

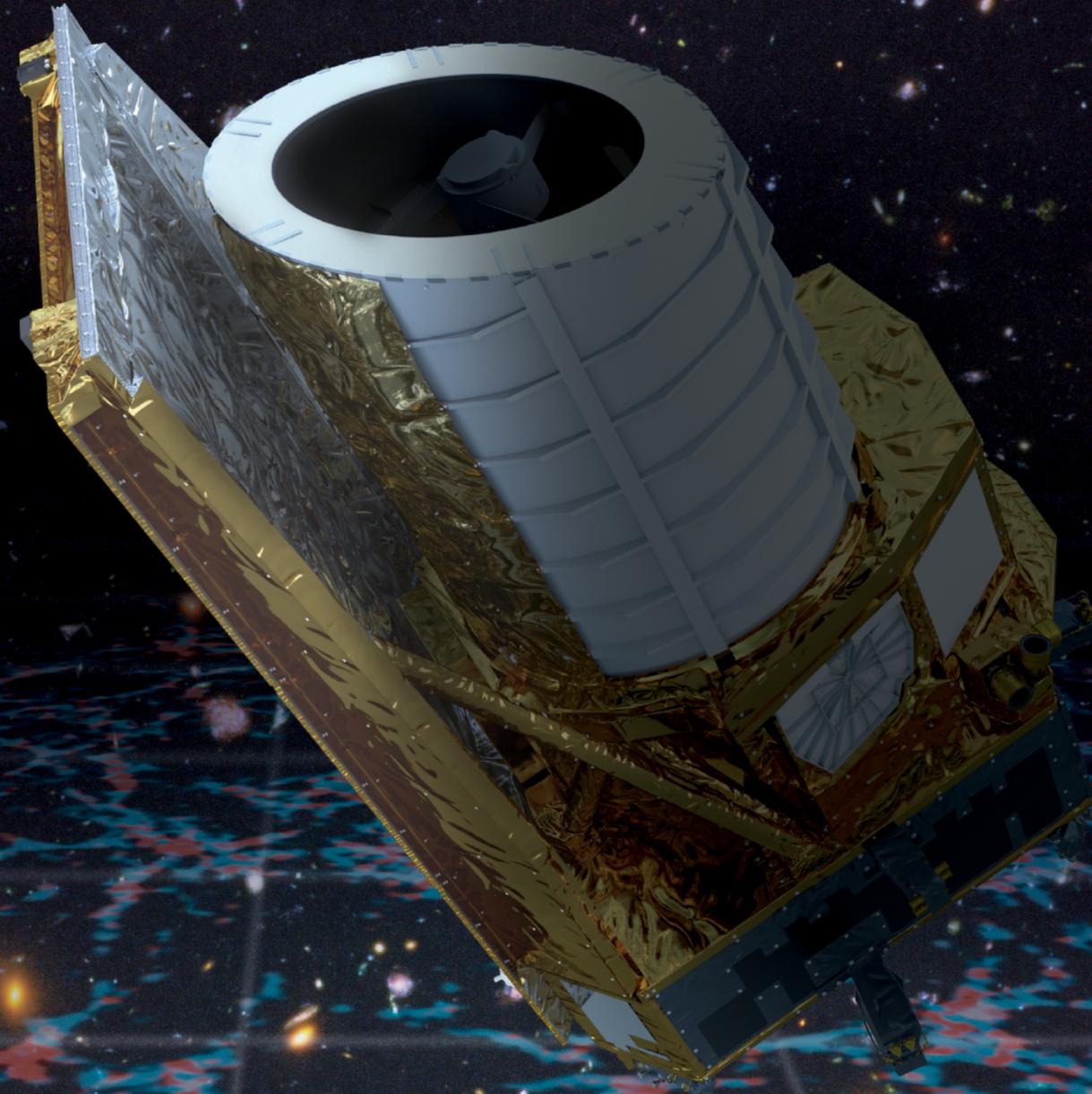
**Status Report of
“Extended Wide Imaging with Subaru
HSC of the Euclid Sky (WISHES+)”**

Subaru Intensive Program S24B-S27A

Ken Osato (Chiba U) on behalf of WISHES+ team

2025/10/30; Subaru Users Meeting FY2025

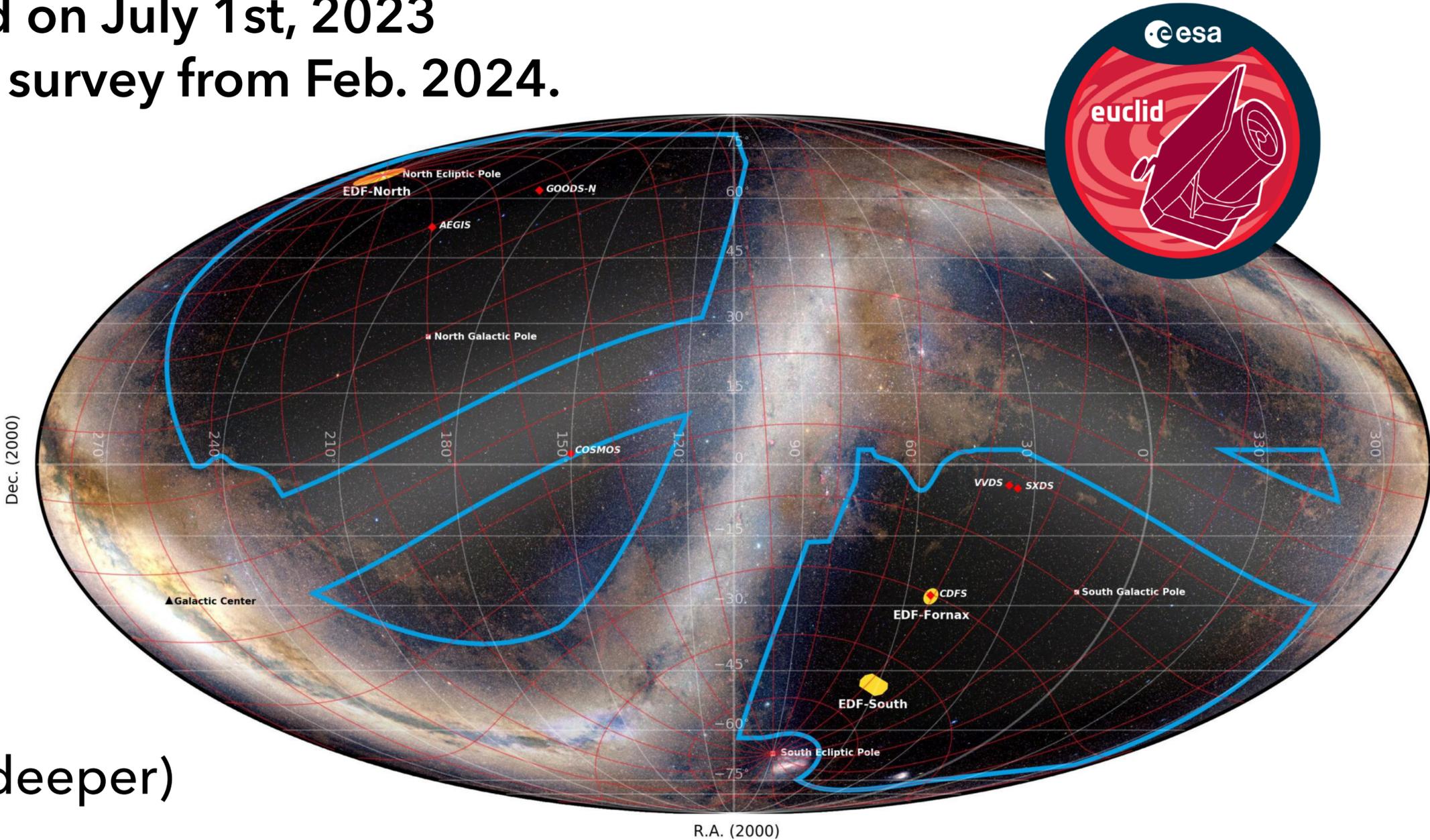
1. WISHES+ Science with Euclid



Euclid Survey

◆ Euclid satellite was launched on July 1st, 2023 and began 6-year wide field survey from Feb. 2024.

