

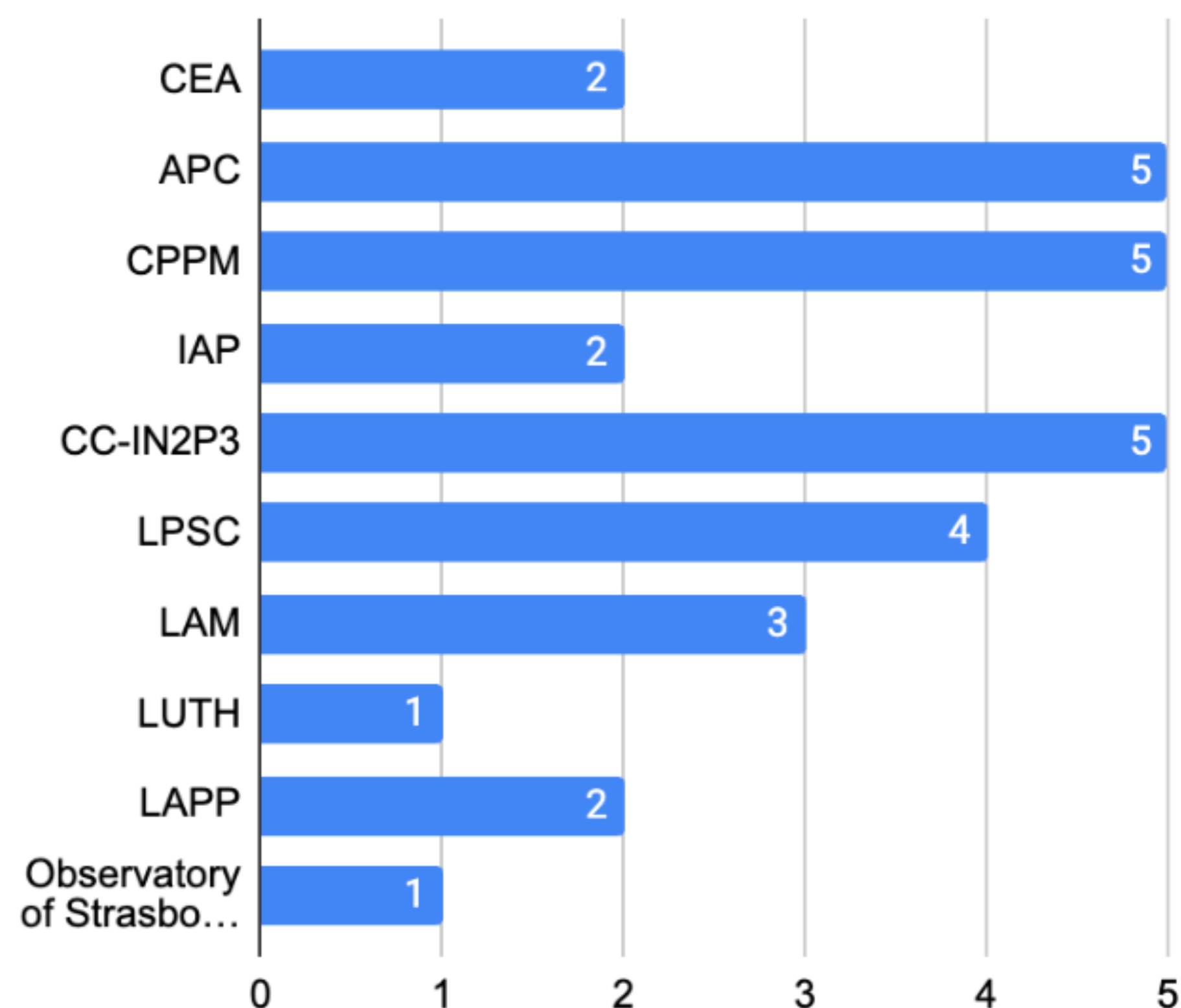
Euclid/LSST workshop



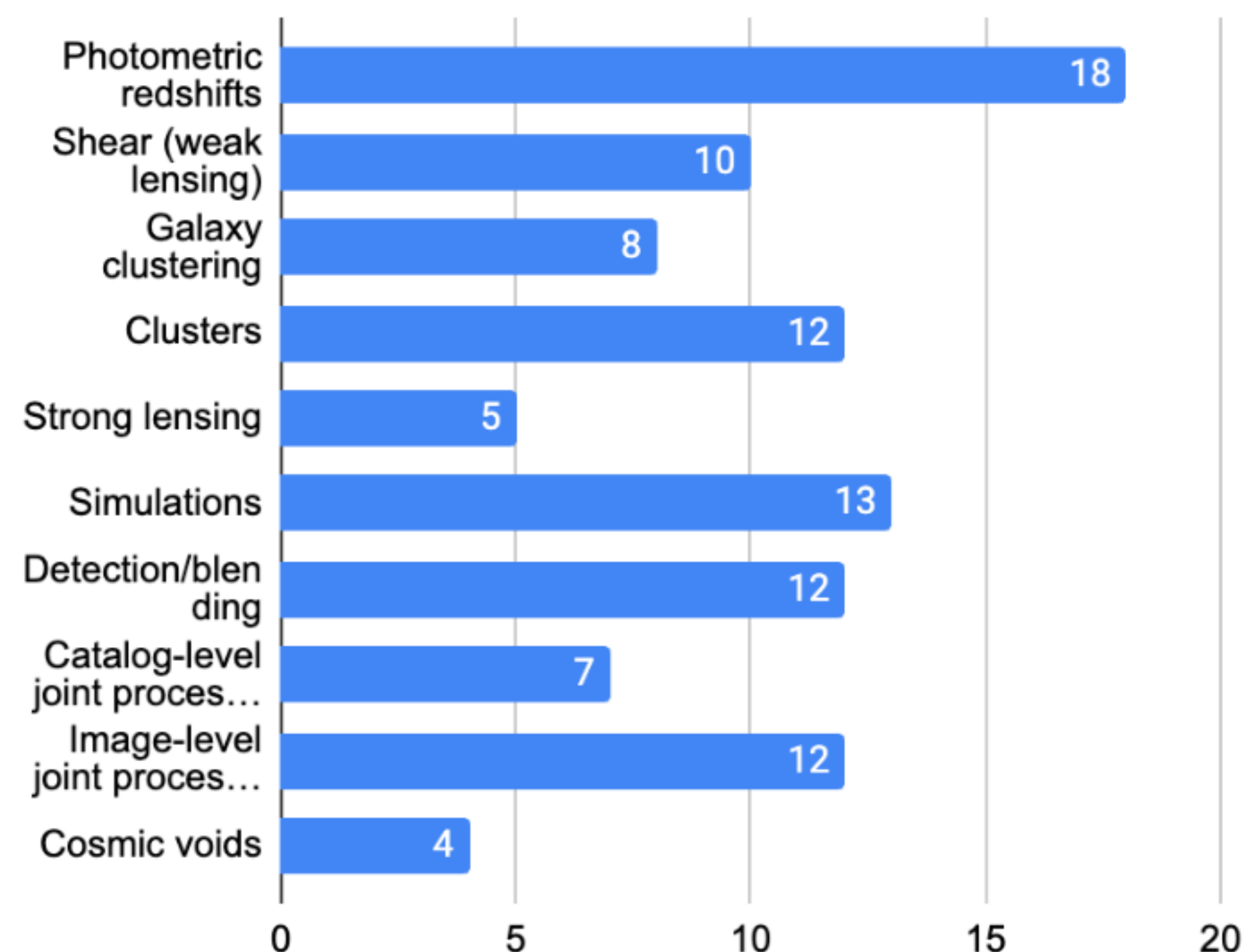
agenda: <https://indico.in2p3.fr/event/34129/timetable/?view=standard>

Who's here for what?

