

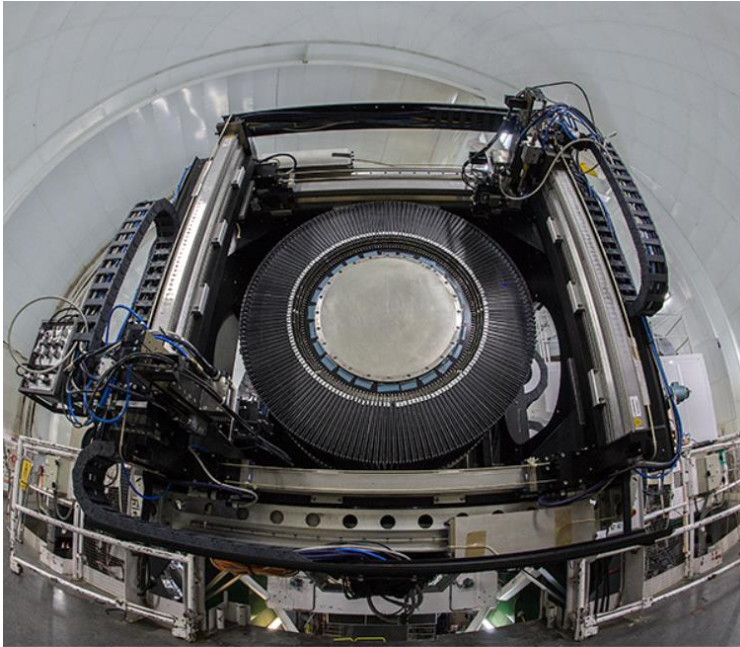


Synergy with WEAVE-OC

Antonella Vallenari
INAF, Osservatorio di Padova, Italy

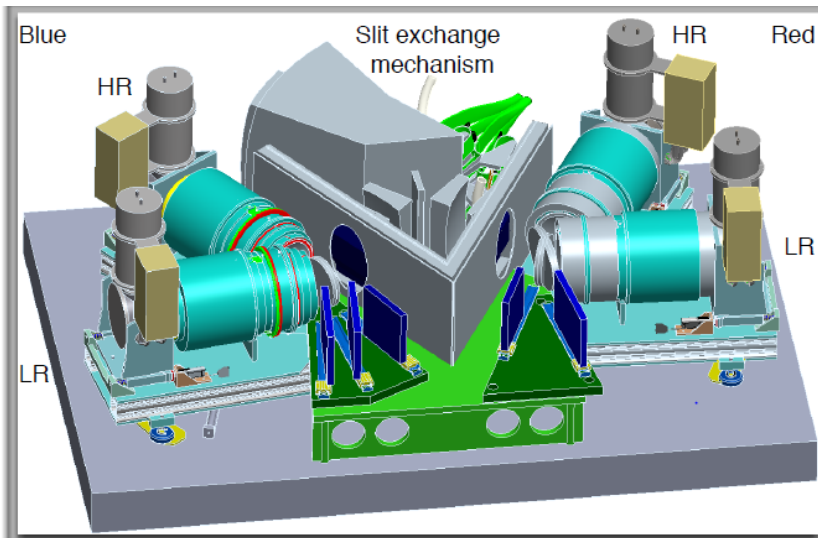
SPA Meeting, Bologna, March 26-29, 2024

What's next: WEAVE@WHT



WEAVE at the top end of the WHT, with the telescope parked near-horizontal. One of the two plates for multi-object spectroscopy can be seen, surrounded by the fibre-retraction boxes. Above these is the gantry supporting the fibre-positioning robots. Credit: Javier Méndez. [More](#).

- WEAVE MOS : only HR multifibre in the Northern Hemisphere for Surveys
- 4m WHT telescope
- 2 deg diameter
- HR(R=20000); LR(R=5000)
- Blue(Green)+Red ;4040A-6850 A
- 960 fibers x field (Plate A &B)
- Multiplex per pointing 960 (Blue(Green) + Red)
- Cannot observe HR and LR at once
- Interfibre minimum distance: 60 arcsec
- Fiber size 1.3 arcsec
- Pointing time 40 min
- miniIFU (790fibres)+LIFU(589 fibre)



