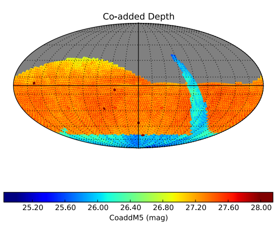
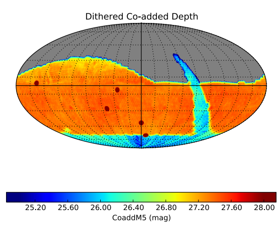
Analyzing Simulated LSST Surveys With MAF

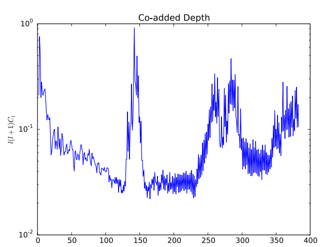
Peter Yoachim, R. Lynne Jones, Srinivasan Chandrasekharan, Andrew P. Connolly, Kem H. Cook, Željko Ivezic, K. Simon Krughoff, Catherine Petry, Stephen T. Ridgway

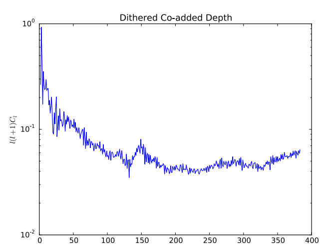
Abstract:
The LSST will make around 2.5 million observations in 6 filters over a 10-year survey. Optimizing the scheduling of these observations involves a variety of scientific trade-offs. We illustrate the wide variety of survey metrics that can be designed and implemented with the Metrics Analysis Framework using simulated LSST surveys. In particular, we illustrate how MAF can (1) be used to compare dithering strategies, (2) quantify how well the observing cadence allows for the characterization of periodic sources, and (3) quantify how efficiently the survey discovers solar system objects. There is nothing LSST-specific about MAF, and we show how it can be easily extended to analyze other surveys such as Stripe 82 in SDSS.

Introduction:
The Large Synoptic Survey Telescope will survey the visible sky approximately every 7 nights in 2 filters, making it possible to do a large number of scientific studies in parallel. To help optimize the scheduling algorithm, we have developed the Metric Analysis Framework to analyze simulated survey properties to measure their scientific potential. MAF provides an all-python framework for reading in a surveys pointing history, slicing the data in a desired manner (e.g., finding all observaitons which overlap a point on the sky), and calculating metrics on those slices.

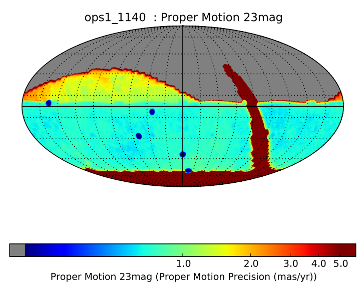




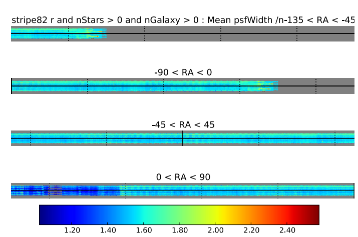




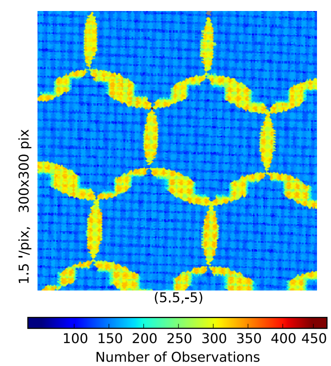
The coadded depth in the *r* filter for a simulated LSST survey. The left panels show the results if the LSST pointings are fixed and not dithered while the right hand panels use a simple dithering strategy. The lack of dithering results in regions of field overlap going much deeper than most of the survey. The lack of dithering results in a large amount of power in the power spectrum at scales of around 1 degree (lower panel).



The expected proper motion precision for a *r*=23 magnitude K-star after 10 years of LSST observations. Most of the survey has an expected precision of 1 milli-arcsecond per year. The deep-drilling fields have even better performance, while the galactic plane and south pole suffer from poor scheduling.



The MAF code can easily be extended to analyze different surveys. Here we look at the mean seeing values across the SDSS Stripe 82 survey area.



By using HEALpixels, we can easily run at different resolutions and display the results in different projections. Here we Lshow the number of visits at high resolution, including the effect of chip gaps in the SST focal plane. For this simulation, the pointings were not dithered.

Please Contribute Your Metrics to MAF:

Help us help you! The LSST cadence and dithering schemes have not yet been finalized! We are very interested in how you would decide which survey strategy best supports your science.

See the MAF documentation at: **http://ls.st/ziz**
Contribute code to our community github repo at: **http://ls.st/zm9**

yoachim@uw.edu
@PeterYoachim
yoachim

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