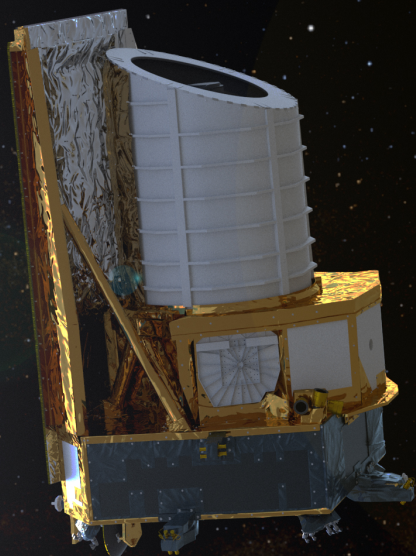




Istituto Nazionale di Fisica Nucleare



Stato missione Euclid

Stefano Dusini - INFN Padova
Referee CSN2 - 11/9/2024





Euclid first year (in short)

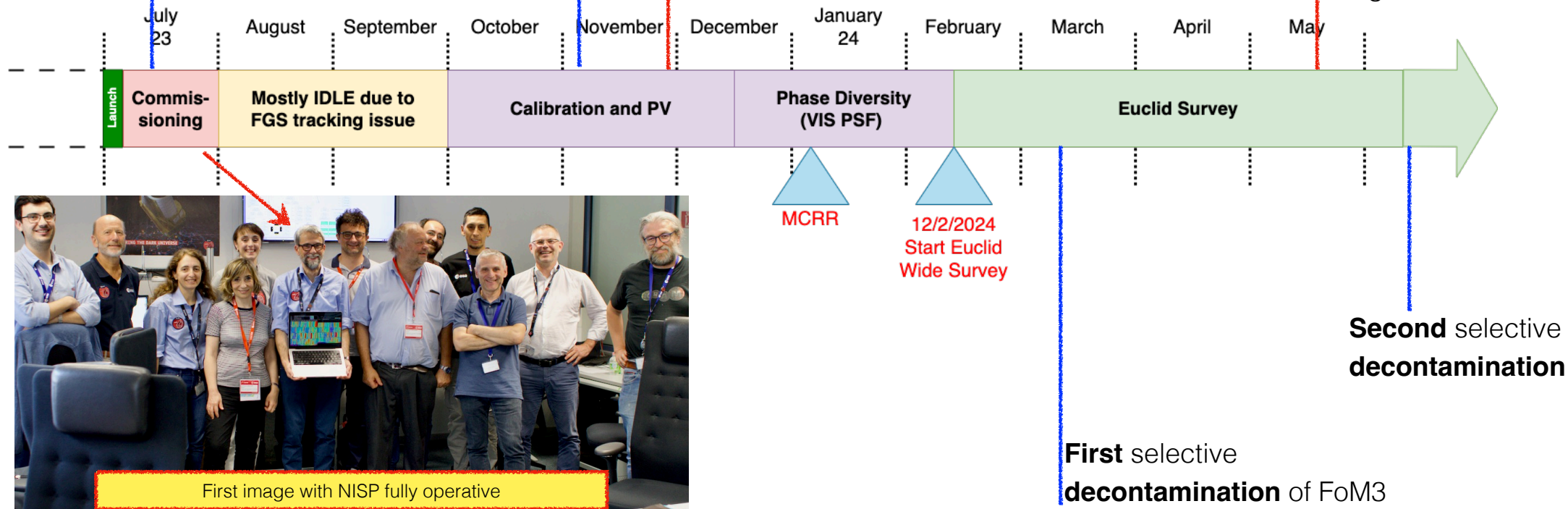
VIS straylight due to sunlight reflected inside optical cavity

