WEAVE @WHT

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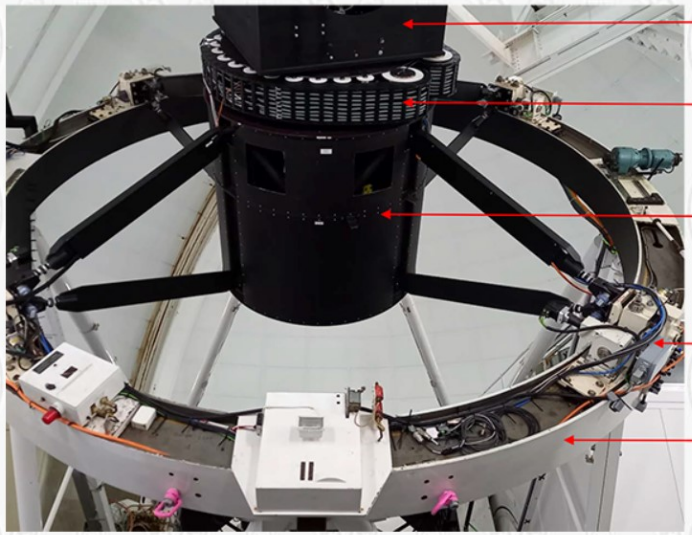
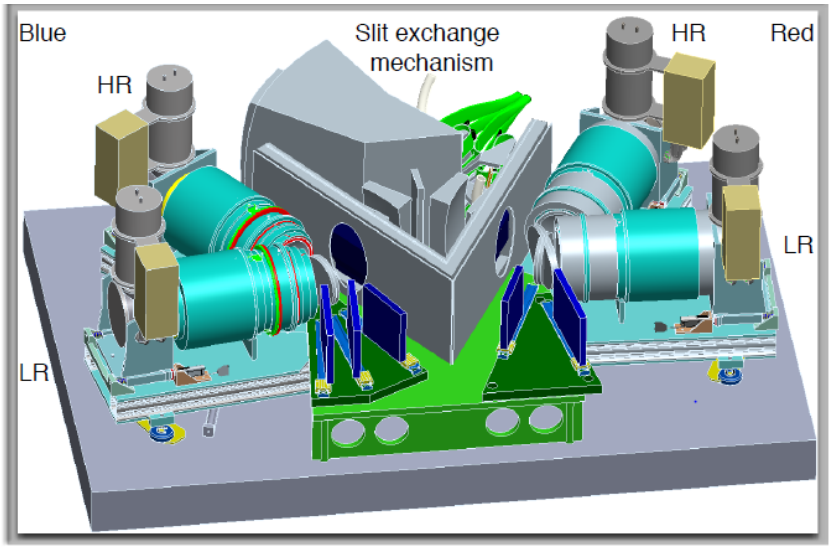
WEAVE Project

- Three sub-units
- WEAVE-0: the Instrument (A.Vallenari)
- WEAVE-1: Galactic Archaeology (A. Vallenari)
- WEAVE-2: The Galactic Plane (M. Guarcello)
- WEAVE-3: Extragalactic Surveys → A. Iovino

WEAVE@WHT



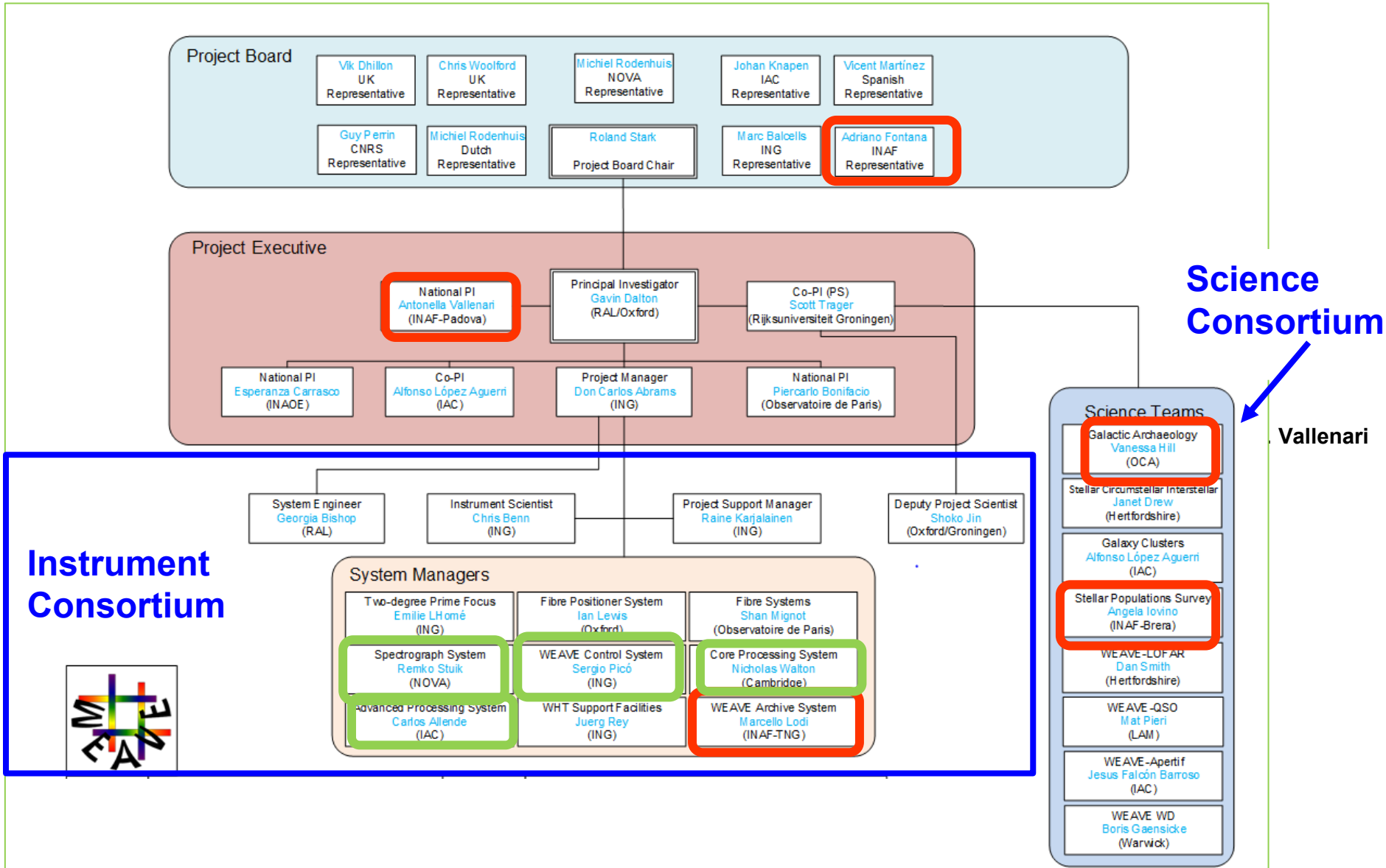
- WEAVE : only HR multifiber in the Northern Hemisphere for Surveys
- First idea 2010 (ING call)+ ASTRONET
- 2 deg diameter
- HR(R=20000); LR(R=5000)
- Blue(Green)+Red ;4040A-6850 A
- 960 fibers x field (Plate A &B)
- miniIFU (790fibres)+LIFU(589 fibre)
- 30% open time
- Competitor MSE (11.5m) in 10 yr time



