WFIRST Deep Fields

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Types of deep fields

- SNe deep fields (Other talks)
- Photo-z calibration fields
- Shape noise calibration fields
- GRISM de-contamination and redshift calibration deep fields
- Self Calibration deep fields
- GO deep fields

Photo-z Calibration Deep Fields

- Need an empirical determination of photometry errors
  - Need to know the tails of the error distribution
  - Deep/repeated fields to measure error distributions
  - Taken under range of conditions for ground based data
  - Verified with simulations
    - Know effects of blending/de-blending
- Optimally tie spectroscopy to photometry
  - A redshift with SNR 10 photometry is worth ~ 1/60th one with SNR 50 photometry for calibration
  - Optimal SNR is ~25

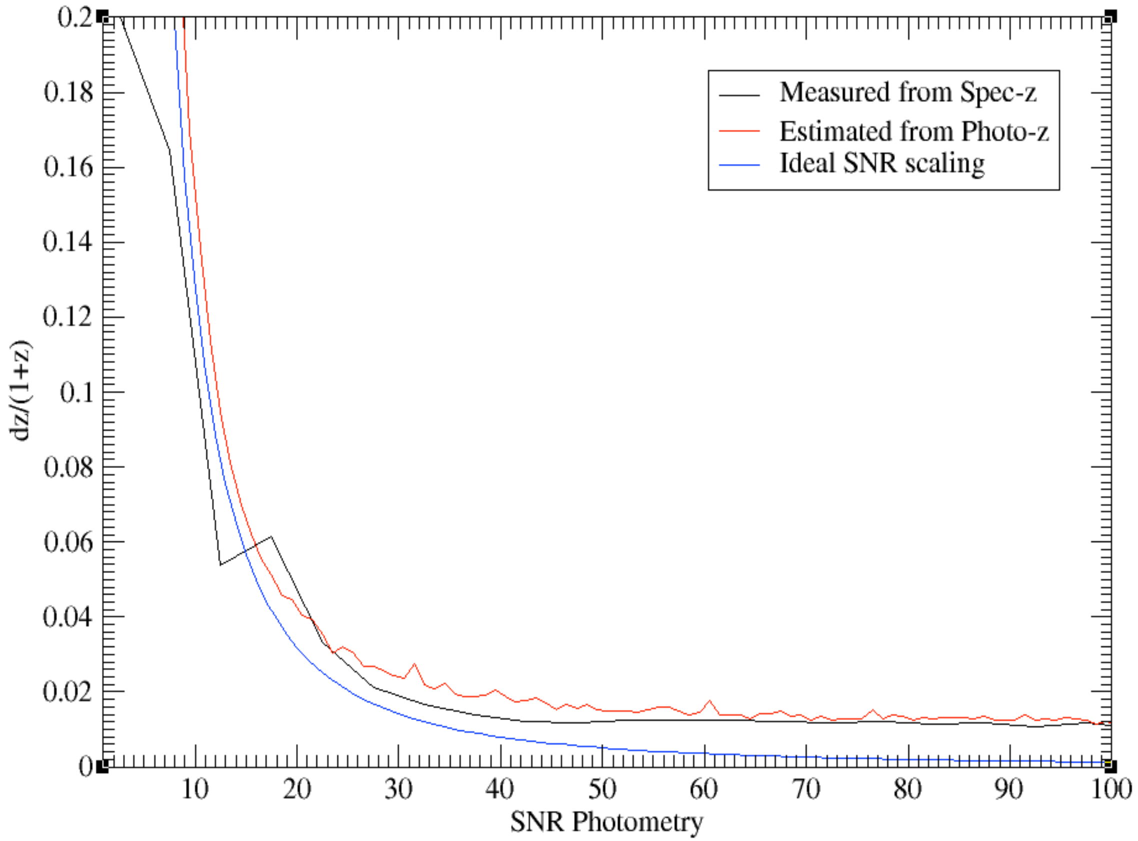
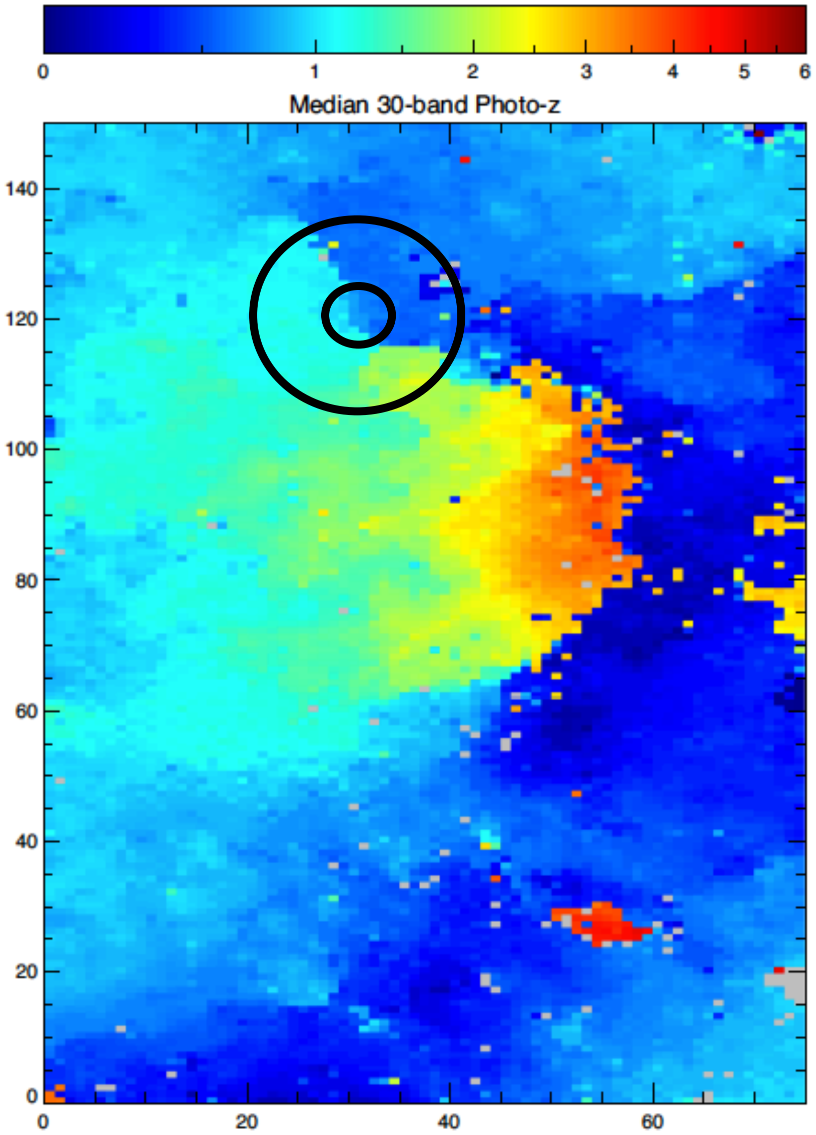