- **Wide Imaging Survey**
(14,000 deg², VIS+NIR)
Core science: *Weak lensing*
- **Wide Spec. Survey**
(14,000 deg², grism)
Core science: *Galaxy clustering*
- **Deep Survey**
(3 patches, 53 deg², 2 mag deeper)



The 15,000 deg.² Euclid Wide Survey, the 53 deg.² Euclid Deep Survey, and the 6 deep auxiliary fields (6.5 deg.²) [Mollweide Celestial]

- ▭ Euclid Wide Survey region of interest : 16 Kdeg.² compliant with a 15 Kdeg.² survey
- ▭ Euclid Deep Fields : North=20 deg.², Fornax=10 deg.², South=23 deg.²
- ◆ Euclid deep auxiliary fields (GOODSN=0.5, AEGIS=1, COSMOS=2, VVDS=0.5, SXDX=2, CDFS=0.5 deg.²)



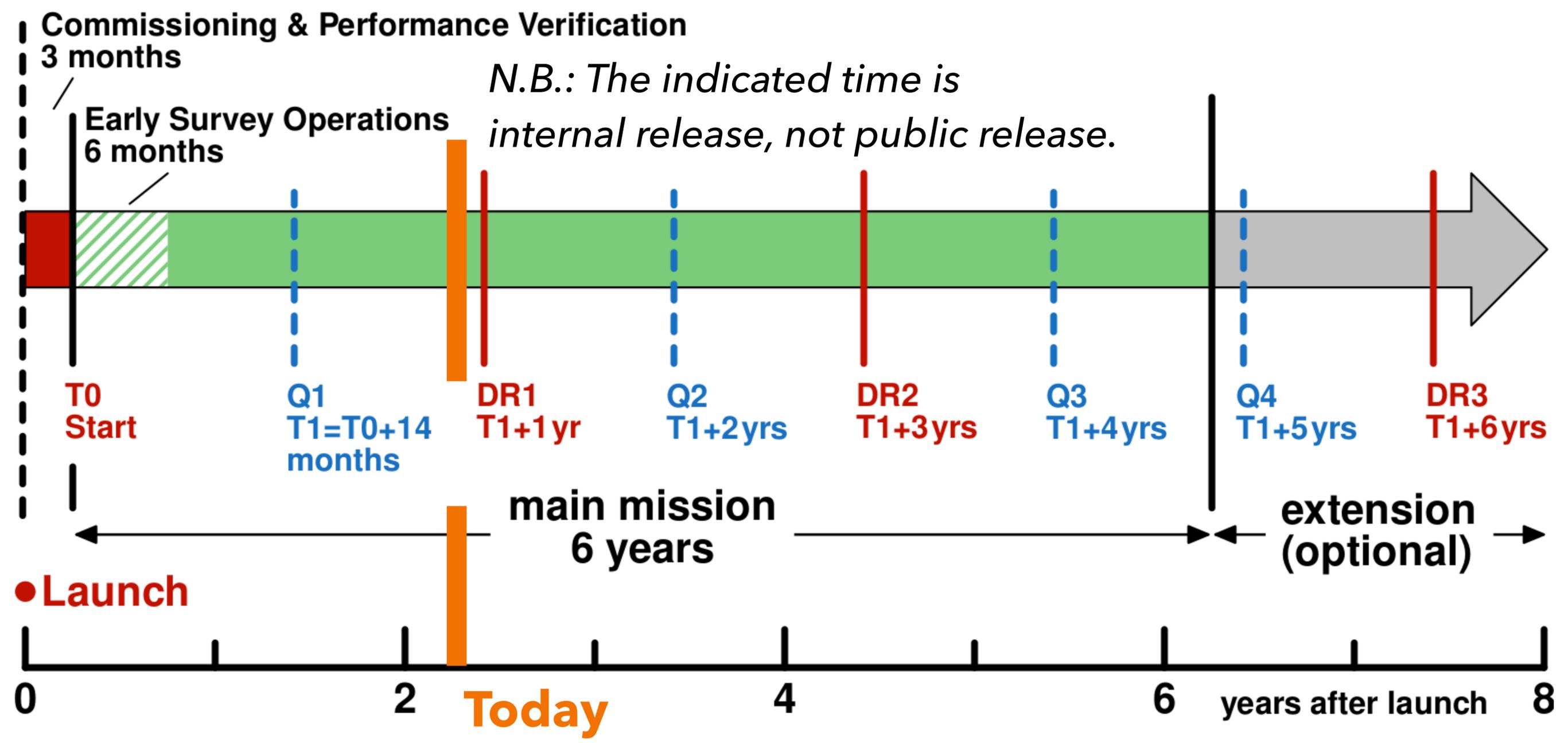
Background image: Euclid Consortium / Planck Collaboration / A. Mellinger

Euclid Deep Field South



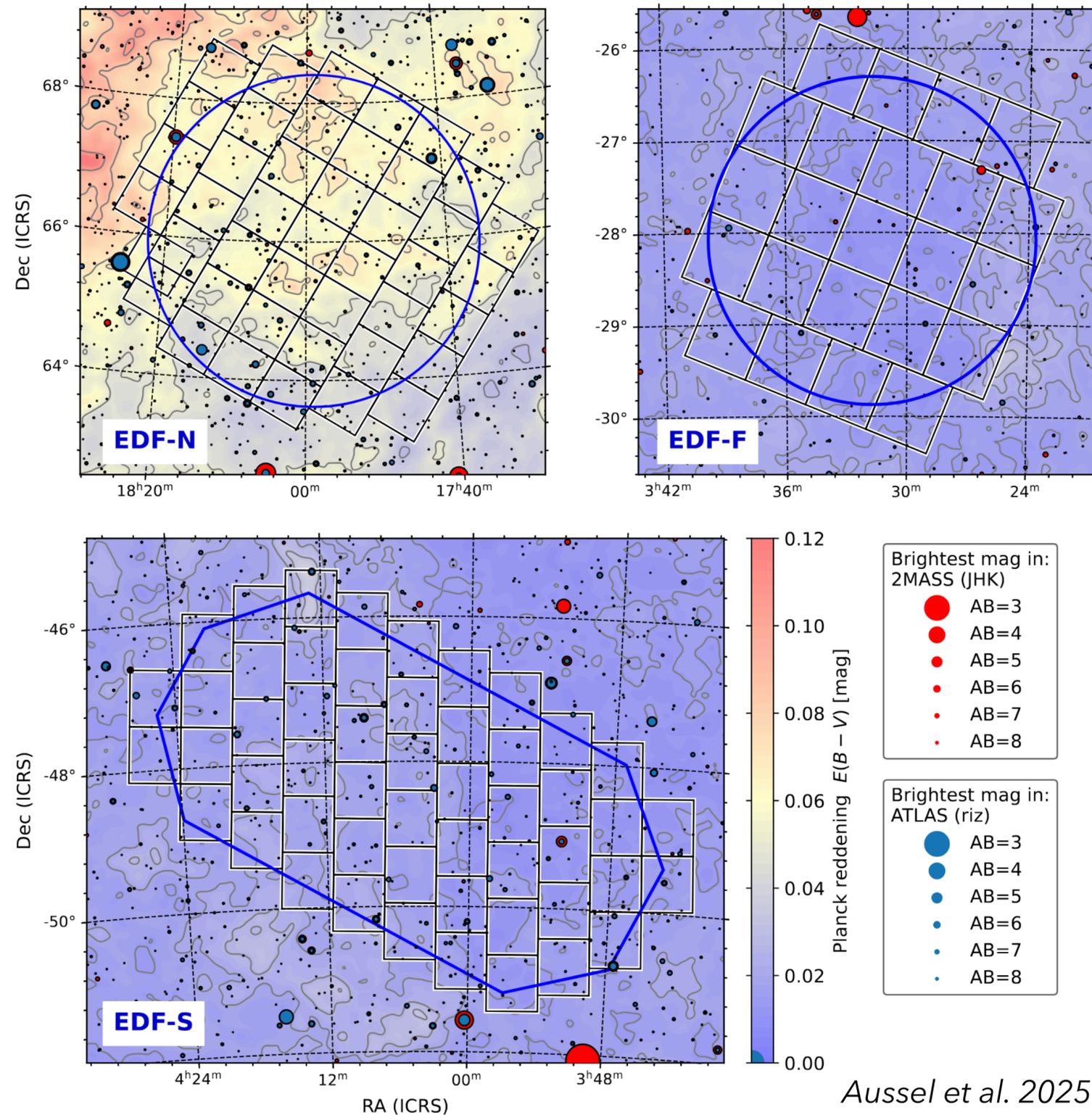
Timeline of Data Release

- Public data release of Q1 (Quick release; 63.1 deg²): Mar 2025
- Public data release of DR1 (~1,900 deg²): Oct. 2026



