Multiband Image Simulations based on HST/CANDELS data

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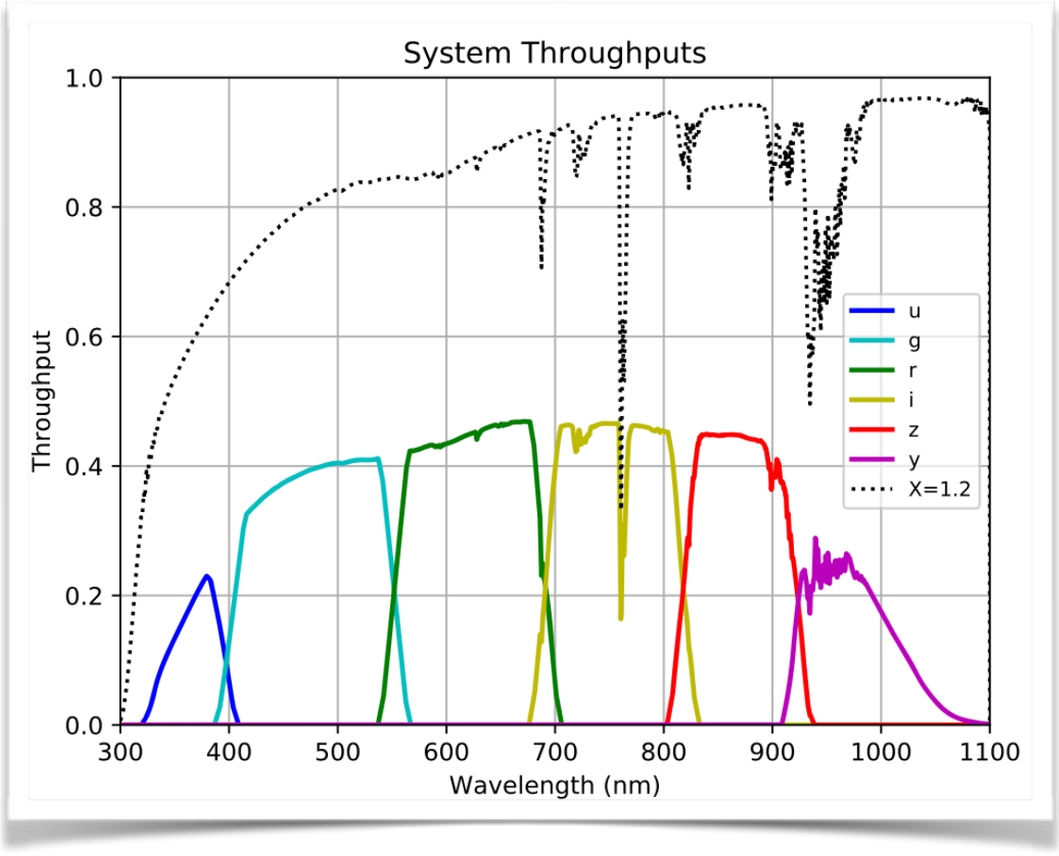
OUTLINE

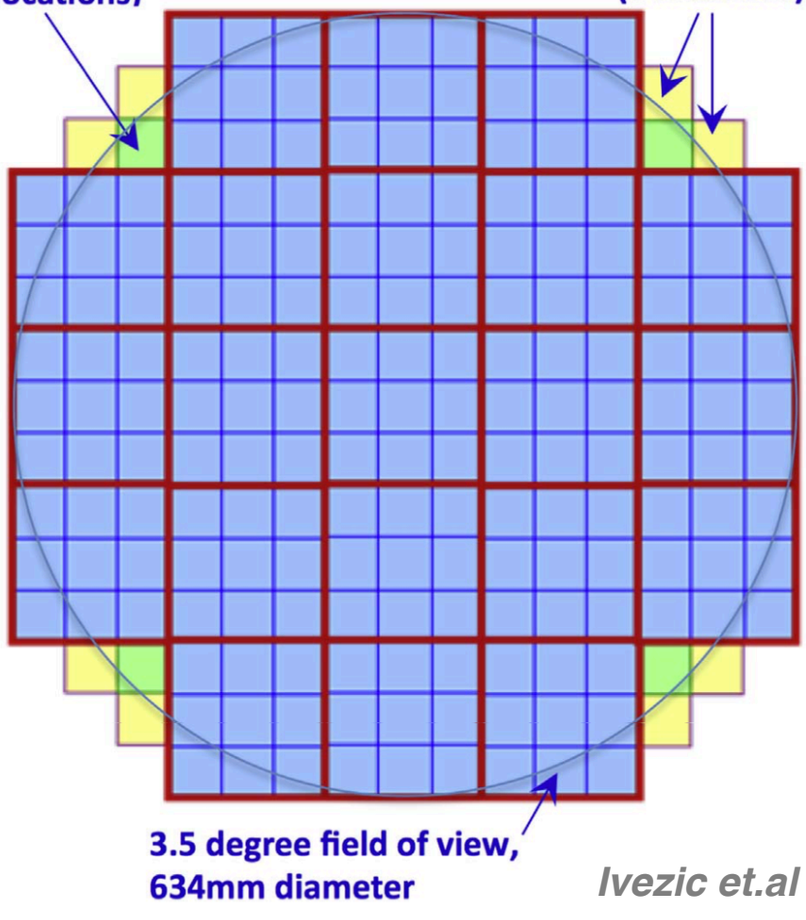
- Introduction to LSST, Euclid and CSS-OS
- Mock image generation
- Preliminary results

Introduction to LSST, Euclid and CSS-OS

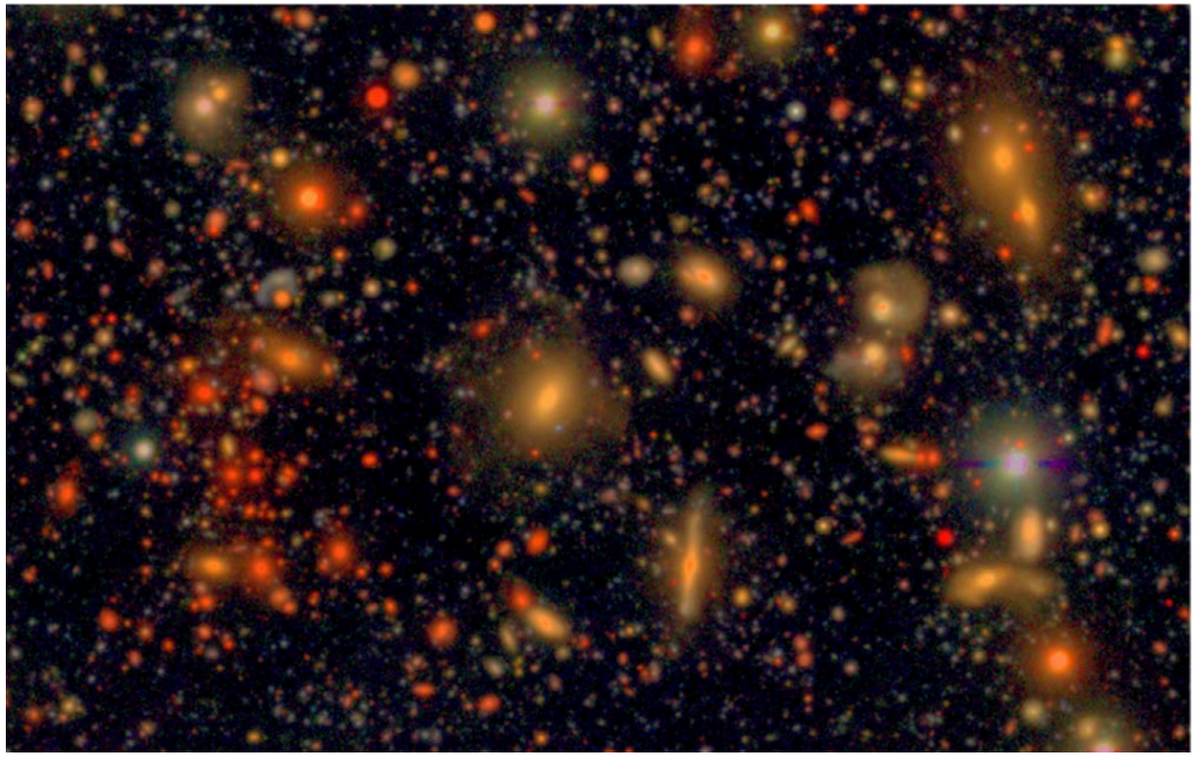
LSST

1) Ground-based optical telescope
2) Imaging in *ugriz* bands with seeing ~0.7 arcsecond
3) Sky coverage: 18000 sq. degrees in southern hemisphere