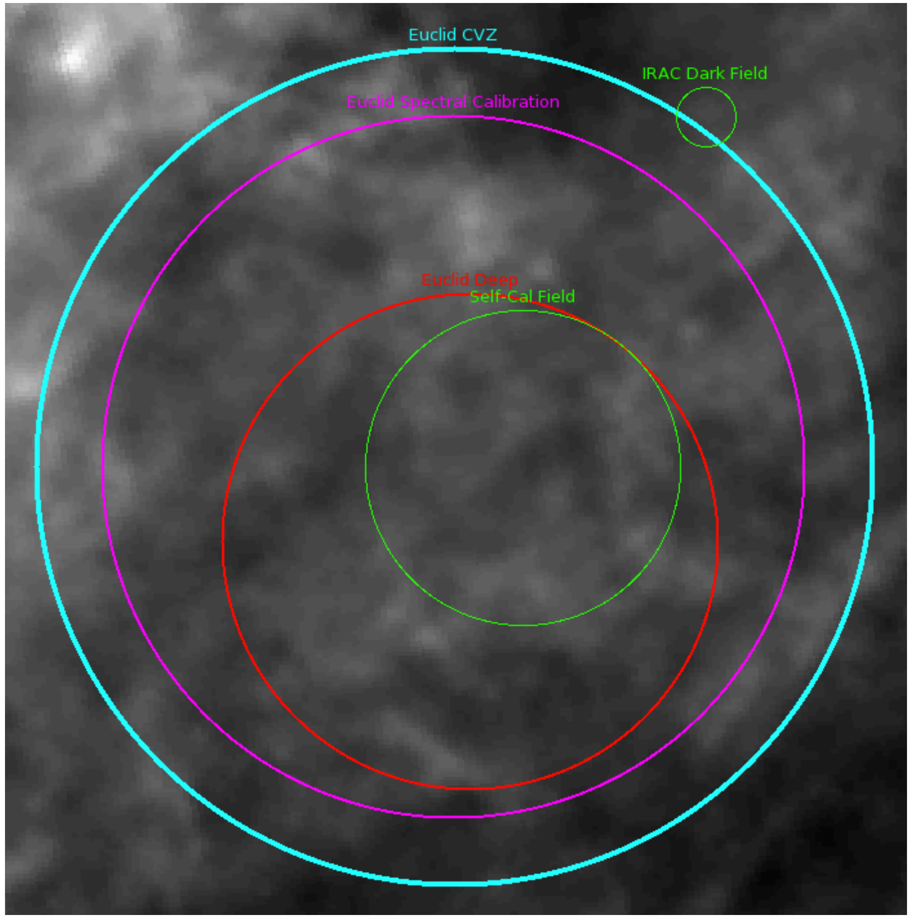
Photo-z Calibration Deep Fields

- Needs to be observable by as many ground based telescopes as possible
  - Ideally Equatorial to calibrate any imaging data set
- Multi-wavelength data
  - Estimate range of object properties not apparent in WFIRST/LSST photometry
- Euclid plan is 6 ~0.7-2 deg fields
  - WFIRST TBD
- Need 10-20k representative spectra in these fields



Shape Noise Calibration Fields

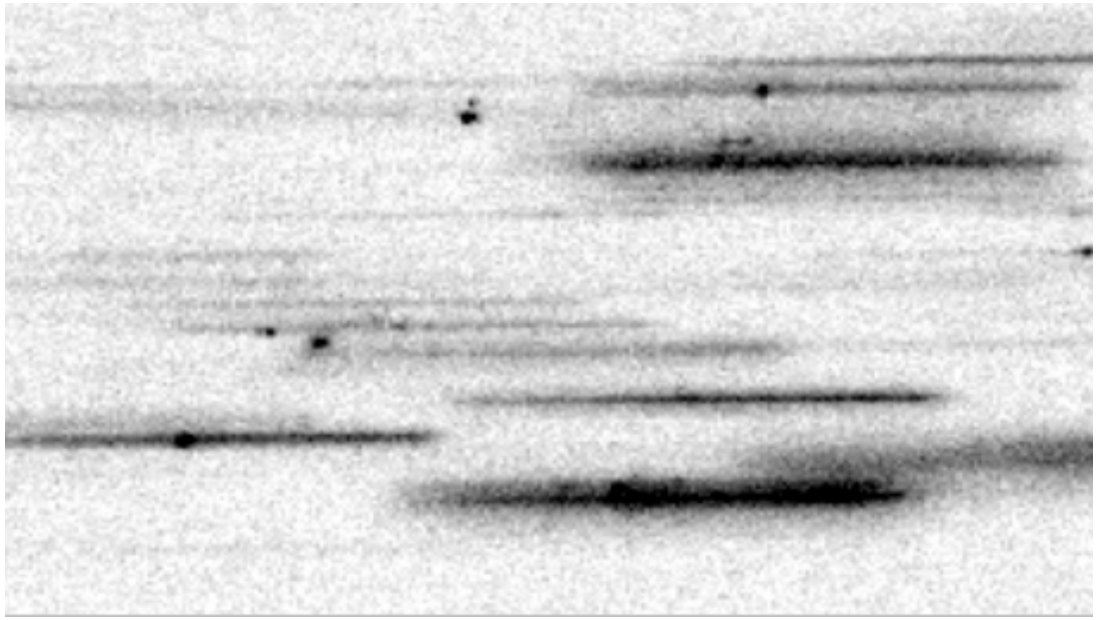
- Goal is to characterize error distribution on shape measurements
- Ideally built up along with wide field survey data
  - Similar set of conditions/roll angles, ect
  - High observability is better
- Euclid requirement is SNR ~30 for lensing sample (40 visits)
  - Three fields, NEP (10 deg), CDFS (10 deg), SEP (20 deg)
  - WFIRST requirement TBD