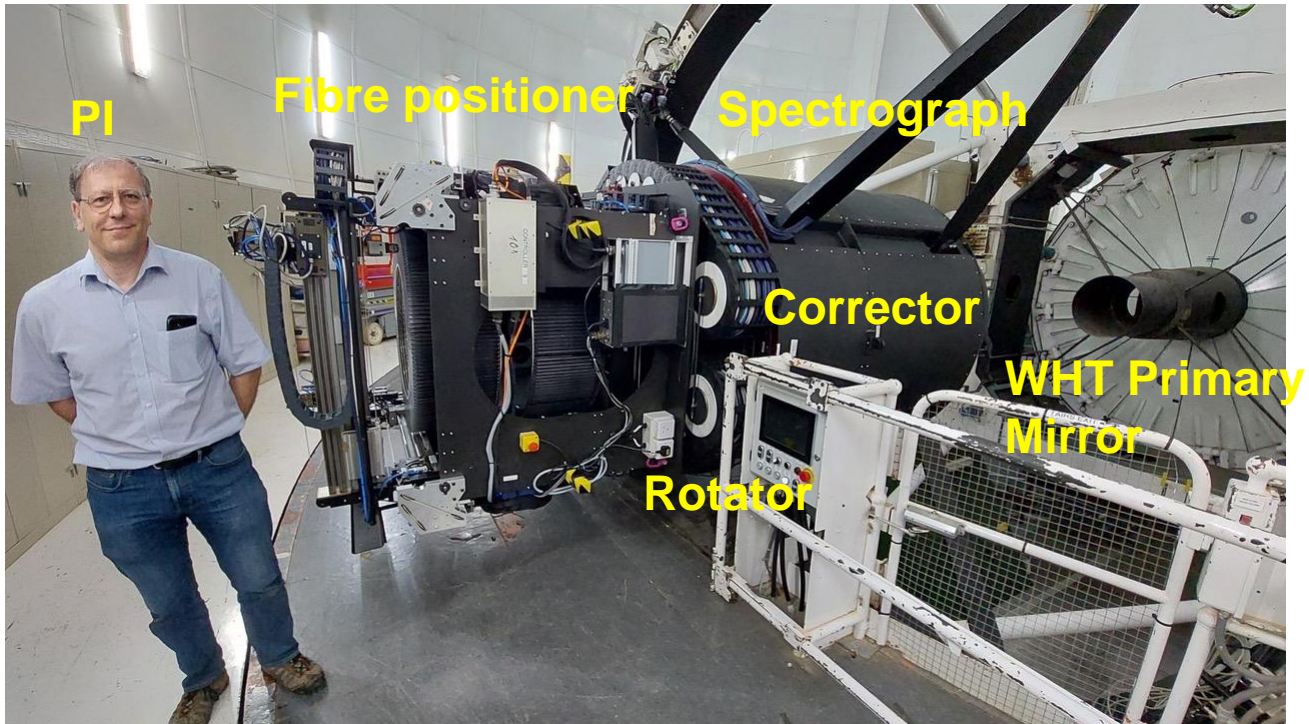
ASTRON

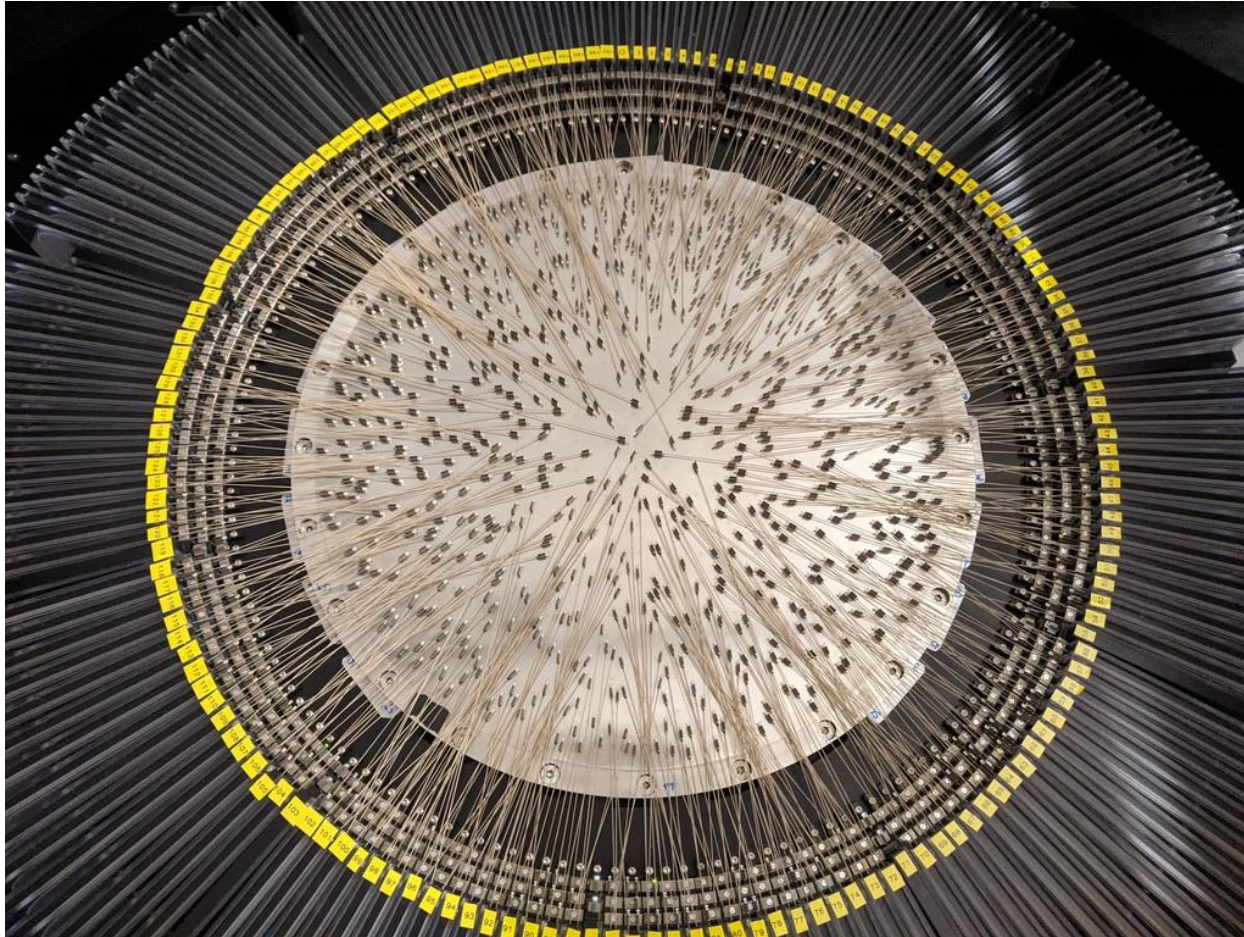


RAL Space

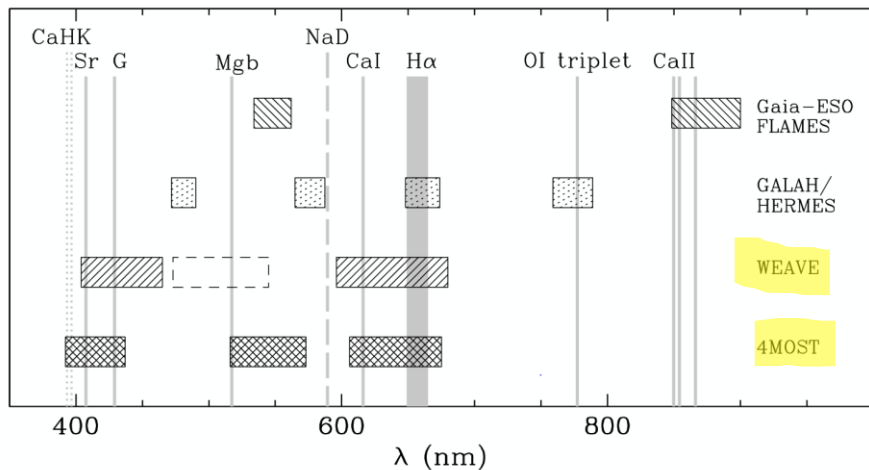


WEAVE as-built



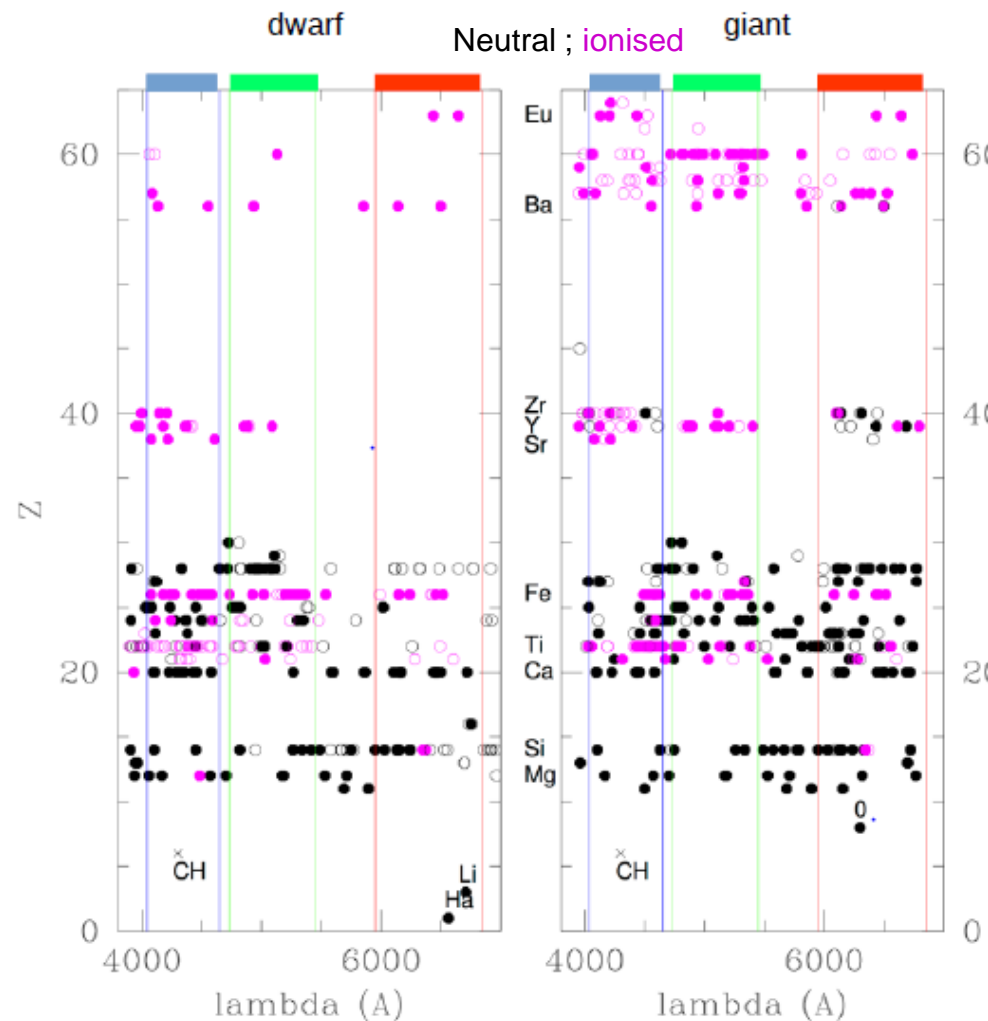


- http://www.ing.iac.es/PR/archive/movies/LaPalma_weavecam1_con_sonido_v1.webm



Feltzing 2020

full wavelength coverage over the range
366–959 nm at nominal resolving power of
5000 (the low-resolution, ‘LR’, mode)

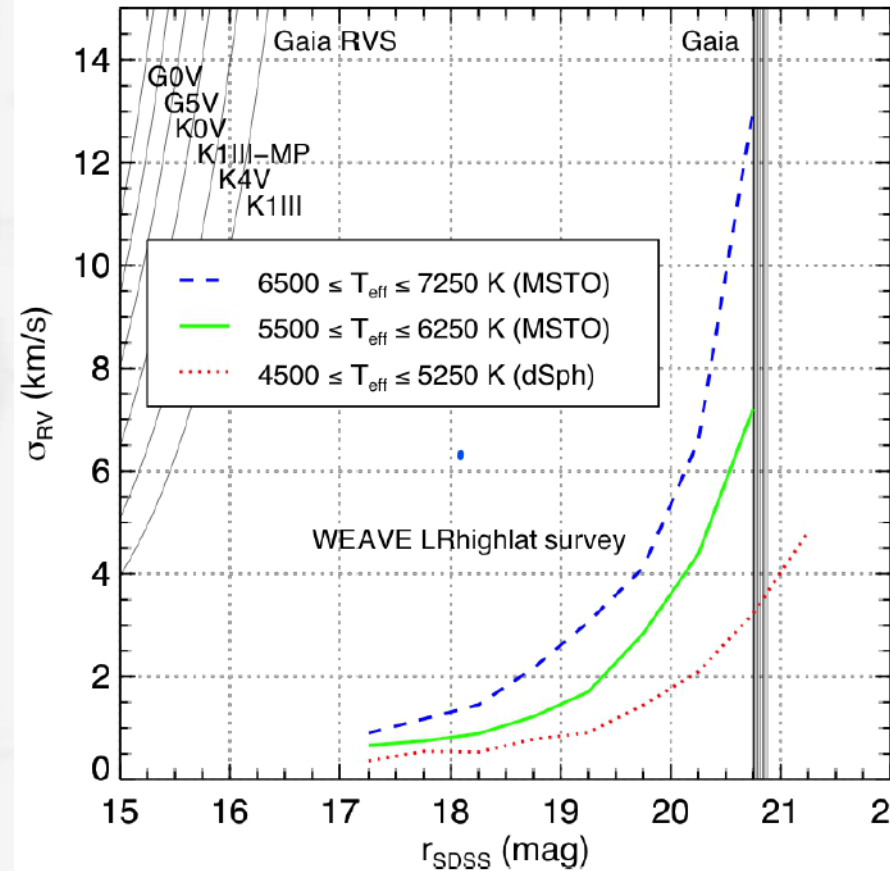


WEAVE Science Book (2020)

