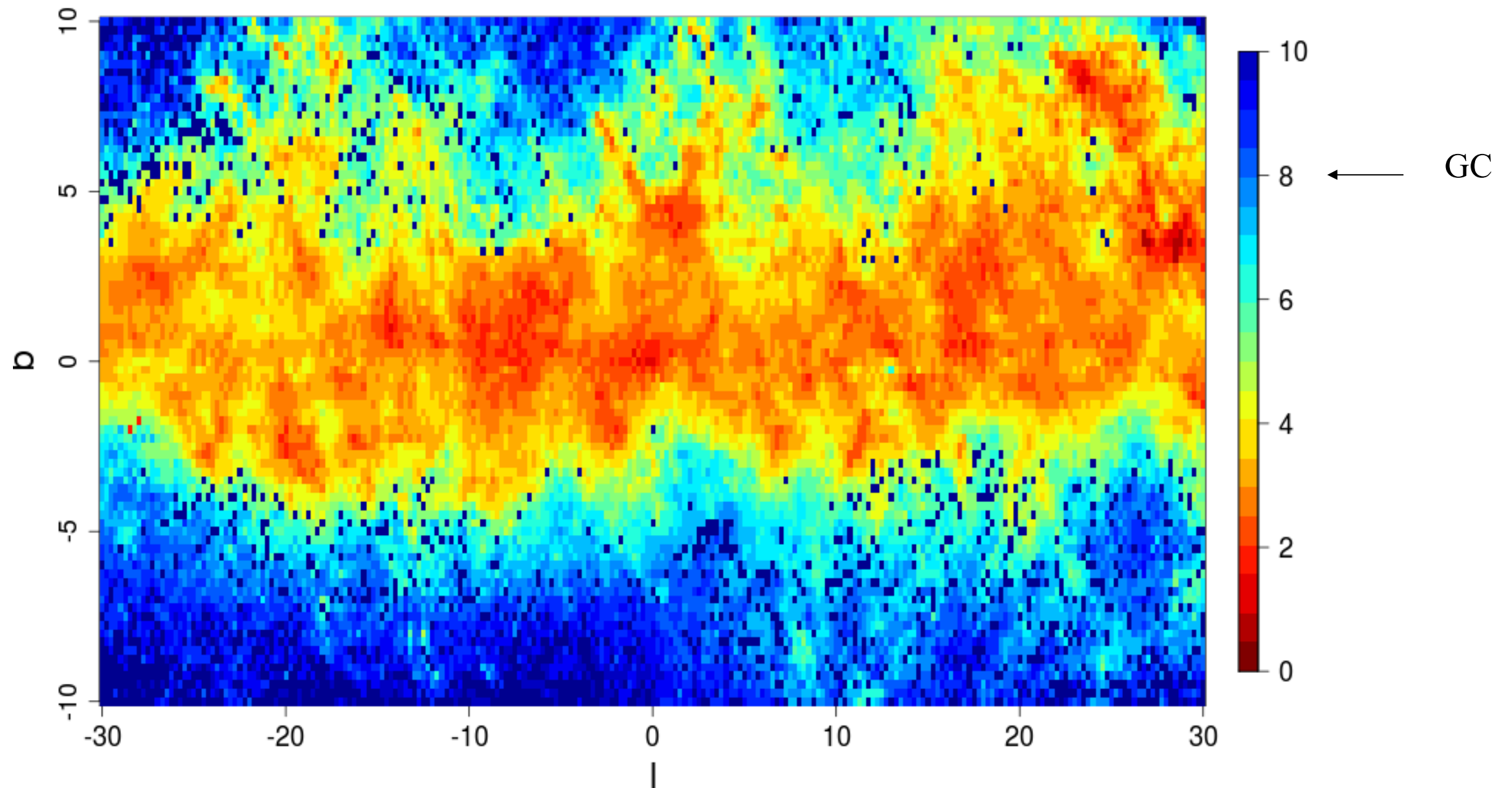
  Vr for G_{RVS}<12 stars

  + …

- DR3

  more Vr

  classification, astrometric parameters

  binaries info

  ...

  http://www.cosmos.esa.int/web/gaia/release

The brightest stars

Distance reached by Red Clump stars at G=16

G=16 at 8kpc (RC with A_G=1) : σ_π/π = 40%, σ_μ = 1 km/s, σ_{Vr} = 15 km/s

Will less suffer from the resource allocation problem

In the landscape...

	GES	HERMES	WEAVE	MOONS	4MOST
Hem.	S	S	N	S	S
wav	optical	optical	optical	NIR	optical
Mag limit	J<18	V<14	V<16	H<15.5	V<16
resolution	20,000	28,000	20,000	20,000	20,000
FoV	0.14	3	3	0.15	3