X-ray background during solar X flairs

VIS photometric loss due to formation of **ICE**

1st Early Release images

2nd Early Release images

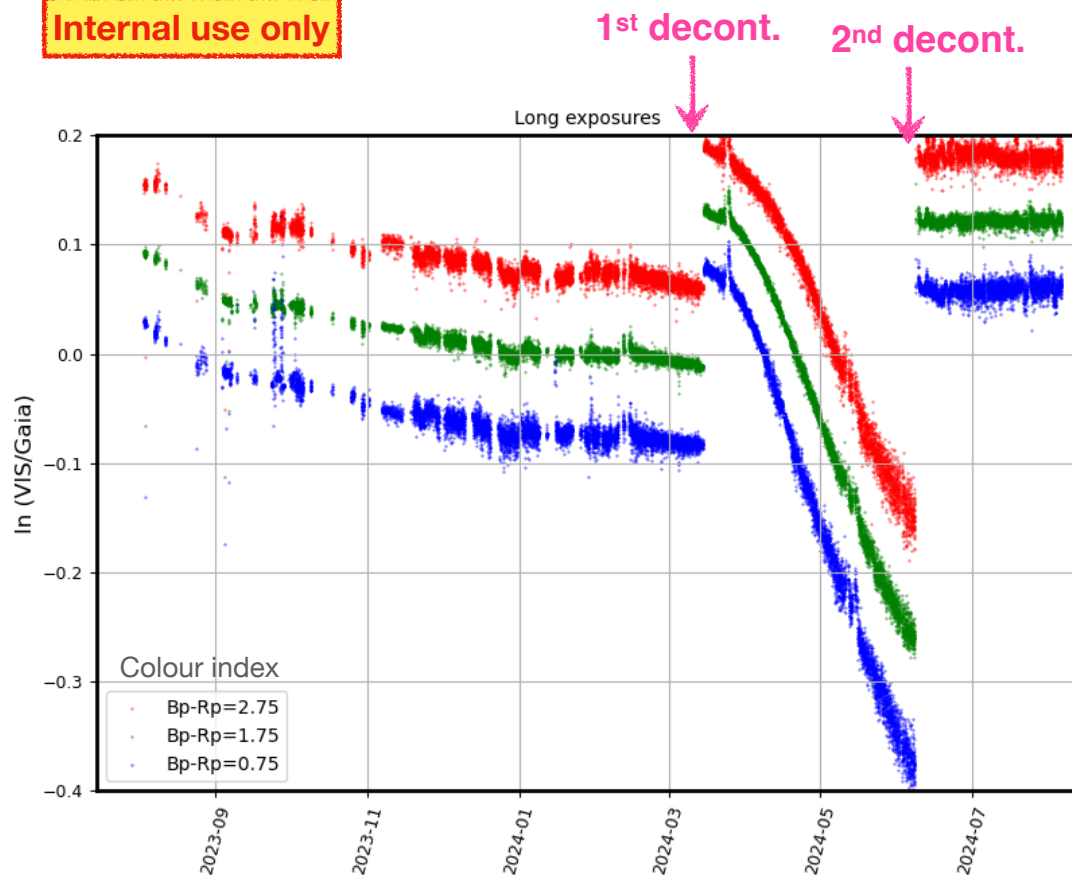


Euclid STAR Prize 2024 to NISP and VIS commissioning teams

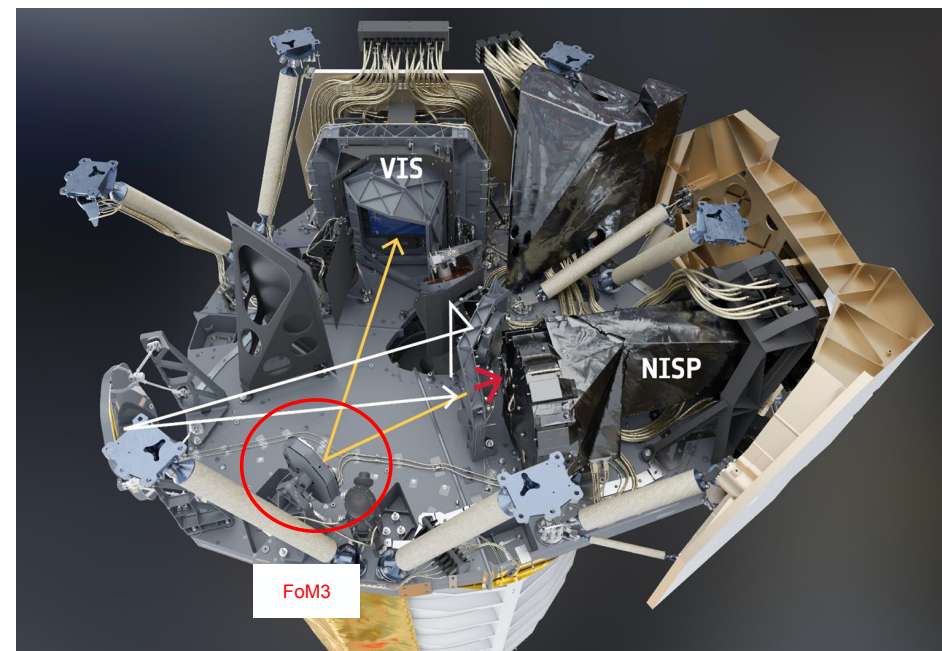


VIS photometric loss (ICE)

Internal use only



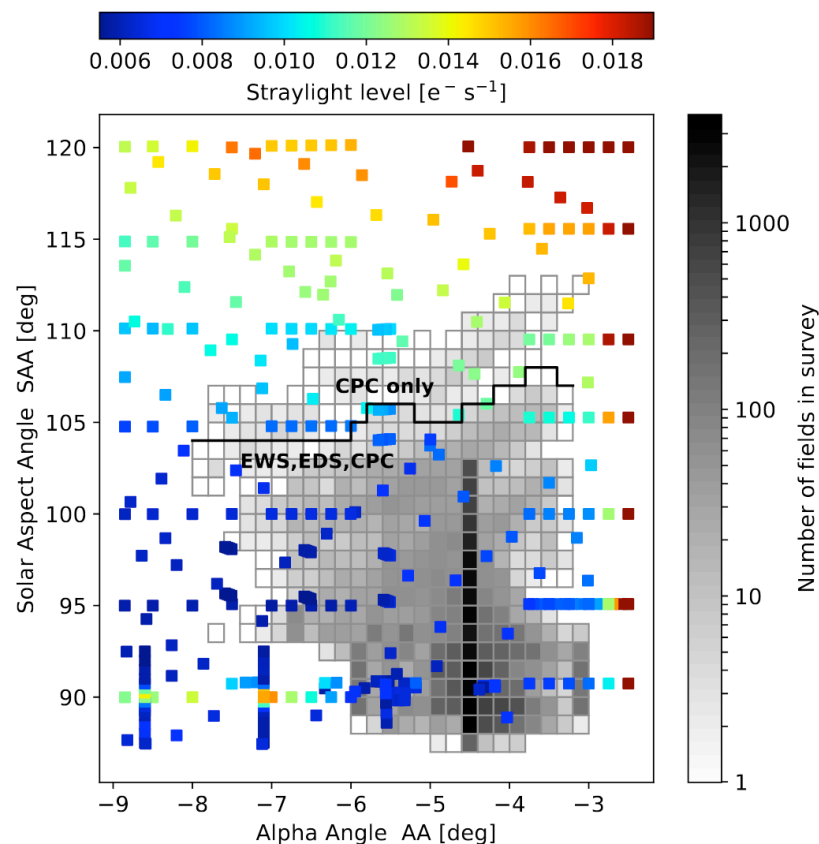
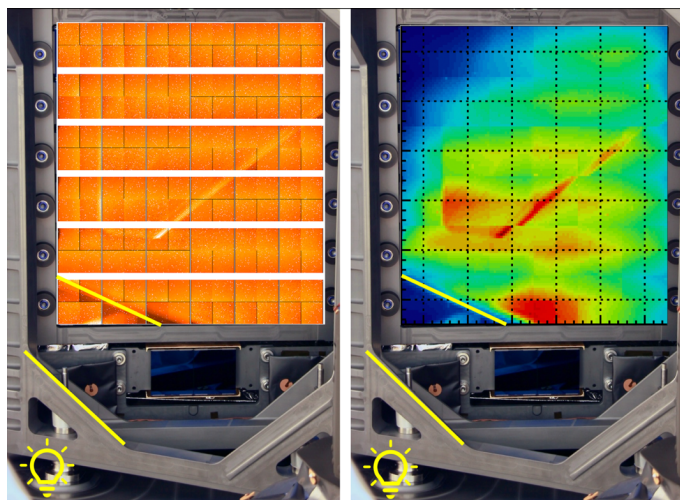
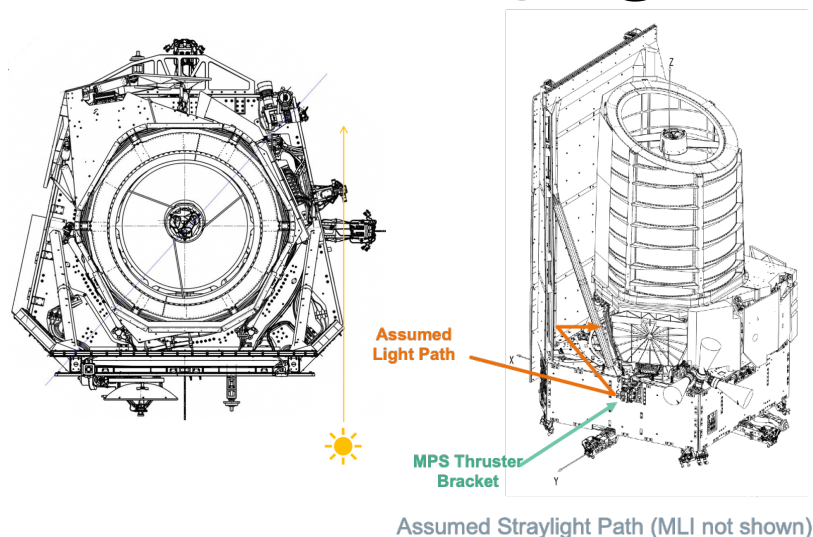
No loss in NISP photometry → ICE on FoM3



