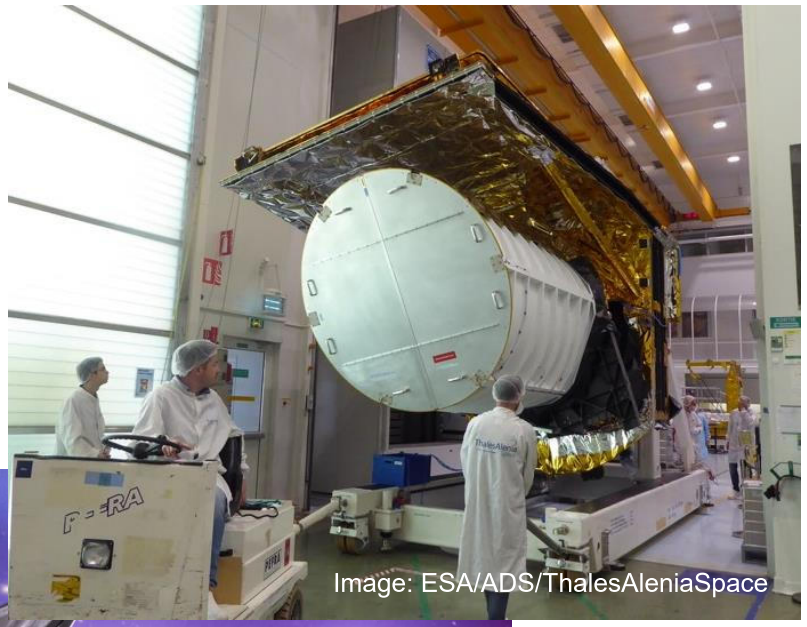
Euclid: contributi italiani alla fase finale di preparazione della missione

A. Di Giorgio

a nome della collaborazione italiana in Euclid

ESA Euclid mission

Started in 2007 with the SPACE proposal (PI: A. Cimatti)
and the DUNE proposal (Co-I: R. Scaramella)
Launch: 2022; 6.5y mission



<u>Spacecraft:</u>
Total Mass - 2 200 kg
Dimensions - 4,5 m x 3 m

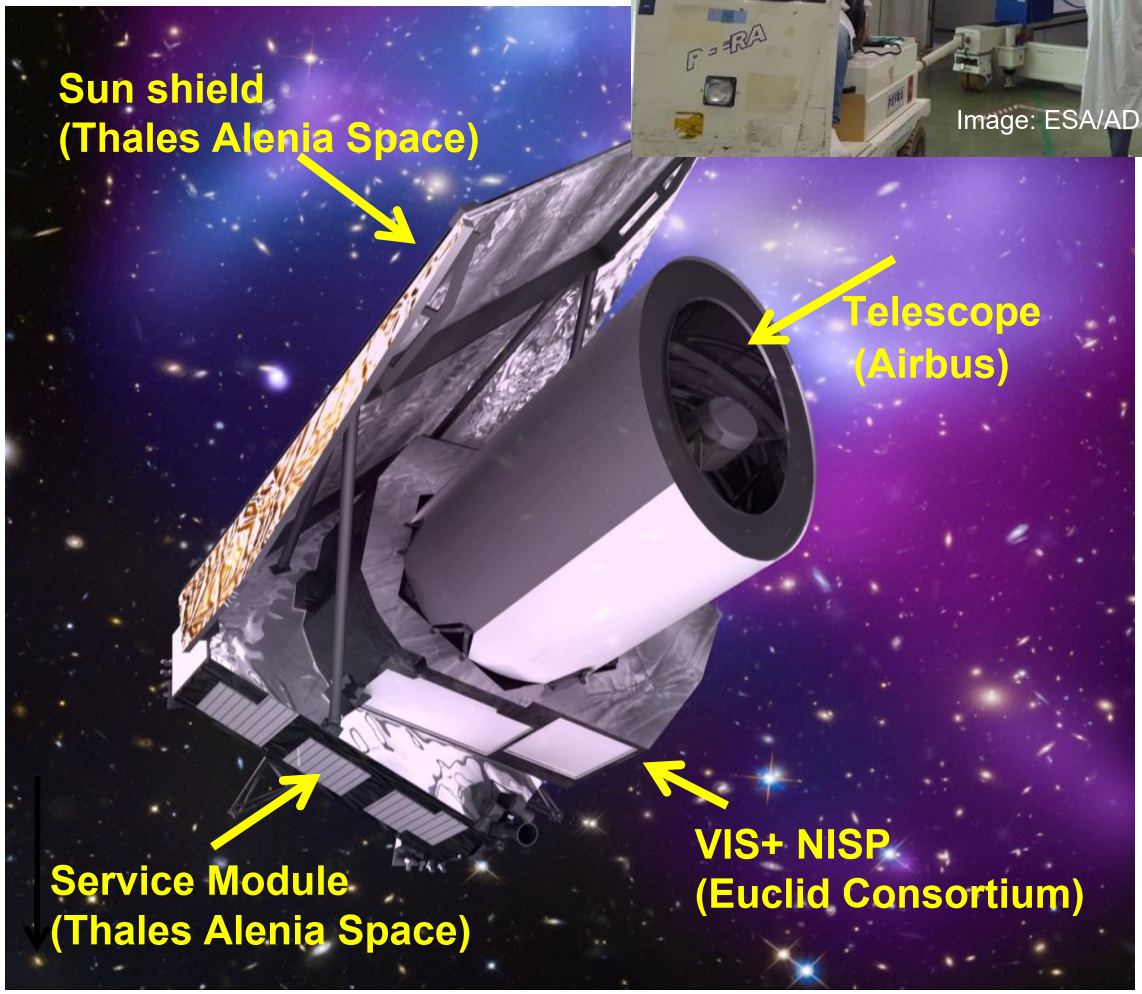
<u>Telescope:</u>
Diameter – 1.2m
Focal length – 24.5m

<u>Wavelength coverage:</u>
Visible – 550-900nm
Near Infrared– 900-2000nm

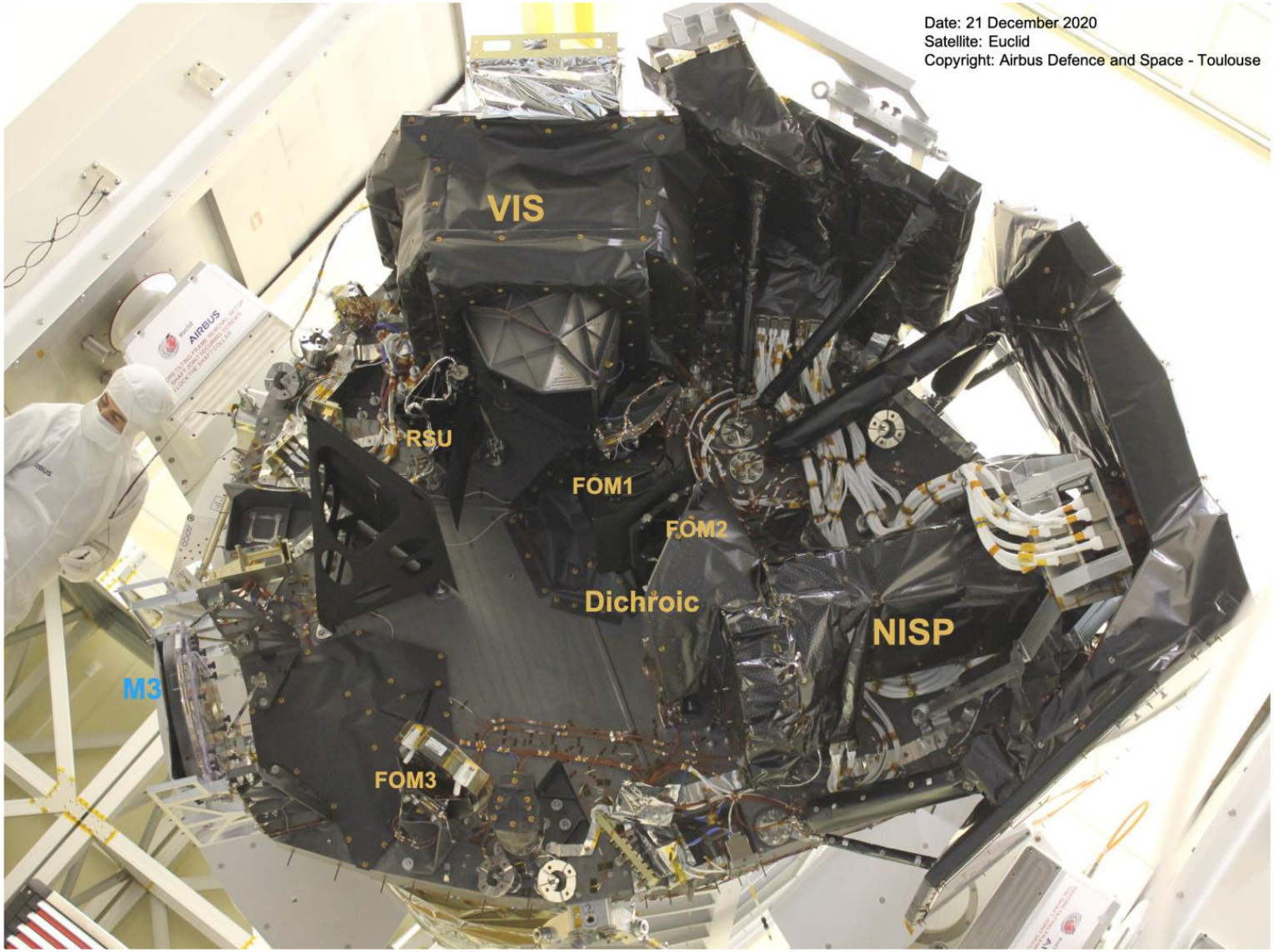
<u>Expected Telemetry</u>:
855 Gbit/day, in 4hrs daily slot

<u>Mission duration</u>:
6 years

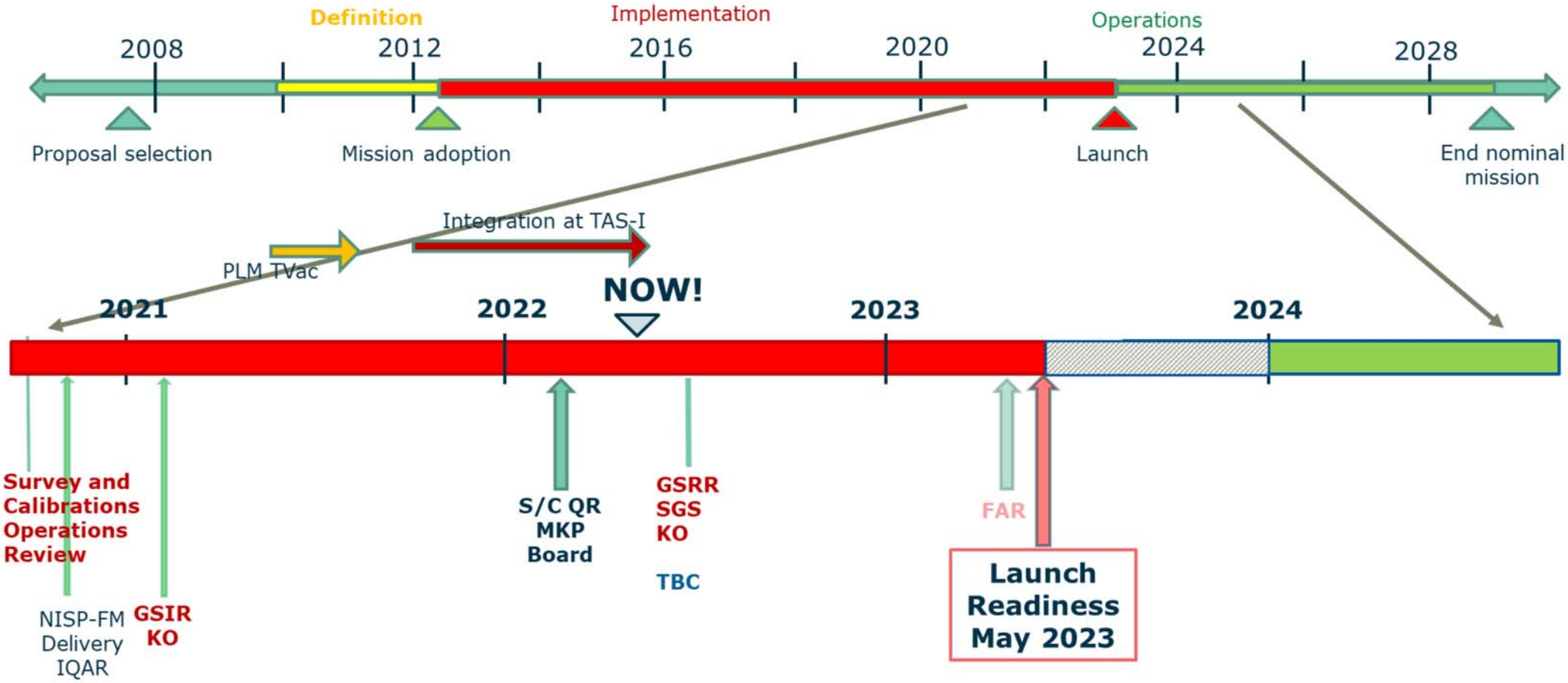
Launch readiness:
May 2023
from the Kourou space port



