

Metrics, LSST, and Microlensing

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Overview

- Defining metrics
- LSST tools
 - OpSim, MAF
- Metrics for microlensing

Defining metrics

- Goal: Understand how observing strategy will impact science results
- Metric: Some quantifiable measure of how a given point in the sky will be observed
- Figure of Merit: A measurement of the total scientific yield from LSST for a given science case

Defining metrics

- For the most-thorough work involving metrics, community has produced a white paper
Science-Driven Optimization of the LSST
Observing Strategy
 - <https://github.com/LSSTScienceCollaborations/ObservingStrategy>
 - <https://arxiv.org/abs/>
- Also see: Lund 2015 on time-domain metrics
 - <https://arxiv.org/abs/1508.03175>

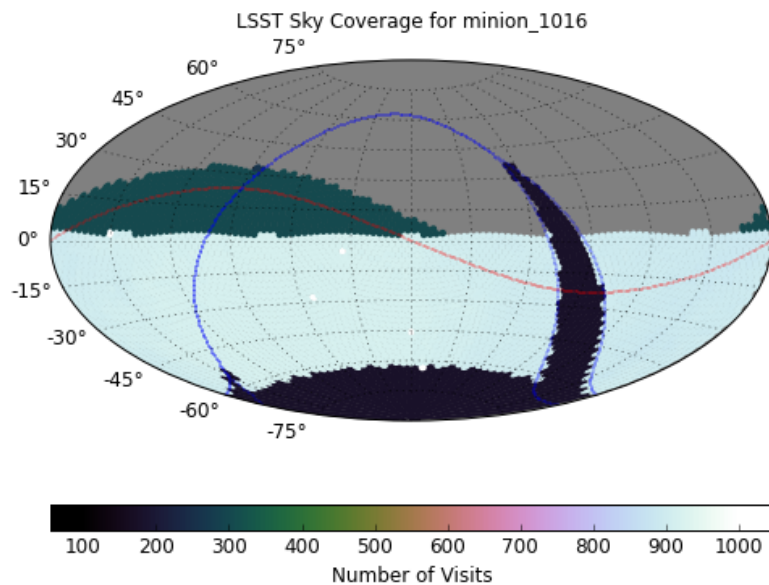
LSST Tools - OpSim

- Operations Simulator (OpSim) produces ten years of simulated schedule under a set of observing guidelines and with simulated downtime and weather
 - Inputs include selecting deep-drilling fields and minisurveys, prioritizing field revisits, etc
 - Outputs include time of observation, band of observation, airmass, photometric noise
- Current standard OpSim: minion_1016

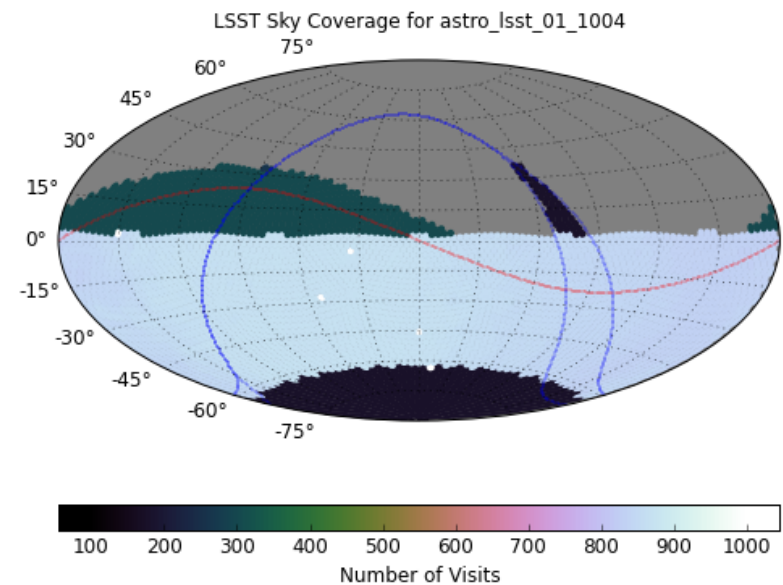
LSST Tools – MAF

- Metric Analysis Framework (MAF) allows for running metrics on the produced OpSim results
 - Large number of included metrics, or write your own
 - Includes data visualization
 - Can be run on subsets of data (see: slicers)

