Some Results on Multi-Epoch Survey Analysis

DES Calibration Meeting

Fermilab
September 17, 2009

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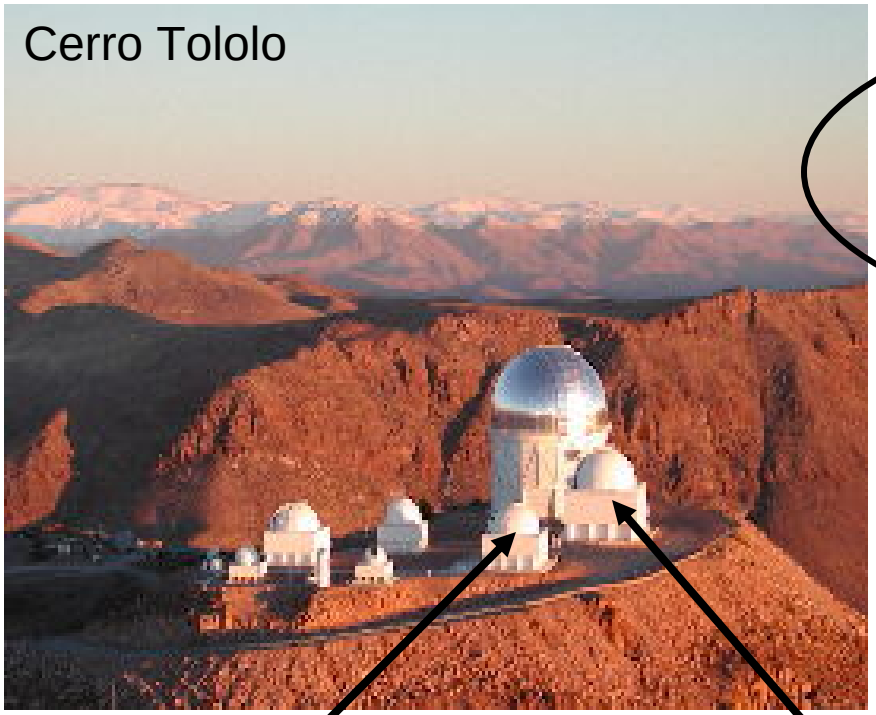
Observing at CTIO Tololo

NOAO Observing Proposal *Standard proposal* Panel: *For office use.*
Date: October 2, 2006 Category: EGAL - Other

