Report attività Genova

Riunione Referee INFN, Settembre 2025

S. Davini on behalf of INFN Ge and UniGe group members

Nome	Afferenza INFN	Posizione	FTE
Enzo Branchini	CSN4	UniGe Prof Ordinario	0.5
Evandro Balbi	CSN2	INFN Assegnista	1
Stefano Davini (RL)	CSN2	INFN Primo Ricercatore	0.4*
Gaia Delucchi	CSN2	UniGe dottoranda	1
Sergio Di Domizio	CSN2	UniGe Prof Associato	0.3
Antonio Farina	CSN4	UniGe dottorando	0.5
Edoardo Maragliano	CSN4	UniGe dottorando	0.5
F. Oppizzi	CSN2	INFN Assegnista	1*
Ilaria Risso	CSN2	INAF Assegnista	1
Gemma Testera	CSN2	INFN Dirigente Ricerca	0.2
Silvano Tosi	CSN1	UniGe Prof Associato	0.2
Alfonso Veropalumbo	CSN4	INAF Ricercatore	0.5

Attività di Ricerca

- **NISP Instrument Operation Team**
  - monitoring NISP health and data quality
  - development of monitoring tools

- **LE3 and Galaxy Clustering analysis**
  - coordination 2-pt 3-pt correlation function pipeline
  - assessing the impact of contaminants and systematic errors
  - getting the most out of clustering analyses

- **Likelihood**
  - development of the official Euclid likelihood code, CLOE

NISP Instrument Operation Team

- IOT oversees the monitoring of the instrument and provides support for the validation of the calibration products and in case of problems with the instrument or anomalies in the data
- **Genova Team members**: E. Balbi, G. Delucchi, S. Tosi, G. Testera (+ exchange student for 3 months)

Contribution of Genova

- Check the health status of NISP on a daily basis
- Monitor the medium-long term (weeks, months) behavior of NISP
- **Implement tools to monitor a list of already approved parameters**
- Developed a framework allowing for a fast overview and stimulating further more detailed analysis
  - Complementary with existing tools (IODA, WebMust)
  - Framework routinely used by the shifters
- **The tools were essential for Quick Data Release 1 (Q1) in March 2025**

Data & tools for the monitor

1) Telemetry data: available on EAS as fits file

2) QLA (Quick Look Analysis): Data Product form SOC
JSON files
Quick analysis of LE1 images performed by SOC (not the NIR pipeline)

- Data available on archive with 1-2 days of delay
- We have setup an automatic download procedure
- Telemetry and QLA are written in ROOT file
- ROOT file are available for analysis
- Plots with daily and monthly data are created (python, C++) and automatically uploaded on a web page
- These plots are used by the shifters (some interactive operations are possible like zooming, value reading, histogram rebin, log/linear scale...)