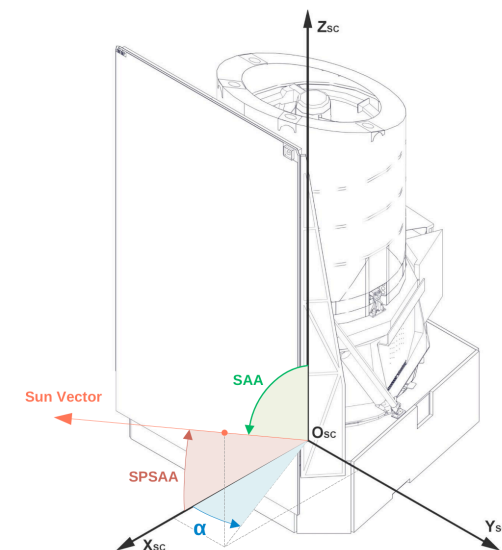
- Duration of the decontamination including pre-post test : ~1 week.
- Minor contamination of NISP dichroic (TBC) after 1st decontamination.
- After the 2nd decontamination the situation is stable



VIS Straylight



Increased field-to-field **overlaps** from 4% to 14%
 → **effective FoV** reduced from 0.55 deg² to 0.49 deg²
 → **EWS area** reduced from 14800 deg² to 13400 deg²





Euclid survey

Wide area: **13244.9 deg²**

Deep Field North: **20 deg²** observed **40 times**

Deep Field South: **23 deg²** observed **45 times**

Deep Field Fornax: **10 deg²** observed **52 times**

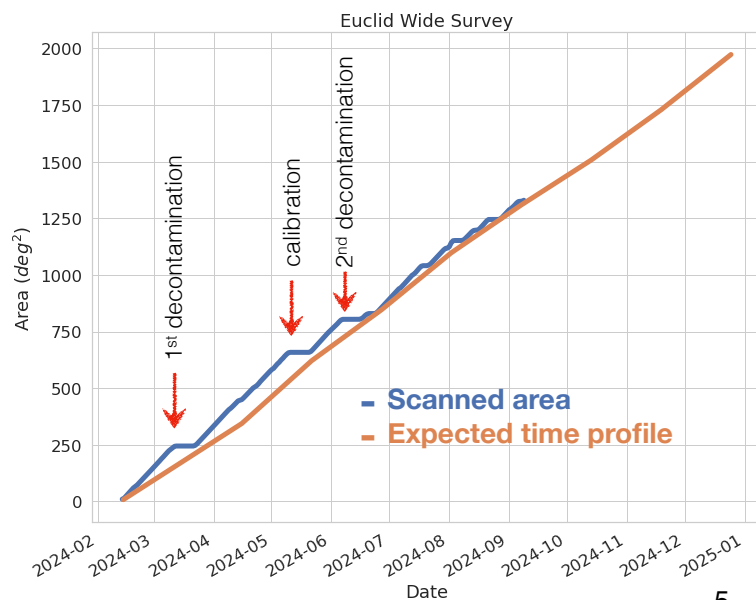
R.Scaramella (INFN RM1) Lead of Survey WG

Wide survey **started** on **14/2/2024**

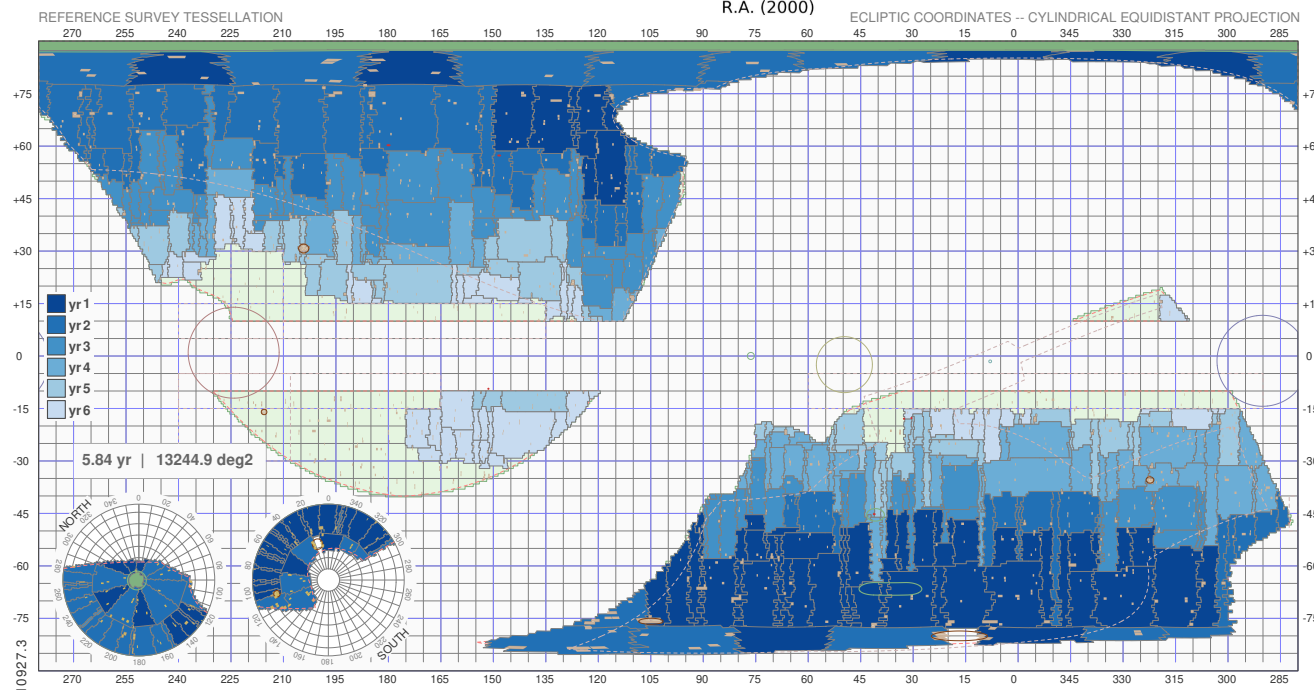
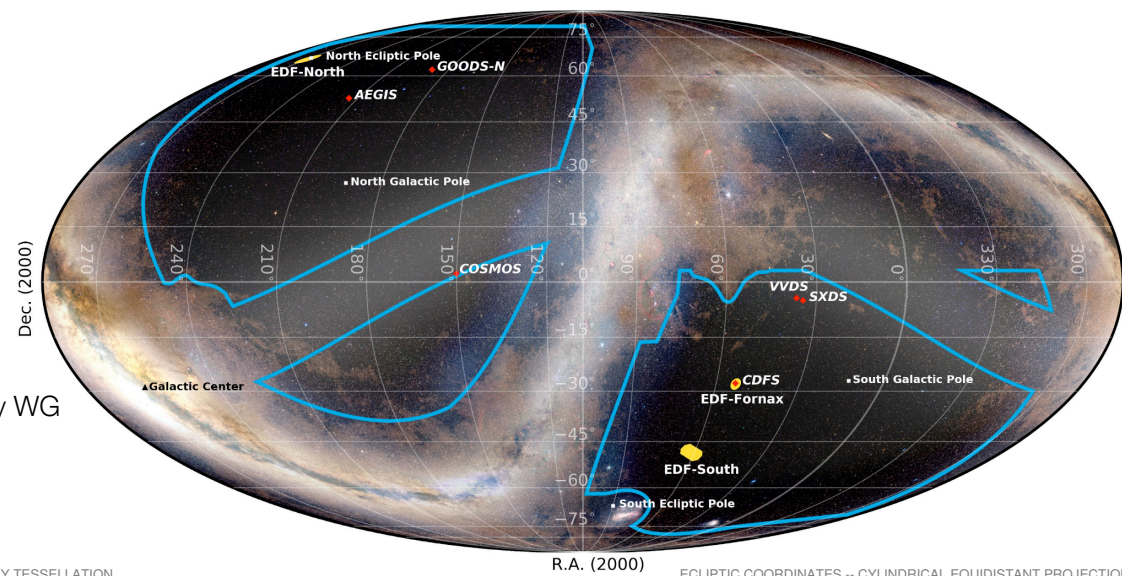
at 9/9/2024 we have scanned **1331 deg²**