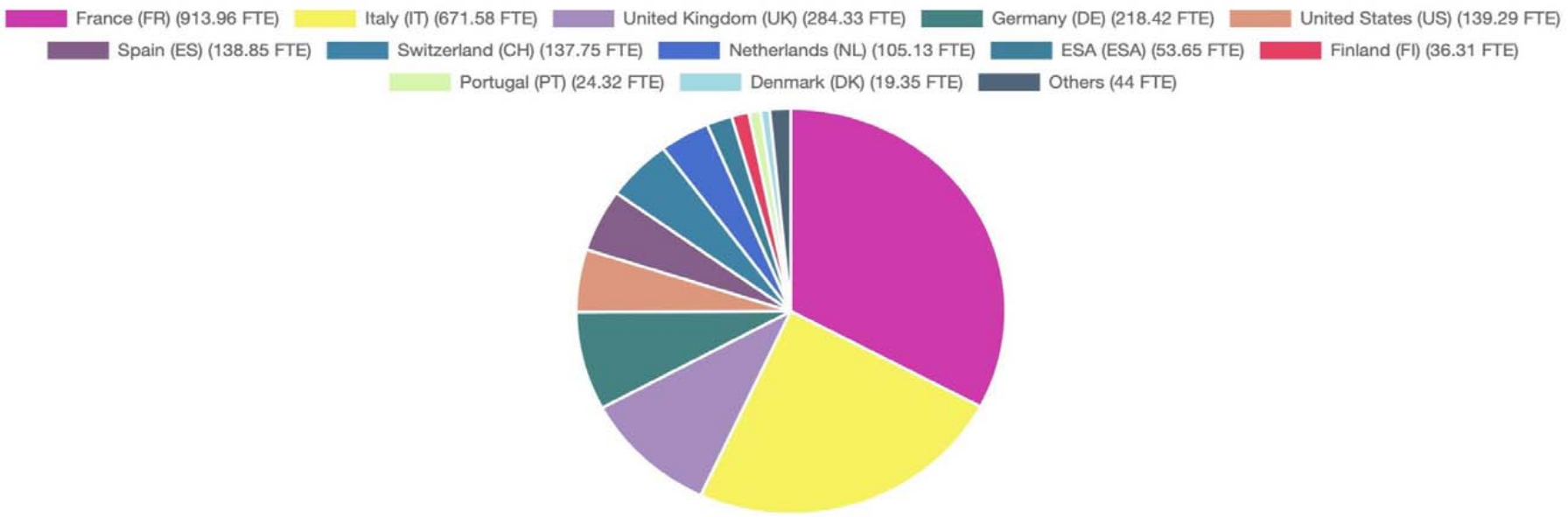
ESA Euclid PLM



Euclid mission timeline



The Euclid Consortium community in 2022



- **17 countries**: AT, BE, CA, CH, DE, DK, ES, FI, FR, IT, JP, NL, NO, PT, RO, UK, US.
- About 260 laboratories, institutions
- 2538 registered « full members » (2370 in 2021) during one/few periods between 2011 and 2022: Registration only validated for applicants using a professional email.
- 1650 currently « active » full members (1500 in 2021)

INAF **highlights** in the Euclid mission

Strong points by INAF

- Scientific leadership in
  - Galaxy Clustering Science
  - Clusters of galaxies
  - Cosmological theories (aka *Theory*)
  - X-CMB
  - Strong lensing
  - Legacy Science
    - Galaxy evolution
    - Local Universe
- Scientific & technical leadership (not limited to Euclid)
  - Space missions system activities
  - Mission survey
  - On-board (real-time) SW
  - Product Assurance
- Science (Science Working Group - SWG highlights)
  - Cosmology
  - Legacy Science
- Science Ground Segment (Science Data Center + OUs)
  - Pipeline development
  - Instrument Operation Team leadership (+NISP and VIS IOT)
- Contribution to instruments
  - 3 On-board Application SWs (VIS CDPU, NISP DPU and ICU)
  - HW (provided by industry with INAF/INFN support)
- Euclid Survey Strategy leadership

La partecipazione italiana in Euclid è finanziata da ASI

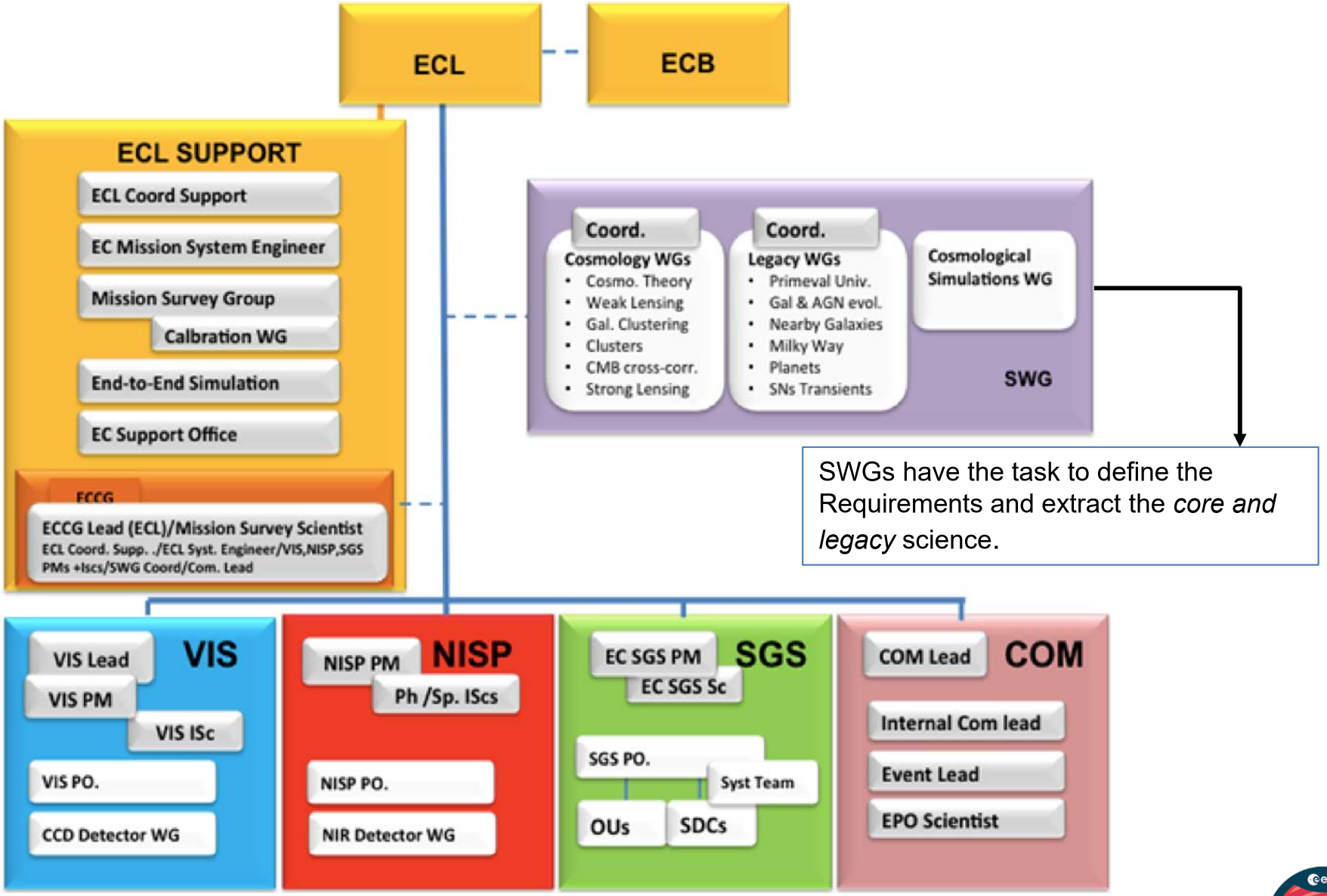
Euclid@INAF

- *132 INAF* (33 FTE/yr + 5) 41>1FTE/3yr
- *62* Associati (12.3 FTE/yr + 1) 12 >1FTe/3yr
- 15 *stabilizzati*
- 12 EC Founders
- 40+ EC Builders
- + altri vincitori concorsi
- + altre persone *formate*

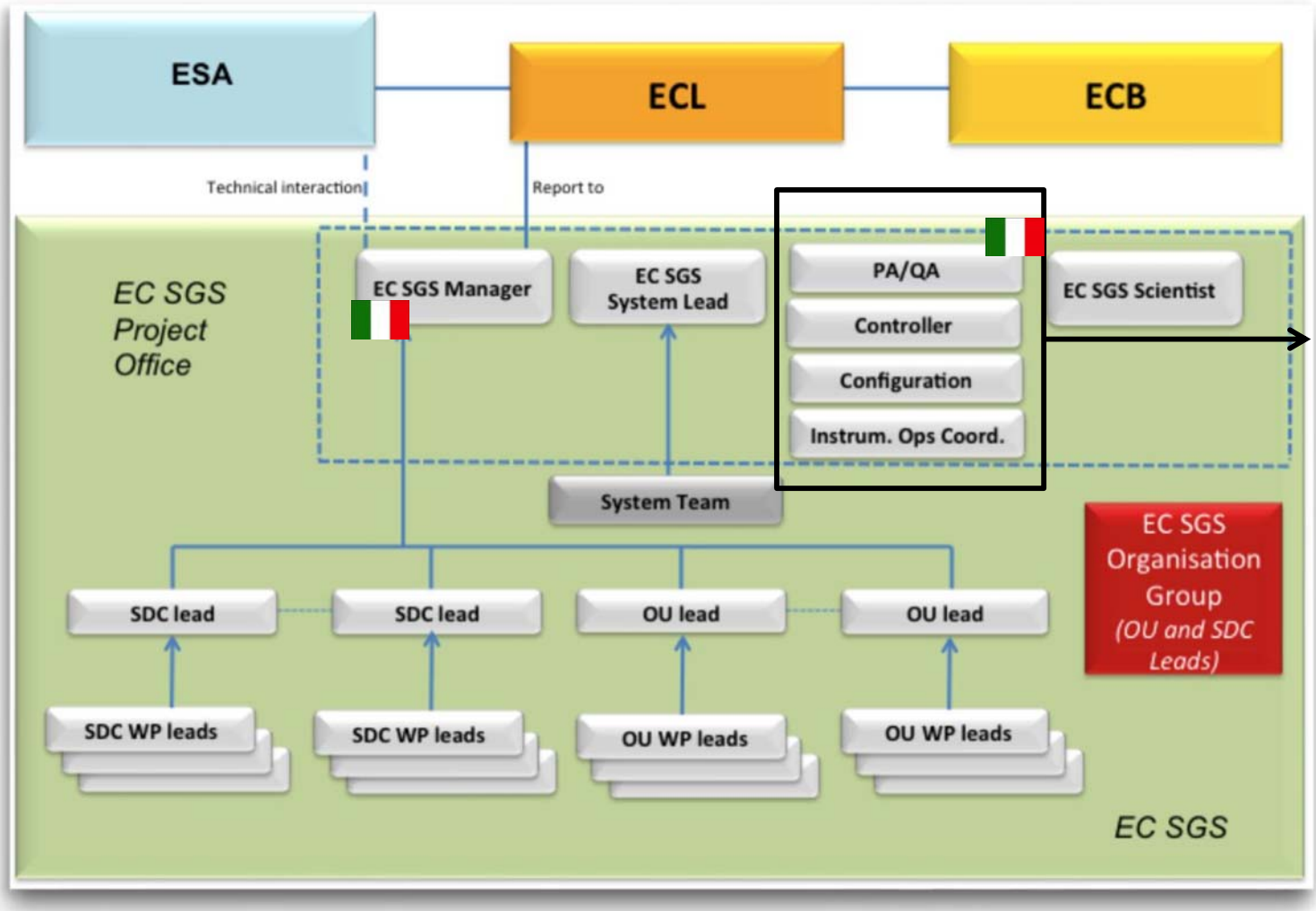
	FTE
OAS BOLOGNA	31
O.A. TRIESTE	24
O.A. CAPODIMONTE	7
O.A. ABRUZZO	1
O.A. PADOVA	4
IASF MILANO	7
O.A. ROMA	8
O.A. TORINO	5
IAPS ROMA	8
O.A. BRERA	4
O.A. ARCETRI	2
NAN	1
IRA BOLOGNA	2
Totali	104

Euclid, come molti grandi e complessi progetti di lunga durata, è una straordinaria palestra di formazione e crescita professionale

The Euclid Consortium Organisation Structure

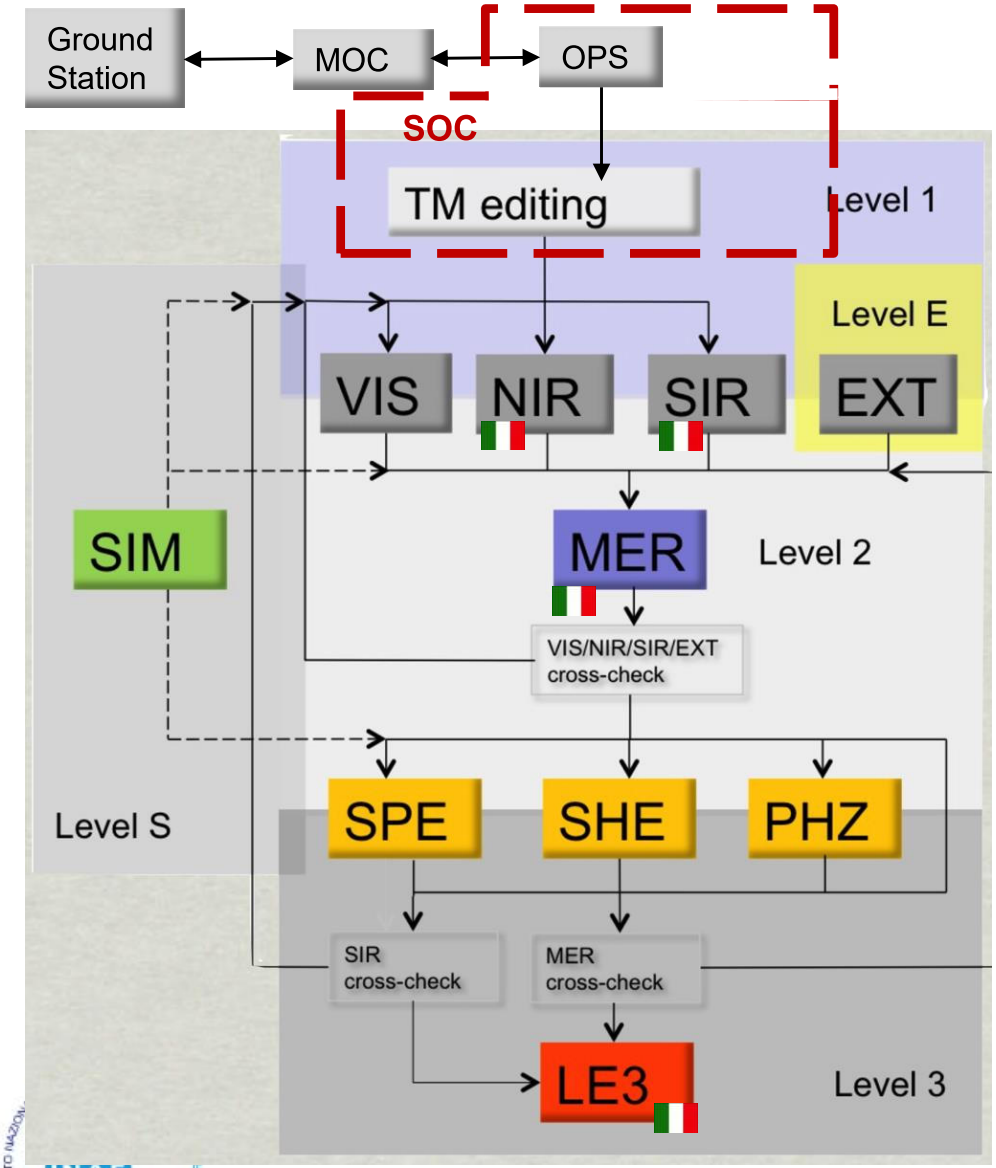


The management structure: SGS



PO support Team
Located in Italy.