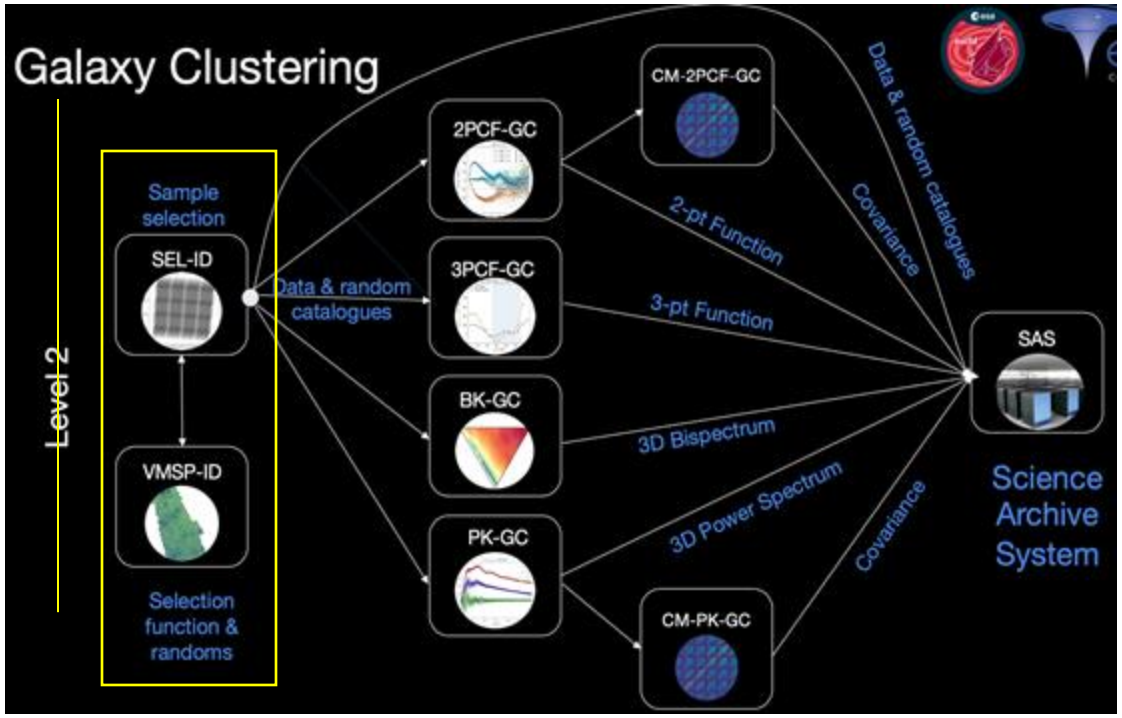
Outlook of IOT activity

- Tools routinely used by shifters since 2024
- Updated version deployed in 2025 (better graphics, faster code and more informative plots)
  - Added calibration data and information from LE2 Data Product
- Tools were used for Quick Data Release Q1 2025

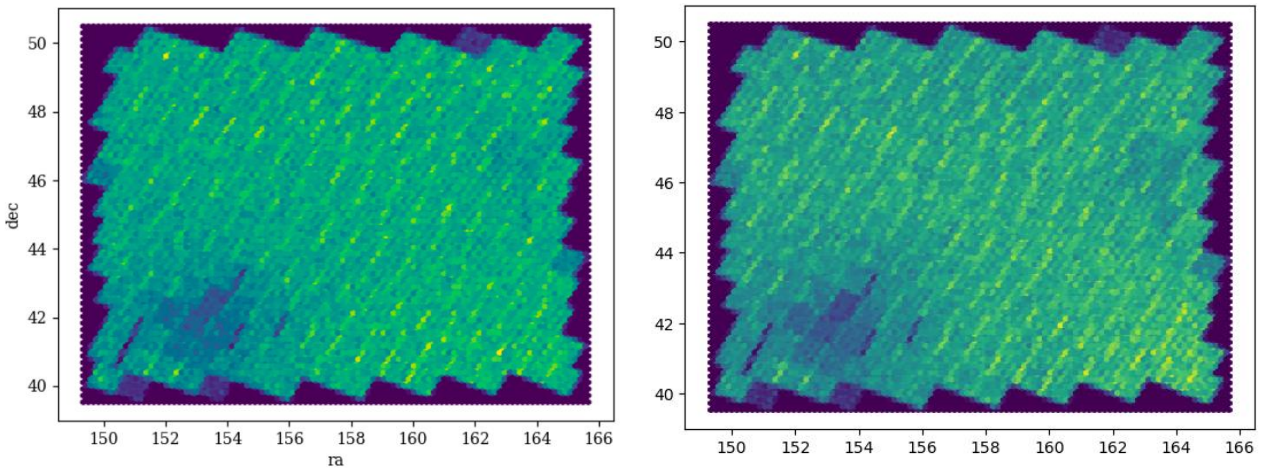
LE3 and Galaxy Clustering

- Construction the spectroscopic galaxy catalog and related 2-point correlation functions, characterization of systematic effects
- Validation of LE3 Processing Function within SGS
- Use of 500 deg2 area: Reprocess Regression Fields (RR)
- **Genova Team members**: E. Branchini (LE3 lead), A. Farina, E. Maragliano, I. Risso, A. Veropalumbo