~ **66k NISP images** (spectro + photo + dark)

~ **32k VIS images**

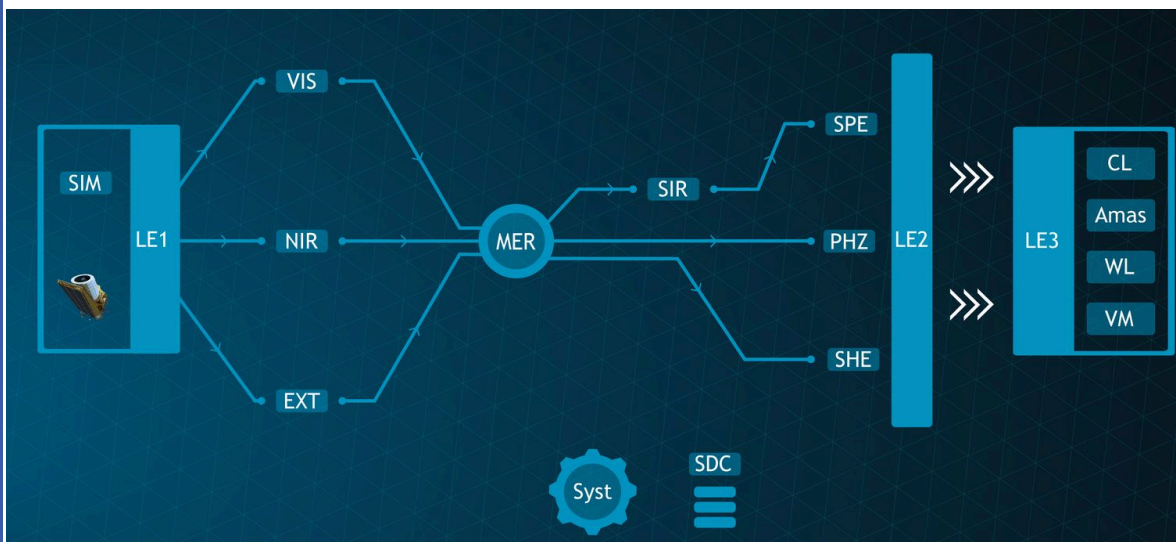


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Status of data processing



LE1 = raw images (how they come down from space)

VIS/NIR = photometric calibrated images

MER = tile images to the same format

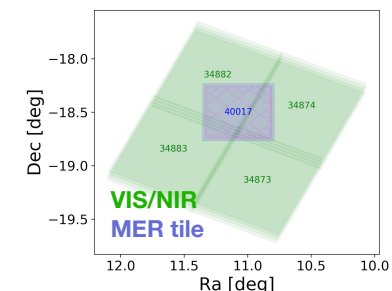
as external data (ground telescope)

SIR = Spectra extraction form combined data

SPE = spectra reconstructed and redshift

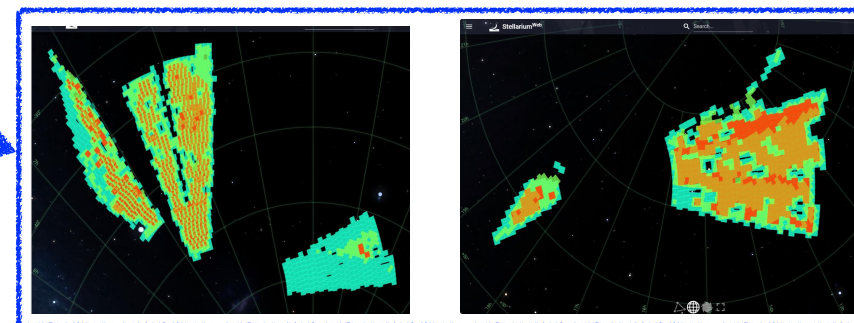
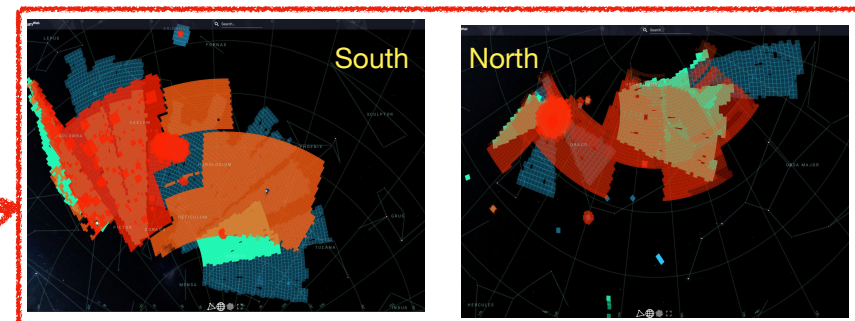
PHZ = photometric redshift

SHE = weak lensing shear



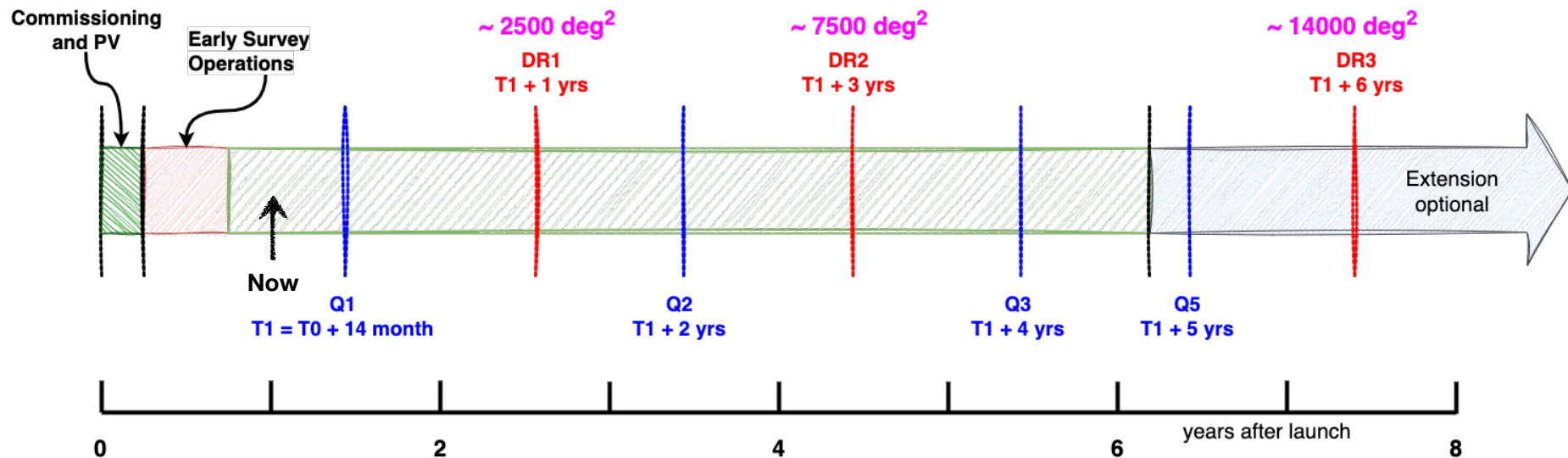
LE1 coverage : $\sim 1000 \text{ deg}^2$
EXT coverage ingested : $\sim 2100 \text{ deg}^2$