WEAVE

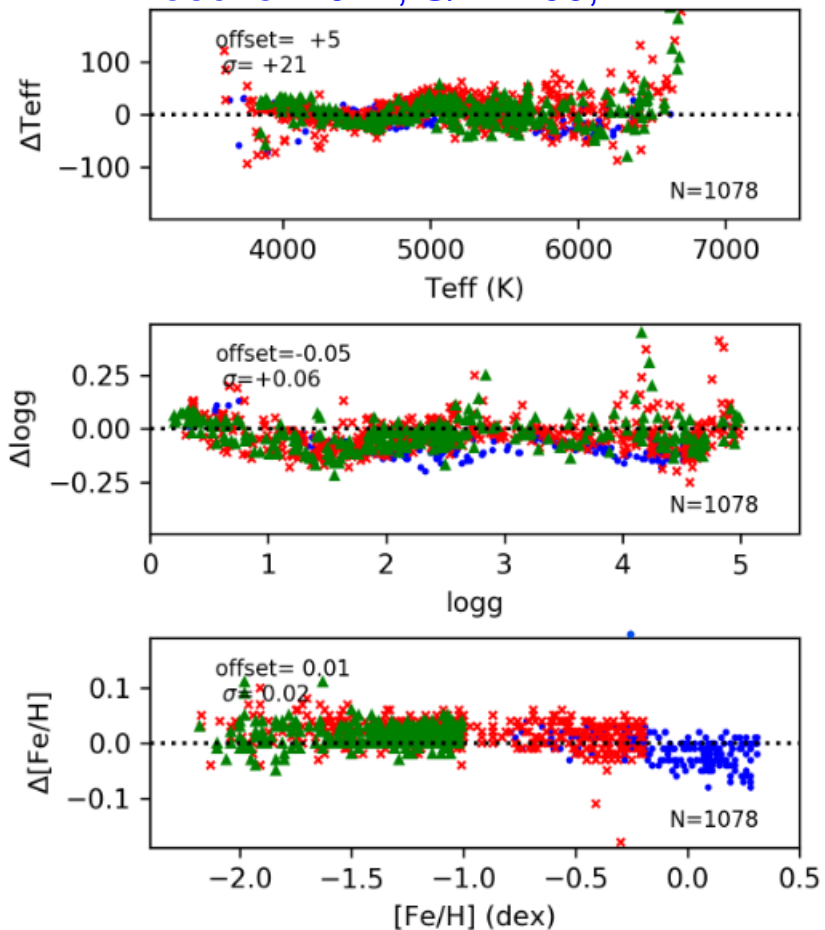
WEAVE, Jin+ 2022

- **LR:** Accurate V_r (2 km/s) (and stellar parameters, incl. Metallicity at 0.2 dex) $16 < G < 20.7$
- **HR:** Accurate stellar parameters and detailed chemistry (at 0.05- 0.1 dex) for $G > 12-16$, $V_r < 0.05$ Km/s
 - T_{eff} , $\log(g)$, V_{rad} , $V_{\text{sin}i}$, .. [H \$\alpha\$](#) , activity index
- Nucleosynthetic channels :
- Lithium \rightarrow young objects
- iron peak (Fe, Ni, Cr, Co, Zn),
- alpha elements (C, Mg, Si, Ca, [O]...),
- neutron-capture slow and rapid elements (Zr, Y, Sr, Ba, La, Nd, Eu),
- odd elements (Na, Al, Sc)

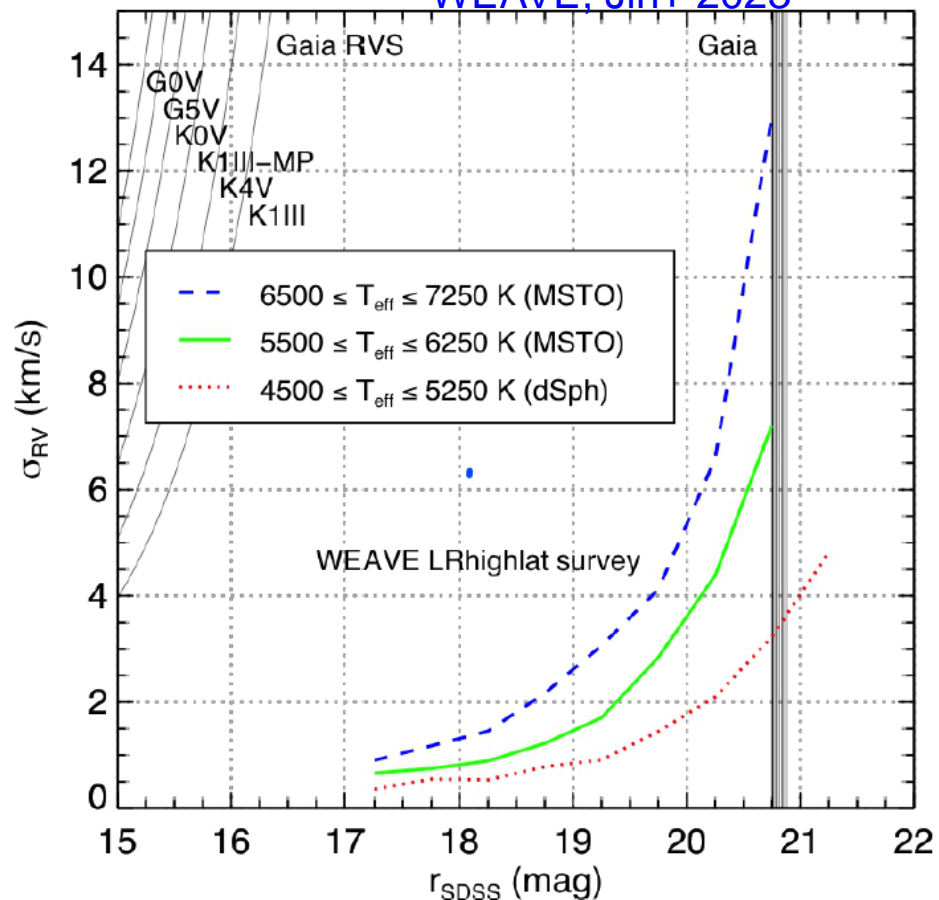


WEAVE Performances

Boeche+2021, S/N=100, HR



WEAVE, Jin+ 2023



Additional pipeline for young stars : T_{eff} , $\log(g)$, V_{rad} , $V_{\text{sin}i}$, .. $H\alpha$, activity index (Frasca+)

Additional pipeline for n-capture elements

Cross-survey calibration targets: Ocs, GCs, asteroseismology

WEAVE Project status

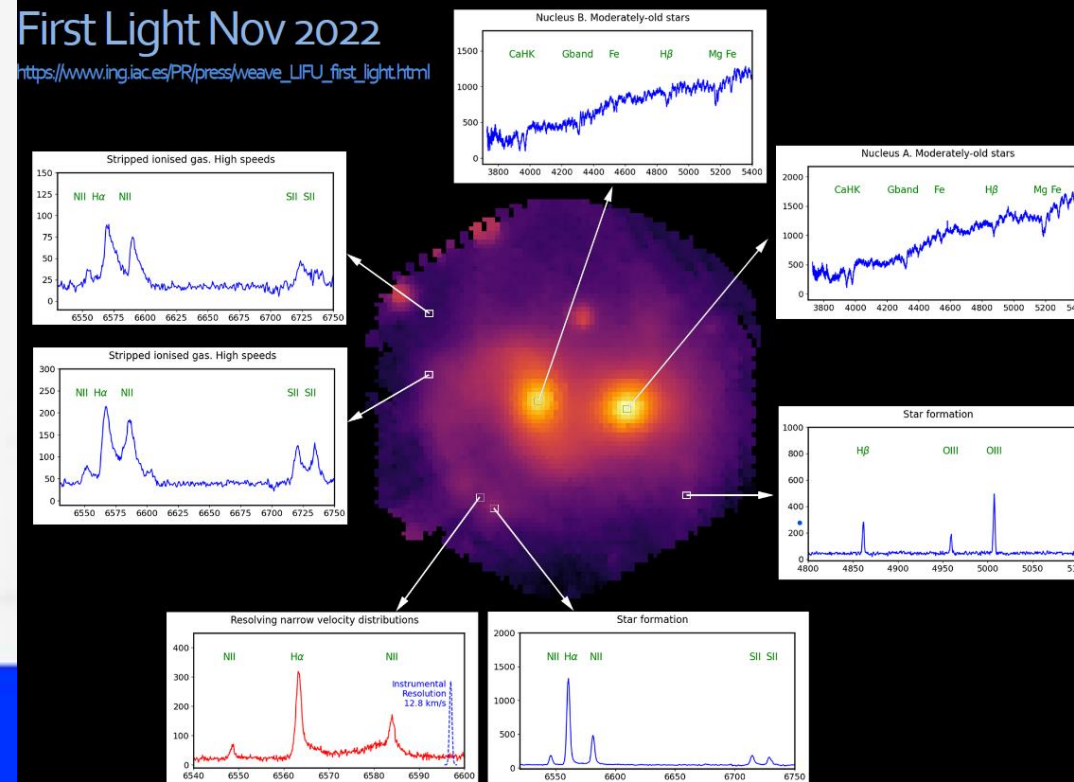
WEAVE

- LIFU: First light Nov 2022+SV
- Inauguration on Oct 30,2023
- mIFU on going commissioning
- MOS: on going commissioning
 - Science Validation: on-going