Validation of the Spectroscopic Pipeline



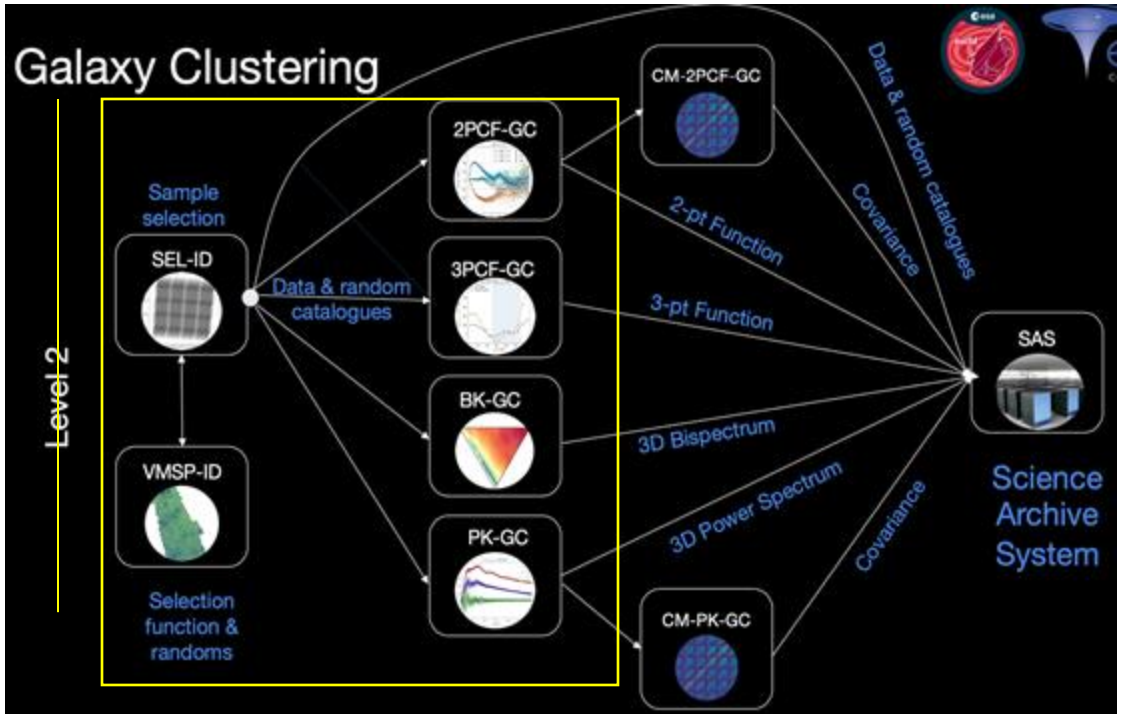
Responsibility role for the Level 3 stage of the SGS data analysis pipeline, which focuses on data from the spectroscopic survey. One of our key objectives is to construct the spectroscopic catalogue and quantify its selection function (yellow box).



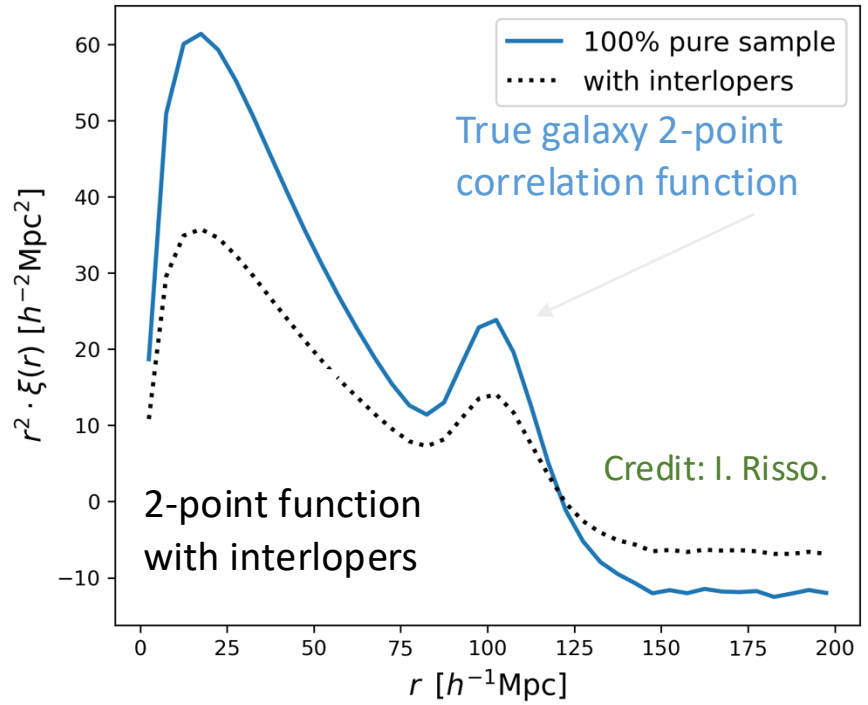
Credit: A. Farina, B. Granett

To compute the selection function, a reference calibration sample is required: the Euclid Deep Survey. However, this will not be completed before the first data release. Focus on alternative methods to estimate the survey's selection function and assess its completeness. AF (PhD) has developed and validated a method based on machine learning (ML) techniques by using the RR fields. This approach allowed us to estimate the 2-pt correlation function of galaxies in Euclid. The results were shown at the Euclid Consortium meeting 2025. A dedicated paper is under review.

