Purity and Completeness

the OU side

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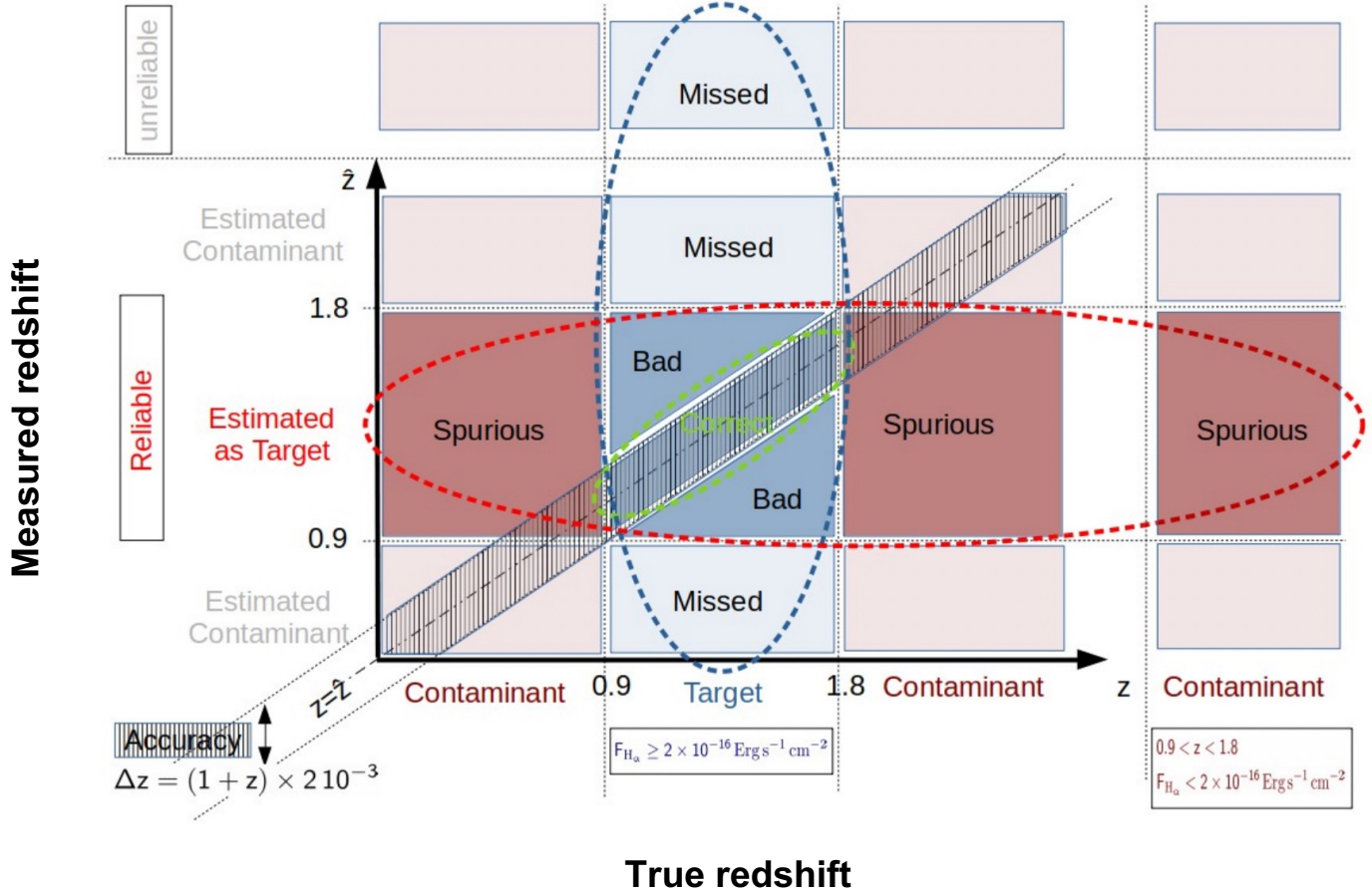
24-02-2022

What are purity and completeness?



Definitions

Definition implemented in SPE:

target: (0.9 < z < 1.8) & (FHalpha > 2e-16 erg/s/cm²)

target_estim: (0.9 < z_estim < 1.8) & reliable

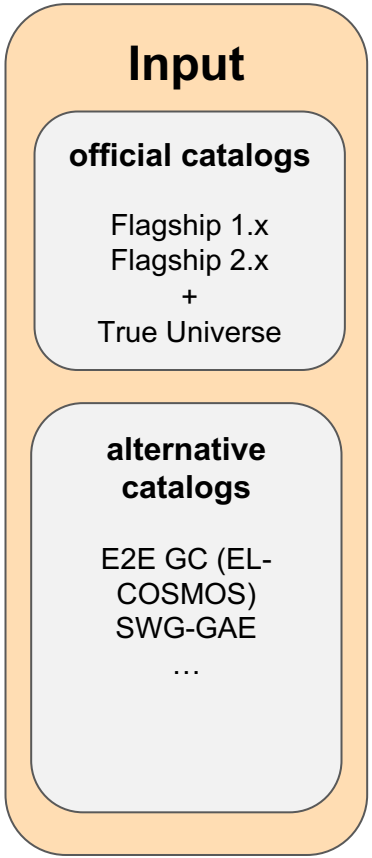
accurate_z: (z - z_estim)/(1+z) < 2e-3

correct: target & target_estim & accurate_z

completeness = #correct / #target

purity = #correct / #target_estim

The OUs in a nutshell (spectroscopic pipeline)