WEAVE LIFU First Light
NGC 7318a/b in Stephan's Quintet
(M. Balcells courtesy)

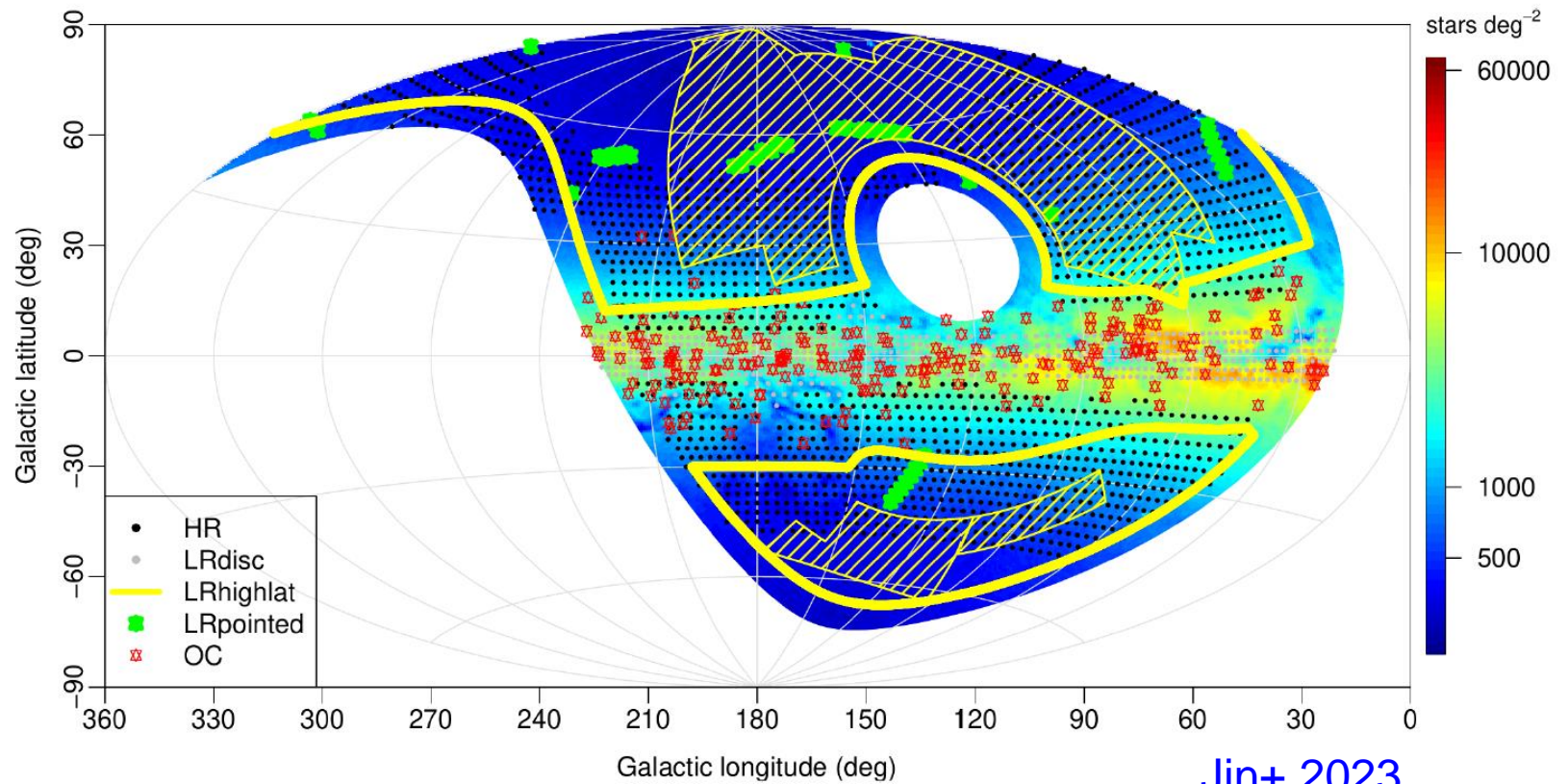
First Light Nov 2022

https://www.ing.iac.es/PR/press/weave_lifu_first_light.html



WEAVE OC Survey

- 8 Surveys (Galactic + Extragal)
- PI: A.Vallenari, Deputy A. Bragaglia



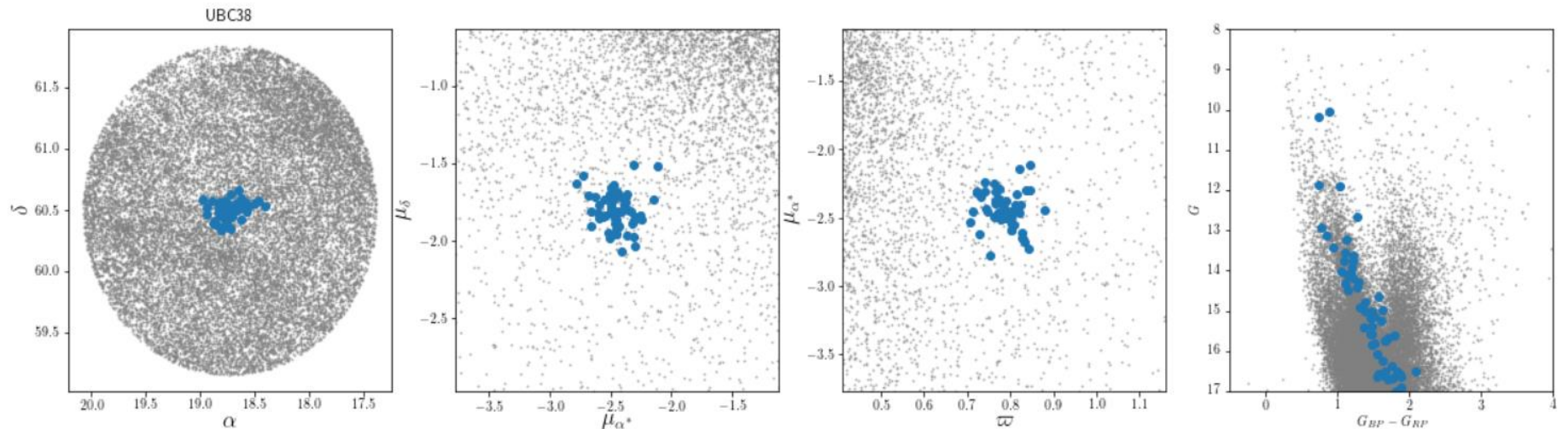
Jin+ 2023

OC Survey goals

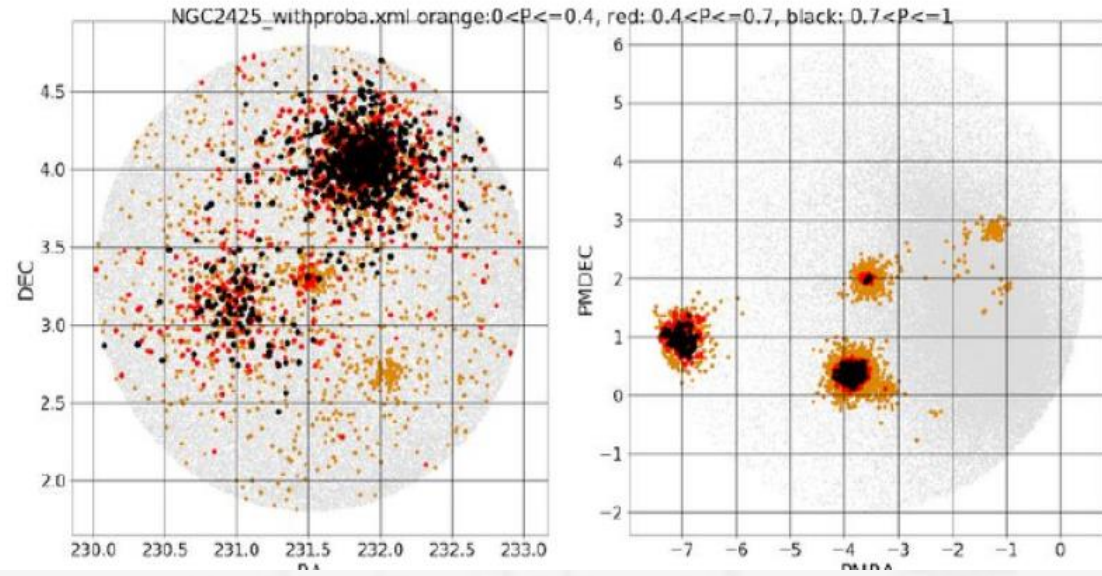
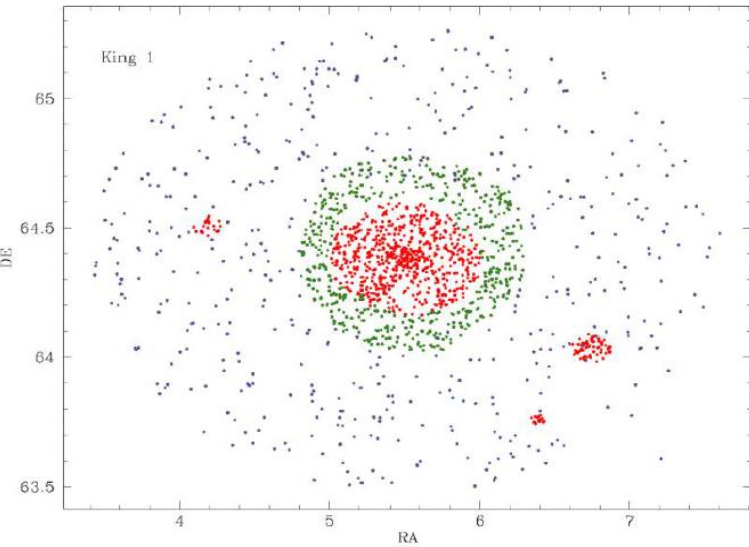
- Goal 1. Formation of stellar systems: clusters and associations
- Goal 2. Disruption of open clusters
- Goal 3. OCs as tracers of the Galactic disc and of its chemical evolution
 - Red clump stars in Ocs older than 100 Myr: $G=16.0$ at $\text{dist}=12 \text{ Kpc}$ --- \rightarrow
 $R_g=20 \text{ Kpc}$
- Goal 4 Star formation, planetary system formation, and early stellar evolution
- Goal 5 Stellar evolution
- HR+LR(synergy with disk surveys)

Pointing Strategy for WEAVE

- Each pointing is mastered by only one survey (with some exceptions) → high completeness
- Targets: high probability & low probability members
- Small compact (70 Ocs) + large diffuse Ocs (20 Ocs) → synergy with LR disk & HR disk WEAVE surveys
