Activities Euclid
INFN Genova

- Meeting with referees
- September 11th 2026

Anagrafica

Nome Esperimento	Euclid		
Nominativo	**Ruolo**	**Afferenza**	**% o n. ore**
Stefano Davini (former RL)	INFN (Primo Ric.)	CSN2	20
Gemma Testera	INFN (Dir. Ric.)	CSN2	20
Enzo Franco Branchini	Università Genova (PO)	CSN4	50
Gaia Delucchi	Università Genova (dott)	CSN2	100
Evandro Balbi	INFN (assegnista)	CSN2	100
Silvano Tosi (new RL)	Università Genova (PA)	CSN1	20
Alfonso Veropalumbo	INAF (TD)	CSN4	20
Edoardo Maragliano	Università Genova (dott)	CSN4	50
Ilaria Risso	Università Genova (assegnista)	CSN2	100
Antonio Farina	INAF (borsista)	CSN4	20

Totale 5 FTE (0.5 FTE / persona)

Main contributions by INFN Genova

NISP Instrument Operation Team: participation in activities during in-flight calibration and wide surveys; monitoring, calibration, and validation of the infrared detector

Solar System Objects: transient identification algorithms (including cosmic rays) adapted for asteroid observations

Ground Segment Level 3 Activity: coordination and validation of numerical codes for calculating 2-point and 3-point correlation functions of galaxy clustering

Main contributions by INFN Genova

Galaxy clustering analysis: impact of contaminants on 2-point and 3-point correlation functions; alternative methods for estimating the spectroscopic selection function without deep-field data. Responsibility for the development, validation, and integration of algorithms for the dynamic reconstruction of galaxy catalogs, aiming to maximize the Baryon Acoustic Oscillation (BAO) signal.

Development of likelihood code: code for inferring cosmological parameters from 2-point correlation function measurements.

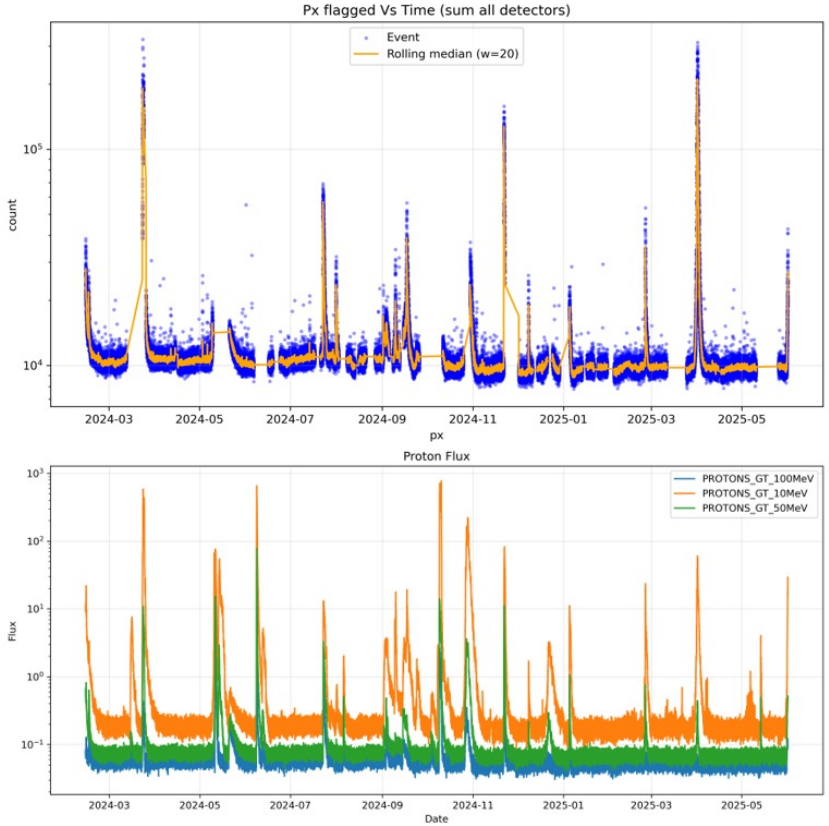
NISP IOT

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 (+ master student Daniele Chioetto)

