PHOTOMETRIC REDSHIFTS IN THE CONTEXT OF ESA'S EUCLID MISSION

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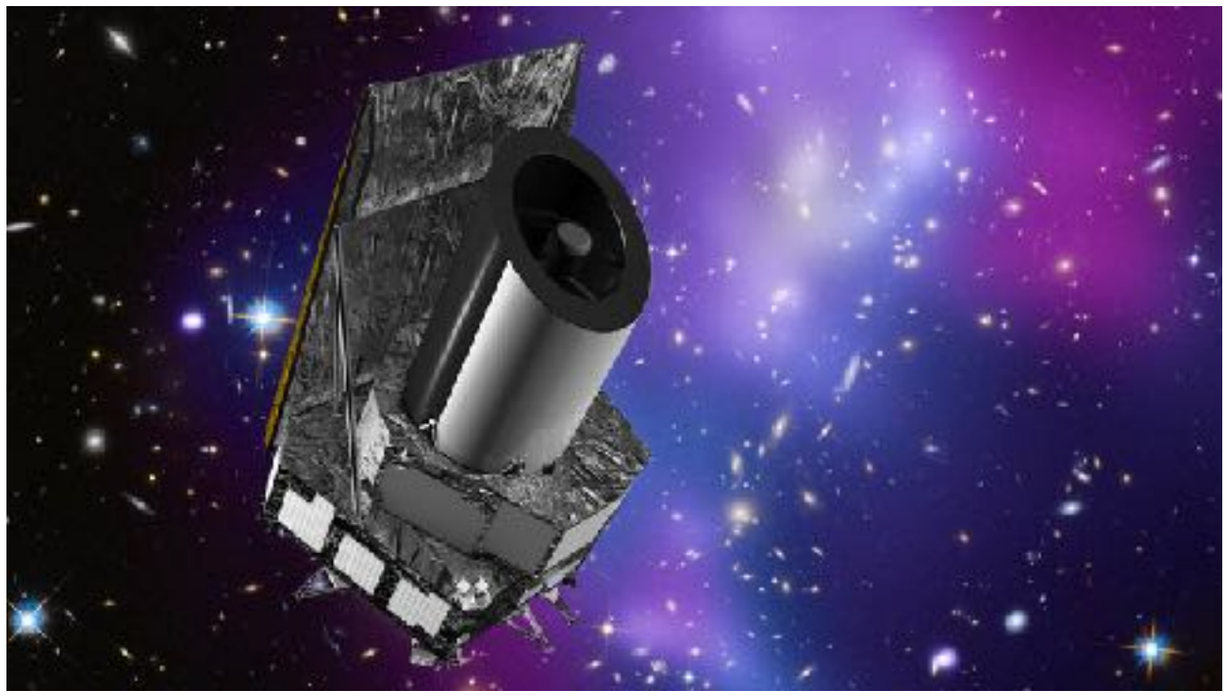
EUCLID MISSION

- A space mission by ESA, launch date: 2021.
- Mission: galaxy surveys (1.5 billions galaxies) for studying the dark universe using visible and near infra-red wavelengths.
- Two main cosmological probes: Weak gravitational lensing and Baryon Acoustic Oscillations.



Credit: ESA

OUTLINE

- The angular two-point correlation function of Planck SZ cluster catalog
- Simulations to investigate systematics effects of photometric redshifts
  - Validation simulation external data (SIM-EXT)
- Future works