Characterizing Atmospheric Absorption for Precision Photometry



SMARTS 0.9m Imager

1.5m Spectrograph

2007 Studies with the 1.5m spectrograph

Establish extraction of atmospheric parameters from spectra

Done

2008 Simultaneous observing with the 1.5m spectrograph and 0.9m imager

Calibrate 0.9m stellar photometry

Done

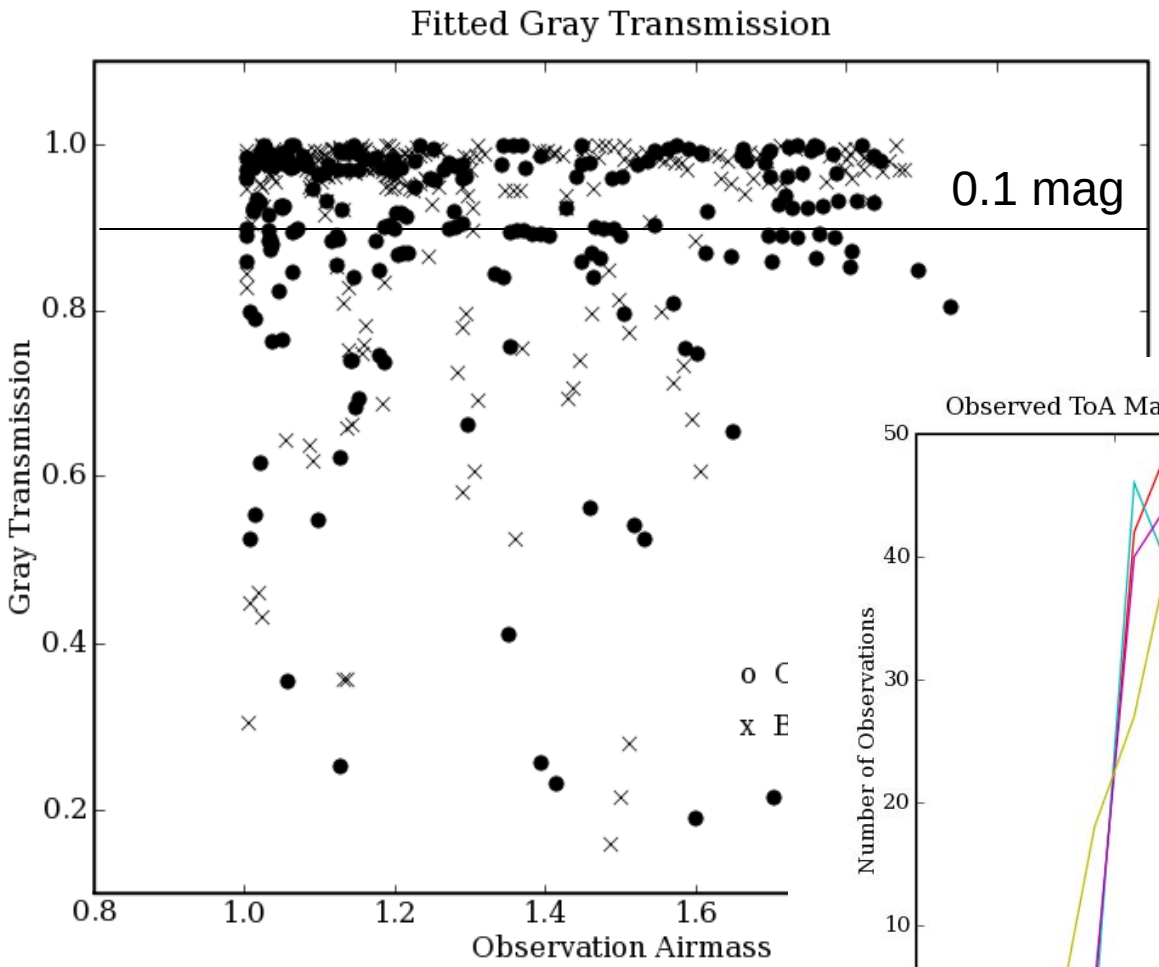
2009 Simultaneous observing with the 1.5m spectrograph and the 4m mosiac

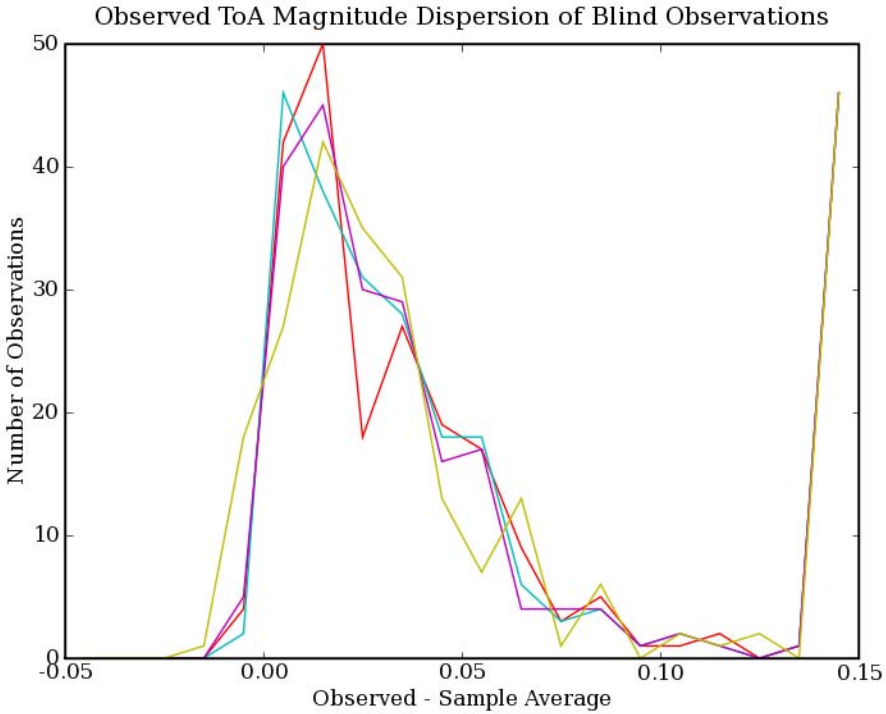
Calibrate 4m mosiac stellar and resolved object photometry

