Report attività Genova

Riunione Referee INFN, Settembre 2024

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 Ricercatore	0.5*
Gaia Delucchi	CSN2	UniGe dottoranda	1
Sergio Di Domizio	CSN2	UniGe Prof Associato	0.3
Antonio Farina	CSN4	UniGe dottorando	0.5
Elisa Lentini	CSN2	UniGe laureanda	-
Edoardo Maragliano	CSN4	UniGe laureando	-
Marco Raveri	CSN4	UniGe Ricercatore	0.2
Ilaria Risso	CSN2	INAF Assegnista	0.5
Gemma Testera	CSN2	INFN Dirigente Ricerca	0.2
Silvano Tosi	CSN1	UniGe Prof Associato	0.3
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**
  - validation of the spectroscopic pipeline
  - assessing the impact of systematic errors
  - getting the most out of clustering analyses

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

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, S.D., G. Delucchi, E. Lentini, S. Tosi, G. Testera (+ D. Roge-Royo guest student for a couple of 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**
- Prepare a framework allowing for a fast overview and stimulating further more detailed analysis
  - Complementary with existing tools (IODA, WebMust)
- **The framework is now routinely used by the shifters**

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...)

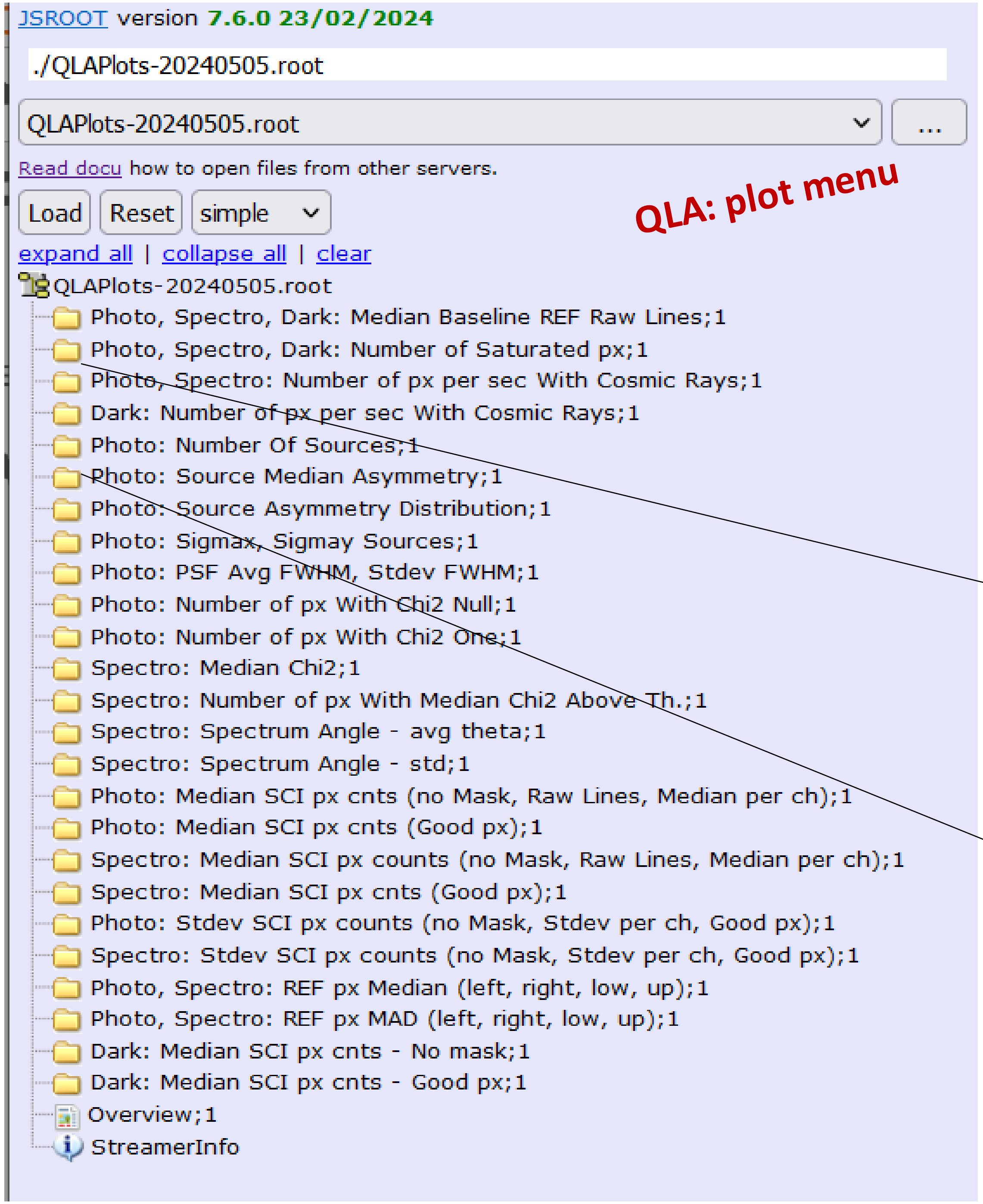
Data selection:

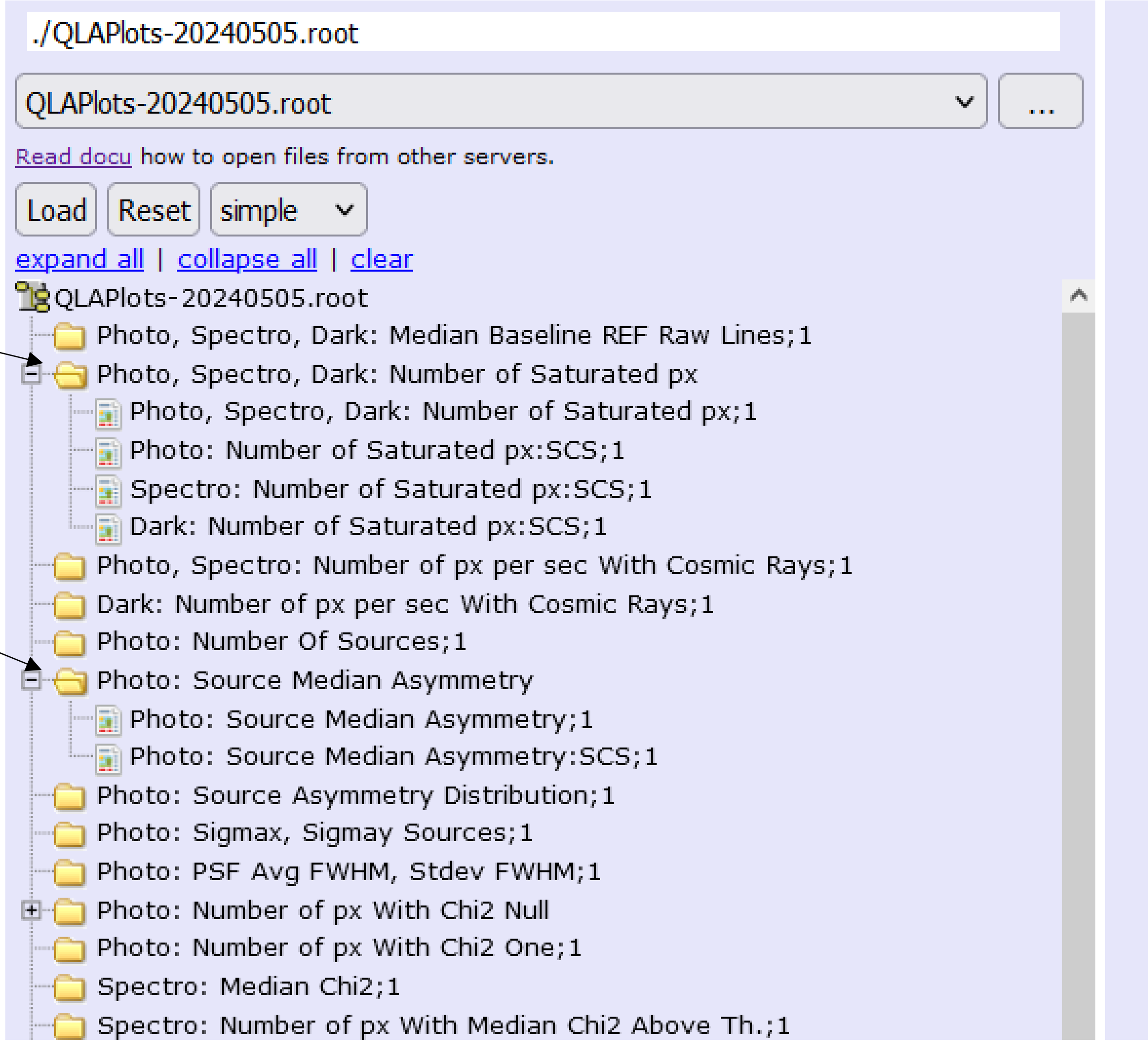
CALBLOCK-F-001, CALBLOCK-F-002,CALBLOCK-F-003,CALBLOCK-F-004
CALBLOCK-F-005,CALBLOCK-F-006,CALBLOCK-F-014,CALBLOCK-F-015
and NISP-P or NISP_S or DARK or combination