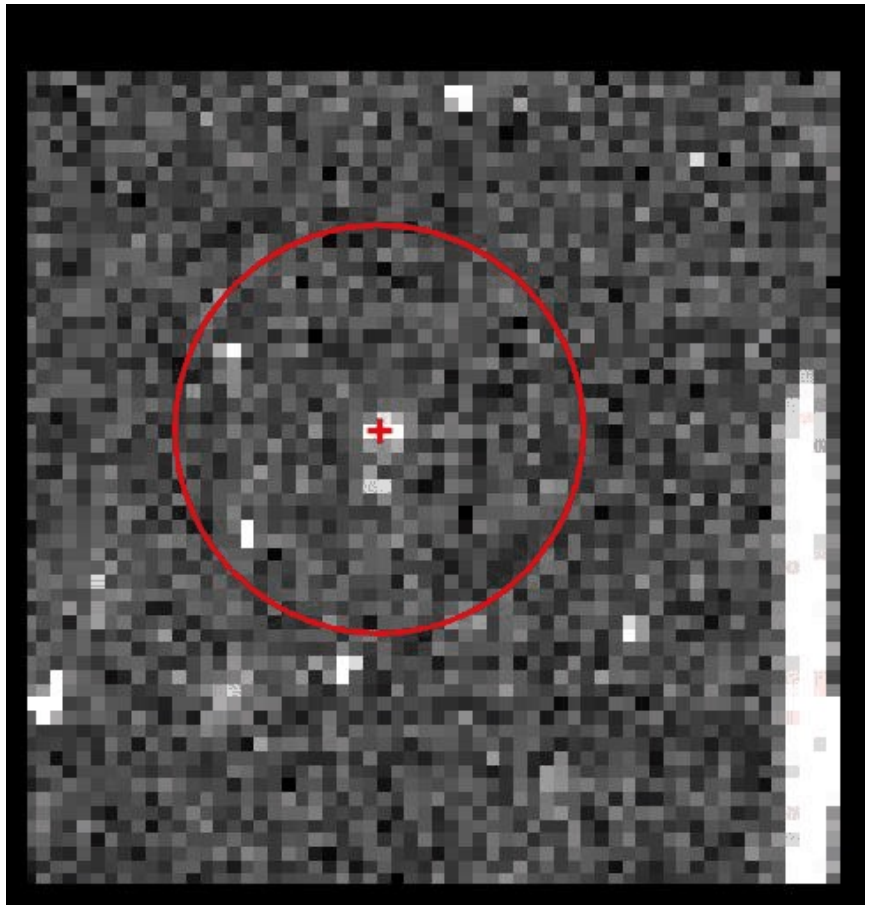
Main contributions

- Check the health status of NISP on a daily basis
- Monitor the medium-long term (weeks, months) behaviours
- **Implement tools to monitor a list of already approved parameters**
- Developed a framework allowing for a fast overview and stimulating furthermore detailed analysis
- Study of impact of cosmic-rays, snowballs, persistency
- Complementary with existing tools (IODA, WebMust)
- Framework routinely used by the shifters : **the tools were essential for Data Releases**
- The work is contained in a paper under review



Solar System Objects

- Work in synergy with INFN – Lecce (A. Nucita)
- **Genova team members**: E. Balbi, S. Tosi (+ master student Daniele Chioetto)
- Over the entire operational period of Euclid, it is expected that more than **150,000 SSOs** will be observed. This will yield a vast amount of novel data on previously unobserved SSOs.
- Using the data provided by VIS, verification that the same objects were also detected by NISP; preliminary photometric analysis of the objects identified so far.
- A paper is in preparation.
- Evandro Balbi is responsible of the proposal of SWG SSO for Q3/Q4