Project Status:

- -Corrector mounted and tested
- -Spectrograph mounted
- -Fibre positioner at ING under tests
- -First light: September 2021
- -5(+2) y surveys

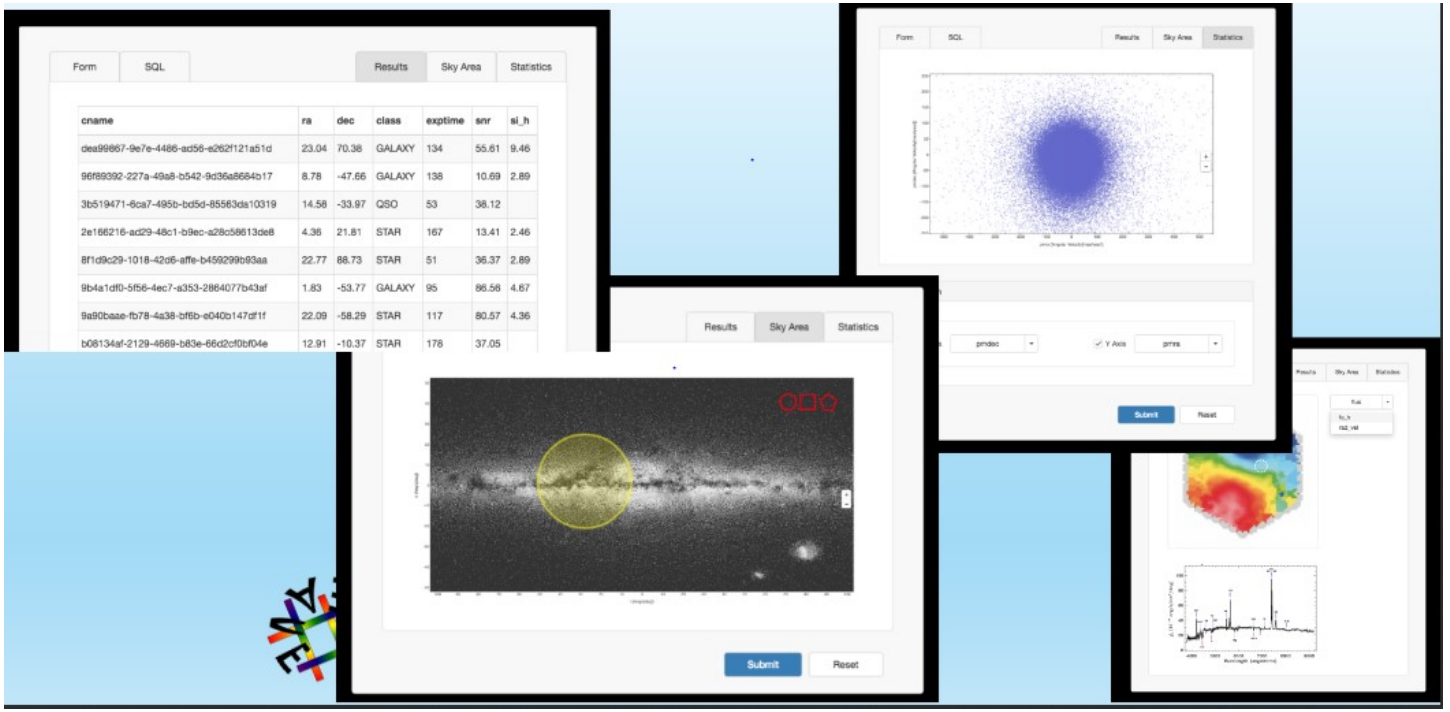
Project structure



Italian participation & Leading roles

- Contribution to the corrector lens polishing
- → A.Bianco
- low level spectrograph control software →A. Baruffolo, B. Salasnich
- design and implementation of the user archive at TNG (WAS) (Managers : E. Molinari, M. Lodi, collaborators: J. Guerra, J. SanJuan, N. Hernandez)
- WAS Archive scientist: D. Bettoni
- 3 pipelines for the analysis of the chemical abundances in
  - FGK stars (C. Boeche)
  - Young stars (A. Frasca)
  - n-capture elements and Li (L. Magrini)