NEP Dust map with Euclid deep fields noted

GRISM Calibration fields

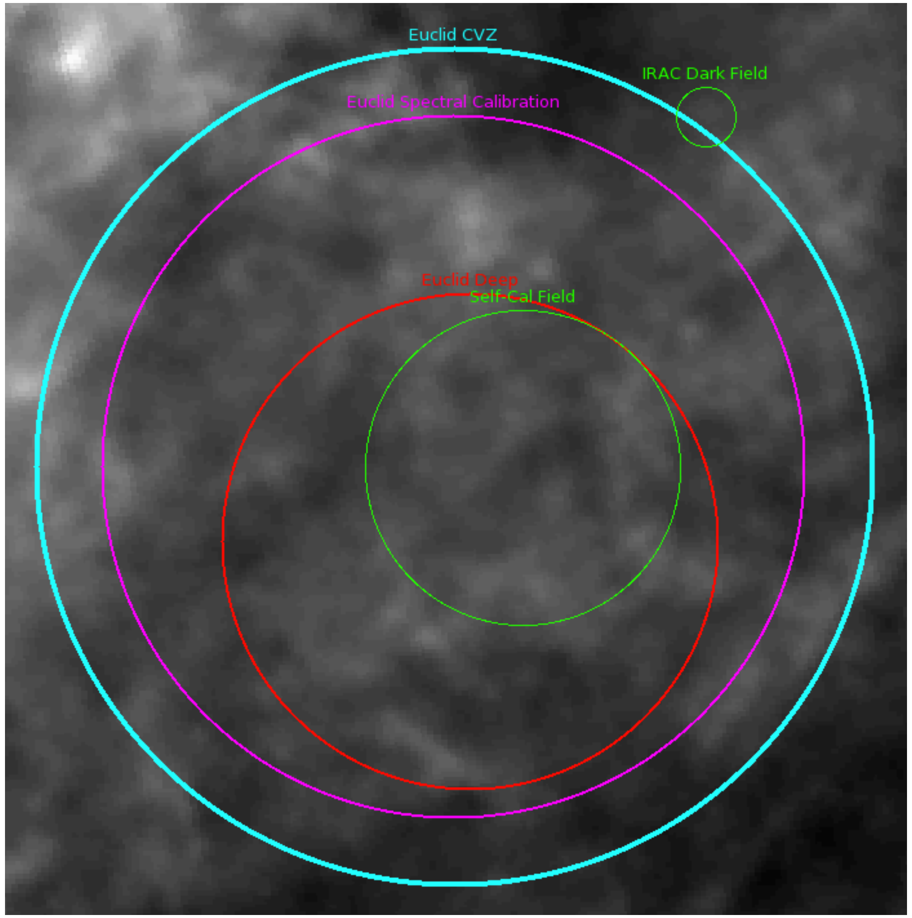
- Determine GRISM selection function
  - Measure object contamination/confusion rate
  - Measure redshift confusion rate
  - Establish selection function
- Needs to have range of orient angles
  - CVZ is ideal location
  - Euclid requirement is 10 angles, all in NEP