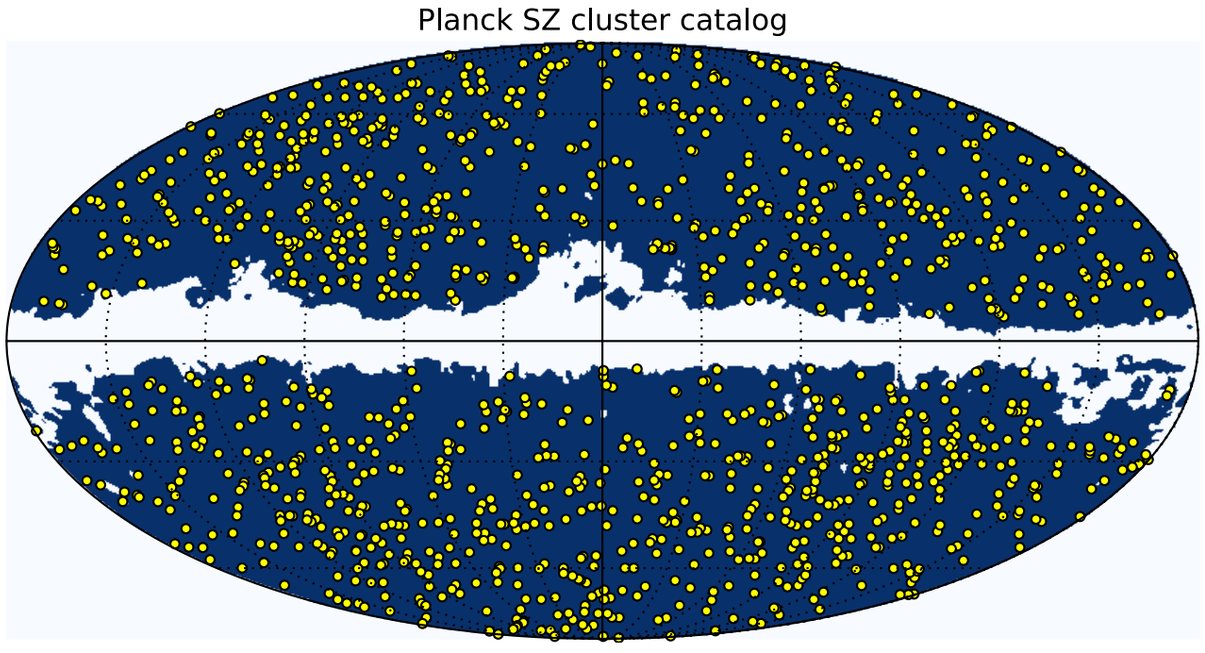
ESTIMATOR OF TWO-POINT CORRELATION FUNCTION

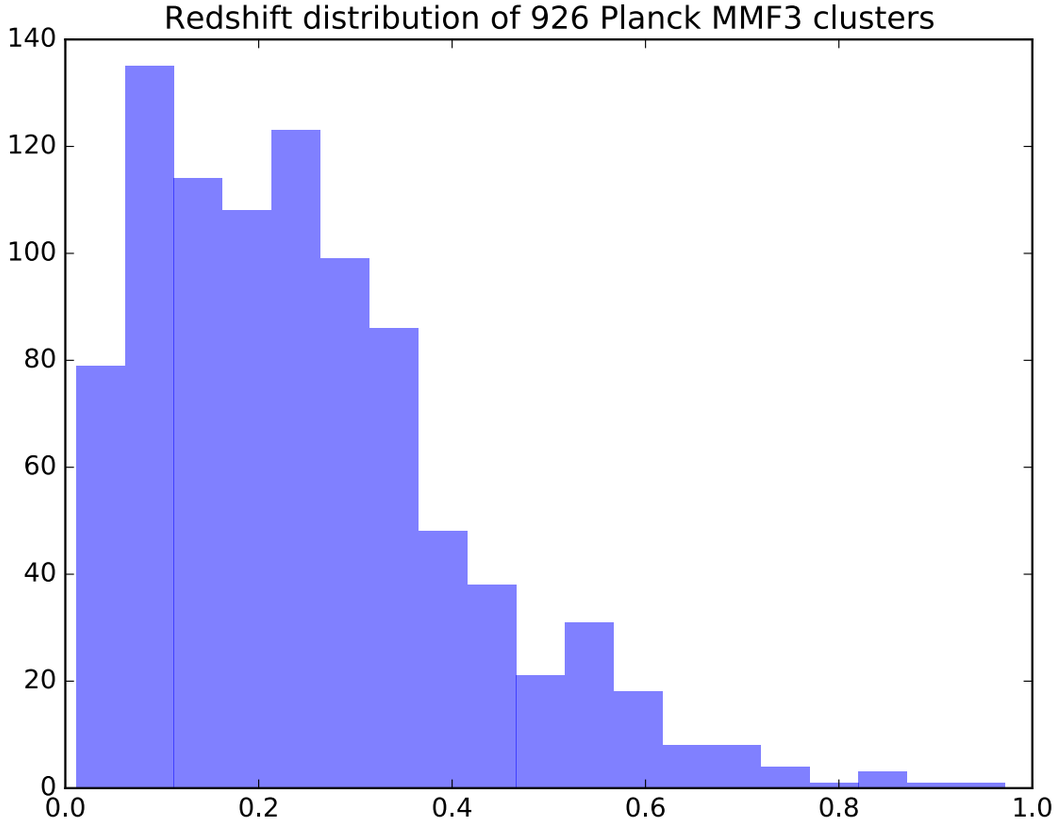
- Galaxy clusters are one of the probes of the large-scale structure of the universe.
- The two-point correlation function is a good statistical tool to quantify the **clustering** of sample.
- Excess probability (with respect to uniform) of finding a galaxy at angular separation $\boldsymbol{\theta}$ from another one.
- Need **random catalog** with the same geometry effects of mask and selection function as the data catalog.
- Landy and Szalay (1993):