Joint LSST/DES
Done

Gray Extinction (Clouds) From Spectroscopic Data

DES Calibration Meeting
FNAL July 13, 2008





April 2008

Corrections for Gray Cloud Extinction in Imaging Data

- First loop through all images taken in a common band
  - Apply bias, flats, etc, and non-gray extinction(*) corrections to obtain observed magnitudes m_{obs} for each star on each image
  - Find brightest observed flux (minimum magnitude m_0) for each star from resulting multi-epoch light curve

- Second loop
  - Compute gray extinction $\delta m = m_{obs} - m_0$ for each star on each image
  - Fit spatial dependence of δm across each image (second order polynomial works well over 13 arcmin on 60 second images)
  - Correct all sources on each image using fitted polynomial

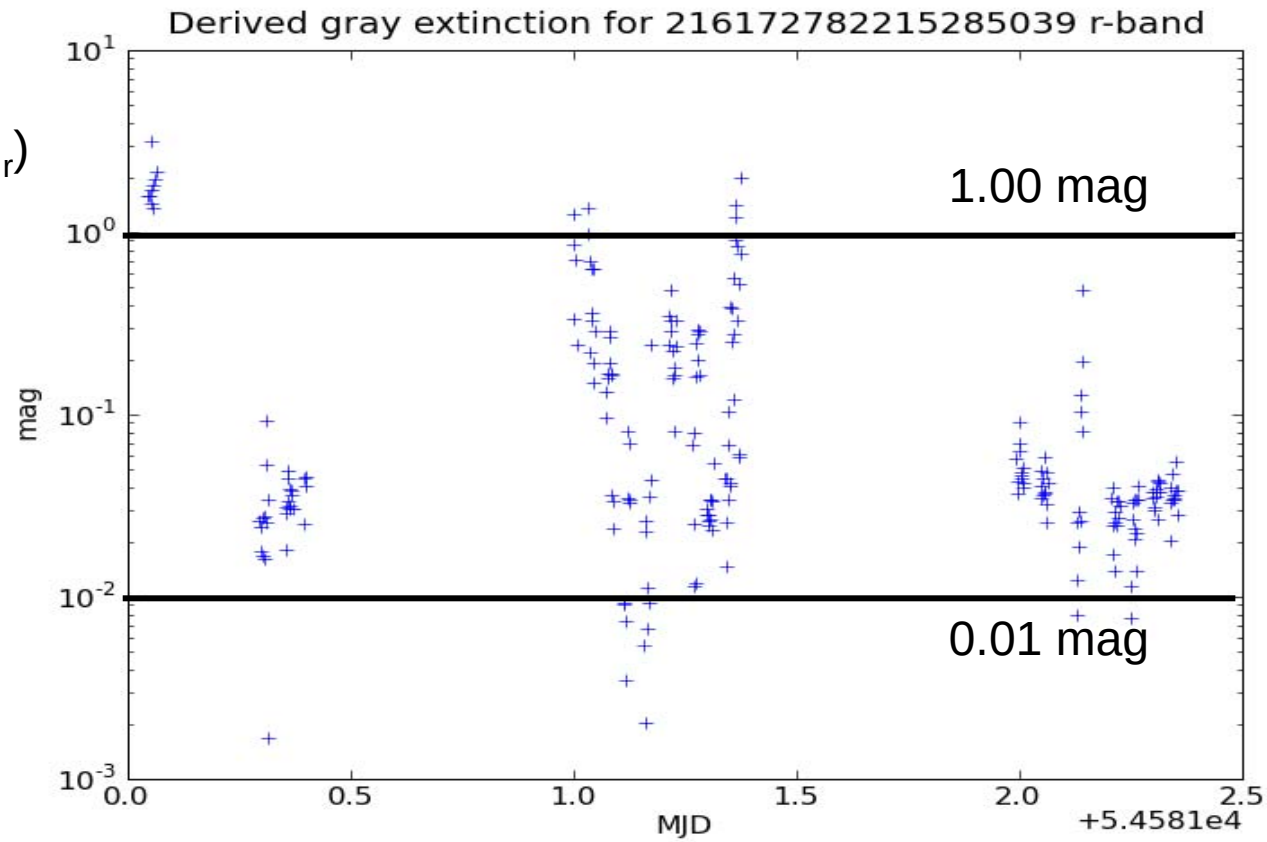
(*) This analysis used only a nightly extinction coefficient per band to make non-gray corrections, as would be the case for DES.

