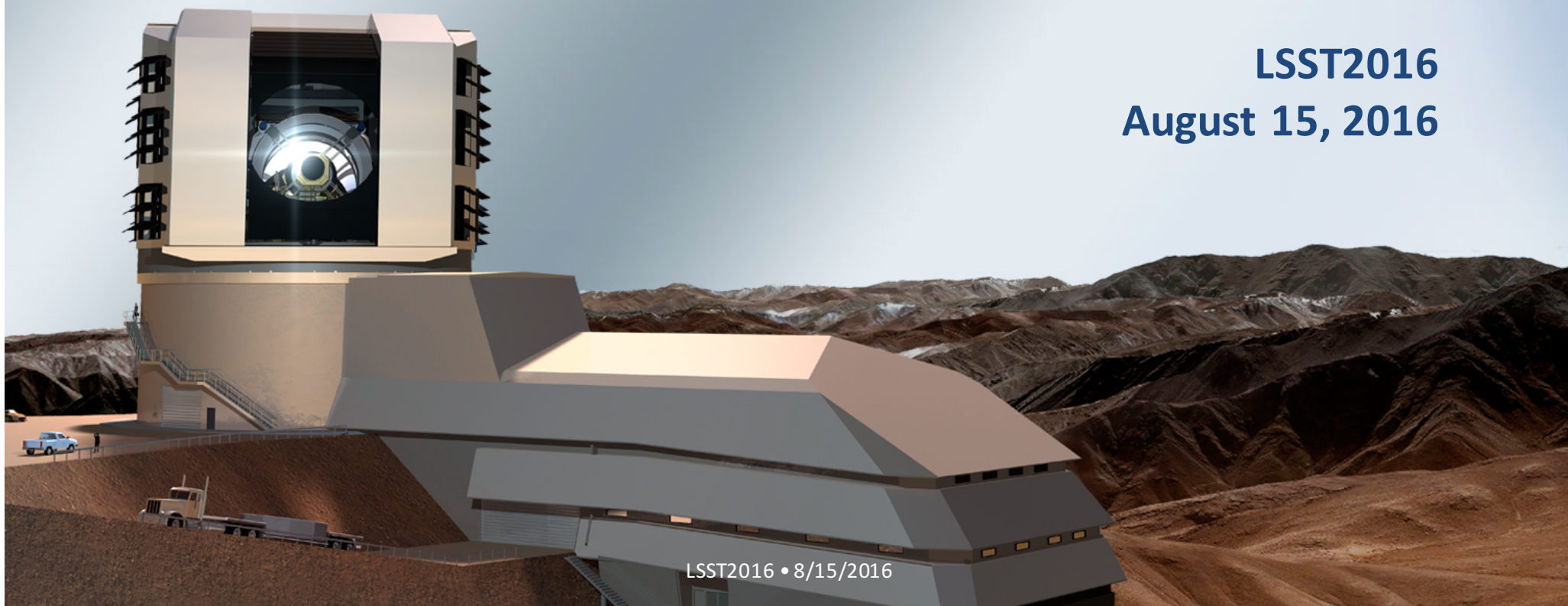




# The LSST Deep-Drilling Fields: White Papers and Science Council Selected Fields

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LSST2016  
August 15, 2016



# Scope of Mini-Surveys



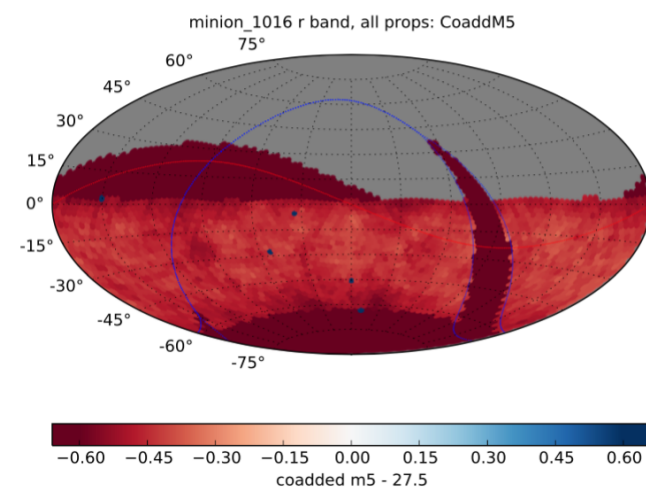
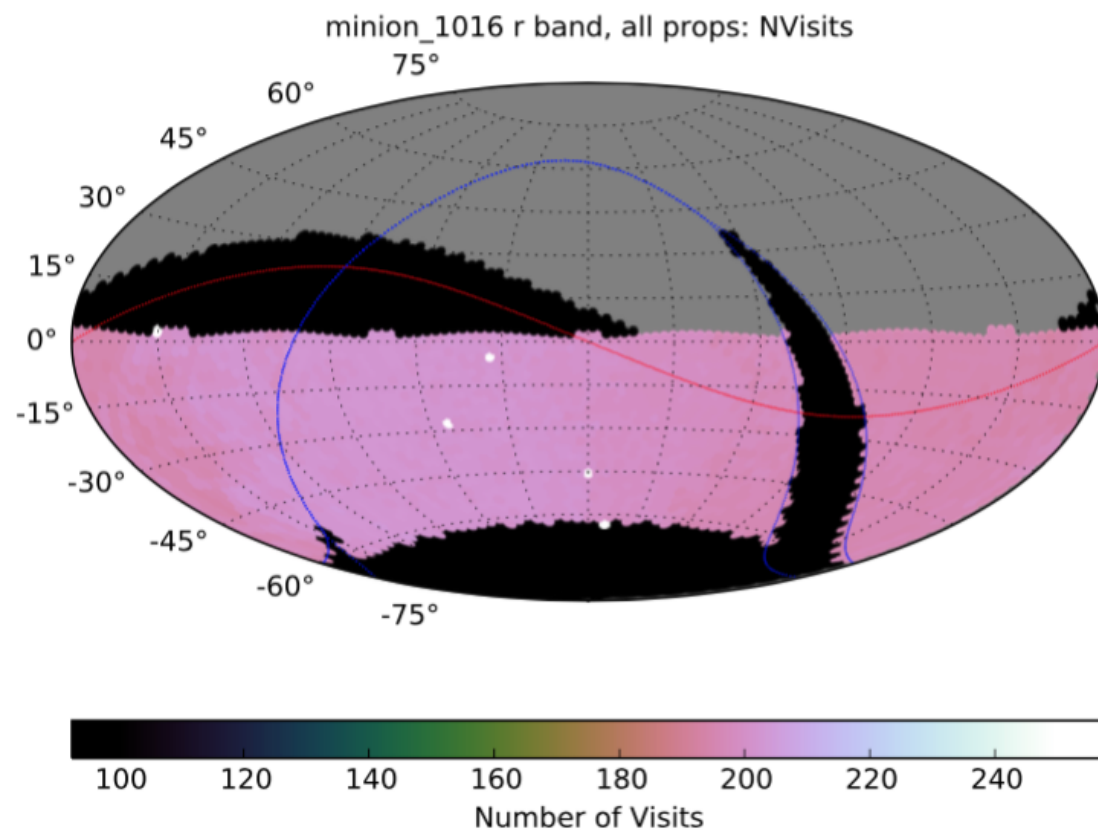
In addition to executing the main survey, the LSST observing program will include a selection of Mini-Surveys.

These have a wide range of science goals and total exposures. They include the Deep-Drilling Fields (DDF) as well as the North Ecliptic Spur (NES), the South Celestial Pole (SCP), the Galactic Plane (GP), and several other programs.

The baseline expectation is that the Mini-Surveys will utilize up to  $\sim 10\%$  of the LSST time, but the final percentage is not yet determined. The final decision will be informed by the ongoing community-based study of observing strategy.

Science plans for these Mini-Surveys still being developed, and the selection of Mini-Surveys is still largely open. Plenty of opportunity to get involved if interested!

Discussions expected to continue up to and beyond first light.



# White Papers



Members of the LSST Deep-Drilling Interest Group (DDIG; ~ 75 members) prepared a set of eight science white papers.

These are not binding in any way, but they do represent some great ideas from the community. Additional white papers are still welcomed.