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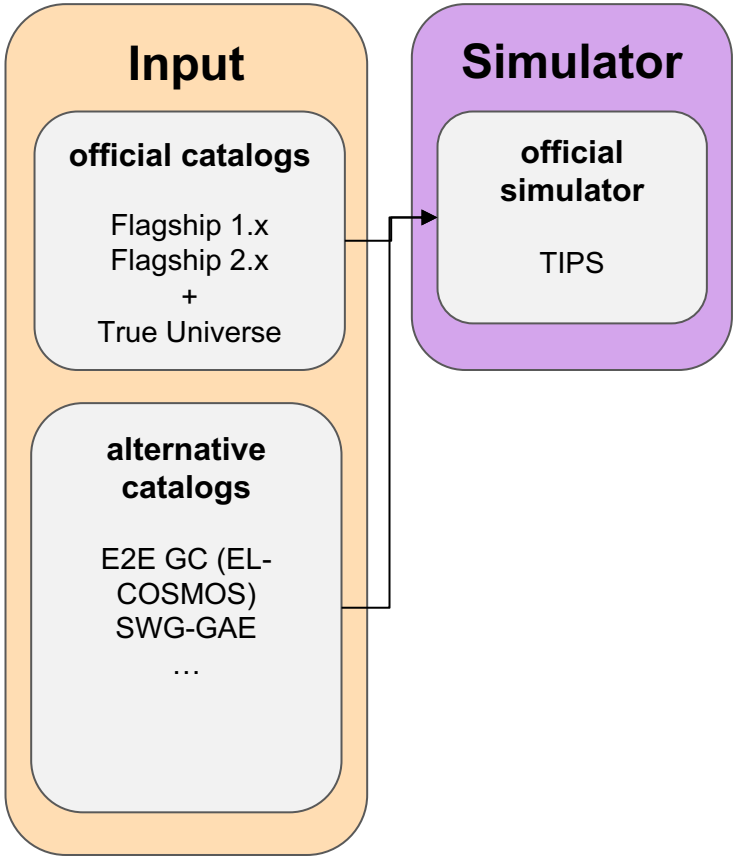

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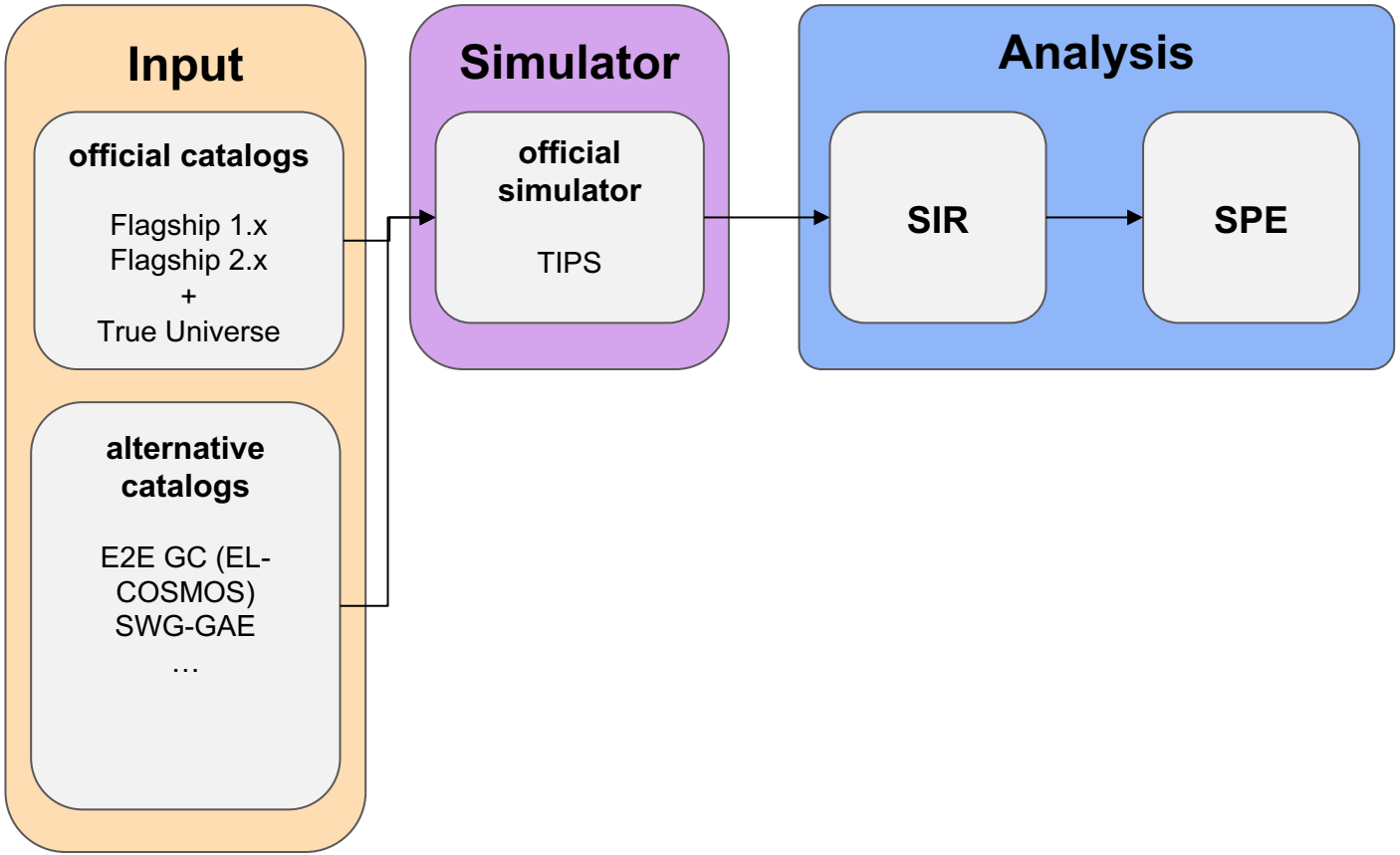