Labs

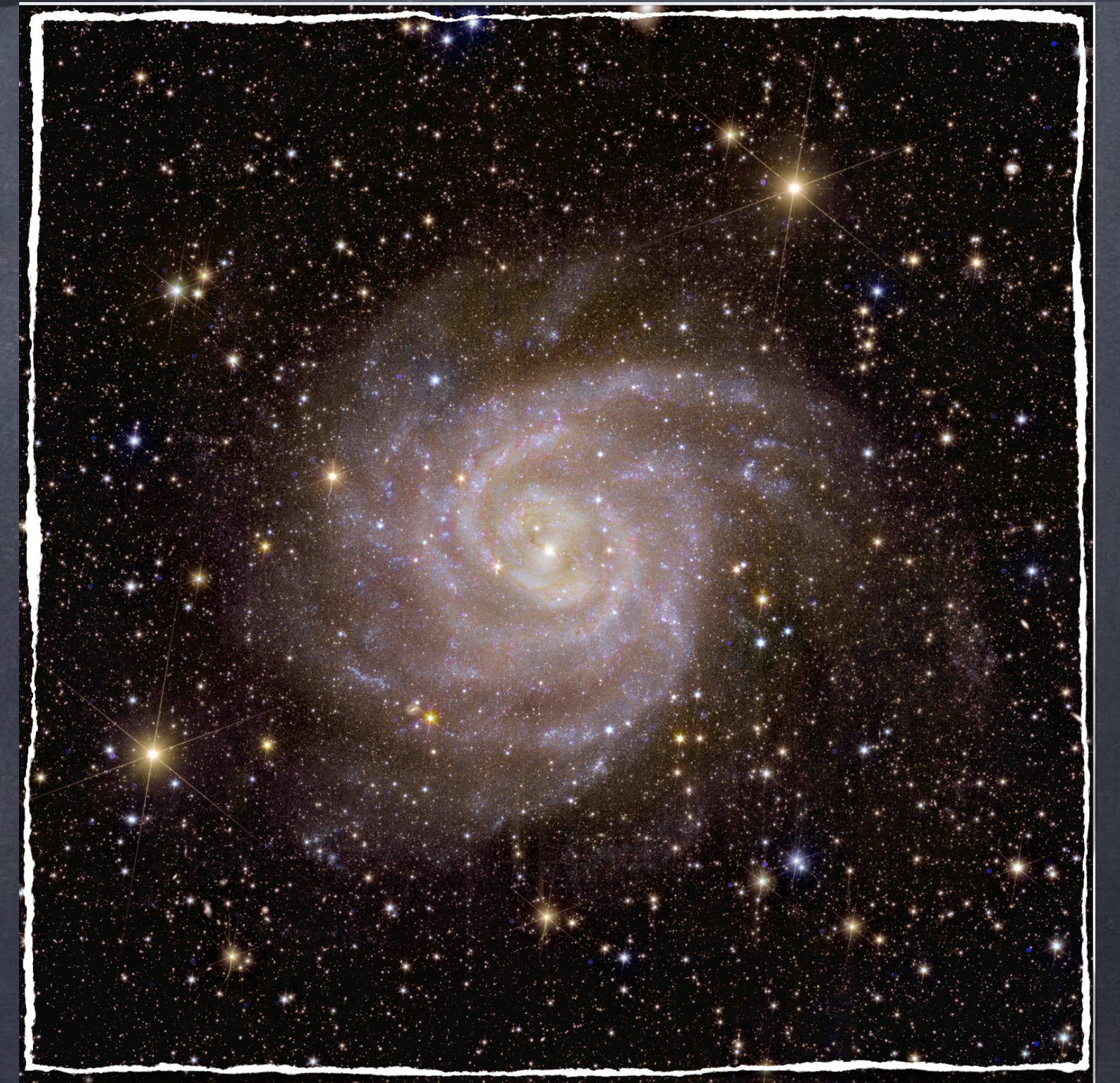
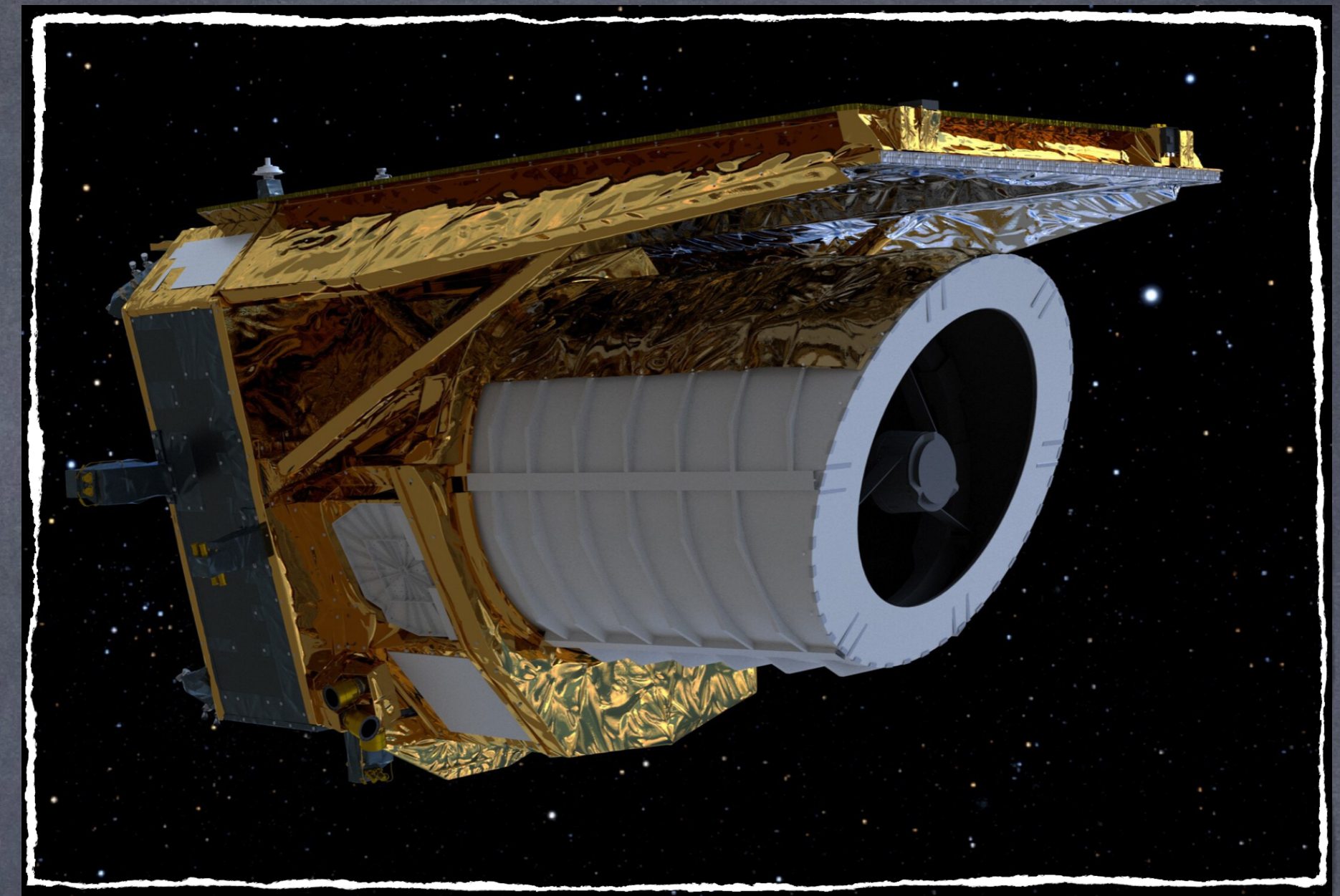