Assessing the impact of systematic errors.

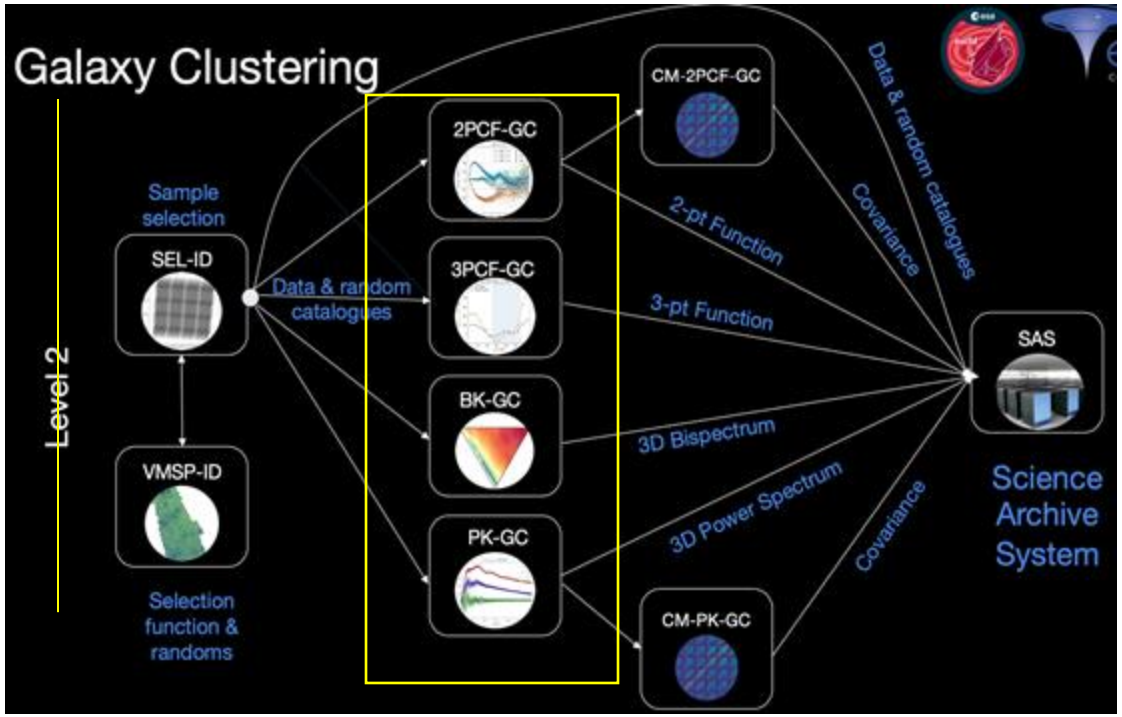


Several known and unknown observational effects will influence the selection and composition of the spectroscopic surveys. If not properly accounted for, these effects could impact the accuracy of clustering statistics estimates (yellow box).

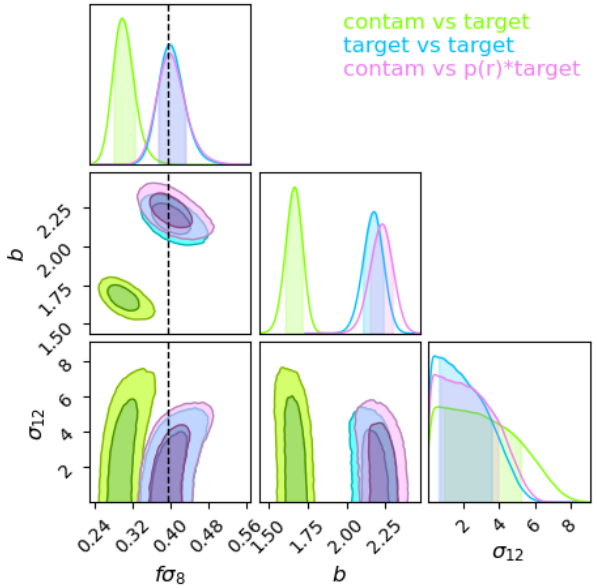


One such effect is the presence of ‘interloper galaxies’ with incorrectly measured redshifts, which are mistakenly included in the sample, reducing its purity. As a result, the galaxy-galaxy 2-point correlation function of the contaminated sample differs from the true function. The impact of interloper was assessed by IR using both real data and simulations. Article submitted to A&A, with IR as first author.