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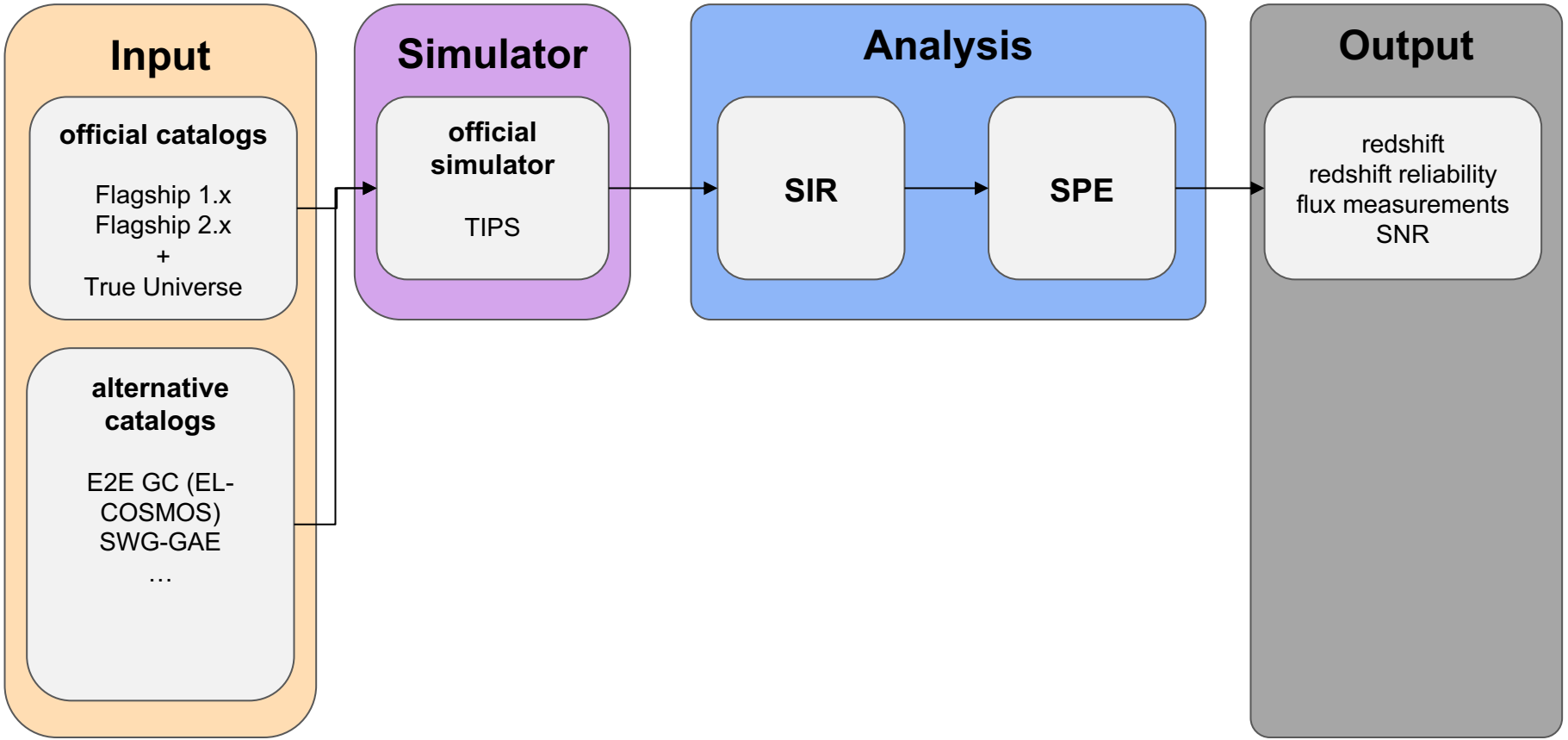

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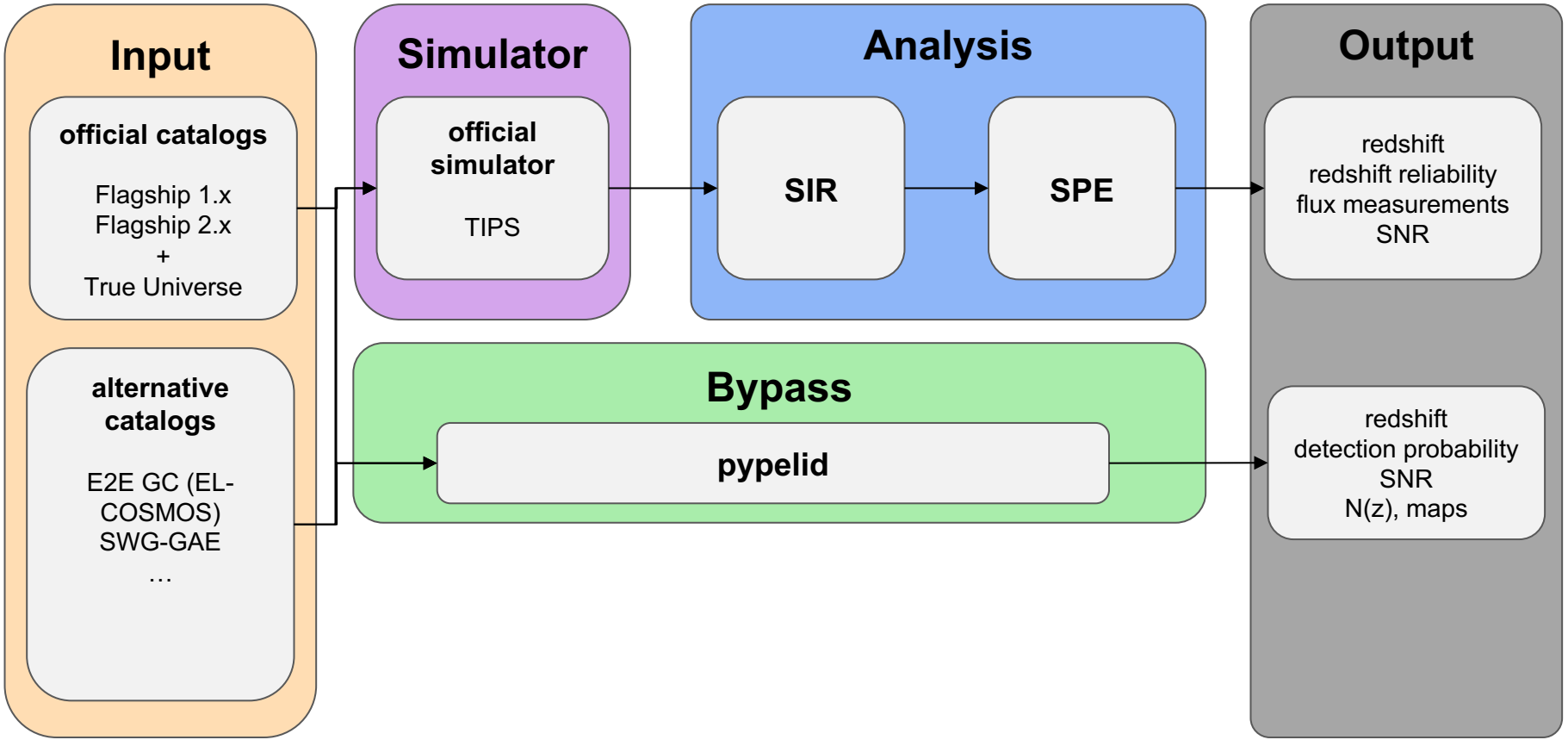