$$\hat{w}_{LS}(\theta) = \frac{DD(\theta) - 2DR(\theta) + RR(\theta)}{RR(\theta)}$$

DATA: PLANCK SZ CLUSTER CATALOG

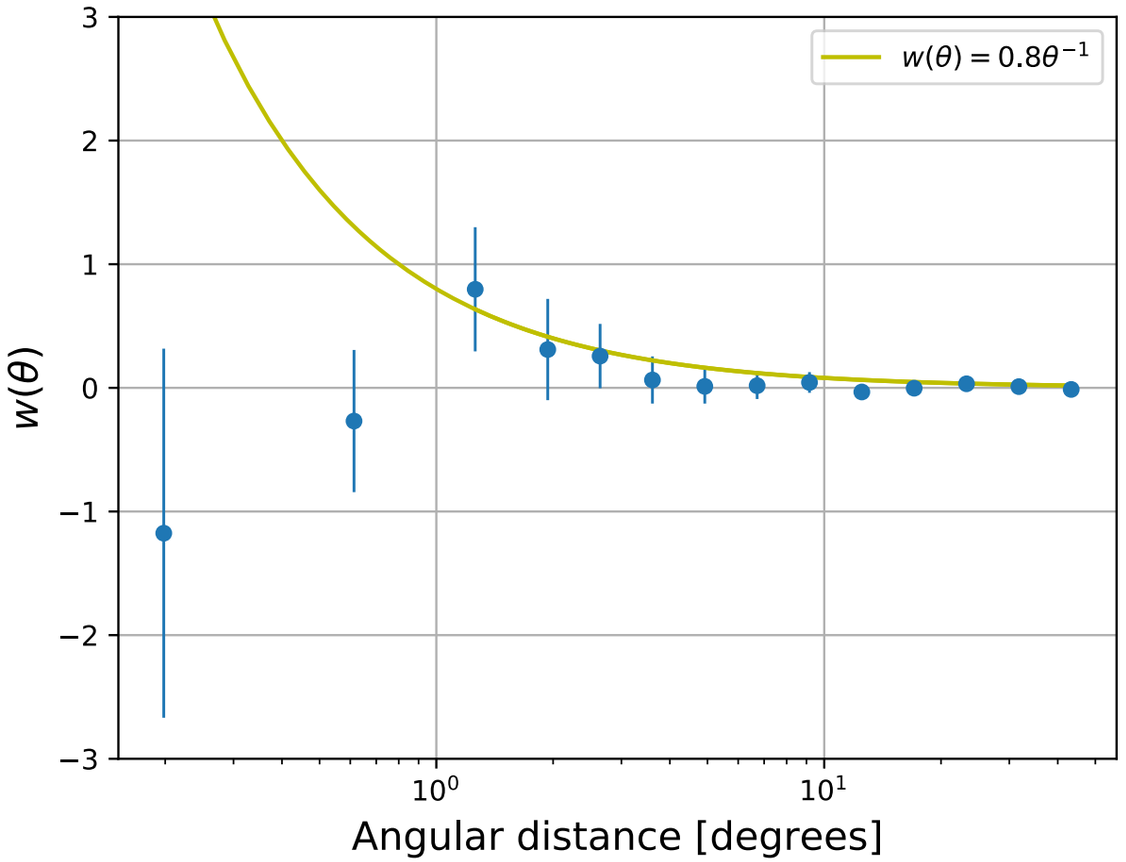
- Planck Sunyaev-Zel'dovich cluster catalog: **1271 clusters** from all sky-survey detected during 29 months (yellow dots), and the galactic mask (white area).
- **926 clusters** have redshift estimates in which 443 clusters SNR>6 and redshift < 0.4