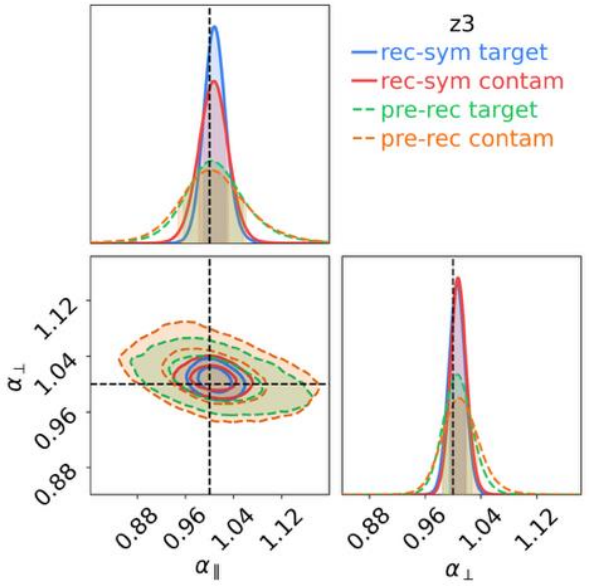
Assessing the impact of systematic errors.



Galaxy 2- and 3-point clustering statistics are the primary probes used by Euclid to trace the expansion history of the Universe and infer cosmological parameters.



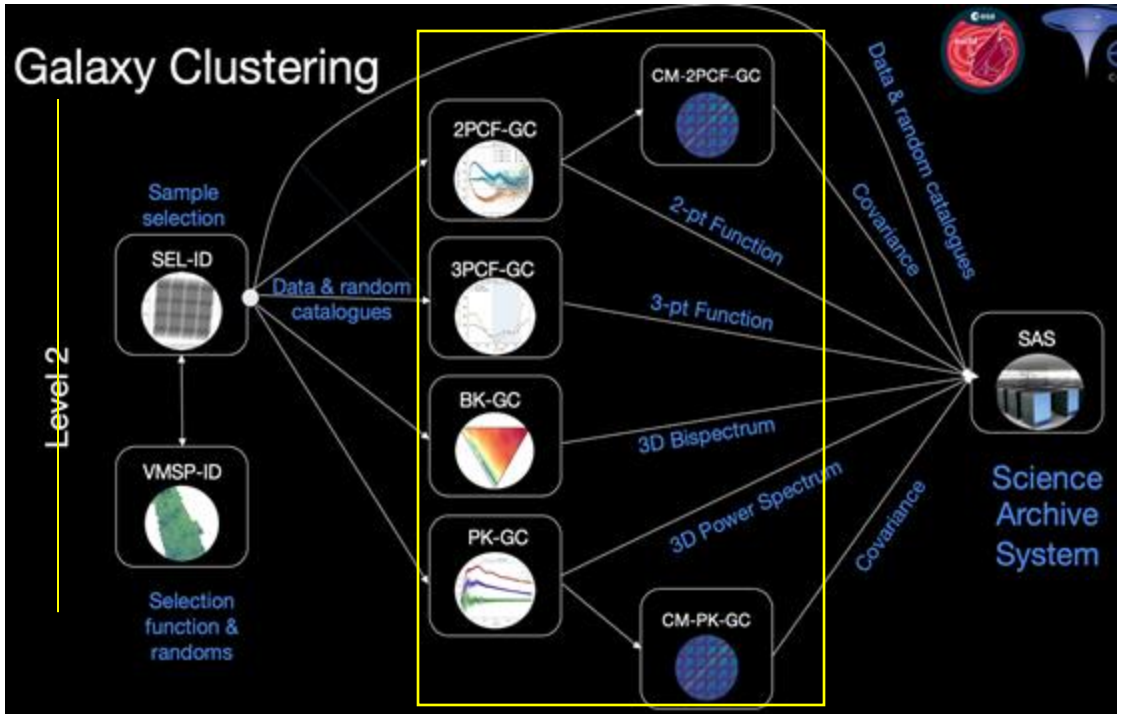
Credit: I. Risso.



