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SURVEY

Steps for Processing and Analyzing PreCam Data

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Overall Strategy

(DES-Brazil Official Processing and FNAL R&D Processing)

1. First do the Golden Nights

- a. Relatively few hardware or software problems
- b. Relatively clean FITS headers
- c. Lots of coverage of Stripe 82

2. Then do the Other Nights

- a. Typically more hardware and software problems
- b. Typically more problematic FITS headers (esp. before about December 15)
- c. Coverage of Stripe 82 was not necessarily a priority



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Proposed Steps

(current major obstacles in red)

1. Fix FITS headers

- Mostly an issue for non-Golden Nights, particularly before Dec. 15
- The 2010-12-02UT FITS headers have special problems.

2. Create Master Bias Frames

- full Nov-Jan run

3. Create Master Flat Frames

- weekly, or full Nov-Jan run

4. De-trend standard star and science images

- Overscan subtraction, bias subtraction, flat-field, horizontal streaking correction



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Proposed Steps

(current major obstacles in red)

5. Create Illumination/Shutter Map Correction from de-trended standard star and science images
 - One Illumination/Shutter Map Correction for each filter and exposure time
 - /data/des06.a/data/PreCam/Analysis/kkuehn/R<Date>UT/<filter>/Illum*.fits
 - /data/des06.a/data/PreCam/Software/preCamFastReduceIllum3.py
6. Apply Illumination/Shutter Map Correction to standard star and science images
7. Run sextractor
8. Run astrometry pre-burner
9. Re-run sextractor
10. Run SCAMP or other astrometry package



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Proposed Steps

(current major obstacles in red)

10. Run psfex or another psf photometry package (e.g., DAOPHOT) to obtain PSF magnitudes

- It does not appear that we are getting faint enough (0.02mag rms at $i=17.7$); PSF photometry might help us achieve our higher S/N requirements.

Processing stops here... or maybe just before Step 10

Analysis starts here... or maybe just before Step 10

11. Calculate catalog-level star flat by matching to Stripe 82 data and fitting the following equation for each filter:

$$\text{mag}_{\text{obs}} - \text{mag}_{\text{SDSS}} = a + b * (\text{stdcolor} - \text{stdcolor}_0) + k * X + d * (x - x_c) + e * (y - y_c) + f * (x - x_c)^2 + g * (y - y_c)^2 + h * (x - x_c) * (y - y_c)$$

- `/data/des06.a/data/PreCam/Software/dtucker/dmag_vs_XYcolor_fit.py5`



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Proposed Steps

(current major obstacles in red)

12. Fixing the values of the d, e, f, g, and h coefficients (and maybe also b), fit the above equation for all the standard stars observed on a given night (solve the nightly photometric equation).

$$\text{mag}_{\text{obs}} - \text{mag}_{\text{SDSS}} = a + b * (\text{stdcolor} - \text{stdcolor}_0) + k * X + d * (x - x_c) + e * (y - y_c) + f * (x - x_c)^2 + g * (y - y_c)^2 + h * (x - x_c) * (y - y_c)$$

13. Apply the results from each nightly photometry solution to the science images from that night.



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Proposed Steps

(current major obstacles in red)

12. Stitch together the photometry from all overlapping PreCam fields using the DESDM Global Calibrations Module (GSM).
13. Create standard stars from the PreCam data by taking the mean (median?) of all PreCam observations of each star from the catalog produced in Step 12, and then culling the final catalog based on number of observations of a star and the rms of its magnitude.
14. Compare PreCam data against other surveys as a sanity check (non-Stripe 82 data in SDSS, APASS, SkyMapper?)



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Other Steps

(For a second iteration?)

1. Add fringing correction for z and y bands
2. Create and apply bad pixel map
 - This is already done in the FNAL R&D processing
3. Apply cross-talk correction.
4. Create and apply Master Dark Frames