CU DATA to be added

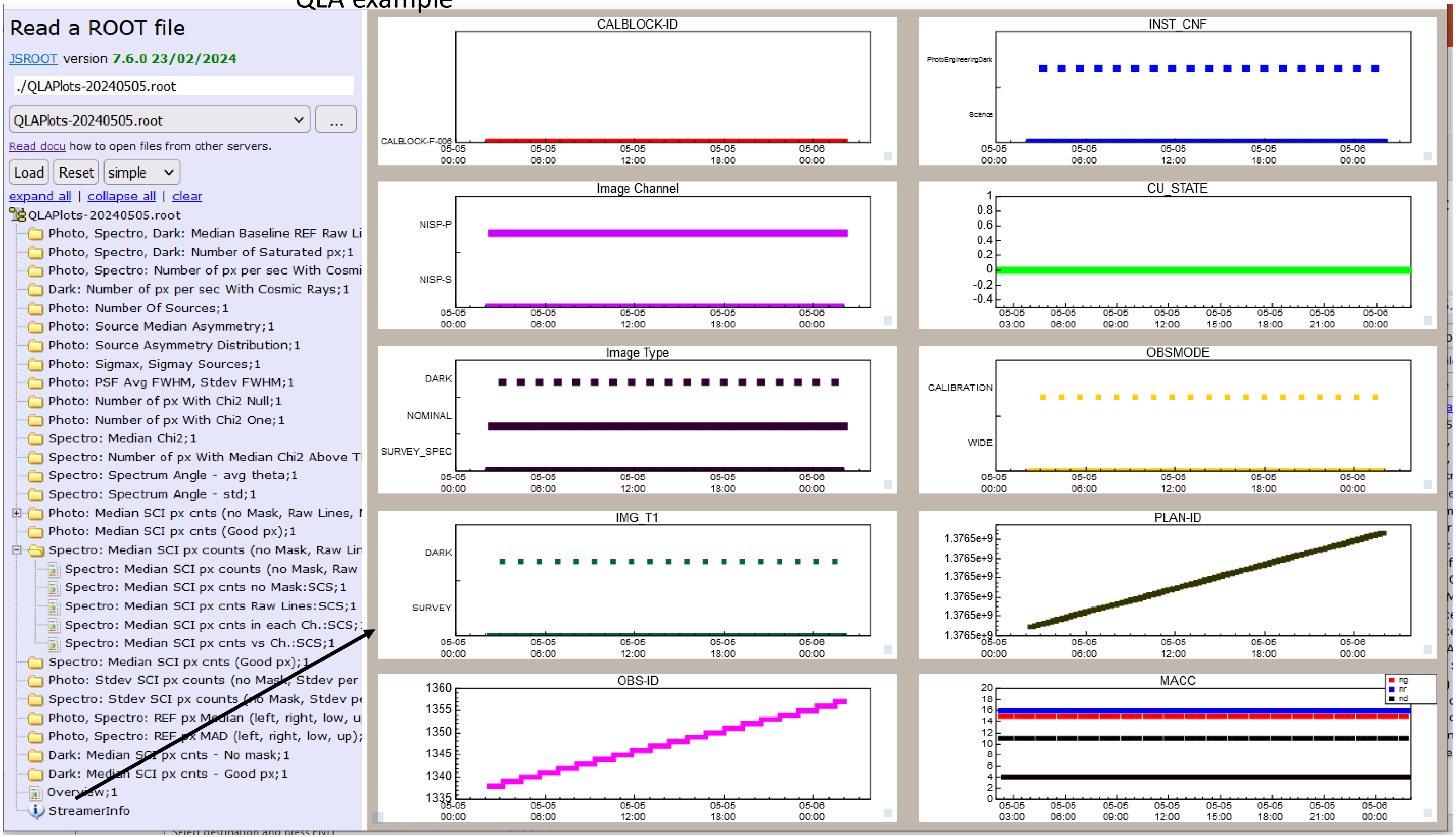
Credit: G. Testera, S. Tosi

QLA: plot menu





QLA example



Read a ROOT file
JSROOT version 7.6.0 23/02/2024
./QLAPlots-20240505.root
QLAPlots-20240505.root
...
Read docu how to open files from other servers.
Load
Reset
simple
expand all | collapse all | clear
QLAPlots-20240505.root
Photo, Spectro, Dark: Median Baseline REF Raw Li
Photo, Spectro, Dark: Number of Saturated px;1
Photo, Spectro: Number of px per sec With Cosmi
Dark: Number of px per sec With Cosmic Rays;1
Photo: Number Of Sources;1
Photo: Source Median Asymmetry;1
Photo: Source Asymmetry Distribution;1
Photo: Sigmax, Sigmay Sources;1
Photo: PSF Avg FWHM, Stdev FWHM;1
Photo: Number of px With Chi2 Null;1
Photo: Number of px With Chi2 One;1
Spectro: Median Chi2;1
Spectro: Number of px With Median Chi2 Above T
Spectro: Spectrum Angle - avg theta;1
Spectro: Spectrum Angle - std;1
Photo: Median SCI px cnts (no Mask, Raw Lines, I