The mapping of OUs on the pipeline



- VIS, NIR, EXT: production of fully calibrated photometric exposures from Euclid and ground-based surveys
- SIR: production of fully calibrated 1D spectra extracted from the NISP spectroscopic exposures.
- MER: production of a source catalog containing consistent photometric and spectroscopic measurements.
- PHZ: production of the photometric redshift for all catalogued sources.
- SPE: production of spectroscopic redshifts for all sources with spectra.
- SHE: measurements of galaxy shapes.
- LE3: production of all high-level science products.
- SIM: production of all the simulated data necessary to validate the data processing stages, and to calibrate observational or method biases.

Science Working Groups

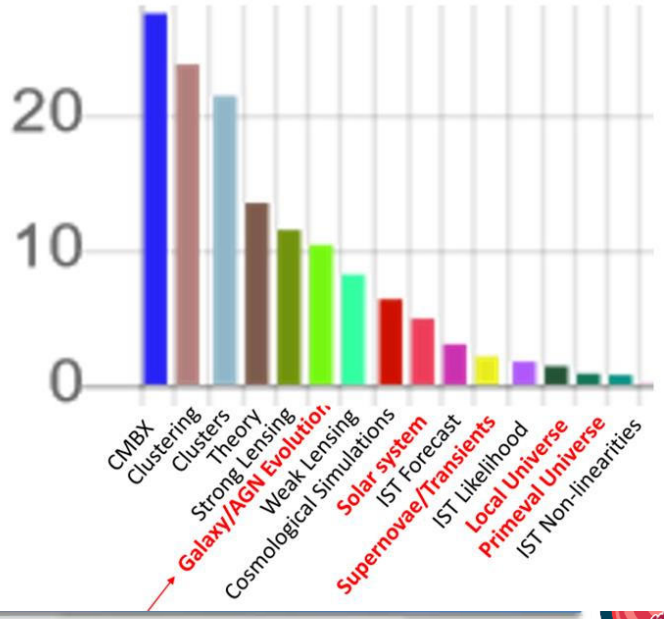
- Weak lensing
- Galaxy clustering
- Clusters of galaxies
- CMB cross-correlations
- Strong lensing
- Cosmological simulations
- Cosmological Theory

- Primeval Universe
- **Galaxy & AGN evolution**
- Milky Way and resolved stellar populations
- **Local Universe**
- **SNe and transients**
- Extrasolar planets
- Solar system objects

Legacy science

Italian contributions to SWG & IST

February 2022



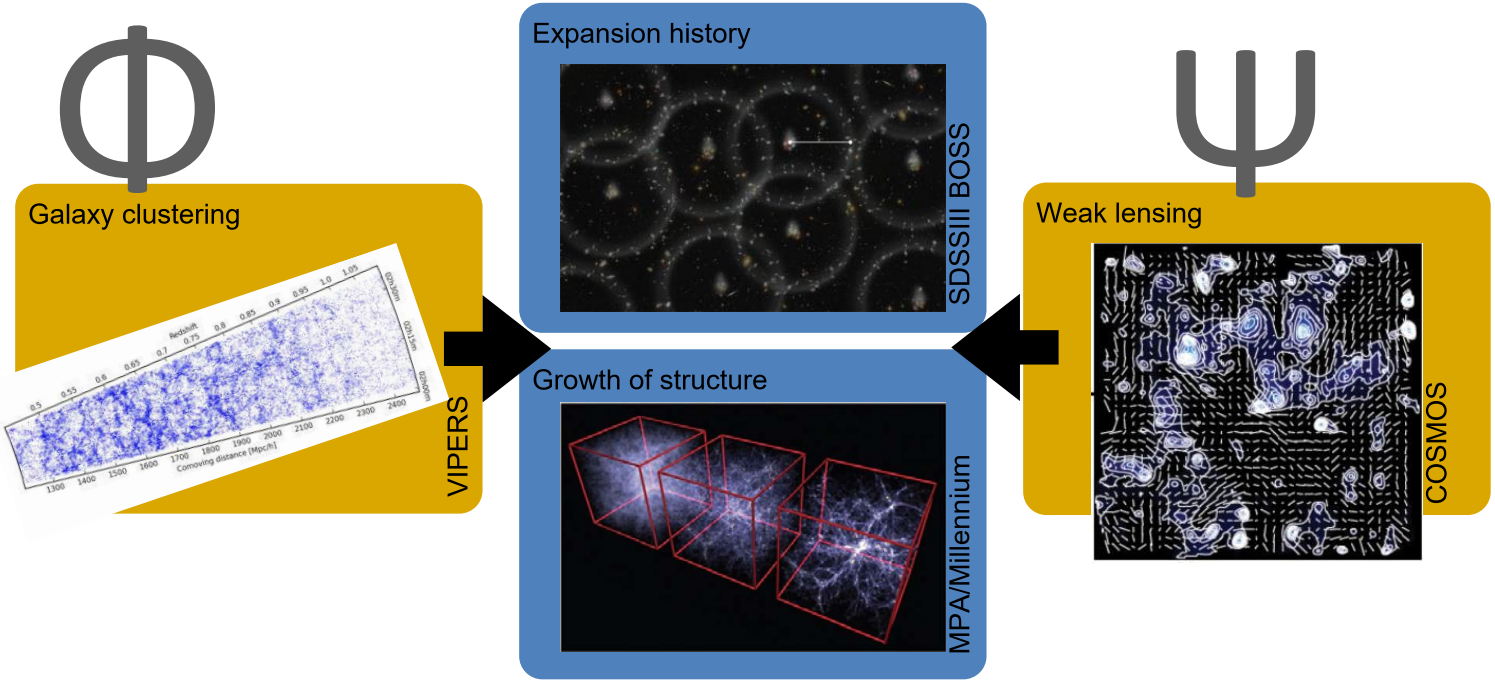
Key Projects (KPs) for the pre-launch phase

A plan as coherent as possible for the overall Euclid pre-launch science.
For each proposed KP, an effort was made as to identify the main SWG where the coordinators of that specific KP should be identified, so that primary responsibility is clear.

Total of 54 KP, 23 with Italian responsibility, 11 with INAF responsible

KP-GC-1	End-to-end galaxy clustering simulations	Sylvain de la Torre	FR	Michele Moresco	IT
KP-GC-2	Galaxy Clustering Systematics	Pierluigi Monaco	IT	Claudia Scarlata	US
KP-GC-3	Baryonic Acoustic Oscillations (BAO) extraction techniques comparison and optimization	Elena Sarpa	FR	Alfonso Veropalumbo	IT
KP-GC-5	Higher-order clustering data analysis and pipeline preparation	Cristiano Porciani	DE	Emiliano Sefusatti	IT
KP-GC-6	Likelihood preparation	Julien Bel	FR	Carmelita Carbone	IT
KP-GC-7	Photometric Galaxy Clustering.	Stefano Camera	IT	Isaac Tutusaus	ES
KP-CL-1	Validation of the Cluster Cosmology Pipeline	Matteo Costanzi	DE	Barbara Sartoris	IT
KP-CL-3	Precision Simulations for Cluster Cosmology	Stefano Borgani	IT	Tiago Castro	
KP-CS-2	Galaxy mock production	Pablo Fosalba	ES	Lucia Pozzetti	IT
KP-GEV-1	Simulated Euclid data for galaxy & AGN evolution	M.Huertas-Company	FR	Margherita Talia	IT
KP-GEV-2	Euclid forecasts for galaxy & AGN evolution	Viola Allevato	IT	Sotiria Fotopoulou	UK
KP-GEV-3	Reconstruction and characterization of galaxy environment .	Manuela Magliocchetti	IT	Jenny Sorce (TBC)	FR
KP-JC-2	Non-linear modelling	Martin Crocce	ES	Carlo Giocoli	IT
KP-JC-3	Likelihood Preparation	Vincenzo Cardone	IT	Shahab Joudaki	CN
KP-JC-6	Simulations & non-linearities beyond LCDM	Marco Baldi	IT	Filippo Vernizzi	FR
KP-JL-1	The Cosmic Dawn Survey	Sune Toft	DK	Giulia Rodighiero	IT
KP-LE3-CL2	Characterization of the properties of detected galaxy clusters	Andrea Biviano	IT	S. Maurogordato	FR
KP-LE3-CL3	Cluster clustering.	Linda Blot	DE	Emiliano Munari	IT
KP-LE3-GC1	3D galaxy clustering in configuration space	Federico Marulli	IT	Matteo Viel	IT
KP-LE3-GC3	Selection Function of the Euclid spectroscopic catalog and its subsamples	Ben Granett	IT	S. Nadathur	UK
KP-LE3-WL4	WL mask	Juan Macias	FR	Elena Zucca	IT
KP-TH-2	Relativistic effects	Daniele Bertacca	IT	Francesca Lepori	CH

Euclid: unveiling gravity and dark energy

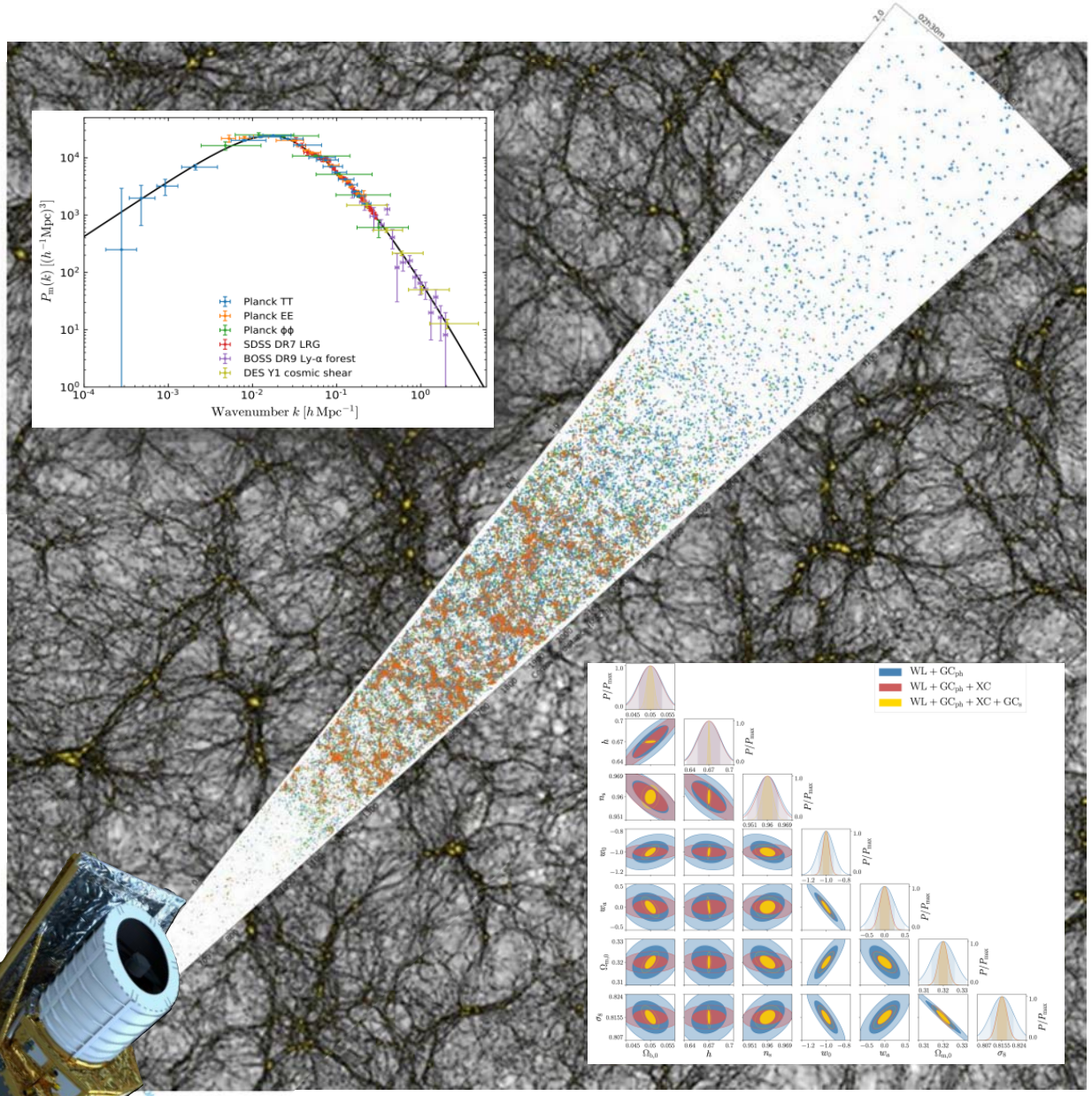


…plus

- Clusters
- CMB cross-correlations
- Strong lensing
- … and more

Slide by B. Granett

Galaxy Clustering Science



Leadership roles:

1) **Science coordination at EC level: ECCG, Science Coordination Group (SCG) & ECEB-ECPG-S** (Guzzo)