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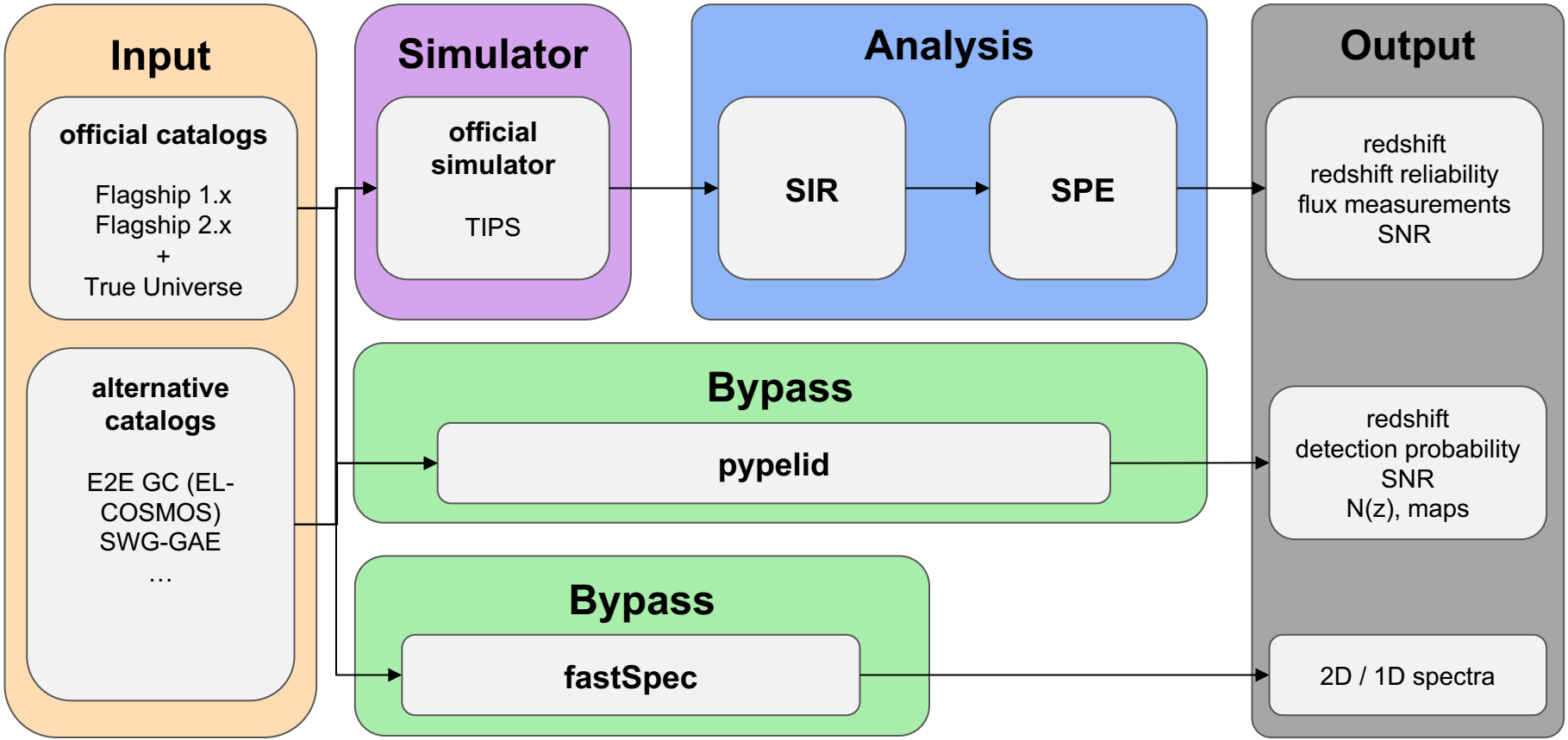


A quick reminder of SPE PF

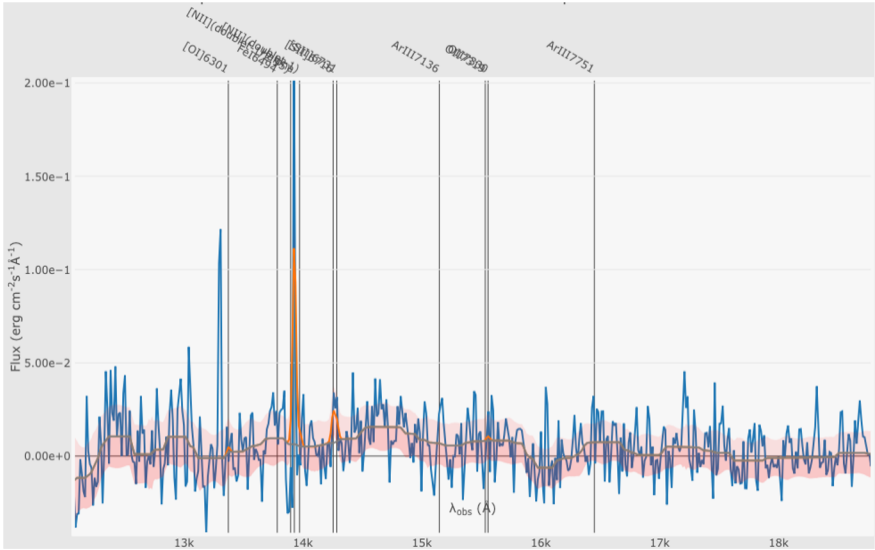
How does PF-SPE work?