Photo: Median SCI px cnts (Good px);1
Spectro: Median SCI px counts (no Mask, Raw Lin
Spectro: Median SCI px counts (no Mask, Raw
Spectro: Median SCI px cnts no Mask:SCS;1
Spectro: Median SCI px cnts Raw Lines:SCS;1
Spectro: Median SCI px cnts in each Ch.:SCS;1
Spectro: Median SCI px cnts vs Ch.:SCS;1
Spectro: Median SCI px cnts (Good px);1
Photo: Stdev SCI px counts (no Mask, Stdev per
Spectro: Stdev SCI px counts (no Mask, Stdev pe
Photo, Spectro: REF px Median (left, right, low, u
Photo, Spectro: REF px MAD (left, right, low, up);
Dark: Median SCI px cnts - No mask;1
Dark: Median SCI px cnts - Good px;1
Overview;1
StreamerInfo
CALBLOCK-ID
CALBLOCK-F-006
INST_CNF
Science
Image Channel
NISP-P
NISP-S
CU_STATE
Image Type
DARK
NOMINAL
SURVEY_SPEC
OBSMODE
CALIBRATION
WIDE
IMG_T1
DARK
SURVEY
PLAN-ID
1.3765e+9
OBS-ID
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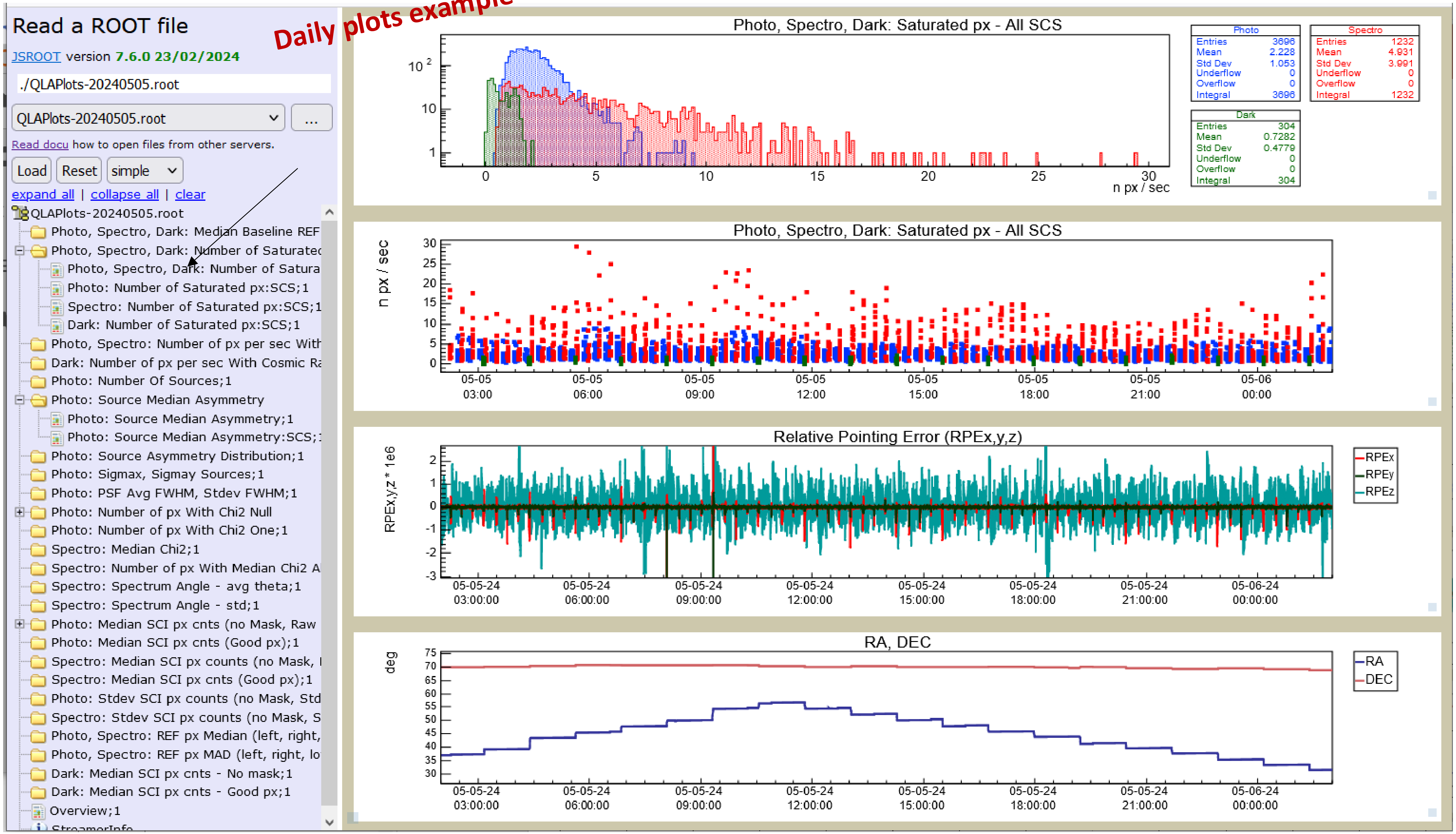
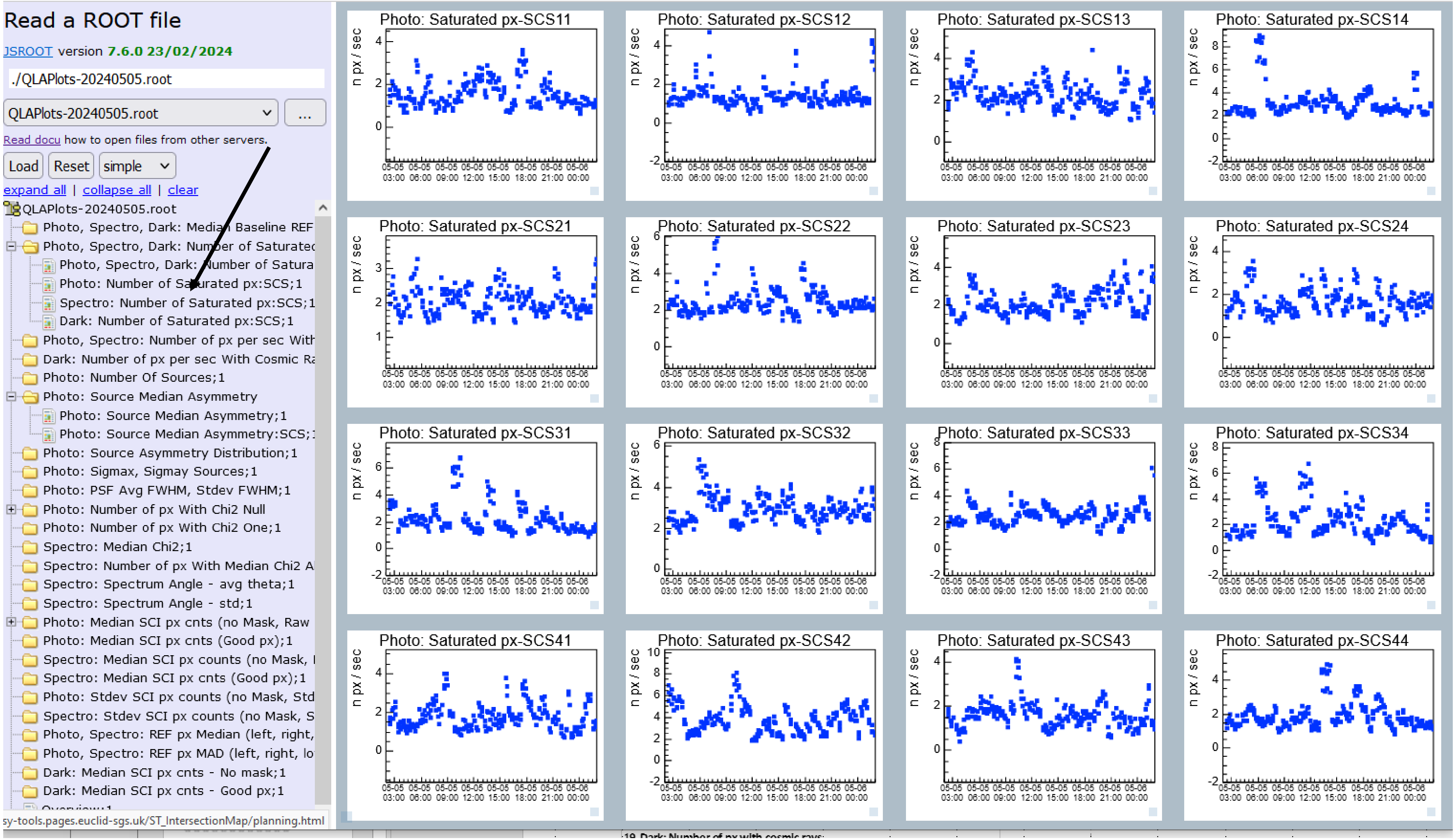
Daily plots example