- Little information on binarity: at best two observations on short time scale (a few days)



WEAVE Targets



- Large nearby clusters within 500 pc
- Clusters with halos, coronae, tidal streams (within 2 degrees)
- Apparent groups of clusters
- Large regions with recent star formation
- Fill all the fibers with high+low probability objects

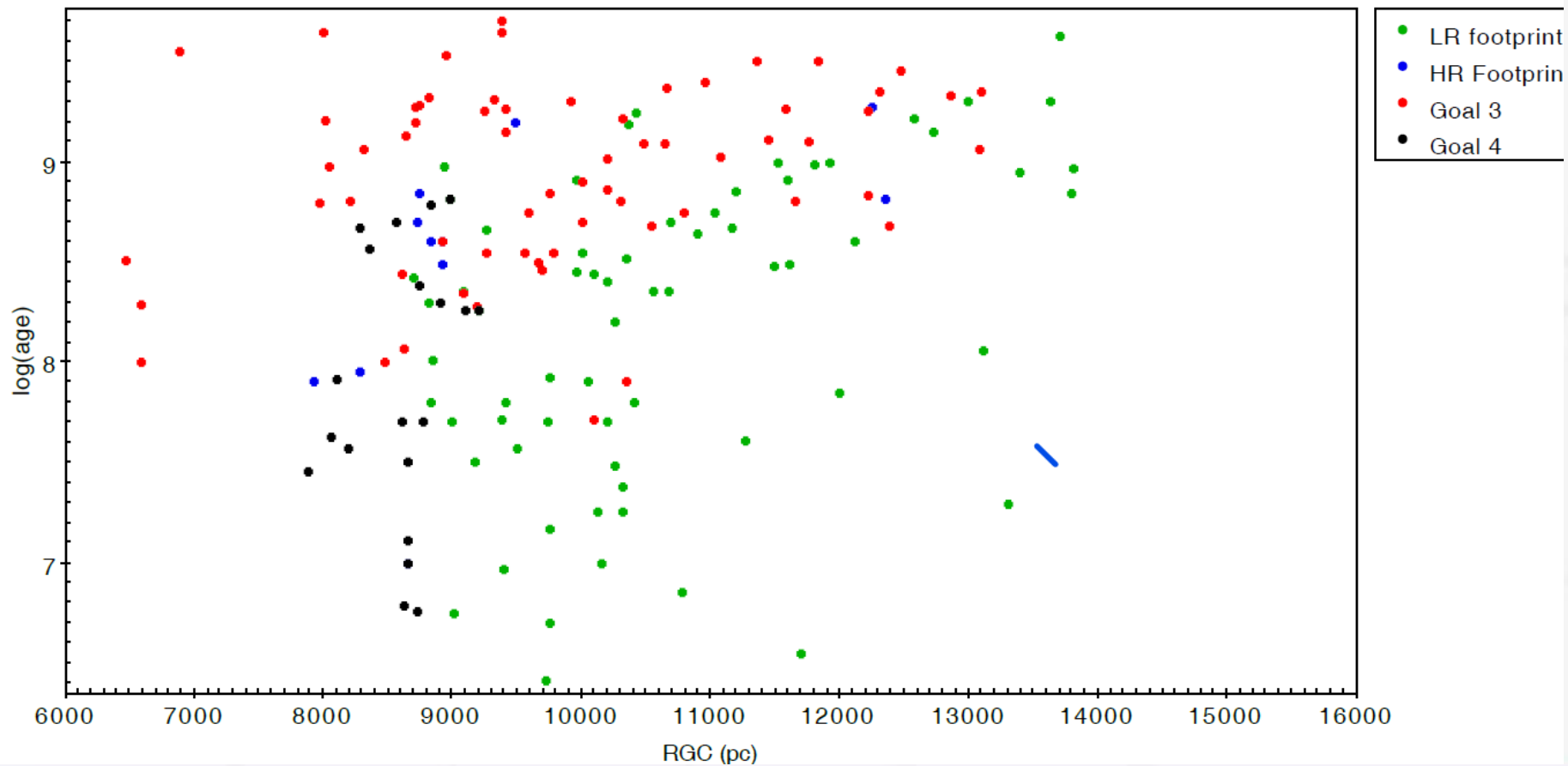
Table 6: Plan for 5 year of observations

| | Area (deg ²) | Target density/tile | OCs | Tiles | Exp.time | N OBS | Fibre hours | Res. mode | Fibre mode |
|------------------------------|--------------------------|---------------------|-----|-------|----------|-------|-------------|-----------|------------|
| Goal 1 | 12 | 950 | 2 | 3 | 1x4h | 12 | 11400 | HR | MOS |
| Goal 2,3,5 | 244 | 950 | 143 | 61 | 1x2h | 122 | 115900 | HR | MOS |
| Goal 4 | 64 | 480 | 16 | 17 | 1x3h | 51 | 25954 | HR | MOS |
| Total HR-OC Goals 2-5 | 308 | 950 | 159 | 77 | variable | 170 | 153254 | HR | MOS |
| Goal 3 HR-disk foot. | 338 | 9-50 | 16 | 84 | 2x1h | 6 | 5712 | HR | MOS |
| Goal 3 LR-disk foot. | 397 | 40 | 50 | 99 | 1x1h | 2.6 | 2534 | LR | MOS |