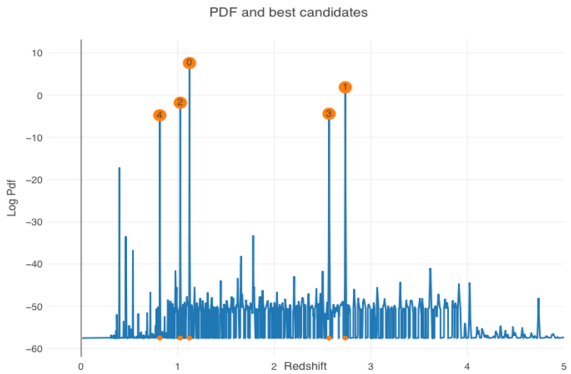
Two main methods:

- *line model*: continuum subtracted with median filtering, fit lines
- *full model*: fit lines+continuum (requires a good background subtraction and decontamination)

Prior for redshift measurements:

- line ratios (free, physical constraints - weak, dependent on templates - strong)
- Hα distribution of sources





Outputs:

- Best redshift, associated reliability, zPDF (format to be finalized)
- List of **5 best redshift solutions**

People involved: **C. Surace , V. Le Brun**, P.Y. Chabaud, A. Allaoui, M. Bethermin, Y. Copin, H. Courtois, T. Fenouillet, B. Garilli, M. Gray, O. Ilbert, E. Marguerite, M. Sarkis, L. Tasca, D. Vibert

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How does PF-SPE work?

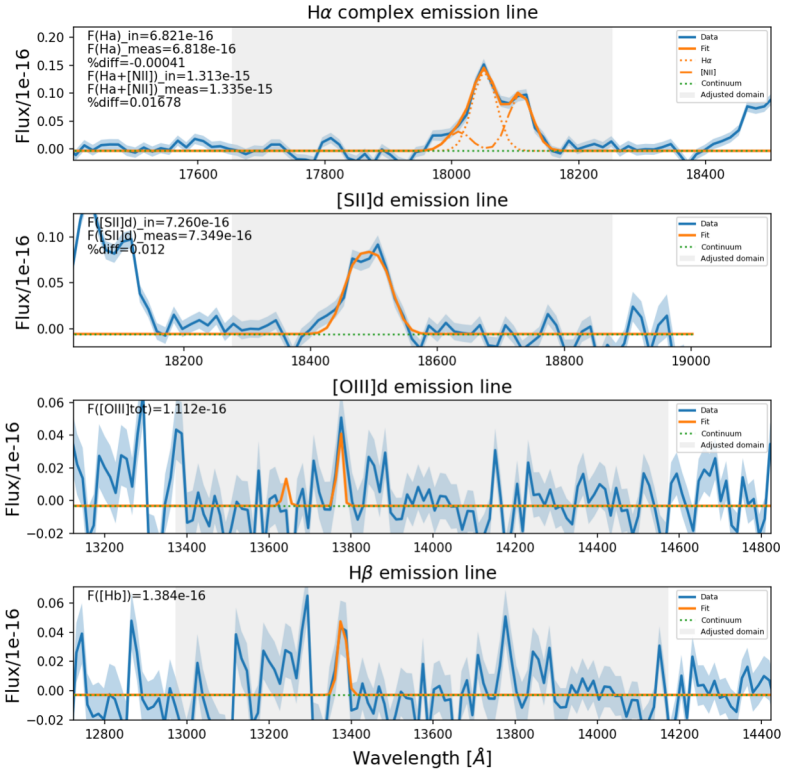
Two main methods:

- *direct integration* → model independent, provides a measurement of the total flux (e.g. blended Hα+[NII])
- *multi-Gaussian fit* → line-ratios free, provides deblended fluxes (may depend on SNR)

Measurements performed for each galaxy at the redshifts provided by PE5200

Emission lines divided between main (e.g. Hα+[NII], [OIII]d, Hβ) that will be always measured, and secondary that will be measured above a threshold

Outputs:
- Measurement of flux, EW, FWHM, SNR and position (with errors) for all the main lines and **for each of the redshift solutions**



Devel.: E. Rossetti, M. Moresco, D. Maino
Valid.: D. Vergani, E. Palazzi, E. Maiorano, M. Talia, M. Moresco, E. Rossetti, P. Focardi, L. Pozzetti, G. Zamorani, A. Cimatti, Y. Copin

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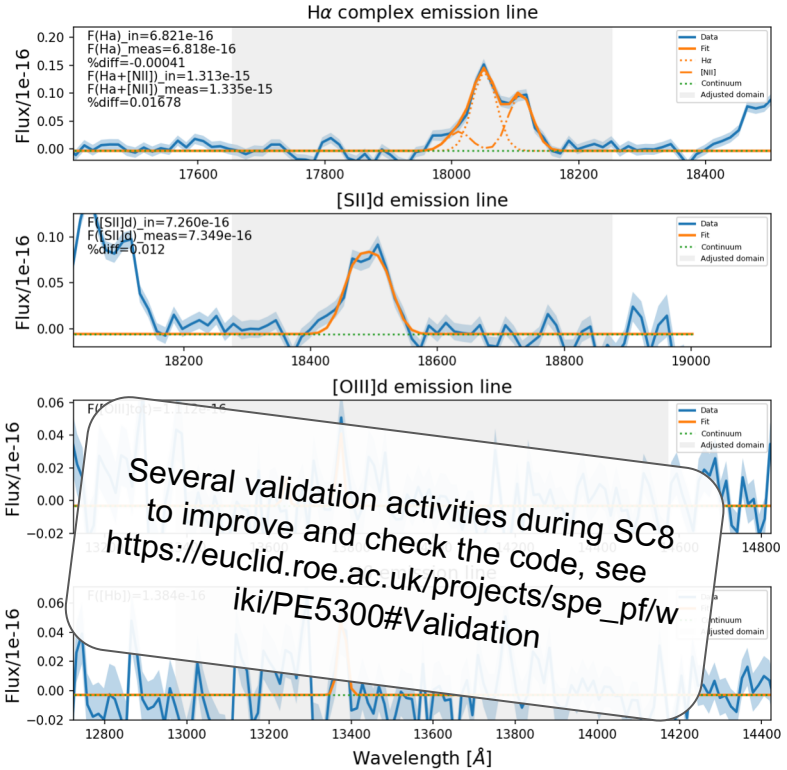