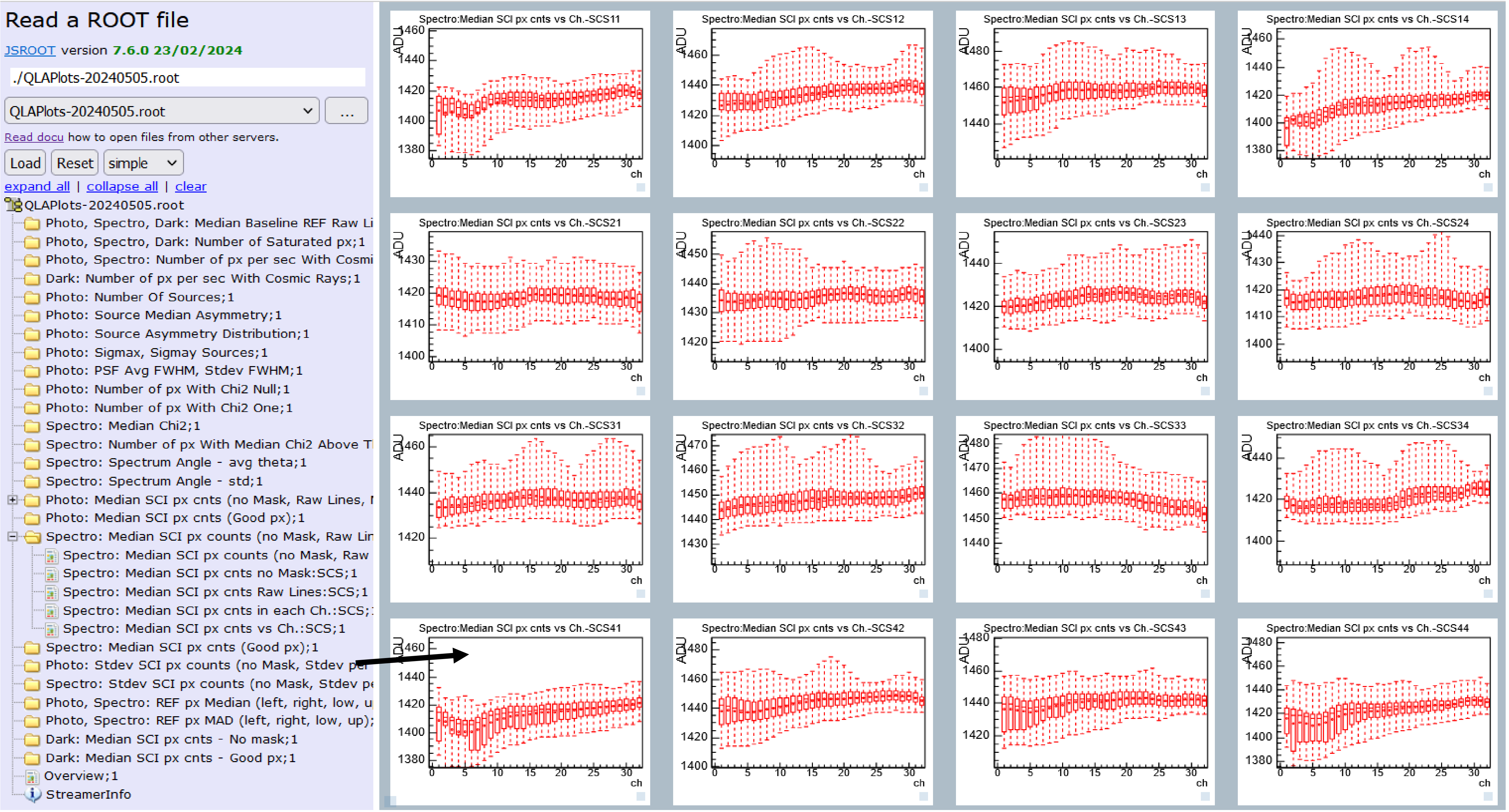


Daily plots for each subdetector: example



Touch with the mouse the marker of the plot to read the ch number and values

32 ch; display the distribution by ch in one day, box plot style



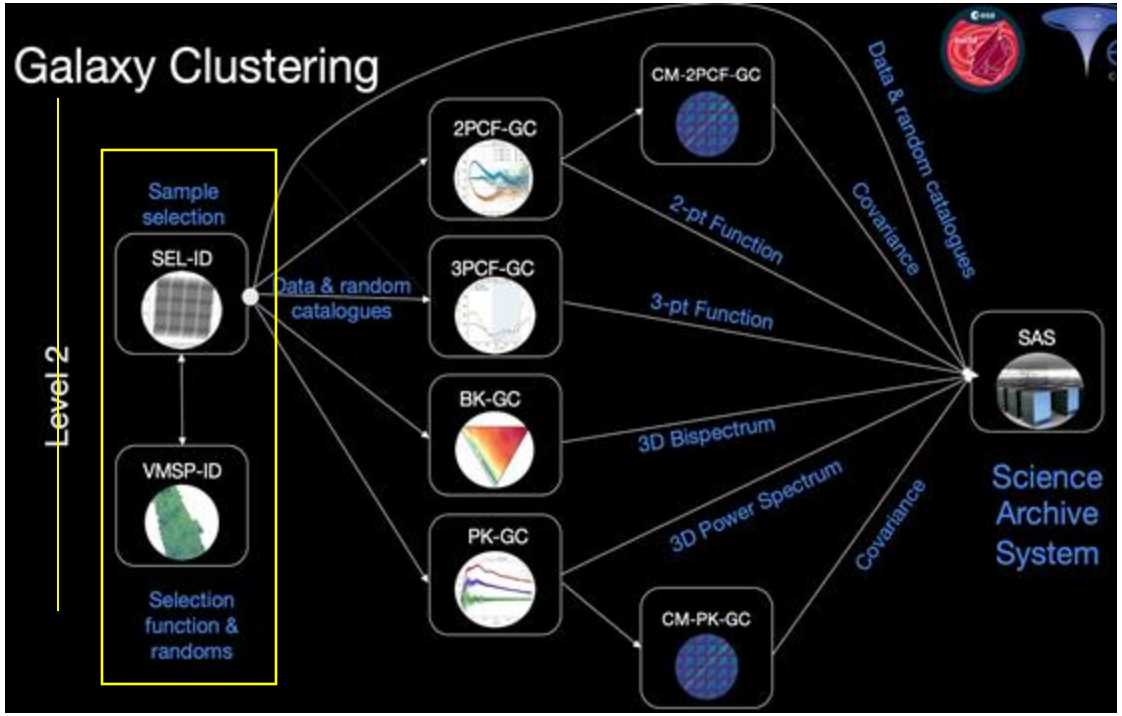
Outlook of IOT activity

- Tools routinely used by shifters since May 2024
- Updated version ready to be deployed (better graphics, faster code and more informative plots)
- The shifter manual, routinely used for the training of shifters from many institutions, has also been written by members of INFN Genova
- In progress:
  Add calibration data
  Add information from LE2 Data Product