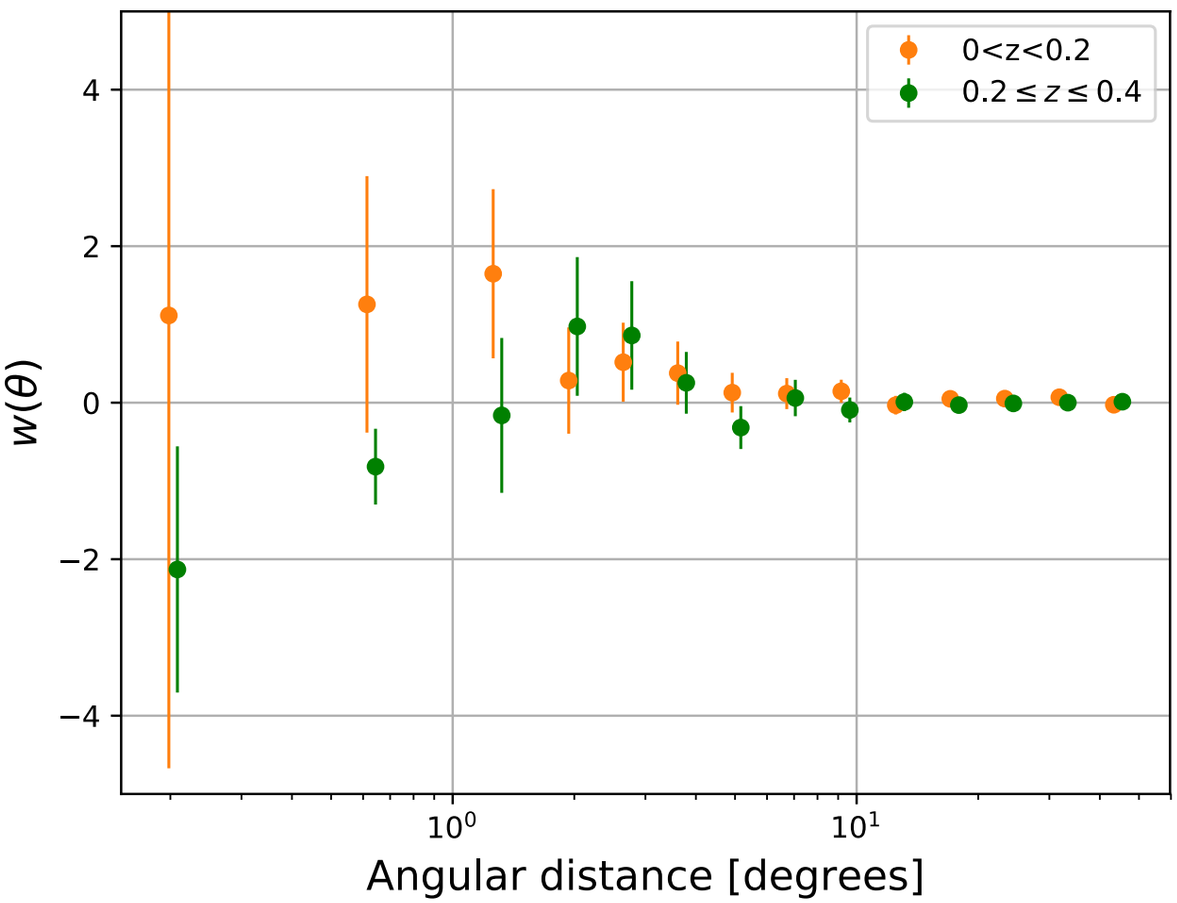
RESULTS

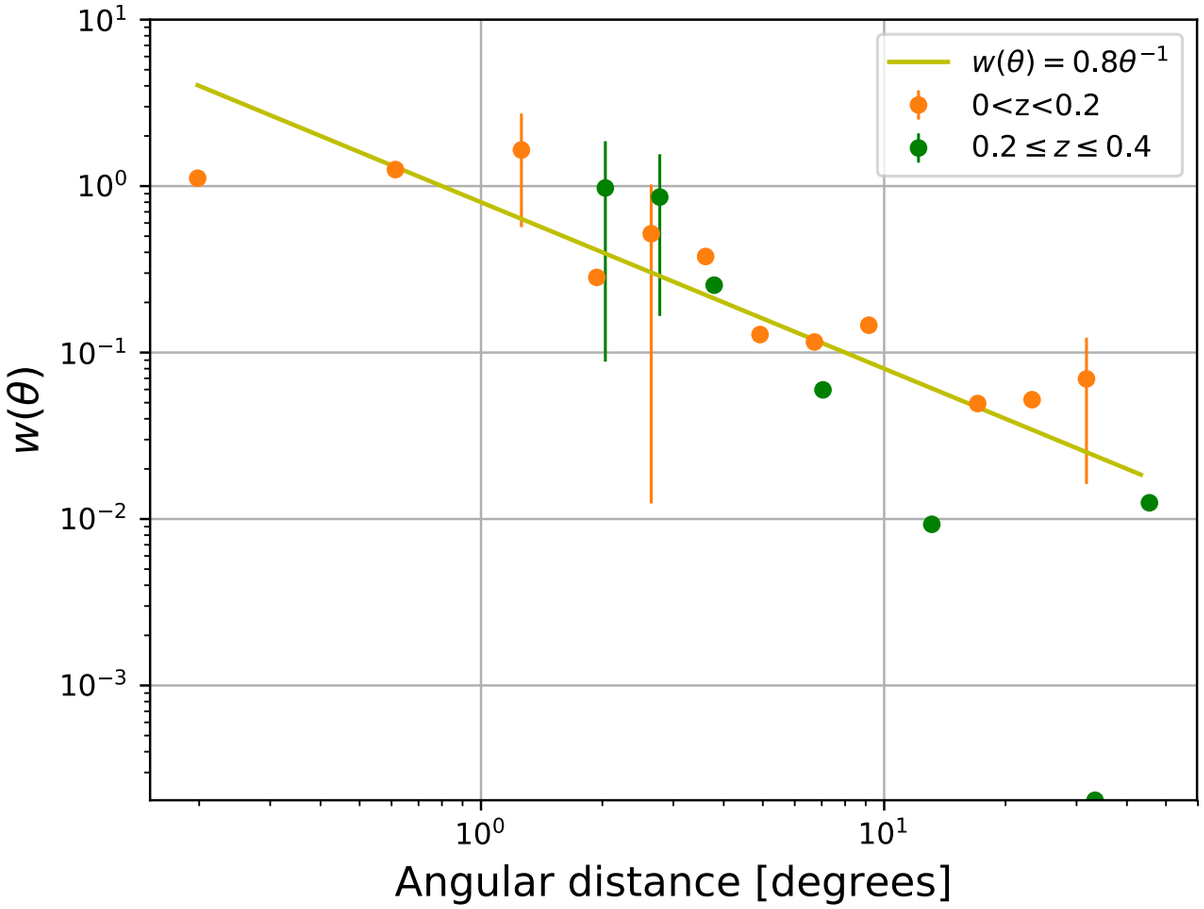
- Error bars are estimated by bootstrap method.
- Anti-correlation at angular distance <1 degrees.
- High correlation at angular distance from 1 to 3 degrees.
- Positive and lower clustering at higher angular distance.



TWO-POINT CORRELATION AT DIFFERENT REDSHIFTS

- 2 redshift groups (SNR>6): z < 0.2 (243 clusters); 0.2 <= z <= 0.4 (197 clusters)





- Strong clustering for low redshift group z < 0.2 at small $\boldsymbol{\theta}$ and it is quite compatible the power law of Bahcall and Soneira (1982) (yellow line).