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Estimate of P/C

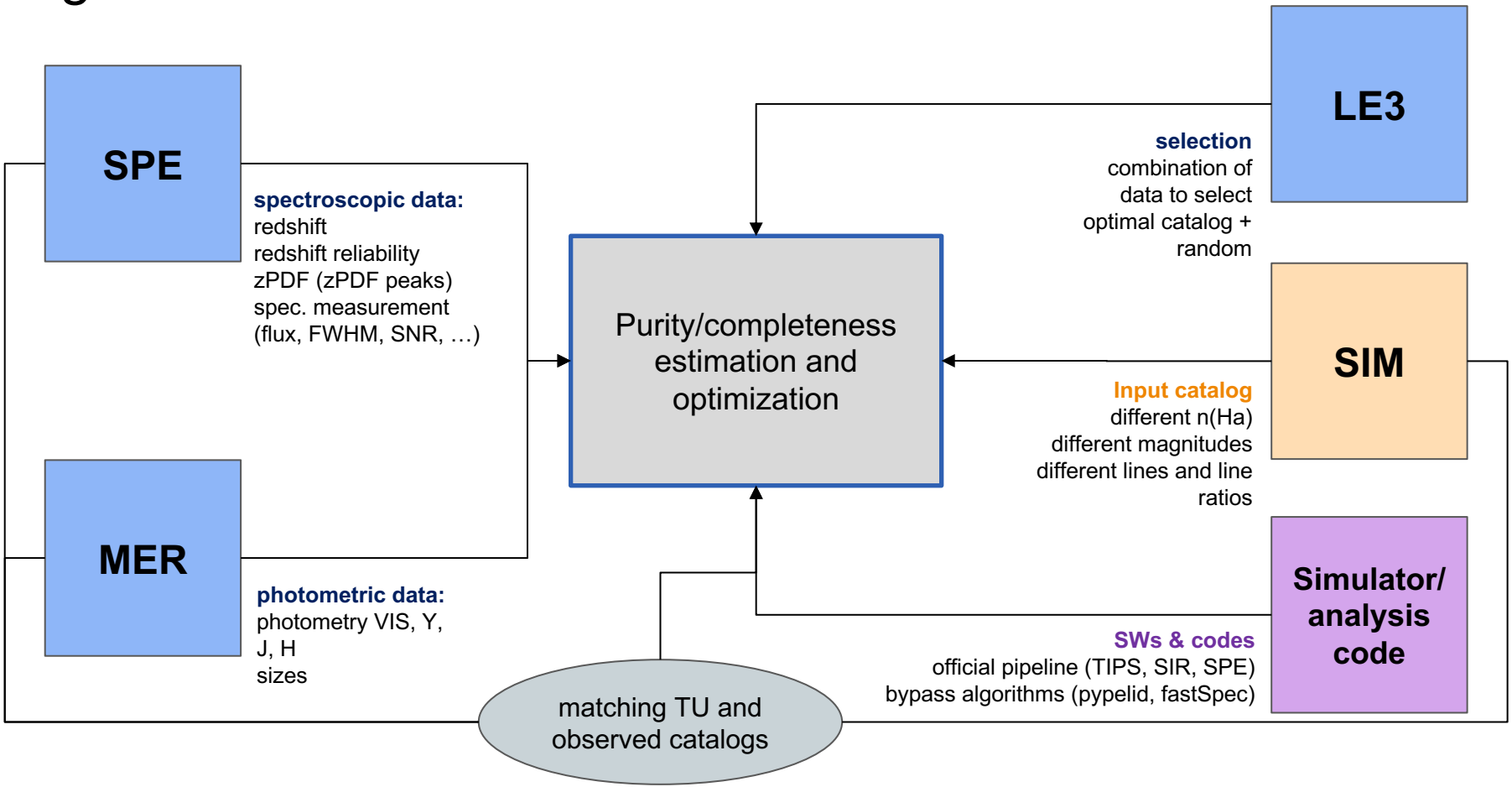
The problem: from a theoretical point of view, the probability of having a random spike of noise with SNR>~3.5 is of the order of 10^{-2} but large fraction of H<24 contaminants

Analysis of P/C in SC8 data indicate.a lower P/C w.r.t. requirements. A tiger team has been set up to assess this effect.

Some effects can negatively impact this estimates

Ingredients for P/C estimation

Measurements/ PFs
Input
SW/codes



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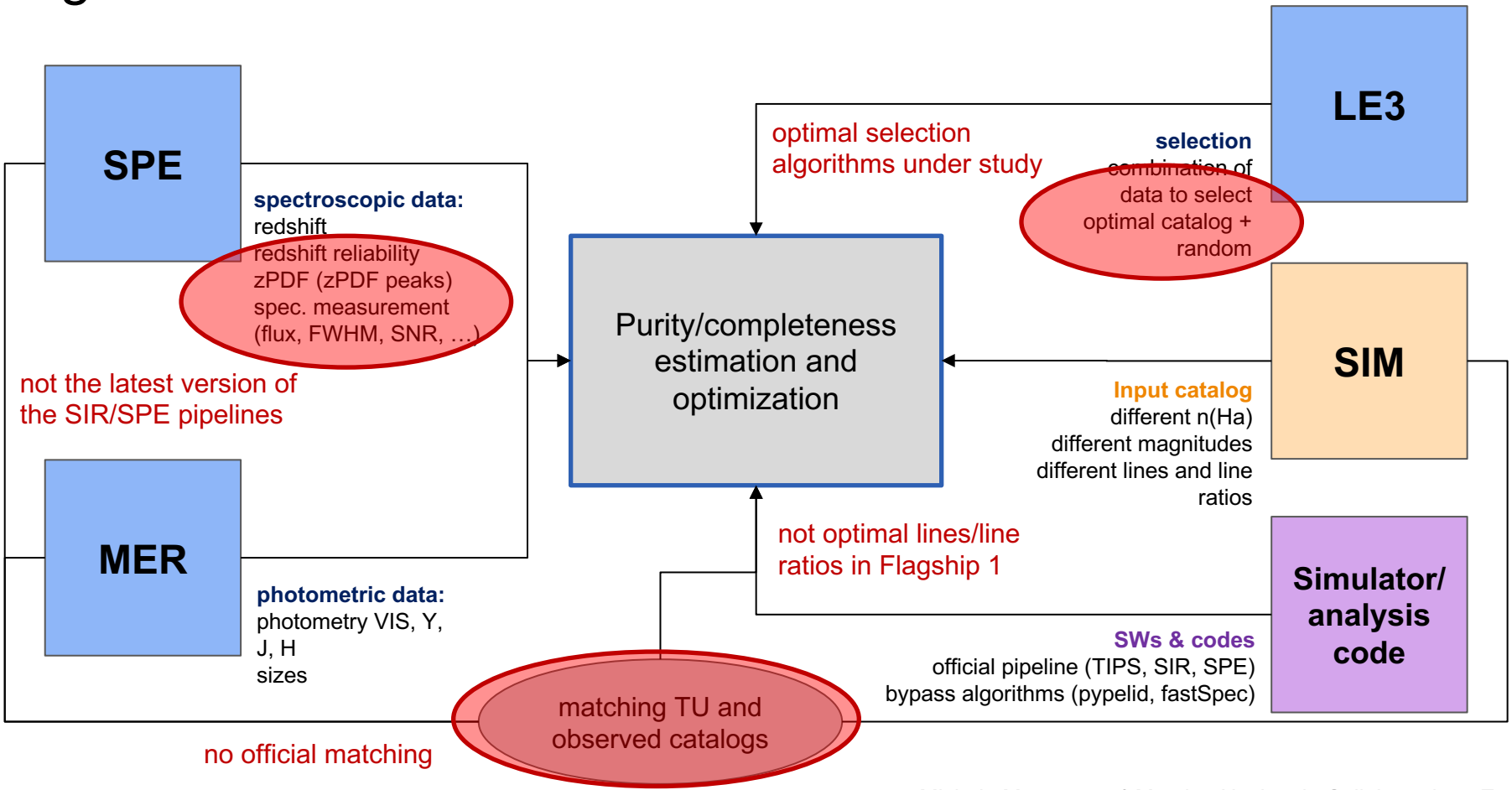