Credit: 3D-HST team

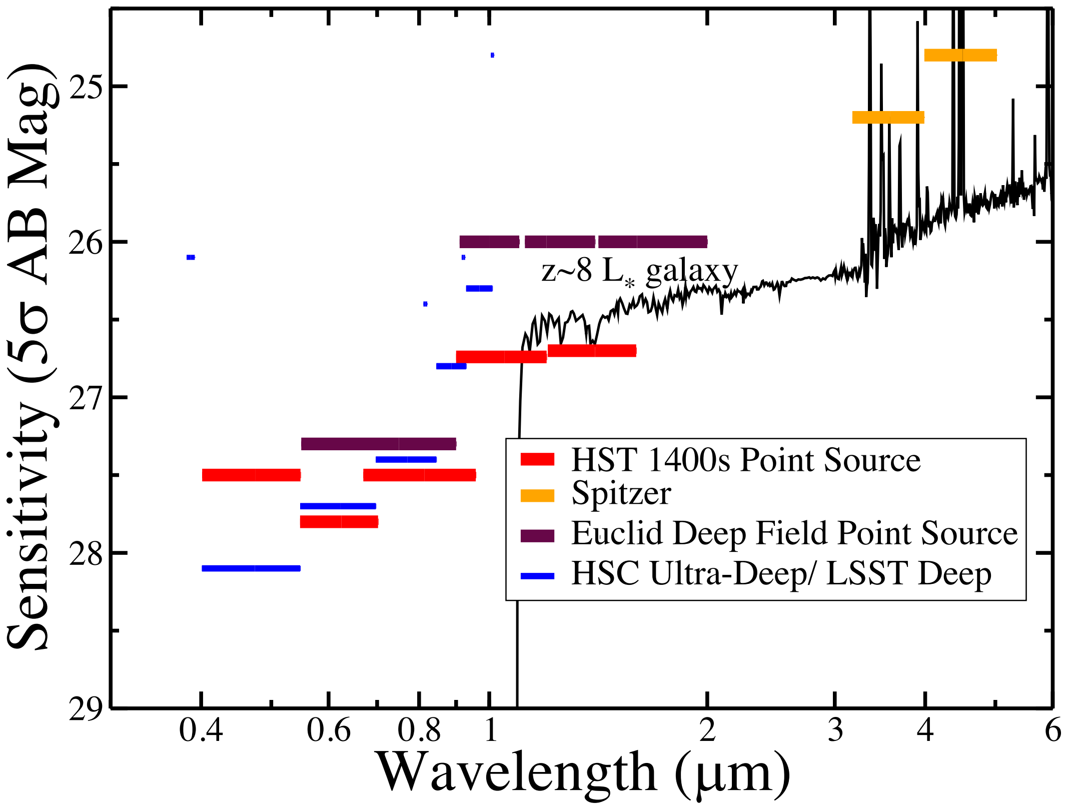
Self Calibration Fields

- Repeat observations
  - Self-calibrate response
  - Verify stability of calibrations
  - Euclid will have a 4 sq deg region at NEP observed monthly
- Survey redundancy reduces the need for this with WFIRST