WEAVE Archive@TNG

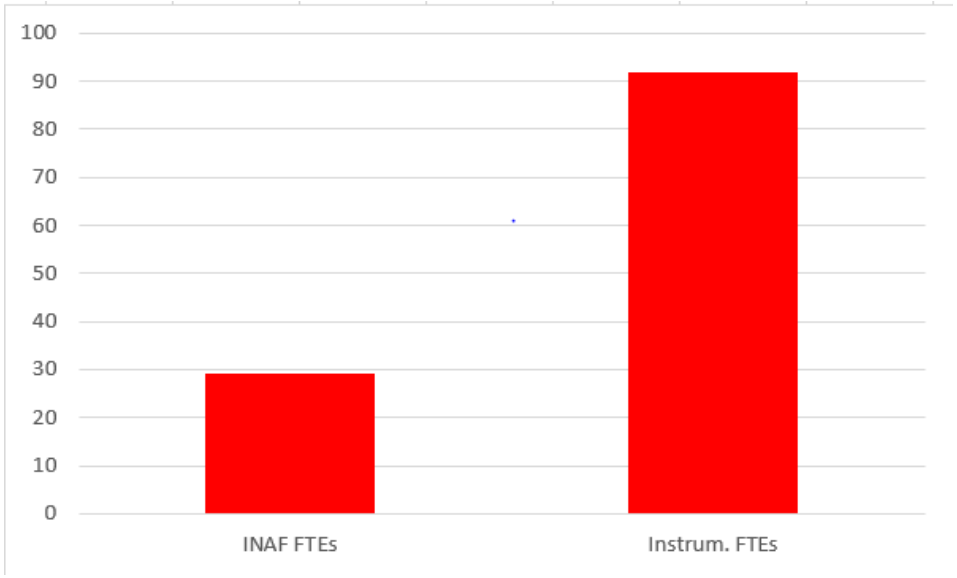


WAS is the interface between WEAVE and the scientific community.

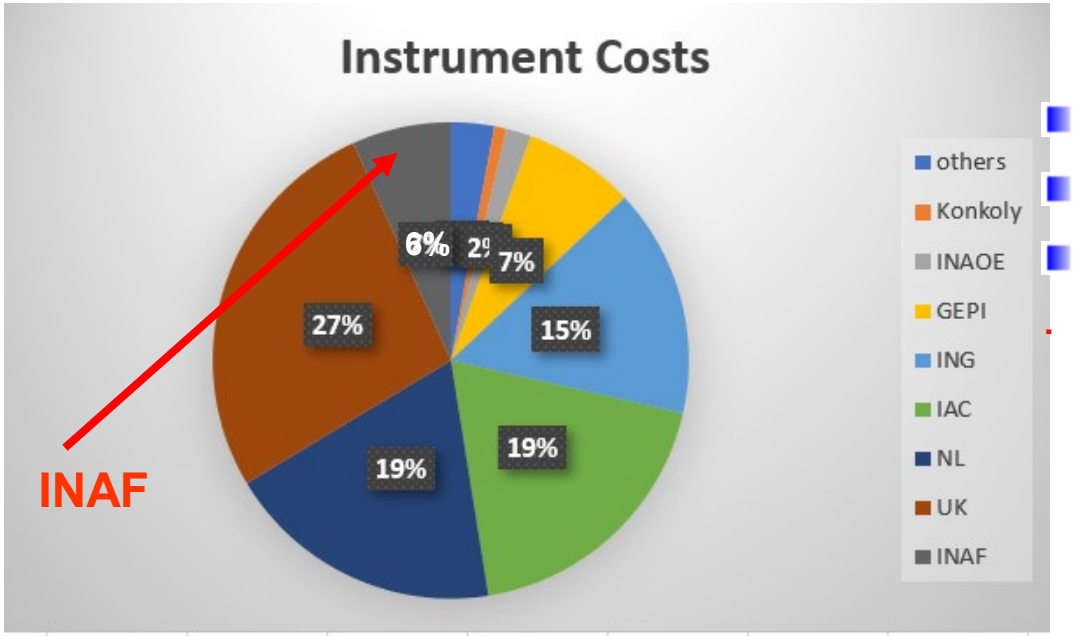
- Supported by Ingesting raw data & metadata including community pipelines
- User interface allowing quick view, queries, Bulk downloads, VO
- Supporting internal and public releases
- Including open time data
- backup in IA2