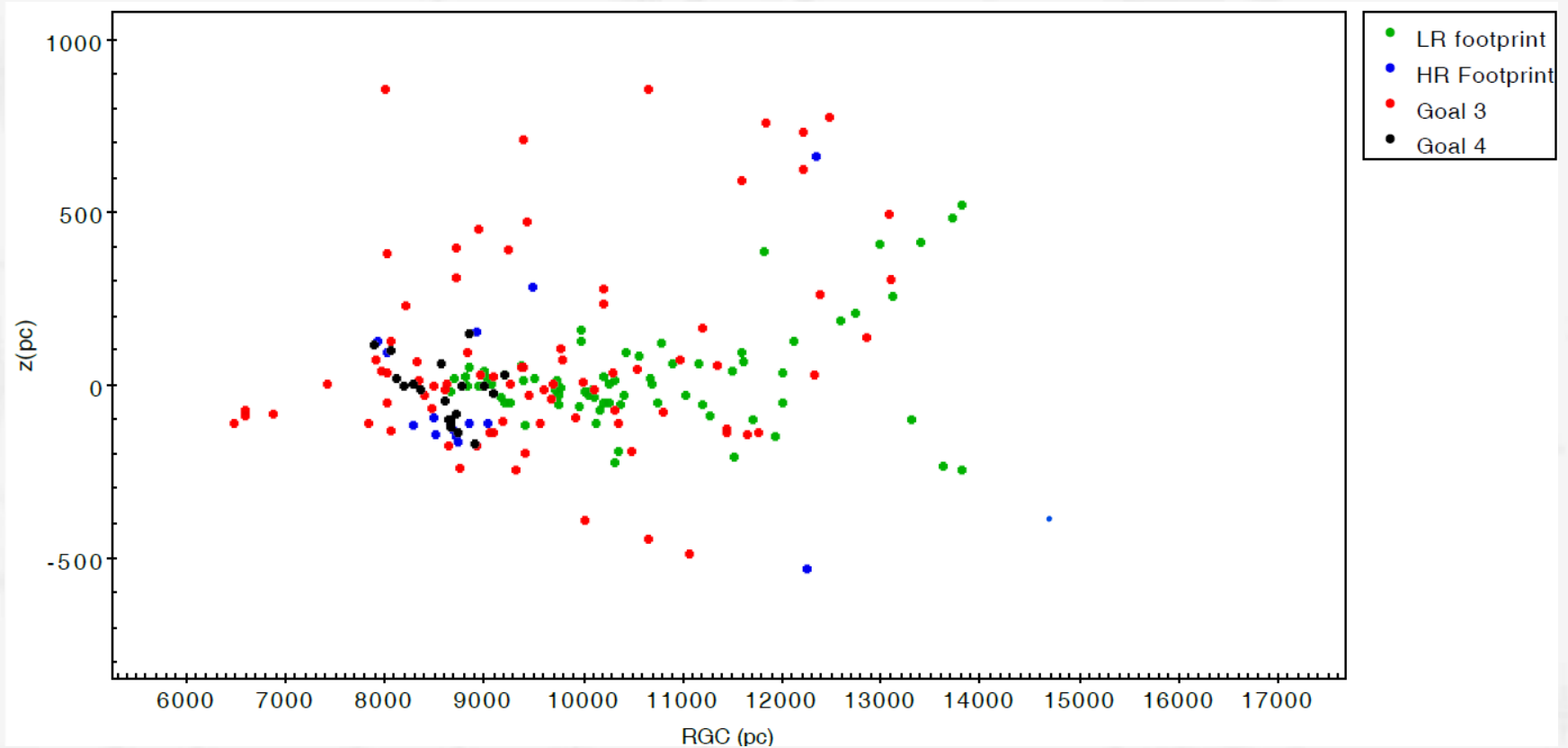
Table 7: Plan for 7 years of observations

| | Area (deg ²) | Target density/tile | OCs | Tiles | Exp.time | N OBS | Fibre hours | Res. mode | Fibre mode |
|------------------------------|--------------------------|---------------------|-----|-------|----------|-------|-------------|-----------|------------|
| Goal 1 | 16 | 950 | 3 | 32 | 1x4h | 120 | 114000 | HR | MOS |
| Goals 2,3,5 | 324 | 950 | 174 | 81 | 1x2h | 162 | 152950 | HR | MOS |
| Goal 4 | 100 | 480 | 22 | 25 | 1x3h | 75 | 36000 | HR | MOS |
| Total HR-OC Goals 2-5 | 424 | 950 | 203 | 106 | variable | 237 | 188950 | HR | MOS |
| Goal 3 HR-disk foot. | 484 | 9-50 | 22 | 121 | 2x1h | 7.5 | 7140 | HR | MOS |
| Goal 3 LR-disk foot. | 568 | 40 | 72 | 142 | 1x1h | 4 | 3621 | LR | MOS |

Target distribution-I



Target distribution-II



Science Verification-LR

NGC2682

ALL: object of the input catalogue located around the field
 TO CONFIGURE: object located IN the field passed to configure
 ASSIGNED: object to which a fibre have been assigned by configure

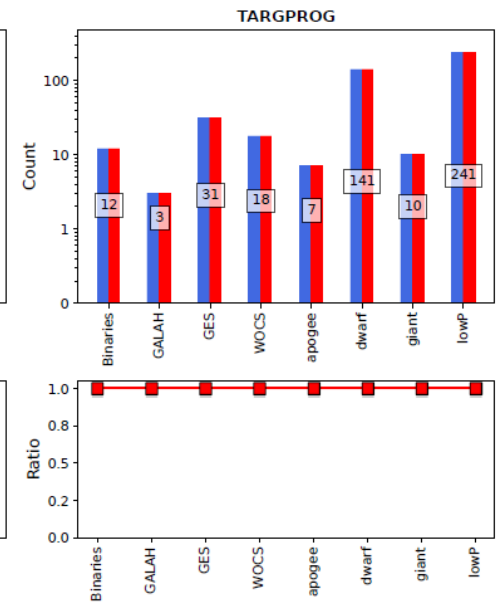
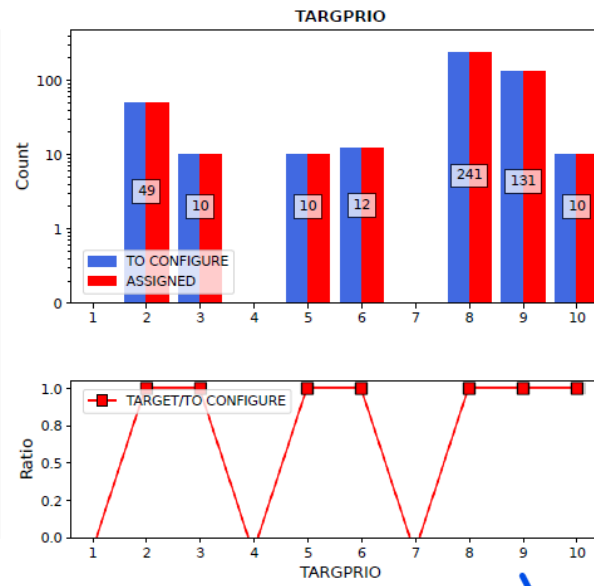
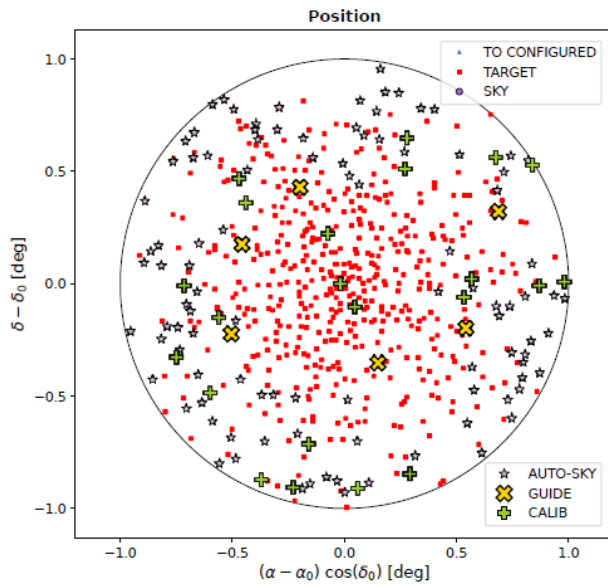
TARGET: scientific object (e.g. star) with a fibre assigned
 SKY: sky position given in the catalogue with a fibre assigned
 AUTO - SKY: sky fibre automatically assigned by configure
 GUIDE: assigned guide star
 CALIB: assigned calibration star

Warning: Some targets might have different TARGPROG and may appear in more than one categories

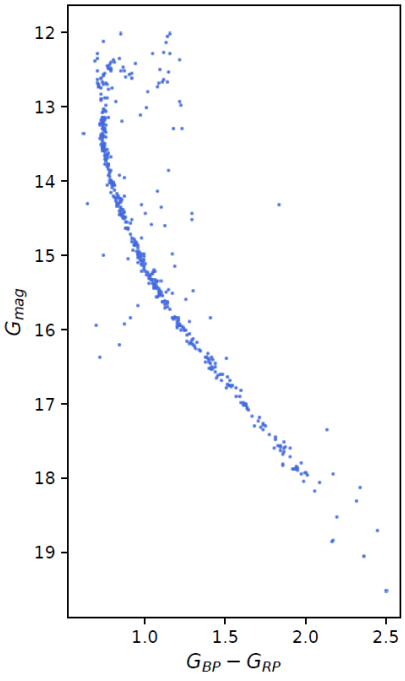
Field center:
 α : 132.846 deg
 δ : 11.814 deg