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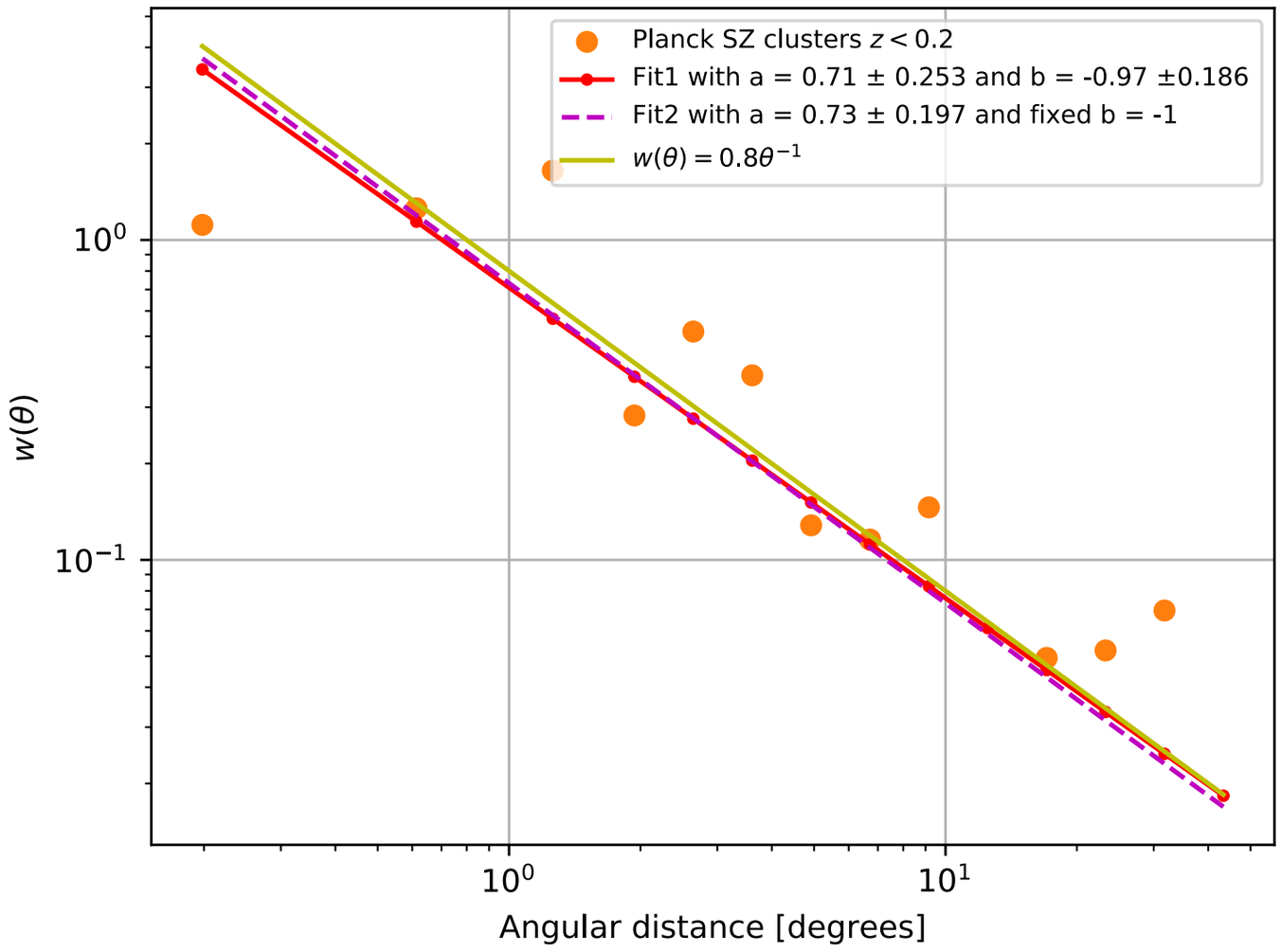