Topics



Euclid

- 1.2m primary mirror
- photometry with VIS (resolution 0.1') and spectroscopy+images with NISP (infrared, resolution 0.3')
- 15000 deg²
- Launched 1st July 2023, in orbit around L2
- Length of the mission : ~7 years



Euclid vs LSST

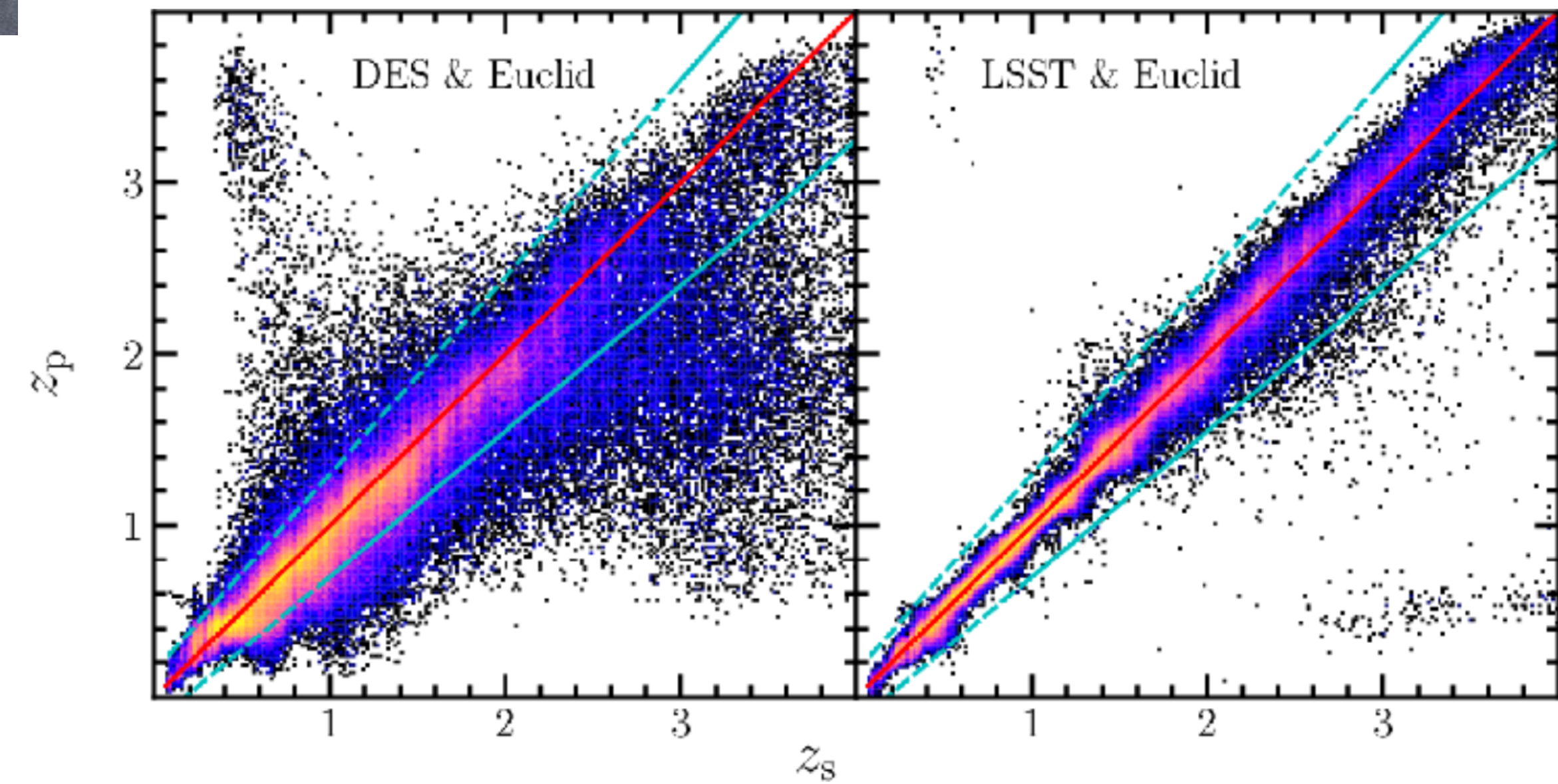
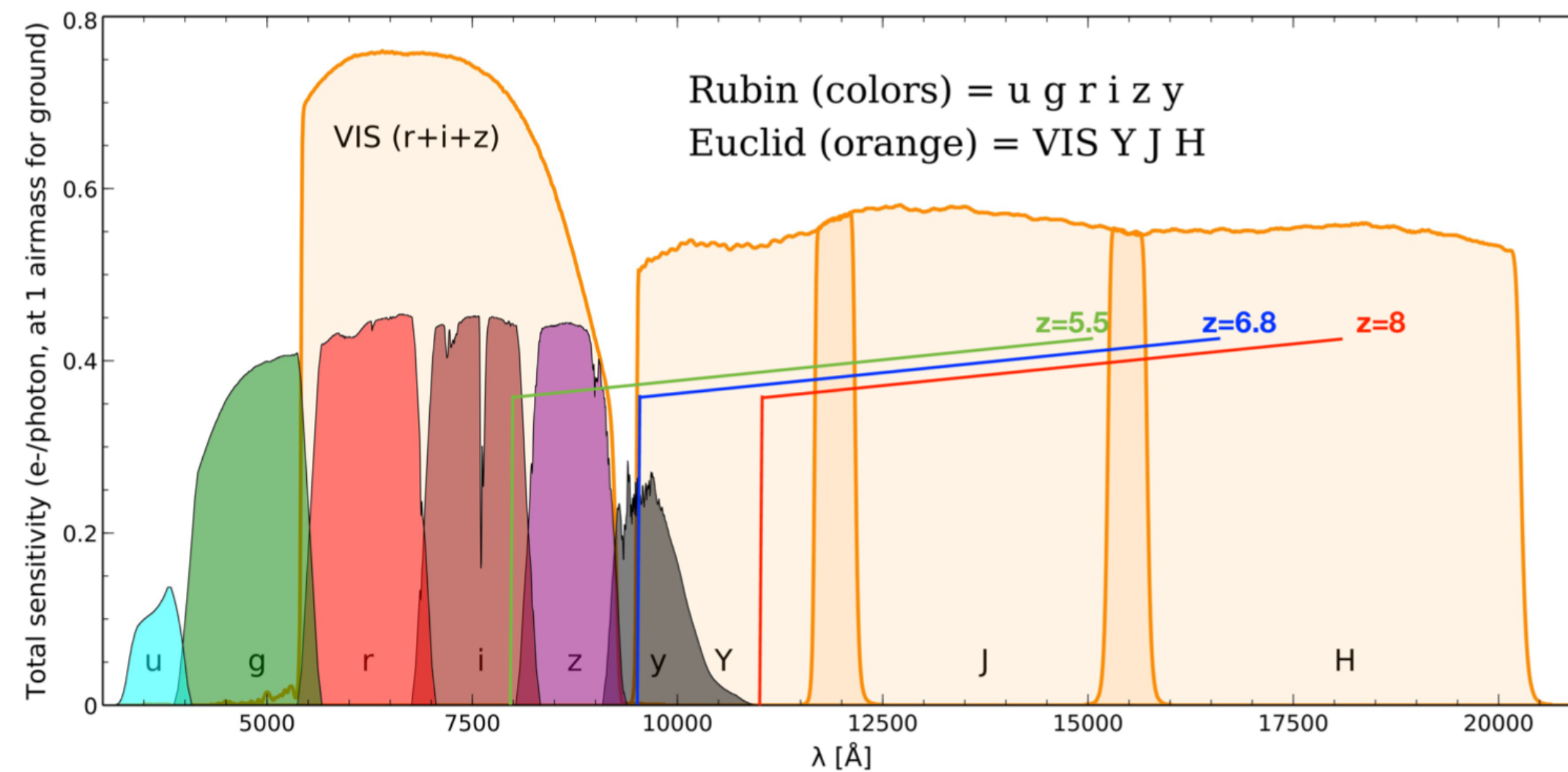