Euclid Q1 Data Release

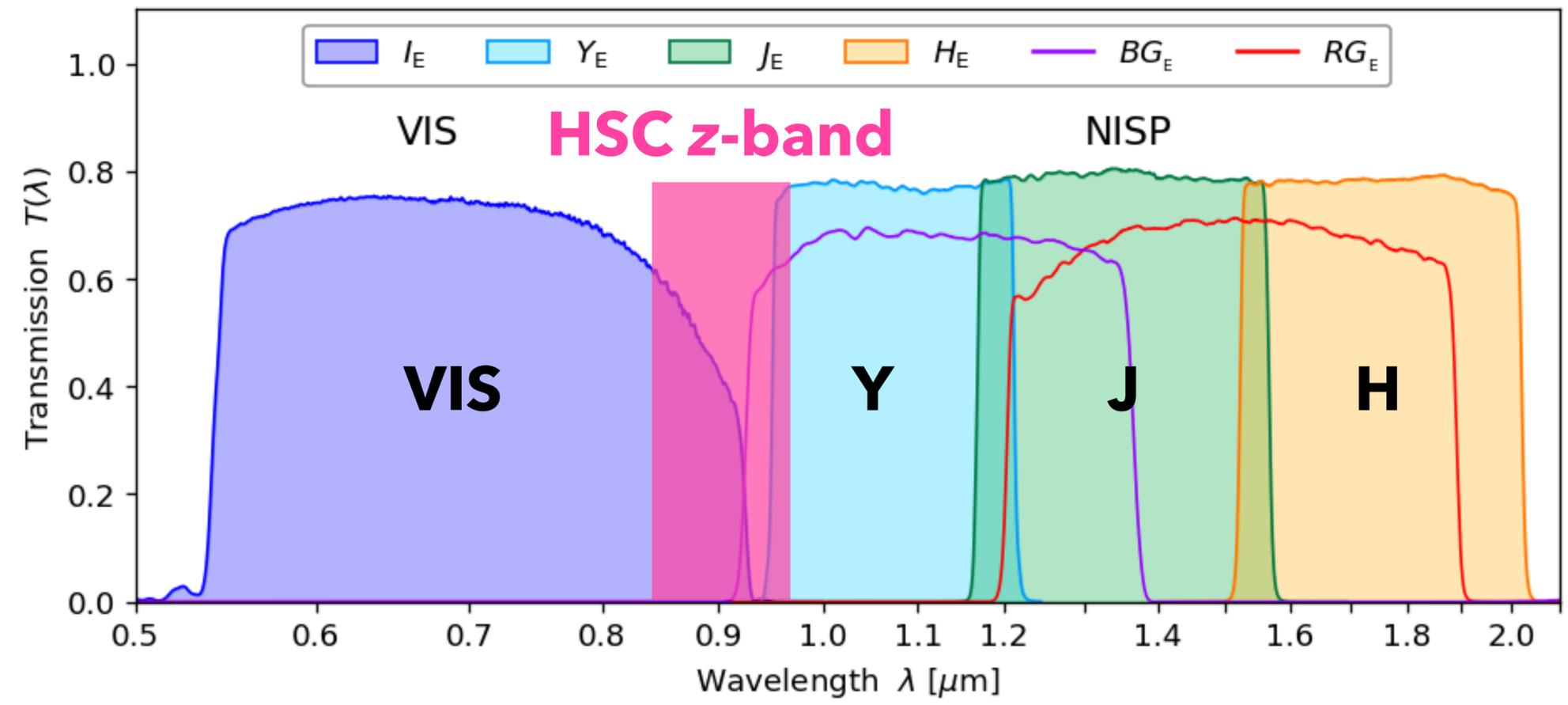
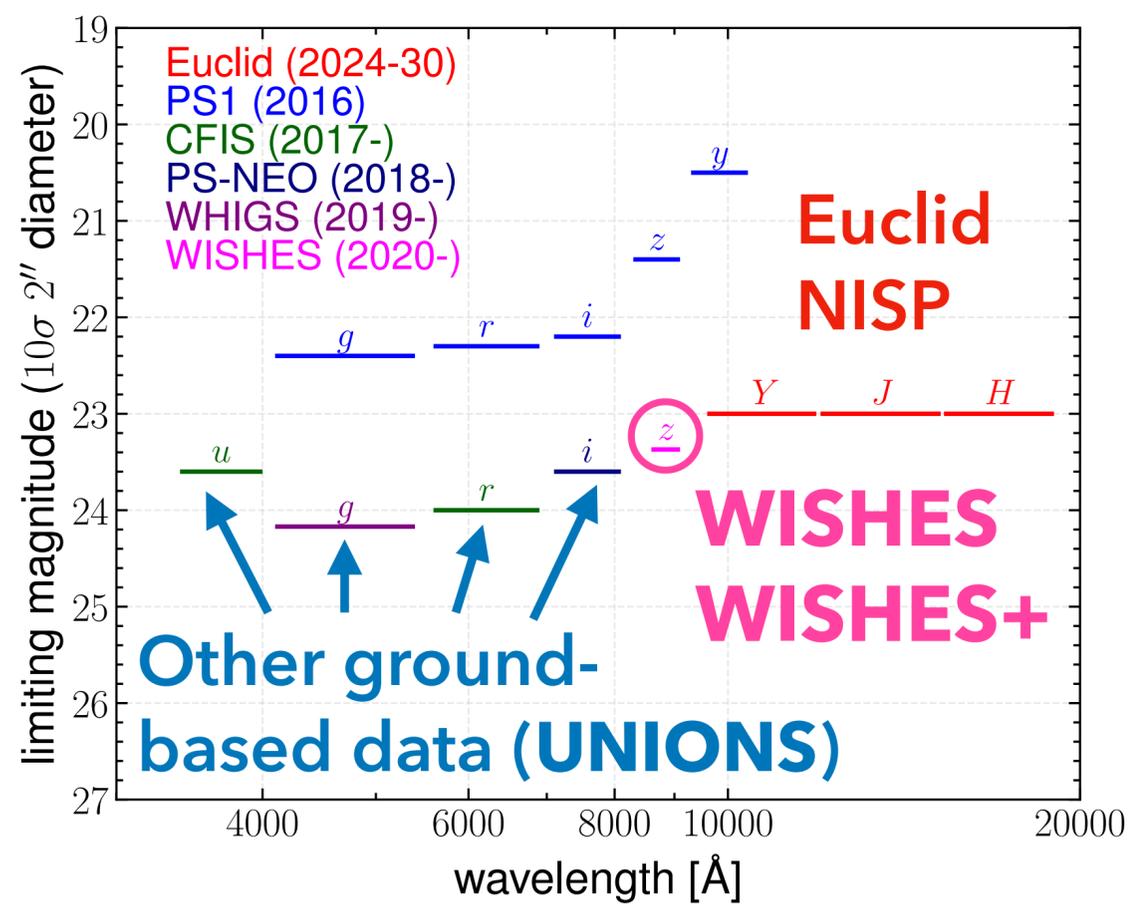
- **Q1 Data Release** happened on **March 19, 2025**
 - ▶ **Full-depth (DR3) area**
 - Total area: 63.1 deg^2
 - 23 deg^2 of the EDF South
 - 10 deg^2 of EDF Fornax
 - 20 deg^2 of the EDF North
 - ▶ **Data product**
 - VIS and NISP image and 2d spectra frames
 - Merged mosaics
 - Ground-based images in g, r, i, z
 - NISP 1d spectra and redshift catalogues
 - Catalogues based on VIS
 - Masks



Aussel et al. 2025

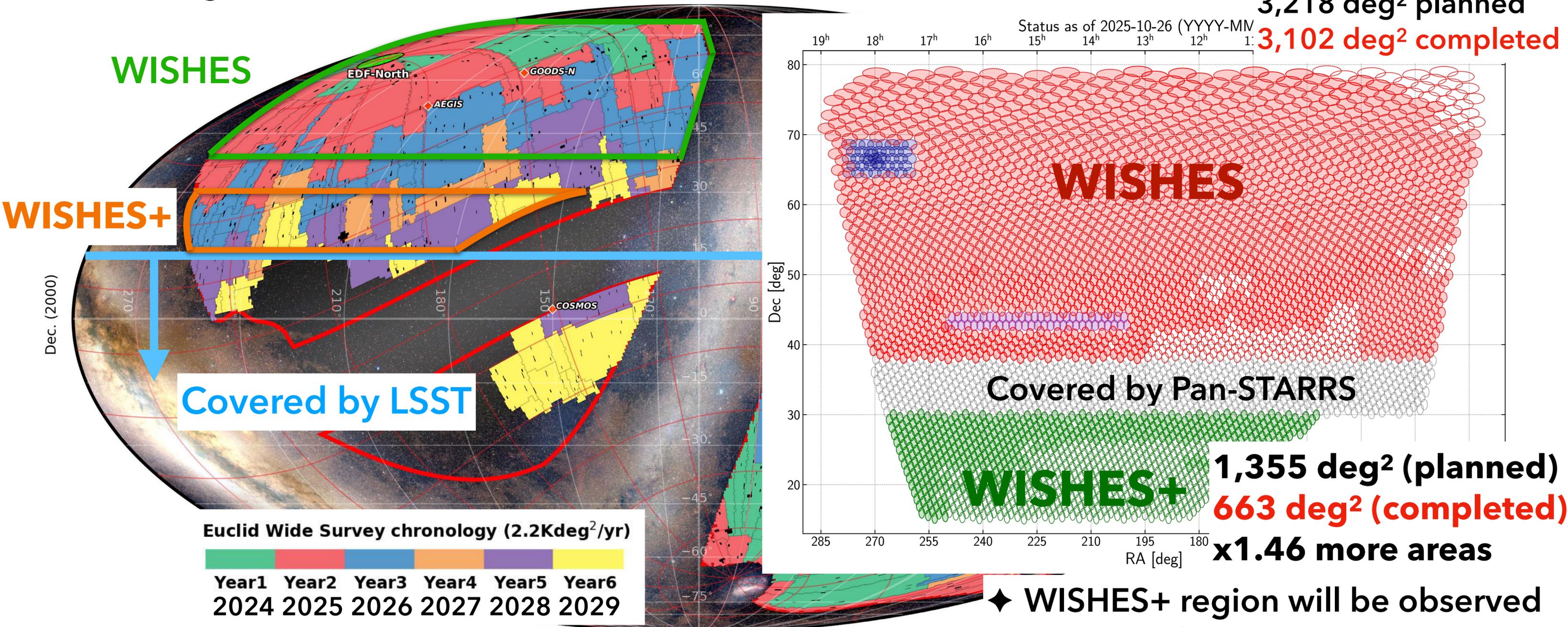
WISHES and WISHES+: z-band Survey for Euclid

- ◆ Wide Imaging with Subaru HSC of the Euclid Sky (WISHES): S20B-S24A (PI: M. Oguri)
 - Provide HSC z-band imaging data covering the northern footprint of Euclid Survey
 - (i) improve photo-z of source galaxies for **cosmic shear science**
 - (ii) search for rare objects such as **high-z quasars**
- ➔ The regions at $+15 \text{ deg} < \text{Dec.} < +30 \text{ deg}$ will not be observed by LSST nor WISHES.
 - WISHES+ will cover the missing sky and open up a synergy with ALMA.**



Survey Footprints of Euclid and WISHES/WISHES+

- ◆ Extended Wide Imaging with Subaru HSC of the Euclid Sky (WISHES+; PI: K. Osato)
15.1 nights are allocated from S24B to S27A.