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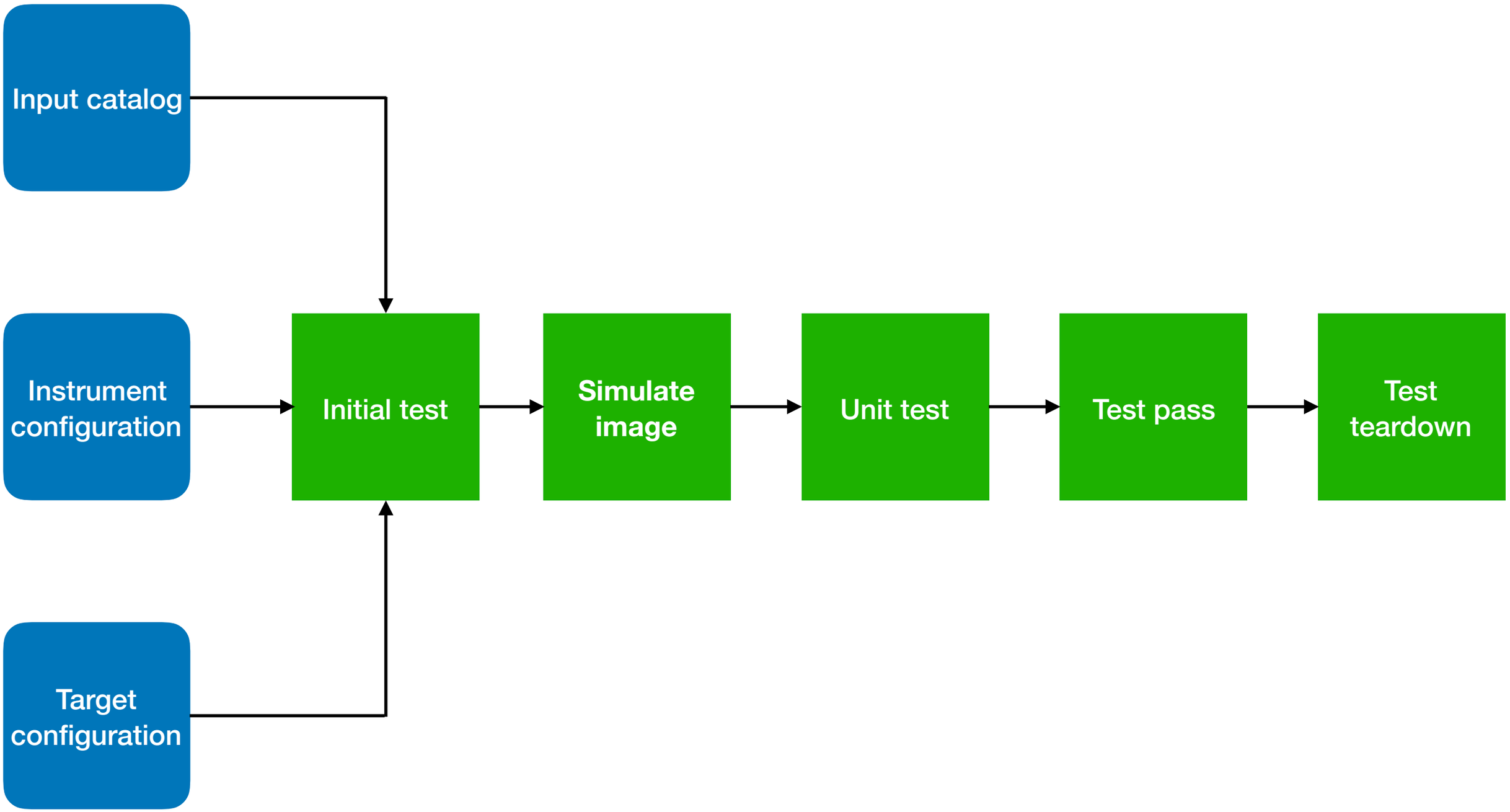
EUCLID SIM-EXT VALIDATION

- Euclid will need photometric redshifts for Weak Lensing.
- In combination with other surveys such as LSST, KiDS, DES, CFIS.
- APC is in charge of external data simulation and Euclid-specific LSST analysis pipeline.
- I tested and validated external simulation software.