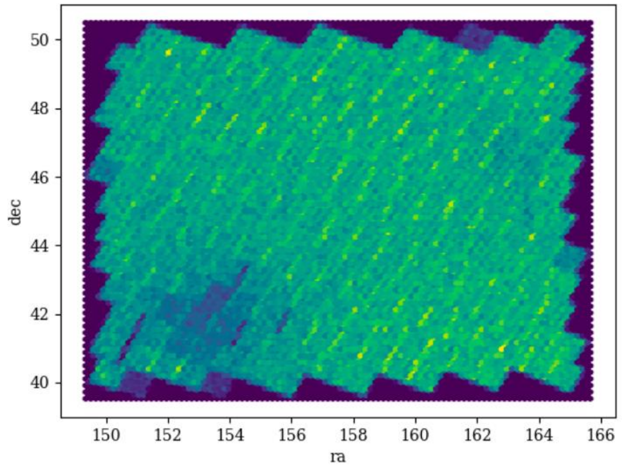
LE3 and Galaxy Clustering

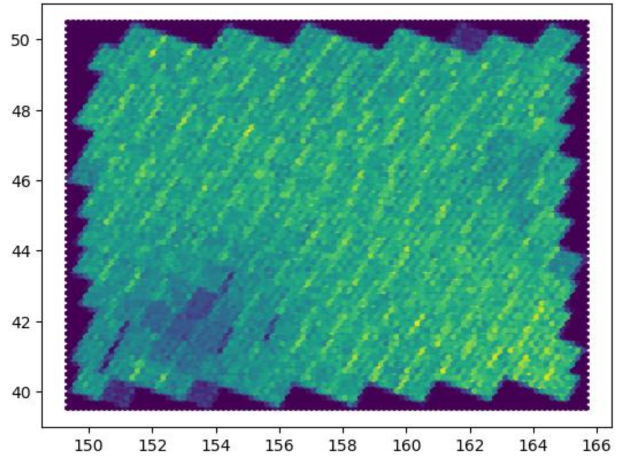
- Construction the spectroscopic galaxy catalog and related 2-point correlation functions, characterization of systematic effects
- **Genova Team members**: E. Branchini (LE3 lead), A. Farina, E. Maragliano, I. Risso, A. Veropalumbo

Validation of the Spectroscopic Pipeline



We are responsible 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 catalog and quantify its selection function (yellow box).

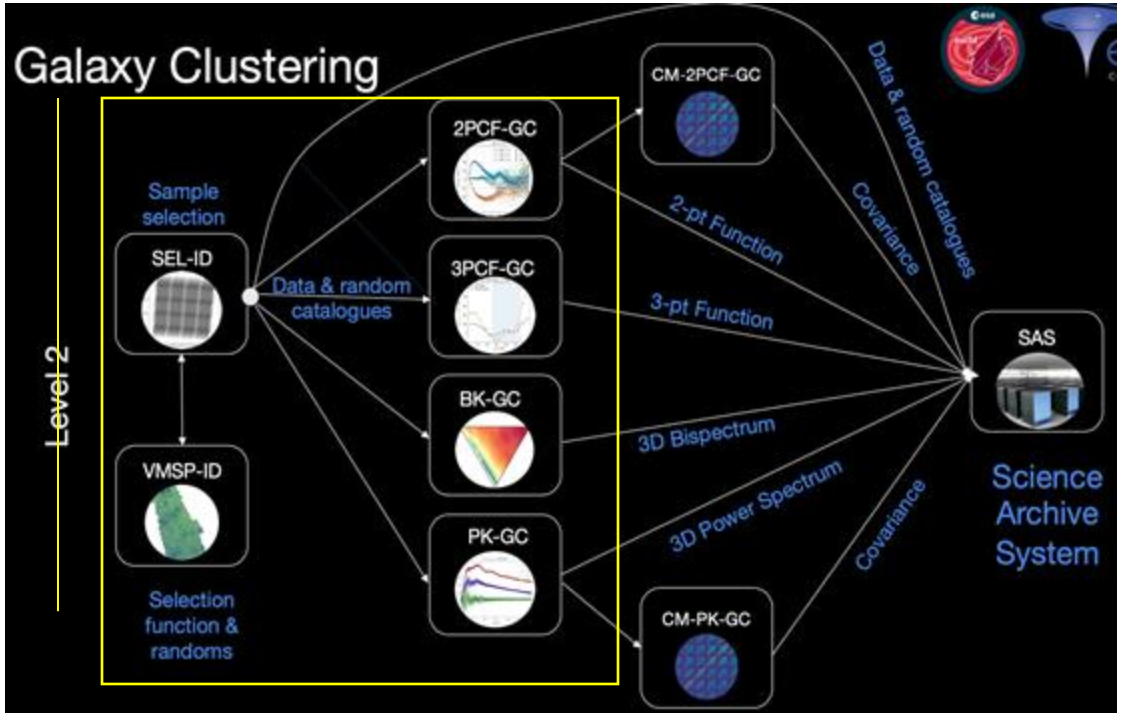




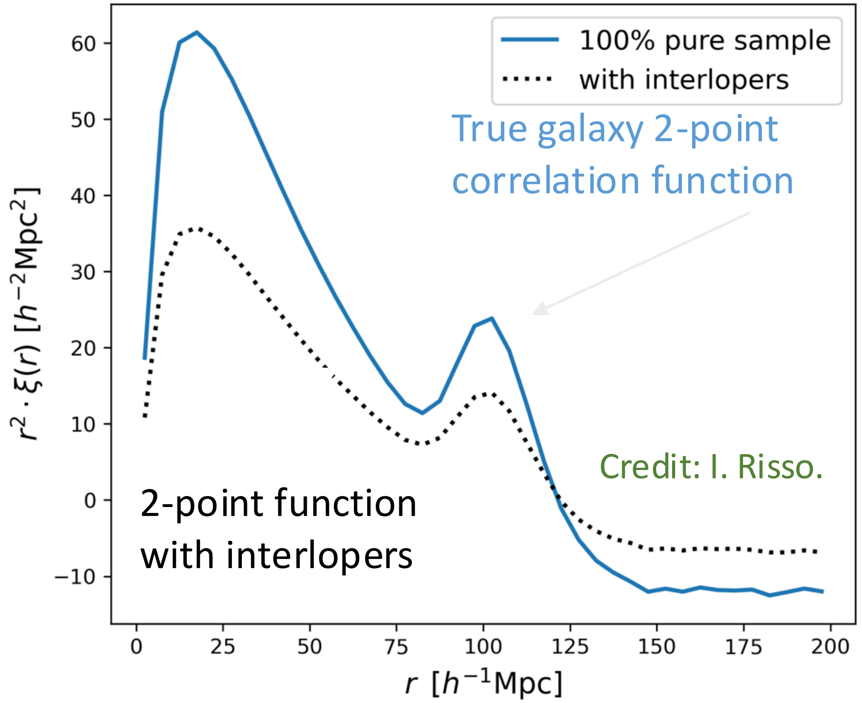
Credit: A. Farina, B. Granett

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. Therefore, an urgent task is to develop alternative methods to estimate the survey's selection function and assess its completeness. Farina (Ph.D.) is currently developing and validating a method based on machine learning (ML) techniques. Left: the selection function of a simulated Euclid survey patch obtained using a calibration field. Right: the same, but using the ML-based method.