Ivezic et.al 2019

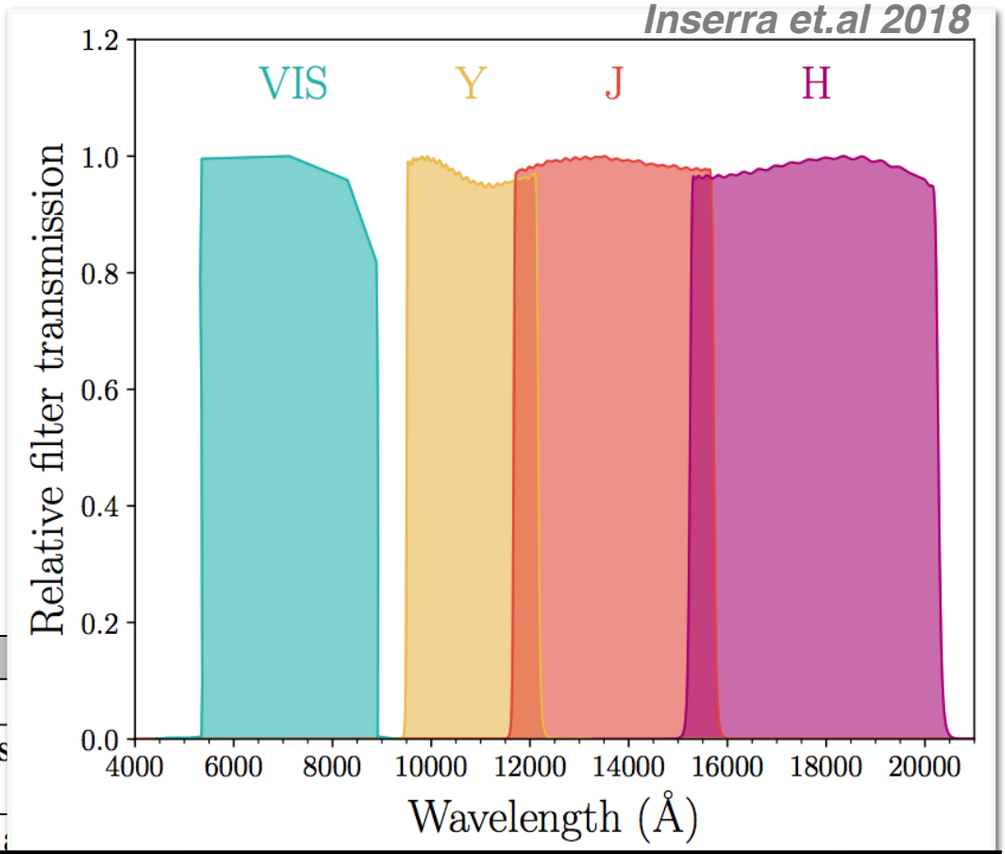


Introduction to LSST, Euclid and CSS-OS

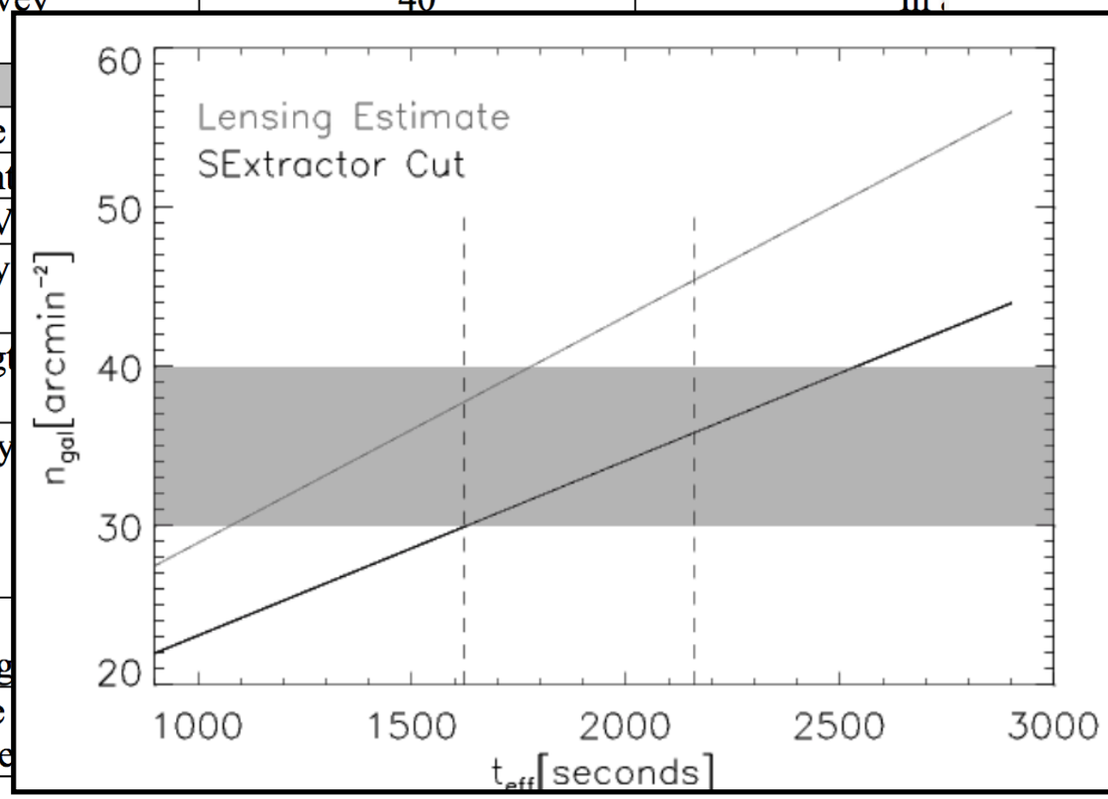
Euclid

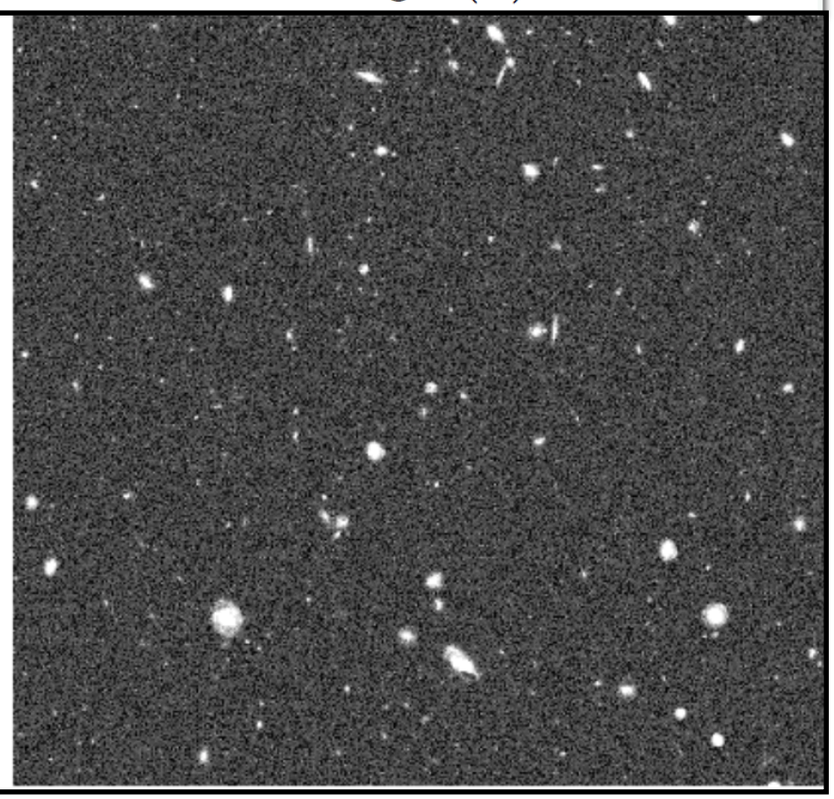
1) Space-based telescope
2) Imaging in *VIS*/*YJH* bands with seeing ~0.2 arcsecond
3) Sky coverage: 15000 sq. degrees