Instrument Consortium: Italian participation

- INAF contribution to the Instrument Consortium is at 50% staff



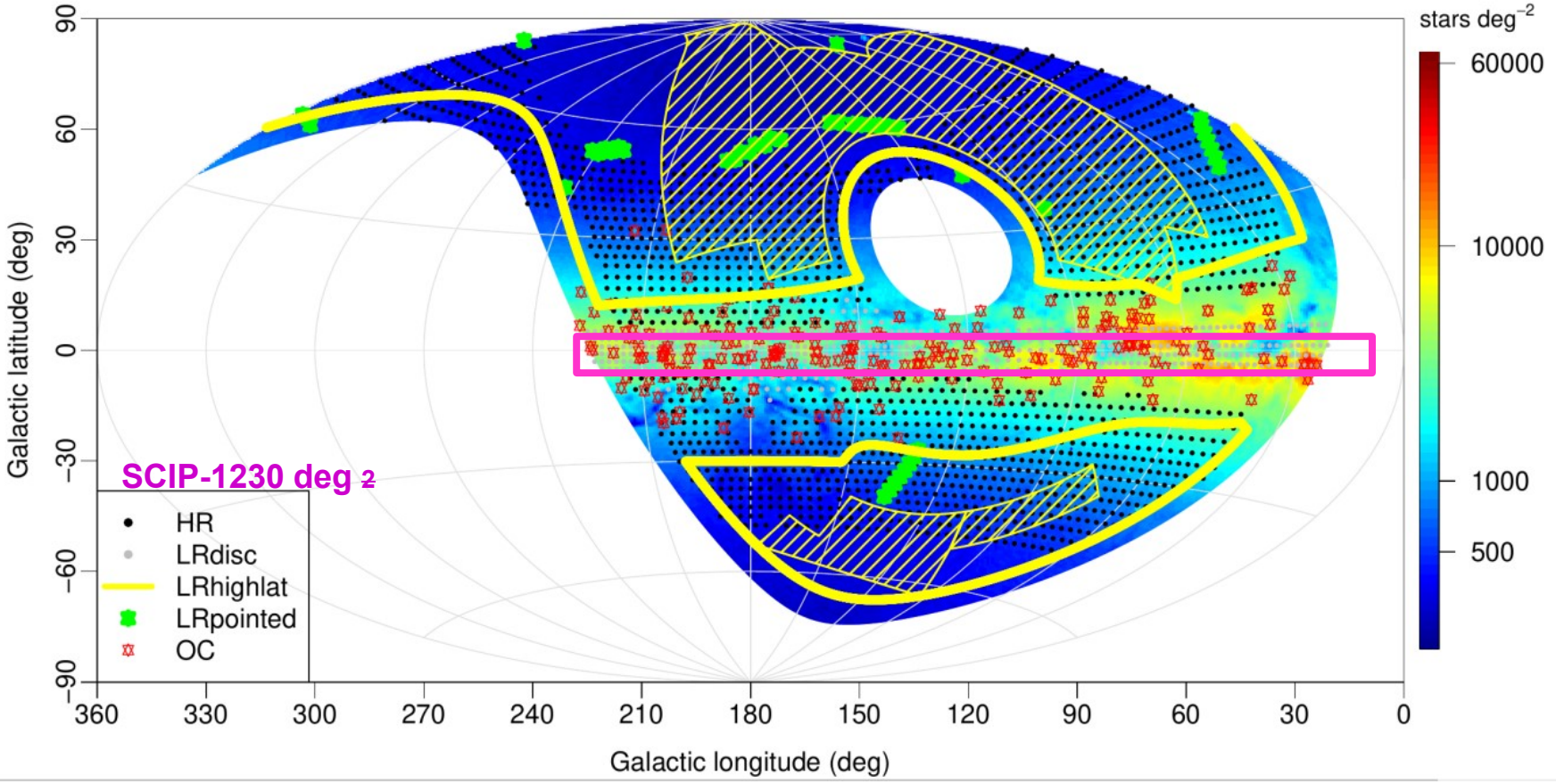
Funds & Critical issues



- Period 2014- 2026
- Total cost : 25,000 KE
- INAF funds to 2020: 1550 KE

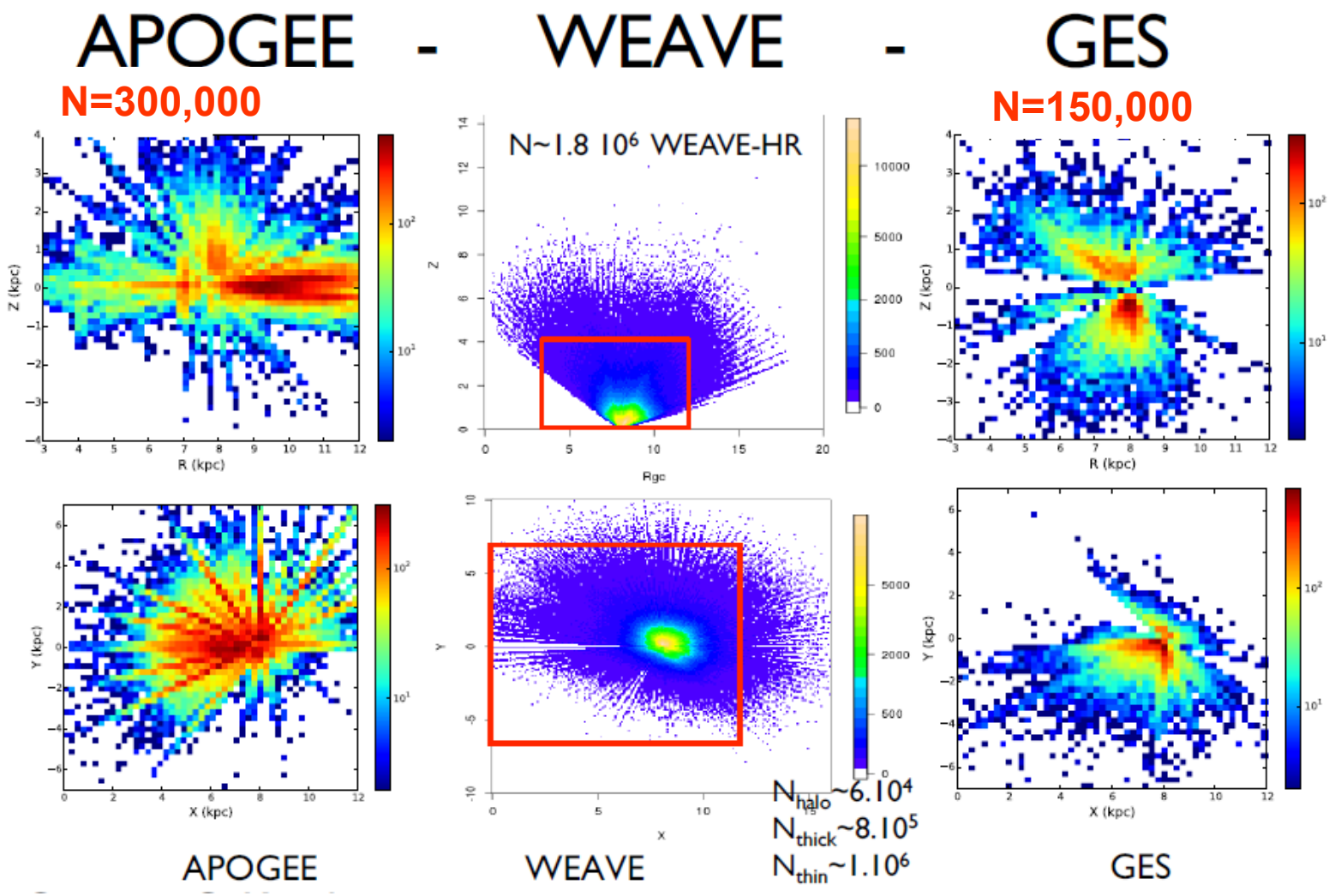
- Good point: A very open data policy
- Future activity &Critical issues:
  - the WAS run, maintenance and upgrade at TNG and data backup in Trieste: Hardware & staff support for 10 years for the Consortium and open time proposals
  - WAS first 2 year non-staff dedicated support + hardware upgrade
  - Maintenance of the 3 pipelines (including non-staff positions for 5(+2) y) (see GA)