Data From 0.9m Imager

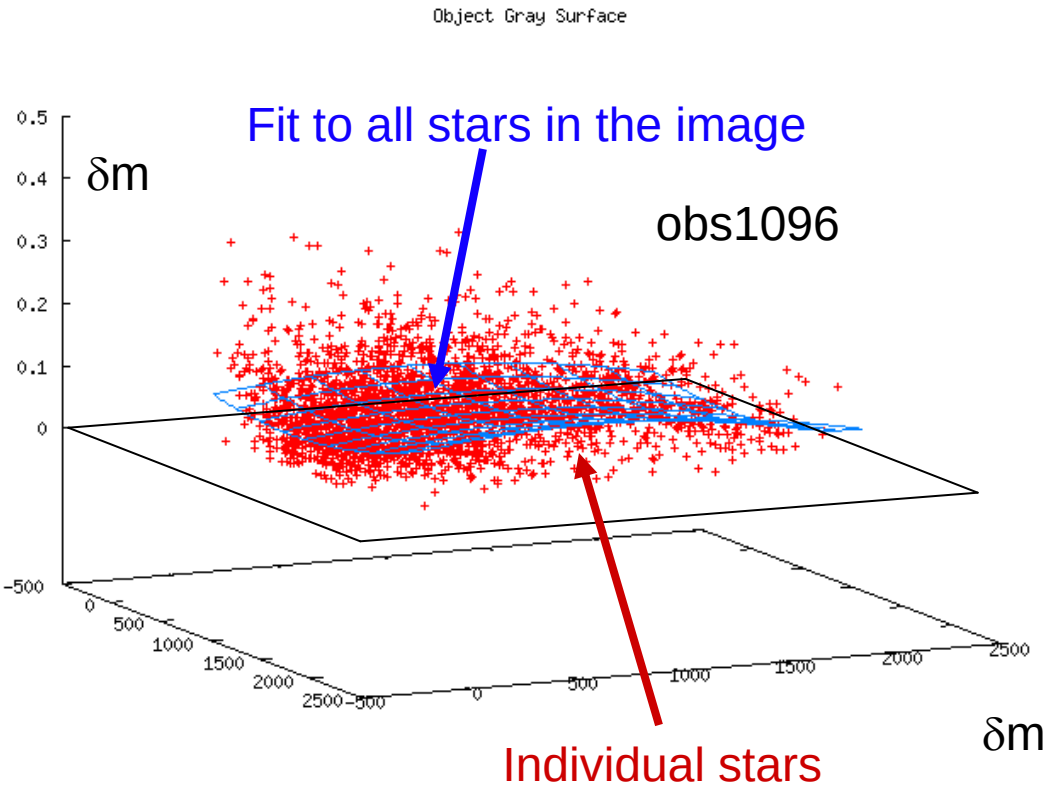
Field (13' x 13') on outskirts of NGC5139 (Omega Cen) with ≅ 300 stars (m_r < 21) in FOV