Inserra et.al 2018



	SURVEYS	
	Area (deg2)	
Wide Survey	15,000 (required) 20,000 (goal)	Step and s
Deep Survey	40	In a
Telescope		
Instrument		
Field-of-V		
Capability		
Wavelengt		
Sensitivity		
Detector Technolog		
Pixel Size		
Spectral re		

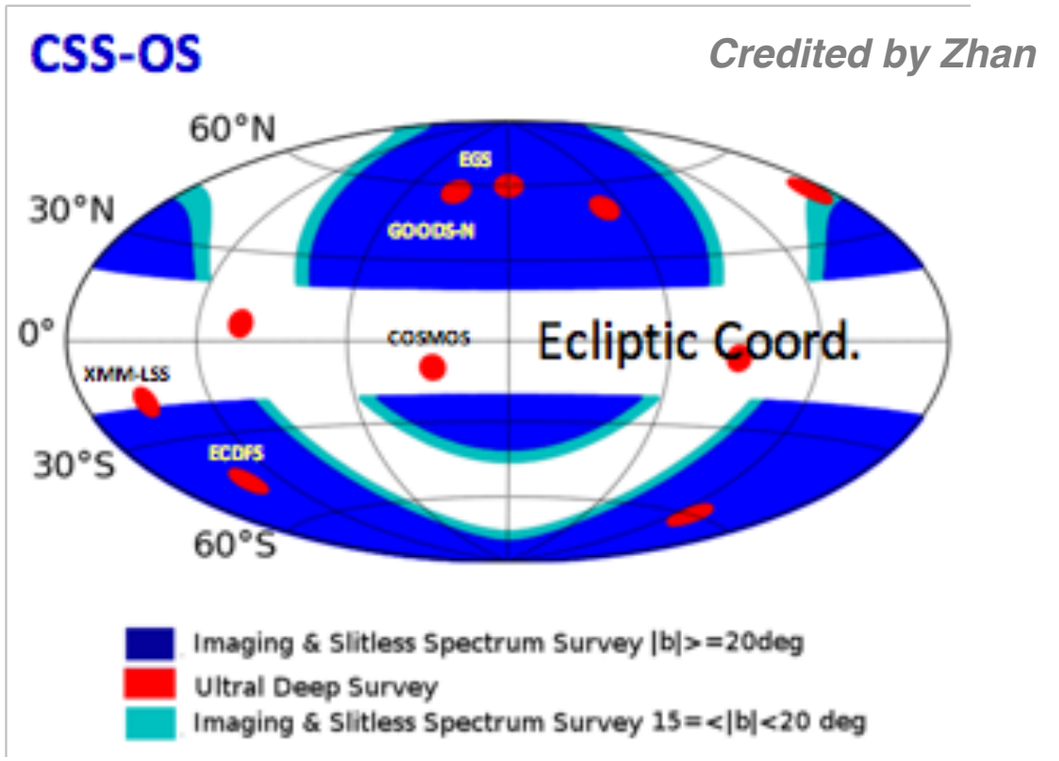


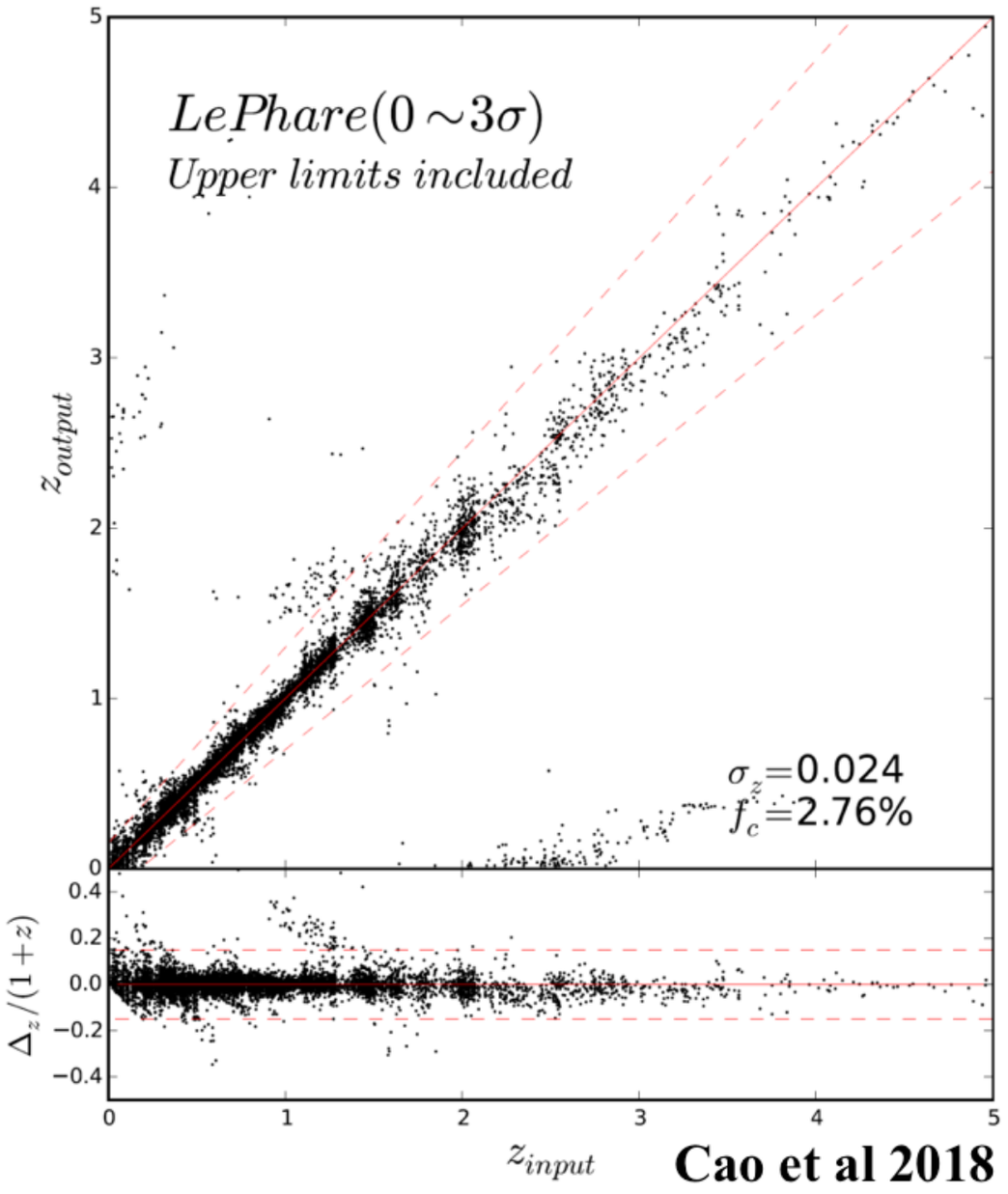


- **Introduction to LSST, Euclid and CSS-OS**

CSS-OS

1) Space-based telescope
2) Imaging in NUV/*ugrizy* bands with seeing ~0.2 arcsecond
3) Sky coverage: 17500 sq. degrees