The spectra machine: Galactic surveys (Schede WEAVE-1-2)



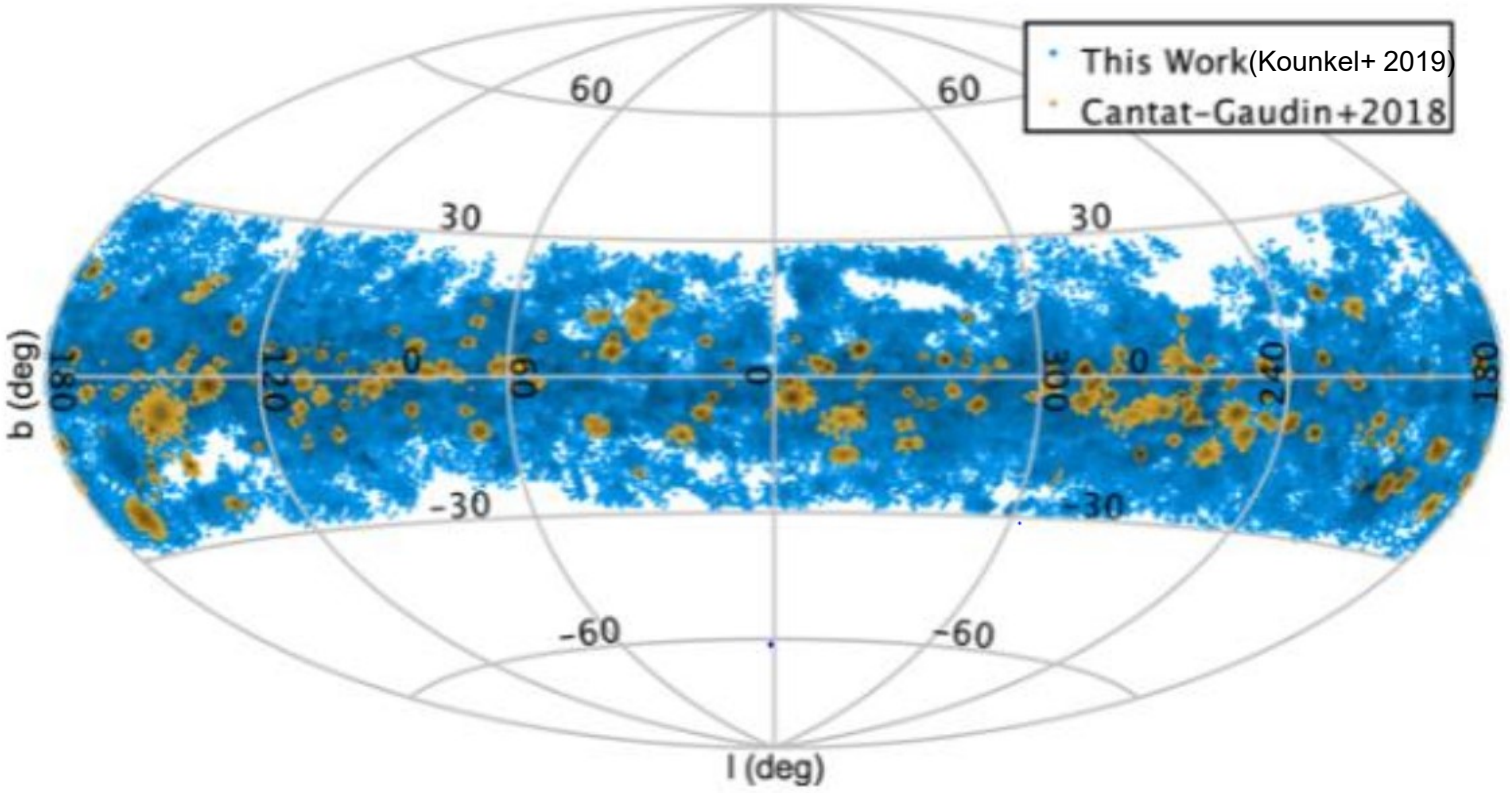
- To complement GAIA & 4MOST & MOONS (South); next competitor MSE in 10 yr time
- The only HR Northern Multiplex, anticenter
- 5 million spectra in 5 years in HR & LR
- More than 300 clusters (OC); young stars in clusters and diffuse envronment (ScIP)
- [Fe/H] uncertainty of 0.1-0.2 dx; + chemical elements from different channels(including community pipelines)