Assessing the impact of systematic errors.

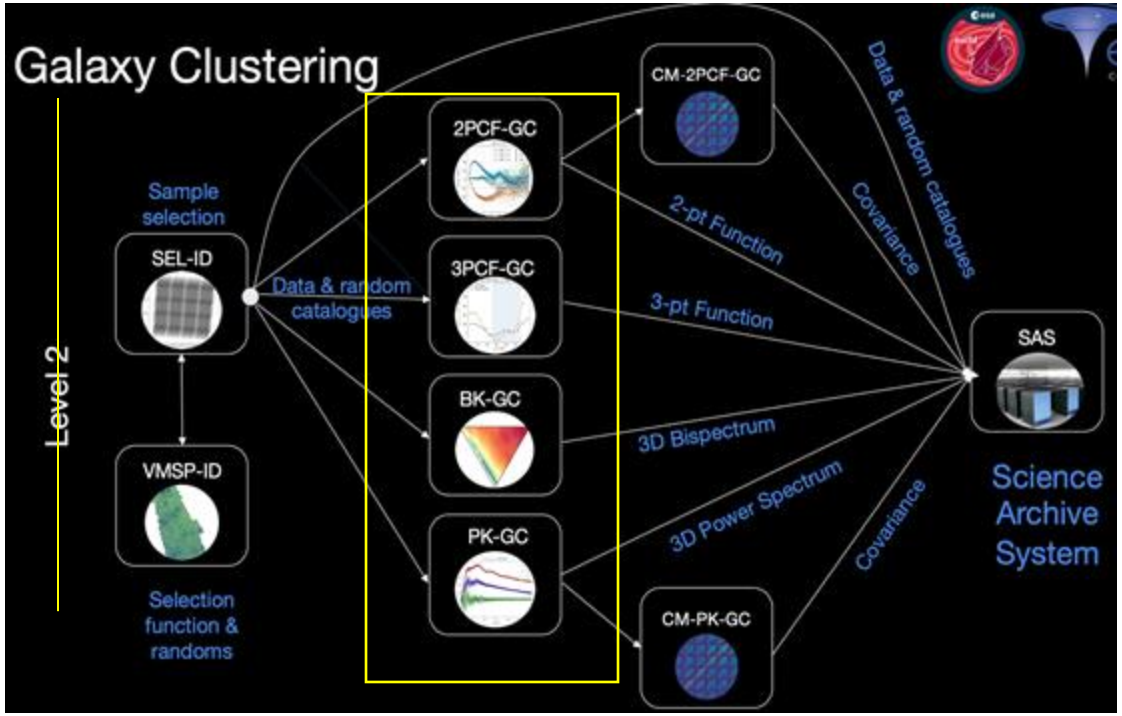


Several known and unknown observational effects will influence the selection and composition of the spectroscopic surveys. If not properly accounted for, these effects could impact the accuracy of clustering statistics estimates (yellow box).

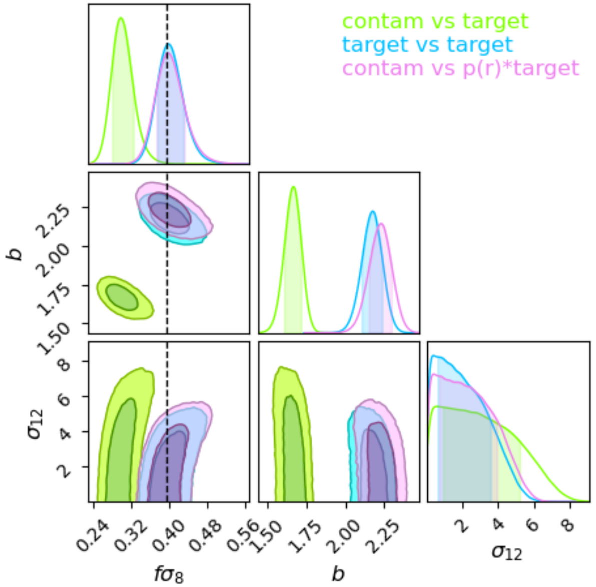


One such effect is the presence of ‘interloper galaxies’ with incorrectly measured redshifts, which are mistakenly included in the sample, reducing its purity. As a result, the galaxy-galaxy 2-point correlation function of the contaminated sample (dotted curve) differs from the true function (continuous curve), typically being lower

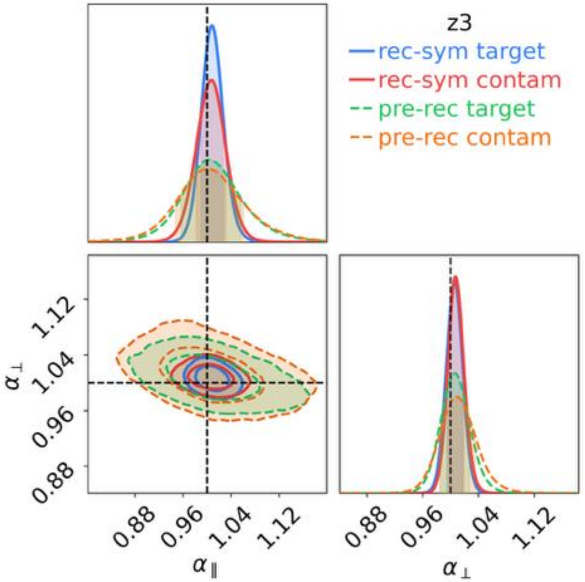
Assessing the impact of systematic errors.



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.