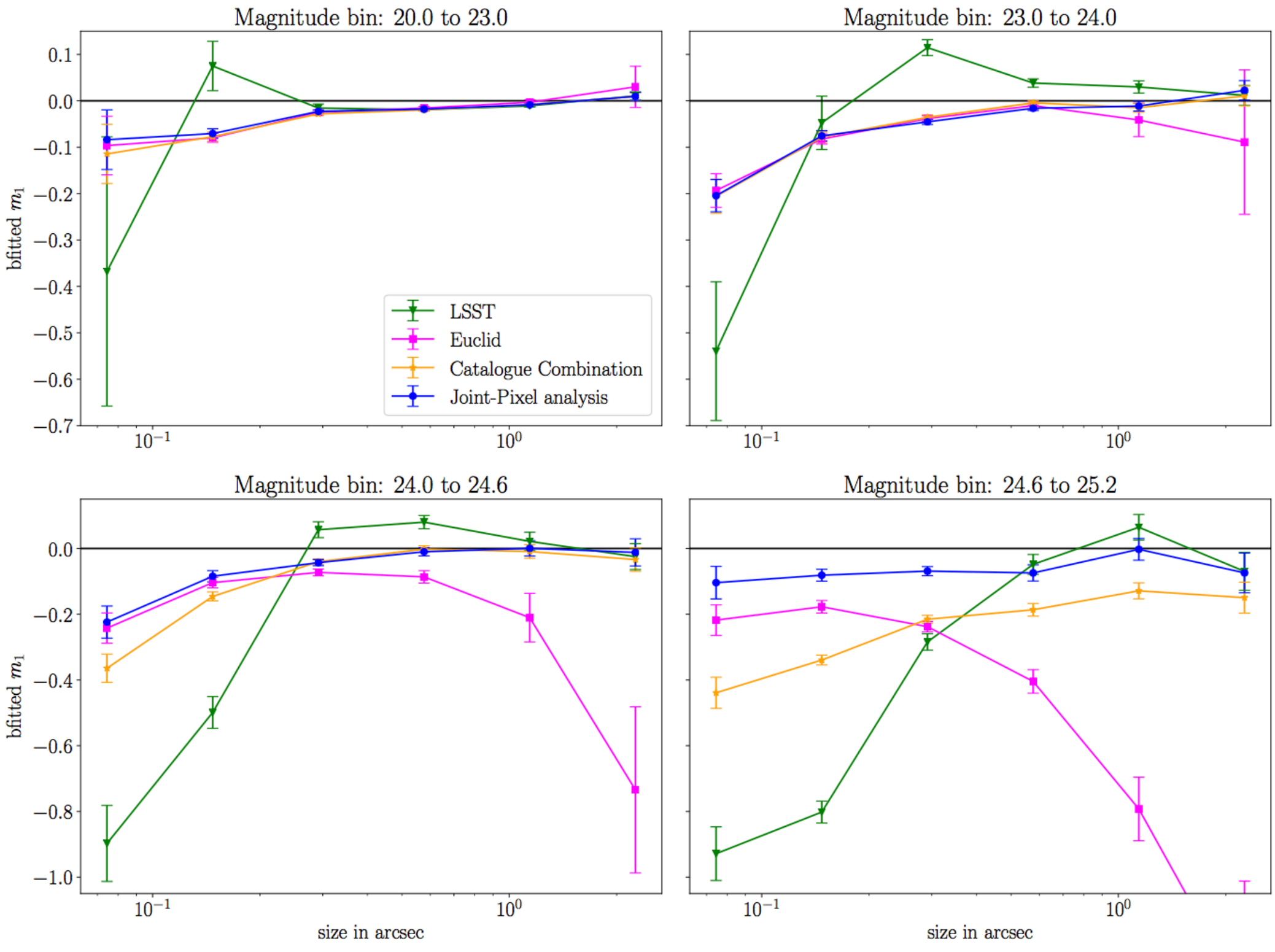


	Exp.	NUV	u	g	r	i	z	y
17500□°	2×150s	25.4	25.4	26.3	26.0	25.9	25.2	24.4

- Introduction to LSST, Euclid and CSS-OS

Synergy between LSST and Euclid

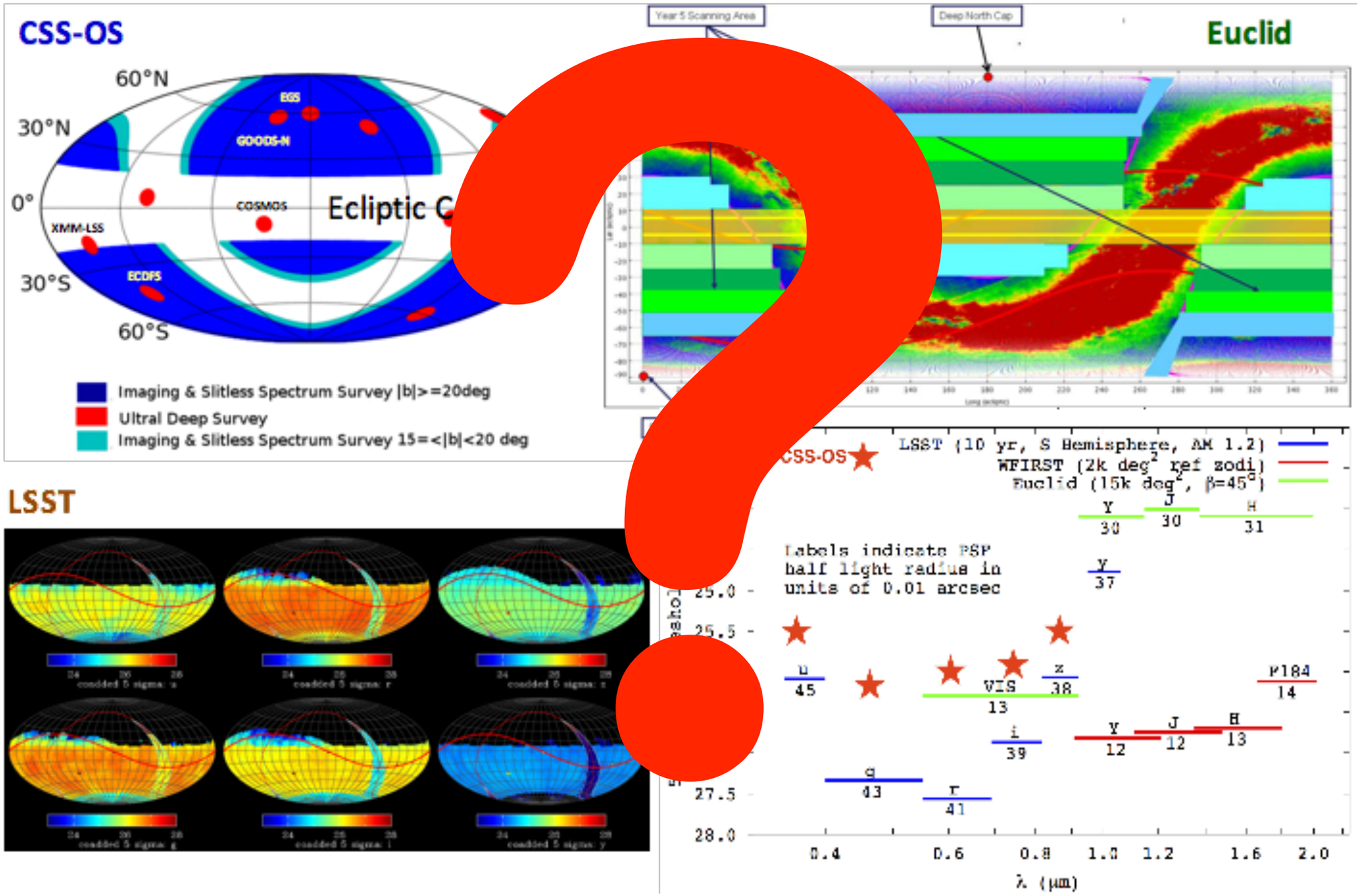
Rhodes et.al 2017 & Schuhmann et al 2019