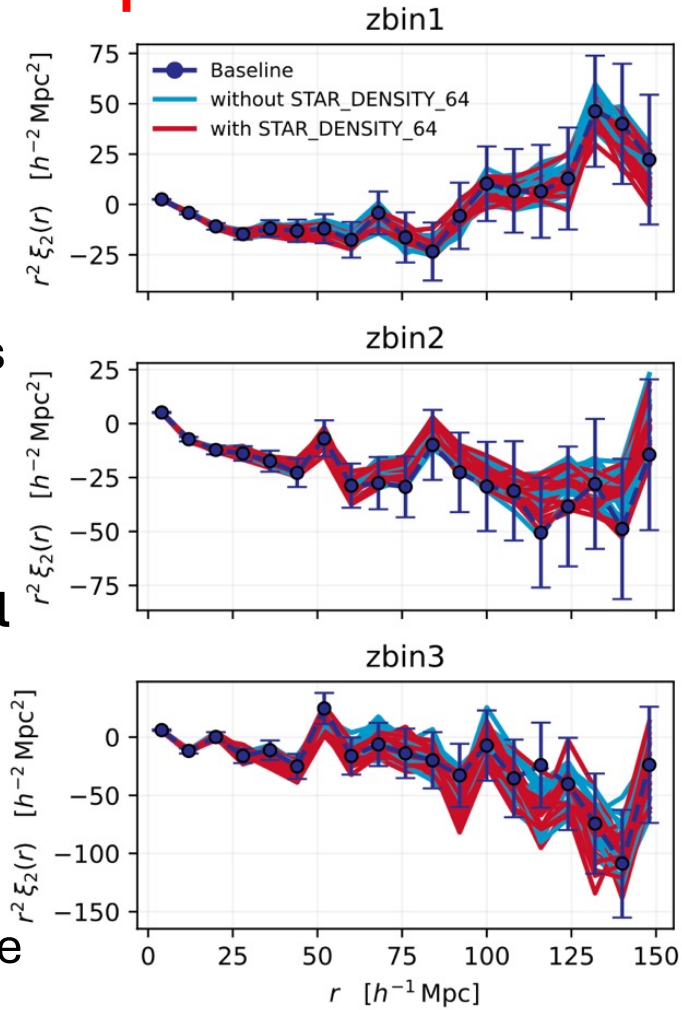


LE3 and Galaxy Clustering

- Construction of the spectroscopic galaxy catalog.
- Characterization and modeling of surveys' selection effects.
- Estimate of 2- and 3-point clustering statisics.
- Validation of the full LE3 data analysis pipeline.
- Preliminary analysis of the DR1 sample, north and south areas
- **Genova Team members**: E. Branchini (LE3 lead), A. Farina, E. Maragliano, I. Risso, A. Veropalumbo (+ master thesis students P. Mongiardini and M. Cicirello)

Validation of the Spectroscopic Pipeline

- The first step of the LE3 galaxy-clustering pipeline is to select a spectroscopic galaxy sample and assess its **completeness and purity**.
- The second step is to estimate its selection function.
- Together, these steps optimize the sample, maximize its scientific return, and enable unbiased clustering measurements.
- Antonio Farina contributed crucially by developing a **machine-learning strategy to characterize and model the selection function**.
- We recently delivered the second version of the DR1 sample and selection function, which are now being analyzed.
- We will continue refining the selection criteria before the final internal DR1 release, expected by the end of the year.