2) **a) Galaxy Clustering -SWG coordination** (Guzzo)
   b) 6 GC WP out of 8 with Italian co-lead:
   - WP1: Systematics (Monaco)
   - WP2: end2end (Granett*, Moresco)
   - WP3: Likelihood (Carbone*)
   - WP4: GC Non-linear effects (Veropalumbo)
   - WP5: GC Higher-order (Sefusatti*)
   - WP7: Photo-z WP (Camera)

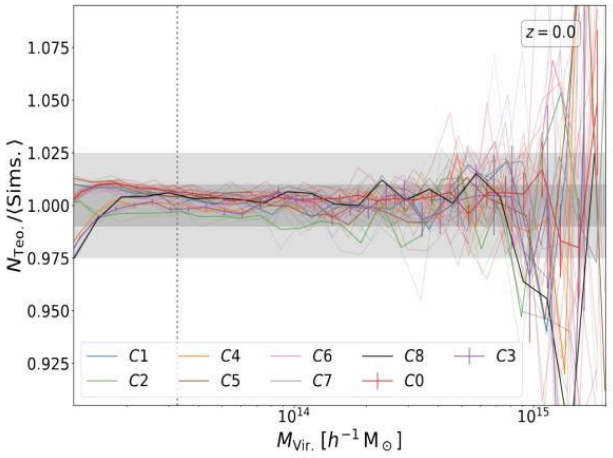
3) **OU-LE3 coordination** (Branchini)

4) **OU-LE3 GC implementation/validation** (Branchini/Viel) and leadership GC-PFs implementation/validation (Marulli, Veropalumbo, Sefusatti*, Rizzo, Moresco, Granett*, Monaco)

5) **Co-leadership of 8 out of 9 Pre-launch Key Projects in GC (GC-SWG + OU-LE3-GC), for a total of 8 Italian scientists (same names as above)**

Clusters of Galaxies

Calibration of the Halo Mass Function

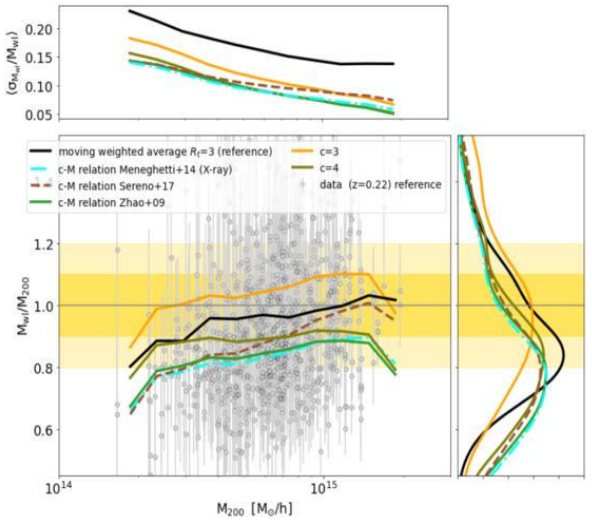


→ ~1% accuracy in the calibration of a Universal HMF

→ Figure showing residuals for different cosmologies:

→ Dependence on: details of halo finder, overdensity threshold

Weak lensing mass bias



<u>Weak lensing mass using different concentration parameterizations:</u>

→ the recovered mass depends on the adopted model for the concentration

→ varying only the concentration the relative uncertainty on the mass is smaller.

Strong Italian involvement:

SWG:

~ 180 members, ~30% Italian

1 Co-coordinator (Moscardini)

11 Working Packages with 8 Italian co-leads (**Mass modelling**: Sereno; **Likelihood:** Costanzi; **Statistics:** Marulli; **Validation:** Bardelli; **Astrophysics**: Ettori; **Simulations:** Borgani, Giocoli; **Protoclusters:** Cucciati).

6 KPs with 4 Italian Leaders (Costanzi, Borgani, Castro, Ettori)

33 pre-launch papers planned

OULE3 Clusters:

1 Co-leader (Implementation: Munari)

15 PFs, 13 of them with an Italian lead (Munari, Sartoris, Andreon, Iovino, Girardi, Sereno, Bolzonella, Zucca, Biviano, Castignani, Marulli, Moresco)

3 KPs with 2 Italian leaders (Biviano, Munari)

10 pre-launch papers planned

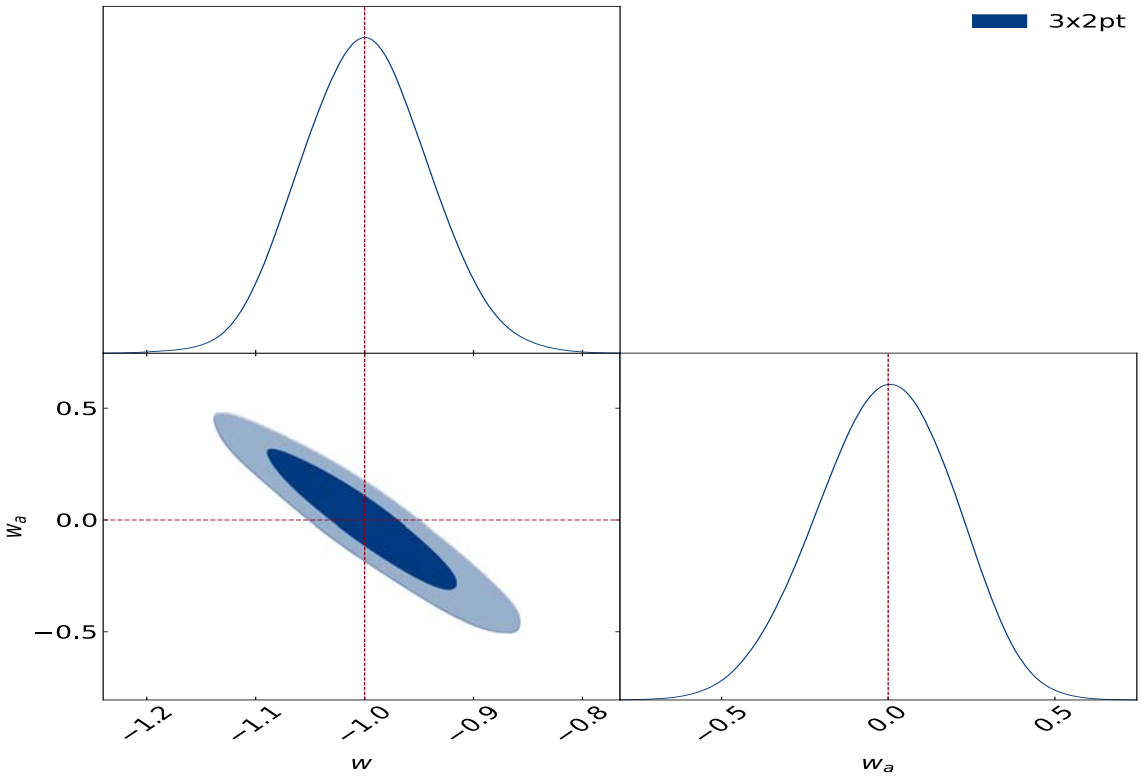
Strong synergy between SWG and OULE3!

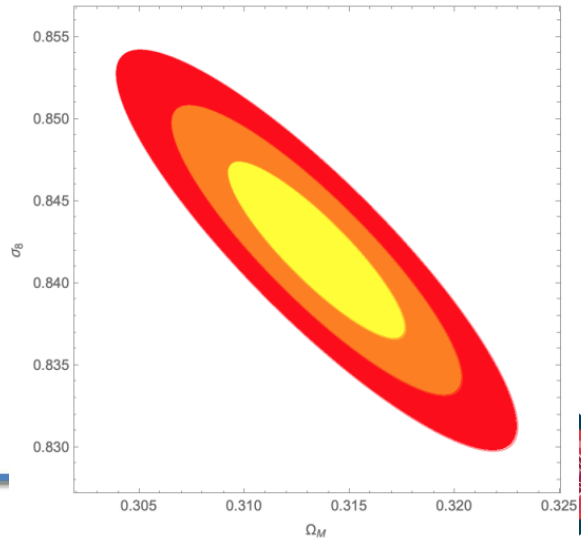
WP-9/KP-CL-3: simulations of galaxy clusters for precision cosmology

S. Borgani, C. Giocoli, T. Castro

Weak Lensing: Likelihood and Higher Order Statistics

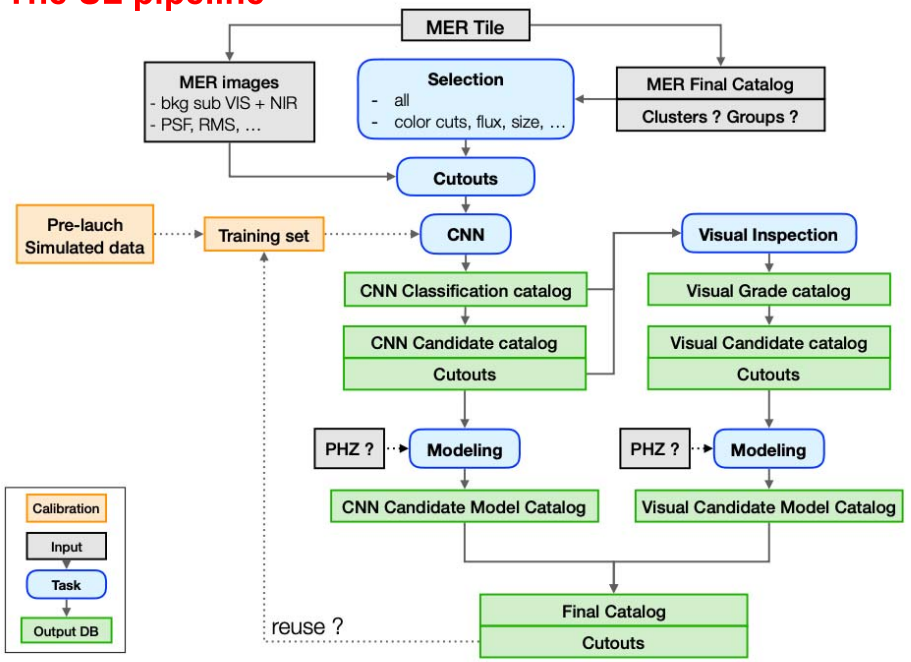
1. Leading IST:Likelihood
   - development of the likelihood code for inferring constraints on cosmological parameters from 3x2pt data
   - CLOE v2.0 to be released on Fall 2022
2. Leading High Order Statistics WP
   - going beyond 2pt probes to improve constraints on cosmological parameters
   - HOWLS project leadership
   - first key project paper soon out
3. Analysis of systematics
   - color gradient bias
   - requirements on photo – z





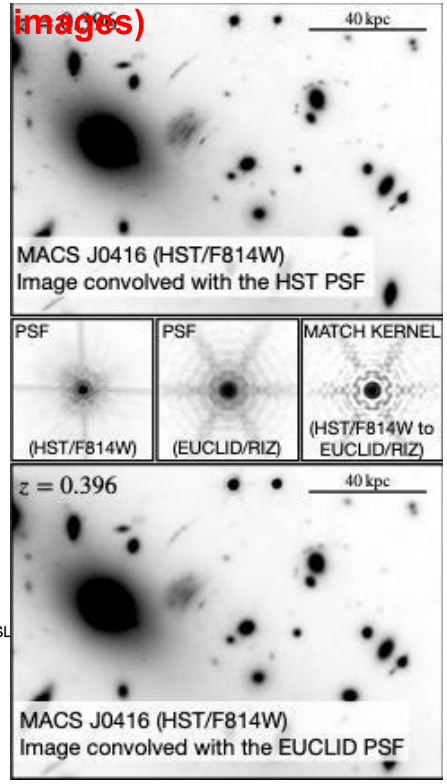
Strong Lensing

The SL pipeline

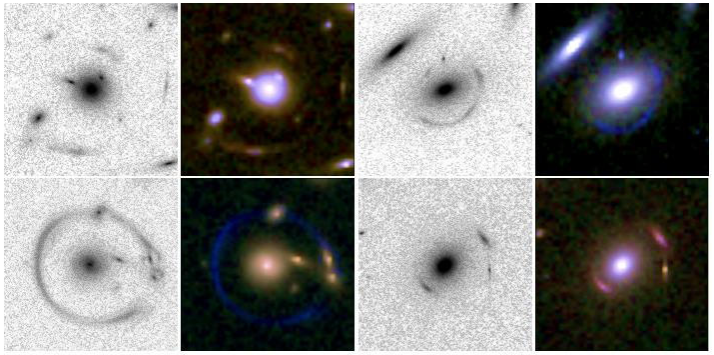


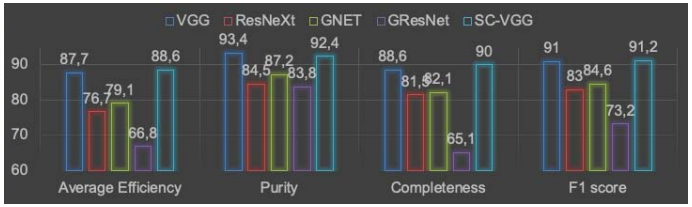
B. Clément - SL

Cluster SLs (Euclidization of HST images)



Simulations of galaxy SLs for the SC8

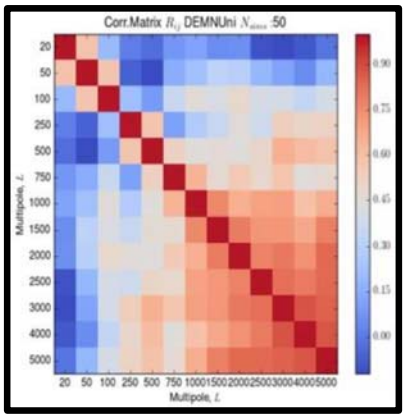




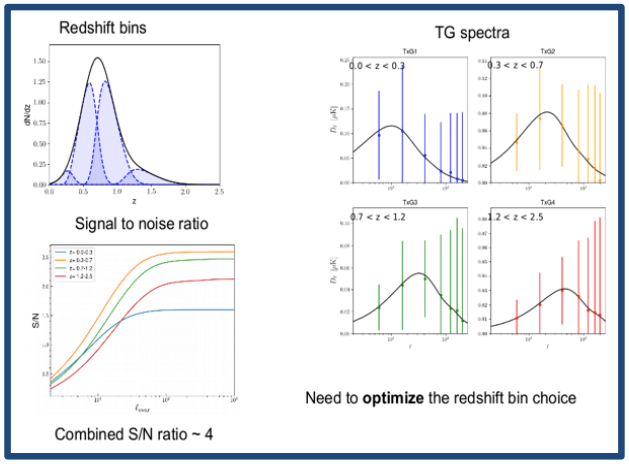
Comparison of deep-learning models to find lenses