- Introduction to LSST, Euclid and CSS-OS

Synergy between CSS-OS and Euclid

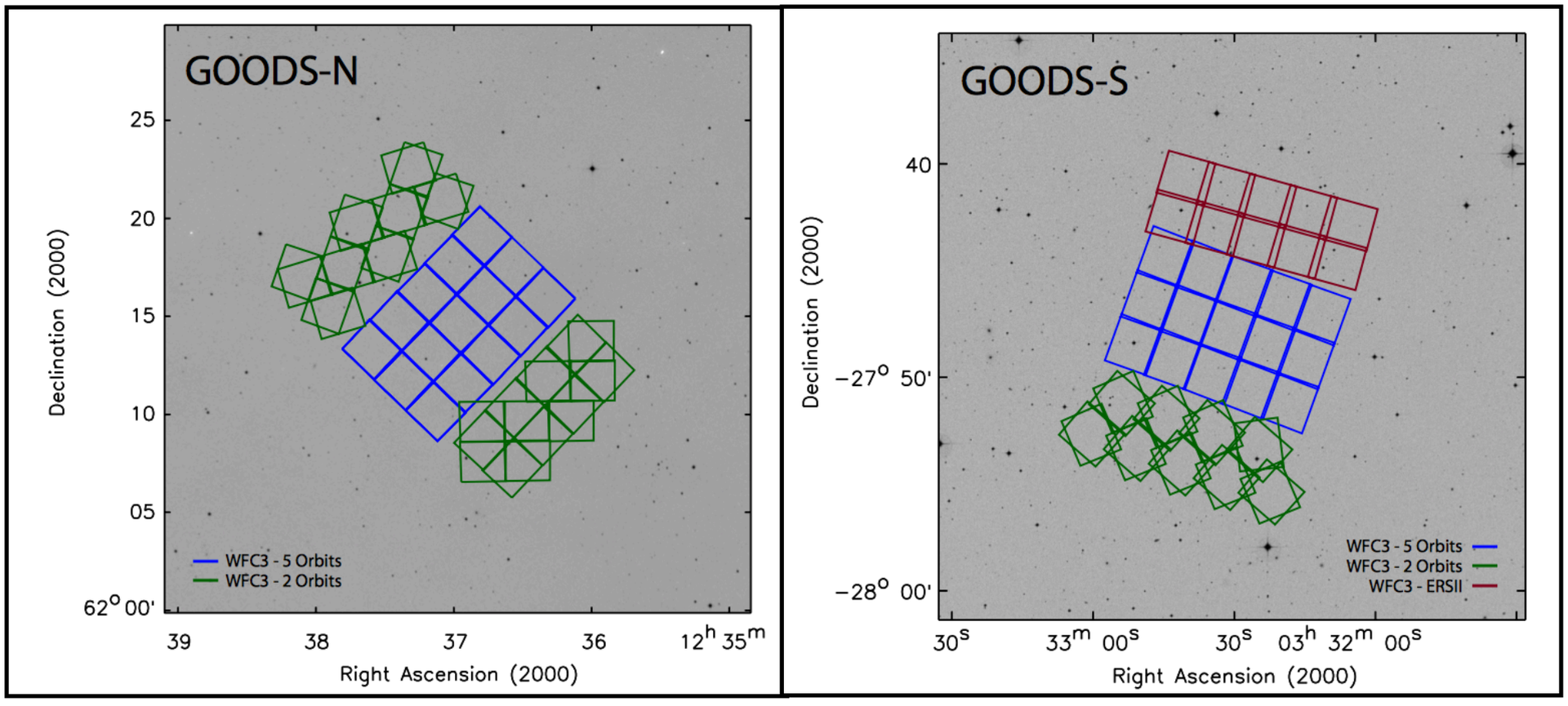
Credited by Zhan



Mock Image Generation

- Parent images are from HST/CANDELS observations
  - Fields: GOODS-North and GOODS-South
  - Nine Filters: F435W, F606W, F775W, F814W, F850LP, F105W, F125W, F140W and F160W
  - Pixel scale: 0.06; seeing 0.1 arcsecond

Field	R.A. (h m s)	Decl. (d m s)	Total Area (arcmin^2)	Science Area (arcmin^2)
GOODS-North	12 35 54.98	+62 11 51.3	164	157.8
GOODS-South	03 32 30.00	−27 47 19.00	177	171.0



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GOODS-N Optical-to-NIR Imaging

Band	$\lambda_{central}$ (μm)	A_λ (mag)	Zero Point (AB)	FWHM (arcsec)	ZP-corr (flux)	5σ Depth [a] (mag)
F435W	0.43179	0.044	25.689	0.10	1.03	27.1
F606W	0.59194	0.030	26.511	0.10	0.97	27.7
F775W	0.76933	0.020	25.671	0.11	0.98	27.2
F814W	0.76933	0.020	25.671	0.11	0.97	28.1
F850LP	0.90364	0.015	24.871	0.11	1.02	26.9
F105W	1.24710	0.009	26.230	0.18	1.03	26.4
F125W	1.24710	0.009	26.230	0.18	1.01	27.5
F140W	1.39240	0.007	26.452	0.18	1.04	26.9
F160W	1.53960	0.006	25.946	0.19	1.03	27.3

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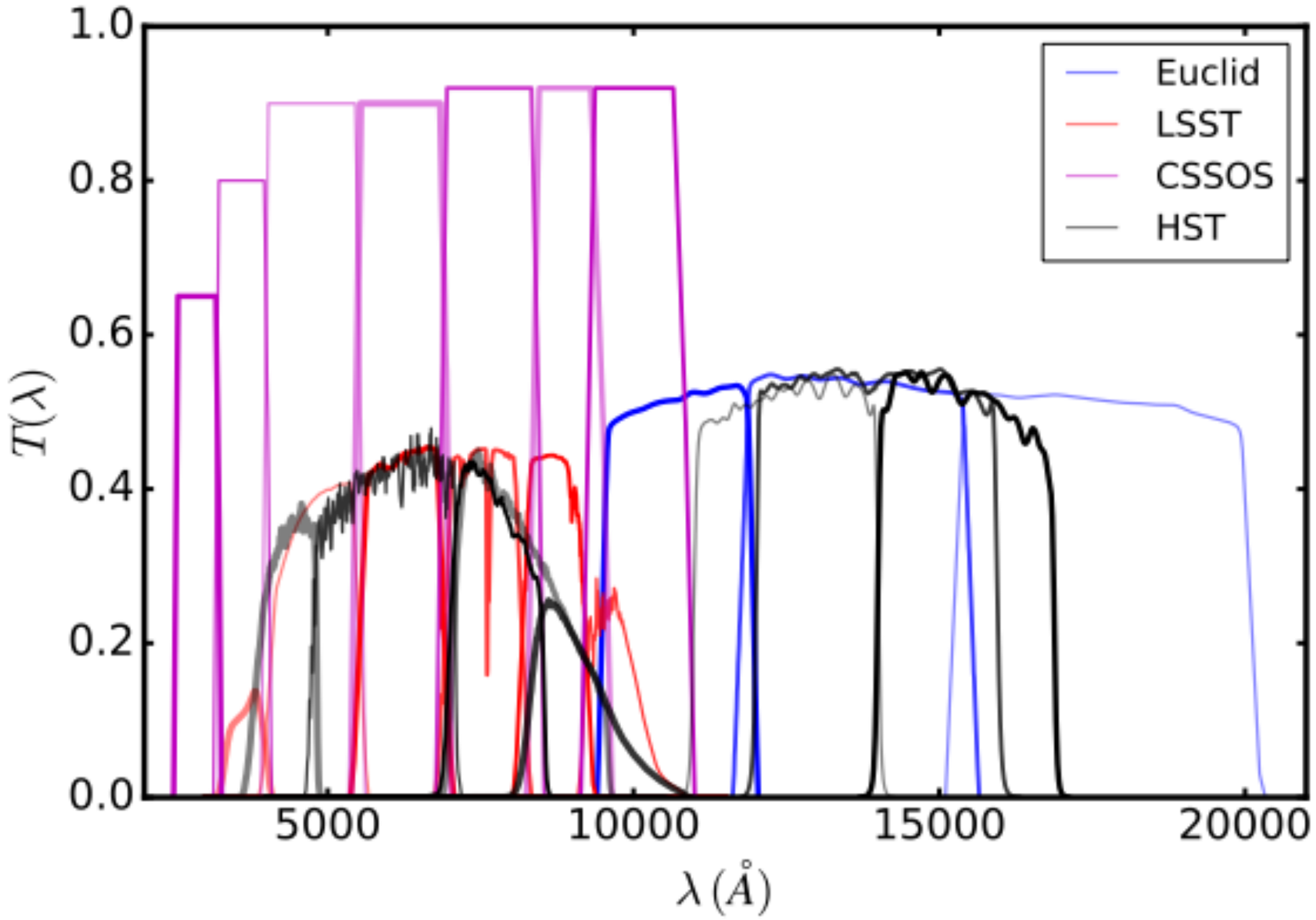

