Status of ubercal simulation for LSST

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LSST/DESC calibration goal

DESC calibration needs, e.g. for SNe ~ 1 mmag

Several approaches, indispensable for cross-checks

One approach : use stars with known Top Of the Atmosphere fluxes

Produce photometric standard stars => see StarDICE talks

Use GAIA photometric catalogue

In order to evaluate the expected precision, we have built an ubercal simulation tool to study :

- feasibility of fitting procedure
- dependence on various cadence strategies
- compare poorly constrained modes with those of GAIA
- …

Progress in the last two months

Upgrade algorithm from Padmanabhan et al. 2008:

Fit the mag of observed stars (m = 16 to 19)

Use sparse matrices for the fit

Use modified-Cholesky suite for the resolution

Change the structure of the data for vectorization

Run on 8 x more stars (1/100 -> 1/12 of sky)

Inputs: Gaia Universe Model (GUM) catalog, m_G 16 – 19 , full sky

750 M stars in 3072 HEALpix patches/files

Camera FOV description

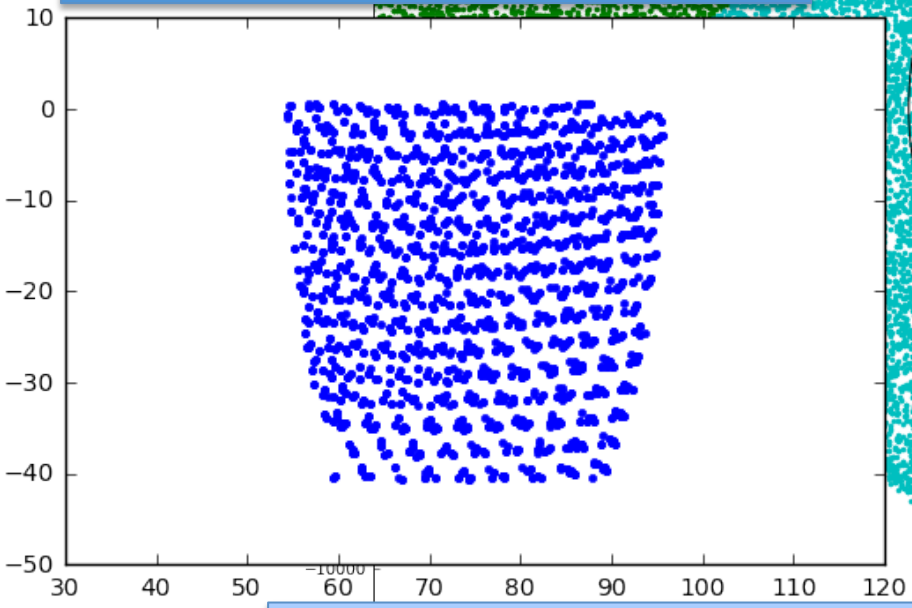
Opsim cadence simulation: minion_1016

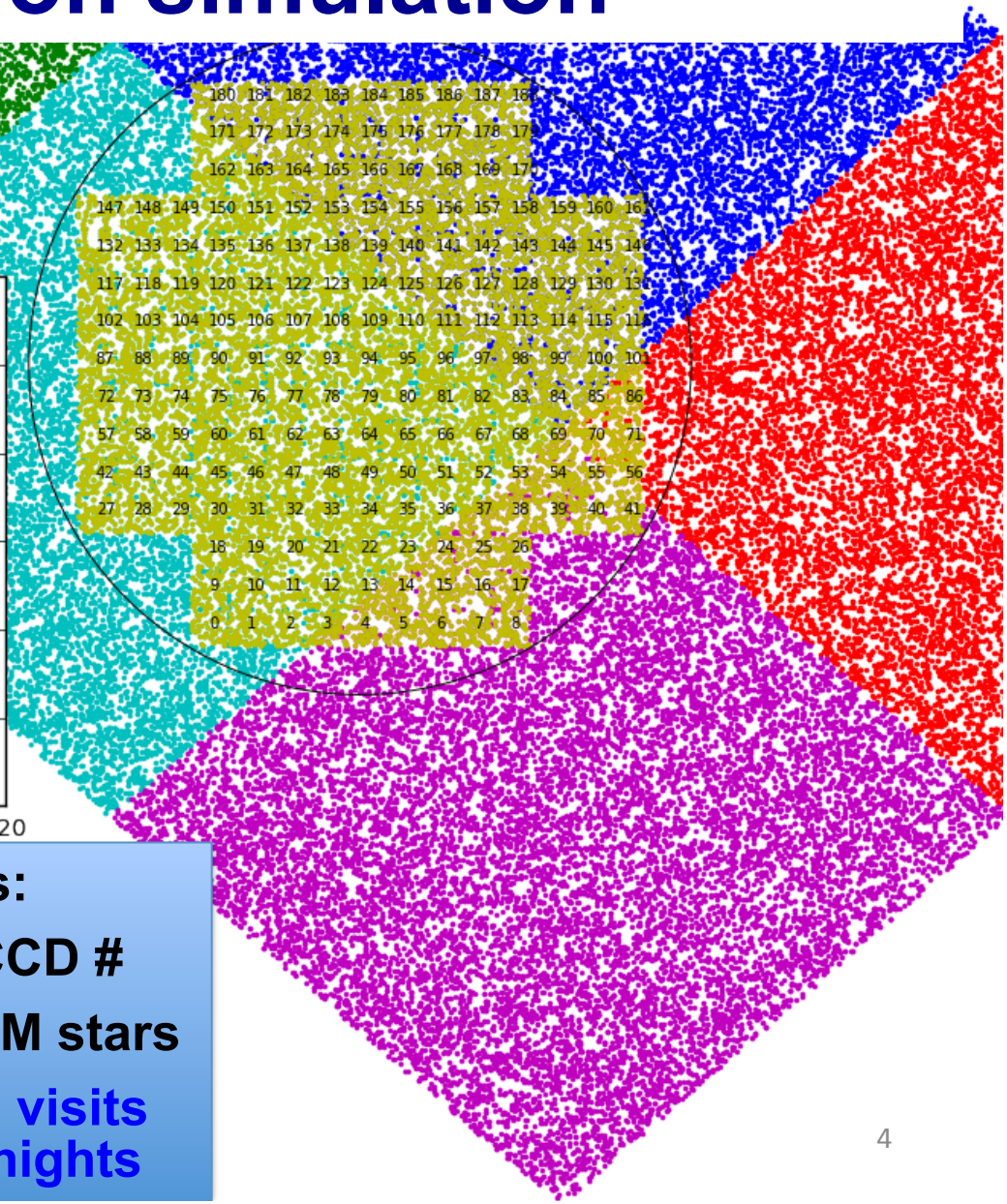
=> FOV *RA, Dec, angle* wrt N, *sky brightness, air mass, date*

Outputs: mags + flat field, atmosphere attn., Fisher matrix, …

Observation simulation

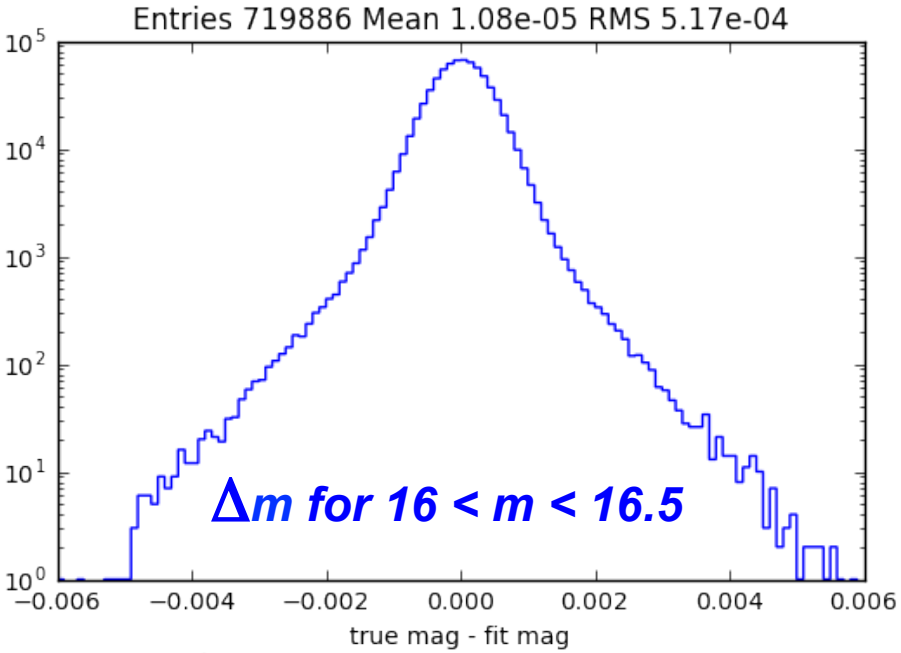
Opsim pointing, dithering
1600 deg2 patch (1/12th sky)
night #: from 100 to 400