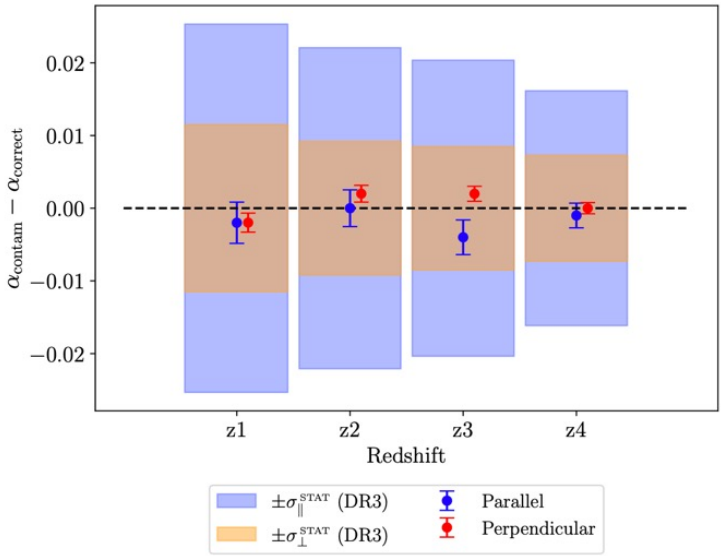


Multipoles of the 2-pt correlation functions measured in the Northern field

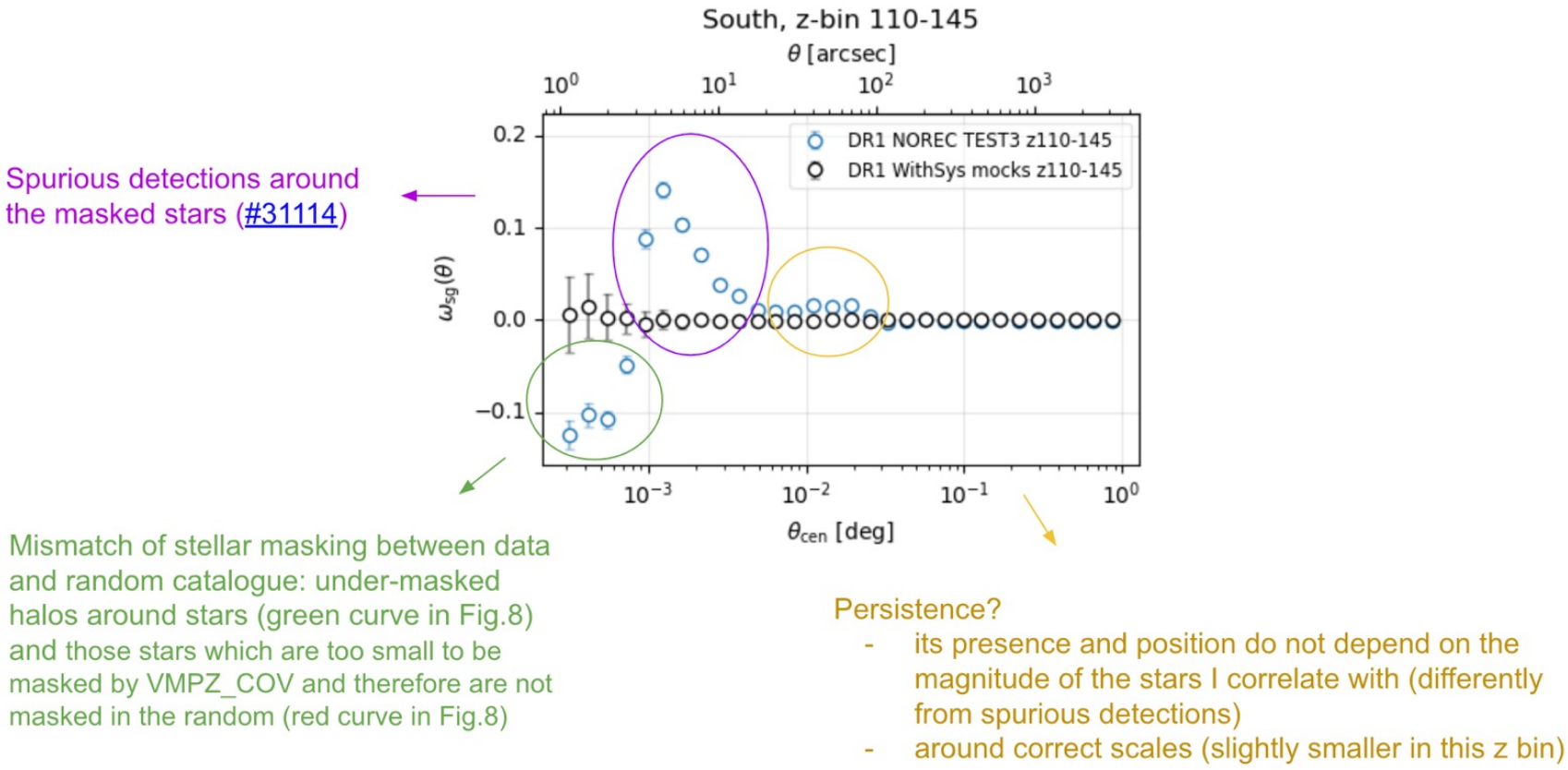
Assessing the impact of systematic errors

- Observational and instrumental effects degrade spectroscopic data and must be characterized to prevent biases in cosmological analyses. Achieving **sub-percent precision** requires accounting for multiple sources of systematic uncertainty.
- "**Interloper galaxies**" with incorrect redshifts can dilute and bias the clustering signal. Their impact was quantified by I. Risso (*Astronomy & Astrophysics*, 2026).