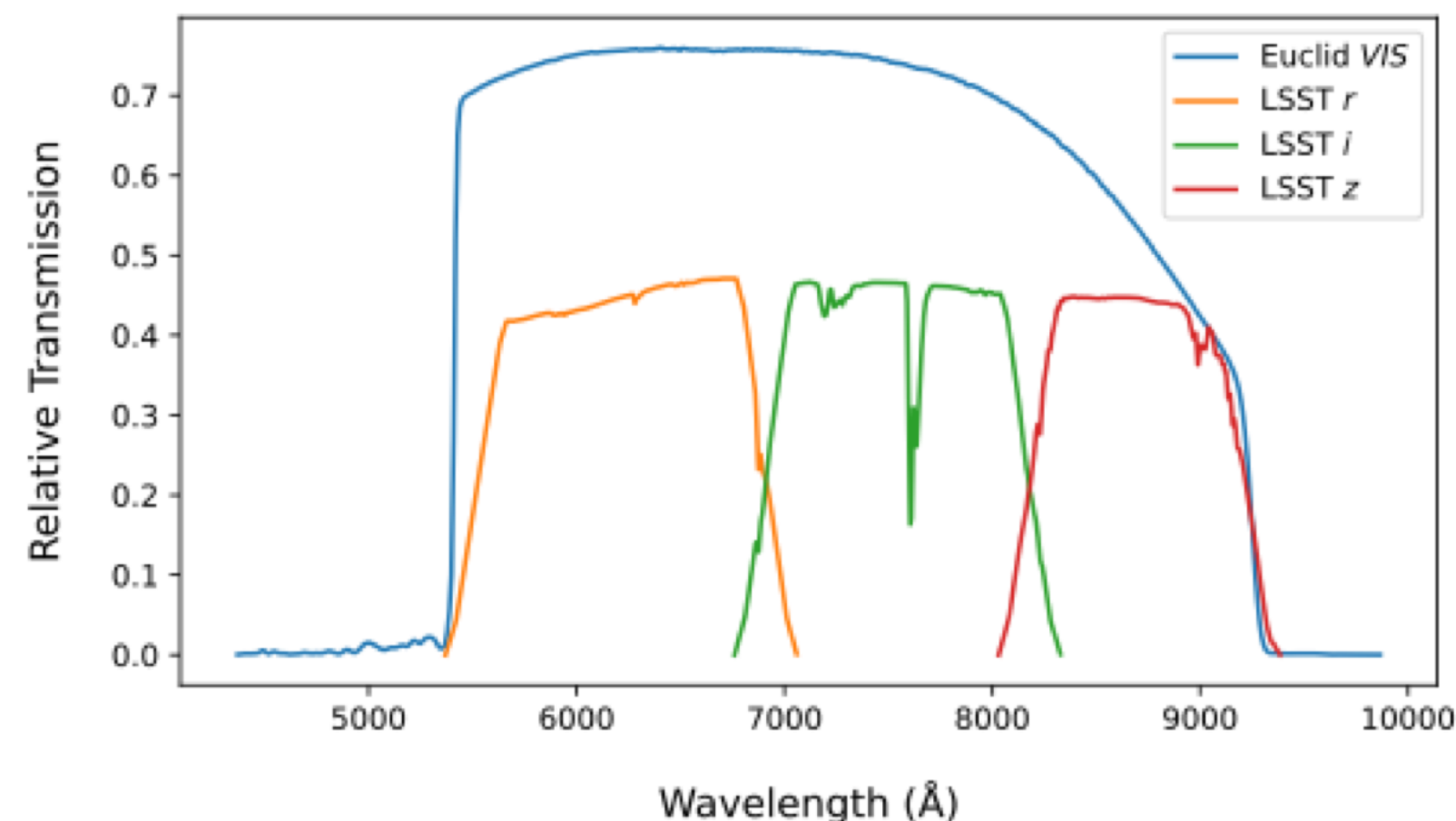
Figure 11: Schematic representation of the spectra of three galaxies at $z = 5.5, 6.8, 8$ (the vertical lines show the position of the Ly α break, the nearly horizontal one the extreme UV spectrum) superimposed to the joint Rubin+Euclid filter set.

Euclid preparation. XI. Mean redshift determination from galaxy redshift probabilities for cosmic shear tomography

Image deconvolution with Euclid and LSST

- Euclid: high resolution but small number of color bands
- LSST: lower resolution but more bands
- See talk (Jean-Luc Starck)

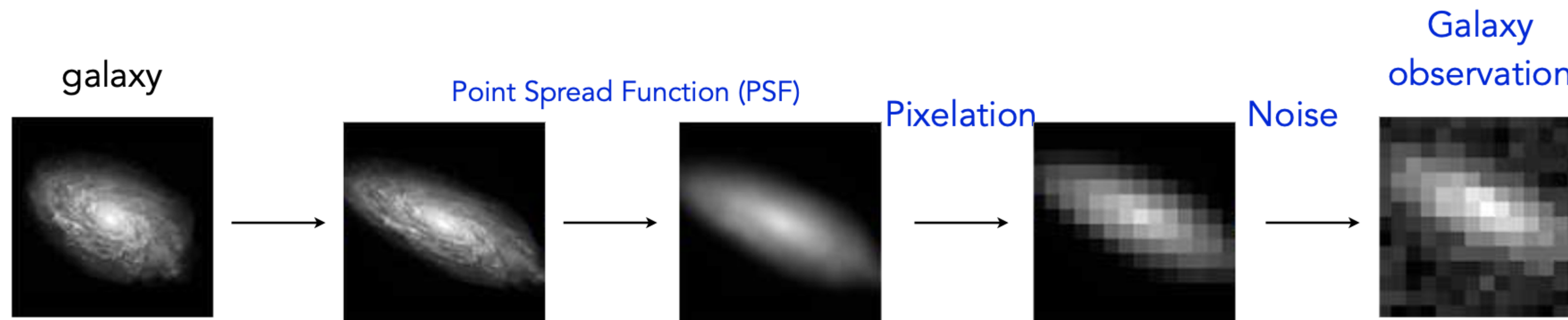
Ideally, we would like to have a Joint Euclid-Rubin (JEUBIN Catalog), using both Euclid resolution and Rubin colours.



$$\mathbf{x}_{euc} = \alpha_r \mathbf{x}_r + \alpha_i \mathbf{x}_i + \alpha_z \mathbf{x}_z$$

Fractional flux contributions

$$\alpha_r, \alpha_i, \alpha_z \in \mathbb{R}^n$$



Ground: Subaru (8.2m)