Mock Image Generation

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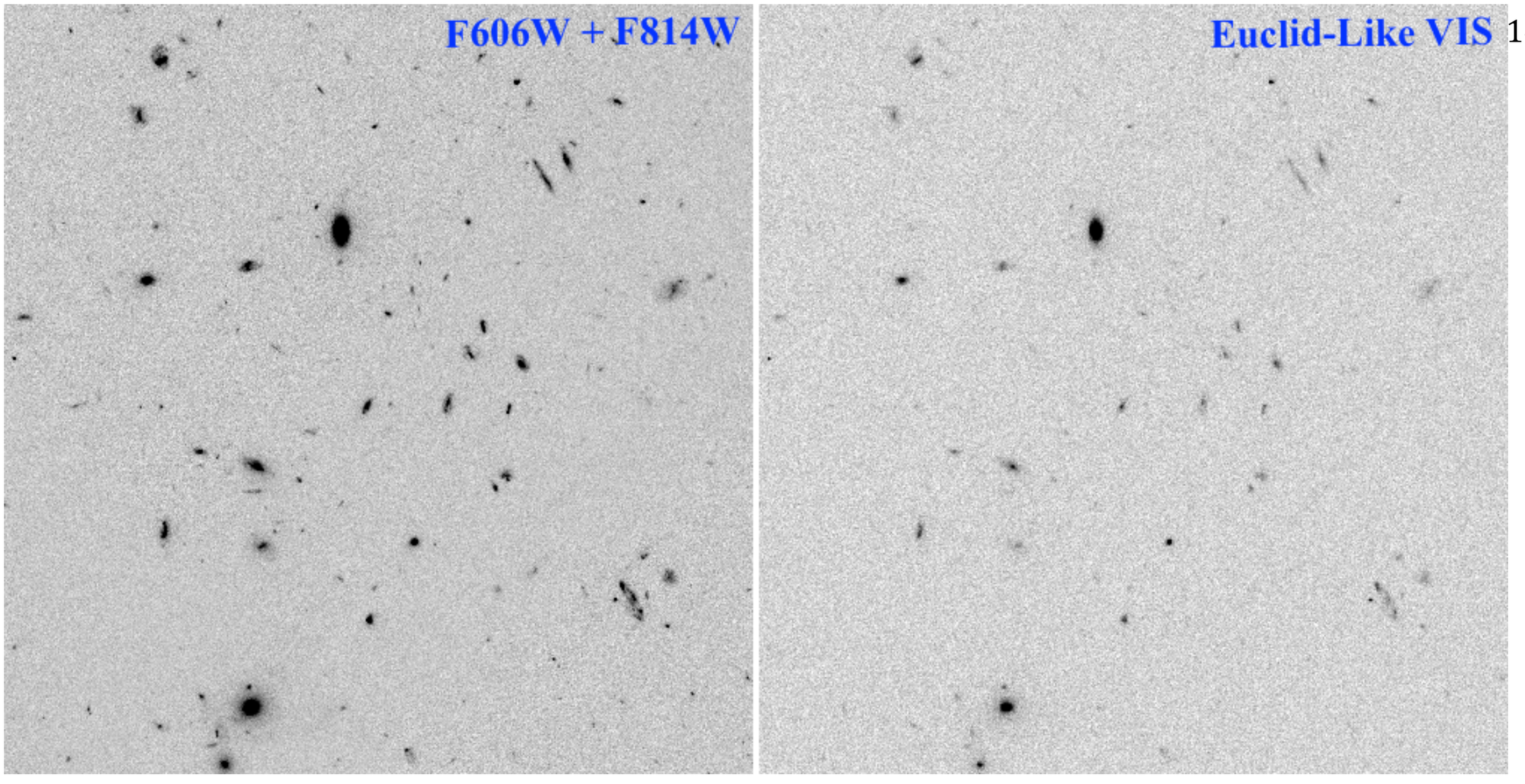
- Mock Euclid VIS image: F606W + F814W



14W

Mock Image Generation

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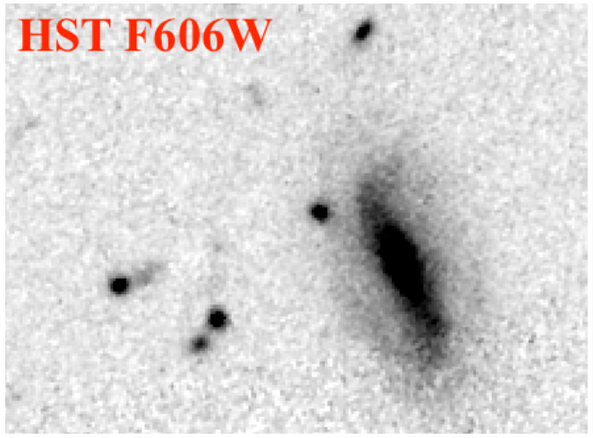
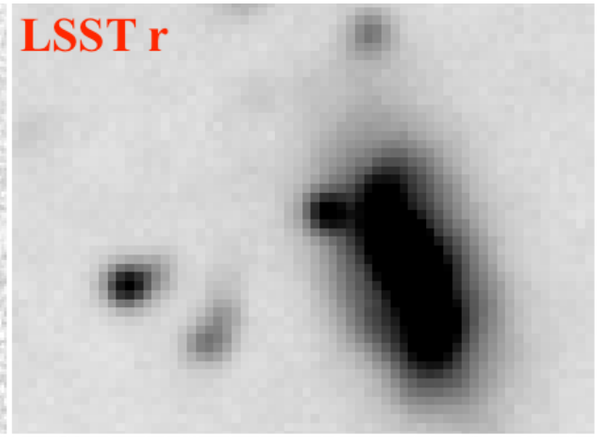
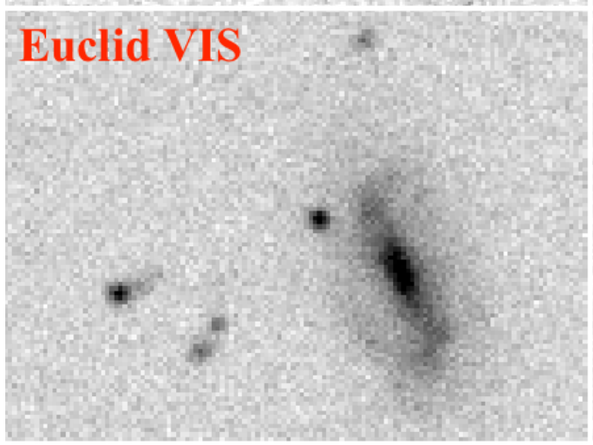
  - Pixel scale: 0.06; seeing 0.1 arcsecond