WEAVE HR in contest



+ GALAH : 600,000 stars

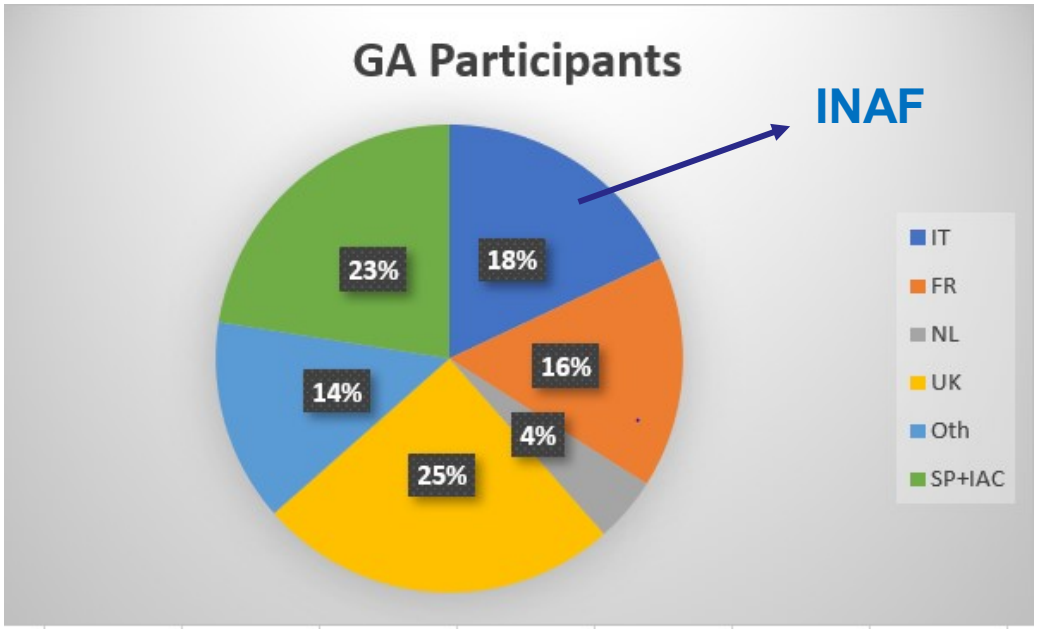
The OC Survey



- OCs trace the Galactic disk
- →only 10% have HR spectroscopy
- Italian Contribution is built on the success of GES
- This survey will increase of a factor 3 the number of HR OCs

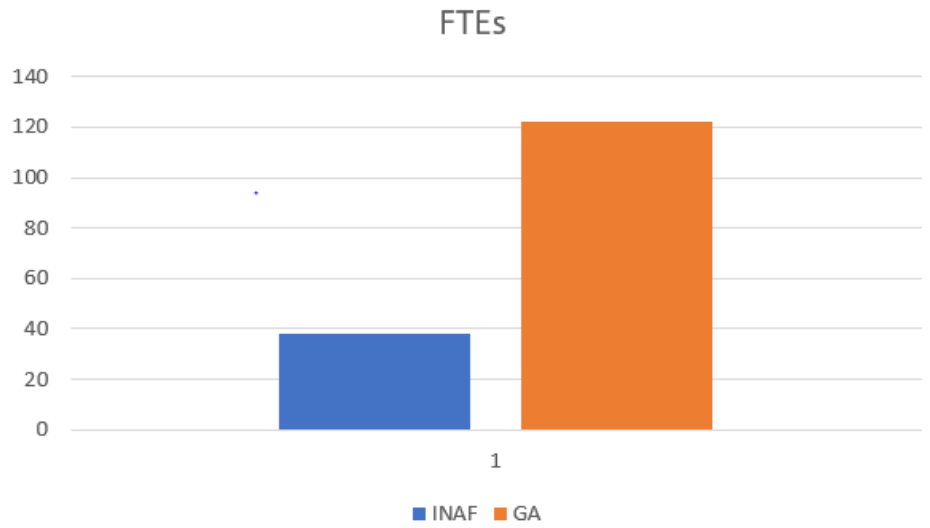
GA Italian Team

- GA: 36 people in 7 Observatories (Padova, Bologna, Torino, Firenze, Palermo, Trieste, Catania) + 7 Universities
- We will contribute with at least 3FTE/y from 2021 to 2023, but it will increase



- Total FTEs (2014-2026) 38
- Total GA FTEs: 122

OC is 28% of GA
INAF is 78% of OC survey



GA Leadership

- PI& Co-PI OC survey (A.Vallenari, A. Bragaglia) ;
- PI calibration, with the goal of providing parameter and chemical abundances homogenization (S. Lucatello).
- target selection(A. Vallenari);
- preparation of the observations (responsibility of the Survey Working Group, A. Bragaglia);
- quality assurance and validation (R. Carrera);
- In addition, we provide to the consortium 3 pipelines, to derive detailed chemical abundances for specific objects and chemical elements not derived by the official WEAVE pipeline,
  - SpAce (12 chemical elements for FGK stars, C. Boeche);
  - young star pipeline (A.Frasca)
  - Li and n-capture element pipeline(L.Magrini).

SCIP (WEAVE-2)

Team: M. G. Guarcello (coordinator), L. Prisinzano, R. Bonito, F. Damiani (from OAPa) and A. Frasca (from OACt) are involved in the sub-project SCIP/YSOs. They are involved in critical tasks including quality assurance.

Goal: study young stellar objects (YSOs) in the Galactic plane brighter than 17.5 in the Gaia G magnitude, both considering stars in young (<30Myrs) clusters within 2kpc from the Sun and affected by moderate extinction, and YSOs in the diffuse medium.

Leadership:

- YSO pipeline (F. Damiani). The team has developed specific software in the framework of the Gaia-ESO Survey that will be run on the YSO WEAVE data

Activity

- YSO target selection
- spectra analysis (physical parameters, disk activity). compare results with cluster early evolution theory

GA &SCIP: Future activity

- Science verification: Oct-Nov 2021

(will be released “soon” and produce first papers; OC, calibration have science verification cases)

- The data releases are expected to be the first after 2 years from the first observations, and then every year.