Sample Metric – observations per field



Minion_1016 (baseline cadence)



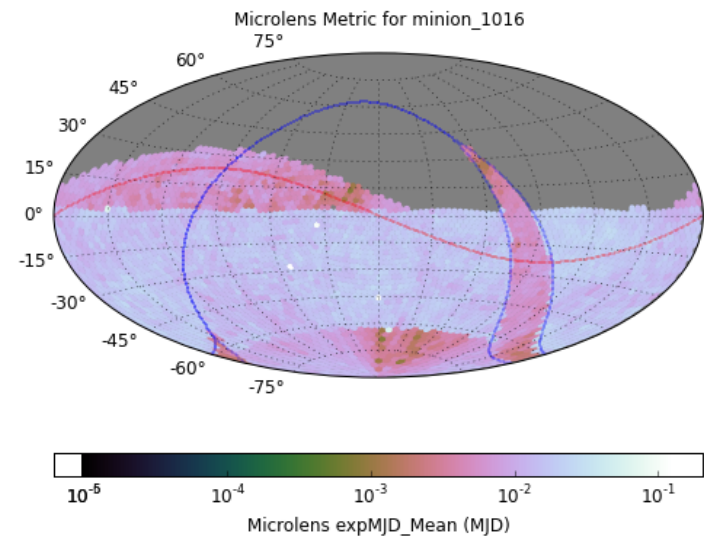
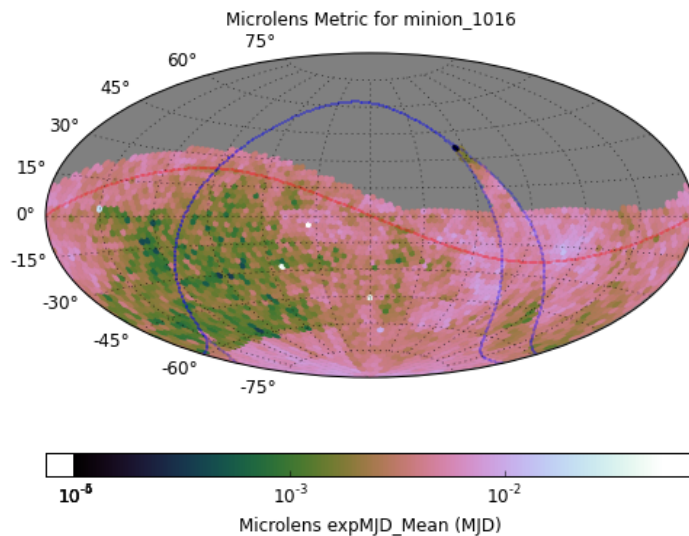
Astro_lsst_01_1004

Metrics for Microlensing

Example of a community-produced metric

- Question: How well can LSST be used as a trigger for microlensing events?
- Requirements:
 - 3 observations that occur within a maximum time frame
 - Minimum spacing between observations

Metrics for Microlensing



- Exoplanet trigger
- Three observations in 2 days separated by 1 hour intervals
- Stellar trigger
- Three observations in 7 days separated by 2 day intervals

Future Metrics and Beyond

- Some existing metrics may be applicable to microlensing but haven't yet been used for this
- New metrics will likely be needed
 - Number of LSST observations during WFIRST
 - Event duration and frequency by sky position
- Full simulations of microlensing light curves will be useful, but may not be best suited as metrics

Microlensing event at LSST cadences

- Microlensing model (left) from Matt Penny
- LSST observing schedule white paper already includes microlensing discussion to some extent