UNIT TEST PIPELINE

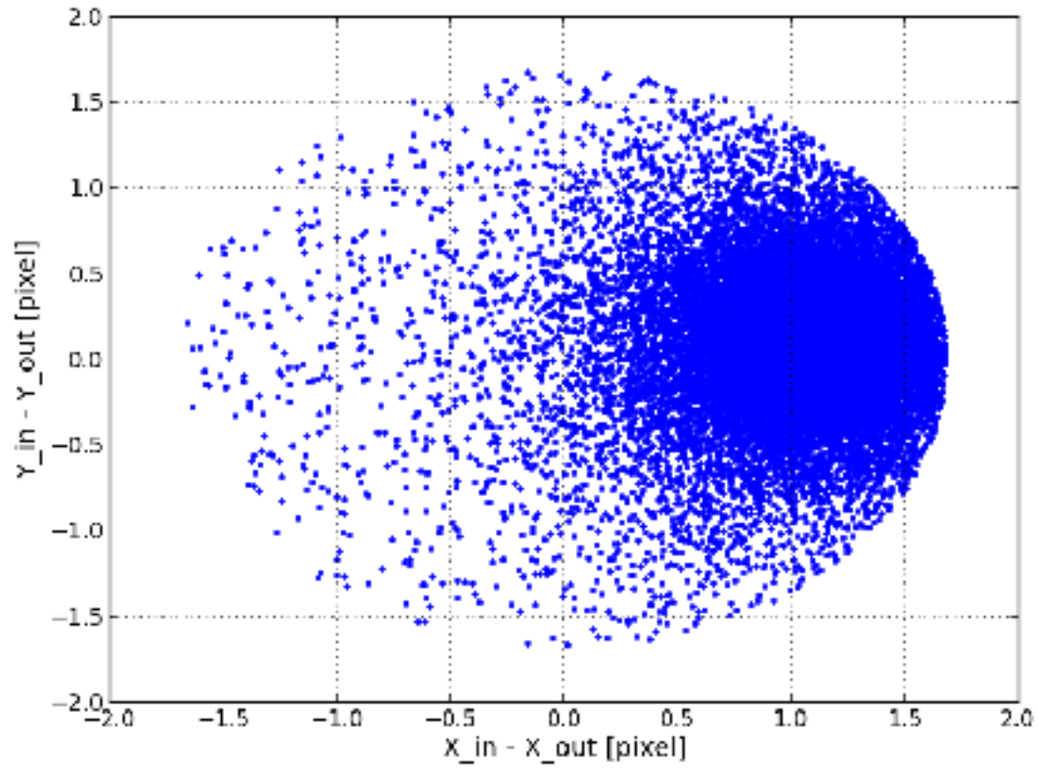


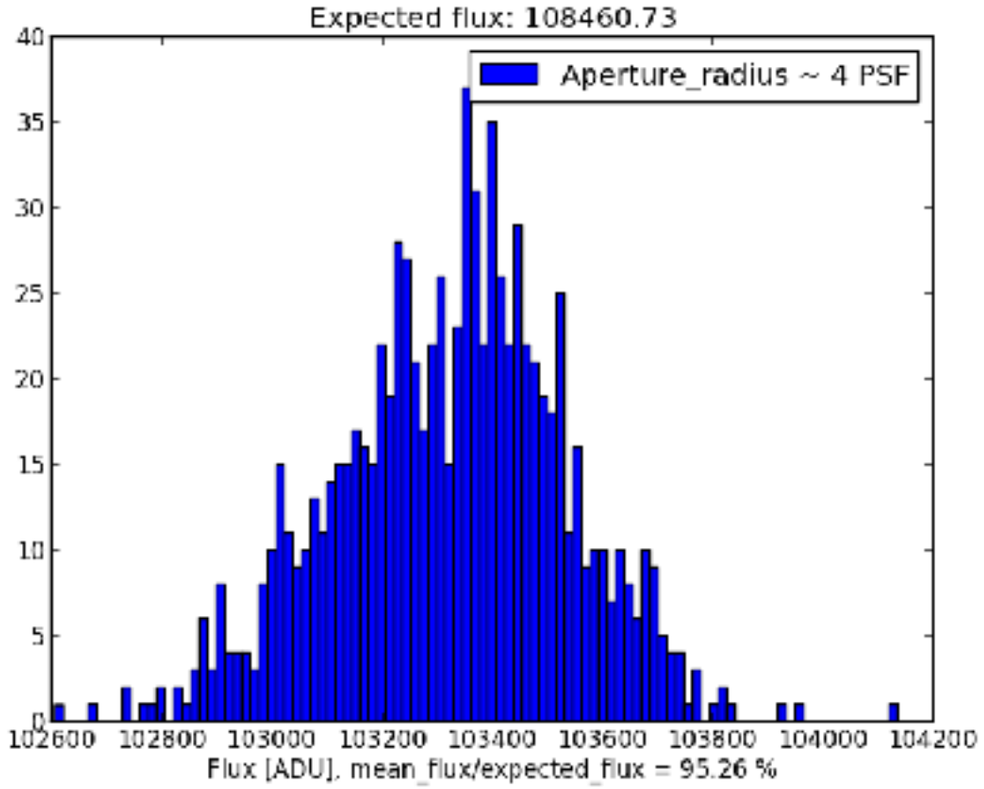
EUCLID SIM-EXT VALIDATION

- Two kinds of objects: star and galaxy.
- Use SExtractor as a tool to extract the output catalog from the simulation image, and make comparison for astrometry and photometry test.
- **Background test: check the background level and background noise.**
- **Astrometry test: validate the positions of simulation objects. It consists of pixel coordinates and equatorial coordinates.**
- **Photometry test: to validate the flux of output objects.**
- **PSF test: to validate the shape of output objects.**

STATUS OF THE VALIDATION

- Detected the shift of 1 pixel to the left of output positions.
- Detected 5% missing of flux of output objects
- These problems have been reported and fixed.





FUTURE WORKS

- Study systematic effects on photo-z: how does this affect cosmological studies ?
- Simple simulation for LSST photometry: adds the effect of the inhomogeneity filters, the observational direction.

CONCLUSIONS

- I studied the clustering of Planck SZ cluster catalog using the angular two point correlation function.
- Learned and understand a full pipeline for simulation of sky image.
- How to extract photometry of stars and galaxies.
- I tested and validated the external simulation software.
- These works are useful for the study of the systematic effects on photo-z.