PROGTEMP: 11331
 OBSTEMP: FBBDF

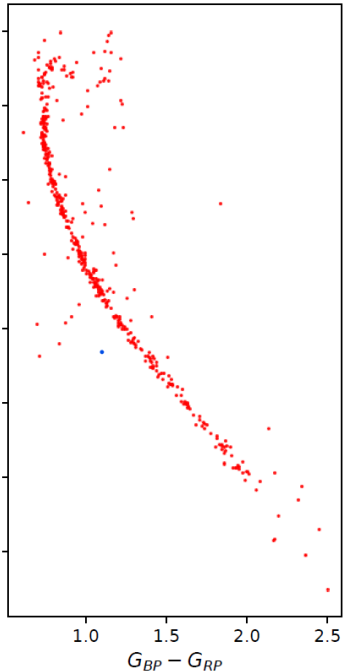
FIBRES ALLOCATED : 585
 TARGET: 463
 GUIDE: 6
 SKY / AUTO-SKY: 0 / 100
 CALIB: 22
 PLATE: A



TO CONFIGURE



ASSIGNED



**In each cell:
ASSIGNED/TO CONFIGURE**

TARGPROG

| | ANY | Binaries | GALAH | GES | LR | WOCS | apogee | dwarf | giant | lowP |
|----|-----|----------|-------|-------|-------|-------|--------|---------|-------|---------|
| 10 | 6/6 | | | | 1/1 | | | | 10/10 | |
| 9 | | | | | | | | 131/131 | | |
| 8 | | | | | | | | | | 241/241 |
| 7 | | | | | 21/21 | | | | | |
| 6 | | 12/12 | | | | | | | | |
| 5 | | | 3/3 | | | | 7/7 | | | |
| 4 | | | | | | | | | | |
| 3 | | | | | | | | 10/10 | | |
| 2 | | | | 31/31 | | 18/18 | | | | |
| 1 | | | | | | | | | | |
| 0 | | | | | | | | | | |



SV-HR

NGC6819

ALL: object of the input catalogue located around the field
 TO CONFIGURE: object located IN the field passed to configure
 ASSIGNED: object to which a fibre have been assigned by configure

TARGET: scientific object (e.g. star) with a fibre assigned
 SKY: sky position given in the catalogue with a fibre assigned
 AUTO - SKY: sky fibre automatically assigned by configure
 GUIDE: assigned guide star
 CALIB: assigned calibration star

Warning: Some targets might have different TARGPROG and may appear in more than one categories

Field center:
 α : 295.327 deg
 δ : 40.19 deg

PROGTEMP: 21331.2
 OBSTEMP: FBBDF

FIBRES ALLOCATED : 424

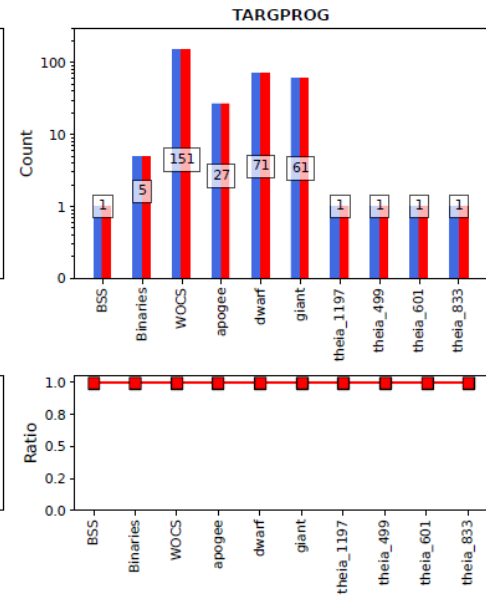
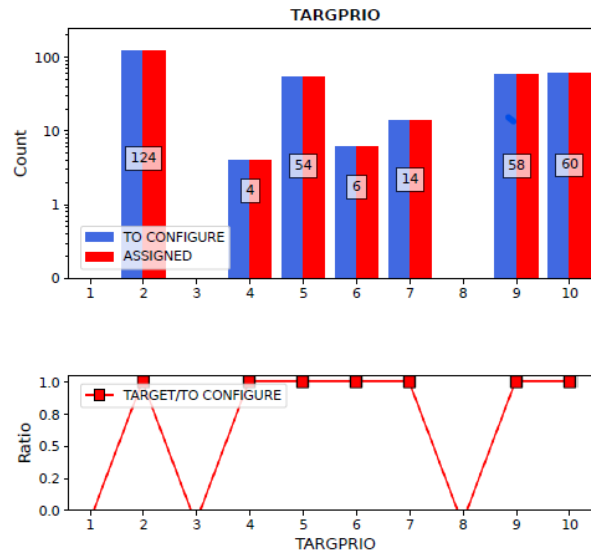
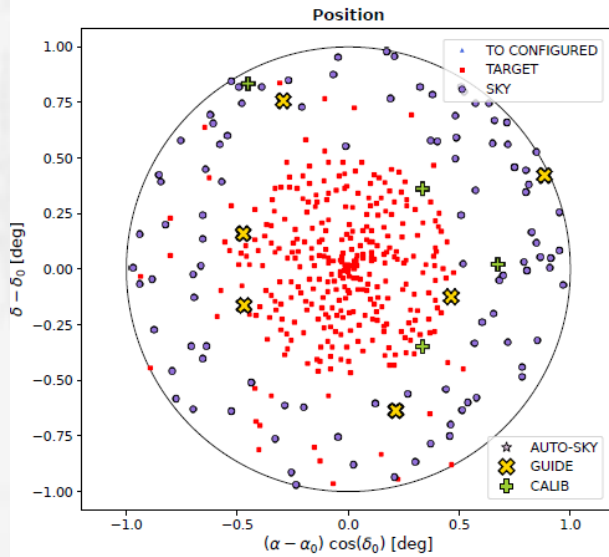
TARGET: 320

GUIDE: 6

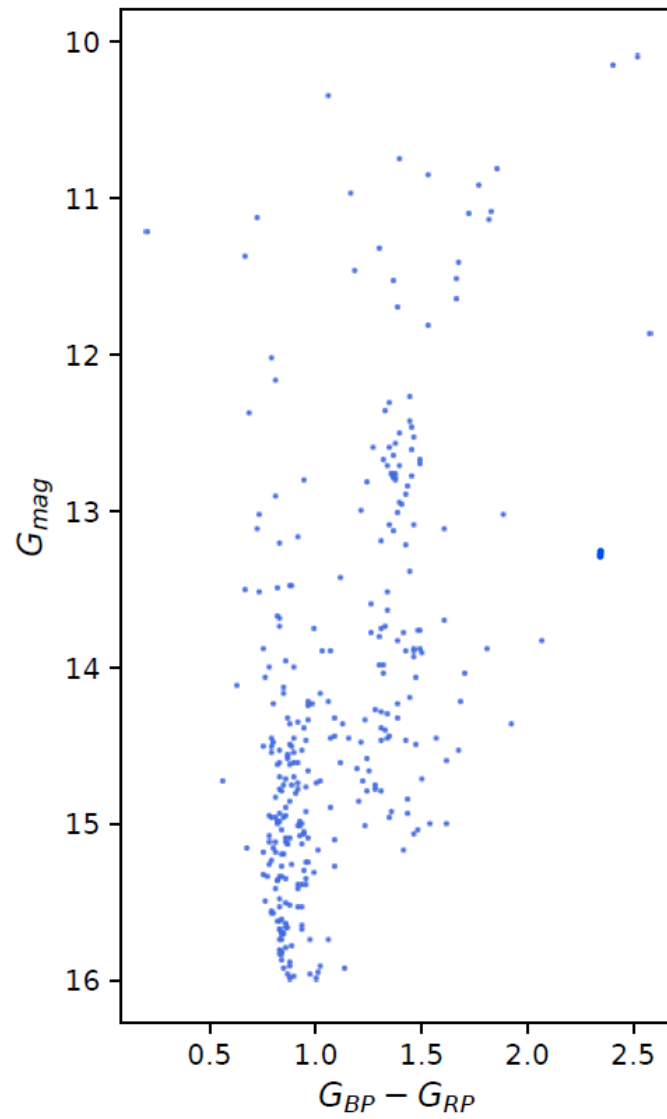
SKY / AUTO-SKY: 100 / 0

CALIB: 4

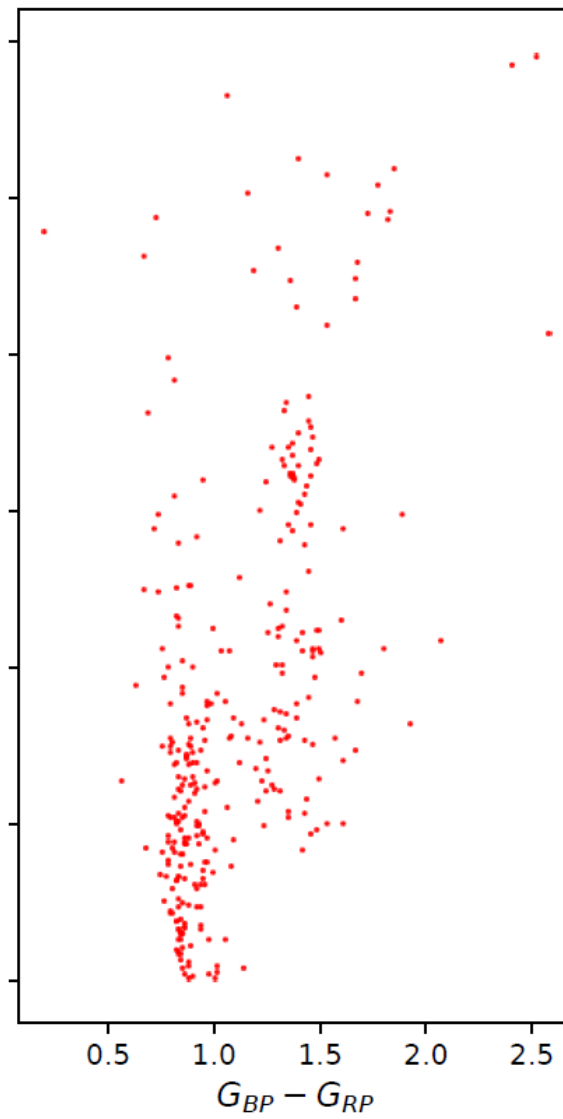
PLATE: A



TO CONFIGURE



ASSIGNED



SV-LR

NGC6819

ALL: object of the input catalogue located around the field
 TO CONFIGURE: object located IN the field passed to configure
 ASSIGNED: object to which a fibre have been assigned by configure