GO Deep field

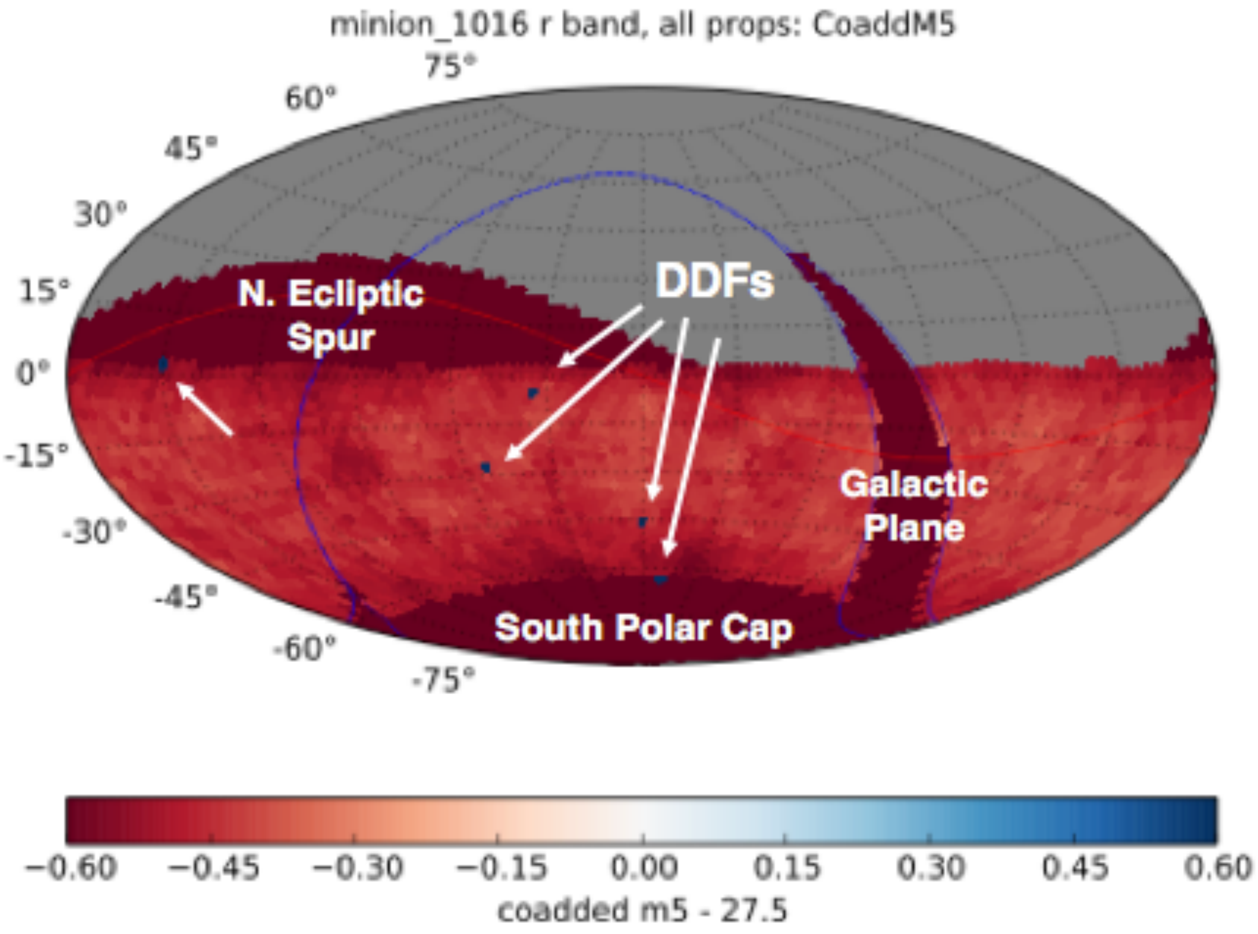
- Wide range of science, hard to predict
- For extragalactic these will focus on well studied fields with significant ancillary data
  - CDFS, VVDS2h, SXDS, COSMOS, EGS, NEP, ect



LSST Mini-surveys

- ~10% of LSST time will be spent on non-standard surveys, including "Deep Drilling" fields

- Current baseline survey spends 6.5% of time on a North Ecliptic Spur survey (esp. for NEO search), 1.7% of time on the Galactic plane (esp. for microlensing), 2.2% on South polar cap (Dec < -60, including parts of LMC & SMC), and 4.5% on 5 extragalactic deep drilling fields



Science enabled by LSST deep fields

- **Measure the properties and clustering of samples of faint/high-redshift galaxies and AGNs**
- **Utilize the dense time sampling to identify and study supernovae, AGNs, transients, and strong lenses.**
- **Test and improve photometric redshifts for main survey.**
- **Assess shear systematics and the effects of lensing magnification upon LSS.**
- **Also proposed to target a nearby galaxy cluster (e.g., Fornax) to study transients, dwarf galaxies, and low-surface-brightness features**