Gray extinction (δm_r) of a typical object

April 24-26, 2008



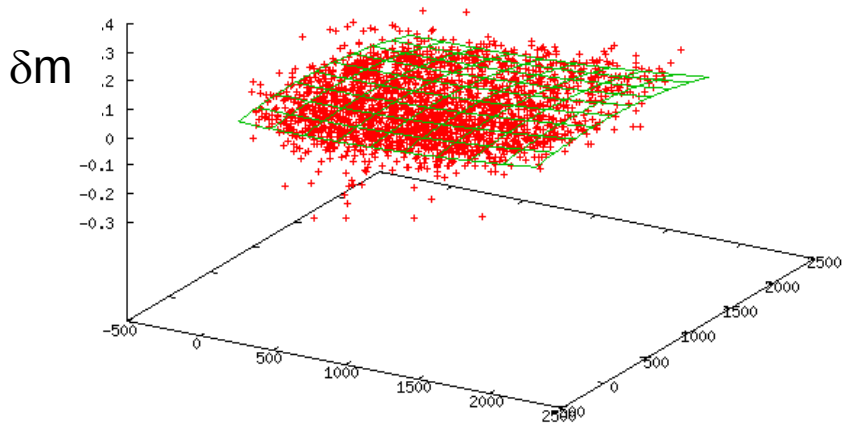
Spatial Fits to Gray Extinction



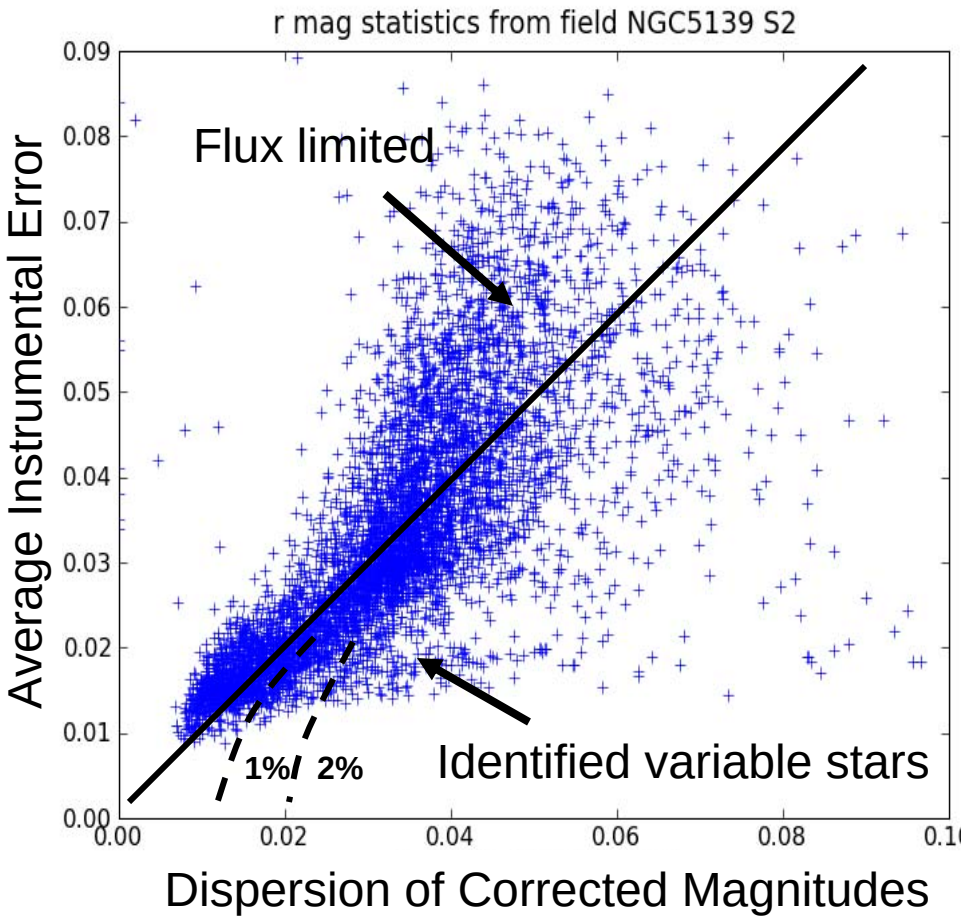
CTIO 0.9m/CFCCD
13’ x 13’ FOV
60 sec exposures

