DARK ENERGY SURVEY

# Ongoing Calibration Work / Areas Needing Work before Survey Start

Douglas L. Tucker

DES Calibration Telecon
3 May 2013

# From Science Verification Report
## DES-doc#6985

DARK ENERGY SURVEY

### 5.4. Photometric Calibration

- Determine standards-fields zeropoints after correction of known instrumental signatures (nonlinearities, star flat, pixel-area corrections).
- Complete an "uber-calibration" of some or all SV data to assign zeropoints to a large number of exposures on many nights.
- Correlation of photometric stability (from standards and uber-cal) with RASICAM outputs. Make sure there is proper feedback to observing & reduction programs when RASICAM outputs indicate non-photometric conditions.
- Use DECal scans and atmospheric monitors to improve agreement between synthetic and observed color terms (Cal-R2/3, Cal-G7).
- Measure color term temporal variation and correlation with atmospheric monitors
- Determine information provided by middle-of-night standards vs only twilight standards.
- Regress exposure zeropoints against seeing to check DESDM photometry algorithms.
- Measure *zY* bandpass and color term changes when focal plane temperature is changed.

DARK ENERGY SURVEY

# From DES Review
# DESDM Schedule Report
## DES-doc#6985

**Science codes in DESDM: The To Do List (based on astronomer and SV feedback)**

| | Important? | Easy? |
|---|---|---|
| 1. Improved coadds | | |
| A. better tile-to-tile zeropoint calibration [Global Calib Mod] | Yes | Medium |
| B. artifact removal (kappa-sigma mean w/ outlier x) SWARP | Yes | Medium |
| C. better masking of bright stars | Yes | Hard |
| D. more SV coadds, including more SN fields with arcs and known cluster fields | Yes | Medium |
| 2. Improved detrending: | | |
| A. Single Epoch CR removal | Yes | Progress |
| B. bad pixel masking (including hot/cold funky cols) | No | Medium |
| C. cross-talk matrix | Med | Progress |
| D. linearity correction | Yes | Medium |
| E. pupil ghost/star flat correction | Med | Hard |
| F. fringe frame correction | No | Progress |
| 3. Fully integrate and automate MANGLE masks | Yes | Progress |
| 4. Add columns for to E(B-V) for every coadd-object | No | Medium |
| 5. Allow exposures to be 'labeled' by different groups As 'seeing too bad for weak lensing', 'guiding too Bad – don't use', 'exposure too short for coadd', 'moon too bright', etc. [import flag sets from Sci Portal] | Med | Medium |
| 6. Fix the galaxy depth and magnitude errors to req. Limits. | Yes | Hard |
| 7. PSF vs flux brigher/fatter relation – allow cuts in [PSFEX] | Med | Hard |
| 8. Check image weighting in coadds | Yes | Hard |

DARK ENERGY SURVEY

# From DES Review
# DESDM Schedule Report
## DES-doc#6985

**Science Processing in DESDM: What is the schedule going forward?**

**1. April 30: Y1C1 Update Release: duplicates (really) removed [done]**
**More tiles added [varying depths and filters]**
**Calibration improved [photo zeropoints]**
**This release should be used by working groups for Sep 1 papers**

**2. May 15: Incorporate remap, PSM calibrate, coadd, diff im steps into refactored system, including database updates.**

**3. June 15, 2013: Deadline for getting science code changes for next Iteration. i.e. fold in astronomy code changes: CR fix, crosstalk, bpms, star flat/pupil ghost, etc.**

**4. July 1: Begin (re) processing of SV data in refactored system.**

**5. (late) Aug 2013: Release of processed SV data (200+ sq deg) to collaboration. Homogenized and non-homogenized coadds, This is a full official processed SV release for working groups.**


# Ongoing Work from DES Review Calibration Plan Presentation

(apologies to those whose names I missed!)

- Pupil Ghost and Star Flat Measurements: Annis, Armstrong, Bauer, Bechtol, Bernstein, Desai, Foust, Gruendl, Lin, Nord, Regnault, Tucker, Wester, Vikram, Yanny (in association with SV and DESDM teams)
- DES Natural System/SDSS, PanSTARRS->DES Transformations: Allam, Bauer, Bechtol, Li, Marshall, Rheault, Tucker, Wester
- Instrumental Response: DePoy, James, Marshall, Rheault, Wester
- Sky Monitoring: Lewis, Reil (RASICAM); Kessler (GPS); DePoy, Li, Marshall, Rheault (atmCam)
- Standard Star Field Calibration (MaxVis, E fields, etc.): Allam, Smith, Tucker, Vikram
- ~~PreCam2: Allam, Annis, Burke, Kuehn, Kuhlmann, Spinka, Tucker~~
- CCD Non-Linearities: Butner, Estrada, Lin, Martini, Vikram, Yanny (in association with SV team)
- Stellar Locus Regression: Armstrong, Desai, Bechtol, Huff
- DA White Dwarf BronzeSample: Allam, Smith (co-lead), Tucker, Wester (co-lead)
- + Standard Star vs. LST list

# Calibration Responses to March 2013 Review: 1.A.1. Number of Tilings Needed for Calibrations

DARK ENERGY SURVEY

| # | Recommendations | Assigned to | Status/Action | Date* |
|---|---|---|---|---|
| 1.A.1 | Confirm that, given the DES strategy of 1 degree dithers of the hex centers between tilings, that a minimum of four tilings will result in a photometric calibration that meets the DES requirements. Then consider survey strategies that will achieve that in each survey year and evaluate the risk of not getting a complete calibration each year. | J. Annis, D. Tucker, S. Kent | Tests of the number of tilings needed to achieve DES photometric calibration requirements are currently being carried out both on simulations and on the SV data. Results should be available by mid-May 2013. In progress? | May 15, 2013 |