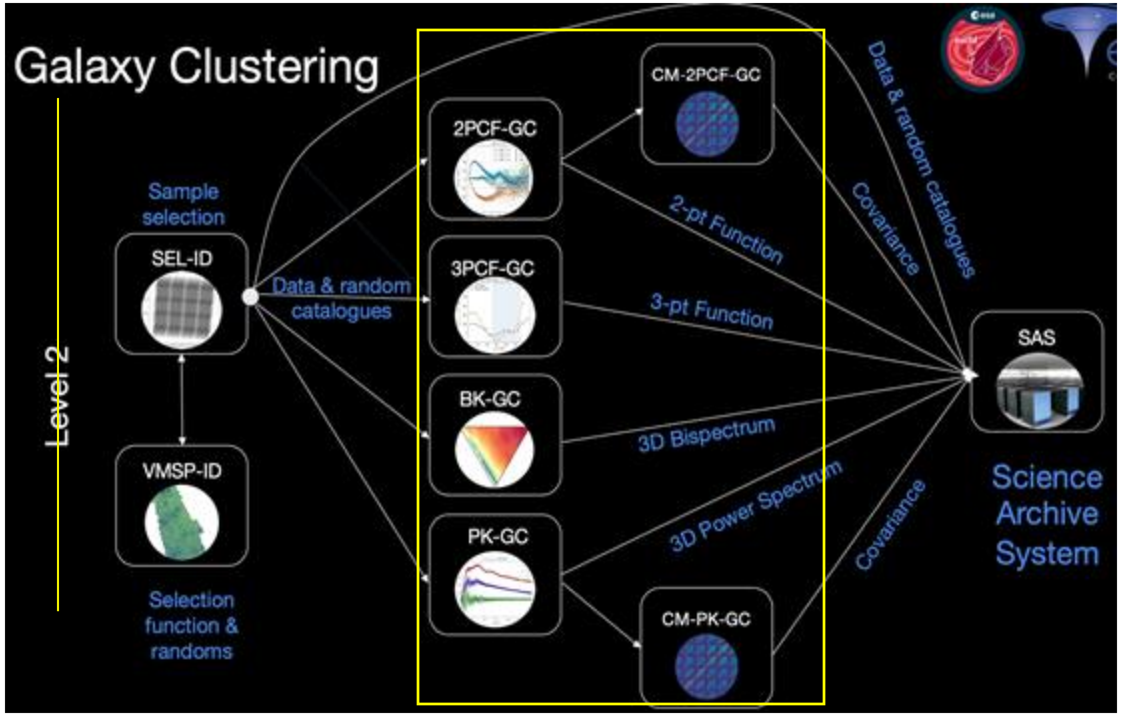
Credit: I. Risso.



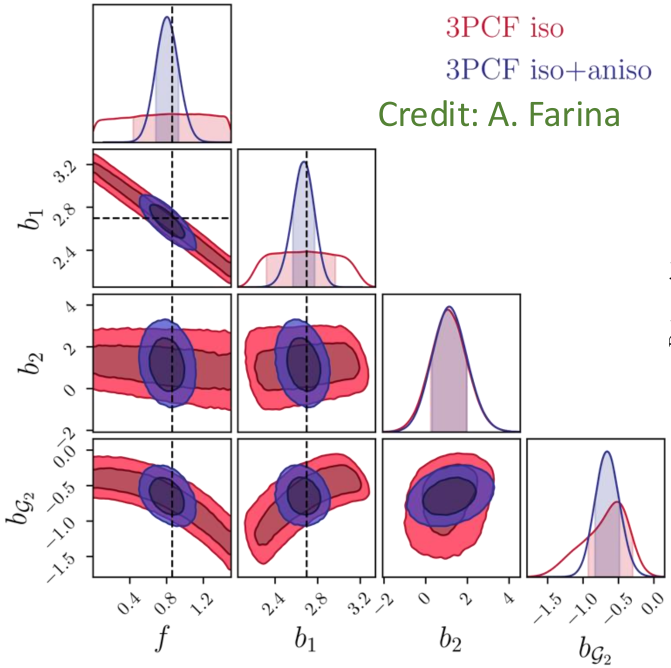
Credit: E. Maragliano

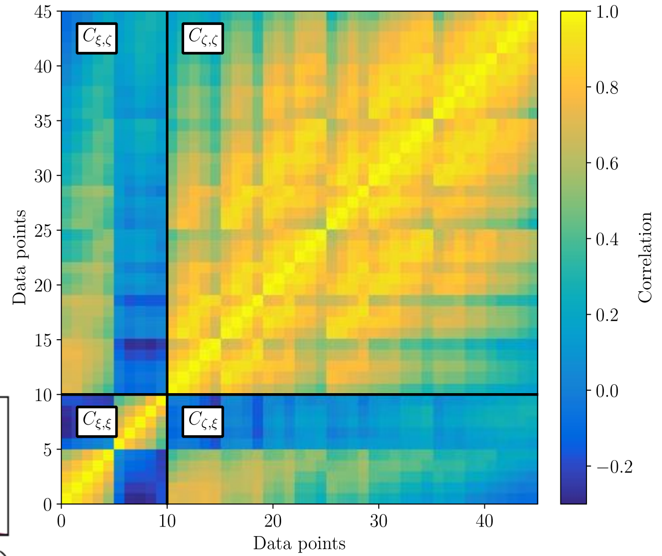
The presence of interlopers will bias the estimation of key cosmological parameters, such as the growth rate of density fluctuations (left panel, top, green curve). The magnitude of this effect depends on the fraction of interlopers (I. Risso). Fortunately, dynamical reconstructions, physically-justified nonlinear transformations applied to the data to enhance the signal are robust against the presence of interlopers (E. Maragliano, LM Thesis), as shown in the right pane

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.





Combining 2- and 3-point correlation functions helps to break parameter degeneracies, particularly when the anisotropic component is included in the analysis (blue vs. red probability contours in the left figure, A. Farina). However, these analyses are computationally expensive. Faster techniques for estimating the data covariance matrix need to be developed (right panel, A. Veropalumbo).

Likelihood CLOE

- Likelihood code: computation of observables (from theory + systematics), comparison with data, then statisitical inference on cosmological (+nuiscance) parameters
- **CLOE release v2.1 during 2024 Euclid Consortium Meeting**
- **Genova Team members**: S. Davini, S. Di Domizio
- Outlook: continue the development effort and join the work package that uses CLOE to obtain the cosmological results with DR1

Euclid Consortium Duties

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