VIS/NIR calibrated coverage : $\sim 900 \text{ deg}^2$
MER coverage : $\sim 600 \text{ deg}^2$
SIR coverage : $\sim 330 \text{ deg}^2$
SPE coverage : $\sim 200 \text{ deg}^2$
PHZ coverage : $\sim 600 \text{ deg}^2$
SHE coverage : $\sim 50 \text{ deg}^2$





Euclid data release timeline



- **March 2025: “Quality release #1”** ~ 50 deg² to show the quality of the data, no cosmologia
- **June 2025: Internal Data Release #1:** release to Euclid Consortium of DR#1 data, **1 year to prepare the papers!!!**
- **June 2026: Public Data Release #1** Submission of the paper and data (images + catalog) released to public
First preliminary results on cosmology

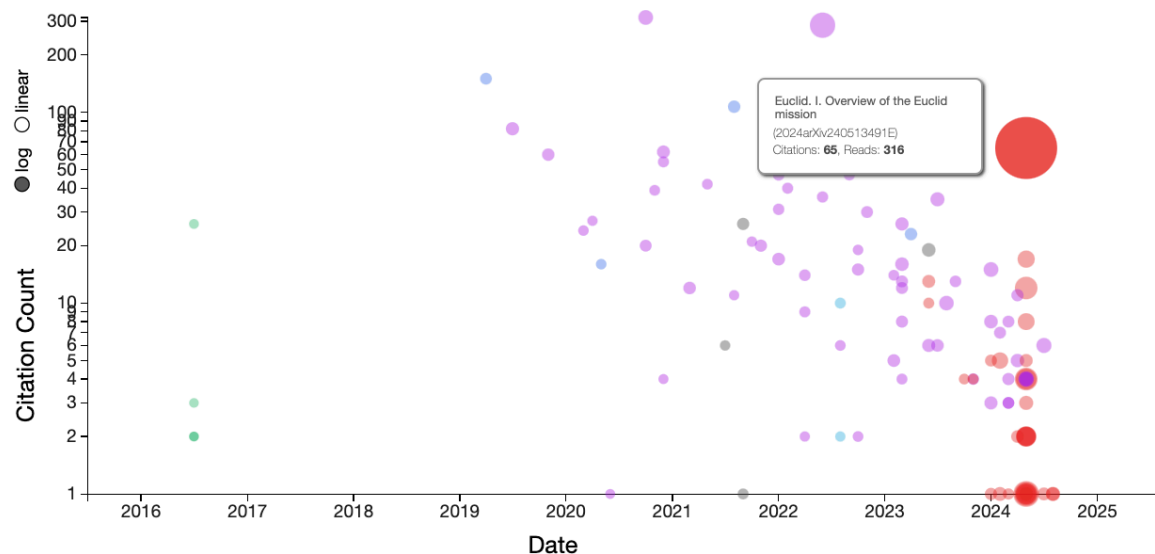
La timeline e' veramente “tosta”....



Euclid publications

Publications with INFN (CSN2) authors

- **71 published** manly on Astronomy & Astrophysics (A&A)
 - 44 submitted and on arXiv,
 - 3 describe the mission and the instruments (NISP + VIS)
 - **12 with scientific results on Early Release Observation** (~ 12 images)
 - 48 active Key project
 - 41 active Standard project
- All with more the 1 planned paper



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Three type of Euclid papers:

Flagship : alphabetic order

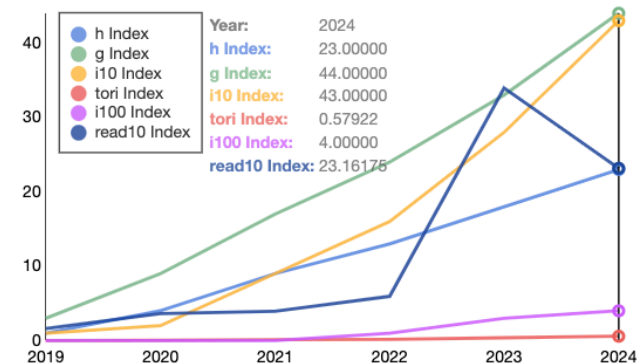
Key and Standard paper : Main author + L1 + L2 + L3

Level	Criterion	Publication rights
L4: Associate	FTE < 2	Only papers they effectively contribute to
L3: Member	$2 \leq \text{FTE} < 4$	All KPPs regardless the scientific, data, or technical nature, + those SPPs where they effectively contribute to
L2: Long Term Contributors	$\text{FTE} \geq 4$	All KPPs, regardless the scientific, data, or technical nature, + any SPP they wish, provided it is in their field of expertise and they confirm they understand its contents, + those SPPs where they effectively contribute to
L1: Founders + Builders	Selected by ECB, according to [AD-02]	All papers