These white papers follow a uniform format and do the following:

1. Provide science goals
2. Suggest fields for observation
3. Describe the needed LSST observations
4. Demonstrate the need for LSST and for Deep Drilling
5. Assess feasibility issues
6. Highlight areas needing additional work and observations

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





## 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

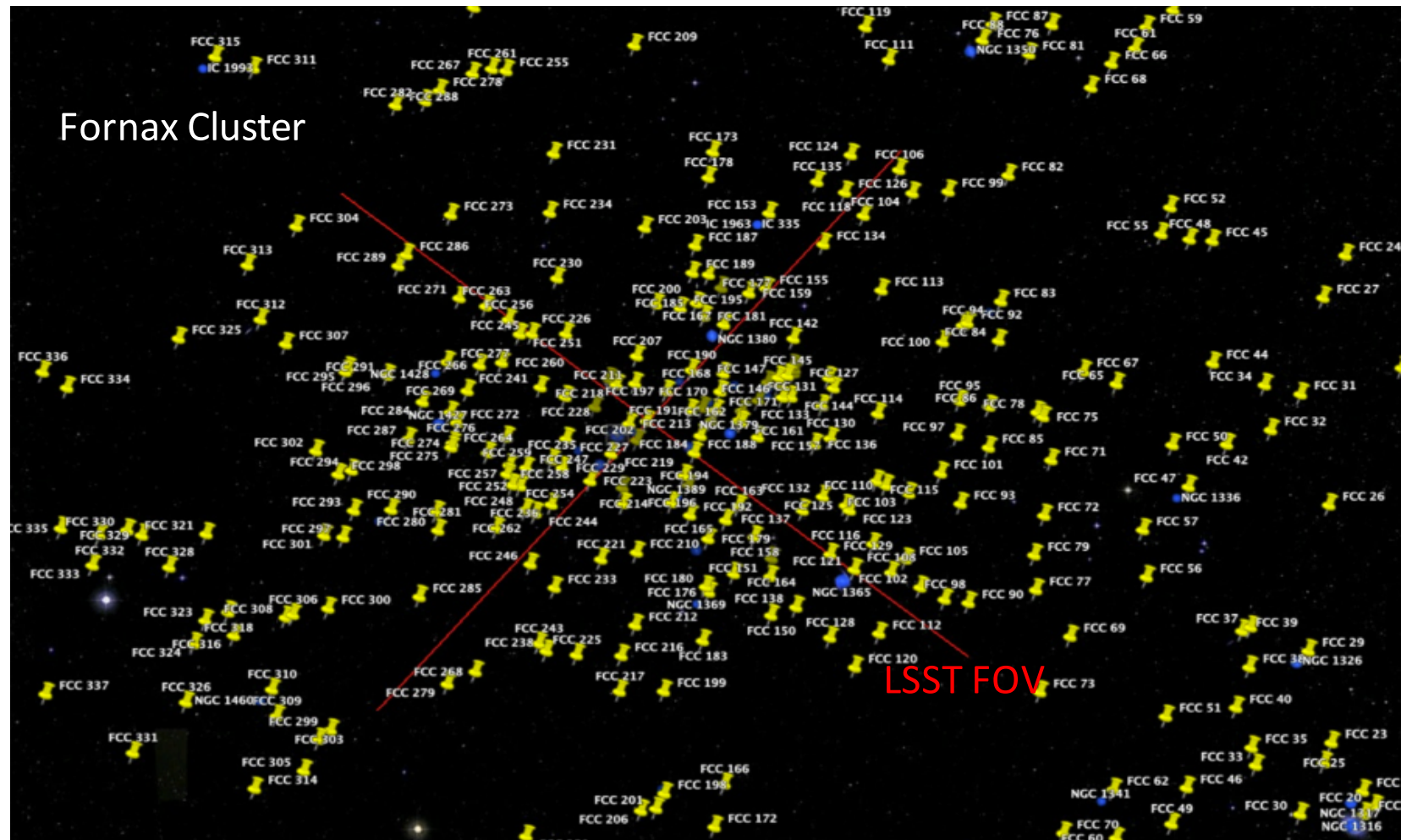
**Authors:** A.C. Becker (U. Washington), C.A. Trujillo (Gemini Observatory), R.L. Jones (U. Washington), N.A. Kaib (CITA), D. Ragozzine (SAO), S.T. Ridgway (NOAO), and the LSST Solar System Science Working Group

Thank you greatly to those who developed these white papers!

# Deep Drilling of a Nearby Galaxy Cluster



Intergalactic and galactic transients, dwarf galaxies, LSB features.



Ferguson et al. white paper

# LMC and SMC: A Few Science Goals



High-cadence observations of LMC and SMC (and 47 Tuc) to characterize binary, pulsating, eruptive, and flaring variables.

Assess metallicity and age effects upon variability by comparing populations in LMC, SMC, galactic clusters, and Galactic halo.