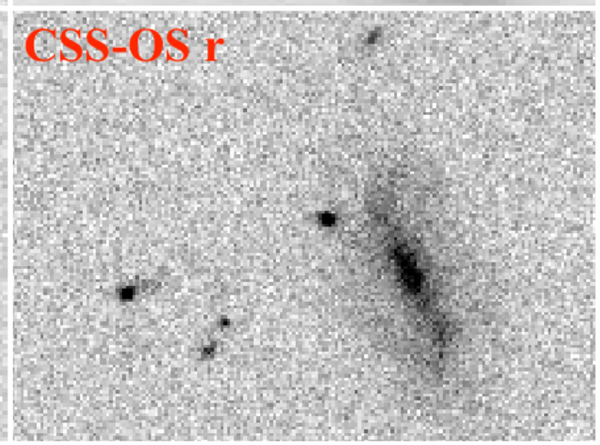
- Mock Euclid VIS image: F606W + F814W

- Mock LSST/CSS-OS *gri* images by linear interpolation









LSST	CANDELS
g	F435W & F606W
r	F606W
i	F775W

CSSOS	CANDELS
g	F435W & F606W
r	F606W
i	F606W & F775W

Mock Image Generation

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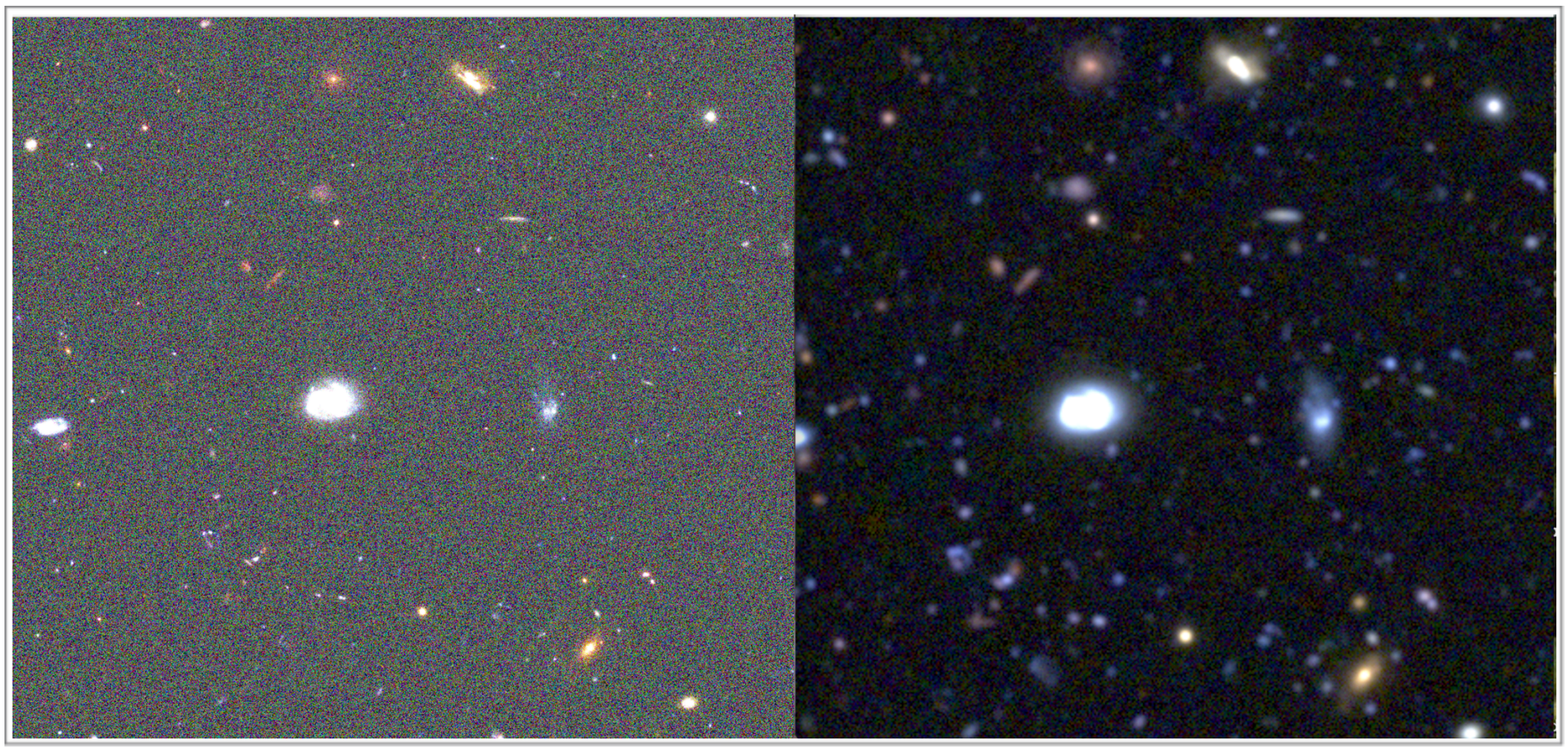
  - Pixel scale: 0.06; seeing 0.1 arcsecond

- Mock Euclid VIS image: F606W + F814W

- Mock LSST/CSS-OS *gri* images by linear interpolation

Color images of CSS-OS (*gri*; left) and LSST (*gri*; right)



Preliminary Results (GOODS-North Only)

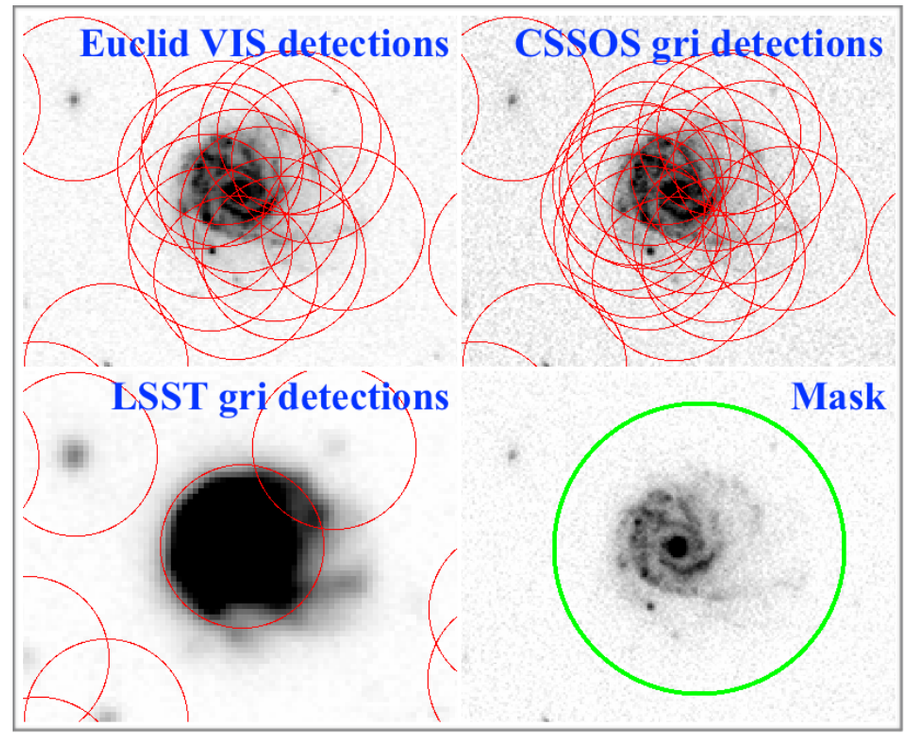
- ☑ Mask saturated stars and large galaxies
- ☑ Photometry with SExtractor: `DETECT_MINAREA=3.0; DETECT_THRESH=3.0; ANALYSIS_THRESH=3.0`
- ☑ Analysis of blending effect
- ☑ Parent sample: GOODS-N catalog (Barro et al 2019): 23611 objects with $SNR_{F814W}>10$

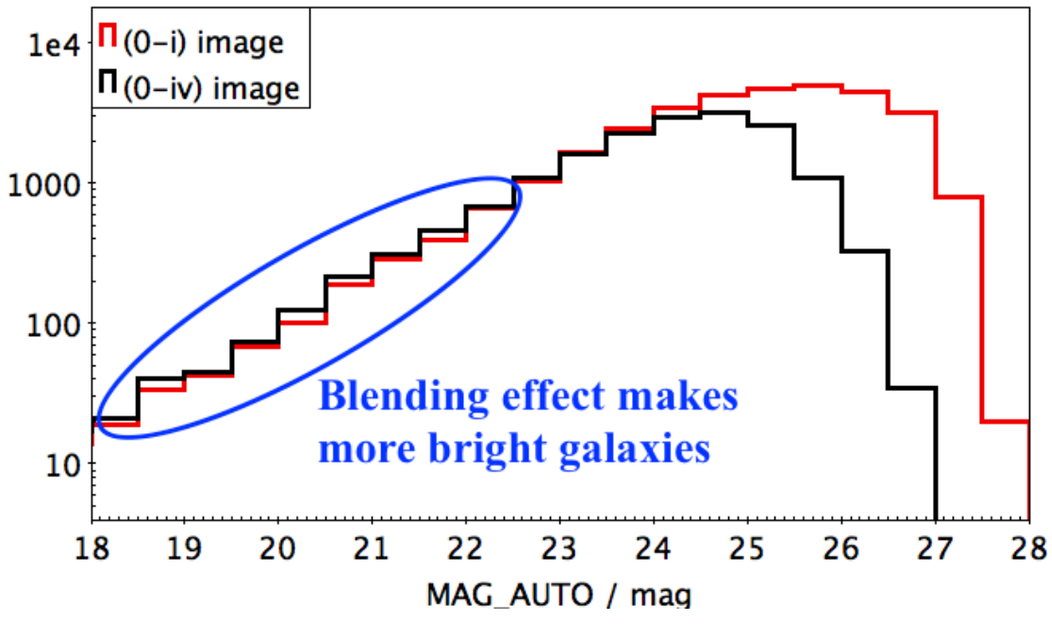
GOODS-N and LSST:

1) match radius is 0.8 arcsec

2) Total 9516 galaxies in LSST have counterparts in GN, of which 622 galaxies in LSST are isolated but are multiple-galaxies in GN

3) blending fraction: 622/9516 = 6.54%





Catalog	Image	Obj (snr>10)
Euclid	VIS	10731
CSS-OS	*gri*	9982
LSST	*gri*	13202

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GOODS-N and Euclid:

1) match radius is 0.26 arcsec

2) Total 8177 galaxies in Euclid have counterparts in GN, of which 0 galaxies in Euclid are isolated but are multiple-galaxies in GN

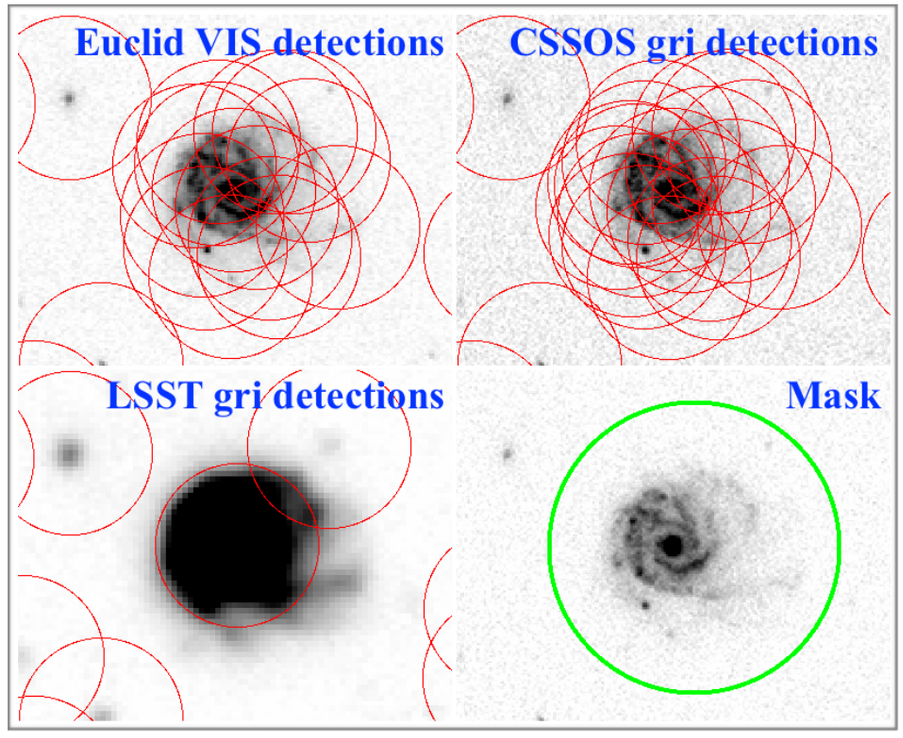
3) blending fraction: 0/8177 = 0.00%

GOODS-N and CSS-OS:

1) match radius is 0.294 arcsec

2) Total 7034 galaxies in CSS-OS have counterparts in GN, of which 0 galaxies in CSS-OS are isolated but are multiple-galaxies in GN

3) blending fraction: 0/7034 = 0.00%



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Euclid	VIS	10731
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LSST	*gri*	13202

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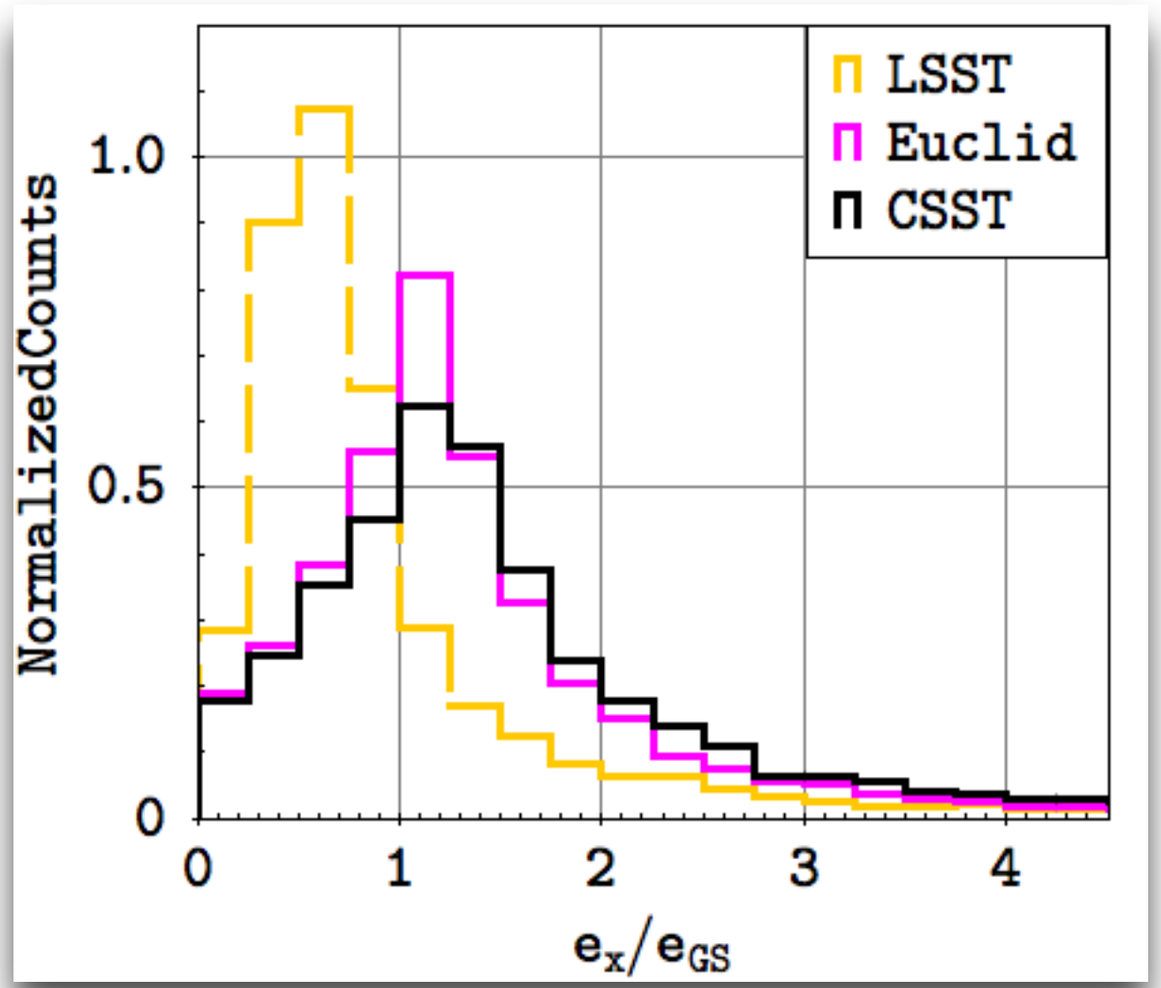
3) blending fraction: 0/7034 = 0.00%

SExtractor measured ellipticity



- **Summary**
  - LSST suffers from significant blending issue due to its low resolution and large seeing
  - In the assumption of Gaussian PSFs, the observed galaxy shapes of CSS-OS and Euclid are less deviated from GOODS-North
  - A large sample is required for weak lensing analysis

Thank you