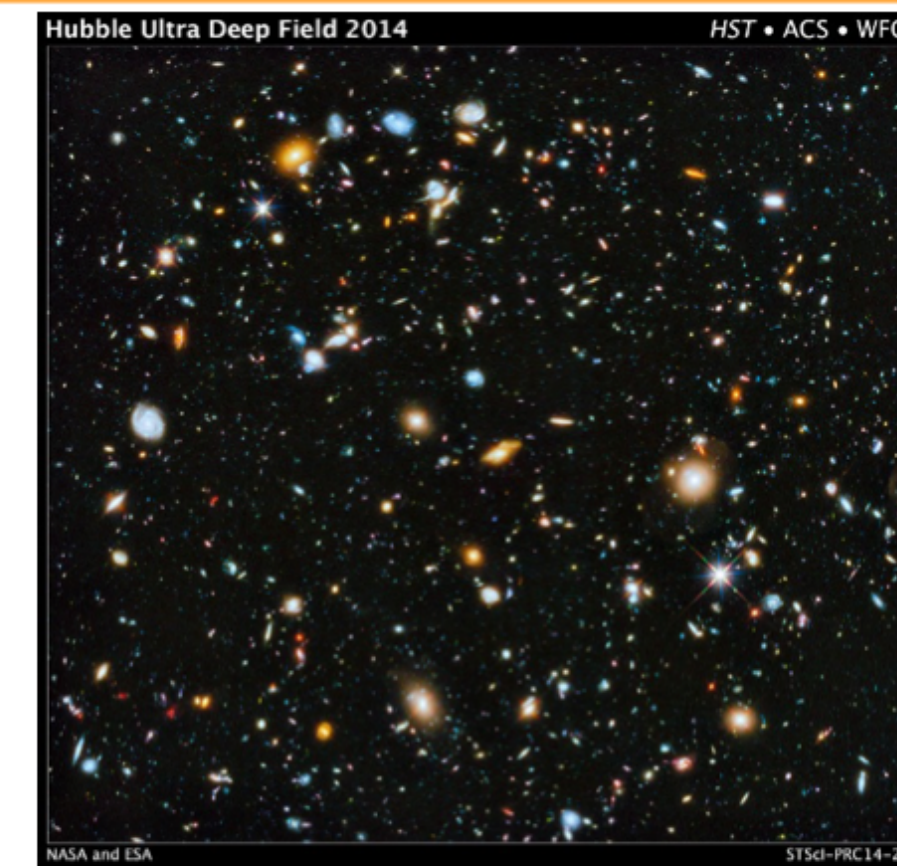
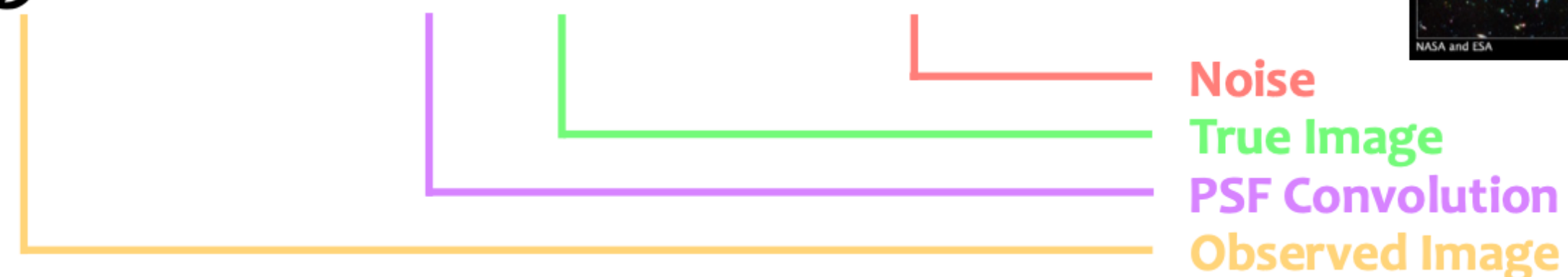


Space: HST (2.4m)



Standard deconvolution framework:

$$\mathbf{y} = \mathbf{H}\mathbf{x} + \mathbf{n}$$



Standard deconvolution framework:

$$\operatorname{argmin}_{\mathbf{X}} \frac{1}{2} \|\mathbf{Y} - \mathbf{HX}\|_2^2 + \|\Phi^t \mathbf{X}\|_p \quad \text{s.t.} \quad \mathbf{X} \geq 0$$

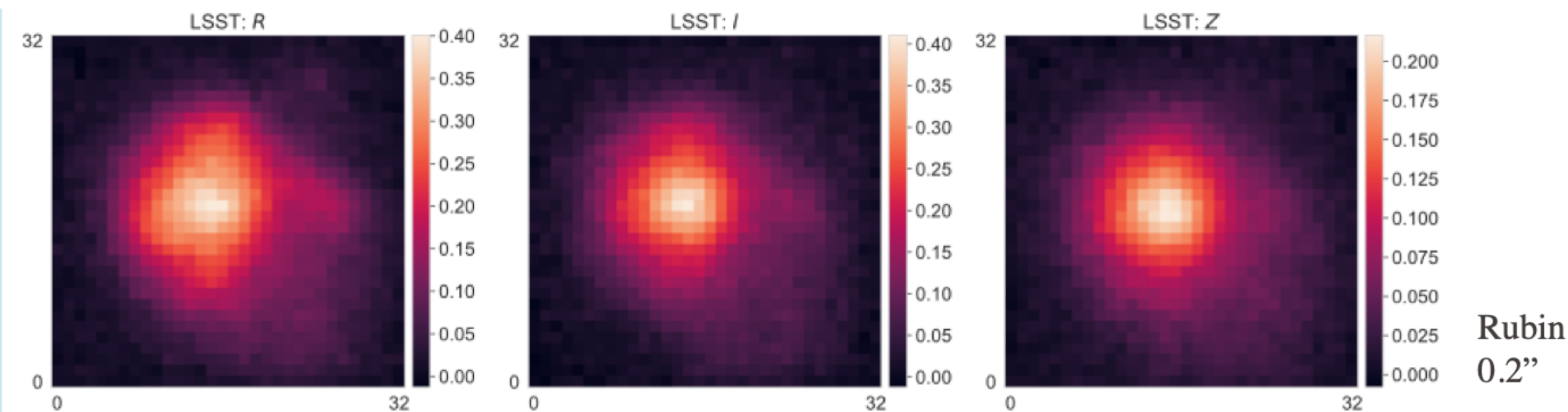
H is huge !!!

Rubin Images

$$\mathbf{y}_r = \mathbf{h}_r * \mathbf{x}_r^t + \eta_r$$

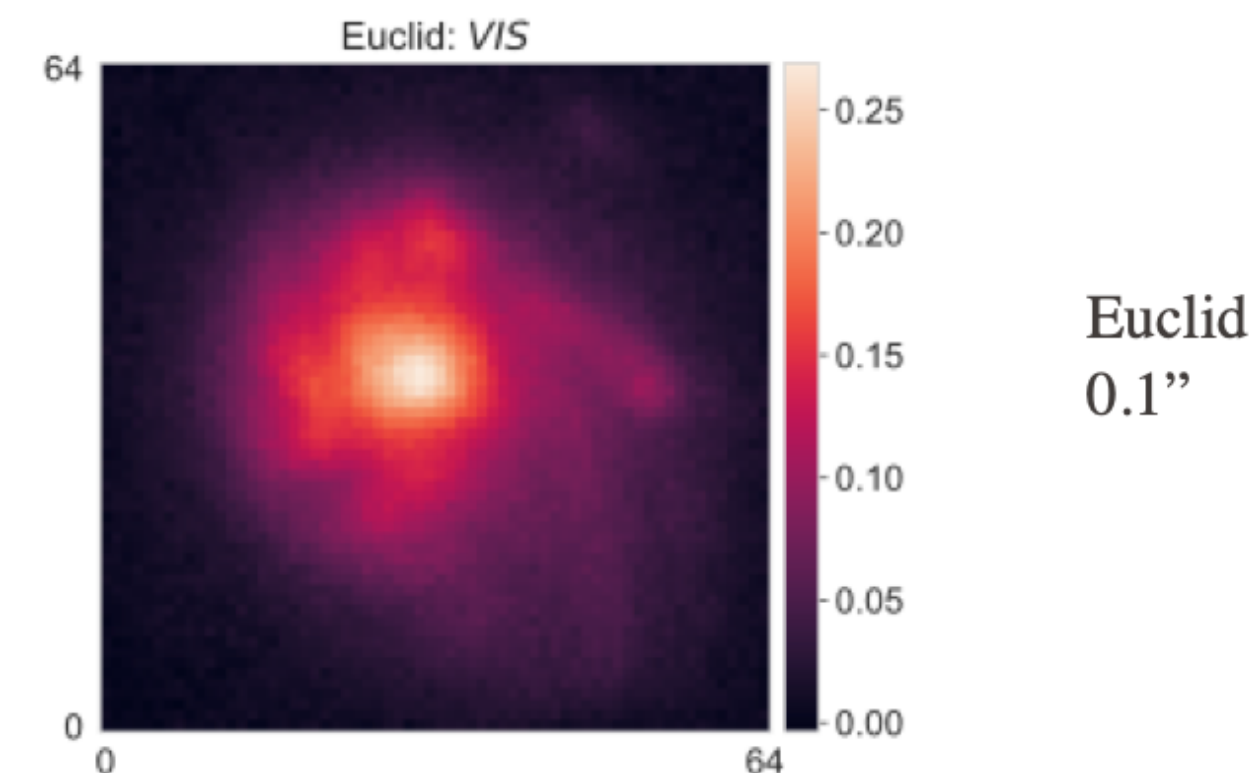
$$\mathbf{y}_i = \mathbf{h}_i * \mathbf{x}_i^t + \eta_i$$