Euclid Founders or Builders associated to INFN

- 2 Founders
- 10 Builders

Evolution of the “impact” of the Euclid papers



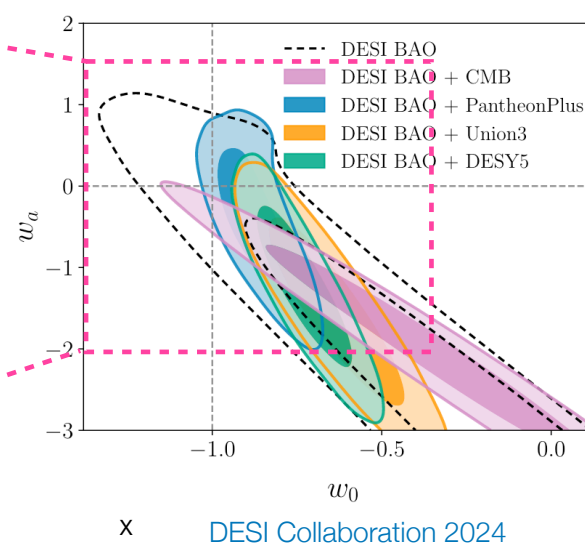
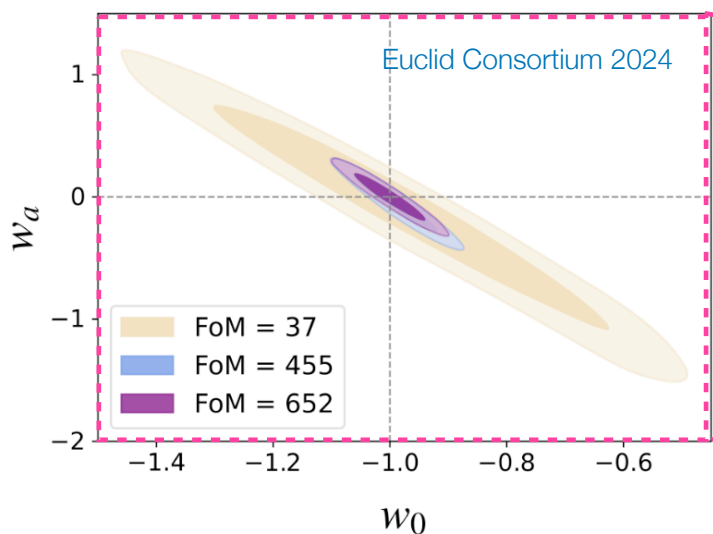


Expected sensitivity

Forecast shear auto-correlation functions, so called “3x2pt”

- Galaxy position : angular auto-correlation functions (galaxy position)
- Galaxy ellipticities : shear auto-correlation function
- position x ellipticity : cross-correlation

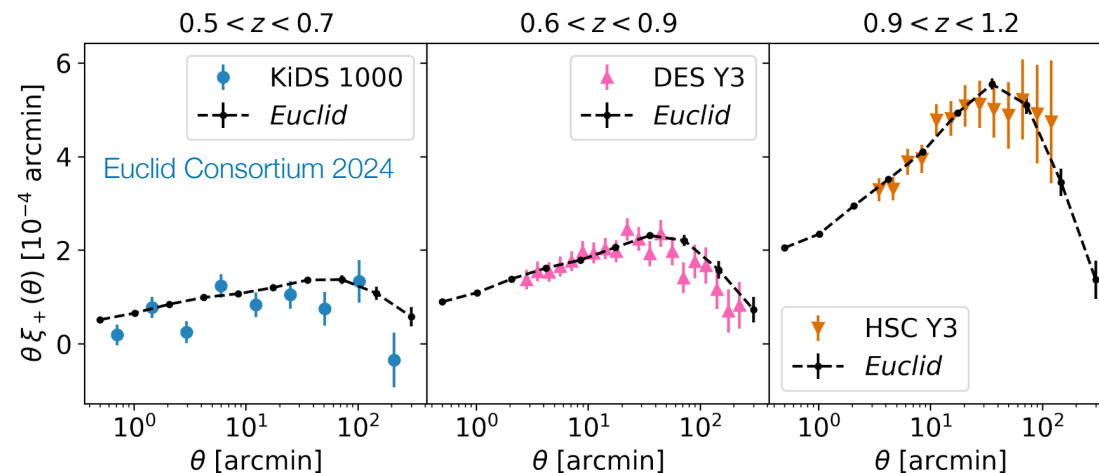
- w_0w_a CDM (GCsp)
- w_0w_a CDM (3x2pt)
- w_0w_a CDM (3x2pt + GCsp)



Sensitivity to Dark energy equation of state
 $w_0 \neq -1$ $\rightarrow$ departure from cosmological constant

$$w(z) = w_0 + w_a \frac{z}{1+z}$$

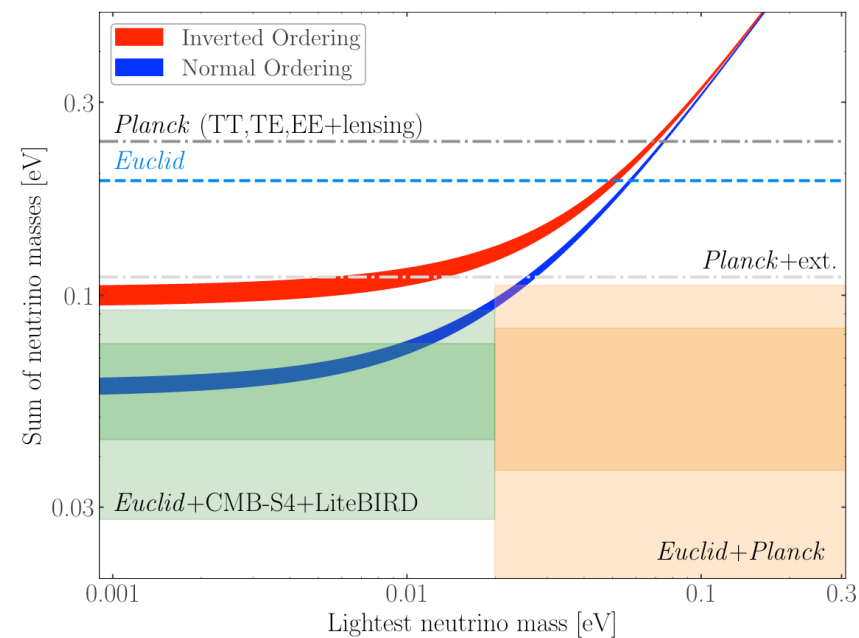
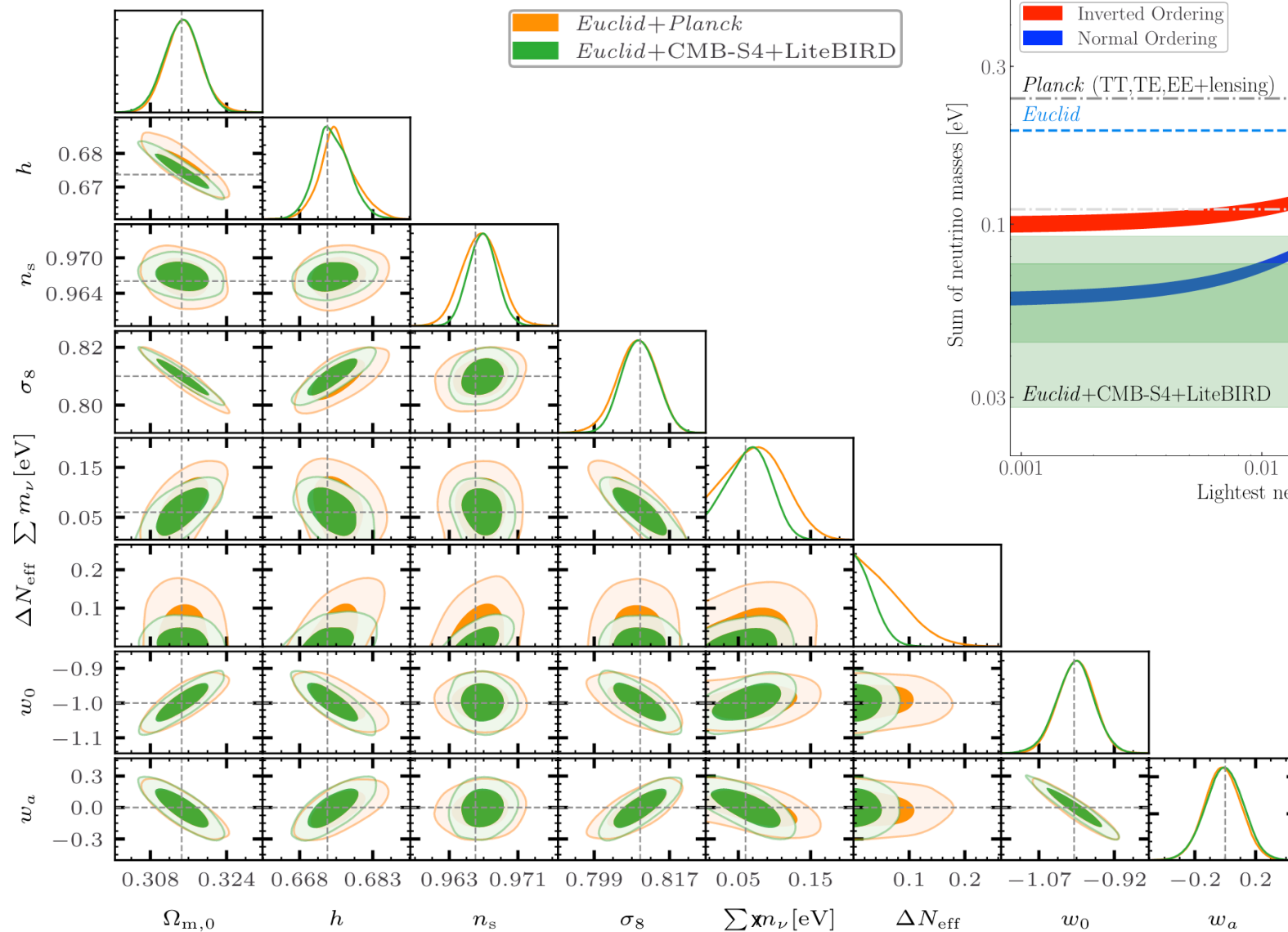
Sensitivity to matter distribution along the line-of sight and history of structure formation