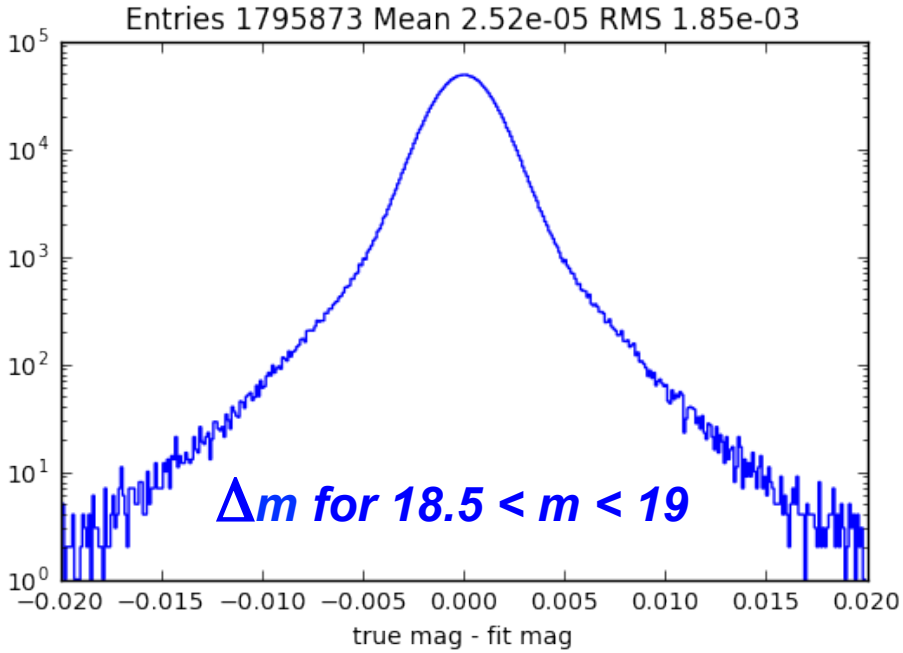


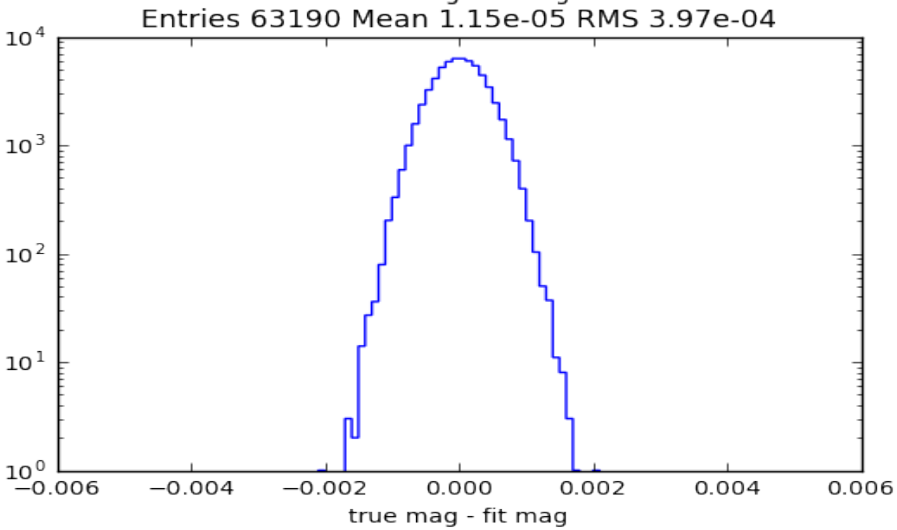


Simulated camera fields:
LSST focal plane with CCD #
HEALpix patches of GUM stars
=> star list for 2500 visits over 39 nights

Fitted magnitudes







Gaussian if limit to equal nr of visits

fit error (shot noise subtracted):

2 10^{-4} , m = 16.25

8 10^{-4} , m = 18.75

Computer time

100 M sources of 7.3 M objects (stars) + ~ 1000 parameters
12 M sources 1.3 M

simulate 2500 visits	**multi core: 20 s (20 s one core)**
build matrix	**multi core: 3 min (15 s multi core)**
solve system	**one core: 9 min (50 s one core)**
total	**12 min (1,5 min)**

Next steps

- **Pursue the development of the ubercal simulation tool**
  move to 20 000 sq. deg. , add parameters
  => more complex model
- **Quantify effects of cadence on calibration precision**
- **Simulate and inject GAIA info**

=> analyse effects on error matrix eigen values, spatial modes, …