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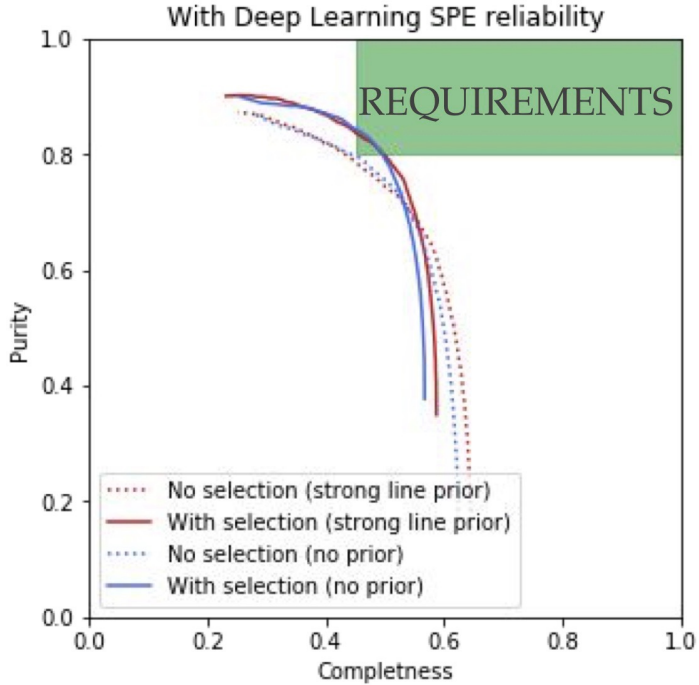
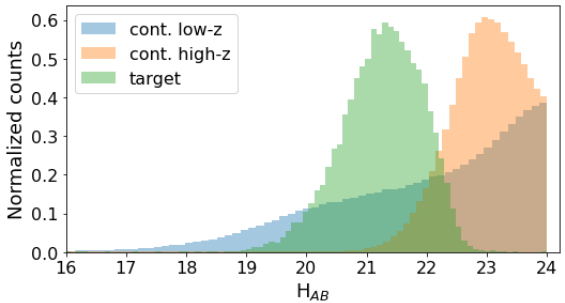
A new catalog based on EL-COSMOS is being created and analyzed

Different approaches explored using VIS+NISP photometry to pre-select targets: this will not impact significantly the selection function and clustering measurements:

- based on colors/magnitudes
- based on ML SVM

Results show that both a magnitude cut and/or ML approach could help to improve P/C



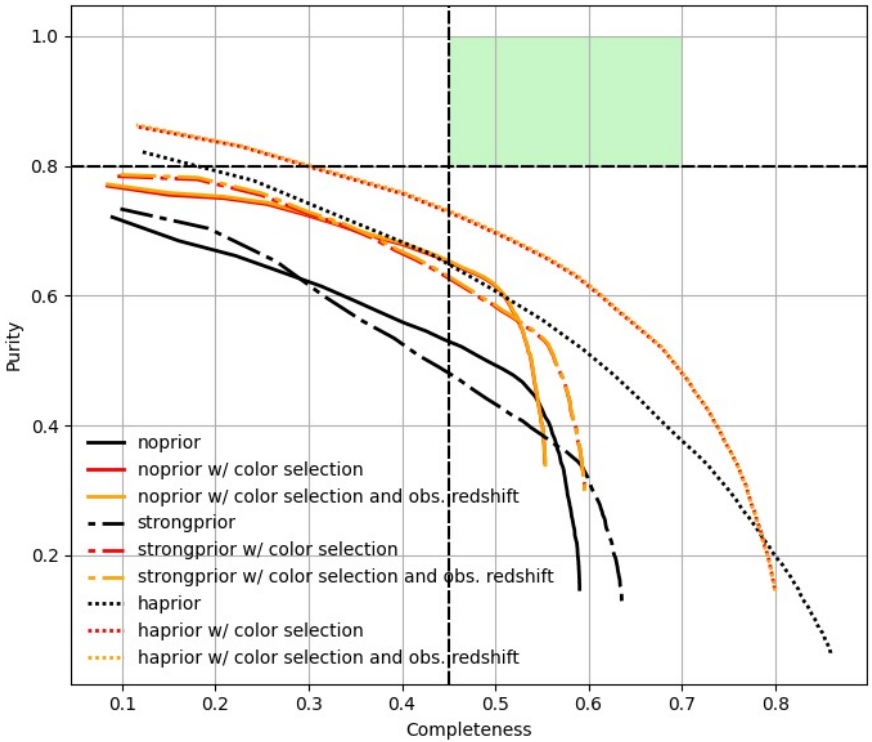


Improving the simulations and the effect of P/C definition

EL-COSMOS simulation has some optimistic assumptions (no contamination, flat number of exposures, …)

New simulations with revised noise and number of exposures are generated and analyzed: road to getting close to the requirement

Our definition currently include a cut in f(Ha) in the denominator: what if we remove it?