Credit: Jean-Charles Cuillandre (CEA)

Current Observing Status of WISHES/WISHES+

- WISHES

Planned area (w/ PS1): **3,218 deg²**

Planned area (w/o PS1): **4,400 deg²**

Observed area: **3,102 deg²**

Completion rate:

70.5% (w/o PS1), **96.9%** (w/ PS1)

Completing WISHES (PI: M. Oguri)
has been conducted in S25A.

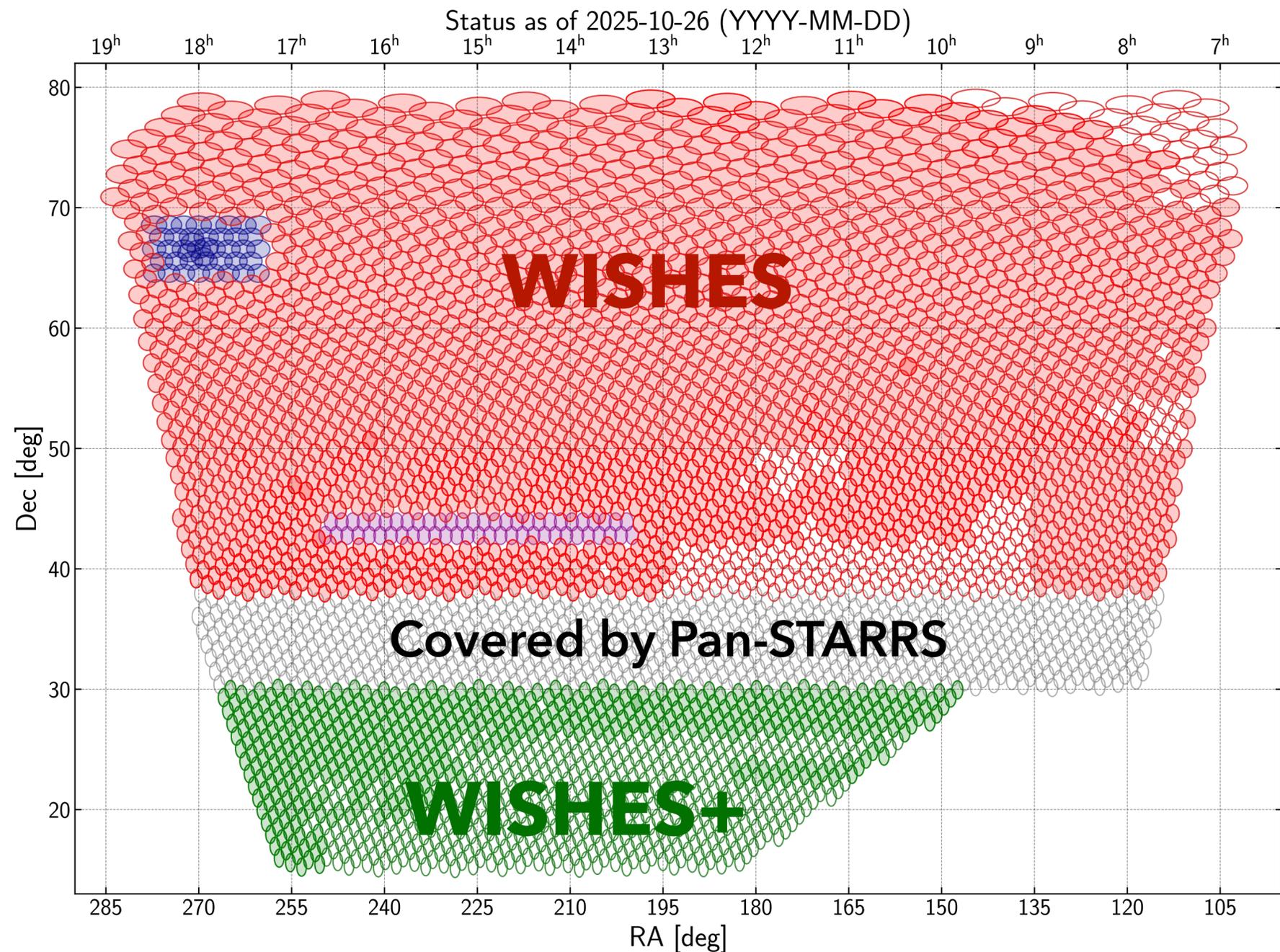
- WISHES+

Planned area: **1,355 deg²**

Observed area (as of today): **663 deg²**

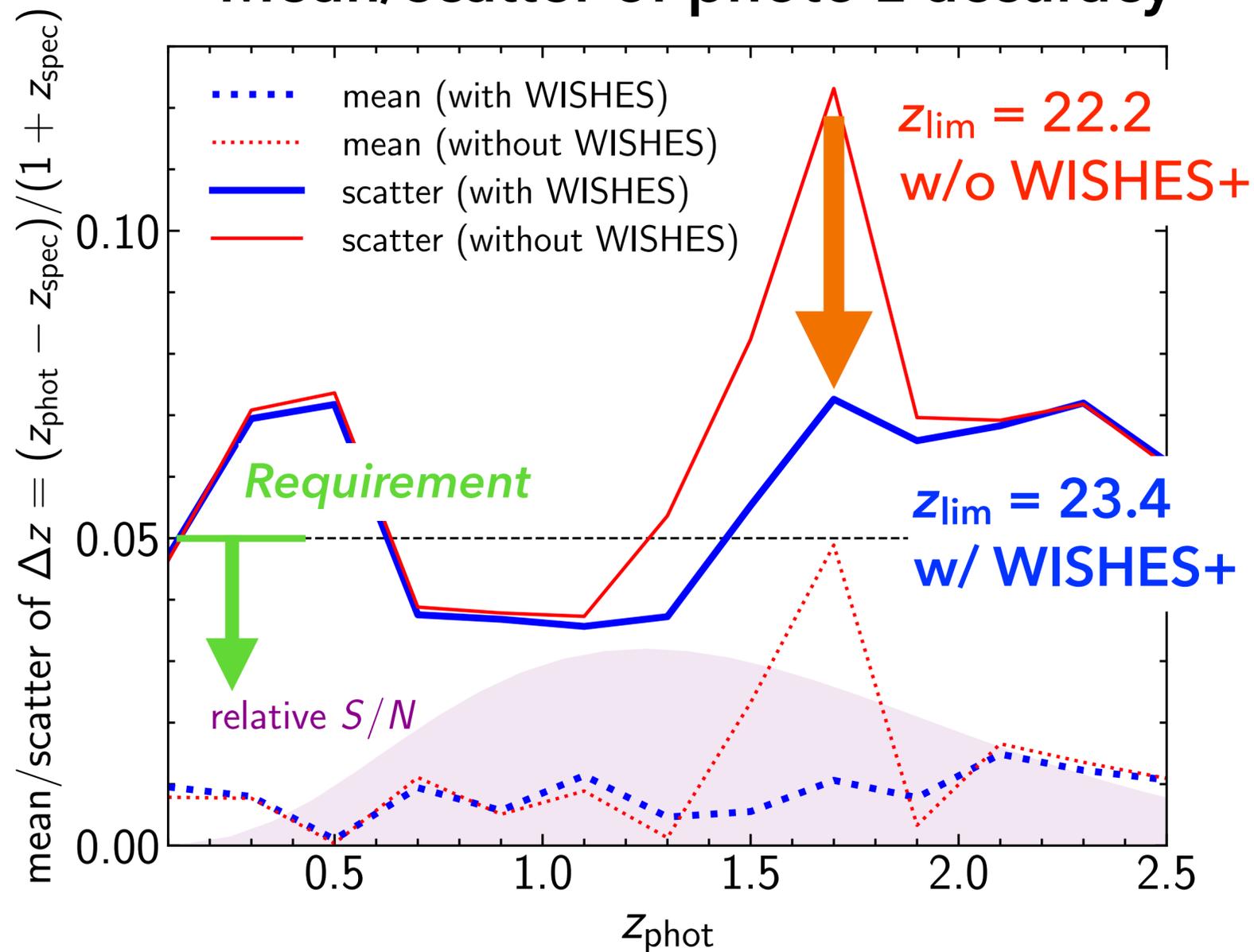
Completion rate: **48.9%**

N.B.: WISHES+ region is more visible
in spring semester. We will request more
nights should be allocated
in spring semesters.

