



# Important ground-based observations for LSST dark energy science

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## Near-IR Photometry

- Outside of Euclid / WFIRST footprints and timescales: where can LSST get NIR photometry for photo-z's?
- Largest current projects: ESO/VISTA Public Surveys.



# ESO Public Surveys Science - VISTA

Deep high z Whole sky Galactic Extragalactic Star Form. History

Surveys	Area deg <sup>2</sup>	Area covered in P85	Filters	Magnitude limit	Depth measure
Ultra-VISTA	1.7 d 0.73 u-d	1.7	Y J H K <sub>s</sub> Y J H K <sub>s</sub> NB	25.7 25.5 25.1 24.5 26.7 26.6 26.1 25.6 24.1	5σ (AB)
VHS	17800	1808	Y J H K <sub>s</sub>	21.2 21.1 20.6 20.0	5σ (AB)
VIDEO	12.0	3.5	Z Y J H K <sub>s</sub>	25.7 24.6 24.5 24.0 23.5	5σ (AB)
VVV	560	519	Z Y J H K <sub>s</sub>	21.9 21.1 20.2 18.2 18.1	5σ (AB)
VIKING	1500	234	Z Y J H K <sub>s</sub>	23.1 22.3 22.1 21.5 21.2	5σ (AB)
VMC	180	14	Y J K <sub>s</sub>	21.9 21.4 20.3	10σ (AB)



## Deep optical spectroscopy

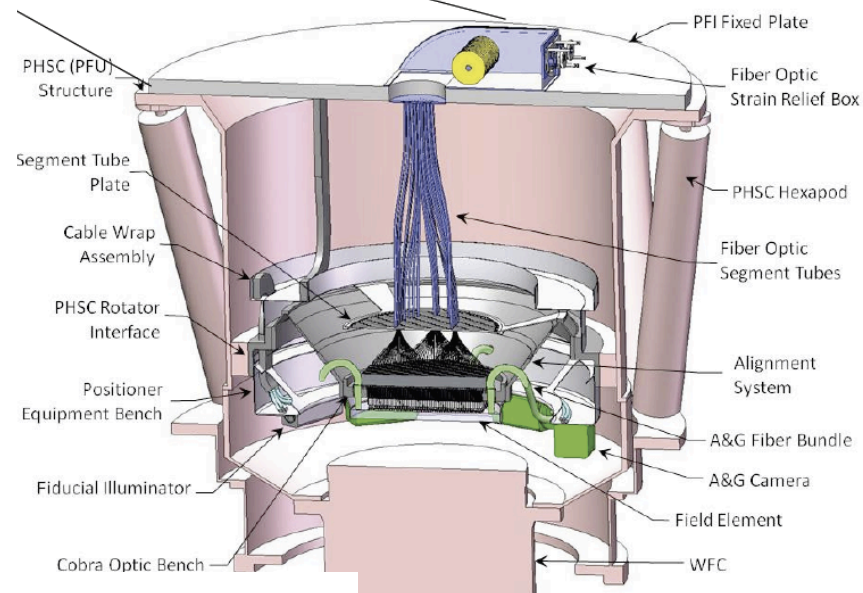
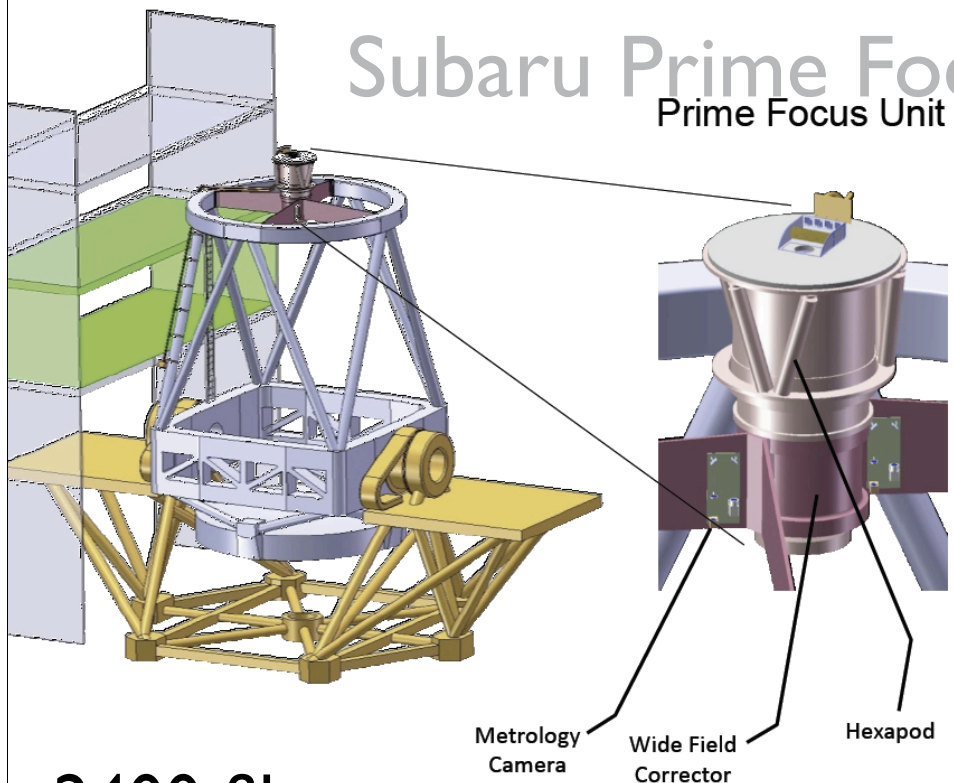
- Near-complete spectroscopic redshift surveys for galaxy photo-z calibration (>10,000 targets, 1 - 2 mag deeper than any current surveys)
- Host z's for large numbers of LSST SNe



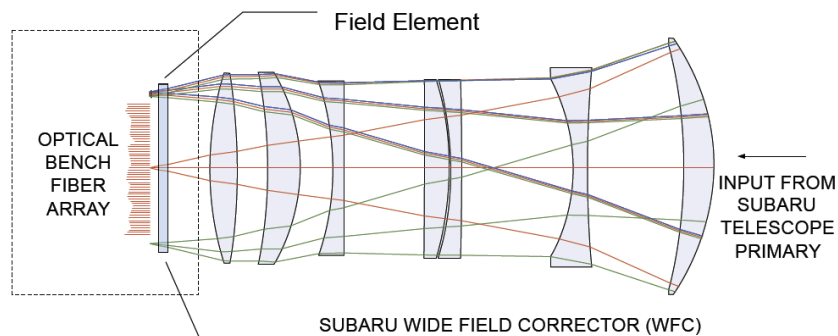
# Subaru Prime Focus Spectrograph

## Prime Focus Unit

## Prime Focus Instrument (PFI)



**2400 fibers**  
**1.3 deg FOV**  
**8m telescope!**





## High-completeness $z$ survey resources

- Consider tiered strategy with PFS optical spectra first. Then look at “failures” with:
- Moderate-multiplex NIR spectrographs on Keck, VLT, ...? Then remaining failures with
- JWST!