$$\mathbf{y}_z = \mathbf{h}_z * \mathbf{x}_z^t + \eta_z$$



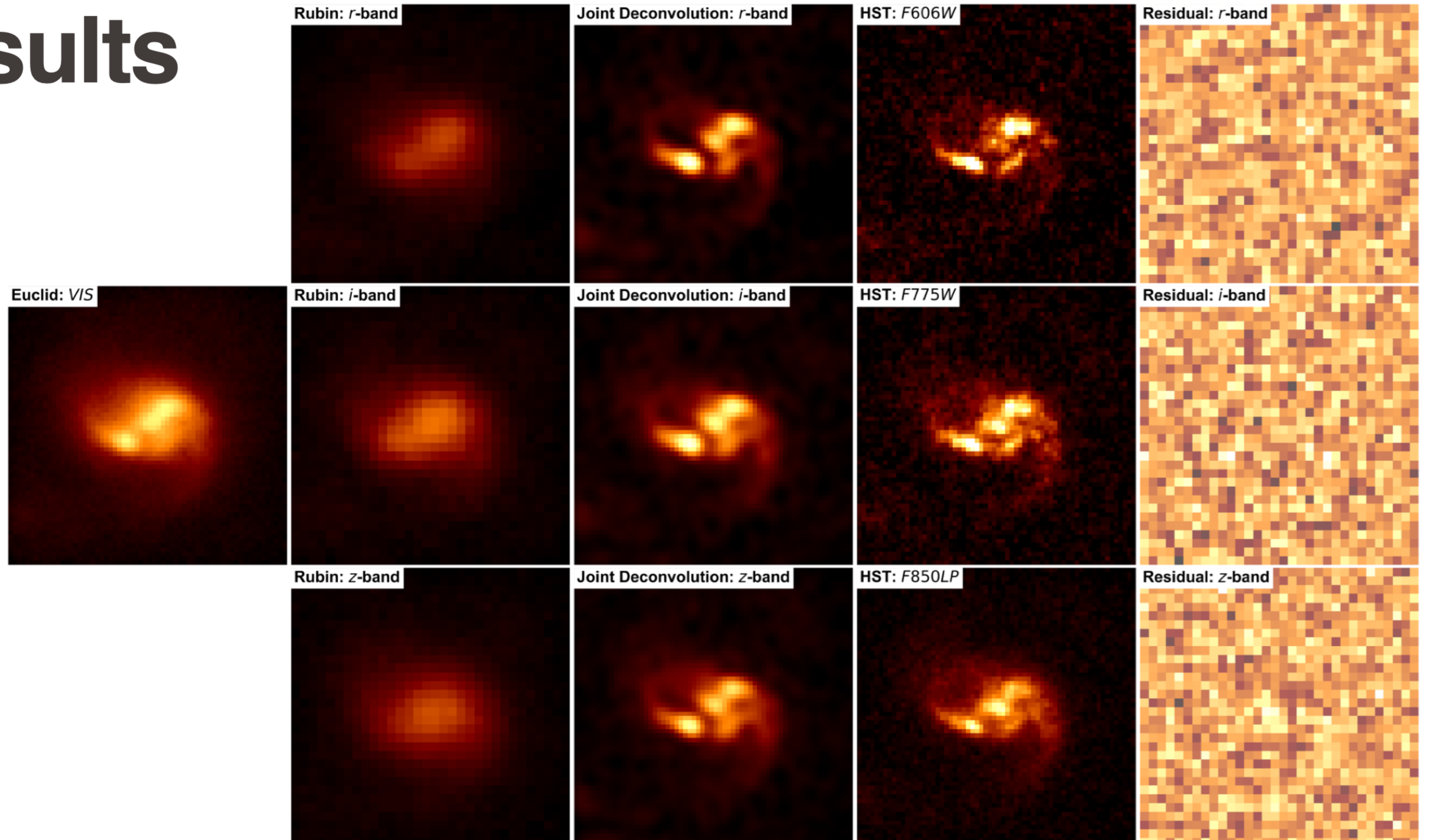
Euclid Image

$$\mathbf{y}_{euc} = \mathbf{h}_{euc} * \mathbf{x}_{euc}^t + \eta_{euc}$$



$$\mathbf{x}_{euc}^t = \alpha_r \mathbf{x}_r^t + \alpha_i \mathbf{x}_i^t + \alpha_z \mathbf{x}_z^t$$

Results



DDP

- Derived data products -> combination of Rubin and Euclid Data
- 10 topics/Science Case(among then Static cosmology)
- See: talk (Eric Jullo) and paper

Recommended Rubin-Euclid Derived Data Products summary table [2/2]

Acronyms/Codes per column: 1) DDP code name; 2) Community served: B(oth), E(uclid), R(ubin); 3) Priority (P1 to P2) + Urgency (**U1** to U3) + Timescale (Real Time, Yearly, Data Releases); 4) Production tier (T0 to T3)

Static Cosmology (SC: weak lensing, clustering, clusters))

DDP-48-SC	E	P1+U1+YR	T1	Baseline 'list-driven' Y1 ugrizy Rubin photometry for Euclid VIS sources
DDP-49-SC	R	P2+U2+DR	T2	Baseline 'list-driven' Euclid NISP YJH photometry for Rubin sources
DDP-50-SC	R	P1+U1+YR	T1	Rubin photometric redshift distributions calibrated with Euclid spectroscopy
DDP-51-SC	E	P2+U2+DR	T3	Deeper ugrizy Rubin photometry of Euclid VIS sources
DDP-52-SC	B	P1+U1+DR	T2	Joint-pixel Rubin ugrizy, Euclid VIS & YJH photometry in the Wide Surveys
DDP-53-SC	B	P2+U2+DR	T3	Joint-pixel Rubin-Euclid galaxy shape analysis
DDP-54-SC	B	P1+U1+YR	T1	Deep Survey joint-pixel photometry and shear analysis of all Rubin+Euclid bands