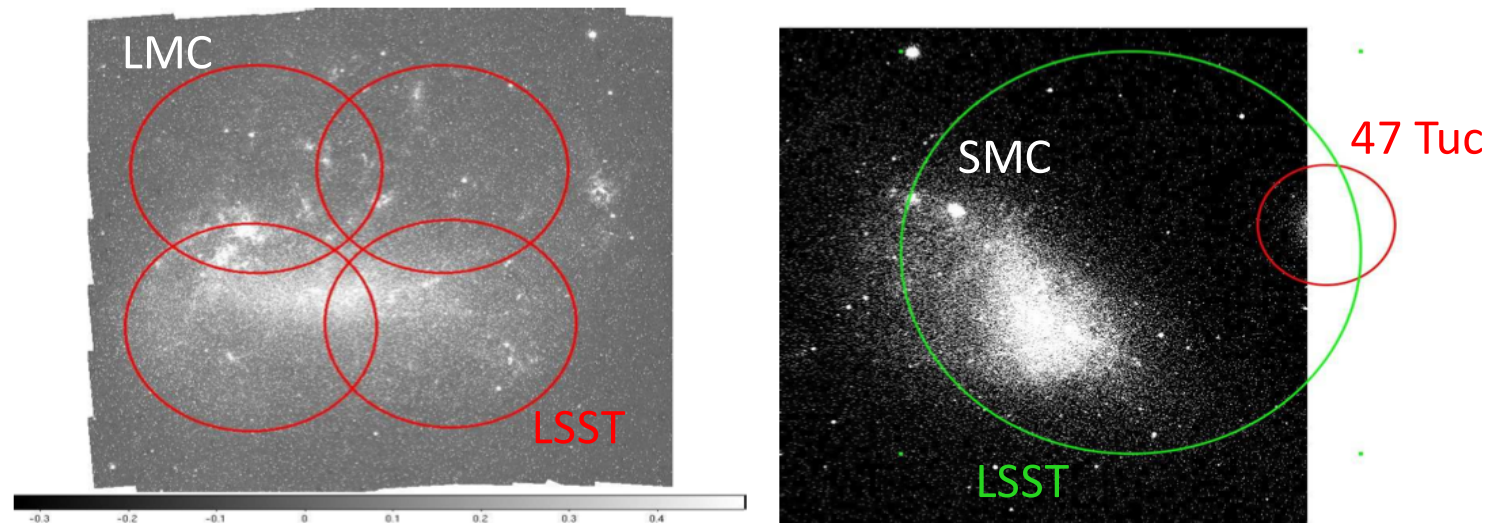


Figure 1: (a) Possible field coverage for LMC assuming a mosaic of 4 pointings. The circular regions indicated have a radius of 1.67 degrees. (b) Possible field coverage assuming a single pointing center for the SMC and 47 Tuc. The position of 47 Tuc is indicated by the red circle.

Szkody et al. white paper



# Basic Proposed Properties of an Extragalactic “Blank-Field” DDF

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5300-13800 visits per band over  $\sim 10$  year period.

265 sequences of 20-52 exposures per band.

Cost is about 335 hours for each such field.

Approx. final co-added depths:  $u = 28.5$ ,  $g = 28.7$ ,  $r = 28.9$ ,  $i = 28.4$ ,  $z = 28.0$ ,  $y = 27.0$ .

Detections for  $\sim 3 \times 10^6$  galaxies and  $\sim 40,000$  AGNs.

Cadence should enable optimal supernova, AGN, transient studies.

Measure the properties and clustering of samples of high-redshift galaxies and AGNs too faint to be detected in the main survey.

Utilize the dense time sampling to identify and study supernovae, AGNs, transients, and strong lenses.

Test and improve photometric redshifts needed for main survey.

Assess shear systematics and the effects of lensing magnification upon LSS.

# DDFs Selected by the Science Council

# Prompt Selection of Four “Blank-Field” DDFs



The LSST Science Council, in consultation with the DDIG, chose four “blank-field” DDFs for observation by LSST. This was done in 2011-2012.

This was separate from the white-paper activities; i.e., the white papers were not “proposals” to the Science Council that were judged competitively.

The Science Council’s motivation was community service. Enables preparatory observations; e.g., those by observatories with limited lifetimes.

Spitzer observations now ongoing for three of the fields. XMM-Newton observations now ongoing for part of XMM-LSS field, and more X-ray coverage proposed for these fields.