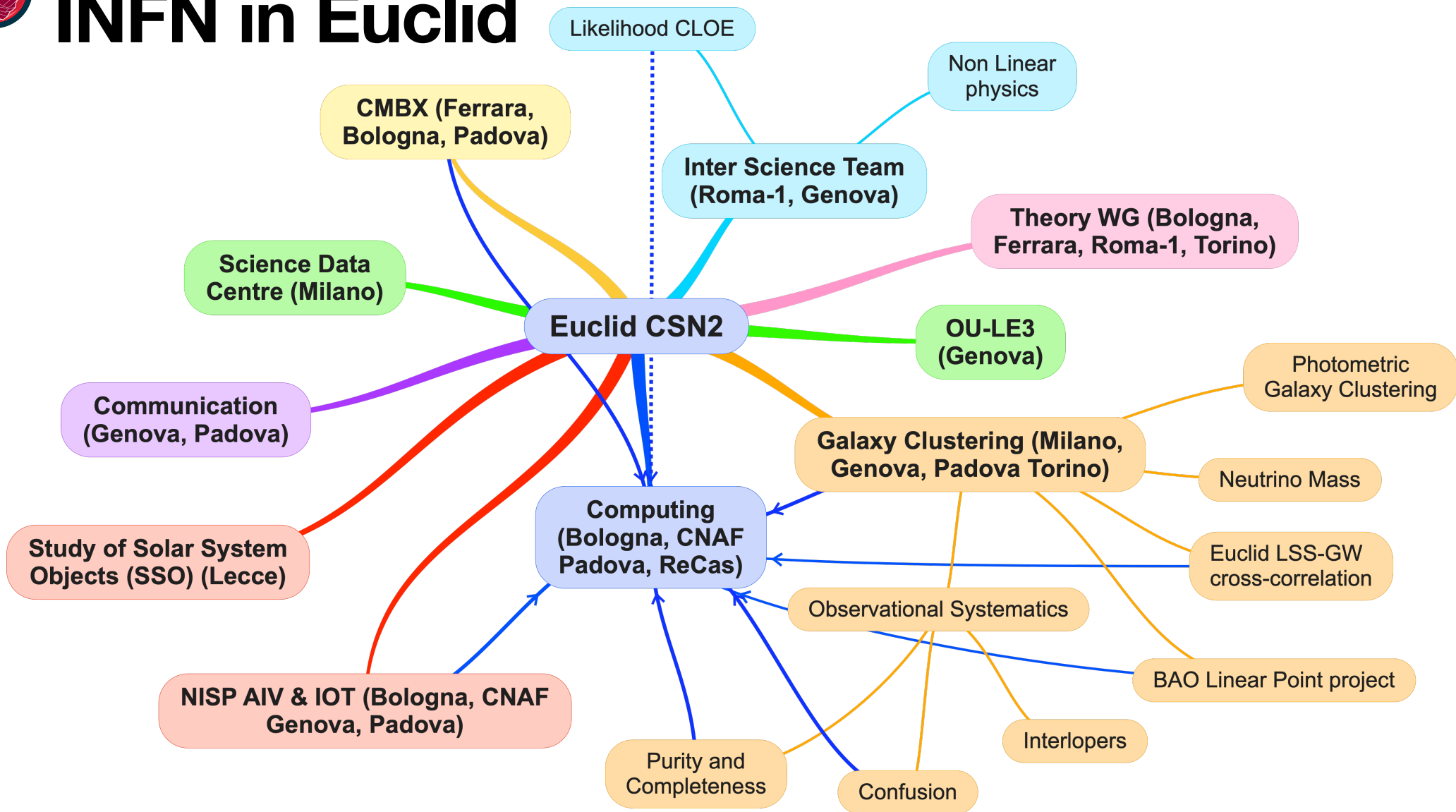
Neutrino Mass with Euclid

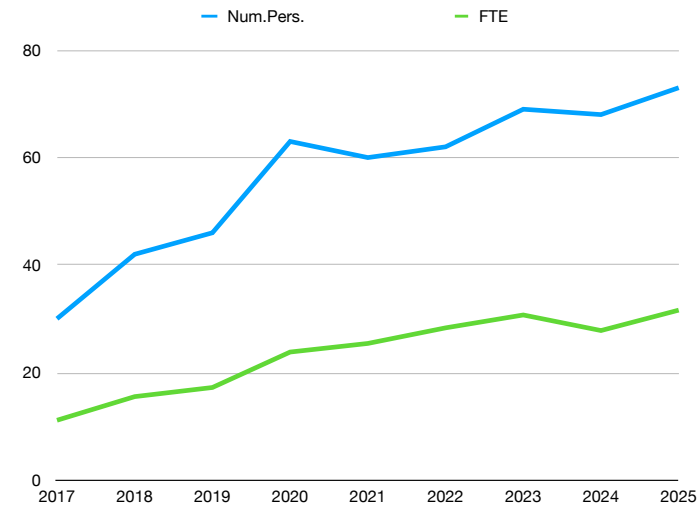
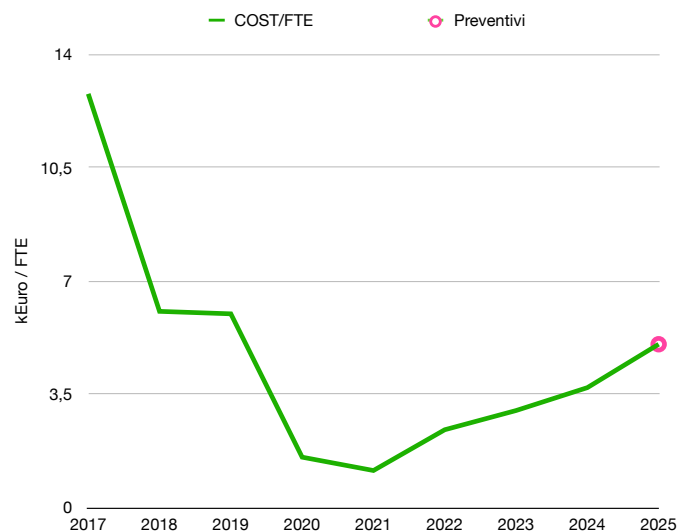
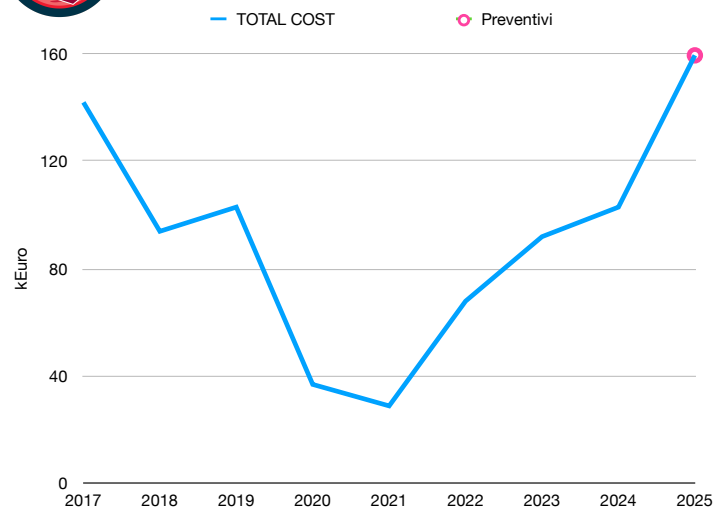
Euclid preparation: Archidiano et. al (2024)



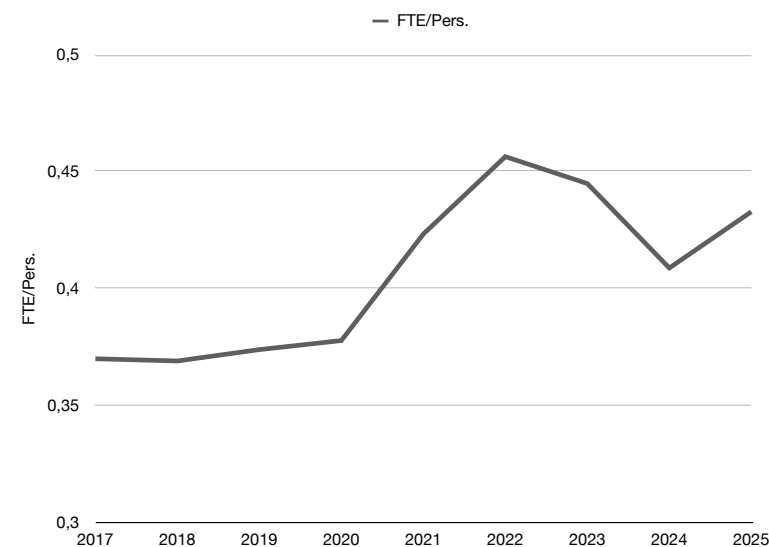
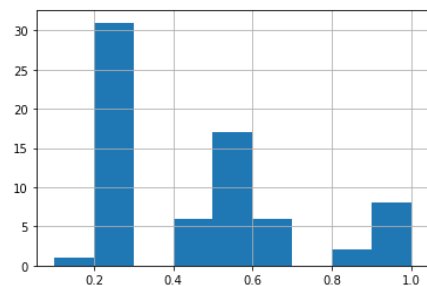


INFN in Euclid





- **Costante crescita** della partecipazione sia in numero di **persone che FTE**
- FTE/persone > 0.4
- **Costo totale a FTE stabile**, si vede la ripresa dei viaggi post-covid.
- Le segnalazioni di violazione delle regole CSN2 sono state (quasi) tutte sanate





Contratto ASI per attività NISP

- Il contratto **ASI “Attività scientifica per la missione Euclid – fase D”** che vede INFN come sotto-contrattare sulle **attività di integrazione, validazione e test della elettronica calda dello strumento NISP**, e' stato **prorogato** a zero-costi fino a **fine settembre 2024**.
- A causa di alcuni ritardi nella gestione dei fondi, non tutti i fondi sono stati spesi per i contratti.
- Si sperava in una proroga di un anno ,a **ASI ha concesso a marzo 2024 solo 6 mesi**.
- L'avanzo previsto di ~20 keuro e' stato stornato a maggio 2024 su missioni e in parte utilizzato per missioni inerenti alle attività NISP AIV.
 - Quindi quest'anno parte del SJ allocato a Euclid non e' stato utilizzato per la presenza di questi fondi ASI.
 - Alcuni fondi ordinari di CSN2 verranno restituiti, si veda report delle sezioni.