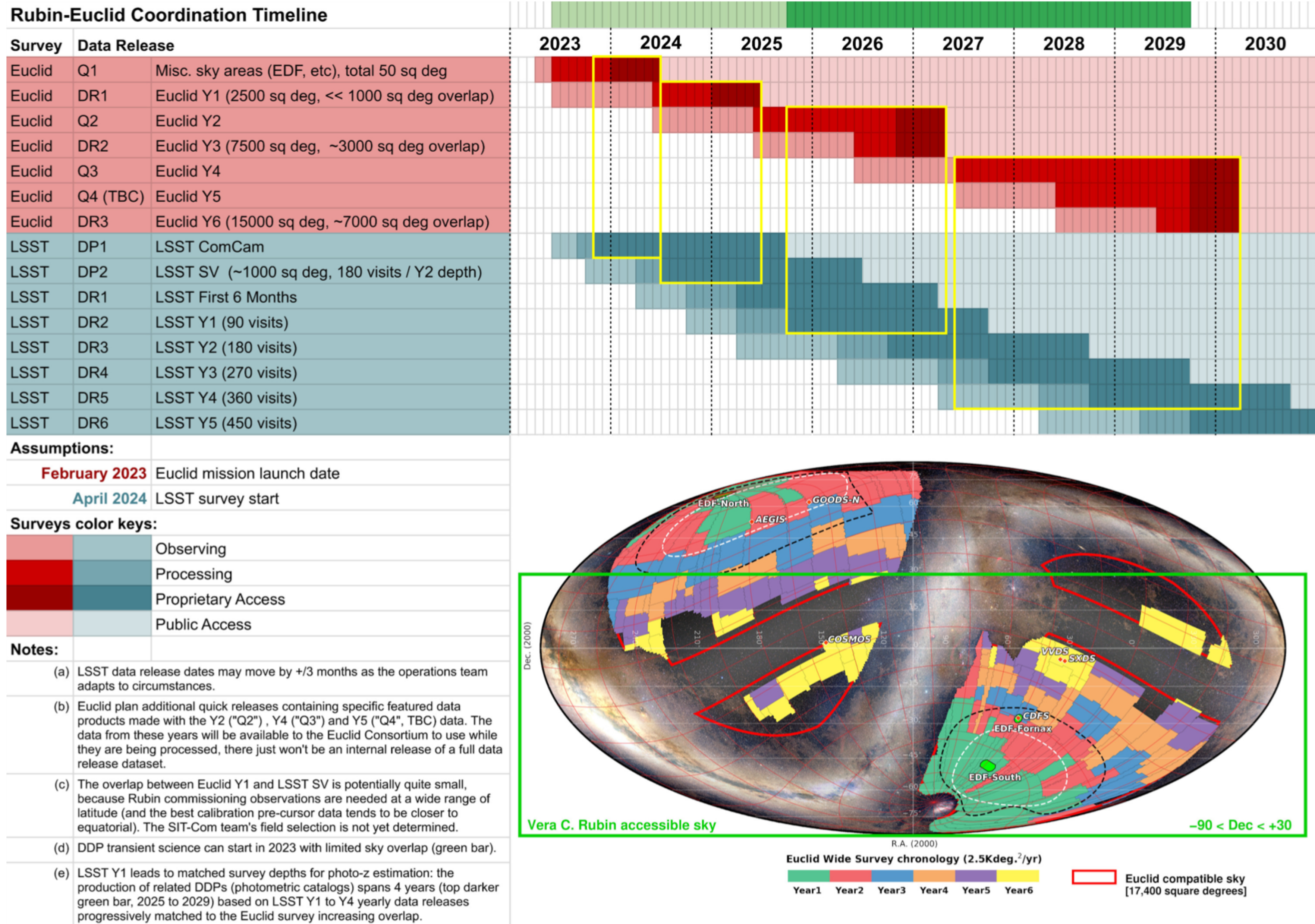


Figure 4: Matched data release schedules for Euclid and Rubin LSST (c.f. included Surveys color keys and Notes on the bottom left). The top green bar shows the proposed time span of the DDPs generation activity while yellow boxes illustrate a scheme for when major DDP generation could take place: a) the two yellow boxes on the left

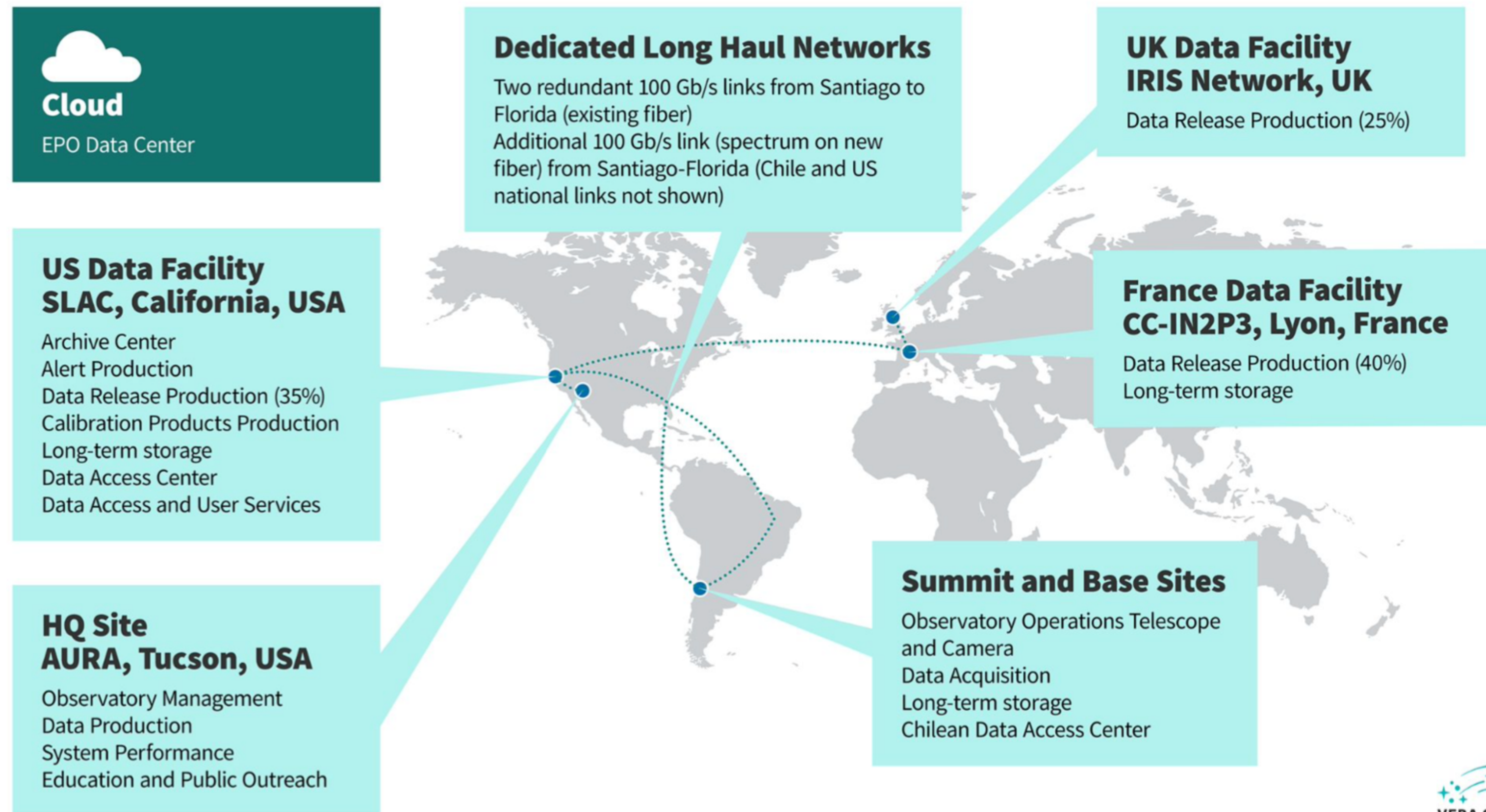
EUCLID COMPUTING MODEL

- 9 Science Data Centers (SDC)
- Complete level 2 pipeline executed in all SDCs
- Distribution of the sky
- CC-IN2P3: 25% of
 - Raw storage (+ replica)
 - Processing
 - Storage of data products
- 25% includes:
 - Part of wide survey
 - Euclid Deep Field North
 - Self calibration field