- Whole project Activity:

  - Target selection and OB preparation: every 3 months (PI+SWG)
  - Validation, support pipeline and CS/CDP output (QAG+Calibration)
  - CDP/CS support
  - WAS support (TNG)
  - Science exploitation

NB: open time proposal data will be processed by the WEAVE pipelines

Critical issues GA & SCIP

- More projects will come in the future (4MOST, MOONS…)
- It collects the interest of a large part of the Italian Stellar community
- We need to sustain the activity of the archive, of the science survey preparation, pipelines to maintain the Italian leadership in the field
- The scientific exploitation requires also special skills in terms of sophisticated algorithms including machine learning. Formation of young people is fundamental
- These activities need financial support (travel, hardware, non-staff hiring)
- These activities would benefit from long-term (TDs) and possibly permanent positions

WEAVE in perspective for ExtraGal astronomy

WEAVE@WHT

a new window of opportunity for some years to come

Only direct comparison: 4MOST
@ Southern hemisphere

Next big step forward will be MSE: 10 mt telescope, 10 years timescale!

Maunakea Spectroscopic Explorer

An ideal instrument

With unique 2D capabilities

mIFU : 20 fibre bundles
each 11" x 12" on the sky

LIFU : a single IFU
1'.5 x 1'.5 on the sky

– ExtraGal

Positive points

Interest shown by a large group of INAF astronomers working on ExtraGal topics

39 INAF colleagues (10 structures)
+
7 Associati INAF colleagues

TOTAL ≈ 5.5 TI FTE/yr in 2021-2023
we expect this number will increase

Team

Team Summary

15. Personale INAF coinvolto

Numero di partecipanti INAF al progetto: 39

Struttura	Nfte	N0	TI 21	TI 22	TI 23	TD 21	TD 22	TD 23	Nex	Extra

Struttura	Nfte	N0	TI 21	TI 22	TI 23	TD 21	TD 22	TD 23	Nex	Extra
O.A. BRERA	3	0	1.30	1.50	1.50	0	0	0	0	0.00
O.A. PADOVA	6	0	1.00	1.10	1.10	0	0	0	0	0.00
O.A. CAPODIMONTE	6	0	1.65	1.65	1.85	0	0	0	0	0.00
OAS BOLOGNA	6	1	0.70	0.70	0.70	0	0	0	0	0.00
O.A. CAGLIARI	1	2	0.00	0.00	0.00	0.10	0.20	0.20	1	0.10
O.A. ARCETRI	2	1	0.30	0.50	0.60	0	0	0	1	0.10
IASF MILANO	1	3	0.10	0.20	0.20	0	0	0	1	0.10
IRA BOLOGNA	0	4	0.00	0.00	0.00	0	0	0	2	0.20
IAPS ROMA	0	1	0.00	0.00	0.00	0	0	0	1	0.10
O.A. ROMA	0	2	0.00	0.00	0.00	0	0	0	0	0.00
Totali	25	14	**5.05**	**5.65**	**5.95**	**0.10**	**0.20**	**0.20**	6	**0.60**

Team

- ExtraGal

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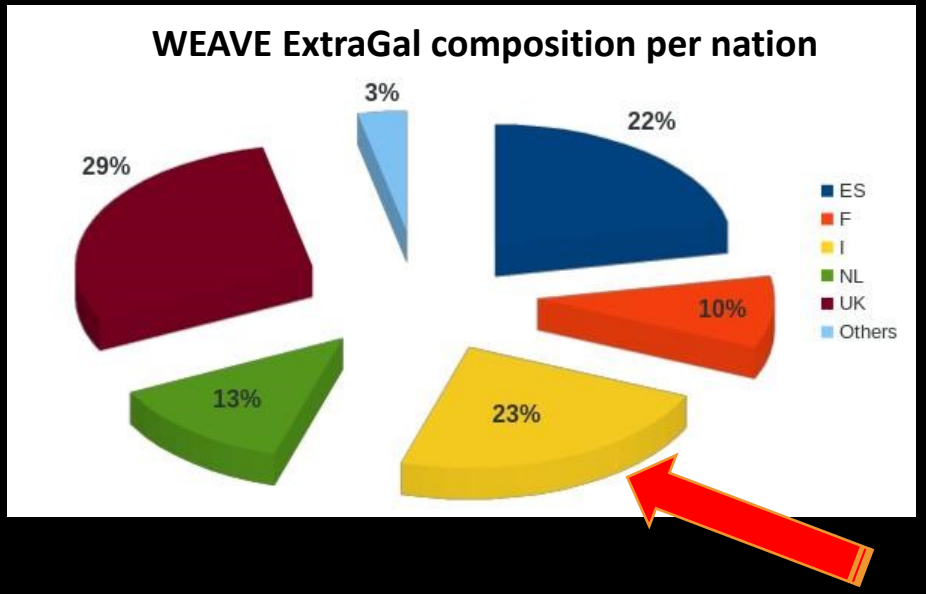


An important percentage of the total ExtraGal WEAVE group

- ExtraGal

Team

Positive points

A variety of ancillary ExtraGal projects all gravitating around WEAVE spectrograph

All in fields where the Italian community expertise is well known and valued

- WEAVE-Clusters
- WEAVE-Apertif
- WEAVE-StePS
- WEAVE-LOFAR
- WEAVE-QSOs

- ExtraGal

Team

Positive points

X-GALCLU

Gal evolution in low-z clusters - synergies with clusters X-ray community

- WEAVE-Clusters
- WEAVE-Apertif
- WEAVE-StePS
- WEAVE-LOFAR
- WEAVE-QSOs

Spectroscopic follow-up of more than 1 million low-frequency radio sources selected by LOFAR - synergies with LOFAR/SKA community

LOFAR-it

resolved/unresolved stellar populations in nearby/intermediate -z galaxies - synergies with radio HI community