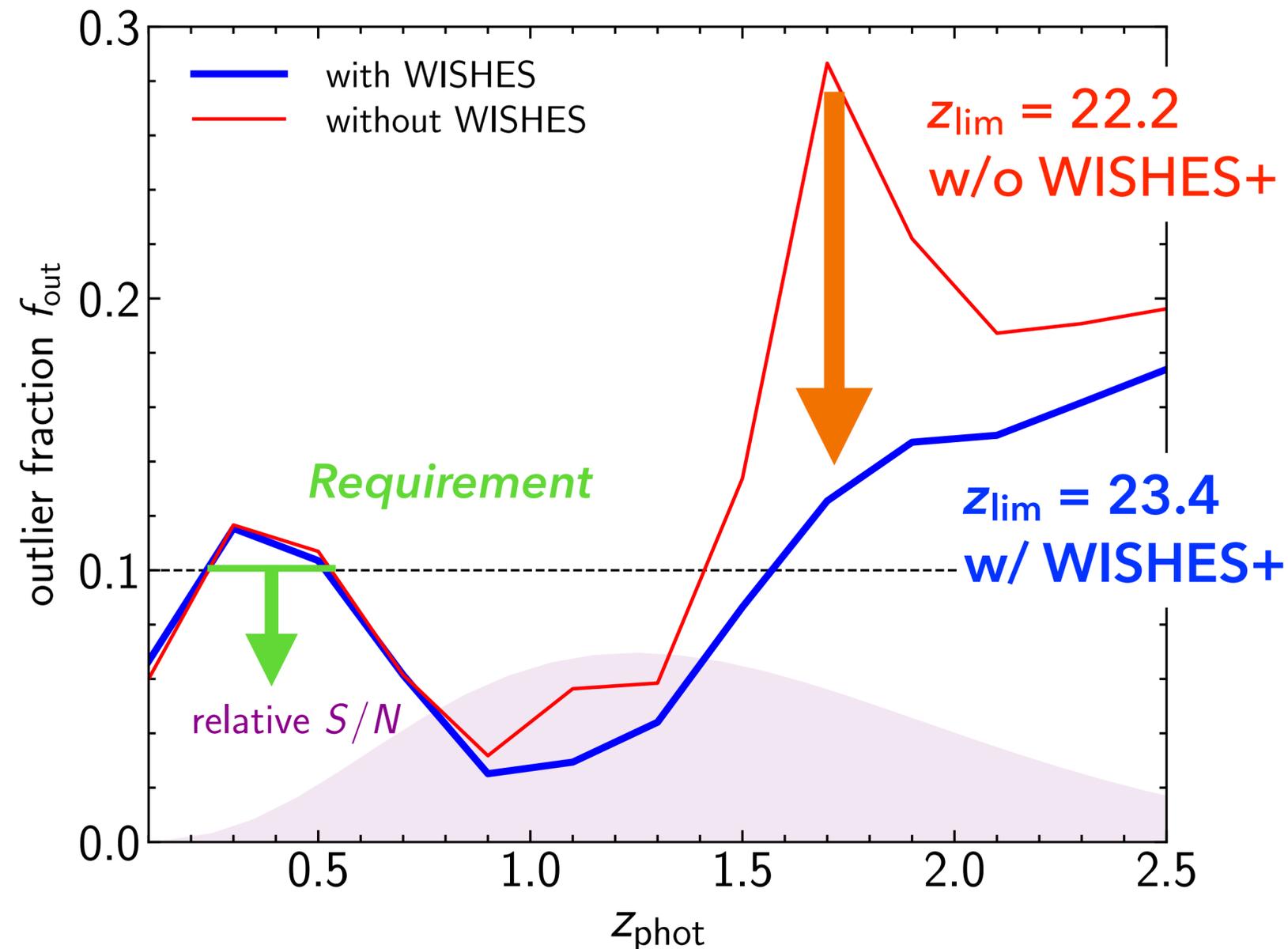


Improving Photo-z for Cosmic Shear Cosmology

• Mean/scatter of photo-z accuracy



• Outlier fraction

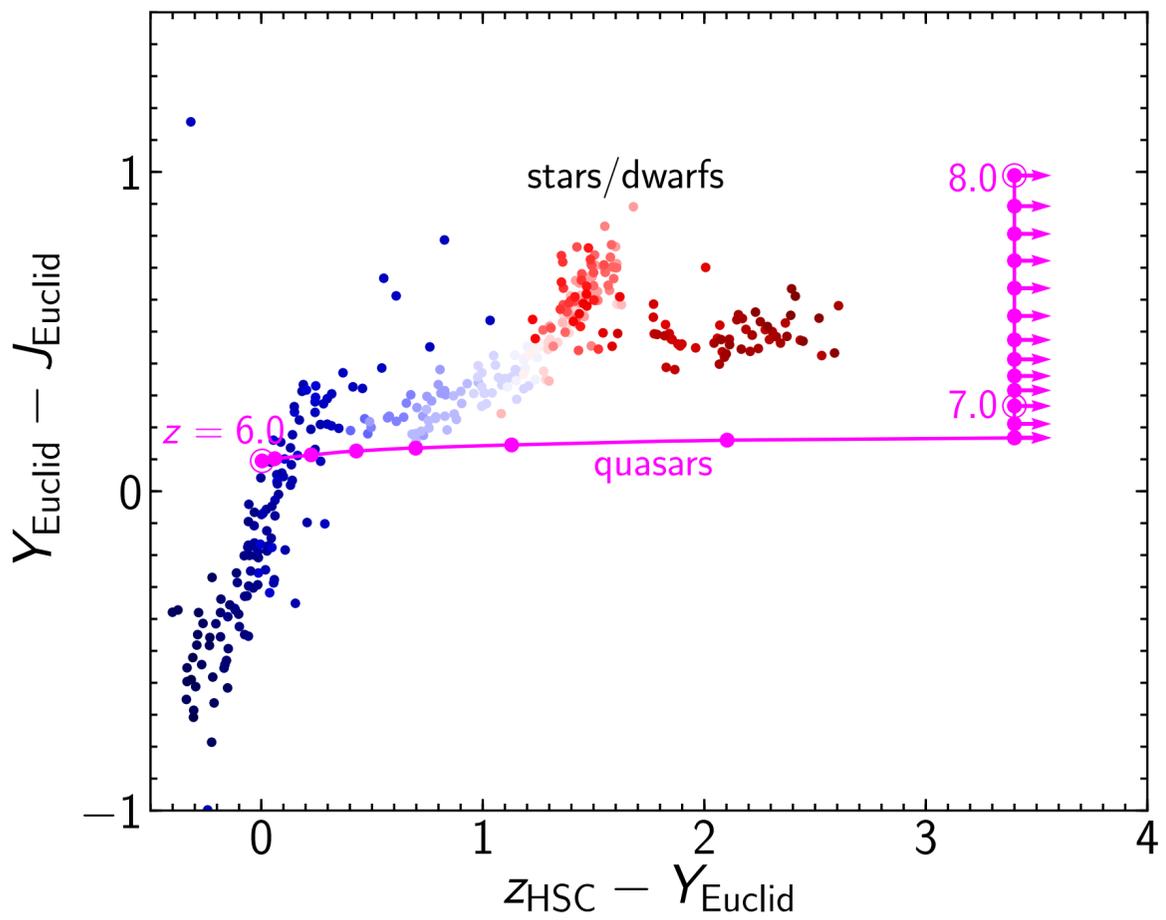


◆ **Blue lines:** Only z-band depth changed with depth of other bands (VIS+ugri+YJH) kept.