# Calibration Responses to March 2013 Review: 1.A.2. Additional Calibration Data

DARK ENERGY SURVEY

| # | Recommendations | Assigned to | Status/Action | Date* |
|---|---|---|---|---|
| 1.A.2 | Consider taking extra calibration data, at least in the first year or two, to make sure that there is enough. For example, observations of dense stellar fields or many tilings of a small area dithered as with the DES observing plan. | D. Tucker, G.Bernstein, P. Martini, S. Kent, J. Annis | A detailed list of periodic and special-case calibrations for DES operations, initially generated in mid-2012 and refined during SV, exists in Section 4 of DES-doc#6584-v5 ("Plan for Calibration of the DES in the Early Years"). The general guiding principle (exercised within limits) is that it is better to take calibration data that are in the end not needed, than to skip calibration data only to discover later that they were needed. Annis, Bernstein, Kent, Martini, and Tucker will confer and sign off on the final version of this list by June 30, 2013. | June 30, 2013 |

Material available.

Still need to sign off.

# Calibration Responses to March 2013 Review: 1.A.3. Extra Bad-Seeing Time for Calibrations

DARK ENERGY SURVEY

| # | Recommendations | Assigned to | Status/Action | Date* |
|---|---|---|---|---|
| 1.A.3 | Develop a metric for when repeated observations of the supernova fields provide diminishing returns and consider using that extra bad-seeing time for calibration or other supporting data. | J. Annis, M. Sako, D. Tucker | Discussions with the SN WG occurred at the April 2013 DES Collaboration Meeting and are ongoing. Extra bad-seeing time could possibly be used for taking additional standard star and star flat data if conditions are otherwise photometric (transparent). These studies will be completed and decision taken by end of May, 2013. | June 1, 2013 |

In progress

# Calibration Responses to March 2013 Review: 1.H.1. Full Utilization of Calibration Systems

DARK ENERGY

| # | Recommendations | Assigned to | Status/Action | Date* |
|---|---|---|---|---|
| 1.H.1 | The plan for making full utilization of the various calibration system data products should be completed by the end of the first survey season, and implemented prior to beginning of the second. | D. Tucker, D. DePoy, R. Kessler, W. Wester, S. Kent | This recommendation is based on the finding that, although the machinery for gathering the instrumental system response data (DECal) the atmospheric transmission data (GPS, prototype atmCam and RASICAM) are ready for DES Operations, the plan for using these data streams for DES calibrations is not yet fully fleshed out. The Oracle database schema for the DECal scans that will form the basis of the interface with DESDM has been tested and is described in DES-doc#6332; this schema is also extendable to the data streams from the atmospheric transmission monitors. A draft plan for using these data streams for improved calibration of the coadds is given in DES-doc#5704. A small task group will be formed to further flesh out the plans for using these data streams for both the wide-field survey and the SN survey; plan will be finalized by February 28, 2014 (end of the first season of operations), and implemented by September 1, 2014 (beginning of the second season of operations). As we learn more over the course of the survey, details of implementation for some of these systems may evolve. | Plan: Feb 28, 2014<br><br>Implementation: Sep 1, 2014 |

Needs work,
but not urgent.

# Calibration Responses to March 2013 Review: 1.H.2. Dealing With Discrete Changes in System

DARK ENERGY SURVEY

| # | Recommendations | Assigned to | Status/Action | Date* |
|---|---|---|---|---|
| 1.H.2 | The plan for dealing with discrete changes in the telescope/camera system should be formalized prior to beginning operations. | D. Tucker, S. Kent, H. T. Diehl, G. Bernstein, J. Annis | A draft list of calibration procedures for dealing with discrete changes in the telescope/camera system (e.g., replacing a CCD or a filter) exists in Section 4.5 of DES-doc#6584-v5 ("Plan for Calibration of the DES in the Early Years"). Annis, Bernstein, Diehl, Kent, and Tucker will confer and sign off on the final version of this list by June 30, 2013. | June 30, 2013 |

Material available.

Still need to sign off.

# Calibration Responses to March 2013 Review: 1.H.3. PreCam

DARK ENERGY SURVEY

| # | Recommendations | Assigned to | Status/Action | Date* |
|---|---|---|---|---|
| 1.H.3 | Completion of the PreCam program should be vigorously pursued, and if possible completed prior to the beginning of the second year of operations. | D. Burke, S. Kuhlman, D. DePoy | The calibration working group will complete analyses of the existing PRECAM 1.0 data combined with DES SV data as they are processed by the DESDM pipelines. These analyses will incorporate available data from other calibration standard sources. The results of these analyses will be used to evaluate our ability to use the PreCam network of standard stars to achieve the science requirements for reproducibility and uniformity of DES photometry, the impact of the PreCAM network on DES operations efficiency, and the need for additional acquisition of spectroscopy and/or imaging of other stadard objects (e.g. white dwarf stars) for calibration of DES color zero points. These analyses will be completed in time to allow necessary observing to be carried out during the first season (2013-2014) of the DES Campaign. | Aug. 1, 2013 |

Have decided not to pursue PreCam 2 at this time.

DARK ENERGY
SURVEY

# Extra Slides