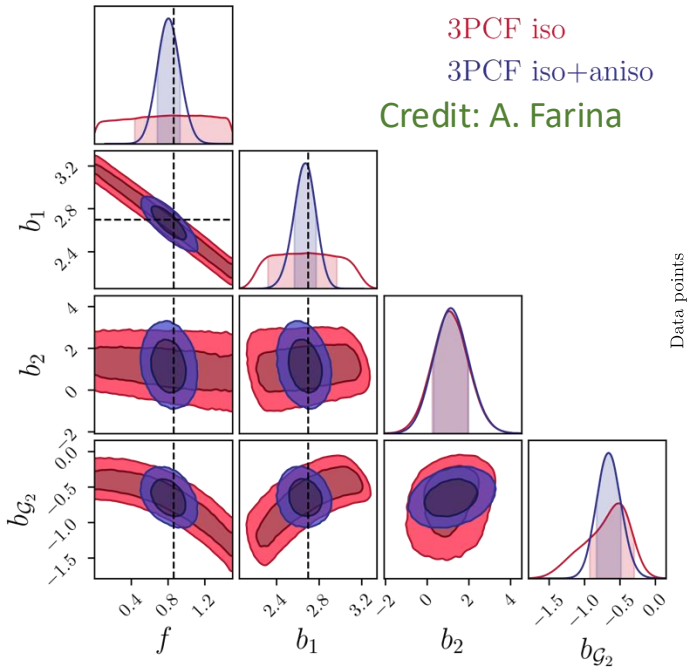
Credit: E. Maragliano

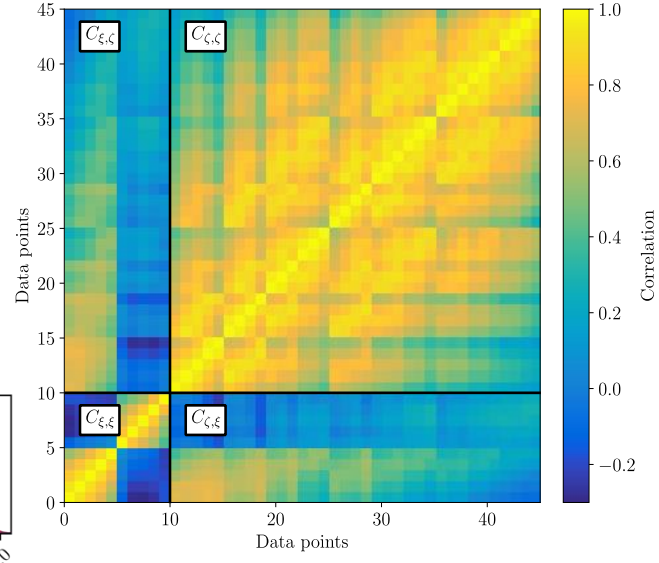
Validation of reconstruction of spectroscopic catalogues.
Estimate of contaminants on 2-pt correlation functions.
New method of reconstruction developed by EM (PhD) based on dynamical models with machine learning approach.
Results submitted to A&A.

Getting the most out of clustering analyses



Clustering analyses are typically limited to 2-point statistics. However, higher-order statistics offer complementary insights. In Euclid, we specifically focus on the 3-point correlation function.





Credit: A. Veropalumbo

Combining 2- and 3-point correlation functions helps to break cosmological parameter degeneracies, particularly when the anisotropic component is included in the analysis (blue vs. red probability contours in the left figure, by AF). However, these analyses are computationally expensive. Faster techniques for estimating the data covariance matrix have been developed and now under validation (right panel, by AV).

Likelihood CLOE

- Likelihood code: computation of observables (from theory + systematics), comparison with data, then statistical inference on cosmological (+nuisance) parameters
- **CLOE release v2.1 during 2024 Euclid Consortium Meeting**
- **Genova Team members**: S. Davini, S. Di Domizio
- 5 Papers submitted to A&A recently.
- Refactoring and speed-up of the code in 2025, work ongoing to be ready for Data Release 1.

Euclid Consortium Duties

- **Communication** - Silvano Tosi
- **Editorial Board** – Gemma Testera
- **Star Prize Committee** – Gemma Testera
- **Speaker Bureau** – Silvano Tosi