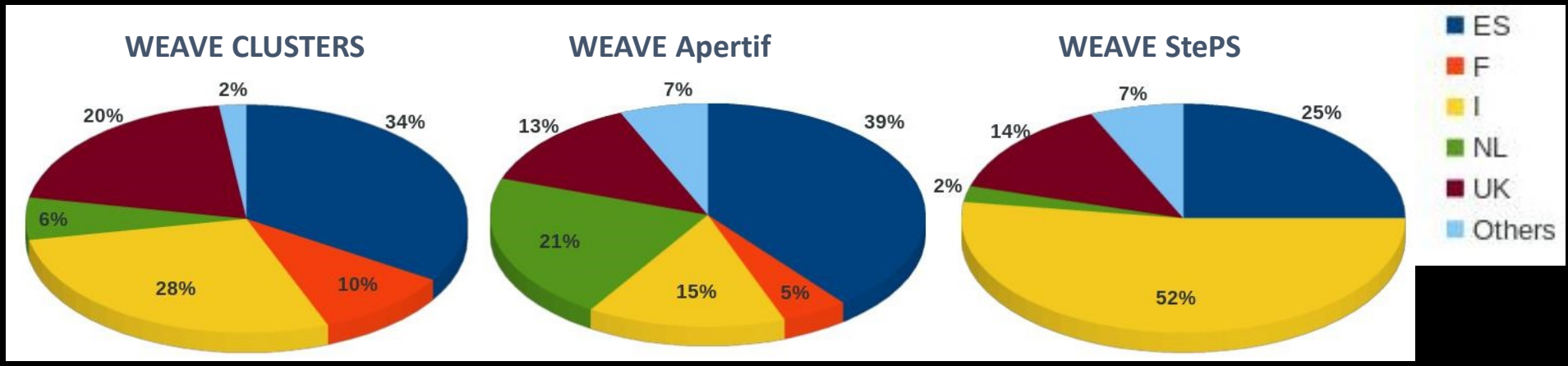
LEGA-C
GAZELLE
GAUSP
MetEvol
Baryonic-Cycling

IGM-CGM medium tomography - LSS and Observational Cosmology

Leadership INAF

- ExtraGal

Larger INAF interest and leading roles in three surveys



Leadership INAF

- ExtraGal

Larger INAF interest and leading roles in three surveys

WEAVE-StePS: PI-ship A. Iovino (with B. Poggianti up to 2019)
Survey Planning A. Mercurio (+ helping to prepare Commissioning OBs)
Quality Assessment Group M. Longhetti, F. La Barbera e S. Zibetti
INAF Target selection group and ancillary data gathering

WEAVE-Clusters: B. Poggianti is co-leading Cluster Infall Regions group
Target selection: D. Bettoni +

WEAVE-Apertif: P. Serra is Core Team member

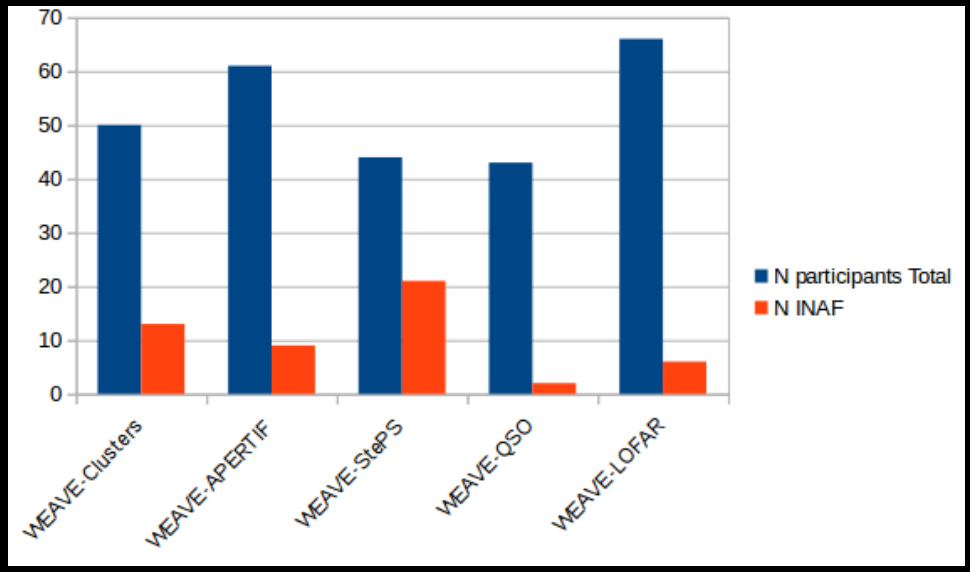
S. Zibetti coordinates and supervises the extra-galactic data-reduction pipeline

D. Bettoni was Science Advisor and Reviewer for the Archive work, now Editorial Board member

Prospettive

- ExtraGal

INAF contribution will probably increase in the near future also for LOFAR/QSO projects …



- ExtraGal

In Numbers:

Funds to WEAVE-ExtraGal 2014- 2020: 100 K€ - both INAF + PRIN-MIUR

INAF funds 2020-2022 35 K€ (WEAVE-Zerbi) + 20K€ StePS Mainstream

Except for WEAVE-LOFAR/Apertif (spin-off of larger projects), all other surveys are WEAVE-only funded.

WEAVE-Extra-Gal request 2 PostDoc/yr 70 K€ /yr
+ usual HW & travel expenses

- ExtraGal Lessons from the past

It has proved difficult to obtain regular INAF funds for PostDocs – only 1.6 years as of today (and in chunks of 1 year, not so attractive), one (only 1) extra year arrived at end 2020 after 1.5 years of funding gap - this has been problematic especially for WEAVE-StePS.

In parallel the APS pipeline - to be provided by the consortium – suffers from under-staffing (0.5 person/yr) and therefore it is still un-tested for its ExtraGal part beyond z estimates – we need to provide support/help – data reduction is crucial for quality of science products.

We are at a critical point – data will start coming soon and we need to be ready, after all the effort spent, to get the appropriate return.

Summary

- *The WEAVE project collects the interest of 79 stellar+ extragalactic INAF staff!*
- *The interest will surely increase once data flow starts*
- *It continues the tradition of surveys with Italian leadership*
- *Clear synergy with future projects (4MOST, MOONS)*
- *The instrument cost for INAF has been relatively modest*
- *Regular investments in the coming years are needed to keep supporting the archive activities and to ensure a satisfying scientific return*