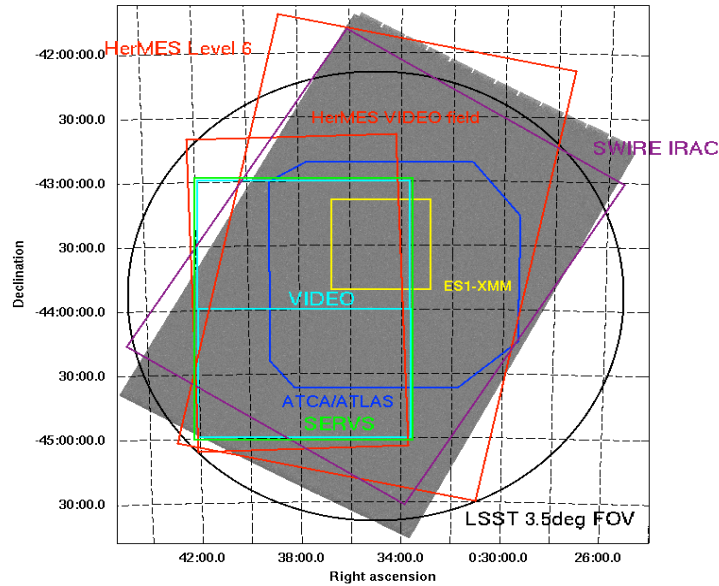
Aside from the field positions, nothing else decided about these fields.

The LSST and broader communities will be engaged, on a longer timescale, in working out the best choices of LSST cadence, filters, filter balance, dithering, etc. for these four fields.