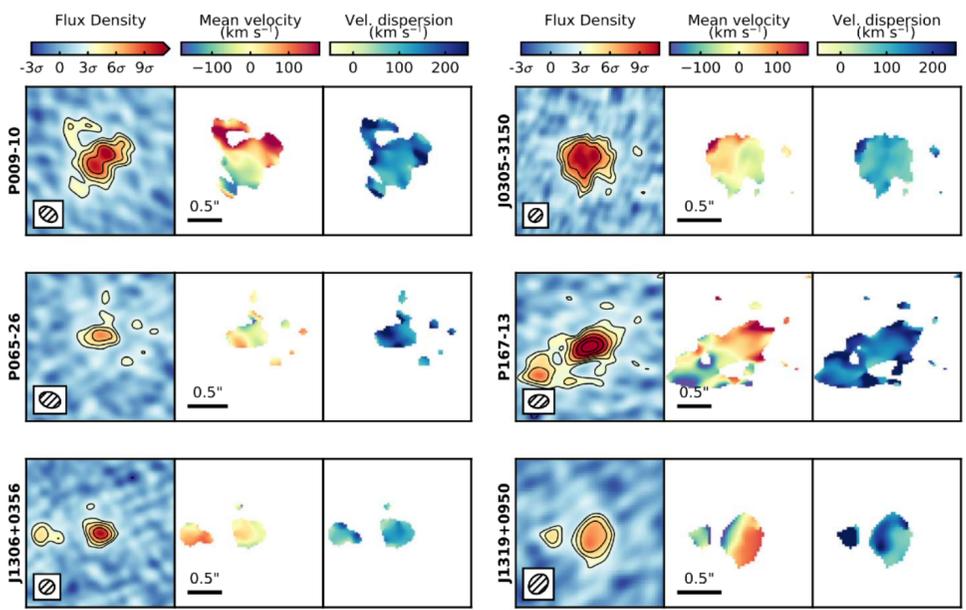
➡ **Without WISHES+, constraints on cosmo. params. would be degraded!**

Search for High- z Quasars

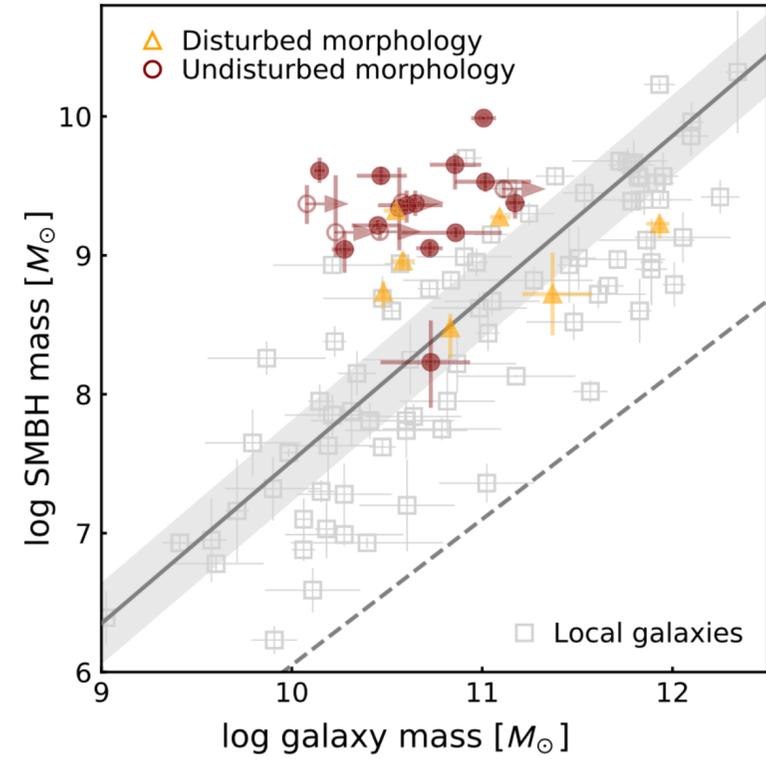
- ◆ Deep z -band images are very important for efficient quasar search from Euclid.
- ◆ WISHES + WISHES+ provide ~ 20 quasars at $7 < z < 7.5$, ~ 15 quasars at $7.54 < z$ (these numbers are limited by z -band depth!)
- ◆ We will start selections with the first UNIONS Grand Unified Catalog ($z_{\text{WISHES}} - y_{\text{PS1}}$), later replaced with Euclid Y .



- ◆ ALMA Host galaxy studies are only possible in the WISHES+ area.



Neeleman et al. 2021



2. WISHES+ Science with UNIONS



The Ultraviolet Near Infrared Optical Northern Survey is a collaboration of 4 scientific projects:

Hawaiian Islands



Pan-STARRS
2 x 1.8m

CFHT
3.6m

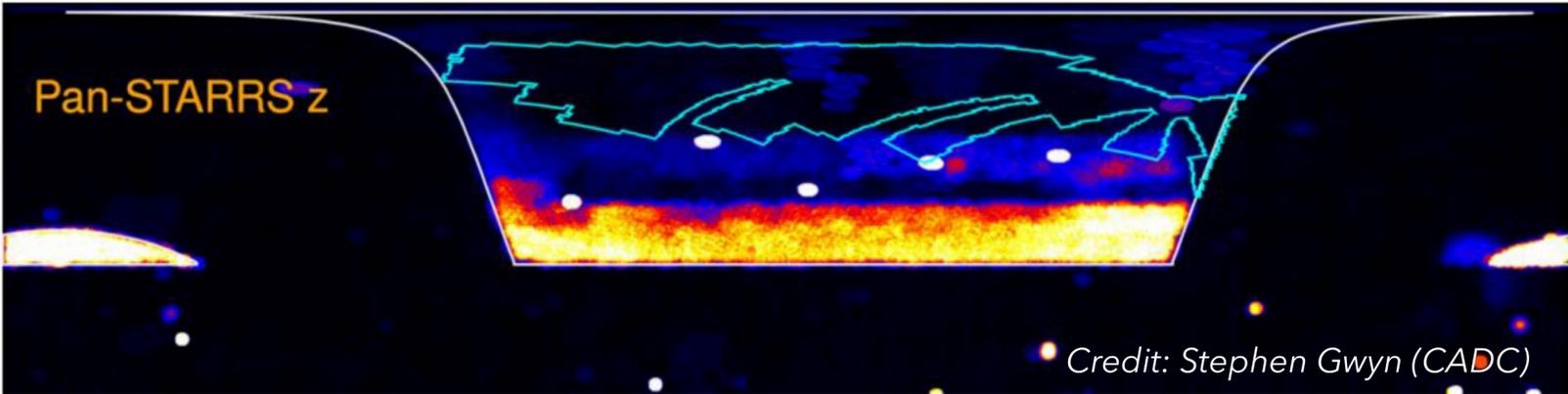
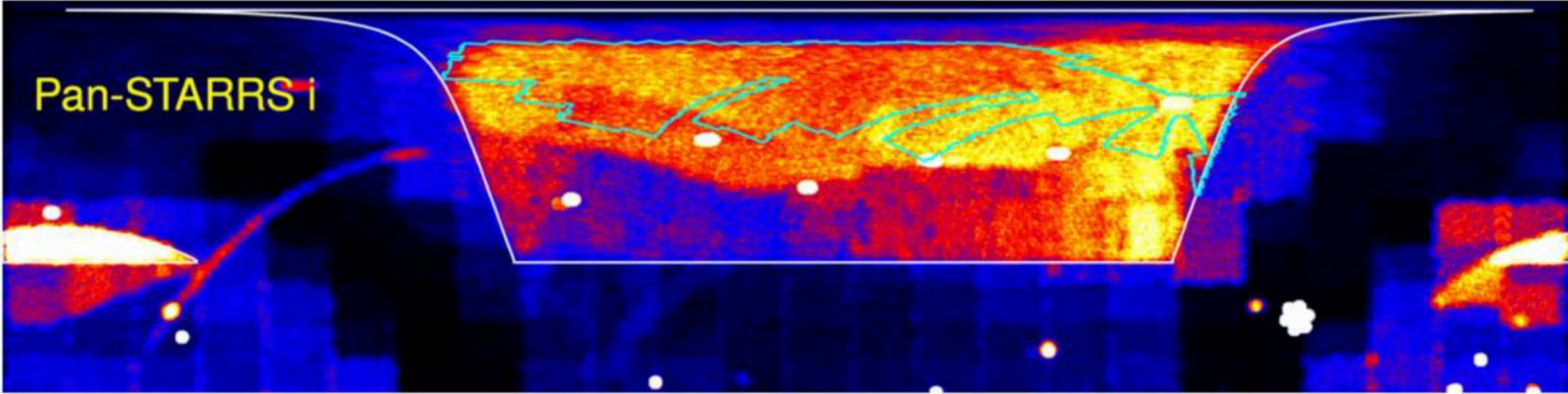
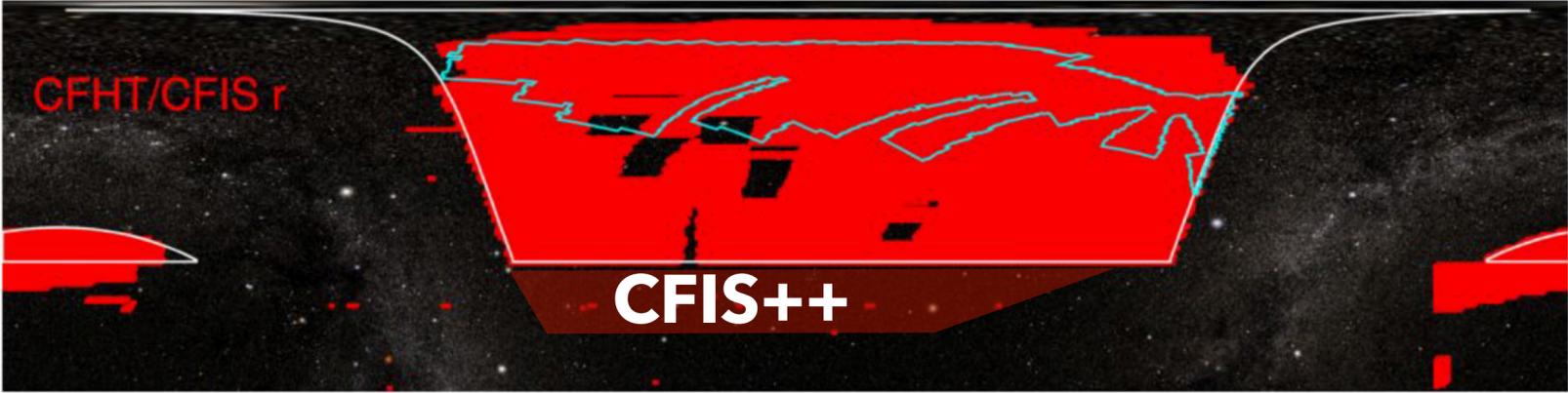
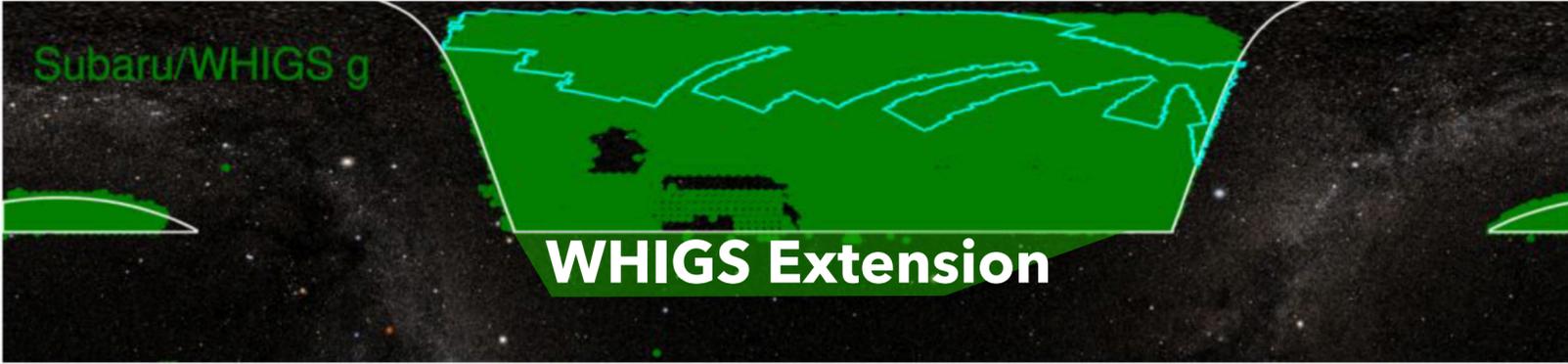