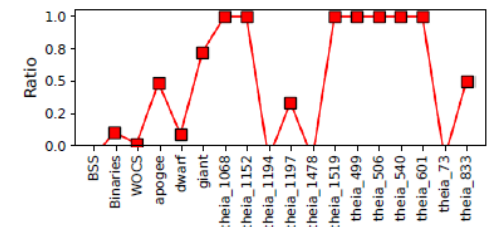
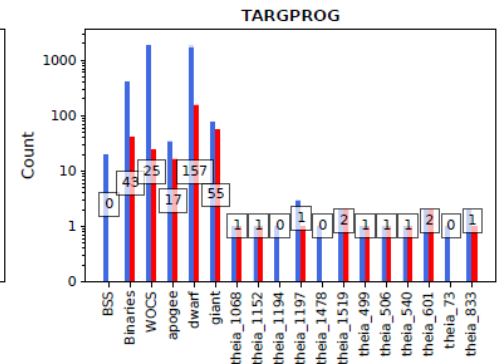
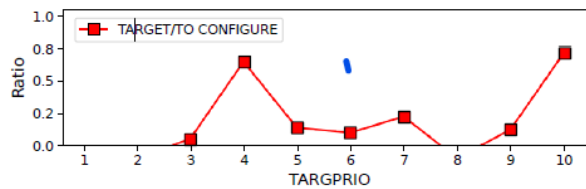
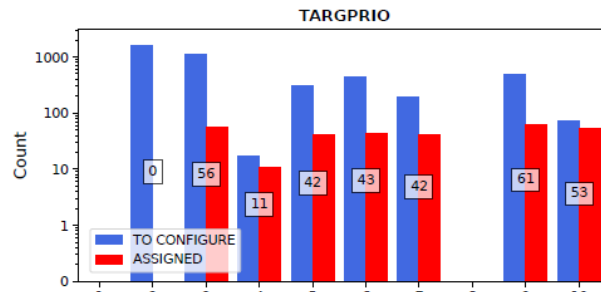
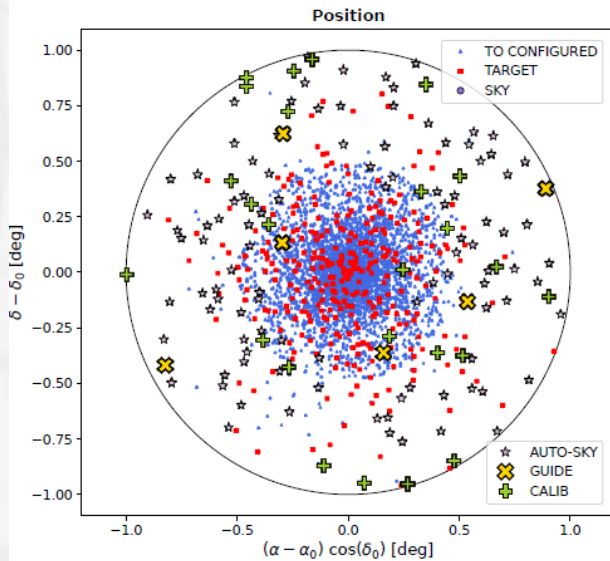
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 SKY: sky position given in the catalogue with a fibre assigned
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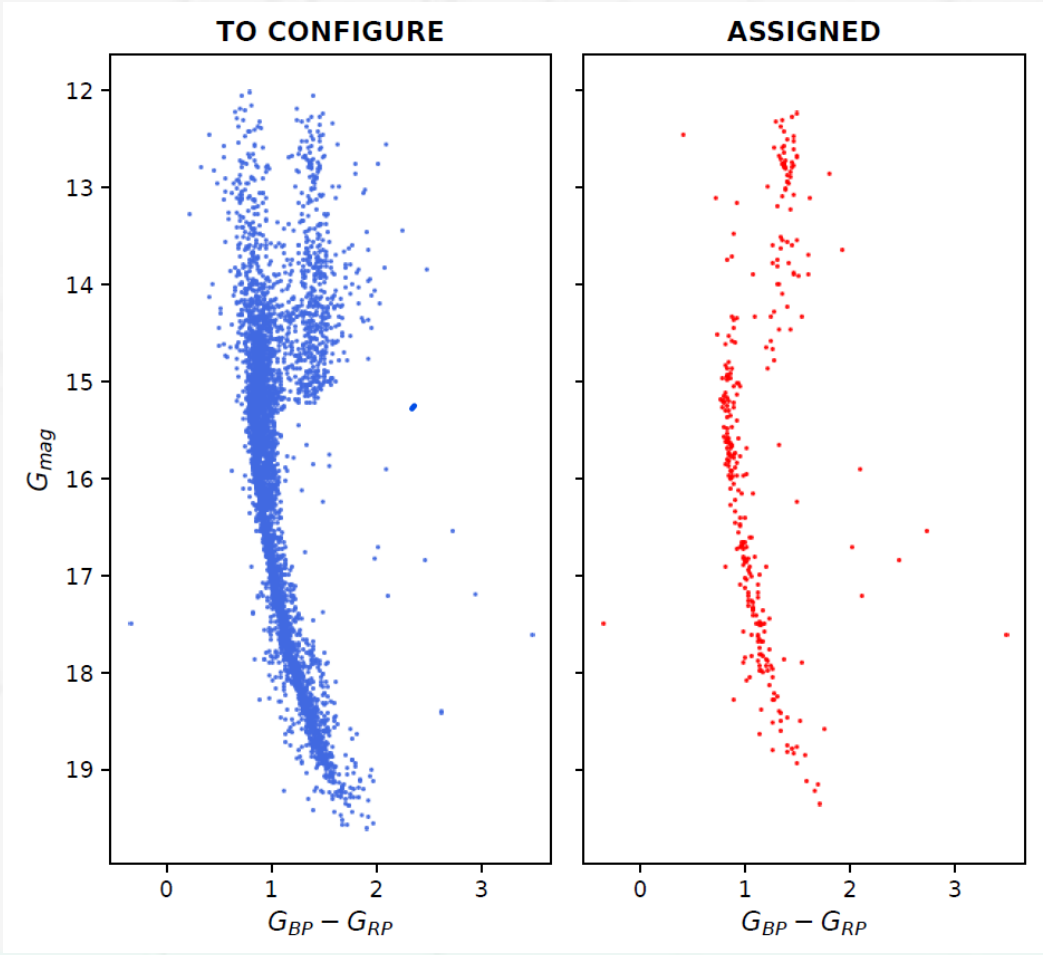
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Field center:
 α : 295.327 deg
 δ : 40.19 deg

PROGTEMP: 11331
 OBSTEMP: FBBDF

FIBRES ALLOCATED : 433
 TARGET: 308
 GUIDE: 6
 SKY / AUTO-SKY: 0 / 100
 CALIB: 25
 PLATE: A





Science cases for the first year

- About 40 pointings selected up to know
- Nearby Ocs for internal kinematics, Ocs with halo/tails (10 Ocs, Tarrig catalog), Theia objects (5 Ocs)
- Groups of clusters (9 pointings, Castro-Ginard Catalog)
- Nearby group of young Ocs/ young OCs (23 pointings, LISCA I-II)
- Older than $5E8$ yr : 17 Ocs
- Observations with SPA; OCCASO; GES, APOGEE, Tess, Kepler
- SPA synergies:
 - Bright objects
 - science cases requiring HR (stellar evolution)
 - Kinematics
 - Comparison and metallicity verification (some pipelines in common)
 - NB: it would be great to have SPA homogenized parameters

Conclusions

■ WEAVE OCs

- High completeness on a limited number of clusters:
 - Internal kinematics
 - Halos
 - Tidal tails within 2 degrees
 - Chemical tagging (similar selection function)
 - Stellar evolution
 - Small number of star forming regions

■ WEAVE+SPA synergy

- Outer disk sampling
- **High legacy value** complementing Gaia-ESO, Gaia, ...