# The Four Selected DDFs: Multiwavelength Coverage

## ELAIS-S1

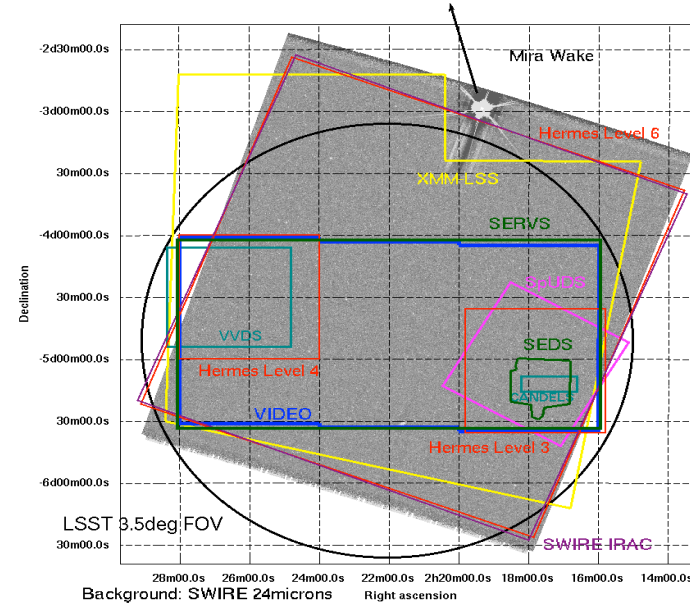
New Spitzer



## XMM-LSS

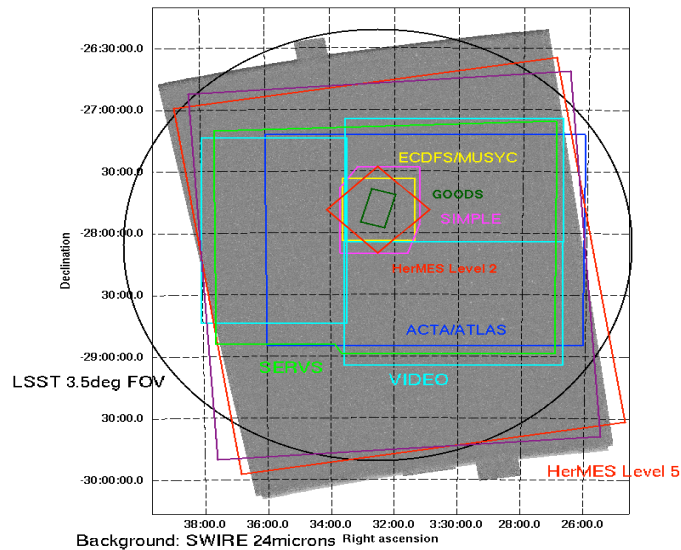
New Spitzer

New XMM-Newton ongoing

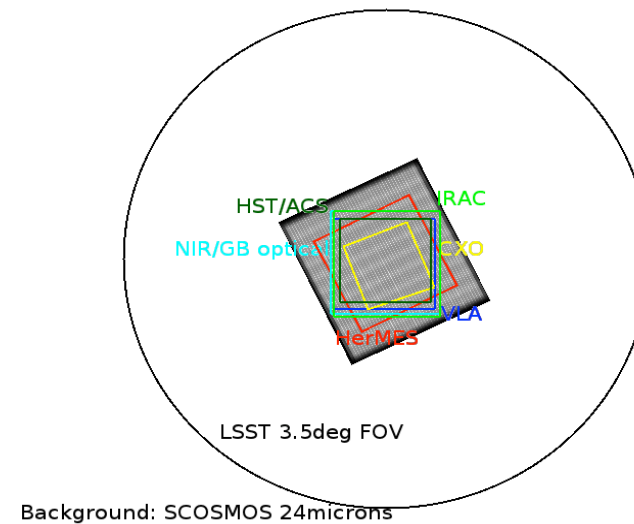


## Extended CDF-S

New Spitzer



## COSMOS

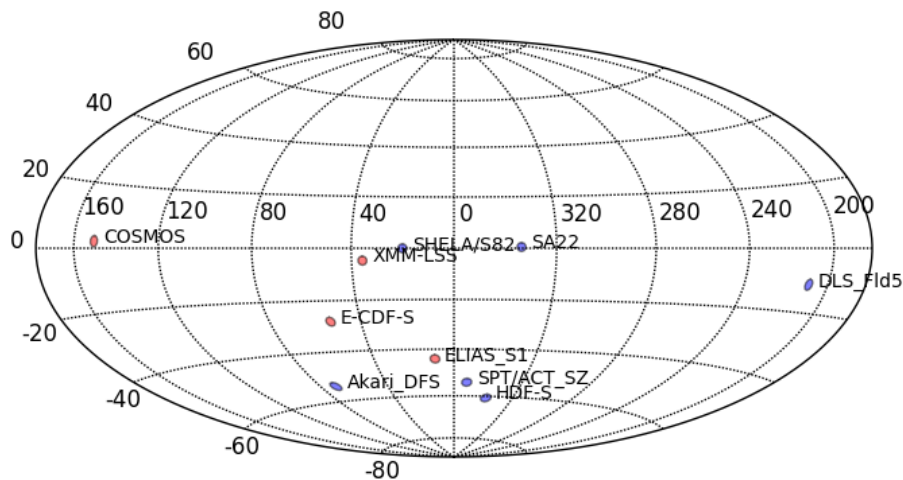


# The Four Selected DDFs on the Sky



	ELAIS S1	XMM-LSS	Extended Chandra Deep Field-South	COSMOS
<b>RA 2000</b>	00 37 48	02 22 50	03 32 30	10 00 24
<b>DEC 2000</b>	-44 00 00	-04 45 00	-28 06 00	+02 10 55
<b>Galactic l</b>	311.30	171.20	224.07	236.83
<b>Galactic b</b>	-72.90	-58.77	-54.47	42.09
<b>Ecliptic l</b>	345.97	31.04	40.29	150.70
<b>Ecliptic b</b>	-43.18	-17.90	-45.47	-9.39

Some possible DDFs (already selected in red)



Ultimately will want to broaden  
RA distribution of extragalactic  
DDFs for efficient observing.

Some additional fields suggested.



# Thursday Session Schedule



"Deep Drilling Fields and Other LSST Mini-Surveys"

Date and Time: Thursday, Aug 18 at 1:30–3:00 pm

Room: Murphey 1

Organizers: Niel Brandt and Lynne Jones

Here is the schedule:

1. Niel Brandt (Penn State)  
"General review of the Deep Drilling Fields and Other LSST Mini-Surveys"  
15 minutes talk + 10 minutes discussion/questions
2. Stephen Ridgway (NOAO)  
"Simulations and metrics for Mini-Surveys"  
15 minutes talk + 10 minutes discussion/questions
3. Gregory Dubois-Felsmann (Caltech IPAC) or stand-in  
"Data-management issues relevant to the Deep Drilling Fields and Other LSST Mini-Surveys"  
15 minutes talk + 10 minutes discussion/questions

# The End

# THIS IS THE TITLE

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