Subaru
Telescope
8.2m

UNIONS

Hawaiian Alliance of ground-based telescopes:

CFHT/CFIS(++) (*u, r*), **Subaru/WISHES(+)** (*z*), Subaru/WHIGS (Extension) (*g*), Pan-STARRS (*i, z*)

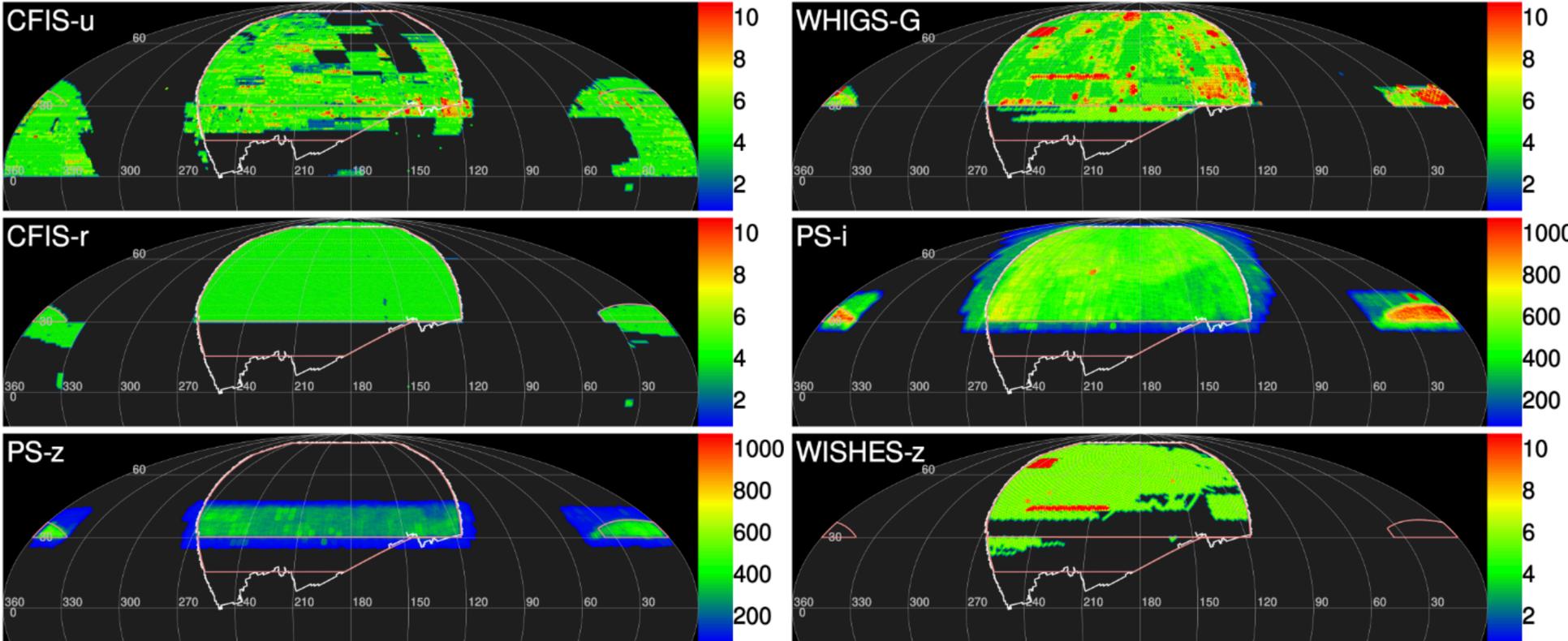


Credit: Stephen Gwyn (CADC)

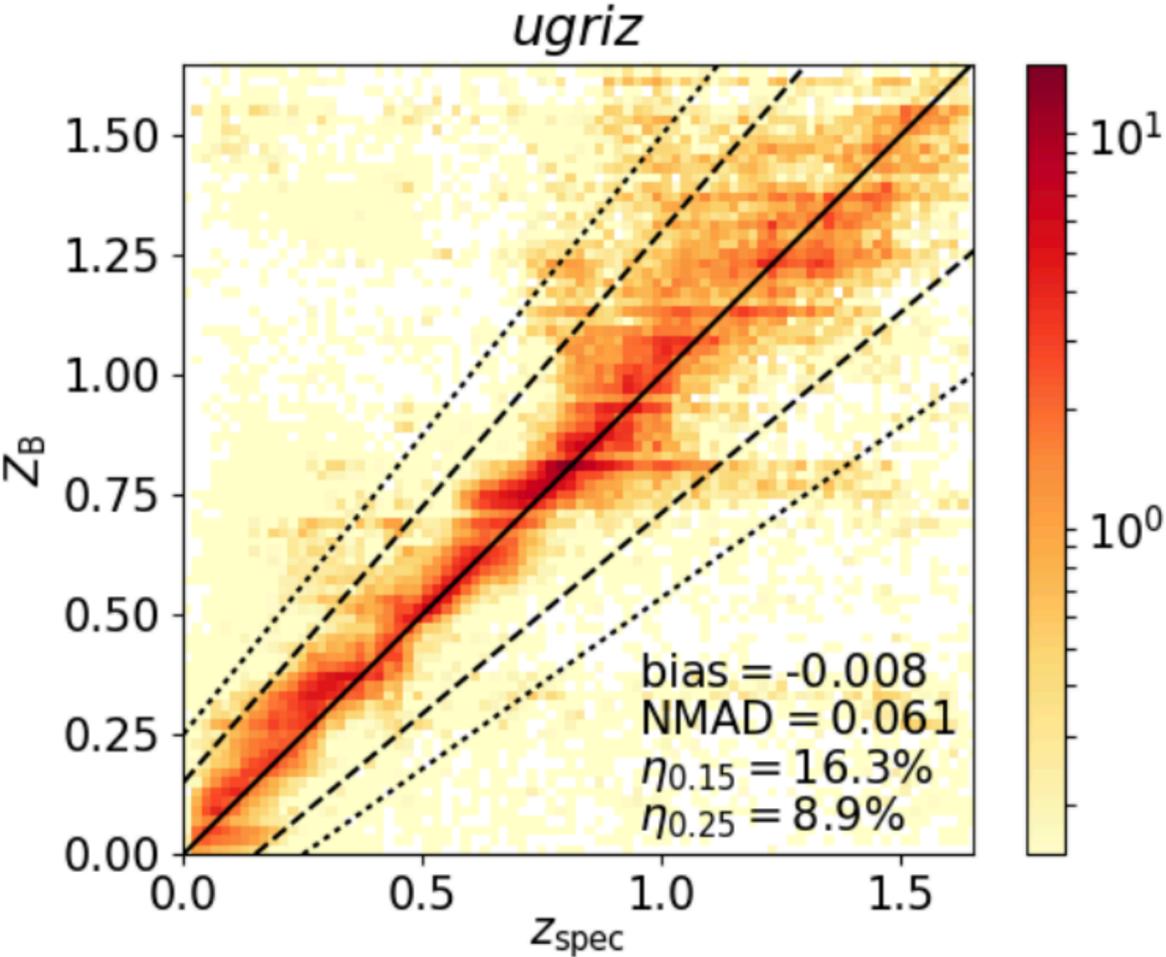
UNIONS Overview Paper

◆ UNIONS Overview Paper (Gwyn et al., 2025; 2503.13783) has been accepted to AJ!