- **Team**
  - M. Meneghetti (SLWG lead, INAF-OAS), P. Bergamini (INAF-OAS, UniMI), L. Leuzzi (INAF-OAS, UniBo), G. Angora, P. Rosati (UniFe), B. Metcalf (UniBo), F. Gentile, G. Covone, C. Tortora (INAF-OAC)
- **Goals**
  - Mapping DM in galaxies and clusters
  - Studying the interplay between DM and baryons
  - Constraining the galaxy evolution model
  - Measuring cosmological parameters
  - Probing the nature of DM
- **Ongoing work**
  - Building the SL processing function (supported by OU-SHE-SL)
  - Realistic image simulations to train deep learning models: find galaxy and cluster-scale SLs; quick modelling of lenses
  - Euclidization tool for HST images
  - Automatization of parametric SL modelling of galaxy-scale lenses
  - Improving current parameteric modeling tools for cluster lenses
  - Characterization of deep-learning models to find SLs: the SL selection function
  - Investigating synergies between Euclid and other instruments: designing a follow-up spectroscopic campaigns (4MOST, MUSE)

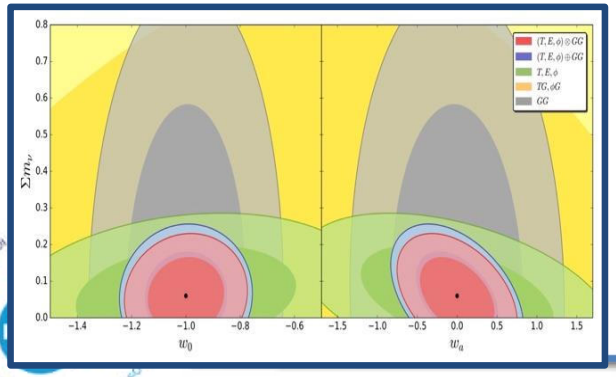
CMBXC SWG



Covariances for CMB Lensing Evaluated over DEMNuni & DUSTGRAIN Euclid N-Body Simulations



Tomographic Analysis and Estimators for Integrated Sachs-Wolfe and Galactic distribution



Constraints on Cosmological Parameters from CMBXC Analyses and Forfecasts

Simulations: national teams lead the development of N-body Simulations dedicated to CMBXC Activities, facing top scientific challenges such as the measurement of observable covariances on simulations (see top Figure).

Estimators: Development of estimators dedicated to the cross-correlation of CMB and Euclid observables.

Likelihood: Development of a likelihood pipeline for CMBXC, based on validated estimators. Will be fully integrated into the Euclid environment, i.e. CLOE.

CMBX science: development of theoretical predictions for the CMB-Euclid cross-correlation and assessment of its relevance alone and in combination with CMB and Euclid information (see Figure at the bottom for the expected constraints on the neutrino mass with dark energy with a redshift dependent parameter of state).

Lead: C. Baccigalupi (SISSA, INAF associate)

@INAF: C. Burigana, C. Carbone, V. Cardone, F. Finelli, A. Gruppuso, D. Paoletti, T. Trombetti

Associates: C. Baccigalupi, M. Baldi, M. Ballardini, N. Bartolo, D. Bertacca, S. Matarrese, P. Natoli, D. Scioti, N. Vittorio

Theory SWG

Purpose

- Prepare beyond-standard analysis; select and study beyond-standard models
- 'Horizon scanning': provide vision for new interesting models & probes
- Support SWG's and IST's for theory

Pre-Launch Key Projects:

KP-TH-1 "Forecasts for beyond standard models in cosmology and fundamental physics"
KP-JC-6 "Simulations and non-linearities beyond LambdaCDM"
KP-TH-2 "Relativistic Effects"
KP-JC-7 "Euclid x Gravitational waves"

10-13 KP papers planned (plus several SP papers) within these KPs.

Organization

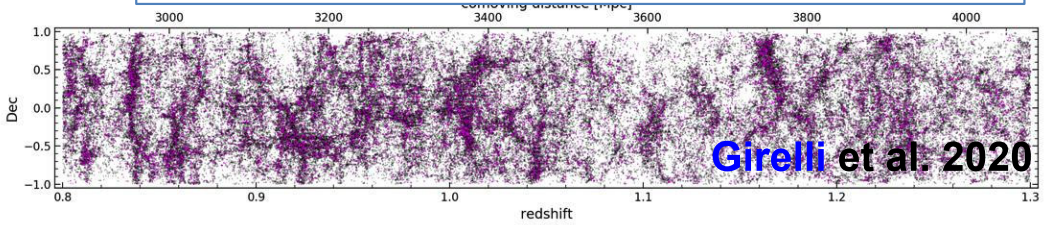
- 10 active Work Packages (more than 1/3 of the leads in italian institutions)
- ~100 active members
- Regular telecons for WP and KP coordination
- Bimonthly SWG general telecons alternate with WP leads telecons
- Annual meetings (in-person when possible)

Co-lead: F. Finelli (INAF)

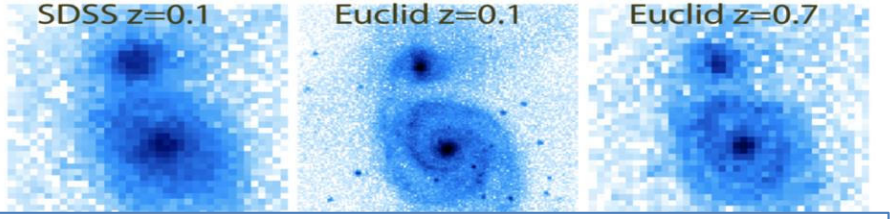
@INAF: V. Cardone, F. Finelli, M. Martinelli, D. Paoletti, R. Scaramella
Associati: M. Baldi, M. Ballardini, N. Bartolo, D. Bertacca, S. Matarrese, M. Viel

Legacy Science with Euclid

Simulation of Euclid Wide survey at z~1 (H<24)



- **The three-dimensional map of the cosmos** produced by Euclid will provide a unique Legacy value to reconstruct galaxy evolution over about 10 billion light-years and **covering at least half the sky with exquisite resolution.**



Euclid @ z~1 will give similar images to SDSS @ z~0.1

- The Euclid database will contain **images and photometry for 1.5 billion galaxies** and **spectra for at least 35 millions of them**, to derive their Physical Properties.

- **INAF** and **INAF's associated** covers leading roles in the Galaxy Evolution (GAEV) Working Group (WG, A. Cimatti), involves several leadership of Work Packages (WPs L.Pozzetti, G.DeLucia, M.Magliocchetti, E.Zucca, V.Allevato, M.Talia , M.Moresco, G.Rodighiero) and related Key Projects (KPs) of this SWG and participates to the Primordial Universe (PU) WG.

- The main science goal is reconstructing the **galaxy assembly history in different environments** and the **connection between galaxies and their dark matter haloes** from **low redshift** to **young primordial epochs**, and deriving the **morphological and physical properties of several millions of galaxies and rare objects**.

DARK

Viola Allevato OACN

Linking Active Galaxies to the Large-scale structure

DARK is a 2 year project (May 2021-2023) **supported by PRIN-INAF 2019,** with the aim of understanding the connection among AGN, host galaxies and dark matter halos by **constructing mock catalogs of AGN to be used to characterise Type 1 & 2 AGN and their large-scale structure in the Euclid Survey.** The project is performed within the **Euclid WP9 "Type 1 & 2 AGN", co-lead by the PI.**

TEAM

		2022	2023
PI: V. Allevato	OAS		
M. Mignoli	OAS		
C. Giocoli	OAS		
I. Delvecchio	OA - Brera		
Total FTE		**1.4**	**0.5**

		2022	2023
E. Lusso	Uni Firenze		
A. Cimatti	Uni Bologna		
S. Gallerani	SNS Pisa		
Total FTE		**0.5**	**0.4**

Fondi a sostegno

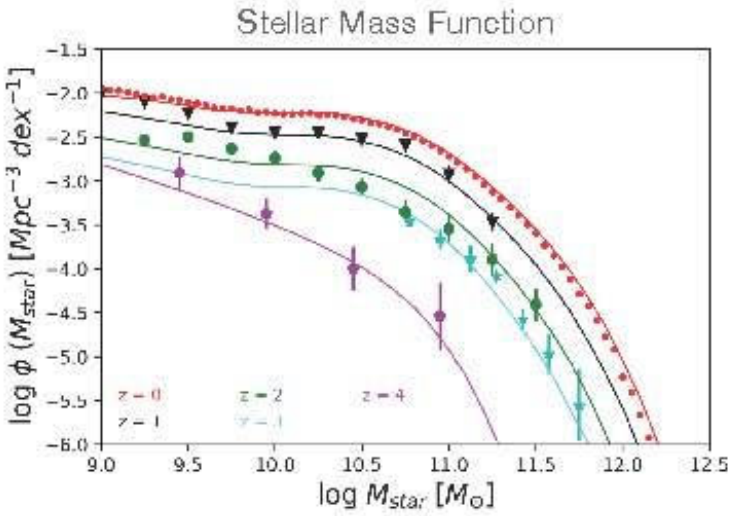
21. Totale fondi a disposizione (dato aggregato, k€)

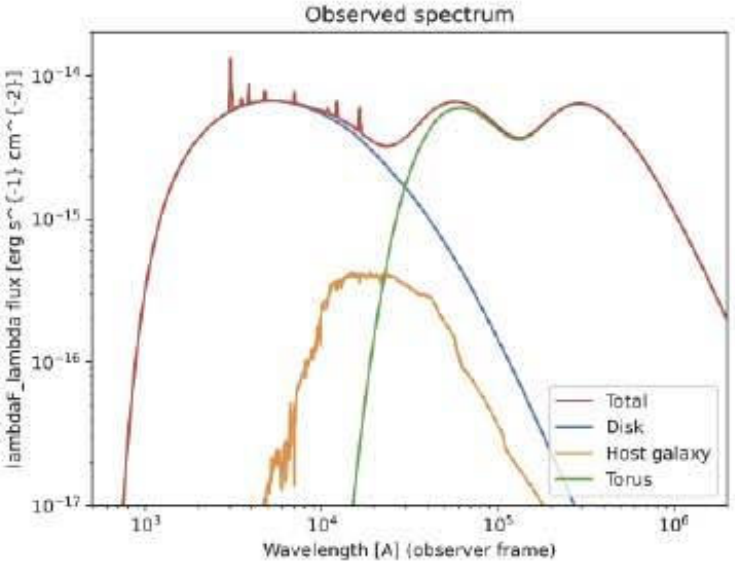
Certi 2022	Certi 2023	Certi 2024	Presunti 22	Presunti 23	Presunti 24
85.0	5.0	0.0	0.0	10.0	10.0

Scientific Aspects

Viola Allevato OACN

- Mock catalogs based on physical relations and on a **few input assumptions** to avoid degeneracy;
- A light-cone of (sub)halos (Giocoli+15) at z<4 (10deg2) is populated with **galaxies and BHs with masses assigned via abundance matching techniques.**
- Our galaxy mocks also include dynamical and structural **galaxy and BH properties** based on empirical relations:
  - Velocity dispersion;
  - Sersic Index;
  - Flag (SF/SB/Q);
  - SFR
  - Luminosity
  - BH mass;
  - Edd. ratio(Mbh,z);
  - Nh (Ueda+14) and Av;
  - Flag Ty1&Ty2
  - AGN luminosity
- **SED assigned to each mock object** (QSFit, Calderone +17). **Magnitudes in Euclid** and LSST bands available for each mock AGN.





Type 1 mock AGN with logMbh [Msun]= 8, with Edd. Ratio. = 0.01 in an elliptical host galaxy at z =1.6.

Results & Schedule

Viola Allevato OACN

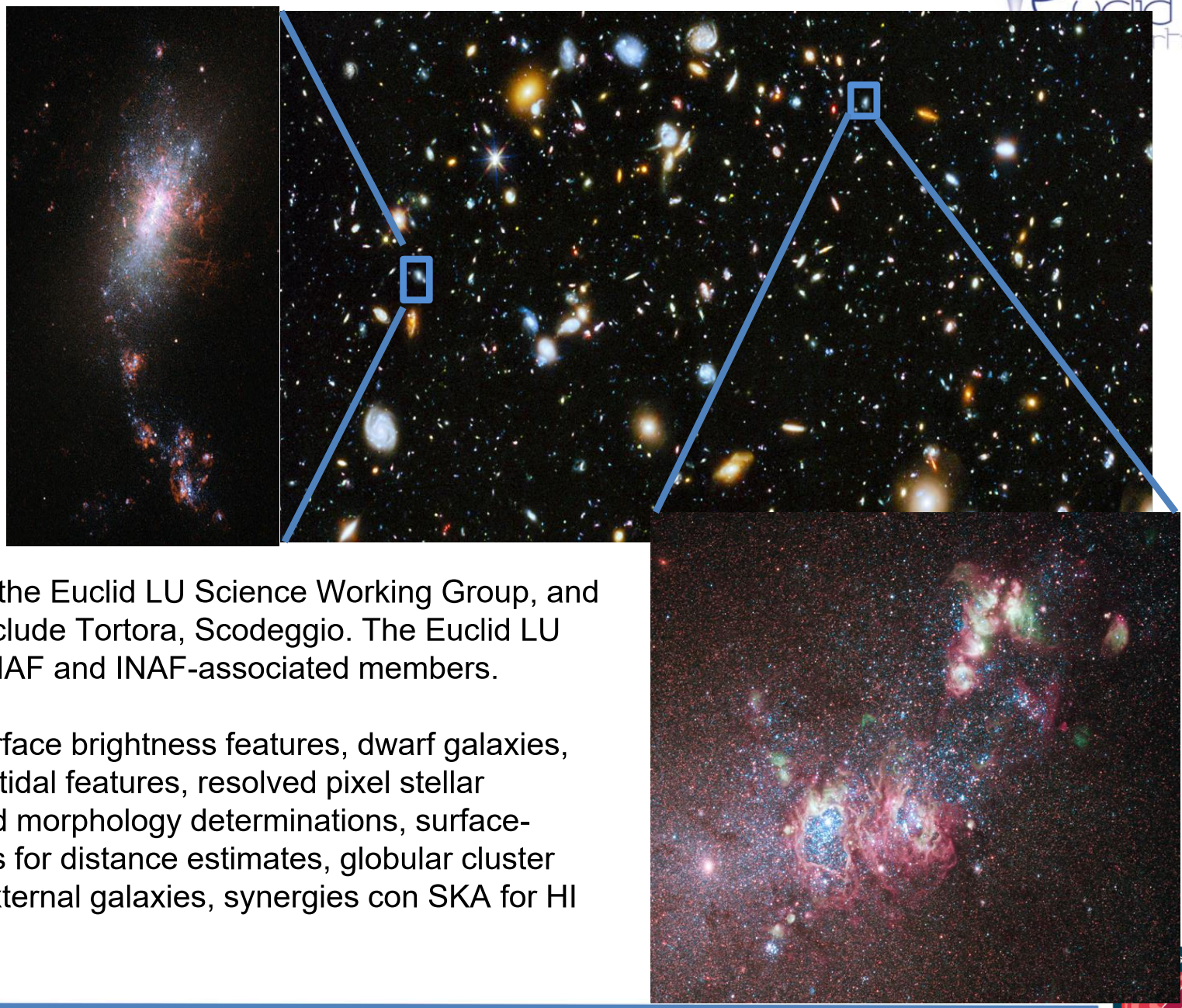
- **Year 1**: creation of the mock catalog of Euclid AGN;
- **Year 2**: forecasting of Euclid AGN clustering as a function of host galaxy properties, redshift, scale, and AGN type;