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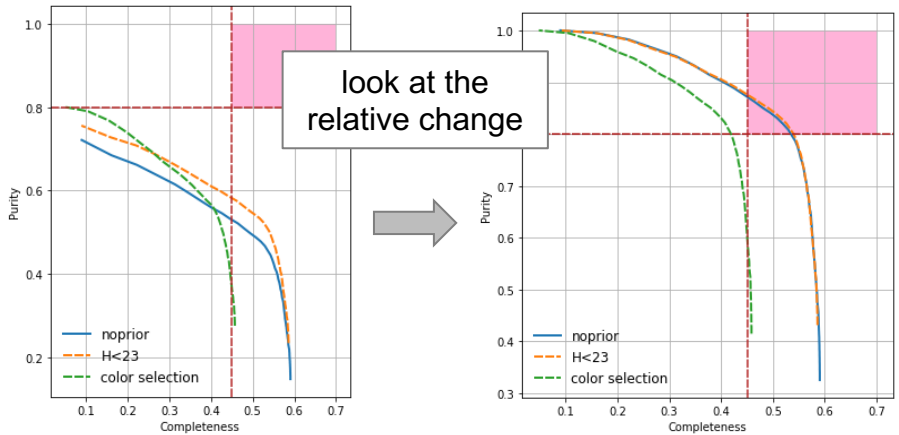

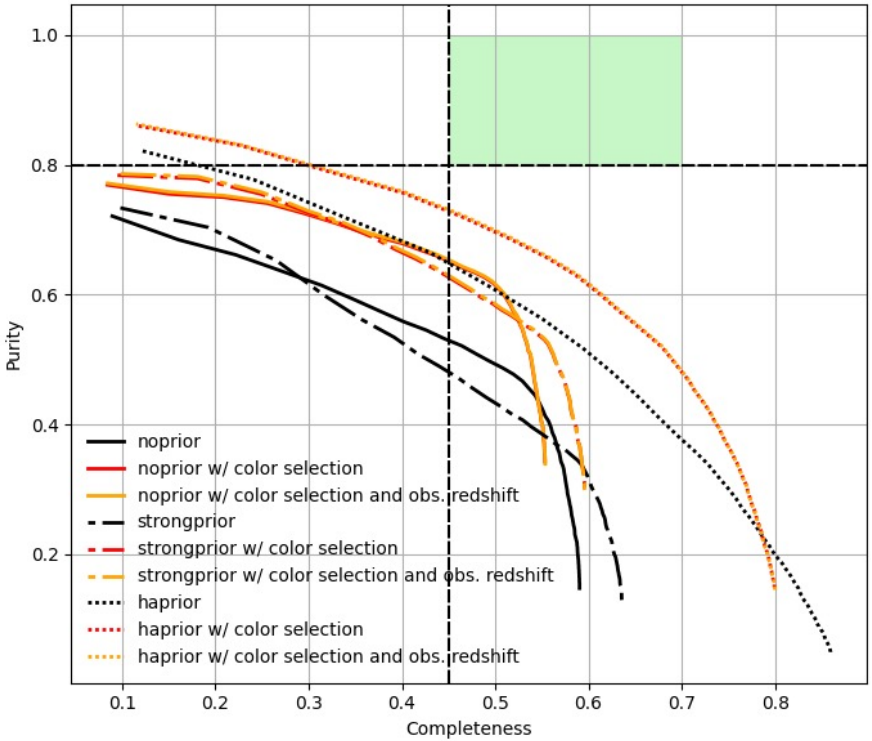

What we have

SC8 Wide and Deep data

- Based on Flagship 1 catalog and analyzed with the official Euclid pipeline (MER+SIR+SPE).
- In the Wide, a large fraction of redshift measurements are spurious, very low purity and completeness. Not clear if this is representative of the instrument performance or problems in the simulations.
- Some issues (line ratios e.g. NII/Ha, missing lines simulated e.g. SIII) that once solved might positively impact the estimate of PC
- Analysis with up-to-date version of the pipelines (SNR, redshift reliability, …) might positively impact the estimate of PC
- Path to improve PC with additional Euclid photometric information
- Simulated observing conditions not representative enough (e.g. patchy on the sky)
- Not inclusion of cosmic rays and persistence might give optimistic estimate of PC.
- Impossible to make a good estimate of N(z) or perform clustering analyses on SC8 data.
- Deep data are not sufficient to estimate the *uncertainty* on the interloper fractions.

EL-COSMOS

- Based on EL-COSMOS SED catalog and fastSpec+SPE.
- FastSpec noise calibration done using SC8 SIR data
- Ha luminosity function differs from baseline model used in SC8 for instance: more optimistic
- 200k spectra at H<24 and realistic distribution of galaxy intrinsic properties
- With color selection (SVM) we can meet the requirements.
- Some issues with the simulations to be solved (lines in air wavelengths, some line ratios…)
- Idealized noise properties. Does not include contamination and confusion effects from overlapping spectra

Roadmap

Missing features:
- Persistence simulations/model
- Cosmic ray simulations/model

SPV3 pixel simulations
Iterate on improved simulations at pipeline level:
    - Updates in the input catalogues (Flagship2.x vs Flagship1.x)
    - Updates in the SIM simulator (inclusion of cosmic rays, persistence, etc..)
    - Optimize the PFs in the pilot run
Focused goals:
    - Fully estimating the CP problem
    - Estimating the impact of some effect on the spectroscopic pipeline (cosmic rays, persistence, improvement in the pipeline) to be then propagated statistically in the bypasses
- Simulations with BG+RG in the Deep, to assess CP and systematics

Large-scale simulations with observed properties
- Need a series of large mocks including e.g. redshift contamination model, angular selection function
- Goal is to assess impact on clustering of specific effects
- Can use pypelid or FastSpec small-scale simulations to introduce observational effects in those