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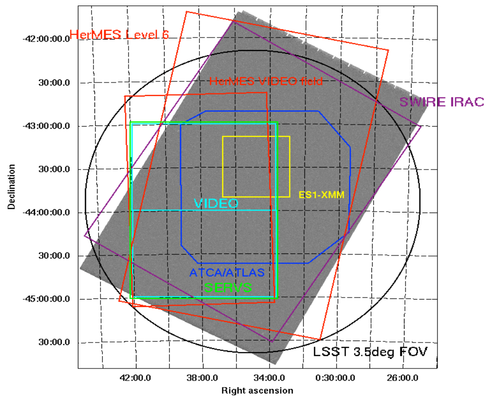
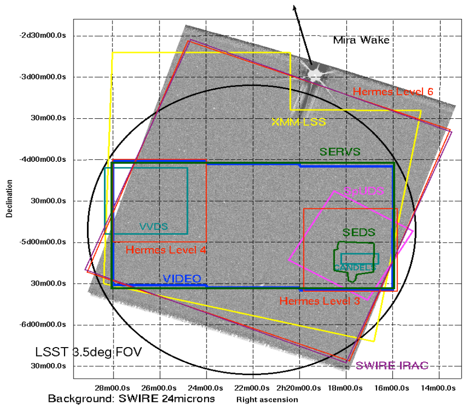
Baseline Deep Drilling Fields

- **Baseline simulation includes 5 Deep Drilling Fields**
- **Approx. final 5σ point-source coadded depths in baseline, 5 DDF survey: *ugrizy*~27.8/28.4/28.6/28.0/27.6/26.1 (vs. median *ugrizy* depth~25.4/27.0/27.1/26.4/25.2/24.4 over full area*)***
- **5k-14k visits per band (>300 hours total), vs. 60-200 visits per band in "Universal" Wide/Fast/Deep cadence**
- **4 Deep Drilling Fields have been selected so far**
- **3 are also Euclid Deep fields (XMM-LSS, ECDFS, COSMOS)**

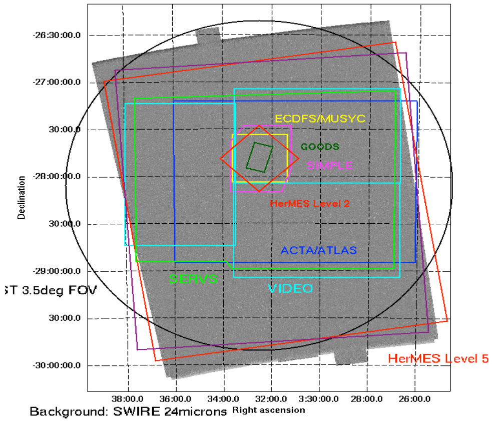
ELAIS-S1



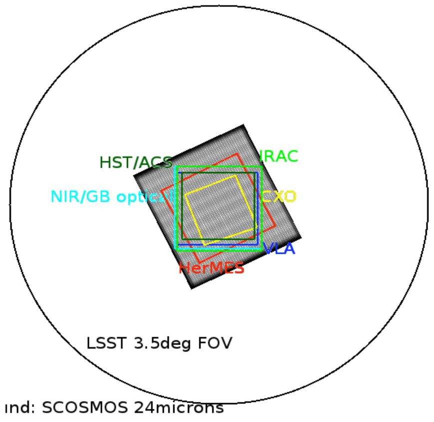
XMM-LSS



Extended CDF-S



COSMOS



Images: M. Lacy

Additional deep drilling programs

- **Deep drilling field proposals were submitted in 2010; requests included:**
  - **More extragalactic DDFs: minimum 10 total.**
    - **Only way to accommodate would probably be to halve exposure time per DDF, reducing depths by 0.4 mag**
  - **3 Milky Way/Local Volume fields (SGP, anticenter, and an open cluster): ~400 hours total**
  - **6 Transient/variable star fields (LMC, SMC+47 Tuc, IC 4651): ~200 hours total**
  - **9 solar system fields (Jupiter + Neptune Trojans): ~100 hours total**
- **These are not currently included in the baseline cadence simulations, and would have to come at the expense of an existing program.**
- **Additional 'mini-surveys' have been proposed in the Observing Strategy white paper**