- Current coverage of each survey

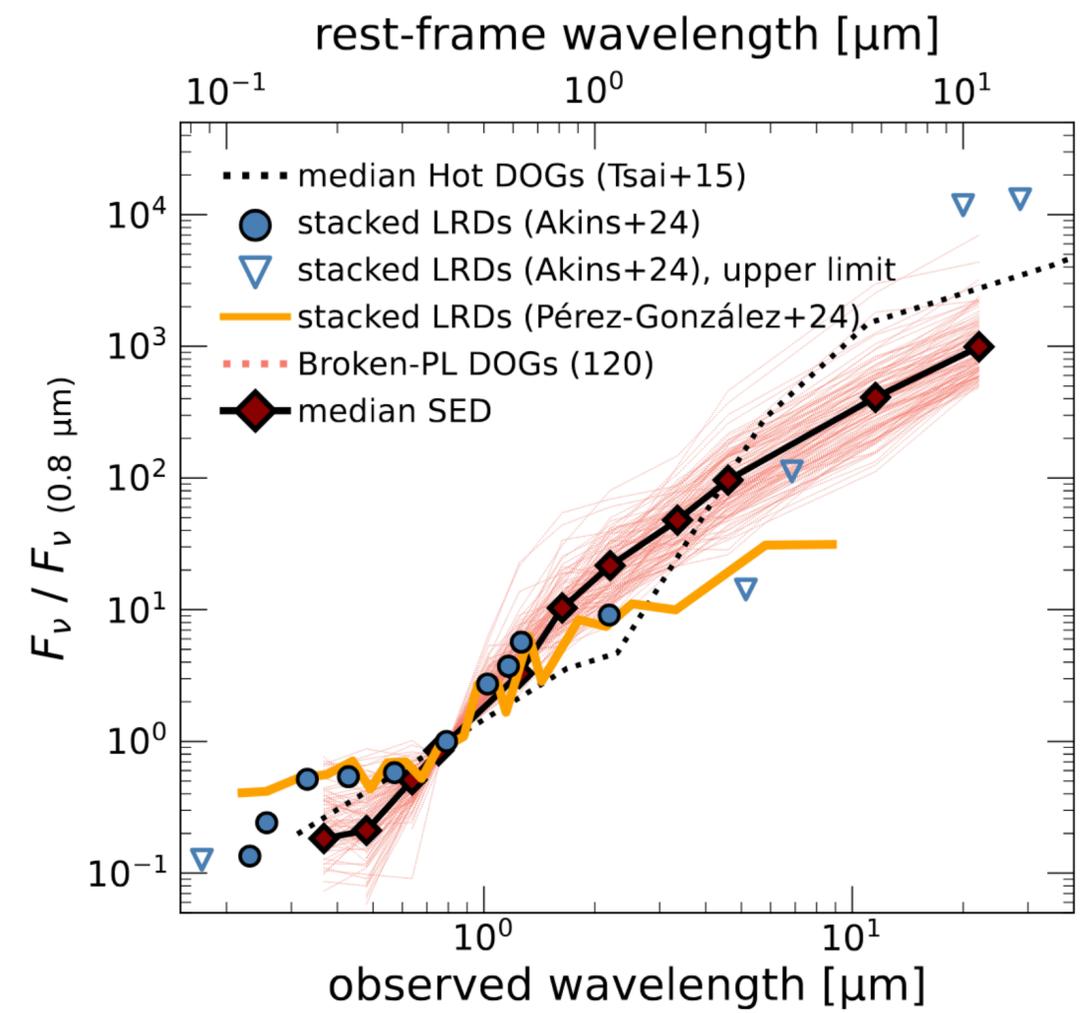


- Photo-z accuracy



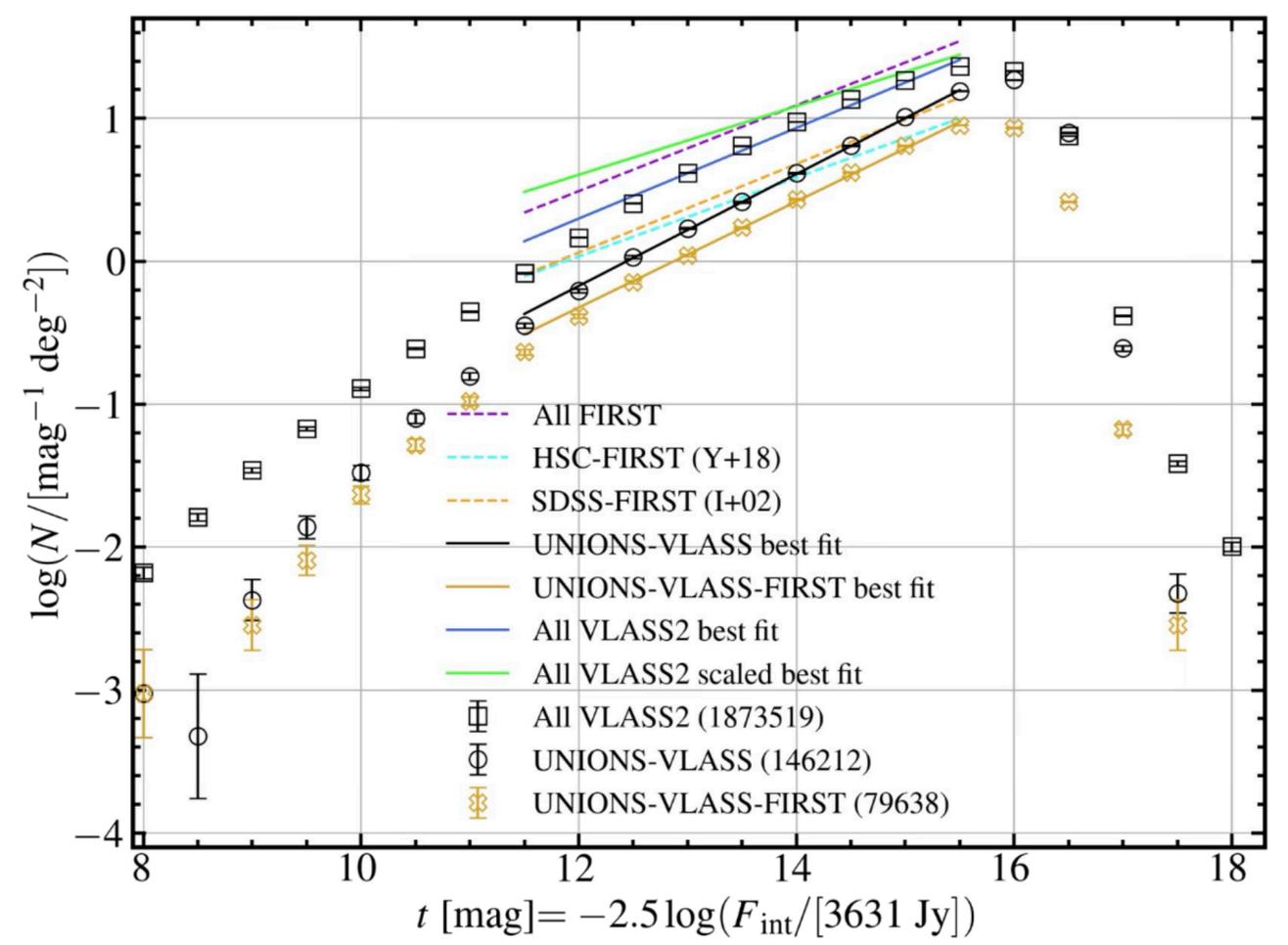
Science results with UNIONS data

- Dust obscured galaxies with broken power law SED (Yoshida et al.; ApJ, 987, 141)



➔ The BPL signature indicates strong dust obscuration and evolution of AGN.

- Constructing radio-loud AGN catalogue with UNIONS (Zhong et al.; ApJS in press.)



➔ Discovered **146,000 radio-loud AGNs** (c.f., 25,000 for SDSS)

Summary

- **WISHES+** is the deep z-band survey for Euclid and stand-alone science. In combination with WISHES, the total survey area reaches **4,550 deg²**. Its legacy value is high; the data can be used for many years in various fields.
- WISHES+ observes the sky at lower latitudes ($+15 \text{ deg} < \text{Dec.} < +30 \text{ deg}$), which overlaps the area visible from **multi-wavelength telescopes: ALMA and TMT**.
- WISHES+ observations are going well; the current observed area is 663 deg² and the completion rate is 48.9%. The rest will be completed in the next 3 semesters.
- We are working with other UNIONS surveys (CFIS, WHIGS, and Pan-STARRS). The synthetic multi-band catalogues have legacy values. The data have already led to several publications and more to come in near future.