	START May 2021					End: May 2023	
Months	**1-4**	**5-8**	**9-12**	**13-16**	**17-20**	**21-24**	**25-36**
Deliverables		Light cone	SEDs	Release of AGN mock catalogs!		Clustering of Type 1 & 2 AGN	AGN clustering vs host galaxy properties

- **Papers in preparation within SWG "Galaxy & AGN evolution"**:
  - PLKP 1.6 "Mock Euclid AGN Catalogs" (2 papers);
  - PLKP 3.2 "Environmental Dependencies of AGN/galaxy physical properties" (1 paper);
- **Criticality**: tight schedule before the launch. Applied for mini-grant (20k) to ensure the continuation of the project also beyond the end of the PRIN fundings.

Euclid Legacy Science in the Local Universe (LU)

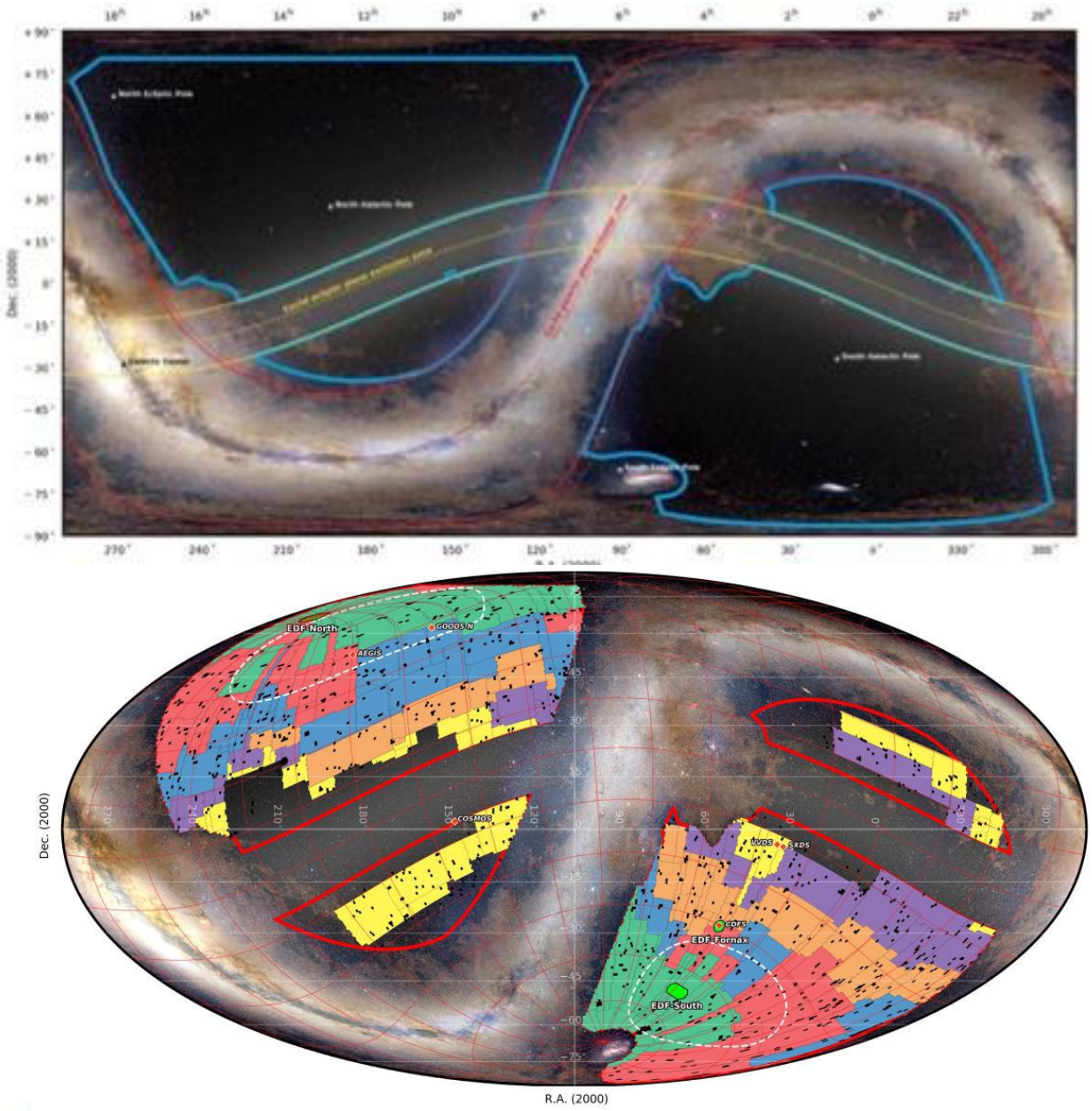
Euclid will image to unprecedented depths faint, low surface brightness galaxies and globular clusters in galaxies up to z~0.3, enabling new galaxy demographics.



INAF co-leads (Hunt) the Euclid LU Science Working Group, and INAF LU WP leads include Tortora, Scodeggio. The Euclid LU SWG comprises 30 INAF and INAF-associated members.

Topics include low surface brightness features, dwarf galaxies, ultra-diffuse galaxies, tidal features, resolved pixel stellar populations, quantified morphology determinations, surface-brightness fluctuations for distance estimates, globular cluster populations around external galaxies, synergies con SKA for HI

Euclid = one 6 year survey (wide+deep fields etc)



INAF/R. Scaramella: Mission Survey Scientist, Euclid Science Team, EC Board, lead of ECSURV group. Euclid Team Star Prize.

- HUGE constraints on pointing, covred area ~1.4E4 sq deg
- 1 year spent on lots of calibrations and the 3 EUCLID DEEP FIELDS = 53 sq degs
- Coverage of best extragalactic sky from both space and ground (collection of surveys, synergy with Rubin)

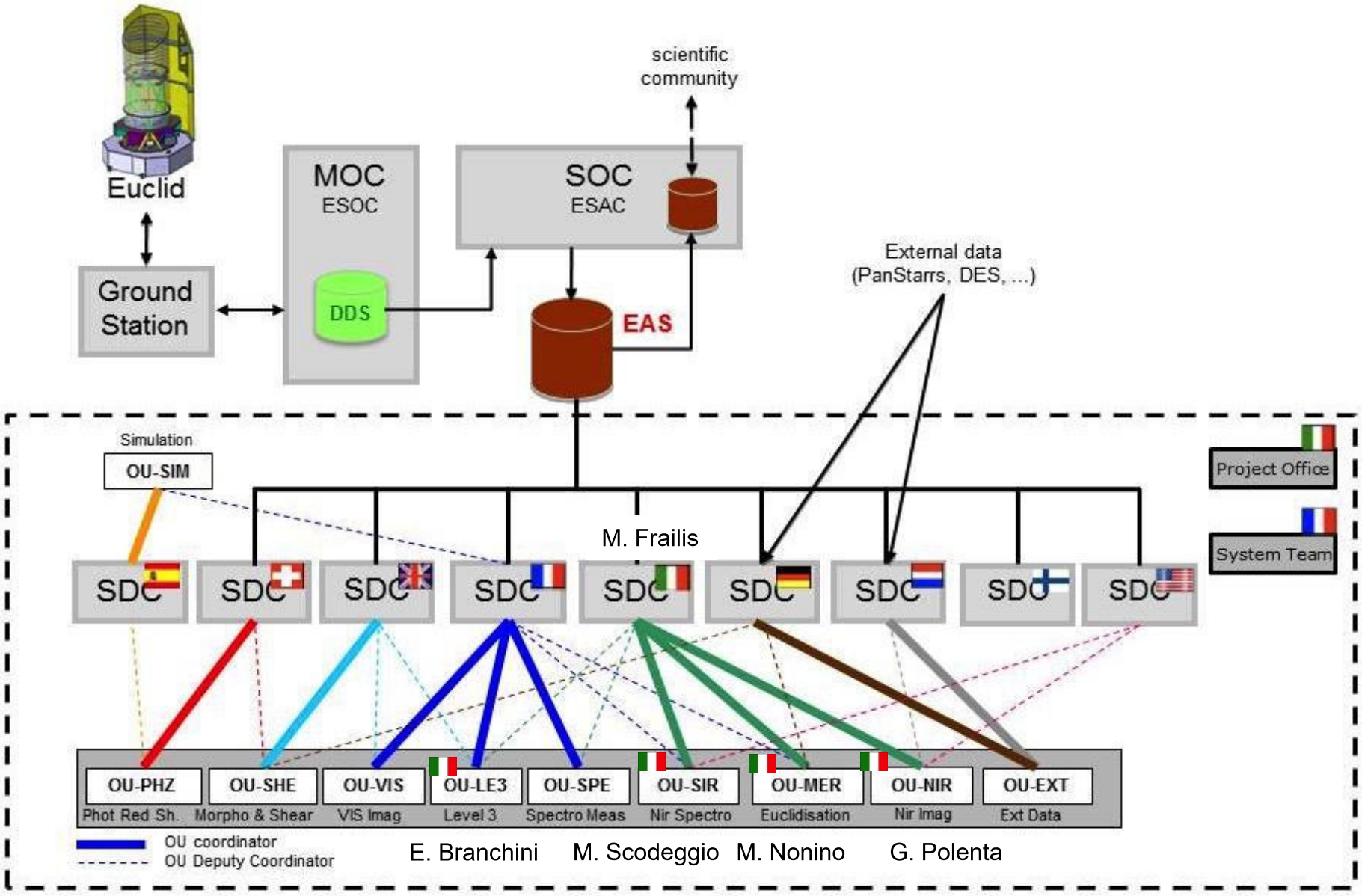
Euclid Wide and Deep Surveys

- **Euclid Wide:**
  - ~15000 deg^2 outside the galactic and ecliptic planes
  - 12 billion sources (3-σ)
  - 1.5 billion galaxies with
    - Very accurate morphometric information (WL)
    - Visible photometry: (u), g, r, i, z , (R+I+Z) AB=24.5, 10.0 σ +
    - NIR photometry : Y, J, H AB = 24.0, 5.0σ
    - Photometric redshifts with 0.05(1+z) accuracy
  - 35 million spectroscopic redshifts of emission line galaxies with
    - 0.001 accuracy
    - Halpha galaxies within 0.7 < z < 1.85
    - Flux line: 2 . 10^{-16} erg.cm^{-2}.s^{-1} ; 3.5σ

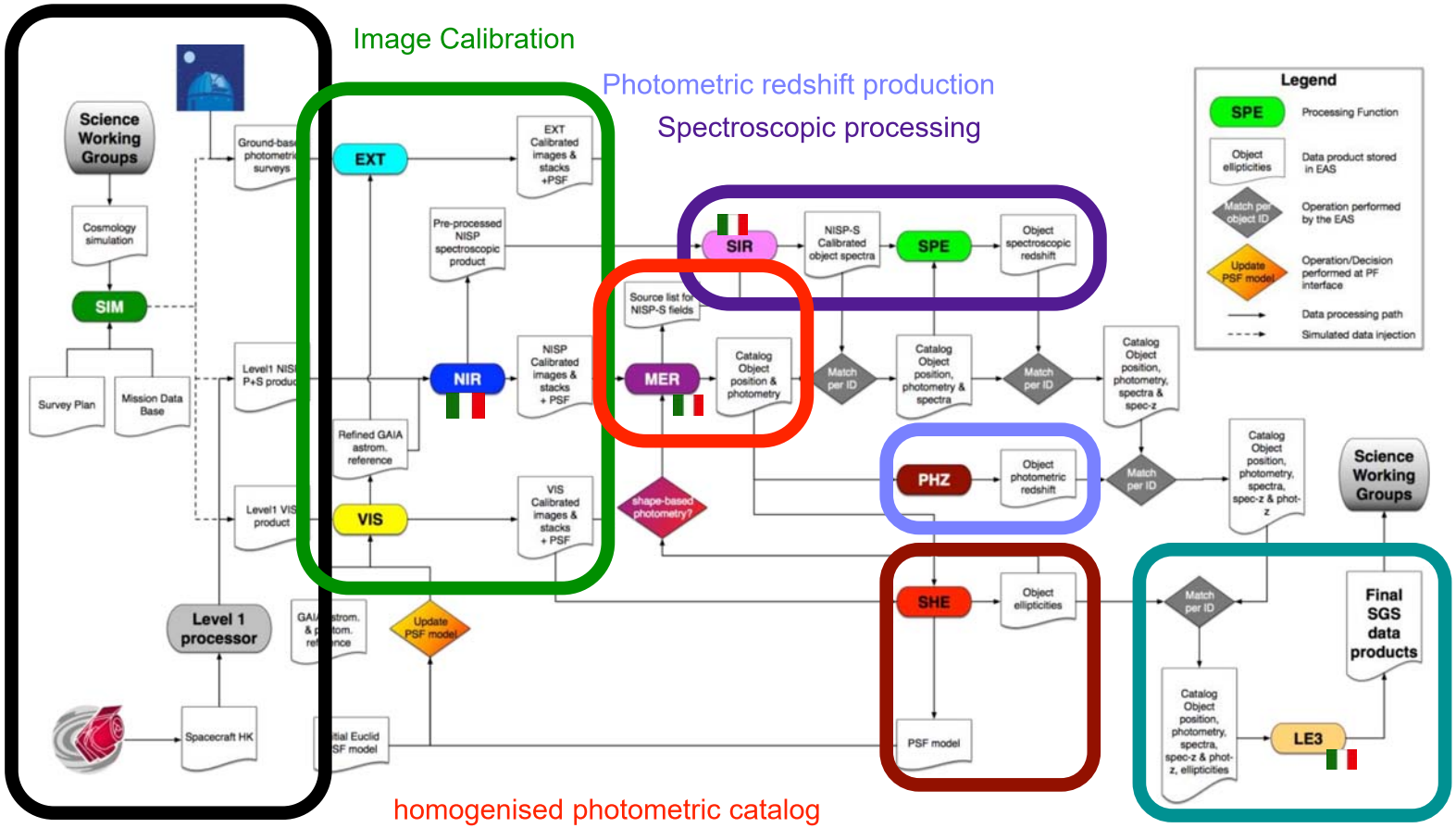
- **Euclid Deep:**
  - 1x10 deg^2 at North Ecliptic pole + 1x20 deg^2 at South Ecliptic pole