The next image (same pointing) …

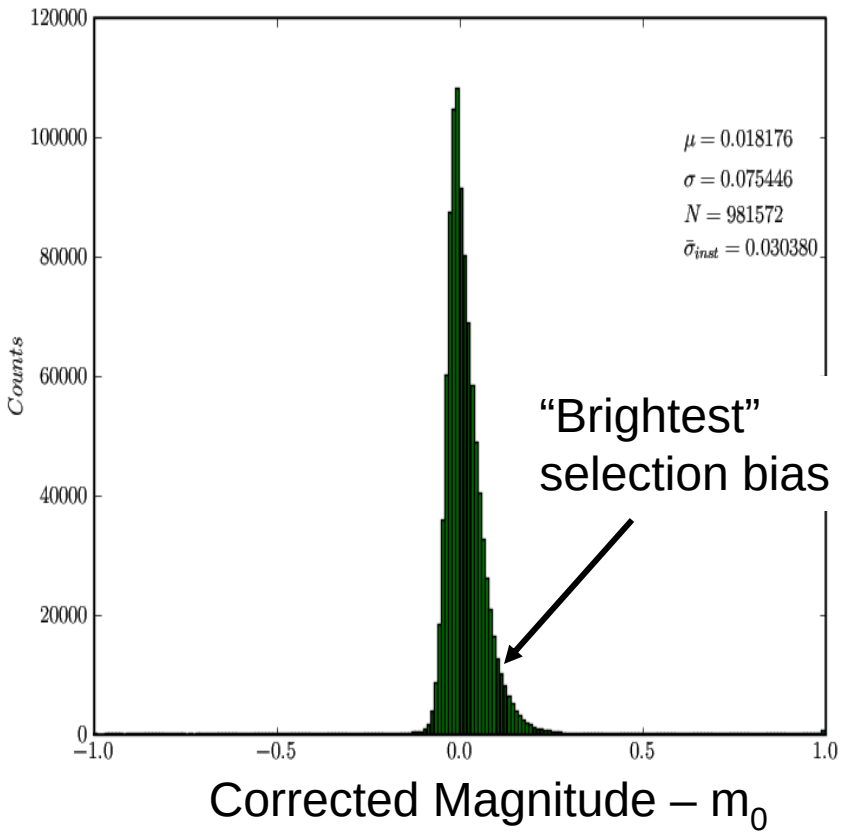
obs1097



Results
Gray-Corrected Magnitudes



Systematic error in m_0 … arises from instrumental resolution



→ Precision of relative calibration 1% or better.

Conclusions

Dispersion of calibrated magnitudes limited by instrumental errors (photon statistics) through a full magnitude of gray extinction

- Relative calibration of 1% or better

Systematic error in absolute calibration due to “Brightest” selection bias is reproduced well in simulation

- Can use shape of resolution function simulated with known instrumental errors to correct

Correction for gray extinction across each image would be a part of PreCam “Rib and Keel” global self-calibration.