LSST Deep-Drilling Field White Papers

Distant Extragalactic

LSST Deep Drilling for Galaxies

Authors: H. C. Ferguson,

Contact Information for Lead Author/Authors: Henry C. Ferguson, Space Telescope Science Institute, 3700 San Martin Drive, Baltimore, MD 21218 ferguson@stsci.edu (410) 338-5098

Ultra-deep *ugrizy* Imaging to Reduce Main Survey Photo-z Systematics and to Probe Faint Galaxy Clustering, AGN, and Strong Lenses

Authors: Eric Gawiser, Jeff Newman, Hu Zhan, David Ballantyne, Niel Brandt, Andy Connolly, Jack Hughes, Philip Marshall, Sam Schmidt, Ohad Shemmer, and Tony Tyson

Using LSST Deep Drilling Fields to Improve Weak Lensing Measurements

Authors: Zhaoming Ma (BNL), Jeffrey Newman (Pittsburgh), Ian Dell'Antonio (Brown), Mike Jarvis (UPenn), Gary Bernstein (UPenn), David Wittman (UC Davis), Tony Tyson (UC Davis), Ryan Scranton (UC Davis), Erin Sheldon (BNL), Rachel Mandelbaum (Princeton), Bhuvnesh Jain (UPenn), Morgan May (BNL/Columbia)

Supernova Light Curves (March 20, 2011)

Authors: Richard Kessler (U.Chicago), Pierre Astier (U.Paris VI& VII), David Cinabro (Wayne State), Joshua Frieman (U.Chicago,FNAL), Saurabh Jha (U.Rutgers), Maryam Modjaz (Columbia U), Dovi Poznanski (U.C. Berkeley), Masao Sako (U.Penn), Michael Wood-Vasey (U.Pitt)

Standard Candle Relations and Photo-diversity of Type Ia Supernovae
Arlin Crotts

Galactic and Local Group

Mapping the Milky Way's Ultracool Dwarfs, Subdwarfs, and White Dwarfs

S. Dhital (Vanderbilt), P. Thorman (UC-Davis), J. J. Bochanski (Penn State), P. Boeshaar (UC-Davis), A. J. Burgasser (UC-San Diego), P. A. Cargile (Vanderbilt), K. R. Covey (Cornell), J. R. A. Davenport (Washington), L. Hebb (Vanderbilt), T. J. Henry (Georgia State), E. J. Hilton (Washington), Z. Ivezić (Washington), J. S. Kalirai (STScI), S. Lépine (AMNH), J. Pepper (Vanderbilt), S. J. Schmidt (Washington), K. G. Stassun (Vanderbilt), L. M. Walkowicz (UC-Berkeley), A. A. West (Boston Univ)

High Cadence Observations of the Magellanic Clouds and Select Galactic Cluster Fields

Authors: P. Szkody (U Washington), K. S. Long (STScI), R. DiStefano (CfA), A. Henden (AAVSO), J. Kalirai (STScI), V. Kashyap (CfA), M. Kasliwal (Cal Tech), J. A. Smith (APSU), K. Stassun (Vanderbilt)

Solar System

Opportunities for Solar System Science

Authors: A.C. Becker (U. Washington), C.A. Trujillo (Gemini Observatory), R.L. Jones (U. Washington), N.A. Kaib (CITA), D. Ragozzine (SAO), S.T. Ridgway (NOAO), *and* the LSST Solar System Science Working Group

Publicly available from https://project.lsst.org/content/whitepapers32012

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Summary

- Multiple types of deep fields
- Different purposes
- Lots of overlap between different projects
  - Need to co-ordinate!