    + 1x10 deg^2 South close to Equatorial area
  - 10 million sources (3-σ)
  - 1.5 million galaxies with
    - Very accurate morphometric information (WL)
    - Visible photometry: (u), g, r, i, z , (R+I+Z) AB=26.5, 10.0 σ +
    - NIR photometry : Y, J, H AB = 26.0, 5.0σ
    - Photometric redshifts with 0.05(1+z) accuracy
  - 150 000 spectroscopic redshifts of emission line galaxies with
    - 0.001 accuracy
    - Halpha galaxies within 0.7 < z < 1.85
    - Flux line: 5 . 10^{-17} erg.cm^{-2}.s^{-1} ; 3.5σ

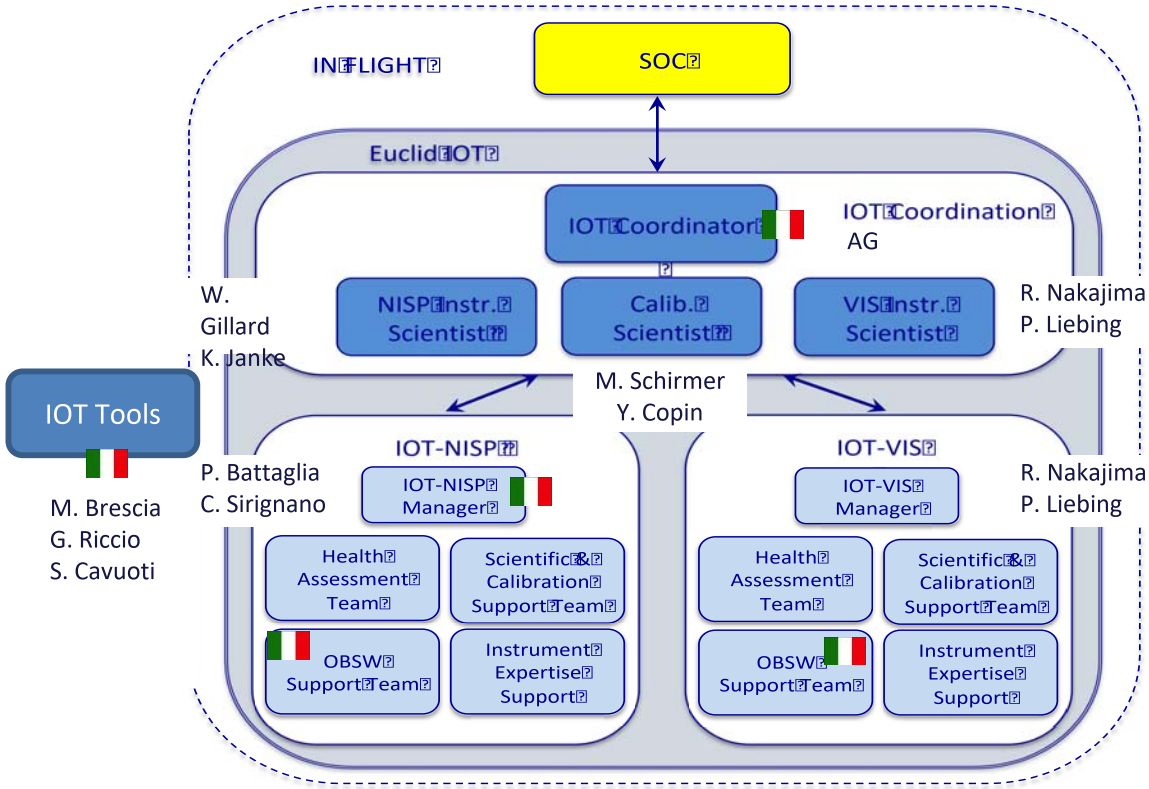
The Ground Segment



The SGS pipeline flow



Euclid IOT Management Structure

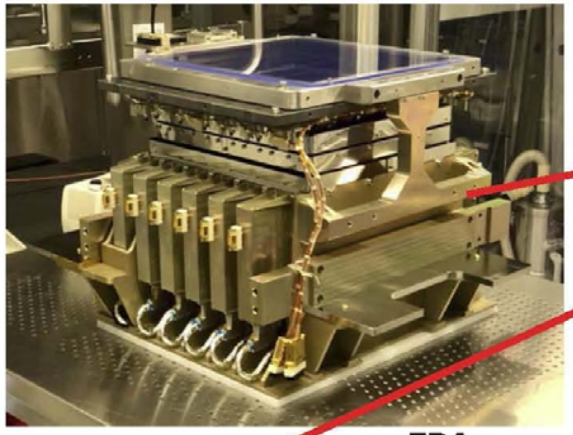


FULL IN PLACE

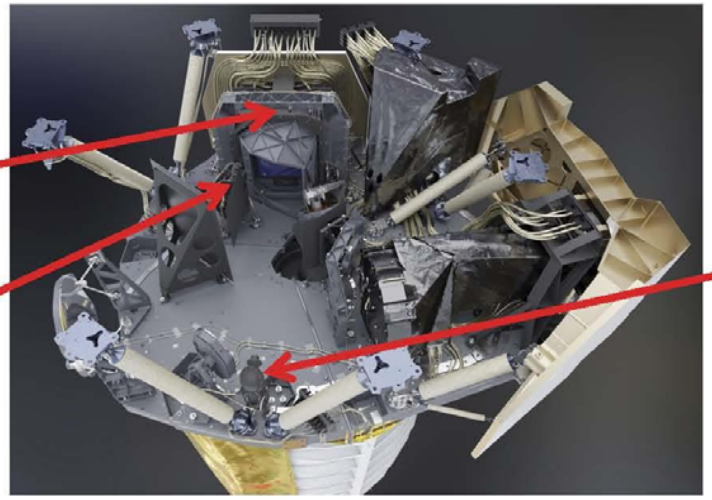
Stato - SGS

- L'SGS ha passato le principali review (SGS-DR, SGS-IR) e si sta preparando per l'ultima review prima del lancio la SGS-RR.
- L'SGS ha verificato e continua a verificare le varie Processing function con test di compessita' crescente.
- L'IOT, a leadership Italiana, e' stato definition ed in Place
- L'SGS e l'IOT nei prossimi mesi verificheranno la loro capacita', come richiesto dalla GS-RR, di operare la PV. Prima fase in cui l'IOT e L'SGS entreranno in gioco.
- Le risorse di calcolo necessarie alla produzione dell'SDC-IT sono assicurate da un contratto ASI-ALTEC che segue le specifiche definite dall'SDC-IT posizionato a Trieste.

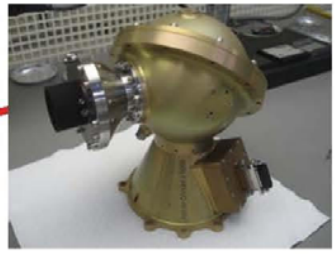
Euclid: the payload instruments



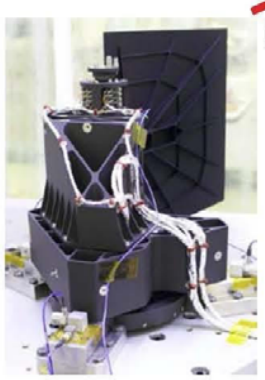
FPA
(Focal Plane Assembly)



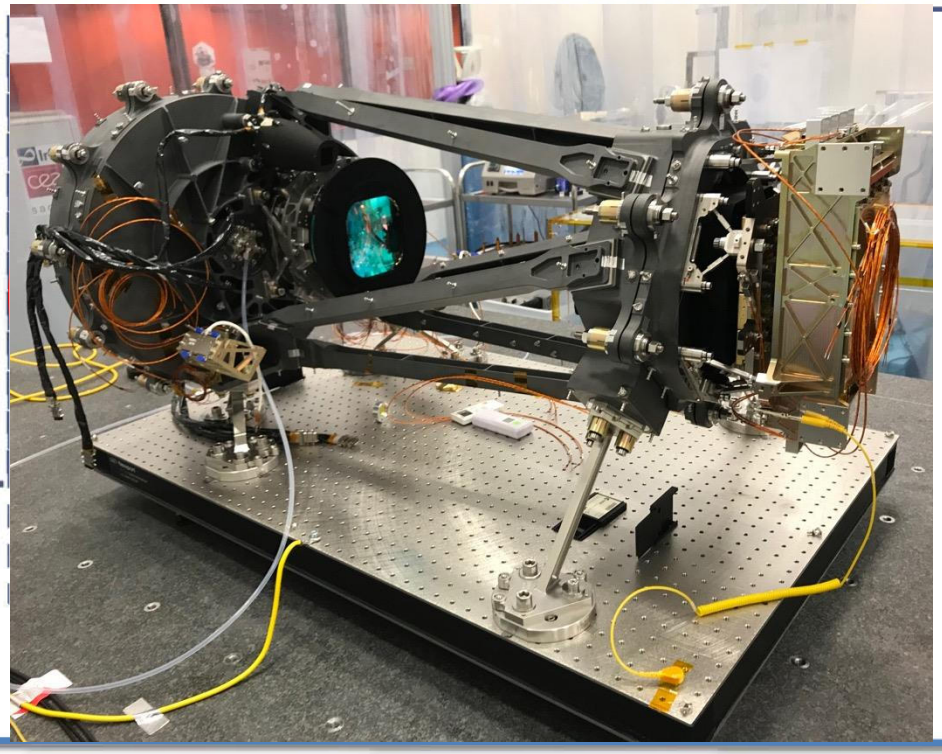
Payload Module



CU
(Calibration Unit)



RSU
(Readout Shutter Unit)



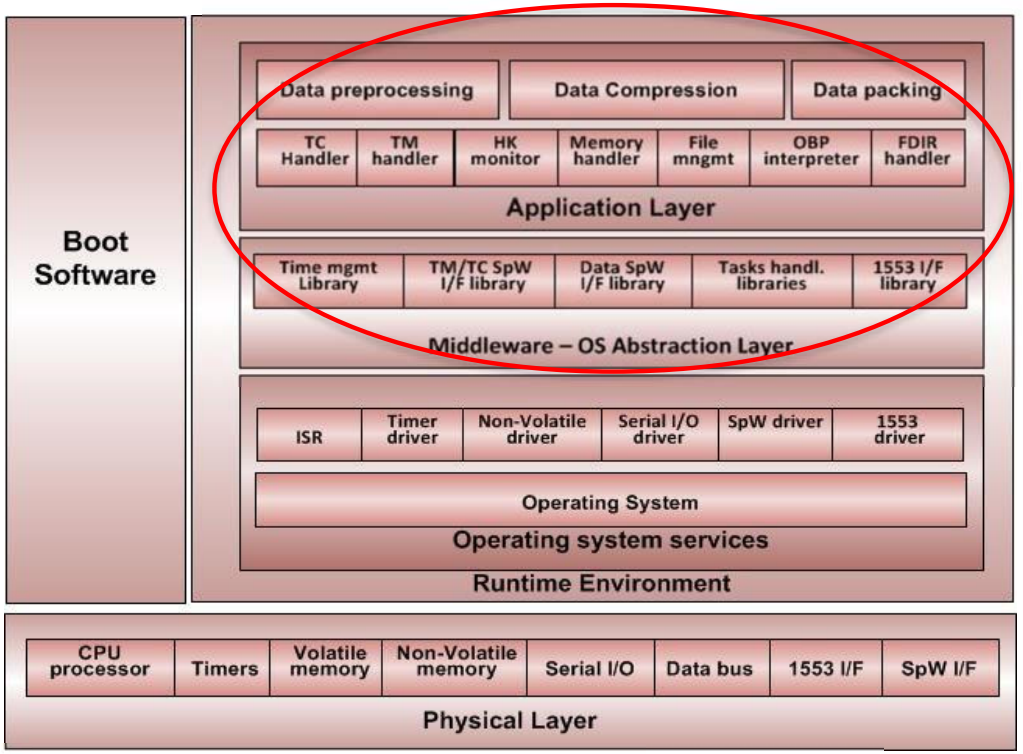
VIS

NISP

VIS and NISP SW

Euclid instruments on board SW design and development

- VIS On Board SW: instrument control and data handling SW (IAPS)
- NISP ICU On Board SW: instrument control and data transfer SW (OATO)
- NISP DPU data acquisition and compression SW (OAPD, OAS)



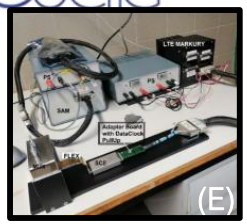
The production of the on-board SW for payload instrumentation is a crucial contribution to scientific space missions, as it allows to have an in-depth knowledge of both the functioning of the instruments and the peculiarities of the acquired data. INAF expertise in this field is an excellence well known at European level that has been further strengthened by the Euclid experience.