Systematic bias between the contaminated and correct cases across all redshift bins



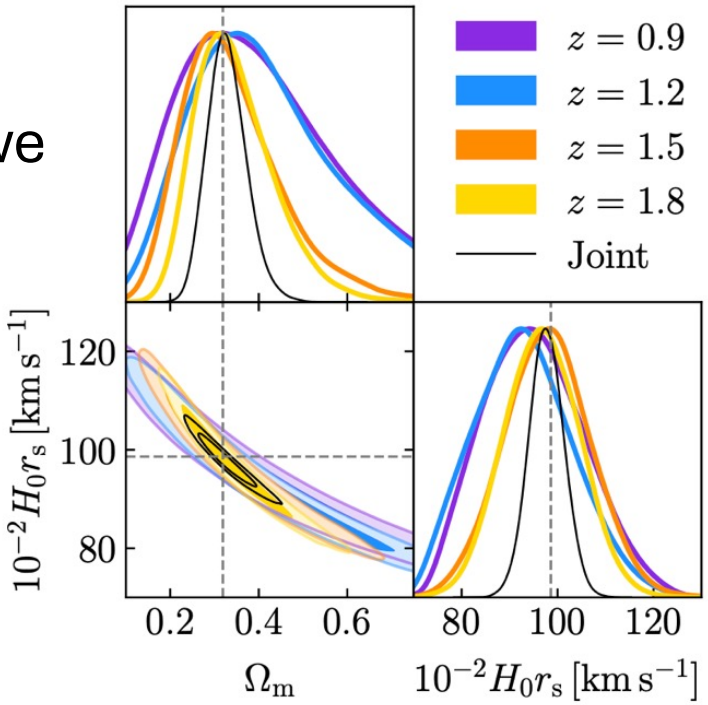
- **Persistence** from photometric images, primarily of bright stars, can contaminate subsequent spectroscopic exposures. I. Risso modeled this effect and assessed the bright-star removal procedure (*Astronomy & Astrophysics*, 2026; submitted).
- Reconstruction techniques can correct systematic and selection effects. E. Maragliano developed and validated a method to quantify their impact on two-point correlation functions and enable unbiased cosmic-void extraction (*Astronomy & Astrophysics*, 2026).



- Ilaria handled the detection of **stellar systematics in the real data** by examining the star-galaxy cross-correlation. In the mock catalogues, she had simulated persistence and a poorly calibrated stellar mask (https://arxiv.org/abs/2609.05155); in the actual data, we are primarily seeing the mask effect, but also other unexpected systematics—such as spurious detections around stars and along diffraction spikes.

Getting the most out of clustering analyses

- Galaxy-clustering analyses generally rely on two-point statistics. However, **higher-order statistics** provide complementary information that can improve cosmological constraints. Within Euclid, we focus specifically on the **three-point correlation function.**
- Combining two- and three-point correlation functions helps break degeneracies among cosmological parameters, particularly when their anisotropic components are included. Since these analyses are computationally demanding, A. Veropalumbo and A. Farina have developed faster techniques for estimating the covariance matrix of the measurements (*Astronomy & Astrophysics*, 2026; submitted).



Posterior constraints on Ω_m and $H_0 r_s$

Institutional roles

- **Editorial Board** – Gemma Testera
- **Speaker Bureau** – Silvano Tosi
- **EC github organization** – Stefano Davini
- **Key Project «clustering systematics» Leader –** Ilaria Risso
- **Key Project «higher order clustering» Leader –** Alfonso Veropalumbo
- **OU-LE3 Coordinator –** Enzo Branchini