 - **Questi fondi di missione ASI sono “One-off”**, la situazione non si ripresenterà nel 2025 e neanche negli anni futuri.
- I contratti in essere a fine settembre (3 assegni) migrano in continuità sul nuovo contratto ASI
- Il **nuovo contratto ASI “Attività scientifica per la missione Euclid – fase E” è stato approvato a fine maggio 2024**. Responsabile S.Dusini
- Gli impegni sull'integrazione dello strumento NISP si sono trasferiti sulla gestione dello strumento e la validazione dei dati e nel nuovo contratto “fase-E”, INFN ha due WP per un totale di 60 mesi-persona (TD) finanziati da ASI.
 - WP3300: Computing for Science Validation
 - WP3400: NISP Health Check Coordination and Scientific Analysis for Operations

Conclusions



- The **first year** of Euclid on-sky was **successful !!!**
 - Spacecraft and instruments are working with **excellent performances**
 - Few major issue (pointing, starlight, ice) which now seems under control
 - The loss in coverage due to starlight can be overcome, we have fuel for 14 years
- Data reconstruction is more difficult than expected (normal !!)
- Simulation and in general the calculus for high level analysis are still an issue
- **The schedule for data release is challenging....**
- **INFN is well integrated** in the Consortium: O(10) KP are lead by INFN associates, with few Key & Standard paper (~4) lead by members of the Euclid-CSN2 “founders” (= Bologna, Genova & Padova) (**Interlopers, Purity and Completeness, Confusion, BAO-Linear Point...**)