See TESICS and TETIS

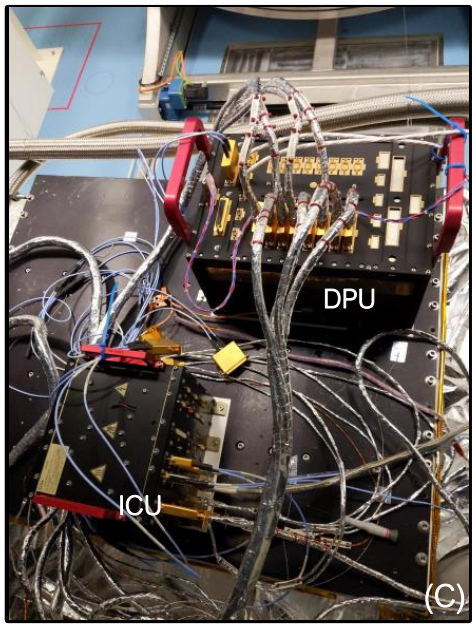
VIS OBS maintenance included in ASI addendum

NISP software maintenance setup - Eduardo Medinaceli OAS

Dedicated ambient @ OAS Bologna – lab. 606



Support Infrastructure for the SW development/engineering



NISP warm electronics – ICU & DPU

Laboratory dedicated to the maintenance of the application software (ASW) of both NISP's Instrument Control (ICU)
and Data Processing (DPU) Units, on-board at the Euclid mission – under assembly (operative untill 2029) (A)

<u>Instrumentation:</u>

- Engineering Qualification Models (EQM) of the ICU and DPU **(C)**
- Development ambient for applications in Real Time OS - VxWorks5.0 on PPC - Maxwell 750 **(B)**
- Ambient for software engineering – space standards ECSS (Jenkins suit):
  Unit Tests (Parasoft C/C++), Static tests/MISRA (CLANG static analyzer, PolySpace©),
- ½ focal plane – flight-like front-end electronics (8xSIDECAR ASICs) **(D)**
- Flight-like infrared sensors (H2RG) with a dedicated criogenic setup (to be refurbished)
- Stand-alone SIDECAR ASICs readout systems (LTE Markury electronics, SAM) **(E)**
- Electrical Ground Support Equipment (EGSE) for the commanding and control **(A)**
- Instument Workstation, to monitor, store and analysis of NISP data products
- Other NISP EQM components (Filter Wheel, Grism Wheel Assemblies, Calibration Unit) **(F)**
- Stand-alone ICU Test Equipment

NISP software maintenance setup - Eduardo Medinaceli OAS

Objectives

- Support activities:
  - analysis of science outcome related to the instrument operability
  - real-time operations interfaced with MOC through the Instrument Working Station
  - interface between the warm electronics and the detector system
  - management of the NISP on-board operations
  - NISP survey group
- Maintenance activities:
  - NISP's instrument operative concept
  - NISP thermal model
  - Instrument Working Station
  - DPU-ASW and ICU-ASW
- Outreach activities

FTE	2022	2023	2024
Accertati	0.5	0.5	0.5
Presunti	5.05	4.85	4.75

Linee di ricerca

- Rivelatori all'infrarosso
- Software engineering
- Standard per software di missioni Spaziale
- Strumentazione spaziale
- Applicazioni per la Cosmologia

Keywords (internal INAF)

- Tecnologie per Astronomia Ottica ed Infrarossa
- Tecnologie Informatiche e software
- Tecnologie per osservazioni da spazio
- Infrastrutture dallo spazio per l'osservazione dell'Universo

SW maintenance team

Total 19 people (OAS, OATo, OAPd, INFN)

NISP Project Leadership

- PI E. Medinaceli, NI-DPU-ASW manager, NI-IDT - OAS
- S. Ligori, NI-ICU-ASW manager, NI-IDT - OATo
- F. Gianotti, NI-IWS manager - OAS
- E. Franceschi, NI-EGSE manager, NI-IDT - OAS
- P. Battaglia, NISP operation manager, NI-IDT - OAS
- N. Auricchio, NISP warm unit Product Assurance manager - OAS

Technical/Science production

- DPU ASW or ICU-ASW release (when applicable)
- NI-DPU/ICU-ASW test plan and updates (if necessary)
- NI-WE test plan and updates (if necessary)
- Periodic reports to ASI
- Maintenance Reports
- Periodic reports to Euclid consortium
- NISP health assessment verifications
- Scientific publications

Founding

INAF overall up to 2021	ASI 2022*
10 k€	2 k€

- Applied for a mini-grant to refurbish the cryogenic setup of the Flight-like detector's readout system

*EUCLID-FASE D – F.O. 1.05.04.37.01 Attività scientifica per la missione - Accordo Attuativo ASI-INAF n. 2018-23-HH.0

Accordo + Addendum ASI - INAF
Attività scientifiche 2018 - 2023

INAF INFN UniRM3 UniBO UniFE SISSA UniMI UniGe
CISAS

Finanziamento totale 5.5Meuro di cui 3.6MEuro per INAF

+ Contratti industriali ASI per

- NISP DPU/DCU
- VIS CDPU
- NISP Grism Wheel
- HW calcolo

Aree critiche

- Figure professionali specifiche sono necessarie
  - Project Manager
  - Product Assurance Manager
  - System Engineer
  - Electrical/Thermal/Mechanical Engineer
  - SW Engineers
  - Profili intermedi: Astronomi con competenze informatiche

  Si formano nel progetto ma non sono sufficienti rispetto alla quantità di lavoro da svolgere

- Per le progression di carriera e le nuove assunzioni:
  - E' necessario prevedere adeguata valutazione dei profili sperimentali anche nelle carriere da ricercatore;
  - E' necessario valutare il lavoro svolto in molti anni per la missione anche negli articoli a molte firme, propri di questo genere di progetti;
  - E' necessario prevedere una adeguata valutazione/riconoscimento del lavoro di dottorandi e post – doc che dedicano gran parte del tempo a Euclid ma si trovano spesso con poche pubblicazioni;
- E' necessario che INAF investa in posizioni a tempo indeterminato in SWGs dove vi sono responsabilita' (e.g. Legacy Local Universe
- Potenziare il confinanziamento INAF/ASI per le posizioni a contratto (e.g. Legacy Local Universe)

Aree critiche

- Centro di calcolo INAF (compresi HPC computing facilities e spazio disco) adeguato alla gestione di dati missioni come Euclid

  Potrebbe aumentare le potenzialità rispetto a nuove missioni

  Esempi:

  - simulazioni cosmologiche e mock data

  - calcolo delle matrici di covarianza analitiche e numeriche

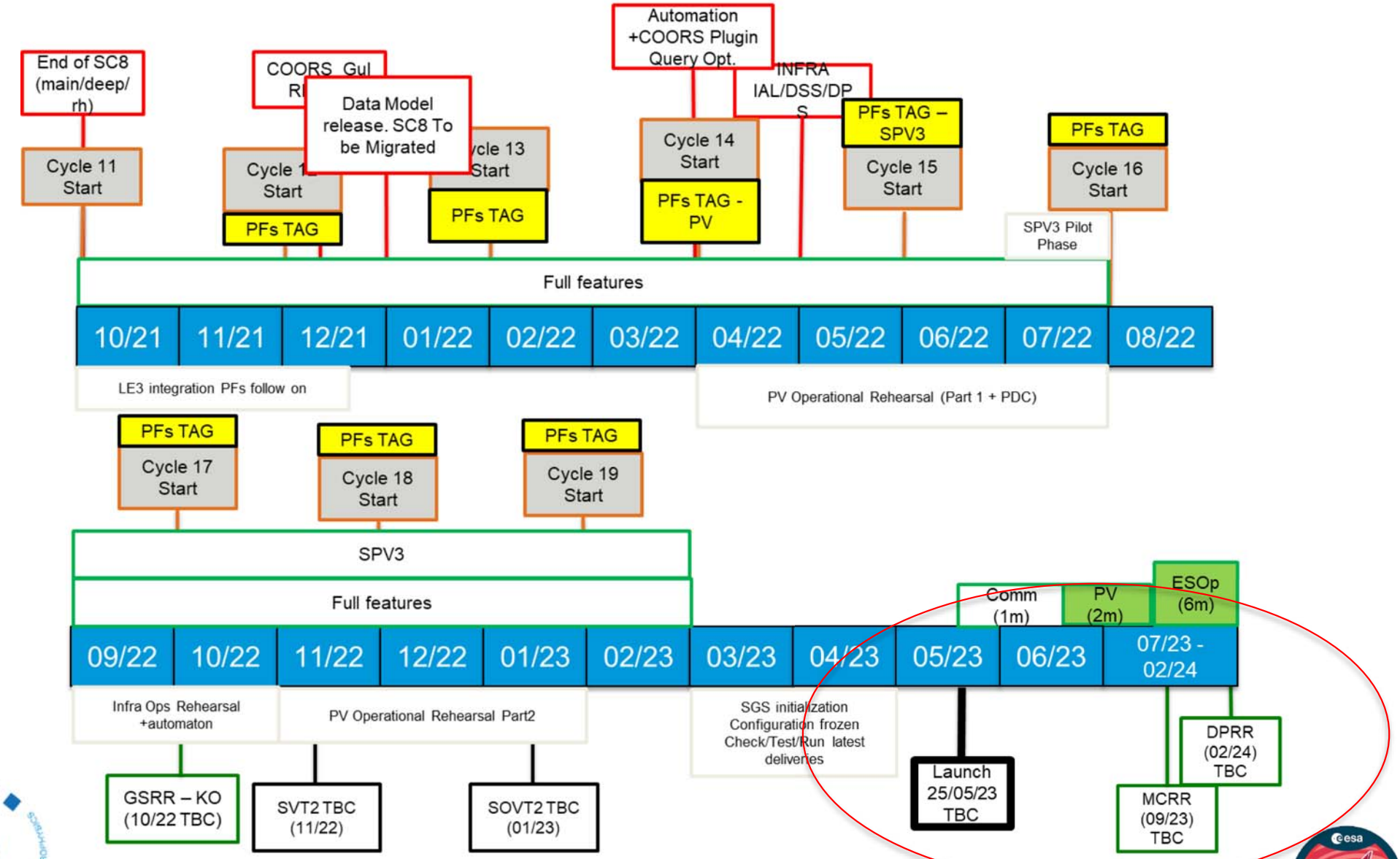
  - Run di CLOE su dati simulati e sui futuri dati Euclid (al momento nessuno sa chi e dove verrà fatta questa analisi che è quella che produce i risultati finali; la decisione spetta al consorzio, ma, dato che già abbiamo la leadership del codice, potremmo chiedere la leadership di questa analisi sui dati reali se avessimo le risorse di calcolo necessarie)

- Riorganizzazione del sistema di comunicazione e management (sia a livello di EC che a livello nazionale)

- Controllo ASI su rendicontazione (anche sul cofinanziamento) rende sempre più difficile la chiusura in tempi utili delle milestones

Aree critiche

Ritardo nel lancio



INAF Personnel in Euclid

Natalia Auricchio, Stefano Andreon, Francesca Annibali , Andrea Balestra, Sandro Bardelli, Paola Battaglia, Pietro Bergamini, Jose Ramon Bermejo-Climent, Laura Bisigello, Andrea Biviano, Micol Bolzonella, Andrea Bonchi, Stefano Borgani, Maria Botticella , Massimo Brescia, Enzo Brocato, Andrea Bulgarelli, Carlo Burigana, DeborahBusonero, Giorgio Calderone, Vito Capobianco, Enrico Cappellaro, Alberto Cappi, Carmelita Carbone, Vincenzo Cardone, Marco Castellano, Stefano Cavuoti, Paolo Ciliegi, Vito Conforti, Leonardo Corcione, Giovanni Cresci, Stefano Cristiani, Olga Cucciati, Gabriella De Lucia, Adriano De Rosa, Massimo Della Valle, Massimo Della Valle, Anna Maria Di Giorgio, Stefano Ettori, Maria Farina, Ruben Farinelli, Fabiana Faustini, Anna Feltre, Juan Antonio Fernández Ontiveros, Fabio Finelli, Adriano Fontana, Fabio Fontanot, Marco Frailis, Enrico Franceschi, Paolo Franzetti, Marco Fumana, Samuele Galeotta, Emanuele Galli, Bianca Garilli, Thomas Gasparetto, Fulvio Gianotti, Carlo Giocoli, Stefano Giuppi, Giovanni Giusi, Benjamin Granett, Andrea Grazian, Anna Gregorio, Alessandro Gruppuso, leslie hunt, Enrichetta Iodice, Angela Iovino, Gianluca Li Causi, Sebastiano Ligori, Scige Liu, Andrea Lorenzani, Gianmarco Maggio, Manuela Magliocchetti, Elisabetta Maiorano, Chiara Mancini, Oriana Mansutti, Michele Maris, Eduardo Medinaceli, Massimo Meneghetti, Amata Mercurio, Emiliano Merlin, Marco Mignoli, Alessia Moretti, Alberto Moretti, Gianluca Morgante, Emiliano Munari, Luciano Nicastro, Mario Nonino, Ronaldo Oliveira, Eliana Palazzi, Daniela Paoletti, Gabriele Parimbelli, Diego Paris, Bianca Poggianti, Lucia Pozzetti, Isabella Prandoni, Mario Radovich, Giuseppe Riccio, Federico Rizzo, Erik Romelli, Valerio Roscani, Valerio Roscani, Ruben salvaterra, Barbara Sartoris, Roberto Scaramella, Filomena Schiavone, Marco Scodeggio, Emiliano Sefusatti, Mauro Sereno, Francesca Sortino, Luigi Spinoglio, John Stephen, Giuliano Taffoni, Daniele Tavagnacco, Vincenzo Testa, Crescenzo Tortora, Massimo Turatto, Luca Valenziano, Daniela Vergani, Martina Vicinanza, Claudio Vuerli, Benedetta Vulcani, Andrea Zacchei, Elena Zucca