RUBIN COMPUTING MODEL

- Data Release Production: reprocessing of the full raw image dataset to produce the annual data release to be jointly performed at 3 data facilities
 - US data facility (SLAC National Accelerator Laboratory, CA, USA): 35%
 - UK data facility (IRIS and GridPP, UK): 25%
 - French data facility (CC-IN2P3, Lyon, FR): 40%



ACCESSING EUCLID DATA

The Euclid Science Archive



Scientific Community

WEB Portal



Astroquery

ESA Datalabs



VO Compliant APIs



TAP+

DataLink

SIA

SSA

SODA

VOSpace



Greenplum open source

MPP DB



Petascale Data Storage
Dell Isilon

Transfer and Ingestion Layer



5

Credit: B. Altieri

CCIN2P3 7

EUCLID DATA RELEASES

- DR1: data from the first year of the Wide survey covered by ground based data
 - Internal: October 2025
 - Public: October 2026
- DR2: 3 years of data
 - Internal: June 2027
 - Public: June 2028
- DR3: 6 years of data
 - Internal: July 2030
 - Public: July 2031

RUBIN DATA RELEASES

Rubin Early Data Release Scenario	Jun 2021	Jun 2022	Aug 2023	Jul 2025 - Aug 2025	#N/A	Mar 2026 - Jun 2026	Sep 2026 - Feb 2027	Sep 2027 - Feb 2028	Sep 2028 - Dec 2028	Sep 2029 - Dec 2029
	DP0.1	DP0.2	DP0.3	DP1	FLD	DP2	DR1	DR2	DR3	DR4
Data Product	DC2 Simulated Sky Survey	Reprocessed DC2 Survey	Solar System PPDB Simulation	ComCam Data	#N/A	LSSTCam Science Validation Data	LSST First 6 Months Data	LSST Year 1 Data	LSST Year 2 Data	LSST Year 3 Data
Raw images	✓	✓	☐	✓	☐	✓	✓	✓	✓	✓
DRP Processed Visit Images and Visit Catalogs	✓	✓	☐	✓	✓	✓	✓	✓	✓	✓
DRP Coadded Images	✓	✓	☐	✓	☐	✓	✓	✓	✓	✓
DRP Object and ForcedSource Catalogs	✓	✓	☐	☐	☐	✓	✓	✓	✓	✓
DRP Difference Images and DIASources	☐	✓	☐	☐	☐	✓	✓	✓	✓	✓
DRP ForcedSource Catalogs including DIA outputs	☐	✓	☐	☐	☐	✓	✓	✓	✓	✓
PP Processed Visit Images	☐	☐	☐	☐	☐	☐	✓	✓	✓	✓
PP Difference Images	☐	☐	☐	☐	☐	☐	✓	✓	✓	✓
PP Catalogs (DIASources, DIAObjects, DIAForcedSources)	☐	☐	☐	☐	☐	✓	✓	✓	✓	✓
PP SSP Catalogs	☐	☐	✓	☐	☐	✓	✓	✓	✓	✓
DRP SSP Catalogs	☐	☐	☐	☐	☐	☐	✓	✓	✓	✓

DP: Data Preview

DR: Data Release

DP1: ComCam Data, 5-6 months after System First Light

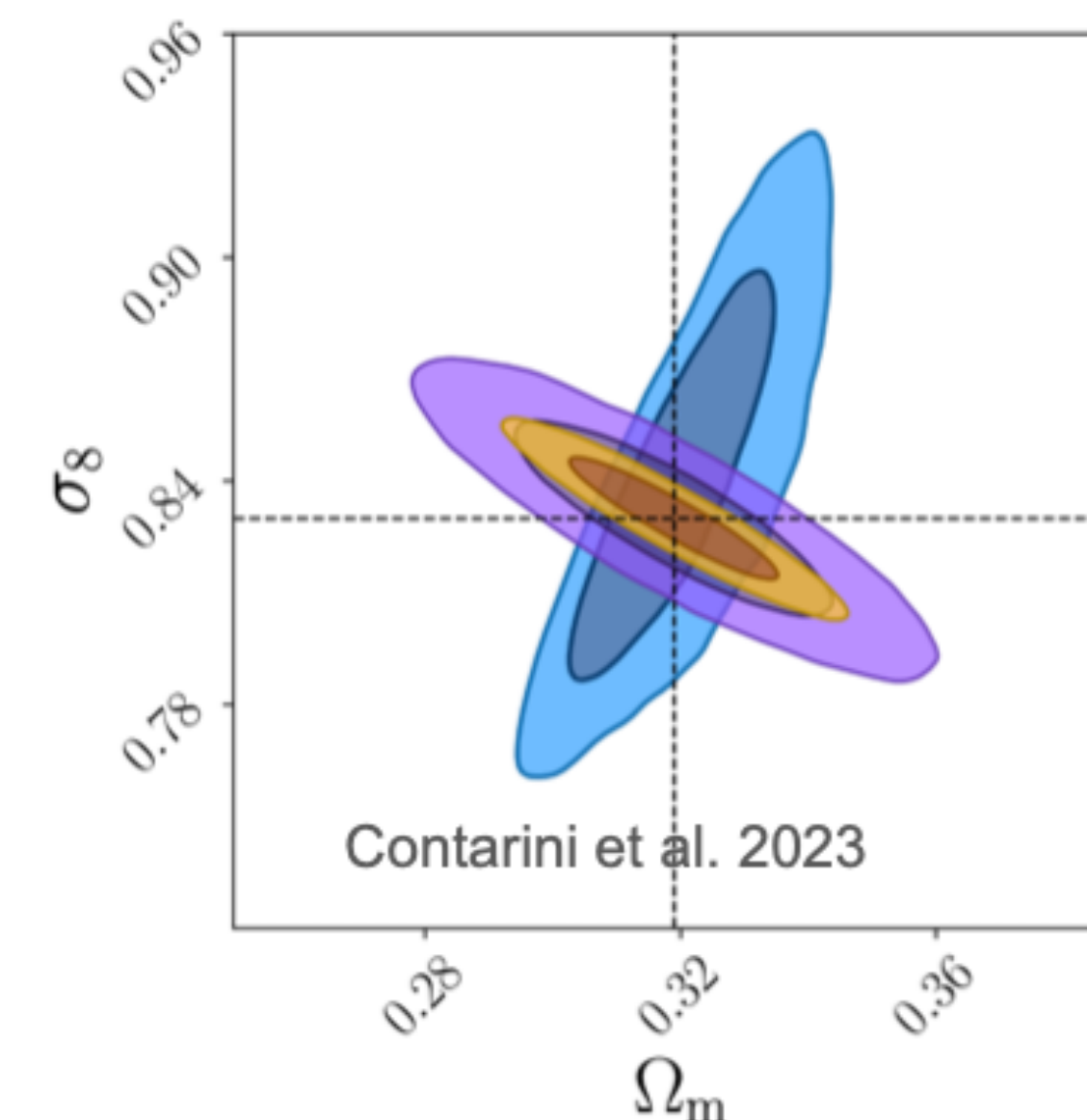
LSST Survey Start, 8-11 months after System First Light

DR1: LSST First 6 Months Data, 20-25 months after System First Light

next data
processing
milestone



- In the future: Rubin void catalogs will allow
 - a better handle on the impact of photometric errors on the measurement of void statistics,
 - extraction of complementary cosmological constraints.
- Future research interests in Euclid/Rubin synergies:
 - Improve the treatment of bias inside voids (studying density profiles) & the void size function model.
 - Joint Euclid-Rubin simulations are key, then move to data.
 - Combination with clusters is of high interest!



IST WL (optimistic)
IST GC_s (optimistic)
Void size function (fixed calib.)